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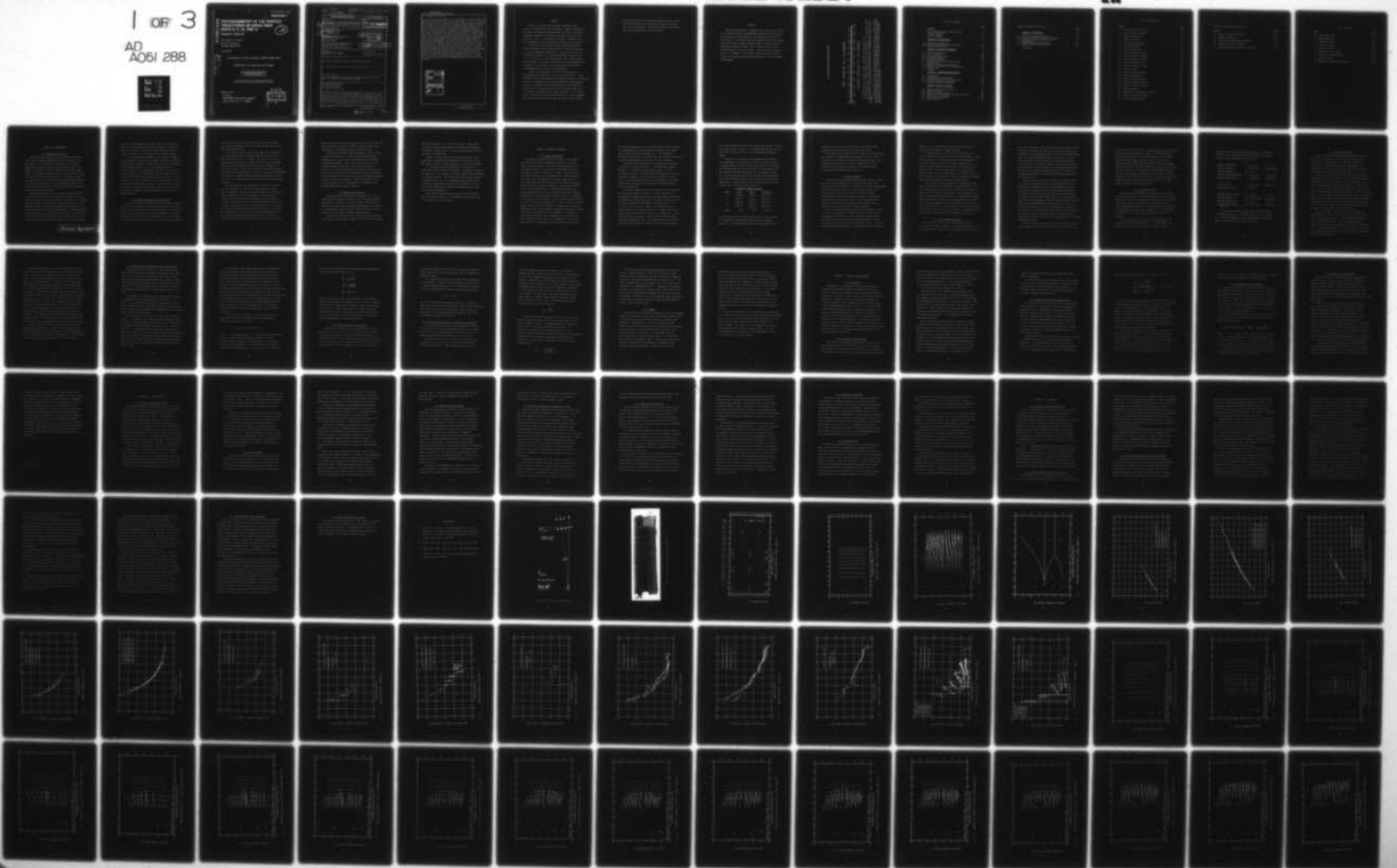
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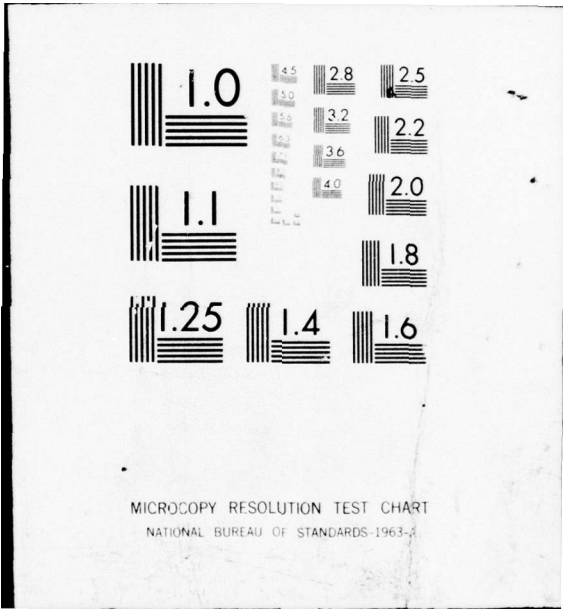
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# PHOTOGRAMMETRY OF THE PARTICLE TRAJECTORIES ON DIPOLE WEST SHOTS 8, 9, 10, AND 11

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Volume I - Shot 10

University of Victoria  
British Columbia  
Canada V8W 2Y2

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## 20. ABSTRACT (Continued)

For each charge configuration, one experiment was carried out over smooth ground and the other over rough ground. In each of the four experiments conducted, photogrammetrical measurements were made of the trajectories of air particle tracers (smoke puffs), which had been placed in a vertical grid at heights ranging from 3 feet to 58 feet above the ground and at radial distances ranging from 25 feet to 140 feet from the vertical axis through the charges. From the measured particle trajectories, calculations were made of the particle velocities, densities, hydrostatic overpressures, and dynamic pressures throughout the blast wave, at times ranging from 3 ms to 100 ms after detonation of the charges. Also determined from the photogrammetrical measurements were the shock front times-of-arrival. These were determined in each experiment for the primary shock front from each of the two charges; for the Mach stems produced above and below the interaction plane midway between the two charges, and for the Mach stem produced at the ground surface. From the shock front times-of-arrival, calculations were made of the shock velocities and, in turn, the peak particle velocities, air densities, and hydrostatic overpressures immediately behind each shock front. Calculations were also made of the variation with time of the particle velocity, density, hydrostatic overpressure and dynamic pressure at several fixed points. Results are presented both graphically and in tables, and are compared to results previously calculated for the same experiment using shock front photogrammetry and refractive image analysis.

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## SUMMARY

Owing to the bulk of the material presented, this report is divided into several volumes. Volume 1 introduces the series and presents and discusses the results for Shot 10. Subsequent volumes will present and discuss the results for Shots 8, 9 and 11. The method of analysis is common to all four experiments and is described in detail only in Volume 1.

So that the results from the four experiments may be easily compared, they have been scaled to remove the effects of varying atmospheric conditions. (Results are scaled to a 1 kg charge weight and a standard atmosphere of dry air at 15 °C at sea level.) For the most part, only scaled results are presented. Exceptions include some derived pressure-time histories, which are meant to be compared to actual gauge measurements made in each of the experiments.

Results are presented in SI units, even though the experiments were originally laid out in British units. Only distance and time measurements are affected, however, as velocity, density, and pressure results are presented as dimensionless ratios. A distance units conversion scale is included for convenience, to convert between SI units (meters scaled to a 1 kg charge) and British units (feet scaled to a 1 lb charge), plus a time scale factor and scale factors to convert pressure ratios to both British and SI pressure units. Scale factors

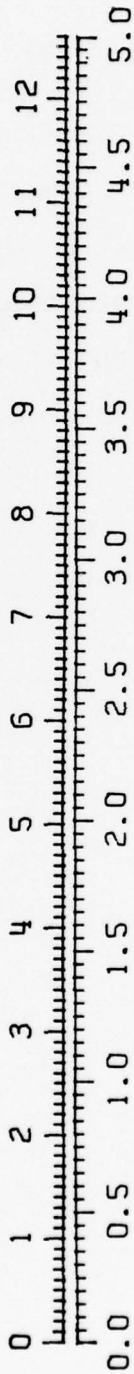
which may be used to compute the distance and time values actually observed under the ambient conditions of each shot are also provided. Real pressure units are used for the results presented at gauge locations.

## PREFACE

The authors gratefully acknowledge the opportunity offered by the Defence Research Establishment Suffield and the Defence Nuclear Agency to participate in the experiments described in this report. The analyses described here were carried out under contract with the Canadian General Electric Company, and with additional financial support from a research grant by the National Research Council (A 2952). The advice and assistance of Mr. A.P. Lambert, C.G.E. Project Officer at DRES, and Mr. J. Keefer, of the Ballistic Research Laboratory, is also gratefully acknowledged.

Unit conversion and scaling factors

FEET (SCALING TO 1 LB CHARGE)



METERS (SCALING TO 1 KG CHARGE)

For feet scaled to a 1000 lb charge, multiply the top scale by 10.

For time scaled to a 1000 lb charge, multiply time scaled to a 1 kg charge by 7.683.

For pressure in kPa, multiply a pressure ratio (in atmospheres) by 101.325. For pressure in psi, multiply the pressure ratio by 14.696. To convert kPa to psi, divide by 6.895.

To obtain distance values actually observed for Shot 10, in meters, multiply scaled values in this report by 8.0718. To obtain the observed distance values in feet, multiply the reported scaled values by 26.482. To obtain observed time values, multiply scaled time values by 8.3742. For observed pressures in kPa, multiply by 94.38; for observed pressures in psi, multiply by 13.69.

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## CHAPTER 1, INTRODUCTION

### 1.1 Blast wave reflection

When a spherical charge is detonated above the ground surface the resulting spherical blast wave reflects from the ground. At a distance from the point on the ground immediately beneath the charge, approximately equal to the height of the charge above the ground, the reflected shock begins to overtake and combine with the primary shock to form a single shock known as the Mach stem. The point at which the primary shock, the reflected shock and the Mach stem meet is called the triple point. As time progresses and the Mach stem shock moves outwards, the triple point moves outwards and upwards in a curved trajectory.

The physical properties of the Mach stem blast wave and the trajectory of the triple point depend primarily on three things: the energy yield of the charge, the height of the charge above the ground, and the nature of the ground surface. When the primary shock reflects from the ground some energy will be absorbed and appear as seismic disturbances, including cratering if the explosion is close enough to the ground. As the blast wave continues to move across the ground surface there will be a continued transfer of energy between the air and the ground,

and also a redistribution of energy within the blast wave. Little is known about the transfer of energy to the ground from an air blast, or about the redistribution of energy within a blast wave as it passes over the ground surface.

In the experiments described in this report, attempts have been made to simulate the "ideal" reflection of spherical blast waves to provide a reference for studies of reflection by real ground surfaces. It is postulated that if two identical charges are simultaneously detonated at a certain distance apart, the two resulting identical spherical blast waves will interact along a plane, and since there will be no energy loss in this interaction it will be possible to observe an ideal spherical blast reflection. The properties of the Mach stems lying above and below the ideal reflecting plane may then be compared with those produced over various real ground surfaces.

### 1.2 General description of the project

The primary purpose of the project was to obtain information on the interaction of spherical blast waves from explosive sources with real and ideal reflecting surfaces. The results may be used, for example, to evaluate hydrodynamic air blast computer codes. The blast wave interactions were obtained by the simultaneous detonation of two identical spherical charges

placed one above the other, such that the distance between the charges was equal to twice the height of the lower charge above the ground surface.

Two different charge heights were used over two different types of ground surface. The four experiments were titled Dipole West Shots 8, 9, 10, and 11. For Shots 8 and 11 the lower charge was placed at a height of 25 ft above the ground surface and the second charge at an additional height of 50 ft above the first. Shot 8 was carried out over smooth ground and Shot 11 over rough ground. For Shots 9 and 10 the corresponding figures for charge height and charge separation were 15 ft and 30 ft. The ground surface was smooth for Shot 9 and rough for Shot 10.

Two photogrammetrical studies were carried out in each of these experiments. The first study involved the high speed photography, against a suitable background, of the shock fronts produced by the two explosions. This permitted a calculation of the shock front trajectories and velocities, and thus a determination of the physical properties immediately behind the shocks as they moved into ambient air. The results of those calculations have been reported by Dewey et al (1975). The second project involved the high speed photography of an array of smoke puffs which acted as particle flow tracers, to determine the particle trajectories within the blast waves.

These trajectories have been analyzed to provide the space and time variations of particle velocity, density, hydrostatic overpressure, and dynamic pressure within the waves.

This volume describes the photogrammetry of the particle trajectories for Shot 10. The particle trajectory photogrammetry for the other three experiments will be reported in subsequent volumes. Shot 10 was analyzed first because the data collected were fewer than those collected for Shots 8 and 11 (fewer smoke puffs were used in Shot 10), and of better quality than those collected for Shot 9 (all smoke puffs detonated in Shot 10 and most remained visible throughout the time interval of interest). Thus the analysis of Shot 10 was carried out with a minimum of data processing and maximum expectation of useful results.

### 1.3 Description of Shot 10

Dipole West Shot 10 was fired on November 2nd, 1973 by the Ballistics Research Laboratories at the Defence Research Establishment Suffield, in Alberta, Canada. Two 1080-lb. spheres of Pentolite were detonated simultaneously, to within 5 microseconds, at nominal charge heights of 15 and 45 feet over a relatively rough (ploughed) ground surface.

Particle trajectory data were gathered by photographing the movement of smoke puffs formed in a vertical plane running

out from ground zero at  $6.7^\circ$  south of west. A WF5 camera operating at about 3400 frames per second was positioned 30 ft above the ground level at the main camera position 600 ft due south of ground zero.

Figure 1 shows a plan view of the field layout. The dashed line represents the approximate line of sight of the WF5 camera. Figure 2 shows the field of view of this camera.

The smoke puff grid was made up of 9 columns of 12 puffs each, hung vertically on strings. The vertical spacing of puffs was 5 ft, beginning 3 ft above ground level and ending at a height of 58 ft. The horizontal spacing of the columns of puffs was 10, 7 or 5 ft, depending on the distance from ground zero, beginning at about 25 ft and ending at about 85 ft. All 108 smoke puffs detonated successfully and a good film record was obtained.

This report describes the analysis of the smoke puff data collected for Shot 10, and presents and discusses some of the results of that analysis.

## CHAPTER 2, METHOD OF ANALYSIS

### 2.1 Camera calibration

The exact orientation and lens position of the camera were determined using the measured positions in the film image of the photomarkers and other surveyed objects, such as pressure gauges. This calibration procedure has been described in detail by Dewey et al (1975). The positions of all fiducial markers, as they appeared in a chosen calibration frame, were transformed to a camera object plane in real space using the camera position, two camera orientation angles, and two "optical" parameters: a magnification factor and an axial rotation angle. The orientation angles and optical parameters were calculated so that the two reference point images in the calibration frame, P1 and P2, transformed to coincide with their positions in the object plane calculated directly from the field survey data. Since an exactly surveyed camera position was not provided, the three camera position coordinates were also calculated, together with the two orientation angles and the two optical parameters. The camera position "optimization" was accomplished by requiring that a third reference point image, P3, transformed to its object plane position as calculated from the survey data, and that

the distance between a pair of reference point images, P4 and P5, transformed to the corresponding distance in the object plane calculated from the survey data. The calibration procedure was iterative, and ended when the results of successive calculations differed by less than a pre-set tolerance.

The field survey data used in the calibration procedure for Shot 10 are listed in Table 1. The calculated camera position ( $\pm 0.1$  feet) and orientation angles ( $\pm 0.001^\circ$ ) are listed in Table 2, together with the positions of all the calibration points in the object plane and their "shifts", that is, the differences between the transformed calibration points and their object plane positions calculated directly from the survey data.

The object plane positions and shifts of the calibration points are also shown in Figure 3. Circles represent the transformed calibration points and squares represent positions calculated using the survey data. The larger circles indicate the three points that were made to coincide exactly, viz. P1 = W1, P2 = W3, and P3 = 300W1. The large half-circle indicates the final reference point (P5 = 300W2) used in the camera position optimization (P4 was set to equal P3). C1 and C2 denote the two charges. Frame centre is near the camera centering photomarker, VP2A. The photomarkers VP1A and VP1B show large shifts probably because they were not re-surveyed

after the pole on which they were mounted was lowered to replace the marker missing on Shot 8. No similar explanation could be found for the vertical shift of the foreground photomarker 300W2.

Consistency in calculating the optimum camera position from experiment to experiment was one of the criteria used in judging whether or not the optimum position was acceptable. The optimum camera positions used were the ones showing the least movement between experiments, on the assumption that the actual camera position was the same for each experiment. The calculated camera positions are shown below for the four experiments. Ground zero was given coordinates 2000 ft east, 2000 ft north, and 2316.32 ft elevation.

CALCULATED CAMERA POSITIONS

<u>Shot</u>	<u>East</u>	<u>North</u>	<u>Elevation</u>
8	2003.38	1385.09	2341.84 ft
9	2002.76	1385.15	2341.66 ft
10	2002.62	1388.29	2341.72 ft
11	2003.25	1386.89	2340.64 ft
Range	0.76	3.20	1.20 ft

The greater range in the north coordinates is probably due to the method of optimization used for this coordinate direction. The method was based on the apparent distance

between two points in the object plane rather than on the apparent position of one point in the object plane.

The position and orientation of a camera, once calculated, were assumed to remain constant throughout an entire film. The magnification factor and axial rotation angle were re-calculated for each frame in the data reduction part of the analysis described below, to account for frame-to-frame variations in the film projection optics.

## 2.2 Data reduction

The positions of the smoke puffs and two reference photo-markers as they appeared in the projected film image were digitized for each frame over a section of film that corresponded approximately to the duration of the positive phase of the blast waves. For the Shot 10 film, this time interval corresponded to frames 10 through 200 (frame 0 corresponded approximately to detonation time). Before each digitizing session, the projection system optics were aligned using a precision grid in the film gate of the projector.

The two reference markers used for the reduction of Shot 10 were P6 = VP3B and P7 = 300W2. The digitized data were transformed mathematically to the camera object plane using the image positions of these two reference markers in each frame and their positions in the calibration frame, to correct for frame-to-frame variations in image magnification and axial

rotation in the film projection optics and to correct for frame-to-frame effects of camera vibration.

The camera object plane was defined to coincide as nearly as possible to the actual plane of smoke puffs. Smoke puff positions in the object plane were then transformed to the actual smoke puff plane, which was assumed to be a vertical plane running from ground zero at an angle of  $6.7^\circ$  south of west. The coordinate system in this plane was defined to have its x-axis horizontal, its y-axis vertical, and its origin at ground zero. Thus the entire grid of smoke puffs was positioned in real space for each frame.

A time (after charge detonation) was assigned to each frame by computing the film speed at selected frames. Film speeds were computed using the 1 ms timing marks placed on the film at the time of its exposure. The reciprocal of a simple polynomial function fitted to the computed film speeds was then integrated to determine the successive frame times. Zero time was determined using the detonation zero timing mark placed on the film. This method of film timing has been described in detail by Dewey et al (1975). A complete set of timing data for the Shot 10 film is provided in Table 3.

### 2.3 The output data plane

The coordinate origin in the smoke puff plane was nominally ground zero. However, the coordinate origin was not located at the ground zero position which was listed with

the field survey data. The location used was instead a value corrected to account for the fact that the charges were not positioned in any experiment exactly above the surveyed ground zero. The smoke puff plane origin was defined to be that point which had the same elevation as the surveyed ground zero, but which lay directly below a point halfway along the line joining the charge centers. This corrected ground zero for Shot 10 was displaced horizontally by 1.2 ft from the surveyed ground zero, in a direction which was approximately 30° south of west.

Particle trajectory data were output in the smoke puff plane using an x-coordinate axis which was defined to run horizontally outwards from the corrected ground zero and a y-coordinate axis which ran vertically upwards from this same point, so that increasing x-coordinate values denoted increasing distance from an idealized vertical charge axis and increasing y-coordinate values denoted increasing distance above an idealized horizontal ground surface. All data in the smoke puff plane as they are presented in the figures of this report have x-coordinate values increasing to the right, so that the smoke puffs appear to run to the right of the charges rather than to the left as they appeared in the original photographic images.

Figure 4 shows the positions of the 108 detonated smoke puffs comprising the grid for Shot 10 at a time prior to the

detonation of the two charges. These positions are in the plane of the smoke puff grid and the charges, as described above. The smoke puff plane is not exactly parallel to the camera image and object planes (Figures 2 and 3), and various geometrical corrections were applied to make the transformation between them. The puffs enclosed in parentheses were not visible in the earlier film frames, but were seen later when they were illuminated by the light of the fireball. Charge positions in the figures are plotted as if they were positioned exactly above the corrected ground zero origin. The data shown in Figure 4 have not been scaled.

#### 2.4 Scaling and units

The position-time histories of individual smoke puffs were extracted from the frame-by-frame positions of the smoke puff grid. This set of particle trajectories was then scaled to standard atmospheric conditions and charge weight to remove experiment-to-experiment differences due to variations in atmospheric conditions and charge weight. A change from British units to SI units was made at this stage of the analysis.

Particle trajectory data were scaled by dividing all distances by Sachs scaling factor  $S = \sqrt[3]{(WP_0)/(W_0P)}$  and multiplying all times by the factor  $C/(C_0S)$ , where  $C$  is

the ambient sound speed computed for Shot 10. Data used to compute C and S, and define the scaled event, are listed below with the computed values of C and S.

Ambient temperature,	$T = -5.94 \text{ }^{\circ}\text{C}$	(21.3 $^{\circ}\text{F}$ )
Ambient pressure,	$P = 94.38 \text{ kPa}$	(13.689 PSI)
Relative humidity,	$\text{RH} = 81.0 \%$	
Computed vapour pressure,	$\text{VP} = 0.32 \text{ kPa}$	(2.4 mm Hg)
Ambient sound speed,	$C = 328.003 \text{ m/s}$	(1076 ft/s)
Charge weight,	$W = 489.9 \text{ kg}$	(1080 lbs)
Sachs scaling factor,	$S = 8.0718$	
Standard charge weight,	$W_{\text{O}} = 1.0 \text{ kg}$	(2.2 lbs)
Standard pressure,	$P_{\text{O}} = 101.325 \text{ kPa}$	(14.7 PSI)
Standard temperature,	$T_{\text{O}} = 15 \text{ }^{\circ}\text{C}$	(59 $^{\circ}\text{F}$ )
Standard sound speed, (dry air)	$C_{\text{O}} = 340.292 \text{ m/s}$	(1116 ft/s)

The results presented in this report therefore apply to a scaled event which is the detonation of two 1 kg charges in a standard atmosphere. The scaled heights of burst for Shot 10 were 0.563 meters and 1.713 meters.

## 2.5 Trajectory fitting

Figure 5 shows the scaled particle trajectory data for Shot 10 in the smoke puff plane with positions measured horizontally and vertically from corrected ground zero. Approximately 9600 puff positions are represented. As represented, the raw trajectory data have not been edited, and a number of obvious film reading errors can be seen.

The raw particle trajectory data were edited to remove obvious data processing errors, such as a single point widely displaced from its trajectory for one or two frames. The trajectories were then smoothed by fitting, for each puff in turn, simple polynomial expressions separately to both the x- and y-coordinate data, these being discrete functions of frame time. A least squares fitting technique was used. The adequacy of each fit was determined by examining on the same graphical output plots of both the raw trajectory data and the fitted curve. For Shot 10 this meant examining and adjusting 216 such plots, at least two or three times each.

For a given puff, the first step in fitting the raw trajectory data was to set the time of arrival of the shock front first hitting the puff. This was done subjectively, using the plotted raw data. The obvious constraint was used that this time for a single puff should be the same for the x- and the y-coordinates. Prior to this time of arrival, the measured positions of the puff were averaged to establish the initial puff position.

The raw trajectory data at times subsequent to the time of arrival were fitted with polynomial functions as described above. The fits were individually adjusted by varying the order of the polynomial and/or the relative weight given to each of the raw data points. The lowest order of polynomial which appeared to describe the particle trajectory was used. In all cases polynomials of fifth order or less were found to be adequate. Data points in obvious error were edited out by weighting them zero. For some puffs undergoing relatively more complex motions (i.e. those nearer to the charges), trajectories were fitted in two sections. If it appeared that the change in motion of the puff was the effect of a second shock wave, then it was not required that the first derivative of the fitting function (the velocity of the puff) be continuous. Otherwise it was required that this derivative at least appear to be continuous. In judging the motion of a particular puff, the motions of its near neighbours were also taken into account.

Using the fitted functions, the positions of the smoke puffs were interpolated at a series of discrete times, which were not necessarily the frame times. The first derivatives of the fitted functions were also calculated at the interpolated times for use in later calculations of particle velocity.

## 2.6 Regionalization and shock strength calculations

Knowing the time of arrival of a shock front at each puff, and the position of each puff, calculations were made of the shock trajectory, the shock velocity, and various peak parameters associated with shock front strength. These shock trajectories and associated peak parameters were then compared to the corresponding results calculated as part of the refractive image analysis already reported (Dewey et al, 1975).

To associate a shock radius with a given puff position, the smoke puff plane was divided into five regions. All puffs in a given region were assumed to have been first hit by the same shock front. The region boundaries were defined using triple point path measurements obtained from the refractive image analysis mentioned above.

The regions which were defined for Shot 10 are shown in Figure 6. In regions 1 and 2 the puffs were assumed to have been first struck by primary shock fronts, and the shock radii were measured from the appropriate charge center. Puffs in regions 3, 4 and 5 were assumed to have been first hit by a Mach stem: along the ground, and below and above the interaction plane, respectively. The interaction surface, along which the upper and lower primary shock fronts interact without energy loss, was assumed to be the plane of symmetry separating the charge centers.

In the two Mach stem regions adjacent to the interaction plane, radius values were measured from the point halfway between the charges, and in the Mach stem region adjacent to the ground surface they were measured from corrected ground zero. This was done in accordance with the assumptions that the Mach stem shock fronts were spherical and that the sphere centers remained fixed with time at the points where the vertical coordinate axis intersected the interaction and ground planes. Shock strength results computed in this way for Shot 10 represented an improvement over similar results computed using the assumption that the Mach stem fronts were cylindrically shaped and centered about the vertical coordinate axis. This question of Mach stem shape is discussed further in a later section of this report.

In each of the five regions, the shock trajectory data obtained from the first movement of the smoke puffs were fitted to a function of the form

$$r(t) = A + Bt + C \log(1 + t) ,$$

where  $r$  is the shock radius,  $t$  is the time after detonation, and  $A$ ,  $B$ , and  $C$  are the fitted coefficients. The shock velocities were calculated by differentiating this function. The peak particle velocity,  $V_s$ , peak density,  $D_s$ , and peak hydrostatic overpressure,  $P_s$ , in each of the five regions were

calculated as functions of shock radius, using extensions of the Rankine-Hugoniot equation, viz:

$$\frac{V_s}{C_a} = \frac{2}{\gamma+1} \frac{M^2-1}{M^2}$$

$$\frac{D_s}{D_a} = \frac{(\gamma+1)M^2}{(\gamma-1)M^2+2}$$

$$\frac{P_s}{P_a} = \frac{2\gamma}{\gamma+1} (M^2-1)$$

where  $C_a$ ,  $D_a$  and  $P_a$  are the ambient values of sound speed, density and pressure, respectively;  $\gamma$  is the ratio of specific heats and  $M$  the Mach speed of the shock front. Peak particle velocity will be used in this report as a measure of shock strength because other independent calculations of this parameter were also made. Peak values of density and pressure were calculated using the above method only.

### 2.7 Particle velocity calculations

Assuming the smoke puffs to be perfect tracers of the gas flow within the blast waves, the gas particle velocities throughout the field of smoke puffs were calculated for a sequence of times. This was done by calculating the derivative of the polynomials used to interpolate the fitted trajectories. The derivatives of these polynomials were also calculated at

the times-of-arrival of the shock at each puff to provide a second measure of  $V_s$ , the peak particle velocity immediately behind the shock.

The peak particle velocities  $V_s$  were also calculated by a third method. At specific times the particle velocities,  $V$ , and the radial positions,  $r$ , of all the puffs within each of the five regions were fitted to a function of the form

$$V(r) = A + B^2 r ,$$

that is, a straight line with positive slope. (The data scatter did not justify the fitting of a more flexible function.) This fitted function, at each time and in each region, was extrapolated to the appropriate shock radius at that time to determine peak particle velocity.

#### 2.8 Density and hydrostatic overpressure calculations

The particle trajectory data were also used to compute time varying air densities throughout the field of the smoke puff grid. The calculated densities were in turn used to compute hydrostatic overpressures in the same field.

The smoke puff grid of 9 columns of 12 puffs each was treated as a grid of 88 cells, each cell being defined by 4 adjacent smoke puffs. Each such quadrilateral cell was

viewed as representing the cross-section of an elemental volume defined by rotating the area of the cell about the axis of cylindrical symmetry rising vertically through the two charges. Conservation of mass within this volume demands that the product  $RAD$  is constant at all times, where  $R$  is the radial coordinate of the centroid of the cell defining the volume,  $A$  is the area of the cell, and  $D$  the average density of air in the volume. In particular, the product  $RAD$  must always equal  $(RAD)_a$ , its ambient value computed before the arrival of any shock fronts at the cell. This equality gives the relative density  $D/D_a$  at any time, as

$$\frac{D}{D_a} = \frac{(AR)_a}{A R}$$

Pressure values were calculated using the fact that  $P/D^\gamma$  remains constant as long as the entropy of the gas in a cell remains constant, where  $P$  is absolute pressure at a point,  $D$  density, and  $\gamma$  the ratio of specific heats of air. In particular, the value of  $P/D^\gamma$  equals the value  $P_s/(D_s)^\gamma$  measured immediately behind the leading shock front, and remains constant until the entropy is changed by the arrival of a second shock. The relative overpressure at a point can be computed using

$$\frac{P}{P_a} - 1 = \frac{P_s (D/D_a)^\gamma}{P_a (D_s/D_a)^\gamma} - 1$$

The values  $P_s/P_a$  and  $D_s/D_a$  were computed at each puff's position immediately after it was first struck by a shock front, taking  $P_s$  and  $D_s$  from the shock velocity data computed according to the method described earlier (section 2.6). The values computed for  $P_s/P_a$  and  $D_s/D_a$  at the cell corners were averaged. The overpressure  $P/P_a - 1$ , subsequently calculated, therefore also represents an average value over a given cell. The arrival of shock fronts subsequent to the first could not be detected accurately, so that no attempt was made to determine exactly those times after which the calculated overpressures in given cells became invalid.

### 2.9 Summary

Previous sections describe the method of particle trajectory analysis by which data of four basic types were obtained: times of shock front arrival, particle velocities, densities and hydrostatic overpressures. To obtain a measure of shock strength the particle trajectory data were analyzed in separate groups according to the shock front which first arrived at the smoke puffs in each group. It was assumed that the shock fronts had a specific regular shape. In this way the smoke puffs at the observed times of shock front arrival were assigned radial position coordinates to supplement their measured Cartesian coordinates. Radial shock velocities

throughout the smoke puff grid were computed and peak particle velocities were derived from the shock velocities. These peak velocity values were used as a measure of shock front strength and were compared with values obtained using smoke puff data in two other ways, and with values obtained previously using refractive image analysis. The particle trajectory analysis depended on the refractive image analysis only to define the five regions in the smoke puff plane. These regions were used only in the analysis of the shock fronts and were of no particular significance in the subsequent analysis of the smoke puff trajectories behind the shocks.

The basic data obtained from the smoke puff trajectories after shock front arrival were derived in Lagrangian coordinates, that is, for a grid of points which moved with the air in the blast wave and did not remain fixed with respect to the ground surface. The method used to transform these data to Eulerian coordinates, that is, fixed in space, and which also permitted the calculation of dynamic pressure fields, is the subject of the next chapter.

## CHAPTER 3. SURFACE REPRESENTATION

### 3.1 Introduction

Measurement of the smoke puff positions permitted the determination of several physical properties of the blast waves in a vertical x-y plane passing through the corrected ground zero. Letting  $z$  denote values of a particular physical property at a specific time, the results of the particle trajectory analysis may be viewed as sets of discrete points on three-dimensional surfaces,  $f(x,y,z) = 0$ . If such surface representations are made explicit, they may be used to interpolate z-coordinate values, i.e. values of the physical property, at x-y positions other than the actual smoke puff positions, such as gauge locations. Such surface representations also may be used to display graphically an entire set of physical properties in the form of contour lines joining points of equal z-value. The following sections describe how the various surfaces were fitted.

### 3.2 Preliminary interpolations

Source data (z-coordinates) for surface fitting were the times-of-arrival of the first shock front at the individual smoke puffs, the measured particle velocities at puff positions at a sequence of times (velocity fields), and average densities

at cell centroids at the same sequence of times (density fields). Values of hydrostatic overpressure at the cell centroids were also fitted, these values being derived from the density data, as described previously. The x-y coordinates were the initial puff positions, the puff positions at a time,  $t$ , and the cell centroid positions at a time,  $t$ .

The first step in the surface fitting procedure was the completion of the data grid. This meant generating x-y coordinates to represent "missing" puffs and cell centroids, and interpolating z-coordinates at these new positions. This was done in a very conservative manner, using linear interpolation in a domain bounded by the completely convex set of straight line sections which connected the outermost of the originally existing puffs. No extrapolation beyond this domain was attempted.

The positions of missing puffs were assigned by interpolating x- and y-coordinates in turn, between those of the adjacent puffs in each missing puff's row and column. The z-data assigned to the new positions were then interpolated along the row and along the column, and the two results were averaged. New z-coordinates were assigned only to new puff locations that fell inside the original domain boundaries. A new puff position on the domain boundary, that is a puff with only one nearest neighbour in its row or column, was given a position coordinate and a z-coordinate equal to

those of its single neighbour in the appropriate row or column calculation.

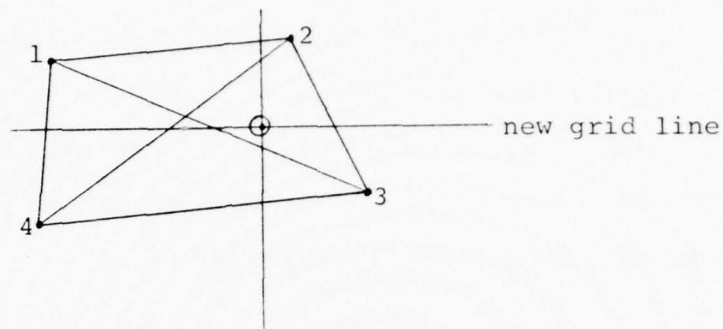
In Shot 10 there were no missing puffs in the original grid and it was not necessary therefore to apply the above technique when fitting the time of arrival surface. In all other cases, missing puff data were generated only to expedite subsequent interpolations.

### 3.3 Interpolation onto an Eulerian grid

The second step in the surface fitting procedure was the definition of a rectangular grid and the subsequent interpolation of a z-coordinate value at each new grid point inside the original domain. In all cases the new grid was a regular square grid with a constant mesh size of 0.1 m, which was approximately one-half the mesh size of the original smoke puff grid after scaling. The new grid was in the same plane as the smoke puffs but, unlike the smoke puff grid, it remained stationary relative to the coordinate origin.

Interpolation at the new grid points was done by fitting a polyhedral surface to the original, completed smoke puff grid. This was done by fitting plane surfaces to triplets of data at the corners of the original smoke puff cells. For example, when a new grid point fell inside an

original cell of smoke puffs (1,2,3, and 4) as shown:



a z-coordinate value was assigned to the new grid position " $\phi$ " by fitting planes to the puff data at 1, 2, and 3, and at 2, 3, and 4, and interpolating at the new grid point using each plane in turn, and averaging the two results. If, at the edge of the domain, a cell was defined by only three puffs, only one interpolation plane was used. When two or more cell corners were beyond the domain, no data were interpolated to the new grid. In this way the original domain boundaries were shrunk, and made concave, on occasion.

The surface represented by the resulting grid of interpolated data was therefore an array of connected triangular plane elements, with four such elements for each complete smoke puff cell. The connected array was everywhere continuous in z, albeit discontinuous in the derivatives of z across the connections, and it passed through all of the original smoke puff data. There was therefore no smoothing of the

original data, and no chance of excessive values of z between original data due to uncontrolled fitting functions.

### 3.4 Dynamic pressure calculations

Surfaces were fitted to the times of shock arrival at each smoke puff and to the particle velocities, densities and hydrostatic overpressures at a sequence of times. The grids were Eulerian in that their position in the x-y plane did not change with time. The z-coordinates were, specifically, the velocity vector magnitudes expressed as Mach numbers, density ratios relative to ambient density, and overpressure ratios relative to ambient pressure.

Since the same interpolated grids were used for velocity and density, the dynamic pressure at each grid point also could be computed using

$$\text{dynamic pressure ratio} = \frac{\frac{1}{2}D|V|^2}{P_o} = \frac{\gamma}{2} \left( \frac{D}{D_o} \right) \left( \frac{|V|}{C_o} \right)^2$$

where  $\gamma = 1.4$ ,  $(D/D_o)$  is the measured relative density,  $(|V|/C_o)$  the measured particle velocity Mach number,  $P_o$  the standard pressure, and  $C_o$  the standard sound speed. Dynamic pressures could not be calculated prior to this point in the analysis because the original, uninterpolated values of relative density and particle velocity were not measured at the same set of points in the x-y plane.

### 3.5 Contours and time histories

The fitted surfaces described above were used only for interpolation; the data were not smoothed. Interpolation onto an Eulerian grid made possible the calculation of dynamic pressure fields. Further interpolation to points inside the Eulerian grid made it possible to compute and plot contour lines over the various data fields, and also time history curves for data at specific fixed locations within those fields.

The contours calculated were those of equal time of shock arrival (isochrones), particle velocity (isotachs), density (isopyknics), hydrostatic overpressure (static isobars), and dynamic pressure (dynamic isobars). The isochrones represent the shock front shapes at different times. The contouring technique therefore provided a complete mapping of all the physical properties of the blast wave within the smoke puff domain without reference to other measurements. The time histories of these physical properties at several fixed locations were also calculated. Some of these were calculated at pressure gauge positions in unscaled units, so they may be compared to actual gauge measurements.

Contours of specific z-values were calculated using linear interpolation, searching between pairs of grid points along the Eulerian-Cartesian grid lines and along the mesh diagonals for possible contour line intersection points, and

joining the points which were found. Time history curves were calculated by interpolating z-values at a fixed location in a time-series of data fields which had been interpolated onto the same Eulerian grid. The interpolations to points inside this common grid were of the polyhedral surface type describe previously. Because all fitted surfaces were continuous in z and because the mesh size could be made relatively small, satisfactory contours and time histories were obtained. Because the fitted surfaces were smooth (comparitively speaking) and, in the limit of an infinitely small mesh, they would pass through all the control points in the measured data fields, the contours and time histories were smooth and represented the measured data faithfully in all cases.

## CHAPTER 4. SHOT 10 RESULTS

### 4.1 Times of shock front arrival

The measured initial puff positions, the times of first shock arrival, and the peak particle velocities obtained by differentiating the functions fitted to the particle trajectories are presented in Table 4. Puff position is given relative to corrected ground zero as origin with horizontal and vertical axes. Puff position and the time of arrival of the first shock are given both as observed and scaled. Particle velocities listed are derivatives of the fitted puff trajectories at the times of shock arrival, and are expressed in Mach units. Expressed this way, the particle velocities are the same scaled as unscaled. Also listed are the initial radial puff positions (scaled) and region codes.

Shock front data determined from the first movement of the smoke puffs, i.e. calculated from the time-of-arrival data in Table 4, are listed in Tables 5.1 - 5.5. Each table corresponds to one of the 5 regions used. Listed are the observed and fitted unscaled shock trajectory data, the scaled fitted shock trajectory data, and the computed shock velocities and peak parameters associated with shock front

strength: peak hydrostatic overpressures in atmospheres and in kilopascals, peak particle velocities in Mach units, and peak density ratios. Given as ratios, these peak parameters are the same scaled as unscaled. Pressure given in kilopascals in the tables refers to the unscaled (observed) case only.

The shock front radius versus time data derived using particle trajectory analysis (PTA) are also shown in Figures 7.1 - 7.3 for the two primary fronts, the two Mach stems at the interaction plane, and the ground Mach stem, respectively. They are compared to corresponding data derived from refractive image analysis (RIA) reported by Dewey et al (1975). The refractive image analysis results were obtained using photogrammetry against a striped canvas backdrop and they describe the shock as it travelled in a direction almost diametrically opposite to the direction of the smoke puff grid.

#### 4.2 Shock strengths

Peak particle velocities calculated from shock front velocities are shown in Figures 8.1 - 8.3 for the primary fronts, interaction Mach stems, and the ground Mach stem. This method of determining peak particle velocities has been labelled method 1, and the data plotted correspond to

those listed in Tables 5.1 - 5.5. The results in the figures are compared with those previously obtained using refractive image analysis (RIA). In the case of the primary shock fronts, results are also compared to those of Brode (1957) for TNT.

Peak particle velocities calculated as the derivatives of the fitted particle trajectory functions at the time of shock arrival are shown in Figures 9.1 - 9.3, labelled method 2. Corresponding numerical data are listed in Table 4. Results are compared to Brode in the primary front case, and with the results of method 1 in the Mach stem cases.

Peak particle velocities calculated by fitting particle velocity as a function of radial position in a region at a fixed time, and extrapolating to the shock radius at that fixed time (method 3), are shown in Figures 10.1 - 10.3. The corresponding numerical data are listed in Tables 6.1 - 6.5. Peak particle velocities are compared to Brode in the primary front case, and to method 1 results in the Mach stem cases.

Some of the data from which the method 3 results were extrapolated are shown in Figure 11.1. Shown are the magnitudes of the particle velocity vectors throughout the blast wave in the regions of the Mach stem regions above and below the interaction plane. Results are plotted versus a radial coordinate computed in the same manner as for the time-of-arrival results. Also shown are the straight line fits to the data, extrapolated to the shock front radius at each of

the times shown. Figure 11.2 shows similar results for the primary shock front regions, compared to the results of Brode for TNT.

#### 4.3 Particle velocity fields

The calculated particle velocities in the plane of the smoke puffs are shown as vectors in Figures 12.1 through 12.23 for times between 0.4 and 1.0 ms in 0.1 ms increments, and for times between 1.0 and 6.5 ms in 0.5 ms increments. The particle velocity field is shown at several other intermediate times to illustrate certain columns of smoke puffs being struck by the advancing shock fronts. All times and positions are scaled to a 1 kg charge in a standard atmosphere. Position coordinate axes extend horizontally and vertically from the corrected ground zero. The charge positions are also shown. The particle velocity vectors represent the derivatives of the smoothed particle trajectories, and their magnitudes may be judged using the standard vector shown on each figure. All velocities are measured in Mach units, relative to the standard sound speed. Puffs not yet struck by a shock wave are represented by small circles (zero velocity).

Numerical data corresponding to Figures 12.1 - 12.23 are listed in Tables 7.1 through 7.16, along with scaled radial positions of the puffs, and region codes as defined in Figure 6.

Conversion factors are given at the foot of each table, which may be used to convert the scaled data in the tables and figures back to their original unscaled values.

#### 4.4 Density and hydrostatic overpressure fields

Calculated average relative densities throughout the smoke puff plane are depicted graphically in Figures 13.1 - 13.23, for times between 0.4 and 1.0 ms in 0.1 ms increments, and between 1.0 and 6.5 ms in 0.5 ms increments. The average density field is shown at several other intermediate times to illustrate the transition of certain cell columns through their periods of peak density. All time values are scaled. Cell positions are scaled and are given relative to the corrected ground zero as origin with horizontal and vertical axes. Charge positions are also shown. The calculated densities may be judged using the density shading scale shown on each figure. Density is given as a ratio, relative to ambient density. Cells not yet struck by a shock wave and cells in which the density has dropped to a value less than ambient density are shown blank.

Corresponding numerical data are listed in Tables 8.1 - 8.8 along with radial cell positions computed according to the regions defined previously. Numerical data describing the fields of hydrostatic overpressure are similarly listed in Tables 9.1 - 9.8. The pressure results for a given cell were obtained by multiplying the density results for that cell by

a factor determined by the strength of the shock which first traversed the cell, but which did not vary with time.

#### 4.5 Times-of-arrival surface

Figure 14 shows a perspective view of the surface fitted to the original smoke puff positions and the observed times of first shock front arrival, i.e. to the data listed in Table 4. The grid mesh size is 0.1 by 0.1 meters (scaled), about 2.5 feet square (unscaled), or about 1/2 that of the original smoke puff grid. The charge positions are indicated on the vertical distance axis.

The times-of-arrival surface is smooth enough to permit contouring and the contours in this case (isochrones) represent shock front shapes at different times. These contours are plotted in Figure 15. The times-of-arrival surface was not smooth enough to permit the calculation of gradient vectors which could be used to compute shock velocity vectors and shock strengths over the new grid.

Two attempts were made to obtain contours of shock strength. In the first, the times-of-arrival surface was smoothed by least-squares fitting low-order, one-dimensional polynomial functions to the time-of-arrival data along each grid row and column separately, and computing the derivatives of the fitted functions to obtain the associated components of the surface

gradient vectors. Shock velocity vectors were obtained from the time-of-arrival gradients, and from these peak particle velocities were computed. The peak particle velocity (shock strength) surface is shown in Figure 16. The contours of this surface (not shown) did not exhibit any discontinuities across the boundaries of the shock front regions, as they would if surfaces were fitted to the times of arrival in each region separately.

The results of the second method used to compute shock strength contours are shown in Figure 17. These were obtained by interpolating an average shock radius at each value of peak particle velocity shown, for each shock front region in turn, using a composite of the various peak particle velocity versus radius curves shown in Figures 8 through 10. Arcs of circles with these radii, centered on the appropriate points along the vertical charge axis, were then drawn in the regions to represent shock strength contours. These peak value contours are discontinuous across triple point locii and other region boundaries. As a result, some horizontal lines are crossed twice by the same contour or, in other words, identical shock strengths can be found at two locations the same vertical distance from a reflecting surface, but at different radial distances from the vertical charge axis. Examples are illustrated in the figure.

#### 4.6 Field surface contours

Contours of equal particle velocity, density, hydrostatic overpressure, and dynamic pressure in the blast waves were determined for a series of times, using surfaces fitted to the various measured data fields at those times. Sample results are shown in Figures 18 through 21 at scaled times of 2.5 ms and 4.0 ms. The shock fronts shown in these figures are obtained from the time-of-arrival surface (as were those in Figure 15). Field contours such as those shown can be drawn for any scaled time between 0.5 ms and 6.5 ms. It should be re-stated that all of these results were obtained from the photography of the smoke puffs only and do not rely on the results obtained using the refractive image analysis (Dewey et al, 1975).

#### 4.7 Time histories

By mapping the physical properties of the blast waves at short time intervals it was possible to determine the time histories of these properties at any selected fixed position within the smoke puff grid. This was done at 12 fixed locations, three in the two primary regions and three in each of the three Mach stem regions, as shown in Figure 22. At each distance from the axis of the charges in the Mach stem regions, each of the time history stations is the same distance from either the interaction plane or the ground plane. Particle velocity time histories could be interpolated closest to the ground level

because these were measured at puff locations, whereas the density and pressure data were measured at cell centers.

Time histories of particle velocity, density, hydrostatic and dynamic overpressure at these locations are given in Figures 23 to 26.

Also plotted with the time histories are the interpolated values of the time of arrival of the first shock front at the stations. The height of this time-of-arrival line represents a peak value derived from the shock velocity analysis.

Time histories for hydrostatic and dynamic pressure are also plotted in Figure 27.1 to 27.7 for stations at the nominal positions of field-mounted pressure gauges on the "60 foot gun barrel". The gauges on this gun barrel were mounted at nominal elevations of 10, 15, 20, 27, 30, 33, and 40 feet. The time histories at these locations are given in unscaled units in order to facilitate comparisons with the gauge measurements.

The dynamic pressures plotted in figures 26 and 27 are maximum values, computed using both the x and y components of particle velocity. Similar plots were made of the horizontal components of dynamic pressure, but the differences were not significant since the y components of particle velocity at these locations were small. Other locations could have been chosen at which the y components would not have been insignificant.

## CHAPTER 5. DISCUSSION

### 5.1 Choice of Dipole West Shot 10

The results presented in this report were obtained from an original attempt to analyze an array of discrete two-dimensional particle trajectories within a blast wave. (During the preparation of this report Suffield Special Publication No. 71, by John Anderson was published, which also describes a blast wave two-dimensional particle trajectory analysis using somewhat different techniques to the ones presented here.) Previous analyses of blast wave particle trajectories were limited to those cases in which it could be assumed that the motion of the particles was rectilinear (Dewey, 1964; 1971).

Particle trajectory photogrammetrical measurements were made on Dipole West Shots 8, 9, 10 and 11, and it was decided to develop the two-dimensional analytical techniques using the measurements from Shot 10 because in this experiment a smaller number of smoke puffs had been used, and these puffs had formed with a high degree of success so as to produce an almost always complete rectangular array of particle tracers.

### 5.2 Particle trajectory analysis technique

The simplest possible techniques were used to analyze the particle trajectories obtained for Shot 10. The trajectory

of each puff was described by least squares fitting a low order polynomial to the time variation of both the x and y coordinates of the puff. The two polynomials obtained in this way could be differentiated at any point to give the particle velocity components, and interpolated to give the particle position at any time. The gas density within the blast wave was determined by using the positions of four adjacent puffs to define a quadrilateral cell. The resulting density is thus an estimate of the average density within the cell, the position of which is described by its centroid.

This analysis system considers each smoke puff in isolation, and although some smoothing of the data is achieved by the least squares fitting, no account is taken of the positions of adjacent puffs. Subsequently linear interpolation is used between the smoke puff positions so as to obtain a complete mapping of the blast wave properties throughout the domain of the smoke puff array.

### 5.3 Reliability and accuracy of the measurements

An attempt has been made in this report to evaluate the reliability of the particle velocity and density measurements obtained from the analysis of the time resolved smoke puff trajectories. This is not easy to do since there are no similar measurements with which the results can be compared. However, the particle trajectory results have been compared

with the peak shock front values obtained from the refractive image shock velocity measurements (Dewey et al, 1975). Also, hydrostatic and dynamic pressure results obtained from the particle trajectory analysis are presented for positions at which pressure gauges were mounted so that a direct comparison of the pressure-time histories will be possible.

Comparisons with the peak values at the shock front are not completely valid because the particle trajectory analysis method does not give results at the shock itself but only in the blast flow behind the shock. This necessitates extrapolating the particle trajectory data to the expected position and time of arrival of the shock. Extrapolation is rarely reliable and in the technique described as method 3, extrapolation was applied to data gathered from a large region of the blast wave and which thus showed significant scatter.

In order to calculate shock velocities assumptions were made about the shapes of the shock fronts. In the case of the primary shocks the assumption of sphericity appears to be valid. The shape of the Mach stem shock is still an open question. In the refractive image analysis (Dewey et al, 1975) the Mach stem shock positions were measured as close as possible to the reflecting surfaces and the assumption of cylindrical symmetry appears to have been valid. However, in the analysis of the smoke puff trajectories, measurements

could not be made so very close to these reflecting surfaces. It was clearly seen that the Mach stems were not cylindrical and as a first approximation it was assumed that these shocks were spherical with the centre at ground zero, or at the equivalent point on the ideal reflecting surface. This assumption gave results which were internally consistent, but it is clear that an investigation of the shape of the Mach stem shocks produced by a spherical shock reflecting from a plane surface, is a matter of urgency.

Three methods of calculating shock strength are described. The first uses the time of arrival of the shock front at the smoke puffs within a given region and analyzes these data in the same way as for the shock front refractive image photogrammetry described by Dewey et al, 1975. These results (PTA) are compared with the refractive image (RIA) results in Figures 8.1 to 8.3. There seem to be some significant differences between the results of the two measurement techniques: in particular the lowering of the Mach stem shock strength over the rough ground compared with the ideal reflecting surface is not so apparent when measured using the particle trajectory technique. This is probably due to the fact that the refractive image measurements were made within 0.3 m of the rough ground surface whereas the particle trajectory time-of-arrival measurements were made throughout the Mach stem region up to a distance of 4 m from the ground. Also,

the two sets of results describe the shock fronts travelling in opposite directions from the charges.

The second method of calculating peak particle velocities (shock strengths) used the derivatives of the two polynomials fitted to each particle trajectory, evaluated at the estimated time of shock arrival. Differentiation of a fitted polynomial at the extreme end of the observed data range is of questionable validity, and as might be expected the results plotted in Figures 9.1 to 9.3 show a considerable amount of scatter. This scatter is, however, uniformly distributed about the expected curve.

The peak particle velocities were also calculated by fitting all particle velocities in a region as a function of radial position in the region at a fixed time, and extrapolating to the shock radius at that time. Because of the scatter in the data obtained throughout the region, fitting the results to a curve of higher than first order did not seem justified. The results of these extrapolations are shown in Figures 10.1 to 10.3.

Although the extrapolation of the particle trajectory data beyond its domain of validity has produced a large degree of scatter, the peak particle velocity results are generally consistent with the results calculated using the method of refractive image analysis.

An attempt has been made to estimate the inherent accuracy and reliability of the particle trajectory measurements. A smoke puff typically has a diameter of about 0.3 m, and it is estimated that the centre of such a puff is identified with an accuracy of approximately  $\pm 0.1$  m. This leads to an estimated maximum error in particle velocity of  $\pm 0.008$  m/ms ( $\pm$ Mach 0.035), and an average density ratio of  $\pm 0.35$ . The mean peak particle velocity and density ratio measured in this experiment were approximately Mach 1 and 2.5 respectively, and so it is estimated that the accuracy of the reported results is approximately 5% for particle velocity and 15% for density ratio.

Dynamic pressure ratios were computed from the velocity and density results and are estimated to be accurate to within about 20%. Hydrostatic pressure ratios were computed using the density results and the peak overpressures computed from the shock velocities. Because the shock velocity data depended on region definitions and, in the case of Mach stems, on assumed shock front shapes, the accuracy of the hydrostatic overpressures computed behind the shock fronts is the most difficult to judge. Hydrostatic pressure ratios computed using cylindrical and spherical Mach stem shapes differed by as much as 10%. Combining this maximum figure with the estimated uncertainty given above for densities, it is estimated that the inaccuracy of the hydrostatic overpressures reported may be as high as 25%.

#### 5.4 Surface mapping and contouring

The initial analysis of the smoke puff positions measured from the films provided a measure of the particle velocity of each smoke puff and the average density in each cell of four adjacent puffs. Chapter 3 described the use of linear and planar interpolation between the discrete values of particle velocity and density so as to provide a complete mapping of the parameters in the x-y plane, at any specified time. From such mappings, various contours were drawn to connect points having the same parameter value. In addition, from sequences of such mappings it was possible to determine the time histories of the parameters at several fixed positions within the smoke puff array.

A considerable amount of information is obtained from the analysis of the particle trajectories, and it seems clear that contour mappings and time histories best display this information. The contours can be compared easily with similar results from computer code predictions of the blast properties, and the time histories of hydrostatic and dynamic pressure can be readily compared with gauge measurements. To facilitate future comparisons the contours can be mapped at any specified time during the passage of the blast wave, and the time histories can be calculated for any specified position within the smoke puff array. Such outputs will be provided on request.

### 5.5 Dynamic pressure corrections

The dynamic pressure presented in this report is defined as one half the local gas density times the square of the maximum velocity component. In comparing these results with total head gauge measurements, compressibility corrections should be applied in the higher velocity regions.

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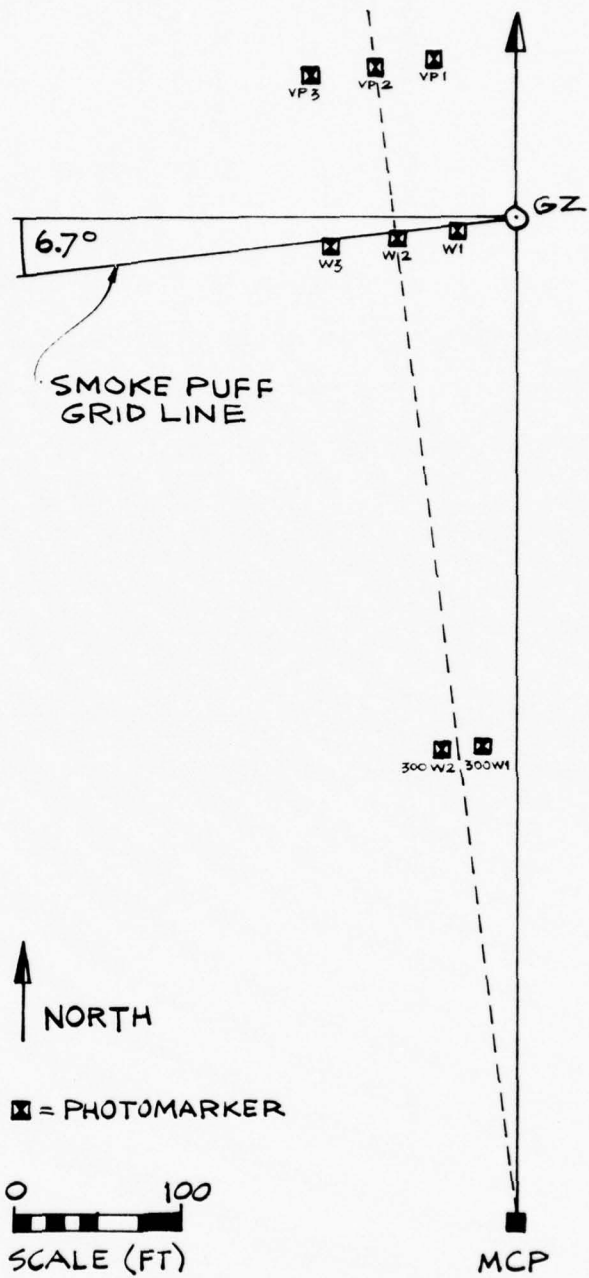


Fig. 1 Plan view of test site, Dipole West/10

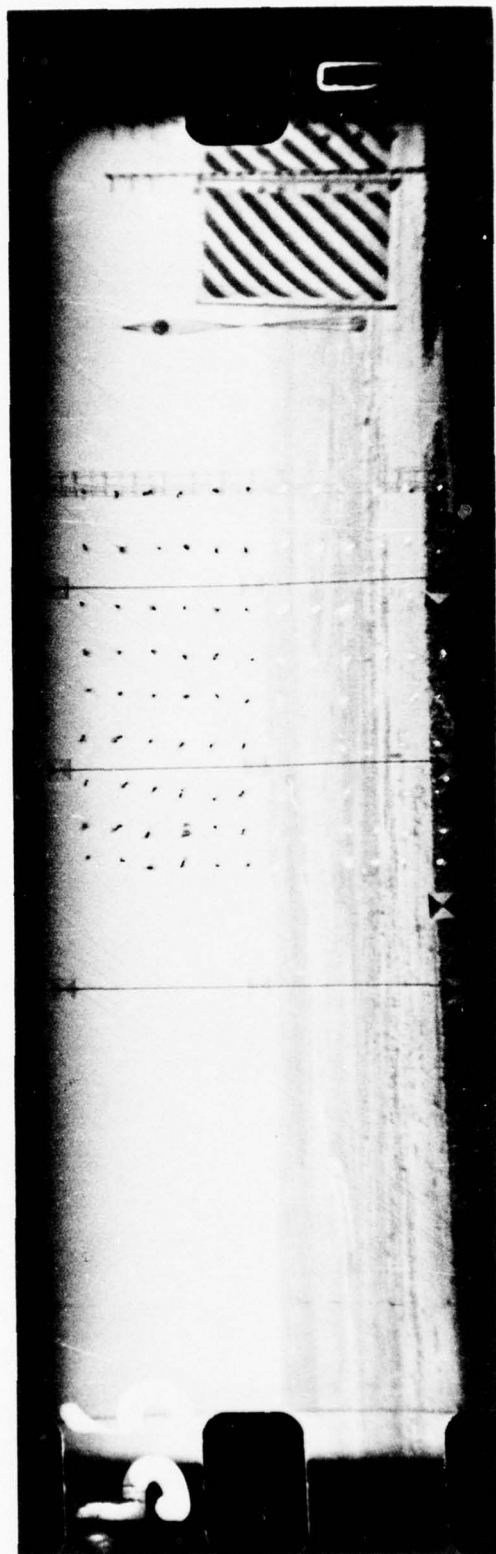


Fig. 2 Field of view of camera, Dipole West/10

□ = PHOTOMARKER POSITION IN OBJECT PLANE CALCULATED FROM SURVEY DATA  
 ○ = PHOTOMARKER POSITION IN OBJECT PLANE TRANSFORMED FROM FILM IMAGE

