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ASYMPTOTIC PERFORMANCE AND LEARNING CURVES IN MARKSMANSHIP EXPERIMENTS

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Interim Report

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14. ABSTRACT

This study investigated means by which the asymptotic level of performance for a marksmanship static-target shooting session may be calculated, as well as the development of learning curves based on asymptotic levels of performance from multiple sessions. This investigation focused on three aspects of marksmanship performance: accuracy and precision without a time constraint, speed-accuracy and visual search. In the accuracy and precision experiment, no significant degree of improvement was observed. In the speed-accuracy experiment, neither asymptotic performance nor learning curves could be computed based on these data, and no statistically significant correlation was found between time and shot distance from the center of the target. In the visual search experiment, results indicated that there were no significant changes in accuracy at any of the visual acuity levels. The results of these experiments will inform the design of future marksmanship performance experiments of a similar nature, while the methods described have potential utility in marksmanship training experiments and the comparison of performance with different weapons and ammunition, due to the reliable means provided for observing the asymptotic plateau of best sustained performance

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1 SUMMARY

In human factors experiments that investigate marksmanship behavior, repeated execution of a course of fire can lead to improvements in performance. Removing this potential source of nuisance variance from experiment treatment effects is a critical step in interpreting and confidently generalizing findings from marksmanship performance studies. A reliable method for the experimental observation of asymptote development will achieve this goal and could also provide marksmanship instructors a valuable method for ascertaining student achievement of a training criterion-of-performance and the level of practice needed to maintain a desired level of proficiency. This study investigated means by which the asymptotic level of performance for a marksmanship session may be calculated, as well as the development of learning curves based on asymptotic levels of performance from multiple sessions. This investigation focused on three aspects of marksmanship performance: accuracy and precision without a time constraint, speed-accuracy and visual search.

In the accuracy and precision experiment, performance with the M9 pistol and M4A1 carbine was assessed over 4 days, during which 30 iterations were fired with each weapon daily. Subjects were placed into one of two groups: experienced and inexperienced. Experienced subjects were those who had served in the military or law enforcement or who had participated in competitive marksmanship or hunting, while inexperienced subjects had none of the aforementioned experience. During each of the 30 iterations, subjects fired 3 shots at a simple cross shaped target. Asymptotic performance was determined by first computing the 5 iteration running variance of the area of dispersion, which was the smallest rectangle able to encompass all of the shots during a given iteration. Once the 5 iteration running variance was computed, the asymptotic dataset was determined by selecting the 2 lowest points on the curve that were also the closest in value, which were designated points n_i and n_{i+1}. The iterations comprising the asymptotic dataset, n_{i-5} through n_{i+1}, were then compared using the appropriate statistical methods. The results of the accuracy and precision experiment indicated that, under the conditions of the experiment, performance in terms of accuracy and precision would not be expected to improve over 4 days of data collection.

In the speed-accuracy experiment, subjects who successfully completed the qualification course of fire were required to shoot 30 iterations of 3 shots at a silhouette target using the M4A1. Time and measures of accuracy were collected, and based on these data, the Inverse Efficiency Scores (IES) and Conditional Accuracy Function (CAF) were calculated, as well as simple correlation between time and shot distance from the center of the target. Neither asymptotic performance nor learning curves could be computed based on these data, and no statistically significant correlation was found between time and shot distance from the center of the target.

In the visual search experiment, subjects who successfully completed the qualification course of fire were required to engage tumbling E targets with the M4A1 at 4 distinct Snellen visual acuities (20/204, 20/165, 20/114 and 20/84). Asymptotic performance was computed by determining the proportion of targets hit for each acuity with a chi-squared

test of proportions and 95% confidence intervals, with learning curves being determined by plotting each day's asymptotic performance on a graph. Through the 4 days of data collection, results indicated that there were no significant changes in accuracy at any of the visual acuity levels.

The results of these experiments will inform the design of future marksmanship performance experiments. Since no significant improvement in accuracy and precision performance or visual search performance is likely to be observed during 4 days of data collection, future experiments may be designed with one day for baseline performance and three days for the addition of treatments, provided the participants have at least a minimal level of marksmanship proficiency at the outset. One such notional design would include a baseline data collection day, a day with pilocarpine treatment, a day with the addition of MOPP-4, and a final day with both pilocarpine treatment and MOPP-4.

2 INTRODUCTION

When a task is performed or practiced repeatedly, there is usually a degree of improvement in the metrics by which performance of that task is measured. In psychology, economics and operations management, such improvement over time is represented through a learning curve.[1,2,3] While task performance and learning curves have been studied for elite chess players, race car drivers, construction workers and surgeons, a literature search found no directly relevant research concerning rifle and pistol marksmanship performance and learning curves in peer reviewed journals in recent years.[3,4,5,6]

Learning curves for rifle and pistol marksmanship performance and target identification are of particular importance to any experiments in which the effects of a treatment on performance are to be evaluated. In such experiments, test subjects' performance, in terms of accuracy and precision, is likely to improve during their participation (a potential source of extraneous variance). Another dimension of marksmanship performance that may potentially improve over the course of the experiments is accuracy under a time constraint. As with any task having a cognitive component, the test subject's accuracy will likely decrease as the time constraint becomes more restrictive.[7] Conversely, accuracy under such circumstances can be improved at the expense of time, but the accuracy gains realized will eventually show diminishing returns.[8] As a result of improvements in any of these dimensions of marksmanship performance, there is the potential for additional variance to be introduced into future test data, which may mask or amplify the effects of the treatment in question on performance.

In general, learning curves consider a test subject's initial performance level with respect to a metric, such as a) the number of practice iterations, b) the test subject's performance level during each practice iteration, c) the change in performance level, and d) the rate of change in performance level.[3,4,9] Although most learning curves incorporate the same fundamental variables, the functions that define them and the resulting shapes of the curves, as well as their predictive validity, can differ significantly.[2,9,10] One way in which learning curves can be described is through the power law, the simplest form of which is shown in equation 1, where *T* is the measure of performance, *a* is the curve's starting point, *P* is the number of iterations, and *b* is the rate at which performance improves.[4]

$$T = a\,P^{b} \quad (1)$$

While some investigators have asserted that the power law is universal in nature, others have disagreed because much of the research that supports the power law is based on the fitting of averaged data of many test subjects.[11] Thus, learning curves based on the power law will not necessarily describe individual learning curves, due in part to individual differences (e.g., novice vs expert marksmen).[12] Among such individual differences are punctuated learning dynamics, which appear as

improvements followed by plateaus, which are in turn followed by improvements, among other features.[13] Another critical drawback to the power law is the fact that some tasks with both motor and cognitive components, such as surgical procedures, have learning curves that do not conform to the smooth curve produced by the power law, but are instead linear, logarithmic, or exponential.[10] Therefore, while the power law does have a long history of application to learning curves for a wide variety of tasks, it is not necessarily suited to the evaluation of individual learning curves or to tasks with both cognitive and motor components, such as marksmanship. It was thus the purpose of this study to evaluate marksmanship metrics in static and visual search targeting scenarios in order to determine the most suitable learning curve model for rifle and pistol performance, so that future CBRN related human performance studies may be conducted without the additional variance introduced by learning curves.

As this report will describe, this study has fulfilled its stated objectives and has demonstrated for the first time reliable methods for determining asymptotic performance and developing learning curves for multiple dimensions of marksmanship performance. These methods have potential utility in the development of courses of fire for military and law enforcement personnel as well as competitive shooters. Using the methods described, the best sustained, or asymptotic, level of performance for a given shooter during a training session can be reliably determined, enabling the development of training programs specific to the individual. Other potential applications include the determination of the amount and frequency of practice required to maintain proficiency and the comparison of performance with different weapons, modifications to weapons or types ammunition. Through application of these methods, investigators and trainers may enhance the statistical rigor of their evaluations.

3 METHODS AND MATERIALS

3.1 Participant Recruitment and Screening

The recruiting goal for the study was 40 participants in order to obtain a total sample of 30 for the experiments. Recruitment and participation were conducted in accordance with a Naval Medical Research Unit Dayton (NAMRU-D) Institutional Review Board approved human subjects research protocol (NAMRUD.2018.0001-Learning Curves and Asymptotic Performance for Simulated Rifle and Pistol Marksmanship and Visual Search Tasks). Participants were recruited through email, word of mouth, posted flyers and advertisements in the Wright Patterson Air Force Base newspaper. Because the research was determined to involve no greater than minimum risk, active duty or retired military, federal employees and civilians were actively recruited. In order to be considered for inclusion in any of the experiments, participants were required to be between the ages of 18 and 40, in good overall health and have vision best corrected to 20/20 for both distant and near vision with glasses or contact lenses. Participants were further required to have a normal slit lap examination and intraocular pressure. Specific exclusion criteria included vision not correctable to 20/20 at distance or near, intraocular pressure outside of the normal limits of 10-21 mm Hg, a history of retinal detachment and the use of toric contact lenses, bifocals or progressive lenses.

3.2 Indoor Simulated Marksmanship Trainer (ISMT) System

In order to conduct the experiments with both safety and fidelity, a Meggitt Training Systems M100 ISMT system was chosen. The ISMT, variants of which are used in the Marine Corps as well as numerous law enforcement agencies, was installed in the Naval Medical Research Unit-Dayton Laser Laboratory. The projector and detection camera were positioned 7 ft (2.1 m) 7 in. (17.8 cm) and 7 ft (2.1 m) 1.5 in. (3.8 cm) above the floor respectively, and 15 ft (4.6 m) away from the screen. The screen measured 8 ft (2.4 m) by 8 ft (2.4 m) and was a Laservision model BC4.F5P01.5003. The system's physical configuration is shown in Figures 1 and 2, and the weapons employed are shown in Figures 3 and 4.

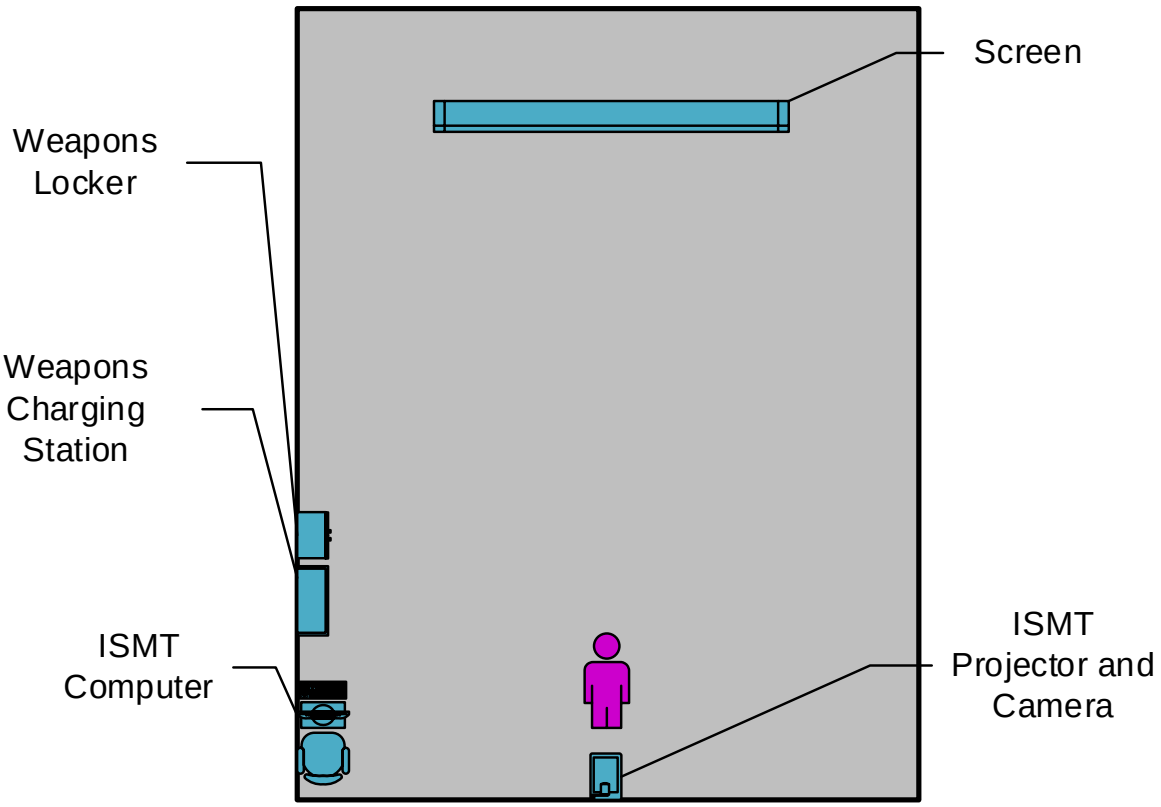

Figure 1. ISMT Physical Configuration

Figure 2. ISMT System in Use

Figure 3. ISMT Wireless M9 pistol

Figure 4. ISMT Wireless M4A1 Carbine

As its name implies, the ISMT was designed for training, rather than human performance experiments. As a result, the pre-installed training courses of fire were not optimal, requiring researchers to use the system's course authoring functionality to develop specialized courses of fire for all experiments. Among the parameters specified for each experiment were data output, ballistics, pass and fail criteria, target types, and visual and auditory cues. Specific aspects of each custom programmed course of fire will be discussed in subsequent sections.

3.2.1 ISMT Data Output

ISMT data output settings required special attention due to the system's intended application as a training, rather than research, system. The default data export settings included basic marksmanship results such as group size, the group's mean point of impact (MPI) and the score. While these data provided some useful information, they did not allow for the computation of many of the metrics which were required. In order to collect the required data, the ISMT was configured to consider each individual shot as a group. As a result, the system provided X and Y data, as well as timing for each shot.

3.2.2 Ballistics

By default, the ISMT incorporates ballistics specific to the weapons which are connected to the system and their standard ammunition. The standard zeroing distance

is 300 yards for the M4A1 carbine and 10 yards for the M9 pistol. While ballistics, particularly with the M4A1 carbine, is very helpful in bringing fidelity to the ISMT, its use in human performance experimentation introduces potential variance because sights must be adjusted to reflect the range to the simulated target, and the M4A1 carbine's sights allow for range adjustments only in increments of 100 yards, thus limiting the types, sizes, and distances of targets in the experiment, and introducing potential variance because of differences in skill level. Since such variance would likely have adverse effects on data collection, the ISMT was configured such that ballistics were not incorporated into the simulated marksmanship. This was accomplished by turning off the ballistics and dispersion options in the ISMT lanes training weapon menu.

3.3 Experiments and Protocols

The study consisted of three distinct experiments. The first experiment investigated the accuracy and precision aspects of marksmanship performance. The second experiment investigated the speed-accuracy aspect of marksmanship performance. The third experiment investigated the visual search aspect of marksmanship performance. Each experiment's protocols will be described in the paragraphs that follow.

3.3.1 Marksmanship Accuracy and Precision Experiment

The marksmanship accuracy and precision experiment was the first to be completed. In this experiment, accuracy and precision in marksmanship against static targets with no time limit were the focus.

3.3.1.1 Objectives and Hypotheses

The objectives of the marksmanship accuracy and precision experiment were to investigate multiple aspects of asymptotic performance with the M9 pistol and the M4A1 carbine. The first aspect of asymptotic performance to be investigated was the influence of test subject experience level on the number of iterations required to reach an asymptotic level of performance during a session. This aspect was investigated because it was not known if inexperienced subjects would achieve a measurable asymptote and because it was not known if 30 iterations would be a suitable number of iterations. The next aspect of asymptotic performance to be investigated concerned the potential for the number of iterations required for a subject to reach asymptote decreasing over time. This aspect was investigated because such a decrease would represent a learning effect. The next aspect to be investigated was the difference in the number of iterations required to reach asymptote with the M9 pistol vs the M4A1 carbine. This aspect was investigated because of the potential for the differences in shooting a pistol versus shooting a rifle, such as weapon weight and trigger pull, to influence the number of iterations required to reach asymptote, and thus the number of iterations required to collect meaningful data in future experiments. The final aspect of asymptotic performance to be investigated was that the level of asymptotic performance would change over time. This aspect was investigated because a change in the level of asymptotic performance, in particular one indicative of improvement, would represent an improvement and could be represented as

a learning curve.

In order to meet the objectives of this experiment, the following hypotheses were tested:

- Hypothesis 1: The number of iterations required to reach asymptote is dependent upon the experience level of the subject, with more experienced subjects requiring fewer iterations;
- Hypothesis 2: The number of iterations required for a subject to reach asymptote will decrease over time;
- Hypothesis 3: The number of iterations required to reach asymptote will be significantly different for rifle and pistol;
- Hypothesis 4: The level of asymptotic performance will improve to a small but significant extent.

The independent variables were marksmanship experience, weapon used (i.e., M4A1 or M9) and day of participation. Dependent variables included raw marksmanship performance and derived marksmanship performance metrics: single-target accuracy, single-target group size, iterations to asymptote, duration of asymptote and to central zero point (CZP) distance.

3.3.1.2 Design and Protocol

The experiment was a mixed design, with test subjects divided into two levels based on their level of marksmanship experience. The experienced level consisted of those test subjects who had received M9 pistol and/or M4A1 carbine training in the past, as well as those who had previous firearms experience through hunting, competition, or general marksmanship. The test subject sample consisted of 10 test subjects, half of whom were experienced, and half of whom were inexperienced. Due to the inability to properly collect data on the first four subjects, however, the subject sample size was limited to 6.

All subjects received orientation training on day 1. During the orientation training, subjects were instructed on basic weapons safety, proper shooting stances and experimental procedures. After instruction on day 1, subjects completed one course of fire with each weapon during which researchers provided basic marksmanship coaching. Coaching consisted of corrections to problems diagnosed by observation as well as by the ISMT's barrel trace function, which provided feedback on muzzle movement immediately before, during and immediately after the trigger was pulled. After completion of firing, subjects were instructed to avoid practicing marksmanship skills outside of the experiment as well as changes to their consumption of caffeine, tobacco, alcohol, or prescription or over the counter drugs for the duration of the experiment. On days 2 through 5, subjects completed one course of fire with each weapon, with a 30 minute rest between weapons. The order of weapon use was counterbalanced.

The M4A1 course of fire consisted of 30 iterations during which the subject would fire 3 shots at a battlesight zero (BZO) target (a simple high-contrast cross-hair image), an

example of which is shown in Figure 5, placed at a simulated distance of 25 yards. Subjects were not given a time limit for each iteration, and were instructed to strive for both accuracy and precision by aiming each shot at the center of the target to the best of their ability. The M9 course of fire also consisted of 30 iterations during which the subject would fire 3 shots at a target similar to that of the M4A1 course of fire, but placed at a simulated range of 10 yards. As with the M4A1 course of fire, there were no time limits imposed. In both courses of fire, subjects were given a 30 second rest period between iterations, during which researchers collected the X and Y coordinates of each shot fired during that iteration. If data for one or more shots in an iteration data were not available due to an ISMT or weapon malfunction, subjects completed additional 3 shot iterations as needed so that subject produced a complete dataset of 30 iterations of 3 shots for each weapon.

Figure 5. Accuracy and Precision Experiment Target

3.3.2 Marksmanship Speed-Accuracy Experiment

The marksmanship speed-accuracy experiment was the second to be completed. In this experiment, the tradeoff between speed and accuracy and the levels of asymptotic performance achieved were the focus.

3.3.2.1 Objectives and Hypothesis

The objectives of the marksmanship speed-accuracy experiment were to investigate asymptotic performance with respect to speed-accuracy, and to determine whether or not the level of asymptotic performance improved over time. When evaluating performance in the context of speed-accuracy, asymptotic performance is the level of performance at

which additional time does not improve accuracy.[8] The hypothesis tested in this experiment was that the level of asymptotic performance will improve to a small, but significant extent over time. The dependent variable was the degree of performance, as measured by accuracy and time, and the independent variable was the day of data collection.

3.3.2.2 Design and Protocol

The experiment was a repeated measures design, with all subjects completing the same course of fire over 4 days of data collection. The test subject sample was limited to 4 subjects, due to the inability to measure asymptotic speed-accuracy performance. As with the previous experiment, subjects received training and orientation on day 1 of the experiment. Training and orientation began with an introduction to basic safety procedures to be followed during the experiment, after which subjects were instructed in the proper stance, grip, stock positions and basic operation of the M4A1. Next, subjects were given the opportunity to shoot 3 iterations of the BZO target describe in the previous experiment, and were provided with feedback on their performance and technique. Upon completion of training and orientation, subjects completed a qualification exercise based on the Marine Corps Table 5 course of fire. Subjects who qualified with a score 80-percent or greater (minimum of 96 out of 120 possible points) were invited to complete the experimental course of fire on days 2 through 5 and were instructed to avoid practicing marksmanship skills outside of the experiment, in addition to keeping their dietary and medication regimes the same throughout the experiment.

The course of fire during days 2 through 5 was conducted once per day with only the M4A1. Subjects were required to shoot 30 iterations, each consisting of 3 shots taken at a silhouette target with a superimposed bullseye, an example of which is shown in Figure 6. Subjects were instructed to aim at a cross-shaped BZO target at the bottom of the screen in order to ensure the same starting position for each iteration. When each iteration began the silhouette target would disappear and the BZO target would remain for an additional second. Then, the BZO target would disappear and the silhouette would reappear and the subject would then have to place all shots as close to the center of the silhouette target as possible, and to do so within 3 seconds. Targets were assigned scores for this course of fire with 10 points being given for the center of the bullseye, 9 points for the first ring outside the bullseye and 8 points for the third, outermost black ring outside the bullseye. Shots within the first white ring outside the bullseye received a score of -5, with each successive white ring receiving an additional -1. Shots completely outside the white rings were assigned a score of -10. Between each 3-shot iteration, there was approximately a 30 second pause during which investigators collected X and Y coordinates and shot times for each shot.

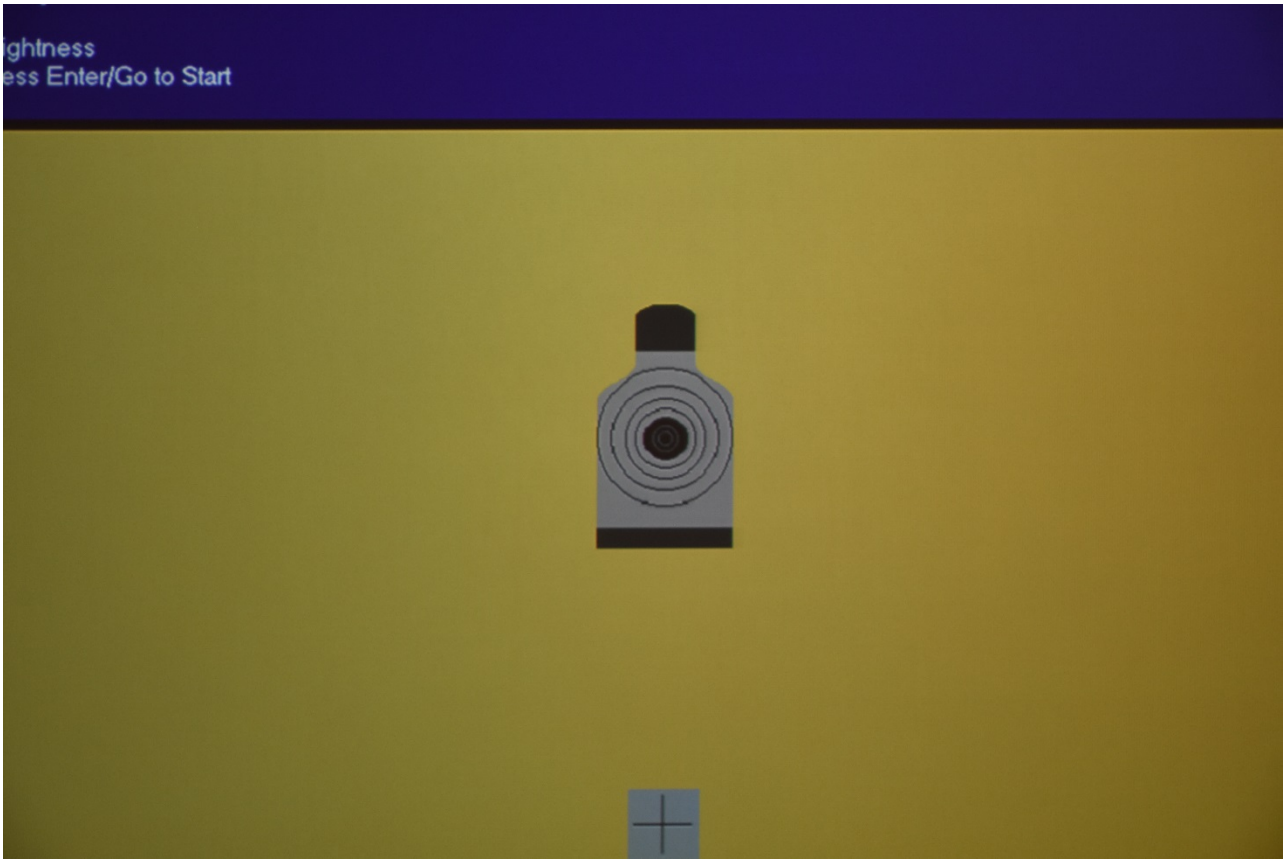

Figure 6. Speed-Accuracy Experiment Target

3.3.3 Marksmanship Visual Search Experiment

The marksmanship visual search experiment was the third to be completed. In this experiment, the ability to discriminate between targets and distractors at 4 Snellen visual acuities was the focus.

3.3.3.1 Objectives and Hypothesis

The objectives of the marksmanship visual search experiment were to investigate asymptotic performance with respect to completion of a visual search task performed at 4 Snellen visual acuities, and to determine whether or not the level of asymptotic performance improved over time. In the context of the visual search tasks in this experiment, asymptotic performance consisted of the proportion of successful shots at each acuity level. The hypothesis tested in this experiment was that the level of asymptotic performance will improve to a small, but significant extent over time. The dependent variable was the proportion of shots that hit the target, and the independent variables were the visual acuity size of the targets and the day on which the data were collected.

3.3.3.2 Design and Protocol

As with the previous experiment, the visual search experiment was a repeated measures design. Subjects who participated in this experiment began day 1 with a period of instruction on safety procedures and basic operation of the M4A1. Next, subjects completed a qualification exercise based on the same Marine Corps table 5 based qualifying course of fire previously described in the marksmanship speed-accuracy experiment. Subjects who achieved a qualifying score were provided with additional instruction in M4A1 marksmanship fundamentals, after which they were allowed to shoot three 3-shot iterations of the BZO target for familiarization at each of the 4 Snellen acuity sizes.

On days 2 through 5, subjects completed the visual search course of fire, which consisted of 128 iterations each comprised of an array of 4 tumbling Es; 3 tumbling E distractors and 1 tumbling E target, an example of which is shown in Figure 7. Each iteration began with a cross-hair BZO target positioned such that it was equidistant from the location of all tumbling E distractors and targets, which appeared after a short pause. Each iteration's Snellen acuity size was quasi-randomly selected from one of the following: 20/204, 20/165, 20/114 or 20/84. No target appeared successively more than twice at the same location and all acuity size targets appeared an equal number of times within a session. Subjects were instructed to shoot the tumbling E that was oriented differently from the other 3 on the screen. Performance on each iteration was graded in a binary manner, with possibilities being "hit" or "no hit". Since the individual tumbling Es did not have a natural central aiming point, subjects were instructed to aim and fire anywhere within a fixed radius around the different tumbling E. Any shots that were detected within the fixed radius, 1/3 the distance between one tumbling E and the next, were considered a "hit". Subjects were instructed to complete each iteration within 2 seconds. After two seconds, a buzzer would sound, indicating that the subject is past the 2 second mark, but the array would remain until the subject selected, and engaged, what he/she believed to be the different tumbling E.

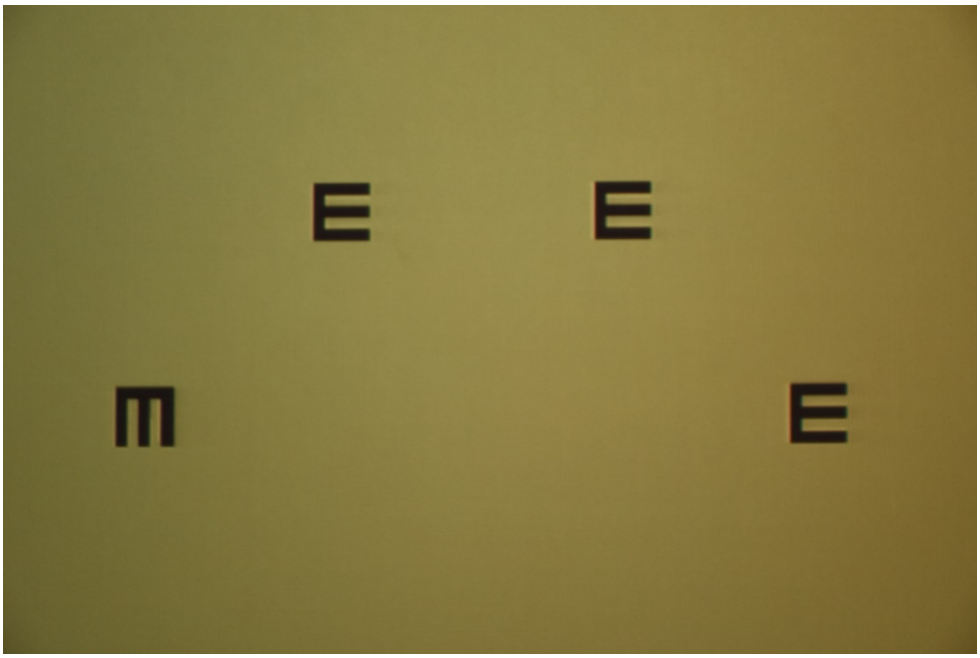

Figure 7. Tumbling E Target

3.4 Statistical Analysis

3.4.1 Overview

Analysis of data from this study's experiments began with the determination of the method by which the level of asymptote was to be determined. Once the method was chosen and applied, the metrics of performance during the period of asymptotic performance were collected, after which statistical tests were used to determine the presence of statistically significant differences between each day's asymptotic data. Datasets to be compared were first tested for normality and heteroscedasticity. The appropriate methods, as shown in Figure 8, were then chosen based on these tests and were executed in R.[14,15,16,17] If data were found to be normal and homoscedastic, then Analysis of Variance (ANOVA), followed by Tukey's Honest Significance Difference (HSD) was used. If data were normal and heteroscedastic, then ANOVA followed by the Games-Howell test was used. If data were not normal and homoscedastic, the Kruskal-Wallis test followed by Dunn's test was used. If data were not normal and heteroscedastic, then the Brunner-Dette-Munk test was used, followed by the REGWQ test.

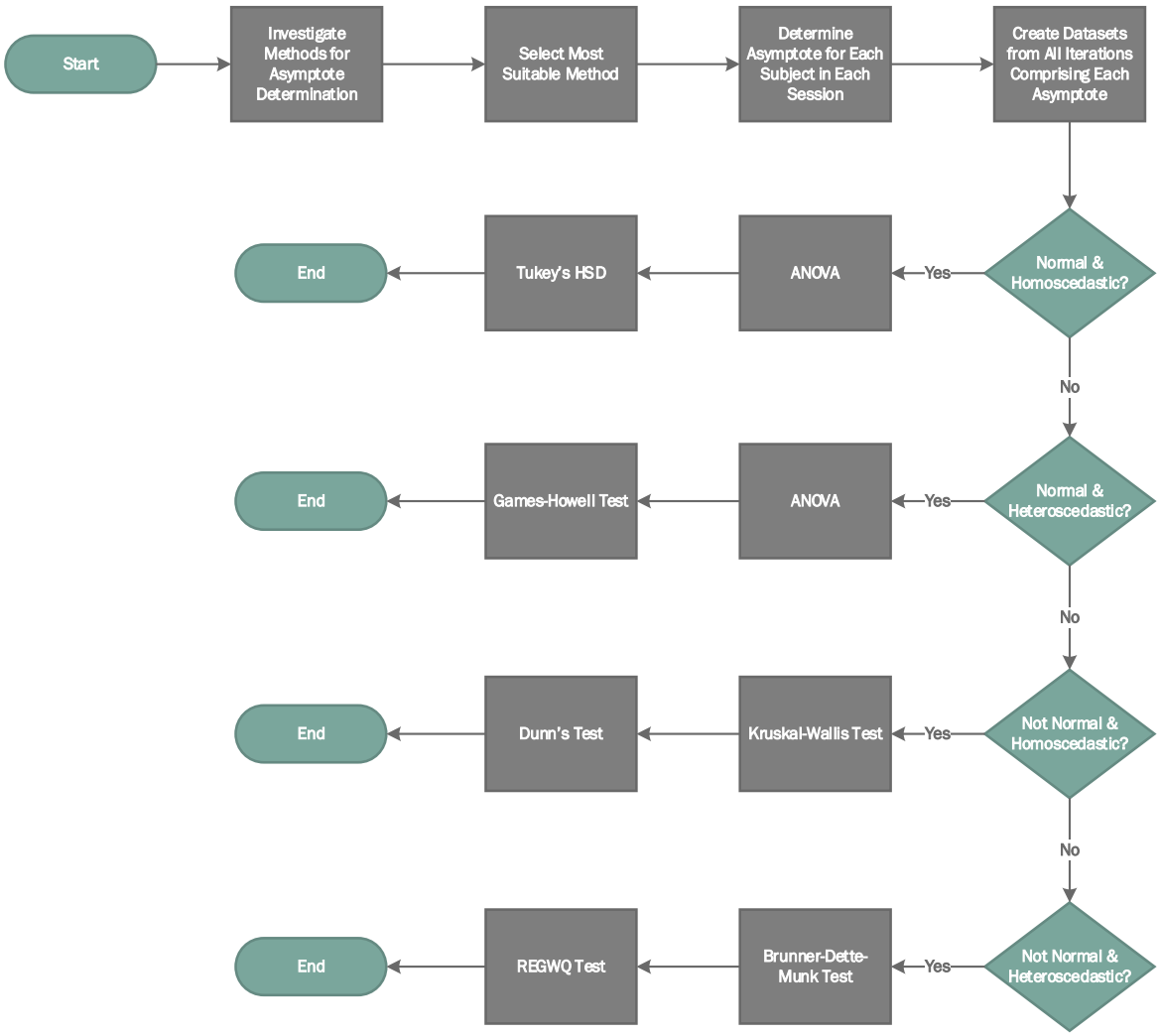

Figure 8. Generalized Statistical Analysis Process

3.4.2 Marksmanship Accuracy and Precision Experiment

Determination of the asymptotic level of performance with respect to accuracy and precision began with an examination of accuracy and precision related metrics over the course of 30 iterations of 3-round shot groups over multiple days. Each metric's values were evaluated by looking for trends in the values and in variance of the values over the course of the 30 iterations. Variances for each iteration and for numbers of iterations up to 10 were computed. A window size of 5 iterations for variance was found to be optimal. The following paragraphs will describe each metric in detail.

3.4.2.1 MPI to CZP Distance

The Mean Point of Impact (MPI) to Center Zone Point (CZP) distance, or MPI to CZP distance, is a measure of the accuracy of a shot group. It is computed automatically by

the ISMT system, and can also be computed using equation 2 if the X and Y coordinates of all shots in the shot group are given.

$$MPI\ to\ CZP\ Distance = \sqrt{\bar{x}^2 + \bar{y}^2} \quad (2)$$

3.4.2.2 Group Size

Group size is a measure of shot group precision. It is also computed automatically by the ISMT system, and can be computed using equation 3 if the X and Y coordinates in the shot group are given.

$$Group\ Size = \sqrt{(x_{max} - x_{min})^2 + (y_{max} - y_{min})^2} \quad (3)$$

3.4.2.3 Shot Distance from Center Mass

The shot Distance from Center Mass, (DCM_{shot} or simply DCM_S), is a measure of the overall accuracy of the shot group that can be thought of as the mean of the linear distance of each shot in the group from the center of the target.[18] While the ISMT system does not automatically compute DCM_S, it is easily computed using equation 4.

$$DCM_S = \frac{\sum\sqrt{(x_i)^2 + (y_i)^2}}{n} \quad (4)$$

3.4.2.4 Mean Radius

The mean radius (MR), is a measure of shot group precision. It is computed from the X and Y coordinates of each shot in the shot group. As its name implies, it describes a circle, the radius of which is the mean linear distance of each shot from the center of the target.[18] Mean radius is computed using equation 5.

$$MR = \frac{\sum\sqrt{(x_i - \bar{x})^2 + (y_i - \bar{y})^2}}{n} \quad (5)$$

3.4.2.5 Horizontal and Vertical Range

Horizontal and vertical range are measures of precision that consider only the dispersion of shots with respect to the horizontal and vertical axes.[18] They are computed using equations 6 and 7.

$$R_H = (x_{max}) - (x_{min}) \quad (6)$$

$$R_V = (y_{max}) - (y_{min}) \quad (7)$$

3.4.2.6 Area of Dispersion

The area of dispersion is a measure of precision that is the smallest rectangle that can encompass all shots in the shot group.[18] As equation 8 shows, it is the product of R_H and R_V.

$$AD = (R_H)(R_V) \tag{8}$$

3.4.2.7 Experience Level and Iterations Required to Reach Asymptote

In order to determine whether or not a significant relationship between experience level and the number of iterations required to reach asymptote existed, pistol and rifle data were divided into datasets based on experience level. Datasets were tested for normality and the appropriate correlation test was performed.

3.4.3 Marksmanship Speed Accuracy Experiment

Analysis of marksmanship speed accuracy data was accomplished by computing Inverse Efficiency Score (IES), Conditional Accuracy Function (CAF), by analyzing the data by quantiles and by determining the degree of correlation between time and shot distance.

3.4.3.1 Inverse Efficiency Score

The IES is a well-established measure of the speed-accuracy tradeoff. It is computed as shown in Equation 9, where RT is the mean response time of correct responses and where PE is the proportion of errors, or incorrect responses.[20]

$$IES = \frac{RT}{1-PE} \tag{9}$$

As the equation implies, both RT and (1-PE) are determined based on the criterion for a correct response. Because speed-accuracy experimental data are vulnerable to bias based on the ease or difficulty of achieving a correct response, IES was determined using both the MPI to CZP Distance and the DCMS metrics and target radii of 2, 3, 4 or 5 cm, with correct shot groups falling within these radii.

3.4.3.2 Conditional Accuracy Function

The CAF considers the rate of accurate responses by response time quantiles.[19] In this method, the response times are divided into an equal number of quantiles, after which the rate of accurate responses is computed for each quantile.[19] In order to gain further insight in the present study, the CAF was modified by binning 1/MPI to CZP distance and

1/DCMS by response time quantiles. With a sample size of 30 iterations for each subject, these metrics were grouped into 5 quantiles of 6 iterations as well as 6 quantiles of 5 iterations.

3.4.3.3 Time and Shot Distance Correlation

The presence and significance of correlations between time and accuracy were determined for individual subjects pistol and rifle sessions over the 4 days of firing, as well as for all subjects combined. Correlation computations were accomplished using the cor.test function in R, and coefficients were computed using Pearson's product moment, Kendall's rank correlation, and Spearman's rank correlation.[14]

3.4.4 Marksmanship Visual Search Experiment

Analysis of marksmanship visual search data began with the sorting of each subject's data by day and by the visual acuity size of the targets shot, after which the proportion of successfully hit targets was determined. All computations were performed in R, using the Chi-Squared test of proportions with an alpha level of 0.95 and applying Yates' correction.[14] Confidence intervals were computed for each proportion by performing the same test on each individual proportion, with the null hypothesis that the true proportion was 0.5.

3.5 Equipment

3.5.1 Ocular Screening

Participants received a vision screening in the NAMRU-D Vision Laboratory, during which an Early Treatment Diabetic Retinopathy Study (EDTRS) chart was used to evaluate distant visual acuity on a Precision Vision Chart Illuminator (model 2425). Near-vision assessment was done with a LogMAR near acuity chart at 40 cm. Spectacles and spherical contact lenses were allowed to provide best corrected distance visual acuity. Ocular dominance was measured using the "hole in the card" method at distance. A positive history of retinal detachment or other ocular abnormalities was considered exclusionary on a case-by-case basis due to future participation with pilocarpine ophthalmic solution.

3.5.2 Marksmanship Experiments

Marksmanship experiments were completed with a Meggitt Training Systems ISMT Model M100 system, which was equipped with two Bluefire ® M4A1 carbines and two Bluefire ® M9 pistols. Each weapon had 3 magazines, which contained compressed air in order to simulate recoil. Magazines were refilled with a standard SCUBA tank, which was connected to a Meggitt Training Systems supplied gas regulator with specialized fittings for the purpose. ISMT targets were projected onto a screen. A digital camera was used as a backup means to capture ISMT screen data.

4 RESULTS AND DISCUSSION

4.1 Results

4.1.1 Marksmanship Accuracy and Precision Experiment

In this experiment, the data collected for subjects 1-4 could not be analyzed using the previously described method because only group size and MPI to CZP distance were available. Data for subjects 6 and 10 were not available because these subjects were unable to complete the entire experiment. Of the subjects in the sample, 5, 7, 8 and 12 were experienced, and subjects 9 and 11 were inexperienced.

4.1.1.1 Hypothesis 1: Experience Level and Iterations to Reach Asymptote

Datasets comprising the number of iterations required to reach asymptotic pistol performance on each day, for both experienced and inexperienced subjects, were assessed for normality with the Shapiro-Wilk test. For experienced subjects, the W value was 0.95075 and the P-value was 0.5016. For inexperienced subjects, the W value was 0.96373 and the P-value was 0.8448. In both cases, there was a failure to reject the null hypothesis of normality, and the boxplot in Figure 9 does not provide information to the contrary. Based on the assumption of normality, Pearson's Product Moment Correlation was performed resulting in a t value of -1.1158, a p value of 0.2766 and a correlation coefficient of -0.2314245. Because the null hypothesis was not rejected, it cannot be concluded that a significant correlation exists between experience level and the number of iterations required to reach pistol asymptote.

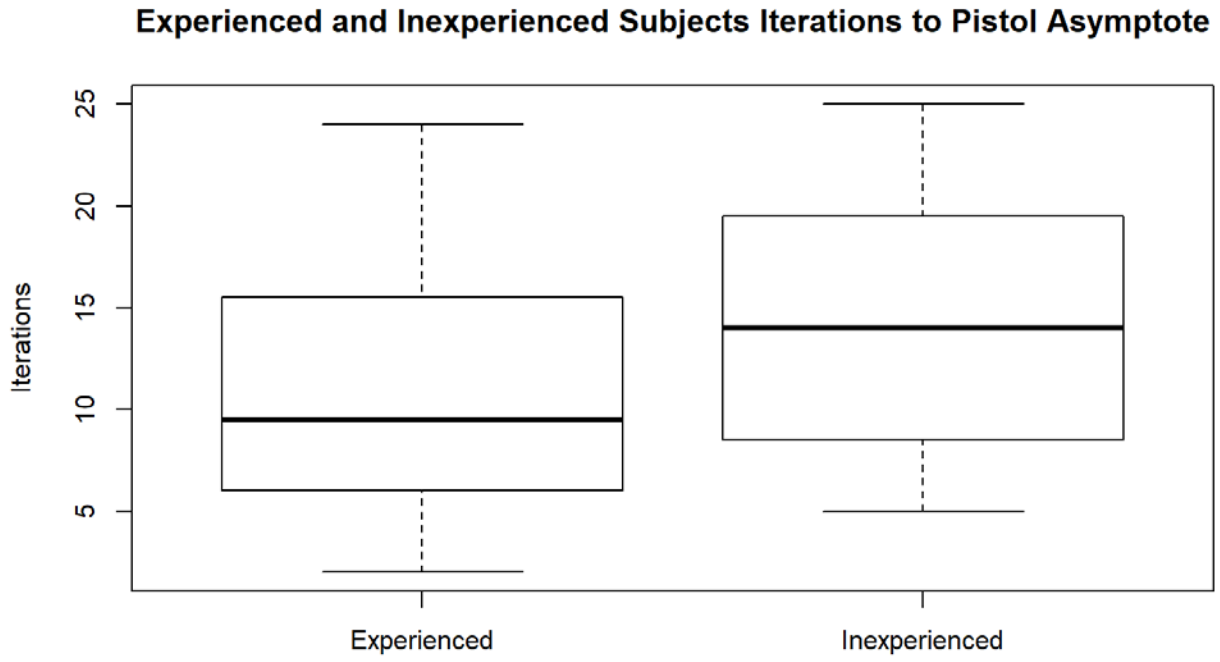

Figure 9. Experienced and Inexperienced Subjects Iterations to Pistol Asymptote

Datasets comprising the number of iterations required to reach asymptotic rifle performance on each day, for both experienced and inexperienced subjects, were assessed for normality with the Shapiro-Wilk test. For experienced subjects, the W value was 0.2822 and the P-value was 0.2284. For inexperienced subjects, the W value was 0.90514 and the P-value was 0.3211. In both cases, there was a failure to reject the null hypothesis of normality, and the boxplot in Figure 10 does not provide information to the contrary. Based on the assumption of normality, Pearson's Product Moment Correlation was performed resulting in a t value of 0.53839, a p value of 0.5957 and a correlation coefficient of 0.1140354. Because the null hypothesis was not rejected, it cannot be concluded that a significant correlation exists between experience level and the number of iterations required to reach rifle asymptote.

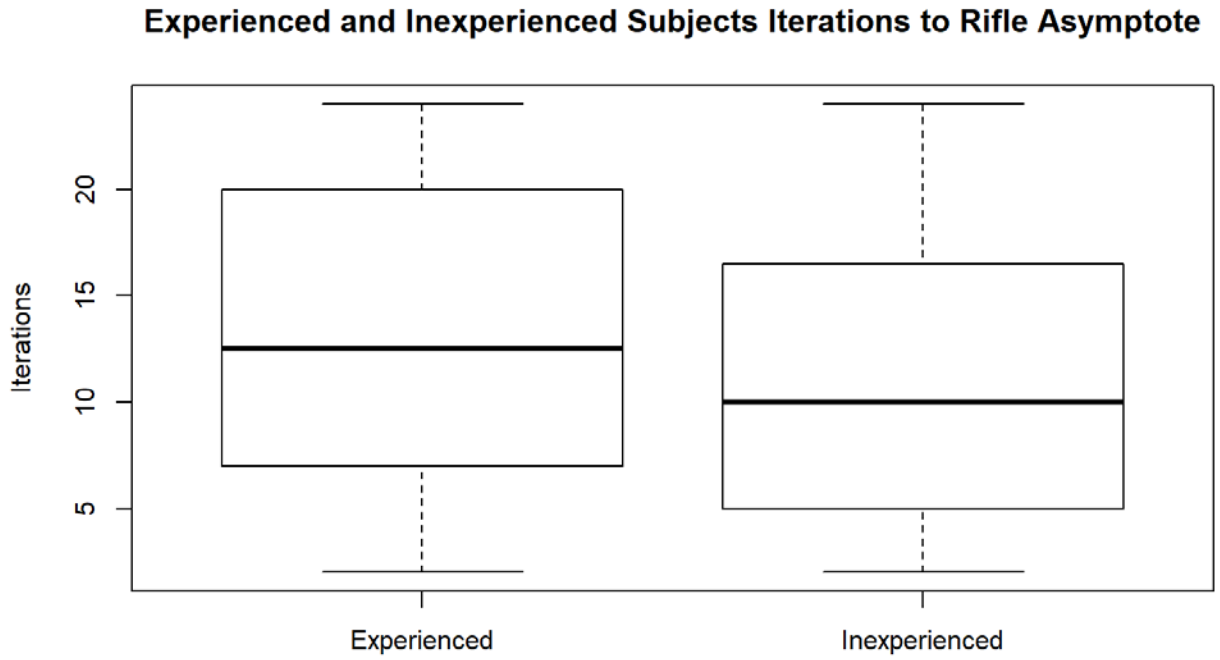

Figure 10. Experienced and Inexperienced Subjects Iterations to Rifle Asymptote

4.1.1.2 Hypothesis 2: Iterations to Reach Asymptote Will Decrease Over Time

As Table 1 indicates, the null hypothesis of a normal distribution was not rejected for any days. The boxplot in Figure 11 is not, however, indicative of a normal distribution. When Bartlett's Test was performed, the resulting K^2 was 1.5517 and the p-value was 0.6704, which failed to reject the null hypothesis of homoscedasticity. The Kruskal-Wallis test yielded a X^2 value of 1.2683 and a p-value of 0.7367, which failed to reject the null hypothesis of equality of dataset location. Because the null hypothesis was rejected, there is no evidence of any change in the number of iterations required to achieve asymptotic performance with the M9 over 4 days of data collection. Therefore, it cannot be concluded that the number of iterations required to achieve asymptotic performance with the M9 has decreased.

Table 1. Iterations to Reach Pistol Asymptote Shapiro-Wilk Test Results

Day	W	P-value
2	0.93559	0.62389
3	0.91989	0.50454
4	0.89534	0.34713
5	0.81029	0.07259

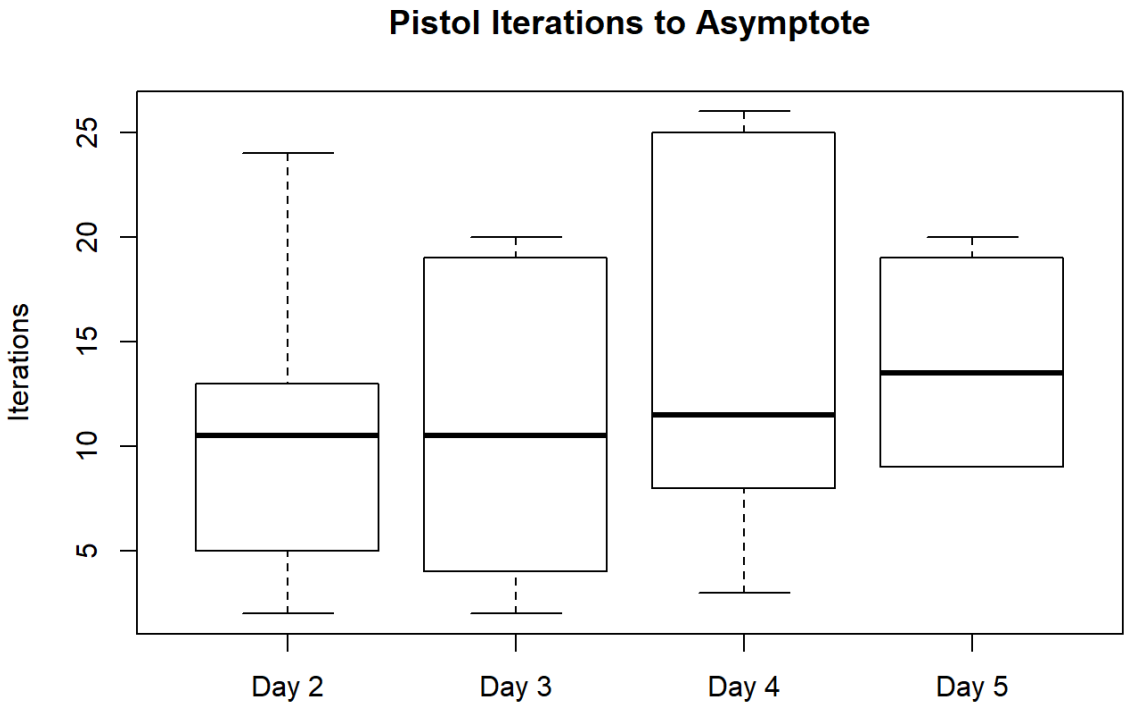

Figure 11. Pistol Iterations to Asymptote

As Table 2 indicates, the null hypothesis of a normal distribution was not rejected for any days. The boxplot in Figure 12 is not, however, indicative of a normal distribution. A closer examination of the boxplot shows that the Day 4 dataset has a much smaller interquartile range with two outliers. This was not caused by lost data or computational error and is only a reflection of the data collected on that day. When Bartlett's Test was performed, the resulting K^2 was 9.0481 and the p-value was 0.02866, which rejected the null hypothesis of homoscedasticity. The Brunner-Dette-Munk test yielded an F value of 1.095642 and a p-value of 0.37161, which failed to reject the null hypothesis of equality of distribution functions. Because the null hypothesis was not rejected, there is no evidence of a change in the number of iterations required to achieve asymptotic performance with the M4A1 over 4 days of data collection. Therefore, it cannot be concluded that the number of iterations required to achieve asymptotic performance with the M4A1 has decreased.

Table 2. Iterations to Reach Rifle Asymptote Shapiro-Wilk Test Results

Day	W	P-value
2	0.90016	0.37489
3	0.947	0.71593
4	0.92409	0.53531
5	0.87271	0.23722

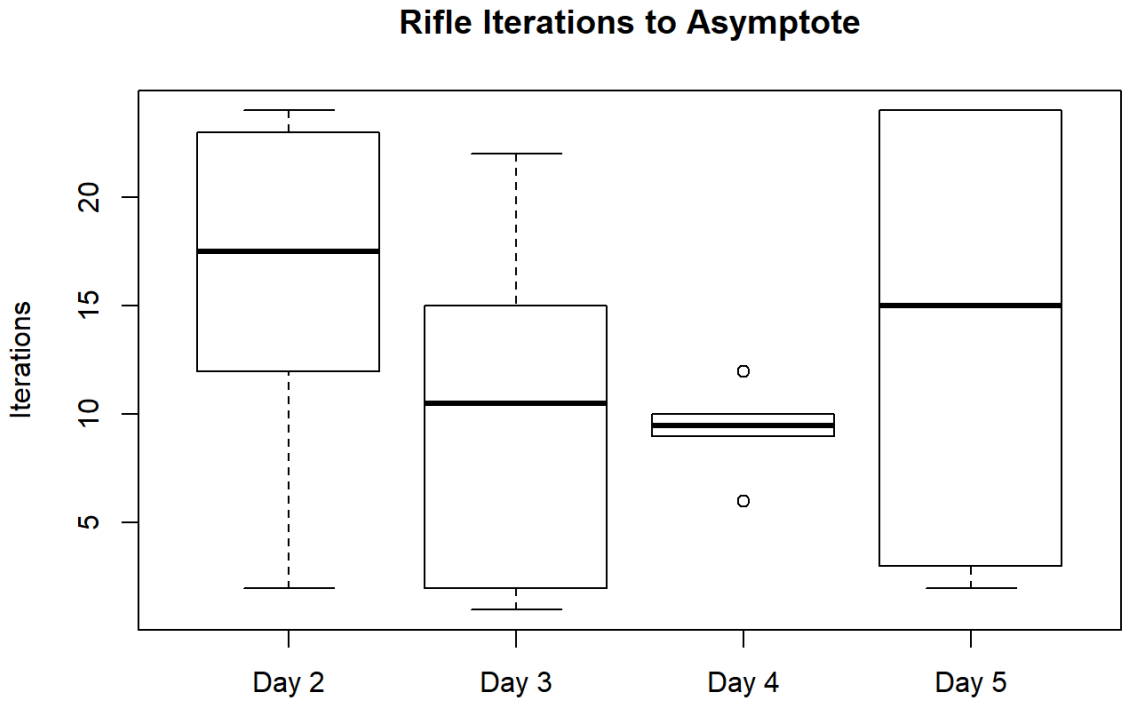

Figure 12. Rifle Iterations to Asymptote

4.1.1.3 Hypothesis 3: Iterations to Reach Asymptote Differ Significantly for Pistol and Rifle

As Table 3 indicates, the null hypothesis of a normal distribution was not rejected for any days. The boxplot in Figure 13 is not, however, indicative of a normal distribution. When Bartlett's Test was performed, the resulting K^2 was 10.683 and the p-value was 0.153, which failed to reject the null hypothesis of homoscedasticity. The Kruskal-Wallis test yielded a X^2 value of 4.0455 and a p-value of 0.7745, which failed to reject the null hypothesis of equality of dataset medians. Because the null hypothesis was not rejected, there is no evidence indicative of a significant difference between the number of iterations required to achieve asymptotic performance with the M9 and M4A1.

Table 3. Pistol and Rifle Iterations to Asymptote Shapiro-Wilk Test Results

Dataset	W	P-value
Pistol Day 2	0.93559	0.62389
Pistol Day 3	0.91989	0.50454
Pistol Day 4	0.89534	0.34713
Pistol Day 5	0.81029	0.07259
Rifle Day 2	0.90016	0.37489
Rifle Day 3	0.947	0.71593
Rifle Day 4	0.92409	0.53531
Rifle Day 5	0.87271	0.23722

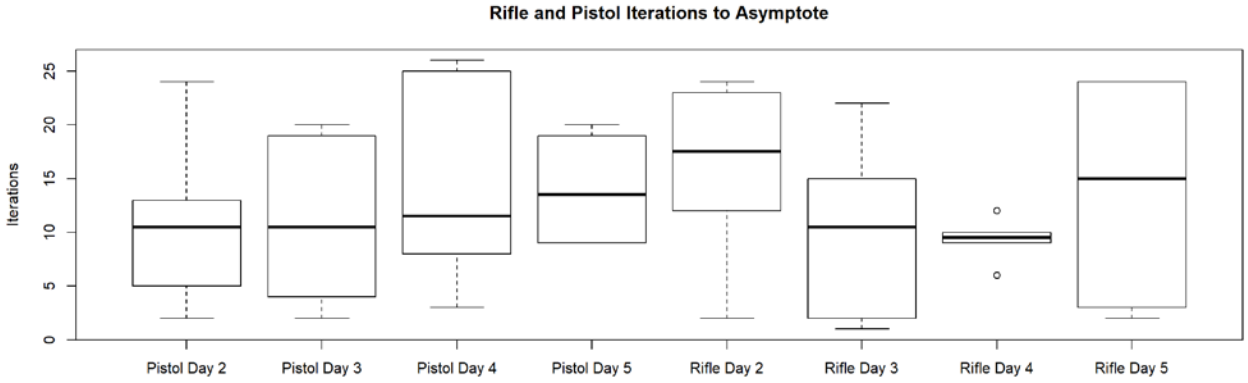

Figure 13. Iterations to Asymptote for Pistol and Rifle

4.1.1.4 Hypothesis 4: Improved Asymptotic Performance Over Time

The sections that follow will present daily performance data analysis for all subjects together and for experienced and inexperienced subjects separately. Data analysis for individual subjects can be found in Appendix A.

4.1.1.4.1 Pistol Data for All Subjects

As Table 4 indicates, the null hypothesis of normality was rejected for all subjects' pistol group size data. The boxplot in Figure 14 does not strongly support a normal distribution. When Bartlett's Test was performed on these data, the resulting K^2 was 29.053 and the p-value was 2.183e-06, which rejected the null hypothesis of homoscedasticity. The Brunner-Dette-Munk Test yielded an F value of 1.752558 and a p-value of 0.1592024, thus failing to reject the null hypothesis of equality of distribution functions. As such, the analysis provides no evidence of a change in group size during days 2-5.

Table 4. All Subjects Pistol Group Size Shapiro-Wilk Test Results

Day	W	P-Value
2	0.79662	3.76E-06
3	0.93475	0.0188
4	0.91268	0.003527
5	0.88292	0.000461

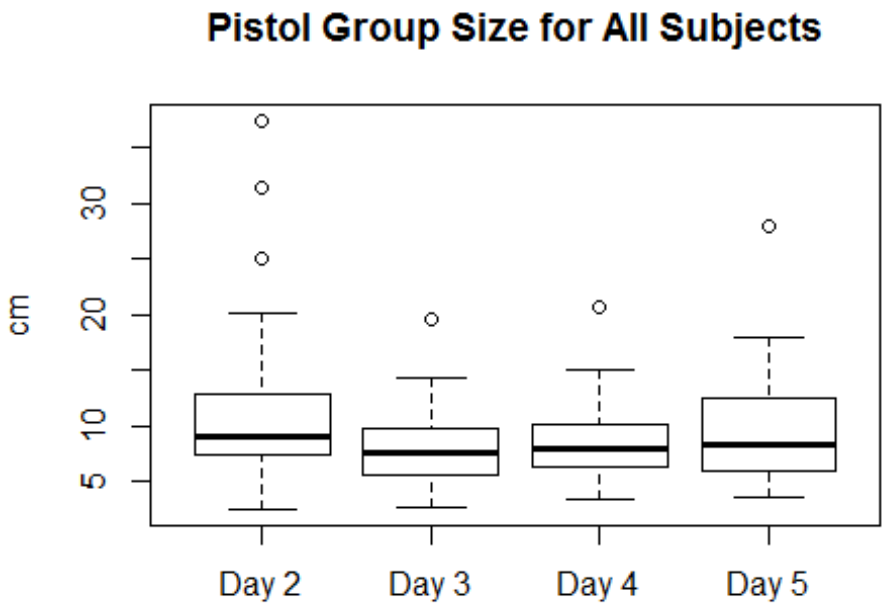

Figure 14. Pistol Group Size for All Subjects

As Table 5 indicates, the null hypothesis of normality was rejected for all subjects' pistol MPI to CZP distance data. The boxplot in Figure 15 does not strongly support a normal distribution. When Bartlett's Test was performed on these data, the resulting K^2 was 11.542 and the p-value was 0.009129, which rejected the null hypothesis of homoscedasticity. The Brunner-Dette-Munk Test yielded an F value of 1.545646 and a p-value of 0.205295, thus failing to reject the null hypothesis of equality of distribution functions. As such, the analysis provides no evidence of a change in MPI to CZP distance during days 2-5.

Table 5. All Subjects Pistol MPI to CZP Distance Shapiro-Wilk Test Results

Day	W	P-Value
2	0.87741	0.000325
3	0.91425	0.003954
4	0.88482	0.000521
5	0.94701	0.05051

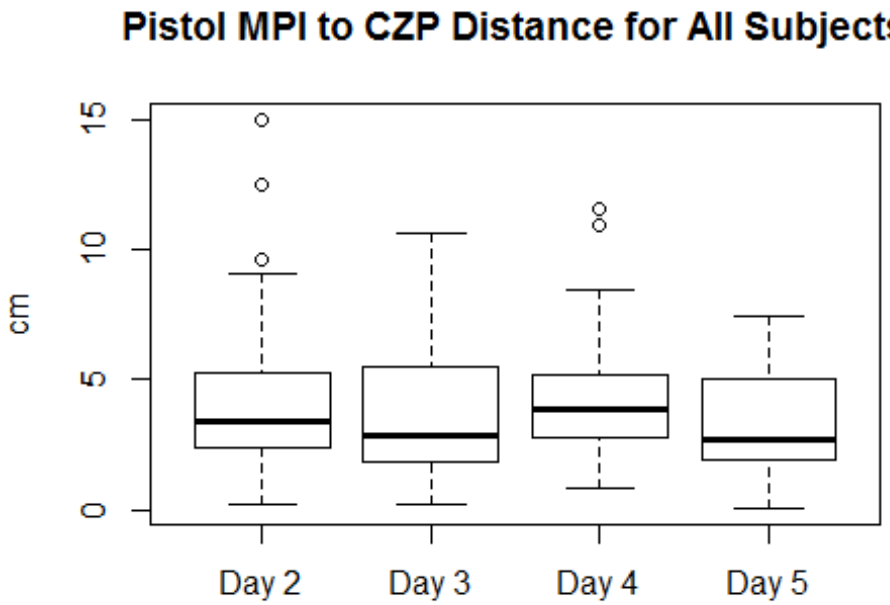

Figure 15. Pistol MPI to CZP Distance for All Subjects

As Table 6 indicates, the null hypothesis of normality was rejected for all subjects' pistol DCMS data. The boxplot in Figure 16 does not strongly support a normal distribution. When Bartlett's Test was performed on these data, the resulting K^2 was 17.504 and the p-value was 0.0005565, which rejected the null hypothesis of homoscedasticity. The Brunner-Dette-Munk Test yielded an F value of 1.912974 and a p-value of 0.1305129, thus failing to reject the null hypothesis of equality of distribution functions. As such, the analysis provides no evidence of a change in DCMS during days 2-5.

Table 6. All Pistol Subjects DCMS Shapiro-Wilk Test Results

Day	W	P-Value
2	0.84205	3.99E-05
3	0.93378	0.01741
4	0.86399	0.000142
5	0.93562	0.02014

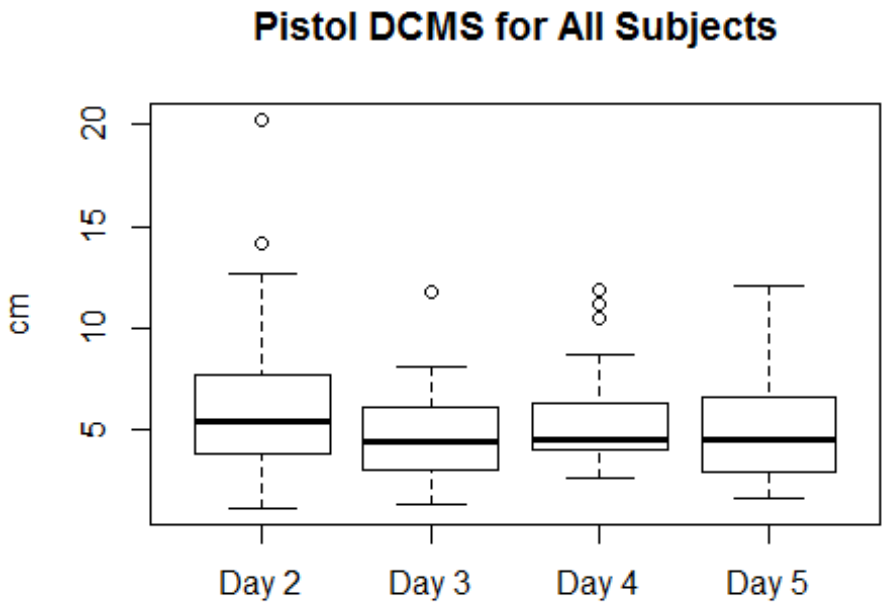

Figure 16. Pistol DCMS for all Subjects

As Table 7 indicates, the null hypothesis of normality was rejected for all subjects' pistol mean radius data. The boxplot in Figure 17 does not strongly support a normal distribution. When Bartlett's Test was performed on these data, the resulting K^2 was 20.514 and the p-value was 0.0001328, which rejected the null hypothesis of homoscedasticity. The Brunner-Dette-Munk Test yielded an F value of 1.667709 and a p-value of 0.1768368, thus failing to reject the null hypothesis of equality of distribution functions. As such, the analysis provides no evidence of a change in mean radius during days 2-5.

Table 7. All Subjects Pistol Mean Radius Shapiro-Wilk Test Results

Day	W	P-Value
2	0.83763	3.12E-05
3	0.92717	0.01041
4	0.88819	0.00065
5	0.85113	6.67E-05

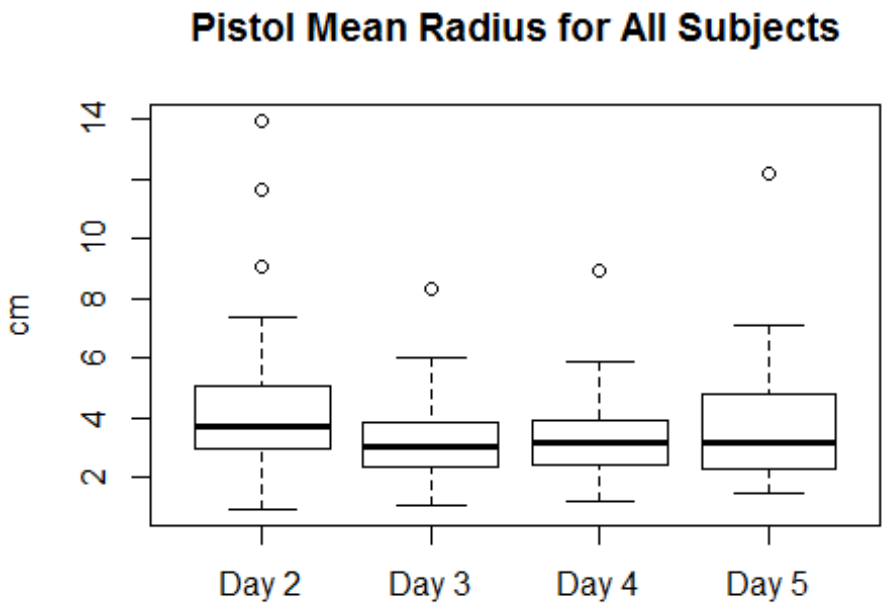

Figure 17. Pistol Mean Radius Data for All Subjects

4.1.1.4.2 Rifle Data for All Subjects

As Table 8 indicates, the null hypothesis of normality was rejected for days 4 and 5 of all subjects' rifle group size data. The boxplot in Figure 18 does not strongly support a normal distribution. When Bartlett's Test was performed on these data, the resulting K^2 was 13.069 and the p-value was 0.004489, which rejected the null hypothesis of homoscedasticity. The Brunner-Dette-Munk Test yielded an F value of 1.069877 and a p-value of 0.3630315, thus failing to reject the null hypothesis of equality of distribution functions. As such, the analysis provides no evidence of a change in group size during days 2-5.

Table 8. All Subjects Rifle Group Size Shapiro-Wilk Test Results

Day	W	P-Value
2	0.97743	0.564
3	0.97697	0.5472
4	0.92054	0.006298
5	0.94075	0.03034

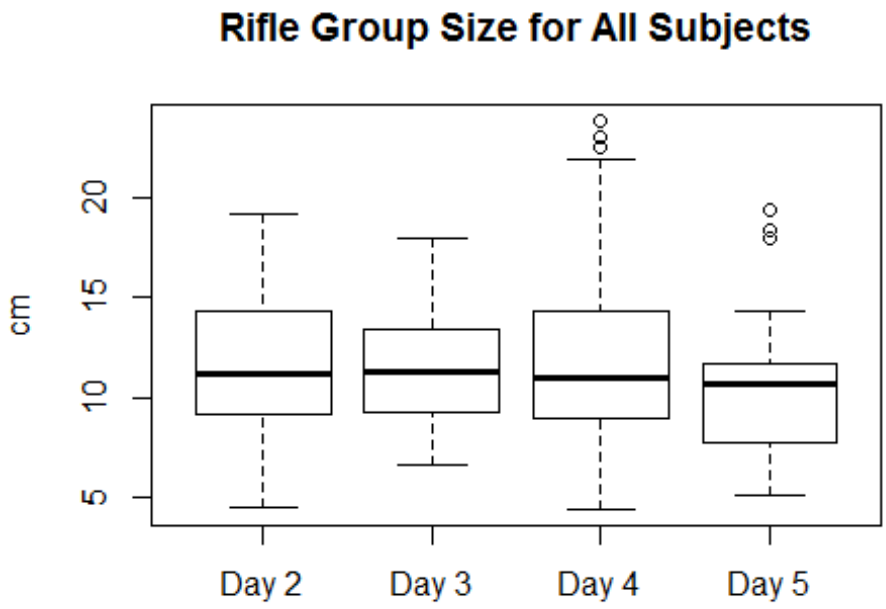

Figure 18. Rifle Group Size Data for All Subjects

As Table 9 indicates, the null hypothesis of normality was rejected for day 3 all subjects' MPI to CZP Distance data. The boxplot in Figure 19 does not strongly support a normal distribution. When Bartlett's Test was performed on these data, the resulting K^2 was 10.432 and the p-value was 0.01523, which rejected the null hypothesis of homoscedasticity. The Brunner-Dette-Munk Test yielded an F value of 0.790427 and a p-value of 0.4976514, thus failing to reject the null hypothesis of equality of distribution functions. As such, the analysis provides no evidence of a change in MPI to CZP distance during days 2-5.

Table 9. All Subjects Rifle MPI to CZP Distance Shapiro-Wilk Test Results

Day	W	P-Value
2	0.97527	0.4875
3	0.87729	0.000322
4	0.9568	0.1133
5	0.97969	0.6495

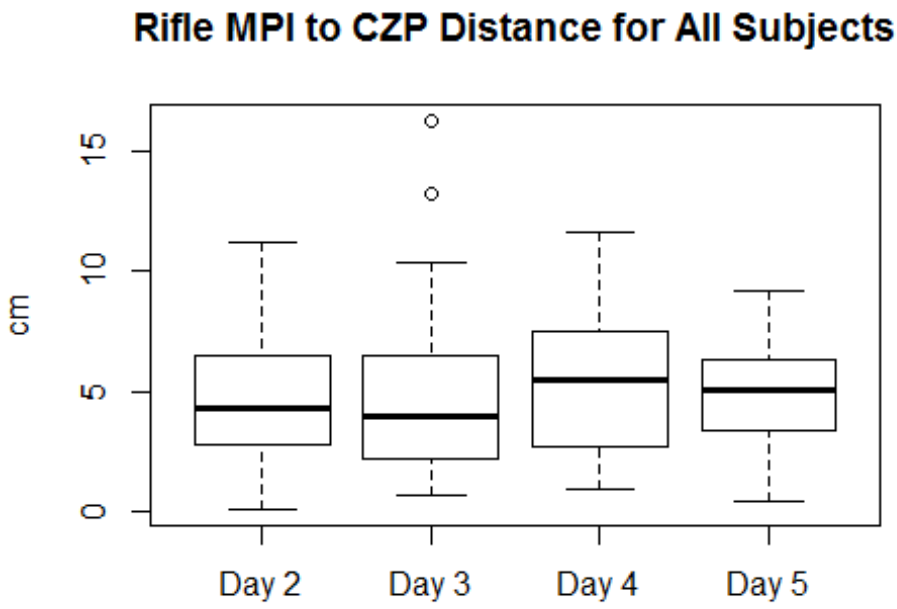

Figure 19. Rifle MPI to CZP Distance Data for All Subjects

As Table 10 indicates, the null hypothesis of normality was rejected for day 2 of all subjects' rifle DCMS data. The boxplot in Figure 20 does not strongly support a normal distribution. When Bartlett's Test was performed on these data, the resulting K^2 was 7.5169 and the p-value was 0.05713, which failed to reject the null hypothesis of homoscedasticity. The Kruskal-Wallis Test yielded a X^2 value of 3.1981 and a p-value of 0.3621, thus failing to reject the null hypothesis of equality of dataset medians. As such, the analysis provides no evidence of a change in DCMS during days 2-5.

Table 10. All Subjects Rifle DCMS Shapiro-Wilk Test Results

Day	W	P-Value
2	0.95101	0.07022
3	0.83626	2.90E-05
4	0.9816	0.7361
5	0.98257	0.7601

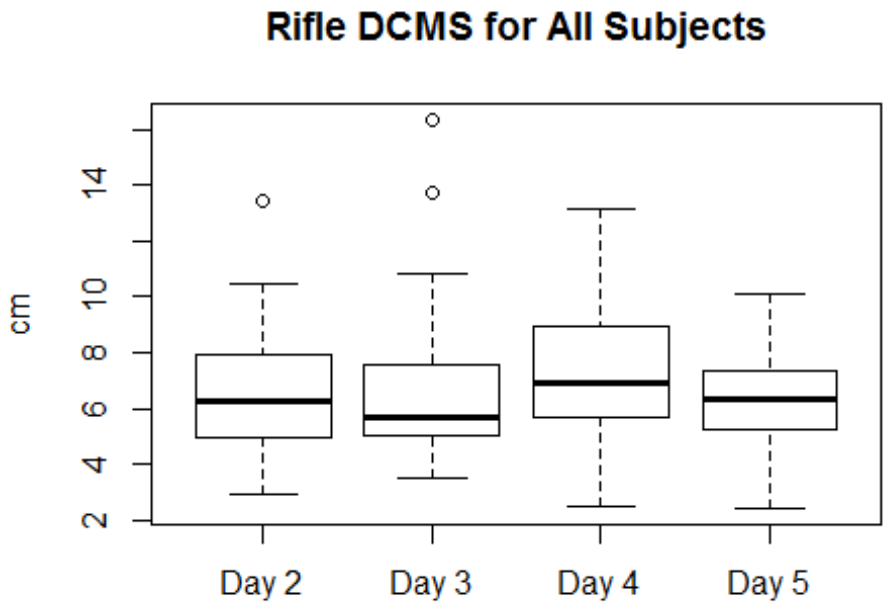

Figure 20. Rifle DCMS Data for All Subjects

As Table 11 indicates, the null hypothesis of normality was rejected for days 4 and 5 of all subjects' rifle mean radius data. The boxplot in Figure 21 does not strongly support a normal distribution. When Bartlett's Test was performed on these data, the resulting K^2 was 11.447 and the p-value was 0.009538, which rejected the null hypothesis of homoscedasticity. The Brunner-Dette-Munk test yielded an F value of 1.662118 and a p-value of 0.1791376, thus failing to reject the null hypothesis of equality of distribution functions. As such, the analysis provides no evidence of change in mean radius during days 2-5.

Table 11. All Subjects Rifle Mean Radius Shapiro-Wilk Test Results

Day	W	P-Value
2	0.98344	0.7926
3	0.97779	0.5775
4	0.90713	0.00271
5	0.92074	0.006393

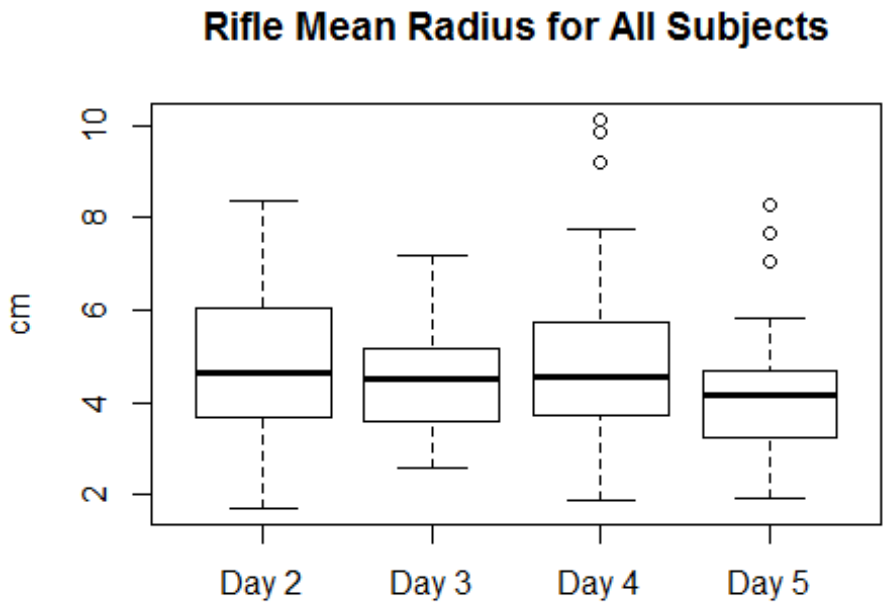

Figure 21. Rifle Mean Radius Data for All Subjects

4.1.1.4.3 Pistol Data for Experienced Subjects

As Table 12 indicates, the null hypothesis of normality was rejected for days 4 and 5. The boxplot in Figure 22 does not provide information to the contrary. When Bartlett's Test was performed on these data, the resulting K^2 was 2.9197 and the p-value was 0.4042, which failed to reject the null hypothesis of homoscedasticity. The Kruskal-Wallis test yielded a X^2 value of 5.919 and a p-value of 0.1156, thus failing to reject the null hypothesis of equality of dataset medians. As such, the analysis provides no evidence of a change in group size during days 2-5.

Table 12. Experienced Subjects Pistol Group Size Shapiro-Wilk Test Results

Day	W	P-Value
2	0.9751557	0.7927767
3	0.96484	0.5430018
4	0.9166054	0.0491648
5	0.8466614	0.0018966

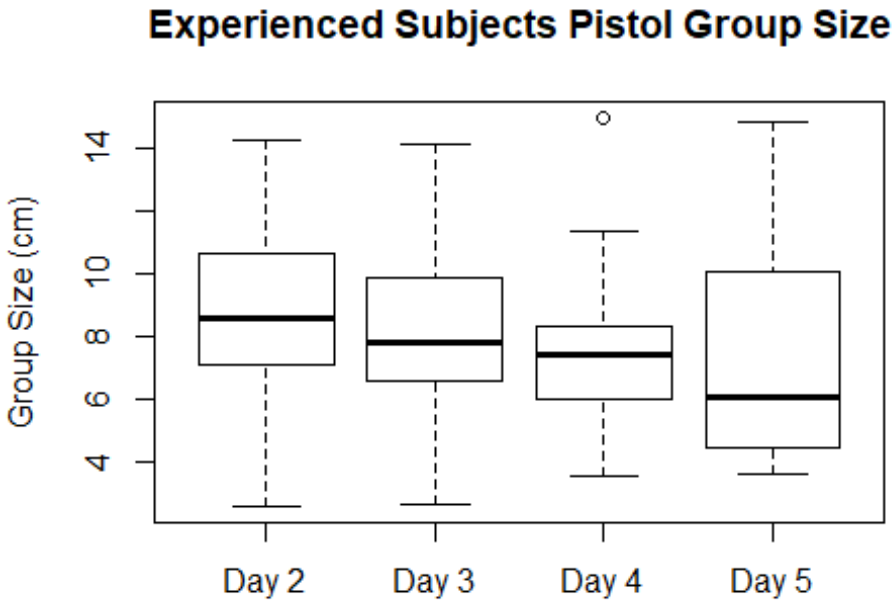

Figure 22. Experienced Subjects Pistol Group Size

As Table 13 indicates, the null hypothesis of normality was rejected for days 3 and 4. The boxplot in Figure 23 does not provide information to the contrary. When Bartlett's Test was performed on these data, the resulting K^2 was 2.4336 and the p-value was 0.4874, which failed to reject the null hypothesis of homoscedasticity. The Kruskal-Wallis test yielded a X^2 value of 9.8918 and a p-value of 0.01951, rejecting the null hypothesis of equality of dataset medians. As Table 14 shows, the only significant differences are between days 3 and 4 and days 4 and 5. These differences are not, however, indicative of a trend because they are not progressive in nature.

Table 13. Experienced Subjects Pistol MPI to CZP Distance Shapiro-Wilk Test Results

Day	W	P-Value
2	0.9255554	0.0775822
3	0.883796	0.0099173
4	0.8876942	0.0119141
5	0.9262214	0.0802784

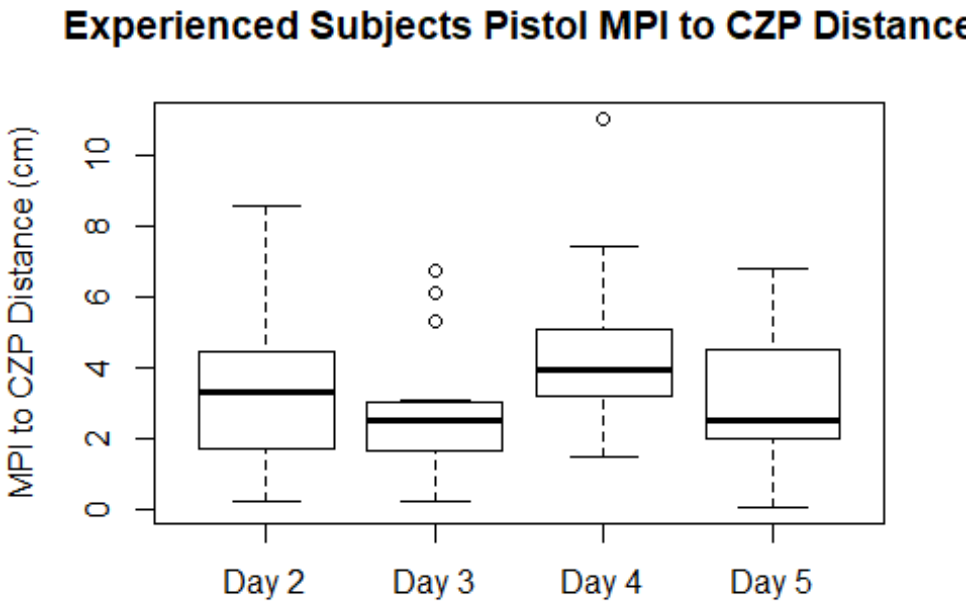

Figure 23. Experienced Subjects Pistol MPI to CZP Distance

Table 14. Experienced Subjects Pistol MPI to CZP Distance Dunn's Test Results

Days	Z	P-Value
2 & 3	1.19173	0.11668
2 & 4	-1.8705	0.03071
2 & 5	0.26425	0.39579
3 & 4	-3.06224	0.0011
3 & 5	-0.92748	0.17684
4 & 5	2.13476	0.01639

As Table 15 indicates, the null hypothesis of normality was rejected for days 4 and 5. The boxplot in Figure 24 does not provide information to the contrary. When Bartlett's Test was performed on these data, the resulting K^2 was 1.5108 and the p-value was 0.6798, which failed to reject the null hypothesis of homoscedasticity. The Kruskal-Wallis

test yielded a X^2 value of 6.638 and a p-value of 0.08438, failing to reject the null hypothesis of equality of dataset medians. As such, the analysis does not provide evidence of a change in DCMS during days 2-5.

Table 15. Experienced Subjects Pistol DCMS Shapiro-Wilk Test Results

Day	W	P-Value
2	0.9701117	0.6697473
3	0.9784591	0.8658544
4	0.8256095	0.0007965
5	0.9104593	0.0360888

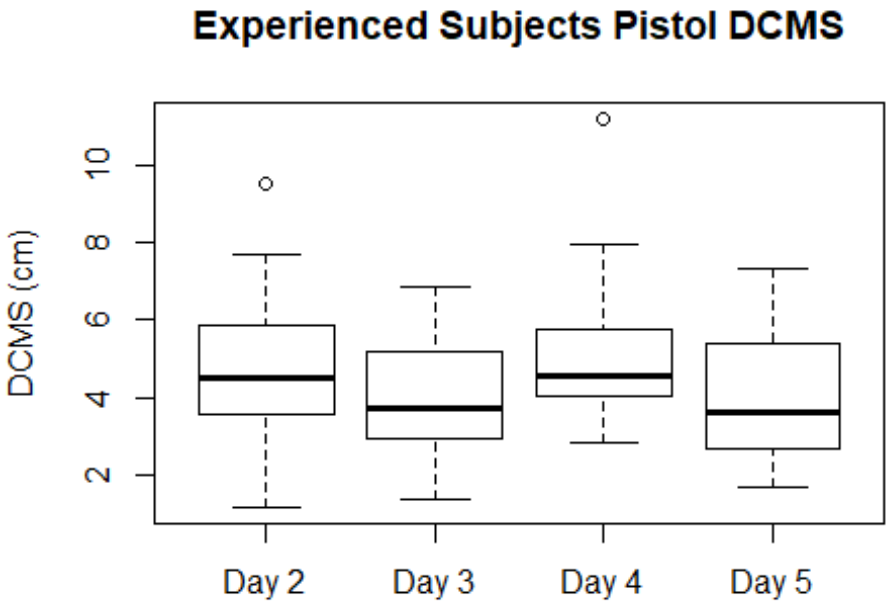

Figure 24. Experienced Subjects Pistol DCMS

As Table 16 indicates, the null hypothesis of normality was rejected for days 4 and 5. The boxplot in Figure 25 does not provide information to the contrary. When Bartlett's Test was performed on these data, the resulting K^2 was 3.7943 and the p-value was 0.2847, which failed to reject the null hypothesis of homoscedasticity. The Kruskal-Wallis test yielded a X^2 value of 5.5405 and a p-value of 0.1362, failing to reject the null hypothesis of equality of dataset medians. As such, the analysis does not provide evidence of a change in mean radius during days 2-5.

Table 16. Experienced Subjects Pistol Mean Radius Shapiro-Wilk Test Results

Day	W	P-Value
2	0.9681227	0.6209021
3	0.9796195	0.88875
4	0.9097156	0.0347727
5	0.8336741	0.0011043

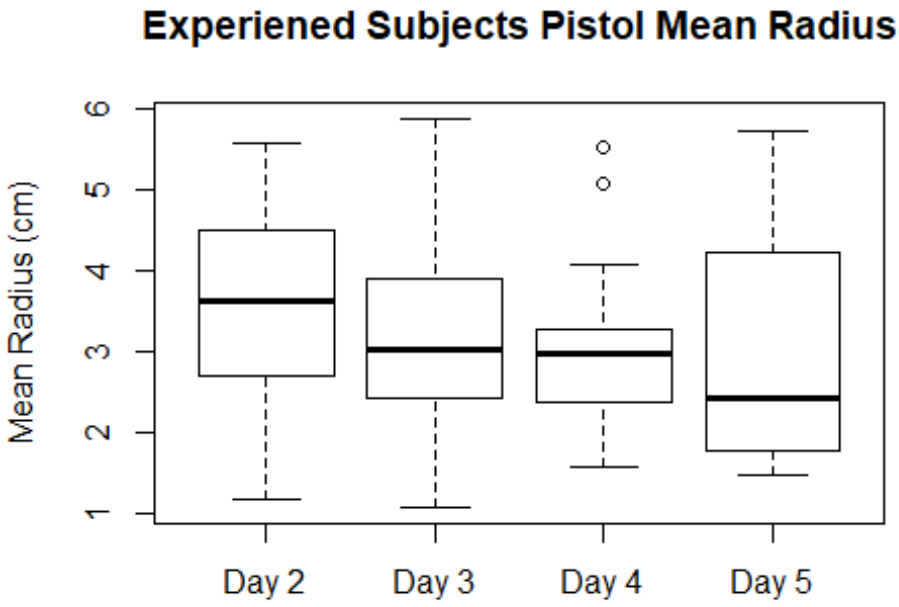

Figure 25. Experienced Subjects Pistol Mean Radius

4.1.1.4.4 Pistol Data for Inexperienced Subjects

As Table 17 indicates, the null hypothesis of normality was rejected for days 2 and 3. The boxplot in Figure 26 does not provide information to the contrary. When Bartlett's Test was performed on these data, the resulting K^2 was 10.479 and the p-value was 0.0149, which rejected the null hypothesis of homoscedasticity. The Brunner-Dette-Munk test yielded an F value of 3.402117 and a p-value of 0.02814133, rejecting the null hypothesis of equality of distribution functions. Despite this rejection of the null hypothesis, the REGWQ test failed to reject the null hypothesis for any of its pairwise comparisons. There is therefore no evidence of statistically significant differences. As such, the analysis provides no evidence of a change in group size during days 2-5.

Table 17. Inexperienced Subjects Pistol Group Size Shapiro-Wilk Test Results

Day	W	P-Value
2	0.82948	0.020675
3	0.737617	0.00199
4	0.932971	0.412665
5	0.920654	0.291379

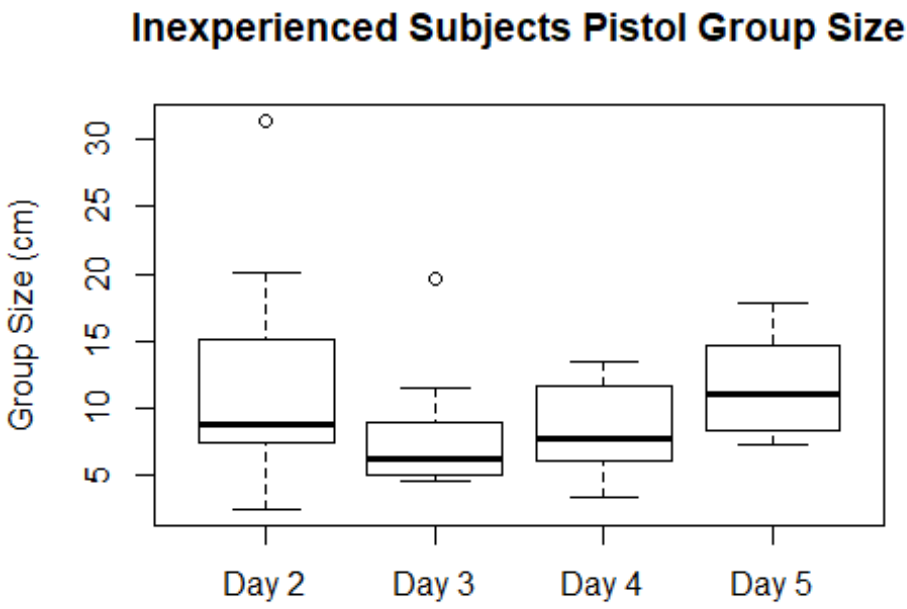

Figure 26. Inexperienced Subjects Pistol Group Size

As Table 18 indicates, the null hypothesis of normality was rejected for day 4. The boxplot in Figure 27 does not provide information to the contrary. When Bartlett's Test was performed on these data, the resulting K^2 was 2.0354 and the p-value was 0.5651, which failed to reject the null hypothesis of homoscedasticity. The Kruskal-Wallis test yielded a X^2 value of 5.1939 and a p-value of 0.1581, failing to reject the null hypothesis of equality of dataset medians. As such, the analysis provides no evidence of a change in MPI to CZP distance during days 2-5.

Table 18. Inexperienced Subjects Pistol MPI to CZP Distance Shapiro-Wilk Test Results

Day	W	P-Value
2	0.917713	0.267537
3	0.931357	0.394723
4	0.745672	0.002409
5	0.922575	0.307967

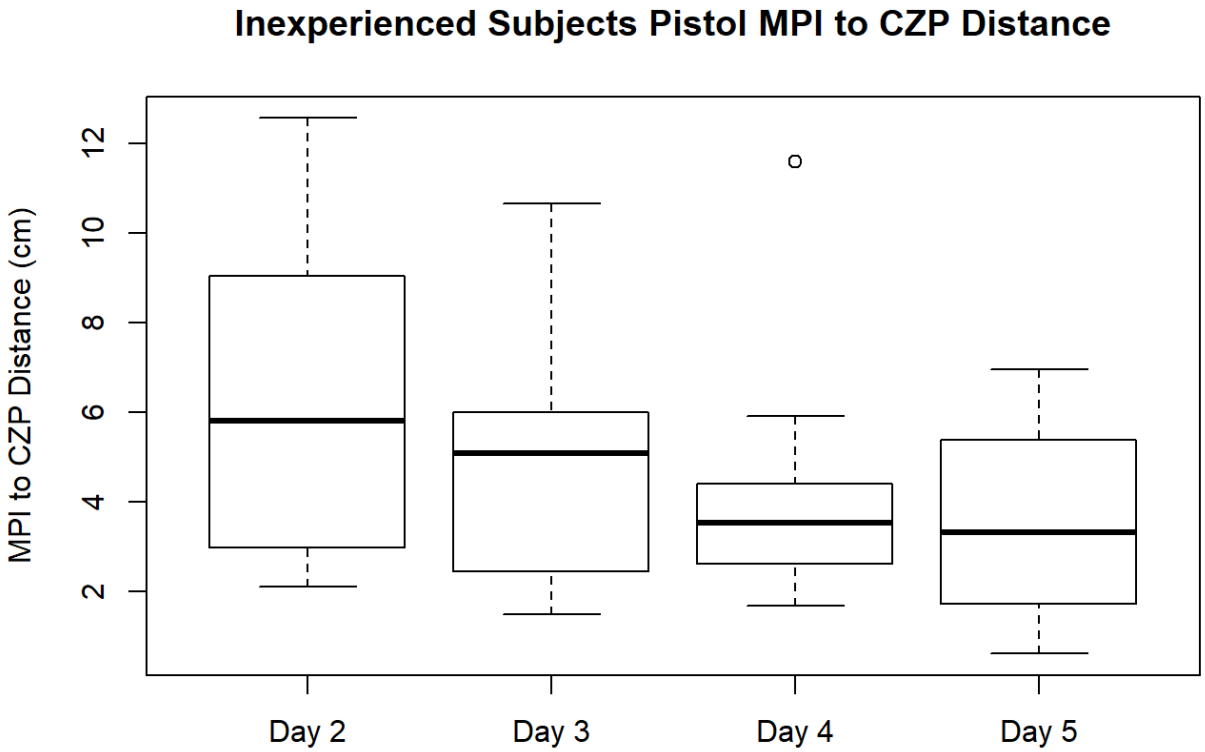

Figure 27. Inexperienced Subjects Pistol MPI to CZP Distance

As Table 19 indicates, the null hypothesis of normality was rejected for day 4. The boxplot in Figure 28 does not provide information to the contrary. When Bartlett's Test was performed on these data, the resulting K^2 was 3.8412 and the p-value was 0.2791, which failed to reject the null hypothesis of homoscedasticity. The Kruskal-Wallis test yielded a X^2 value of 4.7713 and a p-value of 0.1893, failing to reject the null hypothesis of equality of dataset medians. As such, the analysis provides no evidence of a change in DCMS during days 2-5.

Table 19. Inexperienced Subjects Pistol DCMS Shapiro-Wilk Test Results

Day	W	P-Value
2	0.919963	0.285604
3	0.899037	0.154142
4	0.831262	0.021716
5	0.92411	0.321824

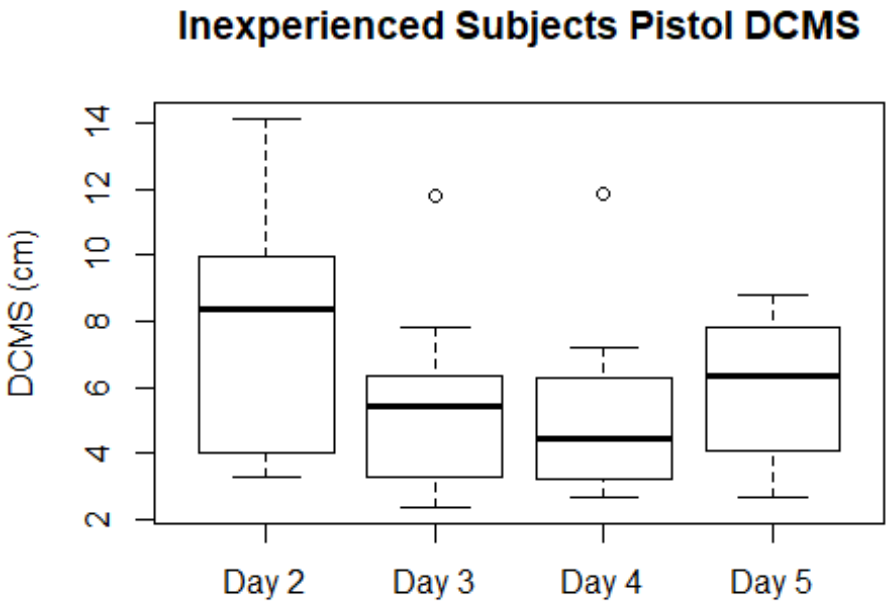

Figure 28. Inexperienced Subjects Pistol DCMS

As Table 20 indicates, the null hypothesis of normality was rejected for days 2 and 3. The boxplot in Figure 29 does not provide information to the contrary. When Bartlett's Test was performed on these data, the resulting K^2 was 6.2437 and the p-value was 0.1003, which failed to reject the null hypothesis of homoscedasticity. The Kruskal-Wallis test yielded a X^2 value of 7.1403 and a p-value of 0.06756, failing to reject the null hypothesis of equality of dataset medians. As such, the analysis provides no evidence of a change in mean radius during days 2-5.

Table 20. Inexperienced Subjects Pistol Mean Radius Shapiro-Wilk Test Results

Day	W	P-Value
2	0.852155	0.039037
3	0.75951	0.003365
4	0.935596	0.443209
5	0.896953	0.144886

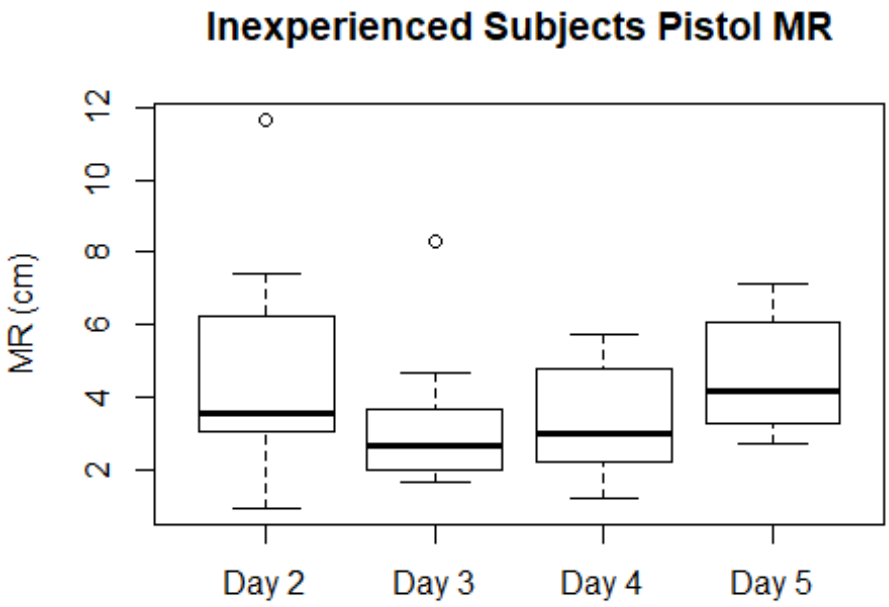

Figure 29. Inexperienced Subjects Pistol Mean Radius

4.1.1.4.5 Rifle Data for Experienced Subjects

As Table 21 indicates, the null hypothesis of normality was not rejected for any days. The boxplot in Figure 30 is not, however, strongly supportive of a normal distribution. When Bartlett's Test was performed on these data, the resulting K^2 was 7.3161 and the p-value was 0.06248, which failed to reject the null hypothesis of homoscedasticity. The Kruskal-Wallis test yielded a X^2 value of 1.7884 and a p-value of 0.6175, failing to reject the null hypothesis of equality of dataset medians. As such, the analysis provides no evidence of a change in group size during days 2-5.

Table 21. Experienced Subjects Rifle Group Size Shapiro-Wilk Test Results

Day	W	P-Value
2	0.9713224	0.6996952
3	0.9713297	0.6998757
4	0.9704841	0.6789547
5	0.9772814	0.8409726

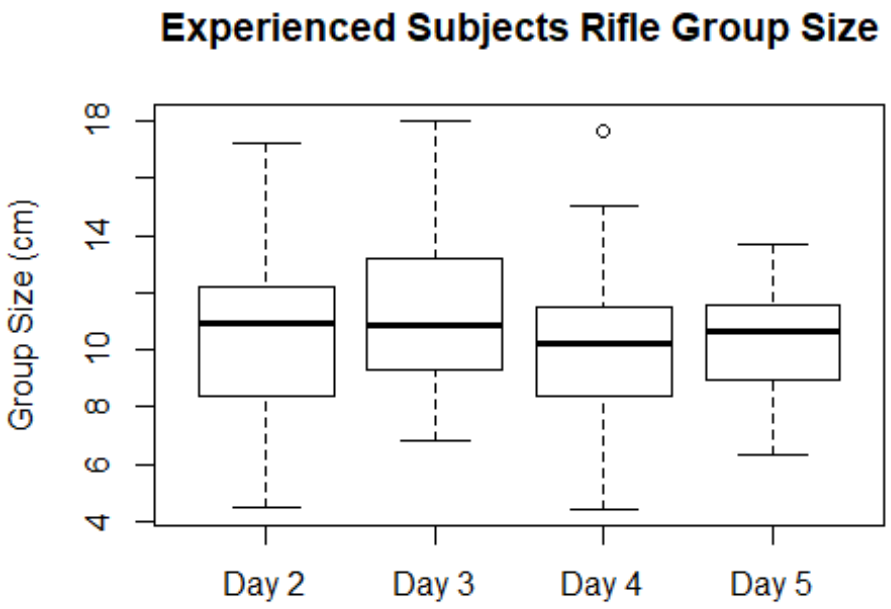

Figure 30. Experienced Subjects Rifle Group Size

As Table 22 indicates, the null hypothesis of normality was rejected for day 3. The boxplot in Figure 31 does not provide information to the contrary. When Bartlett's Test was performed on these data, the resulting K^2 was 10.127 and the p-value was 0.01751, which rejected the null hypothesis of homoscedasticity. The Brunner-Dette-Munk test yielded an F value of 1.589893 and a p-value of 0.1985974, failing to reject the null hypothesis of equality of distribution functions. As such, the analysis provides no evidence of a change in MPI to CZP distance during days 2-5.

Table 22. Experienced Subjects Rifle MPI to CZP Distance Shapiro-Wilk Test Results

Day	W	P-Value
2	0.9534984	0.3220215
3	0.8162298	0.0005493
4	0.9725273	0.7294149
5	0.9771882	0.8389415

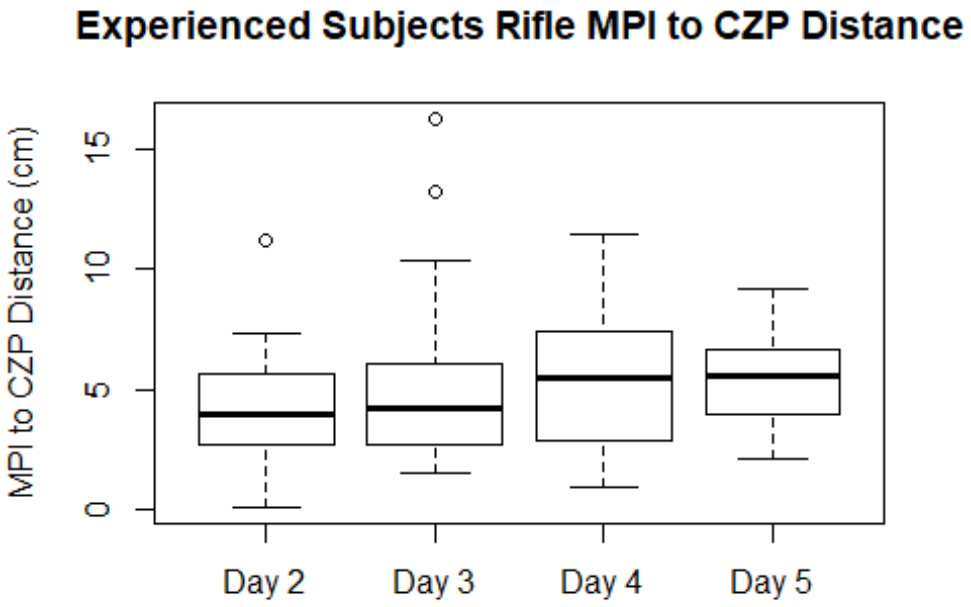

Figure 31. Experienced Subjects Rifle MPI to CZP Distance

As Table 23 indicates, the null hypothesis of normality was rejected for days 2 and 3. The boxplot in Figure 32 does not provide information to the contrary. When Bartlett's Test was performed on these data, the resulting K^2 was 9.7794 and the p-value was 0.02054, which rejected the null hypothesis of homoscedasticity. The Brunner-Dette-Munk test yielded an F value of 1.50276 and a p-value of 0.2195349, failing to reject the null hypothesis of equality of distribution functions. As such, the analysis provides no evidence of a change in DCMS during days 2-5.

Table 23. Experienced Subjects Rifle DCMS Shapiro-Wilk Test Results

Day	W	P-Value
2	0.8356841	0.0011993
3	0.7680956	0.0000926
4	0.9694445	0.6532832
5	0.9722728	0.7231561

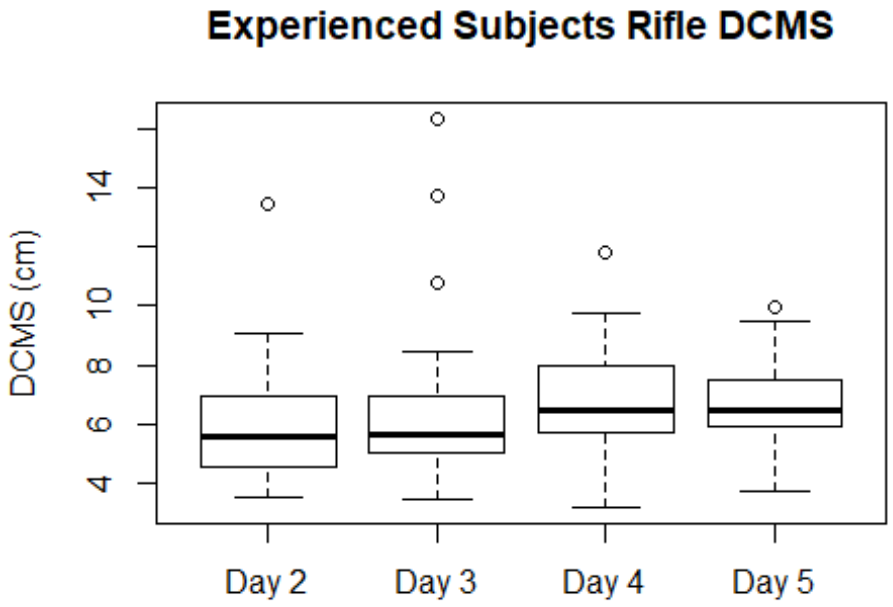

Figure 32. Experienced Subjects Rifle DCMS

As Table 24 indicates, the null hypothesis of normality was not rejected for any days. The boxplot in Figure 33 does not provide information to the contrary. When Bartlett's Test was performed on these data, the resulting K^2 was 7.7411 and the p-value was 0.05168, which failed to reject the null hypothesis of homoscedasticity. When an ANOVA was performed, the resulting F value was 0.265 and the p-value was 0.851, which failed to reject the null hypothesis of equality of dataset means. As the graph in Figure 34 shows, however, the ANOVA residuals exhibit some deviation from normality in the top quantiles. Since normally distributed residuals are an assumption required for ANOVA, the Kruskal-Wallis test was performed, yielding a X^2 value of 0.83988 and a p-value of 0.8399, failing to reject the null hypothesis of equality of dataset medians. As such, the analysis provides no evidence of a change in mean radius during days 2-5.

Table 24. Experienced Subjects Rifle Mean Radius Shapiro-Wilk Test Results

Day	W	P-Value
2	0.9702943	0.6742597
3	0.9759051	0.8101756
4	0.978982	0.876385
5	0.9801422	0.8984698

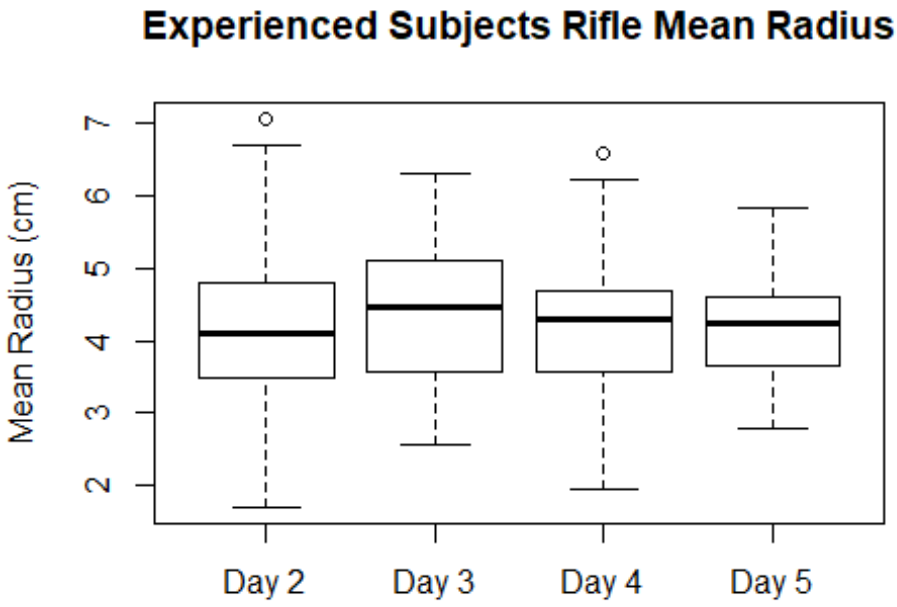

Figure 33. Experienced Subjects Rifle Mean Radius

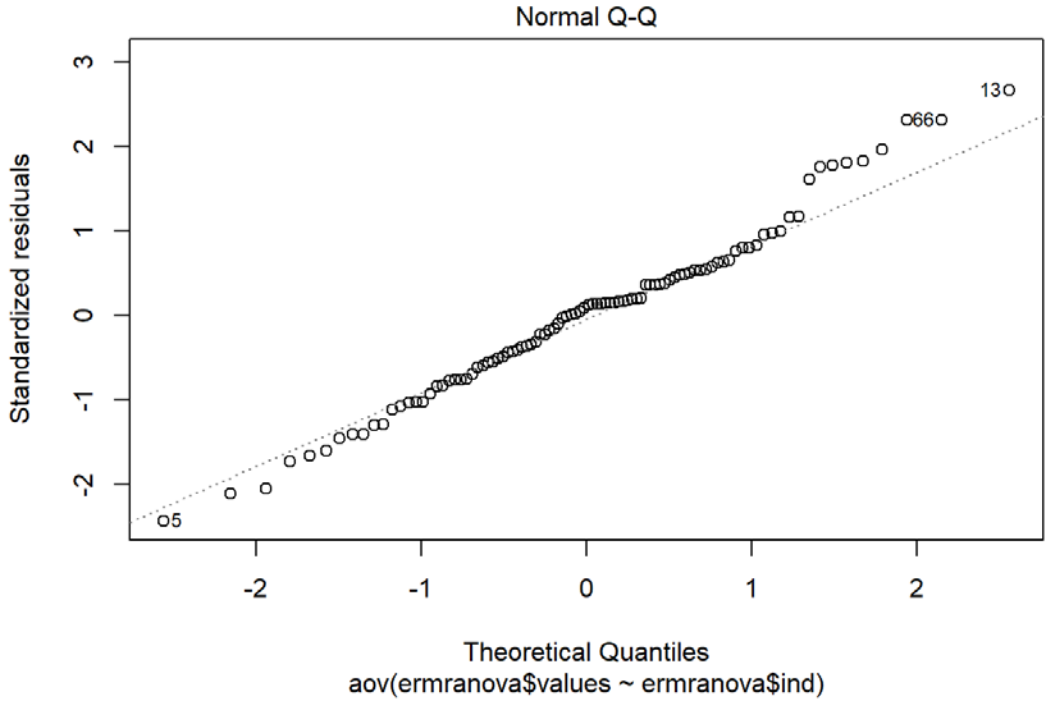

Figure 34. Experienced Subjects Rifle MR ANOVA Residuals QQ Plot

4.1.1.4.6 Rifle Data for Inexperienced Subjects

As Table 25 indicates, the null hypothesis of normality was not rejected for any days. The boxplot in Figure 35 is not, however, indicative of a normal distribution. When Bartlett's Test was performed on these data, the resulting K^2 was 8.3773 and the p-value was 0.003882, which rejected the null hypothesis of homoscedasticity. The Brunner-Dette-Munk test yielded an F value of 2.508499 and a p-value of 0.0737523, failing to reject the null hypothesis of equality of distribution functions. As such, the analysis provides no evidence of a change in group size during days 2-5.

Table 25. Inexperienced Subjects Rifle Group Size Shapiro-Wilk Test Results

Day	W	P-Value
2	0.926821	0.347626
3	0.908272	0.202728
4	0.943159	0.540047
5	0.936879	0.458725

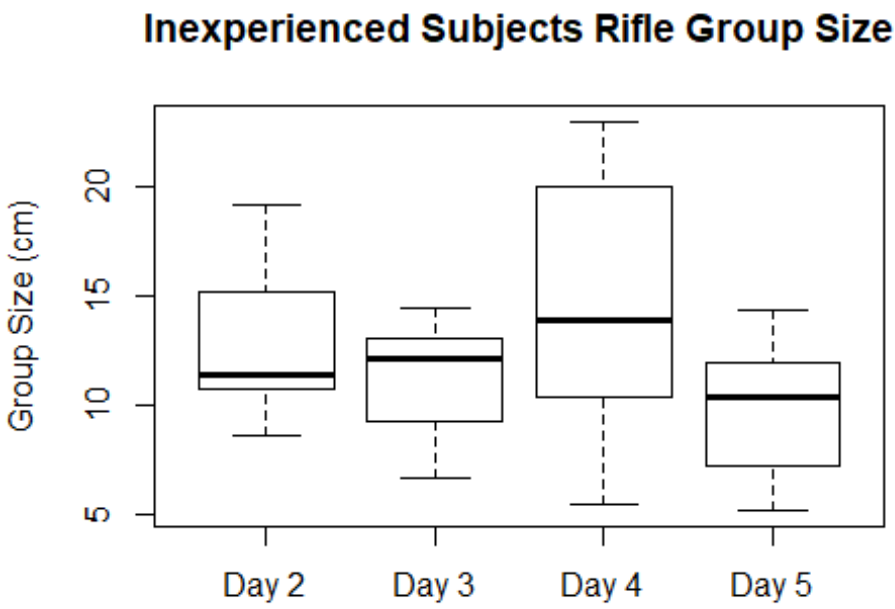

Figure 35. Inexperienced Subjects Rifle Group Size

As Table 26 indicates, the null hypothesis of normality was not rejected for any days. The boxplot in Figure 36 is not, however, indicative of a normal distribution. When Bartlett's Test was performed on these data, the resulting K^2 was 4.3878 and the p-value was 0.2225, which failed to reject the null hypothesis of homoscedasticity. The Kruskal-Wallis test yielded an F value of 1.2764 and a p-value of 0.7348, failing to reject the null hypothesis of equality of dataset medians. As such, the analysis provides no evidence of a change in MPI to CZP distance during days 2-5.

Table 26. Inexperienced Subjects Rifle MPI to CZP Distance Shapiro-Wilk Test Results

Day	W	P-Value
2	0.940044	0.498641
3	0.884976	0.101531
4	0.864742	0.056075
5	0.942258	0.527872

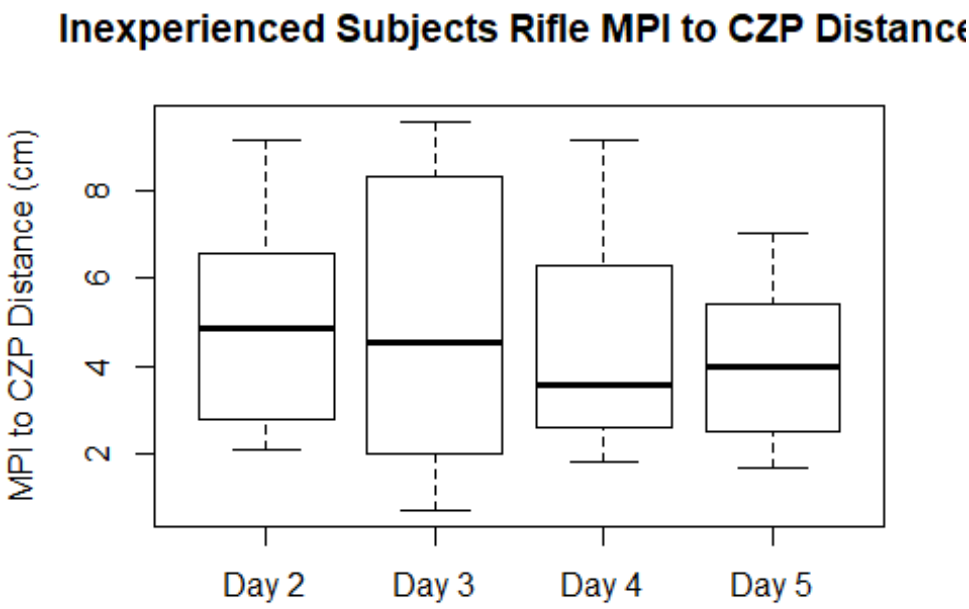

Figure 36. Inexperienced Subjects Rifle MPI to CZP Distance

As Table 27 indicates, the null hypothesis of normality was not rejected for any days. The boxplot in Figure 37 is not, however, indicative of a normal distribution. When Bartlett's Test was performed on these data, the resulting K^2 was 5.0823 and the p-value was 0.1659, which failed to reject the null hypothesis of homoscedasticity. The Kruskal-Wallis test yielded a X^2 value of 5.0354 and a p-value of 0.1348, failing to reject the null hypothesis of equality of dataset medians. As such, the analysis provides no evidence of a change in DCMS during days 2-5.

Table 27. Inexperienced Subjects Rifle DCMS Shapiro-Wilk Test Results

Day	W	P-Value
2	0.952379	0.67198
3	0.914546	0.24388
4	0.963411	0.83119
5	0.912813	0.23178

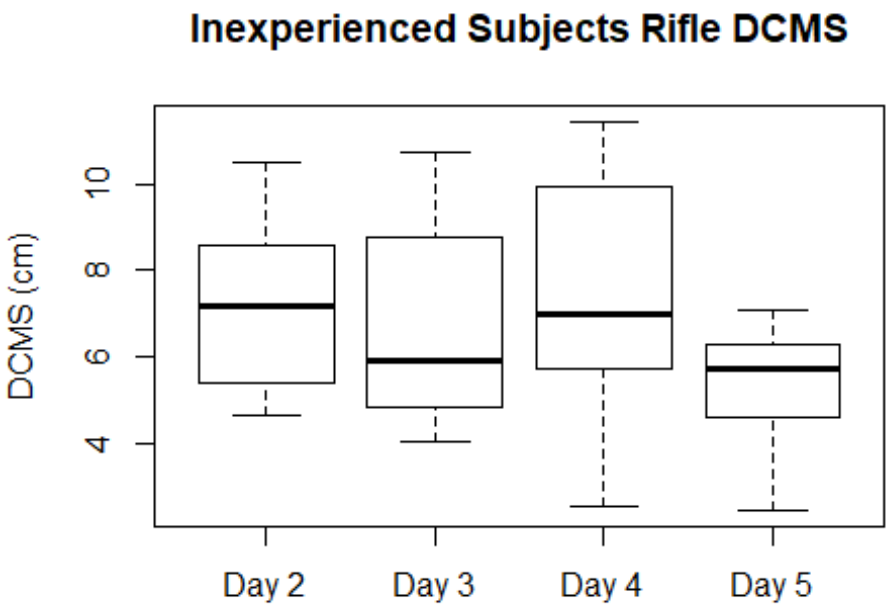

Figure 37. Inexperienced Subjects Rifle DCMS

As Table 28 indicates, the null hypothesis of normality was not rejected for any days. The boxplot in Figure 38 is not, however, indicative of a normal distribution. When Bartlett's Test was performed on these data, the resulting K^2 was 8.9485 and the p-value was 0.02998, which rejected the null hypothesis of homoscedasticity. The Brunner-Dette-Munk test yielded an F value of 4.798265 and a p-value of 0.006580139, rejecting the null hypothesis of equality of distribution functions. As Table 29 shows, the only significant differences were between days 2 and 5 and days 4 and 5. These differences are not, however, indicative of a trend because they are not progressive in nature.

Table 28. Inexperienced Subjects Rifle Mean Radius Shapiro-Wilk Test Results

Day	W	P-Value
2	0.931077	0.391672
3	0.976702	0.966993
4	0.97	0.910807
5	0.950791	0.648578

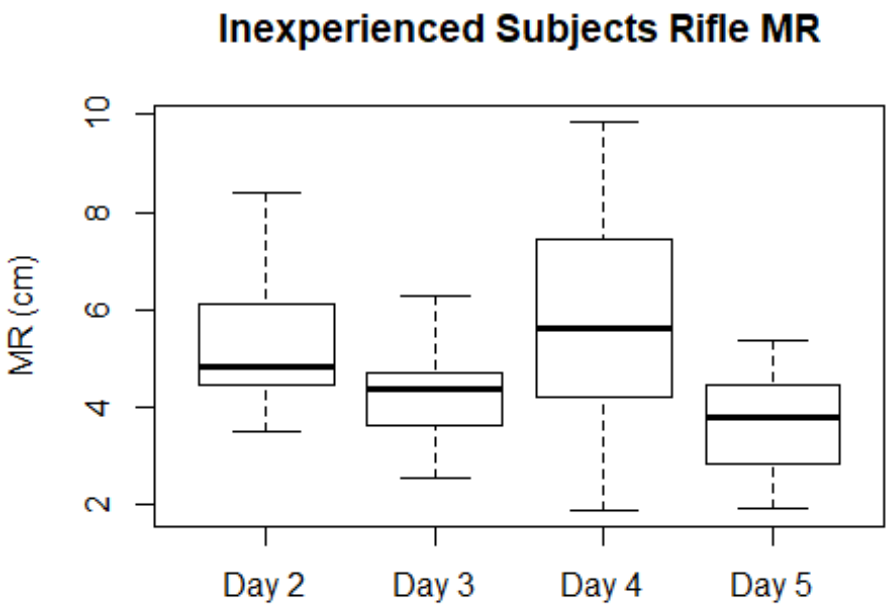

Figure 38. Inexperienced Subjects Rifle Mean Radius

Table 29. Inexperienced Subjects Rifle Mean Radius REGWQ Test Results

Days	Statistic	Adj. P-Values	CI
2 & 3	2.1855	0.1294	0.9864
2 & 4	1.1894	0.4049	0.5368
2 & 5	3.58	0.0391	1.6158
3 & 4	3.3749	0.0547	1.5232
3 & 5	1.3945	0.3295	0.6294
4 & 5	4.7694	0.0082	2.1526

4.1.1.4.7 Experienced and Inexperienced Pistol Data Comparison

As Table 30 indicates, the null hypothesis of normality was rejected for experienced subjects on days 4 and 5 and for inexperienced subjects on days 2 and 3. The boxplot in Figure 39 does not provide information to the contrary. When Bartlett's Test was performed on these data, the resulting K^2 was 30.68 and the p-value was 7.122e-05, which rejected the null hypothesis of homoscedasticity. The Brunner-Dette-Munk test yielded an F value of 3.325502 and a p-value of 0.005955575, rejecting the null hypothesis of equality of distribution functions.

Table 30. Experienced and Inexperienced Subjects Pistol Group Size Shapiro-Wilk Test Results

Dataset	W	P-Value
Exp. Day 2	0.97516	0.79278
Inexp. Day 2	0.82948	0.02067
Exp. Day 3	0.96484	0.543
Inexp. Day 3	0.73762	0.00199
Exp. Day 4	0.91661	0.04916
Inexp. Day 4	0.93297	0.41266
Exp. Day 5	0.84666	0.0019
Inexp. Day 5	0.92065	0.29138

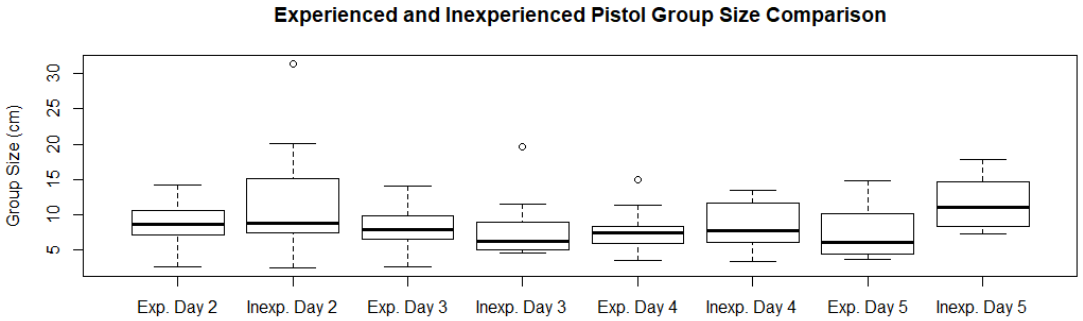

Figure 39. Experienced and Inexperienced Subjects Pistol Group Size

As Table 31 indicates, there were statistically significant differences between experienced and inexperienced subjects only on day 5.

Table 31. Experienced and Inexperienced Subjects Pistol Group Size REGWQ Test Results

Day	Statistic	Adj. P-Value	CI
2	3.2142	0.0631	3.0679
3	0.3548	0.8023	0.3387
4	0.9492	0.9078	0.906
5	4.6675	0.0206	4.455

As Table 32 indicates, the null hypothesis of normality was rejected for experienced subjects on days 3 and 4 and for inexperienced subjects on days 4 and 5. The boxplot in Figure 40 does not provide information to the contrary. When Bartlett's Test was performed on these data, the resulting K^2 was 13.73 and the p-value was 0.05619, which failed to reject the null hypothesis of homoscedasticity. The Kruskal-Wallis test yielded a X^2 value of 21.727 and a p-value of 0.0002831 rejecting the null hypothesis of equality of dataset medians. While this null hypothesis was rejected, the results of Dunn's test in Table 33 indicate that there were significant differences between experienced and inexperienced subjects only on days 2 and 3.

Table 32. Experienced and Inexperienced Subjects Pistol MPI to CZP Distance Shapiro-Wilk Test Results

Dataset	W	P-Value
Exp. Day 2	0.92556	0.07758
Inexp. Day 2	0.91771	0.26754
Exp. Day 3	0.8838	0.00992
Inexp. Day 3	0.93136	0.39472
Exp. Day 4	0.88769	0.01191
Inexp. Day 4	0.74567	0.00241
Exp. Day 5	0.92622	0.08028
Inexp. Day 5	0.74567	0.00241

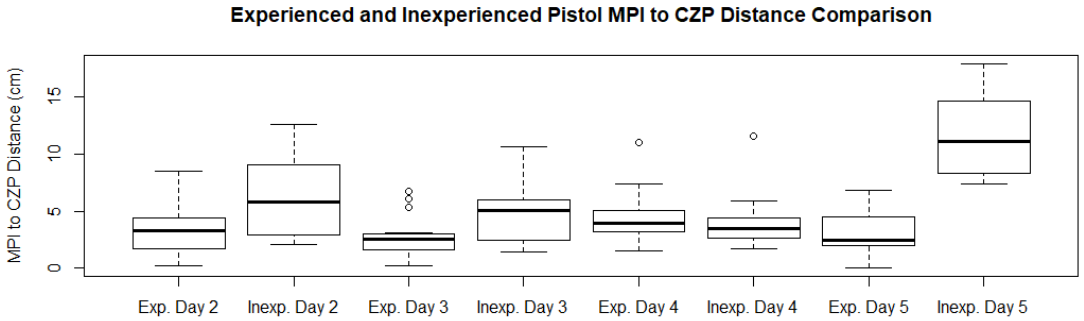

Figure 40. Experienced and Inexperienced Subjects Pistol MPI to CZP Distance

Table 33. Experienced and Inexperienced Subjects Pistol MPI to CZP Distance Dunn's Test Results

Days	Z	P-Value
2	-2.7179	0.0033
3	-2.814	0.0024
4	0.45487	0.3246
5	-0.5425	0.2938

As Table 34 indicates, the null hypothesis of normality was rejected for experienced subjects on days 4 and 5 and for inexperienced subjects on day 4. The boxplot in Figure 41 does not provide information to the contrary. When Bartlett's Test was performed on these data, the resulting K^2 was 19.723 and the p-value was 0.001408, which rejected the null hypothesis of homoscedasticity. The Brunner-Dette-Munk test yielded an F value of 1.995968 and a p-value of 0.106942 failing to reject the null hypothesis of equality of distribution functions. As such, the analysis provides no evidence of a change in DCMS during days 2-5.

Table 34. Experienced and Inexperienced Subjects Pistol DCMS Shapiro-Wilk Test Results

Dataset	W	P-Value
Exp. Day 2	0.97011	0.66975
Inexp. Day 2	0.91996	0.2856
Exp. Day 3	0.97846	0.86585
Inexp. Day 3	0.89904	0.15414
Exp. Day 4	0.82561	0.0008
Inexp. Day 4	0.83126	0.02172
Exp. Day 5	0.91046	0.03609
Inexp. Day 5	0.92411	0.32182

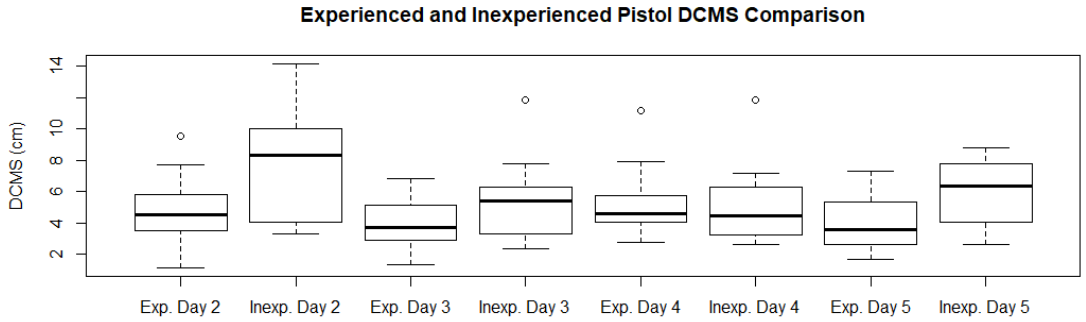

Figure 41. Experienced and Inexperienced Subjects Pistol DCMS

As Table 35 indicates, the null hypothesis of normality was rejected for experienced subjects on days 4 and 5 and for inexperienced subjects on days 2 and 3. The boxplot in Figure 42 does not provide information to the contrary. When Bartlett's Test was performed on these data, the resulting K^2 was 27.578 and the p-value was 0.0002622, which rejected the null hypothesis of homoscedasticity. The Brunner-Dette-Munk test yielded an F value of 2.868689 and a p-value of 0.01472509 rejecting the null hypothesis of equality of distribution functions. While this null hypothesis was rejected, the results of the REGWQ test in Table 36 indicate that significant differences between experienced and inexperienced subjects were present only on day 5.

Table 35. Experienced and Inexperienced Subjects Pistol Mean Radius Shapiro-Wilk Test Results

Dataset	W	P-Value
Exp. Day 2	0.96812	0.6209
Inexp. Day 2	0.85216	0.03904
Exp. Day 3	0.97962	0.88875
Inexp. Day 3	0.75951	0.00336
Exp. Day 4	0.90972	0.03477
Inexp. Day 4	0.9356	0.44321
Exp. Day 5	0.83367	0.0011
Inexp. Day 5	0.89695	0.14489

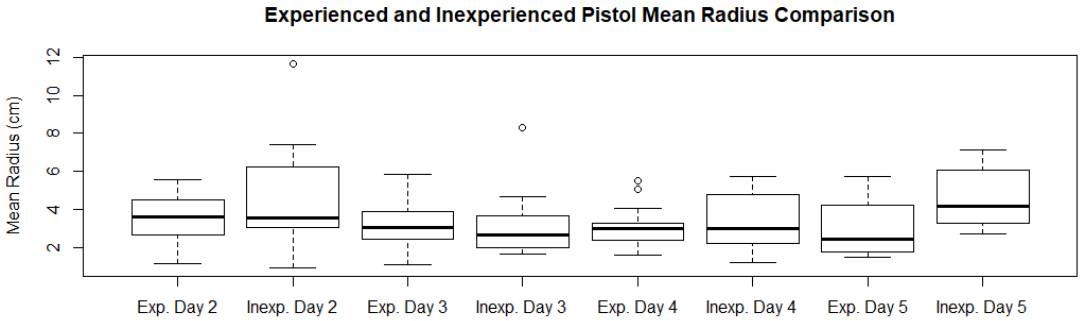

Figure 42. Experienced and Inexperienced Subjects Pistol Mean Radius

Table 36. Experienced and Inexperienced Subjects Pistol Mean Radius REGWQ Test Results

Day	Statistic	P-Value	CI
2	2.9779	0.0924	1.126
3	0.0963	0.9458	0.0364
4	0.9062	0.9186	0.3426
5	4.5458	0.0266	1.7188

4.1.1.4.8 Experienced and Inexperienced Rifle Data Comparison

As Table 37 indicates, the null hypothesis of normality was not rejected for experienced or inexperienced subjects on any days. The boxplot in Figure 43 is not, however, indicative of a normal distribution. When Bartlett's Test was performed on these data, the resulting K^2 was 22.999 and the p-value was 0.001705, which rejected the null hypothesis of homoscedasticity. The Brunner-Dette-Munk test yielded an F value of 1.970595 and a p-value of 0.08144472 failing to reject the null hypothesis of equality of distribution functions. As such, the analysis provides no evidence of a change in group size during days 2-5.

