U.S. DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY

An album of three-dimensional transient electromagnetic responses for the central-induction loop configuration

by

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Open-File Report 85-745

1985

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CONTENTS

ABSTRACT..... 2
INTRODUCTION..... 3
SCOPE and USE of ALBUM..... 4
ACKNOWLEDGMENTS..... 5
REFERENCES..... 5

Appendix -- An album of 3-D TEM responses for CI-loops.. 6
Format of each model presented..... 6
Model classification by groups..... 7
Album model plots and response curves..... 9

ABSTRACT

A small album of computed three-dimensional (3-D) transient electromagnetic (TEM) response curves for a central loop configuration is presented for various 3-D bodies embedded in a one-dimensional (1-D) layered earth. The 3-D TEM results are plotted for each model along with the 1-D layered earth TEM responses for comparison purposes. The 1-D curves show the TEM response of a layered earth without the 3-D body present.

No attempt is made (nor implied) by the authors that the class of models chosen are generally typical or complete in the range of parameters selected. Indeed, the primary intent of this first album is to provide a collection of simple 3-D/1-D TEM curves that show the basic behavior patterns that could be expected in some geothermal and mineral field measurements.

It is beyond the scope of this report to discuss detailed 1-D inverse interpretations applied to 3-D TEM soundings. However, we note that some of the 3-D curves in this collection would yield erroneous or misleading 1-D interpretations if applied as actual observed data. Conversely, 1-D inversions of many of the 3-D curves in this album may yield valid and important results for some of the model parameters. Clearly, additional work needs to be done to further study the bias of 1-D TEM inversions over 3-D structures.

INTRODUCTION

The location of geothermal, mineral, and petroleum resource targets in the earth is often established with surface geophysical techniques. One example is the use of transient electromagnetic (TEM) methods. Many geophysical instrumentation systems can now routinely measure time-domain (or transient) response curves using a variety of controlled source electromagnetic (EM) configurations (e.g., grounded wire and loop, loop-loop, coincident loop, and the popular central-induction loop). However, the mathematical and physical models that are commonly used generally assume a one-dimensional (1-D) layered earth. In many localized environments, the assumption of a 1-D layered earth model may be sufficient. However, in cases where one suspects the presence of 2-D or 3-D structures, non 1-D models are rarely used. This is mainly due to the numerical complexity of the general 3-D body/source problem, but is also due to the common unavailability of supercomputers to perform the large amounts of computations required.

Until recently, very little has been published concerning 3-D transient responses for controlled source EM systems. Previous work has centered on 3-D bodies in a half-space and in free-space; e.g., see SanFilipo et al. (1985), SanFilipo and Hohmann (1985), and Annan (1974). Lee (1981) gave a solution for the TEM response of a sphere in a layered medium. A general solution for the TEM response of an arbitrary 3-D body in a layered earth for any 3-D controlled source has been developed by Newman et al. (1986), and installed on the USGS VAX-11/780 system. This new program uses an integral equation formulation to solve for the frequency-domain response. The frequency response is then Fourier transformed to the time-domain via linear digital filtering methods developed by Anderson (1975). The reader is referred to Newman et al. (1986) for further details on this new 3-D modeling procedure, which was used to produce all 3-D TEM curves in this album.

The purpose of this report is to provide a first album of 3-D and 1-D transient response curves for central-induction source loops at the surface over a small collection of 3-D body structures in a layered host. The 1-D curves are the TEM responses of a layered earth without the body present. An ideal transmitter step current (on-off) waveform is assumed for all transient calculations presented. Our study is restricted to confined 3-D structures in 1- to 4-layered earths, and for a moderate conductivity constrast between the body and its host layer. A conductivity constrast of less than 300:1 is presently required due to a limitation of the 3-D TEM program by Newman et al. (1986). Models with 3-D bodies near the surface are also avoided, which if attempted would require an extreme amount of computer resources (CPU time and storage). Therefore, the choice of models presented in this report is large geothermal-type targets in moderately shallow to deep locations. A few

mineral-type shallow targets are also included, primarily to study the effect of the overburden and various layering on the responses. A square transmitter loop of 1200 m on a side was fixed for all geothermal models to aid in global comparisons between models. The shallow mineral models used a fixed loop of 100 m on a side.

The Appendix contains all 3-D/1-D model TEM results in graphical form. Voltage and apparent resistivity curves are displayed along with body cross- and plan-views. The method used to compute apparent resistivity from voltage curves was taken from Raab and Frischknecht (1983), which gives an approximation applicable to the entire time range (early, intermediate, and late times). A classification of the models that fall in a particular group or sub-group is also listed in the Appendix to aid in a comparison study.

SCOPE and USE of ALBUM

The scope of this first album in intended as a preliminary survey of some typical 3-D and 1-D TEM response curves for comparison purposes of mostly geothermal-type targets; e.g., a very large conductive (or resistive) body is placed in various positions in a layered earth for various sets of body (or layer) conductivities and layer thicknesses. It has been noted that many of the 3-D apparent resistivity curves in the Appendix are similar to some actual field data observed (e.g., see Anderson et al., 1983, p. 21 and 27), which could not be completely fit with a 1-D layered earth model. This implies that nearby or lateral 3-D boundaries could cause a strong effect in the central-loop data, thereby creating difficulty in obtaining 1-D geoelectric inverse solutions. Conversely, a weaker 3-D effect many not actually create problems with 1-D inversions, but nevertheless, it could produce erroneous or misleading interpretations. Other cases, however, can be found (Newman and Hohmann, 1985) where 1-D interpretations yield useful information about the geoelectric section, such as the depth of the 3-D body and the surrounding layered earth parameters. Obviously, a more complete study will be required in order to make a more definitive statement on the influence of 3-D geometry on TEM data interpreted with 1-D models.

This album is given without a detailed analysis or discussion of the results summarized in the Appendix. It may be used for a general comparison of type-curves observed in 1-D and 3-D EM modeling. We recognize that it is virtually impossible to provide a detailed and rigorous set of models because of the large number of combinations of parameters possible. No attempt is made for completeness in the models and range of parameters selected.

ACKNOWLEDGMENTS

We are indebted to Gerald Hohmann (University of Utah) and Frank Frischknecht (USGS) for making the necessary arrangements so that the author's could jointly develop this report.

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Appendix -- An album of 3-D TEM responses for CI-loops

Format of each model presented

Each model is identified by 3-characters within brackets; e.g., [G1A]. The first letter means "type of model" (e.g., G for geothermal, M for mineral, etc.). The number identifies the layers in the host, and the last letter is a variation or sub-model suffix. Thus [G1A], [G1B], and [G1C] denotes geothermal-type models in a half-space with certain parameters varied. Models [G3A],...,[G3D] are also geothermal-types in a 3-layer host, etc.

Each individual model is displayed first in cross- and plan-view, showing the distances and resistivities used. Additionally, the body rectangular cell center points (Newman et al., 1986) are plotted to show the discretization used in the first quadrant (X>0, Y>0), and in the X,Z-plane; by symmetry, the remaining quadrants have the same cell discretization (but are not plotted). This is followed by 3-D and 1-D curves at certain central-induction (CI) loop locations, as indicated by an "X" in the plan-view diagram. Both apparent resistivity (Raab and Frischknecht, 1983) and voltage curves are given for all [G**] models at each CI-loop site in left-to-right station order (i.e., at X=-2200, -1000, 600, and 1800); note that the 3-D responses should be strongest at station 600 (nearest body center), and weakest at station -2200 (farthest from a body edge). A northwest-southeast station order was chosen for all [M**] models, where the receiver coordinates are listed in each plot legend.

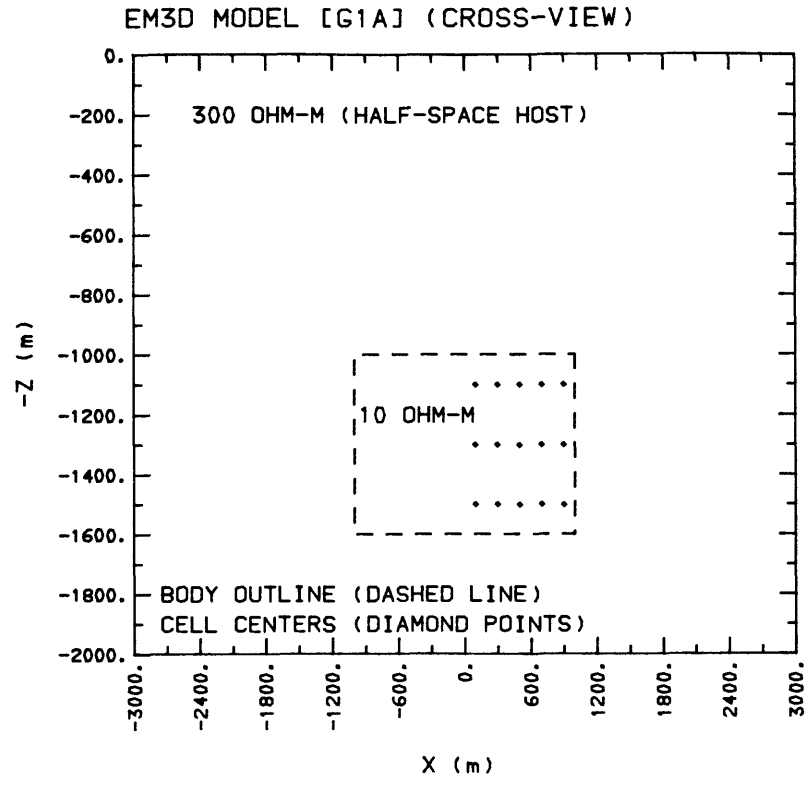
It should be noted that many of the transient responses would have a noticable ripple or error at late time if plotted directly from the output of Newman et al.'s (1986) program; for example, see the plots for model [G1A], marked "uncorrected". This is a result of the 3-D program frequency-domain computation and digital filter accuracy on a 32-bit VAX machine. To overcome late time errors in most of the remaining plots (including [G1A]), we used an asymptotic approximation (Kaufman and Keller, 1983) to smooth both 3-D and 1-D curves. The asymptotic approximation is applied as a 1-D correction whenever both the uncorrected 3-D and 1-D soundings appear noisy but should converge at late time; this adjustment can be noted in the plots whenever both 1-D and 3-D curves exactly coincide at late time in the final plots. However, the early time responses have not been adjusted, where, again, both 1-D and 3-D response curves should exactly join at early times.

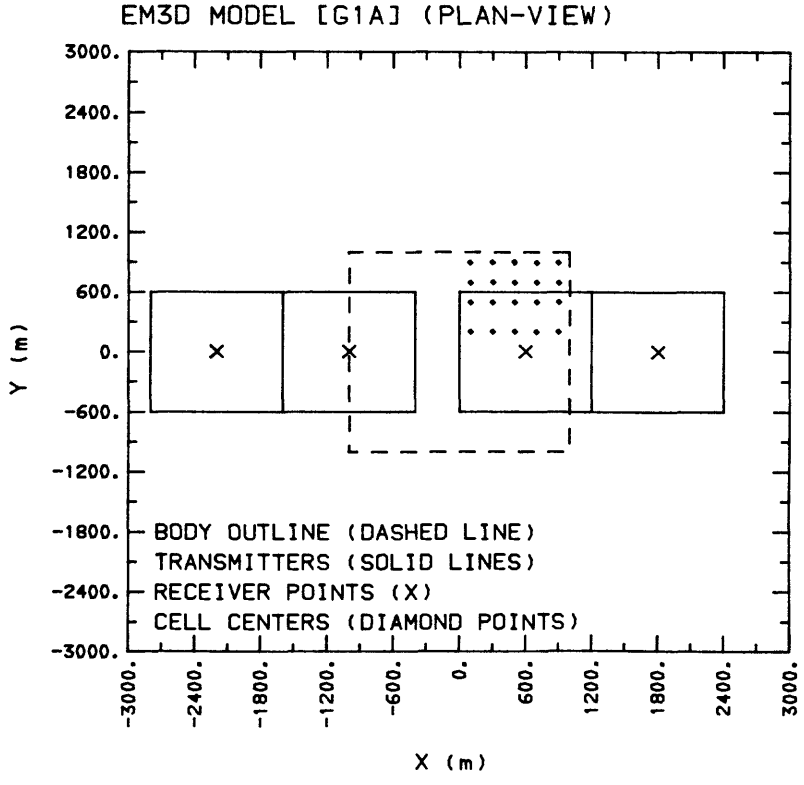
Model classification by groups

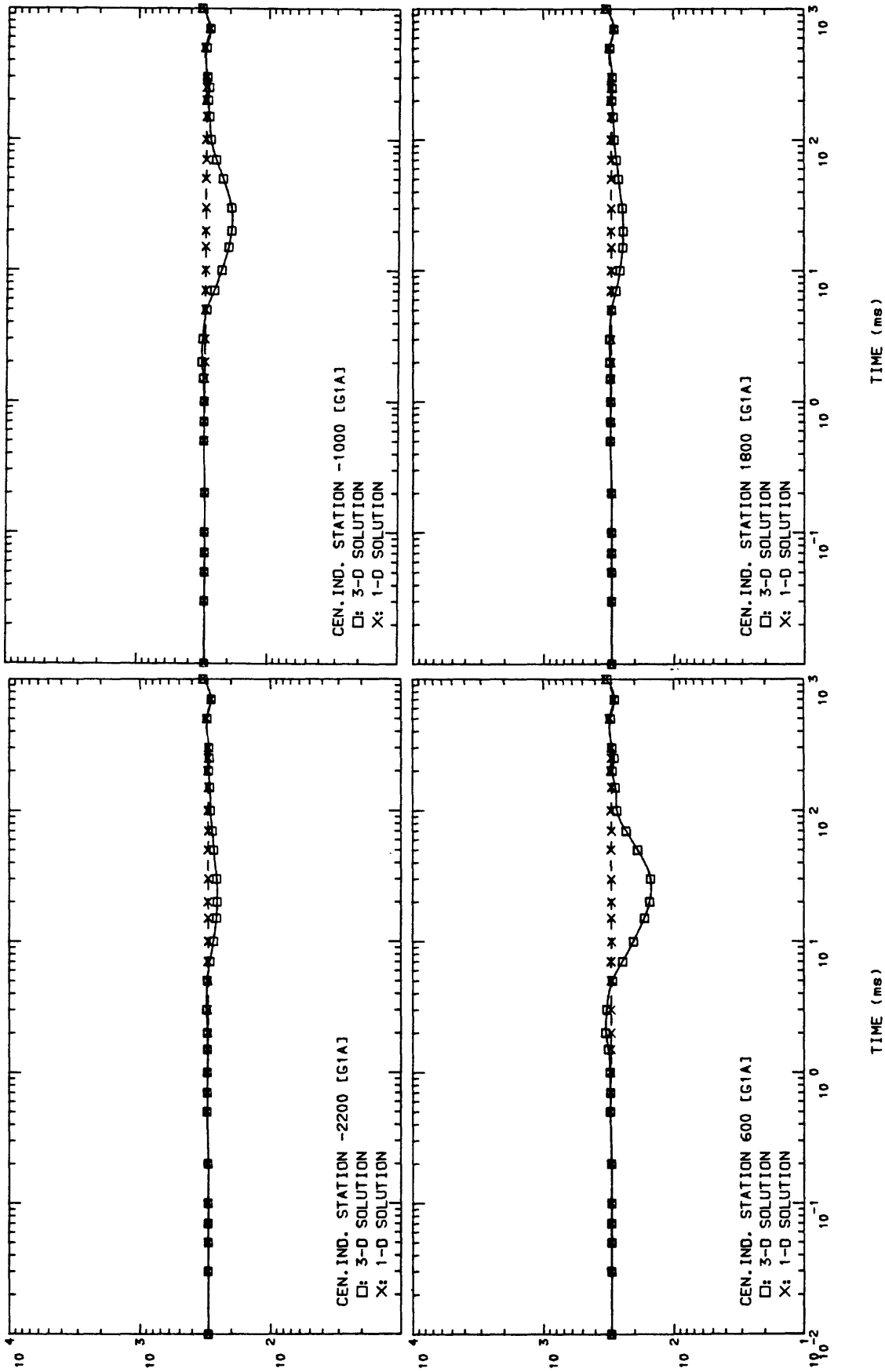
The following table lists the basic attributes of each model in sorted order by model identification. Included in the first table is a column giving the group number(s) that each model can be approximately classified under. A group number is assigned to a set of models that have similar characteristics or have an interesting comparison between response curves. Only a few obvious groups have been identified, where more complicated comparisons have been purposely avoided. Layer resistivities are denoted RHO1, RHO2, RHO3, RHO4 (in ohm-m), and thicknesses H1, H2, H3 (m); the depth (m) to the body from the surface is also given along with the body resistivity (ohm-m). A second table lists all group numbers in ascending order, and gives a cross-reference to the model identifiers in the first table.

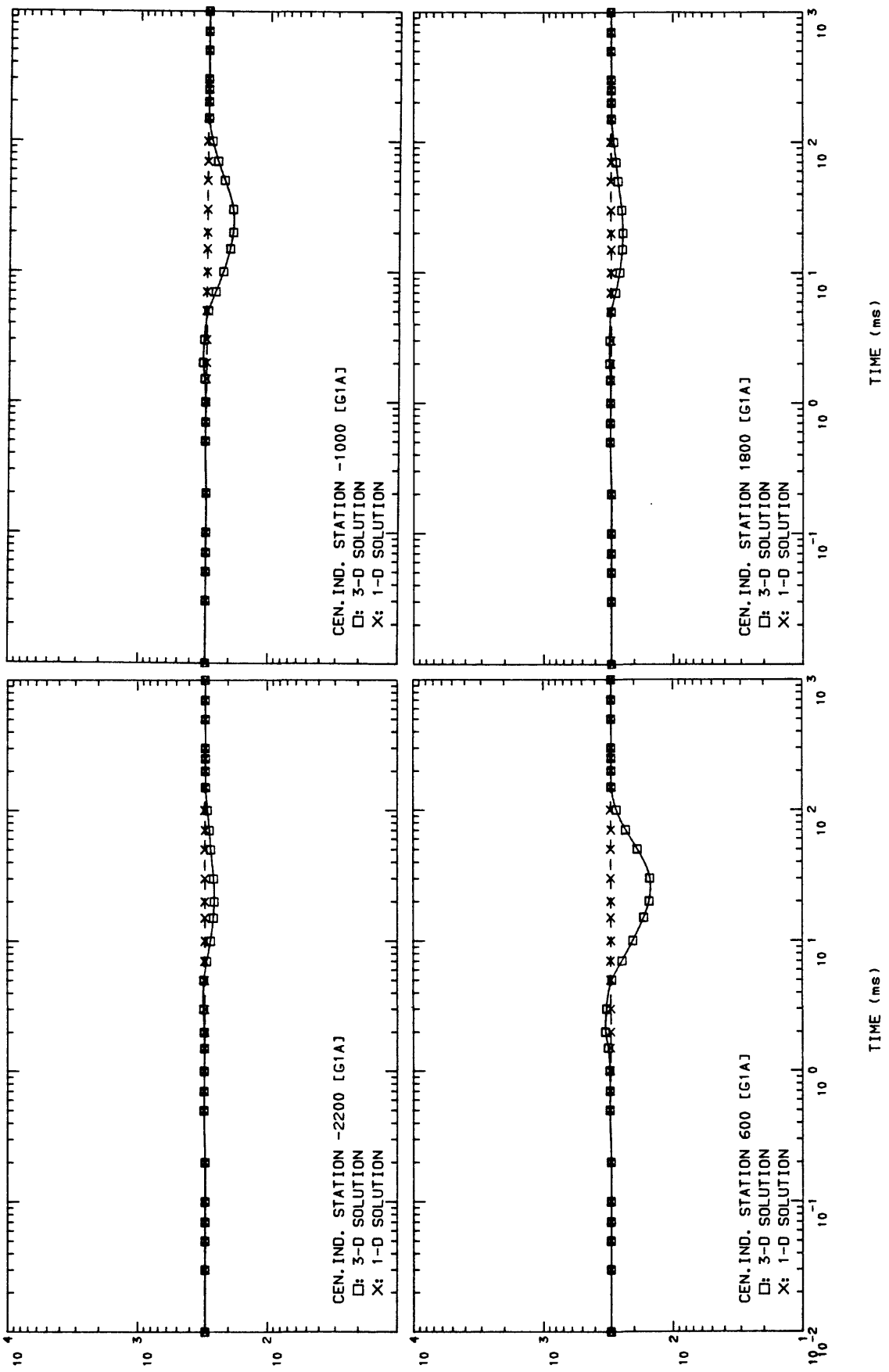
MODEL	BODY-DEPTH	BODY-RHO	1-D LAYER HOST RHO1 (H1)	RHO2 (H2)	RHO3 (H3)	RHO4	GROUP NUMBER(S)
[G1A]	1000	10	300				1
[G1B]	500	10	300				1,2
[G1C]	500	100	300				2
[G2A]	1000	10	1000 (500)	300			3,4,7
[G2B]	1000	10	1000 (500)	100			4
[G2C]	1000	10	100 (200)	300			5
[G2D]	500	10	1000 (500)	300			3,6,11,12
[G2E]	500	10	300(1100)	1000			6
[G2F]	1000	2	1000 (500)	300			3,5,7,10
[G2G]	500	1000	1000 (500)	10			8,9
[G2H]	500	300	300 (500)	10			9
[G2I]	500	300	1000 (500)	100			8,9
[G2J]	500	10	1000 (500)	100			12
[G2K]	1000	2	5000 (500)	300			10
[G2L]	500	10	1000 (500)	30			11
[G2M]	1000	2	100 (200)	300			5
[G2N]	1000	2	1000 (200)	300			5
[G2O]	500	1000	1000 (500)	100			8
[G2P]	500	1000	1000 (500)	300			8
[G3A]	500	3	1000 (500)	30 (600)	3000		13
[G3B]	500	3	1000 (500)	30 (600)	300		13
[G3C]	500	3	1000 (500)	30 (600)	30		13
[G3D]	500	3	1000 (500)	30 (600)	3		13
[M2A]	100	10	1000 (100)	100			14
[M2B]	100	10	300 (100)	100			14,15
[M3A]	100	10	300 (75)	50 (25)	100		15
[M4A]	100	10	3000 (50)	50 (25)	300 (25)	100	15

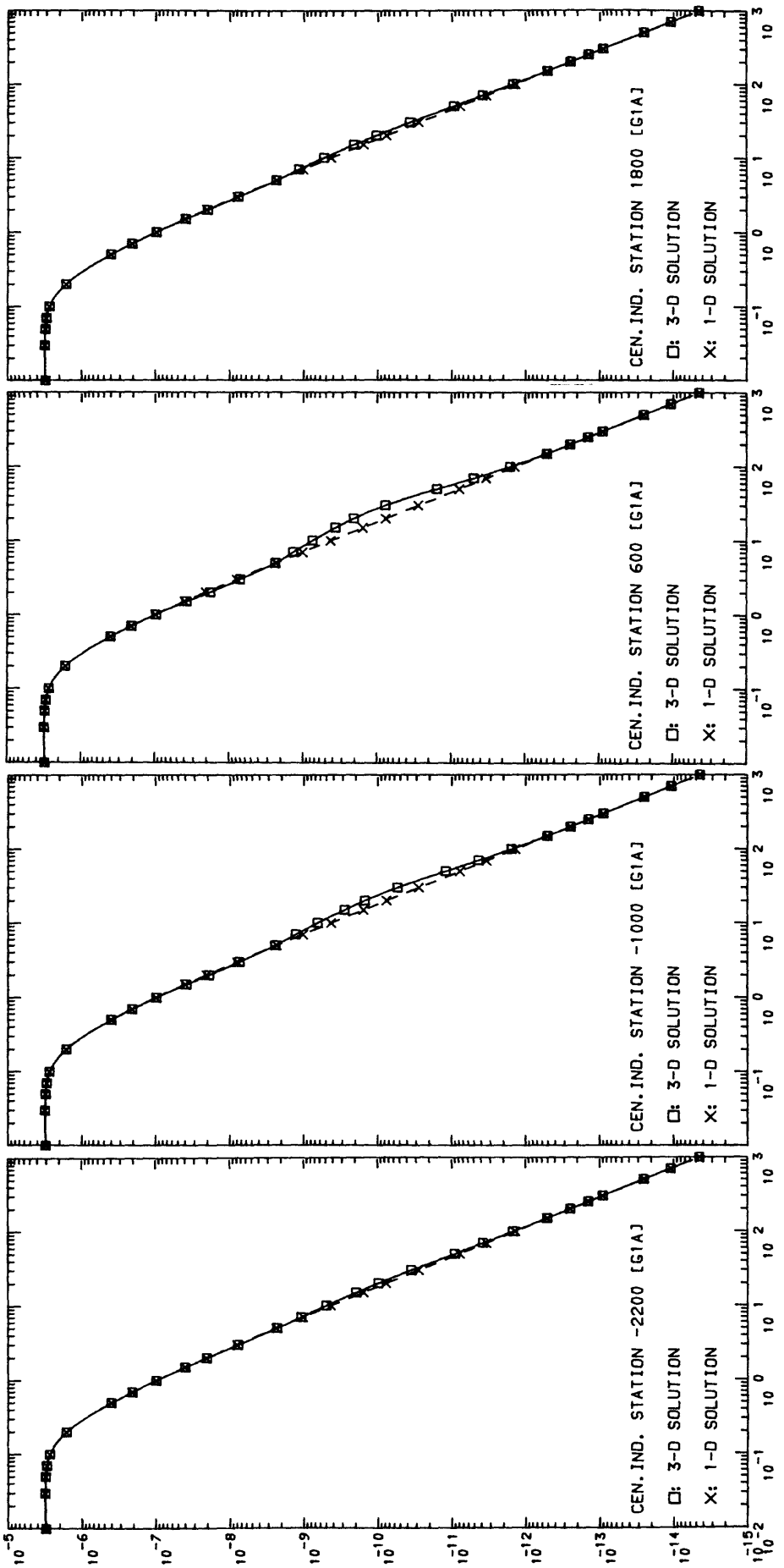
GROUP	MODEL(S)
1	[G1A],[G1B]
2	[G1B],[G1C]
3	[G2A],[G2D],[G2F]
4	[G2A],[G2B]
5	[G2C],[G2F],[G2M],[G2N]
6	[G2D],[G2E]
7	[G2A],[G2F]
8	[G2G],[G2I],[G2O],[G2P]
9	[G2G],[G2H],[G2I]
10	[G2F],[G2K]
11	[G2D],[G2L]
12	[G2D],[G2J]
13	[G3A],[G3B],[G3C],[G3D]
14	[M2A],[M2B]
15	[M2B],[M3A],[M4A]


EM3D MODEL [G1A] (CROSS-VIEW)
300 OHM-M (HALF-SPACE HOST)
10 OHM-M
BODY OUTLINE (DASHED LINE)
CELL CENTERS (DIAMOND POINTS)
-Z (m)
X (m)
0.
-200.
-400.
-600.
-800.
-1000.
-1200.
-1400.
-1600.
-1800.
-2000.
-3000.
-2400.
-1800.
-1200.
-600.
600.
1200.
1800.
2400.
3000.

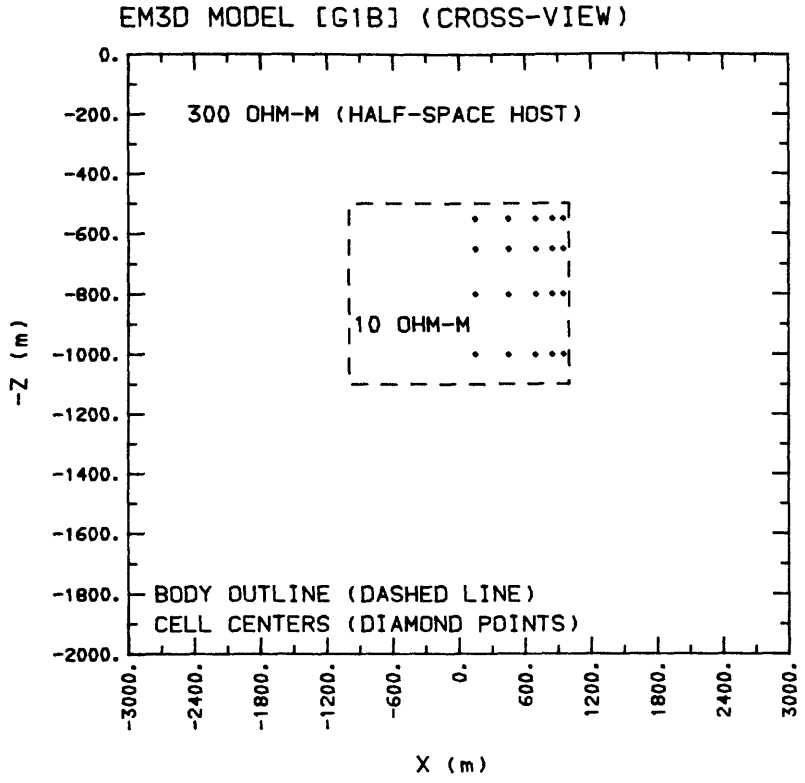

EM3D MODEL [G1A] (PLAN-VIEW)
BODY OUTLINE (DASHED LINE)
TRANSMITTERS (SOLID LINES)
RECEIVER POINTS (X)
CELL CENTERS (DIAMOND POINTS)
Y (m)
X (m)
3000.
2400.
1800.
1200.
600.
0.
-600.
-1200.
-1800.
-2400.
-3000.

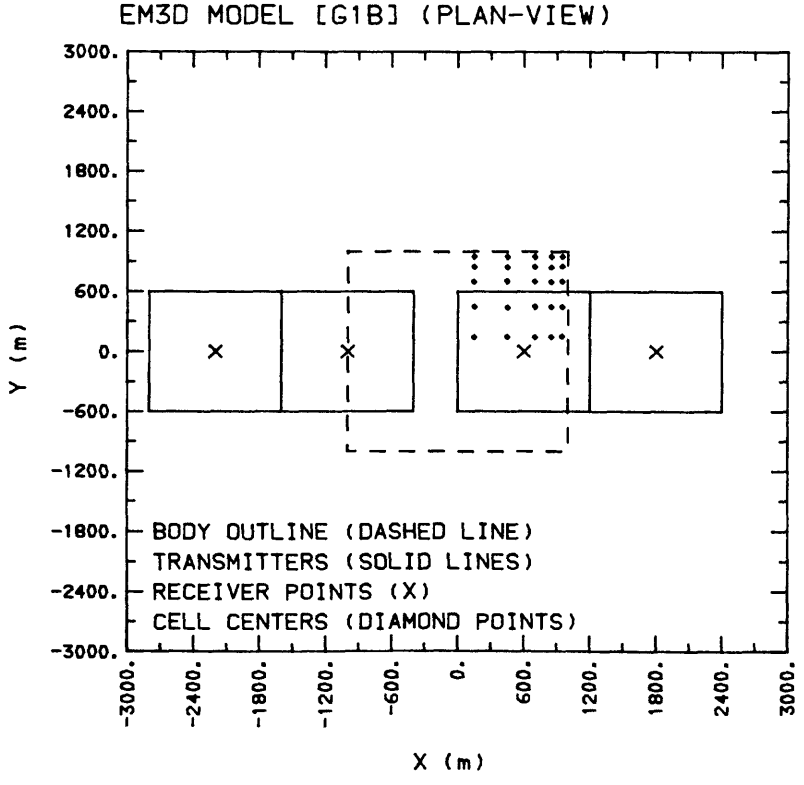

EM3D MODEL [G1A] -- uncorrected
CEN.IND. STATION -1000 [G1A]
□: 3-D SOLUTION
X: 1-D SOLUTION
CEN.IND. STATION 1800 [G1A]
□: 3-D SOLUTION
X: 1-D SOLUTION
CEN.IND. STATION -2200 [G1A]
□: 3-D SOLUTION
X: 1-D SOLUTION
CEN.IND. STATION 600 [G1A]
□: 3-D SOLUTION
X: 1-D SOLUTION
APPARENT RESISTIVITY (ohm-m)
TIME (ms)

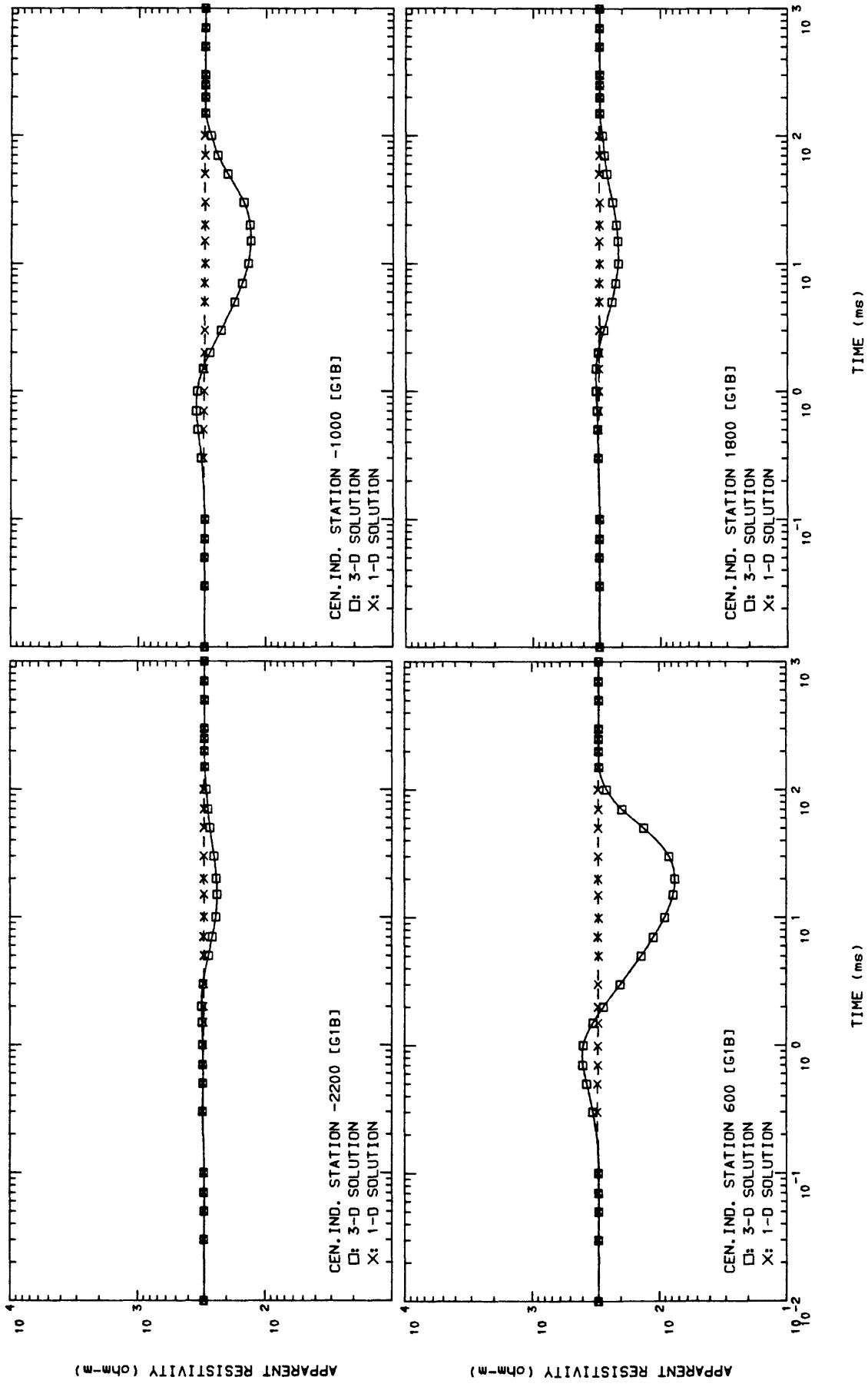

EM3D MODEL [G1A]
CEN.IND. STATION -1000 [G1A]
□: 3-D SOLUTION
X: 1-D SOLUTION
CEN.IND. STATION 1800 [G1A]
□: 3-D SOLUTION
X: 1-D SOLUTION
CEN.IND. STATION -2200 [G1A]
□: 3-D SOLUTION
X: 1-D SOLUTION
CEN.IND. STATION 600 [G1A]
□: 3-D SOLUTION
X: 1-D SOLUTION
APPARENT RESISTIVITY (ohm-m)
APPARENT RESISTIVITY (ohm-m)
TIME (ms)
TIME (ms)