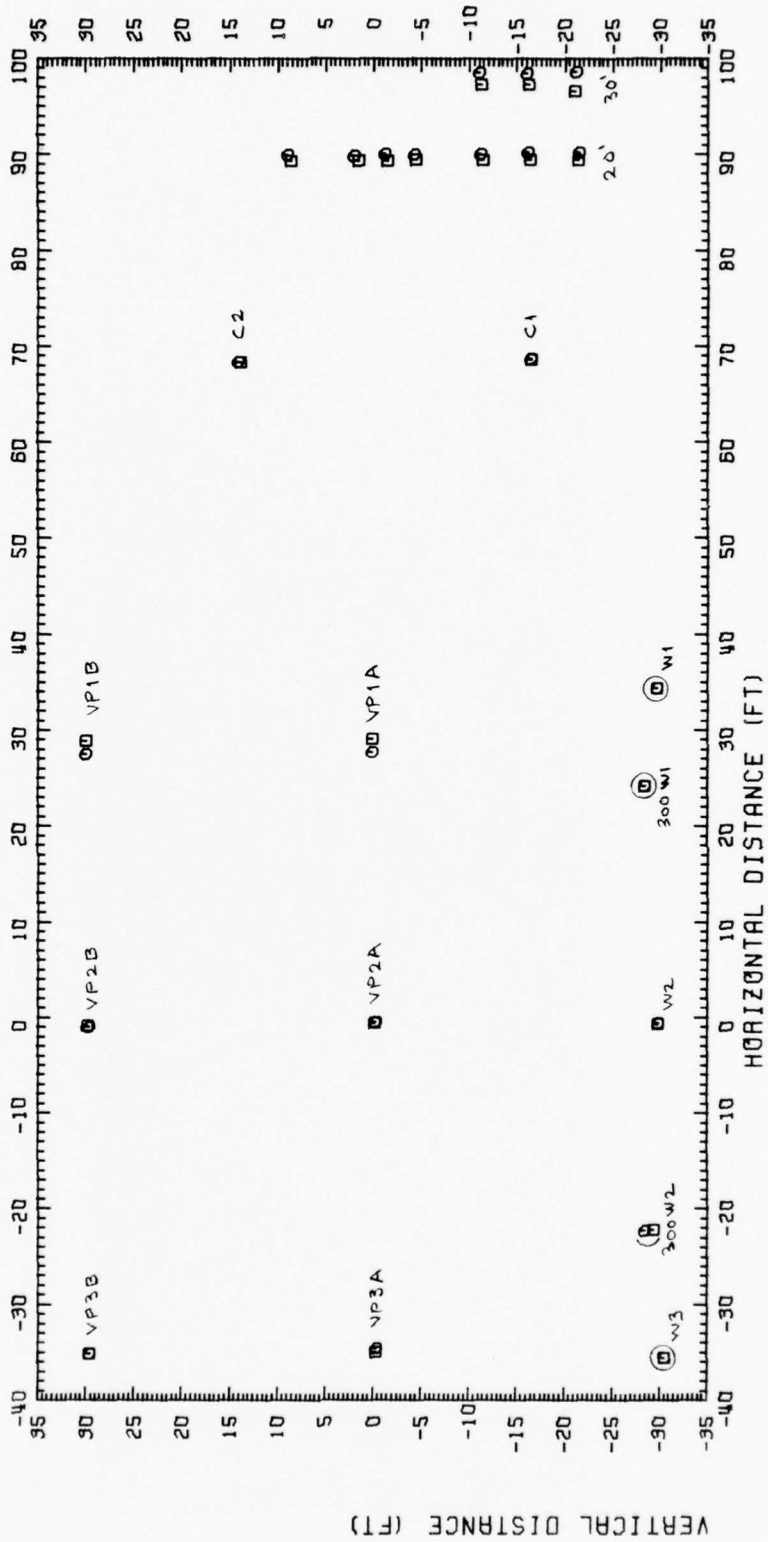


Fig. 3 CAMERA CALIBRATION, DIPOLE WEST/10

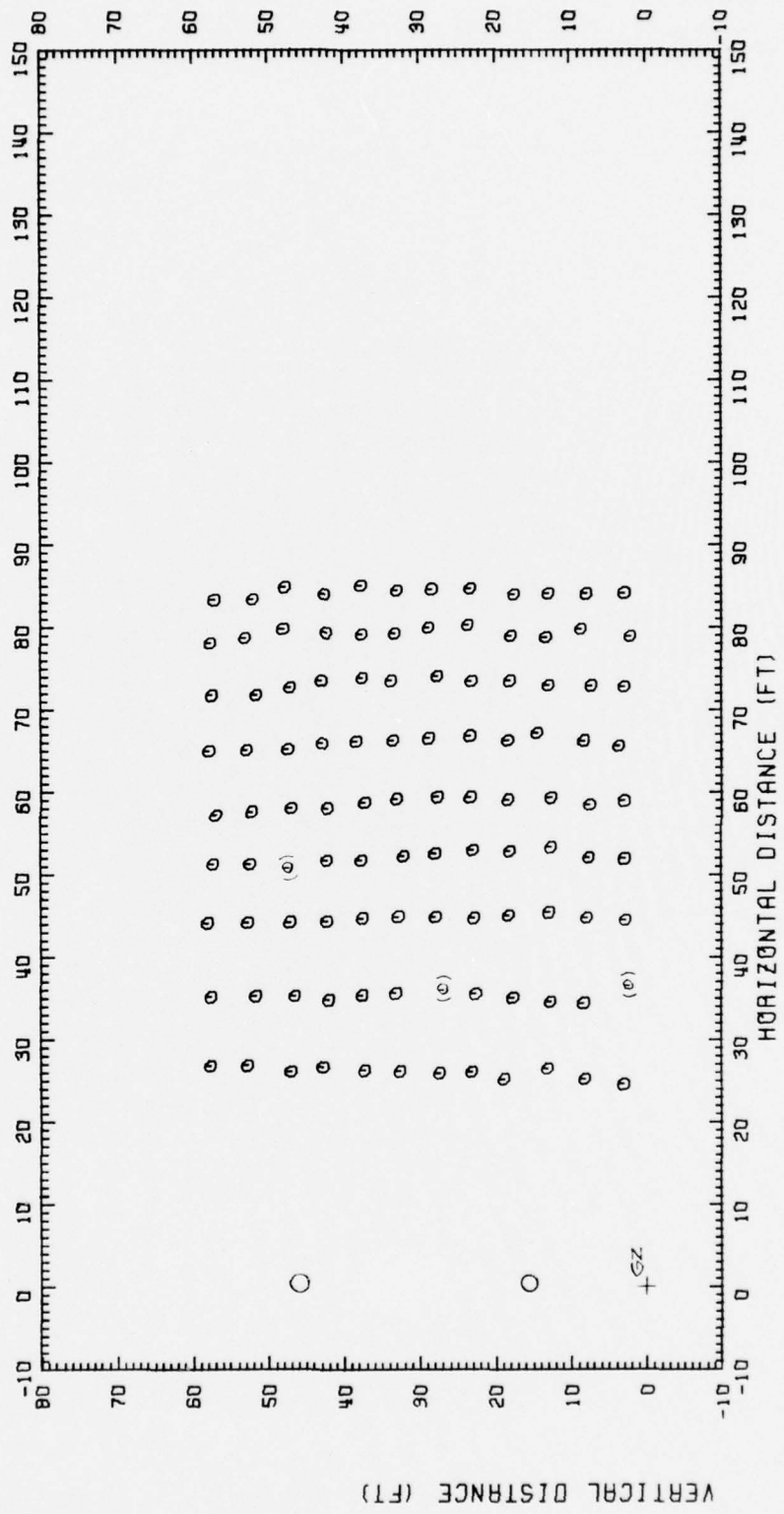


Fig. 4 SMOKE PUFF GRID, DIPOLE WEST/10

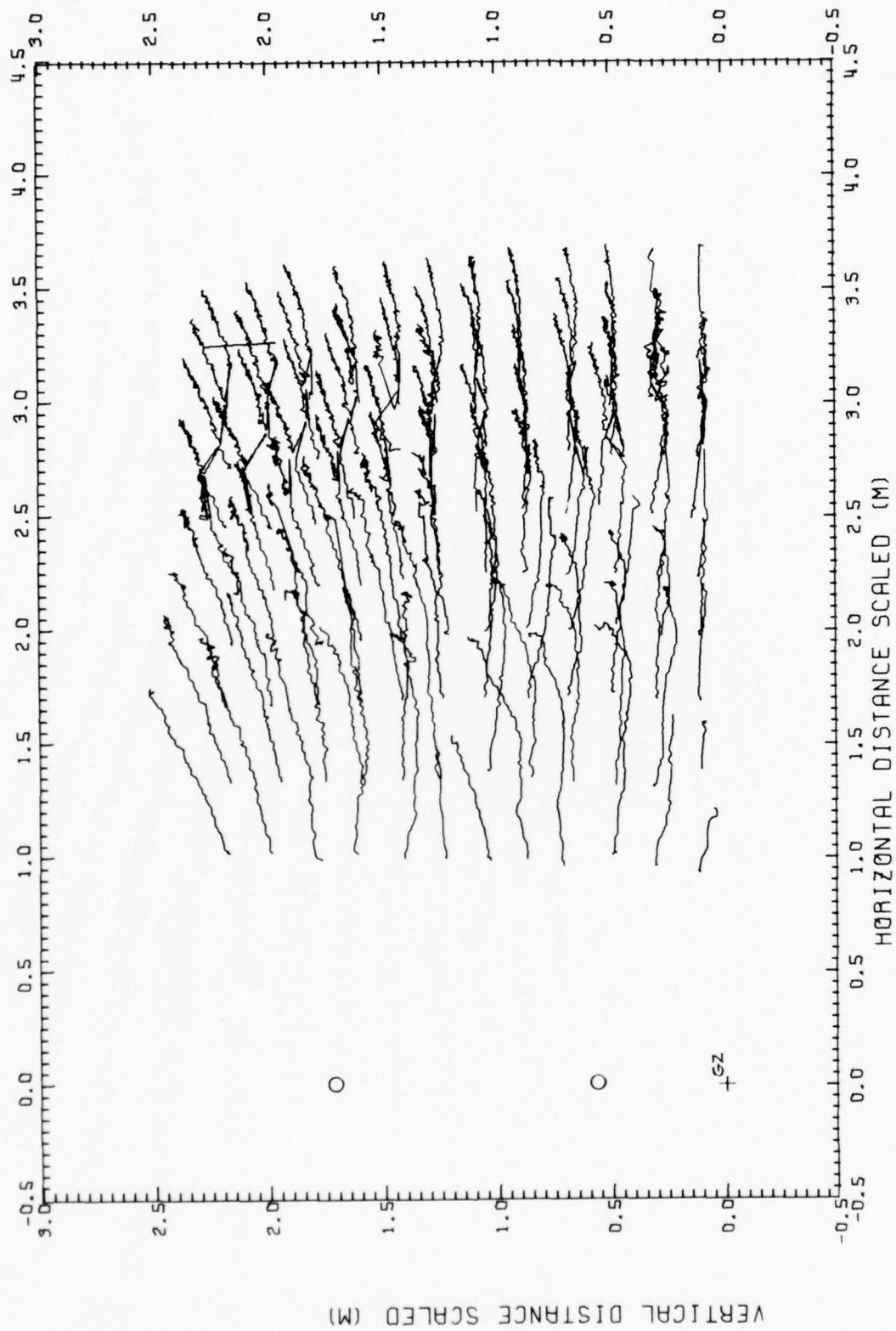


Fig. 5 PARTICLE TRAJECTORIES, DIPOLE WEST/10

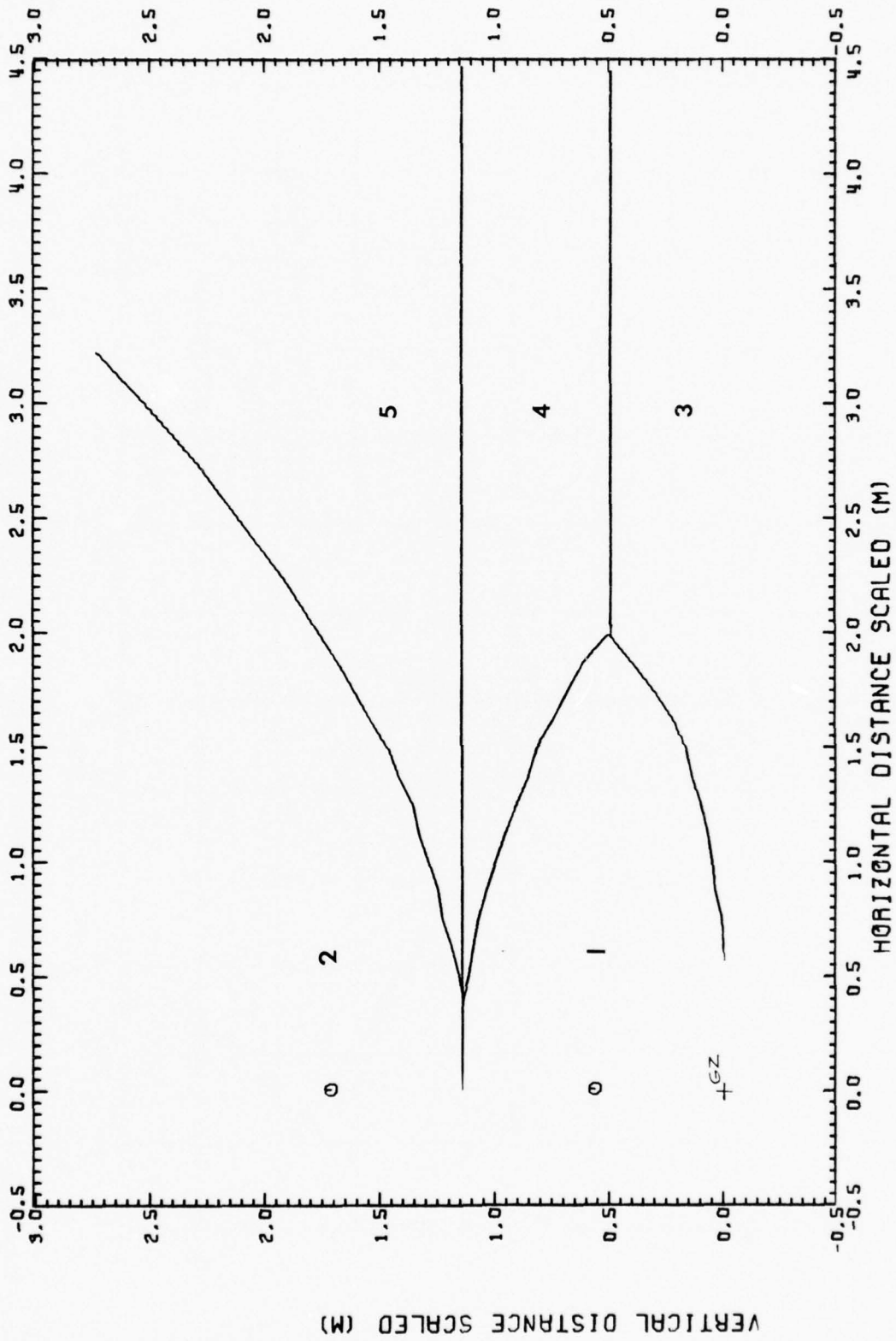


Fig. 6 REGIONS DEFINITION, DIPOLE WEST/10

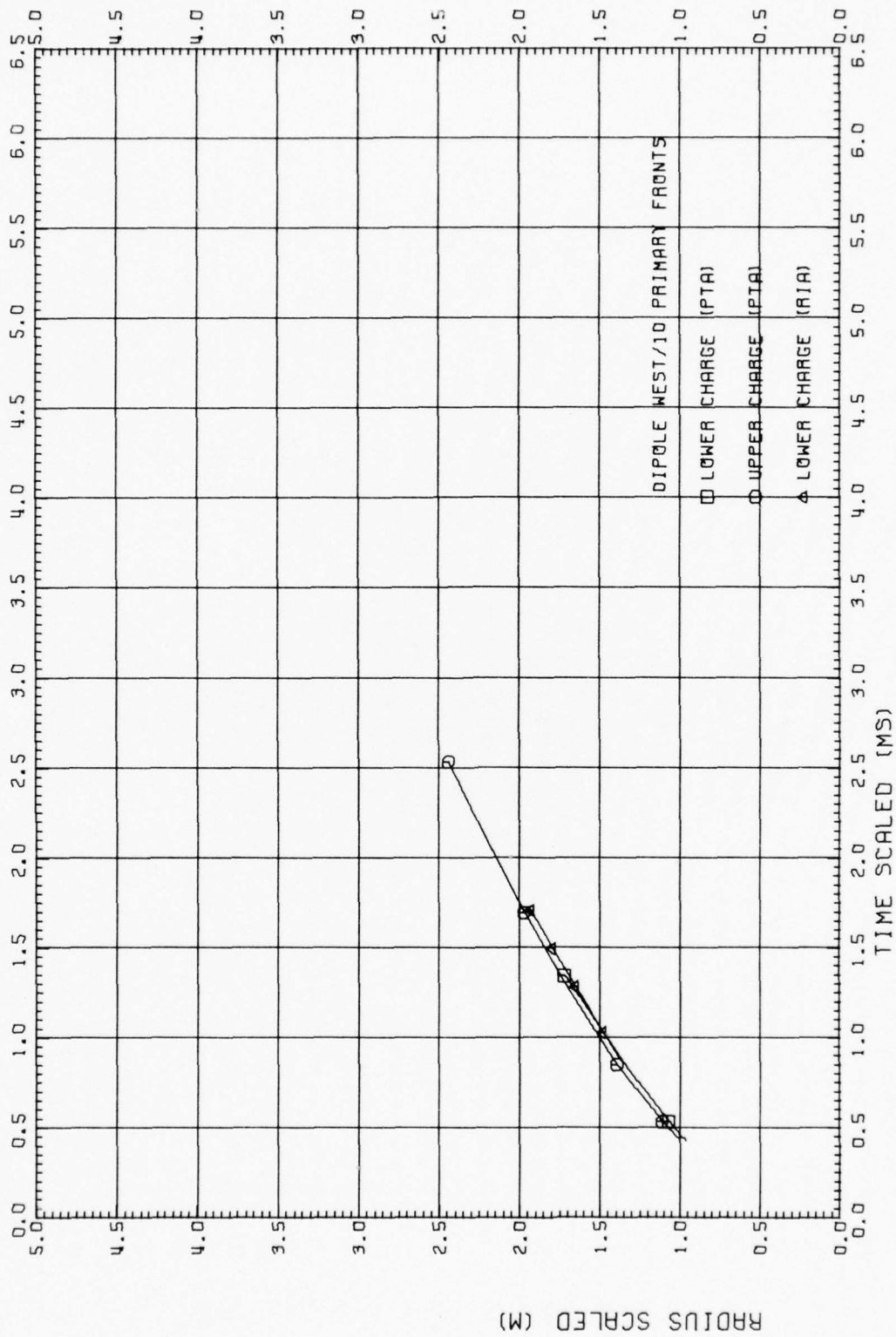


Fig. 7.1 SHOCK TRAJECTORIES, DIPOLE WEST/10

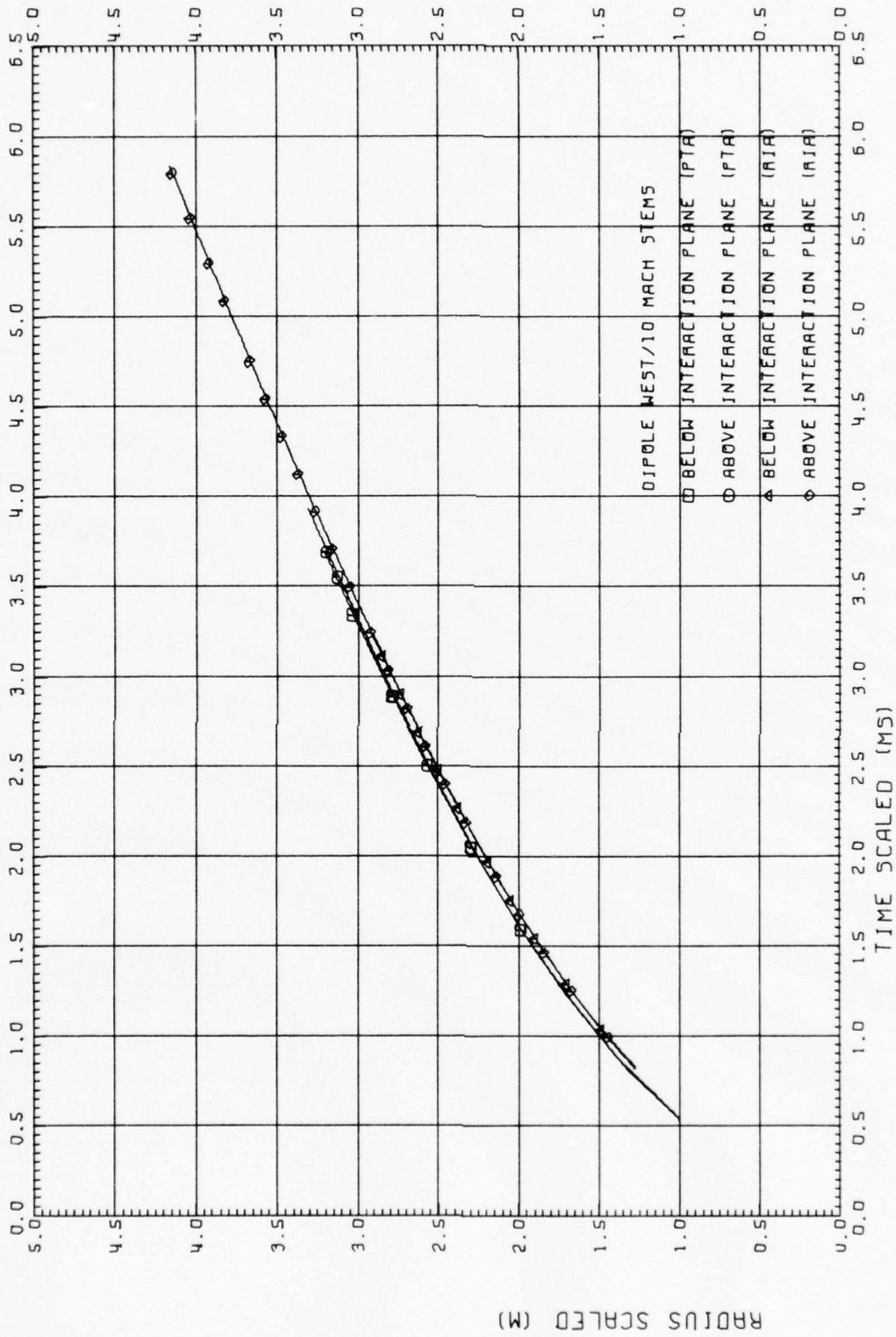


Fig. 7.2 SHOCK TRAJECTORIES, DIPOLE WEST/10

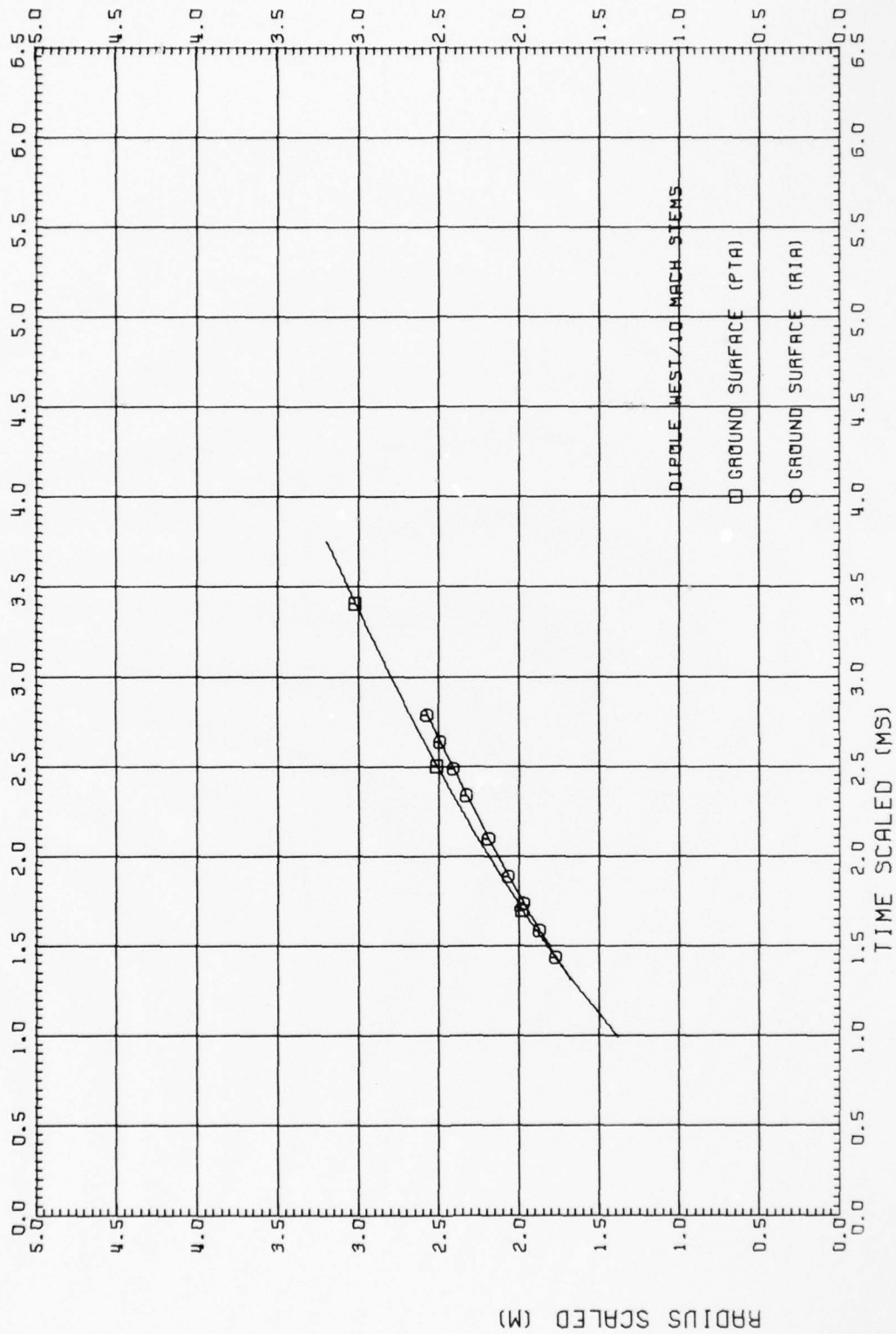


Fig. 7.3 SHOCK TRAJECTORIES, DIPOLE WEST/10

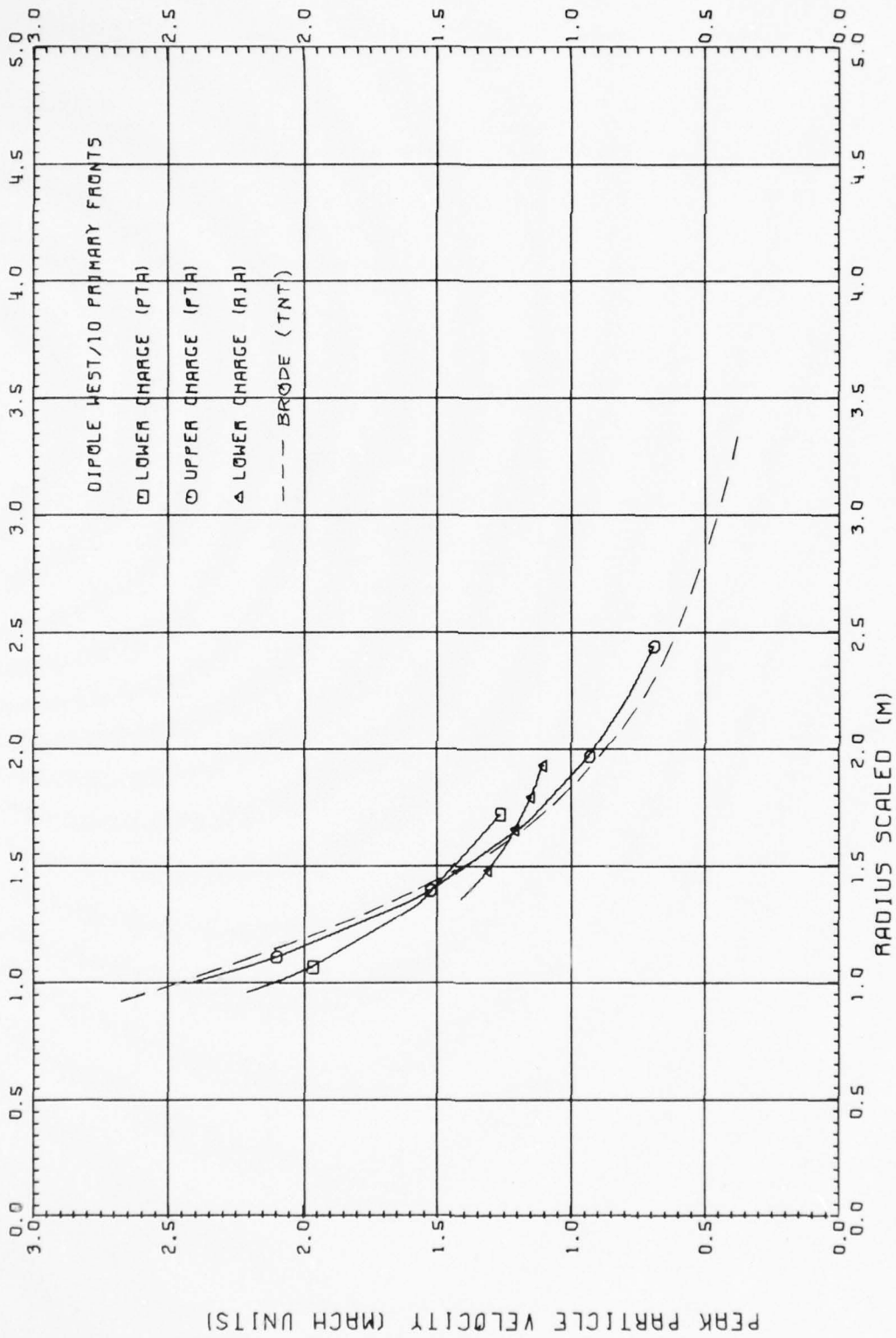


Fig. 8.1 SHOCK STRENGTH, METHOD 1

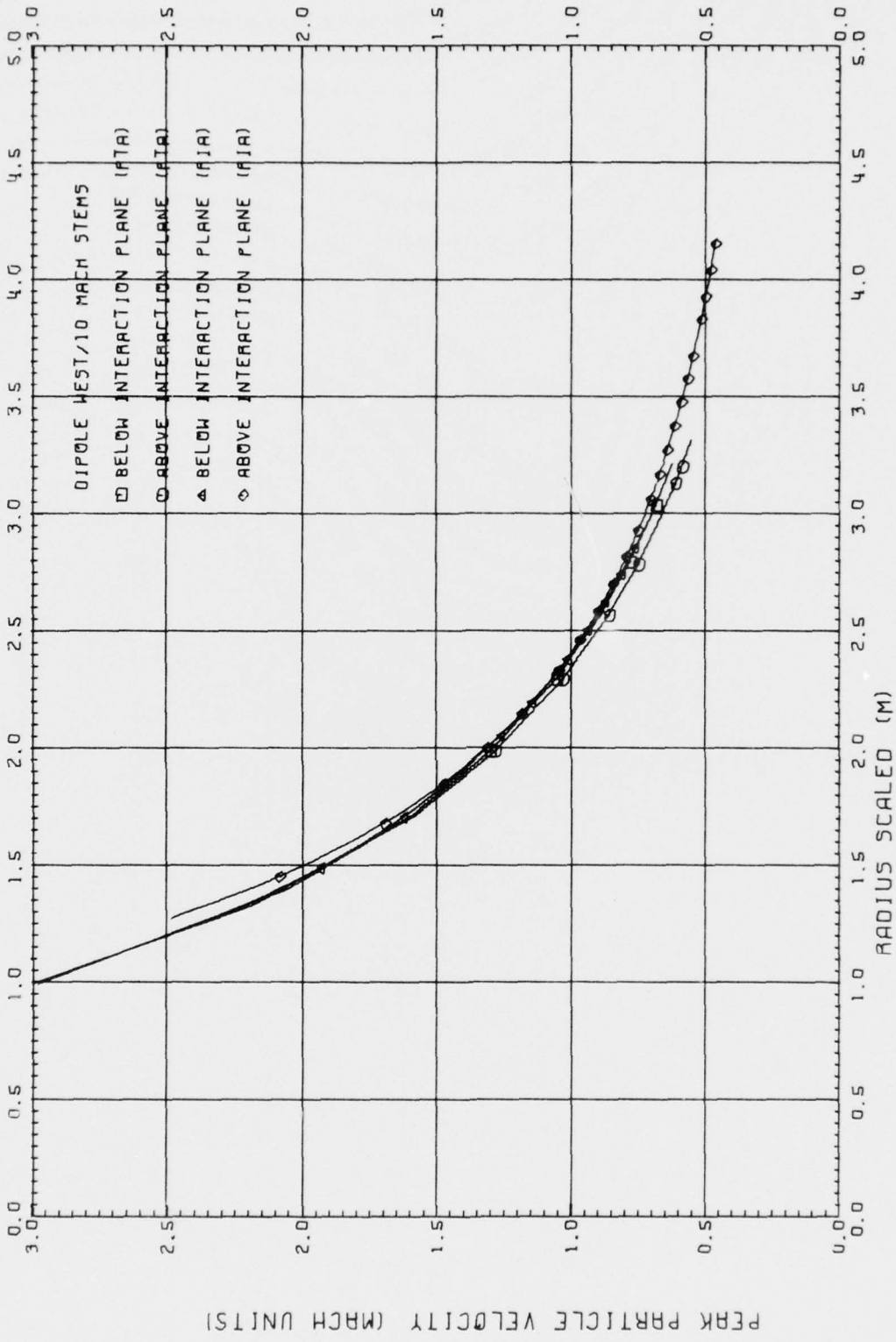


Fig. 8.2 SHOCK STRENGTH, METHOD 1

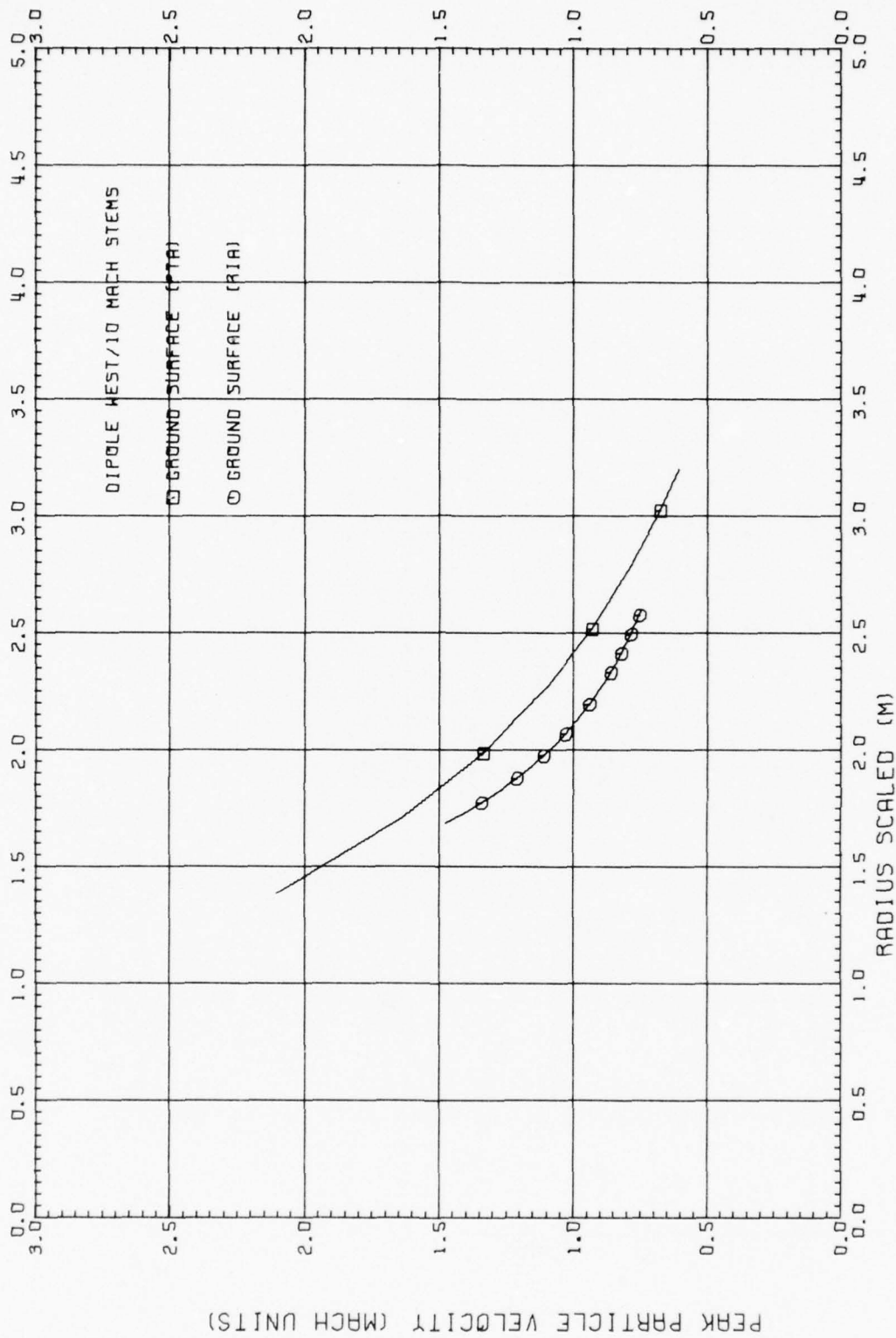


Fig. 8.3 SHOCK STRENGTH, METHOD 1

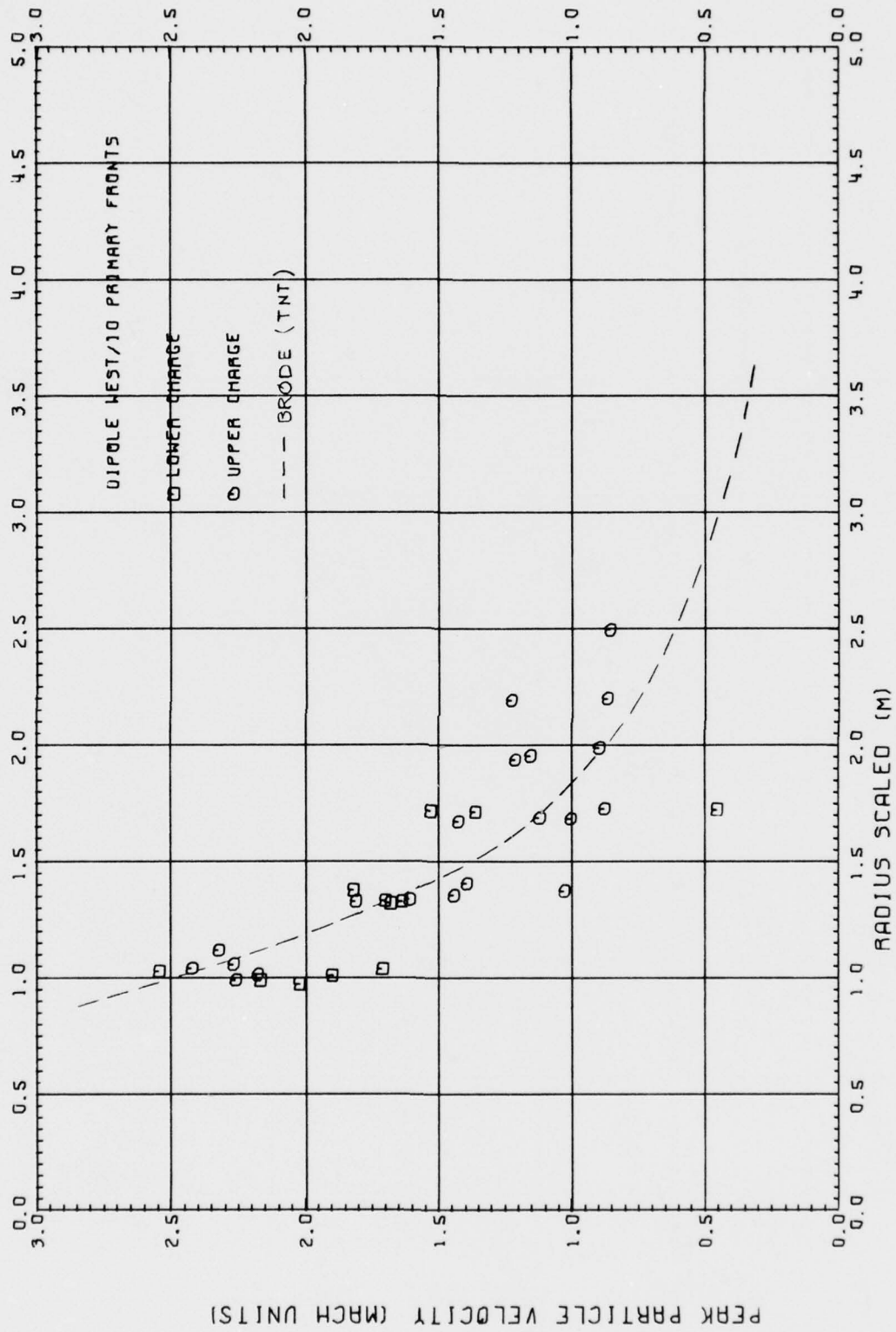


Fig. 9.1 SHOCK STRENGTH, METHOD 2



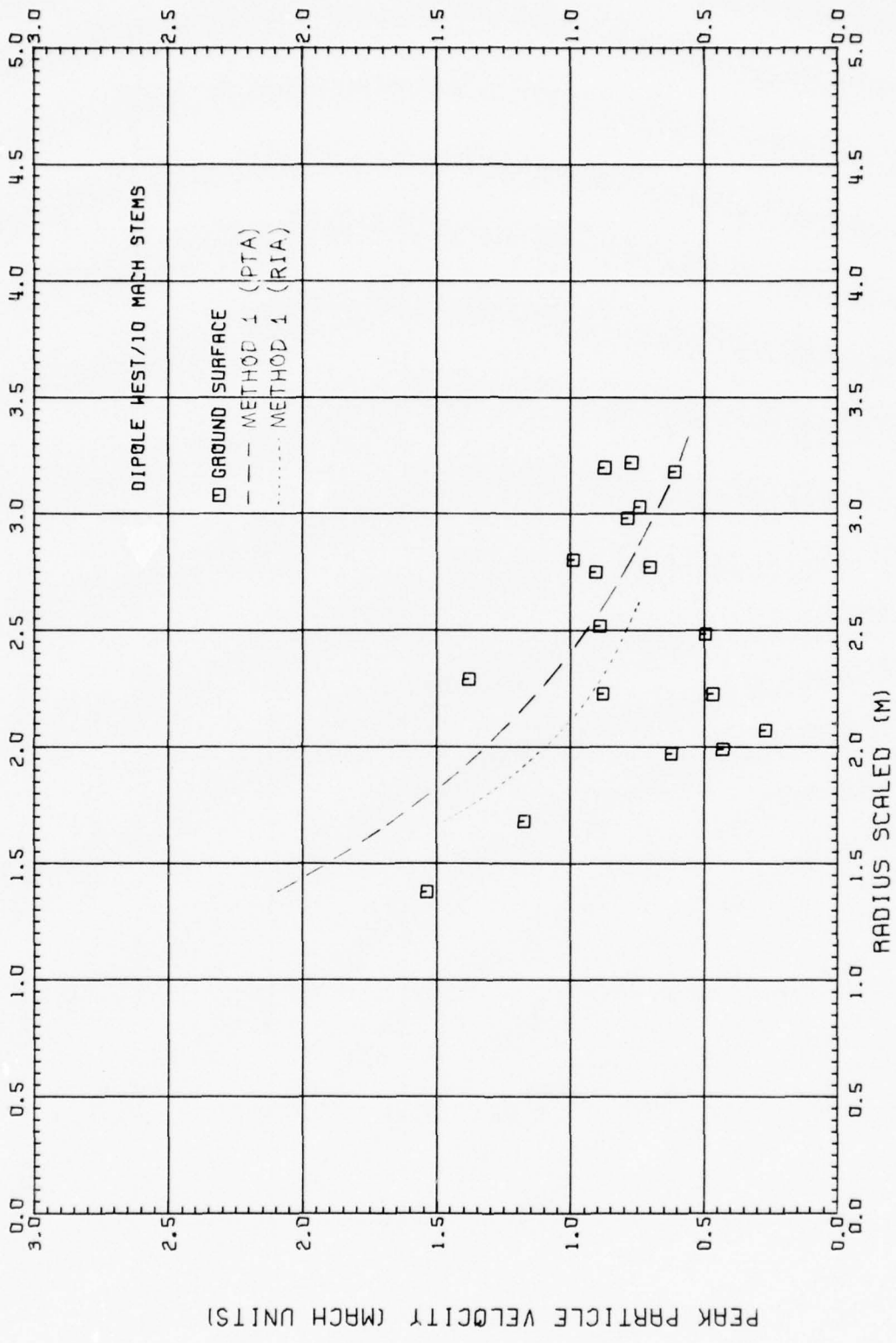


Fig. 9.3 SHOCK STRENGTH, METHOD 2

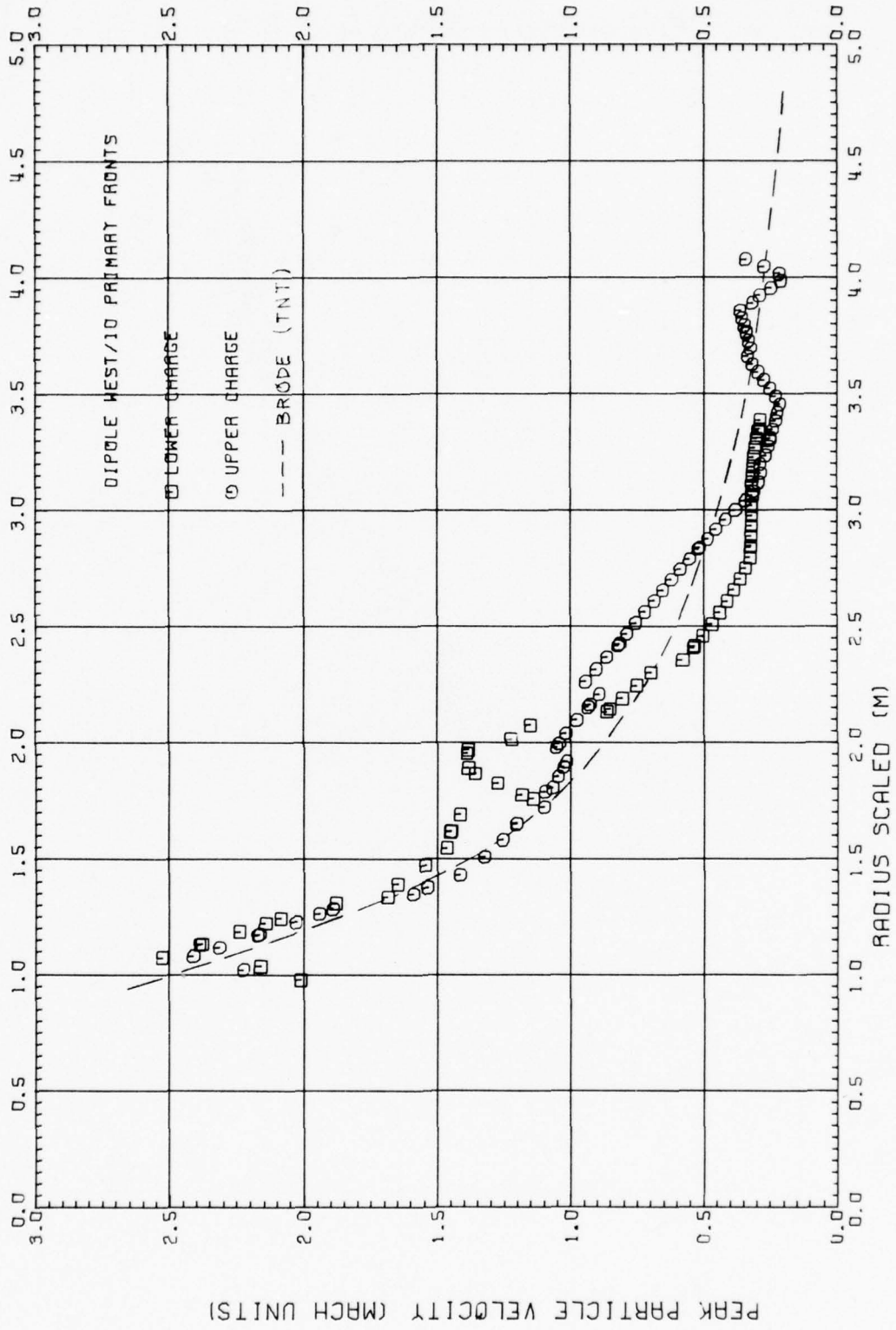


Fig. 10.1 SHOCK STRENGTH, METHOD 3

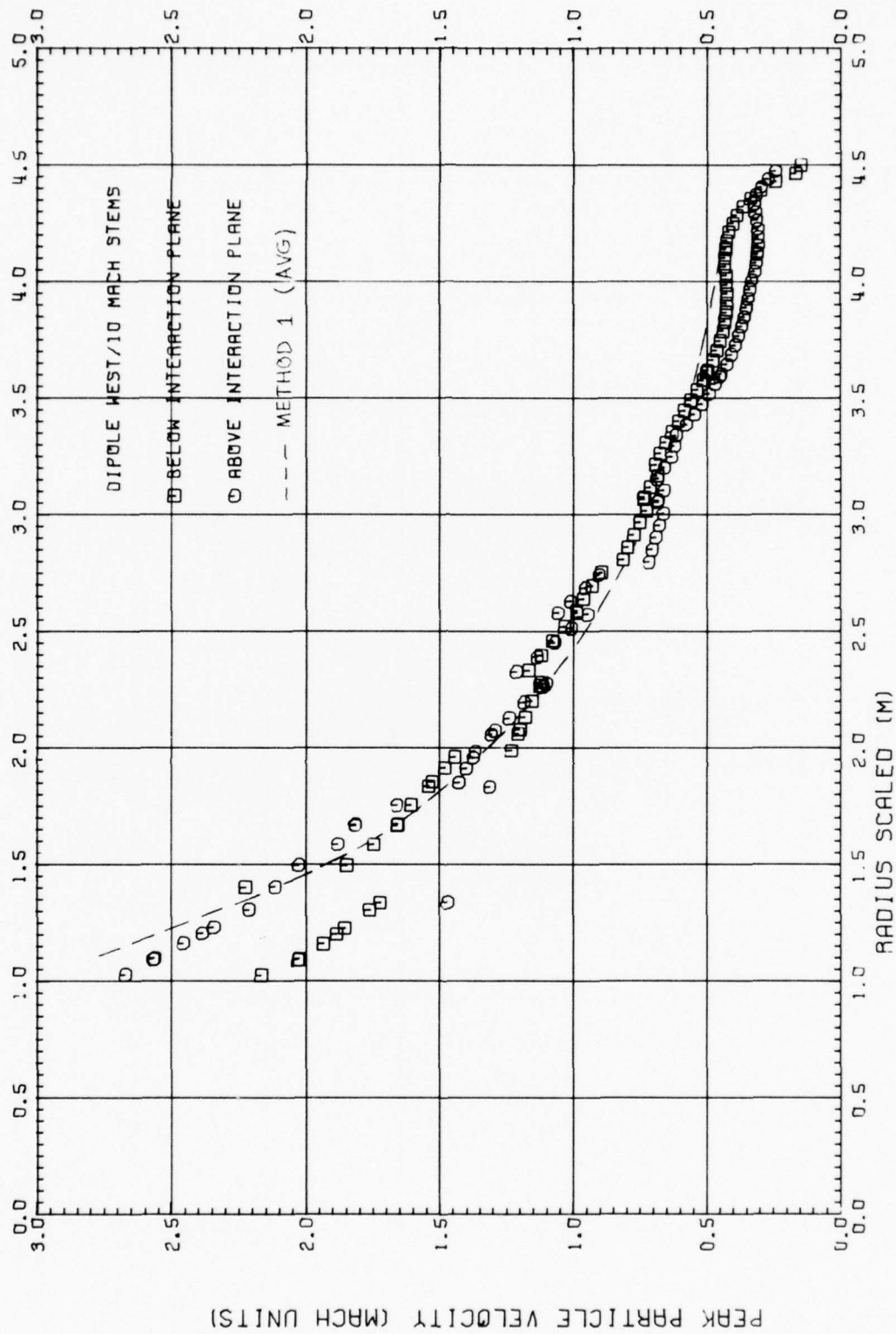


Fig. 10.2 SHOCK STRENGTH, METHOD 3

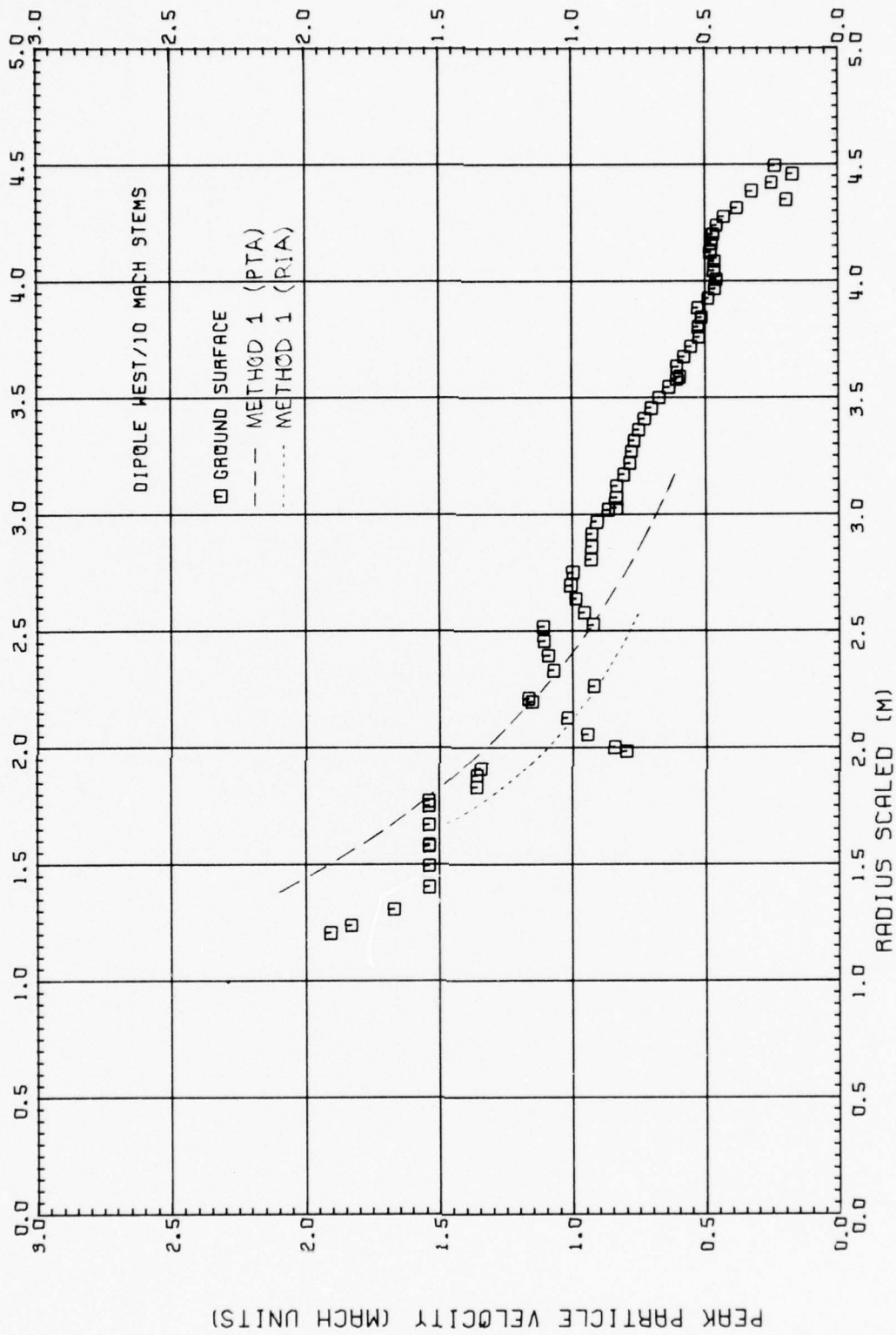


Fig. 10.3 SHOCK STRENGTH, METHOD 3

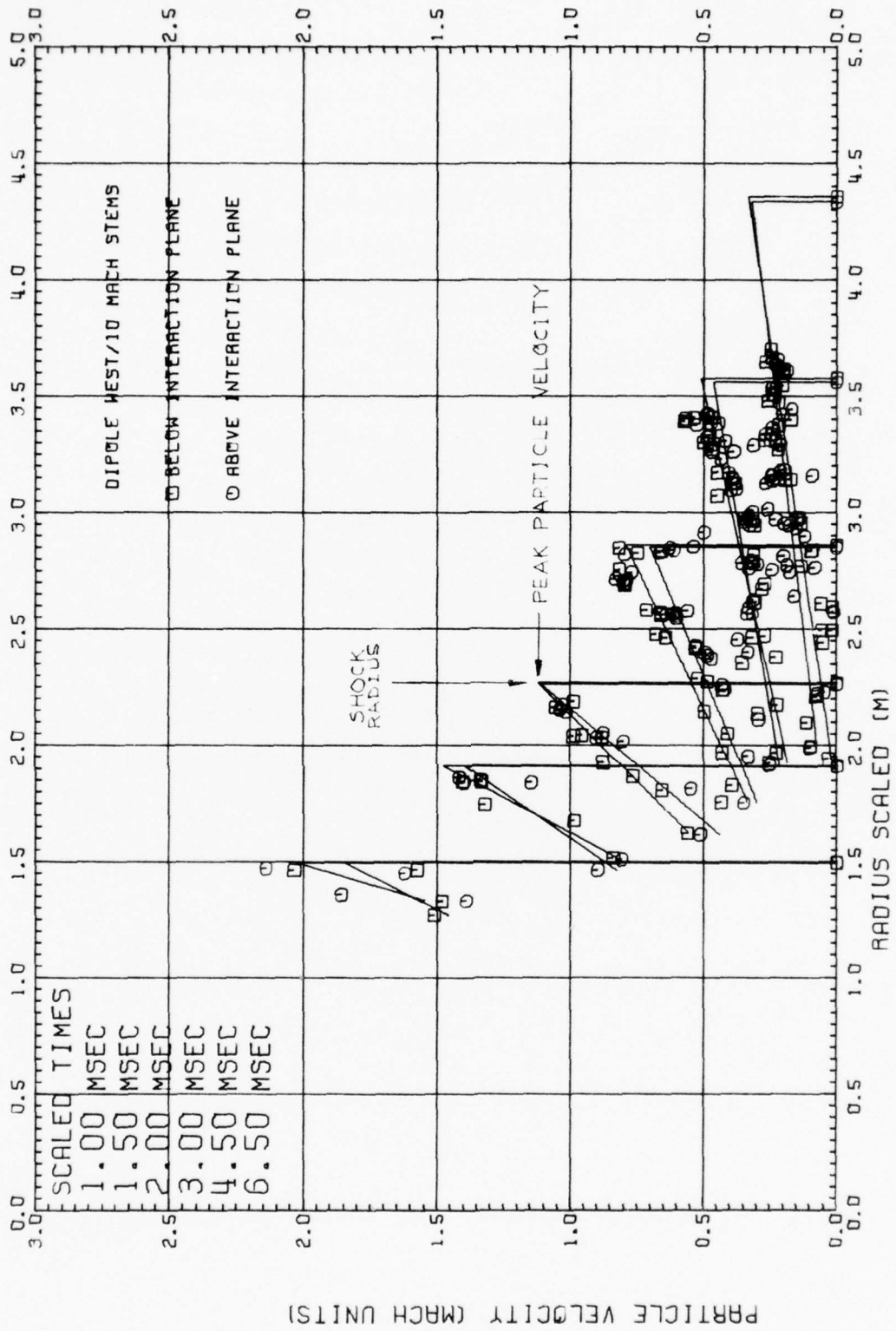


Fig. 11.1 PARTICLE VELOCITY, REGIONS 4 AND 5

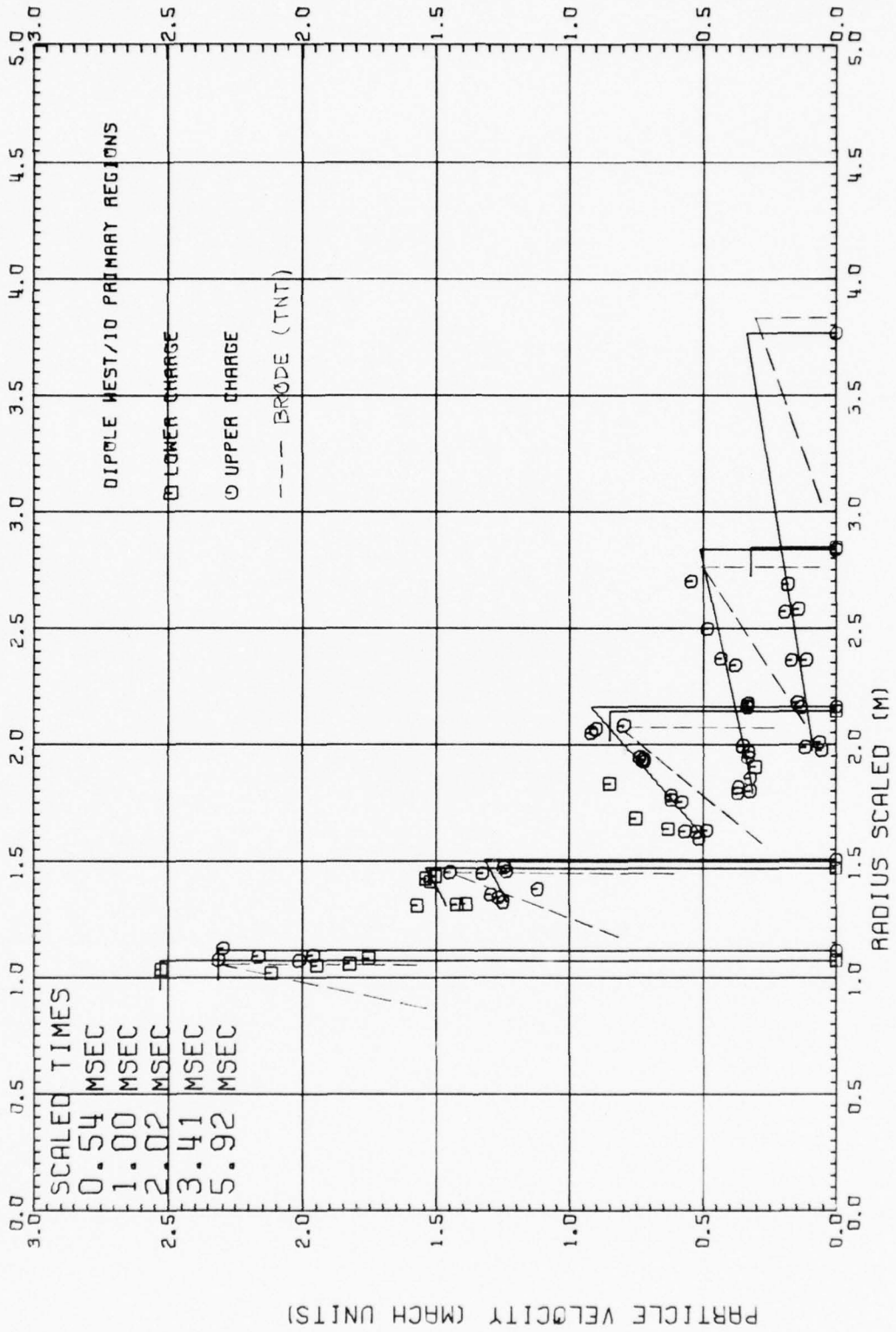


Fig. 11.2 PARTICLE VELOCITY, REGIONS 1 AND 2

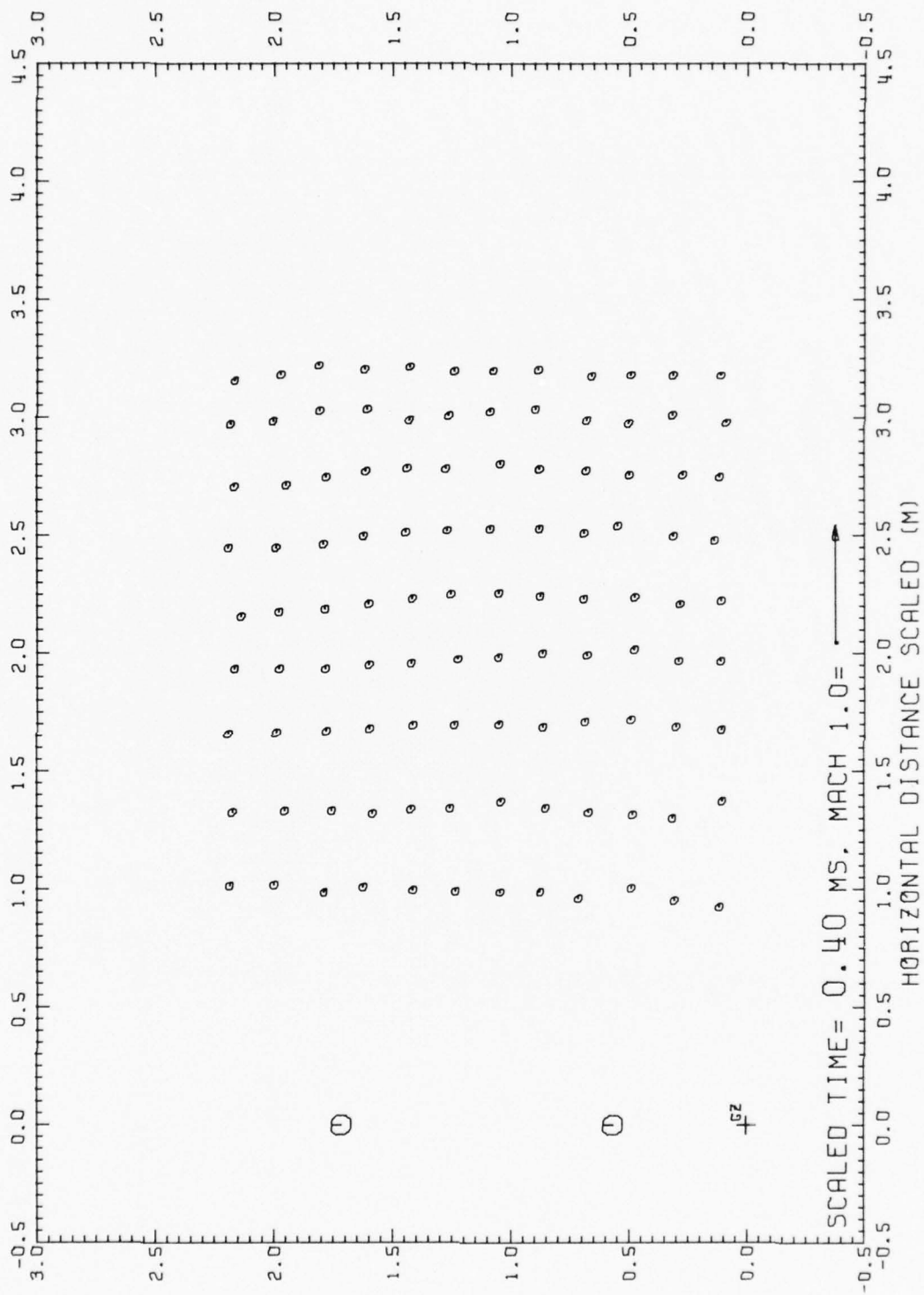


Fig. 12.1 PARTICLE VELOCITY FIELD, DIPOLE WEST/10

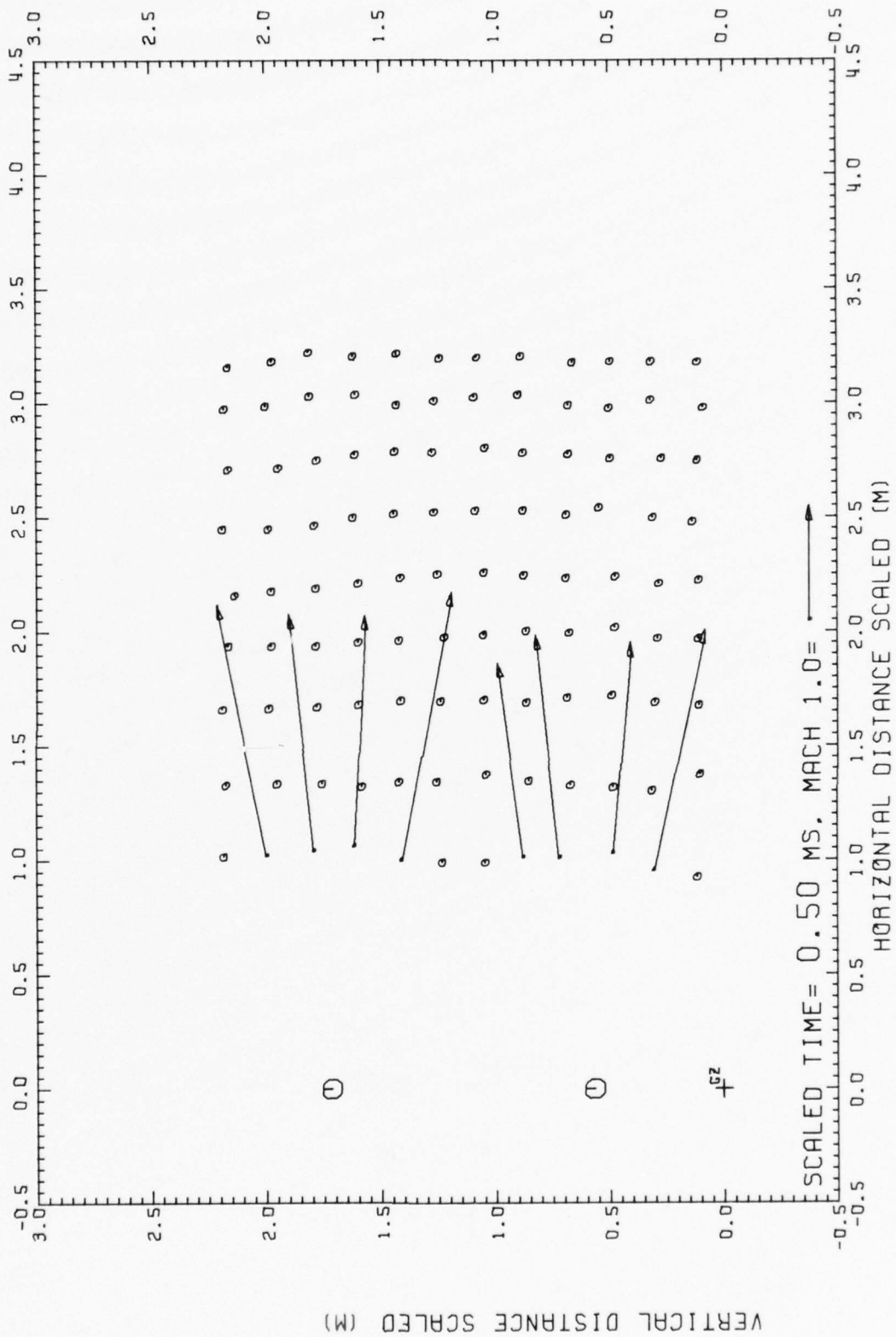


Fig. 12.2 PARTICLE VELOCITY FIELD, DIPOLE WEST/10

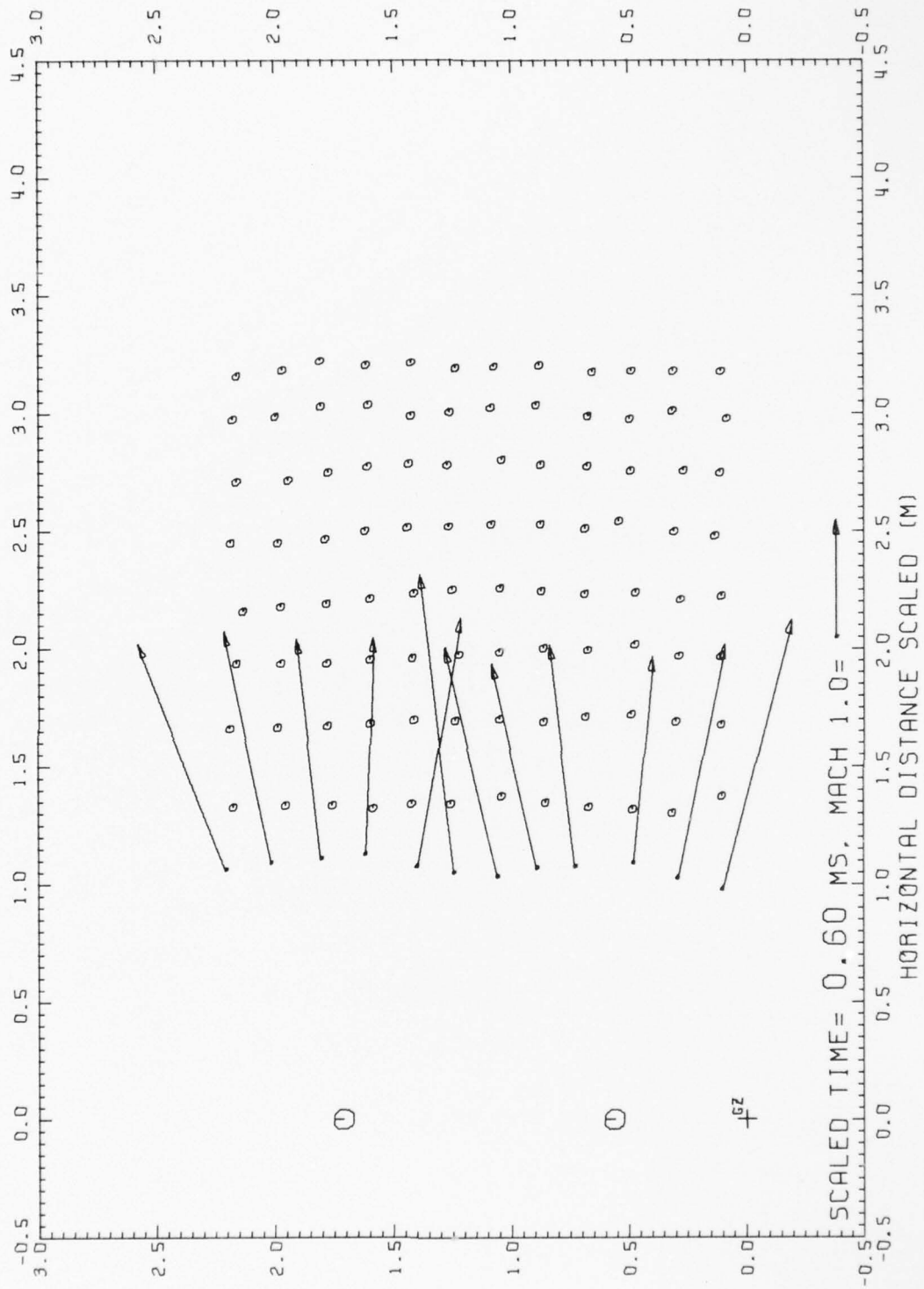