Table 37. Experienced and Inexperienced Subjects Rifle Group Size Shapiro-Wilk Test Results

Dataset	W	P-Value
Exp. Day 2	0.9713224	0.6997
Inexp. Day 2	0.9268205	0.34763
Exp. Day 3	0.9713297	0.69988
Inexp. Day 3	0.9082719	0.20273
Exp. Day 4	0.9704841	0.67895
Inexp. Day 4	0.9431590	0.54005
Exp. Day 5	0.9772814	0.84097
Inexp. Day 5	0.9368787	0.45873

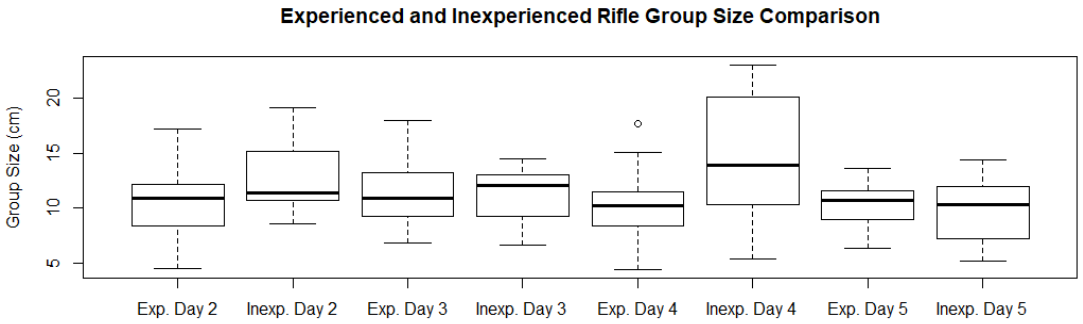

Figure 43. Experienced and Inexperienced Subjects Rifle Group Size

As Table 38 indicates, the null hypothesis of normality was rejected for experienced subjects on days 4 and 5 and for inexperienced subjects on days 2 and 3. The boxplot in Figure 44 does not provide information to the contrary. When Bartlett's Test was performed on these data, the resulting K^2 was 14.888 and the p-value was 0.03746, which rejected the null hypothesis of homoscedasticity. The Brunner-Dette-Munk test yielded an F value of 0.7060654 and a p-value of 0.6359203 failing to reject the null hypothesis of equality of distribution functions. As such, the analysis provides no evidence of a change in MPI to CZP distance during days 2-5.

Table 38. Experienced and Inexperienced Subjects Rifle MPI to CZP Distance Shapiro-Wilk Test Results

Dataset	W	P-Value
Exp. Day 2	0.9751557	0.79278
Inexp. Day 2	0.8294795	0.02067
Exp. Day 3	0.9648400	0.543
Inexp. Day 3	0.7376168	0.00199
Exp. Day 4	0.9166054	0.04916
Inexp. Day 4	0.9329706	0.41266
Exp. Day 5	0.8466614	0.0019
Inexp. Day 5	0.9206544	0.29138

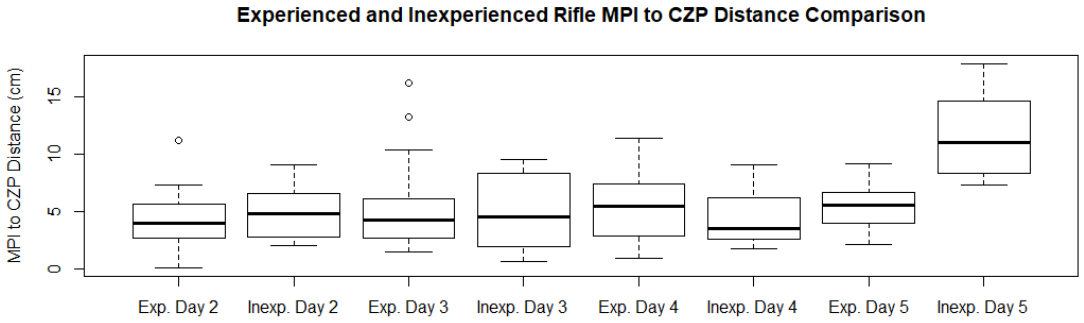

Figure 44. Experienced and Inexperienced Subjects Rifle MPI to CZP Distance

As Table 39 indicates, the null hypothesis of normality was rejected for experienced subjects on days 2 and 3. The boxplot in Figure 45 does not provide information to the contrary. When Bartlett's Test was performed on these data, the resulting K^2 was 15.092 and the p-value was 0.03484, which rejected the null hypothesis of homoscedasticity. The Brunner-Dette-Munk test yielded an F value of 1.607432 and a p-value of 0.1569926 failing to reject the null hypothesis of equality of distribution functions. As such, the analysis provides no evidence of a change in DCMS during days 2-5.

Table 39. Experienced and Inexperienced Subjects Rifle DCMS Shapiro-Wilk Test Results

Dataset	W	P-Value
Exp. Day 2	0.8356841	0.0012
Inexp. Day 2	0.9523788	0.67198
Exp. Day 3	0.7680956	9.3E-05
Inexp. Day 3	0.9145457	0.24388
Exp. Day 4	0.9694445	0.65328
Inexp. Day 4	0.9634113	0.83119
Exp. Day 5	0.9722728	0.72316
Inexp. Day 5	0.9128128	0.23178

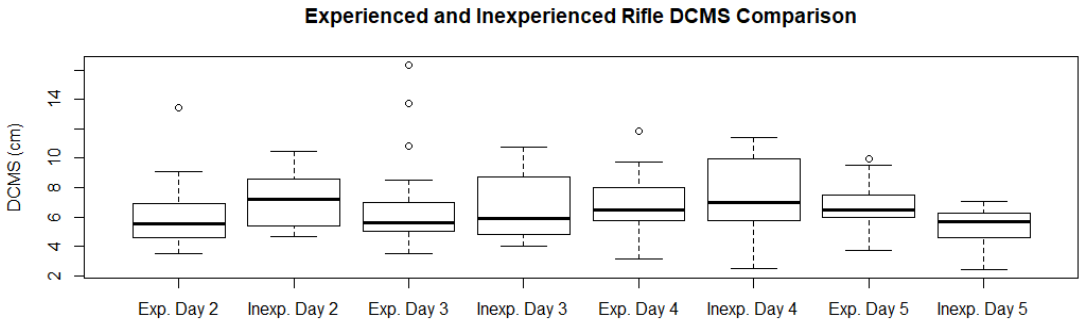

Figure 45. Experienced and Inexperienced Subjects Rifle DCMS

As Table 40 indicates, the null hypothesis of normality was not rejected for any subjects on any days. The boxplot in Figure 46 is not, however, indicative of a normal distribution. When Bartlett's Test was performed on these data, the resulting K^2 was 25.538 and the p-value was 0.0006089, which rejected the null hypothesis of homoscedasticity. The Brunner-Dette-Munk test yielded an F value of 3.14643 and a p-value of 0.007721839 rejecting the null hypothesis of equality of distribution functions. While this null hypothesis was rejected, the results of the REGWQ test in Table 41 indicate that significant differences between experienced and inexperienced subjects were present only on day 4.

Table 40. Experienced and Inexperienced Subjects Rifle Mean Radius Shapiro-Wilk Test Results

Dataset	W	P-Value
Exp. Day 2	0.9702943	0.67426
Inexp. Day 2	0.9310774	0.39167
Exp. Day 3	0.9759051	0.81018
Inexp. Day 3	0.9767017	0.96699
Exp. Day 4	0.9789820	0.87639
Inexp. Day 4	0.9700003	0.91081
Exp. Day 5	0.9801422	0.89847
Inexp. Day 5	0.9507910	0.64858

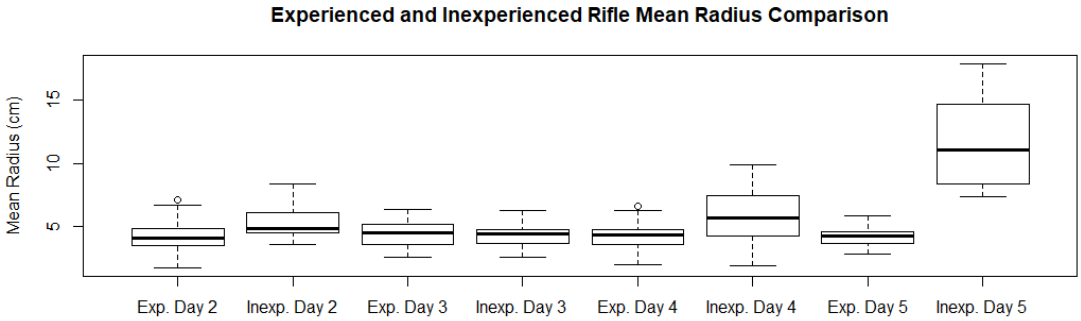

Figure 46. Experienced and Inexperienced Subjects Rifle Mean Radius

Table 41. Experienced and Inexperienced Subjects Rifle Mean Radius REGWQ Test Results

Day	Statistic	Adj. P-Value	CI
2	3.2857	0.0978	1.0293
3	0.2555	0.8569	0.08
4	5.324	0.0033	1.6678
5	1.4778	0.2979	0.4629

4.1.2 Marksmanship Speed-Accuracy Experiment

In this experiment, the hypothesis tested was that the level of asymptotic performance will improve to a small, but significant, extent over time. In the sections that follow, the analyzed data used to test this hypothesis are presented for both all subjects combined. Data analysis for individual subjects can be found in Appendix B.

4.1.2.1 IES Scoring Results

The MPI to CZP distance based IES results shown in Figure 47 are indicative of similar trends for radii of 5 and 4 cm. The trend for 3 cm was similar to those trends, but was greater in amplitude on days 4 and 5.

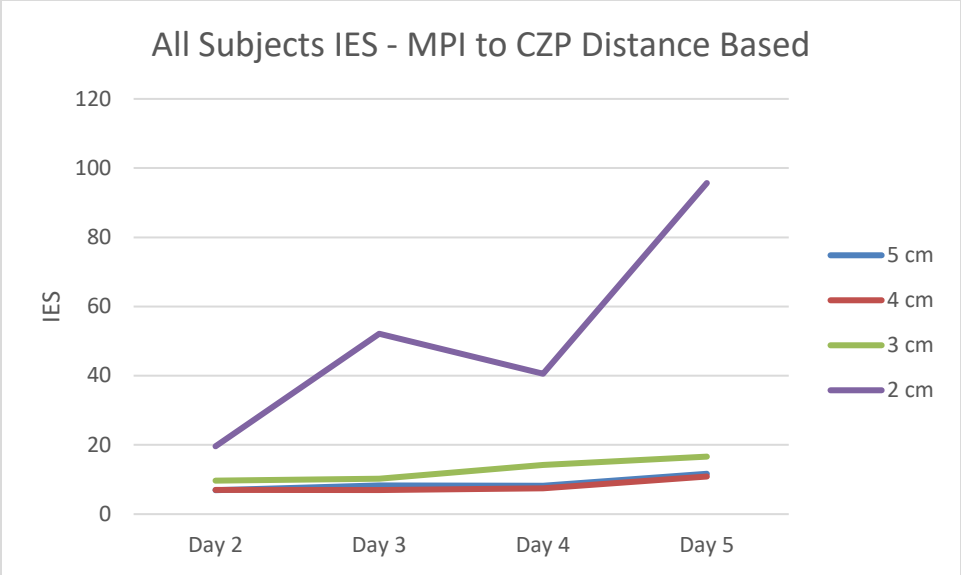

Figure 47. All Subjects IES - MPI to CZP Distance Based

The MPI to CZP distance based RT results in Figure 48 show very similar trends for all radii, with no extreme changes. The amplitude of each curve, however, is different, with the 5 cm curve having the largest amplitude and the 2 cm curve having the smallest. This result is unexpected, as accurate shots at a smaller sized target would be expected to require more time.

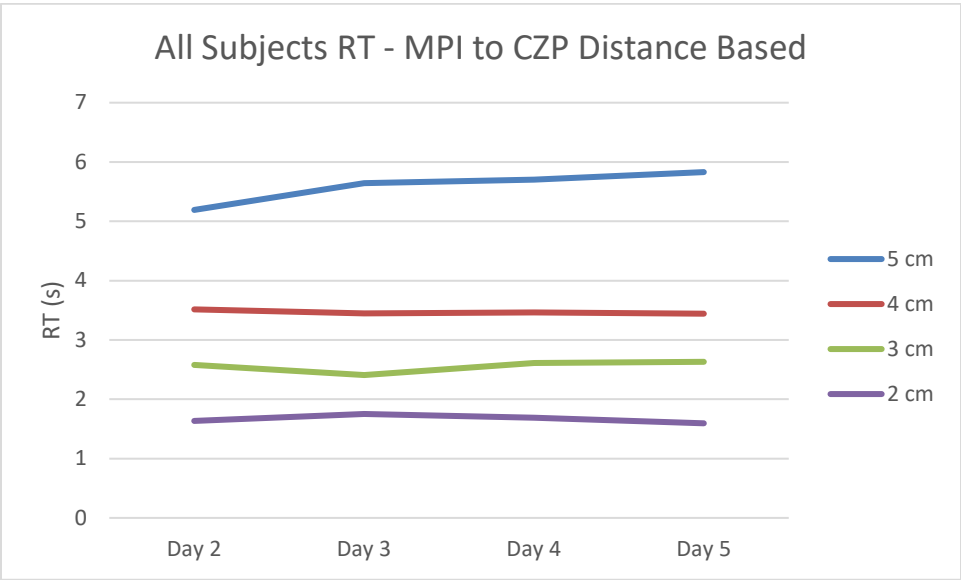

Figure 48. All Subjects RT - MPI to CZP Distance Based

MPI to CZP distance based proportion correct results, illustrated in Figure 49, show

more hits at greater radii, although the hit proportions for the 5 cm and 4 cm radii on day 3 are relatively close, due to the significant decrease in the 5 cm results. Overall, the trend among all radii was a decrease from day 2 to day 5.

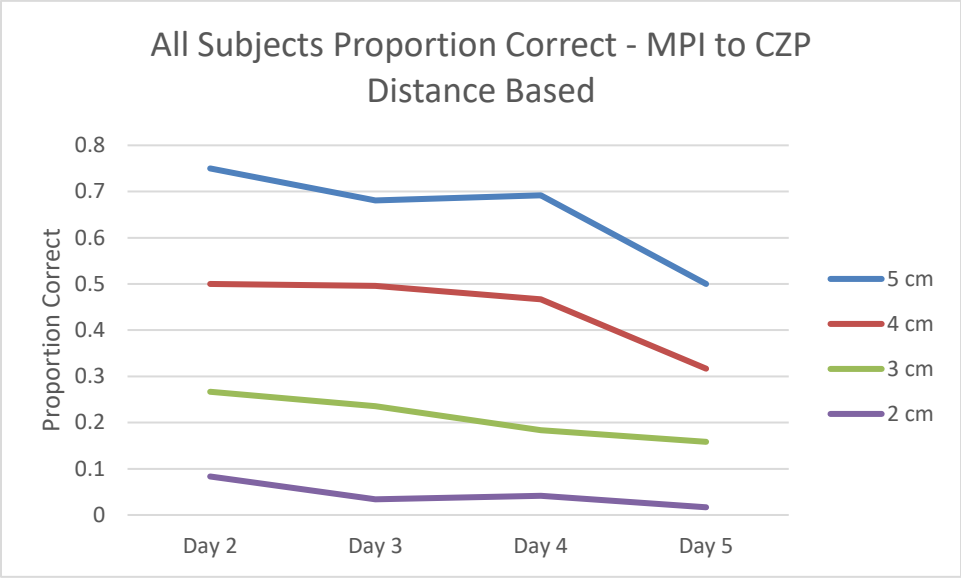

Figure 49. All Subjects Proportion Correct - MPI to CZP Distance Based

The DCMS based IES results, illustrated in Figure 50, show nearly identical trends for radii of 5 and 4 cm. The 3 cm results show an increase from day 2 to day 3 and greater overall values. The 2 cm results are greater overall and show an extreme increase from day 2 to day 3, followed by large decreases.

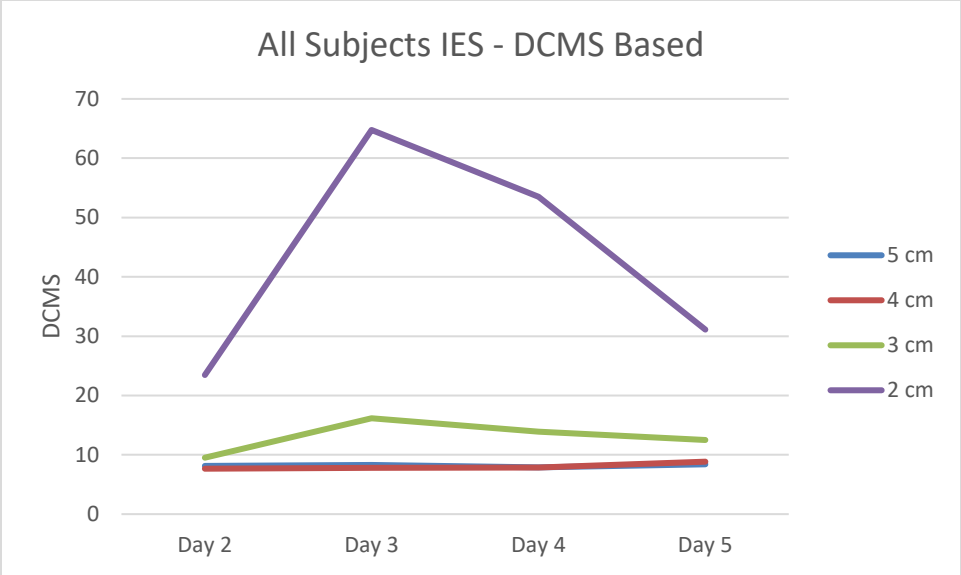

Figure 50. All Subjects IES - DCMS Based

The DCMS based RT results illustrated in Figure 51 show trends similar to those of the MPI to CZP distance based RT results, with the curves having a similar shape and the unexpected result of larger RT values being associated with larger radii.

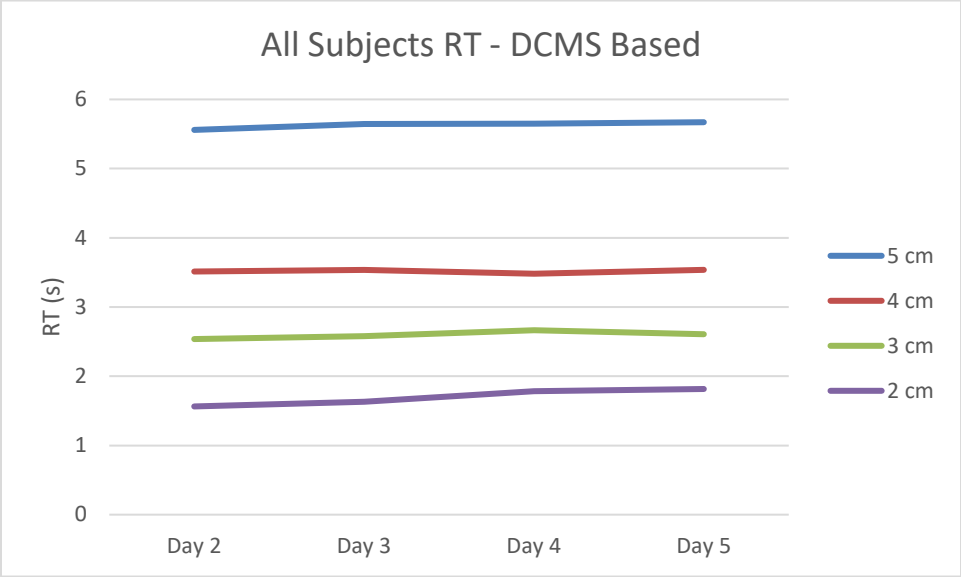

Figure 51. All Subjects RT - DCMS Based

The DCMS based proportion correct results illustrated in Figure 52 show patterns similar to those of the MPI to CZP distance based results, with greater radii having greater overall proportions correct. Additionally, the 2 and 3 cm radii curves showed decreases from day 2 to day 3.

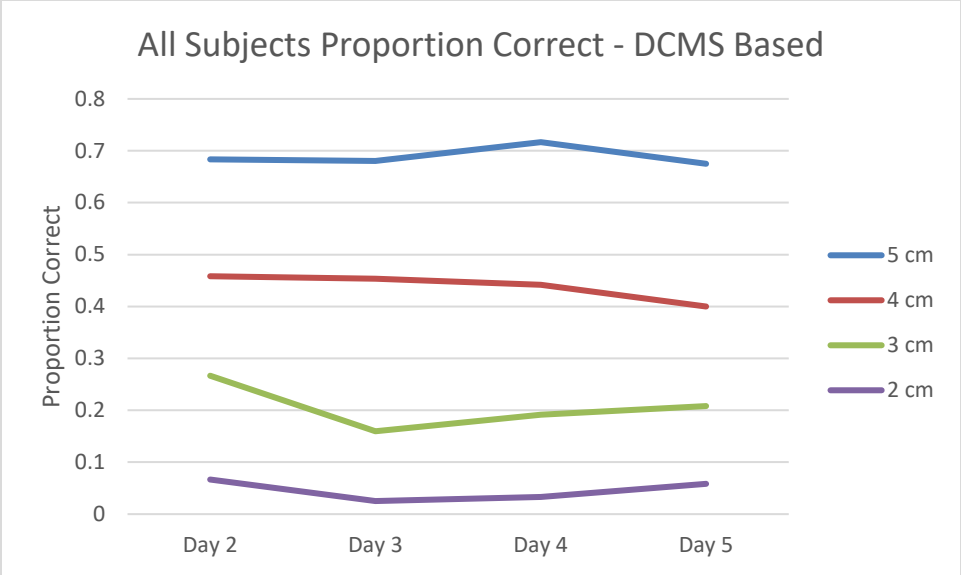

Figure 52. All Subjects Proportion Correct - DCMS Based

4.1.2.2 Conditional Accuracy Function Results

As Table 42 indicates, the null hypothesis of a normal distribution was rejected for all quantiles. The boxplot in Figure 53 does not provide information to the contrary. Bartlett's test produced a K^2 value of 12.94 and a p value of 0.01157, rejecting the null hypothesis of homoscedasticity. The Brunner-Dette-Munk test produced an F value of 0.1432361 and a p value of 0.9642724, failing to reject the null hypothesis of equality of distribution functions. Because this null hypothesis was not rejected, it cannot be concluded that accuracy, as measured by 1/MPI to CZP distance, differed by time quantile on day 2.

Table 42. All Subjects Day 2 Five Quantile 1/MPI to CZP Distance Shapiro-Wilk Test Results

Quantile	W	P-Value
1	0.90448	0.02681
2	0.83262	0.00106
3	0.81975	0.00063
4	0.87244	0.00588
5	0.77883	0.00014

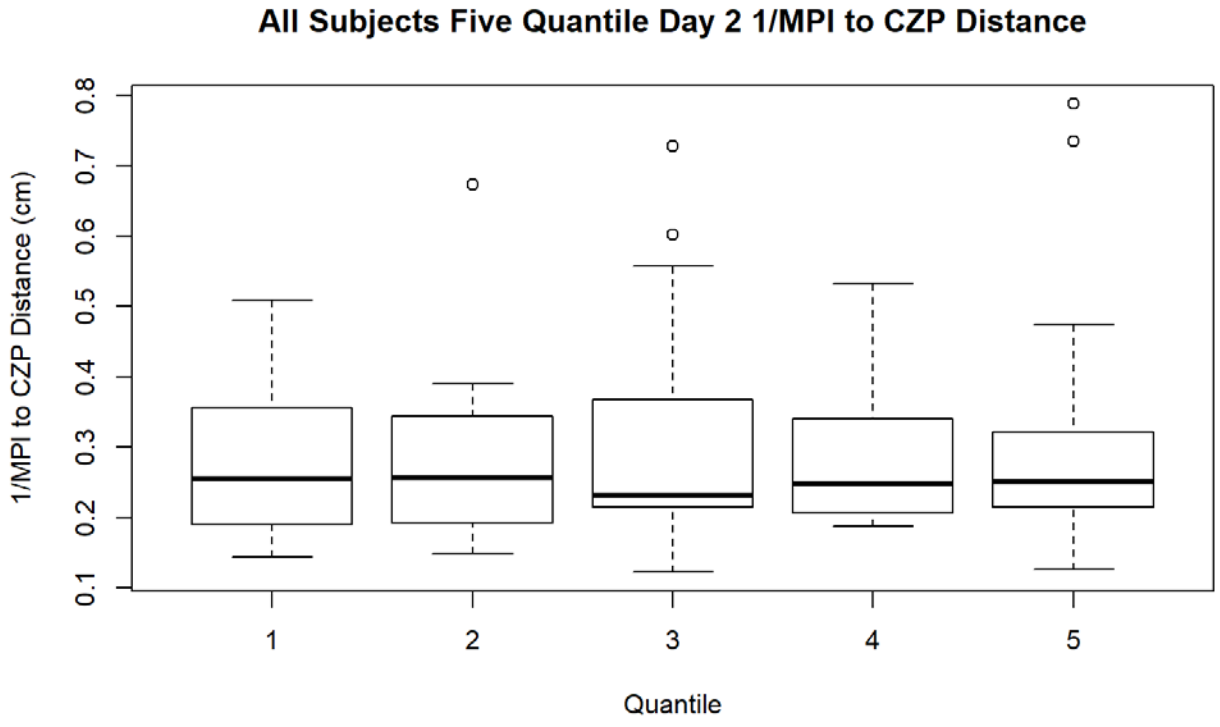

Figure 53. All Subjects Five Quantile Day 2 1/MPI to CZP Distance

As Table 43 indicates, the null hypothesis of a normal distribution was rejected for quantiles 2, 3, 4 and 5. The boxplot in Figure 54 does not provide information to the contrary. Bartlett's test produced a K^2 value of 9.5127 and a p value of 0.04949, rejecting the null hypothesis of homoscedasticity. The Brunner-Dette-Munk test produced an F value of 0.6589039 and a p value of 0.6165921, failing to reject the null hypothesis of equality of distribution functions. Because this null hypothesis was not rejected, it cannot be concluded that accuracy, as measured by 1/DCMS, differed by time quantile on day 2.

Table 43. All Subjects Day 2 Five Quantile 1/DCMS Shapiro-Wilk Test Results

Quantile	W	P-Value
1	0.91841	0.05387
2	0.83269	0.00106
3	0.69473	8.6E-06
4	0.90129	0.02292
5	0.83405	0.00112

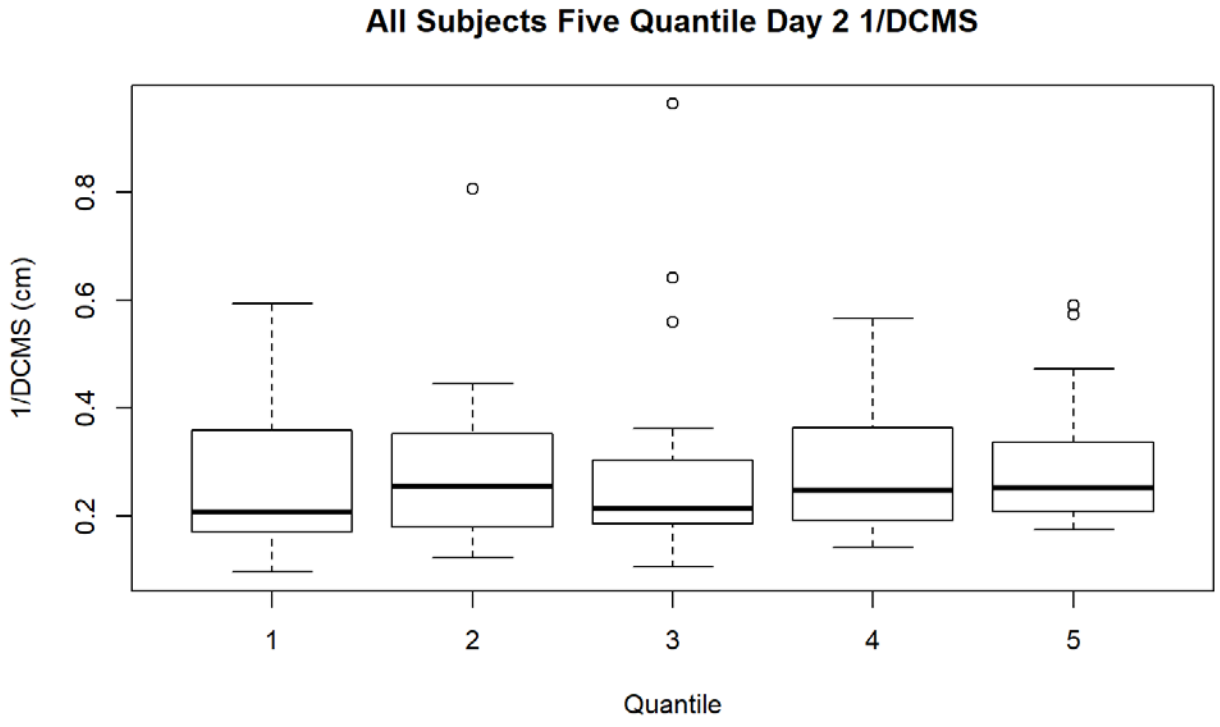

Figure 54. All Subjects Five Quantile Day 2 1/DCMS

As Table 44 indicates, the null hypothesis of a normal distribution was rejected for all quantiles. The boxplot in Figure 55 does not provide information to the contrary. Bartlett's test produced a K^2 value of 62.746, and a p value of 7.676e-13, rejecting the null hypothesis of homoscedasticity. The Brunner-Dette-Munk test produced an F value of 0.8241289 and a p value of 0.5081353, failing to reject the null hypothesis of equality of distribution functions. Because this null hypothesis was not rejected, it cannot be concluded that accuracy, as measured by 1/MPI to CZP distance, differed by time quantile on day 3.

Table 44. All Subjects Day 3 Five Quantile 1/MPI to CZP Distance Shapiro-Wilk Test Results

Quantile	W	P-Value
1	0.6485	2.30E-06
2	0.68261	6.00E-06
3	0.76645	8.75E-05
4	0.60452	7.00E-07
5	0.69618	1.25E-05

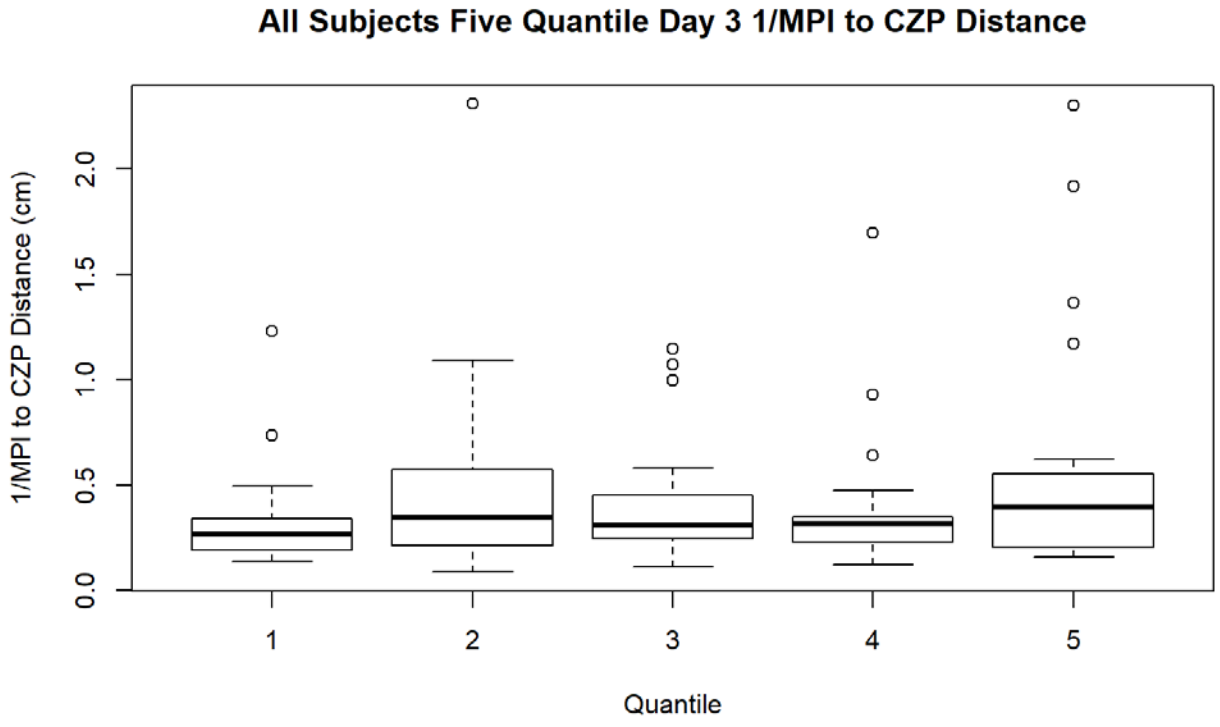

Figure 55. All Subjects Five Quantile Day 3 1/MPI to CZP Distance

As Table 45 indicates, the null hypothesis of a normal distribution was rejected for all quantiles. The boxplot in Figure 56 does not provide information to the contrary. Bartlett's test produced a K^2 value of 2.409, and a p value of 0.661, failing to reject the null hypothesis of homoscedasticity. The Kruskal-Wallis test produced a X^2 value of 0.99073 and a p value of 0.9112, failing to reject the null hypothesis of equality of dataset medians. Because this null hypothesis was not rejected, it cannot be concluded that accuracy, as measured by 1/DCMS, differed by time quantile on day 3.

Table 45. All Subjects Day 3 Five Quantile 1/DCMS Shapiro-Wilk Test Results

Quantile	W	P-Value
1	0.9137	0.04246
2	0.77922	0.00014
3	0.80313	0.00033
4	0.89809	0.01961
5	0.84244	0.00199

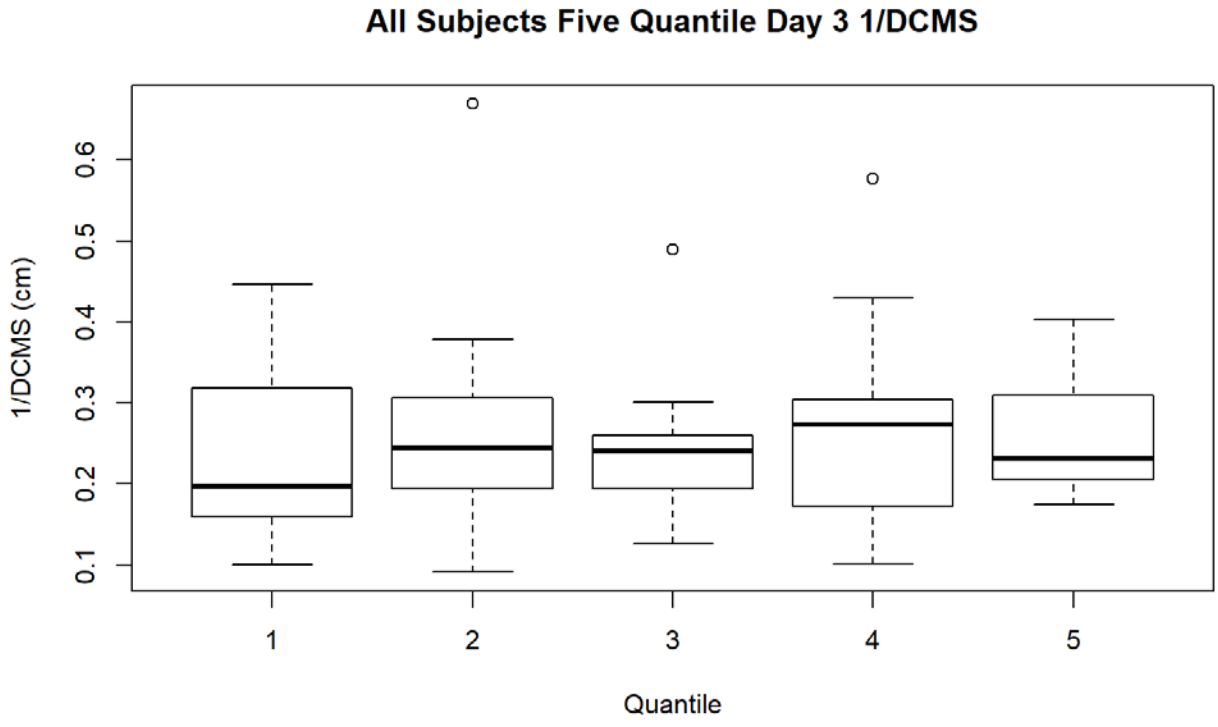

Figure 56. All Subjects Five Quantile Day 3 1/DCMS

As Table 46 indicates, the null hypothesis of a normal distribution was rejected for quantiles 2, 4 and 5. The boxplot in Figure 57 does not provide information to the contrary. Bartlett's test produced a K^2 value of 93.523, and a p value of 2.2e-16, rejecting the null hypothesis of homoscedasticity. The Brunner-Dette-Munk test produced an F value of 0.589869 and a p value of 0.6673954, failing to reject the null hypothesis of equality of distribution functions. Because this null hypothesis was not rejected, it cannot be concluded that accuracy, as measured by 1/MPI to CZP distance, differed by time quantile on day 4.

Table 46. All Subjects Day 4 Five Quantile 1/MPI to CZP Distance Shapiro-Wilk Test Results

Quantile	W	P-Value
1	0.93201	0.10812
2	0.90101	0.02261
3	0.9413	0.17434
4	0.52151	1E-07
5	0.62581	1.2E-06

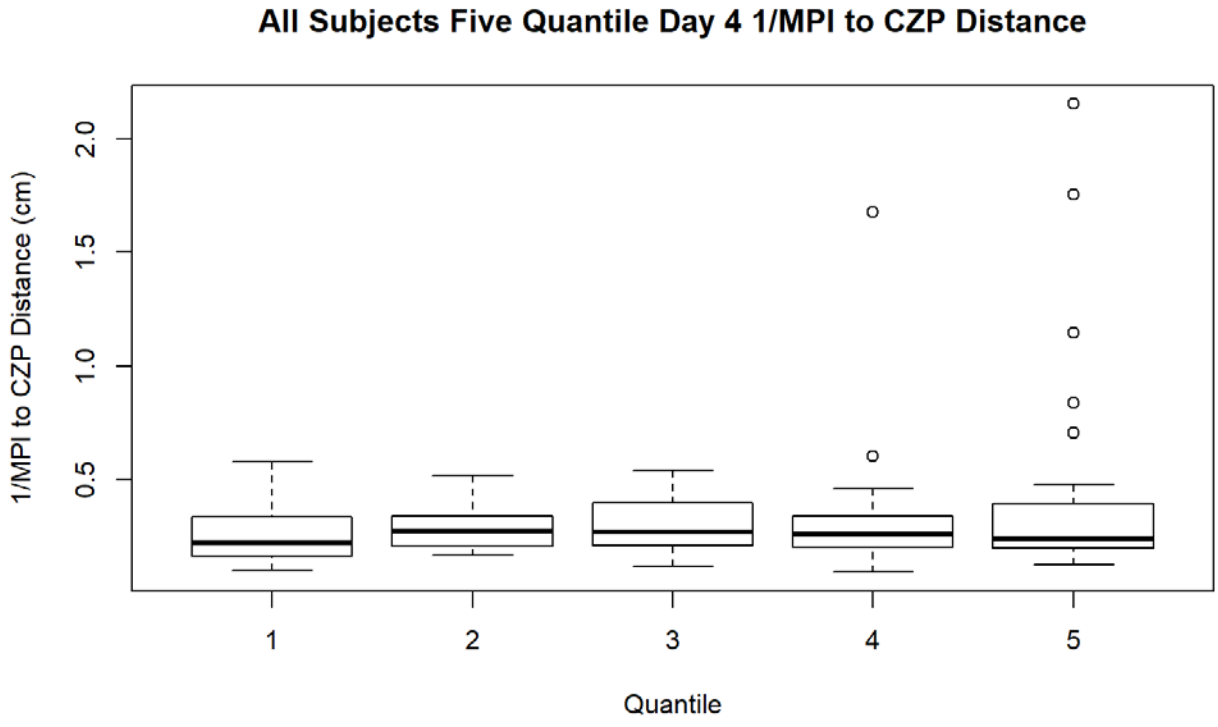

Figure 57. All Subjects Five Quantile Day 41/MPI to CZP Distance

As Table 47 indicates, the null hypothesis of a normal distribution was rejected for quantile 1. The boxplot in Figure 58 does not provide information to the contrary. Bartlett's test produced a K^2 value of 11.469, and a p value of 0.02177, rejecting the null hypothesis of homoscedasticity. The Brunner-Dette-Munk test produced an F value of 1.100987 and a p value of 0.3593446, failing to reject the null hypothesis of equality of distribution functions. Because this null hypothesis was not rejected, it cannot be concluded that accuracy, as measured by 1/DCMS, differed by time quantile on day 4.

Table 47. All Subjects Day 4 Five Quantile 1/DCMS Shapiro-Wilk Test Results

Quantile	W	P-Value
1	0.81437	0.00051
2	0.92716	0.08425
3	0.94521	0.21285
4	0.97598	0.81193
5	0.92895	0.09234

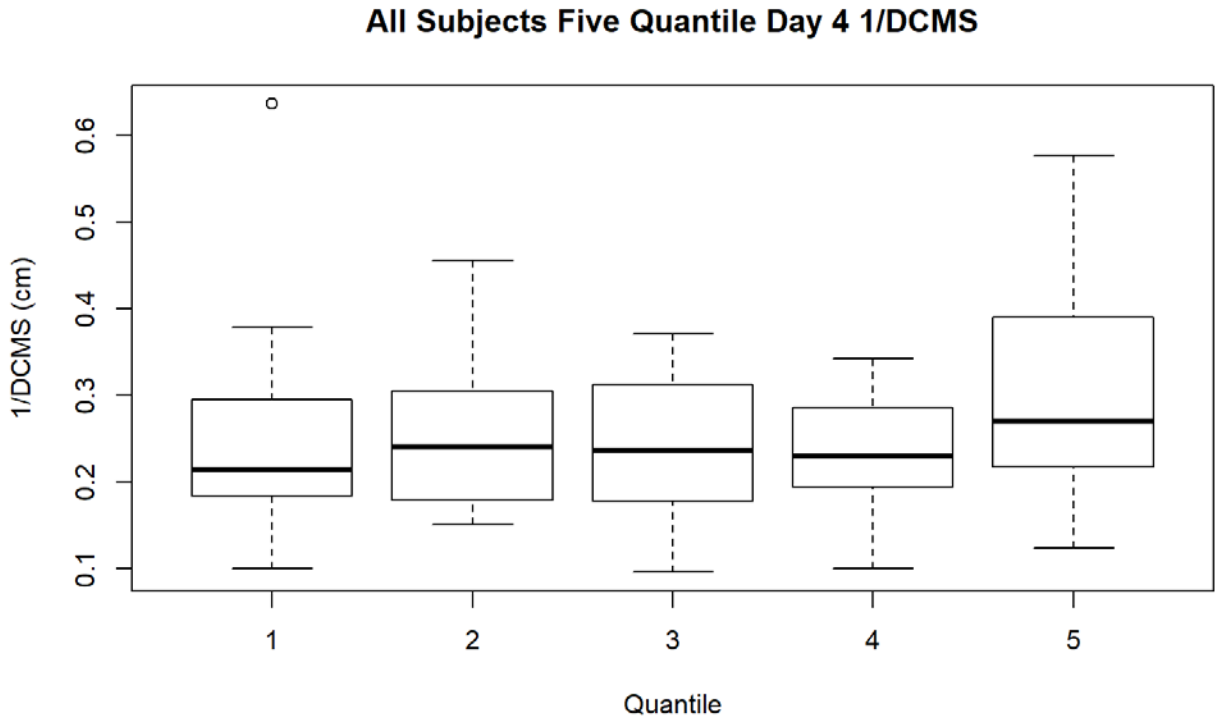

Figure 58. All Subjects Five Quantile Day 4 1/DCMS

As Table 48 indicates, the null hypothesis of a normal distribution was rejected for quantile 4. The boxplot in Figure 59 does not provide information to the contrary. Bartlett's test produced a K^2 value of 9.8443, and a p value of 0.04313, rejecting the null hypothesis of homoscedasticity. The Brunner-Dette-Munk test produced an F value of 0.5221038 and a p value of 0.7190319, failing to reject the null hypothesis of equality of distribution functions. Because this null hypothesis was not rejected, it cannot be concluded that accuracy, as measured by 1/MPI to CZP distance, differed by time quantile on day 5.

Table 48. All Subjects Day 5 Five Quantile 1/MPI to CZP Distance Shapiro-Wilk Test Results

Quantile	W	P-Value
1	0.93149	0.10527
2	0.9557	0.35821
3	0.92185	0.06417
4	0.73381	2.9E-05
5	0.92926	0.09383

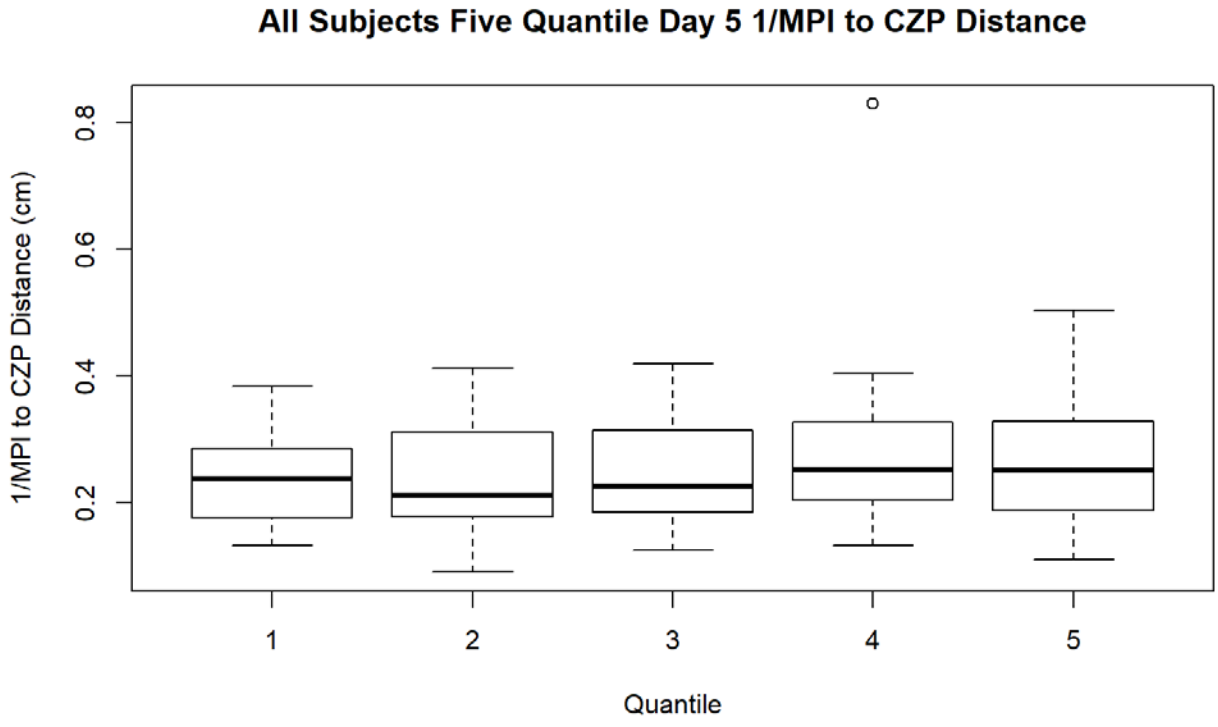

Figure 59. All Subjects Five Quantile Day 5 1/MPI to CZP Distance

As Table 49 indicates, the null hypothesis of a normal distribution was rejected for quantiles 1, 2, 3 and 5. The boxplot in Figure 60 does not provide information to the contrary. Bartlett's test produced a K^2 value of 7.5399, and a p value of 0.11, failing to reject the null hypothesis of homoscedasticity. The Kruskal-Wallis test produced a X^2 value of 11.139 and a p value of 0.02504, rejecting the null hypothesis of equality of dataset medians. Because this null hypothesis was rejected, it can be concluded that accuracy, as measured by 1/DCMS, differed by time quantile on day 5. As Table 50 indicates, differences were found between quantiles 1 and 4 and 5 and quantiles 3 and 4 and 5.

Table 49. All Subjects Day 5 Five Quantile 1/DCMS Shapiro-Wilk Test Results

Quantile	W	P-Value
1	0.88662	0.01133
2	0.83541	0.00119
3	0.80791	0.0004
4	0.94908	0.2588
5	0.8594	0.00328

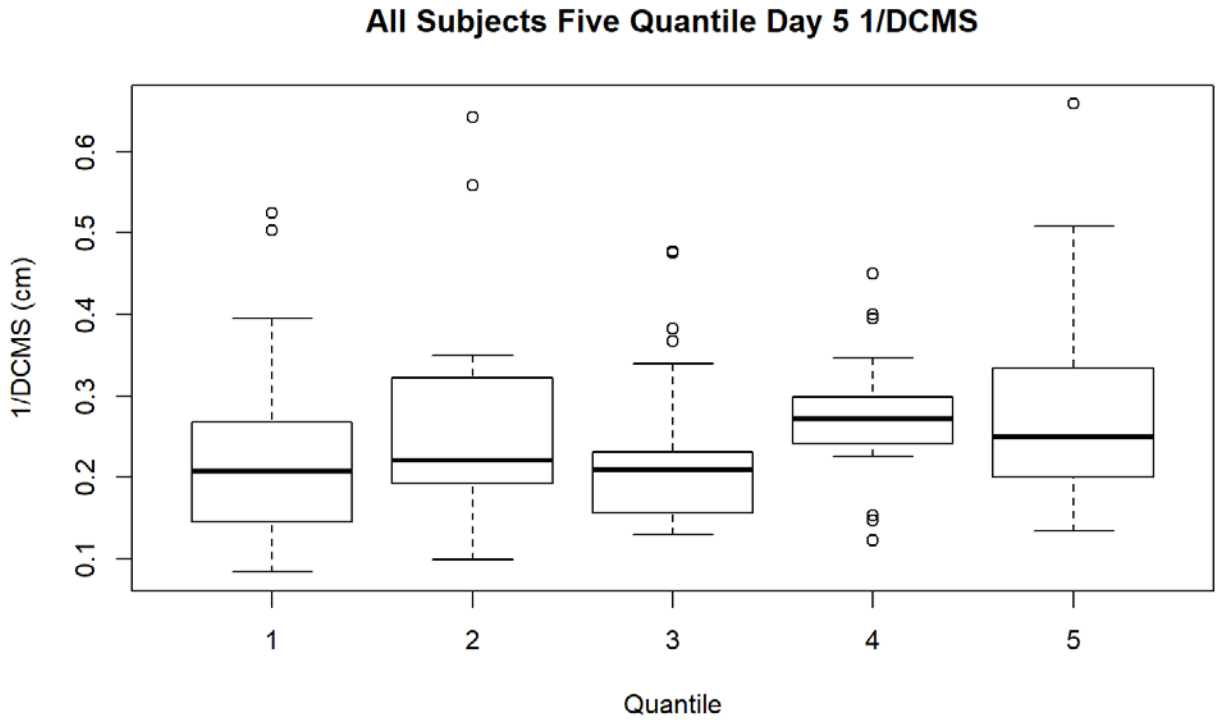

Figure 60. All Subjects Five Quantile Day 5 1/DCMS

Table 50. All Subjects Five Quantile Day 5 1/DCMS Distance Dunn's Test Results

Quantiles	Z	P-Value
1 & 2	-0.83818	0.201
1 & 3	0.07054	0.4719
1 & 4	-2.4938	0.0063
1 & 5	-2.0913	0.0183
2 & 3	0.90872	0.1817
2 & 4	-1.65562	0.0489
2 & 5	-1.25312	0.1051
3 & 4	-2.56434	0.0052
3 & 5	-2.16184	0.0153
4 & 5	0.40249	0.3437

As Table 51 indicates, the null hypothesis of a normal distribution was rejected for quantiles 2, 3, 4, 5 and 6. The boxplot in Figure 61 does not provide information to the contrary. Bartlett's test produced a K^2 value of 8.8693, and a p value of 0.1144, failing to reject the null hypothesis of homoscedasticity. The Kruskal-Wallis test produced a X^2 value of 1.5771 and a p value of 0.904, rejecting the null hypothesis of equality of dataset medians. Because this null hypothesis was not rejected, it cannot be concluded that accuracy, as measured by 1/MPI to CZP distance, differed by time quantile on day 2.

Table 51. All Subjects Day 2 Six Quantile 1/MPI to CZP Distance Shapiro-Wilk Test Results

Quantile	W	P-Value
1	0.91455	0.07786
2	0.81386	0.0014
3	0.79268	0.00067
4	0.79073	0.00063
5	0.89508	0.03338
6	0.75182	0.00018

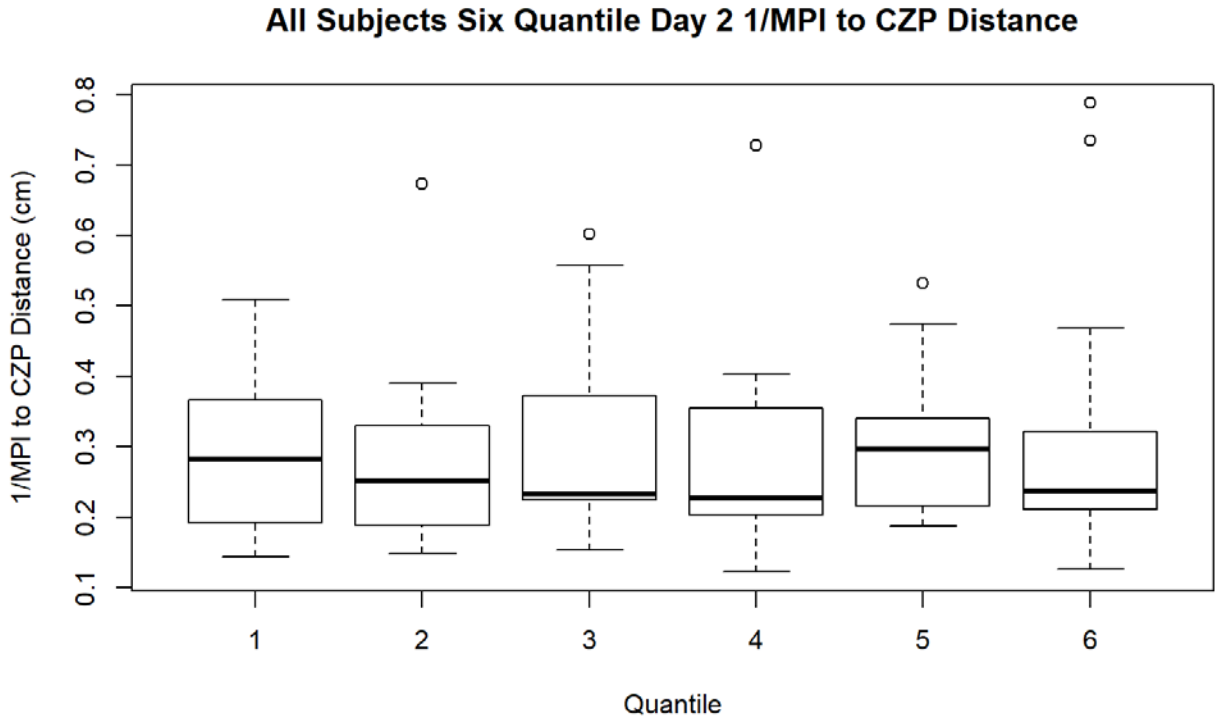

Figure 61. All Subjects Six Quantile Day 2 1/MPI to CZP Distance

As Table 52 indicates, the null hypothesis of a normal distribution was rejected for quantiles 3, 4, 5 and 6. The boxplot in Figure 62 does not provide information to the contrary. Bartlett's test produced a K^2 value of 21.669, and a p value of 0.0006052, rejecting the null hypothesis of homoscedasticity. The Brunner-Dette-Munk test produced an F value of 0.6613966 and a p value of 0.6464815, failing to reject the null hypothesis of equality of distribution functions. Because this null hypothesis was not rejected, it cannot be concluded that accuracy, as measured by 1/DCMS, differed by time quantile on day 2.

Table 52. All Subjects Day 2 Six Quantile 1/DCMS Shapiro-Wilk Test Results

Quantile	W	P-Value
1	0.91378	0.07525
2	0.93683	0.20879
3	0.75231	0.00018
4	0.84797	0.00493
5	0.86068	0.00809
6	0.86795	0.01082

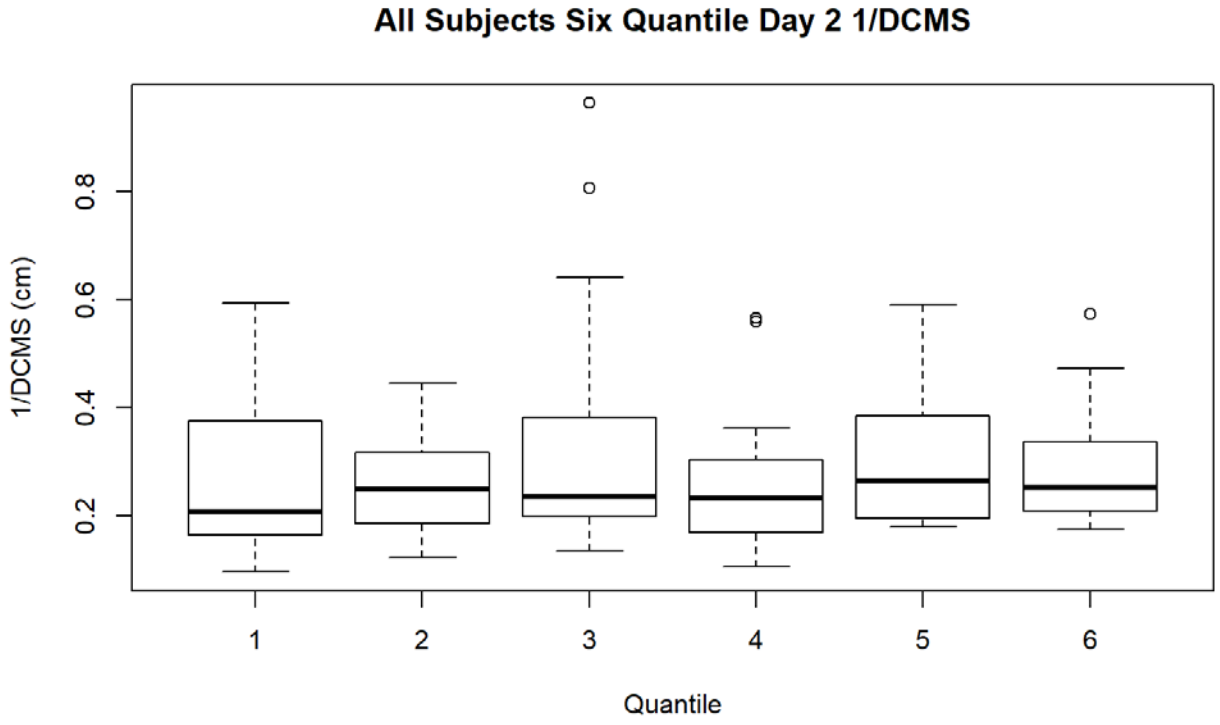

Figure 62. All Subjects Six Quantile Day 2 1/DCMS

As Table 53 indicates, the null hypothesis of a normal distribution was rejected for all quantiles. The boxplot in Figure 63 does not provide information to the contrary. Bartlett's test produced a K^2 value of 68.843, and a p value of 1.784e-13, rejecting the null hypothesis of homoscedasticity. The Brunner-Dette-Munk test produced an F value of 0.4942797 and a p value of 0.7733031, failing to reject the null hypothesis of equality of distribution functions. Because this null hypothesis was not rejected, it cannot be concluded that accuracy, as measured by 1/MPI to CZP distance, differed by time quantile on day 3.

Table 53. All Subjects Day 3 Six Quantile 1/MPI to CZP Distance Shapiro-Wilk Test Results

Quantile	W	P-Value
1	0.82065	0.00179
2	0.72391	7.7E-05
3	0.8826	0.01971
4	0.6899	2.9E-05
5	0.64263	8.4E-06
6	0.69247	4.5E-05

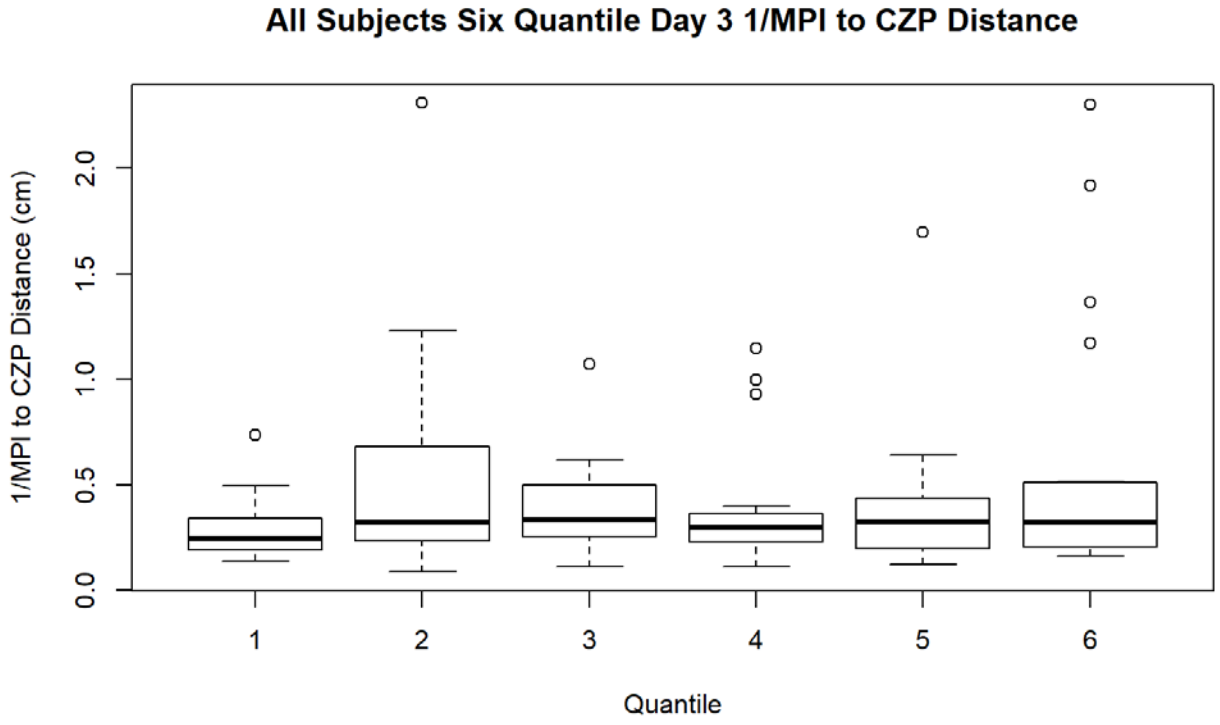

Figure 63. All Subjects Six Quantile Day 3 1/MPI to CZP Distance

As Table 54 indicates, the null hypothesis of a normal distribution was rejected for quantiles 2, 3, 4 and 6. The boxplot in Figure 64 does not provide information to the contrary. Bartlett's test produced a K^2 value of 4.3678, and a p value of 0.4978, failing to reject the null hypothesis of homoscedasticity. The Kruskal-Wallis test produced a X^2 value of 1.7186 and a p value of 0.8865, failing to reject the null hypothesis of equality of dataset medians. Because this null hypothesis was not rejected, it cannot be concluded that accuracy, as measured by 1/DCMS, differed by time quantile on day 3.

Table 54. All Subjects Day 3 Six Quantile 1/DCMS Shapiro-Wilk Test Results

Quantile	W	P-Value
1	0.91008	0.06395
2	0.83327	0.00283
3	0.82343	0.00197
4	0.72446	7.9E-05
5	0.9304	0.15717
6	0.86478	0.01178

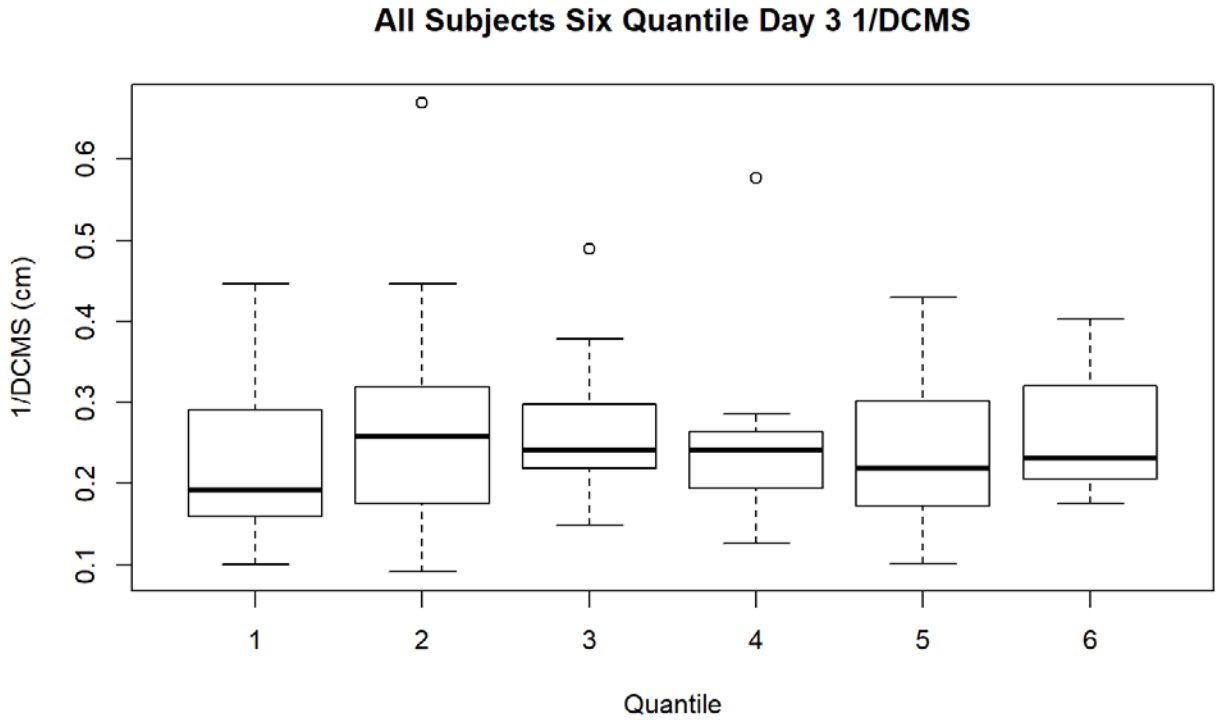

Figure 64. All Subjects Six Quantile Day 3 1/DCMS

As Table 55 indicates, the null hypothesis of a normal distribution was rejected for quantiles 3, 5, and 6. The boxplot in Figure 65 does not provide information to the contrary. Bartlett's test produced a K^2 value of 105.82, and a p value of 2.2e-16, rejecting the null hypothesis of homoscedasticity. The Brunner-Dette-Munk test produced an F value of 0.3614712 and a p value of 0.8711046, failing to reject the null hypothesis of equality of distribution functions. Because this null hypothesis was not rejected, it cannot be concluded that accuracy, as measured by 1/MPI to CZP distance, differed by time quantile on day 4.

Table 55. All Subjects Day 4 Six Quantile 1/MPI to CZP Distance Shapiro-Wilk Test Results

Quantile	W	P-Value
1	0.94203	0.26181
2	0.95983	0.54046
3	0.8908	0.02782
4	0.98927	0.99712
5	0.50129	3E-07
6	0.66824	1.6E-05

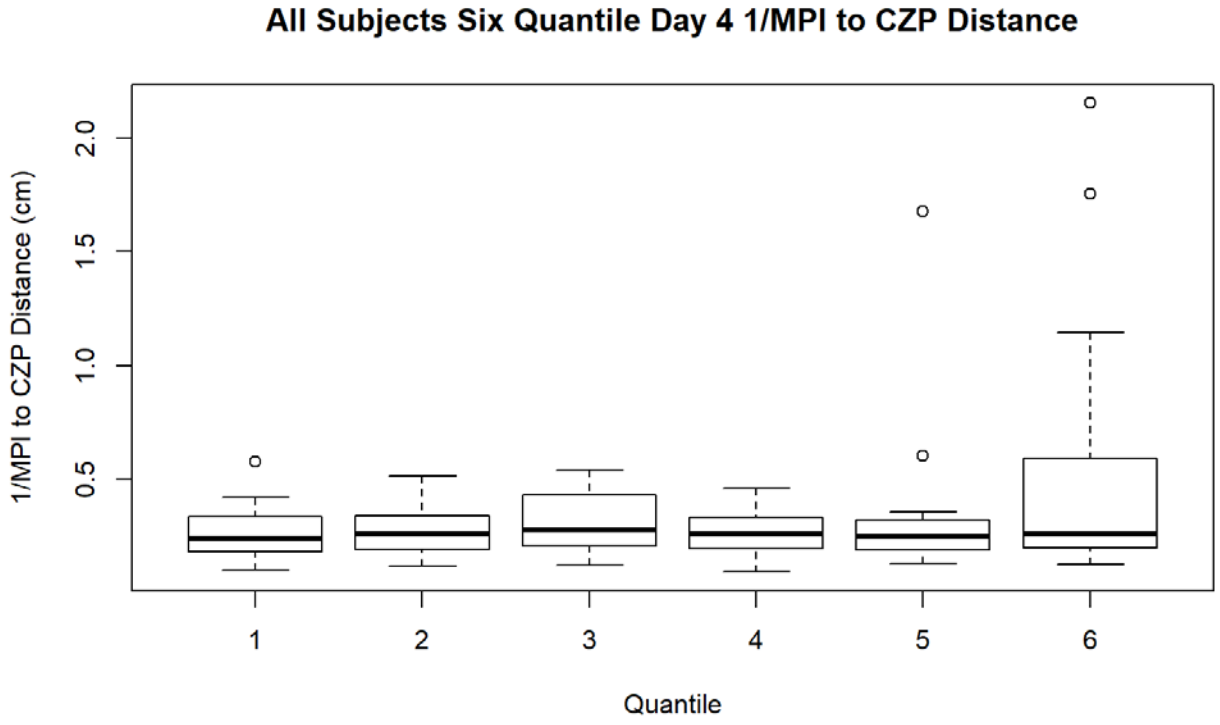

Figure 65. All Subjects Six Quantile Day 41/MPI to CZP Distance

As Table 56 indicates, the null hypothesis of a normal distribution was rejected for quantiles 2, 3, 4, and 6. The boxplot in Figure 66 does not provide information to the contrary. Bartlett's test produced a K^2 value of 12.856, and a p value of 0.02476, rejecting the null hypothesis of homoscedasticity. The Brunner-Dette-Munk test produced an F value of 1.364962 and a p value of 0.2432773, failing to reject the null hypothesis of equality of distribution functions. Because this null hypothesis was not rejected, it cannot be concluded that accuracy, as measured by 1/DCMS, differed by time quantile on day 4.

Table 56. All Subjects Day 4 Six Quantile 1/DCMS Shapiro-Wilk Test Results

Quantile	W	P-Value
1	0.91008	0.06395
2	0.83327	0.00283
3	0.82343	0.00197
4	0.72446	7.9E-05
5	0.9304	0.15717
6	0.86478	0.01178

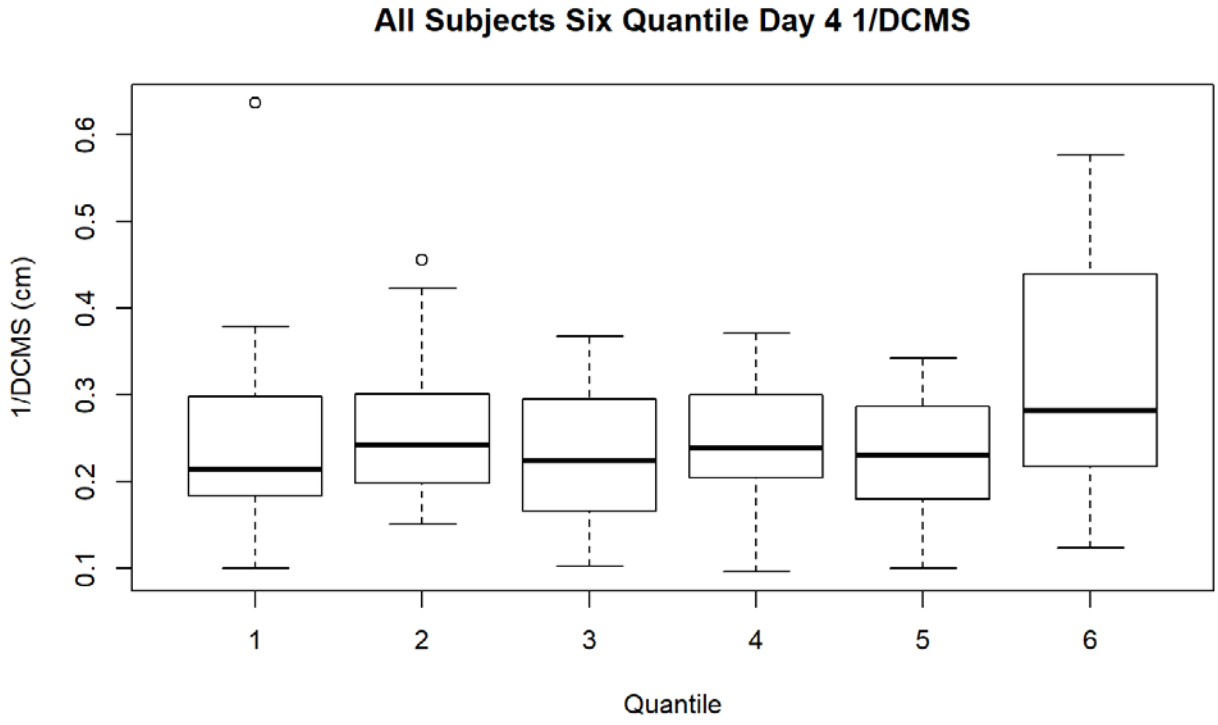

Figure 66. All Subjects Six Quantile Day 4 1/DCMS

As Table 57 indicates, the null hypothesis of a normal distribution was rejected for quantile 5. The boxplot in Figure 67 does not provide information to the contrary. Bartlett's test produced a K^2 value of 11.223, and a p value of 0.04713, rejecting the null hypothesis of homoscedasticity. The Brunner-Dette-Munk test produced an F value of 0.3310675 and a p value of 0.8919332, failing to reject the null hypothesis of equality of distribution functions. Because this null hypothesis was not rejected, it cannot be concluded that accuracy, as measured by 1/MPI to CZP distance, differed by time quantile on day 5.

Table 57. All Subjects Day 5 Six Quantile 1/MPI to CZP Distance Shapiro-Wilk Test Results

Quantile	W	P-Value
1	0.94481	0.29512
2	0.92467	0.1219
3	0.9274	0.13759
4	0.92383	0.11743
5	0.67357	1.9E-05
6	0.95022	0.37049

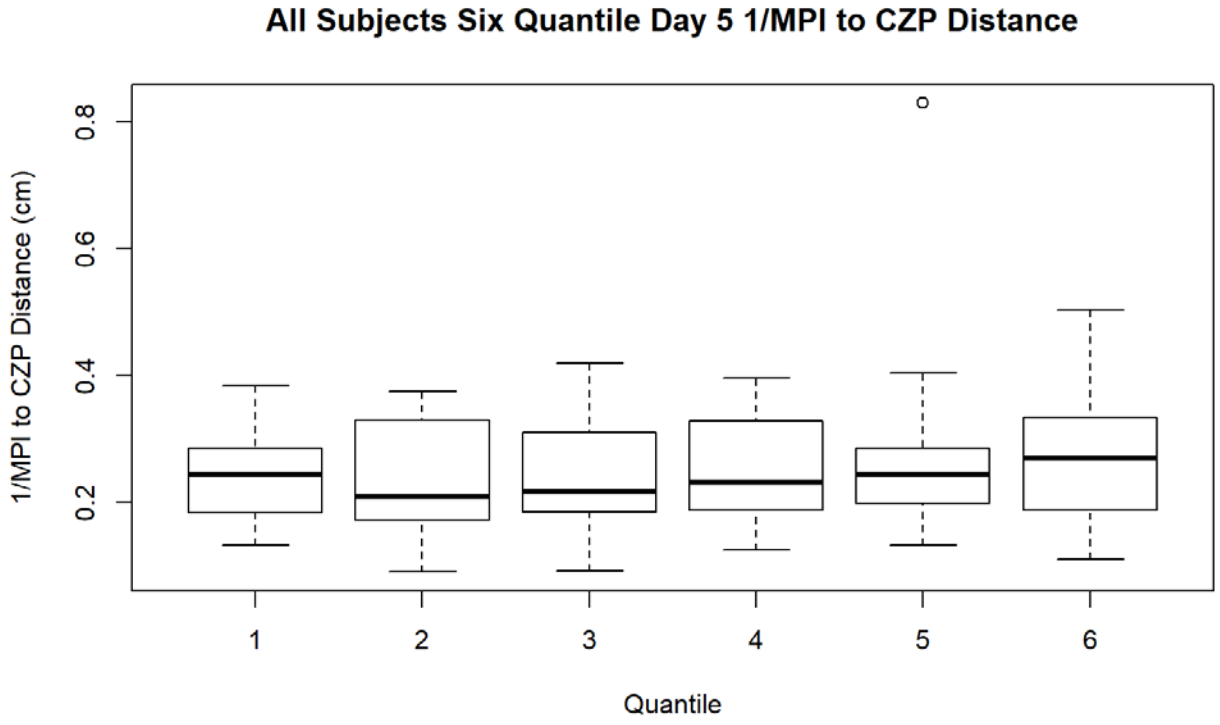

Figure 67. All Subjects Six Quantile Day 5 1/MPI to CZP Distance

As Table 58 indicates, the null hypothesis of a normal distribution was rejected for quantiles 1, 2, 3 and 6. The boxplot in Figure 68 does not provide information to the contrary. Bartlett's test produced a K^2 value of 18.119, and a p value of 0.002801, rejecting the null hypothesis of homoscedasticity. The Brunner-Dette-Munk test produced an F value of 1.441457 and a p value of 0.2179119, failing to reject the null hypothesis of equality of distribution functions. Because this null hypothesis was not rejected, it cannot be concluded that accuracy, as measured by 1/DCMS, differed by time quantile on day 5.

Table 58. All Subjects Day 5 Six Quantile 1/DCMS Shapiro-Wilk Test Results

Quantile	W	P-Value
1	0.89761	0.0372
2	0.847	0.00475
3	0.82338	0.00197
4	0.9321	0.16947
5	0.93417	0.1857
6	0.89273	0.03019

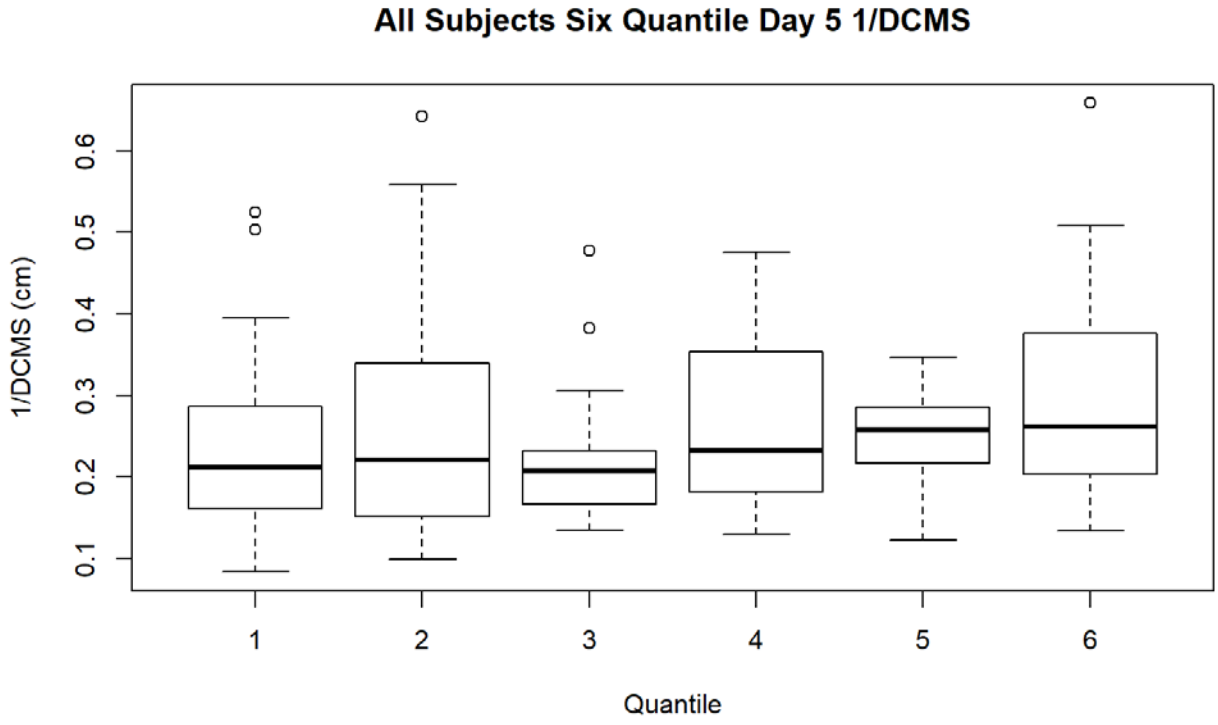

Figure 68. All Subjects Six Quantile Day 5 1/DCMS

4.1.2.3 Quantile Analysis Results

As Table 59 indicates, the null hypothesis of a normal distribution was rejected for day 2. The boxplot in Figure 69 does not provide information to the contrary. Bartlett's test produced a K^2 value of 3.0934 and a p value of 0.3774, failing to reject the null hypothesis of homoscedasticity. The Kruskal-Wallis test produced a X^2 value of 1.3035 and a p value of 0.7283, failing to reject the null hypothesis of equality of dataset medians. Because this null hypothesis was not rejected, it cannot be concluded that accuracy, as measured by the first quantile of 1/MPI to CZP distance changed over the 4 days of firing.

Table 59. All Subjects Quantile 1 of 5 1/MPI to CZP Distance Shapiro-Wilk Test Results

Day	W	P-Value
2	0.90448	0.02681
3	0.92021	0.05904
4	0.95868	0.41249
5	0.93149	0.10527

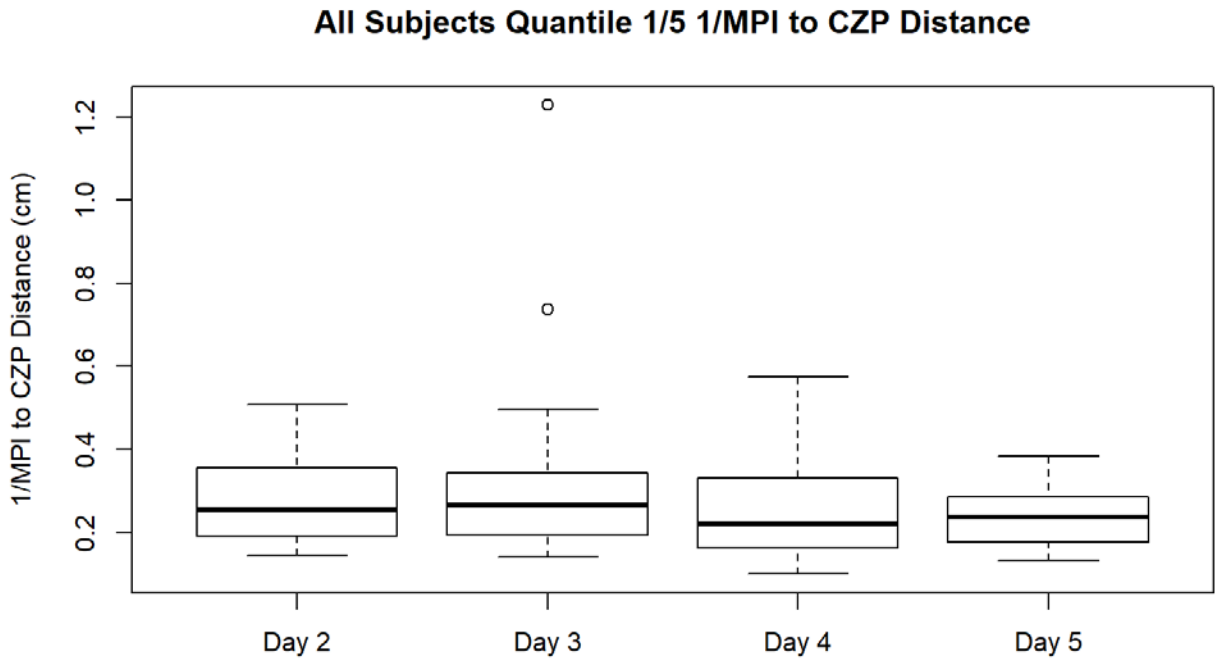

Figure 69. All Subjects Quantile 1 of 5 1/MPI to CZP Distance

As Table 60 indicates, the null hypothesis of a normal distribution was rejected for days 2 and 3. The boxplot in Figure 70 does not provide information to the contrary. Bartlett's test produced a K^2 value of 46.056 and a p value of 5.517e-10, rejecting the null hypothesis of homoscedasticity. The Brunner-Dette-Munk test produced an F value of 0.4992092 and a p value of 0.6689532 failing to reject the null hypothesis of equality of distribution functions. Because this null hypothesis was not rejected, it cannot be concluded that accuracy, as measured by the second quantile of 1/MPI to CZP distance changed over the 4 days of firing.

Table 60. All Subjects Quantile 2 of 5 1/MPI to CZP Distance Shapiro-Wilk Test Results

Day	W	P-Value
2	0.83262	0.00106
3	0.79577	0.00025
4	0.96411	0.52629
5	0.9557	0.35821

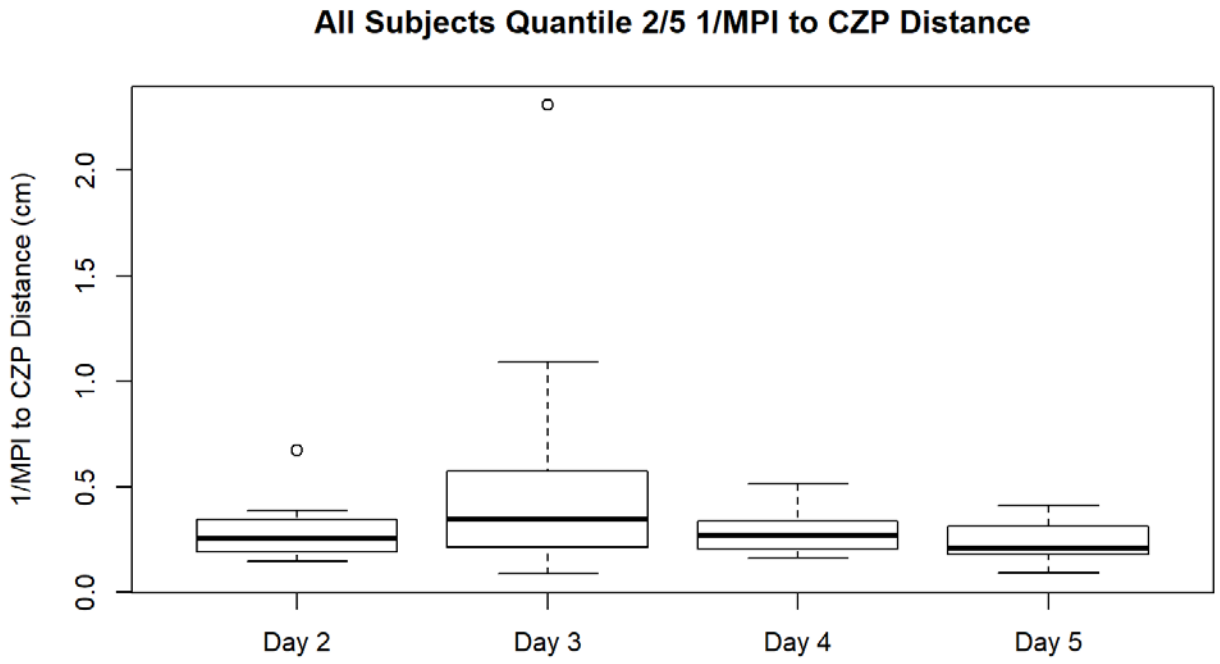

Figure 70. All Subjects Quantile 2 of 5 1/MPI to CZP Distance Results

As Table 61 indicates, the null hypothesis of a normal distribution was rejected for days 2, 3 and 4. The boxplot in Figure 71 does not provide information to the contrary. Bartlett's test produced a K^2 value of 22.779 and a p value of 4.49e-05, rejecting the null hypothesis of homoscedasticity. The Brunner-Dette-Munk test produced an F value of 1.186995 and a p value of 0.3190943 failing to reject the null hypothesis of equality of distribution functions. Because this null hypothesis was not rejected, it cannot be concluded that accuracy, as measured by the third quantile of 1/MPI to CZP distance changed over the 4 days of firing.

Table 61. All Subjects Quantile 3 of 5 1/MPI to CZP Distance Shapiro-Wilk Test Results

Day	W	P-Value
2	0.81975	0.00063
3	0.75963	6.9E-05
4	0.76013	7E-05
5	0.92185	0.06417

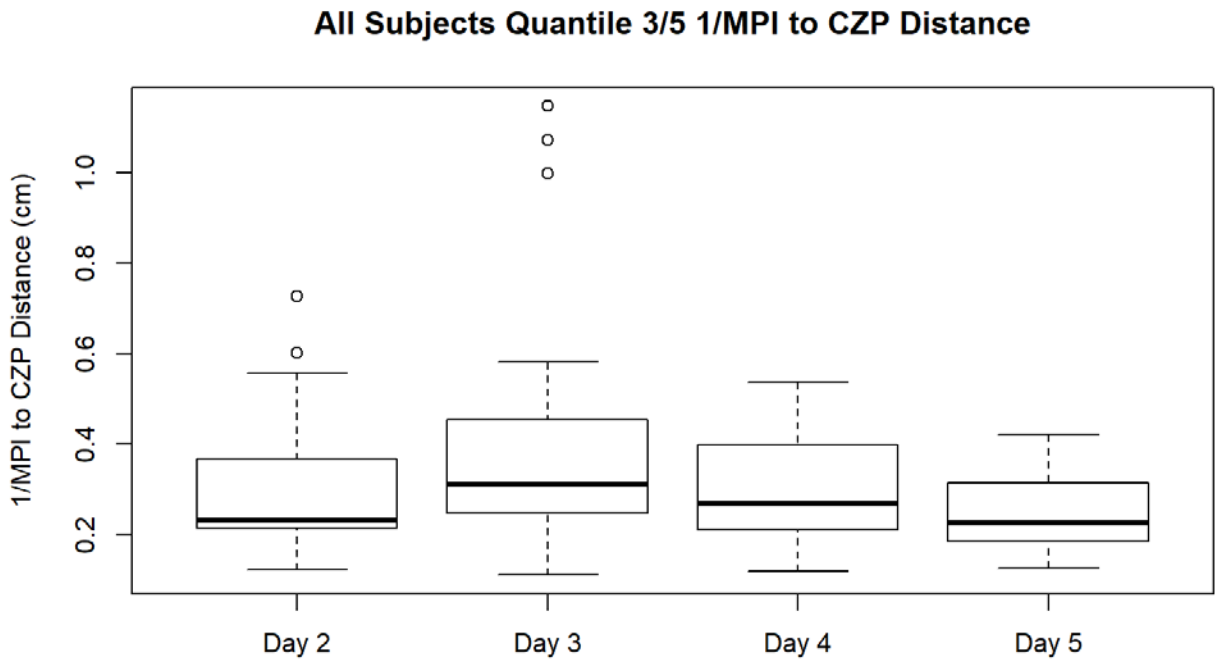

Figure 71. All Subjects Quantile 3 of 5 1/MPI to CZP Distance Results

As Table 62 indicates, the null hypothesis of a normal distribution was rejected for all days. The boxplot in Figure 72 does not provide information to the contrary. Bartlett's test produced a K^2 value of 41.275 and a p value of 5.718e-09, rejecting the null hypothesis of homoscedasticity. The Brunner-Dette-Munk test produced an F value of 0.7322615 and a p value of 0.5347482 failing to reject the null hypothesis of equality of distribution functions. Because this null hypothesis was not rejected, it cannot be concluded that accuracy, as measured by the fourth quantile of 1/MPI to CZP distance changed over the 4 days of firing.

Table 62. All Subjects Quantile 4 of 5 1/MPI to CZP Distance Shapiro-Wilk Test Results

Day	W	P-Value
2	0.87244	0.00588
3	0.52941	1E-07
4	0.79729	0.00027
5	0.73381	2.9E-05

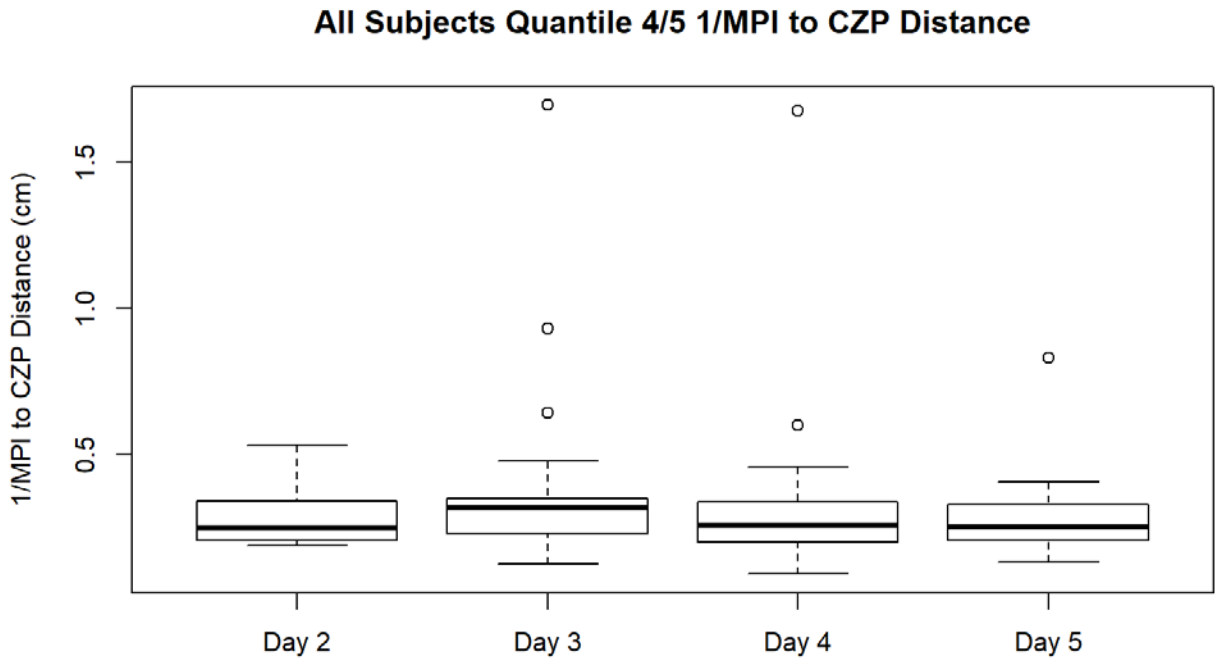

Figure 72. All Subjects Quantile 4 of 5 1/MPI to CZP Distance Results

As Table 63 indicates, the null hypothesis of a normal distribution was rejected for days 2, 3 and 4. The boxplot in Figure 73 does not provide information to the contrary. Bartlett's test produced a K^2 value of 86.146 and a p value of 2.2e-16, rejecting the null hypothesis of homoscedasticity. The Brunner-Dette-Munk test produced an F value of 0.860738 and a p value of 0.462061 failing to reject the null hypothesis of equality of distribution functions. Because this null hypothesis was not rejected, it cannot be concluded that accuracy, as measured by the fifth quantile of 1/MPI to CZP distance changed over the 4 days of firing.

Table 63. All Subjects Quantile 5 of 5 1/MPI to CZP Distance Shapiro-Wilk Test Results

Day	W	P-Value
2	0.77883	0.00014
3	0.546	2E-07
4	0.78885	0.00019
5	0.92926	0.09383

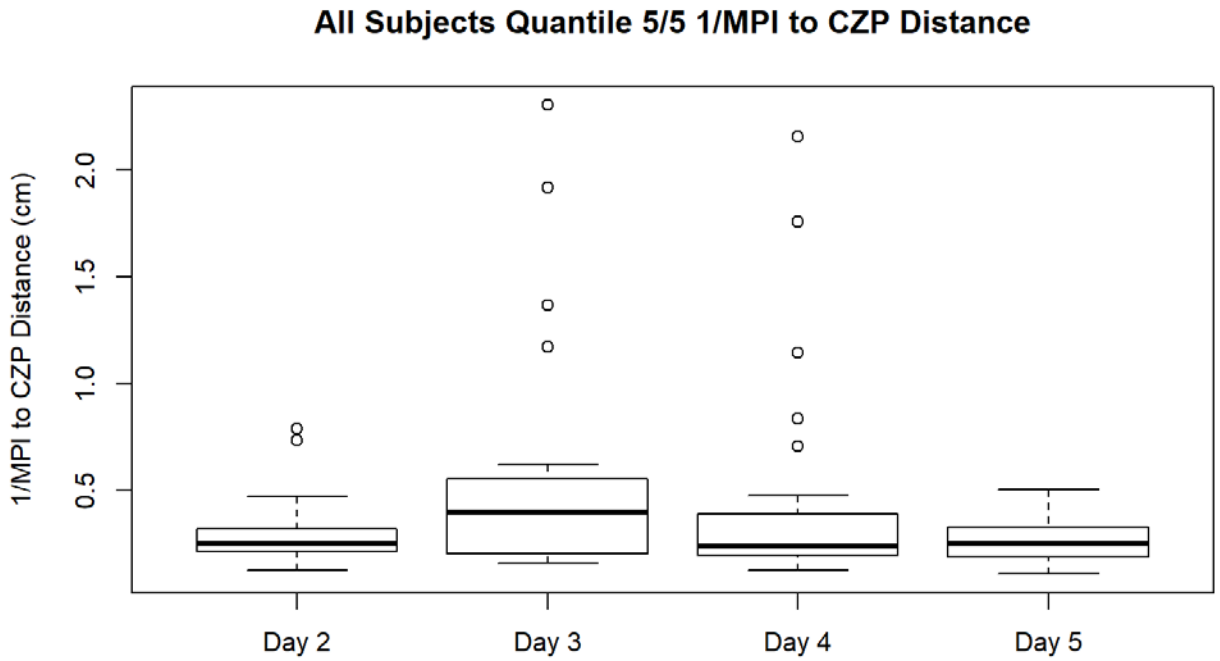

Figure 73. All Subjects Quantile 5 of 5 1/MPI to CZP Distance Results

As Table 64 indicates, the null hypothesis of a normal distribution was rejected for days 4 and 5. The boxplot in Figure 74 does not provide information to the contrary. Bartlett's test produced a K^2 value of 2.062 and a p value of 0.5596, failing to reject the null hypothesis of homoscedasticity. The Kruskal-Wallis test produced a X^2 value of 2.4319 and a p value of 0.4877 failing to reject the null hypothesis of equality of dataset medians. Because this null hypothesis was not rejected, it cannot be concluded that accuracy, as measured by the first quantile of 1/DCMS changed over the 4 days of firing.

Table 64. All Subjects Quantile 1 of 5 1/DCMS Shapiro-Wilk Test Results

Day	W	P-Value
2	0.91841	0.05387
3	0.95246	0.30604
4	0.85214	0.0024
5	0.86047	0.00344

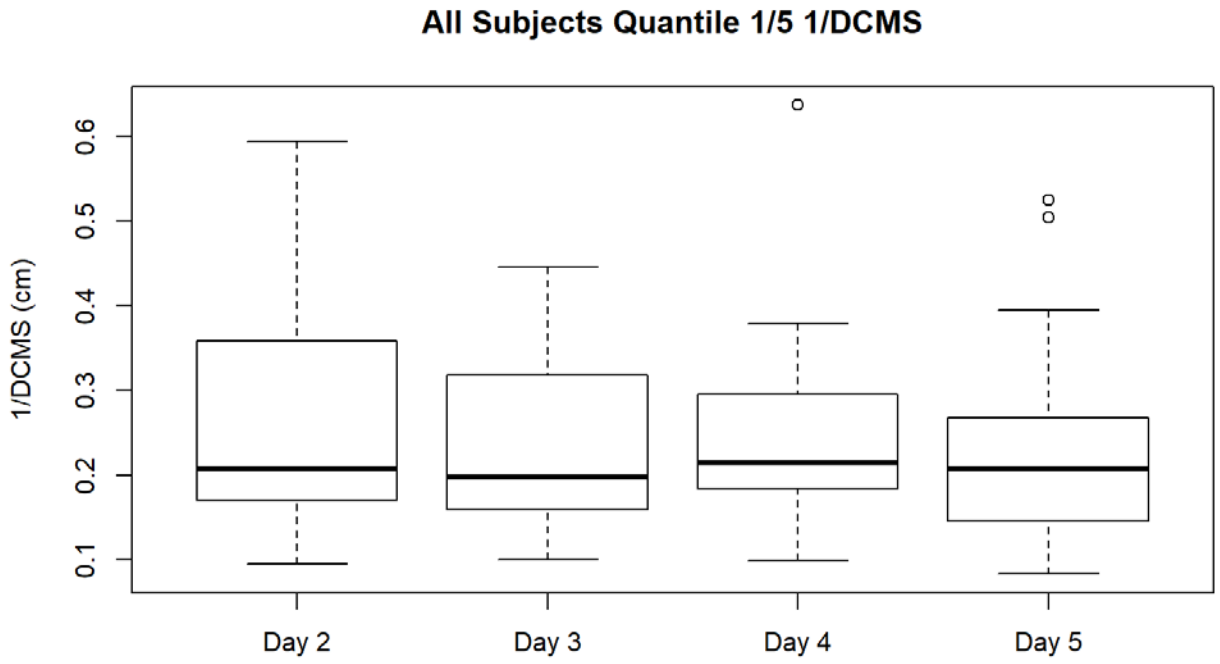

Figure 74. All Subjects Quantile 1 of 5 1/DCMS Results

As Table 65 indicates, the null hypothesis of a normal distribution was rejected for days 2, 3 and 5. The boxplot in Figure 75 does not provide information to the contrary. Bartlett's test produced a K^2 value of 9.0251 and a p value of 0.02896, rejecting the null hypothesis of homoscedasticity. The Brunner-Dette-Munk test produced an F value of 0.3048699 and a p value of 0.8193313 failing to reject the null hypothesis of equality of distribution functions. Because this null hypothesis was not rejected, it cannot be concluded that accuracy, as measured by the second quantile of 1/DCMS changed over the 4 days of firing.

Table 65. All Subjects Quantile 2 of 5 1/DCMS Shapiro-Wilk Test Results

Day	W	P-Value
2	0.83269	0.00106
3	0.82822	0.00088
4	0.93036	0.09931
5	0.83541	0.00119

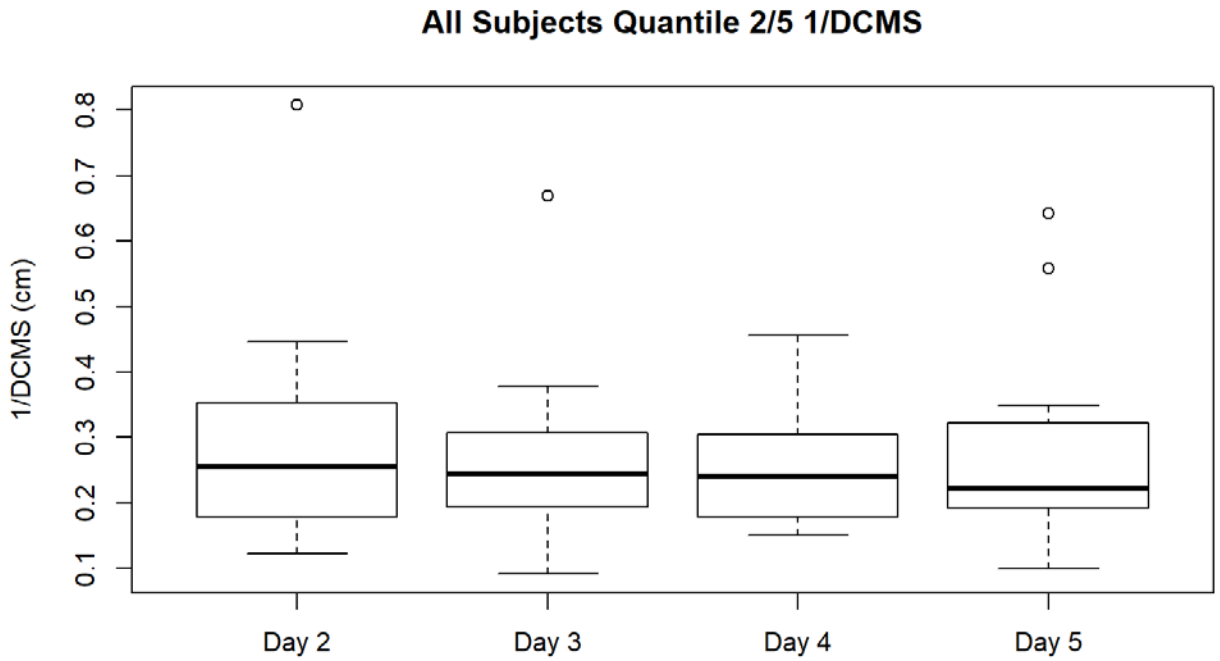

Figure 75. All Subjects Quantile 2 of 5 1/DCMS Results

As Table 66 indicates, the null hypothesis of a normal distribution was rejected for days 2, 3 and 5. The boxplot in Figure 76 does not provide information to the contrary. Bartlett's test produced a K^2 value of 22.238 and a p value of 5.819e-05, rejecting the null hypothesis of homoscedasticity. The Brunner-Dette-Munk test produced an F value of 0.6551942 and a p value of 0.5801358 failing to reject the null hypothesis of equality of distribution functions. Because this null hypothesis was not rejected, it cannot be concluded that accuracy, as measured by the third quantile of 1/DCMS changed over the 4 days of firing.

Table 66. All Subjects Quantile 3 of 5 1/DCMS Shapiro-Wilk Test Results

Day	W	P-Value
2	0.69473	8.6E-06
3	0.8788	0.00786
4	0.94582	0.21953
5	0.80791	0.0004

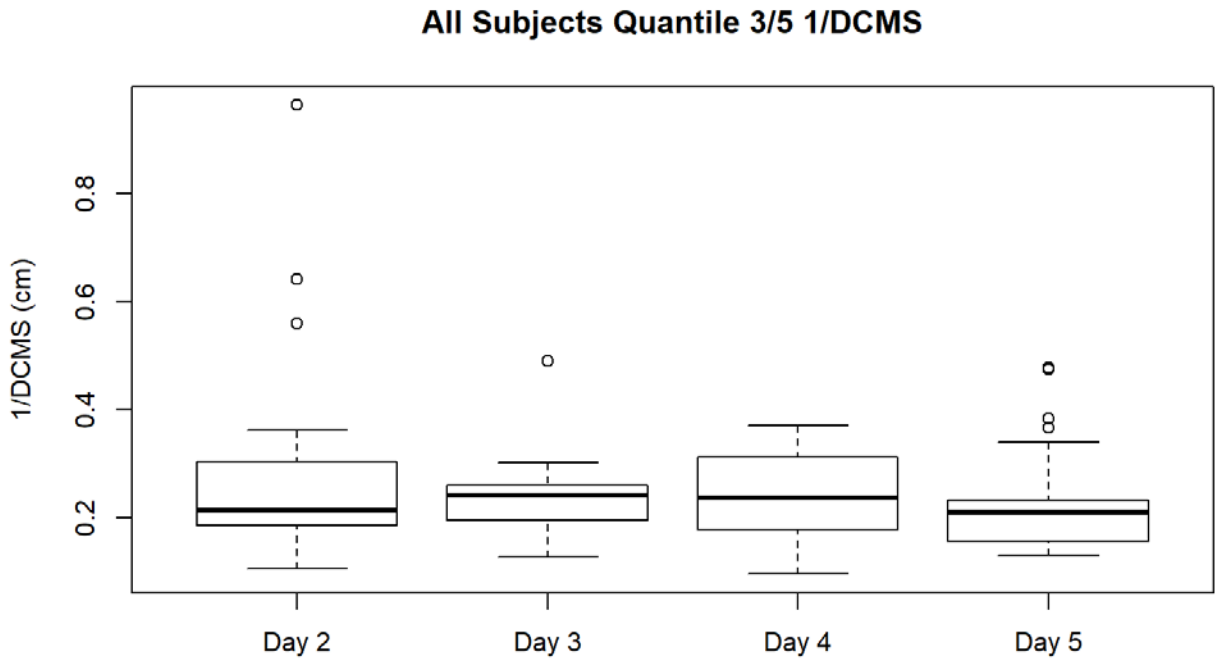

Figure 76. All Subjects Quantile 3 of 5 1/DCMS Results

As Table 67 indicates, the null hypothesis of a normal distribution was rejected for day 2. The boxplot in Figure 77 does not provide information to the contrary. Bartlett's test produced a K^2 value of 8.0069 and a p value of 0.04587, rejecting the null hypothesis of homoscedasticity. The Brunner-Dette-Munk test produced an F value of 0.9929416 and a p value of 0.3986247 failing to reject the null hypothesis of equality of distribution functions. Because this null hypothesis was not rejected, it cannot be concluded that accuracy, as measured by the fourth quantile of 1/DCMS changed over the 4 days of firing.

Table 67. All Subjects Quantile 4 of 5 1/DCMS Shapiro-Wilk Test Results

Day	W	P-Value
2	0.90129	0.02292
3	0.92038	0.05953
4	0.97598	0.81193
5	0.94908	0.2588

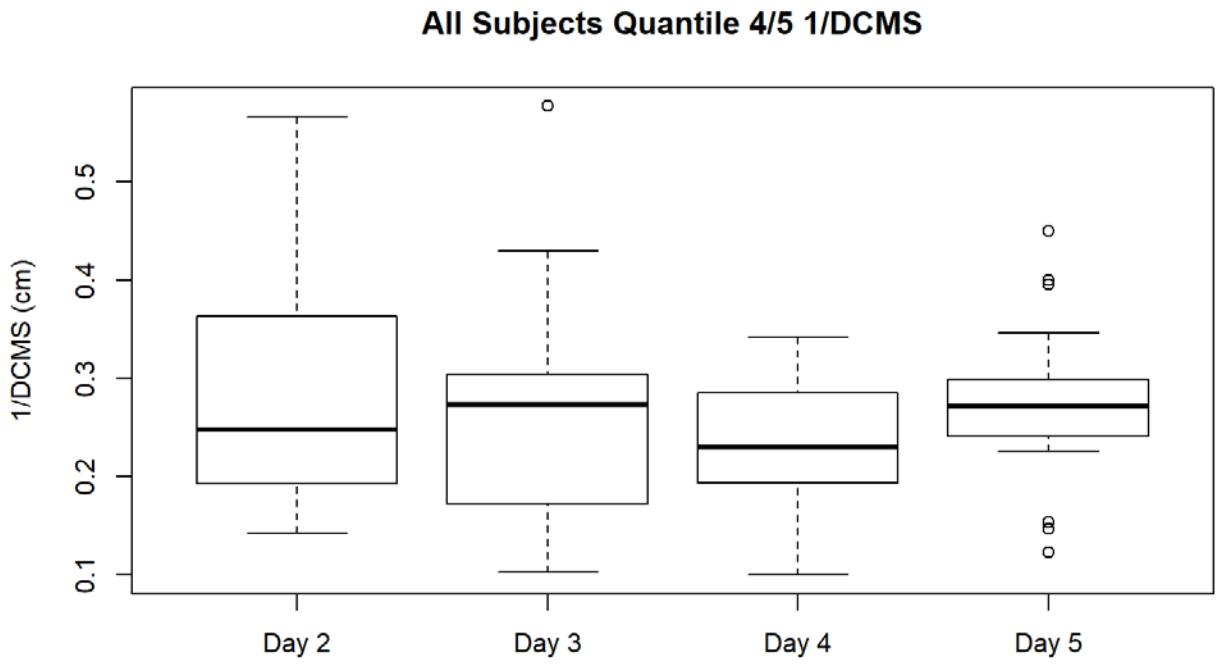

Figure 77. All Subjects Quantile 4 of 5 1/DCMS Results

As Table 68 indicates, the null hypothesis of a normal distribution was rejected for days 2, 3 and 5. The boxplot in Figure 78 does not provide information to the contrary. Bartlett's test produced a K^2 value of 1.9017 and a p value of 0.593, failing to reject the null hypothesis of homoscedasticity. The Kruskal-Wallis test produced a X^2 value of 1.5907 and a p value of 0.6615 failing to reject the null hypothesis of equality of dataset medians. Because this null hypothesis was not rejected, it cannot be concluded that accuracy, as measured by the fifth quantile of 1/DCMS changed over the 4 days of firing.

Table 68. All Subjects Quantile 5 of 5 1/DCMS Shapiro-Wilk Test Results

Day	W	P-Value
2	0.83405	0.00112
3	0.78417	0.00022
4	0.93117	0.10351
5	0.8594	0.00328

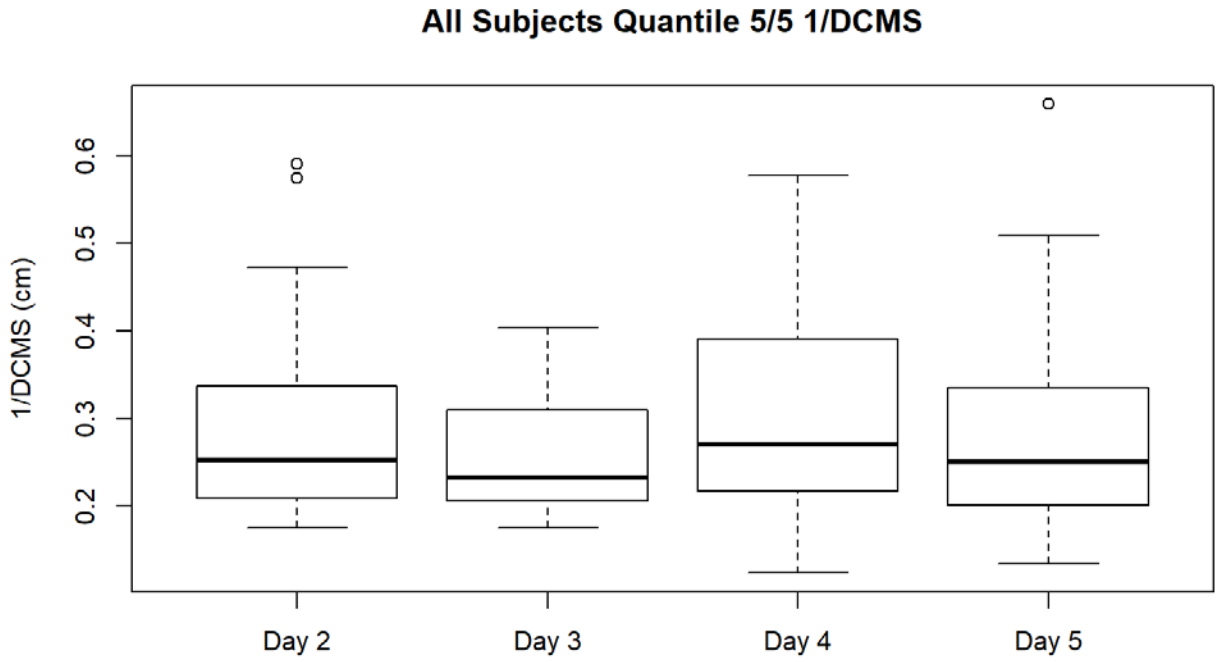

Figure 78. All Subjects Quantile 5 of 5 1/DCMS Results

As Table 69 indicates, the null hypothesis of a normal distribution was not rejected for any days. The boxplot in Figure 79 is not, however, strongly supportive of a normal distribution. Bartlett's test produced a K^2 value of 2.4733 and a p value of 0.4801, failing to reject the null hypothesis of homoscedasticity. The Kruskal-Wallis test produced a X^2 value of 1.5208 and a p value of 0.6775 failing to reject the null hypothesis of equality of dataset medians. Because this null hypothesis was not rejected, it cannot be concluded that accuracy, as measured by the first quantile of 1/MPI to CZP distance changed over the 4 days of firing.

Table 69. All Subjects Quantile 1 of 6 1/MPI to CZP Distance Shapiro-Wilk Test Results

Day	W	P-Value
2	0.91455	0.07786
3	0.91789	0.09025
4	0.96494	0.64638
5	0.94481	0.29512

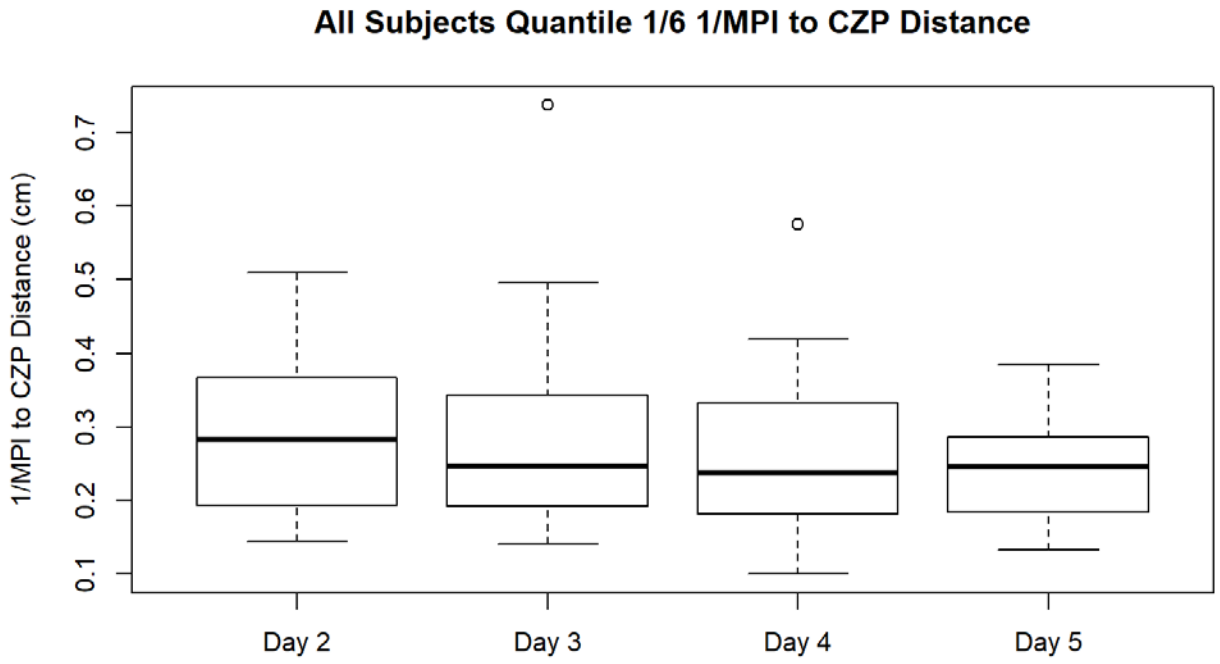

Figure 79. All Subjects Quantile 1 of 6 1/MPI to CZP Distance Results

As Table 70 indicates, the null hypothesis of a normal distribution was rejected for days 2 and 3. The boxplot in Figure 80 does not provide information to the contrary. Bartlett's test produced a K^2 value of 28.779 and a p value of 2.492e-06, rejecting the null hypothesis of homoscedasticity. The Brunner-Dette-Munk test produced an F value of 0.5761924 and a p value of 0.6282732 failing to reject the null hypothesis of equality of distrubiton functions. Because this null hypothesis was not rejected, it cannot be concluded that accuracy, as measured by the second quantile of 1/MPI to CZP distance changed over the 4 days of firing.

Table 70. All Subjects Quantile 2 of 6 1/MPI to CZP Distance Shapiro-Wilk Test Results

Day	W	P-Value
2	0.81386	0.0014
3	0.74961	0.00017
4	0.98496	0.98128
5	0.92467	0.1219

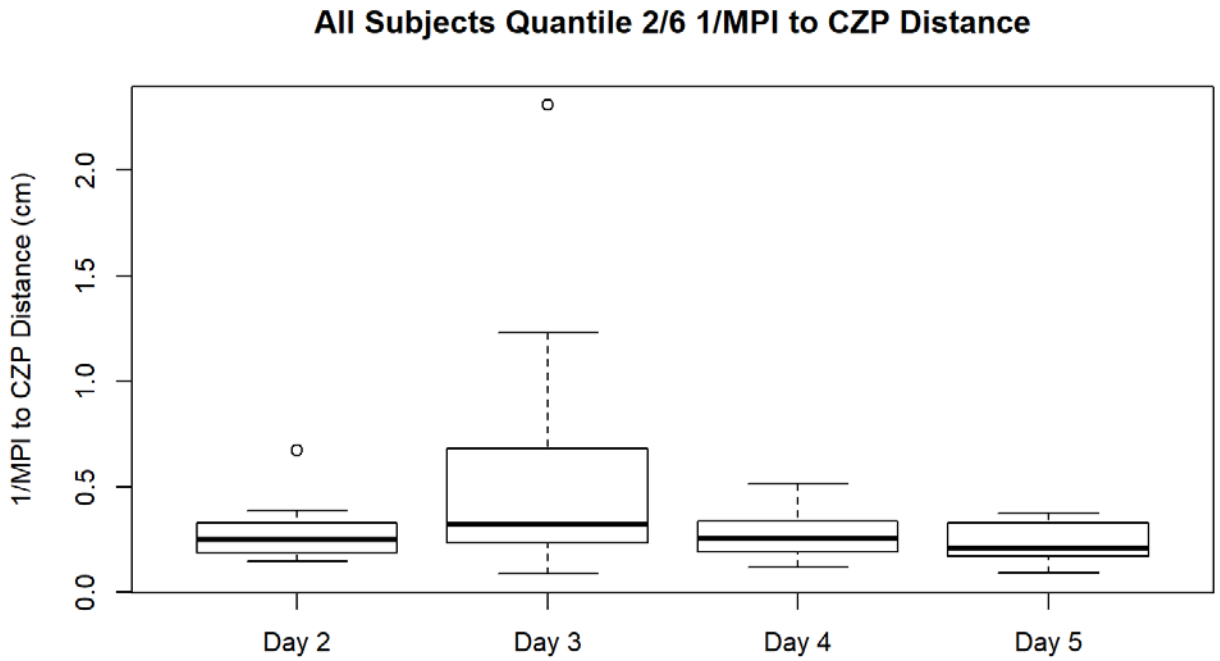

Figure 80. All Subjects Quantile 2 of 6 1/MPI to CZP Distance Results

As Table 71 indicates, the null hypothesis of a normal distribution was rejected for days 2 and 4. The boxplot in Figure 81 does not provide information to the contrary. Bartlett's test produced a K^2 value of 5.3959 and a p value of 0.145, failing to reject the null hypothesis of homoscedasticity. The Kruskal-Wallis test produced a X^2 value of 2.118 and a p value of 0.5483 failing to reject the null hypothesis of equality of dataset medians. Because this null hypothesis was not rejected, it cannot be concluded that accuracy, as measured by the third quantile of 1/MPI to CZP distance changed over the 4 days of firing.

Table 71. All Subjects Quantile 3 of 6 1/MPI to CZP Distance Shapiro-Wilk Test Results

Day	W	P-Value
2	0.79268	0.00067
3	0.91698	0.08667
4	0.87746	0.01593
5	0.9274	0.13759

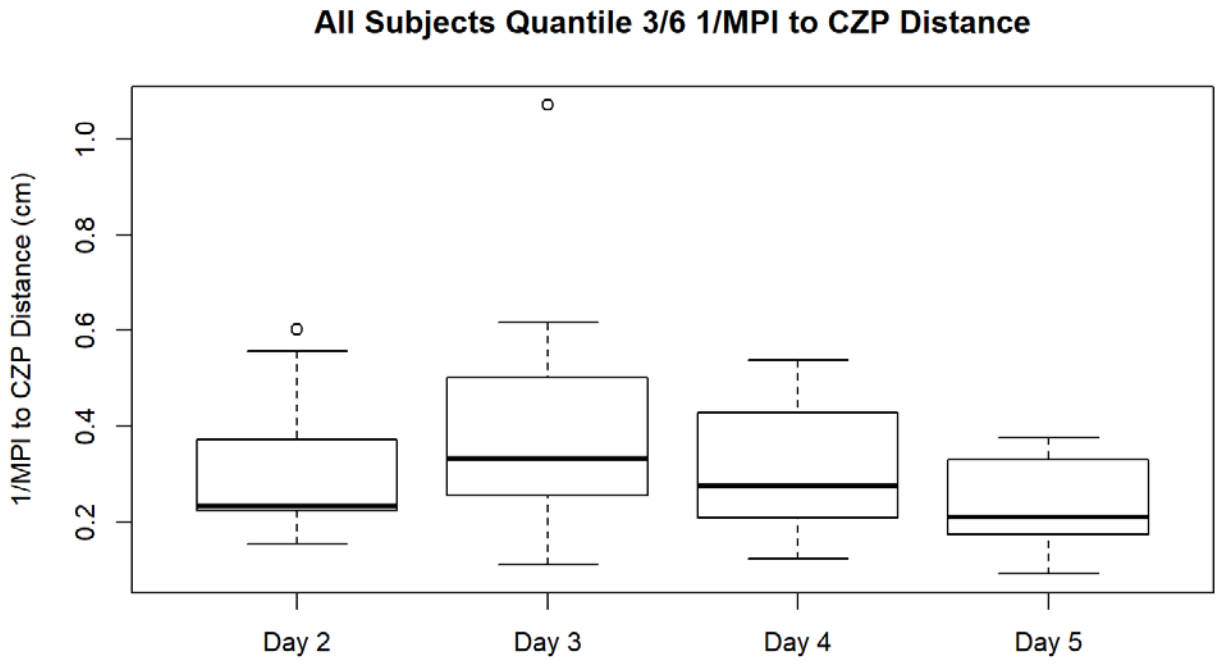

Figure 81. All Subjects Quantile 3 of 6 1/MPI to CZP Distance Results

As Table 72 indicates, the null hypothesis of a normal distribution was rejected for days 2, 3 and 4. The boxplot in Figure 82 does not provide information to the contrary. Bartlett's test produced a K^2 value of 22.313 and a p value of 5.614e-05, rejecting the null hypothesis of homoscedasticity. The Brunner-Dette-Munk test produced an F value of 1.00391 and a p value of 0.3955436 failing to reject the null hypothesis of equality of distribution functions. Because this null hypothesis was not rejected, it cannot be concluded that accuracy, as measured by the fourth quantile of 1/MPI to CZP distance changed over the 4 days of firing.

Table 72. All Subjects Quantile 4 of 6 1/MPI to CZP Distance Shapiro-Wilk Test Results

Day	W	P-Value
2	0.79073	0.00063
3	0.6387	7.6E-06
4	0.60746	3.5E-06
5	0.92383	0.11743

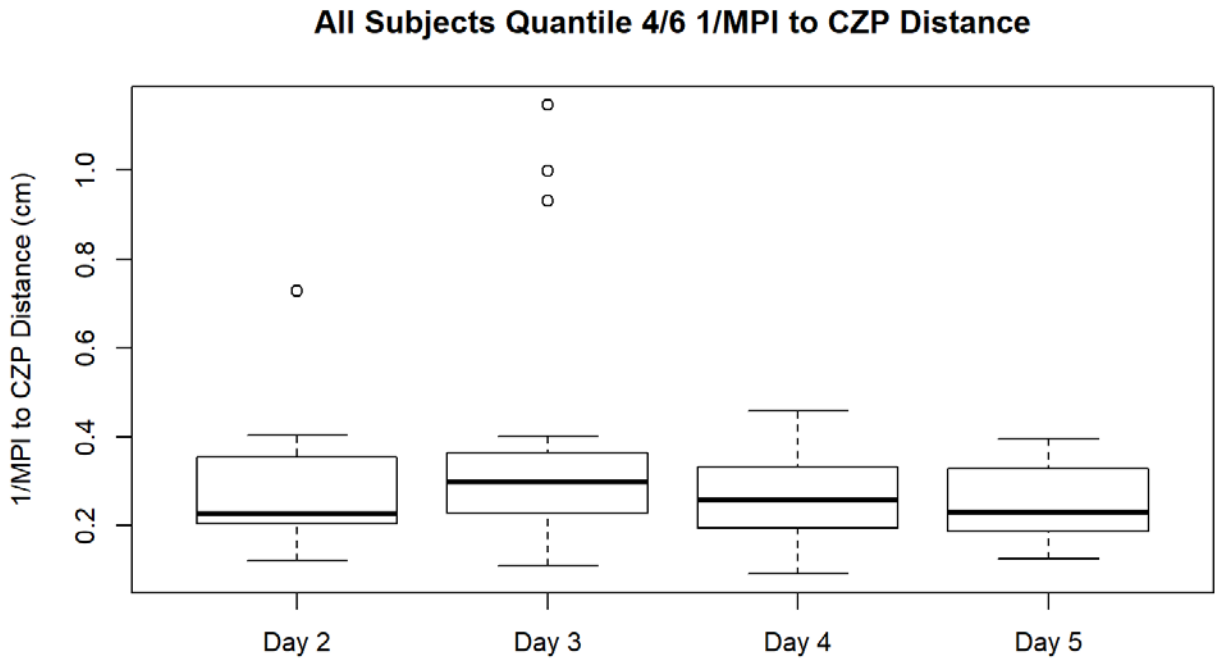

Figure 82. All Subjects Quantile 4 of 6 1/MPI to CZP Distance Results

As Table 73 indicates, the null hypothesis of a normal distribution was rejected for days 2, 3 and 4. The boxplot in Figure 83 does not provide information to the contrary. Bartlett's test produced a K^2 value of 36.349 and a p value of 6.317e-08, rejecting the null hypothesis of homoscedasticity. The Brunner-Dette-Munk test produced an F value of 1.198046 and a p value of 0.3161735 failing to reject the null hypothesis of equality of dataset medians. Because this null hypothesis was not rejected, it cannot be concluded that accuracy, as measured by the fifth quantile of 1/MPI to CZP distance changed over the 4 days of firing.

Table 73. All Subjects Quantile 5 of 6 1/MPI to CZP Distance Shapiro-Wilk Test Results

Day	W	P-Value
2	0.89508	0.03338
3	0.62259	5.1E-06
4	0.78324	0.00049
5	0.67357	1.9E-05

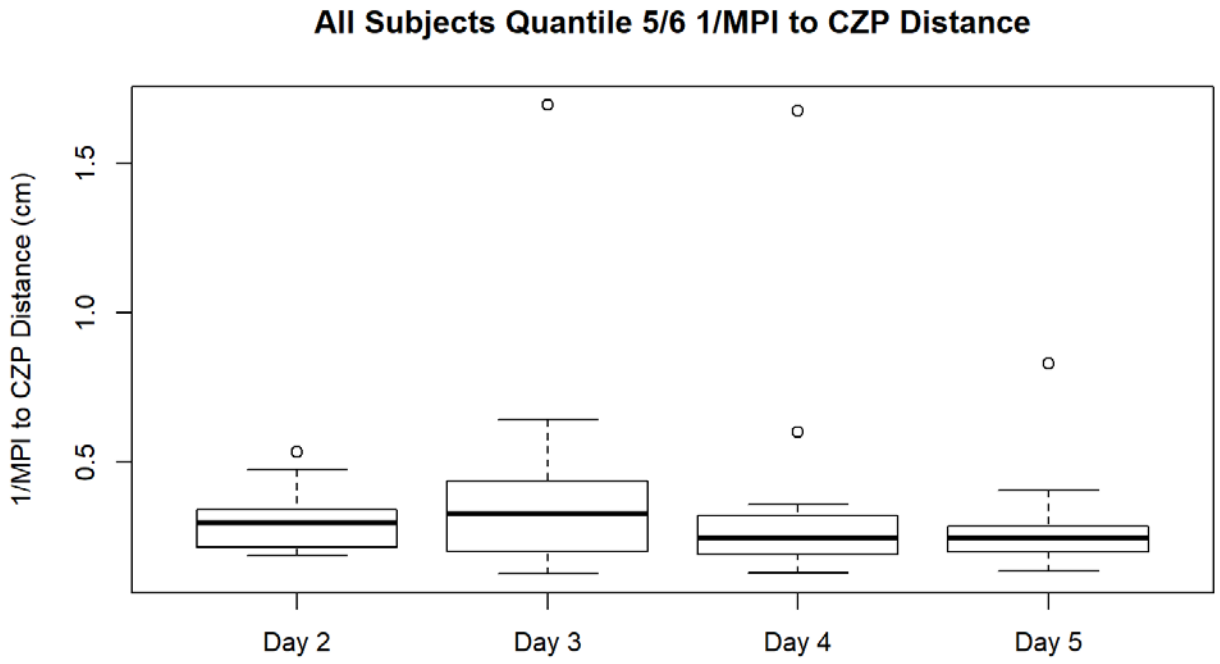

Figure 83. All Subjects Quantile 5 of 6 1/MPI to CZP Distance Results

As Table 74 indicates, the null hypothesis of a normal distribution was rejected for days 2, 3 and 4. The boxplot in Figure 84 does not provide information to the contrary. Bartlett's test produced a K^2 value of 73.623 and a p value of 7.149e-16, rejecting the null hypothesis of homoscedasticity. The Brunner-Dette-Munk test produced an F value of 0.3627782 and a p value of 0.778951 failing to reject the null hypothesis of equality of distribution functions. Because this null hypothesis was not rejected, it cannot be concluded that accuracy, as measured by the sixth quantile of 1/MPI to CZP distance changed over the 4 days of firing.