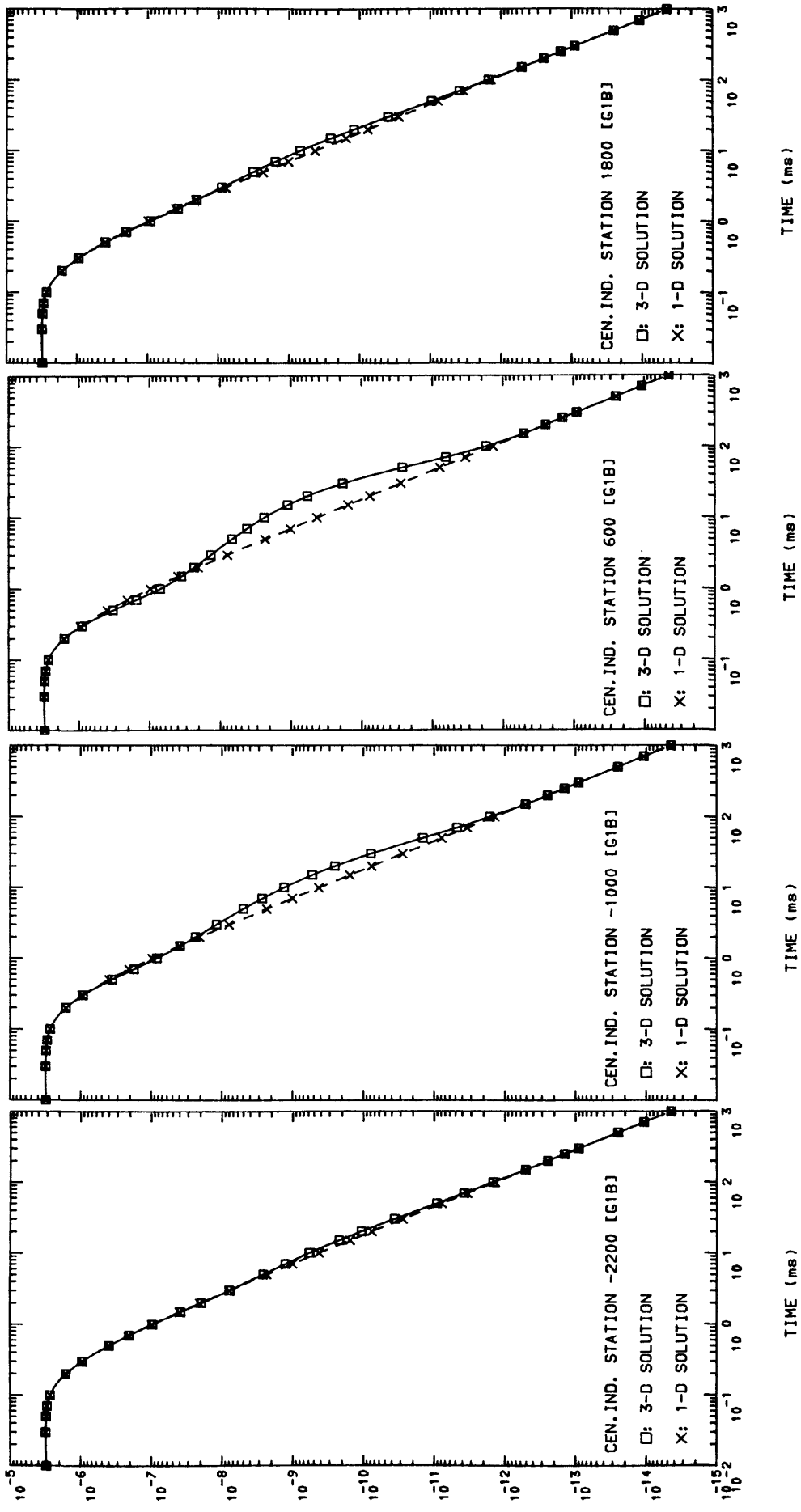


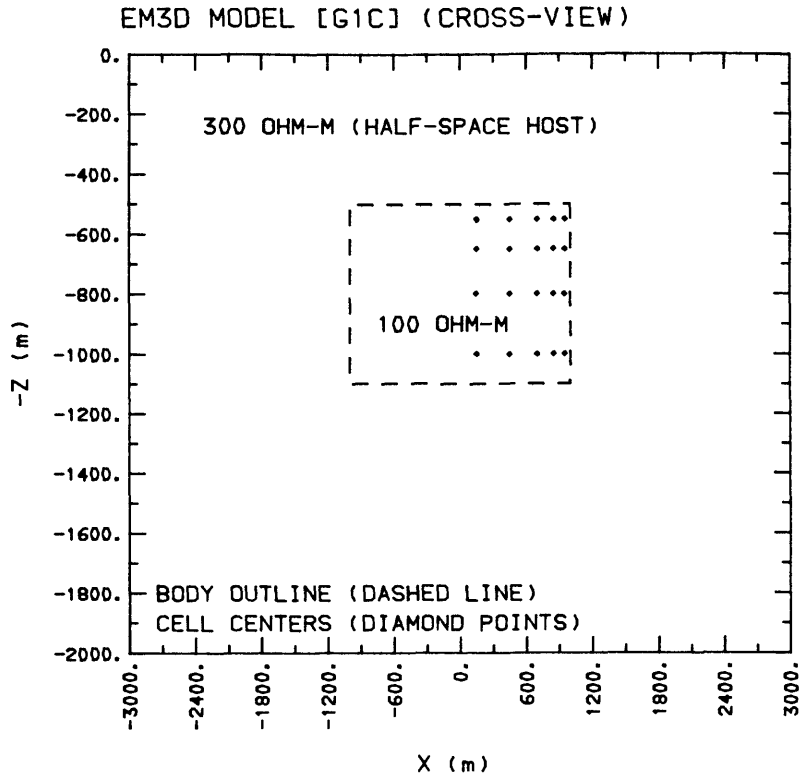
EM3D MODEL [G1A]


EM3D MODEL [G1B] (CROSS-VIEW)
300 OHM-M (HALF-SPACE HOST)
10 OHM-M
BODY OUTLINE (DASHED LINE)
CELL CENTERS (DIAMOND POINTS)
-Z (m)
X (m)
0.
-200.
-400.
-600.
-800.
-1000.
-1200.
-1400.
-1600.
-1800.
-2000.
-3000.
-2400.
-1800.
-1200.
-600.
0.
600.
1200.
1800.
2400.
3000.


EM3D MODEL [G1B] (PLAN-VIEW)
BODY OUTLINE (DASHED LINE)
TRANSMITTERS (SOLID LINES)
RECEIVER POINTS (X)
CELL CENTERS (DIAMOND POINTS)
Y (m)
X (m)
3000.
2400.
1800.
1200.
600.
0.
-600.
-1200.
-1800.
-2400.
-3000.
-3000.
-2400.
-1800.
-1200.
-600.
0.
600.
1200.
1800.
2400.
3000.


EM3D MODEL [G1B]
CEN.IND. STATION -1000 [G1B]
□: 3-D SOLUTION
X: 1-D SOLUTION
CEN.IND. STATION 1800 [G1B]
□: 3-D SOLUTION
X: 1-D SOLUTION
CEN.IND. STATION -2200 [G1B]
□: 3-D SOLUTION
X: 1-D SOLUTION
CEN.IND. STATION 600 [G1B]
□: 3-D SOLUTION
X: 1-D SOLUTION
APPARENT RESISTIVITY (ohm-m)
APPARENT RESISTIVITY (ohm-m)
TIME (ms)
TIME (ms)


EM3D MODEL [G1B]
CEN.IND. STATION 1800 [G1B]
□: 3-D SOLUTION
X: 1-D SOLUTION
CEN.IND. STATION 600 [G1B]
□: 3-D SOLUTION
X: 1-D SOLUTION
CEN.IND. STATION -1000 [G1B]
□: 3-D SOLUTION
X: 1-D SOLUTION
CEN.IND. STATION -2200 [G1B]
□: 3-D SOLUTION
X: 1-D SOLUTION
TIME (ms)
TIME (ms)
TIME (ms)
TIME (ms)
VOLTAGE (volts/amp•m•m)


EM3D MODEL [G1C] (CROSS-VIEW)
300 OHM-M (HALF-SPACE HOST)
100 OHM-M
BODY OUTLINE (DASHED LINE)
CELL CENTERS (DIAMOND POINTS)
-Z (m)
X (m)
0.
-200.
-400.
-600.
-800.
-1000.
-1200.
-1400.
-1600.
-1800.
-2000.
-3000.
-2400.
-1800.
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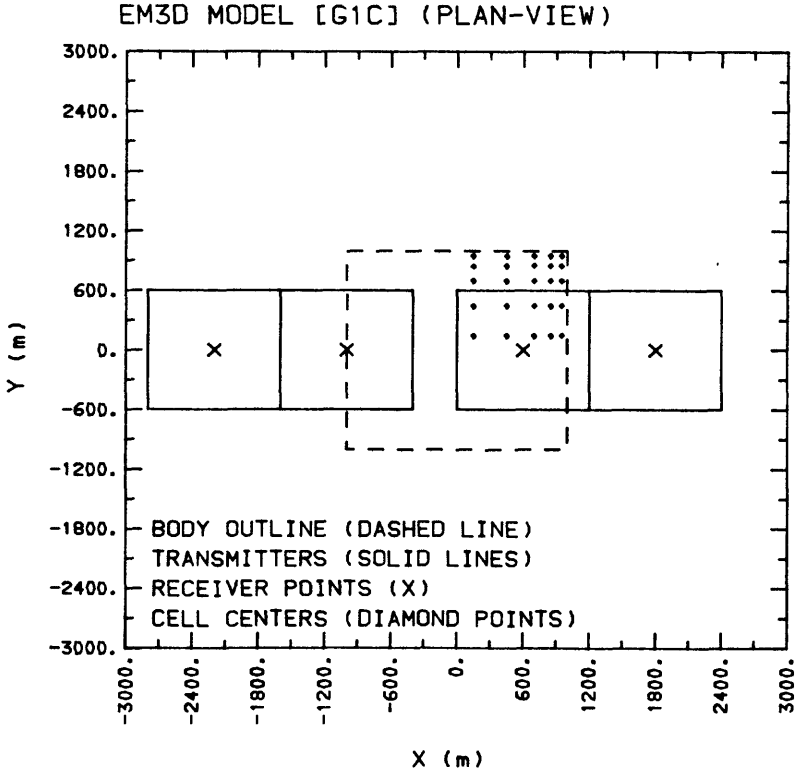
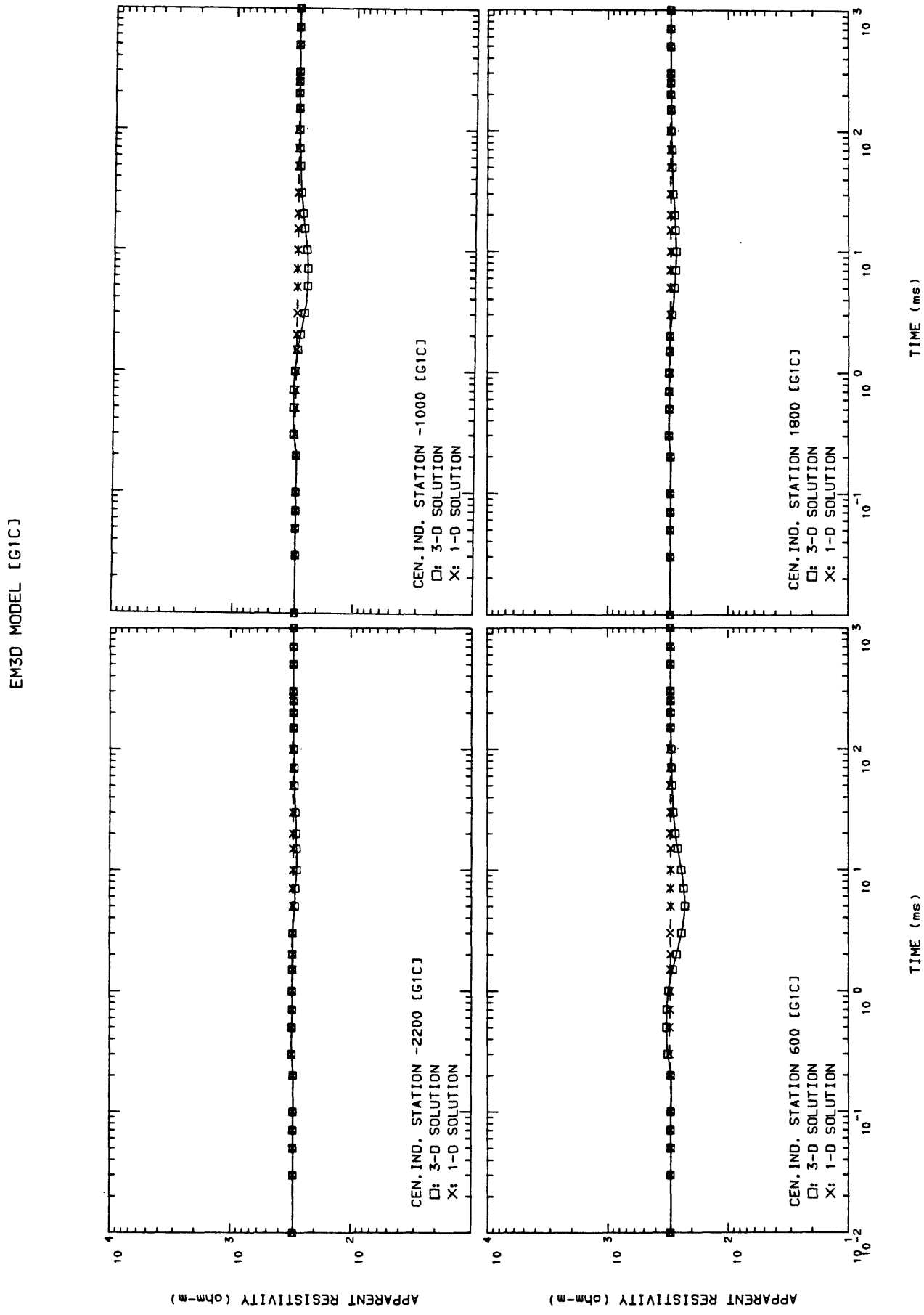
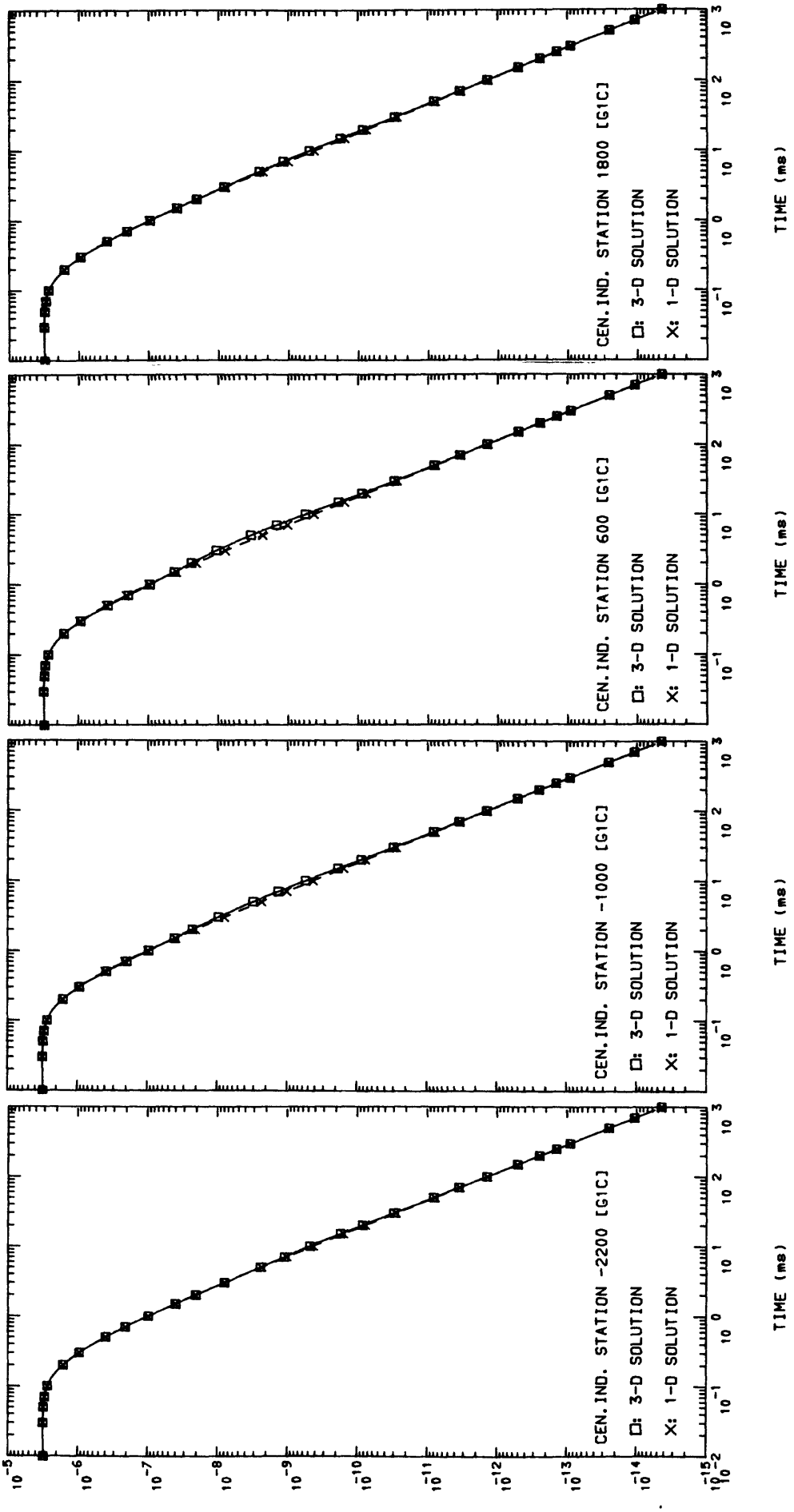
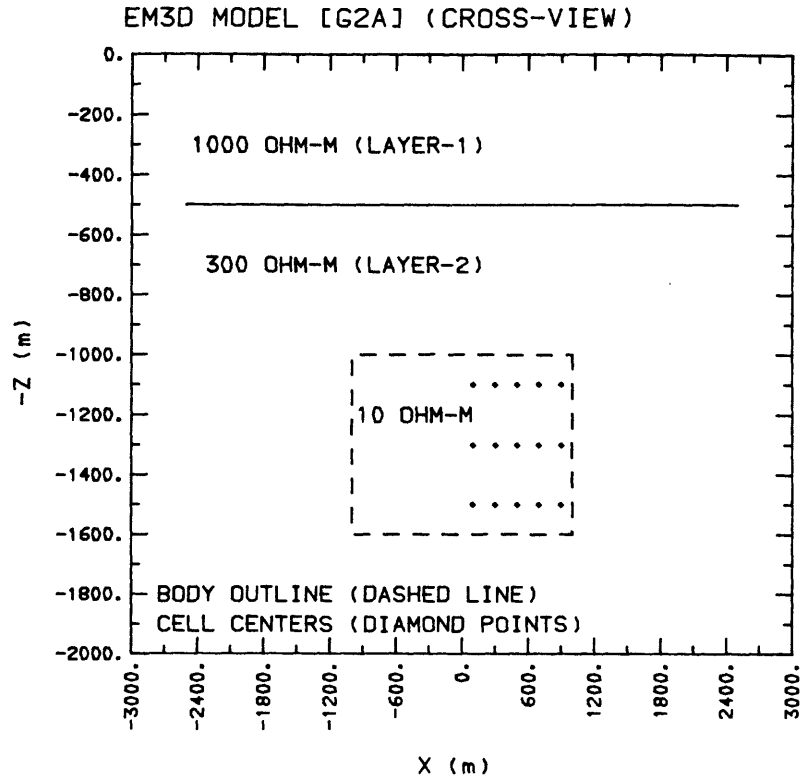
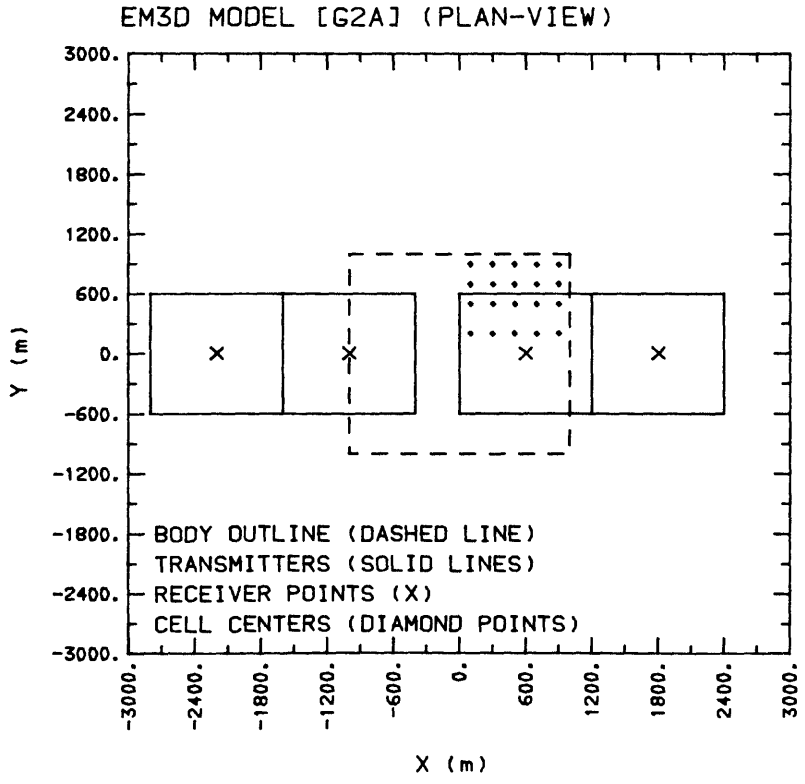
-600.
600.
1200.
1800.
2400.
3000.

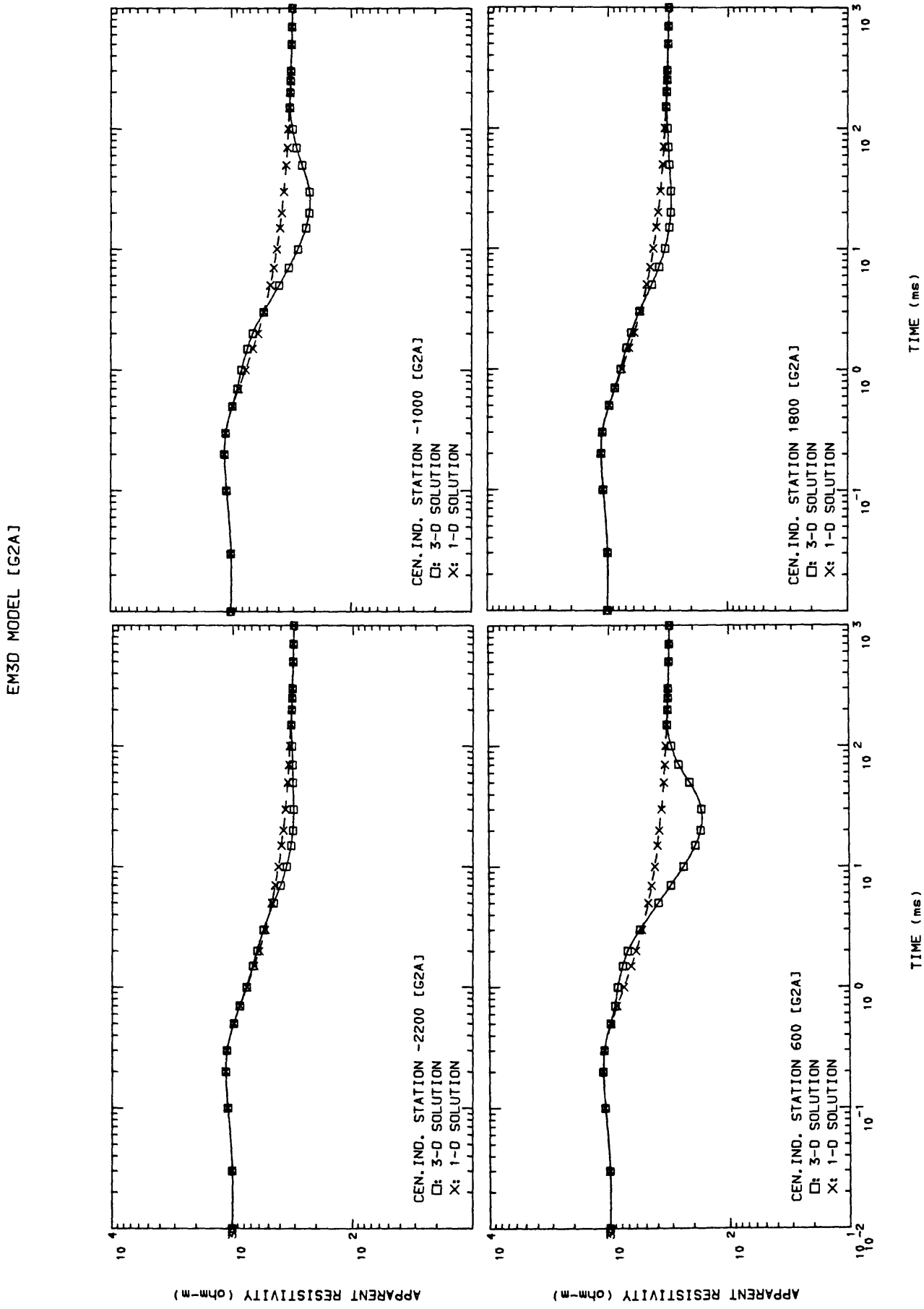

EM3D MODEL [G1C] (PLAN-VIEW)
BODY OUTLINE (DASHED LINE)
TRANSMITTERS (SOLID LINES)
RECEIVER POINTS (X)
CELL CENTERS (DIAMOND POINTS)
Y (m)
X (m)
3000.
2400.
1800.
1200.
600.
0.
-600.
-1200.
-1800.
-2400.
-3000.
-3000.
-2400.
-1800.
-1200.
-600.
0.
600.
1200.
1800.
2400.
3000.

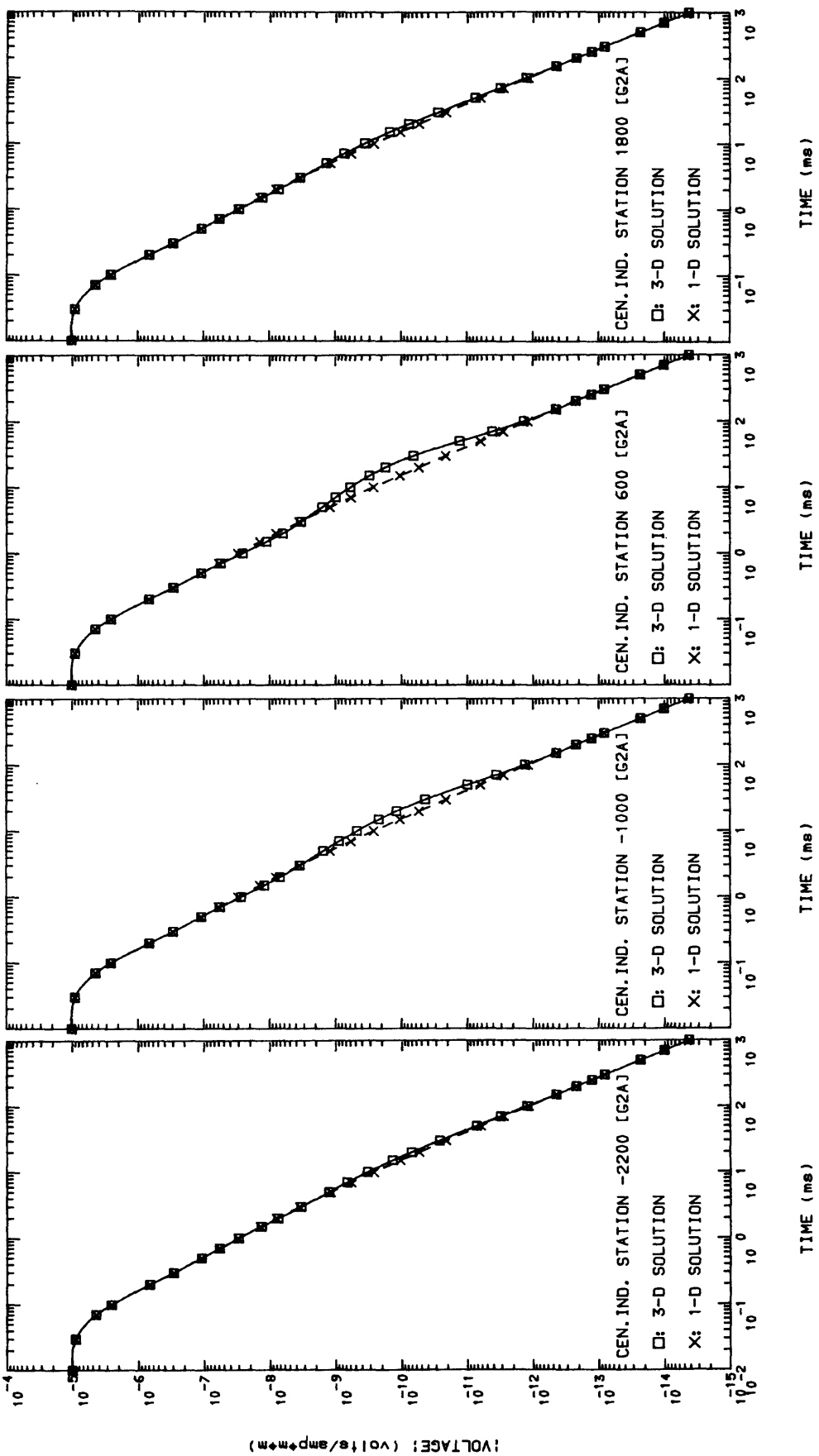

EM3D MODEL [G1C]
CEN.IND. STATION -1000 [G1C]
□: 3-D SOLUTION
X: 1-D SOLUTION
CEN.IND. STATION 1800 [G1C]
□: 3-D SOLUTION
X: 1-D SOLUTION
CEN.IND. STATION -2200 [G1C]
□: 3-D SOLUTION
X: 1-D SOLUTION
CEN.IND. STATION 600 [G1C]
□: 3-D SOLUTION
X: 1-D SOLUTION
APPARENT RESISTIVITY (ohm-m)
APPARENT RESISTIVITY (ohm-m)
TIME (ms)
TIME (ms)

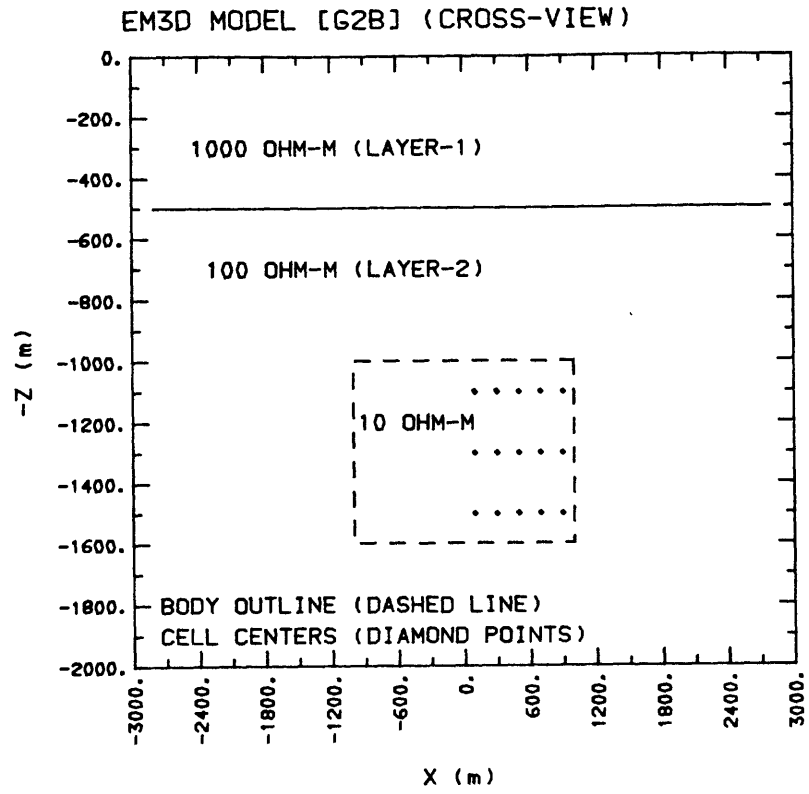

EM3D MODEL [G1C]
CEN.IND. STATION 1800 [G1C]
CEN.IND. STATION 600 [G1C]
CEN.IND. STATION -1000 [G1C]
CEN.IND. STATION -2200 [G1C]
□: 3-D SOLUTION
X: 1-D SOLUTION
TIME (ms)
VOLTAGE (volts/amp•m•m)

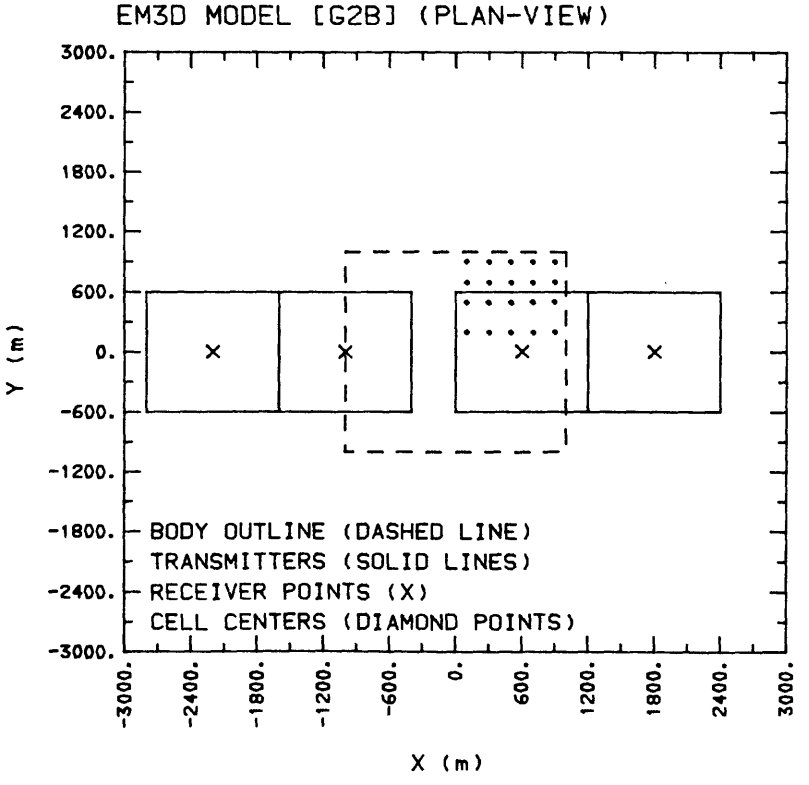

EM3D MODEL [G2A] (CROSS-VIEW)
1000 OHM-M (LAYER-1)
300 OHM-M (LAYER-2)
10 OHM-M
BODY OUTLINE (DASHED LINE)
CELL CENTERS (DIAMOND POINTS)
-Z (m)
X (m)
0.
-200.
-400.
-600.
-800.
-1000.
-1200.
-1400.
-1600.
-1800.
-2000.
-3000.
-2400.
-1800.
-1200.
-600.
600.
1200.
1800.
2400.
3000.

