

**DOT/FAA/AR-95/102**

Office of Aviation Research  
Washington, D.C. 20591

# **Evaluation of Approach Path Indicator Systems for Heliports**

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April 1996

Final Report

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19960708 005



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| 1. Report No.<br>DOT/FAA/AR-95/102                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | 2. Government Accession No.                          | 3. Recipient's Catalog No.                                                                                                                                     |           |
| 4. Title and Subtitle<br>EVALUATION OF APPROACH PATH INDICATORS FOR HELIPORTS                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |                                                      | 5. Report Date<br>April 1996                                                                                                                                   |           |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |                                                      | 6. Performing Organization Code<br>AAR-410                                                                                                                     |           |
| 7. Author(s)<br>Keith Bagot                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |                                                      | 8. Performing Organization Report No.<br>DOT/FAA/AR-95/102                                                                                                     |           |
| 9. Performing Organization Name and Address<br>Airport and Aircraft Safety<br>Research and Development Division<br>FAA Technical Center<br>Atlantic City International Airport, NJ 08405                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |                                                      | 10. Work Unit No. (TRAIS)                                                                                                                                      |           |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |                                                      | 11. Contract or Grant No.                                                                                                                                      |           |
| 12. Sponsoring Agency Name and Address<br>U.S. Department of Transportation<br>Federal Aviation Administration<br>Office of Aviation Research<br>Washington, D.C. 20591                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |                                                      | 13. Type of Report and Period Covered<br>Final Report                                                                                                          |           |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |                                                      | 14. Sponsoring Agency Code                                                                                                                                     |           |
| 15. Supplementary Notes                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |                                                      |                                                                                                                                                                |           |
| 16. Abstract<br><br><p>The objective of this report was to determine the acceptability of using existing approach path indicator technology to develop the criteria for establishing production and installation requirements for approach path indicators for heliports. The approach path indicators give the pilot a visual reference as to his proximity to a specific approach angle to the heliport in visual flight rule (VFR) landing operations.</p> <p>This effort required photometric testing for actual light beam characteristics, the collection of ground tracking data, and flight testing for pilot feedback as to their acceptability of the systems.</p> <p>Results of the evaluation showed that all three existing approach path indicator systems provided the necessary guidance to the pilot to successfully conduct VFR landing operations, and that the data collected could be used to establish criteria for their production and installation.</p> |                                                      |                                                                                                                                                                |           |
| 17. Key Words<br>Approach Path Indicators, Visual Flight Rules<br>International Civil Aviation Organization                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |                                                      | 18. Distribution Statement<br>This document is available to the public through the National Technical Information Service (NTIS), Springfield, Virginia 22161. |           |
| 19. Security Classif. (of this report)<br>Unclassified                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | 20. Security Classif. (of this page)<br>Unclassified | 21. No. of Pages<br>236                                                                                                                                        | 22. Price |

## TABLE OF CONTENTS

|                                                  | Page |
|--------------------------------------------------|------|
| EXECUTIVE SUMMARY                                | vii  |
| INTRODUCTION                                     | 1    |
| Background                                       | 1    |
| Objective                                        | 1    |
| Location                                         | 1    |
| SUPPORT EQUIPMENT                                | 2    |
| Approach Path Indicators                         | 2    |
| Heliport Approach Path Indicator (HAPI)          | 2    |
| Two-Box Precision Approach Path Indicator (PAPI) | 2    |
| Chase Helicopter Approach Path Indicator (CHAPI) | 3    |
| Aircraft                                         | 3    |
| Ground Tracking                                  | 3    |
| Subject Pilots                                   | 4    |
| TEST PROCEDURE (THREE PHASE)                     | 4    |
| Phase I—Photometric Testing                      | 4    |
| Phase II—Flight Testing With FAA Pilots          | 5    |
| Phase III—Flight Testing With Subject Pilots     | 5    |
| DATA COLLECTION                                  | 6    |
| Subjective Data                                  | 6    |
| Objective Test Data                              | 6    |
| RESULTS                                          | 7    |
| In-Flight Questionnaire Results                  | 7    |
| Ground Tracking Results                          | 8    |
| Photometric Results                              | 14   |

|                                                                                                              |    |
|--------------------------------------------------------------------------------------------------------------|----|
| PAPI System Luminous Intensity Measurements                                                                  | 14 |
| CHAPI System Luminous Intensity Measurements                                                                 | 16 |
| HAPI System Luminous Intensity Measurements                                                                  | 16 |
| Photometric Summary                                                                                          | 17 |
| CONCLUSIONS                                                                                                  | 17 |
| APPENDICES                                                                                                   |    |
| A—Sample Questionnaires, Modified Cooper-Harper Rating Scale, and Pilot Numerical Questionnaire Responses    |    |
| B—Pilot Comments from In-Flight and Postflight Questionnaires                                                |    |
| C—Vertical Position Plots                                                                                    |    |
| D—Photometric Data/Plots of Tests Conducted at the Naval Air Warfare Center Aircraft Division, Lakehurst, NJ |    |

## LIST OF FIGURES

| Figure                                 | Page |
|----------------------------------------|------|
| 1     Tracking Plot of Single Approach | 9    |
| 2     Vertical Position Plot for CHAPI | 10   |
| 3     Vertical Position Plot for HAPI  | 11   |
| 4     Vertical Position Plot for PAPI  | 12   |
| 5     CIE Chromaticity Diagram         | 15   |

## LIST OF TABLES

| Table                                                    | Page |
|----------------------------------------------------------|------|
| 1     Visual Presentation of HAPI                        | 2    |
| 2     Visual Presentation of PAPI                        | 3    |
| 3     Visual Presentation of CHAPI                       | 3    |
| 4     Flight Profile with FAA Pilots (Distance 5-7 NM)   | 5    |
| 5     Flight Profile with Subject Pilots (Distance 3 NM) | 6    |
| 6     CHAPI Approach Elevation Errors (Feet)             | 13   |
| 7     HAPI Approach Elevation Errors (Feet)              | 13   |
| 8     PAPI Approach Elevation Errors (Feet)              | 14   |
| 9     Angular Coverage of HAPI                           | 17   |
| 10    Photometric Summary                                | 17   |

## EXECUTIVE SUMMARY

The Heliport Design Guide, Advisory Circular (AC) 150/5390-2A, lists three recommended approach path indicator systems. However, the AC does not identify the equipment production and installation specifications.

The objective of this report was to determine if the existing heliport approach path indicator technology is suitable for developing a standard criteria for the various systems' production and installation. This required photometric testing for actual light beam characteristics, flight testing for pilot feedback as to their acceptability of the systems, and the collection of ground tracking data.

The results of the evaluation showed that all three existing approach path indicator systems provided the necessary pilot guidance to successfully conduct visual flight rule (VFR) landing operations and that the data collected could be used to establish criteria for their production and installation.

## INTRODUCTION

### BACKGROUND.

The Heliport Design Guide, Advisory Circular (AC) 150/5390-2A, lists three recommended approach path indicator systems: the Visual Approach Slope Indicator (VASI), Precision Approach Path Indicator (PAPI), and the Heliport Approach Path Indicator (HAPI). However, the AC does not identify the equipment production and installation specifications of each system. The current International Civil Aviation Organization (ICAO) recommendations and requirements for approach path indicators for heliports are contained in its Annex 14, Volume II. It lists the HAPI, the Abbreviated Precision Approach Path Indicator (APAPI), and the PAPI as their recommended systems. The APAPI system has a similar visual presentation as the PAPI but uses two boxes (light housing assemblies (LHAs)) instead of four as used by the PAPI. The APAPI system is more commonly known as a two-box PAPI system. The HAPI system is a derivative of the Pulse Light Approach Slope Indicator system (PLASI) modified for heliport operations.

The purpose of evaluating the approach path indicator systems for heliports was to collect data for consideration in developing specifications for the production and installation of the systems' equipment. This evaluation was requested by the Office of Airport Safety and Standards (AAS-200) through the Vertical Flight Program Office (AND-610).

### OBJECTIVE.

In pursuing the objective of determining whether the existing heliport approach path indicator technology is suitable to develop production and installation criteria for these systems, the following criteria had to be evaluated: visual presentation, chromaticity, vertical and horizontal beam spreads, light intensities, and pilot recognition. This required both photometric testing for actual light beam characteristics and flight testing to gain pilot responses as to the effectiveness of the systems.

The three systems evaluated and their manufacturers were the Heliport Approach Path Indicator (HAPI, DeVore Aviation), the two-box Precision Approach Path Indicator (PAPI, Multi-Electric Manufacturing, Inc.), and Chase Helicopter Approach Path Indicator (CHAPI, Crouse-Hinds Aviation Lighting, Inc.).

### LOCATION.

Flight testing of the approach path indicators was conducted at the Federal Aviation Administration (FAA) National Concepts Development and Demonstration Heliport located at the FAA Technical Center, Atlantic City International Airport, NJ. The heliport is at the north end of the Technical Center with an obstacle free approach course providing the necessary flexibility for flight tests. The heliport and surrounding airspace are in clear view of the ground tracking facilities. The three systems (HAPI, PAPI, and CHAPI) were installed in the takeoff and landing area on the departure side of the helipad at equal distance from and perpendicular to the centerline.

Photometric testing of the three systems was conducted at the Naval Air Warfare Center, Lakehurst, New Jersey. The testing determined the light intensity distribution, beam spreads, transition widths, and color chromaticity coordinates.

## SUPPORT EQUIPMENT

### APPROACH PATH INDICATORS.

The flight testing was accomplished by using the three glide slope indicator systems installed in the takeoff and landing area on the departure side of the helipad. Each of the three systems provided glide slope (vertical) guidance, but none of the three systems were designed to give azimuth (horizontal) guidance. The following is a description of each of the three systems.

HELIPORT APPROACH PATH INDICATOR (HAPI). The HAPI system was manufactured by DeVore Aviation and is a single unit system. Approach guidance is provided by projecting red or green light signals through a lens and a movable-shutter system. The on glide slope signal (table 1) is a steady green light that subtends an angle of 0.75 degree. This visual presentation is observed when the pilot is within  $\pm 0.375$  degree of the desired approach angle. Deviations below the approach course are indicated by a steady red light for slightly low and a pulsing red light for below course. Deviations above course are indicated by a pulsing green light. The pulsing light is created by chain-driven shutters passing in front of the top and bottom portions of the projection. The on-off ratio of the pulsing signal is 1 to 1. The signal repetition rate of the flashing sector is 2 Hz. The system requires 1567 watts to power one 900-watt, 120-volt lamp and two blower/shutter motors. This system is included in ICAO's Annex 14, Volume II, section 5.3.4.

TABLE 1. VISUAL PRESENTATION OF HAPI

| Flight Condition | Approach Angle                                   | Light Signal         |
|------------------|--------------------------------------------------|----------------------|
| Above Course     | greater than $6\frac{3}{8}^{\circ}$              | Pulsing Green Lights |
| On Glide Slope   | $6\frac{3}{8}^{\circ}$ to $5\frac{5}{8}^{\circ}$ | Steady Green Lights  |
| Slightly Low     | $5\frac{5}{8}^{\circ}$ to $5\frac{3}{8}^{\circ}$ | Steady Red Lights    |
| Below Course     | less than $5\frac{3}{8}^{\circ}$                 | Pulsing Red Lights   |

TWO-BOX PRECISION APPROACH PATH INDICATOR (PAPI). The PAPI system was manufactured by Multi-Electric Manufacturing, Inc. This system consists of two sharp-transition red/white light projection units. The PAPI units were horizontally spaced 20 feet apart. The on glide slope signal is one red- and one white-light unit. The signal subtends an angle of 1.0 degree and is visible when the pilot is within  $\pm 0.5$  degree of the desired approach angle. Deviations below course are indicated by two red-light units and above course by two white-light units (table 2). The system requires 800 watts to power four 200-watt, 6.6-ampere lamps. The system is currently in use on airports in both the two- and four-unit configurations. The PAPI system is

included in the Vertiport Design Guide, AC 150/5390-3, Chapter 4, paragraph 44 and also in ICAO's Annex 14, Volume II, section 5.3.4.

TABLE 2. VISUAL PRESENTATION OF PAPI

| Flight Condition | Approach Angle                                   | Light Signal       |
|------------------|--------------------------------------------------|--------------------|
| Above Course     | greater than $6\frac{1}{2}^{\circ}$              | White/White Lights |
| On Glide Slope   | $6\frac{1}{2}^{\circ}$ to $5\frac{1}{2}^{\circ}$ | Red/White Lights   |
| Below Course     | less than $5\frac{1}{2}^{\circ}$                 | Red/Red Lights     |

CHASE HELICOPTER APPROACH PATH INDICATOR (CHAPI). The CHAPI system was manufactured by Crouse-Hinds Aviation Lighting, Inc. and consists of two sharp-transition red-, green-, and white-light projection units. These units are similar to a PAPI unit with the addition of a two-degree-wide green sector in the center of the beam. The units were horizontally spaced 20 feet apart. The on glide slope signal is two green light signals (table 3). The signal subtends an angle of 1.0 degree and is visible when the pilot is within  $\pm 0.5$  degree of the desired approach angle. Deviations below course are indicated by one green- and one red-light unit for slightly low and two red-light units for below course. A slightly high deviation is indicated by one white- and one green-light unit and two white-light units for above course. The system requires 800 watts to power four 200-watt, 6.6-ampere lamps.

TABLE 3. VISUAL PRESENTATION OF CHAPI

| Flight Condition | Approach Angle                                   | Light Signal       |
|------------------|--------------------------------------------------|--------------------|
| Above Course     | greater than $7\frac{1}{2}^{\circ}$              | White/White Lights |
| Slightly High    | $6\frac{1}{2}^{\circ}$ to $7\frac{1}{2}^{\circ}$ | White/Green Lights |
| On Glide Slope   | $6\frac{1}{2}^{\circ}$ to $5\frac{1}{2}^{\circ}$ | Green/Green Lights |
| Slightly Below   | $4\frac{1}{2}^{\circ}$ to $5\frac{1}{2}^{\circ}$ | Green/Red Lights   |
| Below Course     | less than $4\frac{1}{2}^{\circ}$                 | Red/Red Lights     |

### AIRCRAFT.

The helicopters utilized for the flight tests were the Sikorsky S-76A and the Bell UH-1H. The S-76 (N38) is a twin engine, single main rotor helicopter. It is capable of speeds up to 155 knots and has a maximum takeoff gross weight of 10,300 pounds. The UH-1H (N37) is representative of current civil medium weight, single engine helicopters. It is capable of speeds up to 120 knots and has a maximum takeoff gross weight of 9,500 pounds. These aircraft are both owned and operated by the FAA. For these tests they were both flown under visual flight rules (VFR).

### GROUND TRACKING.

Two different systems were used for tracking the aircraft during the approaches, the GTE Sylvania Precision Automated Tracking System (PATs) and the Vitro RIR778 Tracking Radar.

The GTE Sylvania PATS measures the azimuth (AZ), elevation (EL), and range automatically by transmitting a laser pulse to the target aircraft to measure the round-trip time and the angle of return. The span of angular coverage for the AZ is 540 degrees and for the EL it is 0.5 to 0.85 degree. The angle of accuracy or maximum error for both AZ and EL is 20 arc seconds at all ranges. The maximum reliable range coverage is 25 nm. Accuracies are 1 foot for target ranges up to 5 nm, 2 feet for target ranges of 5 to 10 nm, and 3 feet for target ranges of 10 to 25 nm. The system is capable of tracking an aircraft through touchdown. However, the operational range is limited at the Technical Center to ranges of 7 to 10 nm due to visibility conditions.

The VITRO RIR778 Tracking Radar uses a Nike Hercules radar antenna. It is capable of operating either in beacon (cooperative) mode or in skin paint (passive) mode. It is calibrated to a one sigma range error, 3.3 meters for the beacon mode and 6.0 meters for the skin paint mode.

### SUBJECT PILOTS.

The evaluation was conducted in three phases; phase I was the photometric testing, and phases II and III involved actual flight testing of the systems. The three phases are detailed in the next section. Three FAA Technical Center test pilots participated in phase II of the test, and twelve subject pilots participated in phase III of the test. Subject pilots were selected from industry and from the military. All subject pilots possessed at least an FAA commercial pilot's license with a rotorcraft rating. All pilots were qualified in either the S-76 or the UH-1H.

## TEST PROCEDURE (THREE PHASE)

### PHASE I—PHOTOMETRIC TESTING.

The purpose of the photometric testing is to collect data in reference to the optical signal characteristics of the three approach path indicators. Photometric testing of each of the three approach path indicators was conducted at the Naval Air Warfare Center, Lakehurst, NJ. The types of photometric tests included recordings of lamp intensity distributions, beam spreads, and signal transition widths in the form of photometric curves and isocandela plots. The color measurements were in the form of spectral distribution curves and CIE x and y values. There was also a requirement for determination of flashing light intensity values measured in effective candelas.

Intensity readings in candelas were required at the following angles. Lateral sweeps were taken every one degree from +15 to -15 degrees horizontal and +10 to -10 degrees vertical. The output of these sweeps was displayed in graph plots. System compliance to current ICAO standards under Annex 14, Volume II, sections 5.3.4.8 through 5.3.4.14 were considered. Color measurements were taken to determine compliance with Annex 14, Volume I, Appendix I, section 2.1.3 and Volume II section 5.3.4.15. The width of the signal transition sector was also measured. All of the photometric data and plots are included in appendix D of this report.

## PHASE II—FLIGHT TESTING WITH FAA PILOTS.

Flight tests were conducted using the Bell UH-1H and the Sikorsky S-76 helicopters. Three FAA Technical Center test pilots determined the optimal flight procedures to use when conducting data collection from the subject pilots' flights. These FAA test pilot flights determined the placement of the systems in relation to the helipad and the ideal flight patterns. The flight profile of phase II is detailed in table 4.

TABLE 4. FLIGHT PROFILE WITH FAA PILOTS (DISTANCE 5-7 NM)

| RUN | ELEVATION ANGLE<br>(DEGREES) | SYSTEM |
|-----|------------------------------|--------|
| 1   | 4.5                          | PAPI   |
| 2   | 4.5                          | PAPI   |
| 3   | 6.0                          | PAPI   |
| 4   | 6.0                          | PAPI   |
| 5   | 4.5                          | CHAPI  |
| 6   | 4.5                          | CHAPI  |
| 7   | 6.0                          | CHAPI  |
| 8   | 6.0                          | CHAPI  |
| 9   | 4.5                          | HAPI   |
| 10  | 4.5                          | HAPI   |
| 11  | 6.0                          | HAPI   |
| 12  | 6.0                          | HAPI   |

## PHASE III—FLIGHT TESTING WITH SUBJECT PILOTS.

Evaluations were conducted during daylight in VFR conditions. Each pilot made twelve approaches to the heliport (see table 5 for flight profile). The twelve approaches consisted of four data runs for each of the three systems. The pilots made approaches from a distance of three miles from the heliport at the 6-degree approach angle which was determined during phase II of testing. The order in which the subject pilot evaluated each system was random and determined prior to each flight. This eliminated the possibility of a learning curve benefiting the final system evaluated as the pilot became more familiar with other visual cues in the surrounding environment.

Of the twelve subject pilots involved in the testing, nine pilots flew the S-76, and three flew the Bell UH-1H. Forty-eight approaches were made on each system for a total of 144 approaches. Of these 144 approaches, 98 were in the S-76 and 36 in the UH-1H.

TABLE 5. FLIGHT PROFILE WITH SUBJECT PILOTS (DISTANCE 3 NM)  
Laser or Nike tracking began three miles out and continued until the helicopter hovered over the pad.

| RUN  | ELEVATED<br>ANGLE<br>(DEGREES) | SYSTEM* |
|------|--------------------------------|---------|
| 1-4  | 6.0                            | PAPI    |
| 5-8  | 6.0                            | CHAPI   |
| 9-12 | 6.0                            | HAPI    |

\*The order in which the systems were evaluated varied between subject pilots.

## DATA COLLECTION

### SUBJECTIVE DATA.

Subjective data consisting of in-flight questionnaire responses, postflight comments, and flight deck recordings were evaluated. The data collected from the questionnaires were used to determine the effectiveness of the systems to provide the pilot with acceptable glide slope information for VFR heliport operations. Also determined from the questionnaire was whether the systems could be confused with any other heliport lighting systems. Flight deck conversations were recorded to collect the pilot's comments during the flight testing. General pilot background information was also tabulated.

Using the Modified Cooper-Harper rating scale and immediate pilot recall, the pilots were asked to rate several aspects of the approach path indicators following each approach and prior to departing the helipad. These aspects included acquisition and identification, signal interpretation, ability to maintain the signal and determine deviations, and the perceived workload. The postflight comments were used to elaborate on the ratings the pilots gave during the in-flight questioning. These comments typically give the evaluator greater detail as to what factors influenced a certain rating.

Appendix A shows sample in-flight and postflight questionnaires and the summation of the responses to the in-flight questionnaire as well as the Modified Cooper-Harper rating scale. Generally, higher rating scores on the Modified Cooper-Harper rating scale implied decreased acceptability of an operation. In-flight and postflight comments are listed in appendix B.

### OBJECTIVE TEST DATA.

Laser or Nike ground tracking systems collected objective data during phase III on the airborne characteristics of the approaches. Laser and Nike tracking provided azimuth (horizon) and elevation (glide slope) information. For this evaluation, only the glide slope information was collected. None of the systems provided azimuth guidance. Of primary concern was the pilot's ability to maintain glide path. The tracking began when the aircraft was approximately three

miles from the helipad and stopped when the aircraft was at a hover over the helipad. All tracking data are included in appendix C.

## RESULTS

### IN-FLIGHT QUESTIONNAIRE RESULTS

Following each approach and prior to departing the helipad, the pilots were asked to rate several aspects of the approach path indicators. The pilot's response to each question was a numerical score ranging from 1 to 10 based on the Modified Cooper-Harper rating scale. Higher numerical rating scores on the Cooper-Harper rating scale imply decreased acceptability of an operation, procedure, or condition. A pilot rating of 1 to 3 indicated the subject pilot felt the approach was fully acceptable for routine operations. Ratings of 4 to 6 indicated the pilot felt the approach would be acceptable only on occasion, that there were more deficiencies, and the safety margin has deteriorated. A rating higher than 6 indicated the subject pilot felt the maneuvers should be seldom, if ever, attempted. There were forty-eight responses to each of the questions for each of the three systems. The questions asked were as follows with the results displayed after the questions. For further detail refer to the tables in appendix A.

1. Acquisition and identification of the system. This question refers to the pilot's ability to locate the visual aid at the heliport. The CHAPI and PAPI systems were rated extremely well with thirty-eight and thirty-nine responses in the 1 to 3 range respectively. The HAPI system also performed well with thirty of the forty-eight responses being within the same range.
2. Ability to interpret the system signal. Question 2 was asked to determine the difficulty the pilot had in deciphering the system signal in orienting himself/herself with the glide slope. Of significant importance is that none of the 48 responses for the PAPI or HAPI system rated higher than 6, and only three responses for the CHAPI system were above 6. These numbers show minimal confusion existed in the pilot's attempts to decipher the signal's meaning.
3. Ability to maintain desired glide path signal. The PAPI and CHAPI systems had a  $1^\circ$  on glide slope signal and the HAPI had a  $3/4^\circ$  on glide slope signal. This question was asked to determine if the on glide slope signals were too tight or too loose. The very high number of responses in the 1 to 3 range for the HAPI and PAPI systems indicated that the  $3/4^\circ$  to  $1^\circ$  on glide slope signal widths were ideal for helicopter operations.
4. Ability to determine deviation from glide path. This question was designed to determine the crispness of the signal transition to the pilot's eye. With all three systems ranging in the mid-thirties for responses from 1 to 3, it showed that each system displayed sharp, crisp signal changes.
5. How would you rate the workload needed to fly the approach using this glide slope indicator? Question 5 determined whether the pilot was forced to give extra time and attention to the approach path indicators to acquire or decipher the system signal. The higher ratings for the CHAPI system could be related to the fact that it has five different signal presentations using

three different colors, creating the most complex signal presentation. The simplest system, PAPI, rated the best with 42 of 48 responses in the 1 to 3 range. This system has only three different signal presentations using two colors.

6. Can this system be confused with any other lighting system in a heliport environment? Yes/No. This question was asked on the first and fourth runs of each system. This was done to find out two things: (1) When a pilot sees the light system for the first time, can it be interpreted as something else, and (2) After becoming familiar with the light system, is there less chance to confuse it as something else. This question was asked twenty-four times, twelve on run one and twelve on run four. The data show no significant change between the responses when the pilot was asked after run one than the data from the responses after run four. Pilot comments indicated that the flashing green sector of the HAPI system signal may be more prone to being confused with other types of airport/airplane lighting such as an aircraft wing tip light.

#### GROUND TRACKING RESULTS.

All approaches were tracked using either the GTE Sylvania Precision Automated Tracking System (PATS) or the Vitro RIR778 Tracking Radar system. Vertical deviations to the on glide slope decent angle were the only deviations tracked. None of the approach path indicators provided azimuth guidance. An example of a plot is presented in figure 1. This plot shows the vertical track of the aircraft compared to the 6-degree on glide slope descent angle. All individual and composite plots are located in appendix C. Figures 2 through 4 display the mean and the 3 sigma standard deviation lines against the 6-degree on glide slope line. The on glide slope signal width is also indicated on these plots.

Tabular data for the mean and standard deviations of each system are listed in tables 6 through 8. The on glide slope signal width was calculated for each 1000-ft slant range interval. It is important to note that the on glide slope signal is not a line in space but a corridor for the pilot to fly within. The on glide slope signal was either a 3/4- or 1-degree visual corridor and the further the helicopter was from the helipad the larger the on glide slope signal width. A pilot can fly anywhere within that corridor and receive an on course signal and feel confident with the approach. The only time a pilot would be concerned and require an immediate corrective response is when a too low signal was seen from any of the systems tested. An indication of being too high would not necessarily require immediate action by the pilot but simply indicate that he should begin to lose altitude to prevent overshooting the helipad. The larger statistical numbers would not indicate this situation and should be used as reference data only. They should not be used when determining acceptance of a particular system. The right side column illustrates the size of the on course corridor for each of the systems per 1000-foot slant range interval.

DATA PROCESSED BY THE FAA TECHNICAL CENTER  
ATLANTIC CITY AIRPORT, N J 08405  
6-SEP-1994 08:06

RUN #1  
3/02/93 CHAPI 6.0 DEG CENTERLINE APPROACH  
AZIMUTH : 0.00 ELEVATION : 6.00  
TRACKER DATA

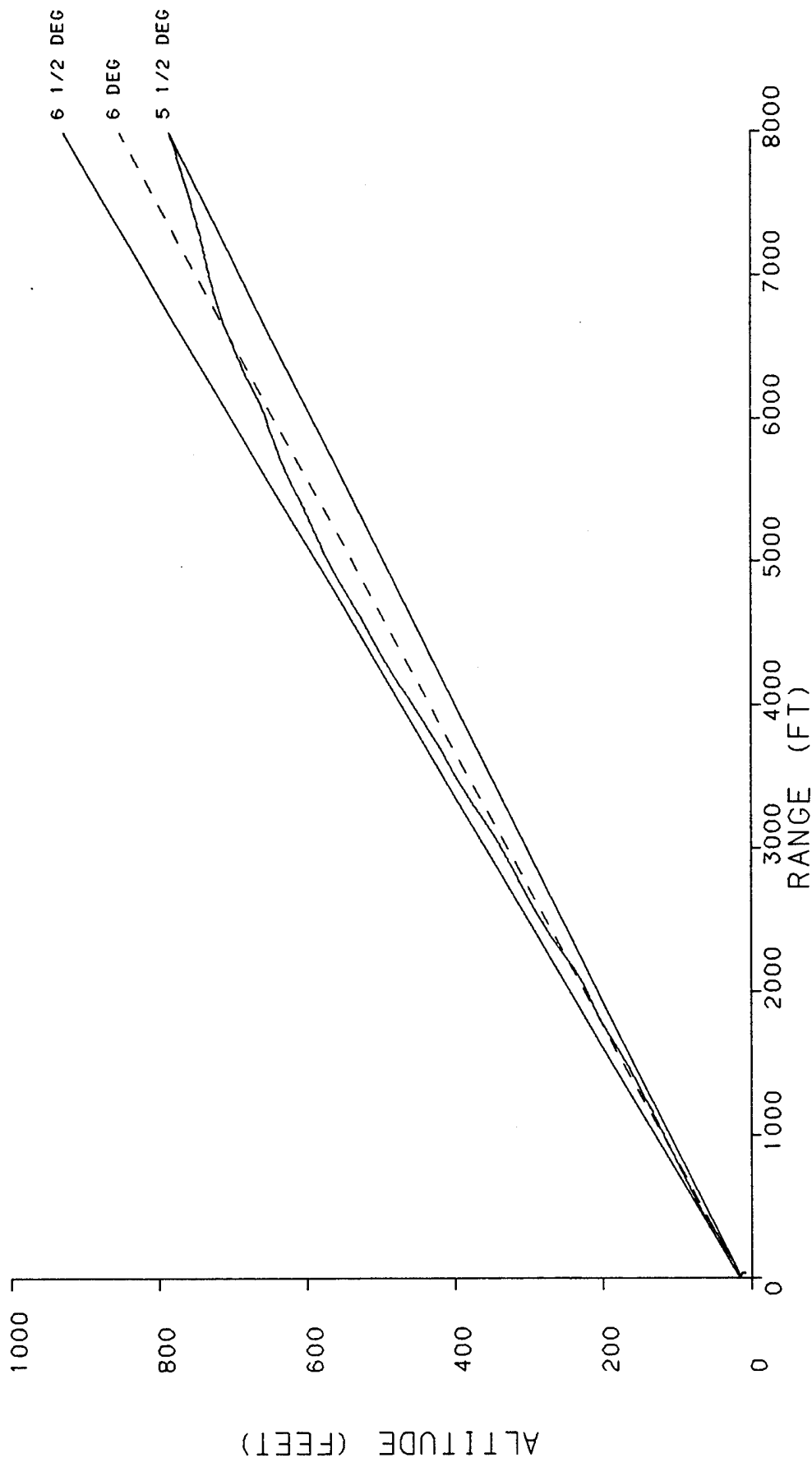


FIGURE 1. TRACKING PLOT OF SINGLE APPROACH

CHAPI LIGHTING TEST  
 6 DEG. CENTERLINE APPROACH  
 MEAN +/- 3 SIGMA

DATA PROCESSED BY THE FAA TECHNICAL CENTER  
 ATLANTIC CITY AIRPORT, N J 08405  
 6-SEP-1994 08:47

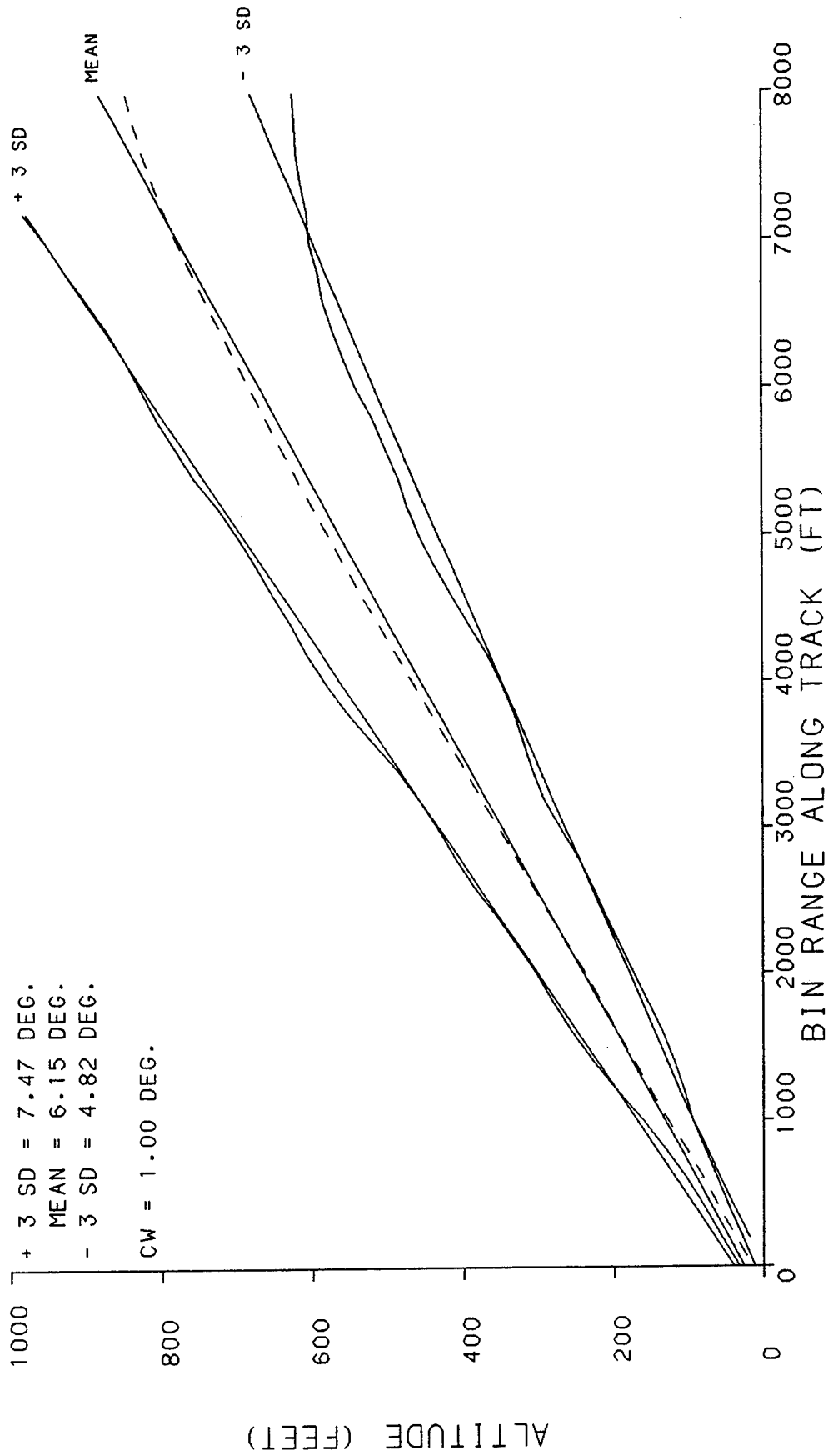


FIGURE 2. VERTICAL POSITION PLOT FOR CHAPI

HAPI LIGHTING TEST  
 6 DEG. CENTERLINE APPROACH  
 MEAN +/- 3 SIGMA

DATA PROCESSED BY THE FAA TECHNICAL CENTER  
 ATLANTIC CITY AIRPORT, N J 08405  
 6-SEP-1994 08:47

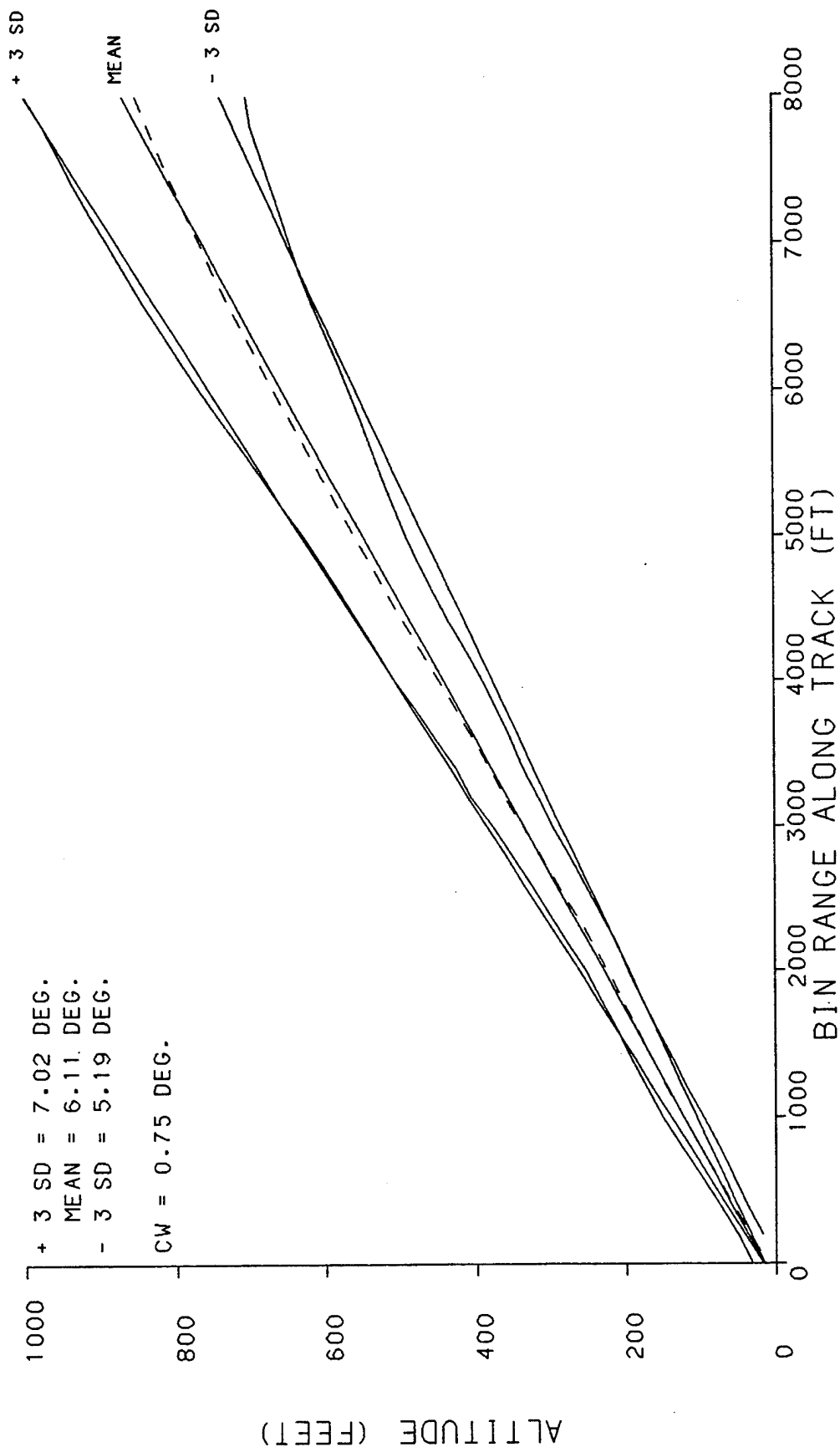


FIGURE 3. VERTICAL POSITION PLOT FOR HAPI

PAPI LIGHTING TEST  
 6 DEG. CENTERLINE APPROACH  
 MEAN +/- 3 SIGMA

DATA PROCESSED BY THE FAA TECHNICAL CENTER  
 ATLANTIC CITY AIRPORT, N J 08405  
 6-SEP-1994 08:50

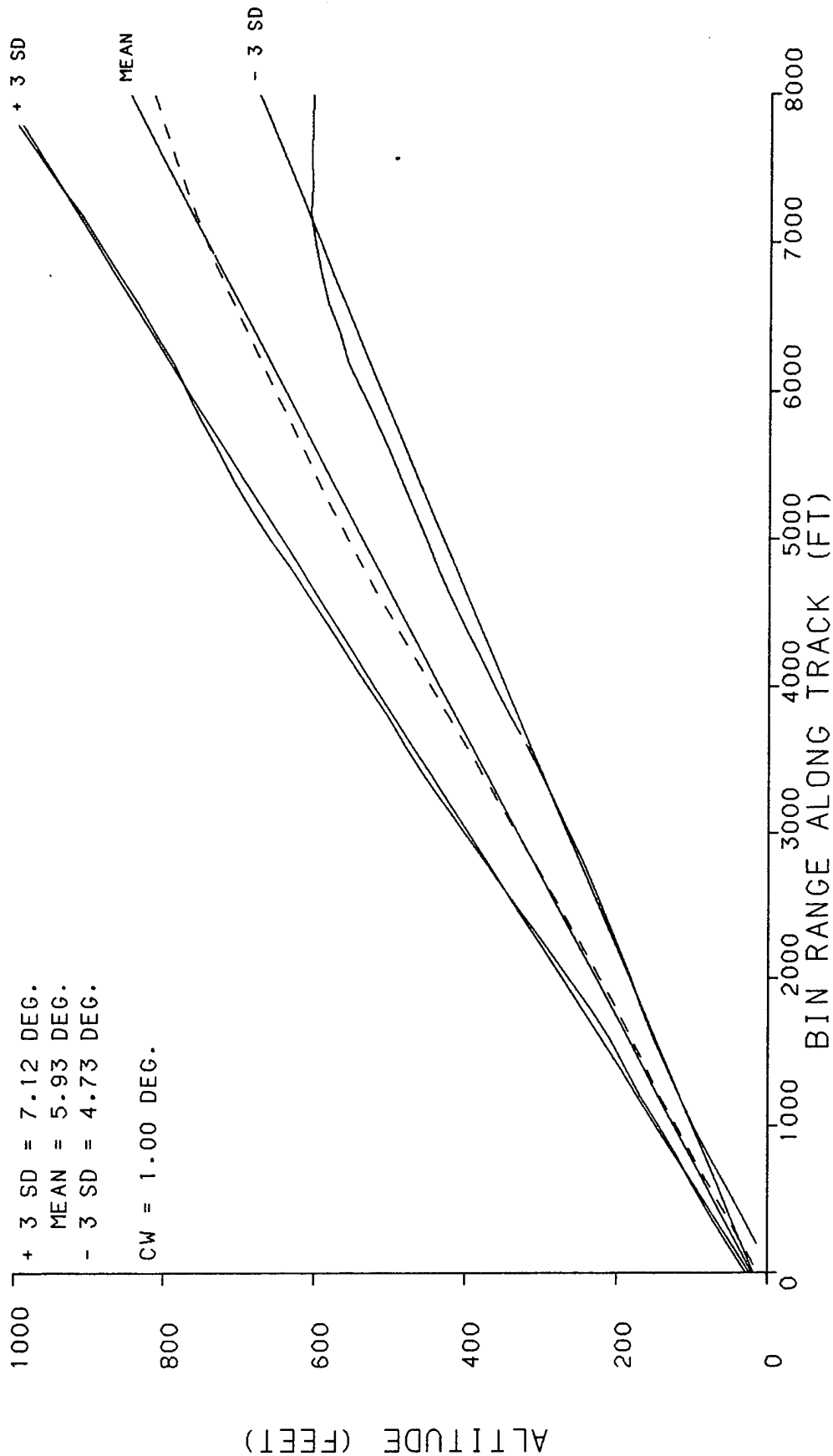


FIGURE 4. VERTICAL POSITION PLOT FOR PAPI

TABLE 6. CHAPI APPROACH ELEVATION ERRORS (FEET)

| DIST. | COUNT   | VERTICAL<br>MEAN | 3 SIGMA<br>STD. DEV. | ON GLIDE SLOPE<br>SIGNAL WIDTH ( $\pm$ ) |
|-------|---------|------------------|----------------------|------------------------------------------|
| 8000  | 7222.0  | -35.125          | 81.561               | 69.820                                   |
| 7000  | 7562.0  | 15.810           | 65.662               | 61.093                                   |
| 6000  | 7916.0  | 33.407           | 50.924               | 52.365                                   |
| 5000  | 8214.0  | 36.357           | 44.518               | 43.638                                   |
| 4000  | 8640.0  | 32.483           | 39.563               | 34.910                                   |
| 3000  | 9348.0  | 23.946           | 31.133               | 26.183                                   |
| 2000  | 10098.0 | 15.189           | 24.361               | 17.455                                   |
| 1000  | 11900.0 | 10.188           | 17.191               | 8.728                                    |
| 0     | 23566.0 | 0.581            | 7.048                | 0.000                                    |

TABLE 7. HAPI APPROACH ELEVATION ERRORS (FEET)

| DIST. | COUNT   | VERTICAL<br>MEAN | 3 SIGMA<br>STD. DEV. | ON GLIDE SLOPE<br>SIGNAL WIDTH ( $\pm$ ) |
|-------|---------|------------------|----------------------|------------------------------------------|
| 8000  | 7158.0  | -23.990          | 58.316               | 52.362                                   |
| 7000  | 7424.0  | 7.182            | 43.843               | 45.818                                   |
| 6000  | 7776.0  | 18.656           | 35.988               | 39.272                                   |
| 5000  | 8138.0  | 18.737           | 26.803               | 32.727                                   |
| 4000  | 8490.0  | 15.271           | 20.427               | 26.181                                   |
| 3000  | 9266.0  | 8.285            | 15.807               | 19.636                                   |
| 2000  | 9890.0  | 0.365            | 11.384               | 13.090                                   |
| 1000  | 11992.0 | 2.244            | 9.169                | 6.545                                    |
| 0     | 21902.0 | -1.657           | 6.762                | 0.000                                    |

TABLE 8. PAPI APPROACH ELEVATION ERRORS (FEET)

| DIST. | COUNT   | VERTICAL<br>MEAN | 3 SIGMA<br>STD. DEV. | ON GLIDE SLOPE<br>SIGNAL WIDTH ( $\pm$ ) |
|-------|---------|------------------|----------------------|------------------------------------------|
| 8000  | 7462.0  | -60.602          | 78.964               | 69.820                                   |
| 7000  | 7808.0  | -18.270          | 57.190               | 61.093                                   |
| 6000  | 8368.0  | 4.110            | 41.120               | 52.365                                   |
| 5000  | 8518.0  | 13.856           | 36.998               | 43.638                                   |
| 4000  | 889460  | 12.731           | 30.325               | 34.910                                   |
| 3000  | 9224.0  | 4.751            | 25.865               | 26.183                                   |
| 2000  | 9598.0  | -1.873           | 17.707               | 17.455                                   |
| 1000  | 11778.0 | -0.722           | 9.416                | 8.728                                    |
| 0     | 21466.0 | -1.811           | 6.749                | 0.000                                    |

The pattern altitude was 1000-ft mean sea level (msl) and the final approach was to be a distance of three miles. On several approaches the subject pilots were just below 1000-ft msl and/or within three miles of the heliport upon turning onto final approach, and they received below glide slope indications from the approach path indicators. Due to the fact that these are visual systems flown under VFR conditions, in most of these cases the pilots would confirm they were free of obstacles and not climb but maintain their present altitude to intercept the on glide slope presentation. This is the reason for the high vertical mean and standard deviation numbers at the 7000- to 8000-foot slant range. All three systems had good, sharp signal presentations from a distance of three miles.

#### PHOTOMETRIC RESULTS.

The luminous intensity measurements were taken in both horizontal and vertical directions. The horizontal coverage was taken from +15 to -15 degrees and the vertical coverage was taken from +10 to -10 degrees. The output measurements are in units of candelas.

ICAO's Annex 14, Volume II, lists requirements for approach path indicators under Section 5.3.4 Visual Approach Slope Indicators. Any references to photometric compliances with ICAO standards are listed as paragraph numbers within that section. Appendix D of ICAO, Annex 14 includes all photometric plots and compliances to paragraph 12's color transmission factors.

PAPI SYSTEM LUMINOUS INTENSITY MEASUREMENTS. The first photometric testing conducted was to determine the projected beam spread of the units. Horizontal beam spreads of  $\pm 10$  degrees are required by the FAA advisory circulars. The total horizontal coverage for the PAPI system was  $\pm 10$  degrees for the white light and  $\pm 9$  degrees for the red corridor. The total vertical coverage was 11 degrees for the white sector and 8 degrees for the red sector. The Y-coordinate of the red light was measured to be 0.3092 and falls within the specified boundary of 0.320 (see figure 5).

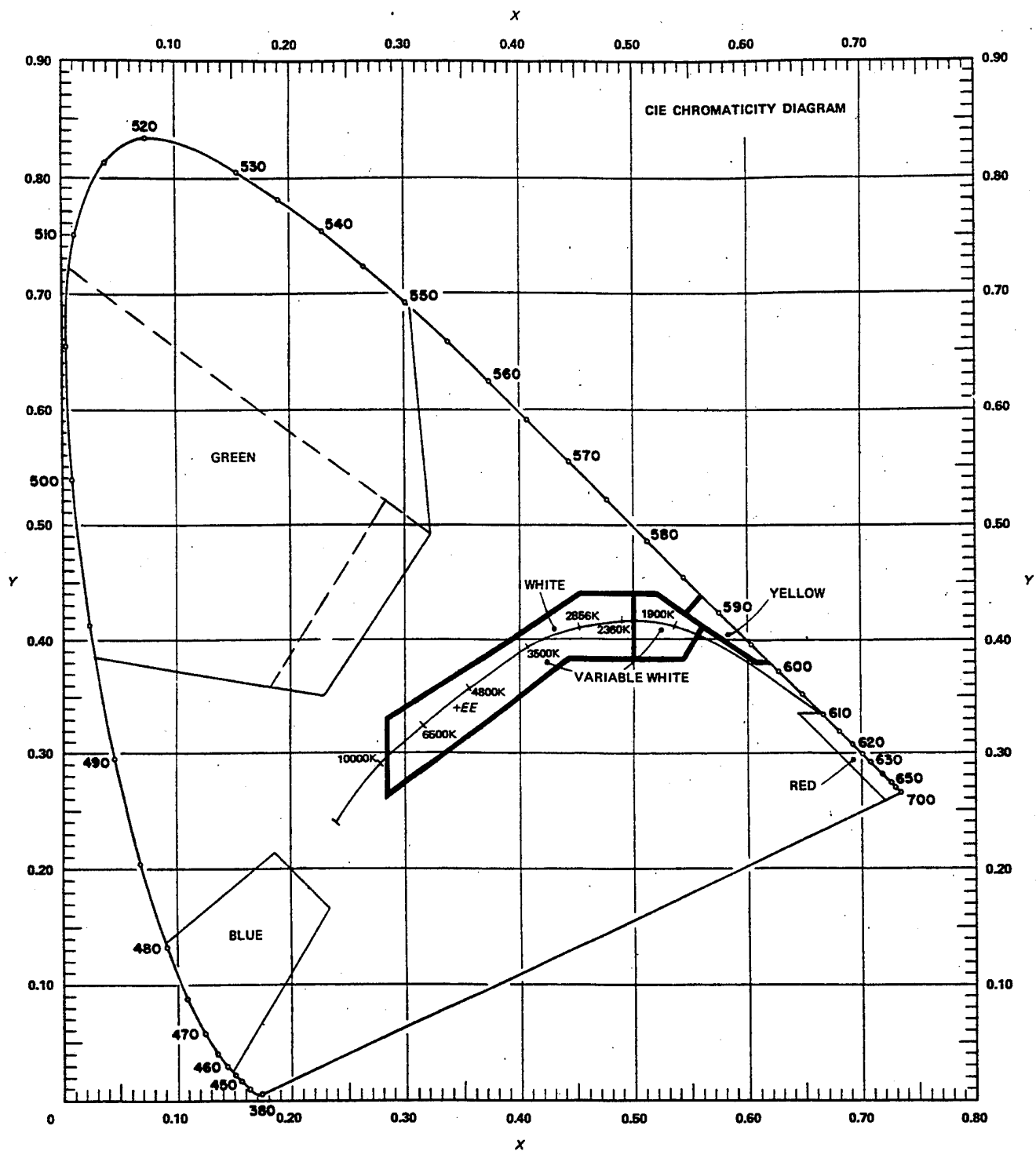


FIGURE 5. CIE CHROMATICITY DIAGRAM (ICAO ANNEX 14, VOL. I)

Paragraph 12 of ICAO's Annex 14, Volume II, states that the transmission factor of a red or green filter shall not be less than 15 percent at the maximum intensity setting. The transmission factor of the red filter of the PAPI system was between 18 and 22 percent. The filter used in this particular PAPI system was an absorption filter.

CHAPI SYSTEM LUMINOUS INTENSITY MEASUREMENTS. Photometric testing for the beam spread coverage indicated the total horizontal coverage for the CHAPI system was  $\pm 10$  degrees for the white light and  $\pm 9$  degrees for the red corridor. The total vertical coverage was 11 degrees for the white sector and 8 degrees for the red sector.

The Y-coordinate of the red light of the CHAPI system was measured to be 0.3266 and falls barely outside the specified boundary of 0.320 (see figure 5). The transmission factor of the red filter was 30 percent and green filter was 50 percent. The filters used in this system were dichroic filters.

HAPI SYSTEM LUMINOUS INTENSITY MEASUREMENTS. The total horizontal coverage was  $\pm 25$  degrees and the total vertical coverage was 10 degrees. The Y-coordinate was measured to be 0.3160 and falls within the boundary of 0.320 (see figure 5).

The HAPI system has a switch allowing operation of the system at either 114 or 108 volts, and the 108 volt selection supposedly greatly extends the lamp life without noticeable loss of intensity. After running the system for a few minutes, voltage readings were measured at 112 volts at the 114 volt setting and 109 volts at the 108 volt setting. It was confirmed by the manufacturer that the unit would be positively stabilized after four hours of system warm-up. However, the system is designed to be operated by remote control at some heliports. Once a pilot activates the system the unit will remain on for only fifteen minutes and therefore never warming up the system to the full 114 volt output. The sweeps were started with the 112 volt output reading.

Intensity readings with the system voltage set at 114 volts are as follows:

- from -4 to 0 degrees, maximum reading = 11884 candelas
- from 0 to 4 degrees, maximum reading = 12792 candelas
- from 4 to 8 degrees, maximum reading = 14482 candelas

Intensity readings with the system voltage set at 108 volts are as follows:

- from -4 to 0 degrees, maximum reading = 10957 candelas
- from 0 to 4 degrees, maximum reading = 12177 candelas
- from 4 to 8 degrees, maximum reading = 13662 candelas

The signal repetition rate was 2.382 Hz for the red sector and 2.326 Hz for the green sector. Paragraph 8 of the ICAO standards states that the repetition rate should be at least 2 Hz. Both color sectors fell within that limitation. The HAPI system also meets the requirement for a one-

to-one, on-to-off ratio as specified in paragraph 9. Compliance to the angular coverage of the HAPI system as stated in paragraphs 10 and 11 are listed in the table 9.

TABLE 9. ANGULAR COVERAGE OF HAPI

| SECTOR         | FORMAT         | ANGULAR COVERAGE* |
|----------------|----------------|-------------------|
| Above          | Flashing Green | 2.56°             |
| On Glide Slope | Green          | 0.71°             |
| Slightly Below | Red            | 0.24°             |
| Below          | Flashing Red   | 5.48°             |

\*Note: The HAPI system provided for the testing was improperly focused. The angular measurements were taken at a distance of 20 meters after the system was refocused.

### PHOTOMETRIC SUMMARY.

All three systems met the ICAO standards specified for photometric testing except for the CHAPI system red sector chromaticity coordinate which was slightly above the maximum Y-coordinate of 0.3200. Table 10 summarizes the results for all three systems.

TABLE 10. PHOTOMETRIC SUMMARY

|                          | HAPI           | PAPI           | CHAPI          |
|--------------------------|----------------|----------------|----------------|
| Max. Luminous Intensity  |                |                |                |
| red (candelas)           | 8056           | 18060          | 29785          |
| green (candelas)         | 14482          | N/A            | 48920          |
| white (candelas)         | N/A            | 100000         | 98240          |
| Horizontal Coverage      | ±25 degrees    | ±10 degrees    | ±10 degrees    |
| Vertical Coverage        | 10 degrees     | ±10 degrees    | ±10 degrees    |
| Chromaticity Coordinates |                |                |                |
| red (x, y)               | 0.6731, 0.3160 | 0.6761, 0.3092 | 0.671, 0.3266  |
| green (x, y)             | 0.1983, 0.3900 | N/A            | 0.1995, 0.4364 |
| white (x, y)             | N/A            | 0.4375, 0.4032 | 0.438, 0.4038  |

### CONCLUSIONS

Results of the evaluation show that all three existing approach path indicator systems provided the necessary approach guidance to the pilot for a safe and successful VFR landing operation. The characteristics of each system were determined to be acceptable for use in developing the production and installation requirements for heliport approach path indicator systems.

There were many pilot comments referencing the visual presentation of the PAPI system due to its simplicity. The three-color display of the CHAPI system was sometimes seen as burdensome to

to the subject pilots due to the additional color combinations. However, once many of these pilots flew approaches using these systems it was indicated that there was an increase in pilot confidence with the systems.

Other comments that indicated pilot preference toward a simpler system were directed toward the more complex flashing component of the HAPI system. Here again, once the pilots were able to fly a few approaches to the HAPI system and the signal presentation became more familiar there was an increase in confidence.

There were two different sizes of the on course corridor tested. The HAPI system had a 0.75-degree on course signal and the PAPI and CHAPI systems had 1.0-degree on course signal. Both size corridors proved to be adequate for safe operations under VFR conditions. While the tighter 0.75-degree signal provided better statistical data for standard deviations, the larger 1.0-degree signal was preferred for a visual system. In using these systems as an approach aid for VFR operations, the pilots also had many other visual cues for referencing obstruction clearance. Data show that the tighter 0.75-degree signal increased their workload on the approach by adding more altitude corrections.

The photometric data for chromaticity, vertical and horizontal beam spreads, light intensities, and transition zones showed that all three systems met the criteria of existing ICAO and FAA standards. The photometric data for all three systems included in appendix D of this report should be used to develop an FAA standard for approach slope indicators for helicopters.

Each system proved to be a valuable heliport approach guidance aid as currently manufactured. The greatest variances in pilot opinion appeared to be as a result of the types of environments that the pilots were familiar with. For example, pilots that operated in metropolitan areas preferred the flashing, single-source characteristic of the HAPI system for acquisition purposes where pilots that operated in more rural areas preferred the steady-burning, dual-light source systems. Each system provides its own unique characteristics that make it better in certain operational environments than others. None of the three systems should be eliminated from consideration for use as an approach aid to heliports. Decisions should be made by the heliport owners/operators as to which of the unique characteristics best suit their operational environment.

APPENDIX A—SAMPLE QUESTIONNAIRES, MODIFIED COOPER-HARPER RATING  
SCALE, AND PILOT NUMERICAL QUESTIONNAIRE RESPONSES

EVALUATION OF APPROACH PATH INDICATORS FOR HELIPORTS

IN-FLIGHT QUESTIONNAIRE

Pilot's Name \_\_\_\_\_ Date \_\_\_\_\_

Organization \_\_\_\_\_ Weather \_\_\_\_\_

Type/Model Helicopter \_\_\_\_\_ Day/Dusk/Night \_\_\_\_\_

System (name): \_\_\_\_\_

NOTE: These questions will be asked after each run by the data technician. All responses will be given using the Cooper-Harper Rating Scale.

1. Acquisition and identification of system.

Run #1: \_\_\_\_\_ Run #2: \_\_\_\_\_ Run #3: \_\_\_\_\_ Run #4: \_\_\_\_\_

2. Ability to interpret the system signals.

Run #1: \_\_\_\_\_ Run #2: \_\_\_\_\_ Run #3: \_\_\_\_\_ Run #4: \_\_\_\_\_

3. Ability to maintain desired glide path signal.

Run #1: \_\_\_\_\_ Run #2: \_\_\_\_\_ Run #3: \_\_\_\_\_ Run #4: \_\_\_\_\_

4. Ability to determine deviations from glide path.

Run #1: \_\_\_\_\_ Run #2: \_\_\_\_\_ Run #3: \_\_\_\_\_ Run #4: \_\_\_\_\_

5. How would you rate the workload needed to fly the approach using this glide slope indicator?

Run #1: \_\_\_\_\_ Run #2: \_\_\_\_\_ Run #3: \_\_\_\_\_ Run #4: \_\_\_\_\_

6. Can this system be confused with any other lighting system in a heliport environment? Yes / No

Run #1: \_\_\_\_\_ Run #4: \_\_\_\_\_

# EVALUATION OF APPROACH PATH INDICATORS FOR HELIPORTS

## POSTFLIGHT QUESTIONNAIRE

Pilot's Name \_\_\_\_\_

Date \_\_\_\_\_

Organization \_\_\_\_\_

Weather \_\_\_\_\_

Type/Model Helicopter \_\_\_\_\_

Day/Dusk/Night \_\_\_\_\_

\*\*\* PLEASE SUPPLY COMMENTS ON THESE ASPECTS OF THE SYSTEMS \*\*\*

1. Acquisition and identification of system.

---

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---

---

2. Ability to interpret the system signals.

---

---

---

---

3. Ability to maintain desired glide path signal.

---

---

---

---

4. Ability to determine deviations from glide path.

---

---

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5. How would you rate the workload needed to fly the approach using this glide slope indicator?

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6. Can this system be confused with any other lighting system in a heliport environment?

---

---

---

---

ADDITIONAL COMMENTS:

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THANK YOU !

## PILOT BACKGROUND QUESTIONNAIRE

Aircraft Type: \_\_\_\_\_

### Pilot Qualifications

Name: \_\_\_\_\_

Affiliation: \_\_\_\_\_

Address: \_\_\_\_\_

City: \_\_\_\_\_ State: \_\_\_\_\_ Zip: \_\_\_\_\_

Phone (optional): \_\_\_\_\_

FAA Helicopter Ratings: \_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

Total Flight Hours: \_\_\_\_\_

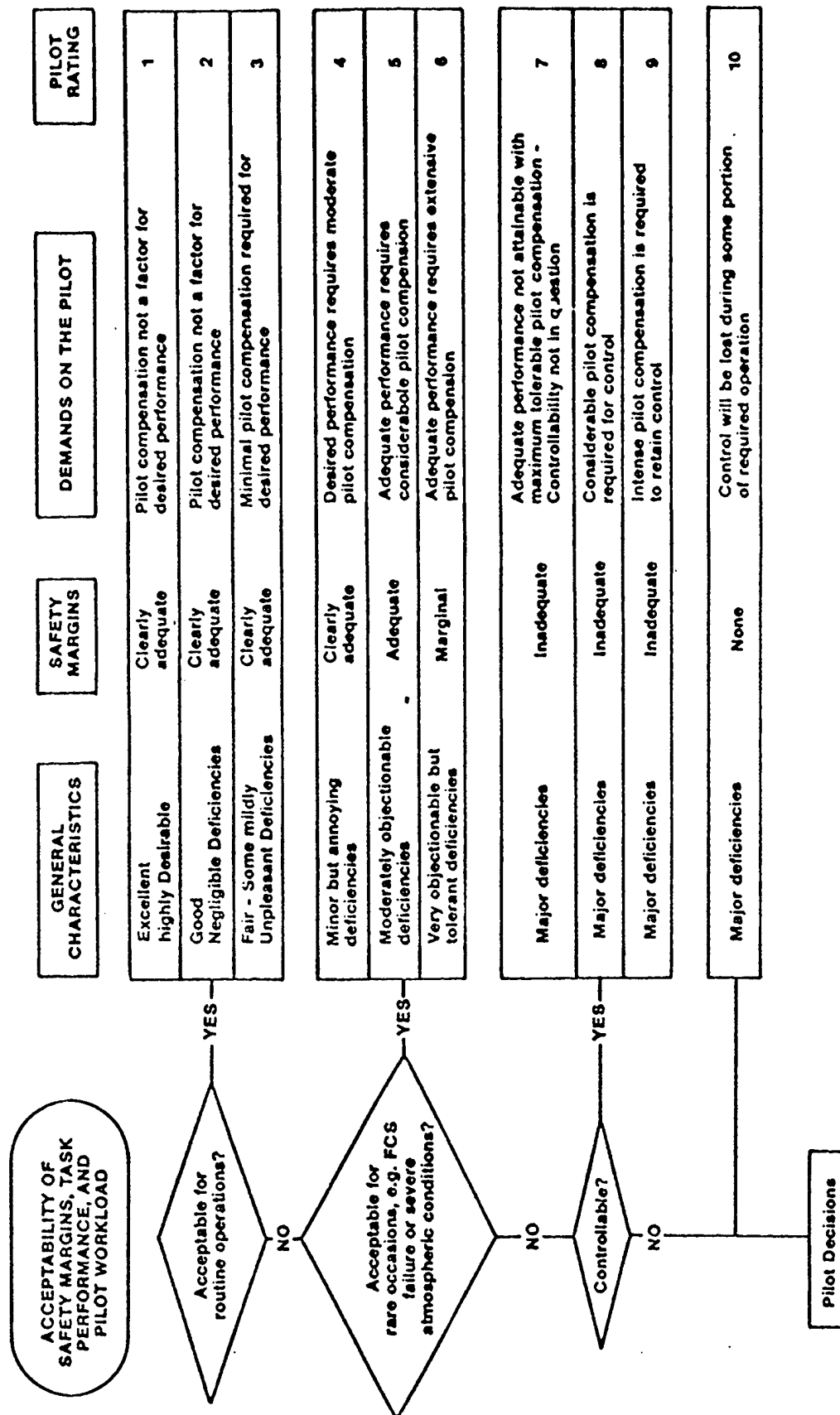
Total Helicopter Hours: \_\_\_\_\_

Total Time in Type: \_\_\_\_\_

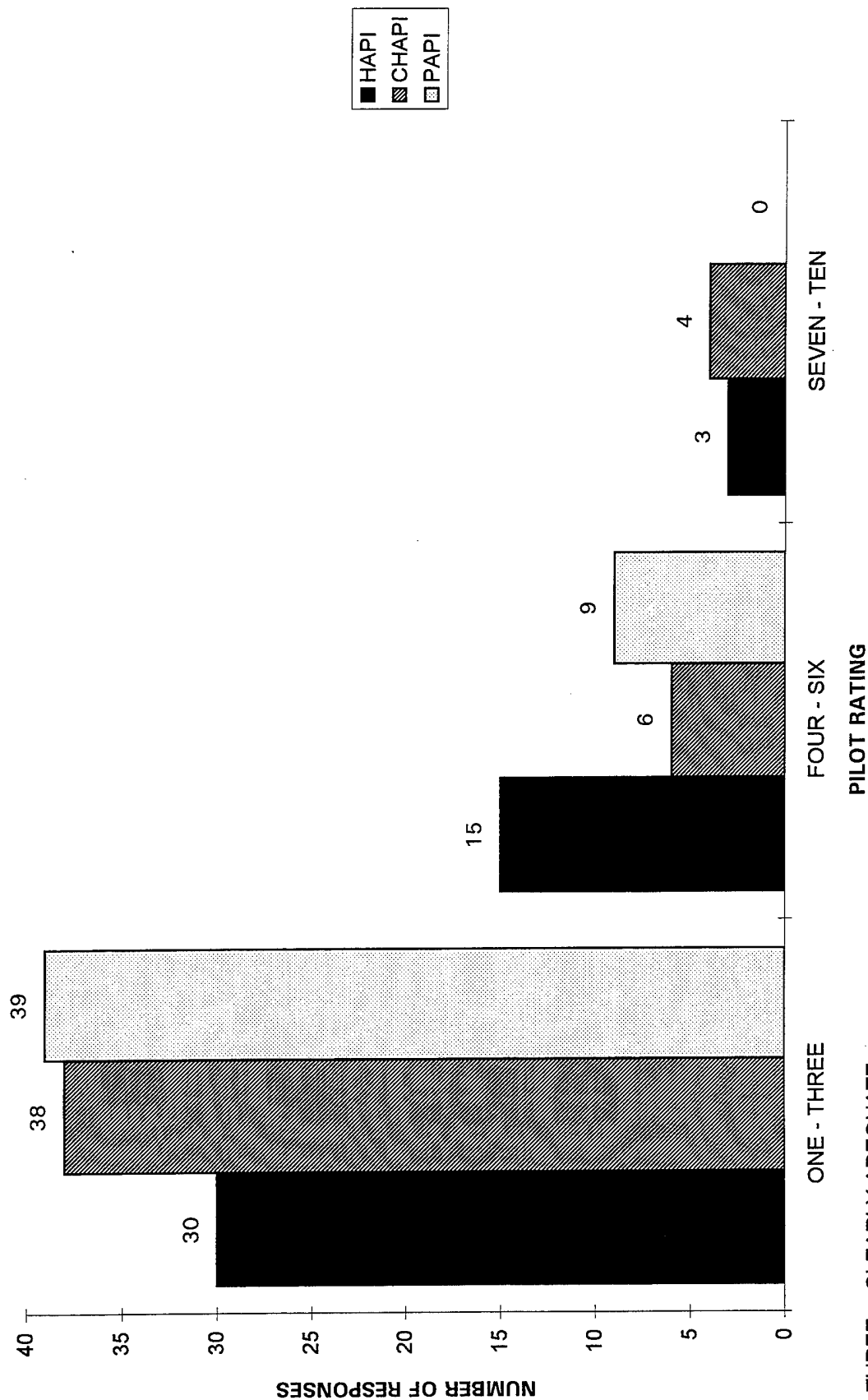
Total Helicopter Hours Last 6 Months: \_\_\_\_\_

Time in Type Last 6 Months: \_\_\_\_\_

# MODIFIED COOPER-HARPER RATING SCALE

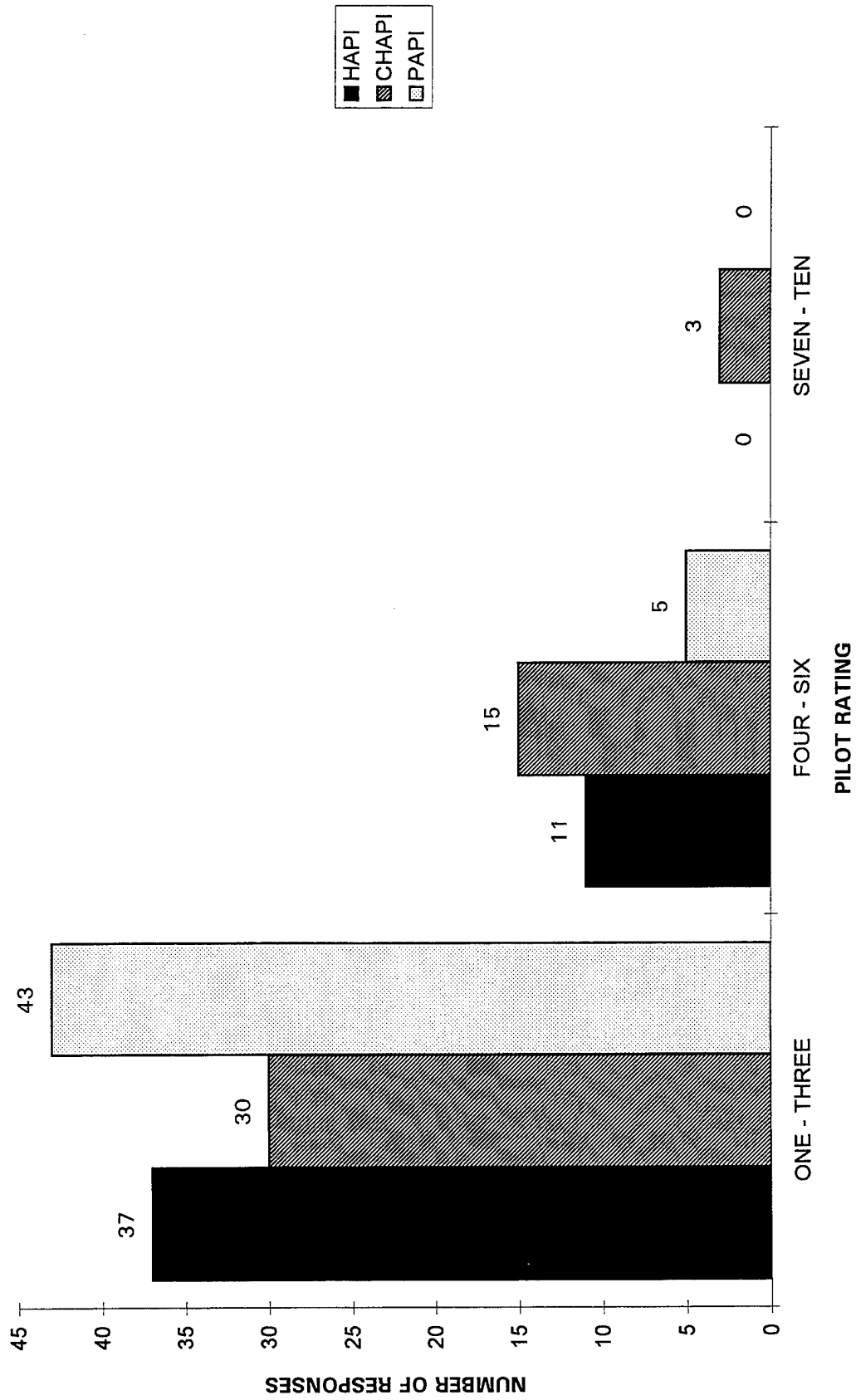


# Question 1: Acquisition and Identification of system



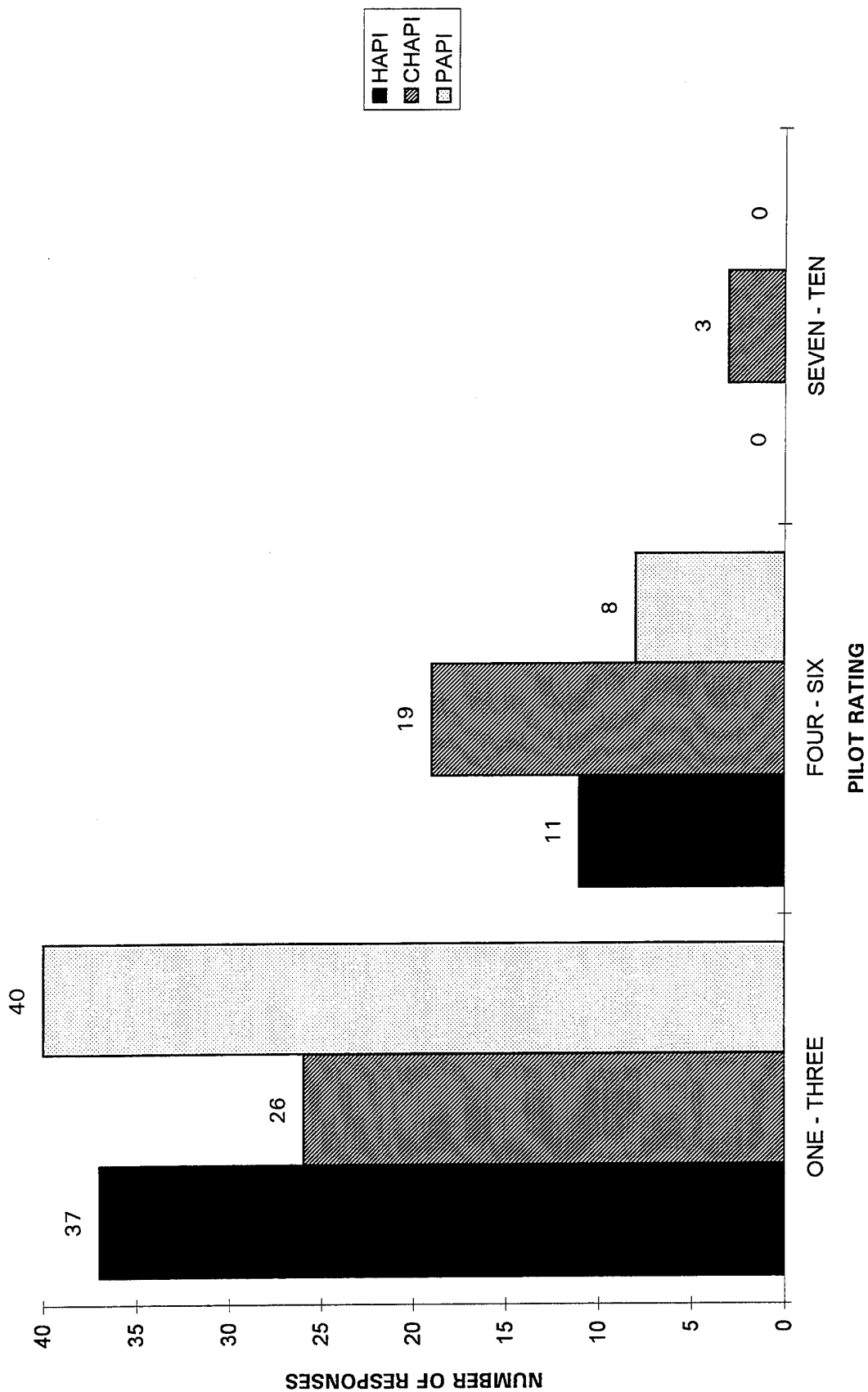
ONE - THREE -- CLEARLY ADEQUATE  
 FOUR - SIX -- ADEQUATE/MARGINAL  
 SEVEN - TEN -- INADEQUATE

## Question 2: Ability to interpret the system signals



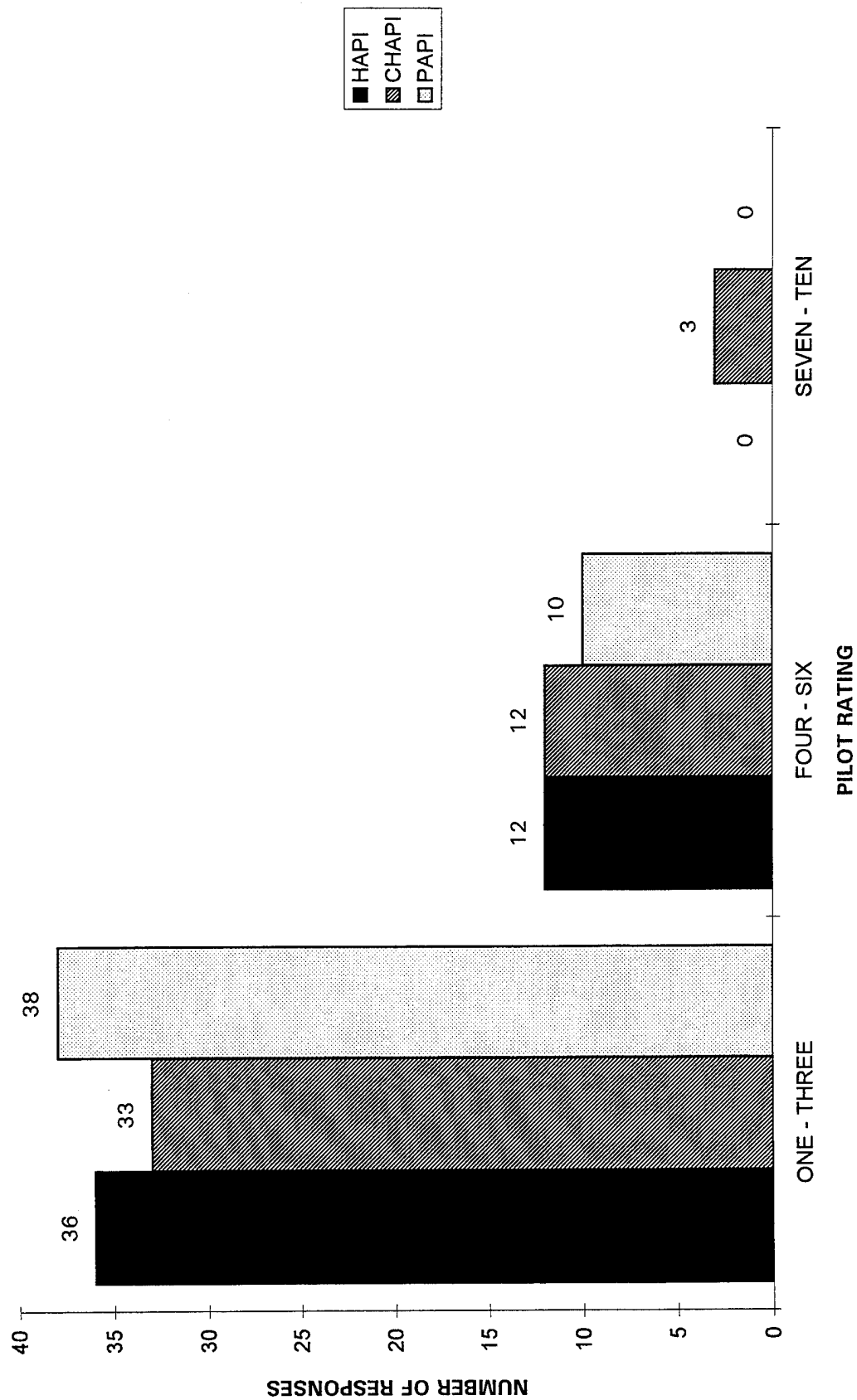
ONE - THREE -- CLEARLY ADEQUATE  
 FOUR - SIX -- ADEQUATE/MARGINAL  
 SEVEN - TEN -- INADEQUATE

### Question 3: Ability to maintain desired glide path signal



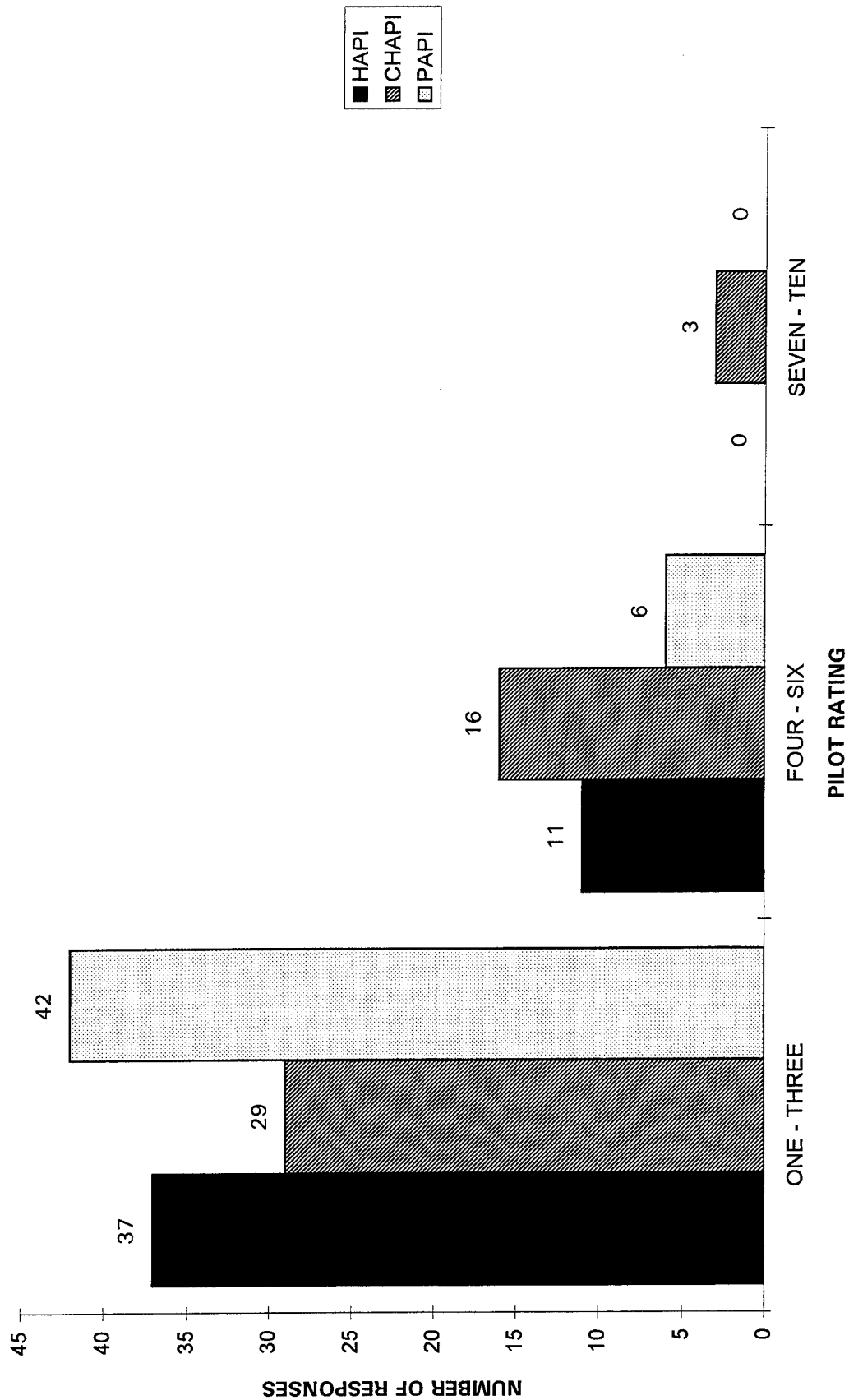
ONE - THREE -- CLEARLY ADEQUATE  
 FOUR - SIX -- ADEQUATE/MARGINAL  
 SEVEN - TEN -- INADEQUATE

# Question 4: Ability to determine deviations from glide path



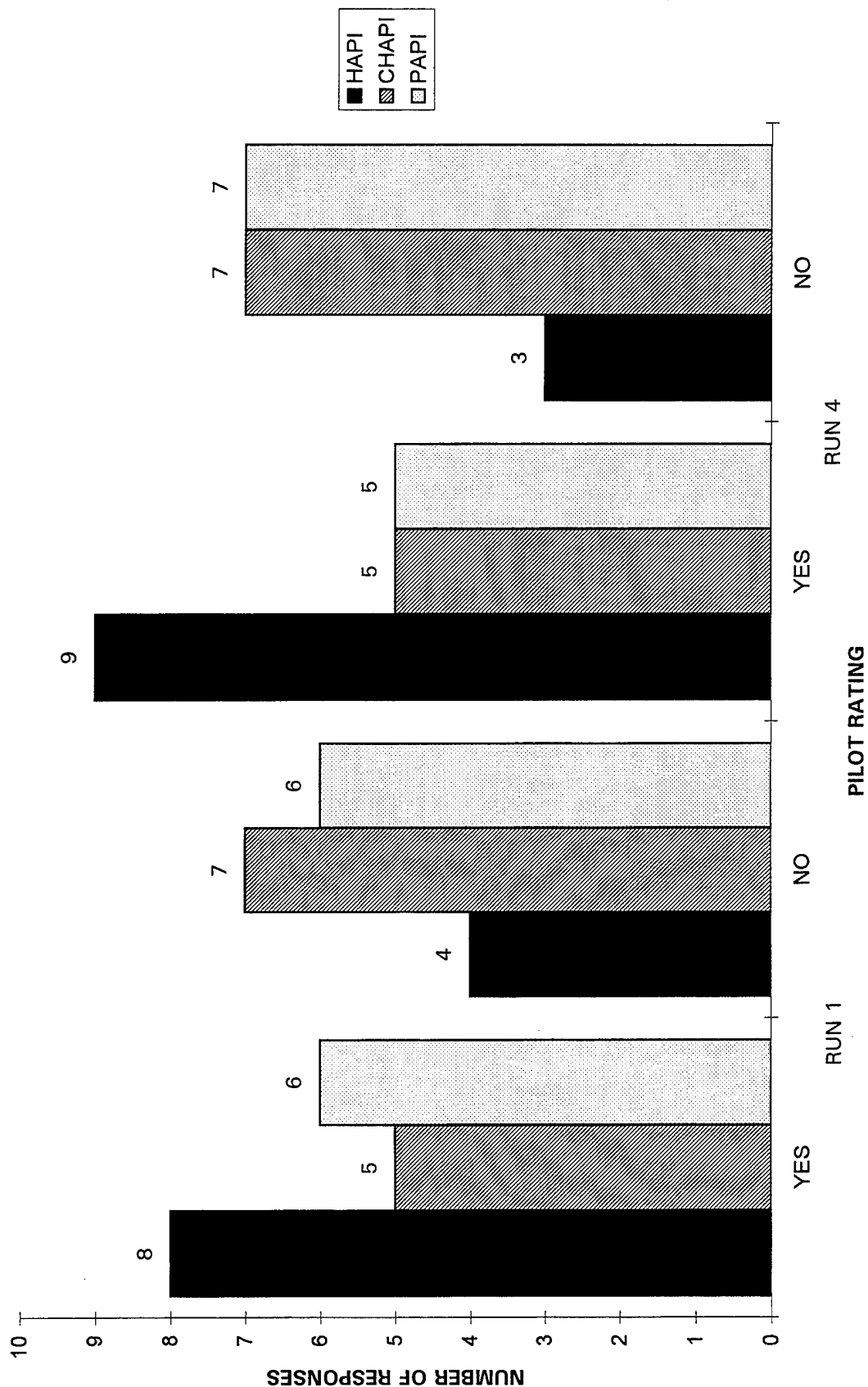
ONE - THREE -- CLEARLY ADEQUATE  
 FOUR - SIX -- ADEQUATE/MARGINAL  
 SEVEN - TEN -- INADEQUATE

**Question 5: How would you rate the workload needed to fly the approach using this glide slope indicator?**



ONE - THREE -- CLEARLY ADEQUATE  
 FOUR - SIX -- ADEQUATE/MARGINAL  
 SEVEN - TEN -- INADEQUATE

**Question 6: Can this system be confused with any other lighting system in a heliport environment? (yes/no)**



## APPENDIX B—PILOT COMMENTS FROM IN-FLIGHT AND POSTFLIGHT QUESTIONNAIRES

### CHAPI

- You have to deviate further out of the corridor to get a definite transition.
- Too many different light colors.
- You can't anticipate the transition as in a PAPI on an airport.
- Green is a little more obvious than just the red or white.
- Tough to keep it green/green.
- Easy to tell when you were off glide slope, but hard to stay on.
- You can see it as soon as you turn inbound.
- Felt more comfortable after flying it once.
- You have to work a little bit to keep that one on.
- Two green together were much easier to see than just one.
- Two red together were easier to see than one as well.
- Was not as sensitive to fly as HAPI.
- Color change is easier to interpret.
- Gives you real finite information.
- It will take experience to get used to but gives you the best information.
- Good clean green.
- No trouble depicting lights and determining what they meant.
- You can pick that up right away.
- No problem bringing aircraft back on to the on course signal.

- Could not be confused with any other lighting systems in a heliport environment.
- Standardization is what we need.
- At a distance the green looked a little white.
- Initial problems came from just flying the previous systems.
- This system required more thinking and remembering more color combinations.
- On glide slope signal for previous system was two different colors, this system has the same colors, this causes confusion when flying one than the other.
- I liked these transitions, they seem to be pretty smooth.
- The on course gets real narrow at the bottom.
- From a distance it may be confused with runway threshold lights.
- Acquisition and identification good.
- Workload was the easiest.
- Clear definition didn't occur until 800' and about 2 miles out.
- More difficult than the others but I believe it was due to the tailwind condition.
- Most difficult to maintain glide path.
- The white/green transition is difficult to determine.
- The addition of the green lenses add one more color to differentiate.
- Third color (green) requires more workload.
- The addition of the green light made it easier to determine when I was on the glide path.
- Workload was not too much of a problem.
- Very bright.
- Very easy to identify.

- Higher workload due to tight signals.
- Very good transition.
- CHAPI required slightly more work but was still safe.
- CHAPI was best as it allowed a trend without confusion with light.
- Double green source is a necessity for positive identification.
- Pairs of lights are more likely to be correctly interpreted.
- At 3 miles initial acquisition was difficult due to low intensity of light source and surrounding colors.
- Too many light combinations; very confusing at times.
- Requires excessive concentration.
- If all approach path indicators are approved and used at different heliports, confusion will exist due to the different "on glide slope" indications. Standardization is a must.
- Signals are confusing.
- Workload seems high because of different light combinations.
- Relatively easy to determine deviations from glide path do to the constant lights going from one color to another, becoming pink first then a complete change in color.

### **HAPI**

- I like the pulsating light, it is a lot easier to pick it up.
- It appears to be harder to see and adjust to.
- The other systems gave you subtle cues with what appears as shading that allows you to anticipate what is going to happen.
- The green appears to wash out in the sunlight when you go from the steady to the flashing green.
- From 3 miles out it is harder to acquire the system than the other two.

- If I didn't know where to look, I'd have a hard time finding this system, especially at an unfamiliar heliport.
- Could be some confusion if there were several red obstruction lights in the area.
- The green appears to wash out in the sunlight when you go from the steady to the flashing green.
- Harder to acquire.
- Doesn't seem to be as bright.
- Don't care for blinking lights around the heliport.
- Workload is not too bad.
- Flashing made it pretty easy to identify.
- Color change (transition) is easy enough.
- The steady green signal disappears in the haze.
- I assumed that if the light disappeared, it was steady green.
- I misinterpreted the signal when I first locked on, this was due to my unfamiliarity of the system.
- That is real sensitive.
- Gives you good information but it is very sensitive to fly.
- Seemed to get more sensitive closer in.
- Green blends in with the background and red may be mistaken for something else.
- Transition to green seems to appear more as a disappearance of red than a change to green.
- When it goes from red to green it is hard to pick up the green.
- Kind of hard to see at first.
- Might confuse it with other red lights (obstruction lights) until you see a color change (transition).

- It goes from flashing red, right through the steady red real quick and into the steady green.
- In daylight it is difficult to see the green, there is not much contrast between the single light source and the surroundings.
- Easy to make corrections from flashing green to steady green.
- Nice transition from different colors.
- Easier to see flashing red than green at a distance.
- Easy to anticipate transition and make necessary corrections.
- Because it is a single source light it may be confused with other heliport lighting.
- Easiest to identify and verify.
- In areas such as hospital heliports, there are often many fixed red, white , and green lights. The pulsing lights seemed less confusing.
- Clearly definite at 900' and 2 1/2 miles out due to the pulsing lights.
- The addition of the green lenses add one more color to differentiate.
- Green sector causes an additional thought process.
- Easiest to acquire provided it was pulsing.
- The addition of the green light made it easier to determine when I was on the glide path.
- Probably the easiest system to determine deviations from the glide path due to the flashing.
- Workload was not too much of a problem.
- Acquisition and identification fair
- It is possible that the HAPI might be confused with other lights at night if it were acquired when it was flashing.
- A bit more difficult to identify - not as bright.
- Transition not as crisp.

- Can be confused with a PLASI or police car.
- Light intensity of green was difficult to see.
- Flashing red very poor - confused with possible emergency equipment.
- Green blends into background.
- Might require some familiarity for perfection in use.
- Don't use flashing red.
- Don't use single green source.
- Single light could easily be confused with other lights at a heliport.
- At 3 miles initial acquisition was difficult because green was very pale and easily confused with surrounding area.
- Easy to follow.
- Seems easy to stay on at different airspeeds.
- System abruptly changes color making it more difficult to determine deviations.
- Background lighting could confuse the pilot as to where exactly the light may be.

### **PAPI**

- I found it a little difficult at first to maintain the proper glide path signal.
- This system is really quite good.
- It is easier to fly than I thought it would be.
- Within 2 miles it was easier to determine red from white through haze.
- Acquisition was difficult farther out on final.
- Pretty easy to maintain glide path.
- Workload is easy.

- The sun in my eyes made it harder to see the transitions.
- Prefer the color green for on glide slope signals.
- At one point in the approach it would always seem to get away from me, visually I thought I was on a good approach but the system said I was high.
- Going into Kennedy at night those two lights could look like an aircraft taxiing.
- For a pilot seated low in the aircraft, there is an angular cutoff at around 300 feet AGL.
- Easily recognizable.
- No confusion because there are two lights side by side instead of a single-point light source.
- Airspeed means a lot in how easy it is to fly the system.
- Could be confused with a car or a tug around the heliport.
- Easy to stay within on course signal.
- Smooth change in signals, easy to anticipate corrections.
- I like the blend (pink) of the white and red as you go through the transition.
- Acquisition and identification good.
- PAPI system was the best because the transitions were not as abrupt and were softer.
- Prefer a system with only white and red.
- Least amount of workload required.
- This is the standard in the airplane world.
- PAPI was difficult to determine if it was red or white when 3 miles out due to haze.
- Workload was not too much of a problem.
- Transition not as crisp as the CHAPI.
- Easier to maintain glide path signal, not as tight.

- Clear definition didn't occur until 800' and about 2 miles out.
- Good for VFR use.
- Easy to interpret.
- Does not give immediate glide slope information.
- Steady lights could be confused with airport/vertiport lighting or equipment.
- User friendly.
- Nothing distinctive about the system, just two lights in the distance, initially I had to concentrate to detect the system, after initial approach I had no problems.
- Simple presentation; not a great deal of thought required to fix position and interpret signals.
- I felt very at ease using this approach aid.
- Minimal workload required; was able to scan and easily regain my perspective of glide path.
- Easily picked out due to the spacing of the lights.
- Relatively easy to determine deviations from glide path do to the constant lights going from one color to another, becoming pink first then a complete change in color.
- Easy to find, difficult to maintain.

**GENERAL - (apply to all three systems)**

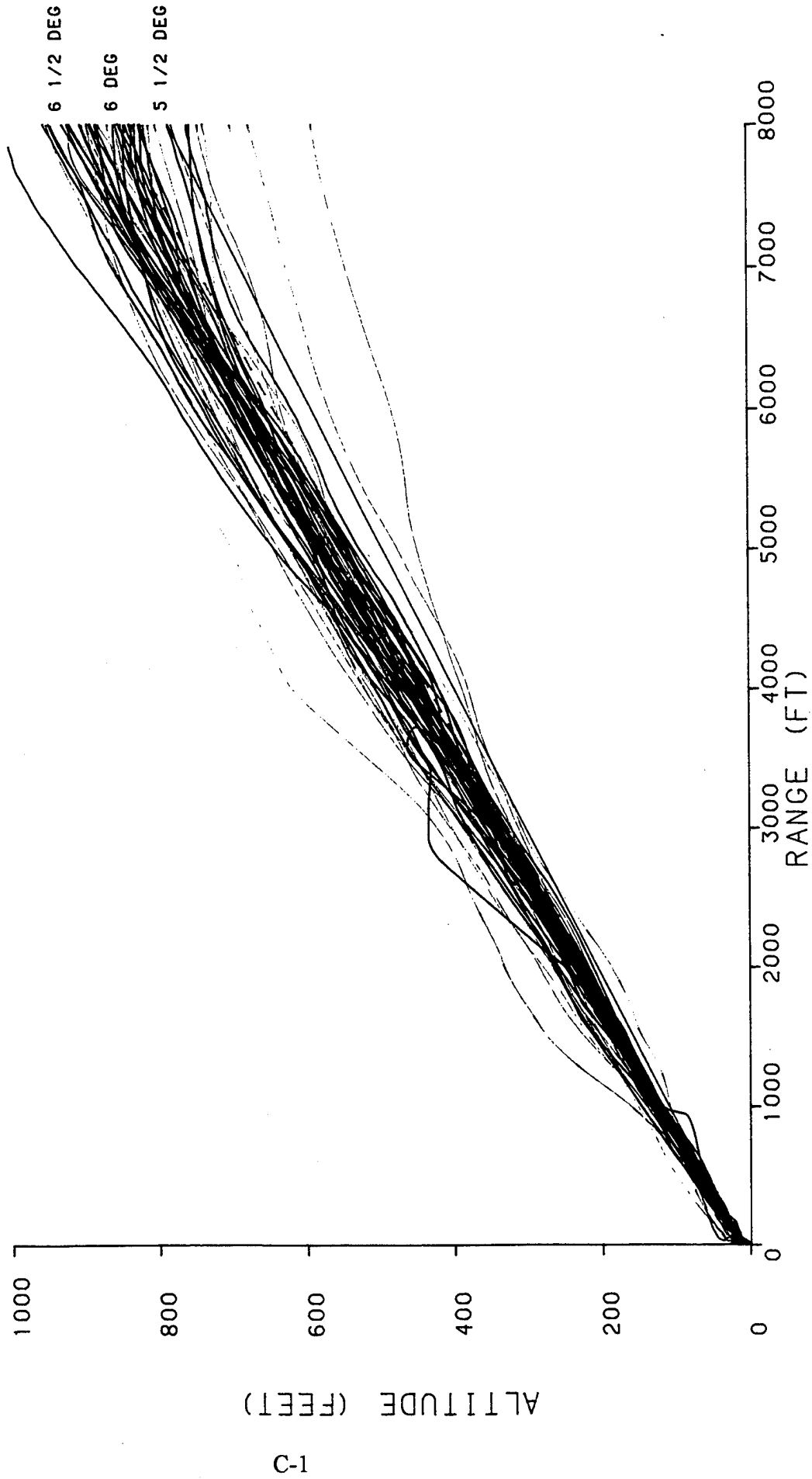
- Transitions are too fast from one color to another in close.
- A contrasting background around the light would aid acquisition.
- Workload would diminish to a minimum with practice.
- Congested visual environments could be confusing.
- Easier to determine deviations as range decreases.
- Approach path indicators (of any type) would be a big safety improvement in most of the heliport environments.

- I frequently fly into congested areas where there are many different lights (cars, trucks, airplanes, obstructions, etc.). All systems could be confused with other grounds lights.
- Workload seemed fairly equal for all systems.
- Due to poor forward visibility in S-76, I would like to see systems located beside the helipad not directly in front.
- Suggestion: Flush mount for tail rotor clearance and takeoff clearance.