Table 74. All Subjects Quantile 6 of 6 1/MPI to CZP Distance Shapiro-Wilk Test Results

Day	W	P-Value
2	0.75182	0.00018
3	0.53648	1.1E-06
4	0.77581	0.00038
5	0.95022	0.37049

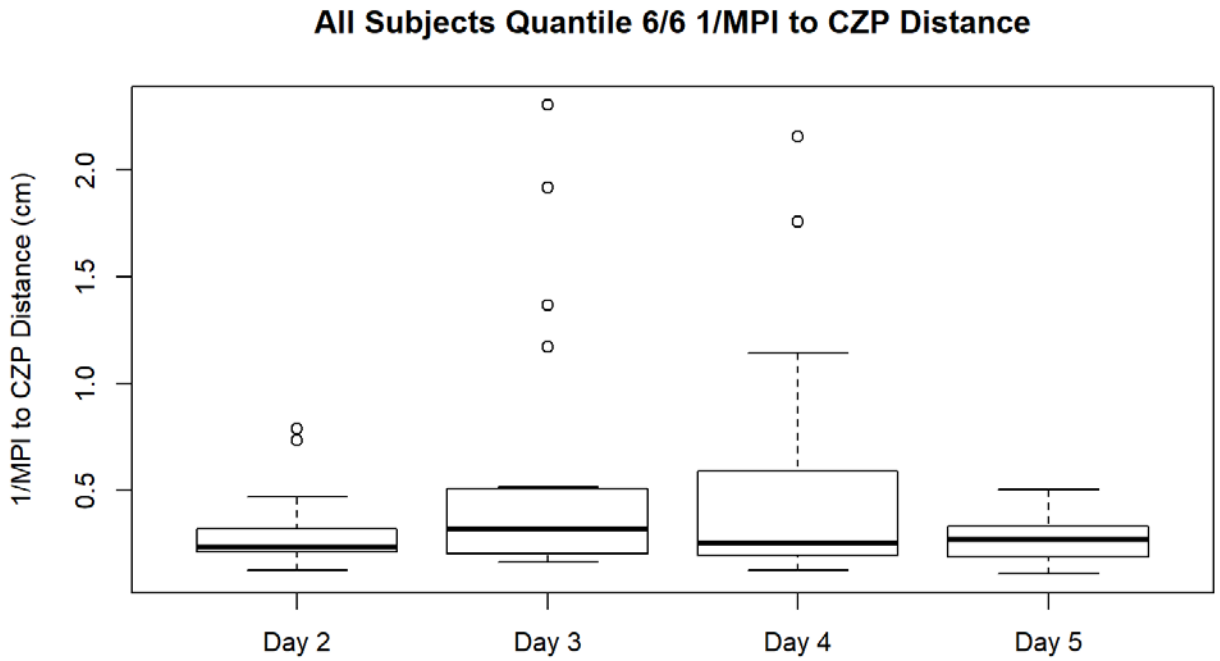

Figure 84. All Subjects Quantile 6 of 6 1/MPI to CZP Distance Results

As Table 75 indicates, the null hypothesis of a normal distribution was rejected for days 3 and 4. The boxplot in Figure 85 does not provide information to the contrary. Bartlett's test produced a K^2 value of 1.8111 and a p value of 0.6125, failing to reject the null hypothesis of homoscedasticity. The Kruskal-Wallis test produced a X^2 value of 0.62796 and a p value of 0.89 failing to reject the null hypothesis of equality of dataset medians. Because this null hypothesis as not rejected, it cannot be concluded that accuracy, as measured by the first quantile of 1/DCMS changed over the 4 days of firing.

Table 75. All Subjects Quantile 1 of 6 1/DCMS Shapiro-Wilk Test Results

Day	W	P-Value
2	0.91378	0.07525
3	0.94506	0.29827
4	0.81101	0.00127
5	0.89761	0.0372

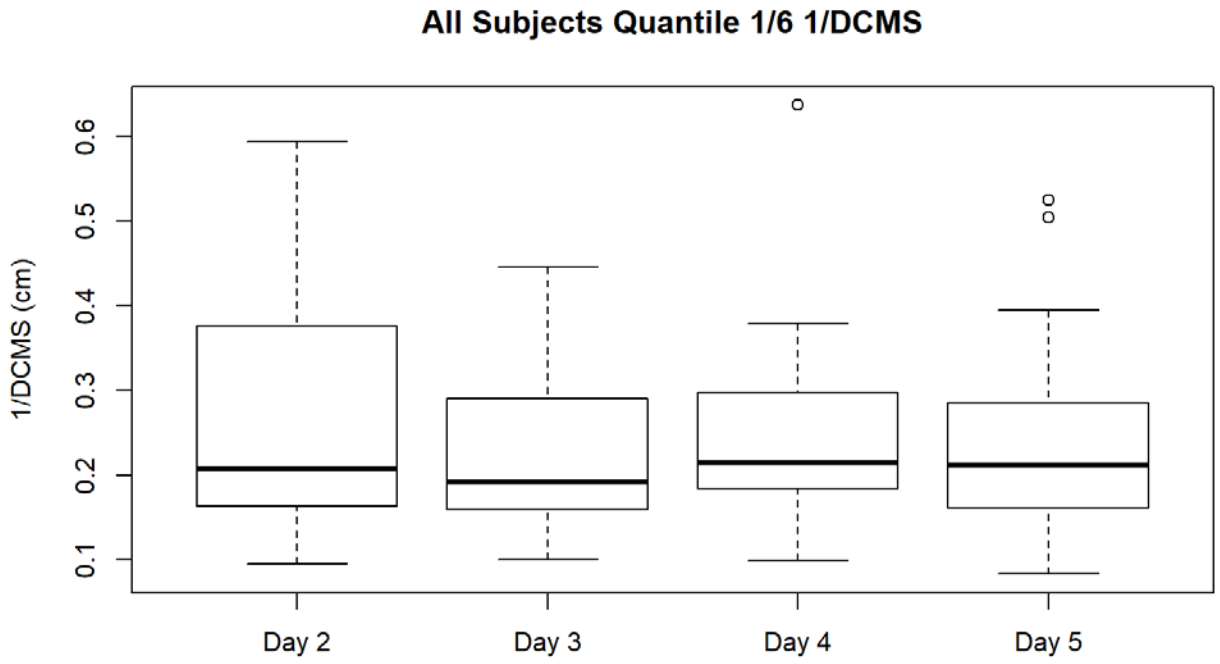

Figure 85. All Subjects Quantile 1 of 6 1/DCMS Results

As Table 76 indicates, the null hypothesis of a normal distribution was rejected for days 3 and 5. The boxplot in Figure 86 does not provide information to the contrary. Bartlett's test produced a K^2 value of 7.2022 and a p value of 0.06573, failing to reject the null hypothesis of homoscedasticity. The Kruskal-Wallis test produced a X^2 value of 1.6213 and a p value of 0.6546 failing to reject the null hypothesis of equality of dataset medians. Because this null hypothesis as not rejected, it cannot be concluded that accuracy, as measured by the second quantile of 1/DCMS changed over the 4 days of firing.

Table 76. All Subjects Quantile 2 of 6 1/DCMS Shapiro-Wilk Test Results

Day	W	P-Value
2	0.93683	0.20879
3	0.81569	0.0015
4	0.93448	0.18821
5	0.847	0.00475

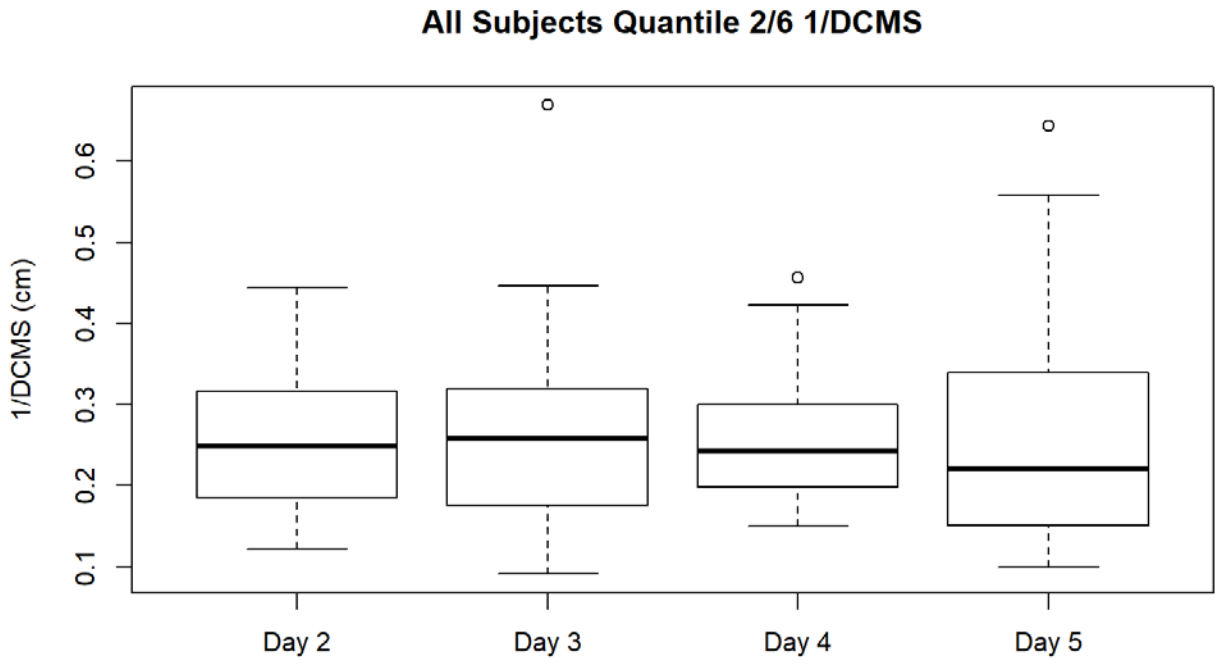

Figure 86. All Subjects Quantile 2 of 6 1/DCMS Results

As Table 77 indicates, the null hypothesis of a normal distribution was rejected for days 2, 3 and 5. The boxplot in Figure 87 does not provide information to the contrary. Bartlett's test produced a K^2 value of 33.711 and a p value of 2.28e-07, rejecting the null hypothesis of homoscedasticity. The Brunner-Dette-Munk test produced an F value of 1.6185 and a p value of 0.1934844 failing to reject the null hypothesis of equality of distribution functions. Because this null hypothesis as not rejected, it cannot be concluded that accuracy, as measured by the third quantile of 1/DCMS changed over the 4 days of firing.

Table 77. All Subjects Quantile 3 of 6 1/DCMS Shapiro-Wilk Test Results

Day	W	P-Value
2	0.75231	0.00018
3	0.88554	0.02229
4	0.94534	0.30186
5	0.82338	0.00197

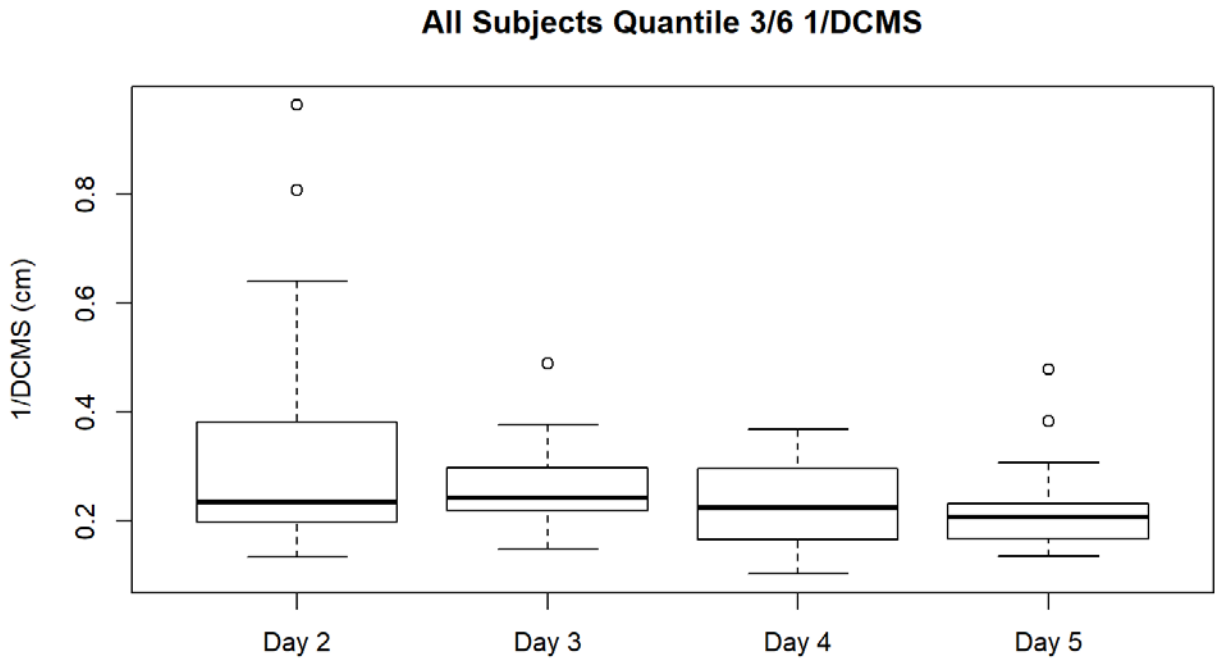

Figure 87. All Subjects Quantile 3 of 6 1/DCMS Results

As Table 78 indicates, the null hypothesis of a normal distribution was rejected for days 2 and 3. The boxplot in Figure 88 does not provide information to the contrary. Bartlett's test produced a K^2 value of 4.6072 and a p value of 0.2029, failing to reject the null hypothesis of homoscedasticity. The Kruskal-Wallis test produced a X^2 value of 0.46463 and a p value of 0.9266 failing to reject the null hypothesis of equality of dataset medians. Because this null hypothesis as not rejected, it cannot be concluded that accuracy, as measured by the fourth quantile of 1/DCMS changed over the 4 days of firing.

Table 78. All Subjects Quantile 4 of 6 1/DCMS Shapiro-Wilk Test Results

Day	W	P-Value
2	0.84797	0.00493
3	0.78856	0.00059
4	0.96566	0.66183
5	0.9321	0.16947

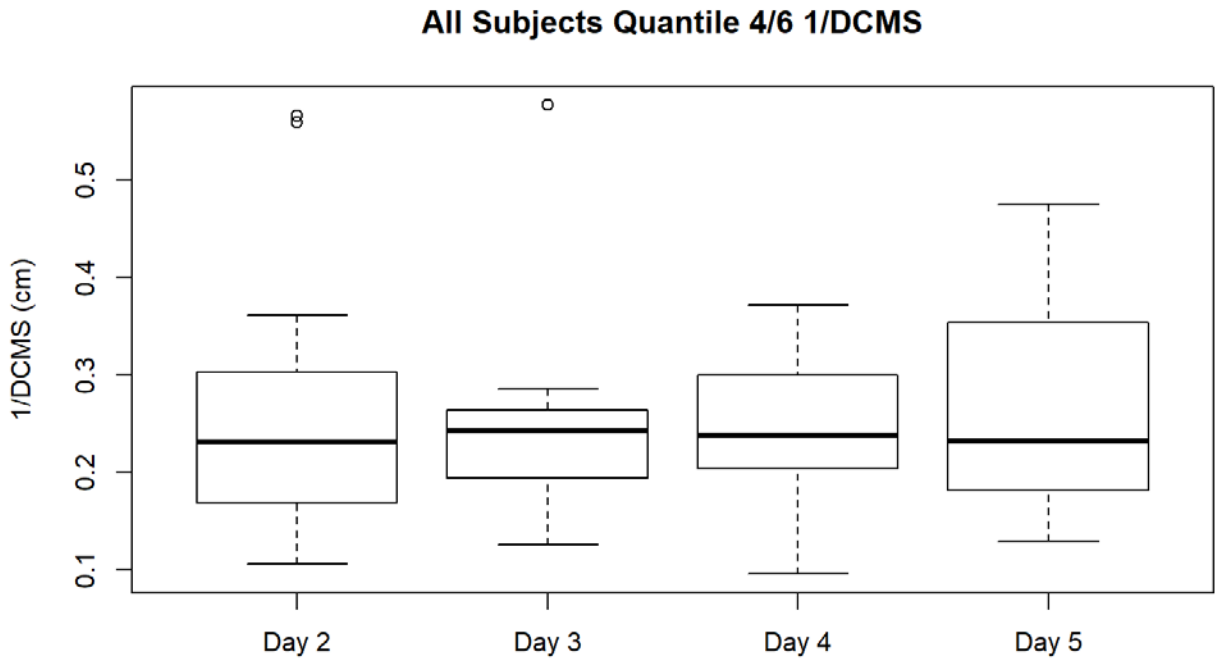

Figure 88. All Subjects Quantile 4 of 6 1/DCMS Results

As Table 79 indicates, the null hypothesis of a normal distribution was rejected for day 2. The boxplot in Figure 89 does not provide information to the contrary. Bartlett's test produced a K^2 value of 10.619 and a p value of 0.01398, rejecting the null hypothesis of homoscedasticity. The Brunner-Dette-Munk test produced an F value of 0.7840732 and a p value of 0.5028214 failing to reject the null hypothesis of equality of distribution functions. Because this null hypothesis as not rejected, it cannot be concluded that accuracy, as measured by the fifth quantile of 1/DCMS changed over the 4 days of firing.

Table 79. All Subjects Quantile 5 of 6 1/DCMS Shapiro-Wilk Test Results

Day	W	P-Value
2	0.86068	0.00809
3	0.97576	0.86847
4	0.97102	0.77627
5	0.93417	0.1857

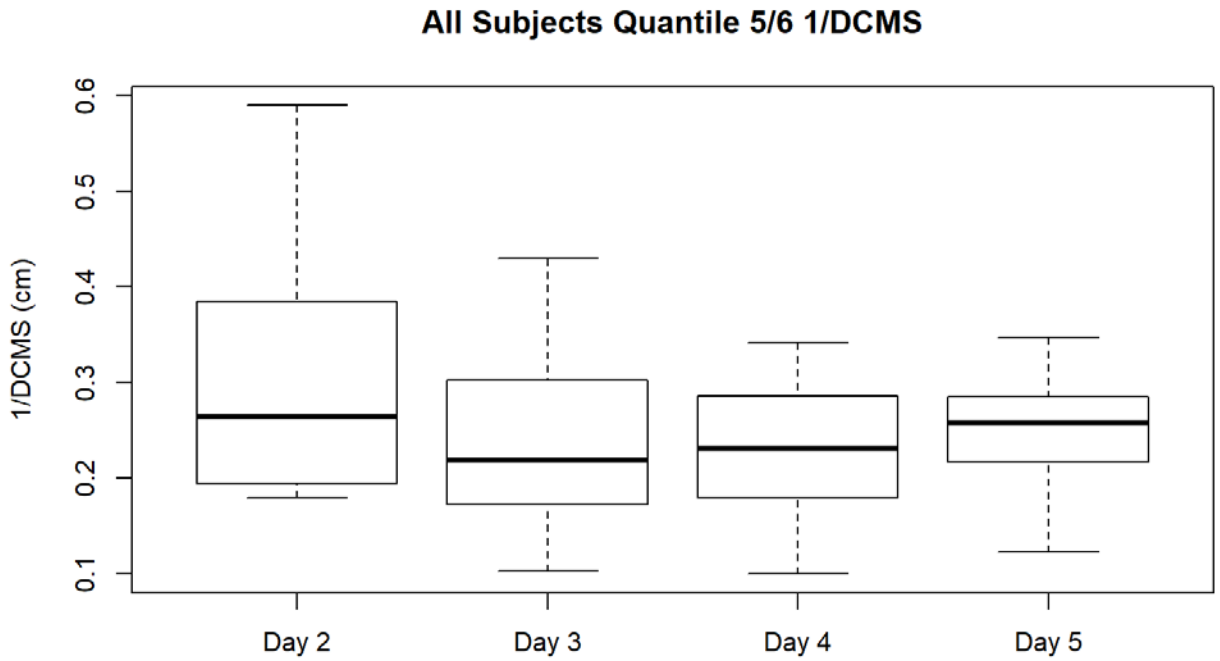

Figure 89. All Subjects Quantile 5 of 6 1/DCMS Results

As Table 80 indicates, the null hypothesis of a normal distribution was rejected for days 2, 3 and 5. The boxplot in Figure 90 does not provide information to the contrary. Bartlett's test produced a K^2 value of 2.2302 and a p value of 0.526, failing to reject the null hypothesis of homoscedasticity. The Kruskal-Wallis test produced a X^2 value of 1.6134 and a p value of 0.6564 failing to reject the null hypothesis of equality of dataset medians. Because this null hypothesis as not rejected, it cannot be concluded that accuracy, as measured by the sixth quantile of 1/DCMS changed over the 4 days of firing.

Table 80. All Subjects Quantile 6 of 6 1/DCMS Shapiro-Wilk Test Results

Day	W	P-Value
2	0.86795	0.01082
3	0.8017	0.00121
4	0.9465	0.31702
5	0.89273	0.03019

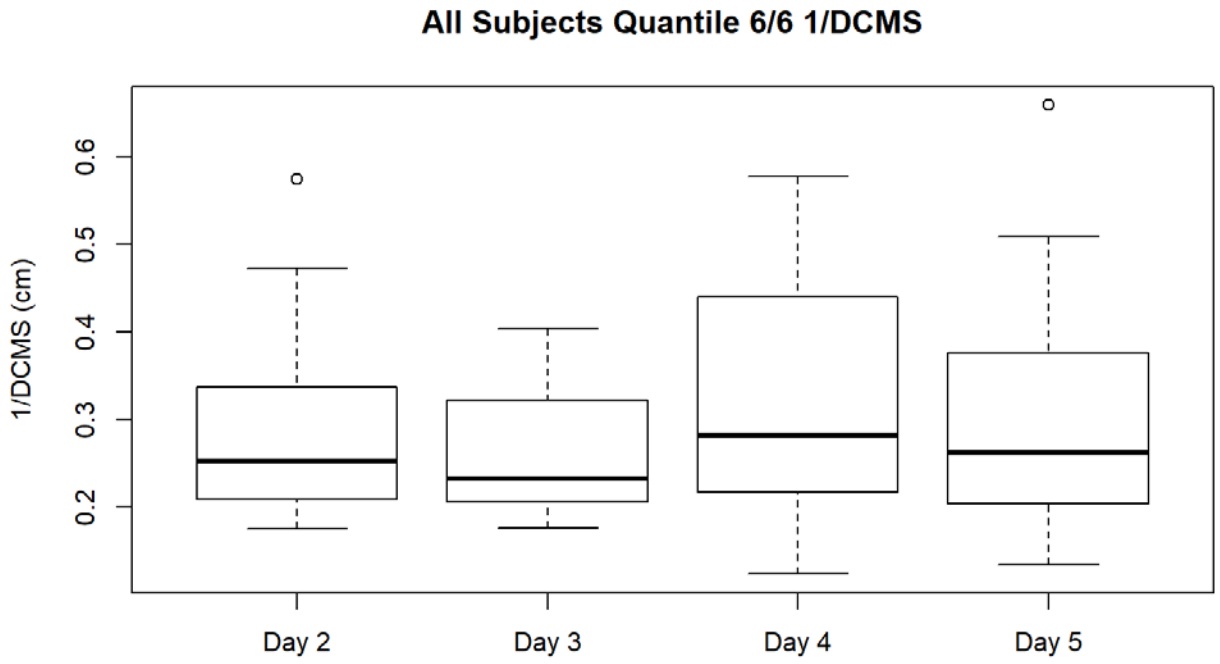

Figure 90. All Subjects Quantile 6 of 6 1/DCMS Results

4.1.2.4 Correlation Results

In Table 81, the results of the Pearson, Kendall, and Spearman tests for correlation between shot timing and the distance from the shot to the center of the target are shown for all subjects. As Table 81 indicates, the respective null hypotheses of no correlation were rejected for days 2 and 5 using the Pearson test, day 5 using the Kendall method, and day 5 using the Spearman method. While the correlations were significant, they were weak as shown by the fact that the largest coefficient was -0.15651.

Table 81. All Subjects Correlation Results

	Pearson			Kendall				Spearman	
Day	T	P-Value	Coefficient	Z	P-Value	Tau	S	P-Value	Rho
2	-2.4955	0.01303	-0.1308	-1.5289	0.1263	-0.05415	8396200	0.1309	-0.07976
3	-1.4147	0.158	-0.07487	-0.58189	0.5606	-0.0207	7807300	0.5778	-0.02955
4	0.5758	0.5651	0.030418	1.7879	0.07378	0.063358	7014300	0.0634	0.097943
5	-2.939	0.003507	-0.15349	-2.9114	0.003598	-0.10319	8992900	0.002906	-0.15651

4.1.3 Marksmanship Visual Search Experiment

The analysis presented in this section was performed on the pooled data of all subjects. Individual subject data analyses are available in Appendix C of this document. As indicated in Table 82, the null hypothesis of equality of proportions was not rejected for any of the visual acuities over the 4 days of firing. As indicated in Table 83, performance did not differ to a significant extent at any of the visual acuities on any individual day of firing. Hit proportions and 95% confidence intervals for each acuity over the days of firing are provided in Figures 91-94.

Table 82. Subjects VS01-VS10 Acuity Hit Proportions

Acuity	Day 2	Day 3	Day 4	Day 5	Chi-Squared	P-Value
A	0.95938	0.95283	0.95313	0.96386	0.57811	0.9014
B	0.95938	0.95925	0.95938	0.95968	0.00069	1
C	0.94375	0.96238	0.94688	0.95968	1.7439	0.6272
D	0.92813	0.925	0.9375	0.92771	0.43322	0.9333

Table 83. Subjects VS01-VS10 Daily Hit Proportions

Day	Acuity A	Acuity B	Acuity C	Acuity D	Chi-Squared	P-Value
2	0.95938	0.95938	0.94375	0.92813	4.3312	0.2279
3	0.94984	0.95925	0.96238	0.925	5.6958	0.1274
4	0.95313	0.95938	0.94688	0.9375	1.7342	0.6294
5	0.96386	0.95968	0.95968	0.92771	4.6755	0.1972

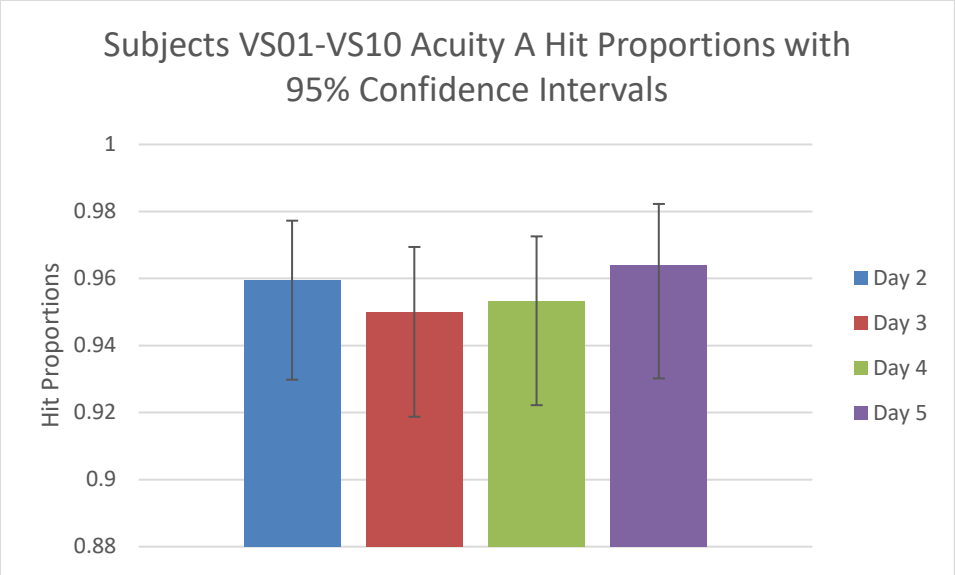

Figure 91. Subjects VS01-VS10 Acuity A Hit Proportions

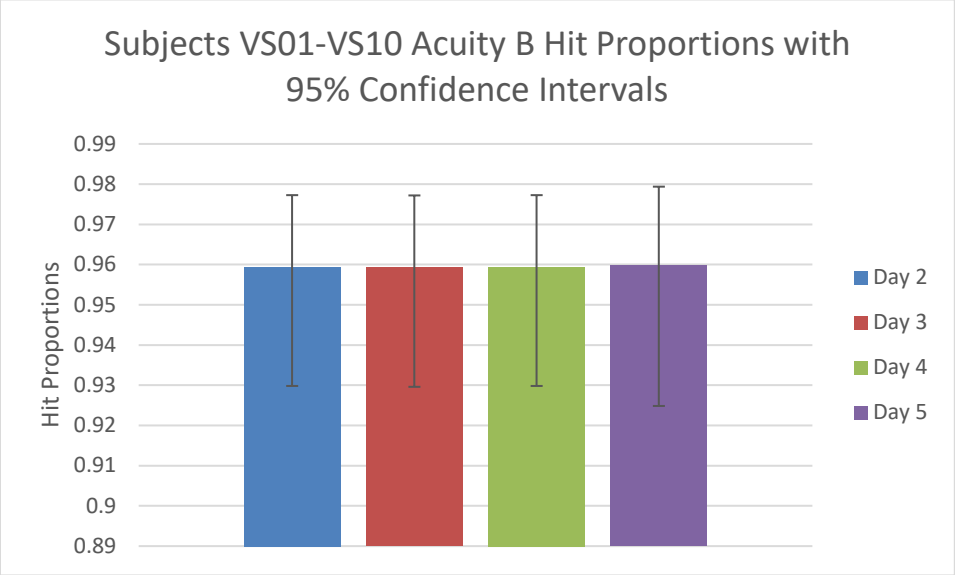

Figure 92. Subjects VS01-VS10 Acuity B Hit Proportions

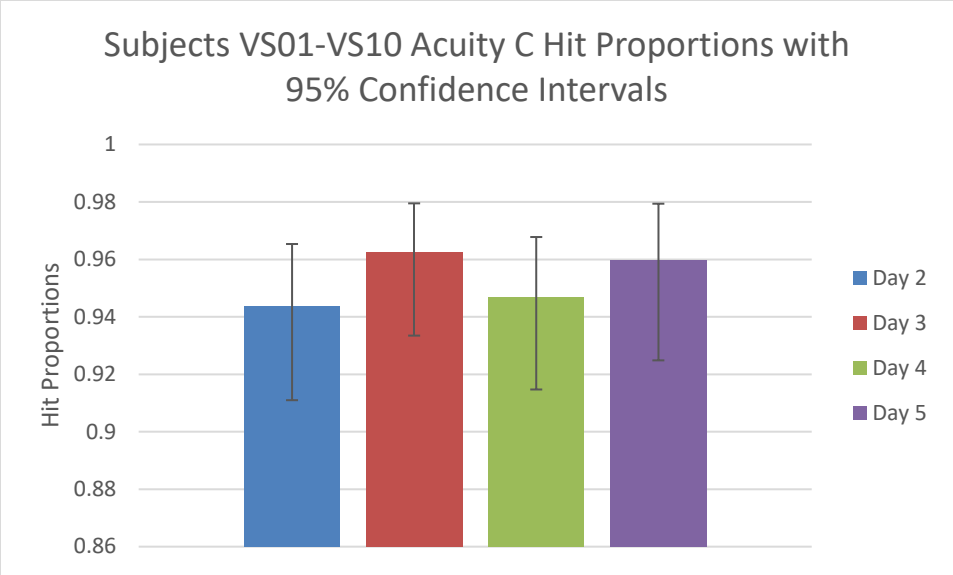

Figure 93. Subjects VS01-VS10 Acuity C Hit Proportions

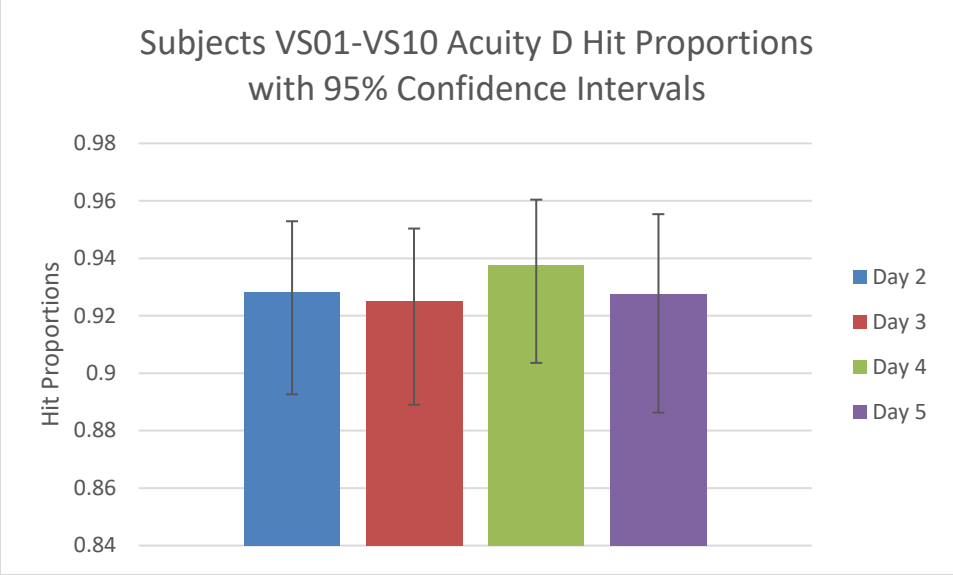

Figure 94. Subjects VS01-VS10 Acuity D Hit Proportions

4.2 Discussion

4.2.1 Marksmanship Accuracy and Precision Experiment

4.2.1.1 Hypothesis 1: Experience Level and Iterations to Reach Asymptote

As presented in section 4.1.1.1, there was no significant correlation found between the experience level of the test subjects and the number of iterations required to reach asymptotic performance during each day of firing. One potential issue with the experiment and its results lies with the sample sizes, which were 4 for experienced subjects and 2 for inexperienced subjects. Since such small and disparate sample sizes have the potential to be problematic when using hypothesis tests that compare two samples, data were pooled and tested for a correlation between experience level and the number of iterations to reach asymptote. By pooling the data and performing the analysis in this manner, the total dataset size was 24 days of firing, with 16 experienced days and 8 inexperienced days.

While the failure to reject the null hypothesis of a correlation between the level of test subject experience and the number of iterations required to reach asymptote does not prove the nonexistence of such a correlation, it does not provide any evidence in support of such a relationship. In practical terms, these results imply that the number of iterations in the experimental design was able to accommodate both experienced and inexperienced subjects. As such, the authors see no reason to change the number of iterations in follow on investigations.

4.2.1.2 Hypothesis 2: Iterations to Reach Asymptote Will Decrease Over Time

In the results presented in section 4.1.1.2, the datasets for all subjects were pooled by day and compared for both pistol and rifle. In the case of the pistol data, testing failed to reject the null hypothesis of normality. The boxplot in Figure 11, however, was indicative of potential bias in the data and did not lend strong support to the assumption of normality. Further analysis, via the Kruskal-Wallis test, resulted in a failure to reject the null hypothesis of equality of dataset location. Since the analyses do not provide evidence of any change in dataset location, it cannot be concluded that the number of iterations required to reach pistol asymptote decreased over the four days of data collection. As with the pistol data, the assumption of normality could not be satisfied for the rifle data in section 4.1.1.2. In addition, it was determined that the assumption of homoscedasticity could not be met. As a result, the Brunner-Dette-Munk test was performed, and the null hypothesis of equality of distribution functions was not rejected. Failure to reject this null hypothesis does not provide evidence of a significant change in the distribution functions, to include measures of central tendency and extremes, over the duration of the experiment. Because there is no evidence in support of such changes, it cannot be concluded that the number of iterations required to reach rifle asymptote decreased during the experiment.

For both the pistol and rifle datasets, the failure to reject the respective null hypotheses does not prove that the number of iterations required to reach asymptote did not change,

but it does not provide sufficient evidence to state that there was a change. While these results imply that the number of iterations required to reach asymptote will not significantly change over four days of firing, the principal practical implication is that there is no need to change the present design, as the number of iterations is adequate and not excessive when subjects have a basic level of proficiency.

4.2.1.3 Hypothesis 3: Iterations to Reach Asymptote Differ Significantly for Pistol and Rifle

Several marksmanship practices, such as proper sight alignment and picture and a smooth and controlled trigger squeeze, are common to both pistols and rifles. Significant differences in the weight of the weapon, the grip and the increased stability provided by resting a rifle against the shoulder, however, compelled the investigators to infer that there may be differences in the number of iterations required to reach asymptotic performance with each weapon. In section 4.1.1.3, the results of the analysis of differences in the number of iterations required to reach asymptote with each weapon were presented. While the null hypothesis of normality was not rejected, the boxplot in Figure 13 was indicative of potential bias in the data. Since the null hypothesis of homoscedasticity was not rejected, the Kruskal-Wallis test was performed, resulting a in a failure to reject the null hypothesis of equality of dataset means. Based on the failure to reject this null hypothesis, the investigators do not have evidence to support any assertion that there is a difference in the number of iterations required to reach asymptotic performance with a pistol or rifle under the conditions of the experiments. The practical implication for these results is that the number of iterations is suitable for both weapons and there is therefore no reason to change it for follow on experiments.

4.2.1.4 Hypothesis 4: Improved Asymptotic Performance Over Time

The investigation of the improvement of asymptotic marksmanship performance over time was of particular interest to the investigators, due to the potential for such improvements to mask the effects of treatment with a pilocarpine solution in follow on studies. In section 4.1.1.4, data for all subjects and for experienced and inexperienced subjects were analyzed. The results of this analysis indicated that there were no significant differences between any days for firing for either the rifle or the pistol. When data for experienced and inexperienced subjects were considered separately, there were 3 instances in which significant differences were found between metrics on two or more days of firing. As with the previously discussed results, these results were not indicative of a trend, and no continuous improvement was found for either group with the pistol or the rifle. The practical implications for these results are profound for the design and execution of further marksmanship studies with treatments that include pilocarpine and various combinations of CBRN protective equipment. Since there is no evidence to support the assertion that statistically significant improvements to accuracy and precision in pistol and rifle marksmanship will occur over 4 days of simulated firing, provided the subjects have a basic level of proficiency, future experiments may be designed with one day of firing to collect control data, followed by three days of firing to collect experimental data with one or more treatments. Such experiments would allow for more meaningful

data collection, and analyses such as the combined effects of pilocarpine induced miosis and the use of a full CBRN protective suit could be investigated. One such potential design would call for a training and orientation day, as in the present study, followed by a day to collect control data. Data collected on the third day would be the same as that of the control day, but with the addition of a pilocarpine treatment. On the fourth day, subjects would complete the same course of fire while wearing a full CBRN protective suit, while on the fifth day subjects would wear the CBRN protective suit and receive the pilocarpine treatment.

4.2.2 Marksmanship Speed-Accuracy Experiment

During the speed-accuracy experiment, the only hypothesis tested was that the level of asymptotic performance would improve over time. In sections 4.1.2.1 through 4.1.2.4, this hypothesis was tested using four distinct methods. In the first method, the IES was evaluated. The IES, as shown in Equation 9, is defined by the mean response time for correct responses and the proportion of responses that were correct. Such scoring is a simple matter in experiments with a relatively small number of discrete outcomes, but was significantly more complicated in the present study because of the continuous nature of the outcomes (i.e. measurements in cm) and because those measurements were derived using two distinct methods and four target sizes. Target sizes ranged from 2 to 5 cm and these distances were measured in terms of both MPI to CZP distance and DCMS. Target sizes of 5 and 4 cm showed minor changes over the four days of firing, but the changes were not indicative of a trend. Target sizes of 3 and 2 cm showed no trends, but significantly greater changes.

One limitation of IES scores is the fact that they are difficult to compare with statistical rigor. In order to address this limitation, and potentially provide evidence to support conclusions implied by the IES scores, CAF analysis was performed for each subject and for all subjects' pooled data. In a CAF analysis, the responses are evenly divided into quantiles based on response time, and the accuracy measurements of each quantile are compared. Because datasets included 30 observations, CAF analysis was performed on 5 quantiles of 6 observations and 6 quantiles of 5 observations. Accuracy was measured in terms of 1/MPI to CZP distance and 1/DCMS, and quantiles were compared both within and between days. As the results of these analyses indicated, no significant differences indicative of trends were noted in any quantiles. The fact that no significant differences indicative of trends were noted between quantiles on any day of firing, implied that greater time did not result in greater accuracy as evaluated by either metric. The fact that no significant differences were noted within quantiles over the four days of firing implied that no improvement took place. While the implication that no improvement took place would seem to indicate that no learning took place, the lack of a difference between the quantiles during each day of firing indicates that the experimental conditions may not have induced a speed-accuracy tradeoff.

In order to investigate the existence of a speed-accuracy tradeoff in the data, all shot time and shot distance data were subject to correlation analysis, both for each individual subject and for all data pooled. As the results of these analyses indicated, any correlations

that were statistically significant were weak. Due to this lack of correlation between the time required to take each shot and the distance of each shot from the target, there was no evidence of a tradeoff between speed and accuracy, let alone an asymptotic level of performance associated with the tradeoff. The most likely causes of the failure to observe the tradeoff were insufficient temporal and spatial resolution. Since neither can be improved on the ISMT M100 system, the practical implication of this experiment is that the speed-accuracy tradeoff aspect of marksmanship will not be measured in subsequent experiments involving the ISMT and pilocarpine treatments.

4.2.3 Marksmanship Visual Search Experiment

During the visual search experiment, the only hypothesis tested was that the level of asymptotic performance would improve. In testing this hypothesis, data were evaluated for individual subjects and pooled to evaluate the sample as a whole. The metric of performance was the proportion of targets successfully hit at each of 4 visual acuity sizes, which were 20/204, 20/165, 20/114 and 20/84 for sizes A, B, C and D respectively. As the results in section Appendix C indicated, statistically significant differences were found in 3 of the 10 subjects' data. In two of these subjects, VS01 and VS08, the differences showed no distinct pattern and consisted of lower hit proportions at a single visual acuity size on one day. Subject VS10's data, however, showed a slightly different pattern in which hit proportions for acuity size D (20/84) were significantly lower on days 2 and 3 than they were on days 4 and 5. Examination of experimental records provided no specific reasons for this improvement, and there was no information given regarding any change in health, vision, diet or sleep. When the data for all subjects were pooled and analyzed, the null hypothesis of equal proportions was not rejected for any of the days and acuity sizes compared. As a result of this failure to reject any of the null hypotheses, there is no evidence to support any significant improvement in performance over the four days of firing. The principal practical implication of these findings is that in future marksmanship visual search testing that includes a treatment with pilocarpine and the use of CBRN protective equipment, any changes in subject performance are unlikely to be due to learning effects or any other phenomena caused by repeated performance of a visual search task. Furthermore, this analysis demonstrated that each acuity size produced a stable control condition that will be useful in similar future studies.

5 CONCLUSIONS

Performance in marksmanship, as in many other tasks, has a tendency to improve with practice. Improvement of this nature has the potential to introduce error into human performance studies of marksmanship because it could mask the effects of a treatment that is expected to degrade performance or amplify the effects of a treatment that is expected to enhance performance. When multiple treatments, such as the addition of a pilocarpine treatment to induce miosis and accommodative spasm and the wearing of CBRN protective equipment, are introduced the potential for learning effects to introduce error increases because data must be collected for each condition, typically over multiple days.

This study investigated the degree to which learning effects may be encountered in marksmanship performance experiments conducted with a Meggitt Training Systems ISMT M100 system. The investigation was accomplished through three experiments, each of which addressed a different aspect of marksmanship. In the first experiment, accuracy and precision were assessed with static targets. The results of this experiment indicated that the experience level is not likely to influence the number of iterations required to reach asymptotic pistol or rifle performance and that the number of iterations required to reach asymptotic pistol or rifle performance is unlikely to decrease due to learning effects. The first experiment's results also implied that there is not a significant difference between the number of iterations required to reach pistol or rifle asymptote, and that pistol and rifle asymptotic performance is not likely to improve over four days of simulated firing. The second experiment investigated the degree to which speed-accuracy performance improved over four days of simulated firing. While initial results using IES scores and target radii of 5 and 4 cm were indicative of relatively stable performance, further analysis of the data using the CAF and simple correlation indicated that the speed-accuracy tradeoff was not observed in the experiment. As a result of the inability to observe a tradeoff between time and shot accuracy, no asymptotic level of performance could be determined. The third experiment investigated the degree to which marksmanship visual search performance improved over four days of simulated firing. Analysis of both individual data and pooled data indicated that no significant change was observed.

Based on these results, the principal conclusion from the present study is that the experimental designs used for the evaluation of marksmanship accuracy and precision and for marksmanship visual search are adequate for the evaluation of marksmanship performance evaluation with single level treatments of pilocarpine and CBRN protective equipment. While the principal benefit of these findings will specifically benefit future studies of a similar nature, the reliable methods used to determine asymptotic marksmanship and visual search performance developed in the course of this study also have strong potential utility in future studies that compare training methods, ammunition, and even weapons.

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LIST OF SYMBOLS, ABBREVIATIONS, AND ACRONYMS

AD	Area of Dispersion
AFRL	Air Force Research Laboratory
ANOVA	Analysis of Variance
BCVA	Best Corrected Visual Acuity
BZO	Battlesight Zero
CAF	Conditional Accuracy Function
CI	Confidence Interval
Cm	Centimeters
CZP	Center Zone Point
DCMs	Shot Distance from Center Mass
EDTRS	Early Treatment Diabetic Retinopathy Study
Ft	Feet
Hg	Mercury
IES	Inverse Efficiency Score
In	inches
ISMT	Indoor Simulated Marksmanship Trainer
M	meters
MPI to CZP	Mean Point of Impact
MR	Mean radius
NAMRU-D	Naval Medical Research Unit Dayton
R	The R statistical programming language
REGWQ	The Ryan, Einot, Gabriel, and Welsch test procedure
Stdev	Standard Deviation

APPENDIX A

6.1 Subject 5 Pistol Data

As Figure A-1 indicates, the iterations with the lowest and most consistent AD 5 iteration running variances for Subject 5's Day 2 pistol data were iterations 17 and 18. Therefore, asymptotic performance was achieved during iterations 13 through 18. Basic descriptive statistics for this asymptote are shown in Table A1.

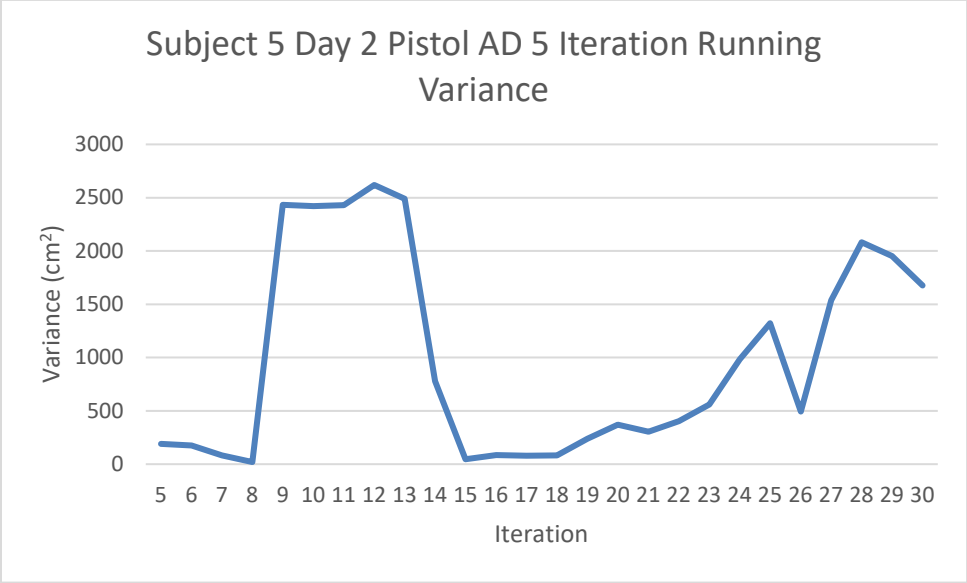

Figure A-1. Subject 5 Day 2 Pistol AD 5 Iteration Running Variance

Table A-1. Subject 5 Day 2 Pistol Asymptote Descriptive Statistics

	Group Size	MPI to CZP	DCMS	MR
Mean	6.93912	1.77959	3.36283	2.84191
Median	7.72227	1.89275	3.54816	3.01836
Stdev	2.26945	1.07108	1.29233	0.91078

As Figure A-2 indicates, the iterations with the lowest and most consistent AD 5 iteration running variances for Subject 5's Day 3 pistol data were iterations 8 and 9. Therefore, asymptotic performance was achieved during iterations 4 through 9. Basic descriptive statistics for this asymptote are shown in Table A-2.

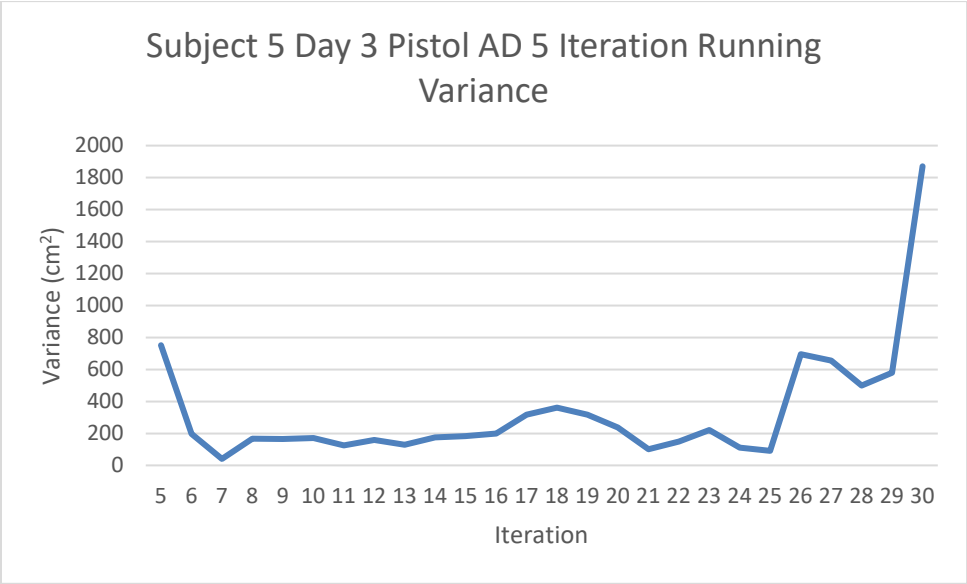

Figure A-2. Subject 5 Day 3 Pistol AD 5 Iteration Running Variance

Table A-2. Subject 5 Day 3 Pistol Asymptote Descriptive Statistics

	Group Size	MPI to CZP	DCMS	MR
Mean	7.61719	2.91069	3.75273	3.06485
Median	7.24227	2.73644	3.53861	2.79029
Stdev	4.07899	1.73644	1.72373	1.65776

As Figure A-3 indicates, the iterations with the lowest and most consistent AD 5 iteration running variances for Subject 5's Day 4 pistol data were iterations 13 and 14. Therefore, asymptotic performance was achieved during iterations 9 through 14. Basic descriptive statistics for this asymptote are shown in Table A-3.

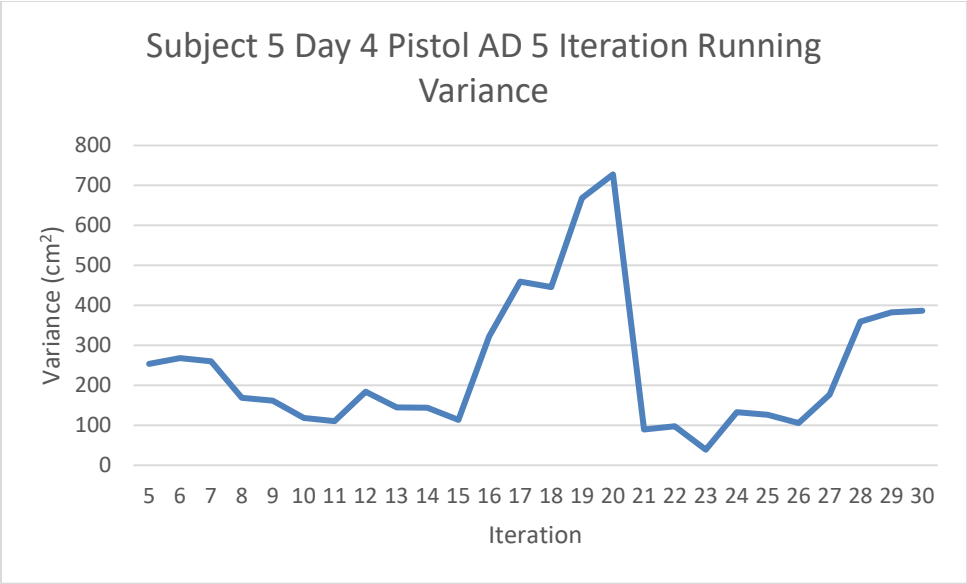

Figure A-3. Subject 5 Day 4 Pistol AD 5 Iteration Running Variance

Table A-3. Subject 5 Day 4 Pistol Asymptote Descriptive Statistics

	Group Size	MPI to CZP	DCMS	MR
Mean	6.56982	4.23775	4.8311	2.67117
Median	6.84682	3.91348	4.41366	2.77521
Stdev	2.12156	1.3395	1.0221	0.79142

As Figure A-4 indicates, the iterations with the lowest and most consistent AD 5 iteration running variances for Subject 5's Day 5 pistol data were iterations 21 and 22. Therefore, asymptotic performance was achieved during iterations 17 through 22. Basic descriptive statistics for this asymptote are shown in Table A-4.

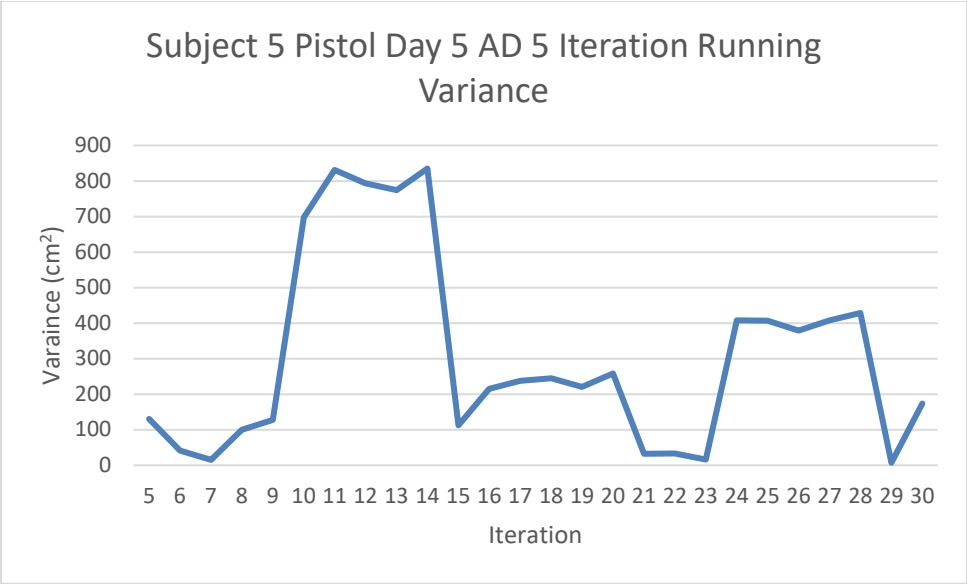

Figure A-4. Subject 5 Pistol Day 5 AD 5 Iteration Running Variance

Table A-4. Subject 5 Pistol Day 5 Pistol Asymptote Descriptive Statistics

	Group Size	MPI to CZP	DCMS	MR
Mean	4.977	1.89324	2.63902	1.98048
Median	5.10147	2.14889	2.65626	1.95926
Stdev	1.00569	0.93648	0.28479	0.40062

As Table A-5 indicates, the assumption of normality could not be met for all of Subject 5's pistol group size data. The boxplot in Figure A-5 does not provide evidence to the contrary. When Bartlett's Test was performed on these data, the resulting K^2 was 7.9205 and the p-value was 0.04769, which rejected the null hypothesis of homoscedasticity. The Brunner-Dette-Munk test yielded an F value of 1.143181 and a p-value of 0.3555183, failing to reject the null hypothesis of equality of distribution functions. As such, the analysis does not find a statistically significant difference in Subject 5's pistol group sizes during days 2-5.

Table A-5. Subject 5 Pistol Group Size Shapiro-Wilk Test Results

Day	W	P-Value
2	0.7901931	0.0478809
3	0.9781372	0.9419320
4	0.8240255	0.0955915
5	0.8999845	0.3738382

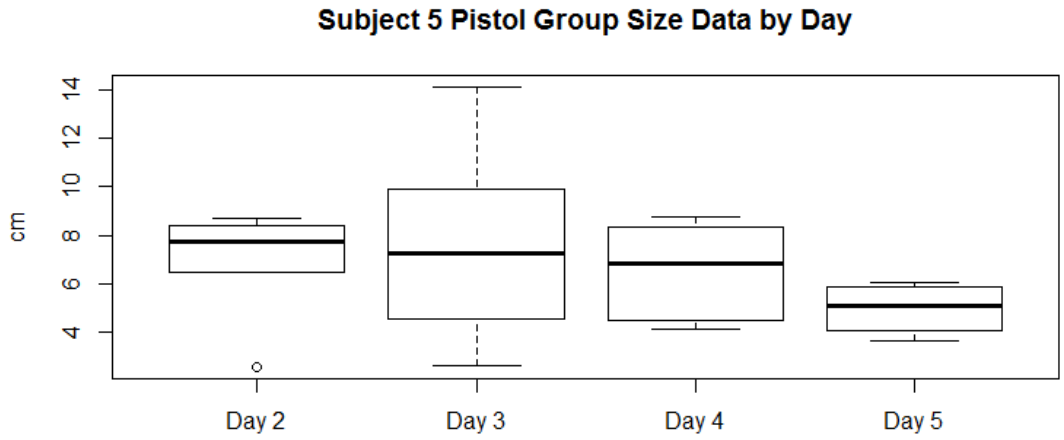

Figure A-5. Subject 5 Pistol Group Size Data by Day

As Table A-6 indicates, the null hypothesis of normality was rejected for day 5 of Subject 5's pistol MPI to CZP distance data. The boxplot in Figure A-6 does not provide information to the contrary. When Bartlett's Test was performed on these data, the resulting K^2 was 2.0674 and the p-value was 0.5585, which failed to reject the null hypothesis of homoscedasticity. The Kruskal-Wallis Test yielded a X^2 value of 9.2733 and a p-value of 0.02587, rejecting the null hypothesis of equality of dataset medians.

Table A-6. Subject 5 Pistol MPI to CZP Distance Shapiro-Wilk Test Results

Day	W	P-Value
2	0.9793661	0.9483635
3	0.8714395	0.2320035
4	0.9209002	0.5118683
5	0.7366391	0.0146952

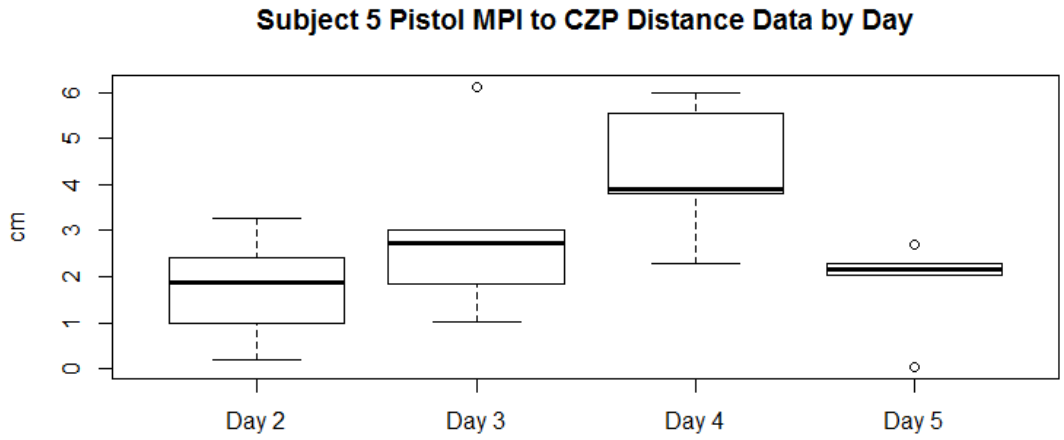

Figure A-6. Subject 5 Pistol MPI to CZP Distance Data by Day

As Table A-7 indicates, statistically significant differences were found between days 2 and 4 and between days 4 and 5. While these differences are significant, they are not indicative of a trend, as there was no progressive change over the days of firing.

Table A-7. Subject 5 Pistol MPI to CZP Distance Dunn's Test Results

Days	Z	P-Value
2 & 3	-1.265569	0.1543
2 & 4	-2.735263	0.0187
2 & 5	-0.244948	0.4032
3 & 4	-1.469693	0.1416
3 & 5	1.020620	0.1845
4 & 5	2.490314	0.0191

As Table A-8 indicates, the null hypothesis of normality was not rejected for Subject 5's pistol DCMS data. The boxplot in Figure A-7, however, is not indicative of a normal distribution. When Bartlett's Test was performed on these data, the resulting K^2 was 10.754 and the p-value was 0.01314, which rejected the null hypothesis of homoscedasticity. The Brunner-Dette-Munk test yielded an F value of 4.850609 and a p-value of 0.02491593, rejecting the null hypothesis of equality of distribution functions.

Table A-8. Subject 5 Pistol DCMS Shapiro-Wilk Test Results

Day	W	P-Value
2	0.9573299	0.7989437
3	0.9770942	0.9362357
4	0.8254901	0.0983940
5	0.9131735	0.4576012

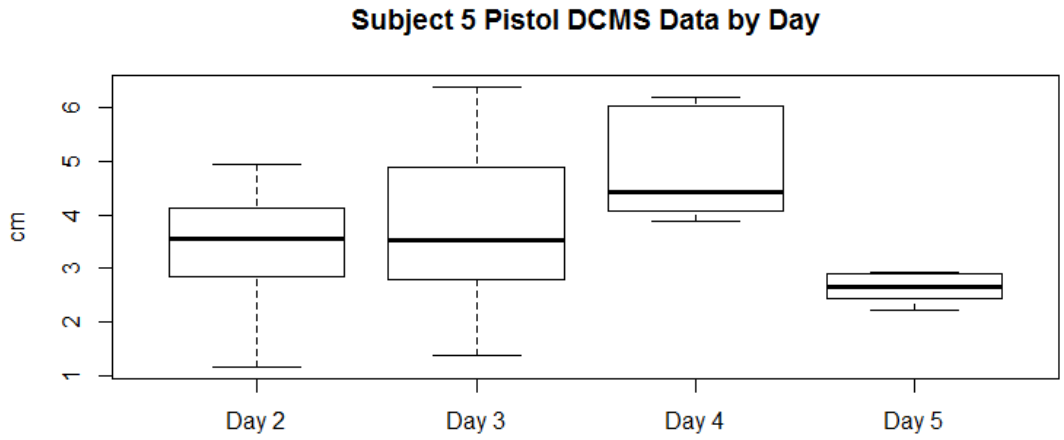

Figure A-7. Subject 5 Pistol DCMS Data by Day

As Table A-9 indicates, statistically significant differences were found between days 4 and 5. While these differences are significant, they are not indicative of a trend, as there was no progressive change during days 2-5.

Table A-9. REGWQ Test Results for Subject 5 Pistol DCMS

Days	Statistic	Adj. P Value	CI
2 & 3	0.7954	0.5801	0.3899
2 & 4	2.9952	0.1115	1.4683
2 & 5	1.4766	0.3089	0.7238
3 & 4	2.1998	0.1355	1.0784
3 & 5	2.2719	0.2661	1.1137
4 & 5	4.4718	0.0233	2.1921

As Table A-10 indicates, the null hypothesis of normality was not rejected for Subject 5's pistol mean radius data. The boxplot in Figure A-8, however, does not support a normal distribution. When Bartlett's Test was performed on these data, the resulting K^2 was 8.41 and the p-value was 0.03826, which rejected the null hypothesis of homoscedasticity. The Brunner-Dette-Munk test yielded an F value of 1.693929 and a p-value of 0.2115169, thus failing to reject the null hypothesis of equality of distribution functions. As such, the analysis does not find a statistically significant difference in Subject 5's pistol DCMS during days 2-5.

Table A-10. Subject 5 Pistol Mean Radius Shapiro-Wilk Test Results

Day	W	P-Value
2	0.8509817	0.1603058
3	0.9566744	0.7937793
4	0.8698722	0.2257159
5	0.8590973	0.1860907

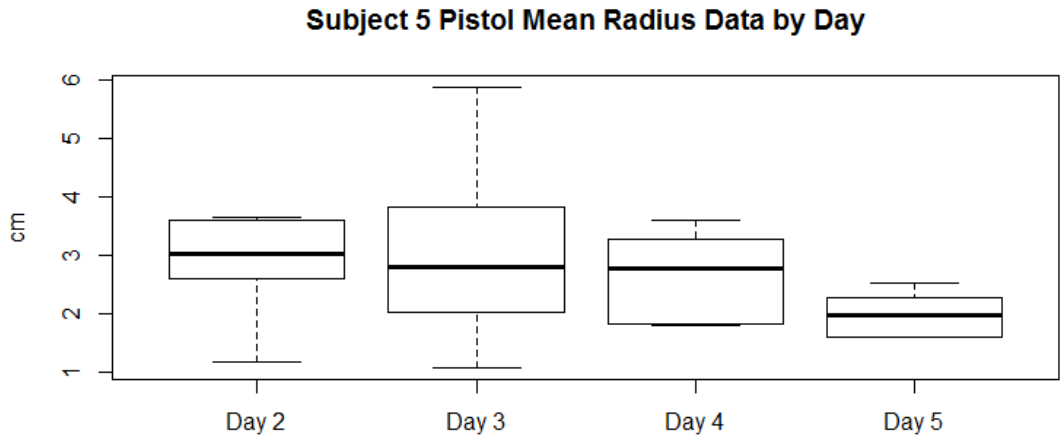

Figure A-8. Subject 5 Pistol Mean Radius Data by Day

6.2 Subject 5 Rifle Data

As Figure A-9 indicates, the iterations with the lowest and most consistent AD 5 iteration running variances for Subject 5's Day 2 rifle data were iterations 27 and 28. Therefore, asymptotic performance was achieved during iterations 23 through 28. Basic descriptive statistics for this asymptote are shown in Table A-11.

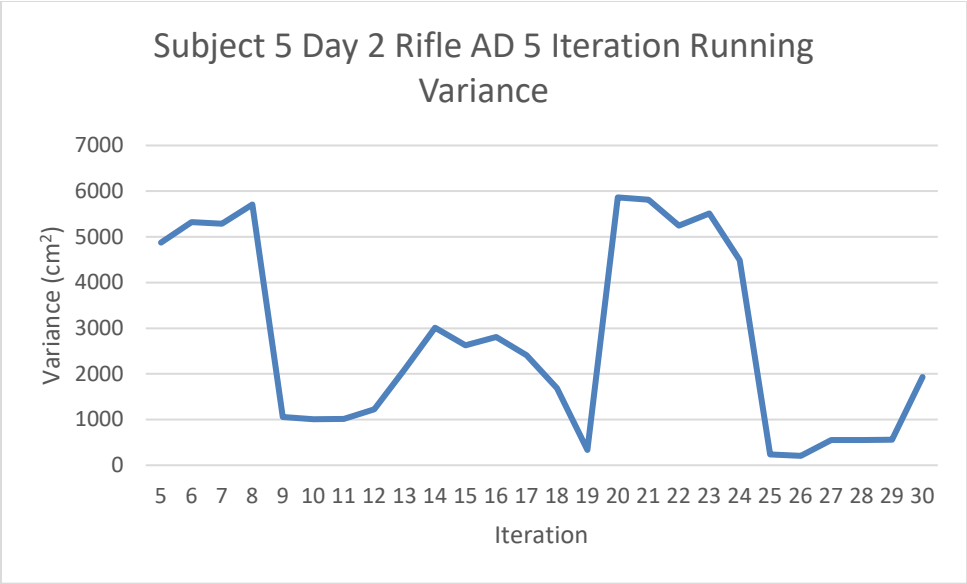

Figure A-9. Subject 5 Day 2 Rifle AD 5 Iteration Running Variance

Table A-11. Subject 5 Day 2 Rifle Asymptote Descriptive Statistics

	Group Size	MPI to CZP	DCMS	MR
Mean	11.4613	3.64871	5.85835	4.61387
Median	12.1677	3.43198	5.55803	4.77957
Stdev	3.69824	1.33404	0.88138	1.61776

As Figure A-10 indicates, the iterations with the lowest and most consistent AD 5 iteration running variances for Subject 5's Day 3 rifle data were iterations 19 and 20. Therefore, asymptotic performance was achieved during iterations 15 through 20. Basic descriptive statistics for this asymptote are shown in Table A-12.

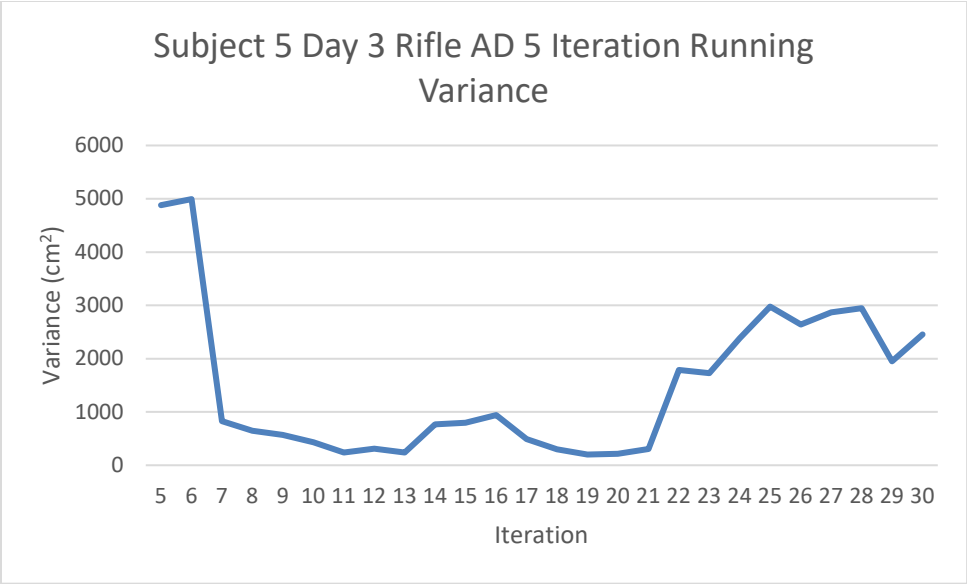

Figure A-10. Subject 5 Day 3 Rifle AD 5 Iteration Running Variance

Table A-12. Subject 5 Day 3 Rifle Asymptote Descriptive Statistics

	Group Size	MPI to CZP	DCMS	MR
Mean	12.996	3.60212	5.38495	5.26779
Median	13.2033	3.41343	5.34008	5.29703
Stdev	2.0676	0.62512	0.64486	0.66754

As Figure A-11 indicates, the iterations with the lowest and most consistent AD 5 iteration running variances for Subject 5's Day 4 rifle data were iterations 10 and 11. Therefore, asymptotic performance was achieved during iterations 6 through 11. Basic descriptive statistics for this asymptote are shown in Table A-13.

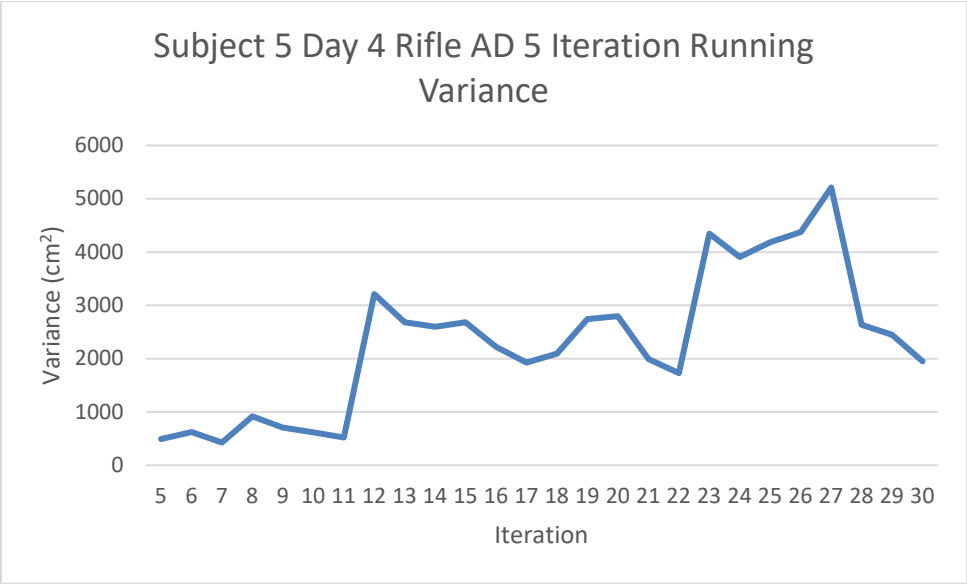

Figure A-11. Subject 5 Day 4 Rifle AD 5 Iteration Running Variance

Table A-13. Subject 5 Rifle Day 4 Asymptote Descriptive Statistics

	Group Size	MPI to CZP	DCMS	MR
Mean	10.9855	4.27981	5.94107	4.40252
Median	10.5291	4.82597	6.57562	4.43125
Stdev	1.75601	2.55345	1.83874	0.68128

As Figure A-12 indicates, the iterations with the lowest and most consistent AD 5 iteration running variances for Subject 5's Day 5 rifle data were iterations 16 and 17. Therefore, asymptotic performance was achieved during iterations 12 through 17. Basic descriptive statistics for this asymptote are shown in Table A-14.

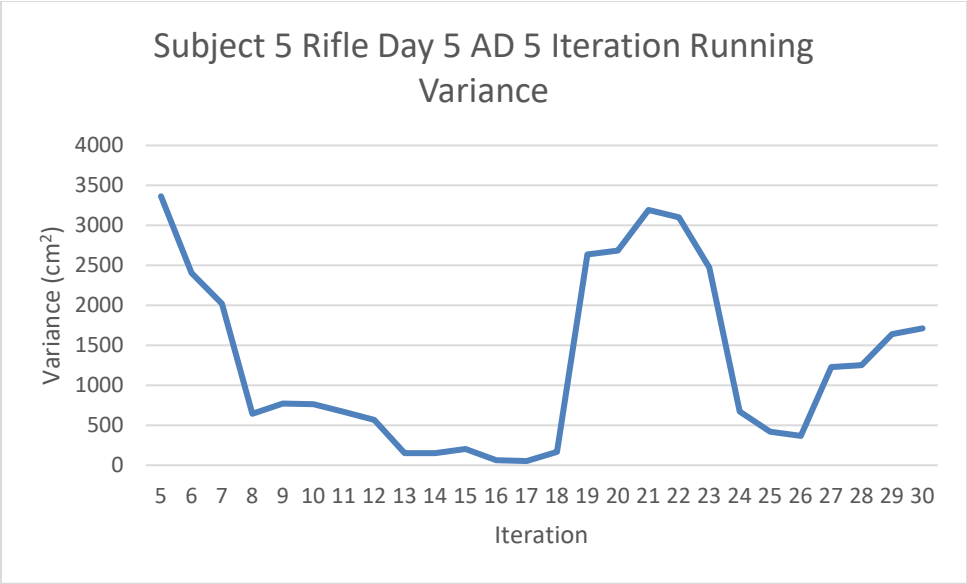

Figure A-12. Subject 5 Rifle Day 5 AD 5 Iteration Running Variance

Table A-14. Subject 5 Rifle Day 5 Asymptote Descriptive Statistics

	Group Size	MPI to CZP	DCMS	MR
Mean	10.3725	6.76124	7.68512	4.03282
Median	10.6778	6.70488	7.38607	4.16448
Stdev	1.01778	1.59484	1.62941	0.61185

As Table A-15 indicates, the null hypothesis of normality was not rejected for Subject 5's rifle group size data. The boxplot in Figure A-13, however, does not support a normal distribution. When Bartlett's Test was performed on these data, the resulting K^2 was 7.3944 and the p-value was 0.06034, which failed to reject the null hypothesis of homoscedasticity. The Kruskal-Wallis Test yielded a X^2 value of 6.46 and a p-value of 0.09125, thus failing to reject the null hypothesis of equality of dataset medians. As such, the analysis does not find any significant differences in rifle group size data during days 2-5.

Table A-15. Subject 5 Rifle Group Size Shapiro-Wilk Test Results

Day	W	P-Value
2	0.8177373	0.0843533
3	0.9609670	0.8271616
4	0.9155670	0.4740200
5	0.9149908	0.4700343

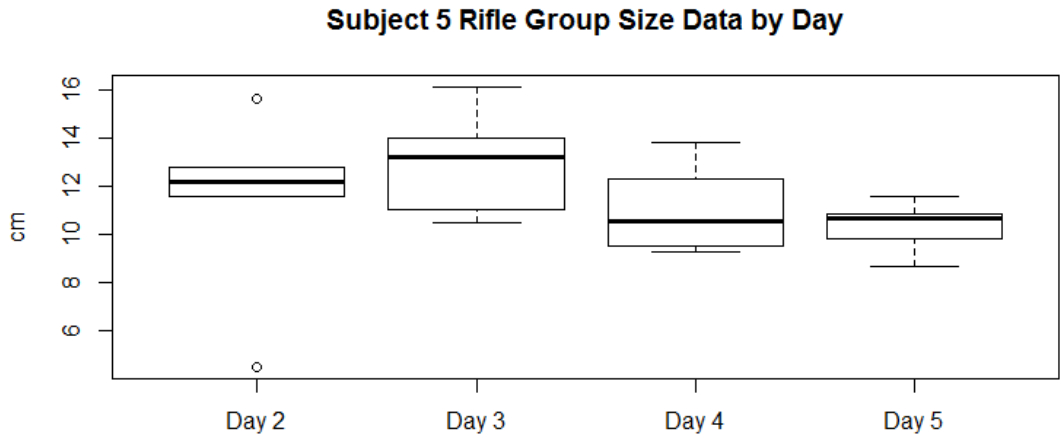

Figure A-13. Subject 5 Rifle Group Size by Day

As Table A-16 indicates, the null hypothesis of normality was not rejected for Subject 5's rifle MPI to CZP distance data. The boxplot in Figure A-14, however, does not support a normal distribution. When Bartlett's Test was performed on these data, the resulting K^2 was 7.7787 and the p-value was 0.0581, which failed to reject the null hypothesis of homoscedasticity. The Kruskal-Wallis Test yielded a X^2 value of 8.98 and a p-value of 0.02956, thus rejecting the null hypothesis of equality of dataset medians.

Table A-16. Subject 5 Rifle MPI to CZP Distance Shapiro-Wilk Test Results

Day	W	P-Value
2	0.9268055	0.5556678
3	0.8976043	0.3599627
4	0.8972969	0.3581990
5	0.9157210	0.4750886

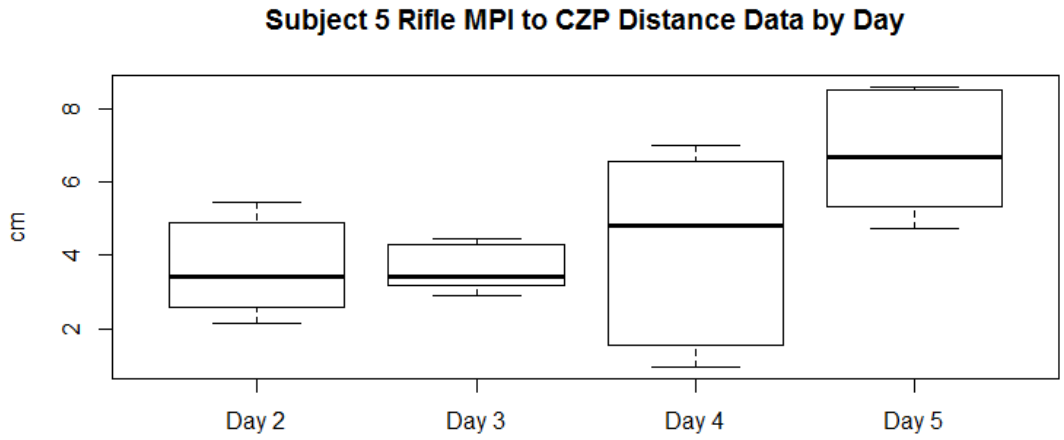

Figure A-14. Subject 5 Rifle MPI to CZP Distance by Day

As Table A-17 indicates, statistically significant differences were found only between days 2 and 5 and 3 and 5. While significant, the differences are not indicative of a progressive trend.

Table A-17. Subject 5 Rifle MPI to CZP Distance Dunn's Test Results

Days	Z	P-Value
2 & 3	-0.040824	0.4837
2 & 4	-0.775671	0.2190
2 & 5	-2.612789	0.0045
3 & 4	-0.734846	0.2312
3 & 5	-2.571964	0.0051
4 & 5	-1.837117	0.331

As Table A-18 indicates, the null hypothesis of normality was not rejected for Subject 5's rifle DCMS data. The boxplot in Figure A-15, however, does not support a normal distribution. When Bartlett's Test was performed on these data, the resulting K^2 was 6.011 and the p-value was 0.1111, which failed to reject the null hypothesis of homoscedasticity. The Kruskal-Wallis Test yielded a X^2 value of 7.38 and a p-value of 0.0672, thus failing to reject the null hypothesis of equality of dataset medians. As such, the analysis does not find significant differences in rifle DCMS during days 2-5.

Table A-18. Subject 5 Rifle DCMS Shapiro-Wilk Test Results

Day	W	P-Value

2	0.8905644	0.3211556
3	0.9571090	0.7972062
4	0.8552487	0.1734517
5	0.9383441	0.6458863

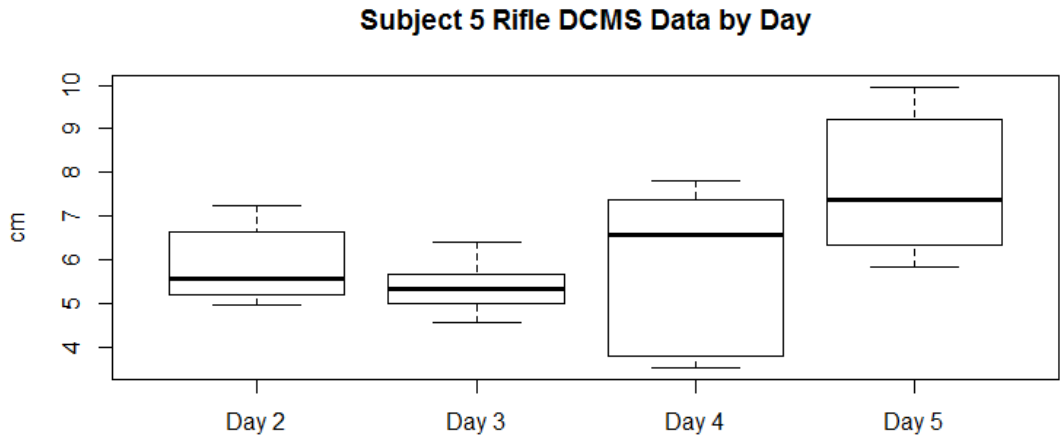

Figure A-15. Subject 5 Rifle DCMS Data by Day

As Table A-19 indicates, the null hypothesis of normality was not rejected for Subject 5's rifle mean radius data. The boxplot in Figure A-16, however, does not support a normal distribution. When Bartlett's Test was performed on these data, the resulting K^2 was 6.9062 and the p-value was 0.07495, which failed to reject the null hypothesis of homoscedasticity. The Kruskal-Wallis Test yielded a X^2 value of 7.5 and a p-value of 0.05756, thus failing to reject the null hypothesis of equality of dataset medians. As such, the analysis is not indicative of differences in mean radius during days 2-5.

Table A-19. Subject 5 Rifle Mean Radius Shapiro-Wilk Test Results

Day	W	P-Value
2	0.8546942	0.1716928
3	0.9435186	0.6876581
4	0.9486914	0.7296724
5	0.9507745	0.7465497

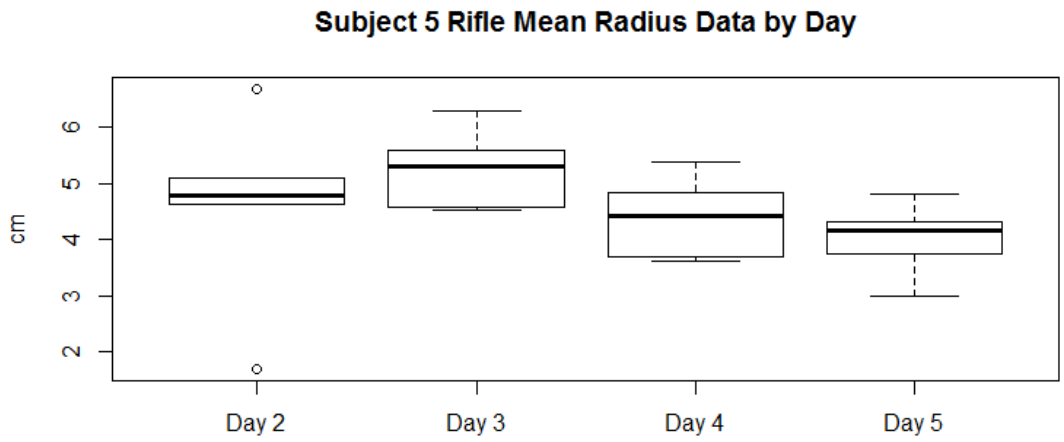

Figure A-16. Subject 5 Rifle Mean Radius Data by Day

6.3 Subject 7 Pistol Data

As Figure A-17 indicates, the iterations with the lowest and most consistent AD 5 iteration running variances for Subject 7's Day 2 pistol data were iterations 17 and 18. Therefore, asymptotic performance was achieved during iterations 13 through 18. Basic descriptive statistics for this asymptote are shown in Table A-20.

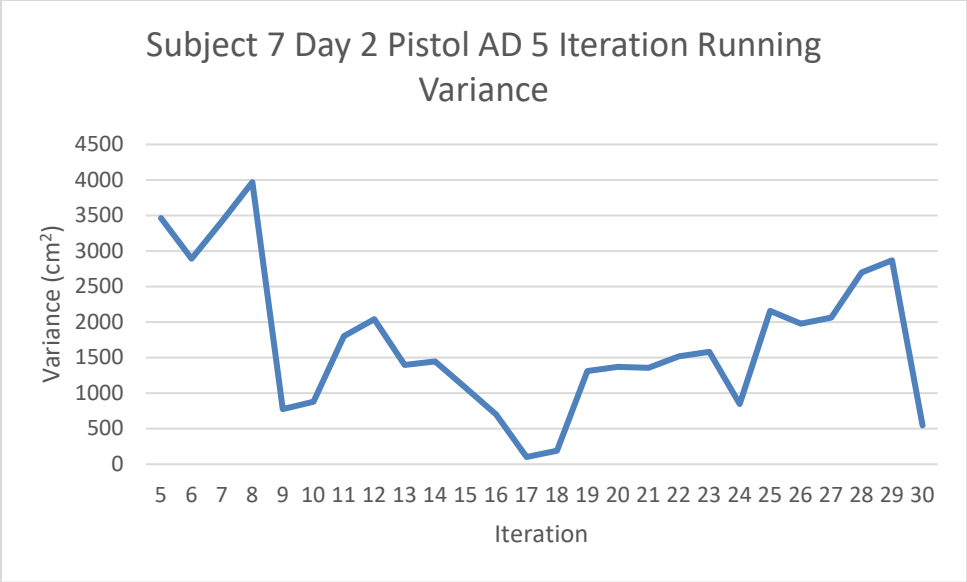

Figure A-17. Subject 7 Day 2 Pistol AD 5 Iteration Running Variance

Table A-20. Subject 7 Day 2 Pistol Asymptote Descriptive Statistics

	Group Size	MPI to CZP	DCMS	MR
Mean	7.954108	2.803714	4.328696	3.210609
Median	8.25239	2.903171	4.083483	3.405215
Stdev	2.676302	1.614079	1.275008	1.010199

As Figure A-18 indicates, the iterations with the lowest and most consistent AD 5 iteration running variances for Subject 7's Day 3 pistol data were iterations 6 and 7. Therefore, asymptotic performance was achieved during iterations 2 through 7. Basic descriptive statistics for this asymptote are shown in Table A-21.

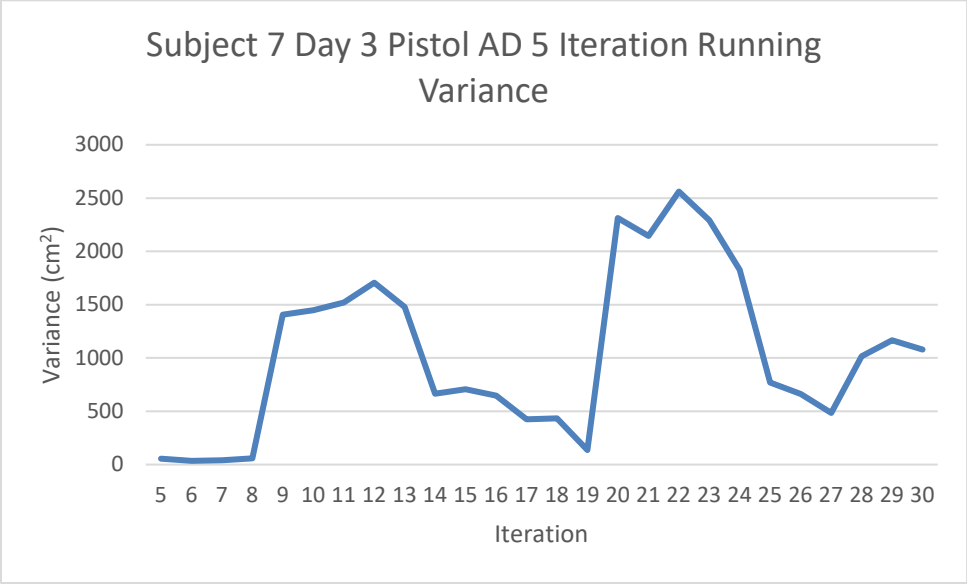

Figure A-18. Subject 7 Day 3 Pistol AD 5 Iteration Running Variance

Table A-21. Subject 7 Day 3 Pistol Asymptote Descriptive Statistics

	Group Size	MPI to CZP	DCMS	MR
Mean	8.119738	2.881472	4.289098	3.299343
Median	8.060883	3.051967	4.267587	3.335438
Stdev	1.003905	1.633432	1.026589	0.634932

As Figure A-19 indicates, the iterations with the lowest and most consistent AD 5 iteration running variances for Subject 7's Day 4 pistol data were iterations 7 and 8. Therefore, asymptotic performance was achieved during iterations 3 through 8. Basic descriptive statistics for this asymptote are shown in Table A-22.

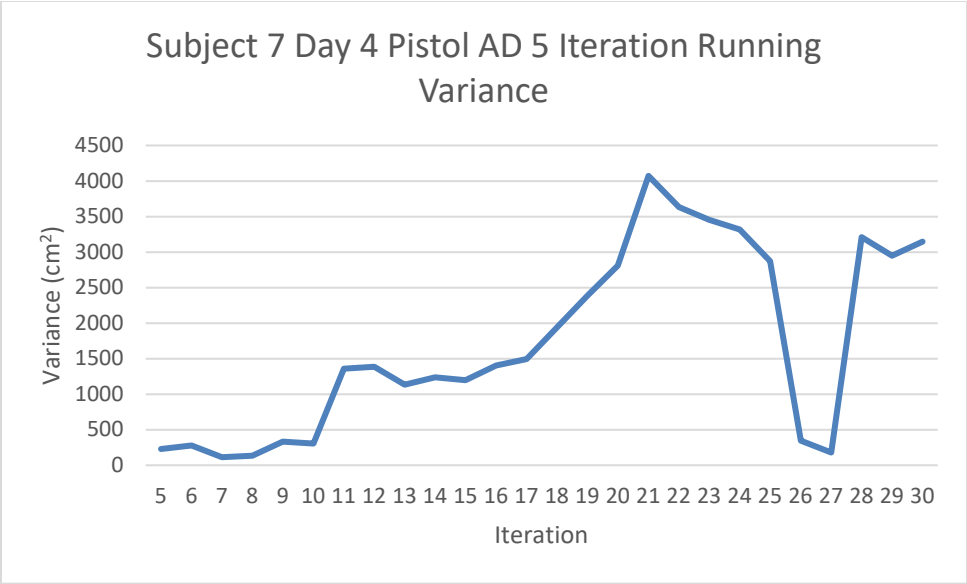

Figure A-19. Subject 7 Day 4 Pistol AD 5 Iteration Running Variance

Table A-22. Subject 7 Day 4 Pistol Asymptote Descriptive Statistics

	Group Size	MPI to CZP	DCMS	MR
Mean	9.03656	5.111083	6.024767	3.513911
Median	7.701577	3.775	4.705936	2.983699
Stdev	3.187585	3.483673	2.962279	1.099067

As Figure A-20 indicates, the iterations with the lowest and most consistent AD 5 iteration running variances for Subject 7's Day 5 pistol data were iterations 13 and 14. Therefore, asymptotic performance was achieved during iterations 9 through 14. Basic descriptive statistics for this asymptote are shown in Table A-23.

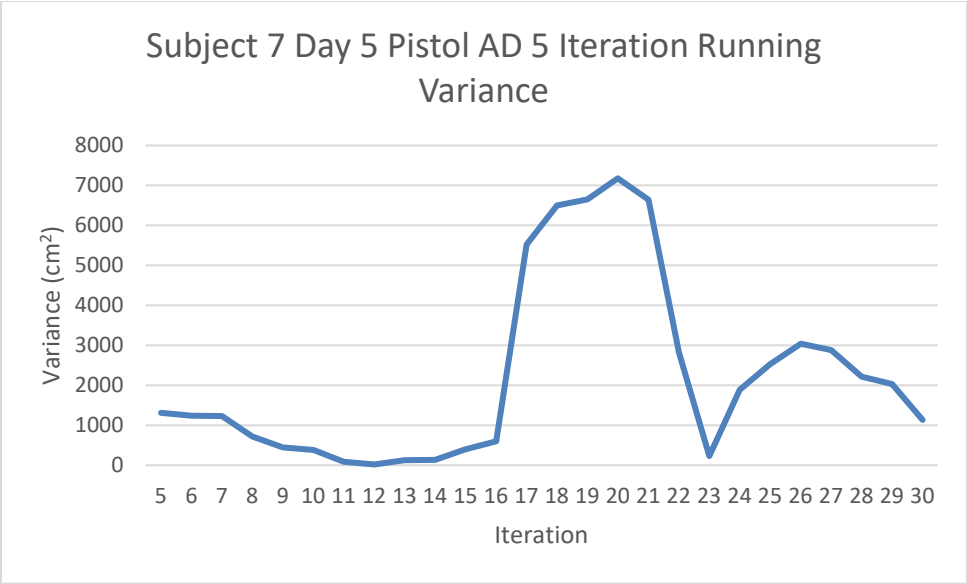

Figure A-20. Subject 7 Day 5 Pistol AD 5 Iteration Running Variance

Table A-23. Subject 7 Day 5 Pistol Asymptote Descriptive Statistics

	Group Size	MPI to CZP	DCMS	MR
Mean	12.58997	3.899054	6.059344	5.048491
Median	12.5225	4.003576	5.855018	4.887903
Stdev	1.428049	1.634954	1.063054	0.469551

As Table A-24 indicates, the null hypothesis of normality was not rejected for Subject 7's pistol group size data. The boxplot in Figure A-21, however, does not support a normal distribution. When Bartlett's Test was performed on these data, the resulting K^2 was 6.9385 and the p-value was 0.07388, which failed to reject the null hypothesis of homoscedasticity. The Kruskal-Wallis Test yielded a X^2 value of 10.327 and a p-value of 0.01598, thus rejecting the null hypothesis of equality of dataset medians.

Table A-24. Subject 7 Pistol Group Size Shapiro-Wilk Test Results

Day	W	P-Value
2	0.9298284	0.5787773
3	0.9371605	0.6364137
4	0.8083995	0.0698494
5	0.9482988	0.7264860

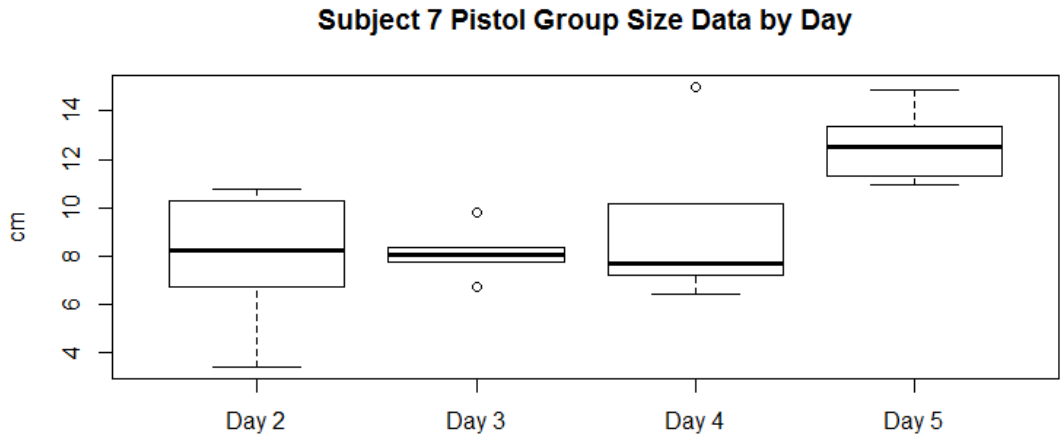

Figure A-21. Subject 7 Pistol Group Size Data by Day

As Table A-25 indicates, significant differences were found between days 2 and 5; days 3 and 5; and days 4 and 5. These differences imply an increase in group size on day 5, but not a progressive increase throughout the days of firing. As such, the analysis does not support a trend.

Table A-25. Dunn's Test Results for Subject 7 Pistol Group Size Data

Days	Z	P-Value
2 & 3	0.24124	0.4191
2 & 4	-0.081649	0.4675
2 & 5	-2.571964	0.0051
3 & 4	-0.285773	0.3875
3 & 5	-2.776088	0.0028
4 & 5	-2.490314	0.0064

As Table A-26 indicates, the null hypothesis of normality was not rejected for Subject 7's pistol MPI to CZP distance data. The boxplot in Figure A-22, however, does not support a normal distribution. When Bartlett's Test was performed on these data, the resulting K^2 was 4.7811 and the p-value was 0.1885, which failed to reject the null hypothesis of homoscedasticity. The Kruskal-Wallis Test yielded a X^2 value of 2.6333 and a p-value of 0.4517, thus failing to reject the null hypothesis of equality of dataset medians. As such, the analysis did not find any significant differences in pistol MPI to CZP distance during days 2-5.

Table A-26. Subject 7 Pistol MPI to CZP Distance Shapiro-Wilk Test Results

Day	W	P-Value
2	0.8783913	0.2617506
3	0.8890961	0.3134788
4	0.8958479	0.3499692
5	0.8475309	0.1503119

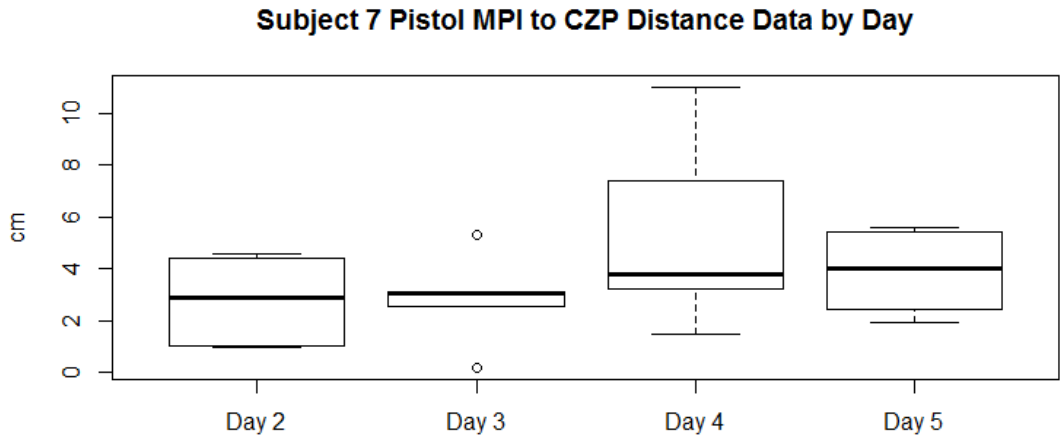

Figure A-22. Subject 7 Pistol MPI to CZP Distance

As Table A-27 indicates, the null hypothesis of normality was not rejected for Subject 7's pistol DCMS data. The boxplot in Figure A-23, however, does not support a normal distribution. When Bartlett's Test was performed on these data, the resulting K^2 was 8.0869 and the p-value was 0.04425, which rejected the null hypothesis of homoscedasticity. The Brunner-Dette-Munk test yielded an F value of 2.413475 and a p-value of 0.1114606, thus failing to reject the null hypothesis of equality of distribution functions. As such, the analysis did not indicate any change in pistol DCMS during days 2-5.

Table A-27. Subject 7 Pistol DCMS Shapiro-Wilk Test Results

Day	W	P-Value
2	0.9603101	0.8221277
3	0.9597675	0.8179469
4	0.8249748	0.0973998
5	0.9009044	0.379302

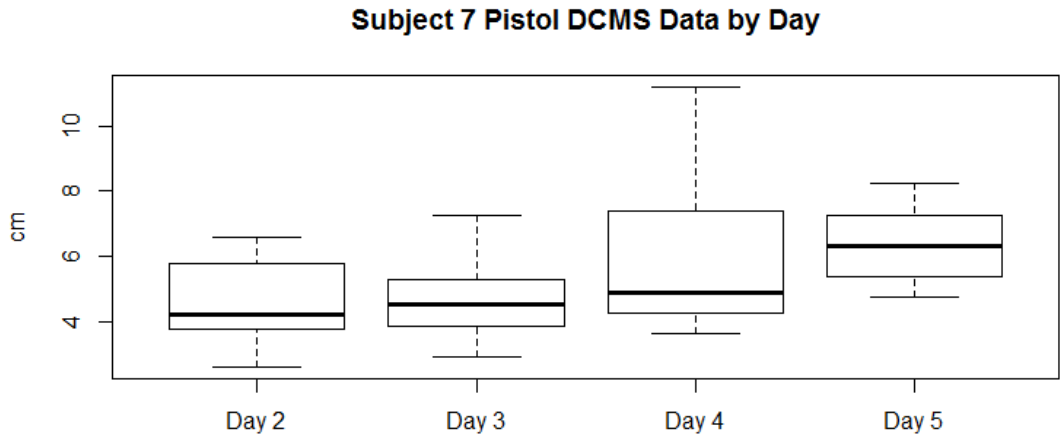

Figure A-23. Subject 7 Pistol DCMS Data

As Table A-28 indicates, the null hypothesis of normality was rejected for day 4 of Subject 7's pistol MR data. The boxplot in Figure A-24 does not provide information to the contrary. When Bartlett's Test was performed on these data, the resulting K^2 was 3.961 and the p-value was 0.2657, which failed to reject the null hypothesis of homoscedasticity. The Kruskal-Wallis Test yielded a X^2 value of 11.14 and a p-value of 0.01099, thus rejecting the null hypothesis of equality of dataset medians.

Table A-28. Subject 7 Pistol Mean Radius Shapiro-Wilk Test Results

Day	W	P-Value
2	0.9409305	0.6667052
3	0.9603439	0.8223869
4	0.7889306	0.0466216
5	0.9012553	0.3814032

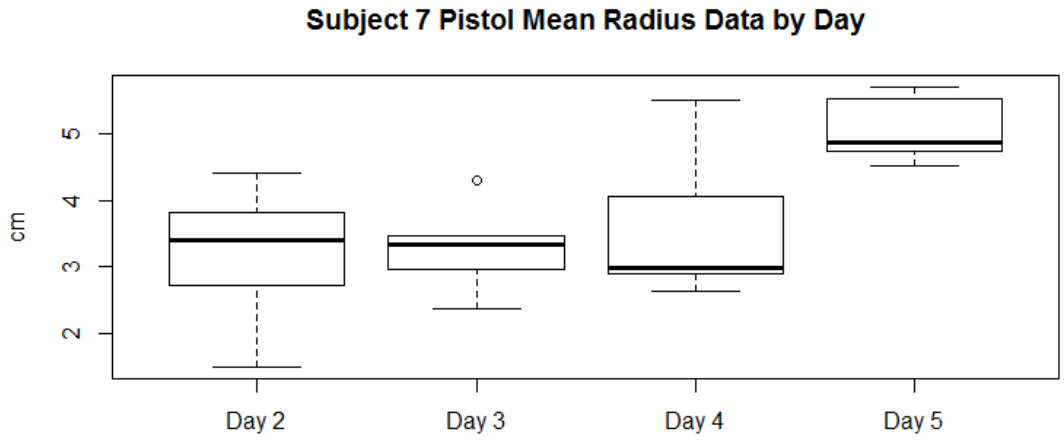

Figure A-24. Subject 7 Pistol Mean Radius Data

As Table A-29 indicates, statistically significant differences were found between days 2 and 5; days 3 & 5; and days 4 & 5. While significant, the differences are not indicative of a progressive trend. Rather, these differences imply that the day 5 pistol mean radius data were different from all others.

Table A-29. Dunn's Test Results for Subject 7 Pistol Mean Radius Data

Days	Z	P-Value
2 & 3	0.122474	0.5415
2 & 4	-0.040824	0.4837
2 & 5	-2.694438	0.0106
3 & 4	-0.163299	0.6527
3 & 5	-2.816913	0.0145
4 & 5	-2.653613	0.0080

6.4 Subject 7 Rifle Data

As Figure A-25 indicates, the iterations with the lowest and most consistent AD 5 iteration running variances for Subject 7's Day 2 rifle data were iterations 28 and 29. Therefore, asymptotic performance was achieved during iterations 24 through 29. Basic descriptive statistics for this asymptote are shown in Table A-30.

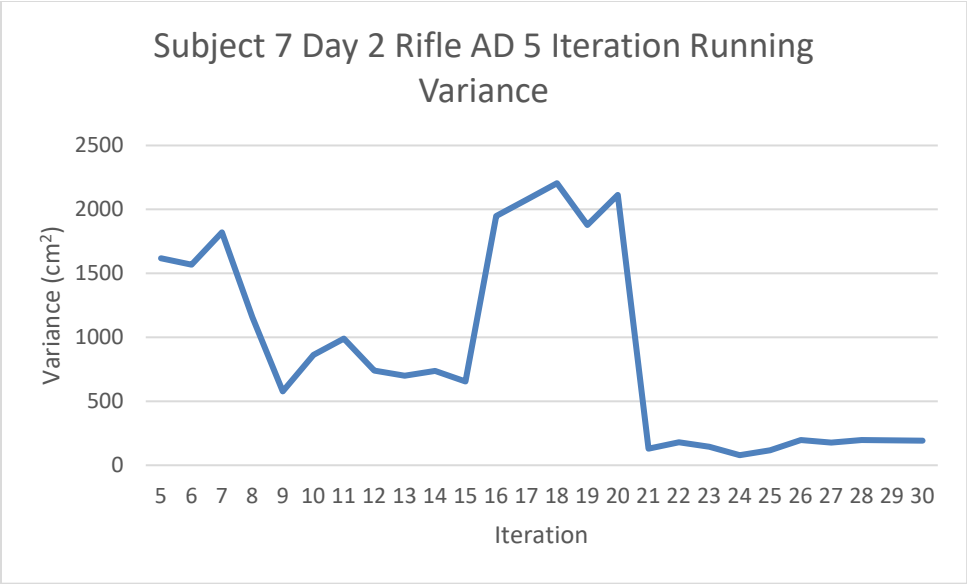

Figure A-25. Subject 7 Day 2 Rifle AD 5 Iteration Running Variance

Table A-30. Subject 7 Day 2 Rifle Descriptive Statistics

	Group Size	MPI to CZP	DCMS	MR
Mean	8.519608	4.202523	5.295696	3.256228
Median	9.091357	3.76449	5.024529	3.564073
Stdev	2.264408	1.639684	1.218939	0.767568

As Figure A-26 indicates, the iterations with the lowest and most consistent AD 5 iteration running variances for Subject 7's Day 3 rifle data were iterations 26 and 27. Therefore, asymptotic performance was achieved during iterations 22 through 27. Basic descriptive statistics for this asymptote are shown in Table A-31.

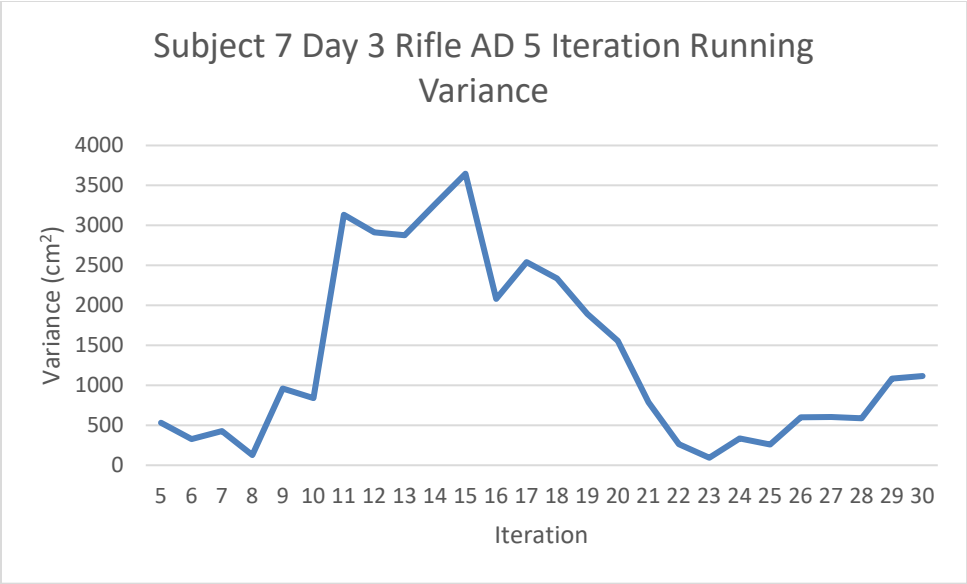

Figure A-26. Subject 7 Day 3 Rifle AD 5 Iteration Running Variance

Table A-31. Subject 7 Day 3 Rifle Asymptote Descriptive Statistics

	Group Size	MPI to CZP	DCMS	MR
Mean	11.02635	3.288301	5.268472	4.135815
Median	9.764071	2.322557	5.27027	4.0514
Stdev	3.779627	1.943892	1.381722	0.946613

As Figure A-27 indicates, the iterations with the lowest and most consistent AD 5 iteration running variances for Subject 7's Day 4 rifle data were iterations 13 and 14. Therefore, asymptotic performance was achieved during iterations 9 through 14. Basic descriptive statistics for this asymptote are shown in Table A-32.

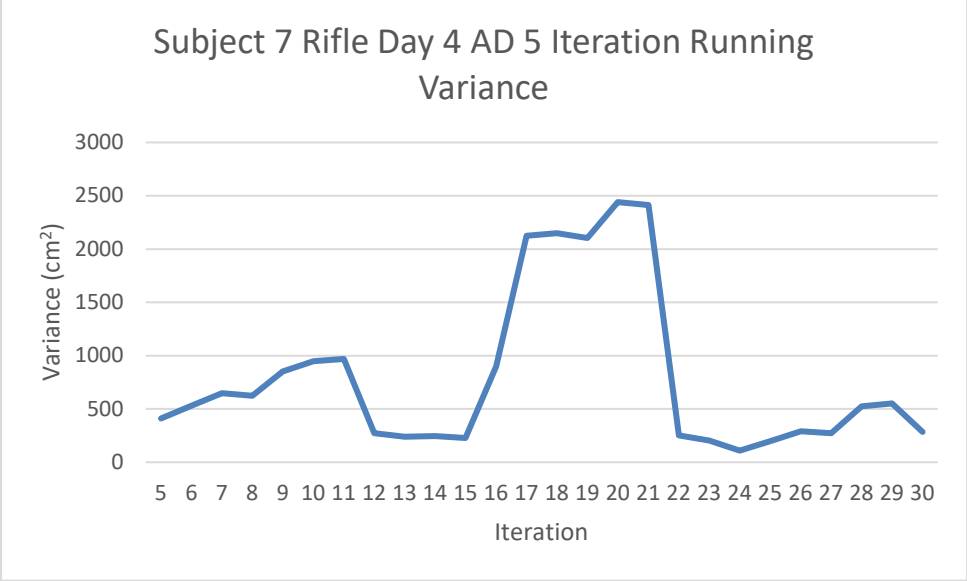

Figure A-27. Subject 7 Day 4 Rifle AD 5 Iteration Running Variance

Table A-32. Subject 7 Day 4 Rifle Asymptote Descriptive Statistics

	Group Size	MPI to CZP	DCMS	MR
Mean	7.456837	5.555495	6.462483	3.412461
Median	6.780601	5.55595	6.149925	3.064773
Stdev	2.310561	2.312154	2.413908	0.958594

As Figure A-28 indicates, the iterations with the lowest and most consistent AD 5 iteration running variances for Subject 7's Day 5 rifle data were iterations 22 and 23. Therefore, asymptotic performance was achieved during iterations 18 through 23. Basic descriptive statistics for this asymptote are shown in Table A-33.

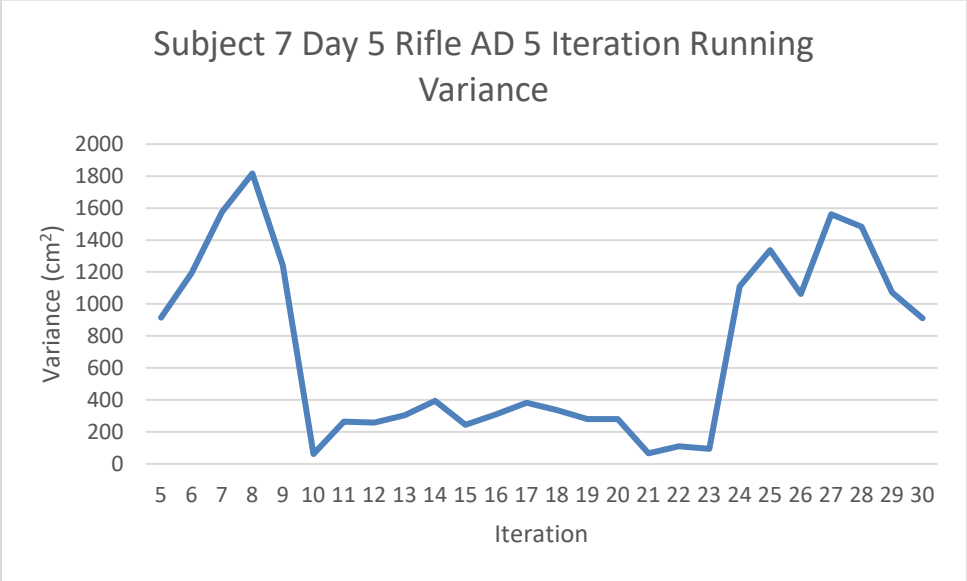

Figure A-28. Subject 7 Day 5 Rifle AD 5 Iteration Running Variance

Table A-33. Subject 7 Day 5 Rifle Asymptote Descriptive Statistics

	Group Size	MPI to CZP	DCMS	MR
Mean	10.30668	4.024082	5.538946	4.22214
Median	9.715975	3.676416	5.747358	4.068113
Stdev	2.501751	1.494772	1.030822	1.071511

As Table A-34 indicates, the null hypothesis of normality was not rejected for Subject 7's rifle group size data. The boxplot in Figure A-29, however, does not support a normal distribution. When Bartlett's Test was performed on these data, the resulting K^2 was 1.7967 and the p-value was 0.6156, which failed to reject the null hypothesis of homoscedasticity. The Kruskal-Wallis Test yielded a X^2 value of 4.86 and a p-value of 0.1823, thus failing to reject the null hypothesis of equality of dataset medians. As such, the analysis does not provide evidence indicative of a change in rifle group size during days 2-5.

Table A-34. Subject 7 Rifle Group Size Shapiro-Wilk Test Results

Day	W	P-Value
2	0.8910881	0.3239282
3	0.8496104	0.1562676
4	0.8918936	0.3282288
5	0.9144715	0.4664601

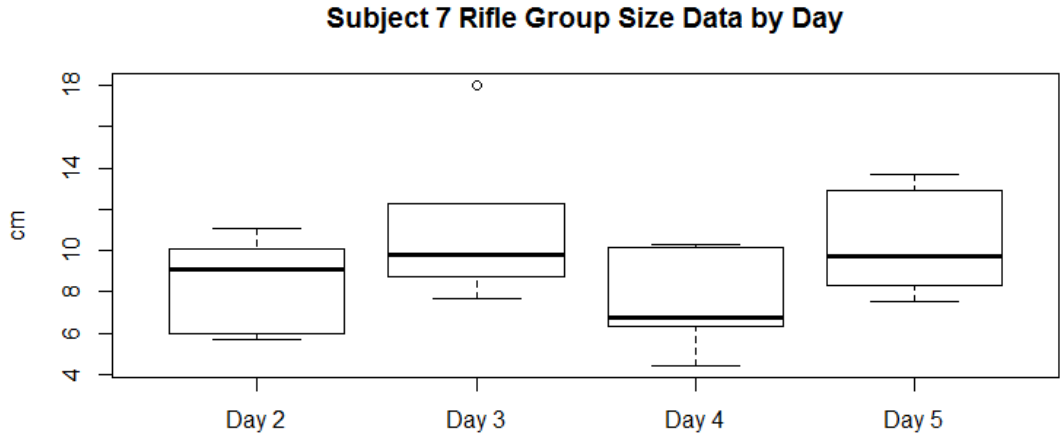

Figure A-29. Subject 7 Rifle Group Size Data

As Table A-35 indicates, the null hypothesis of normality was not rejected for Subject 7's rifle MPI to CZP distance data. The boxplot in Figure A-30, however, does not support a normal distribution. When Bartlett's Test was performed on these data, the resulting K^2 was 1.0429 and the p-value was 0.7909, which failed to reject the null hypothesis of homoscedasticity. The Kruskal-Wallis Test yielded a X^2 value of 3.3 and a p-value of 0.3476, thus failing to reject the null hypothesis of equality of dataset medians. As such, the analysis does not provide evidence indicative of a change in rifle MPI to CZP distance during days 2-5.

Table A-35. Subject 7 Rifle MPI to CZP Distance Shapiro-Wilk Test Results

Day	W	P-Value
2	0.9362513	0.6291636
3	0.7975908	0.0559066
4	0.9528649	0.7634062
5	0.9483983	0.7272937

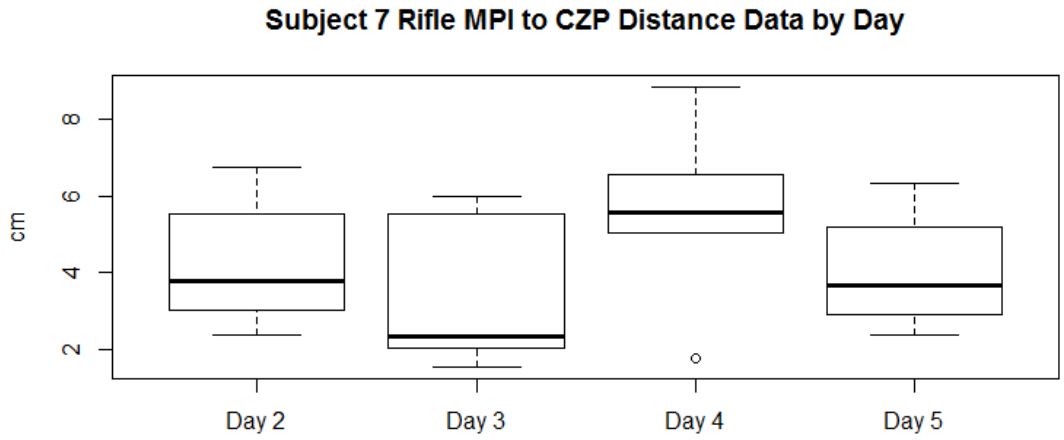

Figure A-30. Subject 7 Rifle MPI to DZP Distance Data

As Table A-36 indicates, the null hypothesis of normality was not rejected for Subject 7's rifle DCMS data. The boxplot in Figure A-31 does not, however, support a normal distribution. When Bartlett's test was performed on these data, the resulting K^2 was 3.7346 and the p-value was 0.2916, which failed to reject the null hypothesis of homoscedasticity. The Kruskal-Wallis Test yielded a X^2 value of 1.2797 and a p-value of 0.734, thus failing to reject the null hypothesis of equality of dataset medians. As such, the analysis does not provide evidence indicative of a change in rifle DCMS during days 2-5.

Table A-36. Subject 7 Rifle DCMS Shapiro-Wilk Test Results

Day	W	P-Value
2	0.9401225	0.6601863
3	0.9508667	0.7472956
4	0.9871317	0.9687162
5	0.9095361	0.4333514

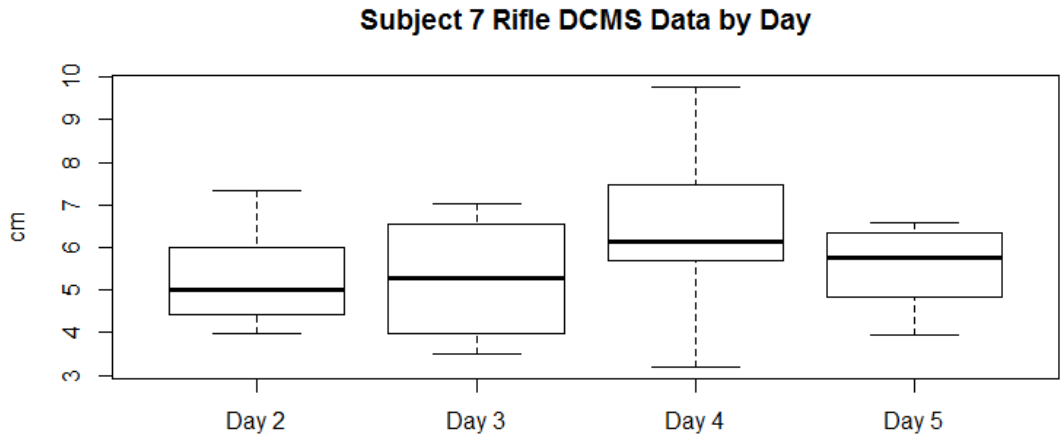

Figure A-31. Subject 7 Rifle DCMS Data

As Table A-37 indicates, the null hypothesis of normality was not rejected for Subject 7's rifle mean radius data. The boxplot in Figure A-32 does not, however, support a normal distribution. When Bartlett's Test was performed on these data, the resulting K^2 was 0.50649 and the p-value was 0.9175, which failed to reject the null hypothesis of homoscedasticity. The Kruskal-Wallis Test yielded a X^2 value of 3.1986 and a p-value of 0.362, thus failing to reject the null hypothesis of equality of dataset medians. As such, the analysis does not provide evidence indicative of a change in rifle mean radius during days 2-5.

Table A-37. Subject 7 Rifle Mean Radius Shapiro-Wilk Test Results

Day	W	P-Value
2	0.8456079	0.1449089
3	0.9207980	0.5111273
4	0.8944972	0.3802228
5	0.9393051	0.6536049

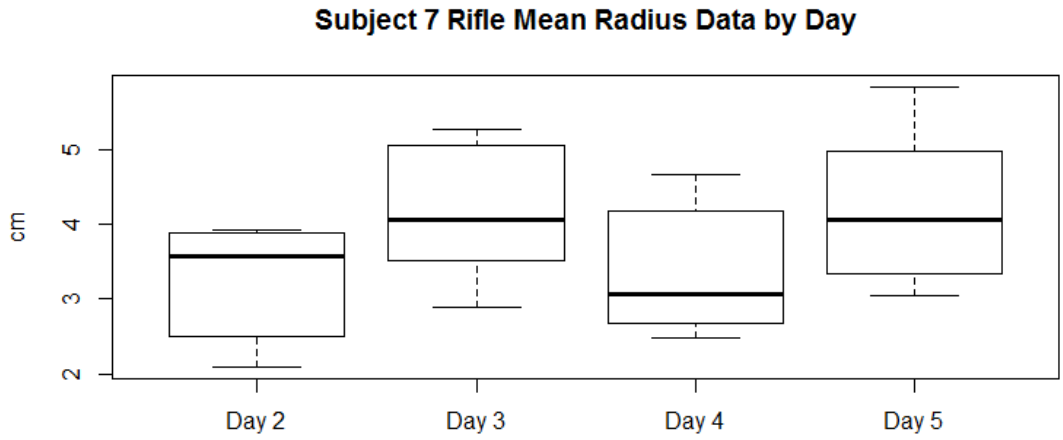

Figure A-32. Subject 7 Rifle Mean Radius Data

6.5 Subject 8 Pistol Data

As Figure A-33 indicates, the iterations with the lowest and most consistent AD 5 iteration running variances for Subject 8's Day 2 pistol data were iterations 28 and 29. Therefore, asymptotic performance was achieved during iterations 24 through 29. Basic descriptive statistics for this asymptote are shown in Table A-38.

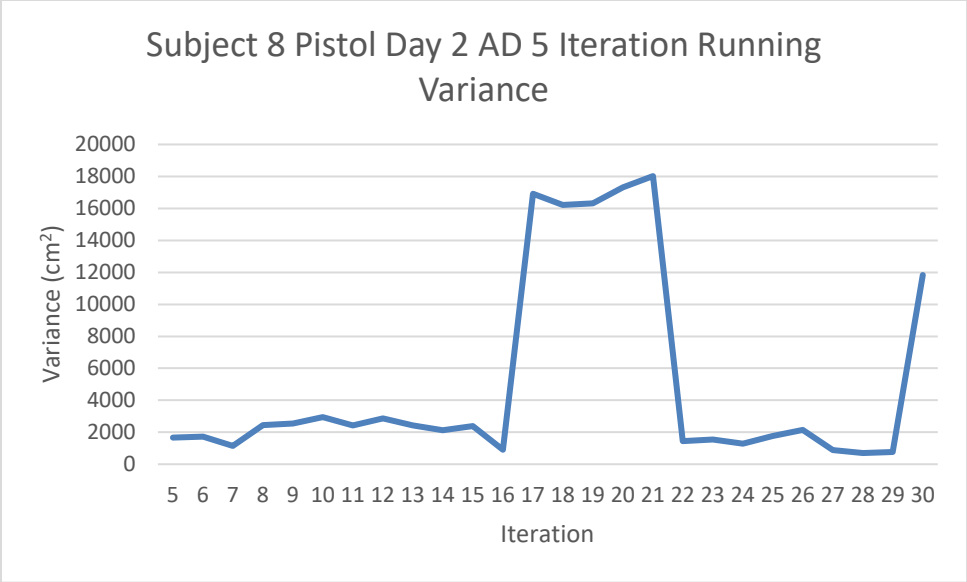

Figure A-33. Subject 8 Pistol Day 2 AD 5 Iteration Running Variance

Table A-38. Subject 8 Pistol Day 2 Asymptote Descriptive Statistics

	Group Size	MPI to CZP	DCMS	MR
Mean	8.43723	3.6904	5.09241	3.47533
Median	8.97857	3.30571	5.02982	3.62457
Stdev	3.6019	2.3936	1.53353	1.64906

As Figure A-34 indicates, the iterations with the lowest and most consistent AD 5 iteration running variances for Subject 8's Day 3 pistol data were iterations 13 and 14. Therefore, asymptotic performance was achieved during iterations 9 through 14. Basic descriptive statistics for this asymptote are shown in Table A-39.

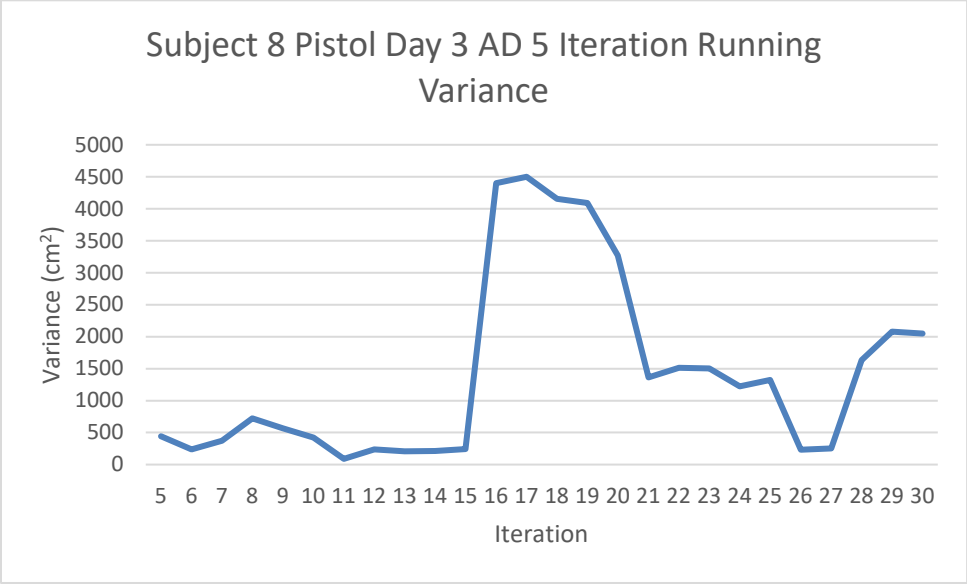

Figure A-34. Subject 8 Pistol Day 3 AD 5 Iteration Running Variance

Table A-39. Subject 8 Pistol Day 3 Asymptote Descriptive Statistics

	Group Size	MPI to CZP	DCMS	MR
Mean	9.61127	2.76553	4.85536	3.7802
Median	9.50962	2.48838	5.49886	3.90329
Stdev	3.68784	2.14848	1.74345	1.34752

As Figure A-35 indicates, the iterations with the lowest and most consistent AD 5 iteration running variances for Subject 8's Day 4 pistol data were iterations 18 and 19. Therefore, asymptotic performance was achieved during iterations 14 through 19. Basic descriptive statistics for this asymptote are shown in Table A-40.

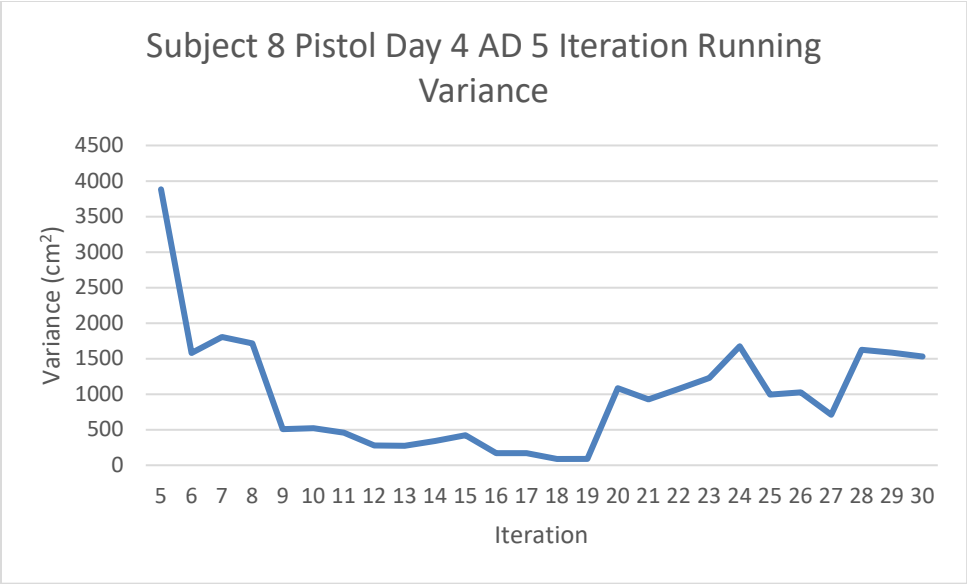

Figure A-35. Subject 8 Pistol Day 4 AD 5 Iteration Running Variance

Table A-40. Subject 8 Pistol Day 4 Asymptote Descriptive Statistics

	Group Size	MPI to CZP	DCMS	MR
Mean	6.57028	4.49171	5.02689	2.63953
Median	6.80438	4.25302	4.97435	2.62567
Stdev	1.78651	1.01418	0.80156	0.67617

As Figure A-36 indicates, the iterations with the lowest and most consistent AD 5 iteration running variances for Subject 8's Day 5 pistol data were iterations 23 and 24. Therefore, asymptotic performance was achieved during iterations 19 through 24. Basic descriptive statistics for this asymptote are shown in Table A-41.

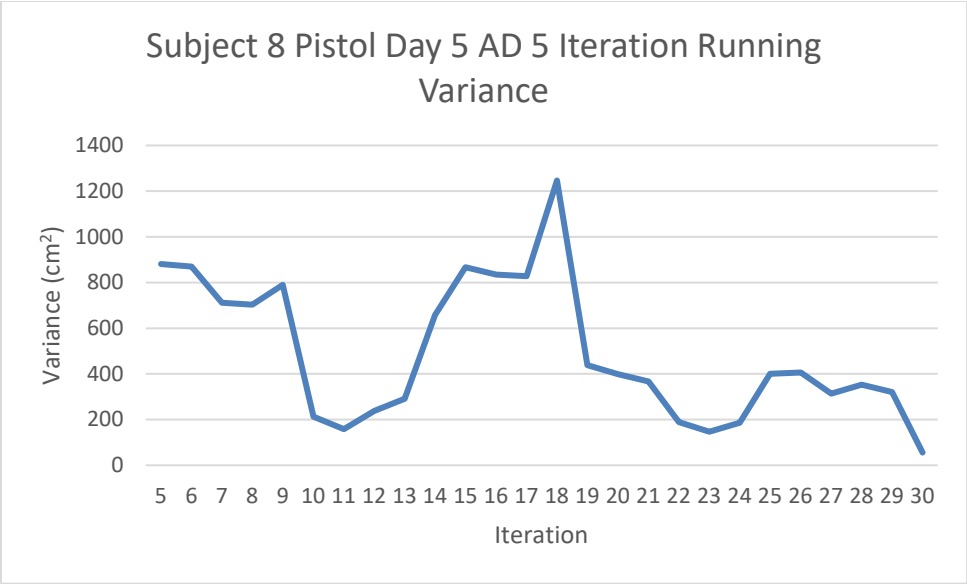

Figure A-36. Subject 8 Pistol Day 5 AD 5 Iteration Running Variance

Table A-41. Subject 8 Pistol Day 5 Asymptote Descriptive Statistics

	Group Size	MPI to CZP	DCMS	MR
Mean	6.01746	3.97873	4.68379	2.52623
Median	6.27041	3.56488	4.61761	2.59699
Stdev	1.99604	1.97952	1.65352	0.84855

As Table A-42 indicates, the null hypothesis of normality was not rejected for Subject 8's pistol group size data. The boxplot in Figure A-37 does not, however, support a normal distribution. When Bartlett's Test was performed on these data, the resulting K^2 was 3.7608 and the p-value was 0.2885, which failed to reject the null hypothesis of homoscedasticity. The Kruskal-Wallis Test yielded a X^2 value of 4.2067 and a p-value of 0.243, thus failing to reject the null hypothesis of equality of dataset medians. As such, the analysis does not provide evidence indicative of a change in pistol group size during days 2-5.