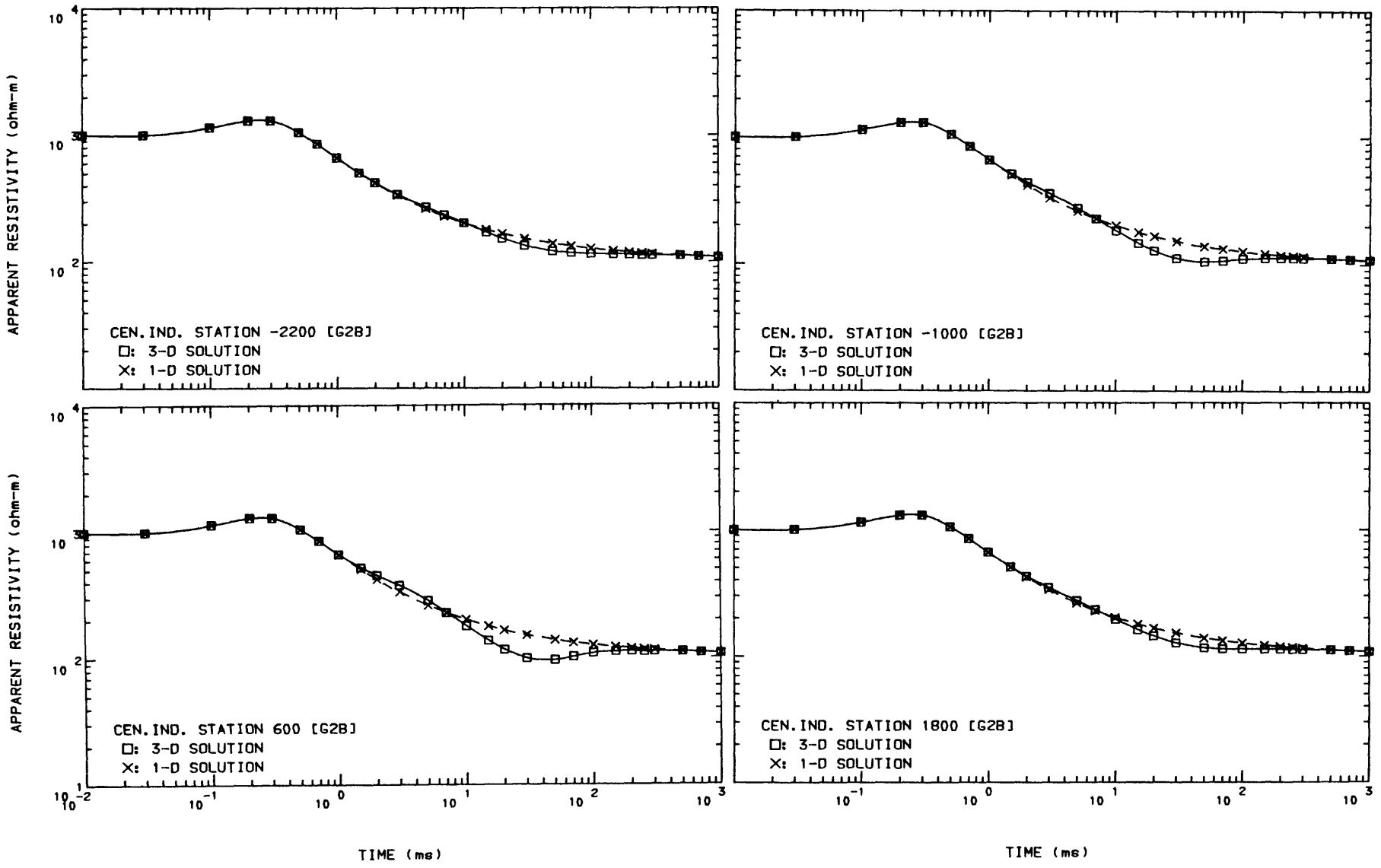

EM3D MODEL [G2A] (PLAN-VIEW)
BODY OUTLINE (DASHED LINE)
TRANSMITTERS (SOLID LINES)
RECEIVER POINTS (X)
CELL CENTERS (DIAMOND POINTS)
Y (m)
X (m)
3000.
2400.
1800.
1200.
600.
0.
-600.
-1200.
-1800.
-2400.
-3000.


EM3D MODEL [G2A]
CEN.IND. STATION -1000 [G2A]
□: 3-D SOLUTION
X: 1-D SOLUTION
CEN.IND. STATION 1800 [G2A]
□: 3-D SOLUTION
X: 1-D SOLUTION
CEN.IND. STATION -2200 [G2A]
□: 3-D SOLUTION
X: 1-D SOLUTION
CEN.IND. STATION 600 [G2A]
□: 3-D SOLUTION
X: 1-D SOLUTION
APPARENT RESISTIVITY (ohm-m)
APPARENT RESISTIVITY (ohm-m)
TIME (ms)
TIME (ms)

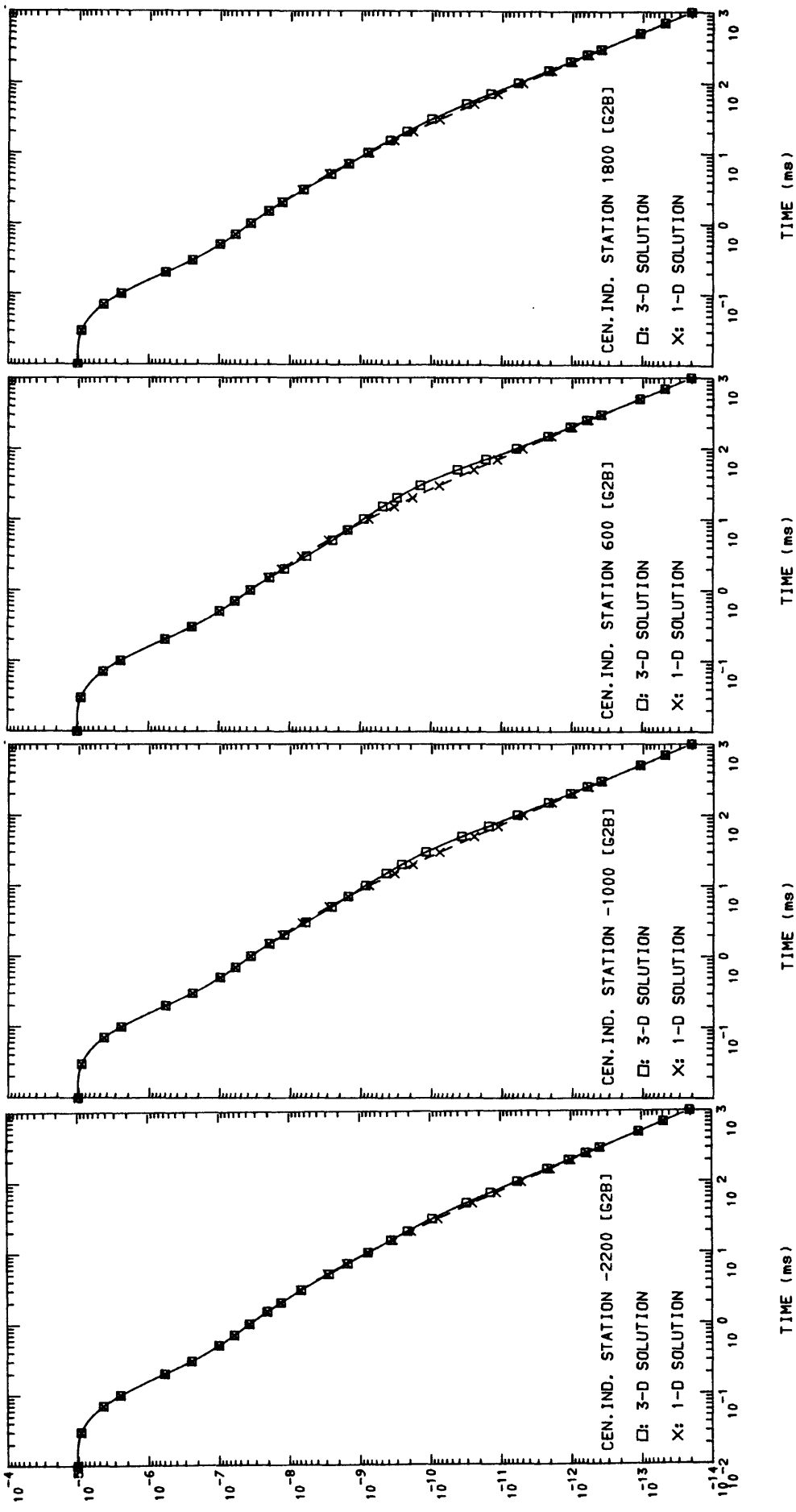

EM3D MODEL [G2A]
CEN.IND. STATION 1800 [G2A]
CEN.IND. STATION 600 [G2A]
CEN.IND. STATION -1000 [G2A]
CEN.IND. STATION -2200 [G2A]
□: 3-D SOLUTION
X: 1-D SOLUTION
TIME (ms)
VOLTAGE (volts/amp*m*m)

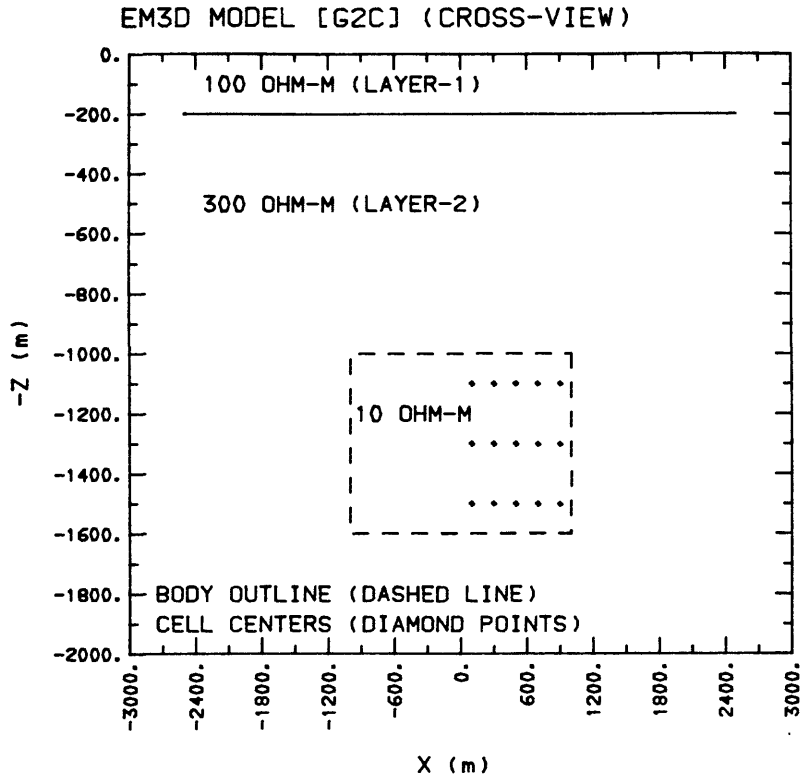

EM3D MODEL [G2B] (CROSS-VIEW)
1000 OHM-M (LAYER-1)
100 OHM-M (LAYER-2)
10 OHM-M
BODY OUTLINE (DASHED LINE)
CELL CENTERS (DIAMOND POINTS)
-Z (m)
X (m)
0.
-200.
-400.
-600.
-800.
-1000.
-1200.
-1400.
-1600.
-1800.
-2000.
-3000.
-2400.
-1800.
-1200.
-600.
600.
1200.
1800.
2400.
3000.

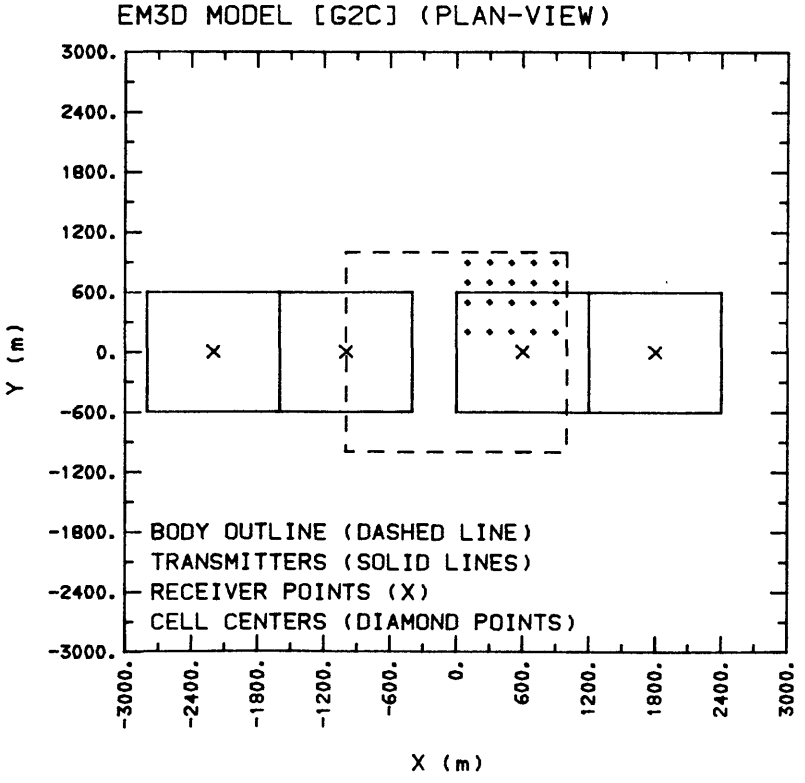

EM3D MODEL [G2B] (PLAN-VIEW)
BODY OUTLINE (DASHED LINE)
TRANSMITTERS (SOLID LINES)
RECEIVER POINTS (X)
CELL CENTERS (DIAMOND POINTS)
Y (m)
X (m)
3000.
2400.
1800.
1200.
600.
0.
-600.
-1200.
-1800.
-2400.
-3000.

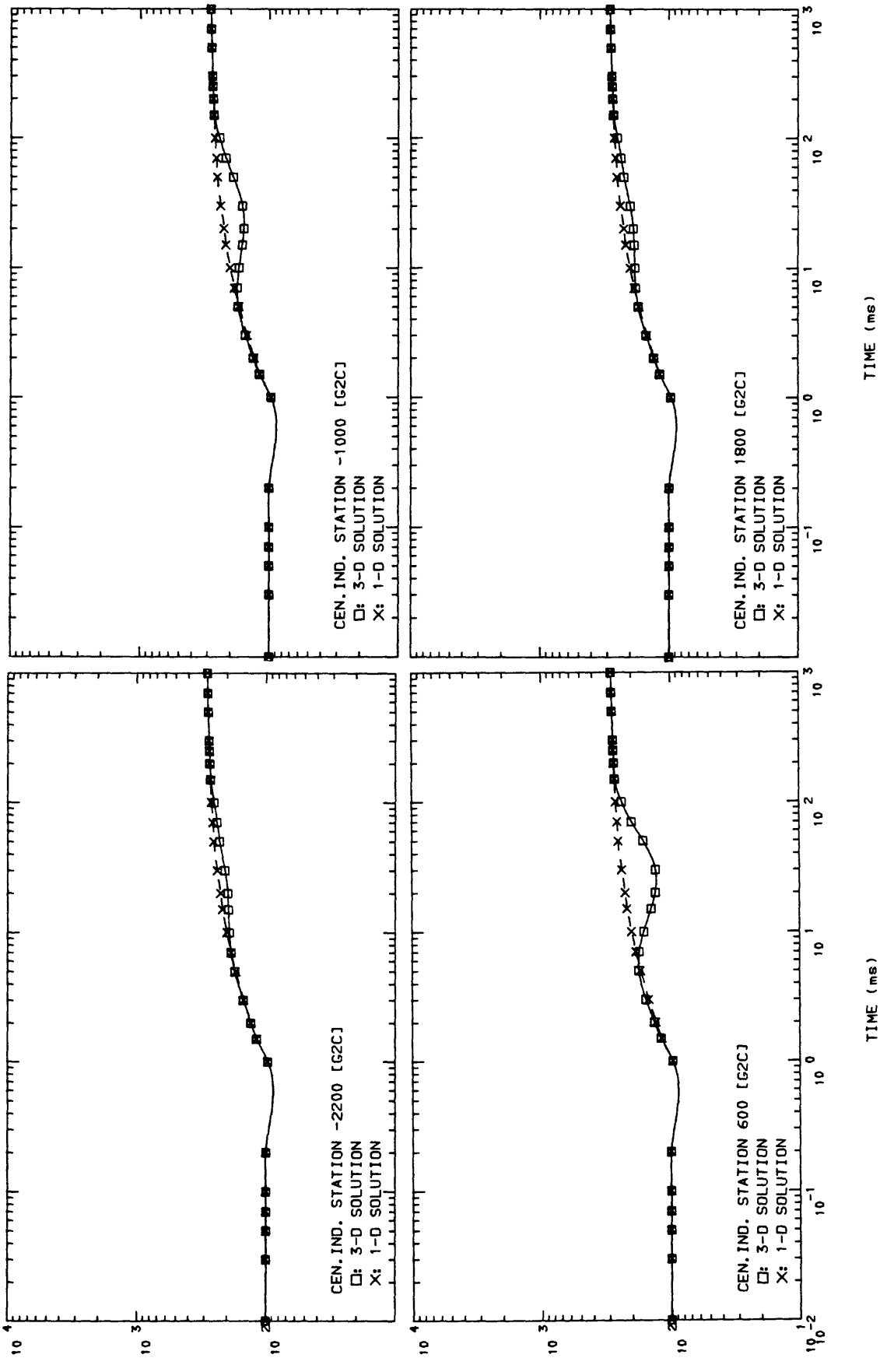


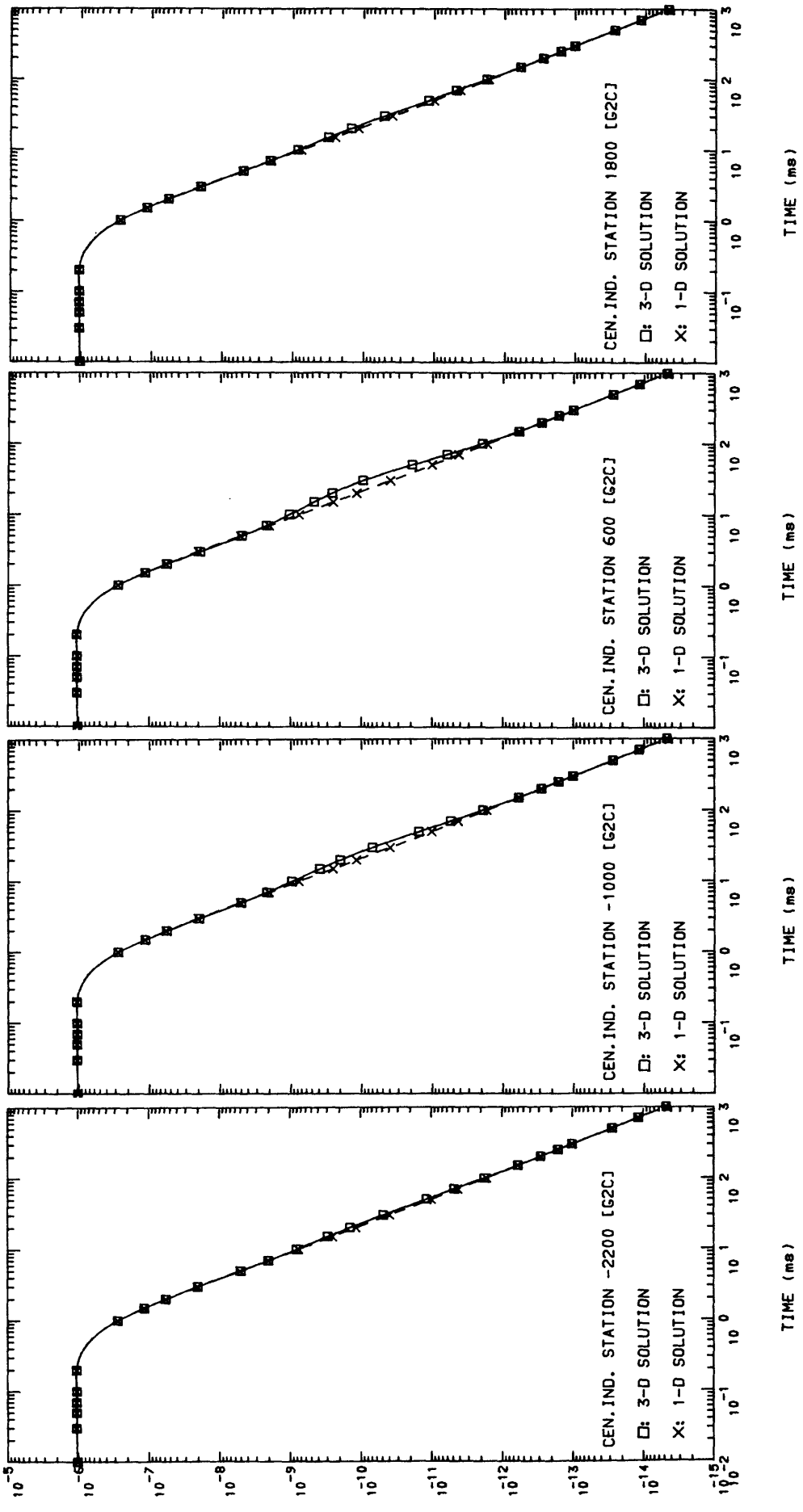
EM3D MODEL [G2B]

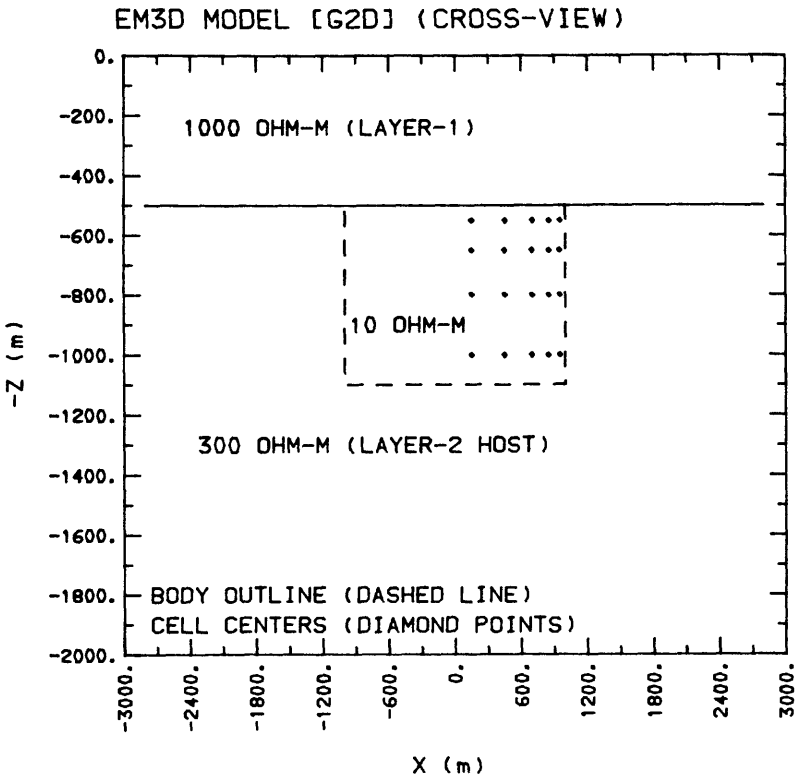

EM3D MODEL [G2B]
CEN.IND. STATION 1800 [G2B]
CEN.IND. STATION 600 [G2B]
CEN.IND. STATION -1000 [G2B]
CEN.IND. STATION -2200 [G2B]
□: 3-D SOLUTION
X: 1-D SOLUTION
TIME (ms)
VOLTAGE (volts/amp•m•m)

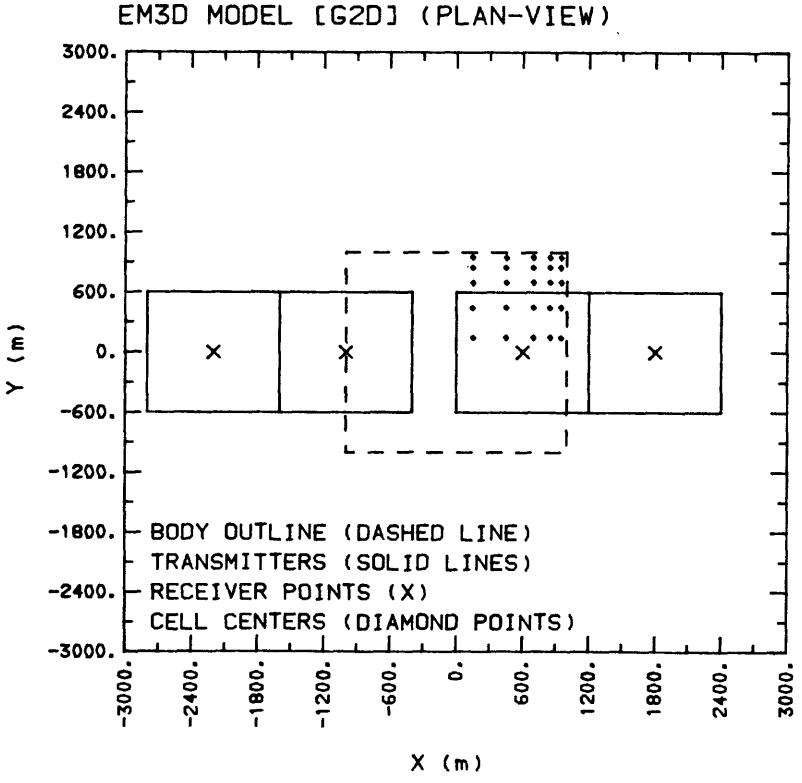

EM3D MODEL [G2C] (CROSS-VIEW)
100 OHM-M (LAYER-1)
300 OHM-M (LAYER-2)
10 OHM-M
BODY OUTLINE (DASHED LINE)
CELL CENTERS (DIAMOND POINTS)
-Z (m)
X (m)
0.
-200.
-400.
-600.
-800.
-1000.
-1200.
-1400.
-1600.
-1800.
-2000.
-3000.
-2400.
-1800.
-1200.
-600.
0.
600.
1200.
1800.
2400.
3000.

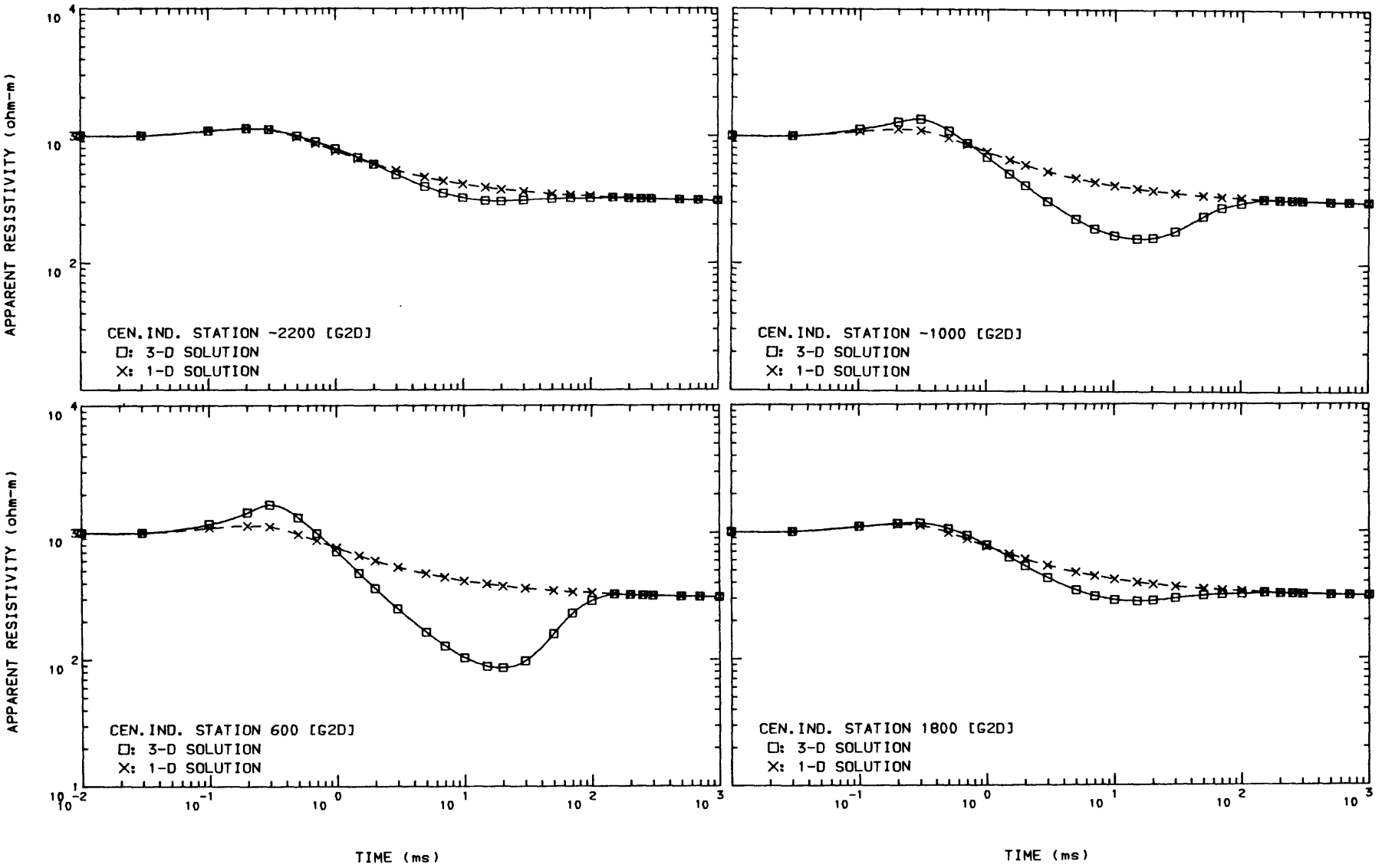

EM3D MODEL [G2C] (PLAN-VIEW)
BODY OUTLINE (DASHED LINE)
TRANSMITTERS (SOLID LINES)
RECEIVER POINTS (X)
CELL CENTERS (DIAMOND POINTS)
Y (m)
X (m)
3000.
2400.
1800.
1200.
600.
0.
-600.
-1200.
-1800.
-2400.
-3000.
-3000.
-2400.
-1800.
-1200.
-600.
0.
600.
1200.
1800.
2400.
3000.