## APPENDIX C—VERTICAL POSITION PLOTS

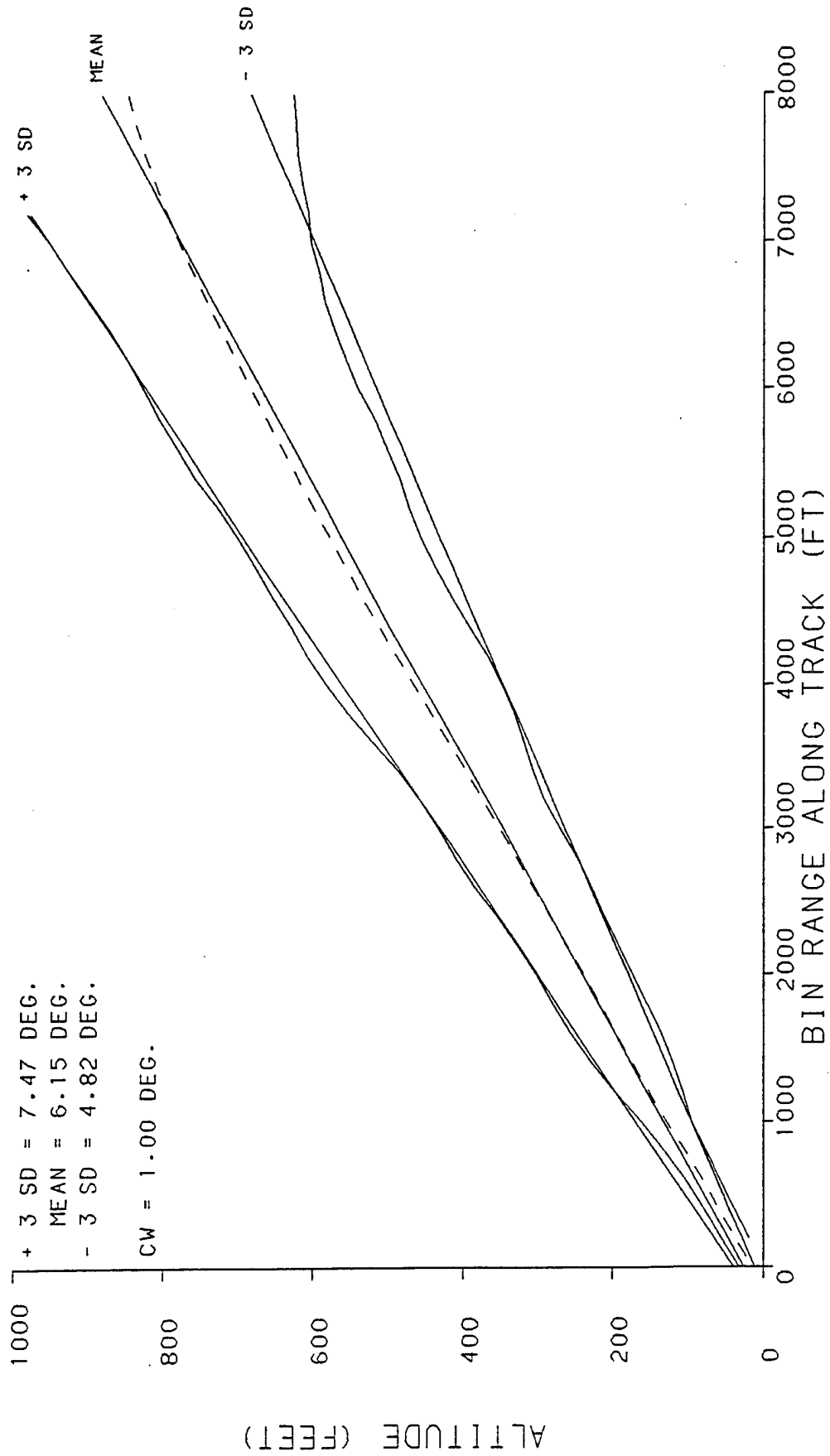
CHAPI LIGHTING TEST  
6 DEG. CENTERLINE APPROACH

DATA PROCESSED BY THE FAA TECHNICAL CENTER  
ATLANTIC CITY AIRPORT, N J 08405  
6-SEP-1994 08:44



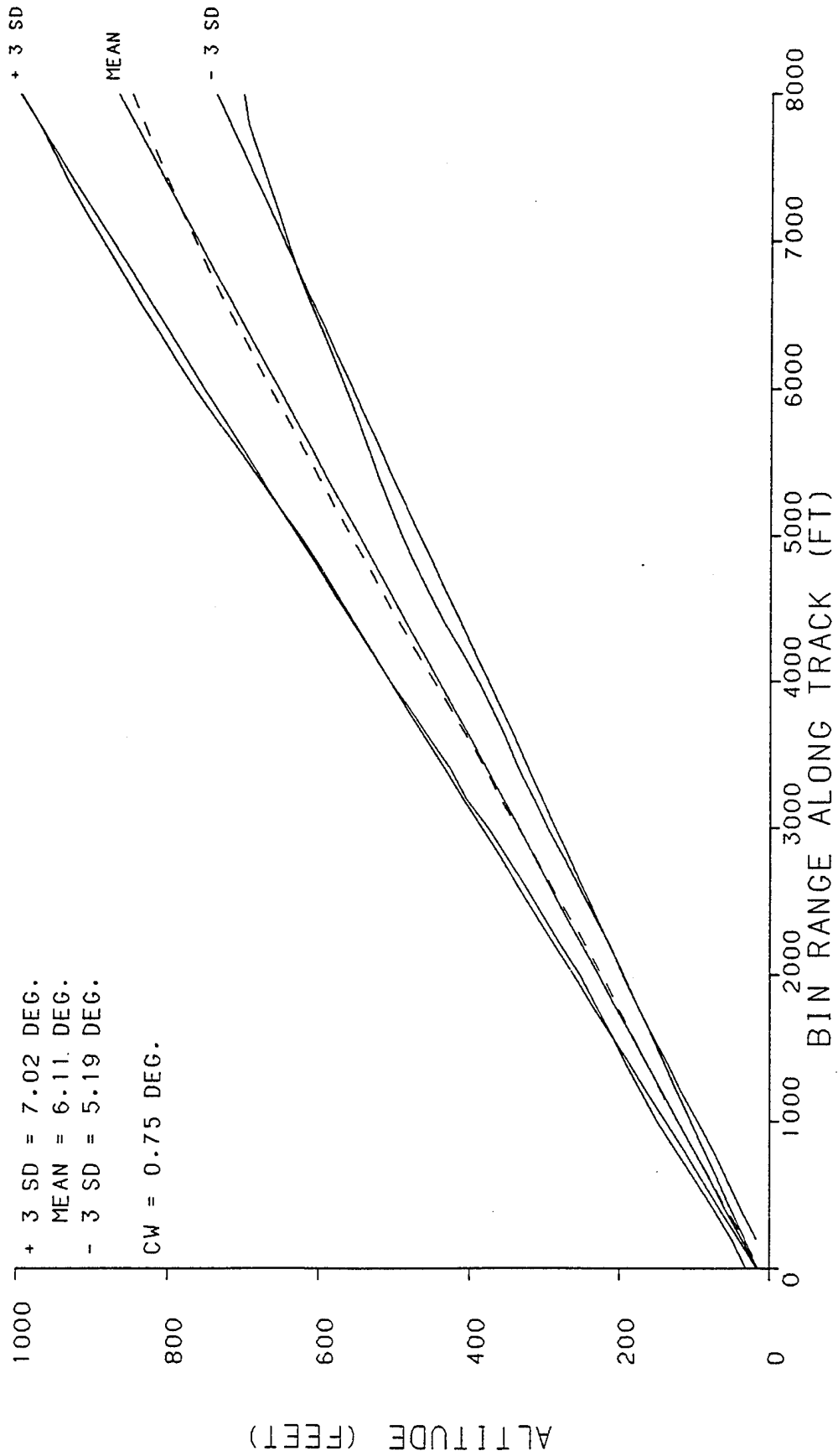
CHAP1 LIGHTING TEST  
 6 DEG. CENTERLINE APPROACH  
 MEAN +/- 3 SIGMA

DATA PROCESSED BY THE FAA TECHNICAL CENTER  
 ATLANTIC CITY AIRPORT, N J 08405  
 6-SEP-1994 08:147



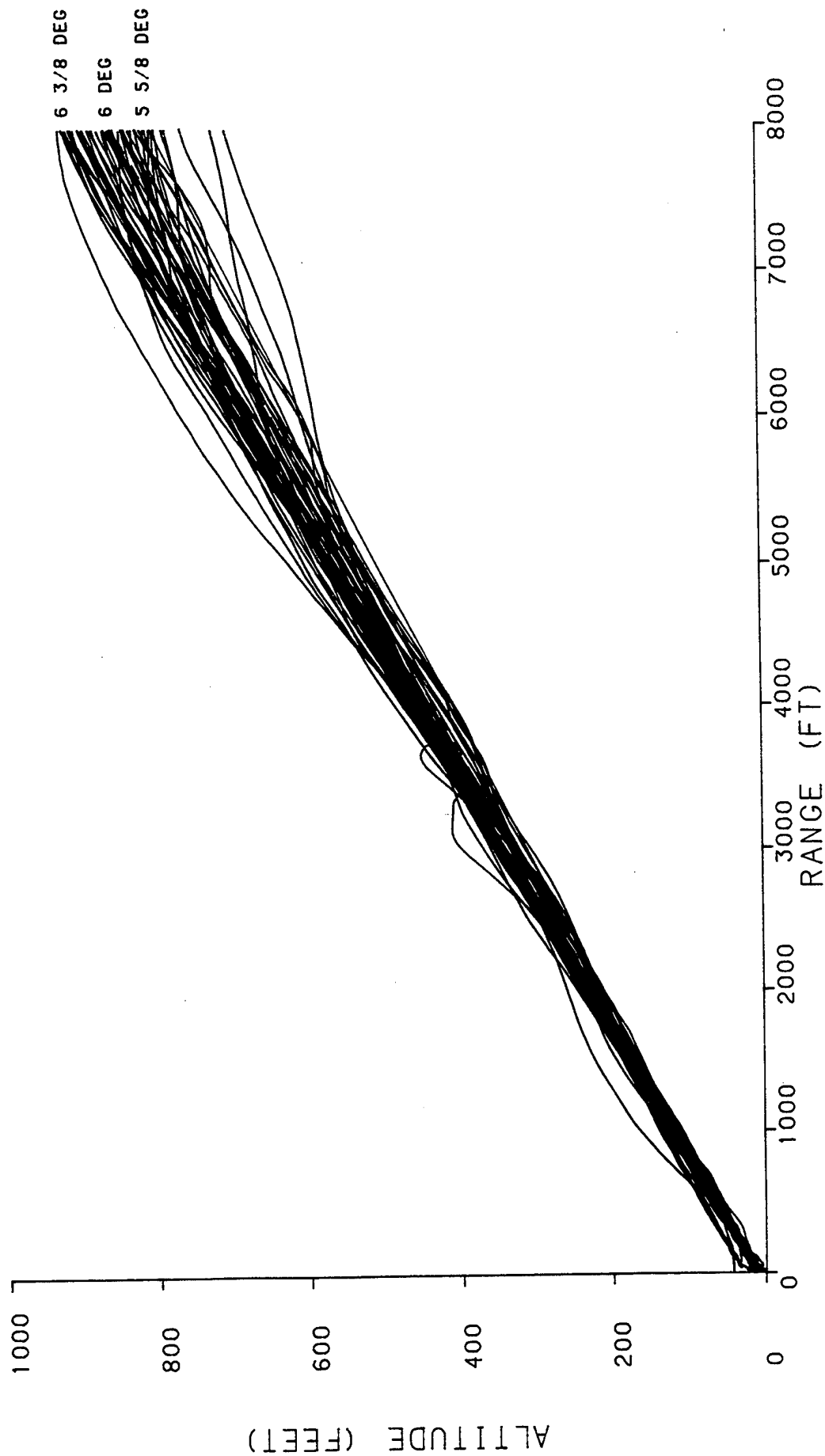
HAPI LIGHTING TEST  
 6 DEG. CENTERLINE APPROACH  
 MEAN +/- 3 SIGMA

DATA PROCESSED BY THE FAA TECHNICAL CENTER  
 ATLANTIC CITY AIRPORT, N J 08405  
 6-SEP-1994 08:47



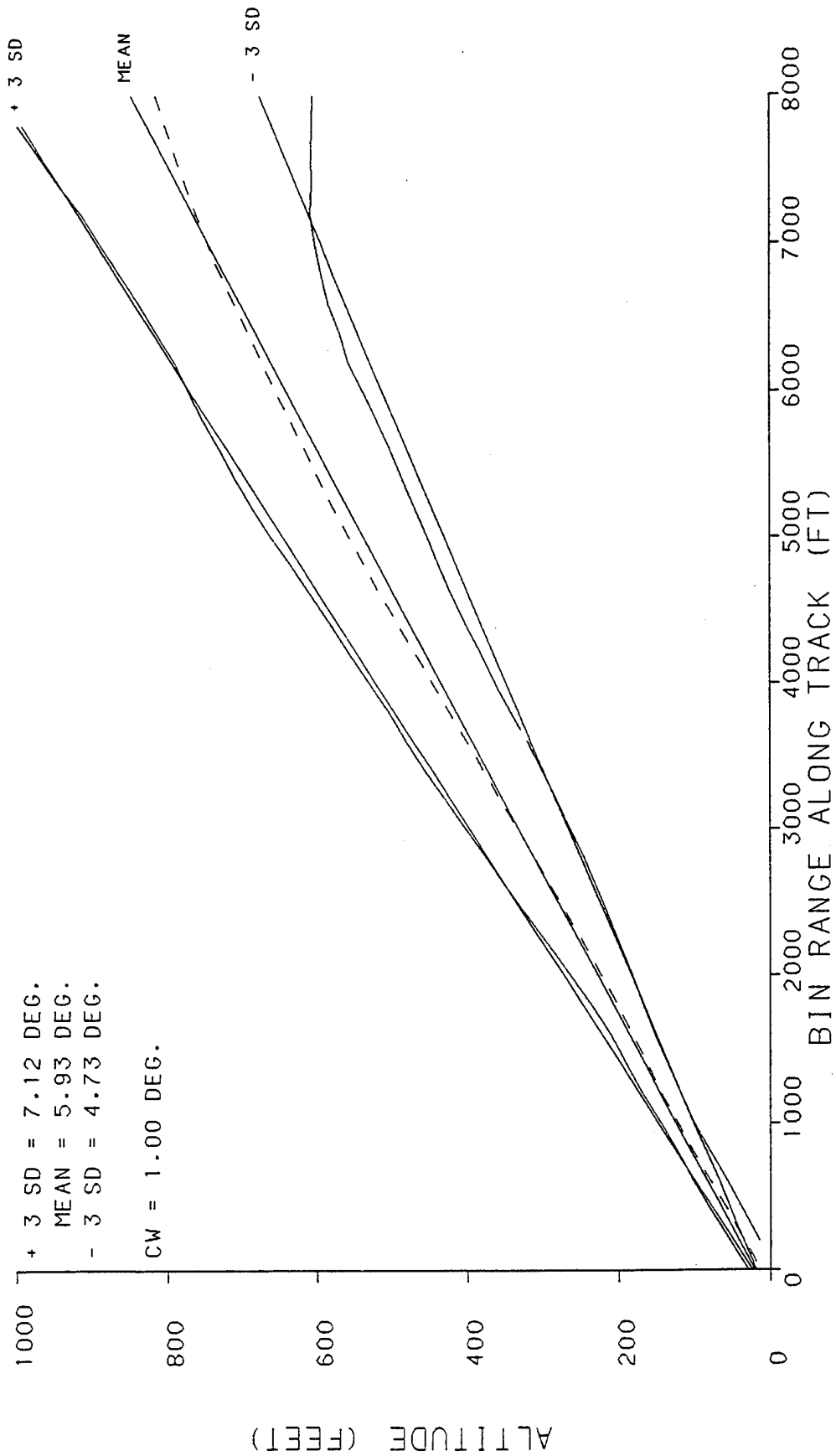
HAPI LIGHTING TEST  
6 DEG. CENTERLINE APPROACH

DATA PROCESSED BY THE FAA TECHNICAL CENTER  
ATLANTIC CITY AIRPORT, N J 08405  
6-SEP-1994 09:20



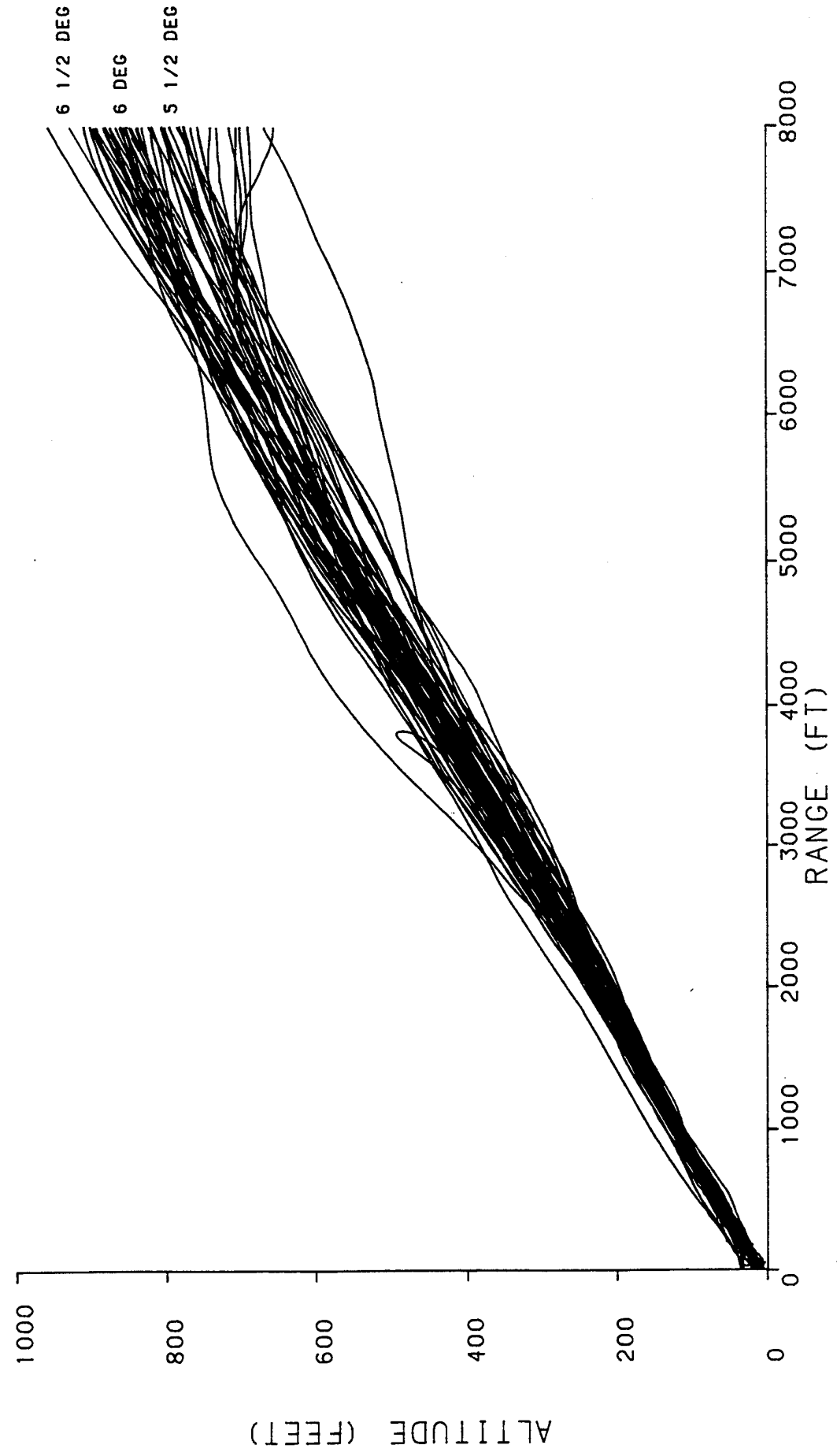
PAPI LIGHTING TEST  
6 DEG. CENTERLINE APPROACH  
MEAN +/- 3 SIGMA

DATA PROCESSED BY THE FAA TECHNICAL CENTER  
ATLANTIC CITY AIRPORT, N J 08405  
6-SEP-1994 08:50



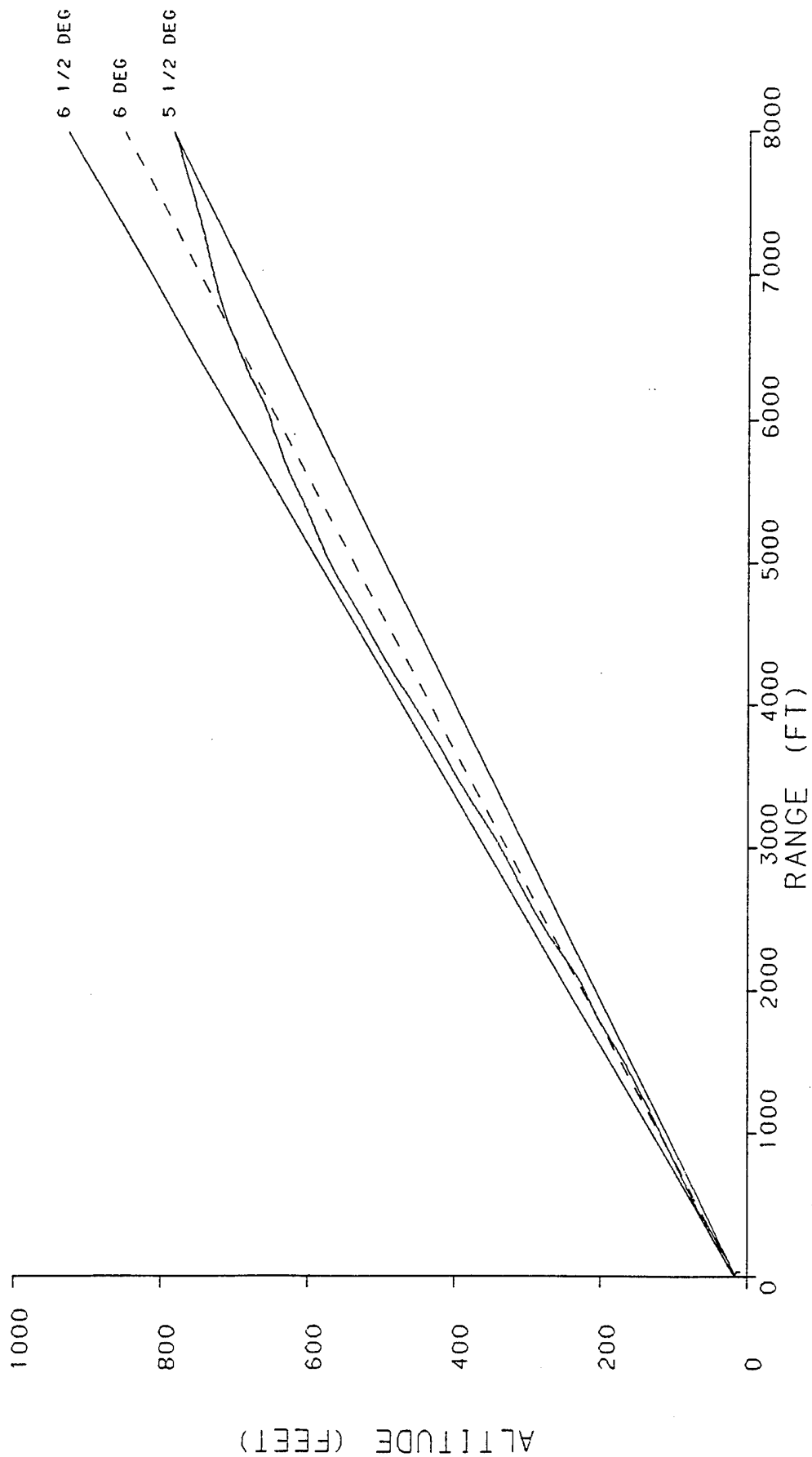
PAPI LIGHTING TEST  
6 DEG. CENTERLINE APPROACH

DATA PROCESSED BY THE FAA TECHNICAL CENTER  
ATLANTIC CITY AIRPORT. N J 08403  
6-SEP-1994 13:19



RUN #1  
3/02/93 CHAP1 6.0 DEG CENTERLINE APPROACH  
AZIMUTH : 0.00 ELEVATION : 6.00  
TRACKER DATA

DATA PROCESSED BY THE FAA TECHNICAL CENTER  
ATLANTIC CITY AIRPORT, N J 08405  
6-SEP-1994 08:06



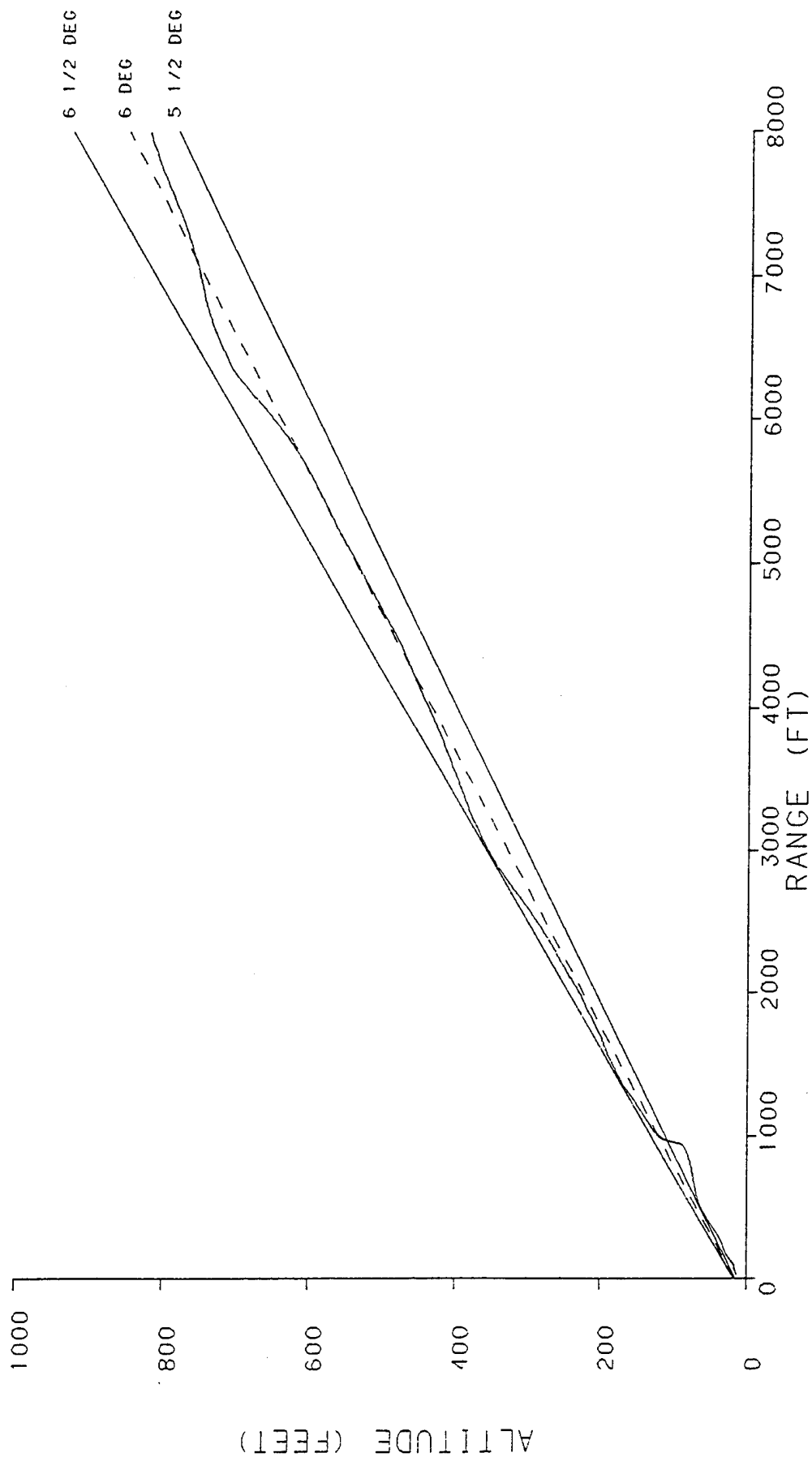
RUN #2

3/02/93 CHAPI 6.0 DEG CENTERLINE APPROACH

AZIMUTH : 0.00 ELEVATION : 6.00

TRACKER DATA

DATA PROCESSED BY THE FAA TECHNICAL CENTER  
ATLANTIC CITY AIRPORT, N J 08405  
6-SEP-1994 08:06



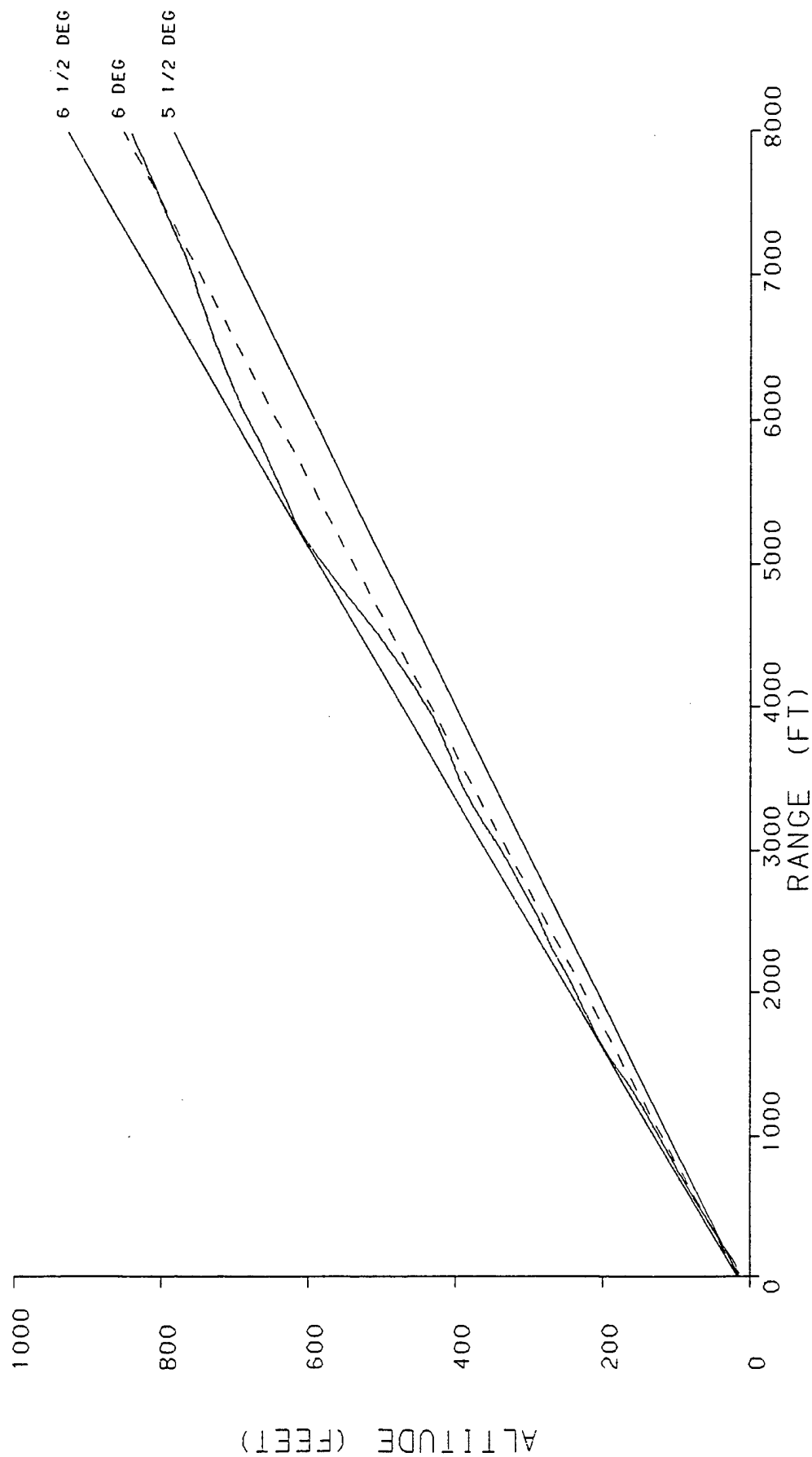
RUN #3

3/02/93 CHAP1 6.0 DEG CENTERLINE APPROACH

AZIMUTH : 0.00 ELEVATION : 6.00

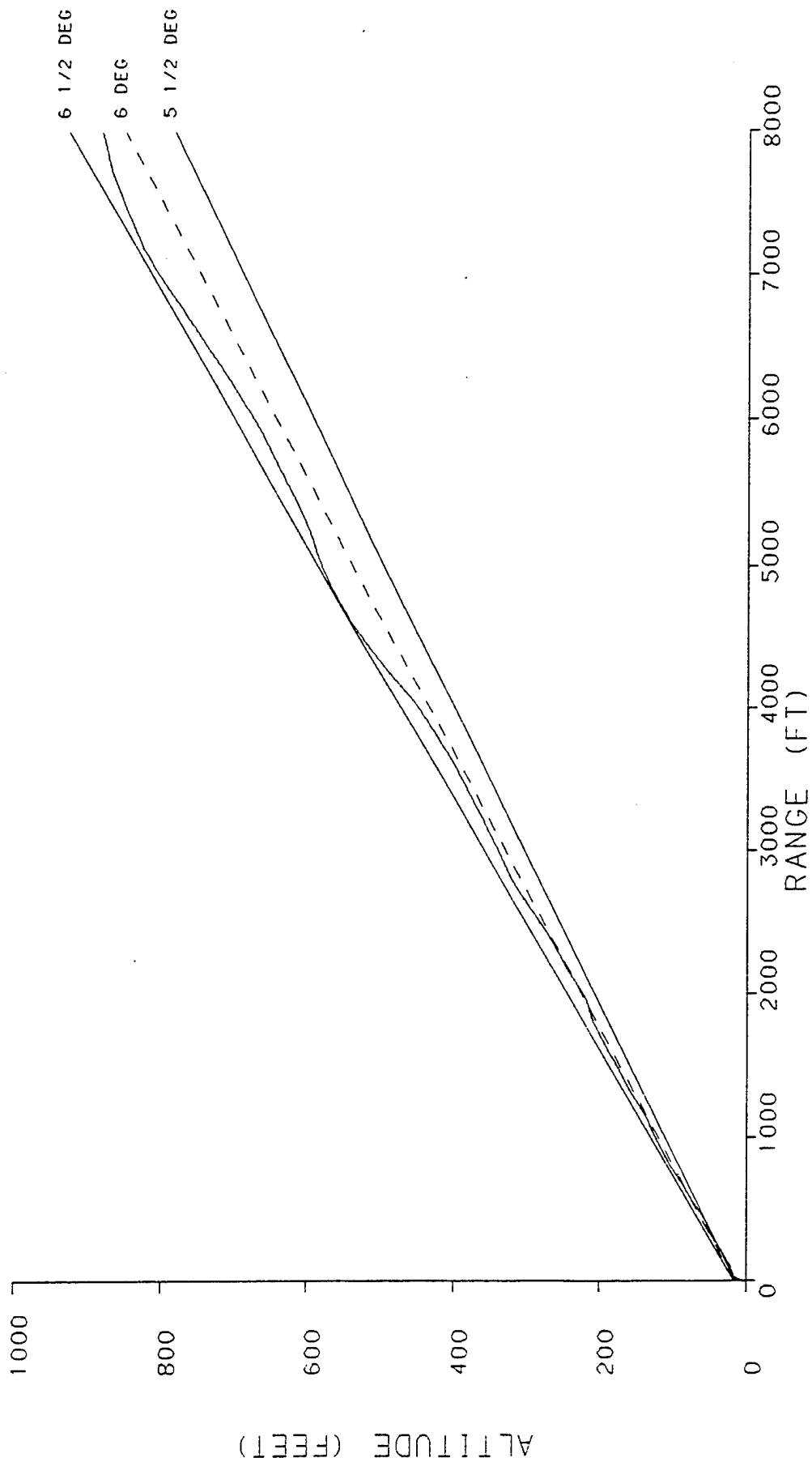
TRACKER DATA

DATA PROCESSED BY THE FAA TECHNICAL CENTER  
ATLANTIC CITY AIRPORT, N J 08405  
6-SEP-1994 08:06



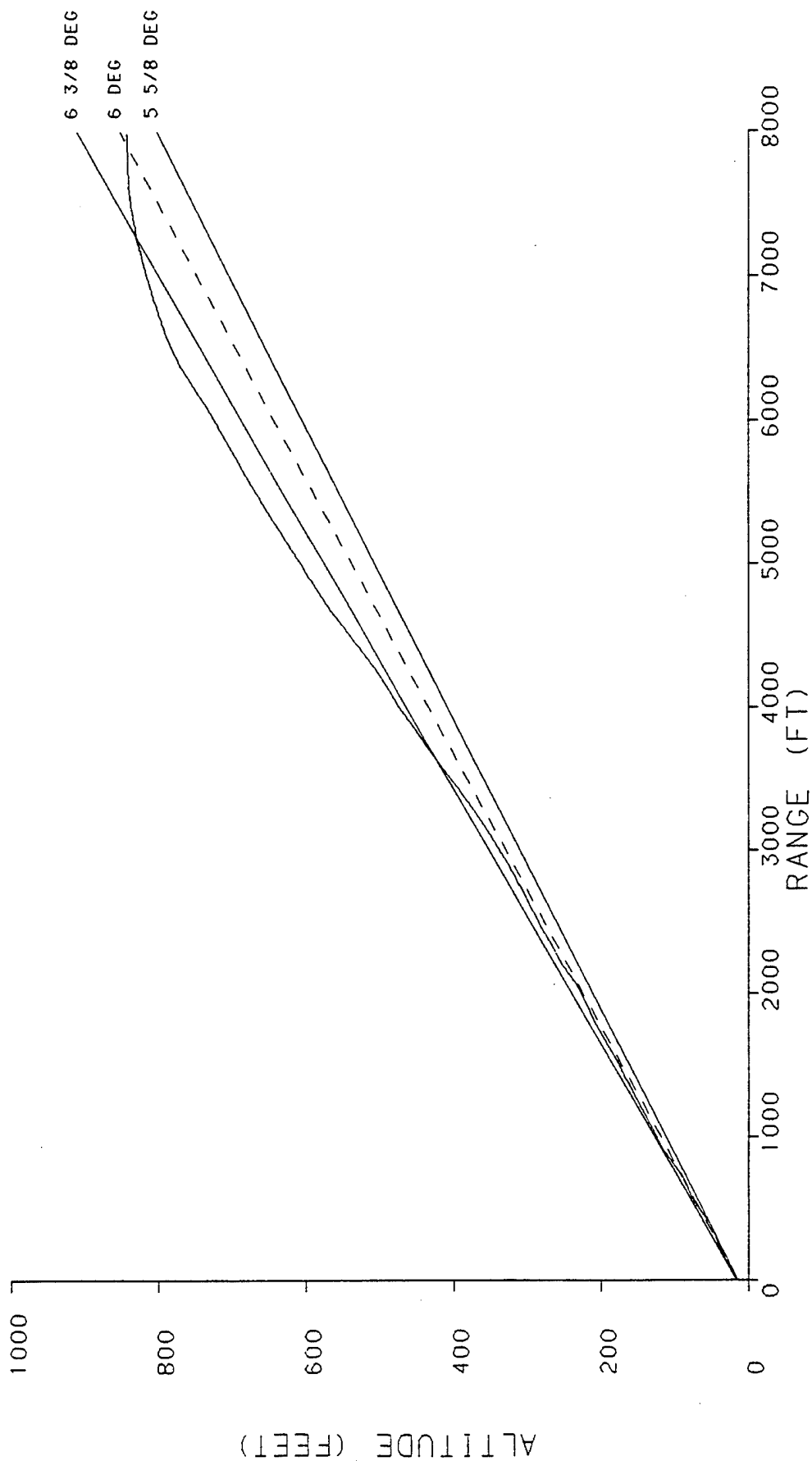
RUN #4  
3/02/93 CHAP1 6.0 DEG CENTERLINE APPROACH  
AZIMUTH : 0.00 ELEVATION : 6.00  
TRACKER DATA

DATA PROCESSED BY THE FAA TECHNICAL CENTER  
ATLANTIC CITY AIRPORT, N J 08405  
6-SEP-1994 08:08



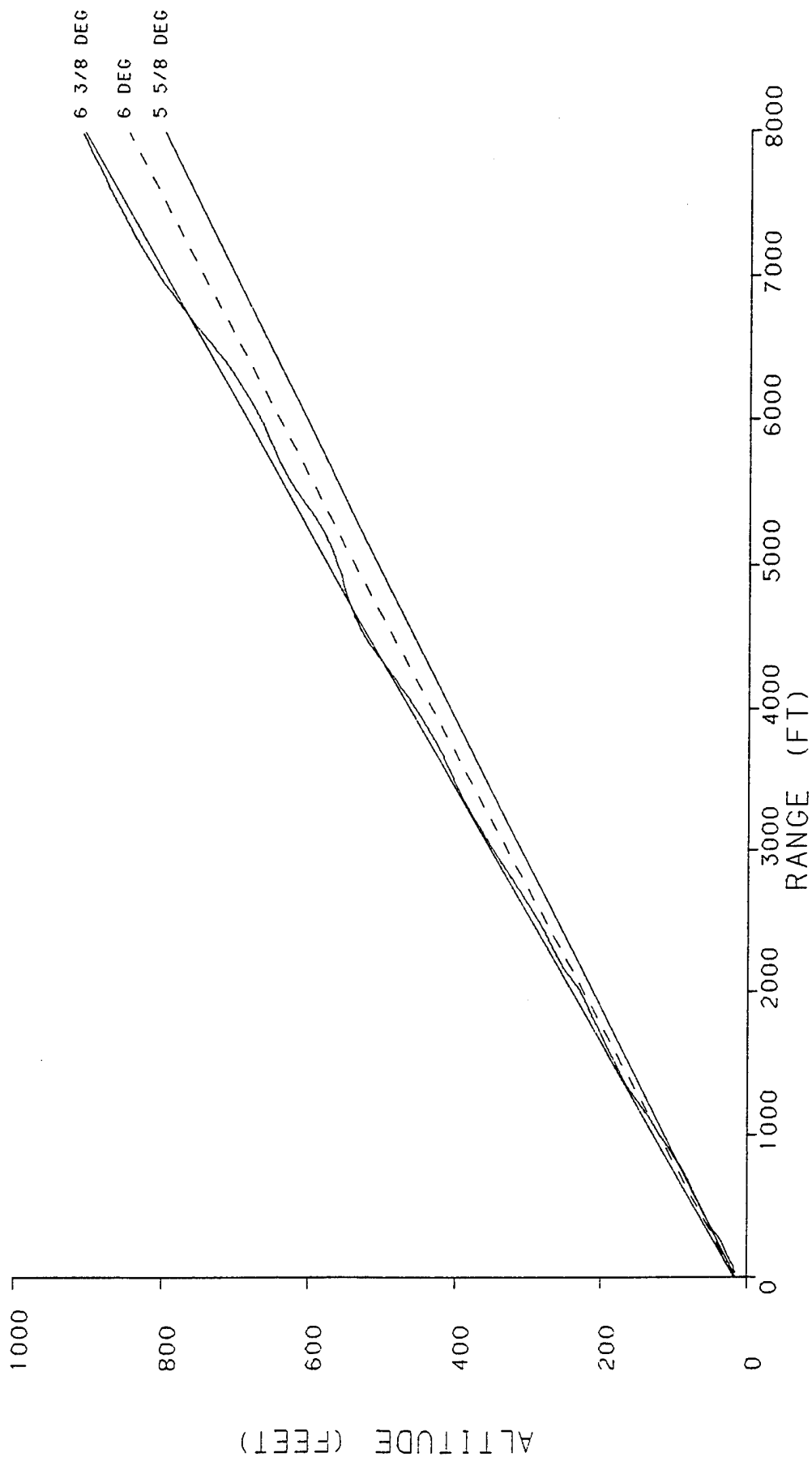
DATA PROCESSED BY THE FAA TECHNICAL CENTER  
ATLANTIC CITY AIRPORT, N J 08405  
6-SEP-1994 08:09

RUN #5  
3/02/93 HAPI 6.0 DEG CENTERLINE APPROACH  
AZIMUTH : 0.00 ELEVATION : 6.00  
TRACKER DATA



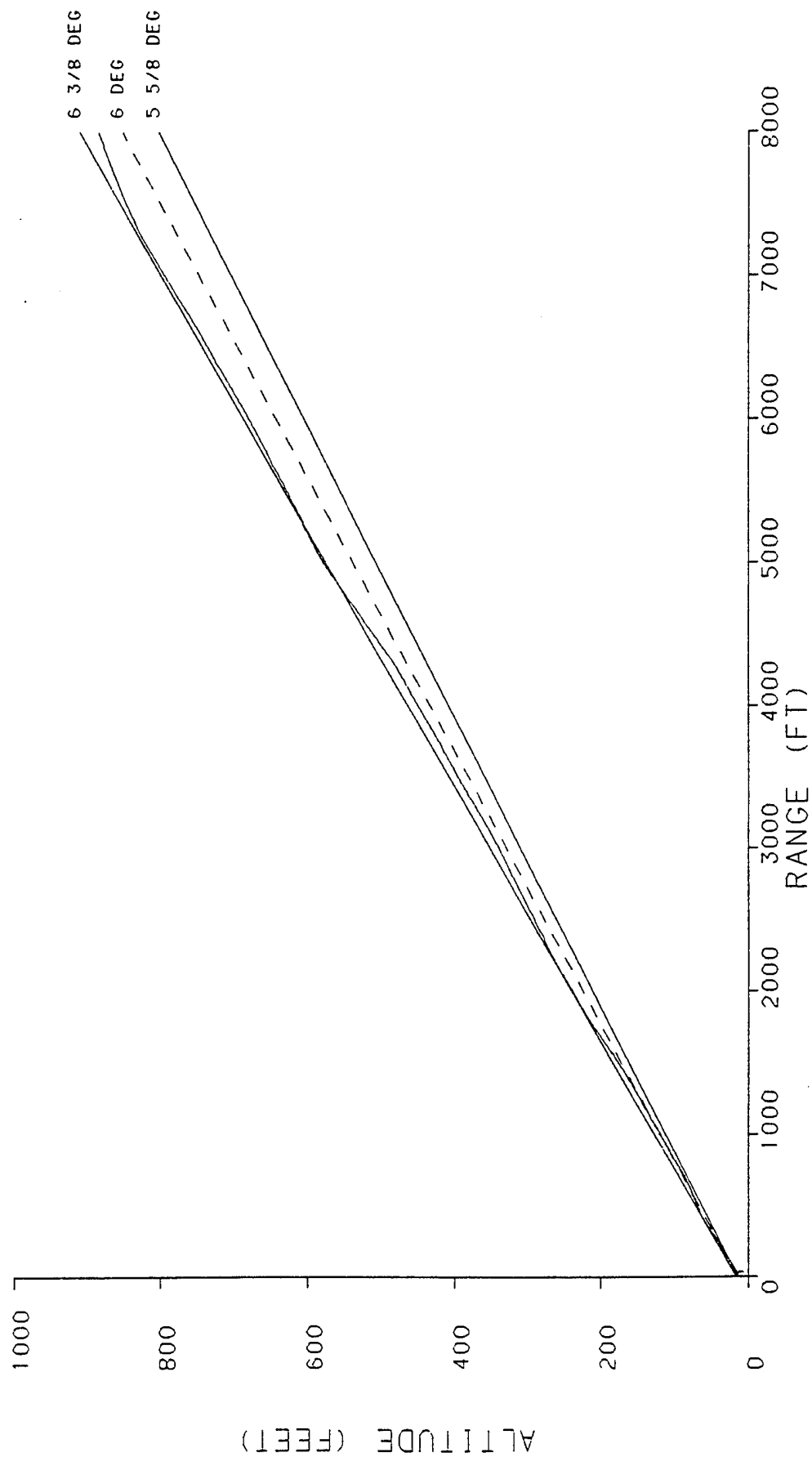
RUN #6  
3/02/93 HAPI 6.0 DEG CENTERLINE APPROACH  
AZIMUTH : 0.00 ELEVATION : 6.00  
TRACKER DATA

DATA PROCESSED BY THE FAA TECHNICAL CENTER  
ATLANTIC CITY AIRPORT, N J 08405  
6-SEP-1994 08:10



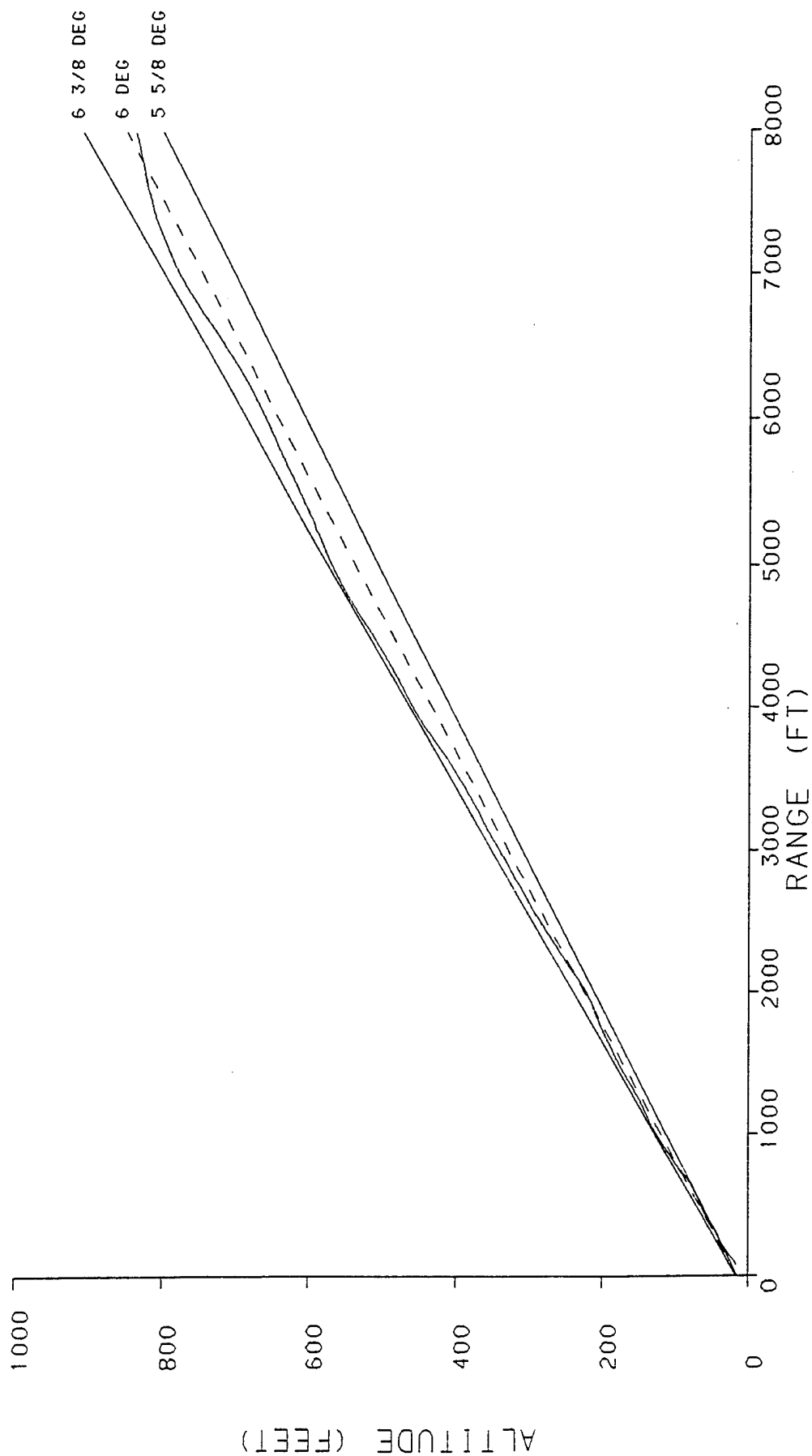
RUN #7  
3/02/93 HAPI 6.0 DEG CENTERLINE APPROACH  
AZIMUTH : 0.00 ELEVATION : 6.00  
TRACKER DATA

DATA PROCESSED BY THE FAA TECHNICAL CENTER  
ATLANTIC CITY AIRPORT, N J 08405  
6-SEP-1994 08:11



DATA PROCESSED BY THE FAA TECHNICAL CENTER  
ATLANTIC CITY AIRPORT, N J 08405  
6-SEP-1994 08:12

RUN #8  
3/02/93 HAPI 6.0 DEG CENTERLINE APPROACH  
AZIMUTH : 0.00 ELEVATION : 6.00  
TRACKER DATA



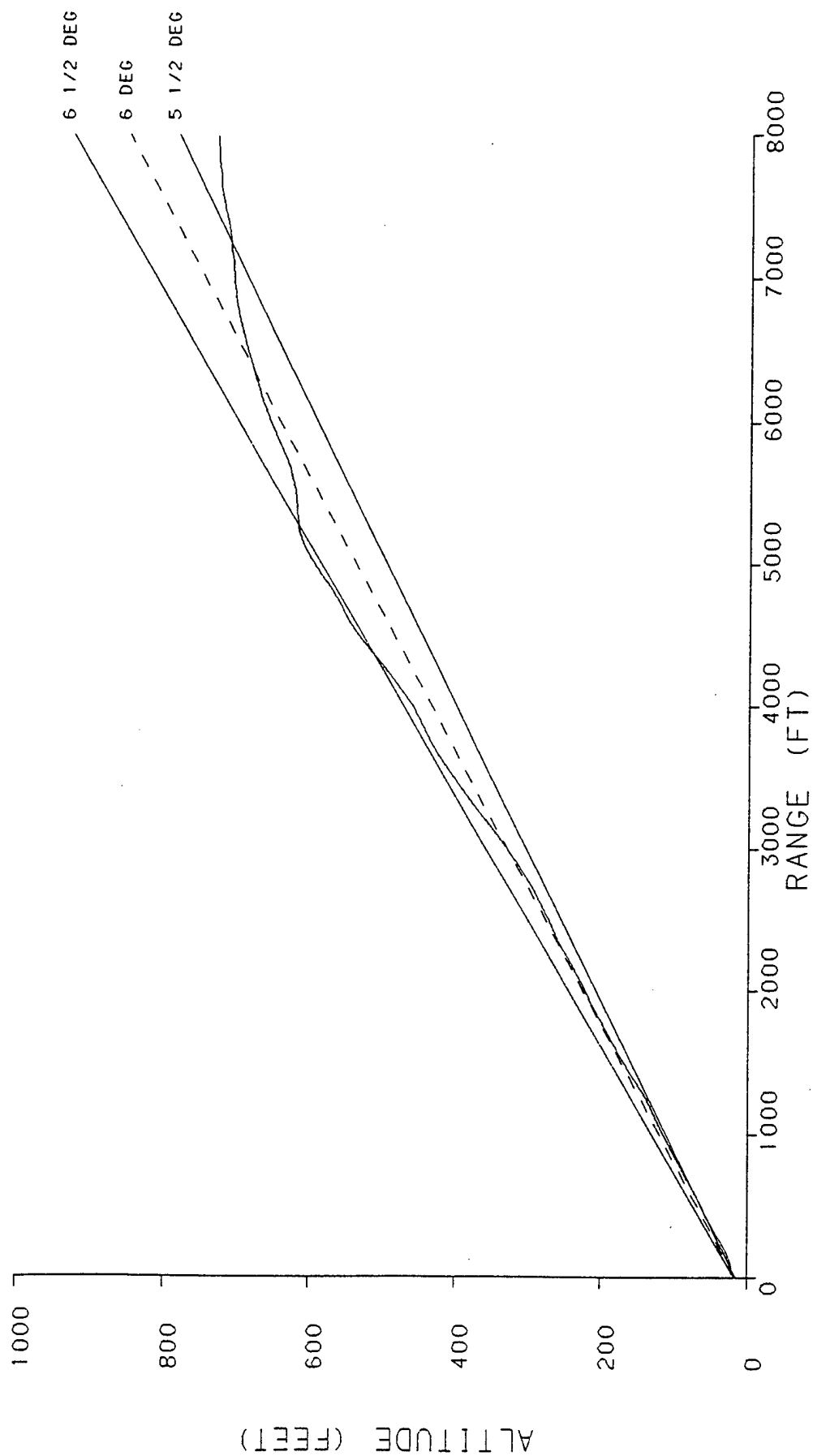
RUN #9

3/02/93 PAPI 6.0 DEG CENTERLINE APPROACH

AZIMUTH : 0.00 ELEVATION : 6.00

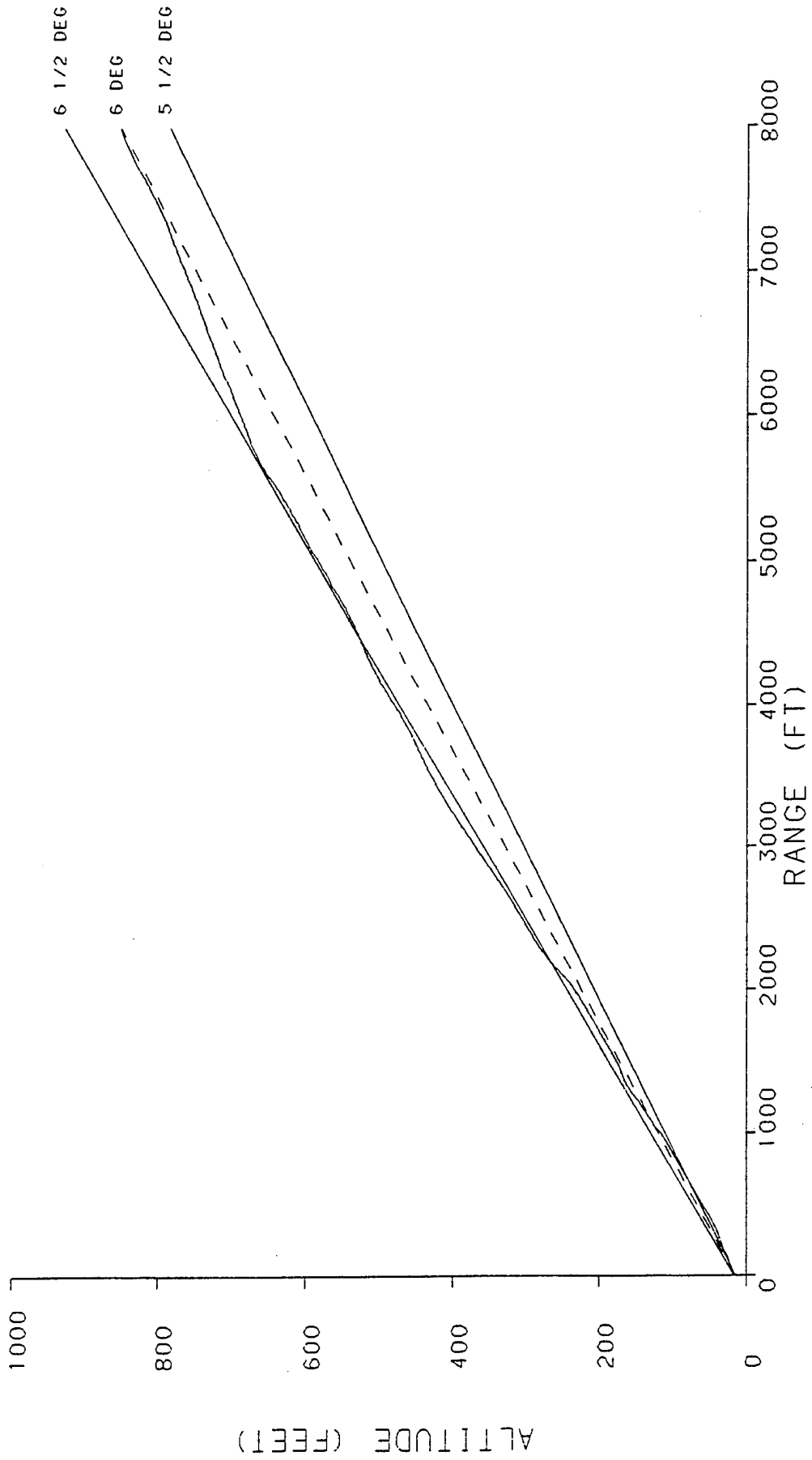
TRACKER DATA

DATA PROCESSED BY THE FAA TECHNICAL CENTER  
ATLANTIC CITY AIRPORT, N J 08405  
6-SEP-1994 08:13



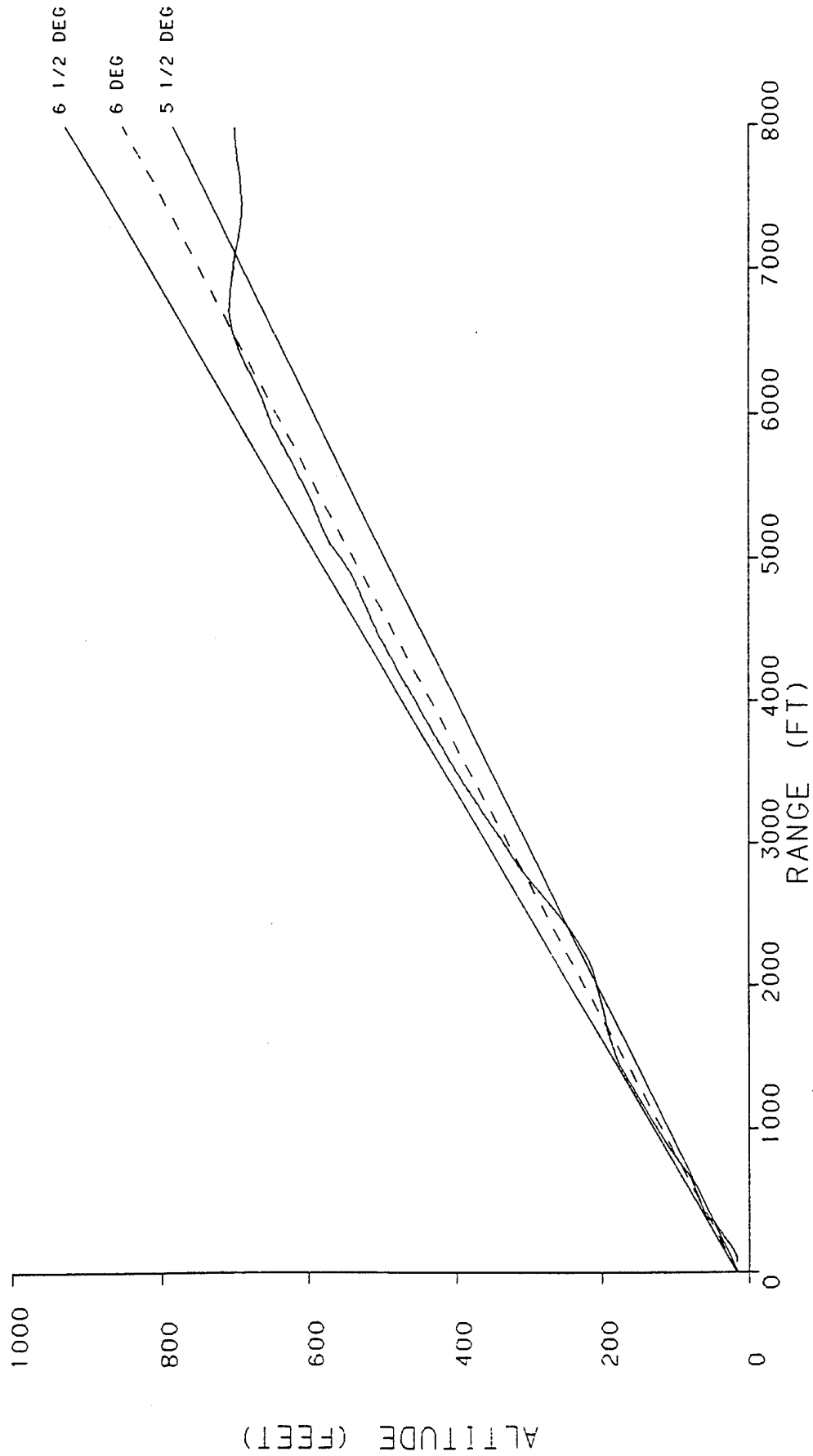
RUN #10  
3/02/93 PAPI 6.0 DEG CENTERLINE APPROACH  
AZIMUTH : 0.00 ELEVATION : 6.00  
TRACKER DATA

DATA PROCESSED BY THE FAA TECHNICAL CENTER  
ATLANTIC CITY AIRPORT, N J 08405  
6-SEP-1994 08:15



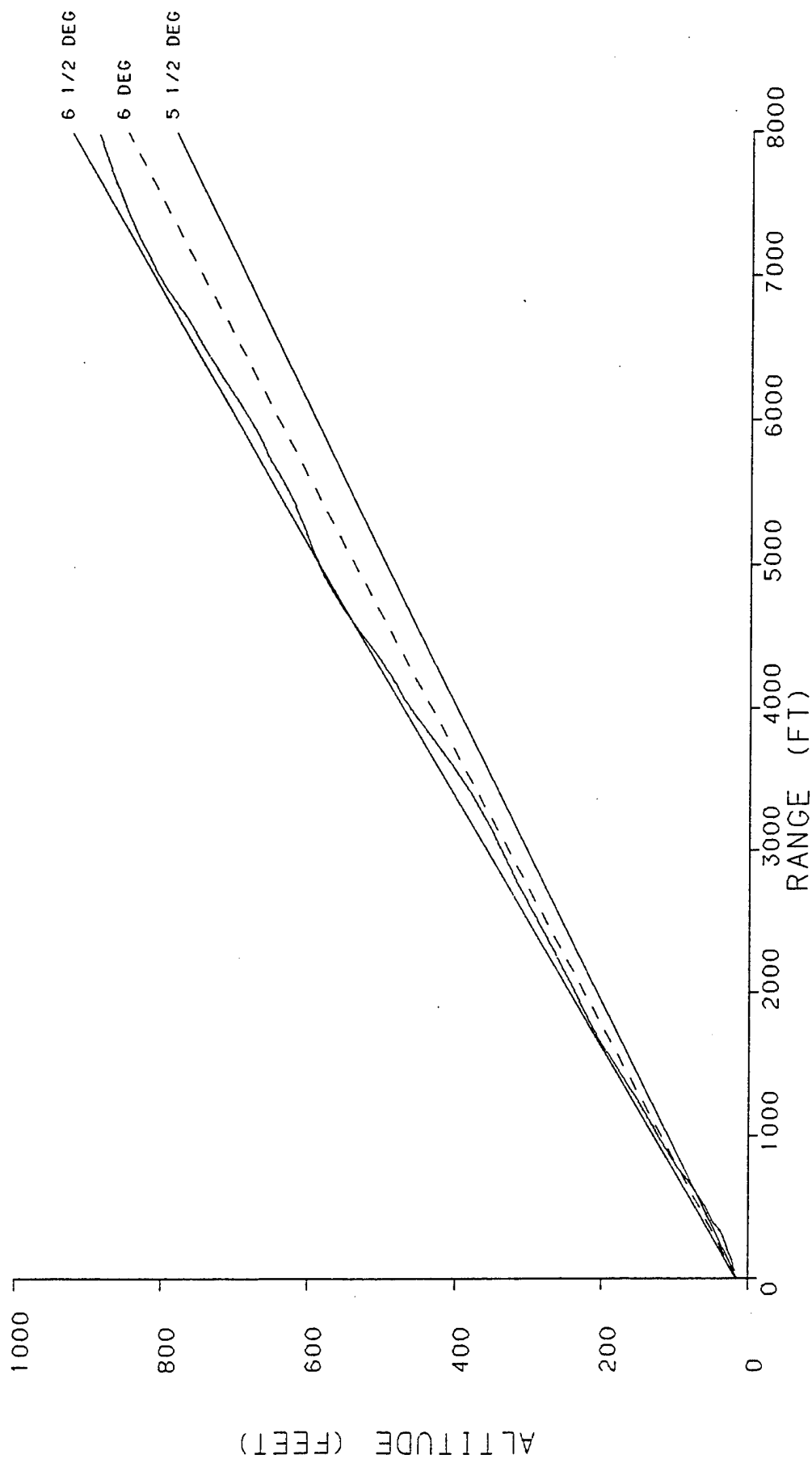
DATA PROCESSED BY THE FAA TECHNICAL CENTER  
ATLANTIC CITY AIRPORT, N J 08403  
6-SEP-1994 08:16

RUN #11  
3/02/93 PAPI 6.0 DEG CENTERLINE APPROACH  
AZIMUTH : 0.00 ELEVATION : 6.00  
TRACKER DATA



RUN #12  
3/02/93 PAPI 6.0 DEG CENTERLINE APPROACH  
AZIMUTH : 0.00 ELEVATION : 6.00  
TRACKER DATA

DATA PROCESSED BY THE FAA TECHNICAL CENTER  
ATLANTIC CITY AIRPORT, N J 08405  
6-SEP-1994 08:17



RUN #1 PLOT UNAVAILABLE

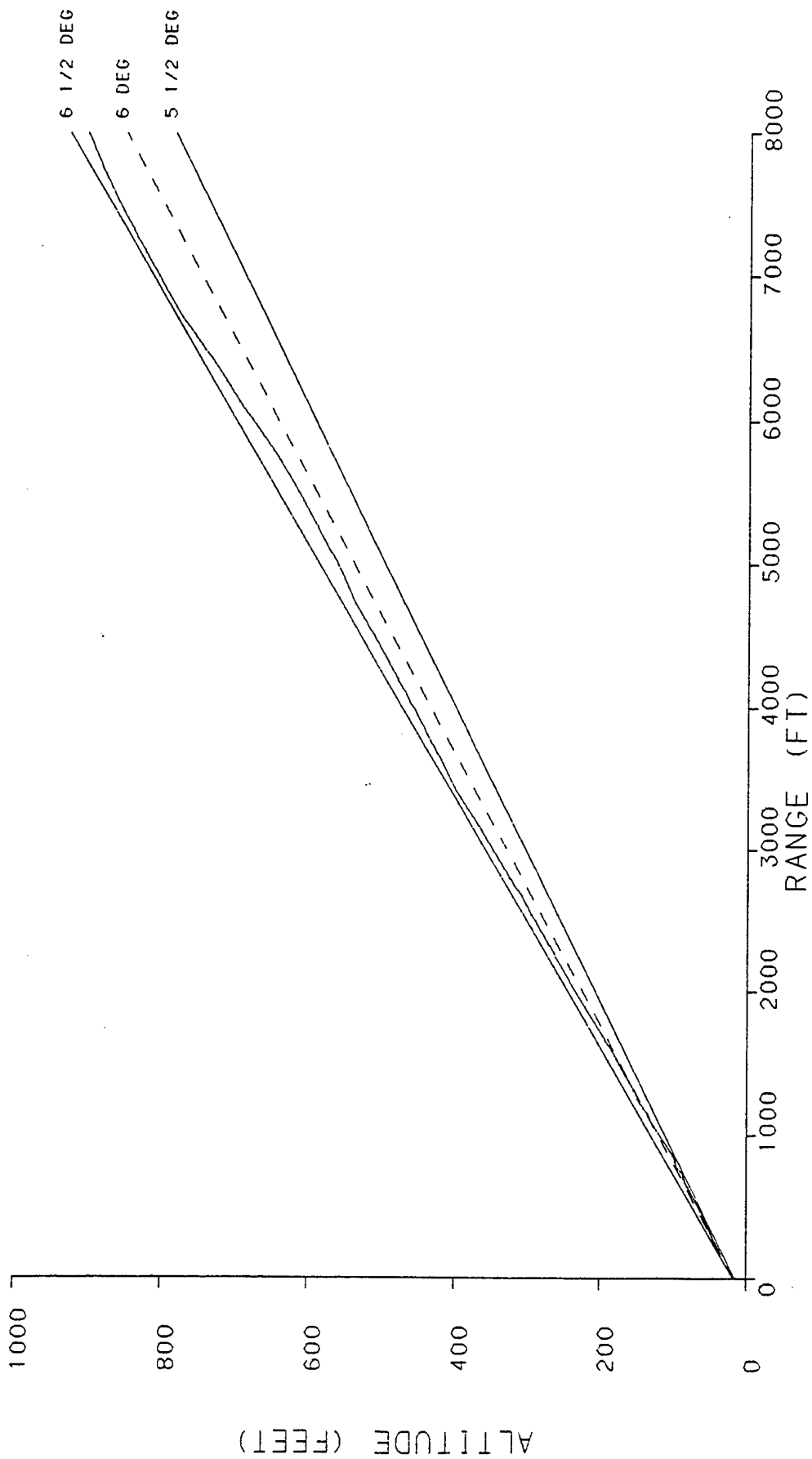
RUN #2

3/08/93 CHAPI 6.0 DEG CENTERLINE APPROACH

AZIMUTH : 0.00 ELEVATION : 6.00

TRACKER DATA

DATA PROCESSED BY THE FAA TECHNICAL CENTER  
ATLANTIC CITY AIRPORT, N J 08405  
15-SEP-1994 15:35



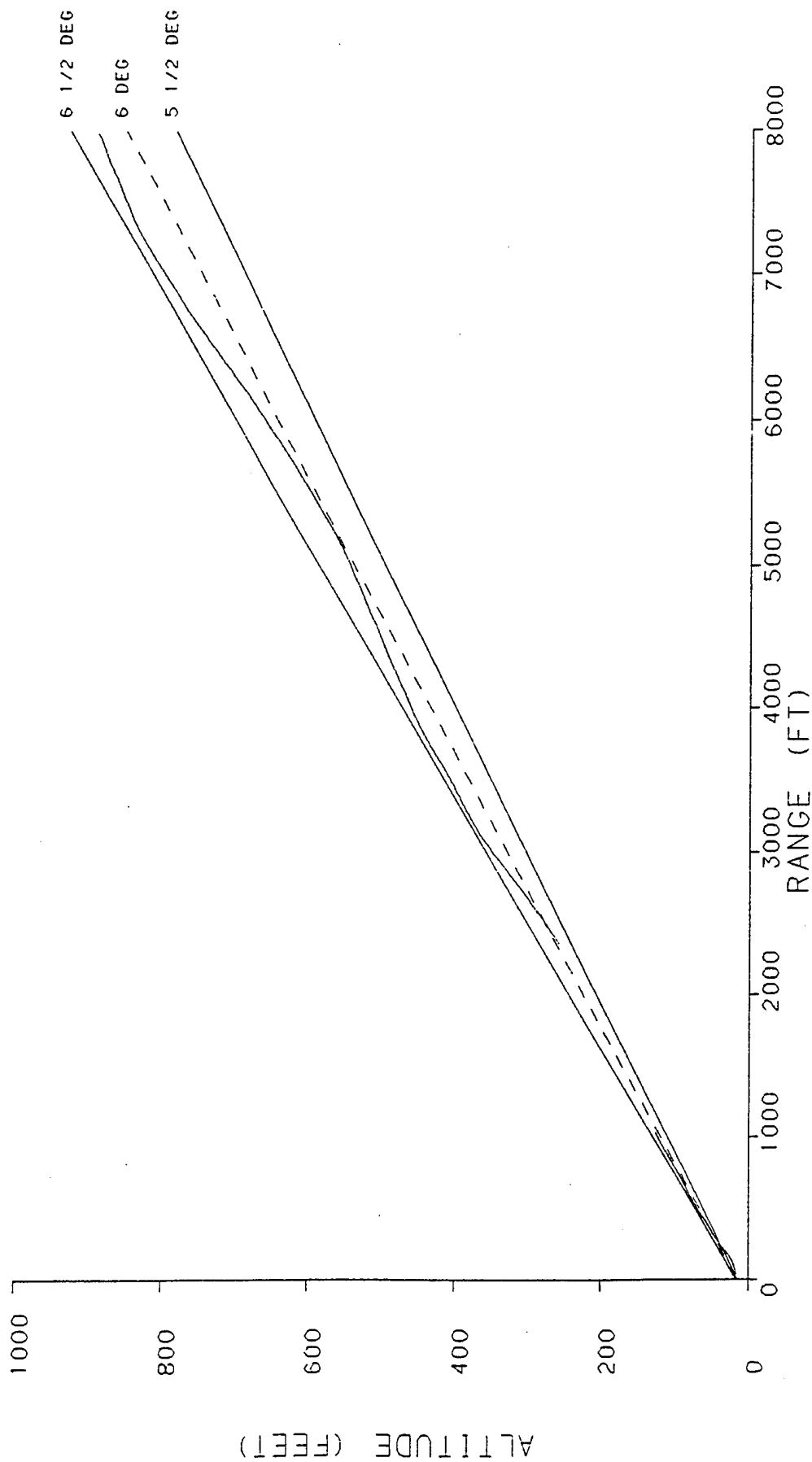
RUN #3

3/08/93 CHAPJ 6.0 DEG CENTERLINE APPROACH

AZIMUTH : 0.00 ELEVATION : 6.00

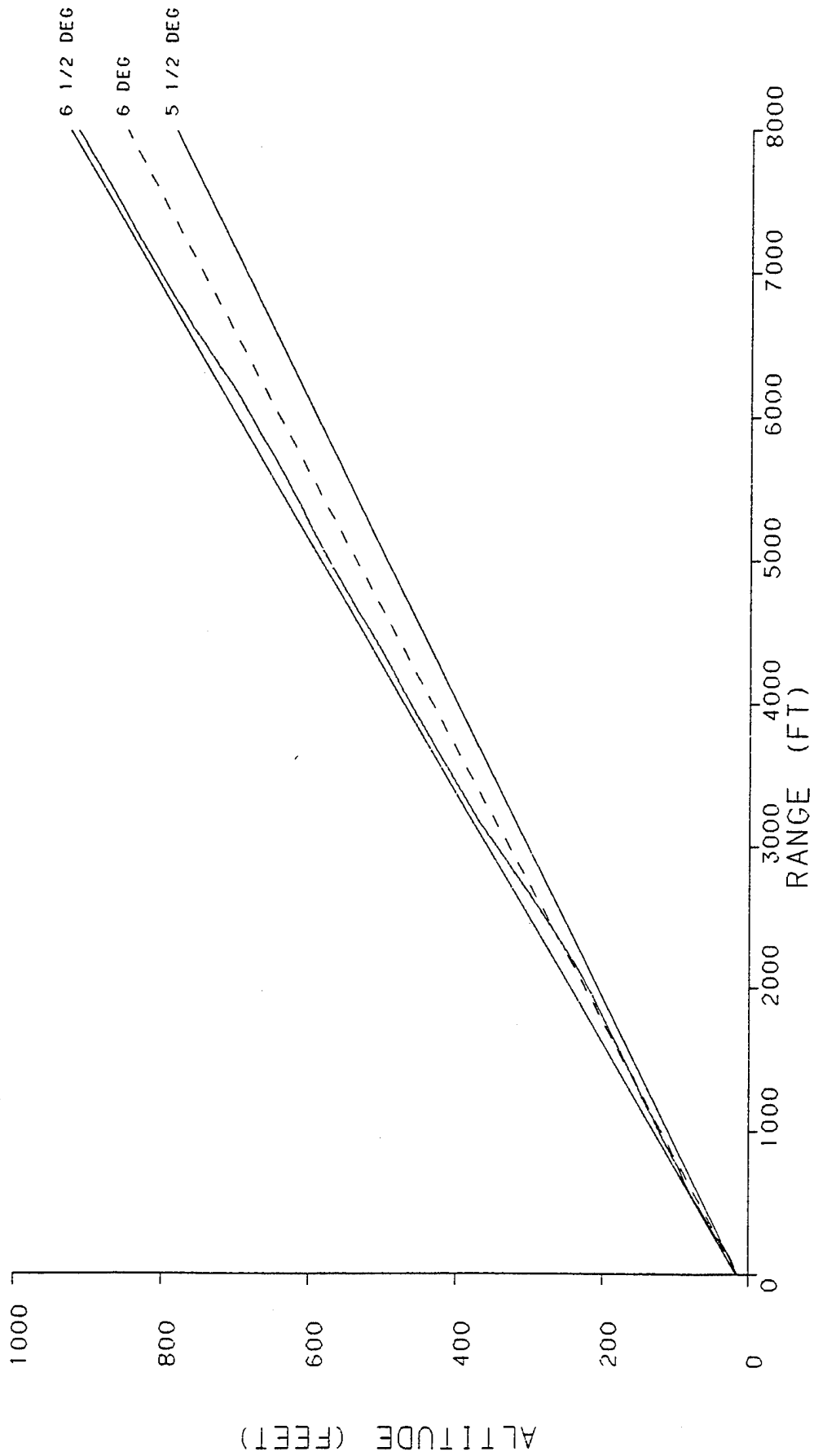
TRACKER DATA

DATA PROCESSED BY THE FAA TECHNICAL CENTER  
ATLANTIC CITY AIRPORT, N J 08403  
15-SEP-1994 15:36



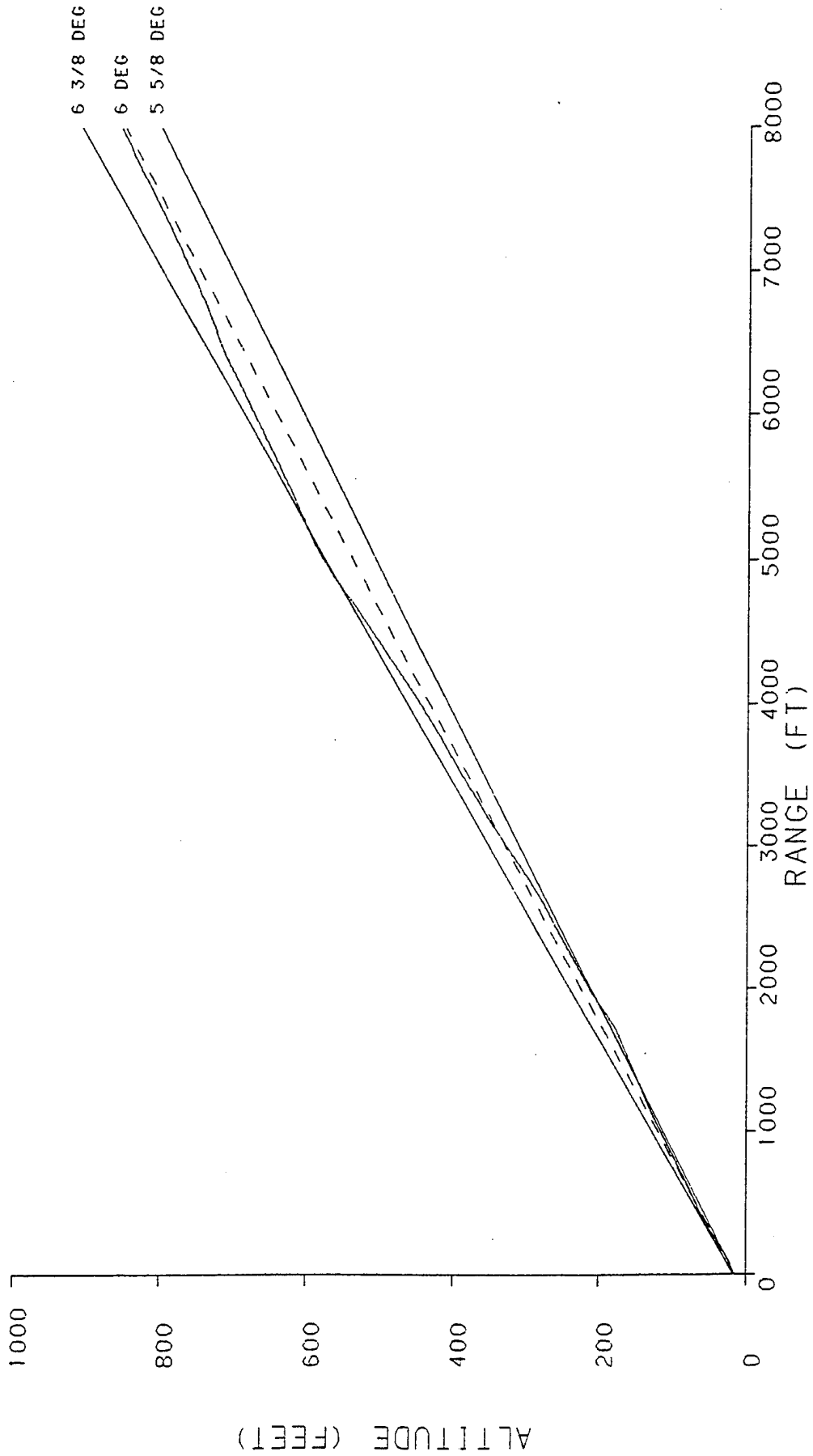
RUN #4  
3/08/93 CHAP1 6.0 DEG CENTERLINE APPROACH  
AZIMUTH : 0.00 ELEVATION : 6.00  
TRACKER DATA

DATA PROCESSED BY THE FAA TECHNICAL CENTER  
ATLANTIC CITY AIRPORT, N J 08403  
15-SEP-1994 15:36



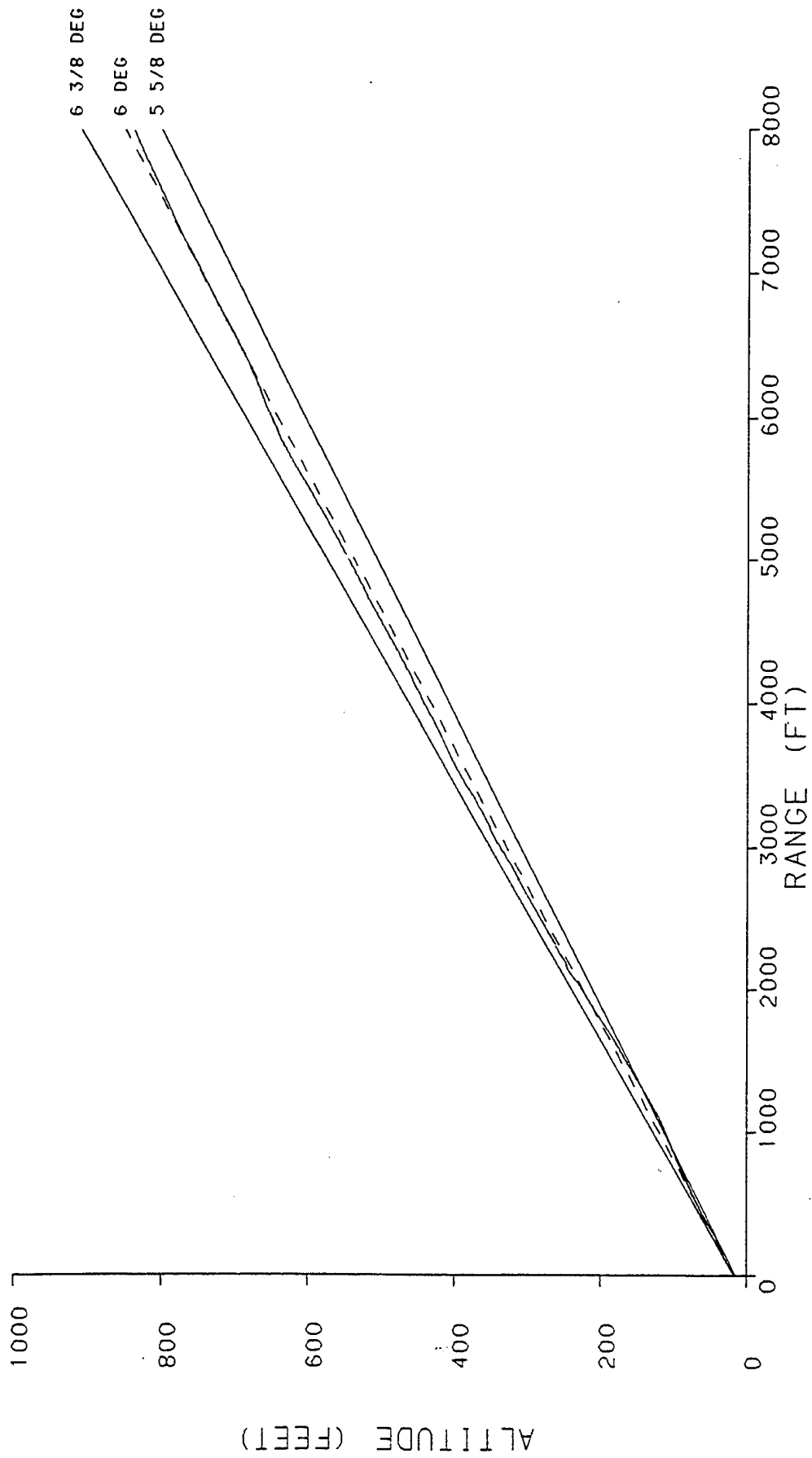
RUN #5  
 3/08/93 HAPI 6.0 DEG CENTERLINE APPROACH  
 AZIMUTH : 0.00 ELEVATION : 6.00  
 TRACKER DATA

DATA PROCESSED BY THE FAA TECHNICAL CENTER  
 ATLANTIC CITY AIRPORT. N J 08405  
 15-SEP-1994 15:37



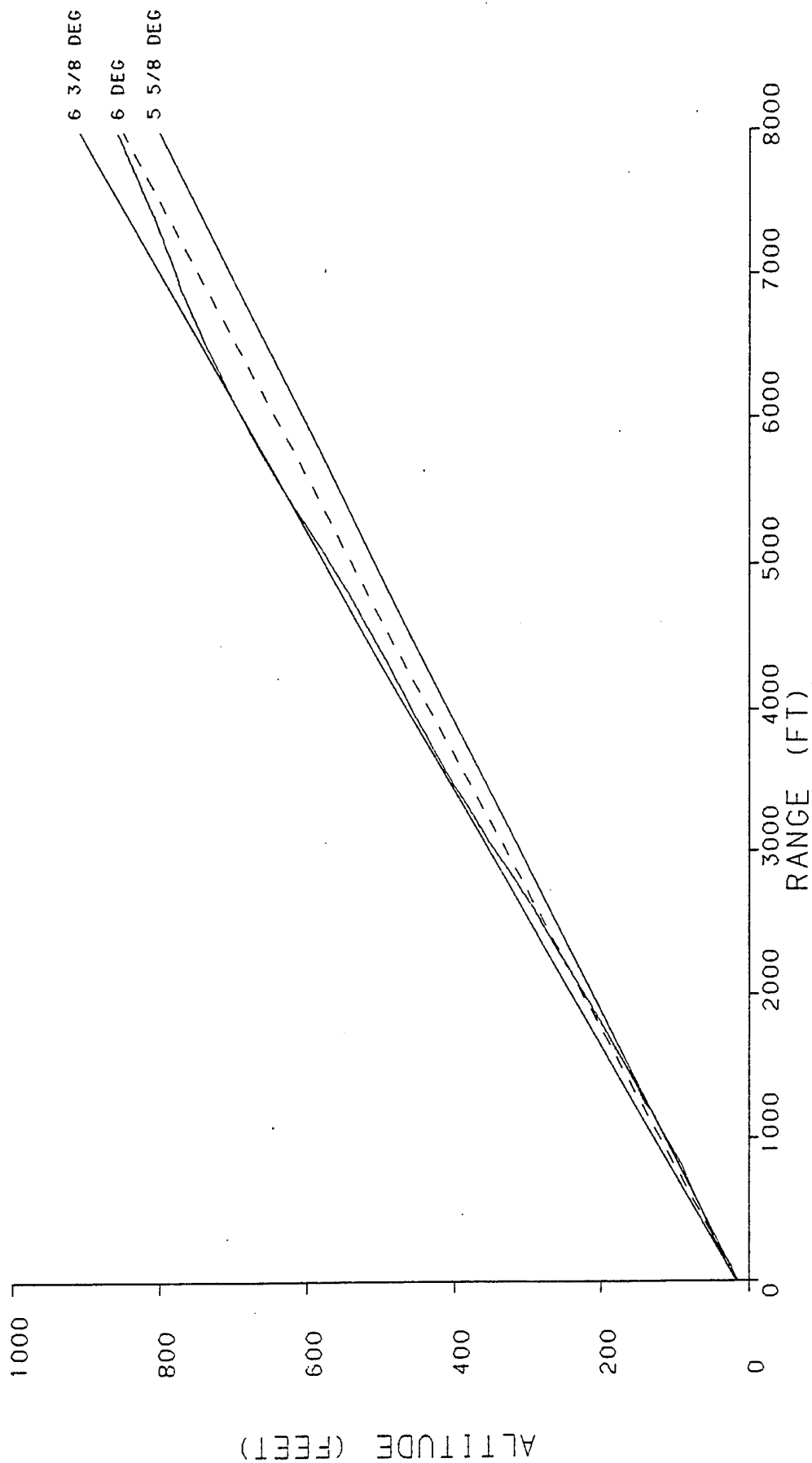
DATA PROCESSED BY THE FAA TECHNICAL CENTER  
ATLANTIC CITY AIRPORT, N J 08405  
15-SEP-1994 15:38

RUN #6  
3/08/93 HAPI 6.0 DEG CENTERLINE APPROACH  
AZIMUTH : 0.00 ELEVATION : 6.00  
TRACKER DATA



DATA PROCESSED BY THE FAA TECHNICAL CENTER  
ATLANTIC CITY AIRPORT, N J 08403  
15-SEP-1994 15139

RUN #7  
3/08/93 HAPI 6.0 DEG CENTERLINE APPROACH  
AZIMUTH : 0.00 ELEVATION : 6.00  
TRACKER DATA



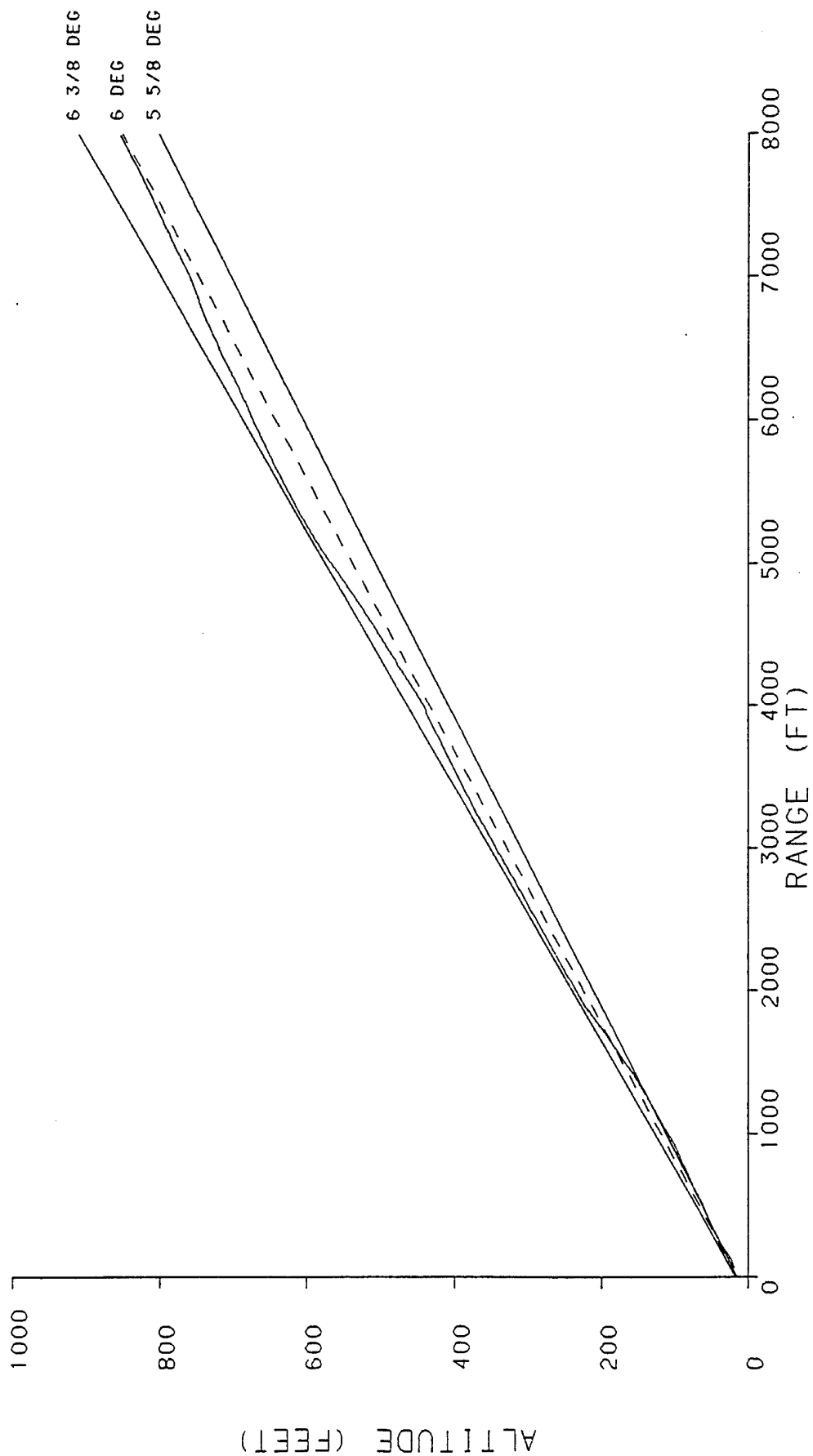
RUN #8

3/08/93 HAPI 6.0 DEG CENTERLINE APPROACH

AZIMUTH : 0.00 ELEVATION : 6.00

TRACKER DATA

DATA PROCESSED BY THE FAA TECHNICAL CENTER  
ATLANTIC CITY AIRPORT. N J 08403  
15-SEP-1994 16:51



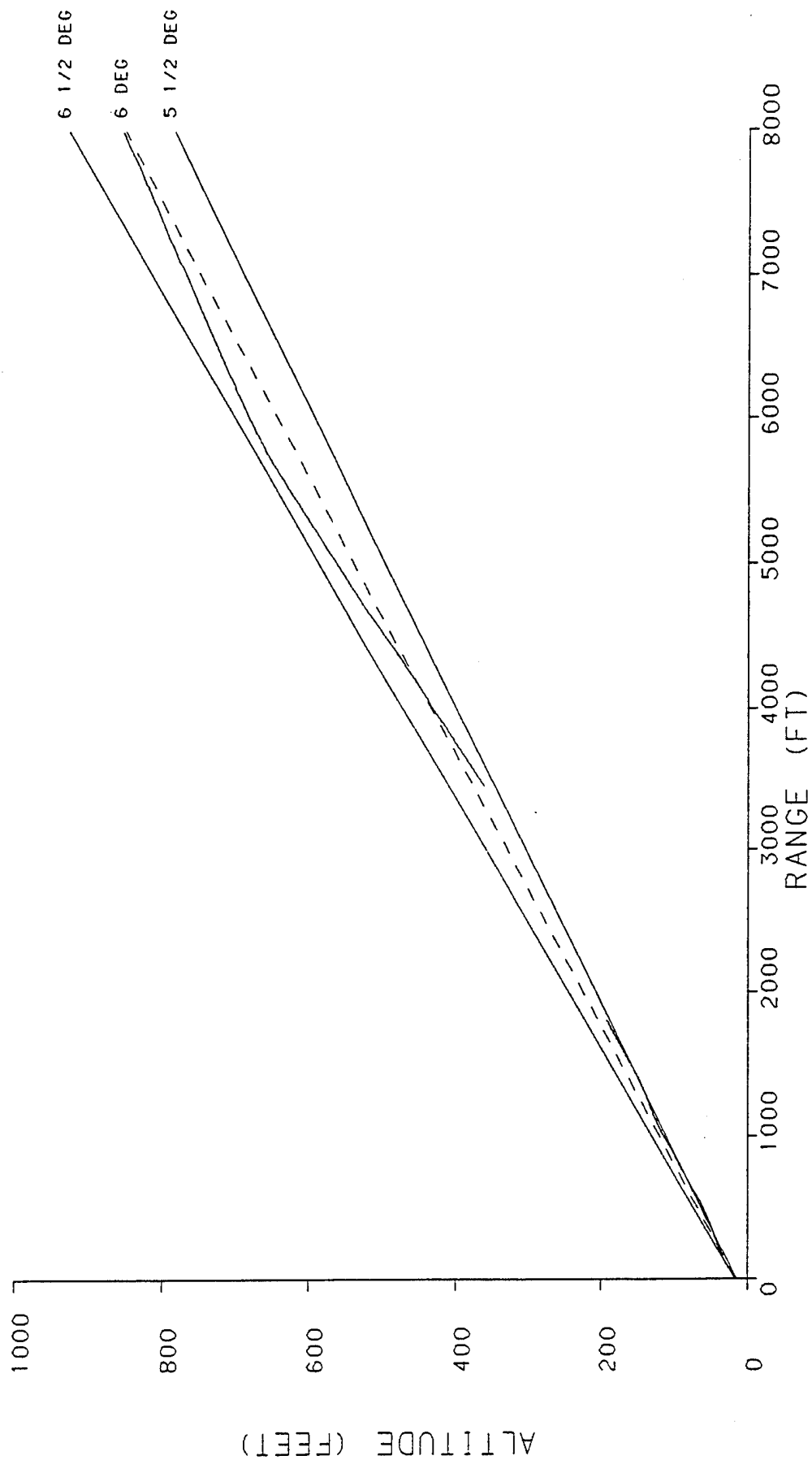
RUN #9

3/08/93 PAPI 6.0 DEG CENTERLINE APPROACH

AZIMUTH : 0.00 ELEVATION : 6.00

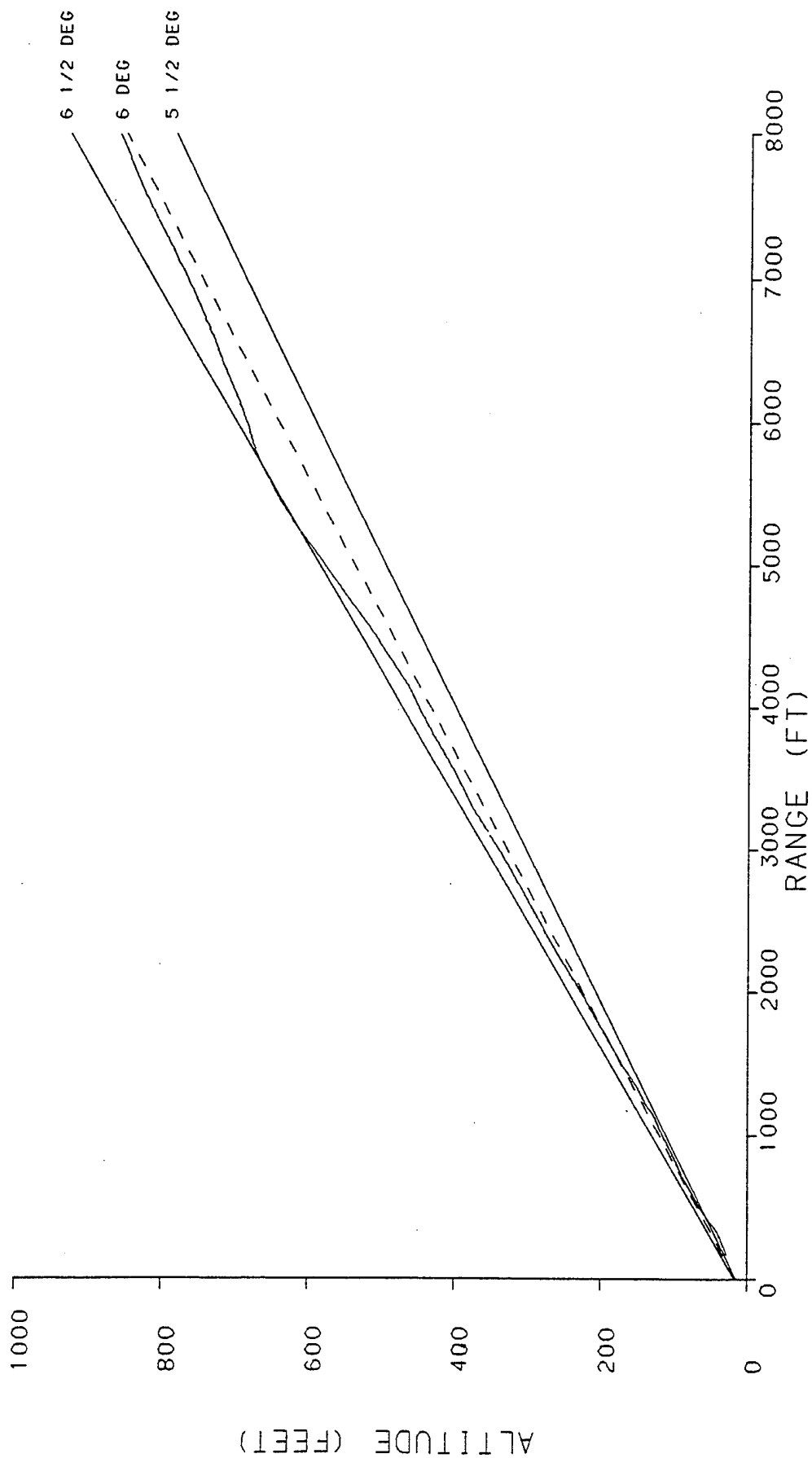
TRACKER DATA

DATA PROCESSED BY THE FAA TECHNICAL CENTER  
ATLANTIC CITY AIRPORT, N J 08405  
15-SEP-1994 16:52



RUN #10  
3/08/93 PAPI 6.0 DEG CENTERLINE APPROACH  
AZIMUTH : 0.00 ELEVATION : 6.00  
TRACKER DATA

DATA PROCESSED BY THE FAA TECHNICAL CENTER  
ATLANTIC CITY AIRPORT, NJ 08405  
15-SEP-1994 16:53



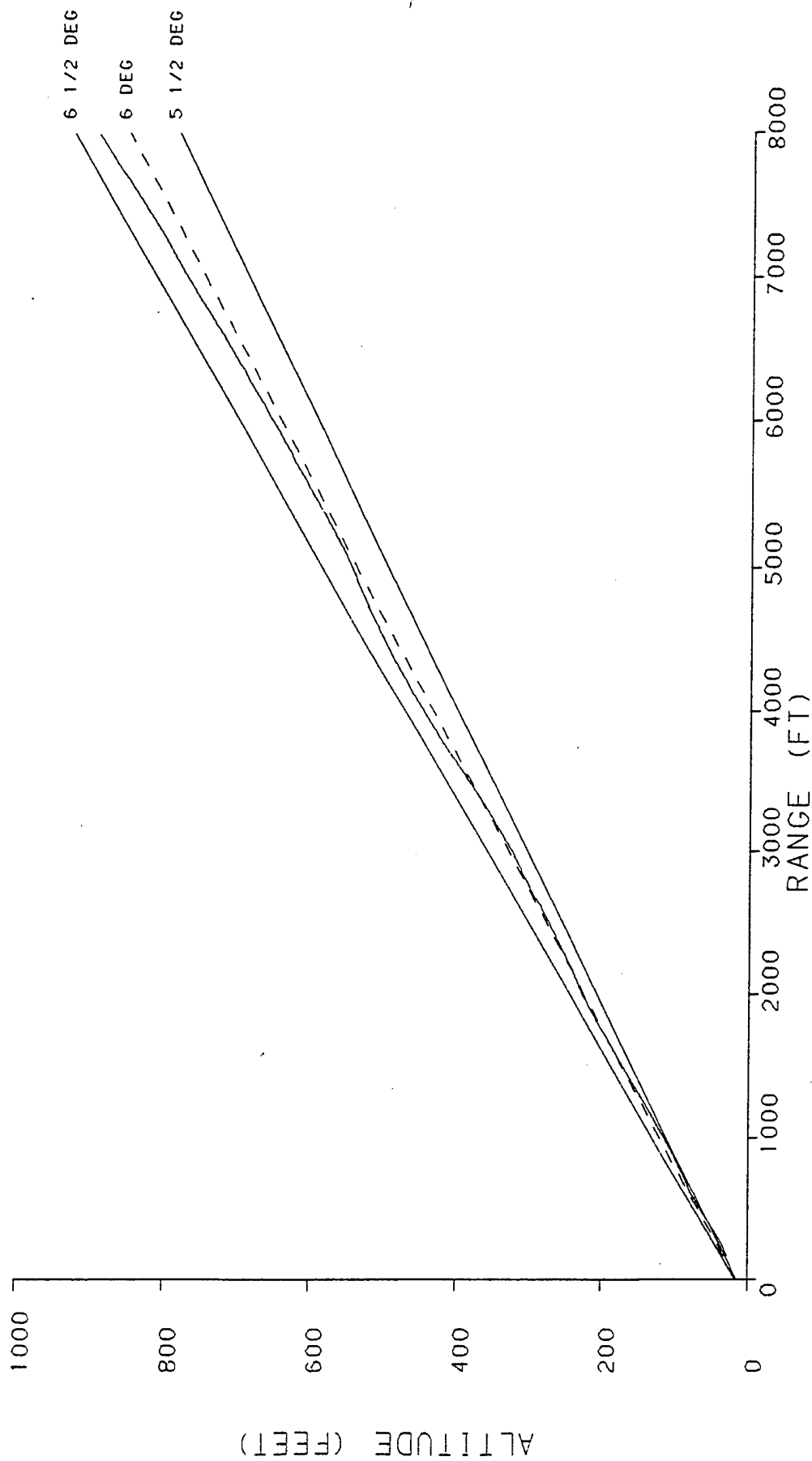
RUN #11

3/08/93 PAPI 6.0 DEG CENTERLINE APPROACH

AZIMUTH : 0.00 ELEVATION : 6.00

TRACKER DATA

DATA PROCESSED BY THE FAA TECHNICAL CENTER  
ATLANTIC CITY AIRPORT, N J 08405  
15-SEP-1994 16:54



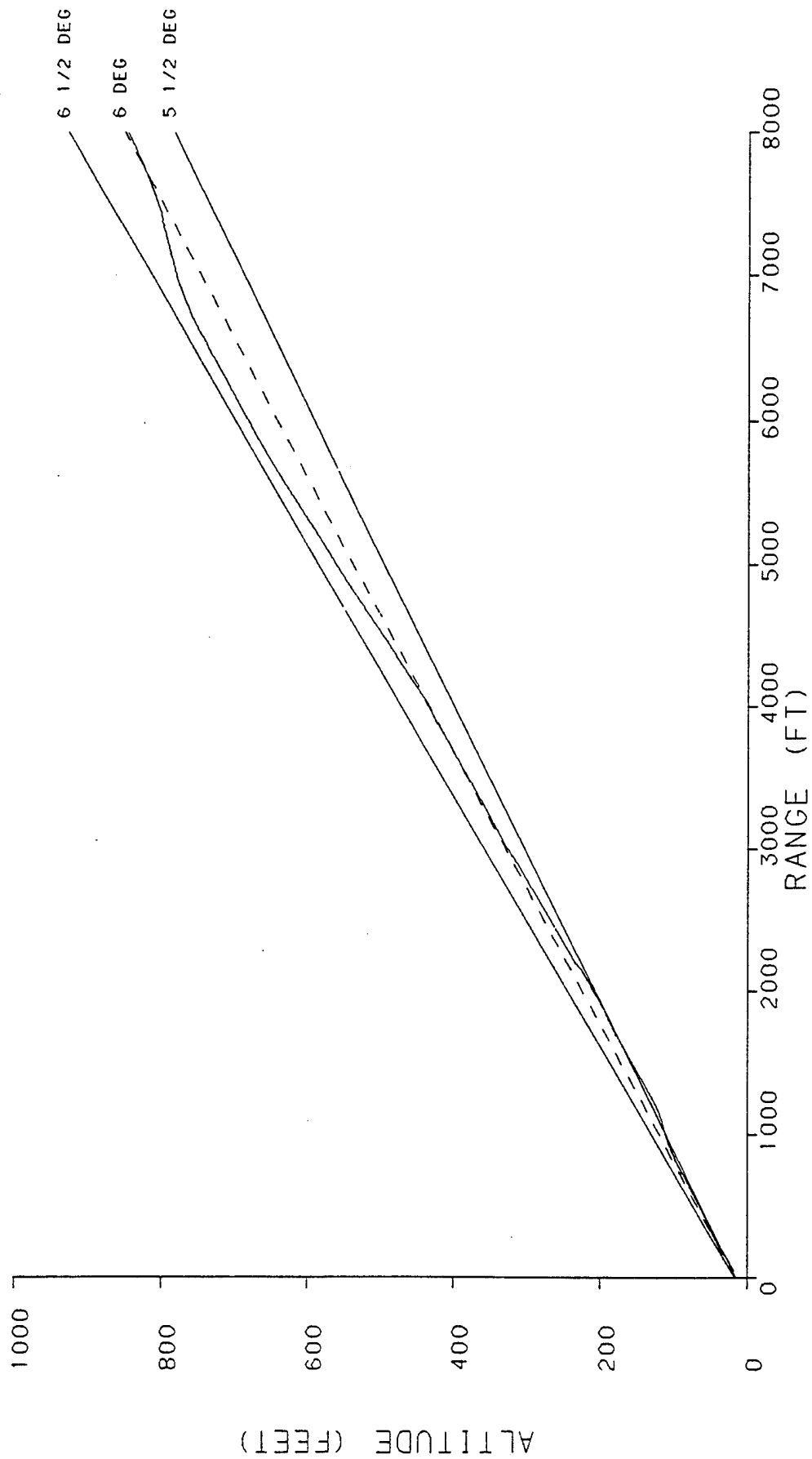
RUN #12

3/08/93 PAPI 6.0 DEG CENTERLINE APPROACH

AZIMUTH : 0.00 ELEVATION : 6.00

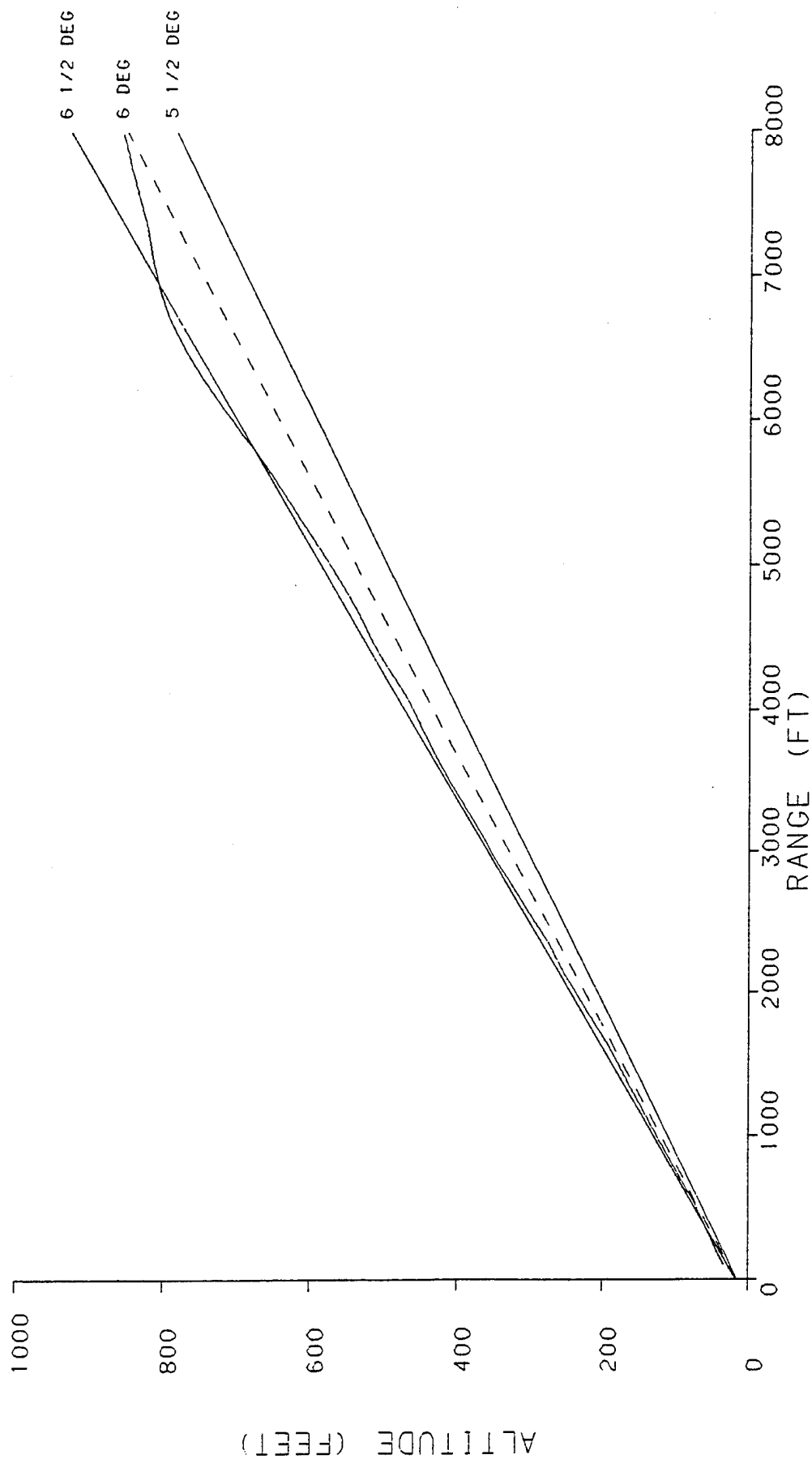
TRACKER DATA

DATA PROCESSED BY THE FAA TECHNICAL CENTER  
ATLANTIC CITY AIRPORT, N J 08405  
15-SEP-1994 16:55



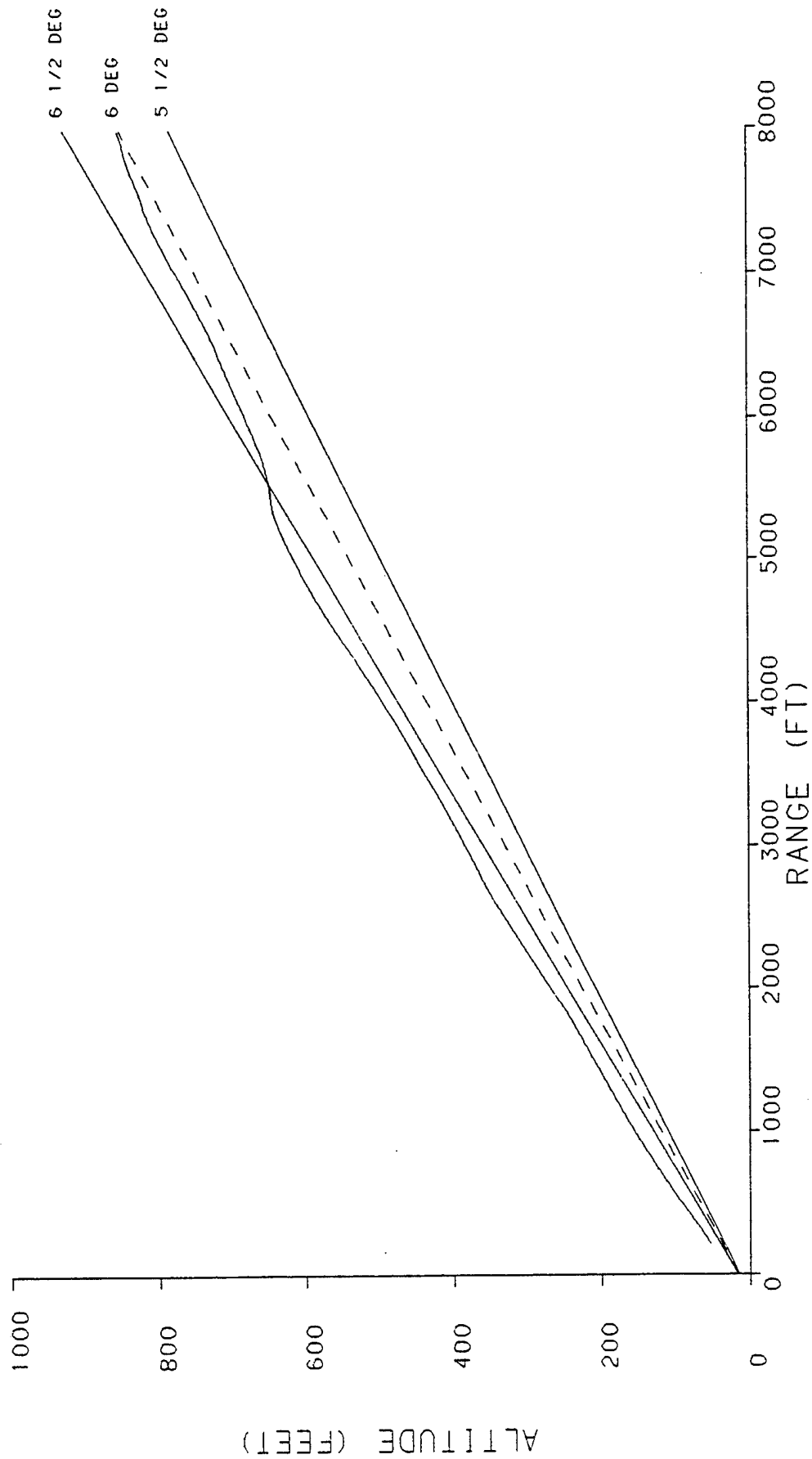
RUN #1  
4/14/93 AM PAPI 6.0 DEG CENTERLINE APPROACH  
AZIMUTH : 0.00 ELEVATION : 6.00  
TRACKER DATA