Table A-42. Subject 8 Pistol Group Size Shapiro-Wilk Test Results

Day	W	P-Value
2	0.9243959	0.5375699
3	0.8738546	0.2420068
4	0.9584184	0.8074723
5	0.9261312	0.5505734

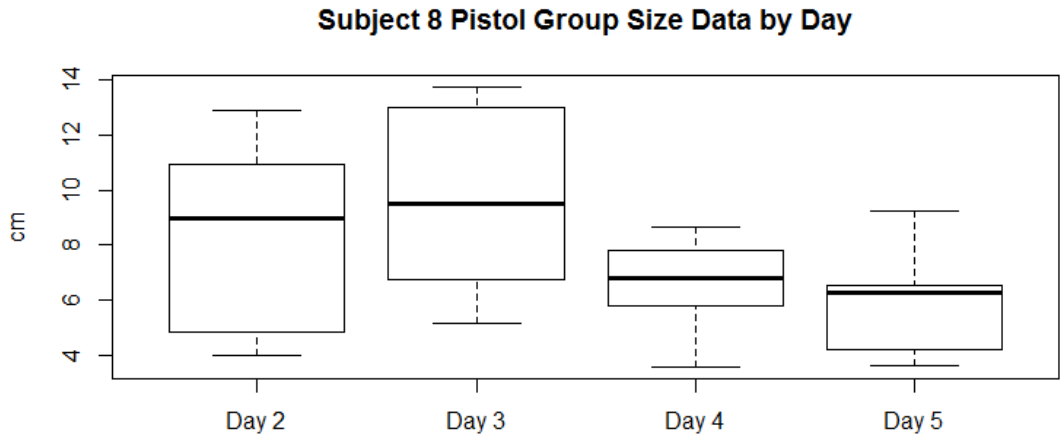

Figure A-37. Subject 8 Pistol Group Size Data

As Table A-43 indicates, the null hypothesis of normality was not rejected for Subject 8's pistol MPI to CZP distance data. The boxplot in Figure A-38 does not, however, support a normal distribution. When Bartlett's Test was performed on these data, the resulting K^2 was 3.2088 and the p-value was 0.3605, which failed to reject the null hypothesis of homoscedasticity. The Kruskal-Wallis Test yielded a X^2 value of 3.7133 and a p-value of 0.29, thus failing to reject the null hypothesis of equality of dataset medians. As such, the analysis does not provide evidence of a change in pistol MPI to CZP distance during days 2-5.

Table A-43. Subject 8 Pistol MPI to CZP Distance Shapiro-Wilk Test Results

Day	W	P-Value
2	0.9491215	0.7331616
3	0.8655021	0.2088570
4	0.9410110	0.6673552
5	0.8938872	0.3396086

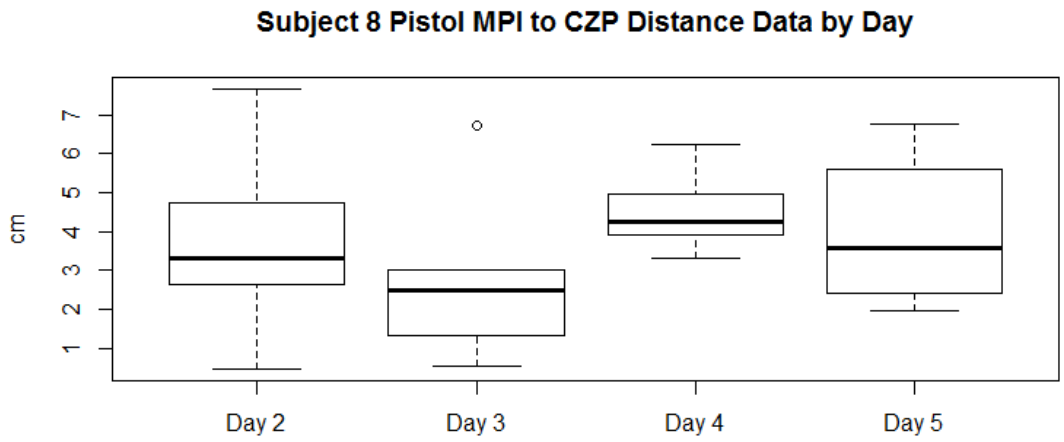

Figure A-38. Subject 8 Pistol MPI to CZP Distance Data

As Table A-44 indicates, the null hypothesis of normality was not rejected for Subject 8's pistol DCMS data. The boxplot in Figure A-39 does not, however, support a normal distribution. When Bartlett's Test was performed on these data, the resulting K^2 was 2.8105 and the p-value was 0.4218, which failed to reject the null hypothesis of homoscedasticity. The Kruskal-Wallis Test yielded a X^2 value of 0.20667 and a p-value of 0.9765, thus failing to reject the null hypothesis of equality of dataset medians. As such, the analysis does not provide evidence of a change in pistol DCMS during days 2-5.

Table A-44. Subject 8 Pistol DCMS Shapiro-Wilk Test Results

Day	W	P-Value
2	0.9458603	0.7066748
3	0.9030025	0.3919813
4	0.8397393	0.1297179
5	0.9876601	0.9827030

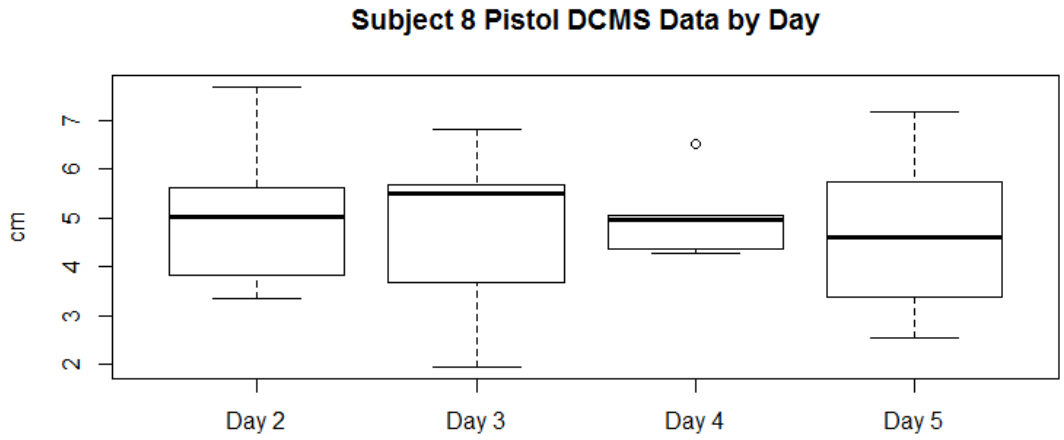

Figure A-39. Subject 8 Pistol DCMS Data

As Table A-45 indicates, the null hypothesis of normality was not rejected for Subject 8's pistol mean radius data. The boxplot in Figure A-40 does not, however, support a normal distribution. When Bartlett's Test was performed on these data, the resulting K^2 was 4.3364 and the p-value was 0.2274, which failed to reject the null hypothesis of homoscedasticity. The Kruskal-Wallis Test yielded a X^2 value of 3.26 and a p-value of 0.3532, thus failing to reject the null hypothesis of equality of dataset medians. As such, the analysis does not provide evidence of a change in mean radius during days 2-5.

Table A-45. Subject 8 Pistol Mean Radius Shapiro-Wilk Test Results

Day	W	P-Value
2	0.8783494	0.2615627
3	0.8899330	0.3178369
4	0.9549667	0.7802312
5	0.9345606	0.6157518

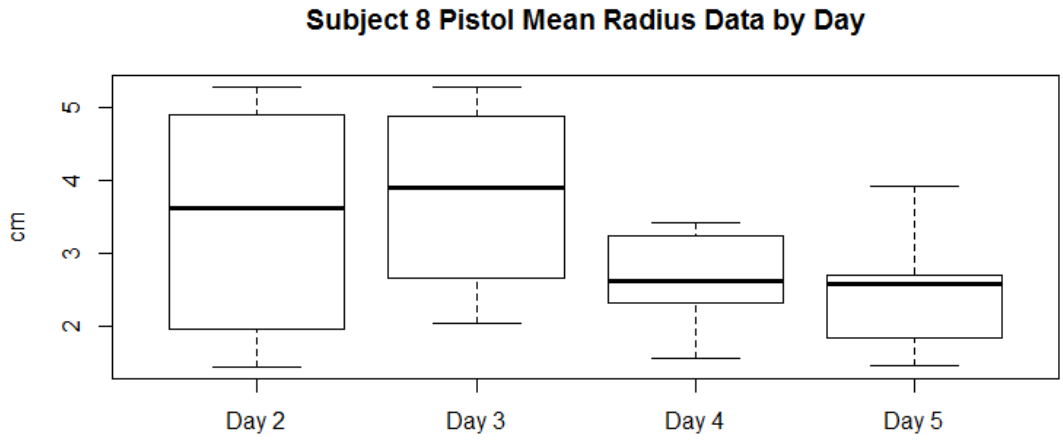

Figure A-40. Subject 8 Pistol Mean Radius Data

6.6 Subject 8 Rifle Data

As Figure A-41 indicates, the iterations with the lowest and most consistent AD 5 iteration running variances for Subject 8's Day 2 rifle data were iterations 6 and 7. Therefore, asymptotic performance was achieved during iterations 2 through 7. Basic descriptive statistics for this asymptote are shown in Table A-46.

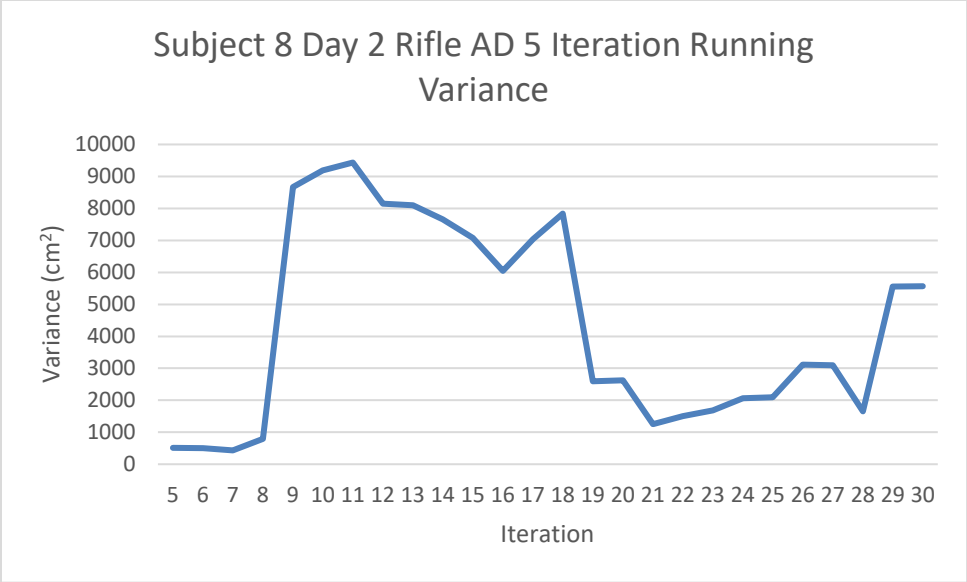

Figure A-41. Subject 8 Day 2 Rifle AD 5 Iteration Running Variances

Table A-46. Subject 8 Day 2 Rifle Asymptote Descriptive Statistics

	Group Size	MPI to CZP	DCMS	MR
Mean	12.53417	5.93198	7.503408	5.067068
Median	11.45876	6.212117	7.127643	4.623409
Stdev	3.018505	3.419964	3.519961	1.256017

As Figure A-42 indicates, the iterations with the lowest and most consistent AD 5 iteration running variances for Subject 8's Day 3 rifle data were iterations 6 and 7. Therefore, asymptotic performance was achieved during iterations 2 through 7. Basic descriptive statistics for this asymptote are shown in Table A-47.

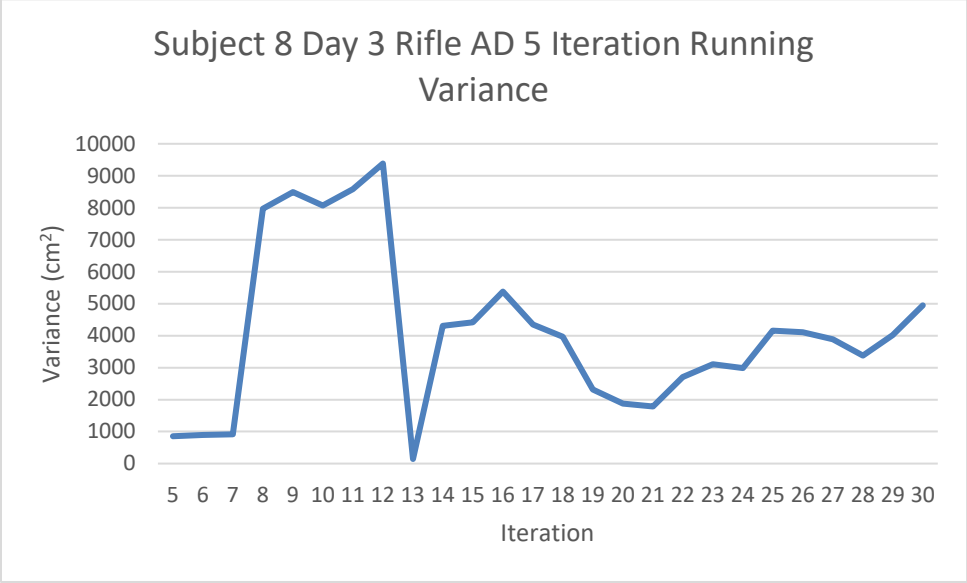

Figure A-42. Subject 8 Day 3 Rifle AD 5 Iteration Running Variance

Table A-47. Subject 8 Day 3 Rifle Asymptote Descriptive Statistics

	Group Size	MPI to CZP	DCMS	MR
Mean	10.22995	9.484427	10.14195	4.12187
Median	9.692537	8.974528	9.58891	3.938469
Stdev	2.65252	4.777667	4.35794	1.232474

As Figure A-43 indicates, the iterations with the lowest and most consistent AD 5 iteration running variances for Subject 8's Day 4 rifle data were iterations 13 and 14. Therefore, asymptotic performance was achieved during iterations 9 through 14. Basic descriptive statistics for this asymptote are shown in Table A-48.

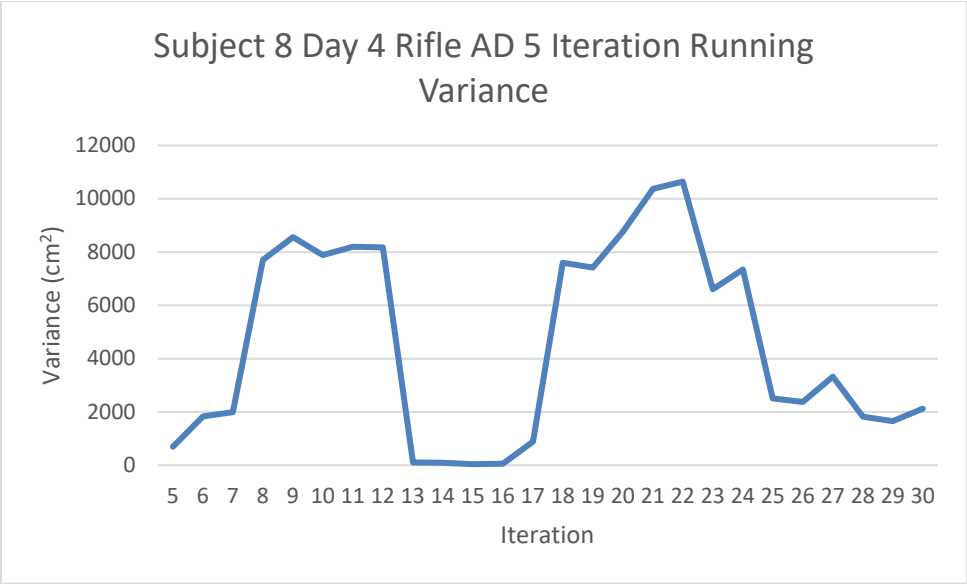

Figure A-43. Subject 8 Day 4 Rifle AD 5 Iteration Running Variance

Table A-48. Subject 8 Day 4 Rifle Asymptote Descriptive Statistics

	Group Size	MPI to CZP	DCMS	MR
Mean	10.86444	7.83432	8.856091	4.422953
Median	9.856523	8.886165	9.195886	4.150009
Stdev	3.483495	3.216469	2.017545	1.134533

As Figure A-44 indicates, the iterations with the lowest and most consistent AD 5 iteration running variances for Subject 8's Day 2 rifle data were iterations 28 and 29. Therefore, asymptotic performance was achieved during iterations 24 through 29. Basic descriptive statistics for this asymptote are shown in Table A-49.

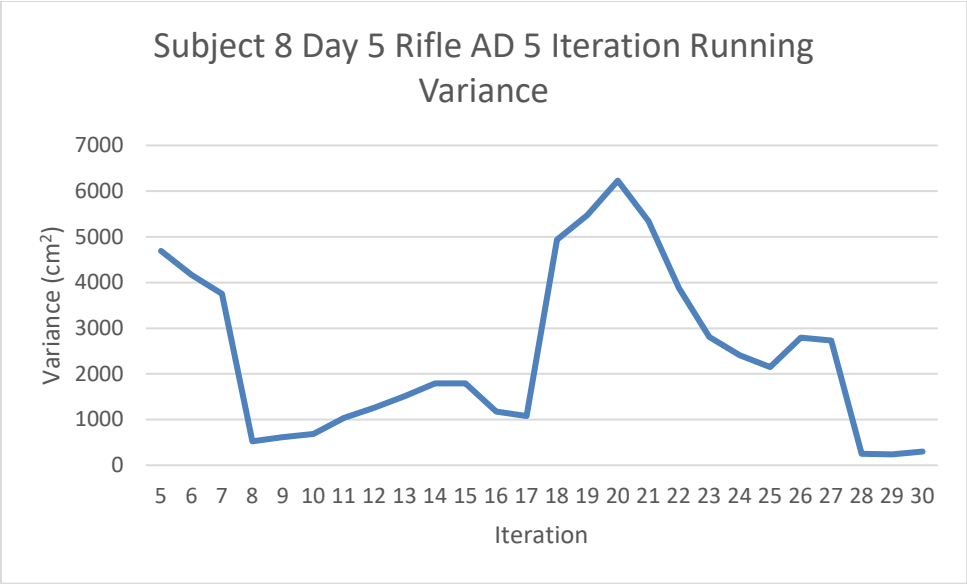

Figure A-44. Subject 8 Day 5 Rifle AD 5 Iteration Running Variance

Table A-49. Subject 8 Day 5 Rifle Asymptote Descriptive Statistics

	Group Size	MPI to CZP	DCMS	MR
Mean	10.34722	6.805636	7.77708	4.065884
Median	11.05756	6.441898	7.525453	4.124809
Stdev	2.398319	1.271123	0.927718	0.8052

As Table A-50 indicates, the null hypothesis of normality was rejected for day 4 of Subject 8's rifle group size data. The boxplot in Figure A-45 does not provide information to the contrary. When Bartlett's Test was performed on these data, the resulting K^2 was 0.72969 and the p-value was 0.8662, which failed to reject the null hypothesis of homoscedasticity. The Kruskal-Wallis Test yielded a X^2 value of 2.82 and a p-value of 0.4202, thus failing to reject the null hypothesis of equality of dataset medians. As such, the analysis does not provide evidence of a change in group size during days 2-5.

Table A-50. Subject 8 Rifle Group Size Shapiro-Wilk Test Results

Day	W	P-Value
2	0.9108802	0.4422123
3	0.8949721	0.3450634
4	0.7780648	0.0369750
5	0.9258933	0.5487817

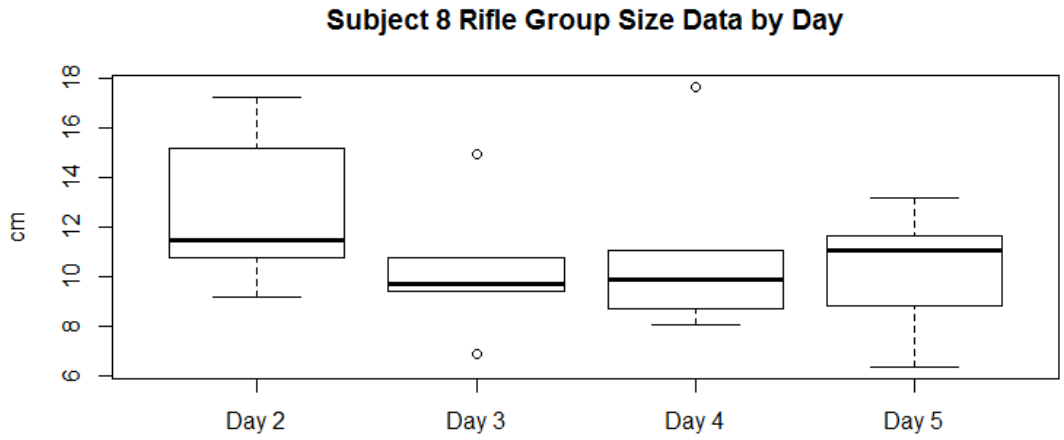

Figure A-45. Subject 8 Rifle Group Size Data

As Table A-51 indicates, the null hypothesis of normality was not rejected Subject 8's rifle MPI to CZP distance data. The boxplot in Figure A-46 does not, however, support a normal distribution. When Bartlett's Test was performed on these data, the resulting K^2 was 6.497 and the p-value was 0.08978, which failed to reject the null hypothesis of homoscedasticity. The Kruskal-Wallis Test yielded a X^2 value of 3.0067 and a p-value of 0.3906, thus failing to reject the null hypothesis of equality of dataset medians. As such, the analysis does not provide evidence of a change in MPI to CZP distance during days 2-5.

Table A-51. Subject 8 Rifle MPI to CZP Distance Shapiro-Wilk Test Results

Day	W	P-Value
2	0.9753089	0.9260061
3	0.9817828	0.9600685
4	0.9247012	0.5398464
5	0.8129630	0.0766295

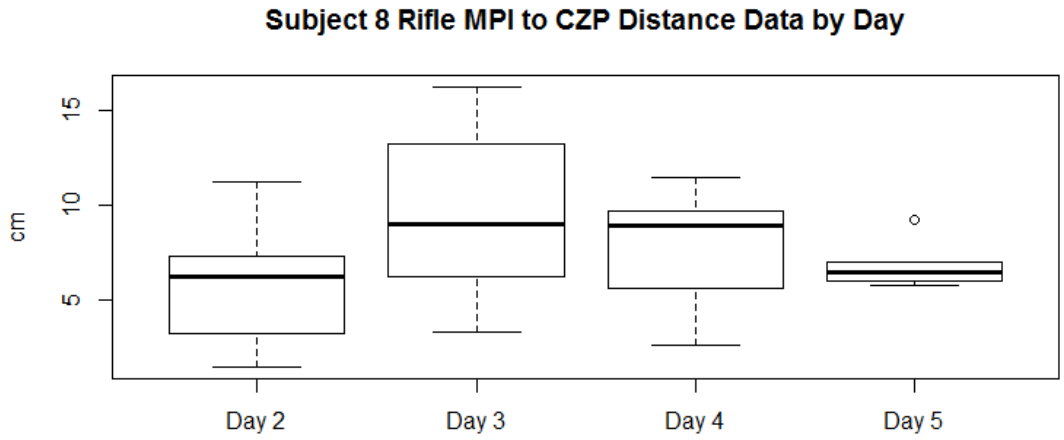

Figure A-46. Subject 8 Rifle MPI to CZP Distance Data

As Table A-52 indicates, the null hypothesis of normality was not rejected Subject 8's rifle DCMS data. The boxplot in Figure A-47 does not, however, support a normal distribution. When Bartlett's Test was performed on these data, the resulting K^2 was 9.7334 and the p-value was 0.02097, which rejected the null hypothesis of homoscedasticity. The Brunner-Dette-Munk test yielded an F value of 0.7407407 and a p-value of 0.5265781, thus failing to reject the null hypothesis of equality of distribution functions. As such, the analysis does not provide evidence of a change in DCMS during days 2-5.

Table A-52. Subject 8 Rifle DCMS Shapiro-Wilk Test Results

Day	W	P-Value
2	0.9358447	0.6259301
3	0.9737031	0.9163217
4	0.9710274	0.8992638
5	0.8547295	0.1718041

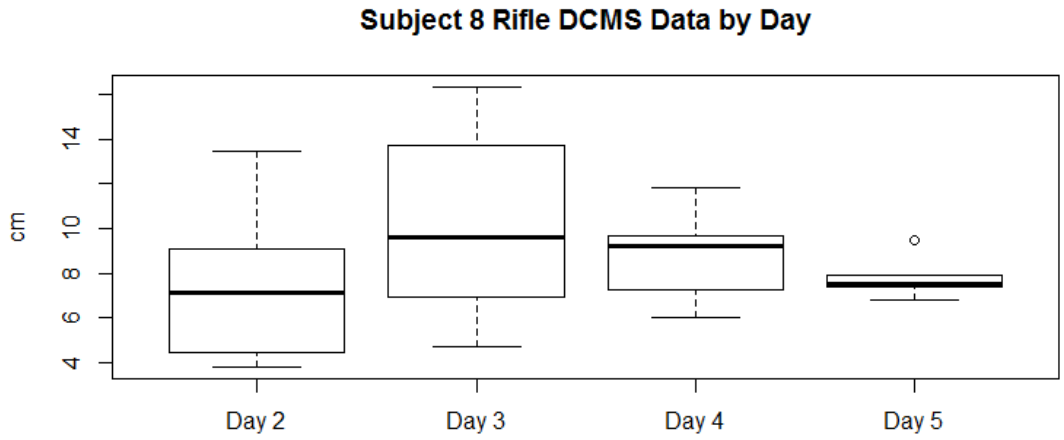

Figure A-47. Subject 8 Rifle DCMS Data

As Table A-53 indicates, the null hypothesis of normality was not rejected for Subject 8's rifle mean radius data. The boxplot in Figure A-48 does not, however, support a normal distribution. When Bartlett's Test was performed on these data, the resulting K^2 was 1.039 and the p-value was 0.7918, which failed to reject the null hypothesis of homoscedasticity. The Kruskal-Wallis Test yielded a X^2 value of 2.94 and a p-value of 0.401, thus failing to reject the null hypothesis of equality of dataset medians. As such, the analysis does not provide evidence of a change in mean radius during days 2-5.

Table A-53. Subject 8 Rifle Mean Radius Shapiro-Wilk Test Results

Day	W	P-Value
2	0.8953439	0.3471397
3	0.9306888	0.5854312
4	0.7995011	0.581695
5	0.9857828	0.9764321

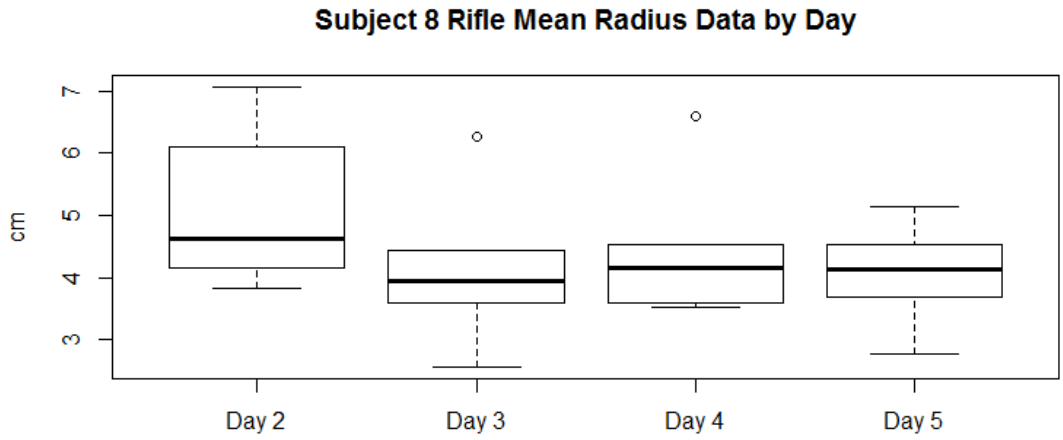

Figure A-48. Subject 8 Rifle Mean Radius Data

6.7 Subject 9 Pistol Data

As Figure A-49 indicates, the iterations with the lowest and most consistent AD 5 iteration running variances for Subject 9's Day 2 pistol data were iterations 12 and 13. Therefore, asymptotic performance was achieved during iterations 8 through 13. Basic descriptive statistics for this asymptote are shown in Table A-54.

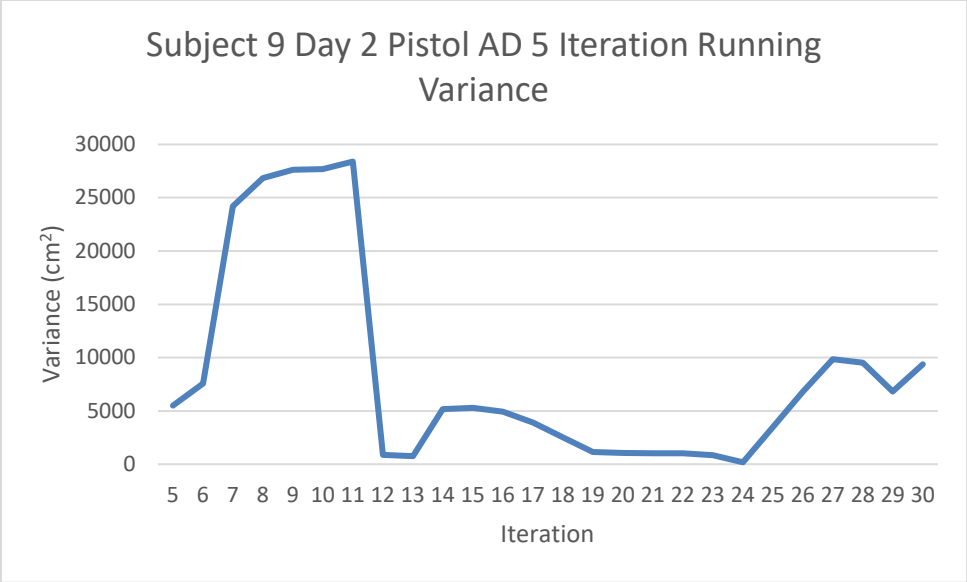

Figure A-49. Subject 9 Day 2 Pistol AD 5 Iteration Running Variance

Table A-54. Subject 9 Day 2 Pistol Asymptote Descriptive Statistics

	Group Size	MPI to CZP	DCMS	MR
Mean	16.3769	8.67452	10.8418	6.35279
Median	15.0585	9.04423	9.98241	6.26341
Stdev	8.74869	2.65293	2.14104	3.15648

As Figure A-50 indicates, the iterations with the lowest and most consistent AD 5 iteration running variances for Subject 9's Day 3 pistol data were iterations 16 and 17. Therefore, asymptotic performance was achieved during iterations 12 through 17. Basic descriptive statistics for this asymptote are shown in Table A-55.

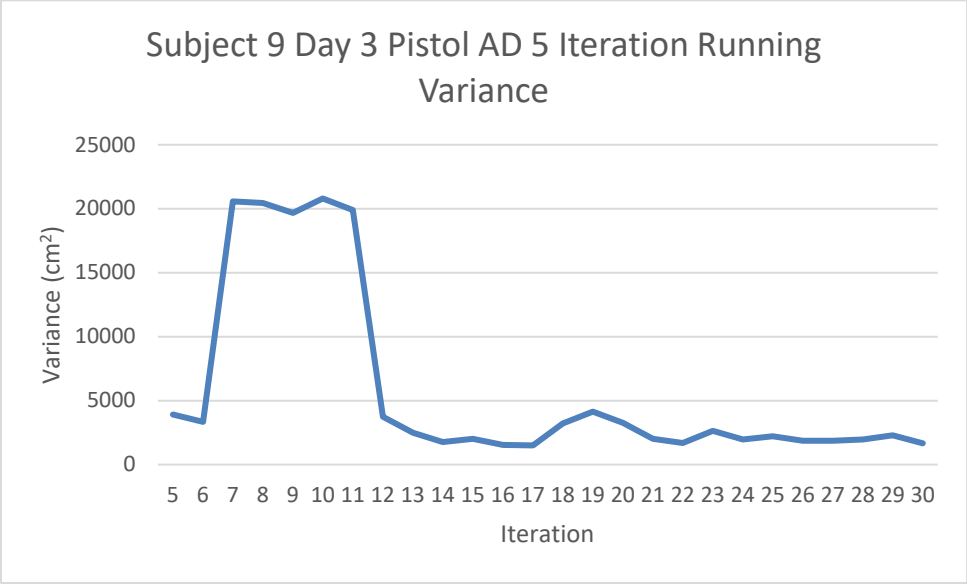

Figure A-50. Subject 9 Day 3 Pistol AD 5 Iteration Running Variance

Table A-55. Subject 9 Day 3 Pistol Asymptote Descriptive Statistics

	Group Size	MPI to CZP	DCMS	MR
Mean	9.43583	5.90781	6.51505	3.88172
Median	7.63154	5.42995	5.8039	3.17751
Stdev	5.53337	3.02575	3.10794	2.38673

As Figure A-51 indicates, the iterations with the lowest and most consistent AD 5 iteration running variances for Subject 9's Day 4 pistol data were iterations 29 and 30. Therefore, asymptotic performance was achieved during iterations 25 through 30. Basic descriptive statistics for this asymptote are shown in Table A-56.

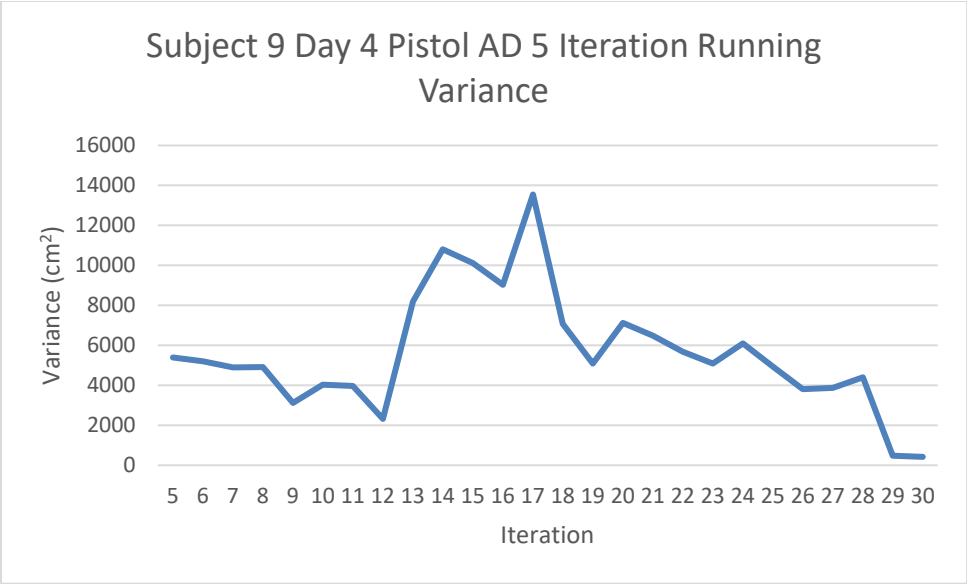

Figure A-51. Subject 9 Day 4 Pistol AD 5 Iteration Running Variance

Table A-56. Subject 9 Day 4 Pistol Asymptote Descriptive Statistics

	Group Size	MPI to CZP	DCMS	MR
Mean	11.2538	5.46427	6.87856	4.58969
Median	11.6393	4.40753	6.29918	4.79171
Stdev	2.14391	3.17753	2.63769	1.00758

As Figure A-52 indicates, the iterations with the lowest and most consistent AD 5 iteration running variances for Subject 9's Day 4 pistol data were iterations 13 and 14. Therefore, asymptotic performance was achieved during iterations 9 through 14. Basic descriptive statistics for this asymptote are shown in Table A-57.

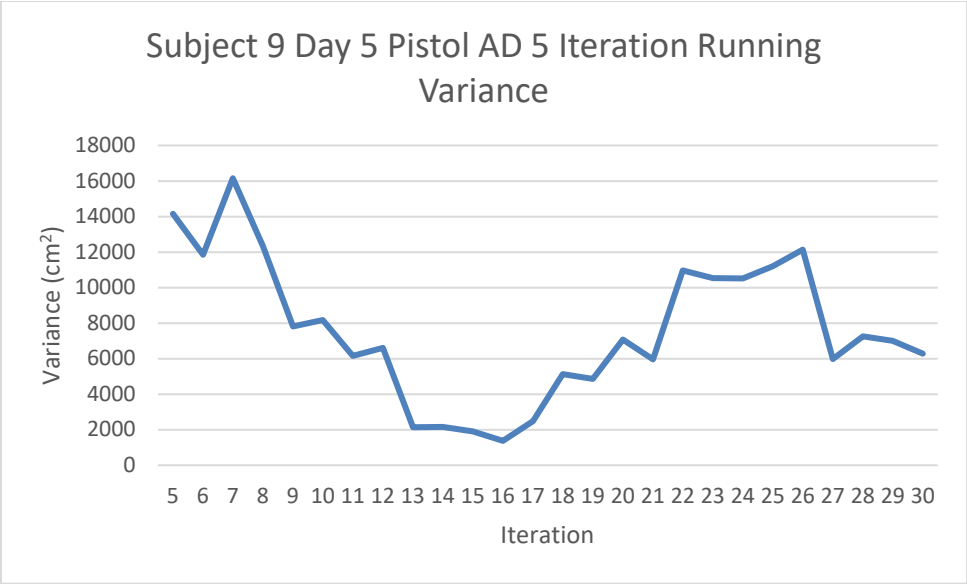

Figure A-52. Subject 9 Day 5 Pistol AD 5 Iteration Running Variance

Table A-57. Subject 9 Day 5 Pistol Asymptote Descriptive Statistics

	Group Size	MPI to CZP	DCMS	MR
Mean	14.6578	4.48738	7.53226	5.9085
Median	14.681	4.22434	7.80687	6.05613
Stdev	2.14558	1.9725	1.01423	1.05745

As Table A-58 indicates, the null hypothesis of normality was not rejected for Subject 9's pistol group size data. The boxplot in Figure A-53 does not, however, support a normal distribution. When Bartlett's Test was performed on these data, the resulting K^2 was 12.323 and the p-value was 0.006354, which rejected the null hypothesis of homoscedasticity. The Brunner-Dette-Munk test yielded an F value of 2.829617 and a p-value of 0.0879442, thus failing to reject the null hypothesis of equality of distribution functions. As such, the analysis does not provide evidence of a change in group size during days 2-5.

Table A-58. Subject 9 Pistol Group Size Data Shapiro-Wilk Test Results

Day	W	P-Value
2	0.9190812	0.4987684
3	0.8302296	0.1079723
4	0.8899338	0.3178410
5	0.9773407	0.9376015

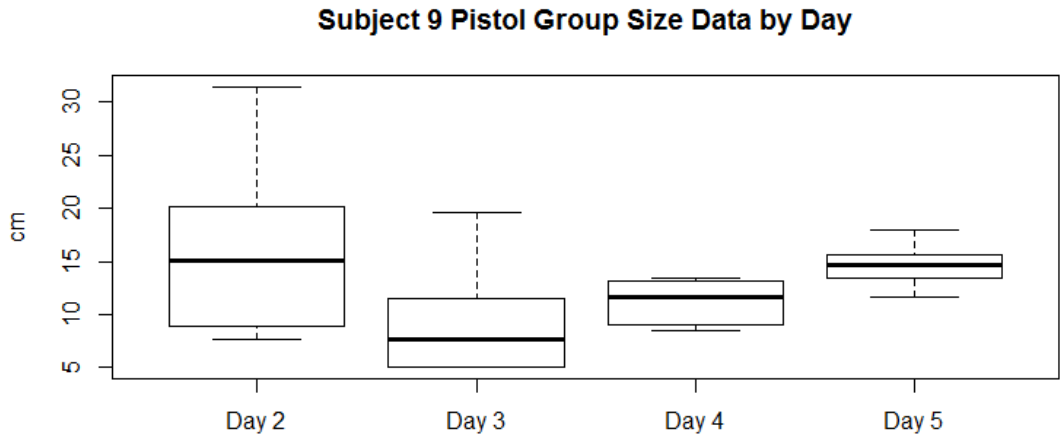

Figure A-53. Subject 9 Pistol Group Size Data

As Table A-59 indicates, the null hypothesis of normality was rejected for day 4 of Subject 9's pistol MPI to CZP distance. The boxplot in Figure A-54 does not provide information to the contrary. When Bartlett's Test was performed on these data, the resulting K^2 was 1.1408 and the p-value was 0.7672, which failed to reject the null hypothesis of homoscedasticity. The Kruskal-Wallis Test yielded a X^2 value of 6.58 and a p-value of 0.08656, thus failing to reject the null hypothesis of equality of dataset medians. As such, the analysis does not provide evidence of a change in MPI to CZP distance during days 2-5.

Table A-59. Subject 9 Pistol MPI to CZP Distance Shapiro-Wilk Test Results

Day	W	P-Value
2	0.9618024	0.8335189
3	0.9564445	0.7919626
4	0.7915947	0.0493153
5	0.9556574	0.7857258

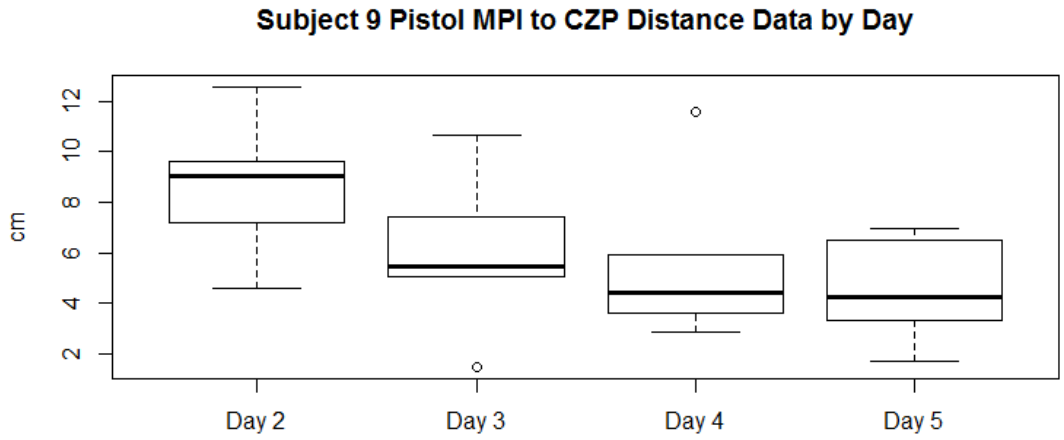

Figure A-54. Subject 9 Pistol MPI to CZP Distance Data

As Table A-60 indicates, the null hypothesis of normality was not rejected for Subject 9's pistol DCMS. The boxplot in Figure A-55 does not, however, support a normal distribution. When Bartlett's Test was performed on these data, the resulting K^2 was 5.0587 and the p-value was 0.1656, which failed to reject the null hypothesis of homoscedasticity. The Kruskal-Wallis Test yielded a X^2 value of 10.3 and a p-value of 0.01618, thus rejecting the null hypothesis of equality of dataset medians.

Table A-60. Subject 9 Pistol DCMS Shapiro-Wilk Test Results

Day	W	P-Value
2	0.8526823	0.1654385
3	0.9357896	0.6254922
4	0.8447170	0.1425677
5	0.9452874	0.7020197

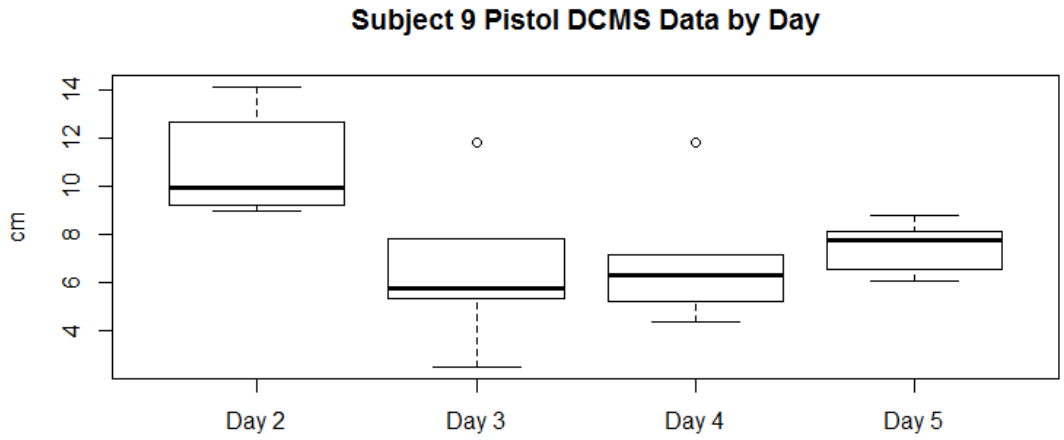

Figure A-55. Subject 9 Pistol DCMS Data

As Table A-61 indicates, significant differences were found between days 2 and 3 and days 2 and 4. These differences imply a reduction in DCMS over the course of the days of firing. The difference between days 2 and 5 is not significant because the P-value must be less than half of the alpha value of 0.05 in order to reject the null hypothesis for Dunn's test.

Table A-61. Subject 9 Pistol DCMS Dunn's Test Results

Days	Z	P-Value
2 & 3	2.816913	0.0024
2 & 4	2.735263	0.0031
2 & 5	1.95591	0.0250
3 & 4	-0.081649	0.4675
3 & 5	0.857321	0.1956
4 & 5	-0.775671	0.2190

As Table A-62 indicates, the null hypothesis of normality was rejected for day 4 of Subject 9's pistol mean radius data. The boxplot in Figure A-56 does not provide information to the contrary. When Bartlett's Test was performed on these data, the resulting K^2 was 8.3285 and the p-value was 0.03969, which rejected the null hypothesis of homoscedasticity. The Brunner-Dette-Munk test yielded an F value of 1.912222 and a p-value of 0.1768024, thus failing to reject the null hypothesis of equality of distribution functions. As such, the analysis provides no evidence of a change in mean radius during days 2-5.

Table A-62. Subject 9 Pistol Mean Radius Shapiro-Wilk Test Results

Day	W	P-Value

2	0.9618024	0.8335189
3	0.9564445	0.7919626
4	0.7915947	0.0493153
5	0.9556574	0.7857258

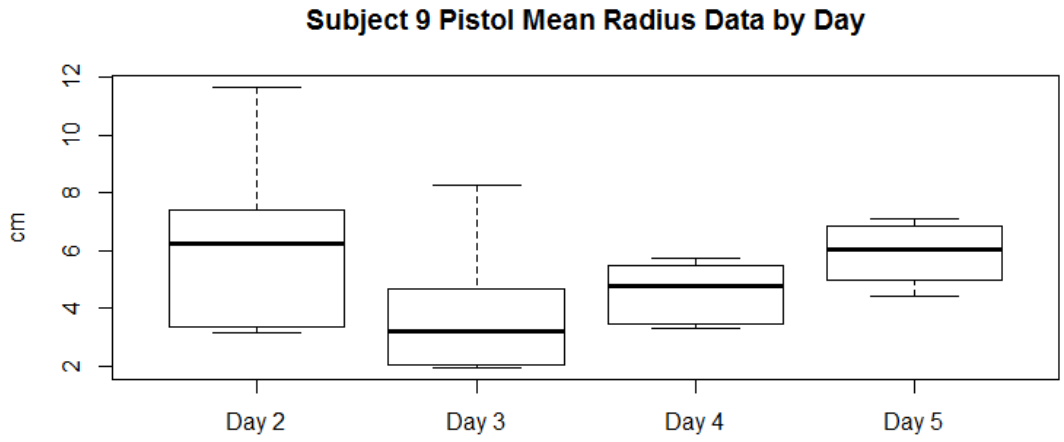

Figure A-56. Subject 9 Pistol Mean Radius Data

6.8 Subject 9 Rifle Data

As Figure A-57 indicates, the iterations with the lowest and most consistent AD 5 iteration running variances for Subject 9's Day 2 rifle data were iterations 25 and 26. Therefore, asymptotic performance was achieved during iterations 21 through 26. Basic descriptive statistics for this asymptote are shown in Table A-63.

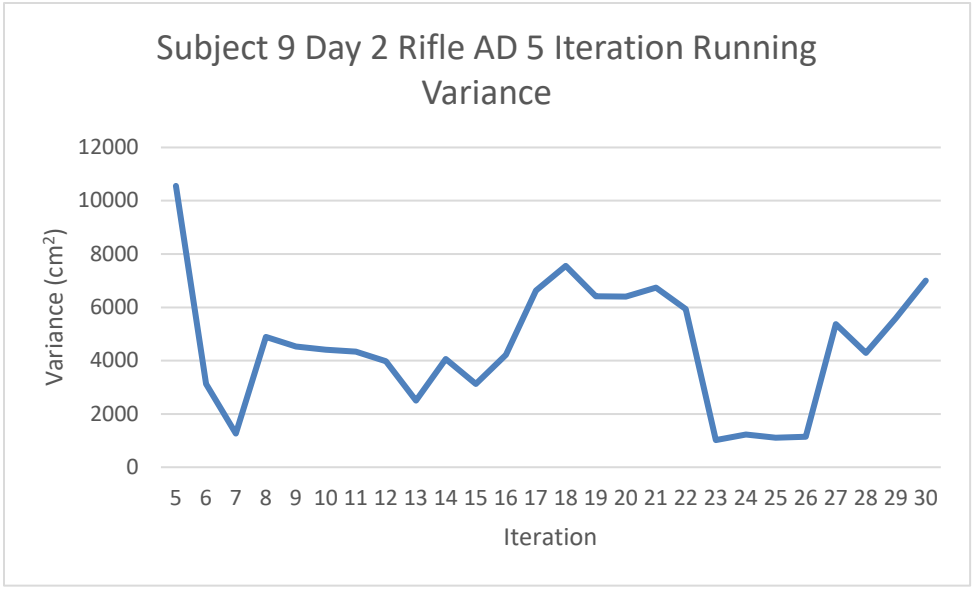

Figure A-57. Subject 9 Day 2 Rifle AD 5 Iteration Running Variance

Table A-63. Subject 9 Day 2 Rifle Asymptote Descriptive Statistics

	Group Size	MPI to CZP	DCMS	MR
Mean	13.1061	6.36123	7.96399	5.36892
Median	12.8406	6.42102	8.02803	5.48377
Stdev	3.2368	2.21585	1.6535	1.21717

As Figure A-58 indicates, the iterations with the lowest and most consistent AD 5 iteration running variances for Subject 9's Day 3 rifle data were iterations 12 and 13. Therefore, asymptotic performance was achieved during iterations 8 through 13. Basic descriptive statistics for this asymptote are shown in Table A-64.

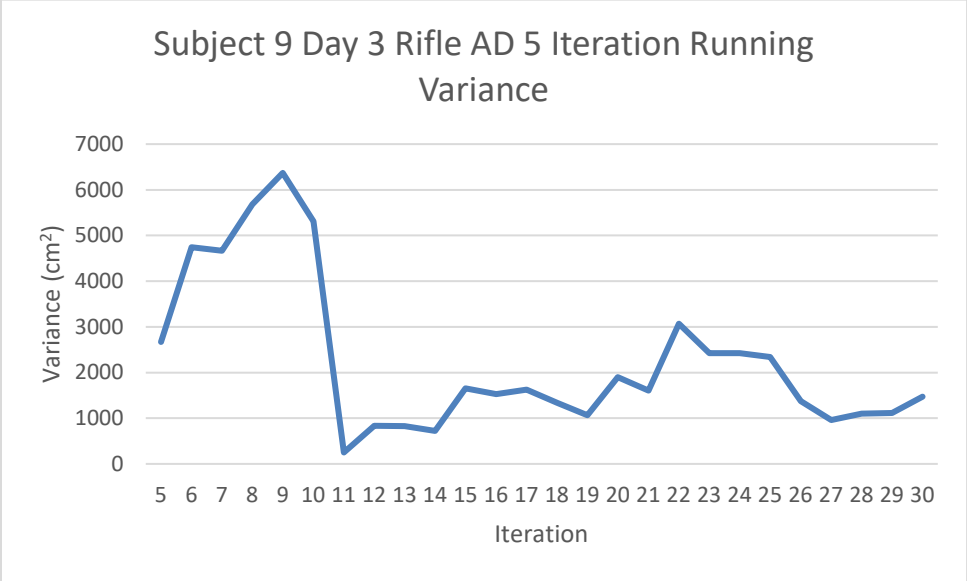

Figure A-58. Subject 9 Day 3 Rifle AD 5 Iteration Running Variance

Table A-64. Subject 9 Day 3 Rifle Asymptote Descriptive Statistics

	Group Size	MPI to CZP	DCMS	MR
Mean	9.95233	7.19032	8.05226	4.04167
Median	9.55282	8.34874	8.74475	3.90543
Stdev	3.0756	2.87562	2.41274	1.31104

As Figure A-59 indicates, the iterations with the lowest and most consistent AD 5 iteration running variances for Subject 9's Day 4 rifle data were iterations 14 and 15. Therefore, asymptotic performance was achieved during iterations 10 through 15. Basic descriptive statistics for this asymptote are shown in Table A-65.

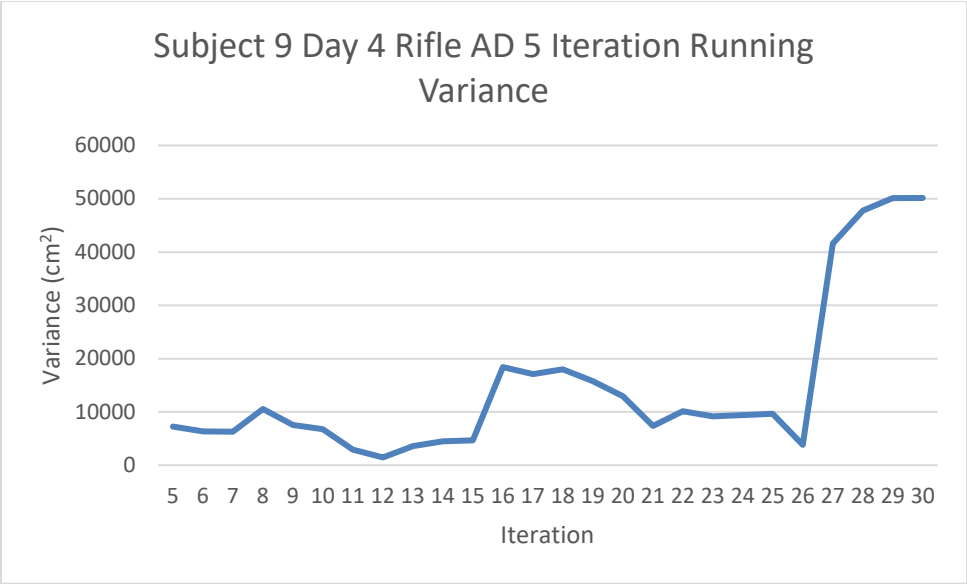

Figure A-59. Subject 9 Day 4 Rifle AD 5 Iteration Running Variance

Table A-65. Subject 9 Day 4 Rifle Asymptote Descriptive Statistics

	Group Size	MPI to CZP	DCMS	MR
Mean	15.7618	5.31969	8.28939	6.33058
Median	15.6687	4.58481	9.29084	6.43304
Stdev	6.42208	3.32312	2.571	2.38859

As Figure A-60 indicates, the iterations with the lowest and most consistent AD 5 iteration running variances for Subject 9's Day 5 rifle data were iterations 6 and 7. Therefore, asymptotic performance was achieved during iterations 2 through 7. Basic descriptive statistics for this asymptote are shown in Table A-66.

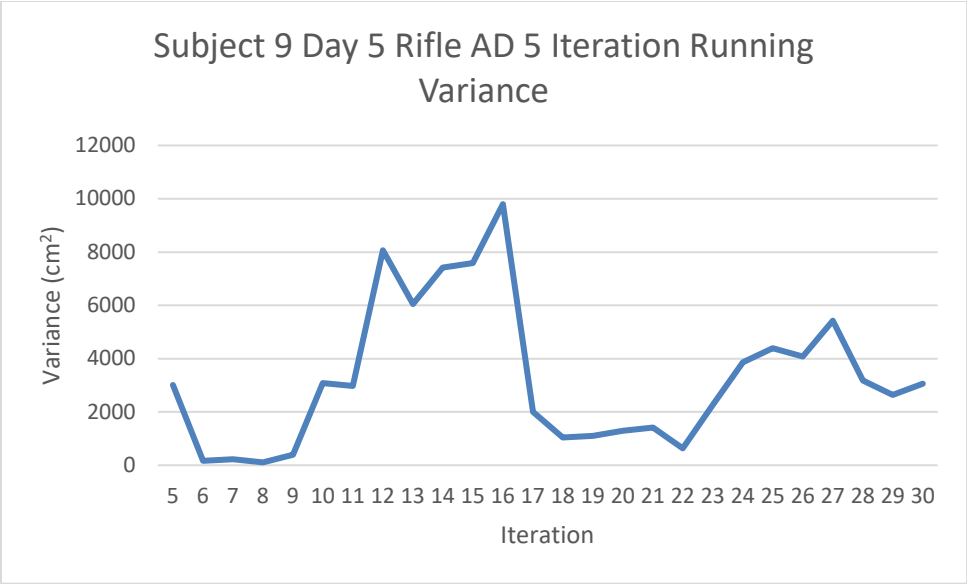

Figure A-60. Subject 9 Day 5 Rifle AD 5 Iteration Running Variance

Table A-66. Subject 9 Day 5 Rifle Asymptote Descriptive Statistics

	Group Size	MPI to CZP	DCMS	MR
Mean	10.2498	5.10767	6.11807	3.88296
Median	11.0276	5.43192	6.12707	4.23942
Stdev	3.29816	1.68532	0.7474	1.15631

As Table A-67 indicates, the null hypothesis of normality was not rejected for Subject 9's rifle group size data. The boxplot in Figure A-61 does not, however, support a normal distribution. When Bartlett's Test was performed on these data, the resulting K^2 was 3.9797 and the p-value was 0.2637, which failed to reject the null hypothesis of homoscedasticity. The Kruskal-Wallis Test yielded a X^2 value of 4.4933 and a p-value of 0.2129, thus failing to reject the null hypothesis of equality of dataset medians. As such, the analysis does not provide evidence of a change in group size during days 2-5.

Table A-67. Subject 9 Rifle Group Size Shapiro-Wilk Test Results

Day	W	P-Value
2	0.9563986	0.7915995
3	0.9269800	0.5569898
4	0.8721177	0.2347776
5	0.9511664	0.7497173

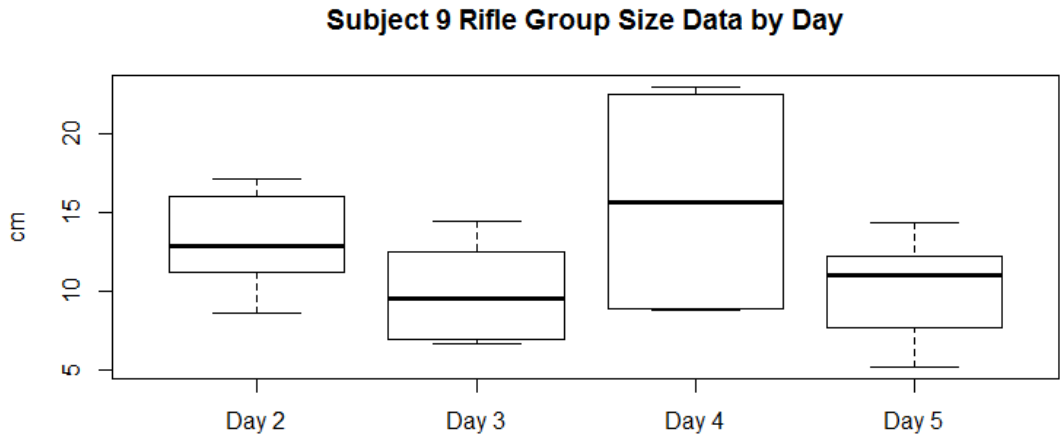

Figure A-61. Subject 9 Rifle Group Size Data

As Table A-68 indicates, the null hypothesis of normality was not rejected for Subject 9's rifle MPI to CZP distance data. The boxplot in Figure A-62 does not, however, support a normal distribution. When Bartlett's Test was performed on these data, the resulting K^2 was 2.298 and the p-value was 0.5129, which failed to reject the null hypothesis of homoscedasticity. The Kruskal-Wallis Test yielded a X^2 value of 3.1067 and a p-value of 0.3755, thus failing to reject the null hypothesis of equality of dataset medians. As such, the analysis does not provide evidence of a change in MPI to CZP distance during days 2-5.

Table A-68. Subject 9 Rifle MPI to CZP Distance Shapiro-Wilk Test Results

Day	W	P-Value
2	0.9700026	0.8924518
3	0.8482531	0.1523577
4	0.8449839	0.1432868
5	0.9084121	0.4260326

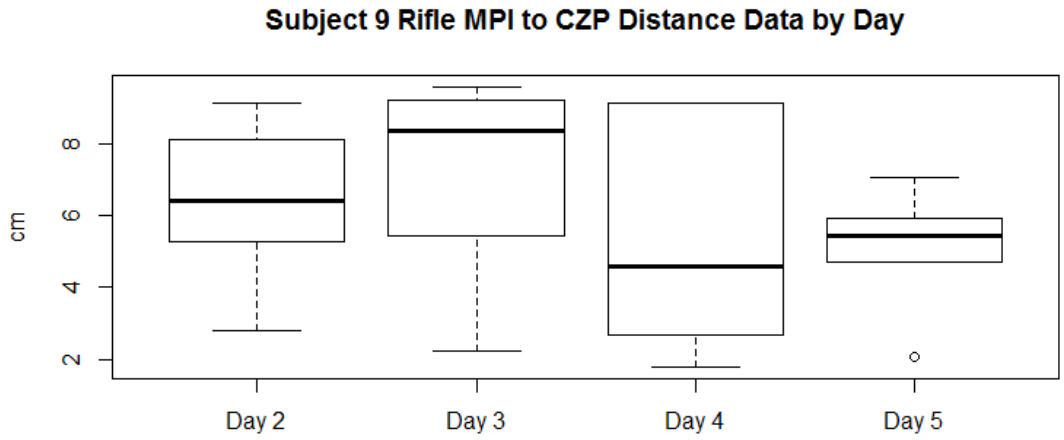

Figure A-62. Subject 9 Rifle MPI to CZP Distance Data

As Table A-69 indicates, the null hypothesis of normality was not rejected for Subject 9's rifle DCMS data. The boxplot in Figure A-63 does not, however, support a normal distribution. When Bartlett's Test was performed on these data, the resulting K^2 was 6.4707 and the p-value was 0.09082, which failed to reject the null hypothesis of homoscedasticity. The Kruskal-Wallis Test yielded a X^2 value of 4.3687 and a p-value of 0.2226, thus failing to reject the null hypothesis of equality of dataset medians. As such, the analysis does not provide evidence of a change in DCMS during days 2-5.

Table A-69. Subject 9 Rifle DCMS Shapiro-Wilk Test Results

Day	W	P-Value
2	0.9880740	0.9839582
3	0.9356728	0.6245639
4	0.8758939	0.2507261
5	0.9373848	0.6382061

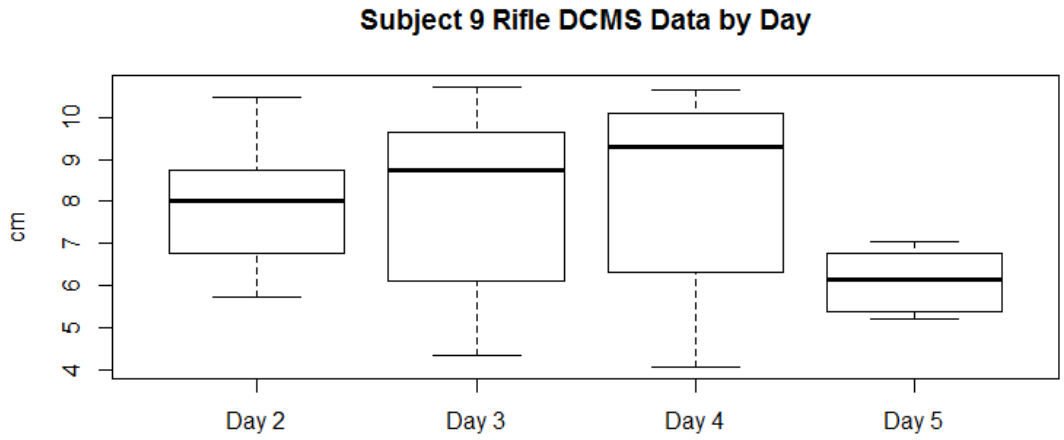

Figure A-63. Subject 9 Rifle DCMS Data

As Table A-70 indicates, the null hypothesis of normality was not rejected for Subject 9's rifle mean radius data. The boxplot in Figure A-64 does not, however, support a normal distribution. When Bartlett's Test was performed on these data, the resulting K^2 was 3.667 and the p-value was 0.2997, which failed to reject the null hypothesis of homoscedasticity. The Kruskal-Wallis Test yielded a X^2 value of 5.9867 and a p-value of 0.1123, thus failing to reject the null hypothesis of equality of dataset medians. As such, the analysis does not provide evidence of a change in mean radius during days 2-5.

Table A-70. Subject 9 Rifle Mean Radius Shapiro-Wilk Test Results

Day	W	P-Value
2	0.9494742	0.7360217
3	0.9464109	0.7111493
4	0.9341543	0.6125436
5	0.9387538	0.6491744

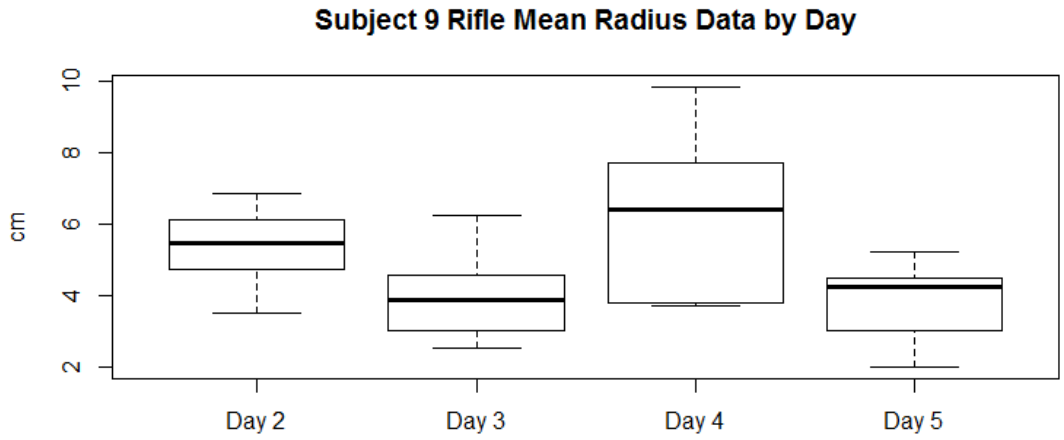

Figure A-64. Subject 9 Rifle Mean Radius Data

6.9 Subject 11 Pistol Data

As Figure A-65 indicates, the iterations with the lowest and most consistent AD 5 iteration running variances for Subject 11's Day 2 pistol data were iterations 9 and 10. Therefore, asymptotic performance was achieved during iterations 5 through 10. Basic descriptive statistics for this asymptote are shown in Table A-71.

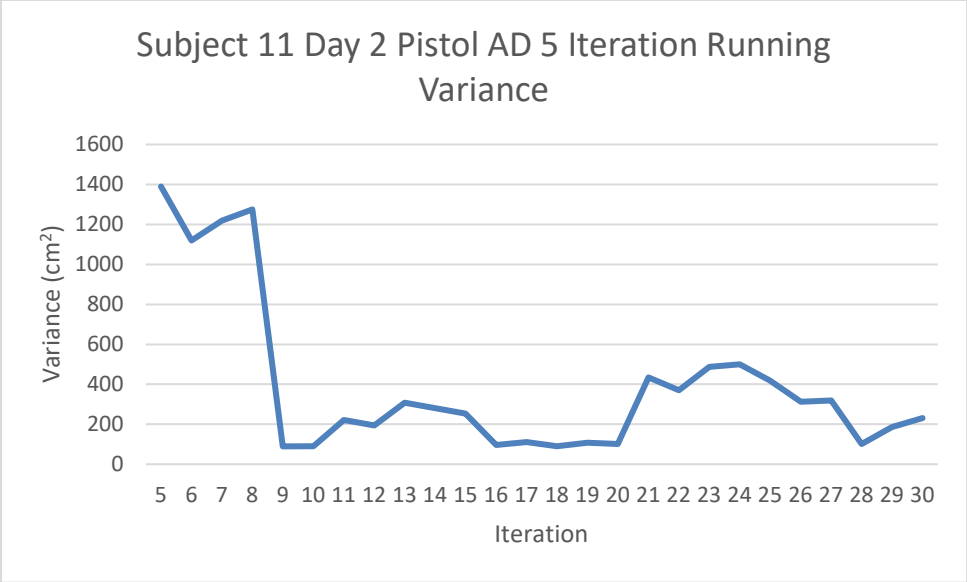

Figure A-65. Subject 11 Day 2 Pistol AD 5 Iteration Running Variance

Table A-71. Subject 11 Day 2 Pistol Asymptote Descriptive Statistics

	Group Size	MPI to CZP	DCMS	MR
Mean	7.15527	3.63336	4.65609	2.91517
Median	7.4849	2.96364	4.03787	3.04063
Stdev	2.50688	1.78536	1.69643	1.05672

As Figure A-66 indicates, the iterations with the lowest and most consistent AD 5 iteration running variances for Subject 11's Day 3 pistol data were iterations 23 and 24. Therefore, asymptotic performance was achieved during iterations 19 through 24. Basic descriptive statistics for this asymptote are shown in Table A-72.

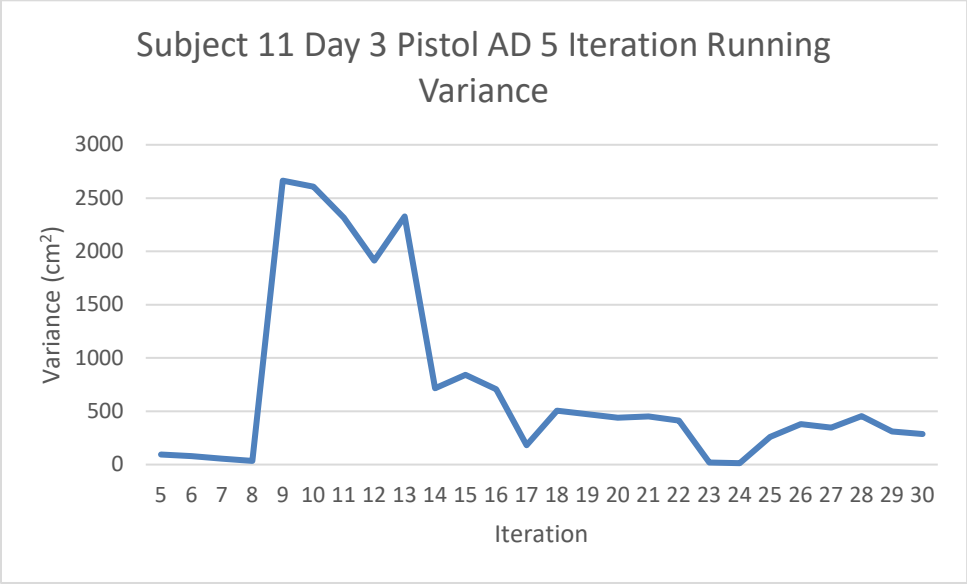

Figure A-66. Subject 11 Day 3 Pistol AD 5 Iteration Running Variance

Table A-72. Subject 11 Day 3 Pistol Asymptote Descriptive Statistics

	Group Size	MPI to CZP	DCMS	MR
Mean	6.16792	3.84975	4.42925	2.54273
Median	5.37172	3.50721	4.24211	2.30597
Stdev	1.87994	1.89468	1.6972	0.81985

As Figure A-67 indicates, the iterations with the lowest and most consistent AD 5 iteration running variances for Subject 11's Day 4 pistol data were iterations 20 and 21. Therefore, asymptotic performance was achieved during iterations 16 through 21. Basic descriptive statistics for this asymptote are shown in Table A-73.

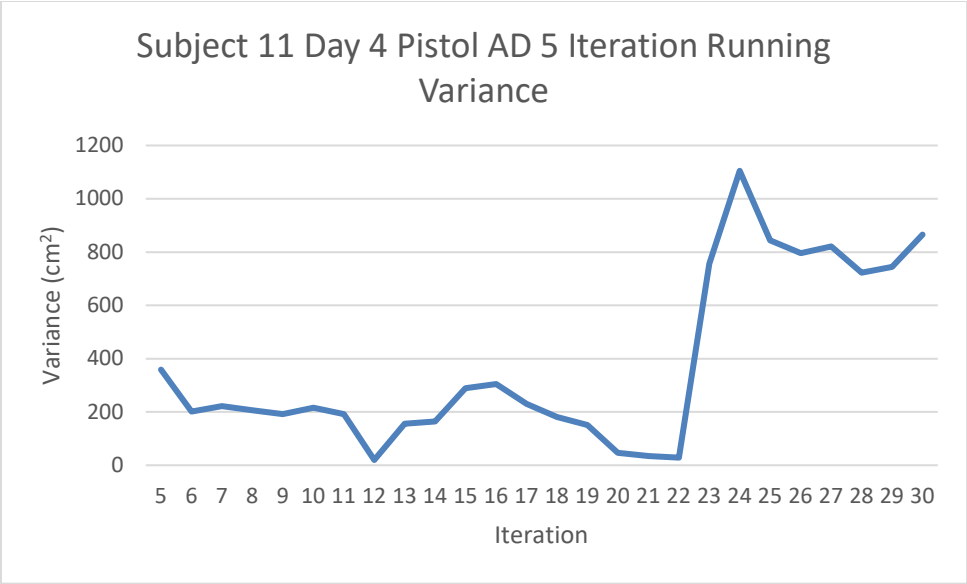

Figure A-67. Subject 11 Day 4 Pistol AD 5 Iteration Running Variance

Table A-73. Subject 11 Day 4 Pistol Asymptote Descriptive Statistics

	Group Size	MPI to CZP	DCMS	MR
Mean	5.51637	2.70493	3.34271	2.11396
Median	6.0198	2.60101	3.24739	2.23818
Stdev	1.46683	0.8396	0.65114	0.58488

As Figure A-68 indicates, the iterations with the lowest and most consistent AD 5 iteration running variances for Subject 11's Day 5 pistol data were iterations 24 and 25. Therefore, asymptotic performance was achieved during iterations 20 through 25. Basic descriptive statistics for this asymptote are shown in Table A-74.

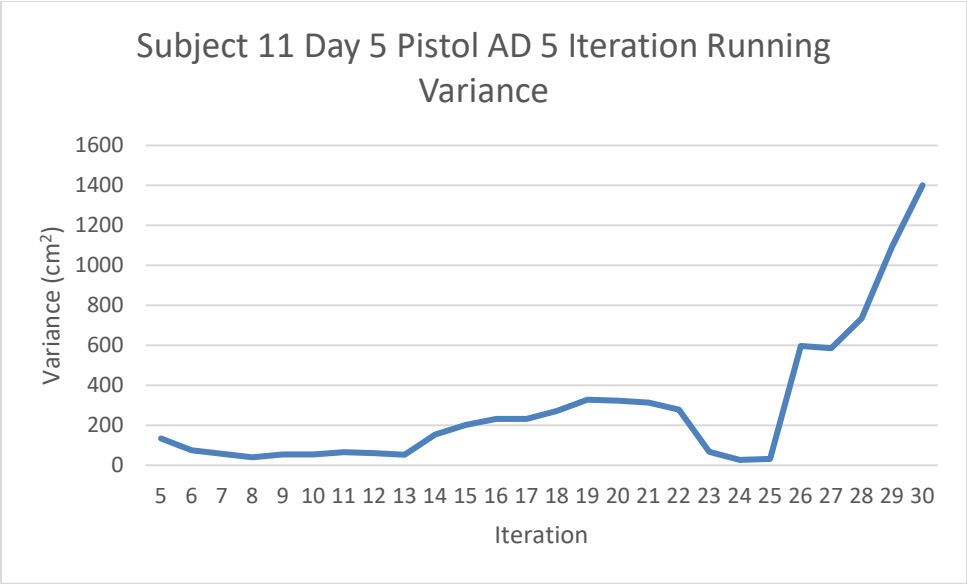

Figure A-68. Subject 11 Day 5 Pistol AD 5 Iteration Running Variance

Table A-74. Subject 11 Day 5 Pistol Asymptote Descriptive Statistics

	Group Size	MPI to CZP	DCMS	MR
Mean	8.63847	2.42089	4.21673	3.30971
Median	8.36373	1.84816	4.0666	3.29522
Stdev	1.07151	2.09073	1.36257	0.40813

As Table A-75 indicates, the null hypothesis of normality was not rejected for Subject 11's pistol group size data. The boxplot in Figure A-69 does not, however, support a normal distribution. When Bartlett's Test was performed on these data, the resulting K^2 was 6.5937 and the p-value was 0.08604, which failed to reject the null hypothesis of homoscedasticity. The Kruskal-Wallis Test yielded a X^2 value of 6.4286 and a p-value of 0.09252, thus failing to reject the null hypothesis of equality of dataset medians. As such, the analysis does not provide evidence of a change in group size during days 2-5.

Table A-75. Subject 11 Pistol Group Size Shapiro-Wilk Test Results

Day	W	P-Value
2	0.8614754	0.1942854
3	0.84138666	0.1338532
4	0.8497372	0.1566371
5	0.9461541	0.7090624

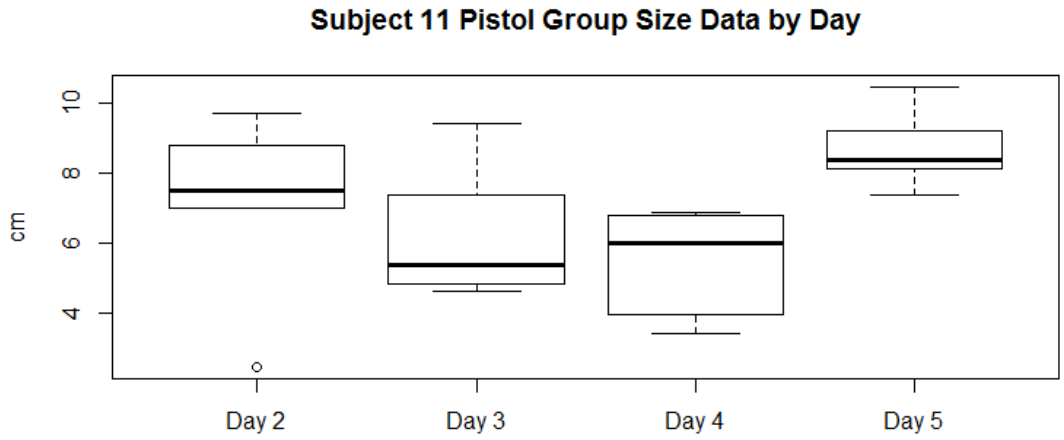

Figure A-69. Pistol Group Size Data

As Table A-76 indicates, the null hypothesis of normality was not rejected for Subject 11's pistol MPI to CZP distance data. The boxplot, however, in Figure A-70 does not support a normal distribution. When Bartlett's Test was performed on these data, the resulting K^2 was 3.6119 and the p-value was 0.3065, which failed to reject the null hypothesis of homoscedasticity. The Kruskal-Wallis Test yielded a X^2 value of 3.5467 and a p-value of 0.3148, thus failing to reject the null hypothesis of equality of dataset medians. As such, the analysis does not provide evidence of a change in MPI to CZP distance during days 2-5.

Table A-76. Subject 11 Pistol MPI to CZP Distance Shapiro-Wilk Test Results

Day	W	P-Value
2	0.8117827	0.0748212
3	0.8851062	0.2933349
4	0.9683237	0.8809905
5	0.8597353	0.1882599

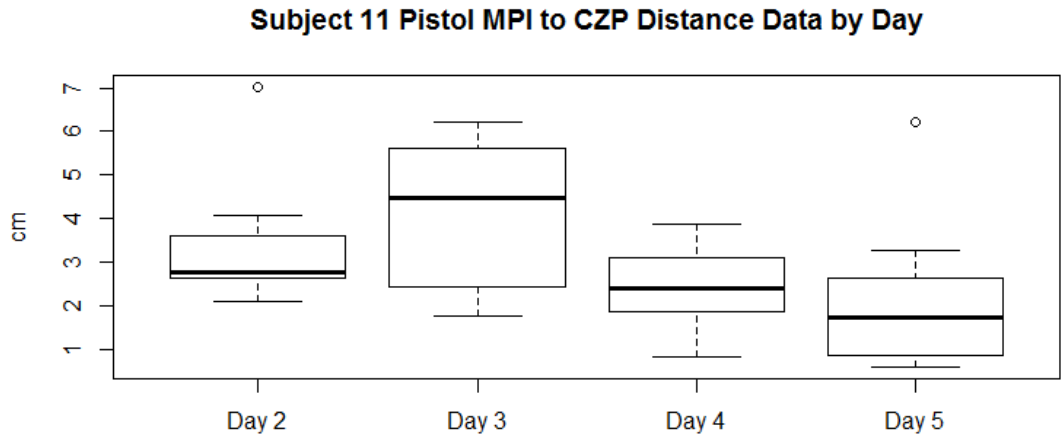

Figure A-70. Subject 11 Pistol MPI to CZP Distance Data

As Table A-77 indicates, the null hypothesis of normality was not rejected for Subject 11's pistol DCMS data. The boxplot in Figure A-71 does not, however, support a normal distribution. When Bartlett's Test was performed on these data, the resulting K^2 was 4.2292 and the p-value was 0.2378, which failed to reject the null hypothesis of homoscedasticity. The Kruskal-Wallis Test yielded a X^2 value of 3.3467 and a p-value of 0.3412, thus failing to reject the null hypothesis of equality of dataset medians. As such, the analysis does not provide evidence of a change in DCMS during days 2-5.

Table A-77. Subject 11 Pistol DCMS Shapiro-Wilk Test Results

Day	W	P-Value
2	0.8241451	0.0958176
3	0.8988912	0.3674173
4	0.8889379	0.3126601
5	0.8639224	0.2030345

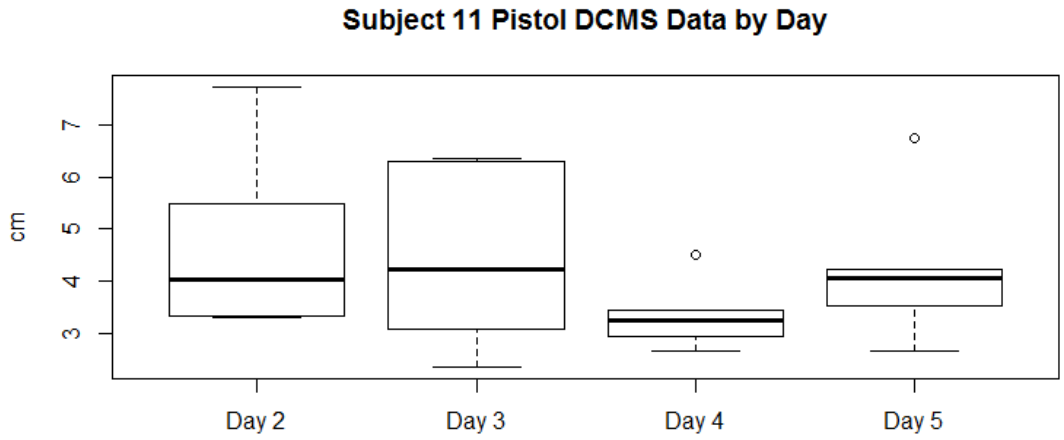

Figure A-71. Subject 11 Pistol DCMS Data

As Table A-78 indicates, the null hypothesis of normality was not rejected for Subject 11's pistol mean radius data. The boxplot in Figure A-72 does not, however, support a normal distribution. When Bartlett's Test was performed on these data, the resulting K^2 was 4.3109 and the p-value was 0.2298, which failed to reject the null hypothesis of homoscedasticity. The Kruskal-Wallis Test yielded a X^2 value of 5.905 and a p-value of 0.12, thus failing to reject the null hypothesis of equality of dataset medians. As such, the analysis does not provide evidence of a change in mean radius during days 2-5.

Table A-78. Subject 11 Pistol Mean Radius Shapiro-Wilk Test Results

Day	W	P-Value
2	0.8367888	0.1225911
3	0.9187759	0.4965885
4	0.9111453	0.4439738
5	0.9800773	0.9519415

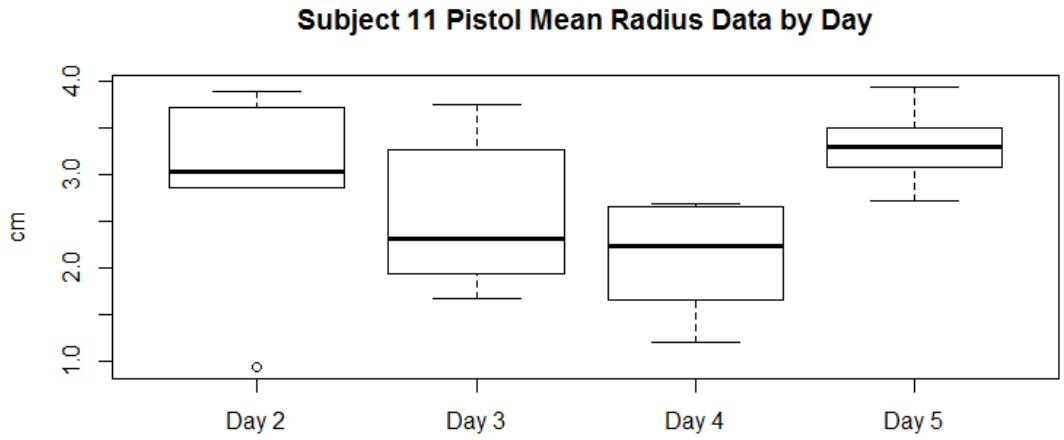

Figure A-72. Subject 11 Pistol Mean Radius Data

6.10 Subject 11 Rifle Data

As Figure A-73 indicates, the iterations with the lowest and most consistent AD 5 iteration running variances for Subject 11's Day 2 rifle data were iterations 16 and 17. Therefore, asymptotic performance was achieved during iterations 12 through 17. Basic descriptive statistics for this asymptote are shown in Table A-79.

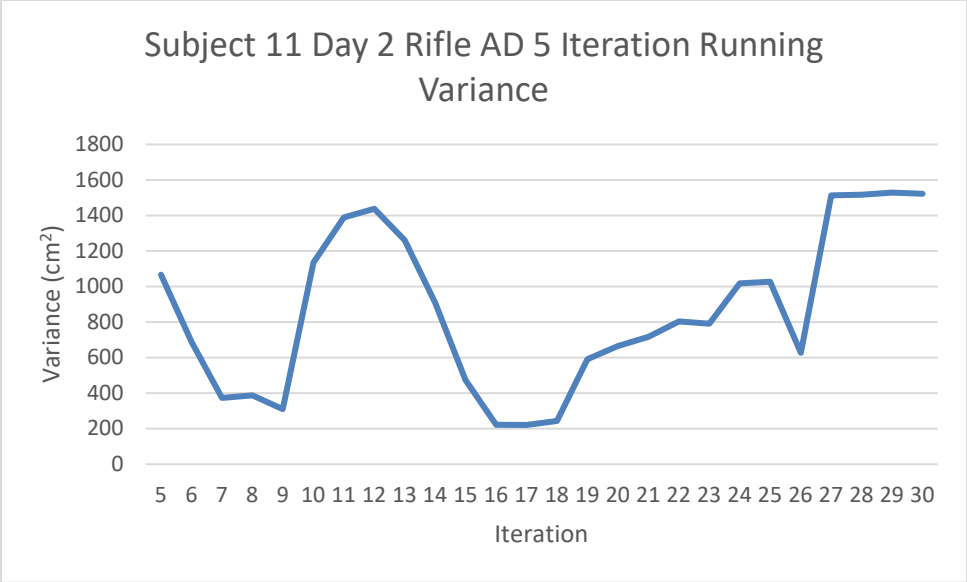

Figure A-73. Subject 11 Day 2 Rifle AD 5 Iteration Running Variance

Table A-79. Subject 11 Day 2 Rifle Asymptote Descriptive Statistics

	Group Size	MPI to CZP	DCMS	MR
Mean	12.4651	3.78825	6.36834	5.20767
Median	12.1563	3.95518	6.40936	5.165
Stdev	10.988	3.87296	5.90841	4.6275

As Figure A-74 indicates, the iterations with the lowest and most consistent AD 5 iteration running variances for Subject 11's Day 3 rifle data were iterations 5 and 6. Therefore, asymptotic performance was achieved during iterations 1 through 6. Basic descriptive statistics for this asymptote are shown in Table A-80.

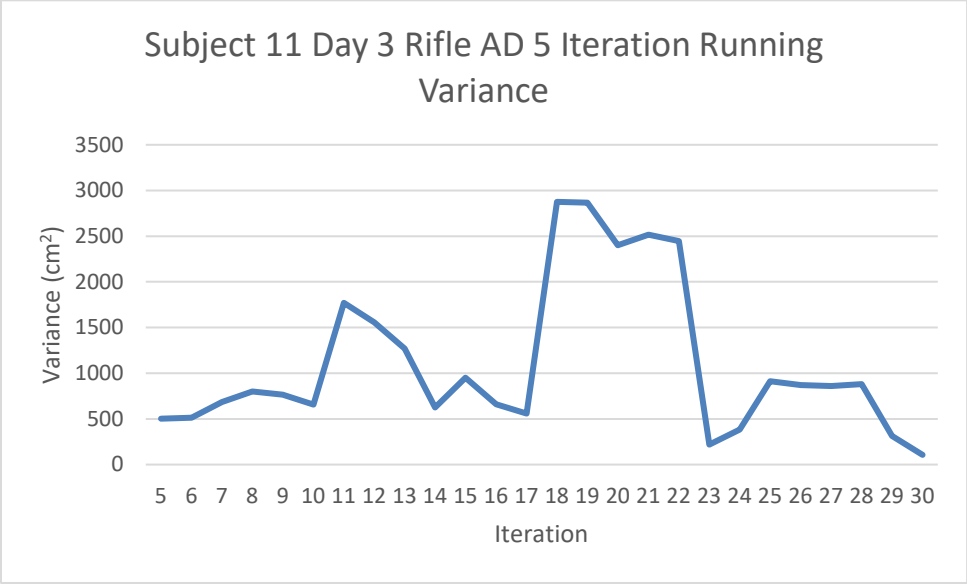

Figure A-74. Subject 11 Day 3 Rifle AD 5 Iteration Running Variance

Table A-80. Subject 11 Day 3 Rifle Asymptote Descriptive Statistics

	Group Size	MPI to CZP	DCMS	MR
Mean	11.91766	2.75126	5.37937	4.58141
Median	12.46021	2.97710	5.65256	4.80303
Stdev	12.55517	2.42206	5.37514	4.82275

As Figure A-75 indicates, the iterations with the lowest and most consistent AD 5 iteration running variances for Subject 11's Day 4 rifle data were iterations 14 and 15. Therefore, asymptotic performance was achieved during iterations 10 through 15. Basic descriptive statistics for this asymptote are shown in Table A-81.

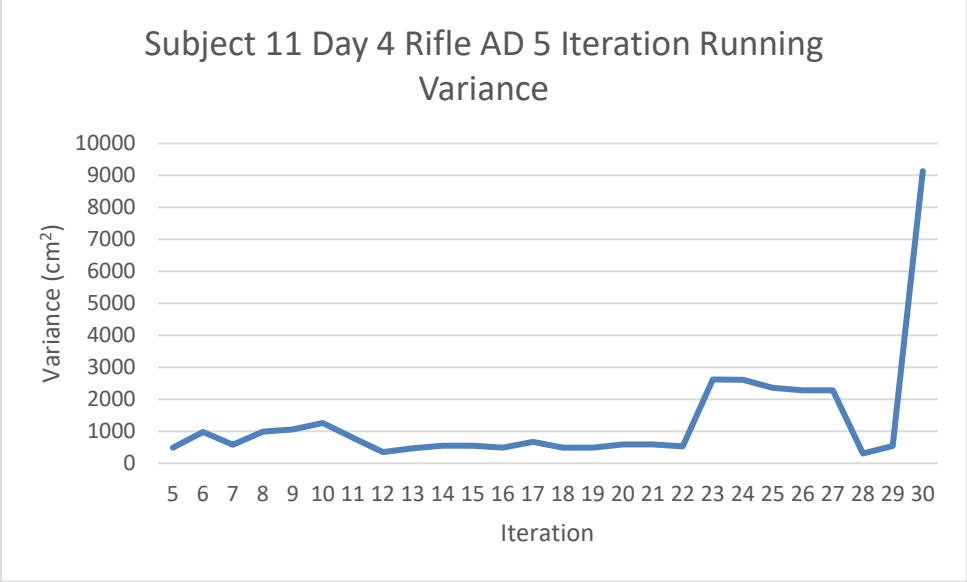

Figure A-75. Subject 11 Day 4 Rifle AD 5 Iteration Running Variance

Table A-81. Subject 11 Day 4 Rifle Asymptote Descriptive Statistics

	Group Size	MPI to CZP	DCMS	MR
Mean	13.53679	4.06425	6.57191	5.31965
Median	13.82902	4.31737	6.74133	5.43480
Stdev	13.54917	4.47249	6.7745	5.37368

As Figure A-76 indicates, the iterations with the lowest and most consistent AD 5 iteration running variances for Subject 11's Day 5 rifle data were iterations 28 and 29. Therefore, asymptotic performance was achieved during iterations 24 through 29. Basic descriptive statistics for this asymptote are shown in Table A-82.

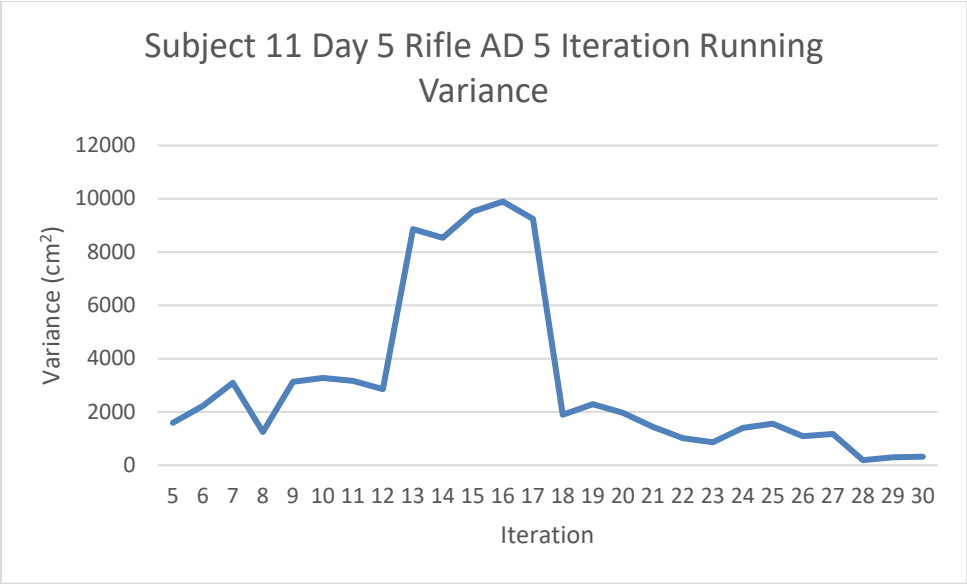

Figure A-76. Subject 11 Day 5 Rifle AD 5 Iteration Running Variance

Table A-82. Subject 11 Day 5 Rifle Asymptote Descriptive Statistics

	Group Size	MPI to CZP	DCMS	MR
Mean	9.10589	2.89864	4.61395	3.46209
Median	9.76041	3.10308	4.97515	3.72107
Stdev	10.1848	3.17526	5.14109	3.86039

As Table A-83 indicates, the null hypothesis of normality was not rejected for Subject 11's rifle group size data. The boxplot in Figure A-77 does not, however, support a normal distribution. When Bartlett's Test was performed on these data, the resulting K^2 was 4.1682 and the p-value was 0.2439, which failed to reject the null hypothesis of homoscedasticity. The Kruskal-Wallis Test yielded a X^2 value of 4.2302 and a p-value of 0.2377, thus failing to reject the null hypothesis of equality of dataset medians. As such, the analysis does not provide evidence of a change in group size during days 2-5.

Table A-83. Subject 11 Rifle Group Size Shapiro-Wilk Test Results

Day	W	P-Value
2	0.8784599	0.2620592
3	0.8726064	0.2367936
4	0.9629918	0.8424755
5	0.9518377	0.7551357

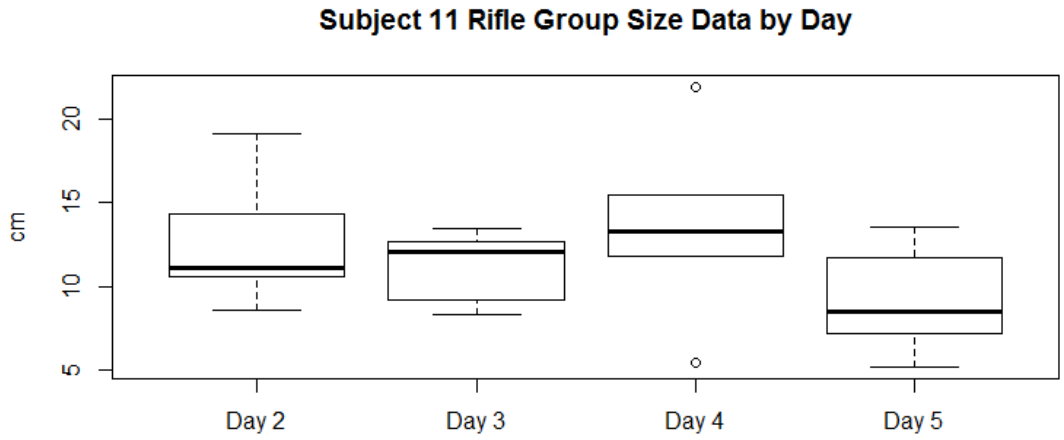

Figure A-77. Subject 11 Rifle Group Size Data

As Table A-84 indicates, the null hypothesis of normality was not rejected for Subject 11's rifle MPI to CZP distance data. The boxplot in Figure A-78 does not, however, support a normal distribution. When Bartlett's Test was performed on these data, the resulting K^2 was 2.2141 and the p-value was 0.5292, which failed to reject the null hypothesis of homoscedasticity. The Kruskal-Wallis Test yielded a X^2 value of 2.58 and a p-value of 0.461 thus failing to reject the null hypothesis of equality of dataset medians. As such, the analysis does not provide evidence of a change in MPI to CZP distance during days 2-5.

Table A-84. Subject 11 Rifle MPI to CZP Distance Shapiro-Wilk Test Results

Day	W	P-Value
2	0.9046271	0.4020024
3	0.9584172	0.8074622
4	0.8632732	0.2006818
5	0.9152376	0.4717391

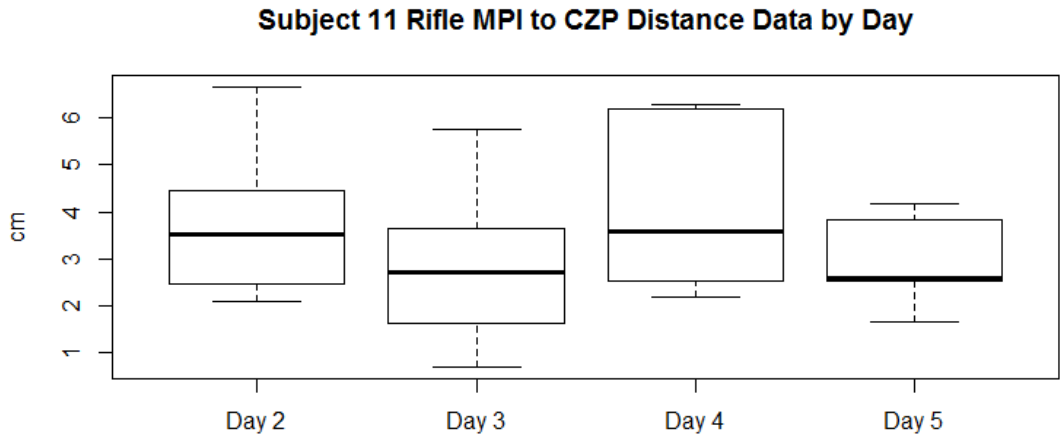

Figure A-78. Subject 11 Rifle MPI to CZP Distance Data

As Table A-85 indicates, the null hypothesis of normality was not rejected for Subject 11's rifle DCMS data. The boxplot in Figure A-79 does not, however, support a normal distribution. When Bartlett's Test was performed on these data, the resulting K^2 was 4.6871 and the p-value was 0.1962, which failed to reject the null hypothesis of homoscedasticity. The Kruskal-Wallis Test yielded a X^2 value of 3.3867 and a p-value of 0.3358, thus failing to reject the null hypothesis of equality of dataset medians. As such, the analysis does not provide evidence of a change in DCMS during days 2-5.

Table A-85. Subject 11 Rifle DCMS Shapiro-Wilk Test Results

Day	W	P-Value
2	0.8663433	0.2120140
3	0.9620732	0.8355676
4	0.9434074	0.6867562
5	0.9038350	0.3970943

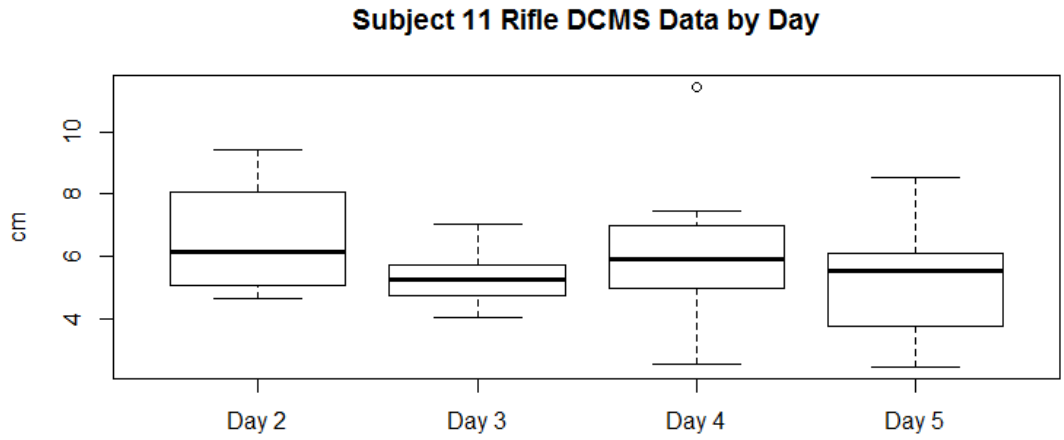

Figure A-79. Subject 11 Rifle DCMS Data

As Table A-86 indicates, the null hypothesis of normality was not rejected for Subject 11's rifle mean radius data. The boxplot in Figure A-80 does not, however, support a normal distribution. When Bartlett's Test was performed on these data, the resulting K^2 was 5.1969 and the p-value was 0.1579, which failed to reject the null hypothesis of homoscedasticity. The Kruskal-Wallis Test yielded a X^2 value of 5.9267 and a p-value of 0.1152, thus failing to reject the null hypothesis of equality of dataset medians. As such, the analysis does not provide evidence of a change in mean radius during days 2-5.

Table A-86. Subject 11 Rifle Mean Radius Shapiro-Wilk Test Results

Day	W	P-Value
2	0.8182026	0.0851422
3	0.9411293	0.6683108
4	0.9310219	0.5880162
5	0.9730923	0.9125258

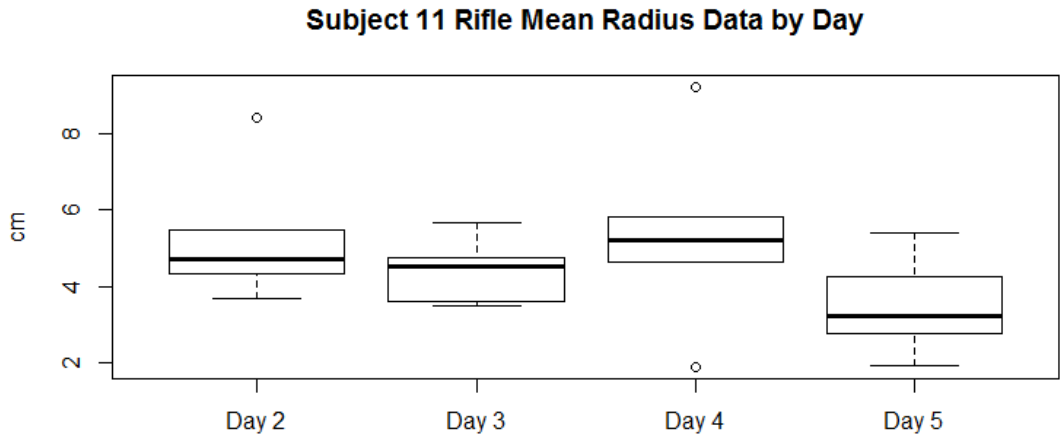

Figure A-80. Subject 11 Rifle Mean Radius Data

6.11 Subject 12 Pistol Data

As Figure A-81 indicates, the iterations with the lowest and most consistent AD 5 iteration running variances for Subject 12's Day 2 pistol data were iterations 5 and 6. Therefore, asymptotic performance was achieved during iterations 2 through 7. Basic descriptive statistics for this asymptote are shown in Table A-87.

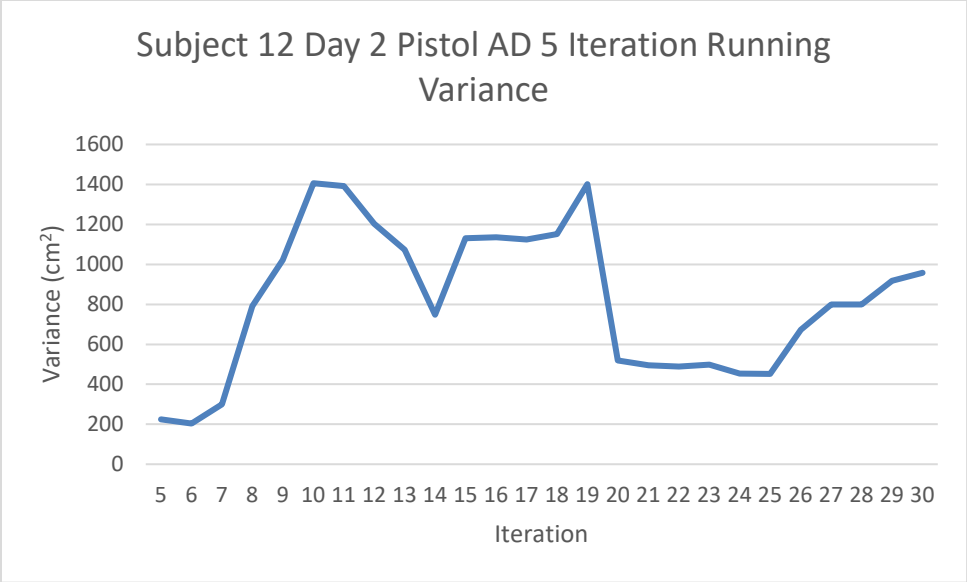

Figure A-81. Subject 12 Day 2 Pistol AD 5 Iteration Running Variance

Table A-87. Subject 12 Day 2 Pistol Asymptote Descriptive Statistics

	Group Size	MPI to CZP	DCMS	MR
Mean	11.46206	4.52751	6.31355	4.50411
Median	11.4944	4.41306	6.45308	4.49330
Stdev	2.055605	2.26867	1.96834	0.745362

As Figure A-82 indicates, the iterations with the lowest and most consistent AD 5 iteration running variances for Subject 12's Day 3 pistol data were iterations 24 and 25. Therefore, asymptotic performance was achieved during iterations 20 through 25. Basic descriptive statistics for this asymptote are shown in Table A-88.

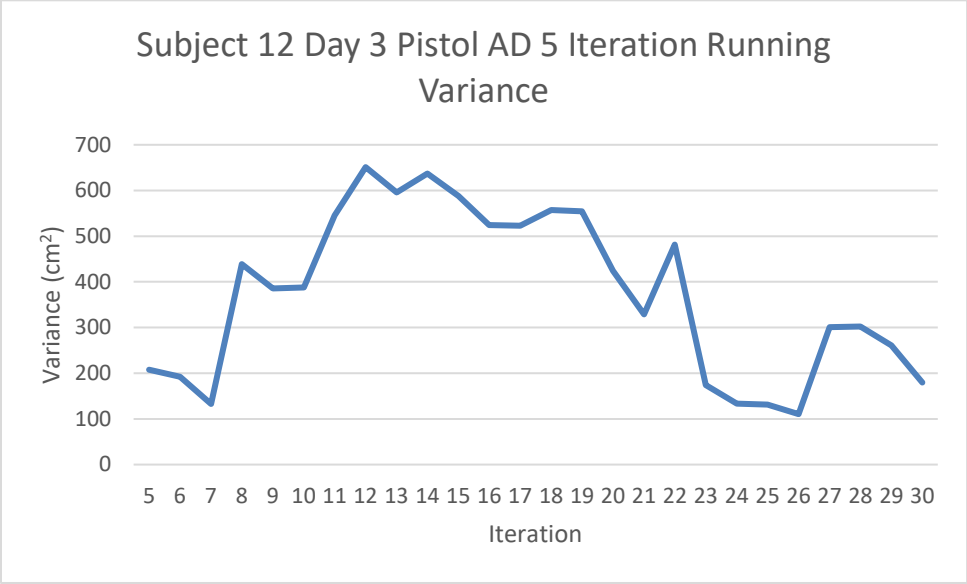

Figure A-82. Subject 12 Day 3 Pistol AD 5 Iteration Running Variance

Table A-88. Subject 12 Day 3 Pistol Asymptote Descriptive Statistics

	Group Size	MPI to CZP	DCMS	MR
Mean	7.21407	1.75719	3.20431	2.85102
Median	6.78011	1.82423	3.17843	2.70711
Stdev	2.64131	0.57739	0.72781	0.93526

As Figure A-83 indicates, the iterations with the lowest and most consistent AD 5 iteration running variances for Subject 12's Day 4 pistol data were iterations 12 and 13. Therefore, asymptotic performance was achieved during iterations 8 through 13. Basic descriptive statistics for this asymptote are shown in Table A-89.

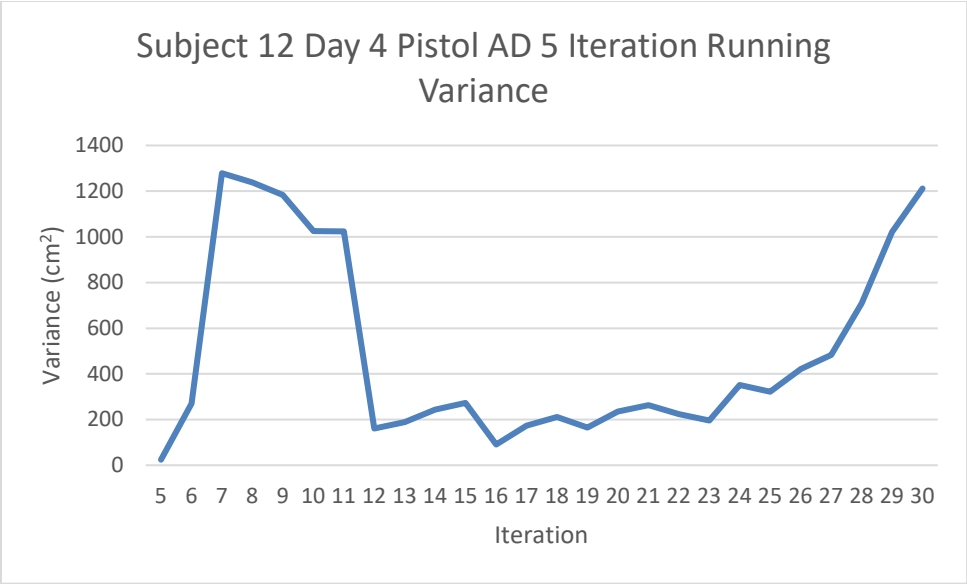

Figure A-83. Subject 12 Day 4 Pistol AD 5 Iteration Running Variance

Table A-89. Subject 12 Day 4 Pistol Asymptote Descriptive Statistics

	Group Size	MPI to CZP	DCMS	MR
Mean	7.73968	3.08062	4.52472	3.21211
Median	7.58259	2.57267	4.10526	3.12088
Stdev	2.04372	1.55789	1.58895	0.98603

As Figure A-84 indicates, the iterations with the lowest and most consistent AD 5 iteration running variances for Subject 12's Day 5 pistol data were iterations 14 and 15. Therefore, asymptotic performance was achieved during iterations 10 through 15. Basic descriptive statistics for this asymptote are shown in Table A-90.

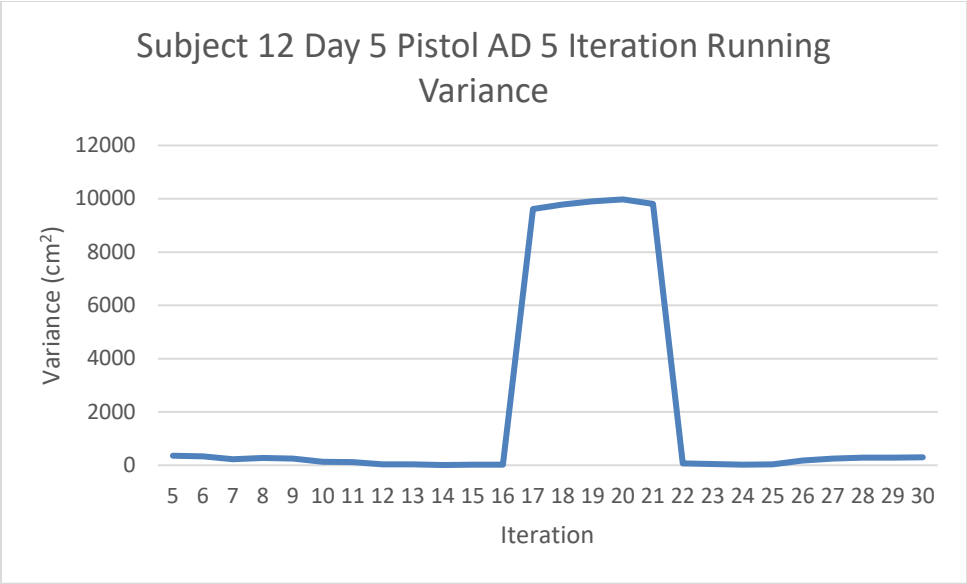

Figure A-84. Subject 12 Day 5 Pistol AD 5 Iteration Running Variance

Table A-90. Subject 12 Day 5 Pistol Asymptote Descriptive Statistics

	Group Size	MPI to CZP	DCMS	MR
Mean	5.18809	2.33313	3.10707	2.00586
Median	4.98697	2.15959	2.99439	1.95267
Stdev	1.18424	1.13367	1.06745	0.40397

As Table A-91 indicates, the null hypothesis of normality was not rejected for Subject 12's pistol group size data. The boxplot in Figure A-85 does not, however, support a normal distribution. When Bartlett's Test was performed on these data, the resulting K^2 was 4.7574 and the p-value was 0.1905, which failed to reject the null hypothesis of homoscedasticity. The Kruskal-Wallis Test yielded a X^2 value of 13.771 and a p-value of 0.003234, thus rejecting the null hypothesis of equality of dataset medians.

Table A-91. Subject 12 Pistol Group Size Shapiro-Wilk Test Results

Day	W	P-Value
2	0.926223	0.519251
3	0.961259	0.829459
4	0.880475	0.228567
5	0.917231	0.448194

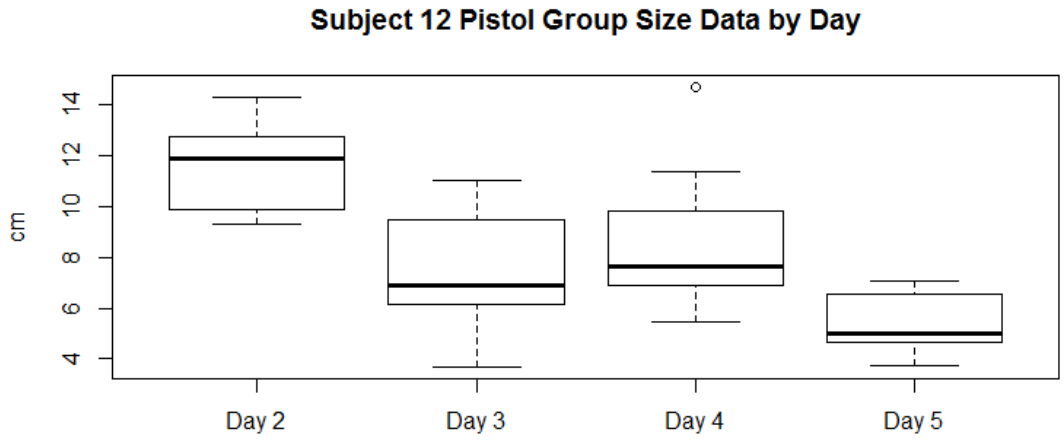

Figure A-85. Subject 12 Pistol Group Size

As Table A-92 indicates, the only statistically significant difference was between Subject 12's day 2 and day 5 pistol group sizes. While the difference is statistically significant, it is not indicative of a trend, as there is not a statistically significant difference between days 3 and 4.

Table A-92. Subject 12 Pistol Group Size Dunn's Test Results

Days	Z	P-Value
2 & 3	2.274294	0.0344
2 & 4	1.559515	0.0892
2 & 5	3.63887	0.0008
3 & 4	0.714778	0.2374
3 & 5	1.364576	0.1034
4 & 5	2.079354	0.0376

As Table A-93 indicates, the null hypothesis of normality was not rejected for Subject 12's MPI to CZP distance data. The boxplot in Figure A-86 does not, however, support a normal distribution. When Bartlett's Test was performed on these data, the resulting K^2 was 8.5619 and the p-value was 0.03572, which rejected the null hypothesis of homoscedasticity. The Brunner-Dette-Munk test yielded an F value of 2.641306 and a p-value of 0.0833049, thus rejecting the null hypothesis of equality of distribution functions. As such, the analysis does not provide evidence of a change in MPI to CZP distance during days 2-5.

Table A-93. Subject 12 Pistol MPI to CZP Distance Shapiro-Wilk Test Results

Day	W	P-Value
2	0.920141	0.470489
3	0.941438	0.651708
4	0.876989	0.213417
5	0.948686	0.717721

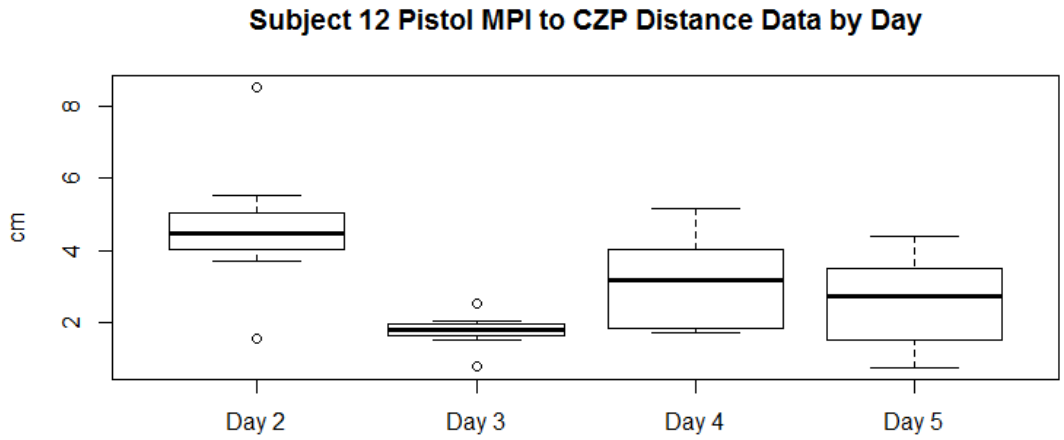

Figure A-86. Subject 12 Pistol MPI to CZP Distance

As Table A-94 indicates, the null hypothesis of normality was not rejected for Subject 12's pistol DCMS data. The boxplot in Figure A-87 does not, however, support a normal distribution. When Bartlett's Test was performed on these data, the resulting K^2 was 5.4985 and the p-value was 0.1387, which failed to reject the null hypothesis of homoscedasticity. The Kruskal-Wallis Test yielded a X^2 value of 12.399 and a p-value of 0.006134, thus rejecting the null hypothesis of equality of dataset medians.

Table A-94. Subject 12 Pistol DCMS Shapiro-Wilk Test Results

Day	W	P-Value
2	0.895809	0.306353
3	0.978311	0.950947
4	0.953601	0.762319
5	0.959463	0.814116

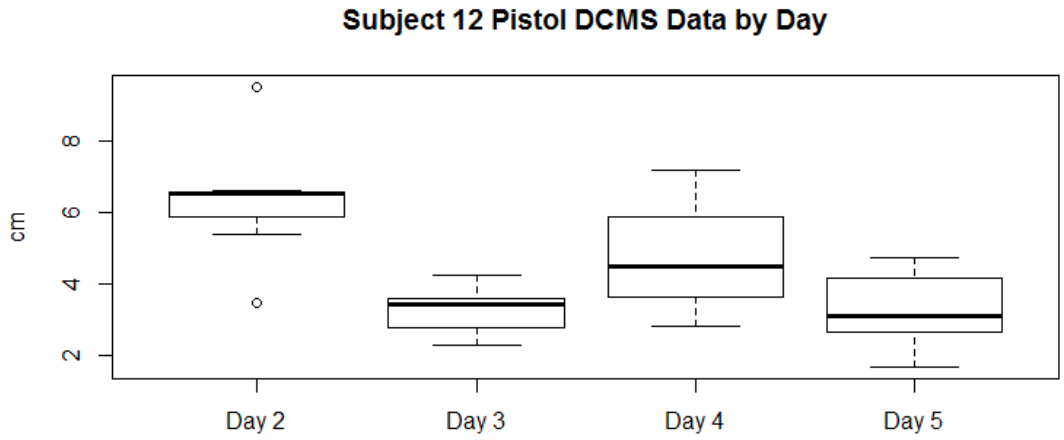

Figure A-87. Subject 12 Pistol DCMS Data

As indicated in Table A-95, the only statistically significant differences in Subject 12's pistol DCMS data are between days 2 and 3 and days 2 and 5. These results imply that day 2's DCMS was greater than that of 3 or 5, but do not necessarily imply a trend.

Table A-95. Subject 12 Pistol DCMS Dunn's Test Results

Days	Z	P-Value
2 & 3	3.086542	0.0061
2 & 4	1.299596	0.1162
2 & 5	2.826622	0.0071
3 & 4	1.786945	0.0739
3 & 5	0.259919	0.3975
4 & 5	1.527026	0.0951

As Table A-96 indicates, the null hypothesis of normality was not rejected for Subject 12's pistol mean radius data. The boxplot in Figure A-88 does not, however, support a normal distribution. When Bartlett's Test was performed on these data, the resulting K^2 was 5.6126 and the p-value was 0.1321, which failed to reject the null hypothesis of homoscedasticity. The Kruskal-Wallis Test yielded a X^2 value of 14.552 and a p-value of 0.002242, thus rejecting the null hypothesis of equality of dataset medians.

Table A-96. Subject 12 Pistol Mean Radius Shapiro-Wilk Test Results

Day	W	P-Value

2	0.959619	0.815459
3	0.920784	0.475507
4	0.839415	0.098117
5	0.966668	0.873471

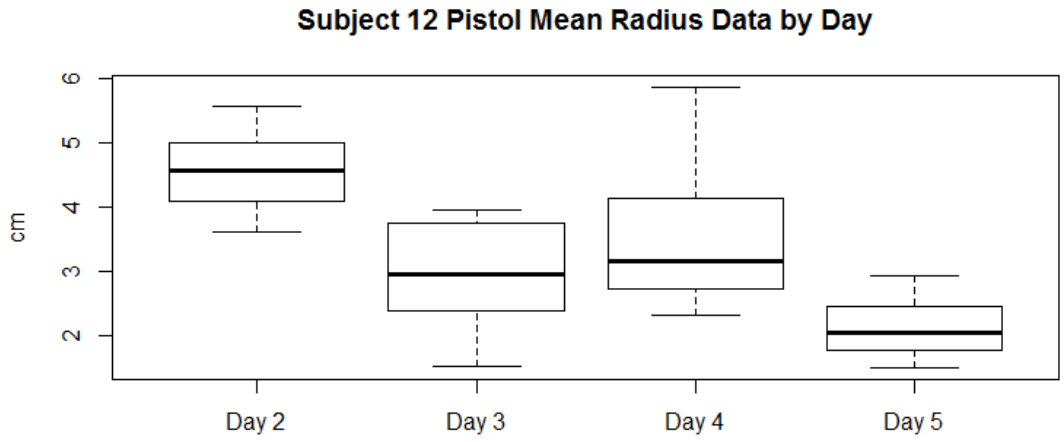

Figure A-88. Subject 12 Pistol Mean Radius Data

As Table A-97 indicates, the only statistically significant difference in Subject 12's pistol mean radius data is between days 2 and 5.

Table A-97. Subject 12 Pistol Mean Radius Dunn's Test Results

Days	Z	P-Value
2 & 3	2.111844	0.0347
2 & 4	1.364576	0.1034
2 & 5	3.73634	0.0006
3 & 4	0.747268	0.2275
3 & 5	1.624495	0.0782
4 & 5	2.371763	0.0266

6.12 Subject 12 Rifle Data

As Figure A-89 indicates, the iterations with the lowest and most consistent AD 5 iteration running variances for Subject 12's Day 2 rifle data were iterations 18 and 19. Therefore, asymptotic performance was achieved during iterations 14 through 19. Basic descriptive statistics for this asymptote are shown in Table A-98.

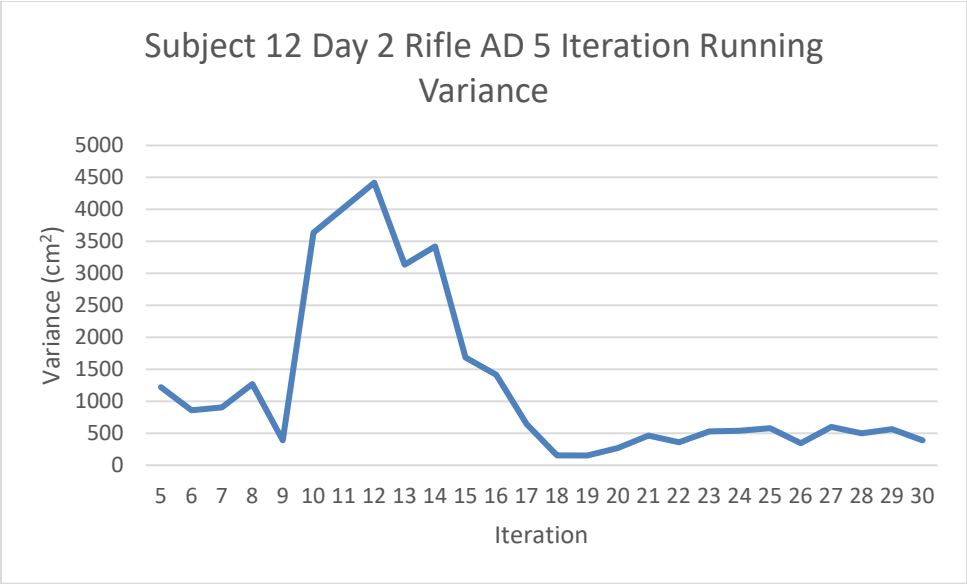

Figure A-89. Subject 12 Day 2 Rifle AD 5 Iteration Running Variance

Table A-98. Subject 12 Day 2 Rifle Asymptote Descriptive Statistics

	Group Size	MPI to CZP	DCMS	MR
Mean	10.62381	3.22597	5.45480	4.09896
Median	9.46903	3.70517	5.32179	3.77485
Stdev	3.16474	2.42904	1.48867	1.10160

As Figure A-90 indicates, the iterations with the lowest and most consistent AD 5 iteration running variances for Subject 12's Day 3 rifle data were iterations 17 and 18. Therefore, asymptotic performance was achieved during iterations 13 through 18. Basic descriptive statistics for this asymptote are shown in Table A-99.

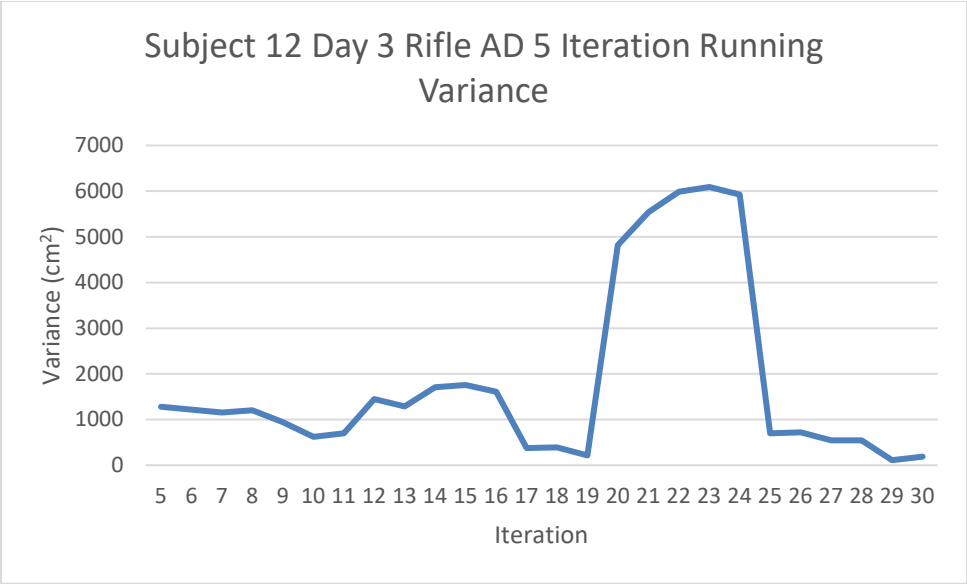

Figure A-90. Subject 12 Day 3 Rifle AD 5 Iteration Running Variance

Table A-99. Subject 12 Day 3 Rifle Asymptote Descriptive Statistics

	Group Size	MPI to CZP	DCMS	MR
Mean	11.00041	4.29972	6.12184	4.00236
Median	11.28481	4.38704	5.91103	4.20631
Stdev	2.74123	2.09810	1.35194	0.82185

As Figure A-91 indicates, the iterations with the lowest and most consistent AD 5 iteration running variances for Subject 12's Day 4 rifle data were iterations 16 and 17. Therefore, asymptotic performance was achieved during iterations 12 through 17. Basic descriptive statistics for this asymptote are shown in Table A-100.

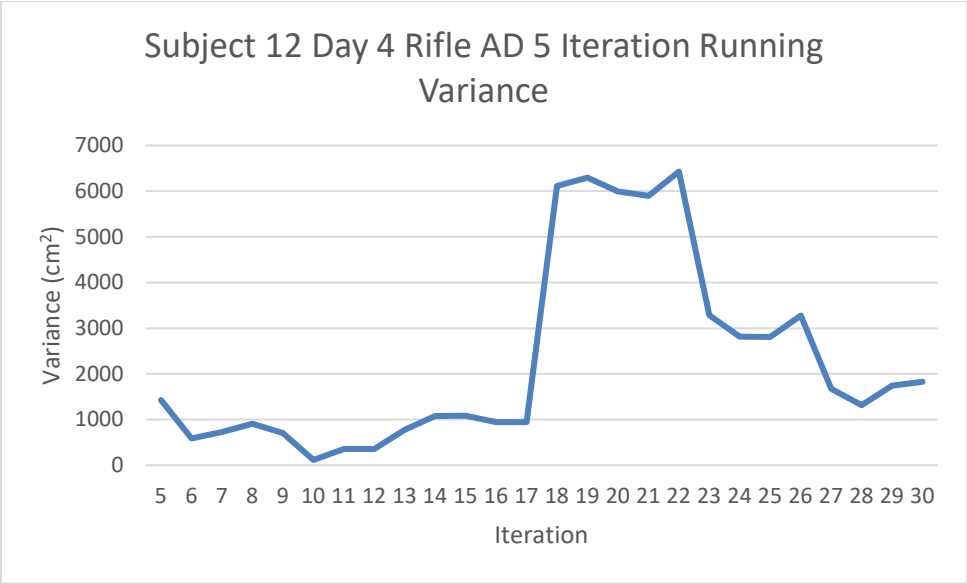

Figure A-91. Subject 12 Day 4 Rifle AD 5 Iteration Running Variance

Table A-100. Subject 12 Day 4 Rifle Asymptote Descriptive Statistics

	Group Size	MPI to CZP	DCMS	MR
Mean	11.22525	4.30128	5.99900	4.63699
Median	11.50244	3.58660	6.36189	4.65920
Stdev	2.84439	2.10056	1.54132	1.12990

As Figure A-92 indicates, the iterations with the lowest and most consistent AD 5 iteration running variances for Subject 12's Day 5 rifle data were iterations 7 and 8. Therefore, asymptotic performance was achieved during iterations 3 through 8. Basic descriptive statistics for this asymptote are shown in Table A-101.

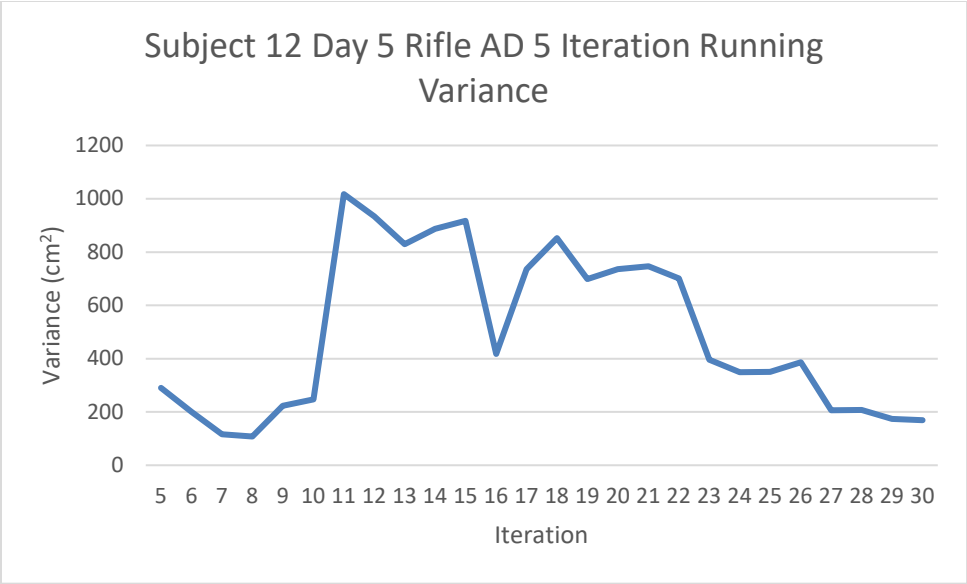

Figure A-92. Subject 12 Day 5 Rifle AD 5 Iteration Running Variance

Table A-101. Subject 12 Day 5 Rifle Asymptote Descriptive Statistics

	Group Size	MPI to CZP	DCMS	MR
Mean	10.56052	4.22686	5.75580	4.22095
Median	11.05873	4.27478	6.09339	4.28571
Stdev	1.59644	1.30330	1.24918	0.52811

As Table A-102 indicates, the null hypothesis of normality was not rejected for Subject 12's rifle group size data. The boxplot in Figure A-93 does not, however, support a normal distribution. When Bartlett's Test was performed on these data, the resulting K^2 was 2.3681 and the p-value was 0.4996, which failed to reject the null hypothesis of homoscedasticity. The Kruskal-Wallis Test yielded a X^2 value of 1.9866 and a p-value of 0.5722, thus failing to reject the null hypothesis of equality of dataset medians. As such, the analysis provides no evidence of a change in group size during days 2-5.