EM3D MODEL [G2C]
CEN.IND. STATION -1000 [G2C]
□: 3-D SOLUTION
X: 1-D SOLUTION
CEN.IND. STATION 1800 [G2C]
□: 3-D SOLUTION
X: 1-D SOLUTION
CEN.IND. STATION -2200 [G2C]
□: 3-D SOLUTION
X: 1-D SOLUTION
CEN.IND. STATION 600 [G2C]
□: 3-D SOLUTION
X: 1-D SOLUTION
APPARENT RESISTIVITY (ohm-m)
APPARENT RESISTIVITY (ohm-m)
TIME (ms)
TIME (ms)

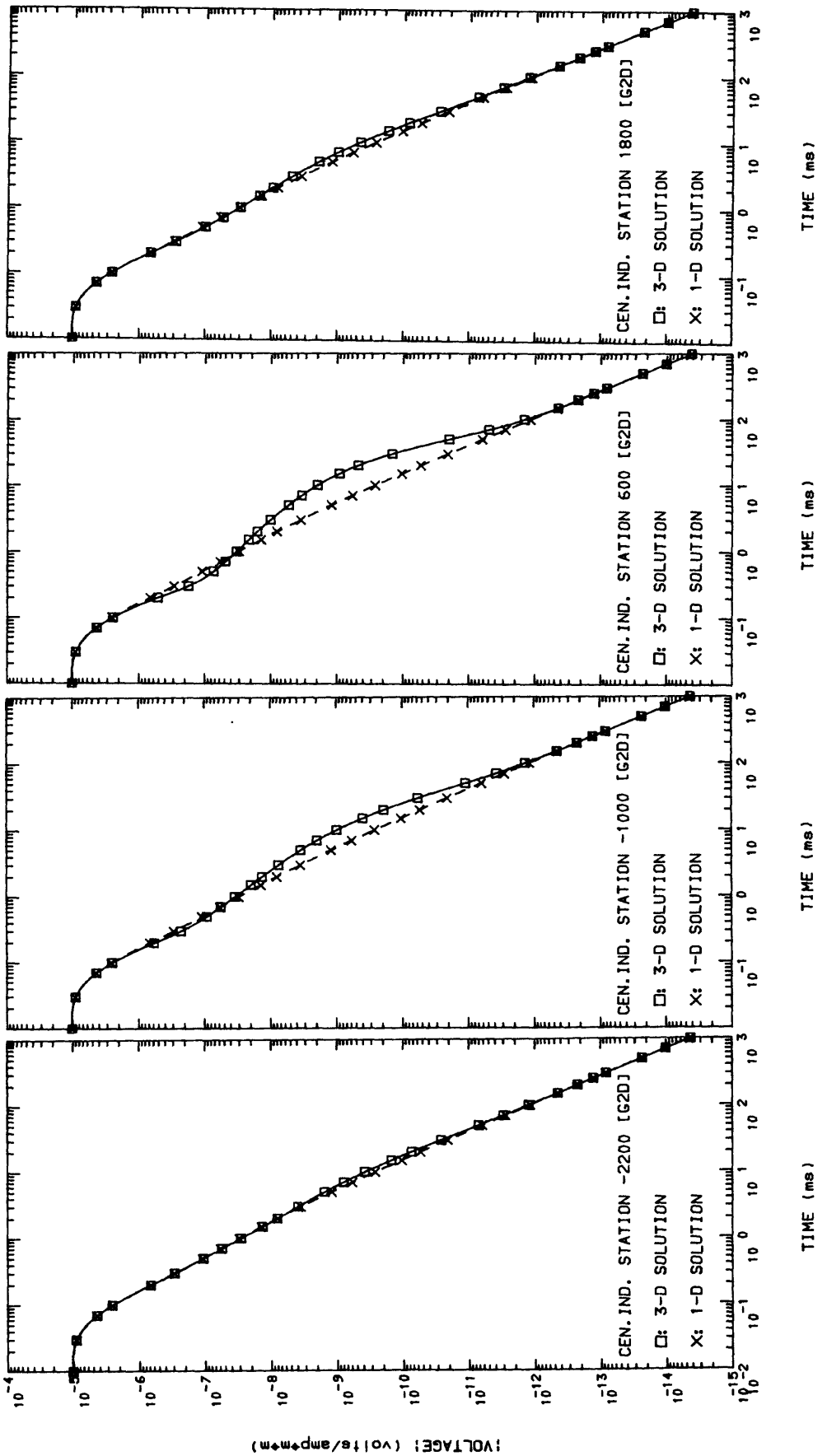

EM3D MODEL [G2C]
CEN.IND. STATION 1800 [G2C]
CEN.IND. STATION 600 [G2C]
CEN.IND. STATION -1000 [G2C]
CEN.IND. STATION -2200 [G2C]
□: 3-D SOLUTION
X: 1-D SOLUTION
TIME (ms)
VOLTAGE: (volts/amp*m*m)

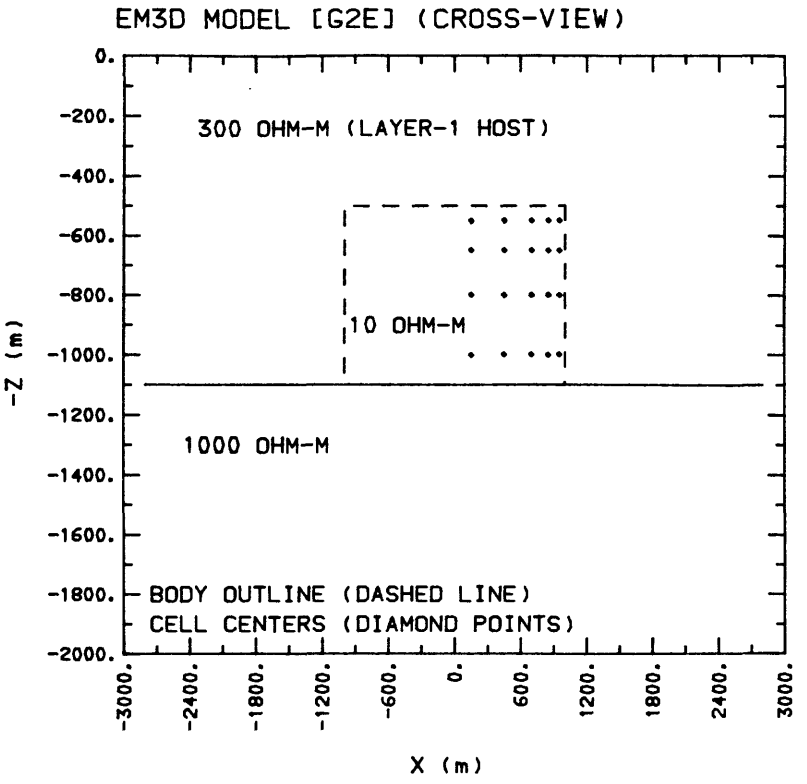

EM3D MODEL [G2D] (CROSS-VIEW)
1000 OHM-M (LAYER-1)
10 OHM-M
300 OHM-M (LAYER-2 HOST)
BODY OUTLINE (DASHED LINE)
CELL CENTERS (DIAMOND POINTS)
-Z (m)
X (m)
0.
-200.
-400.
-600.
-800.
-1000.
-1200.
-1400.
-1600.
-1800.
-2000.
-3000.
-2400.
-1800.
-1200.
-600.
600.
1200.
1800.
2400.
3000.

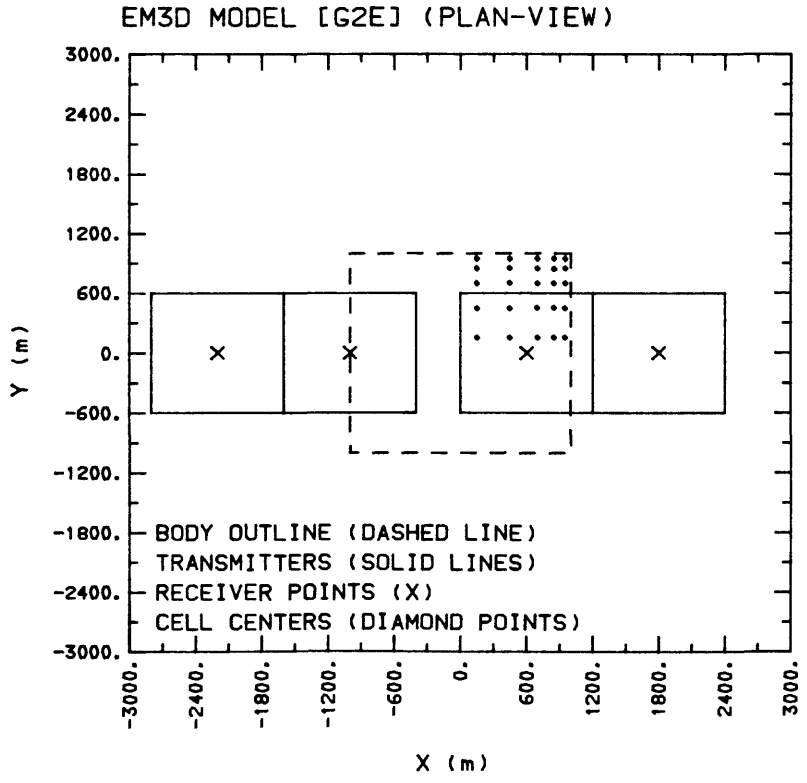

EM3D MODEL [G2D] (PLAN-VIEW)
BODY OUTLINE (DASHED LINE)
TRANSMITTERS (SOLID LINES)
RECEIVER POINTS (X)
CELL CENTERS (DIAMOND POINTS)
Y (m)
X (m)
3000.
2400.
1800.
1200.
600.
0.
-600.
-1200.
-1800.
-2400.
-3000.

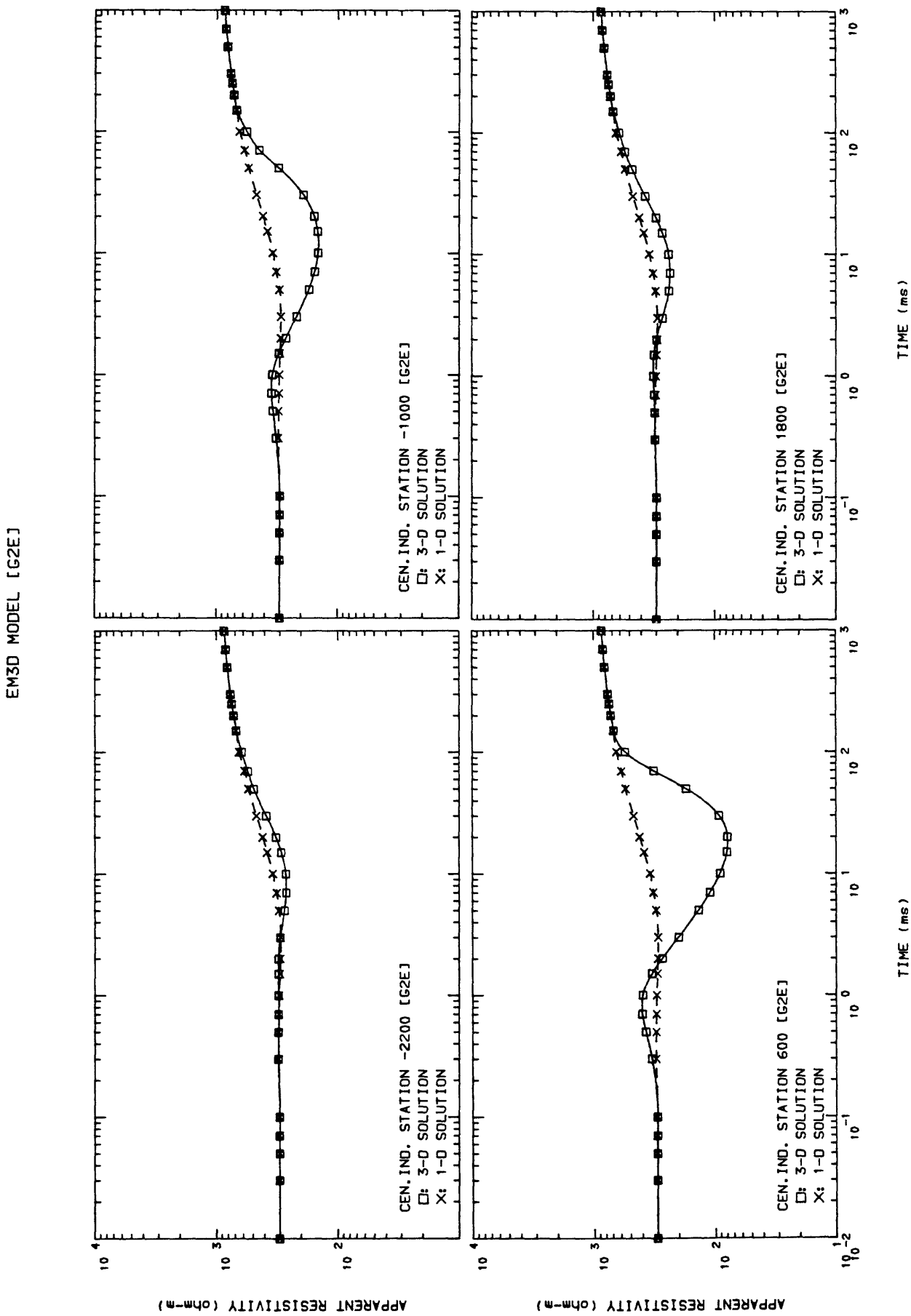


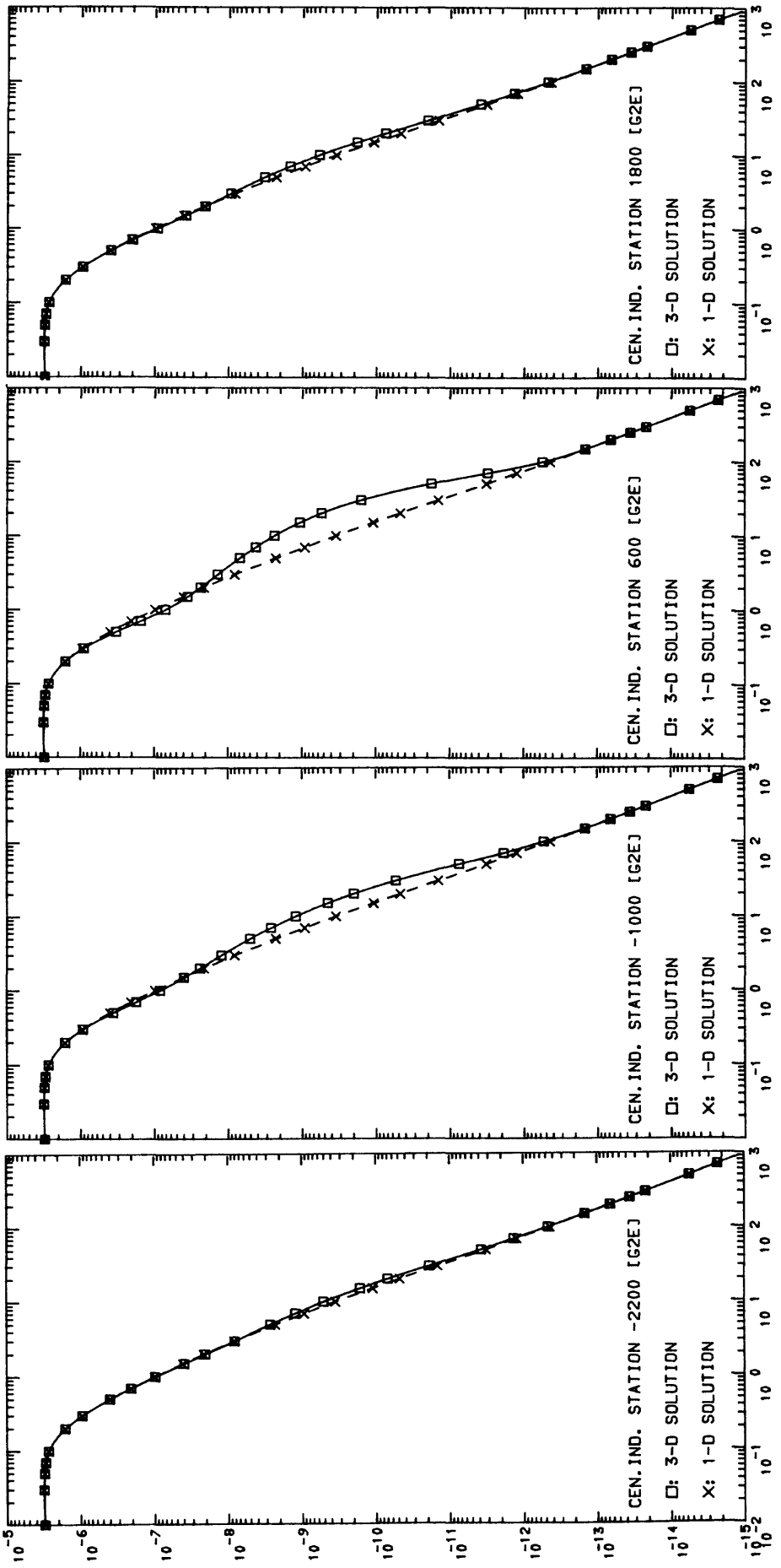
EM3D MODEL [G2D]

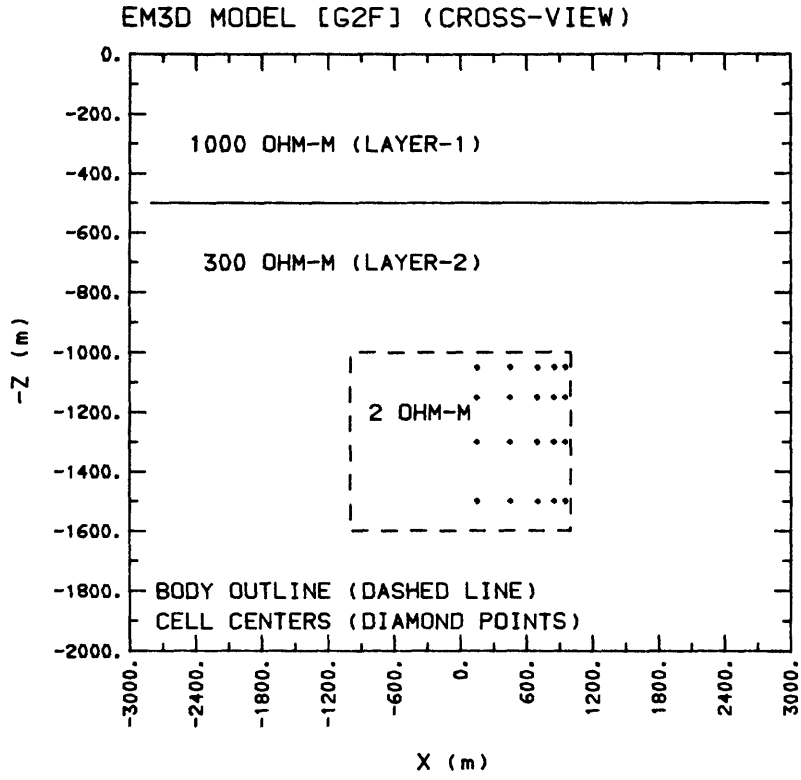

EM3D MODEL [G2D]
CEN.IND. STATION 1800 [G2D]
CEN.IND. STATION 600 [G2D]
CEN.IND. STATION -1000 [G2D]
CEN.IND. STATION -2200 [G2D]
□: 3-D SOLUTION
X: 1-D SOLUTION
TIME (ms)
VOLTAGE (volts/amp*m*m)

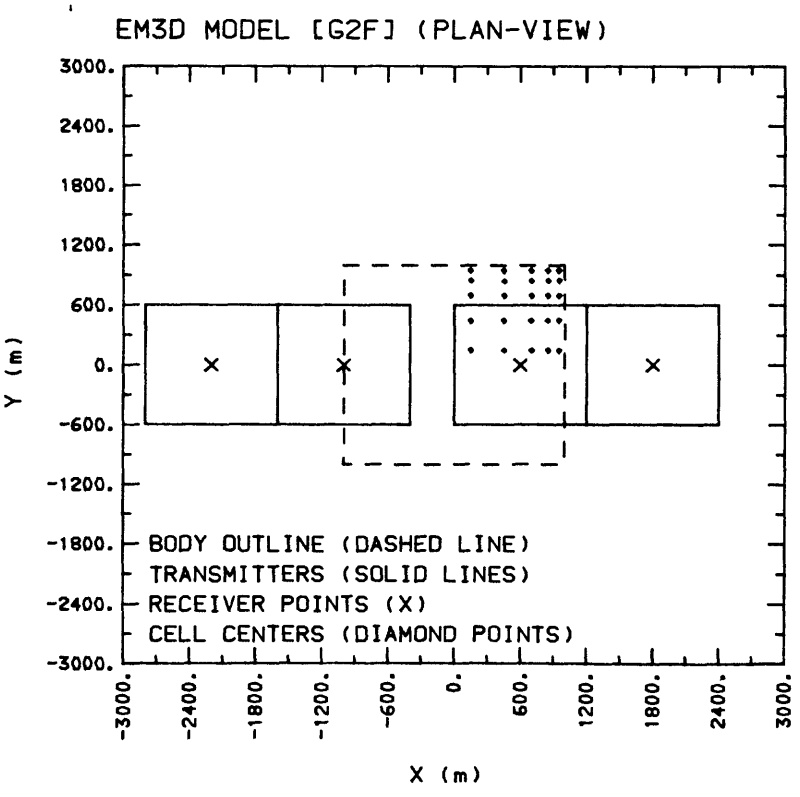

EM3D MODEL [G2E] (CROSS-VIEW)
300 OHM-M (LAYER-1 HOST)
10 OHM-M
1000 OHM-M
BODY OUTLINE (DASHED LINE)
CELL CENTERS (DIAMOND POINTS)
-Z (m)
X (m)
0.
-200.
-400.
-600.
-800.
-1000.
-1200.
-1400.
-1600.
-1800.
-2000.
-3000.
-2400.
-1800.
-1200.
-600.
600.
1200.
1800.
2400.
3000.

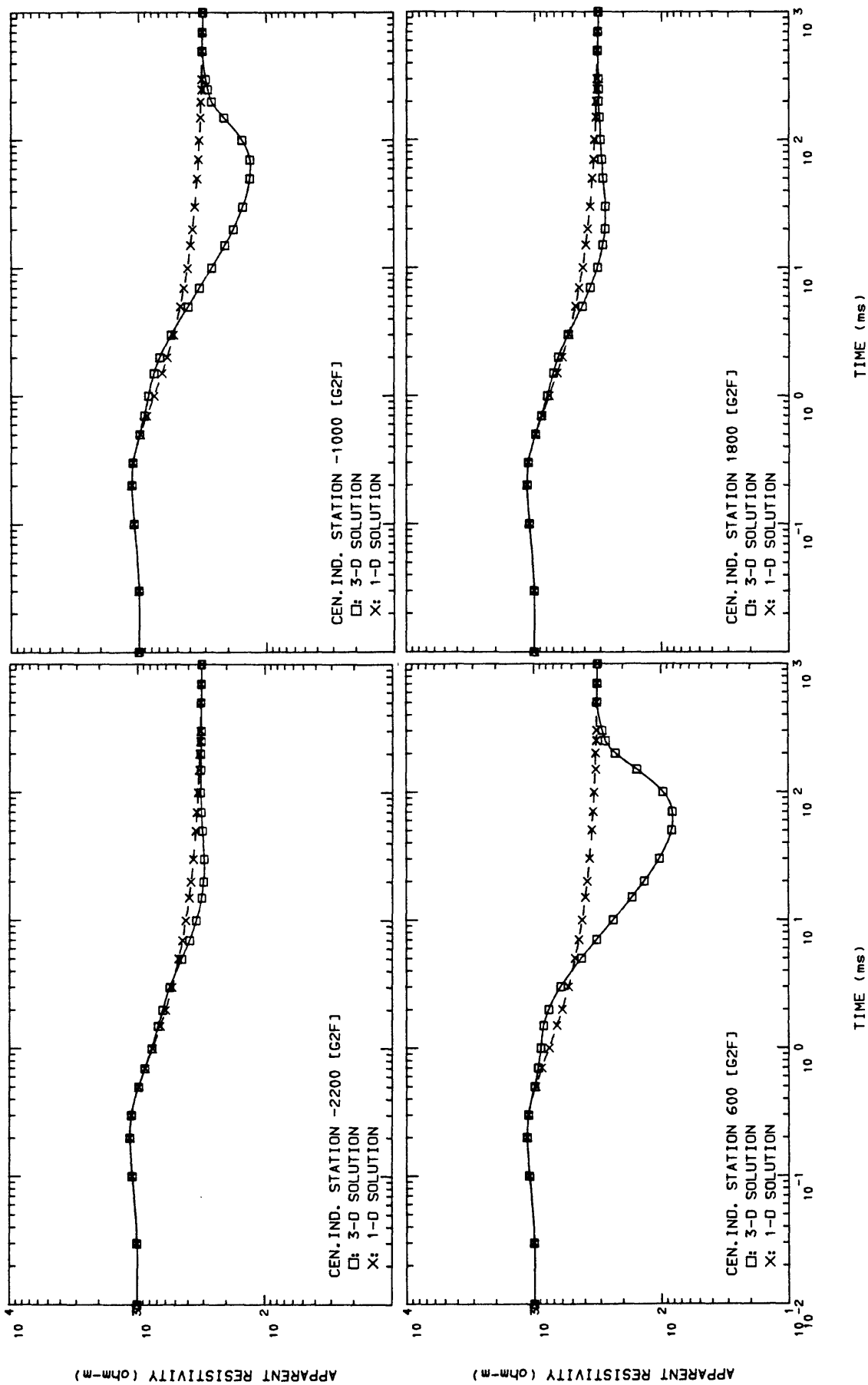

EM3D MODEL [G2E] (PLAN-VIEW)
BODY OUTLINE (DASHED LINE)
TRANSMITTERS (SOLID LINES)
RECEIVER POINTS (X)
CELL CENTERS (DIAMOND POINTS)
Y (m)
X (m)
3000.
2400.
1800.
1200.
600.
0.
-600.
-1200.
-1800.
-2400.
-3000.

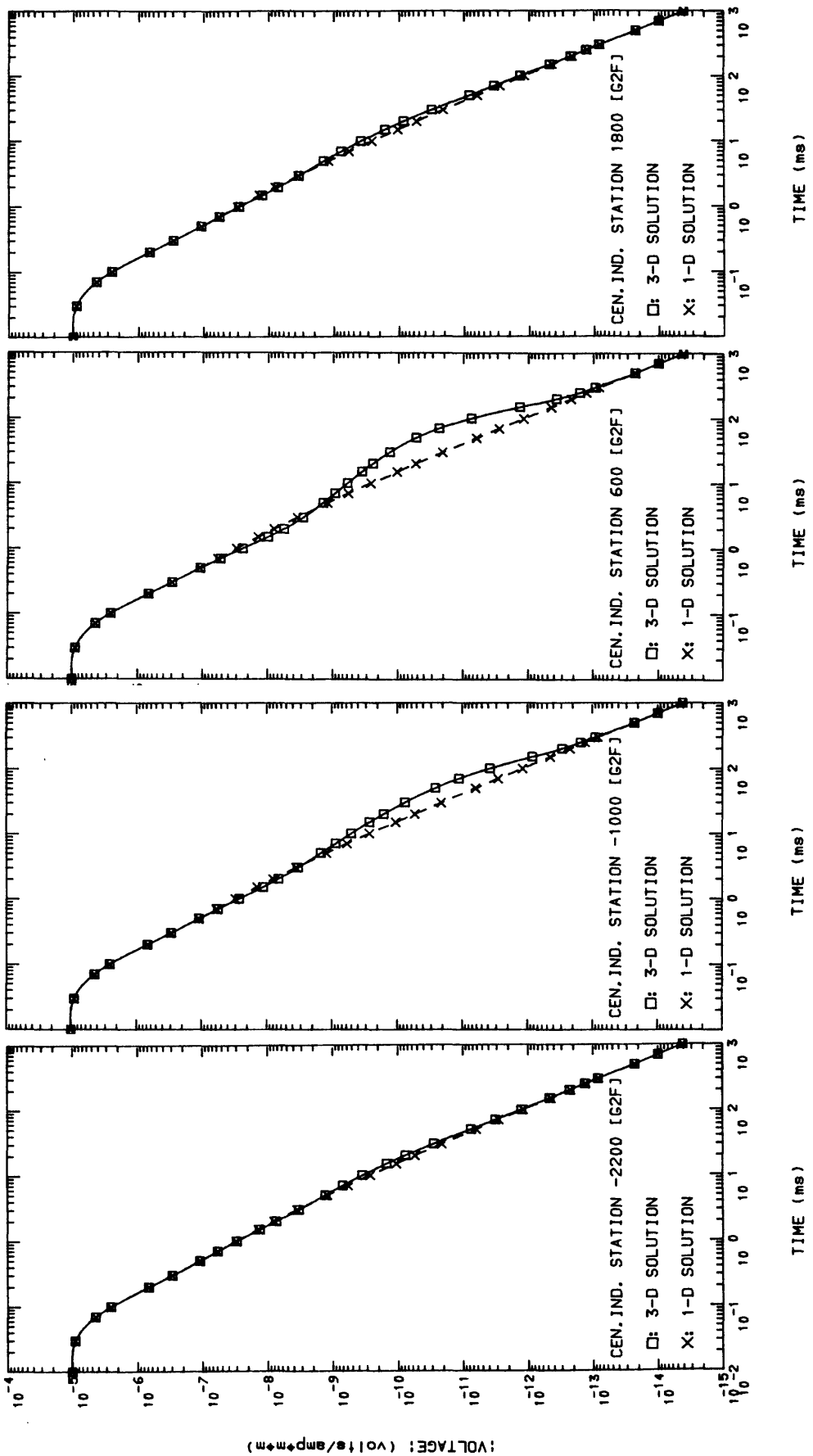

EM3D MODEL [G2E]
CEN.IND. STATION -1000 [G2E]
□: 3-D SOLUTION
X: 1-D SOLUTION
CEN.IND. STATION 1800 [G2E]
□: 3-D SOLUTION
X: 1-D SOLUTION
CEN.IND. STATION -2200 [G2E]
□: 3-D SOLUTION
X: 1-D SOLUTION
CEN.IND. STATION 600 [G2E]
□: 3-D SOLUTION
X: 1-D SOLUTION
APPARENT RESISTIVITY (ohm-m)
APPARENT RESISTIVITY (ohm-m)
TIME (ms)
TIME (ms)

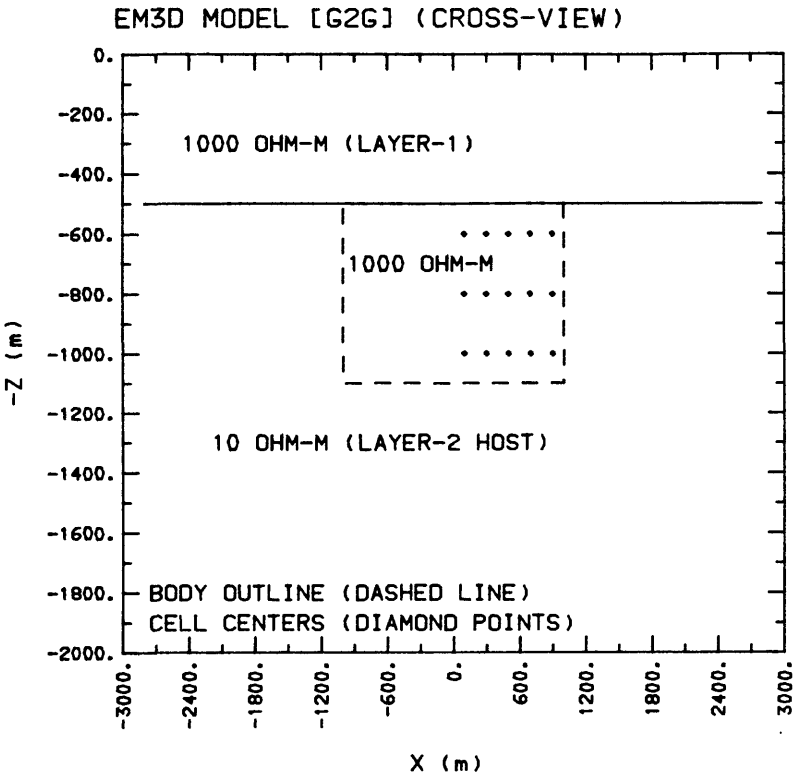

EM3D MODEL [G2E]
CEN.IND. STATION 1800 [G2E]
CEN.IND. STATION 600 [G2E]
CEN.IND. STATION -1000 [G2E]
CEN.IND. STATION -2200 [G2E]
□: 3-D SOLUTION
X: 1-D SOLUTION
TIME (ms)
VOLTAGE (volts/amp•m•m)

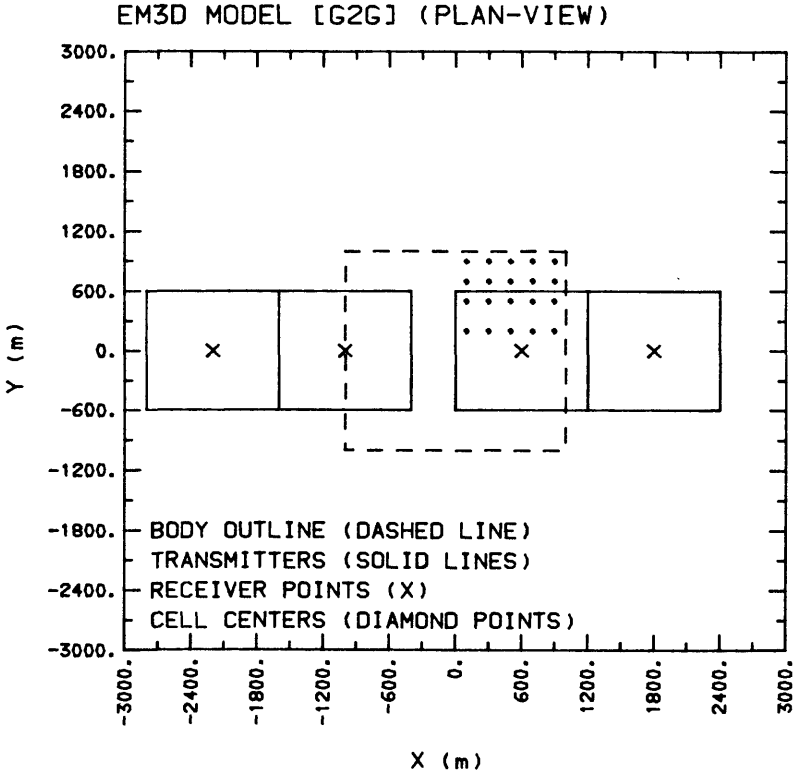

EM3D MODEL [G2F] (CROSS-VIEW)
1000 OHM-M (LAYER-1)
300 OHM-M (LAYER-2)
2 OHM-M
BODY OUTLINE (DASHED LINE)
CELL CENTERS (DIAMOND POINTS)
-Z (m)
X (m)
0.
-200.
-400.
-600.
-800.
-1000.
-1200.
-1400.
-1600.
-1800.
-2000.
-3000.
-2400.
-1800.
-1200.
-600.
600.
1200.
1800.
2400.
3000.

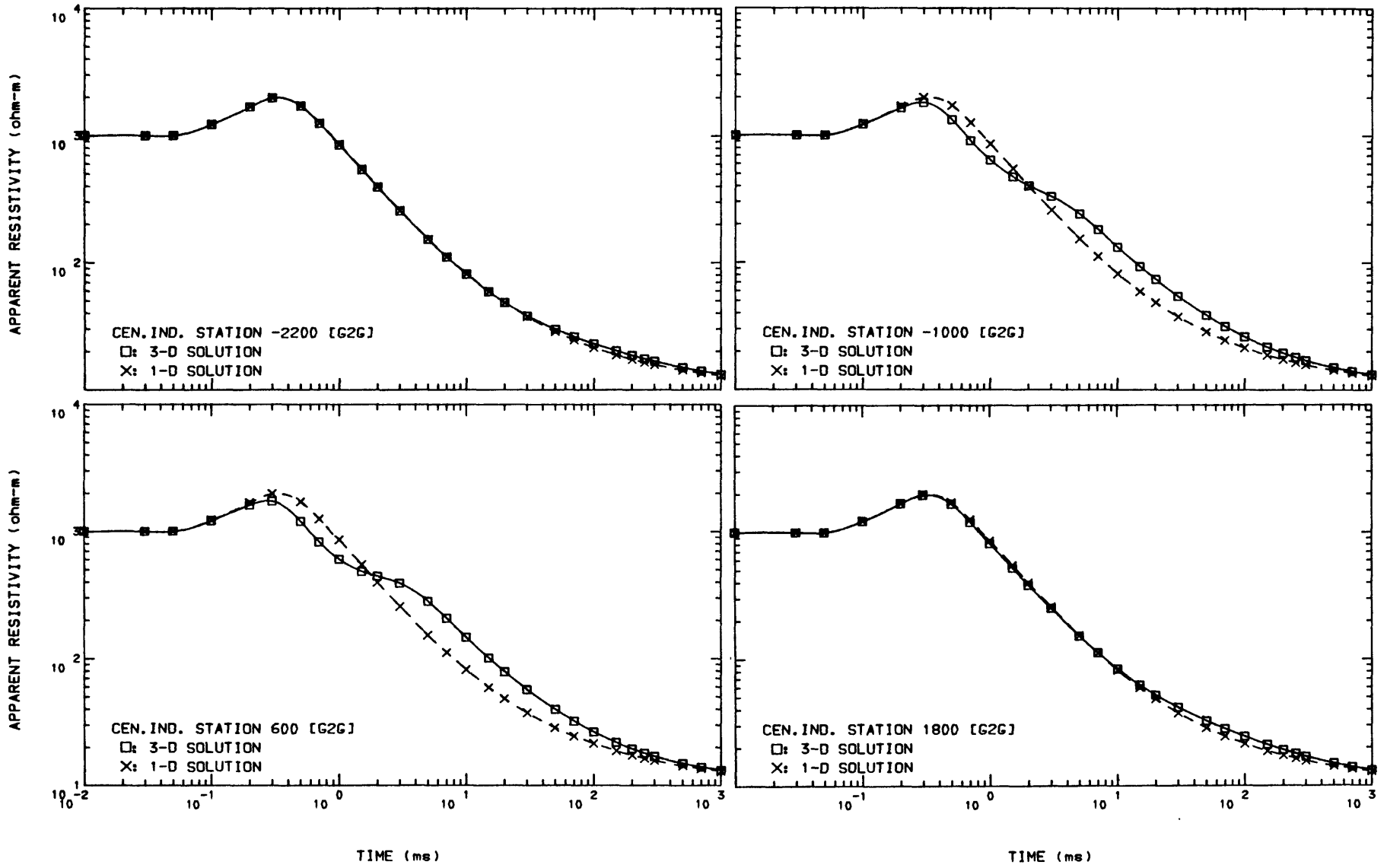

EM3D MODEL [G2F] (PLAN-VIEW)
BODY OUTLINE (DASHED LINE)
TRANSMITTERS (SOLID LINES)
RECEIVER POINTS (X)
CELL CENTERS (DIAMOND POINTS)
Y (m)
X (m)
3000.
2400.
1800.
1200.
600.
0.
-600.
-1200.
-1800.
-2400.
-3000.