DATA PROCESSED BY THE FAA TECHNICAL CENTER  
ATLANTIC CITY AIRPORT, N J 08405  
16-SEP-1994 13:45



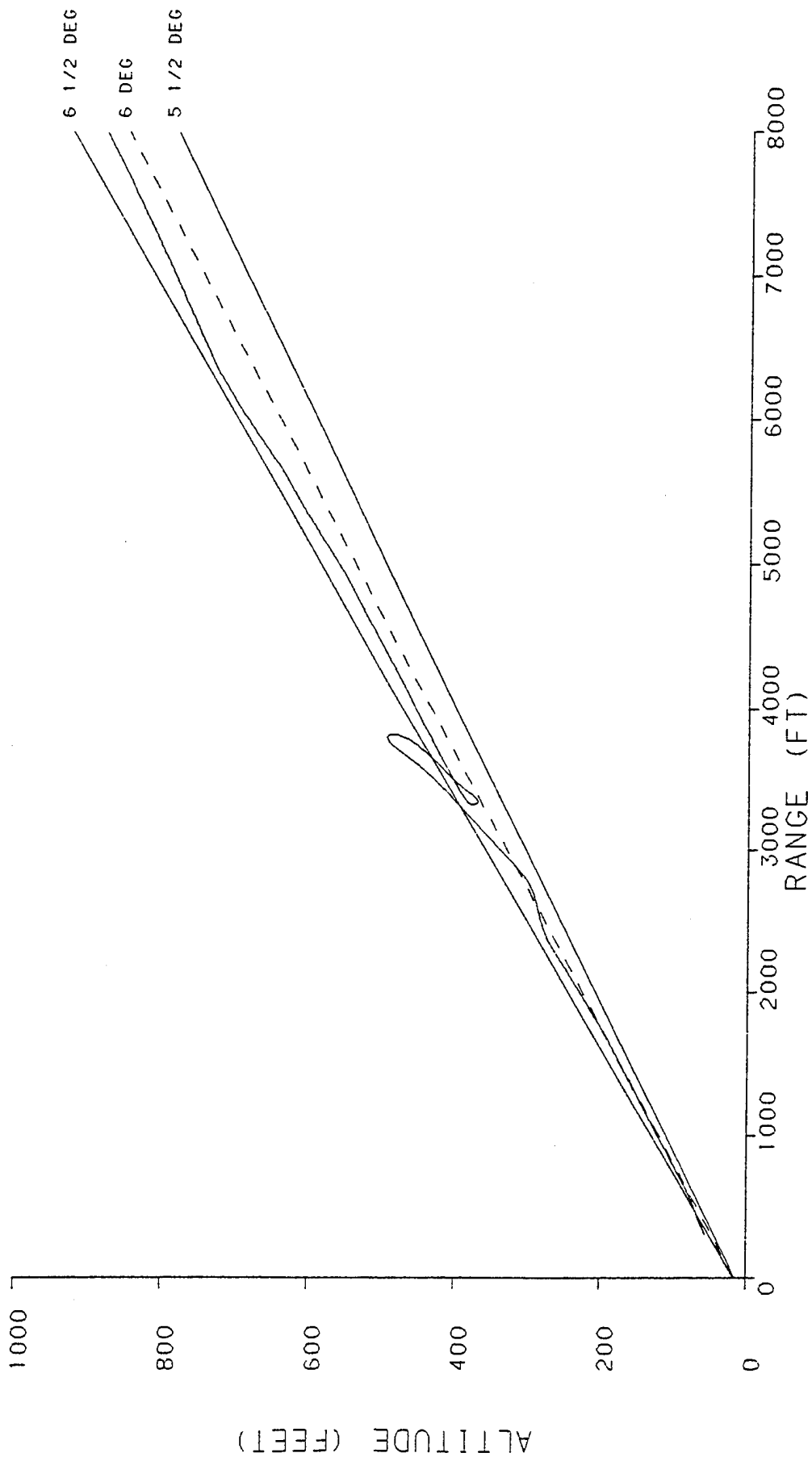
RUN #2  
4/14/93 AM PAPI 6.0 DEG CENTERLINE APPROACH  
AZIMUTH : 0.00 ELEVATION : 6.00  
TRACKER DATA

DATA PROCESSED BY THE FAA TECHNICAL CENTER  
ATLANTIC CITY AIRPORT, N J 08405  
16-SEP-1994 13:45



RUN #3  
4/14/93 AM PAPJ 6.0 DEG CENTERLINE APPROACH  
AZIMUTH : 0.00 ELEVATION : 6.00  
TRACKER DATA

DATA PROCESSED BY THE FAA TECHNICAL CENTER  
ATLANTIC CITY AIRPORT, NJ 08405  
16-SEP-1994 13:46



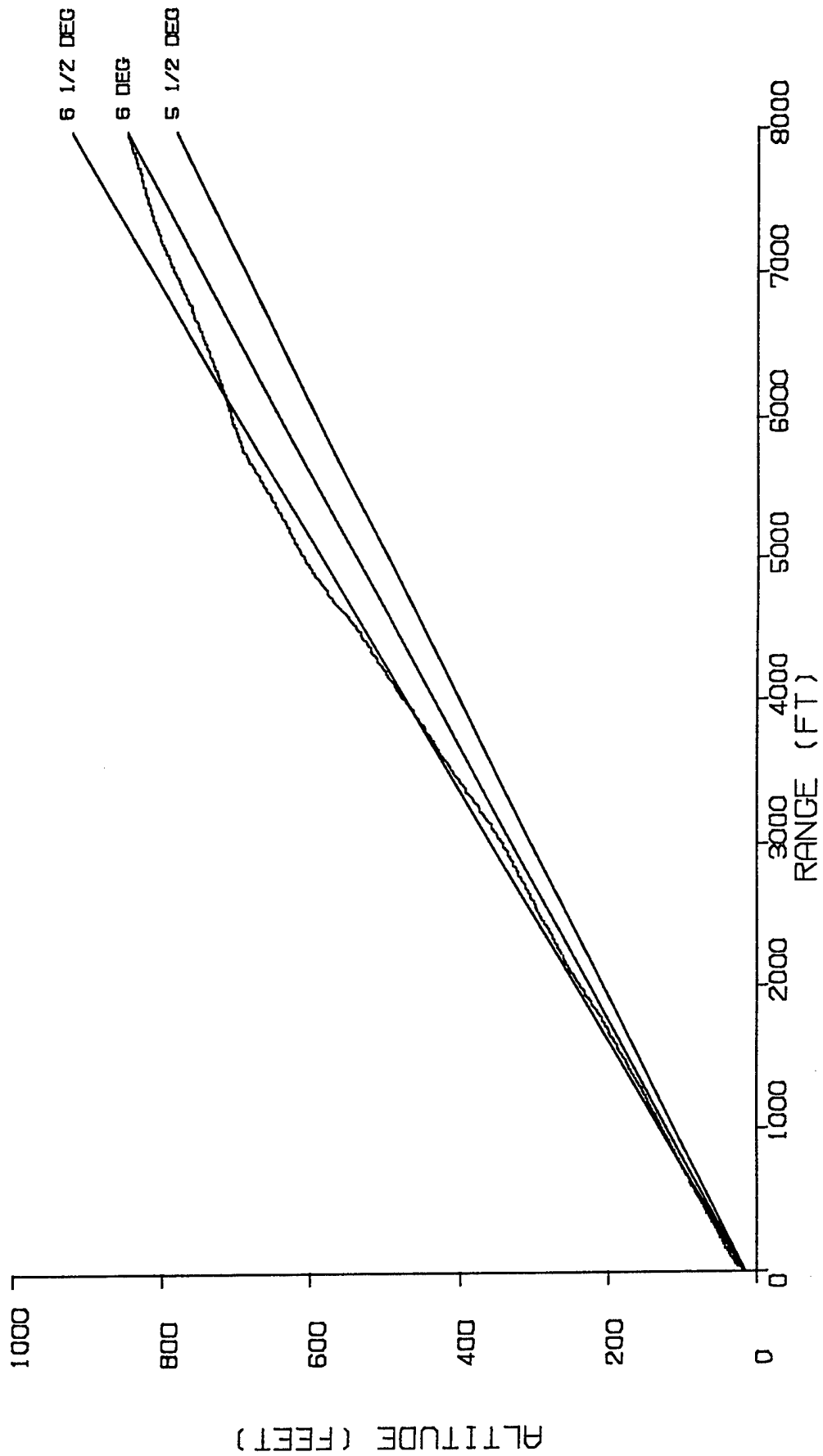
RUN #4

4/14/93 AM PAP1 6.0 DEG CENTERLINE APPROACH

AZIMUTH : 0.00 ELEVATION : 6.00

TRACKER DATA

DATA PROCESSED BY THE FAA TECHNICAL CENTER  
ATLANTIC CITY AIRPORT, N J 08405  
14-NOV-1995 11:07



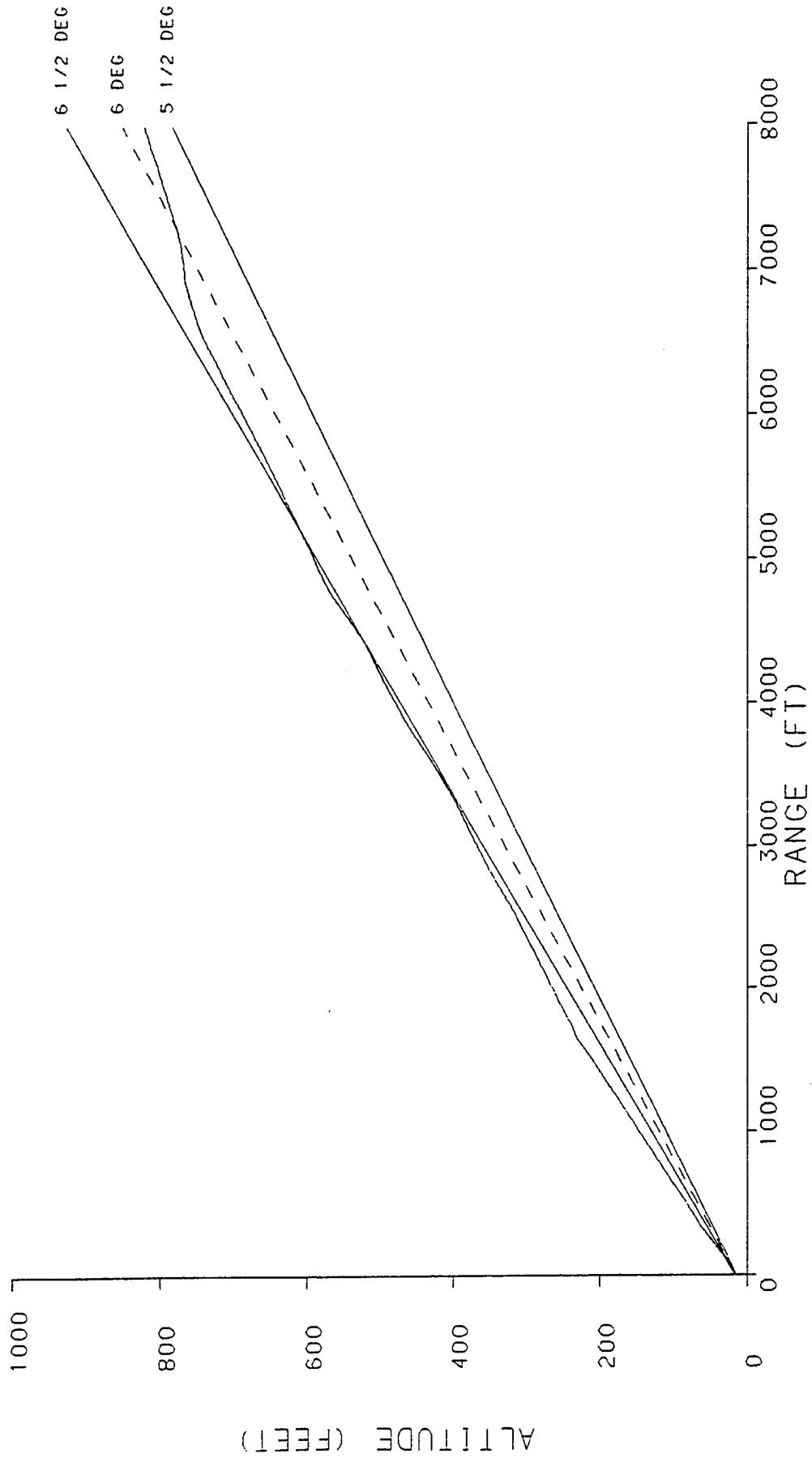
RUN #5

4/14/93 AM CHAP1 6.0 DEG CENTERLINE APPROACH

AZIMUTH : 0.00 ELEVATION : 6.00

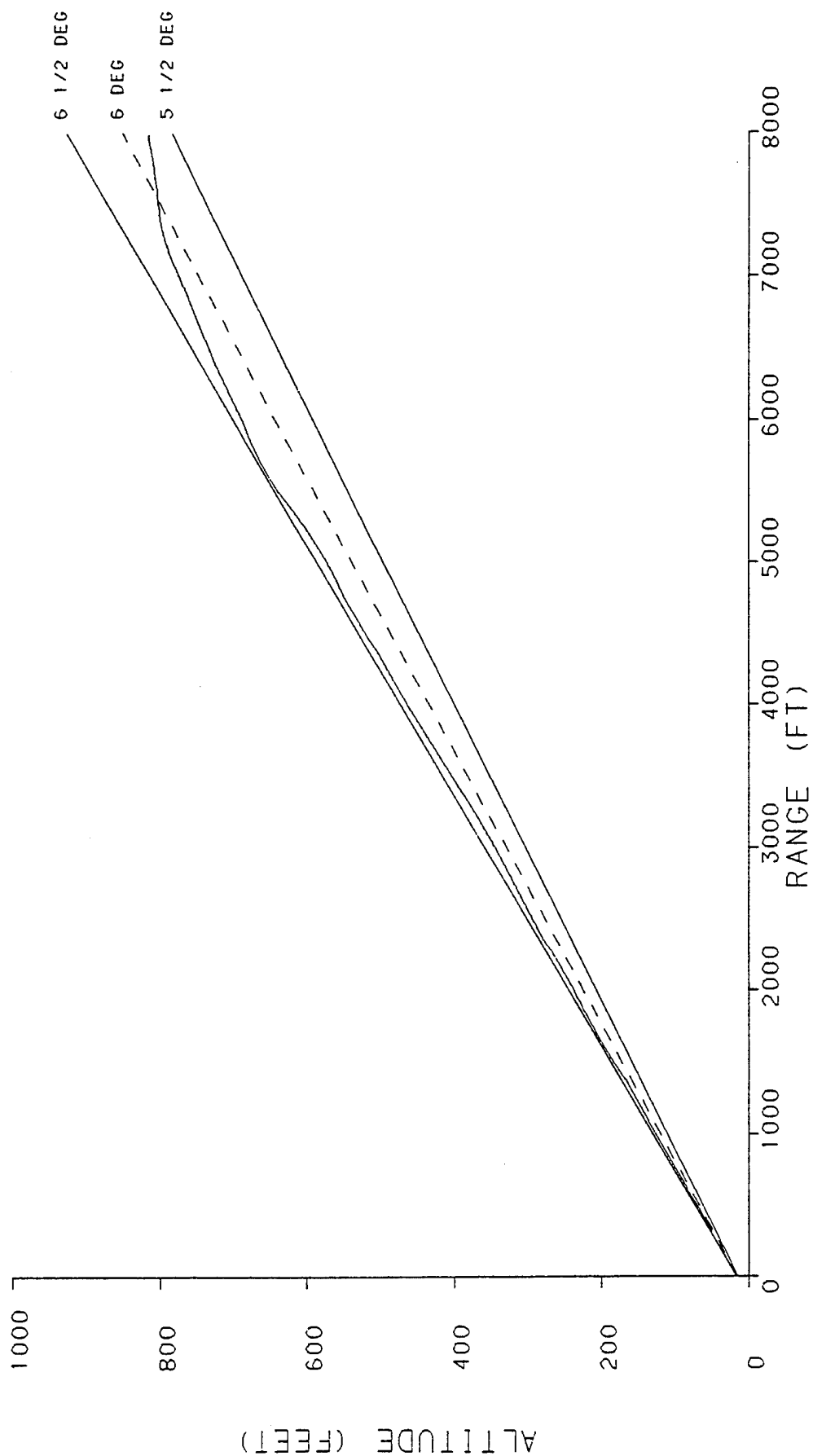
TRACKER DATA

DATA PROCESSED BY THE FAA TECHNICAL CENTER  
ATLANTIC CITY AIRPORT, N J 08405  
16-SEP-1994 13:48



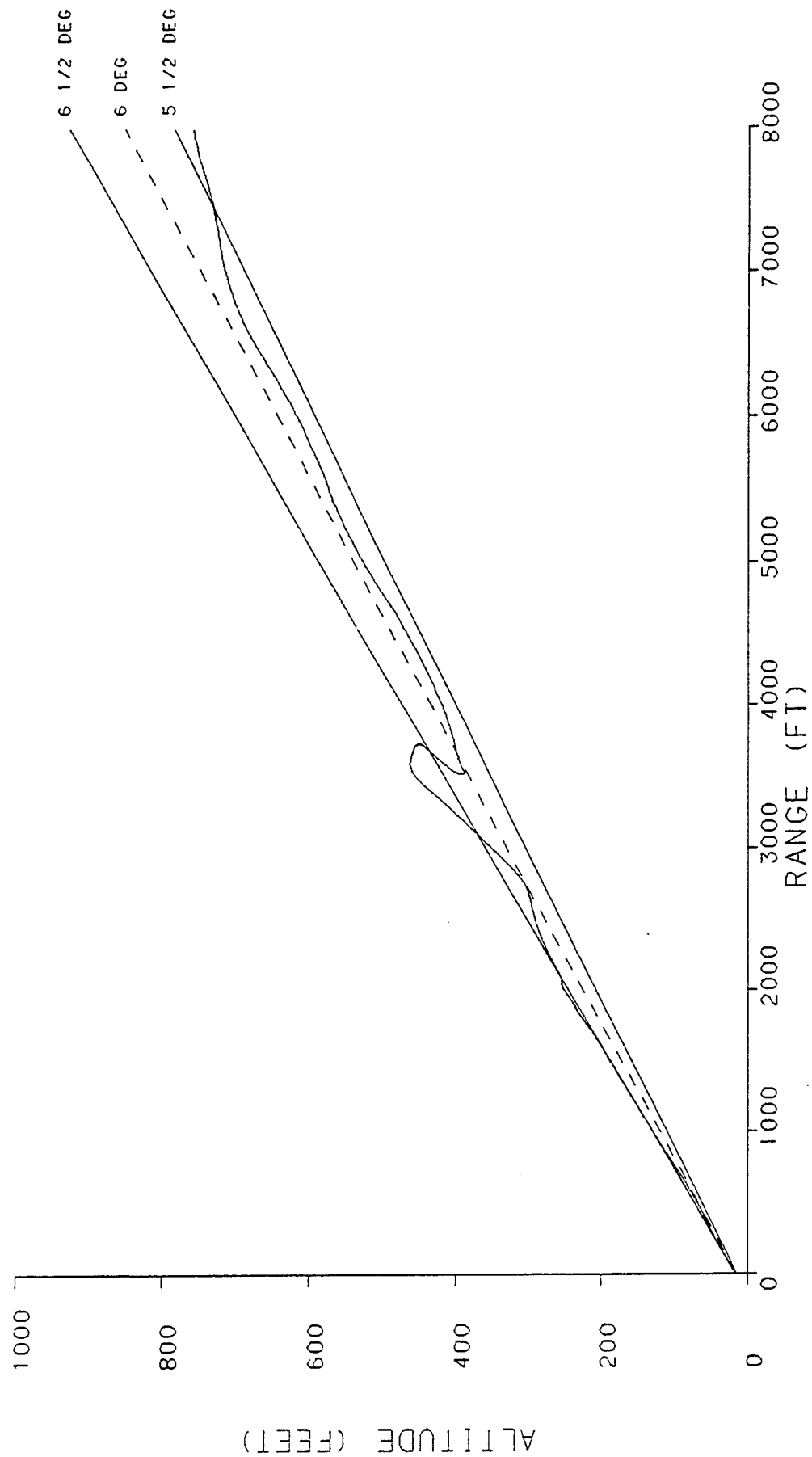
RUN #6  
4/14/93 AM CHAPI 6.0 DEG CENTERLINE APPROACH  
AZIMUTH : 0.00 ELEVATION : 6.00  
TRACKER DATA

DATA PROCESSED BY THE FAA TECHNICAL CENTER  
ATLANTIC CITY AIRPORT, N J 08405  
16-SEP-1994 13:49



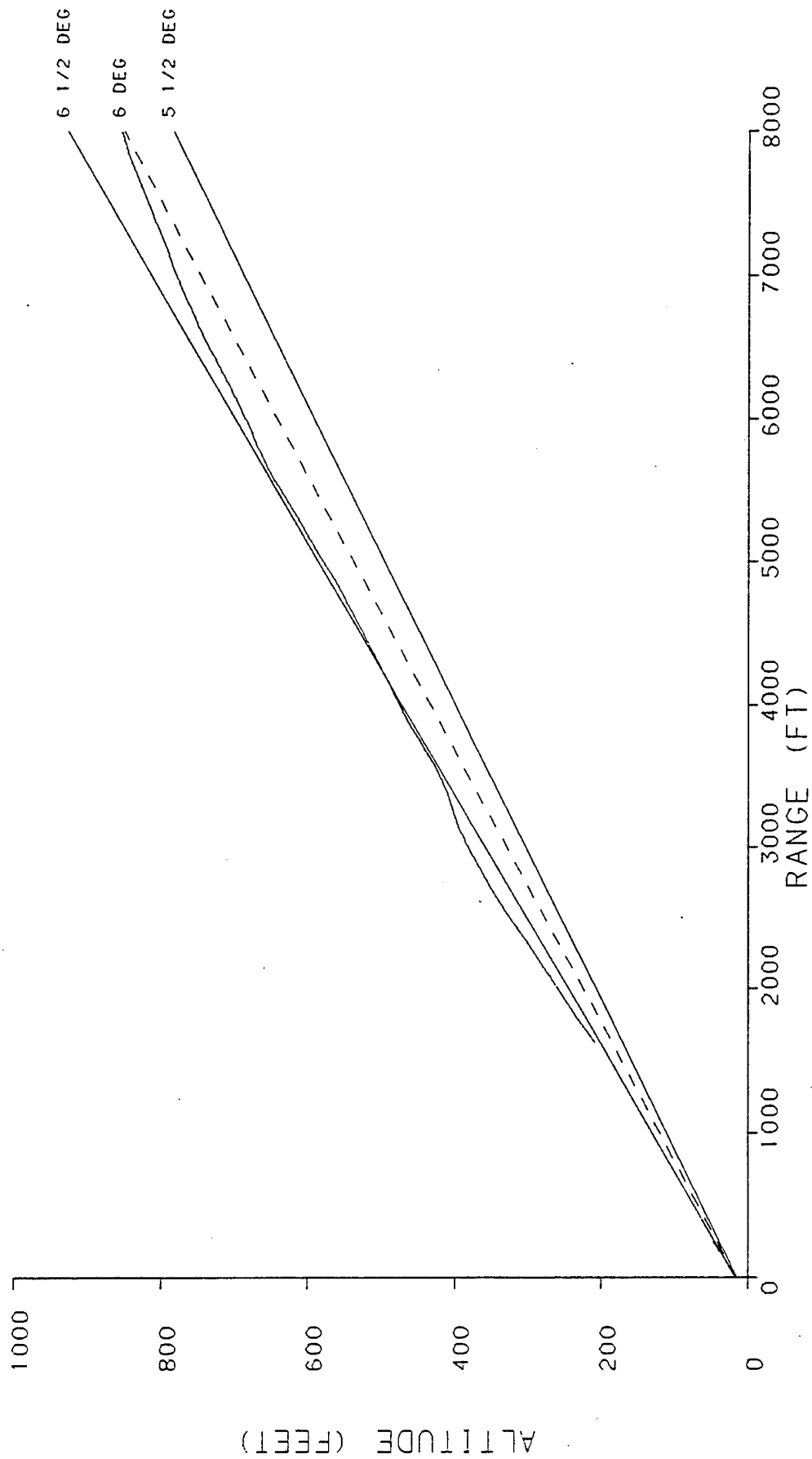
RUN #7  
4/14/93 AM CHAP1 6.0 DEG CENTERLINE APPROACH  
AZIMUTH : 0.00 ELEVATION : 6.00  
TRACKER DATA

DATA PROCESSED BY THE FAA TECHNICAL CENTER  
ATLANTIC CITY AIRPORT, N J 08405  
16-SEP-1994 13:50



RUN #8  
4/14/93 AM CHAP1 6.0 DEG CENTERLINE APPROACH  
AZIMUTH : 0.00 ELEVATION : 6.00  
TRACKER DATA

DATA PROCESSED BY THE FAA TECHNICAL CENTER  
ATLANTIC CITY AIRPORT, N J 08405  
16-SEP-1994 13:51



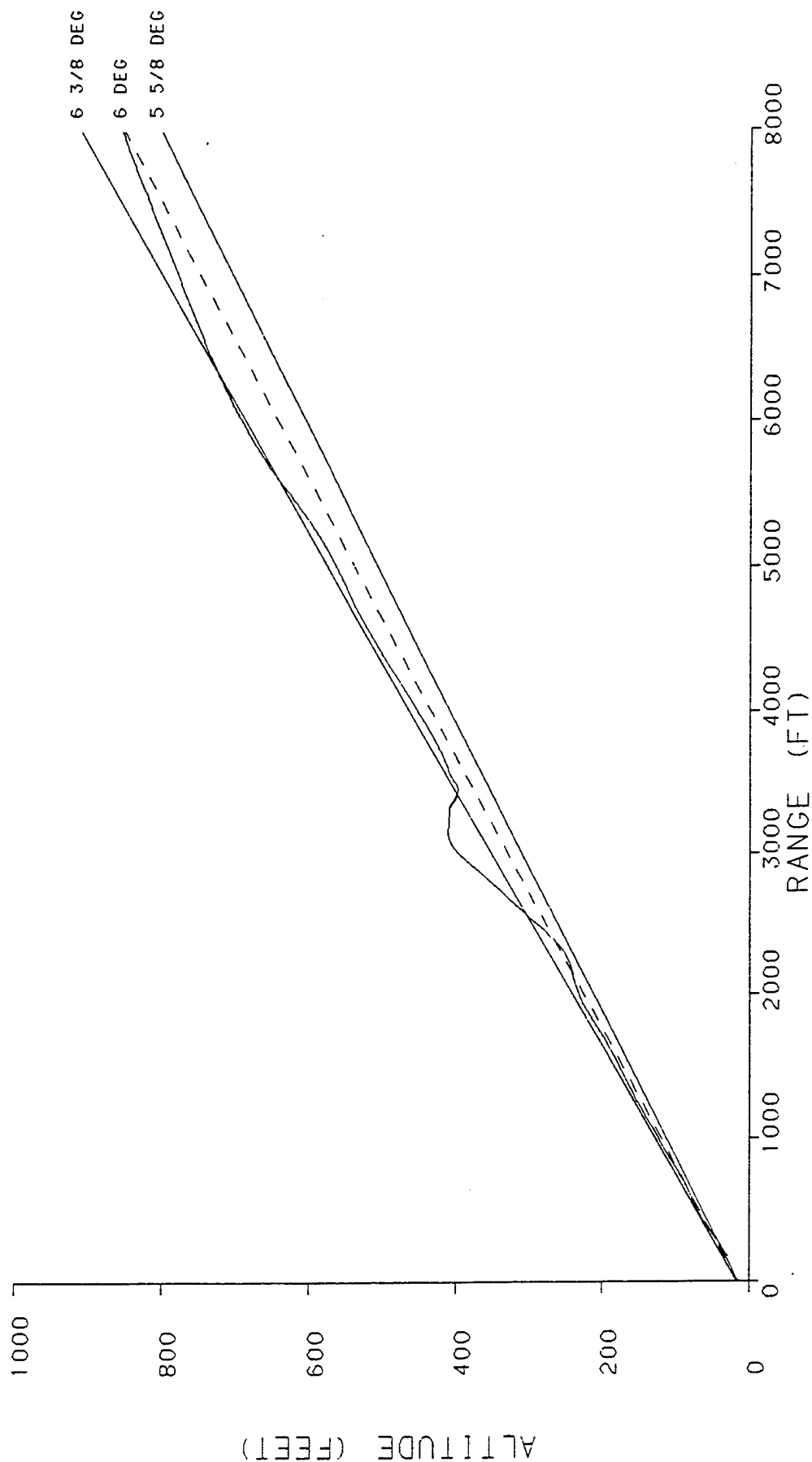
RUN #9

4/14/93 AM HAP1 6.0 DEG CENTERLINE APPROACH

AZIMUTH : 0.00 ELEVATION : 6.00

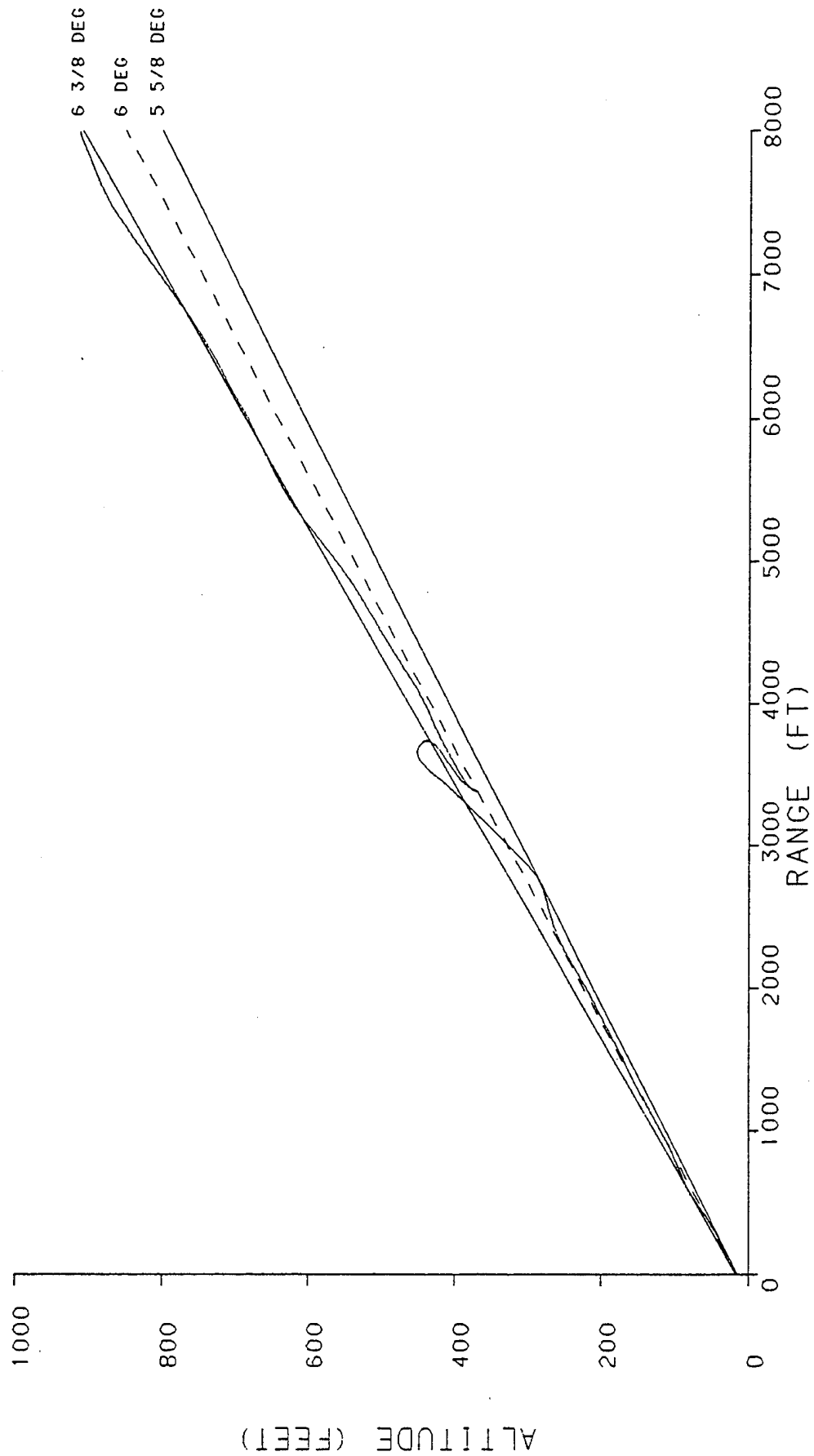
TRACKER DATA

DATA PROCESSED BY THE FAA TECHNICAL CENTER  
ATLANTIC CITY AIRPORT, N J 08405  
16-SEP-1994 13152



RUN #10  
 4/14/93 AM IAPJ 6.0 DEG CENTERLINE APPROACH  
 AZIMUTH : 0.00 ELEVATION : 6.00  
 TRACKER DATA

DATA PROCESSED BY THE FAA TECHNICAL CENTER  
 ATLANTIC CITY AIRPORT, N J 08405  
 16-SEP-1994 13:53



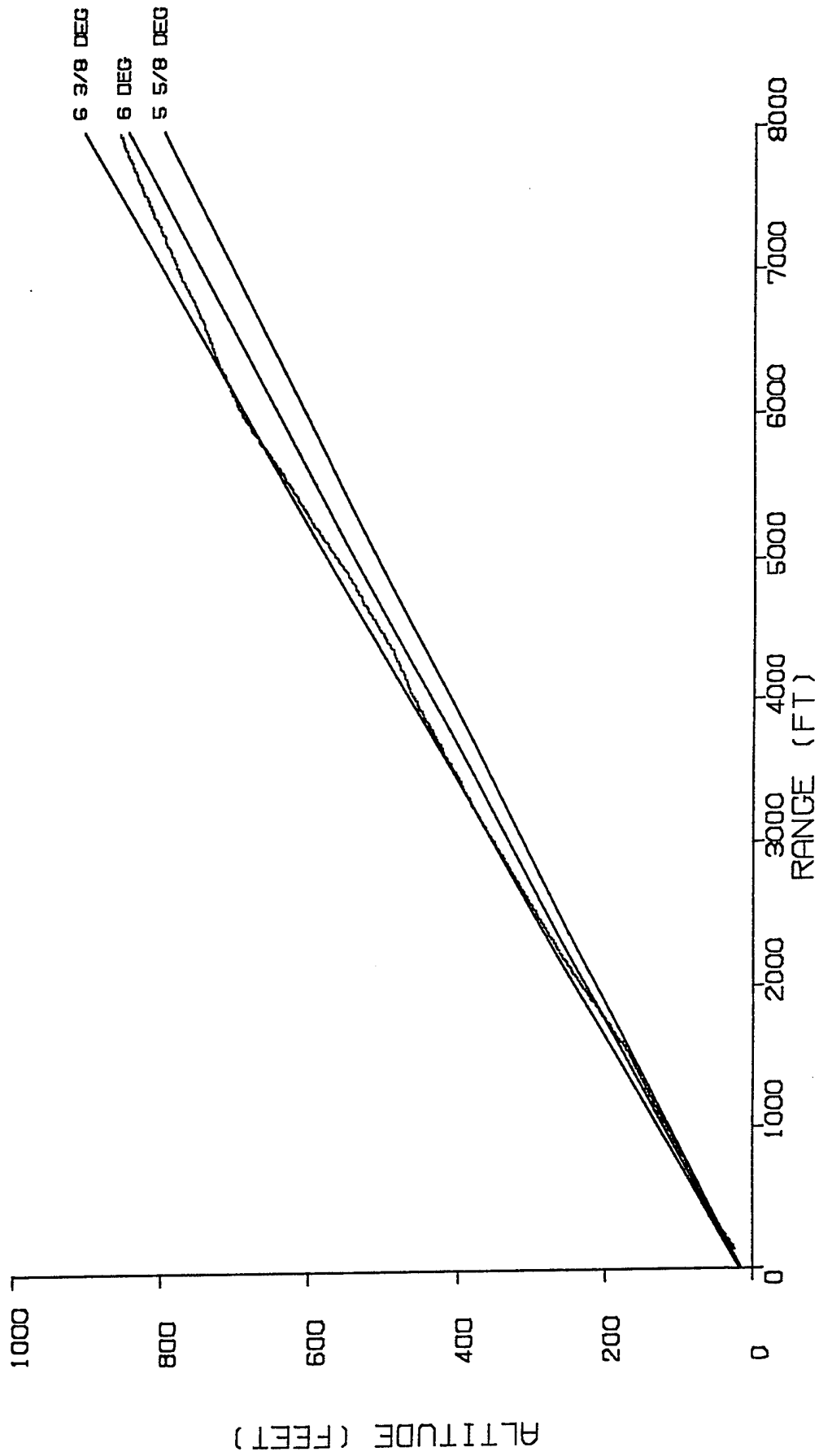
RUN #11

4/14/93 AM HAPI 6.0 DEG CENTERLINE APPROACH

AZIMUTH : 0.00 ELEVATION : 6.00

TRACKER DATA

DATA PROCESSED BY THE FAA TECHNICAL CENTER  
ATLANTIC CITY AIRPORT, N J 08405  
14-NOV-1996 11:09



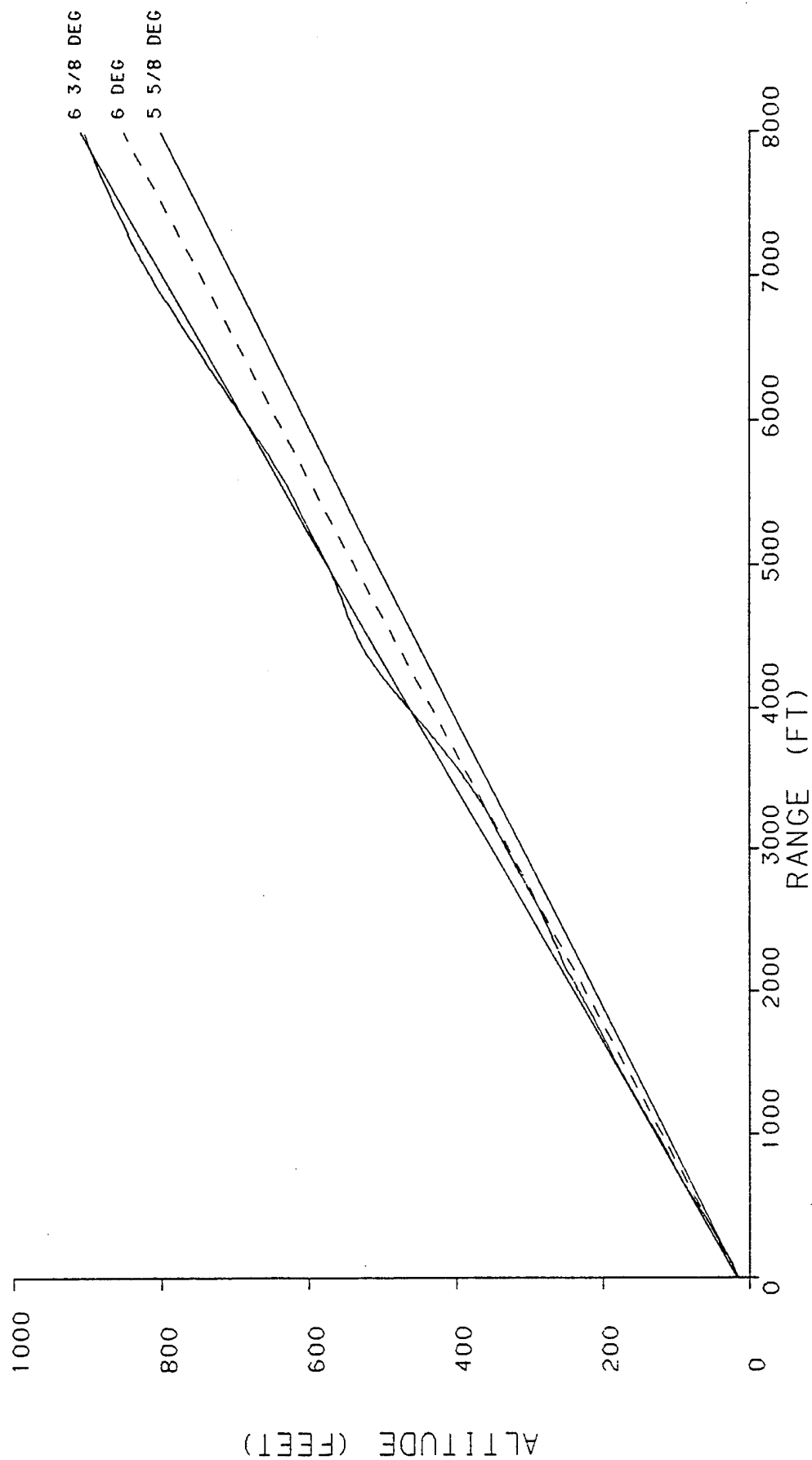
RUN #12

4/14/93 AM HAPI 6.0 DEG CENTERLINE APPROACH

AZIMUTH : 0.00 ELEVATION : 6.00

TRACKER DATA

DATA PROCESSED BY THE FAA TECHNICAL CENTER  
ATLANTIC CITY AIRPORT. N J 08405  
16-SEP-1994 13:55



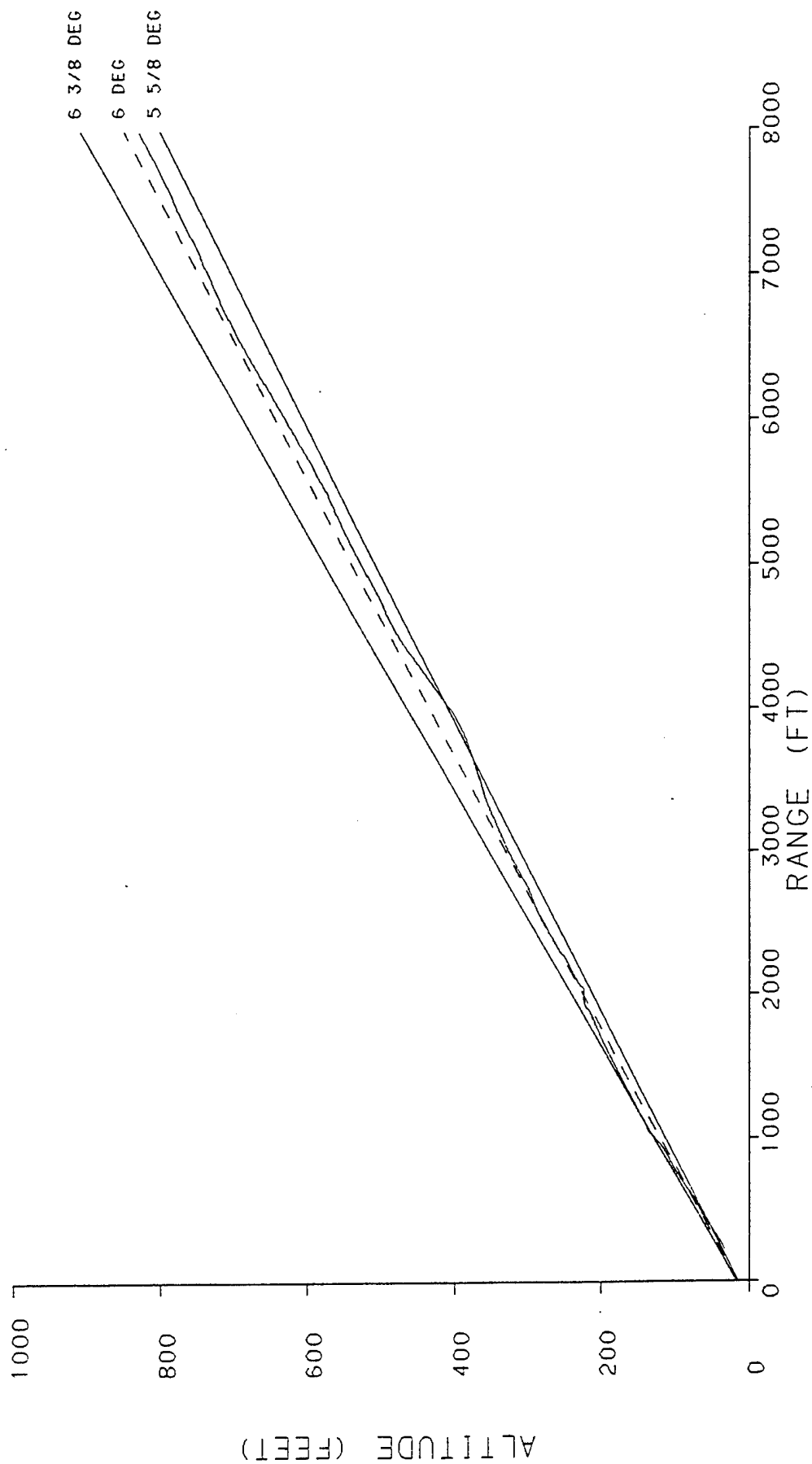
RUN #1

4/14/93 PM HAP1 6.0 DEG CENTERLINE APPROACH

AZIMUTH : 0.00 ELEVATION : 6.00

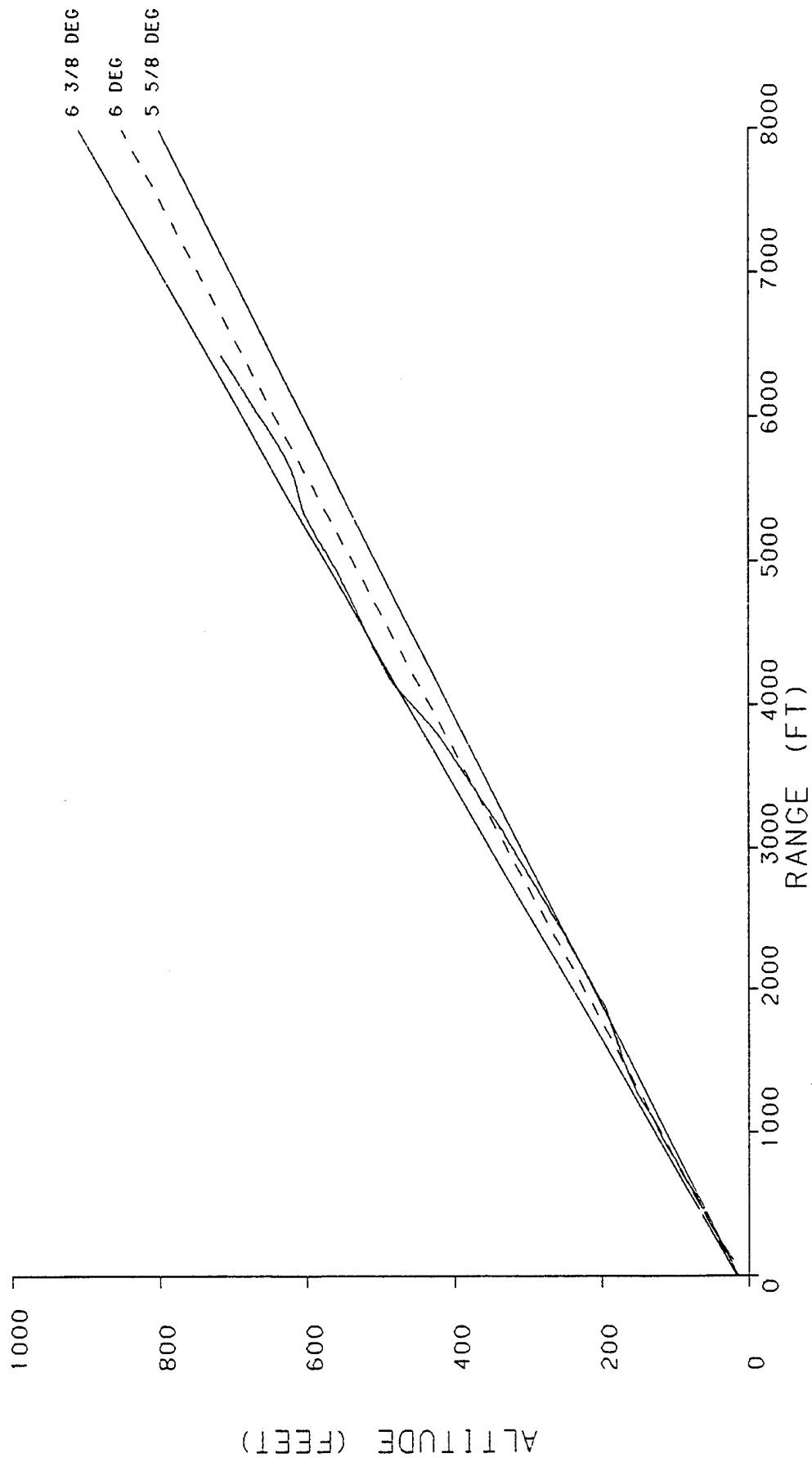
TRACKER DATA

DATA PROCESSED BY THE FAA TECHNICAL CENTER  
ATLANTIC CITY AIRPORT. N J 08405  
16-SEP-1994 14:10



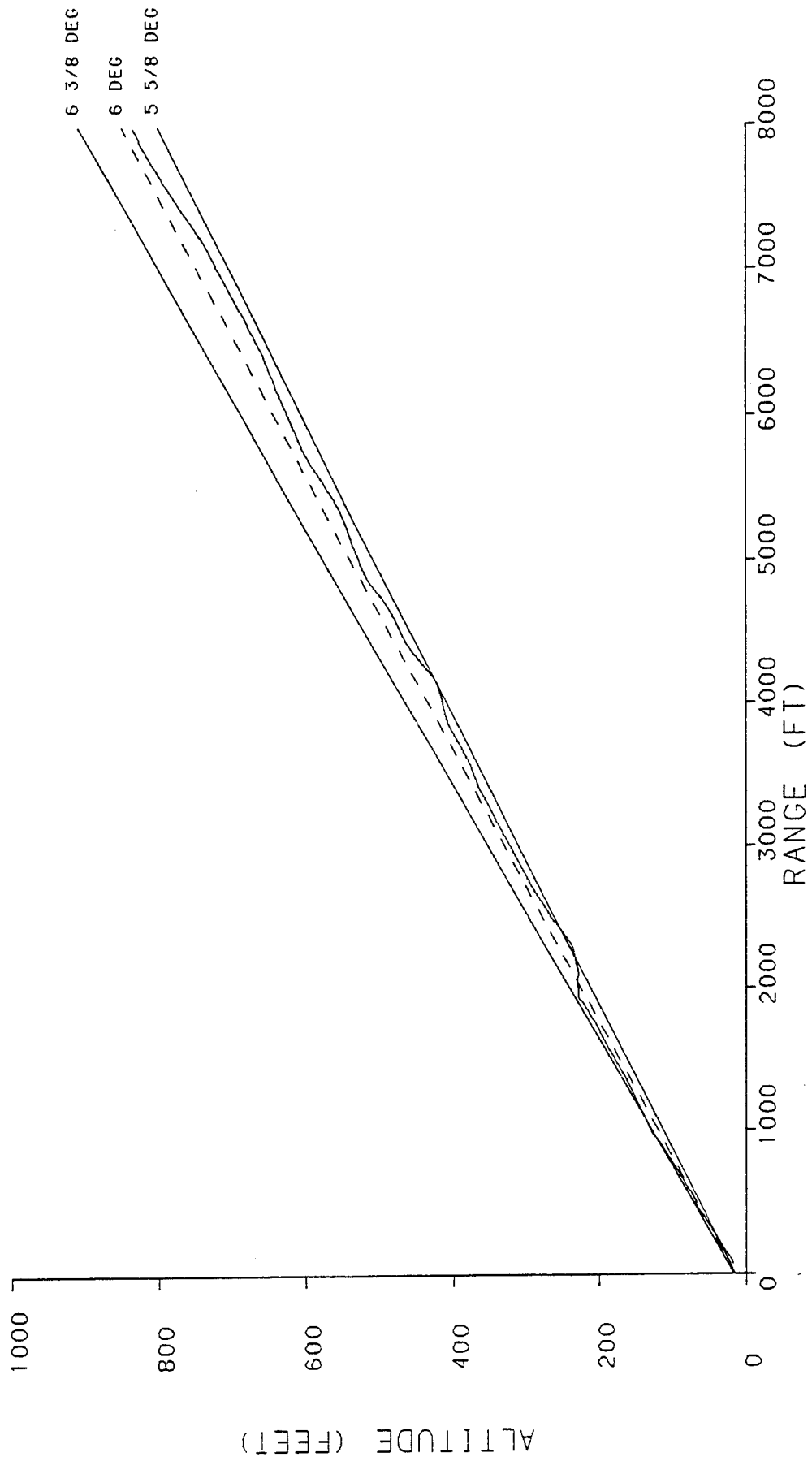
RUN #2  
4/14/93 PM HAPJ 6.0 DEG CENTERLINE APPROACH  
AZIMUTH : 0.00 ELEVATION : 6.00  
TRACKER DATA

DATA PROCESSED BY THE FAA TECHNICAL CENTER  
ATLANTIC CITY AIRPORT, N J 08405  
16-SEP-1994 14:10



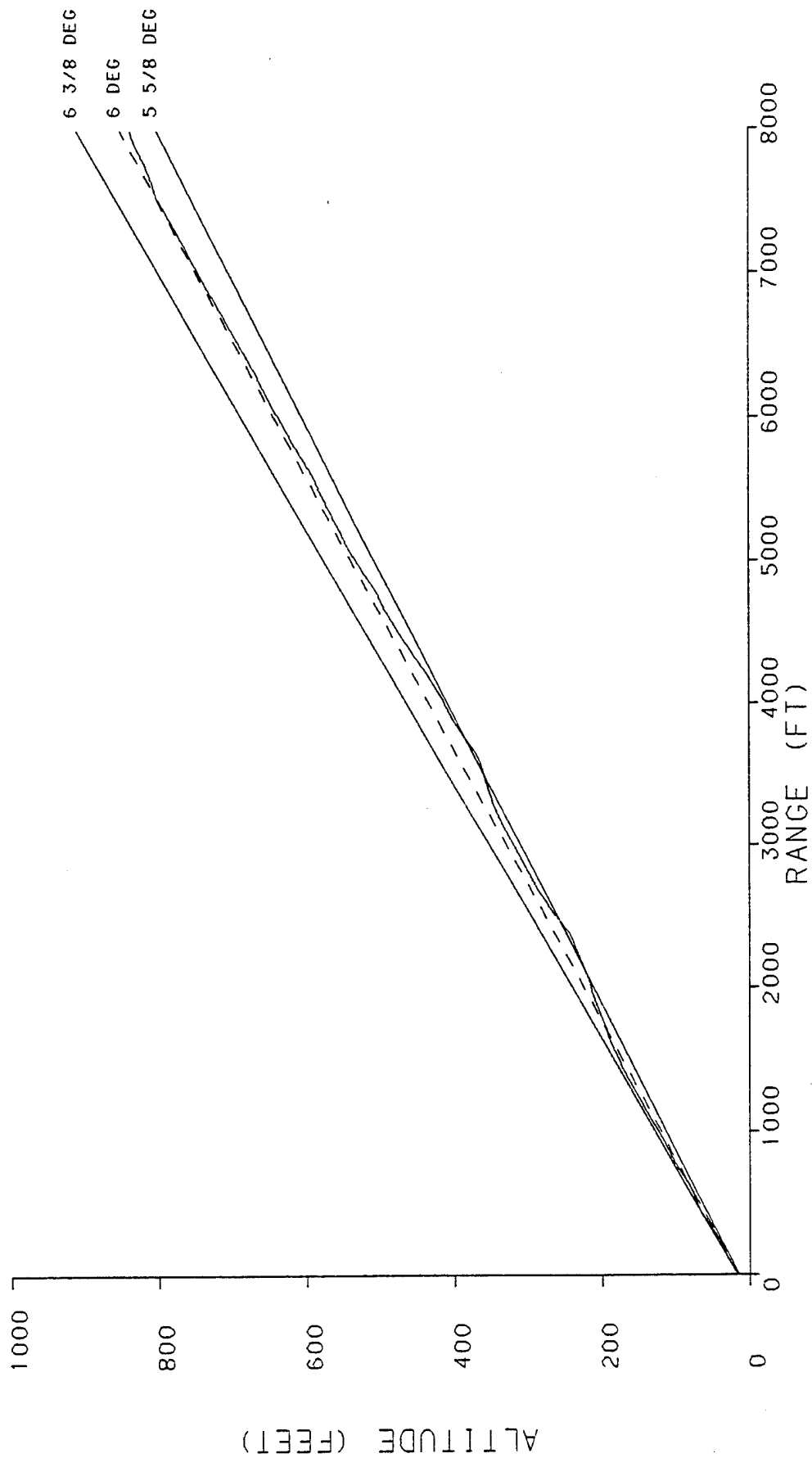
DATA PROCESSED BY THE FAA TECHNICAL CENTER  
ATLANTIC CITY AIRPORT, N J 08403  
16-SEP-1994 14:11

RUN #3  
4/14/93 PM HAPI 6.0 DEG CENTERLINE APPROACH  
AZIMUTH : 0.00 ELEVATION : 6.00  
TRACKER DATA



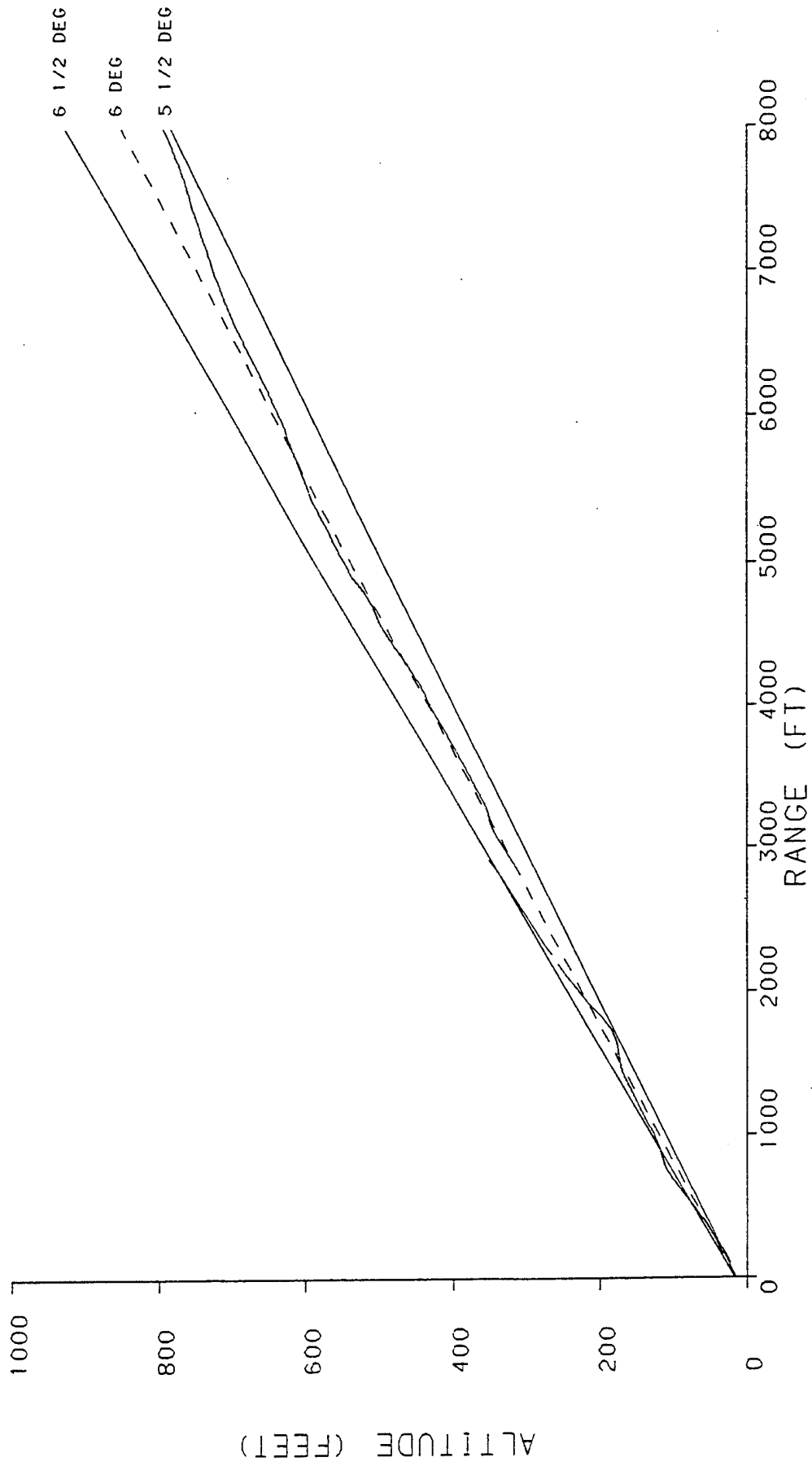
DATA PROCESSED BY THE FAA TECHNICAL CENTER  
ATLANTIC CITY AIRPORT, N J 08405  
16-SEP-1994 14:12

RUN #4  
4/14/93 PM HAPJ 6.0 DEG CENTERLINE APPROACH  
AZIMUTH : 0.00 ELEVATION : 6.00  
TRACKER DATA



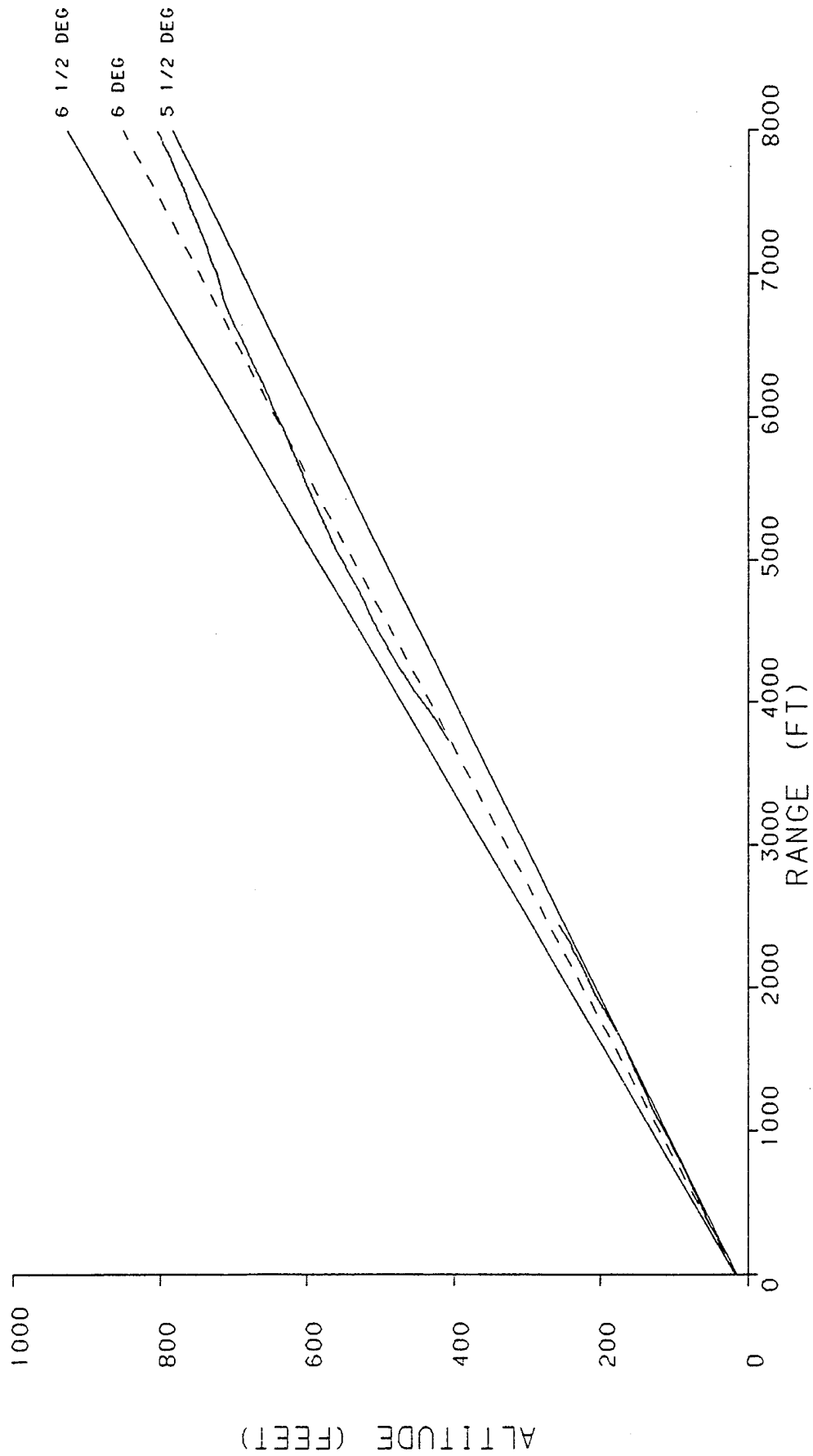
DATA PROCESSED BY THE FAA TECHNICAL CENTER  
ATLANTIC CITY AIRPORT, NJ 08405  
16-SEP-1994 14:13

RUN #5  
4/14/93 PM PAPI 6.0 DEG CENTERLINE APPROACH  
AZIMUTH : 0.00 ELEVATION : 6.00  
TRACKER DATA



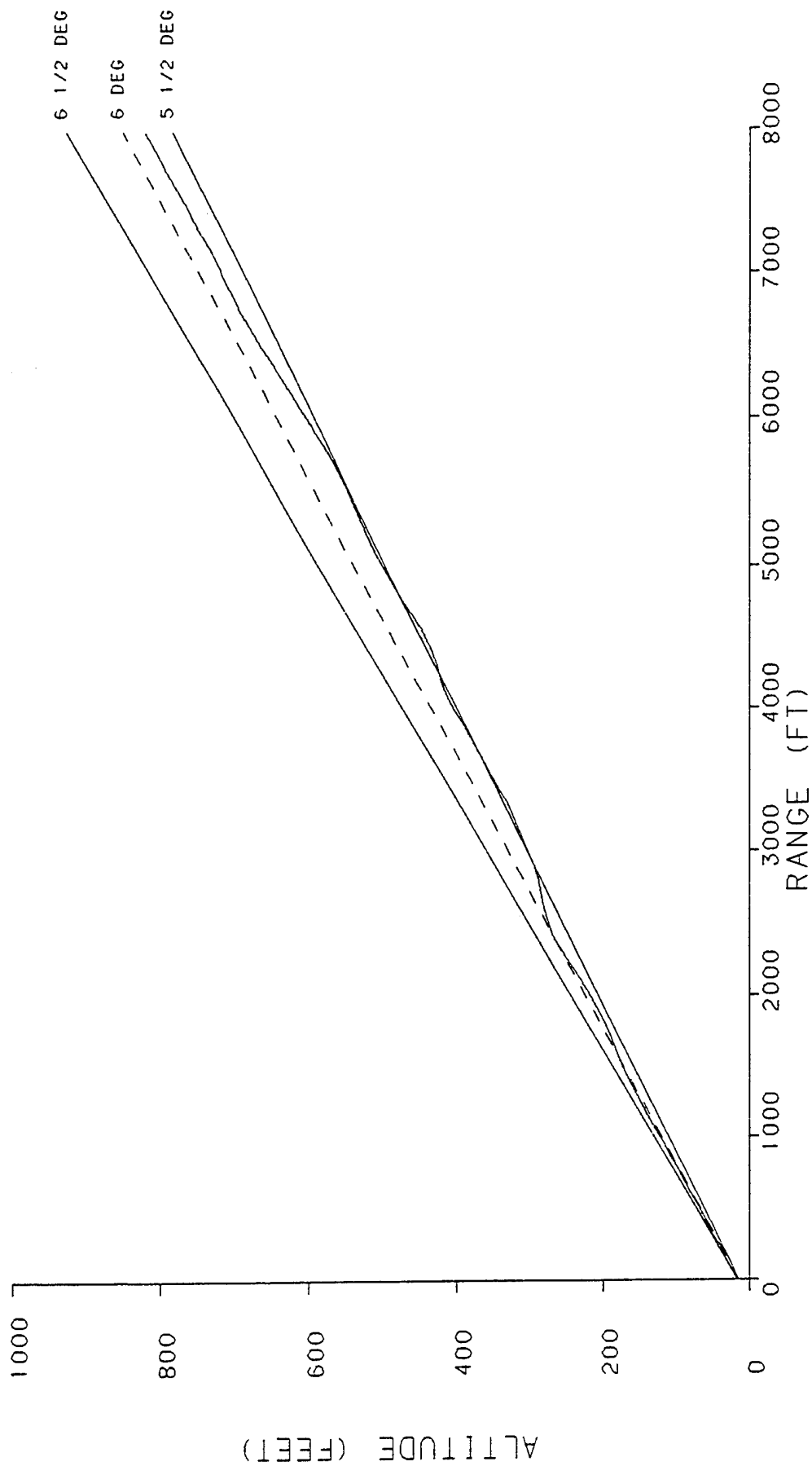
RUN #6  
4/14/93 PM PAPJ 6.0 DEG CENTERLINE APPROACH  
AZIMUTH : 0.00 ELEVATION : 6.00  
TRACKER DATA

DATA PROCESSED BY THE FAA TECHNICAL CENTER  
ATLANTIC CITY AIRPORT, N J 08405  
16-SEP-1994 14:14



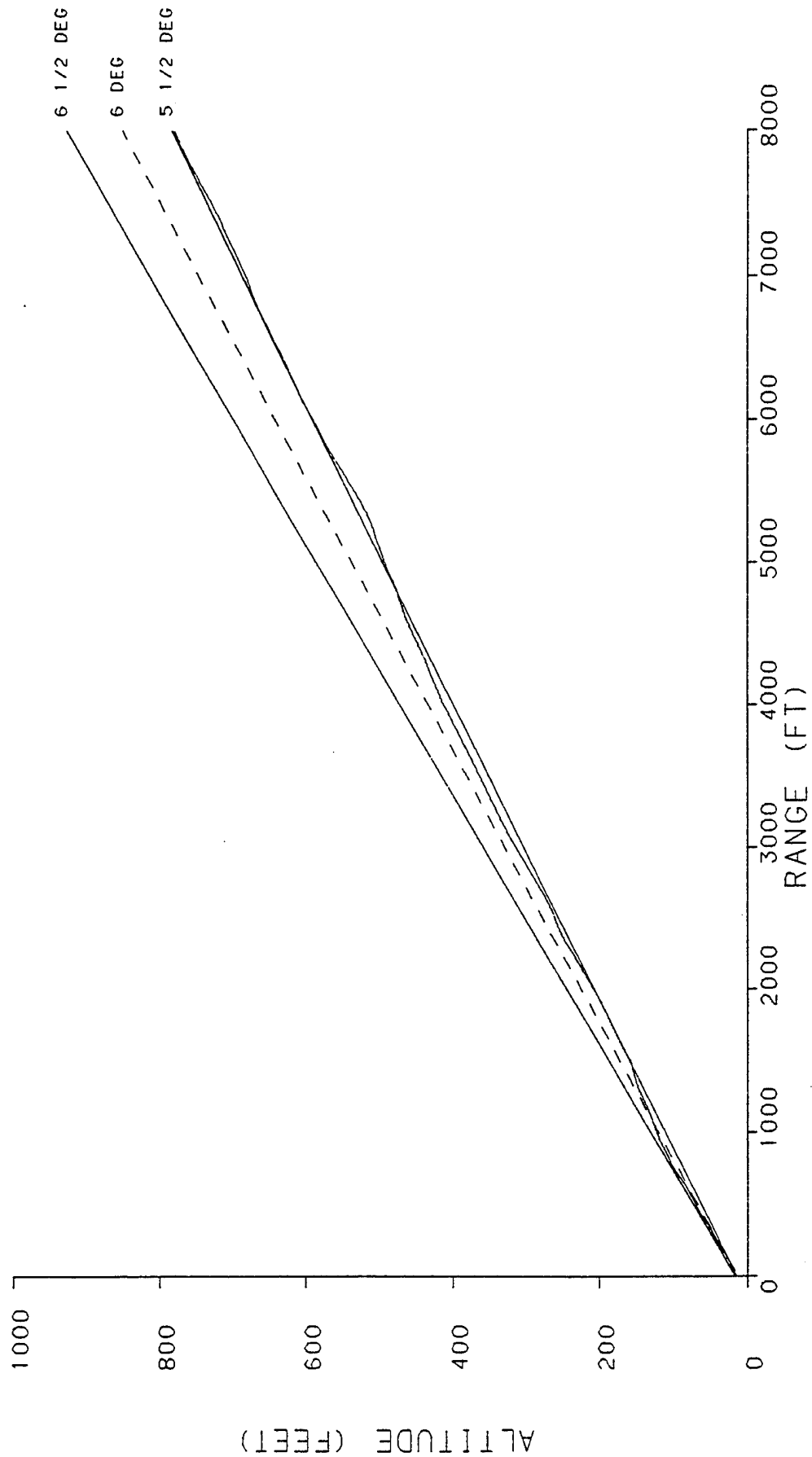
RUN #7  
4/14/93 PM PAP1 6.0 DEG CENTERLINE APPROACH  
AZIMUTH : 0.00 ELEVATION : 6.00  
TRACKER DATA

DATA PROCESSED BY THE FAA TECHNICAL CENTER  
ATLANTIC CITY AIRPORT, N J 08405  
16-SEP-1994 14:15



RUN #8  
4/14/93 PM PAPI 6.0 DEG CENTERLINE APPROACH  
AZIMUTH : 0.00 ELEVATION : 6.00  
TRACKER DATA

DATA PROCESSED BY THE FAA TECHNICAL CENTER  
ATLANTIC CITY AIRPORT, N J 08405  
16-SEP-1994 14:16



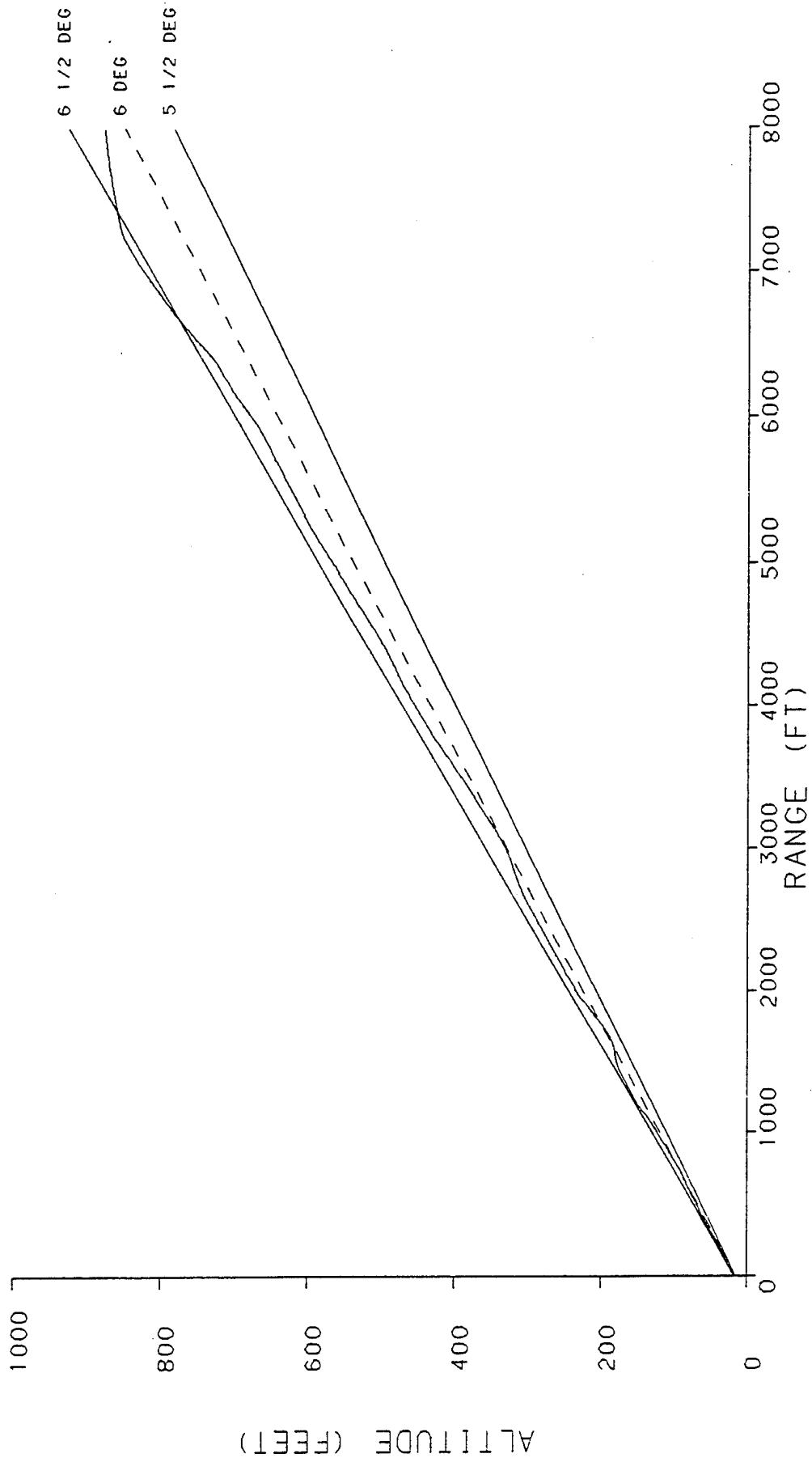
RUN #9

4/14/93 PM CHAP1 6.0 DEG CENTERLINE APPROACH

AZIMUTH : 0.00 ELEVATION : 6.00

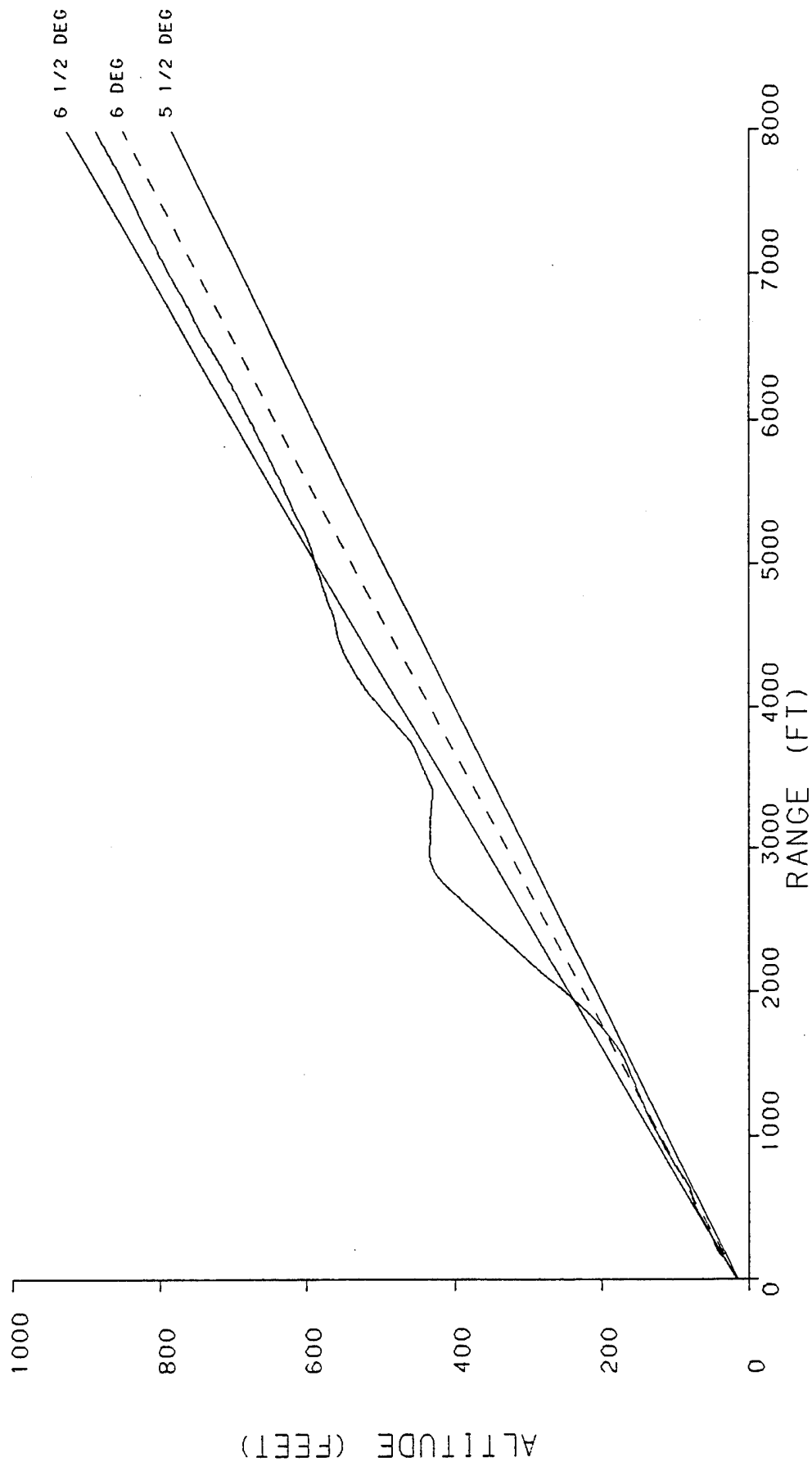
TRACKER DATA

DATA PROCESSED BY THE FAA TECHNICAL CENTER  
ATLANTIC CITY AIRPORT, N J 08405  
16-SEP-1994 14:17



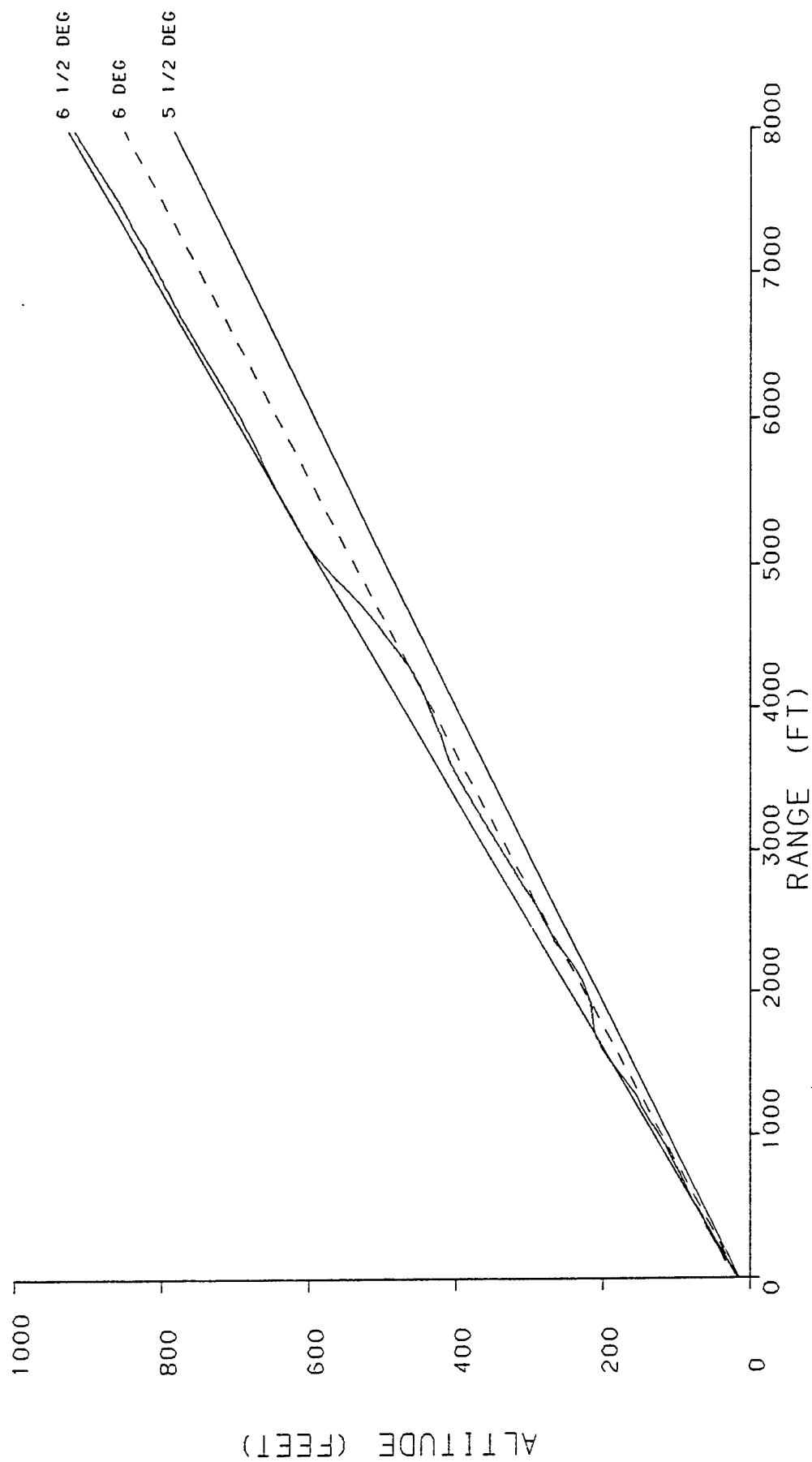
RUN #10  
4/14/93 PM CHAP1 6.0 DEG CENTERLINE APPROACH  
AZIMUTH : 0.00 ELEVATION : 6.00  
TRACKER DATA

DATA PROCESSED BY THE FAA TECHNICAL CENTER  
ATLANTIC CITY AIRPORT, N J 08405  
16-SEP-1994 14:54



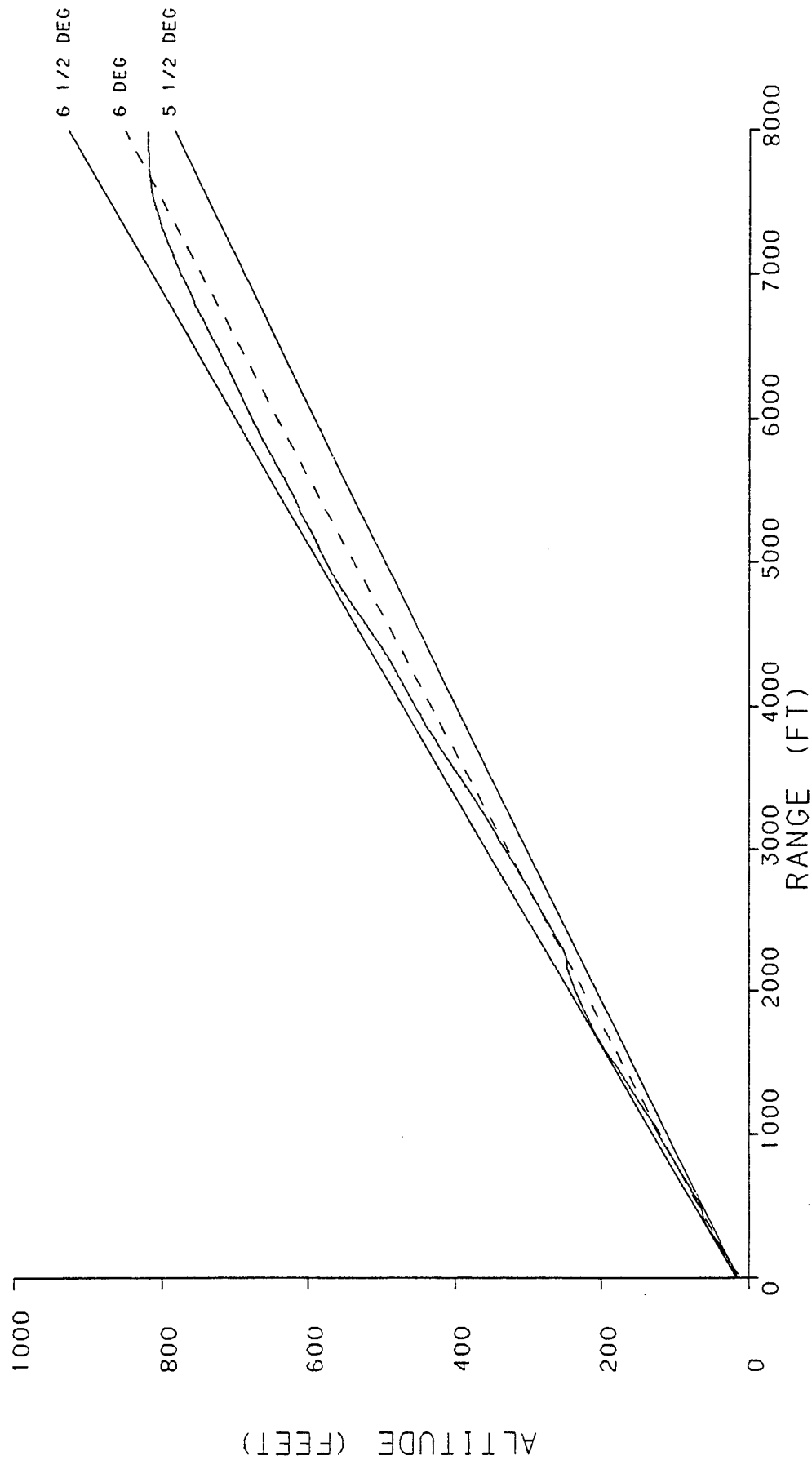
RUN #11  
4/14/93 PM CHAP1 6.0 DEG CENTERLINE APPROACH  
AZIMUTH : 0.00 ELEVATION : 6.00  
TRACKER DATA

DATA PROCESSED BY THE FAA TECHNICAL CENTER  
ATLANTIC CITY AIRPORT, N J 08405  
16-SEP-1994 14:54



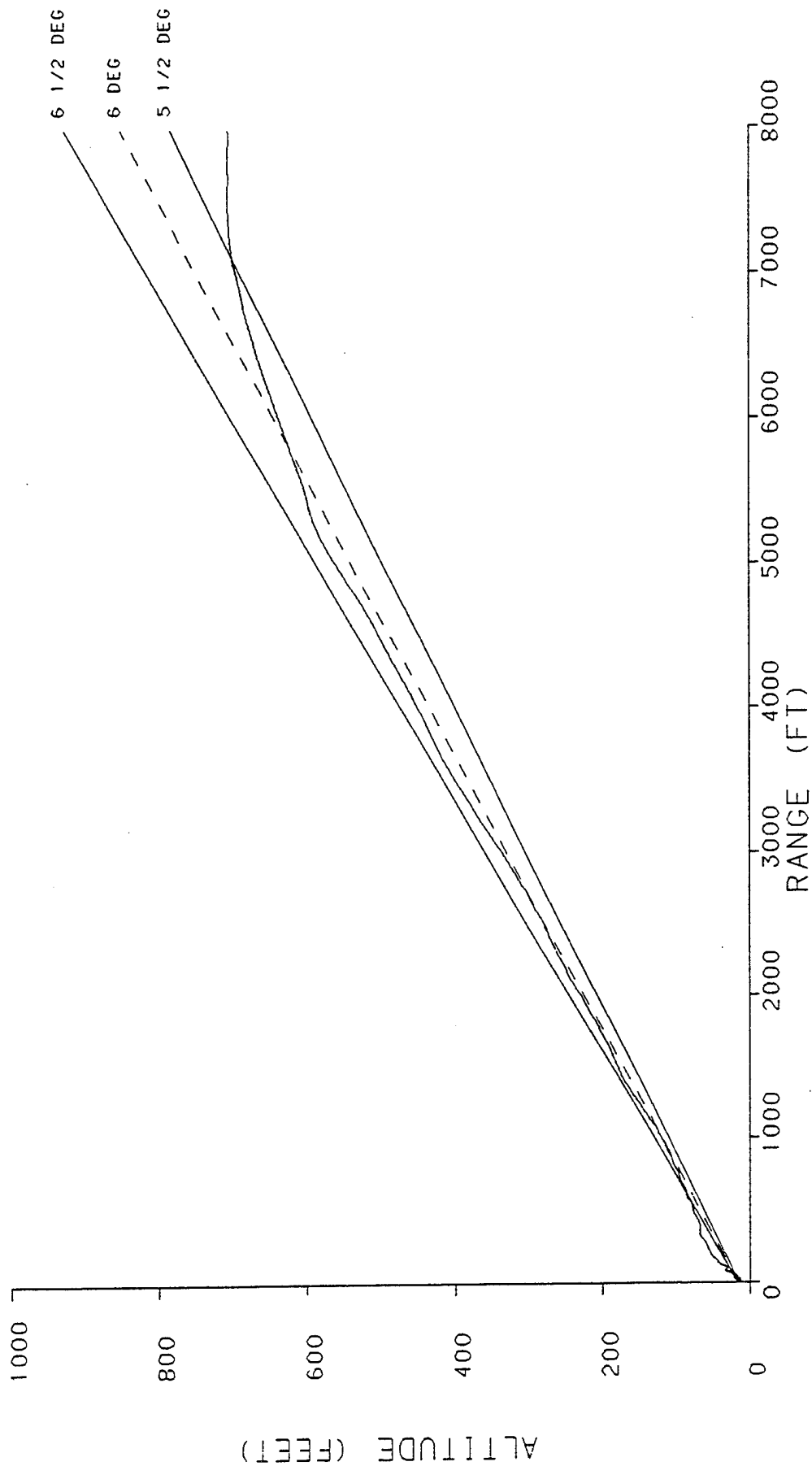
RUN #12  
4/14/93 PM CHAP1 6.0 DEG CENTERLINE APPROACH  
AZIMUTH : 0.00 ELEVATION : 6.00  
TRACKER DATA

DATA PROCESSED BY THE FAA TECHNICAL CENTER  
ATLANTIC CITY AIRPORT, N J 08405  
16-SEP-1994 14:55



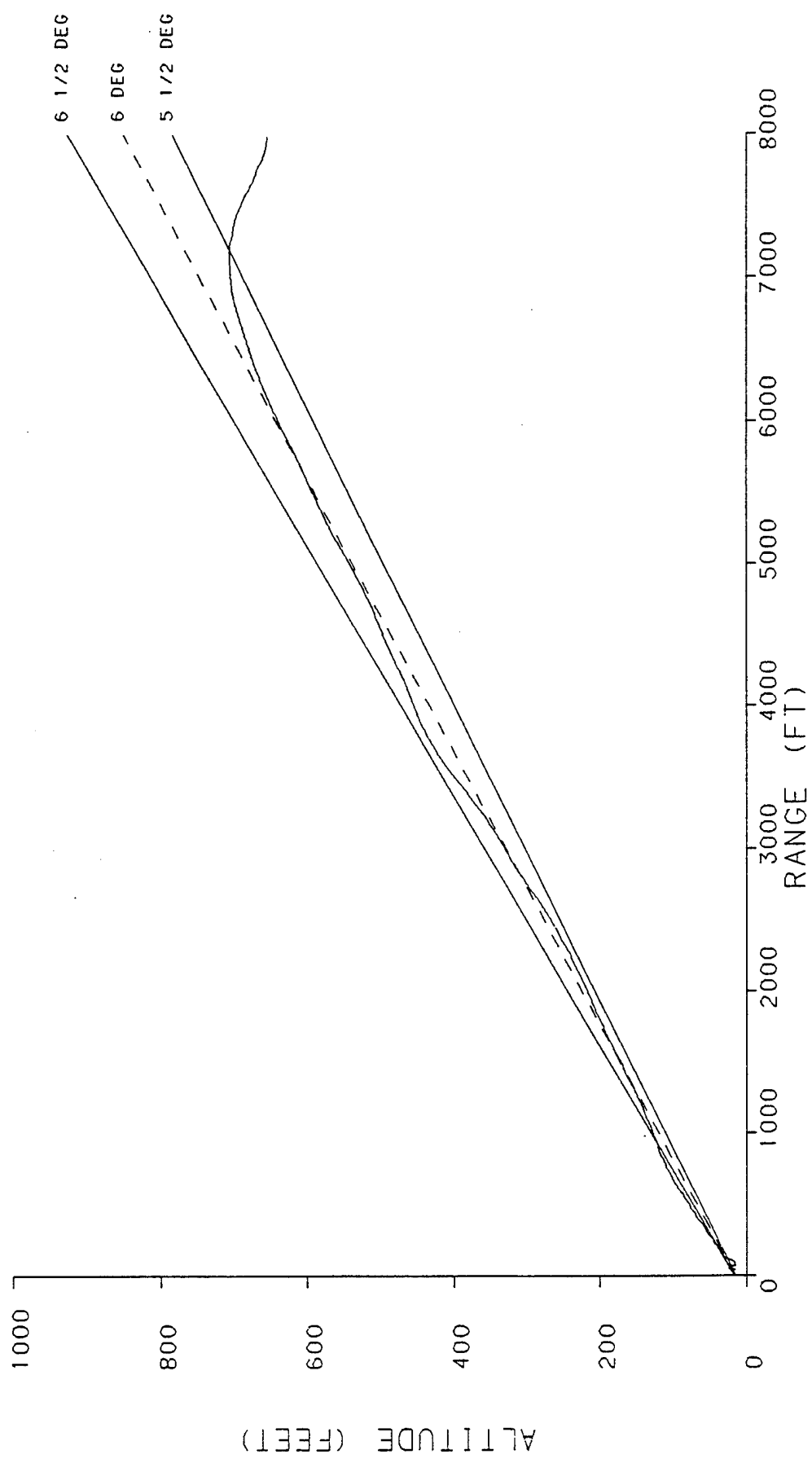
DATA PROCESSED BY THE FAA TECHNICAL CENTER  
ATLANTIC CITY AIRPORT, N J 08405  
16-SEP-1994 14155