Table A-102. Subject 12 Rifle Group Size Shapiro-Wilk Test Results

Day	W	P-Value
2	0.877552	0.2158
3	0.993422	0.997901
4	0.947699	0.708719
5	0.880901	0.23048

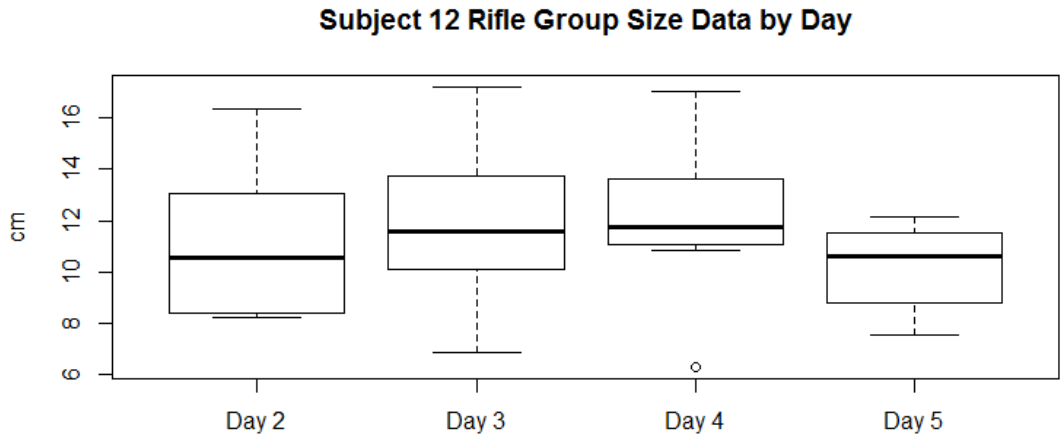

Figure A-93. Subject 12 Rifle Group Size Data

As Table A-103 indicates, the null hypothesis of normality was not rejected for Subject 12's rifle MPI to CZP distance data. The boxplot in Figure A-94 does not, however, support a normal distribution. When Bartlett's Test was performed on these data, the resulting K^2 was 0.5 and the p-value was 0.9189, which failed to reject the null hypothesis of homoscedasticity. The Kruskal-Wallis Test yielded a X^2 value of 0.74 and a p-value of 0.8638, thus failing to reject the null hypothesis of equality of dataset medians. As such, the analysis provides no evidence of a change in MPI to CZP distance during days 2-5.

Table A-103. Subject 12 Rifle MPI to CZP Distance Shapiro-Wilk Test Results

Day	W	P-Value
2	0.909011	0.389068
3	0.944948	0.683608
4	0.86931	0.183063
5	0.94738	0.705804

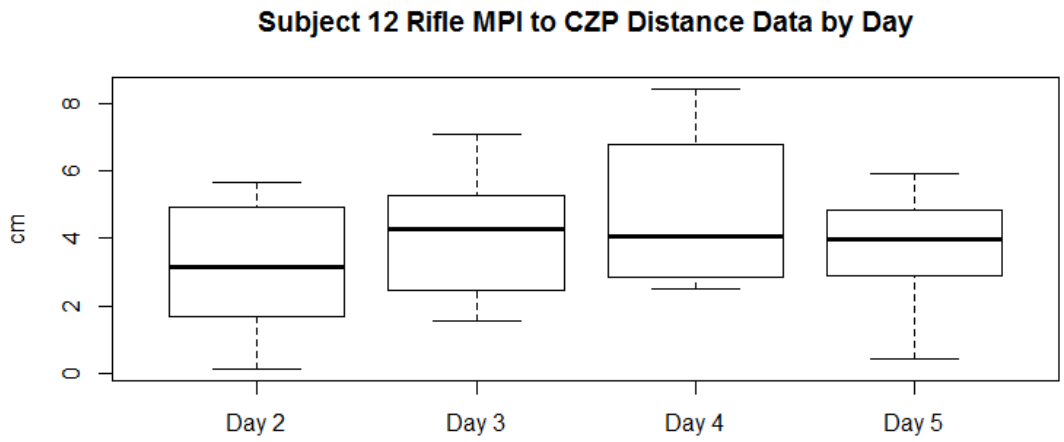

Figure A-94. Subject 12 Rifle MPI to CZP Distance

As Table A-104 indicates, the null hypothesis of normality was not rejected for Subject 12's rifle DCMS data. The boxplot in Figure A-95 does not, however, support a normal distribution. When Bartlett's Test was performed on these data, the resulting K^2 was 0.59083 and the p-value was 0.8985, which failed to reject the null hypothesis of homoscedasticity. The Kruskal-Wallis Test yielded a X^2 value of 2.24 and a p-value of 0.5241, thus failing to reject the null hypothesis of equality of dataset medians. As such, the analysis does not provide evidence of a change in DCMS during days 2-5.

Table A-104. Subject 12 Rifle DCMS Shapiro-Wilk Test Results

Day	W	P-Value
2	0.980222	0.96061
3	0.974546	0.929124
4	0.951065	0.739381
5	0.926314	0.520006

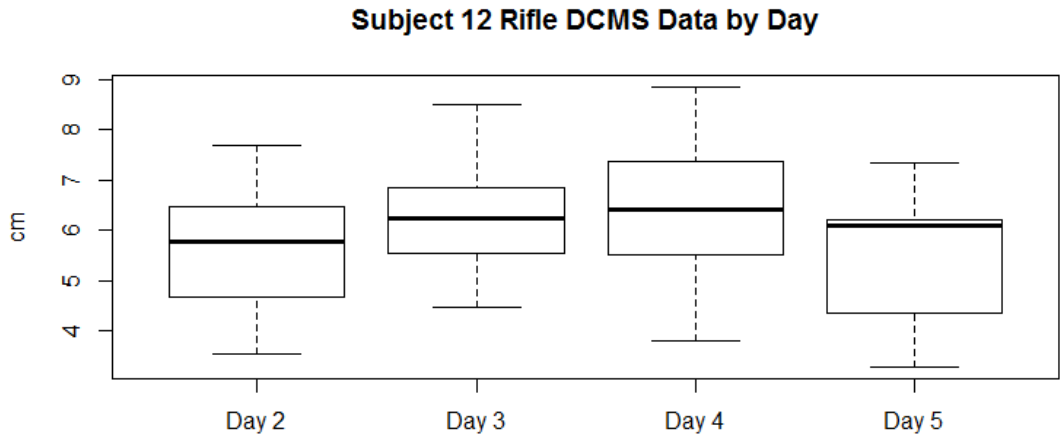

Figure A-95. Subject 12 Rifle DCMS Data

As Table A-105 indicates, the null hypothesis of normality was not rejected for Subject 12's rifle mean radius data. The boxplot in Figure A-96 does not, however, support a normal distribution. When Bartlett's Test was performed on these data, the resulting K^2 was 3.6775 and the p-value was 0.2985, which failed to reject the null hypothesis of homoscedasticity. The Kruskal-Wallis Test yielded a X^2 value of 1.9613 and a p-value of 0.5805, thus failing to reject the null hypothesis of equality of dataset medians. As such, the analysis does not provide evidence of a change in mean radius during days 2-5.

Table A-105. Subject 12 Rifle Mean Radius Shapiro-Wilk Test Results

Day	W	P-Value
2	0.841988	0.103681
3	0.911767	0.408242
4	0.951628	0.744493
5	0.847747	0.117193

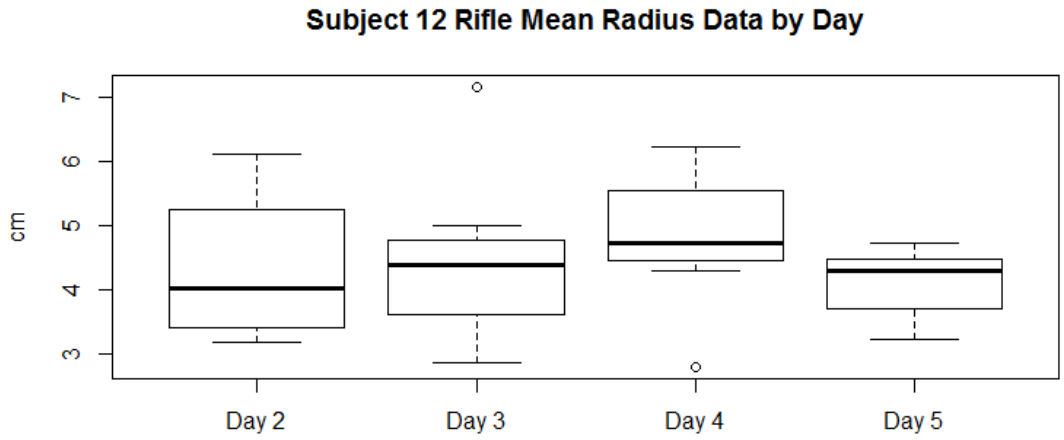

Figure A-96. Subject 12 Rifle Mean Radius Data

APPENDIX B

6.1 Subject CSA02 Results

6.1.1 IES Scoring Results

As Figure B-1 indicates, when correct response radii were 5 and 4 cm, based on MPI to CZP distance calculations, the trends were similar. Significant changes occurred when radii were reduced to 3 and 2 cm. At a radius of 3 cm, Subject CSA02 showed a decrease in IES on day 4, followed by a large increase on day 5. At a radius of 2 cm, however, the trend is reversed with a large increase on day 4 followed by a large decrease on day 5.

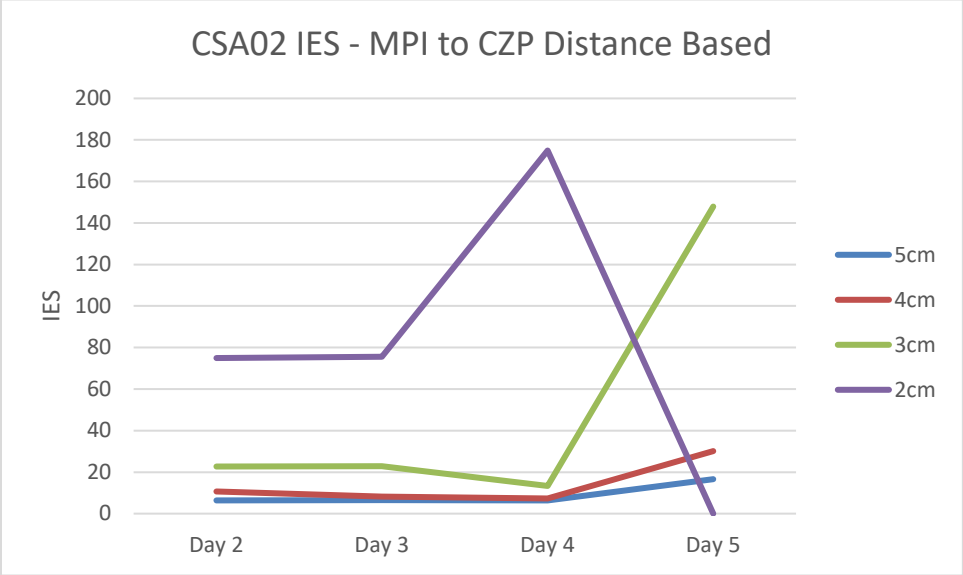

Figure B-1. Subject CSA02 IES - MPI to CZP Distance Based

As Figure B-2 indicates, MPI to CZP distance based RT showed a similar trend for radii ranging from 5 to 3 cm. At a radius of 2 cm, however, there is a dramatic change on day 5 where the RT value was 0 because no shot groups were observed within a 2 cm radius of the center of the target.

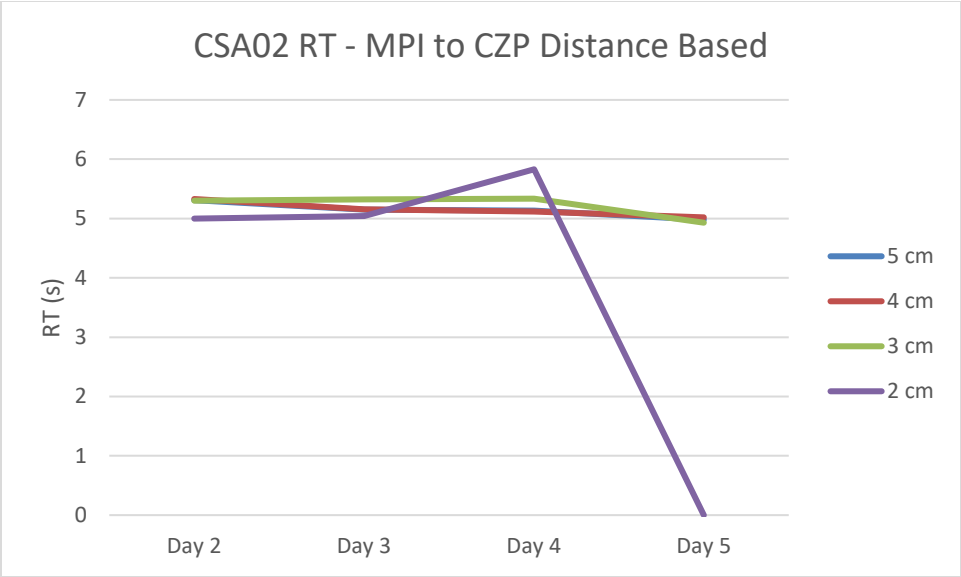

Figure B-2. Subject CSA02 RT - MPI to CZP Distance Based

As Figure B-3 indicates, the larger radii resulted in larger proportions of hits during each day of firing. At a radius of 4 cm three was an improvement from day 2 to day 4 of firing, while at a radius of 3 cm there was an improvement from day 3 to day 4. Overall, however, the most noteworthy trend was the large decline in performance on day 5 of firing.

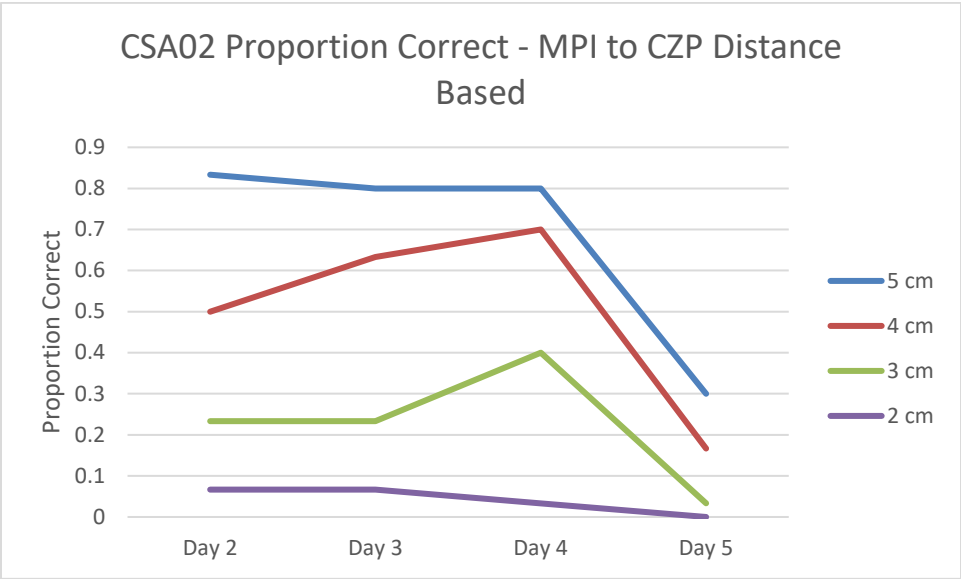

Figure B-3. Subject CSA02 Proportion Correct - MPI to CZP Distance Based

When IES was calculated at multiple radii based on DCMS measurements, the trends for 5 and 4 cm radii were very similar, as shown in Figure B-4. The overall 3 cm trend showed slightly higher overall scores and a slight decrease on day 4 of firing. The 2 cm trend, however, was markedly different in both overall IES value and the trend, which was

relatively constant from day 2 to day 3, but increased on day 4 before drastically decreasing on day 5.

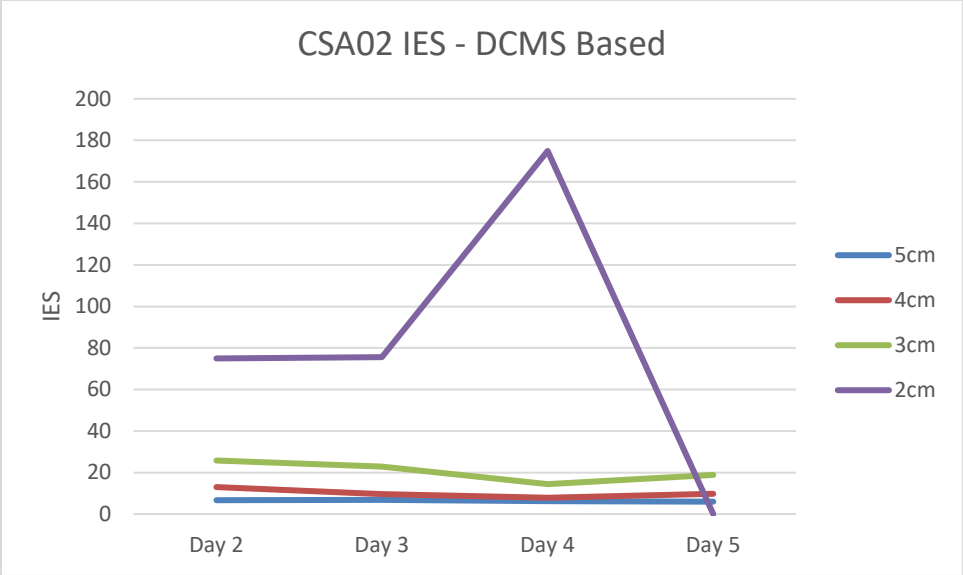

Figure B-4. Subject CSA02 IES - DCMS Based

An examination of trends in DCMS based RT values, as shown in Figure B-5, indicates highly similar results for radii from 5 to 3 cm, with an increase on day 4 followed by a significant decrease on day 5. This decrease was due to the fact that the no shot groups fell within the 2 cm radius on that day of firing.

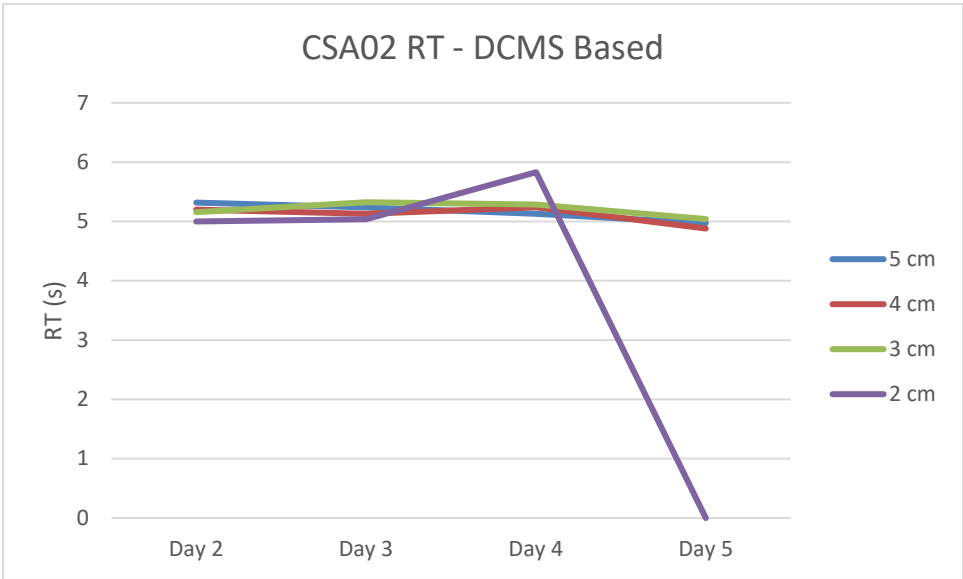

Figure B-5. Subject CSA02 RT – DCMS Based

The DCMS based proportion correct results, as shown in Figure B-6, follow the expected trend of greater value with greater radius. Each radius, however, follows a slightly different trend from day to day, with 5 cm showing a slight decrease from day 2 to day 3, but 4 and 3 cm showing increases while 2 cm remains relatively stable. Overall, proportion correct showed an improvement from day 2 to day 5 only for a radius of 5 cm.

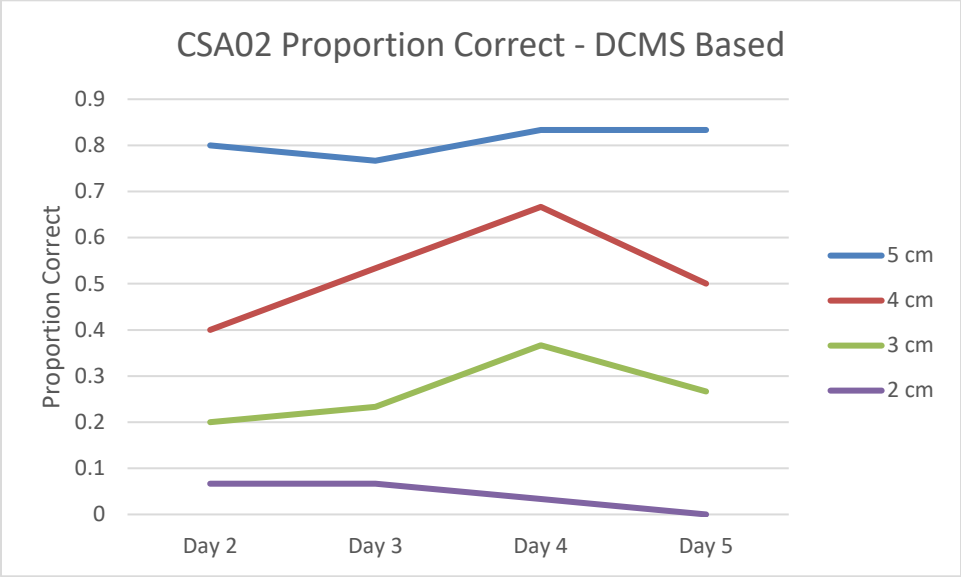

Figure B-6. Subject CSA02 Proportion Correct - DCMS Based

6.1.2 Conditional Accuracy Function Results

As Table B-1 indicates, the null hypothesis of a normal distribution was rejected for some quantiles. The boxplot in Figure B-7 does not provide information to the contrary. Bartlett's test produced a K^2 value of 8.5268 and a p value of 0.07408, failing to reject the null hypothesis of homoscedasticity. The Kruskal-Wallis test produced a X^2 value of 0.43011 and a p value of 0.9799, failing to reject the null hypothesis of equality of dataset medians. Because this null hypothesis was not rejected, it cannot be concluded that accuracy, as measured by 1/MPI to CZP distance, differed by time quantile on day 2.

Table B-1. Subject CSA02 Day 2 Five Quantile 1/MPI to CZP Distance Shapiro-Wilk Test Results

Quantile	W	P-Value
1	0.9314	0.5907
2	0.9164	0.4801
3	0.654	0.002
4	0.8258	0.0989
5	0.6853	0.0043

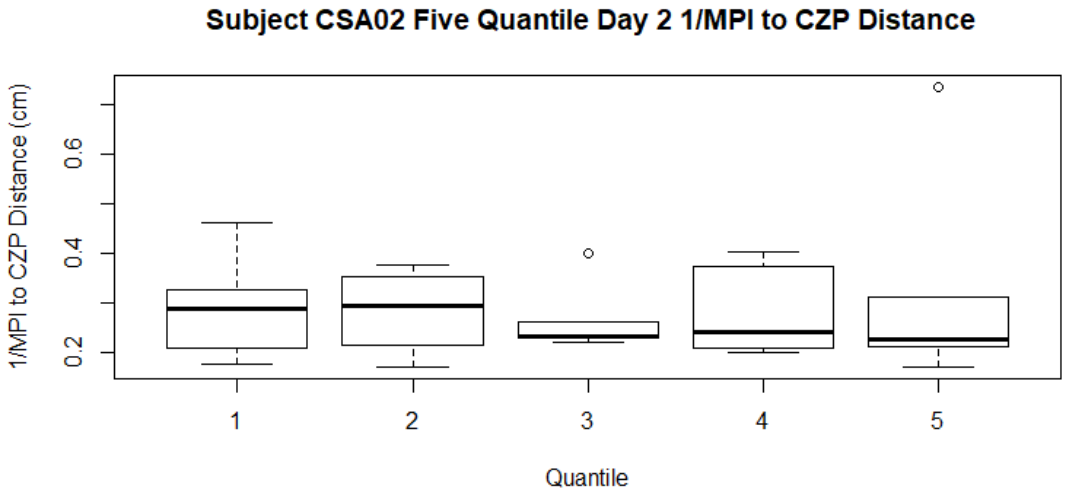

Figure B-7. Subject CSA02 Five Quantile Day 2 1/MPI to CZP Distance

As Table B-2 indicates, the null hypothesis of a normal distribution was rejected for some quantiles. The boxplot in Figure B-8 does not provide information to the contrary. Bartlett's test produced a K^2 value of 10.505 and a p value of 0.03272, rejecting the null hypothesis of homoscedasticity. The Brunner-Dette-Munk test produced an F value of 0.4448328 and a p value of 0.7515274, failing to reject the null hypothesis of equality of distribution functions. Because this null hypothesis was not rejected, it cannot be concluded that accuracy, as measured by 1/DCMS, differed by time quantile on day 2.

Table B-2. Subject CSA02 Day 2 Five Quantile 1/DCMS Shapiro-Wilk Test Results

Quantile	W	P-Value
1	0.9038	0.3971
2	0.9557	0.7859
3	0.8891	0.3136
4	0.8815	0.2758
5	0.7784	0.0373

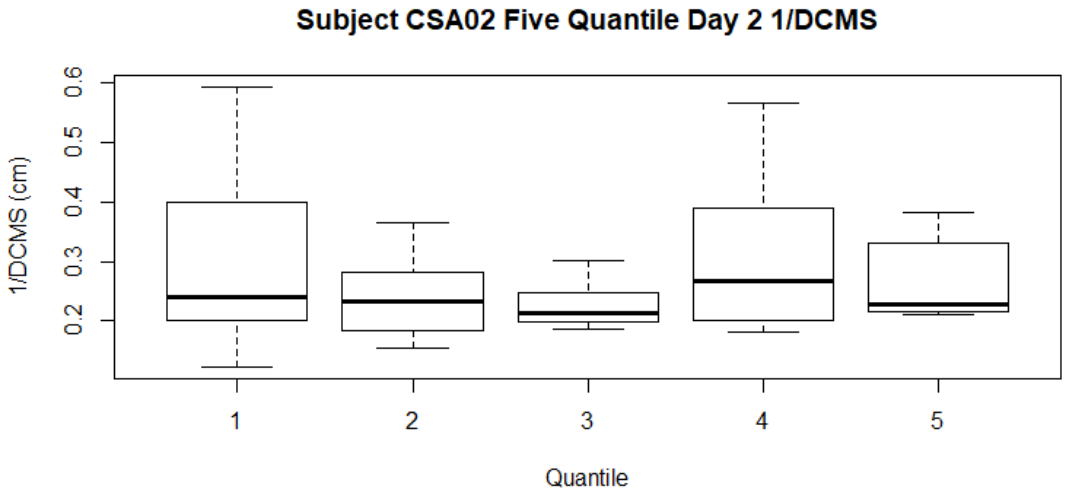

Figure B-8. Subject CSA02 Five Quantile Day 2 1/DCMS

As Table B-3 indicates, the null hypothesis of a normal distribution was rejected for some quantiles. The boxplot in Figure B-9 does not provide information to the contrary. Bartlett's test produced a K^2 value of 11.646 and a p value of 0.02019, rejecting the null hypothesis of homoscedasticity. The Brunner-Dette-Munk test produced an F value of 1.336754 and a p value of 0.2935303, failing to reject the null hypothesis of equality of distribution functions. Because this null hypothesis was not rejected, it cannot be concluded that accuracy, as measured by 1/MPI to CZP distance, differed by time quantile on day 3.

Table B-3. Subject CSA02 Day 3 Five Quantile 1/MPI to CZP Distance Shapiro-Wilk Test Results

Quantile	W	P-Value
1	0.8976	0.3601
2	0.7456	0.0181
3	0.6115	0.0006
4	0.685	0.0043
5	0.8648	0.2063

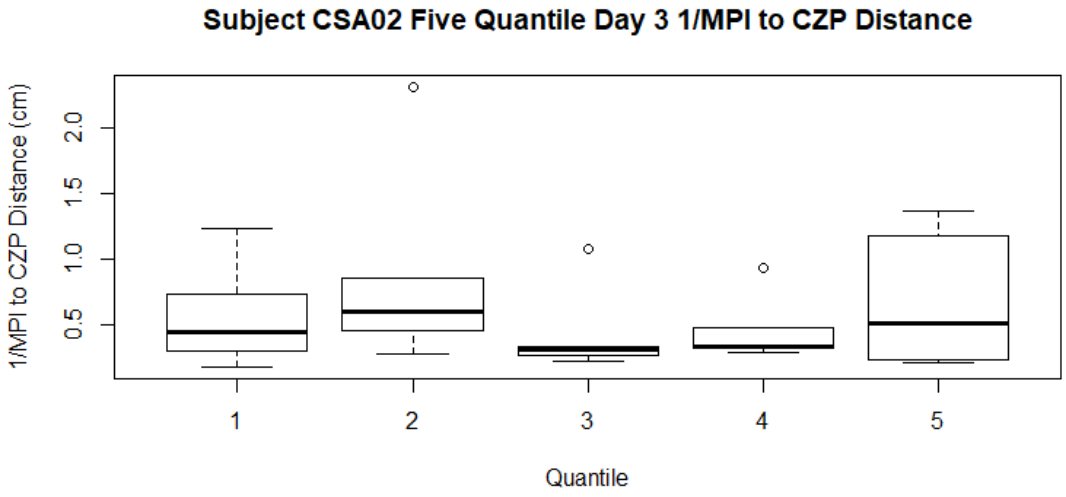

Figure B-9. Subject CSA02 Five Quantile Day 3 1/MPI to CZP Distance

As Table B-4 indicates, the null hypothesis of a normal distribution was rejected for some quantiles. The boxplot in Figure B-10 does not provide information to the contrary. Bartlett's test produced a K^2 value of 2.0804 and a p value of 0.721, failing to reject the null hypothesis of homoscedasticity. The Kruskal-Wallis test produced a X^2 value of 2.3097 and a p value of 0.679, failing to reject the null hypothesis of equality of dataset medians. Because this null hypothesis was not rejected, it cannot be concluded that accuracy, as measured by 1/DCMS, differed by time quantile on day 3.

Table B-4. Subject CSA02 Day 3 Five Quantile 1/DCMS Shapiro-Wilk Test Results

Quantile	W	P-Value
1	0.7783	0.0371
2	0.7591	0.0244
3	0.7246	0.0111
4	0.9242	0.536
5	0.801	0.06

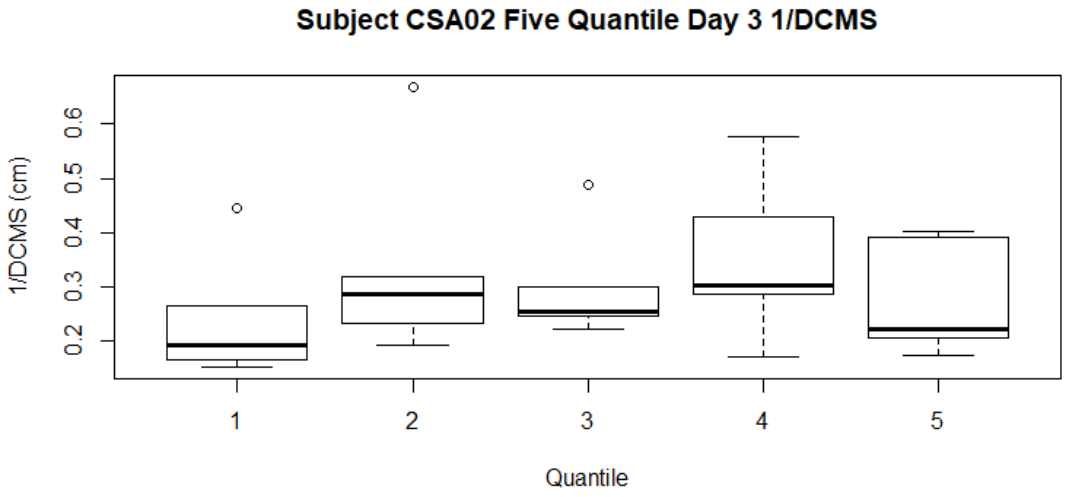

Figure B-10. Subject CSA02 Five Quantile Day 3 1/DCMS

As Table B-5 indicates, the null hypothesis of a normal distribution was rejected for some quantiles. The boxplot in Figure B-11 does not provide information to the contrary. Bartlett's test produced a K^2 value of 35.103 and a p value of 4.424e-07, rejecting the null hypothesis of homoscedasticity. The Brunner-Dette-Munk test produced an F value of 2.127025 and a p value of 0.1187848, failing to reject the null hypothesis of equality of distribution functions. Because this null hypothesis was not rejected, it cannot be concluded that accuracy, as measured by 1/MPI to CZP distance, differed by time quantile on day 4.

Table B-5. Subject CSA02 Day 4 Five Quantile 1/MPI to CZP Distance Shapiro-Wilk Test Results

Quantile	W	P-Value
1	0.9122	0.4513
2	0.9166	0.4811
3	0.9331	0.6042
4	0.6493	0.0017
5	0.9428	0.6815

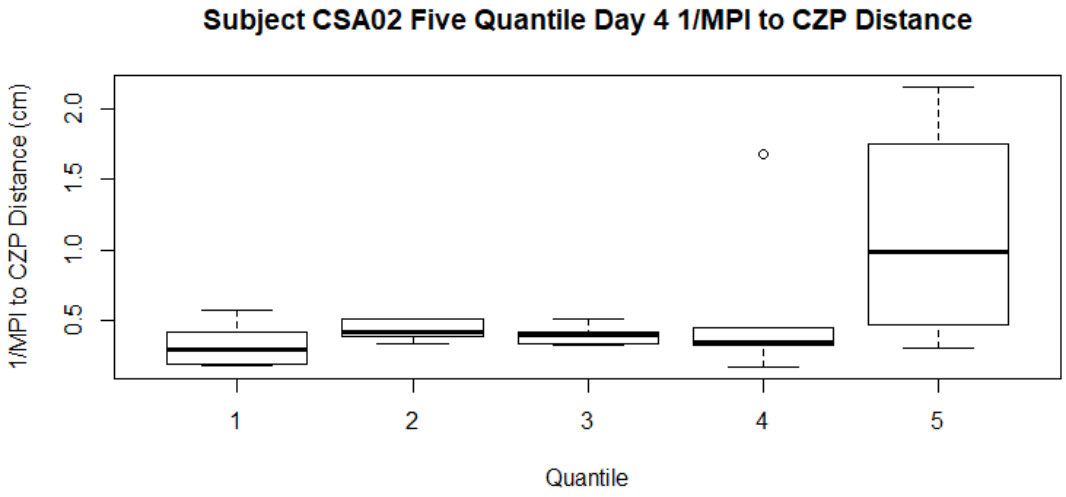

Figure B-11. Subject CSA02 Five Quantile Day 4 1/MPI to CZP Distance

As Table B-6 indicates, the null hypothesis of a normal distribution was not rejected for any quantiles. The boxplot in Figure B-12 is not, however, indicative of a normal distribution for all datasets. Bartlett's test produced a K^2 value of 2.8966 and a p value of 0.5753, failing to reject the null hypothesis of homoscedasticity. The Kruskal-Wallis test produced a X^2 value of 9.8323 and a p value of 0.04335, rejecting the null hypothesis of equality of dataset medians. Because this null hypothesis was rejected, it can be concluded that accuracy, as measured by 1/DCMS, differed by time quantile on day 4.

Table B-6. Subject CSA02 Day 4 Five Quantile 1/DCMS Shapiro-Wilk Test Results

Quantile	W	P-Value
1	0.9143	0.4655
2	0.9814	0.9581
3	0.8996	0.3716
4	0.8043	0.0643
5	0.9922	0.9939

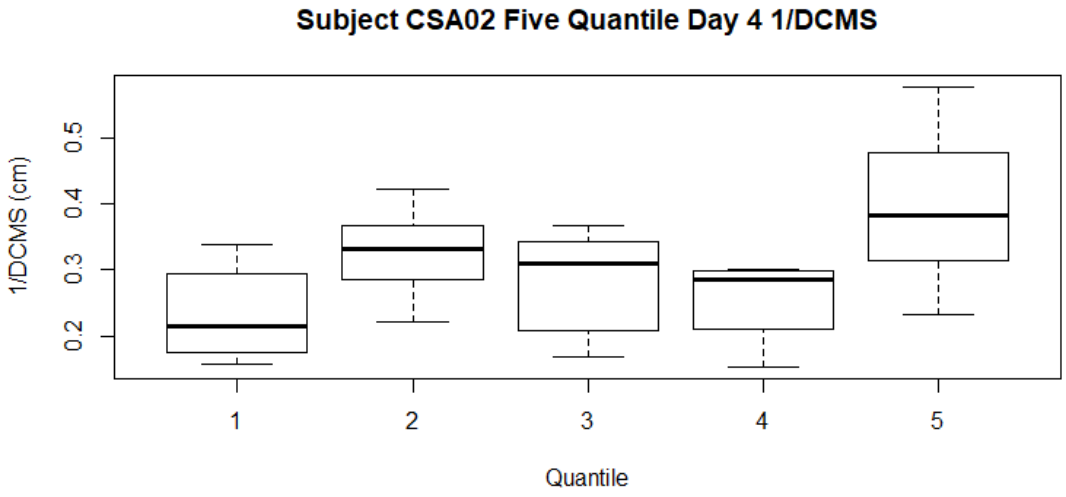

Figure B-12. Subject CSA02 Five Quantile Day 4 1/DCMS

As Table B-7 indicates, significant differences were found between quantiles 1 and 2; 1 and 5; and 4 and 5. These differences are not progressive, however, and do not appear to be indicative of a trend.

Table B-7. Subject CSA02 Day 4 Five Quantile 1/DCMS Dunn's Test Results

Quantiles	Z	P-Value
1 & 2	-1.96748	0.0246
1 & 3	-1.1149	0.1324
1 & 4	-0.32791	0.3715
1 & 5	-2.65609	0.0040
2 & 3	0.852573	0.1969
2 & 4	1.639564	0.0505
2 & 5	-0.68862	0.2455
3 & 4	0.786991	0.2156
3 & 5	-1.54119	0.0616
4 & 5	-2.32818	0.0100

As Table B-8 indicates, the null hypothesis of a normal distribution was not rejected for any quantiles. The boxplot in Figure B-13 is not, however, indicative of a normal distribution for all datasets. Bartlett's test produced a K^2 value of 1.7437 and a p value of 0.7828, failing to reject the null hypothesis of homoscedasticity. The Kruskal-Wallis test produced a X^2 value of 1.9542 and a p value of 0.7442, failing to reject the null hypothesis of equality of dataset medians. Because this null hypothesis was not rejected, it cannot be concluded that accuracy, as measured by 1/MPI to CZP distance, differed by time quantile on day 5.

Table B-8. Subject CSA02 Day 5 Five Quantile 1/MPI to CZP Distance Shapiro-Wilk Test Results

Quantile	W	P-Value

1	0.9421	0.6761
2	0.9797	0.9499
3	0.8994	0.3706
4	0.8928	0.3332
5	0.889	0.3128

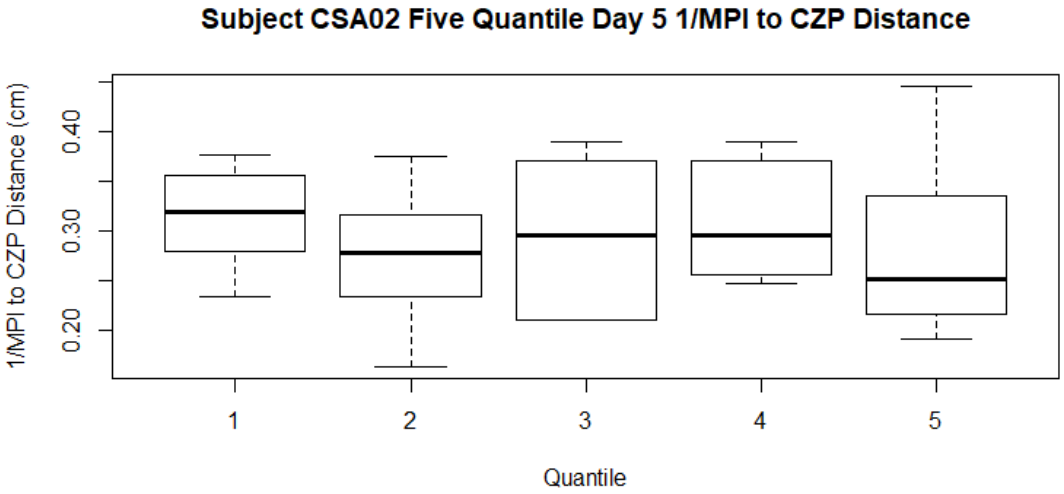

Figure B-13. Subject CSA02 Five Quantile Day 5 1/MPI to CZP Distance

As Table B-9 indicates, the null hypothesis of a normal distribution was not rejected for any quantiles. The boxplot in Figure B-14 is not, however, indicative of a normal distribution for all datasets. Bartlett's test produced a K^2 value of 4.3976 and a p value of 0.3549, failing to reject the null hypothesis of homoscedasticity. The Kruskal-Wallis test produced a X^2 value of 2.628 and a p value of 0.6219, failing to reject the null hypothesis of equality of dataset medians. Because this null hypothesis was not rejected, it cannot be concluded that accuracy, as measured by 1/DCMS, differed by time quantile on day 5.

Table B-9. Subject CSA02 Day 5 Five Quantile 1/DCMS Shapiro-Wilk Test Results

Quantile	W	P-Value
1	0.9906	0.9906
2	0.9314	0.5912
3	0.9191	0.4986

4	0.8933	0.3357
5	0.8681	0.2189

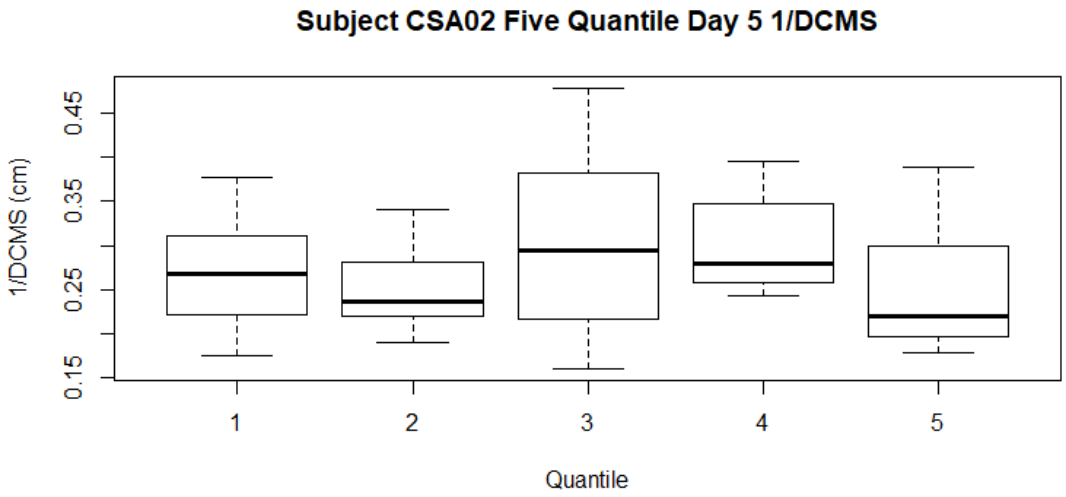

Figure B-14. Subject CSA02 Five Quantile Day 5 1/DCMS

As Table B-10 indicates, the null hypothesis of a normal distribution was rejected for some quantiles. The boxplot in Figure B-15 does not provide information to the contrary. Bartlett's test produced a K^2 value of 10.624 and a p value of 0.05936, failing to reject the null hypothesis of homoscedasticity. The Kruskal-Wallis test produced a X^2 value of 2.8787 and a p value of 0.7187, failing to reject the null hypothesis of equality of dataset medians. Because this null hypothesis was not rejected, it cannot be concluded that accuracy, as measured by 1/MPI to CZP distance, differed by time quantile on day 2.

Table B-10. Subject CSA02 Day 2 Six Quantile 1/MPI to CZP Distance Shapiro-Wilk Test Results

Quantile	W	P-Value
1	0.8957	0.3867
2	0.8849	0.3322
3	0.905	0.4381
4	0.7803	0.0555

5	0.7133	0.0131
6	0.7374	0.0226

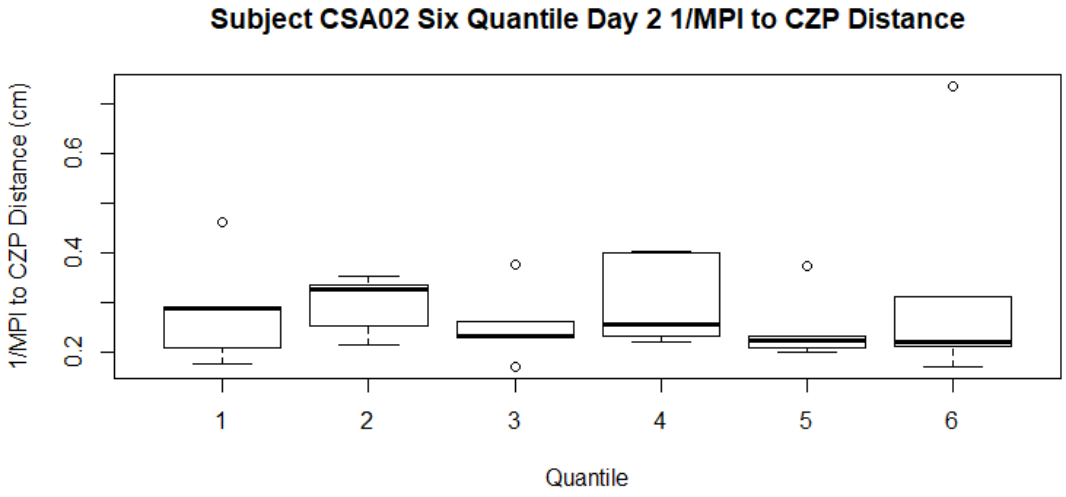

Figure B-15. Subject CSA02 Six Quantile Day 2 1/MPI to CZP Distance

As Table B-11 indicates, the null hypothesis of a normal distribution was not rejected for any quantiles. The boxplot in Figure B-16 is not, however, indicative of a normal distribution for all datasets. Bartlett's test produced a K^2 value of 10.606 and a p value of 0.05978, failing to reject the null hypothesis of homoscedasticity. The Kruskal-Wallis test produced a X^2 value of 3.0387 and a p value of 0.694, failing to reject the null hypothesis of equality of dataset medians. Because this null hypothesis was not rejected, it cannot be concluded that accuracy, as measured by 1/DCMS, differed by time quantile on day 2.

Table B-11. Subject CSA02 Day 2 Six Quantile 1/DCMS Shapiro-Wilk Test Results

Quantile	W	P-Value
1	0.9075	0.4525
2	0.952	0.7516
3	0.9698	0.8738
4	0.7947	0.0733
5	0.8744	0.2845
6	0.8346	0.1506

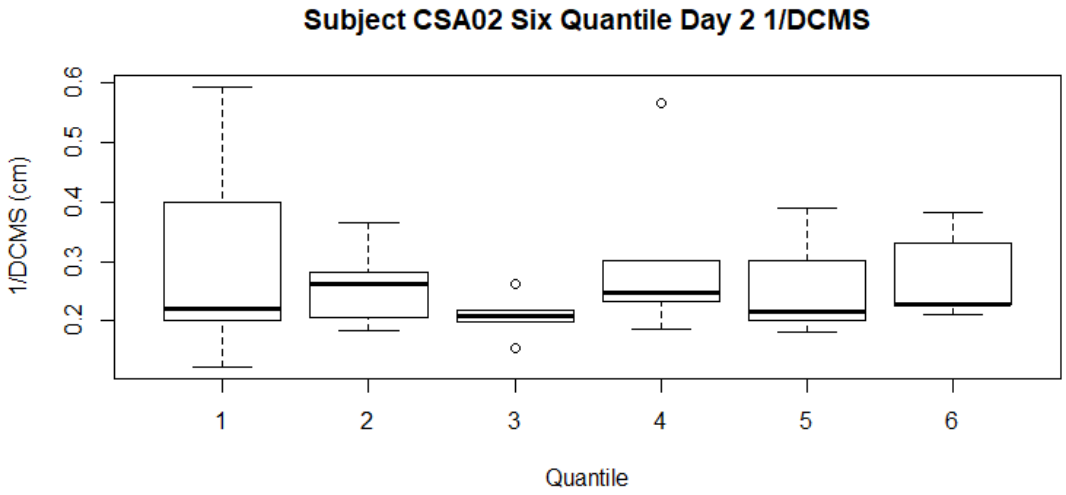

Figure B-16. Subject CSA03 Six Quantile Day 2 1/DCMS

As Table B-12 indicates, the null hypothesis of a normal distribution was rejected for some quantiles. The boxplot in Figure B-17 is not, however, indicative of a normal distribution for all datasets. Bartlett's test produced a K^2 value of 12.866 and a p value of 0.02467, rejecting the null hypothesis of homoscedasticity. The Brunner-Dette-Munk test produced an F value of 1.10129 and a p value of 0.3821321, failing to reject the null hypothesis of equality of distribution functions. Because this null hypothesis was not rejected, it cannot be concluded that accuracy, as measured by 1/MPI to CZP distance, differed by time quantile on day 3.

Table B-12. Subject CSA02 Day 3 Six Quantile 1/MPI to CZP Distance Shapiro-Wilk Test Results

Quantile	W	P-Value
1	0.9709	0.8807
2	0.922	0.543
3	0.8027	0.0853
4	0.6596	0.0035
5	0.8024	0.0847
6	0.825	0.1276

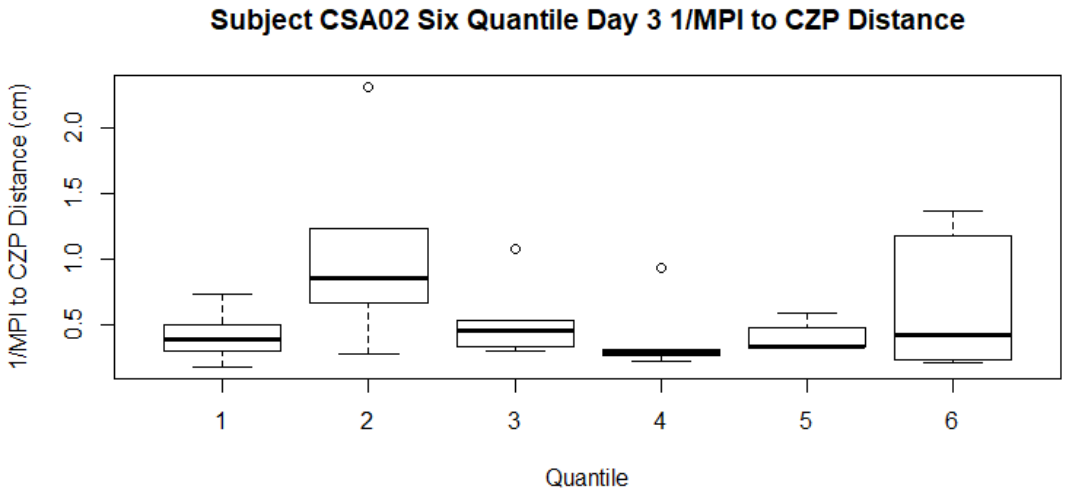

Figure B-17. Subject CSA02 Six Quantile Day 3 1/MPI to CZP Distance

As Table B-13 indicates, the null hypothesis of a normal distribution was rejected for some quantiles. The boxplot in Figure B-18 does not provide information to the contrary. Bartlett's test produced a K^2 value of 2.2291 and a p value of 0.8166, failing to reject the null hypothesis of homoscedasticity. The Kruskal-Wallis test produced a X^2 value of 2.7342 and a p value of 0.7409, failing to reject the null hypothesis of equality of dataset medians. Because this null hypothesis was not rejected, it cannot be concluded that accuracy, as measured by 1/DCMS, differed by time quantile on day 3.

Table B-13. Subject CSA02 Day 3 Six Quantile 1/DCMS Shapiro-Wilk Test Results

Quantile	W	P-Value
1	0.8907	0.3605
2	0.8596	0.2267
3	0.8347	0.1509
4	0.7018	0.01
5	0.8884	0.3493
6	0.7709	0.046

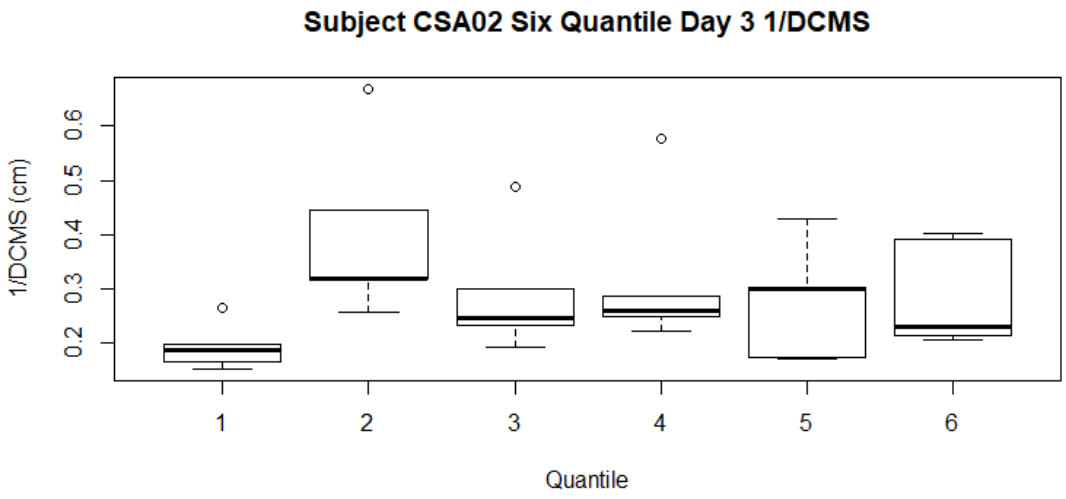

Figure B-18. Subject CSA02 Six Quantile Day 3 1/DCMS

As Table B-14 indicates, the null hypothesis of a normal distribution was rejected for some quantiles. The boxplot in Figure B-19 does not provide information to the contrary. Bartlett's test produced a K^2 value of 28.941 and a p value of 2.382e-05, rejecting the null hypothesis of homoscedasticity. The Brunner-Dette-Munk test produced an F value of 3.212478 and a p value of 0.03385637, rejecting the null hypothesis of equality of distribution functions. Because this null hypothesis was rejected, it can be concluded that accuracy, as measured by 1/MPI to CZP distance, differed by time quantile on day 4.

Table B-14. Subject CSA02 Day 4 Six Quantile 1/MPI to CZP Distance Shapiro-Wilk Test Results

Quantile	W	P-Value
1	0.974992	0.906219
2	0.966978	0.855524
3	0.897938	0.398592
4	0.91024	0.469036
5	0.582943	0.000367
6	0.965864	0.848103

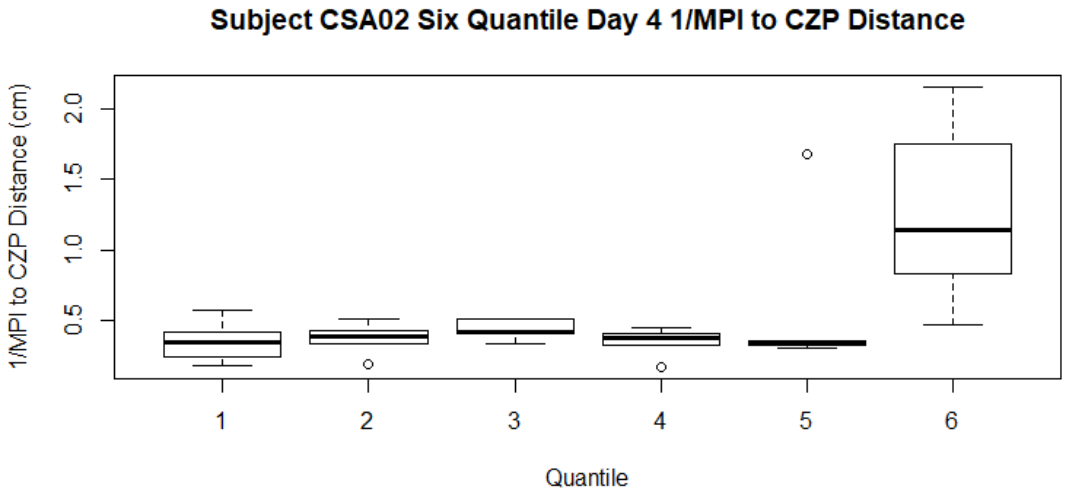

Figure B-19. Subject CSA02 Six Quantile Day 4 1/MPI to CZP Distance

As Table B-15 indicates, significant differences were found between quantile 6 and all others. These differences were not progressive in nature or indicative of a trend.

Table B-15. Subject CSA02 Six Quantile Day 4 1/MPI to CZP Distance REGWQ Test Results

Quantiles	Statistic	CI	Adj P-Value
1 & 2	0.1018	0.0174	0.9432
1 & 3	0.5090	0.087	0.9313
1 & 4	0.0260	0.0044	0.9855
1 & 5	1.4372	0.2458	0.7416
1 & 6	5.3643	0.9173	0.0072
2 & 3	0.4072	0.0696	0.7759
2 & 4	0.1278	0.0219	0.9955
2 & 5	1.3355	0.2284	0.6182

2 & 6	5.2625	0.8999	0.0055
3 & 4	0.5350	0.0915	0.9811
3 & 5	0.9282	0.1587	0.5179
3 & 6	4.8553	0.8303	0.0059
4 & 5	1.4632	0.2502	0.8368
4 & 6	5.3903	0.9218	0.0097
5 & 6	3.9270	0.6716	0.0105

As Table B-16 indicates, the null hypothesis of a normal distribution was rejected for some quantiles. The boxplot in Figure B-20 does not provide information to the contrary. Bartlett's test produced a K^2 value of 3.4961 and a p value of 0.624, failing to reject the null hypothesis of homoscedasticity. The Kruskal-Wallis test produced a X^2 value of 9.031 and a p value of 0.1078, failing to reject the null hypothesis of equality of dataset medians. Because this null hypothesis was not rejected, it cannot be concluded that accuracy, as measured by 1/DCMS, differed by time quantile on day 4.

Table B-16. Subject CSA02 Day 4 Six Quantile 1/DCMS Shapiro-Wilk Test Results

Quantile	W	P-Value
1	0.8907	0.3605
2	0.8596	0.2267
3	0.8347	0.1509
4	0.7018	0.01
5	0.8884	0.3493
6	0.7709	0.046

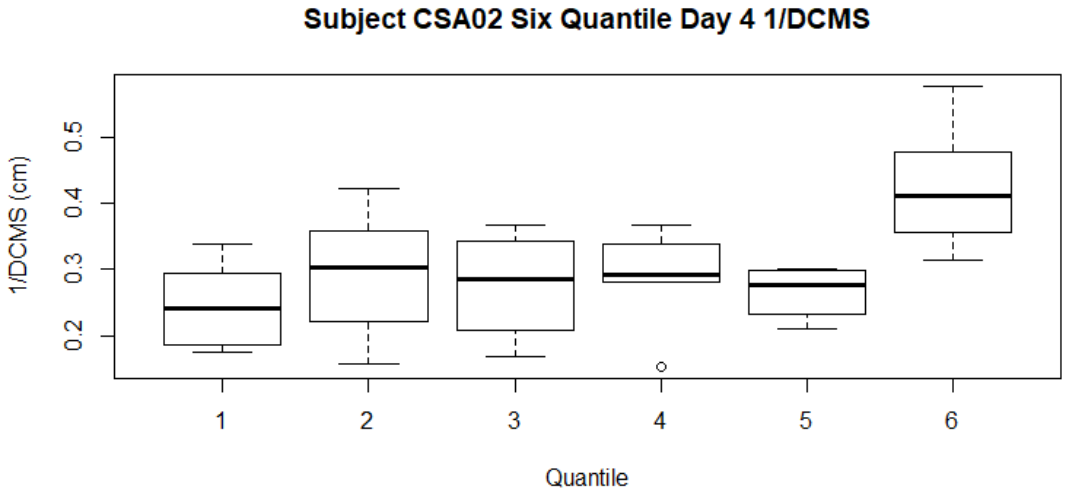

Figure B-20. Subject CSA02 Six Quantile Day 4 1/DCMS

As Table B-17 indicates, the null hypothesis of a normal distribution was not rejected for any quantiles. The boxplot in Figure B-21 is not, however, indicative of a normal distribution

for all datasets. Bartlett's test produced a K^2 value of 2.909 and a p value of 0.714, failing to reject the null hypothesis of homoscedasticity. The Kruskal-Wallis test produced a X^2 value of 3.3685 and a p value of 0.6434, failing to reject the null hypothesis of equality of dataset medians. Because this null hypothesis was not rejected, it cannot be concluded that accuracy, as measured by 1/MPI to CZP distance, differed by time quantile on day 4.

Table B-17. Subject CSA02 Day 5 Six Quantile 1/MPI to CZP Distance Shapiro-Wilk Test Results

Quantile	W	P-Value
1	0.9481	0.7236
2	0.9733	0.8962
3	0.9548	0.7713
4	0.9532	0.7603
5	0.8674	0.256
6	0.9328	0.6159

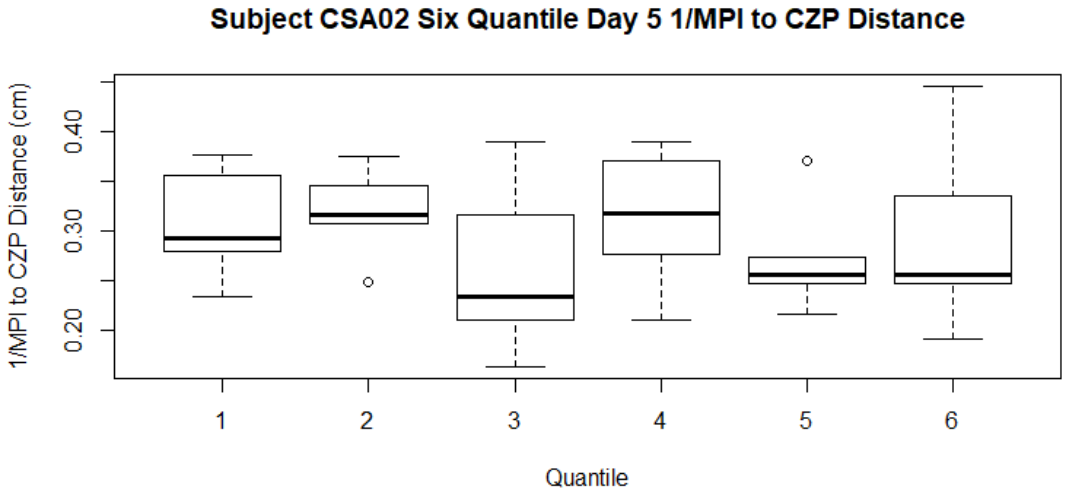

Figure B-21. Subject CSA02 Six Quantile Day 5 1/MPI to CZP Distance

As Table B-18 indicates, the null hypothesis of a normal distribution was not rejected for any quantiles. The boxplot in Figure B-22 is not, however, indicative of a normal distribution for all datasets. Bartlett's test produced a K^2 value of 3.9553 and a p value of 0.5559, failing to reject the null hypothesis of homoscedasticity. The Kruskal-Wallis test produced a X^2 value of 0.53548 and a p value of 0.9908, failing to reject the null hypothesis of equality of dataset medians. Because this null hypothesis was not rejected, it cannot be concluded that accuracy, as measured by 1/DCMS, differed by time quantile on day 5.

Table B-18. Subject CSA02 Six Quantile 1/DCMS Shapiro-Wilk Test Results

Quantile	W	P-Value
1	0.9884	0.9737
2	0.8601	0.2285

3	0.9356	0.635
4	0.947	0.716
5	0.9448	0.7
6	0.9285	0.5859

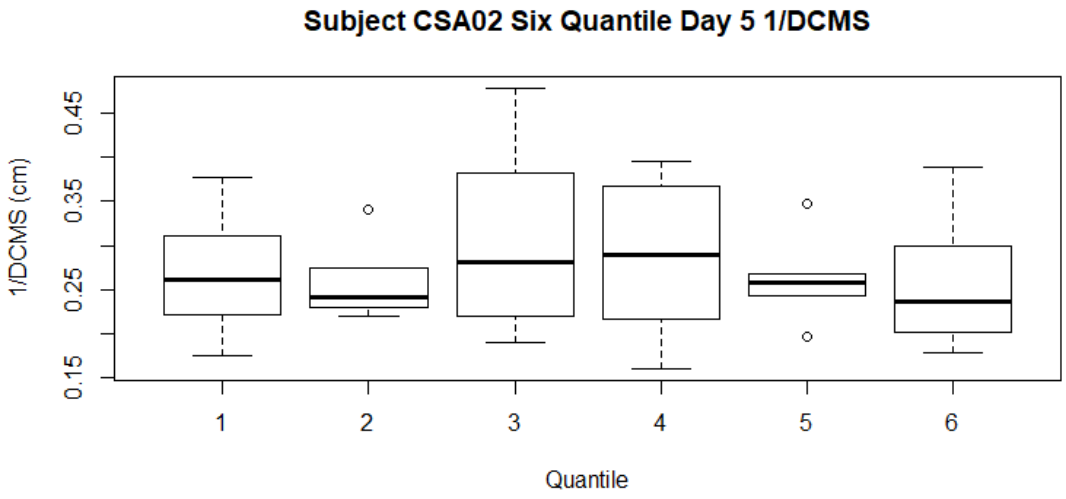

Figure B-22. Subject CSA02 Six Quantile Day 5 1/DCMS

6.1.3 Quantile Analysis

As Table B-19 indicates, the null hypothesis of a normal distribution was not rejected for any days. The boxplot in Figure B-23 is not, however, indicative of a normal distribution for all datasets. Bartlett's test produced a K^2 value of 4.1479 and a p value of 0.2459, failing to reject the null hypothesis of homoscedasticity. The Kruskal-Wallis test produced a X^2 value of 4.3667 and a p value of 0.2245, failing to reject the null hypothesis of equality of dataset medians. Because this null hypothesis was not rejected, it cannot be concluded that accuracy, as measured by the first quantile of 1/MPI to CZP distance, changed over the 4 days of firing.

Table B-19. Subject CSA02 Quantile 1 of 5 1/MPI to CZP Distance Shapiro-Wilk Test Results

Day	W	P-Value
2	0.9314	0.5907
3	0.8976	0.3601
4	0.9122	0.4513
5	0.9421	0.6761

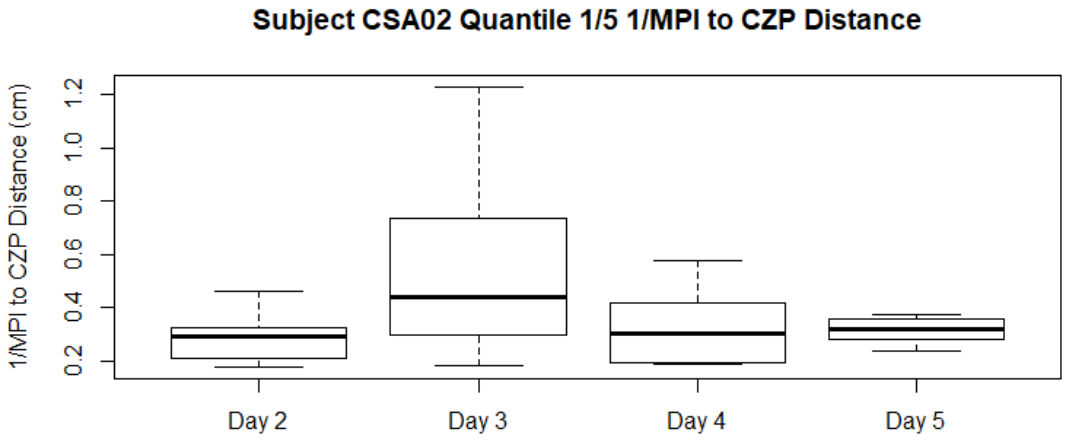

Figure B-23. Subject CSA02 Quantile 1 of 5 1/MPI to CZP Distance

As Table B-20 indicates, the null hypothesis of a normal distribution was rejected for day 3. The boxplot in Figure B-24 is not, however, indicative of a normal distribution. Bartlett's test produced a K^2 value of 6.6059 and a p value of 0.08558, failing to reject the null hypothesis of homoscedasticity. The Kruskal-Wallis test produced a X^2 value of 3.98 and a p value of 0.2636, failing to reject the null hypothesis of equality of dataset medians. Because this null hypothesis was not rejected, it cannot be concluded that accuracy, as measured by the second quantile of 1/MPI to CZP distance, changed over the 4 days of firing.

Table B-20. Subject CSA02 Quantile 2 of 5 1/MPI to CZP Distance Shapiro-Wilk Test Results

Day	W	P-Value
2	0.9164	0.4801
3	0.7456	0.0181
4	0.9166	0.4811
5	0.9797	0.9499

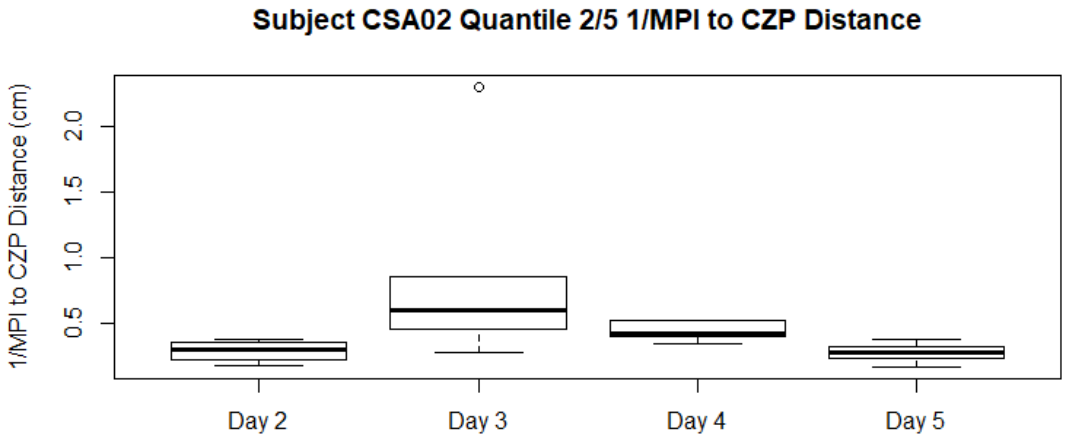

Figure B-24. Subject CSA02 Quantile 2 of 5 1/MPI to CZP Distance

As Table B-21 indicates, the null hypothesis of a normal distribution was rejected for days 2 and 3. The boxplot in Figure B-25 does not provide information to the contrary. Bartlett's test produced a K^2 value of 16.577 and a p value of 0.00008636, rejecting the null hypothesis of homoscedasticity. The Brunner-Dette-Munk test produced an F value of 1.848698 and a p value of 0.1779037, failing to reject the null hypothesis of equality of distribution functions. Because this null hypothesis was not rejected, it cannot be concluded that accuracy, as measured by the third quantile of 1/MPI to CZP distance, changed over the 4 days of firing.

Table B-21. Subject CSA02 Quantile 3 of 5 1/MPI to CZP Distance Shapiro-Wilk Test Results

Day	W	P-Value
2	0.654	0.002
3	0.6115	0.0006
4	0.9331	0.6042
5	0.8994	0.3706

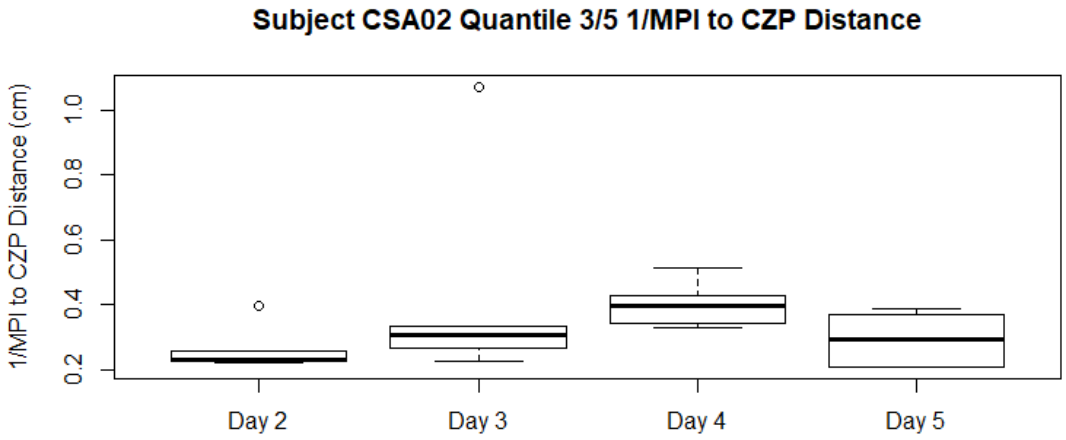

Figure B-25. Subject CSA02 Quantile 3 of 5 1/MPI to CZP Distance

As Table B-22 indicates, the null hypothesis of a normal distribution was rejected for days 3 and 4. The boxplot in Figure B-26 does not provide information to the contrary. Bartlett's test produced a K^2 value of 5.9107 and a p value of 0.116, failing to reject the null hypothesis of homoscedasticity. The Kruskal-Wallis test produced a X^2 value of 1.2467 and a p value of 0.7418, failing to reject the null hypothesis of equality of dataset medians. Because this null hypothesis was not rejected, it cannot be concluded that accuracy, as measured by the fourth quantile of 1/MPI to CZP distance, changed over the 4 days of firing.

Table B-22. Subject CSA02 Quantile 4/5 1/MPI to CZP Distance Shapiro-Wilk Test Results

Day	W	P-Value
2	0.8258	0.0989
3	0.685	0.0043
4	0.6493	0.0017
5	0.8928	0.3332

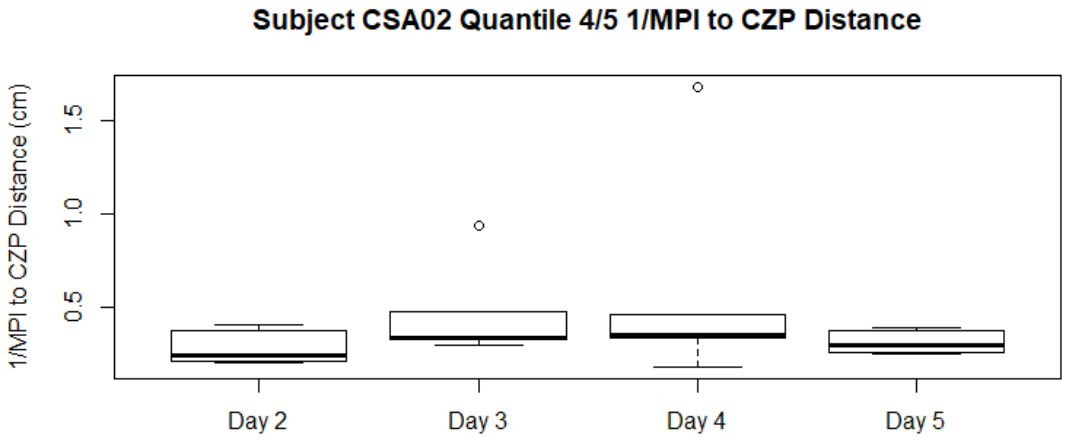

Figure B-26. Subject CSA02 Quantile 4 of 5 1/MPI to CZP Distance

As Table B-23 indicates, the null hypothesis of a normal distribution was rejected for day 2. The boxplot in Figure B-27 does not provide information to the contrary. Bartlett's test produced a K^2 value of 6.4342 and a p value of 0.09229, failing to reject the null hypothesis of homoscedasticity. The Kruskal-Wallis test produced a X^2 value of 1.1467 and a p value of 0.7658, failing to reject the null hypothesis of equality of dataset medians. Because this null hypothesis was not rejected, it cannot be concluded that accuracy, as measured by the fifth quantile of 1/MPI to CZP distance, changed over the 4 days of firing.

Table B-23. Subject CSA02 Quantile 5 of 5 1/MPI to CZP Distance Shapiro-Wilk Test Results

Day	W	P-Value
2	0.6853	0.0043
3	0.8648	0.2063
4	0.9428	0.6815
5	0.889	0.3128

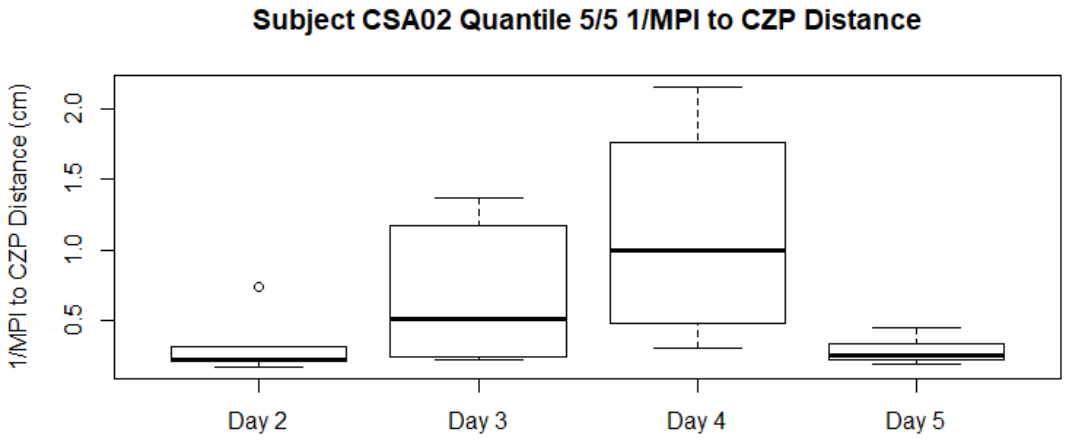

Figure B-27. Subject CSA02 Quantile 5 of 5 1/MPI to CZP Distance

As Table B-24 indicates, the null hypothesis of a normal distribution was rejected for day 3. The boxplot in Figure B-28 does not provide information to the contrary. Bartlett's test produced a K^2 value of 1.5831 and a p value of 0.6632, failing to reject the null hypothesis of homoscedasticity. The Kruskal-Wallis test produced a X^2 value of 0.18048 and a p value of 0.9807, failing to reject the null hypothesis of equality of dataset medians. Because this null hypothesis was not rejected, it cannot be concluded that accuracy, as measured by the first quantile of 1/DCMS changed over the 4 days of firing.

Table B-24. Subject CSA02 Quantile 1 of 5 1/DCMS Shapiro-Wilk Test Results

Day	W	P-Value
2	0.90384	0.3971
3	0.77828	0.03714
4	0.91433	0.46549
5	0.99061	0.99061

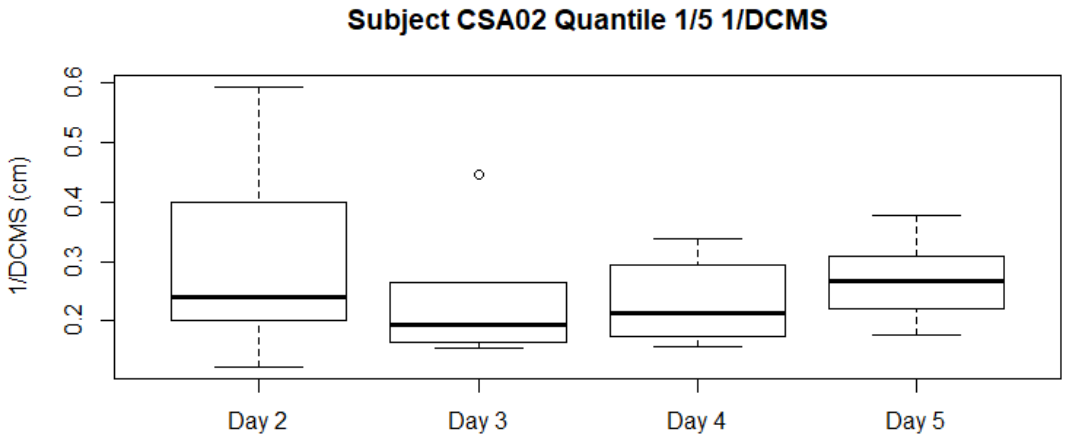

Figure B-28. Subject CSA02 Quantile 1 of 5 1/DCMS

As Table B-25 indicates, the null hypothesis of a normal distribution was rejected for day 3. The boxplot in Figure B-29 does not provide information to the contrary. Bartlett's test produced a K^2 value of 9.1971 and a p value of 0.02678, rejecting the null hypothesis of homoscedasticity. The Brunner-Dette-Munk test produced an F value of 0.9416694 and a p value of 0.4371605, failing to reject the null hypothesis of equality of distribution functions. Because this null hypothesis was not rejected, it cannot be concluded that accuracy, as measured by the second quantile of 1/DCMS changed over the 4 days of firing.

Table B-25. Subject CSA02 Quantile 2 of 5 1/DCMS Shapiro-Wilk Test Results

Day	W	P-Value
2	0.9557	0.7859
3	0.7591	0.0244
4	0.9814	0.9581
5	0.9314	0.5912

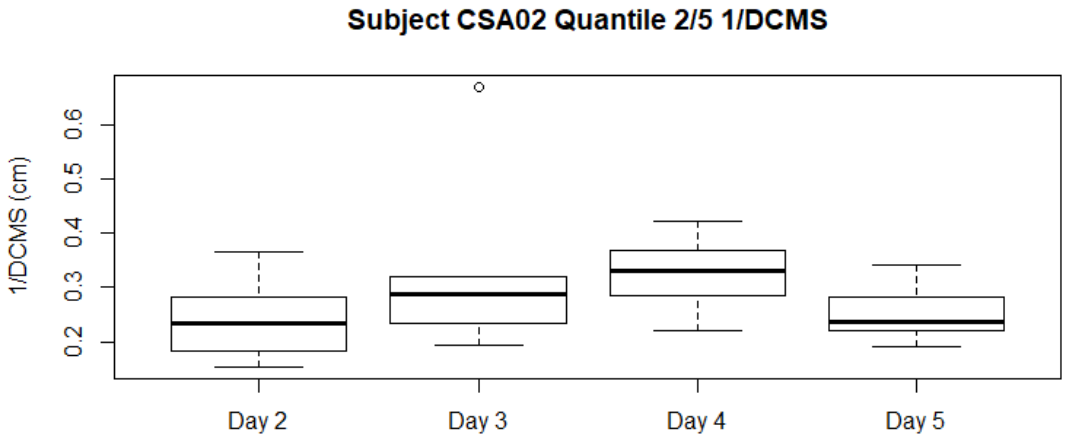

Figure B-29. Subject CSA02 Quantile 2 of 5 1/DCMS

As Table B-26 indicates, the null hypothesis of a normal distribution was rejected for day 3. The boxplot in Figure B-30 does not provide information to the contrary. Bartlett's test produced a K^2 value of 4.8488 and a p value of 0.1832, failing to reject the null hypothesis of homoscedasticity. The Kruskal-Wallis test produced a X^2 value of 1.8467 and a p value of 0.6048, failing to reject the null hypothesis of equality of dataset medians. Because this null hypothesis was not rejected, it cannot be concluded that accuracy, as measured by the third quantile of 1/DCMS changed over the 4 days of firing.

Table B-26. Subject CSA02 Quantile 3 of 5 1/DCMS Shapiro-Wilk Test Results

Day	W	P-Value
2	0.8891	0.3136
3	0.7246	0.0111
4	0.8996	0.3716
5	0.9191	0.4986

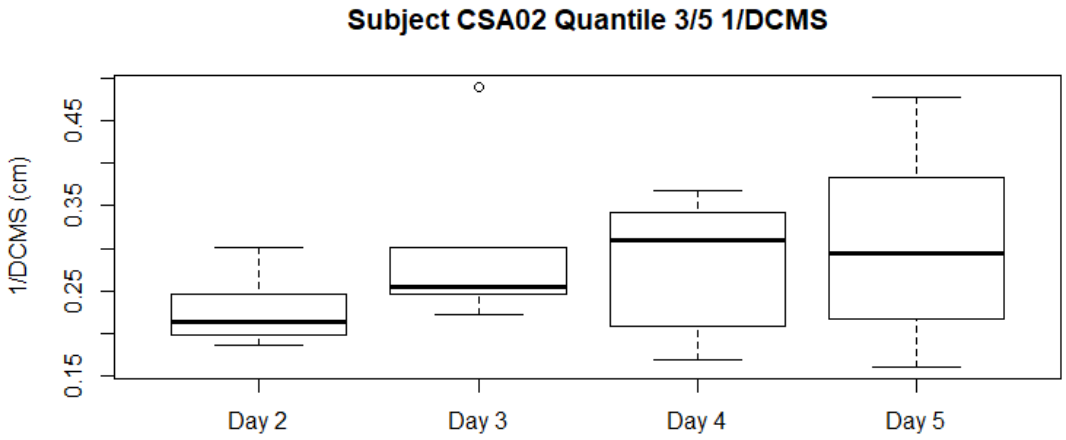

Figure B-30. Subject CSA02 Quantile 3 of 5 1/DCMS

As Table B-27 indicates, the null hypothesis of a normal distribution was not rejected for any days. The boxplot in Figure B-31 is not, however, indicative of a normal distribution. Bartlett's test produced a K^2 value of 6.241 and a p value of 0.1005, failing to reject the null hypothesis of homoscedasticity. The Kruskal-Wallis test produced a X^2 value of 1.8333 and a p value of 0.6077, failing to reject the null hypothesis of equality of dataset medians. Because this null hypothesis was not rejected, it cannot be concluded that accuracy, as measured by the fourth quantile of 1/DCMS changed over the 4 days of firing.

Table B-27. Subject CSA02 Quantile 4 of 5 1/DCMS Shapiro-Wilk Test Results

Day	W	P-Value
2	0.8815	0.2758
3	0.9242	0.536
4	0.8043	0.0643
5	0.8933	0.3357

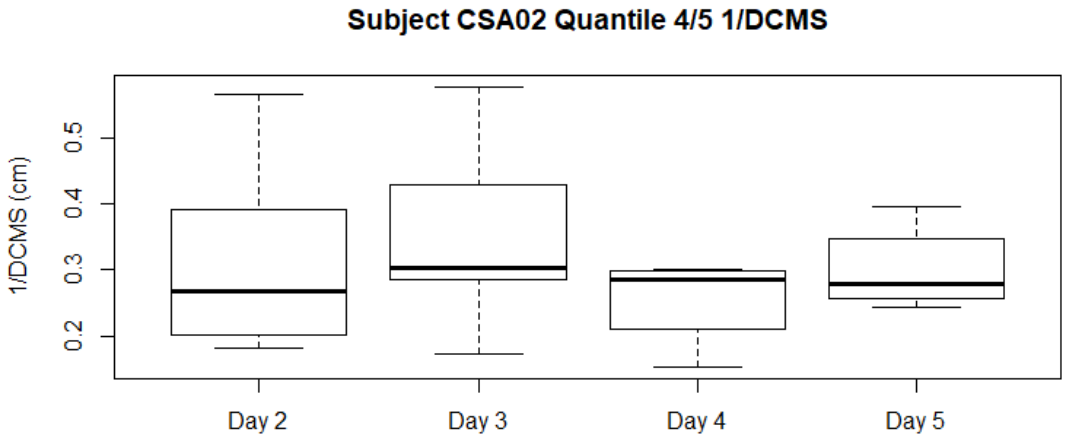

Figure B-31. Subject CSA02 Quantile 4 of 5 1/DCMS

As Table B-28 indicates, the null hypothesis of a normal distribution was rejected for days 2 and 3. The boxplot in Figure B-32 does not provide information to the contrary. Bartlett's test produced a K^2 value of 1.4299 and a p value of 0.6985, failing to reject the null hypothesis of homoscedasticity. The Kruskal-Wallis test produced a X^2 value of 6.6933 and a p value of 0.08234, failing to reject the null hypothesis of equality of dataset medians. Because this null hypothesis was not rejected, it cannot be concluded that accuracy, as measured by the fifth quantile of 1/DCMS changed over the 4 days of firing.

Table B-28. Subject CSA02 Quantile 5 of 5 1/DCMS Shapiro-Wilk Test Results

Day	W	P-Value
2	0.7784	0.0373
3	0.801	0.06
4	0.9922	0.9939
5	0.8681	0.2189

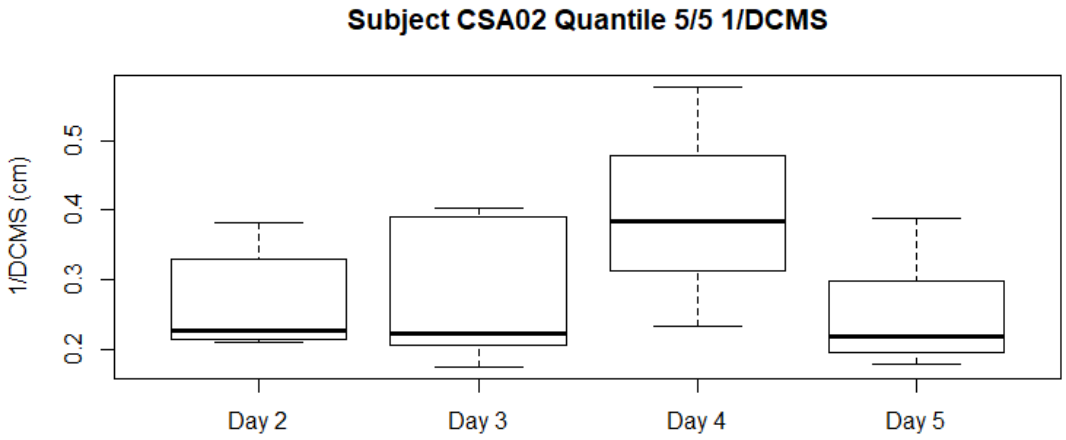

Figure B-32. Subject CSA02 Quantile 5 of 5 1/DCMS

As Table B-29 indicates, the null hypothesis of a normal distribution was not rejected for any days. The boxplot in Figure B-33 is not, however, indicative of a normal distribution. Bartlett's test produced a K^2 value of 3.507 and a p value of 0.3199, failing to reject the null hypothesis of homoscedasticity. The Kruskal-Wallis test produced a X^2 value of 3.7314 and a p value of 0.292, failing to reject the null hypothesis of equality of dataset medians. Because this null hypothesis was not rejected, it cannot be concluded that accuracy, as measured by the first quantile of 1/MPI to CZP distance changed over the 4 days of firing.

Table B-29. Subject CSA02 Quantile 1 of 6 1/MPI to CZP Distance Shapiro-Wilk Test Results

Day	W	P-Value
2	0.8957	0.3867
3	0.9709	0.8807
4	0.97499	0.90622
5	0.9481	0.7236

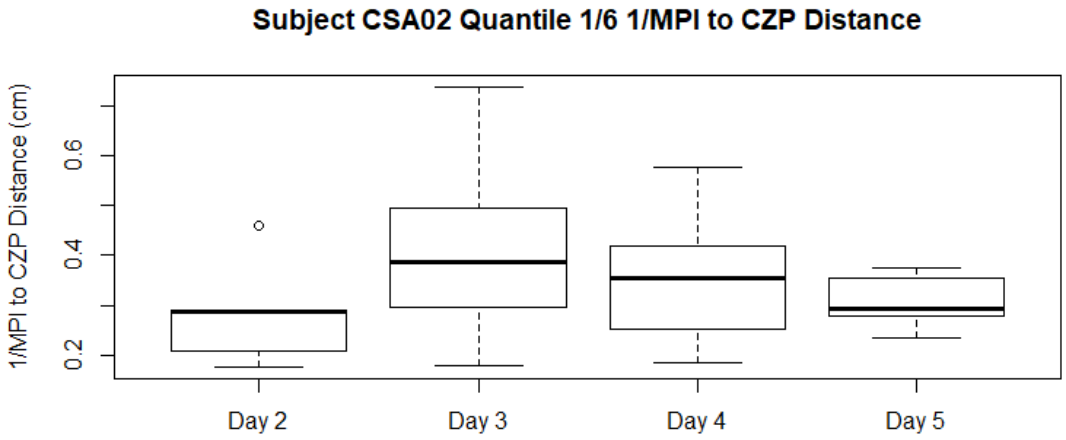

Figure B-33. Subject CSA02 Quantile 1 of 6 1/MPI to CZP Distance

As Table B-30 indicates, the null hypothesis of a normal distribution was not rejected for any days. The boxplot in Figure B-34 is not, however, indicative of a normal distribution. Bartlett's test produced a K^2 value of 8.0655 and a p value of 0.04468, rejecting the null hypothesis of homoscedasticity. The Brunner-Dette-Munk test produced an F value of 1.303393 and a p value of 0.3107099, failing to reject the null hypothesis of equality of distribution functions. Because this null hypothesis was not rejected, it cannot be concluded that accuracy, as measured by the second quantile of 1/MPI to CZP distance changed over the 4 days of firing.

Table B-30. Subject CSA02 Quantile 2 of 6 1/MPI to CZP Distance Shapiro-Wilk Test Results

Day	W	P-Value
2	0.8849	0.3322
3	0.922	0.543
4	0.96698	0.85552
5	0.9733	0.8962

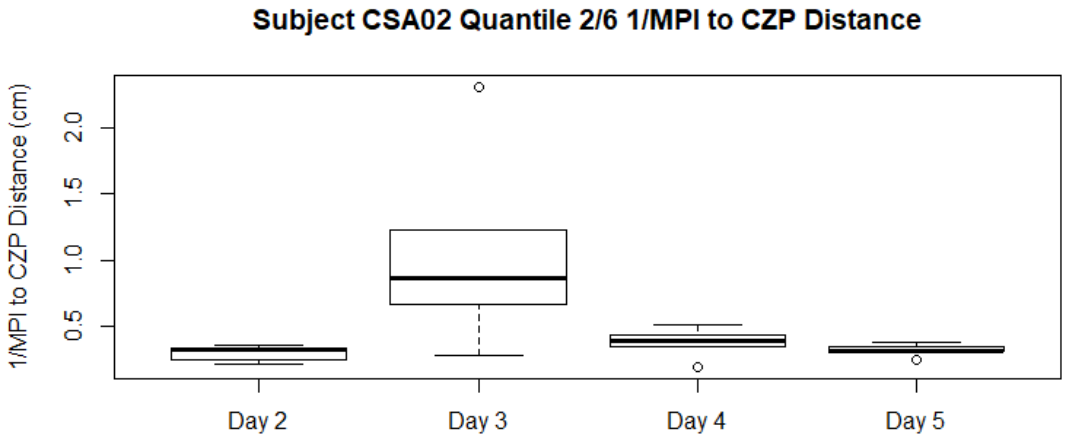

Figure B-34. Subject CSA02 Quantile 2 of 6 1/MPI to CZP Distance

As Table B-31 indicates, the null hypothesis of a normal distribution was not rejected for any days. The boxplot in Figure B-35 is not, however, indicative of a normal distribution. Bartlett's test produced a K^2 value of 0.38342 and a p value of 0.9436, failing to reject the null hypothesis of homoscedasticity. The Kruskal-Wallis test produced a X^2 value of 4.7371 and a p value of 0.1921, failing to reject the null hypothesis of equality of dataset medians. Because this null hypothesis was not rejected, it cannot be concluded that accuracy, as measured by the third quantile of 1/MPI to CZP distance changed over the 4 days of firing.

Table B-31. Subject CSA02 Quantile 3 of 6 1/MPI to CZP Distance Shapiro-Wilk Test Results

Day	W	P-Value
2	0.905	0.43814
3	0.80273	0.08527
4	0.89794	0.39859
5	0.95479	0.77129

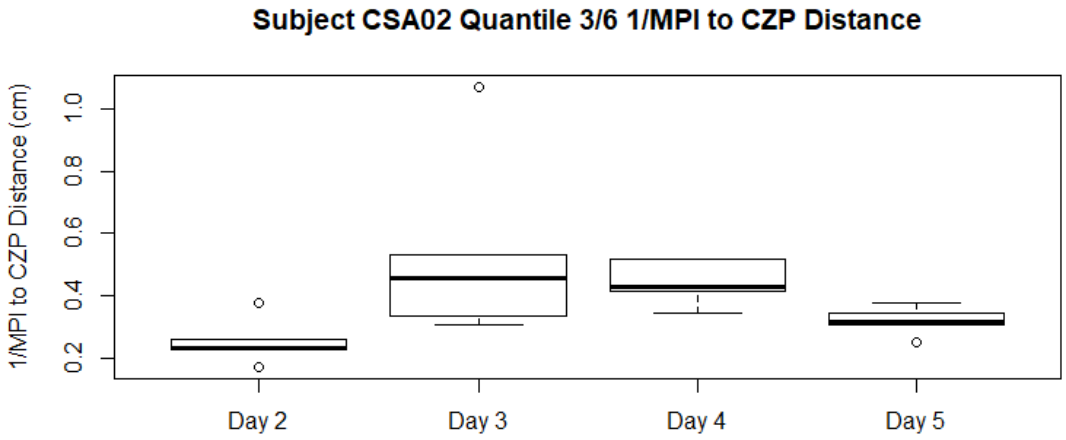

Figure B-35. Subject CSA02 Quantile 3 of 6 1/MPI to CZP Distance

As Table B-32 indicates, the null hypothesis of a normal distribution was rejected for day 3. The boxplot in Figure B-36 does not provide information to the contrary. Bartlett's test produced a K^2 value of 15.393 and a p value of 0.00151, rejecting the null hypothesis of homoscedasticity. The Brunner-Dette-Munk test produced an F value of 1.771368 and a p value of 0.1985625, failing to reject the null hypothesis of equality of distribution functions. Because this null hypothesis was not rejected, it cannot be concluded that accuracy, as measured by the fourth quantile of 1/MPI to CZP distance changed over the 4 days of firing.

Table B-32. Subject CSA02 Quantile 4 of 6 1/MPI to CZP Distance Shapiro-Wilk Test Results

Day	W	P-Value
2	0.7803	0.0555
3	0.6596	0.0035
4	0.91024	0.46904
5	0.9532	0.7603

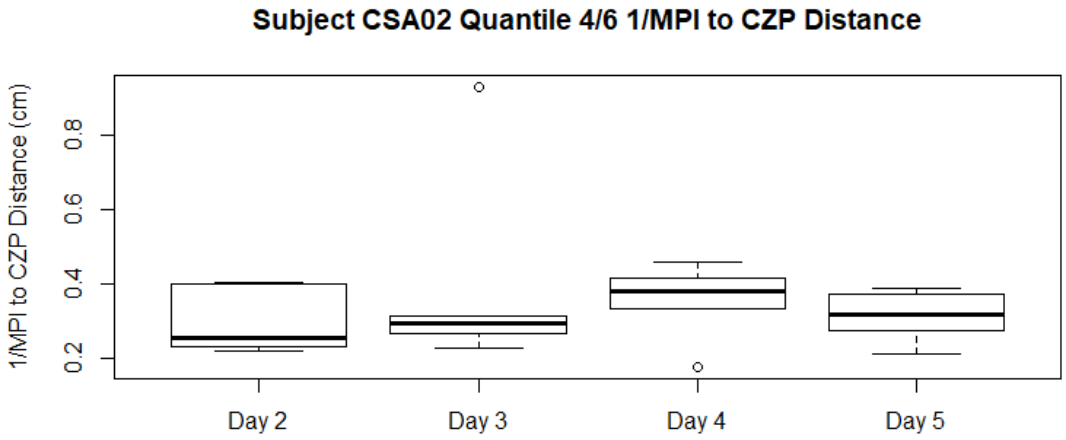

Figure B-36. Subject CSA02 Quantile 4 of 6 1/MPI to CZP Distance

As Table B-33 indicates, the null hypothesis of a normal distribution was rejected for days 2 and 4. The boxplot in Figure B-37 does not provide information to the contrary. Bartlett's test produced a K^2 value of 7.3458 and a p value of 0.06166, failing to reject the null hypothesis of homoscedasticity. The Kruskal-Wallis test produced a X^2 value of 3.4343 and a p value of 0.3294, failing to reject the null hypothesis of equality of dataset medians. Because this null hypothesis was not rejected, it cannot be concluded that accuracy, as measured by the fifth quantile of 1/MPI to CZP distance changed over the 4 days of firing.

Table B-33. Subject CSA02 Quantile 5 of 6 1/MPI to CZP Shapiro-Wilk Test Results

Day	W	P-Value
2	0.7133	0.0131
3	0.8024	0.0847
4	0.58294	0.00037
5	0.8674	0.256

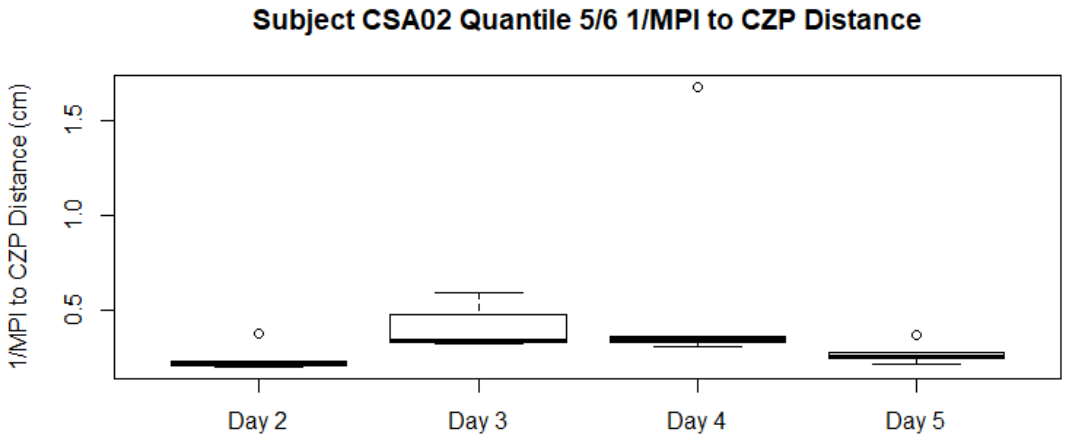

Figure B-37. Subject CSA02 Quantile 5 of 6 1/MPI to CZP Distance

As Table B-34 indicates, the null hypothesis of a normal distribution was rejected for day 2. The boxplot in Figure B-38 does not provide information to the contrary. Bartlett's test produced a K^2 value of 4.8164 and a p value of 0.1857, failing to reject the null hypothesis of homoscedasticity. The Kruskal-Wallis test produced a X^2 value of 0.34857 and a p value of 0.9506, failing to reject the null hypothesis of equality of dataset medians. Because this null hypothesis was not rejected, it cannot be concluded that accuracy, as measured by the sixth quantile of 1/MPI to CZP distance changed over the 4 days of firing.

Table B-34. Subject CSA02 Quantile 6 of 6 1/MPI to CZP Distance Shapiro-Wilk Test Results

Day	W	P-Value
2	0.7374	0.0226
3	0.825	0.1276
4	0.9659	0.8481
5	0.9328	0.6159

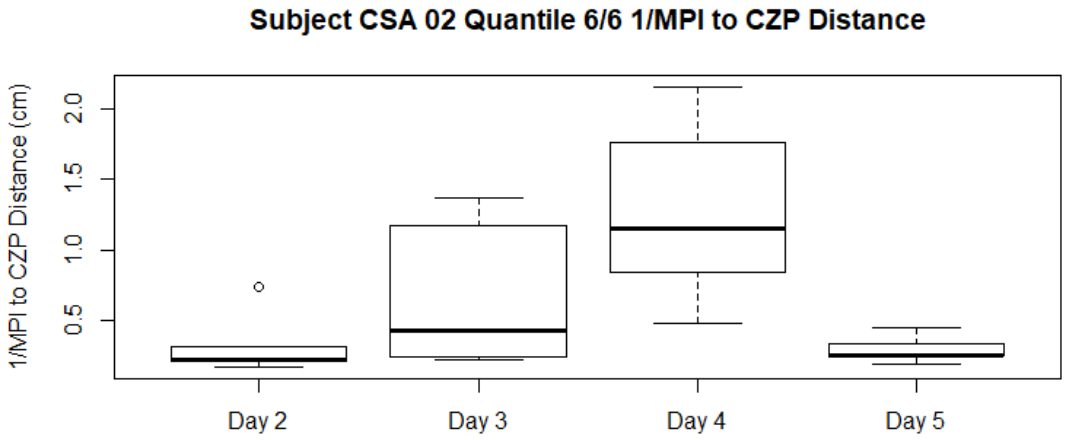

Figure B-38. Subject CSA02 Quantile 6 of 6 1/MPI to CZP Distance

As Table B-35 indicates, the null hypothesis of a normal distribution was not rejected for any days. The boxplot in Figure B-39 does not provide information to the contrary. Bartlett's test produced a K^2 value of 3.9437 and a p value of 0.2676, failing to reject the null hypothesis of homoscedasticity. The Kruskal-Wallis test produced a X^2 value of 1.1486 and a p value of 0.7654, failing to reject the null hypothesis of equality of dataset medians. Because this null hypothesis was not rejected, it cannot be concluded that accuracy, as measured by the first quantile of 1/DCMS changed over the 4 days of firing.

Table B-35. Subject CSA02 Quantile 1 of 6 1/DCMS Shapiro-Wilk Test Results

Day	W	P-Value
2	0.90747	0.4525
3	0.89067	0.3605
4	0.93225	0.6118
5	0.9884	0.9737

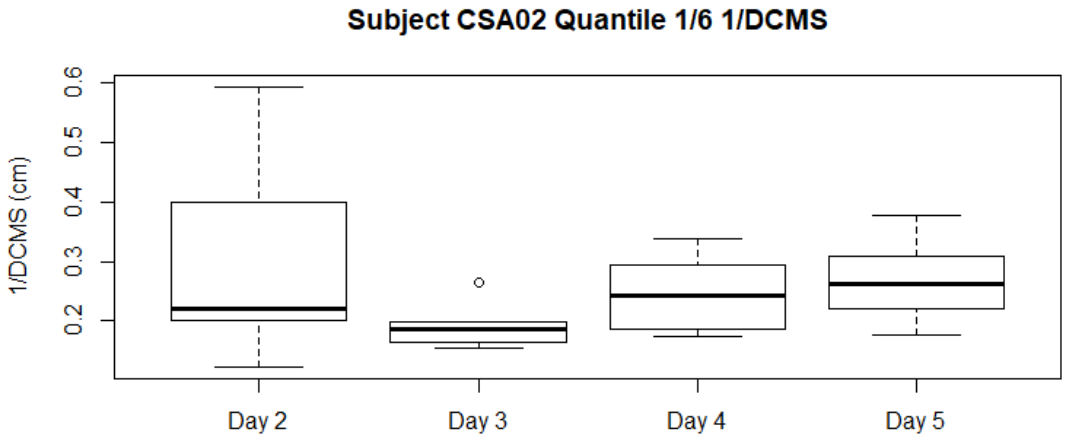

Figure B-39. Subject CSA02 Quantile 1 of 6 1/DCMS

As Table B-36 indicates, the null hypothesis of a normal distribution was not rejected for any days. The boxplot in Figure B-40 is not, however, indicative of a normal distribution. Bartlett's test produced a K^2 value of 7.2976 and a p value of 0.06299, failing to reject the null hypothesis of homoscedasticity. The Kruskal-Wallis test produced a X^2 value of 1.4686 and a p value of 0.6895, failing to reject the null hypothesis of equality of dataset medians. Because this null hypothesis was not rejected, it cannot be concluded that accuracy, as measured by the second quantile of 1/DCMS changed over the 4 days of firing.

Table B-36. Subject CSA02 Quantile 2 of 6 1/DCMS Shapiro-Wilk Test Results

Day	W	P-Value
2	0.95201	0.7516
3	0.85956	0.2267
4	0.9794	0.9314
5	0.86007	0.2285

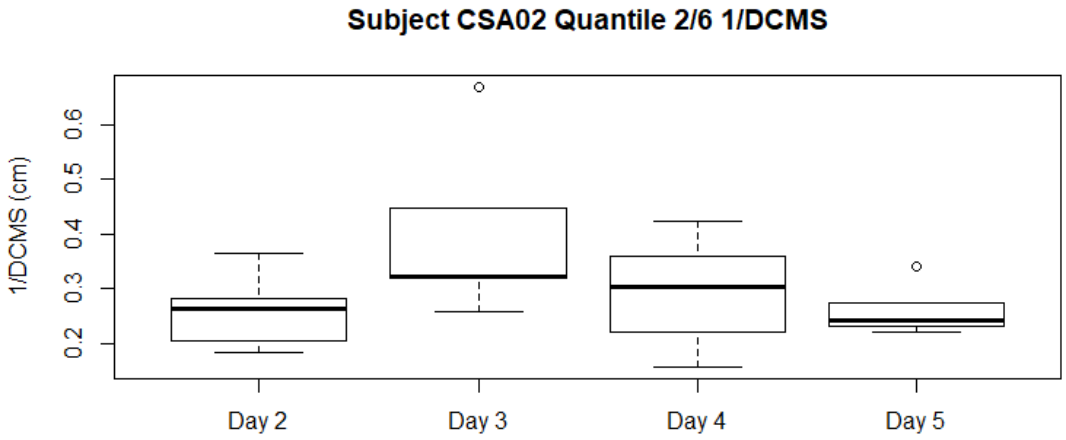

Figure B-40. Subject CSA02 Quantile 2 of 6 1/DCMS

As Table B-37 indicates, the null hypothesis of a normal distribution was not rejected for any days. The boxplot in Figure B-41 is not, however, indicative of a normal distribution. Bartlett's test produced a K^2 value of 4.0939 and a p value of 0.2515, failing to reject the null hypothesis of homoscedasticity. The Kruskal-Wallis test produced a X^2 value of 4.0514 and a p value of 0.256, failing to reject the null hypothesis of equality of dataset medians. Because this null hypothesis was not rejected, it cannot be concluded that accuracy, as measured by the third quantile of 1/DCMS changed over the 4 days of firing.

Table B-37. Subject CSA02 Quantile 3 of 6 1/DCMS Shapiro-Wilk Test Results

Day	W	P-Value
2	0.96978	0.8738
3	0.83473	0.1509
4	0.93556	0.6347
5	0.9356	0.635

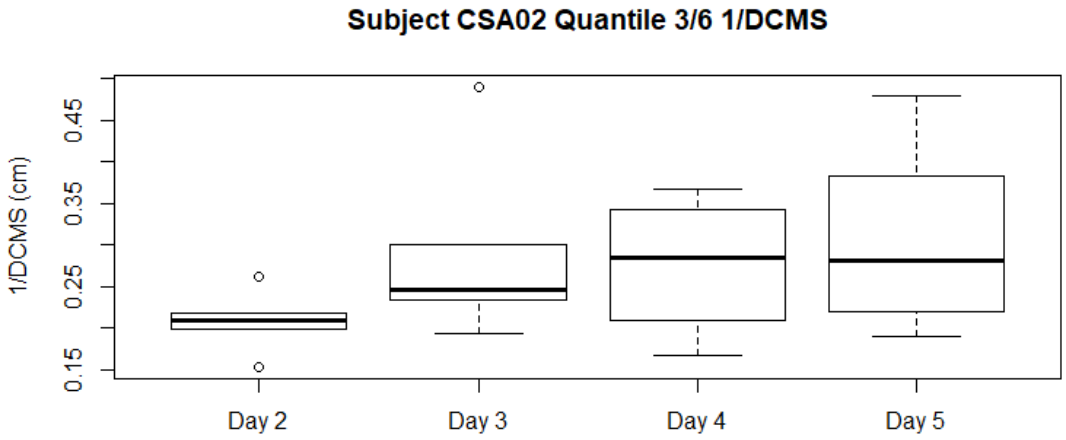

Figure B-41. Subject CSA02 Quantile 3 of 6 1/DCMS

As Table B-38 indicates, the null hypothesis of a normal distribution was rejected for day 3. The boxplot in Figure B-42 does not provide information to the contrary. Bartlett's test produced a K^2 value of 1.9382 and a p value of 0.5853, failing to reject the null hypothesis of homoscedasticity. The Kruskal-Wallis test produced a X^2 value of 0.12 and a p value of 0.9893, failing to reject the null hypothesis of equality of dataset medians. Because this null hypothesis was not rejected, it cannot be concluded that accuracy, as measured by the fourth quantile of 1/DCMS changed over the 4 days of firing.

Table B-38. Subject CSA02 Quantile 4 of 6 1/DCMS Shapiro-Wilk Test Results

Day	W	P-Value
2	0.79468	0.07328
3	0.70179	0.009997
4	0.90294	0.4264
5	0.94704	0.716

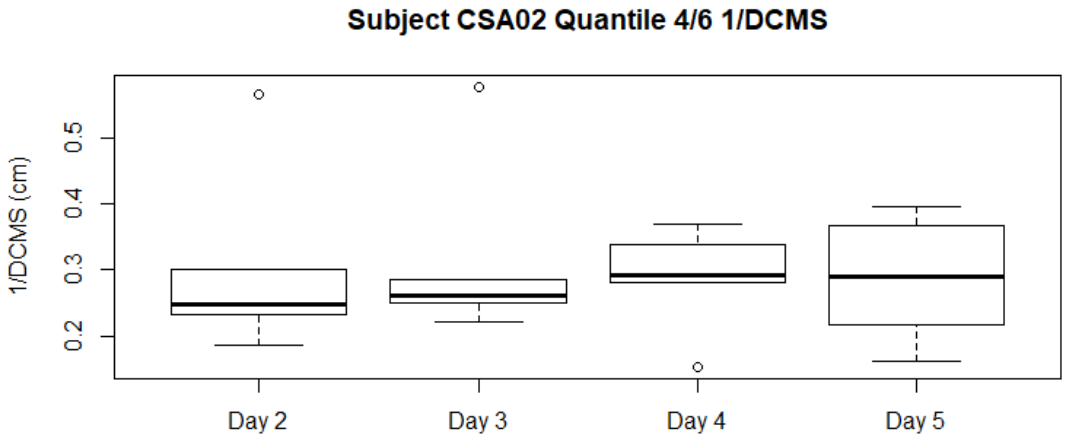

Figure B-42. Subject CSA02 Quantile 4 of 6 1/DCMS

As Table B-39 indicates, the null hypothesis of a normal distribution was not rejected for any days. The boxplot in Figure B-43 does not, however, support a normal distribution. Bartlett's test produced a K^2 value of 3.7612 and a p value of 0.2884, failing to reject the null hypothesis of homoscedasticity. The Kruskal-Wallis test produced a X^2 value of 0.062857 and a p value of 0.9959, failing to reject the null hypothesis of equality of dataset medians. Because this null hypothesis was not rejected, it cannot be concluded that accuracy, as measured by the fifth quantile of 1/DCMS changed over the 4 days of firing.

Table B-39. Subject CSA02 Quantile 5 of 6 1/DCMS Shapiro-Wilk Test Results

Day	W	P-Value
2	0.87435	0.2845
3	0.88843	0.3493
4	0.88211	0.319
5	0.94479	0.7

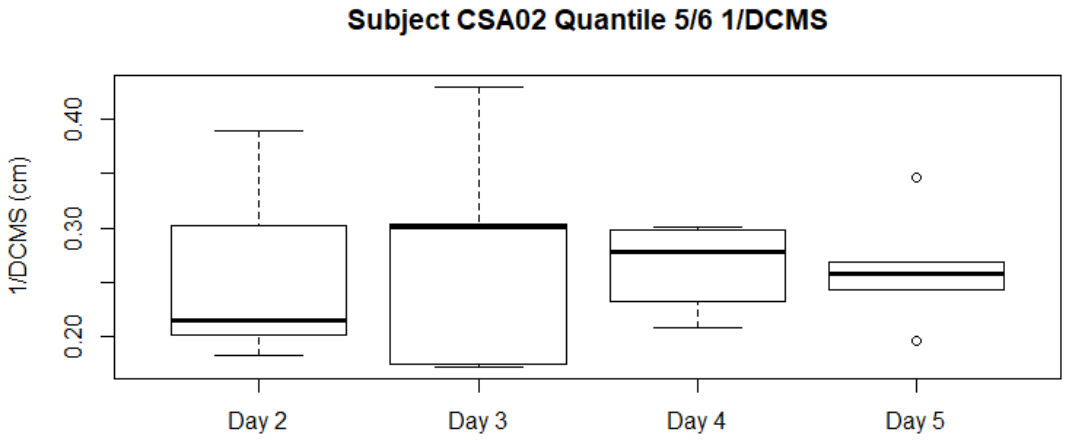

Figure B-43. Subject CSA02 Quantile 5 of 6 1/DCMS

As Table B-40 indicates, the null hypothesis of a normal distribution was rejected for day 3. The boxplot in Figure B-44 does not provide information to the contrary. Bartlett's test produced a K^2 value of 0.3969 and a p value of 0.9409, failing to reject the null hypothesis of homoscedasticity. The Kruskal-Wallis test produced a X^2 value of 6.6 and a p value of 0.0858, failing to reject the null hypothesis of equality of dataset medians. Because this null hypothesis was not rejected, it cannot be concluded that accuracy, as measured by the sixth quantile of 1/DCMS changed over the 4 days of firing.

Table B-40. Subject CSA02 Quantile 6 of 6 1/DCMS Shapiro-Wilk Test Results

Day	W	P-Value
2	0.83461	0.1506
3	0.77091	0.04596
4	0.96648	0.8522
5	0.92846	0.5859

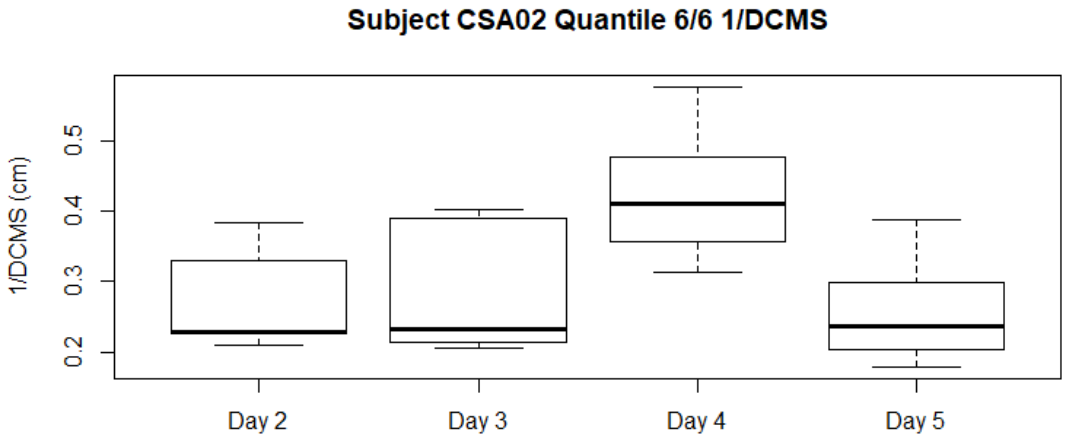

Figure B-44. Subject CSA02 Quantile 5 of 6 1/DCMS

6.1.4 Correlation Results

In Table B-41, the results of the Pearson, Kendall, and Spearman tests for correlation between shot timing and the distance from the shot to the center of the target are shown. As Table B-41 indicates, the respective null hypotheses of no correlation for all tests were rejected on days 3 and 4. While the correlations were significant, they were weak as shown by the fact that the largest coefficient was 0.234724.

Table B-41. Subject CSA02 Correlation Results

		Pearson			Kendall			Spearman	
Day	T	P-Value	Coefficient	Z	P-Value	Tau	S	P-Value	Rho
2	-0.54397	0.5878	-0.05789	-0.17777	0.8589	-0.01277	124210	0.8338	-0.02242
3	2.2652	0.02596	0.234724	1.9798	0.04772	0.142125	96123	0.0483	0.208771
4	2.1935	0.03091	0.227686	2.0846	0.03711	0.149819	94077	0.03251	0.225612
5	-1.1714	0.2446	-0.1239	-1.1468	0.2515	-0.08239	137750	0.2084	-0.13386

6.2 Subject CSA03 Results

6.2.1 IES Scoring Results

As Figure B-45 indicates, MPI to CZP distanced based IES scores were relatively consistent across all days of firing for radii of 5 and 4 cm. A radius of 3 cm showed an increase from day 2 to day 4, after which it decreased to a level close to that of day 2. At a radius of 2 cm, there was a slight decrease from day 2 to day 3, after which there was a significant increase through day 5.

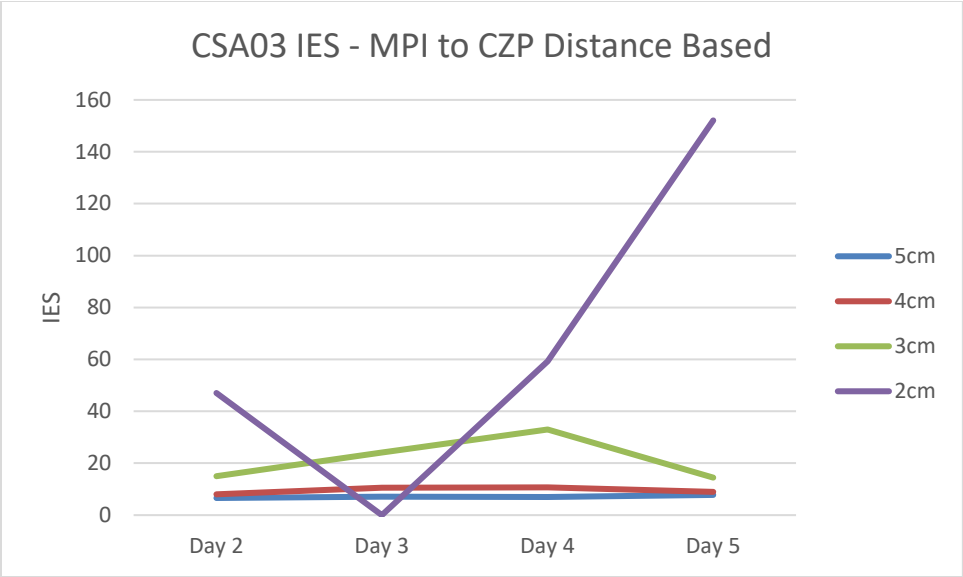

Figure B-45. Subject CSA03 IES - MPI to CZP Distance Based

As Figure B-46 indicates, MPI to CZP distance based RT showed a slight overall decrease from day 2 to day 4 for radii of 5, 4 and 3 cm, after which there was a slight increase. The results for the 2cm radius, however, show a plunge on day 2 because no shot groups had an MPI to CZP distance of 2 cm or less on that day.

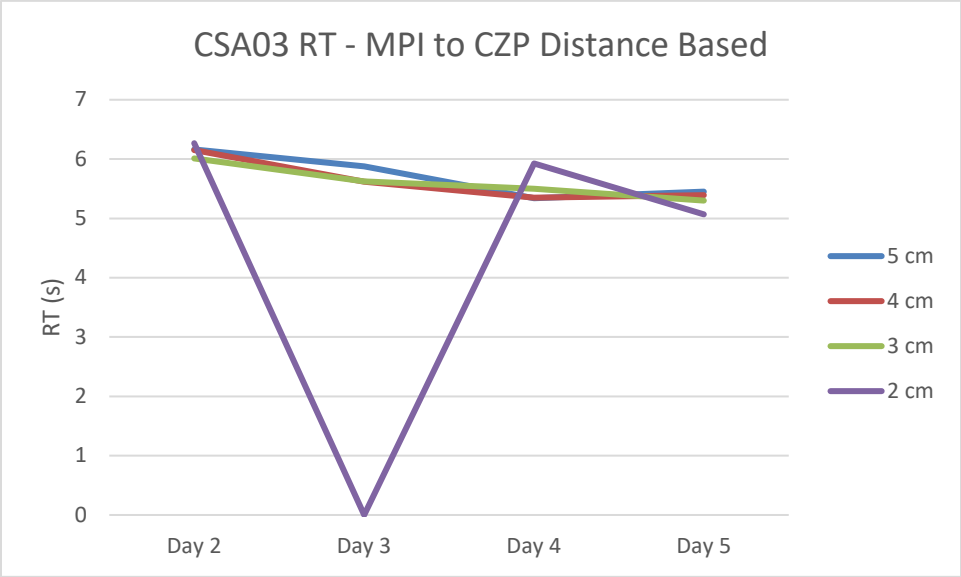

Figure B-46. Subject CSA03 RT - MPI to CZP Distance Based

MPI to CZP distanced based proportion correct data, as Figure B-47 indicates, show the expected trend of greater hit proportions at greater radii. Interestingly, the trend for a radius of 5 cm decreased substantially from day 2 to day 5, while the 4 and 3 cm radii showed similar patterns of a decrease from day 2 to day 3 and an increase from day 4 to day 5. At

a radius of 2 cm, however, the trend was different with a decrease followed by an increase followed by a decrease.

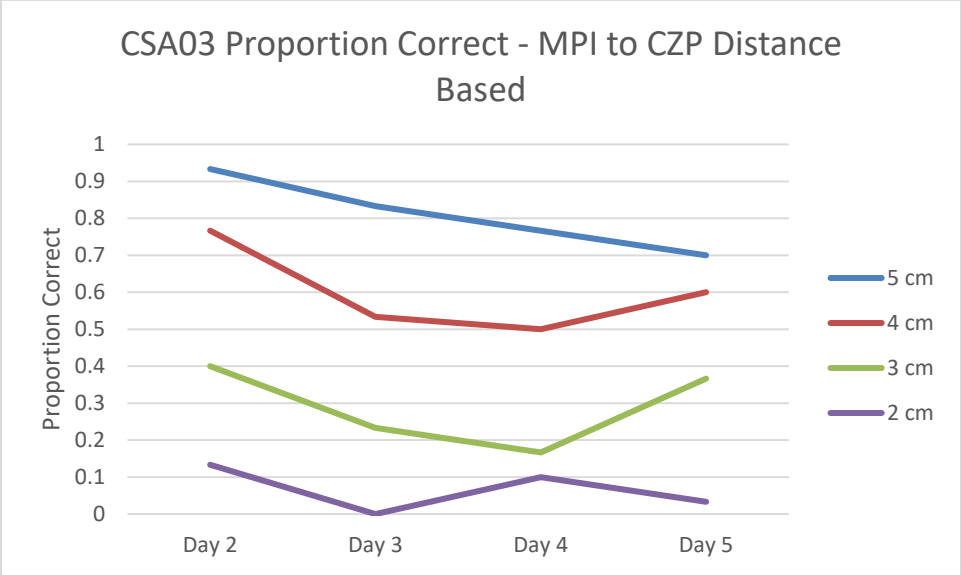

Figure B-47. Subject CSA03 Proportion Correct - MPI to CZP Distance Based

As Figure B-48 shows, DCMS based IES trends were very similar for radii of 5 and 4 cm, but differed significantly for 3 and 2 cm. At a radius of 3 cm, IES increased from day 2 to day 4, after which it decreased significantly. At a radius of 2 cm, IES increased significantly from day 2 to day 3, after which it decreased through day 5.

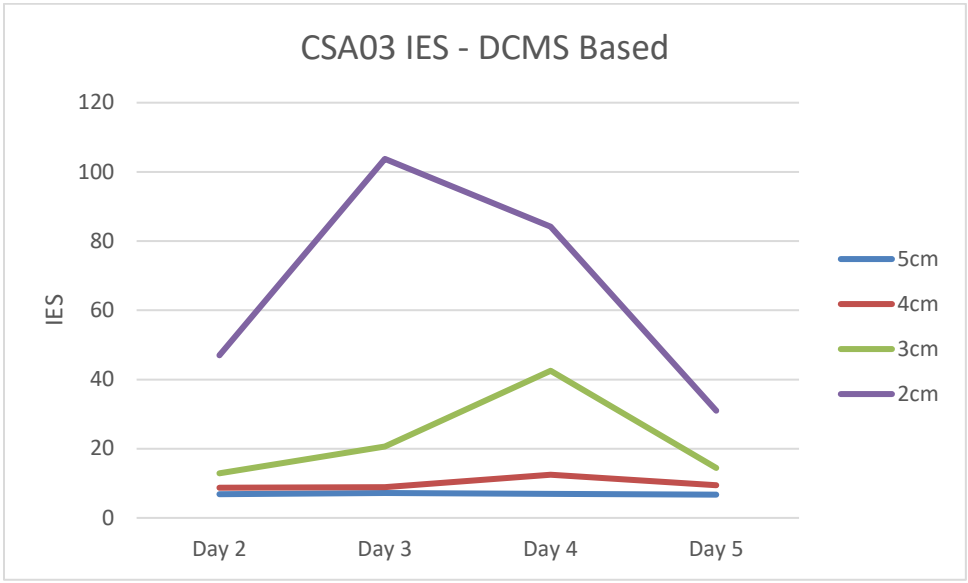

Figure B-48. Subject CSA03 IES – DCMS Based

As Figure B-49 shows, DCMS based RT for radii of 5, 4 and 3 cm showed an overall

decreasing trend, while the 2cm data showed a similar trend punctuated by a more dramatic decrease from day 2 to day 3.

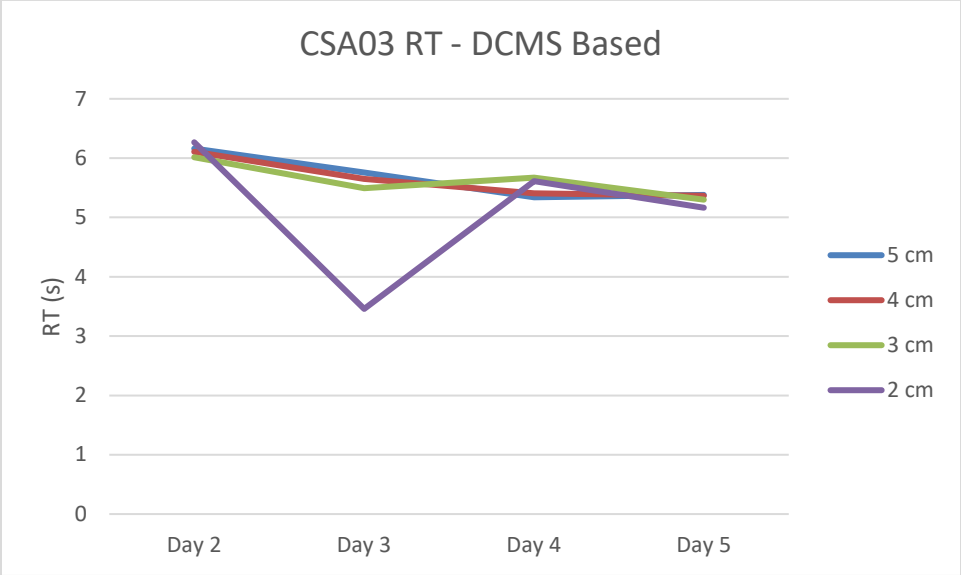

Figure B-49. Subject CSA03 RT - DCMS Based

Figure B-50 shows the expected trend of greater hit proportions with greater DCMS based radius. At a radius of 5 cm, there was an overall decrease in proportion, while at radii of 4, 3 and 2 cm there was a decrease followed by an increase.

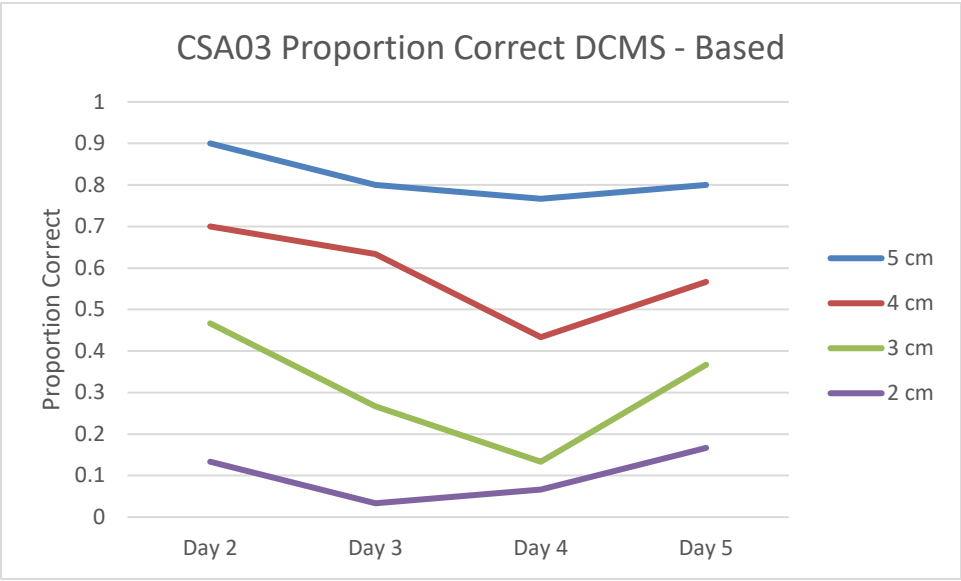

Figure B-50. Subject CSA03 Proportion Correct - DCMS Based

6.2.2 Conditional Accuracy Function Results

As Table B-42 indicates, the null hypothesis of a normal distribution was rejected for quantile 5. The boxplot in Figure B-51 does not provide information to the contrary. Bartlett's test produced a K^2 value of 11.659 and a p value of 0.02008, rejecting the null hypothesis of homoscedasticity. The Brunner-Dette-Munk test produced an F value of 0.7113653 and a p value of 0.577957, failing to reject the null hypothesis of equality of distribution functions. Because this null hypothesis was not rejected, it cannot be concluded that accuracy, as measured by 1/MPI to CZP distance, differed by time quantile on day 2.