Fig. 12.3 PARTICLE VELOCITY FIELD, DIPOLE WEST/10

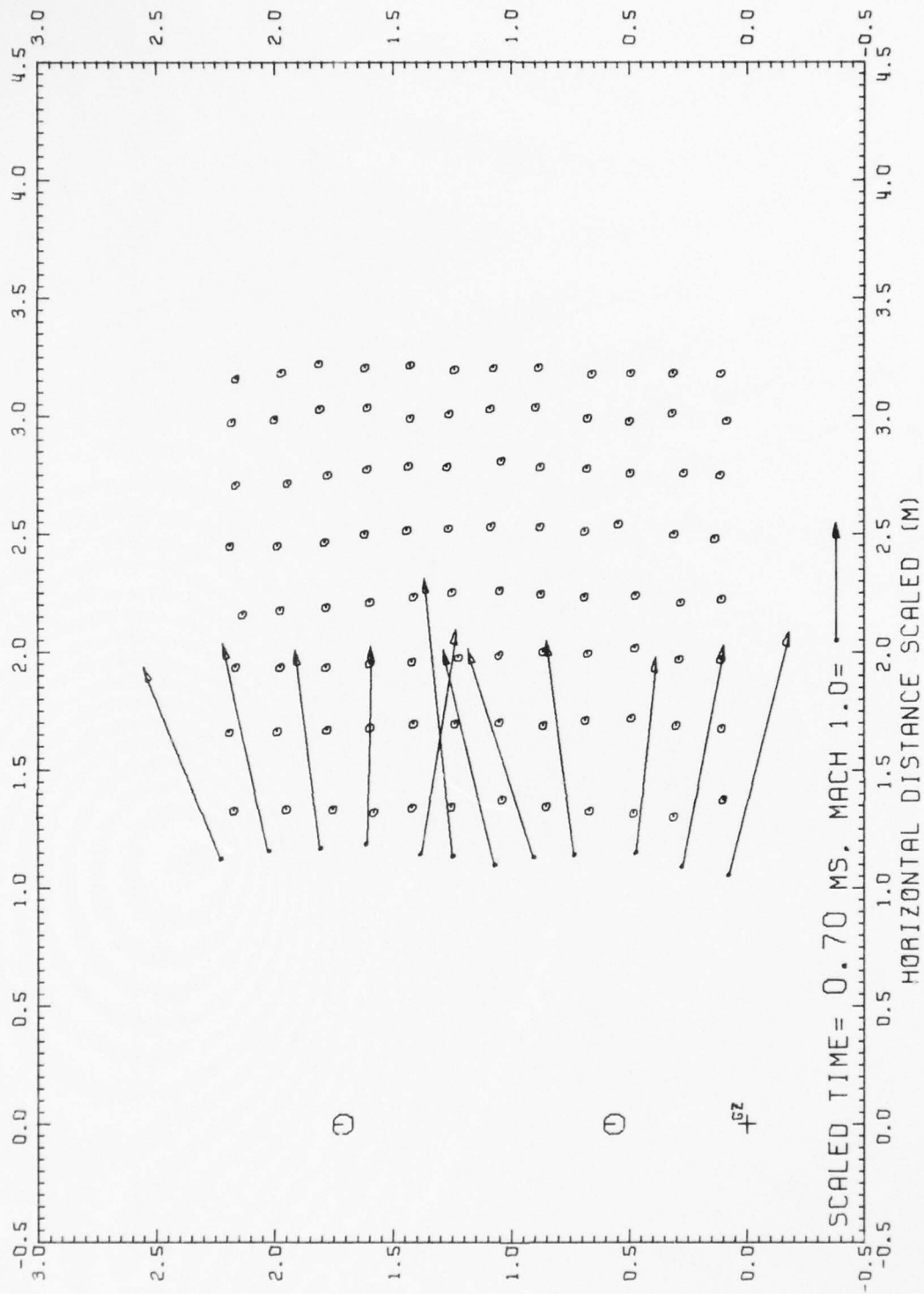


Fig. 12.4 PARTICLE VELOCITY FIELD, DIPOLE WEST/10

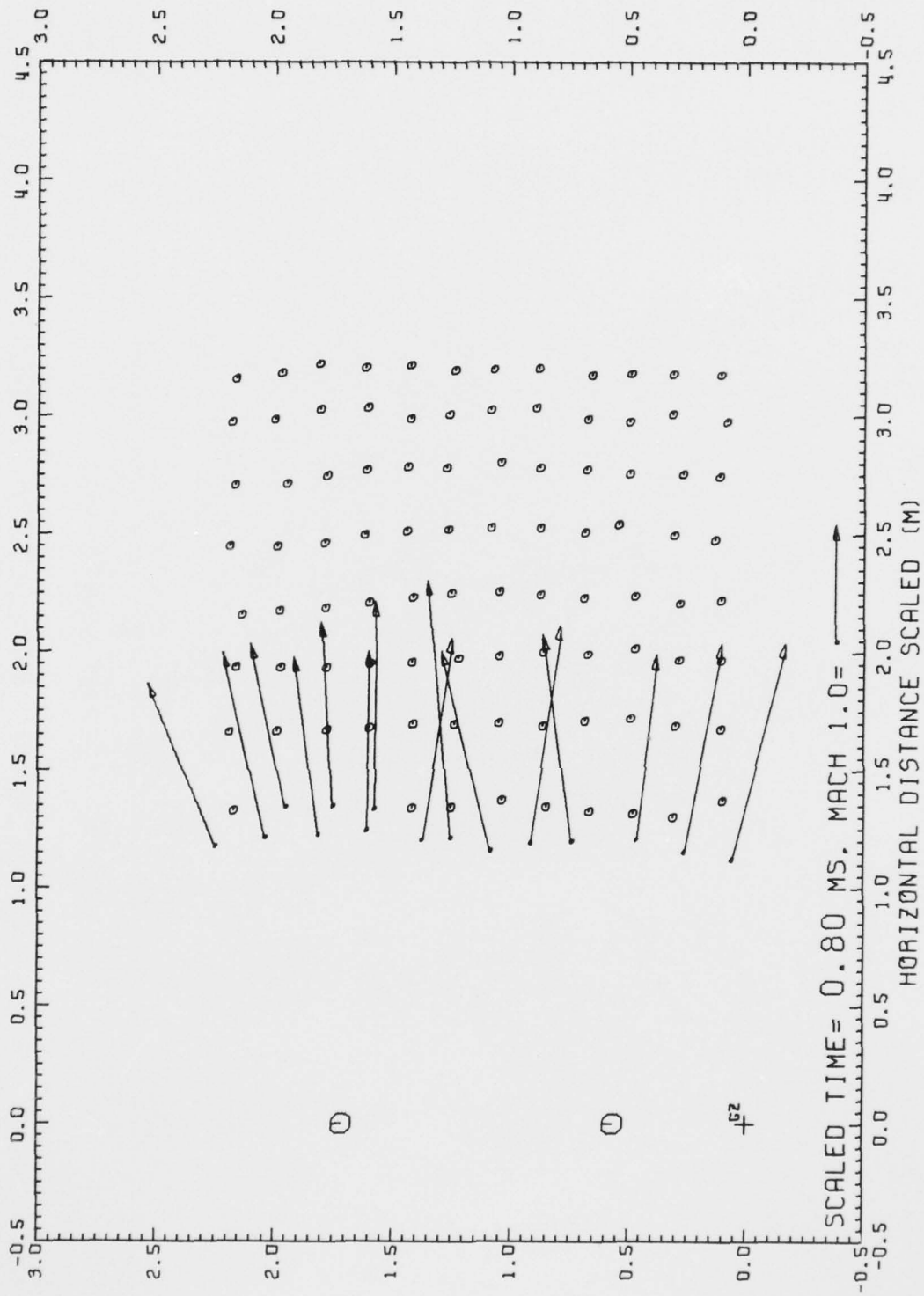


Fig. 12.5 PARTICLE VELOCITY FIELD, DIPOLE WEST/10

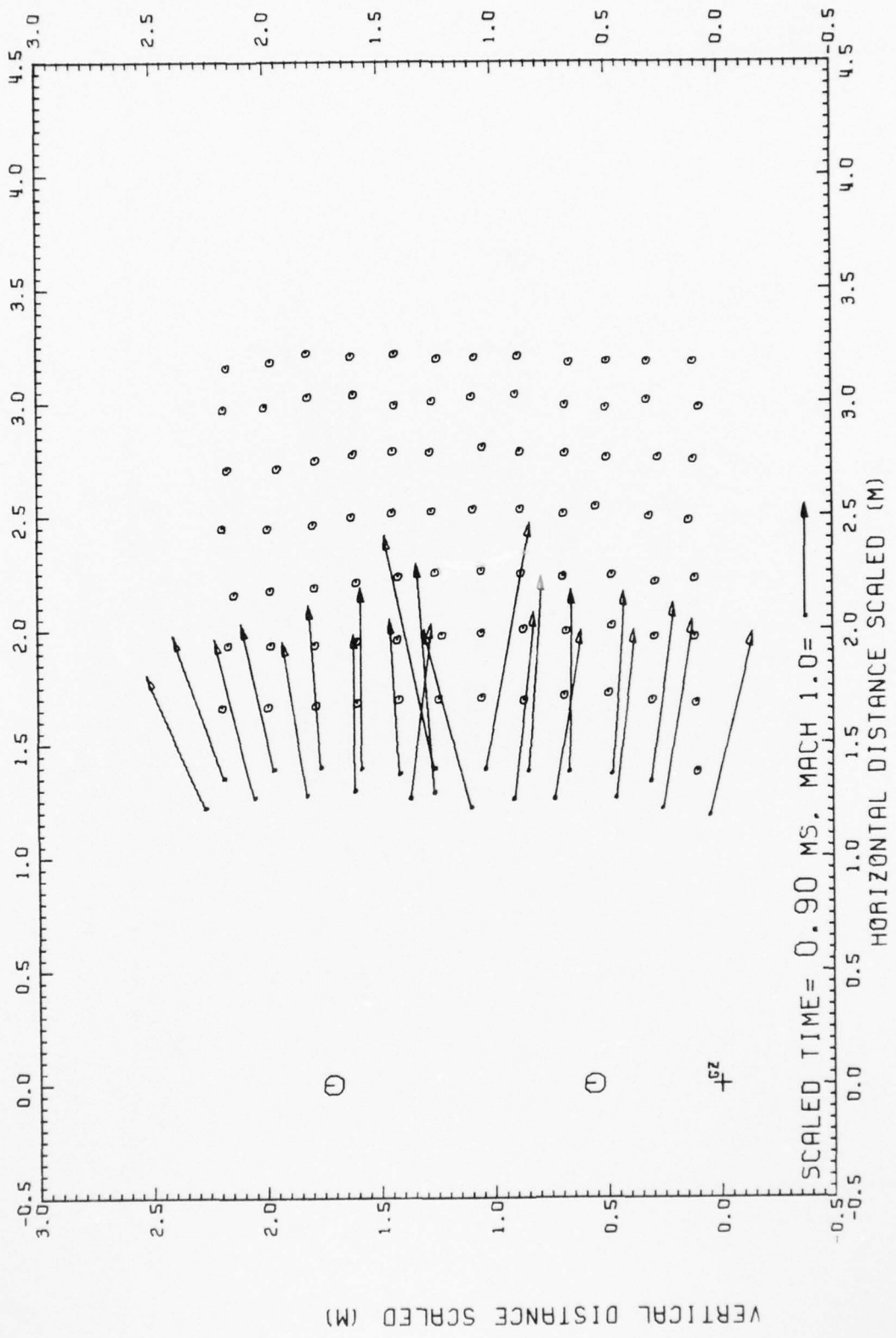


Fig. 12.6 PARTICLE VELOCITY FIELD, DIPOLE WEST/10

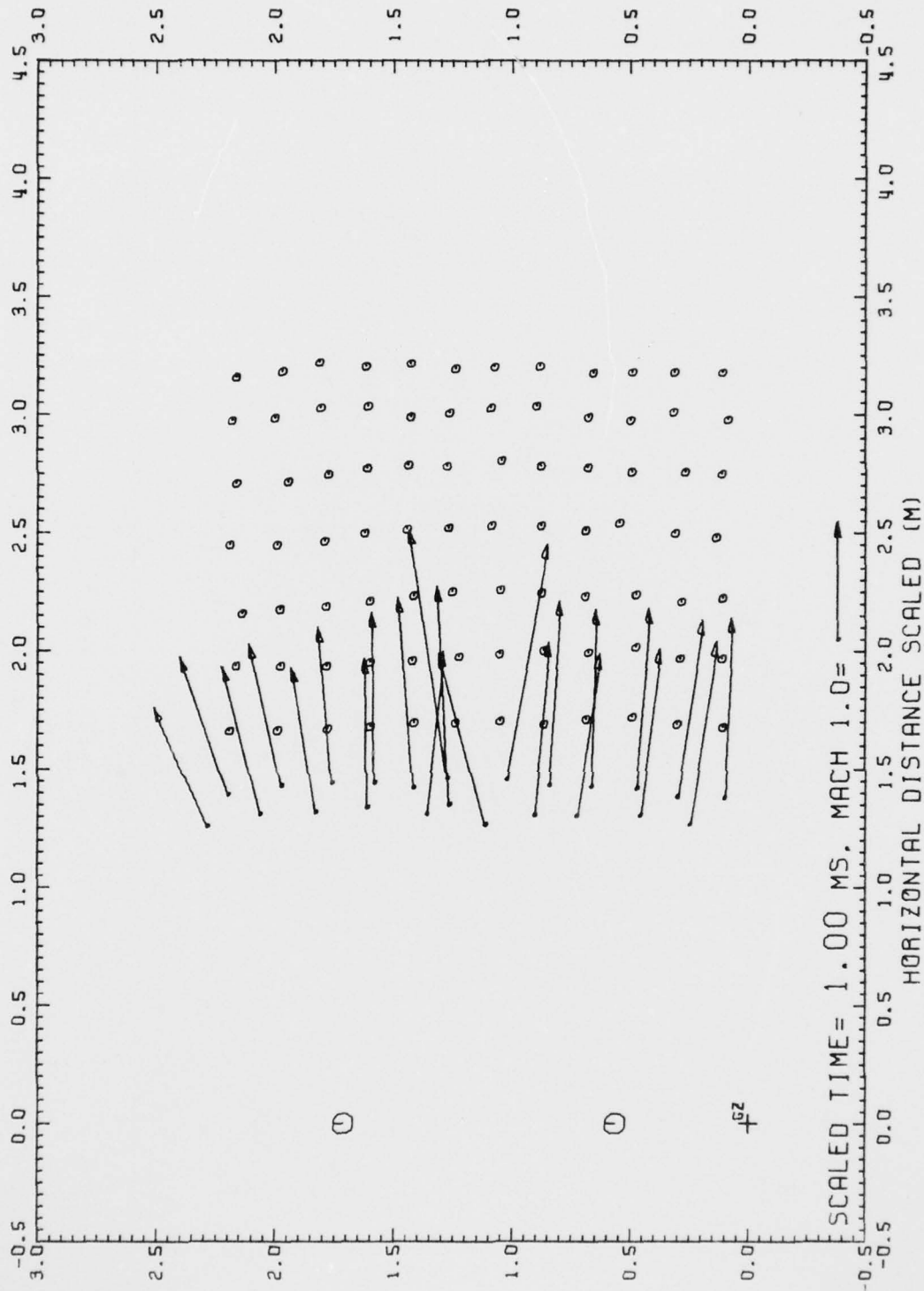


Fig. 12.7 PARTICLE VELOCITY FIELD, DIPOLE WEST/10

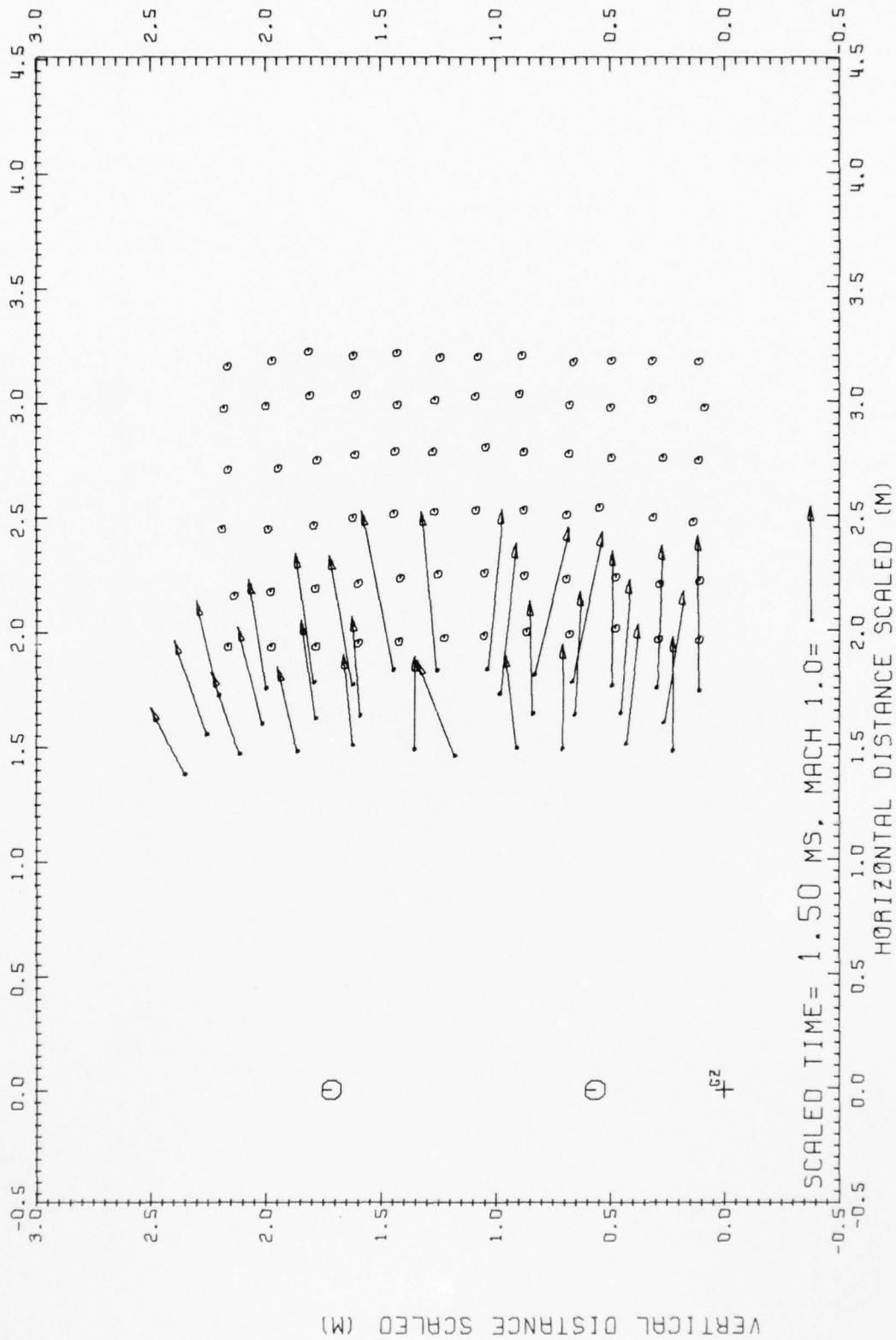


Fig. 12.8 PARTICLE VELOCITY FIELD, DIPOLE WEST/10

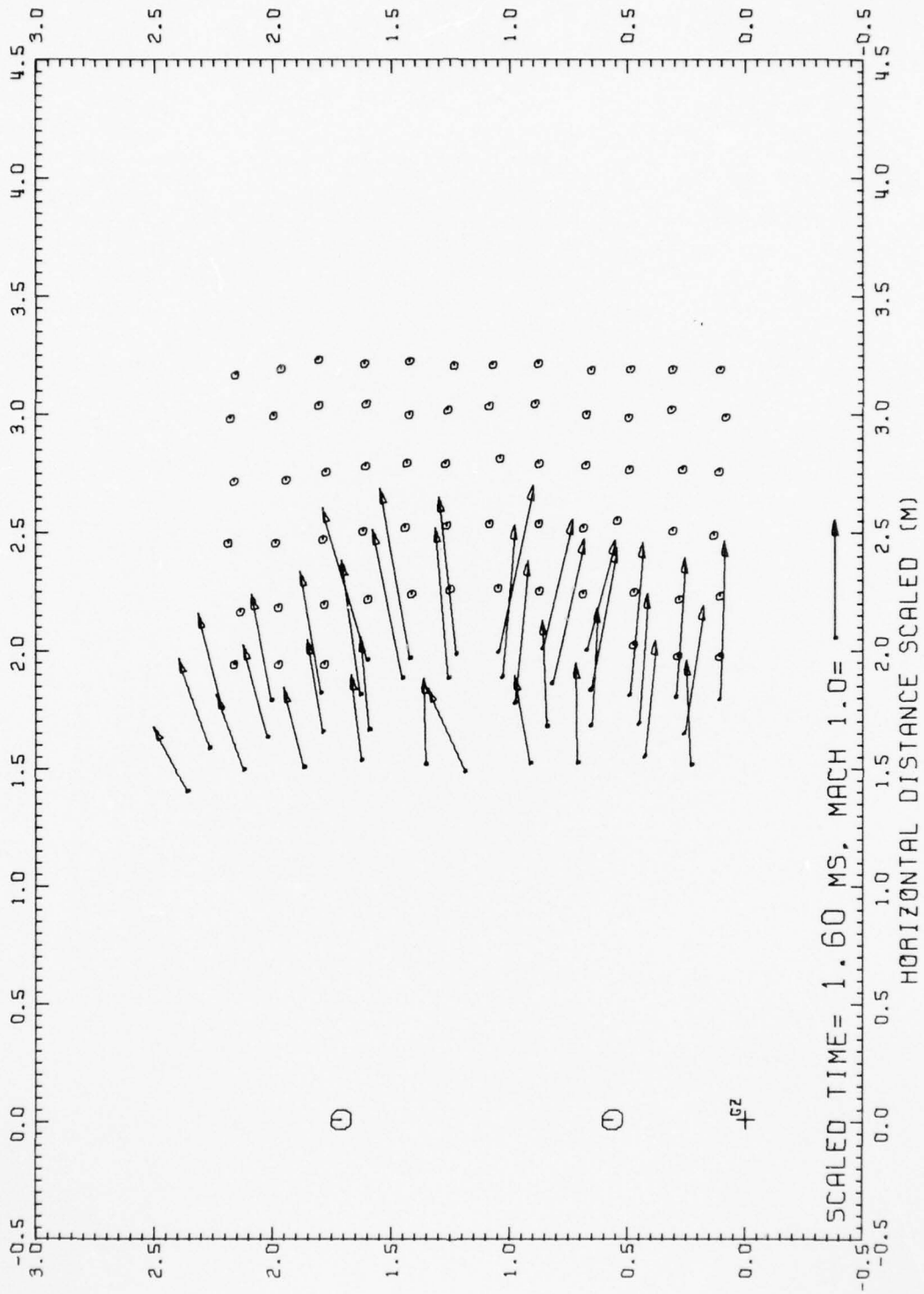


Fig. 12.9 PARTICLE VELOCITY FIELD, DIPOLE WEST/10

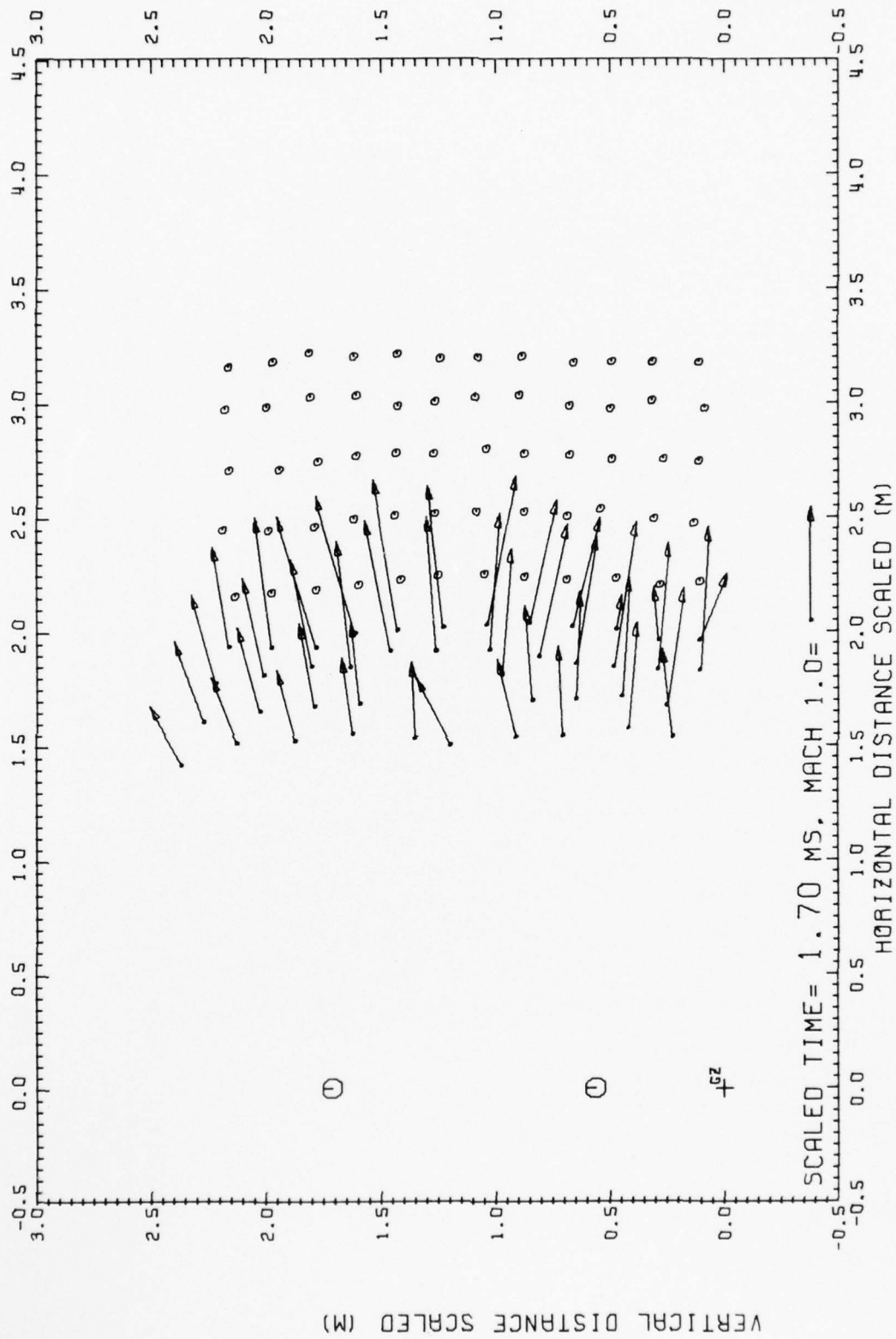


Fig. 12.10 PARTICLE VELOCITY FIELD, DIPOLE WEST/10

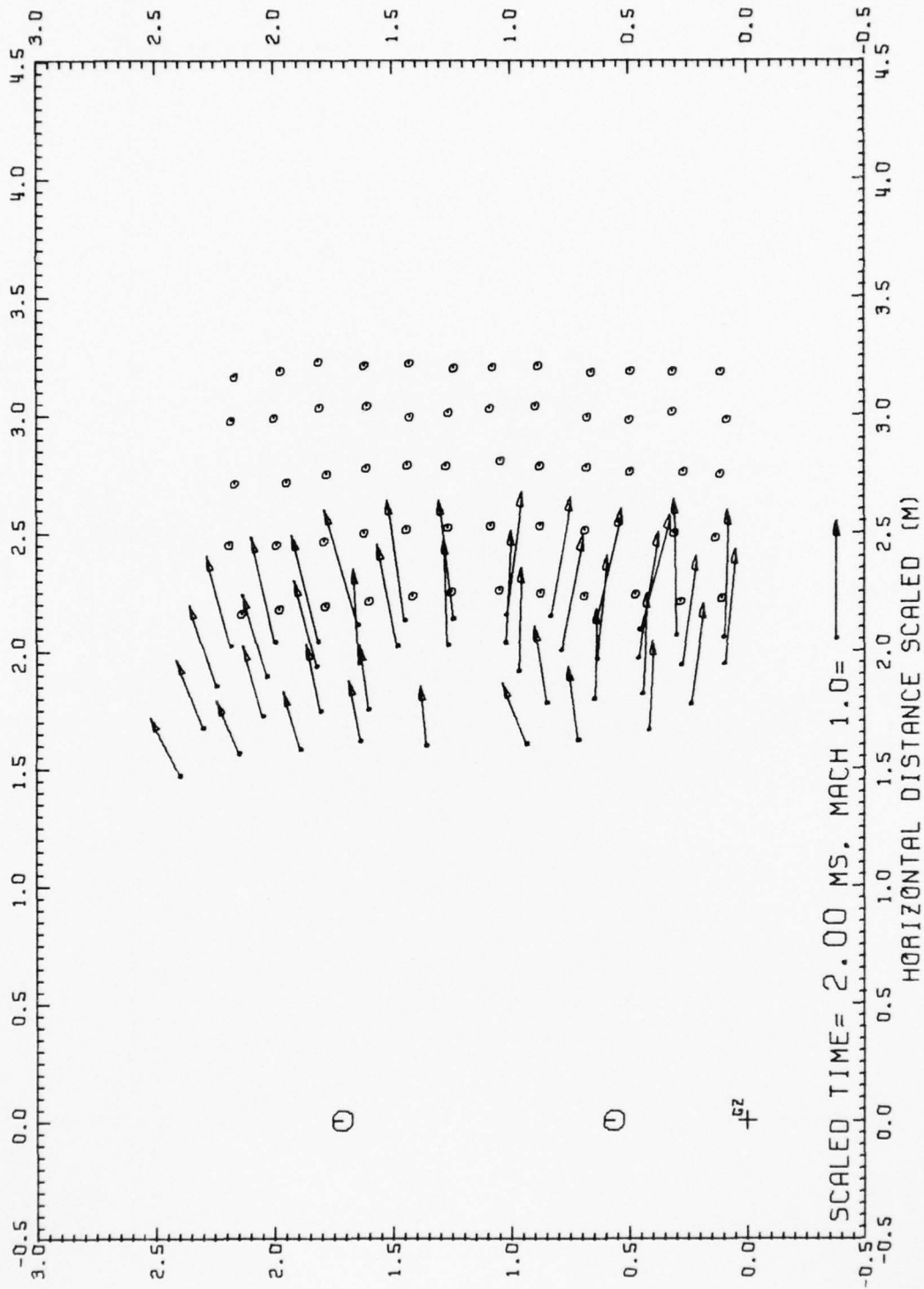


Fig. 12.11 PARTICLE VELOCITY FIELD, DIPOLE WEST/10

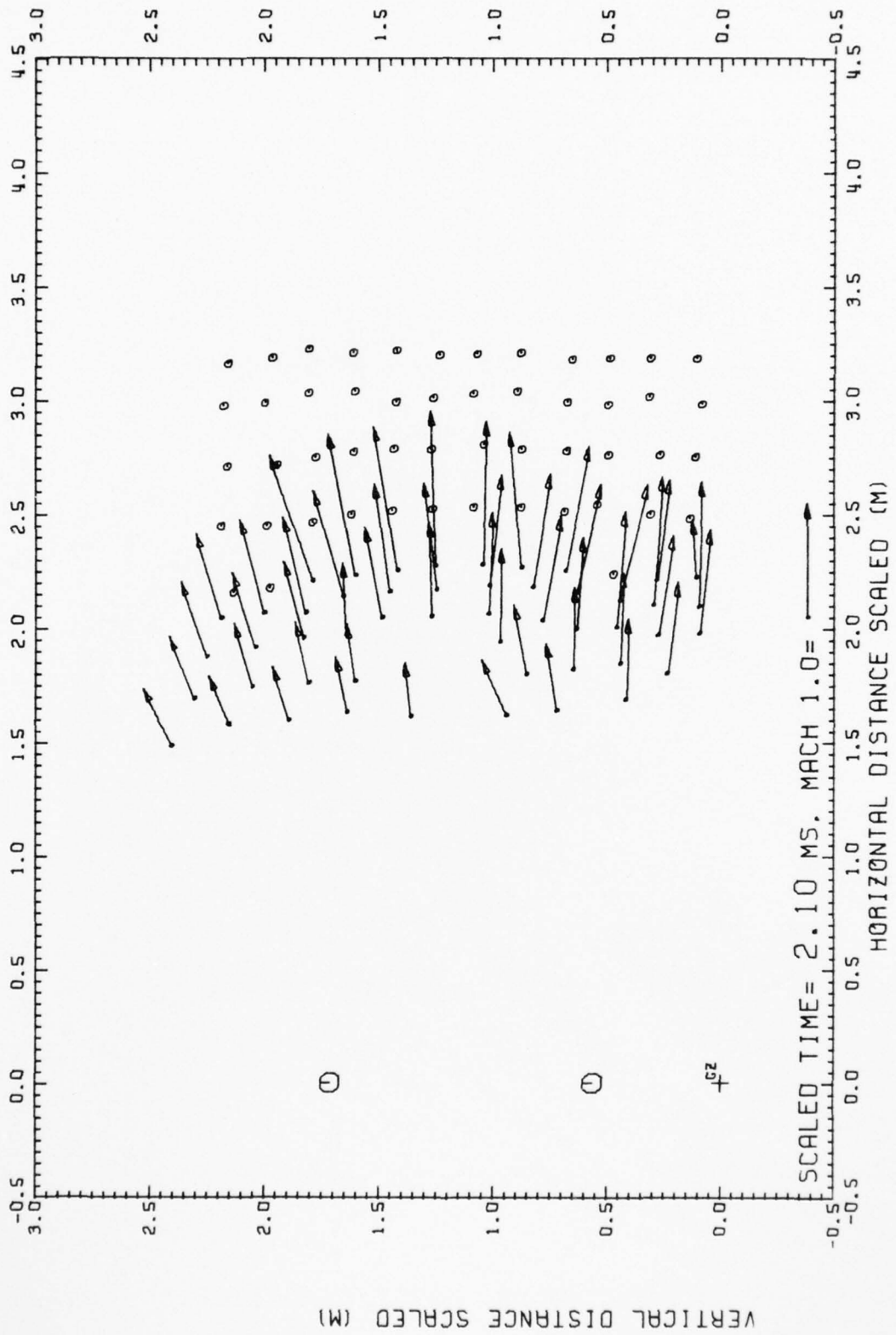


Fig. 12.12 PARTICLE VELOCITY FIELD, DIPOLE WEST/10

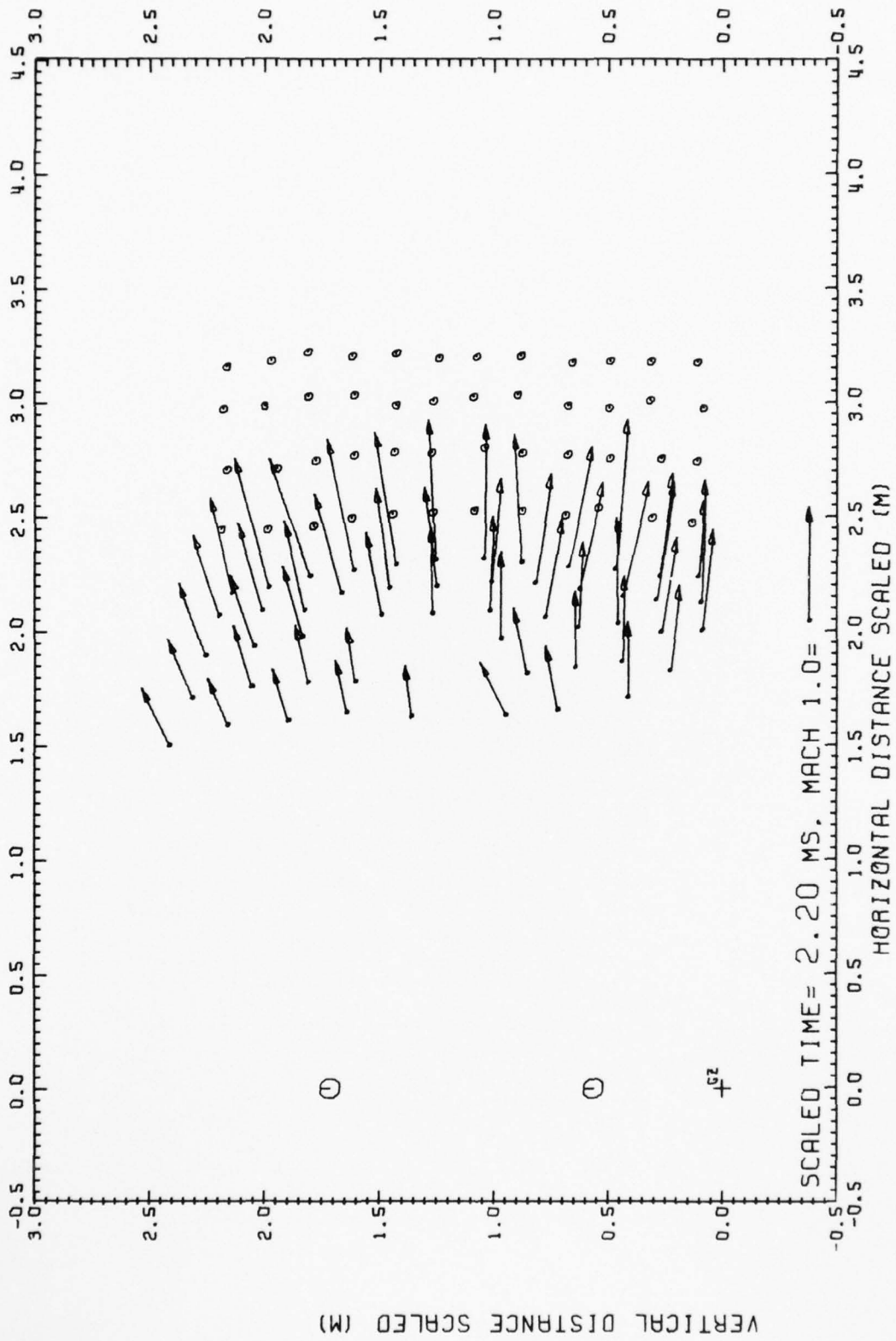


Fig. 12.13 PARTICLE VELOCITY FIELD, DIPOLE WEST/10

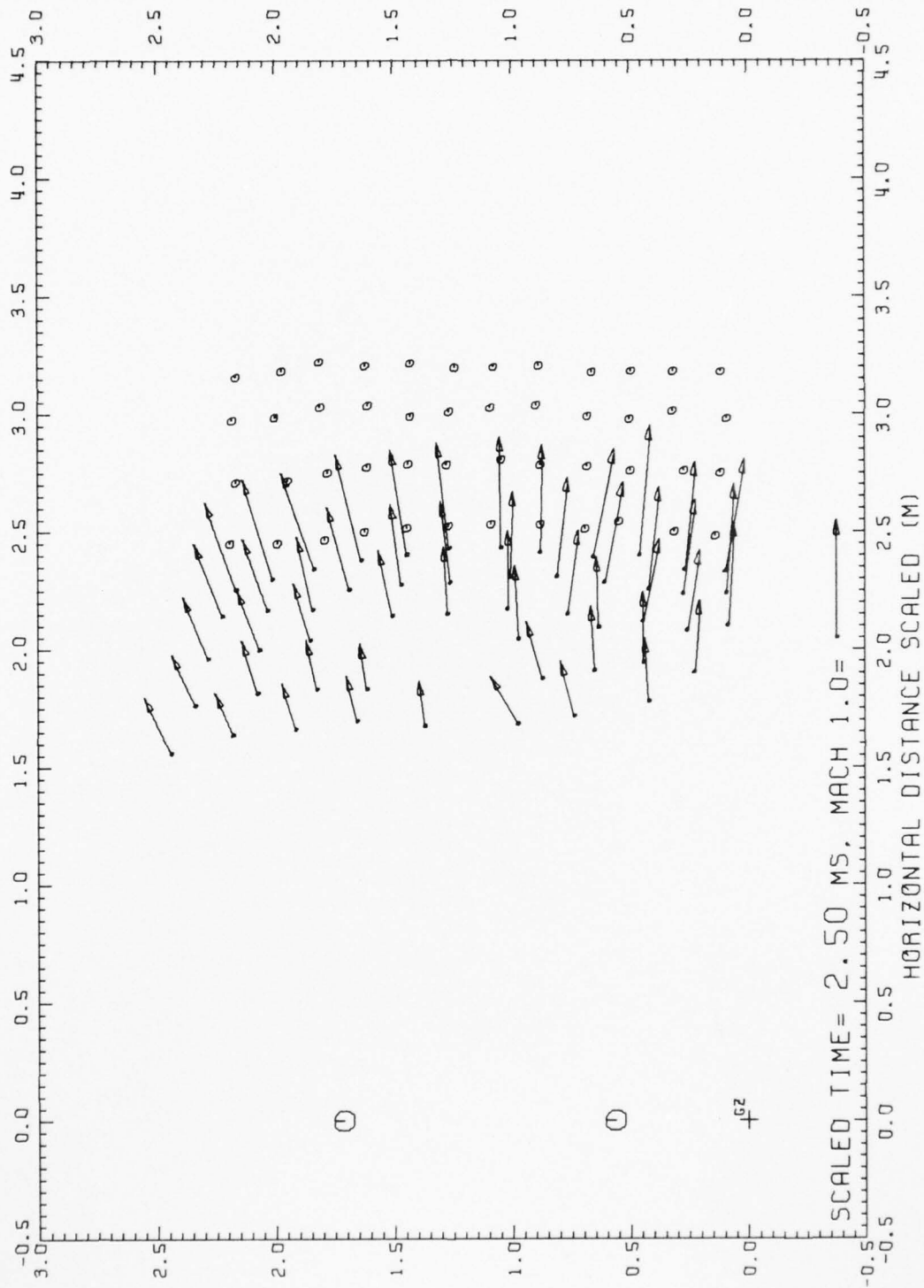


Fig. 12.14 PARTICLE VELOCITY FIELD, DIPOLE WEST/10

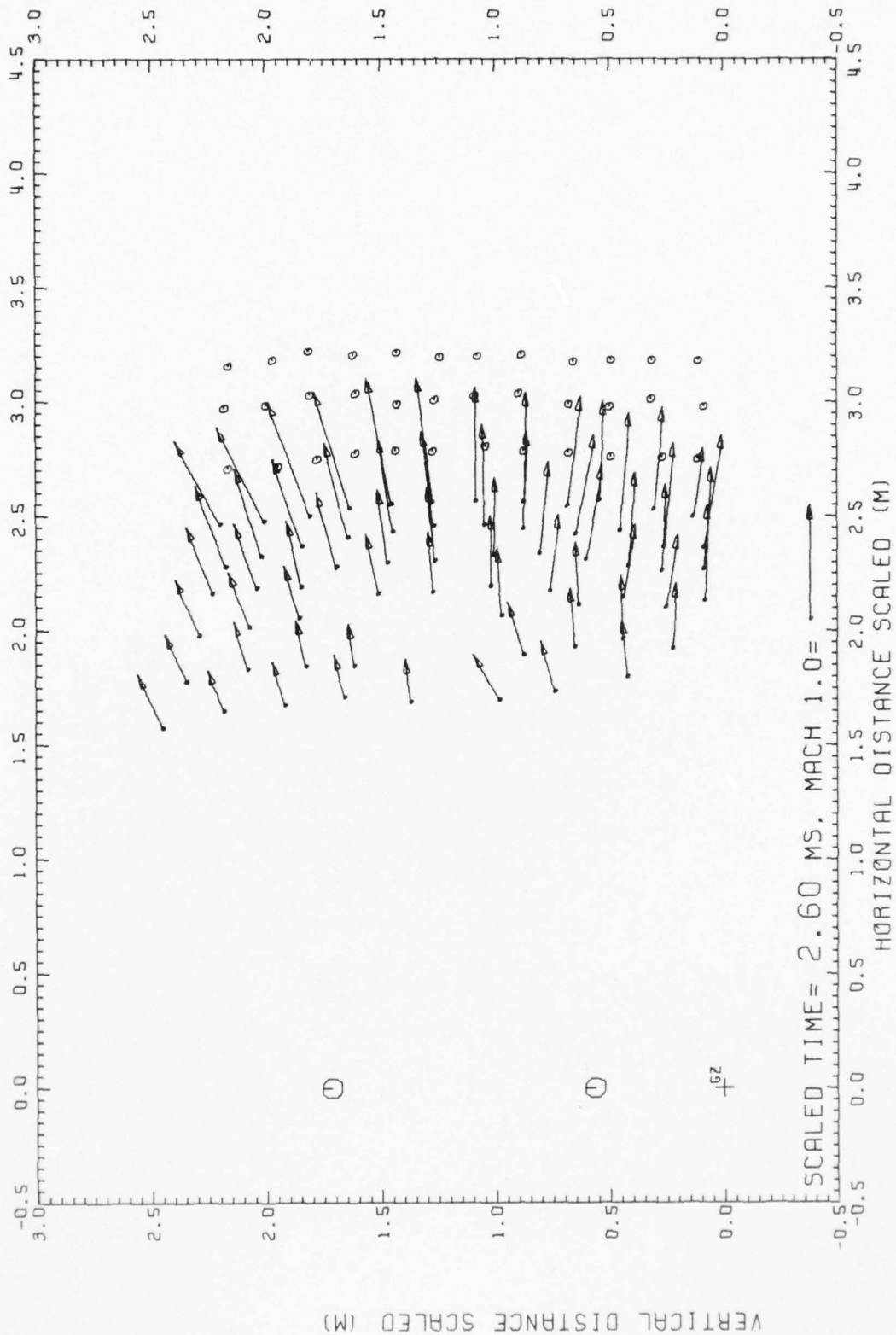


Fig. 12.15 PARTICLE VELOCITY FIELD, DIPOLE WEST/10

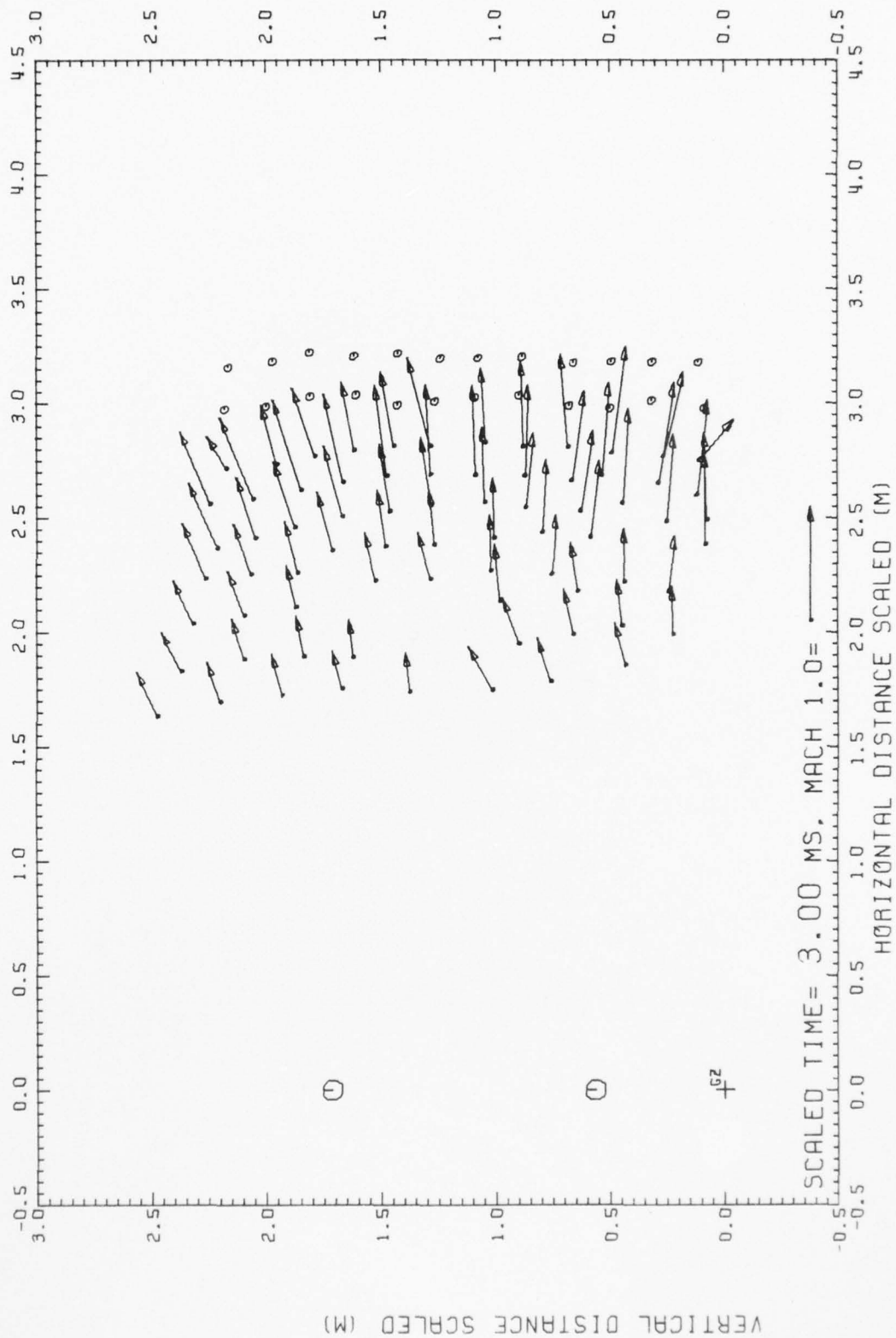


Fig. 12.16 PARTICLE VELOCITY FIELD, DIPOLE WEST/10

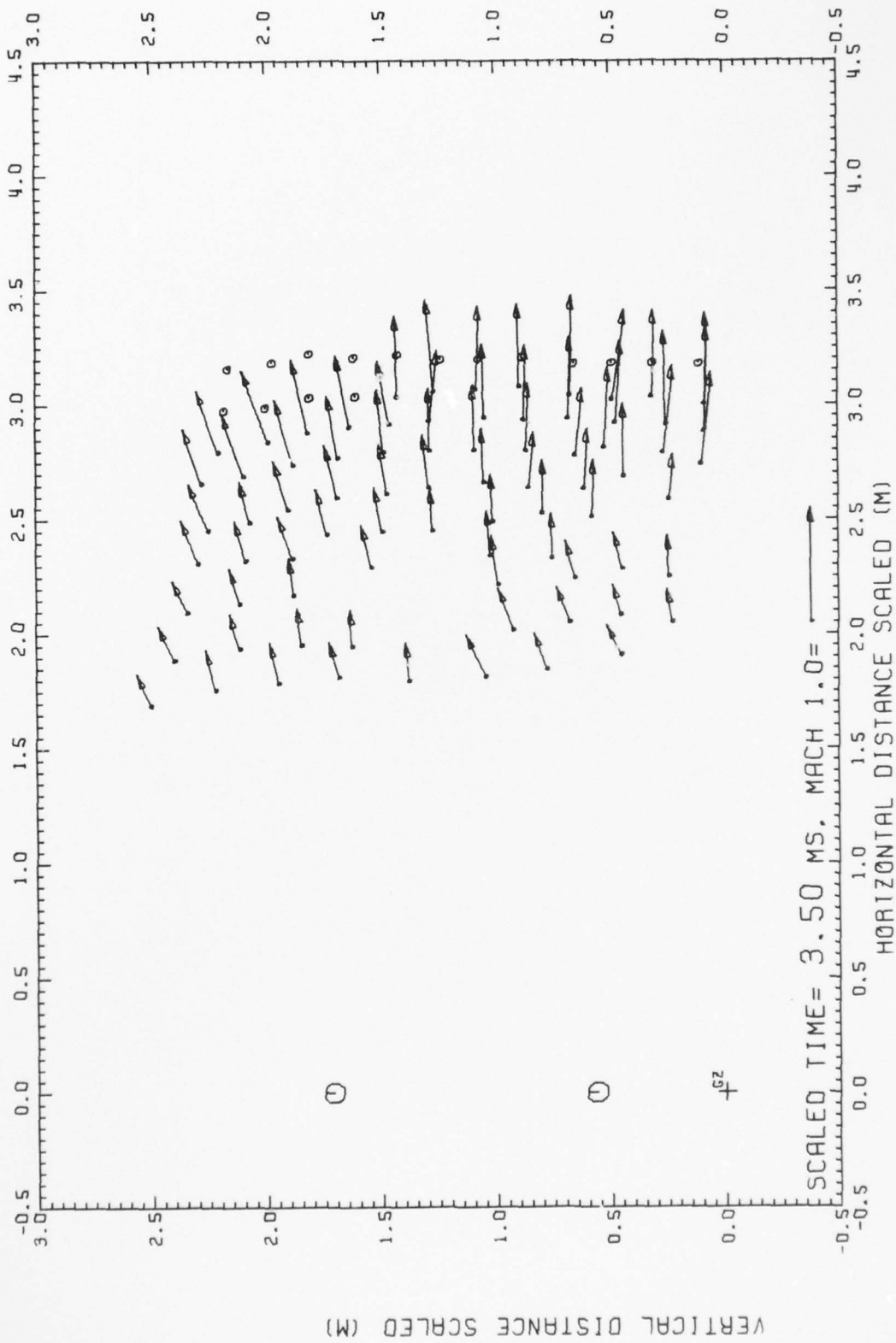


Fig. 12.17 PARTICLE VELOCITY FIELD, DIPOLE WEST/10

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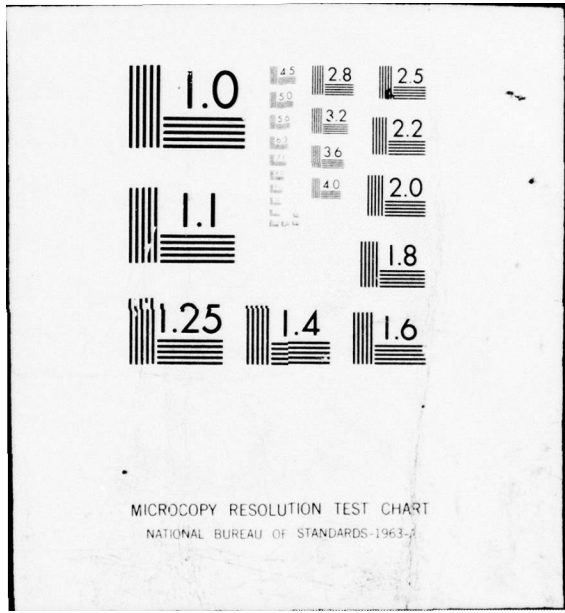
VICTORIA UNIV (BRITISH COLUMBIA)  
PHOTOGRAMMETRY OF THE PARTICLE TRAJECTORIES ON DIPOLE WEST SHOT--ETC(U)  
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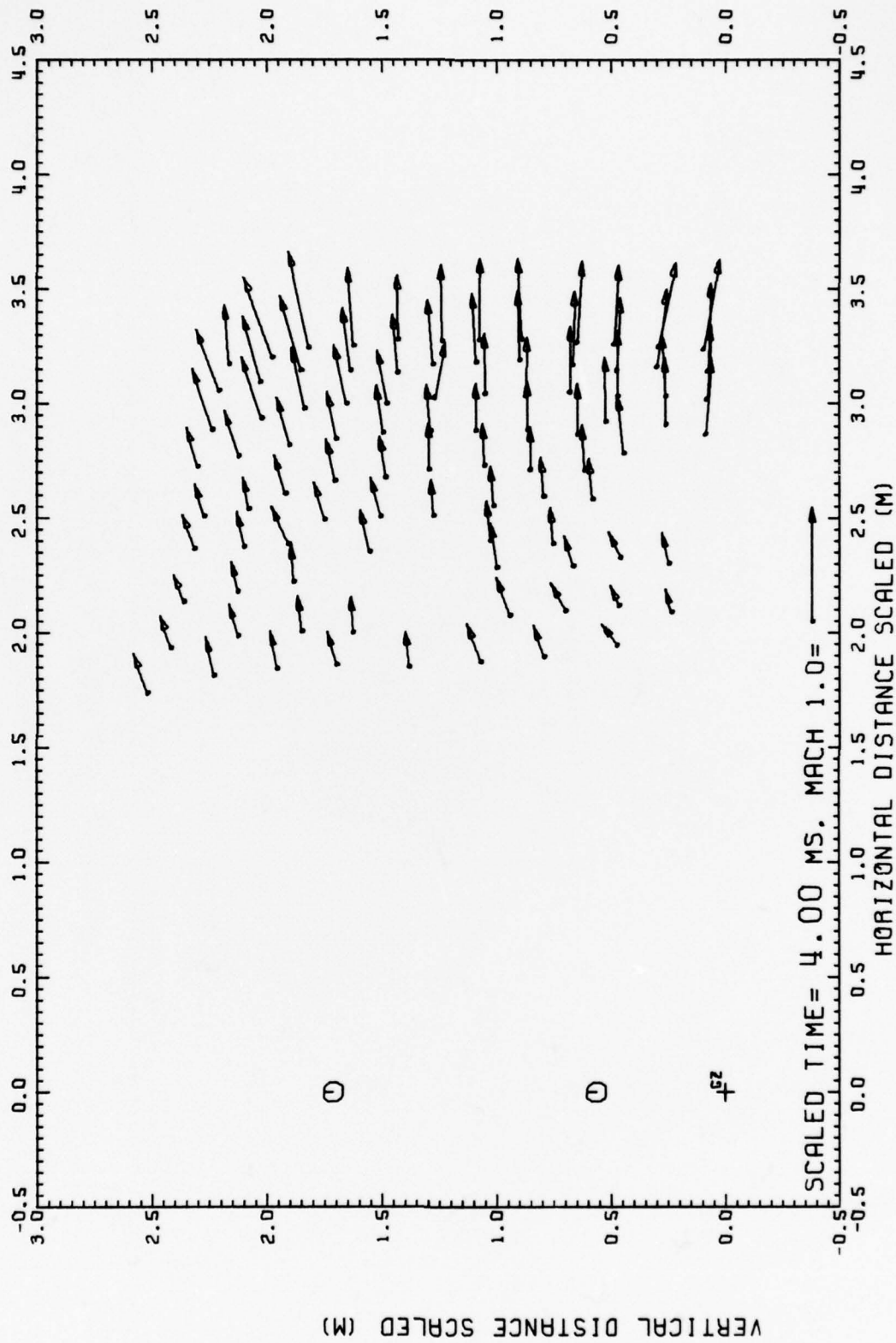