EM3D MODEL [G2F]
CEN.IND. STATION -1000 [G2F]
□: 3-D SOLUTION
X: 1-D SOLUTION
CEN.IND. STATION 1800 [G2F]
□: 3-D SOLUTION
X: 1-D SOLUTION
CEN.IND. STATION -2200 [G2F]
□: 3-D SOLUTION
X: 1-D SOLUTION
CEN.IND. STATION 600 [G2F]
□: 3-D SOLUTION
X: 1-D SOLUTION
APPARENT RESISTIVITY (ohm-m)
APPARENT RESISTIVITY (ohm-m)
TIME (ms)
TIME (ms)

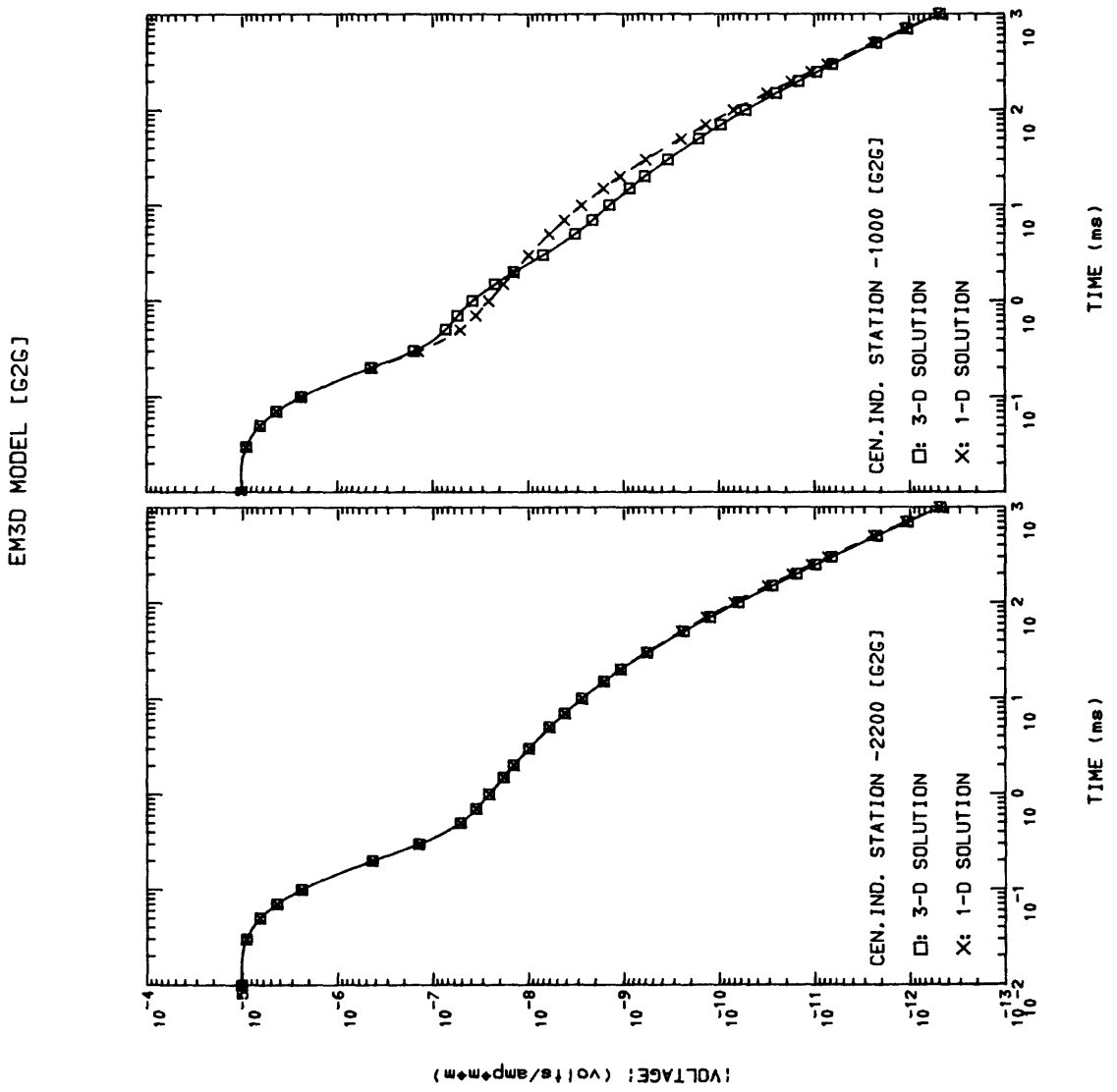

EM3D MODEL [G2F]
CEN.IND. STATION 1800 [G2F]
CEN.IND. STATION 600 [G2F]
CEN.IND. STATION -1000 [G2F]
CEN.IND. STATION -2200 [G2F]
□: 3-D SOLUTION
X: 1-D SOLUTION
TIME (ms)
VOLTAGE: (volts/amp*m*m)

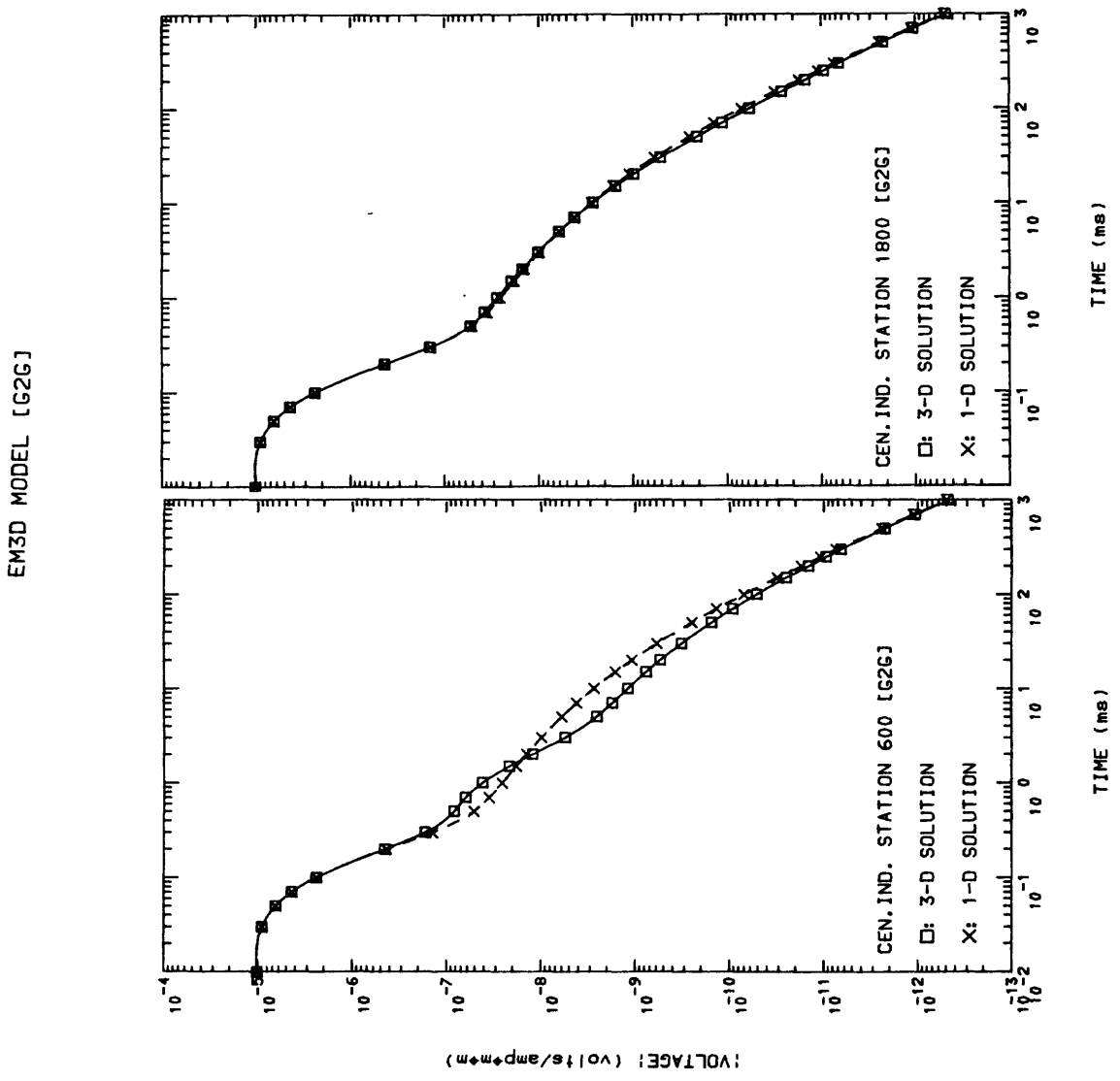

EM3D MODEL [G2G] (CROSS-VIEW)
1000 OHM-M (LAYER-1)
1000 OHM-M
10 OHM-M (LAYER-2 HOST)
BODY OUTLINE (DASHED LINE)
CELL CENTERS (DIAMOND POINTS)
-Z (m)
X (m)
0.
-200.
-400.
-600.
-800.
-1000.
-1200.
-1400.
-1600.
-1800.
-2000.
-3000.
-2400.
-1800.
-1200.
-600.
600.
1200.
1800.
2400.
3000.

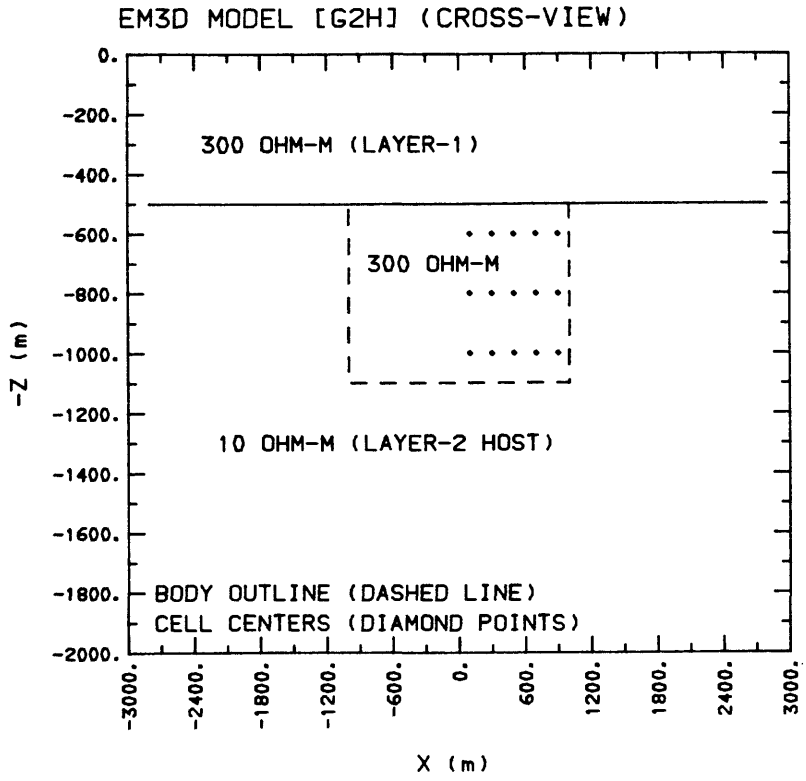

EM3D MODEL [G2G] (PLAN-VIEW)
BODY OUTLINE (DASHED LINE)
TRANSMITTERS (SOLID LINES)
RECEIVER POINTS (X)
CELL CENTERS (DIAMOND POINTS)
Y (m)
X (m)
3000.
2400.
1800.
1200.
600.
0.
-600.
-1200.
-1800.
-2400.
-3000.

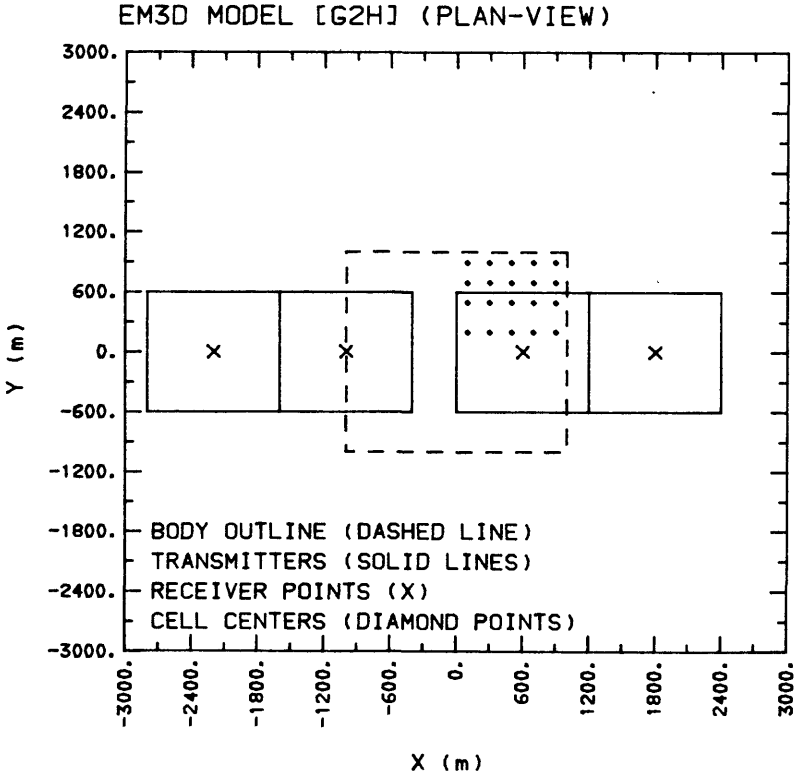


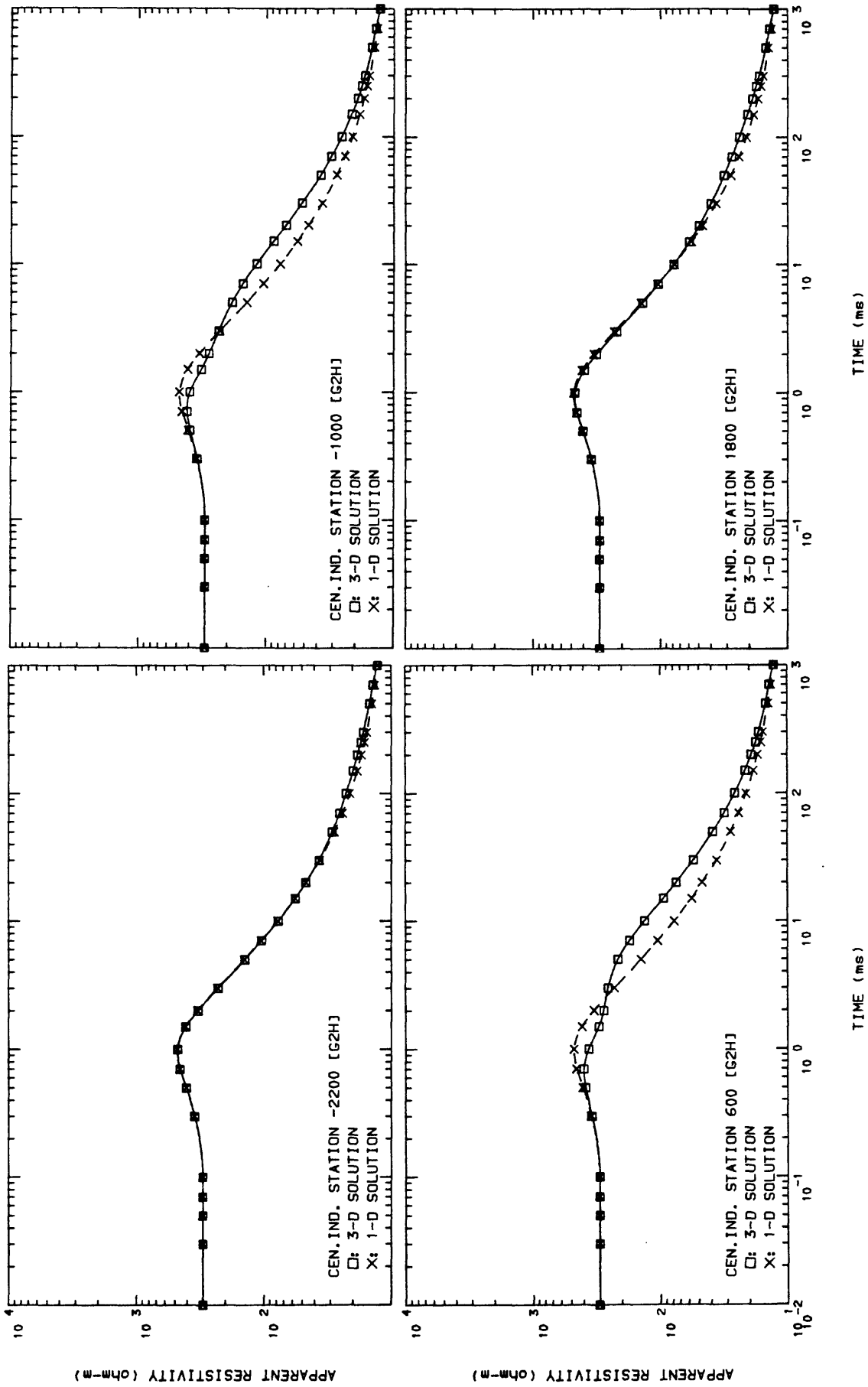
EM3D MODEL [G2G]

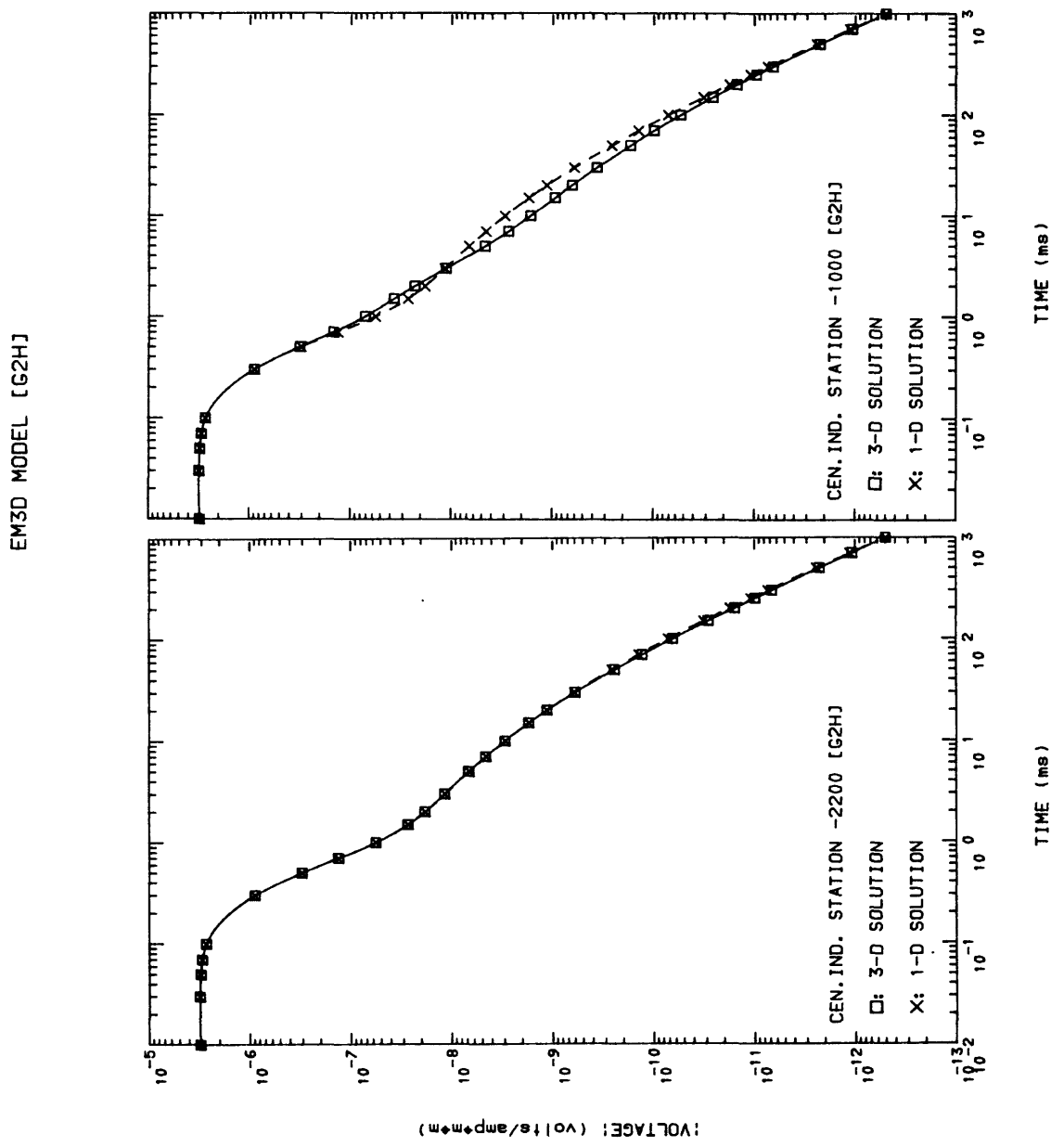

EM3D MODEL [G2G]
CEN.IND. STATION -1000 [G2G]
□: 3-D SOLUTION
X: 1-D SOLUTION
CEN.IND. STATION -2200 [G2G]
□: 3-D SOLUTION
X: 1-D SOLUTION
TIME (ms)
TIME (ms)
VOLTAGE (volts/amp*m*m)

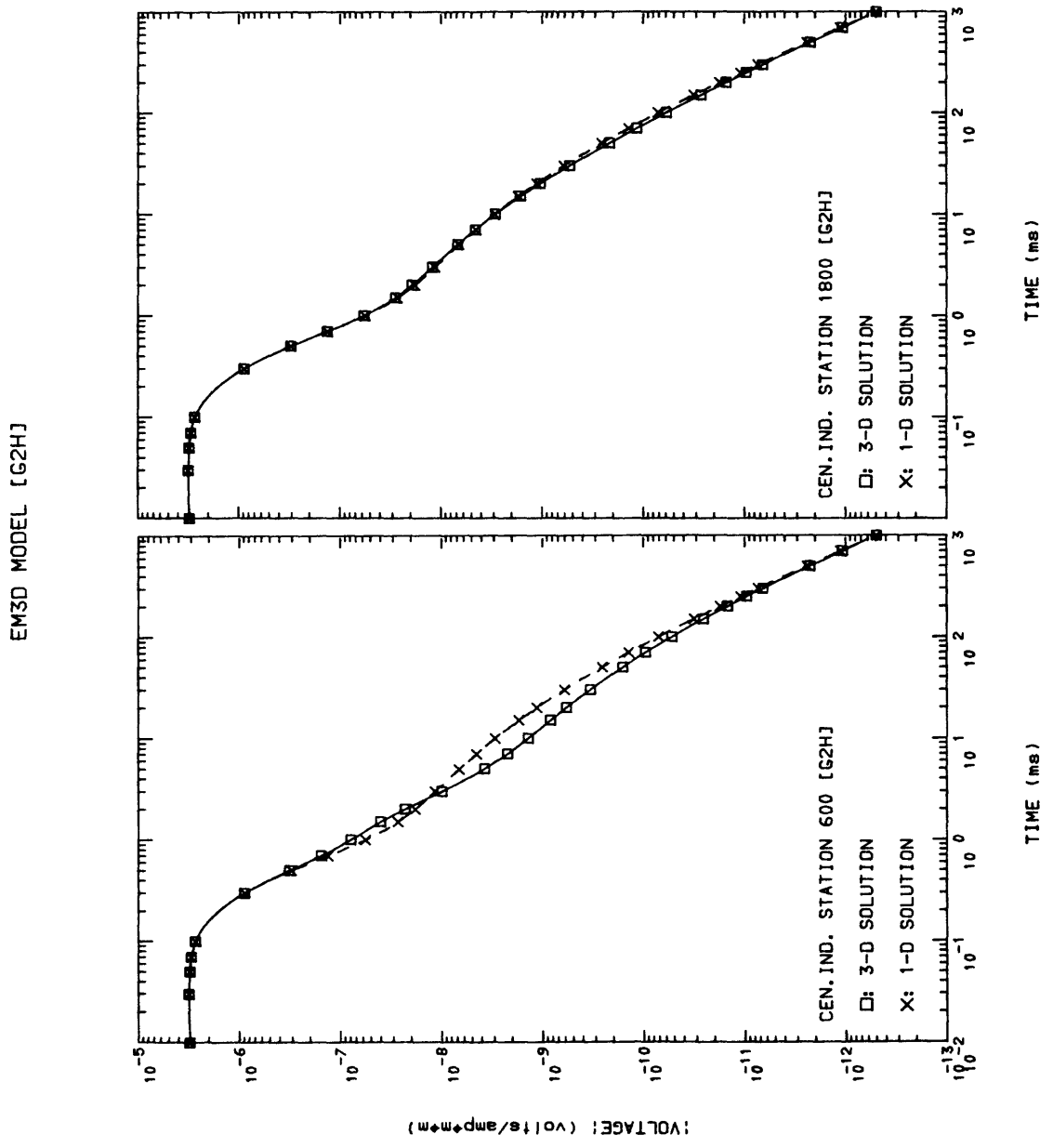

EM3D MODEL [G2G]
CEN.IND. STATION 1800 [G2G]
□: 3-D SOLUTION
X: 1-D SOLUTION
CEN.IND. STATION 600 [G2G]
□: 3-D SOLUTION
X: 1-D SOLUTION
TIME (ms)
TIME (ms)
VOLTAGE (volts/amp*m*m)

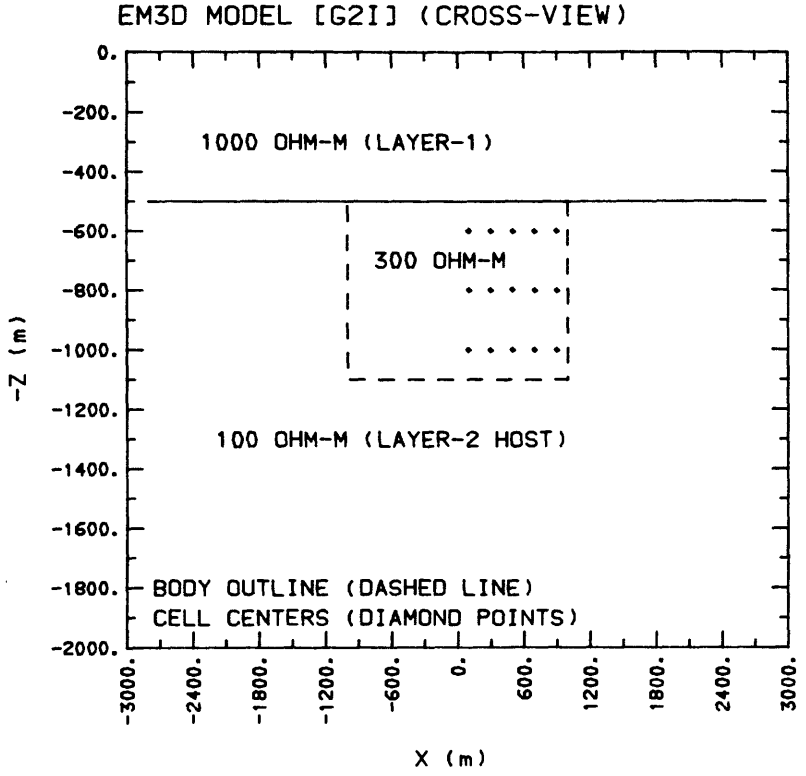

EM3D MODEL [G2H] (CROSS-VIEW)
0.
-200.
-400.
-600.
-800.
-1000.
-1200.
-1400.
-1600.
-1800.
-2000.
-Z (m)
300 OHM-M (LAYER-1)
300 OHM-M
10 OHM-M (LAYER-2 HOST)
BODY OUTLINE (DASHED LINE)
CELL CENTERS (DIAMOND POINTS)
-3000.
-2400.
-1800.
-1200.
-600.
0.
600.
1200.
1800.
2400.
3000.
X (m)

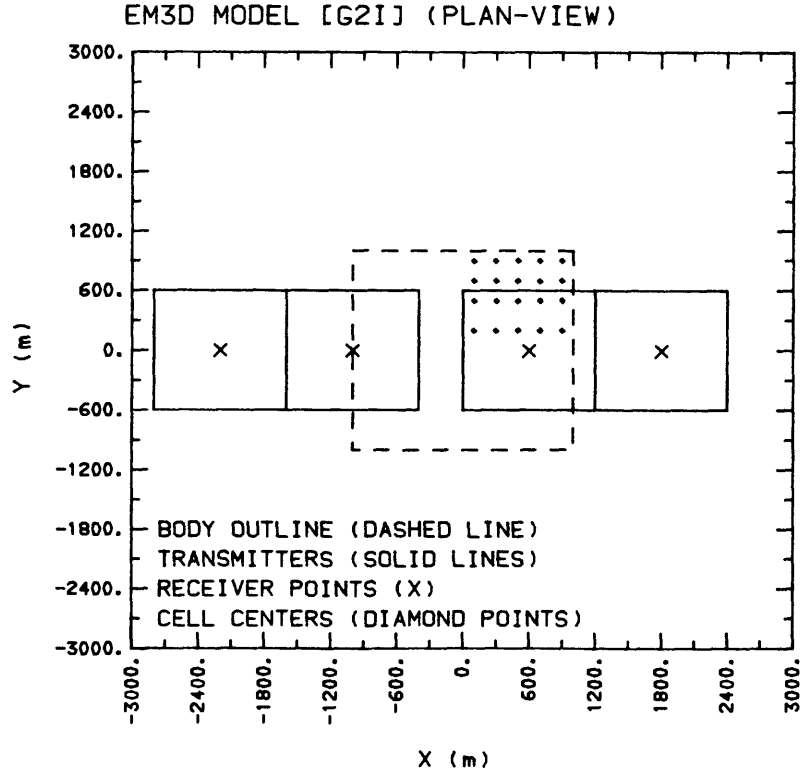

EM3D MODEL [G2H] (PLAN-VIEW)
3000.
2400.
1800.
1200.
600.
0.
-600.
-1200.
-1800.
-2400.
-3000.
Y (m)
BODY OUTLINE (DASHED LINE)
TRANSMITTERS (SOLID LINES)
RECEIVER POINTS (X)
CELL CENTERS (DIAMOND POINTS)
-3000.
-2400.
-1800.
-1200.
-600.
0.
600.
1200.
1800.
2400.
3000.
X (m)

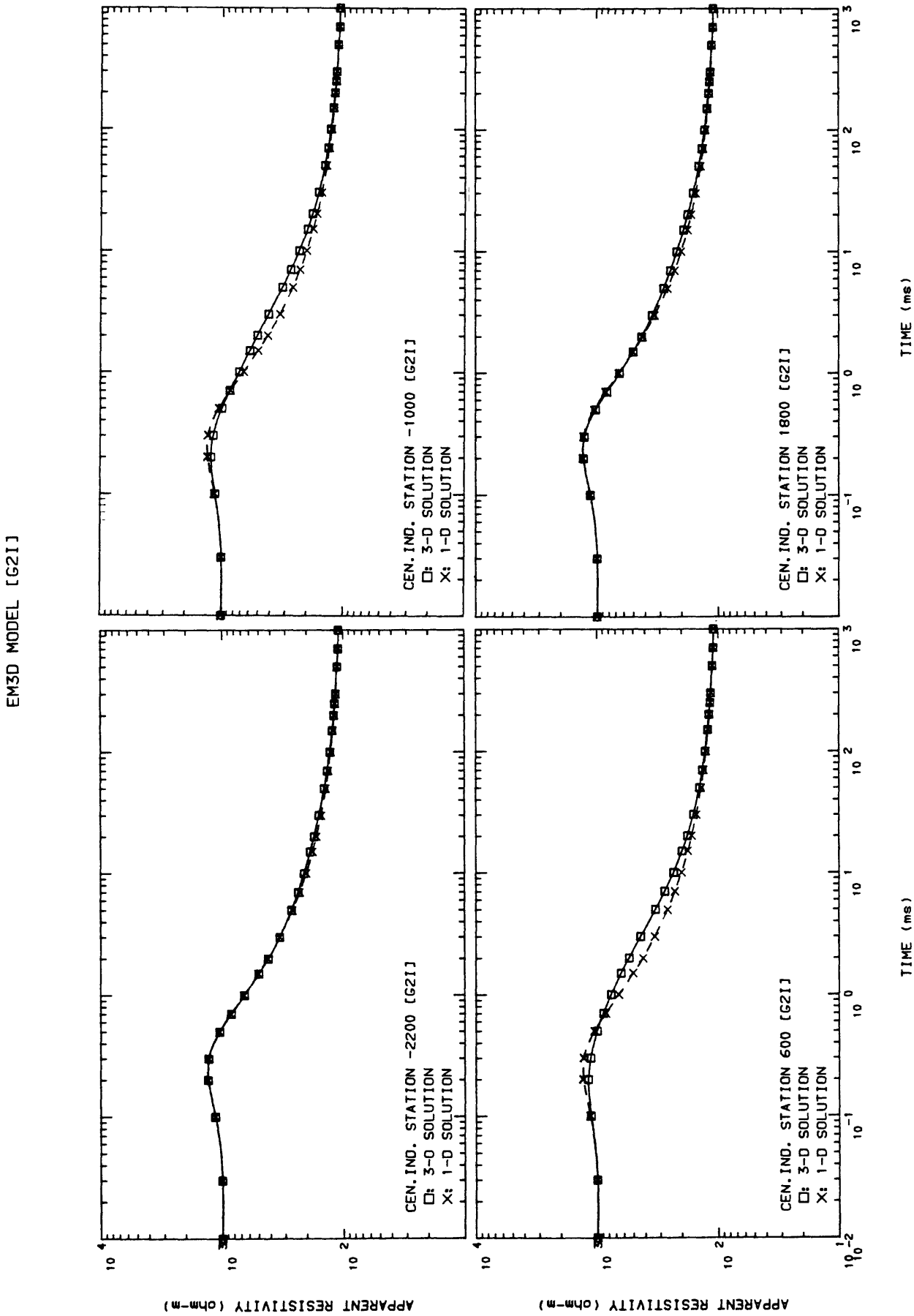

EM3D MODEL [G2H]
CEN.IND. STATION -1000 [G2H]
□: 3-D SOLUTION
X: 1-D SOLUTION
CEN.IND. STATION 1800 [G2H]
□: 3-D SOLUTION
X: 1-D SOLUTION
CEN.IND. STATION -2200 [G2H]
□: 3-D SOLUTION
X: 1-D SOLUTION
CEN.IND. STATION 600 [G2H]
□: 3-D SOLUTION
X: 1-D SOLUTION
APPARENT RESISTIVITY (ohm-m)
TIME (ms)