RUN #1  
5/03/93 PAPI 6.0 DEG CENTERLINE APPROACH  
AZIMUTH : 0.00 ELEVATION : 6.00  
TRACKER DATA



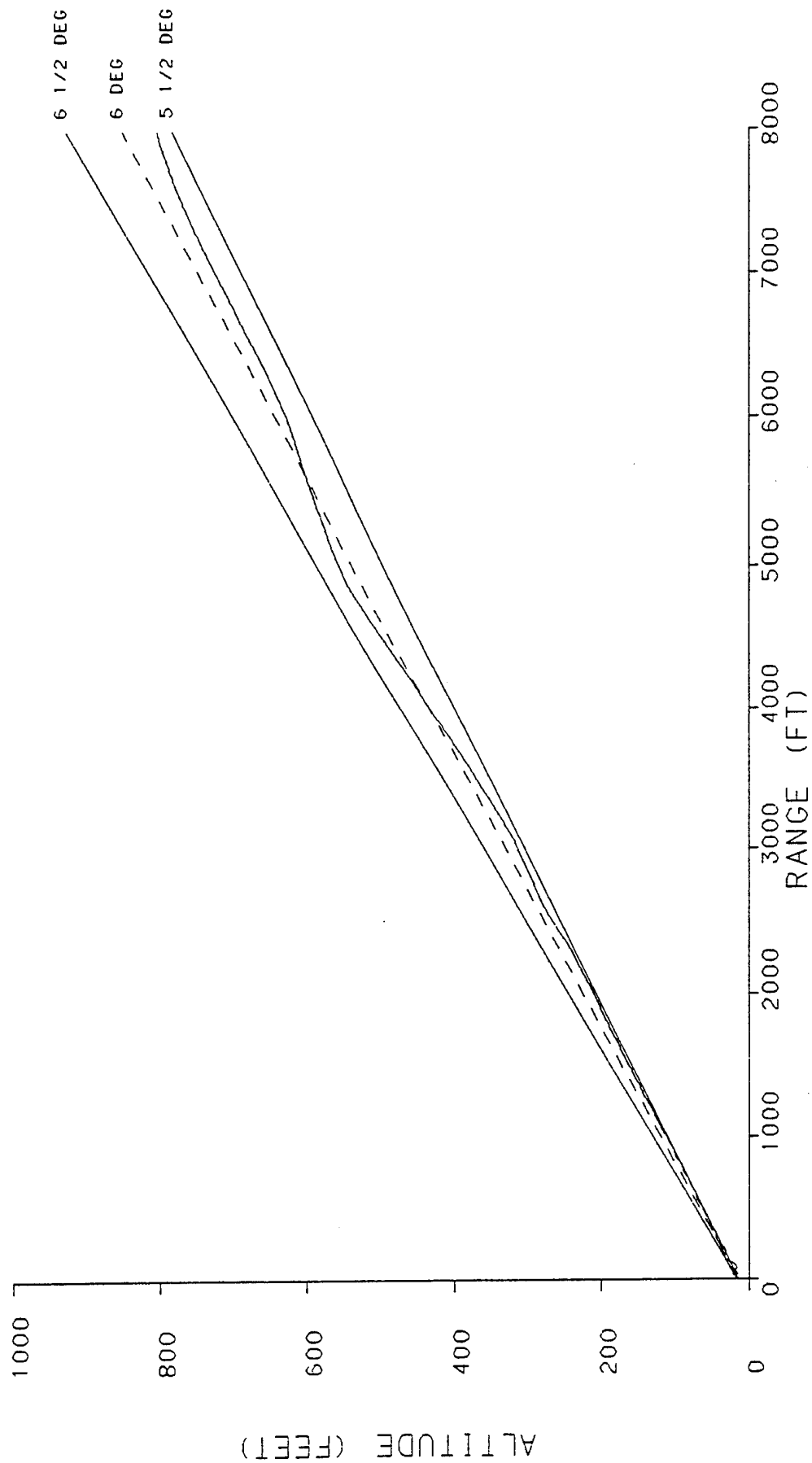
DATA PROCESSED BY THE FAA TECHNICAL CENTER  
ATLANTIC CITY AIRPORT, N J 08405  
16-SEP-1994 14:56

RUN #2  
5/03/93 PAPI 6.0 DEG CENTERLINE APPROACH  
AZIMUTH : 0.00 ELEVATION : 6.00  
TRACKER DATA



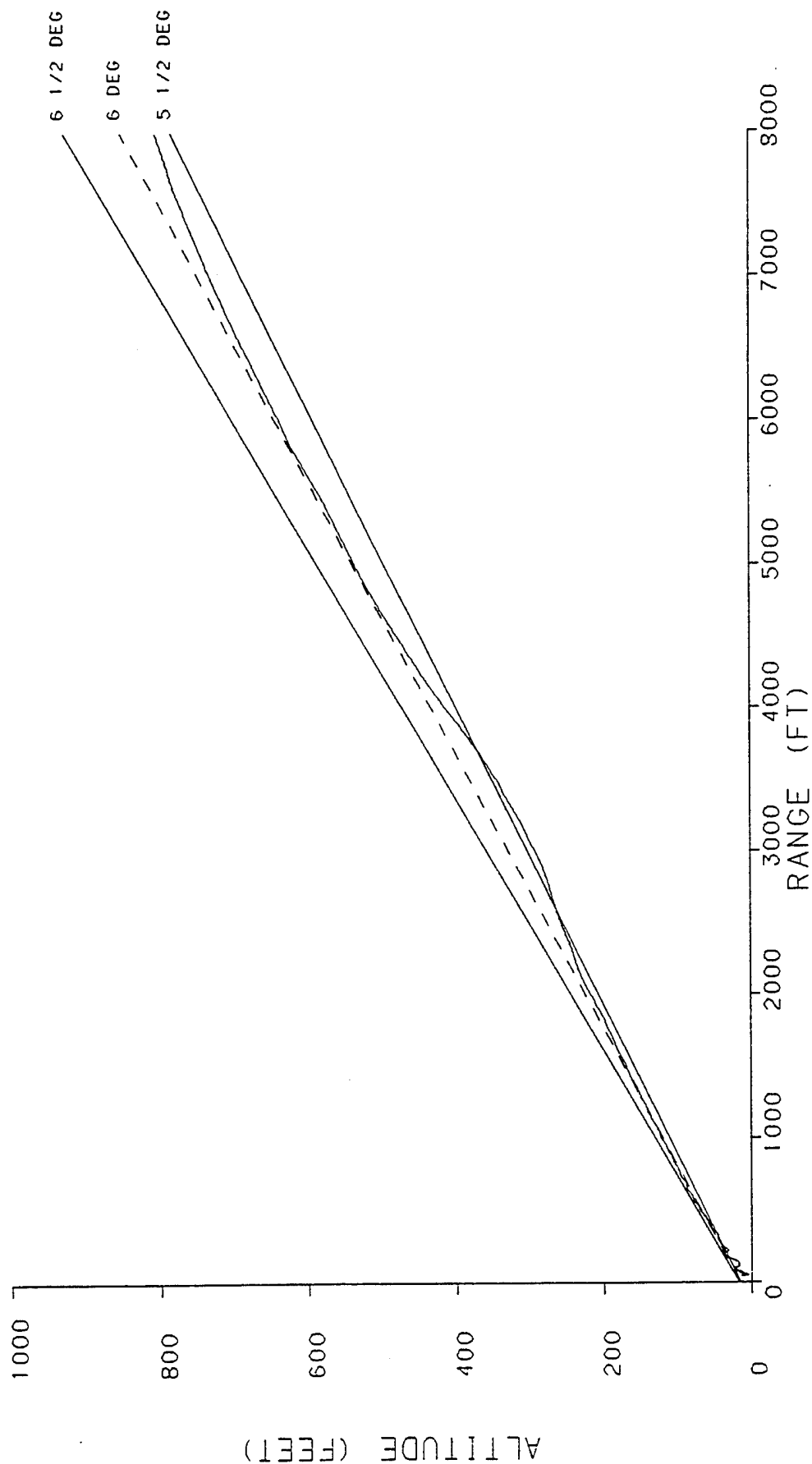
RUN #3  
5/03/93 PAPI 6.0 DEG CENTERLINE APPROACH  
AZIMUTH : 0.00 ELEVATION : 6.00  
TRACKER DATA

DATA PROCESSED BY THE FAA TECHNICAL CENTER  
ATLANTIC CITY AIRPORT, N J 08403  
16-SEP-1994 14:57



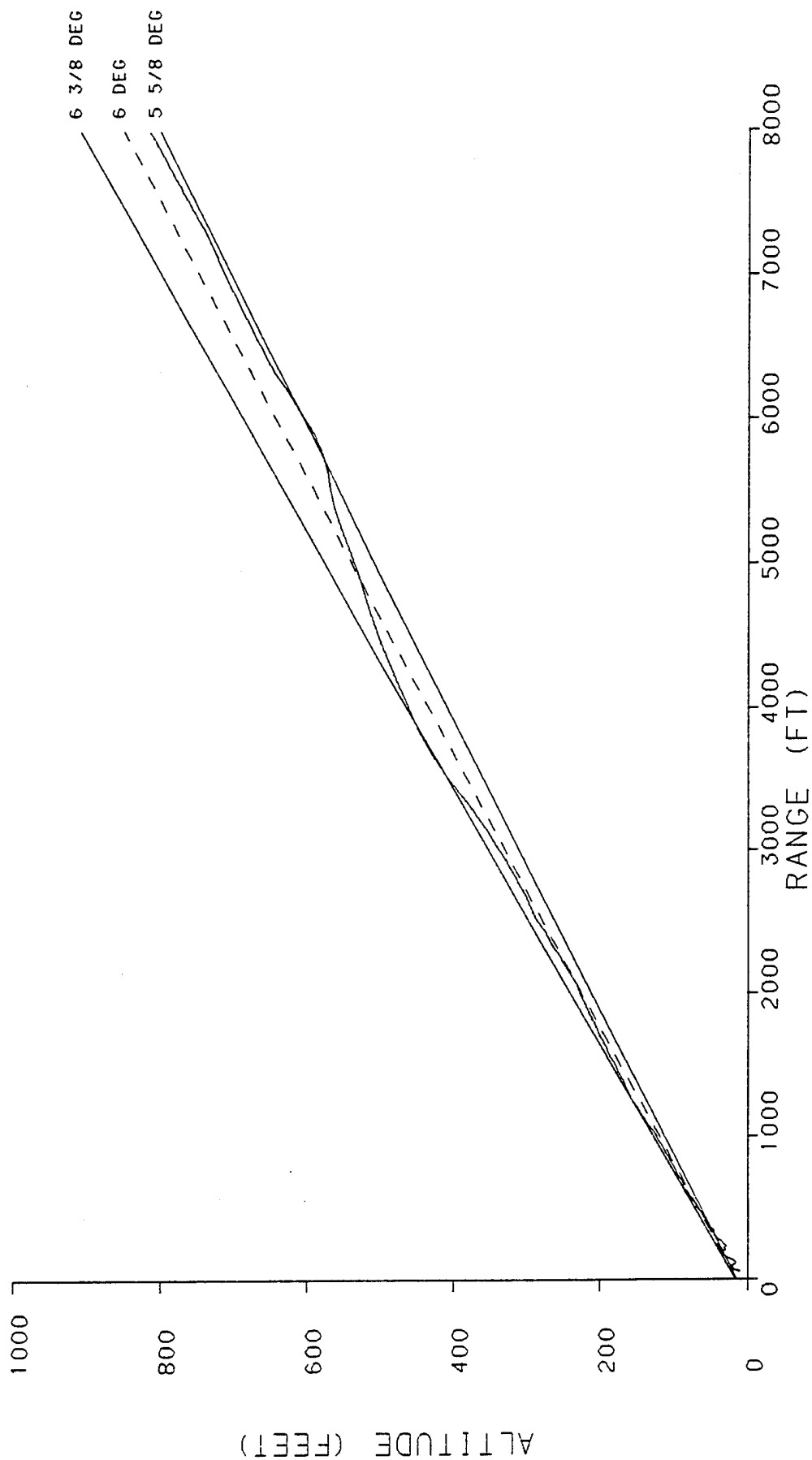
DATA PROCESSED BY THE FAA TECHNICAL CENTER  
ATLANTIC CITY AIRPORT, N J 08405  
16-SEP-1994 14:59

RUN #4  
5/03/93 PAPI 6.0 DEG CENTERLINE APPROACH  
AZIMUTH : 0.00 ELEVATION : 6.00  
TRACKER DATA



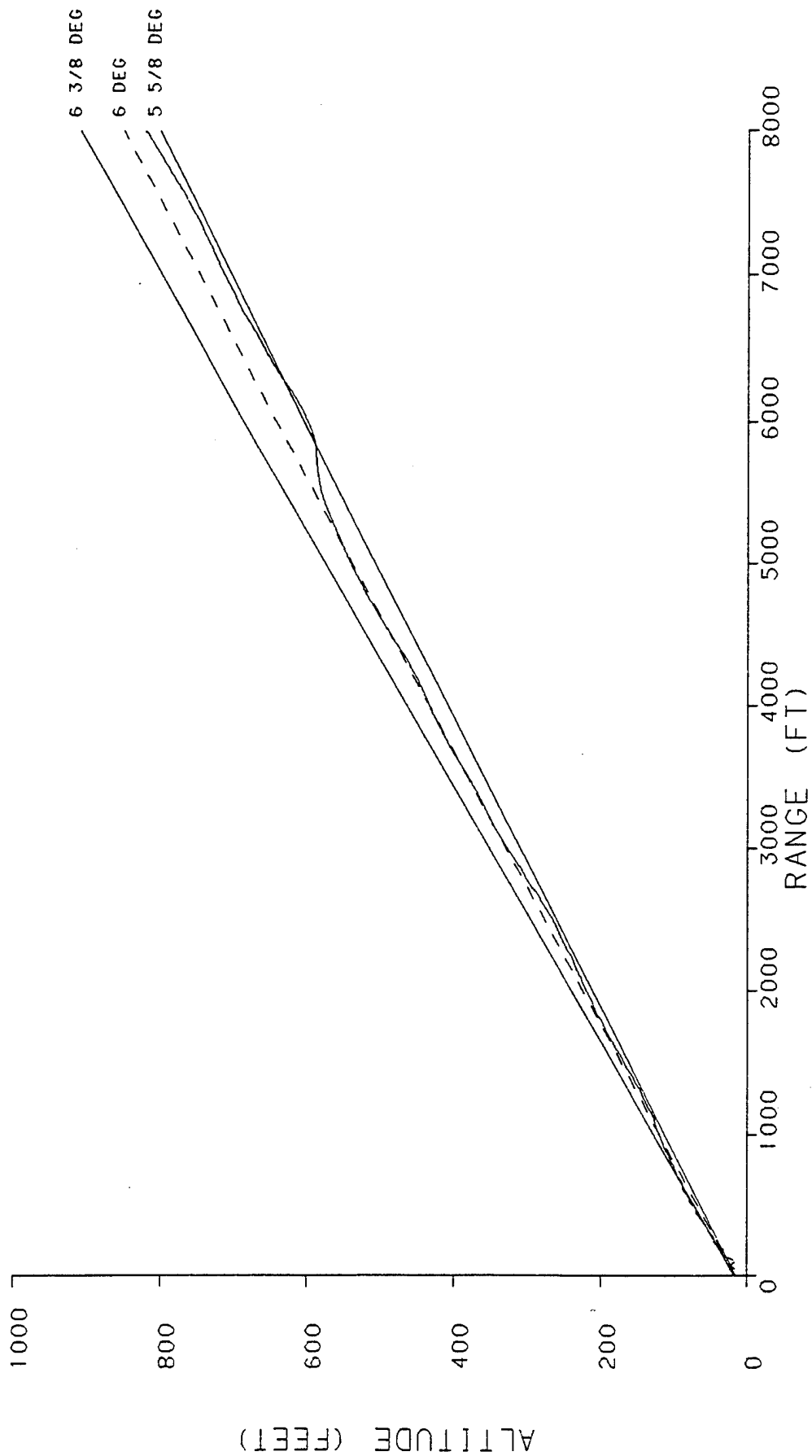
RUN #5  
5/03/93 HAPI 6.0 DEG CENTERLINE APPROACH  
AZIMUTH : 0.00 ELEVATION : 6.00  
TRACKER DATA

DATA PROCESSED BY THE FAA TECHNICAL CENTER  
ATLANTIC CITY AIRPORT. N J 08405  
16-SEP-1994 15:00



RUN #6  
5/03/93 HAPI 6.0 DEG CENTERLINE APPROACH  
AZIMUTH : 0.00 ELEVATION : 6.00  
TRACKER DATA

DATA PROCESSED BY THE FAA TECHNICAL CENTER  
ATLANTIC CITY AIRPORT, N J 08405  
16-SEP-1994 15:00



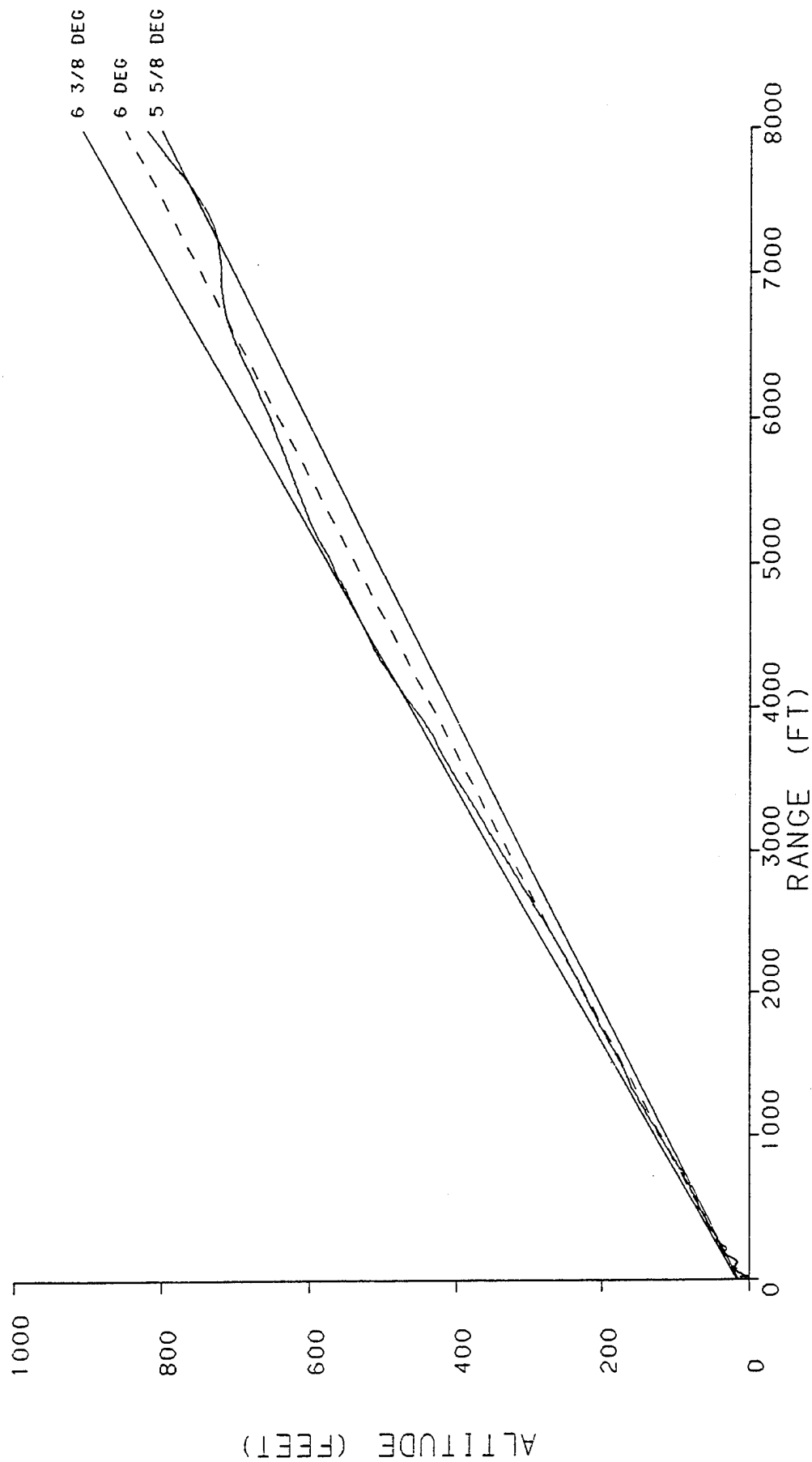
RUN #7

5/03/93 HAPI 6.0 DEG CENTERLINE APPROACH

AZIMUTH : 0.00 ELEVATION : 6.00

TRACKER DATA

DATA PROCESSED BY THE FAA TECHNICAL CENTER  
ATLANTIC CITY AIRPORT. N J 08405  
16-SEP-1994 15:02



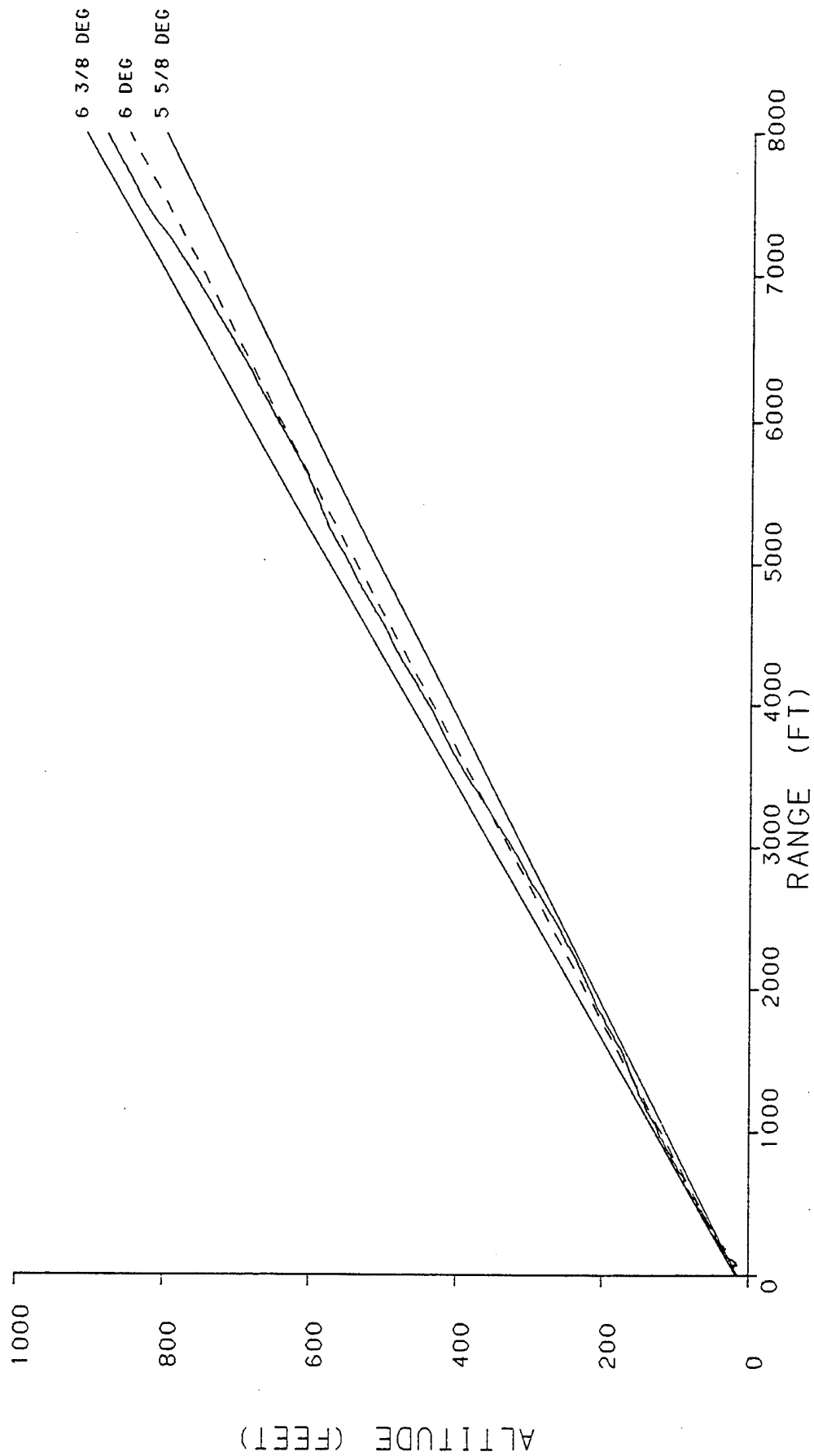
RUN #8

5/03/93 HAPI 6.0 DEG CENTERLINE APPROACH

AZIMUTH : 0.00 ELEVATION : 6.00

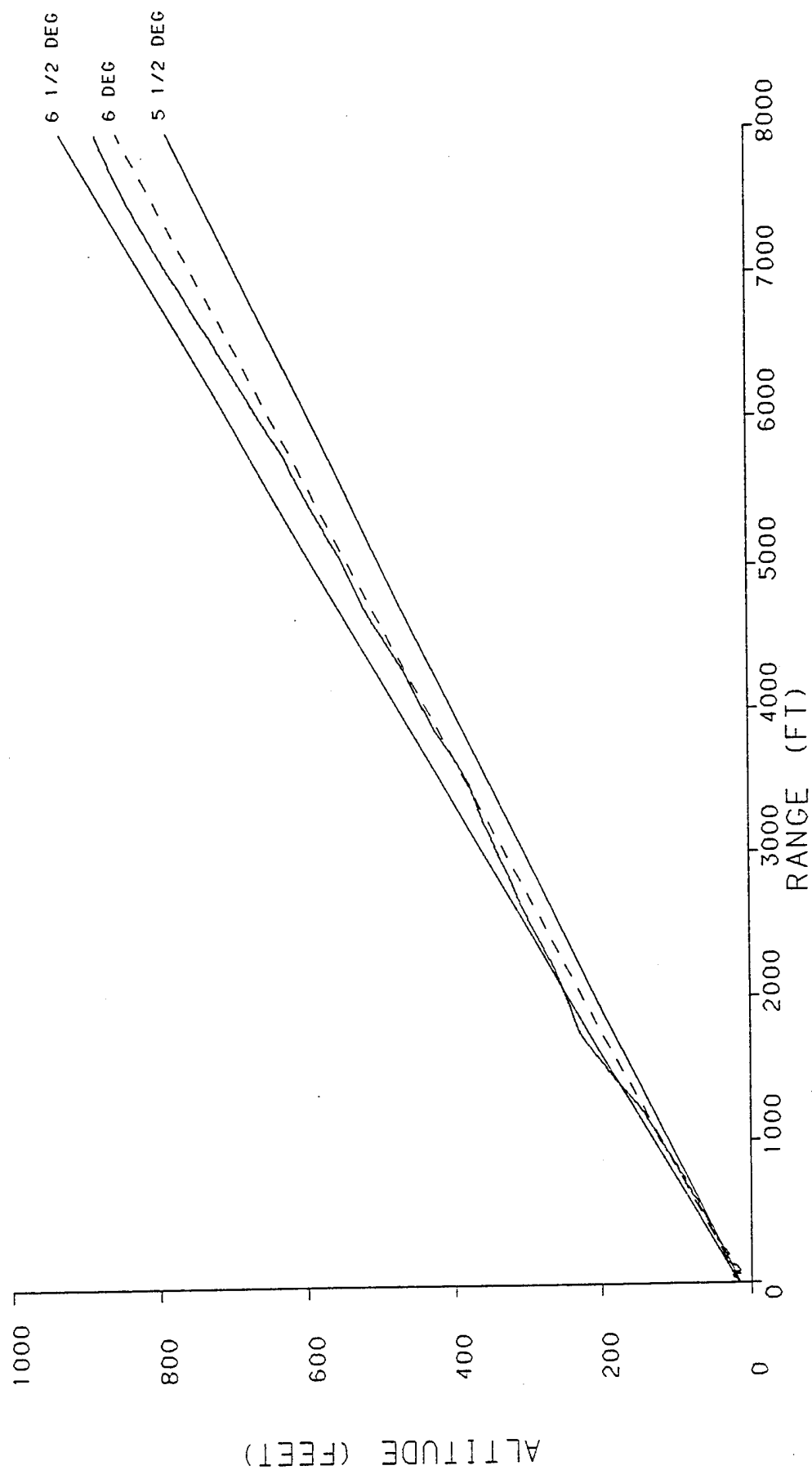
TRACKER DATA

DATA PROCESSED BY THE FAA TECHNICAL CENTER  
ATLANTIC CITY AIRPORT, N J 08405  
16-SEP-1994 15:03



DATA PROCESSED BY THE FAA TECHNICAL CENTER  
ATLANTIC CITY AIRPORT, N J 08405  
16-SEP-1994 15:04

RUN #9  
5/03/93 CHAP1 6.0 DEG CENTERLINE APPROACH  
AZIMUTH : 0.00 ELEVATION : 6.00  
TRACKER DATA



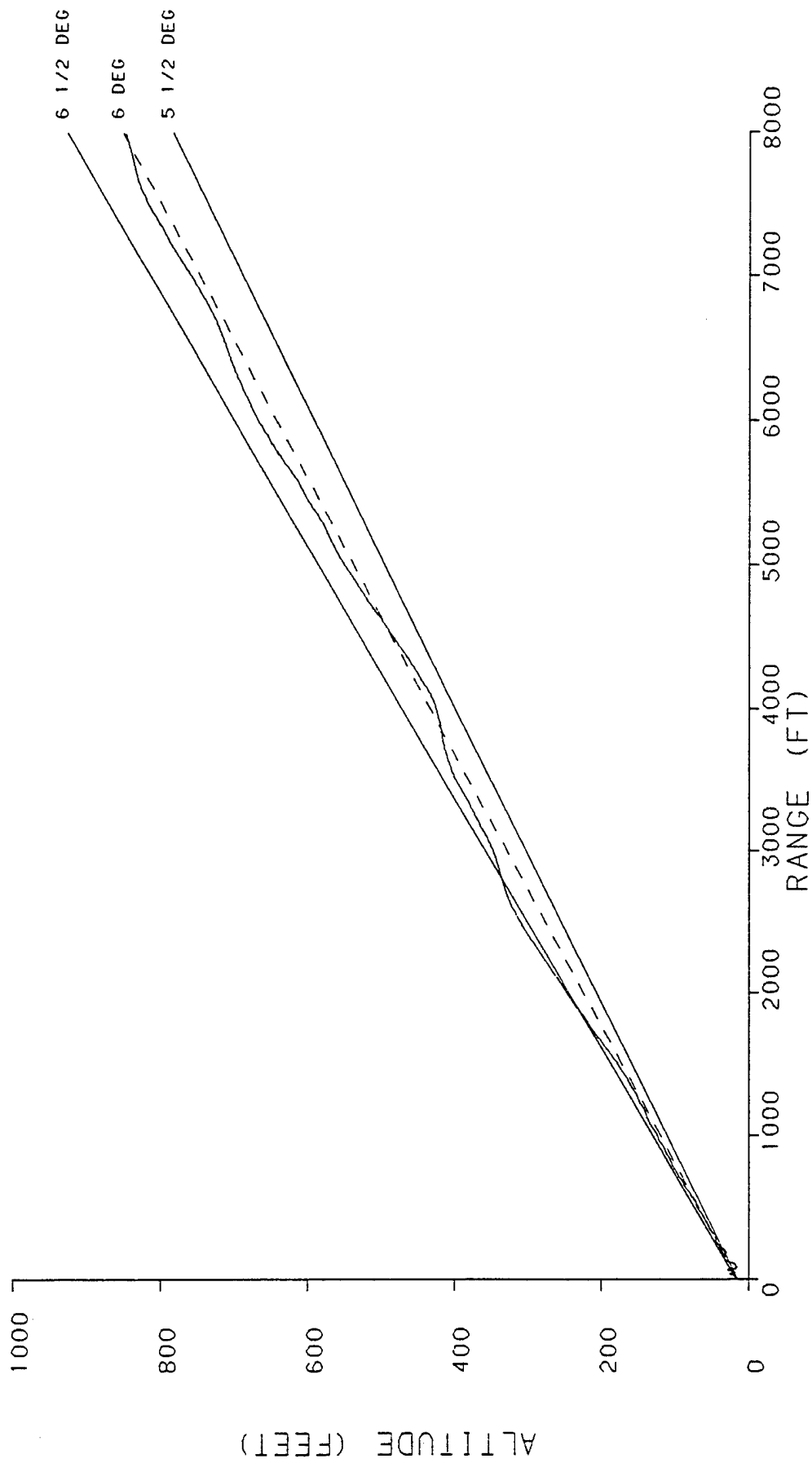
RUN #10

5/03/93 CHAP1 6.0 DEG CENTERLINE APPROACH

AZIMUTH : 0.00 ELEVATION : 6.00

TRACKER DATA

DATA PROCESSED BY THE FAA TECHNICAL CENTER  
ATLANTIC CITY AIRPORT, N J 08405  
16-SEP-1994 15:05



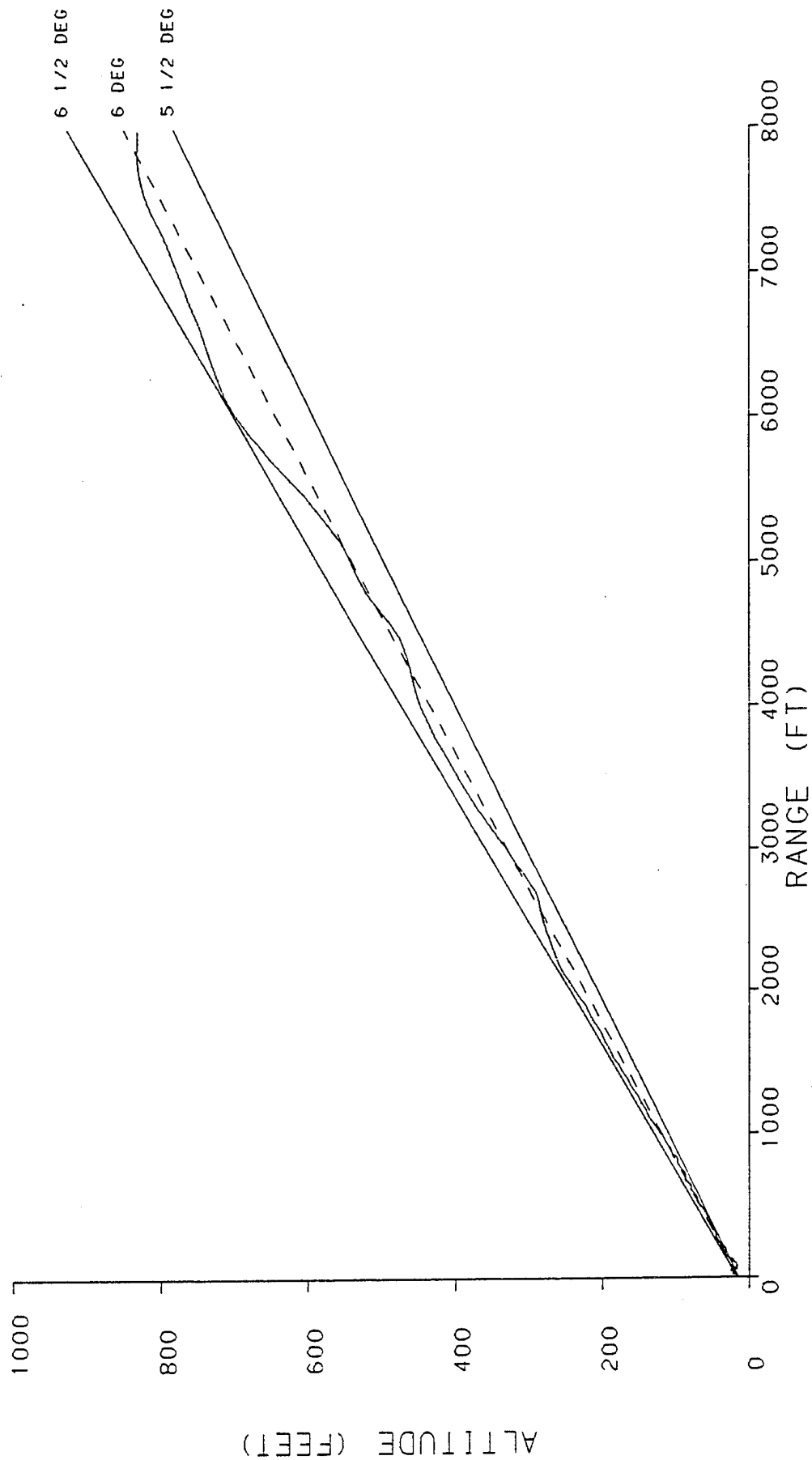
RUN #11

5/03/93 CHAPI 6.0 DEG CENTERLINE APPROACH

AZIMUTH : 0.00 ELEVATION : 6.00

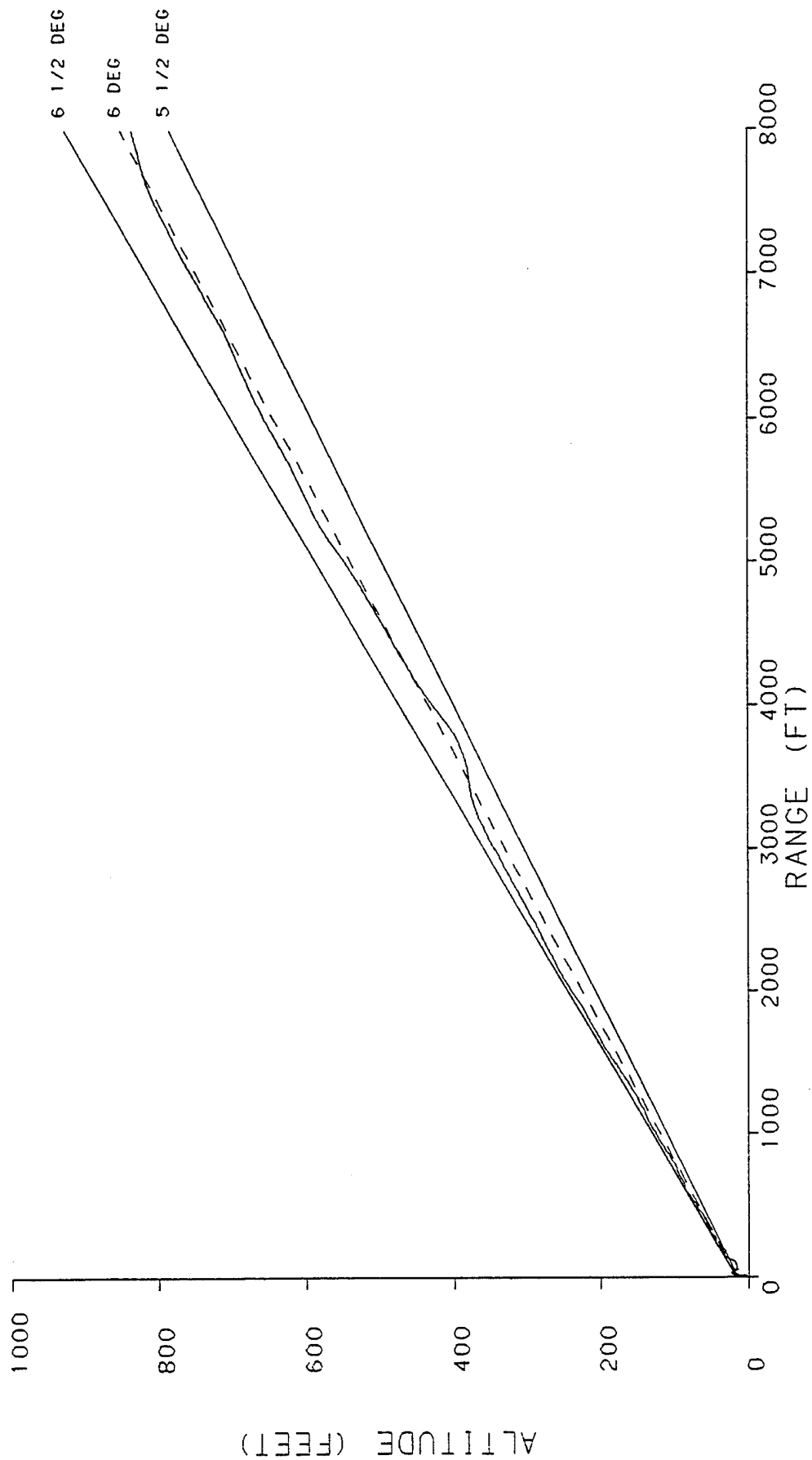
TRACKER DATA

DATA PROCESSED BY THE FAA TECHNICAL CENTER  
ATLANTIC CITY AIRPORT, N J 08405  
16-SEP-1994 15:06



RUN #12  
5/03/93 CHAP1 6.0 DEG CENTERLINE APPROACH  
AZIMUTH : 0.00 ELEVATION : 6.00  
TRACKER DATA

DATA PROCESSED BY THE FAA TECHNICAL CENTER  
ATLANTIC CITY AIRPORT, N J 08405  
16-SEP-1994 15:07



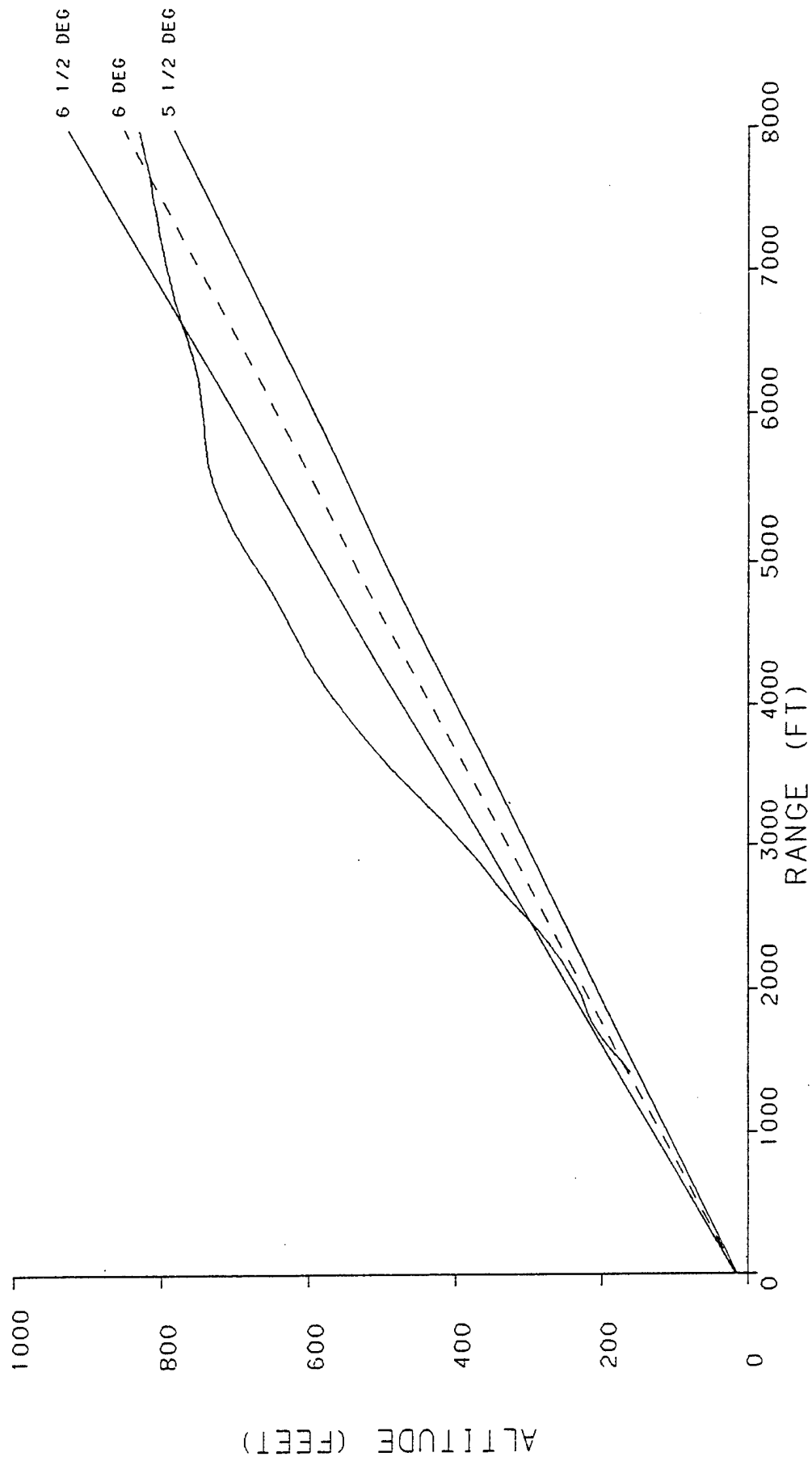
RUN #1

5/11/93 PAPI 6.0 DEG CENTERLINE APPROACH

AZIMUTH : 0.00 ELEVATION : 6.00

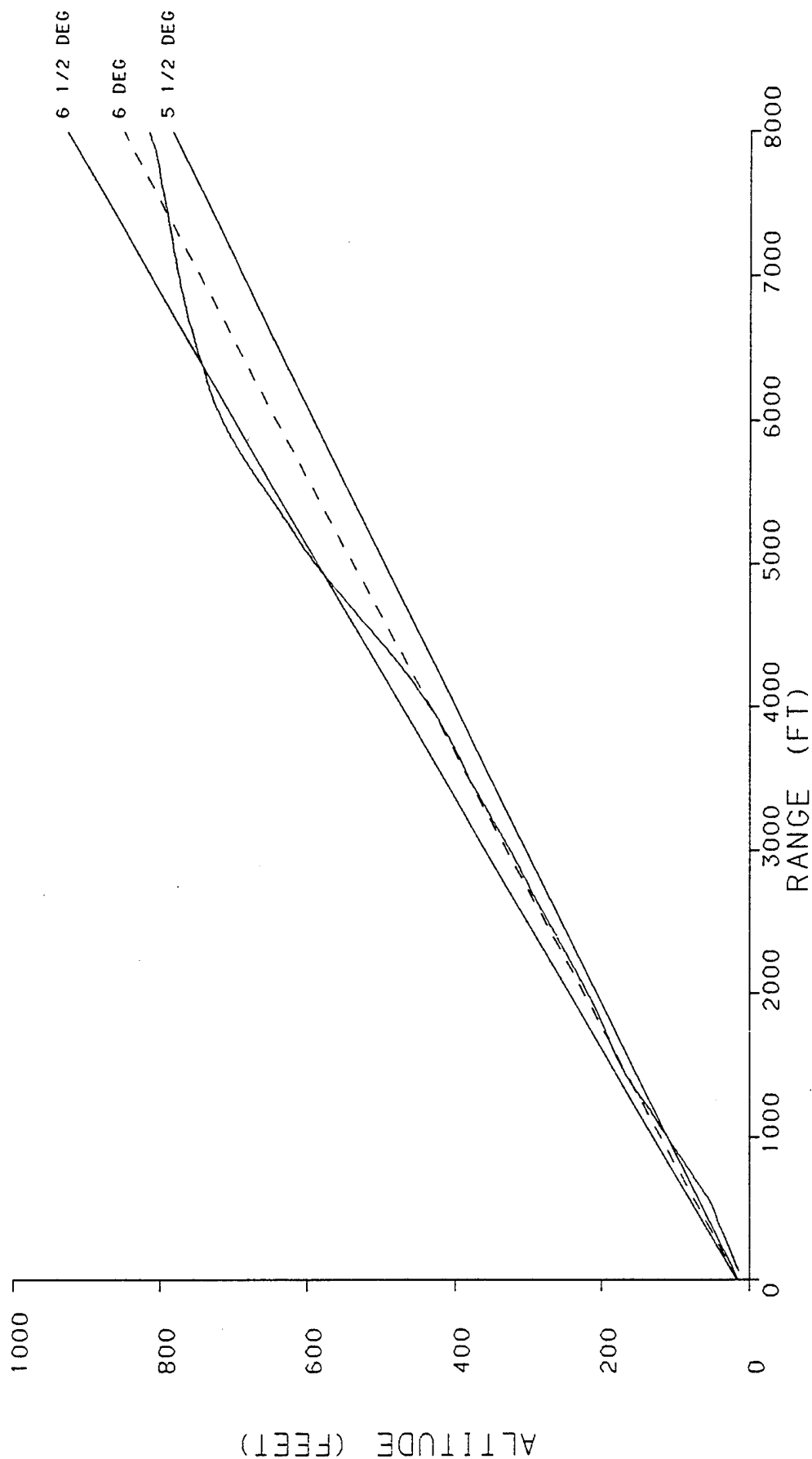
TRACKER DATA

DATA PROCESSED BY THE FAA TECHNICAL CENTER  
ATLANTIC CITY AIRPORT, N J 08405  
16-SEP-1994 15:07



DATA PROCESSED BY THE FAA TECHNICAL CENTER  
ATLANTIC CITY AIRPORT, N J 08405  
16-SEP-1994 15:08

RUN #2  
5/11/93 PAPI 6.0 DEG CENTERLINE APPROACH  
AZIMUTH : 0.00 ELEVATION : 6.00  
TRACKER DATA



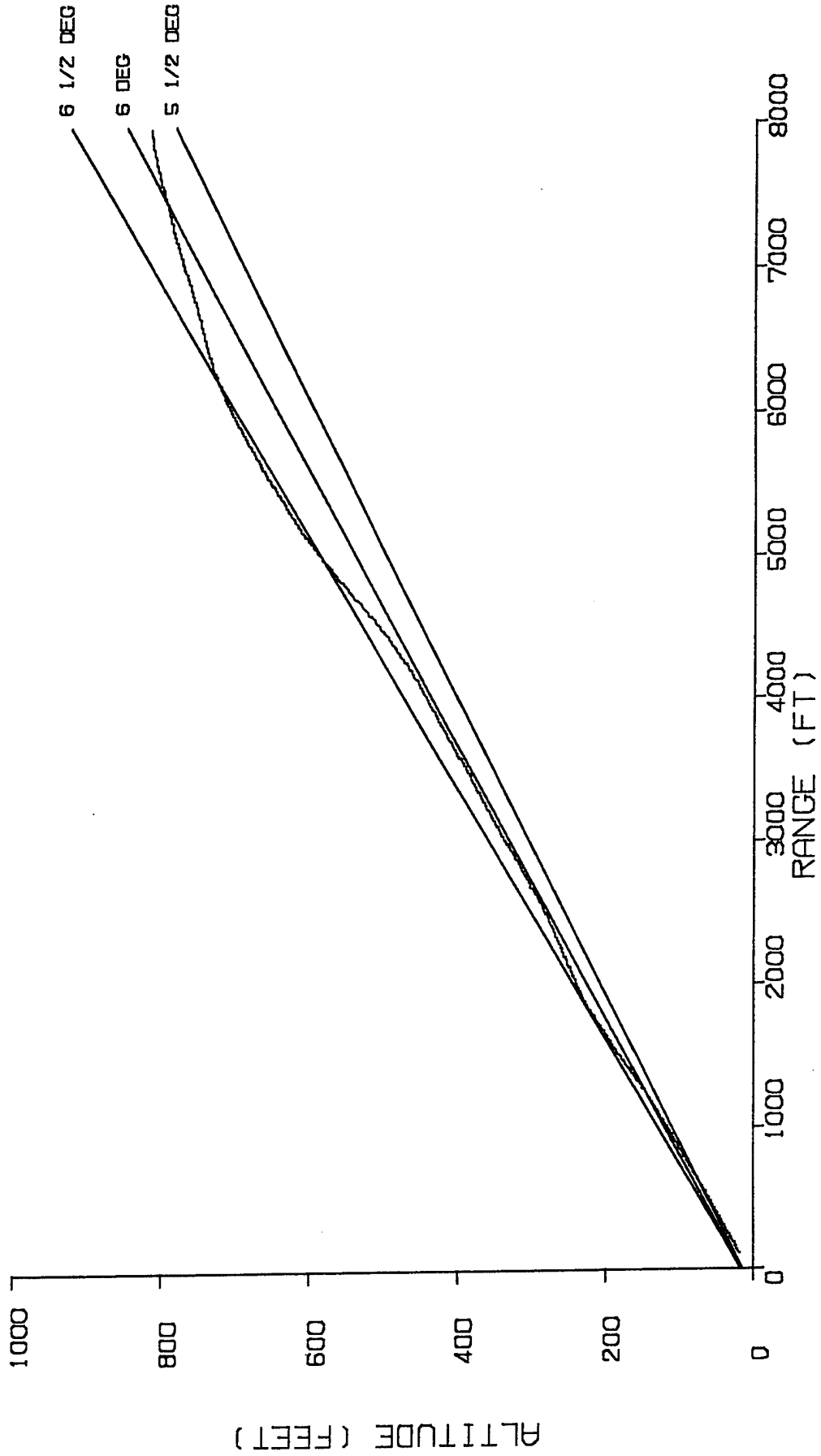
RUN #3

5/11/93 PAPI 6.0 DEG CENTERLINE APPROACH

AZIMUTH : 0.00 ELEVATION : 6.00

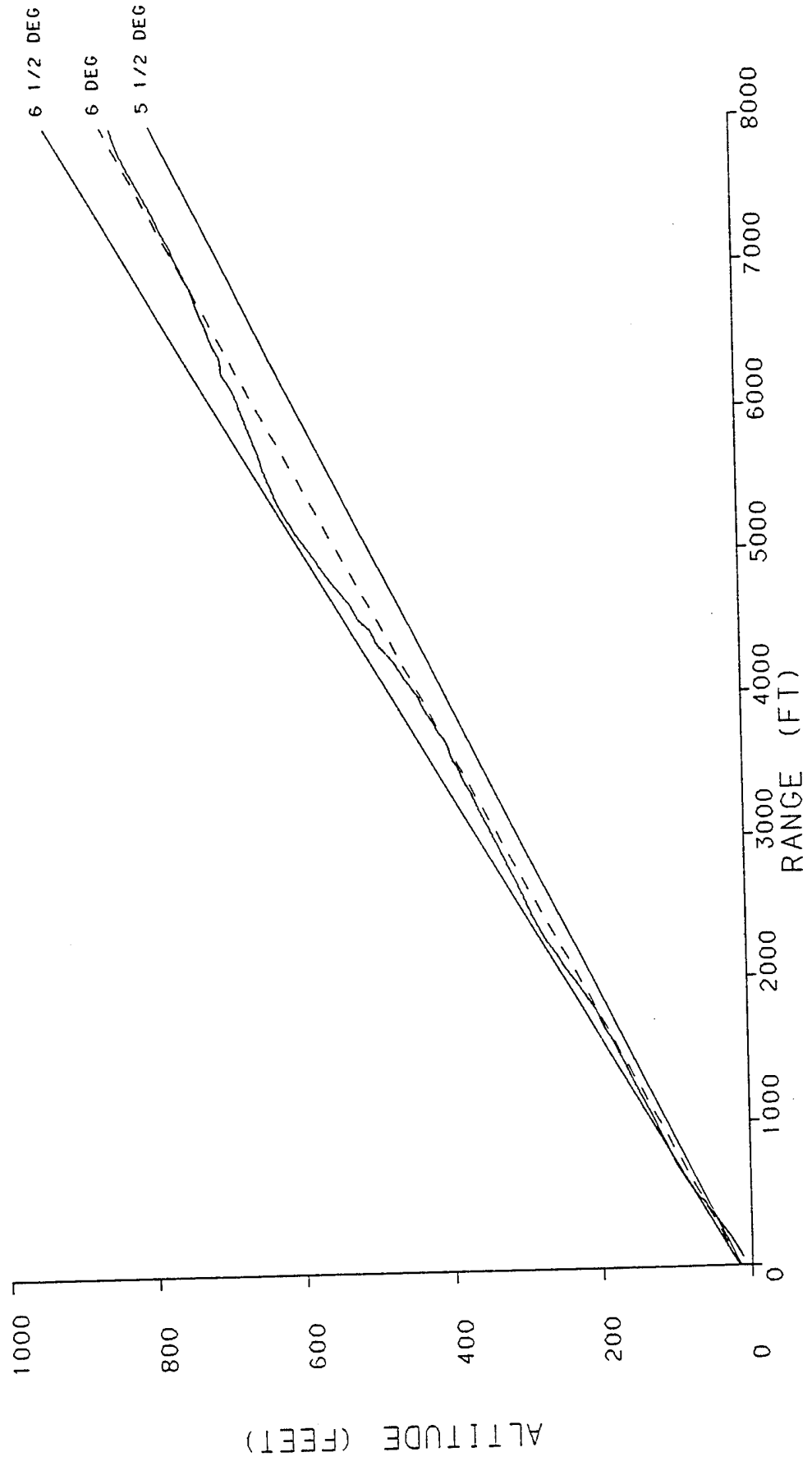
TRACKER DATA

DATA PROCESSED BY THE FAA TECHNICAL CENTER  
ATLANTIC CITY AIRPORT, N J 08405  
14-NOV-1995 11:08



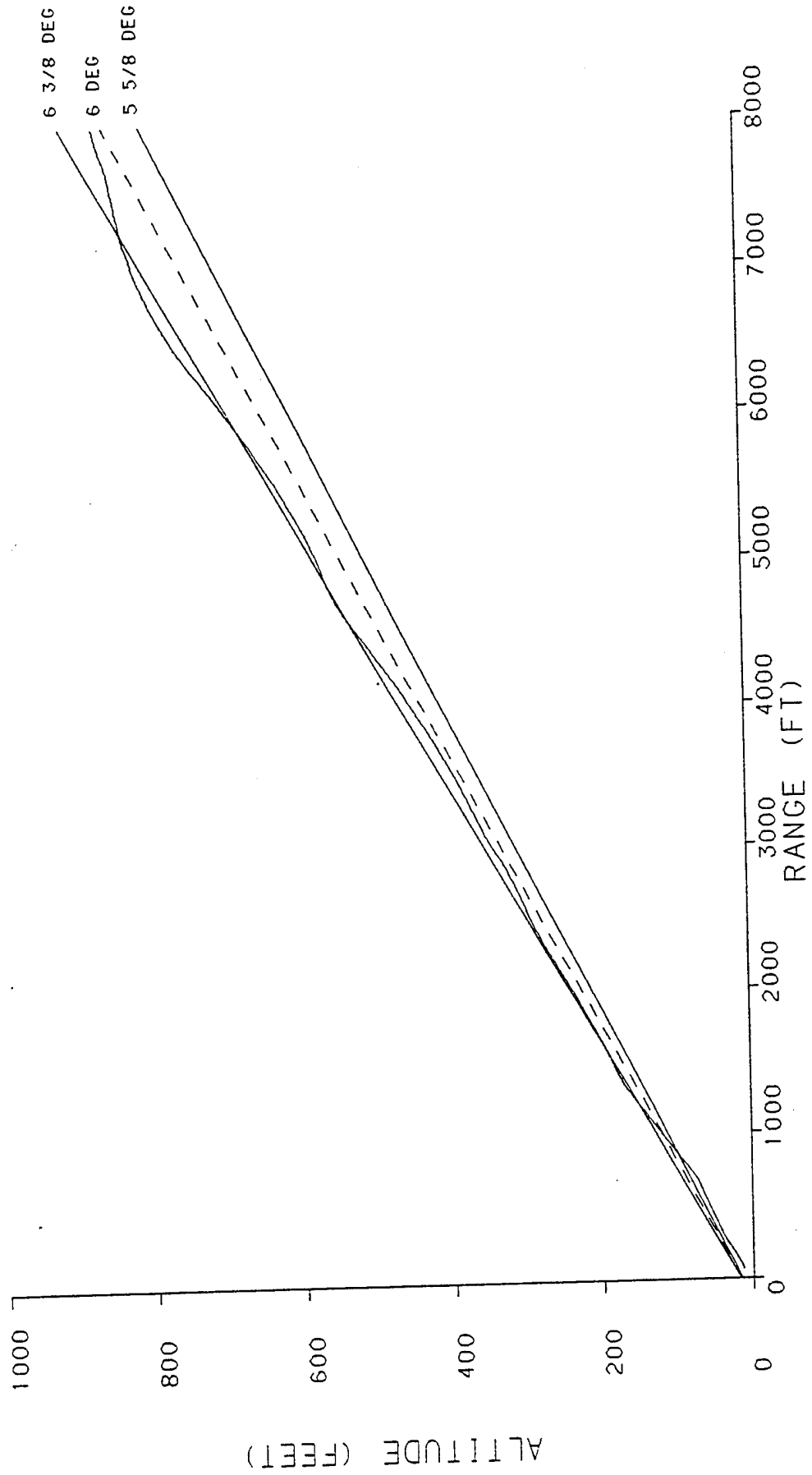
DATA PROCESSED BY THE FAA TECHNICAL CENTER  
ATLANTIC CITY AIRPORT, N J 08405  
16-SEP-1994 15:10

RUN #4  
5/11/93 PAPI 6.0 DEG CENTERLINE APPROACH  
AZIMUTH : 0.00 ELEVATION : 6.00  
TRACKER DATA



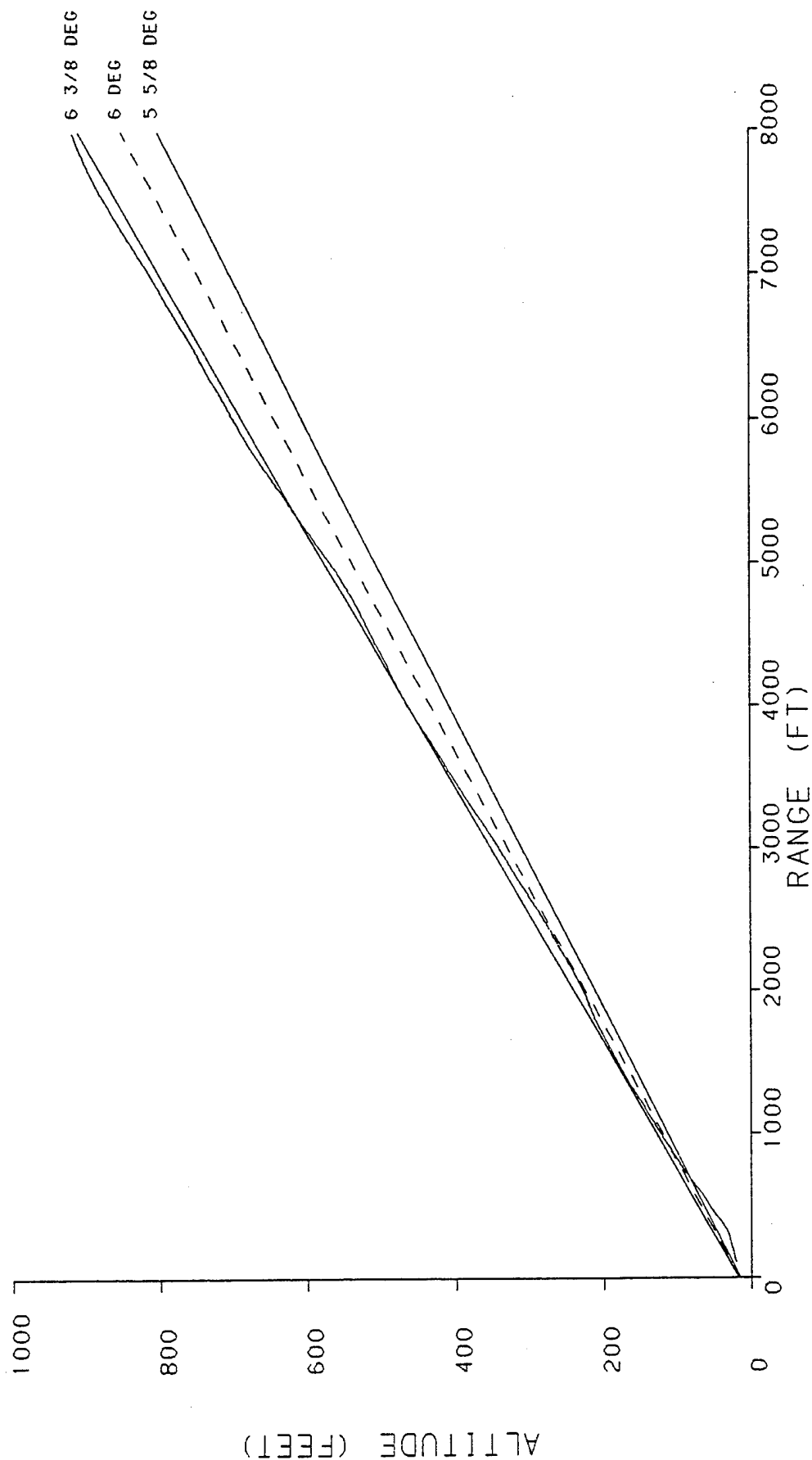
DATA PROCESSED BY THE FAA TECHNICAL CENTER  
ATLANTIC CITY AIRPORT, N J 08405  
16-SEP-1994 15:11

RUN #5  
5/11/93 HAPI 6.0 DEG CENTERLINE APPROACH  
AZIMUTH : 0.00 ELEVATION : 6.00  
TRACKER DATA



DATA PROCESSED BY THE FAA TECHNICAL CENTER  
ATLANTIC CITY AIRPORT, N J 08405  
16-SEP-1994 15:12

RUN #6  
5/11/93 HAPI 6.0 DEG CENTERLINE APPROACH  
AZIMUTH : 0.00 ELEVATION : 6.00  
TRACKER DATA



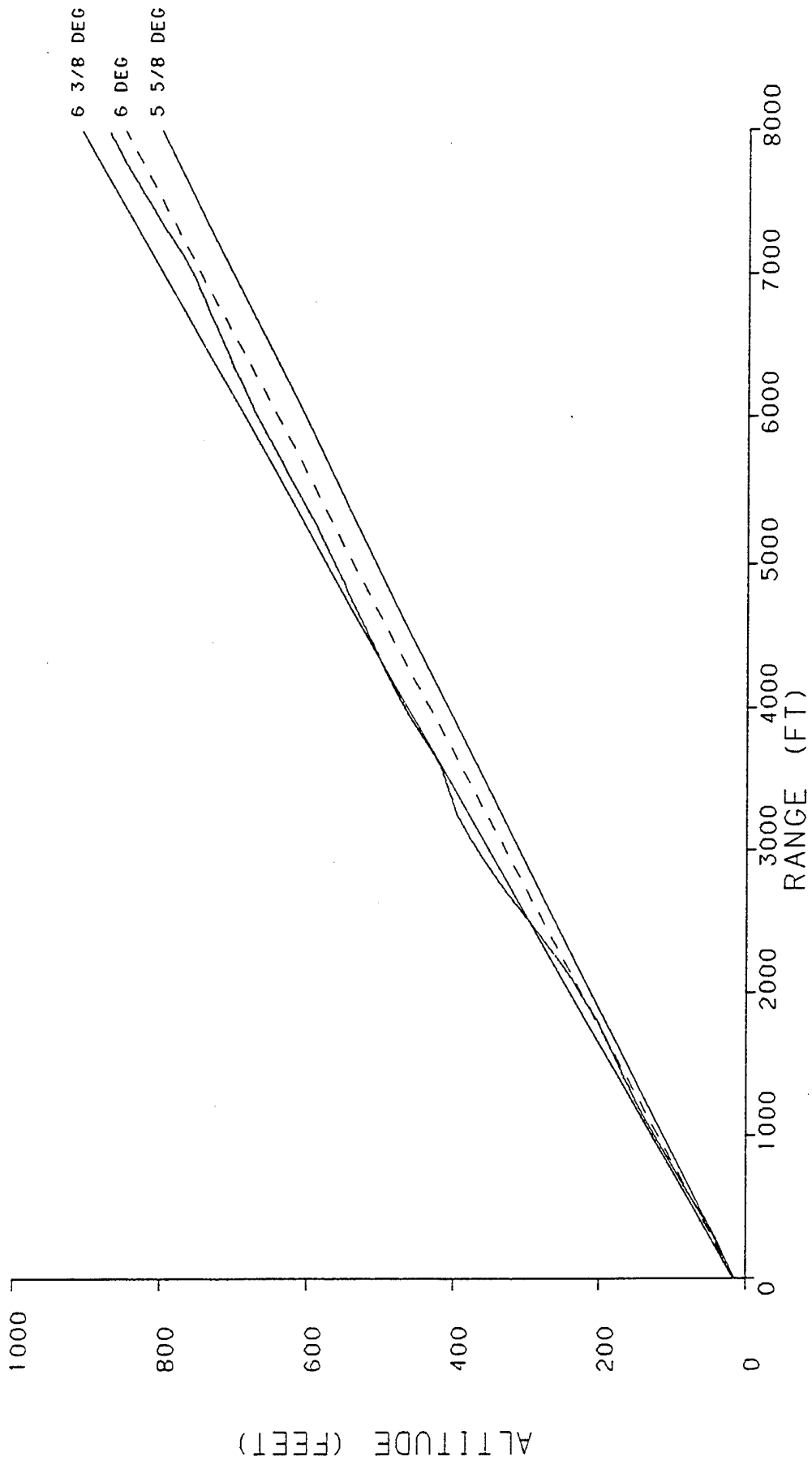
RUN #7

5/11/93 HAPI 6.0 DEG CENTERLINE APPROACH

AZIMUTH : 0.00 ELEVATION : 6.00

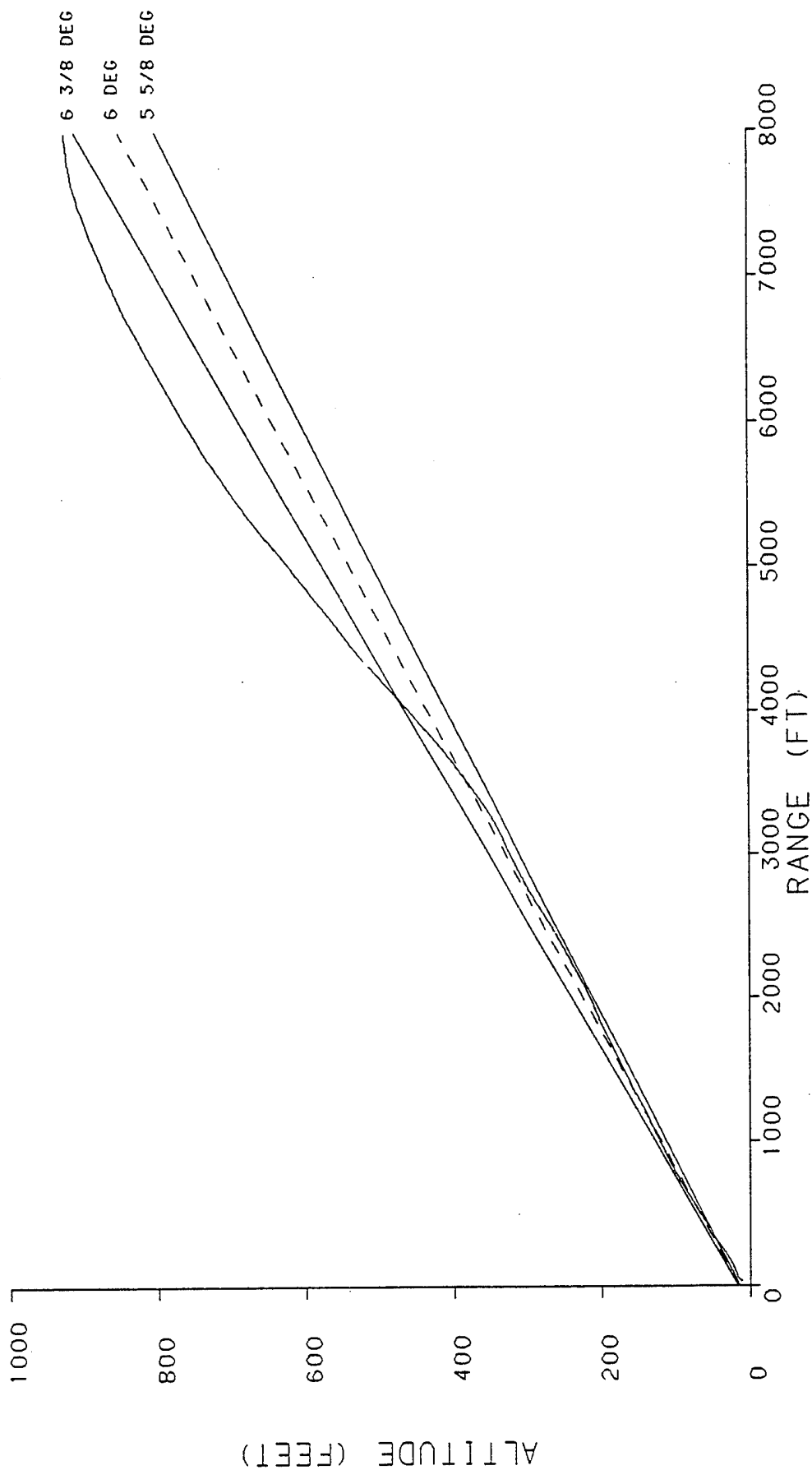
TRACKER DATA

DATA PROCESSED BY THE FAA TECHNICAL CENTER  
ATLANTIC CITY AIRPORT, N J 08405  
16-SEP-1994 15:13



DATA PROCESSED BY THE FAA TECHNICAL CENTER  
ATLANTIC CITY AIRPORT, N J 08405  
16-SEP-1994 15:14

RUN #8  
5/11/93 HAPI 6.0 DEG CENTERLINE APPROACH  
AZIMUTH : 0.00 ELEVATION : 6.00  
TRACKER DATA



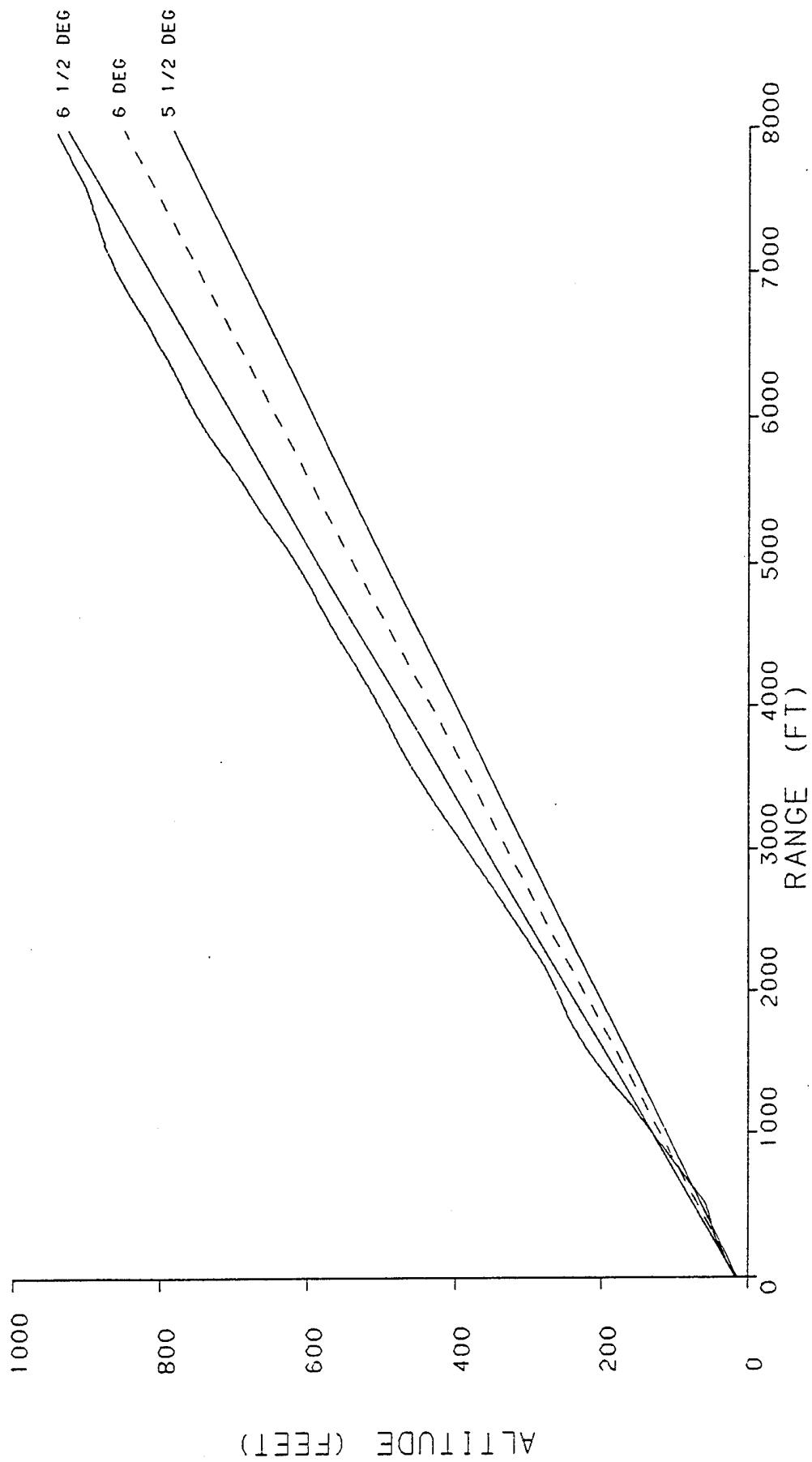
RUN #9

5/11/93 CHAP1 6.0 DEG CENTERLINE APPROACH

AZIMUTH : 0.00 ELEVATION : 6.00

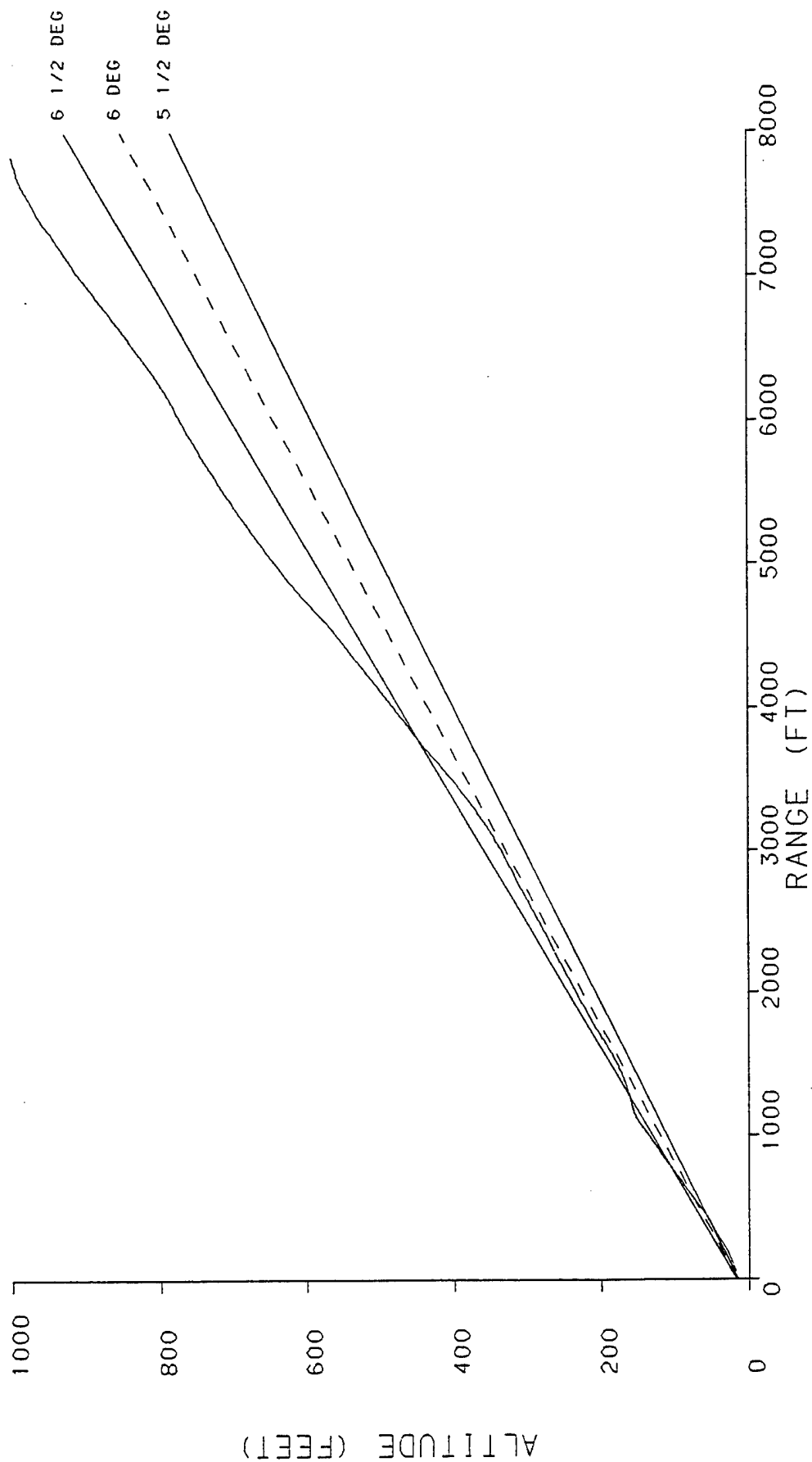
TRACKER DATA

DATA PROCESSED BY THE FAA TECHNICAL CENTER  
ATLANTIC CITY AIRPORT, N J 08405  
16-SEP-1994 15:15



DATA PROCESSED BY THE FAA TECHNICAL CENTER  
ATLANTIC CITY AIRPORT, N J 08405  
16-SEP-1994 15:16

RUN #10  
5/11/93 CHAP1 6.0 DEG CENTERLINE APPROACH  
AZIMUTH : 0.00 ELEVATION : 6.00  
TRACKER DATA



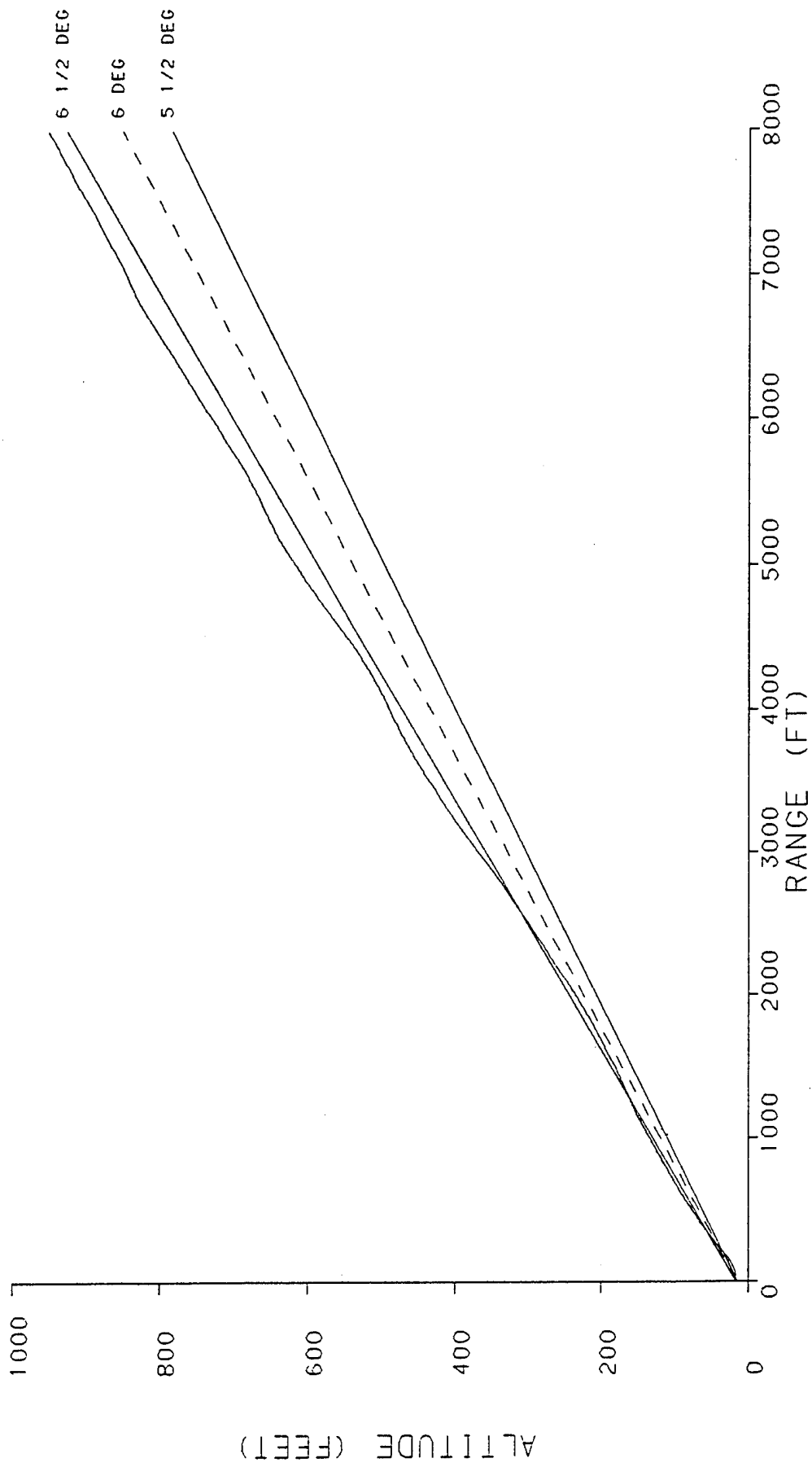
RUN #11

5/11/93 CHAP1 6.0 DEG CENTERLINE APPROACH

AZIMUTH : 0.00 ELEVATION : 6.00

TRACKER DATA

DATA PROCESSED BY THE FAA TECHNICAL CENTER  
ATLANTIC CITY AIRPORT, N J 08405  
16-SEP-1994 15:17



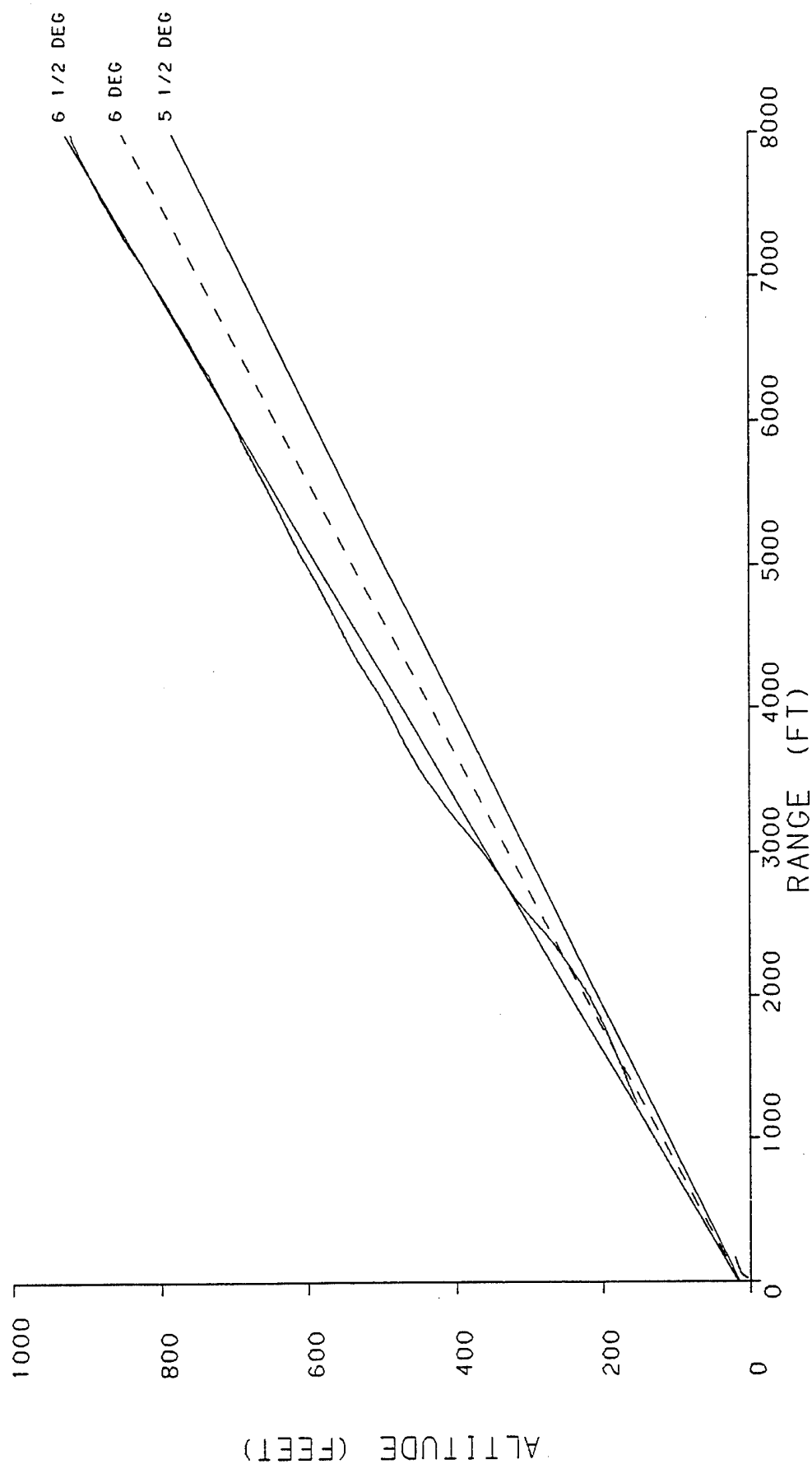
RUN #12

5/11/93 CHAPI 6.0 DEG CENTERLINE APPROACH

AZIMUTH : 0.00 ELEVATION : 6.00

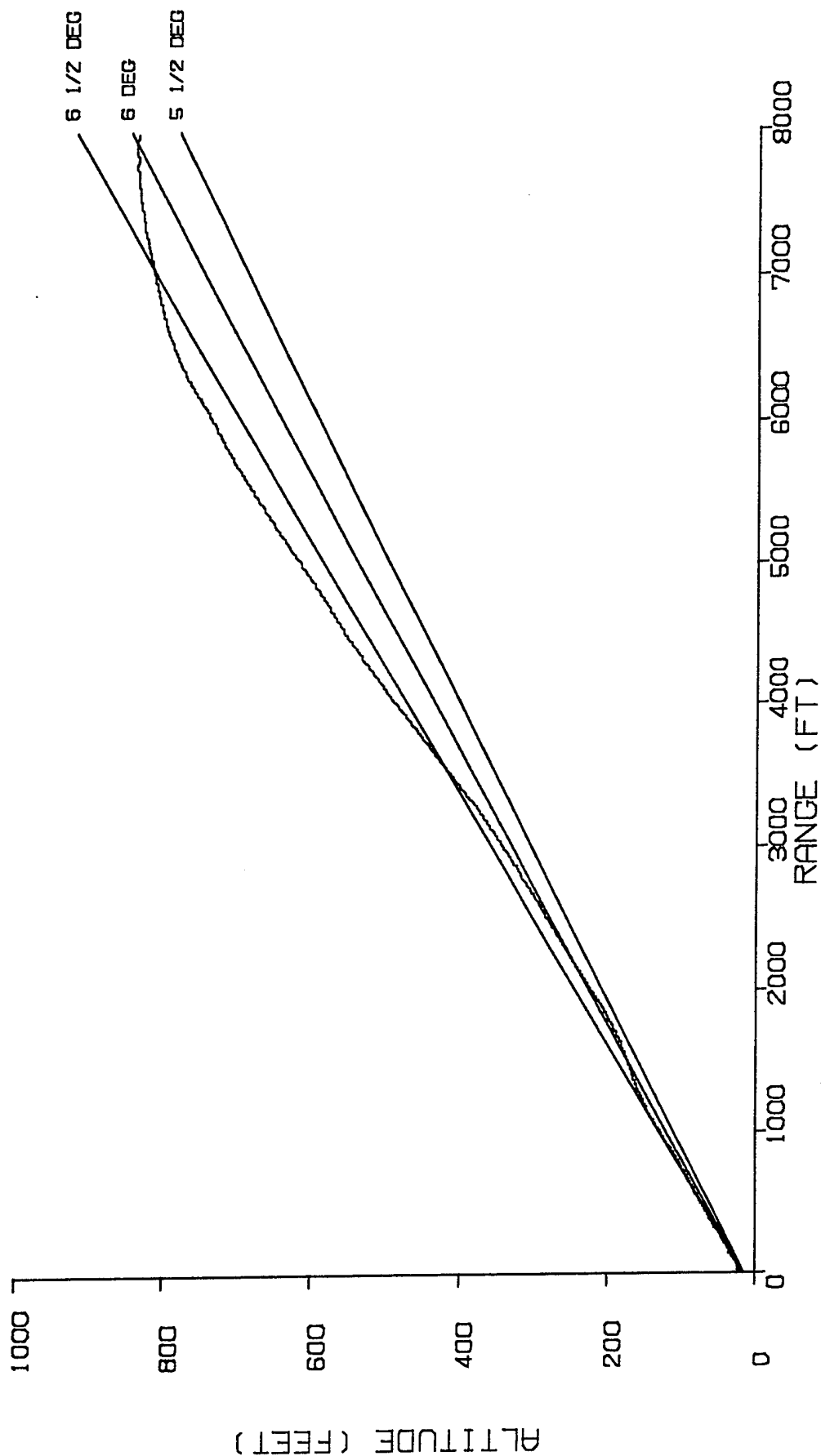
TRACKER DATA

DATA PROCESSED BY THE FAA TECHNICAL CENTER  
ATLANTIC CITY AIRPORT, N J 08403  
16-SEP-1994 15:49



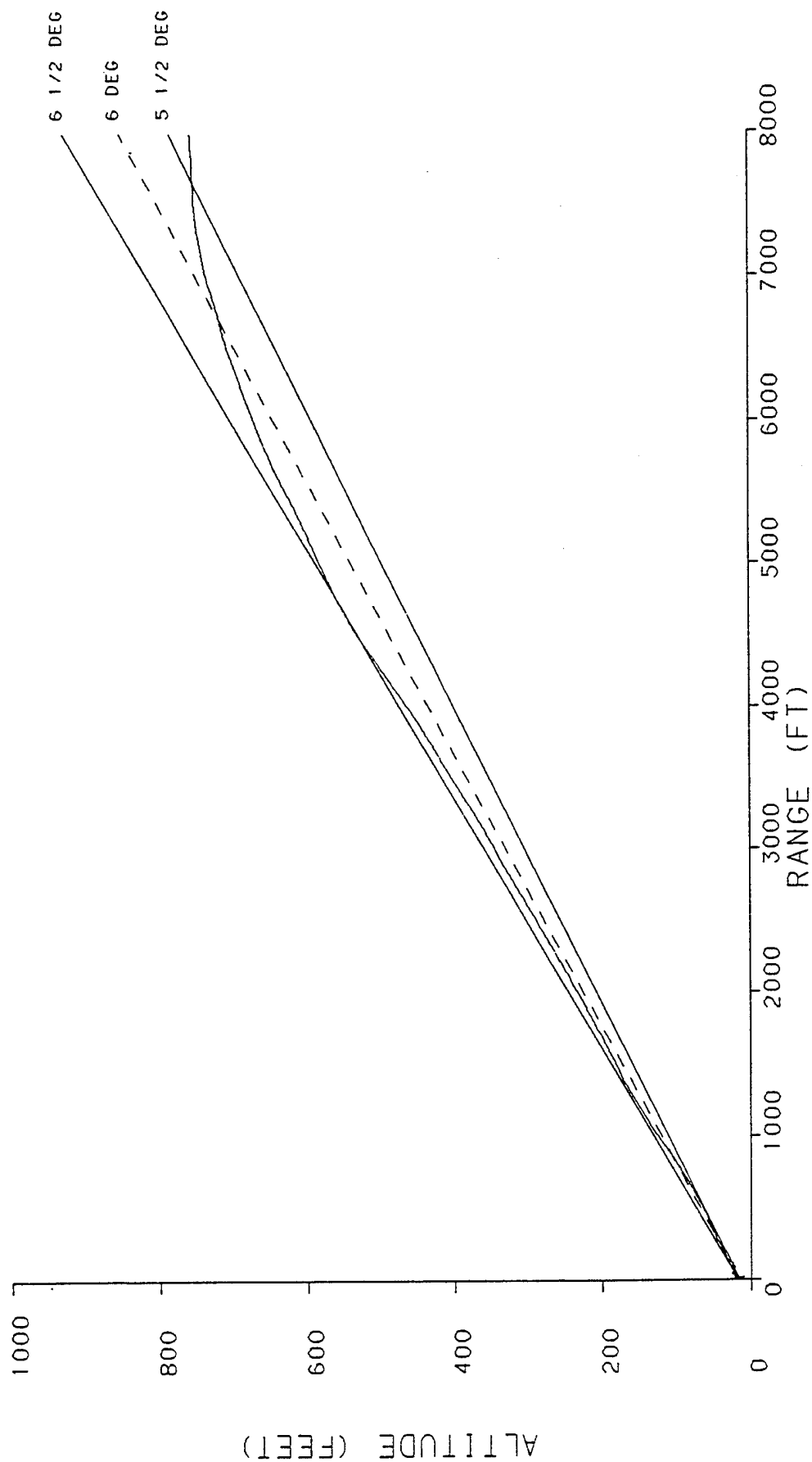
RUN #1  
S/21/93 CHAPI 6.0 DEG CENTERLINE APPROACH  
AZIMUTH : 0.00 ELEVATION : 6.00  
TRACKER DATA