Table B-42. Subject CSA03 Five Quantile Day 2 1/MPI to CZP Distance Shapiro-Wilk Test Results

Quantile	W	P-Value
1	0.8671	0.2148
2	0.897	0.3567
3	0.8717	0.2331
4	0.8672	0.2154
5	0.6632	0.0025

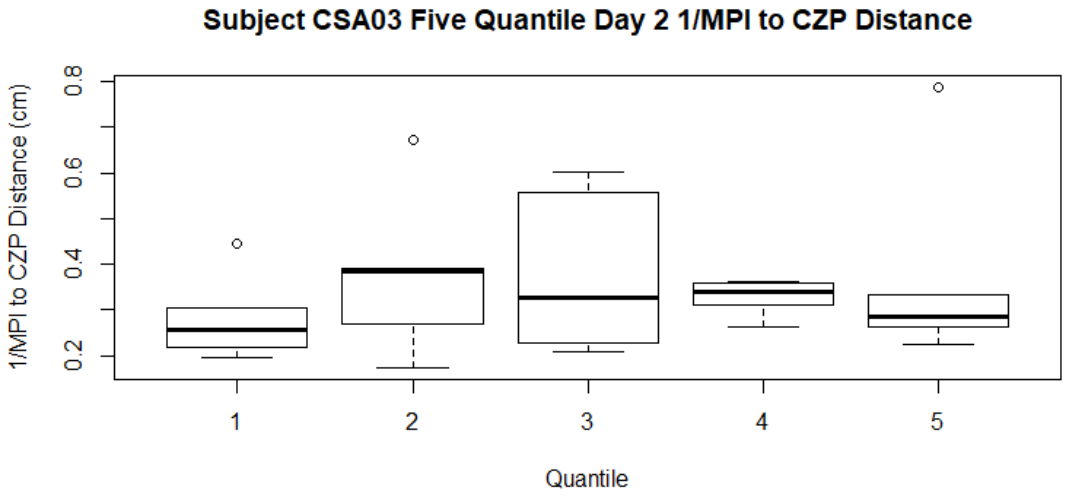

Figure B-51. Subject CSA03 Five Quantile Day 2 1/MPI to CZP Distance

As Table B-43 indicates, the null hypothesis of a normal distribution was rejected for quantile 5. The boxplot in Figure B-52 does not provide information to the contrary. Bartlett's test produced a K^2 value of 12.494 and a p value of 0.01403, rejecting the null hypothesis of homoscedasticity. The Brunner-Dette-Munk test produced an F value of 0.6815939 and a p value of 0.5968041, failing to reject the null hypothesis of equality of distribution functions. Because this null hypothesis was not rejected, it cannot be concluded that accuracy, as measured by 1/DCMS, differed by time quantile on day 2.

Table B-43. Subject CSA03 Five Quantile Day 2 1/DCMS Shapiro-Wilk Test Results

Quantile	W	P-Value
1	0.9351	0.6197
2	0.9111	0.4438
3	0.8565	0.1776
4	0.9721	0.9063
5	0.762	0.026

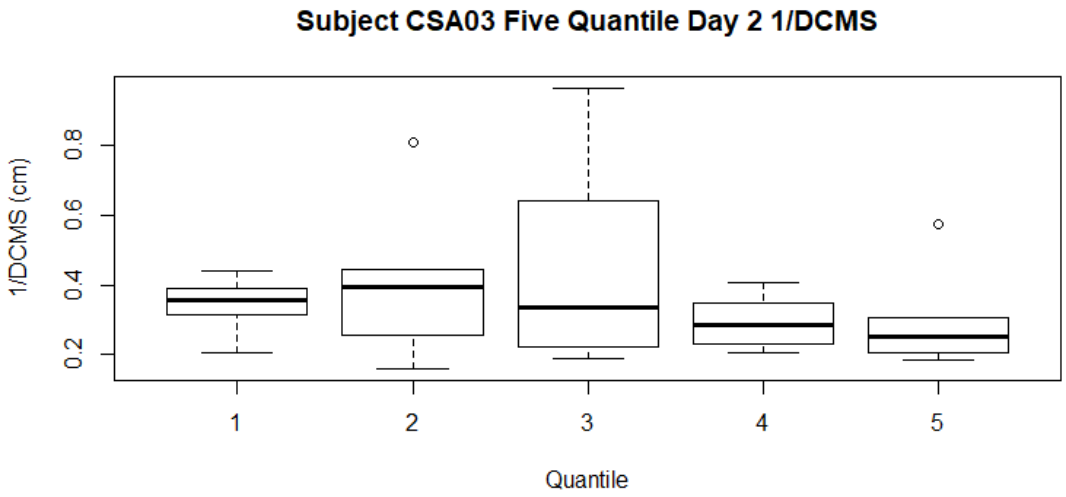

Figure B-52. Subject CSA03 Five Quantile Day 2 1/DCMS

As Table B-44 indicates, the null hypothesis of a normal distribution was rejected for quantile 2. The boxplot in Figure B-53 does not provide information to the contrary. Bartlett's test produced a K^2 value of 2.2259 and a p value of 0.6943, failing to reject the null hypothesis of homoscedasticity. The Kruskal-Wallis test produced a X^2 value of 3.6602 and a p value of 0.4539, failing to reject the null hypothesis of equality of dataset medians. Because this null hypothesis was not rejected, it cannot be concluded that accuracy, as measured by 1/MPI to CZP distance, differed by time quantile on day 3.

Table B-44. Subject CSA03 Five Quantile Day 3 1/MPI to CZP Distance Shapiro-Wilk Test Results

Quantile	W	P-Value
1	0.8594	0.187
2	0.7847	0.0426
3	0.9253	0.5445
4	0.848	0.1516
	245	

5	0.9441	0.6922

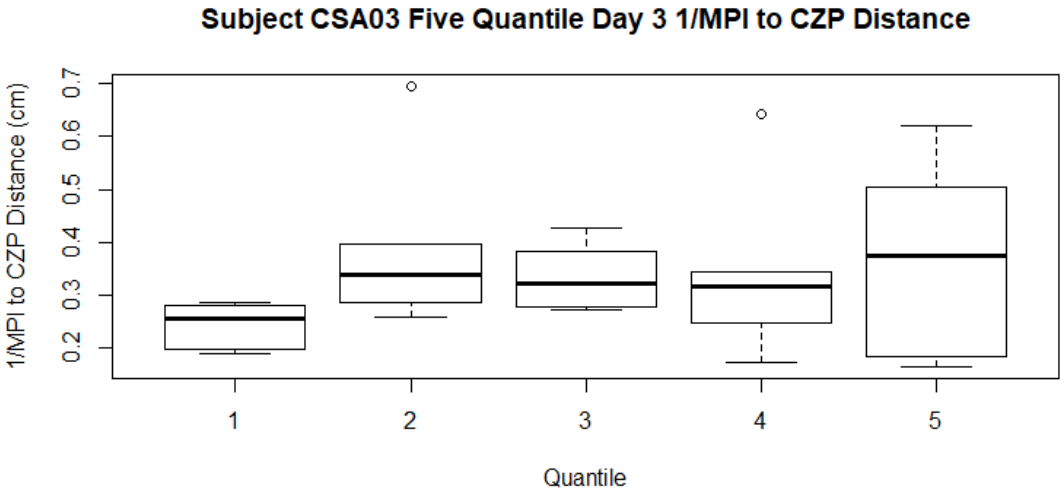

Figure B-53. Subject CSA03 Five Quantile Day 3 1/MPI to CZP Distance

As Table B-45 indicates, the null hypothesis of a normal distribution was rejected for quantiles 2 and 3. The boxplot in Figure B-54 does not provide information to the contrary. Bartlett's test produced a K^2 value of 5.3662 and a p value of 0.2517, failing reject the null hypothesis of homoscedasticity. The Kruskal-Wallis test produced a X^2 value of 3.4882 and a p value of 0.4797, failing to reject the null hypothesis of equality of dataset medians. Because this null hypothesis was not rejected, it cannot be concluded that accuracy, as measured by 1/DCMS, differed by time quantile on day 3.

Table B-45. Subject CSA03 Five Quantile Day 3 1/DCMS Shapiro-Wilk Test Results

Quantile	W	P-Value
1	0.8917	0.3271
2	0.7068	0.0073
3	0.7837	0.0417
4	0.9242	0.536
5	0.801	0.06

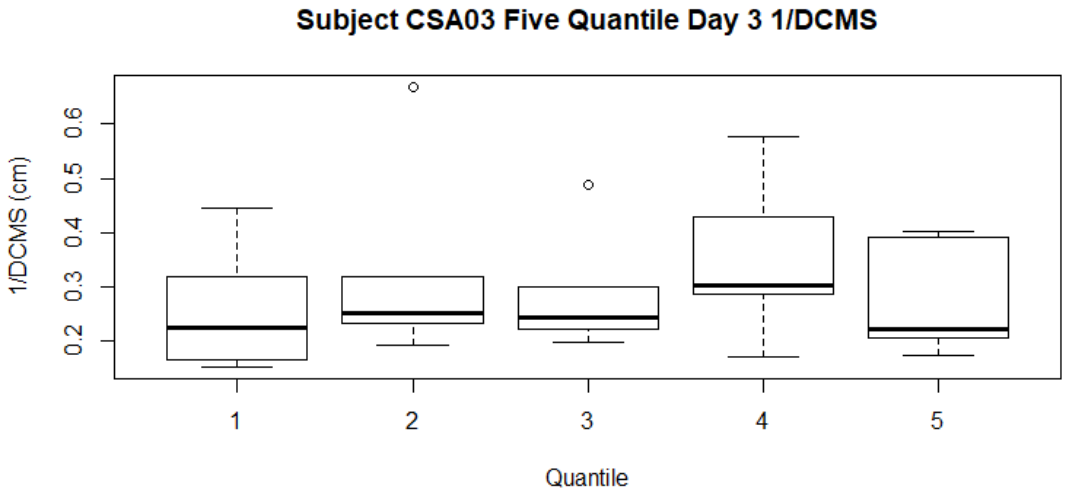

Figure B-54. Subject CSA03 Five Quantile Day 3 1/DCMS

As Table B-46 indicates, the null hypothesis of a normal distribution was rejected for quantile 5. The boxplot in Figure B-55 does not provide information to the contrary. Bartlett's test produced a K^2 value of 10.304 and a p value of 0.03561, rejecting the null hypothesis of homoscedasticity. The Brunner-Dette-Munk test produced an F value of 0.8330532 and a p value of 0.5124386, failing to reject the null hypothesis of equality of distribution functions. Because this null hypothesis was not rejected, it cannot be concluded that accuracy, as measured by 1/MPI to CZP distance, differed by time quantile on day 4.

Table B-46. Subject CSA03 Five Quantile Day 4 1/MPI to CZP Distance Shapiro-Wilk Test Results

Quantile	W	P-Value
1	0.9835	0.9676
2	0.8836	0.286
3	0.8001	0.0588
4	0.8783	0.2612
5	0.6162	0.0007

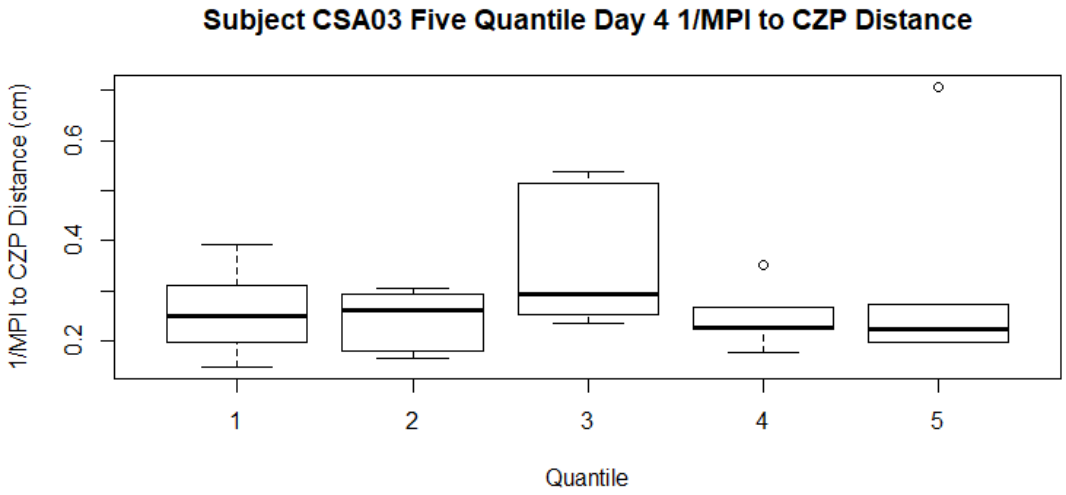

Figure B-55. Subject CSA03 Five Quantile Day 4 1/MPI to CZP Distance

As Table B-47 indicates, the null hypothesis of a normal distribution was rejected for quantile 1. The boxplot in Figure B-56 does not provide information to the contrary. Bartlett's test produced a K^2 value of 14.334 and a p value of 0.006302, rejecting the null hypothesis of homoscedasticity. The Brunner-Dette-Munk test produced an F value of 0.7857501 and a p value of 0.5335947, failing to reject the null hypothesis of equality of distribution functions. Because this null hypothesis was not rejected, it cannot be concluded that accuracy, as measured by 1/DCMS, differed by time quantile on day 4.

Table B-47. Subject CSA03 Five Quantile Day 4 1/DCMS Shapiro-Wilk Test Results

Quantile	W	P-Value
1	0.748	0.019
2	0.8766	0.2537
3	0.9425	0.6792
4	0.9374	0.6379
5	0.8614	0.1941

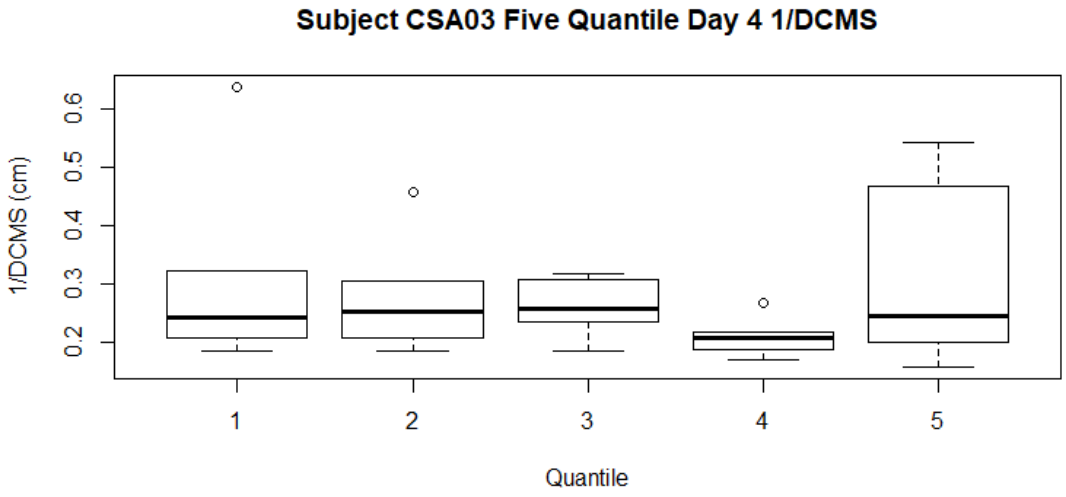

Figure B-56. Subject CSA03 Five Quantile Day 4 1/DCMS

As Table B-48 indicates, the null hypothesis of a normal distribution was not rejected for any quantiles. The boxplot in Figure B-57 is not, however, indicative of a normal distribution. Bartlett's test produced a K^2 value of 15.556 and a p value of 0.008232, rejecting the null hypothesis of homoscedasticity. The Brunner-Dette-Munk test produced an F value of 0.7904519 and a p value of 0.5384977, failing to reject the null hypothesis of equality of distribution functions. Because this null hypothesis was not rejected, it cannot be concluded that accuracy, as measured by 1/MPI to CZP distance, differed by time quantile on day 5.

Table B-48. Subject CSA03 Five Quantile Day 5 1/MPI to CZP Distance Shapiro-Wilk Test Results

Quantile	W	P-Value
1	0.8507	0.1595
2	0.8176	0.0841
3	0.937	0.635
4	0.9382	0.6449
5	0.8949	0.3449

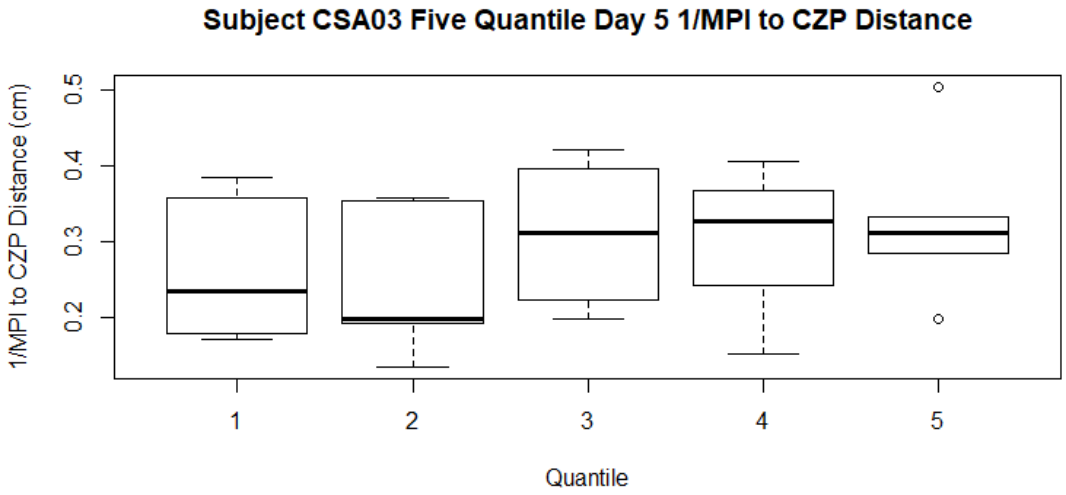

Figure B-57. Subject CSA03 Five Quantile Day 5 1/MPI to CZP Distance

As Table B-49 indicates, the null hypothesis of a normal distribution was rejected for quantile 4. The boxplot in Figure B-58 does not provide information to the contrary. Bartlett's test produced a K^2 value of 5.7509 and a p value of 0.2222, failing to reject the null hypothesis of homoscedasticity. The Kruskal-Wallis test produced a X^2 value of 3.5871 and a p value of 0.4648, failing to reject the null hypothesis of equality of dataset medians. Because this null hypothesis was not rejected, it cannot be concluded that accuracy, as measured by 1/DCMS, differed by time quantile on day 5.

Table B-49. Subject CSA03 Five Quantile Day 5 1/DCMS Shapiro-Wilk Test Results

Quantile	W	P-Value
1	0.794	0.0518
2	0.8917	0.3272
3	0.8717	0.2331
4	0.787	0.0448
5	0.8292	0.1059

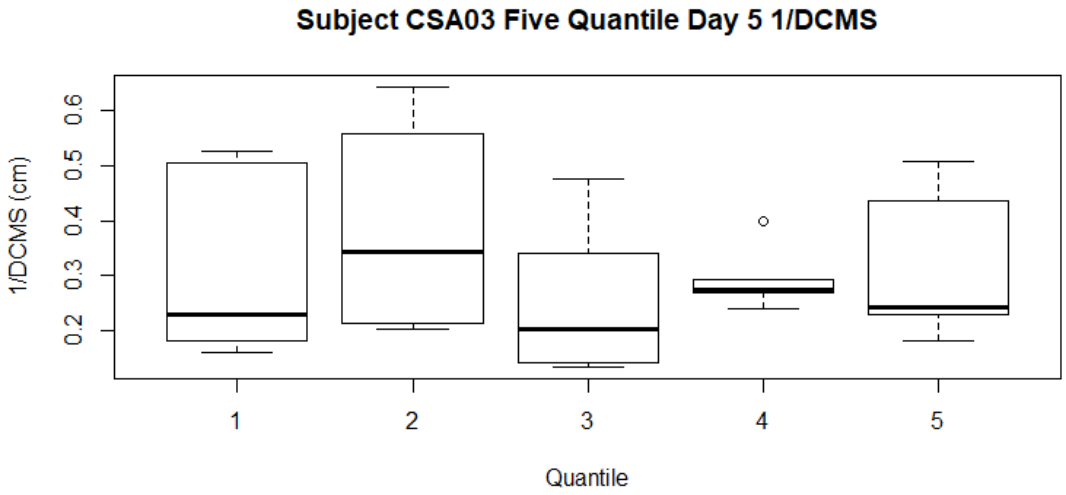

Figure B-58. Subject CSA03 Five Quantile Day 5 1/DCMS

As Table B-50 indicates, the null hypothesis of a normal distribution was rejected for quantile 6. The boxplot in Figure B-59 does not provide information to the contrary. Bartlett's test produced a K^2 value of 16.578 and a p value of 0.005373, rejecting the null hypothesis of homoscedasticity. The Brunner-Dette-Munk test produced an F value of 0.3607348 and a p value of 0.8337162, failing to reject the null hypothesis of equality of distribution functions. Because this null hypothesis was not rejected, it cannot be concluded that accuracy, as measured by 1/MPI to CZP distance, differed by time quantile on day 2.

Table B-50. Subject CSA03 Six Quantile Day 2 1/MPI to CZP Distance Shapiro-Wilk Test Results

Quantile	W	P-Value
1	0.917	0.511
2	0.9051	0.4385
3	0.9022	0.422
4	0.948	0.7228
5	0.9052	0.4393
6	0.6996	0.0095

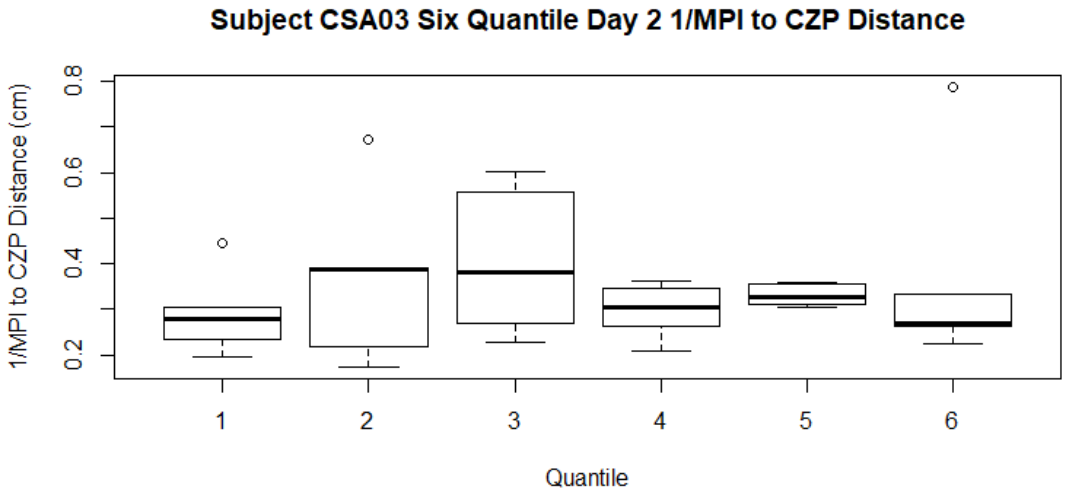

Figure B-59. Subject CSA03 Six Quantile Day 2 1/MPI to CZP Distance

As Table B-51 indicates, the null hypothesis of a normal distribution was rejected for quantile 6. The boxplot in Figure B-60 does not provide information to the contrary. Bartlett's test produced a K^2 value of 12.291 and a p value of 0.03102, rejecting the null hypothesis of homoscedasticity. The Brunner-Dette-Munk test produced an F value of 1.563851 and a p value of 0.2128644, failing to reject the null hypothesis of equality of distribution functions. Because this null hypothesis was not rejected, it cannot be concluded that accuracy, as measured by 1/DCMS, differed by time quantile on day 2.

Table B-51. Subject CSA03 Six Quantile Day 2 1/DCMS Shapiro-Wilk Test Results

Quantile	W	P-Value
1	0.9571	0.7877
2	0.9773	0.9195
3	0.9834	0.9521
4	0.9144	0.4944
5	0.9589	0.8004
6	0.7155	0.0138

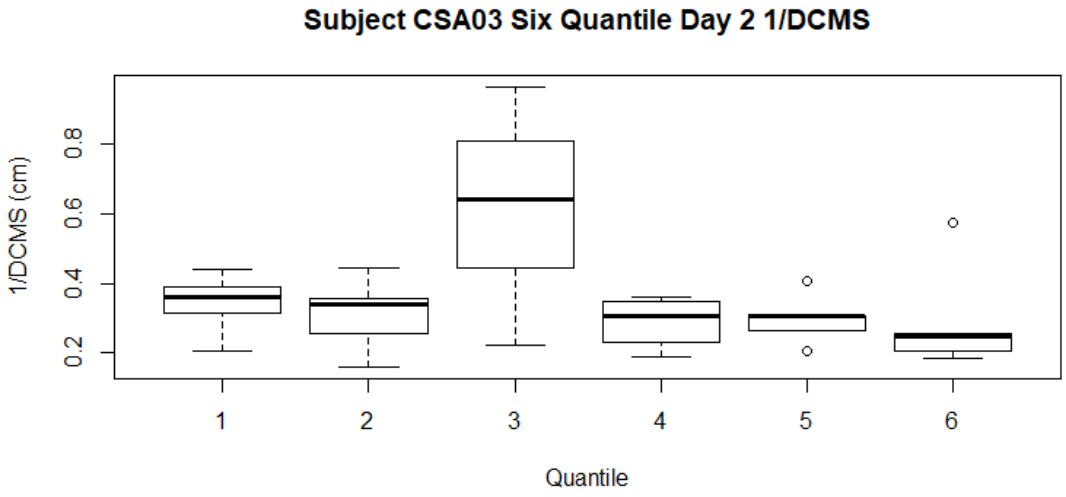

Figure B-60. Subject CSA03 Six Quantile Day 2 1/DCMS

As Table B-52 indicates, the null hypothesis of a normal distribution was rejected for quantile 2. The boxplot in Figure B-61 does not provide information to the contrary. Bartlett's test produced a K^2 value of 6.7722 and a p value of 0.2381, failing to reject the null hypothesis of homoscedasticity. The Kruskal-Wallis test produced a X^2 value of 9.0258 and a p value of 0.108, failing to reject the null hypothesis of equality of dataset medians. Because this null hypothesis was not rejected, it cannot be concluded that accuracy, as measured by 1/MPI to CZP distance, differed by time quantile on day 3.

Table B-52. Subject CSA03 Six Quantile Day 3 1/MPI to CZP Distance Shapiro-Wilk Test Results

Quantile	W	P-Value
1	0.9013	0.4172
2	0.715	0.0136
3	0.932	0.61
4	0.9755	0.909
5	0.8722	0.2754
6	0.9193	0.5254

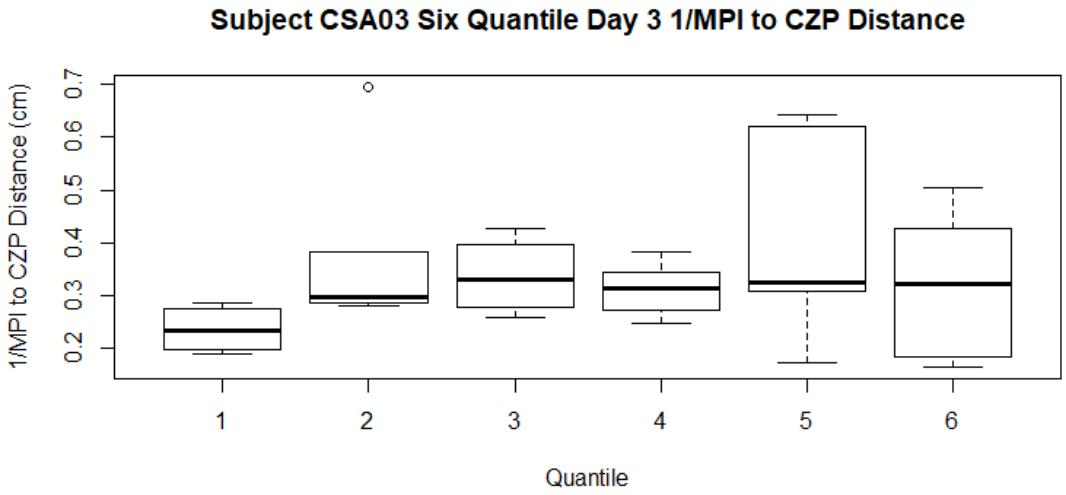

Figure B-61. Subject CSA03 Six Quantile Day 3 1/MPI to CZP Distance

As Table B-53 indicates, the null hypothesis of a normal distribution was rejected for quantiles 3, 4 and 6. The boxplot in Figure B-62 does not provide information to the contrary. Bartlett's test produced a K^2 value of 6.0796 and a p value of 0.2985, failing to reject the null hypothesis of homoscedasticity. The Kruskal-Wallis test produced a X^2 value of 4.3497 and a p value of 0.5002, failing to reject the null hypothesis of equality of dataset medians. Because this null hypothesis was not rejected, it cannot be concluded that accuracy, as measured by 1/DCMS, differed by time quantile on day 3.

Table B-53. Subject CSA03 Six Quantile Day 3 1/DCMS Shapiro-Wilk Test Results

Quantile	W	P-Value
1	0.8111	0.0995
2	0.8031	0.0858
3	0.7635	0.0395
4	0.7552	0.0332
5	0.8884	0.3493
6	0.7708	0.0459

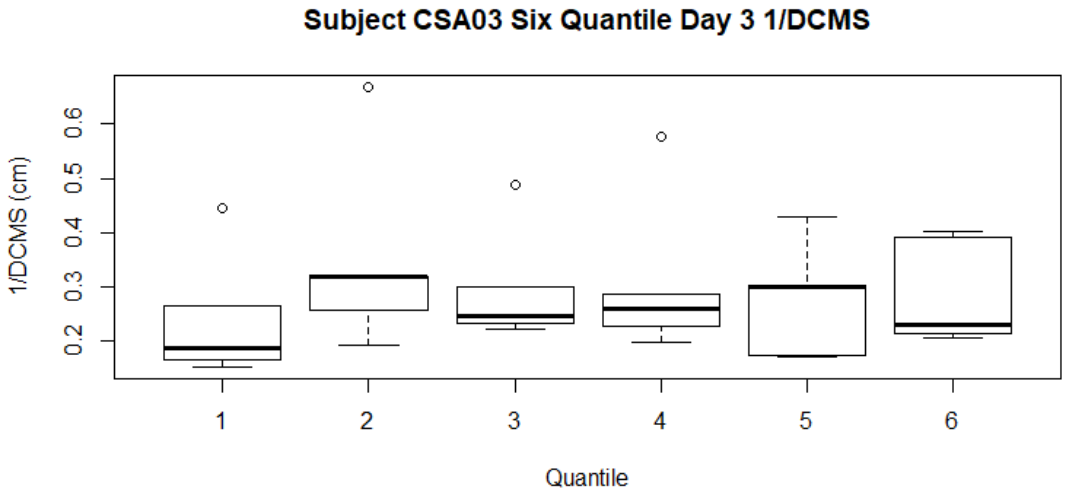

Figure B-62. Subject CSA03 Six Quantile Day 3 1/DCMS

As Table B-54 indicates, the null hypothesis of a normal distribution was rejected for quantile 6. The boxplot in Figure B-63 does not provide information to the contrary. Bartlett's test produced a K^2 value of 15.556 and a p value of 0.008232, rejecting the null hypothesis of homoscedasticity. The Brunner-Dette-Munk test produced an F value of 0.860021 and a p value of 0.5154562, failing to reject the null hypothesis of equality of distribution functions. Because this null hypothesis was not rejected, it cannot be concluded that accuracy, as measured by 1/MPI to CZP distance, differed by time quantile on day 4.

Table B-54. Subject CSA03 Six Quantile Day 4 1/MPI to CZP Distance Shapiro-Wilk Test Results

Quantile	W	P-Value
1	0.964	0.8357
2	0.9066	0.4475
3	0.8752	0.288
4	0.8638	0.2421
5	0.9686	0.8664
6	0.6724	0.0048

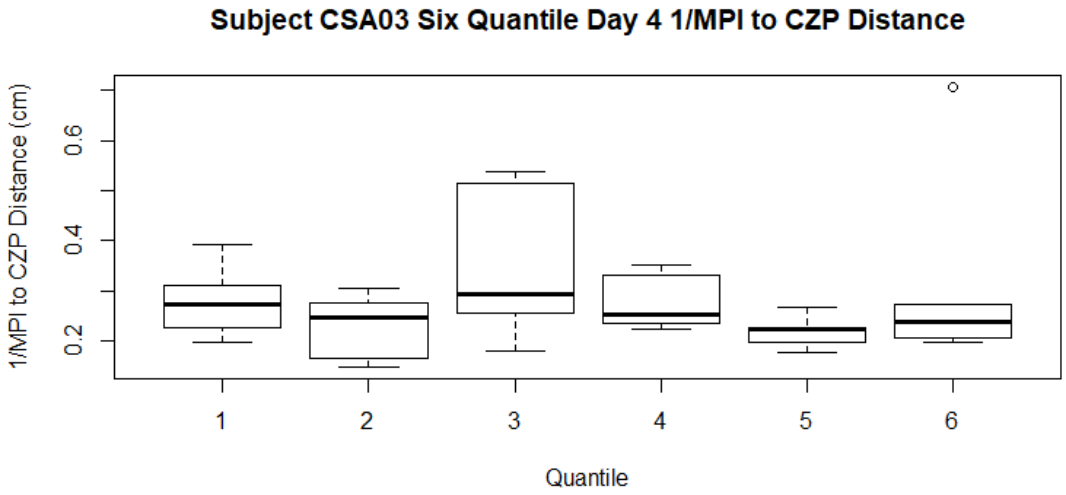

Figure B-63. Subject CSA03 Six Quantile Day 4 1/MPI to CZP Distance

As Table B-55 indicates, the null hypothesis of a normal distribution was rejected for quantiles 3, 4 and 6. The boxplot in Figure B-64 does not provide information to the contrary. Bartlett's test produced a K^2 value of 14.837 and a p value of 0.01108, rejecting the null hypothesis of homoscedasticity. The Brunner-Dette-Munk test produced an F value of 0.6573047 and a p value of 0.6346021, failing to reject the null hypothesis of equality of distribution functions. Because this null hypothesis was not rejected, it cannot be concluded that accuracy, as measured by 1/DCMS, differed by time quantile on day 4.

Table B-55. Subject CSA03 Six Quantile Day 4 1/DCMS Shapiro-Wilk Test Results

Quantile	W	P-Value
1	0.8111	0.0995
2	0.8031	0.0858
3	0.7635	0.0395
4	0.7552	0.0332
5	0.8884	0.3493
6	0.7708	0.0459

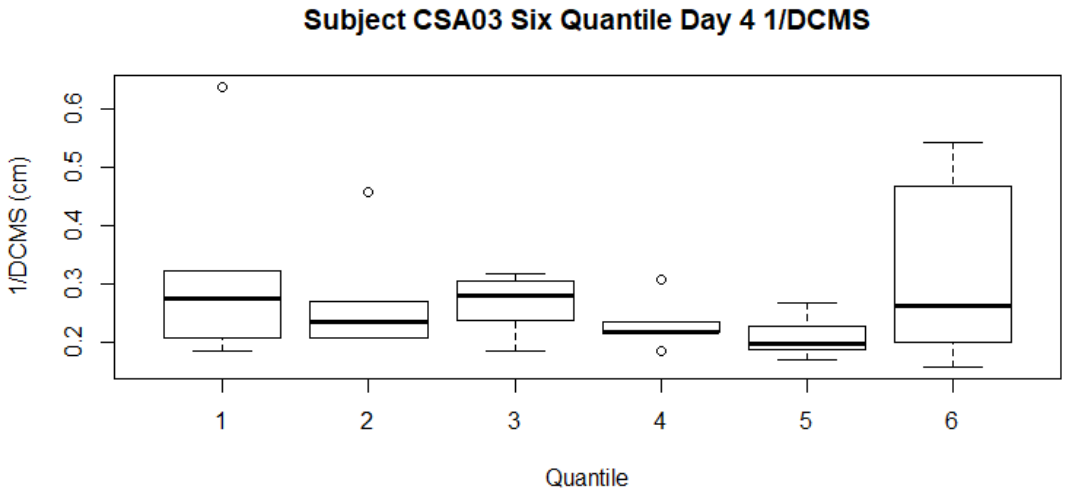

Figure B-64. Subject CSA03 Six Quantile Day 4 1/DCMS

As Table B-56 indicates, the null hypothesis of a normal distribution was not rejected for any quantiles. The boxplot in Figure B-65 is not, however, indicative of a normal distribution. Bartlett's test produced a K^2 value of 0.58913 and a p value of 0.9885, failing to reject the null hypothesis of homoscedasticity. The Kruskal-Wallis test produced a X^2 value of 2.8684 and a p value of 0.7203, failing to reject the null hypothesis of equality of dataset medians. Because this null hypothesis was not rejected, it cannot be concluded that accuracy, as measured by 1/MPI to CZP distance, differed by time quantile on day 5.

Table B-56. Subject CSA03 Six Quantile Day 5 1/MPI to CZP Distance Shapiro-Wilk Test Results

Quantile	W	P-Value
1	0.8894	0.3542
2	0.8261	0.1299
3	0.8272	0.1326
4	0.8883	0.3489
5	0.9936	0.9906
6	0.9287	0.5872

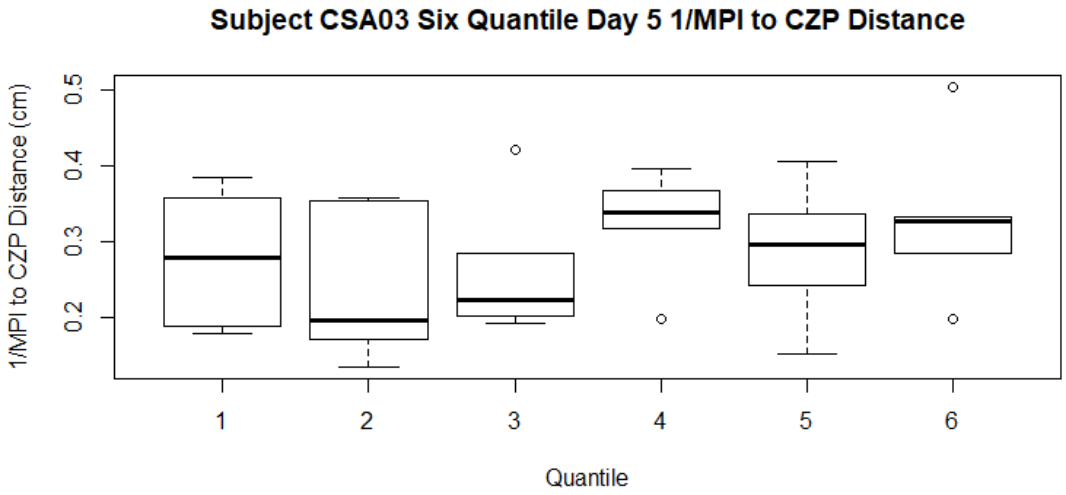

Figure B-65. Subject CSA03 Six Quantile Day 5 1/MPI to CZP Distance

As Table B-57 indicates, the null hypothesis of a normal distribution was not rejected for any quantiles. The boxplot in Figure B-66 is not, however, indicative of a normal distribution. Bartlett's test produced a K^2 value of 16.741 and a p value of 0.005017, rejecting the null hypothesis of homoscedasticity. The Brunner-Dette-Munk test produced an F value of 1.698795 and a p value of 0.198044, failing to reject the null hypothesis of equality of distribution functions. Because this null hypothesis was not rejected, it cannot be concluded that accuracy, as measured by 1/DCMS, differed by time quantile on day 5.

Table B-57. Subject CSA03 Six Quantile Day 5 1/DCMS Shapiro-Wilk Test Results

Quantile	W	P-Value
1	0.8086	0.095
2	0.9482	0.7246
3	0.9074	0.4519
4	0.9827	0.9486
5	0.9146	0.4958
6	0.8771	0.2964

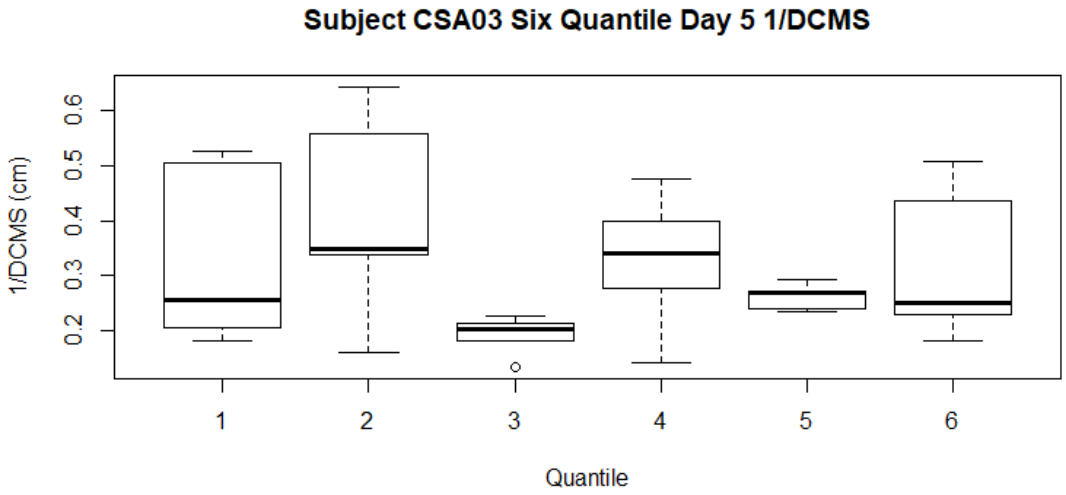

Figure B-66. Subject CSA034 Six Quantile Day 5 1/DCMS

6.2.3 Quantile Analysis

As Table B-58 indicates, the null hypothesis of a normal distribution was not rejected for any days. The boxplot in Figure B-67 is not, however, indicative of a normal distribution. Bartlett's test produced a K^2 value of 0.60462 and a p value of 0.8954, failing to reject the null hypothesis of homoscedasticity. The Kruskal-Wallis test produced a X^2 value of 0.42 and a p value of 0.9361, failing to reject the null hypothesis of equality of dataset medians. Because this null hypothesis was not rejected, it cannot be concluded that accuracy, as measured by the first quantile of 1/MPI to CZP distance changed over the 4 days of firing.

Table B-58. Subject CSA03 Quantile 1 of 5 1/MPI to CZP Distance Shapiro-Wilk Test Results

Day	W	P-Value
2	0.86709	0.21484
3	0.85938	0.18703
4	0.98349	0.96755
5	0.85071	0.15951

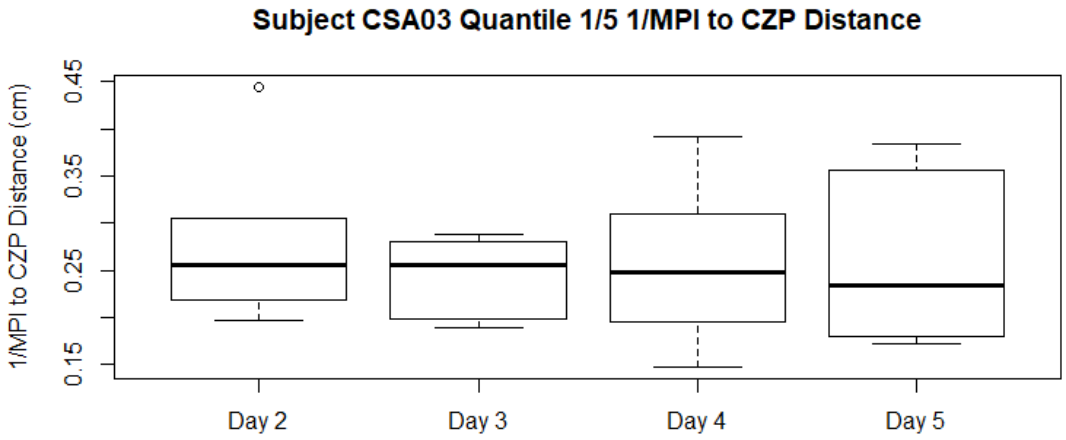

Figure B-67. Subject CSA03 Quantile 1 of 5 1/MPI to CZP Distance

As Table B-59 indicates, the null hypothesis of a normal distribution was rejected for day 3. The boxplot in Figure B-68 does not provide information to the contrary. Bartlett's test produced a K^2 value of 5.3374 and a p value of 0.1487, failing to reject the null hypothesis of homoscedasticity. The Kruskal-Wallis test produced a X^2 value of 3.98 and a p value of 0.2636, failing to reject the null hypothesis of equality of dataset medians. Because this null hypothesis was not rejected, it cannot be concluded that accuracy, as measured by the second quantile of 1/MPI to CZP distance changed over the 4 days of firing.

Table B-59. Subject CSA03 Quantile 2 of 5 1/MPI to CZP Distance Shapiro-Wilk Test Results

Day	W	P-Value
2	0.89704	0.35675
3	0.78471	0.04263
4	0.88359	0.28595
5	0.81759	0.0841

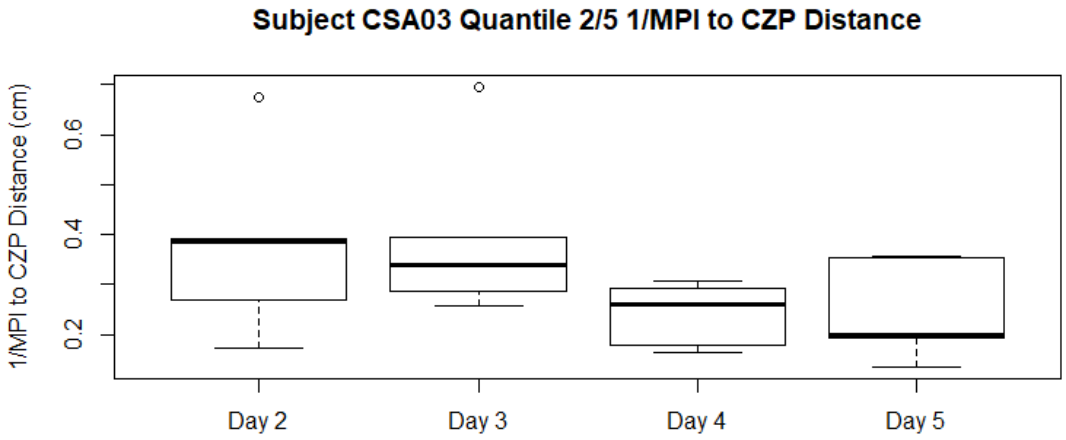

Figure B-68. Subject CSA03 Quantile 2 of 5 1/MPI to CZP Distance

As Table B-60 indicates, the null hypothesis of a normal distribution was not rejected for any days. The boxplot in Figure B-69 is not, however, indicative of a normal distribution. Bartlett's test produced a K^2 value of 5.143 and a p value of 0.1616, failing to reject the null hypothesis of homoscedasticity. The Kruskal-Wallis test produced a X^2 value of 1.5933 and a p value of 0.6609, failing to reject the null hypothesis of equality of dataset medians. Because this null hypothesis was not rejected, it cannot be concluded that accuracy, as measured by the third quantile of 1/MPI to CZP distance changed over the 4 days of firing.

Table B-60. Subject CSA03 Quantile 3 of 5 1/MPI to CZP Distance Shapiro-Wilk Test Results

Day	W	P-Value
2	0.87171	0.23313
3	0.92533	0.54454
4	0.80006	0.05885
5	0.93699	0.63503

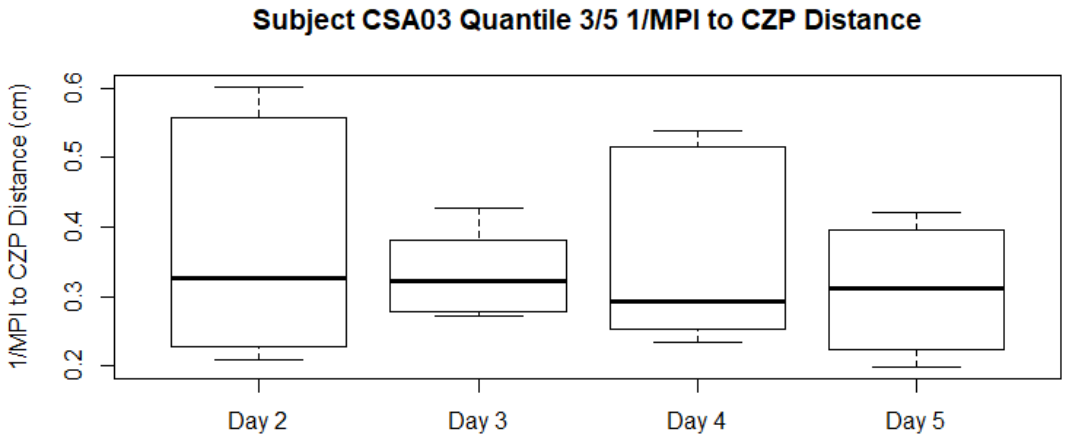

Figure B-69. Subject CSA03 Quantile 3 of 5 1/MPI to CZP Distance

As Table B-61 indicates, the null hypothesis of a normal distribution was not rejected for any days. The boxplot in Figure B-70 is not, however, indicative of a normal distribution. Bartlett's test produced a K^2 value of 3.8544 and a p value of 0.2776, failing to reject the null hypothesis of homoscedasticity. The Kruskal-Wallis test produced a X^2 value of 5.66 and a p value of 0.1294, failing to reject the null hypothesis of equality of dataset medians. Because this null hypothesis was not rejected, it cannot be concluded that accuracy, as measured by the fourth quantile of 1/MPI to CZP distance changed over the 4 days of firing.

Table B-61. Subject CSA03 Quantile 4 of 5 1/MPI to CZP Distance Shapiro-Wilk Test Results

Day	W	P-Value
2	0.86723	0.21538
3	0.84799	0.1516
4	0.87827	0.26122
5	0.93822	0.64492

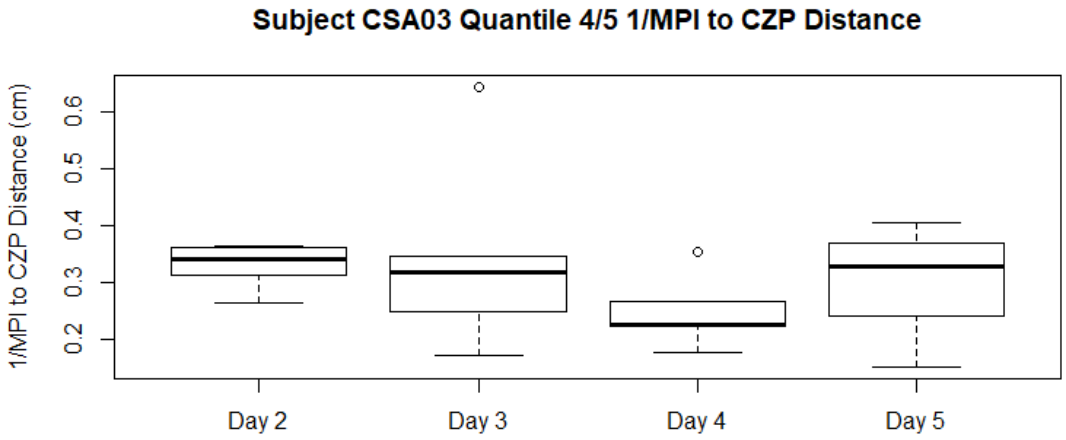

Figure B-70. Subject CSA03 Quantile 4 of 5 1/MPI to CZP Distance

As Table B-62 indicates, the null hypothesis of a normal distribution was rejected for days 2 and 4. The boxplot in Figure B-71 does not provide information to the contrary. Bartlett's test produced a K^2 value of 4.8688 and a p value of 0.1817, failing to reject the null hypothesis of homoscedasticity. The Kruskal-Wallis test produced a X^2 value of 3.0867 and a p value of 0.3785, failing to reject the null hypothesis of equality of dataset medians. Because this null hypothesis was not rejected, it cannot be concluded that accuracy, as measured by the fifth quantile of 1/MPI to CZP distance changed over the 4 days of firing.

Table B-62. Subject CSA03 Quantile 5 of 5 1/MPI to CZP Distance Shapiro-Wilk Test Results

Day	W	P-Value
2	0.66324	0.00248
3	0.94408	0.69224
4	0.61624	0.00072
5	0.89494	0.34489

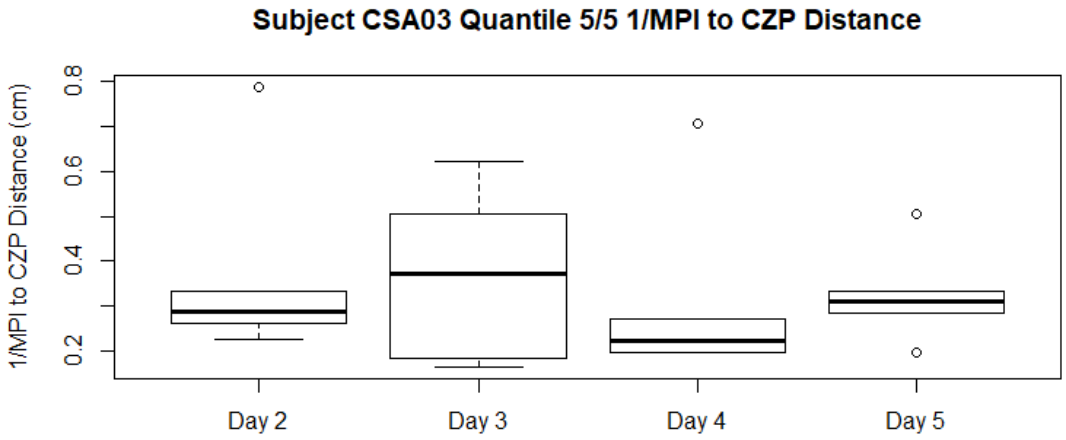

Figure B-71. Subject CSA03 Quantile 5 of 5 1/MPI to CZP Distance

As Table B-63 indicates, the null hypothesis of a normal distribution was rejected for day 4. The boxplot in Figure B-72 does not provide information to the contrary. Bartlett's test produced a K^2 value of 5.5446 and a p value of 0.136, failing to reject the null hypothesis of homoscedasticity. The Kruskal-Wallis test produced a X^2 value of 2.26 and a p value of 0.5202, failing to reject the null hypothesis of equality of dataset medians. Because this null hypothesis was not rejected, it cannot be concluded that accuracy, as measured by the first quantile of 1/DCMS changed over the 4 days of firing.

Table B-63. Subject CSA03 Quantile 1 of 5 1/DCMS Shapiro-Wilk Test Results

Day	W	P-Value
2	0.93506	0.61967
3	0.89168	0.32708
4	0.748	0.01904
5	0.79395	0.05182

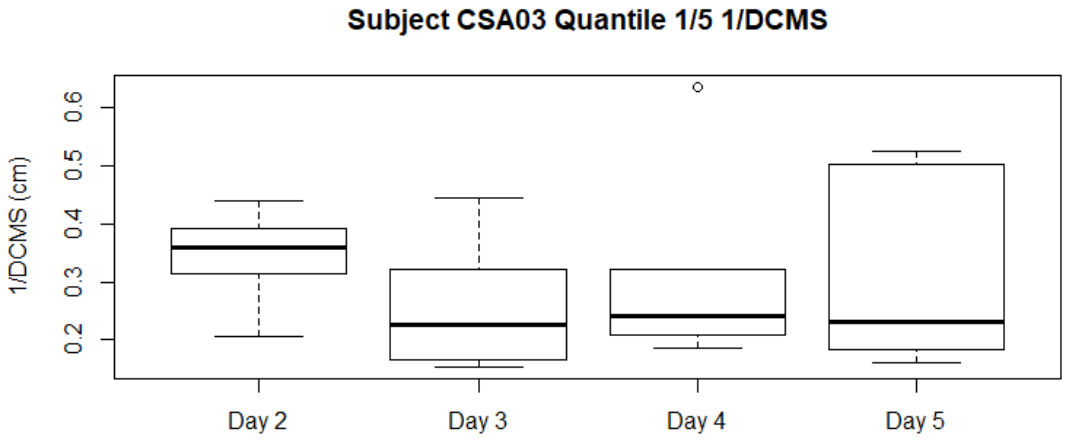

Figure B-72. Subject CSA03 Quantile 1/5 1/DCMS

As Table B-64 indicates, the null hypothesis of a normal distribution was rejected for day 3. The boxplot in Figure B-73 does not provide information to the contrary. Bartlett's test produced a K^2 value of 5.299 and a p value of 0.1512, failing to reject the null hypothesis of homoscedasticity. The Kruskal-Wallis test produced a X^2 value of 3.84 and a p value of 0.2793, failing to reject the null hypothesis of equality of dataset medians. Because this null hypothesis was not rejected, it cannot be concluded that accuracy, as measured by the second quantile of 1/DCMS changed over the 4 days of firing.

Table B-64. Subject CSA03 Quantile 2 of 5 1/DCMS Shapiro-Wilk Test Results

Day	W	P-Value
2	0.91112	0.44378
3	0.70678	0.00728
4	0.87659	0.25375
5	0.8917	0.32717

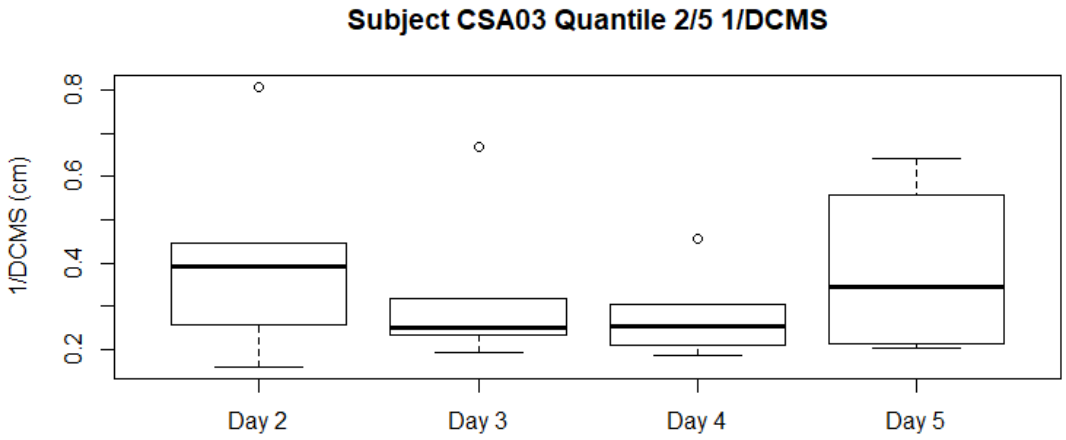

Figure B-73. Subject CSA03 Quantile 2 of 5 1/DCMS

As Table B-65 indicates, the null hypothesis of a normal distribution was rejected for day 3. The boxplot in Figure B-74 does not provide information to the contrary. Bartlett's test produced a K^2 value of 14.909 and a p value of 0.001897, rejecting the null hypothesis of homoscedasticity. The Brunner-Dette-Munk test produced an F value of 0.9416694 and a p value of 0.4327972, failing to reject the null hypothesis of equality of distribution functions. Because this null hypothesis was not rejected, it cannot be concluded that accuracy, as measured by the third quantile of 1/DCMS changed over the 4 days of firing.

Table B-65. Subject CSA03 Quantile 3 of 5 1/DCMS Shapiro-Wilk Test Results

Day	W	P-Value
2	0.85653	0.17757
3	0.78371	0.04173
4	0.94247	0.67918
5	0.87171	0.2331

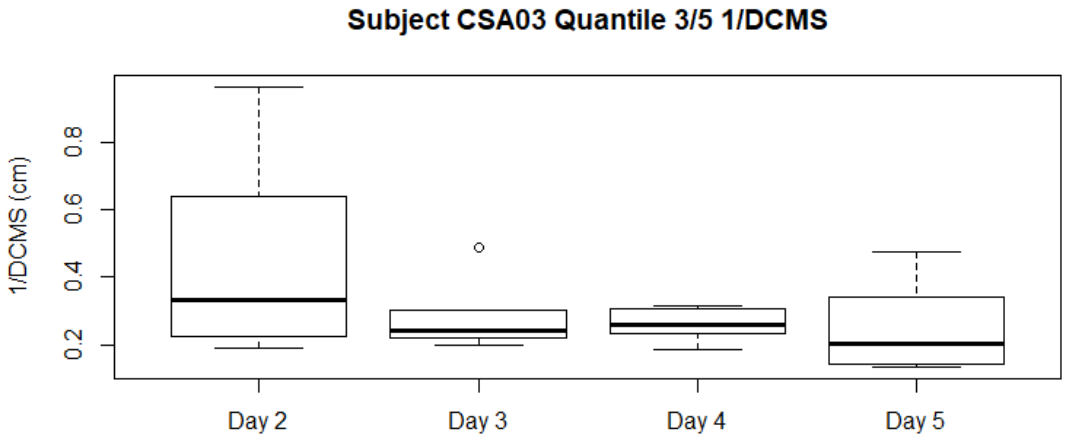

Figure B-74. Subject CSA03 Quantile 3 of 5 1/DCMS

As Table B-66 indicates, the null hypothesis of a normal distribution was rejected for day 5. The boxplot in Figure B-75 does not provide information to the contrary. Bartlett's test produced a K^2 value of 2.7396 and a p value of 0.4335, failing to reject the null hypothesis of homoscedasticity. The Kruskal-Wallis test produced a X^2 value of 8.58 and a p value of 0.03543, rejecting the null hypothesis of equality of dataset medians. Because this null hypothesis was rejected, it can be concluded that accuracy, as measured by the fourth quantile of 1/DCMS differed over the 4 days of firing. The differences, as shown in Table B-67, were between day 2 and day 4 and between day 4 and day 5. While significant, they are not progressive in nature and do not appear to be indicative of a trend.

Table B-66. Subject CSA03 Quantile 4 of 5 1/DCMS Shapiro-Wilk Test Results

Day	W	P-Value
2	0.97211	0.90628
3	0.92419	0.53603
4	0.93735	0.63794
5	0.78704	0.04479

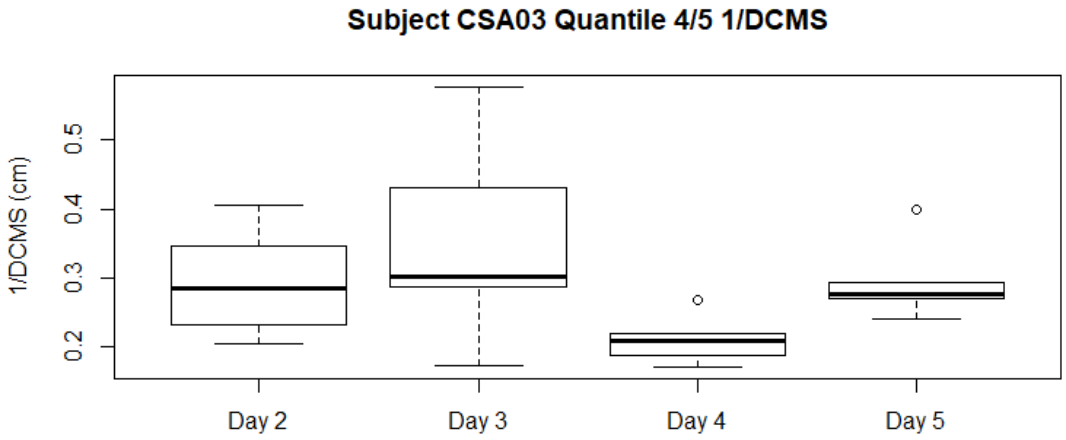

Figure B-75. Subject CSA03 Quantile 4 of 5 1/DCMS

Table B-67. Subject CSA03 Quantile 4 of 5 1/DCMS Dunn's Test Results

Days	Z	Adj. P-Value
2 & 3	0.4899	0.3121
2 & 4	2.32702	0.01
2 & 5	-0.3674	0.3567
3 & 4	1.83712	0.0331
3 & 5	-0.8573	0.1956
4 & 5	-2.6944	0.0035

As Table B-68 indicates, the null hypothesis of a normal distribution was rejected for day 2. The boxplot in Figure B-76 does not provide information to the contrary. Bartlett's test produced a K^2 value of 0.17181 and a p value of 0.982, failing to reject the null hypothesis of homoscedasticity. The Kruskal-Wallis test produced a X^2 value of 0.066667 and a p value of 0.9955, failing to reject the null hypothesis of equality of dataset medians. Because this null hypothesis was not rejected, it cannot be concluded that accuracy, as measured by the fifth quantile of 1/DCMS changed over the 4 days of firing.

Table B-68. Subject CSA03 Quantile 5 of 5 1/DCMS Shapiro-Wilk Test Results

Day	W	P-Value
2	0.76198	0.02603

3	0.80096	0.05996
4	0.86141	0.19406
5	0.82923	0.10588

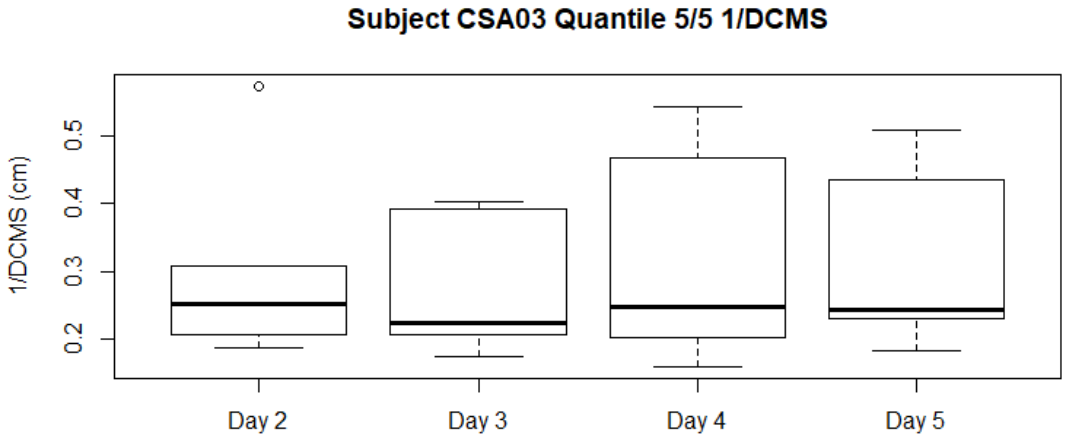

Figure B-76. Subject CSA03 Quantile 5 of 5 1/DCMS

As Table B-69 indicates, the null hypothesis of a normal distribution was not rejected for any days. The boxplot in Figure B-77 is not, however, indicative of a normal distribution. Bartlett's test produced a K^2 value of 0.93417 and a p value of 0.8172, failing to reject the null hypothesis of homoscedasticity. The Kruskal-Wallis test produced a X^2 value of 0.097143 and a p value of 0.9922, failing to reject the null hypothesis of equality of dataset medians. Because this null hypothesis was not rejected, it cannot be concluded that accuracy, as measured by the first quantile of 1/MPI to CZP distance changed over the 4 days of firing.

Table B-69. Subject CSA03 Quantile 1 of 6 1/MPI to CZP Distance Shapiro-Wilk Test Results

Day	W	P-Value
2	0.91703	0.51096
3	0.90131	0.41719
4	0.96403	0.83573
5	0.88941	0.35415

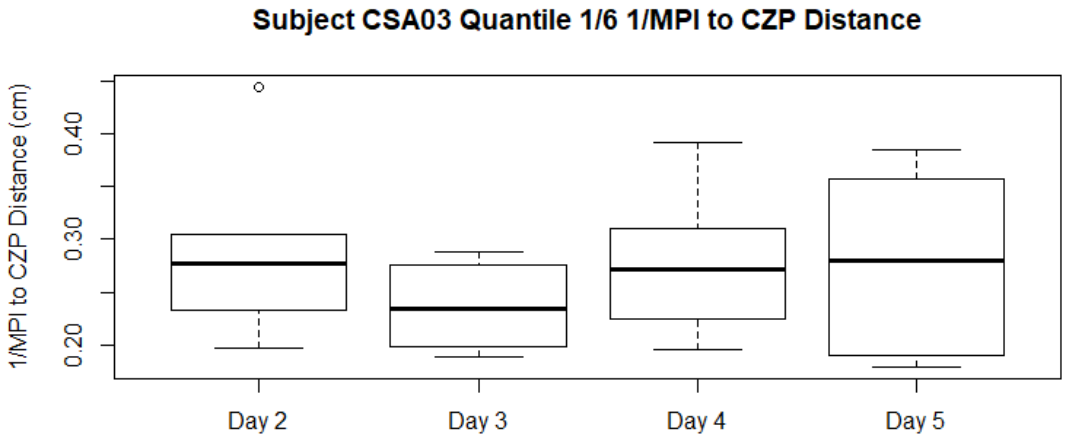

Figure B-77. Subject CSA03 Quantile 1 of 6 1/MPI to CZP Distance

As Table B-70 indicates, the null hypothesis of a normal distribution was rejected for day 3. The boxplot in Figure B-78 does not provide information to the contrary. Bartlett's test produced a K^2 value of 4.7996 and a p value of 0.1871, failing to reject the null hypothesis of homoscedasticity. The Kruskal-Wallis test produced a X^2 value of 3.08 and a p value of 0.3795, failing to reject the null hypothesis of equality of dataset medians. Because this null hypothesis was not rejected, it cannot be concluded that accuracy, as measured by the second quantile of 1/MPI to CZP distance changed over the 4 days of firing.

Table B-70. Subject CSA03 Quantile 2 of 6 1/MPI to CZP Distance Shapiro-Wilk Test Results

Day	W	P-Value
2	0.90507	0.43852
3	0.71496	0.01364
4	0.90661	0.44749
5	0.82607	0.12994

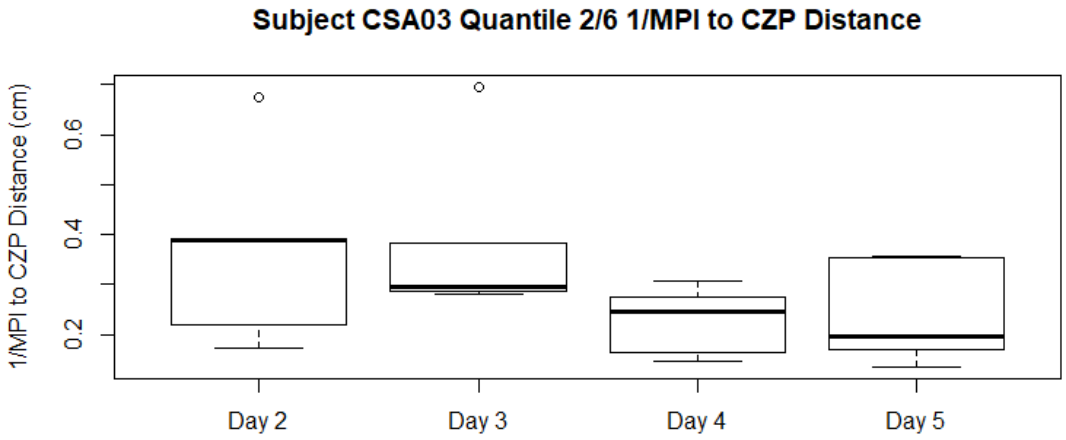

Figure B-78. Subject CSA03 Quantile 2 of 6 1/MPI to CZP Distance

As Table B-71 indicates, the null hypothesis of a normal distribution was not rejected for any days. The boxplot in Figure B-79 is not, however, indicative of a normal distribution. Bartlett's test produced a K^2 value of 6.4364 and a p value of 0.0922, failing to reject the null hypothesis of homoscedasticity. The Kruskal-Wallis test produced a X^2 value of 5.1714 and a p value of 0.1597, failing to reject the null hypothesis of equality of dataset medians. Because this null hypothesis was not rejected, it cannot be concluded that accuracy, as measured by the third quantile of 1/MPI to CZP distance changed over the 4 days of firing.

Table B-71. Subject CSA03 Quantile 3 of 6 1/MPI to CZP Distance Shapiro-Wilk Test Results

Day	W	P-Value
2	0.90217	0.422
3	0.93199	0.60999
4	0.87517	0.28801
5	0.82724	0.13263

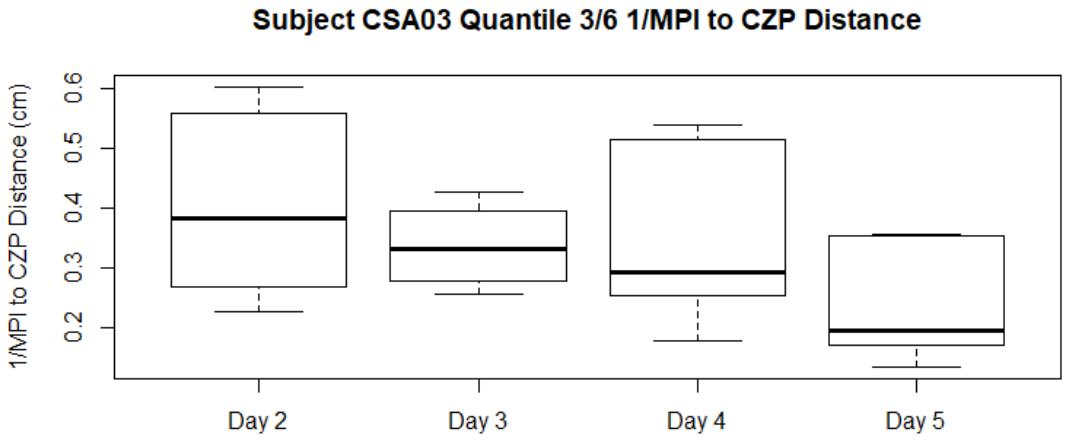

Figure B-79. Subject CSA03 Quantile 3 of 6 1/MPI to CZP Distance

As Table B-72 indicates, the null hypothesis of a normal distribution was not rejected for any days. The boxplot in Figure B-80 is not, however, indicative of a normal distribution. Bartlett's test produced a K^2 value of 1.2628 and a p value of 0.738, failing to reject the null hypothesis of homoscedasticity. The Kruskal-Wallis test produced a X^2 value of 1.7429 and a p value of 0.6274, failing to reject the null hypothesis of equality of dataset medians. Because this null hypothesis was not rejected, it cannot be concluded that accuracy, as measured by the fourth quantile of 1/MPI to CZP distance changed over the 4 days of firing.

Table B-72. Subject CSA03 Quantile 4 of 6 1/MPI to CZP Distance Shapiro-Wilk Test Results

Day	W	P-Value
2	0.94799	0.72282
3	0.97547	0.90903
4	0.86376	0.24207
5	0.88835	0.34886

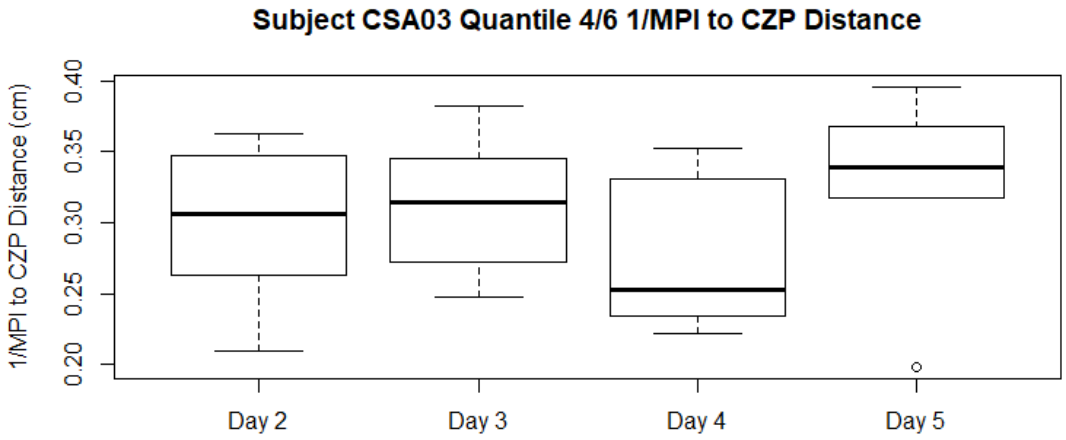

Figure B-80. Subject CSA03 Quantile 4 of 6 1/MPI to CZP Distance

As Table B-73 indicates, the null hypothesis of a normal distribution was not rejected for any days. The boxplot in Figure B-81 is not, however, indicative of a normal distribution. Bartlett's test produced a K^2 value of 8.401 and a p value of 0.03841, rejecting the null hypothesis of homoscedasticity. The Brunner-Dette-Munk test produced an F value of 4.5625 and a p value of 0.03809867, rejecting the null hypothesis of equality of distribution functions. As Table B-74 shows, significant differences were found between days 3 and 4. These differences were not significant or indicative of a trend.

Table B-73. Subject CSA03 Quantile 5 of 6 1/MPI to CZP Distance Shapiro-Wilk Test Results

Day	W	P-Value
2	0.90521	0.43935
3	0.87219	0.27541
4	0.96863	0.86638
5	0.99357	0.99059

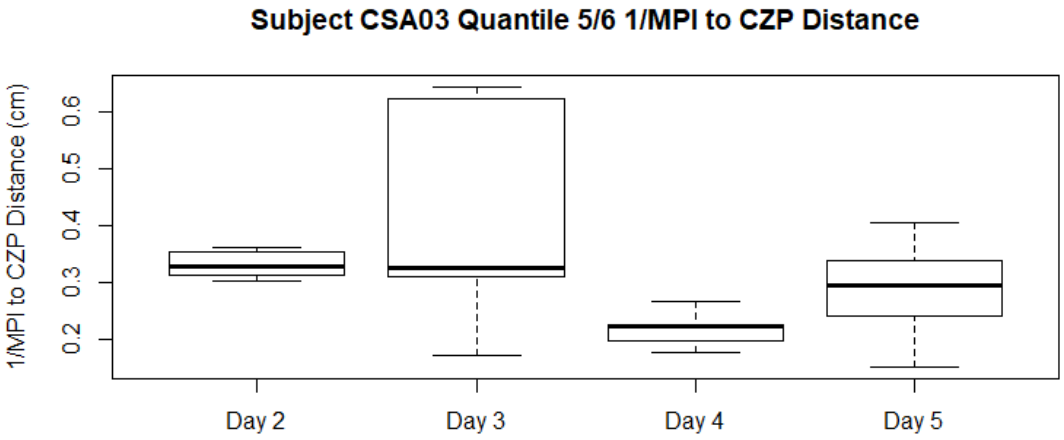

Figure B-81. Subject CSA03 Quantile 5 of 6 1/MPI to CZP Distance

Table B-74. Subject CSA03 Quantile 5 of 6 1/MPI to CZP Distance REGWQ Test Results

Days	Statistic	Adj. P-Value	CI
2 & 3	1.1258	0.4376	0.0357
2 & 4	3.573	0.0554	0.1133
2 & 5	1.4227	0.3294	0.0451
3 & 4	4.6987	0.0202	0.149
3 & 5	2.5485	0.2005	0.0808
4 & 5	2.1502	0.1479	0.0682

As Table B-75 indicates, the null hypothesis of a normal distribution was rejected for days 2 and 4. The boxplot in Figure B-82 does not provide information to the contrary. Bartlett's test produced a K^2 value of 6.2416 and a p value of 0.1004, failing to reject the null hypothesis of homoscedasticity. The Kruskal-Wallis test produced a X^2 value of 3.0229 and a p value of 0.3881, failing to reject the null hypothesis of equality of dataset medians. Because this null hypothesis was not rejected, it cannot be concluded that accuracy, as measured by the sixth quantile of 1/MPI to CZP distance changed over the 4 days of firing.

Table B-75. Subject CSA03 Quantile 6 of 6 1/MPI to CZP Distance Shapiro-Wilk Test Results

Day	W	P-Value
2	0.6996	0.00948
3	0.9193	0.52543
4	0.67239	0.00482
5	0.92865	0.58719

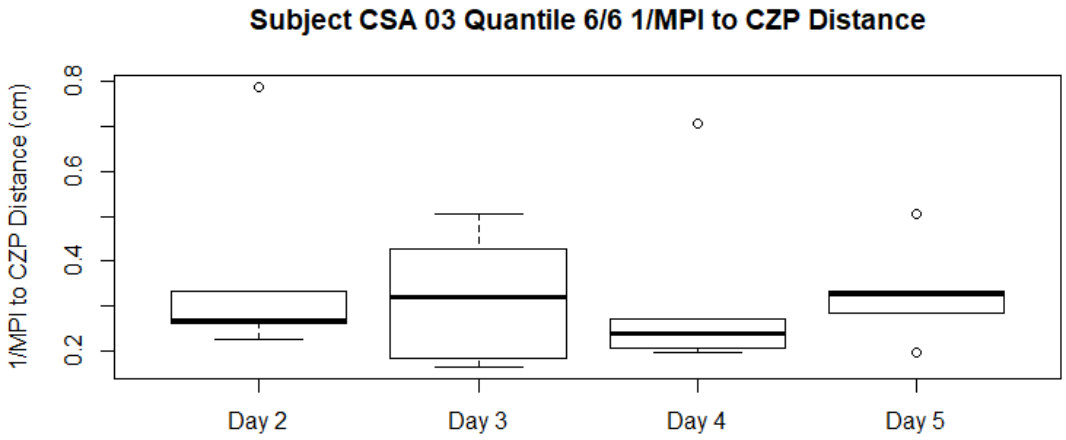

Figure B-82. Subject CSA03 Quantile 6 of 6 1/MPI to CZP Distance

As Table B-76 indicates, the null hypothesis of a normal distribution was not rejected for any days. The boxplot in Figure B-83 does not provide information to the contrary. Bartlett's test produced a K^2 value of 4.2899 and a p value of 0.2318, failing to reject the null hypothesis of homoscedasticity. The Kruskal-Wallis test produced a X^2 value of 0.82857 and a p value of 0.8426, failing to reject the null hypothesis of equality of dataset medians. Because this null hypothesis was not rejected, it cannot be concluded that accuracy, as measured by the first quantile of 1/DCMS changed over the 4 days of firing.

Table B-76. Subject CSA03 Quantile 1 of 6 1/DCMS Shapiro-Wilk Test Results

Day	W	P-Value
2	0.9571	0.78765
3	0.81112	0.09952
4	0.80928	0.09624
5	0.8086	0.09504

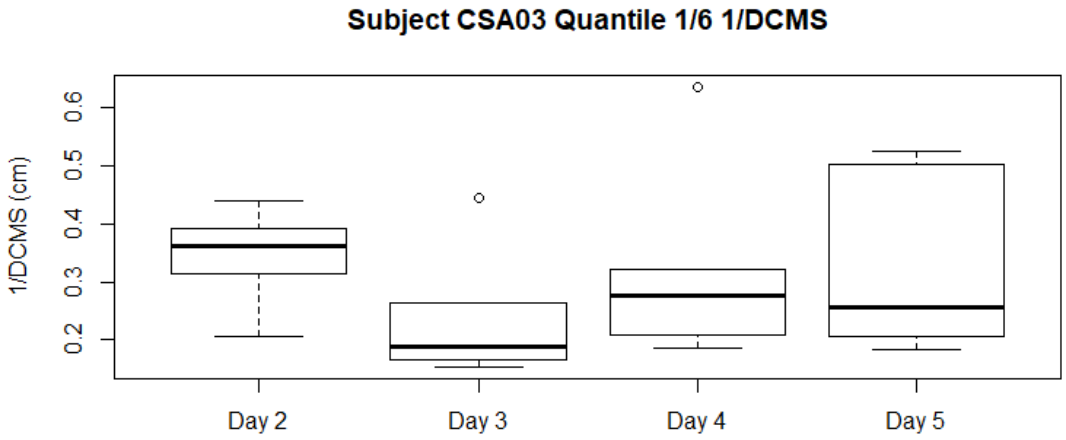

Figure B-83. Subject CSA03 Quantile 1 of 6 1/DCMS

As Table B-77 indicates, the null hypothesis of a normal distribution was rejected for day 4. The boxplot in Figure B-84 does not provide information to the contrary. Bartlett's test produced a K^2 value of 2.6248 and a p value of 0.4532, failing to reject the null hypothesis of homoscedasticity. The Kruskal-Wallis test produced a X^2 value of 2.4507 and a p value of 0.4926, failing to reject the null hypothesis of equality of dataset medians. Because this null hypothesis was not rejected, it cannot be concluded that accuracy, as measured by the second quantile of 1/DCMS changed over the 4 days of firing.

Table B-77. Subject CSA03 Quantile 2 of 6 1/DCMS Shapiro-Wilk Test Results

Day	W	P-Value
2	0.97726	0.91947
3	0.80307	0.08582
4	0.75058	0.03013
5	0.94824	0.72459

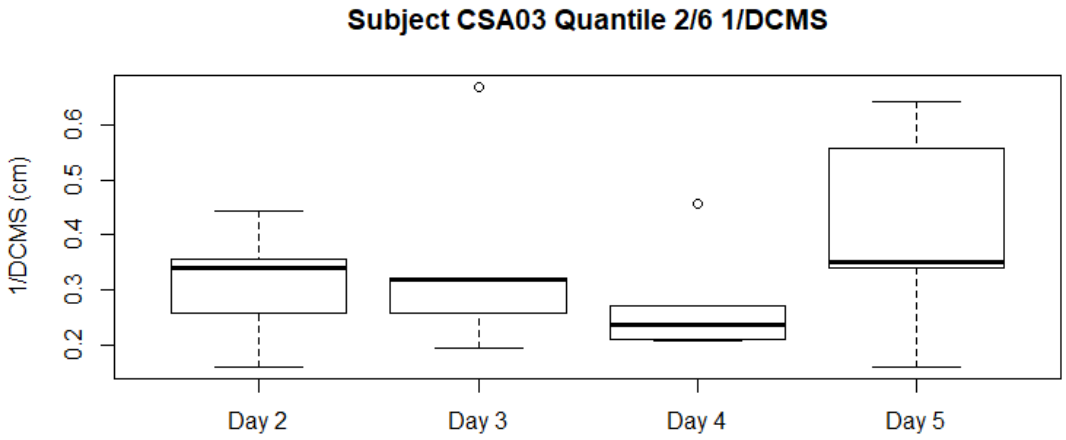

Figure B-84. Subject CSA03 Quantile 2 of 6 1/DCMS

As Table B-78 indicates, the null hypothesis of a normal distribution was rejected for days 3 and 4. The boxplot in Figure B-85 does not provide information to the contrary. Bartlett's test produced a K^2 value of 18.254 and a p value of 0.0003898, rejecting the null hypothesis of homoscedasticity. The Brunner-Dette-Munk test produced an F value of 5.000777 and a p value of 0.01642005, rejecting the null hypothesis of equality of distribution functions. Because this null hypothesis was rejected, it can be concluded that accuracy, as measured by the third quantile of 1/DCMS changed over the 4 days of firing. As Table B-79 shows, 1/DCMS was significantly greater on day 2 than on any other day.

Table B-78. Subject CSA03 Quantile 3 of 6 1/DCMS Shapiro-Wilk Test Results

Day	W	P-Value
2	0.98343	0.95211
3	0.7635	0.0395
4	0.92614	0.5703
5	0.90737	0.45195

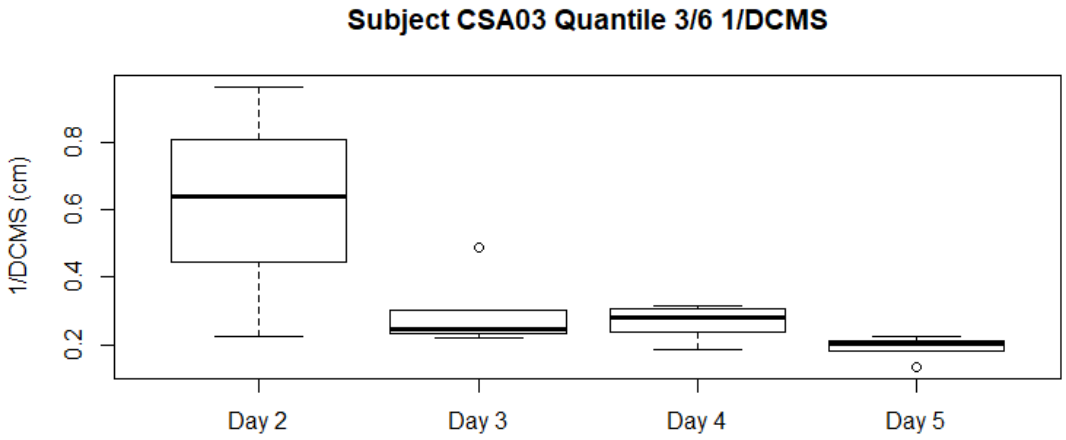

Figure B-85. Subject CSA03 Quantile 3 of 6 1/DCMS

Table B-79. Subject CSA03 Quantile 3 of 6 1/DCMS REGWQ Test Results

Days	Statistic	Adj. P-Values	CI
2 & 3	5.1192	0.0061	0.3558
2 & 4	5.0471	0.0026	0.3507
2 & 5	6.1081	0.0027	0.4245
3 & 5	0.989	0.4944	0.0687
3 & 4	0.0721	0.96	0.005
4 & 5	1.061	0.7378	0.0737

As Table B-80 indicates, the null hypothesis of a normal distribution was rejected for day 3. The boxplot in Figure B-86 does not provide information to the contrary. Bartlett's test produced a K^2 value of 3.7785 and a p value of 0.2864, failing to reject the null hypothesis of homoscedasticity. The Kruskal-Wallis test produced a X^2 value of 3.32 and a p value of 0.3449, failing to reject the null hypothesis of equality of dataset medians. Because this null hypothesis was not rejected, it cannot be concluded that accuracy, as measured by the fourth quantile of 1/DCMS changed over the 4 days of firing.

Table B-80. Subject CSA03 Quantile 4 of 6 1/DCMS Shapiro-Wilk Test Results

Day	W	P-Value
2	0.91438	0.49437

3	0.75515	0.03319
4	0.87735	0.2975
5	0.98271	0.94857

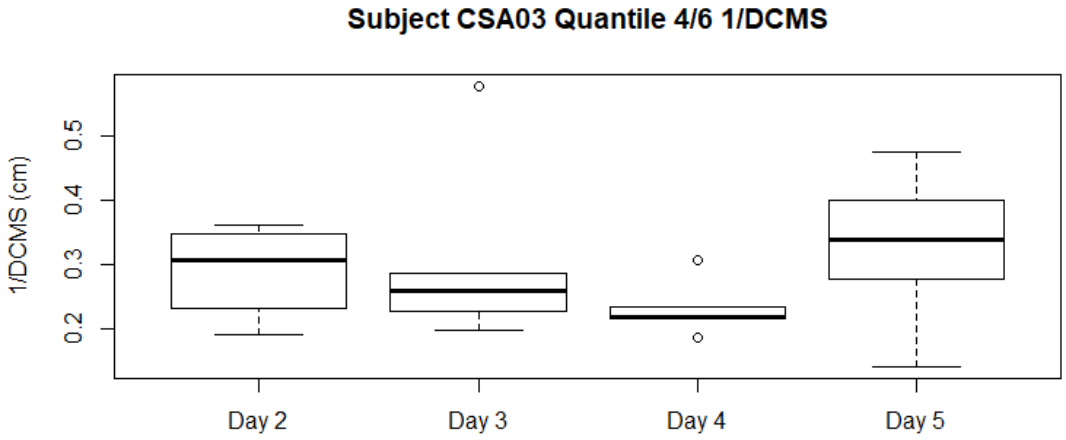

Figure B-86. Subject CSA03 Quantile 4 of 6 1/DCMS

As Table B-81 indicates, the null hypothesis of a normal distribution was not rejected for any days. The boxplot in Figure B-87 is not, however, indicative of a normal distribution. Bartlett's test produced a K^2 value of 4.4276 and a p value of 0.2188, failing to reject the null hypothesis of homoscedasticity. The Kruskal-Wallis test produced a X^2 value of 7 and a p value of 0.0719, failing to reject the null hypothesis of equality of dataset medians. Because this null hypothesis was not rejected, it cannot be concluded that accuracy, as measured by the fifth quantile of 1/DCMS changed over the 4 days of firing.

Table B-81. Subject CSA03 Quantile 5 of 6 1/DMCS Shapiro-Wilk Test Results

Day	W	P-Value
2	0.95892	0.80041
3	0.88843	0.34928
4	0.94716	0.7169
5	0.91461	0.4958

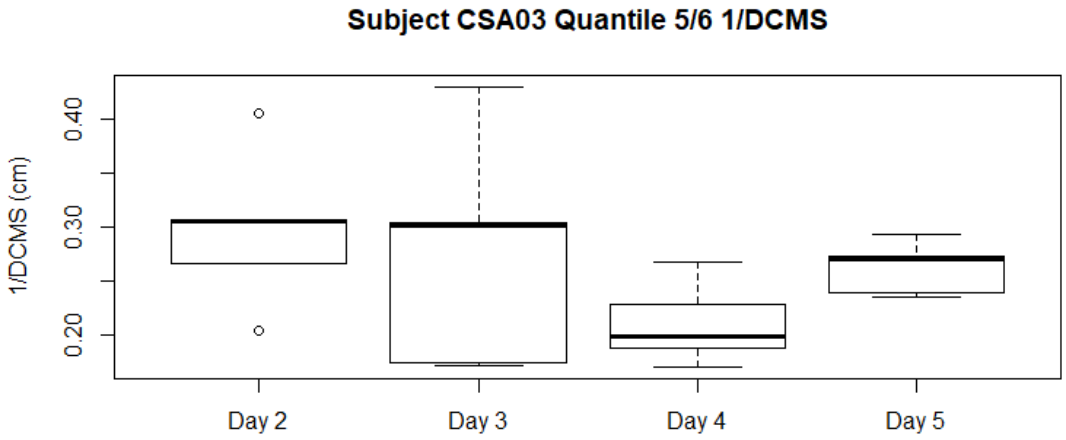

Figure B-87. Subject CSA03 Quantile 5 of 6 1/DCMS

As Table B-82 indicates, the null hypothesis of a normal distribution was rejected for days 2 and 3. The boxplot in Figure B-88 does not provide information to the contrary. Bartlett's test produced a K^2 value of 0.1592 and a p value of 0.9839, failing to reject the null hypothesis of homoscedasticity. The Kruskal-Wallis test produced a X^2 value of 0.12 and a p value of 0.9893, failing to reject the null hypothesis of equality of dataset medians. Because this null hypothesis was not rejected, it cannot be concluded that accuracy, as measured by the sixth quantile of 1/DCMS changed over the 4 days of firing.

Table B-82. Subject CSA03 6 of 6 1/DCMS Shapiro-Wilk Test Results

Day	W	P-Value
2	0.71554	0.01383
3	0.77082	0.04587
4	0.89206	0.3675
5	0.87711	0.29644

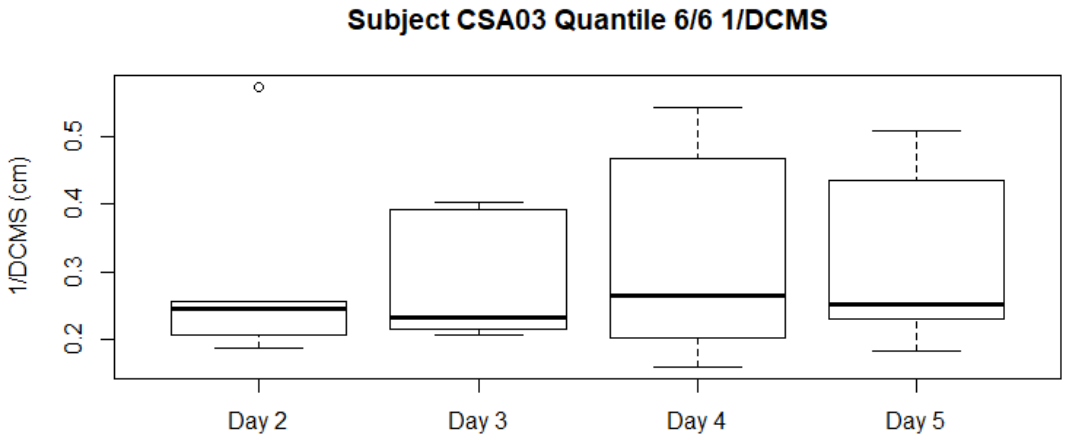

Figure B-88. Subject CSA03 Quantile 6 of 6 1/DCMS

6.2.4 Correlation Results

In Table B-83, the results of the Pearson, Kendall, and Spearman tests for correlation between shot timing and the distance from the shot to the center of the target are shown. As Table B-83 indicates, the respective null hypotheses of no correlation were rejected for day 4 using the Pearson test, days 3 and 4 using the Kendall method, and day 4 using the Spearman method. While the correlations were significant, they were weak as shown by the fact that the largest coefficient was 0.263937.

Table B-83. Subject CSA03 Correlation Results

	Pearson			Kendall				Spearman	
Day	T	P-Value	Coefficient	Z	P-Value	Tau	S	P-Value	Rho
2	0.87382	0.3846	0.092748	0.7181	0.4727	0.051623	111200	0.4273	0.084701
3	1.5714	0.1197	0.165208	1.7744	0.076	0.127634	99454	0.08716	0.181349
4	2.2733	0.02544	0.235522	2.6286	0.008575	0.189139	89421	0.01195	0.263937
5	1.5852	0.1165	0.166623	1.1678	0.2429	0.083939	107000	0.2631	0.119216

6.3 Subject CSA04 Results

6.3.1 IES Scoring Results

As Figure B-89 shows, MPI to CZP distance IES shows similar, slightly increasing trends for radii of 5 and 4 cm. At a radius of 3 cm, there is a significant increase from day 3 to day 4, followed by a decrease. At a radius of 2 cm, there is a decrease from day 2 to day 4, when no shot groups were within 2 cm of the center of the target, flowed by a significant increase to day 5.

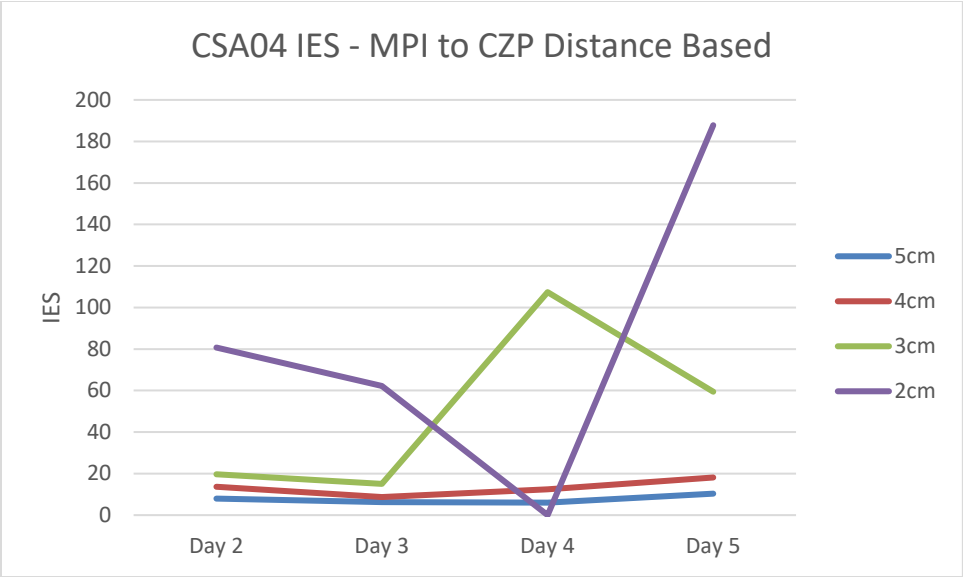

Figure B-89. Subject CSA04 IES – MPI to CZP Distance Based

As Figure B-90 shows, the MPI to CZP distance based RT trends were very similar for radii of 5 and 4 cm. The trends for 3 and 2 cm were similar, but more extreme, in shape, with a value of 0 for 2 cm on day 4 because no shot groups were within 2 cm of the center of the target.

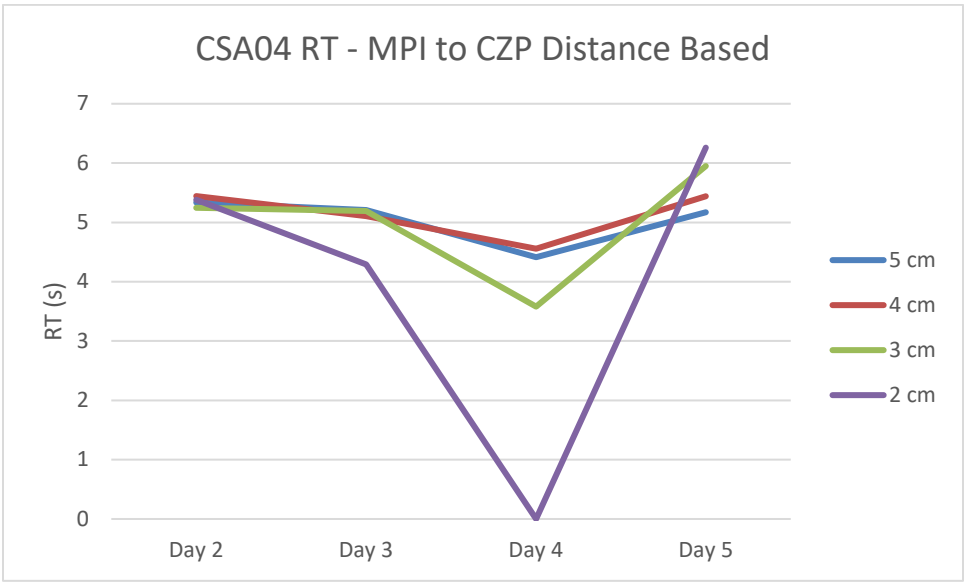

Figure B-90. Subject CSA04 RT - MPI to CZP Distance Based

The MPI to CZP distance based proportion correct results, as shown in Figure B-91, show the expected trend of a greater proportion with a greater radius. At radii of 5, 4 and 3 cm, there is an early increase, followed by a decrease, with the highest proportion being on day 3. At a radius of 2 cm, there were no shot groups within that distance of the center of

the target.

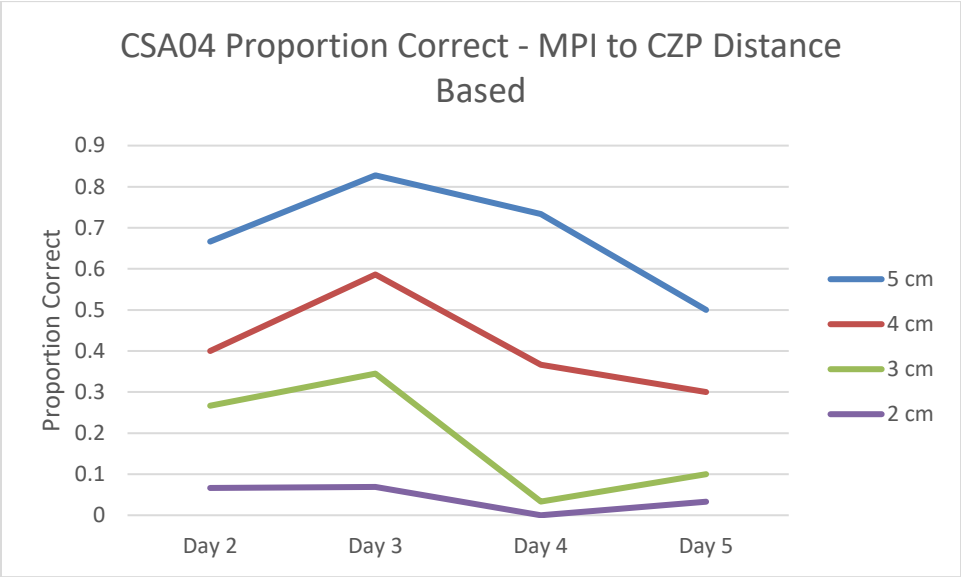

Figure B-91. Subject CSA04 Proportion Correct – MPI to CZP Distance Based

The DCMS based IES results in Figure B-92 show a similar slightly increasing trend for radii of 5 and 4 cm. At a radius of 3 cm, there is an increase on day 3, followed by a decrease on day 4, with little change through day 5. At a radius of 2 cm, there was an overall decrease, punctuated by an IES of zero on days 3 and 4, due to the fact that no shot groups were within 2 cm of the center of the target.

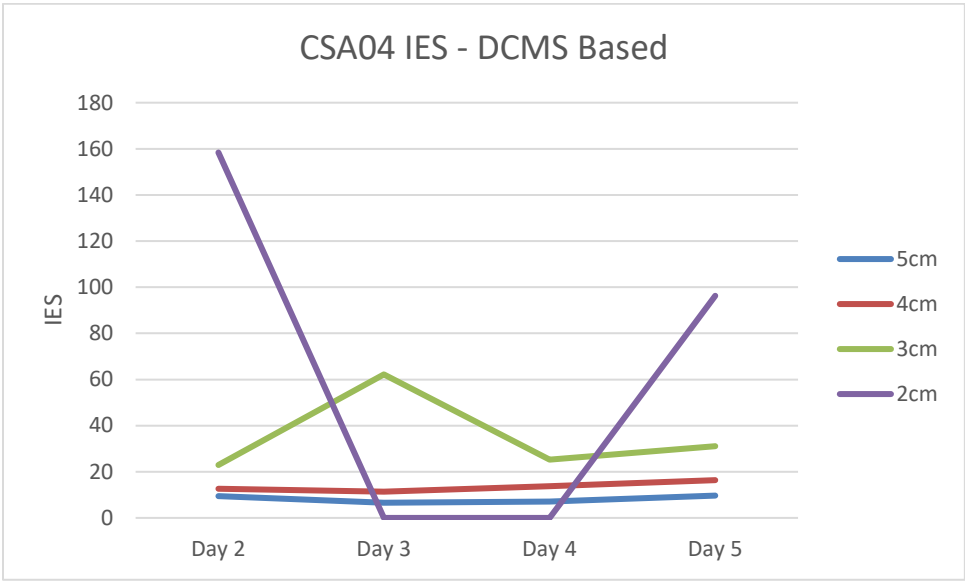

Figure B-92. Subject CSA04 IES – DCMS Based

DCMS based RT, as illustrated in Figure B-93, showed similar trends for radii of 5 and

4 cm with a decrease from day 2 to day 4, followed by an increase from day 4 to day 5. At a radius of day 3, the trend is similar, but with little change between day 3 and day 4. The trend at 2 cm is marked by a very steep drop from day 2 to day 3 and a very steep increase from day 4 to day 5, due to the fact that no shot groups on days 3 or 4 were within 2 cm of the center of the target.

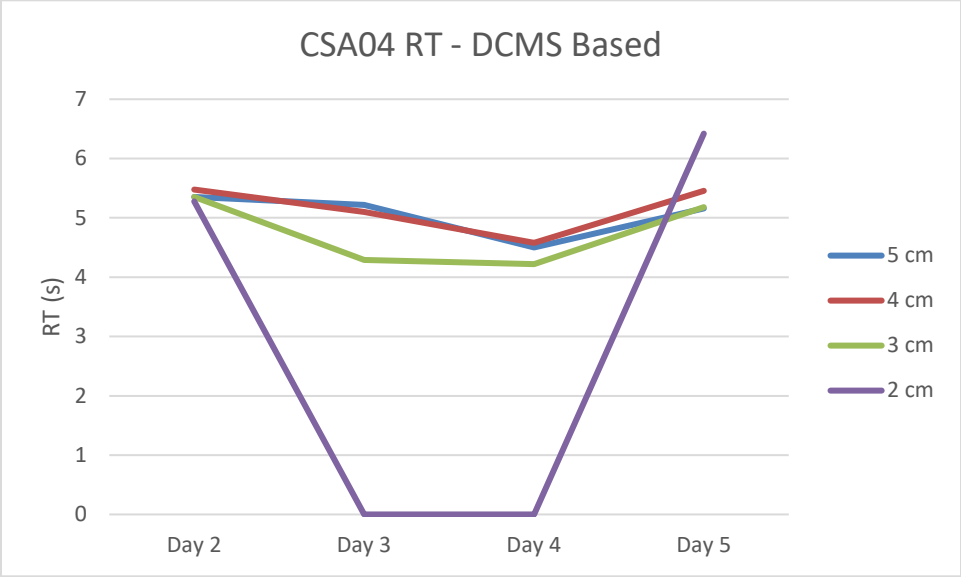

Figure B-93. Subject CSA04 RT - DCMS Based

The DCMS based proportion correct results in Figure B-94 show the familiar trend of grater hit proportions with greater radius. At a radius of 5 cm, the hit proportion rose to a peak at day 3, after which it declined steadily. All other radii showed an overall decrease without such a peak.

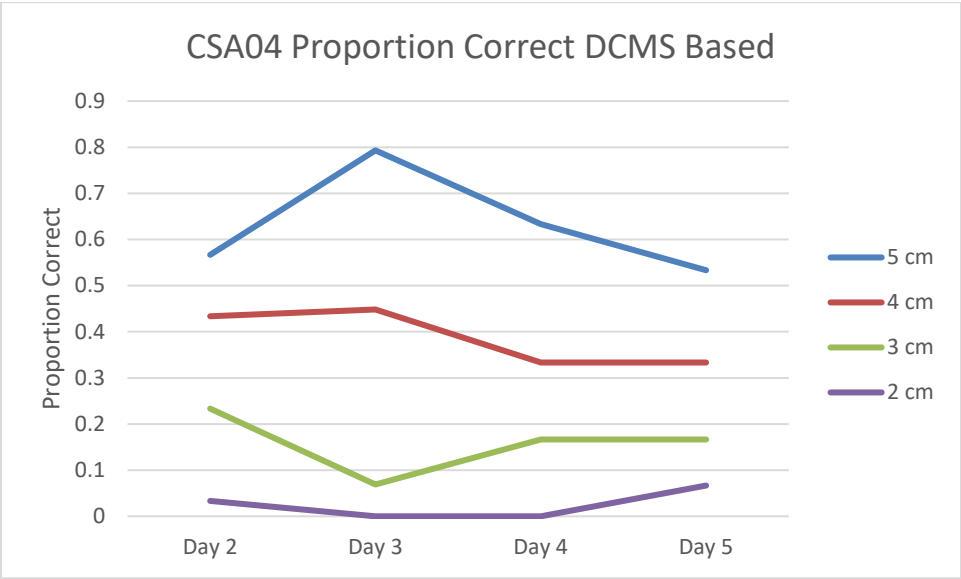

Figure B-94. Subject CSA04 Proportion Correct - DCMS Based

6.3.2 Conditional Accuracy Function Results

As Table B-84 indicates, the null hypothesis of a normal distribution was rejected for quantiles 1 and 4. The boxplot in Figure B-95 does not provide information to the contrary. Bartlett's test produced a K^2 value of 17.344 and a p value of 0.001657, rejecting the null hypothesis of homoscedasticity. The Brunner-Dette-Munk test produced an F value of 0.4919606 and a p value of 0.7066425, failing to reject the null hypothesis of equality of distribution functions. Because this null hypothesis was not rejected, it cannot be concluded that accuracy, as measured by 1/MPI to CZP distance, differed by time quantile on day 2.

Table B-84. Subject CSA04 Five Quantile Day 2 1/MPI to CZP Distance Shapiro-Wilk Test Results

Quantile	W	P-Value
1	0.765	0.0278
2	0.9557	0.7858
3	0.8971	0.357
4	0.7871	0.0448
5	0.8457	0.1451

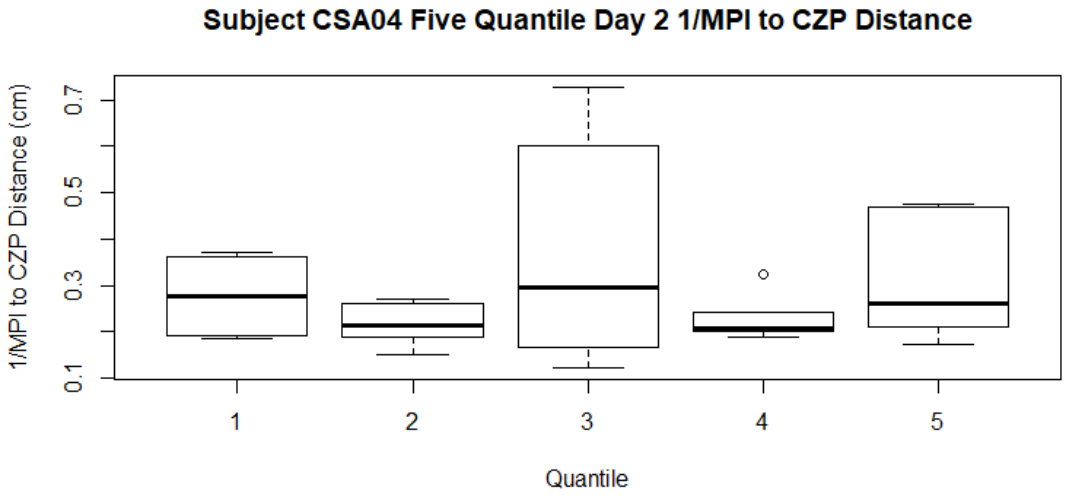

Figure B-95. Subject CSA04 Five Quantile Day 2 1/MPI to CZP Distance

As Table B-85 indicates, the null hypothesis of a normal distribution was rejected for quantiles 1, 3 and 4. The boxplot in Figure B-96 does not provide information to the contrary. Bartlett's test produced a K^2 value of 3.6059 and a p value of 0.462, failing to reject the null hypothesis of homoscedasticity. The Kruskal-Wallis test produced a X^2 value of 4.2882 and a p value of 0.3684, failing to reject the null hypothesis of equality of dataset medians.

Because this null hypothesis was not rejected, it cannot be concluded that accuracy, as measured by 1/DCMS, differed by time quantile on day 2.

Table B-85. Subject CSA04 Day 2 Five Quantile 1/DCMS Shapiro-Wilk Test Results

Quantile	W	P-Value
1	0.7747	0.0344
2	0.9279	0.5637
3	0.7874	0.0452
4	0.7433	0.0171
5	0.9613	0.8296

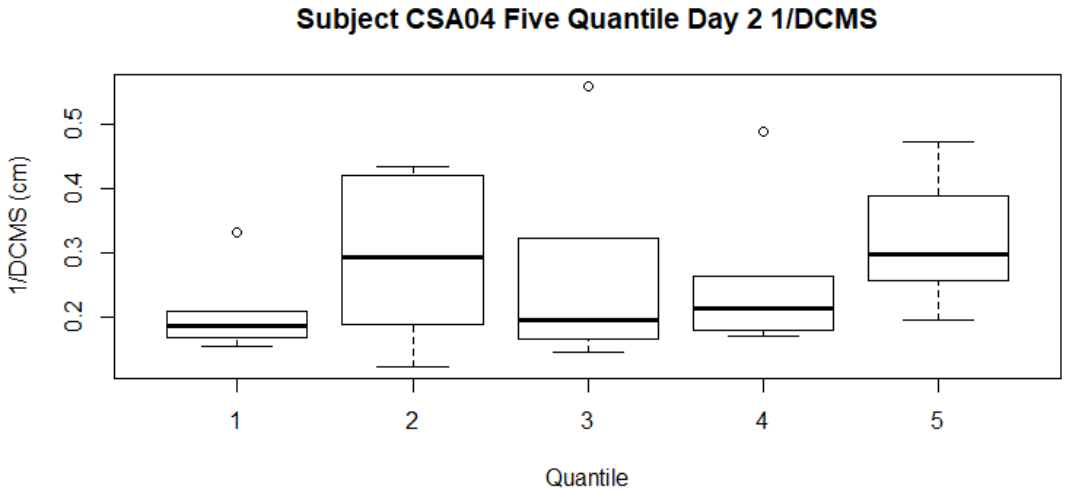

Figure B-96. Subject CSA04 Five Quantile Day 2 1/DCMS

As Table B-86 indicates, the null hypothesis of a normal distribution was rejected for quantile 4. The boxplot in Figure B-97 does not provide information to the contrary. Bartlett's test produced a K^2 value of 19.937 and a p value of 0.0005139, rejecting the null hypothesis of homoscedasticity. The Brunner-Dette-Munk test produced an F value of 2.71404 and a p value of 0.05972412, failing to reject the null hypothesis of equality of distribution functions. Because this null hypothesis was not rejected, it cannot be concluded that accuracy, as measured by 1/MPI to CZP distance, differed by time quantile on day 3.

Table B-86. Subject CSA04 Day 3 Five Quantile 1/MPI to CZP Distance Shapiro-Wilk Test Results

Quantile	W	P-Value
1	0.9213	0.5146
2	0.8013	0.0604
3	0.9127	0.4544
4	0.5451	9E-05
5	0.7994	0.0802

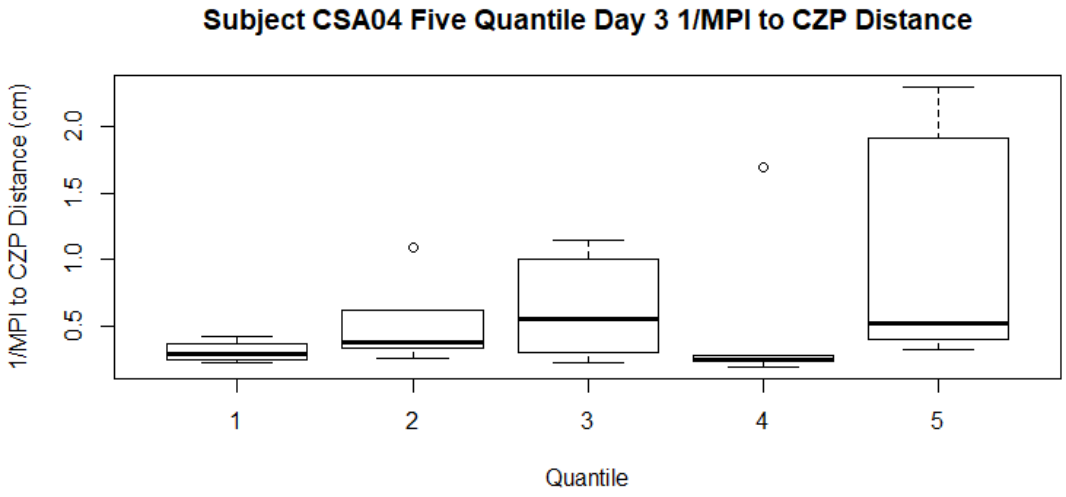

Figure B-97. Subject CSA04 Five Quantile Day 3 1/MPI to CZP Distance

As Table B-87 indicates, the null hypothesis of a normal distribution was not rejected for any quantiles. The boxplot in Figure B-98 is not, however, indicative of a normal distribution. Bartlett's test produced a K^2 value of 2.3293 and a p value of 0.6754, failing to reject the null hypothesis of homoscedasticity. The Kruskal-Wallis test produced a X^2 value of 4.3766 and a p value of 0.3574, failing to reject the null hypothesis of equality of dataset medians. Because this null hypothesis was not rejected, it cannot be concluded that accuracy, as measured by 1/DCMS, differed by time quantile on day 3.

Table B-87. Subject CSA04 Day 3 Five Quantile 1/DCMS Shapiro-Wilk Test Results

Quantile	W	P-Value
1	0.9167	0.4821
2	0.9778	0.9402
3	0.8846	0.2909
4	0.8637	0.2022
5	0.846	0.1821

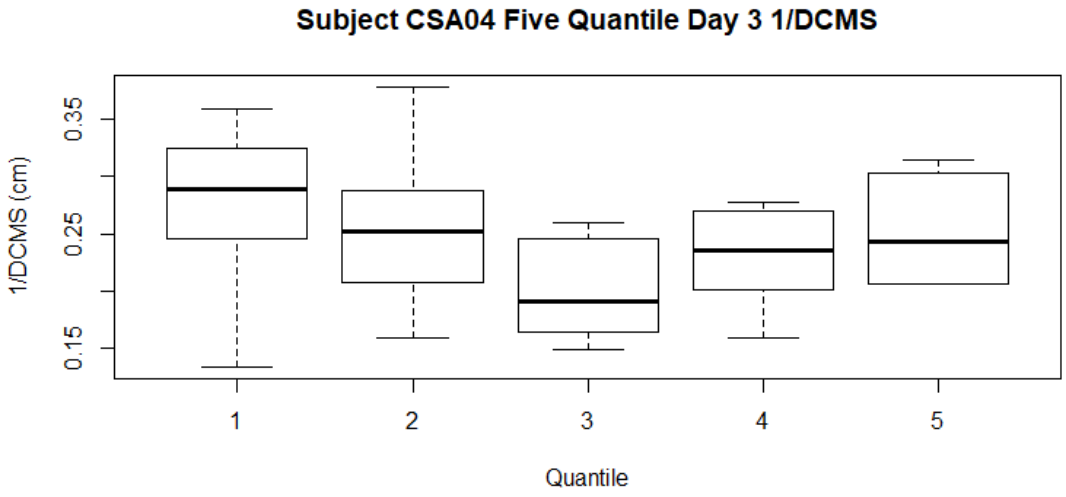

Figure B-98. Subject CSA04 Five Quantile Day 3 1/DCMS

As Table B-88 indicates, the null hypothesis of a normal distribution was not rejected for any quantiles. The boxplot in Figure B-99 is not, however, indicative of a normal distribution. Bartlett's test produced a K^2 value of 3.7954 and a p value of 0.4344, failing to reject the null hypothesis of homoscedasticity. The Kruskal-Wallis test produced a X^2 value of 1.071 and a p value of 0.8989, failing to reject the null hypothesis of equality of dataset medians. Because this null hypothesis was not rejected, it cannot be concluded that accuracy, as measured by 1/MPI to CZP distance, differed by time quantile on day 4.

Table B-88. Subject CSA04 Day 4 Five Quantile 1/MPI to CZP Distance Shapiro-Wilk Test Results

Quantile	W	P-Value
1	0.9967	0.9992
2	0.8916	0.3266
3	0.9741	0.9188
4	0.8898	0.3173
5	0.9666	0.869

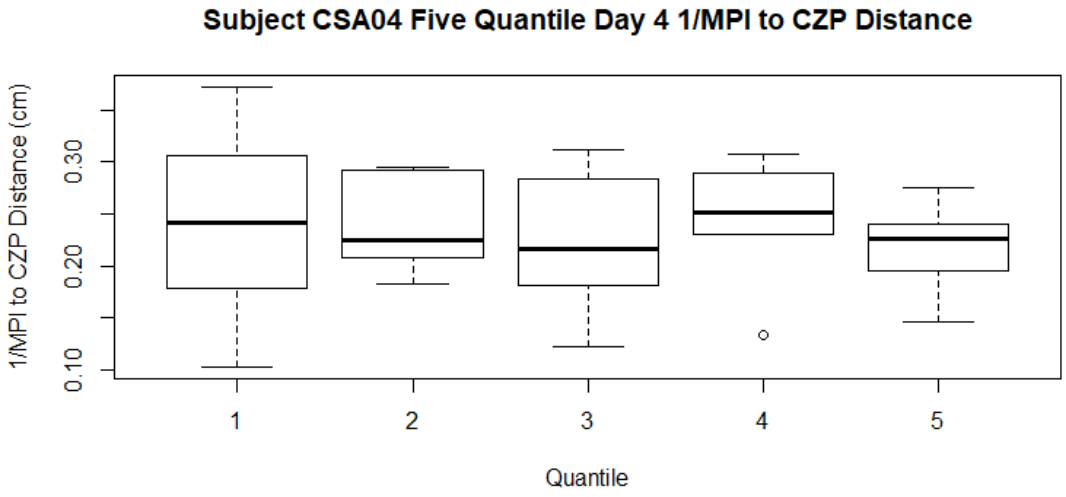

Figure B-99. Subject CSA04 Five Quantile Day 4 1/MPI to CZP Distance

As Table B-89 indicates, the null hypothesis of a normal distribution was rejected for quantile 2. The boxplot in Figure B-100 does not provide information to the contrary. Bartlett's test produced a K^2 value of 0.95186 and a p value of 0.917, failing to reject the null hypothesis of homoscedasticity. The Kruskal-Wallis test produced a X^2 value of 2.3183 and a p value of 0.6774, failing to reject the null hypothesis of equality of dataset medians. Because this null hypothesis was not rejected, it cannot be concluded that accuracy, as measured by 1/DCMS, differed by time quantile on day 4.

Table B-89. Subject CSA04 Day 4 Five Quantile 1/DCMS Shapiro-Wilk Test Results

Quantile	W	P-Value
1	0.966	0.8644
2	0.7441	0.0174
3	0.9341	0.6124
4	0.9725	0.9086
5	0.973	0.912

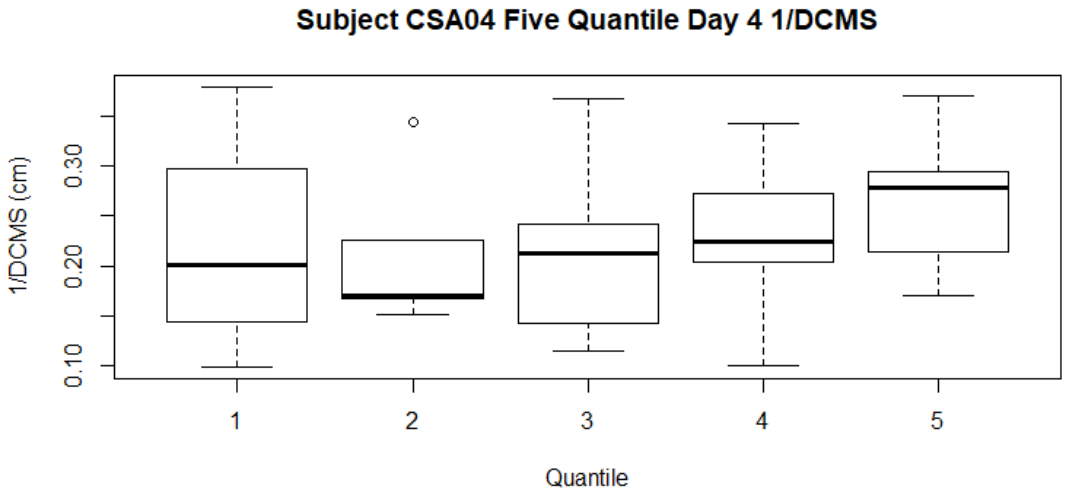

Figure B-100. Subject CSA04 Five Quantile Day 4 1/DCMS

As Table B-90 indicates, the null hypothesis of a normal distribution was rejected for quantile 4. The boxplot in Figure B-101 does not provide information to the contrary. Bartlett's test produced a K^2 value of 26.319 and a p value of 2.728e-05, rejecting the null hypothesis of homoscedasticity. The Brunner-Dette-Munk test produced an F value of 2.646997 and a p value of 0.07260911, failing to reject the null hypothesis of equality of distribution functions. Because this null hypothesis was not rejected, it cannot be concluded that accuracy, as measured by 1/MPI to CZP distance, differed by time quantile on day 5.

Table B-90. Subject CSA04 Day 5 Five Quantile 1/MPI to CZP Distance Shapiro-Wilk Test Results

Quantile	W	P-Value
1	0.8924	0.331
2	0.9078	0.4222
3	0.9492	0.7336
4	0.6065	0.0005
5	0.8538	0.1688

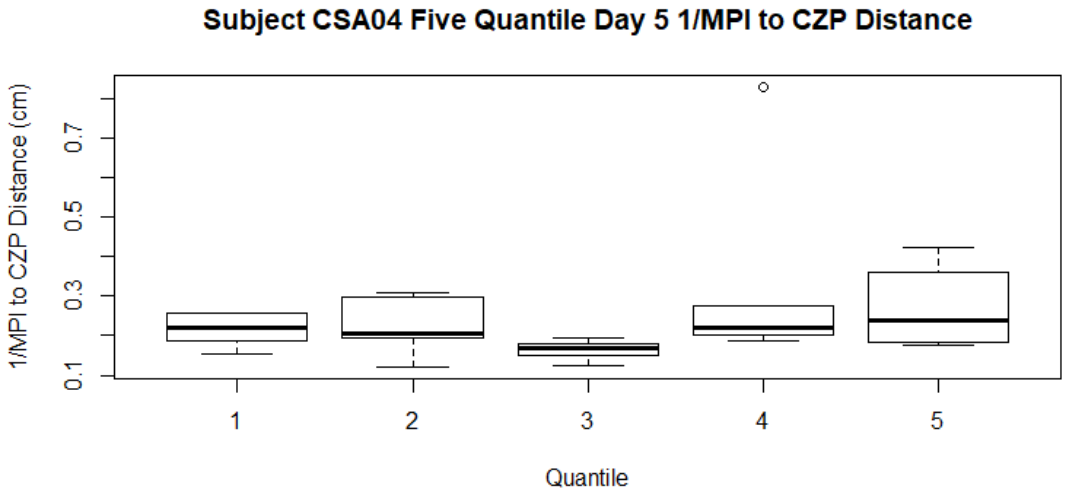

Figure B-101. Subject CSA04 Five Quantile Day 5 1/MPI to CZP Distance

As Table B-91 indicates, the null hypothesis of a normal distribution was not rejected for any quantiles. The boxplot in Figure B-102 is not, however, indicative of a normal distribution. Bartlett's test produced a K^2 value of 9.0017 and a p value of 0.06106, failing to reject the null hypothesis of homoscedasticity. The Kruskal-Wallis test produced a X^2 value of 8.2108 and a p value of 0.08416, failing to reject the null hypothesis of equality of dataset medians. Because this null hypothesis was not rejected, it cannot be concluded that accuracy, as measured by 1/DCMS, differed by time quantile on day 5.

Table B-91. Subject CSA04 Day 5 Five Quantile 1/DCMS Shapiro-Wilk Test Results

Quantile	W	P-Value
1	0.793	0.0508
2	0.9611	0.8283
3	0.9389	0.6502
4	0.8959	0.35
5	0.8805	0.2715

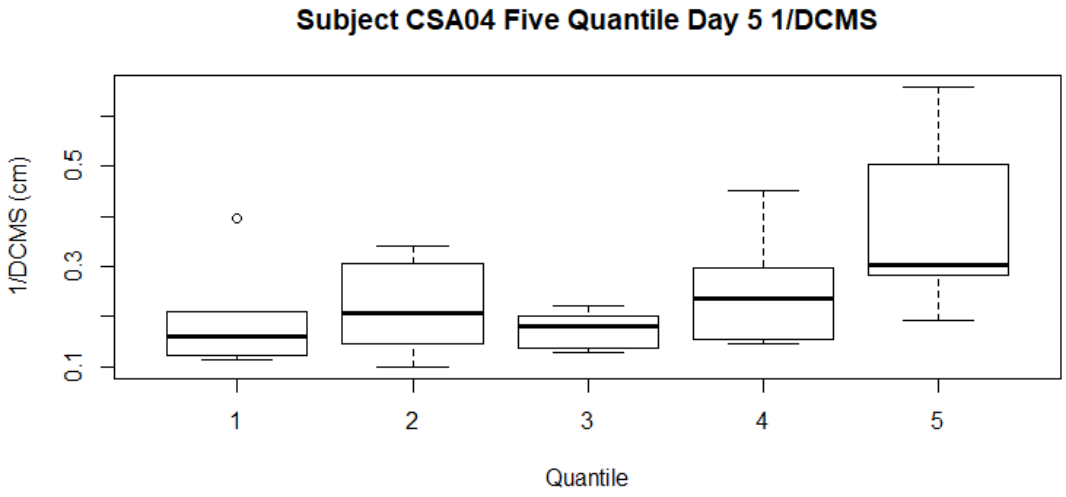

Figure B-102. Subject CSA04 Five Quantile Day 5 1/DCMS

As Table B-92 indicates, the null hypothesis of a normal distribution was rejected for quantile 4. The boxplot in Figure B-103 does not provide information to the contrary. Bartlett's test produced a K^2 value of 10.43 and a p value of 0.06392, failing to reject the null hypothesis of homoscedasticity. The Kruskal-Wallis test produced a X^2 value of 6.2181 and a p value of 0.2856, failing to reject the null hypothesis of equality of dataset medians. Because this null hypothesis was not rejected, it cannot be concluded that accuracy, as measured by 1/MPI to CZP distance, differed by time quantile on day 2.

Table B-92. Subject CSA04 Day 2 Six Quantile 1/MPI to CZP Distance Shapiro-Wilk Test Results

Quantile	W	P-Value
1	0.7792	0.0543
2	0.8993	0.4059
3	0.8056	0.0899
4	0.6828	0.0063
5	0.8757	0.2905
6	0.8627	0.2381

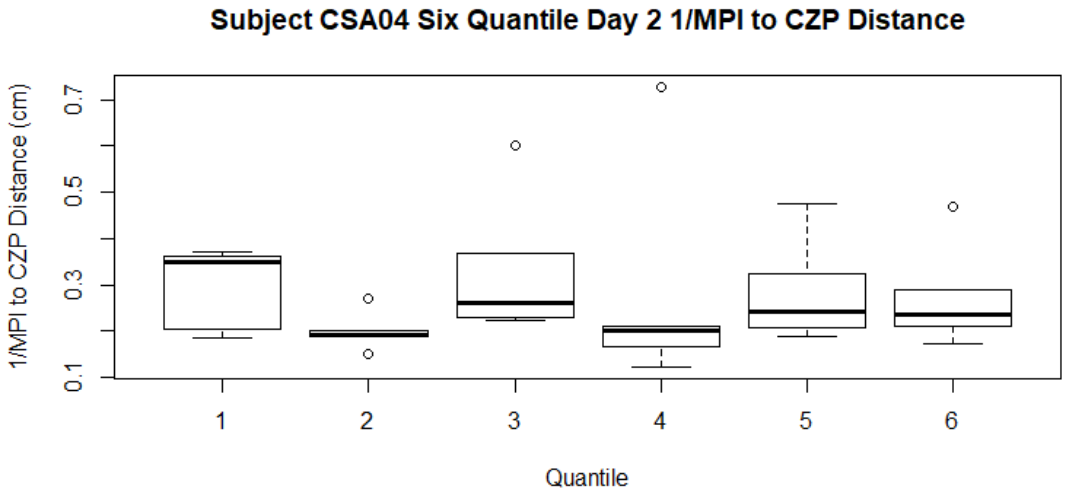

Figure B-103. Subject CSA04 Day 2 Six Quantile 1/MPI to CZP Distance

As Table B-93 indicates, the null hypothesis of a normal distribution was rejected for quantiles 4 and 5. The boxplot in Figure B-104 does not provide information to the contrary. Bartlett's test produced a K^2 value of 3.7629 and a p value of 0.584, failing to reject the null hypothesis of homoscedasticity. The Kruskal-Wallis test produced a X^2 value of 6.3419 and a p value of 0.2744, failing to reject the null hypothesis of equality of dataset medians. Because this null hypothesis was not rejected, it cannot be concluded that accuracy, as measured by 1/DCMS, differed by time quantile on day 2.