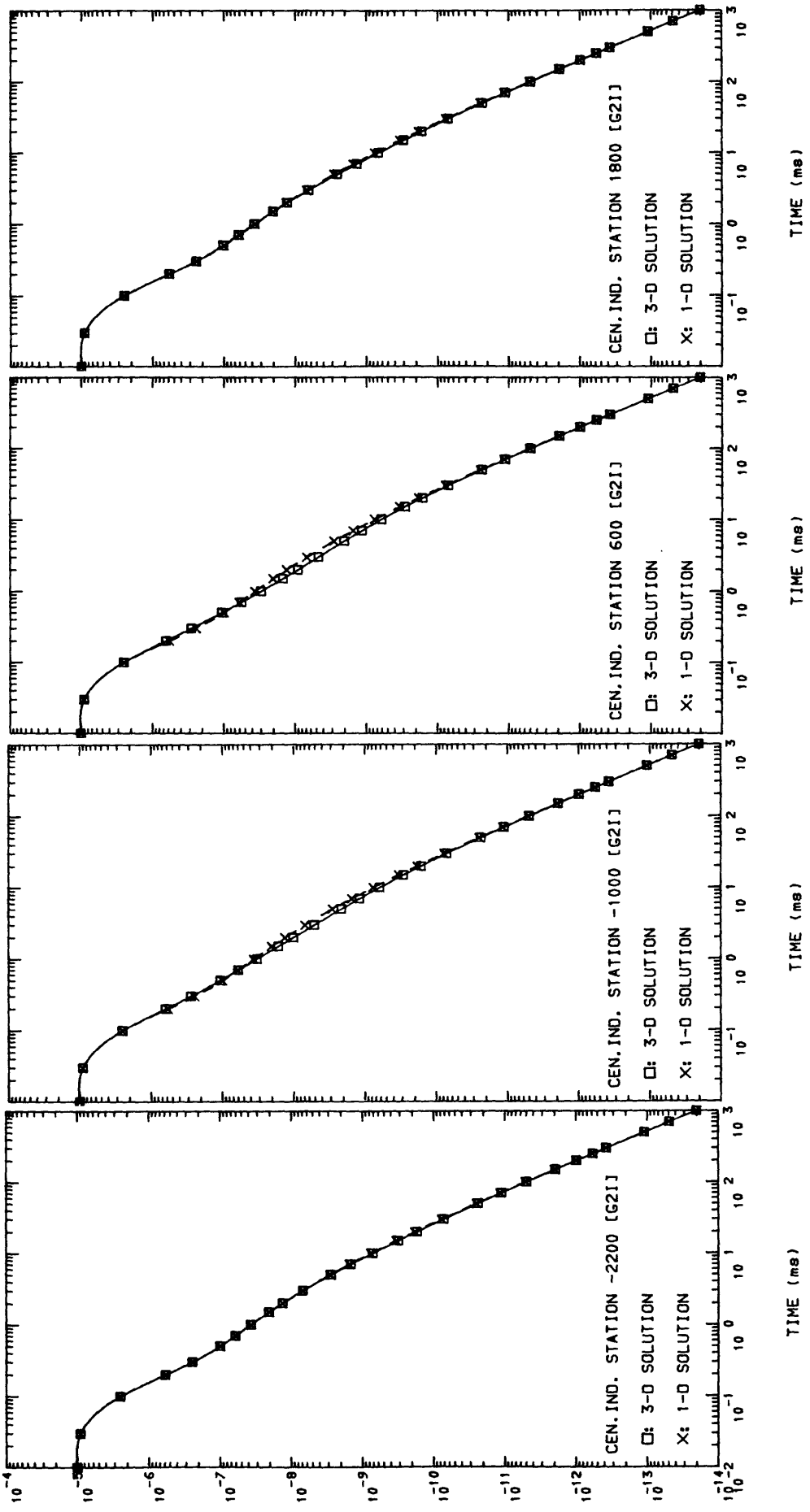

EM3D MODEL [G2H]
CEN.IND. STATION -1000 [G2H]
□: 3-D SOLUTION
X: 1-D SOLUTION
CEN.IND. STATION -2200 [G2H]
□: 3-D SOLUTION
X: 1-D SOLUTION
TIME (ms)
TIME (ms)
VOLTAGE (volts/amp•m•m)

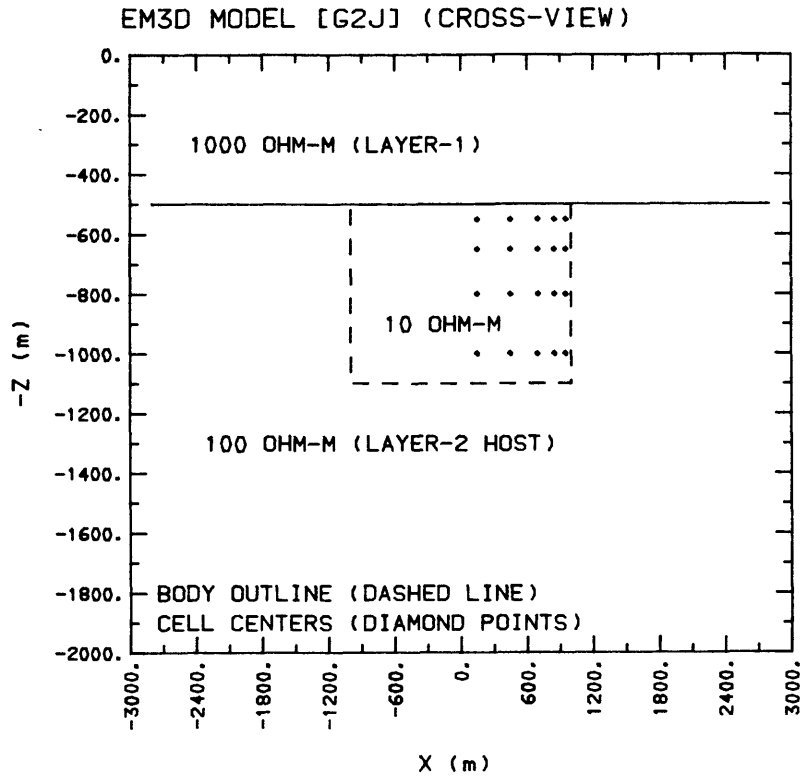

EM3D MODEL [G2H]
CEN.IND. STATION 1800 [G2H]
□: 3-D SOLUTION
X: 1-D SOLUTION
CEN.IND. STATION 600 [G2H]
□: 3-D SOLUTION
X: 1-D SOLUTION
TIME (ms)
TIME (ms)
VOLTAGE (volts/amp*m*m)

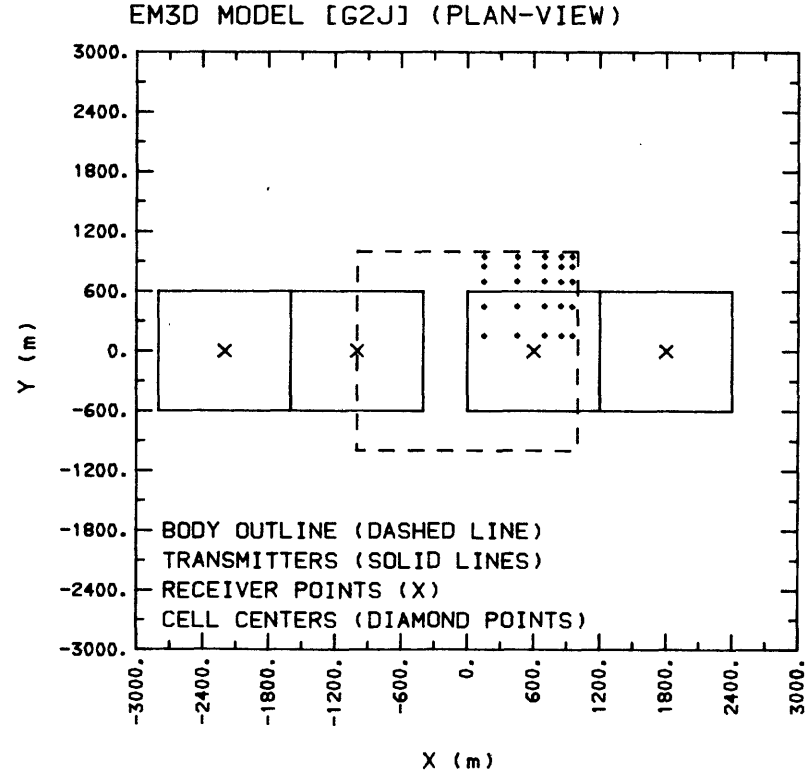

EM3D MODEL [G2I] (CROSS-VIEW)
1000 OHM-M (LAYER-1)
300 OHM-M
100 OHM-M (LAYER-2 HOST)
BODY OUTLINE (DASHED LINE)
CELL CENTERS (DIAMOND POINTS)
-Z (m)
X (m)
0.
-200.
-400.
-600.
-800.
-1000.
-1200.
-1400.
-1600.
-1800.
-2000.
-3000.
-2400.
-1800.
-1200.
-600.
600.
1200.
1800.
2400.
3000.

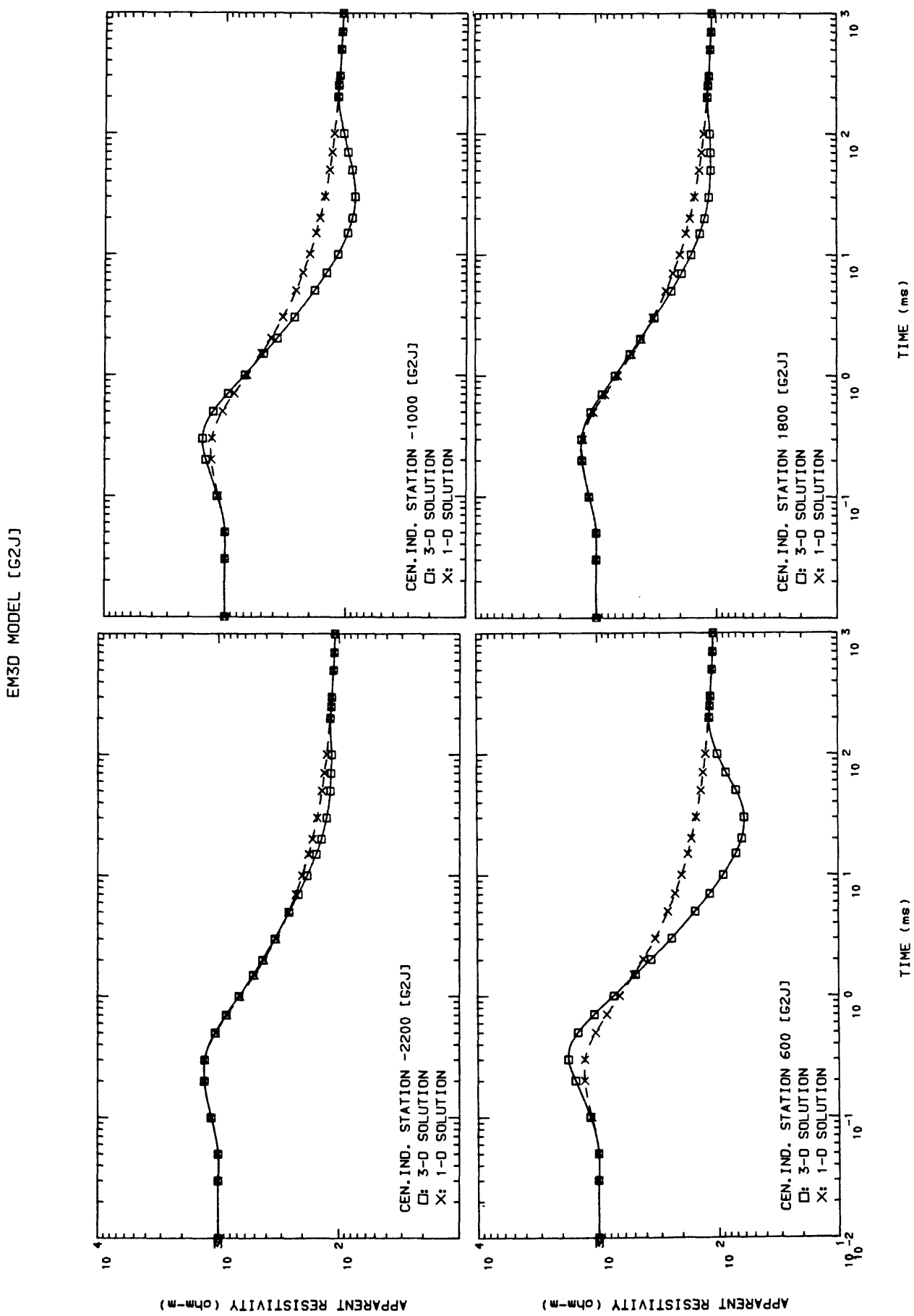

EM3D MODEL [G2I] (PLAN-VIEW)
BODY OUTLINE (DASHED LINE)
TRANSMITTERS (SOLID LINES)
RECEIVER POINTS (X)
CELL CENTERS (DIAMOND POINTS)
Y (m)
X (m)
3000.
2400.
1800.
1200.
600.
0.
-600.
-1200.
-1800.
-2400.
-3000.

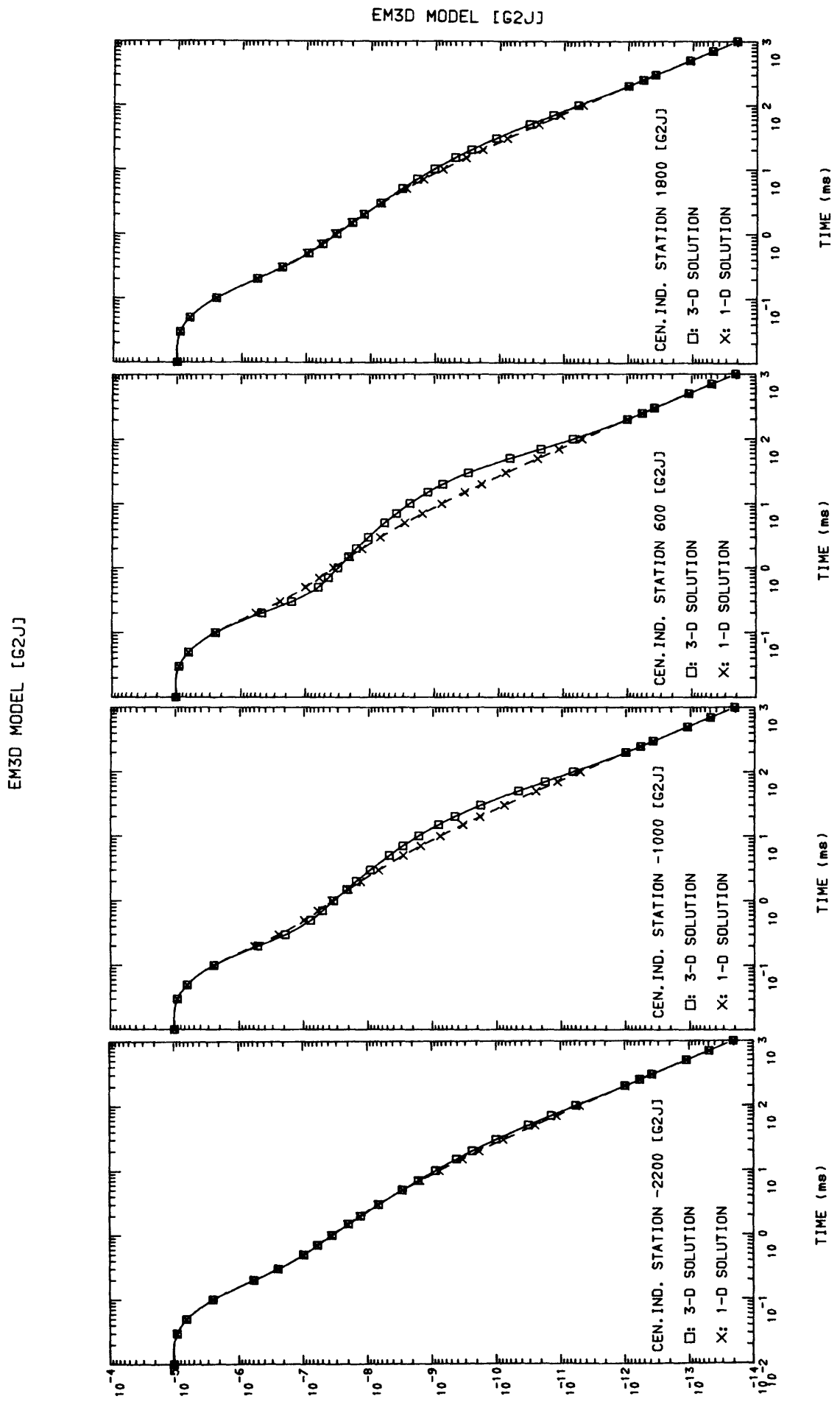

EM3D MODEL [G2I]
CEN.IND. STATION -1000 [G2I]
□: 3-D SOLUTION
X: 1-D SOLUTION
CEN.IND. STATION 1800 [G2I]
□: 3-D SOLUTION
X: 1-D SOLUTION
CEN.IND. STATION -2200 [G2I]
□: 3-D SOLUTION
X: 1-D SOLUTION
CEN.IND. STATION 600 [G2I]
□: 3-D SOLUTION
X: 1-D SOLUTION
APPARENT RESISTIVITY (ohm-m)
APPARENT RESISTIVITY (ohm-m)
TIME (ms)
TIME (ms)

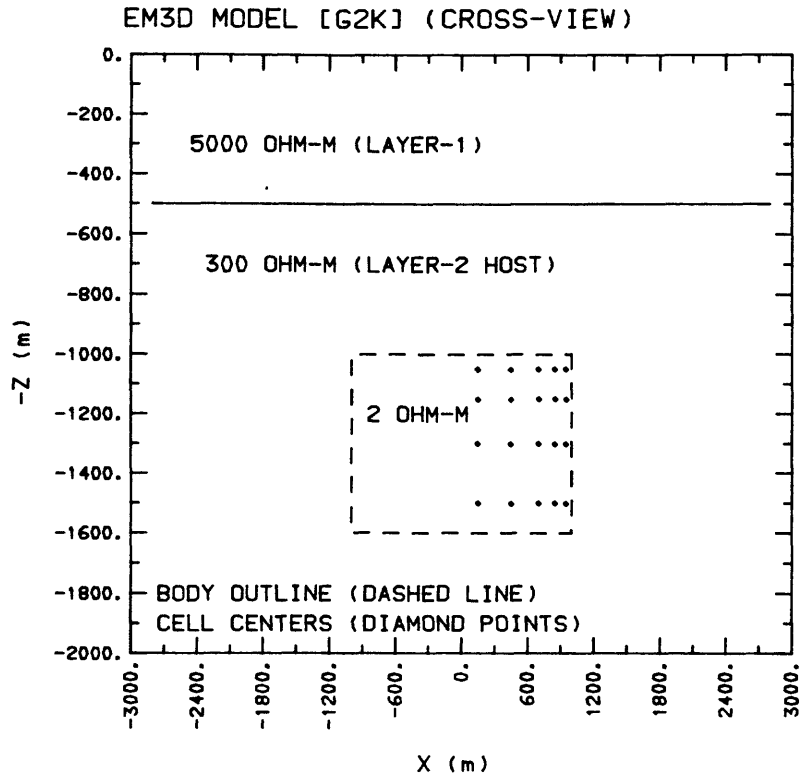

EM3D MODEL [G2I]
CEN.IND. STATION -2200 [G2I]
CEN.IND. STATION -1000 [G2I]
CEN.IND. STATION 600 [G2I]
CEN.IND. STATION 1800 [G2I]
□: 3-D SOLUTION
X: 1-D SOLUTION
TIME (ms)
VOLTAGE: (volts/amp*m*m)

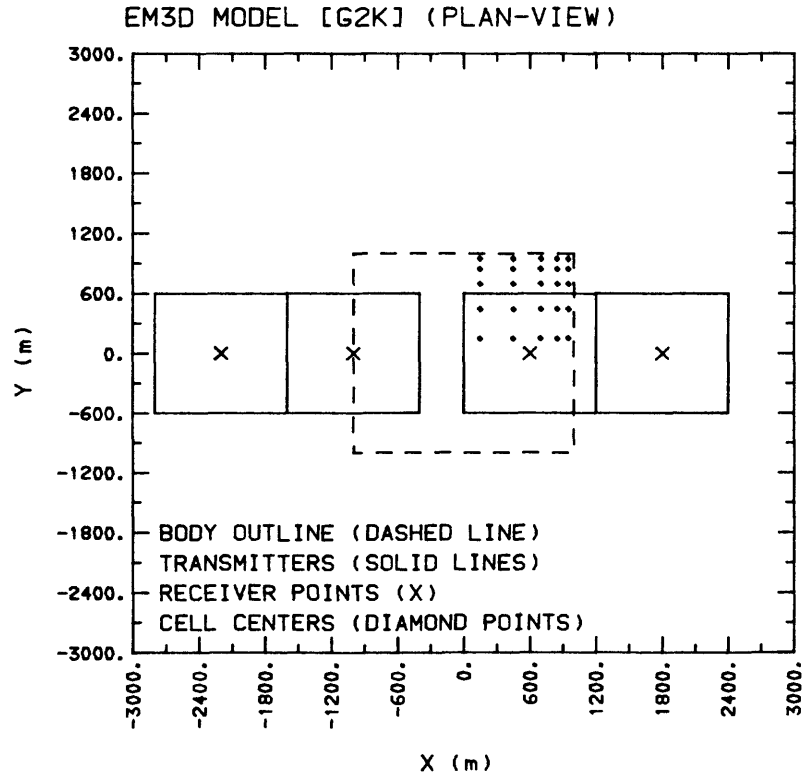

EM3D MODEL [G2J] (CROSS-VIEW)
1000 OHM-M (LAYER-1)
10 OHM-M
100 OHM-M (LAYER-2 HOST)
BODY OUTLINE (DASHED LINE)
CELL CENTERS (DIAMOND POINTS)
-Z (m)
X (m)
0.
-200.
-400.
-600.
-800.
-1000.
-1200.
-1400.
-1600.
-1800.
-2000.
-3000.
-2400.
-1800.
-1200.
-600.
0.
600.
1200.
1800.
2400.
3000.

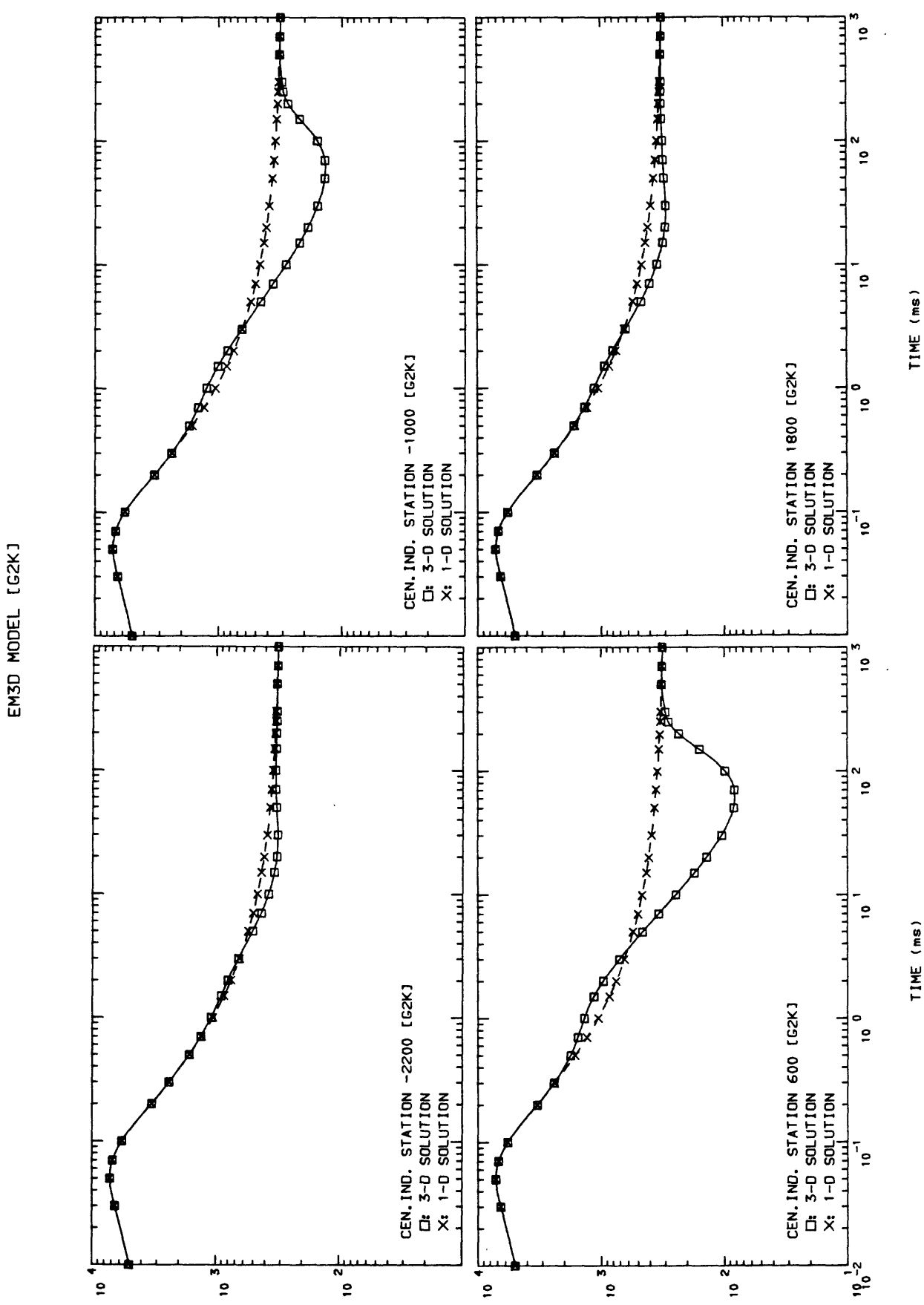

EM3D MODEL [G2J] (PLAN-VIEW)
BODY OUTLINE (DASHED LINE)
TRANSMITTERS (SOLID LINES)
RECEIVER POINTS (X)
CELL CENTERS (DIAMOND POINTS)
Y (m)
X (m)
3000.
2400.
1800.
1200.
600.
0.
-600.
-1200.
-1800.
-2400.
-3000.
-3000.
-2400.
-1800.
-1200.
-600.
0.
600.
1200.
1800.
2400.
3000.

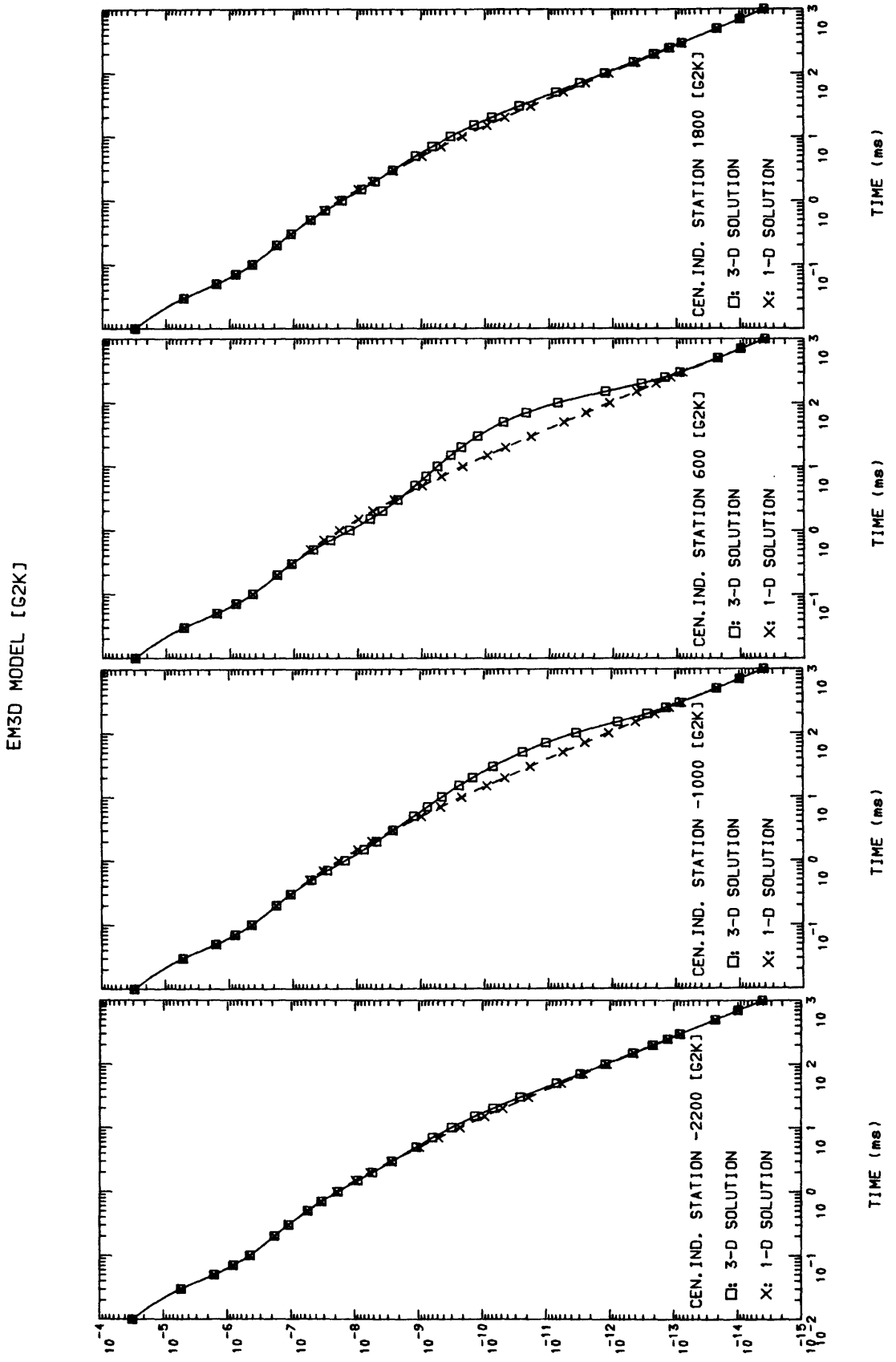

EM3D MODEL [G2J]
CEN.IND. STATION -1000 [G2J]
□: 3-D SOLUTION
X: 1-D SOLUTION
CEN.IND. STATION 1800 [G2J]
□: 3-D SOLUTION
X: 1-D SOLUTION
CEN.IND. STATION -2200 [G2J]
□: 3-D SOLUTION
X: 1-D SOLUTION
CEN.IND. STATION 600 [G2J]
□: 3-D SOLUTION
X: 1-D SOLUTION
APPARENT RESISTIVITY (ohm-m)
APPARENT RESISTIVITY (ohm-m)
TIME (ms)
TIME (ms)

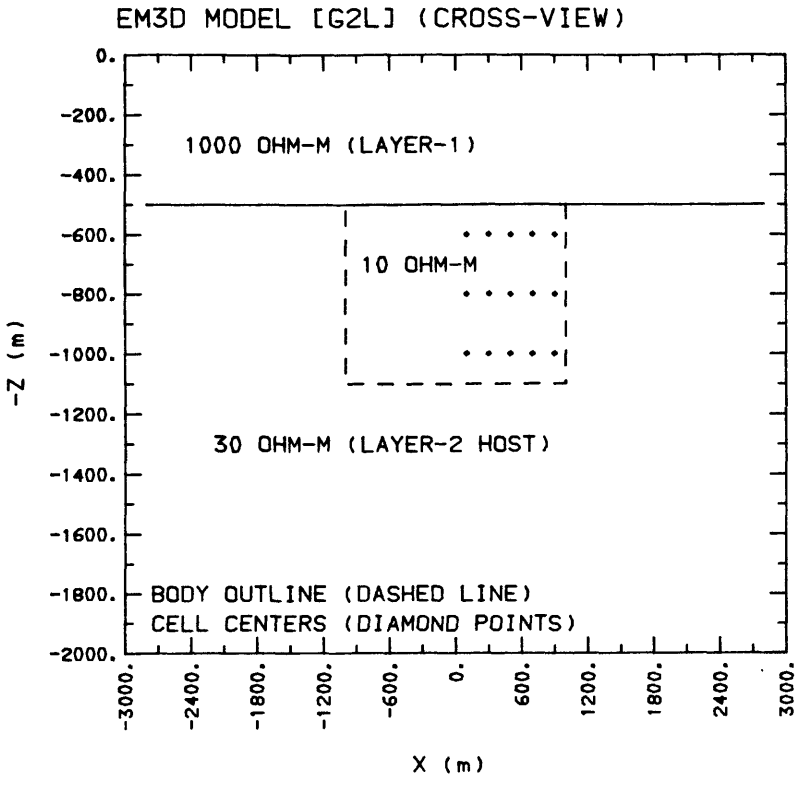

EM3D MODEL [G2J]
EM3D MODEL [G2J]
CEN.IND. STATION 1800 [G2J]
□: 3-D SOLUTION
X: 1-D SOLUTION
CEN.IND. STATION 600 [G2J]
□: 3-D SOLUTION
X: 1-D SOLUTION
CEN.IND. STATION -1000 [G2J]
□: 3-D SOLUTION
X: 1-D SOLUTION
CEN.IND. STATION -2200 [G2J]
□: 3-D SOLUTION
X: 1-D SOLUTION
TIME (ms)
TIME (ms)
TIME (ms)
TIME (ms)
VOLTAGE: (volts/amp•m•m)

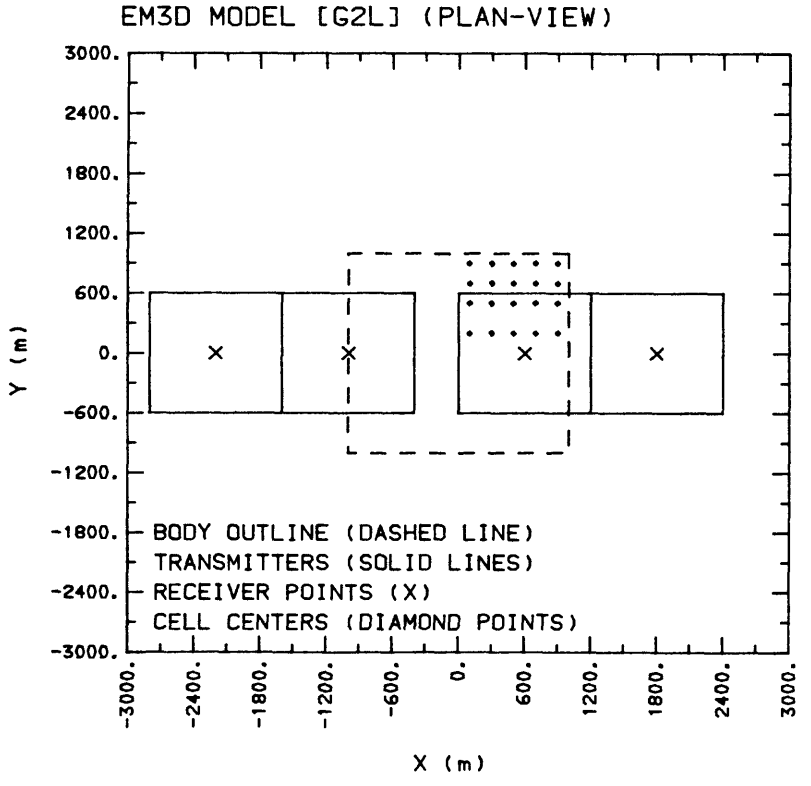

EM3D MODEL [G2K] (CROSS-VIEW)
5000 OHM-M (LAYER-1)
300 OHM-M (LAYER-2 HOST)
2 OHM-M
BODY OUTLINE (DASHED LINE)
CELL CENTERS (DIAMOND POINTS)
-Z (m)
X (m)
0.
-200.
-400.
-600.
-800.
-1000.
-1200.
-1400.
-1600.
-1800.
-2000.
-3000.
-2400.
-1800.
-1200.
-600.
600.
1200.
1800.
2400.
3000.