DATA PROCESSED BY THE FPA TECHNICAL CENTER  
ATLANTIC CITY AIRPORT, N J 08405  
14-NOV-1995 11.10



DATA PROCESSED BY THE FAA TECHNICAL CENTER  
ATLANTIC CITY AIRPORT, N J 08405  
16-SEP-1994 15:50

RUN #2  
5/21/93 CHAP1 6.0 DEG CENTERLINE APPROACH  
AZIMUTH : 0.00 ELEVATION : 6.00  
TRACKER DATA



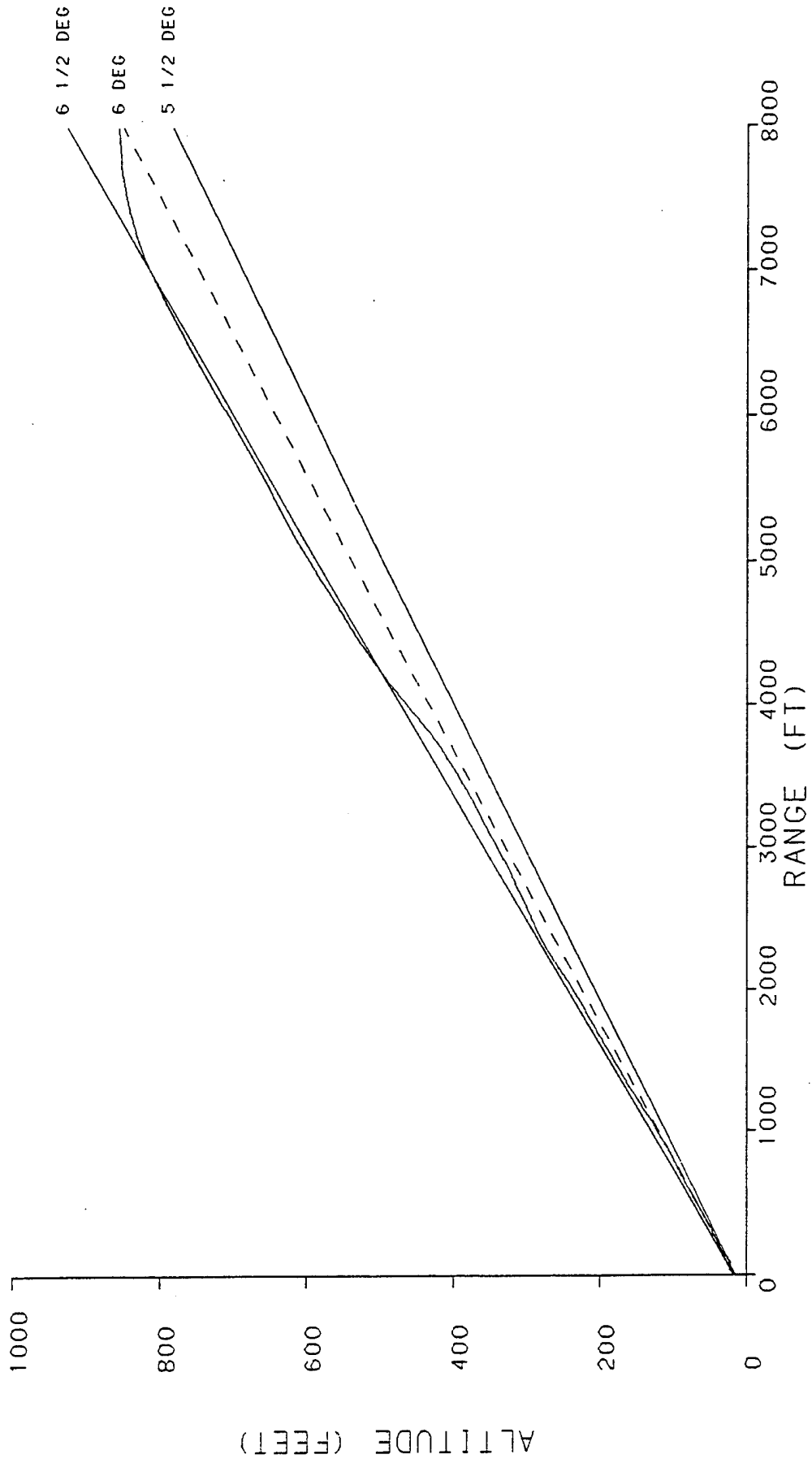
RUN #3

5/21/93 CHAP1 6.0 DEG CENTERLINE APPROACH

AZIMUTH : 0.00 ELEVATION : 6.00

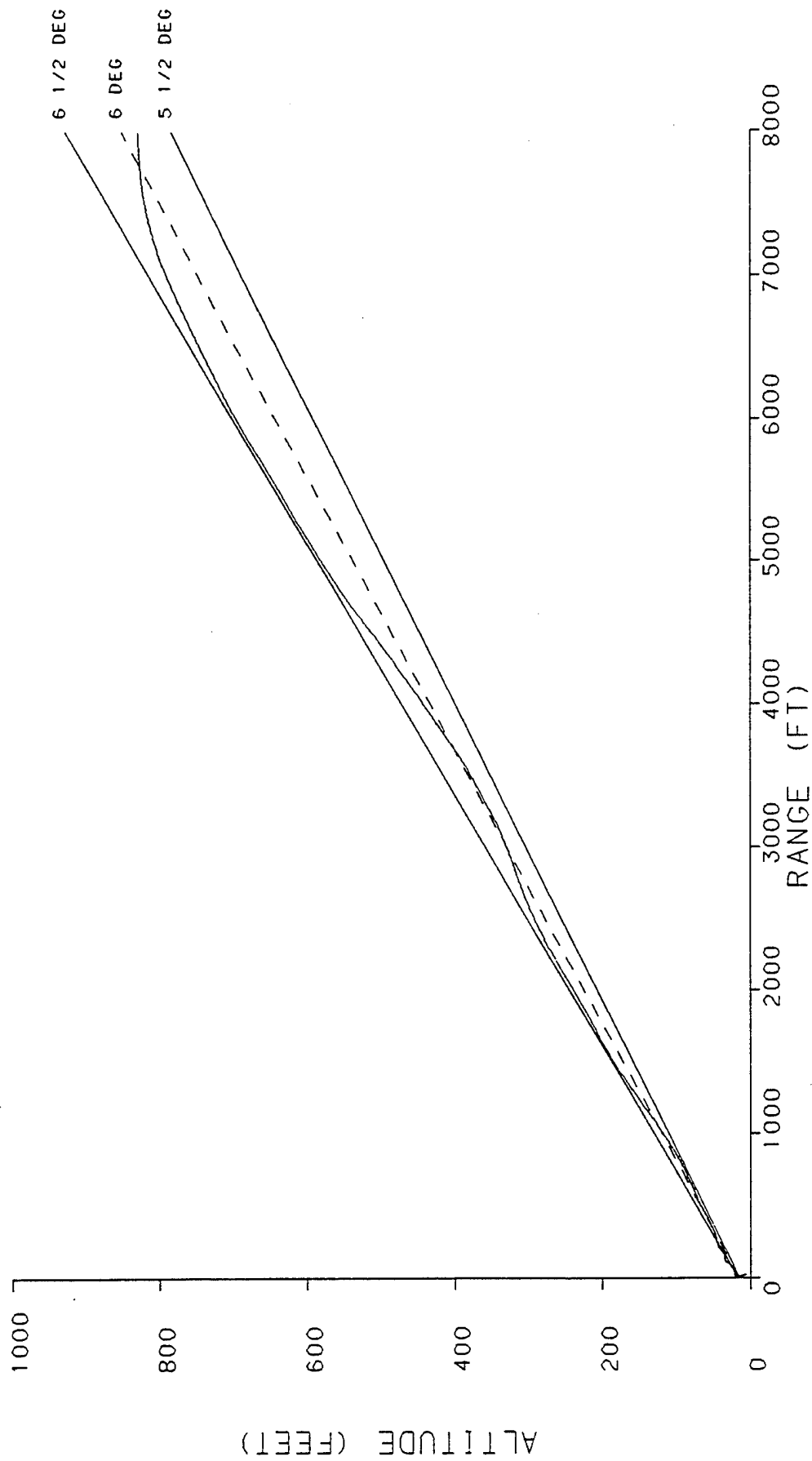
TRACKER DATA

DATA PROCESSED BY THE FAA TECHNICAL CENTER  
ATLANTIC CITY AIRPORT, N J 08405  
16-SEP-1994 15:51



RUN #4  
5/21/93 CHAP1 6.0 DEG CENTERLINE APPROACH  
AZIMUTH : 0.00 ELEVATION : 6.00  
TRACKER DATA

DATA PROCESSED BY THE FAA TECHNICAL CENTER  
ATLANTIC CITY AIRPORT, N J 08403  
16-SEP-1994 15:52



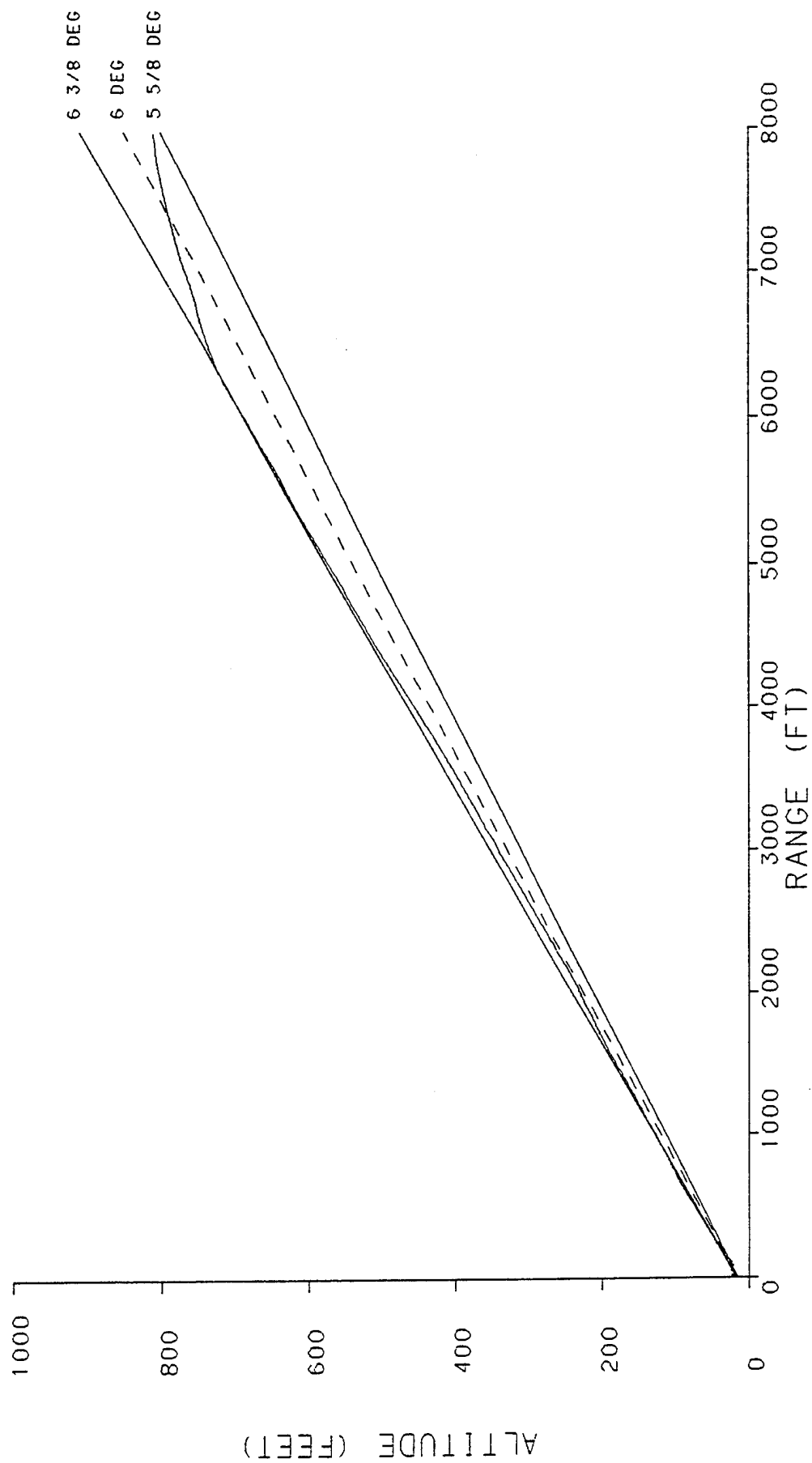
RUN #5

5/21/93 HAPI 6.0 DEG CENTERLINE APPROACH

AZIMUTH : 0.00 ELEVATION : 6.00

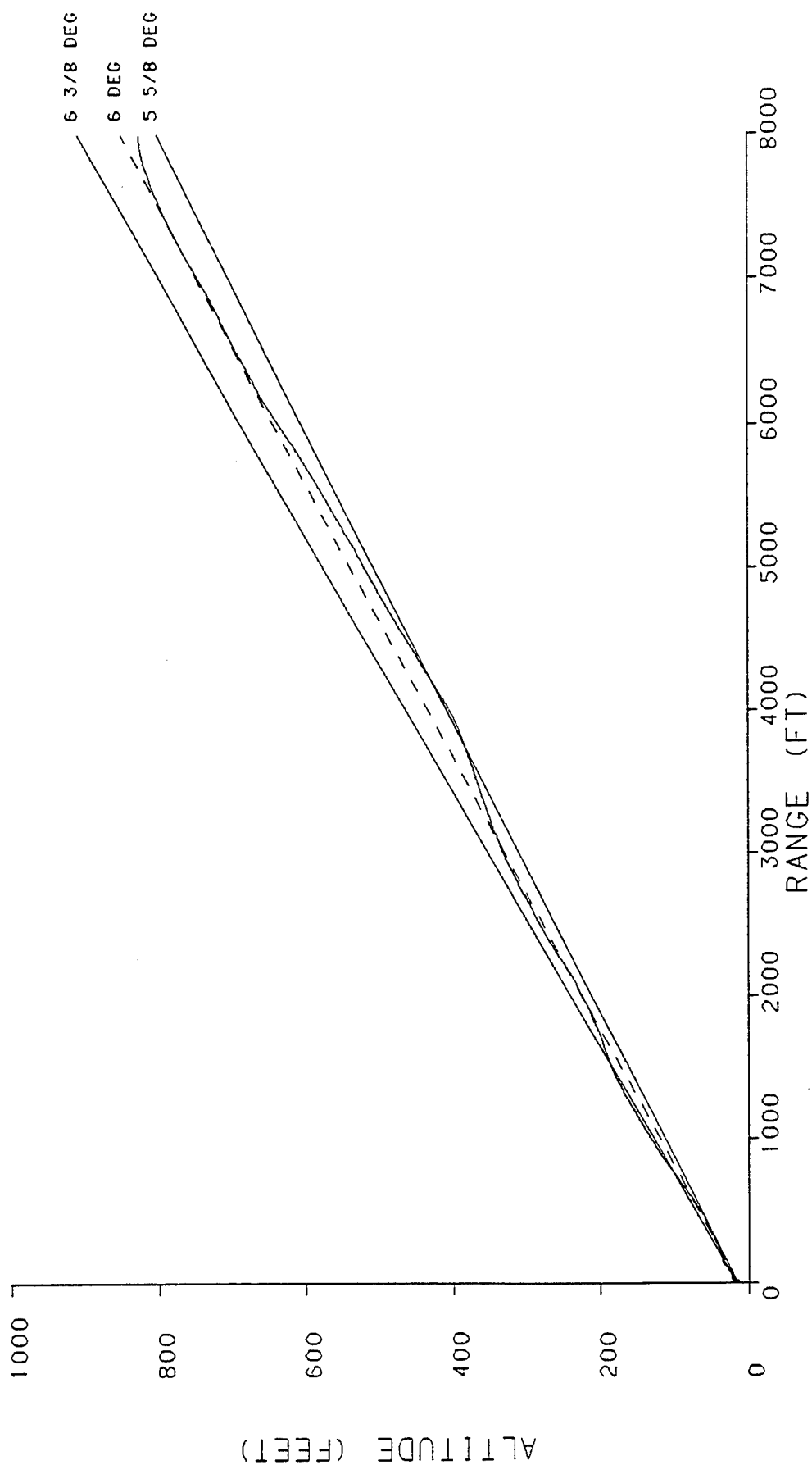
TRACKER DATA

DATA PROCESSED BY THE FAA TECHNICAL CENTER  
ATLANTIC CITY AIRPORT, N J 08405  
16-SEP-1994 15:53



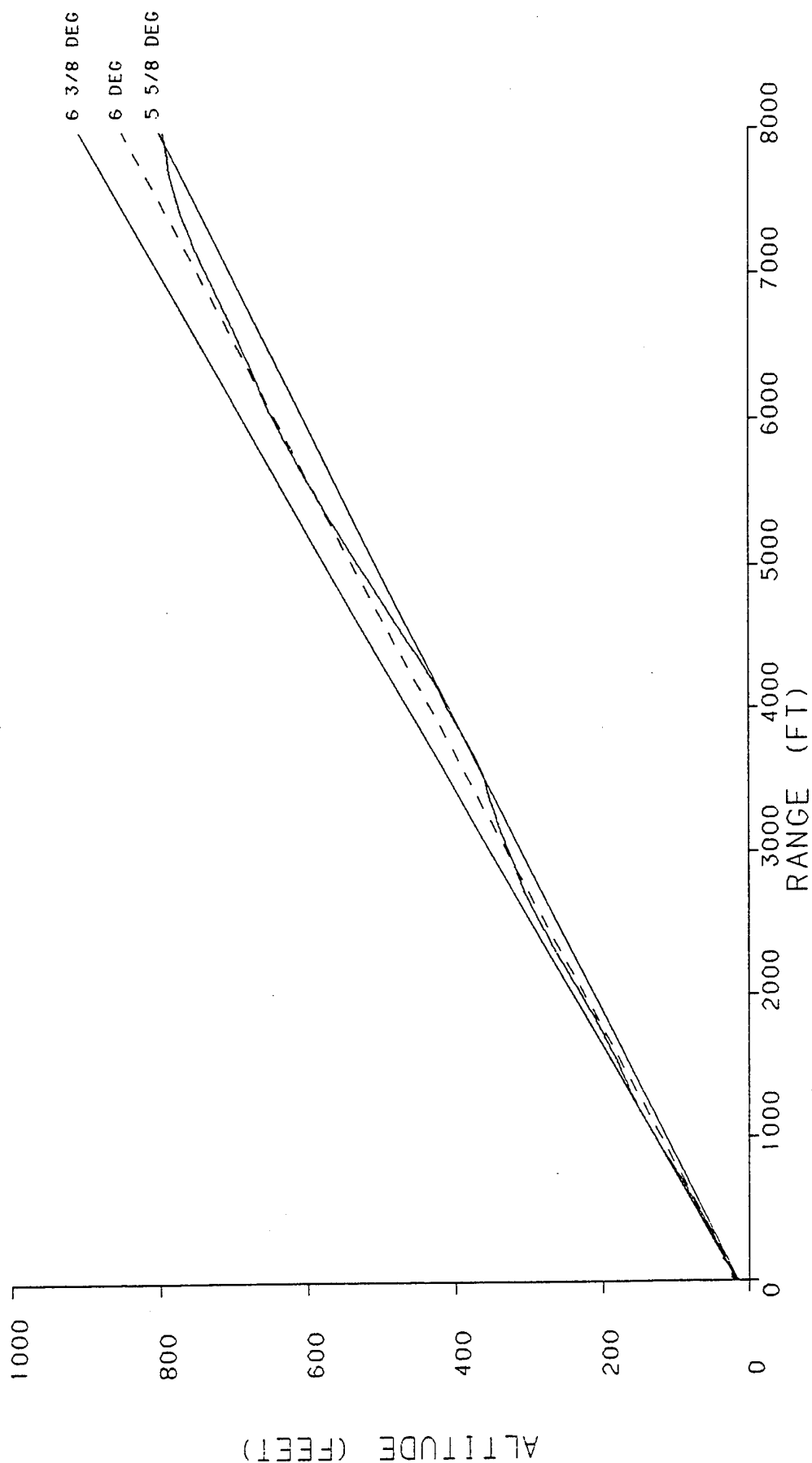
DATA PROCESSED BY THE FAA TECHNICAL CENTER  
ATLANTIC CITY AIRPORT, N J 08405  
16-SEP-1994 15:54

RUN #6  
5/21/93 HAPI 6.0 DEG CENTERLINE APPROACH  
AZIMUTH : 0.00 ELEVATION : 6.00  
TRACKER DATA



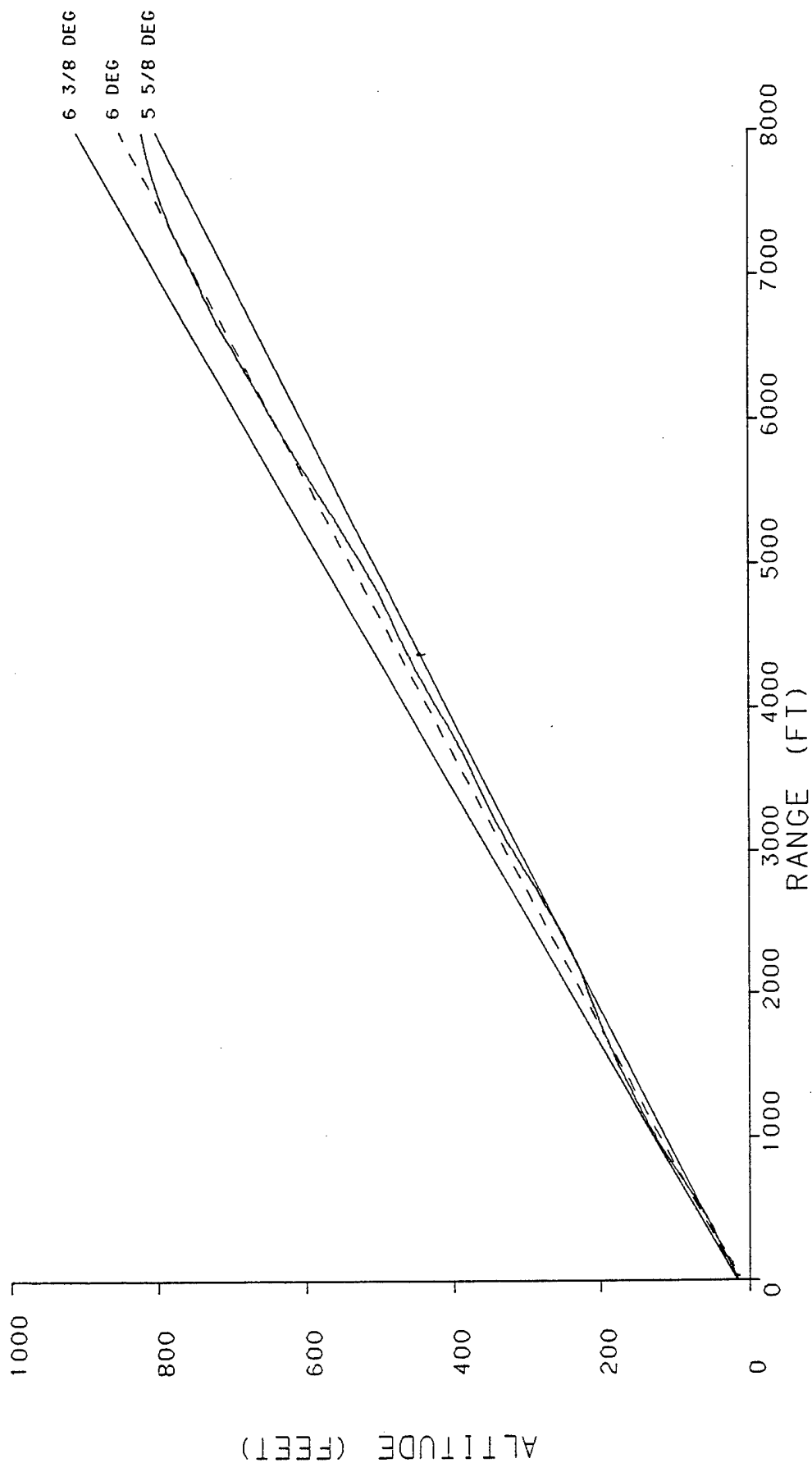
DATA PROCESSED BY THE FAA TECHNICAL CENTER  
ATLANTIC CITY AIRPORT, N J 08403  
16-SEP-1994 15:55

RUN #7  
5/21/93 HAPI 6.0 DEG CENTERLINE APPROACH  
AZIMUTH : 0.00 ELEVATION : 6.00  
TRACKER DATA



DATA PROCESSED BY THE FAA TECHNICAL CENTER  
ATLANTIC CITY AIRPORT, N J 08405  
16-SEP-1994 15:56

RUN #8  
5/21/93 HAPI 6.0 DEG CENTERLINE APPROACH  
AZIMUTH : 0.00 ELEVATION : 6.00  
TRACKER DATA



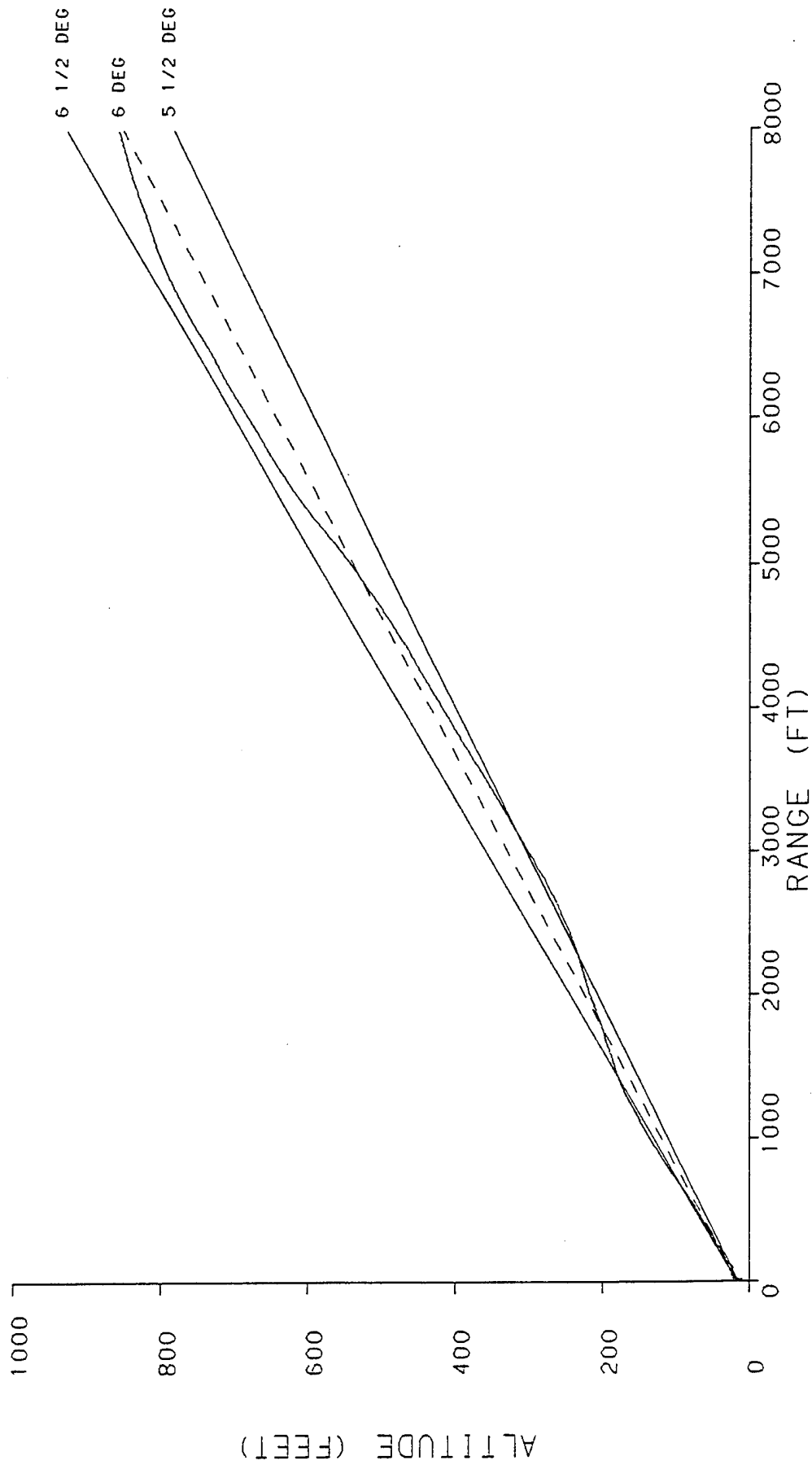
RUN #9

5/21/93 PAPI 6.0 DEG CENTERLINE APPROACH

AZIMUTH : 0.00 ELEVATION : 6.00

TRACKER DATA

DATA PROCESSED BY THE FAA TECHNICAL CENTER  
ATLANTIC CITY AIRPORT. N J 08403  
16-SEP-1994 15:57



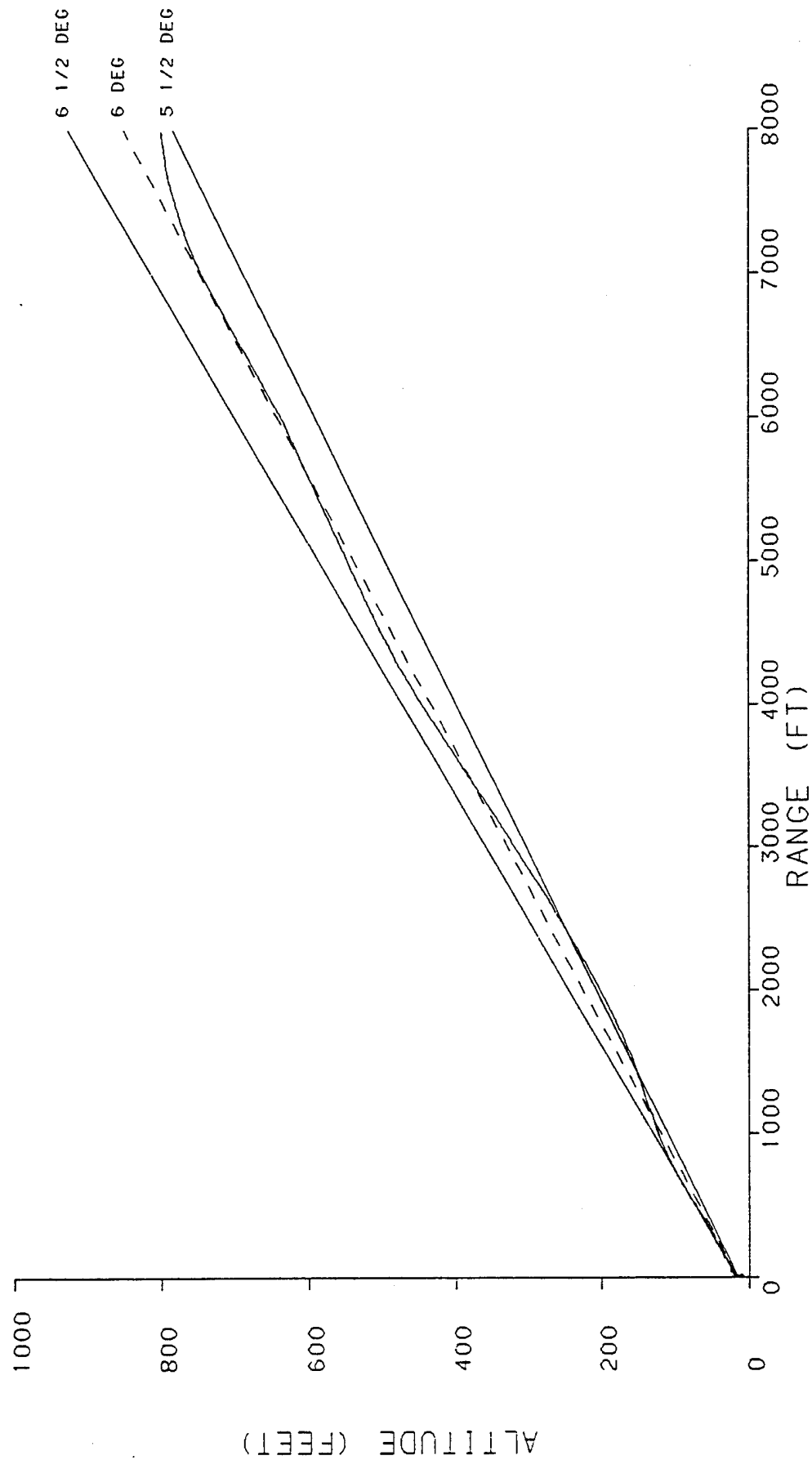
RUN #10

5/21/93 PAPI 6.0 DEG CENTERLINE APPROACH

AZIMUTH : 0.00 ELEVATION : 6.00

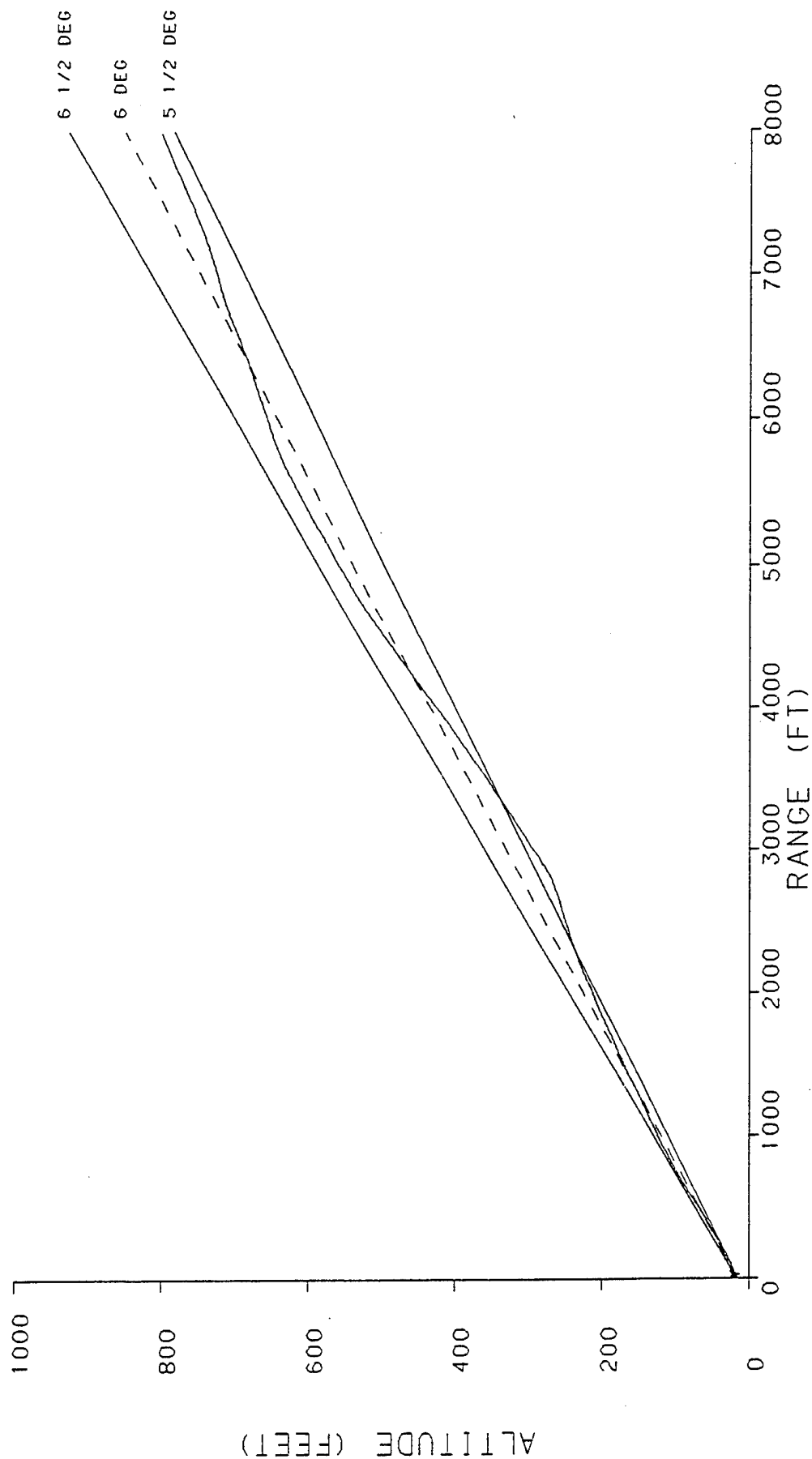
TRACKER DATA

DATA PROCESSED BY THE FAA TECHNICAL CENTER  
ATLANTIC CITY AIRPORT, N J 08405  
16-SEP-1994 15:58



RUN #11  
5/21/93 PAPI 6.0 DEG CENTERLINE APPROACH  
AZIMUTH : 0.00 ELEVATION : 6.00  
TRACKER DATA

DATA PROCESSED BY THE FAA TECHNICAL CENTER  
ATLANTIC CITY AIRPORT. M J 08405  
16-SEP-1994 15:59



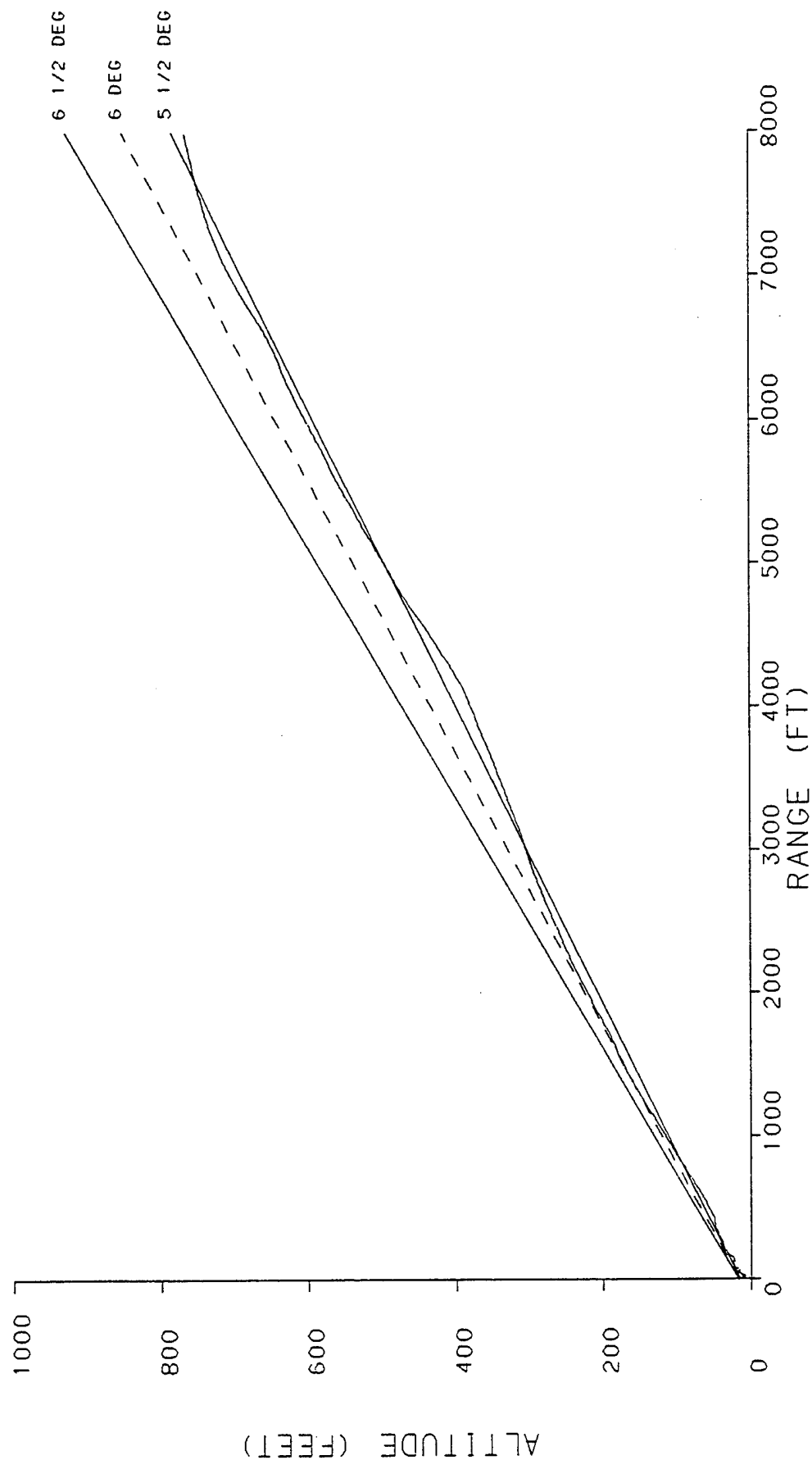
RUN #12

5/21/93 PAPI 6.0 DEG CENTERLINE APPROACH

AZIMUTH : 0.00 ELEVATION : 6.00

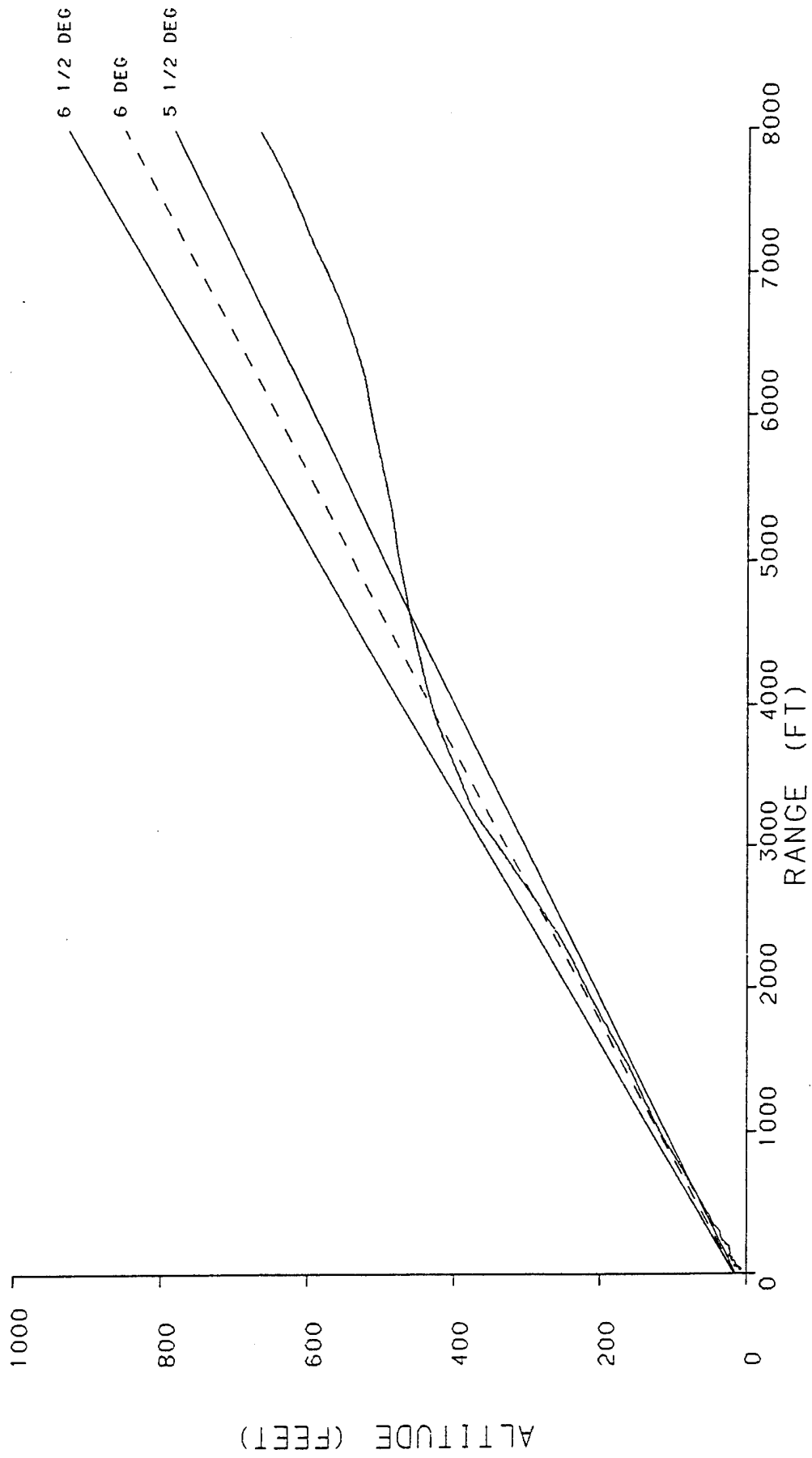
TRACKER DATA

DATA PROCESSED BY THE FAA TECHNICAL CENTER  
ATLANTIC CITY AIRPORT, N J 08403  
16-SEP-1994 16:00



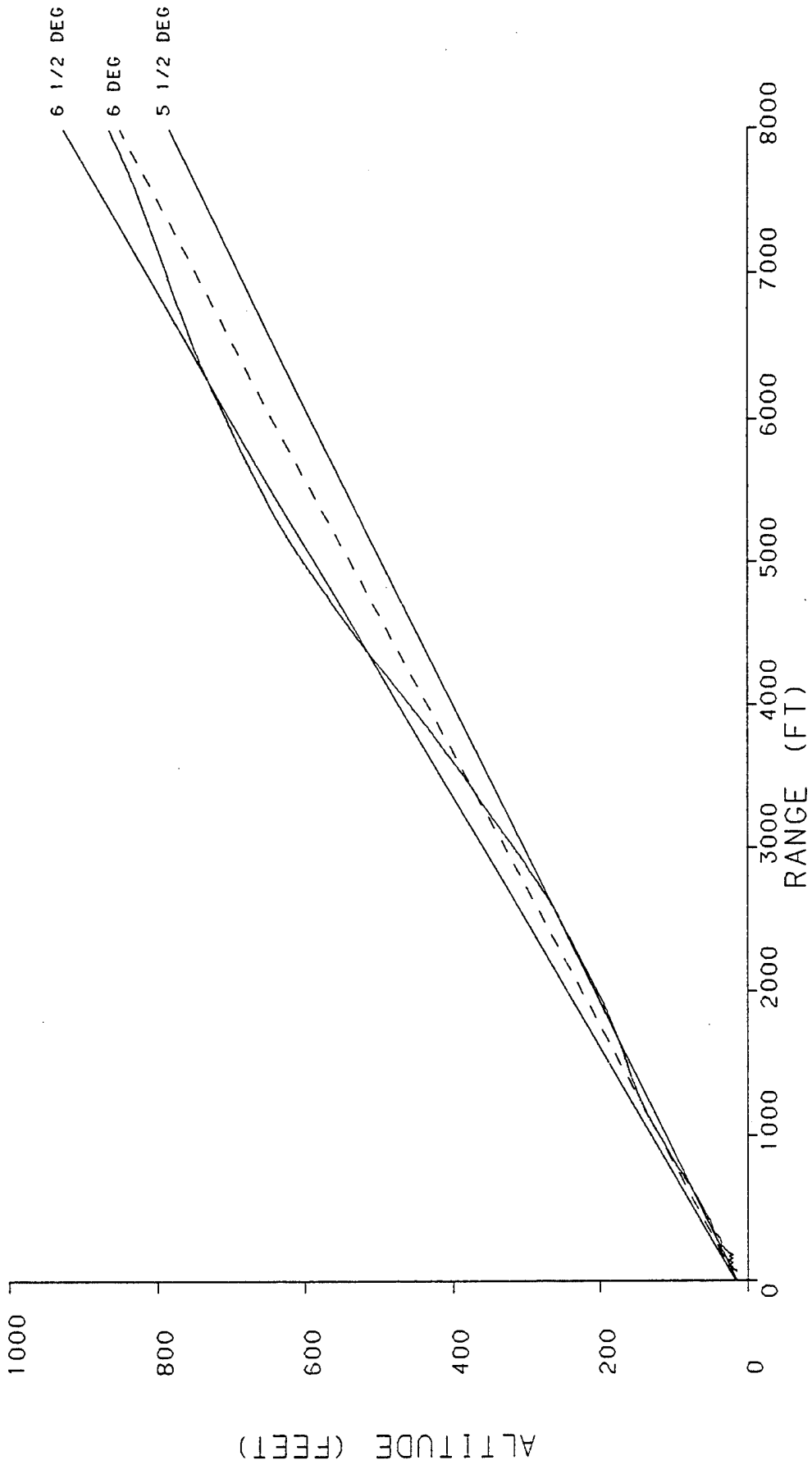
DATA PROCESSED BY THE FAA TECHNICAL CENTER  
ATLANTIC CITY AIRPORT, N J 08403  
16-SEP-1994 16:01

RUN #1  
5/25/93 AM PAPI 6.0 DEG CENTERLINE APPROACH  
AZIMUTH : 0.00 ELEVATION : 6.00  
TRACKER DATA



DATA PROCESSED BY THE FAA TECHNICAL CENTER  
ATLANTIC CITY AIRPORT, N J 08405  
16-SEP-1994 16:02

RUN #2  
5/25/93 AM PAP1 6.0 DEG CENTERLINE APPROACH  
AZIMUTH : 0.00 ELEVATION : 6.00  
TRACKER DATA



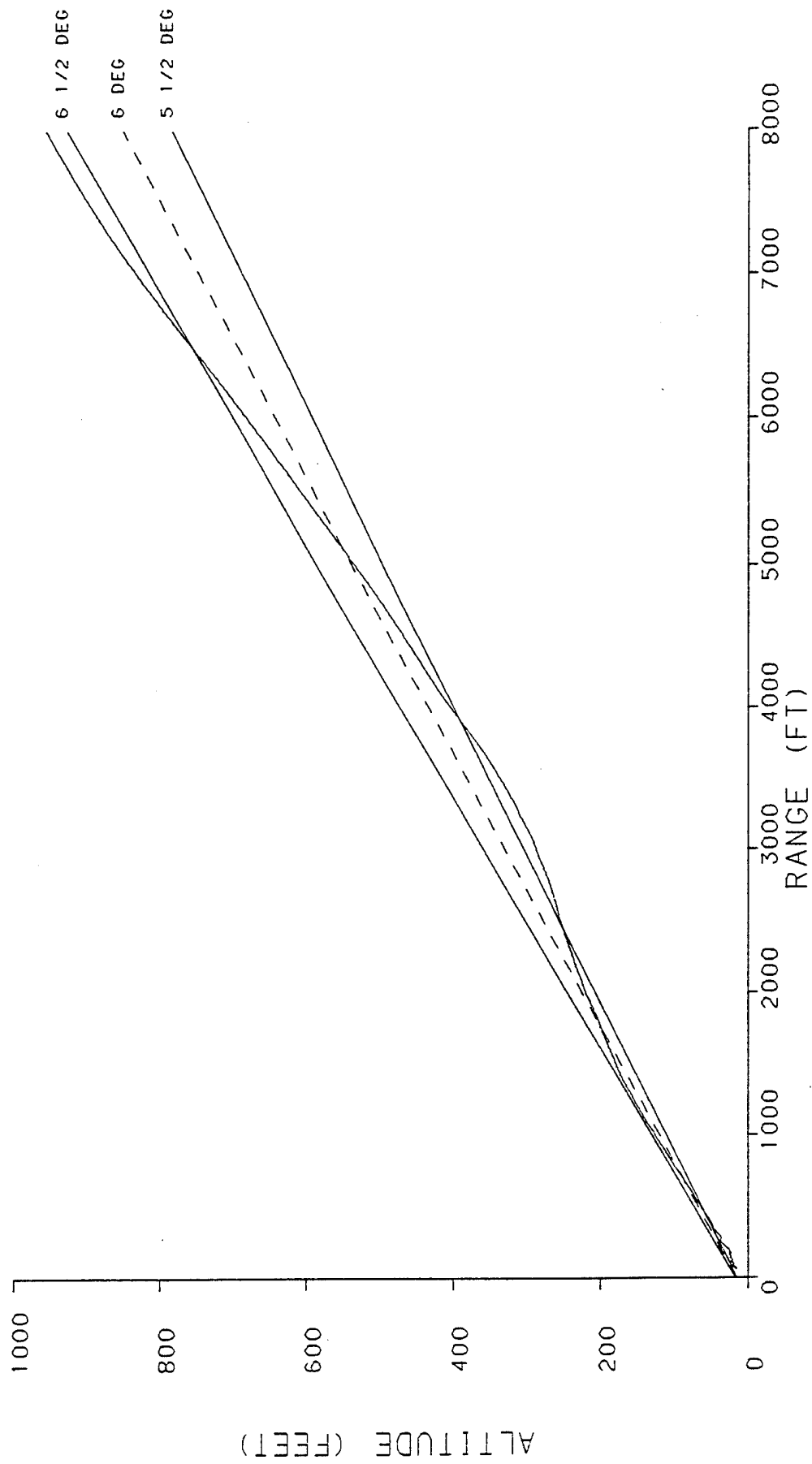
RUN #3

5/25/93 AM PAPI 6.0 DEG CENTERLINE APPROACH

AZIMUTH : 0.00 ELEVATION : 6.00

TRACKER DATA

DATA PROCESSED BY THE FAA TECHNICAL CENTER  
ATLANTIC CITY AIRPORT, N J 08405  
16-SEP-1994 16:03



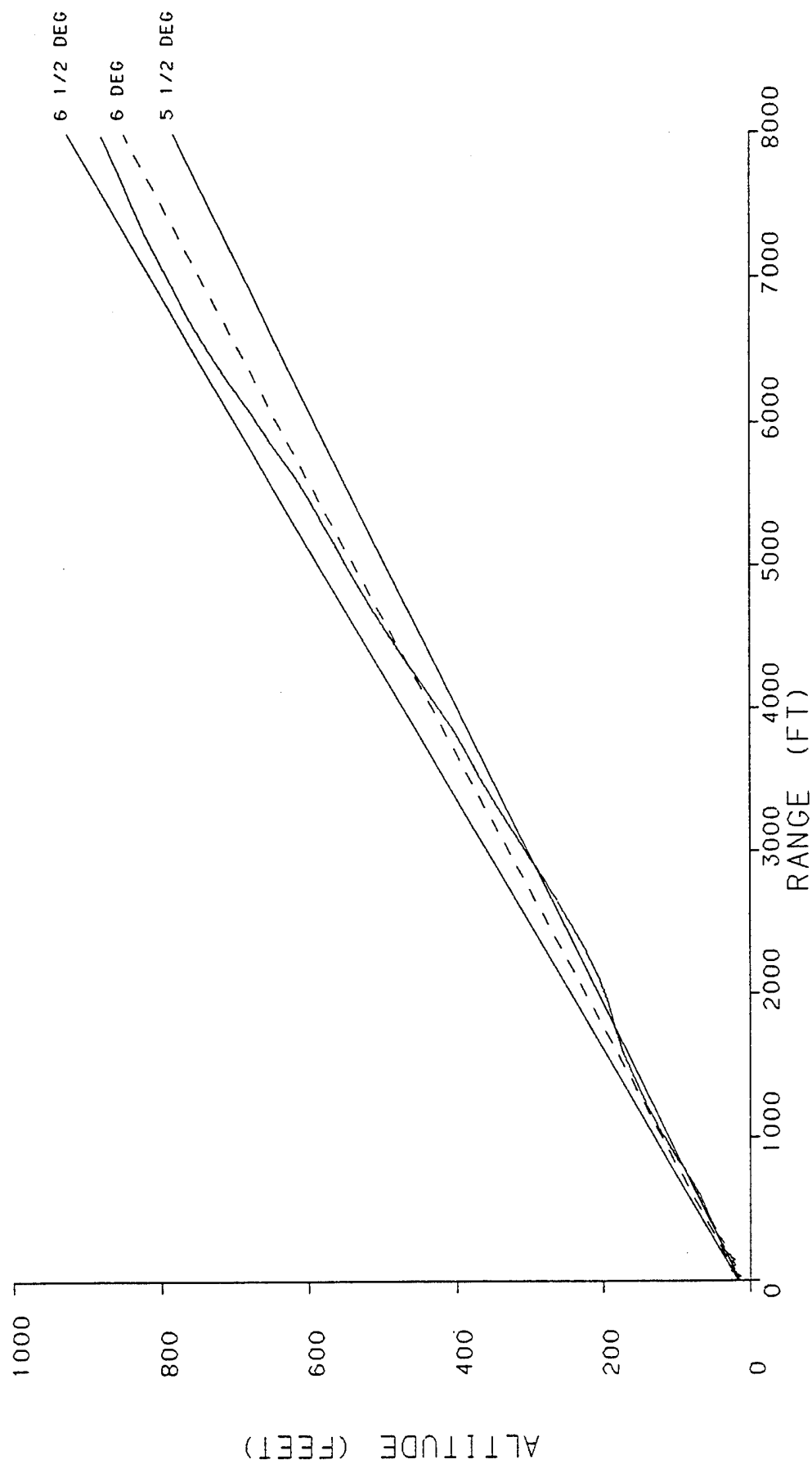
RUN #4

5/25/93 AM PAPI 6.0 DEG CENTERLINE APPROACH

AZIMUTH : 0.00 ELEVATION : 6.00

TRACKER DATA

DATA PROCESSED BY THE FAA TECHNICAL CENTER  
ATLANTIC CITY AIRPORT, N J 08405  
16-SEP-1994 16:04



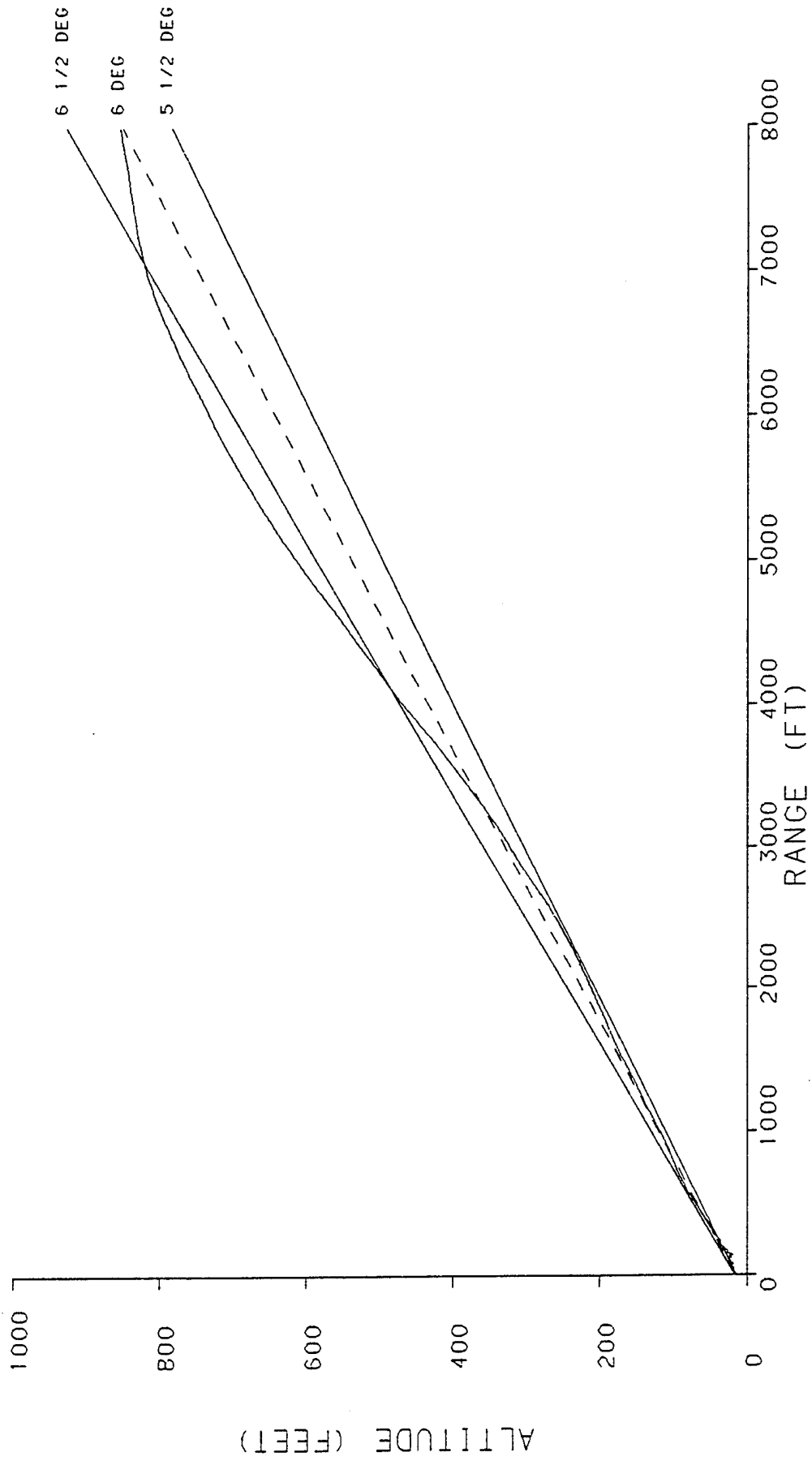
RUN #5

5/25/93 AM CHAPI 6.0 DEG CENTERLINE APPROACH

AZIMUTH : 0.00 ELEVATION : 6.00

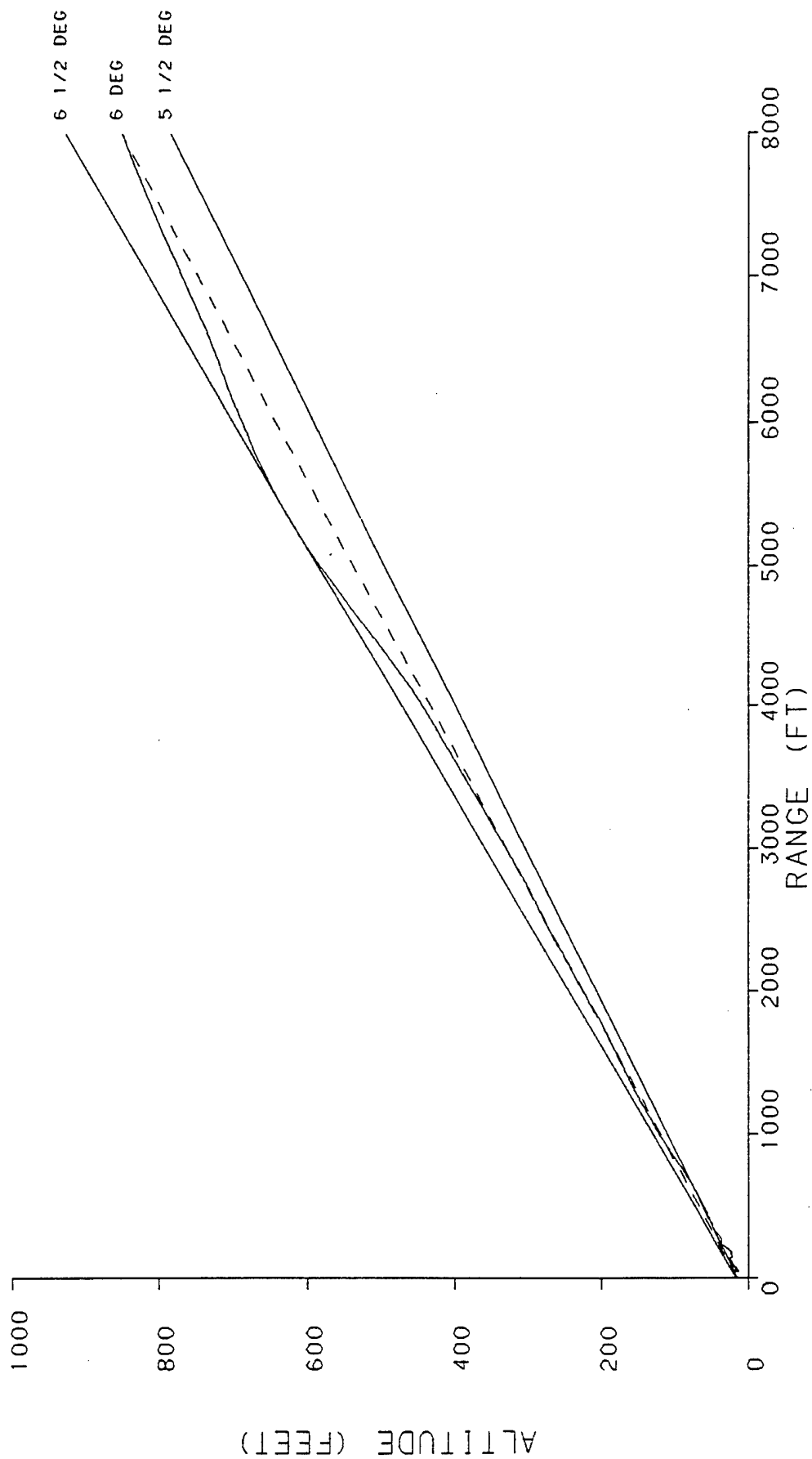
TRACKER DATA

DATA PROCESSED BY THE FAA TECHNICAL CENTER  
ATLANTIC CITY AIRPORT, N J 08403  
16-SEP-1994 16:05



RUN #6  
5/25/93 AM CHAP1 6.0 DEG CENTERLINE APPROACH  
AZIMUTH : 0.00 ELEVATION : 6.00  
TRACKER DATA

DATA PROCESSED BY THE FAA TECHNICAL CENTER  
ATLANTIC CITY AIRPORT, N J 08403  
16-SEP-1994 16:06



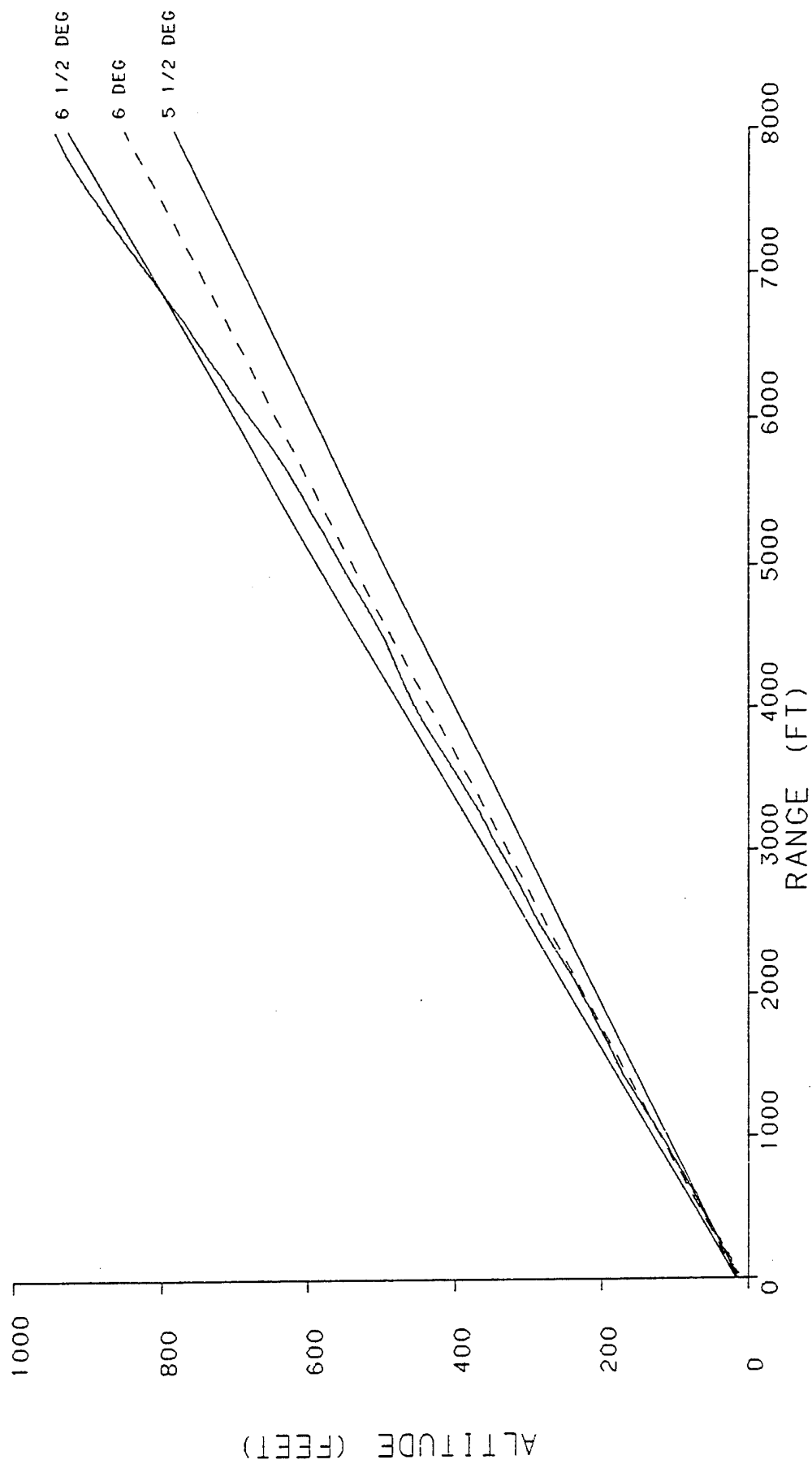
RUN #7

5/25/93 AM CHAP1 6.0 DEG CENTERLINE APPROACH

AZIMUTH : 0.00 ELEVATION : 6.00

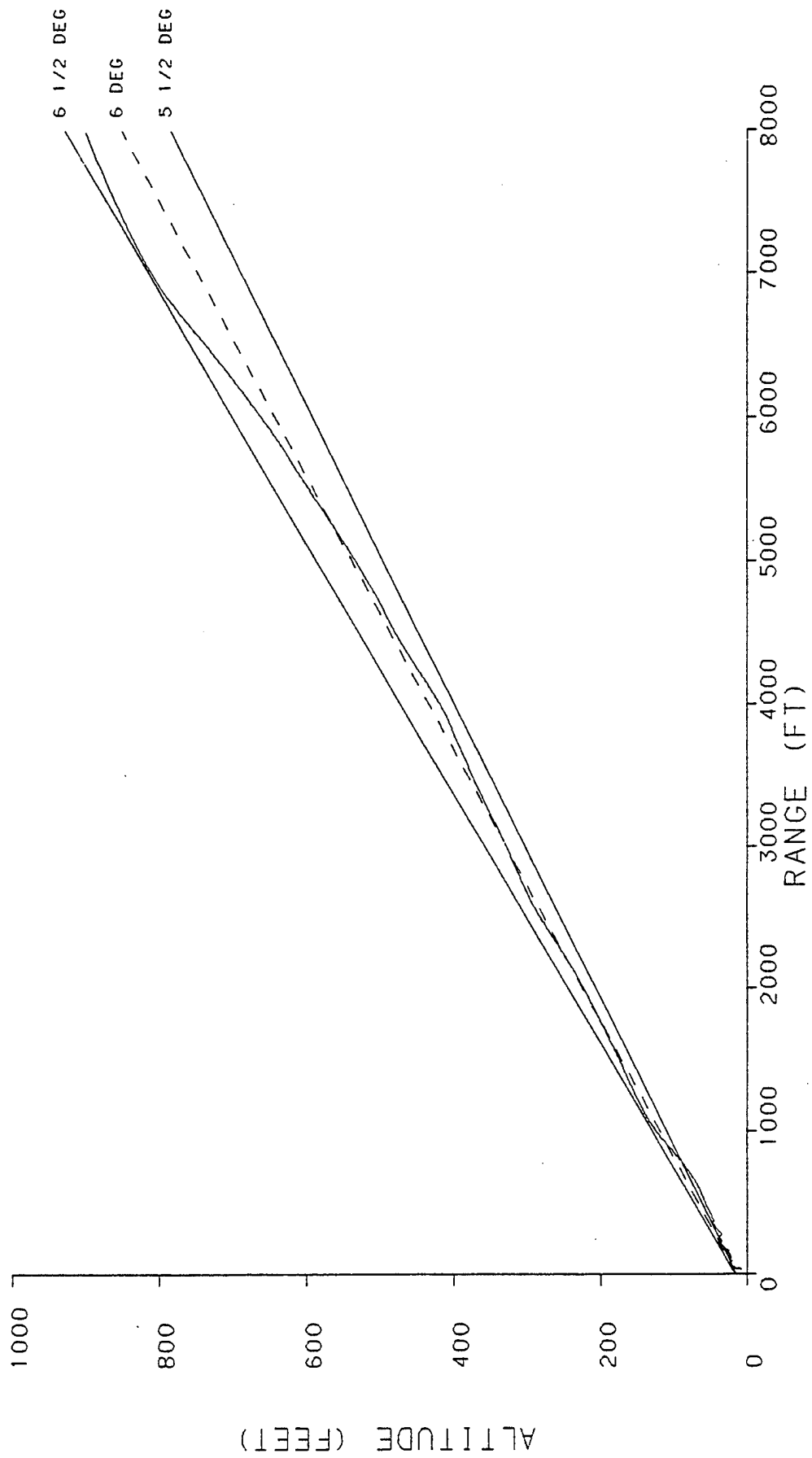
TRACKER DATA

DATA PROCESSED BY THE FAA TECHNICAL CENTER  
ATLANTIC CITY AIRPORT, N J 08405  
16-SEP-1994 16:07



DATA PROCESSED BY THE FAA TECHNICAL CENTER  
ATLANTIC CITY AIRPORT, N J 08405  
16-SEP-1994 16:08

RUN #8  
5/25/93 AM CHAP1 6.0 DEG CENTERLINE APPROACH  
AZIMUTH : 0.00 ELEVATION : 6.00  
TRACKER DATA



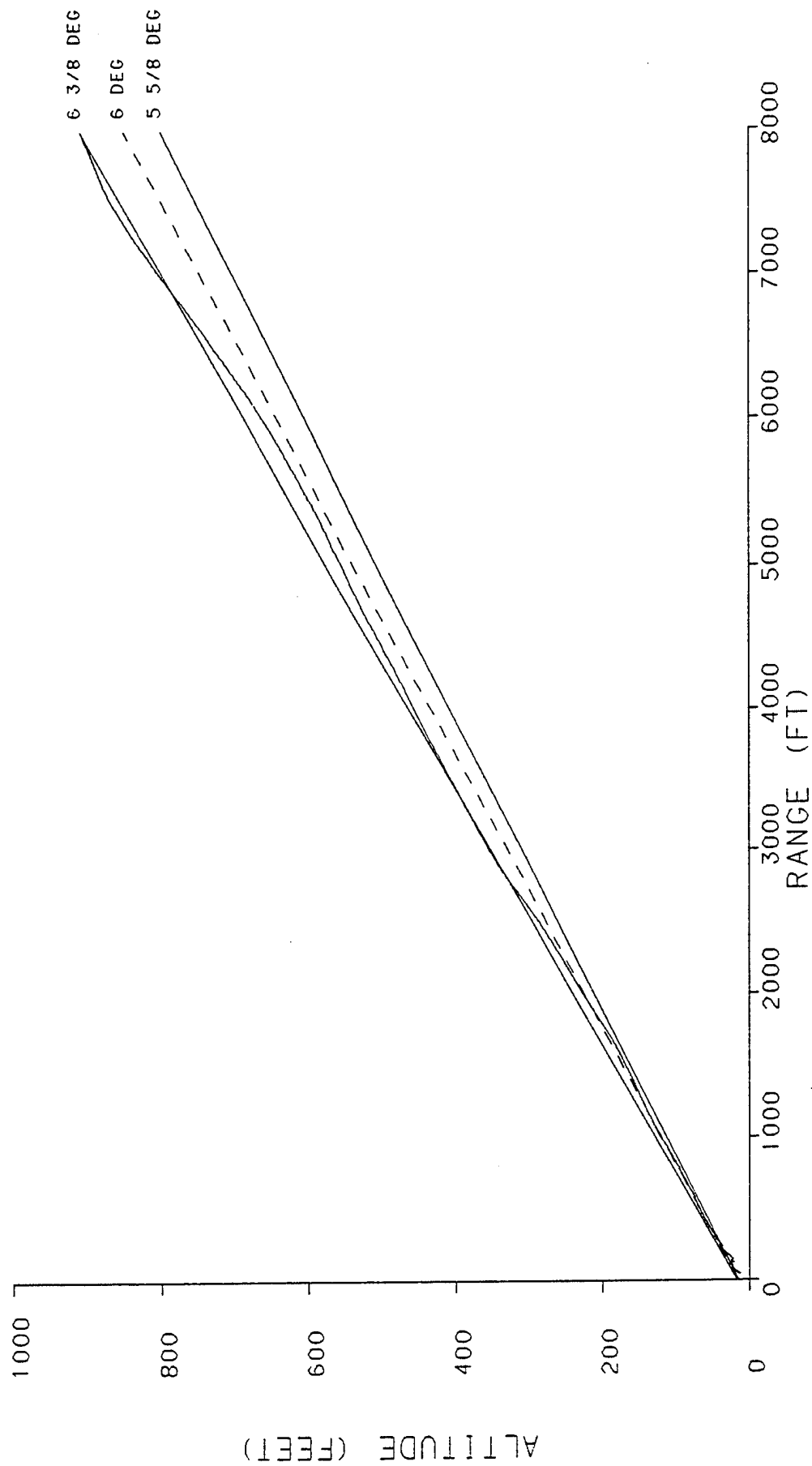
RUN #9

5/25/93 AM HAP1 6.0 DEG CENTERLINE APPROACH

AZIMUTH : 0.00 ELEVATION : 6.00

TRACKER DATA

DATA PROCESSED BY THE FAA TECHNICAL CENTER  
ATLANTIC CITY AIRPORT, N J 08405  
16-SEP-1994 16:09



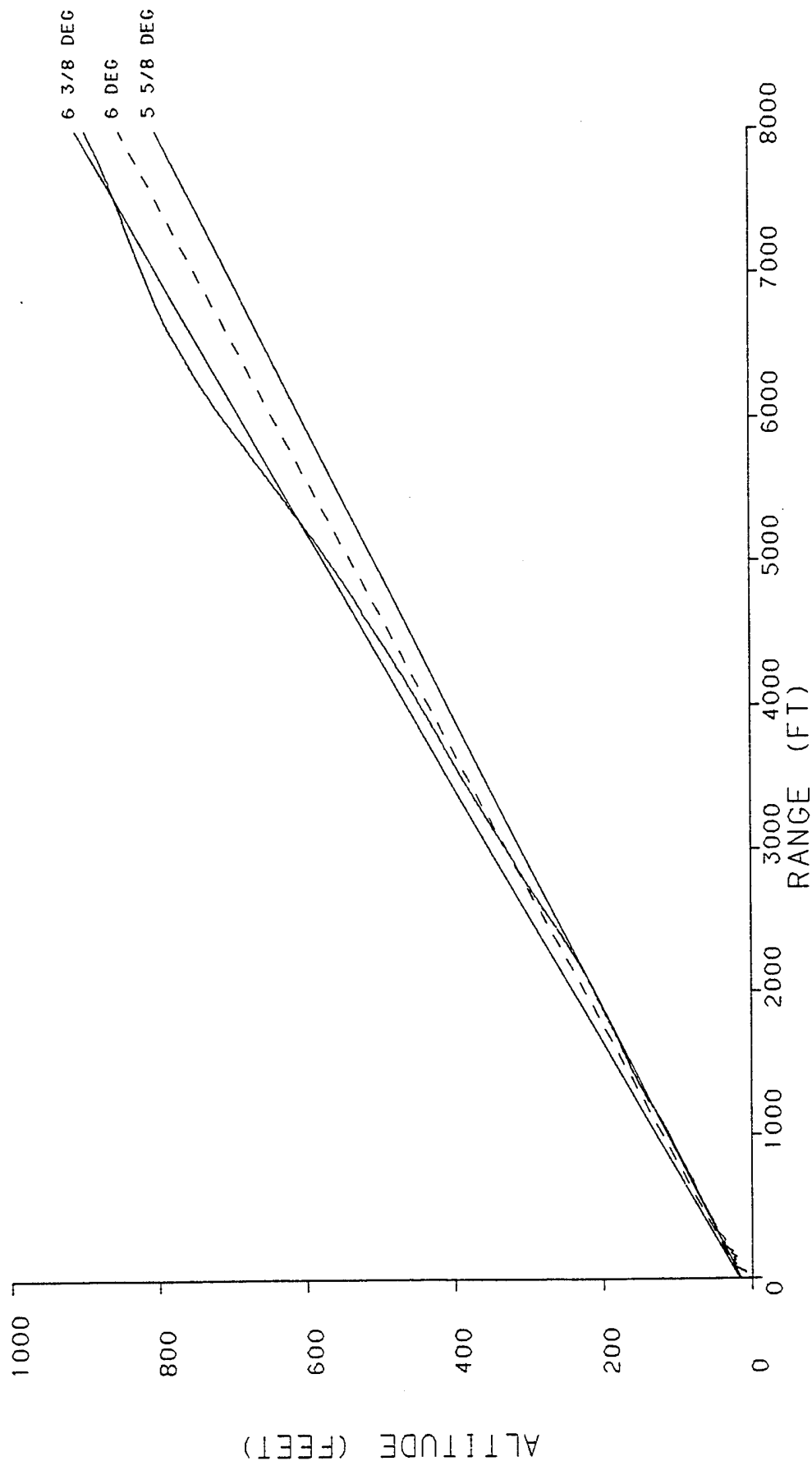
RUN #10

5/25/93 AM HAPJ 6.0 DEG CENTERLINE APPROACH

AZIMUTH : 0.00 ELEVATION : 6.00

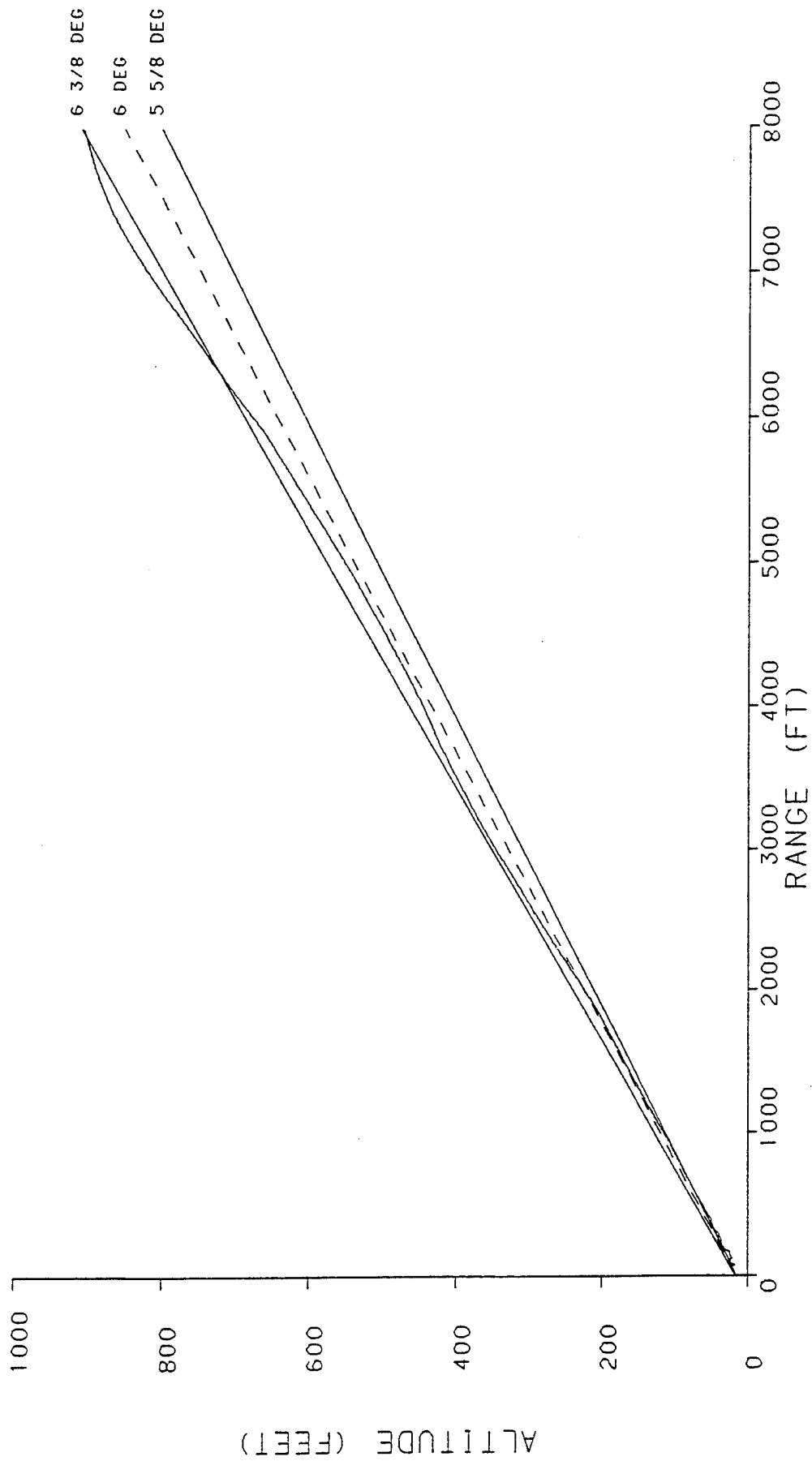
TRACKER DATA

DATA PROCESSED BY THE FAA TECHNICAL CENTER  
ATLANTIC CITY AIRPORT, N J 08405  
16-SEP-1994 16:10



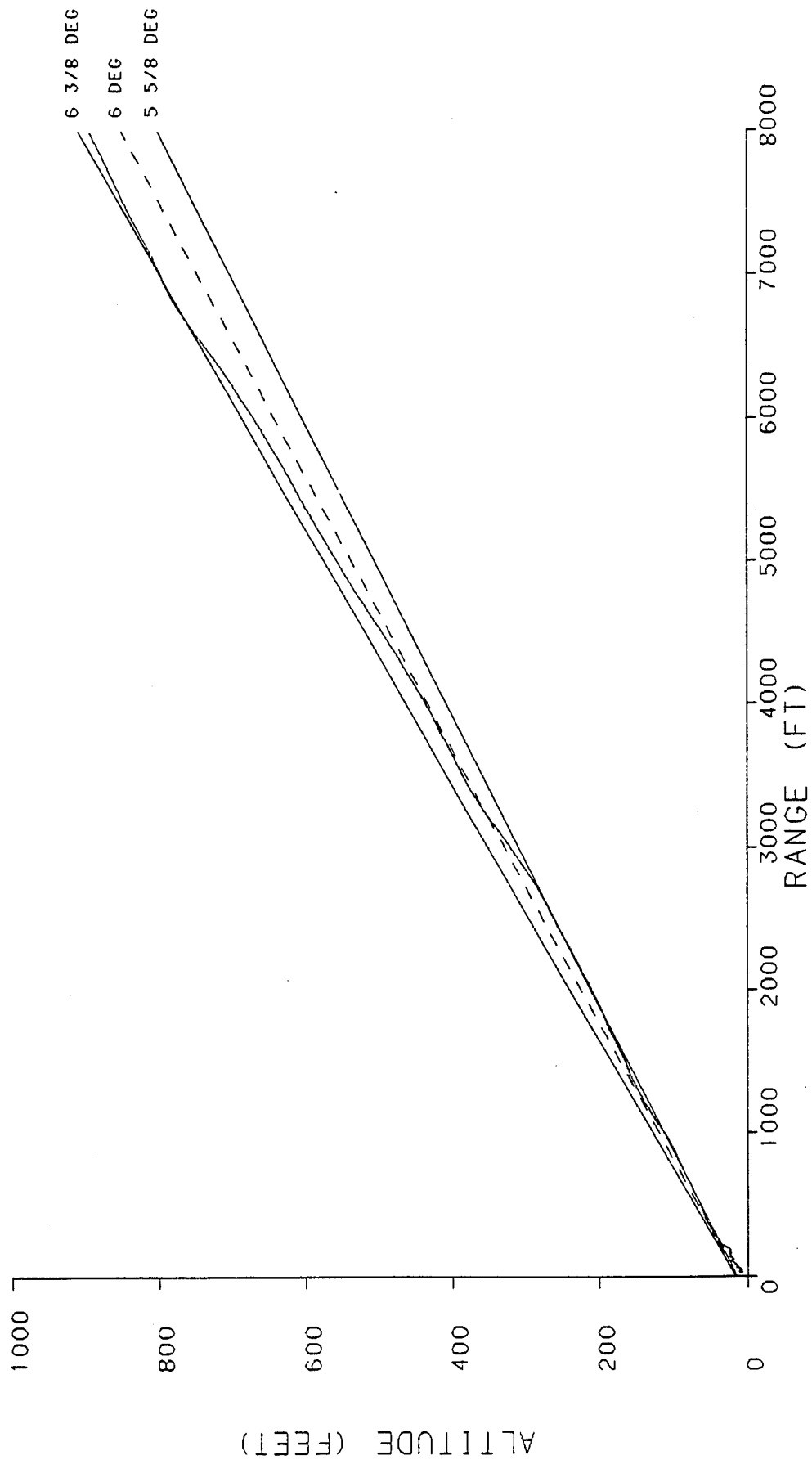
RUN #11  
5/25/93 AM HAP1 6.0 DEG CENTERLINE APPROACH  
AZIMUTH : 0.00 ELEVATION : 6.00  
TRACKER DATA

DATA PROCESSED BY THE FAA TECHNICAL CENTER  
ATLANTIC CITY AIRPORT, N J 08405  
16-SEP-1994 16:11



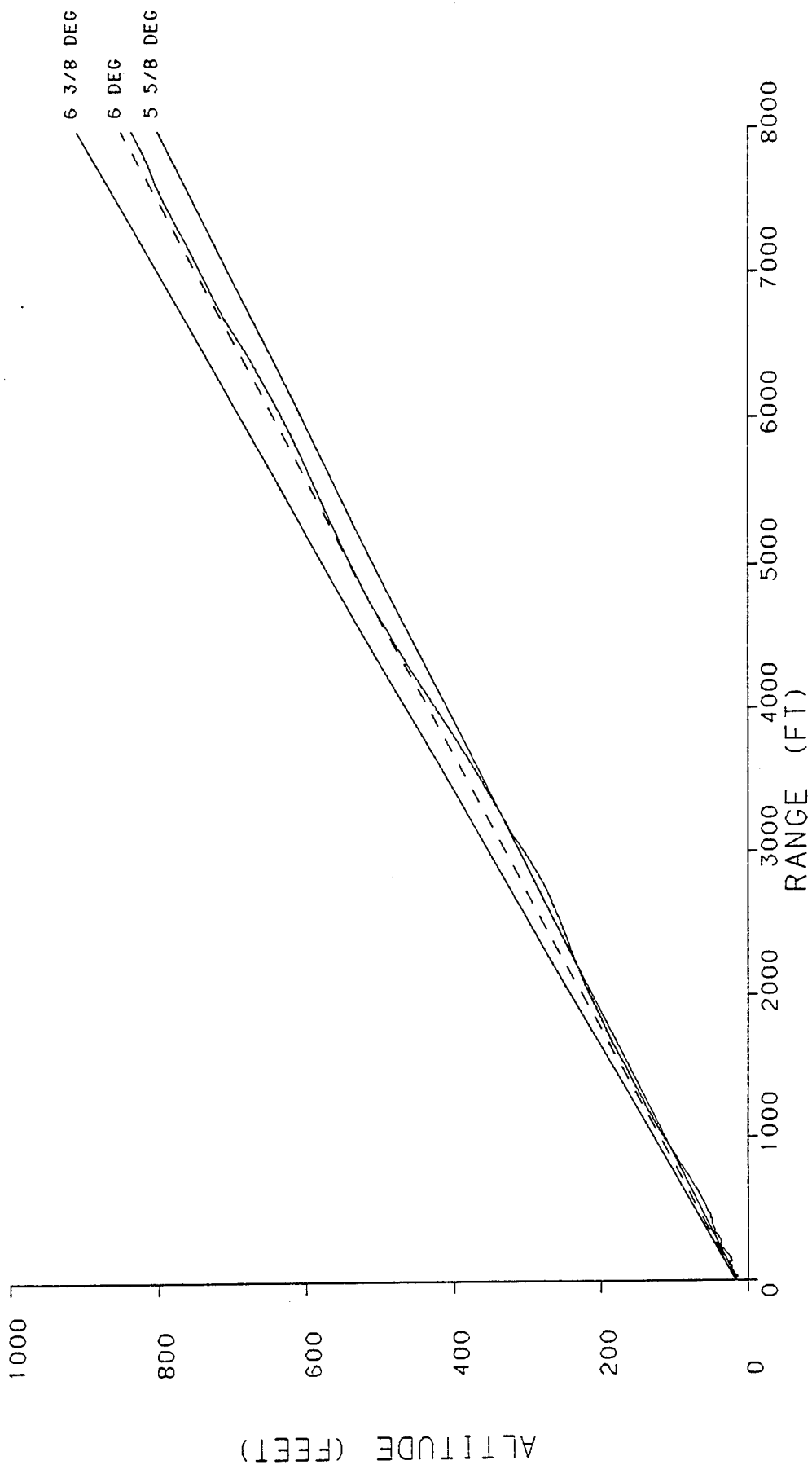
RUN #12  
5/25/93 AM HAP1 6.0 DEG CENTERLINE APPROACH  
AZIMUTH : 0.00 ELEVATION : 6.00  
TRACKER DATA

DATA PROCESSED BY THE FAA TECHNICAL CENTER  
ATLANTIC CITY AIRPORT, N J 08405  
16-SEP-1994 16:12



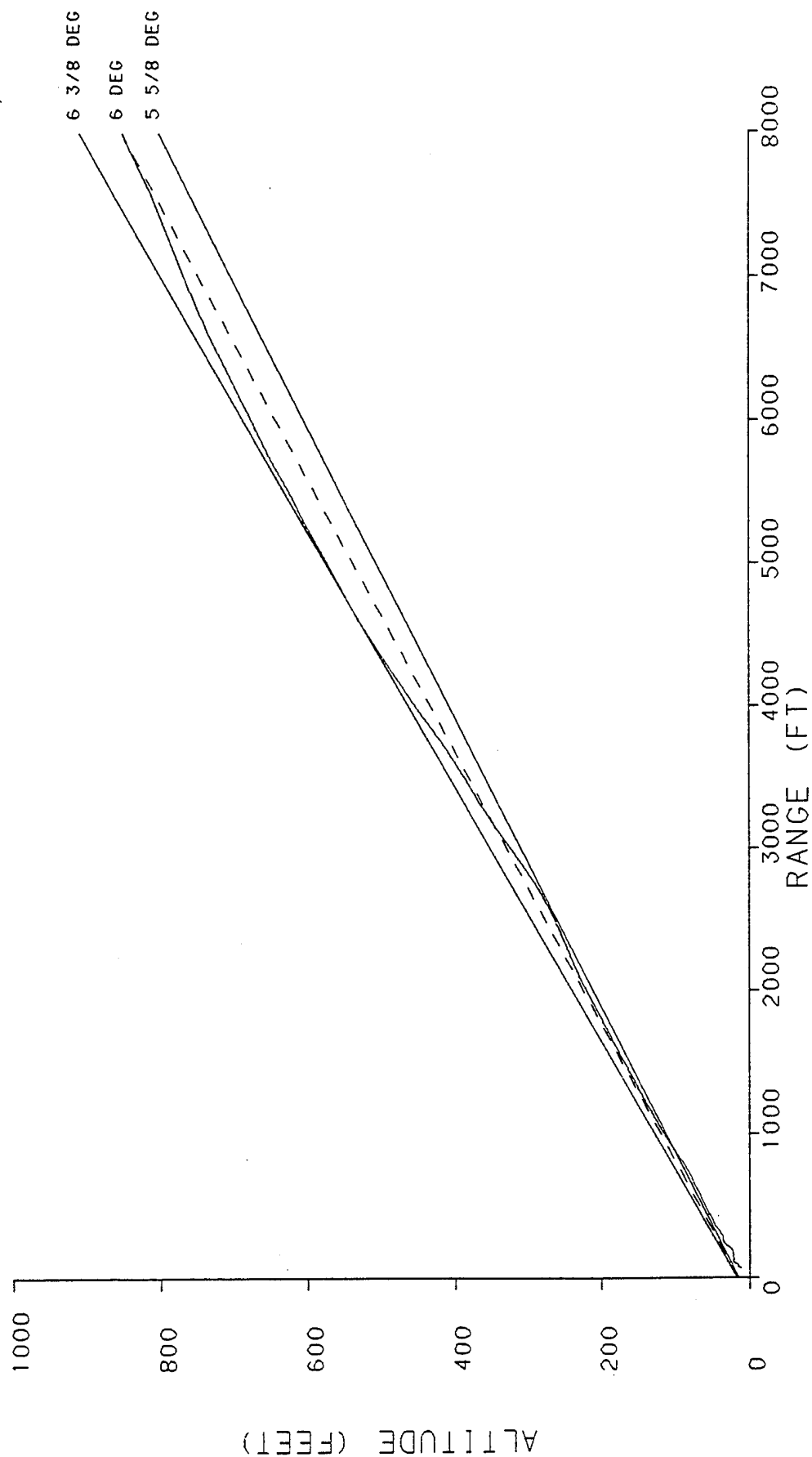
DATA PROCESSED BY THE FAA TECHNICAL CENTER  
ATLANTIC CITY AIRPORT. N J 08405  
16-SEP-1994 16:12

RUN #1  
5/25/93 PM HAP1 6.0 DEG CENTERLINE APPROACH  
AZIMUTH : 0.00 ELEVATION : 6.00  
TRACKER DATA



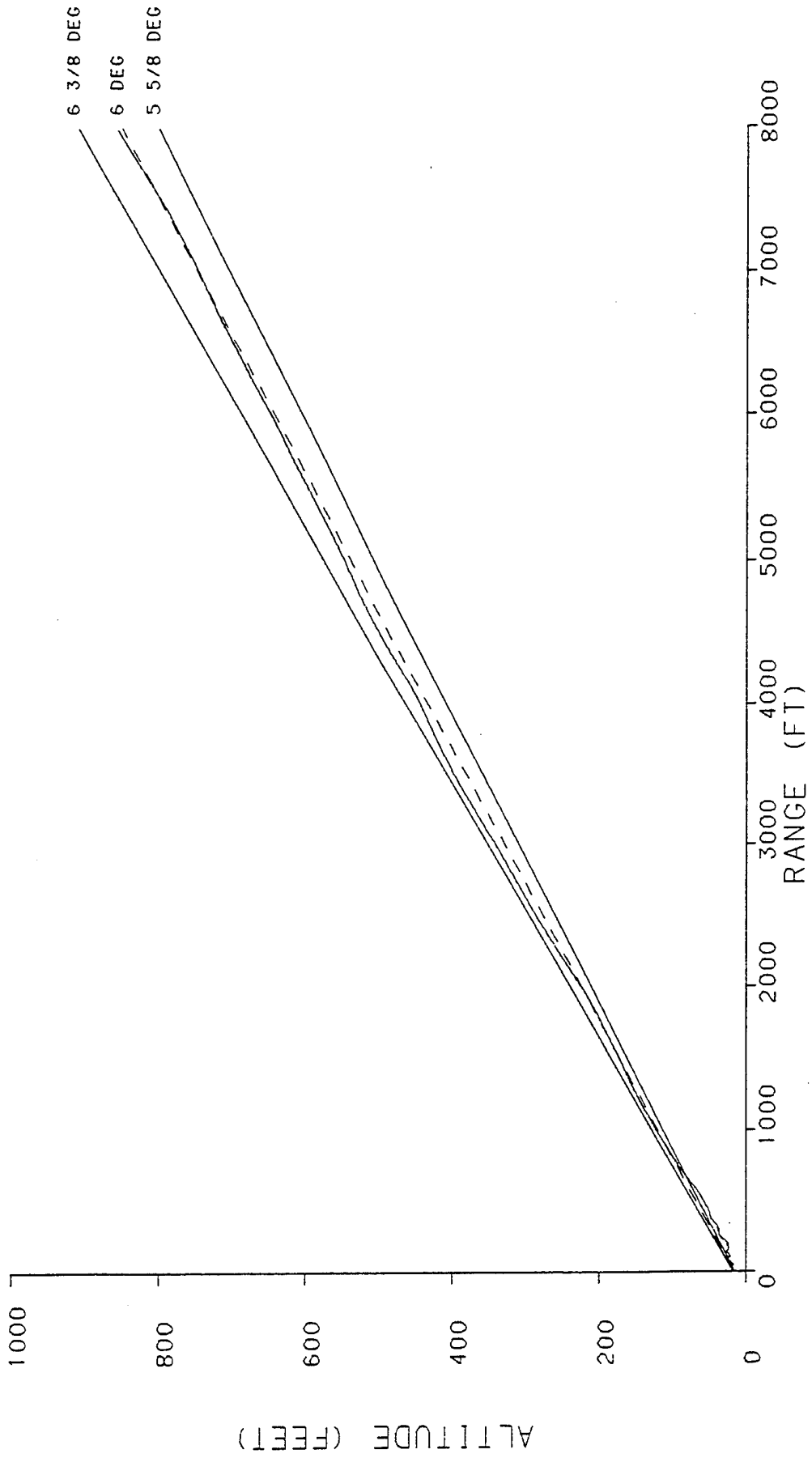
DATA PROCESSED BY THE FAA TECHNICAL CENTER  
ATLANTIC CITY AIRPORT, N J 08405  
16-SEP-1994 16:13

RUN #2  
5/25/93 PM HAPI 6.0 DEG CENTERLINE APPROACH  
AZIMUTH : 0.00 ELEVATION : 6.00  
TRACKER DATA



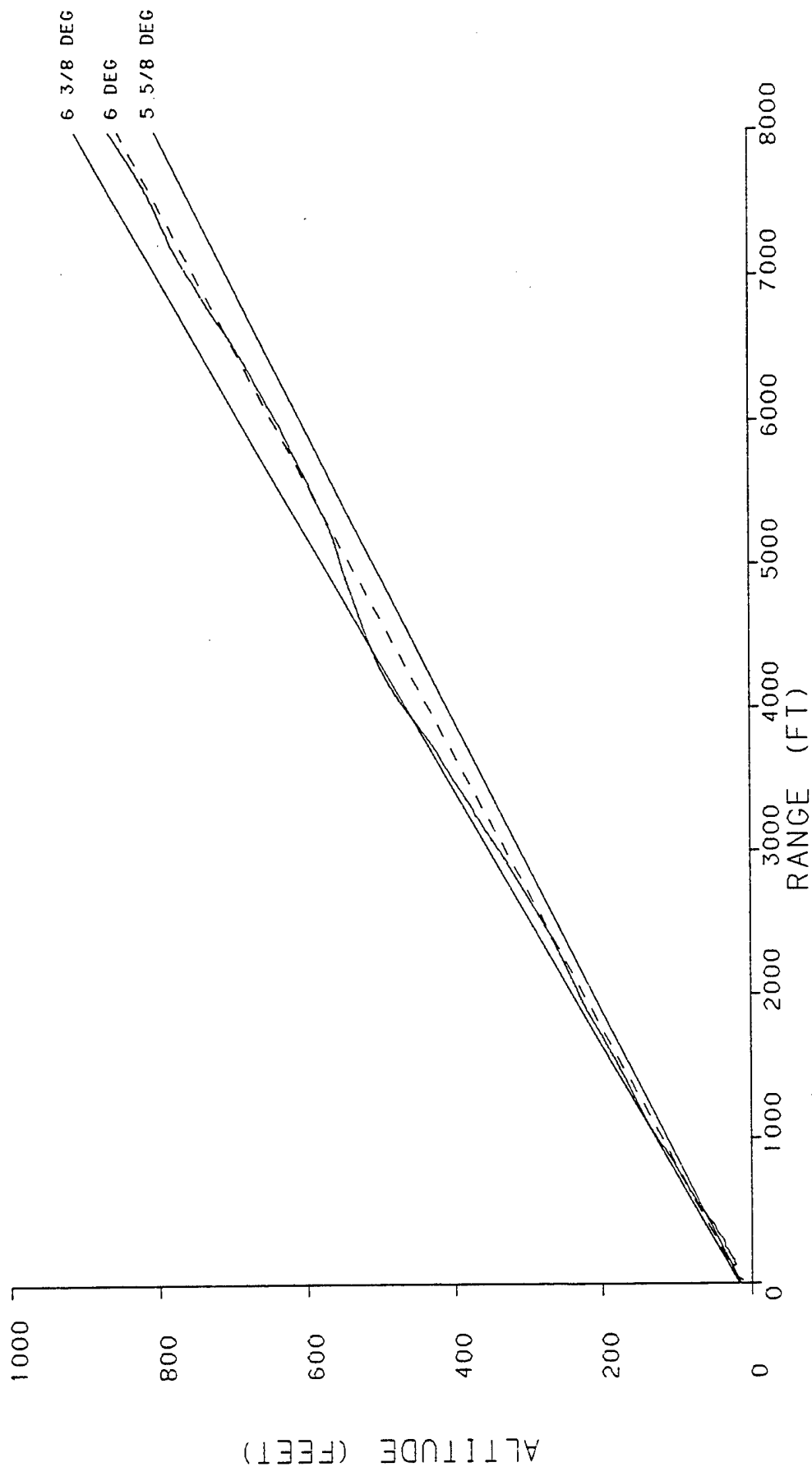
DATA PROCESSED BY THE FAA TECHNICAL CENTER  
ATLANTIC CITY AIRPORT, N J 08403  
16-SEP-1994 16:14

RUN #3  
5/25/93 PM HAPJ 6.0 DEG CENTERLINE APPROACH  
AZIMUTH : 0.00 ELEVATION : 6.00  
TRACKER DATA



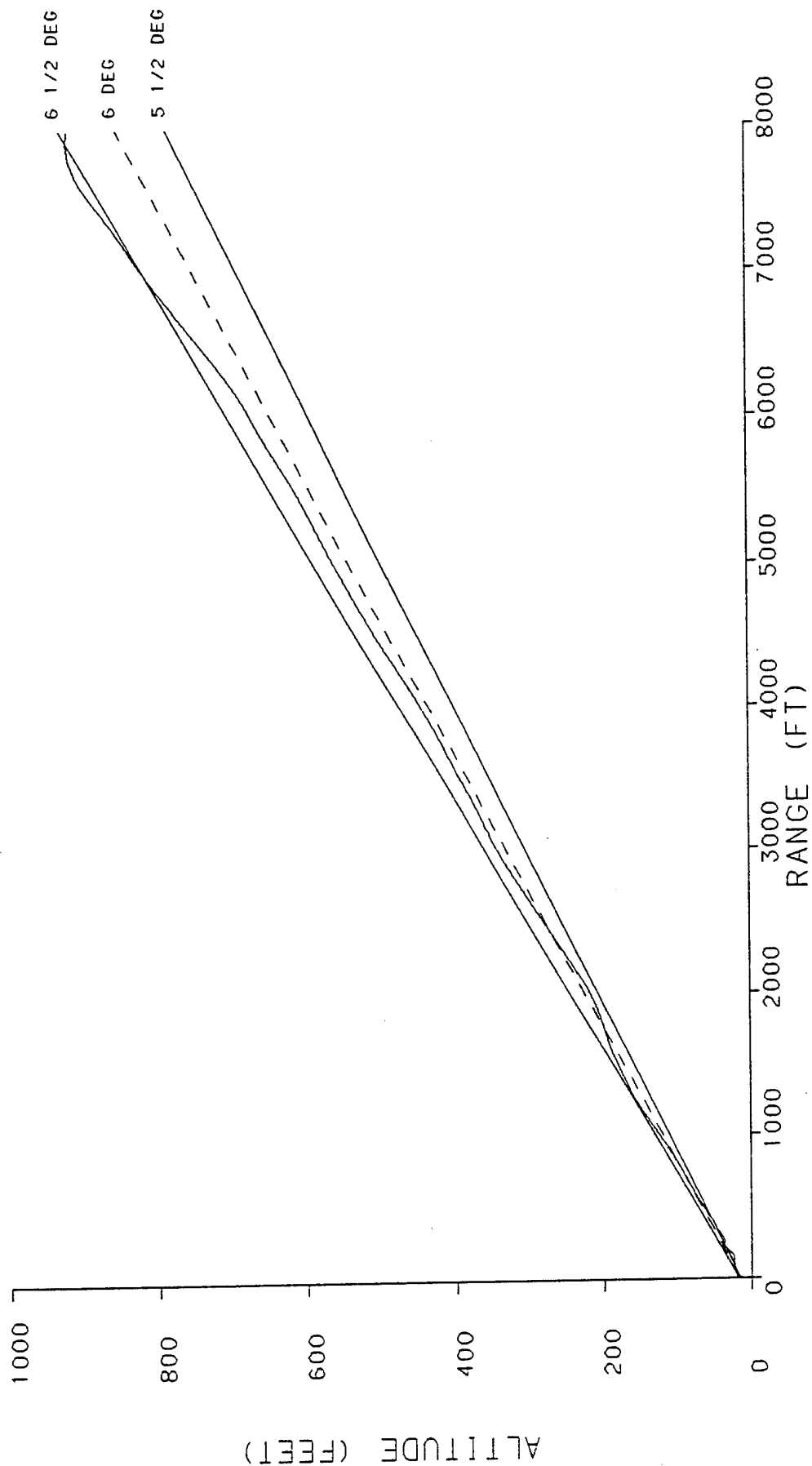
DATA PROCESSED BY THE FAA TECHNICAL CENTER  
ATLANTIC CITY AIRPORT, N J 08405  
16-SEP-1994 16:15

RUN #4  
5/25/93 PM HAP1 6.0 DEG CENTERLINE APPROACH  
AZIMUTH : 0.00 ELEVATION : 6.00  
TRACKER DATA



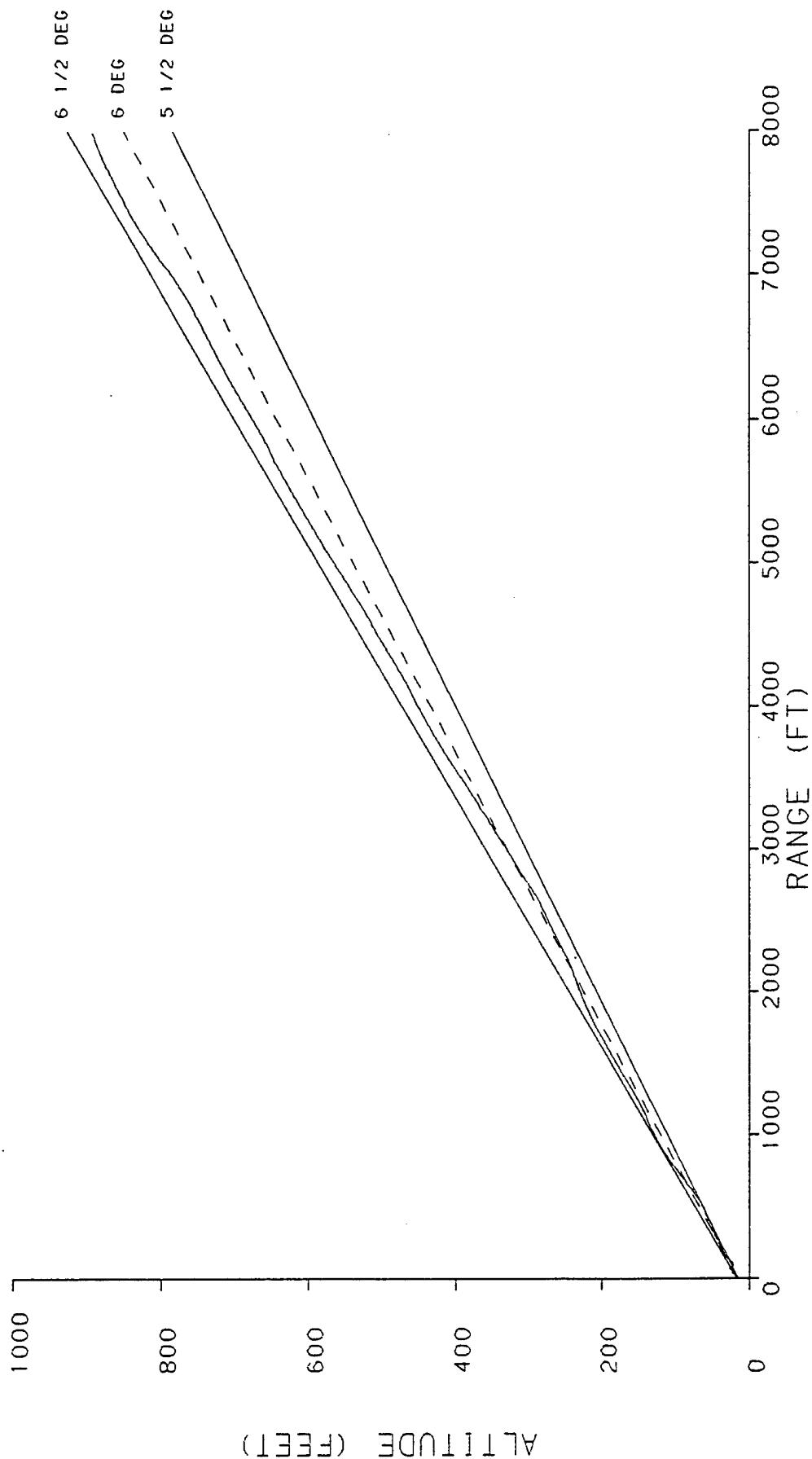
DATA PROCESSED BY THE FAA TECHNICAL CENTER  
ATLANTIC CITY AIRPORT, N J 08403  
16-SEP-1994 16:16