Fig. 12.18 PARTICLE VELOCITY FIELD, DIPOLE WEST/10

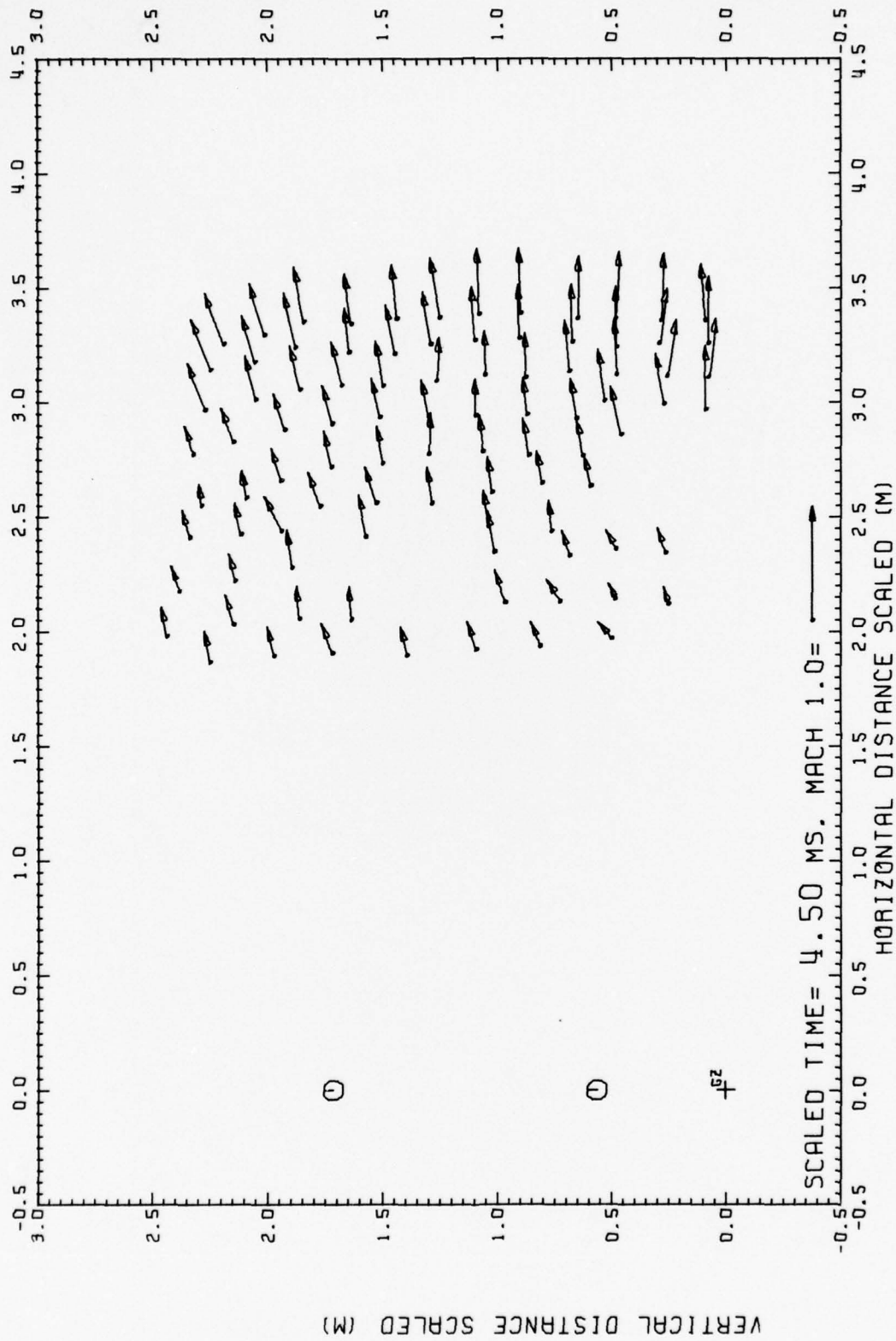


Fig. 12.19 PARTICLE VELOCITY FIELD, DIPOLE WEST/10

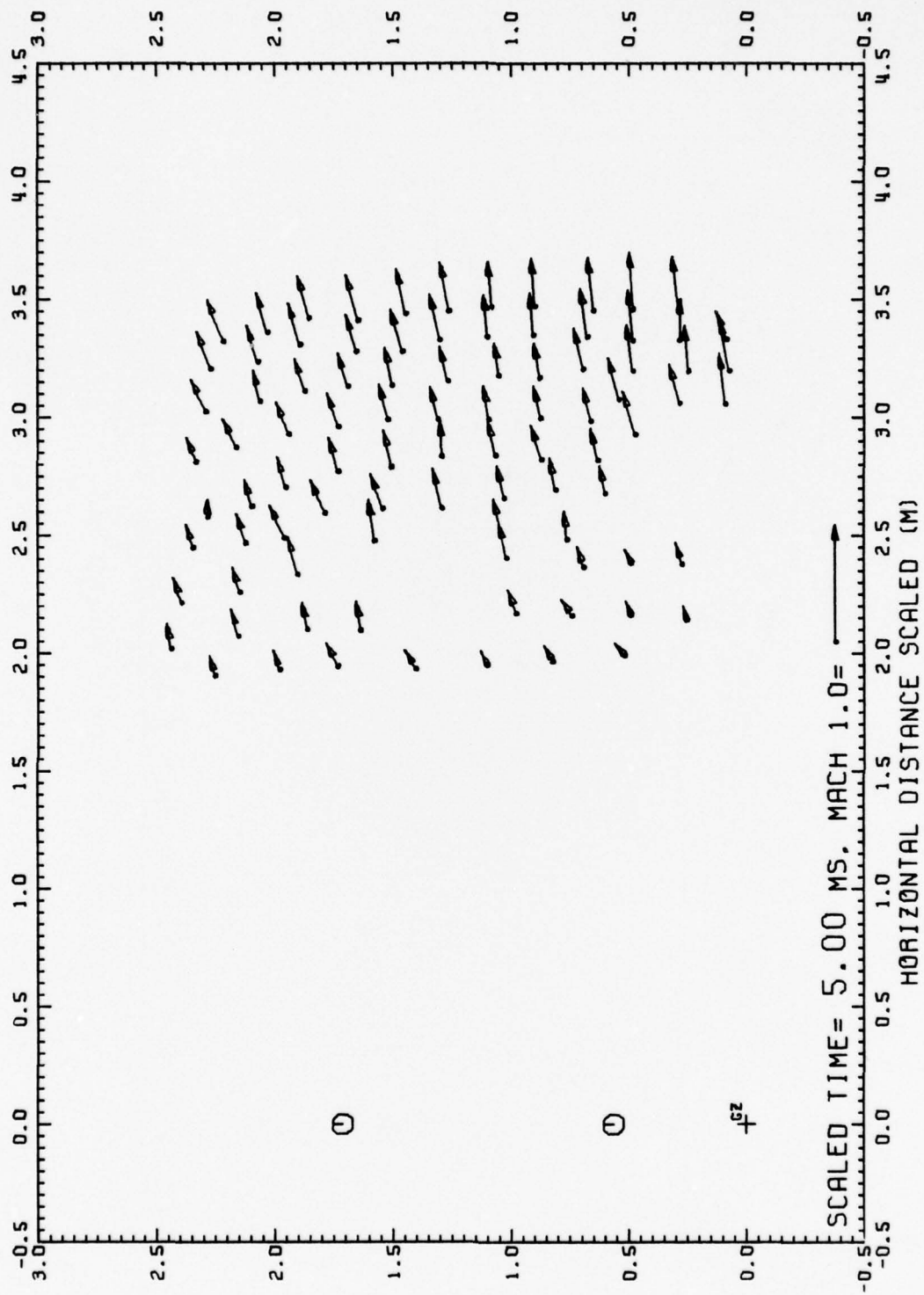


Fig. 12.20 PARTICLE VELOCITY FIELD, DIPOLE WEST/10

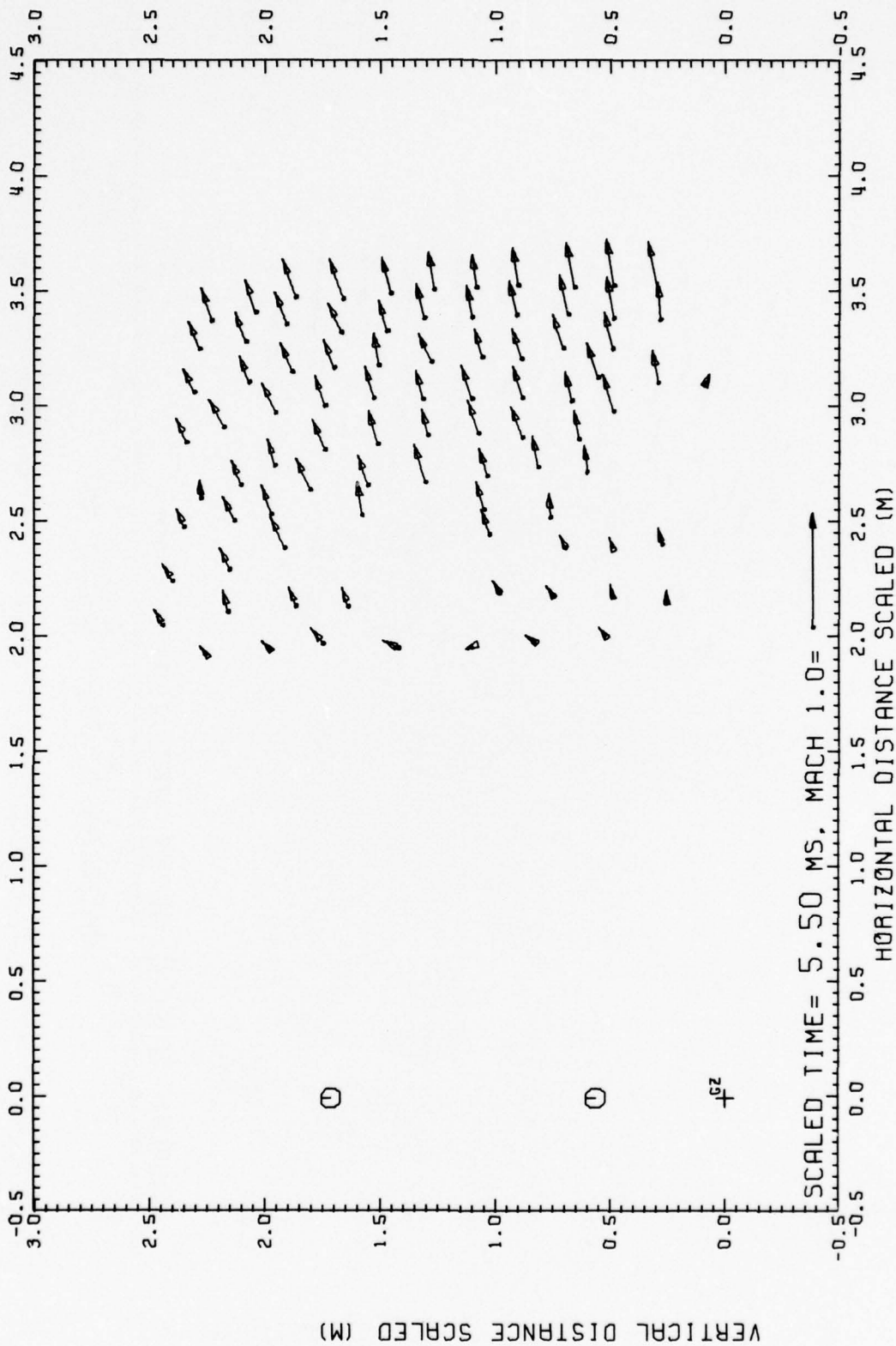


Fig. 12.21 PARTICLE VELOCITY FIELD, DIPOLE WEST/10

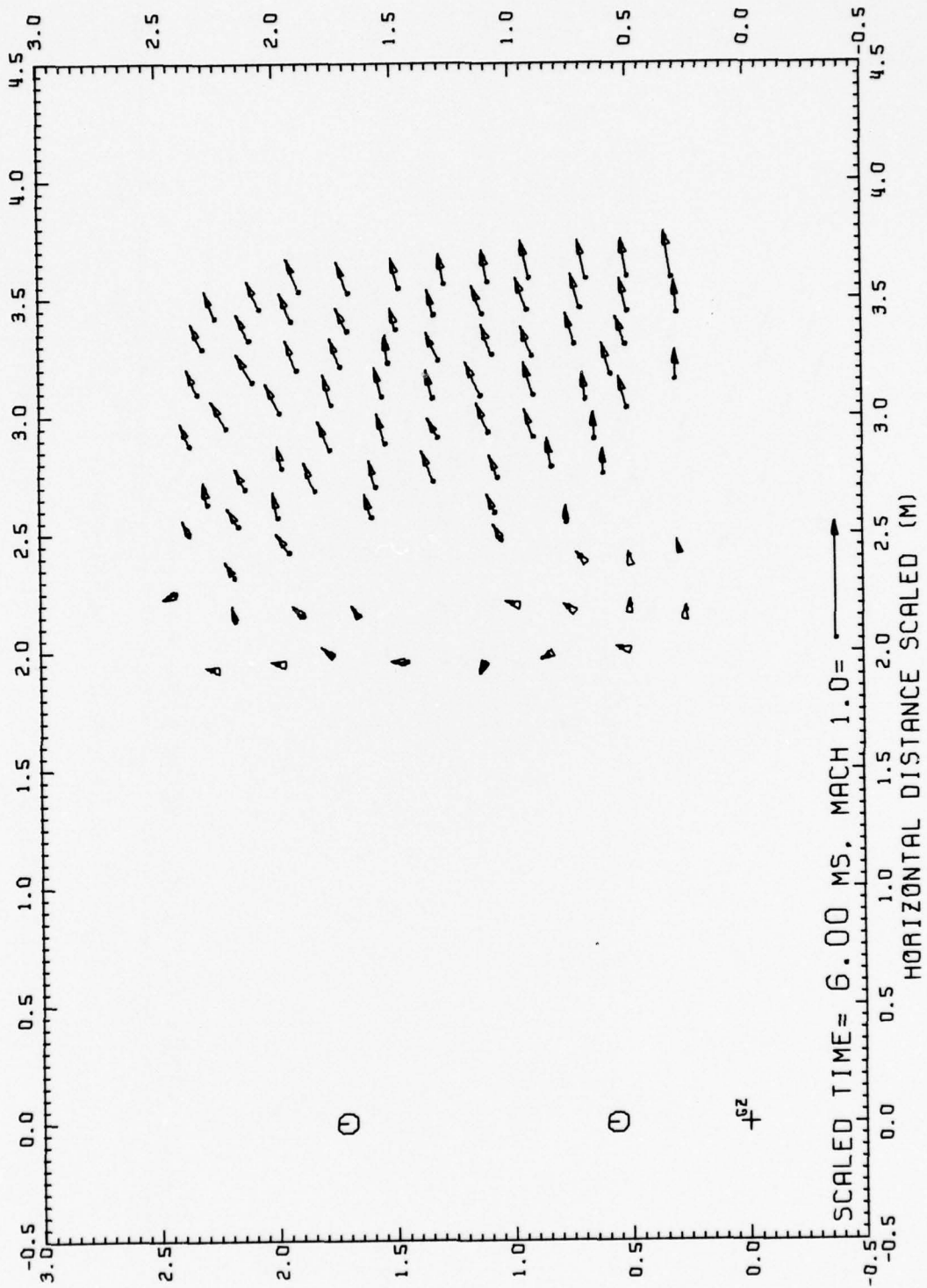


Fig. 12.22 PARTICLE VELOCITY FIELD, DIPOLE WEST/10

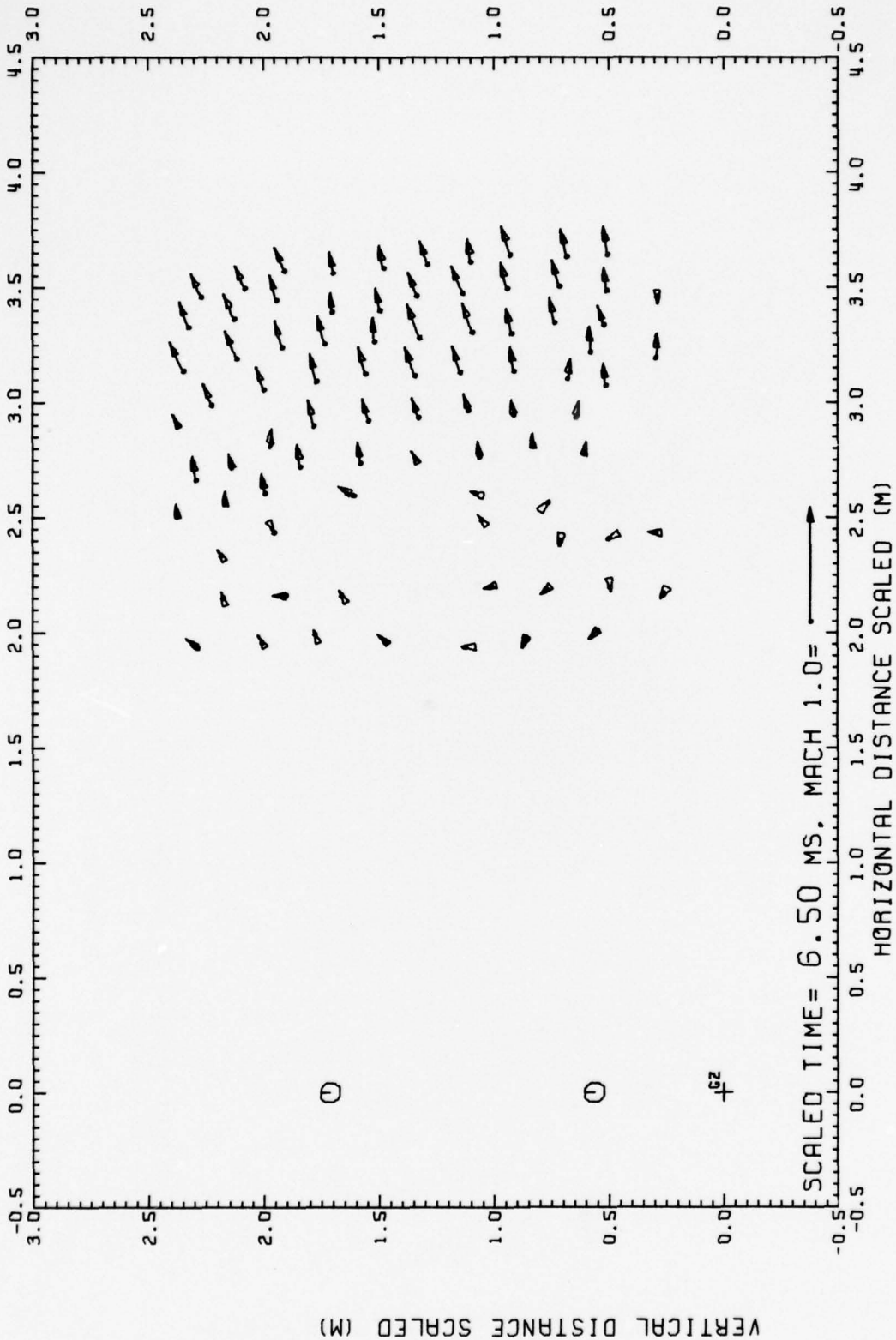


Fig. 12.23 PARTICLE VELOCITY FIELD, DIPOLE WEST/10

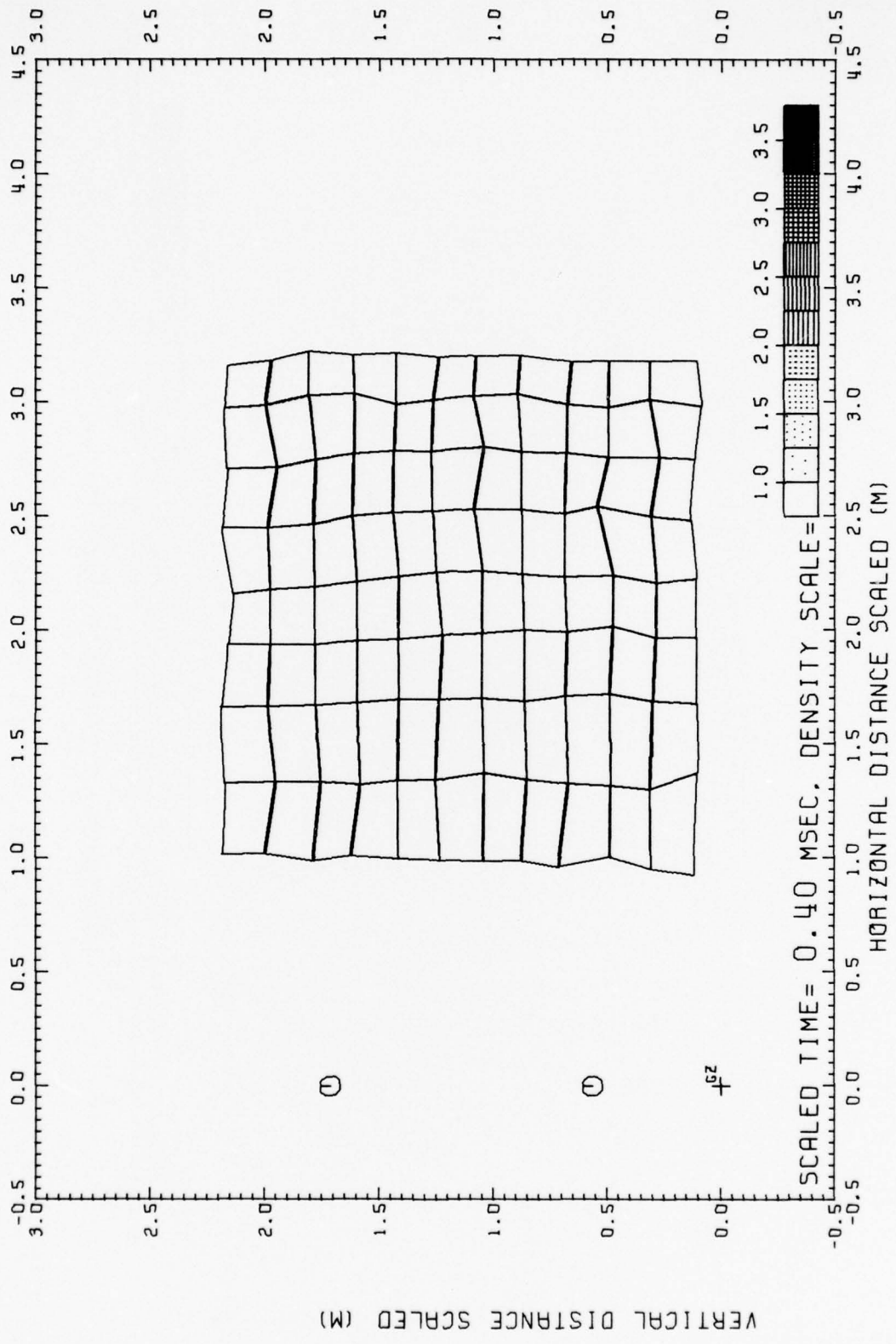


Fig. 13.1 DENSITY FIELD, DIPOLE WEST/10

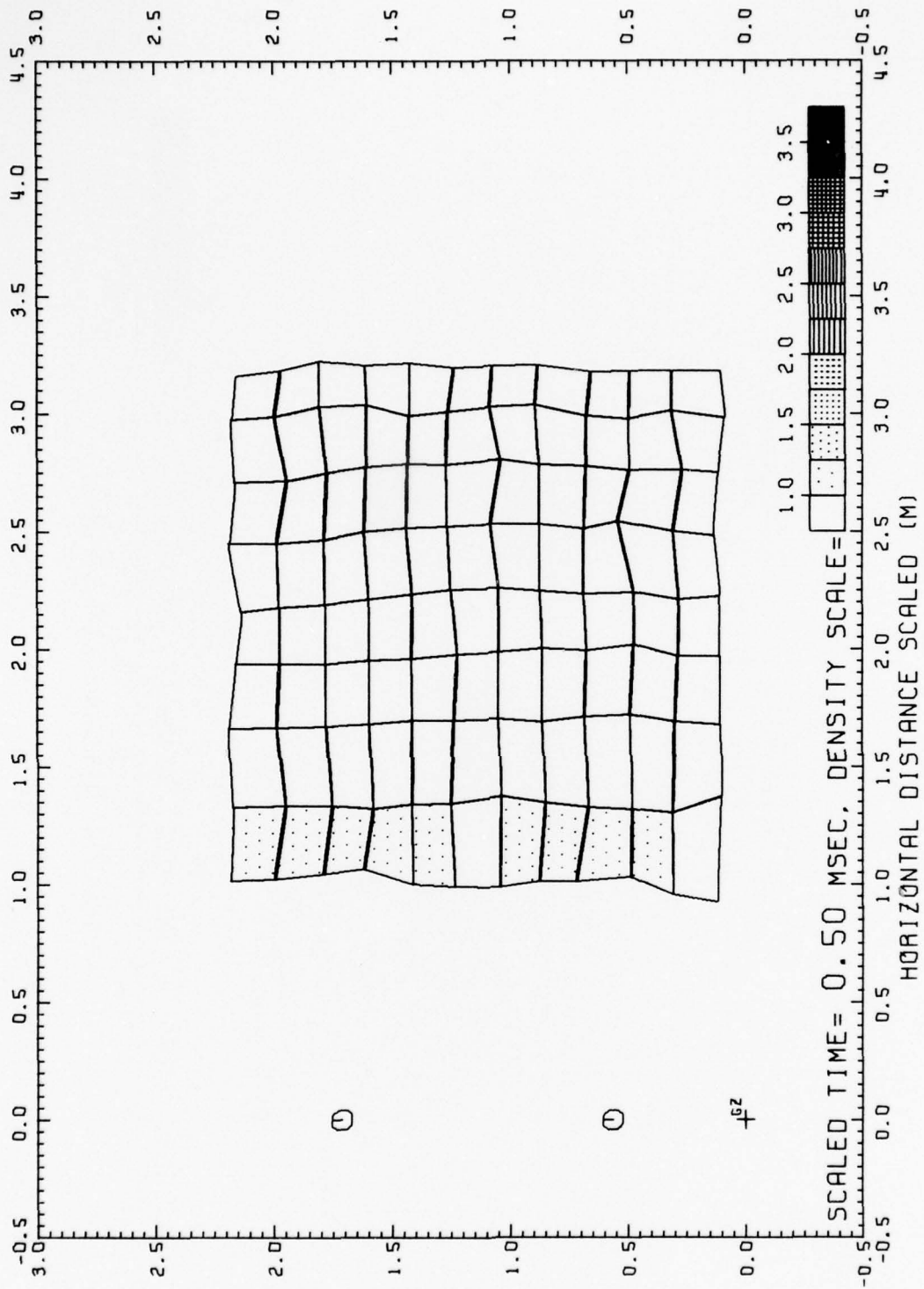


Fig. 13.2 DENSITY FIELD, DIPOLE WEST/10

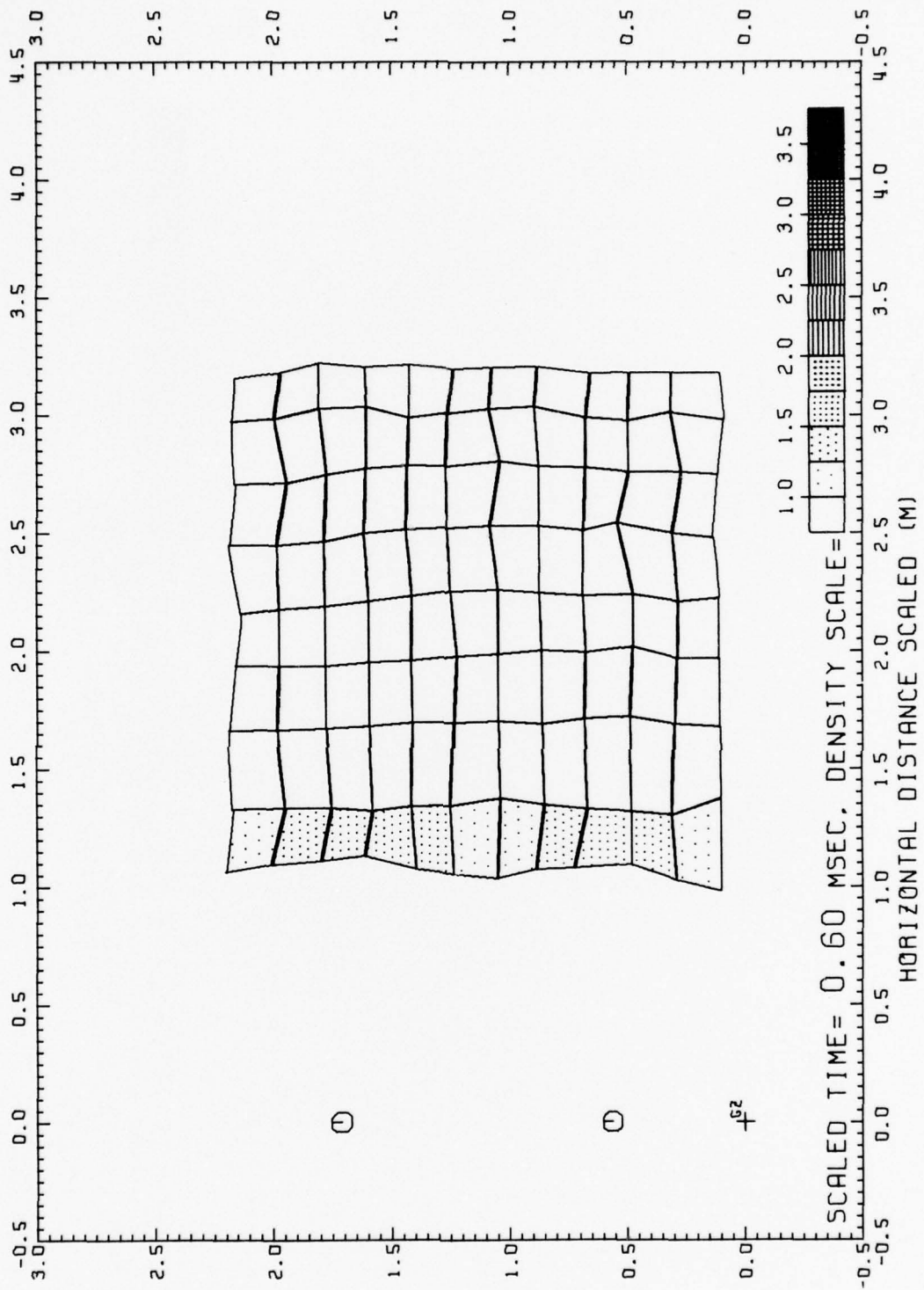


Fig. 13.3 DENSITY FIELD, DIPOLE WEST/10

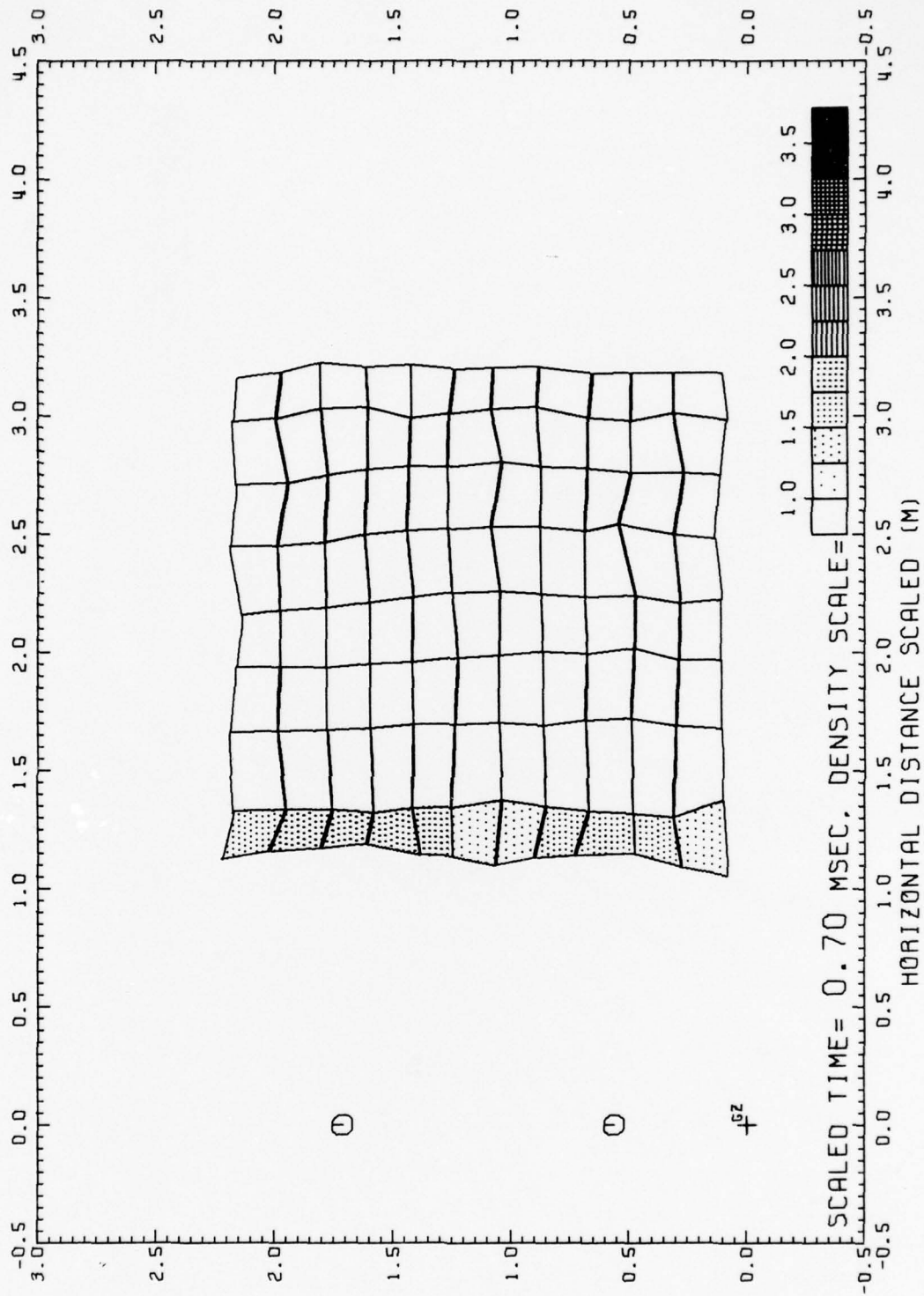


Fig. 13.4 DENSITY FIELD, DIPOLE WEST/10

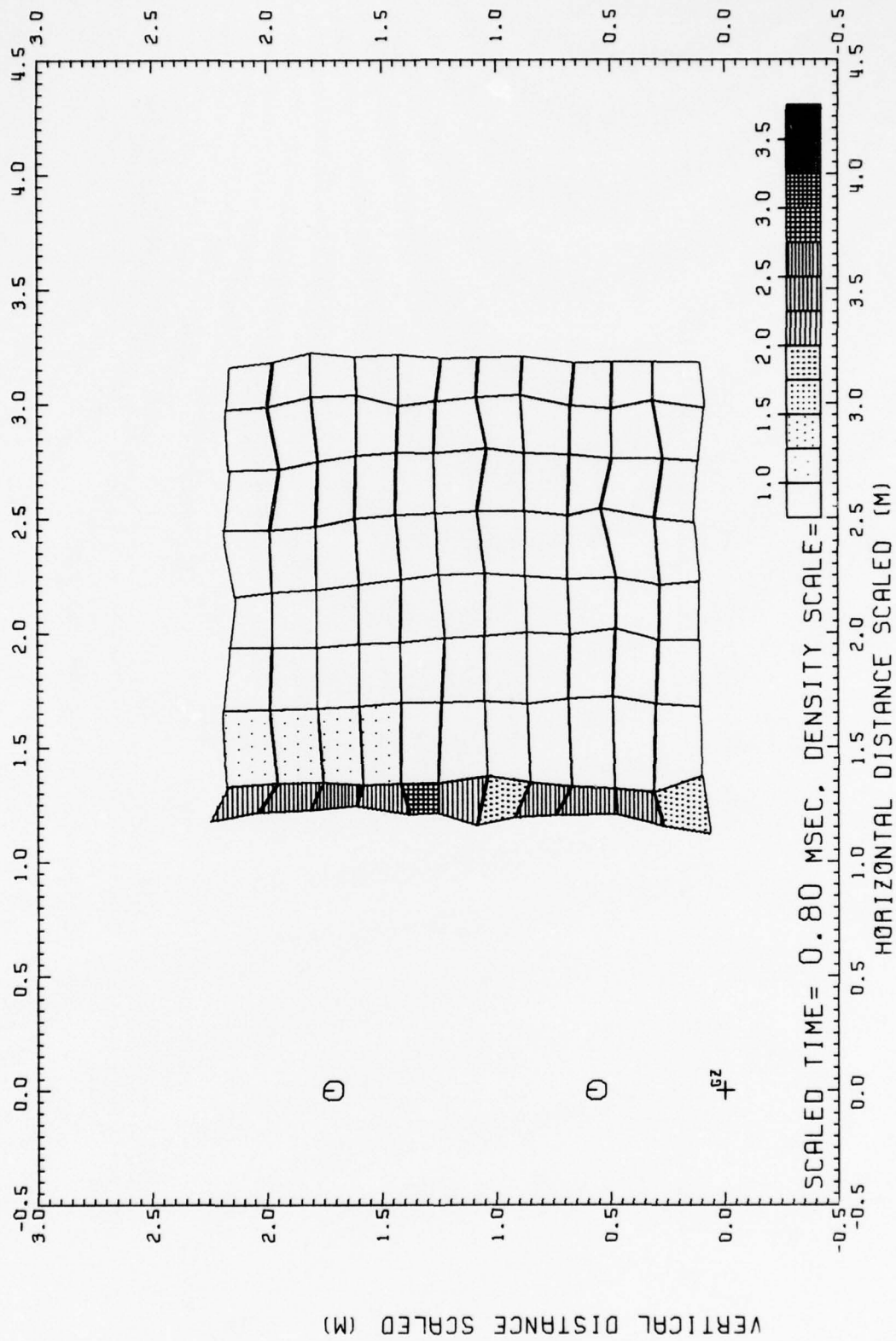


Fig. 13.5 DENSITY FIELD, DIPOLE WEST/10

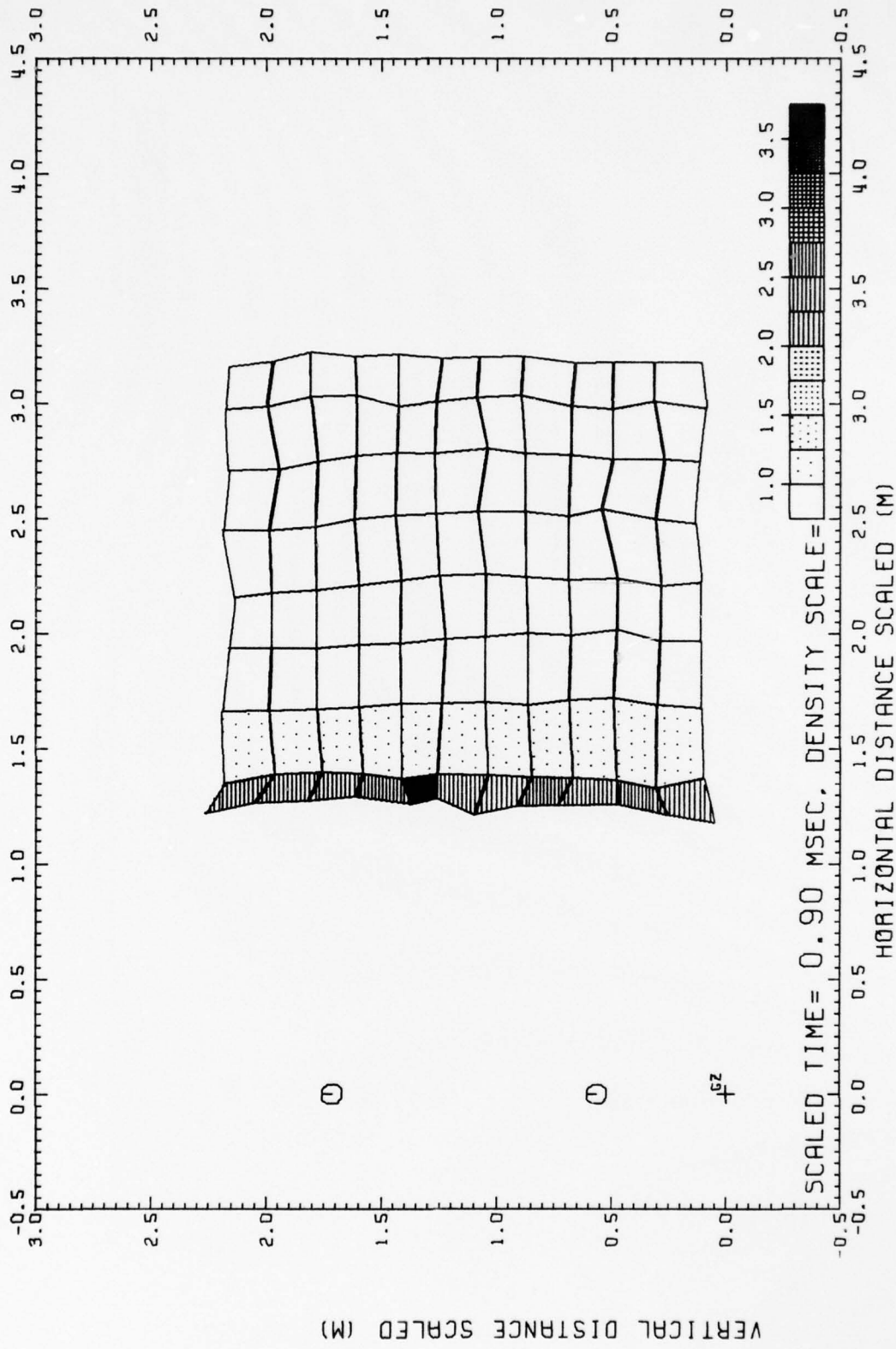


Fig. 13.6 DENSITY FIELD, DIPOLE WEST/10

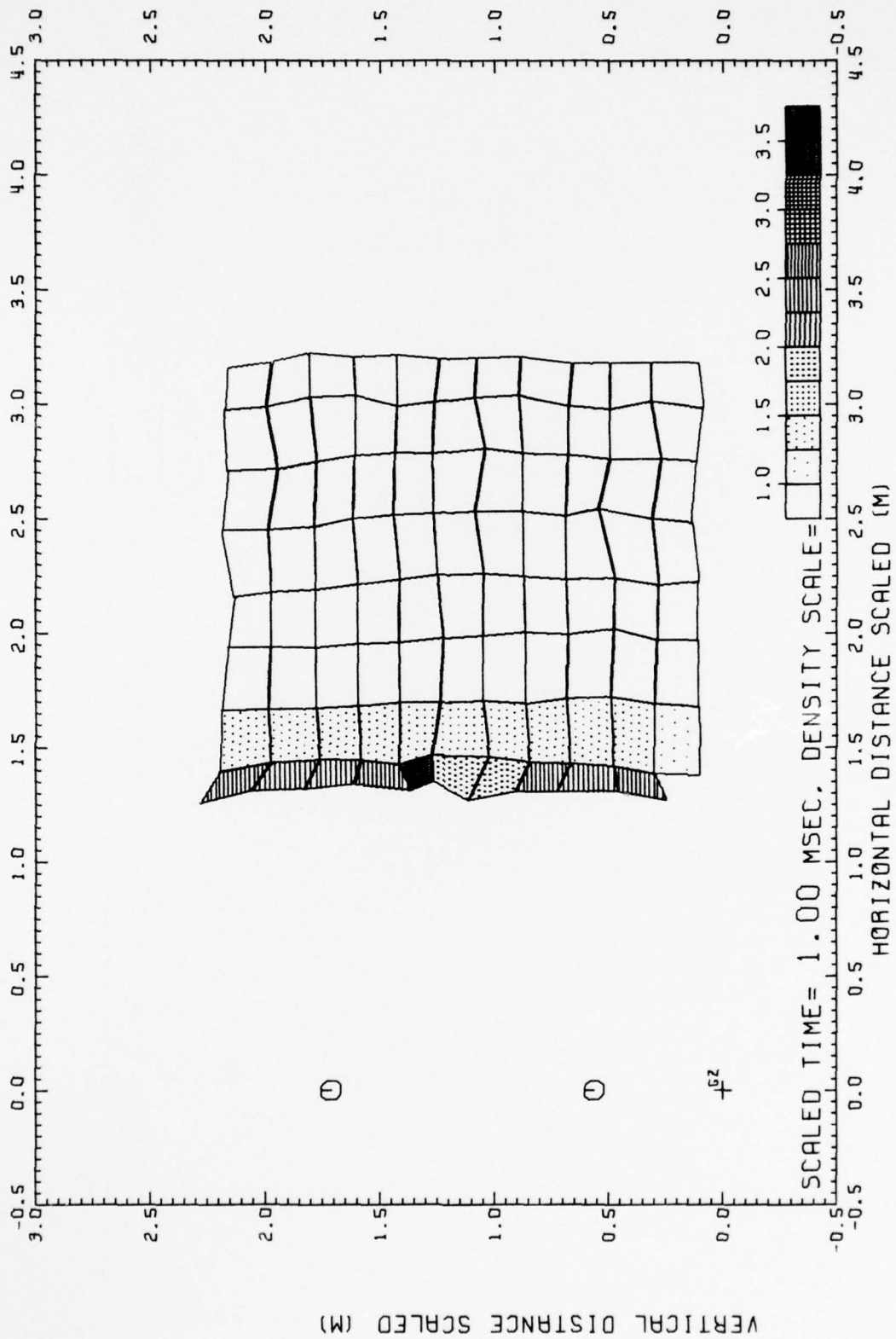


Fig. 13.7 DENSITY FIELD, DIPOLE WEST/10

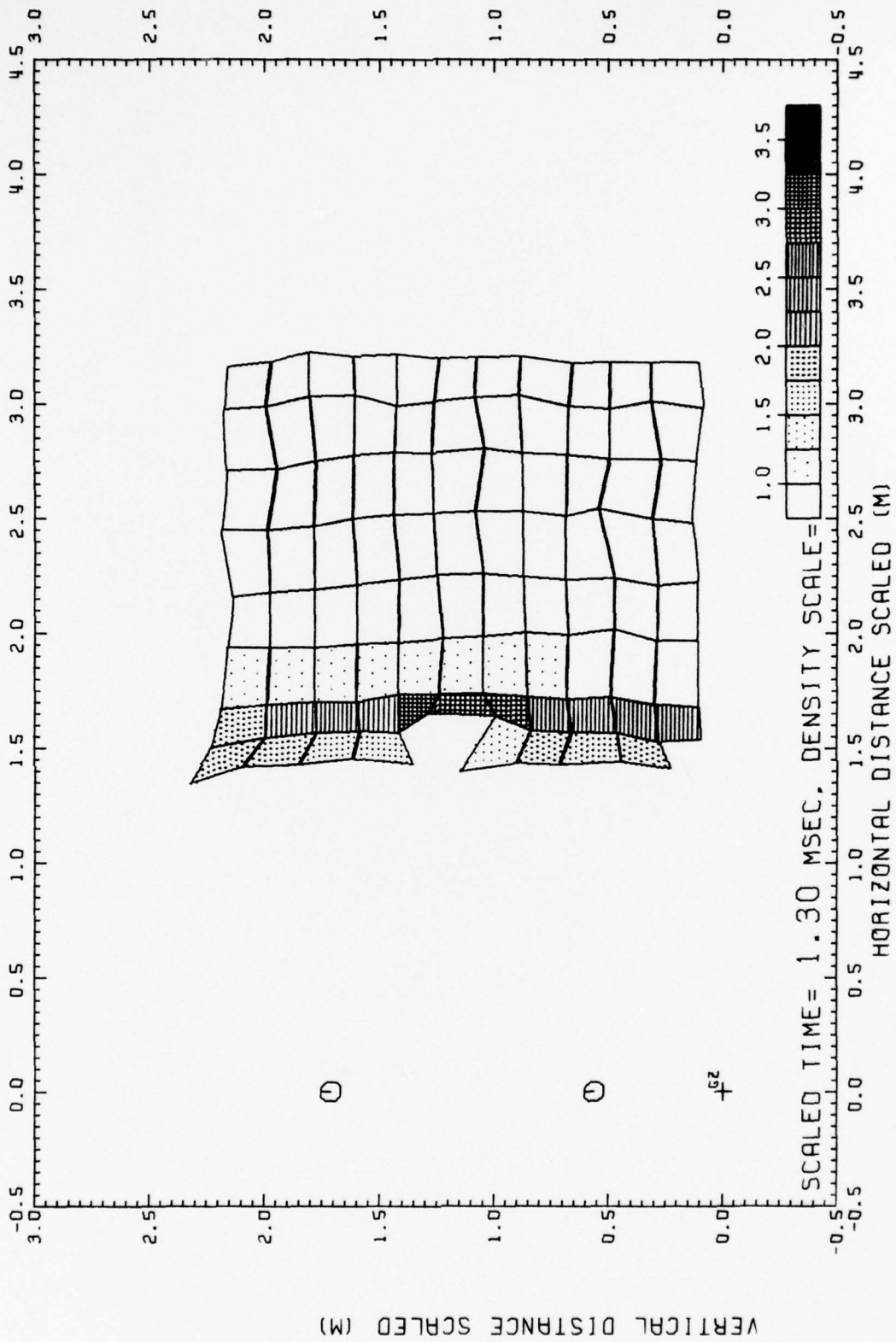


Fig. 13.8 DENSITY FIELD, DIPOLE WEST/10

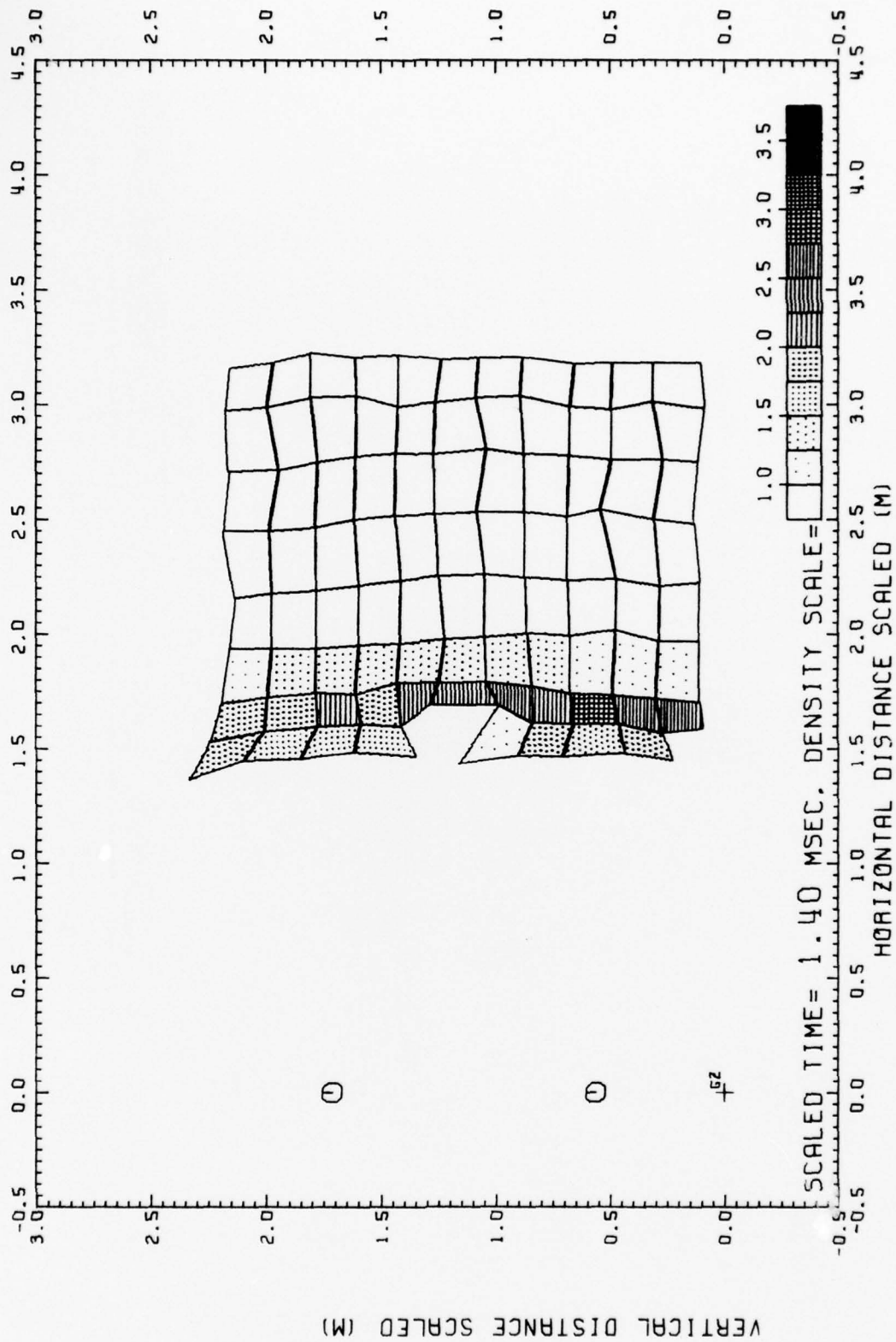


Fig. 13.9 DENSITY FIELD, DIPOLE WEST/10

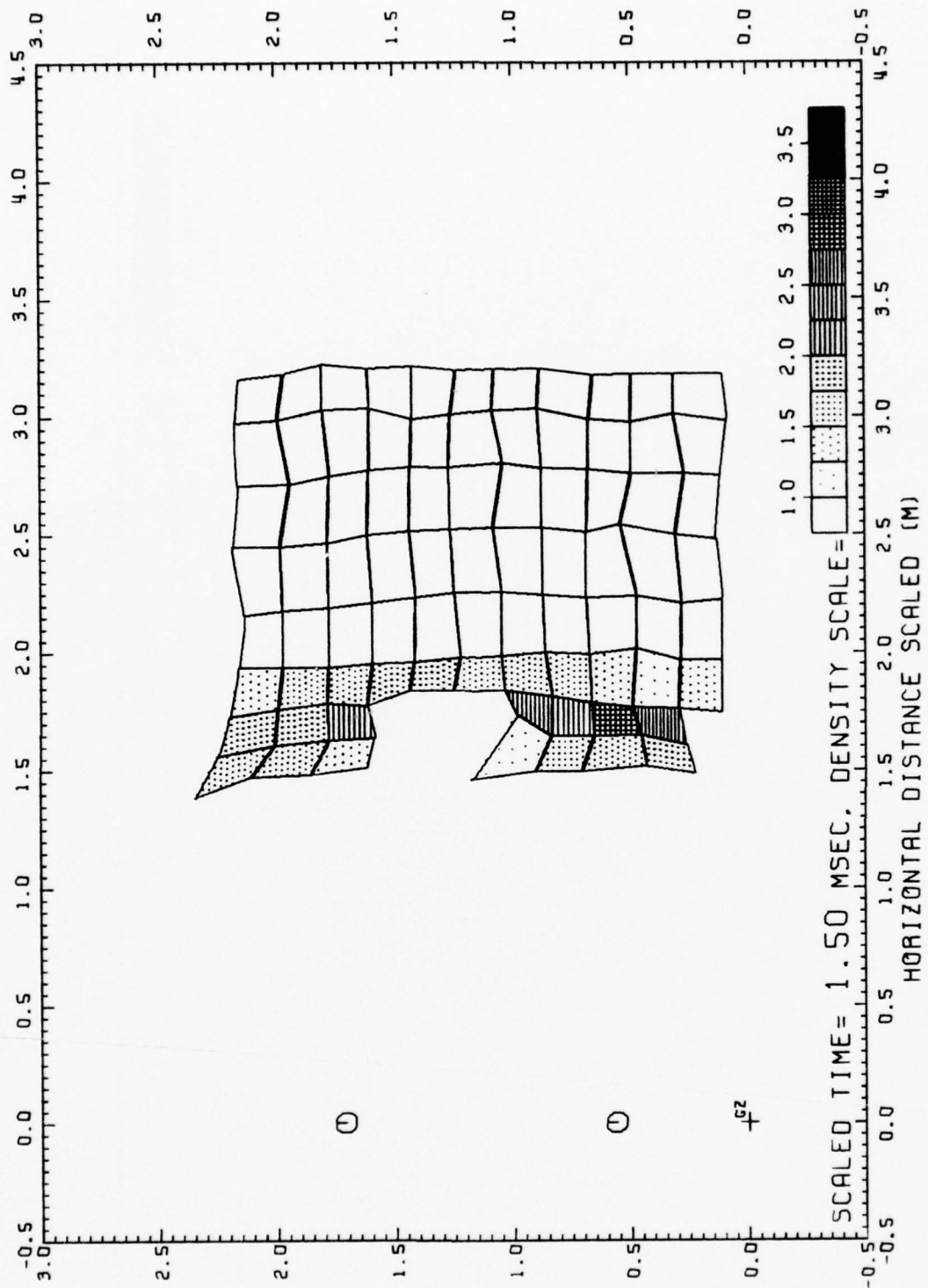


Fig. 13.10 DENSITY FIELD, DIPOLE WEST/10

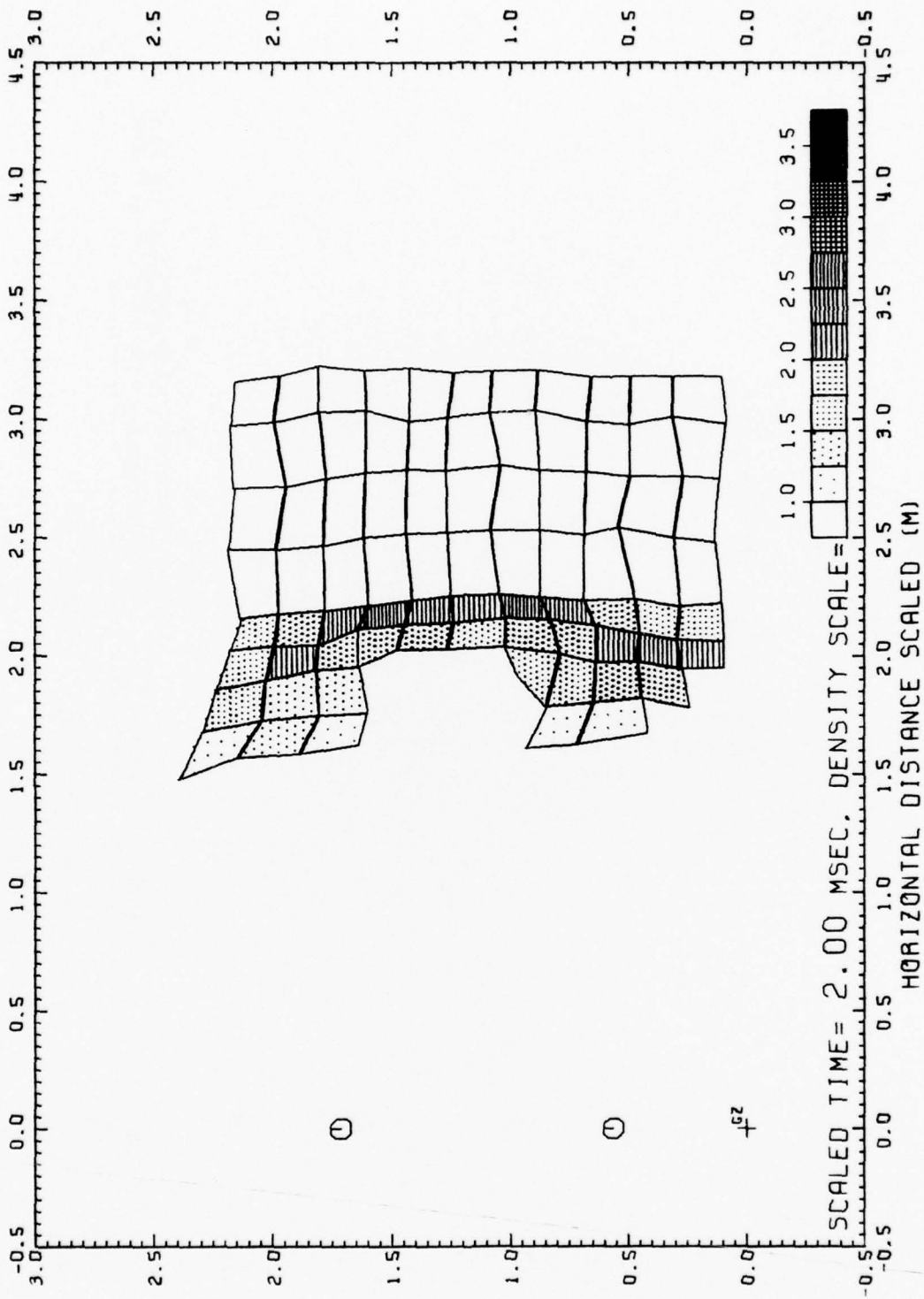


Fig. 13.11 DENSITY FIELD, DIPOLE WEST/10

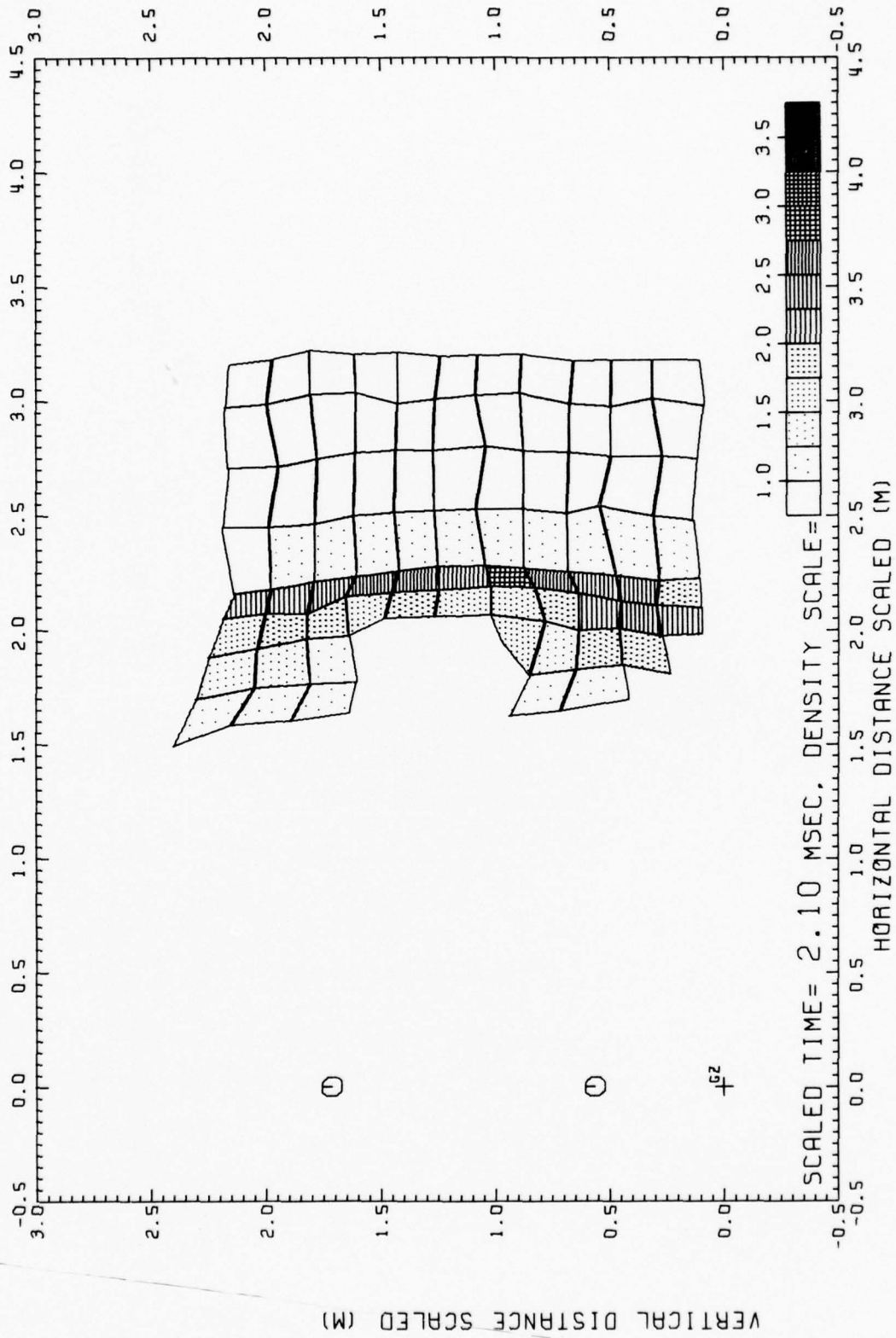


Fig. 13.12 DENSITY FIELD, DIPOLE WEST/10

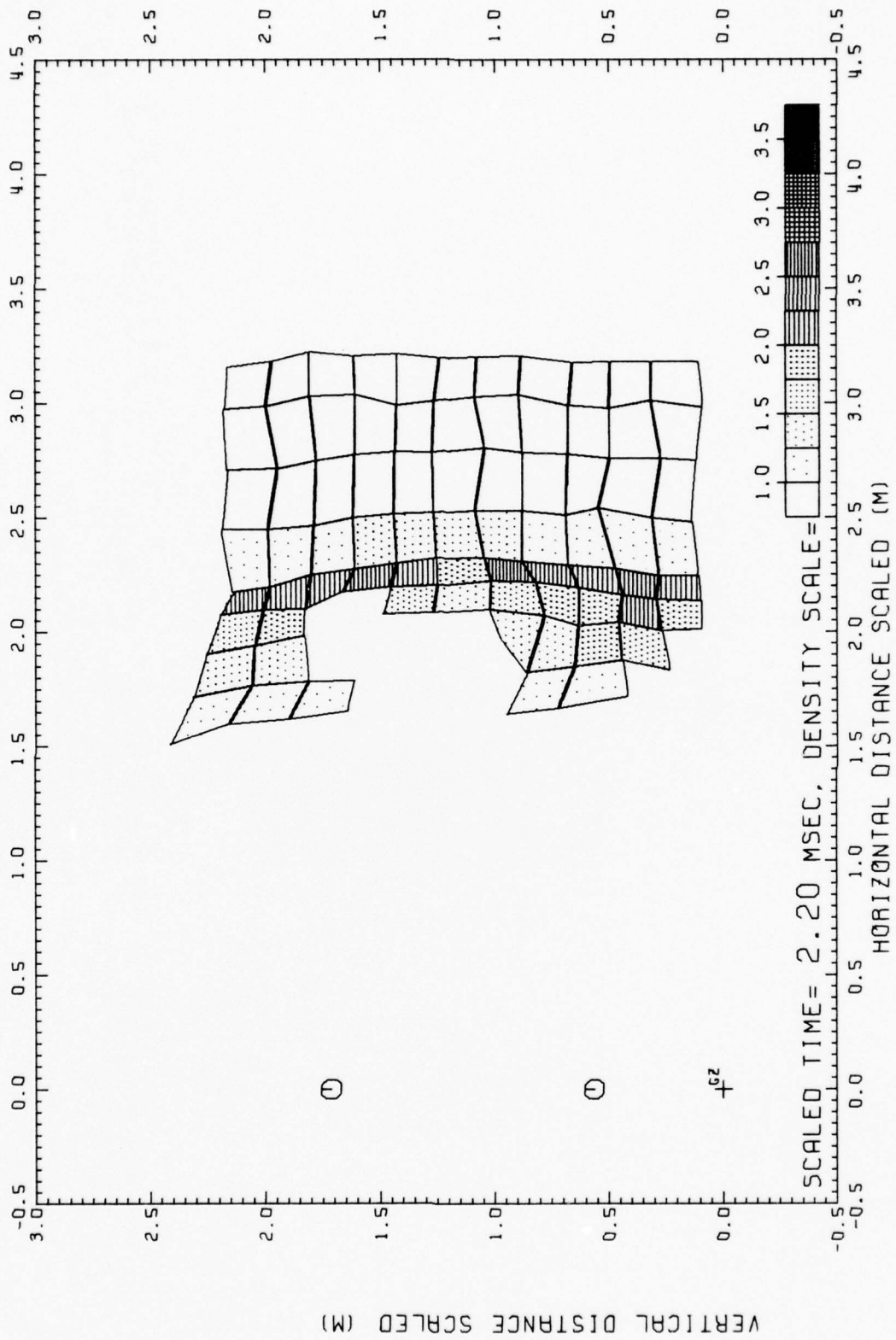


Fig. 13.13 DENSITY FIELD, DIPOLE WEST/10

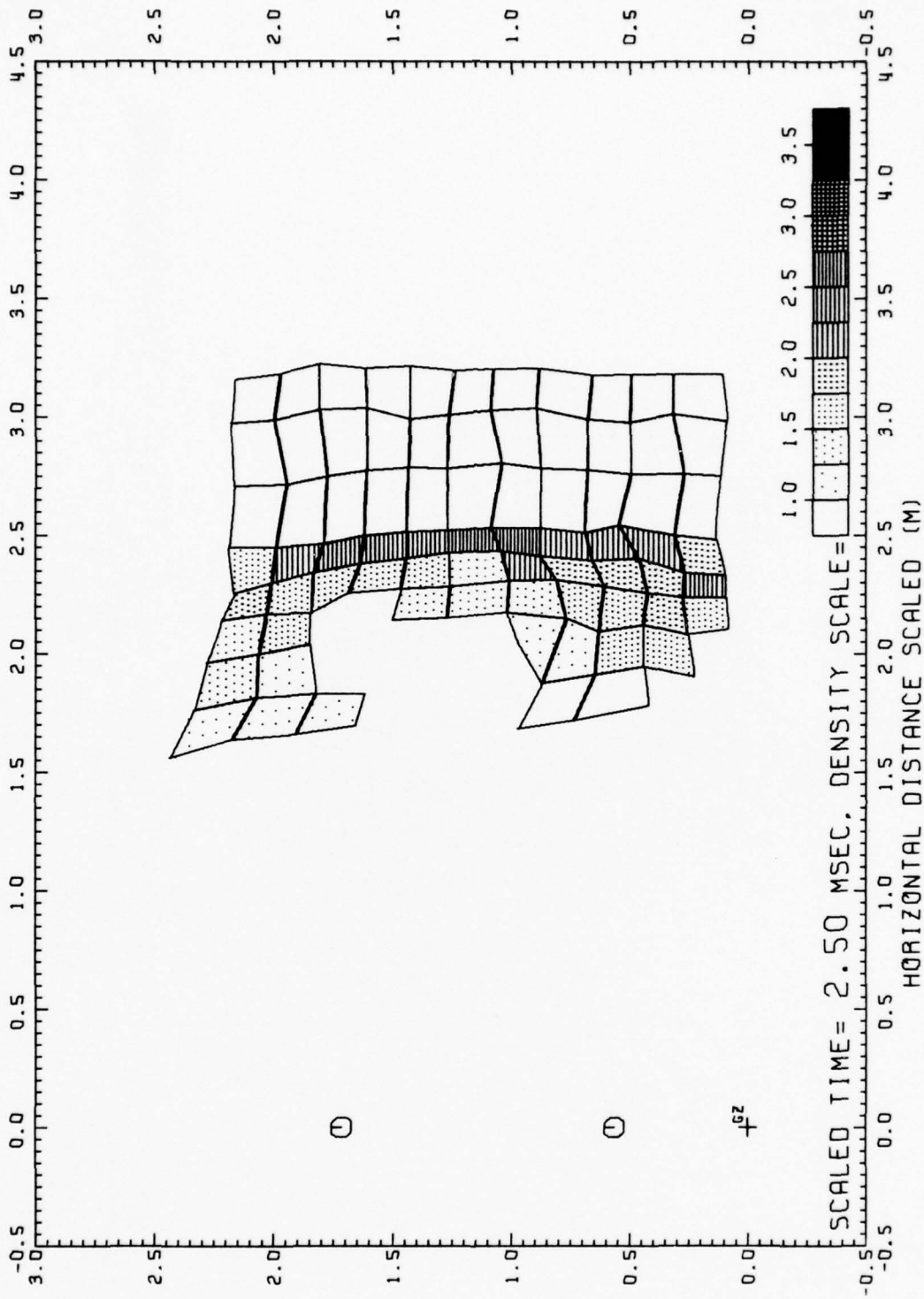


Fig. 13.14 DENSITY FIELD, DIPOLE WEST/10

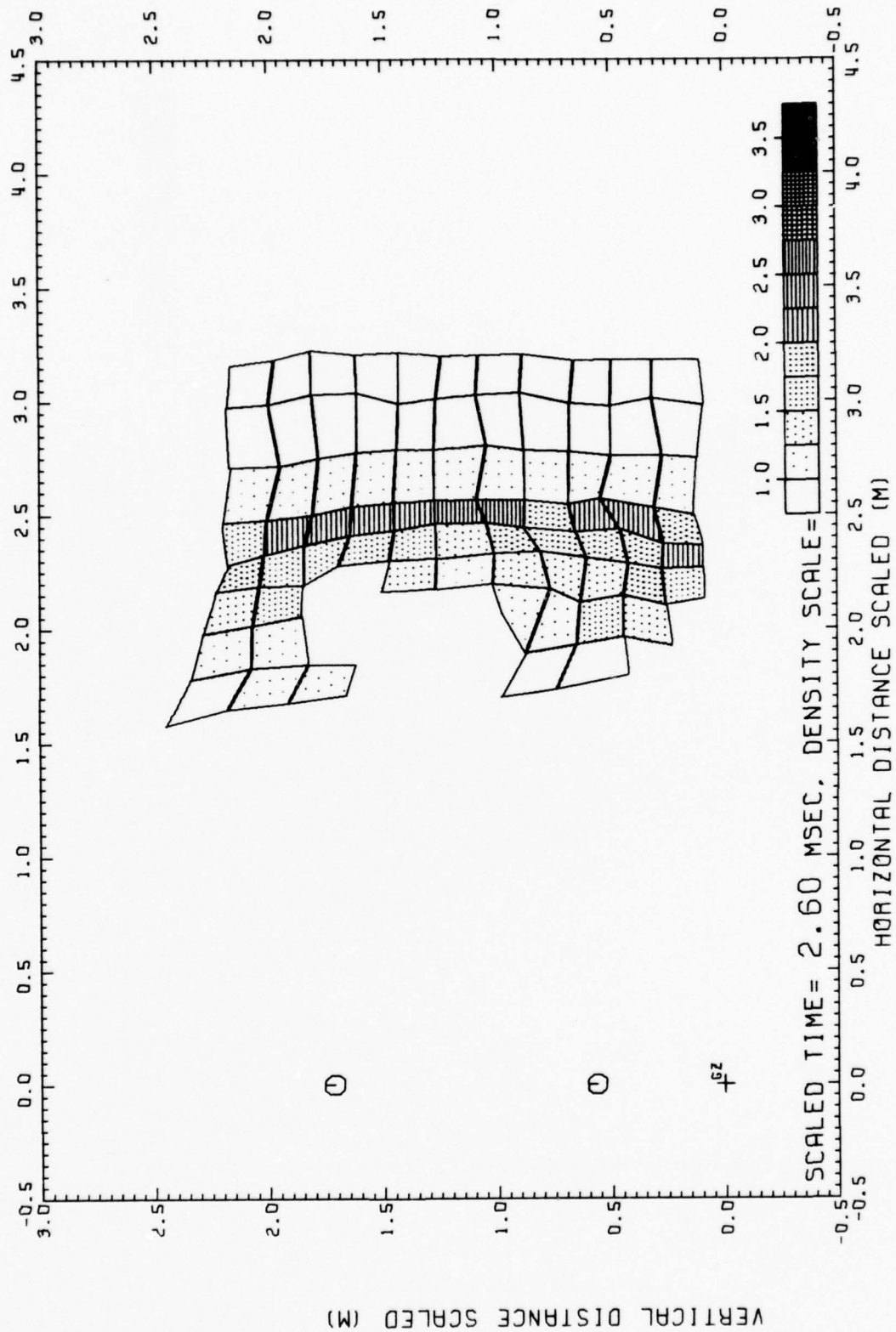


Fig. 13.15 DENSITY FIELD, DIPOLE WEST/10

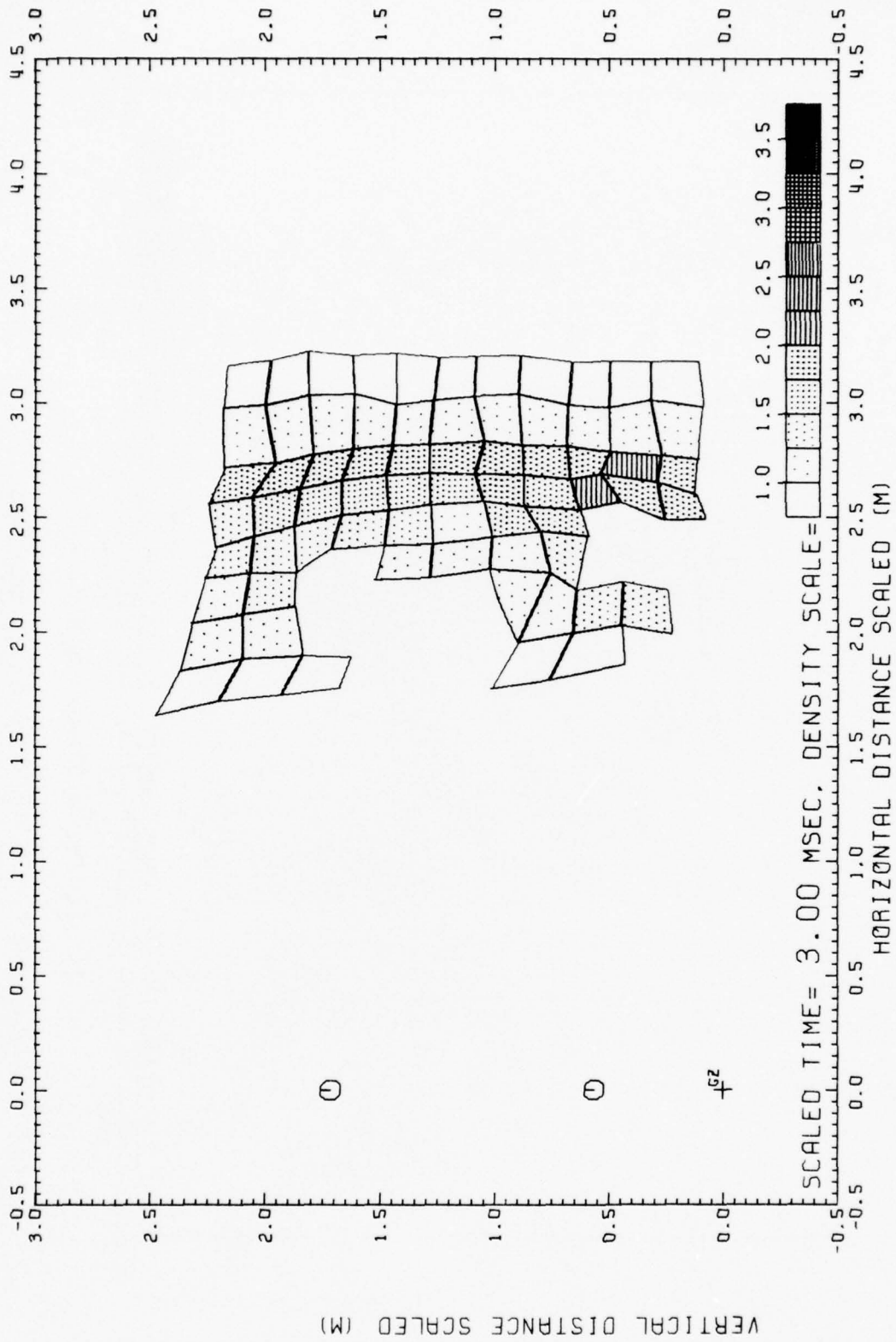


Fig. 13.16 DENSITY FIELD, DIPOLE WEST/10

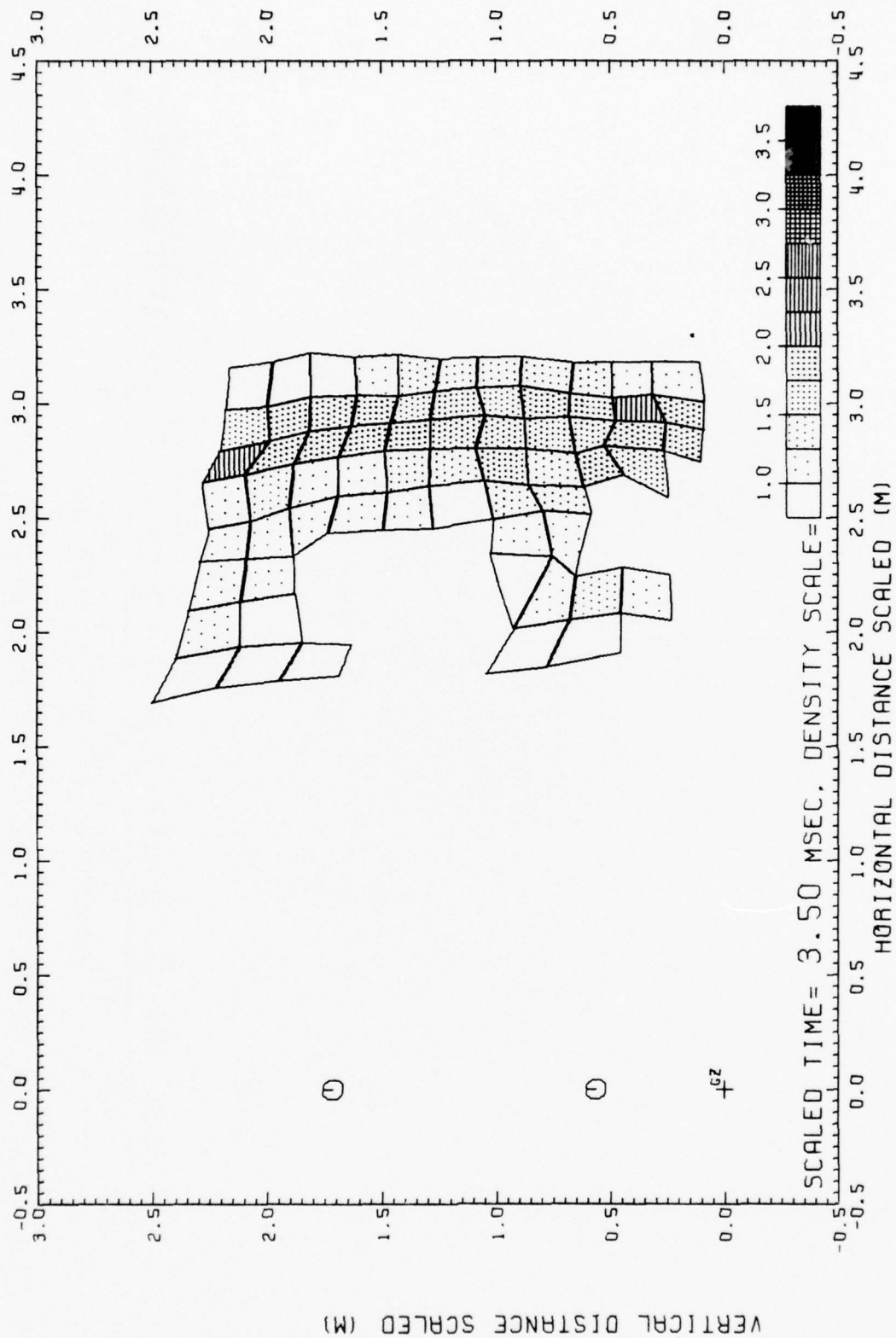


Fig. 13.17 DENSITY FIELD, DIPOLE WEST/10

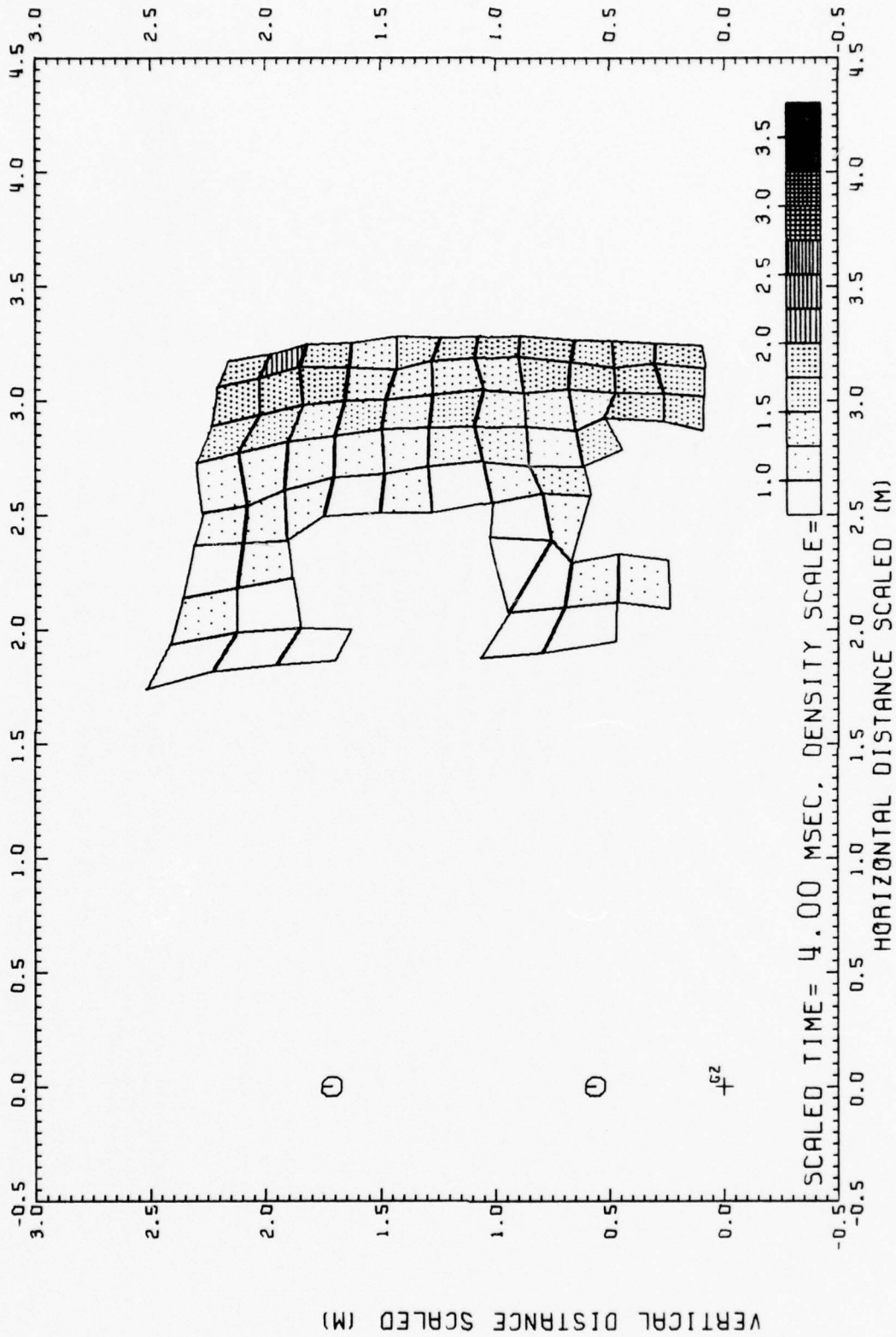


Fig. 13.18 DENSITY FIELD, DIPOLE WEST/10

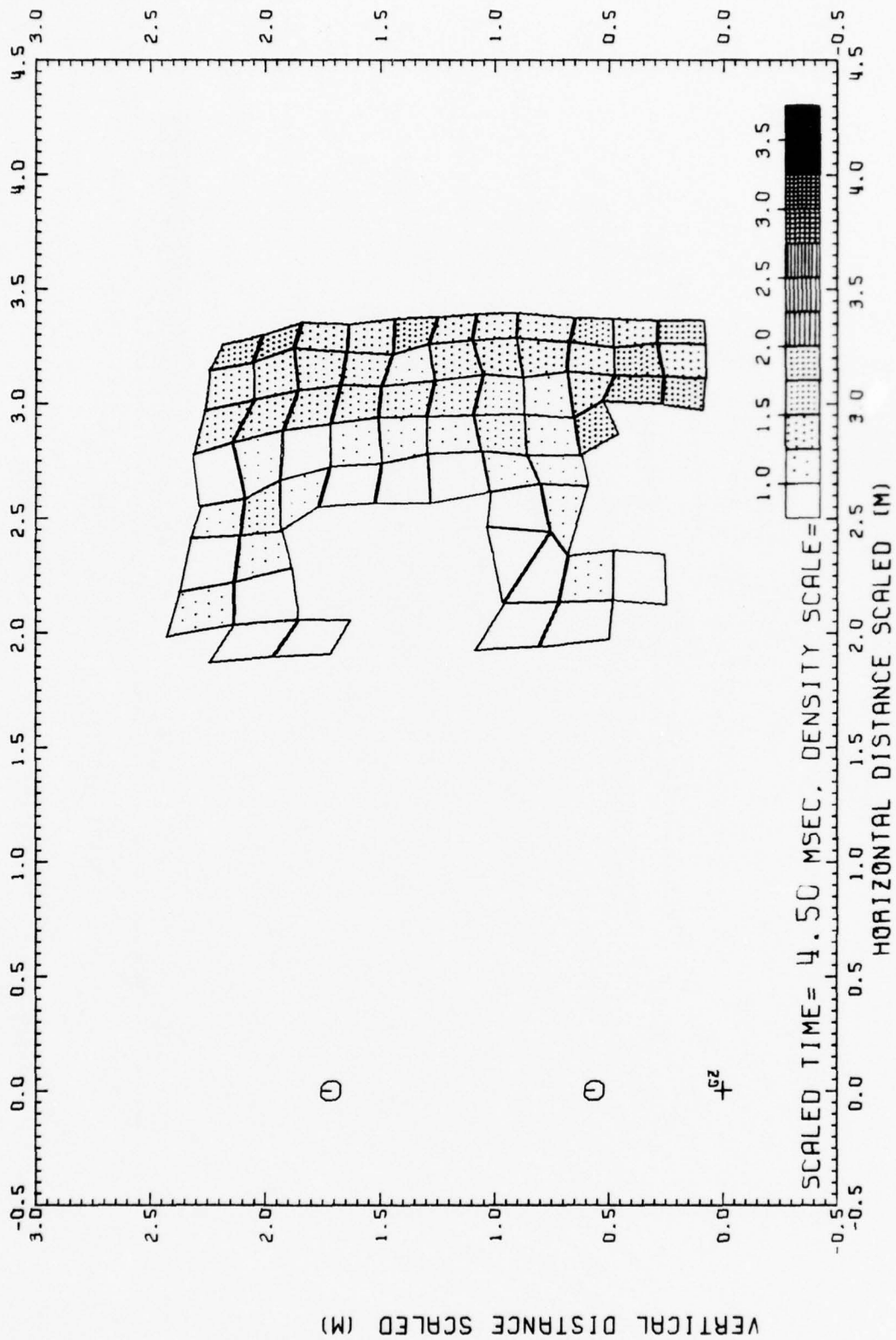
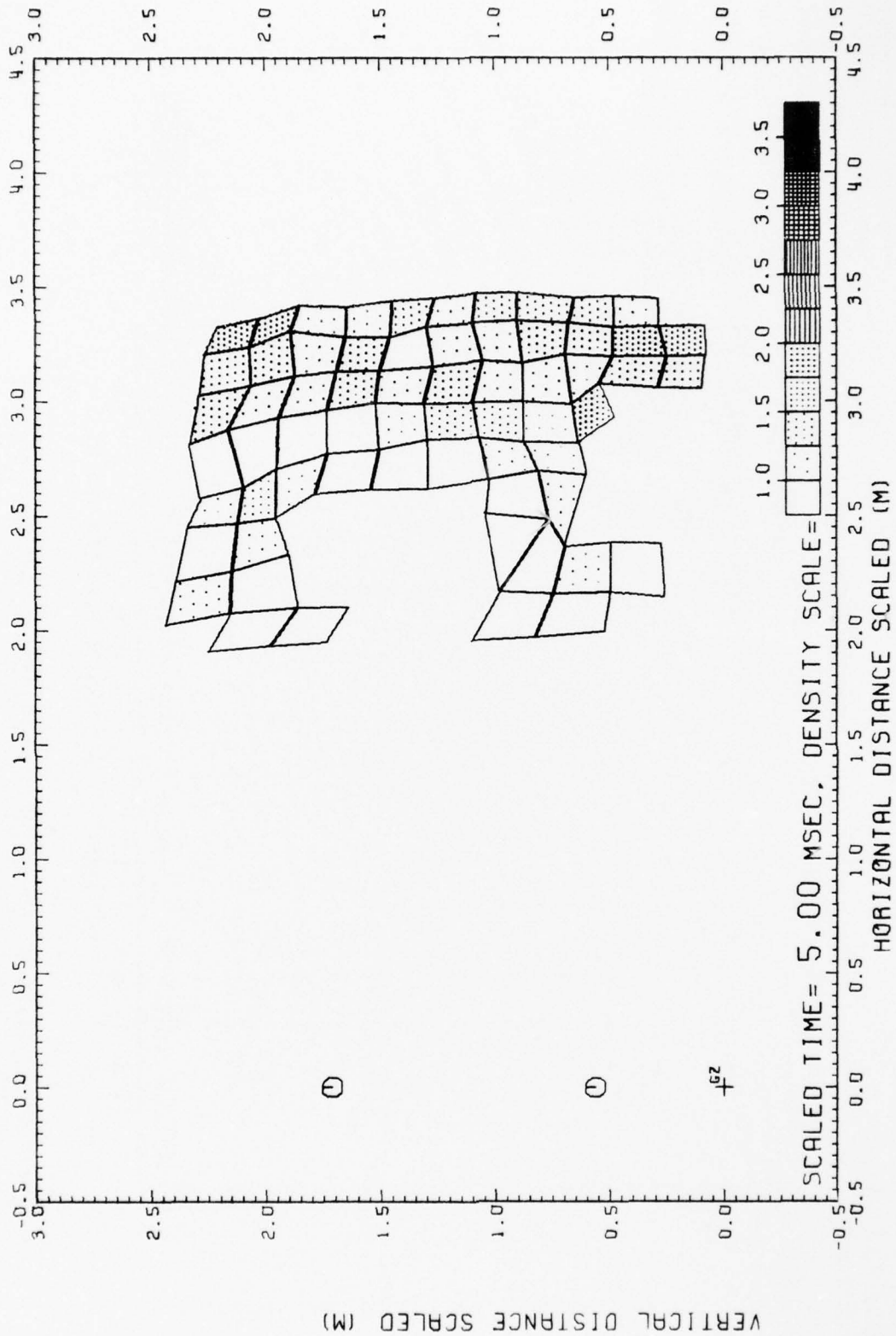