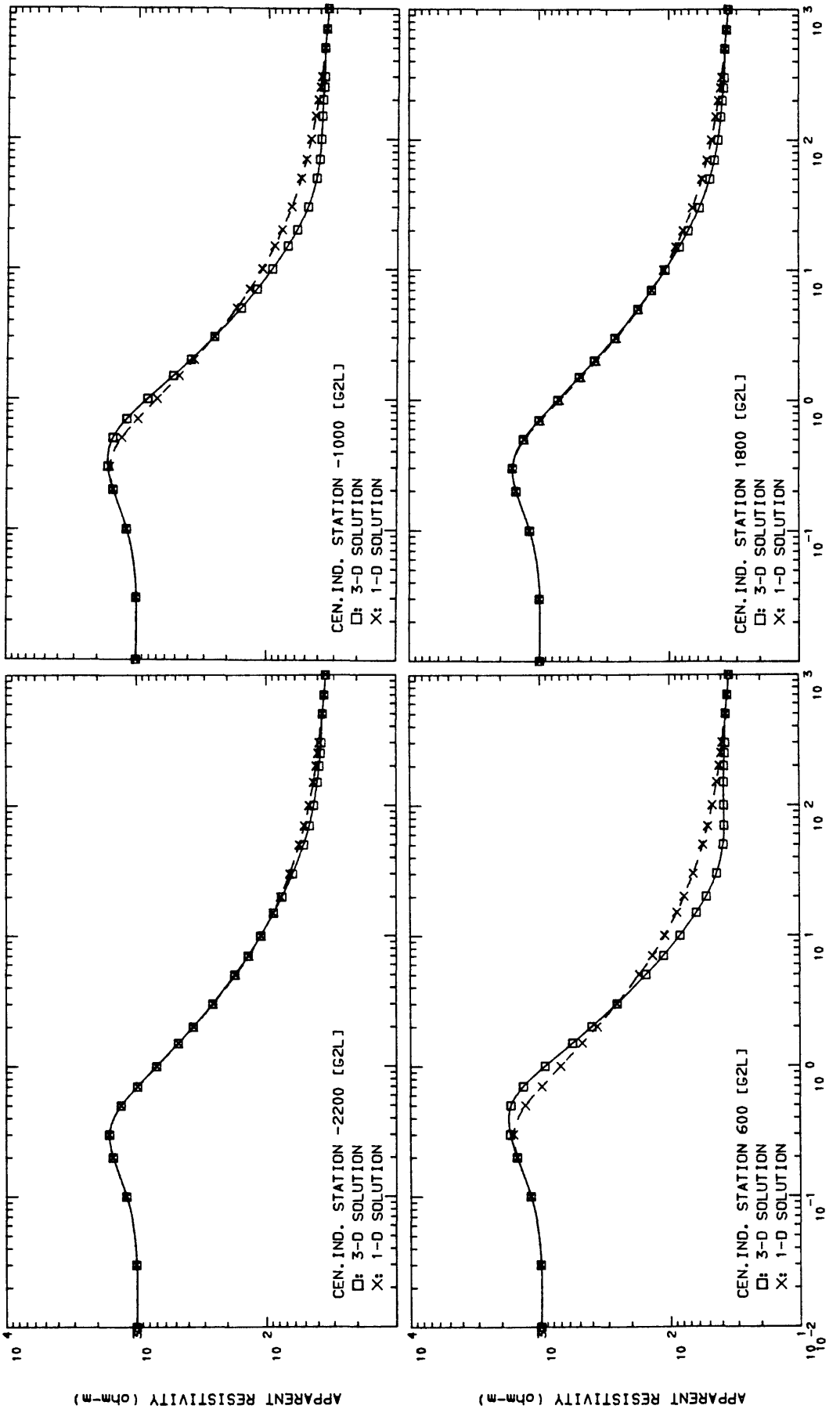

EM3D MODEL [G2K] (PLAN-VIEW)
BODY OUTLINE (DASHED LINE)
TRANSMITTERS (SOLID LINES)
RECEIVER POINTS (X)
CELL CENTERS (DIAMOND POINTS)
Y (m)
X (m)
3000.
2400.
1800.
1200.
600.
0.
-600.
-1200.
-1800.
-2400.
-3000.

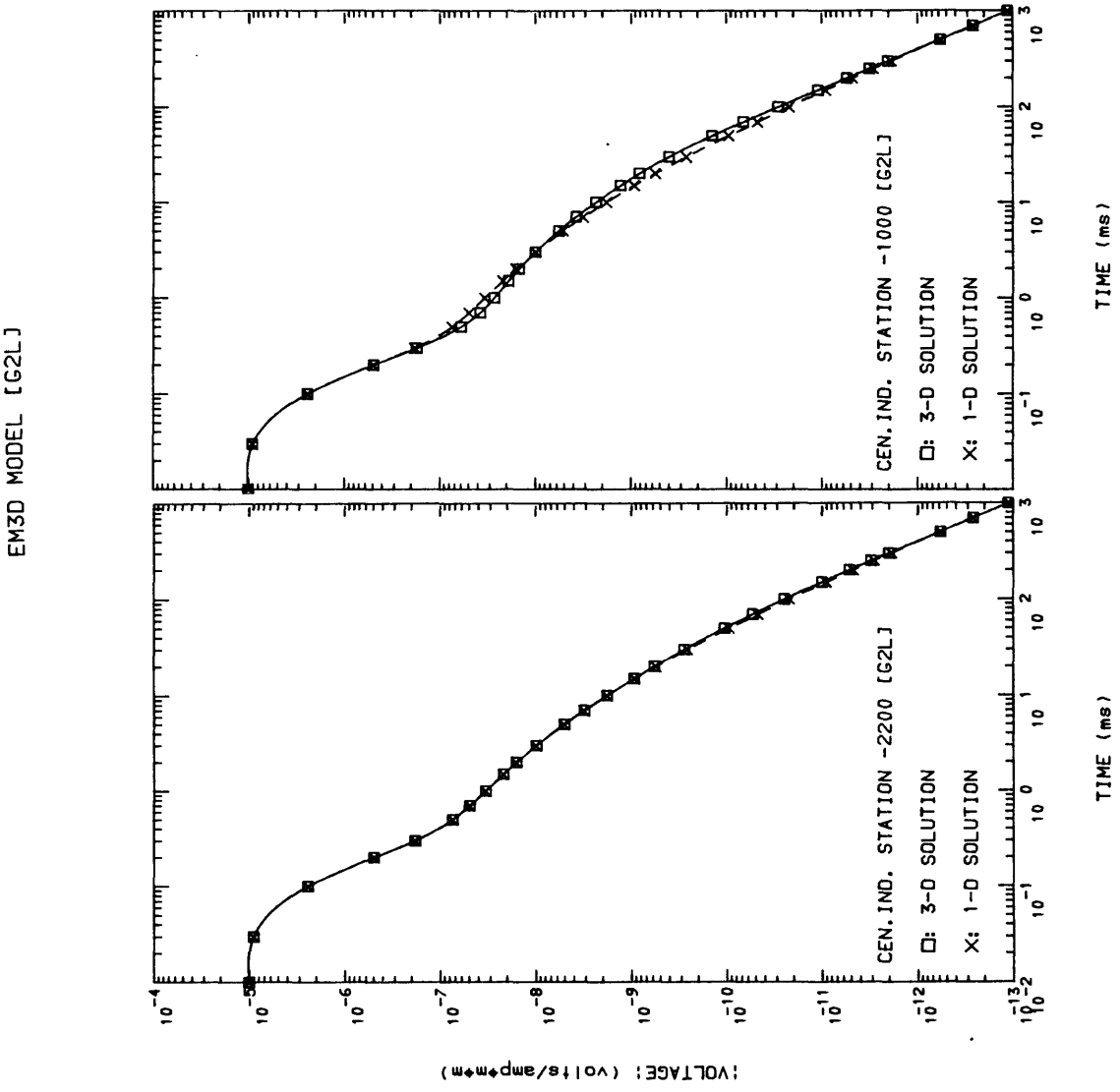

EM3D MODEL [G2K]
CEN.IND. STATION -1000 [G2K]
□: 3-D SOLUTION
X: 1-D SOLUTION
CEN.IND. STATION 1800 [G2K]
□: 3-D SOLUTION
X: 1-D SOLUTION
CEN.IND. STATION -2200 [G2K]
□: 3-D SOLUTION
X: 1-D SOLUTION
CEN.IND. STATION 600 [G2K]
□: 3-D SOLUTION
X: 1-D SOLUTION
APPARENT RESISTIVITY (ohm-m)
APPARENT RESISTIVITY (ohm-m)
TIME (ms)
TIME (ms)

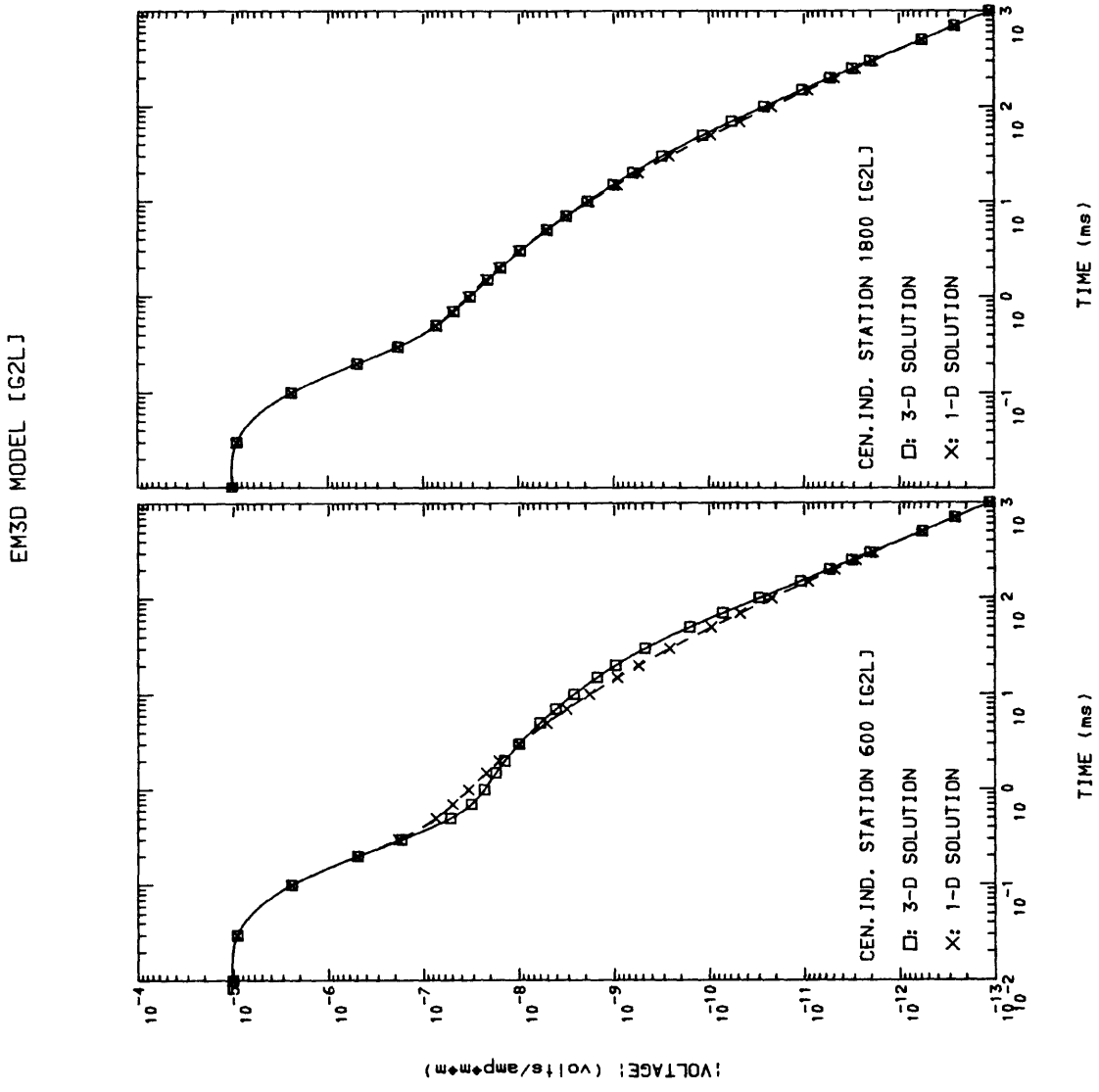

EM3D MODEL [G2K]
CEN.IND. STATION -2200 [G2K]
CEN.IND. STATION -1000 [G2K]
CEN.IND. STATION 600 [G2K]
CEN.IND. STATION 1800 [G2K]
□: 3-D SOLUTION
X: 1-D SOLUTION
TIME (ms)
VOLTAGE (volt/s/amp*m*m)

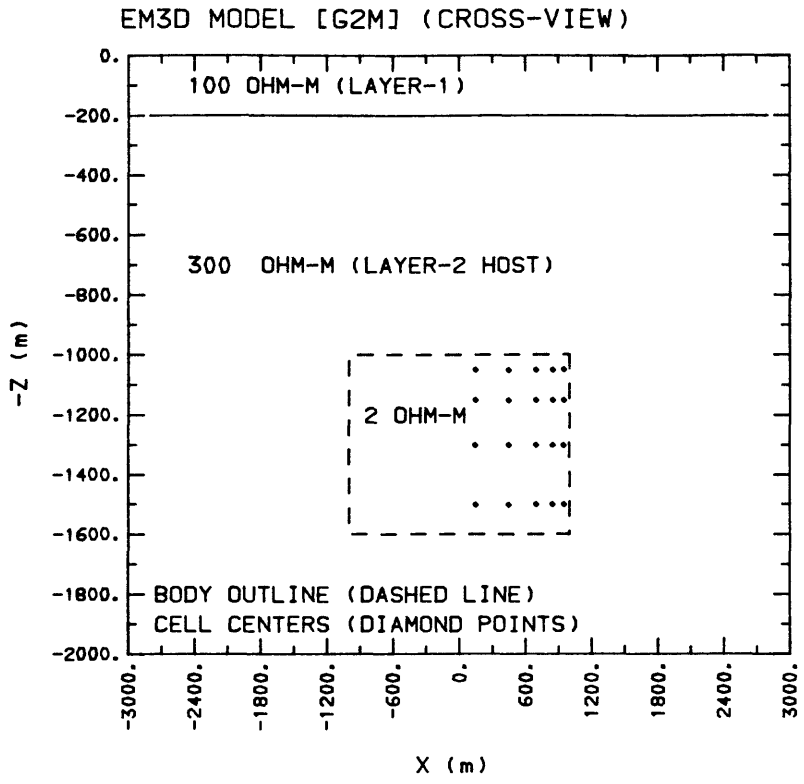

EM3D MODEL [G2L] (CROSS-VIEW)
1000 OHM-M (LAYER-1)
10 OHM-M
30 OHM-M (LAYER-2 HOST)
BODY OUTLINE (DASHED LINE)
CELL CENTERS (DIAMOND POINTS)
-Z (m)
X (m)
0.
-200.
-400.
-600.
-800.
-1000.
-1200.
-1400.
-1600.
-1800.
-2000.
-3000.
-2400.
-1800.
-1200.
-600.
600.
1200.
1800.
2400.
3000.

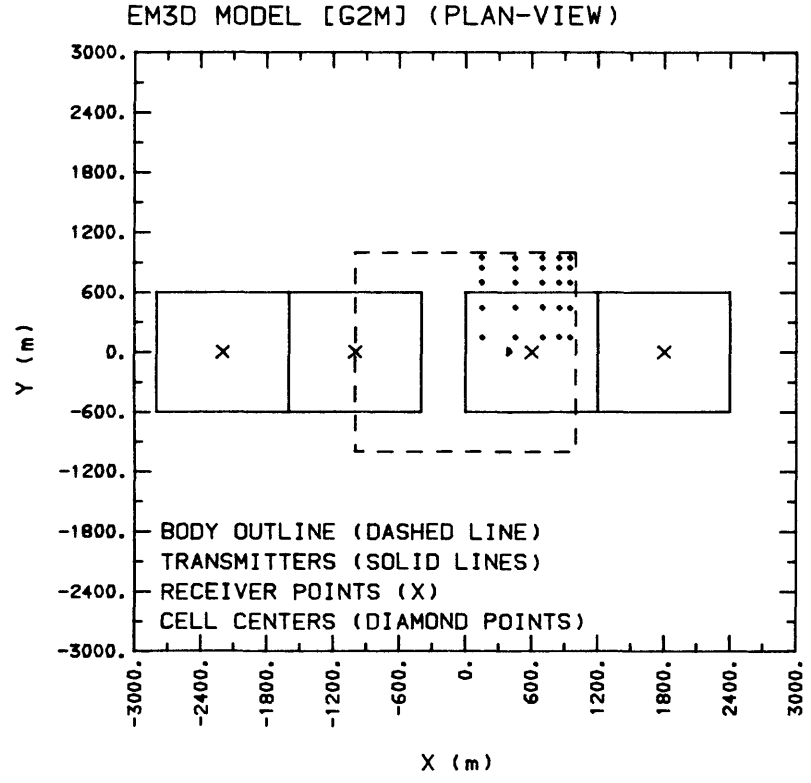

EM3D MODEL [G2L] (PLAN-VIEW)
BODY OUTLINE (DASHED LINE)
TRANSMITTERS (SOLID LINES)
RECEIVER POINTS (X)
CELL CENTERS (DIAMOND POINTS)
Y (m)
X (m)
3000.
2400.
1800.
1200.
600.
0.
-600.
-1200.
-1800.
-2400.
-3000.

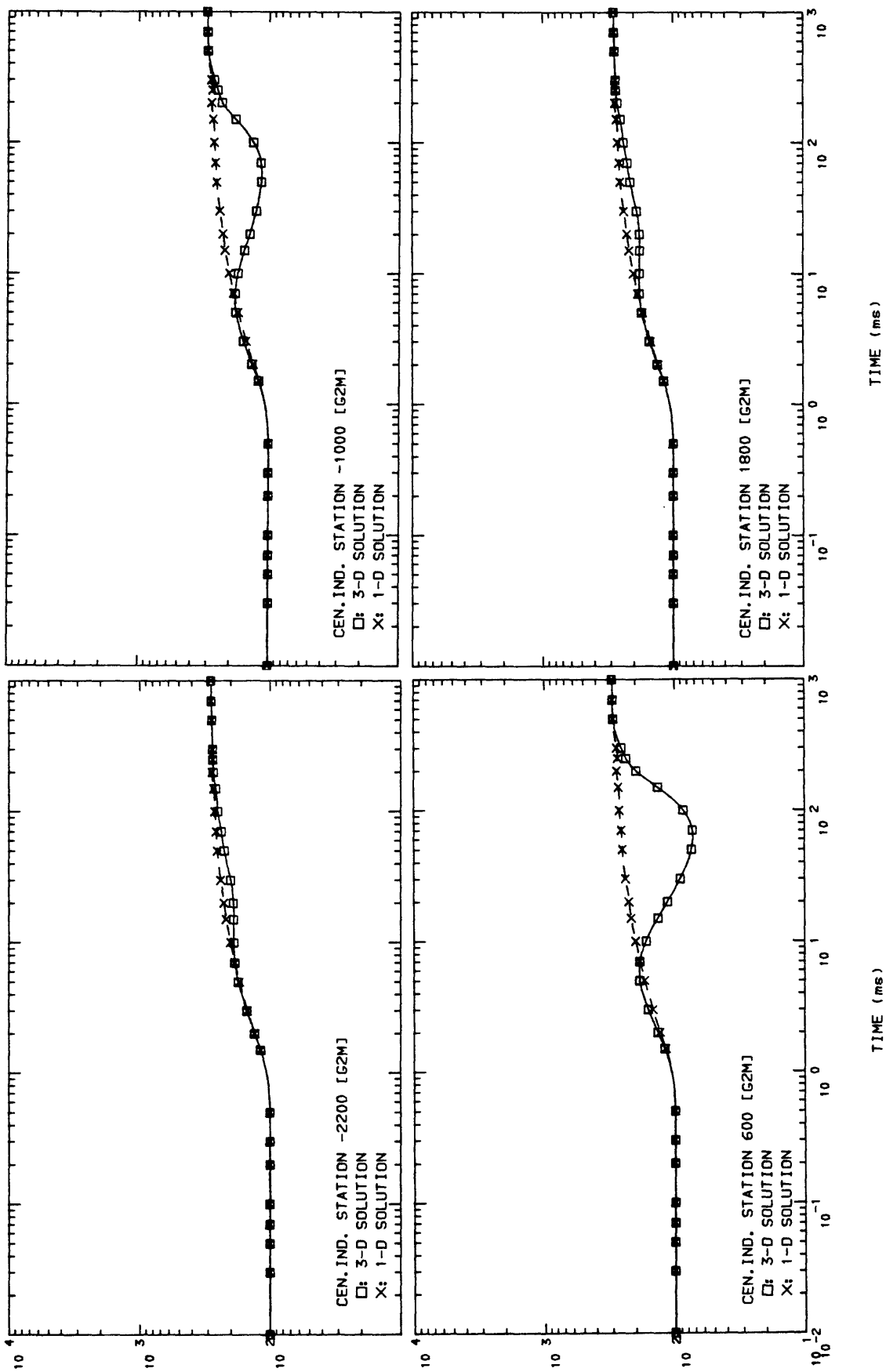

EM3D MODEL [G2L]
CEN.IND. STATION -1000 [G2L]
□: 3-D SOLUTION
X: 1-D SOLUTION
CEN.IND. STATION 1800 [G2L]
□: 3-D SOLUTION
X: 1-D SOLUTION
CEN.IND. STATION -2200 [G2L]
□: 3-D SOLUTION
X: 1-D SOLUTION
CEN.IND. STATION 600 [G2L]
□: 3-D SOLUTION
X: 1-D SOLUTION
APPARENT RESISTIVITY (ohm-m)
APPARENT RESISTIVITY (ohm-m)
TIME (ms)
TIME (ms)

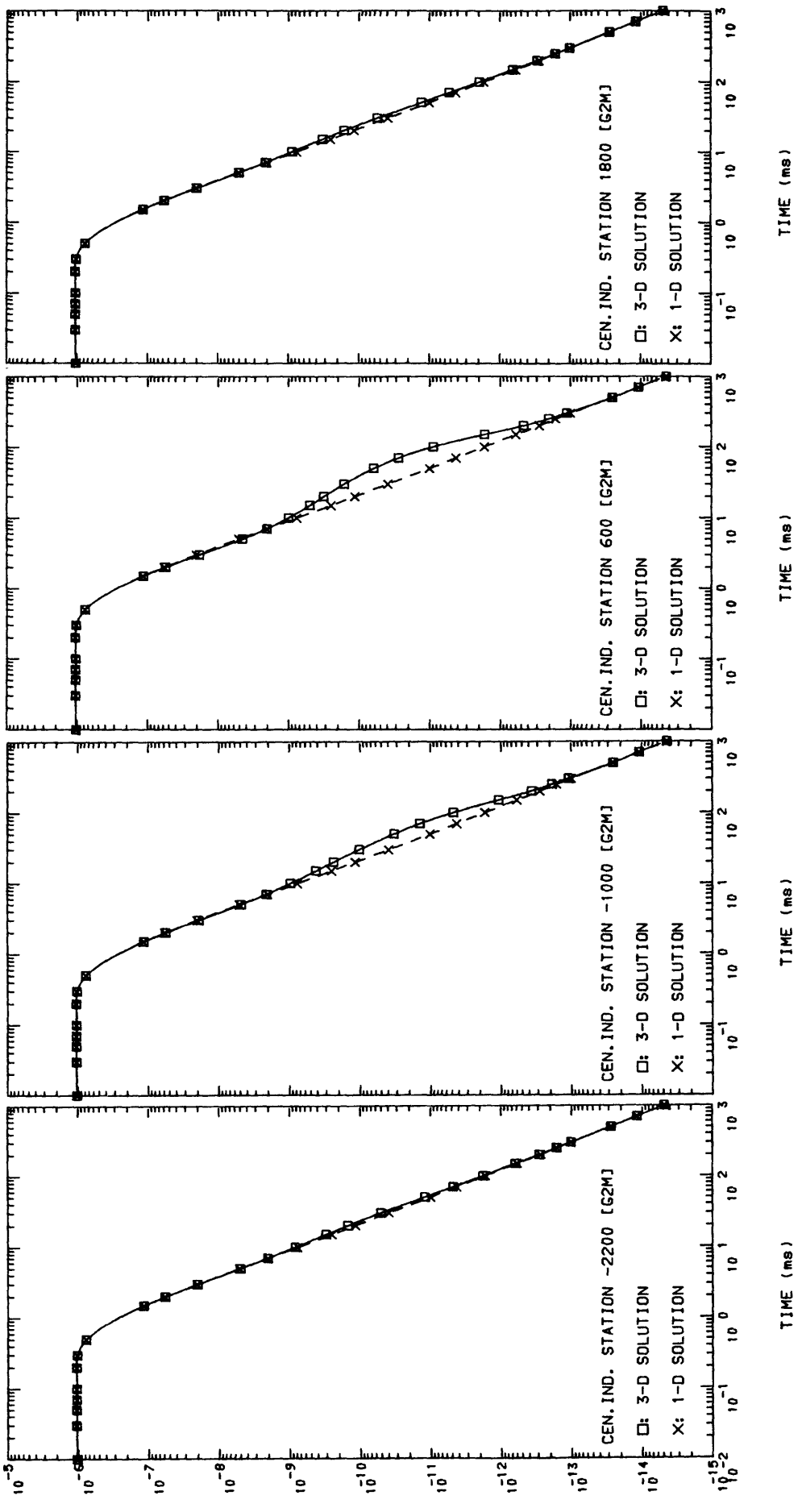

EM3D MODEL [G2L]
CEN.IND. STATION -1000 [G2L]
□: 3-D SOLUTION
X: 1-D SOLUTION
CEN.IND. STATION -2200 [G2L]
□: 3-D SOLUTION
X: 1-D SOLUTION
TIME (ms)
TIME (ms)
VOLTAGE: (volts/amp•m•m)

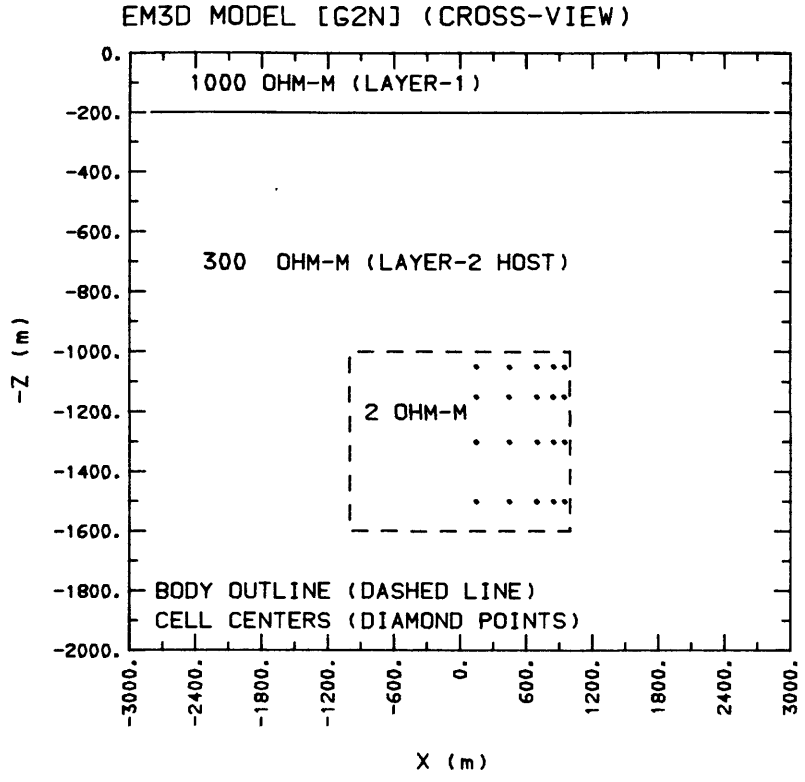

EM3D MODEL [G2L]
CEN.IND. STATION 1800 [G2L]
□: 3-D SOLUTION
X: 1-D SOLUTION
CEN.IND. STATION 600 [G2L]
□: 3-D SOLUTION
X: 1-D SOLUTION
TIME (ms)
TIME (ms)
VOLTAGE (volts/amp•m•m)

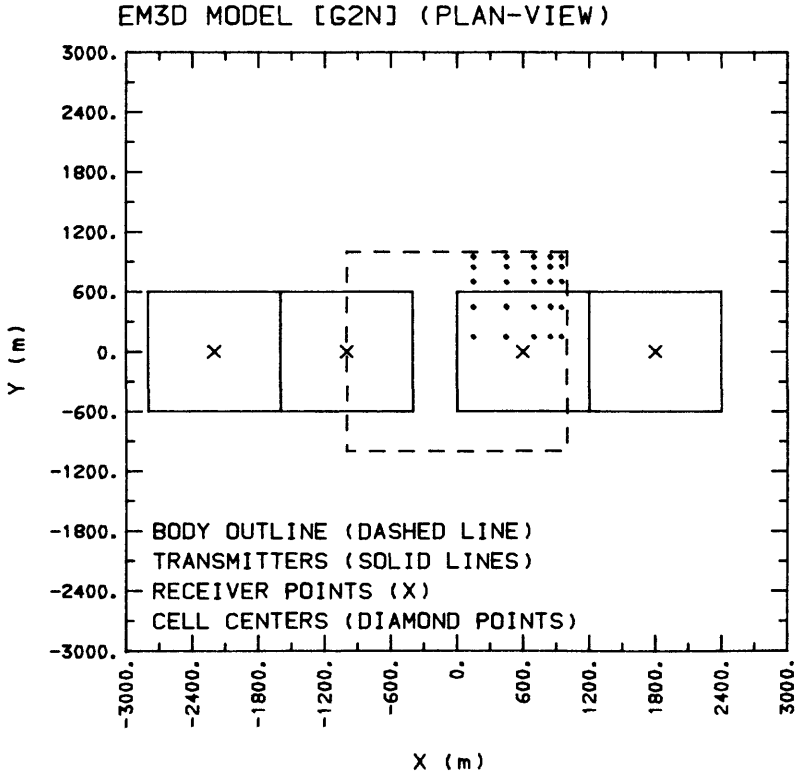

EM3D MODEL [G2M] (CROSS-VIEW)
100 OHM-M (LAYER-1)
300 OHM-M (LAYER-2 HOST)
2 OHM-M
BODY OUTLINE (DASHED LINE)
CELL CENTERS (DIAMOND POINTS)
-Z (m)
X (m)
0.
-200.
-400.
-600.
-800.
-1000.
-1200.
-1400.
-1600.
-1800.
-2000.
-3000.
-2400.
-1800.
-1200.
-600.
600.
1200.
1800.
2400.
3000.

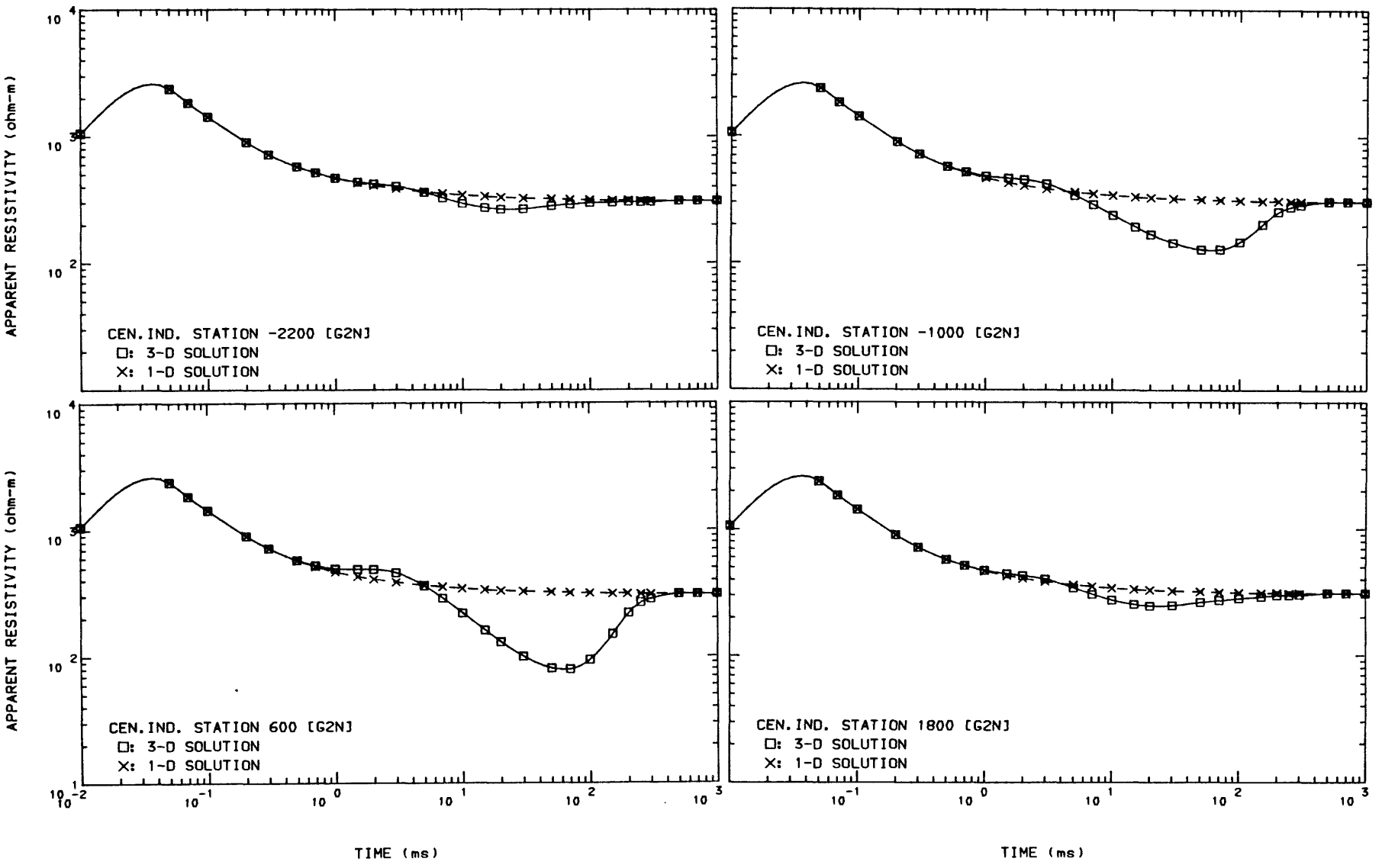

EM3D MODEL [G2M] (PLAN-VIEW)
BODY OUTLINE (DASHED LINE)
TRANSMITTERS (SOLID LINES)
RECEIVER POINTS (X)
CELL CENTERS (DIAMOND POINTS)
Y (m)
X (m)
3000.
2400.
1800.
1200.
600.
0.
-600.
-1200.
-1800.
-2400.
-3000.