RUN #5  
5/25/93 PM CHAP1 6.0 DEG CENTERLINE APPROACH  
AZIMUTH : 0.00 ELEVATION : 6.00  
TRACKER DATA



RUN #6  
5/25/93 PM CHAPI 6.0 DEG CENTERLINE APPROACH  
AZIMUTH : 0.00 ELEVATION : 6.00  
TRACKER DATA

DATA PROCESSED BY THE FAA TECHNICAL CENTER  
ATLANTIC CITY AIRPORT, N J 08405  
16-SEP-1994 16:17



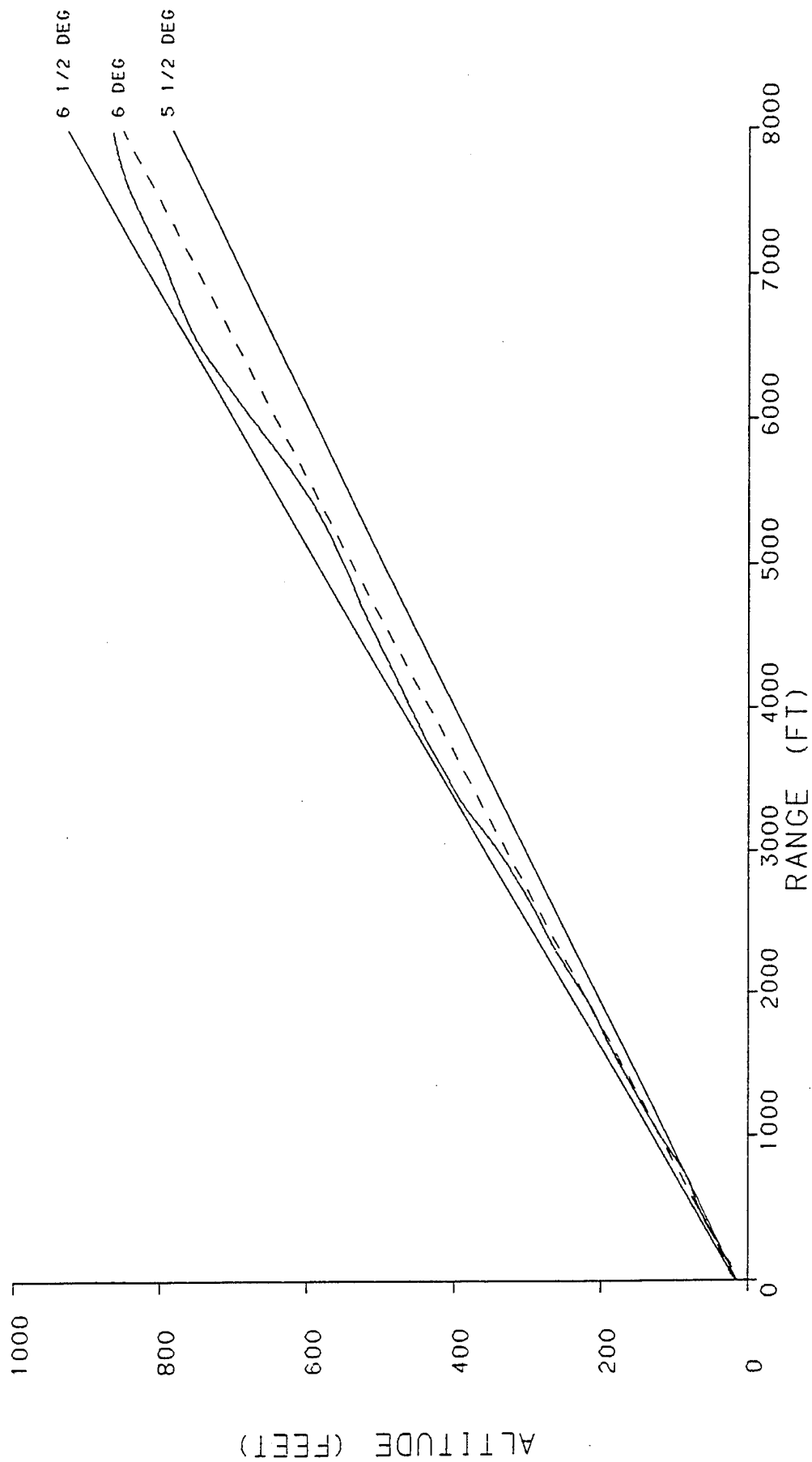
RUN #7

5/25/93 PM CHAPI 6.0 DEG CENTERLINE APPROACH

AZIMUTH : 0.00 ELEVATION : 6.00

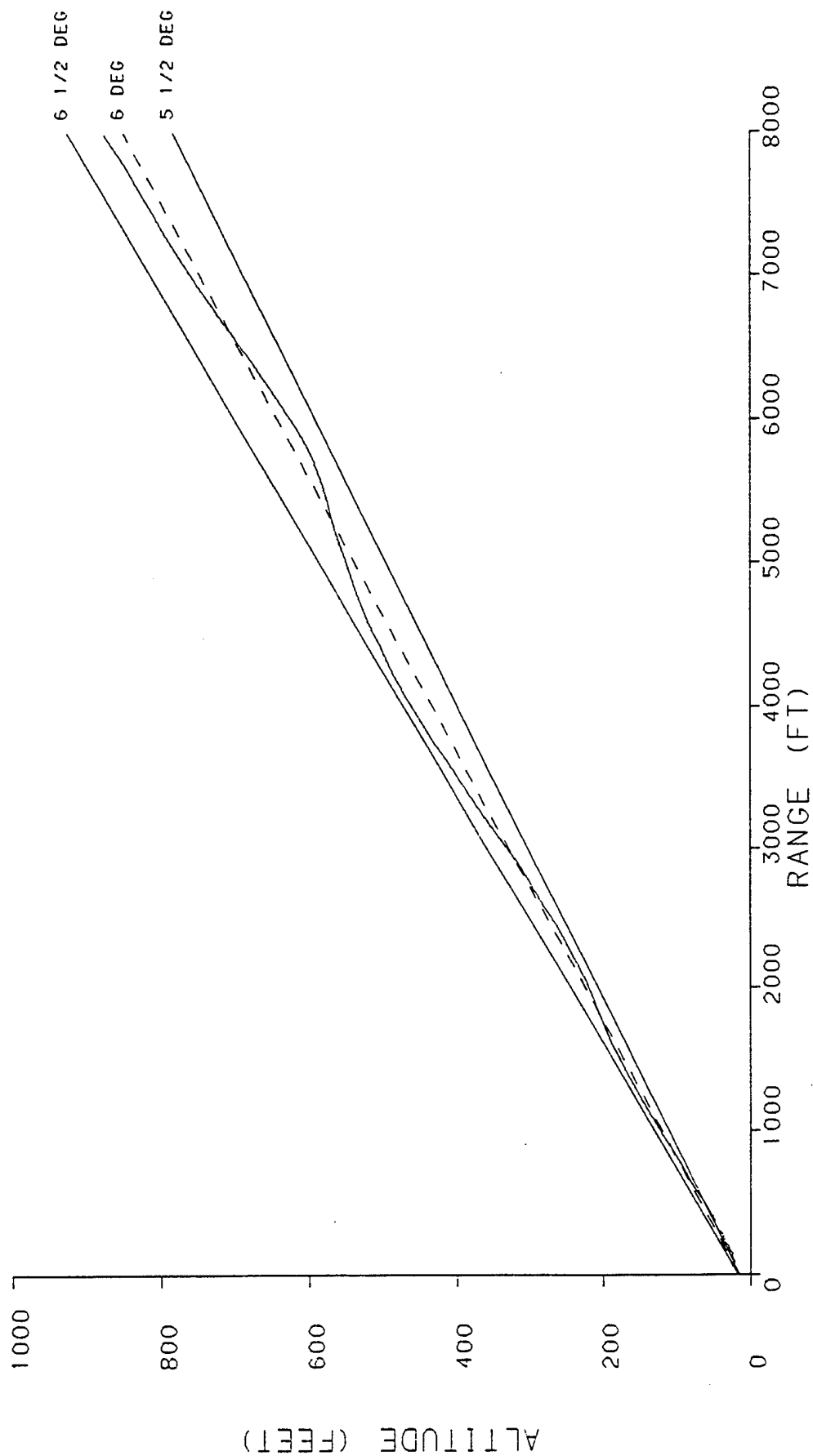
TRACKER DATA

DATA PROCESSED BY THE FAA TECHNICAL CENTER  
ATLANTIC CITY AIRPORT, N J 08405  
16-SEP-1994 16:18



RUN #8  
5/25/93 PM CHAP1 6.0 DEG CENTERLINE APPROACH  
AZIMUTH : 0.00 ELEVATION : 6.00  
TRACKER DATA

DATA PROCESSED BY THE FAA TECHNICAL CENTER  
ATLANTIC CITY AIRPORT, N J 08403  
16-SEP-1994 16:19



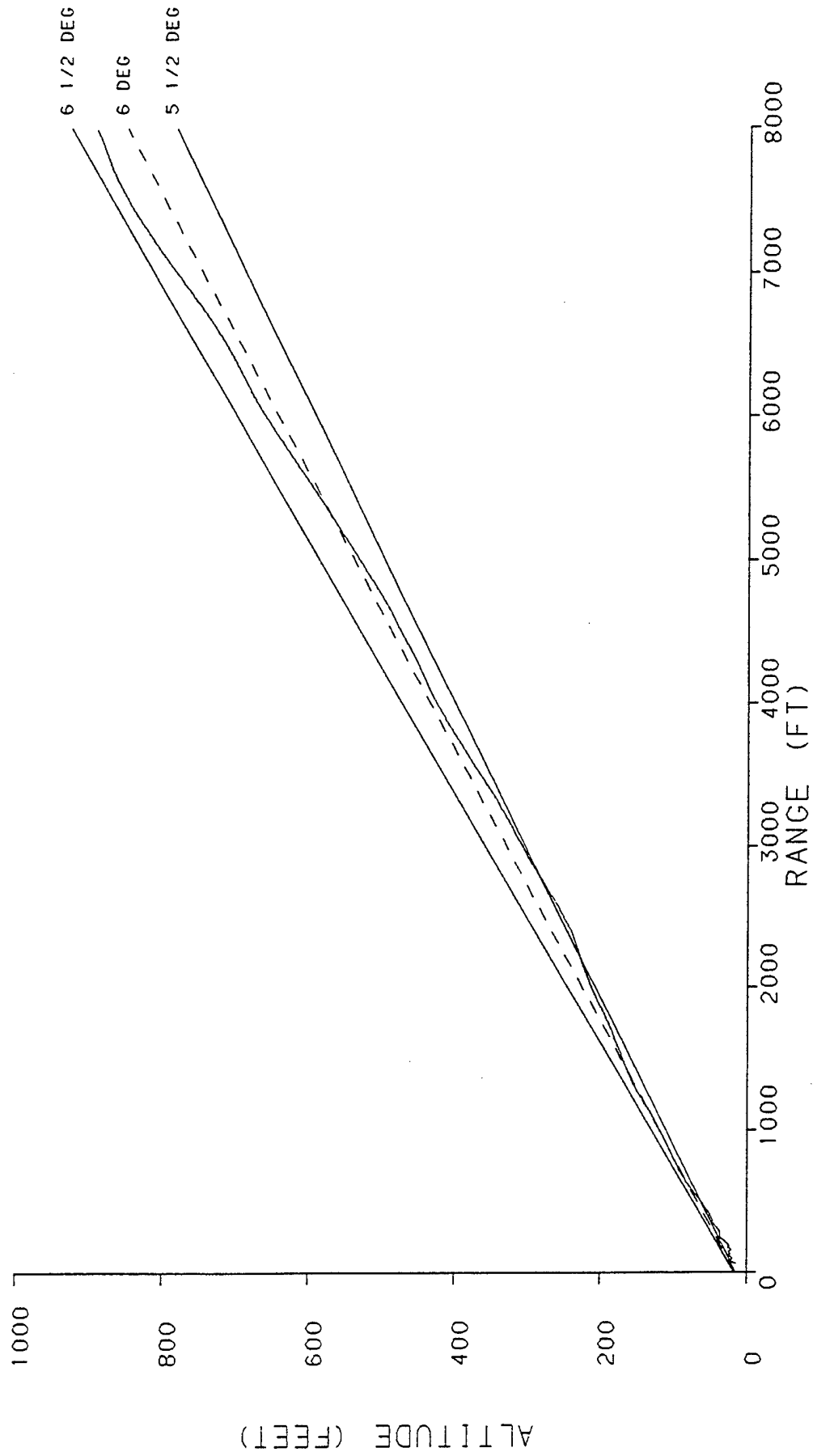
RUN #9

5/25/93 PM PAPI 6.0 DEG CENTERLINE APPROACH

AZIMUTH : 0.00 ELEVATION : 6.00

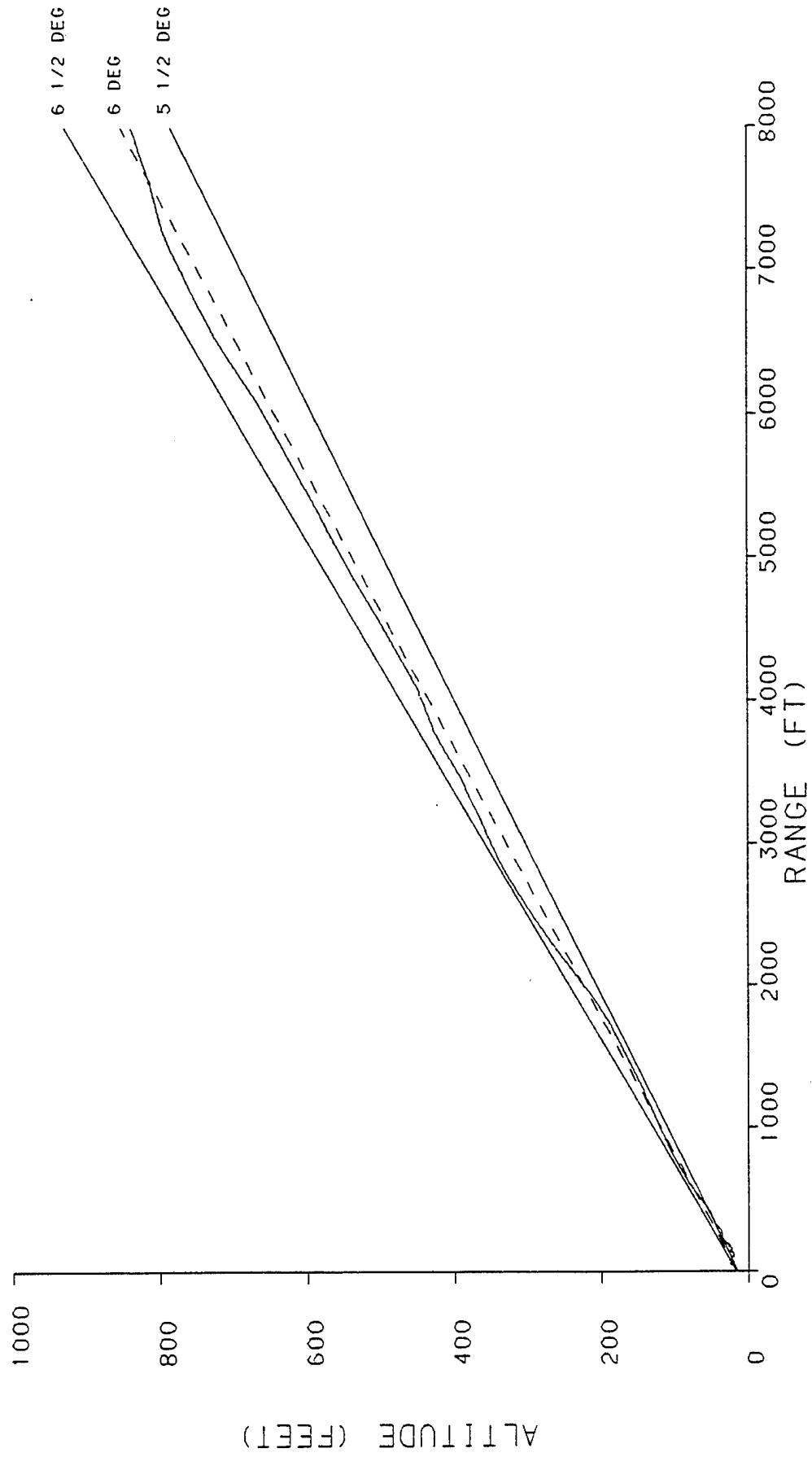
TRACKER DATA

DATA PROCESSED BY THE FAA TECHNICAL CENTER  
ATLANTIC CITY AIRPORT, N J 08405  
16-SEP-1994 16:20



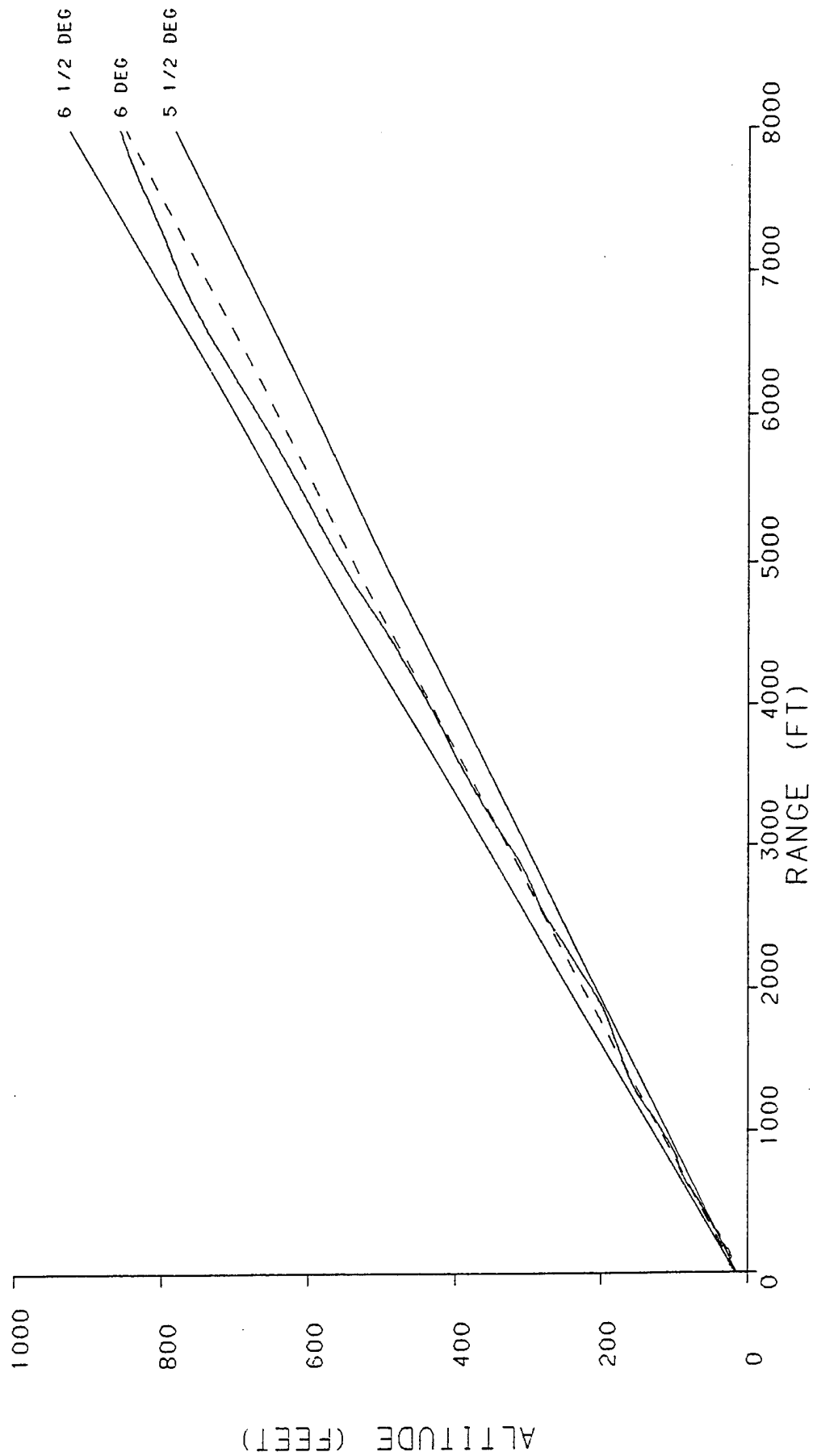
RUN #10  
5/25/93 PM PAPI 6.0 DEG CENTERLINE APPROACH  
AZIMUTH : 0.00 ELEVATION : 6.00  
TRACKER DATA

DATA PROCESSED BY THE FAA TECHNICAL CENTER  
ATLANTIC CITY AIRPORT, N J 08405  
16-SEP-1994 16:22



RUN #11  
5/25/93 PM PAPI 6.0 DEG CENTERLINE APPROACH  
AZIMUTH : 0.00 ELEVATION : 6.00  
TRACKER DATA

DATA PROCESSED BY THE FAA TECHNICAL CENTER  
ATLANTIC CITY AIRPORT, N J 08405  
19-SEP-1994 09:29



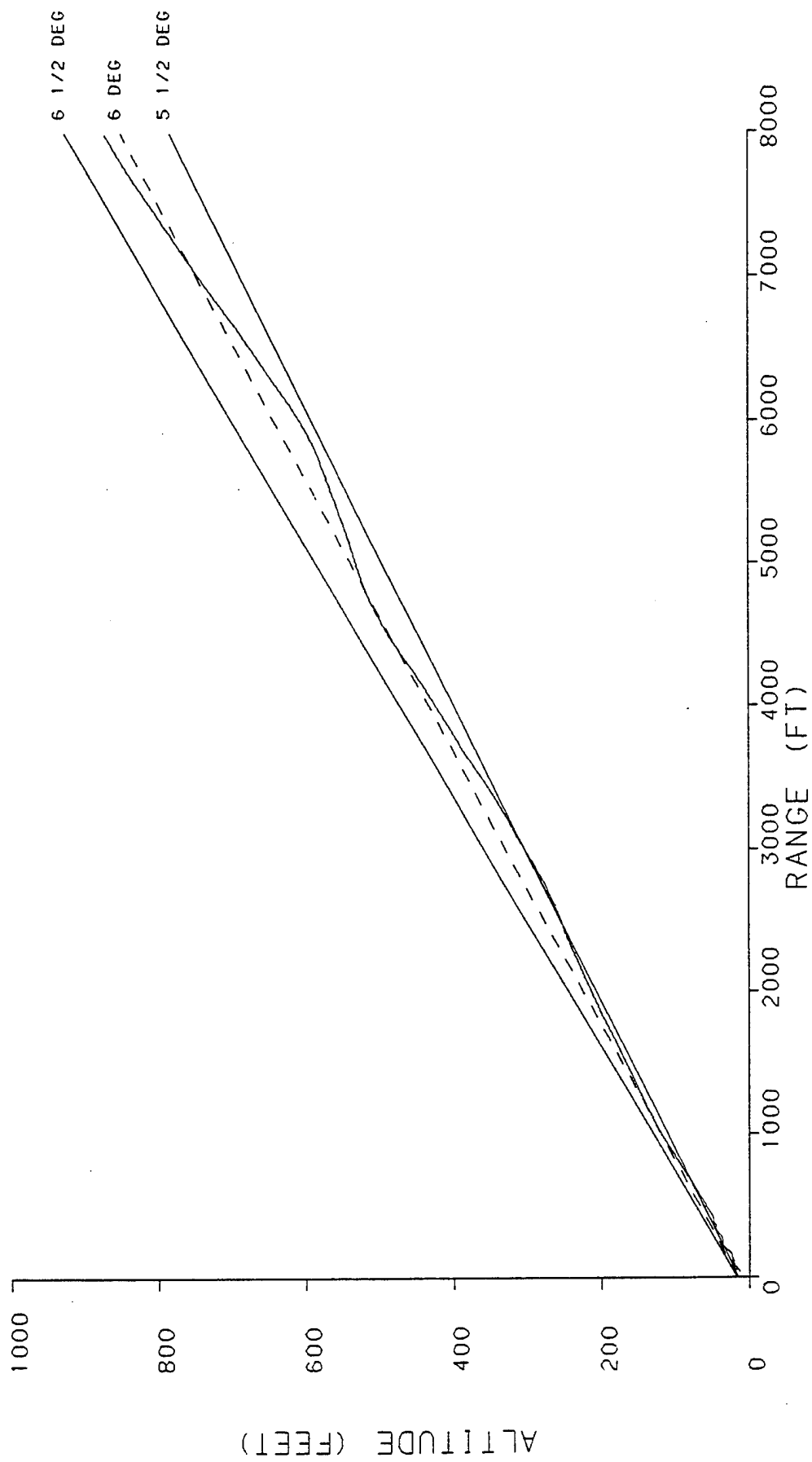
RUN #12

5/25/93 PM PAPJ 6.0 DEG CENTERLINE APPROACH

AZIMUTH : 0.00 ELEVATION : 6.00

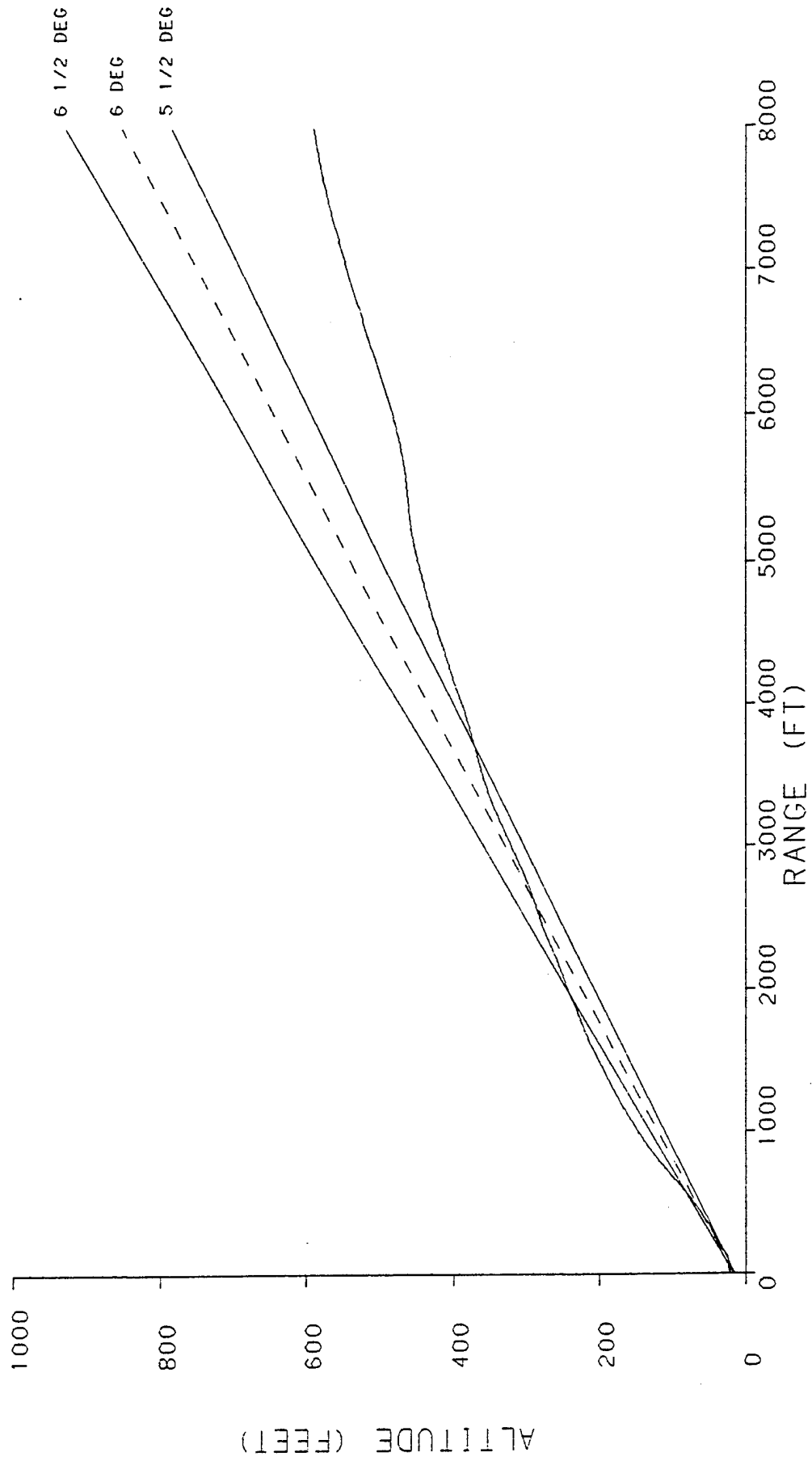
TRACKER DATA

DATA PROCESSED BY THE FAA TECHNICAL CENTER  
ATLANTIC CITY AIRPORT. M J 08405  
19-SEP-1994 09:30



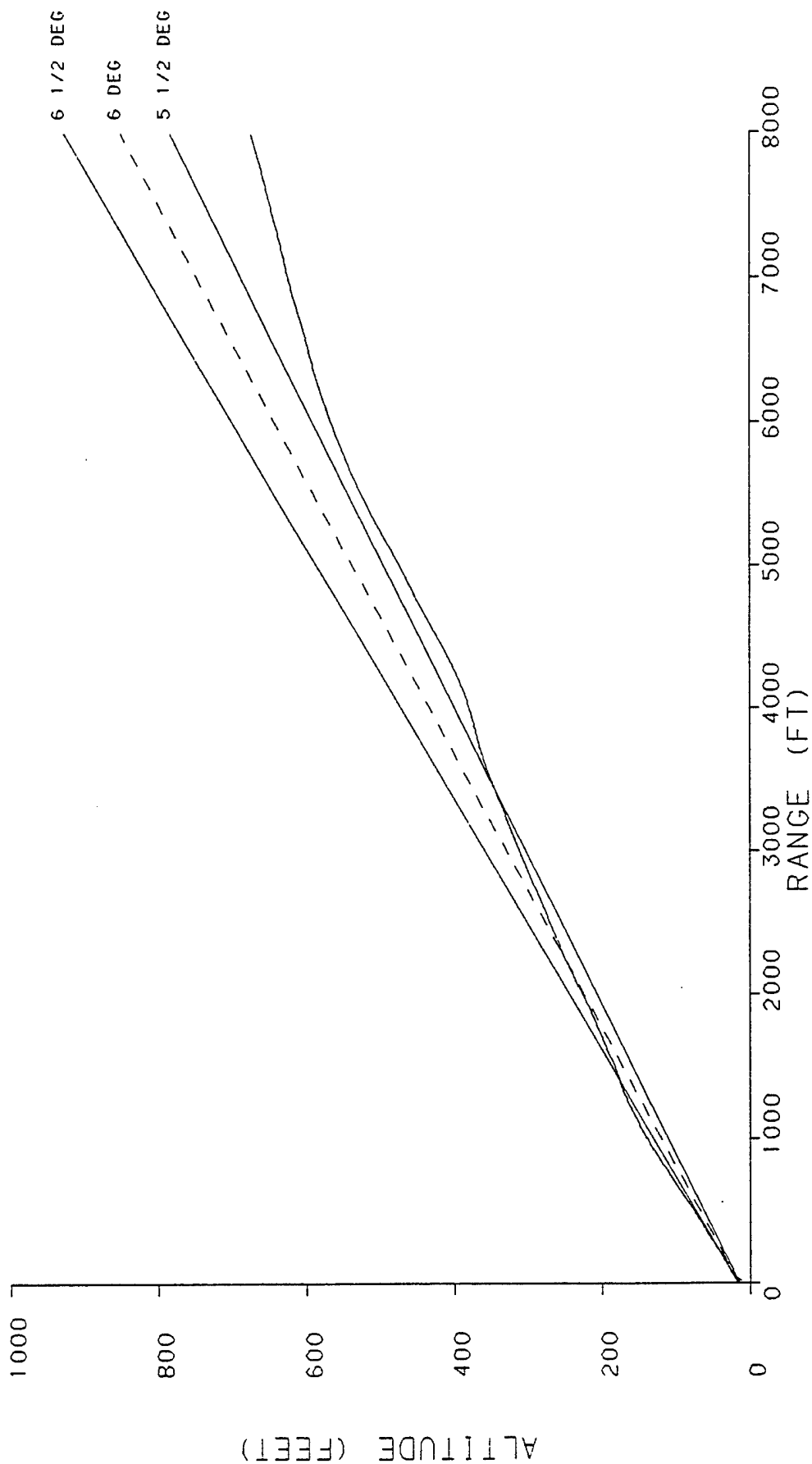
DATA PROCESSED BY THE FAA TECHNICAL CENTER  
ATLANTIC CITY AIRPORT, N J 08405  
19-SEP-1994 12:55

RUN #1  
5/27/93 CHAP1 6.0 DEG CENTERLINE APPROACH  
AZIMUTH : 0.00 ELEVATION : 6.00  
TRACKER DATA



DATA PROCESSED BY THE FAA TECHNICAL CENTER  
ATLANTIC CITY AIRPORT, N J 08405  
19-SEP-1994 09:31

RUN #2  
5/27/93 CHAP1 6.0 DEG CENTERLINE APPROACH  
AZIMUTH : 0.00 ELEVATION : 6.00  
TRACKER DATA



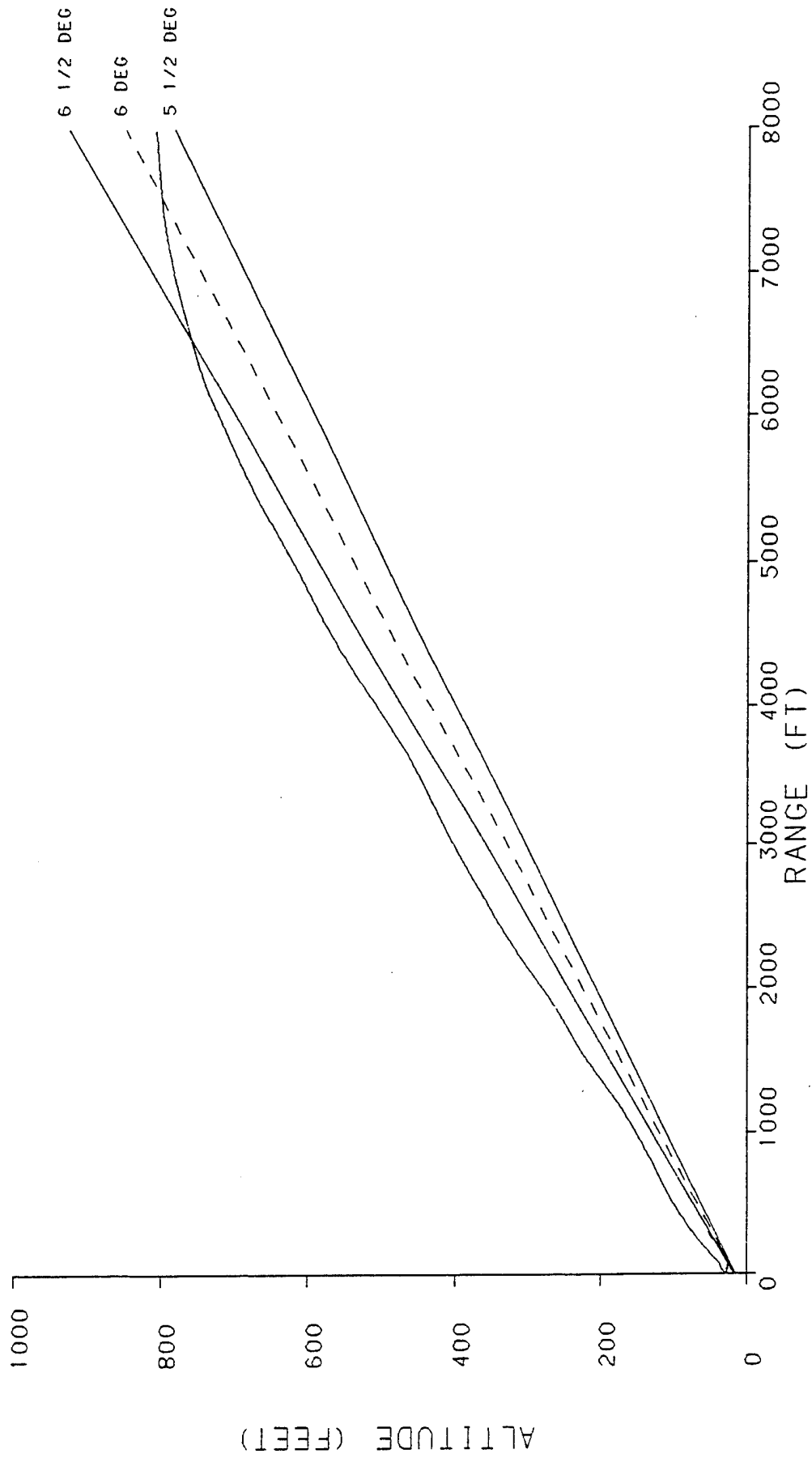
RUN #3

5/27/93 CHAP1 6.0 DEG CENTERLINE APPROACH

AZIMUTH : 0.00 ELEVATION : 6.00

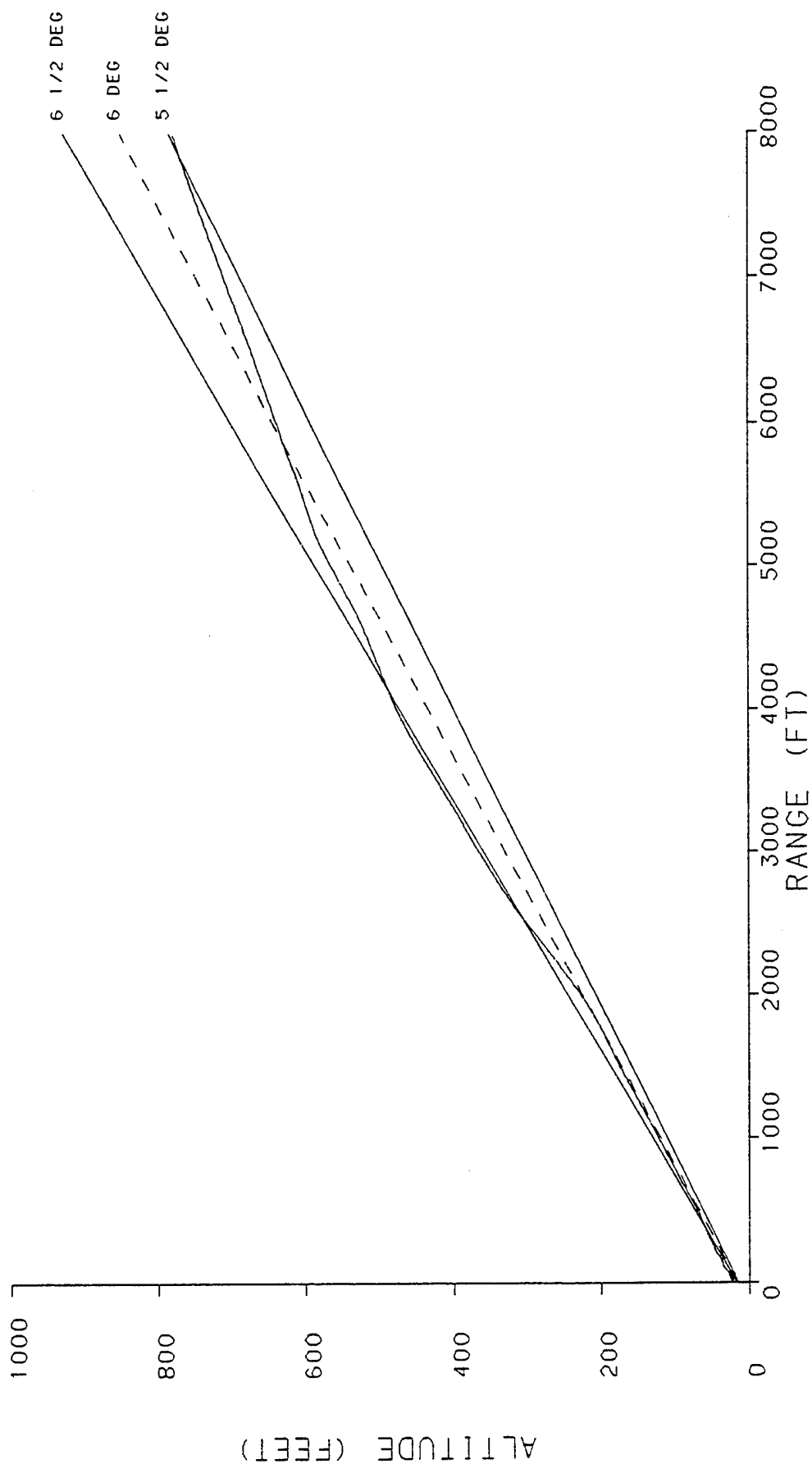
TRACKER DATA

DATA PROCESSED BY THE FAA TECHNICAL CENTER  
ATLANTIC CITY AIRPORT, N J 08405  
19-SEP-1994 09:32



DATA PROCESSED BY THE FAA TECHNICAL CENTER  
ATLANTIC CITY AIRPORT, N J 08405  
19-SEP-1994 09:33

RUN #4  
5/27/93 CHAP1 6.0 DEG CENTERLINE APPROACH  
AZIMUTH : 0.00 ELEVATION : 6.00  
TRACKER DATA



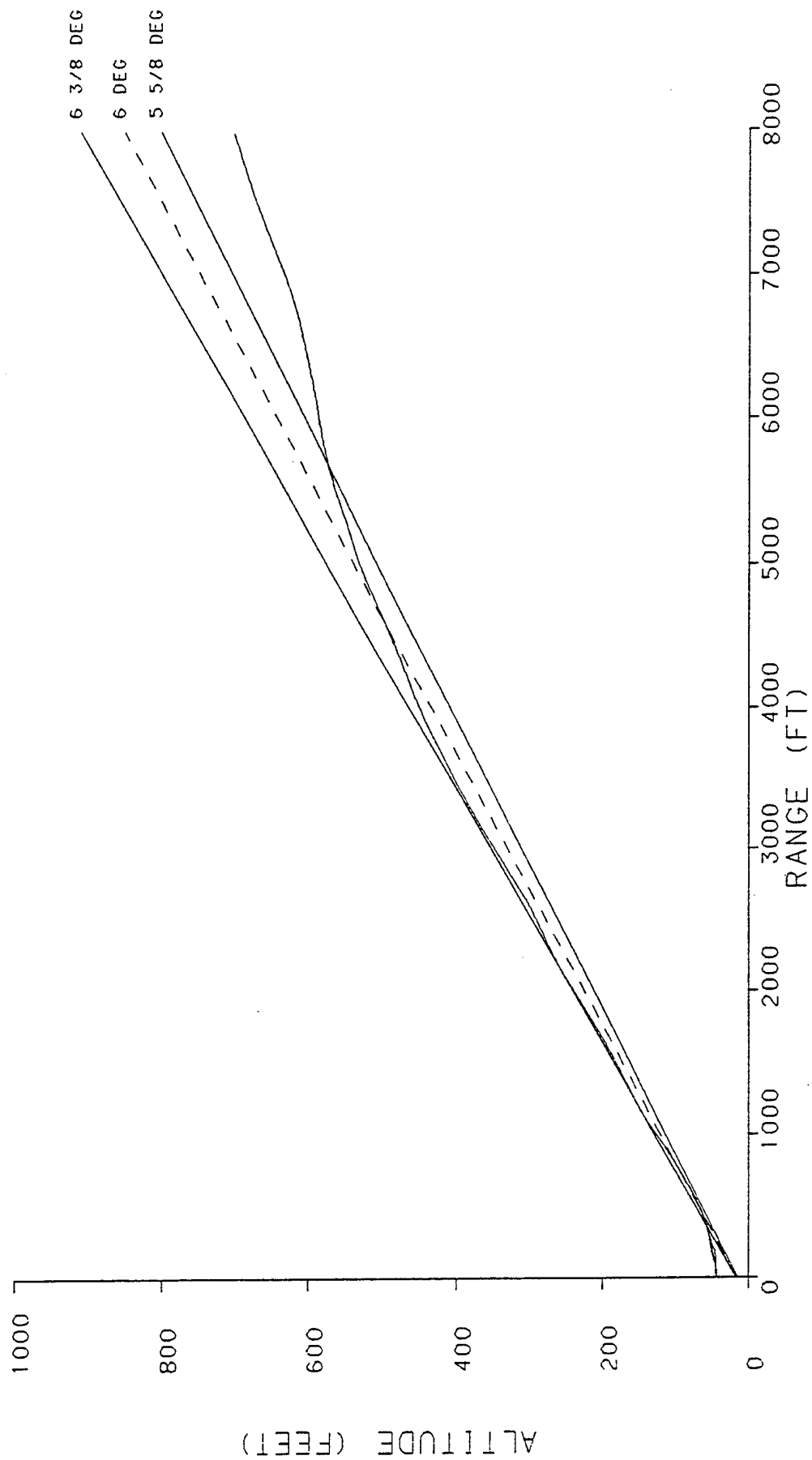
RUN #5

5/27/93 HAPI 6.0 DEG CENTERLINE APPROACH

AZIMUTH : 0.00 ELEVATION : 6.00

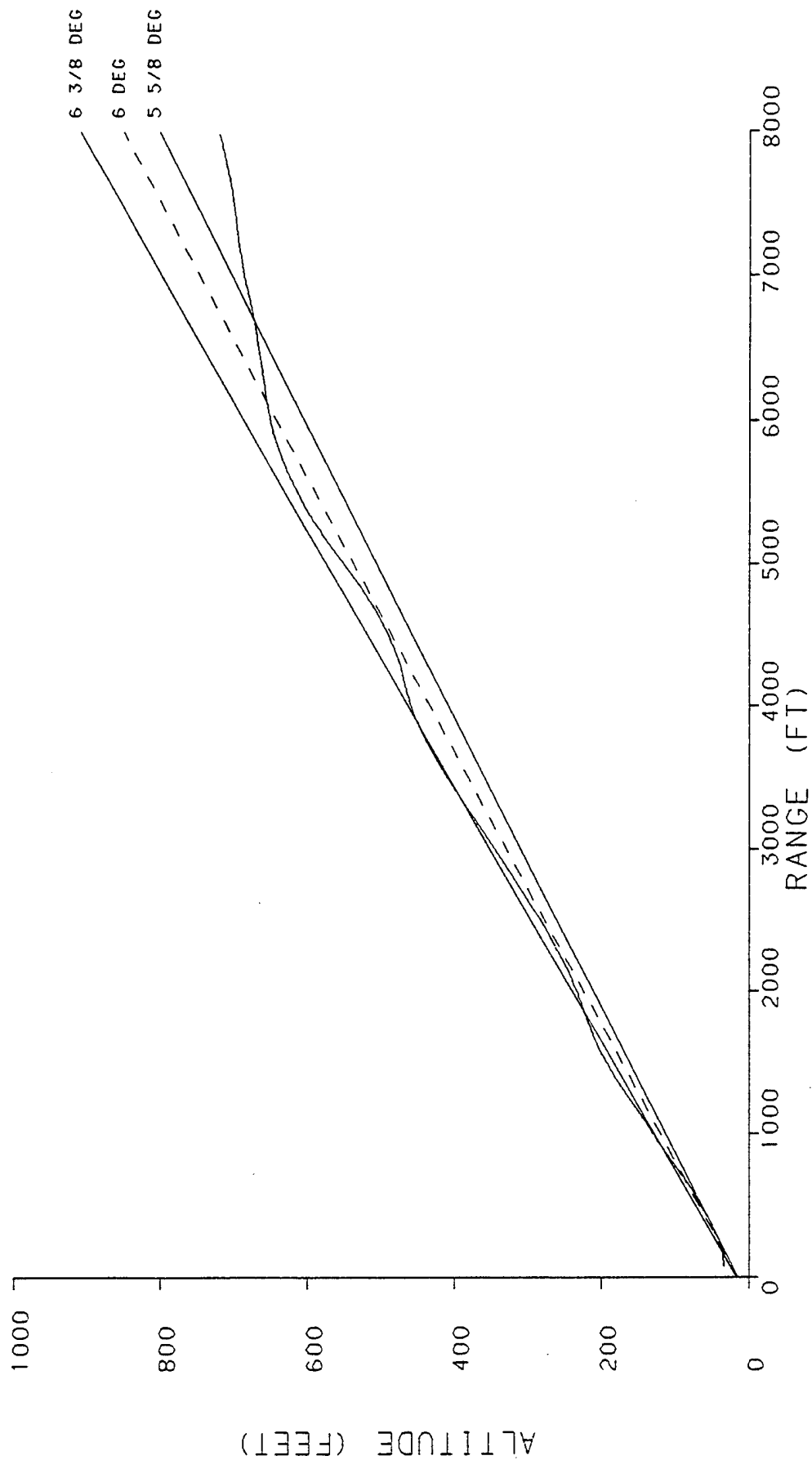
TRACKER DATA

DATA PROCESSED BY THE FAA TECHNICAL CENTER  
ATLANTIC CITY AIRPORT, N J 08405  
19-SEP-1994 09:34



RUN #6  
5/27/93 HAPI 6.0 DEG CENTERLINE APPROACH  
AZIMUTH : 0.00 ELEVATION : 6.00  
TRACKER DATA

DATA PROCESSED BY THE FAA TECHNICAL CENTER  
ATLANTIC CITY AIRPORT, N J 08405  
19-SEP-1994 09:34



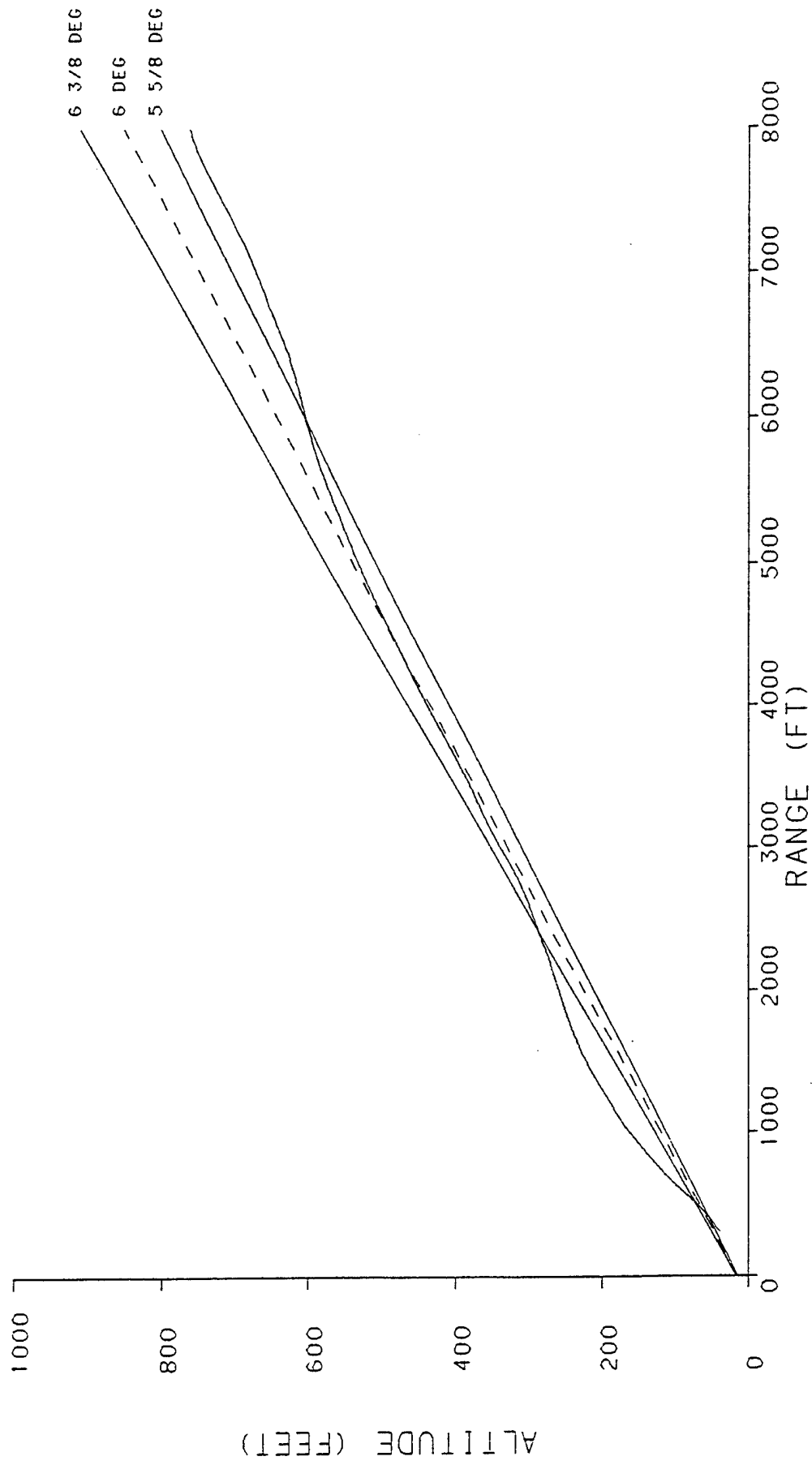
RUN #7

5/27/93 HAPI 6.0 DEG CENTERLINE APPROACH

AZIMUTH : 0.00 ELEVATION : 6.00

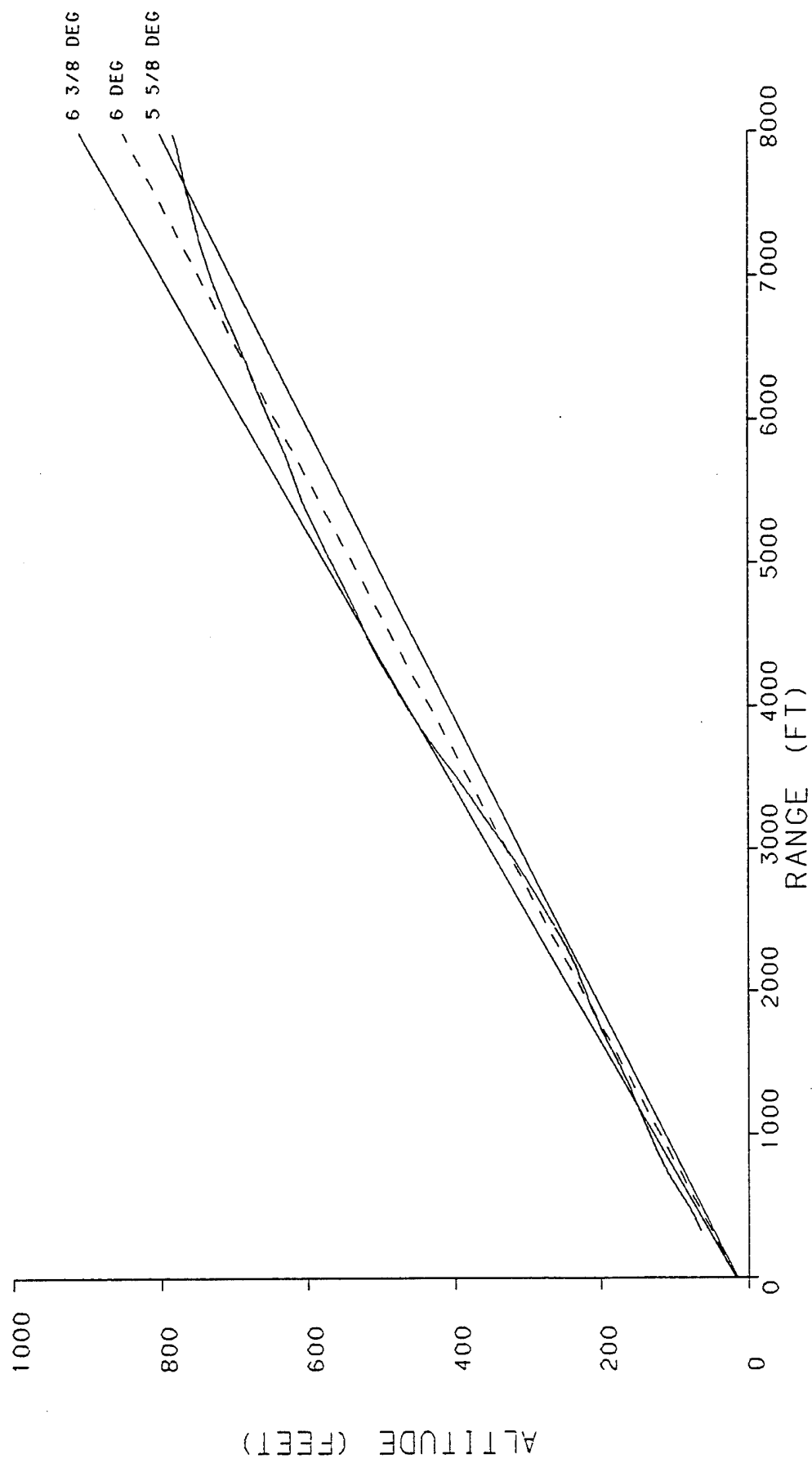
TRACKER DATA

DATA PROCESSED BY THE FAA TECHNICAL CENTER  
ATLANTIC CITY AIRPORT, N J 08405  
19-SEP-1994 09:36



DATA PROCESSED BY THE FAA TECHNICAL CENTER  
ATLANTIC CITY AIRPORT, N J 08405  
19-SEP-1994 09:37

RUN #8  
5/27/93 HAPI 6.0 DEG CENTERLINE APPROACH  
AZIMUTH : 0.00 ELEVATION : 6.00  
TRACKER DATA



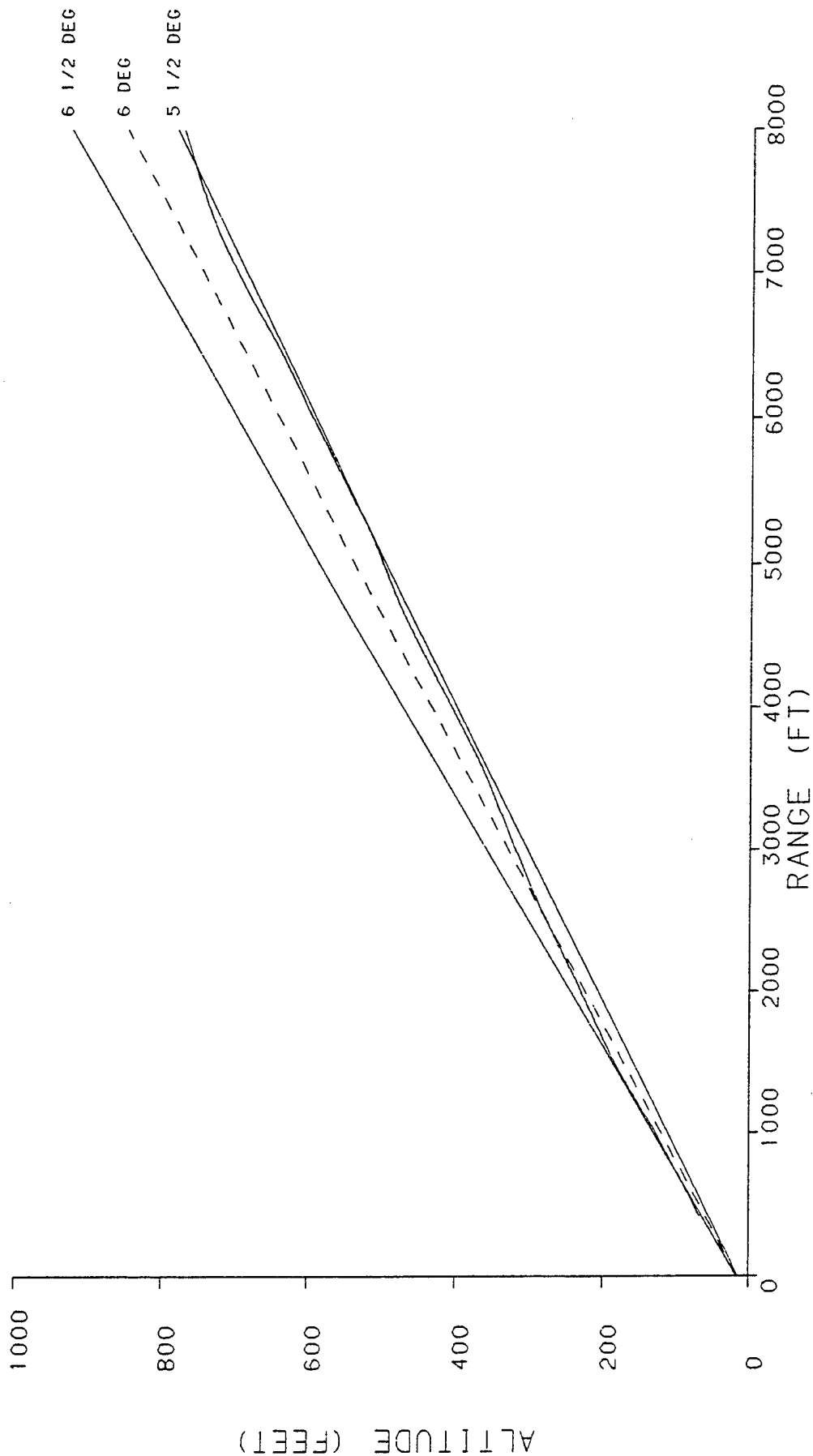
RUN #9

5/27/93 PAPI 6.0 DEG CENTERLINE APPROACH

AZIMUTH : 0.00 ELEVATION : 6.00

TRACKER DATA

DATA PROCESSED BY THE FAA TECHNICAL CENTER  
ATLANTIC CITY AIRPORT, N J 08405  
19-SEP-1994 09:38



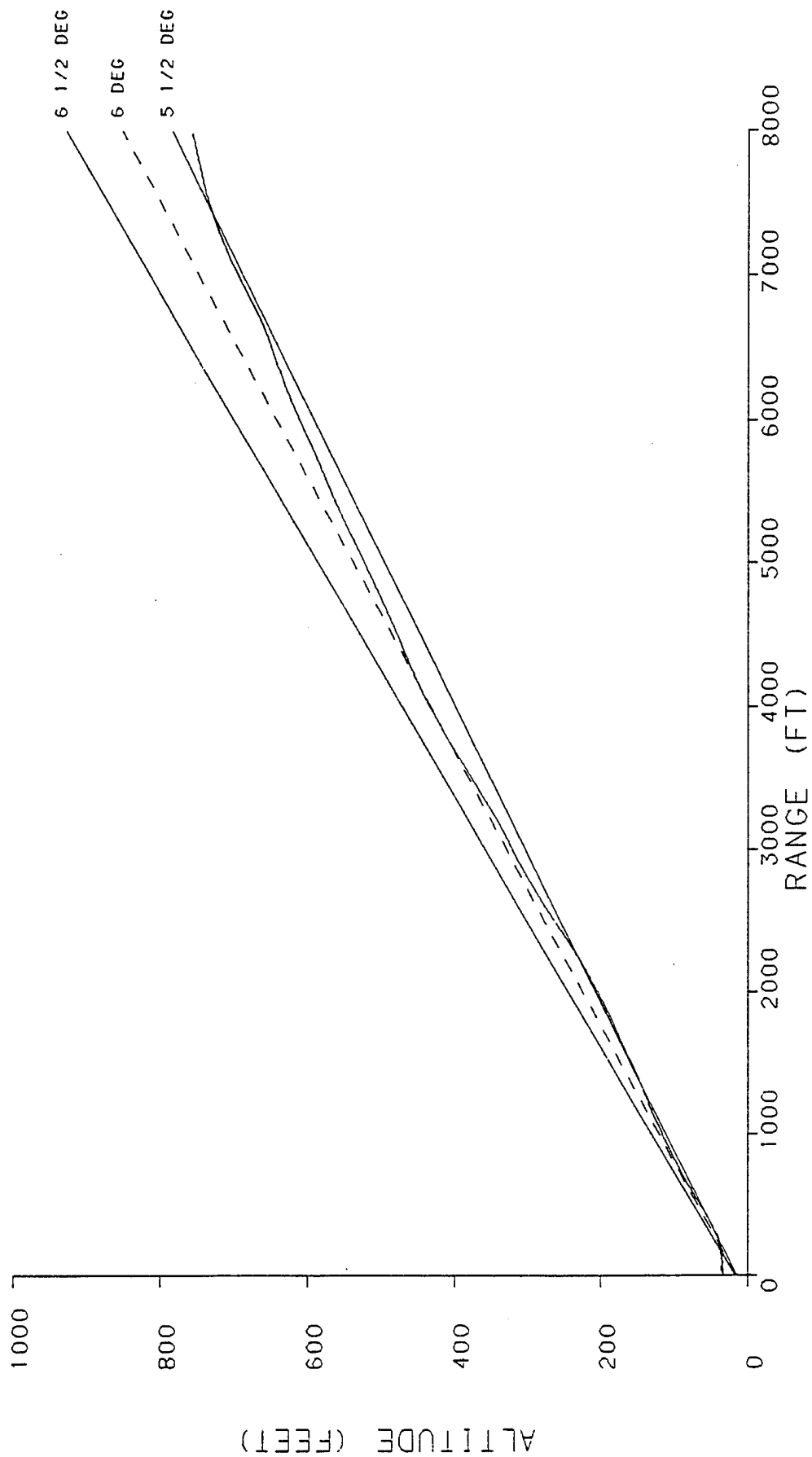
RUN #10

5/27/93 PAPI 6.0 DEG CENTERLINE APPROACH

AZIMUTH : 0.00 ELEVATION : 6.00

TRACKER DATA

DATA PROCESSED BY THE FAA TECHNICAL CENTER  
ATLANTIC CITY AIRPORT, N J 08405  
19-SEP-1994 09:39



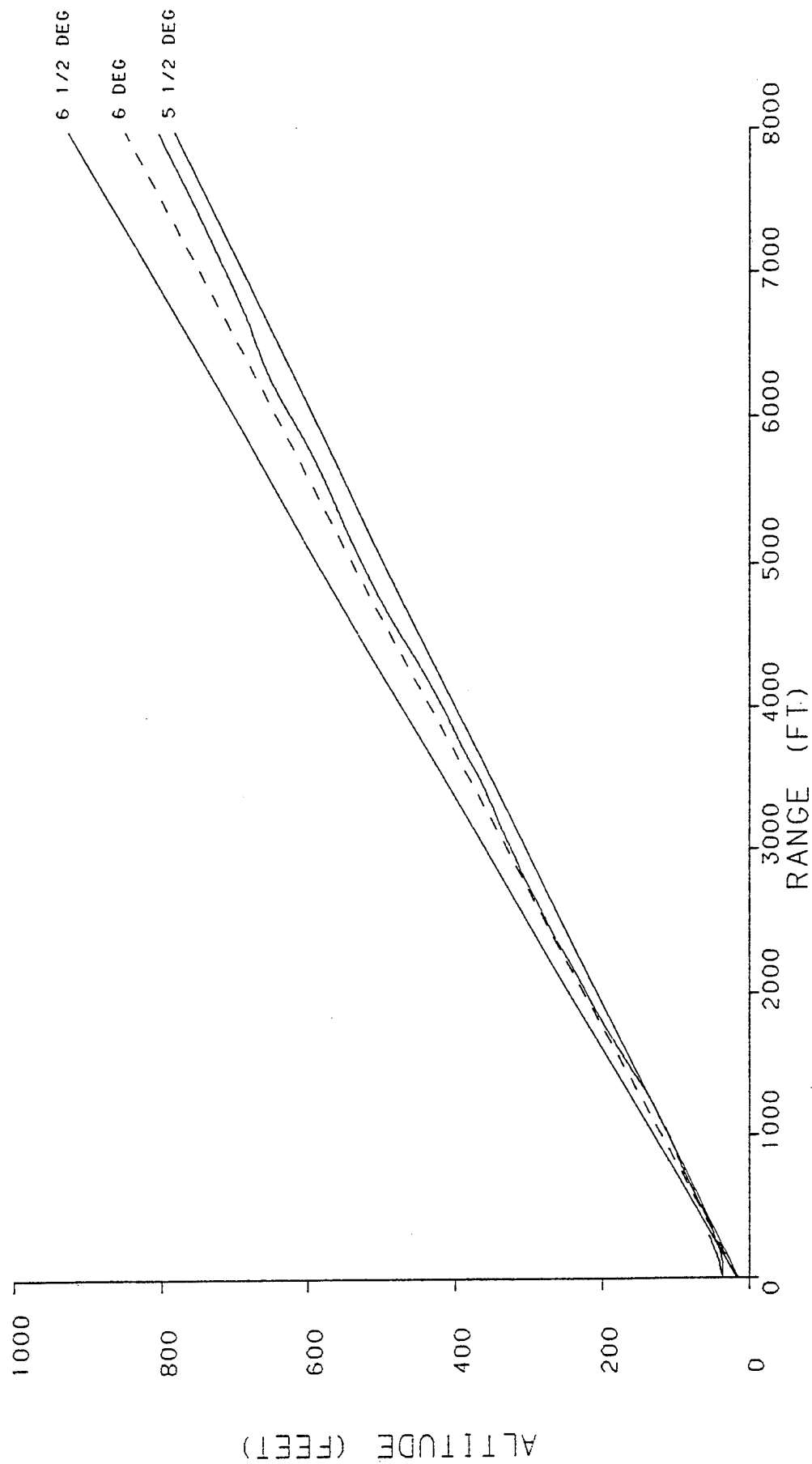
RUN #11

5/27/93 PAPI 6.0 DEG CENTERLINE APPROACH

AZIMUTH : 0.00 ELEVATION : 6.00

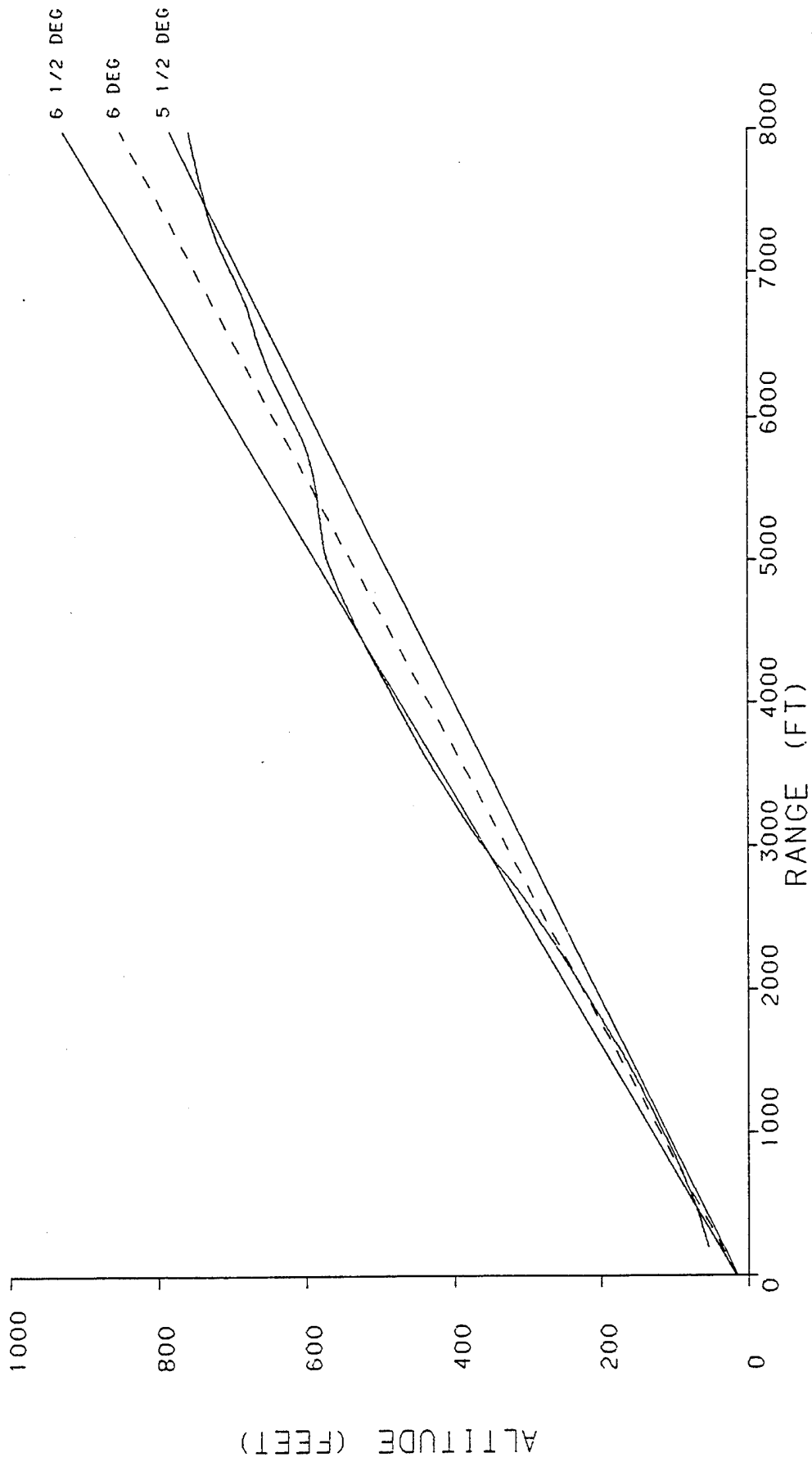
TRACKER DATA

DATA PROCESSED BY THE FAA TECHNICAL CENTER  
ATLANTIC CITY AIRPORT, N J 08405  
19-SEP-1994 09:40



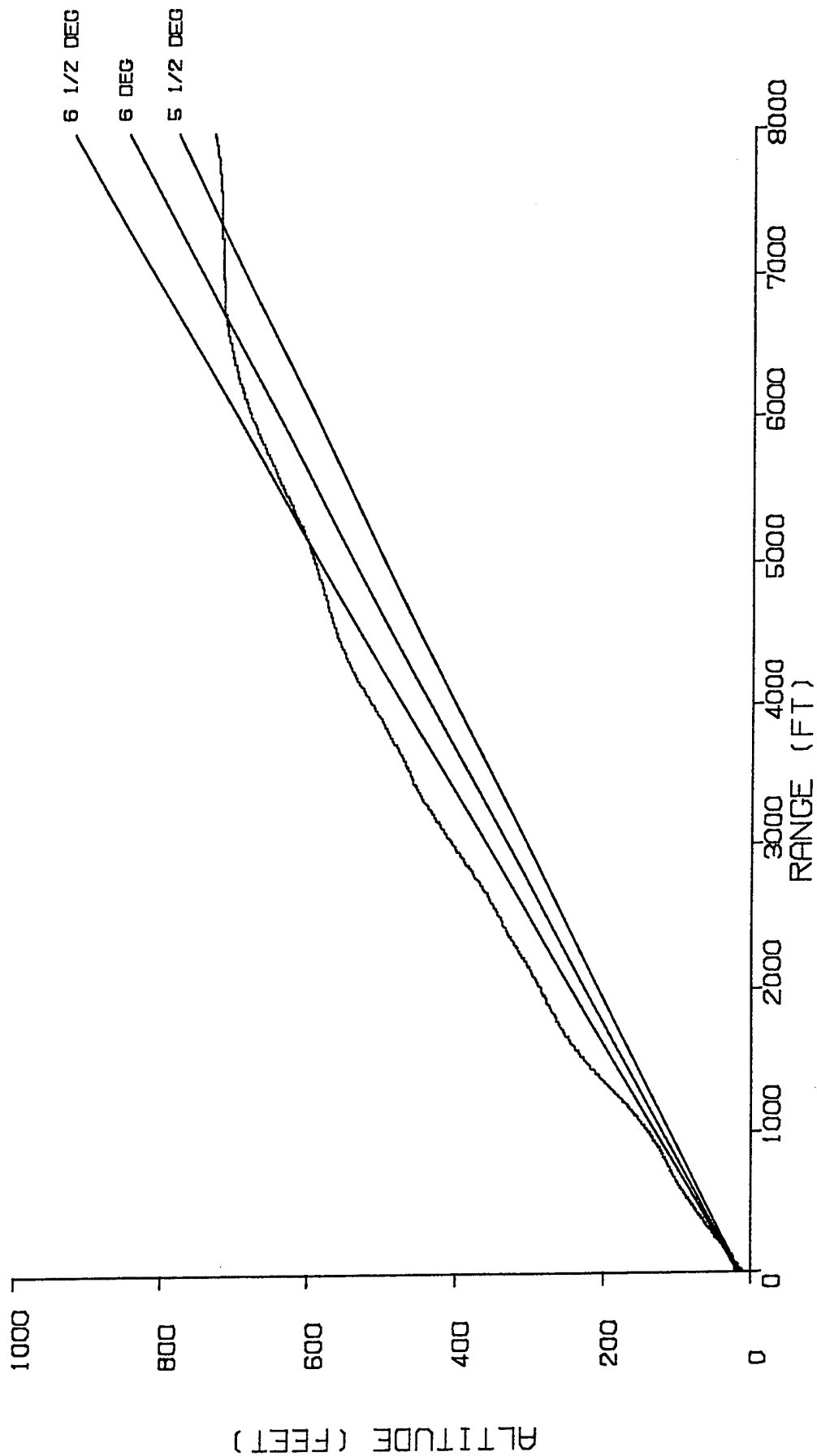
DATA PROCESSED BY THE FAA TECHNICAL CENTER  
ATLANTIC CITY AIRPORT, N J 08405  
19-SEP-1994 09:41

RUN #12  
5/27/93 PAPI 6.0 DEG CENTERLINE APPROACH  
AZIMUTH : 0.00 ELEVATION : 6.00  
TRACKER DATA



RUN #1  
6/02/93 CHAPI 6.0 DEG CENTERLINE APPROACH  
AZIMUTH : 0.00 ELEVATION : 6.00  
TRACKER DATA

DATA PROCESSED BY THE FAA TECHNICAL CENTER  
ATLANTIC CITY AIRPORT, N.J. 08405  
14-NOV-1995 11:11



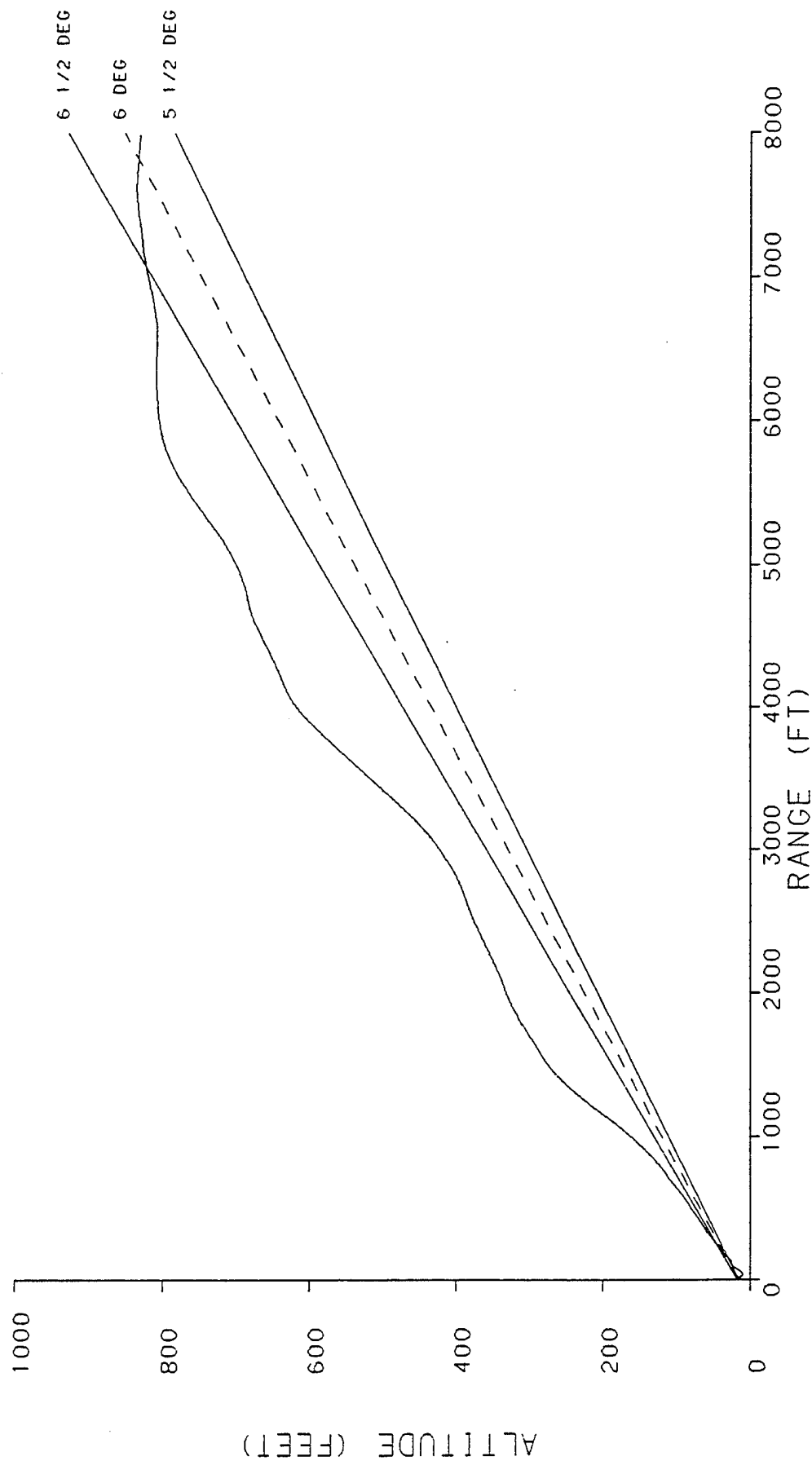
RUN #2

6/02/93 CHAP1 6.0 DEG CENTERLINE APPROACH

AZIMUTH : 0.00 ELEVATION : 6.00

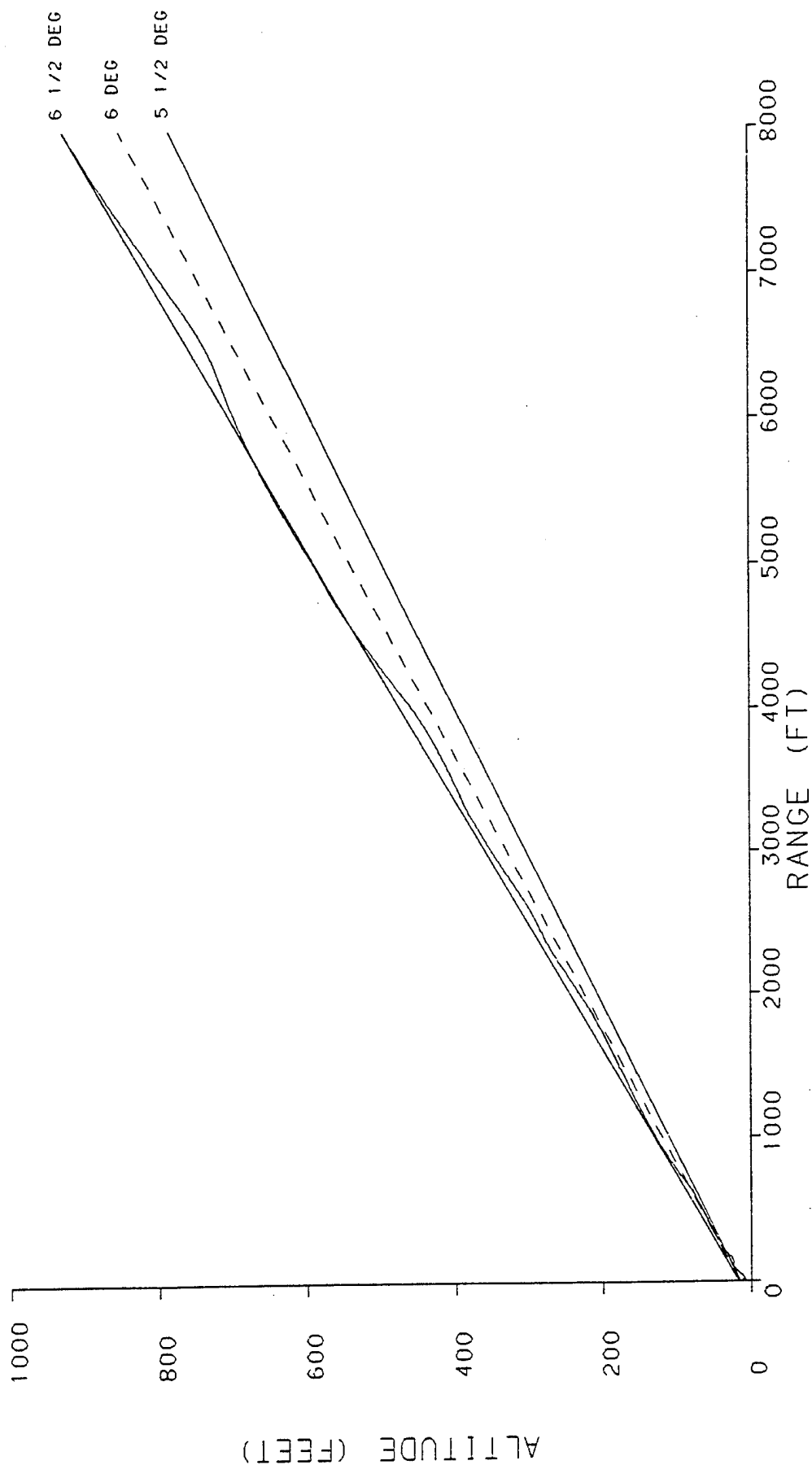
TRACKER DATA

DATA PROCESSED BY THE FAA TECHNICAL CENTER  
ATLANTIC CITY AIRPORT, N J 08405  
19-SEP-1994 09:43



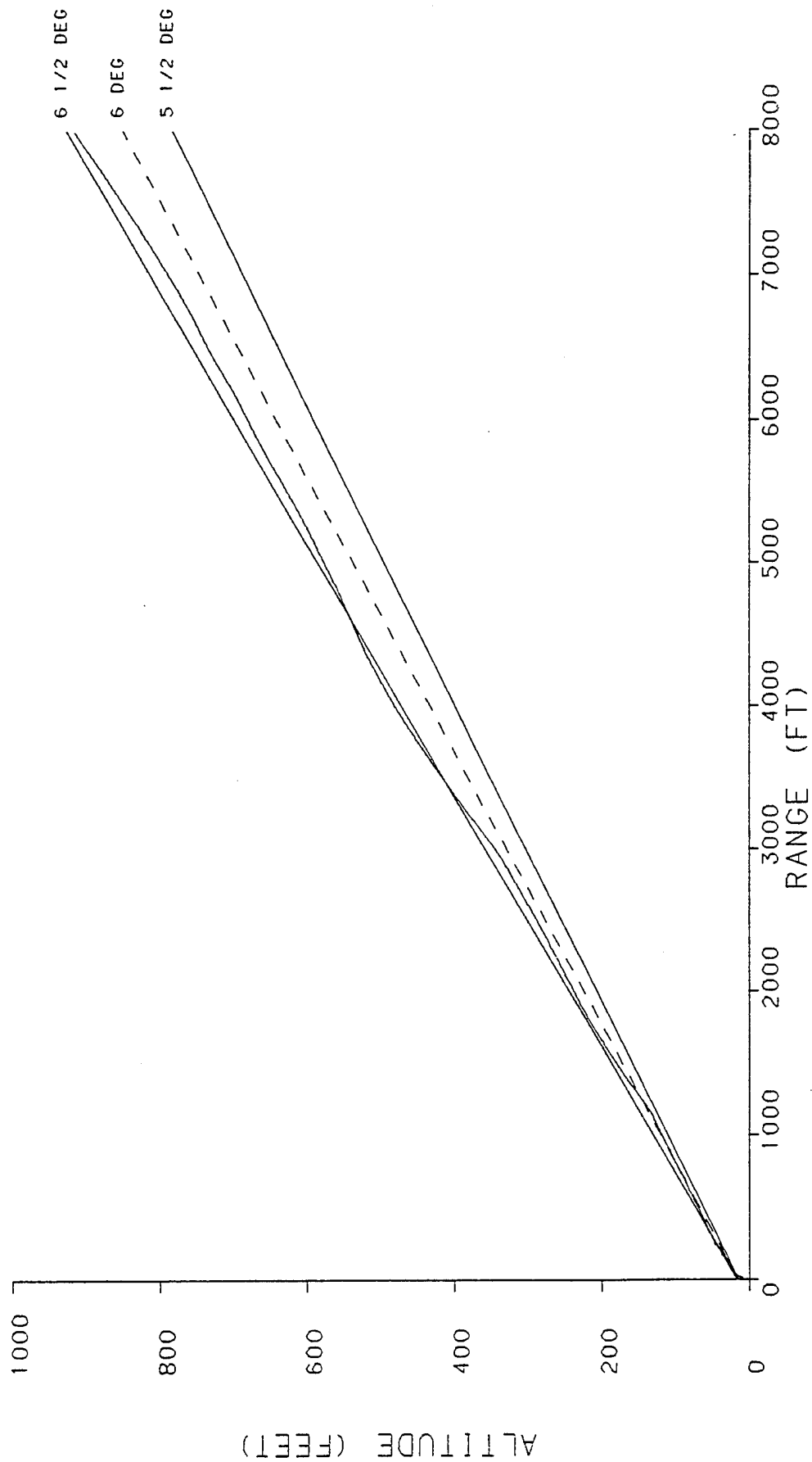
RUN #3  
6/02/93 CHAP1 6.0 DEG CENTERLINE APPROACH  
AZIMUTH : 0.00 ELEVATION : 6.00  
TRACKER DATA

DATA PROCESSED BY THE FAA TECHNICAL CENTER  
ATLANTIC CITY AIRPORT, N J 08403  
19-SEP-1994 09:44



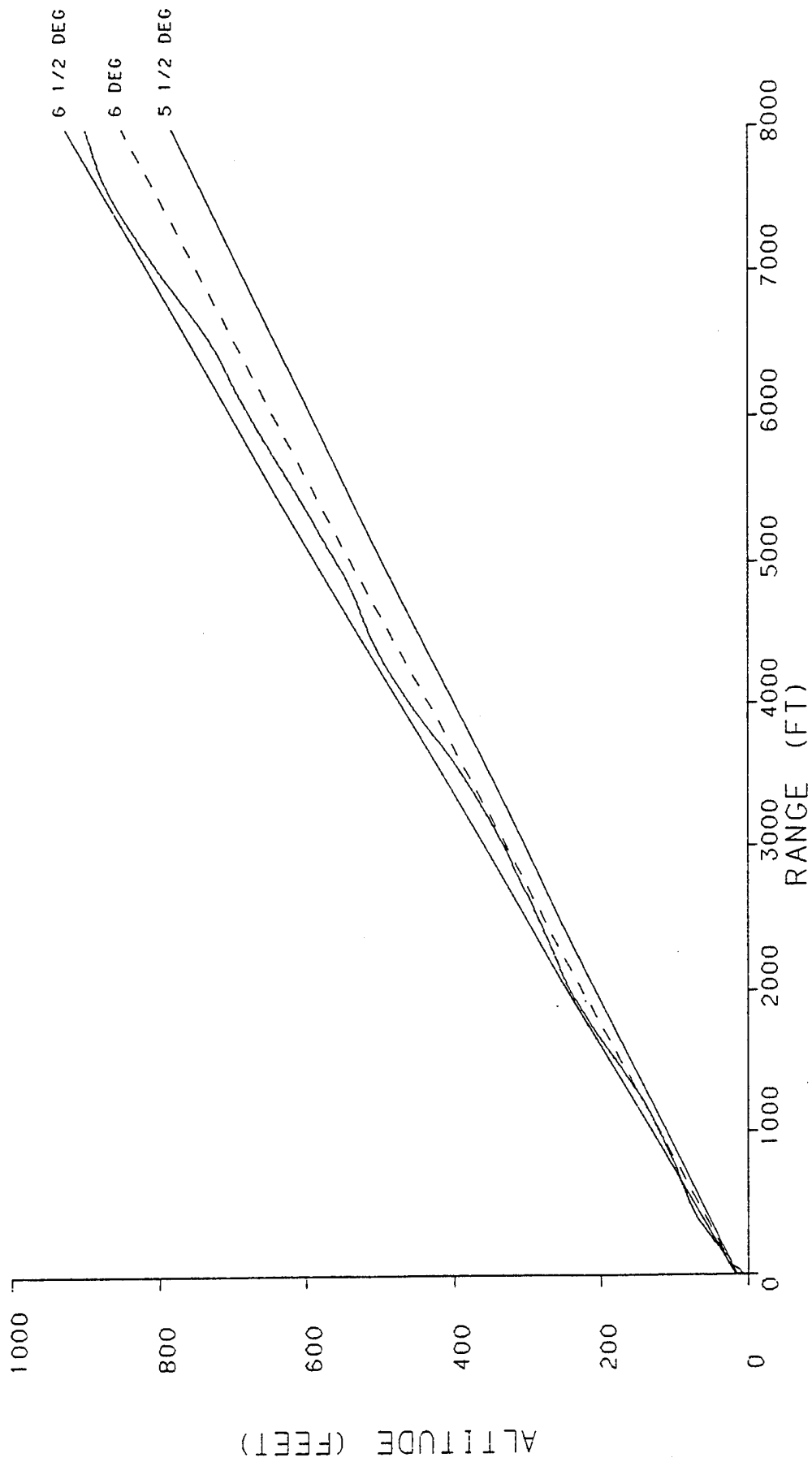
RUN #4  
6/02/93 CHAPI 6.0 DEG CENTERLINE APPROACH  
AZIMUTH : 0.00 ELEVATION : 6.00  
TRACKER DATA