Fig. 13.19 DENSITY FIELD, DIPOLE WEST/10



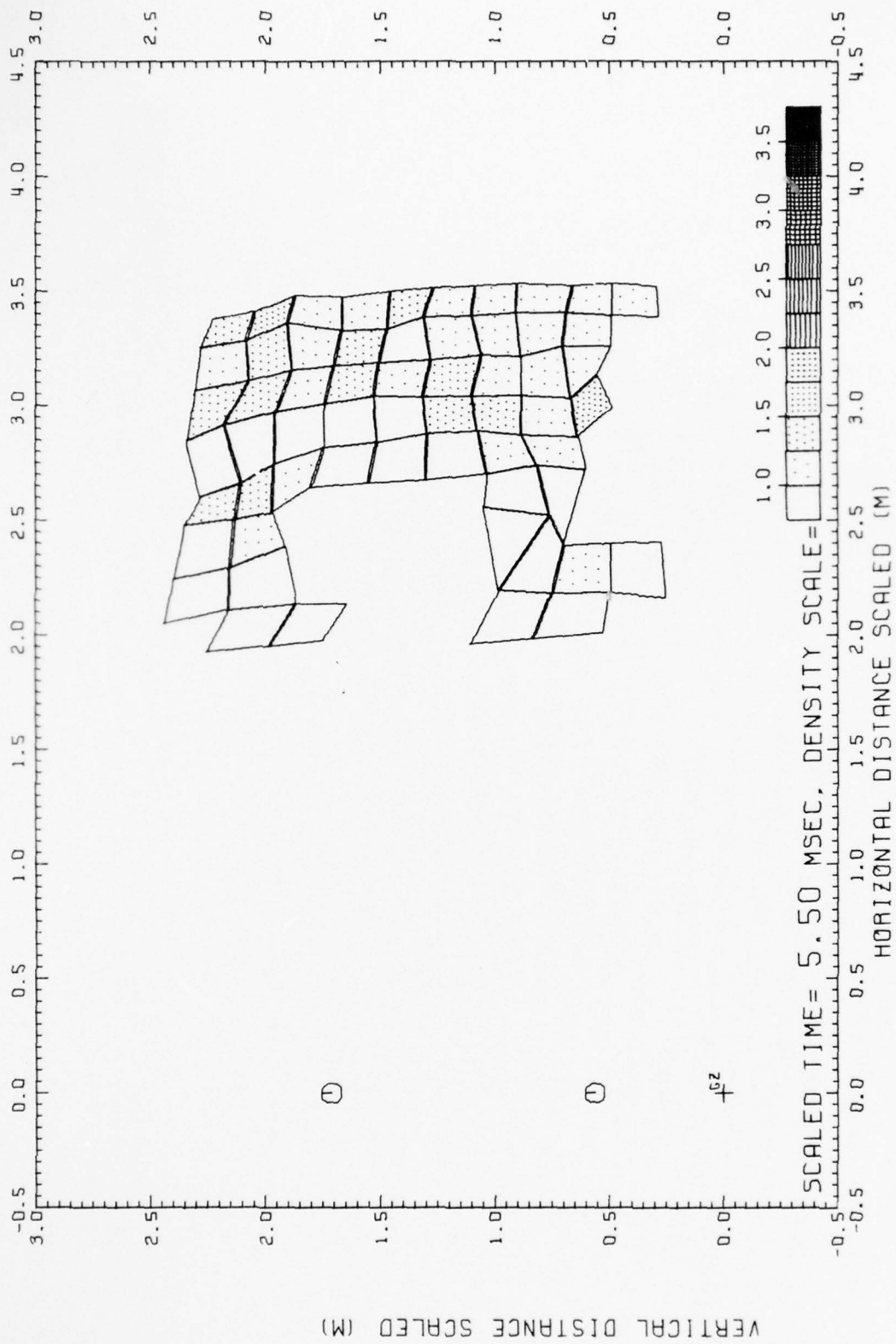


Fig. 13.21 DENSITY FIELD, DIPOLE WEST/10

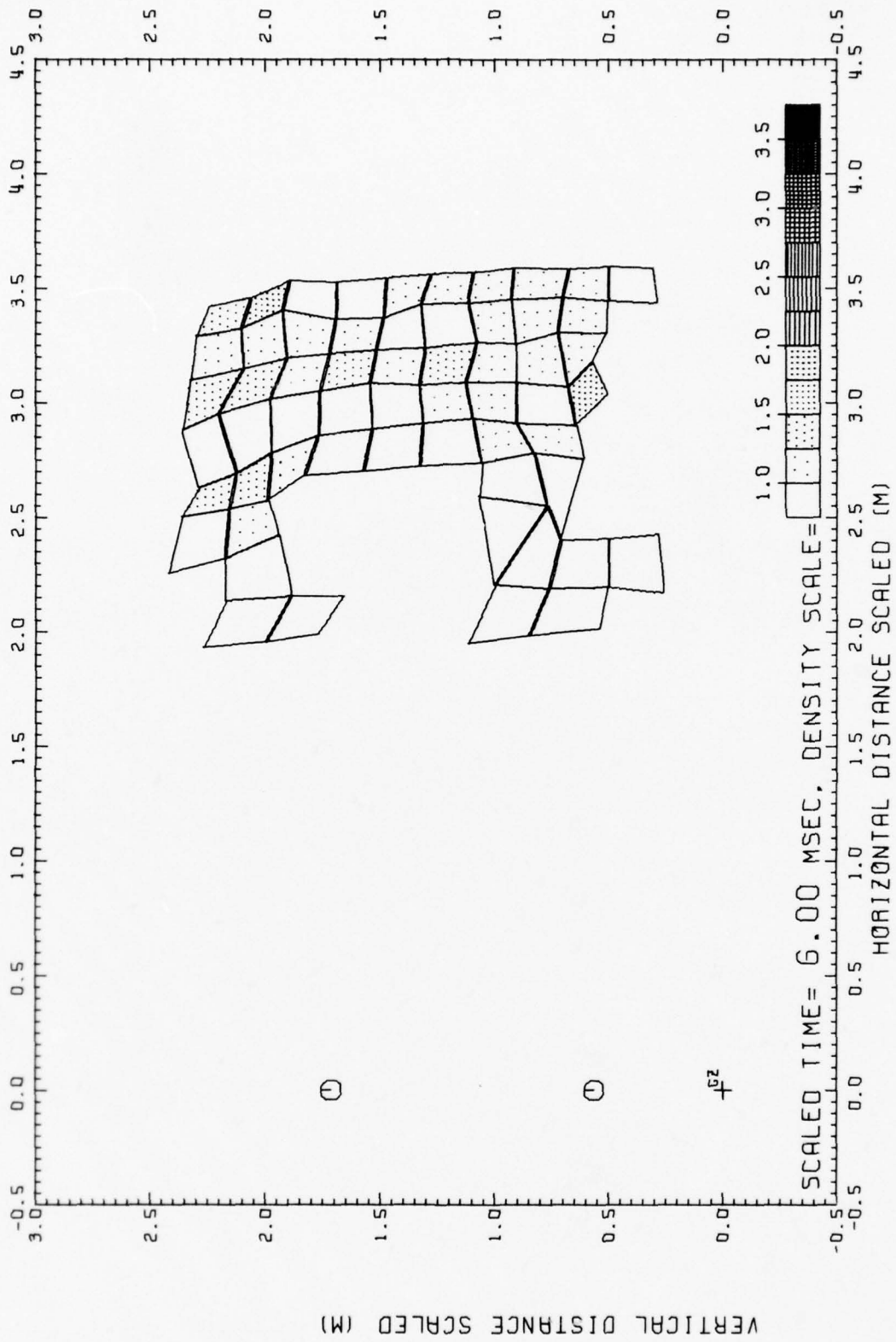


Fig. 13.22 DENSITY FIELD, DIPOLE WEST/10

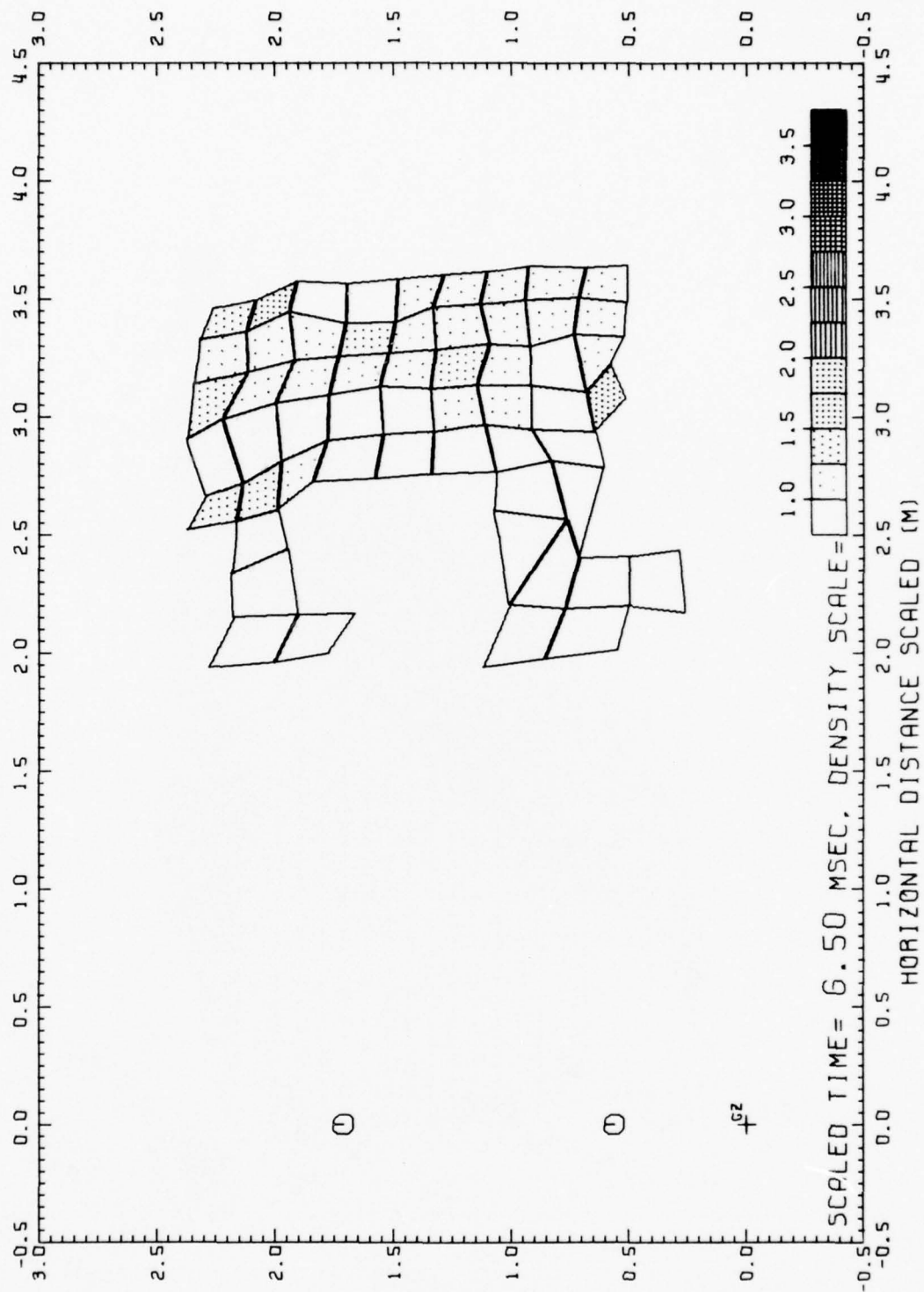


Fig. 13.23 DENSITY FIELD, DIPOLE WEST/10

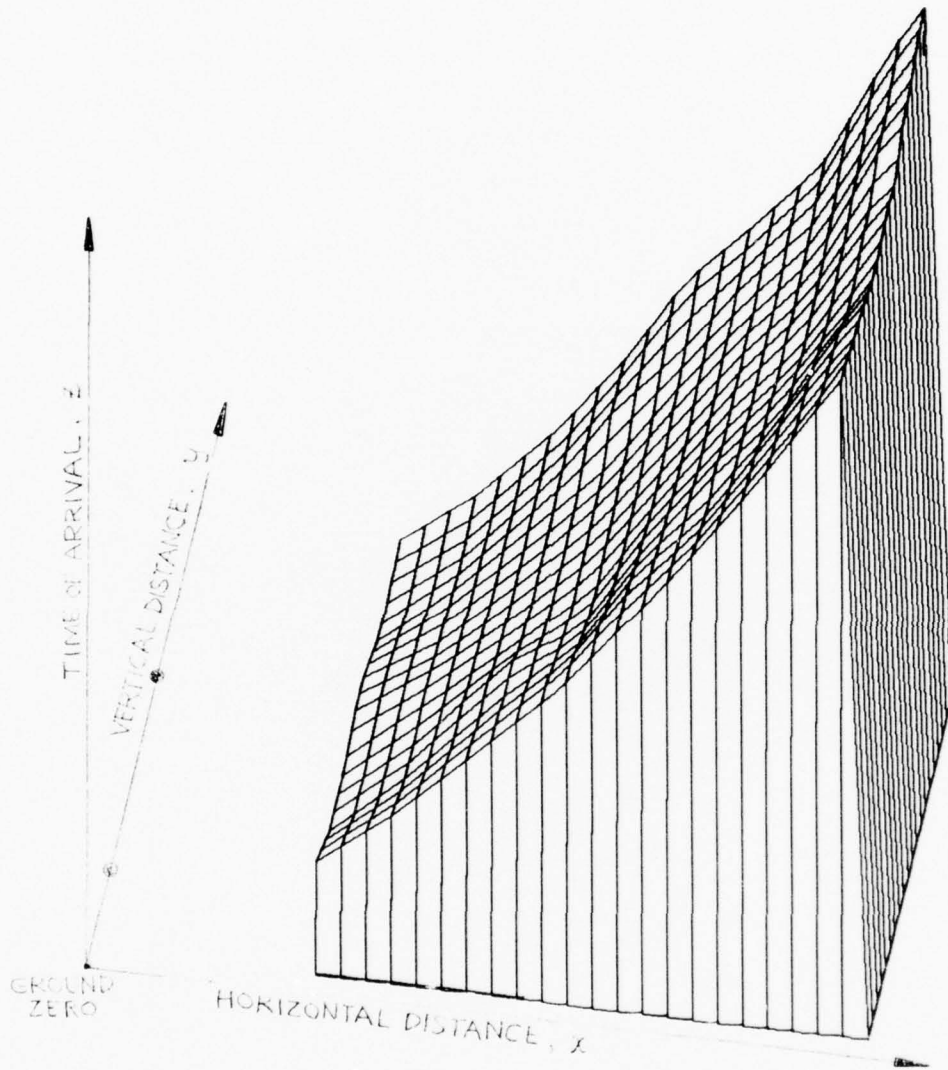


Fig. 14 Time-of-arrival surface, Dipole West/10

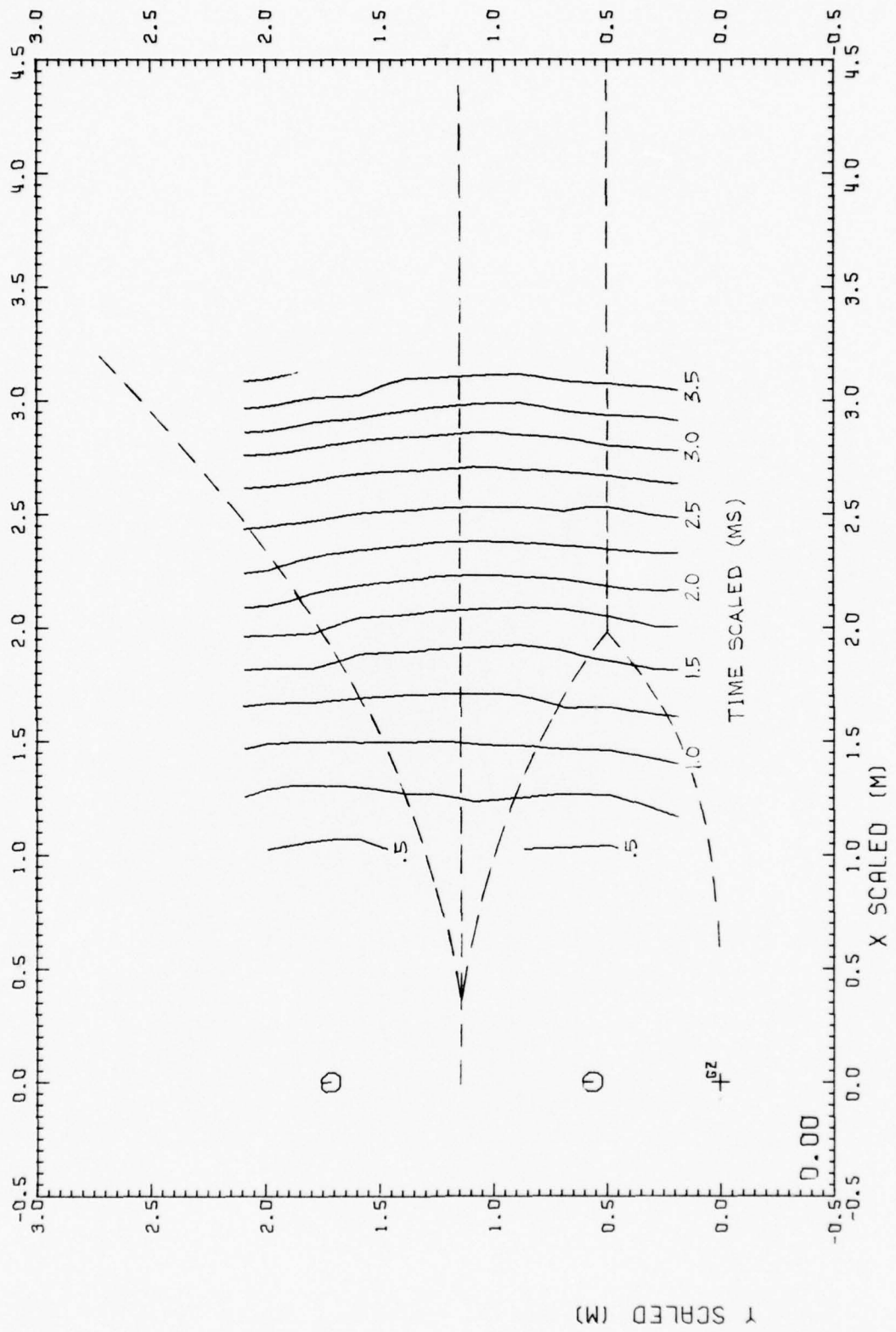


Fig. 15 SHOCK FRONT SHAPES, DIPOLE WEST/10

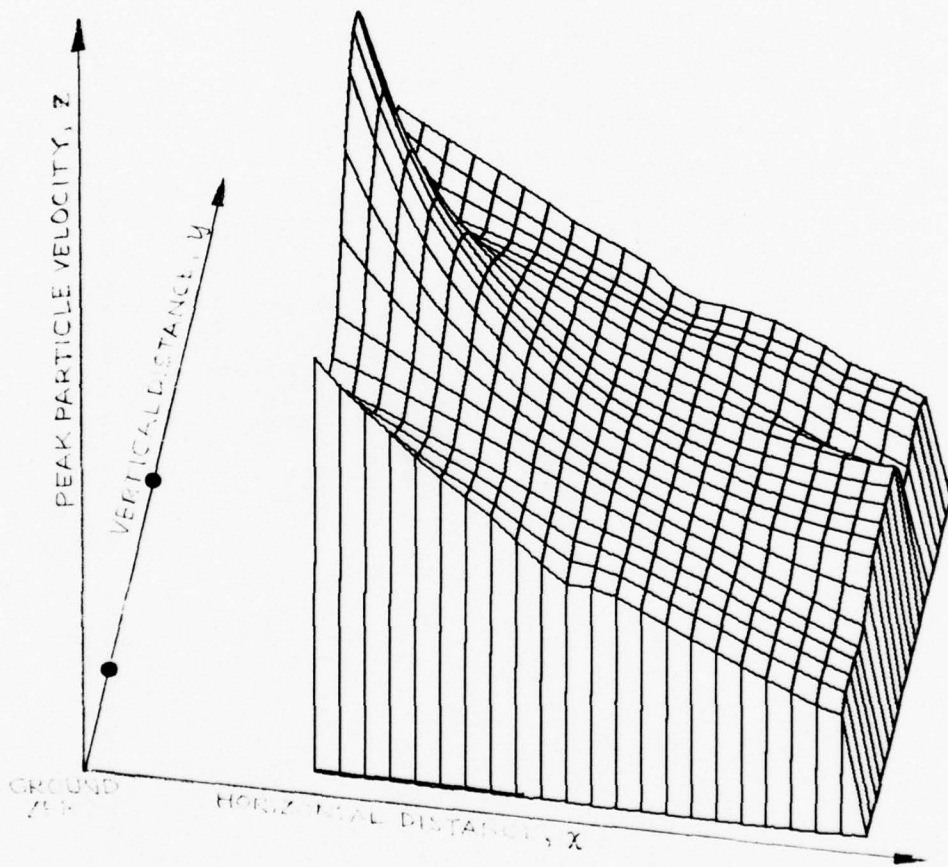


Fig. 16 A shock strength surface, Dipole West/10

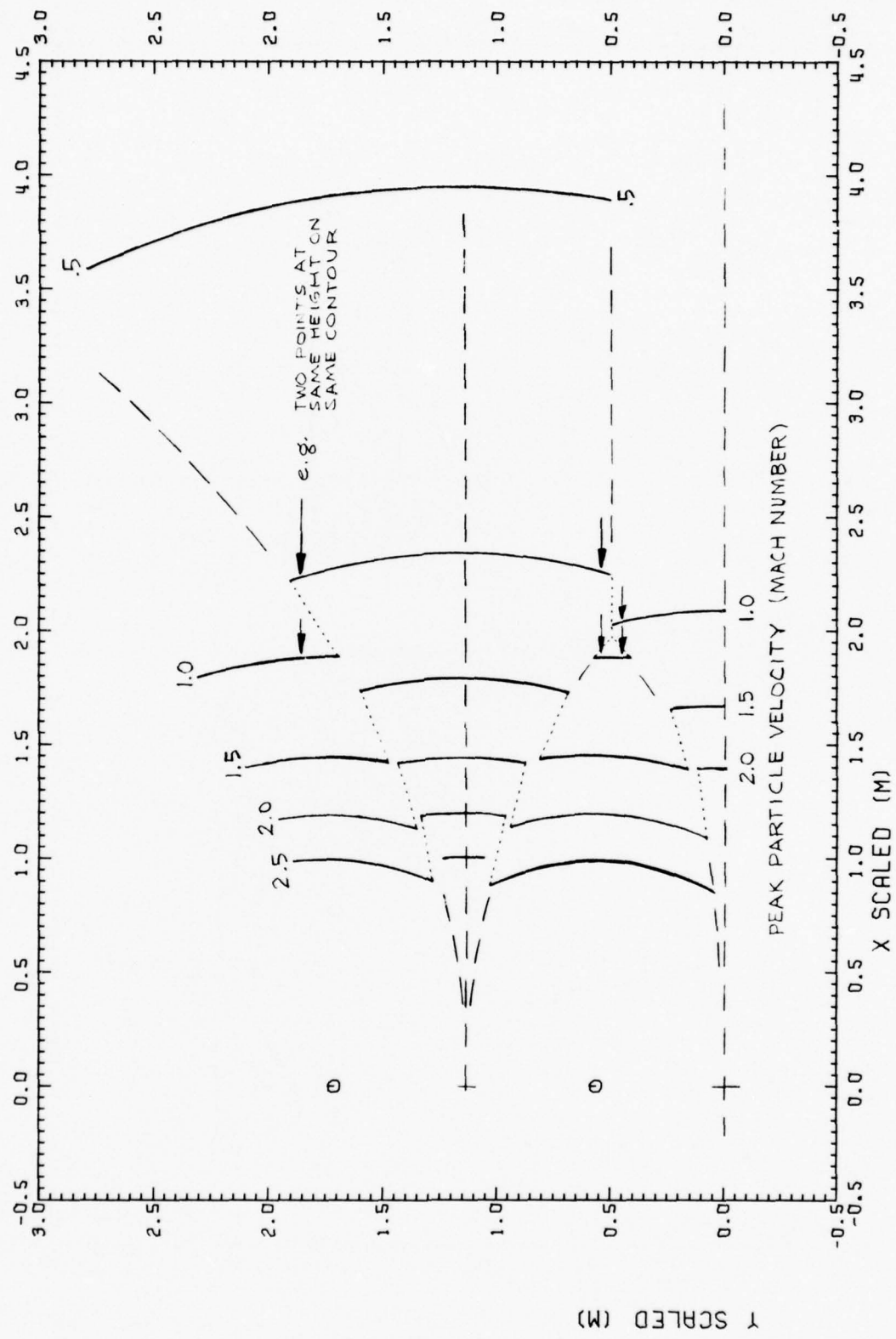


Fig. 17 SHOCK STRENGTH CONTOURS, DIPOLE WEST/10

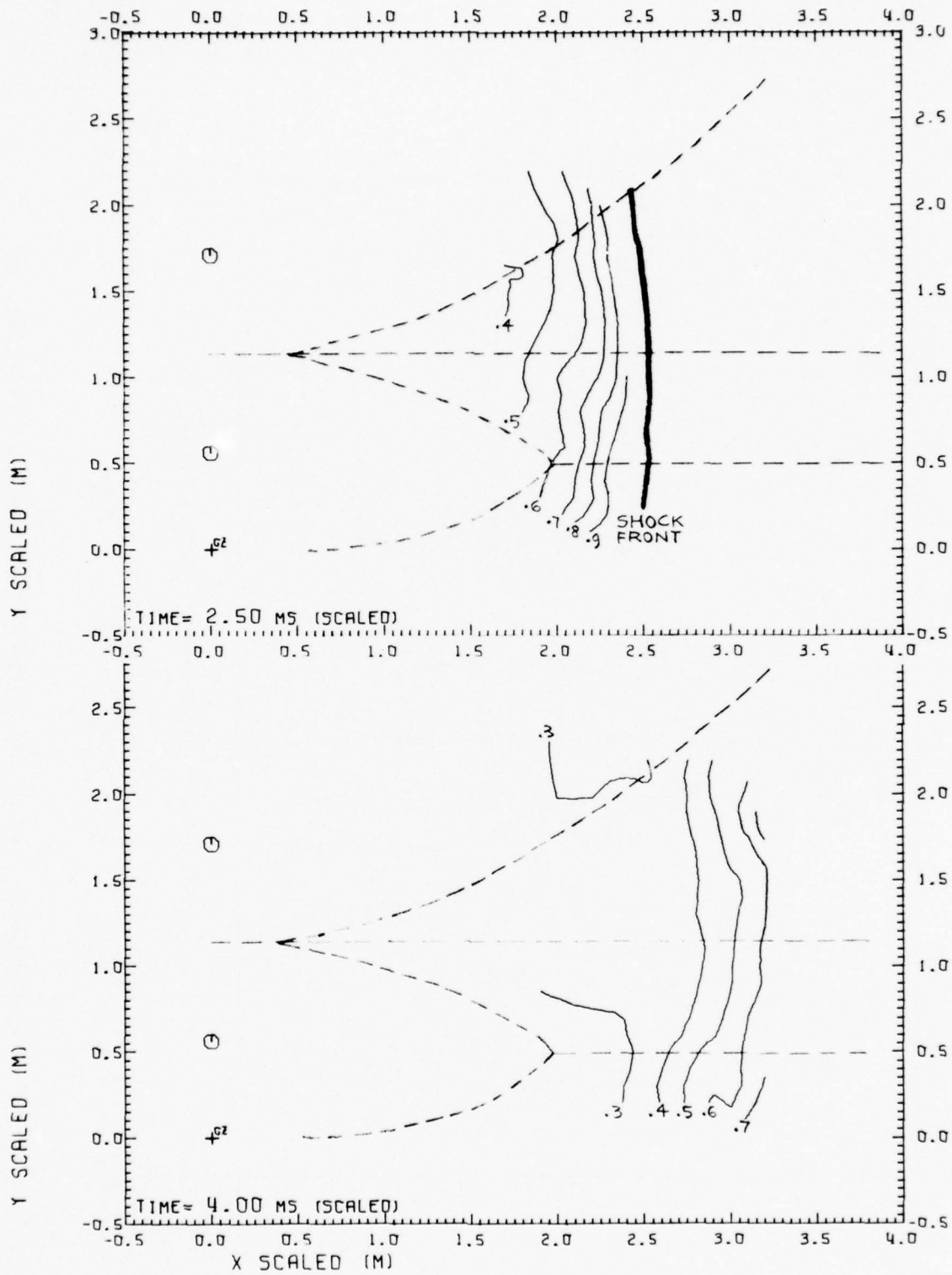


Fig. 18 DIPOLE WEST/10 PARTICLE VELOCITY

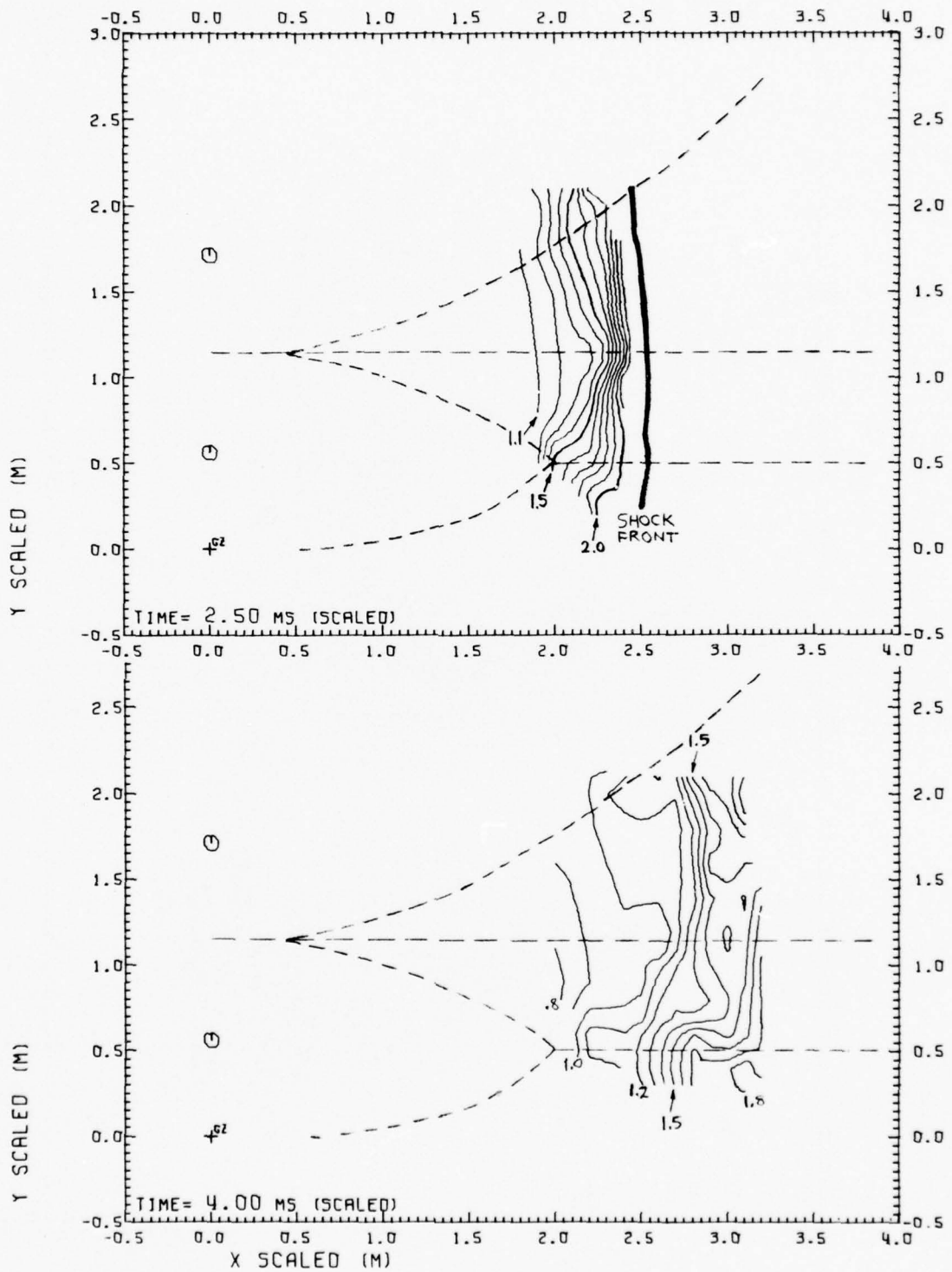


Fig. 19

DIPOLE WEST/10 DENSITY

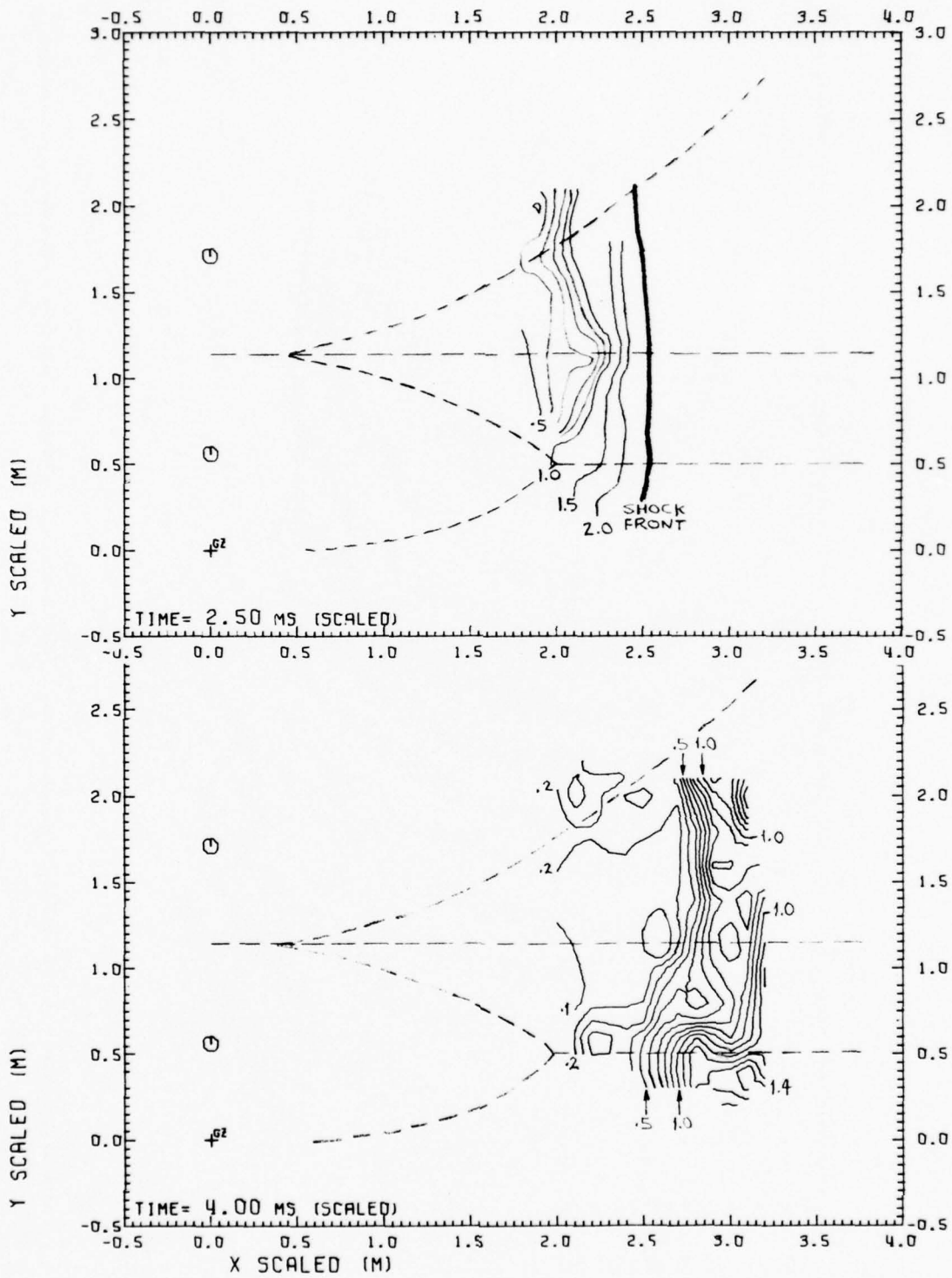


Fig. 20 DIPOLE WEST/10 HYDROSTATIC OVERPRESSURE

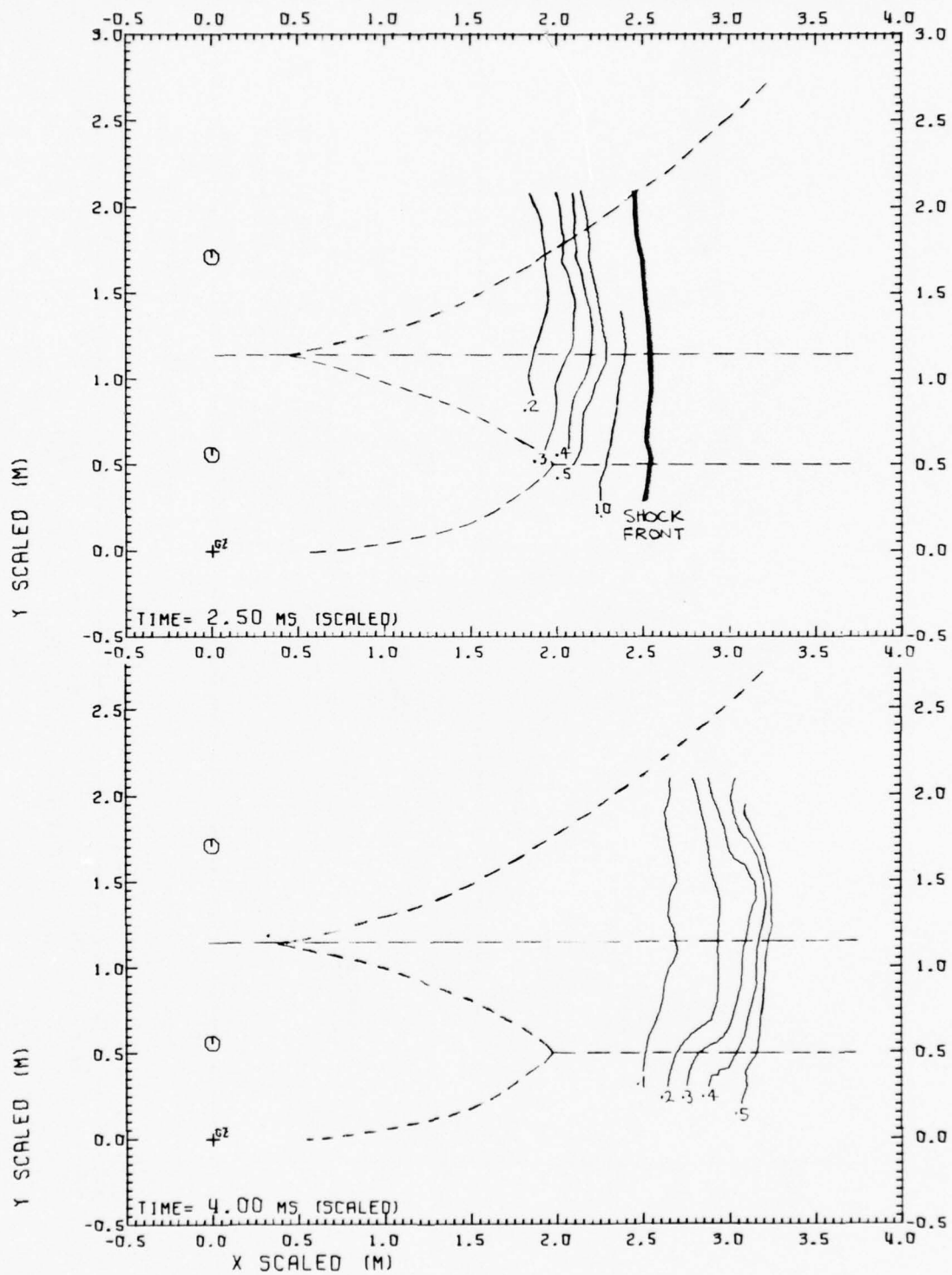


Fig. 21 DIPOLE WEST/10 DYNAMIC PRESSURE

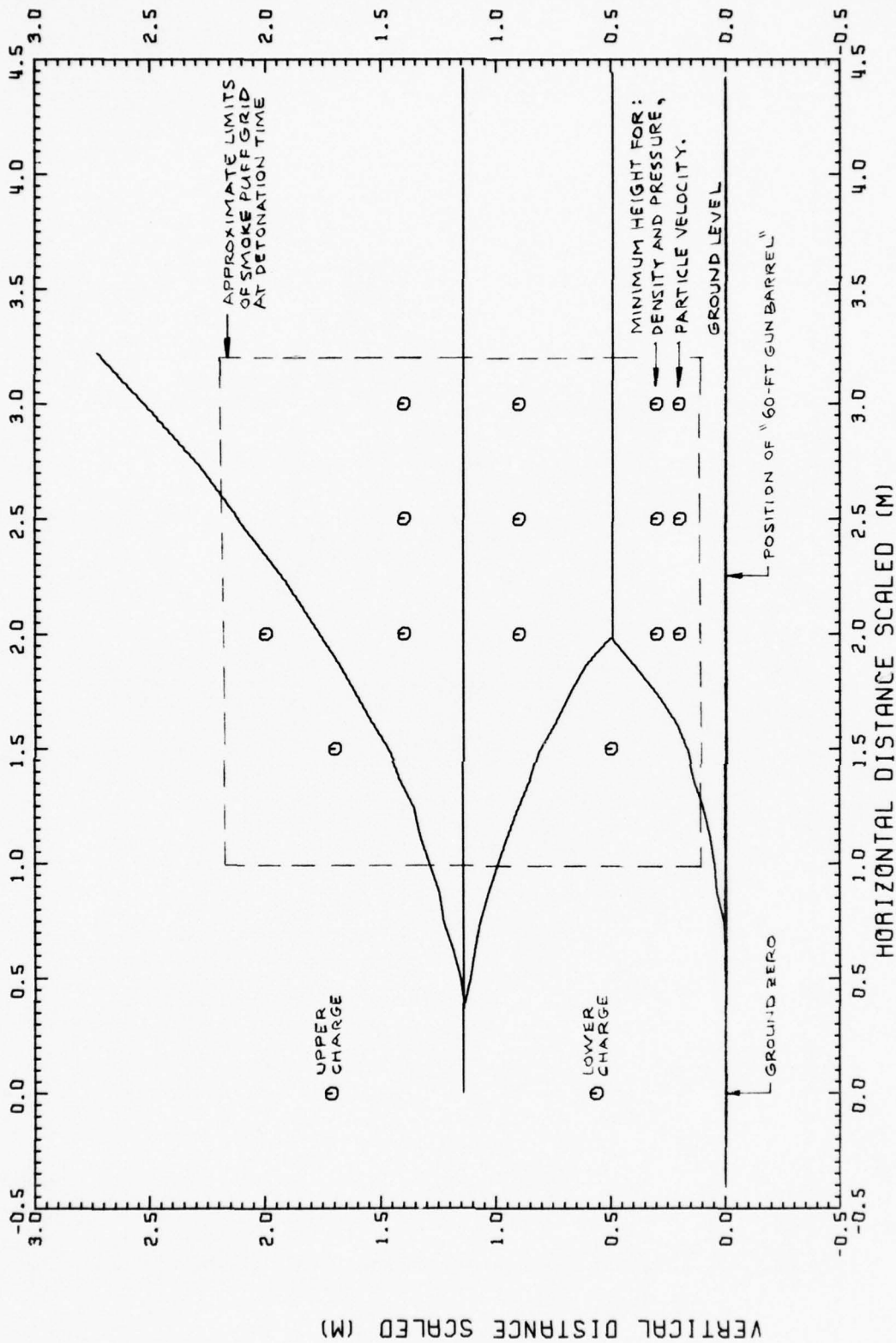


Fig. 22 TIME HISTORY STATIONS, DIPOLE WEST/10

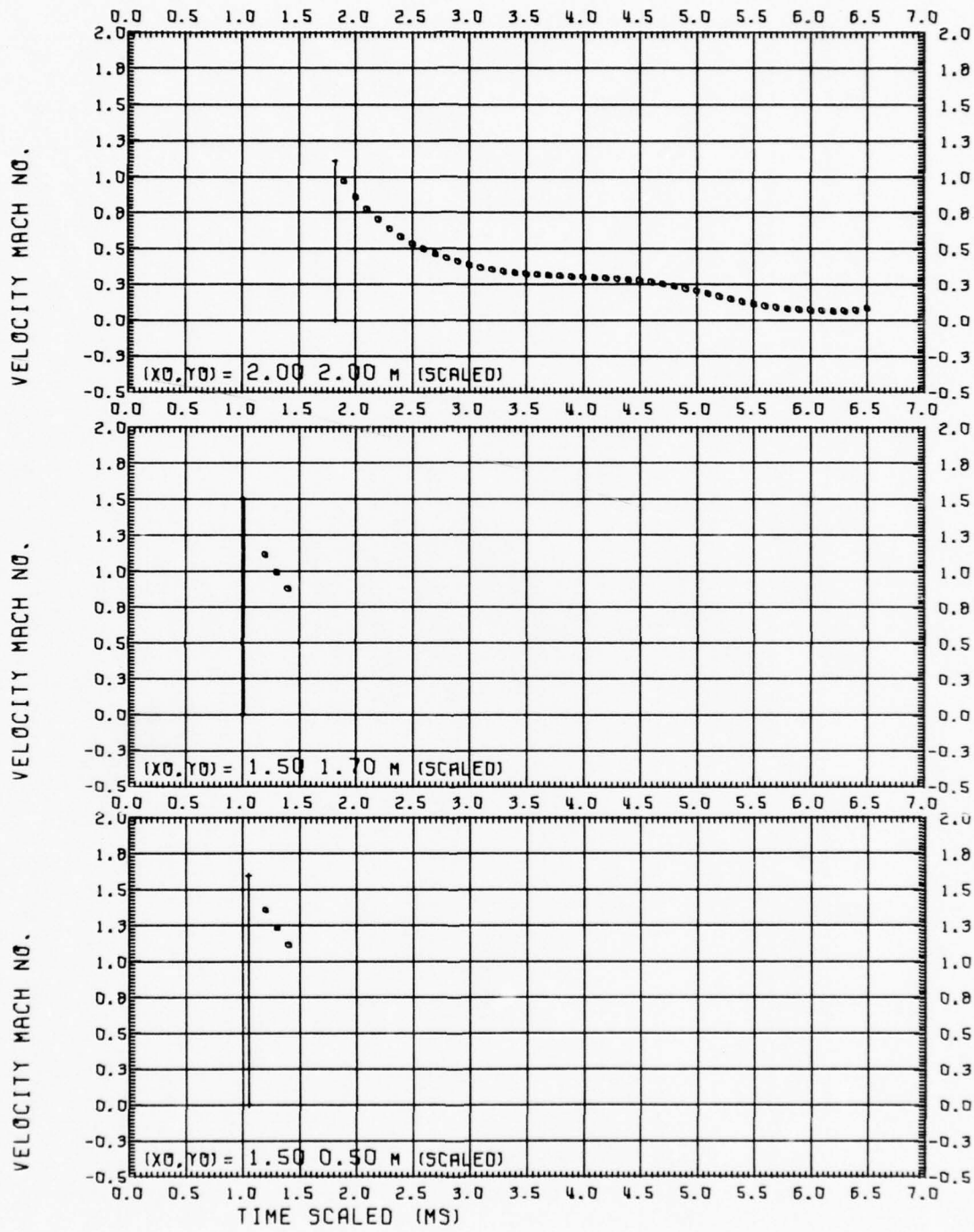


Fig. 23.1 DIPOLE WEST/10 PARTICLE VELOCITY

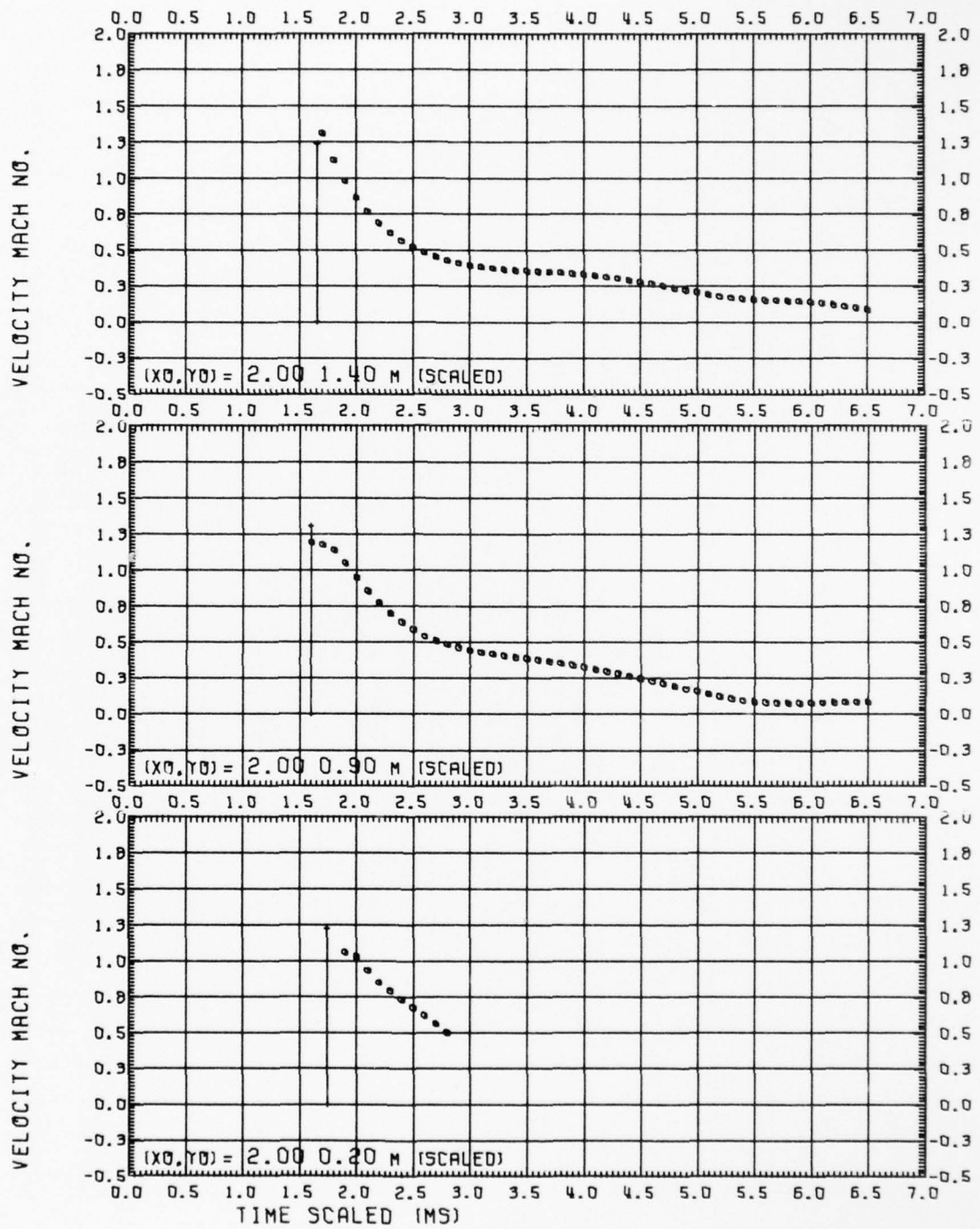


Fig. 23.2 DIPOLE WEST/10 PARTICLE VELOCITY

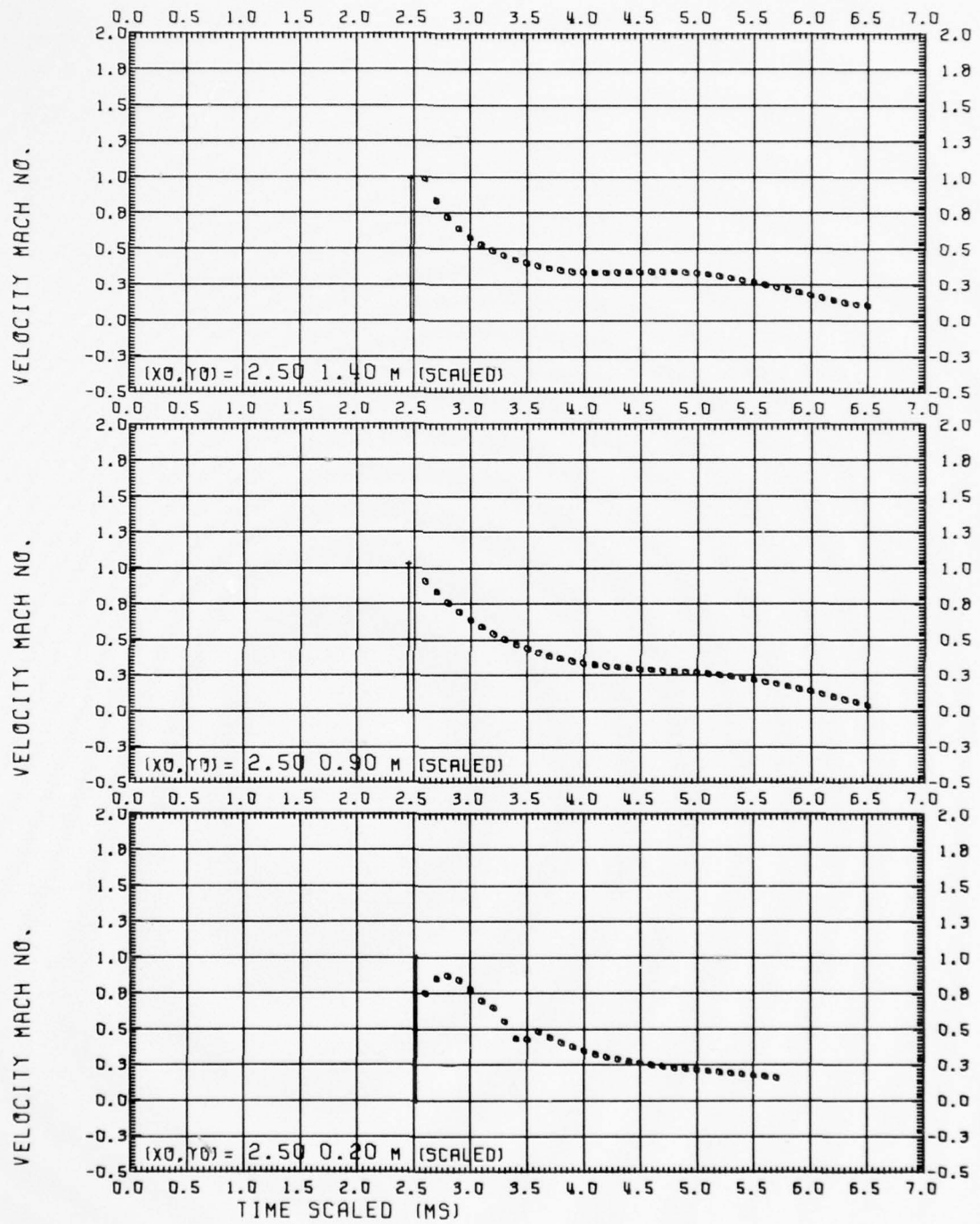


Fig. 23.3 DIPOLE WEST/10 PARTICLE VELOCITY

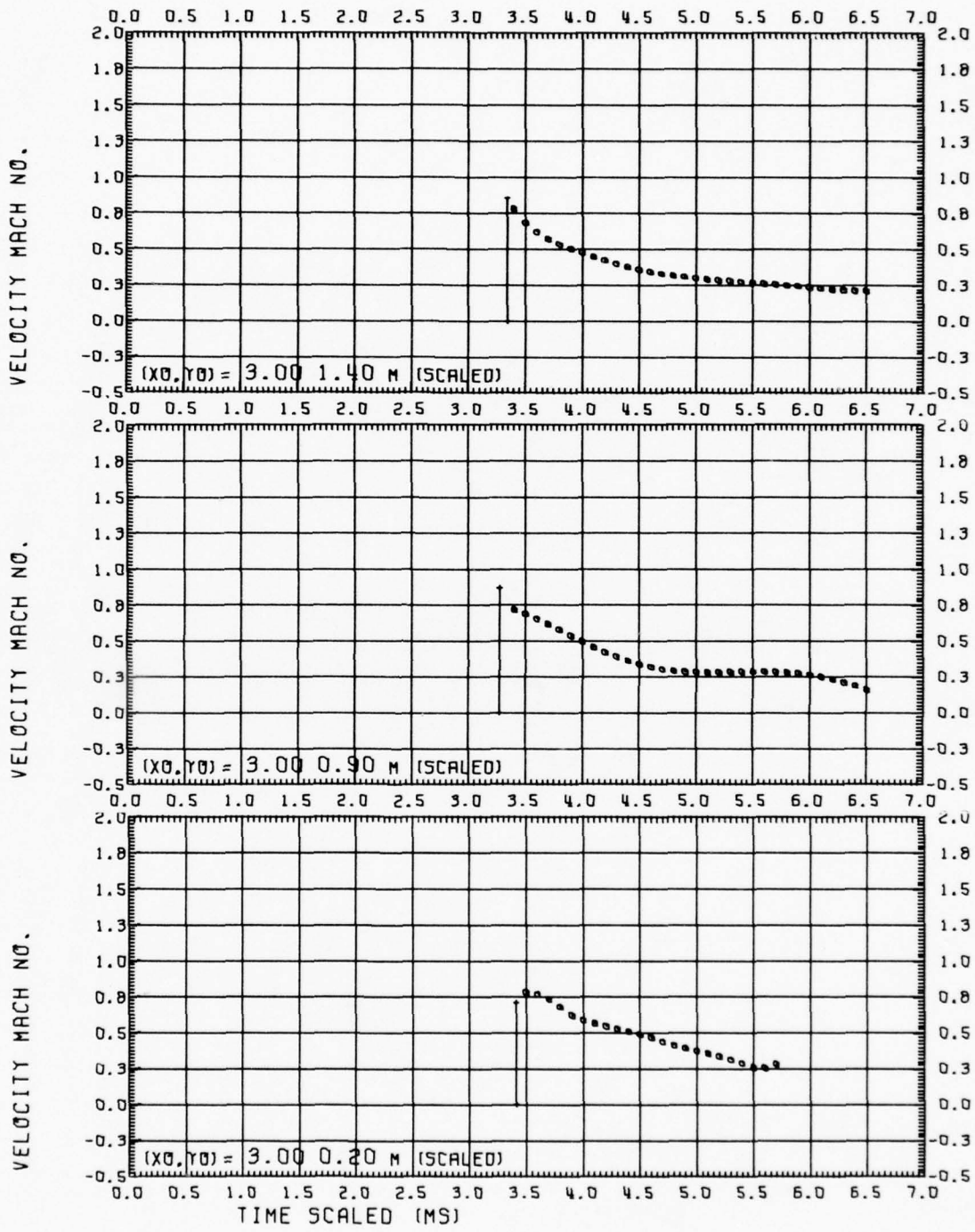


Fig. 23.4 DIPOLE WEST/10 PARTICLE VELOCITY

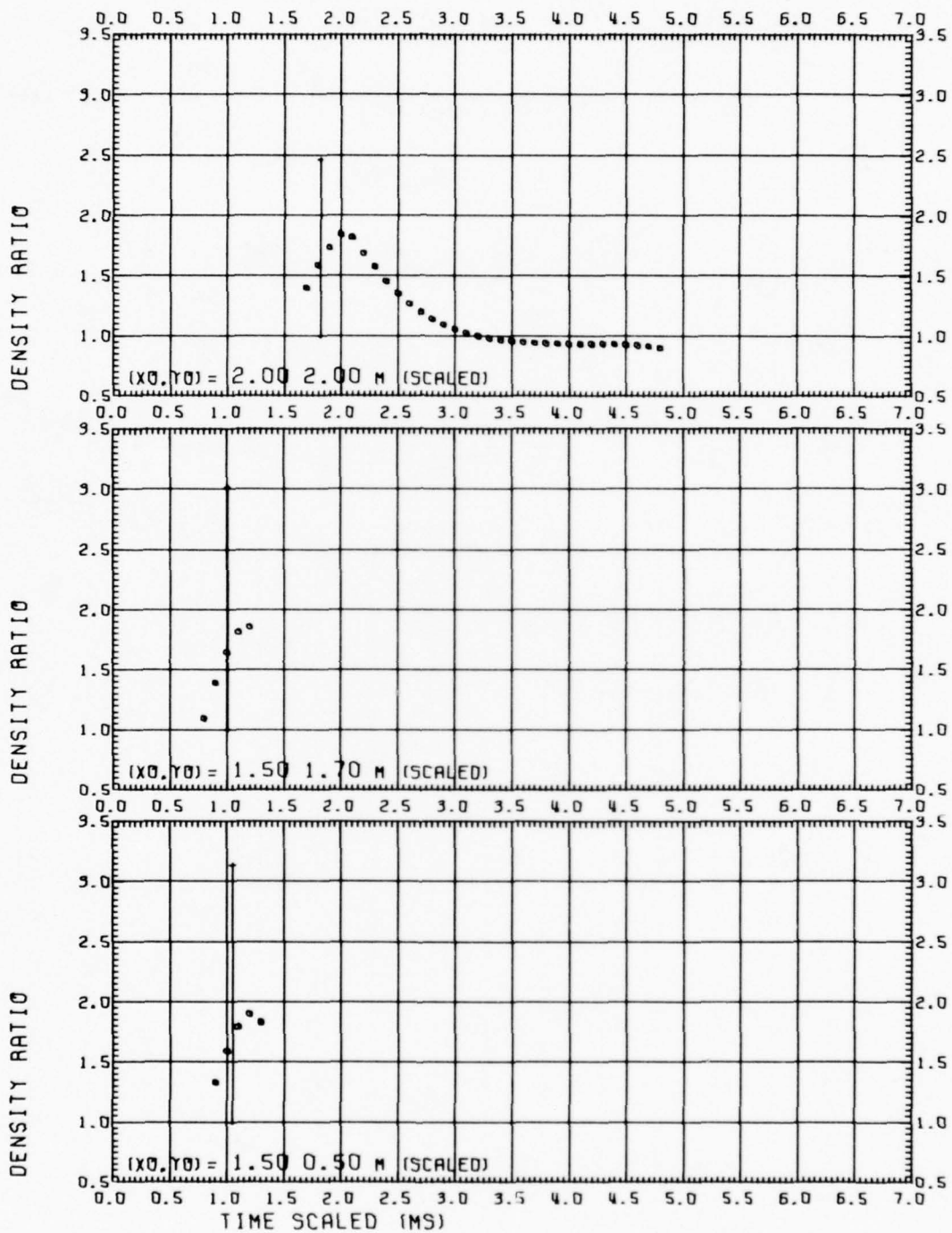


Fig. 24.1 DIPOLE WEST/10 DENSITY

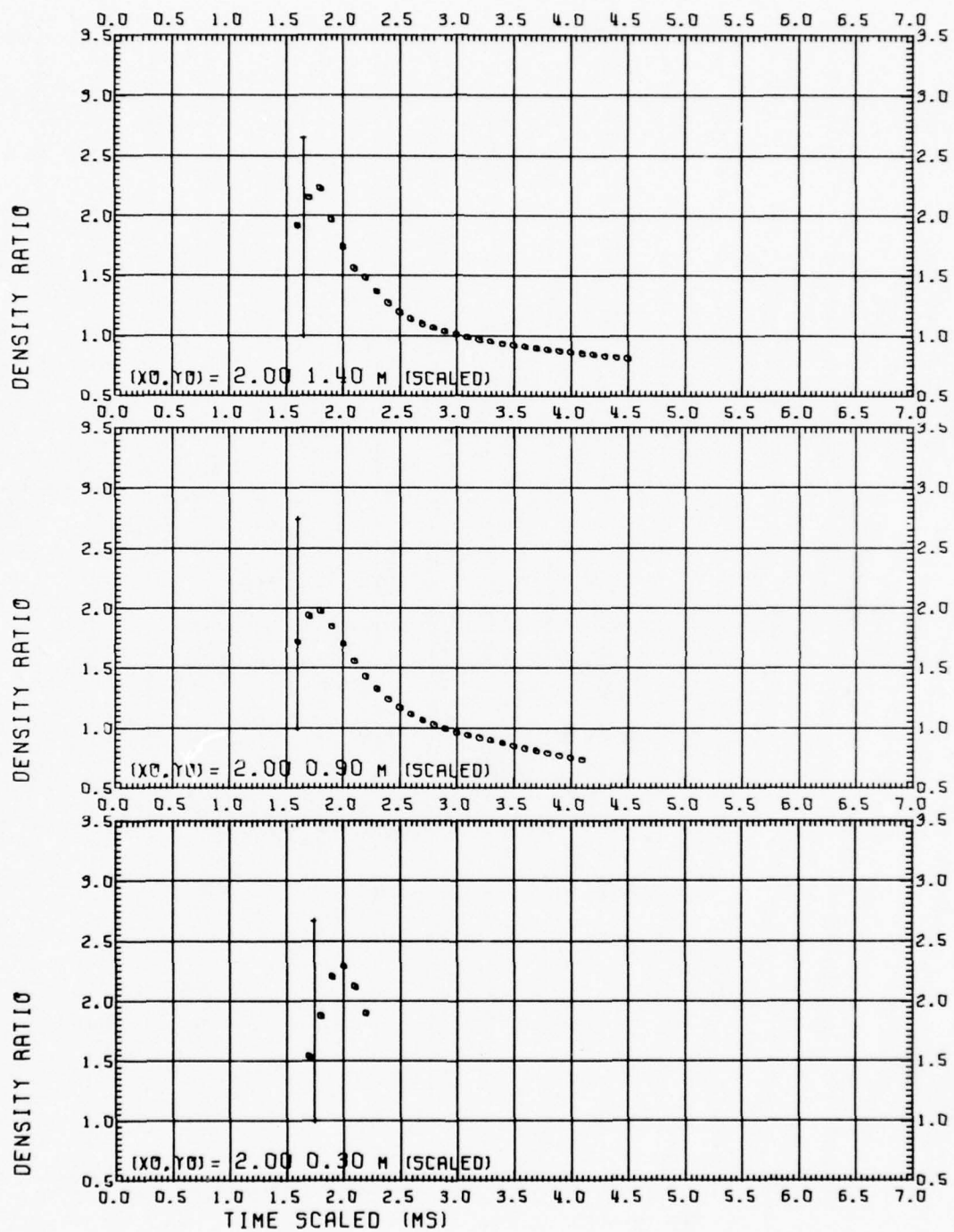


Fig. 24.2 DIPOLE WEST/10 DENSITY

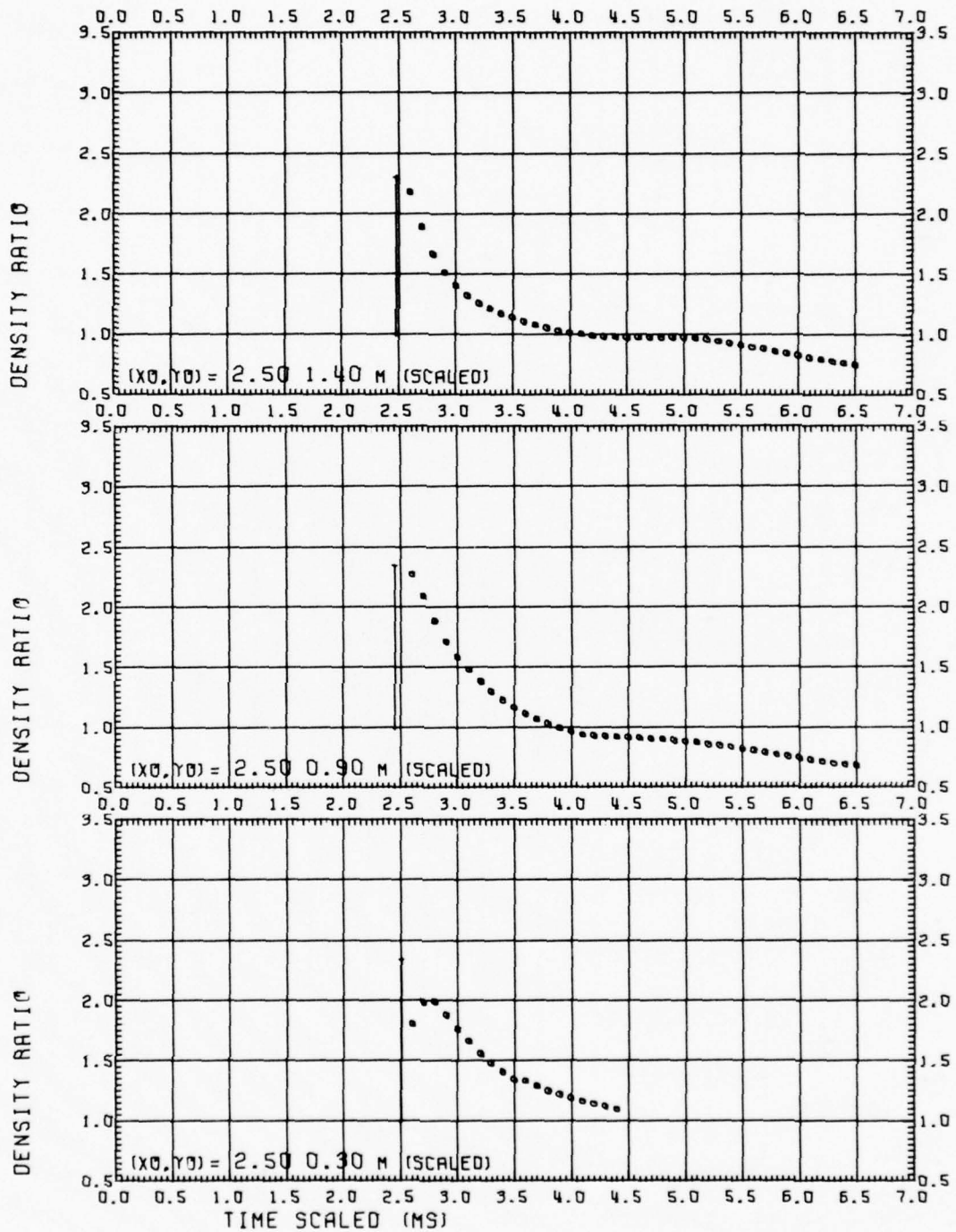


Fig. 24.3 DIPOLE WEST/10 DENSITY

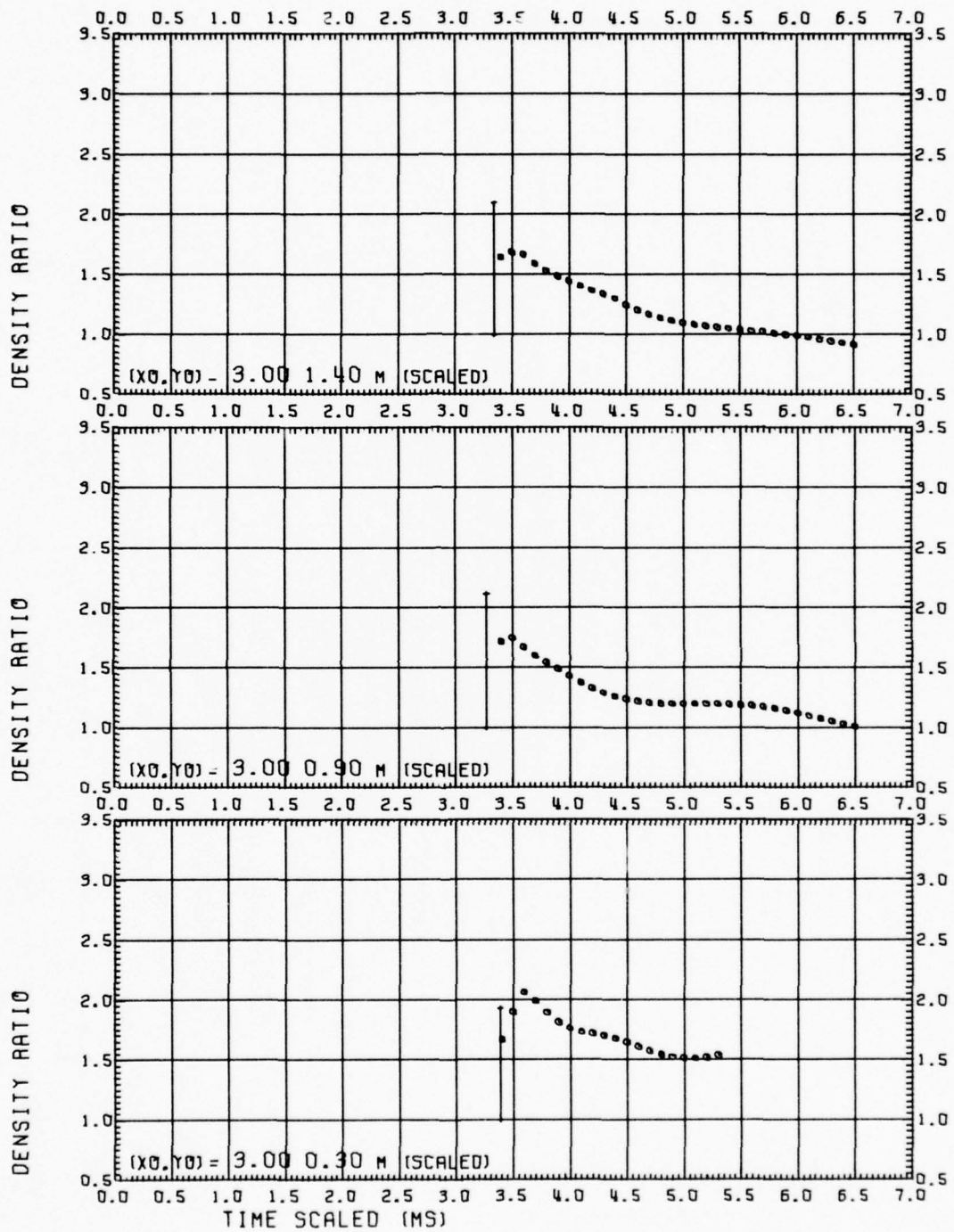


Fig. 24.4 DIPOLE WEST/10 DENSITY

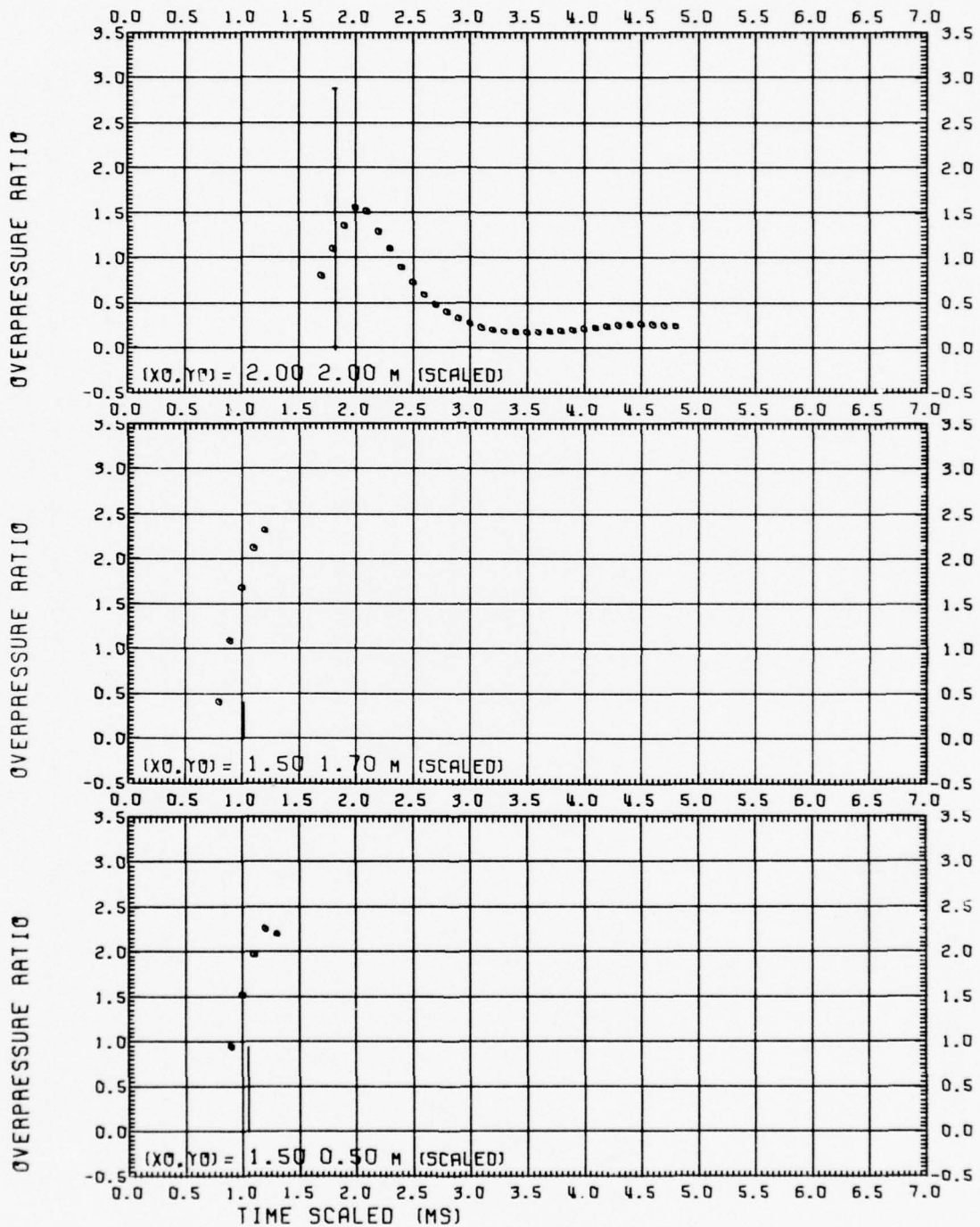


Fig. 25.1 DIPOLE WEST/10 HYDROSTATIC OVERPRESSURE

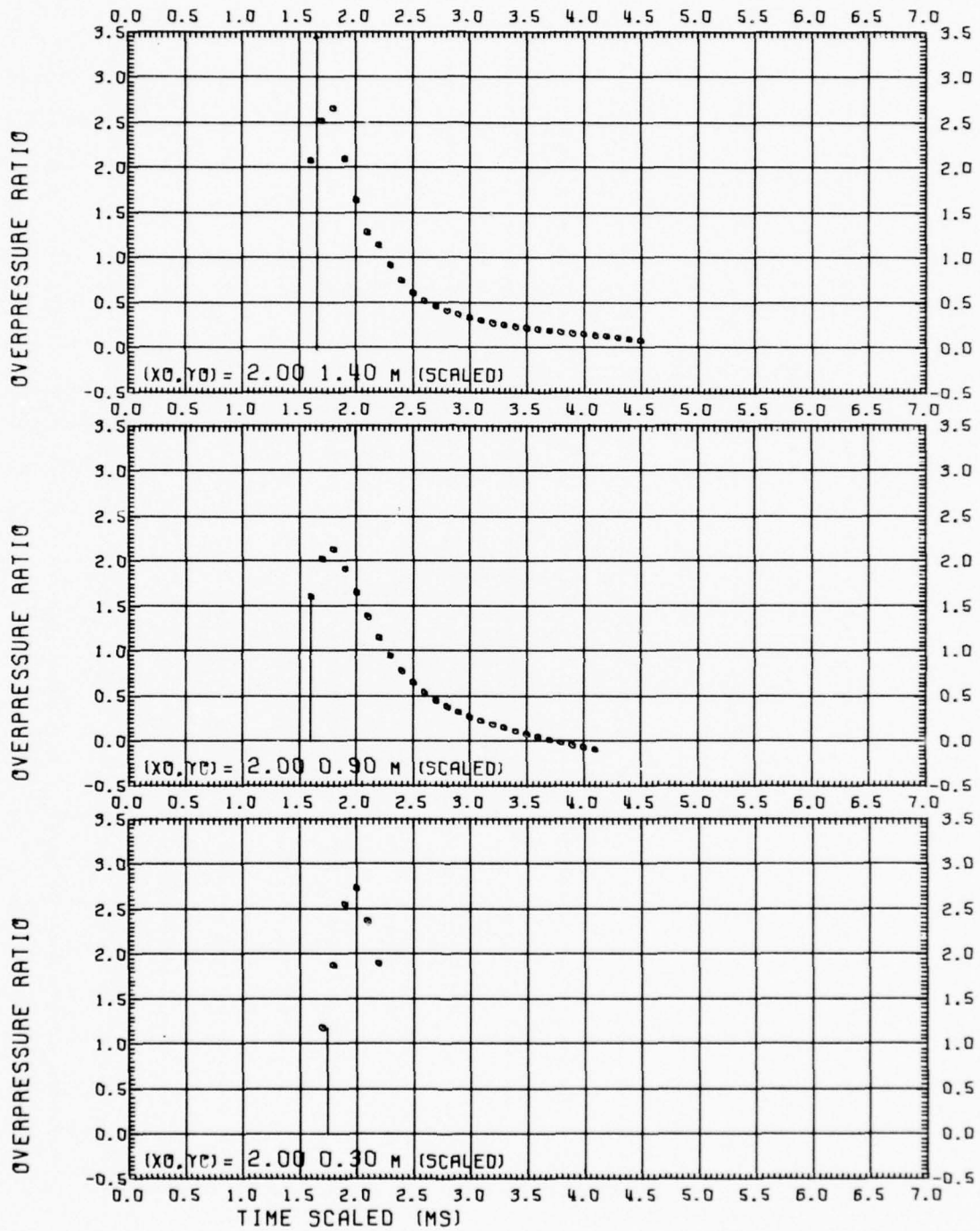


Fig. 25.2 DIPOLE WEST/10 HYDROSTATIC OVERPRESSURE

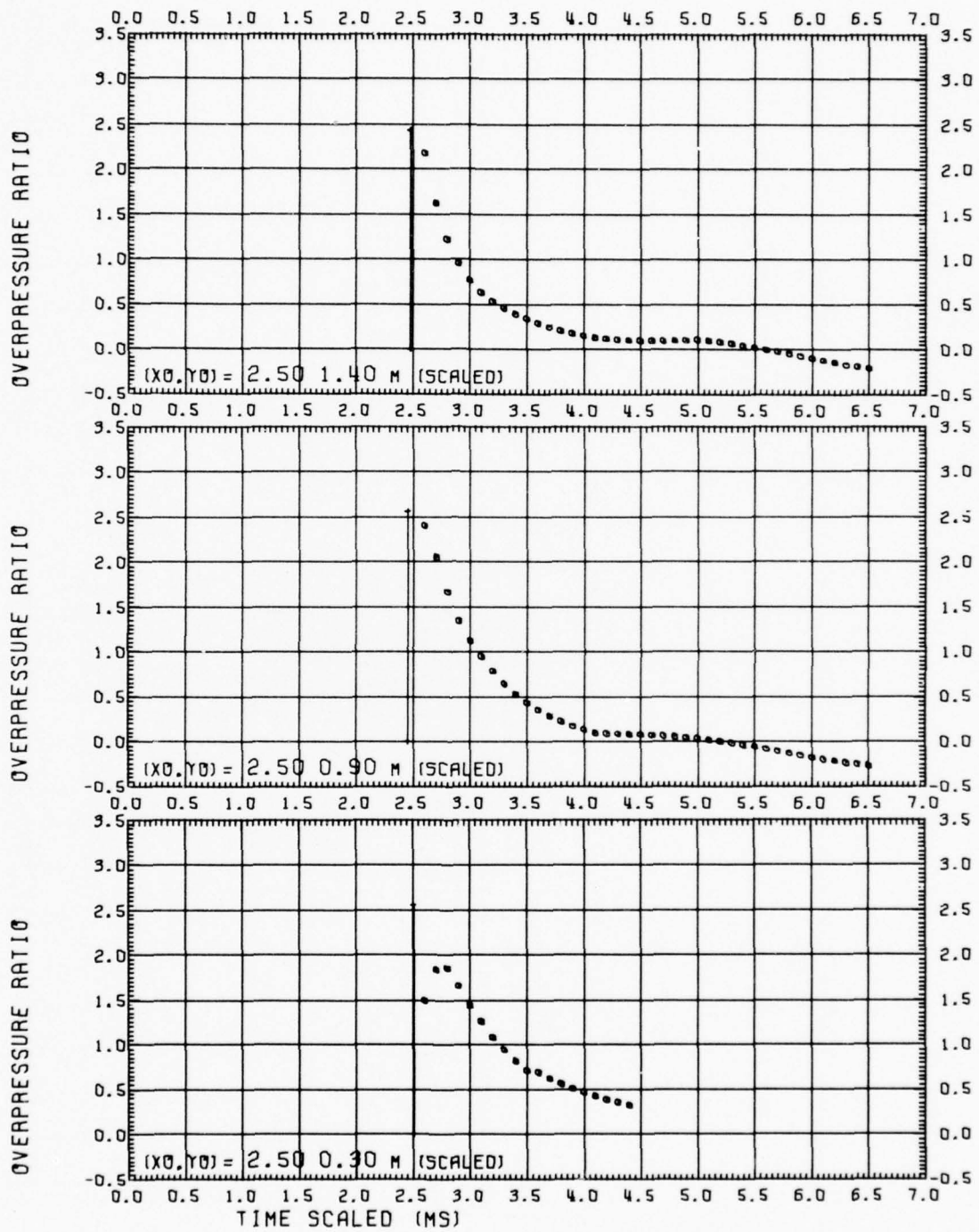


Fig. 25.3 DIPOLE WEST/10 HYDROSTATIC OVERPRESSURE

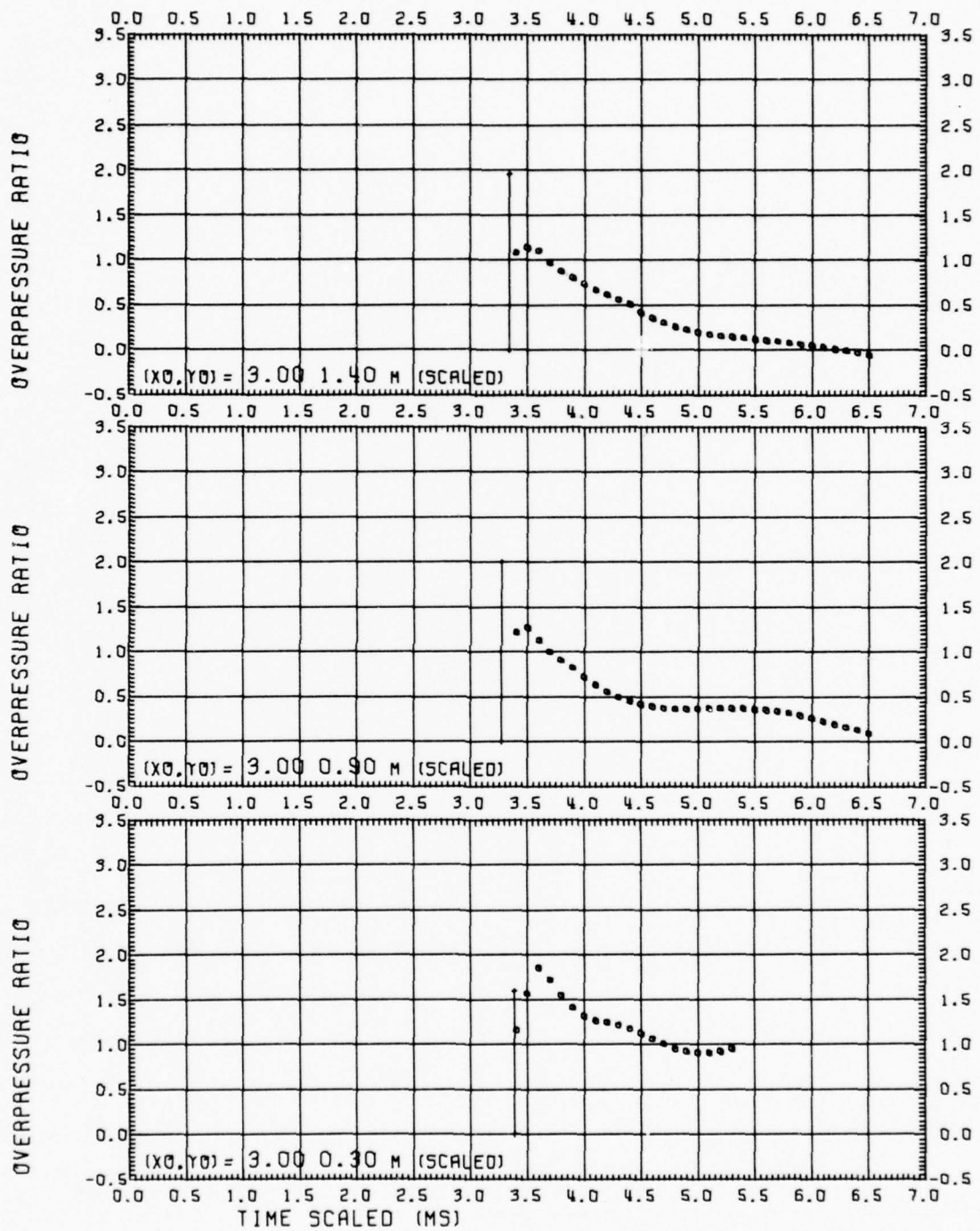


Fig. 25.4 DIPOLE WEST/10 HYDROSTATIC OVERPRESSURE

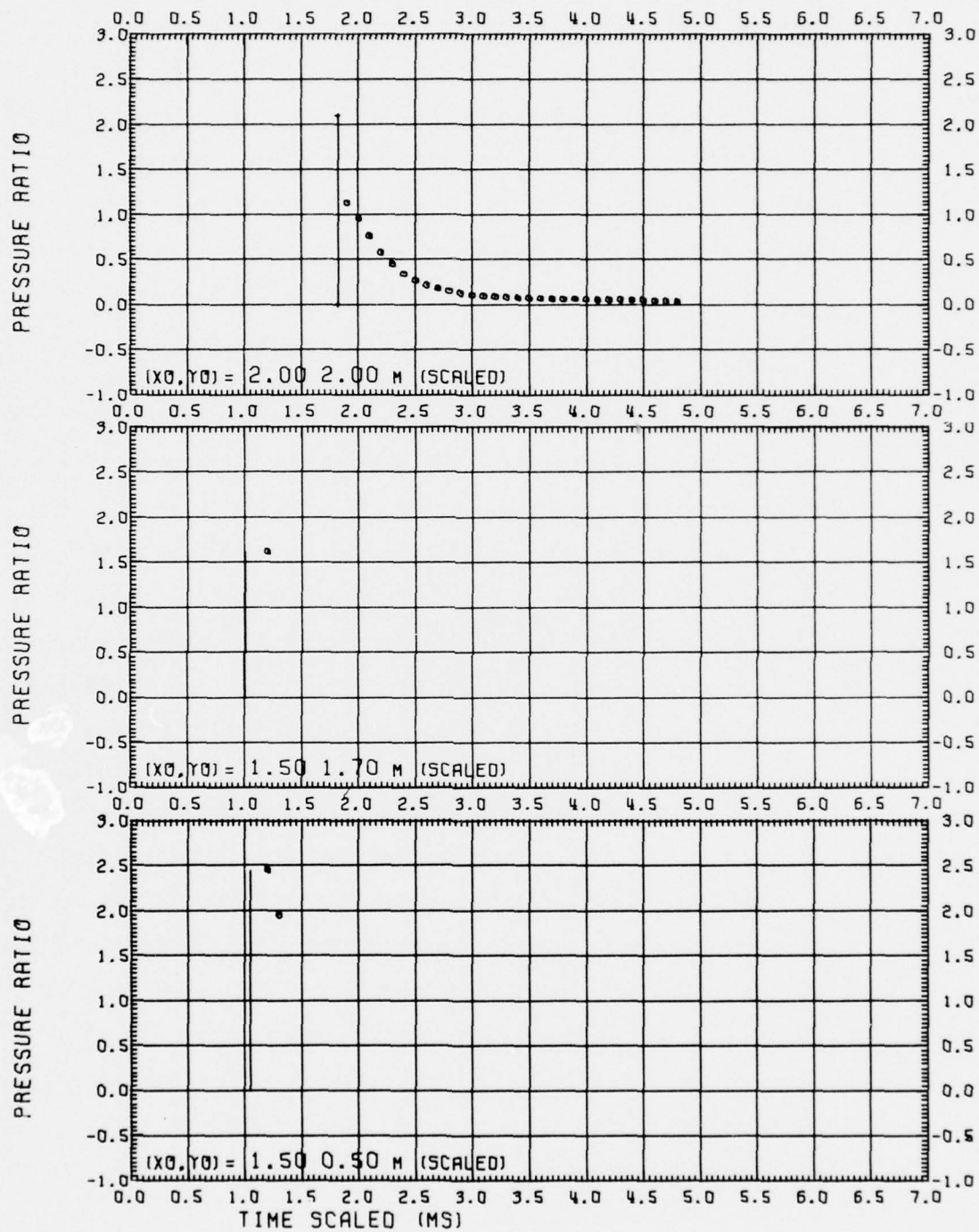


Fig. 26.1

DIPOLE WEST/10 DYNAMIC PRESSURE

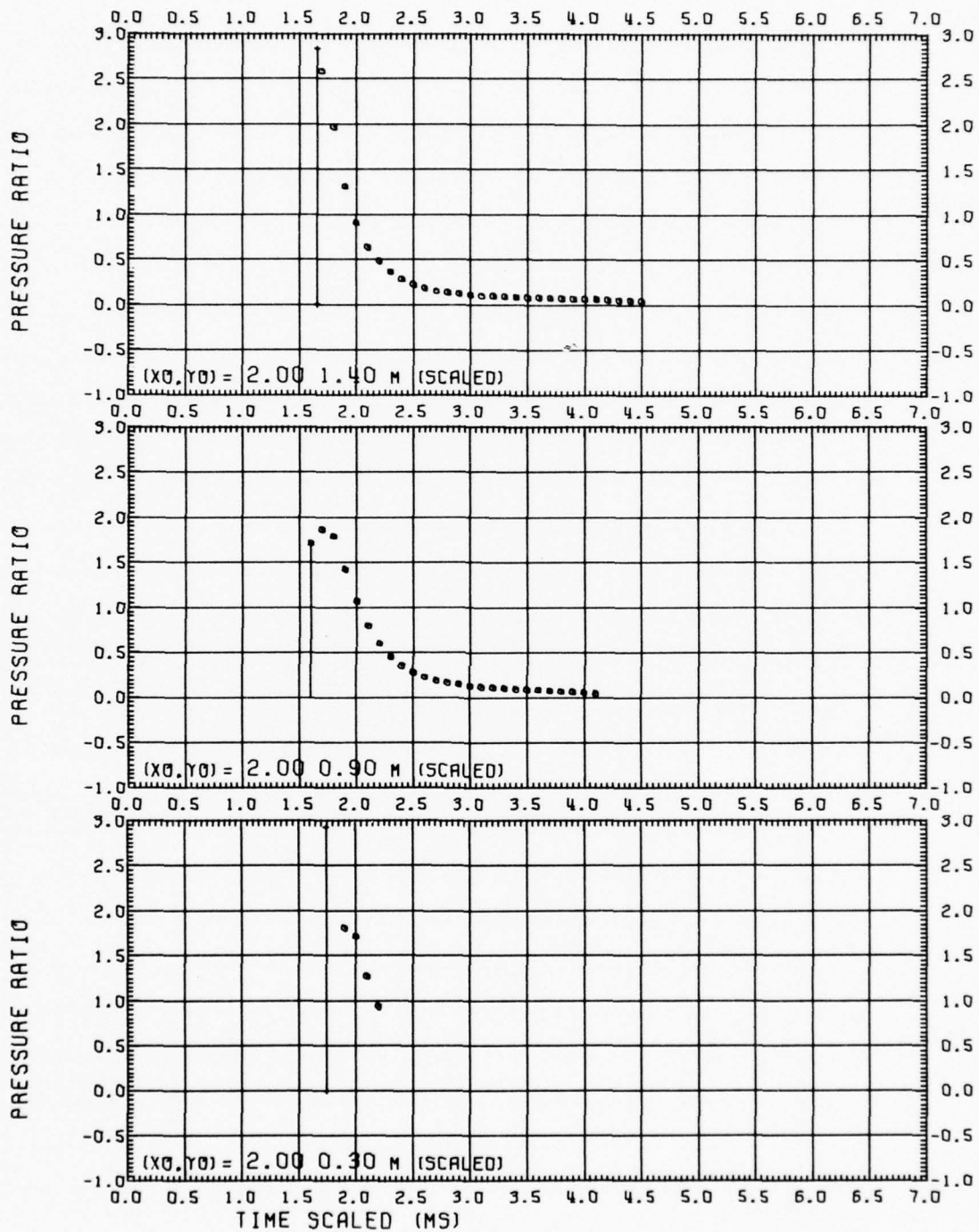


Fig. 26.2 DIPOLE WEST/10 DYNAMIC PRESSURE

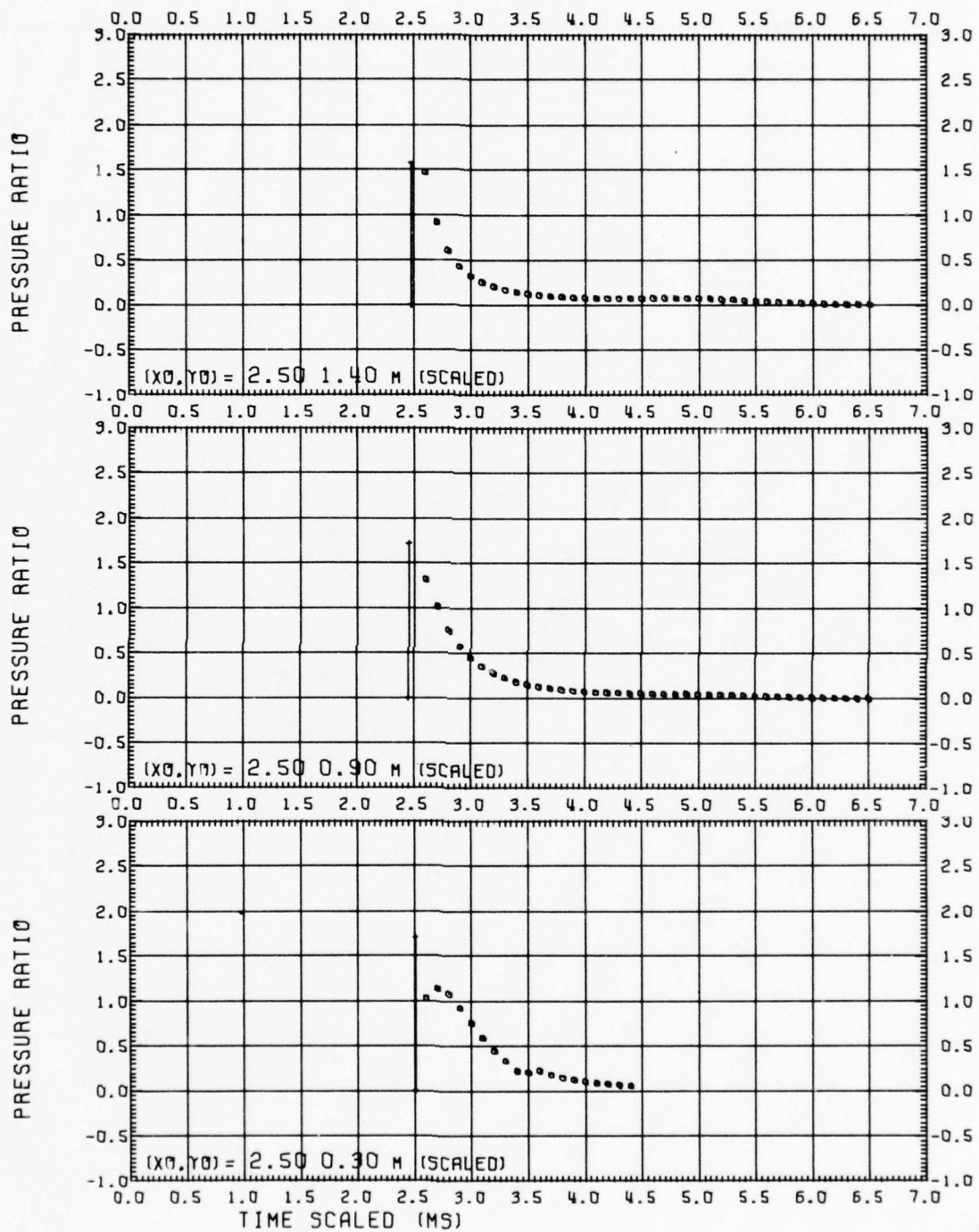


Fig. 26.3

DIPOLE WEST/10 DYNAMIC PRESSURE

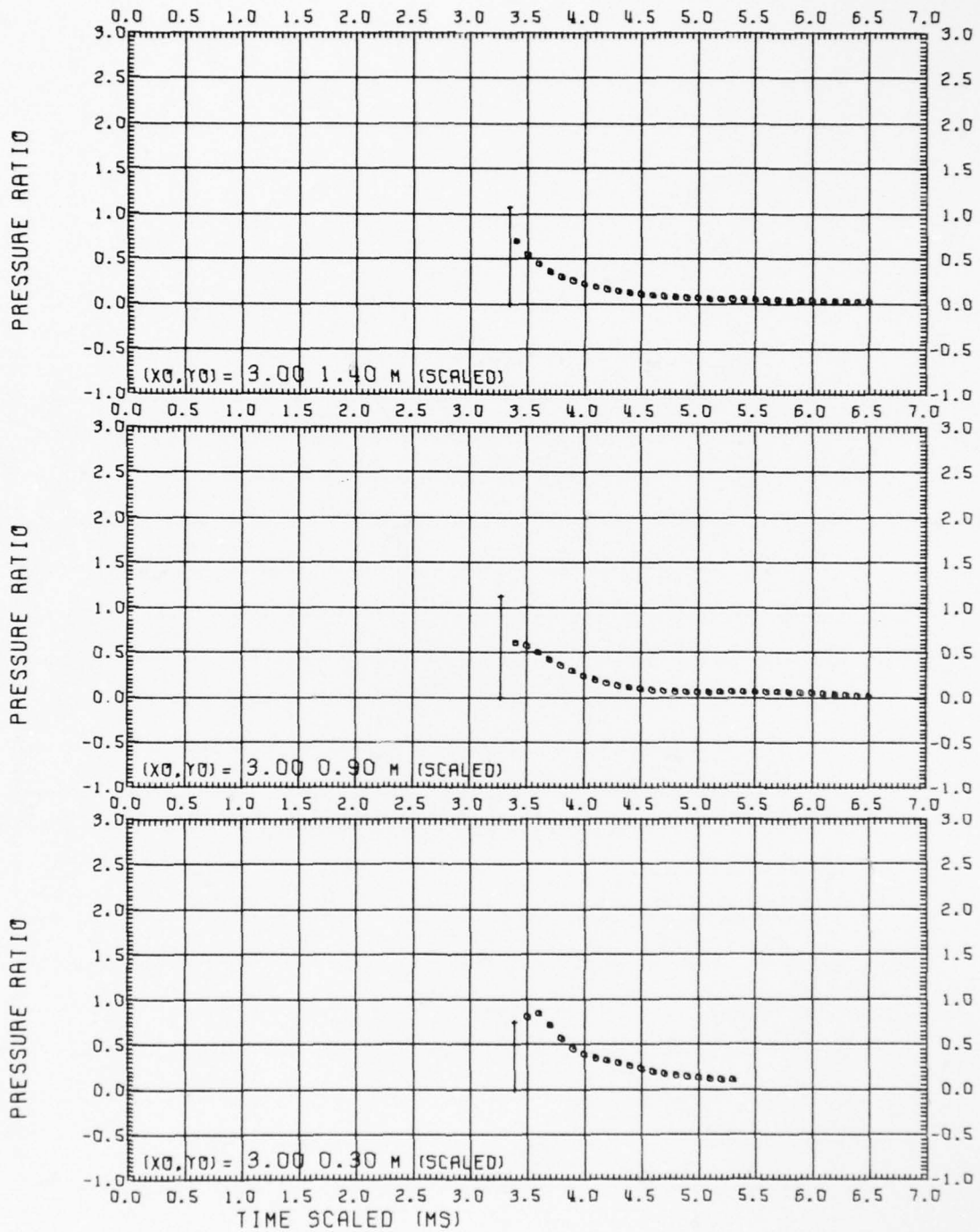
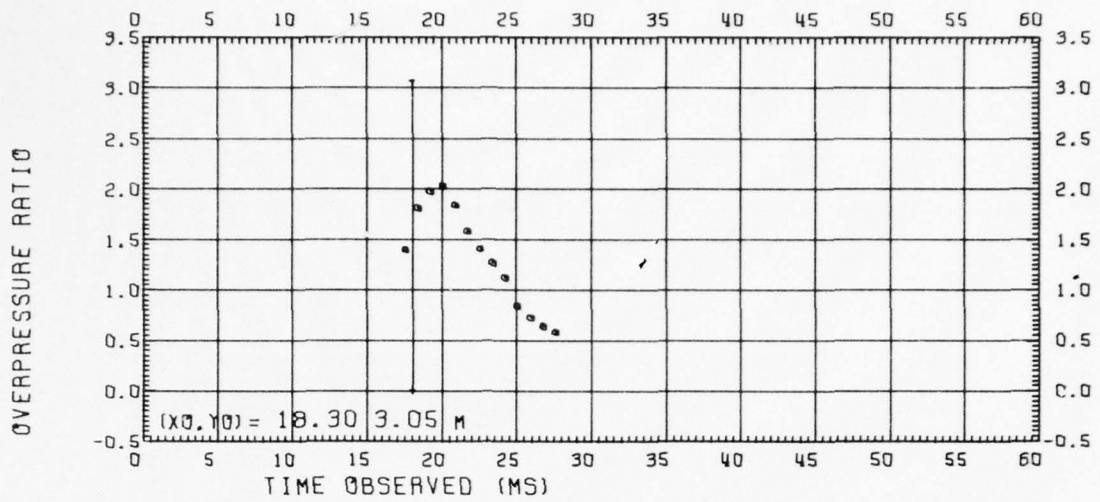
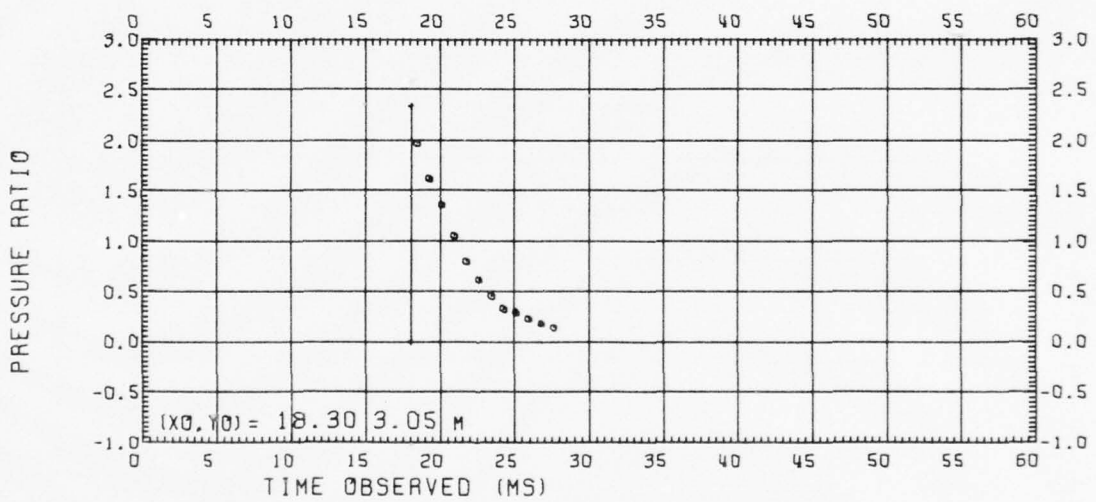