Table B-93. Subject CSA04 Day 2 Six Quantile 1/DCMS Shapiro-Wilk Test Results

Quantile	W	P-Value
1	0.827	0.1321
2	0.8648	0.2459
3	0.9275	0.5797
4	0.7049	0.0108
5	0.7331	0.0206
6	0.9081	0.4563

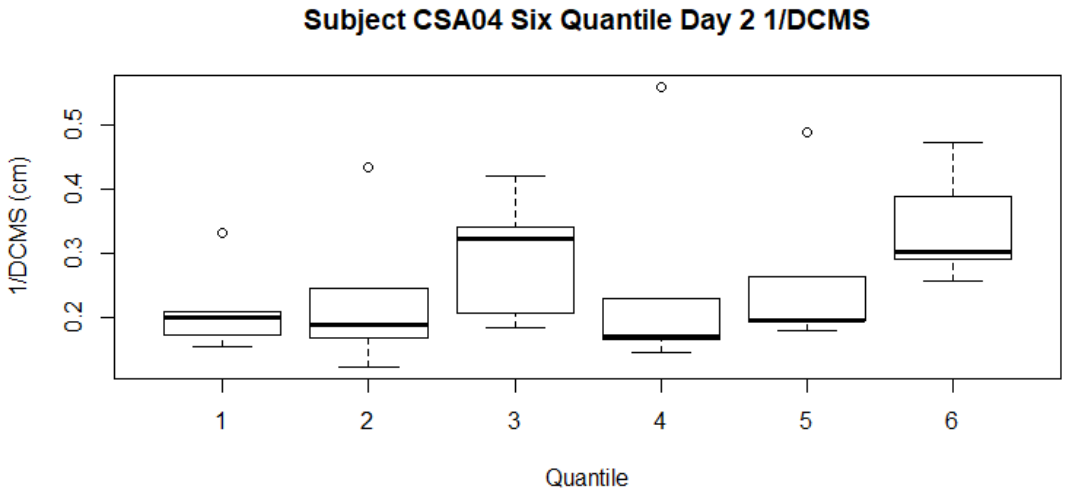

Figure B-104. Subject CSA04 Day 2 Six Quantile 1/DCMS

As Table B-94 indicates, the null hypothesis of a normal distribution was rejected for quantiles 2, 4 and 5. The boxplot in Figure B-105 does not provide information to the contrary. Bartlett's test produced a K^2 value of 19.587 and a p value of 0.001493, rejecting the null hypothesis of homoscedasticity. The Brunner-Dette-Munk test produced an F value of 1.406089 and a p value of 0.2724887, failing to reject the null hypothesis of equality of distribution functions. Because this null hypothesis was not rejected, it cannot be concluded that accuracy, as measured by 1/MPI to CZP distance, differed by time quantile on day 3.

Table B-94. Subject CSA04 Day 3 Six Quantile 1/MPI to CZP Distance Shapiro-Wilk Test Results

Quantile	W	P-Value
1	0.8633	0.2403
2	0.6362	0.0018
3	0.8543	0.2084
4	0.7573	0.0347
5	0.6372	0.0019
6	0.8624	0.2688

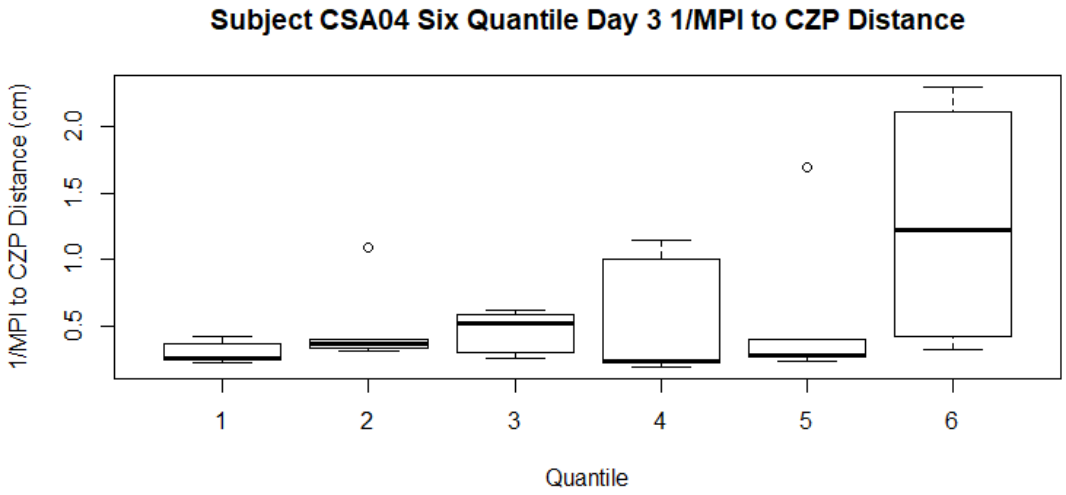

Figure B-105. Subject CSA04 Day 3 Six Quantile 1/MPI to CZP Distance

As Table B-95 indicates, the null hypothesis of a normal distribution was not rejected for any quantiles. The boxplot in Figure B-106 is not, however, indicative of a normal distribution. Bartlett's test produced a K^2 value of 2.8862 and a p value of 0.7175, failing to reject the null hypothesis of homoscedasticity. The Kruskal-Wallis test produced a X^2 value of 3.8676 and a p value of 0.5686, failing to reject the null hypothesis of equality of dataset medians. Because this null hypothesis was not rejected, it cannot be concluded that accuracy, as measured by 1/DCMS, differed by time quantile on day 3.

Table B-95. Subject CSA04 Day 3 Six Quantile 1/DCMS Shapiro-Wilk Test Results

Quantile	W	P-Value
1	0.8672	0.2553
2	0.962	0.8217
3	0.9153	0.5003
4	0.8391	0.1624
5	0.9082	0.4569
6	0.9102	0.4837

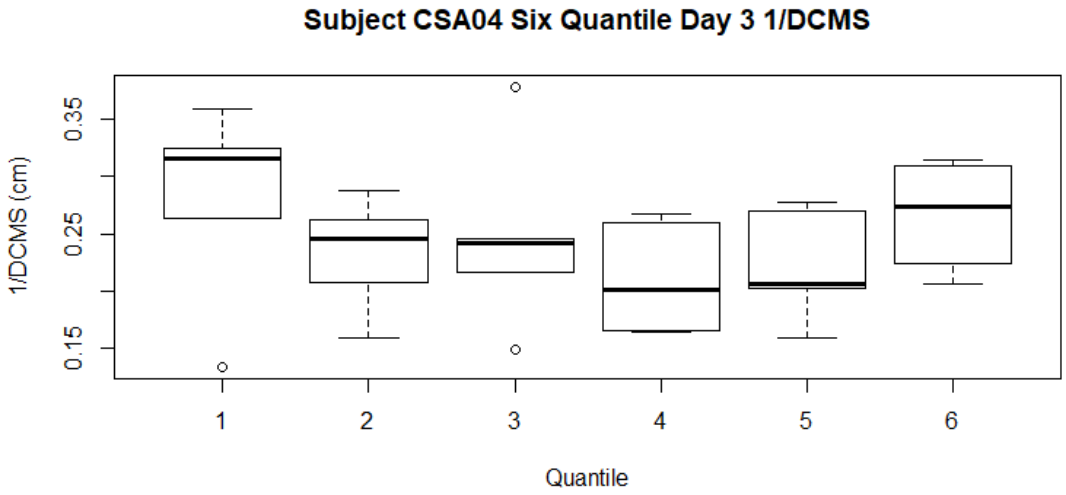

Figure B-106. Subject CSA04 Day 3 Six Quantile 1/DCMS

As Table B-96 indicates, the null hypothesis of a normal distribution was not rejected for any quantiles. The boxplot in Figure B-107 is not, however, indicative of a normal distribution. Bartlett's test produced a K^2 value of 2.4544 and a p value of 0.7833, failing to reject the null hypothesis of homoscedasticity. The Kruskal-Wallis test produced a X^2 value of 3.3071 and a p value of 0.6528, failing to reject the null hypothesis of equality of dataset medians. Because this null hypothesis was not rejected, it cannot be concluded that accuracy, as measured by 1/MPI to CZP distance, differed by time quantile on day 4.

Table B-96. Subject CSA04 Six Quantile Day 4 1/MPI to CZP Distance Shapiro-Wilk Test Results

Quantile	W	P-Value
1	0.9843	0.9562
2	0.8841	0.3282
3	0.989	0.976
4	0.9482	0.724
5	0.9229	0.549
6	0.9938	0.9911

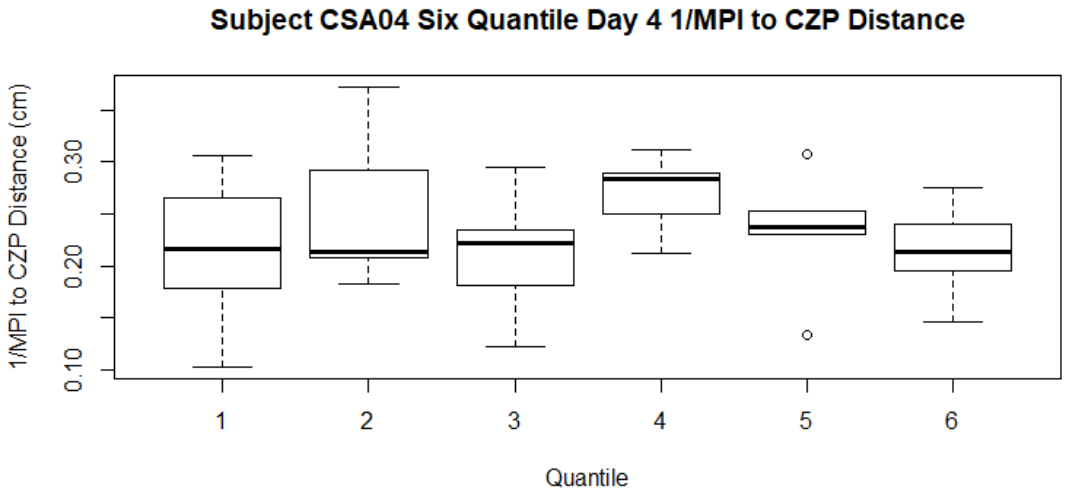

Figure B-107. Subject CSA04 Six Quantile Day 4 1/MPI to CZP Distance Shapiro-Wilk Test Results

As Table B-97 indicates, the null hypothesis of a normal distribution was not rejected for any quantiles. The boxplot in Figure B-108 is not, however, indicative of a normal distribution. Bartlett's test produced a K^2 value of 8.5213 and a p value of 0.1298, failing to reject the null hypothesis of homoscedasticity. The Kruskal-Wallis test produced a X^2 value of 3.7406 and a p value of 0.5873, failing to reject the null hypothesis of equality of dataset medians. Because this null hypothesis was not rejected, it cannot be concluded that accuracy, as measured by 1/DCMS, differed by time quantile on day 4.

Table B-97. Subject CSA04 Six Quantile Day 4 1/DCMS Shapiro-Wilk Test Results

Quantile	W	P-Value
1	0.8672	0.2553
2	0.962	0.8217
3	0.9153	0.5003
4	0.8391	0.1624
5	0.9082	0.4569
6	0.9102	0.4837

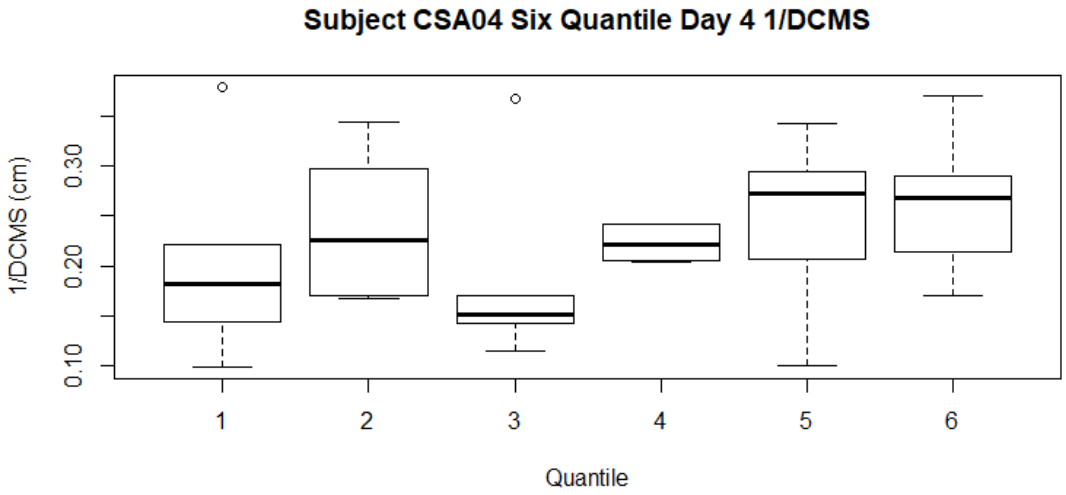

Figure B-108. Subject CSA04 Six Quantile Day 4 1/DCMS

As Table B-98 indicates, the null hypothesis of a normal distribution was rejected for quantile 5. The boxplot in Figure B-109 does not provide information to the contrary. Bartlett's test produced a K^2 value of 23.92 and a p value of 0.0002249, rejecting the null hypothesis of homoscedasticity. The Brunner-Dette-Munk test produced an F value of 1.240314 and a p value of 0.3251065, failing to reject the null hypothesis of equality of distribution functions. Because this null hypothesis was not rejected, it cannot be concluded that accuracy, as measured by 1/MPI to CZP distance, differed by time quantile on day 5.

Table B-98. Subject CSA04 Six Quantile Day 5 1/MPI to CZP Distance Shapiro-Wilk Test Results

Quantile	W	P-Value
1	0.8554	0.2121
2	0.9183	0.5191
3	0.8729	0.2785
4	0.9641	0.836
5	0.6652	0.004
6	0.9109	0.4731

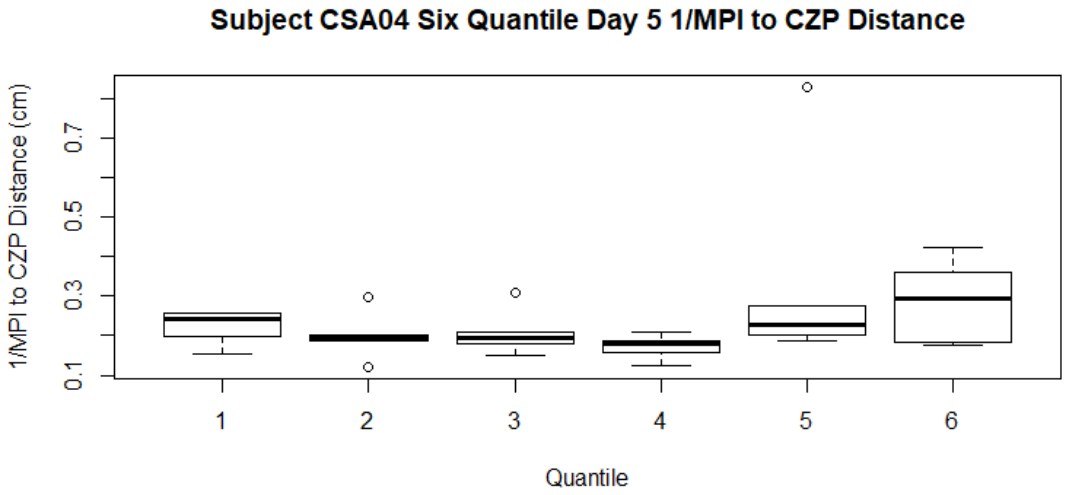

Figure B-109. Subject CSA04 Six Quantile Day 5 1/MPI to CZP Distance

As Table B-99 indicates, the null hypothesis of a normal distribution was not rejected for any quantiles. The boxplot in Figure B-110 is not, however, indicative of a normal distribution. Bartlett's test produced a K^2 value of 5.9849 and a p value of 0.3077, failing to reject the null hypothesis of homoscedasticity. The Kruskal-Wallis test produced a X^2 value of 5.935 and a p value of 0.3478, failing to reject the null hypothesis of equality of dataset medians. Because this null hypothesis was not rejected, it cannot be concluded that accuracy, as measured by 1/DCMS, differed by time quantile on day 5.

Table B-99. Subject CSA04 Six Quantile Day 5 1/DCMS Shapiro-Wilk Test Results

Quantile	W	P-Value
1	0.8432	0.174
2	0.9363	0.64
3	0.9178	0.5161
4	0.8139	0.1048
5	0.8499	0.1942
6	0.9274	0.5789

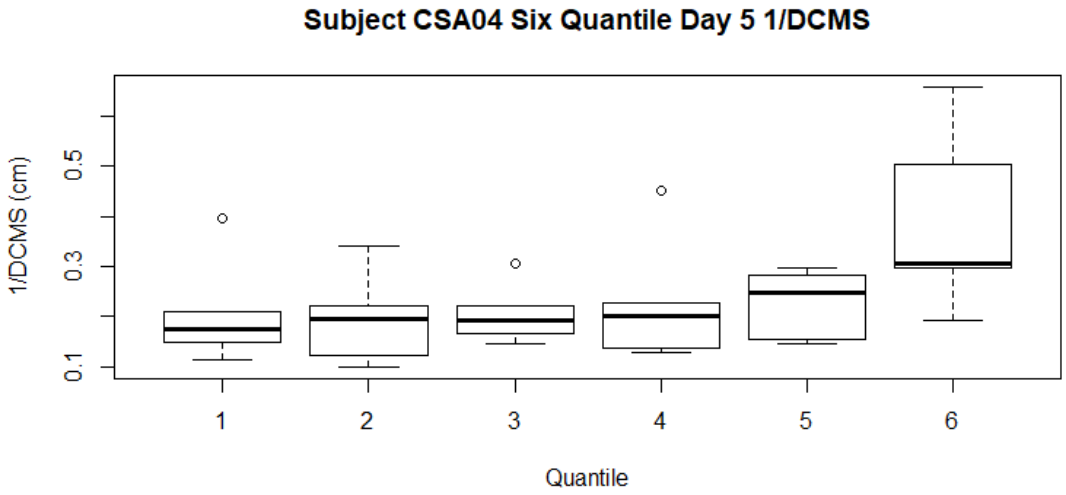

Figure B-110. Subject CSA04 Six Quantile Day 5 1/DCMS

6.3.3 Quantile Analysis

As Table B-100 indicates, the null hypothesis of a normal distribution was rejected for day 2. The boxplot in Figure B-111 is not in agreement, but does not provide strong support for a normal distribution for all datasets. Bartlett's test produced a K^2 value of 3.0844 and a p value of 0.3788, failing to reject the null hypothesis of homoscedasticity. The Kruskal-Wallis test produced a X^2 value of 3.0867 and a p value of 0.3785, failing to reject the null hypothesis of equality of dataset medians. Because this null hypothesis was not rejected, it cannot be concluded that accuracy, as measured by the first quantile of 1/MPI to CZP distance changed over the 4 days of firing.

Table B-100. Subject CSA04 Quantile 1 of 5 1/MPI to CZP Distance Shapiro-Wilk Test Results

Day	W	P-Value
2	0.76501	0.02783
3	0.92128	0.51464
4	0.99668	0.99918
5	0.89241	0.33101

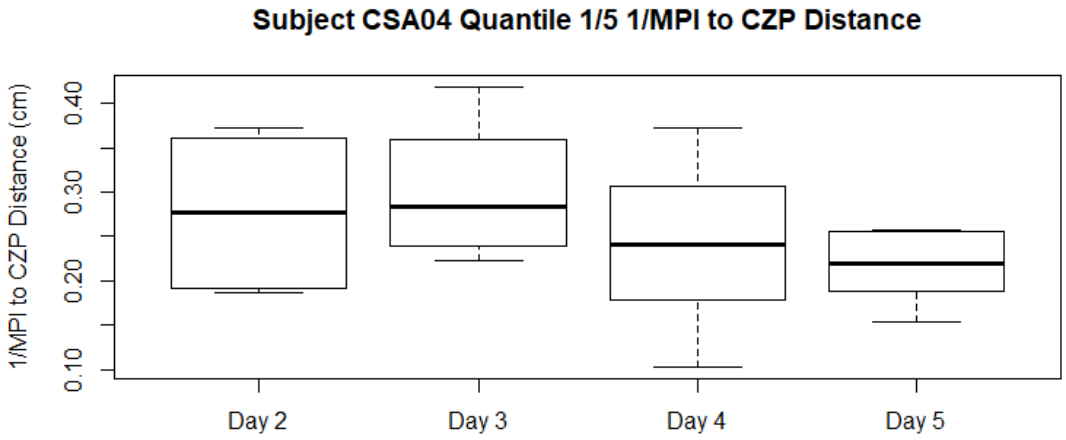

Figure B-111. Subject CSA04 Quantile 1 of 5 1/MPI to CZP Distance

As Table B-101 indicates, the null hypothesis of a normal distribution was not rejected for any days. The boxplot in Figure B-112 is not, however, indicative of a normal distribution. Bartlett's test produced a K^2 value of 25.017 and a p value of 1.532e-05, rejecting the null hypothesis of homoscedasticity. The Brunner-Dette-Munk test produced an F value of 5.665773 and a p value of 0.00850945, rejecting the null hypothesis of equality of distribution functions. Because this null hypothesis was rejected, it can be concluded that accuracy, as measured by the second quantile of 1/MPI to CZP distance changed over the 4 days of firing. As Table B-102 shows, day 3's 1/MPI to CZP distance for this quantile was significantly greater than the other days.

Table B-101. Subject CSA04 Quantile 2 of 5 1/MPI to CZP Distance Shapiro-Wilk Test Results

Day	W	P-Value
2	0.95566	0.78577
3	0.80128	0.06035
4	0.89159	0.32659
5	0.90782	0.42219

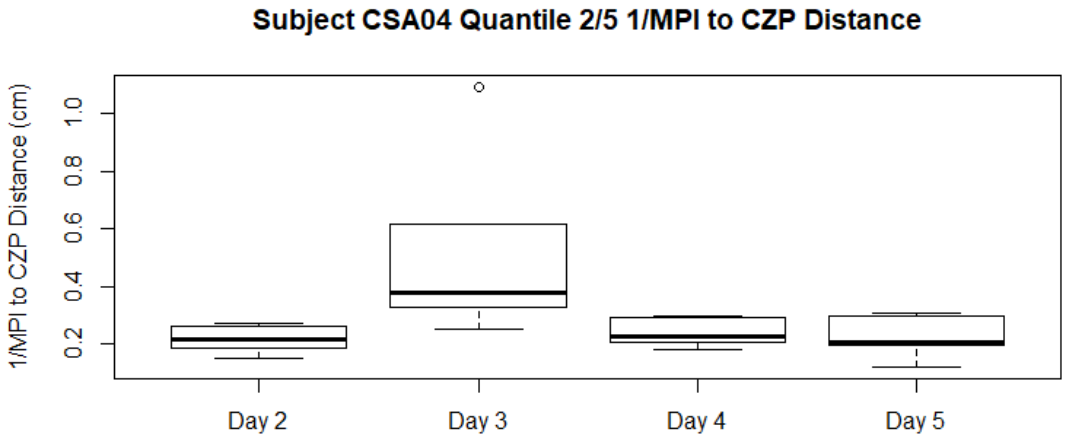

Figure B-112. Subject CSA04 Quantile 2 of 5 1/MPI to CZP Distance

Table B-102. Subject CSA04 Quantile 2 of 5 1/MPI to CZP Distance REGWQ Test Results

Days	Statistic	Adj. P-Value	CI
2 & 3	4.3641	0.0274	0.2909
2 & 4	0.3241	0.9715	0.0216
2 & 5	0.099	0.9449	0.0066
3 & 4	4.04	0.0098	0.2693
3 & 5	4.2651	0.0179	0.2843
4 & 5	0.2251	0.8751	0.015

As Table B-103 indicates, the null hypothesis of a normal distribution was not rejected for any days. The boxplot in Figure B-113 is not, however, indicative of a normal distribution. Bartlett's test produced a K^2 value of 25.94 and a p value of 9.815e-06, rejecting the null hypothesis of homoscedasticity. The Brunner-Dette-Munk test produced an F value of 5.718901 and a p value of 0.01520875, rejecting the null hypothesis of equality of distribution functions. Because this null hypothesis was rejected, it can be concluded that accuracy, as measured by the third quantile of 1/MPI to CZP distance changed over the 4 days of firing. As Figure B-113 and Table B-104 show, day 3's 1/MPI to CZP distance for this quantile was significantly greater than days 4 and 5.

Table B-103. Subject CSA04 Quantile 3 of 5 1/MPI to CZP Distance Shapiro-Wilk Test Results

Day	W	P-Value
2	0.89709	0.35699

3	0.9127	0.45438
4	0.97411	0.91881
5	0.94918	0.7336

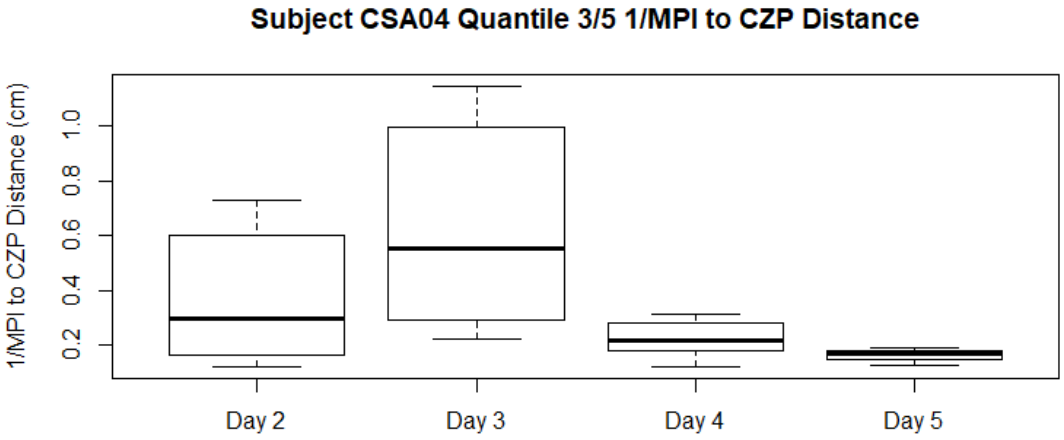

Figure B-113. Subject CSA04 Quantile 3 of 5 1/MPI to CZP Distance

Table B-104. Subject CSA04 Quantile 3 of 5 1/MPI to CZP Distance REGWQ Test Results

Days		Test Stat.	Adj. P-Value	Conf. Int.
2	3	2.8093	0.0609	0.2598
2	4	1.5763	0.2782	0.1458
2	5	2.1972	0.2883	0.2032
3	4	4.3856	0.0149	0.4056
3	5	5.0065	0.0102	0.4631
4	5	0.6209	0.6653	0.0574

As Table B-105 indicates, the null hypothesis of a normal distribution was rejected for days 2, 3 and 5. The boxplot in Figure B-114 does not provide information to the contrary. Bartlett's test produced a K^2 value of 29.496 and a p value of 1.761e-06, rejecting the null hypothesis of homoscedasticity. The Brunner-Dette-Munk test produced an F value of 0.5006752 and a p value of 0.6844, failing to reject the null hypothesis of equality of distribution functions. Because this null hypothesis was not rejected, it cannot be concluded that accuracy, as measured by the fourth quantile of 1/MPI to CZP distance changed over the 4 days of firing.

Table B-105. Subject CSA04 Quantile 4 of 5 1/MPI to CZP Distance Shapiro-Wilk Test Results

Day	W	P-Value
2	0.78707	0.044824
3	0.54509	9.42E-05
4	0.88983	0.317319

5	0.60655	0.00055

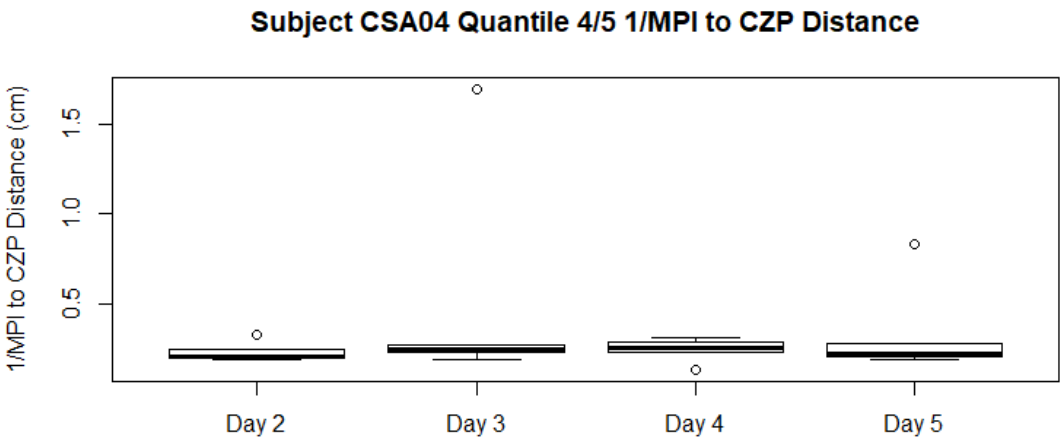

Figure B-114. Subject CSA04 Quantile 4 of 5 1/MPI to CZP Distance

As Table B-106 indicates, the null hypothesis of a normal distribution was not rejected for any days. The boxplot in Figure B-115 is not, however, indicative of a normal distribution. Bartlett's test produced a K^2 value of 39.845 and a p value of 1.149e-08, rejecting the null hypothesis of homoscedasticity. The Brunner-Dette-Munk test produced an F value of 4.949106 and a p value of 0.01619872, rejecting the null hypothesis of equality of distribution functions. Because this null hypothesis not rejected, it can be concluded that accuracy, as measured by the fifth quantile of 1/MPI to CZP distance changed over the 4 days of firing. As shown in Table B-107, day 3 has a significantly greater 1/MPI to CZP distance than days 2, 4 and 5.

Table B-106. Subject CSA04 Quantile 5 of 5 1/MPI to CZP Distance Shapiro-Wilk Test Results

Day	W	P-Value
2	0.84567	0.14514
3	0.79944	0.08018
4	0.96661	0.86896
5	0.85376	0.16876

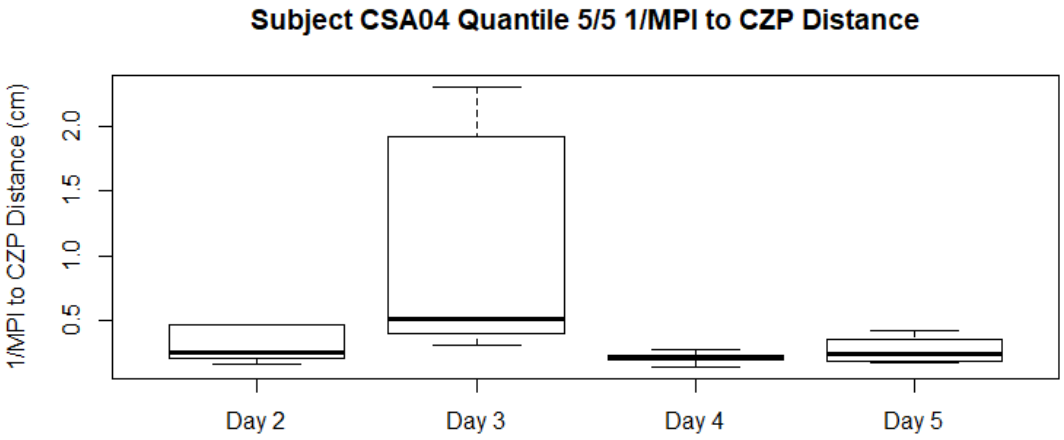

Figure B-115. Subject CSA04 Quantile 5 of 5 1/MPI to CZP Distance

Table B-107. Subject CSA04 Quantile 5 of 5 1/MPI to CZP Distance REGWQ Test Results

Days	Statistic	Adj. P-Value	CI
2 & 3	4.1318	0.0088	0.7815
2 & 4	0.5	0.9337	0.0902
2 & 5	0.2045	0.8865	0.0369
3 & 4	4.6086	0.0197	0.8717
3& 5	4.3268	0.0169	0.8184
4 & 5	0.2955	0.8367	0.0533

As Table B-108 indicates, the null hypothesis of a normal distribution was rejected for day 2. The boxplot in Figure B-116 does not provide information to the contrary. Bartlett's test produced a K^2 value of 1.3562 and a p value of 0.7158, failing to reject the null hypothesis of homoscedasticity. The Kruskal-Wallis test produced a X^2 value of 2.7133 and a p value of 0.438, failing to reject the null hypothesis of equality of dataset medians. Because this null hypothesis not rejected, it can be concluded that accuracy, as measured by the first quantile of 1/DCMS did not change over the 4 days of firing.

Table B-108. Subject CSA04 Quantile 1 of 5 1/DCMS Shapiro-Wilk Test Results

Day	W	P-Value
2	0.77468	0.03437
3	0.91673	0.4821
4	0.96597	0.86435
5	0.79303	0.05083

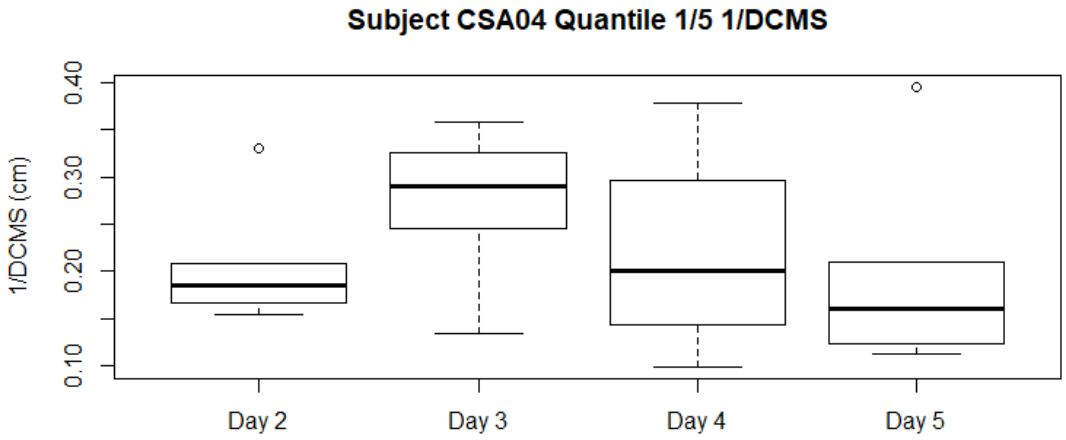

Figure B-116. Subject CSA04 Quantile 1 of 5 1/DCMS

As Table B-109 indicates, the null hypothesis of a normal distribution was rejected for day 4. The boxplot in Figure B-117 does not provide information to the contrary. Bartlett's test produced a K^2 value of 1.967 and a p value of 0.5793, failing to reject the null hypothesis of homoscedasticity. The Kruskal-Wallis test produced a X^2 value of 2.7467 and a p value of 0.4324, failing to reject the null hypothesis of equality of dataset medians. Because this null hypothesis not rejected, it can be concluded that accuracy, as measured by the second quantile of 1/DCMS did not change over the 4 days of firing.

Table B-109. Subject CSA04 Quantile 2 of 5 1/DCMS Shapiro-Wilk Test Results

Day	W	P-Value
2	0.92786	0.5637
3	0.97781	0.94019
4	0.74414	0.01745
5	0.96112	0.82834

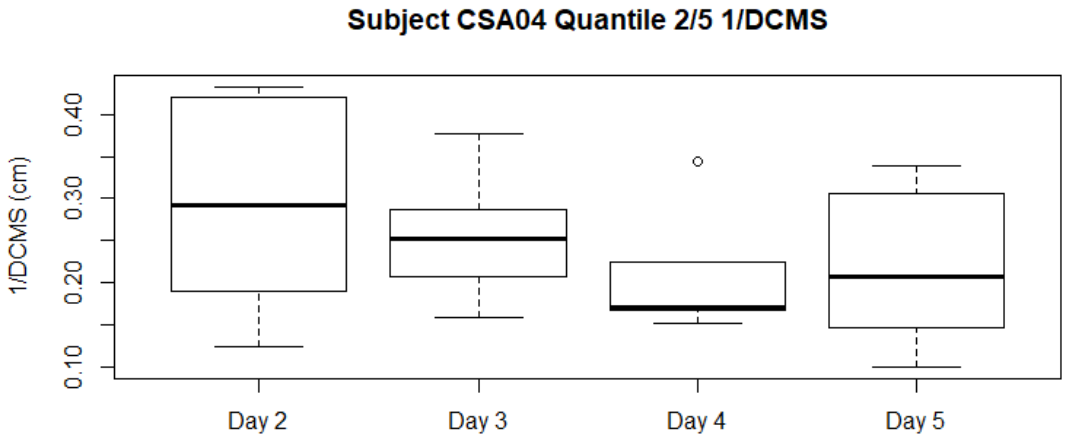

Figure B-117. Subject CSA04 Quantile 2 of 5 1/DCMS

As Table B-110 indicates, the null hypothesis of a normal distribution was rejected for day 2. The boxplot in Figure B-118 does not provide information to the contrary. Bartlett's test produced a K^2 value of 11.358 and a p value of 0.009938, rejecting the null hypothesis of homoscedasticity. The Brunner-Dette-Munk test produced an F value of 0.4872991 and a p value of 0.6854672, failing to reject the null hypothesis of equality of distribution functions. Because this null hypothesis was not rejected, it can be concluded that accuracy, as measured by the third quantile of 1/DCMS did not change over the 4 days of firing.

Table B-110. Subject CSA04 Quantile 3 of 5 1/DCMS Shapiro-Wilk Test Results

Day	W	P-Value
2	0.78743	0.04516
3	0.88461	0.29091
4	0.93414	0.61241
5	0.93888	0.65023

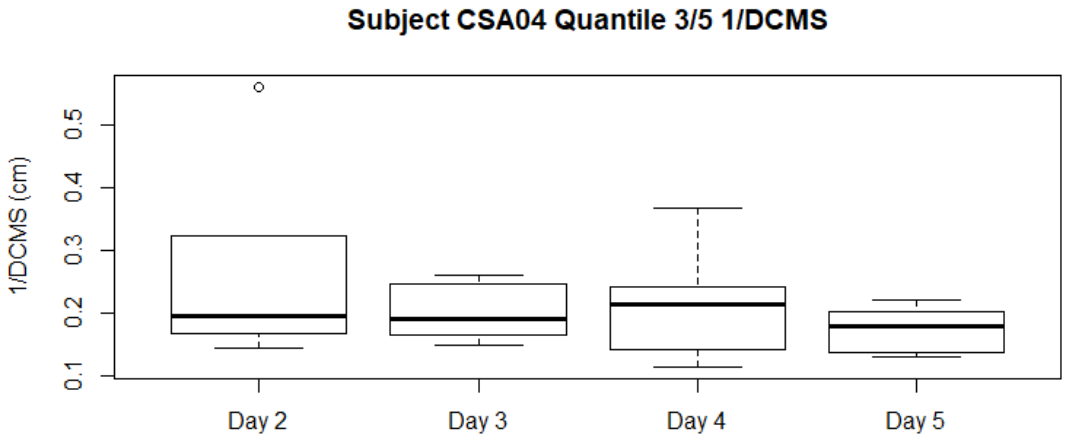

Figure B-118. Subject CSA04 Quantile 3 of 5 1/DCMS

As Table B-111 indicates, the null hypothesis of a normal distribution was rejected for day 2. The boxplot in Figure B-119 does not provide information to the contrary. Bartlett's test produced a K^2 value of 3.8515 and a p value of 0.278, failing to reject the null hypothesis of homoscedasticity. The Kruskal-Wallis test produced a X^2 value of 0.073333 and a p value of 0.9948, failing to reject the null hypothesis of equality of dataset medians. Because this null hypothesis was not rejected, it can be concluded that accuracy, as measured by the fourth quantile of 1/DCMS did not change over the 4 days of firing.

Table B-111. Subject CSA04 Quantile 4 of 5 1/DCMS Shapiro-Wilk Test Results

Day	W	P-Value
2	0.74327	0.017104
3	0.86369	0.202193
4	0.97247	0.90857
5	0.89585	0.349982

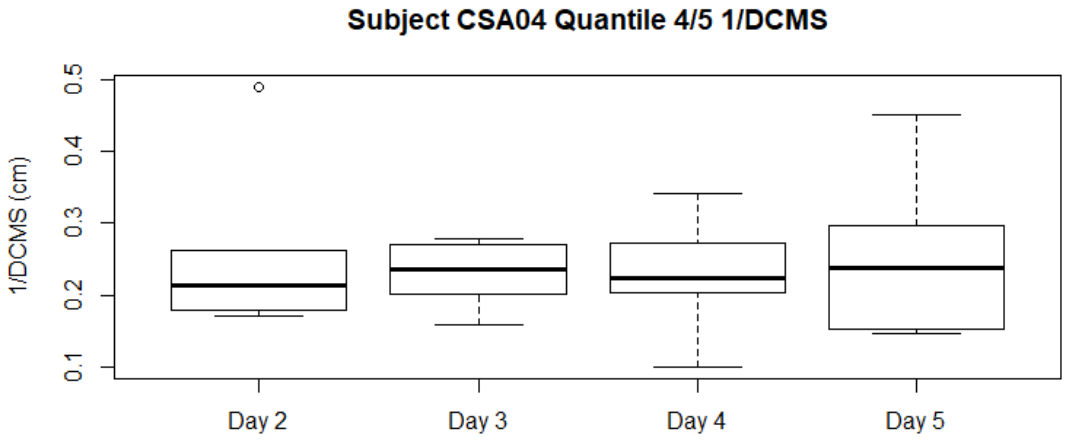

Figure B-119. Subject CSA04 Quantile 4 of 5 1/DCMS

As Table B-112 indicates, the null hypothesis of a normal distribution was not rejected for any days. The boxplot in Figure B-120 is not, however, indicative of a normal distribution. Bartlett's test produced a K^2 value of 6.8354 and a p value of 0.07733, failing to reject the null hypothesis of homoscedasticity. The Kruskal-Wallis test produced a X^2 value of 2.1522 and a p value of 0.5414, failing to reject the null hypothesis of equality of dataset medians. Because this null hypothesis was not rejected, it can be concluded that accuracy, as measured by the fifth quantile of 1/DCMS did not change over the 4 days of firing.

Table B-112. Subject CSA04 Quantile 5 of 5 1/DCMS Shapiro-Wilk Test Results

Day	W	P-Value
2	0.96129	0.8296
3	0.84595	0.18206
4	0.97301	0.912
5	0.88053	0.2715

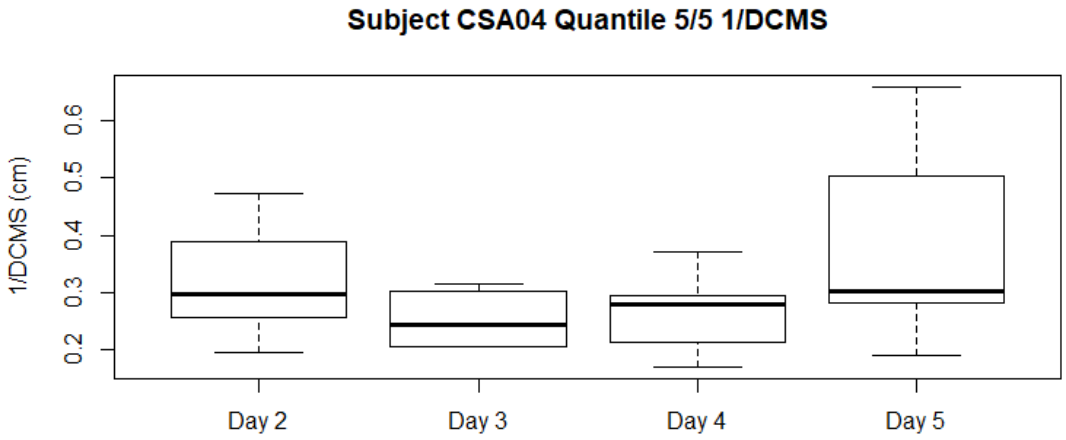

Figure B-120. Subject CSA04 Quantile 5 of 5 1/DCMS

As Table B-113 indicates, the null hypothesis of a normal distribution was not rejected for any days. The boxplot in Figure B-121 is not, however, indicative of a normal distribution. Bartlett's test produced a K^2 value of 1.8391 and a p value of 0.6065, failing to reject the null hypothesis of homoscedasticity. The Kruskal-Wallis test produced a X^2 value of 3.0457 and a p value of 0.3846, failing to reject the null hypothesis of equality of dataset medians. Because this null hypothesis was not rejected, it can be concluded that accuracy, as measured by the first quantile of 1/MPI to CZP distance did not change over the 4 days of firing.

Table B-113. Subject CSA04 Quantile 1 of 6 1/MPI to CZP Distance Shapiro-Wilk Test Results

Day	W	P-Value
2	0.77921	0.05427
3	0.86329	0.24032
4	0.9843	0.95624
5	0.85536	0.21207

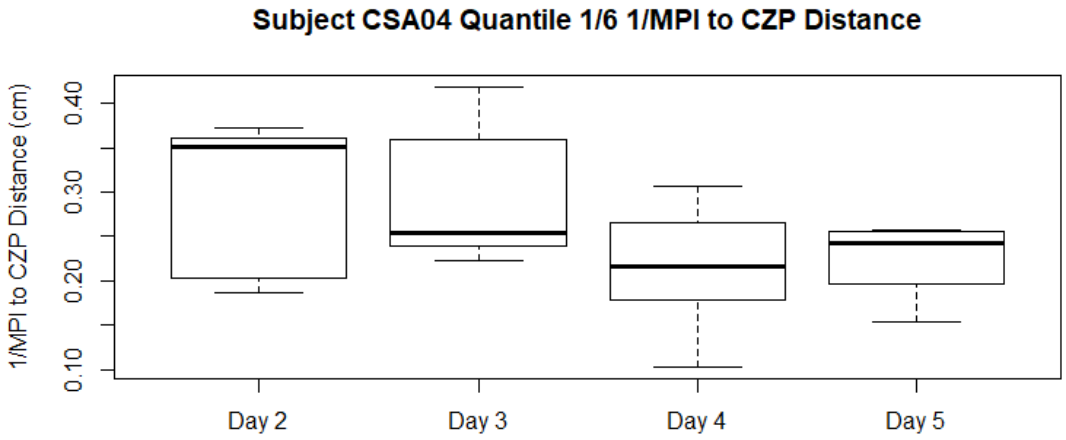

Figure B-121. Subject CSA04 Quantile 1 of 6 1/MPI to CZP Distance

As Table B-114 indicates, the null hypothesis of a normal distribution was rejected for day 3. The boxplot in Figure B-122 does not provide information to the contrary. Bartlett's test produced a K^2 value of 18.643 and a p value of 0.000324, rejecting the null hypothesis of homoscedasticity. The Brunner-Dette-Munk test produced an F value of 7.015785 and a p value of 0.006520171, rejecting the null hypothesis of equality of distribution functions. As Table B-115 shows, significant differences were found only between days 3 and 4.

Table B-114. Subject CSA04 Quantile 2 of 6 1/MPI to CZP Distance Shapiro-Wilk Test Results

Day	W	P-Value
2	0.89929	0.40595
3	0.63625	0.00182
4	0.88407	0.32817
5	0.91831	0.51913

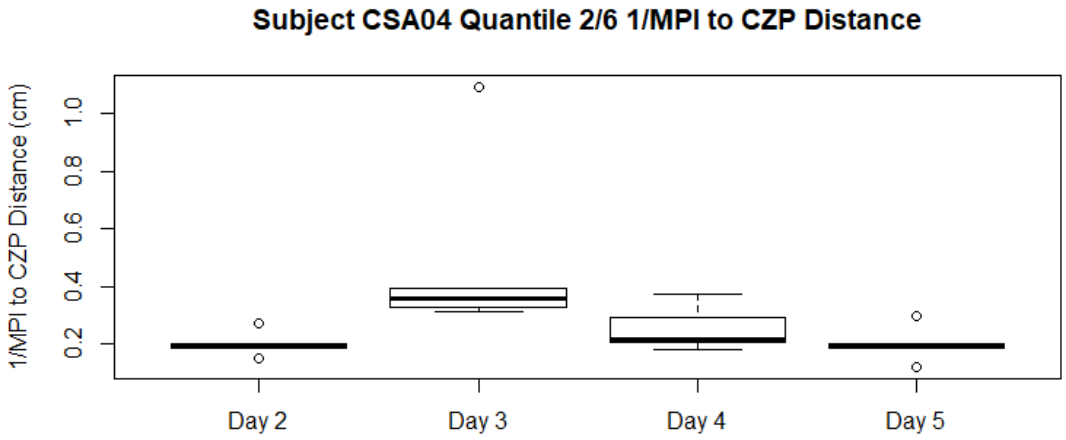

Figure B-122. Subject CSA04 Quantile 2 of 6 1/MPI to CZP Distance

Table B-115. Subject CSA04 Quantile 2 of 6 1/MPI to CZP Distance REGWQ Test Results

Days	Statistic	Adj. P-Value	CI
2 & 3	3.7908	0.0704	0.298
2 & 4	0.6903	0.8779	0.0543
2 & 5	0.0264	0.9853	0.0021
3 & 4	3.1005	0.0435	0.2438
3 & 5	3.7645	0.05	0.296
4 & 5	0.6639	0.6451	0.0522

As Table B-116 indicates, the null hypothesis of a normal distribution was not rejected for any days. The boxplot in Figure B-123 is not, however, indicative of a normal distribution. Bartlett's test produced a K^2 value of 5.9618 and a p value of 0.1135, failing to reject the null hypothesis of homoscedasticity. The Kruskal-Wallis test produced a X^2 value of 8.6571 and a p value of 0.03471, rejecting the null hypothesis of equality of dataset medians. Because this null hypothesis was rejected, it can be concluded that accuracy, as measured by the third quantile of 1/MPI to CZP distance changed over the 4 days of firing. As Table B-117 shows, there were significant differences between day 3 and days 4 and 5.

Table B-116. Subject CSA04 Quantile 3 of 6 1/MPI to CZP Distance Shapiro-Wilk Test Results

Day	W	P-Value
2	0.80556	0.08987

3	0.85427	0.2084
4	0.98897	0.97595
5	0.87294	0.27851

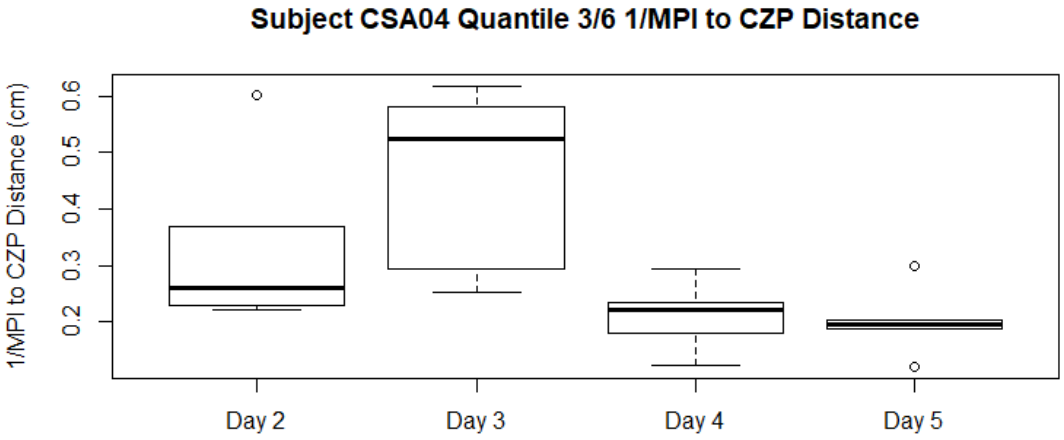

Figure B-123. Subject CSA04 Quantile 3 of 6 1/MPI to CZP Distance

Table B-117. Subject CSA04 Quantile 3 of 6 1/MPI to CZP Distance Dunn's Test Results

Days	Z	P-Value
2 & 3	-0.8552	0.1962
2 & 4	1.38976	0.0823
2 & 5	1.71047	0.0436
3 & 4	2.24499	0.0124
3 & 5	2.56571	0.0051
4 & 5	0.32071	0.3742

As Table B-118 indicates, the null hypothesis of a normal distribution was rejected for days 2 and 3. The boxplot in Figure B-124 does not provide information to the contrary. Bartlett's test produced a K^2 value of 25.948 and a p value of 9.782e-06, rejecting the null hypothesis of homoscedasticity. The Brunner-Dette-Munk test produced an F value of 5.260056 and a p value of 0.02417996 rejecting the null hypothesis of equality of distribution functions. Because this null hypothesis was rejected, it can be concluded that accuracy, as measured by the fourth quantile of 1/MPI to CZP distance changed over the 4 days of firing. As Table B-119 shows, however, no statistically significant differences were found.

Table B-118. Subject CSA04 Quantile 4 of 6 1/MPI to CZP Distance Shapiro-Wilk Test Results

Day	W	P-Value
2	0.68275	0.006266
3	0.75731	0.034735
4	0.94816	0.724011
5	0.96408	0.836037

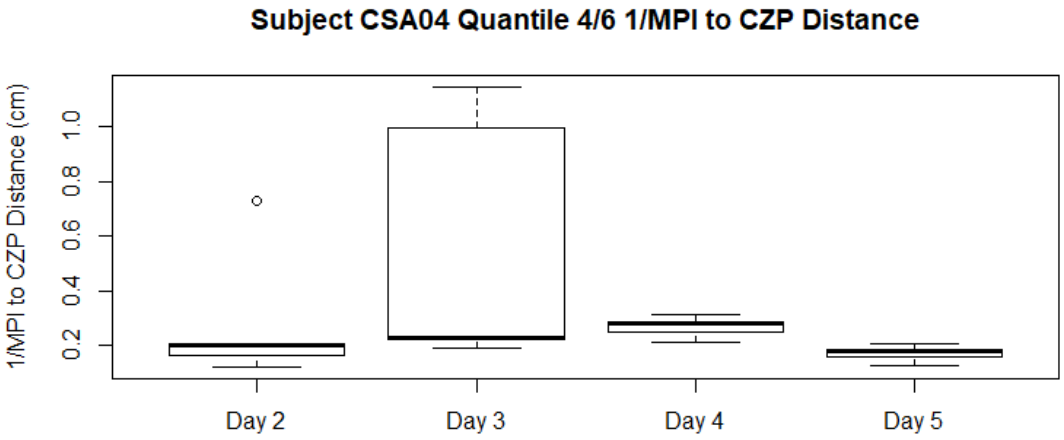

Figure B-124. Subject CSA04 Quantile 4 of 6 1/MPI to CZP Distance

Table B-119. Subject CSA04 Quantile 4 of 6 1/MPI to CZP Distance REGWQ Test Results

Days	Statistic	Adj. P-Value	CI
2 & 3	2.2747	0.1273	0.2731
2 & 4	0.129	0.9285	0.0155
2 & 5	0.9403	0.7867	0.1129
3 & 4	2.4037	0.2357	0.2886
3 & 5	3.215	0.1461	0.3859
4 & 5	0.8113	0.5742	0.0974

As Table B-120 indicates, the null hypothesis of a normal distribution was rejected for days 3 and 5. The boxplot in Figure B-125 does not provide information to the contrary. Bartlett's test produced a K^2 value of 17.909 and a p value of 0.0004593, rejecting the null hypothesis of homoscedasticity. The Brunner-Dette-Munk test produced an F value of 0.637486 and a p value of 0.5953076, failing to reject the null hypothesis of equality of dataset medians. Because this null hypothesis was not rejected, it cannot be concluded that accuracy, as measured by the fifth quantile of 1/MPI to CZP distance changed over the 4 days of firing.

Table B-120. Subject CSA04 Quantile 5 of 6 1/MPI to CZP Distance Shapiro-Wilk Test Results

Day	W	P-Value
2	0.87574	0.29046
3	0.63721	0.00187
4	0.92292	0.54895
5	0.66521	0.004

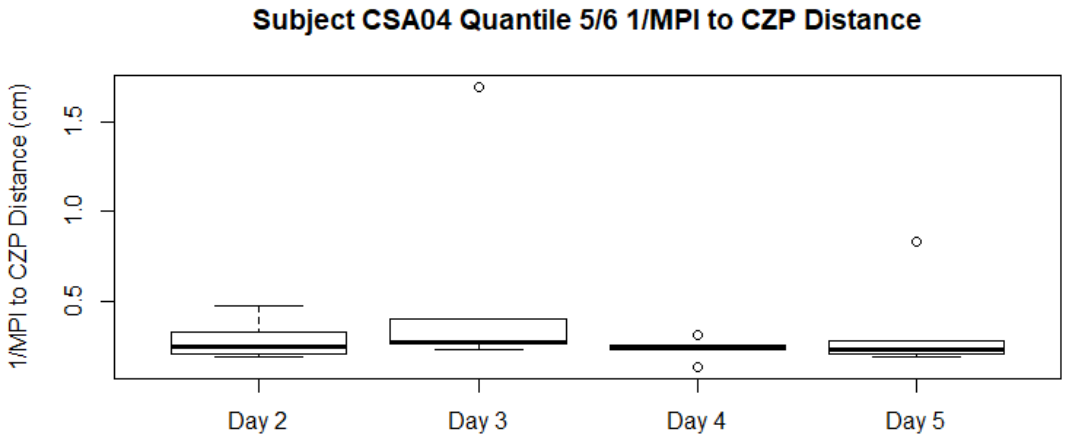

Figure B-125. Subject CSA04 Quantile 5 of 6 1/MPI to CZP Distance

As Table B-121 indicates, the null hypothesis of a normal distribution was not rejected for any days. The boxplot in Figure B-126 is not, however, indicative of a normal distribution. Bartlett's test produced a K^2 value of 31.904 and a p value of 5.482e-07, rejecting the null hypothesis of homoscedasticity. The Brunner-Dette-Munk test produced an F value of 4.920495 and a p value of 0.0200959 rejecting the null hypothesis of equality of distribution functions. Because this null hypothesis was rejected, it can be concluded that accuracy, as measured by the sixth quantile of 1/MPI to CZP distance changed over the 4 days of firing. As Table B-122 shows, there were significant differences between day 2 and days 3; 3 and 4 4 and 5.

Table B-121. Subject CSA04 Quantile 6 of 6 1/MPI to CZP Shapiro-Wilk Test Results

Day	W	P-Value
2	0.86269	0.23808
3	0.86238	0.2688
4	0.99377	0.99109
5	0.91092	0.47314

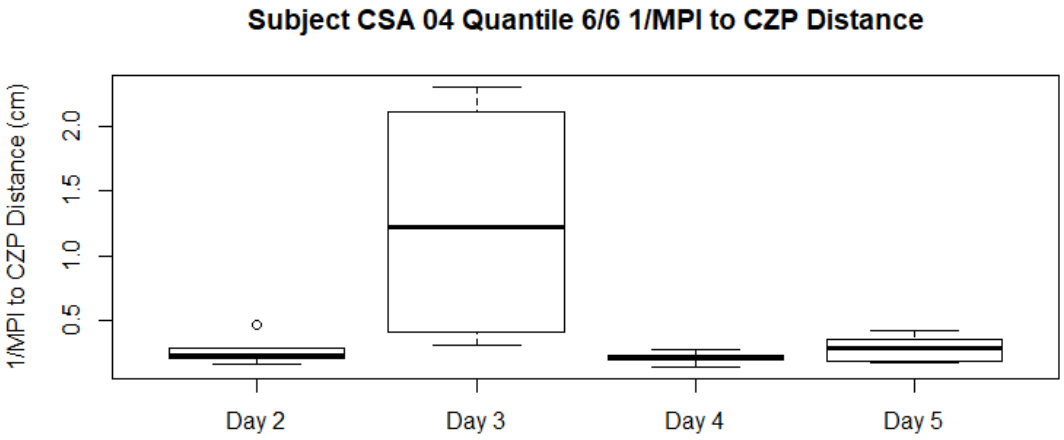

Figure B-126. Subject CSA04 Quantile 6 of 6 1/MPI to CZP Distance

Table B-122. Subject CSA04 Quantile 6/6 1/MPI to CZP Distance REGWQ Test Results

Days	Statistic	Adj. P-Value	CI
2 & 3	4.603	0.0139	0.9875
2 & 4	0.3013	0.8342	0.0609
2 & 5	0.0656	0.9636	0.0133
3 & 4	4.8871	0.0166	1.0484
3 & 5	4.5412	0.0058	0.9742
4 & 5	0.3669	0.9637	0.0742

As Table B-123 indicates, the null hypothesis of a normal distribution was not rejected for any days. The boxplot in Figure B-127 is not, however, indicative of a normal distribution. Bartlett's test produced a K^2 value of 0.93501 and a p value of 0.817, failing to reject the null hypothesis of homoscedasticity. The Kruskal-Wallis test produced a X^2 value of 1.4686 and a p value of 0.6895, failing to reject the null hypothesis of equality of dataset medians. Because this null hypothesis was not rejected, it cannot be concluded that accuracy, as measured by the first quantile of 1/DCMS changed over the 4 days of firing.

Table B-123. Subject CSA04 Quantile 1 of 6 1/DCMS Shapiro-Wilk Test Results

Day	W	P-Value
2	0.82703	0.13214
3	0.86722	0.25535
4	0.91035	0.4697
5	0.84322	0.17402

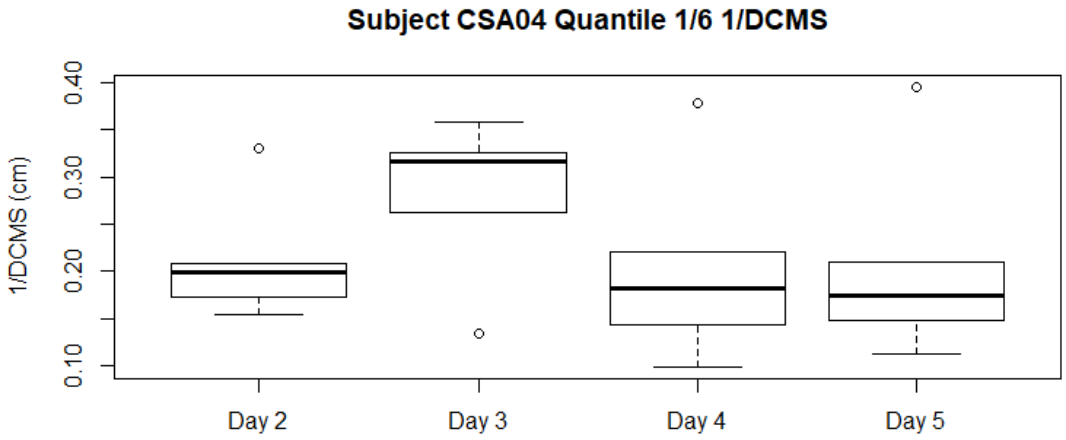

Figure B-127. Subject CSA04 Quantile 1 of 6 1/DCMS

As Table B-124 indicates, the null hypothesis of a normal distribution was not rejected for any days. The boxplot in Figure B-128 is not, however, indicative of a normal distribution. Bartlett's test produced a K^2 value of 2.6483 and a p value of 0.4491, failing to reject the null hypothesis of homoscedasticity. The Kruskal-Wallis test produced a X^2 value of 1.2629 and a p value of 0.738, failing to reject the null hypothesis of equality of dataset medians. Because this null hypothesis was not rejected, it cannot be concluded that accuracy, as measured by the second quantile of 1/DCMS changed over the 4 days of firing.

Table B-124. Subject CSA04 Quantile 2 of 6 1/DCMS Shapiro-Wilk Test Results

Day	W	P-Value
2	0.86478	0.24594
3	0.96198	0.8217
4	0.89751	0.3963
5	0.93631	0.63999

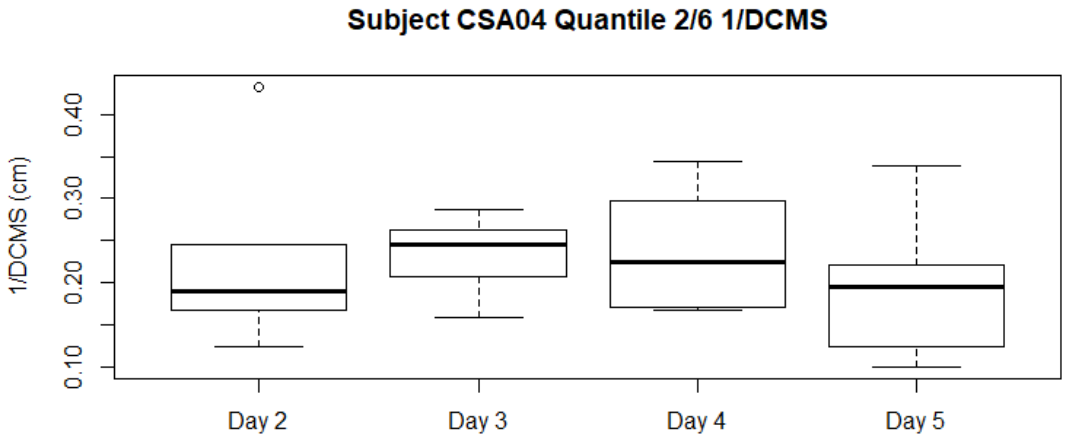

Figure B-128. Subject CSA04 Quantile 2 of 6 1/DCMS

As Table B-125 indicates, the null hypothesis of a normal distribution was rejected for day 4. The boxplot in Figure B-129 is not, however, indicative of a normal distribution. Bartlett's test produced a K^2 value of 0.98158 and a p value of 0.8057, failing to reject the null hypothesis of homoscedasticity. The Kruskal-Wallis test produced a X^2 value of 4.8629 and a p value of 0.1821, failing to reject the null hypothesis of equality of dataset medians. Because this null hypothesis was not rejected, it cannot be concluded that accuracy, as measured by the third quantile of 1/DCMS changed over the 4 days of firing.

Table B-125. Subject CSA04 Quantile 3 of 6 1/DCMS Shapiro-Wilk Test Results

Day	W	P-Value
2	0.92754	0.57972
3	0.91533	0.50026
4	0.74306	0.02563
5	0.91785	0.51615

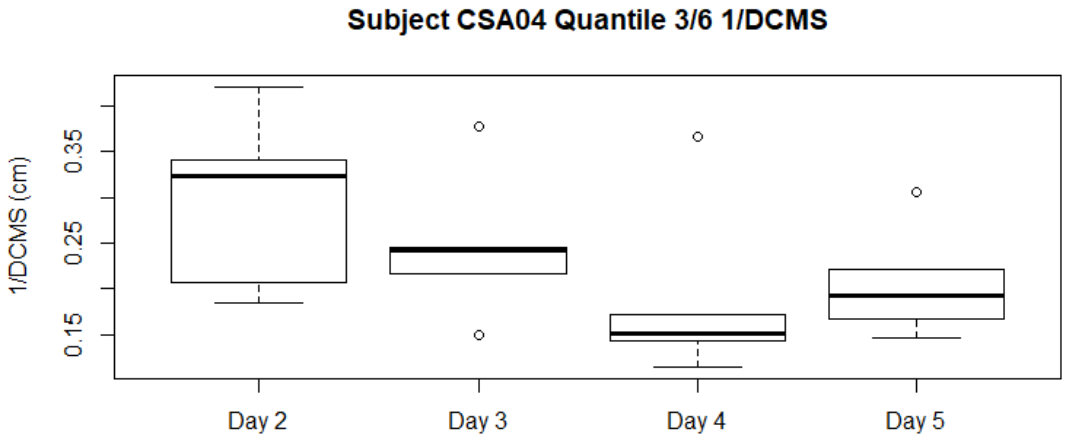

Figure B-129. Subject CSA04 Quantile 3 of 6 1/DCMS

As Table B-126 indicates, the null hypothesis of a normal distribution was rejected for day 2. The boxplot in Figure B-130 does not provide information to the contrary. Bartlett's test produced a K^2 value of 14.537 and a p value of 0.002259, rejecting the null hypothesis of homoscedasticity. The Brunner-Dette-Munk test produced an F value of 0.3613787 and a p value of 0.7538462, failing to reject the null hypothesis of equality of distribution functions. Because this null hypothesis was not rejected, it cannot be concluded that accuracy, as measured by the fourth quantile of 1/DCMS changed over the 4 days of firing.

Table B-126. Subject CSA04 Quantile 4 of 6 1/DCMS Shapiro-Wilk Test Results

Day	W	P-Value
2	0.70488	0.010764
3	0.83906	0.162352
4	0.83889	0.1619
5	0.81394	0.10475

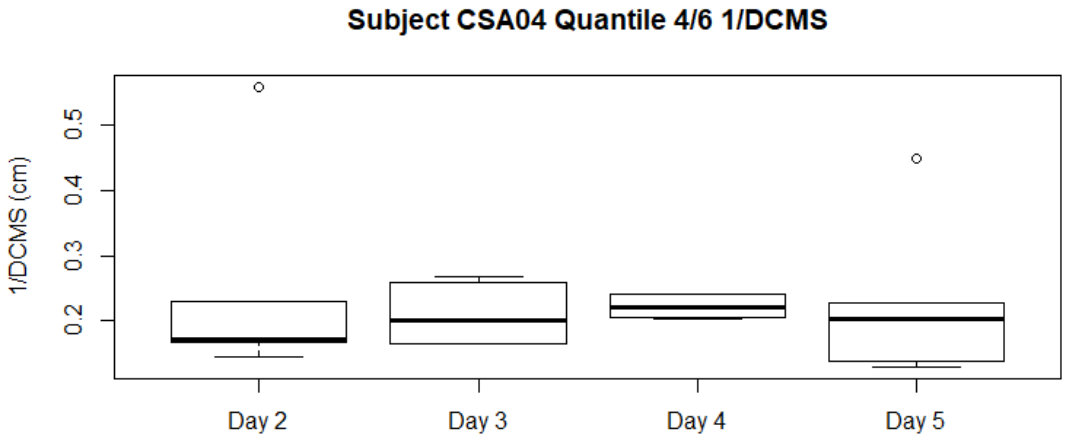

Figure B-130. Subject CSA04 Quantile 4 of 6 1/DCMS

As Table B-127 indicates, the null hypothesis of a normal distribution was rejected for day 2. The boxplot in Figure B-131 does not provide information to the contrary. Bartlett's test produced a K^2 value of 3.3775 and a p value of 0.337, failing to reject the null hypothesis of homoscedasticity. The Kruskal-Wallis test produced a X^2 value of 0.55429 and a p value of 0.9068, failing to reject the null hypothesis of equality of dataset medians. Because this null hypothesis was not rejected, it cannot be concluded that accuracy, as measured by the fifth quantile of 1/DCMS changed over the 4 days of firing.

Table B-127. Subject CSA04 Quantile 5 of 6 1/DCMS Shapiro-Wilk Test Results

Day	W	P-Value
2	0.73313	0.02061
3	0.90821	0.4569
4	0.94489	0.7007
5	0.84991	0.19424

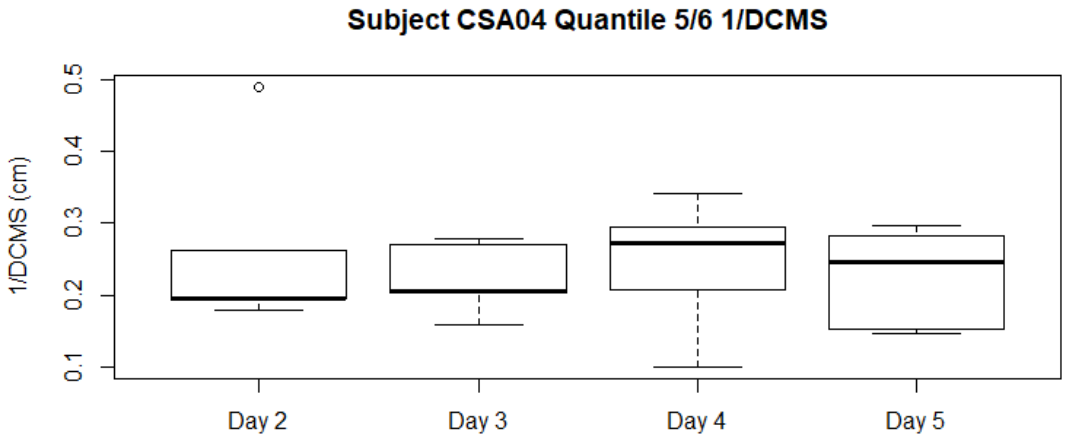

Figure B-131. Subject CSA04 Quantile 5 of 6 1/DCMS

As Table B-128 indicates, the null hypothesis of a normal distribution was not rejected for any days. The boxplot in Figure B-132 is not, however, indicative of a normal distribution. Bartlett's test produced a K^2 value of 6.0155 and a p value of 0.1109, failing to reject the null hypothesis of homoscedasticity. The Kruskal-Wallis test produced a X^2 value of 3.1263 and a p value of 0.3726, failing to reject the null hypothesis of equality of dataset medians. Because this null hypothesis was not rejected, it cannot be concluded that accuracy, as measured by the sixth quantile of 1/DCMS changed over the 4 days of firing.

Table B-128. Subject CSA04 Quantile 6 of 6 1/DCMS Shapiro-Wilk Test Results

Day	W	P-Value
2	0.90811	0.45632
3	0.91024	0.4837
4	0.98411	0.9553
5	0.92742	0.57889

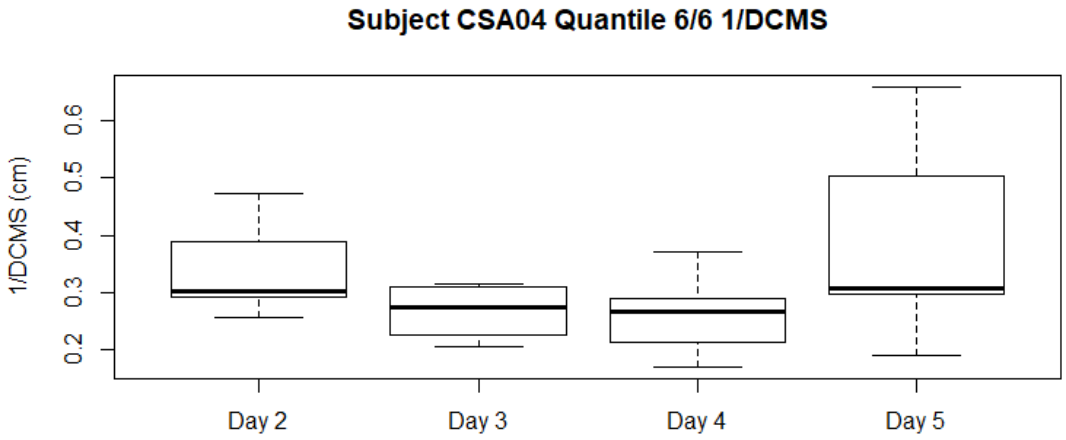

Figure B-132. Subject CSA04 Quantile 6 of 6 1/DCMS

6.3.4 Correlation Results

In Table B-129, the results of the Pearson, Kendall, and Spearman tests for correlation between shot time and the distance from the shot to the center of the target are shown. As Table B-129 indicates, the respective null hypotheses of no correlation were not rejected for any days using any of the tests. As such, it cannot be concluded that there is a significant correlation between shot time and shot distance.

Table B-129. Subject CSA04 Correlation Results

		Pearson			Kendall			Spearman	
Day	T	P-Value	Coefficient	Z	P-Value	Tau	S	P-Value	Rho
2	-0.88478	0.3787	-0.0939	-0.54377	0.5866	-0.03905	129470	0.5381	-0.06575
3	-1.6998	0.09283	-0.18131	-1.0342	0.301	-0.07582	121330	0.3302	-0.10562
4	-0.75112	0.4546	-0.07981	-0.47063	0.6379	-0.03385	126550	0.6965	-0.04168
5	-1.6931	0.09398	-0.17761	-1.0214	0.3071	-0.07347	134450	0.3167	-0.10672

6.4 Subject CSA05 Results

6.4.1 IES Scoring Results

The MPI to CZP distance based IES results shown in Figure B-133 are indicative of similar trends for radii of 5 and 4 cm. The trend for 3 cm was similar to those trends, but was greater in amplitude. The trend for 2 cm had extreme changes due to the fact that no shot groups were within 2 cm of the center of the target on day 3 or day 5.

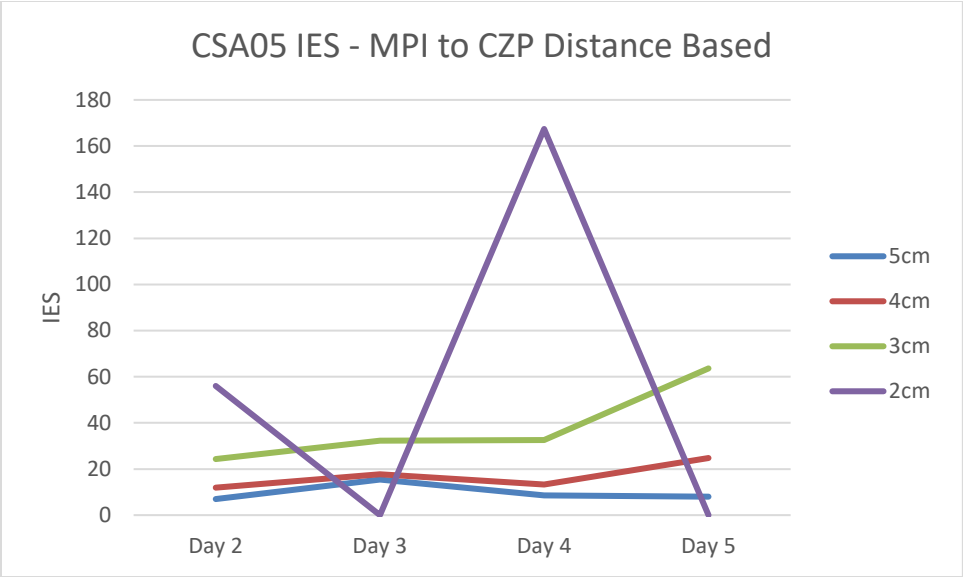

Figure B-133. Subject CSA05 IES - MPI to CZP Distance Based

The MPI to CZP distance based RT results in Figure B-134 show very similar trends for radii from 5 to 3 cm, with the 5 cm data showing an overall decrease. The 2 cm data showed a trend of extreme changes caused by the fact that no shot groups were within 2 cm of the center of the target on days 3 and 5.

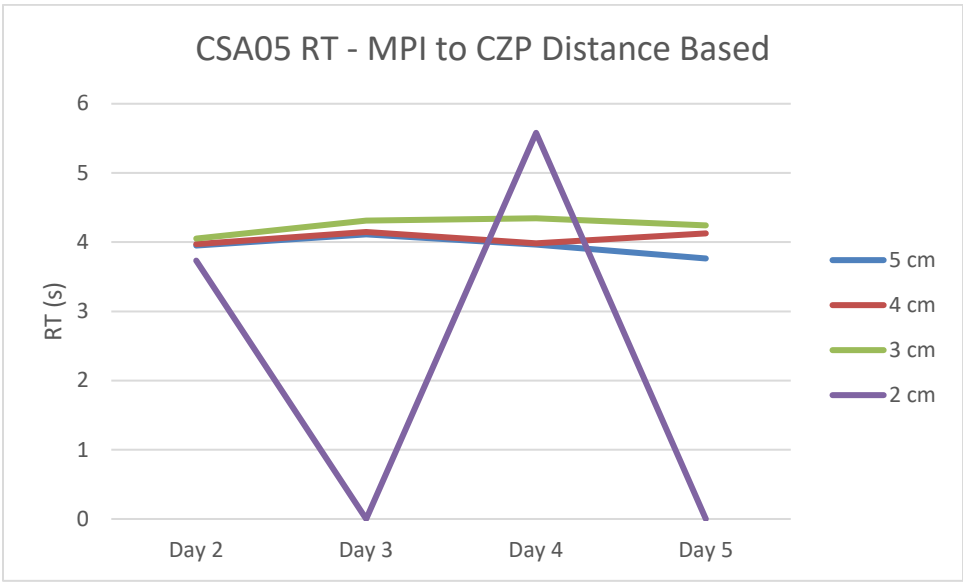

Figure B-134. Subject CSA05 RT – MPI to CZP Distance Based

MPI to CZP distance based proportion correct results, illustrated in Figure B-135, show more hits at greater radii, although the hit proportions for the 5 cm and 4 cm radii on day 3 are relatively close, due to the significant decrease in the 5 cm results. Overall, the trend among all radii was a decrease from day 2 to day 5.

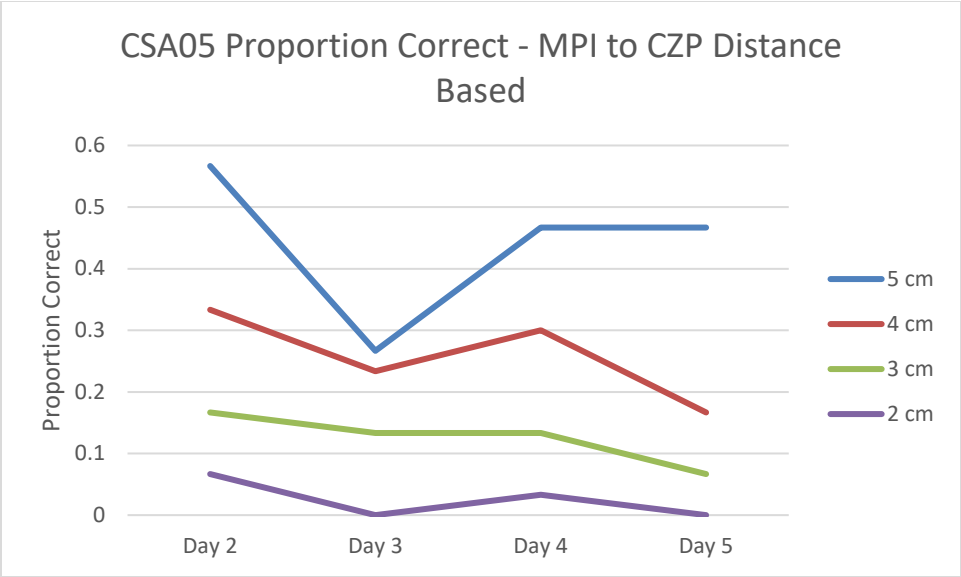

Figure B-135. Subject CSA05 Proportion Correct - MPI to CZP Distance Based

The DCMS based IES results, illustrated in Figure B-136, show similar trends for radii of 5 and 4 cm, while the 3 cm results show greater overall values and more extreme changes. The 2 cm results show extreme changes due to the fact that no shot groups were within 2 cm of the center of the target on days 3 and 5.

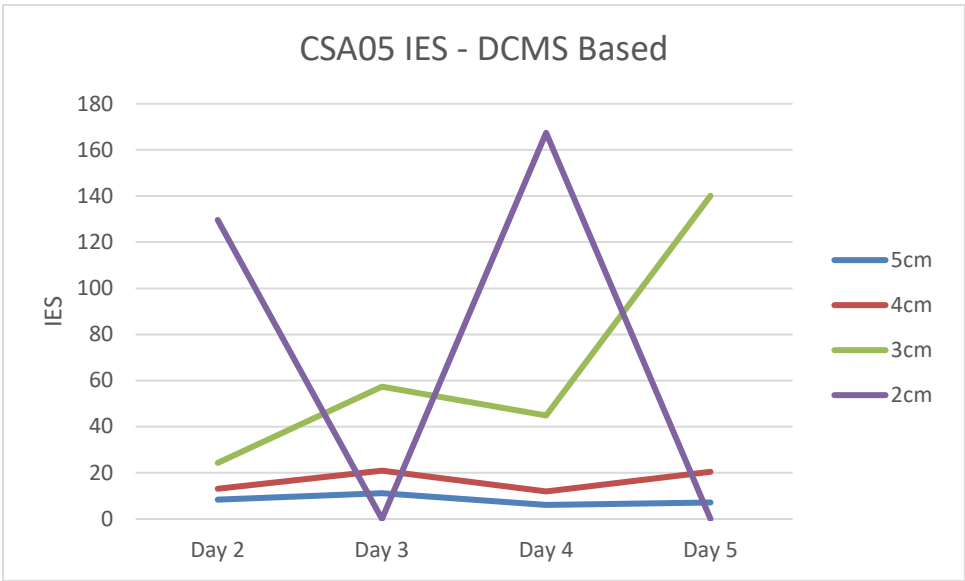

Figure B-136. Subject CSA05 IES – DCMS Based

The DCMS based RT results illustrated in Figure B-137 show similar trends for radii of 5 and 4 cm. The trend for 3 cm differs, showing a decrease followed by an increase from day 3 to day 5. The 2 cm results have extreme changes due to the fact that no shot groups were within 2 cm of the center of the target.

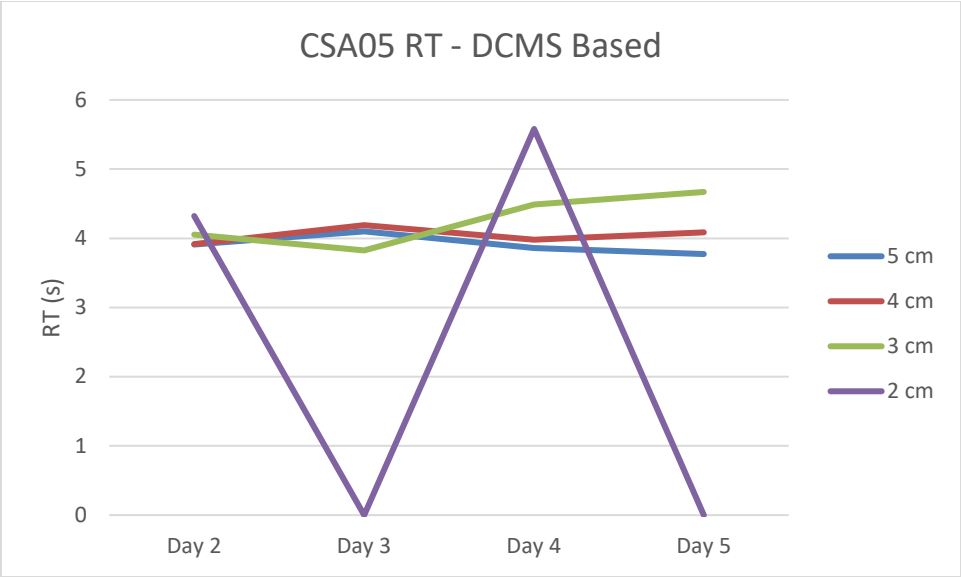

Figure B-137. Subject CSA05 RT - DCMS Based

The DCMS based proportion correct results illustrated in Figure B-138 show similar patterns for the 5 cm and 4 cm radii. The 3 cm results show less extreme changes, while the 2 cm results were indicative of little change except for values of 0 on day 3 and day 5.

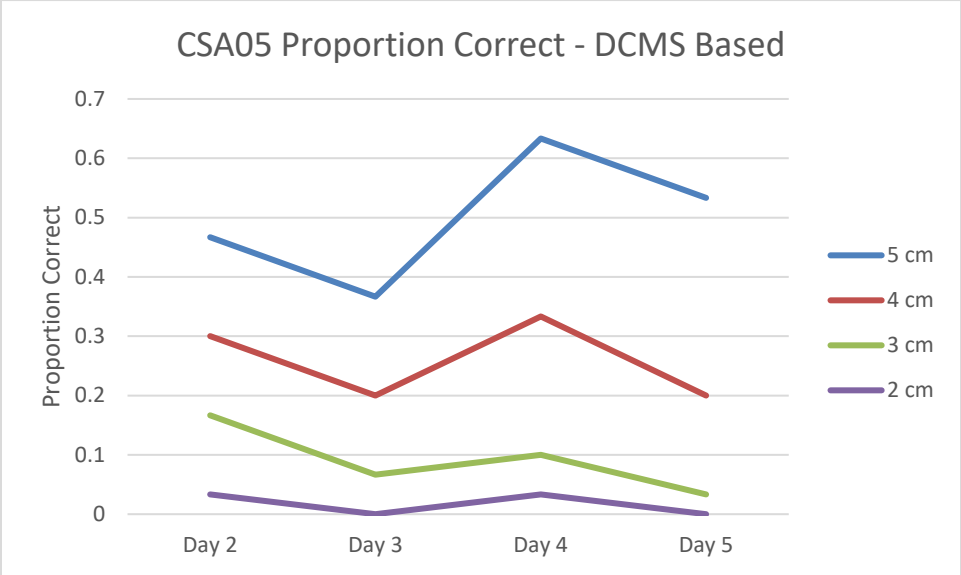

Figure B-138. Subject CSA05 Proportion Correct - DCMS Based

6.4.2 Conditional Accuracy Function Results

As Table B-130 indicates, the null hypothesis of a normal distribution was rejected for quantiles 1 and 4. The boxplot in Figure B-139 does not provide information to the contrary. Bartlett's test produced a K^2 value of 6.3617 and a p value of 0.1737, failing to reject the

null hypothesis of homoscedasticity. The Kruskal-Wallis test produced a X^2 value of 1.071 and a p value of 0.8989, failing to reject the null hypothesis of equality of dataset medians. Because this null hypothesis was not rejected, it cannot be concluded that accuracy, as measured by 1/MPI to CZP distance, differed by time quantile on day 2.

Table B-130. Subject CSA05 Day 2 Five Quantile 1/MPI to CZP Distance Shapiro-Wilk Test Results

Quantile	W	P-Value
1	0.7546	0.0221
2	0.8586	0.1843
3	0.8428	0.1374
4	0.735	0.0141
5	0.9484	0.7274

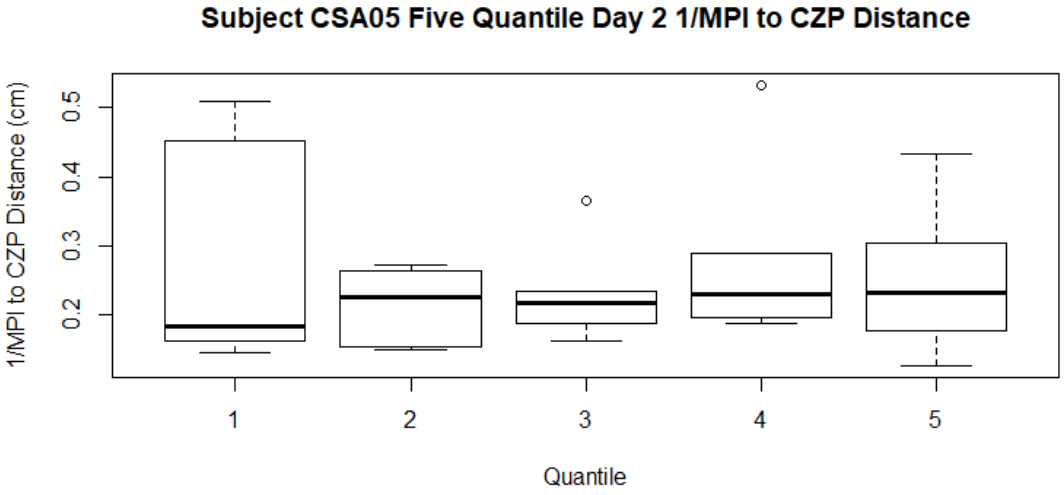

Figure B-139. Subject CSA05 Five Quantile Day 2 1/MPI to CZP Distance

As Table B-131 indicates, the null hypothesis of a normal distribution was rejected for quantiles 1 and 5. The boxplot in Figure B-140 does not provide information to the contrary. Bartlett's test produced a K^2 value of 7.0812 and a p value of 0.1317, failing to reject the null hypothesis of homoscedasticity. The Kruskal-Wallis test produced a X^2 value of 4.4387 and a p value of 0.3499, failing to reject the null hypothesis of equality of dataset medians. Because this null hypothesis was not rejected, it cannot be concluded that accuracy, as measured by 1/DCMS, differed by time quantile on day 2.

Table B-131. Subject CSA05 Five Quantile Day 2 Five Quantile 1/DCMS Shapiro-Wilk Test Results

Quantile	W	P-Value
1	0.7487	0.0193
2	0.9431	0.6841
3	0.9353	0.6214

4	0.8798	0.2683
5	0.7878	0.0455

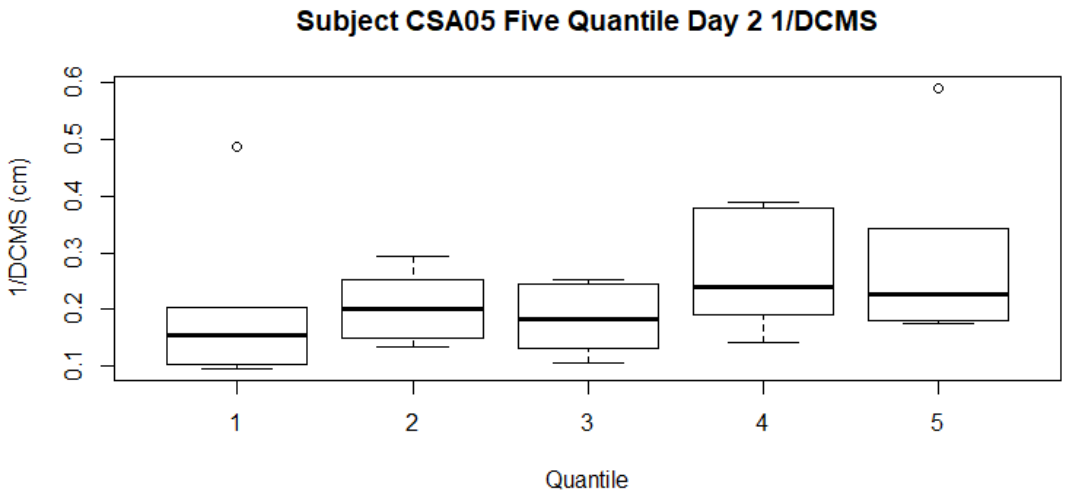

Figure B-140. Subject CSA05 Five Quantile Day 2 1/DCMS

As Table B-132 indicates, the null hypothesis of a normal distribution was rejected for quantiles 1 and 5. The boxplot in Figure B-141 does not provide information to the contrary. Bartlett's test produced a K^2 value of 8.6197 and a p value of 0.07134, failing to reject the null hypothesis of homoscedasticity. The Kruskal-Wallis test produced a X^2 value of 8.2194 and a p value of 0.08387, failing to reject the null hypothesis of equality of dataset medians. Because this null hypothesis was not rejected, it cannot be concluded that accuracy, as measured by 1/MPI to CZP distance, differed by time quantile on day 3.

Table B-132. Subject CSA05 Five Quantile Day 3 1/MPI to CZP Distance Shapiro-Wilk Test Results

Quantile	W	P-Value
1	0.7828	0.0409
2	0.93	0.5801
3	0.8157	0.081
4	0.8599	0.1889
5	0.7435	0.0172

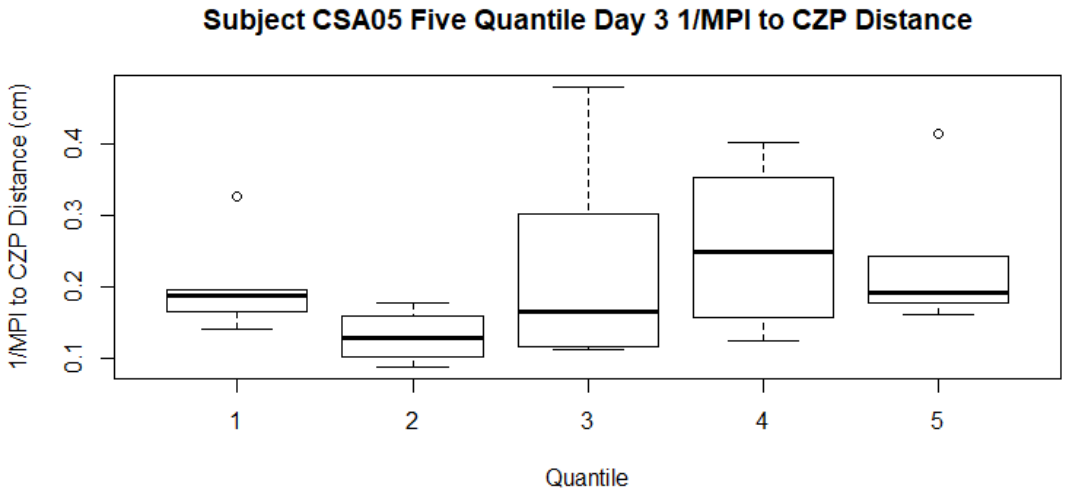

Figure B-141. Subject CSA05 Five Quantile Day 3 1/MPI to CZP Distance

As Table B-133 indicates, the null hypothesis of a normal distribution was not rejected for any quantiles. The boxplot in Figure B-142 is not, however, indicative of a normal distribution. Bartlett's test produced a K^2 value of 2.0189 and a p value of 0.7323, failing to reject the null hypothesis of homoscedasticity. The Kruskal-Wallis test produced a X^2 value of 3.9527 and a p value of 0.4124, failing to reject the null hypothesis of equality of dataset medians. Because this null hypothesis was not rejected, it cannot be concluded that accuracy, as measured by 1/DCMS, differed by time quantile on day 3.

Table B-133. Subject CSA05 Five Quantile Day 3 1/DCMS Shapiro-Wilk Test Results

Quantile	W	P-Value
1	0.8165	0.0822
2	0.9612	0.8291
3	0.9204	0.5084
4	0.8405	0.1316
5	0.831	0.1096

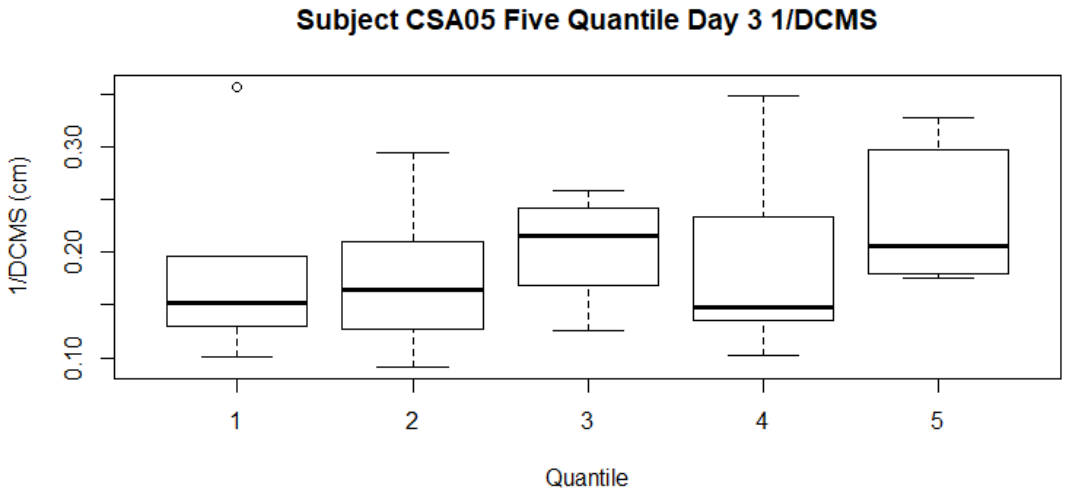

Figure B-142. Subject CSA05 Five Quantile Day 3 1/DCMS

As Table B-134 indicates, the null hypothesis of a normal distribution was rejected for quantiles 1, 3 and 5. The boxplot in Figure B-143 does not provide information to the contrary. Bartlett's test produced a K^2 value of 7.0844 and a p value of 0.1315, failing to reject the null hypothesis of homoscedasticity. The Kruskal-Wallis test produced a X^2 value of 3.686 and a p value of 0.4502, failing to reject the null hypothesis of equality of dataset medians. Because this null hypothesis was not rejected, it cannot be concluded that accuracy, as measured by 1/MPI to CZP distance, differed by time quantile on day 4.

Table B-134. Subject CSA05 Five Quantile Day 4 1/MPI to CZP Distance Shapiro-Wilk Test Results

Quantile	W	P-Value
1	0.7626	0.0264
2	0.8697	0.225
3	0.7907	0.0484
4	0.8704	0.2279
5	0.7707	0.0315

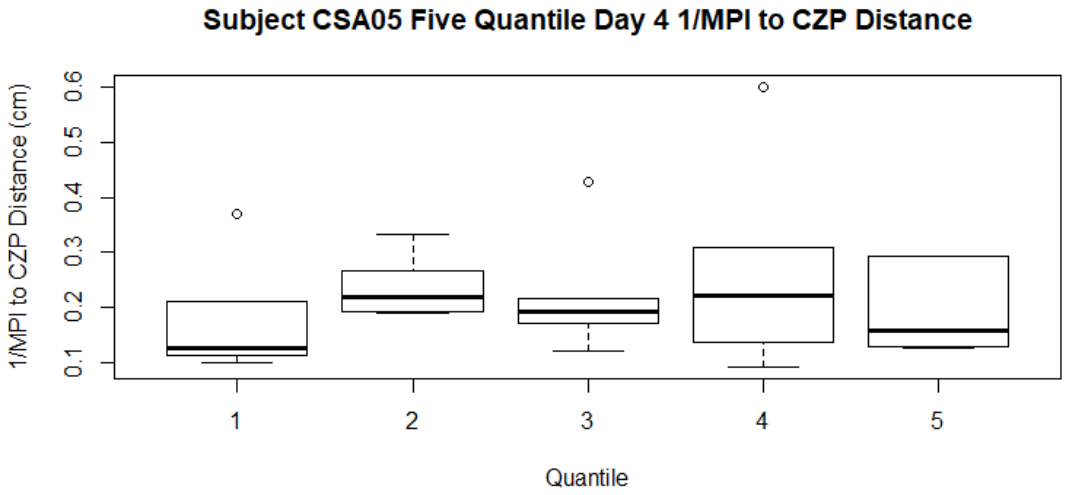

Figure B-143. Subject CSA05 Five Quantile Day 4 1/MPI to CZP Distance

As Table B-135 indicates, the null hypothesis of a normal distribution was not rejected for any quantiles. The boxplot in Figure B-144 is not, however, indicative of a normal distribution. Bartlett's test produced a K^2 value of 7.3426 and a p value of 0.1189, failing to reject the null hypothesis of homoscedasticity. The Kruskal-Wallis test produced a X^2 value of 2.7398 and a p value of 0.6023, failing to reject the null hypothesis of equality of dataset medians. Because this null hypothesis was not rejected, it cannot be concluded that accuracy, as measured by 1/DCMS, differed by time quantile on day 4.

Table B-135. Subject CSA05 Five Quantile Day 4 1/DCMS Shapiro-Wilk Test Results

Quantile	W	P-Value
1	0.957294	0.798659
2	0.927353	0.55982
3	0.847831	0.151158
4	0.910643	0.440642
5	0.862223	0.196923

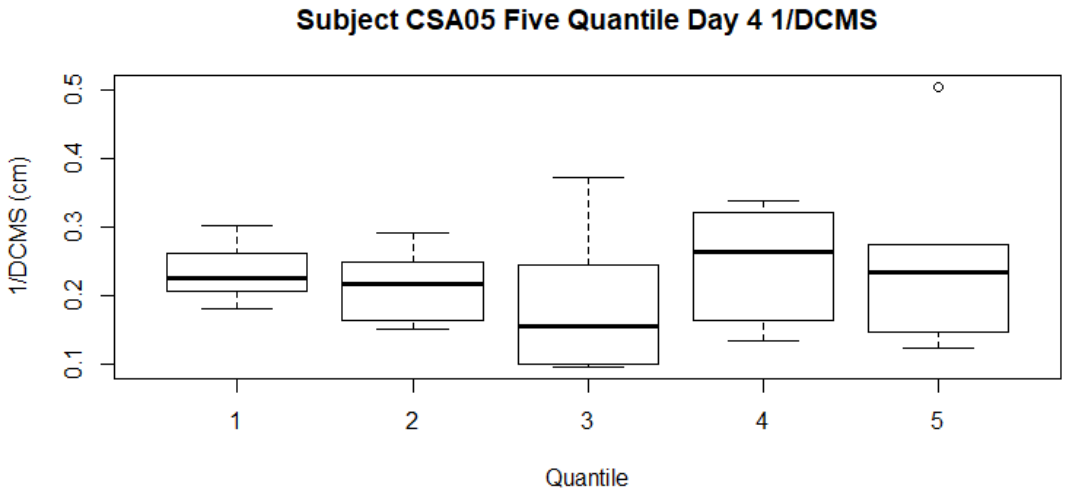

Figure B-144. Subject CSA05 Five Quantile Day 4 1/DCMS

As Table B-136 indicates, the null hypothesis of a normal distribution was not rejected for any quantiles. The boxplot in Figure B-145 is not, however, indicative of a normal distribution. Bartlett's test produced a K^2 value of 9.062 and a p value of 0.0597, failing to reject the null hypothesis of homoscedasticity. The Kruskal-Wallis test produced a X^2 value of 2.2753 and a p value of 0.6853, failing to reject the null hypothesis of equality of dataset medians. Because this null hypothesis was not rejected, it cannot be concluded that accuracy, as measured by 1/MPI to CZP distance, differed by time quantile on day 5.

Table B-136. Subject CSA05 Day 5 1/MPI to CZP Distance Shapiro-Wilk Test Results

Quantile	W	P-Value
1	0.8985	0.365
2	0.8943	0.3414
3	0.9097	0.4344
4	0.9492	0.7336
5	0.9156	0.4745

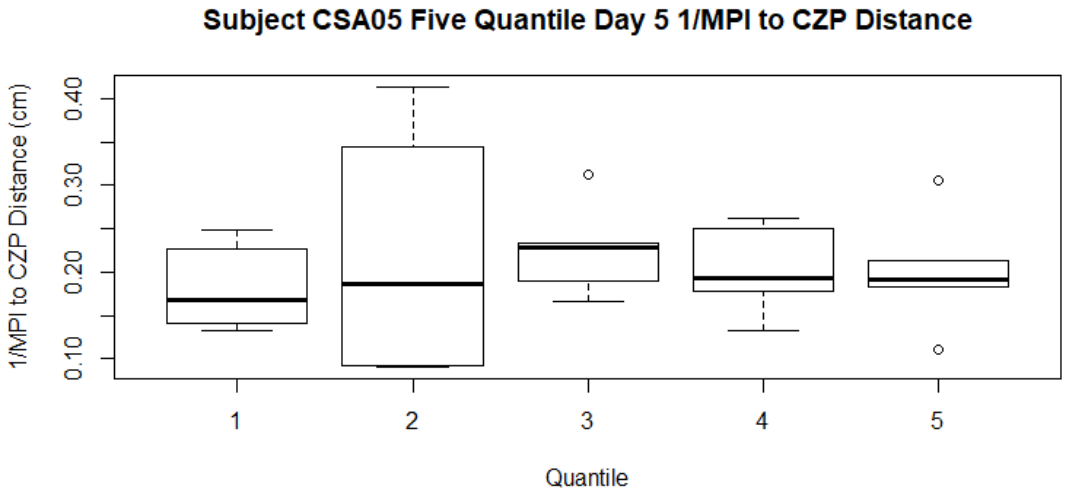

Figure B-145. Subject CSA05 Five Quantile Day 5 1/MPI to CZP Distance

As Table B-137 indicates, the null hypothesis of a normal distribution was not rejected for any quantiles. The boxplot in Figure B-146 is not, however, indicative of a normal distribution. Bartlett's test produced a K^2 value of 2.3775 and a p value of 0.6667, failing to reject the null hypothesis of homoscedasticity. The Kruskal-Wallis test produced a X^2 value of 8.1333 and a p value of 0.08681, failing to reject the null hypothesis of equality of dataset medians. Because this null hypothesis was not rejected, it cannot be concluded that accuracy, as measured by 1/DCMS, differed by time quantile on day 5.

Table B-137. Subject CSA05 Five Quantile Day 5 1/DCMS Shapiro-Wilk Test Results

Quantile	W	P-Value
1	0.8982	0.3632
2	0.8929	0.3338
3	0.8661	0.211
4	0.8722	0.2351
5	0.9714	0.9017

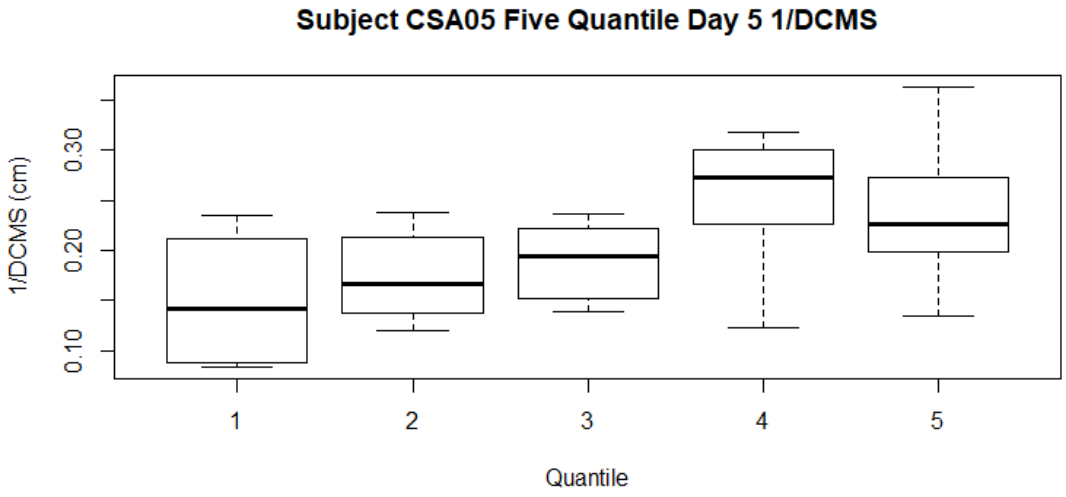

Figure B-146. Subject CSA05 Five Quantile Day 5 1/DCMS

As Table B-138 indicates, the null hypothesis of a normal distribution was rejected for quantile 4. The boxplot in Figure B-147 does not provide information to the contrary. Bartlett's test produced a K^2 value of 9.635 and a p value of 0.08626, failing to reject the null hypothesis of homoscedasticity. The Kruskal-Wallis test produced a X^2 value of 4.1381 and a p value of 0.5297, failing to reject the null hypothesis of equality of dataset medians. Because this null hypothesis was not rejected, it cannot be concluded that accuracy, as measured by 1/MPI to CZP distance, differed by time quantile on day 2.

Table B-138. Subject CSA05 Six Quantile Day 2 1/MPI to CZP Distance Shapiro-Wilk Test Results

Quantile	W	P-Value
1	0.8049	0.0888
2	0.806	0.0906
3	0.8787	0.3036
4	0.6931	0.0081
5	0.8439	0.1759
6	0.8798	0.3084

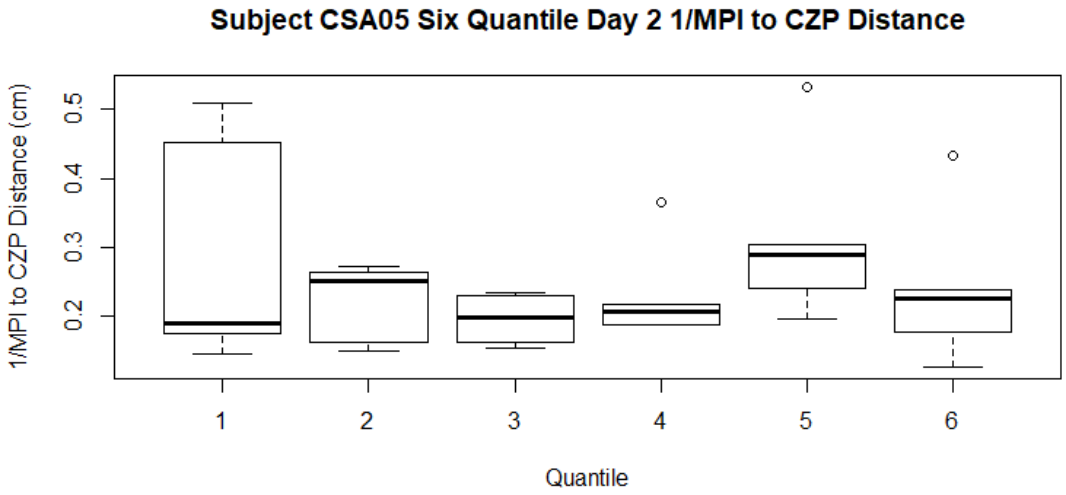

Figure B-147. Subject CSA05 Six Quantile Day 2 1/MPI to CZP Distance

As Table B-139 indicates, the null hypothesis of a normal distribution was rejected for quantile 1. The boxplot in Figure B-148 does not provide information to the contrary. Bartlett's test produced a K^2 value of 10.932 and a p value of 0.05274, failing to reject the null hypothesis of homoscedasticity. The Kruskal-Wallis test produced a X^2 value of 7.8232 and a p value of 0.1663, failing to reject the null hypothesis of equality of dataset medians. Because this null hypothesis was not rejected, it cannot be concluded that accuracy, as measured by 1/DCMS, differed by time quantile on day 2.

Table B-139. Subject CSA05 Six Quantile Day 2 1/DCMS Shapiro-Wilk Test Results

Quantile	W	P-Value
1	0.7443	0.0264
2	0.9565	0.7834
3	0.8959	0.3874
4	0.8476	0.1869
5	0.8878	0.3462
6	0.8487	0.1904

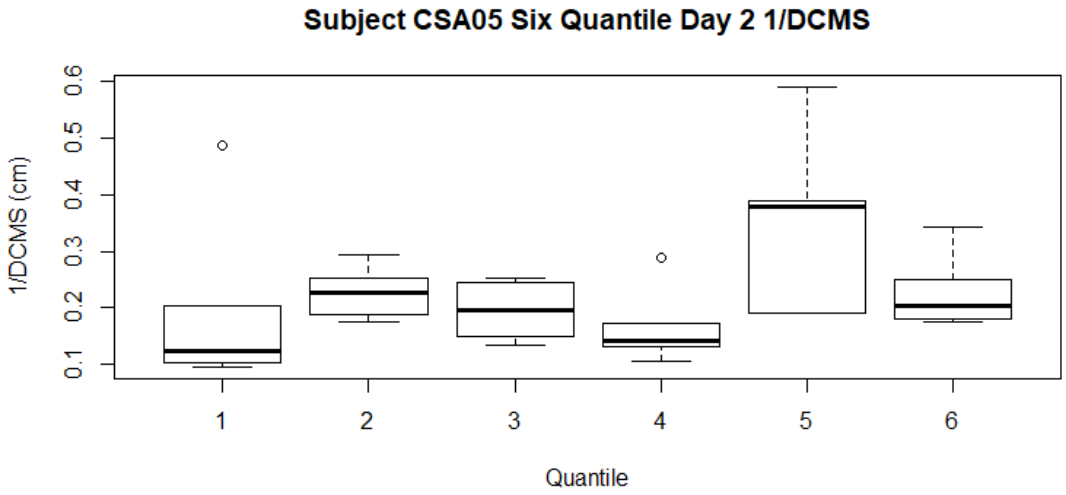

Figure B-148. Subject CSA05 Six Quantile Day 2 1/DCMS

As Table B-140 indicates, the null hypothesis of a normal distribution was rejected for quantiles 3, 5 and 6. The boxplot in Figure B-149 does not provide information to the contrary. Bartlett's test produced a K^2 value of 5.694 and a p value of 0.3371, failing to reject the null hypothesis of homoscedasticity. The Kruskal-Wallis test produced a X^2 value of 6.8477 and a p value of 0.2332, failing to reject the null hypothesis of equality of dataset medians. Because this null hypothesis was not rejected, it cannot be concluded that accuracy, as measured by 1/MPI to CZP distance, differed by time quantile on day 3.

Table B-140. Subject CSA05 Six Quantile Day 3 1/MPI to CZP Distance Shapiro-Wilk Test Results

Quantile	W	P-Value
1	0.8191	0.1149
2	0.9049	0.4373
3	0.6888	0.0073
4	0.9398	0.6649
5	0.7099	0.0121
6	0.7519	0.031

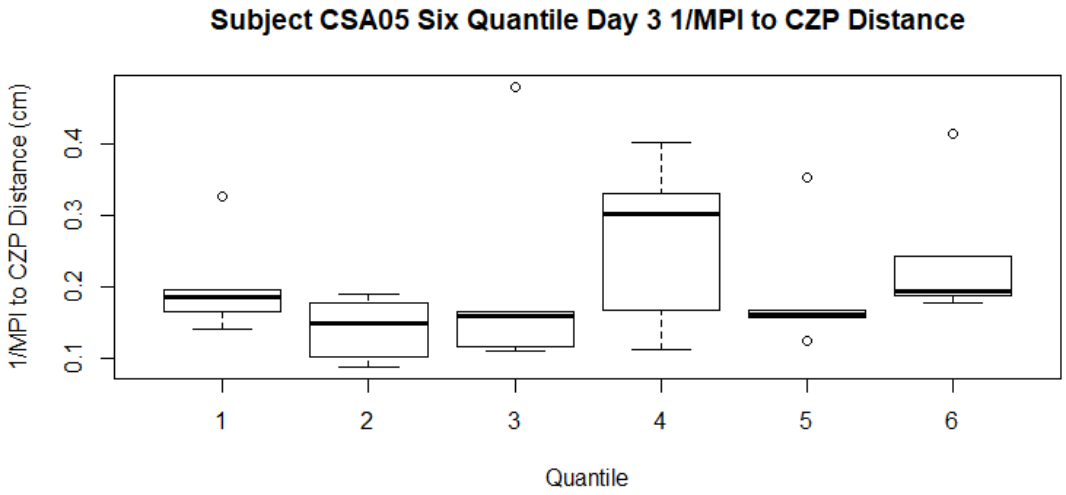

Figure B-149. Subject CSA05 Six Quantile Day 3 1/MPI to CZP Distance

As Table B-141 indicates, the null hypothesis of a normal distribution was rejected for quantile 6. The boxplot in Figure B-150 does not provide information to the contrary. Bartlett's test produced a K^2 value of 4.1164 and a p value of 0.5328, failing to reject the null hypothesis of homoscedasticity. The Kruskal-Wallis test produced a X^2 value of 6.3574 and a p value of 0.273, failing to reject the null hypothesis of equality of dataset medians. Because this null hypothesis was not rejected, it cannot be concluded that accuracy, as measured by 1/DCMS, differed by time quantile on day 3.

Table B-141. Subject CSA05 Six Quantile Day 3 1/DCMS Shapiro-Wilk Test Results

Quantile	W	P-Value
1	0.8683	0.2596
2	0.9497	0.7351
3	0.9016	0.419
4	0.9511	0.7449
5	0.8871	0.3429
6	0.7597	0.0365

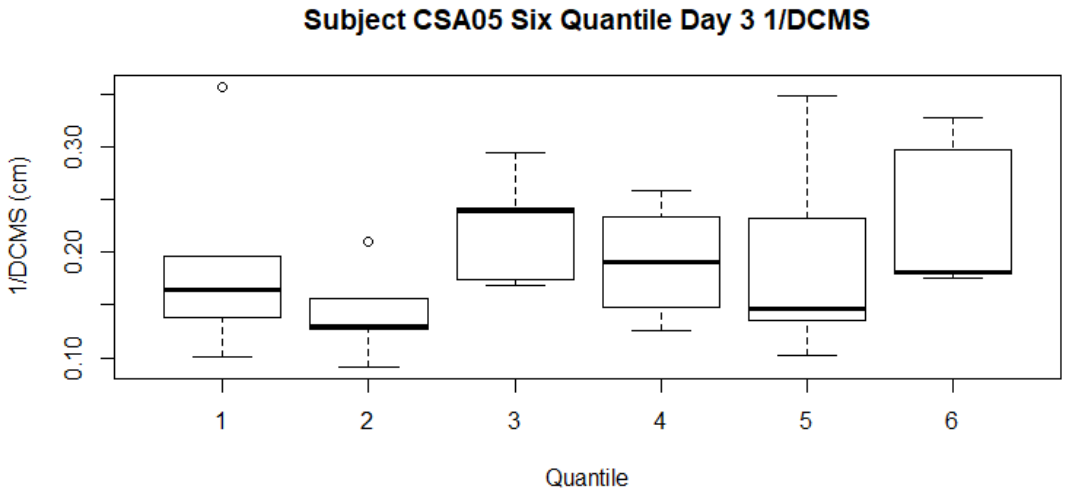

Figure B-150. Subject CSA05 Six Quantile Day 3 1/DCMS

As Table B-142 indicates, the null hypothesis of a normal distribution was rejected for quantile 3. The boxplot in Figure B-151 does not provide information to the contrary. Bartlett's test produced a K^2 value of 6.4759 and a p value of 0.2626, failing to reject the null hypothesis of homoscedasticity. The Kruskal-Wallis test produced a X^2 value of 4.2413 and a p value of 0.5152, failing to reject the null hypothesis of equality of dataset medians. Because this null hypothesis was not rejected, it cannot be concluded that accuracy, as measured by 1/MPI to CZP distance, differed by time quantile on day 4.

Table B-142. Subject CSA05 Six Quantile Day 4 1/MPI to CZP Distance Shapiro-Wilk Test Results

Quantile	W	P-Value
1	0.8248	0.1272
2	0.9992	0.9998
3	0.6399	0.002
4	0.9503	0.739
5	0.8077	0.0935
6	0.8117	0.1006

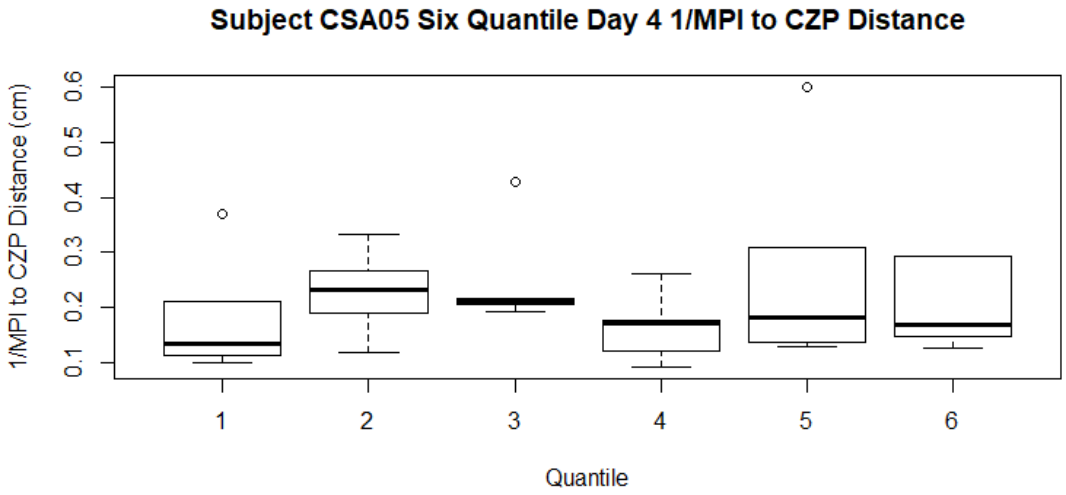

Figure B-151. Subject CSA05 Six Quantile Day 4 1/MPI to CZP Distance

As Table B-143 indicates, the null hypothesis of a normal distribution was rejected for quantile 6. The boxplot in Figure B-152 does not provide information to the contrary. Bartlett's test produced a K^2 value of 7.2274 and a p value of 0.2043, failing to reject the null hypothesis of homoscedasticity. The Kruskal-Wallis test produced a X^2 value of 1.6968 and a p value of 0.8893, failing to reject the null hypothesis of equality of dataset medians. Because this null hypothesis was not rejected, it cannot be concluded that accuracy, as measured by 1/DCMS, differed by time quantile on day 4.

Table B-143. Subject CSA05 Six Quantile Day 4 1/DCMS Shapiro-Wilk Test Results

Quantile	W	P-Value
1	0.8683	0.2596
2	0.9497	0.7351
3	0.9016	0.419
4	0.9511	0.7449
5	0.8871	0.3429
6	0.7597	0.0365

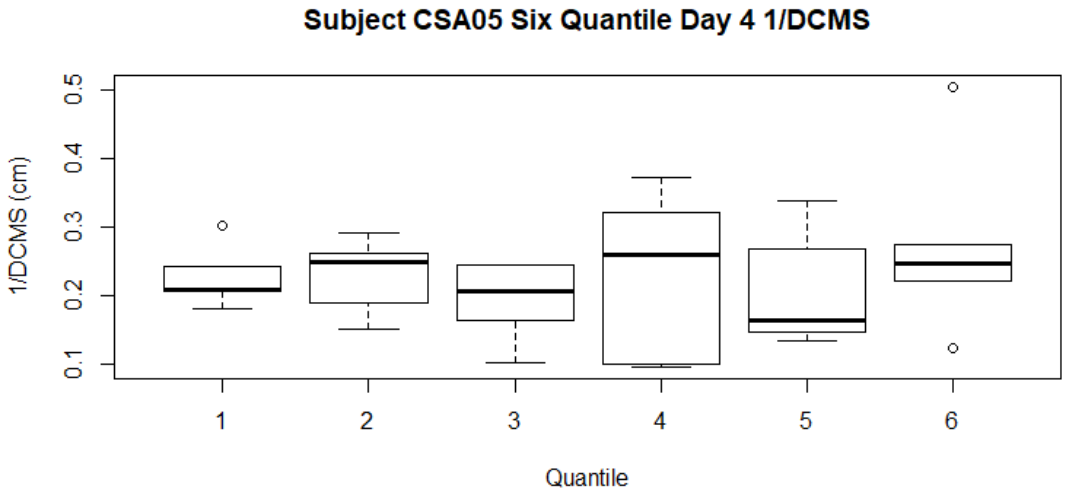

Figure B-152. Subject CSA05 Six Quantile Day 4 1/DCMS

As Table B-144 indicates, the null hypothesis of a normal distribution was not rejected for any quantiles. The boxplot in Figure B-153 is not, however, indicative of a normal distribution. Bartlett's test produced a K^2 value of 8.4847 and a p value of 0.1315, failing to reject the null hypothesis of homoscedasticity. The Kruskal-Wallis test produced a X^2 value of 2.3161 and a p value of 0.8039, failing to reject the null hypothesis of equality of dataset medians. Because this null hypothesis was not rejected, it cannot be concluded that accuracy, as measured by 1/MPI to CZP distance, differed by time quantile on day 5.

Table B-144. Subject CSA05 Six Quantile Day 5 1/MPI to CZP Distance Shapiro-Wilk Test Results

Quantile	W	P-Value
1	0.8661	0.2508
2	0.9408	0.6716
3	0.9868	0.9672
4	0.9356	0.635
5	0.9832	0.9509
6	0.9431	0.6878

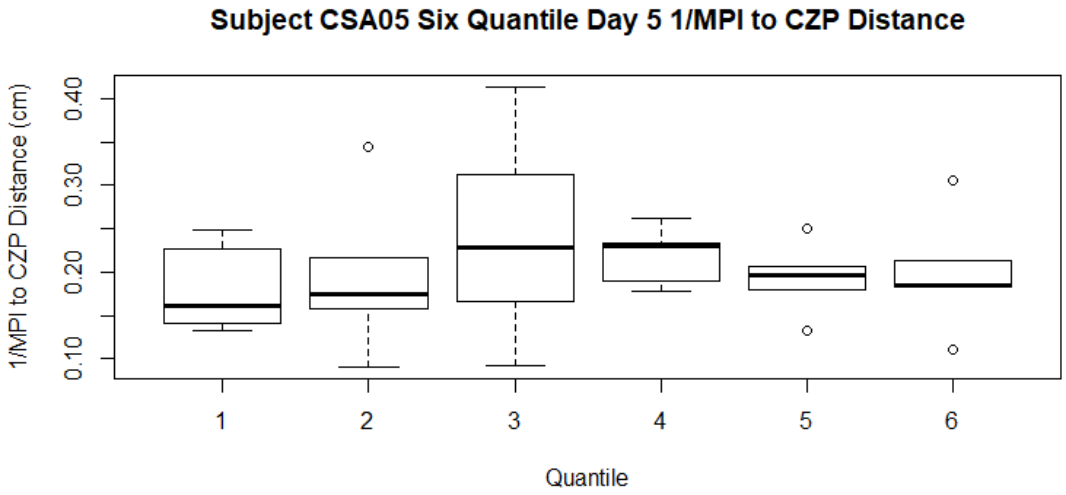

Figure B-153. Subject CSA05 Six Quantile Day 5 1/MPI to CZP Distance

As Table B-145 indicates, the null hypothesis of a normal distribution was not rejected for any quantiles. The boxplot in Figure B-154 is not, however, indicative of a normal distribution. Bartlett's test produced a K^2 value of 2.8789 and a p value of 0.7186, failing to reject the null hypothesis of homoscedasticity. The Kruskal-Wallis test produced a X^2 value of 7.6426 and a p value of 0.1771, failing to reject the null hypothesis of equality of dataset medians. Because this null hypothesis was not rejected, it cannot be concluded that accuracy, as measured by 1/DCMS, differed by time quantile on day 5.

Table B-145. Subject CSA05 Six Quantile Day 5 1/DCMS Shapiro-Wilk Test Results

Quantile	W	P-Value
1	0.8767	0.2948
2	0.8832	0.3242
3	0.8939	0.3769
4	0.9312	0.6043
5	0.9035	0.4292
6	0.9926	0.9881

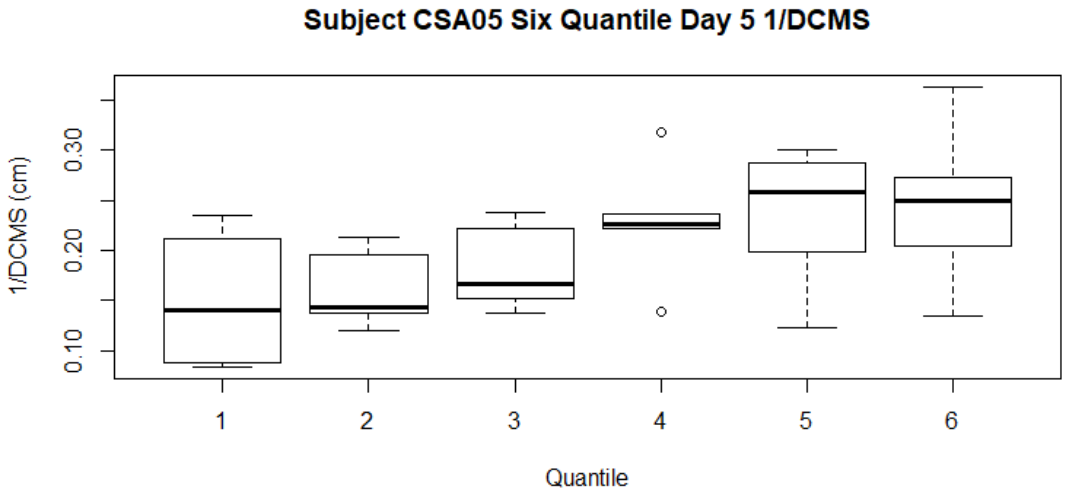

Figure B-154. Subject CSA05 Six Quantile Day 5 1/DCMS

6.4.3 Quantile Analysis

As Table B-146 indicates, the null hypothesis of a normal distribution was rejected for days 2, 3 and 4. The boxplot in Figure B-155 does not provide information to the contrary. Bartlett's test produced a K^2 value of 7.8333 and a p value of 0.04959, rejecting the null hypothesis of homoscedasticity. The Brunner-Dette-Munk test produced an F value of 1.207349 and a p value of 0.3339989, failing to reject the null hypothesis of equality of distribution functions. Because this null hypothesis was not rejected, it cannot be concluded that accuracy, as measured by the first quantile of 1/MPI to CZP distance changed over the 4 days of firing.

Table B-146. Subject CSA05 Quantile 1 of 5 1/MPI to CZP Distance Shapiro-Wilk Test Results

Day	W	P-Value
2	0.75456	0.02207
3	0.78278	0.04091
4	0.76263	0.02641
5	0.89848	0.36502

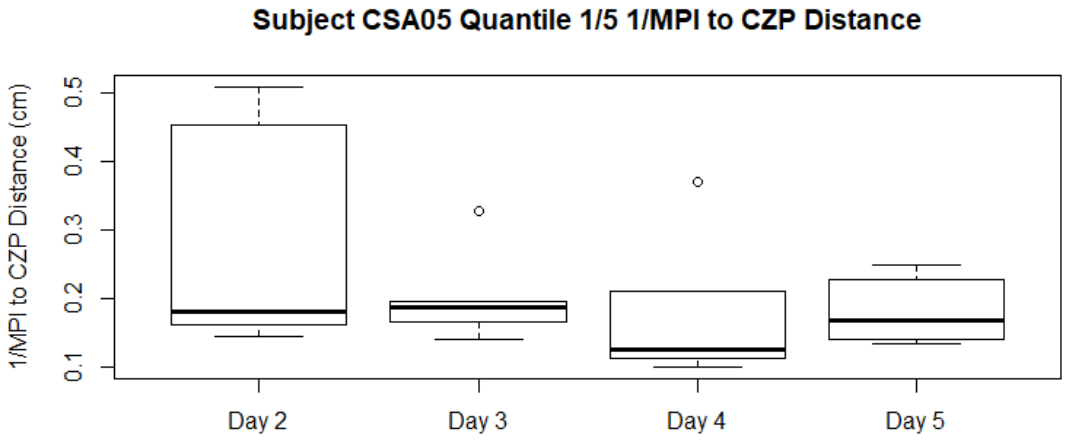

Figure B-155. Subject CSA05 Quantile 1 of 5 1/MPI to CZP Distance

As Table B-147 indicates, the null hypothesis of a normal distribution was not rejected for any days. The boxplot in Figure B-156 is not, however, indicative of a normal distribution. Bartlett's test produced a K^2 value of 9.161 and a p value of 0.02722, rejecting the null hypothesis of homoscedasticity. The Brunner-Dette-Munk test produced an F value of 3.054382 and a p value of 0.08327041, failing to reject the null hypothesis of equality of distribution functions. Because this null hypothesis was not rejected, it cannot be concluded that accuracy, as measured by the second quantile of 1/MPI to CZP distance changed over the 4 days of firing.

Table B-147. Subject CSA05 Quantile 2 of 5 1/MPI to CZP Distance Shapiro-Wilk Test Results

Day	W	P-Value
2	0.85856	0.18427
3	0.93	0.58007
4	0.86971	0.22503
5	0.89431	0.34137

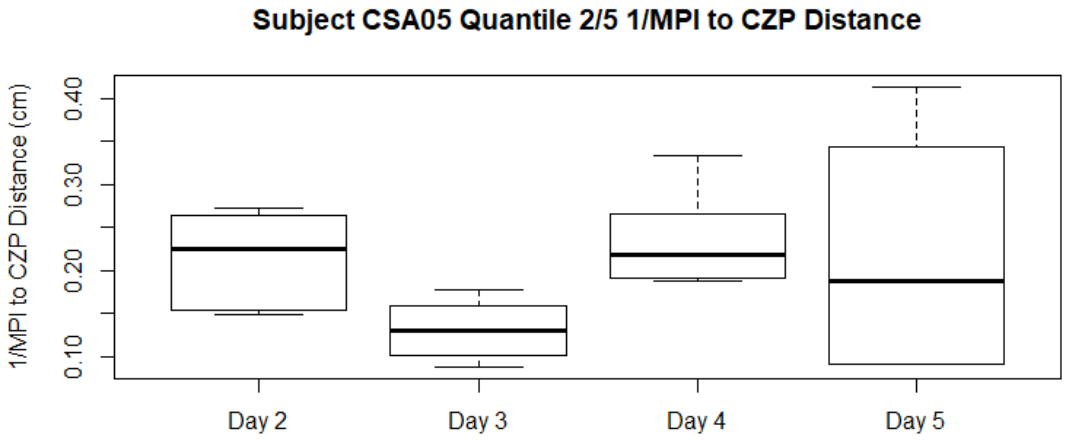

Figure B-156. Subject CSA05 Quantile 2 of 5 1/MPI to CZP Distance

As Table B-148 indicates, the null hypothesis of a normal distribution was rejected for day 4. The boxplot in Figure B-157 does not provide information to the contrary. Bartlett's test produced a K^2 value of 5.318 and a p value of 0.1499, failing to reject the null hypothesis of homoscedasticity. The Kruskal-Wallis test produced a X^2 value of 1.7133 and a p value of 0.634, failing to reject the null hypothesis of equality of distribution functions. Because this null hypothesis was not rejected, it cannot be concluded that accuracy, as measured by the third quantile of 1/MPI to CZP distance changed over the 4 days of firing.