DATA PROCESSED BY THE FAA TECHNICAL CENTER  
ATLANTIC CITY AIRPORT, N J 08405  
19-SEP-1994 09:45



DATA PROCESSED BY THE FAA TECHNICAL CENTER  
ATLANTIC CITY AIRPORT, N J 08403  
19-SEP-1994 09:46

RUN #5  
6/02/93 PAPI 6.0 DEG CENTERLINE APPROACH  
AZIMUTH : 0.00 ELEVATION : 6.00  
TRACKER DATA



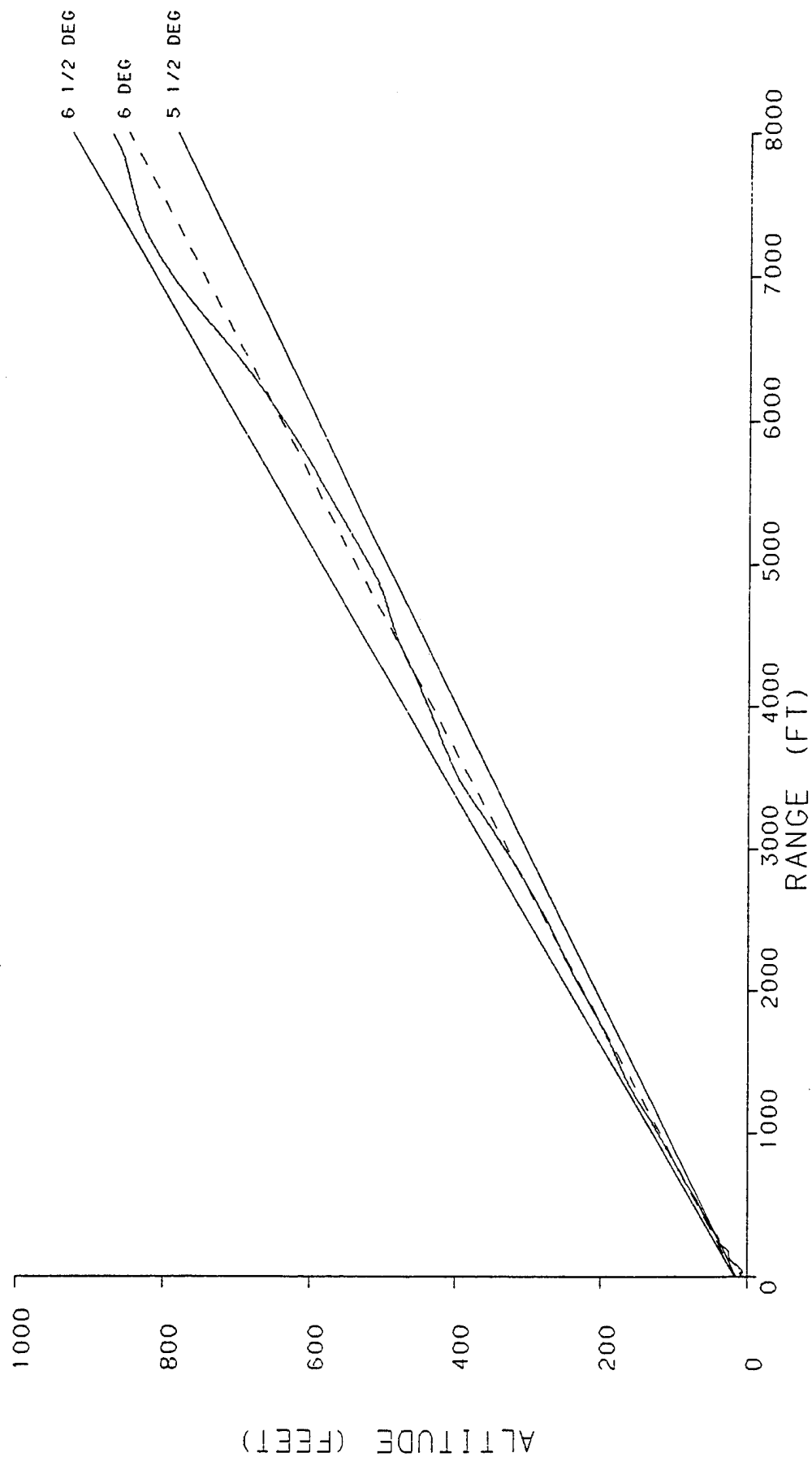
RUN #6

6/02/93 PAPI 6.0 DEG CENTERLINE APPROACH

AZIMUTH : 0.00 ELEVATION : 6.00

TRACKER DATA

DATA PROCESSED BY THE FAA TECHNICAL CENTER  
ATLANTIC CITY AIRPORT, N J 08403  
19-SEP-1994 09:47



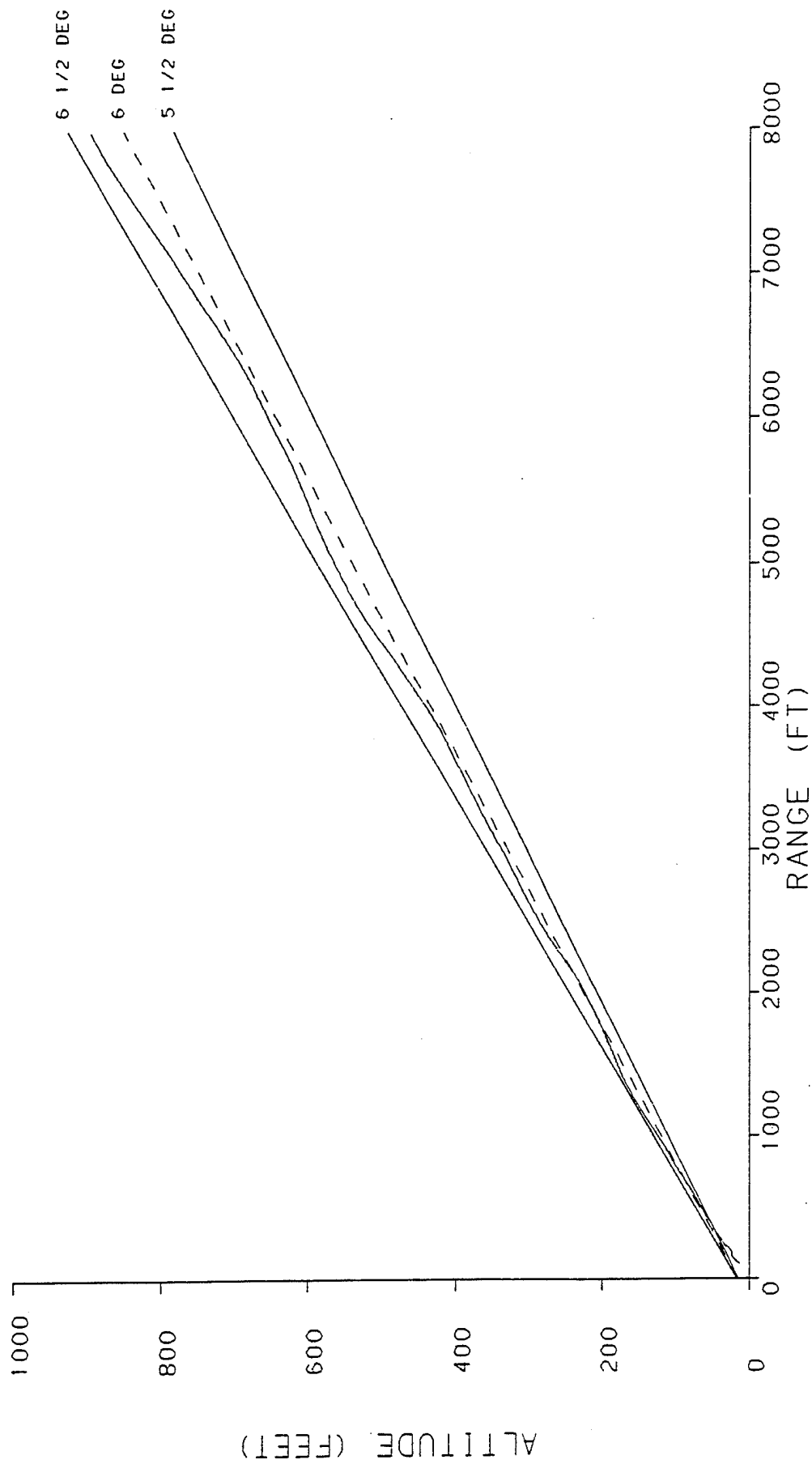
RUN #7

6/02/93 PAPI 6.0 DEG CENTERLINE APPROACH

AZIMUTH : 0.00 ELEVATION : 6.00

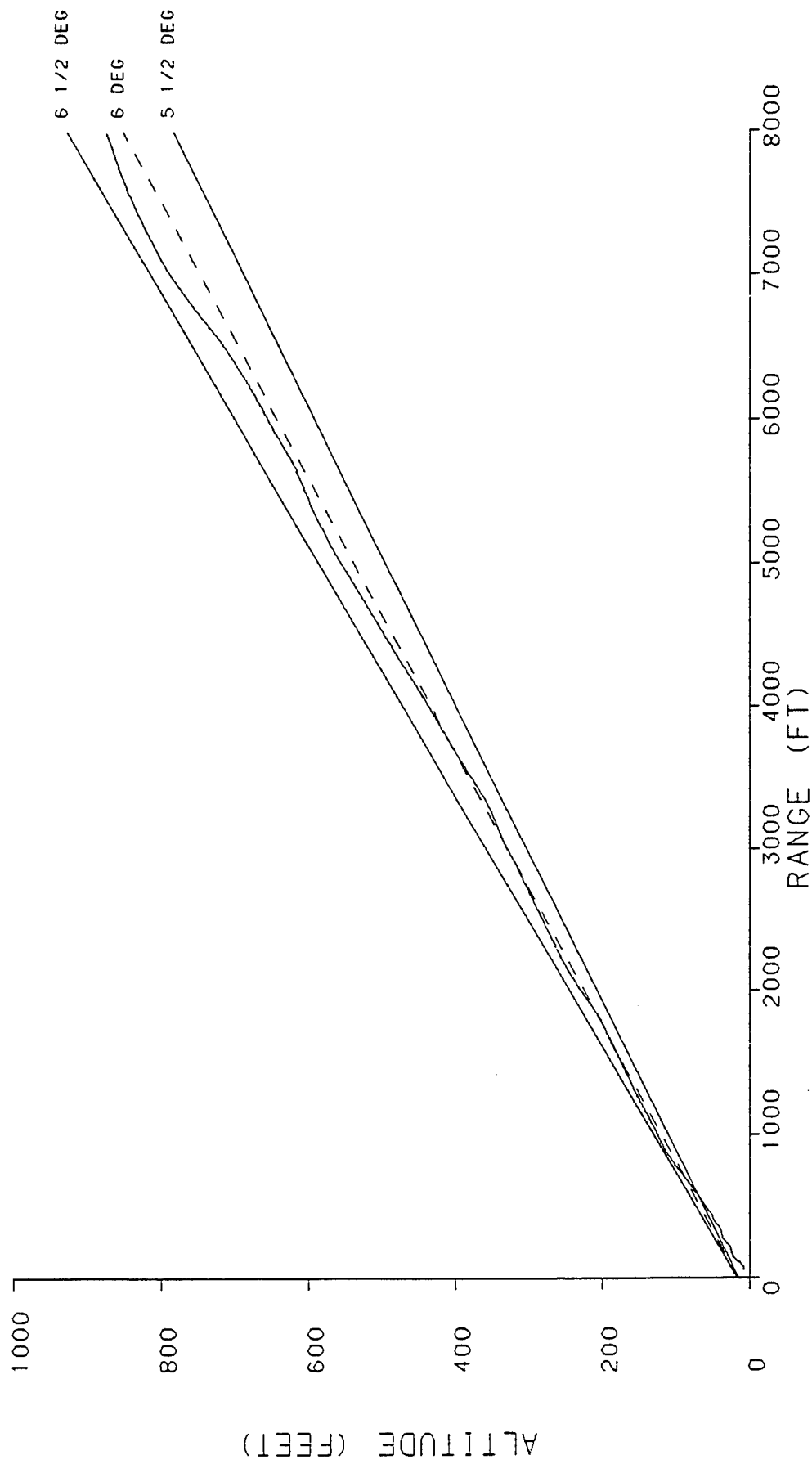
TRACKER DATA

DATA PROCESSED BY THE FAA TECHNICAL CENTER  
ATLANTIC CITY AIRPORT, N J 08405  
19-SEP-1994 09:48



DATA PROCESSED BY THE FAA TECHNICAL CENTER  
ATLANTIC CITY AIRPORT, N J 08405  
19-SEP-1994 10:15

RUN #8  
6/02/93 PAPI 6.0 DEG CENTERLINE APPROACH  
AZIMUTH : 0.00 ELEVATION : 6.00  
TRACKER DATA



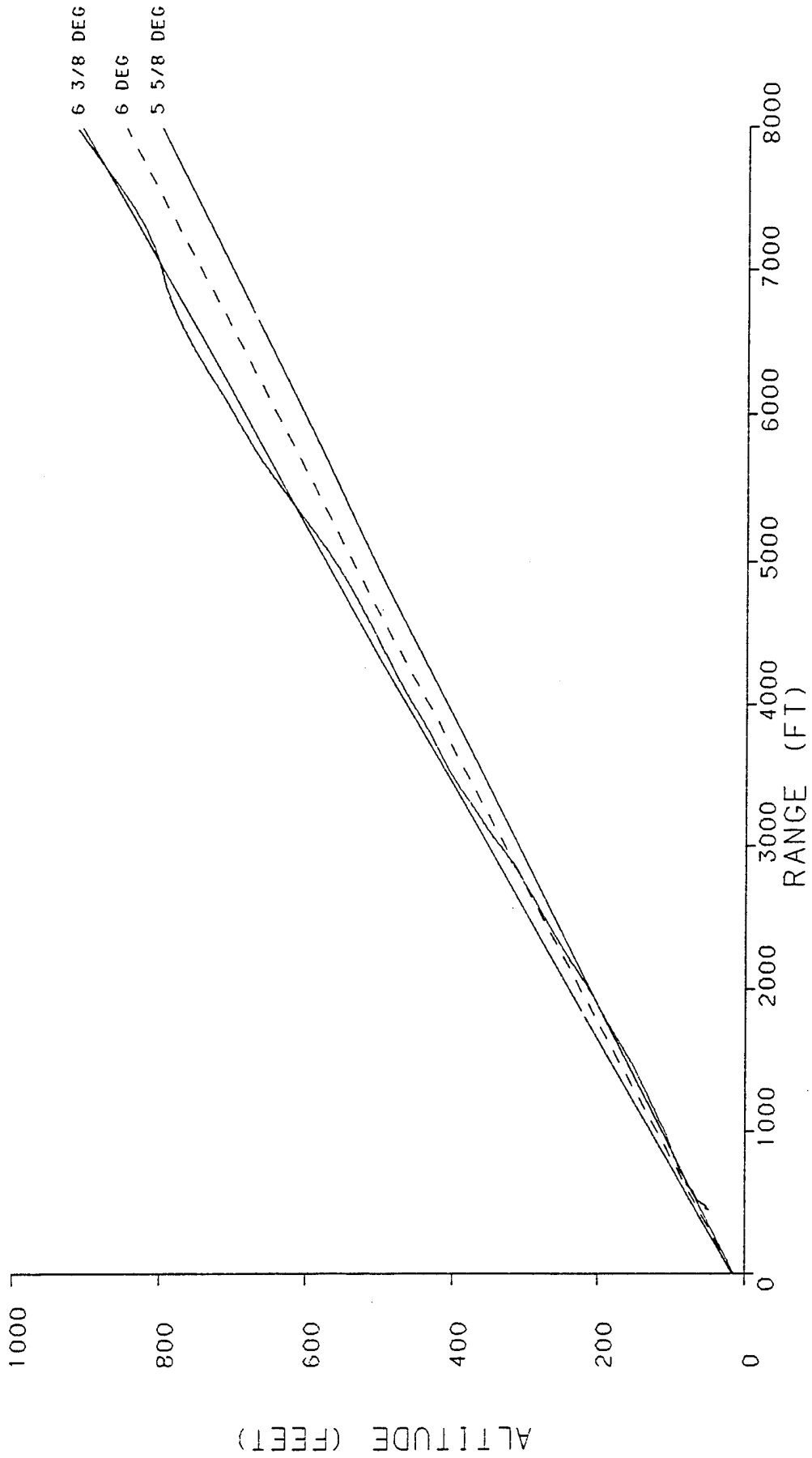
RUN #9

6/02/93 HAPI 6.0 DEG CENTERLINE APPROACH

AZIMUTH : 0.00 ELEVATION : 6.00

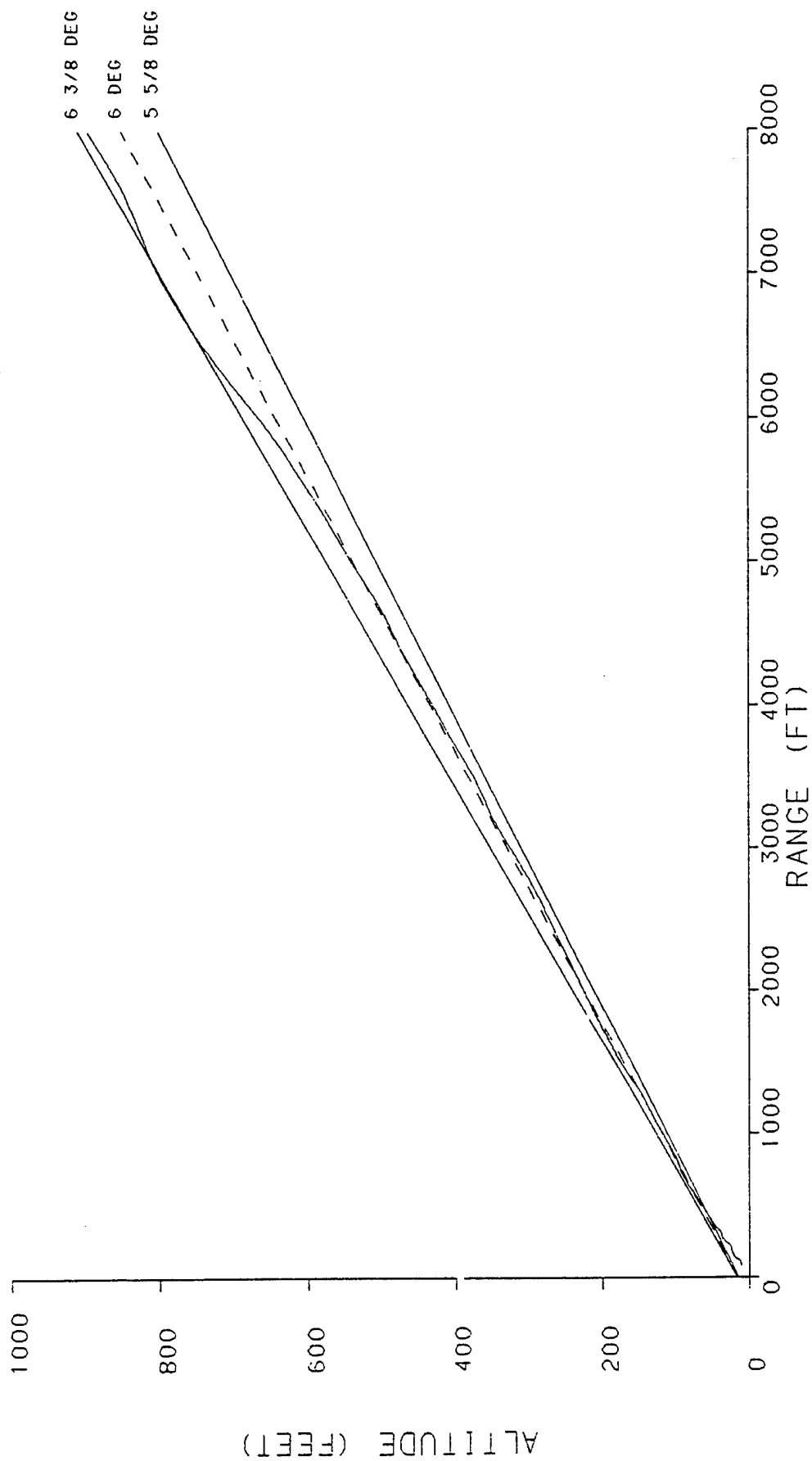
TRACKER DATA

DATA PROCESSED BY THE FAA TECHNICAL CENTER  
ATLANTIC CITY AIRPORT, N J 08405  
19-SEP-1994 10:15



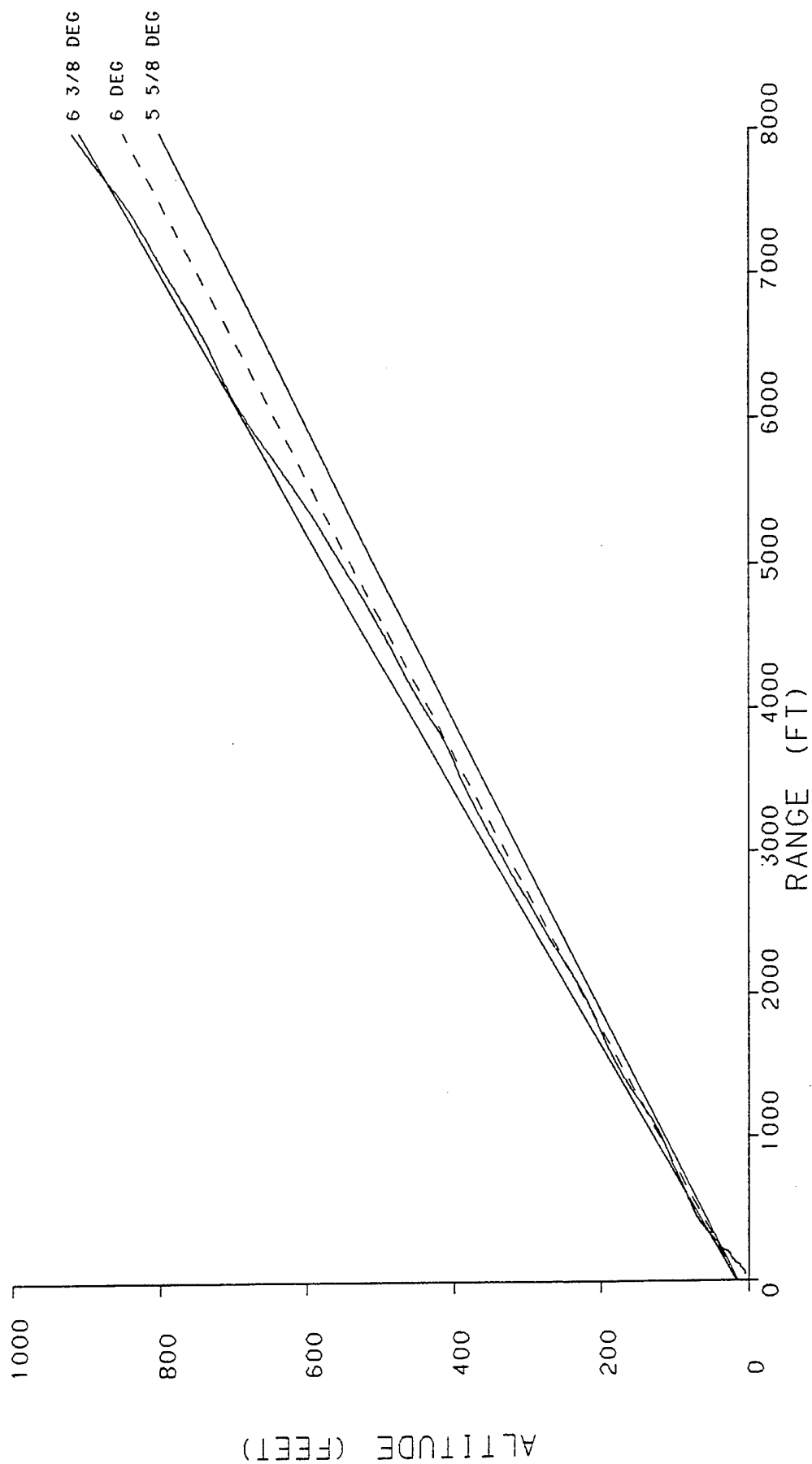
DATA PROCESSED BY THE FAA TECHNICAL CENTER  
ATLANTIC CITY AIRPORT, N J 08405  
19-SEP-1994 10:16

RUN #10  
6/02/93 HAPI 6.0 DEG CENTERLINE APPROACH  
AZIMUTH : 0.00 ELEVATION : 6.00  
TRACKER DATA



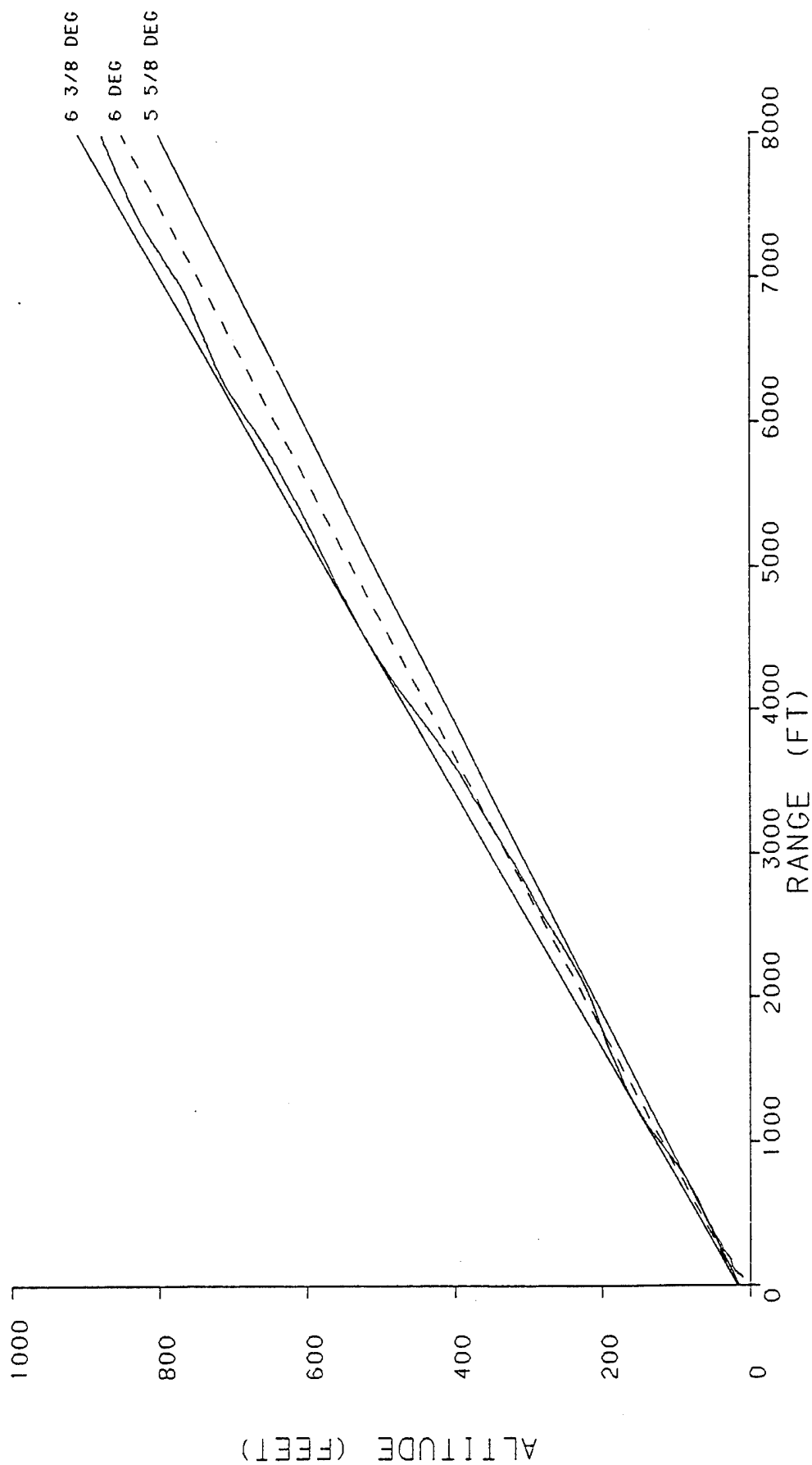
DATA PROCESSED BY THE FAA TECHNICAL CENTER  
ATLANTIC CITY AIRPORT, N J 08405  
19-SEP-1994 10:17

RUN #11  
6/02/93 HAPI 6.0 DEG CENTERLINE APPROACH  
AZIMUTH : 0.00 ELEVATION : 6.00  
TRACKER DATA



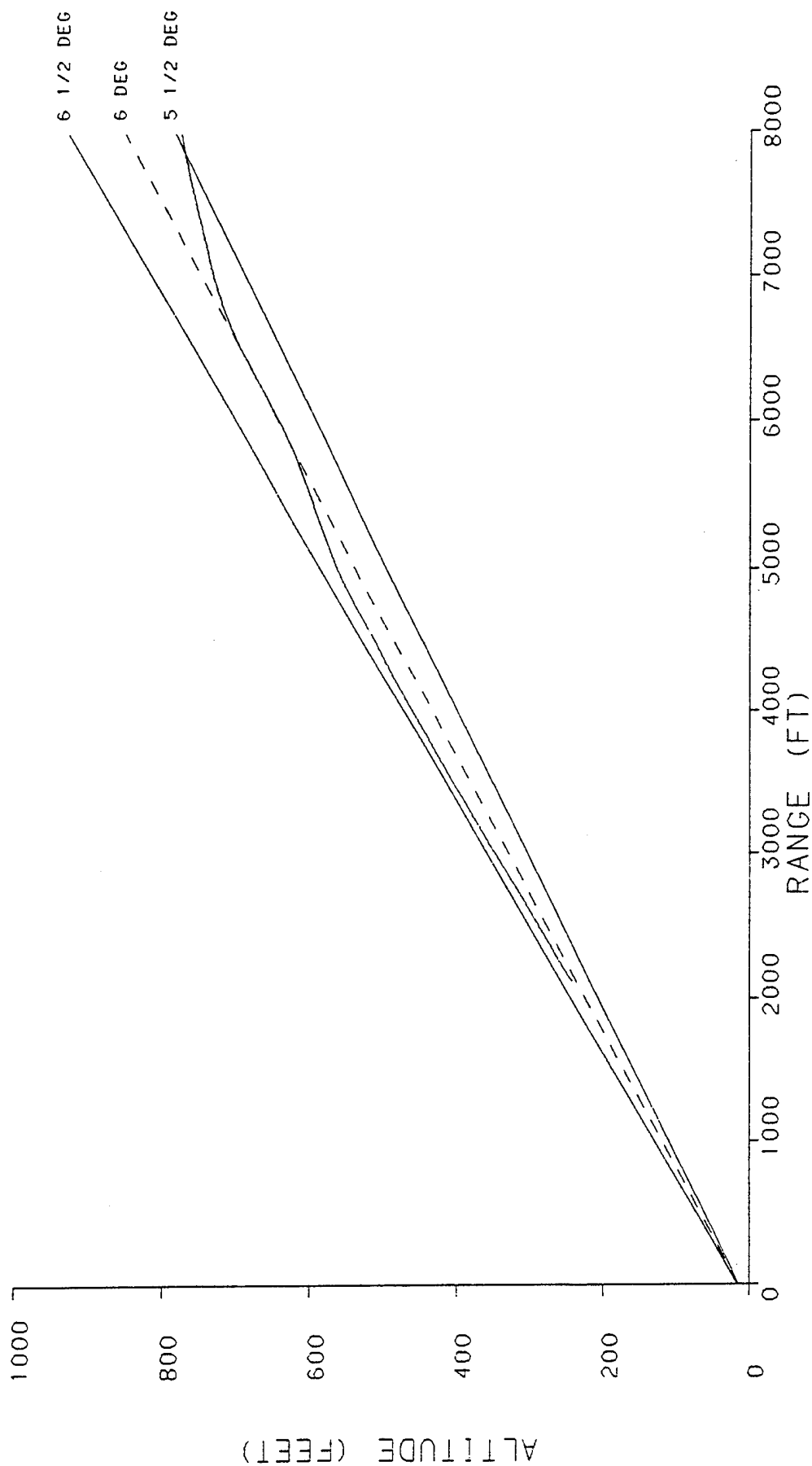
DATA PROCESSED BY THE FAA TECHNICAL CENTER  
ATLANTIC CITY AIRPORT, N J 08405  
19-SEP-1994 10:18

RUN #12  
6/02/93 HAPI 6.0 DEG CENTERLINE APPROACH  
AZIMUTH : 0.00 ELEVATION : 6.00  
TRACKER DATA



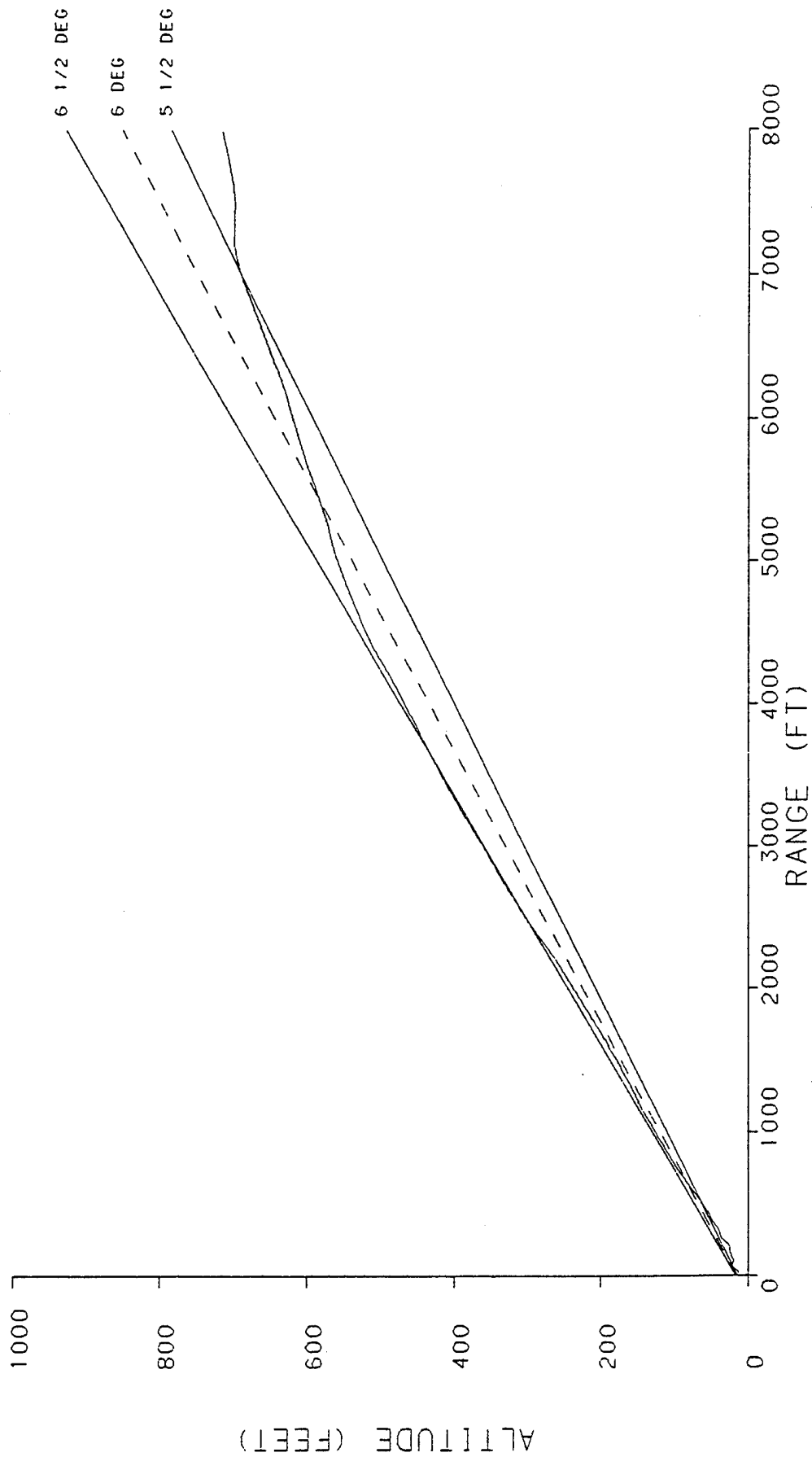
RUN #1  
6/14/93 PAPI 6.0 DEG CENTERLINE APPROACH  
AZIMUTH : 0.00 ELEVATION : 6.00  
TRACKER DATA

DATA PROCESSED BY THE FAA TECHNICAL CENTER  
ATLANTIC CITY AIRPORT, N J 08405  
19-SEP-1994 10:19



RUN #2  
6/14/93 PAPI 6.0 DEG CENTERLINE APPROACH  
AZIMUTH : 0.00 ELEVATION : 6.00  
TRACKER DATA

DATA PROCESSED BY THE FAA TECHNICAL CENTER  
ATLANTIC CITY AIRPORT, N J 08403  
19-SEP-1994 12:56



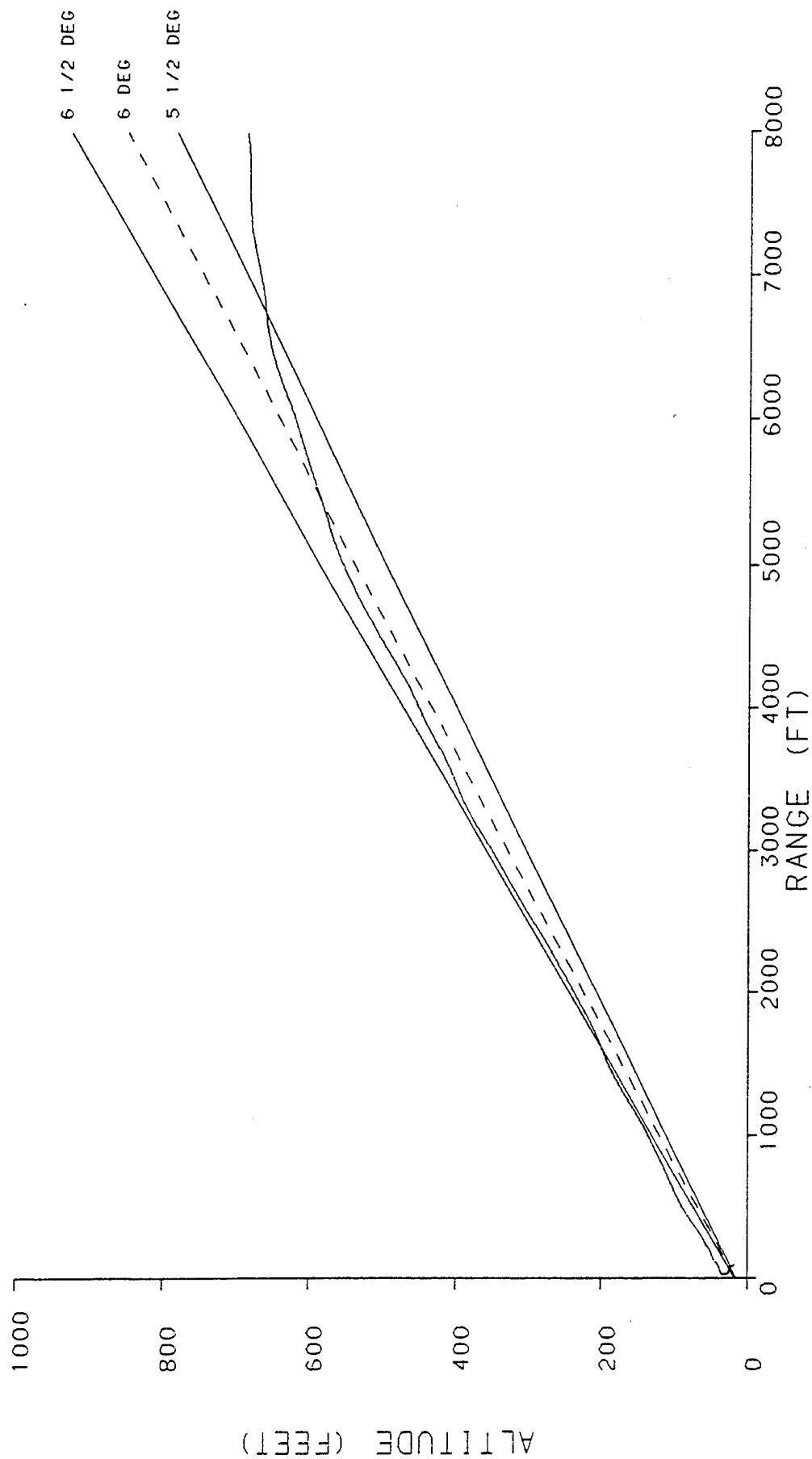
RUN #3

6/14/93 PAPI 6.0 DEG CENTERLINE APPROACH

AZIMUTH : 0.00 ELEVATION : 6.00

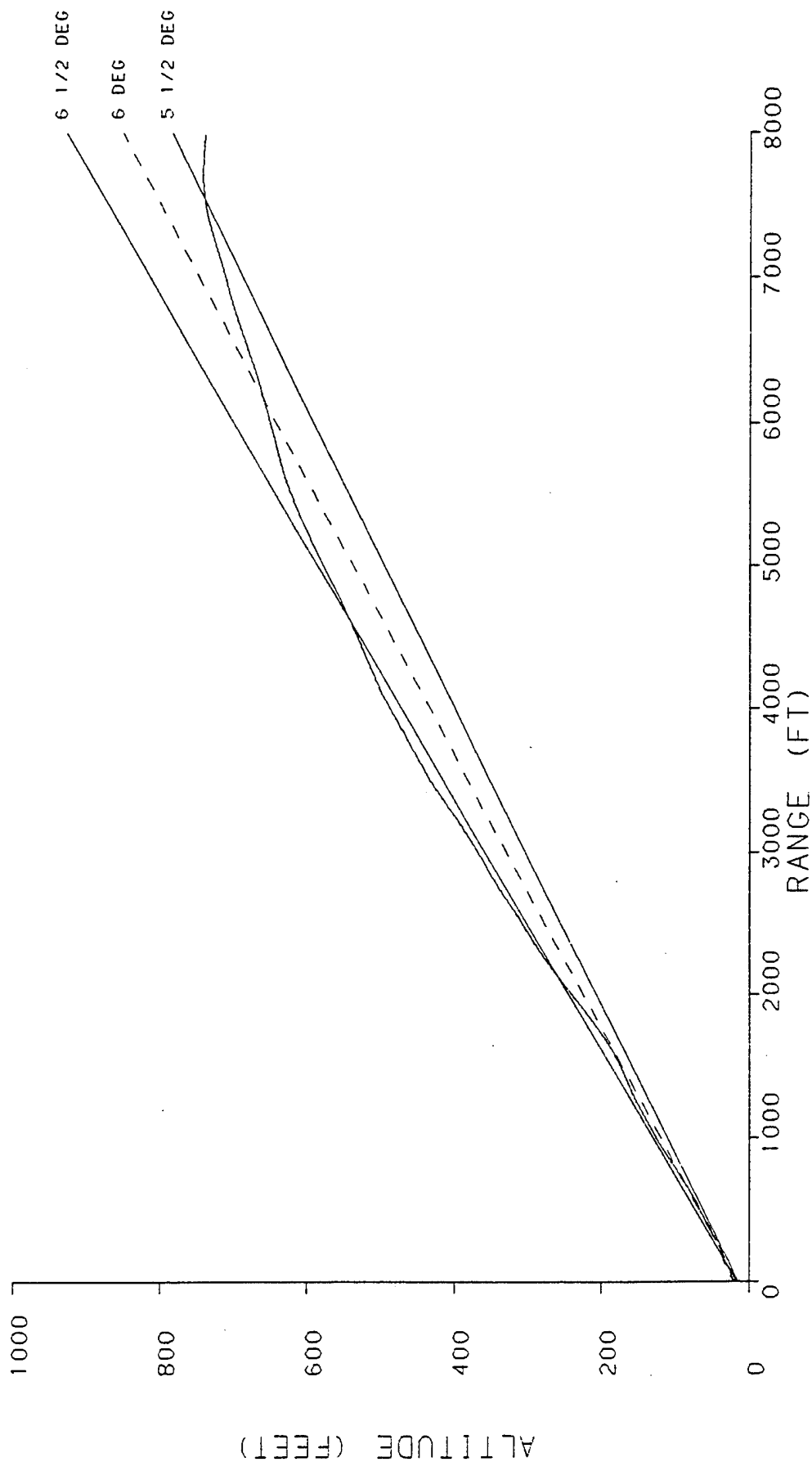
TRACKER DATA

DATA PROCESSED BY THE FAA TECHNICAL CENTER  
ATLANTIC CITY AIRPORT, N J 08403  
19-SEP-1994 12156



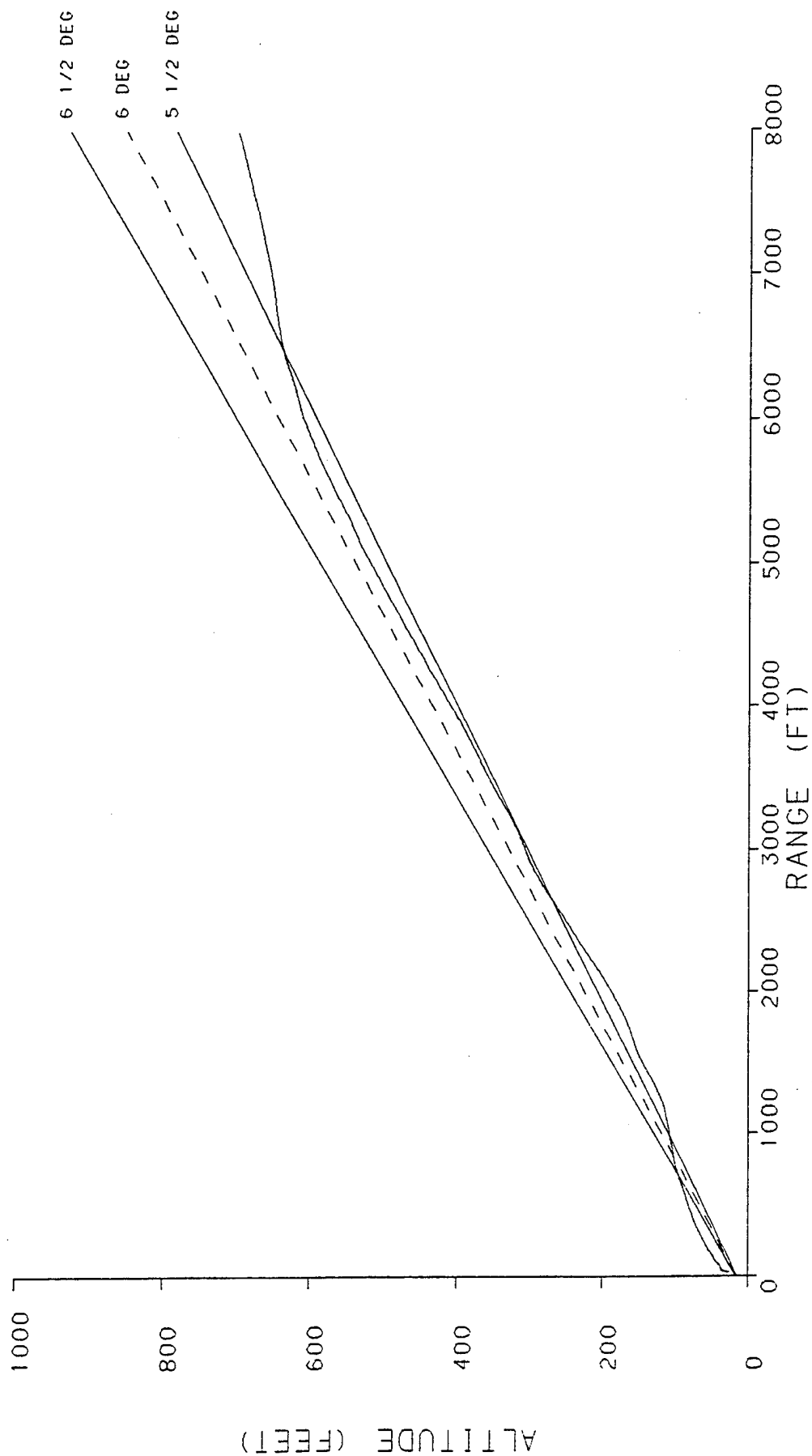
RUN #4  
6/14/93 PAPI 6.0 DEG CENTERLINE APPROACH  
AZIMUTH : 0.00 ELEVATION : 6.00  
TRACKER DATA

DATA PROCESSED BY THE FAA TECHNICAL CENTER  
ATLANTIC CITY AIRPORT. N J 08405  
19-SEP-1994 12:57



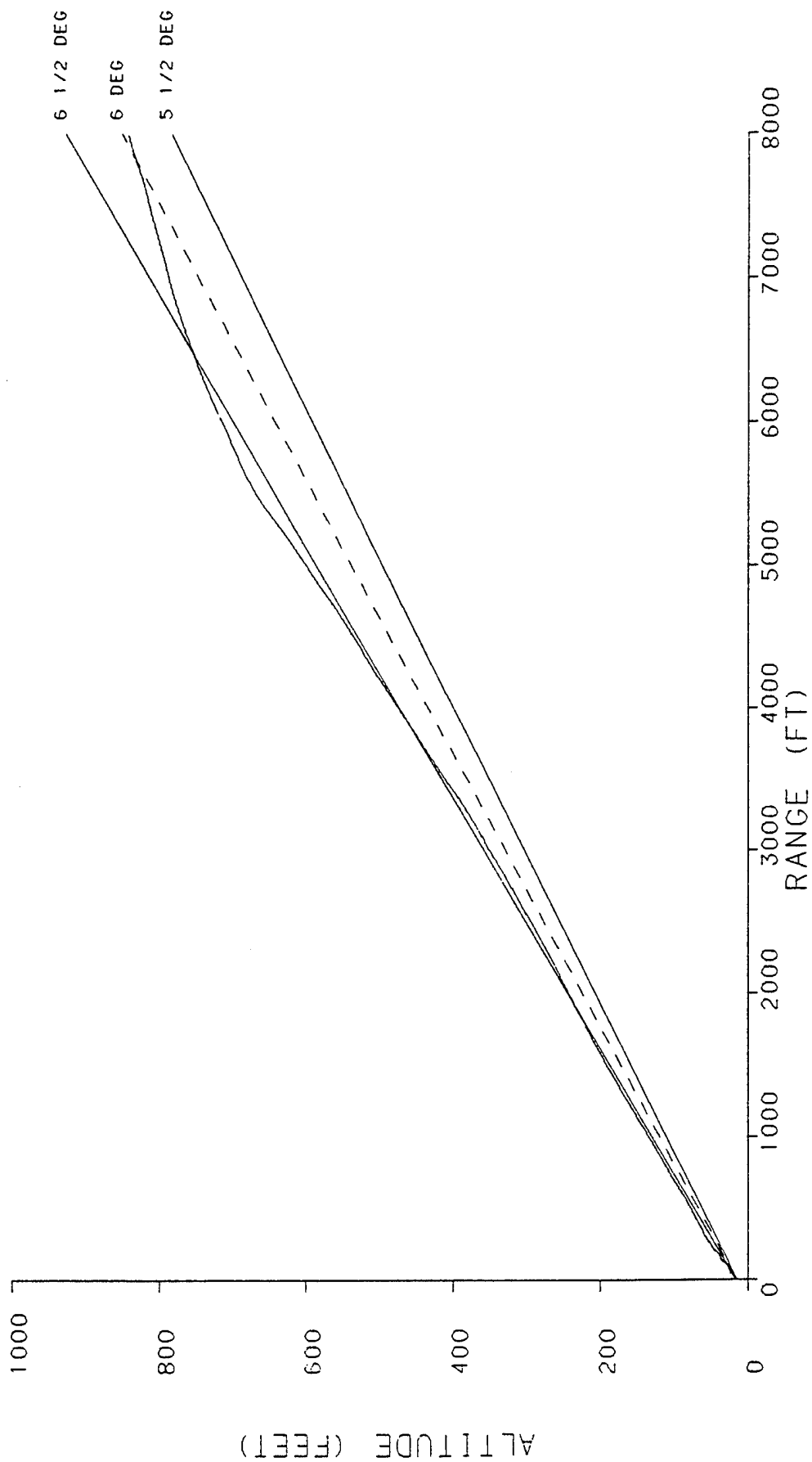
RUN #5  
6/14/93 CHAPI 6.0 DEG CENTERLINE APPROACH  
AZIMUTH : 0.00 ELEVATION : 6.00  
TRACKER DATA

DATA PROCESSED BY THE FAA TECHNICAL CENTER  
ATLANTIC CITY AIRPORT, N J 08405  
19-SEP-1994 12:58



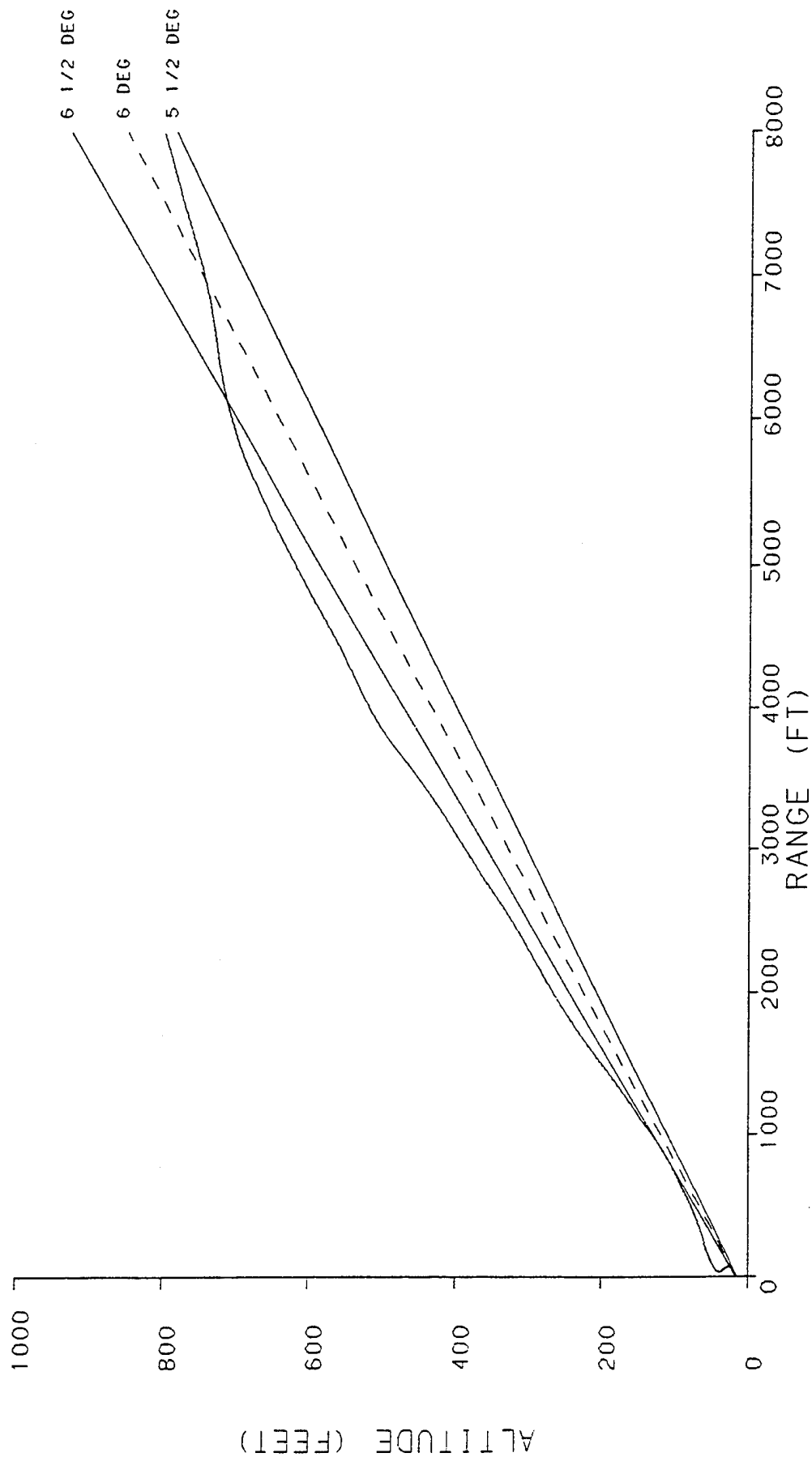
DATA PROCESSED BY THE FAA TECHNICAL CENTER  
ATLANTIC CITY AIRPORT, N J 08403  
19-SEP-1994 13:00

RUN #6  
6/14/93 CHAPI 6.0 DEG CENTERLINE APPROACH  
AZIMUTH : 0.00 ELEVATION : 6.00  
TRACKER DATA



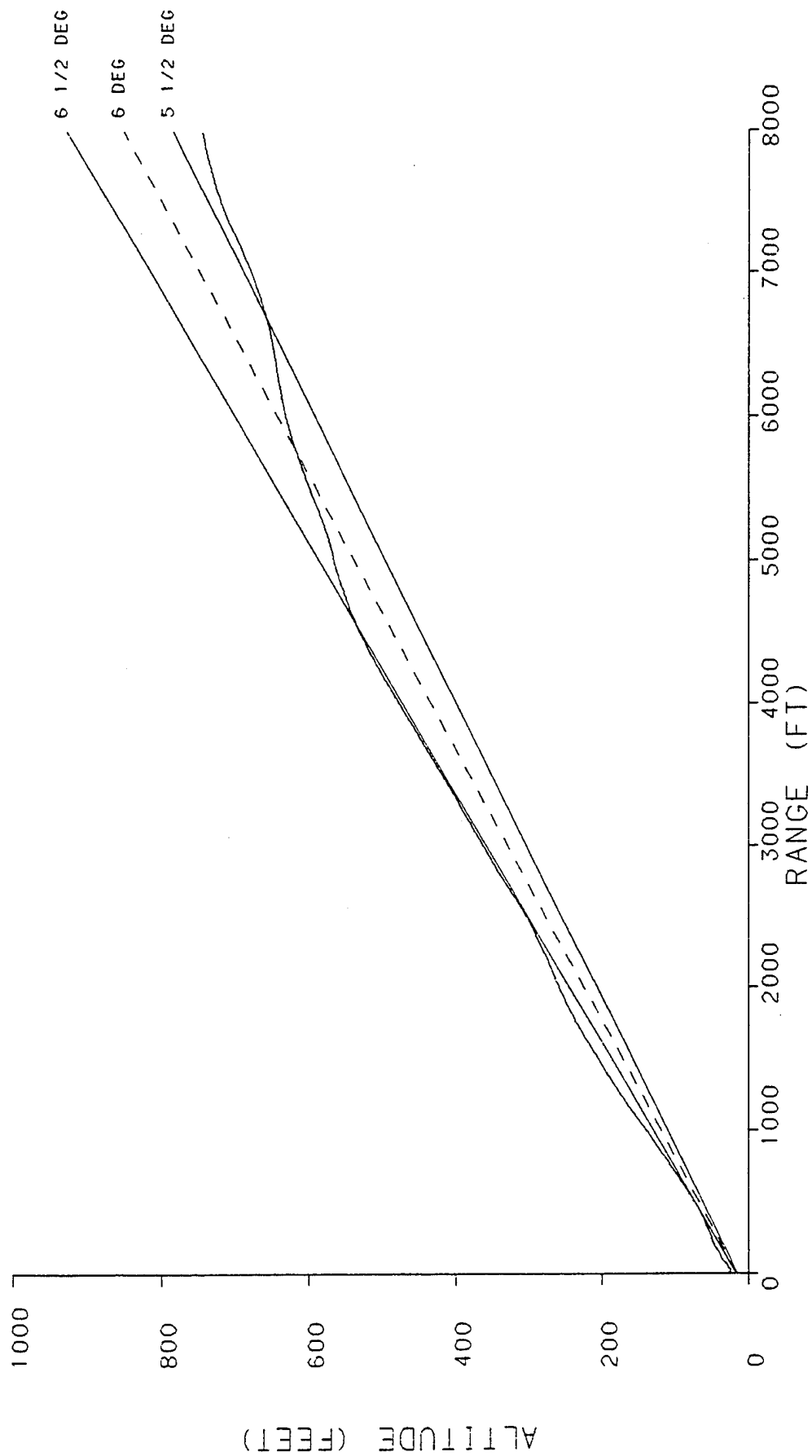
RUN #7  
6/14/93 CHAP1 6.0 DEG CENTERLINE APPROACH  
AZIMUTH : 0.00 ELEVATION : 6.00  
TRACKER DATA

DATA PROCESSED BY THE FAA TECHNICAL CENTER  
ATLANTIC CITY AIRPORT, N J 08405  
19-SEP-1994 13:01



RUN #8  
6/14/93 CHAP1 6.0 DEG CENTERLINE APPROACH  
AZIMUTH : 0.00 ELEVATION : 6.00  
TRACKER DATA

DATA PROCESSED BY THE FAA TECHNICAL CENTER  
ATLANTIC CITY AIRPORT, N J 08405  
19-SEP-1994 13:02



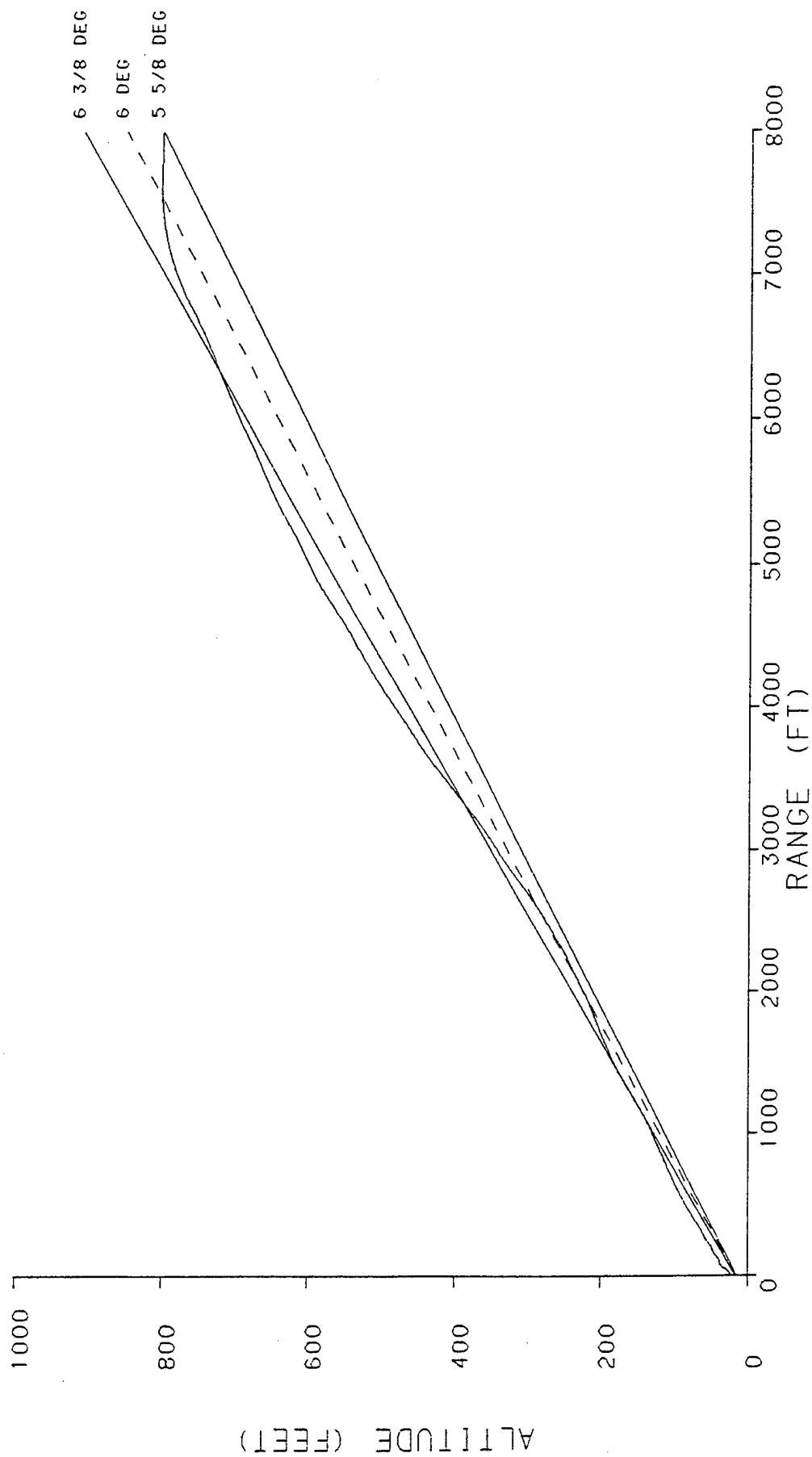
RUN #9

6/14/93 HAPI 6.0 DEG CENTERLINE APPROACH

AZIMUTH : 0.00 ELEVATION : 6.00

TRACKER DATA

DATA PROCESSED BY THE FAA TECHNICAL CENTER  
ATLANTIC CITY AIRPORT, N J 08405  
19-SEP-1994 13:03



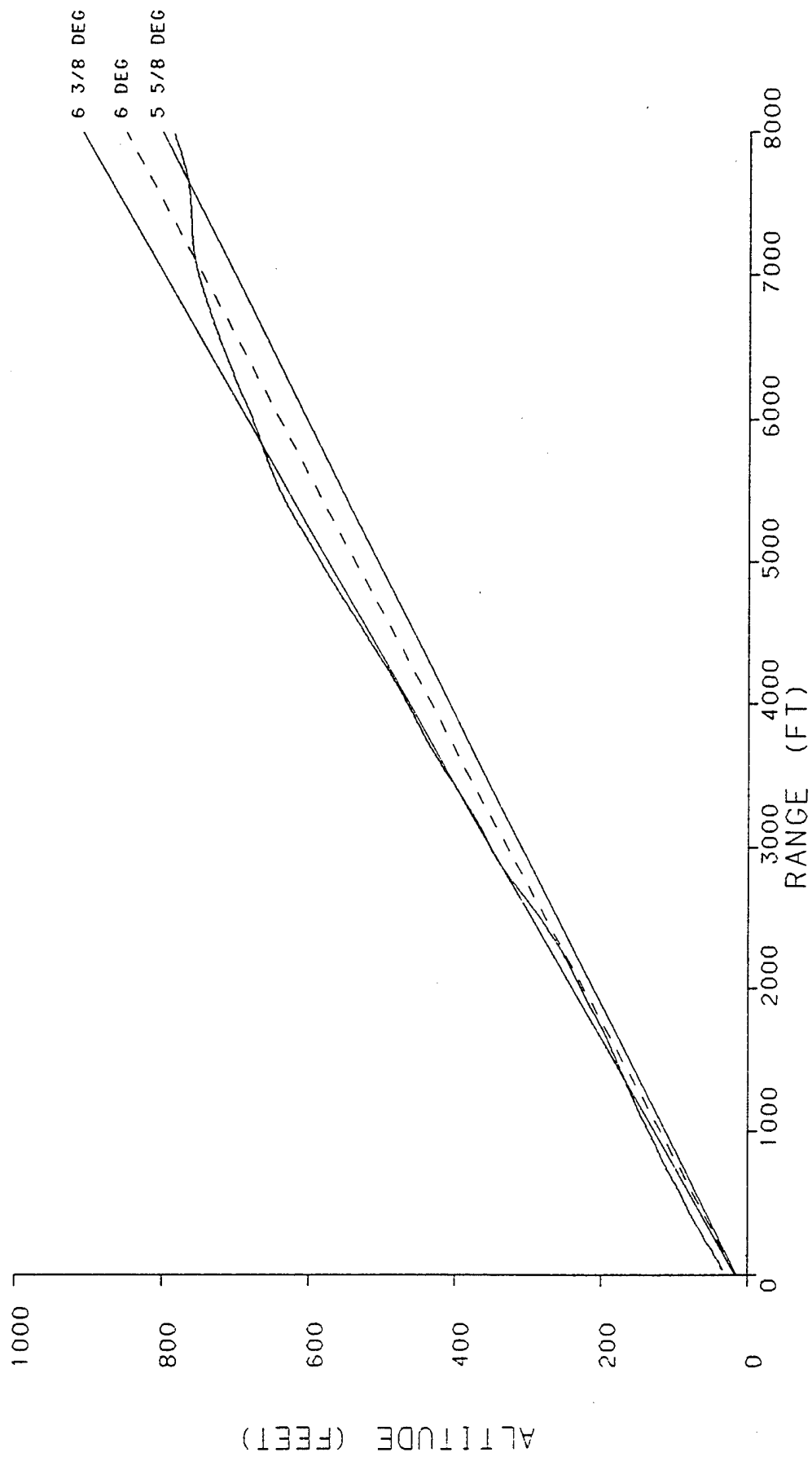
RUN #10

6/14/93 HAPI 6.0 DEG CENTERLINE APPROACH

AZIMUTH : 0.00 ELEVATION : 6.00

TRACKER DATA

DATA PROCESSED BY THE FAA TECHNICAL CENTER  
ATLANTIC CITY AIRPORT. N J 08403  
19-SEP-1994 13:04



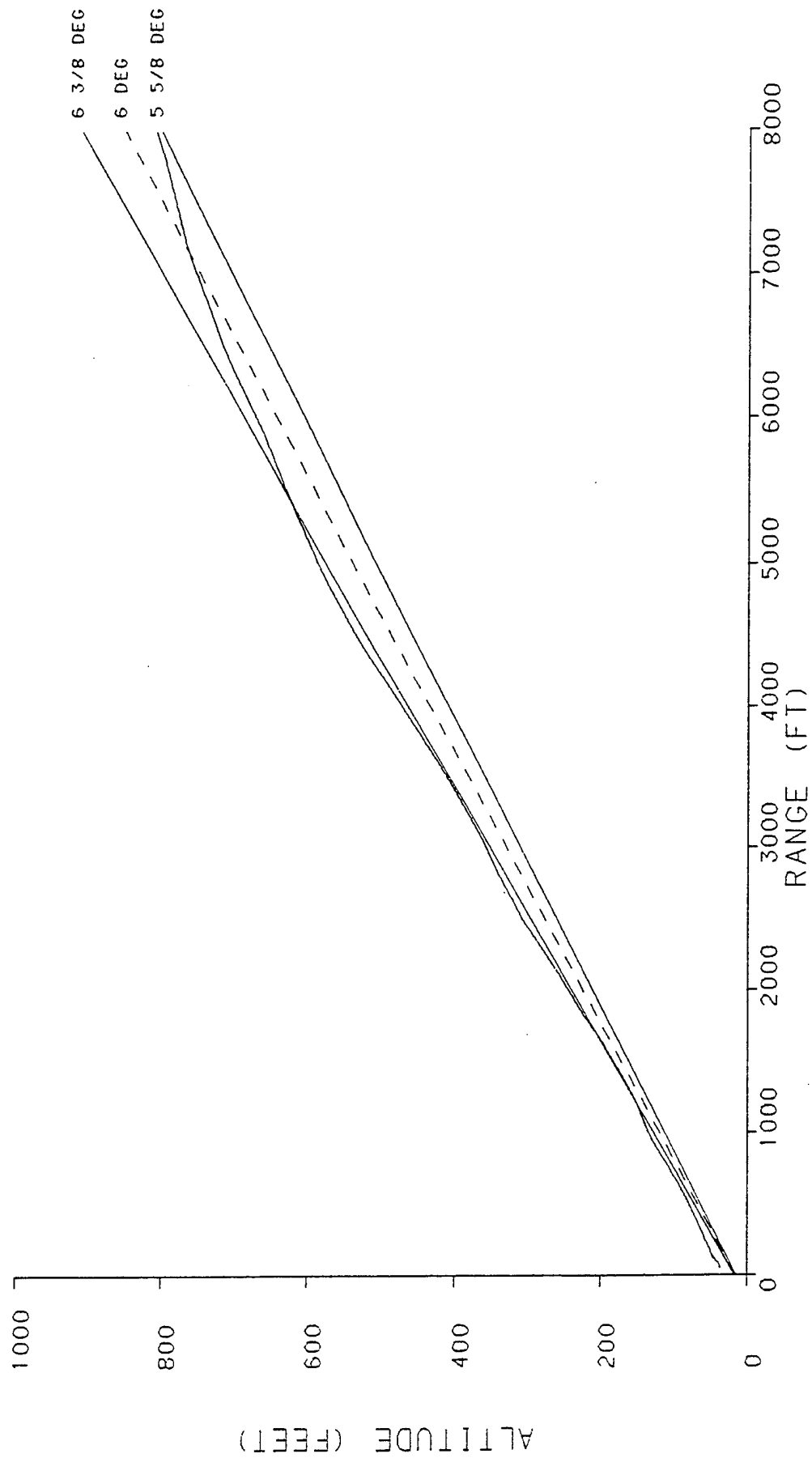
RUN #11

6/14/93 HAPI 6.0 DEG CENTERLINE APPROACH

AZIMUTH : 0.00 ELEVATION : 6.00

TRACKER DATA

DATA PROCESSED BY THE FAA TECHNICAL CENTER  
ATLANTIC CITY AIRPORT, N J 08405  
19-SEP-1994 13:05



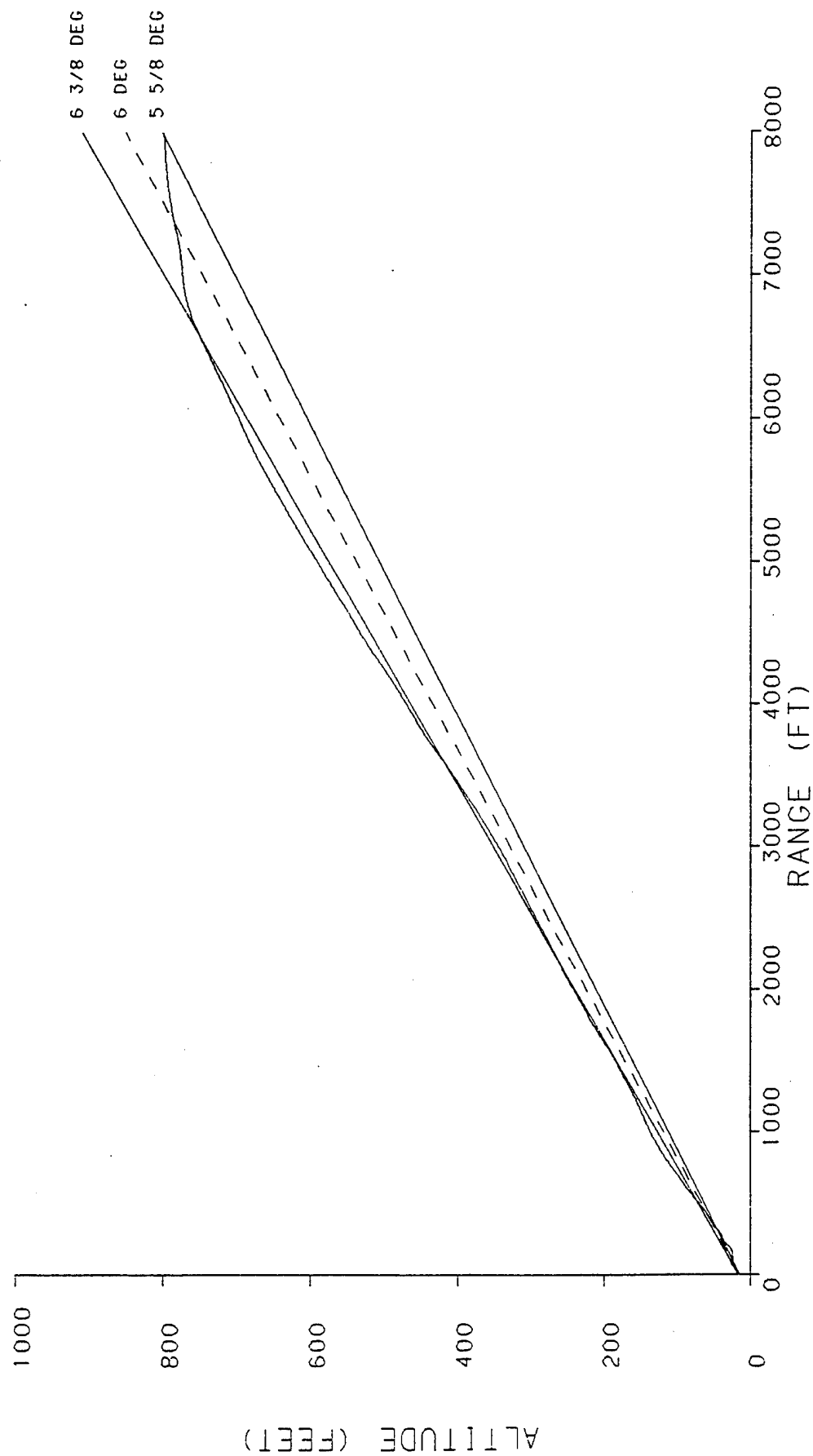
RUN #12

6/14/93 HAPI 6.0 DEG CENTERLINE APPROACH

AZIMUTH : 0.00 ELEVATION : 6.00

TRACKER DATA

DATA PROCESSED BY THE FAA TECHNICAL CENTER  
ATLANTIC CITY AIRPORT, N J 08405  
19-SEP-1994 13:06



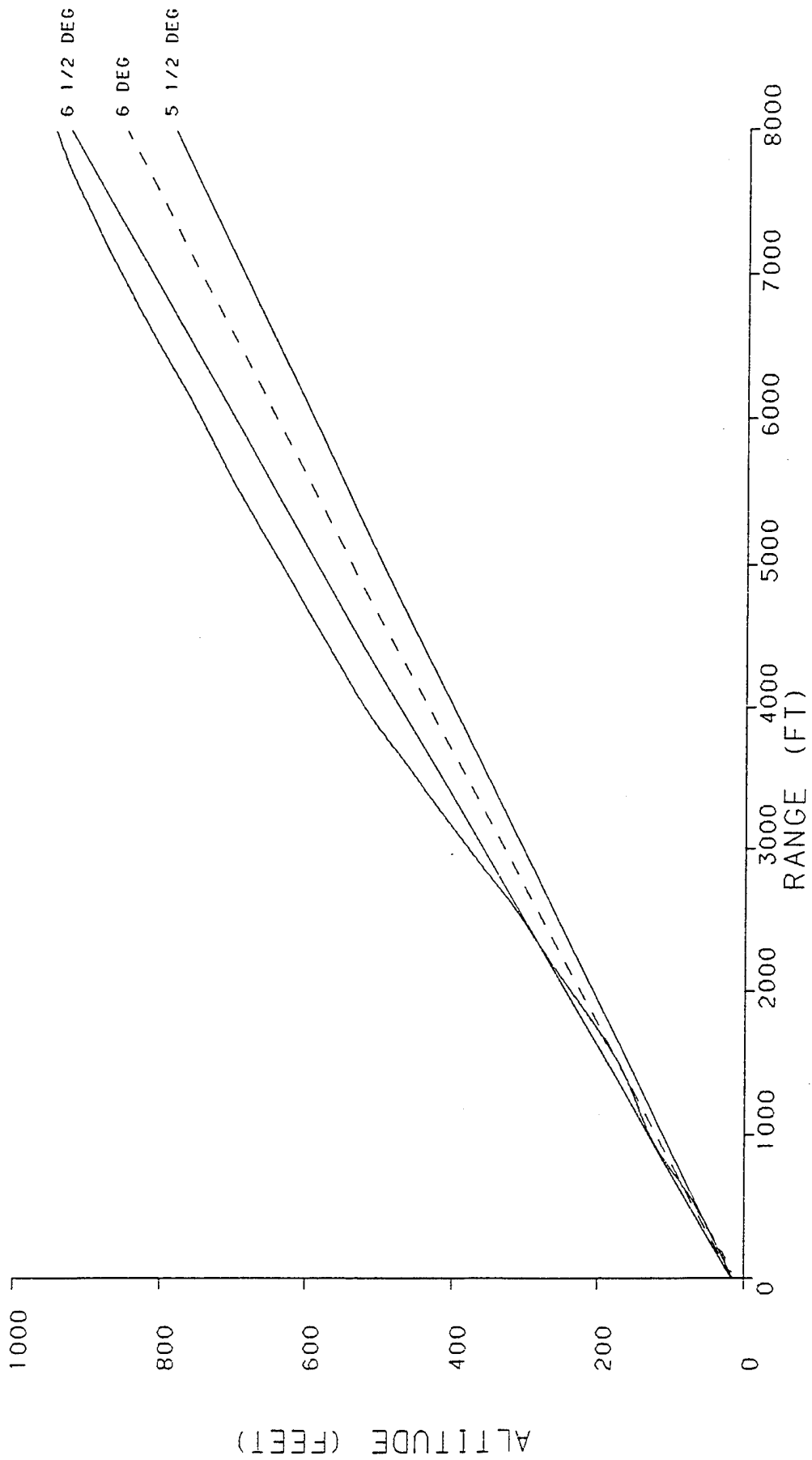
RUN #1

6/16/93 CHAP1 6.0 DEG CENTERLINE APPROACH

AZIMUTH : 0.00 ELEVATION : 6.00

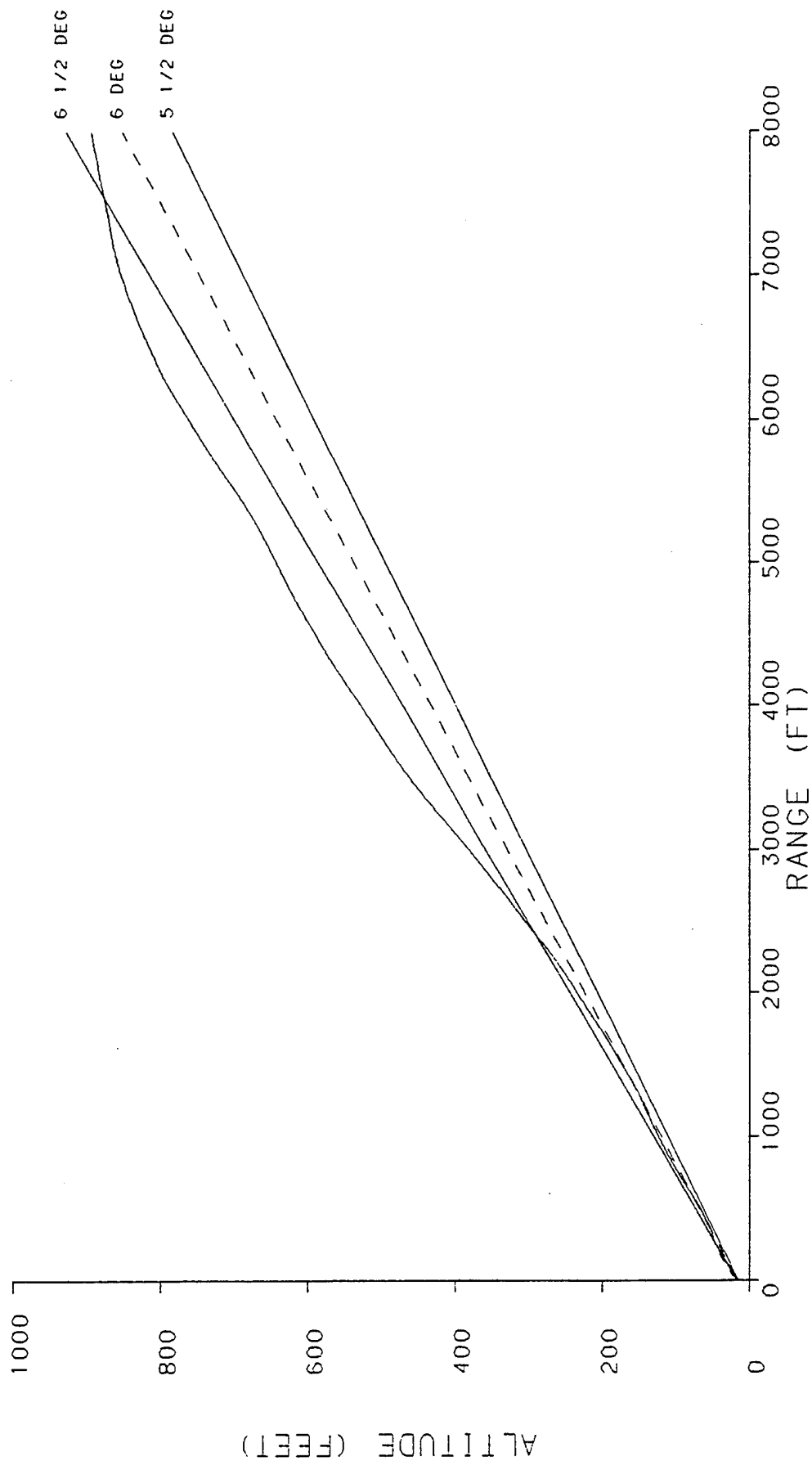
TRACKER DATA

DATA PROCESSED BY THE FAA TECHNICAL CENTER  
ATLANTIC CITY AIRPORT, N J 08405  
19-SEP-1994 13:07



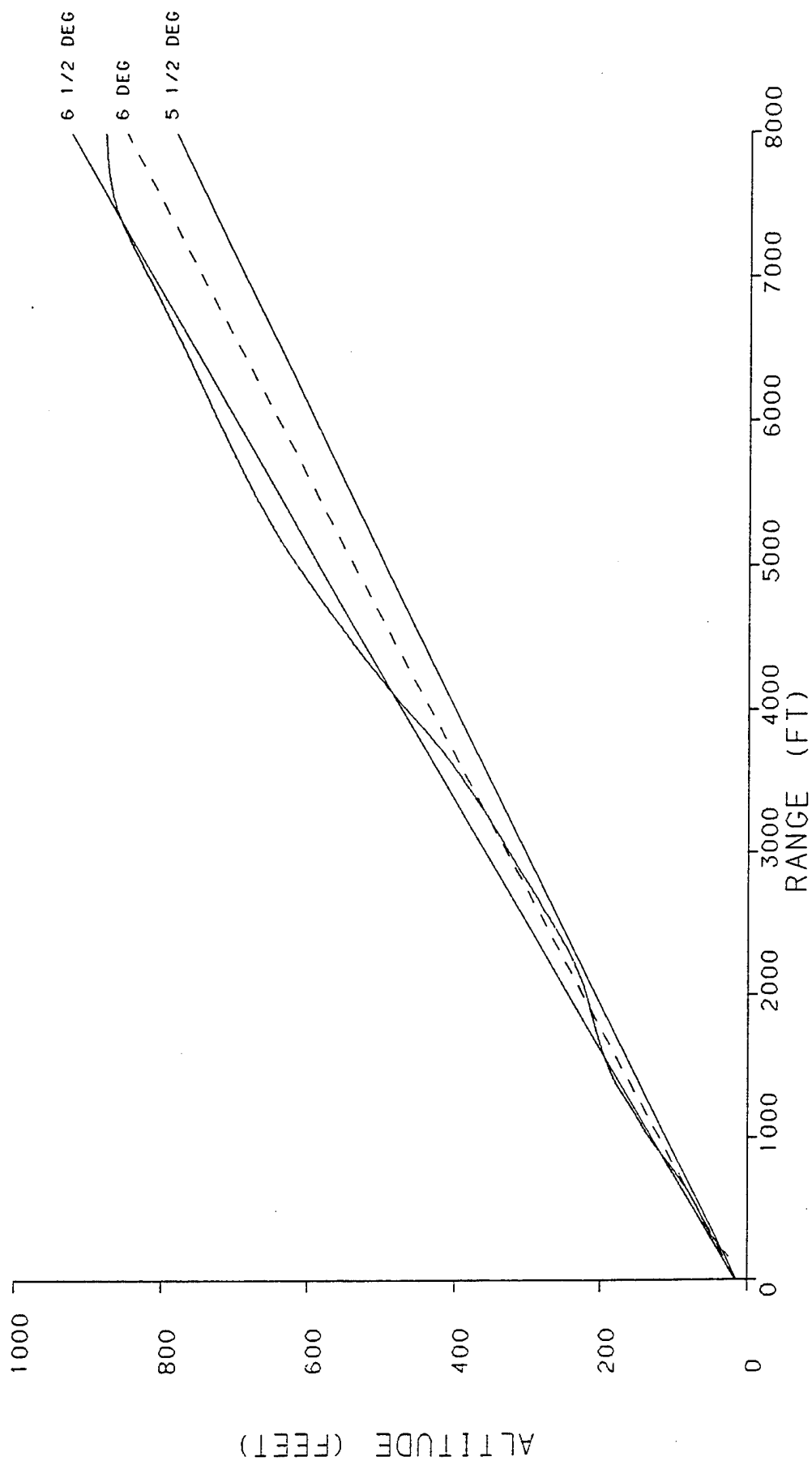
DATA PROCESSED BY THE FAA TECHNICAL CENTER  
ATLANTIC CITY AIRPORT, N J 08403  
19-SEP-1994 13:08

RUN #2  
6/16/93 CHAP1 6.0 DEG CENTERLINE APPROACH  
AZIMUTH : 0.00 ELEVATION : 6.00  
TRACKER DATA



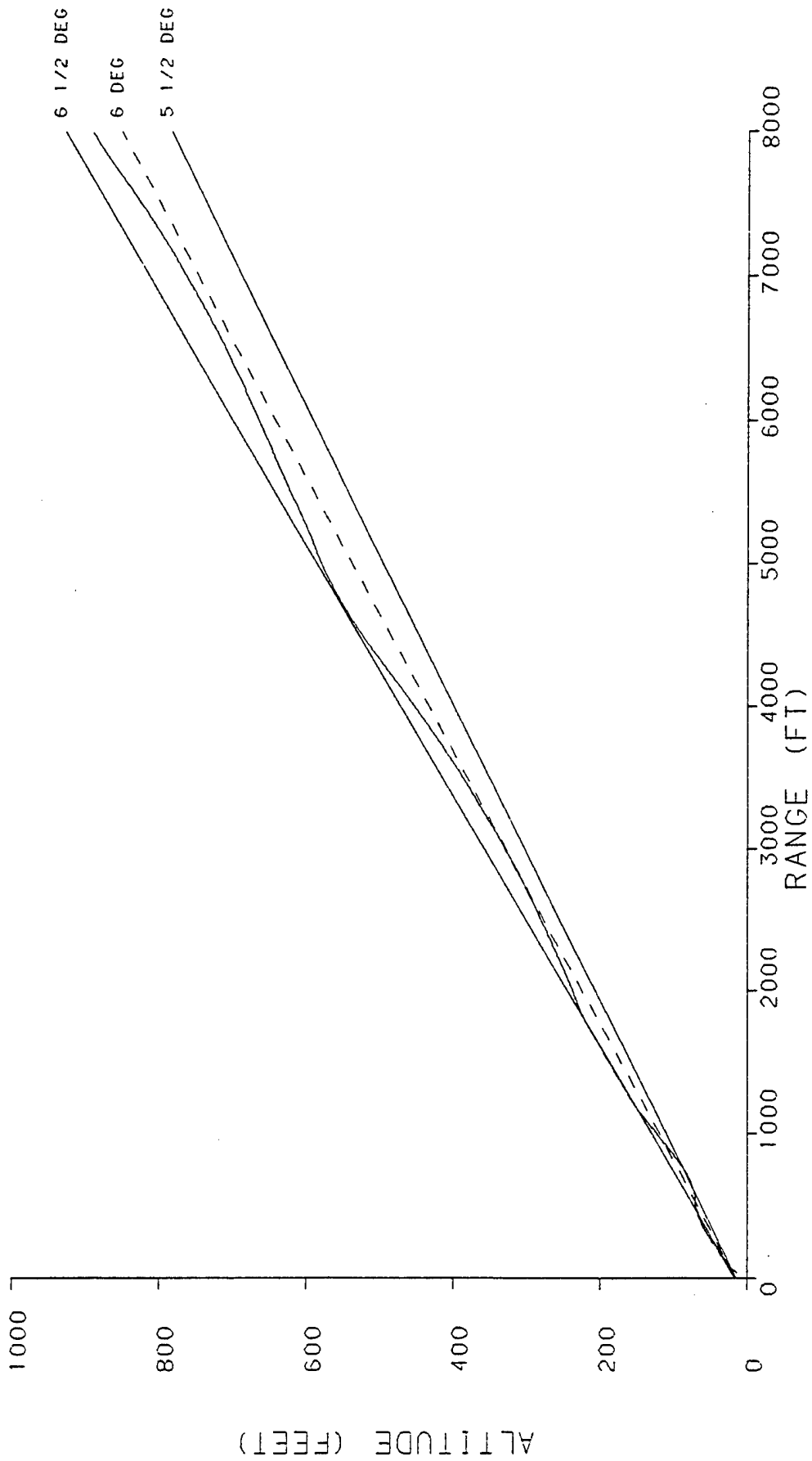
RUN #3  
6/16/93 CHAP1 6.0 DEG CENTERLINE APPROACH  
AZIMUTH : 0.00 ELEVATION : 6.00  
TRACKER DATA

DATA PROCESSED BY THE FAA TECHNICAL CENTER  
ATLANTIC CITY AIRPORT, N J 08403  
19-SEP-1994 13:09



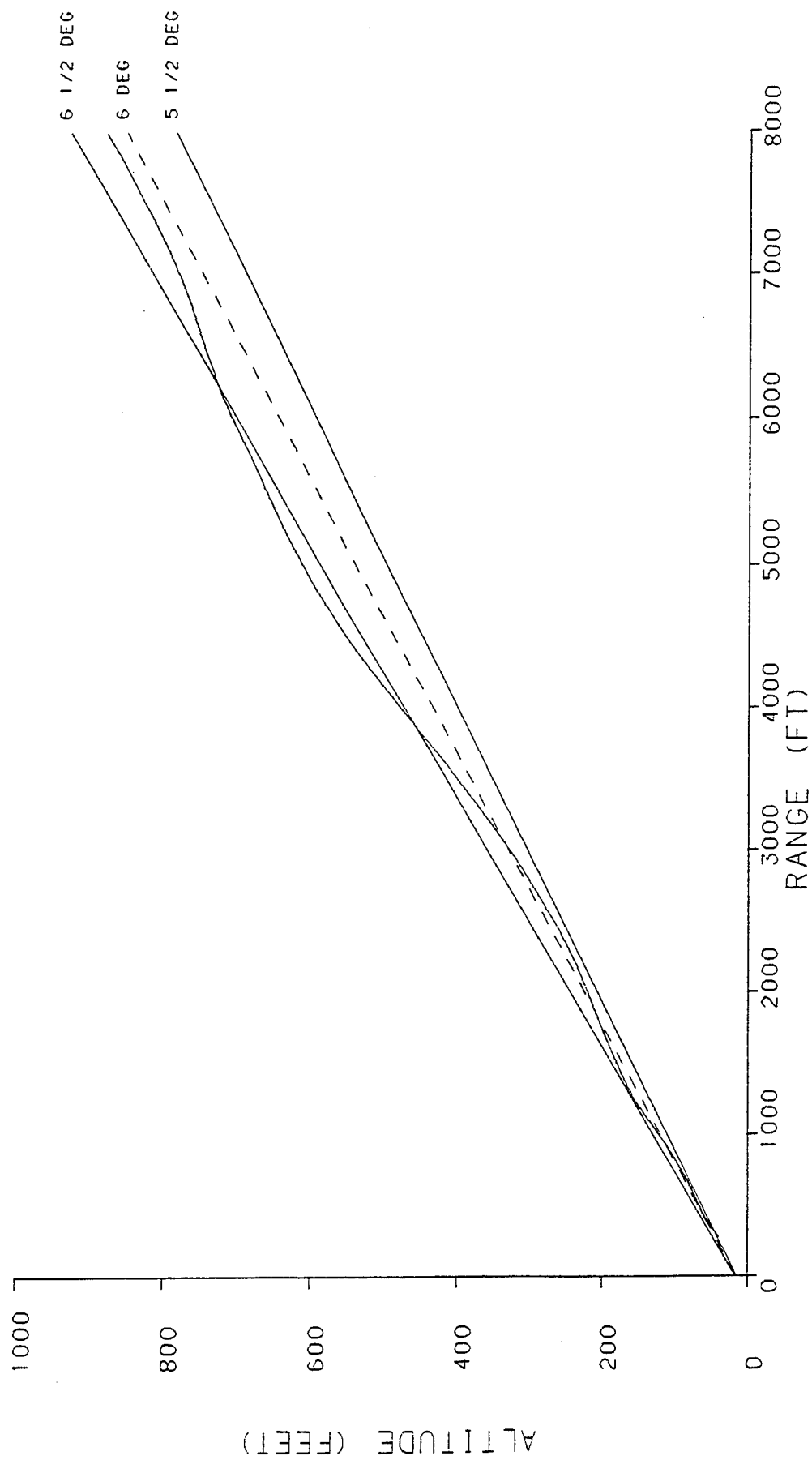
DATA PROCESSED BY THE FAA TECHNICAL CENTER  
ATLANTIC CITY AIRPORT, N J 08405  
19-SEP-1994 13:09

RUN #4  
6/16/93 CHAP1 6.0 DEG CENTERLINE APPROACH  
AZIMUTH : 0.00 ELEVATION : 6.00  
TRACKER DATA



RUN #5  
6/16/93 PAPI 6.0 DEG CENTERLINE APPROACH  
AZIMUTH : 0.00 ELEVATION : 6.00  
TRACKER DATA

DATA PROCESSED BY THE FAA TECHNICAL CENTER  
ATLANTIC CITY AIRPORT, N J 08405  
19-SEP-1994 13:10



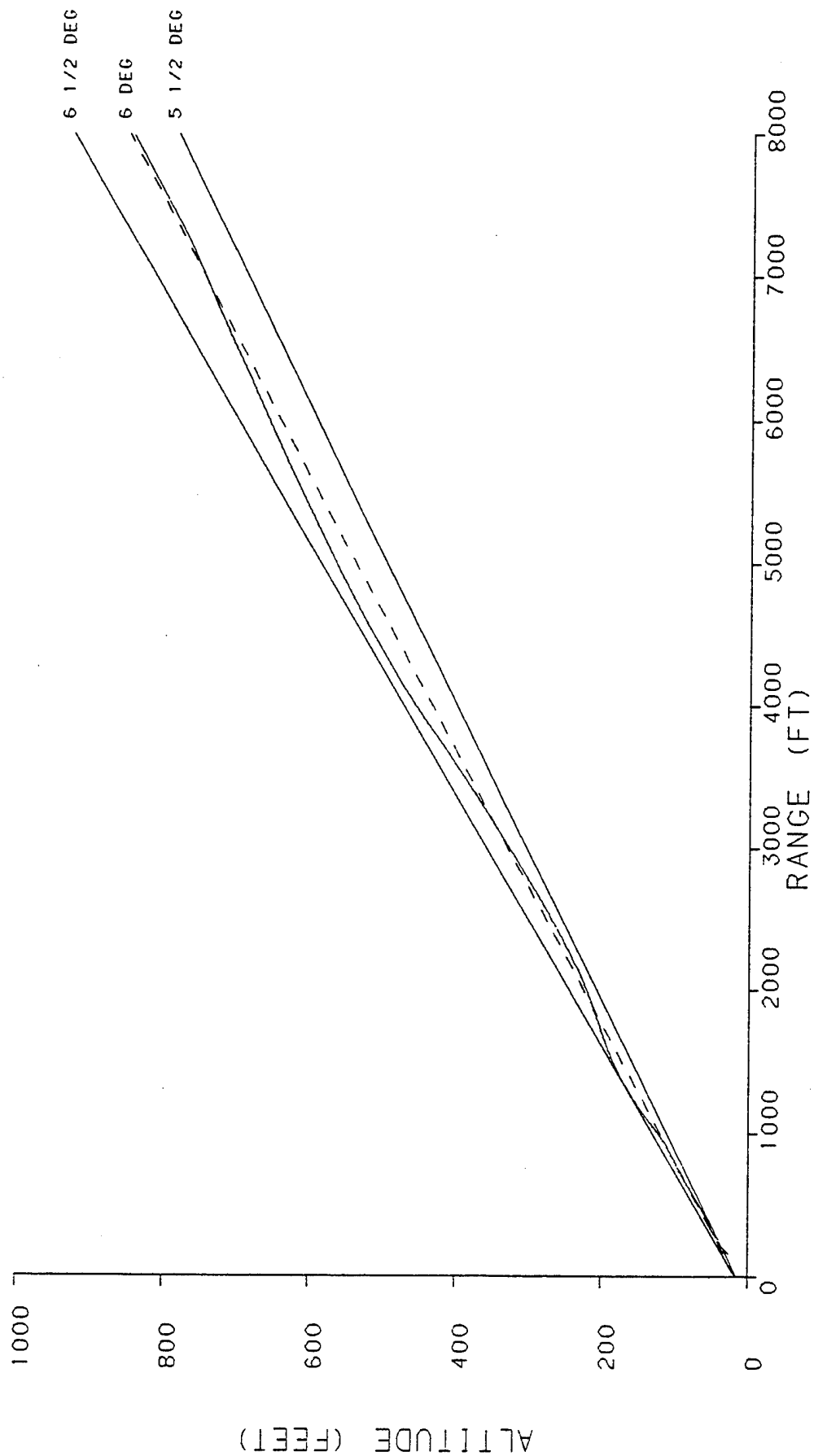
RUN #6

6/16/93 PAPI 6.0 DEG CENTERLINE APPROACH

AZIMUTH : 0.00 ELEVATION : 6.00

TRACKER DATA

DATA PROCESSED BY THE FAA TECHNICAL CENTER  
ATLANTIC CITY AIRPORT, N J 08403  
19-SEP-1994 13112



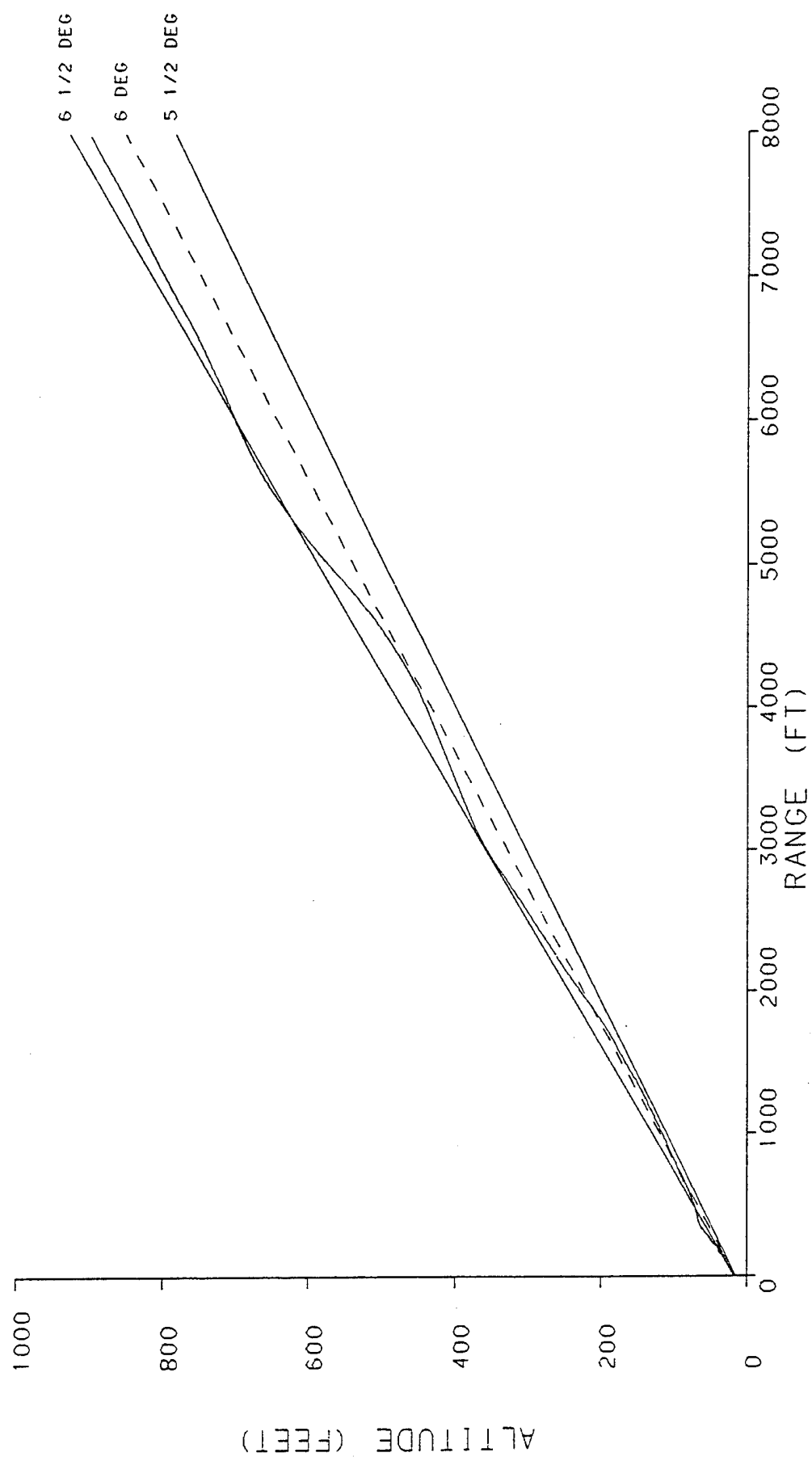
RUN #7

6/16/93 PAPI 6.0 DEG CENTERLINE APPROACH

AZIMUTH : 0.00 ELEVATION : 6.00

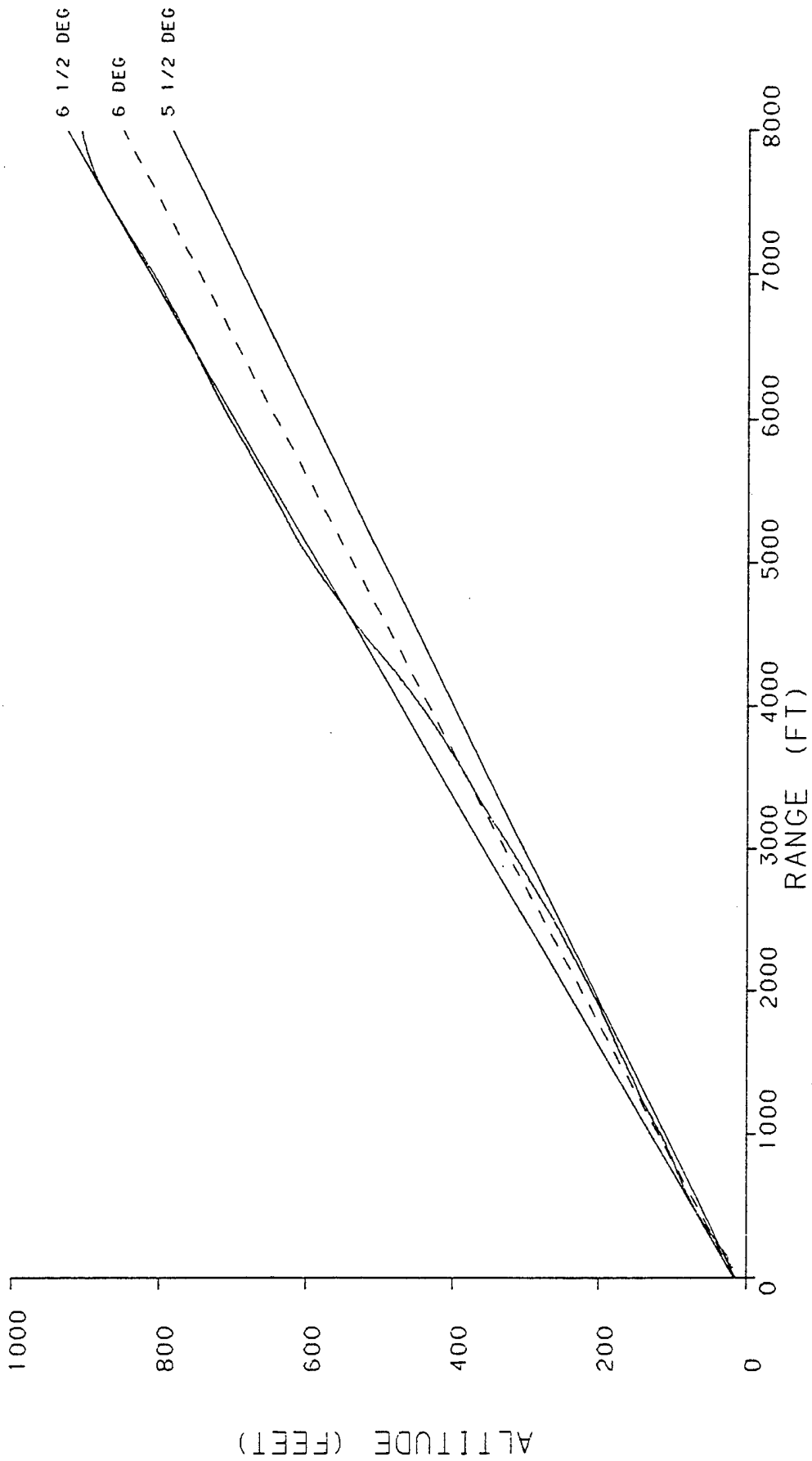
TRACKER DATA

DATA PROCESSED BY THE FAA TECHNICAL CENTER  
ATLANTIC CITY AIRPORT, N J 08405  
19-SEP-1994 13113



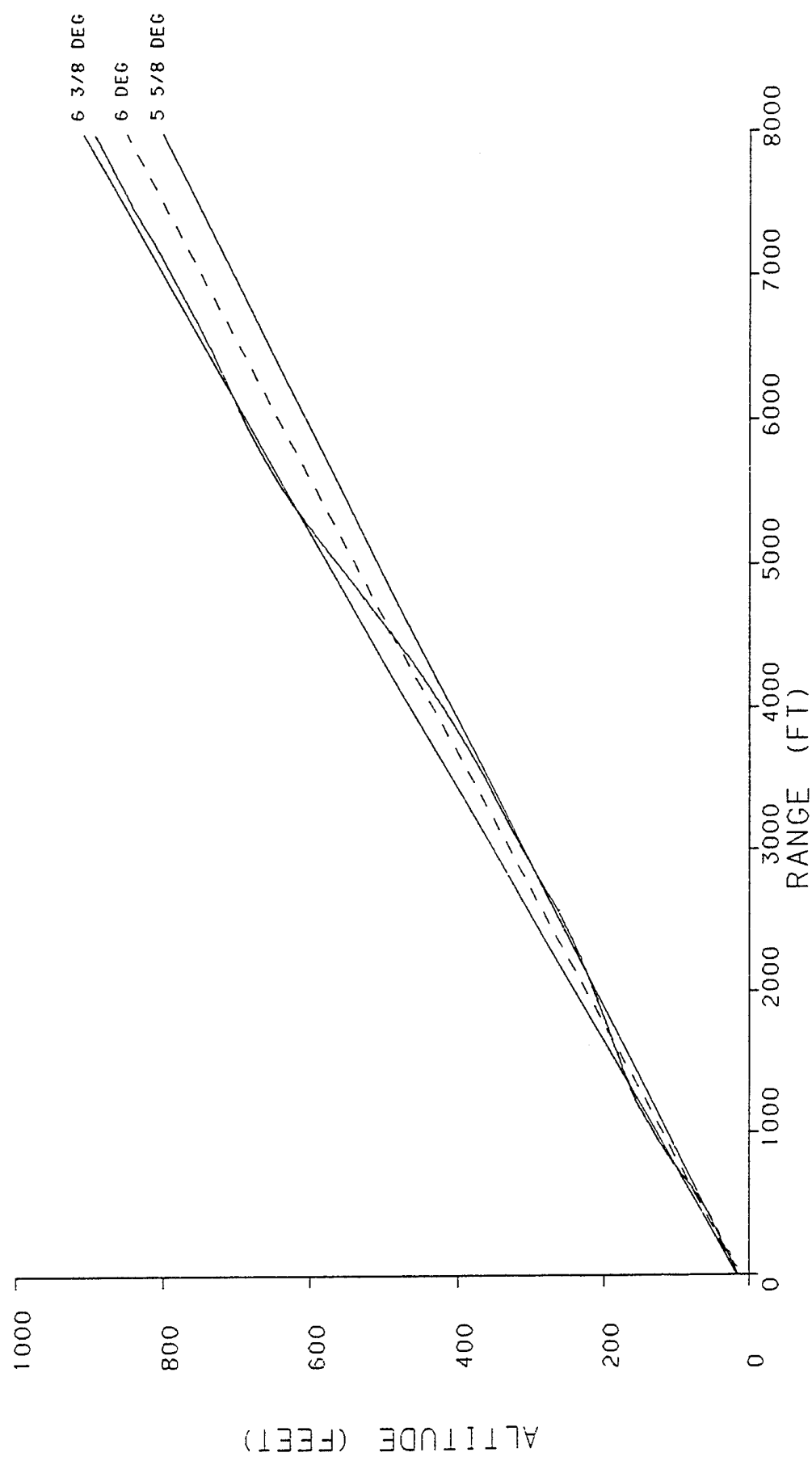
DATA PROCESSED BY THE FAA TECHNICAL CENTER  
ATLANTIC CITY AIRPORT, N J 08405  
19-SEP-1994 13:13