Fig. 26.4

DIPOLE WEST/10 DYNAMIC PRESSURE



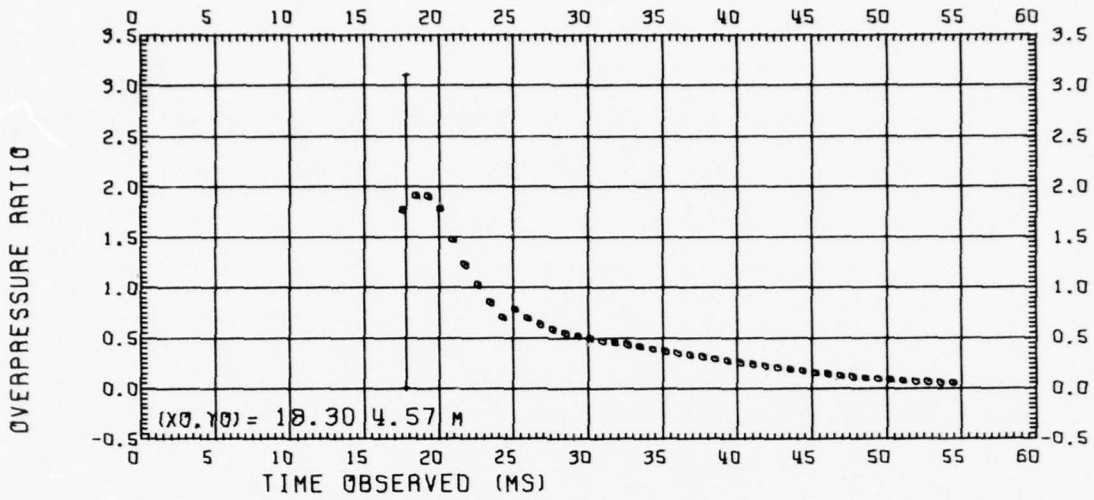
DIPOLE WEST/10 HYDROSTATIC OVERPRESSURE



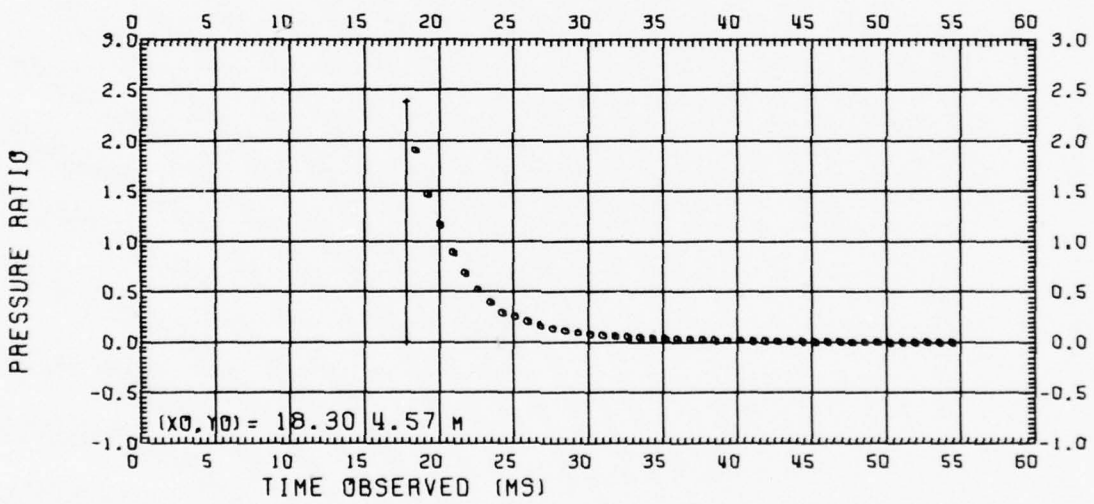
DIPOLE WEST/10 DYNAMIC PRESSURE

Fig. 27.1

PRESSURE RESULTS AT GAUGE POSITION (X0,Y0) = 60 FT. 10 FT



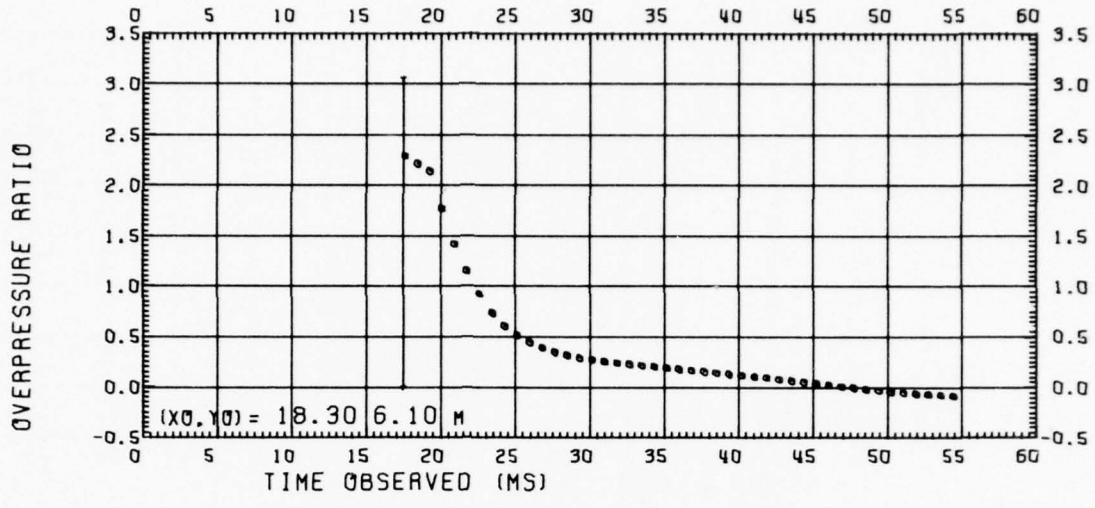
DIPOLE WEST/10 HYDROSTATIC OVERPRESSURE



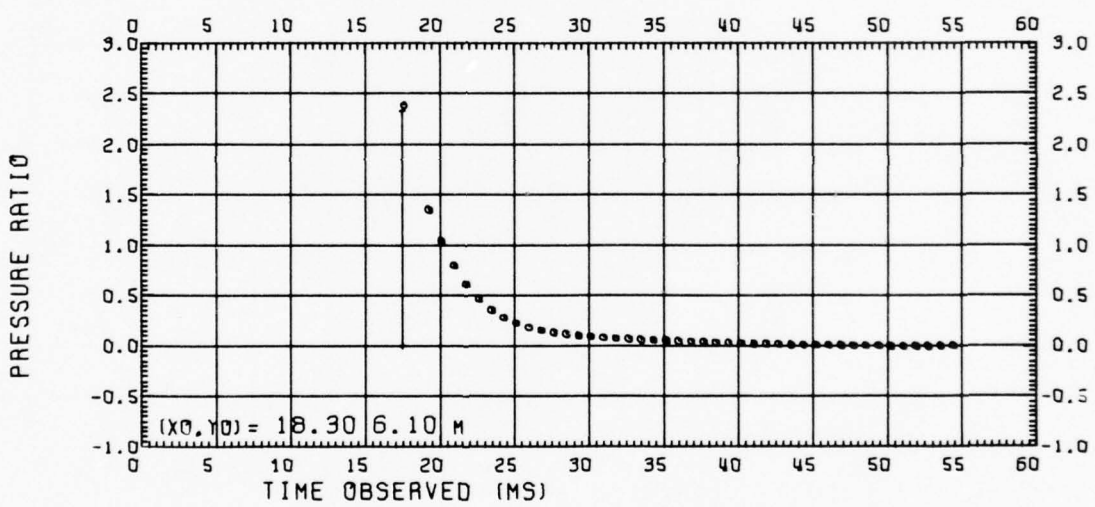
DIPOLE WEST/10 DYNAMIC PRESSURE

Fig. 27.2

PRESSURE RESULTS AT GAUGE POSITION (X0, Y0) = 60 FT. 15 FT



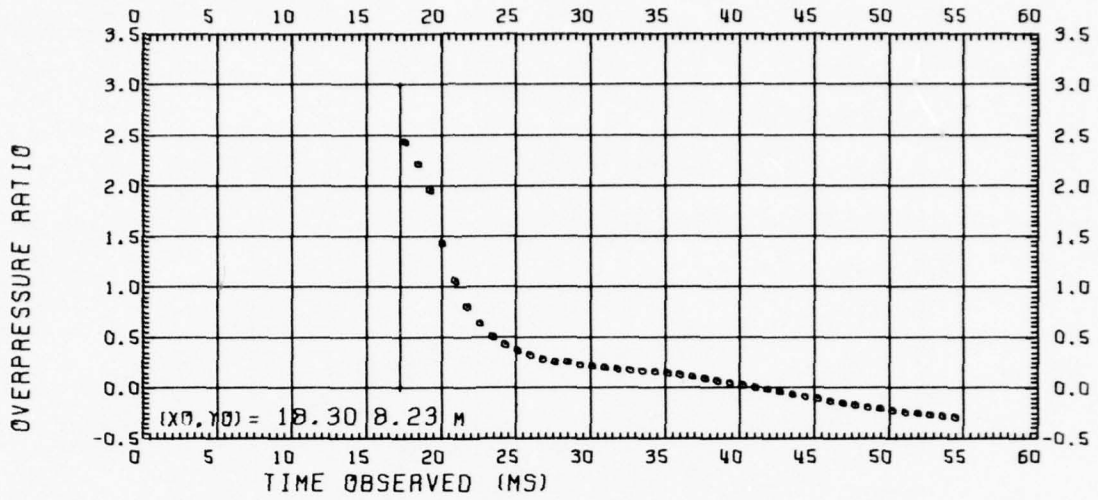
DIPOLE WEST/10 HYDROSTATIC OVERPRESSURE



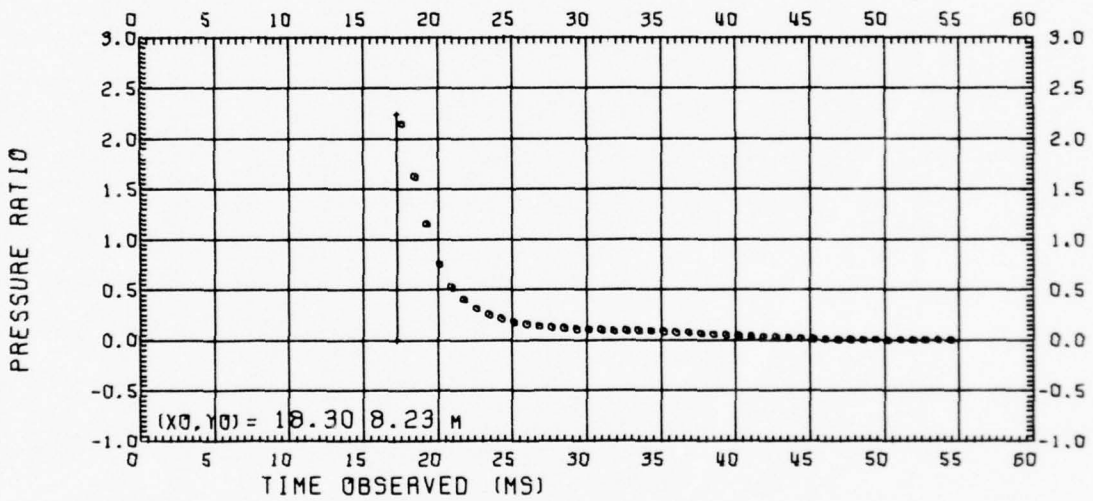
DIPOLE WEST/10 DYNAMIC PRESSURE

Fig. 27.3

PRESSURE RESULTS AT GAUGE POSITION (X0,Y0) = 60 FT. 20 FT



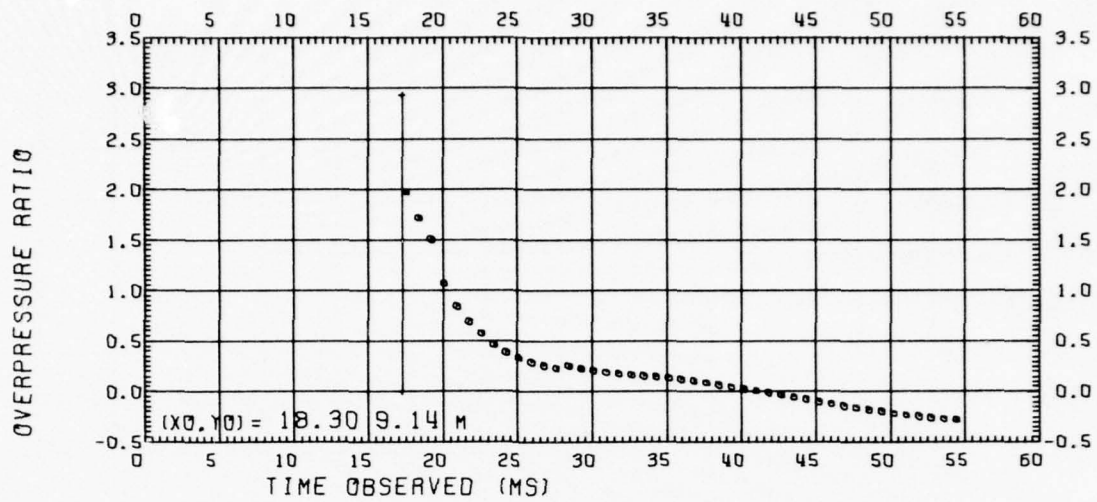
DIPOLE WEST/10 HYDROSTATIC OVERPRESSURE



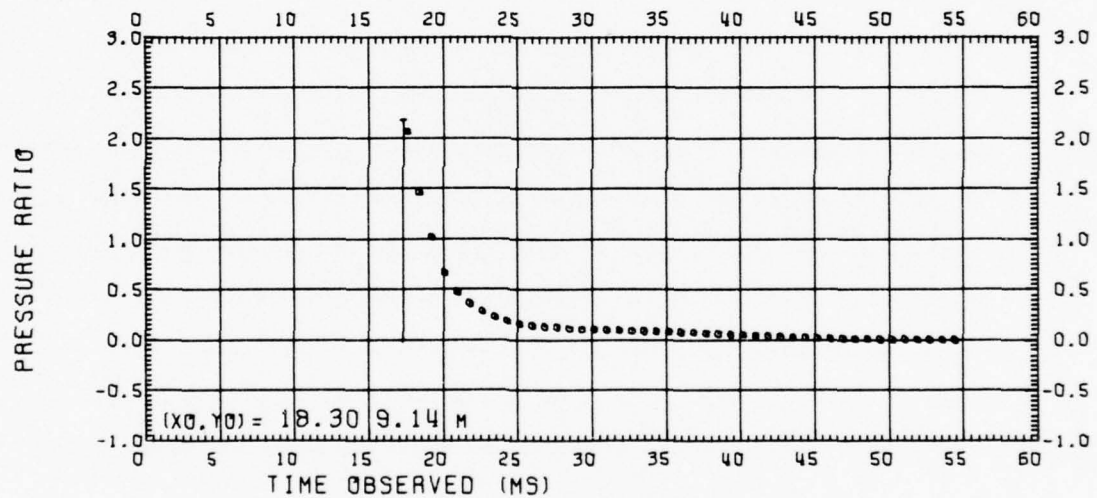
DIPOLE WEST/10 DYNAMIC PRESSURE

Fig. 27.4

PRESSURE RESULTS AT GAUGE POSITION  $(X_0, Y_0) = 60 \text{ FT}, 27 \text{ FT}$



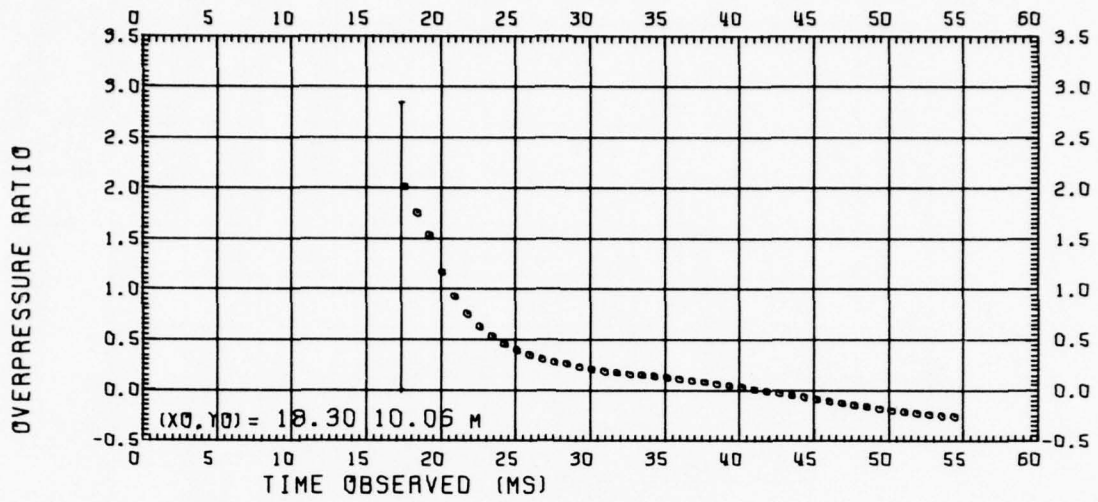
DIPOLE WEST/10 HYDROSTATIC OVERPRESSURE



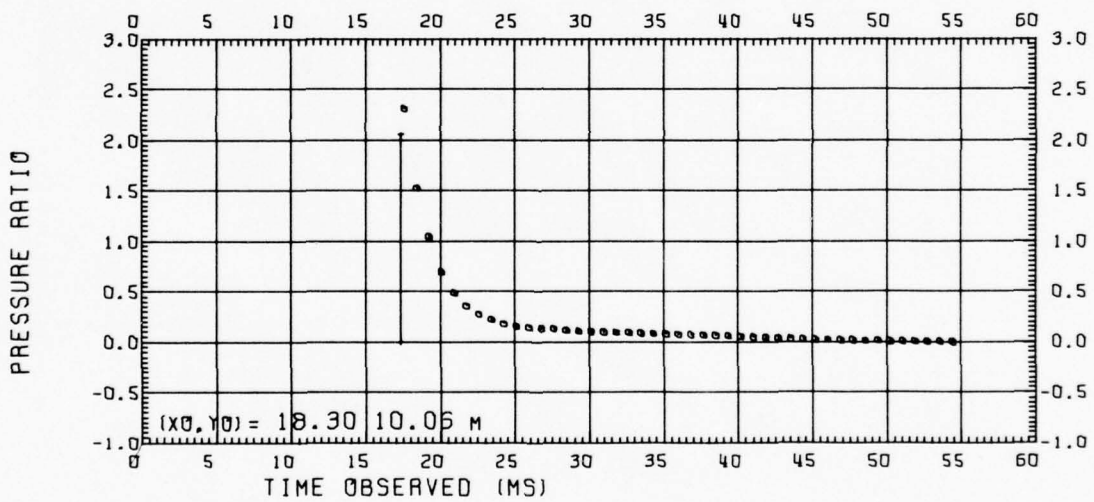
DIPOLE WEST/10 DYNAMIC PRESSURE

Fig. 27.5

PRESSURE RESULTS AT GAUGE POSITION (X0, Y0) = 60 FT. 30 FT



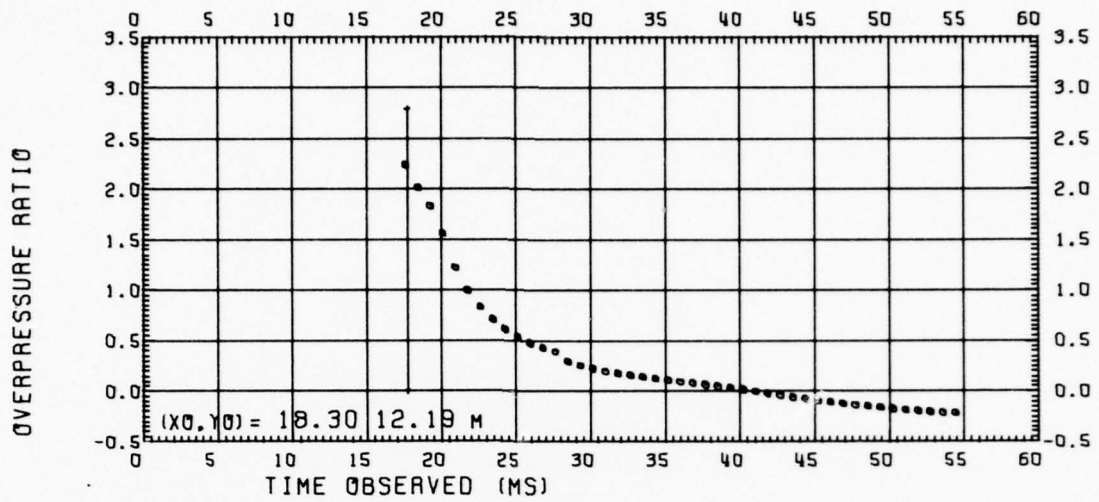
DIPOLE WEST/10 HYDROSTATIC OVERPRESSURE



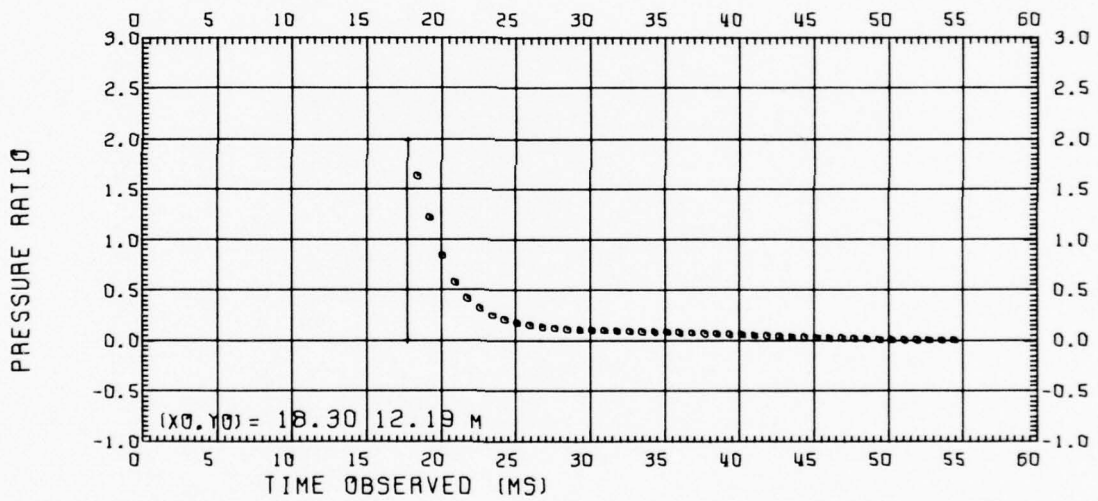
DIPOLE WEST/10 DYNAMIC PRESSURE

Fig. 27.6

PRESSURE RESULTS AT GAUGE POSITION (X0, Y0) = 60 FT. 33 FT



DIPOLE WEST/10 HYDROSTATIC OVERPRESSURE



DIPOLE WEST/10 DYNAMIC PRESSURE

Fig. 27.7

PRESSURE RESULTS AT GAUGE POSITION (X0, Y0) = 60 FT. 40 FT

TABLE 1

SURVEY DATA LIST

DIPOLE WEST/10

/A770322

PT. NAME	BEARING	DISTANCE	COORD. E	COORD. N	COORD. H
GRD.ZERO	0.0.0	0.0	2000.000	2000.000	2316.320
G.ZERO.B	230.55.5	1.229	1952.046	1999.237	2316.320
G.ZERO.C	230.55.5	1.229	1952.046	1999.237	2316.320
TOP.CRG.	249.41.17	598.713	1994.884	1939.683	2311.683
BOT.CRG.	180.2.47		2002.619	1401.280	2311.720
WFS4295			1952.046	2035.022	2349.422
VP 1A	333.24.43	106.133	1952.046	2035.022	2349.422
VP 1B	333.24.43	106.133	1952.046	2035.022	2349.422
VP 2A	317.56.24	121.406	1917.929	2050.582	2349.422
VP 2B	317.56.24	121.406	1917.929	2050.582	2349.422
VP 3A	305.12.35	149.142	1874.448	2066.514	2349.422
VP 3B	305.12.35	149.142	1874.448	2066.514	2349.422
W 1	257.20.55	35.589	1932.259	1972.289	2318.150
W 2	260.21.43	70.394	1932.259	1972.289	2318.150
W 3	260.21.43	70.394	1932.259	1972.289	2318.150
300 W1	123.39.47	105.189	1932.259	1972.289	2318.150
1-20.10	123.39.47	105.189	1932.259	1972.289	2318.150
1-20.15	123.39.47	105.189	1932.259	1972.289	2318.150
1-20.20	123.39.47	105.189	1932.259	1972.289	2318.150
1-20.25	123.39.47	105.189	1932.259	1972.289	2318.150
1-20.30	123.39.47	105.189	1932.259	1972.289	2318.150
1-20.35	123.39.47	105.189	1932.259	1972.289	2318.150
1-30.10	67.25.11	29.823	2017.717	2022.082	2343.354
1-30.15	67.25.11	29.823	2017.717	2022.082	2343.354
1-30.20	67.25.11	29.823	2017.717	2022.082	2343.354
1-30.25	67.25.11	29.823	2017.717	2022.082	2343.354
1-30.30	67.25.11	29.823	2017.717	2022.082	2343.354
1-30.33	67.25.11	29.823	2017.717	2022.082	2343.354
1-30.40	67.25.11	29.823	2017.717	2022.082	2343.354

BEARING IN DEGREES, MINUTES, AND SECONDS, AND DISTANCE IN FEET  
 BEARING AND DISTANCE FROM GRD.ZERO UNLESS NOTED OTHERWISE  
 COORDINATES EAST AND NORTH AND ELEVATION IN FEET  
 TOTAL NUMBER OF POINTS SURVEYED IS 32

SUNDRY DATA LIST

TE 21.3 DEG F. P = 13.7 PSI. SVP 2.95 MM HG. PHE 81.0%. W = 1030.0 LBS  
 SCALING TO WCE 2.2 LBS USING FACTORS S = 9.072 AND C = 1.076 FT/MSEC  
 CALCULATED DISTANCE BETWEEN BOT.CRG. AND G.ZERO.B IS 14.920 FEET 1  
 CALCULATED DISTANCE BETWEEN TOP.CRG. AND BOT.CRG. IS 30.445 FEET 2  
 CALCULATED DISTANCE BETWEEN GRD.ZERO AND G.ZERO.C IS 1.193 FEET  
 FIRED ON 02NOV73

TABLE 2

/A770322

PHOTOGRAMMETRICS DIPOLE WEST/10 WFS/295

CAMERA (LENS) POSITION IS 2002.619 FEET EAST, 1388.290 FEET NORTH, AND 2341.720 FEET ELEVATION  
 OPTICAL AXIS IS ORIENTED TO -5.780 DEGREES EAST OF NORTH AND 0.575 DEGREES ELEVATION ( $\pm 0.001$ )  
 OBJECT PLANE IS 606.599 FEET FROM CAMERA, PERPENDICULAR TO OPTICAL AXIS, AND INCLUDES GZERO.C

CALIBRATION DATA TRANSFORMED TO THE OBJECT PLANE IN FEET

PT. NAME	COORD X	COORD Y	SHIFT X	SHIFT Y
ROT.CRG.	68.649	-15.411	-0.094	-0.146
TOP.CRG.	68.319	14.100	0.048	-0.253
VP 1A	27.451	0.083	1.351	-0.057
VP 1B	27.435	30.034	1.430	-0.109
VP 2A	-0.555	-0.290	-0.038	0.133
VP 2B	-1.061	25.635	0.130	0.177
VP 3A	-14.632	-0.388	-0.408	-0.001
VP 3B	-35.154	29.553	-0.024	0.031
M 1	34.360	-29.787	0.000	-0.000
M 2	-0.555	-29.564	-0.044	0.003
M 3	-24.105	-30.568	0.001	0.002
300 M	-22.207	-28.431	0.021	-0.076
1-20.10	50.205	-15.119	-0.607	0.076
1-20.15	50.192	-15.171	-0.602	-0.252
1-20.20	50.060	-11.231	-0.618	-0.202
1-20.25	50.218	-4.277	-0.536	-0.156
1-20.30	50.003	-1.215	-0.569	-0.242
1-20.33	50.860	1.986	-0.546	-0.453
1-20.40	50.527	8.330	-0.346	-0.346
1-30.10	50.639	-21.283	-2.089	0.165
1-30.15	50.457	-15.055	-1.223	-0.190
1-30.20	49.512	-11.103	-1.233	-0.175
AVERAGES			-0.292	-0.135

REFERENCE POINT P1  
 REFERENCE POINT P2

X-AXIS IS PARALLEL TO HORIZONTAL PLANE AND ORIGIN IS WHERE OPTICAL AXIS INTERSECTS OBJECT PLANE  
 SHIFTS IN CALIBRATION DATA DEFINE THE POSITION OF POINT AS CALCULATED DIRECTLY FROM SURVEY DATA

MAXIMUM CALIBRATION ERROR SCALED= 0.090 FEET  
 MAXIMUM CAMERA ORIENTATION ERROR= 0.011 FEET

TOTAL ERRORS IN THE OBJECT PLANE= 0.091 FEET

RUNNING DATA IS TRANSFORMED TO OBJECT PLANE USING REFERENCE POINTS VP 3B AND 300 M2  
 AND A CAMERA OPTICS BASED ON CALIBRATION DATA IN THE OBJECT PLANE RATHER THAN SURVEY DATA

TABLE 3

/A770322

DIPOLE WEST/10 WFS/295  
 STATIC ZERO = 3.30 CM  
 ACTUAL ZERO = 4.93 CM  
 FRAME LENGTH = 0.24620 CM

FRAME NO. 5-SEC DISTANCE FILM SPEED  
 ---31 15.92 CM 3344.7/SEC  
 ---06 16.15 CM 3416.7/SEC  
 ---169 16.53 CM 3492.7/SEC  
 ---269 16.93 CM 3557.7/SEC

STATIC ZERO IS CONSTANT FOR THE CAMERA  
 OTHER LENGTHS ARE FROM FILM MEASUREMENT

FRAME	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
1	0.6	1.2	1.8	2.4	3.0	3.6	4.2	4.8	5.4	6.0	6.6	7.2	7.8	8.4	9.0	9.6	10.2	10.8	11.4	12.0
2	0.6	1.2	1.8	2.4	3.0	3.6	4.2	4.8	5.4	6.0	6.6	7.2	7.8	8.4	9.0	9.6	10.2	10.8	11.4	12.0
3	0.6	1.2	1.8	2.4	3.0	3.6	4.2	4.8	5.4	6.0	6.6	7.2	7.8	8.4	9.0	9.6	10.2	10.8	11.4	12.0
4	0.6	1.2	1.8	2.4	3.0	3.6	4.2	4.8	5.4	6.0	6.6	7.2	7.8	8.4	9.0	9.6	10.2	10.8	11.4	12.0
5	0.6	1.2	1.8	2.4	3.0	3.6	4.2	4.8	5.4	6.0	6.6	7.2	7.8	8.4	9.0	9.6	10.2	10.8	11.4	12.0
6	0.6	1.2	1.8	2.4	3.0	3.6	4.2	4.8	5.4	6.0	6.6	7.2	7.8	8.4	9.0	9.6	10.2	10.8	11.4	12.0
7	0.6	1.2	1.8	2.4	3.0	3.6	4.2	4.8	5.4	6.0	6.6	7.2	7.8	8.4	9.0	9.6	10.2	10.8	11.4	12.0
8	0.6	1.2	1.8	2.4	3.0	3.6	4.2	4.8	5.4	6.0	6.6	7.2	7.8	8.4	9.0	9.6	10.2	10.8	11.4	12.0
9	0.6	1.2	1.8	2.4	3.0	3.6	4.2	4.8	5.4	6.0	6.6	7.2	7.8	8.4	9.0	9.6	10.2	10.8	11.4	12.0
10	0.6	1.2	1.8	2.4	3.0	3.6	4.2	4.8	5.4	6.0	6.6	7.2	7.8	8.4	9.0	9.6	10.2	10.8	11.4	12.0
11	0.6	1.2	1.8	2.4	3.0	3.6	4.2	4.8	5.4	6.0	6.6	7.2	7.8	8.4	9.0	9.6	10.2	10.8	11.4	12.0
12	0.6	1.2	1.8	2.4	3.0	3.6	4.2	4.8	5.4	6.0	6.6	7.2	7.8	8.4	9.0	9.6	10.2	10.8	11.4	12.0
13	0.6	1.2	1.8	2.4	3.0	3.6	4.2	4.8	5.4	6.0	6.6	7.2	7.8	8.4	9.0	9.6	10.2	10.8	11.4	12.0
14	0.6	1.2	1.8	2.4	3.0	3.6	4.2	4.8	5.4	6.0	6.6	7.2	7.8	8.4	9.0	9.6	10.2	10.8	11.4	12.0
15	0.6	1.2	1.8	2.4	3.0	3.6	4.2	4.8	5.4	6.0	6.6	7.2	7.8	8.4	9.0	9.6	10.2	10.8	11.4	12.0
16	0.6	1.2	1.8	2.4	3.0	3.6	4.2	4.8	5.4	6.0	6.6	7.2	7.8	8.4	9.0	9.6	10.2	10.8	11.4	12.0
17	0.6	1.2	1.8	2.4	3.0	3.6	4.2	4.8	5.4	6.0	6.6	7.2	7.8	8.4	9.0	9.6	10.2	10.8	11.4	12.0
18	0.6	1.2	1.8	2.4	3.0	3.6	4.2	4.8	5.4	6.0	6.6	7.2	7.8	8.4	9.0	9.6	10.2	10.8	11.4	12.0
19	0.6	1.2	1.8	2.4	3.0	3.6	4.2	4.8	5.4	6.0	6.6	7.2	7.8	8.4	9.0	9.6	10.2	10.8	11.4	12.0
20	0.6	1.2	1.8	2.4	3.0	3.6	4.2	4.8	5.4	6.0	6.6	7.2	7.8	8.4	9.0	9.6	10.2	10.8	11.4	12.0

TABLE 4

7A770322

SMOKE PUFF GRID 1209

DIPOLE WEST/10 WE5/295

TIMES OF ARRIVAL

AMBIENT TEMPERATURE T = -5.874 DEGREES CELSIUS  
 AMBIENT PRESSURE P = 94.38 KILOPASCALS  
 RELATIVE HUMIDITY RH = 81.0 PER CENT  
 AMBIENT PRESSURE VP = 0.32 KILOPASCALS  
 WIND VELOCITY V = 324.004 METERS/SECOND  
 CHARGE WEIGHT W = 489.0 KILOGRAMS  
 CHARGE HEIGHT H = 4.55 METERS  
 SEPARATION HS = 4.64 METERS  
 SACHS SCALING FACTOR SF = R.0718  
 SCALING TO CHARGE WEIGHT WCF = 1.0 KILOGRAMS

INITIAL PUFF POSITIONS, TIMES OF ARRIVAL, AND PEAK PARTICLE VELOCITIES DERIVED BY TRAJECTORY FITTING

PUFF NUMBER	X-CRS METERS	Y-OBS METERS	T-OBS MSEC	X-SCAL METERS	Y-SCAL METERS	T-SCAL MSEC	U=DX/DT MACH NO	V=DY/DT MACH NO	PARTICLE VELOCITY METERS	R-SCAL METERS	REGION CODE
1	10.0000	17.624	4.447	1.016	2.143	0.531	2.162	0.429	2.222	1.119	2
2	9.274	14.417	4.151	1.015	1.556	0.425	2.227	0.215	2.257	1.059	2
3	8.0000	11.083	3.558	1.010	1.521	0.425	2.372	-0.131	2.257	1.015	2
4	8.0000	11.083	3.558	1.010	1.521	0.425	2.372	-0.131	2.257	1.015	2
5	7.774	9.034	4.447	0.992	1.231	0.531	2.043	0.455	2.095	0.556	2
6	7.774	9.034	3.554	0.990	0.974	0.460	1.705	0.154	1.711	0.333	1
7	7.774	7.051	3.554	0.992	0.712	0.425	2.010	0.194	1.711	0.333	1
8	7.774	5.072	3.554	1.007	0.450	0.460	1.889	0.168	1.856	1.009	1
9	7.774	2.922	4.447	0.954	0.307	0.425	2.117	-0.463	2.166	0.549	1
10	7.774	0.538	4.447	0.929	0.113	0.531	1.310	0.476	1.394	1.028	1
11	7.774	1.574	7.051	1.334	0.752	0.775	1.411	0.302	1.443	1.355	1
12	7.774	1.574	7.051	1.334	0.752	0.775	1.411	0.302	1.443	1.355	1
13	7.774	1.574	7.051	1.334	0.752	0.775	1.411	0.302	1.443	1.355	1
14	7.774	1.574	7.051	1.334	0.752	0.775	1.411	0.302	1.443	1.355	1
15	7.774	1.574	7.051	1.334	0.752	0.775	1.411	0.302	1.443	1.355	1
16	7.774	1.574	7.051	1.334	0.752	0.775	1.411	0.302	1.443	1.355	1
17	7.774	1.574	7.051	1.334	0.752	0.775	1.411	0.302	1.443	1.355	1
18	7.774	1.574	7.051	1.334	0.752	0.775	1.411	0.302	1.443	1.355	1
19	7.774	1.574	7.051	1.334	0.752	0.775	1.411	0.302	1.443	1.355	1
20	7.774	1.574	7.051	1.334	0.752	0.775	1.411	0.302	1.443	1.355	1
21	7.774	1.574	7.051	1.334	0.752	0.775	1.411	0.302	1.443	1.355	1
22	7.774	1.574	7.051	1.334	0.752	0.775	1.411	0.302	1.443	1.355	1
23	7.774	1.574	7.051	1.334	0.752	0.775	1.411	0.302	1.443	1.355	1
24	7.774	1.574	7.051	1.334	0.752	0.775	1.411	0.302	1.443	1.355	1
25	7.774	1.574	7.051	1.334	0.752	0.775	1.411	0.302	1.443	1.355	1
26	7.774	1.574	7.051	1.334	0.752	0.775	1.411	0.302	1.443	1.355	1
27	7.774	1.574	7.051	1.334	0.752	0.775	1.411	0.302	1.443	1.355	1
28	7.774	1.574	7.051	1.334	0.752	0.775	1.411	0.302	1.443	1.355	1
29	7.774	1.574	7.051	1.334	0.752	0.775	1.411	0.302	1.443	1.355	1
30	7.774	1.574	7.051	1.334	0.752	0.775	1.411	0.302	1.443	1.355	1
31	7.774	1.574	7.051	1.334	0.752	0.775	1.411	0.302	1.443	1.355	1
32	7.774	1.574	7.051	1.334	0.752	0.775	1.411	0.302	1.443	1.355	1
33	7.774	1.574	7.051	1.334	0.752	0.775	1.411	0.302	1.443	1.355	1
34	7.774	1.574	7.051	1.334	0.752	0.775	1.411	0.302	1.443	1.355	1
35	7.774	1.574	7.051	1.334	0.752	0.775	1.411	0.302	1.443	1.355	1
36	7.774	1.574	7.051	1.334	0.752	0.775	1.411	0.302	1.443	1.355	1
37	7.774	1.574	7.051	1.334	0.752	0.775	1.411	0.302	1.443	1.355	1
38	7.774	1.574	7.051	1.334	0.752	0.775	1.411	0.302	1.443	1.355	1
39	7.774	1.574	7.051	1.334	0.752	0.775	1.411	0.302	1.443	1.355	1
40	7.774	1.574	7.051	1.334	0.752	0.775	1.411	0.302	1.443	1.355	1
41	7.774	1.574	7.051	1.334	0.752	0.775	1.411	0.302	1.443	1.355	1
42	7.774	1.574	7.051	1.334	0.752	0.775	1.411	0.302	1.443	1.355	1
43	7.774	1.574	7.051	1.334	0.752	0.775	1.411	0.302	1.443	1.355	1
44	7.774	1.574	7.051	1.334	0.752	0.775	1.411	0.302	1.443	1.355	1
45	7.774	1.574	7.051	1.334	0.752	0.775	1.411	0.302	1.443	1.355	1



TABLE 4 (continued)

X IS DISTANCE MEASURED HORIZONTALLY FROM GROUND ZERO.  
 Y IS DISTANCE MEASURED VERTICALLY ABOVE GROUND ZERO. AND  
 Z IS TIME-OF-ARRIVAL INDICATED BY THE PUFF TRAJECTORY.  
 VELOCITIES ARE DERIVATIVES AT THE TIME OF ARRIVAL,  
 AND ARE EXPRESSED IN MACH UNITS RELATIVE TO C ABOVE.  
 R IS A RADIUS CALCULATED ACCORDING TO REGIONS DEFINED  
 ON BASIS OF FIRST SHOCK FRONT PASSING, CODED USING:  
 1= PRIMARY FRONT FROM LOWER CHARGE  
 2= PRIMARY FRONT FROM UPPER CHARGE  
 3= MACH STEM AT GROUND SURFACE  
 4= MACH STEM BELOW INTERACTION PLANE  
 5= MACH STEM ABOVE INTERACTION PLANE  
 SCALED TIME = OBSERVED TIME MULTIPLIED BY (C/C0)/S, WHERE C0 = 340.292 METERS/SECOND  
 AND SCALED DISTANCE = OBSERVED DISTANCE DIVIDED BY SE CUBE ROOT OF (W/WC)\*(PC/P),  
 WHERE PC = 101.325 KILOPASCALS. (W, WC, AND P ARE DEFINED ABOVE.)  
 SCALED EVENT = STANDARD CHARGE WD IN ATMOSPHERE WHERE C0 AND P0 ARE AMBIENT (T0 = 15 DEGREES CELSIUS).  
 VELOCITY EXPRESSED IN MACH UNITS IS INVARIANT UNDER SCALING.

TABLE 5.1

SHOCK FRONT DATA DIPOLE WEST/10 WFS/293 R1 /A770322  
 SMOKE PUFF GRID 1209  
 PRIMARY FRONT FROM LOWER CHARGE

AMBIENT TEMPERATURE T = -5.94 DEGREES CELSIUS  
 AMBIENT PRESSURE P = 94.38 KILOPASCALS  
 RELATIVE HUMIDITY RH = 81.0 PER CENT  
 VAPOR PRESSURE VP = 0.32 KILOPASCALS  
 AMBIENT SPEED OF SOUND C = 328.004 METERS/SECOND  
 CHARGE WEIGHT W = 489.9 KILOGRAMS  
 CHARGE HEIGHT H = 4.55 METERS  
 SEPARATION  $\Delta Z$  HSE = 4.64 METERS  
 SACHS SCALING FACTOR S = 9.0718  
 SCALING TC CHARGE WEIGHT WD = 1.0 KILOGRAMS

SHOCK FRONT DATA COMPUTED FROM PARTICLE TRAJECTORY TIMES OF ARRIVAL

T-OBS MSEC	R-OBS METERS	R-FIT METERS	DIFFERENCE METERS	T-SCAL MSEC	R-SCAL METERS	SFUCK VELOCITY	PRESSURE RATIO	PRESSURE KPA	PARTICLE VELOCITY	DENSITY RATIO	PUFF NUMBER
3.558	7.855	7.759	-0.096	0.425	0.961	2.776	9.165	865.016	24200	3.835	9
3.864	8.148	8.055	-0.093	0.460	0.938	2.882	8.524	804.511	24113	3.745	10
4.151	8.375	8.441	0.066	0.460	0.793	2.926	8.524	804.511	24113	3.745	11
4.447	8.528	8.420	-0.108	0.436	1.028	2.926	7.877	752.528	24035	3.643	12
4.816	8.228	8.250	0.022	0.371	1.318	2.936	7.407	707.622	14765	3.586	122
5.816	10.564	10.540	-0.024	0.314	1.318	2.936	5.198	450.604	14590	3.131	21
7.112	10.770	10.674	-0.096	0.349	1.347	2.936	5.021	473.923	14557	3.089	23
11.246	13.818	13.891	0.073	0.549	1.347	2.936	3.555	335.512	14262	2.684	33
11.246	13.818	13.891	0.073	1.343	1.720	2.012	3.555	335.512	14262	2.684	33
11.246	13.818	13.891	0.073	1.343	1.720	2.012	3.555	335.512	14262	2.684	34

T IS TIME-OF-ARRIVAL AND R IS RADIAL PUFF POSITION. RADIUS VALUES ARE FITTED USING  $R_{FIT} = A + B * T^C * LGS(1 + T)$ .  
 SFC AND PARTICLE VELOCITIES ARE EXPRESSED IN MACH UNITS, RELATIVE TO THE AMBIENT SOUND SPEED C ABOVE.  
 PRESSURE IS PEAK OVERPRESSURE RATIO (P/PA - P/PA) AND PEAK OVERPRESSURE (P/PA - P) IN KILOPASCALS OBSERVED.  
 WHERE P IS AMBIENT PRESSURE. DENSITY IS EXPRESSED AS A RATIO, RELATIVE TO THE AMBIENT DENSITY D.

SCALED TIME = OBSERVED TIME MULTIPLIED BY (C/C0)/S, WHERE C0 = 340.292 METERS/SECOND  
 AND SCALED DISTANCE = OBSERVED DISTANCE DIVIDED BY S = CUBE ROOT OF (W/W0)\*(P0/P),  
 WHERE P = 101.325 KILOPASCALS. (W, W0, AND P ARE DEFINED ABOVE.)  
 SCALED EVENT = STANDARD CHARGE W0 IN ATMOSPHERE WHERE CO AND P0 ARE AMBIENT (TC = 15 DEGREES CELSIUS).  
 VELOCITY, PRESSURE, AND DENSITY, EXPRESSED AS RATIOS, ARE INVARIANT UNDER SCALING.

TABLE 5.2

SHOCK FRONT DATA DIPOLE WEST/10 WFS/295 SMOKE PUFF GRID 1209 R2 /A770322  
 ----- PRIMARY FRONT FROM UPPER CHARGE

AMBIENT TEMPERATURE T = 5.04 DEGREES CELSIUS  
 AMBIENT PRESSURE P = 94.35 KILOPASCALS  
 RELATIVE HUMIDITY RH = 0.12 KILOPASCALS  
 VARIATION PRESSURE VS SOUND C = 324.006 METERS/SECOND  
 AMBIENT TEMPERATURE T = 15.04 DEGREES CELSIUS  
 AMBIENT PRESSURE P = 94.35 KILOPASCALS  
 RELATIVE HUMIDITY RH = 0.12 KILOPASCALS  
 VARIATION PRESSURE VS SOUND C = 324.006 METERS/SECOND  
 AMBIENT TEMPERATURE T = 15.04 DEGREES CELSIUS  
 AMBIENT PRESSURE P = 94.35 KILOPASCALS  
 RELATIVE HUMIDITY RH = 0.12 KILOPASCALS  
 VARIATION PRESSURE VS SOUND C = 324.006 METERS/SECOND

SHOCK FRONT DATA COMPUTED FROM PARTICLE TRAJECTORY TIMES OF ARRIVAL

T-OBS MSEC	R-OBS METERS	R-FIT METERS	DIFFERENCE METERS	T-SCAL MSEC	R-SCAL METERS	SHOCK VELOCITY	PRESSURE RATIO	PRESSURE KPA	PARTICLE VELOCITY	DENSITY RATIO	PUFF NUMBER
7.4568	8.120	8.019	-0.101	0.425	0.996	3.221	10.939	1032.356	2.426	4.049	4
7.4568	7.075	8.019	0.944	0.425	0.996	3.221	10.939	1032.356	2.426	4.049	4
7.4568	8.403	8.019	-0.384	0.425	0.996	3.221	10.939	1032.356	2.426	4.049	4
7.4568	8.536	8.019	-0.517	0.425	0.996	3.221	10.939	1032.356	2.426	4.049	4
7.4568	8.447	8.019	-0.428	0.425	0.996	3.221	10.939	1032.356	2.426	4.049	4
7.4568	10.729	10.784	0.055	0.779	1.336	2.867	2.374	702.803	1.620	3.170	1
7.4568	10.784	10.784	0.000	0.779	1.336	2.867	2.374	702.803	1.620	3.170	1
7.4568	10.784	10.784	0.000	0.779	1.336	2.867	2.374	702.803	1.620	3.170	1
7.4568	10.784	10.784	0.000	0.779	1.336	2.867	2.374	702.803	1.620	3.170	1
7.4568	11.045	11.020	-0.025	0.819	1.392	2.817	2.098	505.802	1.571	3.107	1
7.4568	11.045	11.020	-0.025	0.819	1.392	2.817	2.098	505.802	1.571	3.107	1
7.4568	11.045	11.020	-0.025	0.819	1.392	2.817	2.098	505.802	1.571	3.107	1
7.4568	13.575	13.543	-0.032	1.237	1.678	1.923	3.146	457.845	1.526	3.047	1
7.4568	13.575	13.543	-0.032	1.237	1.678	1.923	3.146	457.845	1.526	3.047	1
7.4568	13.575	13.543	-0.032	1.237	1.678	1.923	3.146	457.845	1.526	3.047	1
7.4568	13.575	13.543	-0.032	1.237	1.678	1.923	3.146	457.845	1.526	3.047	1
7.4568	13.575	13.543	-0.032	1.237	1.678	1.923	3.146	457.845	1.526	3.047	1
7.4568	15.837	15.877	0.040	1.665	1.969	1.703	3.048	295.924	1.169	2.550	2
7.4568	15.837	15.877	0.040	1.665	1.969	1.703	3.048	295.924	1.169	2.550	2
7.4568	15.837	15.877	0.040	1.665	1.969	1.703	3.048	295.924	1.169	2.550	2
7.4568	15.837	15.877	0.040	1.665	1.969	1.703	3.048	295.924	1.169	2.550	2
7.4568	15.837	15.877	0.040	1.665	1.969	1.703	3.048	295.924	1.169	2.550	2
7.4568	15.837	15.877	0.040	1.665	1.969	1.703	3.048	295.924	1.169	2.550	2
7.4568	17.709	18.020	0.311	2.151	2.232	1.573	2.418	209.358	0.930	2.203	3
7.4568	17.709	18.020	0.311	2.151	2.232	1.573	2.418	209.358	0.930	2.203	3
7.4568	17.709	18.020	0.311	2.151	2.232	1.573	2.418	209.358	0.930	2.203	3
7.4568	17.709	18.020	0.311	2.151	2.232	1.573	2.418	209.358	0.930	2.203	3
7.4568	17.709	18.020	0.311	2.151	2.232	1.573	2.418	209.358	0.930	2.203	3
7.4568	20.145	20.145	0.000	2.535	2.441	1.457	1.719	132.744	0.781	1.986	50
7.4568	20.145	20.145	0.000	2.535	2.441	1.457	1.719	132.744	0.781	1.986	50
7.4568	20.145	20.145	0.000	2.535	2.441	1.457	1.719	132.744	0.781	1.986	50
7.4568	20.145	20.145	0.000	2.535	2.441	1.457	1.719	132.744	0.781	1.986	50
7.4568	20.145	20.145	0.000	2.535	2.441	1.457	1.719	132.744	0.781	1.986	50
7.4568	20.145	20.145	0.000	2.535	2.441	1.457	1.719	132.744	0.781	1.986	50

T IS TIME OF ARRIVAL AND P IS AMBIENT PRESSURE. RADIUS VALUES ARE FITTED USING  $R_{FIT} = A + B \cdot T + C \cdot \log(1 + T)$ .  
 SHOCK AND PARTICLE VELOCITIES ARE EXPRESSED IN MACH UNITS, RELATIVE TO THE AMBIENT SOUND SPEED C ABOVE.  
 PRESSURE IS PEAK OVERPRESSURE  $RATIO = (P_{MAX} - P) / P$ , AND PEAK OVERPRESSURE  $(P_{MAX} - P)$  IN KILOPASCALS OBSERVED.  
 \*HERE P IS AMBIENT PRESSURE. DENSITY IS EXPRESSED AS A RATIO, RELATIVE TO THE AMBIENT DENSITY D.  
 SCALED TIME = OBSERVED TIME MULTIPLIED BY  $(C/C_0)^{0.75}$ , WHERE  $C_0 = 340.292$  METERS/SECOND  
 SCALED DISTANCE = OBSERVED DISTANCE DIVIDED BY  $5 \cdot \text{CUBE ROOT OF } (W/W_0) \cdot (P/P_0)$ ,  
 WHERE W AND P ARE DEFINED ABOVE.  
 SCALED VELOCITY = OBSERVED VELOCITY DIVIDED BY  $5 \cdot \text{CUBE ROOT OF } (W/W_0) \cdot (P/P_0)$ ,  
 WHERE W AND P ARE DEFINED ABOVE.  
 SCALED EVENT STANDARD CHARGE W0 IN ATMOSPHERE WHERE CO AND P0 ARE AMBIENT (TC = 15 DEGREES CELSIUS).  
 VELOCITY, PRESSURE, AND DENSITY, EXPRESSED AS RATIOS, ARE INVARIANT UNDER SCALING.

TABLE 5.3

SHOCK FRONT DATA      DIPOLE WEST/10      WF5/295      SMOKE PUFF GRID 1209      R4 /A770322  
 -----  
 MACH STEM BELOW INTERACTION PLANE

AMBIENT TEMPERATURE T = -5.474 DEGREES CELSIUS  
 AMBIENT PRESSURE P = 54.38 KILOPASCALS  
 RELATIVE HUMIDITY RH = 41.0 PER CENT  
 WIND VELOCITY V = 0.32 KILOPASCALS  
 VELOCITY OF SOUND C = 325.004 METERS/SECOND  
 CHARGE WEIGHT W = 489.0 KILOGRAMS  
 CHARGE HEIGHT H = 4.55 METERS  
 SEPARATION  $\Delta Z$  HSE = 4.64 METERS  
 SACHS SCALING FACTOR SF = 0.0718  
 SCALING TO CHARGE WEIGHT  $\Delta C$  = 1.0 KILOGRAMS

SHOCK FRONT DATA COMPUTED FROM PARTICLE TRAJECTORY TIMES OF ARRIVAL

T-CBS MSEC	T-CBS METERS	R-FIT METERS	DIFFERENCE METERS	T-SCAL MSEC	R-SCAL METERS	SHOCK VELOCITY	PRESSURE RATIO	PRESSURE KPA	PARTICLE VELOCITY	DENSITY RATIO	PUFF NUMBER
4.447	9.000	8.007	-0.013	0.4531	0.392	3.435	15.992	1509.384	2.979	4.476	7
7.407	11.438	11.234	-0.142	0.4835	1.394	2.916	8.083	763.359	2.051	3.490	12
10.361	13.874	13.645	-0.007	1.237	1.715	2.532	5.163	487.257	1.583	3.122	31
13.308	16.308	16.057	-0.044	1.589	1.984	2.043	3.705	349.701	1.295	2.731	43
16.257	18.742	18.477	-0.032	1.589	1.984	2.043	3.705	349.701	1.295	2.731	43
19.204	21.176	20.891	-0.019	2.045	2.295	1.811	2.661	251.168	1.049	2.377	57
22.151	23.610	23.304	-0.019	2.045	2.295	1.811	2.661	251.168	1.049	2.377	57
25.098	26.044	25.716	-0.017	2.501	2.573	1.660	2.050	193.467	0.882	2.133	70
28.045	28.478	28.131	-0.215	2.501	2.573	1.660	2.050	193.467	0.882	2.133	70
30.992	30.912	30.545	-0.117	2.984	2.791	1.509	2.050	193.467	0.882	2.133	69
33.939	33.346	32.959	-0.143	2.984	2.791	1.509	1.704	160.829	0.776	1.879	81
36.886	35.780	35.373	-0.101	2.984	2.791	1.509	1.704	160.829	0.776	1.879	81
39.833	38.214	37.797	-0.016	3.337	3.035	1.487	1.412	133.240	0.678	1.639	94
42.780	40.648	40.221	-0.011	3.337	3.035	1.487	1.412	133.240	0.678	1.639	94
45.727	43.082	42.645	-0.003	3.337	3.035	1.487	1.412	133.240	0.678	1.639	94
48.674	45.516	45.079	-0.003	3.684	3.214	1.437	1.242	117.249	0.618	1.754	105
51.621	47.950	47.513	-0.004	3.684	3.214	1.437	1.242	117.249	0.618	1.754	105
54.568	50.384	50.000	-0.018	3.684	3.214	1.437	1.242	117.249	0.618	1.754	104
57.515	52.818	52.424	-0.018	3.684	3.214	1.437	1.242	117.249	0.618	1.754	104

T IS TIME-OF-ARRIVAL AND R IS RADIAL PUFF POSITION. RADIUS VALUES ARE FITTED USING  $R_{FIT} = A + B \cdot T + C \cdot LOG(T)$ .  
 SHOCK AND PARTICLE VELOCITIES ARE EXPRESSED IN MACH UNITS, RELATIVE TO THE AMBIENT SOUND SPEED  $C_{AMBIENT}$ .  
 PRESSURE IS PEAK OVERPRESSURE RATIO  $(P_{MAX} - P)/P$ , AND PEAK OVERPRESSURE  $(P_{MAX} - P)$  IN KILOPASCALS OBSERVED,  
 WHERE P IS AMBIENT PRESSURE. DENSITY IS EXPRESSED AS A RATIO, RELATIVE TO THE AMBIENT DENSITY  $D_{AMBIENT}$ .  
 SCALED TIME OBSERVED TIME MULTIPLIED BY  $(C/C_{AMBIENT})^2$ , WHERE C = 340.292 METERS/SECOND  
 AND SCALED DISTANCE OBSERVED DISTANCE DIVIDED BY SE CUBE ROOT OF  $(W/MC) \cdot (P/P)$ .  
 W, WC, AND P ARE DEFINED ABOVE.  
 SCALED VELOCITY IS IN KILOPASCALS. (W, WC, AND P ARE DEFINED ABOVE.)  
 SCALED VELOCITY STANDARD CHARGE  $W_0$  IN ATMOSPHERE WHERE  $C_0$  AND  $P_0$  ARE AMBIENT (TCF IS 15 DEGREES CELSIUS).  
 VELOCITY, PRESSURE, AND DENSITY, EXPRESSED AS RATIOS, ARE INVARIANT UNDER SCALING.

TABLE 5.4

R5 /A770322

SMOKE PUFF GRID 1203  
MACH STEM ABOVE INTERACTION PLANE

DIPLOLE WEST/10 WFE/295

SHOCK FRONT DATA

AMBIENT TEMPERATURE T<sub>a</sub> = 5.94 DEGREES CELSIUS  
AMBIENT PRESSURE P<sub>a</sub> = 94.38 KILOPASCALS  
RELATIVE HUMIDITY RH = 41.0 PER CENT  
RELATIVE VELOCITY V<sub>rel</sub> = 0.32 KILOPASCALS  
VELOCITY OF SOUND C = 325.004 METERS/SECOND  
AMBIENT DENSITY ρ<sub>a</sub> = 4.039 KILOGRAMS  
CHARGE VELOCITY V<sub>c</sub> = 4.55 METERS  
CHARGE MASS M<sub>c</sub> = 4.64 METERS  
SEPARATION ΔZ = 4.64 METERS  
SCALING FACTOR S = 0.0718  
SCALING TO CHARGE WEIGHT W<sub>c</sub> = 1.0 KILOGRAMS

SHOCK FRONT DATA COMPUTED FROM PARTICLE TRAJECTORY TIMES OF ARRIVAL

T-MS	R-TORS METERS	R-FIT METERS	DIFFERENCE METERS	T-MSCL	R-SCALE METERS	SPOCK VELOCITY	PRESSURE RATIO	PRESSURE KPA	PARTICLE VELOCITY	DENSITY RATIO	PUFF NUMBER
4.437	4.038	4.025	-0.014	0.531	0.994	3.885	16.085	1518.099	2.989	4.484	6
6.814	10.722	10.722	0.000	0.814	1.324	2.855	9.018	851.177	2.989	3.415	13
10.341	13.724	13.724	0.000	1.237	1.715	2.315	5.088	480.259	1.570	3.105	29
11.338	13.466	13.466	0.000	1.237	1.715	2.315	5.088	480.259	1.570	3.105	42
11.338	13.466	13.466	0.000	1.237	1.715	2.315	5.088	480.259	1.570	3.105	40
11.338	13.466	13.466	0.000	1.237	1.715	2.315	5.088	480.259	1.570	3.105	44
11.338	13.466	13.466	0.000	1.237	1.715	2.315	5.088	480.259	1.570	3.105	51
11.338	13.466	13.466	0.000	1.237	1.715	2.315	5.088	480.259	1.570	3.105	52
11.338	13.466	13.466	0.000	1.237	1.715	2.315	5.088	480.259	1.570	3.105	53
11.338	13.466	13.466	0.000	1.237	1.715	2.315	5.088	480.259	1.570	3.105	62
11.338	13.466	13.466	0.000	1.237	1.715	2.315	5.088	480.259	1.570	3.105	63
11.338	13.466	13.466	0.000	1.237	1.715	2.315	5.088	480.259	1.570	3.105	64
11.338	13.466	13.466	0.000	1.237	1.715	2.315	5.088	480.259	1.570	3.105	65
11.338	13.466	13.466	0.000	1.237	1.715	2.315	5.088	480.259	1.570	3.105	66
11.338	13.466	13.466	0.000	1.237	1.715	2.315	5.088	480.259	1.570	3.105	67
11.338	13.466	13.466	0.000	1.237	1.715	2.315	5.088	480.259	1.570	3.105	68
11.338	13.466	13.466	0.000	1.237	1.715	2.315	5.088	480.259	1.570	3.105	69
11.338	13.466	13.466	0.000	1.237	1.715	2.315	5.088	480.259	1.570	3.105	70
11.338	13.466	13.466	0.000	1.237	1.715	2.315	5.088	480.259	1.570	3.105	71
11.338	13.466	13.466	0.000	1.237	1.715	2.315	5.088	480.259	1.570	3.105	72
11.338	13.466	13.466	0.000	1.237	1.715	2.315	5.088	480.259	1.570	3.105	73
11.338	13.466	13.466	0.000	1.237	1.715	2.315	5.088	480.259	1.570	3.105	74
11.338	13.466	13.466	0.000	1.237	1.715	2.315	5.088	480.259	1.570	3.105	75
11.338	13.466	13.466	0.000	1.237	1.715	2.315	5.088	480.259	1.570	3.105	76
11.338	13.466	13.466	0.000	1.237	1.715	2.315	5.088	480.259	1.570	3.105	77
11.338	13.466	13.466	0.000	1.237	1.715	2.315	5.088	480.259	1.570	3.105	78
11.338	13.466	13.466	0.000	1.237	1.715	2.315	5.088	480.259	1.570	3.105	79
11.338	13.466	13.466	0.000	1.237	1.715	2.315	5.088	480.259	1.570	3.105	80
11.338	13.466	13.466	0.000	1.237	1.715	2.315	5.088	480.259	1.570	3.105	81
11.338	13.466	13.466	0.000	1.237	1.715	2.315	5.088	480.259	1.570	3.105	82
11.338	13.466	13.466	0.000	1.237	1.715	2.315	5.088	480.259	1.570	3.105	83
11.338	13.466	13.466	0.000	1.237	1.715	2.315	5.088	480.259	1.570	3.105	84
11.338	13.466	13.466	0.000	1.237	1.715	2.315	5.088	480.259	1.570	3.105	85
11.338	13.466	13.466	0.000	1.237	1.715	2.315	5.088	480.259	1.570	3.105	86
11.338	13.466	13.466	0.000	1.237	1.715	2.315	5.088	480.259	1.570	3.105	87
11.338	13.466	13.466	0.000	1.237	1.715	2.315	5.088	480.259	1.570	3.105	88
11.338	13.466	13.466	0.000	1.237	1.715	2.315	5.088	480.259	1.570	3.105	89
11.338	13.466	13.466	0.000	1.237	1.715	2.315	5.088	480.259	1.570	3.105	90
11.338	13.466	13.466	0.000	1.237	1.715	2.315	5.088	480.259	1.570	3.105	91
11.338	13.466	13.466	0.000	1.237	1.715	2.315	5.088	480.259	1.570	3.105	92
11.338	13.466	13.466	0.000	1.237	1.715	2.315	5.088	480.259	1.570	3.105	93
11.338	13.466	13.466	0.000	1.237	1.715	2.315	5.088	480.259	1.570	3.105	94
11.338	13.466	13.466	0.000	1.237	1.715	2.315	5.088	480.259	1.570	3.105	95
11.338	13.466	13.466	0.000	1.237	1.715	2.315	5.088	480.259	1.570	3.105	96
11.338	13.466	13.466	0.000	1.237	1.715	2.315	5.088	480.259	1.570	3.105	97
11.338	13.466	13.466	0.000	1.237	1.715	2.315	5.088	480.259	1.570	3.105	98
11.338	13.466	13.466	0.000	1.237	1.715	2.315	5.088	480.259	1.570	3.105	99
11.338	13.466	13.466	0.000	1.237	1.715	2.315	5.088	480.259	1.570	3.105	100
11.338	13.466	13.466	0.000	1.237	1.715	2.315	5.088	480.259	1.570	3.105	101
11.338	13.466	13.466	0.000	1.237	1.715	2.315	5.088	480.259	1.570	3.105	102
11.338	13.466	13.466	0.000	1.237	1.715	2.315	5.088	480.259	1.570	3.105	103
11.338	13.466	13.466	0.000	1.237	1.715	2.315	5.088	480.259	1.570	3.105	104
11.338	13.466	13.466	0.000	1.237	1.715	2.315	5.088	480.259	1.570	3.105	105
11.338	13.466	13.466	0.000	1.237	1.715	2.315	5.088	480.259	1.570	3.105	106
11.338	13.466	13.466	0.000	1.237	1.715	2.315	5.088	480.259	1.570	3.105	107
11.338	13.466	13.466	0.000	1.237	1.715	2.315	5.088	480.259	1.570	3.105	108
11.338	13.466	13.466	0.000	1.237	1.715	2.315	5.088	480.259	1.570	3.105	109
11.338	13.466	13.466	0.000	1.237	1.715	2.315	5.088	480.259	1.570	3.105	110
11.338	13.466	13.466	0.000	1.237	1.715	2.315	5.088	480.259	1.570	3.105	111
11.338	13.466	13.466	0.000	1.237	1.715	2.315	5.088	480.259	1.570	3.105	112
11.338	13.466	13.466	0.000	1.237	1.715	2.315	5.088	480.259	1.570	3.105	113
11.338	13.466	13.466	0.000	1.237	1.715	2.315	5.088	480.259	1.570	3.105	114
11.338	13.466	13.466	0.000	1.237	1.715	2.315	5.088	480.259	1.570	3.105	115
11.338	13.466	13.466	0.000	1.237	1.715	2.315	5.088	480.259	1.570	3.105	116
11.338	13.466	13.466	0.000	1.237	1.715	2.315	5.088	480.259	1.570	3.105	117
11.338	13.466	13.466	0.000	1.237	1.715	2.315	5.088	480.259	1.570	3.105	118
11.338	13.466	13.466	0.000	1.237	1.715	2.315	5.088	480.259	1.570	3.105	119
11.338	13.466	13.466	0.000	1.237	1.715	2.315	5.088	480.259	1.570	3.105	120

T IS TIME-OF-ARRIVAL AND R IS RADIAL PUFF POSITION. RADIUS VALUES ARE FITTED USING RFIT=A+BT+C\*LCG(1+T).  
SPOCK AND PARTICLE VELOCITIES ARE EXPRESSED IN MACH UNITS, RELATIVE TO THE AMBIENT SOUND SPEED C ABOVE.  
PRESSURE IS PEAK OVERPRESSURE RATIO (P/PA) AND PEAK OVERPRESSURE (P/PA) IN KILOPASCALS OBSERVED.  
WHERE P IS AMBIENT PRESSURE, DENSITY IS EXPRESSED AS A RATIO, RELATIVE TO THE AMBIENT DENSITY ρ.  
SCALED TIME= OBSERVED TIME MULTIPLIED BY (C/C0)/S, WHERE C0= 340.292 METERS/SECOND  
AND SCALED DISTANCE= OBSERVED DISTANCE DIVIDED BY S, WHERE C0= 340.292 METERS/SECOND  
WHERE PC= 101.325 KILOPASCALS. (W, WD, AND P ARE DEFINED ABOVE.)

TABLE 5.5

SHOCK FRONT DATA      DIPOLE WEST/10    WFS/295      SMOKE PUFF GRID 1209      R3 /A770322  
 -----  
 MACH STEM AT GROUND SURFACE

AMBIENT TEMPERATURE T = -5.04 DEGREES CELSIUS  
 AMBIENT PRESSURE PE = 94.24 KILOPASCALS  
 RELATIVE HUMIDITY RHE = 11.0 PER CENT  
 WIND VELOCITY V = 0.22 KILOPASCALS  
 AMBIENT SPEED OF SOUND C = 328.004 METERS/SECND  
 CHARGE WEIGHT W = 489.2 KILOGRAMS  
 CHARGE LENGTH L = 4.52 METERS  
 SEPARATION S = 4.64 METERS  
 SCALING FACTOR SF = 8.0714  
 SCALING TO CHARGE WEIGHT WOF = 1.0 KILOGRAMS

SHOCK FRONT DATA COMPUTED FROM PARTICLE TRAJECTORY TIMES OF ARRIVAL

T-095 MSEC	R-095 METERS	R-095 METERS	R-095 METERS	DIFFERENCE METERS	T-SCAL MSEC	R-SCAL METERS	SPOCK VELOCITY	PRESSURE RATIO	PRESSURE KPA	PARTICLE VELOCITY	DENSITY RATIO	PUFF NUMBER
9.264	11.124	11.175	0.050	0.960	1.304	2.868	8.124	795.298	2.099	2.099	3.731	24
11.224	11.575	13.748	0.050	1.343	1.708	2.380	5.443	511.866	1.634	1.634	3.188	36
14.111	12.014	14.014	0.000	1.695	1.204	2.083	5.443	367.742	1.336	1.336	2.788	48
14.111	12.014	14.014	0.000	1.625	1.204	2.083	5.890	367.742	1.336	1.336	2.788	46
17.073	14.178	14.178	0.000	2.085	2.252	1.856	5.890	273.453	1.109	1.109	2.464	60
17.073	14.178	14.178	0.000	2.081	2.252	1.856	5.890	273.453	1.109	1.109	2.464	59
17.777	14.443	14.344	-0.110	2.110	2.575	1.856	5.890	209.224	0.921	0.921	2.464	72
20.040	20.050	20.304	0.254	2.501	2.516	1.703	5.890	164.520	0.750	0.750	2.007	82
24.479	22.311	22.267	-0.044	2.501	2.516	1.595	5.890	164.520	0.750	0.750	2.007	81
24.479	22.311	22.424	0.113	2.954	2.778	1.577	5.890	132.607	0.674	0.674	1.692	93
24.524	24.042	24.393	0.351	3.405	3.022	1.483	5.890	132.607	0.674	0.674	1.692	86
28.582	24.453	25.547	1.094	3.404	3.165	1.437	5.890	117.153	0.617	0.617	1.633	95
30.051	25.491	25.830	0.339	3.684	3.200	1.426	5.890	113.825	0.604	0.604	1.735	108
31.432	25.491	25.830	0.339	3.753	3.200	1.426	5.890	113.825	0.604	0.604	1.735	107

T IS TIME OF ARRIVAL AND R IS RADIAL PUFF POSITION. RADIUS VALUES ARE FITTED USING  $R^2 = A + B * T + C * LOG(1 + T)$ .  
 SHOCK AND PARTICLE VELOCITIES ARE EXPRESSED IN MACH UNIT, RELATIVE TO THE AMBIENT SOUND SPEED C ABOVE.  
 PRESSURE IS PEAK OVERPRESSURE RATIO (P MAX - P) AND PEAK OVERPRESSURE (P MAX - P) IN KILOPASCALS OBSERVED.  
 WHERE P IS AMBIENT PRESSURE. DENSITY IS EXPRESSED AS A RATIO, RELATIVE TO THE AMBIENT DENSITY D.  
 SCALED TIME OBSERVED TIME MULTIPLIED BY (C/C0)/S, WHERE C0 = 340.292 METERS/SECOND  
 AND SCALED DISTANCE OBSERVED DISTANCE DIVIDED BY SE CURE ROOT OF (W/WC)\*(P0/P).  
 WHERE P0 = 101.325 KILOPASCALS. (W, W0, AND P ARE DEFINED ABOVE.)  
 SCALED EVENT STANDARD CHARGE W0 IN ATMOSPHERE WHERE C0 AND P0 ARE AMBIENT (TCF IS DEGREES CELSIUS).  
 VELOCITY, PRESSURE, AND DENSITY, EXPRESSED AS RATIOS, ARE INVARIANT UNDER SCALING.

TABLE 6.1

PEAK VELOCITIES DIPOLE WEST/10 WFS/395

SMOKE PUFF GRID 1209 /A770322  
PRIMARY FRONT FROM LOWER CHARGE

AMBIENT TEMPERATURE T = -5.94 DEGREES CELSIUS  
AMBIENT PRESSURE P = 94.38 KILOPASCALS  
RELATIVE HUMIDITY RHF = 81.0 PERCENT  
VAPOR PRESSURE VP = 0.33 KILOPASCALS  
WIND SPEED OF SOUND CS = 328.00 METERS/SECOND  
CHARGE WEIGHT W = 480.7 KILOGRAMS  
CHARGE HEIGHT H = 4.55 METERS  
SEPARATION ΔR HS = 4.64 METERS  
SACHS SCALING FACTOR SF = R/0718  
SCALING TO CHARGE WEIGHT WCF = 1.0 KILOGRAMS

PEAK PARTICLE VELOCITY DATA, BY EXTRAPOLATION

T-OBS MSEC	R-OBS METERS	T-SCAL MSEC	R-SCAL METERS	PARTICLE VELOCITY	T-OBS MSEC	R-OBS METERS	T-SCAL MSEC	R-SCAL METERS	PARTICLE VELOCITY	T-OBS MSEC	R-OBS METERS	T-SCAL MSEC	R-SCAL METERS	PARTICLE VELOCITY
3.625	7.887	0.440	0.977	2.010	19.268	18.554	2.700	2.700	0.496	2.700	2.700	2.700	2.700	0.577
4.187	8.367	0.500	1.037	2.161	20.036	19.297	2.800	2.800	0.577	2.800	2.800	2.800	2.800	0.577
4.506	8.662	0.538	1.073	2.326	20.059	19.480	2.900	2.900	0.577	2.900	2.900	2.900	2.900	0.577
4.825	9.109	0.597	1.129	2.375	20.773	19.938	3.000	3.000	0.577	3.000	3.000	3.000	3.000	0.577
5.027	9.172	0.600	1.171	2.375	20.610	20.248	3.100	3.100	0.577	3.100	3.100	3.100	3.100	0.577
5.842	9.859	0.700	1.242	2.143	20.245	20.748	3.200	3.200	0.577	3.200	3.200	3.200	3.200	0.577
6.669	10.554	0.800	1.307	1.879	20.245	21.046	3.300	3.300	0.577	3.300	3.300	3.300	3.300	0.577
7.537	11.218	0.932	1.334	1.696	20.769	21.817	3.400	3.400	0.577	3.400	3.400	3.400	3.400	0.577
8.374	11.857	1.000	1.330	1.542	20.635	22.177	3.500	3.500	0.577	3.500	3.500	3.500	3.500	0.577
9.212	12.471	1.100	1.449	1.463	20.472	22.357	3.600	3.600	0.577	3.600	3.600	3.600	3.600	0.577
10.007	13.034	1.195	1.515	1.445	20.351	22.584	3.700	3.700	0.577	3.700	3.700	3.700	3.700	0.577
10.846	13.624	1.200	1.614	1.447	20.310	23.259	3.800	3.800	0.577	3.800	3.800	3.800	3.800	0.577
10.886	13.696	1.300	1.689	1.413	20.147	23.852	3.900	3.900	0.577	3.900	3.900	3.900	3.900	0.577
11.724	14.191	1.400	1.774	1.138	20.055	24.465	4.000	4.000	0.577	4.000	4.000	4.000	4.000	0.577
11.925	14.321	1.424	1.774	1.133	20.009	24.805	4.100	4.100	0.577	4.100	4.100	4.100	4.100	0.577
12.521	14.729	1.500	1.825	1.274	20.009	25.093	4.200	4.200	0.577	4.200	4.200	4.200	4.200	0.577
13.067	15.045	1.564	1.866	1.319	20.009	25.093	4.300	4.300	0.577	4.300	4.300	4.300	4.300	0.577
13.269	15.261	1.600	1.882	1.334	20.009	25.093	4.400	4.400	0.577	4.400	4.400	4.400	4.400	0.577
14.046	15.895	1.700	1.952	1.334	20.009	25.093	4.500	4.500	0.577	4.500	4.500	4.500	4.500	0.577
14.744	16.275	1.800	2.014	1.220	20.009	26.042	4.600	4.600	0.577	4.600	4.600	4.600	4.600	0.577
15.911	16.738	1.900	2.074	1.148	20.009	26.042	4.700	4.700	0.577	4.700	4.700	4.700	4.700	0.577
16.744	17.210	2.000	2.132	0.961	20.009	26.042	4.800	4.800	0.577	4.800	4.800	4.800	4.800	0.577
16.916	17.303	2.000	2.144	0.949	20.009	26.042	4.900	4.900	0.577	4.900	4.900	4.900	4.900	0.577
17.525	17.671	2.100	2.189	0.804	20.009	26.042	5.000	5.000	0.577	5.000	5.000	5.000	5.000	0.577
18.423	18.122	2.200	2.245	0.745	20.009	26.042	5.100	5.100	0.577	5.100	5.100	5.100	5.100	0.577

R IS FITTED SHOCK RADIUS AT TIME T, CALCULATED FROM PARTICLE TRAJECTORY DATA.  
VELOCITY IS EXPRESSED IN MACH UNITS, RELATIVE TO THE AMBIENT SOUND SPEED C, AND  
IS EXTRAPOLATED FROM VELOCITY VERSUS RADIUS DATA AT T, USING VFIT=A\*E\*\*RADIUS.

TABLE 6.2

7A770322

SMCKE PUFF GRID 1209

DIPOLE WEST/10 WFS/295

PEAK VELOCITIES

PRIMARY FRONT FROM UPPER CHARGE

AMBIENT TEMPERATURE T = -5.94 DEGREES CELSIUS  
 AMBIENT PRESSURE PE = 94.38 KILOPASCALS  
 RELATIVE HUMIDITY PH = 21.0 PER CENT  
 WIND VELOCITY V = 0.32 KILOPASCALS  
 AMBIENT SPEED OF SOUND C = 324.004 METERS/SECOND  
 CHARGE WEIGHT WE = 485.9 KILOGRAMS  
 CHARGE HEIGHT HE = 4.35 METERS  
 SEPARATION R = 2 HSE = 4.354 METERS  
 SACHS SCALING FACTOR SF = R/0.718  
 SCALING TO CHARGE WEIGHT \*OF = 1.0 KILOGRAMS

PEAK PARTICLE VELOCITY DATA, BY EXTRAPOLATION

T-OBS MSEC	R-OBS METERS	T-SCAL MSEC	R-SCAL METERS	PARTICLE VELOCITY	T-OBS MSEC	R-OBS METERS	T-SCAL MSEC	R-SCAL METERS	PARTICLE VELOCITY
3.695	2.215	0.440	1.020	2.233	2.635	2.205	3.300	2.831	0.317
4.187	1.710	0.500	1.079	2.410	2.854	2.254	3.400	2.857	0.313
4.505	1.003	0.539	1.115	2.314	3.055	2.319	3.500	2.874	0.308
5.025	0.446	0.597	1.170	2.171	3.095	2.357	3.600	2.912	0.305
5.527	0.004	0.660	1.227	2.037	3.187	2.420	3.700	2.957	0.301
6.042	1.0187	0.700	1.262	1.940	3.281	2.480	3.800	3.008	0.294
6.567	1.0355	0.724	1.283	1.870	3.375	2.526	3.900	3.078	0.284
7.092	1.0505	0.750	1.347	1.836	3.469	2.574	4.000	3.118	0.275
7.617	1.0685	0.832	1.373	1.811	3.563	2.614	4.100	3.166	0.266
8.142	1.0854	0.900	1.422	1.811	3.657	2.654	4.200	3.195	0.257
8.667	1.1012	1.000	1.505	1.821	3.751	2.694	4.300	3.223	0.248
9.192	1.1154	1.100	1.580	1.821	3.845	2.734	4.400	3.270	0.239
9.717	1.1276	1.155	1.649	1.819	3.939	2.774	4.500	3.307	0.230
10.242	1.1339	1.200	1.662	1.819	4.033	2.814	4.600	3.344	0.221
10.767	1.1439	1.300	1.722	1.806	4.127	2.854	4.700	3.381	0.212
11.292	1.1566	1.400	1.805	1.804	4.221	2.894	4.800	3.417	0.203
11.817	1.1724	1.500	1.884	1.804	4.315	2.934	4.900	3.452	0.194
12.342	1.1863	1.600	1.977	1.804	4.409	2.974	5.000	3.488	0.185
12.867	1.1925	1.700	2.093	1.802	4.503	3.014	5.100	3.523	0.176
13.392	1.1974	1.800	2.207	1.802	4.597	3.054	5.200	3.557	0.167
13.917	1.2046	1.900	2.321	1.801	4.691	3.094	5.300	3.592	0.158
14.442	1.2136	2.000	2.435	1.801	4.785	3.134	5.400	3.626	0.149
14.967	1.2241	2.100	2.549	1.800	4.879	3.174	5.500	3.660	0.140
15.492	1.2361	2.200	2.663	1.800	4.973	3.214	5.600	3.693	0.131
16.017	1.2496	2.300	2.777	1.800	5.067	3.254	5.700	3.726	0.122
16.542	1.2646	2.400	2.891	1.800	5.161	3.294	5.800	3.759	0.113
17.067	1.2811	2.500	3.005	1.800	5.255	3.334	5.900	3.792	0.104
17.592	1.2991	2.600	3.119	1.800	5.349	3.374	6.000	3.824	0.095
18.117	1.3186	2.700	3.233	1.800	5.443	3.414	6.100	3.857	0.086
18.642	1.3396	2.800	3.347	1.800	5.537	3.454	6.200	3.889	0.077
19.167	1.3621	2.900	3.461	1.800	5.631	3.494	6.300	3.922	0.068
19.692	1.3861	3.000	3.575	1.800	5.725	3.534	6.400	3.954	0.059
20.217	1.4116	3.100	3.689	1.800	5.819	3.574	6.500	3.987	0.050
20.742	1.4386	3.200	3.803	1.800	5.913	3.614	6.600	4.019	0.041
21.267	1.4671	3.300	3.917	1.800	6.007	3.654	6.700	4.052	0.032
21.792	1.4971	3.400	4.031	1.800	6.101	3.694	6.800	4.084	0.023
22.317	1.5286	3.500	4.145	1.800	6.195	3.734	6.900	4.117	0.014

R IS FITTED SHOCK RADIUS AT TIME T, CALCULATED FROM PARTICLE TRAJECTORY DATA.  
 VELOCITY IS EXPRESSED IN MACH UNITS RELATIVE TO THE AMBIENT SOUND SPEED C, AND  
 IS EXTRAPOLATED FROM VELOCITY VERSUS RADIUS DATA AT T, USING VFIT=A+B\*R\*\*RADIUS.

TABLE 6.3

7A770322

SMCKE PUFF GRID 1207  
MACH STEM BELOW INTERACTION PLANE

PEAK VELOCITIES  
-----  
DIPOLE WEST/10 WFS/295

AMBIENT TEMPERATURE T = -5.94 DEGREES CELSIUS  
AMBIENT PRESSURE P = 94.39 KILOPASCALS  
RELATIVE HUMIDITY RH = 81.0 PER CENT  
VAPOR PRESSURE VP = 0.32 KILOPASCALS  
AMBIENT SPEED OF SOUND C = 339.004 METERS/SECOND  
CHARGE WEIGHT W = 499.9 KILOGRAMS  
CHARGE WEIGHT WE = 4.55 METERS  
SEPARATION R2 = 4.4 METERS  
SCALS SCAL:RG FACTOR = 58.0718  
SCALING TO CHARGE WEIGHT \*OF 1.0 KILOGRAMS

PEAK PARTICLE VELOCITY DATA, BY EXTRAPOLATION

T-DBS MSEC	E-DBS METERS	T-SCAL MSEC	R-SCAL METERS	PARTICLE VELOCITY	T-DBS MSEC	E-DBS METERS	T-SCAL MSEC	R-SCAL METERS	PARTICLE VELOCITY
10.007	10.007	0.578	1.023	2.164	28.472	24.736	3.400	3.067	0.737
10.096	8.793	0.579	1.023	2.029	28.451	24.604	3.413	3.073	0.712
11.023	8.793	0.580	1.093	2.023	29.210	25.157	3.500	3.117	0.696
12.049	5.927	0.581	1.158	1.734	30.147	25.551	3.500	3.166	0.693
13.075	5.927	0.582	1.201	1.385	30.925	25.944	3.700	3.261	0.672
14.074	5.862	0.583	1.226	1.355	31.522	26.324	3.800	3.308	0.652
15.097	5.862	0.584	1.303	1.720	32.059	26.702	3.900	3.350	0.629
16.057	5.862	0.585	1.335	1.401	33.477	27.075	4.000	3.390	0.606
17.057	5.862	0.586	1.401	2.223	34.334	27.443	4.100	3.428	0.582
18.174	7.517	0.587	1.495	1.847	35.172	27.808	4.200	3.465	0.556
19.212	7.517	0.588	1.565	1.745	36.009	28.164	4.300	3.502	0.536
20.267	13.435	0.589	1.667	1.659	36.847	28.519	4.400	3.537	0.514
21.344	13.435	0.590	1.675	1.607	37.684	28.875	4.500	3.572	0.490
22.444	14.159	0.591	1.754	1.541	38.521	29.231	4.600	3.609	0.494
23.569	14.159	0.592	1.833	1.527	39.359	29.587	4.700	3.645	0.463
24.724	14.308	0.593	1.853	1.491	40.199	29.943	4.800	3.681	0.440
25.900	15.438	0.594	1.912	1.443	41.043	30.299	4.900	3.717	0.440
27.100	15.926	0.595	1.961	1.443	41.871	30.655	5.000	3.752	0.432
28.332	16.042	0.596	2.021	1.231	42.708	31.011	5.100	3.787	0.425
29.591	16.776	0.597	2.078	1.190	43.549	31.367	5.200	3.822	0.425
30.874	17.203	0.598	2.131	1.190	44.393	31.723	5.300	3.857	0.426
32.191	17.760	0.599	2.180	1.153	45.221	32.079	5.400	3.892	0.426
33.544	18.301	0.600	2.234	1.124	46.058	32.435	5.500	3.927	0.426
34.935	18.408	0.601	2.291	1.118	46.896	32.791	5.600	3.962	0.431
36.366	18.822	0.602	2.343	1.166	47.733	33.147	5.700	4.000	0.431
37.839	19.244	0.603	2.397	1.119	48.570	33.504	5.800	4.038	0.426
39.354	19.448	0.604	2.452	1.077	49.408	33.860	5.900	4.076	0.426
40.911	19.887	0.605	2.507	1.033	50.245	34.216	6.000	4.114	0.426
42.514	20.339	0.606	2.562	1.033	51.082	34.572	6.100	4.152	0.426
44.161	20.802	0.607	2.617	0.988	51.920	34.928	6.200	4.190	0.426
45.854	21.277	0.608	2.672	0.941	52.757	35.284	6.300	4.228	0.426
47.593	21.764	0.609	2.727	0.893	53.595	35.640	6.400	4.266	0.426
49.378	22.262	0.610	2.782	0.845	54.432	36.000	6.500	4.304	0.426
51.211	22.771	0.611	2.837	0.797	55.270	36.356	6.600	4.342	0.426
53.094	23.291	0.612	2.892	0.749	56.107	36.712	6.700	4.380	0.426
55.027	23.822	0.613	2.947	0.701	56.945	37.068	6.800	4.418	0.426
57.010	24.364	0.614	3.002	0.653	57.782	37.424	6.900	4.456	0.426
59.043	24.917	0.615	3.057	0.605					

R IS FITTED SHOCK RADIUS AT TIME T, CALCULATED FROM PARTICLE TRAJECTORY DATA.  
VELOCITY IS EXPRESSED IN MACH UNITS RELATIVE TO THE AMBIENT SOUND SPEED C, AND  
IS EXTRAPOLATED FROM VELOCITY VERSUS RADIUS DATA AT T, USING VEIT=A+BE\*\*RADIUS.

TABLE 6.4

7A770322

SMOKE PUFF GRID 1209

WF5/295

PEAK VELOCITIES

MACH STEM ABOVE INTERACTION PLANE

AMBIENT TEMPERATURE T = -5.84 DEGREES CELSIUS  
 AMBIENT PRESSURE P = 94.38 KILOPASCALS  
 RELATIVE HUMIDITY RH = 81.0 PER CENT  
 VAPOR PRESSURE VP = 0.32 KILOPASCALS  
 AMBIENT SPEED OF SOUND C = 328.004 METERS/SECOND  
 CHARGE WEIGHT W = 487.9 KILOGRAMS  
 CHARGE HEIGHT H = 4.55 METERS  
 SEPARATION \*S = 4.54 METERS  
 SACHS SCALING FACTOR SF = 0.0718  
 SCALING TO CHARGE WEIGHT WCF = 1.0 KILOGRAMS

PEAK PARTICLE VELOCITY DATA, BY EXTRAPOLATION

T-OBS MSEC	R-OBS METERS	T-SCAL MSEC	R-SCAL METERS	PARTICLE VELOCITY	T-OBS MSEC	R-OBS METERS	T-SCAL MSEC	R-SCAL METERS	PARTICLE VELOCITY
4.0509	9.2118	0.3339	1.0295	2.5555	28.4772	24.4704	3.4000	3.0054	0.6685
4.0525	8.9445	0.3350	1.0092	2.5555	25.5811	24.4704	3.4113	3.0061	0.6682
5.0527	6.3159	0.3450	1.0096	2.5555	25.5811	25.5811	3.5000	3.0102	0.6684
5.0542	6.3700	0.3470	1.0203	2.5555	30.1147	25.5811	3.6200	3.0200	0.6689
5.0563	6.3710	0.3474	1.0203	2.5555	30.1147	25.5811	3.6800	3.0247	0.6691
6.0577	4.0531	0.3532	1.0305	2.5555	32.2459	26.6931	3.9000	3.0293	0.6718
6.0597	4.0531	0.3532	1.0305	2.5555	32.2459	26.6931	4.0000	3.0339	0.6716
7.0534	1.0715	0.3630	1.0405	2.5555	33.4734	27.8051	4.1200	3.0384	0.6744
7.0574	1.0715	0.3630	1.0405	2.5555	33.4734	27.8051	4.2000	3.0429	0.6746
8.0512	1.0715	0.3630	1.0405	2.5555	35.6067	29.0330	4.3000	3.0473	0.6760
8.0527	1.0715	0.3630	1.0405	2.5555	35.6067	29.0330	4.4000	3.0519	0.6760
9.0507	1.0715	0.3630	1.0405	2.5555	37.7402	30.2610	4.5000	3.0564	0.6774
10.0496	1.0715	0.3630	1.0405	2.5555	39.8737	31.4890	4.6000	3.0609	0.6788
11.0484	1.0715	0.3630	1.0405	2.5555	40.0072	32.7170	4.7000	3.0654	0.6802
11.0507	1.0715	0.3630	1.0405	2.5555	40.0072	32.7170	4.8000	3.0699	0.6802
11.0525	1.0715	0.3630	1.0405	2.5555	41.1407	34.0000	4.9000	3.0744	0.6816
11.0542	1.0715	0.3630	1.0405	2.5555	41.1407	34.0000	5.0000	3.0789	0.6816
11.0561	1.0715	0.3630	1.0405	2.5555	42.2742	35.2830	5.1000	3.0834	0.6830
11.0579	1.0715	0.3630	1.0405	2.5555	42.2742	35.2830	5.2000	3.0879	0.6830
11.0597	1.0715	0.3630	1.0405	2.5555	43.4077	36.5660	5.3000	3.0924	0.6844
11.0614	1.0715	0.3630	1.0405	2.5555	43.4077	36.5660	5.4000	3.0969	0.6844
11.0632	1.0715	0.3630	1.0405	2.5555	44.5412	37.8490	5.5000	3.1014	0.6858
11.0649	1.0715	0.3630	1.0405	2.5555	44.5412	37.8490	5.6000	3.1059	0.6858
11.0667	1.0715	0.3630	1.0405	2.5555	45.6747	39.1320	5.7000	3.1104	0.6872
11.0684	1.0715	0.3630	1.0405	2.5555	45.6747	39.1320	5.8000	3.1149	0.6872
11.0702	1.0715	0.3630	1.0405	2.5555	46.8082	40.4150	5.9000	3.1194	0.6886
11.0719	1.0715	0.3630	1.0405	2.5555	46.8082	40.4150	6.0000	3.1239	0.6886
11.0737	1.0715	0.3630	1.0405	2.5555	47.9417	41.6980	6.1000	3.1284	0.6900
11.0754	1.0715	0.3630	1.0405	2.5555	47.9417	41.6980	6.2000	3.1329	0.6900
11.0772	1.0715	0.3630	1.0405	2.5555	49.0752	42.9810	6.3000	3.1374	0.6914
11.0789	1.0715	0.3630	1.0405	2.5555	49.0752	42.9810	6.4000	3.1419	0.6914
11.0807	1.0715	0.3630	1.0405	2.5555	50.2087	44.2640	6.5000	3.1464	0.6928
11.0824	1.0715	0.3630	1.0405	2.5555	50.2087	44.2640	6.6000	3.1509	0.6928
11.0842	1.0715	0.3630	1.0405	2.5555	51.3422	45.5470	6.7000	3.1554	0.6942
11.0859	1.0715	0.3630	1.0405	2.5555	51.3422	45.5470	6.8000	3.1599	0.6942
11.0877	1.0715	0.3630	1.0405	2.5555	52.4757	46.8300	6.9000	3.1644	0.6956
11.0894	1.0715	0.3630	1.0405	2.5555	52.4757	46.8300	7.0000	3.1689	0.6956
11.0912	1.0715	0.3630	1.0405	2.5555	53.6092	48.1130	7.1000	3.1734	0.6970
11.0929	1.0715	0.3630	1.0405	2.5555	53.6092	48.1130	7.2000	3.1779	0.6970
11.0947	1.0715	0.3630	1.0405	2.5555	54.7427	49.3960	7.3000	3.1824	0.6984
11.0964	1.0715	0.3630	1.0405	2.5555	54.7427	49.3960	7.4000	3.1869	0.6984
11.0982	1.0715	0.3630	1.0405	2.5555	55.8762	50.6790	7.5000	3.1914	0.6998
11.0999	1.0715	0.3630	1.0405	2.5555	55.8762	50.6790	7.6000	3.1959	0.6998
11.1017	1.0715	0.3630	1.0405	2.5555	57.0097	51.9620	7.7000	3.2004	0.7012
11.1034	1.0715	0.3630	1.0405	2.5555	57.0097	51.9620	7.8000	3.2049	0.7012
11.1052	1.0715	0.3630	1.0405	2.5555	58.1432	53.2450	7.9000	3.2094	0.7026
11.1069	1.0715	0.3630	1.0405	2.5555	58.1432	53.2450	8.0000	3.2139	0.7026
11.1087	1.0715	0.3630	1.0405	2.5555	59.2767	54.5280	8.1000	3.2184	0.7040
11.1104	1.0715	0.3630	1.0405	2.5555	59.2767	54.5280	8.2000	3.2229	0.7040
11.1122	1.0715	0.3630	1.0405	2.5555	60.4102	55.8110	8.3000	3.2274	0.7054
11.1139	1.0715	0.3630	1.0405	2.5555	60.4102	55.8110	8.4000	3.2319	0.7054
11.1157	1.0715	0.3630	1.0405	2.5555	61.5437	57.0940	8.5000	3.2364	0.7068
11.1174	1.0715	0.3630	1.0405	2.5555	61.5437	57.0940	8.6000	3.2409	0.7068
11.1192	1.0715	0.3630	1.0405	2.5555	62.6772	58.3770	8.7000	3.2454	0.7082
11.1209	1.0715	0.3630	1.0405	2.5555	62.6772	58.3770	8.8000	3.2499	0.7082
11.1227	1.0715	0.3630	1.0405	2.5555	63.8107	59.6600	8.9000	3.2544	0.7096
11.1244	1.0715	0.3630	1.0405	2.5555	63.8107	59.6600	9.0000	3.2589	0.7096
11.1262	1.0715	0.3630	1.0405	2.5555	64.9442	60.9430	9.1000	3.2634	0.7110
11.1279	1.0715	0.3630	1.0405	2.5555	64.9442	60.9430	9.2000	3.2679	0.7110
11.1297	1.0715	0.3630	1.0405	2.5555	66.0777	62.2260	9.3000	3.2724	0.7124
11.1314	1.0715	0.3630	1.0405	2.5555	66.0777	62.2260	9.4000	3.2769	0.7124
11.1332	1.0715	0.3630	1.0405	2.5555	67.2112	63.5090	9.5000	3.2814	0.7138
11.1349	1.0715	0.3630	1.0405	2.5555	67.2112	63.5090	9.6000	3.2859	0.7138
11.1367	1.0715	0.3630	1.0405	2.5555	68.3447	64.7920	9.7000	3.2904	0.7152
11.1384	1.0715	0.3630	1.0405	2.5555	68.3447	64.7920	9.8000	3.2949	0.7152
11.1402	1.0715	0.3630	1.0405	2.5555	69.4782	66.0750	9.9000	3.2994	0.7166
11.1419	1.0715	0.3630	1.0405	2.5555	69.4782	66.0750	10.0000	3.3039	0.7166

R IS FITTED SHOCK RADIUS AT TIME T. CALCULATED FROM PARTICLE TRAJECTORY DATA.  
 VELOCITY IS EXPRESSED IN MACH UNITS RELATIVE TO THE AMBIENT SOUND SPEED C. AND  
 IS EXTRAPOLATED FROM VELOCITY VERSUS RADIUS DATA AT T. USING VFI = A\*B\*\*RADIUS.