Table B-148. Subject CSA05 Quantile 3 of 5 1/MPI to CZP Distance Shapiro-Wilk Test Results

Day	W	P-Value
2	0.84278	0.13744
3	0.81572	0.08101
4	0.79073	0.04843
5	0.9097	0.4344

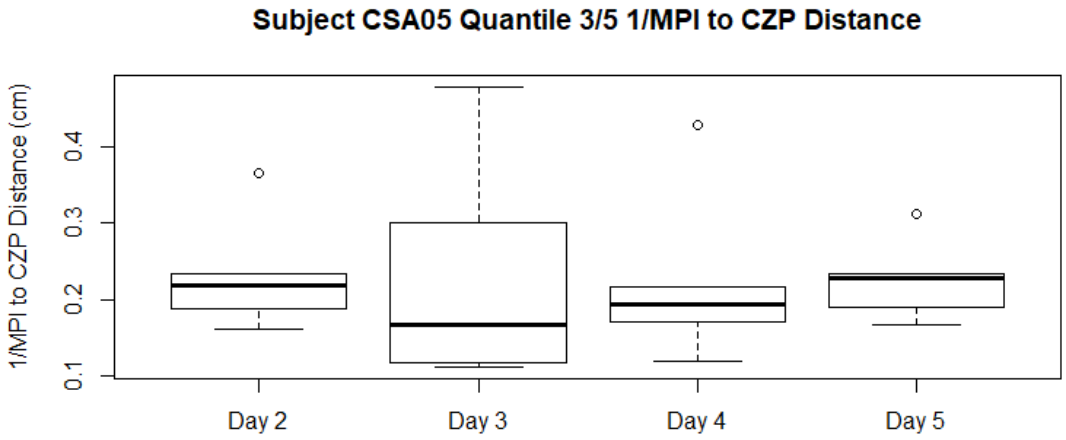

Figure B-157. Subject CSA05 Quantile 3 of 5 1/MPI to CZP Distance

As Table B-149 indicates, the null hypothesis of a normal distribution was rejected for day 2. The boxplot in Figure B-158 does not provide information to the contrary. Bartlett's test produced a K^2 value of 6.612 and a p value of 0.08535 failing to reject the null hypothesis of homoscedasticity. The Kruskal-Wallis test produced a X^2 value of 1.2333 and a p value of 0.745, failing to reject the null hypothesis of equality of dataset medians. Because this null hypothesis was not rejected, it cannot be concluded that accuracy, as measured by the fourth quantile of 1/MPI to CZP distance changed over the 4 days of firing.

Table B-149. Subject CSA05 Quantile 4 of 5 1/MPI to CZP Distance Shapiro-Wilk Test Results

Day	W	P-Value
2	0.73495	0.01414
3	0.85992	0.18887
4	0.87041	0.22786
5	0.94918	0.7336

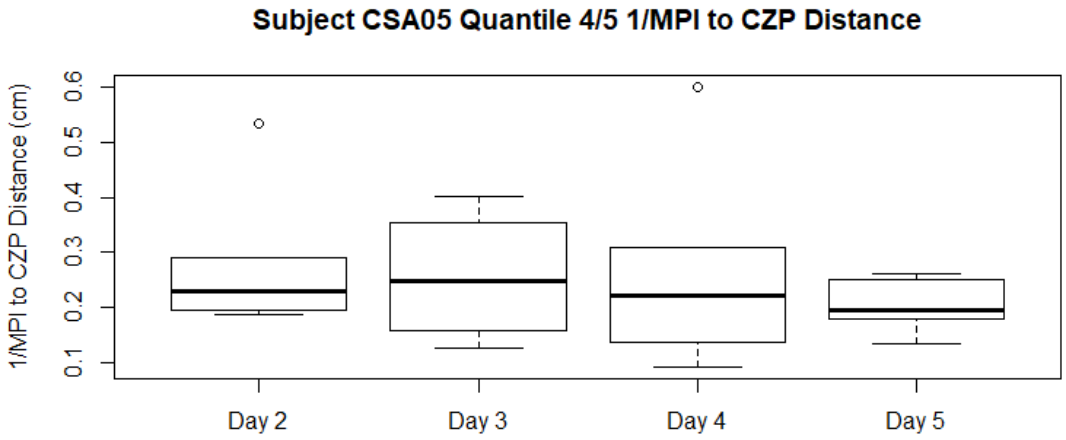

Figure B-158. Subject CSA05 Quantile 4/5 1/MPI to CZP Distance

As Table B-150 indicates, the null hypothesis of a normal distribution was rejected for days 3 and 4. The boxplot in Figure B-159 does not provide information to the contrary. Bartlett's test produced a K^2 value of 1.3833 and a p value of 0.7095 failing to reject the null hypothesis of homoscedasticity. The Kruskal-Wallis test produced a X^2 value of 1.7133 and a p value of 0.634, failing to reject the null hypothesis of equality of dataset medians. Because this null hypothesis was not rejected, it cannot be concluded that accuracy, as measured by the fifth quantile of 1/MPI to CZP distance changed over the 4 days of firing.

Table B-150. Quantile 5 of 5 1/MPI to CZP Distance Shapiro-Wilk Test Results

Day	W	P-Value
2	0.94842	0.72744
3	0.74347	0.01718
4	0.77069	0.03152
5	0.91563	0.47446

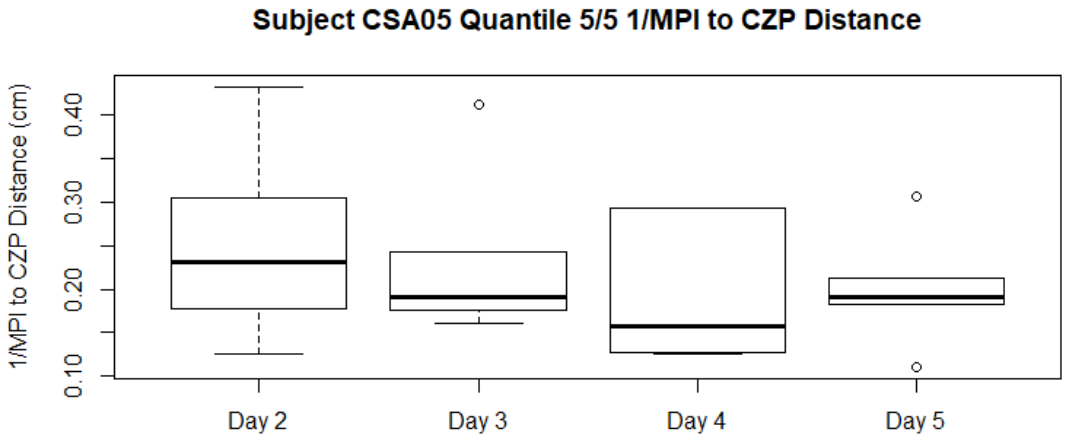

Figure B-159. Subject CSA05 Quantile 5 of 5 1/MPI to CZP Distance

As Table B-151 indicates, the null hypothesis of a normal distribution was rejected for day 2. The boxplot in Figure B-160 does not provide information to the contrary. Bartlett's test produced a K^2 value of 7.226 and a p value of 0.06503 failing to reject the null hypothesis of homoscedasticity. The Kruskal-Wallis test produced a X^2 value of 4.9667 and a p value of 0.1743, failing to reject the null hypothesis of equality of dataset medians. Because this null hypothesis was not rejected, it cannot be concluded that accuracy, as measured by the first quantile of 1/DCMS changed over the 4 days of firing.

Table B-151. Subject CSA05 Quantile 1 of 5 1/DCMS Shapiro-Wilk Test Results

Day	W	P-Value
2	0.7487	0.01934
3	0.81648	0.08225
4	0.95729	0.79866
5	0.89816	0.36317

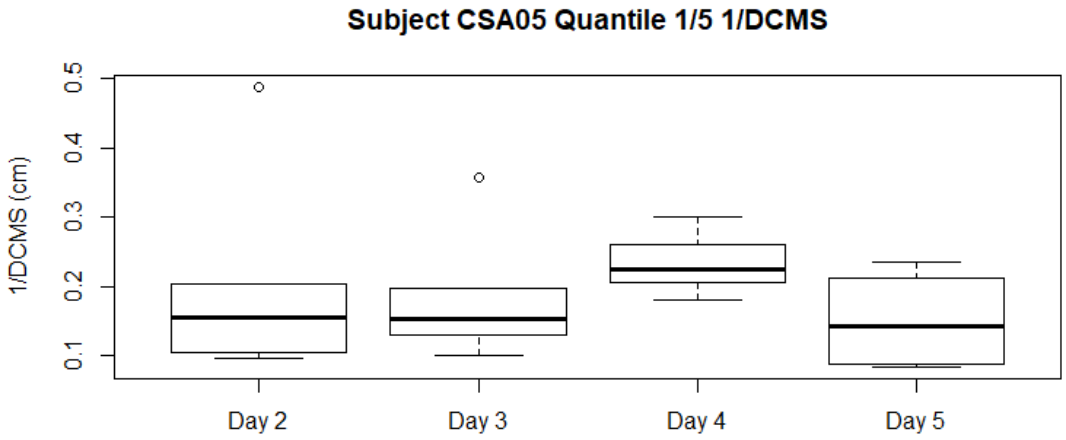

Figure B-160. Subject CSA05 Quantile 1 of 5 1/DCMS

As Table B-152 indicates, the null hypothesis of a normal distribution was not rejected for any days. The boxplot in Figure B-161 is not, however, strongly indicative of a normal distribution. Bartlett's test produced a K^2 value of 0.75445 and a p value of 0.8603 failing to reject the null hypothesis of homoscedasticity. The Kruskal-Wallis test produced a X^2 value of 2.3667 and a p value of 0.4999, failing to reject the null hypothesis of equality of dataset medians. Because this null hypothesis was not rejected, it cannot be concluded that accuracy, as measured by the second quantile of 1/DCMS changed over the 4 days of firing.

Table B-152. Subject CSA05 Quantile 2 of 5 1/DCMS Shapiro-Wilk Test Results

Day	W	P-Value
2	0.94308	0.6841
3	0.96123	0.82915
4	0.92735	0.55982
5	0.89292	0.33375

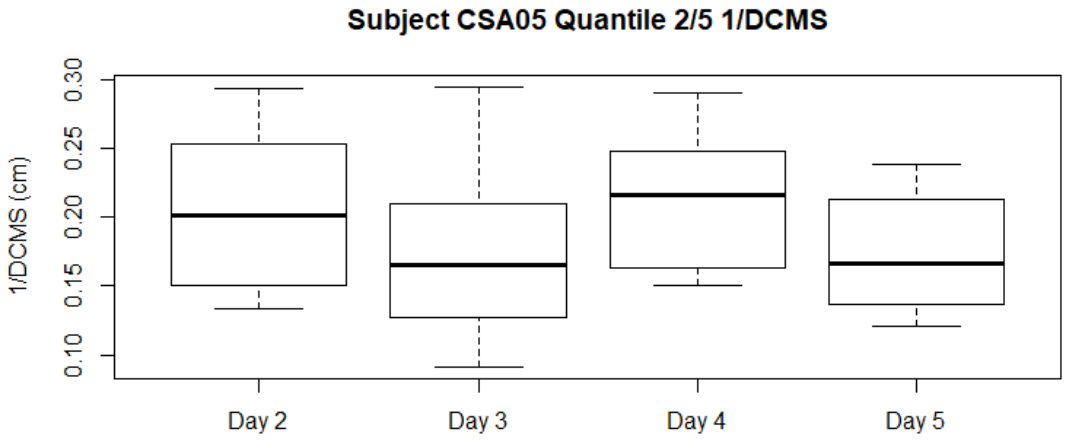

Figure B-161. Subject CSA05 Quantile 2 of 5 1/DCMS

As Table B-153 indicates, the null hypothesis of a normal distribution was not rejected for any days. The boxplot in Figure B-162 is not, however, indicative of a normal distribution. Bartlett's test produced a K^2 value of 5.3402 and a p value of 0.1485 failing to reject the null hypothesis of homoscedasticity. The Kruskal-Wallis test produced a X^2 value of 0.92667 and a p value of 0.819, failing to reject the null hypothesis of equality of dataset medians. Because this null hypothesis was not rejected, it cannot be concluded that accuracy, as measured by the third quantile of 1/DCMS changed over the 4 days of firing.

Table B-153. Subject CSA05 Quantile 3 of 5 1/DCMS Shapiro-Wilk Test Results

Day	W	P-Value
2	0.93528	0.62143
3	0.92042	0.50842
4	0.84783	0.15116
5	0.86608	0.21103

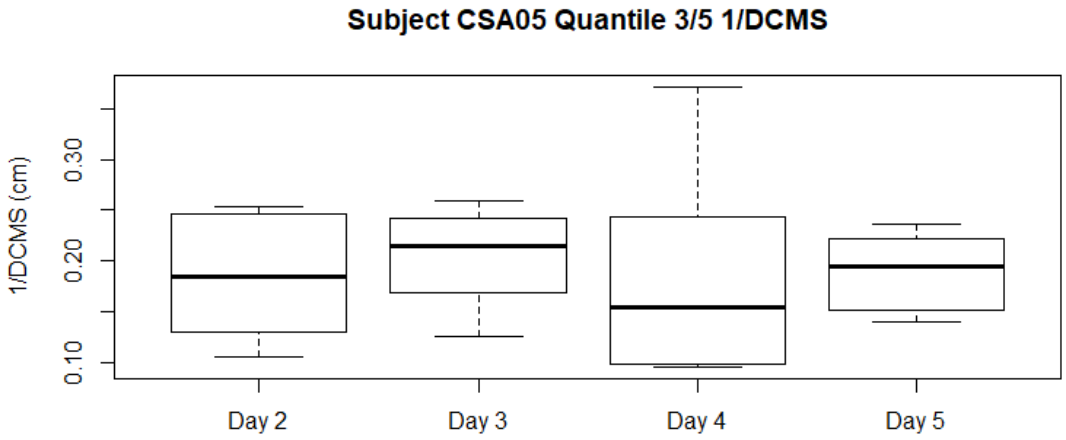

Figure B-162. Subject CAS05 Quantile 3 of 5 1/DCMS

As Table B-154 indicates, the null hypothesis of a normal distribution was not rejected for any days. The boxplot in Figure B-163 is not, however, indicative of a normal distribution. Bartlett's test produced a K^2 value of 0.74799 and a p value of 0.8619 failing to reject the null hypothesis of homoscedasticity. The Kruskal-Wallis test produced a X^2 value of 2.5 and a p value of 0.4753, failing to reject the null hypothesis of equality of dataset medians. Because this null hypothesis was not rejected, it cannot be concluded that accuracy, as measured by the fourth quantile of 1/DCMS changed over the 4 days of firing.

Table B-154. Subject CSA05 Quantile 4 of 5 1/DCMS Shapiro-Wilk Test Results

Day	W	P-Value
2	0.87983	0.26826
3	0.84049	0.13158
4	0.91064	0.44064
5	0.87218	0.23505

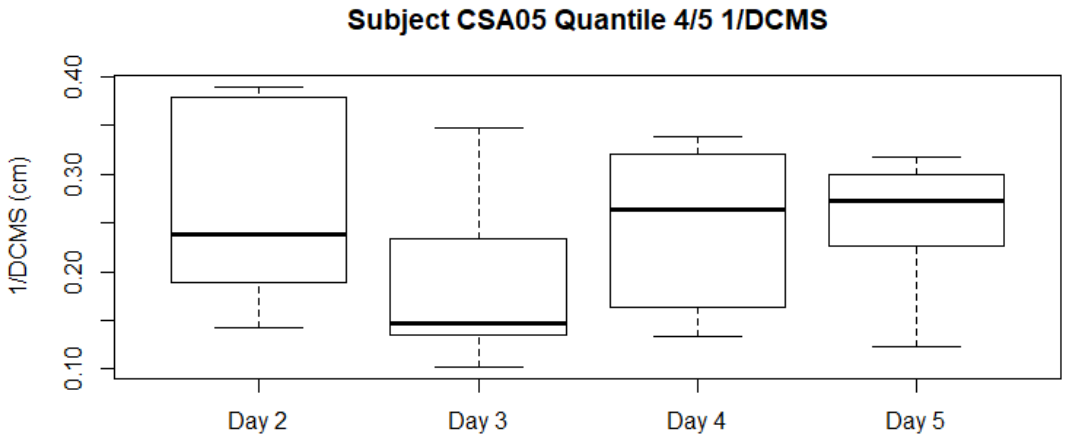

Figure B-163. Subject CSA05 Quantile 4 of 5 1/DCMS

As Table B-155 indicates, the null hypothesis of a normal distribution was rejected for day 2. The boxplot in Figure B-164 does not provide information to the contrary. Bartlett's test produced a K^2 value of 4.6261 and a p value of 0.213 failing to reject the null hypothesis of homoscedasticity. The Kruskal-Wallis test produced a X^2 value of 0.28667 and a p value of 0.9625, failing to reject the null hypothesis of equality of dataset medians. Because this null hypothesis was not rejected, it cannot be concluded that accuracy, as measured by the fifth quantile of 1/DCMS changed over the 4 days of firing.

Table B-155. Subject CSA05 Quantile 5 of 5 1/DCMS Shapiro-Wilk Test Results

Day	W	P-Value
2	0.78778	0.0455
3	0.10957	0.10957
4	0.86222	0.19692
5	0.97139	0.90167

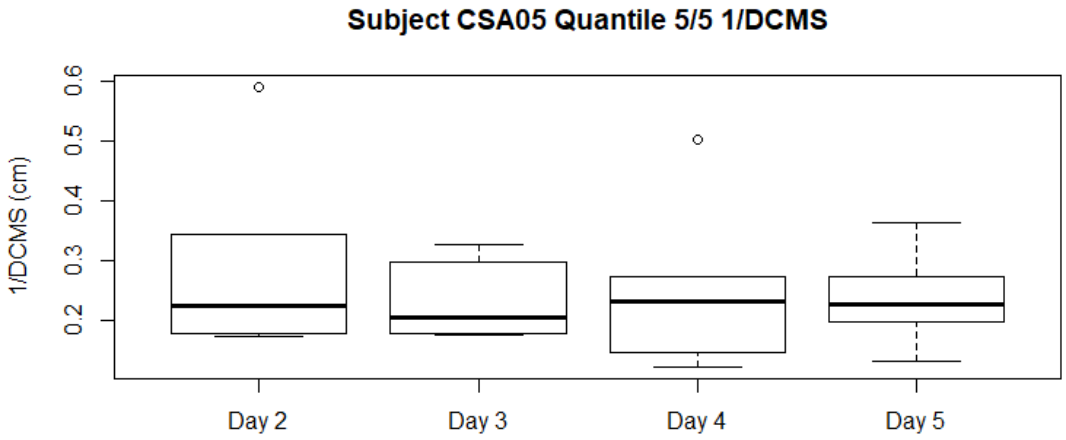

Figure B-164. Subject CSA05 Quantile 5 of 5 1/DCMS

As Table B-156 indicates, the null hypothesis of a normal distribution was not rejected for any days. The boxplot in Figure B-165 is not, however, indicative of a normal distribution. Bartlett's test produced a K^2 value of 5.5883 and a p value of 0.1335 failing to reject the null hypothesis of homoscedasticity. The Kruskal-Wallis test produced a X^2 value of 2.68 and a p value of 0.4436, failing to reject the null hypothesis of equality of dataset medians. Because this null hypothesis was not rejected, it cannot be concluded that accuracy, as measured by the first quantile of 1/MPI to CZP distance changed over the 4 days of firing.

Table B-156. Subject CSA05 Quantile 1 of 6 1/MPI to CZP Distance Shapiro-Wilk Test Results

Day	W	P-Value
2	0.80488	0.08876
3	0.8191	0.11491
4	0.82483	0.12716
5	0.86606	0.25083

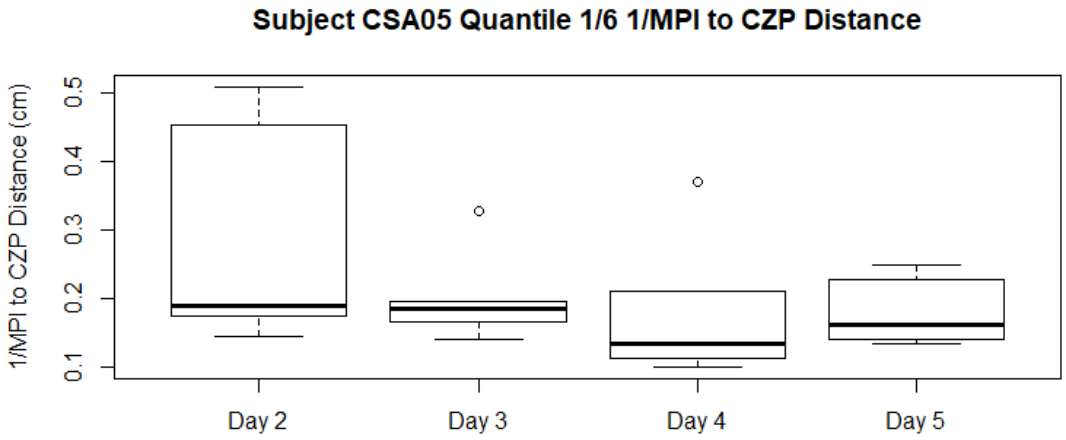

Figure B-165. Subject CSA05 Quantile 1 of 6 MPI to CZP Distance

As Table B-157 indicates, the null hypothesis of a normal distribution was not rejected for any days. The boxplot in Figure B-166 is not, however, indicative of a normal distribution. Bartlett's test produced a K^2 value of 2.1271 and a p value of 0.5464 failing to reject the null hypothesis of homoscedasticity. The Kruskal-Wallis test produced a X^2 value of 4.1771 and a p value of 0.24, failing to reject the null hypothesis of equality of dataset medians. Because this null hypothesis was not rejected, it cannot be concluded that accuracy, as measured by the second quantile of 1/MPI to CZP distance changed over the 4 days of firing.

Table B-157. Subject CSA05 Quantile 2 of 6 1/MPI to CZP Distance Shapiro-Wilk Test Results

Day	W	P-Value
2	0.80601	0.09062
3	0.90485	0.43728
4	0.99922	0.99976
5	0.9408	0.67161

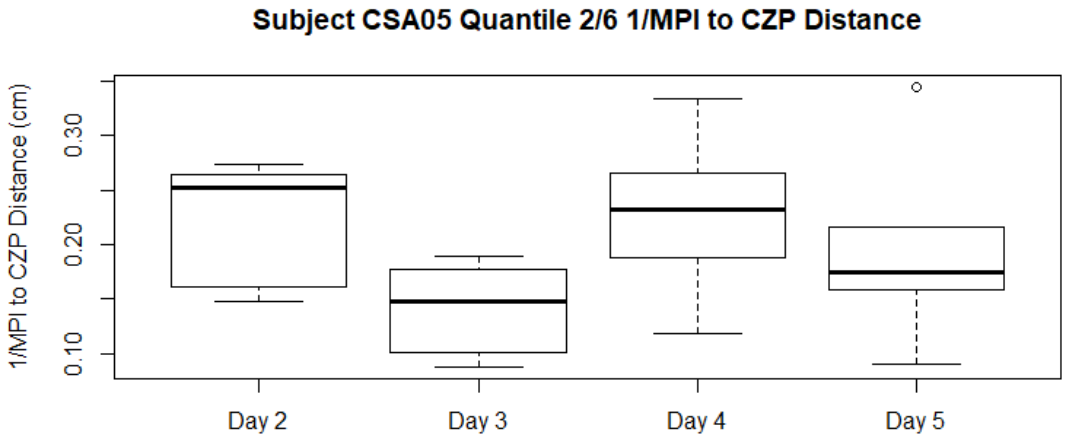

Figure B-166. Subject CSA05 Quantile 2 of 6 1/MPI to CZP Distance

As Table B-158 indicates, the null hypothesis of a normal distribution was rejected for days 3 and 4. The boxplot in Figure B-167 does not provide information to the contrary. Bartlett's test produced a K^2 value of 5.8528 and a p value of 0.119 failing to reject the null hypothesis of homoscedasticity. The Kruskal-Wallis test produced a X^2 value of 2.3143 and a p value of 0.5098, failing to reject the null hypothesis of equality of dataset medians. Because this null hypothesis was not rejected, it cannot be concluded that accuracy, as measured by the third quantile of 1/MPI to CZP distance changed over the 4 days of firing.

Table B-158. Subject CSA05 Quantile 3 of 6 1/MPI to CZP Distance Shapiro-Wilk Test Results

Day	W	P-Value
2	0.87873	0.30361
3	0.68881	0.00729
4	0.63995	0.00202
5	0.98676	0.96715

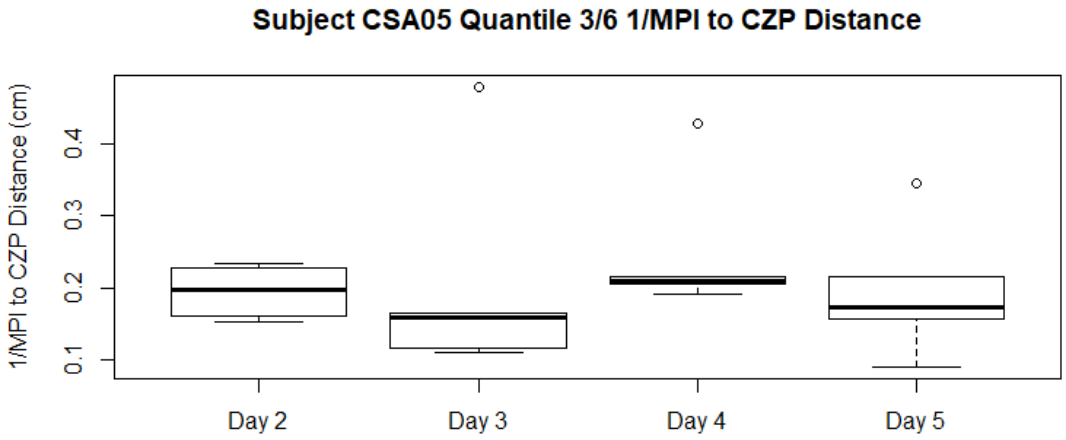

Figure B-167. Subject CSA05 Quantile 3 of 6 1/MPI to CZP Distance

As Table B-159 indicates, the null hypothesis of a normal distribution was rejected for day 2. The boxplot in Figure B-168 does not provide information to the contrary. Bartlett's test produced a K^2 value of 5.0622 and a p value of 0.1673 failing to reject the null hypothesis of homoscedasticity. The Kruskal-Wallis test produced a X^2 value of 3.8686 and a p value of 0.276, failing to reject the null hypothesis of equality of dataset medians. Because this null hypothesis was not rejected, it cannot be concluded that accuracy, as measured by the fourth quantile of 1/MPI to CZP distance changed over the 4 days of firing.

Table B-159. Subject CSA05 Quantile 4 of 6 1/MPI to CZP Distance Shapiro-Wilk Test Results

Day	W	P-Value
2	0.6931	0.0081
3	0.93985	0.66487
4	0.95026	0.73903
5	0.93559	0.63498

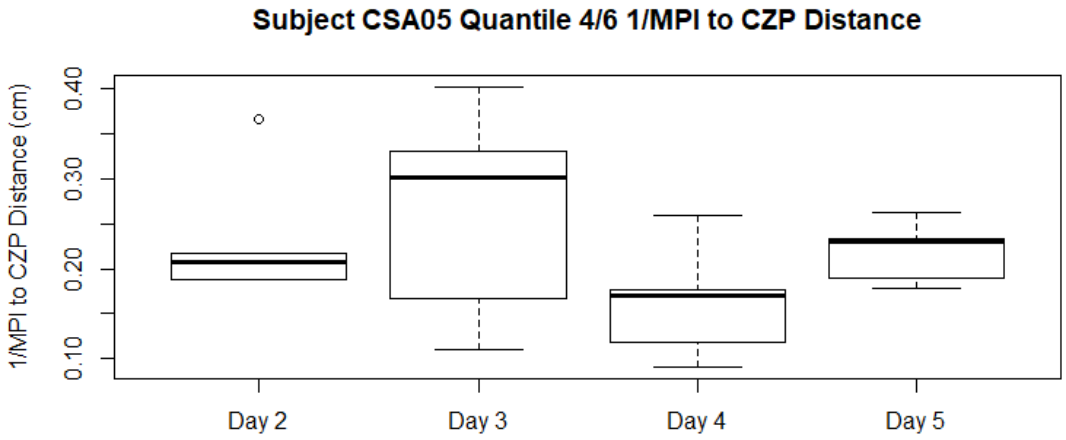

Figure B-168. Subject CSA05 Quantile 4 of 6 1/MPI to CZP Distance

As Table B-160 indicates, the null hypothesis of a normal distribution was rejected for day 3. The boxplot in Figure B-169 does not provide information to the contrary. Bartlett's test produced a K^2 value of 7.328 and a p value of 0.0625 failing to reject the null hypothesis of homoscedasticity. The Kruskal-Wallis test produced a X^2 value of 3.8914 and a p value of 0.2734, failing to reject the null hypothesis of equality of dataset medians. Because this null hypothesis was not rejected, it cannot be concluded that accuracy, as measured by the fifth quantile of 1/MPI to CZP distance changed over the 4 days of firing.

Table B-160. Subject CSA05 Quantile 5 of 6 1/MPI to CZP Distance Shapiro-Wilk Test Results

Day	W	P-Value
2	0.84387	0.1759
3	0.70989	0.01212
4	0.80772	0.09354
5	0.98318	0.95089

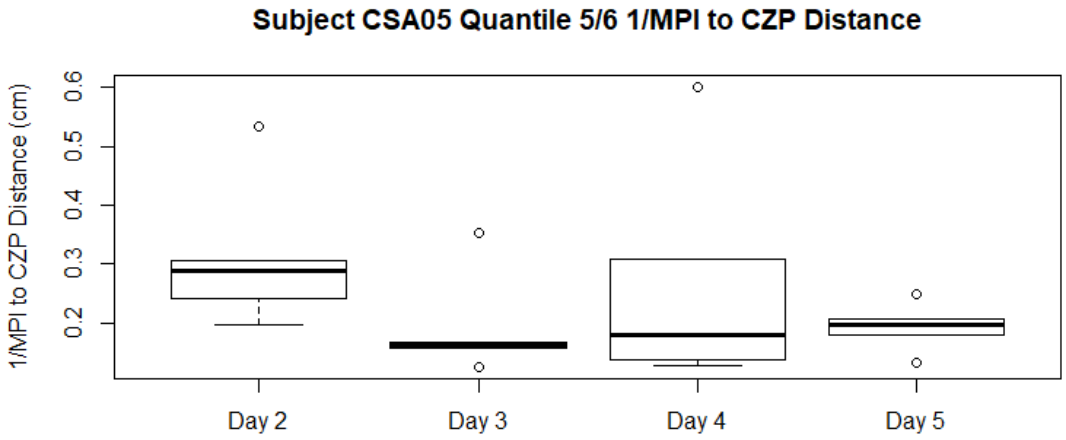

Figure B-169. Subject CSA05 Quantile 5 of 6 1/MPI to CZP Distance

As Table B-161 indicates, the null hypothesis of a normal distribution was rejected for day 3. The boxplot in Figure B-170 does not provide information to the contrary. Bartlett's test produced a K^2 value of 1.0329 and a p value of 0.7933 failing to reject the null hypothesis of homoscedasticity. The Kruskal-Wallis test produced a X^2 value of 0.92 and a p value of 0.8296, failing to reject the null hypothesis of equality of dataset medians. Because this null hypothesis was not rejected, it cannot be concluded that accuracy, as measured by the sixth quantile of 1/MPI to CZP distance changed over the 4 days of firing.

Table B-161. Subject CSA05 Quantile 6 of 6 1/MPI to CZP Distance Shapiro-Wilk Test Results

Day	W	P-Value
2	0.87979	0.30838
3	0.75189	0.03098
4	0.8117	0.10058
5	0.94309	0.68784

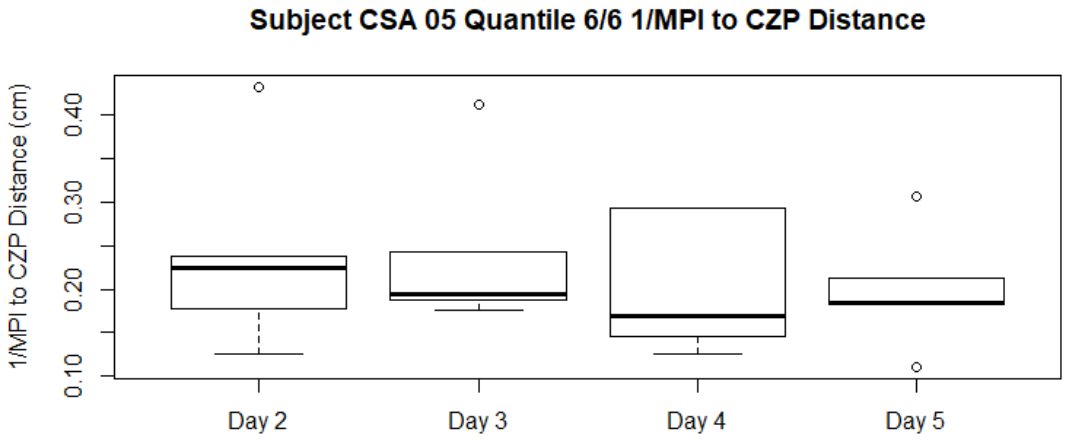

Figure B-170. Subject CSA05 Quantile 6 of 6 1/MPI to CZP Distance

As Table B-162 indicates, the null hypothesis of a normal distribution was rejected for day 2. The boxplot in Figure B-171 does not provide information to the contrary. Bartlett's test produced a K^2 value of 5.9855 and a p value of 0.1123 failing to reject the null hypothesis of homoscedasticity. The Kruskal-Wallis test produced a X^2 value of 3.08 and a p value of 0.3795, failing to reject the null hypothesis of equality of dataset medians. Because this null hypothesis was not rejected, it cannot be concluded that accuracy, as measured by the first quantile of 1/DCMS changed over the 4 days of firing.

Table B-162. Subject CSA05 Quantile 1 of 6 1/DCMS Shapiro-Wilk Test Results

Day	W	P-Value
2	0.74434	0.02636
3	0.8683	0.25962
4	0.90676	0.4484
5	0.87674	0.29482

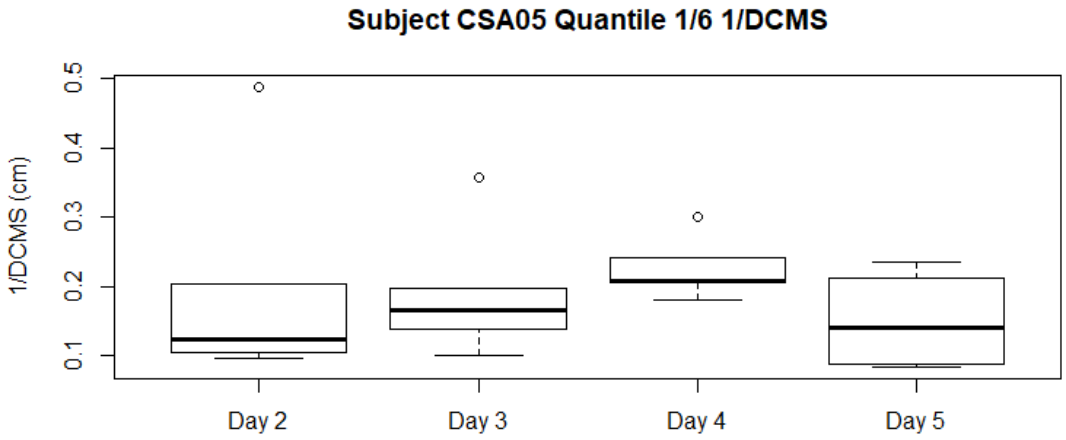

Figure B-171. Subject CSA05 Quantile 1 of 6 1/DCMS

As Table B-163 indicates, the null hypothesis of a normal distribution was not rejected for any days. The boxplot in Figure B-172 is not, however, indicative of a normal distribution. Bartlett's test produced a K^2 value of 0.47779 and a p value of 0.9237 failing to reject the null hypothesis of homoscedasticity. The Kruskal-Wallis test produced a X^2 value of 8.1086 and a p value of 0.04382, rejecting the null hypothesis of equality of dataset medians. Because this null hypothesis was rejected, it can be concluded that accuracy, as measured by the second quantile of 1/DCMS changed over the 4 days of firing. As Table B-164 shows, the differences were between days 2 and 3 and days 3 and 4. While there were differences in dataset location, these differences were not indicative of a trend.

Table B-163. Subject CSA05 Quantile 2 of 6 1/DCMS Shapiro-Wilk Test Results

Day	W	P-Value
2	0.9565	0.78341
3	0.94971	0.73515
4	0.9416	0.6773
5	0.88324	0.32424

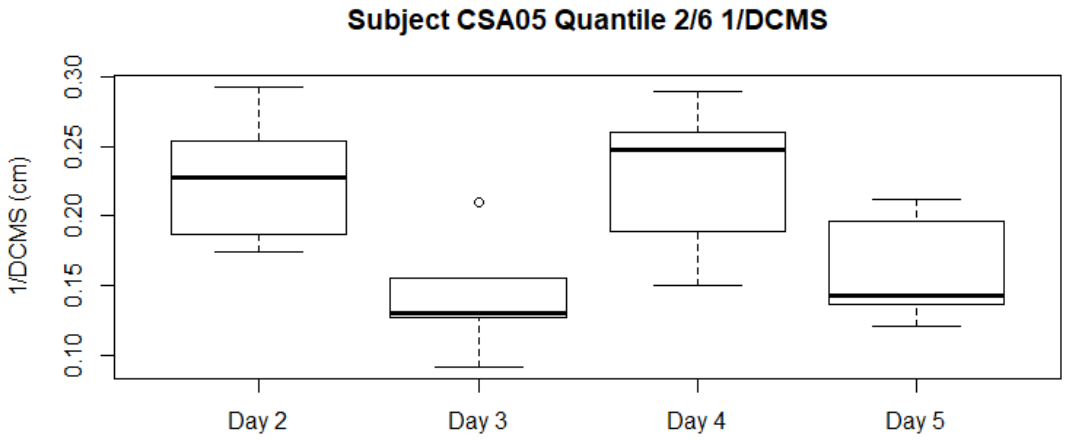

Figure B-172. Subject CSA05 Quantile 2 of 6 1/DCMS

Table B-164. Subject CSA05 Quantile 2 of 6 1/DCMS Dunn's Test Results

Days	Z	P-Value
2 & 3	2.24499	0.0124
2 & 4	0	0.5
2 & 5	1.71047	0.0436
3 & 4	-2.245	0.0124
3 & 5	-0.5345	0.2965
4 & 5	1.71047	0.0436

As Table B-165 indicates, the null hypothesis of a normal distribution was not rejected for any days. The boxplot in Figure B-173 is not, however, indicative of a normal distribution. Bartlett's test produced a K^2 value of 0.34011 and a p value of 0.9523 failing to reject the null hypothesis of homoscedasticity. The Kruskal-Wallis test produced a X^2 value of 1.9486 and a p value of 0.5831, failing to reject the null hypothesis of equality of dataset medians. Because this null hypothesis was not rejected, it cannot be concluded that accuracy, as measured by the third quantile of 1/DCMS changed over the 4 days of firing.

Table B-165. Subject CSA05 Quantile 3 of 6 1/DCMS Shapiro-Wilk Test Results

Day	W	P-Value
2	0.89586	0.38743

3	0.90164	0.41904
4	0.89618	0.3891
5	0.89387	0.37692

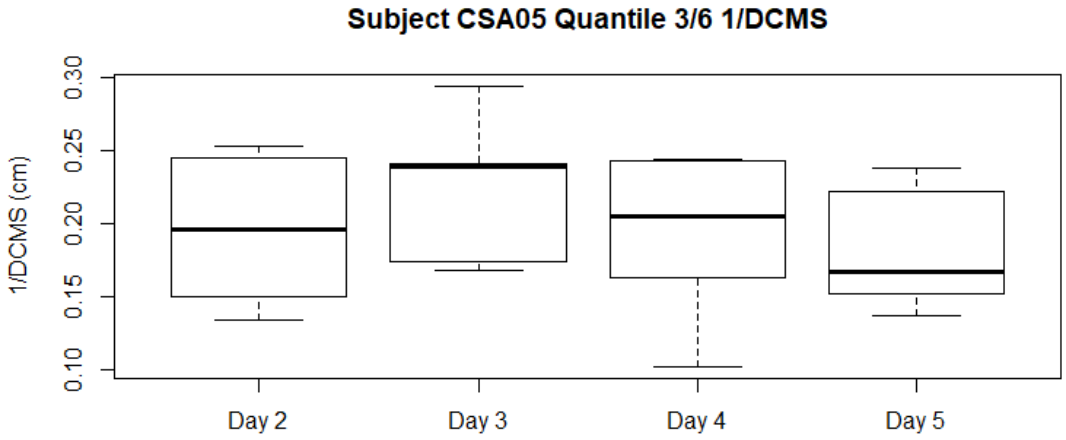

Figure B-173. Subject CSA05 Quantile 3 of 6 1/DCMS

As Table B-166 indicates, the null hypothesis of a normal distribution was not rejected for any days. The boxplot in Figure B-174 is not, however, indicative of a normal distribution. Bartlett's test produced a K^2 value of 3.2626 and a p value of 0.3529 failing to reject the null hypothesis of homoscedasticity. The Kruskal-Wallis test produced a X^2 value of 1.3771 and a p value of 0.7109, failing to reject the null hypothesis of equality of dataset medians. Because this null hypothesis was not rejected, it cannot be concluded that accuracy, as measured by the fourth quantile of 1/DCMS changed over the 4 days of firing.

Table B-166. Subject CSA05 Quantile 4 of 6 1/DCMS Shapiro-Wilk Test Results

Day	W	P-Value
2	0.84756	0.18694
3	0.95108	0.74491
4	0.87102	0.2706
5	0.93115	0.60426

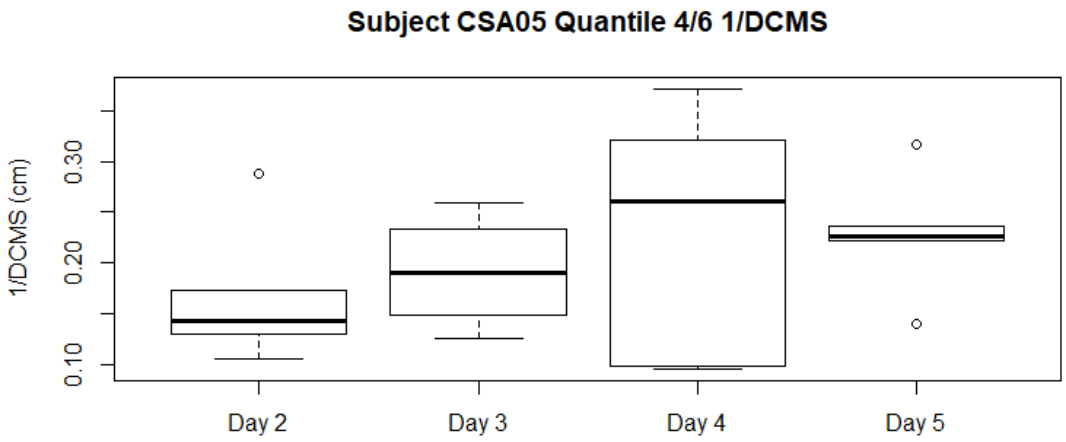

Figure B-174. Subject CSA05 Quantile 4 of 6 1/DCMS

As Table B-167 indicates, the null hypothesis of a normal distribution was not rejected for any days. The boxplot in Figure B-175 is not, however, indicative of a normal distribution. Bartlett's test produced a K^2 value of 2.9869 and a p value of 0.3936 failing to reject the null hypothesis of homoscedasticity. The Kruskal-Wallis test produced a X^2 value of 4.1657 and a p value of 0.2441, failing to reject the null hypothesis of equality of dataset medians. Because this null hypothesis was not rejected, it cannot be concluded that accuracy, as measured by the fifth quantile of 1/DCMS changed over the 4 days of firing.

Table B-167. Subject CSA05 Quantile 5 of 6 1/DCMS Shapiro-Wilk Test Results

Day	W	P-Value
2	0.88781	0.34619
3	0.88713	0.34288
4	0.86206	0.2357
5	0.90345	0.42925

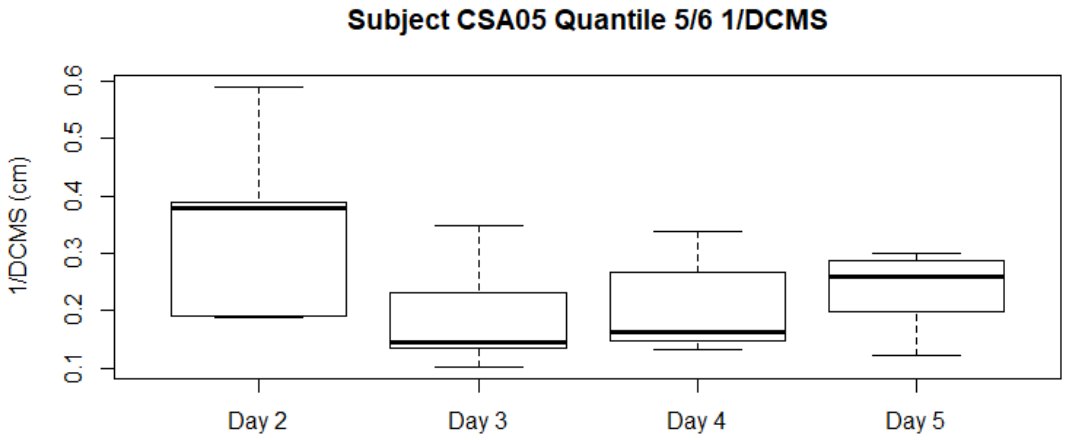

Figure B-175. Subject CSA05 Quantile 5 of 6 1/DCMS

As Table B-168 indicates, the null hypothesis of a normal distribution was rejected for day 3. The boxplot in Figure B-176 is not, however, indicative of a normal distribution. Bartlett's test produced a K^2 value of 2.479 and a p value of 0.4791 failing to reject the null hypothesis of homoscedasticity. The Kruskal-Wallis test produced a X^2 value of 0.48571 and a p value of 0.922, failing to reject the null hypothesis of equality of dataset medians. Because this null hypothesis was not rejected, it cannot be concluded that accuracy, as measured by the sixth quantile of 1/DCMS changed over the 4 days of firing.

Table B-168. Subject CSA05 Quantile 6 of 6 1/DCMS Shapiro-Wilk Test Results

Day	W	P-Value
2	0.84869	0.19042
3	0.75967	0.03649
4	0.89148	0.3646
5	0.99264	0.98808

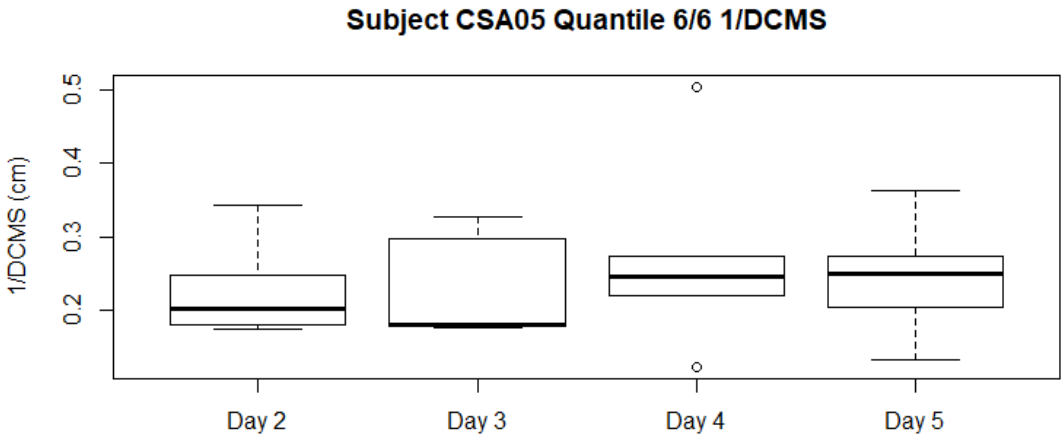

Figure B-176. Subject CSA05 Quantile 6 of 6 1/DCMS

6.4.4 Correlation Results

In Table B-169, the results of the Pearson, Kendall, and Spearman tests for correlation between shot timing and the distance from the shot to the center of the target are shown. As Table B-169 indicates, the respective null hypotheses of no correlation were rejected for day 4 using the Kendall method and the Spearman method. While the correlations were significant, they were moderately weak as shown by the fact that the largest coefficient was 0.316915.

Table B-169. Subject CSA05 Correlation Results

	Pearson			Kendall				Spearman	
Day	T	P-Value	Coefficient	Z	P-Value	Tau	S	P-Value	Rho
2	0.40082	0.6895	0.042689	0.89244	0.3722	0.064201	108920	0.3321	0.103409
3	0.17138	0.8643	0.018267	0.6694	0.5032	0.048212	112380	0.4828	7492611
4	1.8967	0.06115	0.198177	3.0469	0.002312	0.219242	82985	0.00234	0.316915
5	-0.1093	0.9132	-0.01165	0.097634	0.9222	0.007047	120240	0.9235	0.01026

APPENDIX C

6.1 Subject VS01 Data

As indicated in Table C-1, the null hypothesis of equality of proportions was not rejected for any of the visual acuities over the 3 days of firing. As indicated in Table C-2, Subject VS01's performance at visual acuity A was lower than the other visual acuities on day 3 of firing, but the difference was not statistically significant. Hit proportions and 95% confidence intervals for each acuity over the days of firing are provided in Figures C-1 through C-4.

Table C-1. Subject VS01 Acuity Hit Proportions

Acuity	Day 2	Day 3	Day 4	Chi-Squared	P-Value
A	0.96875	0.875	0.90625	1.9091	0.385
B	1	0.90625	0.9375	2.9538	0.2283
C	0.9375	1	1	4.0851	0.1297
D	1	1	1	NA	NA

Table C-2. Subject VS01 Daily Hit Proportions

Day	Acuity A	Acuity B	Acuity C	Acuity D	Chi-Squared	P-Value
2	0.96875	1	0.9375	1	3.7547	0.2892
3	0.875	0.90625	1	1	7.7072	0.05247
4	0.90625	0.9375	1	1	5.6195	0.1317

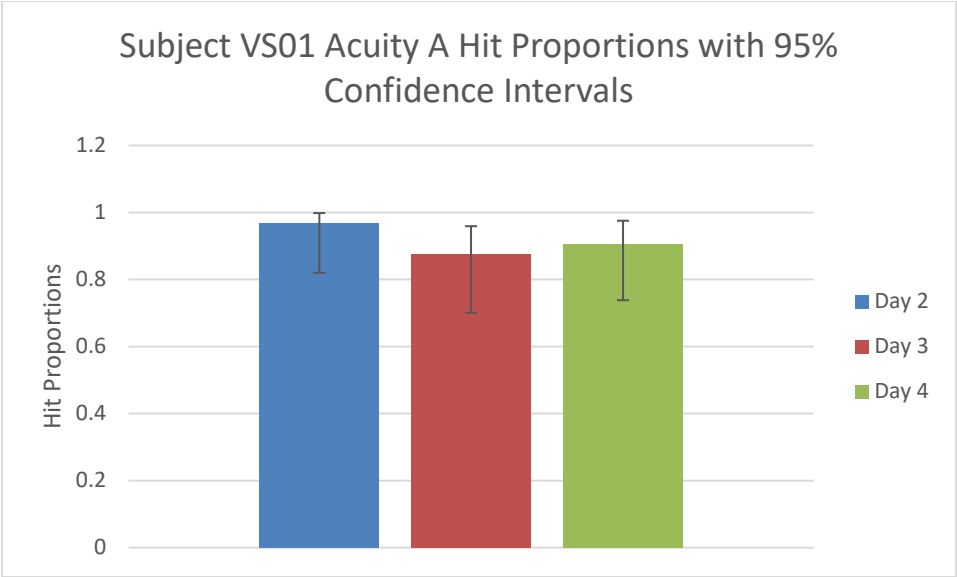

Figure C-1. Subject VS01 Acuity A Hit Proportions

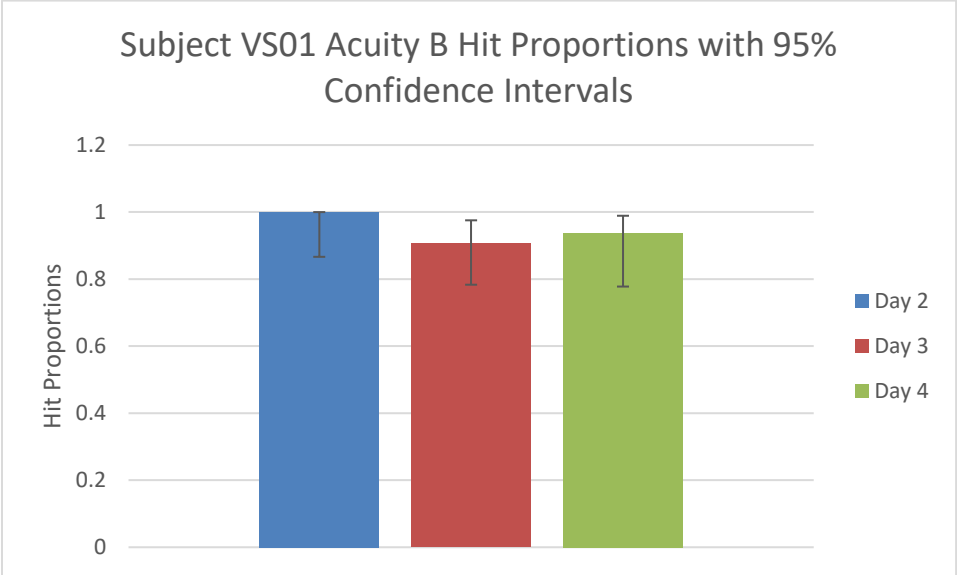

Figure C-2. Subject VS01 Acuity B Hit Proportions

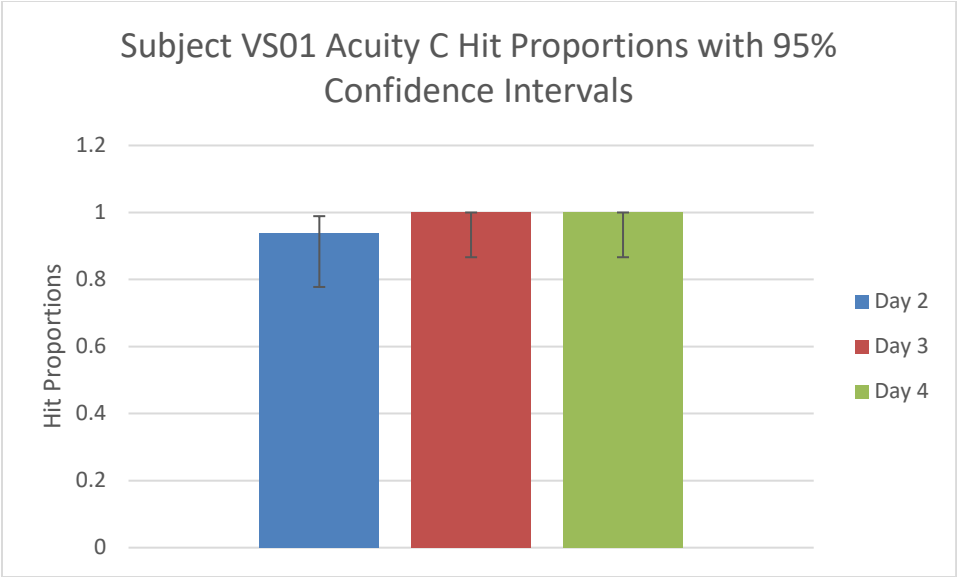

Figure C-3. Subject VS01 Acuity C Hit Proportions

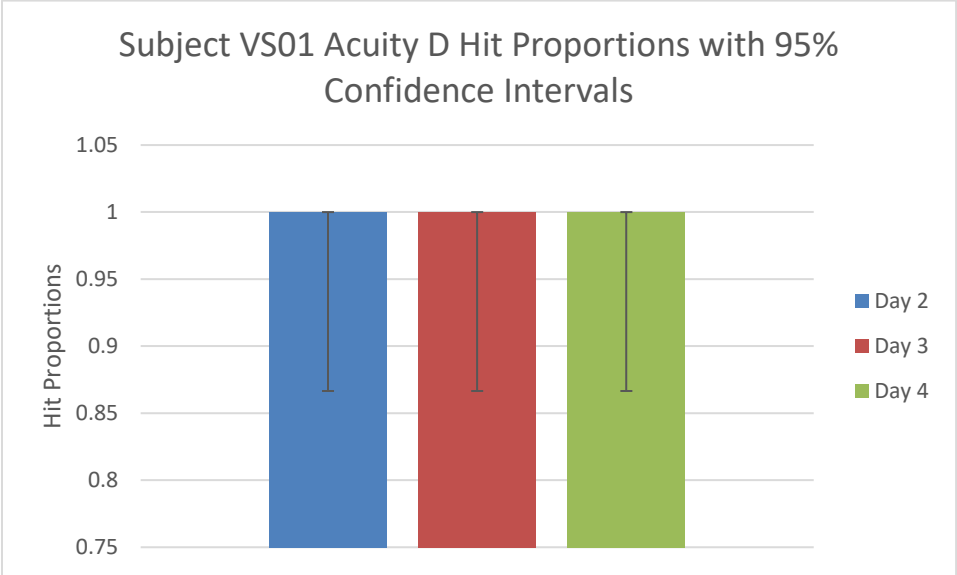

Figure C-4. Subject VS01 Acuity D Hit Proportions

6.2 Subject VS02 Data

As indicated in Table C-3, the null hypothesis of equality of proportions was not rejected for any of the visual acuities over the 4 days of firing. As indicated in Table C-4, Subject VS02's performance did not differ to a significant extent at any of the visual acuities on any

individual day of firing. Hit proportions and 95% confidence intervals for each acuity over the days of firing are provided in Figures C-5 through C-8.

Table C-3. Subject VS02 Acuity Hit Proportions

Acuity	Day 2	Day 3	Day 4	Chi-Squared	P-Value
A	1	0.933333	0.9375	2.1629	0.3391
B	0.9375	0.935484	0.9375	0.001435	0.9993
C	0.90625	0.9375	0.90625	0.27273	0.8725
D	0.9375	0.84375	0.9375	2.2069	0.3317

Table C-4. Subject VS02 Daily Hit Proportions

Day	Acuity A	Acuity B	Acuity C	Acuity D	Chi-Squared	P-Value
2	1	0.9375	0.90625	0.9375	2.8713	0.4119
3	0.903226	0.935484	0.9375	0.84375	2.1208	0.5477
4	0.9375	0.9375	0.90625	0.9375	0.35854	0.9487

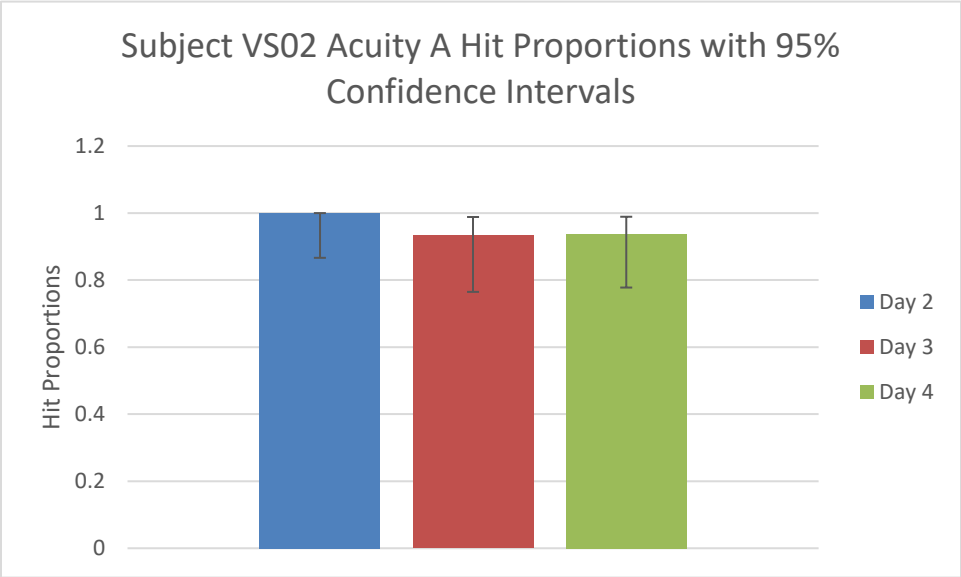

Figure C-5. Subject VS02 Acuity A Hit Proportions

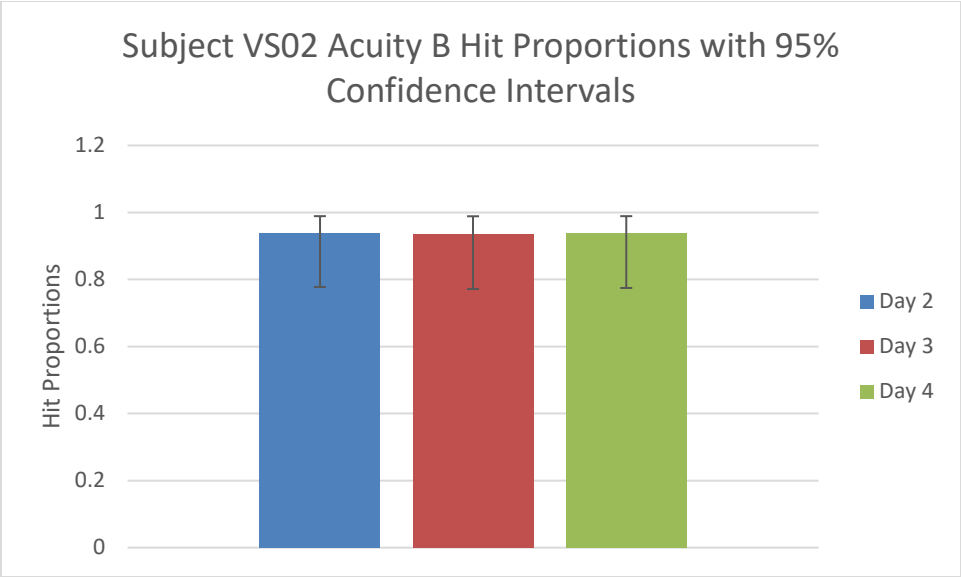

Figure C-6. Subject VS02 Acuity B Hit Proportions

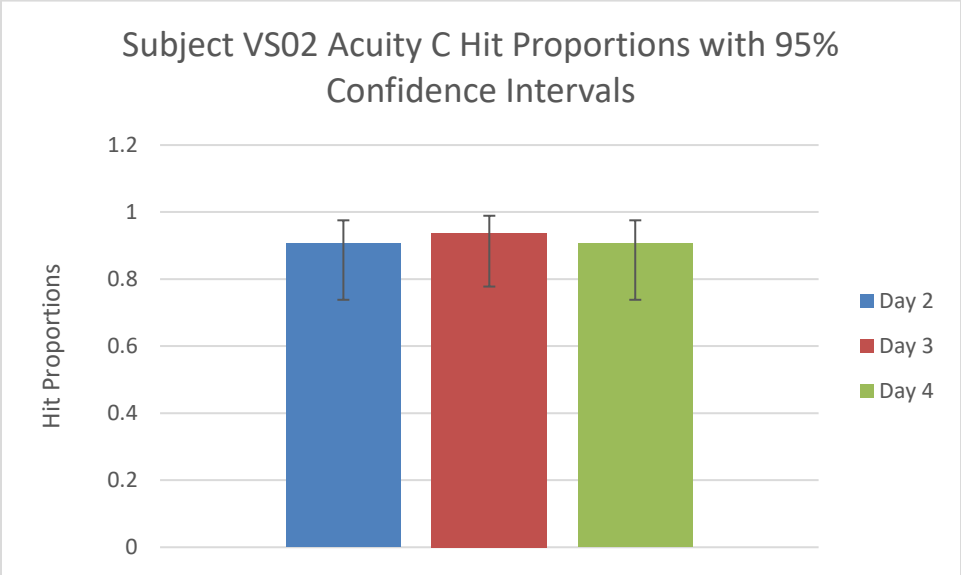

Figure C-7. Subject VS02 Acuity C Hit Proportions

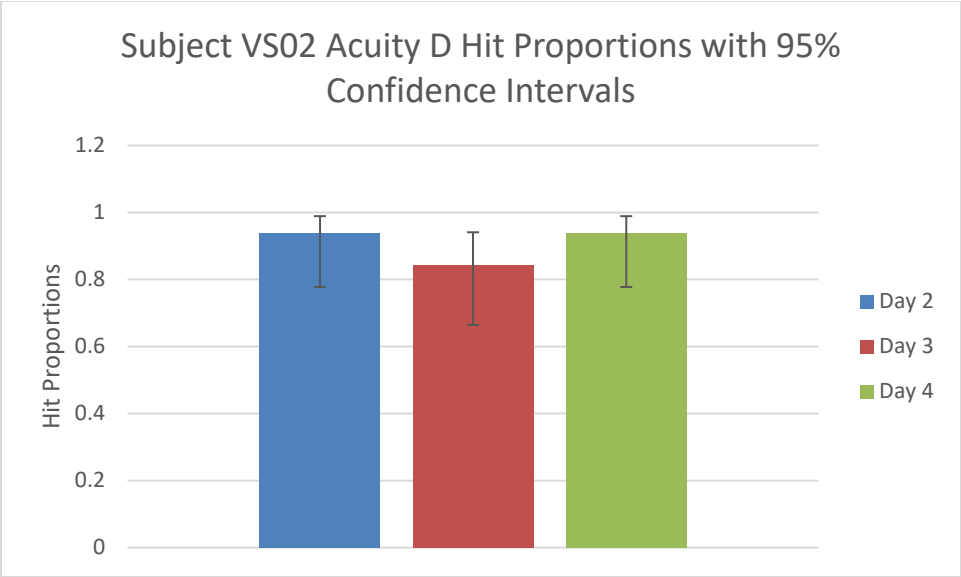

Figure C-8. Subject VS02 Acuity D Hit Proportions

6.3 Subject VS03 Data

As indicated in Table C-5, the null hypothesis of equality of proportions was not rejected for any of the visual acuities over the 4 days of firing. As indicated in Table C-6, Subject VS03's performance did not differ to a significant extent at any of the visual acuities on any individual day of firing. Hit proportions and 95% confidence intervals for each acuity over the days of firing are provided in Figures C-9 through C-12.

Table C-5. Subject VS03 Acuity Hit Proportions

Acuity	Day 2	Day 3	Day 4	Day 5	Chi-Squared	P-Value
A	0.96875	1	1	1	2.8044	0.4228
B	0.9375	1	1	1	5.5932	0.1332
C	0.96875	1	1	1	2.7731	0.4279
D	0.96875	0.9375	1	1	3.386	0.3358

Table C-6. Subject VS03 Daily Hit Proportions

Day	Acuity A	Acuity B	Acuity C	Acuity D	Chi-Squared	P-Value
2	0.96875	0.9375	0.96875	0.96875	0.62439	0.8908
3	1	1	1	0.9375	6.0952	0.1071
4	1	1	1	1	NA	NA
5	1	1	1	1	NA	NA

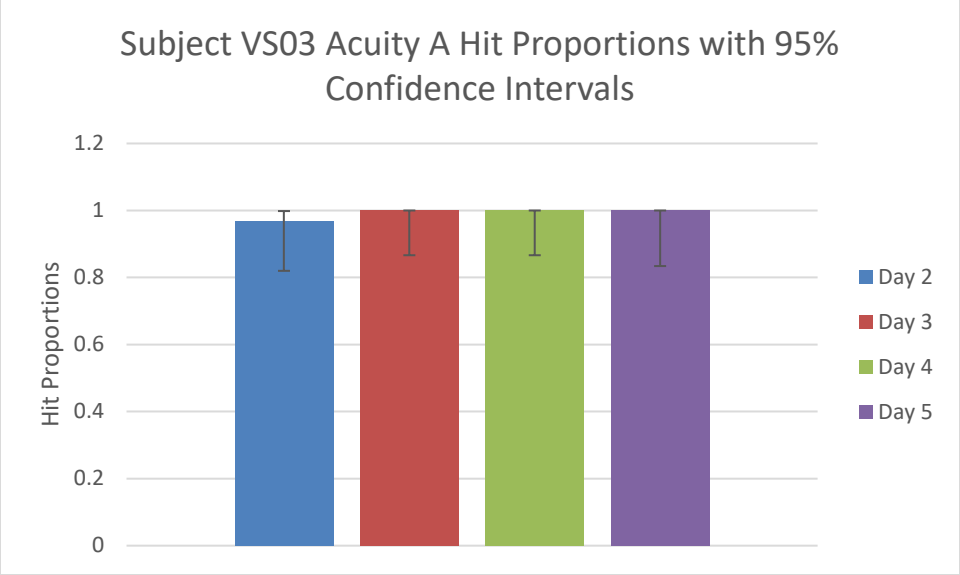

Figure C-9. Subject VS03 Acuity A Hit Proportions

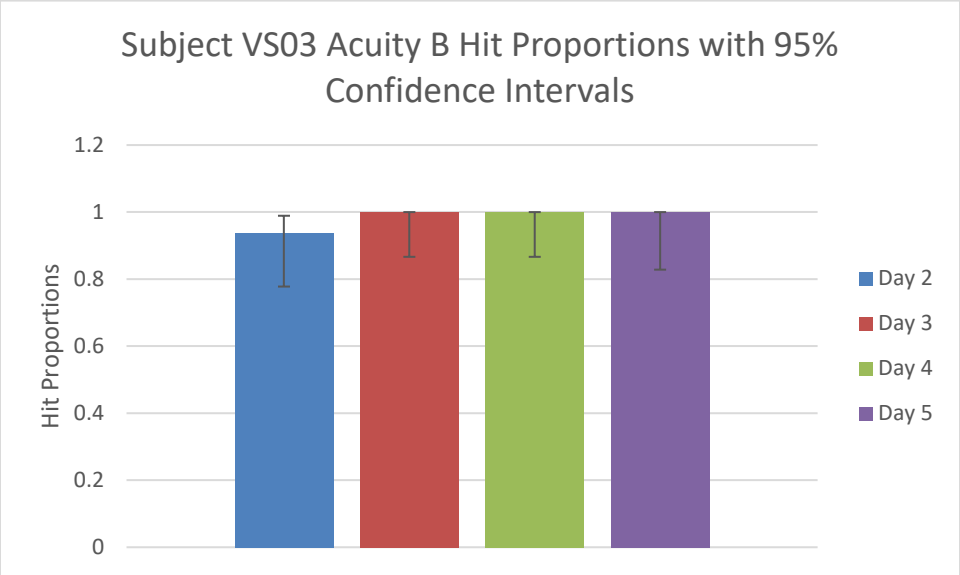

Figure C-10. Subject VS03 Acuity B Hit Proportions

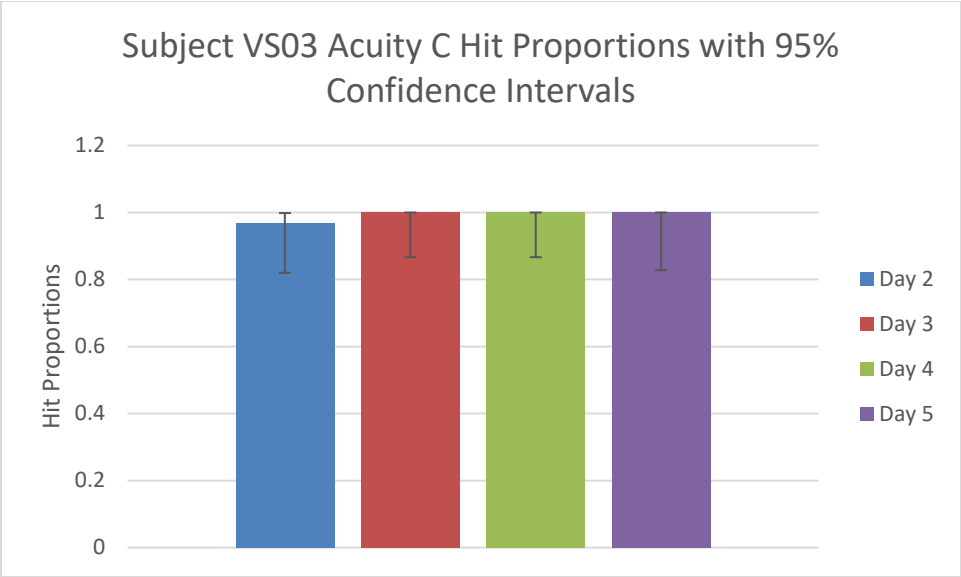

Figure C-11. Subject VS03 Acuity C Hit Proportions

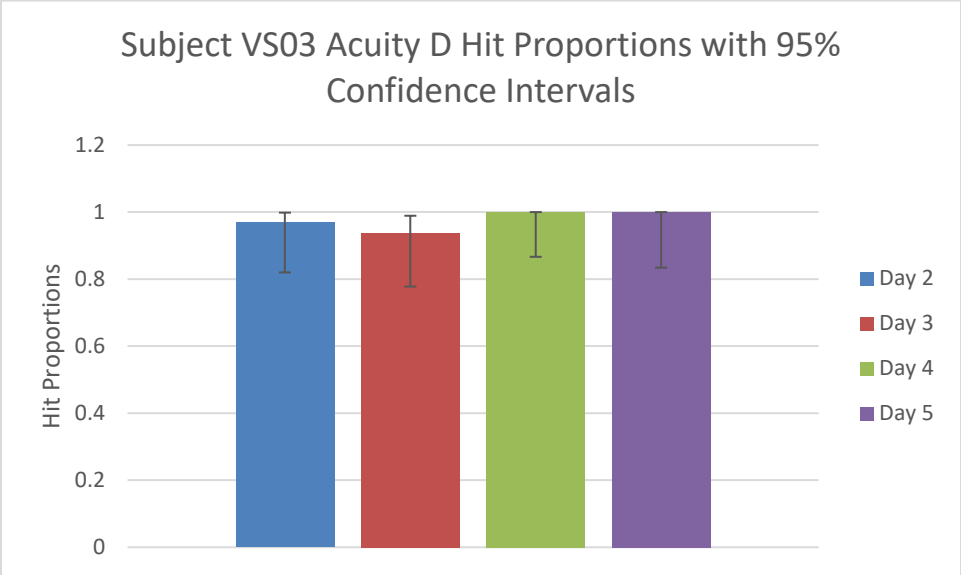

Figure C-12. Subject VS03 Acuity D Hit Proportions

6.4 Subject VS04 Data

As indicated in Table C-7, the null hypothesis of equality of proportions was not rejected for any of the visual acuities over the 4 days of firing. As indicated in Table C-8, Subject VS04's performance did not differ to a significant extent at any of the visual acuities on any

individual day of firing. Hit proportions and 95% confidence intervals for each acuity over the days of firing are provided in Figures C-13 through C-16.

Table C-7. Subject VS04 Acuity Hit Proportions

Acuity	Day 2	Day 3	Day 4	Day 5	Chi-Squared	P-Value
A	0.84375	0.84375	0.75	0.78125	1.3421	0.7192
B	0.9375	0.78125	0.78125	0.6875	6.371	0.09489
C	0.90625	0.8125	0.75	0.78125	2.8718	0.4118
D	0.78125	0.8125	0.6875	0.625	3.5785	0.3107

Table C-8. Subject VS04 Daily Hit Proportions

Day	Acuity A	Acuity B	Acuity C	Acuity D	Chi-Squared	P-Value
2	0.84375	0.9375	0.90625	0.78125	4.0021	0.2612
3	0.84375	0.78125	0.8125	0.8125	0.41026	0.9381
4	0.75	0.78125	0.75	0.6875	0.77576	0.8553
5	0.78125	0.6875	0.78125	0.625	2.7826	0.4264

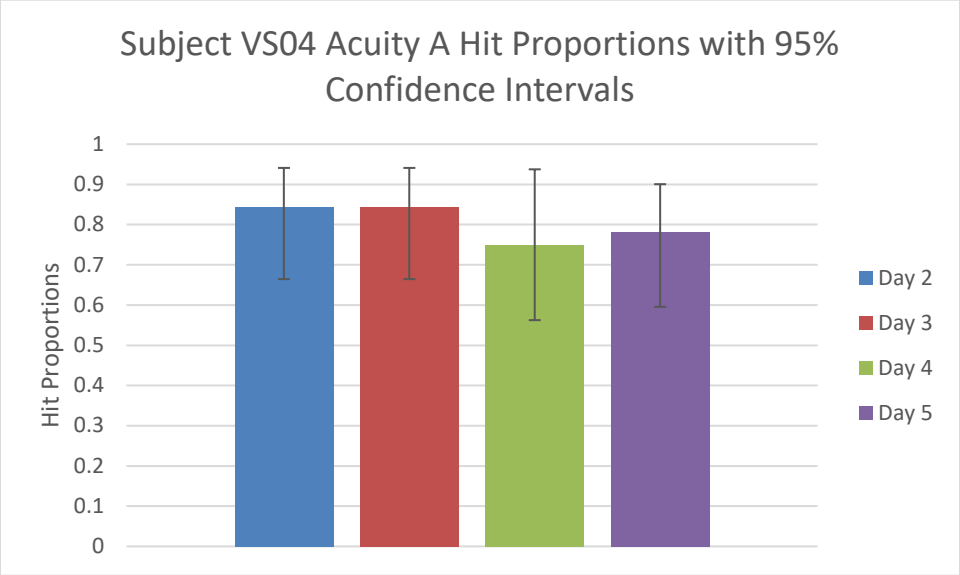

Figure C-13. Subject VS04 Acuity A Hit Proportions

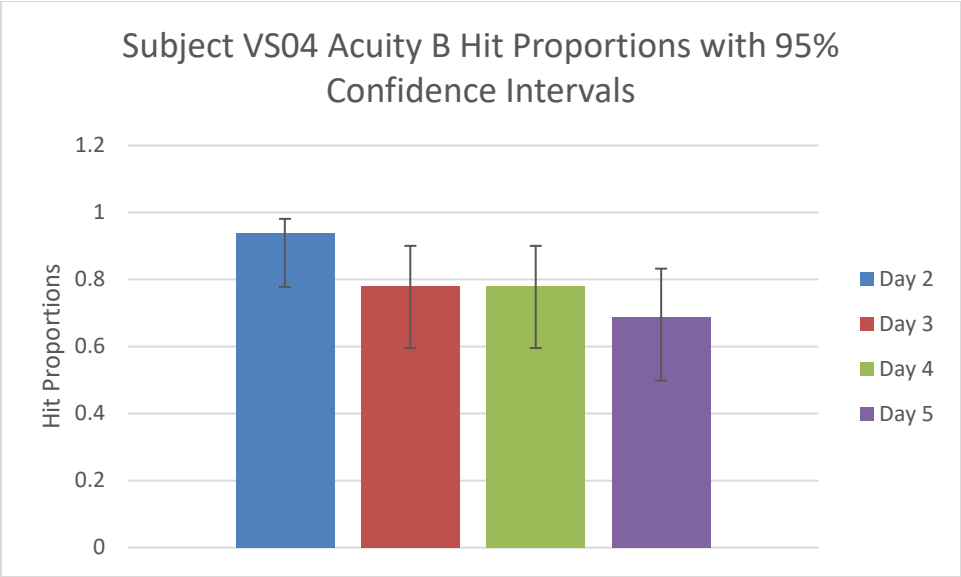

Figure C-14. Subject VS04 Acuity B Hit Proportions

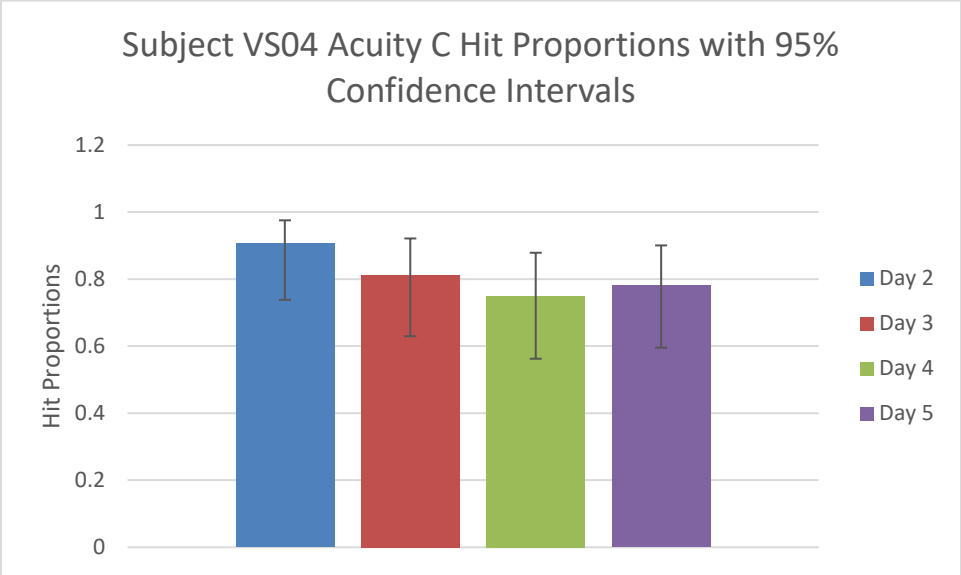

Figure C-15. Subject VS04 Acuity C Hit Proportions

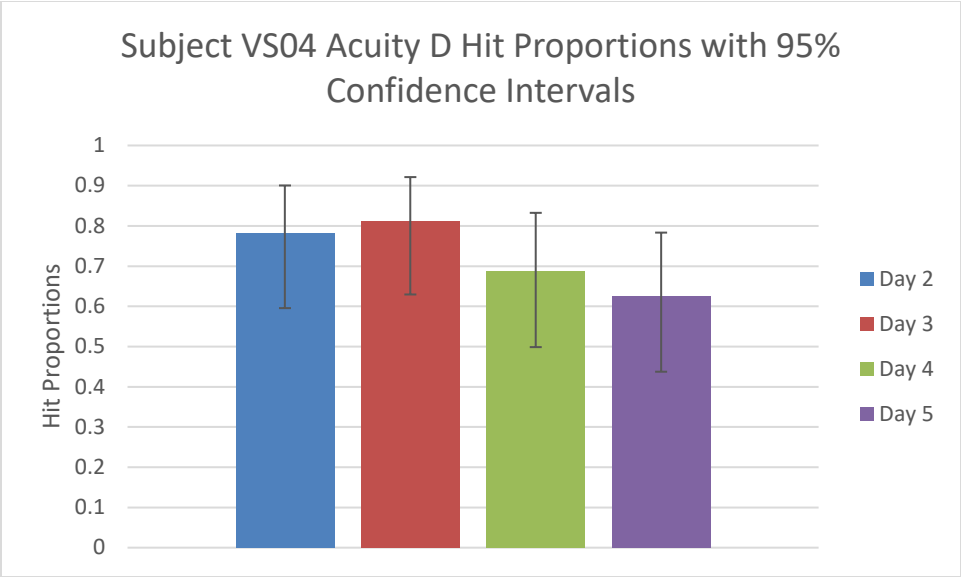

Figure C-16. Subject VS04 Acuity D Hit Proportions

6.5 Subject VS05 Data

As indicated in Table C-9, the null hypothesis of equality of proportions was not rejected for any of the visual acuities over the 4 days of firing. As indicated in Table C-10, Subject VS05's performance did not differ to a significant extent at any of the visual acuities on any individual day of firing. Hit proportions and 95% confidence intervals for each acuity over the days of firing are provided in Figures C-17 through C-20.

Table C-9. Subject VS05 Acuity Hit Proportions

Acuity	Day 2	Day 3	Day 4	Day 5	Chi-Squared	P-Value
A	0.9375	0.96875	0.96875	0.96875	0.62439	0.8908
B	0.9375	0.96875	0.9375	1	2.2894	0.5145
C	0.96875	1	1	1	3.0236	0.388
D	0.96875	0.90625	0.96875	0.96875	2.0984	0.5522

Table C-10. Subject VS05 Daily Hit Proportions

Day	Acuity A	Acuity B	Acuity C	Acuity D	Chi-Squared	P-Value
2	0.9375	0.9375	0.96875	0.96875	0.69945	0.8733
3	0.96875	0.96875	1	0.90625	3.9545	0.2664
4	0.96875	0.9375	1	0.96875	2.0645	0.5591
5	0.96875	1	1	0.96875	2.0317	0.5658

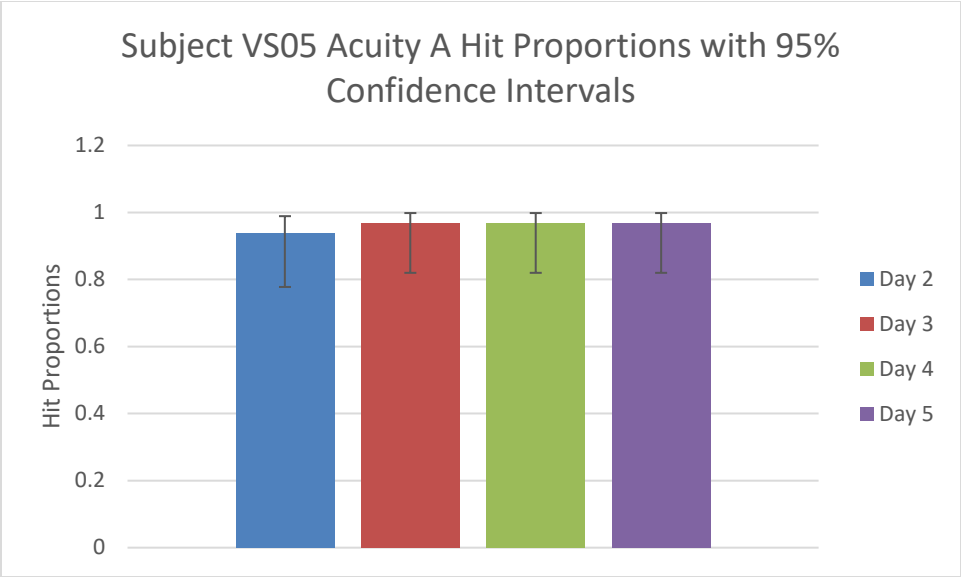

Figure C-17. Subject VS05 Acuity A Hit Proportions

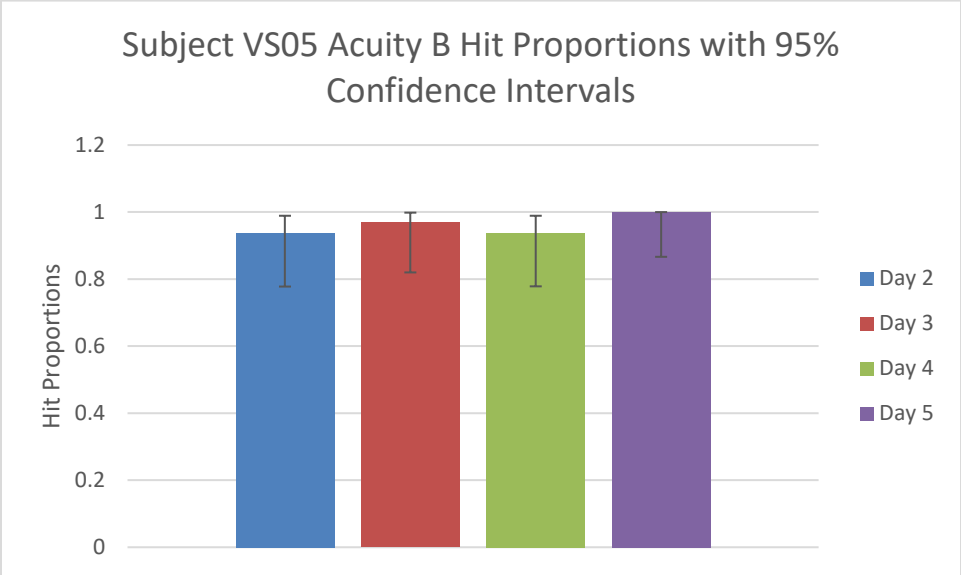

Figure C-18. Subject VS05 Acuity B Hit Proportions

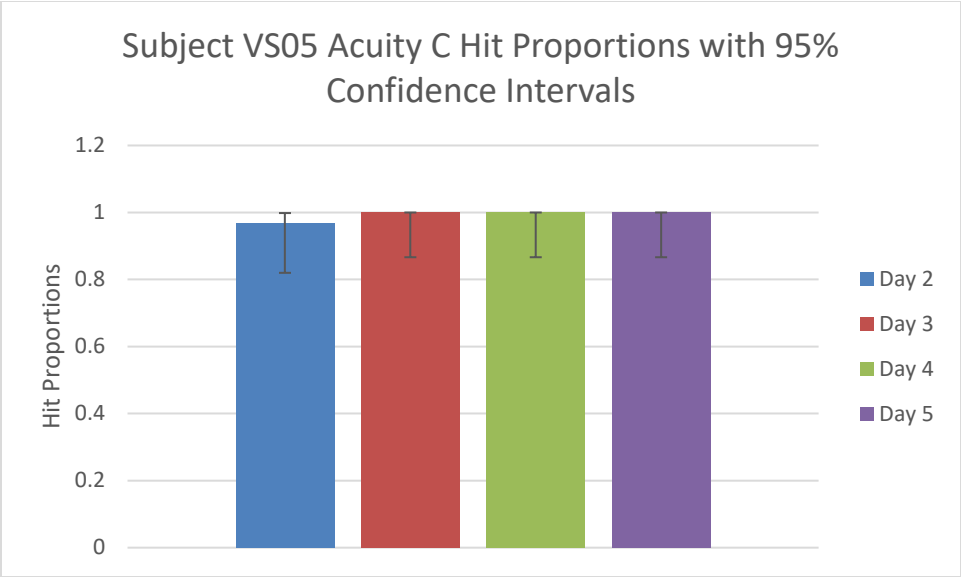

Figure C-19. Subject VS05 Acuity C Hit Proportions

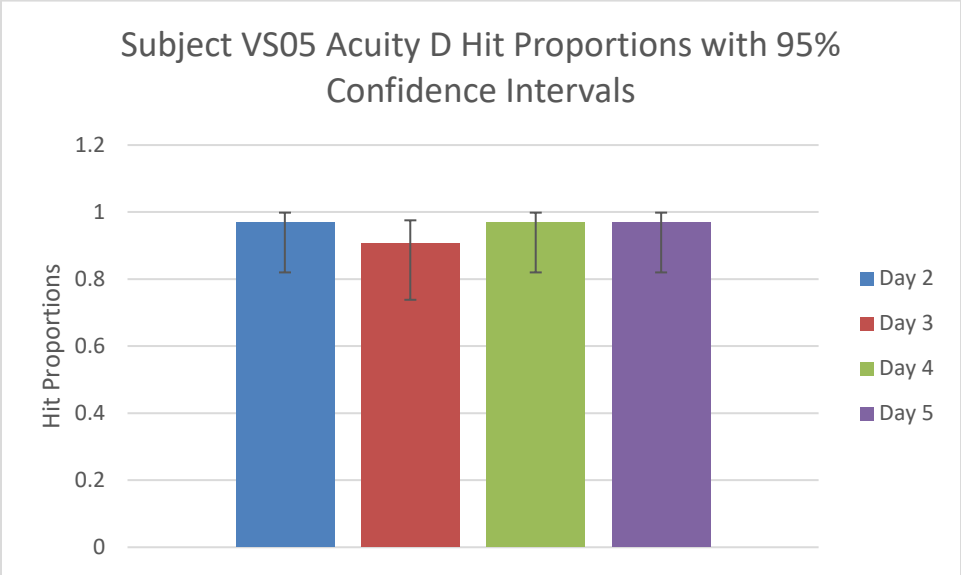

Figure C-20. Subject VS05 Acuity D Hit Proportions

6.6 Subject VS06 Data

As indicated in Table C-11, the null hypothesis of equality of proportions was not rejected

for any of the visual acuities over the 4 days of firing. As indicated in Table C-12, Subject VS06's performance did not differ to a significant extent at any of the visual acuities on any individual day of firing. Hit proportions and 95% confidence intervals for each acuity over the days of firing are provided in Figures C-21 through C-24.

Table C-11. Subject VS06 Acuity Hit Proportions

Acuity	Day 2	Day 3	Day 4	Day 5	Chi-Squared	P-Value
A	1	1	1	1	NA	NA
B	1	1	1	1	NA	NA
C	1	1	1	1	NA	NA
D	0.96875	1	1	1	3.0236	0.388

Table C-12. Subject VS06 Daily Hit Proportions

Day	Acuity A	Acuity B	Acuity C	Acuity D	Chi-Squared	P-Value
2	1	1	1	0.96875	2.8984	0.4076
3	1	1	1	1	NA	NA
4	1	1	1	1	NA	NA
5	1	1	1	1	NA	NA

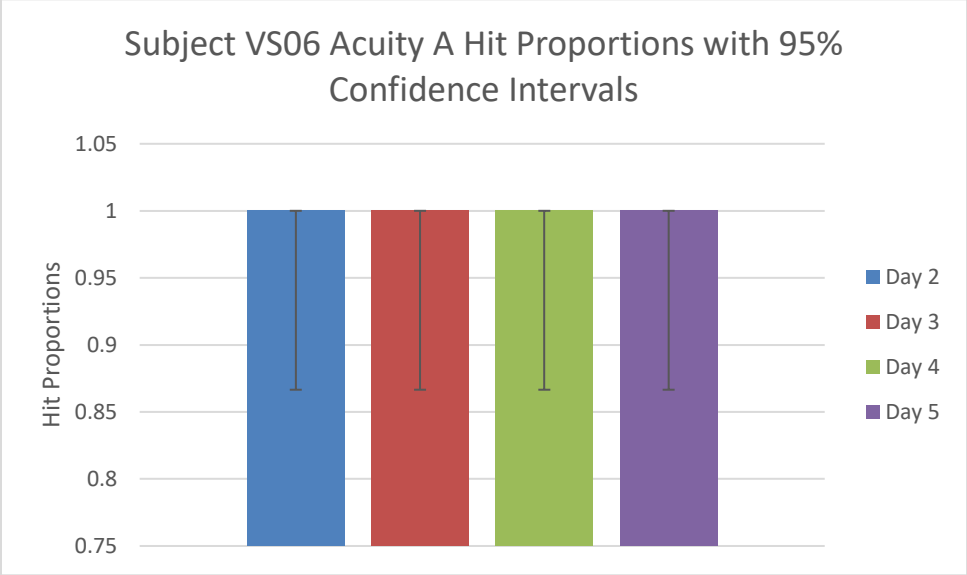

Figure C-21. Subject VS06 Acuity A Hit Proportions

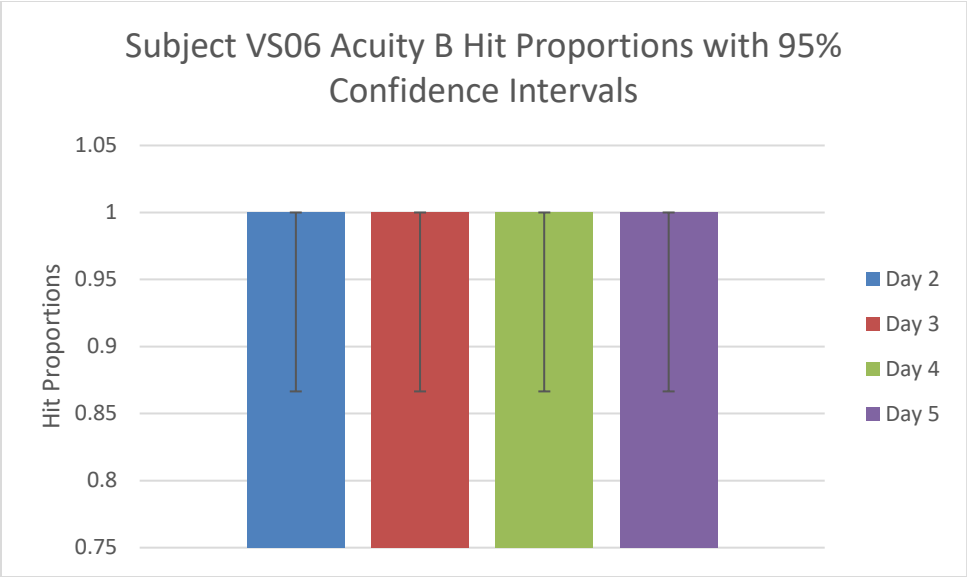

Figure C-22. Subject VS06 Acuity B Hit Proportions

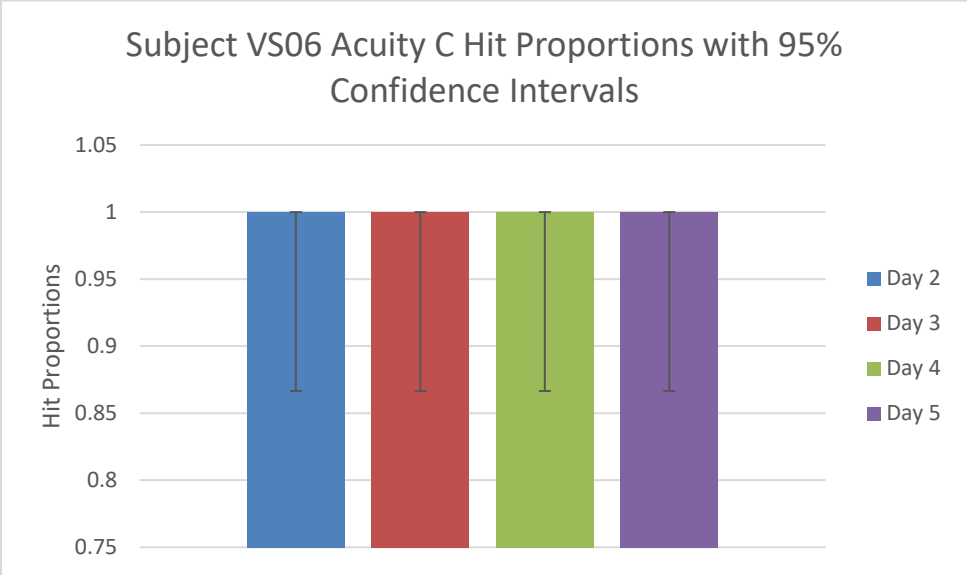

Figure C-23. Subject VS06 Acuity C Hit Proportions

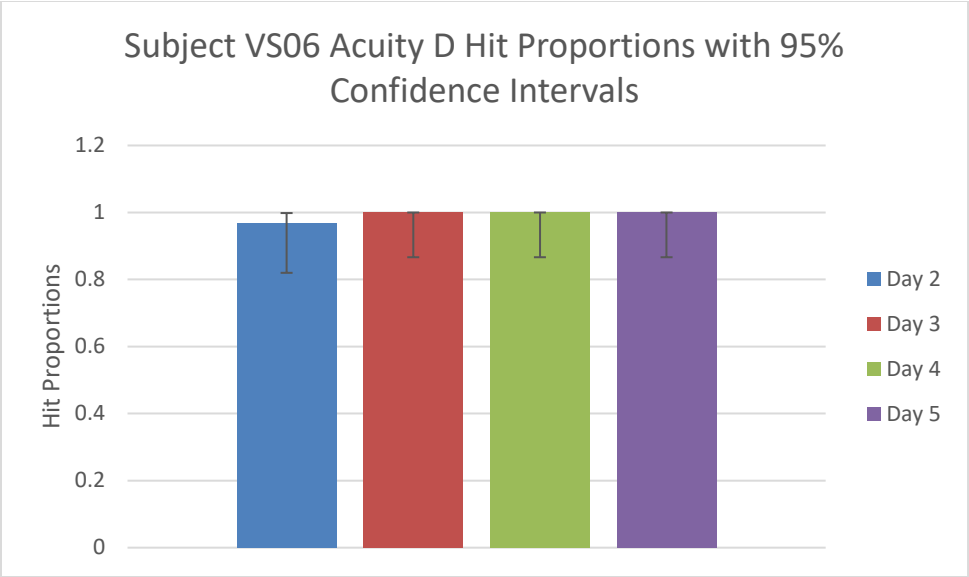

Figure C-24. Subject VS06 Acuity D Hit Proportions

6.7 Subject VS07 Data

As indicated in Table C-13, the null hypothesis of equality of proportions was not rejected for any of the visual acuities over the 4 days of firing. As indicated in Table C-14, Subject VS07's performed did not differ to a significant extent at any of the visual acuities on any individual day of firing. Hit proportions and 95% confidence intervals for each acuity over the days of firing are provided in Figures C-25 through C-28.

Table C-13. Subject VS07 Acuity Hit Proportions

Acuity	Day 2	Day 3	Day 4	Day 5	Chi-Squared	P-Value
A	1	0.96875	0.96875	1	2.0317	0.5658
B	0.96875	1	1	1	30.236	0.388
C	1	1	1	1	NA	NA
D	1	1	1	1	NA	NA

Table C-14. Subject VS07 Daily Hit Proportions

Day	Acuity A	Acuity B	Acuity C	Acuity D	Chi-Squared	P-Value
2	1	0.96876	1	1	3.0236	0.388
3	0.96875	1	1	1	2.9923	0.3928
4	0.96875	1	1	1	3.0236	0.388
5	1	1	1	1	NA	NA

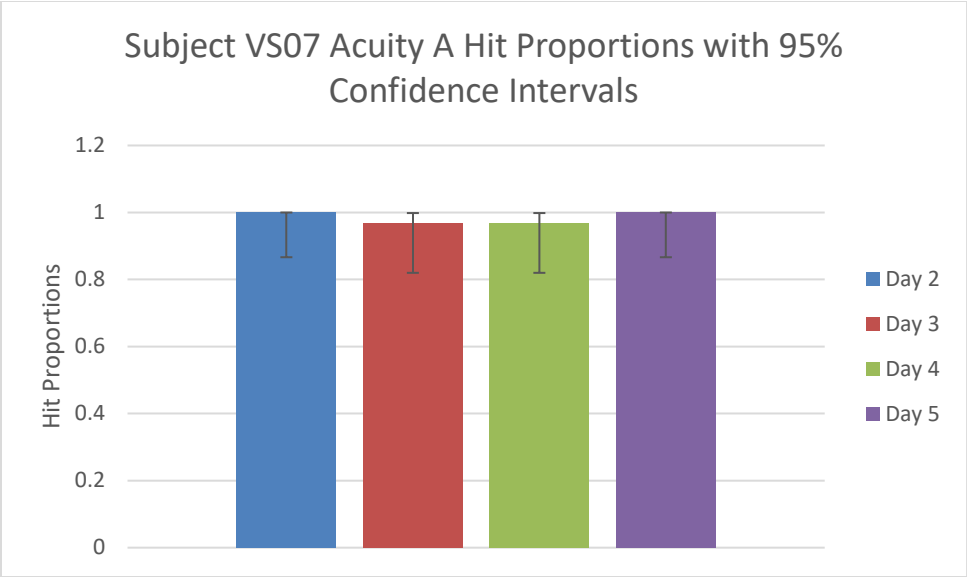

Figure C-25. Subject VS07 Acuity A Hit Proportions

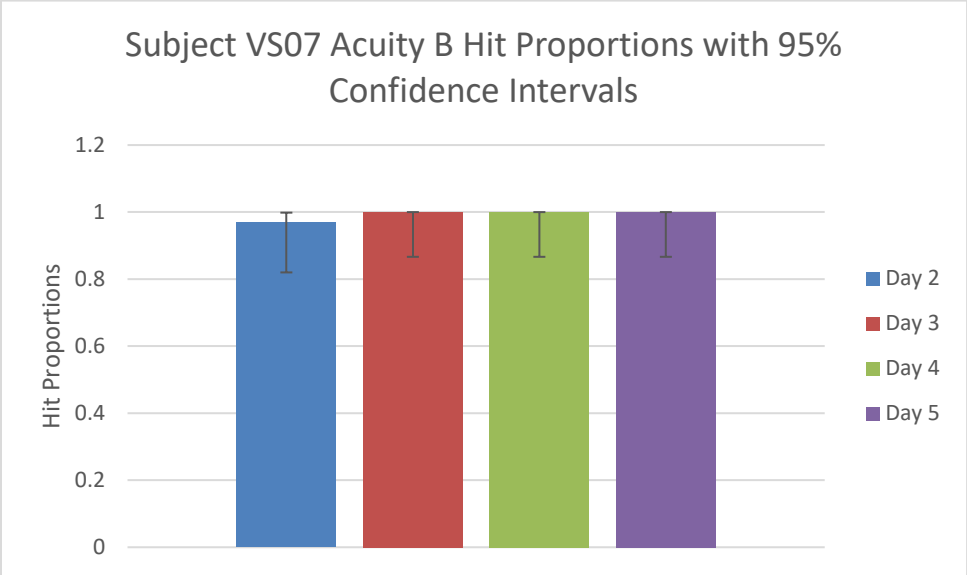

Figure C-26. Subject VS07 Acuity B Hit Proportions

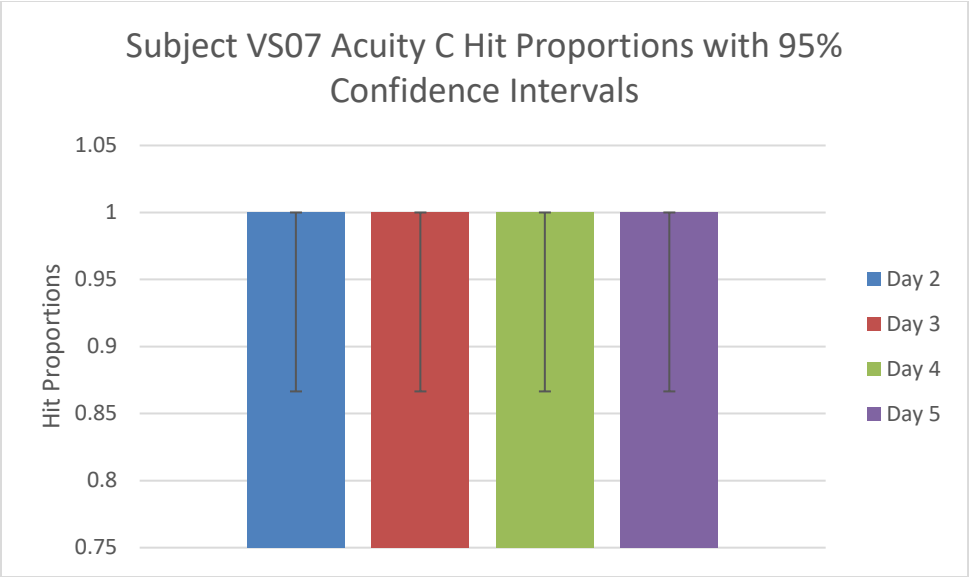

Figure C-27. Subject VS07 Acuity C Hit Proportions

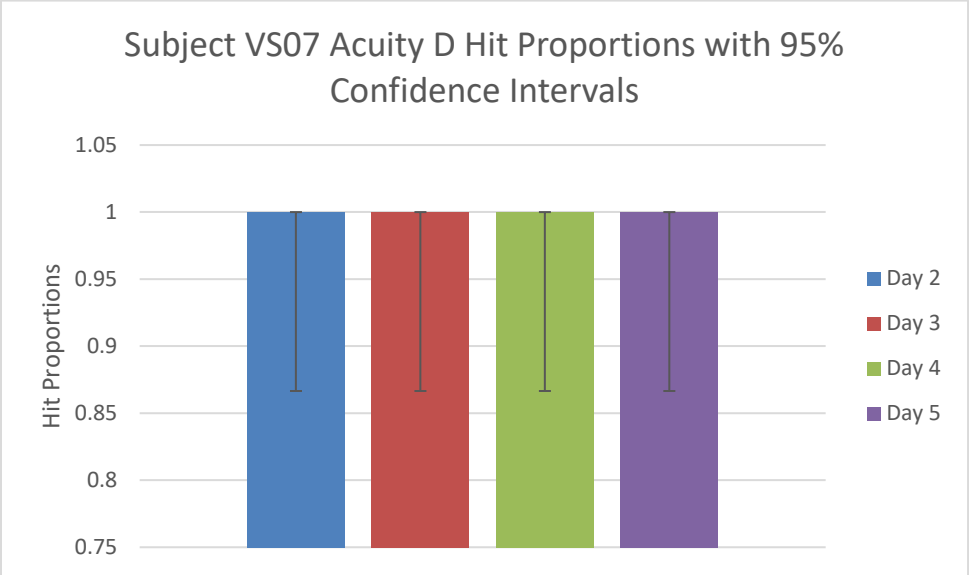

Figure C-28. Subject VS07 Acuity D Hit Proportions

6.8 Subject VS08 Data

As indicated in Table C-15, the null hypothesis of equality of proportions was rejected

for visual acuity B on day 2 of firing. As indicated in Table C-16, Subject VS08's performance at acuity C was significantly lower than the other acuities on day 3 of firing. Hit proportions and 95% confidence intervals for each acuity over the days of firing are provided in Figures C-29 through C-32.

Table C-15. Subject VS08 Acuity Hit Proportions

Acuity	Day 2	Day 3	Day 4	Day 5	Chi-Squared	P-Value
A	1	1	1	1	NA	NA
B	0.90625	1	1	1	9.216	0.02655
C	0.96875	0.90625	0.90625	0.96875	2.1333	0.5452
D	0.9375	1	0.96875	0.9375	2.2894	0.5145

Table C-16. Subject VS08 Daily Hit Proportions

Day	Acuity A	Acuity B	Acuity C	Acuity D	Chi-Squared	P-Value
2	1	0.90625	0.96875	0.9375	3.4973	0.3211
3	1	1	0.90625	1	9.216	0.02655
4	1	1	0.90625	0.96875	6.1935	0.1026
5	1	1	0.96875	0.9375	3.7547	0.2892

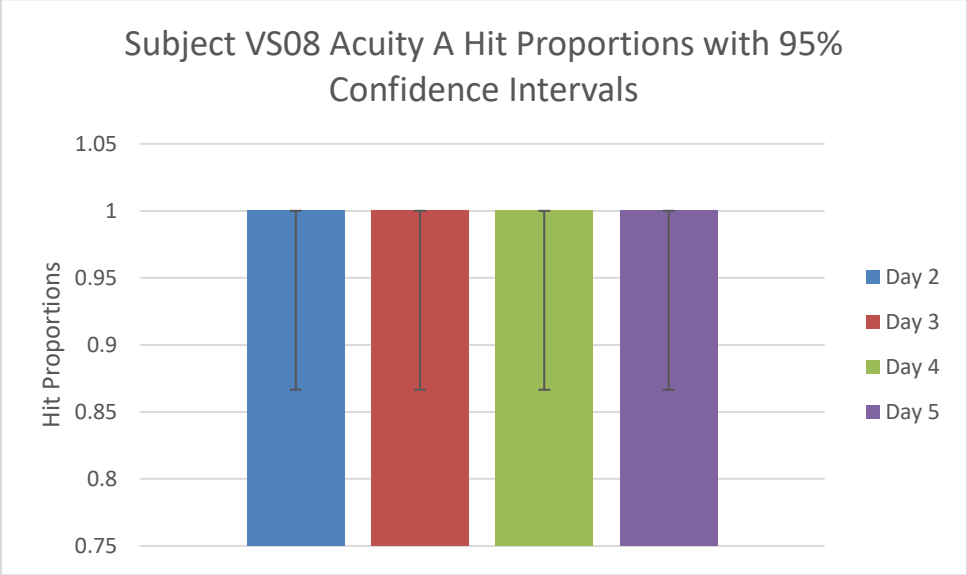

Figure C-29. Subject VS08 Acuity A Hit Proportions

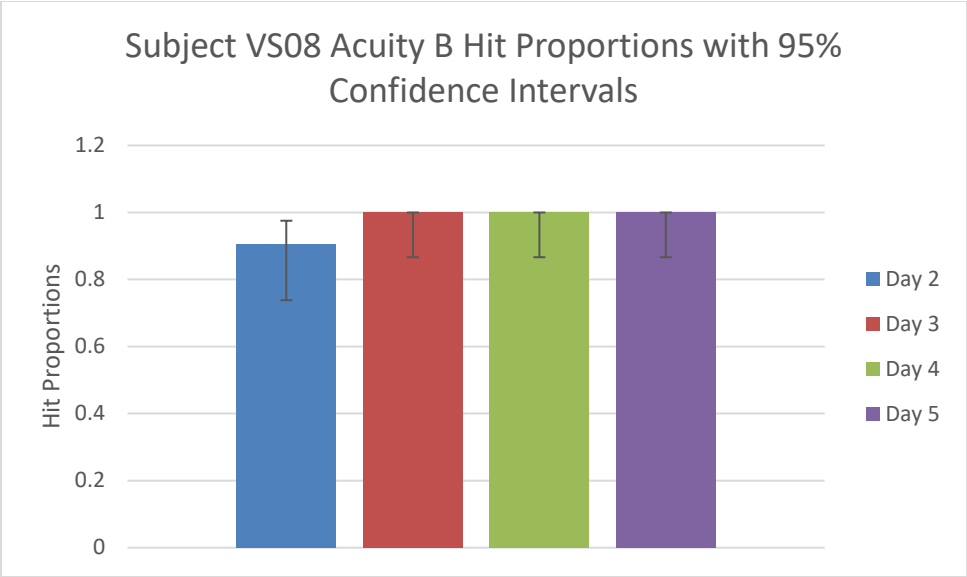

Figure C-30. Subject VS08 Acuity B Hit Proportions

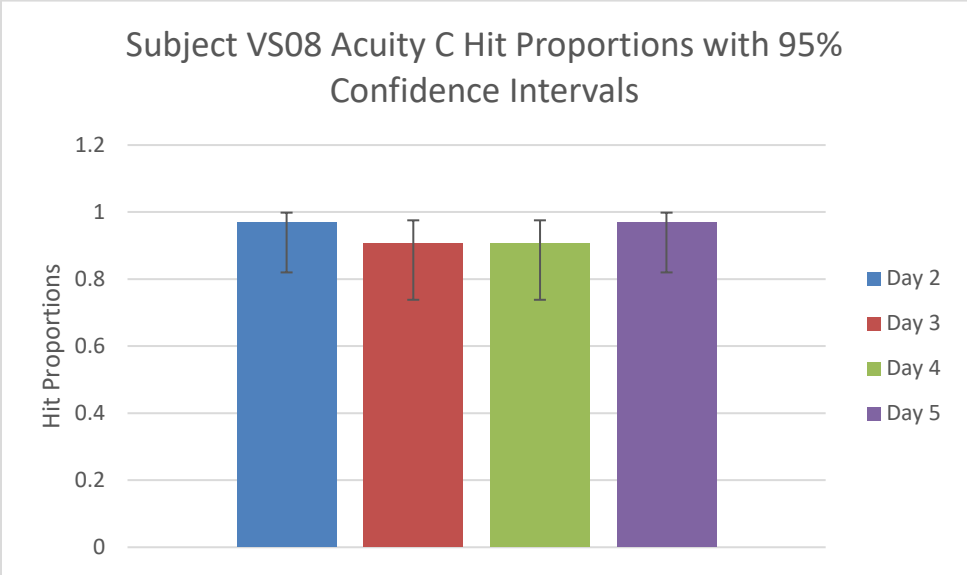

Figure C-31. Subject VS08 Acuity C Hit Proportions

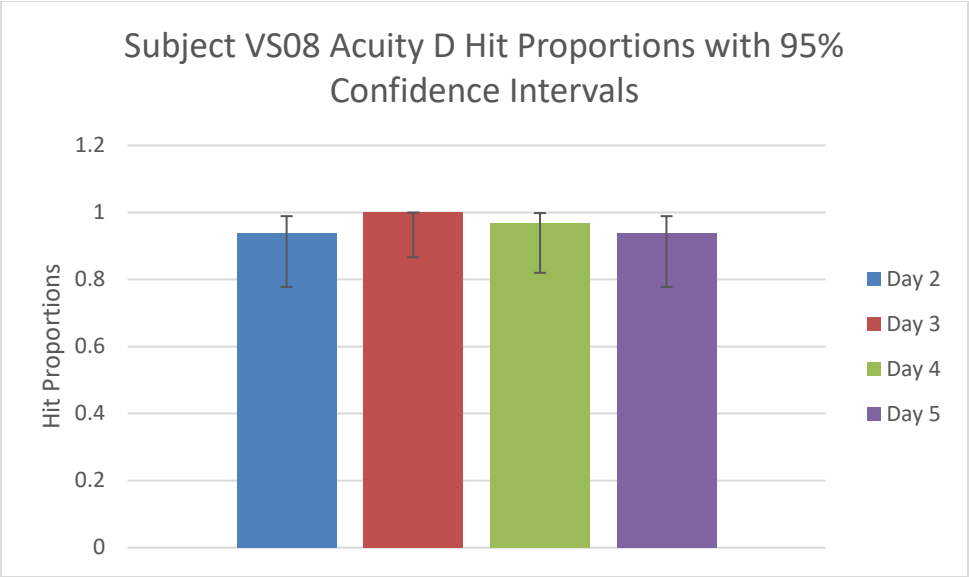

Figure C-32. Subject VS08 Acuity D Hit Proportions

6.9 Subject VS09 Data

As indicated in Table C-17, the null hypothesis of equality of proportions was not rejected for any of the visual acuities over the 4 days of firing. As indicated in Table C-18, Subject VS09's performance did not differ to a significant extent at any of the visual acuities on any individual day of firing. Hit proportions and 95% confidence intervals for each acuity over the days of firing are provided in Figures C-33 through C-36.

Table C-17. Subject VS09 Acuity Hit Proportions

Acuity	Day 2	Day 3	Day 4	Day 5	Chi-Squared	P-Value
A	0.96875	1	1	0.96875	2.0317	0.5658
B	1	1	1	1	NA	NA
C	0.9375	1	0.96875	0.96875	2.0645	0.5591
D	1	0.96875	0.90625	1	6.1935	0.1026

Table C-18. Subject VS09 Daily Hit Proportions

Day	Acuity A	Acuity B	Acuity C	Acuity D	Chi-Squared	P-Value
2	0.96875	1	0.9375	1	3.7547	0.2892
3	1	1	1	0.96875	3.0236	0.388
4	1	1	0.96875	0.90624	6.1935	0.1026
5	0.96875	1	0.96875	1	2.0317	0.5658

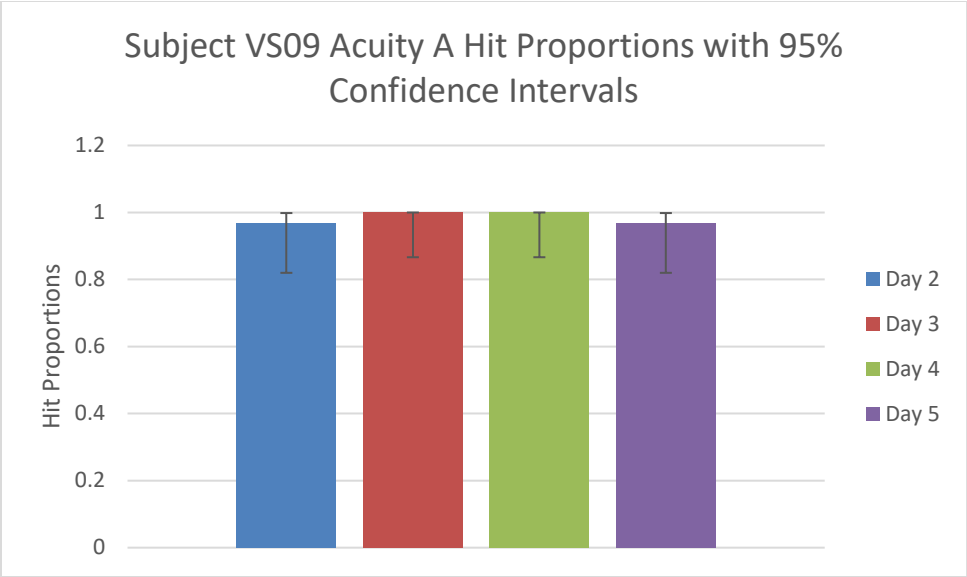

Figure C-33. Subject VS09 Acuity A Hit Proportions

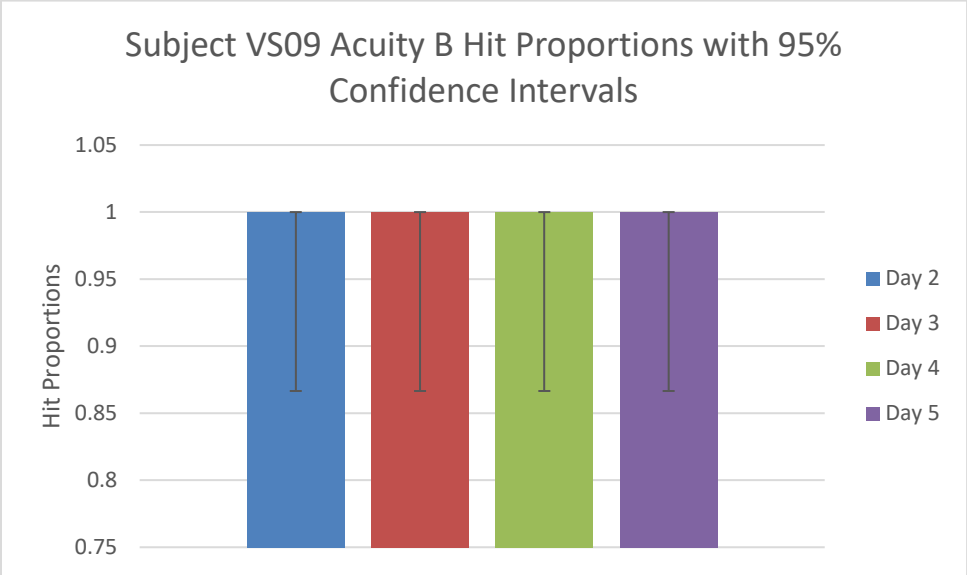

Figure C-34. Subject VS09 Acuity B Hit Proportions

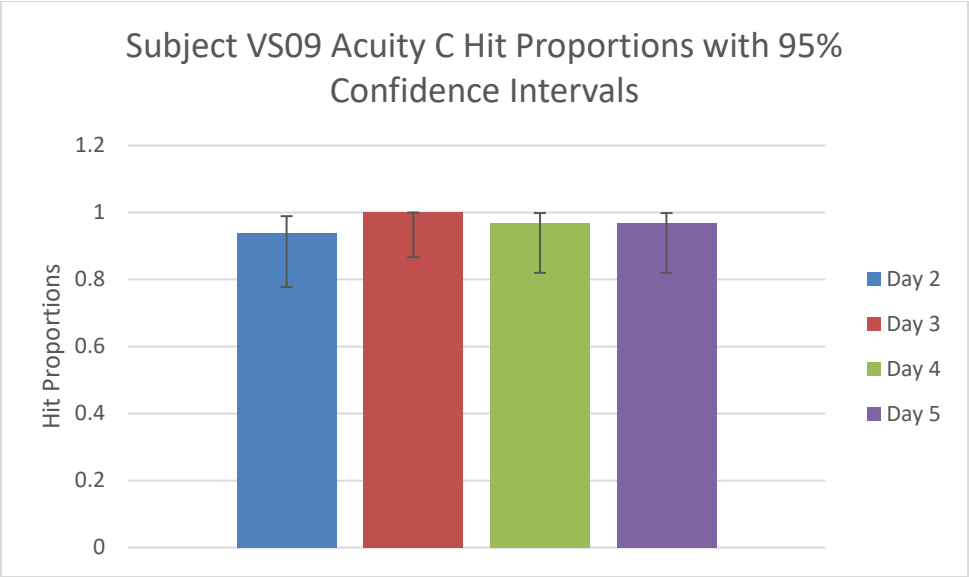

Figure C-35. Subject VS09 Acuity C Hit Proportions

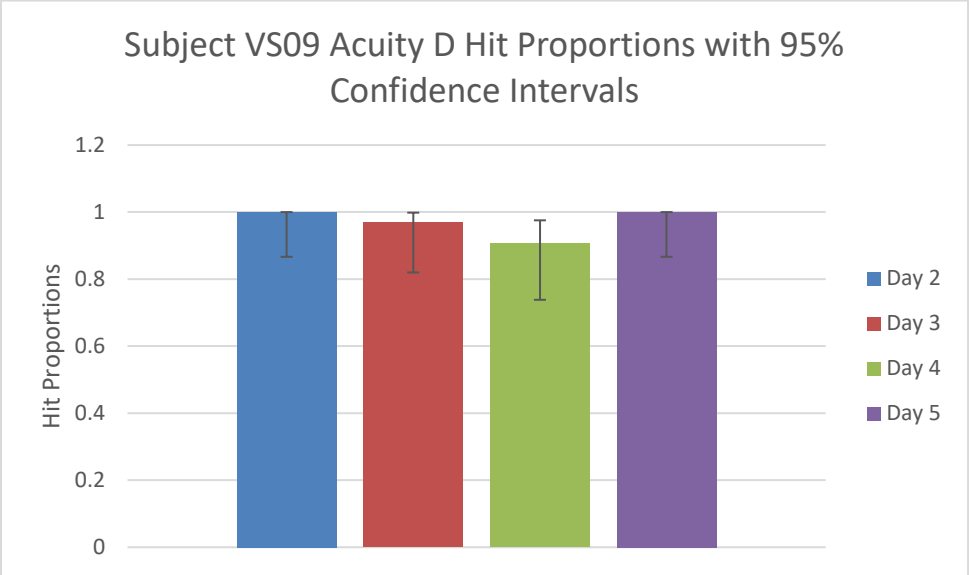

Figure C-36. Subject VS09 Acuity D Hit Proportions

6.10 Subject VS10 Data

As indicated in Table C-19, the null hypothesis of equality of proportions was not rejected

for any of the visual acuities over the 4 days of firing. While the null hypothesis was not rejected for acuity D, Table C-19 does provide evidence that indicates that Subject VS10 does appear to have had difficulty at acuity D, and that this difficulty was more pronounced on days 2 and 3 of firing. As indicated in Table C-20, Subject VS10's performance at acuity D on day 3 was significantly lower than performance at the other acuities. Hit proportions and 95% confidence intervals for each acuity over the days of firing are provided in Figures C-37 through C-40.

Table C-19. Subject VS10 Acuity Hit Proportions

Acuity	Day 2	Day 3	Day 4	Day 5	Chi-Squared	P-Value
A	0.90625	0.9375	1	1	5.6195	0.1317
B	0.96875	1	1	1	3.0236	0.388
C	0.84375	0.96875	0.9375	0.96875	5.1391	0.1619
D	0.71875	0.78125	0.90625	0.90625	5.928	0.1152

Table C-20. Subject VS10 Daily Hit Proportions

Day	Acuity A	Acuity B	Acuity C	Acuity D	Chi-Squared	P-Value
2	0.90625	0.96875	0.84375	0.71875	9.0505	0.02863
3	0.9375	1	0.96875	0.78125	12.583	0.005631
4	1	1	0.9375	0.90625	5.6195	0.1317
5	1	1	0.96875	0.90625	6.1935	0.1026

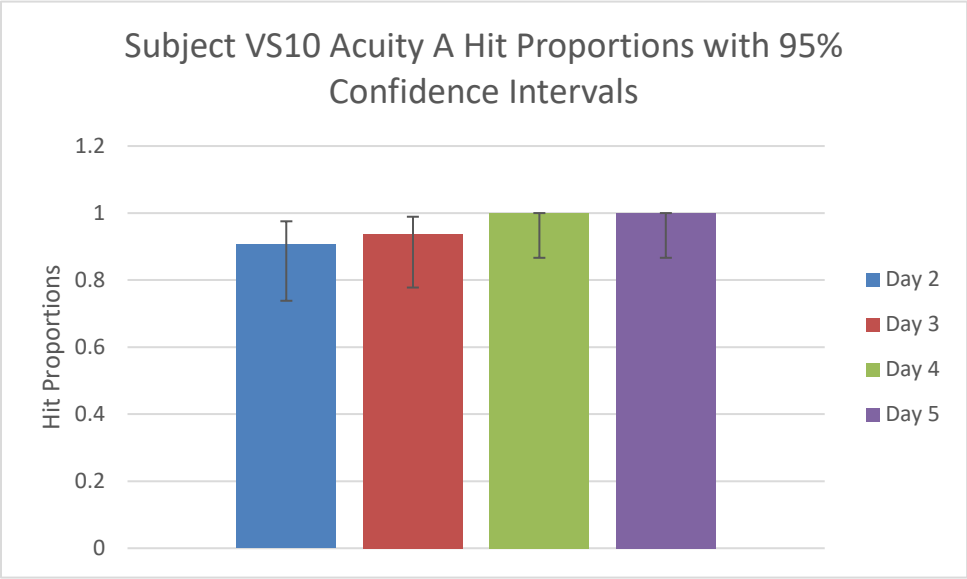

Figure C-37. Subject VS10 Acuity A Hit Proportions

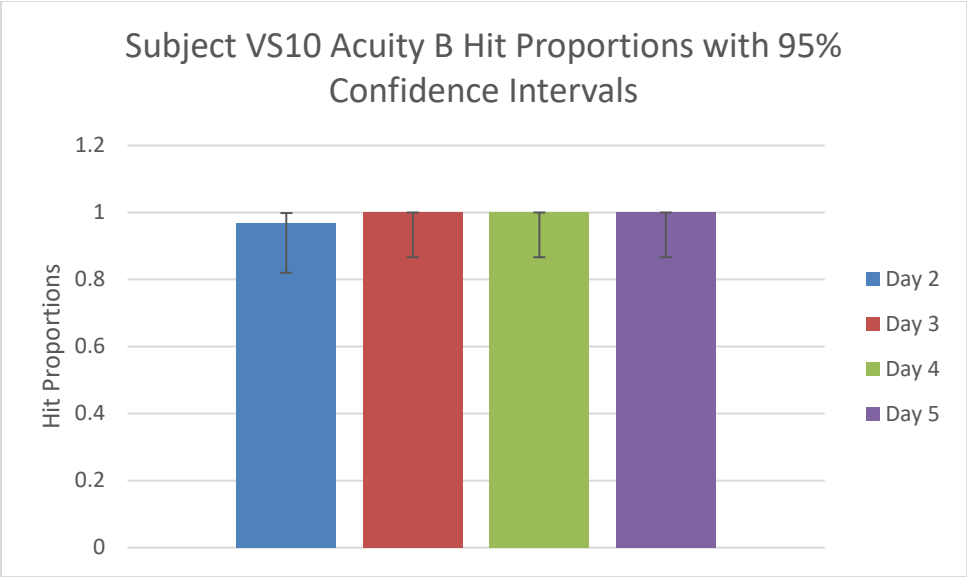

Figure C-38. Subject VS10 Acuity B Hit Proportions

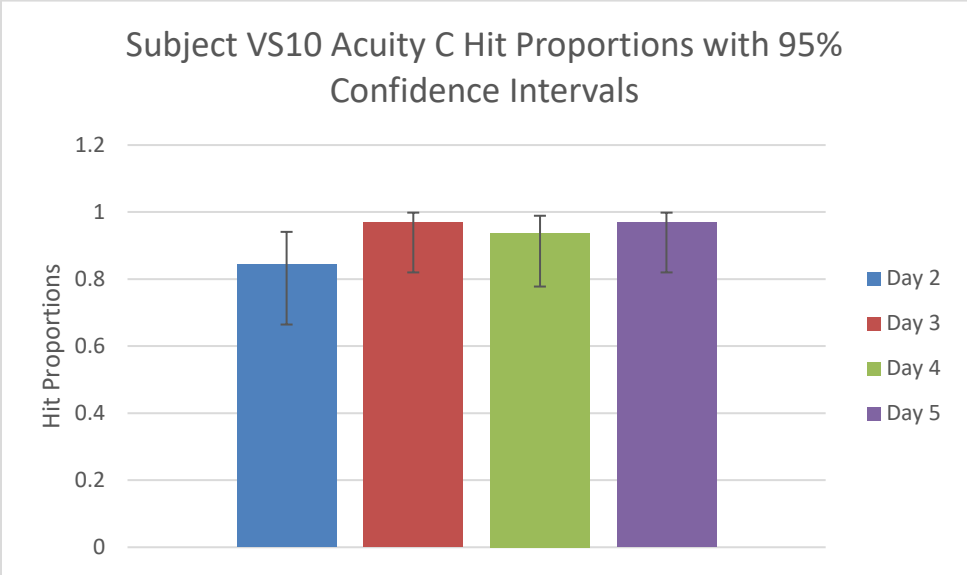

Figure C-39. Subject VS10 Acuity C Hit Proportions

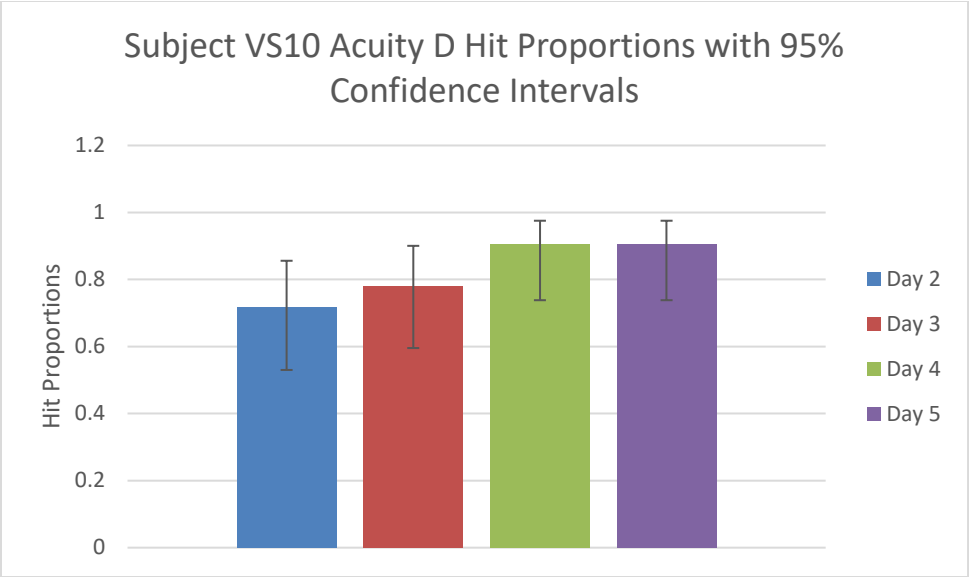

Figure C-40. Subject VS10 Acuity D Hit Proportions