RUN #8  
6/16/93 PAPI 6.0 DEG CENTERLINE APPROACH  
AZIMUTH : 0.00 ELEVATION : 6.00  
TRACKER DATA



DATA PROCESSED BY THE FAA TECHNICAL CENTER  
ATLANTIC CITY AIRPORT, N J 08405  
19-SEP-1994 13:15

RUN #9  
6/16/93 HAP1 6.0 DEG CENTERLINE APPROACH  
AZIMUTH : 0.00 ELEVATION : 6.00  
TRACKER DATA



RUN #11 AND #12 PLOTS UNAVAILABLE

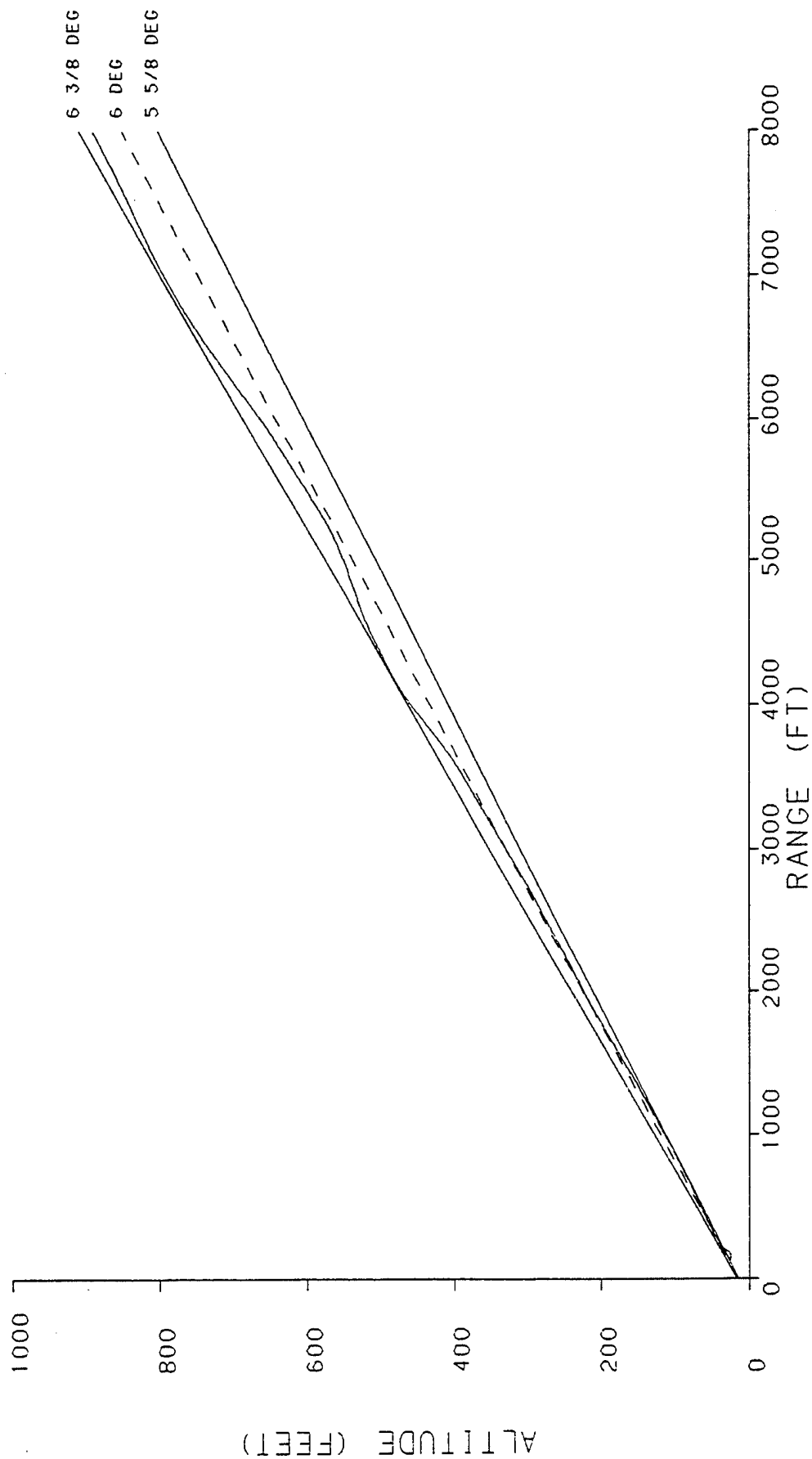
RUN #10

6/16/93 HAPI 6.0 DEG CENTERLINE APPROACH

AZIMUTH : 0.00 ELEVATION : 6.00

TRACKER DATA

DATA PROCESSED BY THE FAA TECHNICAL CENTER  
ATLANTIC CITY AIRPORT, N J 08405  
19-SEP-1994 13:16



C-159/C-160

APPENDIX D—PHOTOMETRIC DATA/PLOTS OF TESTS CONDUCTED AT  
THE NAVAL AIR WARFARE CENTER AIRCRAFT DIVISION, LAKEHURST, NJ

NAWC A/D LAKEHURST  
PHOTOMETRICS LABORATORY

TEST DATA SHEET

DATE: NOVEMBER 1992

TEST CONDUCTED FOR: FAA

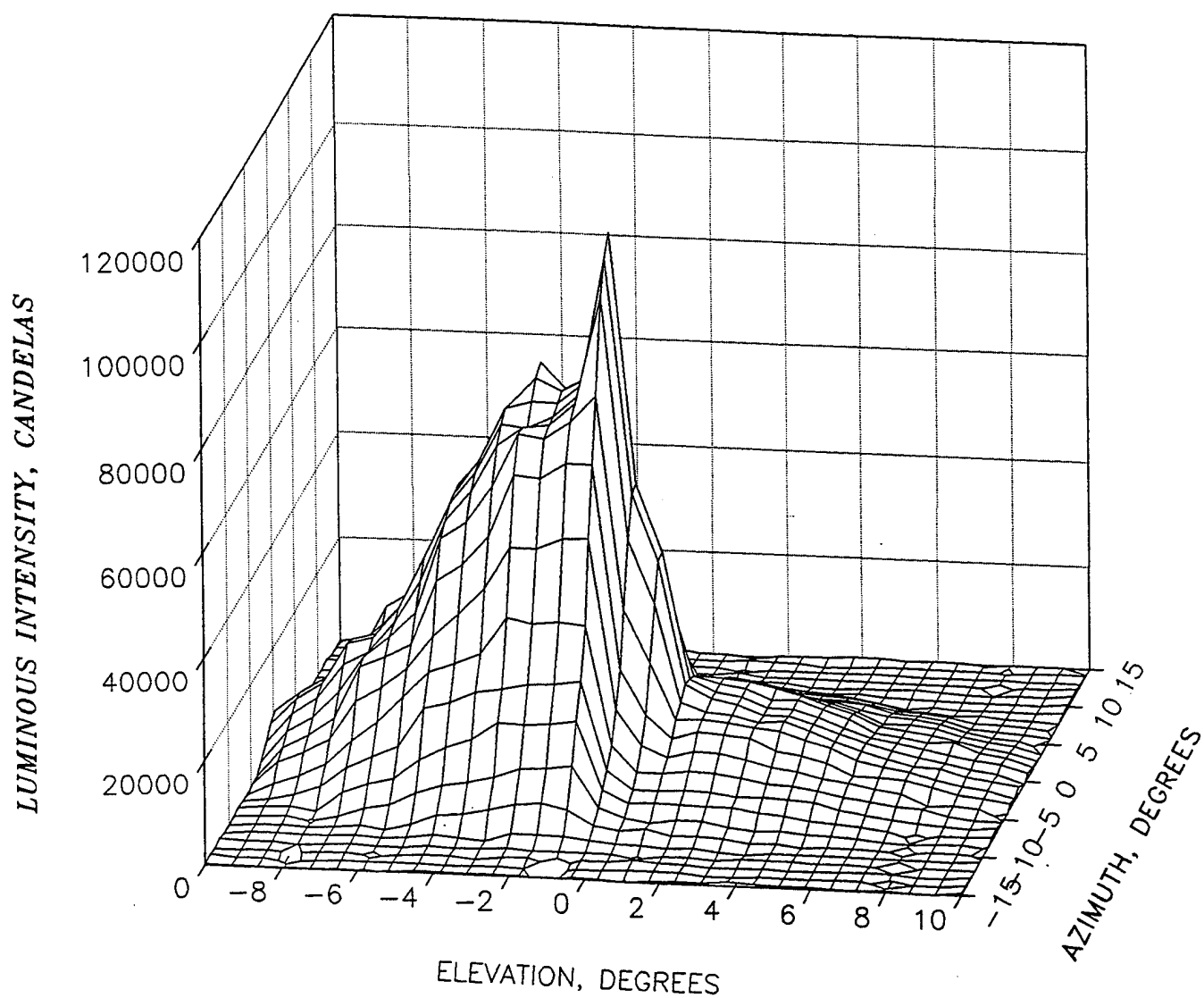
|                            |                                                                                   |
|----------------------------|-----------------------------------------------------------------------------------|
| TEST ENGINEER:             | S. BORDEN                                                                         |
| SECTION:                   | PD-31                                                                             |
| SYSTEM:                    | PAPI                                                                              |
| SERIAL NUMBER:             | 5902                                                                              |
| LAMP P/N:                  | 15P                                                                               |
| RATED VOLTS:               |                                                                                   |
| TEST VOLTAGE               | 34.35                                                                             |
| RATED AMPS:                | 6.6                                                                               |
| LAMP<br>MANUFACTURER:      | SYLVANIA                                                                          |
| DISTANCE TO<br>PHOTOMETER: | 100 FEET                                                                          |
| MULTIPLER:                 | 2                                                                                 |
| UNIT OF<br>MEASUREMENT:    | LUMINOUS INTENSITY                                                                |
| RANGE SETTING:             | A                                                                                 |
| ND SETTING                 | ND-4                                                                              |
| ADAPTERS                   | IB-80                                                                             |
| FILE NAME:                 | PAP                                                                               |
| COMMENTS:                  | ND-1 FILTER USED. MUST<br>MULTIPLY ALL INTENSITY<br>READINGS BY A FACTOR<br>OF 10 |

TEST EQUIPMENT

PRITCHARD PHOTOMETER W/IB-80 BAFFLE  
COMPUTER CONTROLLED GONIOMETER  
AMP METER  
VOLT METER  
EG&G SPECTRORADIOMETER

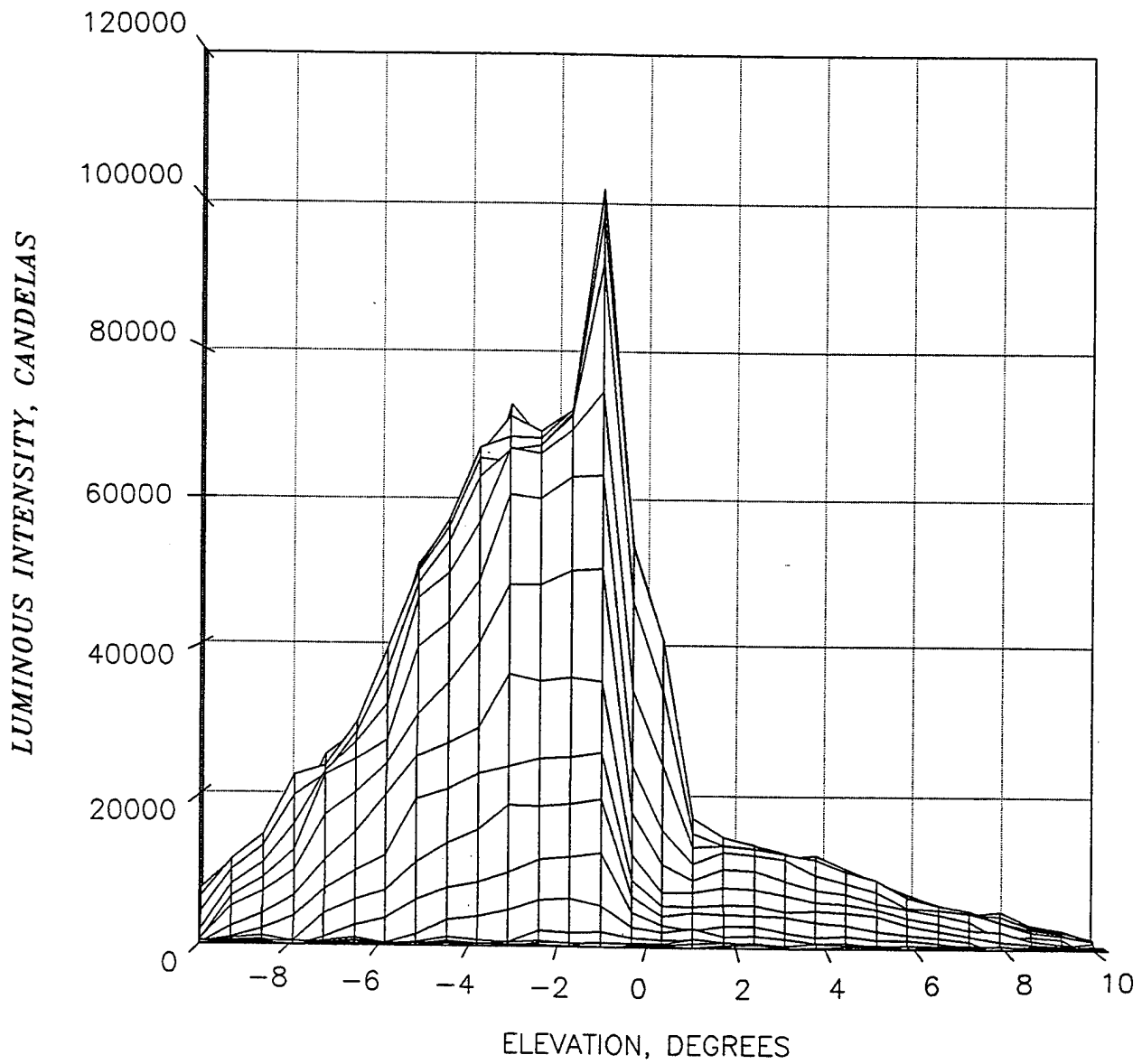
FAA  
PAPI SYSTEM

NAWC A/D LAKEHURST  
PHOTOMETRICS LABORATORY



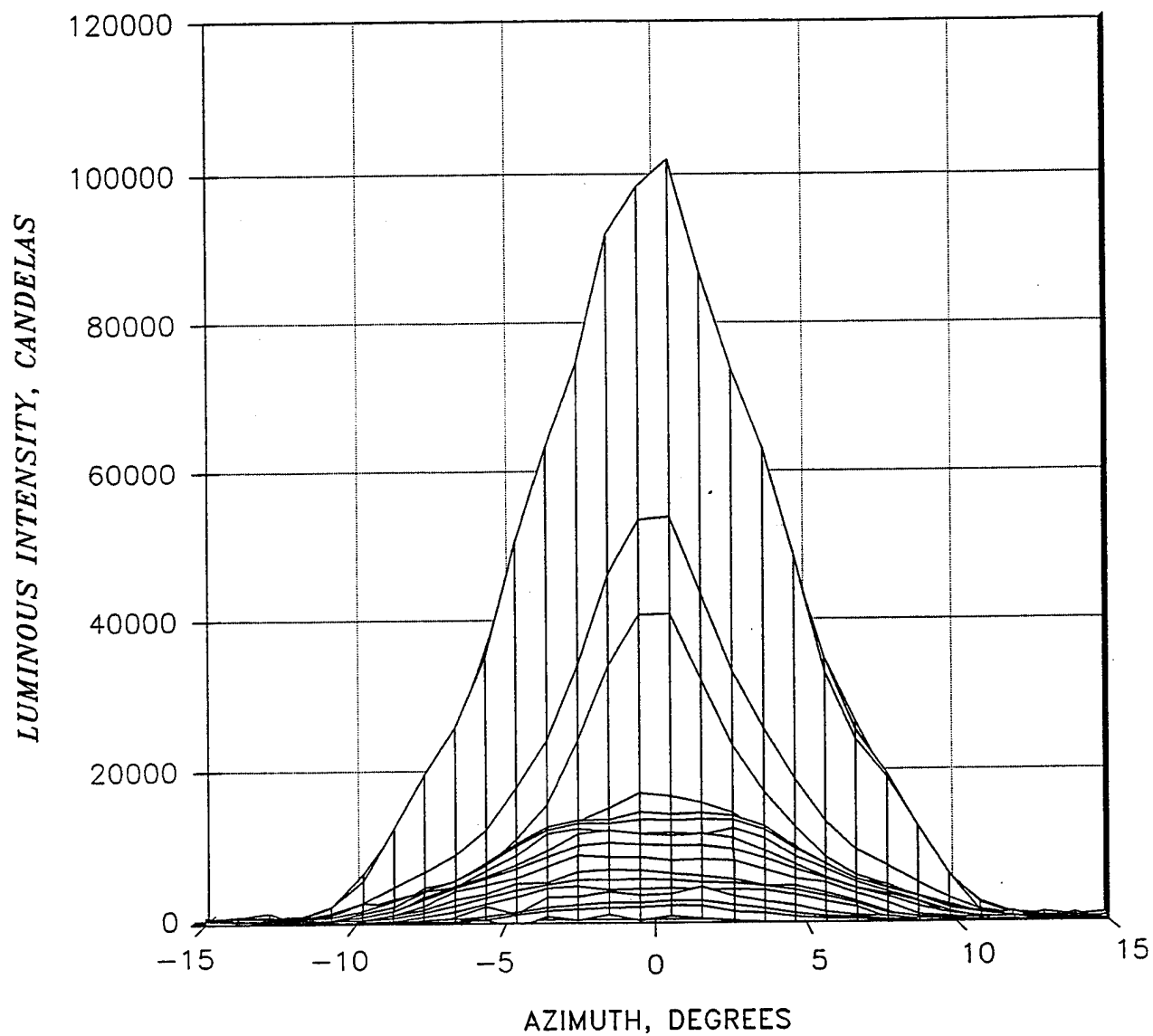
FAA  
PAPI SYSTEM

NAWC A/D LAKEHURST  
PHOTOMETRICS LABORATORY



FAA  
PAPI SYSTEM

NAWC A/D LAKEHURST  
PHOTOMETRICS LABORATORY

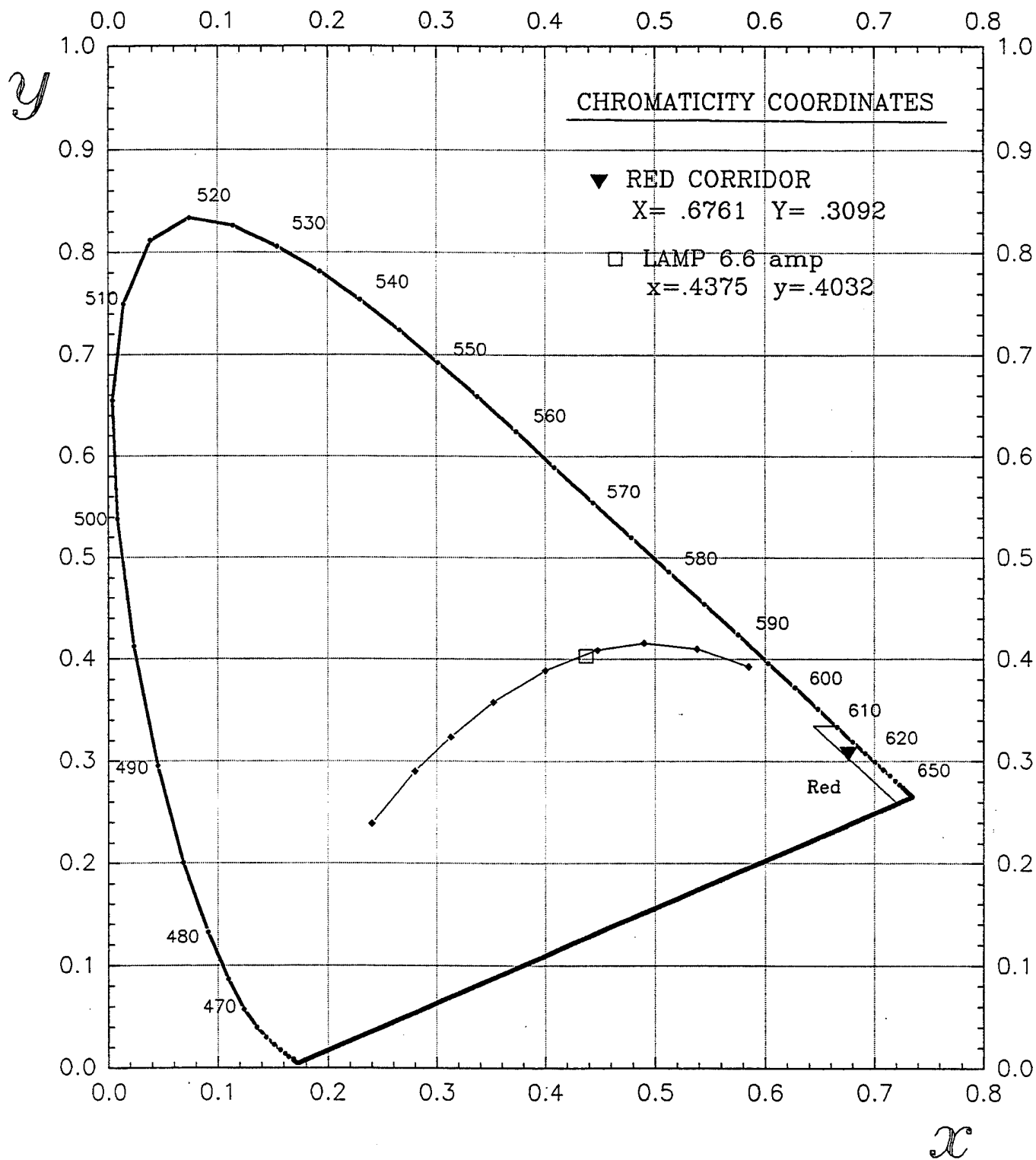


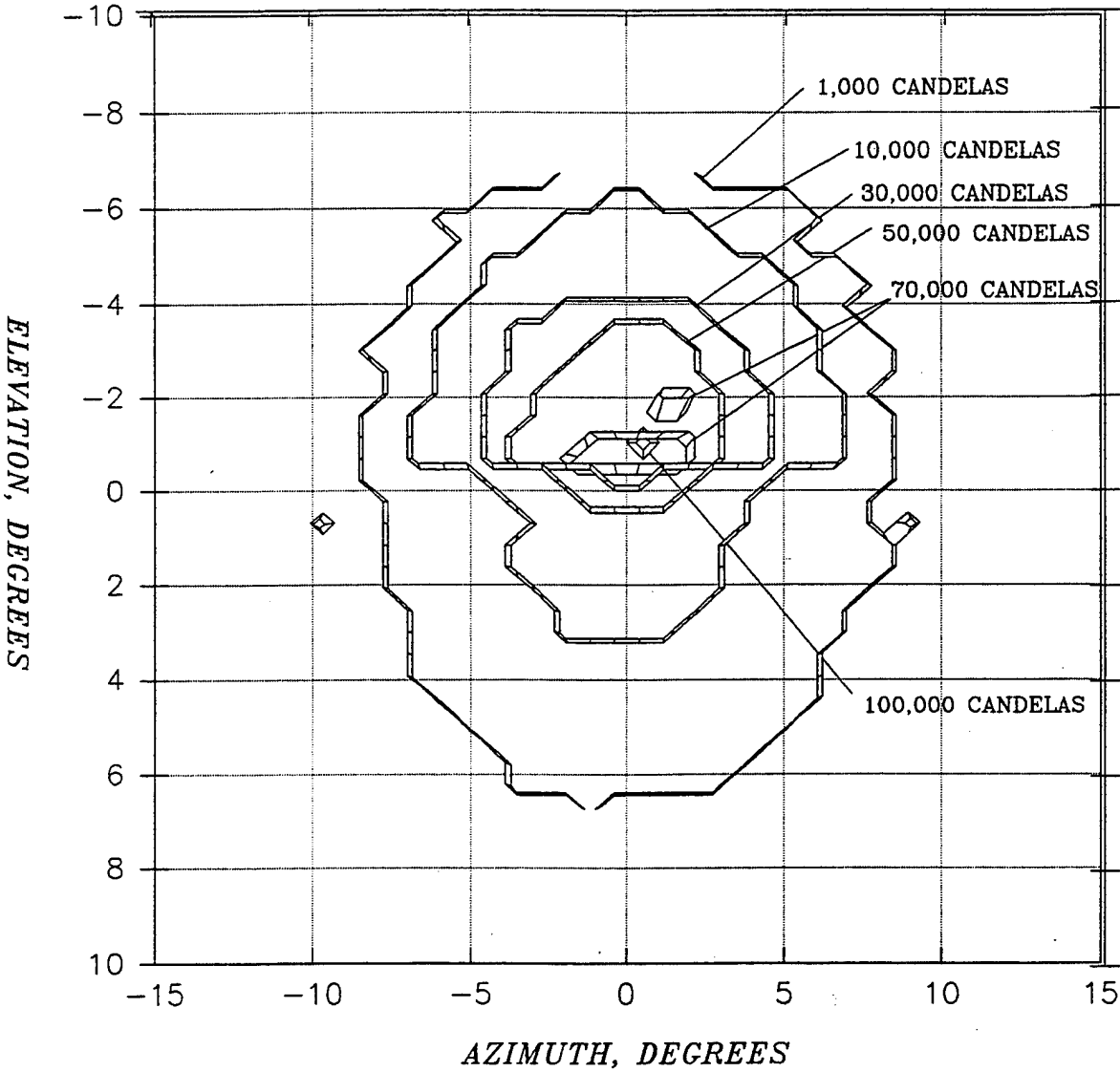
FAA  
PAPI SYSTEM

C.I.E. CHROMATICITY DIAGRAM

2° Observer (CIE 1931)

NAWC A/D LAKEHURST





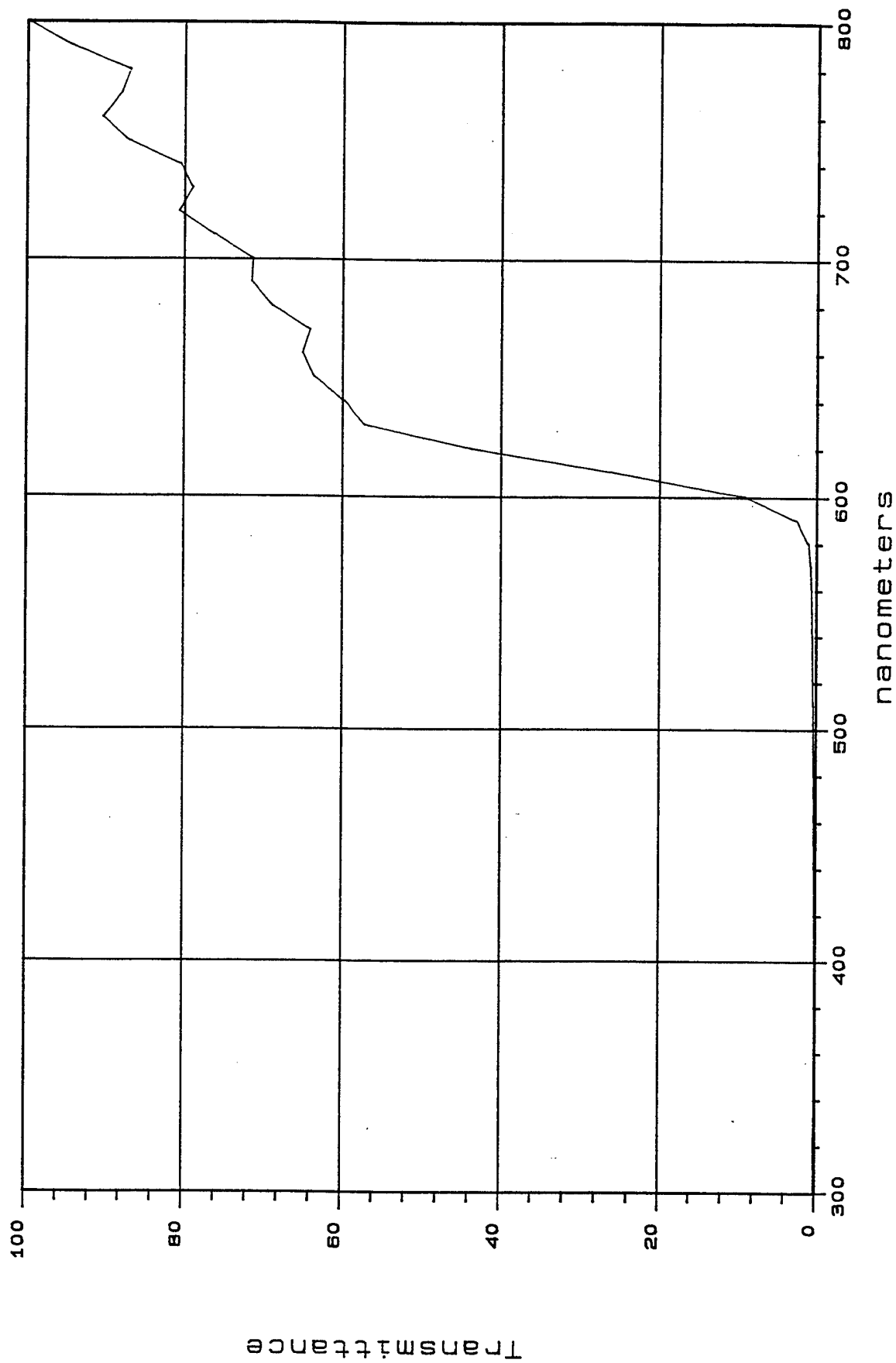
TITLE: PAPI RED CORRIDOR FILTER

DEVICE: Rapapired2\$

DATE: 11-04-1992

MAX: 6.8662

MIN: 8.7505E-03



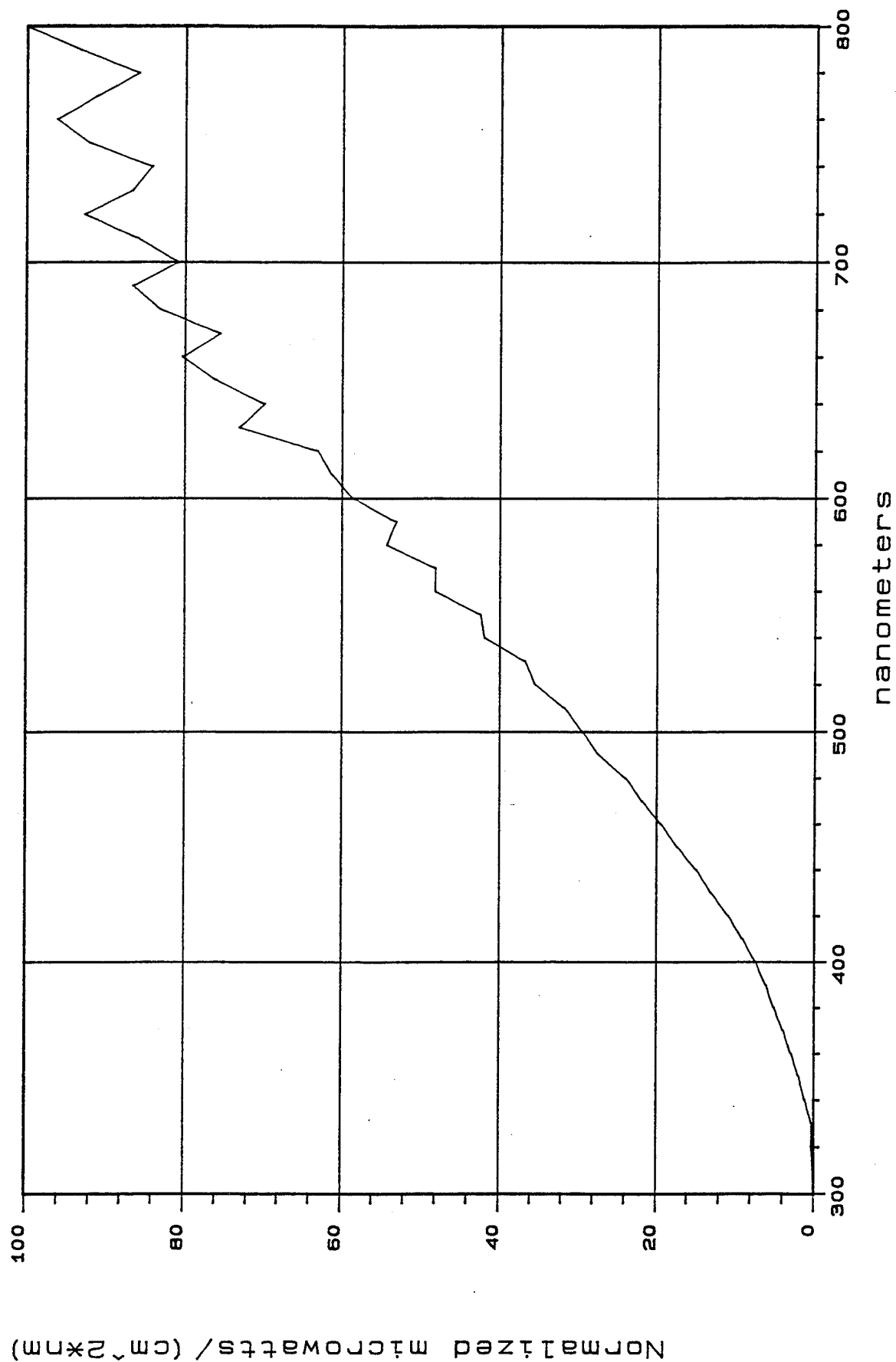
TITLE: PAPI LAMP @ 6.6 AMPS (WHITE)

DEVICE: RAPI LAMP6\_6\$

DATE: 11-04-1992

MAX: 2999

MIN: 6.9616



**NAWC A/D LAKEHURST  
PHOTOMETRICS LABORATORY**

**TEST DATA SHEET**

**DATE:** NOVEMBER 1992

**TEST CONDUCTED FOR:** FAA

|                            |                                                                                   |
|----------------------------|-----------------------------------------------------------------------------------|
| TEST ENGINEER:             | S. BORDEN                                                                         |
| SECTION:                   | PD-31                                                                             |
| SYSTEM:                    | CHAPI                                                                             |
| SERIAL NUMBER:             | 8812b-2-10-11                                                                     |
| LAMP P/N:                  | c-h 20531                                                                         |
| RATED VOLTS:               |                                                                                   |
| TEST VOLTAGE               | 68.6                                                                              |
| RATED AMPS:                | 6.6                                                                               |
| LAMP<br>MANUFACTURER:      |                                                                                   |
| DISTANCE TO<br>PHOTOMETER: | 100 FEET                                                                          |
| MULTIPLIER:                | 2                                                                                 |
| UNIT OF<br>MEASUREMENT:    | LUMINOUS INTENSITY                                                                |
| RANGE SETTING:             | A                                                                                 |
| ND SETTING                 | ND-4                                                                              |
| ADAPTERS                   | IB-80                                                                             |
| FILE NAME:                 | CHP                                                                               |
| COMMENTS:                  | ND-1 FILTER USED. MUST<br>MULTIPLY ALL INTENSITY<br>READINGS BY A FACTOR<br>OF 10 |

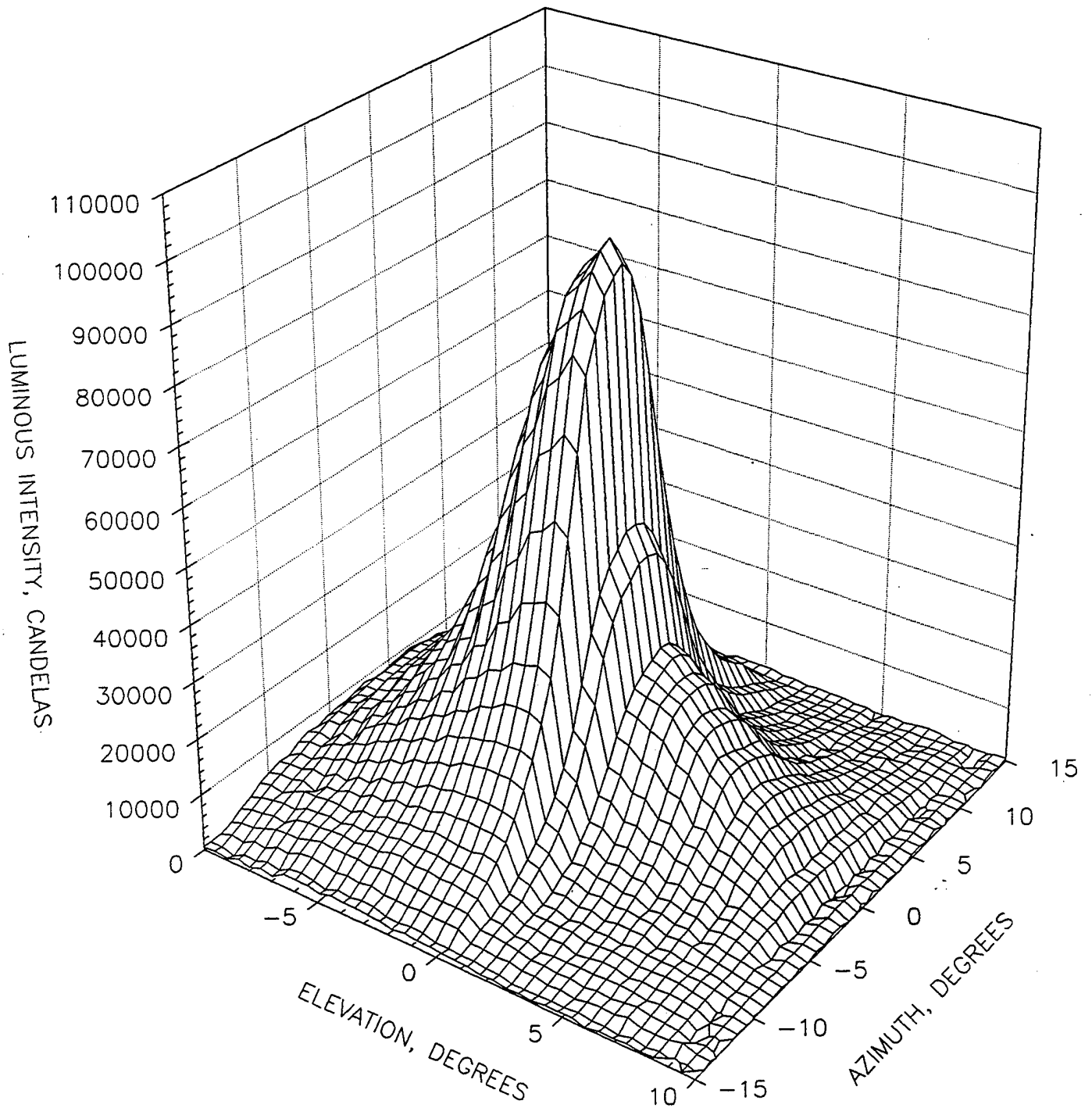
**TEST EQUIPMENT**

PRITCHARD PHOTOMETER W/IB-80 BAFFLE  
COMPUTER CONTROLLED GONIOMETER  
AMP METER  
VOLT METER  
EG&G SPECTRORADIOMETER

FAA

CHAPI SYSTEM

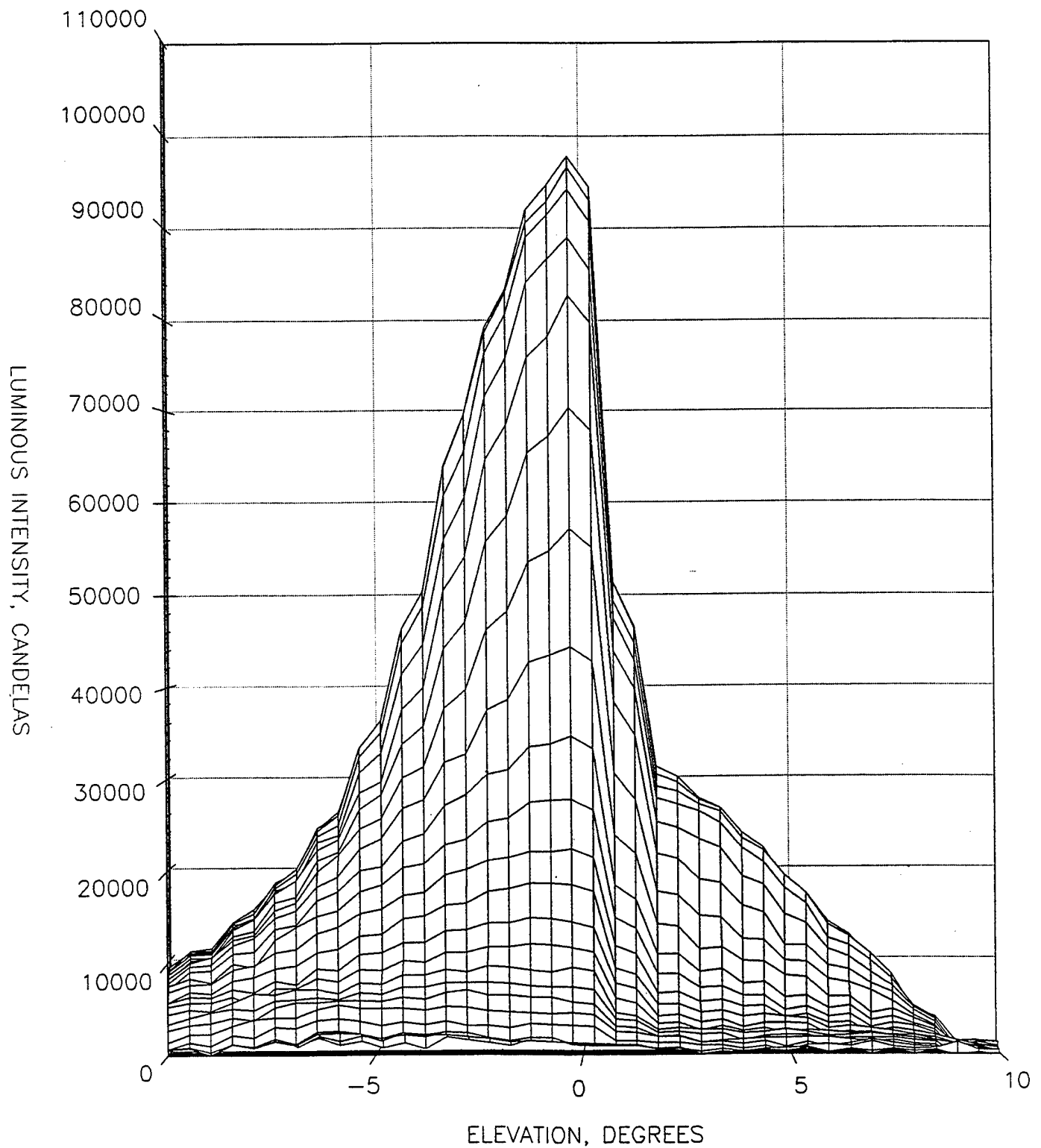
NAWC A/D LAKEHURST  
PHOTOMETRICS LABORATORY



FAA

CHAPI SYSTEM

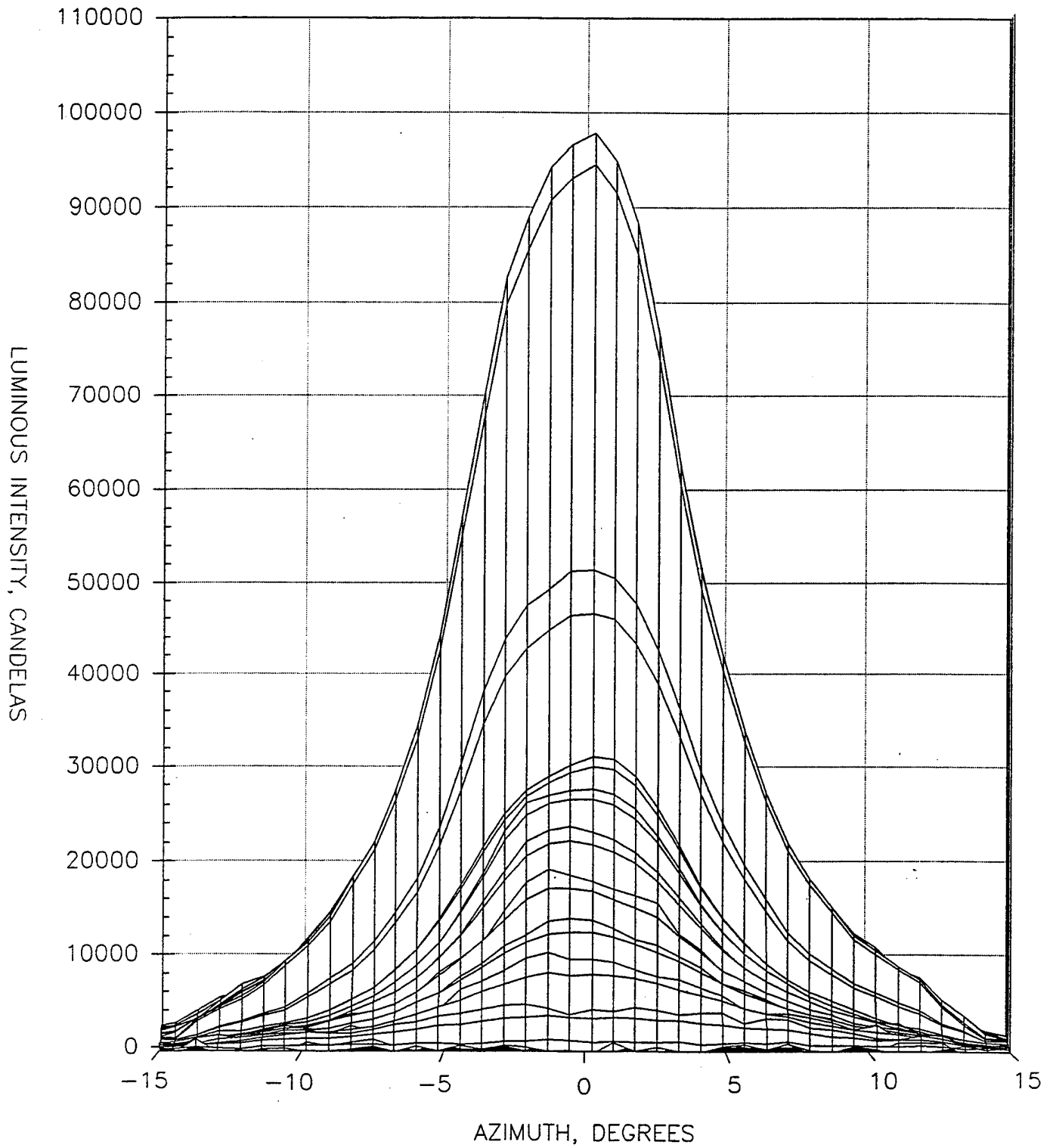
NAWC A/D LAKEHURST  
PHOTOMETRICS LABORATORY



FAA

CHAPI SYSTEM

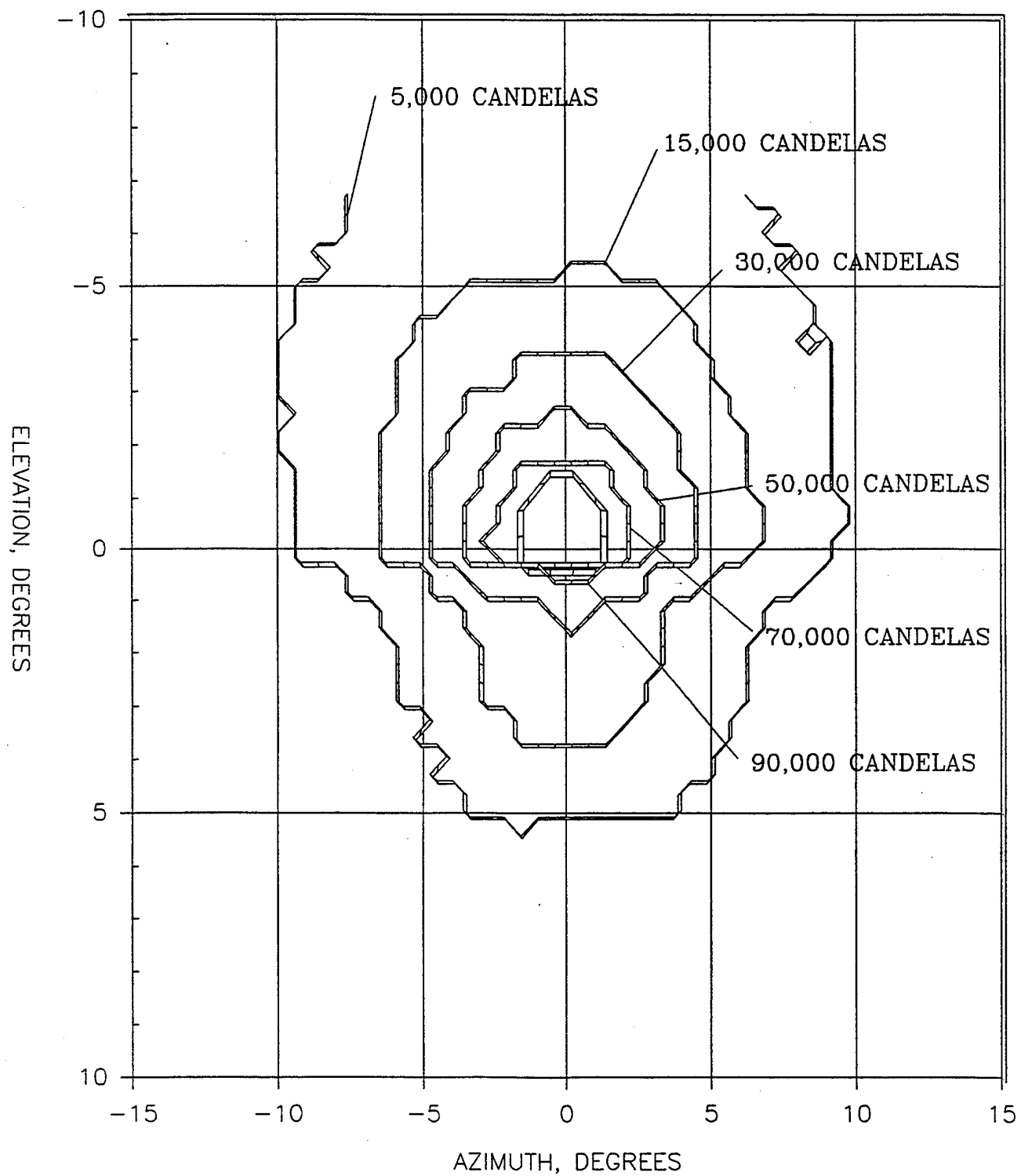
NAWC A/D LAKEHURST  
PHOTOMETRICS LABORATORY



FAA

CHAPI SYSTEM

NAWC A/D LAKEHURST  
PHOTOMETRICS LABORATORY

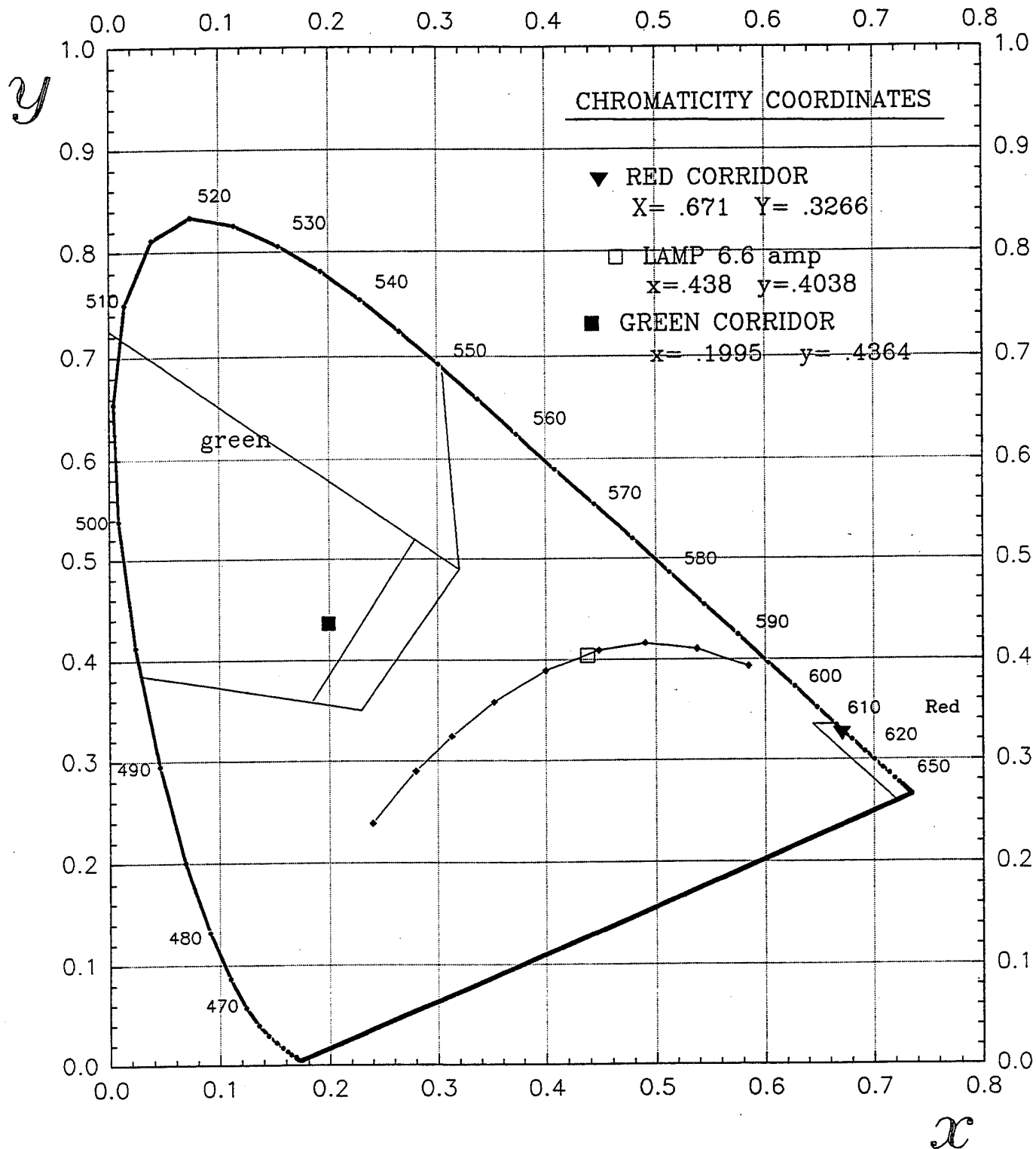


FAA  
CHAPI SYSTEM

C.I.E. CHROMATICITY DIAGRAM

2° Observer (CIE 1931)

NAWC A/D LAKEHURST



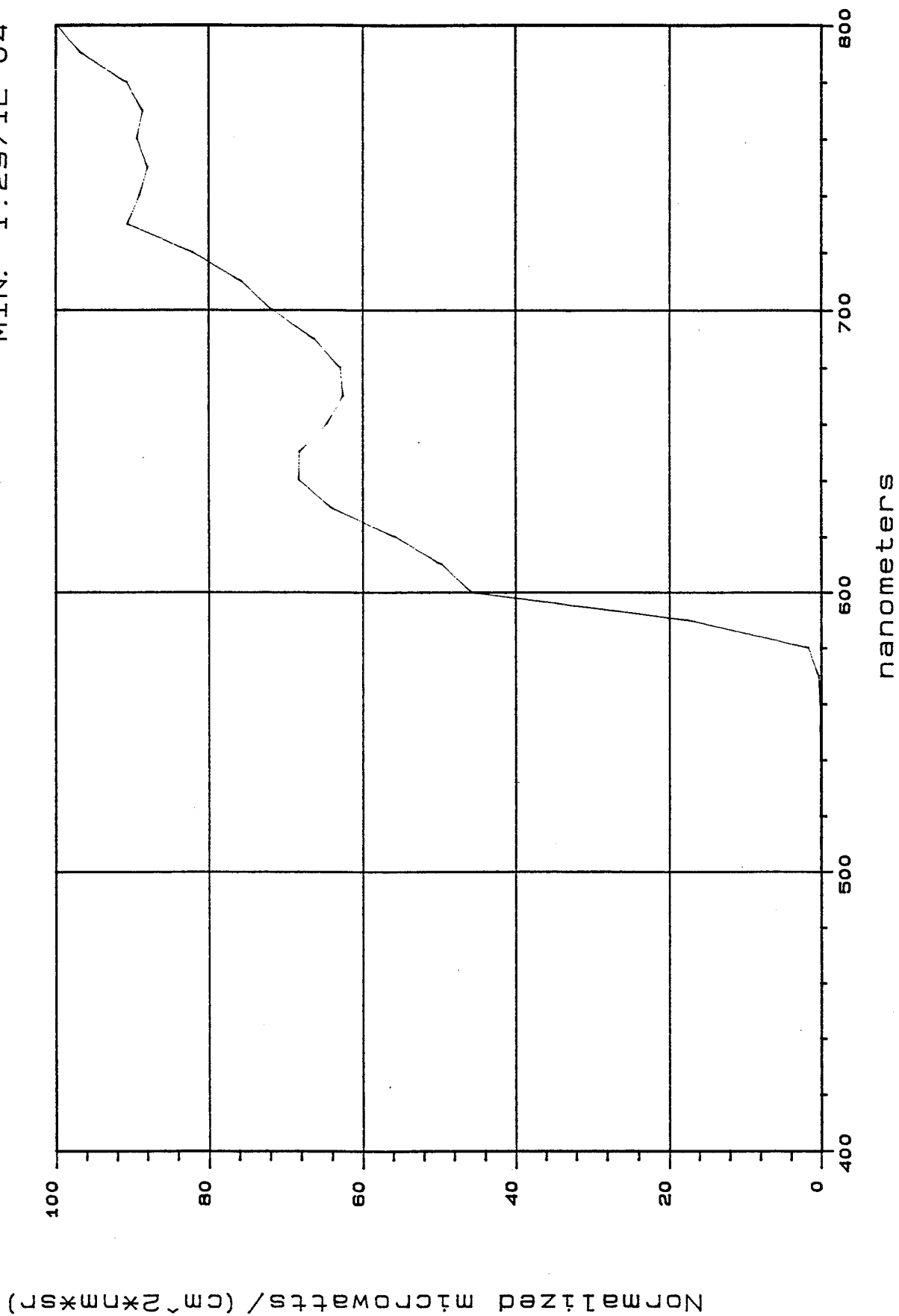
TITLE: CHAPI--RED SEGMENT

DEVICE: Rachapiredt2\$

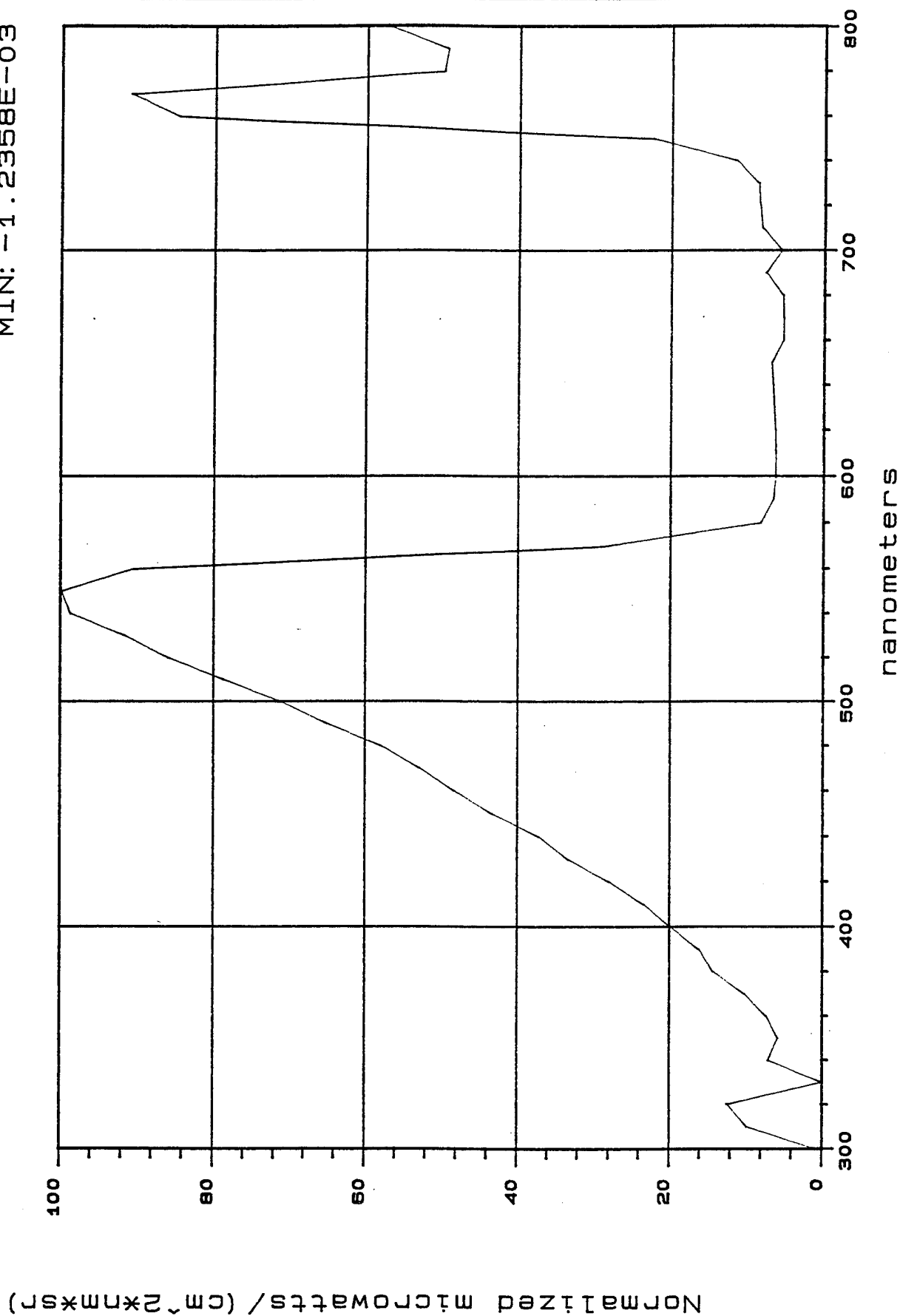
DATE: 12-14-1992

MAX: .26018

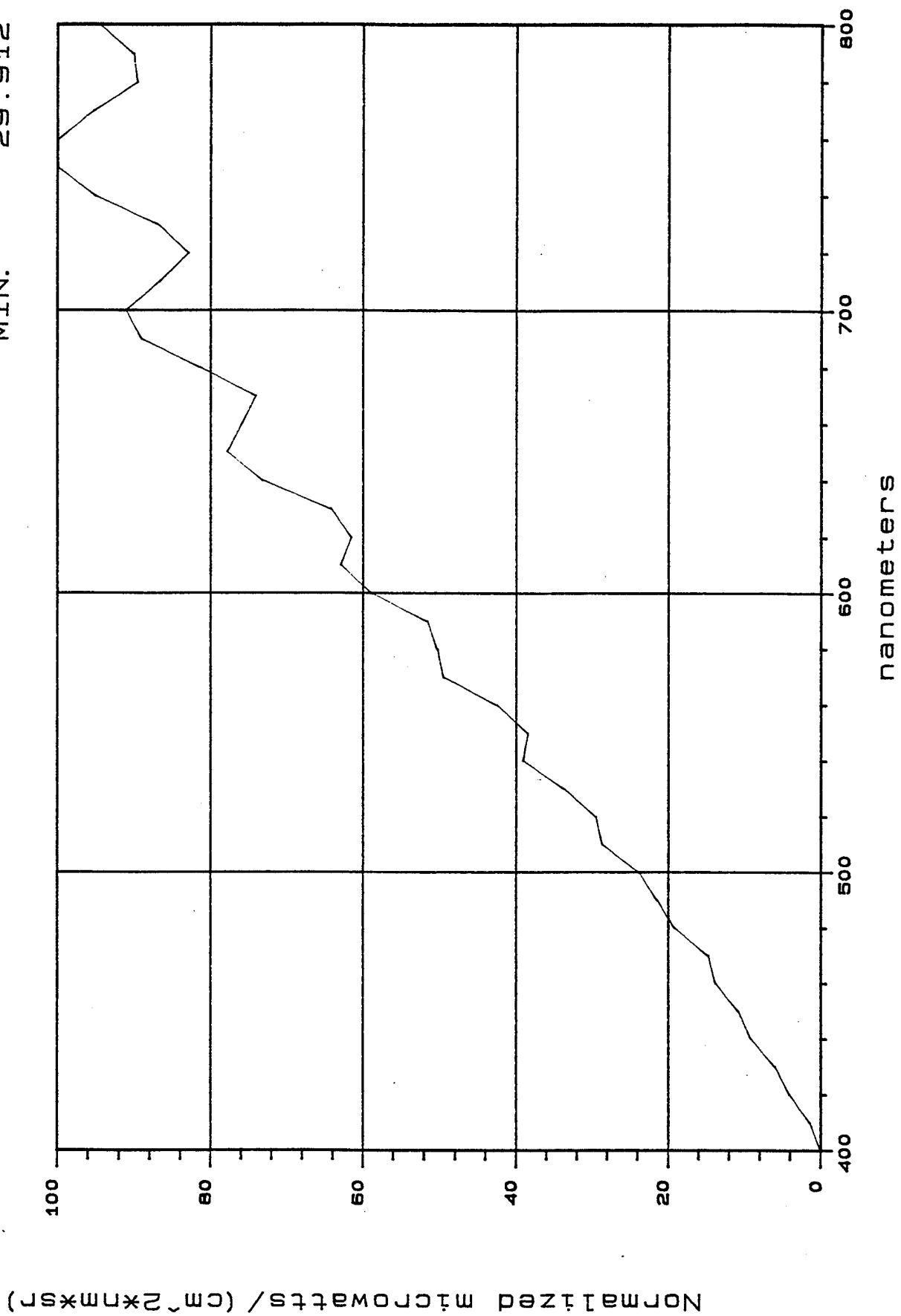
MIN: 1.2971E-04



TITLE: FAA--CHAPI GREEN CORRIDOR-x=.1995    y=.4364    DATE: 12-14-1992  
 DEVICE: Raapignt2\$    MAX: .026816  
 MIN: -1.2358E-03



TITLE: FAA--CHAPI LAMP 6.6 AMP    x=.438    y=.4038    DATE: 11-06-1992  
DEVICE: RaAPI/WHITE\$    MAX: 393.06  
MIN: 29.912



**NAWC A/D LAKEHURST**  
**PHOTOMETRICS LABORATORY**

**TEST DATA SHEET**

**DATE:** NOVEMBER 1992

**TEST CONDUCTED FOR:** FAA

|                            |                    |
|----------------------------|--------------------|
| TEST ENGINEER:             | S. BORDEN          |
| SECTION:                   | PD-31              |
| SYSTEM:                    | HAPI               |
| SERIAL NUMBER:             | da2501-1           |
| LAMP P/N:                  | BVA-08p            |
| RATED VOLTS:               | 120                |
| TEST VOLTAGE               | 109.15             |
| RATED AMPS:                |                    |
| LAMP<br>MANUFACTURER:      |                    |
| DISTANCE TO<br>PHOTOMETER: | 100 FEET           |
| MULTIPLIER:                | 2                  |
| UNIT OF<br>MEASUREMENT:    | LUMINOUS INTENSITY |
| RANGE SETTING:             | A                  |
| ND SETTING                 | ND-4               |
| ADAPTERS                   | IB-80              |
| FILE NAME:                 | dpl                |
| COMMENTS:                  |                    |

**TEST EQUIPMENT**

PRITCHARD PHOTOMETER W/IB-80 BAFFLE  
COMPUTER CONTROLLED GONIOMETER  
AMP METER  
VOLT METER  
EG&G SPECTRORADIOMETER

## THE SIGNAL REPETITION RATE OF THE FLASHING SECTOR OF THE HAPI SYSTEM

### 1. THE RED FLASHING SECTOR

SEE ATTACHED STRIP CHART RECORDING

ON-TO-OFF RATIO IS 1 TO 1

MODULATION DEPTH IS 100 PERCENT

RECORDED CYCLE =

$$F := 21 \frac{\text{mm}}{\text{cycle}}$$

$$s := 50 \frac{\text{mm}}{\text{sec}} \quad ; s \text{ is the chart speed in mm/sec}$$

$$d := \frac{s}{F} \quad ; d \text{ is the frequency of the flash cycle in Hz}$$

$$d = 2.381 \frac{\text{cycle}}{\text{sec}} \quad \text{or} \quad 2.381 \text{ Hz}$$

### 2. THE GREEN FLASHING SECTOR

SEE ATTACHED STRIP CHART RECORDING

ON-TO-OFF RATIO IS 1 TO 1

MODULATION DEPTH IS 100 PERCENT

RECORDED CYCLE =

$$T := 21.5 \frac{\text{mm}}{\text{cycle}}$$

$$s = 50 \frac{\text{mm}}{\text{sec}} \quad ; s \text{ is the chart speed in mm/sec}$$

$$d2 := \frac{s}{T} \quad ; d2 \text{ is the frequency of the flash cycle in Hz}$$

$$d2 = 2.326 \frac{\text{cycle}}{\text{sec}} \quad \text{or} \quad 2.326 \text{ Hz}$$

SYSTEM COMPLIANCE WITH ICAO STANDARDS UNDER ANNEX 14, VOLUME II, SECTIONS 5.3.4.8 AND 5.3.4.9 WHERE THE SIGNAL REPETITION RATE SHALL BE AT LEAST 2 Hz AND THE ON-TO-OFF RATIO SHALL BE 1 TO 1 AND THE MODULATION DEPTH SHOULD BE AT LEAST 80 PERCENT ARE FULLY MET.

## CALCULATION OF EFFECTIVE INTENSITY

(SEE ATTACHED STRIP CHART RECORDING)

### A. HAPI SYSTEM RED FLASHING SECTOR

$E := 54$  ; instantaneous footcandles

$d := 15$  ; distance in feet

$I := E \cdot d^2$  ; calculate the instantaneous intensity

$t1 := .04$  ; first time limit of integration

$t2 := .24$  ; second time limit of integration

$$b := \frac{\int_{t1}^{t2} I dt}{.2 + (t2 - t1)} \quad ; b \text{ is the effective intensity}$$

$b = 6.075 \cdot 10^3$  candelas

## B. HAPI SYSTEM GREEN FLASHING SECTOR

**E** := 50 ; instantaneous footcandles

**d** := 15 ; distance in feet

**I** :=  $E \cdot d^2$  ; calculate the instantaneous intensity

**t1** := .04 ; first time limit of integration

**t2** := .24 ; second time limit of integration

**b** :=  $\frac{\int_{t1}^{t2} I \, dt}{.2 + (t2 - t1)}$  ; b is the effective intensity

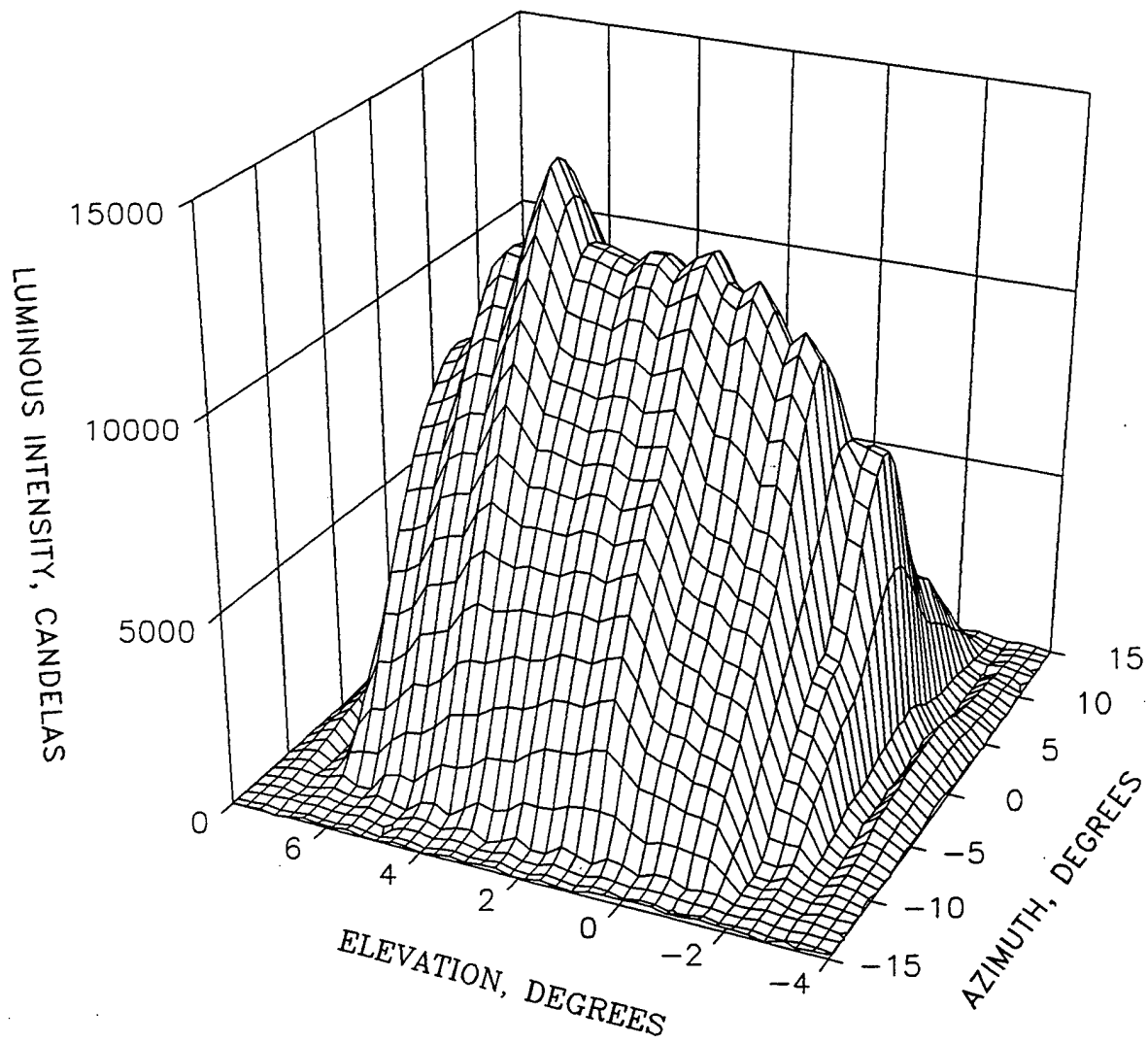
**b** =  $5.625 \cdot 10^3$  candelas

FAA

NAWC LAKEHURST  
PHOTOMETRIC LABORATORY

HAPI SYSTEM

114 VOLT SETTING

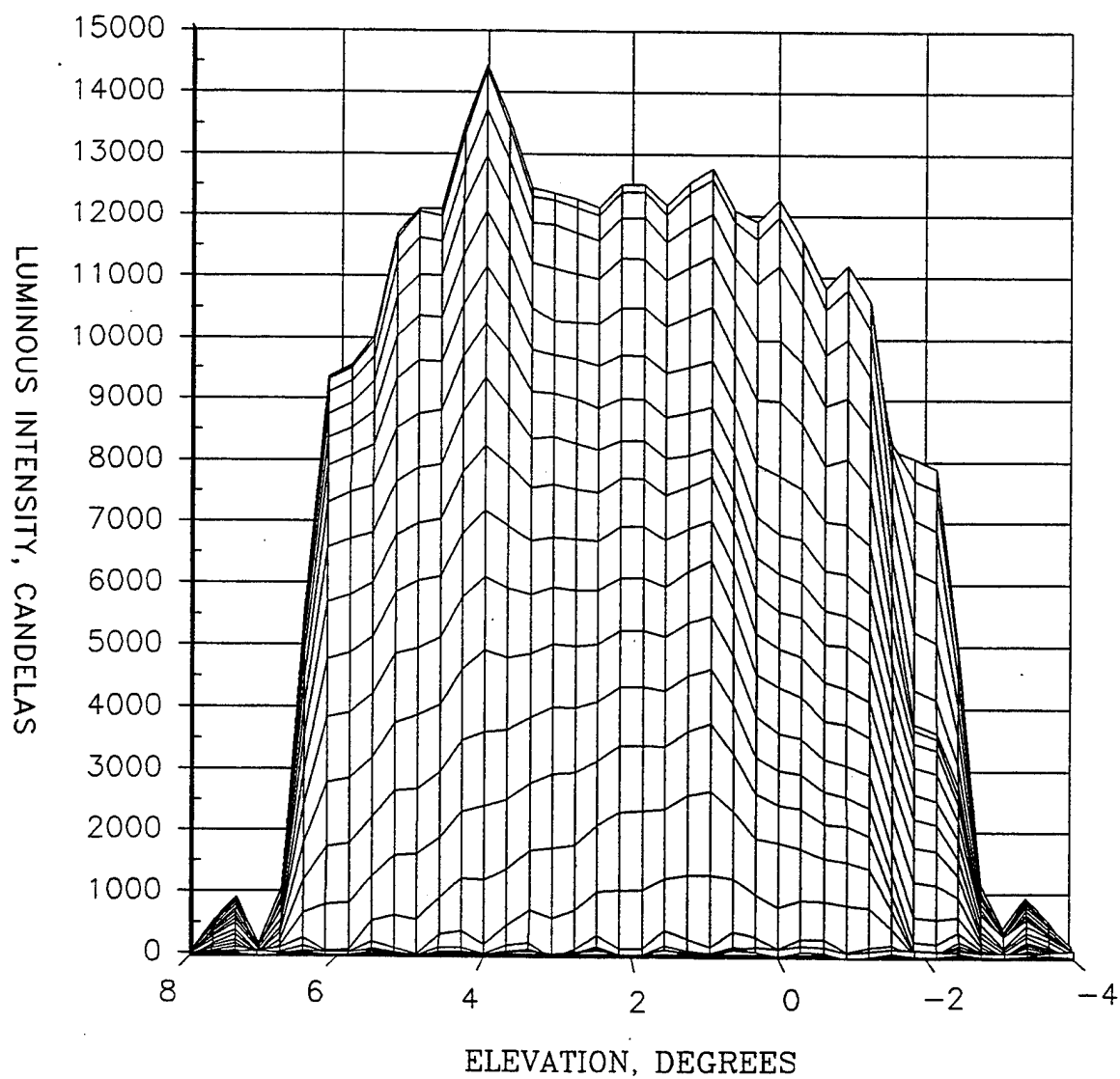


FAA

NAWC LAKEHURST  
PHOTOMETRIC LABORATORY

HAPI SYSTEM

114 VOLT SETTING

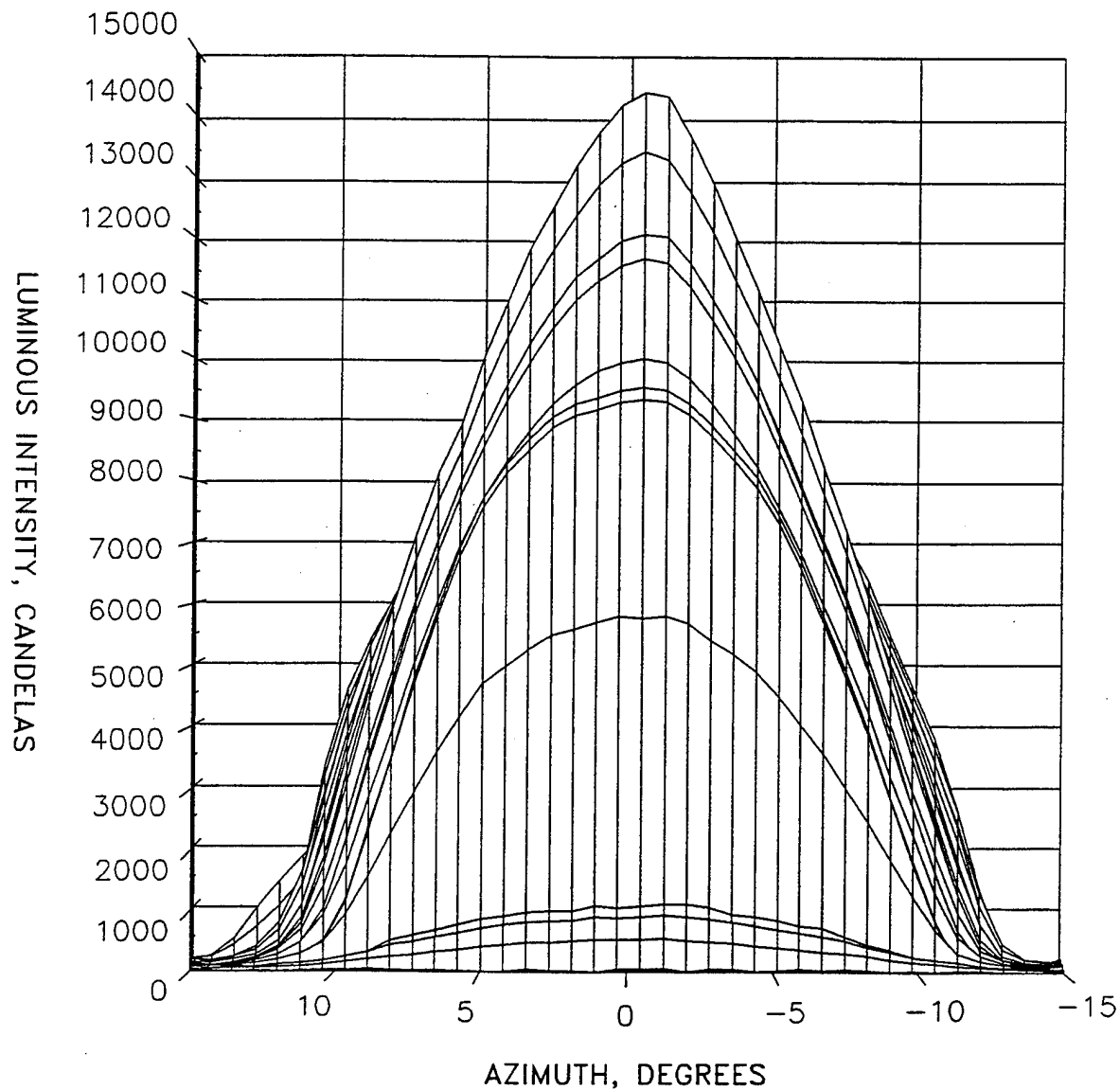


FAA

NAWC LAKEHURST  
PHOTOMETRIC LABORATORY

HAPI SYSTEM

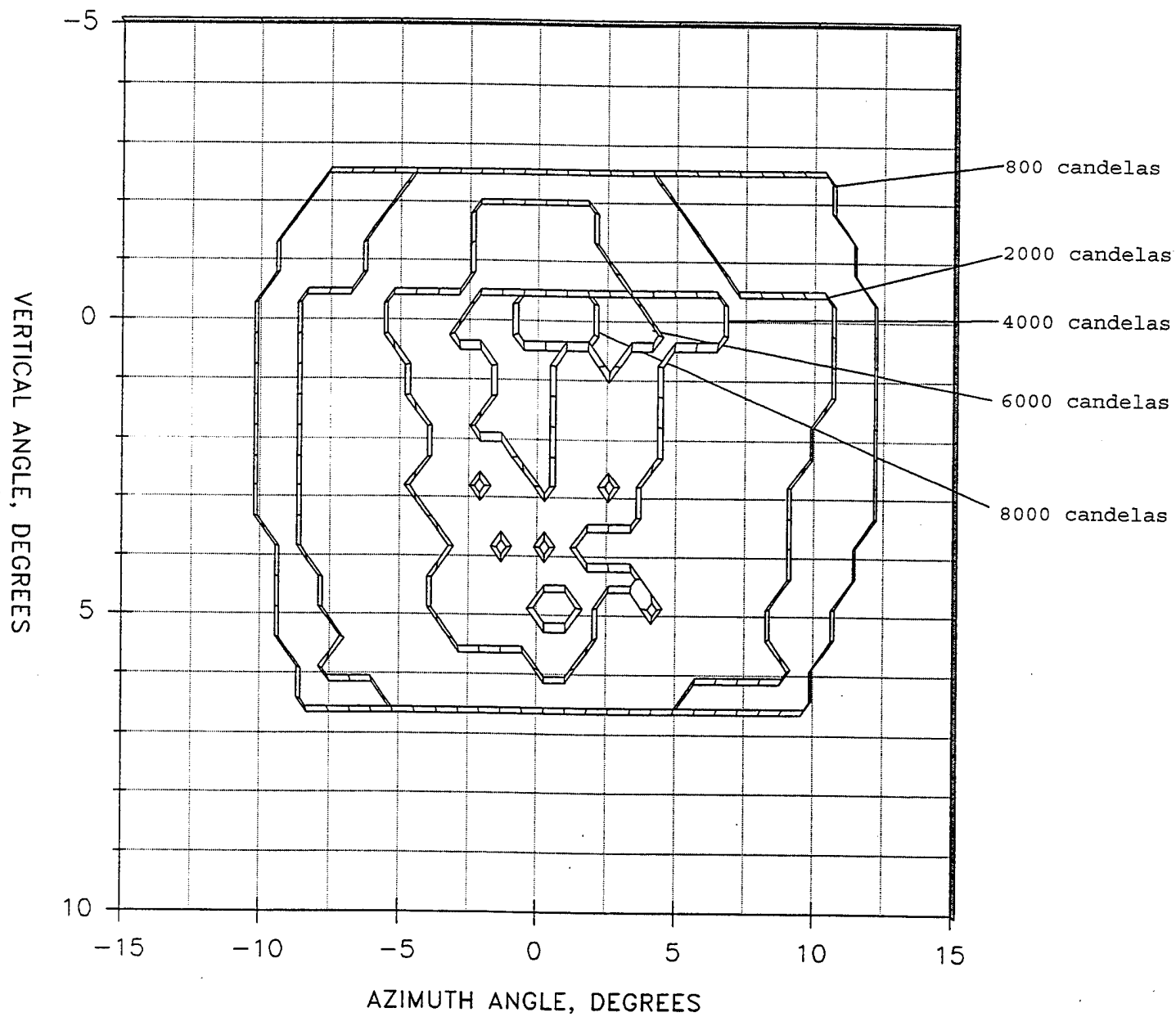
114 VOLT SETTING



FAA

HAPI SYSTEM

NAWC A/D LAKEHURST  
PHOTOMETRICS LABORATORY

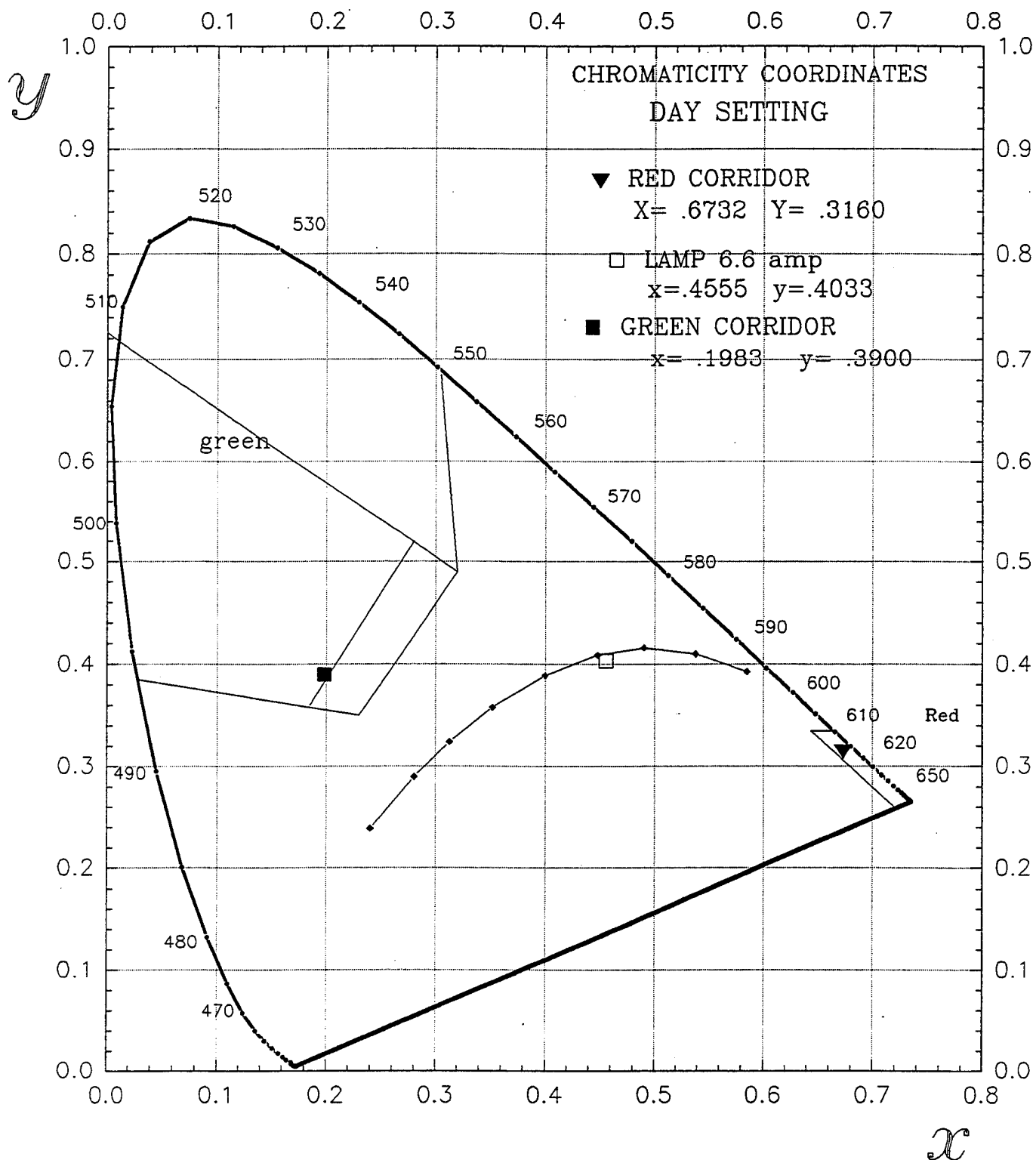


FAA  
HAPI SYSTEM

# C.I.E. CHROMATICITY DIAGRAM

2° Observer (CIE 1931)

NAWC A/D LAKEHURST

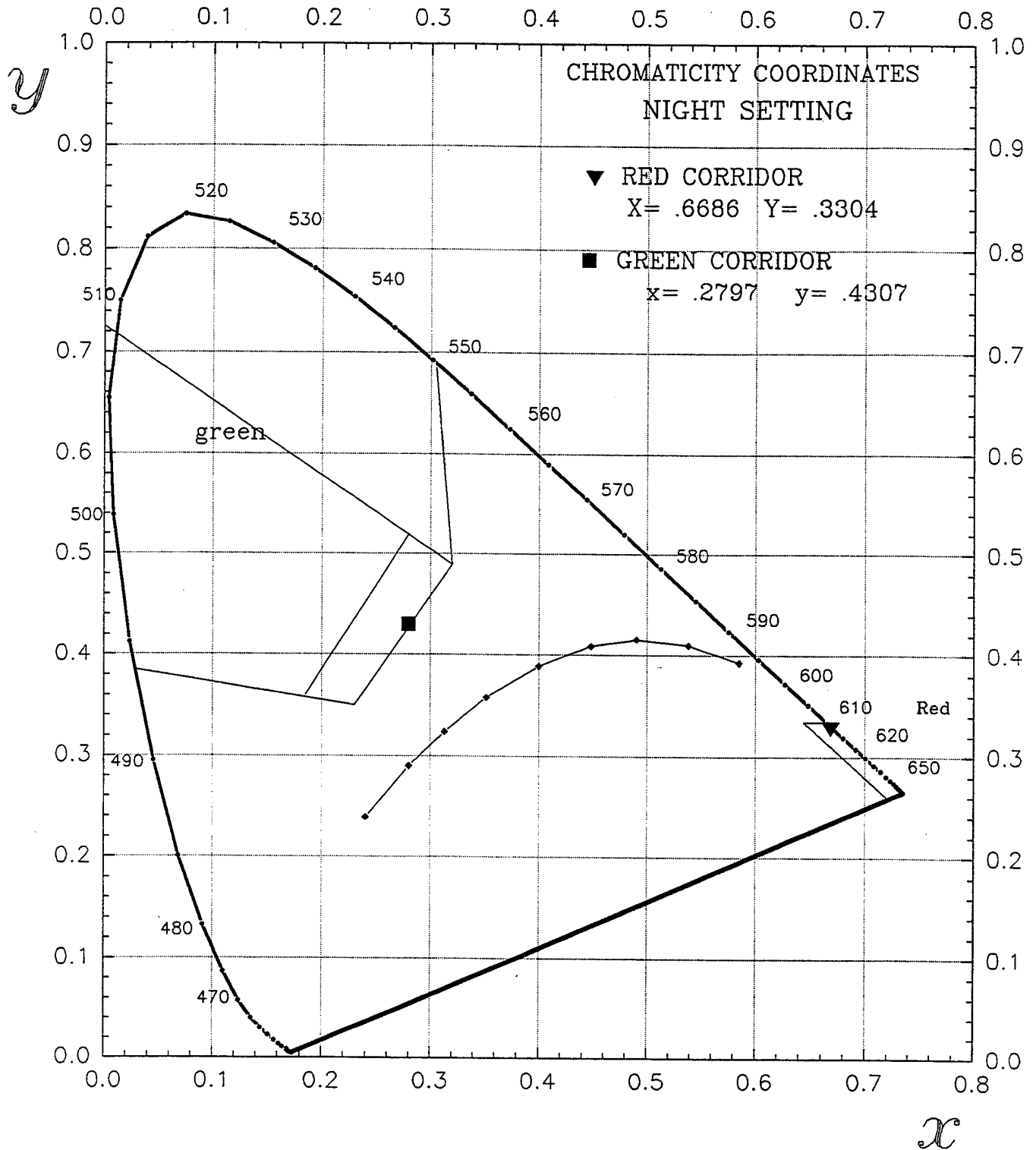


FAA  
HAPI SYSTEM

C.I.E. CHROMATICITY DIAGRAM

2° Observer (CIE 1931)

NAWC A/D LAKEHURST

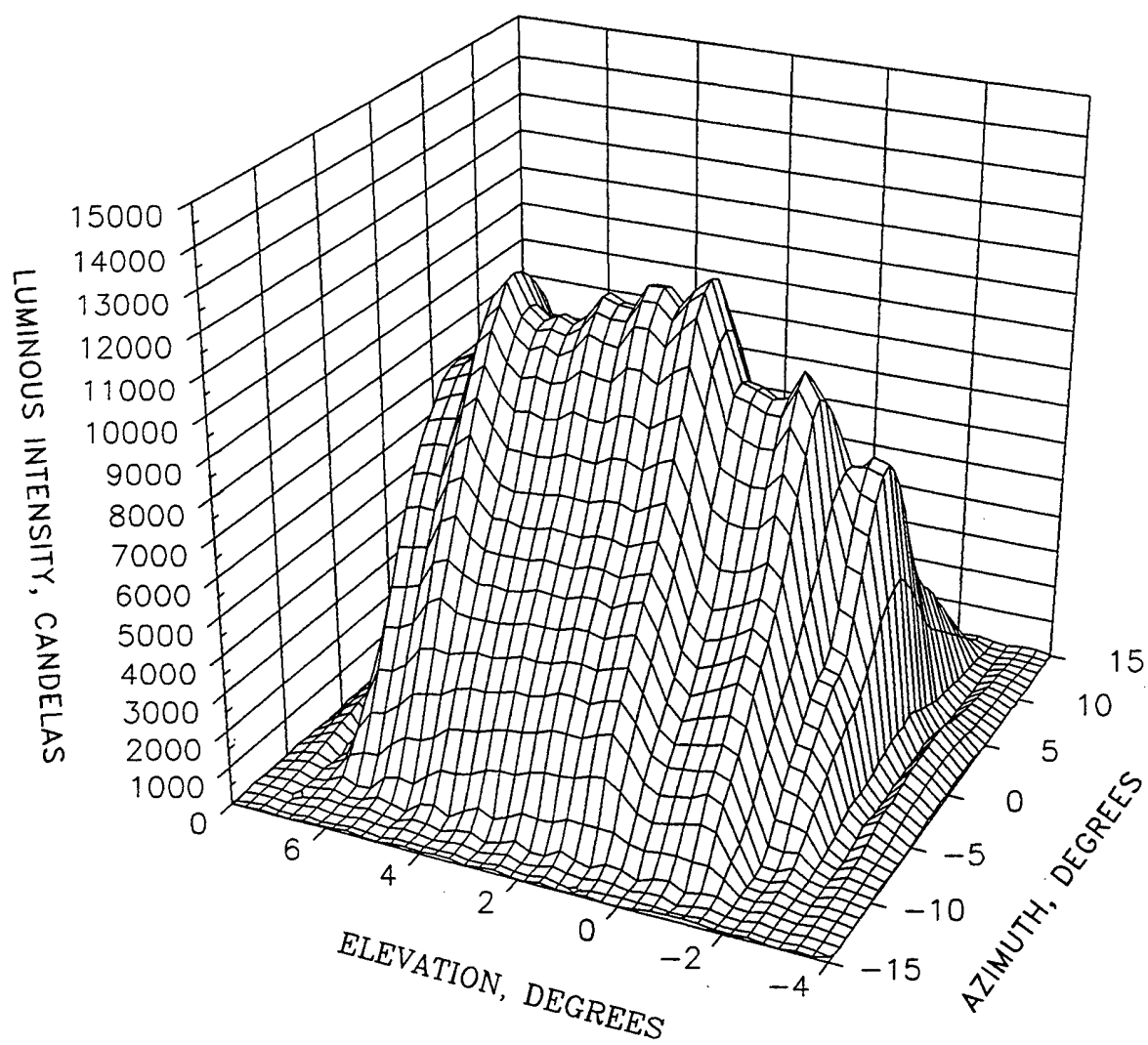


FAA

NAWC LAKEHURST  
PHOTOMETRIC LABORATORY

HAPI SYSTEM

108 VOLT SETTING

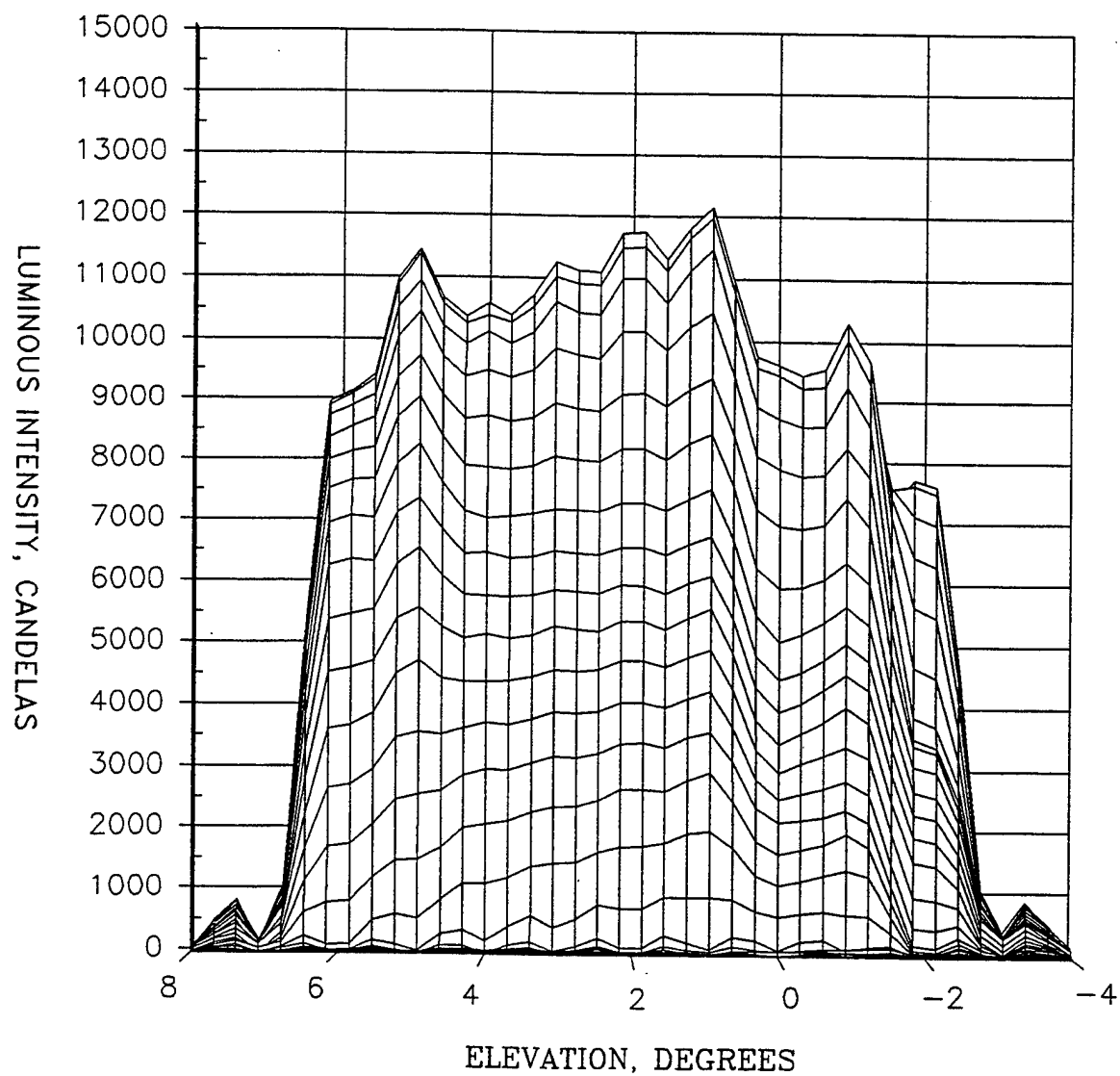


FAA

NAWC LAKEHURST  
PHOTOMETRIC LABORATORY

HAPI SYSTEM

108 VOLT SETTING

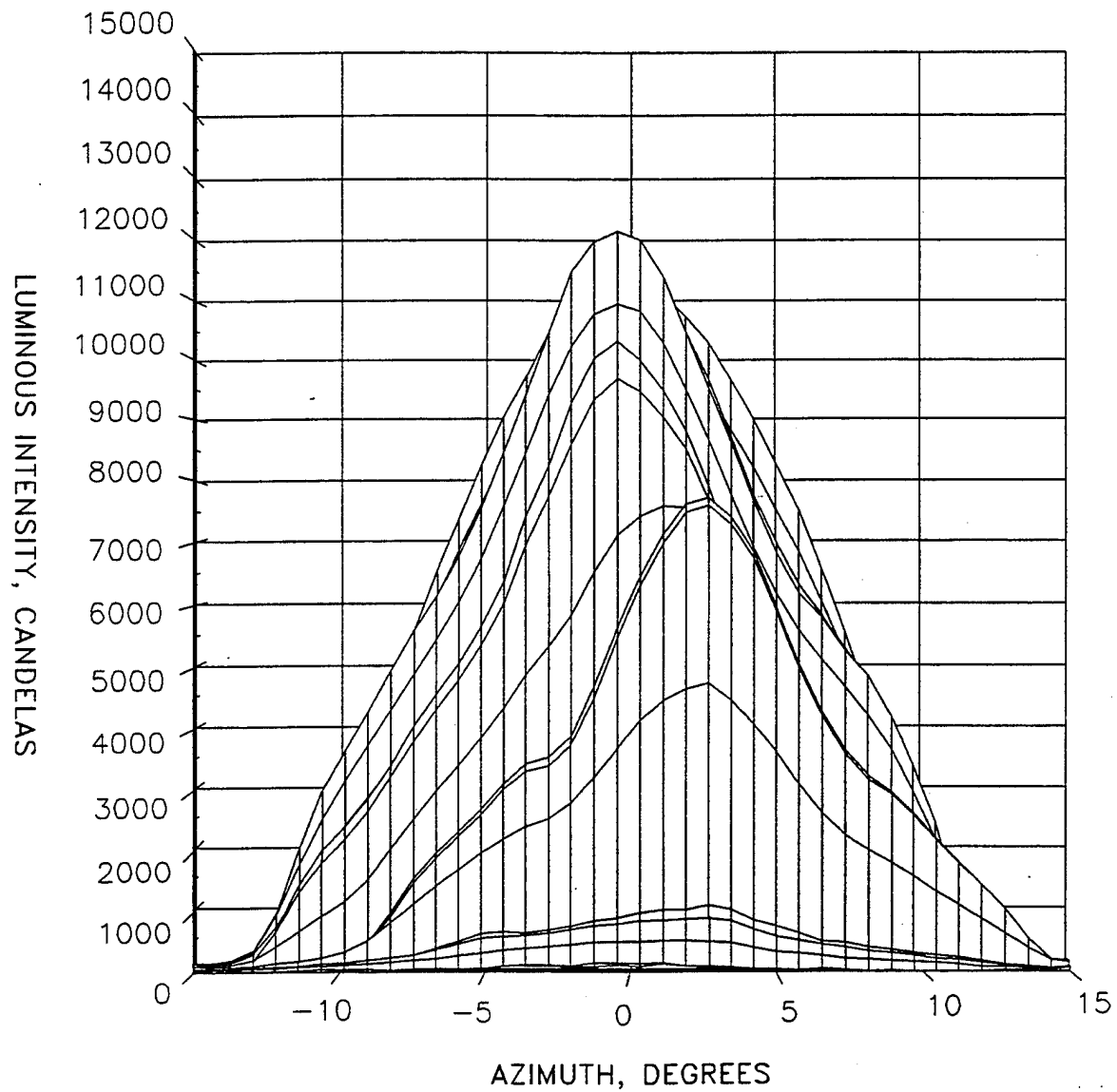


FAA

NAWC LAKEHURST  
PHOTOMETRIC LABORATORY

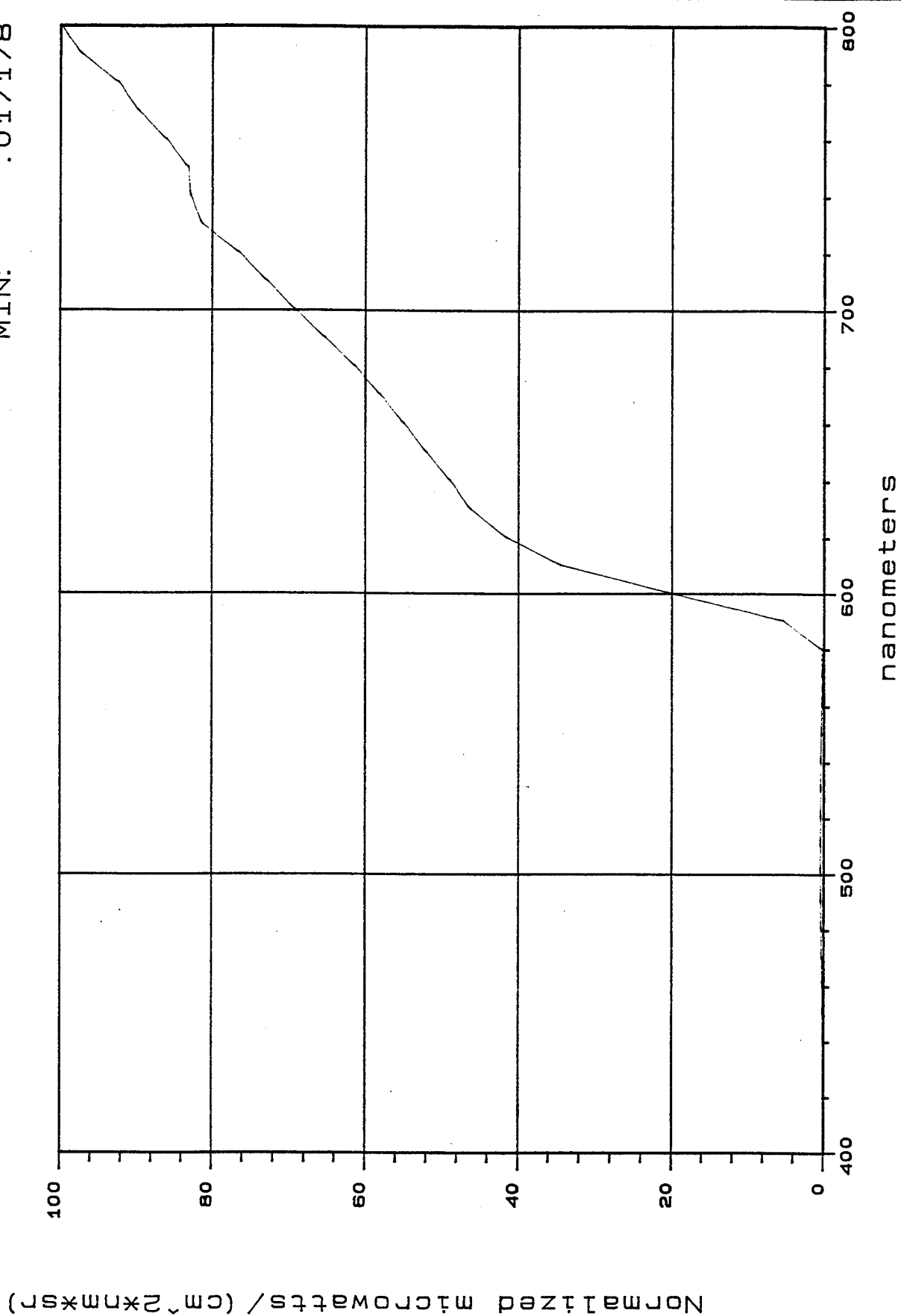
HAPI SYSTEM

108 VOLT SETTING



TITLE: PLASI/RED-STDY/DAY  
DEVICE: RaASiREDSTDYDAY\$

DATE: 11-08-1992  
MAX: 25.52  
MIN: .017178



TITLE: PLASI/GREEN-STDY/DAY  
DEVICE: RaASIGREENSTDYDAY\$

DATE: 11-08-1992  
MAX: 85.235  
MIN: .19048