TABLE 6.5

PEAK VELOCITIES  
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 AMBIENT TEMPERATURE T<sub>A</sub> = -5.94 DEGREES CELSIUS  
 AMBIENT PRESSURE P<sub>A</sub> = 64.39 KILOGRAMS  
 RELATIVE HUMIDITY RH = 41.30 PERCENT  
 WIND VELOCITY V<sub>W</sub> = 0.32 KILOGRAMS  
 AMBIENT SPEED OF SOUND C = 326.02 METERS/SECOND  
 CHARGE WEIGHT W<sub>C</sub> = 499.9 KILOGRAMS  
 SEPARATION ΔR = 4.55 METERS  
 SCALING FACTOR S = 6.44 METERS  
 SCALING CHARGE WEIGHT W<sub>SC</sub> = 1.0 KILOGRAMS

/A770322

SMOKE PUFF GRID 1209  
 MACH STEM AT GROUND SURFACE

DIPOLE WEST/10 WFS/295

T-OBS MSEC	R-OBS METERS	T-SCAL MSEC	R-SCAL METERS	PARTICLE VELOCITY	T-OBS MSEC	R-OBS METERS	T-SCAL MSEC	R-SCAL METERS	PARTICLE VELOCITY
6.977	2.726	0.500	1.205	1.306	3.147	2.616	3.500	3.121	0.335
7.597	1.538	0.532	1.238	1.331	3.171	2.616	3.500	3.171	0.335
7.597	1.538	0.500	1.205	1.331	3.220	2.616	3.500	3.220	0.335
7.597	1.538	0.500	1.205	1.331	3.268	2.616	3.500	3.268	0.335
7.597	1.538	0.500	1.205	1.331	3.316	2.616	3.500	3.316	0.335
9.212	1.062	1.100	1.494	1.535	3.409	2.616	3.500	3.409	0.335
10.007	1.062	1.165	1.579	1.535	3.445	2.616	3.500	3.445	0.335
10.045	1.062	1.200	1.633	1.535	3.500	2.616	3.500	3.500	0.335
10.045	1.062	1.200	1.633	1.535	3.545	2.616	3.500	3.545	0.335
11.224	1.062	1.400	1.721	1.535	3.589	2.616	3.500	3.589	0.335
11.224	1.062	1.424	1.751	1.535	3.633	2.616	3.500	3.633	0.335
11.224	1.062	1.424	1.751	1.535	3.677	2.616	3.500	3.677	0.335
11.224	1.062	1.424	1.751	1.535	3.721	2.616	3.500	3.721	0.335
11.224	1.062	1.424	1.751	1.535	3.765	2.616	3.500	3.765	0.335
11.224	1.062	1.424	1.751	1.535	3.809	2.616	3.500	3.809	0.335
11.224	1.062	1.424	1.751	1.535	3.853	2.616	3.500	3.853	0.335
11.224	1.062	1.424	1.751	1.535	3.897	2.616	3.500	3.897	0.335
11.224	1.062	1.424	1.751	1.535	3.941	2.616	3.500	3.941	0.335
11.224	1.062	1.424	1.751	1.535	3.985	2.616	3.500	3.985	0.335
11.224	1.062	1.424	1.751	1.535	4.029	2.616	3.500	4.029	0.335
11.224	1.062	1.424	1.751	1.535	4.073	2.616	3.500	4.073	0.335
11.224	1.062	1.424	1.751	1.535	4.117	2.616	3.500	4.117	0.335
11.224	1.062	1.424	1.751	1.535	4.161	2.616	3.500	4.161	0.335
11.224	1.062	1.424	1.751	1.535	4.205	2.616	3.500	4.205	0.335
11.224	1.062	1.424	1.751	1.535	4.249	2.616	3.500	4.249	0.335
11.224	1.062	1.424	1.751	1.535	4.293	2.616	3.500	4.293	0.335
11.224	1.062	1.424	1.751	1.535	4.337	2.616	3.500	4.337	0.335
11.224	1.062	1.424	1.751	1.535	4.381	2.616	3.500	4.381	0.335
11.224	1.062	1.424	1.751	1.535	4.425	2.616	3.500	4.425	0.335
11.224	1.062	1.424	1.751	1.535	4.469	2.616	3.500	4.469	0.335
11.224	1.062	1.424	1.751	1.535	4.513	2.616	3.500	4.513	0.335
11.224	1.062	1.424	1.751	1.535	4.557	2.616	3.500	4.557	0.335
11.224	1.062	1.424	1.751	1.535	4.601	2.616	3.500	4.601	0.335
11.224	1.062	1.424	1.751	1.535	4.645	2.616	3.500	4.645	0.335
11.224	1.062	1.424	1.751	1.535	4.689	2.616	3.500	4.689	0.335
11.224	1.062	1.424	1.751	1.535	4.733	2.616	3.500	4.733	0.335
11.224	1.062	1.424	1.751	1.535	4.777	2.616	3.500	4.777	0.335
11.224	1.062	1.424	1.751	1.535	4.821	2.616	3.500	4.821	0.335
11.224	1.062	1.424	1.751	1.535	4.865	2.616	3.500	4.865	0.335
11.224	1.062	1.424	1.751	1.535	4.909	2.616	3.500	4.909	0.335
11.224	1.062	1.424	1.751	1.535	4.953	2.616	3.500	4.953	0.335
11.224	1.062	1.424	1.751	1.535	4.997	2.616	3.500	4.997	0.335
11.224	1.062	1.424	1.751	1.535	5.041	2.616	3.500	5.041	0.335
11.224	1.062	1.424	1.751	1.535	5.085	2.616	3.500	5.085	0.335
11.224	1.062	1.424	1.751	1.535	5.129	2.616	3.500	5.129	0.335
11.224	1.062	1.424	1.751	1.535	5.173	2.616	3.500	5.173	0.335
11.224	1.062	1.424	1.751	1.535	5.217	2.616	3.500	5.217	0.335
11.224	1.062	1.424	1.751	1.535	5.261	2.616	3.500	5.261	0.335
11.224	1.062	1.424	1.751	1.535	5.305	2.616	3.500	5.305	0.335
11.224	1.062	1.424	1.751	1.535	5.349	2.616	3.500	5.349	0.335
11.224	1.062	1.424	1.751	1.535	5.393	2.616	3.500	5.393	0.335
11.224	1.062	1.424	1.751	1.535	5.437	2.616	3.500	5.437	0.335
11.224	1.062	1.424	1.751	1.535	5.481	2.616	3.500	5.481	0.335
11.224	1.062	1.424	1.751	1.535	5.525	2.616	3.500	5.525	0.335
11.224	1.062	1.424	1.751	1.535	5.569	2.616	3.500	5.569	0.335
11.224	1.062	1.424	1.751	1.535	5.613	2.616	3.500	5.613	0.335
11.224	1.062	1.424	1.751	1.535	5.657	2.616	3.500	5.657	0.335
11.224	1.062	1.424	1.751	1.535	5.701	2.616	3.500	5.701	0.335
11.224	1.062	1.424	1.751	1.535	5.745	2.616	3.500	5.745	0.335
11.224	1.062	1.424	1.751	1.535	5.789	2.616	3.500	5.789	0.335
11.224	1.062	1.424	1.751	1.535	5.833	2.616	3.500	5.833	0.335
11.224	1.062	1.424	1.751	1.535	5.877	2.616	3.500	5.877	0.335
11.224	1.062	1.424	1.751	1.535	5.921	2.616	3.500	5.921	0.335
11.224	1.062	1.424	1.751	1.535	5.965	2.616	3.500	5.965	0.335
11.224	1.062	1.424	1.751	1.535	6.009	2.616	3.500	6.009	0.335
11.224	1.062	1.424	1.751	1.535	6.053	2.616	3.500	6.053	0.335
11.224	1.062	1.424	1.751	1.535	6.097	2.616	3.500	6.097	0.335
11.224	1.062	1.424	1.751	1.535	6.141	2.616	3.500	6.141	0.335
11.224	1.062	1.424	1.751	1.535	6.185	2.616	3.500	6.185	0.335
11.224	1.062	1.424	1.751	1.535	6.229	2.616	3.500	6.229	0.335
11.224	1.062	1.424	1.751	1.535	6.273	2.616	3.500	6.273	0.335
11.224	1.062	1.424	1.751	1.535	6.317	2.616	3.500	6.317	0.335
11.224	1.062	1.424	1.751	1.535	6.361	2.616	3.500	6.361	0.335
11.224	1.062	1.424	1.751	1.535	6.405	2.616	3.500	6.405	0.335
11.224	1.062	1.424	1.751	1.535	6.449	2.616	3.500	6.449	0.335
11.224	1.062	1.424	1.751	1.535	6.493	2.616	3.500	6.493	0.335
11.224	1.062	1.424	1.751	1.535	6.537	2.616	3.500	6.537	0.335
11.224	1.062	1.424	1.751	1.535	6.581	2.616	3.500	6.581	0.335
11.224	1.062	1.424	1.751	1.535	6.625	2.616	3.500	6.625	0.335
11.224	1.062	1.424	1.751	1.535	6.669	2.616	3.500	6.669	0.335
11.224	1.062	1.424	1.751	1.535	6.713	2.616	3.500	6.713	0.335
11.224	1.062	1.424	1.751	1.535	6.757	2.616	3.500	6.757	0.335
11.224	1.062	1.424	1.751	1.535	6.801	2.616	3.500	6.801	0.335
11.224	1.062	1.424	1.751	1.535	6.845	2.616	3.500	6.845	0.335
11.224	1.062	1.424	1.751	1.535	6.889	2.616	3.500	6.889	0.335
11.224	1.062	1.424	1.751	1.535	6.933	2.616	3.500	6.933	0.335
11.224	1.062	1.424	1.751	1.535	6.977	2.616	3.500	6.977	0.335
11.224	1.062	1.424	1.751	1.535	7.021	2.616	3.500	7.021	0.335
11.224	1.062	1.424	1.751	1.535	7.065	2.616	3.500	7.065	0.335
11.224	1.062	1.424	1.751	1.535	7.109	2.616	3.500	7.109	0.335
11.224	1.062	1.424	1.751	1.535	7.153	2.616	3.500	7.153	0.335
11.224	1.062	1.424	1.751	1.535	7.197	2.616	3.500	7.197	0.335
11.224	1.062	1.424	1.751	1.535	7.241	2.616	3.500	7.241	0.335
11.224	1.062	1.424	1.751	1.535	7.285	2.616	3.500	7.285	0.335
11.224	1.062	1.424	1.751	1.535	7.329	2.616	3.500	7.329	0.335
11.224	1.062	1.424	1.751	1.535	7.373	2.616	3.500	7.373	0.335
11.224	1.062	1.424	1.751	1.535	7.417	2.616	3.500	7.417	0.335
11.224	1.062	1.424	1.751	1.535	7.461	2.616	3.500	7.461	0.335
11.224	1.062	1.424	1.751	1.535	7.505	2.616	3.500	7.505	0.335
11.224	1.062	1.424	1.751	1.535	7.549	2.616	3.500	7.549	0.335
11.224	1.062	1.424	1.751	1.535	7.593	2.616	3.500	7.593	0.335
11.224	1.062	1.424	1.751	1.535	7.637	2.616	3.500	7.637	0.335
11.224	1.062	1.424	1.751	1.535	7.681	2.616	3.500	7.681	0.335
11.224	1.062	1.424	1.751	1.535	7.725	2.616	3.500	7.725	0.335
11.224	1.062	1.424	1.751	1.535	7.769	2.616	3.500	7.769	0.335
11.224	1.062	1.424	1.751	1.535	7.813	2.616	3.500	7.813	0.335
11.224	1.062	1.424	1.751	1.535	7.857	2.616	3.500	7.857	0.335
11.224	1.062	1.424	1.751	1.535	7.901	2.616	3.500	7.901	0.335
11.224	1.062	1.424	1.751	1.535	7.945	2.616	3.500	7.945	0.335
11.224	1.062	1.424	1.751	1.535	7.989	2.616	3.500	7.989	0.335
11.224	1.062	1.424	1.751	1.535	8.033	2.616	3.500	8.033	0.335</

TABLE 7.1

DIPOLE WEST/10 WFS/295 SMOKE PUFF GRID 1209 /A770322													
VELOCITY FIELD													
PARTICLE VELOCITIES AT SCALED TIME= 0.500 MS													
X-SCAL METERS	Y-SCAL METERS	U=DX/DT MACH NO	V=DY/DT MACH NO	PARTICLE VELOCITY	R-SCAL METERS	REGN CODE	Y-SCAL METERS	X-SCAL METERS	U=DX/DT MACH NO	V=DY/DT MACH NO	PARTICLE VELOCITY	R-SCAL METERS	REGN CODE
1.023	1.975	2.21	0.43	2.255	1.061	2	0.876	1.013	1.72	0.32	1.731	1.060	1
1.043	1.792	2.08	0.21	2.031	1.045	2	0.718	1.032	1.65	0.30	1.659	1.024	1
1.054	1.618	2.03	-0.11	2.030	1.058	2	0.486	1.032	1.85	-0.17	1.859	1.035	1
1.000	1.411	2.37	-0.45	2.410	1.045	2	0.306	0.958	2.11	-0.45	2.161	0.992	1
PARTICLE VELOCITIES AT SCALED TIME= 0.600 MS													
1.044	2.202	1.94	0.76	2.078	1.171	2	1.054	1.050	1.96	0.55	2.009	1.039	4
1.034	2.011	1.58	0.41	2.023	1.133	2	0.897	1.072	1.75	0.39	1.791	1.120	1
1.110	1.799	1.88	0.21	1.838	1.114	2	0.725	1.075	1.89	0.32	1.906	1.090	1
1.175	1.615	1.85	-0.07	1.850	1.134	2	0.480	1.033	2.00	-0.18	1.766	1.095	1
1.053	1.438	2.13	-0.38	2.154	1.122	2	0.291	1.028	2.30	-0.41	2.375	1.063	1
1.053	1.238	2.54	0.29	2.550	1.057	5	0.100	0.981	2.30	-0.50	2.375	1.085	1
PARTICLE VELOCITIES AT SCALED TIME= 0.700 MS													
1.025	2.224	1.64	0.66	1.749	1.238	2	1.069	1.100	1.83	0.44	1.885	1.103	4
1.157	2.024	1.77	0.39	1.812	1.199	2	0.903	1.132	1.78	0.57	1.885	1.152	1
1.171	1.805	1.55	0.21	1.703	1.175	2	0.732	1.191	1.83	0.23	1.841	1.155	1
1.190	1.513	1.68	-0.05	1.604	1.175	2	0.474	1.132	1.87	-0.18	1.677	1.155	1
1.145	1.345	1.92	-0.31	1.980	1.191	2	0.278	1.084	1.89	-0.37	1.924	1.130	1
1.115	1.247	2.37	0.24	2.334	1.141	5	0.081	1.085	2.08	-0.53	2.114	1.160	1

OBSERVED DISTANCE VALUES = 8.0718 TIMES SCALED VALUES  
 AND OBSERVED TIME VALUES = 8.3742 TIMES SCALED VALUES  
 VELOCITY VALUES AS SHOWN ARE INVARIANT UNDER SCALING.

TABLE 7.2

VELOCITY FIELD DIPOLE WEST/10 WFS/295 SMCKE PUFF GRIC 1209 /A770322

PARTICLE VELOCITIES AT SCALED TIME= 0.900 MS

X-SCAL METERS	Y-SCAL METERS	U=DX/DT MACH NO	V=DY/DT MACH NO	PARTICLE VELOCITY	R-SCAL METERS	REGN CODE	X-SCAL METERS	Y-SCAL METERS	U=DX/DT MACH NO	V=DY/DT MACH NO	PARTICLE VELOCITY	R-SCAL METERS	REGN CODE
1.176	2.247	1.39	0.59	1.510	1.292	2	1.202	0.740	1.76	0.24	1.778	1.215	1
1.174	2.037	1.58	0.37	1.621	1.257	2	1.207	0.468	1.58	-0.19	1.500	1.211	1
1.226	1.813	1.52	0.21	1.535	1.230	2	1.155	0.468	1.78	-0.32	1.806	1.194	3
1.225	1.512	1.53	-0.02	1.532	1.249	2	1.122	0.064	1.65	-0.46	1.906	1.124	2
1.214	1.375	1.72	-0.25	1.738	1.253	5	1.343	1.952	1.39	0.30	1.421	1.368	2
1.161	1.254	2.20	0.19	2.208	1.220	4	1.347	1.553	1.58	0.09	1.579	1.348	2
1.164	0.518	1.85	-0.26	1.879	1.162	1	1.336	1.581	1.77	-0.03	1.571	1.342	2

PARTICLE VELOCITIES AT SCALED TIME= 0.900 MS

X-SCAL METERS	Y-SCAL METERS	U=DX/DT MACH NO	V=DY/DT MACH NO	PARTICLE VELOCITY	R-SCAL METERS	REGN CODE	X-SCAL METERS	Y-SCAL METERS	U=DX/DT MACH NO	V=DY/DT MACH NO	PARTICLE VELOCITY	R-SCAL METERS	REGN CODE
1.220	2.256	1.19	0.52	1.294	1.339	2	1.351	2.181	1.26	0.45	1.342	1.430	2
1.225	2.049	1.41	0.35	1.450	1.309	2	1.350	1.562	1.29	0.29	1.412	1.412	2
1.275	1.820	1.37	0.21	1.394	1.279	2	1.359	1.566	1.44	0.10	1.447	1.399	2
1.282	1.611	1.39	-0.00	1.393	1.258	5	1.371	1.581	1.60	-0.00	1.402	1.359	5
1.286	1.368	1.54	-0.15	1.555	1.292	5	1.371	1.411	2.07	0.83	1.711	1.395	5
1.217	1.095	2.03	0.41	2.033	1.217	4	1.337	1.036	2.18	-0.41	2.230	1.391	4
1.255	0.510	1.58	-0.19	1.609	1.274	4	1.378	0.846	1.73	-0.13	1.845	1.407	4
1.257	0.734	1.49	-0.05	1.506	1.267	1	1.367	0.667	1.61	-0.04	1.607	1.380	1
1.215	0.255	1.67	-0.18	1.670	1.253	1	1.357	0.478	1.61	-0.32	1.603	1.369	1
1.141	0.049	1.62	-0.49	1.670	1.192	3	1.332	0.308	1.58	-0.22	1.598	1.356	1

PARTICLE VELOCITIES AT SCALED TIME= 1.000 MS

X-SCAL METERS	Y-SCAL METERS	U=DX/DT MACH NO	V=DY/DT MACH NO	PARTICLE VELOCITY	R-SCAL METERS	REGN CODE	X-SCAL METERS	Y-SCAL METERS	U=DX/DT MACH NO	V=DY/DT MACH NO	PARTICLE VELOCITY	R-SCAL METERS	REGN CODE
1.257	2.283	1.02	0.47	1.114	1.340	2	1.433	1.572	1.20	0.27	1.235	1.456	2
1.310	2.067	1.25	0.33	1.276	1.354	2	1.445	1.570	1.32	0.01	1.374	1.446	2
1.340	1.827	1.27	0.20	1.249	1.324	2	1.424	1.581	1.45	0.01	1.422	1.451	2
1.352	1.611	1.34	-0.15	1.331	1.344	5	1.455	1.416	1.72	0.32	1.612	1.471	5
1.293	1.254	1.64	-0.10	1.858	1.358	5	1.450	1.023	2.01	-0.10	2.036	1.463	5
1.207	0.705	1.46	0.03	1.512	1.267	4	1.434	0.842	1.57	-0.00	1.505	1.464	4
1.305	0.726	1.48	-0.20	1.430	1.315	4	1.420	0.479	1.39	-0.03	1.438	1.423	4
1.303	0.454	1.41	-0.17	1.424	1.313	1	1.430	0.301	1.53	-0.23	1.501	1.423	1
1.267	0.247	1.55	-0.23	1.571	1.308	1	1.379	0.101	1.54	-0.07	1.539	1.409	1
1.392	2.196	1.17	0.61	1.246	1.474	2						1.383	

OBSERVED DISTANCE VALUES = 8.0718 TIMES SCALED VALUES AND OBSERVED TIME VALUE = 8.3742 TIMES SCALED VALUE. VELOCITY VALUES AS SHOWN ARE INVARIANT UNDER SCALING.

TABLE 7.3

/A770322

SMOKE PUFF GRID 1209

DIPOLE WEST/10 WES/295

VELOCITY FIELD

PARTICLE VELOCITIES AT SCALED TIME= 1.500 MS

X-SCAL METERS	Y-SCAL METERS	U=DX/DT MACH NO	V=DY/DT MACH NO	PARTICLE VELOCITY	R-SCAL METERS	REGN CODE	X-SCAL METERS	Y-SCAL METERS	U=DX/DT MACH NO	V=DY/DT MACH NO	PARTICLE VELOCITY	R-SCAL METERS	REGN CODE
1.473	2.167	0.59	0.31	0.558	1.523	2	1.550	0.456	1.07	-0.06	1.077	1.549	1
1.473	2.167	0.71	0.25	0.764	1.523	2	1.550	0.456	1.17	-0.09	1.178	1.549	1
1.473	2.167	0.74	0.18	0.795	1.514	2	1.540	0.456	1.15	-0.19	1.169	1.549	1
1.473	2.167	0.81	0.08	0.807	1.514	2	1.540	0.456	0.83	-0.19	0.852	1.549	1
1.473	2.167	0.81	0.33	0.839	1.509	5	1.758	0.963	0.95	0.16	0.963	1.549	1
1.473	2.167	0.81	0.10	0.839	1.514	5	1.758	0.963	1.13	0.16	1.139	1.549	1
1.473	2.167	0.81	0.01	0.839	1.514	4	1.758	0.963	1.39	0.20	1.419	1.549	1
1.473	2.167	0.81	0.12	0.839	1.523	1	1.836	1.441	1.39	0.28	1.419	1.549	1
1.473	2.167	0.82	0.00	0.839	1.523	1	1.836	1.441	1.33	0.13	1.308	1.549	1
1.473	2.167	0.82	0.29	0.839	1.523	2	1.836	1.441	1.40	-0.13	1.406	1.549	1
1.473	2.167	0.85	0.13	0.839	1.523	2	1.836	1.441	1.31	-0.27	1.334	1.549	1
1.473	2.167	0.87	0.07	0.839	1.523	2	1.836	1.441	1.18	-0.22	1.183	1.549	1
1.473	2.167	0.87	0.15	0.839	1.523	4	1.836	1.441	1.25	-0.06	1.249	1.549	1
1.473	2.167	0.89	0.02	0.839	1.523	4	1.836	1.441	1.36	0.00	1.359	1.549	1

PARTICLE VELOCITIES AT SCALED TIME= 1.600 MS

X-SCAL METERS	Y-SCAL METERS	U=DX/DT MACH NO	V=DY/DT MACH NO	PARTICLE VELOCITY	R-SCAL METERS	REGN CODE	X-SCAL METERS	Y-SCAL METERS	U=DX/DT MACH NO	V=DY/DT MACH NO	PARTICLE VELOCITY	R-SCAL METERS	REGN CODE
1.494	2.157	0.55	0.27	0.564	1.545	2	1.754	0.903	0.81	0.21	0.834	1.545	2
1.494	2.157	0.64	0.24	0.629	1.545	2	1.754	0.903	0.90	0.17	0.934	1.545	2
1.494	2.157	0.68	0.14	0.679	1.540	2	1.754	0.903	1.03	0.17	1.071	1.545	2
1.494	2.157	0.73	0.02	0.709	1.540	2	1.754	0.903	1.14	0.16	1.146	1.545	2
1.494	2.157	0.75	0.23	0.740	1.530	5	1.832	1.450	1.28	0.25	1.288	1.545	5
1.494	2.157	0.82	0.13	0.839	1.541	4	1.832	1.450	1.30	0.11	1.288	1.545	4
1.494	2.157	0.82	0.00	0.839	1.533	1	1.832	1.450	1.23	-0.23	1.230	1.545	1
1.494	2.157	0.84	0.04	0.839	1.558	1	1.832	1.450	1.21	-0.23	1.210	1.545	1
1.494	2.157	0.84	0.37	0.839	1.558	1	1.832	1.450	1.29	-0.12	1.290	1.545	1
1.494	2.157	0.84	0.13	0.839	1.558	2	1.832	1.450	1.18	-0.05	1.182	1.545	2
1.494	2.157	0.84	0.07	0.839	1.558	2	1.832	1.450	1.44	0.25	1.444	1.545	2
1.494	2.157	0.85	0.12	0.839	1.558	2	1.832	1.450	1.29	0.25	1.290	1.545	2
1.494	2.157	0.85	0.22	0.839	1.558	4	1.832	1.450	1.34	0.14	1.344	1.545	4
1.494	2.157	0.87	0.04	0.839	1.558	4	1.832	1.450	1.41	-0.21	1.414	1.545	4
1.494	2.157	0.87	0.08	0.839	1.558	4	1.832	1.450	1.09	-0.26	1.094	1.545	4
1.494	2.157	0.89	0.17	0.839	1.558	1	1.832	1.450	1.04	0.00	1.044	1.545	1

OBSERVED DISTANCE VALUES = R \* 0.718 TIMES SCALED VALUES  
 AND OBSERVED TIME VALUES = R \* 0.742 TIMES SCALED VALUES  
 VELOCITY VALUES AS SHOWN ARE INVARIANT UNDER SCALING

TABLE 7.4

VELOCITY FIELD

DIPOLE WEST/10 WFS/295

SMOKE PUFF GRID 1209

PARTICLE VELOCITIES AT SCALED TIME = 1.700 MS

X-SCAL METERS	Y-SCAL METERS	U=DX/DT MACH NO	V=DY/DT MACH NO	PARTICLE VELOCITY	REGN CODE	X-SCAL METERS	Y-SCAL METERS	U=DX/DT MACH NO	V=DY/DT MACH NO	PARTICLE VELOCITY	REGN CODE
1.422	2.147	0.53	0.29	0.598	2	1.852	1.432	1.11	0.32	1.113	5
1.517	2.126	0.58	0.23	0.624	2	1.924	1.458	1.15	0.28	1.148	5
1.523	1.972	0.42	0.17	0.644	2	1.923	1.253	1.18	0.05	1.180	5
1.561	1.825	0.44	0.09	0.669	2	1.923	1.023	1.20	-0.04	1.180	5
1.593	1.652	0.55	0.03	0.651	5	1.900	0.811	1.16	-0.25	1.187	4
1.612	1.494	0.59	0.31	0.661	5	1.871	0.651	1.12	-0.19	1.131	4
1.654	1.314	0.68	0.16	0.694	4	1.856	0.495	1.27	-0.20	1.216	1
1.683	1.110	0.73	0.03	0.734	1	1.838	0.332	1.27	-0.11	1.268	2
1.685	0.925	0.93	0.09	0.772	1	1.838	0.170	1.27	-0.07	1.268	2
1.647	0.720	0.77	0.08	0.777	1	1.839	0.012	1.22	0.14	0.594	2
1.619	0.527	0.71	0.26	0.757	2	1.839	1.775	1.14	0.19	1.149	2
1.549	0.327	0.73	0.20	0.750	2	1.839	1.741	1.15	0.35	1.206	2
1.481	0.133	0.72	0.13	0.735	2	2.001	1.612	1.21	0.35	1.259	5
1.401	1.533	0.71	0.07	0.717	2	2.013	1.427	1.33	0.22	1.324	5
1.319	1.326	1.116	0.09	1.116	4	2.026	1.227	1.35	0.14	1.357	4
1.240	1.116	0.83	0.06	0.829	4	2.039	1.033	1.31	-0.25	1.305	4
1.173	0.945	0.94	-0.05	0.940	1	2.045	0.853	1.08	-0.24	1.305	4
1.109	0.754	1.04	0.07	1.041	1	2.031	0.676	0.96	-0.25	0.988	3
1.043	0.554	1.03	-0.16	1.041	1	2.018	0.474	0.29	-0.06	0.254	3
1.000	0.351	0.79	0.22	0.813	3	1.970	0.287	0.46	0.04	0.462	3
1.000	0.151	0.84	0.18	0.861	2	1.970	0.109	0.46	-0.24	0.654	3
1.000	0.000	0.84	0.18	0.861	2	1.970	0.109	0.46	-0.24	0.654	3

PARTICLE VELOCITIES AT SCALED TIME = 2.000 MS

X-SCAL METERS	Y-SCAL METERS	U=DX/DT MACH NO	V=DY/DT MACH NO	PARTICLE VELOCITY	REGN CODE	X-SCAL METERS	Y-SCAL METERS	U=DX/DT MACH NO	V=DY/DT MACH NO	PARTICLE VELOCITY	REGN CODE
1.474	2.147	0.50	0.26	0.557	2	1.478	1.478	0.86	0.17	0.877	5
1.540	2.147	0.45	0.13	0.492	2	1.525	1.265	0.90	0.03	0.897	5
1.589	1.889	0.50	0.15	0.519	2	1.520	1.020	0.96	-0.05	0.897	5
1.623	1.645	0.52	0.10	0.530	2	1.520	0.788	0.97	-0.19	0.897	5
1.609	1.373	0.51	0.05	0.512	5	1.572	0.537	0.88	-0.07	0.811	4
1.624	1.155	0.52	0.21	0.524	4	1.546	0.282	0.93	-0.14	0.811	4
1.671	0.919	0.63	0.04	0.634	1	1.546	0.057	0.97	-0.10	0.811	4
1.671	0.677	0.76	0.04	0.762	1	1.546	0.280	0.97	-0.10	0.811	4
1.671	0.419	0.76	0.23	0.627	1	1.546	0.057	0.97	-0.10	0.811	4
1.671	0.177	0.59	0.04	0.527	1	1.546	0.057	0.97	-0.10	0.811	4
1.727	2.147	0.60	0.12	0.587	2	2.042	1.953	0.87	0.21	0.804	2
1.750	1.901	0.57	0.07	0.587	2	2.042	1.710	0.91	0.23	0.804	2
1.750	1.654	0.88	0.07	0.879	2	2.042	1.446	0.94	0.23	0.804	2
1.754	1.404	0.88	0.07	0.879	2	2.042	1.182	1.03	0.12	1.040	2
1.802	1.154	0.65	0.10	0.658	4	2.042	0.919	1.01	0.15	1.040	2
1.802	0.904	0.77	-0.03	0.764	4	2.042	0.651	1.05	-0.14	1.051	2
1.802	0.654	0.85	-0.05	0.841	4	2.042	0.383	1.02	-0.19	0.988	2
1.802	0.404	0.85	-0.05	0.841	4	2.042	0.119	1.02	-0.19	0.988	2
1.802	0.154	0.69	0.23	0.663	4	2.042	0.054	0.98	-0.25	1.142	2
1.857	2.147	0.72	0.21	0.733	2	2.042	0.054	0.98	-0.25	1.142	2
1.857	1.897	0.69	0.21	0.729	2	2.042	0.054	0.98	-0.25	1.142	2
1.857	1.647	0.82	0.19	0.749	2	2.042	0.054	0.98	-0.25	1.142	2
1.857	1.397	0.73	0.19	0.749	2	2.042	0.054	0.98	-0.25	1.142	2
1.857	1.147	0.80	0.04	0.802	2	2.042	0.054	0.98	-0.25	1.142	2
1.857	0.897	0.80	0.04	0.802	2	2.042	0.054	0.98	-0.25	1.142	2

OBSERVED DISTANCE VALUES = 8.0719 TIMES SCALED VALUES  
 AND OBSERVED TIME VALUE = 8.3742 TIMES SCALED VALUE  
 VELOCITY VALUES AS SHOWN ARE INVARIANT UNDER SCALING

TABLE 7.5

DIPOLE WEST/10 WFF/295 SMOKE PUFF GRID 1500 /A770322

VELOCITY FIELD

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PARTICLE VELOCITIES AT SCALED TIME= 2.100 MS

X-SCAL METERS		Y-SCAL METERS		U=DX/DT MACH NO		V=DY/DT MACH NO		PARTICLE VELOCITY		REGN CODE	X-SCAL METERS		Y-SCAL METERS		U=DX/DT MACH NO		V=DY/DT MACH NO		PARTICLE VELOCITY		REGN CODE
1.484	2.404	0.50	0.50	0.42	0.42	0.26	0.26	0.502	0.502	2	2.000	0.534	0.534	0.81	0.81	-0.06	-0.06	0.812	0.812	4	
1.584	2.154	0.47	0.47	0.49	0.49	0.19	0.19	0.482	0.482	2	2.010	0.454	0.454	0.88	0.88	-0.04	-0.04	1.084	1.084	4	
1.602	1.983	0.47	0.47	0.49	0.49	0.14	0.14	0.490	0.490	2	1.976	0.275	0.275	0.88	0.88	-0.04	-0.04	1.084	1.084	3	
1.619	1.839	0.46	0.46	0.48	0.48	0.10	0.10	0.475	0.475	2	1.953	0.094	0.094	0.88	0.88	-0.04	-0.04	1.084	1.084	3	
1.619	1.658	0.47	0.47	0.48	0.48	0.06	0.06	0.475	0.475	2	2.071	0.187	0.187	0.88	0.88	-0.04	-0.04	1.084	1.084	3	
1.647	1.540	0.49	0.49	0.49	0.49	0.22	0.22	0.532	0.532	4	2.072	1.217	1.217	0.88	0.88	-0.04	-0.04	1.084	1.084	3	
1.695	1.417	0.56	0.56	0.71	0.71	0.05	0.05	0.597	0.597	1	2.145	1.254	1.254	0.88	0.88	-0.04	-0.04	1.084	1.084	3	
1.697	2.705	0.56	0.56	0.23	0.23	0.16	0.16	0.591	0.591	1	2.156	1.450	1.450	0.88	0.88	-0.04	-0.04	1.084	1.084	3	
1.746	2.651	0.54	0.54	0.16	0.16	0.23	0.23	0.585	0.585	2	2.174	1.244	1.244	0.88	0.88	-0.04	-0.04	1.084	1.084	3	
1.773	1.803	0.50	0.50	0.07	0.07	0.12	0.12	0.548	0.548	2	2.193	1.015	1.015	0.88	0.88	-0.04	-0.04	1.084	1.084	4	
1.805	1.559	0.52	0.52	0.01	0.01	0.07	0.07	0.506	0.506	2	2.187	0.235	0.235	0.88	0.88	-0.04	-0.04	1.084	1.084	4	
1.827	1.451	0.51	0.51	0.01	0.01	0.11	0.11	0.616	0.616	4	2.127	0.456	0.456	0.88	0.88	-0.04	-0.04	1.084	1.084	3	
1.851	0.742	0.80	0.80	0.04	0.04	0.02	0.02	0.716	0.716	4	2.108	0.056	0.056	0.88	0.88	-0.04	-0.04	1.084	1.084	3	
1.809	0.236	0.80	0.80	0.04	0.04	0.04	0.04	0.804	0.804	1	2.100	0.788	0.788	0.88	0.88	-0.04	-0.04	1.084	1.084	3	
1.880	2.349	0.66	0.66	0.23	0.23	0.23	0.23	0.702	0.702	1	2.235	1.418	1.418	0.88	0.88	-0.04	-0.04	1.084	1.084	3	
1.920	2.036	0.66	0.66	0.21	0.21	0.21	0.21	0.689	0.689	2	2.288	1.251	1.251	0.88	0.88	-0.04	-0.04	1.084	1.084	3	
1.953	1.826	0.67	0.67	0.18	0.18	0.18	0.18	0.691	0.691	2	2.284	1.045	1.045	0.88	0.88	-0.04	-0.04	1.084	1.084	4	
2.053	1.841	0.79	0.79	0.03	0.03	0.03	0.03	0.628	0.628	2	2.271	0.874	0.874	0.88	0.88	-0.04	-0.04	1.084	1.084	4	
2.054	1.826	0.82	0.82	0.02	0.02	0.02	0.02	0.801	0.801	5	2.256	0.683	0.683	0.88	0.88	-0.04	-0.04	1.084	1.084	4	
2.070	1.019	0.89	0.89	0.04	0.04	0.04	0.04	0.887	0.887	5	2.217	0.217	0.217	0.88	0.88	-0.04	-0.04	1.084	1.084	4	
2.041	0.782	0.91	0.91	0.17	0.17	0.17	0.17	0.829	0.829	4	2.227	0.107	0.107	0.88	0.88	-0.04	-0.04	1.084	1.084	3	

OBSERVED DISTANCE VALUES = 8.0718 TIMES SCALED VALUES  
 AND OBSERVED TIME VALUE = 8.3742 TIMES SCALED VALUE.  
 VELOCITY VALUES AS SHOWN ARE INVARIANT UNDER SCALING.

TABLE 7.6

VELOCITY FIELD ----- DIPOLE WEST/10 WFS/295 SMOKE PUFF GRID 1209 /A770322

PARTICLE VELOCITIES AT SCALED TIME= 2.200 MS

X-SCAL METERS	Y-SCAL METERS	U=DX/DT MACH NO	V=DY/DT MACH NO	PARTICLE VELOCITY	R-SCAL METERS	REGN CODE	X-SCAL METERS	Y-SCAL METERS	U=DX/DT MACH NO	V=DY/DT MACH NO	PARTICLE VELOCITY	R-SCAL METERS	REGN CODE
1.508	2.113	0.50	0.25	0.558	1.508	2	2.005	0.270	0.14	0.834	2.023	3	
1.509	1.810	0.44	0.14	0.438	1.509	2	2.014	0.000	0.09	0.894	2.016	3	
1.617	1.843	0.44	0.14	0.438	1.617	2	2.074	0.155	0.23	0.747	2.013	3	
1.635	1.830	0.44	0.05	0.467	1.635	4	2.058	0.074	0.22	0.790	2.019	2	
1.642	0.849	0.44	0.05	0.467	1.642	4	2.100	0.077	0.24	0.854	2.023	2	
1.669	0.822	0.55	0.10	0.510	1.669	4	2.177	0.066	0.12	0.879	2.023	2	
1.719	0.416	0.64	0.01	0.563	1.719	4	2.204	0.087	0.10	0.877	2.027	2	
1.765	2.313	0.51	0.22	0.563	1.765	2	2.220	0.090	0.08	0.907	2.023	3	
1.783	2.057	0.50	0.16	0.514	1.783	2	2.194	0.066	0.14	0.956	2.023	3	
1.806	1.810	0.46	0.07	0.469	1.806	2	2.161	0.437	0.21	0.955	2.023	3	
1.825	0.947	0.57	0.00	0.570	1.825	4	2.145	0.252	0.15	1.028	2.023	3	
1.850	0.835	0.57	0.00	0.570	1.850	4	2.137	0.252	0.20	1.050	2.023	3	
1.877	0.441	0.75	0.09	0.752	1.877	4	2.174	0.300	0.30	1.072	2.023	3	
1.892	0.233	0.75	0.09	0.752	1.892	4	2.158	0.179	0.20	1.084	2.023	3	
1.902	2.063	0.62	0.21	0.651	1.902	3	2.276	1.500	0.36	1.173	2.023	3	
1.945	1.833	0.51	0.18	0.539	1.945	2	2.240	1.610	0.19	1.172	2.023	3	
2.073	1.489	0.72	0.14	0.752	2.073	2	2.300	1.424	0.06	1.172	2.023	3	
2.099	1.205	0.82	0.03	0.833	2.099	2	2.325	1.253	0.02	1.126	2.023	3	
2.071	0.777	0.86	0.03	0.833	2.071	4	2.310	1.044	0.06	1.121	2.023	3	
2.027	0.632	0.75	0.15	0.752	2.027	4	2.247	0.875	0.11	1.072	2.023	3	
2.043	0.457	0.92	0.04	0.923	2.043	5	2.247	0.469	0.12	1.010	2.023	3	
			0.01	0.923			0.106	0.278	0.05	0.866			

OBSERVED DISTANCE VALUES = 8.0719 TIMES SCALED VALUES  
 AND OBSERVED TIME VALUES = 8.3742 TIMES SCALED VALUES  
 VELOCITY VALUES AS SHOWN ARE INVARIANT UNDER SCALING.

TABLE 7.7

VELOCITY FIELD		DIPLOLE WEST/10		WFS/295		SMOKE PUFF GRID 1209		/A770322					
PARTICLE VELOCITIES AT SCALED TIME= 2.500 MS													
X-SCAL METERS	Y-SCAL METERS	U=DX/DT MACH NO	V=DY/DT MACH NO	PARTICLE VELOCITY	R-SCAL METERS	REGN CODE	X-SCAL METERS	Y-SCAL METERS	U=DX/DT MACH NO	V=DY/DT MACH NO	PARTICLE VELOCITY	R-SCAL METERS	REGN CODE
1.238	2.176	0.36	0.24	0.536	1.719	2	2.082	0.257	0.68	-0.12	0.699	2.093	3
1.296	2.176	0.60	0.12	0.332	1.791	2	2.143	0.220	0.88	-0.04	0.849	2.105	3
1.304	1.651	0.39	0.19	0.416	1.697	2	2.168	0.229	0.61	0.21	0.644	2.191	3
1.626	1.655	0.38	0.09	0.388	1.692	5	2.171	1.839	0.72	0.19	0.628	2.201	2
1.978	0.732	0.47	0.12	0.447	1.953	4	2.252	1.464	0.70	0.09	0.759	2.229	2
1.778	0.418	0.54	0.04	0.482	1.766	4	2.284	1.257	0.69	0.03	0.693	2.287	2
1.815	2.374	0.44	0.21	0.535	1.850	1	2.308	1.006	0.73	0.08	0.730	2.312	2
1.819	2.621	0.42	0.10	0.464	1.834	2	2.315	0.808	0.84	-0.10	0.848	2.335	2
2.025	1.612	0.39	0.06	0.390	1.892	2	2.257	0.421	0.85	-0.16	0.858	2.346	4
1.623	0.859	0.63	0.03	0.628	2.053	5	2.237	0.274	0.80	-0.11	0.845	2.254	3
1.912	0.848	0.49	0.14	0.459	1.857	4	2.235	0.049	0.93	-0.07	0.922	2.261	3
1.925	0.440	0.60	0.00	0.599	1.995	4	2.299	2.163	0.75	0.26	0.732	2.300	2
1.924	0.225	0.61	0.00	0.612	1.917	3	2.343	1.833	0.85	0.25	0.800	2.317	2
1.921	2.280	0.51	0.22	0.574	2.042	3	2.380	1.633	0.82	0.28	0.868	2.343	2
2.000	2.664	0.51	0.19	0.549	2.030	2	2.404	1.441	0.59	0.22	0.583	2.423	2
2.011	1.549	0.49	0.15	0.509	2.045	2	2.429	1.262	0.51	0.14	0.511	2.433	2
2.144	1.502	0.56	0.12	0.573	2.174	6	2.413	1.044	0.95	0.01	0.919	2.438	4
2.155	1.259	0.57	0.03	0.573	2.156	4	2.393	0.878	0.92	-0.02	0.919	2.442	3
2.151	1.016	0.66	-0.01	0.664	2.178	4	2.402	0.459	1.10	-0.08	1.107	2.446	4
2.095	0.764	0.71	-0.10	0.720	2.183	4	2.340	0.267	0.92	-0.10	0.922	2.356	3
2.123	0.631	0.60	0.01	0.595	2.156	4	2.332	0.094	0.92	-0.17	0.971	2.334	3
	0.444	0.69	-0.15	0.710	2.169	3							

OBSERVED DISTANCE VALUES = 8.0718 TIMES SCALED VALUES  
 AND OBSERVED TIME VALUE = 8.3742 TIMES SCALED VALUE.  
 VELOCITY VALUES AS SHOWN ARE INVARIANT UNDER SCALING.

TABLE 7.8

7A770322

SMOKE PUFF GRID 1209

DIPOLE WEST/10 WFS/295

VELOCITY FIELD

PARTICLE VELOCITIES AT SCALED TIME = 2.600 MS

X-SCAL METERS		Y-SCAL METERS		U=DX/DT MACH NO		V=DY/DT MACH NO		PARTICLE VELOCITY		R-SCAL METERS		REGN CODE
1.575	2.486	0.47	0.23	0.36	0.15	0.34	0.15	0.523	1.737	2.332	5	
1.644	2.492	0.39	0.12	0.405	0.09	0.382	0.05	0.486	1.714	2.310	5	
1.709	2.495	0.37	0.05	0.375	0.05	0.375	0.05	0.486	1.706	2.336	4	
1.799	2.499	0.39	0.12	0.451	0.05	0.451	0.05	0.486	1.706	2.336	4	
1.864	2.503	0.44	0.12	0.451	0.05	0.451	0.05	0.486	1.779	2.324	3	
1.904	2.507	0.50	0.05	0.462	0.05	0.462	0.05	0.486	1.804	2.280	3	
1.978	2.511	0.41	0.20	0.445	0.13	0.445	0.13	0.486	1.865	2.272	3	
2.020	2.515	0.42	0.09	0.414	0.09	0.414	0.09	0.486	1.865	2.346	2	
2.064	2.519	0.40	0.09	0.373	0.05	0.373	0.05	0.486	1.848	2.472	2	
2.108	2.523	0.59	0.04	0.594	0.04	0.594	0.04	0.486	1.905	2.461	2	
2.152	2.527	0.46	0.14	0.430	0.14	0.430	0.14	0.486	1.972	2.442	2	
2.196	2.531	0.51	0.04	0.516	0.04	0.516	0.04	0.486	1.991	2.468	4	
2.240	2.535	0.57	0.04	0.563	0.04	0.563	0.04	0.486	1.937	2.473	4	
2.284	2.539	0.50	0.04	0.513	0.04	0.513	0.04	0.486	2.061	2.481	3	
2.328	2.543	0.48	0.13	0.474	0.13	0.474	0.13	0.486	2.061	2.367	3	
2.372	2.547	0.52	0.04	0.535	0.04	0.535	0.04	0.486	2.195	2.513	2	
2.416	2.551	0.62	0.00	0.620	0.00	0.620	0.00	0.486	2.200	2.625	5	
2.460	2.555	0.67	0.08	0.675	0.08	0.675	0.08	0.486	2.207	2.583	4	
2.504	2.559	0.55	0.03	0.554	0.03	0.554	0.03	0.486	2.175	2.566	4	
2.548	2.563	0.64	0.11	0.645	0.11	0.645	0.11	0.486	2.190	2.572	4	
2.592	2.567	0.64	0.03	0.636	0.03	0.636	0.03	0.486	2.134	2.579	3	
2.636	2.571	0.59	0.24	0.637	0.24	0.637	0.24	0.486	2.223	2.586	3	
2.680	2.575	0.57	0.20	0.601	0.20	0.601	0.20	0.486	2.211	2.640	4	
2.724	2.579	0.58	0.12	0.593	0.12	0.593	0.12	0.486	2.302	2.549	4	
2.768	2.583	0.66	0.18	0.692	0.18	0.692	0.18	0.486	2.344	2.502	3	
2.812	2.587	0.66	0.18	0.692	0.18	0.692	0.18	0.486	2.344	2.502	3	

OBSERVED DISTANCE VALUES = 8.0718 TIMES SCALED VALUES  
 AND OBSERVED TIME VALUE = 8.3742 TIMES SCALED VALUE.  
 VELOCITY VALUES AS SHOWN ARE INVARIANT UNDER SCALING.



TABLE 7.10

VELOCITY FIELD DIPOLE WEST/10 WFS/295 SMOKE PUFF GRID 1209 /A770322

PARTICLE VELOCITIES AT SCALED TIME= 3.500 MS

X-SCAL METERS	Y-SCAL METERS	R-SCAL METERS	REGN CODE	U=DX/DT MACH NO	V=DY/DT MACH NO	W=DZ/DT MACH NO	U=DX/DT MACH NO	V=DY/DT MACH NO	W=DZ/DT MACH NO	Y-SCAL METERS	REGN CODE	X-SCAL METERS	Y-SCAL METERS	R-SCAL METERS	REGN CODE	U=DX/DT MACH NO	V=DY/DT MACH NO	W=DZ/DT MACH NO	U=DX/DT MACH NO	V=DY/DT MACH NO	W=DZ/DT MACH NO	Y-SCAL METERS	REGN CODE	X-SCAL METERS	Y-SCAL METERS	R-SCAL METERS	REGN CODE
2.000	1.000	1.000	5	0.28	0.13	0.00	0.28	0.13	0.00	1.000	5	2.000	1.000	1.000	5	0.43	0.20	0.00	0.43	0.20	0.00	1.000	5	2.000	1.000	1.000	5
1.750	2.218	1.801	2	0.35	0.09	0.00	0.35	0.09	0.00	1.801	2	1.750	2.218	1.801	2	0.47	0.14	0.00	0.47	0.14	0.00	1.801	2	1.750	2.218	1.801	2
1.757	1.544	1.801	3	0.36	0.08	0.00	0.36	0.08	0.00	1.801	3	1.757	1.544	1.801	3	0.47	0.14	0.00	0.47	0.14	0.00	1.801	3	1.757	1.544	1.801	3
1.810	1.682	1.819	2	0.31	0.09	0.00	0.31	0.09	0.00	1.819	2	1.810	1.682	1.819	2	0.44	0.15	0.00	0.44	0.15	0.00	1.819	2	1.810	1.682	1.819	2
1.774	1.378	1.812	2	0.34	0.02	0.00	0.34	0.02	0.00	1.812	2	1.774	1.378	1.812	2	0.43	0.15	0.00	0.43	0.15	0.00	1.812	2	1.774	1.378	1.812	2
1.814	1.044	1.833	4	0.37	0.17	0.00	0.37	0.17	0.00	1.833	4	1.814	1.044	1.833	4	0.40	0.19	0.00	0.40	0.19	0.00	1.833	4	1.814	1.044	1.833	4
1.847	0.775	1.833	4	0.32	0.11	0.00	0.32	0.11	0.00	1.833	4	1.847	0.775	1.833	4	0.37	0.15	0.00	0.37	0.15	0.00	1.833	4	1.847	0.775	1.833	4
1.907	0.449	1.833	4	0.26	0.11	0.00	0.26	0.11	0.00	1.833	4	1.907	0.449	1.833	4	0.32	0.15	0.00	0.32	0.15	0.00	1.833	4	1.907	0.449	1.833	4
1.923	2.195	1.833	4	0.31	0.15	0.00	0.31	0.15	0.00	1.833	4	1.923	2.195	1.833	4	0.37	0.15	0.00	0.37	0.15	0.00	1.833	4	1.923	2.195	1.833	4
1.933	1.624	1.837	2	0.32	0.04	0.00	0.32	0.04	0.00	1.837	2	1.933	1.624	1.837	2	0.37	0.15	0.00	0.37	0.15	0.00	1.837	2	1.933	1.624	1.837	2
1.947	1.624	1.837	2	0.32	0.04	0.00	0.32	0.04	0.00	1.837	2	1.947	1.624	1.837	2	0.37	0.15	0.00	0.37	0.15	0.00	1.837	2	1.947	1.624	1.837	2
2.017	0.547	1.837	2	0.43	0.05	0.00	0.43	0.05	0.00	1.837	2	2.017	0.547	1.837	2	0.43	0.05	0.00	0.43	0.05	0.00	1.837	2	2.017	0.547	1.837	2
2.082	0.675	1.837	2	0.37	0.14	0.00	0.37	0.14	0.00	1.837	2	2.082	0.675	1.837	2	0.43	0.05	0.00	0.43	0.05	0.00	1.837	2	2.082	0.675	1.837	2
2.084	0.454	1.837	2	0.26	0.07	0.00	0.26	0.07	0.00	1.837	2	2.084	0.454	1.837	2	0.37	0.14	0.00	0.37	0.14	0.00	1.837	2	2.084	0.454	1.837	2
2.095	0.827	1.837	2	0.29	0.05	0.00	0.29	0.05	0.00	1.837	2	2.095	0.827	1.837	2	0.37	0.14	0.00	0.37	0.14	0.00	1.837	2	2.095	0.827	1.837	2
2.095	2.041	1.837	2	0.33	0.09	0.00	0.33	0.09	0.00	1.837	2	2.095	2.041	1.837	2	0.37	0.14	0.00	0.37	0.14	0.00	1.837	2	2.095	2.041	1.837	2
2.170	1.179	1.837	2	0.31	0.14	0.00	0.31	0.14	0.00	1.837	2	2.170	1.179	1.837	2	0.37	0.14	0.00	0.37	0.14	0.00	1.837	2	2.170	1.179	1.837	2
2.222	1.537	1.837	2	0.32	0.04	0.00	0.32	0.04	0.00	1.837	2	2.222	1.537	1.837	2	0.37	0.14	0.00	0.37	0.14	0.00	1.837	2	2.222	1.537	1.837	2
2.345	1.021	1.837	2	0.39	0.03	0.00	0.39	0.03	0.00	1.837	2	2.345	1.021	1.837	2	0.39	0.03	0.00	0.39	0.03	0.00	1.837	2	2.345	1.021	1.837	2
2.332	0.750	1.837	2	0.33	0.08	0.00	0.33	0.08	0.00	1.837	2	2.332	0.750	1.837	2	0.39	0.03	0.00	0.39	0.03	0.00	1.837	2	2.332	0.750	1.837	2
2.243	0.551	1.837	2	0.32	0.05	0.00	0.32	0.05	0.00	1.837	2	2.243	0.551	1.837	2	0.39	0.03	0.00	0.39	0.03	0.00	1.837	2	2.243	0.551	1.837	2
2.286	0.443	1.837	2	0.32	0.09	0.00	0.32	0.09	0.00	1.837	2	2.286	0.443	1.837	2	0.32	0.09	0.00	0.32	0.09	0.00	1.837	2	2.286	0.443	1.837	2
2.251	0.340	1.837	2	0.26	0.02	0.00	0.26	0.02	0.00	1.837	2	2.251	0.340	1.837	2	0.32	0.09	0.00	0.32	0.09	0.00	1.837	2	2.251	0.340	1.837	2
2.310	0.821	1.837	2	0.35	0.16	0.00	0.35	0.16	0.00	1.837	2	2.310	0.821	1.837	2	0.35	0.16	0.00	0.35	0.16	0.00	1.837	2	2.310	0.821	1.837	2
2.320	2.044	1.837	2	0.37	0.10	0.00	0.37	0.10	0.00	1.837	2	2.320	2.044	1.837	2	0.35	0.16	0.00	0.35	0.16	0.00	1.837	2	2.320	2.044	1.837	2
2.330	1.070	1.837	2	0.37	0.13	0.00	0.37	0.13	0.00	1.837	2	2.330	1.070	1.837	2	0.35	0.16	0.00	0.35	0.16	0.00	1.837	2	2.330	1.070	1.837	2
2.444	1.443	1.837	2	0.39	0.08	0.00	0.39	0.08	0.00	1.837	2	2.444	1.443	1.837	2	0.37	0.13	0.00	0.37	0.13	0.00	1.837	2	2.444	1.443	1.837	2
2.453	1.008	1.837	2	0.30	0.02	0.00	0.30	0.02	0.00	1.837	2	2.453	1.008	1.837	2	0.39	0.08	0.00	0.39	0.08	0.00	1.837	2	2.453	1.008	1.837	2
2.493	0.792	1.837	2	0.41	0.04	0.00	0.41	0.04	0.00	1.837	2	2.493	0.792	1.837	2	0.30	0.02	0.00	0.30	0.02	0.00	1.837	2	2.493	0.792	1.837	2
2.515	0.578	1.837	2	0.49	0.01	0.00	0.49	0.01	0.00	1.837	2	2.515	0.578	1.837	2	0.41	0.04	0.00	0.41	0.04	0.00	1.837	2	2.515	0.578	1.837	2
2.482	2.047	1.837	2	0.41	0.18	0.00	0.41	0.18	0.00	1.837	2	2.482	2.047	1.837	2	0.49	0.01	0.00	0.49	0.01	0.00	1.837	2	2.482	2.047	1.837	2
2.484	2.046	1.837	2	0.36	0.09	0.00	0.36	0.09	0.00	1.837	2	2.484	2.046	1.837	2	0.41	0.18	0.00	0.41	0.18	0.00	1.837	2	2.484	2.046	1.837	2
2.545	1.829	1.837	2	0.43	0.13	0.00	0.43	0.13	0.00	1.837	2	2.545	1.829	1.837	2	0.36	0.09	0.00	0.36	0.09	0.00	1.837	2	2.545	1.829	1.837	2
2.557	1.653	1.837	2	0.45	0.11	0.00	0.45	0.11	0.00	1.837	2	2.557	1.653	1.837	2	0.43	0.13	0.00	0.43	0.13	0.00	1.837	2	2.557	1.653	1.837	2

OBSERVED DISTANCE VALUES = 8.0716 TIMES SCALED VALUES  
 AND OBSERVED TIME VALUE = 8.3742 TIMES SCALED VALUE  
 VELOCITY VALUES AS SHOWN ARE INVARIANT UNDER SCALING

TABLE 7.11

VELOCITY FIELD DIPOLE WEST/10 WFS4295 SACKE PUFF GRID 1209 /A770322

PARTICLE VELOCITIES AT SCALED TIME = 4.000 MS

X-SCAL METERS	Y-SCAL METERS	U=DX/DT MACH NO	V=DY/DT MACH NO	PARTICLE VELOCITY	R-SCAL METERS	REGN CODE	X-SCAL METERS	Y-SCAL METERS	U=DX/DT MACH NO	V=DY/DT MACH NO	PARTICLE VELOCITY	R-SCAL METERS	REGN CODE
1.739	2.221	0.34	0.13	0.357	1.916	2	2.232	1.901	0.41	0.11	0.428	2.233	2
1.715	2.232	0.33	0.07	0.343	1.934	2	2.247	1.957	0.41	0.09	0.414	2.248	2
1.645	1.956	0.32	0.07	0.331	1.841	2	2.281	1.943	0.41	0.05	0.416	2.282	2
1.641	1.956	0.31	0.09	0.310	1.827	2	2.296	1.950	0.41	0.05	0.401	2.297	2
1.574	1.352	0.31	0.12	0.352	1.875	2	2.311	1.924	0.40	0.00	0.406	2.312	2
1.597	1.049	0.27	0.14	0.244	1.924	2	2.326	1.949	0.40	0.00	0.441	2.327	2
1.736	0.773	0.19	0.10	0.231	1.949	2	2.341	2.050	0.40	0.01	0.524	2.342	2
1.739	2.017	0.20	0.08	0.209	2.050	2	2.356	2.027	0.40	0.01	0.571	2.357	2
2.007	1.626	0.31	0.03	0.309	2.011	2	2.371	2.030	0.40	0.09	0.520	2.372	2
2.001	1.626	0.32	0.01	0.315	2.060	2	2.386	2.033	0.40	0.15	0.520	2.387	2
2.047	0.597	0.33	0.06	0.374	2.032	2	2.401	1.955	0.40	0.11	0.520	2.402	2
2.077	0.597	0.33	0.12	0.354	2.043	2	2.416	1.925	0.40	0.09	0.520	2.417	2
2.120	0.464	0.27	0.14	0.272	2.171	2	2.431	1.870	0.40	0.10	0.474	2.432	2
2.120	0.464	0.27	0.09	0.209	2.105	2	2.446	1.847	0.40	0.10	0.474	2.447	2
2.142	0.230	0.23	0.10	0.255	2.234	2	2.461	1.804	0.40	0.02	0.520	2.462	2
2.142	0.230	0.23	0.06	0.255	2.221	2	2.476	1.804	0.40	0.01	0.520	2.477	2
2.154	1.552	0.32	0.06	0.323	2.326	2	2.491	1.804	0.40	0.03	0.520	2.492	2
2.154	1.552	0.32	0.08	0.316	2.300	2	2.506	1.804	0.40	0.04	0.520	2.507	2
2.166	1.026	0.31	0.04	0.342	2.402	2	2.521	1.804	0.40	0.09	0.520	2.522	2
2.166	1.026	0.31	0.02	0.313	2.341	2	2.536	1.804	0.40	0.17	0.520	2.537	2
2.166	0.666	0.27	0.11	0.274	2.317	2	2.551	1.804	0.40	0.04	0.520	2.552	2
2.177	0.271	0.22	0.06	0.244	2.422	2	2.566	1.804	0.40	0.04	0.520	2.567	2
2.177	0.271	0.22	0.11	0.320	2.317	2	2.581	1.804	0.40	0.04	0.520	2.582	2
2.177	0.271	0.22	0.07	0.310	2.422	2	2.596	1.804	0.40	0.04	0.520	2.597	2
2.188	1.904	0.33	0.15	0.359	2.422	2	2.611	1.804	0.40	0.04	0.520	2.612	2
2.188	1.904	0.33	0.10	0.342	2.508	2	2.626	1.804	0.40	0.02	0.520	2.627	2
2.188	1.904	0.33	0.09	0.342	2.508	2	2.641	1.804	0.40	0.03	0.520	2.642	2
2.188	1.904	0.33	0.02	0.314	2.513	2	2.656	1.804	0.40	0.04	0.520	2.657	2
2.188	1.904	0.33	0.03	0.314	2.513	2	2.671	1.804	0.40	0.04	0.520	2.672	2
2.188	1.904	0.33	0.02	0.339	2.510	2	2.686	1.804	0.40	0.10	0.520	2.687	2
2.188	1.904	0.33	0.03	0.339	2.510	2	2.701	1.804	0.40	0.04	0.520	2.702	2
2.188	1.904	0.33	0.09	0.351	2.510	2	2.716	1.804	0.40	0.04	0.520	2.717	2
2.188	1.904	0.33	0.05	0.324	2.510	2	2.731	1.804	0.40	0.04	0.520	2.732	2
2.188	1.904	0.33	0.10	0.351	2.510	2	2.746	1.804	0.40	0.04	0.520	2.747	2
2.188	1.904	0.33	0.06	0.359	2.510	2	2.761	1.804	0.40	0.04	0.520	2.762	2
2.188	1.904	0.33	0.00	0.341	2.510	2	2.776	1.804	0.40	0.02	0.520	2.777	2
2.188	1.904	0.33	0.02	0.371	2.510	2	2.791	1.804	0.40	0.04	0.520	2.792	2
2.188	1.904	0.33	0.05	0.356	2.510	2	2.806	1.804	0.40	0.05	0.520	2.807	2
2.188	1.904	0.33	0.10	0.356	2.510	2	2.821	1.804	0.40	0.10	0.520	2.822	2
2.188	1.904	0.33	0.05	0.324	2.510	2	2.836	1.804	0.40	0.05	0.520	2.837	2
2.188	1.904	0.33	0.00	0.371	2.510	2	2.851	1.804	0.40	0.05	0.520	2.852	2
2.188	1.904	0.33	0.02	0.356	2.510	2	2.866	1.804	0.40	0.05	0.520	2.867	2
2.188	1.904	0.33	0.05	0.356	2.510	2	2.881	1.804	0.40	0.05	0.520	2.882	2
2.188	1.904	0.33	0.13	0.418	2.510	2	2.896	1.804	0.40	0.13	0.520	2.897	2

OBSERVED DISTANCE VALUES = 8.0718 TIMES SCALED VALUES  
 AND OBSERVED TIME VALUE = 8.3742 TIMES SCALED VALUE  
 VELOCITY VALUES AS SHOWN ARE INVARIANT UNDER SCALING

TABLE 7.12

VELOCITY FIELD ----- DIPOLE WEST/10 WF5/295 SMOKE PUFF GRID 1209 /A770322

PARTICLE VELOCITIES AT SCALED TIME= 4.500 MS

X-SCAL METERS	Y-SCAL METERS	U=DX/DT MACH NO	V=DY/DT MACH NO	W=VZ/DT MACH NO	PARTICLE VELOCITY	REGN CODE	Y-SCAL METERS	X-SCAL METERS	U=DX/DT MACH NO	V=DY/DT MACH NO	W=VZ/DT MACH NO	PARTICLE VELOCITY	REGN CODE	Y-SCAL METERS	X-SCAL METERS	U=DX/DT MACH NO	V=DY/DT MACH NO	W=VZ/DT MACH NO	PARTICLE VELOCITY	REGN CODE
1.869	2.442	0.27	0.05	0.00	0.277	2	1.941	2.393	0.31	0.10	0.00	0.310	2	1.919	2.393	0.31	0.10	0.00	0.310	2
1.865	1.447	0.25	0.06	0.00	0.255	2	1.942	1.910	0.33	0.09	0.00	0.330	2	1.919	1.910	0.33	0.09	0.00	0.330	2
1.909	1.713	0.25	0.10	0.00	0.252	2	1.908	2.334	0.34	0.08	0.00	0.339	2	1.925	2.334	0.34	0.08	0.00	0.339	2
1.923	1.047	0.24	0.08	0.00	0.255	2	1.916	2.745	0.32	0.09	0.00	0.320	2	1.925	2.745	0.32	0.09	0.00	0.320	2
1.934	0.209	0.21	0.09	0.00	0.255	4	1.924	2.959	0.31	0.07	0.00	0.317	4	1.945	2.959	0.31	0.07	0.00	0.317	4
1.973	0.456	0.14	0.12	0.00	0.184	4	1.974	2.959	0.28	0.05	0.00	0.280	4	1.973	2.959	0.28	0.05	0.00	0.280	4
1.981	2.430	0.25	0.07	0.00	0.260	1	2.017	2.959	0.26	0.07	0.00	0.260	1	2.017	2.959	0.26	0.07	0.00	0.260	1
2.033	2.140	0.28	0.03	0.00	0.282	2	2.072	2.959	0.28	0.03	0.00	0.282	2	2.072	2.959	0.28	0.03	0.00	0.282	2
2.053	1.655	0.29	0.02	0.00	0.293	2	2.111	2.959	0.29	0.02	0.00	0.293	2	2.111	2.959	0.29	0.02	0.00	0.293	2
2.053	1.629	0.29	0.02	0.00	0.293	2	2.111	2.959	0.29	0.02	0.00	0.293	2	2.111	2.959	0.29	0.02	0.00	0.293	2
2.129	0.950	0.29	0.06	0.00	0.293	4	2.134	2.959	0.30	0.06	0.00	0.300	4	2.134	2.959	0.30	0.06	0.00	0.300	4
2.133	0.720	0.19	0.13	0.00	0.224	4	2.173	2.959	0.22	0.13	0.00	0.224	4	2.173	2.959	0.22	0.13	0.00	0.224	4
2.145	0.479	0.15	0.05	0.00	0.157	3	2.185	2.959	0.15	0.05	0.00	0.157	3	2.185	2.959	0.15	0.05	0.00	0.157	3
2.177	2.375	0.22	0.05	0.00	0.235	2	2.279	2.959	0.22	0.05	0.00	0.235	2	2.279	2.959	0.22	0.05	0.00	0.235	2
2.220	2.135	0.23	0.05	0.00	0.237	2	2.283	2.959	0.23	0.05	0.00	0.237	2	2.283	2.959	0.23	0.05	0.00	0.237	2
2.240	1.893	0.33	0.04	0.00	0.333	5	2.400	2.959	0.33	0.04	0.00	0.333	5	2.400	2.959	0.33	0.04	0.00	0.333	5
2.262	1.565	0.31	0.07	0.00	0.317	4	2.470	2.959	0.31	0.07	0.00	0.317	4	2.470	2.959	0.31	0.07	0.00	0.317	4
2.262	1.033	0.27	0.03	0.00	0.270	4	2.470	2.959	0.27	0.03	0.00	0.270	4	2.470	2.959	0.27	0.03	0.00	0.270	4
2.262	0.757	0.22	0.07	0.00	0.228	4	2.470	2.959	0.22	0.07	0.00	0.228	4	2.470	2.959	0.22	0.07	0.00	0.228	4
2.262	0.477	0.16	0.09	0.00	0.181	3	2.470	2.959	0.16	0.09	0.00	0.181	3	2.470	2.959	0.16	0.09	0.00	0.181	3
2.345	0.269	0.21	0.04	0.00	0.228	2	2.359	2.959	0.21	0.04	0.00	0.228	2	2.359	2.959	0.21	0.04	0.00	0.228	2
2.413	2.329	0.24	0.08	0.00	0.252	2	2.450	2.959	0.24	0.08	0.00	0.252	2	2.450	2.959	0.24	0.08	0.00	0.252	2
2.441	2.103	0.27	0.06	0.00	0.273	2	2.459	2.959	0.27	0.06	0.00	0.273	2	2.459	2.959	0.27	0.06	0.00	0.273	2
2.441	1.532	0.30	0.15	0.00	0.337	2	2.557	2.959	0.30	0.15	0.00	0.337	2	2.557	2.959	0.30	0.15	0.00	0.337	2
2.448	1.745	0.29	0.11	0.00	0.314	2	2.522	2.959	0.29	0.11	0.00	0.314	2	2.522	2.959	0.29	0.11	0.00	0.314	2
2.454	1.521	0.31	0.04	0.00	0.329	5	2.522	2.959	0.31	0.04	0.00	0.329	5	2.522	2.959	0.31	0.04	0.00	0.329	5
2.454	1.279	0.31	0.04	0.00	0.329	5	2.522	2.959	0.31	0.04	0.00	0.329	5	2.522	2.959	0.31	0.04	0.00	0.329	5
2.462	1.017	0.30	0.04	0.00	0.305	5	2.614	2.959	0.30	0.04	0.00	0.305	5	2.614	2.959	0.30	0.04	0.00	0.305	5
2.460	0.800	0.28	0.04	0.00	0.271	4	2.671	2.959	0.28	0.04	0.00	0.271	4	2.671	2.959	0.28	0.04	0.00	0.271	4
2.460	0.559	0.25	0.06	0.00	0.271	4	2.671	2.959	0.25	0.06	0.00	0.271	4	2.671	2.959	0.25	0.06	0.00	0.271	4
2.460	0.280	0.19	0.02	0.00	0.192	2	2.694	2.959	0.19	0.02	0.00	0.192	2	2.694	2.959	0.19	0.02	0.00	0.192	2
2.460	0.245	0.24	0.04	0.00	0.244	2	2.753	2.959	0.24	0.04	0.00	0.244	2	2.753	2.959	0.24	0.04	0.00	0.244	2
2.461	1.935	0.31	0.09	0.00	0.317	2	2.775	2.959	0.31	0.09	0.00	0.317	2	2.775	2.959	0.31	0.09	0.00	0.317	2
2.471	1.421	0.32	0.07	0.00	0.329	2	2.782	2.959	0.32	0.07	0.00	0.329	2	2.782	2.959	0.32	0.07	0.00	0.329	2
2.473	1.202	0.36	0.06	0.00	0.357	2	2.783	2.959	0.36	0.06	0.00	0.357	2	2.783	2.959	0.36	0.06	0.00	0.357	2
2.473	1.055	0.31	0.03	0.00	0.312	2	2.791	2.959	0.31	0.03	0.00	0.312	2	2.791	2.959	0.31	0.03	0.00	0.312	2
2.473	0.855	0.31	0.06	0.00	0.319	2	2.780	2.959	0.31	0.06	0.00	0.319	2	2.780	2.959	0.31	0.06	0.00	0.319	2
2.477	0.621	0.31	0.06	0.00	0.313	2	2.819	2.959	0.31	0.06	0.00	0.313	2	2.819	2.959	0.31	0.06	0.00	0.313	2
2.483	0.463	0.42	0.09	0.00	0.428	4	2.898	2.959	0.42	0.09	0.00	0.428	4	2.898	2.959	0.42	0.09	0.00	0.428	4
2.483	2.776	0.28	0.09	0.00	0.258	3	3.014	2.959	0.28	0.09	0.00	0.258	3	3.014	2.959	0.28	0.09	0.00	0.258	3
2.483	2.141	0.29	0.11	0.00	0.231	5	3.002	2.959	0.29	0.11	0.00	0.231	5	3.002	2.959	0.29	0.11	0.00	0.231	5

OBSERVED DISTANCE VALUES = 8.071P TIMES SCALED VALUES  
AND OBSERVED TIME VALUE = 8.3742 TIMES SCALED VALUE.  
VELOCITY VALUES AS SHOWN ARE INVARIANT UNDER SCALING.

TABLE 7.13

VELOCITY FIELD

DIPOLE WEST/10 WF5/295

SMOKE PUFF GRID 1209

/A770322

PARTICLE VELOCITIES AT SCALED TIME = 5.000 MS

X-SCAL METERS		Y-SCAL METERS		U=DX/DT MACH NO		V=DY/DT MACH NO		PARTICLE VELOCITY		R-SCAL METERS		REGN CODE
2.000	1.000	2.000	1.000	0.17	0.05	0.179	0.05	0.179	0.05	1.939	2	
2.000	1.000	2.000	1.000	0.16	0.05	0.173	0.05	0.173	0.05	1.939	2	
2.000	1.000	2.000	1.000	0.20	0.11	0.226	0.11	0.226	0.11	2.034	5	
2.000	1.000	2.000	1.000	0.15	0.05	0.156	0.05	0.156	0.05	1.934	4	
2.000	1.000	2.000	1.000	0.14	0.08	0.157	0.08	0.157	0.08	1.933	4	
2.000	1.000	2.000	1.000	0.21	0.03	0.212	0.03	0.212	0.03	2.017	4	
2.000	1.000	2.000	1.000	0.23	0.07	0.237	0.07	0.237	0.07	2.047	4	
2.000	1.000	2.000	1.000	0.23	0.04	0.245	0.04	0.245	0.04	2.046	2	
2.000	1.000	2.000	1.000	0.29	0.07	0.302	0.07	0.302	0.07	2.047	2	
2.000	1.000	2.000	1.000	0.14	0.10	0.170	0.10	0.170	0.10	2.170	4	
2.000	1.000	2.000	1.000	0.11	0.03	0.121	0.03	0.121	0.03	2.120	4	
2.000	1.000	2.000	1.000	0.21	0.06	0.219	0.06	0.219	0.06	2.315	3	
2.000	1.000	2.000	1.000	0.32	0.05	0.333	0.05	0.333	0.05	2.332	3	
2.000	1.000	2.000	1.000	0.29	0.05	0.319	0.05	0.319	0.05	2.315	5	
2.000	1.000	2.000	1.000	0.24	0.02	0.242	0.02	0.242	0.02	2.512	4	
2.000	1.000	2.000	1.000	0.17	0.06	0.190	0.06	0.190	0.06	2.434	4	
2.000	1.000	2.000	1.000	0.11	0.06	0.124	0.06	0.124	0.06	2.320	3	
2.000	1.000	2.000	1.000	0.19	0.07	0.204	0.07	0.204	0.07	2.320	3	
2.000	1.000	2.000	1.000	0.24	0.08	0.254	0.08	0.254	0.08	2.503	3	
2.000	1.000	2.000	1.000	0.23	0.11	0.305	0.11	0.305	0.11	2.575	2	
2.000	1.000	2.000	1.000	0.33	0.08	0.340	0.08	0.340	0.08	2.622	5	
2.000	1.000	2.000	1.000	0.27	0.05	0.271	0.05	0.271	0.05	2.653	5	
2.000	1.000	2.000	1.000	0.24	0.05	0.241	0.05	0.241	0.05	2.716	4	
2.000	1.000	2.000	1.000	0.15	0.01	0.152	0.01	0.152	0.01	2.733	4	
2.000	1.000	2.000	1.000	0.25	0.03	0.254	0.03	0.254	0.03	2.640	2	
2.000	1.000	2.000	1.000	0.28	0.03	0.285	0.03	0.285	0.03	2.723	5	
2.000	1.000	2.000	1.000	0.31	0.07	0.317	0.07	0.317	0.07	2.825	5	
2.000	1.000	2.000	1.000	0.30	0.01	0.302	0.01	0.302	0.01	2.814	5	
2.000	1.000	2.000	1.000	0.29	0.04	0.294	0.04	0.294	0.04	2.836	5	
2.000	1.000	2.000	1.000	0.27	0.06	0.274	0.06	0.274	0.06	2.836	4	
2.000	1.000	2.000	1.000	0.36	0.11	0.378	0.11	0.378	0.11	3.059	4	
2.000	1.000	2.000	1.000	0.31	0.12	0.325	0.12	0.325	0.12	3.051	5	
2.000	1.000	2.000	1.000	0.24	0.12	0.252	0.12	0.252	0.12	3.051	5	

OBSERVED DISTANCE VALUES = 5.0718 TIMES SCALED VALUES  
 AND OBSERVED TIME VALUES = 0.3742 TIMES SCALED VALUES  
 VELOCITY VALUES AS SHOWN ARE INVARIANT UNDER SCALING



TABLE 7.15

VELOCITY FIELD ----- DIPOLE WEST/10 WFS/295 SMOKE PUFF GRID 1209 /A770322

PARTICLE VELOCITIES AT SCALED TIME = 6.000 MS

X-SCAL METERS	Y-SCAL METERS	U=DX/DT MACH NO	PARTICLE VELOCITY	V=DY/DT MACH NO	REGN CODE	F-SCAL METERS	U=DX/DT MACH NO	PARTICLE VELOCITY	V=DY/DT MACH NO	REGN CODE	X-SCAL METERS	Y-SCAL METERS	U=DX/DT MACH NO	PARTICLE VELOCITY	V=DY/DT MACH NO	REGN CODE	R-SCAL METERS	PARTICLE VELOCITY	V=DY/DT MACH NO	U=DX/DT MACH NO	REGN CODE
1.522	2.028	0.01	0.057	0.07	2	2.028	0.01	0.057	0.07	2	2.028	2.028	0.01	0.057	0.07	2	2.028	0.207	0.09	0.09	5
1.926	1.757	0.04	0.105	0.08	2	1.926	0.04	0.105	0.08	2	1.926	1.926	0.04	0.105	0.08	2	1.926	0.275	0.12	0.12	5
1.997	1.445	0.01	0.142	0.14	2	1.997	0.01	0.142	0.14	2	1.997	1.997	0.01	0.142	0.14	2	1.997	0.262	0.07	0.07	5
1.540	1.115	-0.03	0.074	0.07	4	1.540	-0.03	0.074	0.07	4	1.540	1.540	-0.03	0.074	0.07	4	1.540	0.247	0.06	0.06	5
2.016	0.525	0.01	0.04	0.04	4	2.016	0.01	0.04	0.04	4	2.016	2.016	0.01	0.04	0.04	4	2.016	0.210	0.13	0.13	4
2.137	1.170	0.13	0.134	0.09	4	2.137	0.13	0.134	0.09	4	2.137	2.137	0.13	0.134	0.09	4	2.137	0.287	0.08	0.08	4
2.150	1.853	0.09	0.125	0.09	2	2.150	0.09	0.125	0.09	2	2.150	2.150	0.09	0.125	0.09	2	2.150	0.222	0.07	0.07	4
2.479	1.041	0.13	0.143	0.07	6	2.479	0.13	0.143	0.07	6	2.479	2.479	0.13	0.143	0.07	6	2.479	0.271	0.01	0.01	4
2.206	0.526	0.02	0.060	0.06	4	2.206	0.02	0.060	0.06	4	2.206	2.206	0.02	0.060	0.06	4	2.206	0.250	0.10	0.10	4
2.197	0.751	0.03	0.048	0.04	4	2.197	0.03	0.048	0.04	4	2.197	2.197	0.03	0.048	0.04	4	2.197	0.279	0.14	0.14	4
2.107	0.426	0.04	0.057	-0.00	4	2.107	0.04	0.057	-0.00	4	2.107	2.107	0.04	0.057	-0.00	4	2.107	0.258	0.10	0.10	4
2.153	0.565	0.04	0.041	0.04	3	2.153	0.04	0.041	0.04	3	2.153	2.153	0.04	0.041	0.04	3	2.153	0.238	0.03	0.03	4
2.225	2.021	-0.06	0.130	0.06	2	2.225	-0.06	0.130	0.06	2	2.225	2.225	-0.06	0.130	0.06	2	2.225	0.294	0.11	0.11	4
2.424	1.973	0.11	0.120	0.09	5	2.424	0.11	0.120	0.09	5	2.424	2.424	0.11	0.120	0.09	5	2.424	0.268	0.10	0.10	4
2.552	1.925	0.17	0.207	0.06	4	2.552	0.17	0.207	0.06	4	2.552	2.552	0.17	0.207	0.06	4	2.552	0.274	0.09	0.09	4
2.553	1.265	0.20	0.142	0.07	4	2.553	0.20	0.142	0.07	4	2.553	2.553	0.20	0.142	0.07	4	2.553	0.252	0.10	0.10	4
2.407	0.707	0.14	0.098	0.03	4	2.407	0.14	0.098	0.03	4	2.407	2.407	0.14	0.098	0.03	4	2.407	0.263	0.11	0.11	4
2.427	0.424	0.03	0.092	0.02	3	2.427	0.03	0.092	0.02	3	2.427	2.427	0.03	0.092	0.02	3	2.427	0.265	0.10	0.10	4
2.503	2.024	0.10	0.135	0.04	2	2.503	0.10	0.135	0.04	2	2.503	2.503	0.10	0.135	0.04	2	2.503	0.215	0.05	0.05	4
2.575	1.446	0.21	0.126	0.10	2	2.575	0.21	0.126	0.10	2	2.575	2.575	0.21	0.126	0.10	2	2.575	0.219	0.05	0.05	4
2.580	1.027	0.24	0.224	0.10	2	2.580	0.24	0.224	0.10	2	2.580	2.580	0.24	0.224	0.10	2	2.580	0.251	0.09	0.09	4
2.703	1.071	0.22	0.233	0.07	5	2.703	0.22	0.233	0.07	5	2.703	2.703	0.22	0.233	0.07	5	2.703	0.259	0.10	0.10	4
2.725	1.025	0.26	0.205	0.11	5	2.725	0.26	0.205	0.11	5	2.725	2.725	0.26	0.205	0.11	5	2.725	0.258	0.08	0.08	4
2.730	1.052	0.19	0.243	0.04	4	2.730	0.19	0.243	0.04	4	2.730	2.730	0.19	0.243	0.04	4	2.730	0.239	0.02	0.02	4
2.759	0.806	0.24	0.211	0.00	4	2.759	0.24	0.211	0.00	4	2.759	2.759	0.24	0.211	0.00	4	2.759	0.253	0.09	0.09	4
2.625	2.024	0.18	0.187	0.03	2	2.625	0.18	0.187	0.03	2	2.625	2.625	0.18	0.187	0.03	2	2.625	0.259	0.11	0.11	4
2.783	1.070	0.19	0.198	0.03	2	2.783	0.19	0.198	0.03	2	2.783	2.783	0.19	0.198	0.03	2	2.783	0.294	0.11	0.11	4
2.883	1.074	0.24	0.262	0.11	5	2.883	0.24	0.262	0.11	5	2.883	2.883	0.24	0.262	0.11	5	2.883	0.291	0.09	0.09	4
2.912	1.010	0.25	0.184	0.08	5	2.912	0.25	0.184	0.08	5	2.912	2.912	0.25	0.184	0.08	5	2.912	0.259	0.09	0.09	4
2.914	1.085	0.10	0.262	0.10	5	2.914	0.10	0.262	0.10	5	2.914	2.914	0.10	0.262	0.10	5	2.914	0.235	0.07	0.07	4
2.905	0.022	0.23	0.241	0.08	4	2.905	0.23	0.241	0.08	4	2.905	2.905	0.23	0.241	0.08	4	2.905	0.235	0.07	0.07	4
2.905	0.445	0.08	0.224	0.00	4	2.905	0.08	0.224	0.00	4	2.905	2.905	0.08	0.224	0.00	4	2.905	0.231	0.05	0.05	4
3.037	0.004	0.27	0.275	0.07	4	3.037	0.27	0.275	0.07	4	3.037	3.037	0.27	0.275	0.07	4	3.037	0.259	0.05	0.05	4

OBSERVED DISTANCE VALUES = 0.0712 TIMES SCALED VALUES  
 AND OBSERVED TIME VALUES = 0.3742 TIMES SCALED VALUES.  
 VELOCITY VALUES AS SHOWN ARE INVARIANT UNDER SCALING.









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VICTORIA UNIV (BRITISH COLUMBIA)

F/6 18/3

PHOTOGAMMETRY OF THE PARTICLE TRAJECTORIES ON DIPOLE WEST SHOT--ETC(U)

JUN 77 J M DEWEY, D J MCMILLIN, D TRILL

DNA001-76-C-0250

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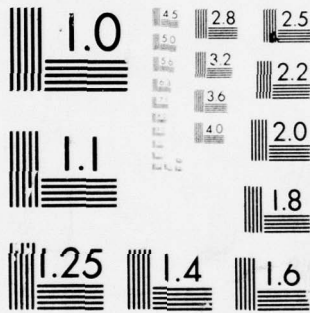
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MICROCOPY RESOLUTION TEST CHART  
NATIONAL BUREAU OF STANDARDS-1963-A

TABLE 8.4

DENSITY FIELD DIPOLE WEST/10 WFS/293 SMOKE PUFF GRID 1209 /A770322

AVERAGE DENSITIES AT SCALED TIME= 2.500 MS

X-SCAL METERS	Y-SCAL METERS	DENSITY RATIO	R-SCAL METERS	REGN CODE	X-SCAL METERS	Y-SCAL METERS	DENSITY RATIO	R-SCAL METERS	REGN CODE	X-SCAL METERS	Y-SCAL METERS	DENSITY RATIO	R-SCAL METERS	REGN CODE
1.693	2.258	1.029	2.230	2	1.137	1.260	1.412	2.230	4	2.336	0.631	1.839	2.413	3
1.735	1.596	1.063	2.233	2	0.935	1.412	1.590	2.247	4	2.313	0.359	1.364	2.413	3
1.752	1.754	1.054	2.216	2	0.659	1.590	1.590	2.259	4	2.287	0.182	2.261	2.413	3
1.833	0.804	0.943	2.191	4	0.531	1.590	1.590	2.273	4	2.367	0.182	2.261	2.413	3
1.822	0.552	0.049	2.172	1	0.348	1.692	1.692	2.193	3	2.351	1.508	2.103	2.413	5
1.919	2.144	1.041	2.166	2	0.178	1.692	1.692	2.193	3	2.421	1.718	2.251	2.413	5
2.005	1.643	1.152	2.214	2	2.103	1.887	1.887	2.244	2	2.449	1.535	2.357	2.413	5
2.003	0.736	1.224	2.244	4	1.923	1.621	1.621	2.377	5	2.478	1.355	2.491	2.413	5
2.017	0.541	1.216	2.043	4	1.731	1.728	1.728	2.364	5	2.478	1.162	2.529	2.413	5
2.012	0.742	1.529	2.327	4	1.555	1.691	1.691	2.357	5	2.461	0.774	2.560	2.413	5
2.066	2.150	1.365	2.347	3	1.354	1.451	1.451	2.362	5	2.460	0.583	2.101	2.413	4
2.093	1.650	1.570	2.362	2	0.936	2.077	2.077	2.373	4	2.449	0.362	2.180	2.413	4
2.213	1.373	1.451	2.352	5	0.736	1.941	1.941	2.386	4	2.443	0.202	2.079	2.413	3

AVERAGE DENSITIES AT SCALED TIME= 2.600 MS

X-SCAL METERS	Y-SCAL METERS	DENSITY RATIO	R-SCAL METERS	REGN CODE	X-SCAL METERS	Y-SCAL METERS	DENSITY RATIO	R-SCAL METERS	REGN CODE	X-SCAL METERS	Y-SCAL METERS	DENSITY RATIO	R-SCAL METERS	REGN CODE
1.703	2.264	1.003	2.157	2	0.345	1.840	1.840	2.224	3	2.911	1.199	2.442	2.518	5
1.744	2.001	1.040	2.172	2	0.175	1.644	1.644	2.200	3	2.912	0.971	2.442	2.518	4
1.745	1.757	1.047	1.766	2	0.110	1.704	1.704	2.272	2	2.493	0.771	2.442	2.518	4
1.813	0.810	0.951	1.842	4	1.070	1.519	1.519	2.402	2	2.440	0.580	2.440	2.518	4
1.850	2.195	1.224	2.044	1	1.520	1.520	1.520	2.390	5	2.440	0.300	2.440	2.518	4
1.897	0.964	1.224	2.073	2	1.327	1.520	1.520	2.391	5	2.508	0.207	1.913	2.518	5
1.923	1.353	1.173	2.041	4	1.127	1.742	1.742	2.389	5	2.508	0.181	1.913	2.518	5
2.005	0.597	1.175	2.041	4	0.936	1.842	1.842	2.411	4	2.629	1.704	1.945	2.518	5
2.005	0.640	1.540	2.021	4	0.733	1.842	1.842	2.411	4	2.662	1.531	1.945	2.518	5
2.014	2.157	1.540	2.041	3	0.536	1.842	1.842	2.411	4	2.662	1.359	1.945	2.518	5
2.014	1.655	1.320	2.041	2	0.344	1.842	1.842	2.411	4	2.664	1.155	1.945	2.518	5
2.017	1.655	1.502	2.317	2	0.170	1.842	1.842	2.411	4	2.676	0.670	1.945	2.518	5
2.031	1.379	1.394	2.040	5	0.100	1.642	1.642	2.422	3	2.676	0.476	1.945	2.518	5
2.025	1.139	1.209	2.041	4	1.919	2.001	2.001	2.453	2	2.669	0.276	1.945	2.518	4
2.025	0.623	1.374	2.053	4	1.720	2.052	2.052	2.523	5	2.653	0.100	1.945	2.518	4
2.029	0.624	1.491	2.085	4	1.542	2.124	2.124	2.515	5	2.652	0.090	1.945	2.518	4
2.215	0.529	1.495	2.028	4	1.360	2.215	2.215	2.511	5	2.652	0.204	1.945	2.518	3

X AND Y LOCATE THE CENTER OF A PLANE QUADRILATERAL WHICH IS A CELL OF A NEIGHBORING SMOKE PUFFS. DENSITY IS AVERAGED OVER THE AREA OF THE CELL AND IS EXPRESSED AS A RATIO TO THE AMBIENT DENSITY.

OBSERVED DISTANCE VALUES= 8.0718 TIMES SCALED VALUES AND OBSERVED TIME VALUES= 8.1742 TIMES SCALED VALUES. DENSITY VALUES AS SHOWN ARE INVARIANT UNDER SCALING.

TABLE 8.5

----- DENSITY FIELD DIPOLE WEST/10 WF5/295 SMOKE PUFF GRID 1209 /A770322 -----

AVERAGE DENSITIES AT SCALED TIME= 3.000 MS

X-SCAL METERS	Y-SCAL METERS	DENSITY RATIO	R-SCAL METERS	REGN CODE	X-SCAL METERS	Y-SCAL METERS	DENSITY RATIO	R-SCAL METERS	REGN CODE	X-SCAL METERS	Y-SCAL METERS	DENSITY RATIO	R-SCAL METERS	REGN CODE
1.761	1.851	0.820	1.851	2	2.440	1.379	1.336	2.040	5	2.748	1.305	1.967	1.821	5
1.774	1.825	0.850	1.825	2	2.478	1.351	1.083	2.049	5	2.759	1.170	1.828	1.828	5
1.815	1.759	1.001	1.816	2	2.478	1.151	1.550	2.048	5	2.743	0.970	1.773	1.828	4
1.869	1.684	0.854	1.895	4	2.489	0.933	1.590	2.045	4	2.741	0.598	1.932	1.828	4
1.921	1.609	0.810	2.017	4	2.484	0.712	1.579	2.043	2	2.741	0.392	2.067	1.828	3
1.989	1.530	1.002	1.922	2	2.553	1.472	1.524	2.035	5	2.741	0.171	1.829	1.828	5
2.065	1.454	1.007	1.594	4	2.561	1.254	1.522	2.035	5	2.741	1.805	1.079	1.828	5
2.105	1.374	1.074	1.175	4	2.624	1.035	1.747	2.032	5	2.741	1.709	1.079	1.828	5
2.150	1.294	1.163	2.130	7	2.624	0.815	1.735	2.030	5	2.741	1.521	1.079	1.828	5
2.174	1.214	1.237	2.120	2	2.608	0.595	1.607	2.027	4	2.741	1.357	1.112	1.828	5
2.202	1.134	1.205	2.316	2	2.557	0.374	2.164	2.020	4	2.741	1.172	1.112	1.828	5
2.225	1.054	1.150	2.325	5	2.500	0.153	1.898	2.026	4	2.741	0.974	1.126	1.828	4
2.231	0.974	1.088	2.374	4	2.554	1.103	1.714	2.024	3	2.741	0.785	1.126	1.828	4
2.231	0.894	1.028	2.355	5	2.554	1.909	1.942	2.027	5	2.741	0.595	1.126	1.828	4
2.246	0.814	1.407	2.355	2	2.676	1.726	1.802	2.022	5	2.741	0.388	1.047	1.828	4
2.246	0.734	1.240	2.484	5	2.711	1.547	1.933	2.022	5	2.741	0.195	1.047	1.828	4
2.290	1.773	1.360	2.484	5	2.736	1.366	1.933	2.022	5	2.741	0.001	1.047	1.828	4

AVERAGE DENSITIES AT SCALED TIME= 3.500 MS

X-SCAL METERS	Y-SCAL METERS	DENSITY RATIO	R-SCAL METERS	REGN CODE	X-SCAL METERS	Y-SCAL METERS	DENSITY RATIO	R-SCAL METERS	REGN CODE	X-SCAL METERS	Y-SCAL METERS	DENSITY RATIO	R-SCAL METERS	REGN CODE
1.818	2.039	0.892	1.913	2	2.580	0.932	1.313	2.518	4	2.861	0.378	1.835	1.835	5
1.873	1.979	0.962	1.874	2	2.582	0.709	1.431	2.618	4	2.861	0.174	1.732	1.835	5
1.931	1.914	0.773	1.951	4	2.572	2.171	1.169	2.672	5	2.861	0.092	1.707	1.835	5
1.967	0.851	0.812	2.042	4	2.620	1.986	1.256	2.757	5	2.861	1.901	1.837	1.835	5
2.007	1.004	1.033	2.078	2	2.661	1.789	1.209	2.735	5	2.861	1.717	1.830	1.835	5
2.047	1.064	1.095	2.065	2	2.714	1.580	1.272	2.725	5	2.861	1.539	1.733	1.835	5
2.080	0.949	0.973	2.243	4	2.725	1.384	1.405	2.759	5	2.861	1.359	1.673	1.835	5
2.151	0.871	1.000	2.144	4	2.730	0.542	1.406	2.776	4	2.861	1.170	1.608	1.835	4
2.162	0.791	1.243	2.243	4	2.714	0.749	1.530	2.771	4	2.861	0.977	1.608	1.835	4
2.162	0.711	1.149	2.193	3	2.726	0.555	1.546	2.778	4	2.861	0.581	1.927	1.835	4
2.214	0.632	1.011	2.269	2	2.724	0.358	1.546	2.778	3	2.861	0.380	2.054	1.835	3
2.237	1.002	1.156	2.254	4	2.751	2.139	1.555	2.947	5	2.861	0.186	2.054	1.835	3
2.247	0.836	1.010	2.436	4	2.784	1.943	1.543	2.948	5	2.861	1.518	1.116	1.835	5
2.247	0.756	1.008	2.459	4	2.824	1.753	1.572	2.948	5	2.861	1.343	1.116	1.835	5
2.291	1.177	1.177	2.434	4	2.844	1.566	1.572	2.948	5	2.861	1.166	1.296	1.835	5
2.419	1.075	1.164	2.521	5	2.859	1.377	1.511	2.965	5	2.861	0.994	1.319	1.835	5
2.440	1.006	1.193	2.558	5	2.873	1.175	1.472	2.973	5	2.861	0.775	1.332	1.835	5
2.452	1.022	1.075	2.553	5	2.868	0.970	1.675	2.873	5	2.861	0.575	1.288	1.835	5
2.456	1.158	1.158	2.549	5	2.864	0.765	1.675	2.888	5	2.861	0.380	1.240	1.835	5
2.456	1.075	0.928	2.561	5	2.871	0.589	1.462	2.923	5	2.861	0.203	1.149	1.835	5

X AND Y LOCATE THE CENTER OF A PLANE QUADRIATERAL WHICH IS A CELL OF 4 NEIGHBORING SMOKE PUFFS. DENSITY IS AVERAGED OVER THE AREA OF THE CELL AND IS EXPRESSED AS A RATIO TO THE AMBIENT DENSITY.

OBSERVED DISTANCE VALUES = 8.0718 TIMES SCALED VALUES AND OBSERVED TIME VALUE = 8.3742 TIMES SCALED VALUES. DENSITY VALUES AS SHOWN ARE INVARIANT UNDER SCALING.

TABLE 8.6

DENSITY FIELD DIPOLE WEST/10 WFS/295 SMOKE PUFF GRID 1209 /A770322

AVERAGE DENSITIES AT SCALED TIME= 4.000 MS

X-SCAL METERS	Y-SCAL METERS	DENSITY RATIO	R-SCAL METERS	RCGN CODE	X-SCAL METERS	Y-SCAL METERS	DENSITY RATIO	R-SCAL METERS	RCGN CODE	X-SCAL METERS	Y-SCAL METERS	DENSITY RATIO	R-SCAL METERS	RCGN CODE
1.664	2.327	0.966	1.548	2	2.654	0.708	1.310	3.040	4	3.040	1.093	1.639	3.040	5
1.614	2.642	0.955	1.923	2	2.639	0.707	1.047	3.072	4	3.072	1.745	1.633	3.072	5
1.574	1.794	0.930	1.493	2	2.621	0.707	1.047	3.080	4	3.080	1.560	1.633	3.080	5
1.534	0.875	0.774	2.001	4	2.775	1.592	1.024	3.116	4	3.116	1.170	1.633	3.116	5
2.010	0.411	1.007	2.074	4	2.749	1.392	1.024	3.116	4	3.116	0.784	1.633	3.116	5
2.057	1.354	0.903	2.117	4	2.740	1.182	1.276	3.116	4	3.116	0.595	1.633	3.116	5
2.201	0.507	0.946	2.303	2	2.807	0.961	1.311	3.091	4	3.091	0.595	1.633	3.091	5
2.209	0.577	1.178	2.233	4	2.818	0.554	1.196	3.091	4	3.091	0.595	1.633	3.091	5
2.209	0.552	1.041	2.238	4	2.818	0.745	1.196	3.091	4	3.091	0.595	1.633	3.091	5
2.245	2.224	1.003	2.322	3	2.874	1.167	1.735	3.016	4	3.016	2.044	1.633	3.016	5
2.245	0.899	1.094	2.308	2	2.874	1.167	1.539	3.016	4	3.016	1.942	1.633	3.016	5
2.448	0.690	1.037	2.498	4	2.932	1.672	1.437	3.196	4	3.196	1.728	1.633	3.196	5
2.477	1.824	1.035	2.521	4	2.946	1.171	1.564	3.225	4	3.225	1.168	1.633	3.225	5
2.477	1.524	1.192	2.623	5	2.960	0.970	1.437	3.225	4	3.225	0.774	1.633	3.225	5
2.596	1.609	0.997	2.633	5	2.959	0.751	1.319	3.228	4	3.228	0.568	1.633	3.228	5
2.600	1.395	1.022	2.622	5	2.972	0.587	1.442	3.209	4	3.209	0.368	1.633	3.209	5
2.648	0.654	1.022	2.627	5	2.972	0.375	1.790	3.205	3	3.205	0.192	1.633	3.205	5
2.648	0.633	1.021	2.627	5	2.945	0.170	1.648	3.151	3	3.151	0.192	1.633	3.151	5
2.648	0.633	1.021	2.656	4	2.944	0.122	1.636	3.151	3	3.151	0.192	1.636	3.151	5

AVERAGE DENSITIES AT SCALED TIME= 4.500 MS

X-SCAL METERS	Y-SCAL METERS	DENSITY RATIO	Q-SCAL METERS	RCGN CODE	X-SCAL METERS	Y-SCAL METERS	DENSITY RATIO	P-SCAL METERS	RCGN CODE	X-SCAL METERS	Y-SCAL METERS	DENSITY RATIO	P-SCAL METERS	RCGN CODE
1.964	2.051	0.939	1.003	2	2.693	2.203	0.971	2.087	5	3.153	1.763	1.361	3.214	5
1.977	1.734	0.935	1.979	2	2.745	2.024	1.023	2.087	5	3.148	1.500	1.405	3.176	5
2.043	0.829	0.785	2.043	4	2.792	1.823	0.875	2.087	5	3.157	1.365	1.128	3.165	5
2.101	2.070	1.009	2.106	4	2.826	1.604	1.028	2.087	5	3.167	1.172	1.300	3.204	4
2.147	0.000	1.000	2.173	2	2.862	1.400	1.052	2.087	5	3.200	0.976	1.292	3.222	4
2.143	0.017	0.959	2.354	4	2.862	1.184	1.214	2.087	5	3.202	0.785	1.359	3.222	4
2.240	0.537	0.942	2.275	4	2.855	0.964	1.261	2.087	5	3.192	0.575	1.458	3.209	4
2.240	0.517	1.110	2.307	4	2.891	0.561	1.139	2.087	5	3.189	0.372	1.458	3.193	4
2.309	2.240	0.969	2.272	3	2.899	2.190	1.492	2.087	5	3.218	2.119	1.739	3.364	5
2.337	0.019	0.876	2.378	2	2.944	1.950	1.307	2.087	5	3.207	1.942	1.739	3.364	5
2.539	0.095	1.073	2.357	2	2.990	1.789	1.279	2.087	5	3.207	1.799	1.739	3.364	5
2.530	0.197	1.023	2.568	4	2.998	1.598	1.445	2.087	5	3.207	1.532	1.266	3.310	5
2.422	2.019	1.109	2.568	4	3.014	1.395	1.254	2.087	5	3.205	1.354	1.514	3.312	5
2.527	2.010	1.294	2.673	5	3.029	0.827	1.475	2.087	5	3.233	1.174	1.383	3.323	5
2.595	1.042	1.034	2.695	5	3.032	0.762	1.174	2.087	5	3.235	0.990	1.450	3.339	5
2.641	1.022	0.997	2.685	5	3.057	0.591	1.304	2.087	5	3.235	0.762	1.450	3.339	5
2.654	1.032	0.916	2.670	5	3.059	0.380	1.702	2.087	5	3.311	0.564	1.450	3.340	5
2.683	1.145	0.932	2.683	5	3.049	0.167	1.656	2.087	5	3.311	0.368	1.656	3.340	5
2.709	0.578	1.151	2.711	4	3.072	0.123	1.652	2.087	5	3.310	0.192	1.652	3.310	5
2.709	0.715	1.026	2.742	4	3.123	1.952	1.457	2.087	5	3.310	0.192	1.457	3.310	5

X AND Y LOCATE THE CENTER OF A PLANE QUADRIATERAL WHICH IS A CELL OF A NEIGHBORING SMOKE PUFFS. Q AND Y IS AVERAGED OVER THE AREA OF THE CELL AND IS EXPRESSED AS A RATIO TO THE AMBIENT DENSITY.

OBSERVED DISTANCE VALUES = 8.0718 TIMES SCALED VALUES AND OBSERVED TIME VALUE = 8.3742 TIMES SCALED VALUE. DENSITY VALUES AS SHOWN ARE INVARIANT UNDER SCALING.

TABLE 8.7

DENSITY FIELD		DIPOLE WEST/10		WFS/295		SMOKE PUFF GRID 1209		/A770322	
AVERAGE DENSITIES AT SCALED TIME= 5.000 MS									
X-SCAL METERS	Y-SCAL METERS	DENSITY RATIO	R-SCAL METERS	REGN CODE	X-SCAL METERS	Y-SCAL METERS	DENSITY RATIO	R-SCAL METERS	REGN CODE
2.004	2.000	0.882	2.034	2	2.756	0.725	1.172	2.787	5
2.019	1.993	0.847	2.071	4	2.721	0.714	0.940	2.925	4
2.041	1.975	0.813	2.107	4	2.686	0.703	0.752	3.035	5
2.069	1.954	0.779	2.144	4	2.651	0.692	0.563	3.148	5
2.100	1.931	0.745	2.181	4	2.616	0.681	0.374	3.264	5
2.136	1.907	0.711	2.218	4	2.581	0.670	0.185	3.381	4
2.176	1.882	0.677	2.255	4	2.546	0.659	0.000	3.500	4
2.220	1.857	0.643	2.292	4	2.511	0.648	0.000	3.620	4
2.268	1.832	0.609	2.329	3	2.476	0.637	0.000	3.741	4
2.320	1.807	0.575	2.366	2	2.441	0.626	0.000	3.863	3
2.376	1.782	0.541	2.403	2	2.406	0.615	0.000	3.986	3
2.436	1.757	0.507	2.440	4	2.371	0.604	0.000	4.110	3
2.500	1.732	0.473	2.477	4	2.336	0.593	0.000	4.235	3
2.568	1.707	0.439	2.514	4	2.301	0.582	0.000	4.360	3
2.640	1.682	0.405	2.551	2	2.266	0.571	0.000	4.485	3
2.716	1.657	0.371	2.588	2	2.231	0.560	0.000	4.610	3
2.800	1.632	0.337	2.625	4	2.196	0.549	0.000	4.735	3
2.892	1.607	0.303	2.662	4	2.161	0.538	0.000	4.860	3
2.992	1.582	0.269	2.699	4	2.126	0.527	0.000	4.985	3
3.100	1.557	0.235	2.736	2	2.091	0.516	0.000	5.110	3
3.216	1.532	0.201	2.773	2	2.056	0.505	0.000	5.235	3
3.340	1.507	0.167	2.810	2	2.021	0.494	0.000	5.360	3
3.472	1.482	0.133	2.847	2	1.986	0.483	0.000	5.485	3
3.612	1.457	0.099	2.884	2	1.951	0.472	0.000	5.610	3
3.760	1.432	0.065	2.921	2	1.916	0.461	0.000	5.735	3
3.916	1.407	0.031	2.958	2	1.881	0.450	0.000	5.860	3
4.080	1.382	0.000	3.000	2	1.846	0.439	0.000	5.985	3
4.252	1.357	0.000	3.040	2	1.811	0.428	0.000	6.110	3
4.432	1.332	0.000	3.080	2	1.776	0.417	0.000	6.235	3
4.620	1.307	0.000	3.120	2	1.741	0.406	0.000	6.360	3
4.816	1.282	0.000	3.160	2	1.706	0.395	0.000	6.485	3
5.020	1.257	0.000	3.200	2	1.671	0.384	0.000	6.610	3
5.232	1.232	0.000	3.240	2	1.636	0.373	0.000	6.735	3
5.452	1.207	0.000	3.280	2	1.601	0.362	0.000	6.860	3
5.680	1.182	0.000	3.320	2	1.566	0.351	0.000	6.985	3
5.916	1.157	0.000	3.360	2	1.531	0.340	0.000	7.110	3
6.160	1.132	0.000	3.400	2	1.496	0.329	0.000	7.235	3
6.412	1.107	0.000	3.440	2	1.461	0.318	0.000	7.360	3
6.672	1.082	0.000	3.480	2	1.426	0.307	0.000	7.485	3
6.940	1.057	0.000	3.520	2	1.391	0.296	0.000	7.610	3
7.216	1.032	0.000	3.560	2	1.356	0.285	0.000	7.735	3
7.500	1.007	0.000	3.600	2	1.321	0.274	0.000	7.860	3
7.792	0.982	0.000	3.640	2	1.286	0.263	0.000	7.985	3
8.092	0.957	0.000	3.680	2	1.251	0.252	0.000	8.110	3
8.400	0.932	0.000	3.720	2	1.216	0.241	0.000	8.235	3
8.716	0.907	0.000	3.760	2	1.181	0.230	0.000	8.360	3
9.040	0.882	0.000	3.800	2	1.146	0.219	0.000	8.485	3
9.372	0.857	0.000	3.840	2	1.111	0.208	0.000	8.610	3
9.712	0.832	0.000	3.880	2	1.076	0.197	0.000	8.735	3
10.060	0.807	0.000	3.920	2	1.041	0.186	0.000	8.860	3
10.416	0.782	0.000	3.960	2	1.006	0.175	0.000	8.985	3
10.780	0.757	0.000	4.000	2	0.971	0.164	0.000	9.110	3
11.152	0.732	0.000	4.040	2	0.936	0.153	0.000	9.235	3
11.532	0.707	0.000	4.080	2	0.901	0.142	0.000	9.360	3
11.920	0.682	0.000	4.120	2	0.866	0.131	0.000	9.485	3
12.316	0.657	0.000	4.160	2	0.831	0.120	0.000	9.610	3
12.720	0.632	0.000	4.200	2	0.796	0.109	0.000	9.735	3
13.132	0.607	0.000	4.240	2	0.761	0.098	0.000	9.860	3
13.552	0.582	0.000	4.280	2	0.726	0.087	0.000	9.985	3
13.980	0.557	0.000	4.320	2	0.691	0.076	0.000	10.110	3
14.416	0.532	0.000	4.360	2	0.656	0.065	0.000	10.235	3
14.860	0.507	0.000	4.400	2	0.621	0.054	0.000	10.360	3
15.312	0.482	0.000	4.440	2	0.586	0.043	0.000	10.485	3
15.772	0.457	0.000	4.480	2	0.551	0.032	0.000	10.610	3
16.240	0.432	0.000	4.520	2	0.516	0.021	0.000	10.735	3
16.716	0.407	0.000	4.560	2	0.481	0.010	0.000	10.860	3
17.200	0.382	0.000	4.600	2	0.446	0.000	0.000	10.985	3
17.692	0.357	0.000	4.640	2	0.411	0.000	0.000	11.110	3
18.192	0.332	0.000	4.680	2	0.376	0.000	0.000	11.235	3
18.700	0.307	0.000	4.720	2	0.341	0.000	0.000	11.360	3
19.216	0.282	0.000	4.760	2	0.306	0.000	0.000	11.485	3
19.740	0.257	0.000	4.800	2	0.271	0.000	0.000	11.610	3
20.272	0.232	0.000	4.840	2	0.236	0.000	0.000	11.735	3
20.812	0.207	0.000	4.880	2	0.201	0.000	0.000	11.860	3
21.360	0.182	0.000	4.920	2	0.166	0.000	0.000	11.985	3
21.916	0.157	0.000	4.960	2	0.131	0.000	0.000	12.110	3
22.480	0.132	0.000	5.000	2	0.096	0.000	0.000	12.235	3
23.052	0.107	0.000	5.040	2	0.061	0.000	0.000	12.360	3
23.632	0.082	0.000	5.080	2	0.026	0.000	0.000	12.485	3
24.220	0.057	0.000	5.120	2	0.000	0.000	0.000	12.610	3
24.816	0.032	0.000	5.160	2	0.000	0.000	0.000	12.735	3
25.420	0.007	0.000	5.200	2	0.000	0.000	0.000	12.860	3
26.032	0.000	0.000	5.240	2	0.000	0.000	0.000	12.985	3
26.652	0.000	0.000	5.280	2	0.000	0.000	0.000	13.110	3
27.280	0.000	0.000	5.320	2	0.000	0.000	0.000	13.235	3
27.916	0.000	0.000	5.360	2	0.000	0.000	0.000	13.360	3
28.560	0.000	0.000	5.400	2	0.000	0.000	0.000	13.485	3
29.212	0.000	0.000	5.440	2	0.000	0.000	0.000	13.610	3
29.872	0.000	0.000	5.480	2	0.000	0.000	0.000	13.735	3
30.540	0.000	0.000	5.520	2	0.000	0.000	0.000	13.860	3
31.216	0.000	0.000	5.560	2	0.000	0.000	0.000	13.985	3
31.900	0.000	0.000	5.600	2	0.000	0.000	0.000	14.110	3
32.592	0.000	0.000	5.640	2	0.000	0.000	0.000	14.235	3
33.292	0.000	0.000	5.680	2	0.000	0.000	0.000	14.360	3
34.000	0.000	0.000	5.720	2	0.000	0.000	0.000	14.485	3
34.716	0.000	0.000	5.760	2	0.000	0.000	0.000	14.610	3
35.440	0.000	0.000	5.800	2	0.000	0.000	0.000	14.735	3
36.172	0.000	0.000	5.840	2	0.000	0.000	0.000	14.860	3
36.912	0.000	0.000	5.880	2	0.000	0.000	0.000	14.985	3
37.660	0.000	0.000	5.920	2	0.000	0.000	0.000	15.110	3
38.416	0.000	0.000	5.960	2	0.000	0.000	0.000	15.235	3
39.180	0.000	0.000	6.000	2	0.000	0.000	0.000	15.360	3
39.952	0.000	0.000	6.040	2	0.000	0.000	0.000	15.485	3
40.732	0.000	0.000	6.080	2	0.000	0.000	0.000	15.610	3
41.520	0.000	0.000	6.120	2	0.000	0.000	0.000	15.735	3
42.316	0.000	0.000	6.160	2	0.000	0.000	0.000	15.860	3
43.120	0.000	0.000	6.200	2	0.000	0.000	0.000	15.985	3
43.932	0.000	0.000	6.240	2	0.000	0.000	0.000	16.110	3
44.752	0.000	0.000	6.280	2	0.000	0.000	0.000	16.235	3
45.580	0.000	0.000	6.320	2	0.000	0.000	0.000	16.360	3
46.416	0.000	0.000	6.360	2	0.000	0.000	0.000	16.485	3
47.260	0.000	0.000	6.400	2	0.000	0.000	0.000	16.610	3
48.112	0.000	0.000	6.440	2	0.000	0.000	0.000	16.735	3
48.972	0.000	0.000	6.480	2	0.000	0.000	0.000	16.860	3
49.840	0.000	0.000	6.520	2	0.000	0.000	0.000	16.985	3
50.716	0.000	0.000	6.560	2	0.000	0.000	0.000	17.110	3
51.600	0.000	0.000	6.600	2	0.000	0.000	0.000	17.235	3
52.492	0.000	0.000	6.640	2	0.000	0.000	0.000	17.360	3
53.392	0.000	0.000	6.680	2	0.000	0.000	0.000	17.485	3
54.300	0.000	0.000	6.720	2	0.000	0.000	0.000	17.610	3
55.216	0.000	0.000	6.760	2	0.000	0.000	0.000	17.735	3
56.140	0.000	0.000	6.800	2	0.000	0.000	0.000	17.860	3
57.072	0.000	0.000	6.840	2	0.000	0.000	0.000	17.985	3

TABLE 8.8

DENSITY FIELD DIPOLE WEST/10 \*FS/295

SMOKE PUFF GRID 1209

/A770322

AVERAGE DENSITIES AT SCALED TIME= 6.000 MS

Y-SCAL METERS	DENSITY RATIO	R-SCAL METERS	REGN CODE	X-SCAL METERS	DENSITY RATIO	R-SCAL METERS	REGN CODE	Y-SCAL METERS	DENSITY RATIO	R-SCAL METERS	REGN CODE
2.046	0.850	2.076	2	2.042	0.742	2.070	4	3.470	2.093	3.431	5
2.065	1.028	2.069	2	2.071	0.530	2.001	4	3.470	1.043	3.431	5
2.082	0.635	2.082	4	2.073	0.858	2.017	4	3.470	1.003	3.431	5
2.095	0.753	2.084	4	2.075	0.650	2.015	5	3.470	1.005	3.431	5
2.120	0.632	2.082	4	2.077	0.937	2.014	5	3.470	1.003	3.431	5
2.150	0.455	2.080	4	2.079	0.640	2.004	5	3.470	1.003	3.431	5
2.185	0.425	2.077	4	2.081	1.215	2.004	5	3.470	1.003	3.431	5
2.220	0.470	2.074	4	2.083	1.232	2.014	4	3.470	1.003	3.431	5
2.250	0.730	2.071	4	2.085	1.062	2.014	4	3.470	1.003	3.431	5
2.280	0.657	2.067	4	2.087	0.558	2.014	4	3.470	1.003	3.431	5
2.315	0.657	2.064	4	2.089	0.280	2.026	4	3.470	1.003	3.431	5
2.345	0.716	2.062	4	2.091	2.040	2.026	4	3.470	1.003	3.431	5
2.380	0.716	2.060	4	2.093	1.841	2.026	4	3.470	1.003	3.431	5
2.415	1.349	2.060	2	2.095	1.630	2.026	5	3.470	1.003	3.431	5
2.450	1.143	2.061	2	2.097	1.420	2.026	5	3.470	1.003	3.431	5
2.485	0.645	2.061	5	2.099	1.205	2.026	5	3.470	1.003	3.431	5
2.520	0.870	2.061	5	2.102	1.002	2.026	5	3.470	1.003	3.431	5
2.555	0.870	2.061	5	2.104	0.738	2.026	5	3.470	1.003	3.431	5
2.590	1.124	2.061	5	2.106	0.630	2.026	5	3.470	1.003	3.431	5
2.625	1.012	2.061	5	2.108	0.795	2.026	5	3.470	1.003	3.431	5
2.660	1.012	2.061	5	2.110	0.630	2.026	5	3.470	1.003	3.431	5
2.695	1.012	2.061	5	2.112	0.795	2.026	5	3.470	1.003	3.431	5
2.730	1.012	2.061	5	2.114	1.213	2.026	5	3.470	1.003	3.431	5

AVERAGE DENSITIES AT SCALED TIME= 6.500 MS

Y-SCAL METERS	DENSITY RATIO	R-SCAL METERS	REGN CODE	X-SCAL METERS	DENSITY RATIO	R-SCAL METERS	REGN CODE	Y-SCAL METERS	DENSITY RATIO	R-SCAL METERS	REGN CODE
2.053	1.002	2.088	2	2.073	0.744	2.070	4	3.470	2.093	3.431	5
2.073	1.033	2.077	2	2.075	0.937	2.061	5	3.470	1.043	3.431	5
2.093	0.643	2.085	4	2.077	0.685	2.051	5	3.470	1.043	3.431	5
2.113	0.643	2.085	4	2.079	0.854	2.051	5	3.470	1.043	3.431	5
2.133	0.643	2.085	4	2.081	0.609	2.051	5	3.470	1.043	3.431	5
2.153	0.643	2.085	4	2.083	0.843	2.051	5	3.470	1.043	3.431	5
2.173	0.643	2.085	4	2.085	0.614	2.051	5	3.470	1.043	3.431	5
2.193	0.643	2.085	4	2.087	1.102	2.051	5	3.470	1.043	3.431	5
2.213	0.643	2.085	4	2.089	0.914	2.051	5	3.470	1.043	3.431	5
2.233	0.643	2.085	4	2.091	1.634	2.051	5	3.470	1.043	3.431	5
2.253	0.643	2.085	4	2.093	1.271	2.051	5	3.470	1.043	3.431	5
2.273	0.643	2.085	4	2.095	1.178	2.051	5	3.470	1.043	3.431	5
2.293	0.643	2.085	4	2.097	1.126	2.051	5	3.470	1.043	3.431	5
2.313	0.643	2.085	4	2.099	1.247	2.051	5	3.470	1.043	3.431	5
2.333	0.643	2.085	4	2.101	1.199	2.051	5	3.470	1.043	3.431	5
2.353	0.643	2.085	4	2.103	1.199	2.051	5	3.470	1.043	3.431	5
2.373	0.643	2.085	4	2.105	1.222	2.051	5	3.470	1.043	3.431	5
2.393	0.643	2.085	4	2.107	1.199	2.051	5	3.470	1.043	3.431	5
2.413	0.643	2.085	4	2.109	1.018	2.051	5	3.470	1.043	3.431	5
2.433	0.643	2.085	4	2.111	0.803	2.051	5	3.470	1.043	3.431	5
2.453	0.643	2.085	4	2.113	0.639	2.051	5	3.470	1.043	3.431	5
2.473	0.643	2.085	4	2.115	1.125	2.051	5	3.470	1.043	3.431	5

X AND Y LOCATE THE CENTER OF A PLANE QUADRILATERAL WHICH IS A CELL OF 4 NEIGHBORING SMOKE PUFFS. DENSITY IS AVERAGED OVER THE AREA OF THE CELL AND IS EXPRESSED AS A RATIO TO THE AMBIENT DENSITY.

OBSERVED DISTANCE VALUES= 6.0718 TIMES SCALED VALUES AND OBSERVED TIME VALUE = 0.3742 TIMES SCALED VALUE. DENSITY VALUES AS SHOWN ARE INVARIANT UNDER SCALING.

TABLE 9.1

PRESSURE FIELD		DIPOLE WEST/10		WFS/295		SMOKE PUFF GRID 1209		/A770322	
AVERAGE HYDROSTATIC OVERPRESSURES AT SCALED TIME = 0.500 MS									
X-SCAL METERS	Y-SCAL METERS	PRESSURE RATIO	R-SCAL METERS	REGN CODE	X-SCAL METERS	Y-SCAL METERS	PRESSURE RATIO	R-SCAL METERS	REGN CODE
1.190	2.075	0.395	1.234	2	1.157	1.328	0.614	1.187	4
1.193	1.874	0.672	1.194	2	1.186	0.652	1.200	1.200	5
1.192	1.687	0.777	1.192	2	1.179	0.604	1.198	1.198	1
1.175	1.504	0.602	1.193	2	1.158	0.553	1.168	1.168	1
AVERAGE HYDROSTATIC OVERPRESSURES AT SCALED TIME = 0.600 MS									
X-SCAL METERS	Y-SCAL METERS	PRESSURE RATIO	R-SCAL METERS	REGN CODE	X-SCAL METERS	Y-SCAL METERS	PRESSURE RATIO	R-SCAL METERS	REGN CODE
1.209	2.095	0.821	1.265	2	1.205	1.315	1.315	1.220	5
1.217	1.879	1.266	1.229	2	1.206	1.143	1.199	1.206	5
1.224	1.689	1.420	1.224	2	1.212	0.960	1.006	1.225	4
1.211	1.497	1.162	1.230	2	1.209	0.783	1.037	1.225	1
AVERAGE HYDROSTATIC OVERPRESSURES AT SCALED TIME = 0.700 MS									
X-SCAL METERS	Y-SCAL METERS	PRESSURE RATIO	R-SCAL METERS	REGN CODE	X-SCAL METERS	Y-SCAL METERS	PRESSURE RATIO	R-SCAL METERS	REGN CODE
1.238	2.095	1.591	1.296	2	1.245	1.326	1.326	1.259	5
1.244	1.896	2.325	1.260	2	1.242	1.147	2.133	1.242	5
1.254	1.692	2.643	1.264	2	1.243	0.969	1.668	1.254	4
1.245	1.494	2.204	1.264	2	1.239	0.790	1.787	1.255	1
AVERAGE HYDROSTATIC OVERPRESSURES AT SCALED TIME = 0.800 MS									
X-SCAL METERS	Y-SCAL METERS	PRESSURE RATIO	R-SCAL METERS	REGN CODE	X-SCAL METERS	Y-SCAL METERS	PRESSURE RATIO	R-SCAL METERS	REGN CODE
1.257	2.105	2.647	1.326	2	1.276	1.149	3.917	1.276	5
1.262	1.890	3.832	1.294	2	1.273	0.976	2.663	1.282	4
1.271	1.694	4.451	1.298	2	1.269	0.795	3.325	1.290	1
1.278	1.491	4.119	1.297	2	1.260	0.593	3.431	1.261	1
1.290	1.327	6.059	1.294	5	1.244	0.378	3.332	1.258	1
AVERAGE HYDROSTATIC OVERPRESSURES AT SCALED TIME = 0.900 MS									
X-SCAL METERS	Y-SCAL METERS	PRESSURE RATIO	R-SCAL METERS	REGN CODE	X-SCAL METERS	Y-SCAL METERS	PRESSURE RATIO	R-SCAL METERS	REGN CODE
1.317	2.115	3.633	1.367	2	1.311	0.998	3.421	1.311	1
1.331	1.909	5.223	1.344	2	1.291	0.825	4.201	1.308	1
1.337	1.695	6.204	1.339	2	1.277	0.671	3.301	1.336	1
1.350	1.492	7.068	1.345	5	1.265	0.482	0.331	1.555	2
1.321	1.284	5.068	1.321	5	1.252	0.297	0.482	1.540	2
1.310	0.977	3.840	1.320	4	1.237	0.149	0.528	1.537	2
1.316	0.773	4.102	1.335	1	1.243	0.133	0.624	1.556	5

X AND Y LOCATE THE CENTER OF A PLANE QUADRILATERAL WHICH IS A CELL OF A NEIGHBORING SMOKE PUFFS.  
 OVERPRESSURE IS AVERAGED OVER THE AREA OF THE CELL AND IS EXPRESSED AS A RATIO TO THE AMBIENT PRESSURE.  
 OBSERVED DISTANCE VALUES = 8.0718 TIMES SCALED VALUES  
 AND OBSERVED TIME VALUES = 3742 TIMES SCALED VALUES.  
 PRESSURE VALUES AS SHOWN ARE INVARIANT UNDER SCALING.

TABLE 9.2

DIPOLE WEST/10 MF5/295 SMOKE PUFF G710 1209 /A770322

AVERAGE HYDROSTATIC OVERPRESSURES AT SCALED TIME = 1.000 MS									
X-SCAL METERS	Y-SCAL METERS	PRESSURE RATIO	R-SCAL METERS	REGN CODE	X-SCAL METERS	Y-SCAL METERS	PRESSURE RATIO	R-SCAL METERS	REGN CODE
1.44	2.130	3.402	1.411	2	1.363	0.735	3.683	1.396	1
1.57	1.605	3.208	1.369	2	1.362	0.583	3.083	1.362	1
1.76	1.493	3.103	1.346	2	1.334	0.377	3.737	1.352	1
1.91	1.331	3.085	1.304	2	1.335	0.075	0.675	1.562	2
1.94	1.187	3.085	1.404	5	1.353	0.829	0.829	1.562	2
1.97	0.977	2.885	1.376	4	1.364	1.500	0.939	1.561	2
							0.852	1.505	5
AVERAGE HYDROSTATIC OVERPRESSURES AT SCALED TIME = 1.300 MS									
X-SCAL METERS	Y-SCAL METERS	PRESSURE RATIO	R-SCAL METERS	REGN CODE	X-SCAL METERS	Y-SCAL METERS	PRESSURE RATIO	R-SCAL METERS	REGN CODE
1.51	2.160	2.366	1.520	2	1.423	1.876	2.271	1.532	2
1.67	1.924	2.304	1.502	2	1.634	2.870	2.870	1.634	2
1.82	1.490	2.043	1.502	2	1.945	1.502	2.572	1.684	2
1.97	1.071	1.744	1.518	4	1.350	4.711	4.711	1.687	2
1.91	0.971	2.354	1.516	4	1.577	0.195	4.610	1.683	4
1.94	0.971	2.967	1.458	1	1.670	3.129	3.129	1.698	4
1.97	0.971	2.592	1.450	1	1.642	0.573	0.573	1.642	4
1.99	2.105	2.074	1.645	2	1.627	0.332	2.767	1.637	1
AVERAGE HYDROSTATIC OVERPRESSURES AT SCALED TIME = 1.400 MS									
X-SCAL METERS	Y-SCAL METERS	PRESSURE RATIO	R-SCAL METERS	REGN CODE	X-SCAL METERS	Y-SCAL METERS	PRESSURE RATIO	R-SCAL METERS	REGN CODE
1.50	2.177	2.070	1.570	2	1.670	1.692	2.508	1.670	2
1.64	1.971	1.713	1.574	2	1.724	1.692	2.003	1.724	5
1.64	1.711	1.920	1.573	5	1.716	1.691	3.669	1.731	5
1.67	1.491	1.929	1.552	4	1.719	0.775	3.009	1.732	5
1.67	0.977	2.035	1.552	4	1.673	3.064	3.064	1.673	4
1.67	0.544	2.035	1.537	1	1.672	3.064	3.064	1.672	4
1.67	0.350	2.291	1.541	1	1.656	0.107	3.064	1.657	1
1.67	0.312	2.291	1.678	2	1.645	0.077	3.064	1.657	1
1.67	1.890	1.978	1.668	2	1.623	2.004	0.403	1.650	2
AVERAGE HYDROSTATIC OVERPRESSURES AT SCALED TIME = 1.500 MS									
X-SCAL METERS	Y-SCAL METERS	PRESSURE RATIO	R-SCAL METERS	REGN CODE	X-SCAL METERS	Y-SCAL METERS	PRESSURE RATIO	R-SCAL METERS	REGN CODE
1.50	2.190	1.755	1.578	2	1.704	1.697	2.203	1.704	2
1.64	1.971	1.602	1.578	2	1.697	1.697	3.631	1.704	2
1.64	1.715	1.508	1.543	2	1.692	0.770	3.631	1.704	4
1.67	0.977	1.579	1.591	2	1.712	0.570	3.631	1.712	4
1.67	0.777	1.755	1.612	4	1.596	0.777	3.733	1.706	4
1.67	0.545	1.455	1.574	4	1.638	2.007	0.776	1.676	4
1.67	0.346	2.000	1.590	1	1.643	1.643	1.044	1.661	2
1.67	2.114	1.794	1.702	1	1.653	1.653	1.228	1.661	2
1.67	1.894	1.667	1.702	2	1.691	1.655	1.660	1.660	2

X AND Y LOCATE THE CENTER OF A PLANE QUADRILATERAL WHICH IS A CELL OF A NEIGHBORING SMOKE PUFFS. PRESSURE IS AVERAGED OVER THE AREA OF THE CELL AND IS EXPRESSED AS A RATIO TO THE AMBIENT PRESSURE.

OBSERVED DISTANCE VALUES = R\*0.0718 TIMES SCALED VALUES  
 AND OBSERVED TIME VALUE = R\*3742 TIMES SCALED VALUE.  
 PRESSURE VALUES AS SHOWN ARE INVARIANT UNDER SCALING.

TABLE 9.3

PRESSURE FIELD		DIPOLE WEST/10		WFE/235		SMOKE PUFF GRID 1209		7A770322	
AVERAGE HYDROSTATIC OVERPRESSURES AT SCALED TIME = 2.000 MS									
X-SCAL METERS	Y-SCAL METERS	R-SCAL METERS	PRESSURE RATIO	REGN CODE	X-SCAL METERS	Y-SCAL METERS	R-SCAL METERS	PRESSURE RATIO	REGN CODE
1.640	2.233	0.749	0.852	2	1.854	1.201	1.994	1.347	2
1.640	1.676	0.863	0.812	2	1.579	1.507	1.949	2.190	2
1.640	1.020	0.895	0.749	2	2.012	1.757	2.095	2.190	2
1.640	0.364	0.914	0.665	4	2.357	1.337	2.099	2.332	2
1.640	0.000	0.929	0.665	4	2.091	1.195	2.091	2.332	2
1.640	0.000	0.941	0.665	4	2.087	0.912	2.100	2.332	2
1.640	0.000	0.959	0.665	4	2.068	0.721	2.110	2.332	2
1.640	0.000	1.068	0.665	4	2.043	0.553	2.120	2.332	2
1.640	0.000	1.106	0.665	4	2.016	0.373	2.053	2.332	2
1.640	0.000	1.198	0.665	4	2.008	0.194	2.017	2.332	2
1.640	0.000	1.578	0.665	3	2.009	2.071	2.130	2.332	2

AVERAGE HYDROSTATIC OVERPRESSURES AT SCALED TIME = 2.100 MS									
X-SCAL METERS	Y-SCAL METERS	R-SCAL METERS	PRESSURE RATIO	REGN CODE	X-SCAL METERS	Y-SCAL METERS	R-SCAL METERS	PRESSURE RATIO	REGN CODE
1.640	2.233	0.749	0.852	2	1.854	1.201	1.994	1.347	2
1.640	1.676	0.863	0.812	2	1.579	1.507	1.949	2.190	2
1.640	1.020	0.895	0.749	2	2.012	1.757	2.095	2.190	2
1.640	0.364	0.914	0.665	4	2.357	1.337	2.099	2.332	2
1.640	0.000	0.929	0.665	4	2.091	1.195	2.091	2.332	2
1.640	0.000	0.941	0.665	4	2.087	0.912	2.100	2.332	2
1.640	0.000	0.959	0.665	4	2.068	0.721	2.110	2.332	2
1.640	0.000	1.068	0.665	4	2.043	0.553	2.120	2.332	2
1.640	0.000	1.106	0.665	4	2.016	0.373	2.053	2.332	2
1.640	0.000	1.198	0.665	4	2.008	0.194	2.017	2.332	2
1.640	0.000	1.578	0.665	3	2.009	2.071	2.130	2.332	2

AVERAGE HYDROSTATIC OVERPRESSURES AT SCALED TIME = 2.200 MS									
X-SCAL METERS	Y-SCAL METERS	R-SCAL METERS	PRESSURE RATIO	REGN CODE	X-SCAL METERS	Y-SCAL METERS	R-SCAL METERS	PRESSURE RATIO	REGN CODE
1.640	2.233	0.749	0.852	2	1.854	1.201	1.994	1.347	2
1.640	1.676	0.863	0.812	2	1.579	1.507	1.949	2.190	2
1.640	1.020	0.895	0.749	2	2.012	1.757	2.095	2.190	2
1.640	0.364	0.914	0.665	4	2.357	1.337	2.099	2.332	2
1.640	0.000	0.929	0.665	4	2.091	1.195	2.091	2.332	2
1.640	0.000	0.941	0.665	4	2.087	0.912	2.100	2.332	2
1.640	0.000	0.959	0.665	4	2.068	0.721	2.110	2.332	2
1.640	0.000	1.068	0.665	4	2.043	0.553	2.120	2.332	2
1.640	0.000	1.106	0.665	4	2.016	0.373	2.053	2.332	2
1.640	0.000	1.198	0.665	4	2.008	0.194	2.017	2.332	2
1.640	0.000	1.578	0.665	3	2.009	2.071	2.130	2.332	2

X AND Y LOCATE THE CENTER OF A PLANE QUADRILATERAL WHICH IS A CELL OF A NEIGHBORING SMOKE PUFFS.  
 OVERPRESSURE IS AVERAGED OVER THE AREA OF THE CELL AND IS EXPRESSED AS A RATIO TO THE AMBIENT PRESSURE.  
 OBSERVED DISTANCE VALUES = R\*0.719 TIMES SCALED VALUES  
 AND OBSERVED TIME VALUE = R\*3742 TIMES SCALED VALUE.  
 PRESSURE VALUES AS SHOWN ARE INVARIANT UNDER SCALING.

TABLE 9.4

PRESSURE FIELD		DIPPLE WEST/10		MFS/295		SMOKE RUFF GRID 1209		/A770322	
AVERAGE HYDROSTATIC OVERPRESSURES AT SCALED TIME= 2.500 MS									
X-SCAL METERS	Y-SCAL METERS	PRESSURE RATIO	R-SCAL METERS	REGN CODE	X-SCAL METERS	Y-SCAL METERS	PRESSURE RATIO	R-SCAL METERS	REGN CODE
1.678	2.024	0.439	1.734	2	2.133	2.237	0.654	2.330	4
1.748	2.001	0.521	1.774	2	2.233	2.254	0.913	2.333	4
1.774	1.757	0.572	1.753	2	2.236	2.254	1.173	2.337	4
1.811	0.544	0.243	1.442	4	2.231	2.254	1.674	2.337	4
1.850	0.544	0.243	1.450	1	2.231	2.254	1.674	2.337	4
1.877	2.195	0.566	1.559	2	2.231	2.254	1.674	2.337	4
1.935	1.653	0.400	1.550	2	2.231	2.254	1.674	2.337	4
2.022	0.737	0.532	2.101	4	2.231	2.254	1.674	2.337	4
2.039	0.740	1.194	2.123	4	2.231	2.254	1.674	2.337	4
2.033	0.740	1.069	2.131	4	2.231	2.254	1.674	2.337	4
2.085	2.157	0.605	2.125	2	2.231	2.254	1.674	2.337	4
2.111	1.555	0.927	2.125	5	2.231	2.254	1.674	2.337	4
2.223	1.376	0.385	2.246	4	2.231	2.254	1.674	2.337	4
2.253	1.139	0.562	2.252	4	2.231	2.254	1.674	2.337	4
2.259	0.803	0.425	2.271	4	2.231	2.254	1.674	2.337	4
2.242	0.695	1.055	2.285	4	2.231	2.254	1.674	2.337	4
2.215	0.529	1.021	2.299	4	2.231	2.254	1.674	2.337	4

AVERAGE HYDROSTATIC OVERPRESSURES AT SCALED TIME= 2.600 MS									
X-SCAL METERS	Y-SCAL METERS	PRESSURE RATIO	R-SCAL METERS	REGN CODE	X-SCAL METERS	Y-SCAL METERS	PRESSURE RATIO	R-SCAL METERS	REGN CODE
1.708	2.224	0.419	1.734	2	2.133	2.237	0.654	2.330	4
1.748	2.001	0.521	1.774	2	2.233	2.254	0.913	2.333	4
1.774	1.757	0.572	1.753	2	2.236	2.254	1.173	2.337	4
1.811	0.544	0.243	1.442	4	2.231	2.254	1.674	2.337	4
1.850	0.544	0.243	1.450	1	2.231	2.254	1.674	2.337	4
1.877	2.195	0.566	1.559	2	2.231	2.254	1.674	2.337	4
1.935	1.653	0.400	1.550	2	2.231	2.254	1.674	2.337	4
2.022	0.737	0.532	2.101	4	2.231	2.254	1.674	2.337	4
2.039	0.740	1.194	2.123	4	2.231	2.254	1.674	2.337	4
2.033	0.740	1.069	2.131	4	2.231	2.254	1.674	2.337	4
2.085	2.157	0.605	2.125	2	2.231	2.254	1.674	2.337	4
2.111	1.555	0.927	2.125	5	2.231	2.254	1.674	2.337	4
2.223	1.376	0.385	2.246	4	2.231	2.254	1.674	2.337	4
2.253	1.139	0.562	2.252	4	2.231	2.254	1.674	2.337	4
2.259	0.803	0.425	2.271	4	2.231	2.254	1.674	2.337	4
2.242	0.695	1.055	2.285	4	2.231	2.254	1.674	2.337	4
2.215	0.529	1.021	2.299	4	2.231	2.254	1.674	2.337	4

AVERAGE HYDROSTATIC OVERPRESSURES AT SCALED TIME= 2.600 MS									
X-SCAL METERS	Y-SCAL METERS	PRESSURE RATIO	R-SCAL METERS	REGN CODE	X-SCAL METERS	Y-SCAL METERS	PRESSURE RATIO	R-SCAL METERS	REGN CODE
1.642	2.511	1.165	2.507	3	2.333	2.437	1.654	2.430	4
1.915	2.511	0.977	2.544	3	2.433	2.454	1.913	2.433	4
2.509	2.511	0.580	2.500	2	2.533	2.454	1.654	2.433	4
2.544	2.511	0.333	2.544	2	2.633	2.454	1.654	2.433	4
2.511	2.511	0.207	2.567	3	2.733	2.454	1.654	2.433	4
2.760	2.511	1.881	2.760	5	2.833	2.454	1.654	2.433	4
2.712	2.511	1.704	2.760	5	2.933	2.454	1.654	2.433	4
2.691	2.511	1.531	2.760	5	3.033	2.454	1.654	2.433	4
2.684	2.511	1.359	2.760	5	3.133	2.454	1.654	2.433	4
2.681	2.511	1.155	2.760	5	3.233	2.454	1.654	2.433	4
2.693	2.511	0.976	2.760	5	3.333	2.454	1.654	2.433	4
2.683	2.511	0.602	2.760	5	3.433	2.454	1.654	2.433	4
2.683	2.511	0.204	2.760	5	3.533	2.454	1.654	2.433	4

X AND Y LOCATE THE CENTER OF A PLANE QUADRILATERAL WHICH IS A CELL OF 4 NEIGHBORING SMOKE PUFFS. OVERPRESSURE IS AVERAGED OVER THE AREA OF THE CELL AND IS EXPRESSED AS A RATIO TO THE AMBIENT PRESSURE.

OBSERVED DISTANCE VALUES= R\*0.0718 TIMES SCALED VALUES AND OBSERVED TIME VALUE = R\*3742 TIMES SCALED VALUE. PRESSURE VALUES AS SHOWN ARE INVARIANT UNDER SCALING.



TABLE 9.6

DIPOLE WEST10 WFS/293 SMOKE PUFF GRID 1209 /A770322

AVERAGE HYDROSTATIC OVERPRESSURES AT SCALED TIME = 4.000 MS

X-SCAL METERS	Y-SCAL METERS	PRESSURE RATIO	R-SCAL METERS	REGN CODE	X-SCAL METERS	Y-SCAL METERS	PRESSURE RATIO	R-SCAL METERS	REGN CODE	X-SCAL METERS	Y-SCAL METERS	PRESSURE RATIO	R-SCAL METERS	REGN CODE
1.574	2.327	0.129	2.054	2	2.054	2.054	0.470	2.839	4	3.040	1.632	1.033	3.142	5
1.614	2.042	0.350	1.642	2	1.642	1.642	0.102	2.639	5	3.072	1.545	0.866	3.110	5
1.627	1.796	0.132	2.091	4	2.091	2.091	0.139	2.815	5	3.080	1.550	0.746	3.100	5
1.694	0.674	-0.103	2.001	4	2.001	2.001	0.139	2.815	5	3.104	1.170	0.540	3.115	5
2.057	0.611	0.105	2.078	4	2.078	2.078	0.211	2.800	5	3.114	0.974	0.791	3.110	4
2.057	0.507	0.102	2.117	2	2.117	2.117	0.261	2.804	5	3.091	0.575	0.512	3.114	3
2.004	0.593	0.032	2.303	2	2.303	2.303	0.566	2.813	5	3.090	0.587	0.587	3.114	3
2.004	0.777	0.174	2.233	4	2.233	2.233	0.377	2.878	4	3.090	1.181	1.181	3.114	3
2.004	0.571	0.507	2.280	4	2.280	2.280	1.337	2.801	4	3.172	2.094	1.434	3.226	5
2.010	0.352	0.263	2.238	3	2.238	2.238	1.027	2.994	5	3.203	1.523	1.571	3.226	5
2.009	0.606	0.237	2.308	2	2.308	2.308	1.053	2.964	5	3.225	1.346	1.002	3.226	5
2.009	0.689	0.110	2.498	2	2.498	2.498	0.891	2.964	5	3.225	1.169	1.008	3.226	5
2.011	0.690	0.195	2.521	4	2.521	2.521	0.956	2.961	5	3.228	0.974	1.180	3.226	5
2.017	0.685	0.360	2.462	4	2.462	2.462	0.741	2.965	5	3.209	0.774	1.256	3.226	5
2.017	1.424	0.227	2.633	5	2.633	2.633	0.544	3.085	5	3.205	0.568	1.157	3.226	5
2.000	1.609	0.150	2.612	5	2.612	2.612	0.711	3.025	5	3.197	0.396	1.199	3.226	5
2.027	1.385	0.150	2.627	5	2.627	2.627	1.119	2.966	5					
2.027	0.633	-0.648	2.656	4	2.656	2.656	1.049	3.151	5					

AVERAGE HYDROSTATIC OVERPRESSURES AT SCALED TIME = 4.500 MS

X-SCAL METERS	Y-SCAL METERS	PRESSURE RATIO	R-SCAL METERS	REGN CODE	X-SCAL METERS	Y-SCAL METERS	PRESSURE RATIO	R-SCAL METERS	REGN CODE	X-SCAL METERS	Y-SCAL METERS	PRESSURE RATIO	R-SCAL METERS	REGN CODE
1.574	2.327	0.318	2.093	2	2.093	2.093	-0.002	2.887	5	3.153	1.763	0.583	3.214	5
1.614	2.042	0.261	1.643	4	1.643	1.643	0.070	2.685	5	3.148	1.500	0.650	3.214	5
1.627	1.796	-0.155	2.043	4	2.043	2.043	0.023	2.875	5	3.187	1.365	0.219	3.214	5
1.694	0.674	0.011	2.105	4	2.105	2.105	0.109	2.804	5	3.200	1.172	0.479	3.217	4
2.057	0.611	0.194	2.173	4	2.173	2.173	0.145	2.861	5	3.184	0.975	0.479	3.222	4
2.057	0.507	0.040	2.374	4	2.374	2.374	0.287	2.871	5	3.192	0.575	0.355	3.222	4
2.004	0.593	0.123	2.592	4	2.592	2.592	0.749	2.948	4	3.184	0.370	0.355	3.222	4
2.004	0.777	0.353	2.591	4	2.591	2.591	1.104	2.948	4	3.169	0.172	1.075	3.222	4
2.004	0.571	0.215	2.572	3	2.572	2.572	0.618	3.084	5	3.218	2.119	1.203	3.222	5
2.010	0.352	0.025	2.759	2	2.759	2.759	0.518	3.050	5	3.267	1.942	1.310	3.222	5
2.009	0.606	0.015	2.573	4	2.573	2.573	0.472	3.065	5	3.269	1.744	0.419	3.222	5
2.009	0.689	0.211	2.573	4	2.573	2.573	0.747	3.033	5	3.267	1.532	0.621	3.222	5
2.011	0.690	0.522	2.625	2	2.625	2.625	0.432	3.024	5	3.305	1.354	0.611	3.222	5
2.017	1.424	0.150	2.648	5	2.648	2.648	0.475	3.034	5	3.325	0.990	0.773	3.222	5
2.017	0.685	0.014	2.670	5	2.670	2.670	0.311	3.056	5	3.329	0.776	0.731	3.222	5
2.000	1.609	0.014	2.683	5	2.683	2.683	1.205	3.105	5	3.311	0.564	0.837	3.222	5
2.027	1.385	-0.151	2.683	5	2.683	2.683	1.215	3.083	5	3.309	0.384	1.091	3.222	5
2.027	0.633	0.364	2.711	4	2.711	2.711	0.941	3.053	5	3.310	0.182	1.132	3.222	5
2.027	0.715	0.524	2.742	4	2.742	2.742	0.740	3.227	5					

X AND Y LOCATE THE CENTER OF A PLANE QUADRILATERAL WHICH IS A CELL OF A NEIGHBORING SMOKE PUFFS. OVERPRESSURE IS AVERAGED OVER THE AREA OF THE CELL AND IS EXPRESSED AS A RATIO TO THE AMBIENT PRESSURE. OBSERVED DISTANCE VALUE = R\*0.718 TIMES SCALED VALUE. AND CPSEVED TIME VALUE = R\*3742 TIMES SCALED VALUE. PRESSURE VALUES AS SHOWN ARE INVARIANT UNDER SCALING.

TABLE 9.7

PRESSURE FIELD DIPOLE WEST/10 WFS/295 SMOKE PUFF GRID 1209 /A770322

AVERAGE HYDROSTATIC OVERPRESSURES AT SCALED TIME = 5.000 MS

X-SCAL METERS	Y-SCAL METERS	PRESSURE RATIO	R-SCAL METERS	REGN CODE	X-SCAL METERS	Y-SCAL METERS	PRESSURE RATIO	R-SCAL METERS	REGN CODE	X-SCAL METERS	Y-SCAL METERS	PRESSURE RATIO	R-SCAL METERS	REGN CODE
2.004	2.050	0.206	2.071	2	2.079	2.076	0.400	2.097	4	3.131	2.171	0.176	3.207	5
2.010	1.803	0.180	2.021	2	2.026	2.020	-0.046	2.032	4	3.131	2.171	0.176	3.207	5
2.019	1.851	0.202	2.027	2	2.032	2.026	0.036	2.038	4	3.131	2.171	0.176	3.207	5
2.049	0.644	-0.042	2.017	4	2.021	2.014	-0.034	2.026	5	3.220	1.874	0.570	3.227	5
2.191	2.004	-0.107	2.011	2	2.016	2.014	0.057	2.014	5	3.220	1.874	0.570	3.227	5
2.339	0.605	0.035	2.008	4	2.015	2.015	0.077	2.014	5	3.263	1.179	0.033	3.269	5
2.466	0.601	0.062	2.008	4	2.015	2.015	0.474	2.015	5	3.263	1.179	0.033	3.269	5
2.537	0.601	0.291	2.007	4	2.015	2.015	0.512	2.015	5	3.263	1.179	0.033	3.269	5
2.538	2.251	-0.194	2.007	2	2.015	2.015	1.012	2.015	5	3.263	1.179	0.033	3.269	5
2.552	0.505	0.210	2.007	2	2.015	2.015	0.426	2.015	5	3.263	1.179	0.033	3.269	5
2.572	0.702	0.026	2.007	4	2.015	2.015	0.376	2.015	5	3.263	1.179	0.033	3.269	5
2.622	2.026	0.191	2.006	4	2.015	2.015	0.571	2.015	5	3.354	1.856	0.110	3.432	3
2.644	1.859	0.336	2.006	4	2.015	2.015	0.571	2.015	5	3.354	1.856	0.110	3.432	3
2.652	1.859	0.140	2.006	2	2.015	2.015	0.325	2.015	5	3.377	1.183	0.089	3.439	5
2.652	1.859	0.140	2.006	5	2.015	2.015	0.325	2.015	5	3.398	1.183	0.089	3.439	5
2.652	1.859	0.003	2.006	5	2.015	2.015	0.325	2.015	5	3.409	0.994	0.432	3.442	4
2.712	1.402	-0.106	2.006	5	2.015	2.015	0.402	2.015	5	3.409	0.994	0.432	3.442	4
2.735	1.171	-0.160	2.006	5	2.015	2.015	0.376	2.015	5	3.394	0.732	0.302	3.442	4
2.752	0.947	0.310	2.006	4	2.015	2.015	0.832	2.015	5	3.351	0.568	0.151	3.442	3

AVERAGE HYDROSTATIC OVERPRESSURES AT SCALED TIME = 5.500 MS

X-SCAL METERS	Y-SCAL METERS	PRESSURE RATIO	R-SCAL METERS	REGN CODE	X-SCAL METERS	Y-SCAL METERS	PRESSURE RATIO	R-SCAL METERS	REGN CODE	X-SCAL METERS	Y-SCAL METERS	PRESSURE RATIO	R-SCAL METERS	REGN CODE
2.031	2.069	0.079	2.062	2	2.070	2.070	0.239	2.082	4	3.176	2.198	0.355	3.344	5
2.048	1.815	0.009	2.051	2	2.080	2.075	0.293	2.082	4	3.176	2.198	0.355	3.344	5
2.079	0.655	-0.053	2.049	4	2.076	2.076	-0.001	2.076	4	3.220	1.874	0.456	3.344	5
2.173	2.203	-0.097	2.041	4	2.071	2.071	-0.031	2.071	4	3.220	1.874	0.456	3.344	5
2.270	2.019	0.173	2.040	2	2.071	2.071	-0.071	2.071	4	3.220	1.874	0.456	3.344	5
2.325	0.935	-0.169	2.040	2	2.071	2.071	0.019	2.071	4	3.220	1.874	0.456	3.344	5
2.325	0.935	-0.094	2.040	4	2.071	2.071	0.041	2.071	4	3.220	1.874	0.456	3.344	5
2.325	0.935	-0.012	2.040	4	2.071	2.071	0.430	2.071	4	3.220	1.874	0.456	3.344	5
2.324	0.611	0.223	2.035	4	2.064	2.064	0.572	2.064	4	3.323	2.622	0.121	3.500	4
2.374	2.264	0.205	2.031	3	2.051	2.051	0.519	2.051	4	3.323	2.622	0.121	3.500	4
2.424	2.050	-0.047	2.042	2	2.051	2.051	1.052	2.051	4	3.323	2.622	0.121	3.500	4
2.424	2.050	-0.047	2.042	5	2.051	2.051	1.052	2.051	4	3.323	2.622	0.121	3.500	4
2.511	0.712	0.120	2.038	4	2.036	2.036	0.447	2.036	4	3.400	1.677	0.268	3.468	3
2.511	0.712	0.495	2.038	4	2.036	2.036	0.354	2.036	5	3.400	1.677	0.268	3.468	3
2.612	2.041	0.741	2.044	2	2.077	2.077	0.529	2.077	5	3.475	1.192	0.164	3.468	3
2.623	1.876	0.109	2.044	5	2.077	2.077	0.331	2.077	5	3.475	1.192	0.164	3.468	3
2.623	1.876	-0.052	2.044	5	2.077	2.077	0.471	2.077	5	3.475	1.192	0.164	3.468	3
2.623	1.876	-0.122	2.044	5	2.077	2.077	0.331	2.077	5	3.475	1.192	0.164	3.468	3
2.623	1.876	-0.147	2.044	5	2.077	2.077	0.159	2.077	5	3.475	1.192	0.164	3.468	3
2.623	1.876	-0.147	2.044	5	2.077	2.077	0.159	2.077	5	3.475	1.192	0.164	3.468	3

X AND Y LOCATE THE CENTER OF A PLANE QUADRILATERAL WHICH IS A CELL OF A NEIGHBOURING SMOKE PUFFS.  
 OVERPRESSURE IS AVERAGED OVER THE AREA OF THE CELL AND IS EXPRESSED AS A RATIO TO THE AMBIENT PRESSURE.  
 OBSERVED DISTANCE VALUES = 0.0714 TIMES SCALED VALUES  
 AND OBSERVED TIME VALUES = 0.3742 TIMES SCALED VALUES  
 PRESSURE VALUES AS SHOWN ARE INVARIANT UNDER SCALING.

TABLE 9.8

7A770322

SMOKE PUFF GRID 1209

DIPOLE WEST/10 W5/295

PRESSURE FIELD

AVERAGE HYDROSTATIC OVERPRESSURES AT SCALED TIME = 6.000 MS

X-SCAL METERS	Y-SCAL METERS	PRESSURE RATIO	R-SCAL METERS	REGN CODE	X-SCAL METERS	Y-SCAL METERS	PRESSURE RATIO	R-SCAL METERS	REGN CODE	X-SCAL METERS	Y-SCAL METERS	PRESSURE RATIO	R-SCAL METERS	REGN CODE
2.045	2.080	-0.103	2.079	2	2.072	0.742	0.215	0.970	4	3.270	2.003	0.400	3.383	5
2.065	1.928	0.031	2.069	2	2.072	2.072	0.041	0.017	5	3.301	1.814	0.280	3.469	5
2.082	0.935	-0.305	2.092	4	2.072	3.073	-0.133	0.017	5	3.296	1.603	0.387	3.428	5
2.095	0.453	-0.456	2.102	4	2.072	1.673	-0.102	0.014	5	3.315	1.400	0.300	3.325	5
2.250	0.032	-0.529	2.256	2	2.072	1.643	-0.022	0.004	5	3.342	1.205	0.310	3.342	4
2.450	0.943	-0.620	2.458	4	3.003	1.431	0.432	0.004	5	3.356	1.003	0.186	3.356	4
2.482	0.422	-0.680	2.484	4	3.003	1.215	0.425	0.013	5	3.373	0.818	0.303	3.373	4
2.705	0.456	0.032	2.711	4	3.003	1.003	0.078	0.014	4	3.380	0.608	0.448	3.380	4
2.901	0.930	-0.072	2.907	3	3.093	0.793	1.073	0.014	4	3.374	2.178	0.651	3.374	5
2.934	2.074	-0.076	2.940	4	3.093	0.578	1.042	0.014	4	3.421	1.995	0.606	3.421	5
2.945	0.715	-0.143	2.951	5	3.093	0.348	0.446	0.093	5	3.450	1.793	-0.005	3.450	5
2.974	0.258	-0.001	2.979	4	3.077	2.046	0.444	0.226	5	3.483	1.590	0.065	3.483	5
2.985	0.915	0.515	2.990	4	3.114	1.841	0.308	0.197	5	3.480	1.392	0.089	3.480	5
2.997	2.064	0.330	2.999	4	3.159	1.630	0.479	0.184	5	3.500	1.201	0.298	3.500	5
2.999	0.901	-0.119	3.001	5	3.159	1.420	0.297	0.170	5	3.513	1.011	0.298	3.513	4
2.703	1.872	-0.119	2.934	5	3.170	1.205	0.519	0.170	5	3.524	0.804	0.265	3.524	4
2.753	1.872	-0.093	2.921	5	3.172	1.002	0.413	0.175	5	3.521	0.589	0.232	3.521	4
2.824	1.894	-0.134	2.825	5	3.140	0.795	0.069	0.195	4	3.516	0.398	-0.011	3.516	5
2.824	0.874	0.119	2.844	4	3.215	2.205	0.229	0.264	4	3.516	0.398	-0.011	3.516	5

AVERAGE HYDROSTATIC OVERPRESSURES AT SCALED TIME = 6.500 MS

X-SCAL METERS	Y-SCAL METERS	PRESSURE RATIO	R-SCAL METERS	REGN CODE	X-SCAL METERS	Y-SCAL METERS	PRESSURE RATIO	R-SCAL METERS	REGN CODE	X-SCAL METERS	Y-SCAL METERS	PRESSURE RATIO	R-SCAL METERS	REGN CODE
2.063	2.092	-0.141	2.098	2	2.073	0.744	0.112	2.000	4	3.263	2.025	0.375	3.440	4
2.073	1.878	-0.014	2.077	2	2.072	2.055	-0.050	2.030	4	3.263	1.825	0.375	3.440	4
2.076	0.643	-0.344	2.095	4	2.070	1.884	-0.242	2.051	5	3.310	1.628	0.377	3.470	4
2.091	0.449	-0.220	2.141	4	2.068	1.684	-0.146	2.050	5	3.330	1.411	0.376	3.470	4
2.093	2.064	-0.205	2.297	4	3.010	1.640	-0.059	3.055	5	3.352	1.210	0.375	3.492	4
2.095	0.959	-0.326	2.446	4	3.027	1.442	-0.049	3.042	5	3.381	1.019	0.375	3.492	4
2.097	0.419	-0.153	2.353	4	3.038	1.230	0.282	3.040	5	3.398	0.810	0.375	3.492	4
2.102	0.605	0.146	2.364	4	3.044	1.018	0.229	3.051	5	3.416	0.619	0.375	3.492	4
2.102	0.439	0.000	2.334	3	3.022	0.798	0.605	3.045	4	3.420	0.410	0.375	3.492	4
2.102	0.075	0.052	2.651	5	3.092	2.601	1.137	3.045	4	3.420	0.210	0.375	3.492	4
2.102	0.446	-0.027	2.694	4	3.092	2.264	0.452	3.125	4	3.472	2.071	0.375	3.492	4
2.102	0.115	-0.114	2.669	4	3.065	2.064	0.312	3.125	5	3.472	1.871	-0.072	3.492	4
2.113	2.239	0.451	2.666	2	3.119	1.850	0.232	3.125	5	3.467	1.680	0.375	3.492	4
2.113	0.062	0.503	2.830	5	3.187	1.646	0.421	3.027	5	3.467	1.480	0.375	3.492	4
2.123	2.755	0.451	2.845	5	3.198	1.431	0.344	3.027	5	3.479	1.282	0.375	3.492	4
2.120	1.684	-0.173	2.873	5	3.213	1.222	0.501	3.014	5	3.479	1.081	0.375	3.492	4
2.134	1.444	-0.077	2.854	5	3.215	1.018	0.351	3.014	5	3.570	0.811	0.375	3.492	4
2.134	0.205	-0.170	2.855	5	3.220	0.803	-0.014	3.037	5	3.560	0.619	0.375	3.492	4
2.137	0.693	0.051	2.875	4	3.261	0.639	0.237	3.037	4	3.560	0.423	0.375	3.492	4

X AND Y LOCATE THE CENTER OF A PLANE QUADRILATERAL WHICH IS A CELL OF 4 NEIGHBORING SMOKE PUFFS.  
 OVERPRESSURE IS AVERAGED OVER THE AREA OF THE CELL AND IS EXPRESSED AS A RATIO TO THE AMBIENT PRESSURE.  
 OBSERVED DISTANCE VALUE = 8.0718 TIMES SCALED VALUE  
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