EM3D MODEL [G2M]
CEN.IND. STATION -1000 [G2M]
□: 3-D SOLUTION
X: 1-D SOLUTION
CEN.IND. STATION 1800 [G2M]
□: 3-D SOLUTION
X: 1-D SOLUTION
CEN.IND. STATION -2200 [G2M]
□: 3-D SOLUTION
X: 1-D SOLUTION
CEN.IND. STATION 600 [G2M]
□: 3-D SOLUTION
X: 1-D SOLUTION
APPARENT RESISTIVITY (ohm-m)
APPARENT RESISTIVITY (ohm-m)
TIME (ms)
TIME (ms)

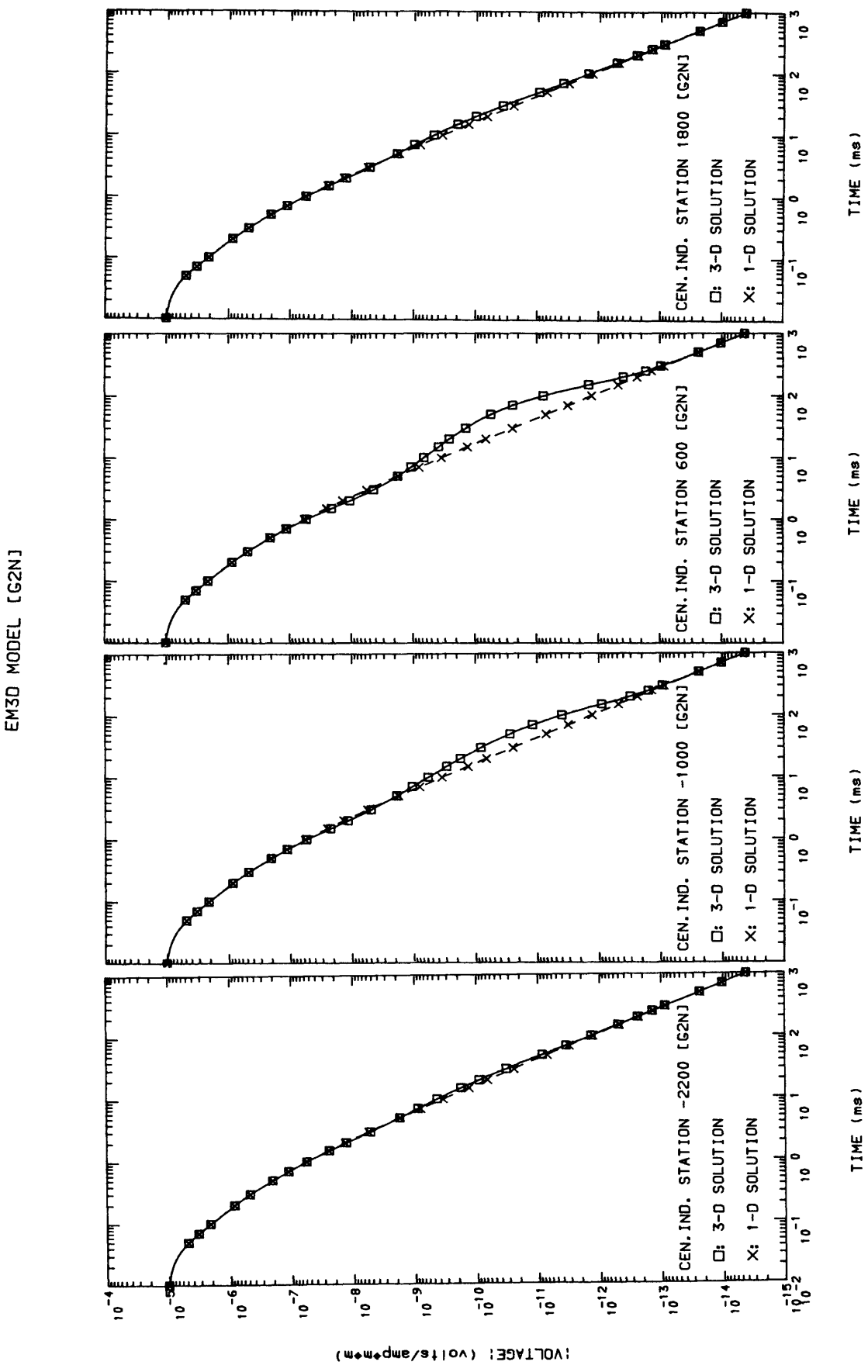

EM3D MODEL [G2M]
CEN.IND. STATION 1800 [G2M]
CEN.IND. STATION 600 [G2M]
CEN.IND. STATION -1000 [G2M]
CEN.IND. STATION -2200 [G2M]
□: 3-D SOLUTION
X: 1-D SOLUTION
TIME (ms)
VOLTAGE (volts/amp•m•m)

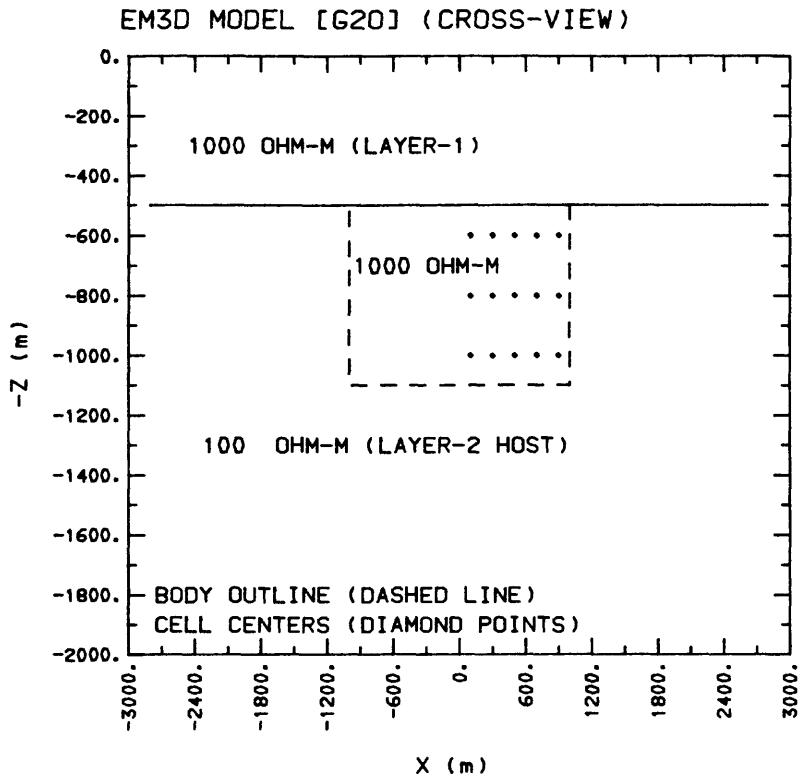

EM3D MODEL [G2N] (CROSS-VIEW)
1000 OHM-M (LAYER-1)
300 OHM-M (LAYER-2 HOST)
2 OHM-M
BODY OUTLINE (DASHED LINE)
CELL CENTERS (DIAMOND POINTS)
-Z (m)
X (m)
0.
-200.
-400.
-600.
-800.
-1000.
-1200.
-1400.
-1600.
-1800.
-2000.
-3000.
-2400.
-1800.
-1200.
-600.
600.
1200.
1800.
2400.
3000.

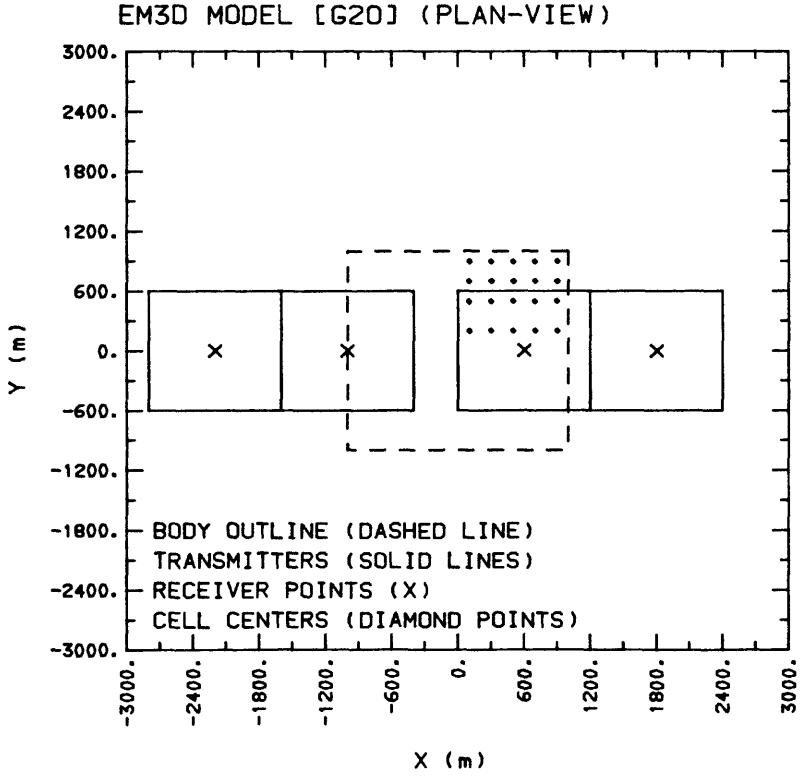

EM3D MODEL [G2N] (PLAN-VIEW)
BODY OUTLINE (DASHED LINE)
TRANSMITTERS (SOLID LINES)
RECEIVER POINTS (X)
CELL CENTERS (DIAMOND POINTS)
Y (m)
X (m)
3000.
2400.
1800.
1200.
600.
0.
-600.
-1200.
-1800.
-2400.
-3000.

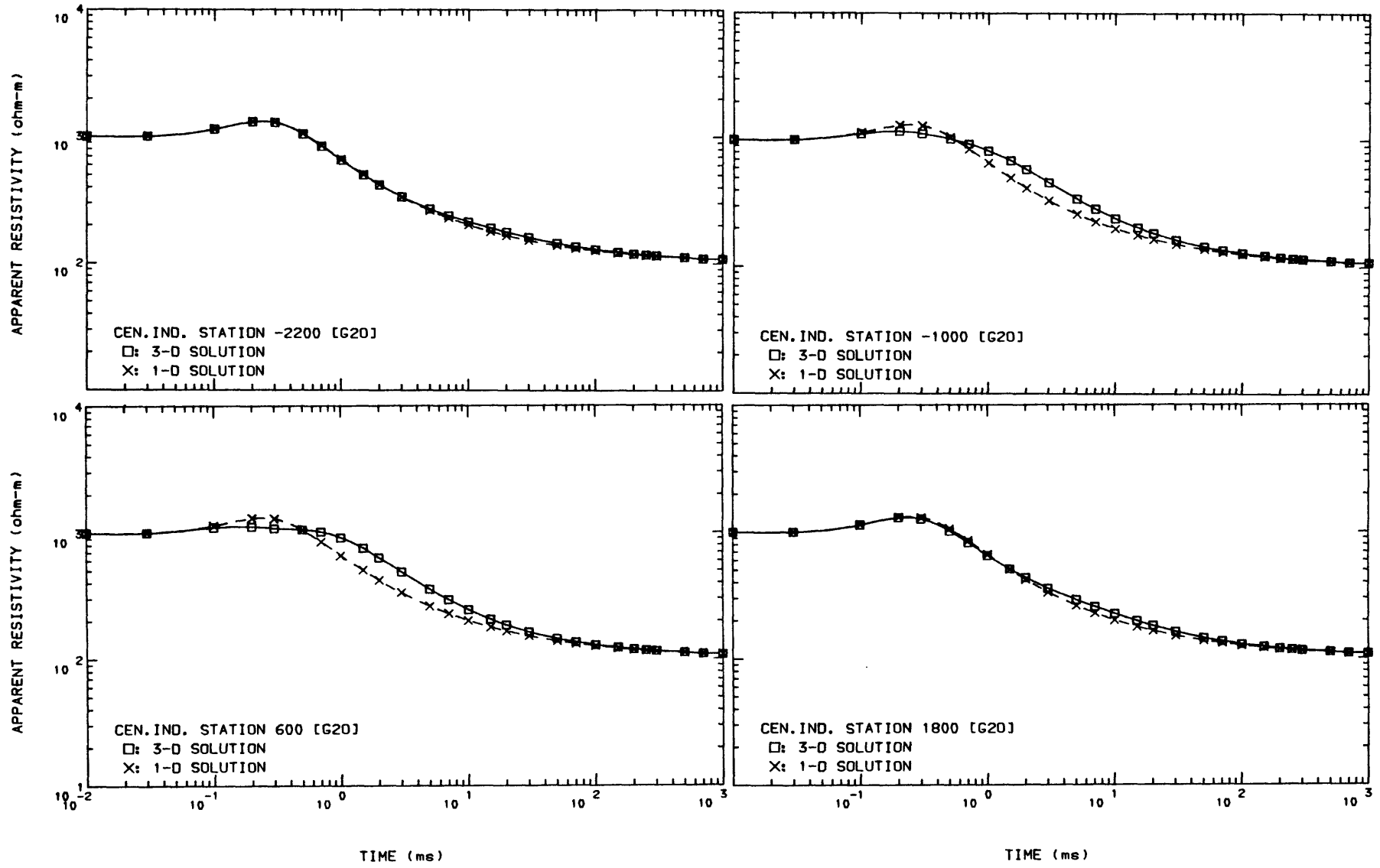


EM3D MODEL [G2N]

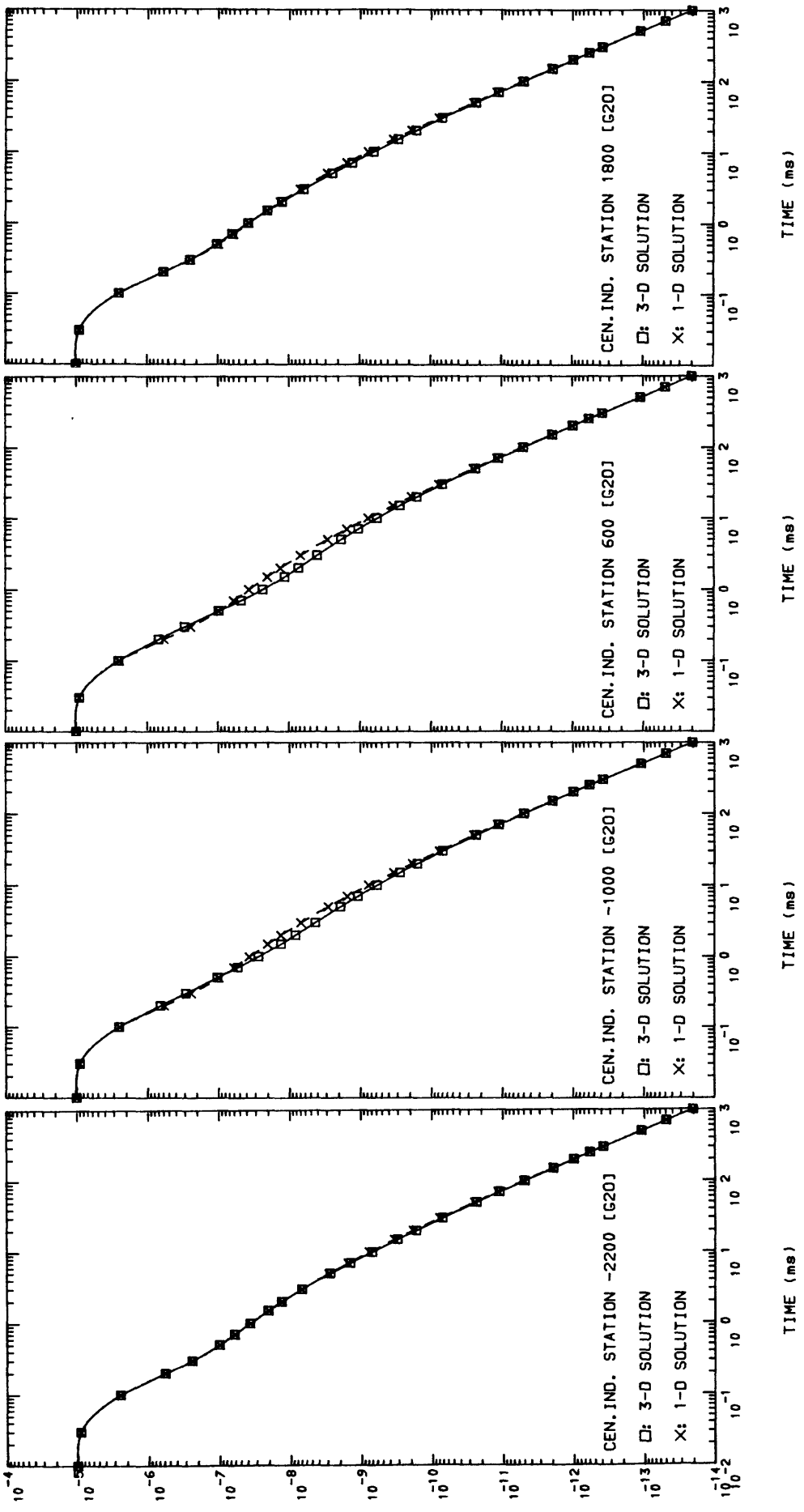

EM3D MODEL [G2N]
CEN.IND. STATION 1800 [G2N]
CEN.IND. STATION 600 [G2N]
CEN.IND. STATION -1000 [G2N]
CEN.IND. STATION -2200 [G2N]
□: 3-D SOLUTION
X: 1-D SOLUTION
TIME (ms)
VOLTAGE (volts/amp*m*m)

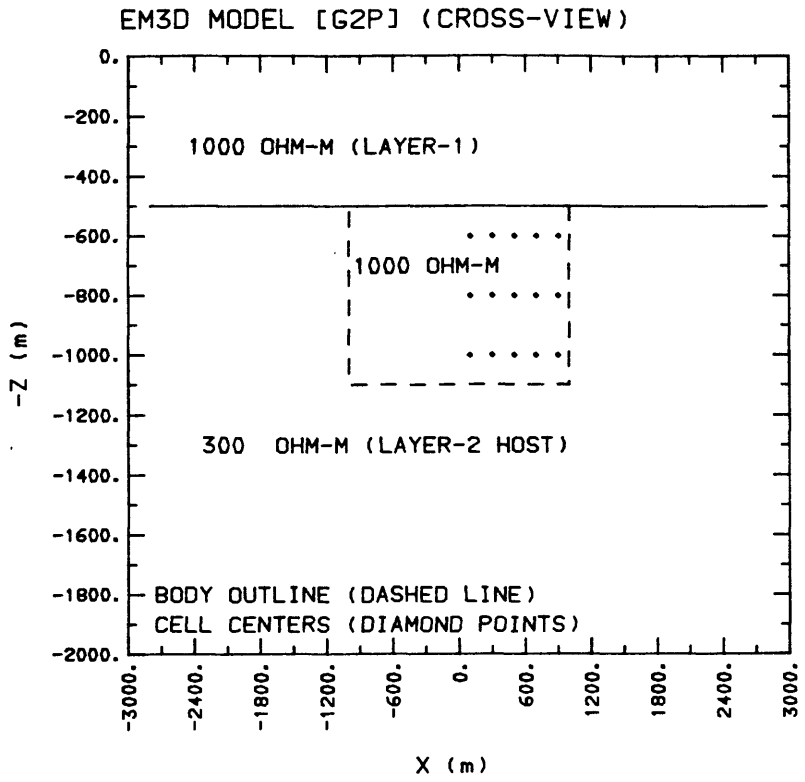

EM3D MODEL [G20] (CROSS-VIEW)
1000 OHM-M (LAYER-1)
1000 OHM-M
100 OHM-M (LAYER-2 HOST)
BODY OUTLINE (DASHED LINE)
CELL CENTERS (DIAMOND POINTS)
-Z (m)
X (m)
0.
-200.
-400.
-600.
-800.
-1000.
-1200.
-1400.
-1600.
-1800.
-2000.
-3000.
-2400.
-1800.
-1200.
-600.
600.
1200.
1800.
2400.
3000.

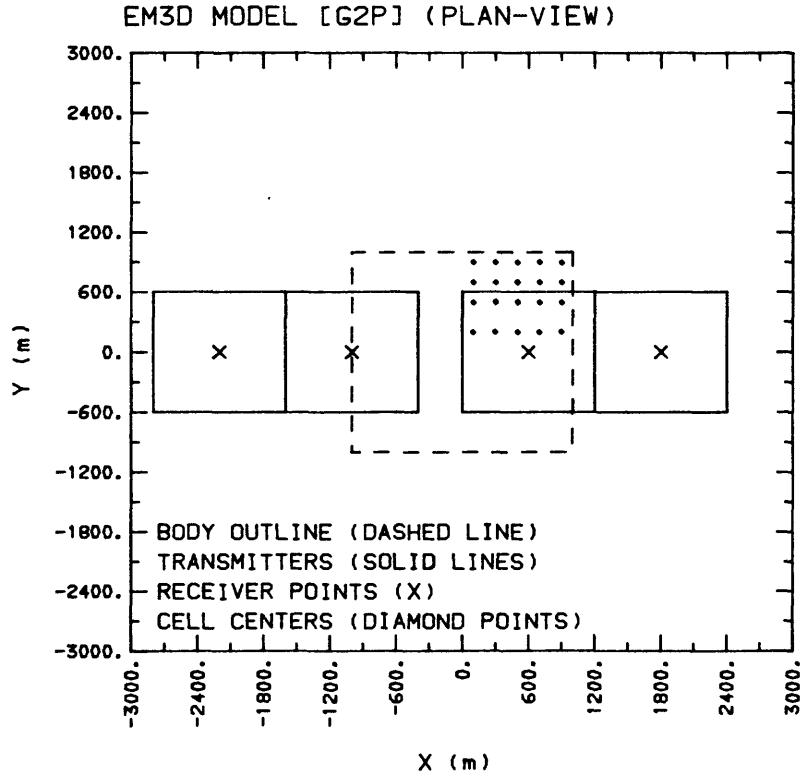

EM3D MODEL [G20] (PLAN-VIEW)
BODY OUTLINE (DASHED LINE)
TRANSMITTERS (SOLID LINES)
RECEIVER POINTS (X)
CELL CENTERS (DIAMOND POINTS)
Y (m)
X (m)
3000.
2400.
1800.
1200.
600.
0.
-600.
-1200.
-1800.
-2400.
-3000.

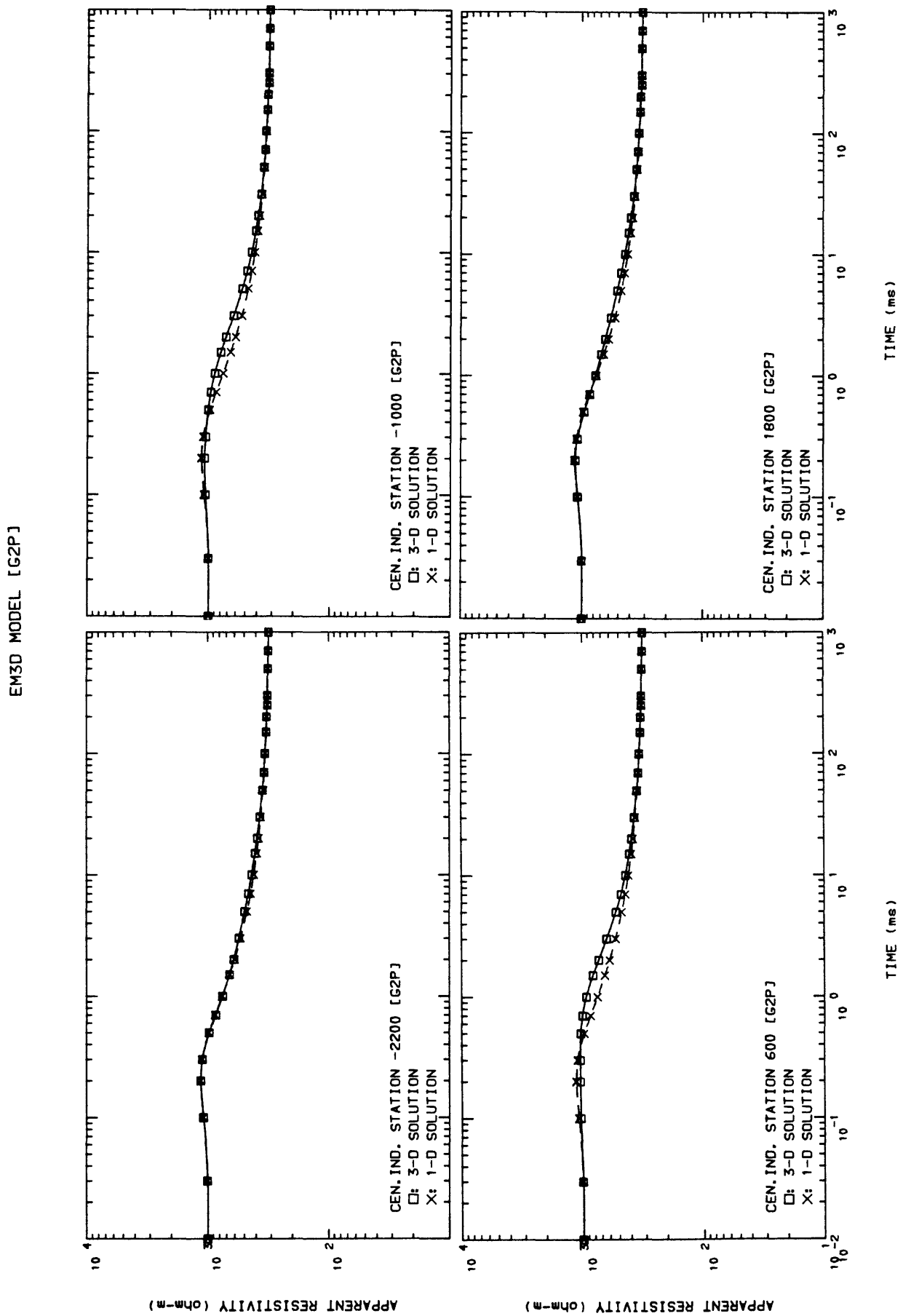


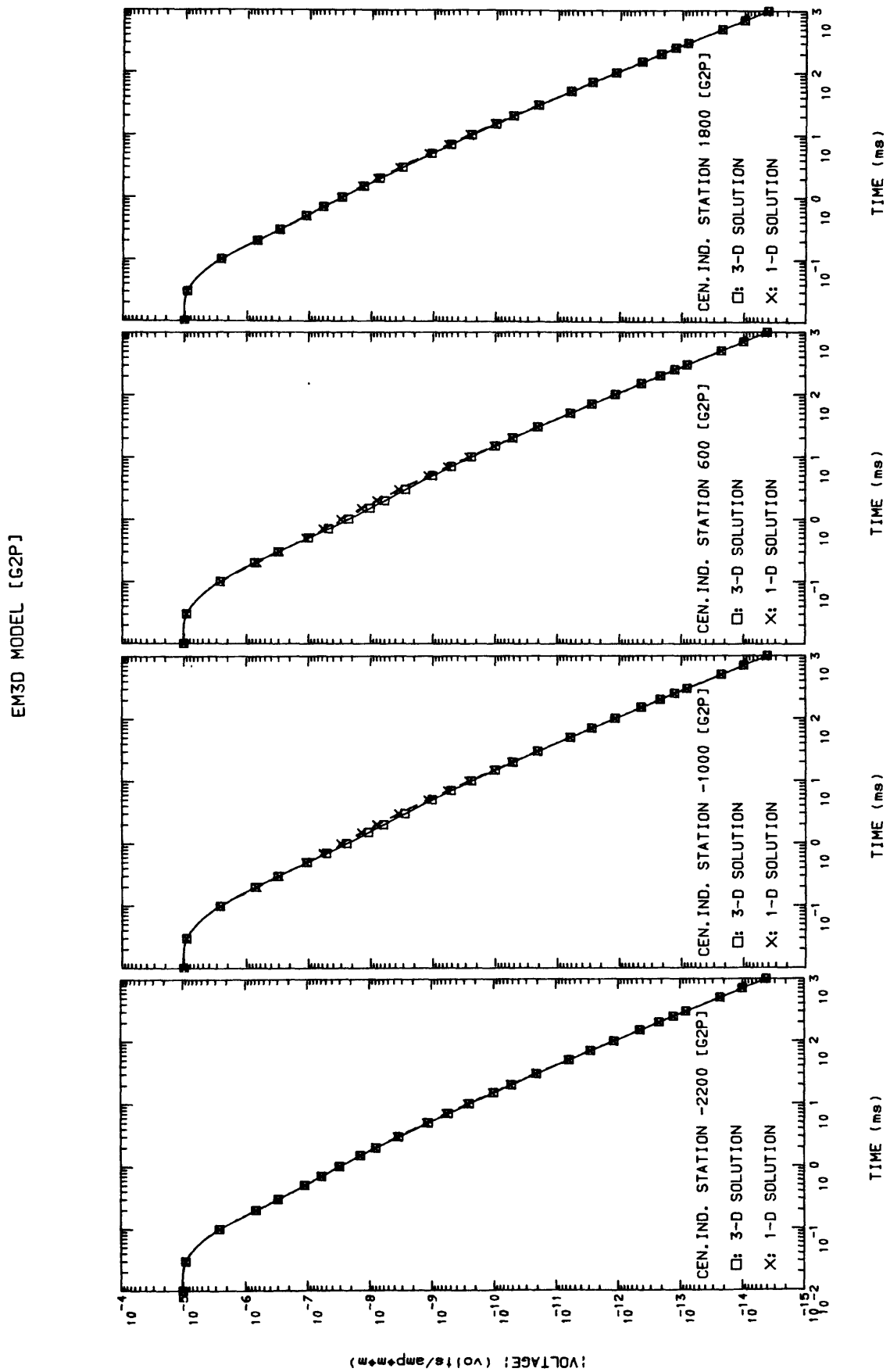
EM3D MODEL [G20]

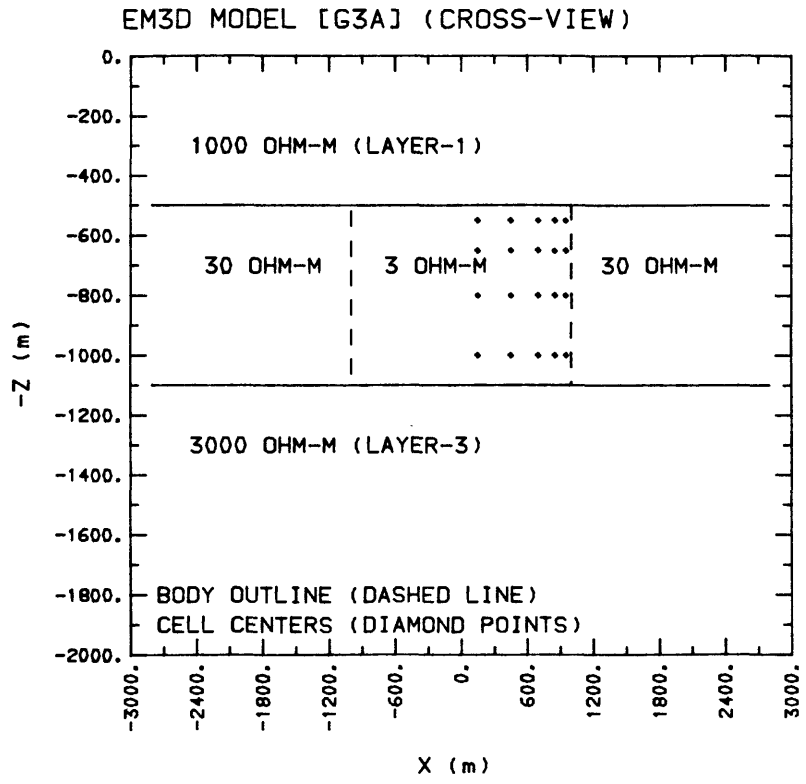

EM3D MODEL [G20]
CEN.IND. STATION 1800 [G20]
CEN.IND. STATION 600 [G20]
CEN.IND. STATION -1000 [G20]
CEN.IND. STATION -2200 [G20]
□: 3-D SOLUTION
X: 1-D SOLUTION
TIME (ms)
VOLTAGE: (volts/amp*m*m)

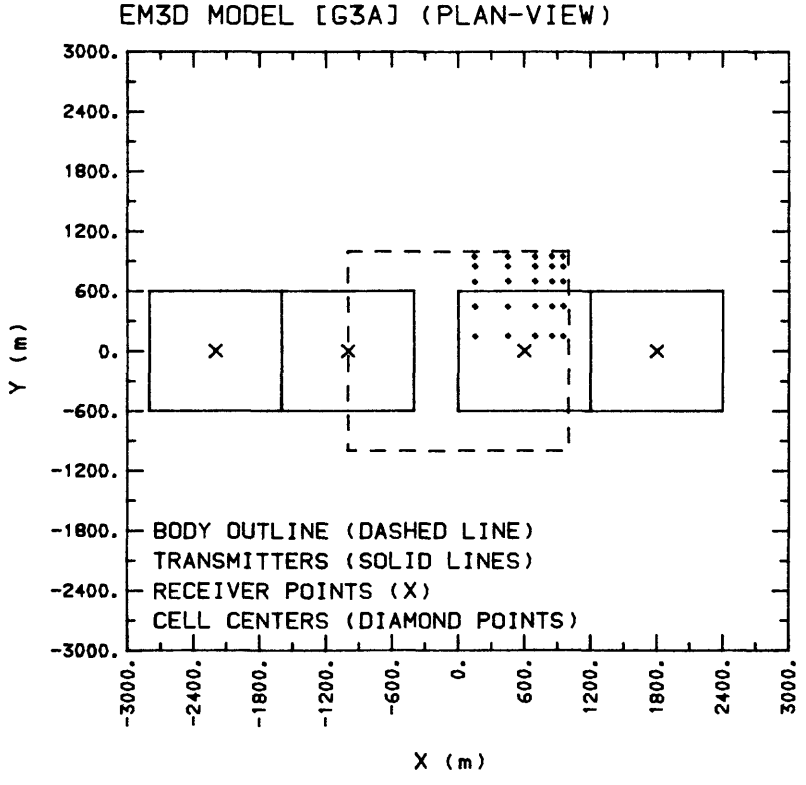

EM3D MODEL [G2P] (CROSS-VIEW)
0.
-200.
-400.
-600.
-800.
-1000.
-1200.
-1400.
-1600.
-1800.
-2000.
-Z (m)
1000 OHM-M (LAYER-1)
1000 OHM-M
300 OHM-M (LAYER-2 HOST)
BODY OUTLINE (DASHED LINE)
CELL CENTERS (DIAMOND POINTS)
-3000.
-2400.
-1800.
-1200.
-600.
0.
600.
1200.
1800.
2400.
3000.
X (m)

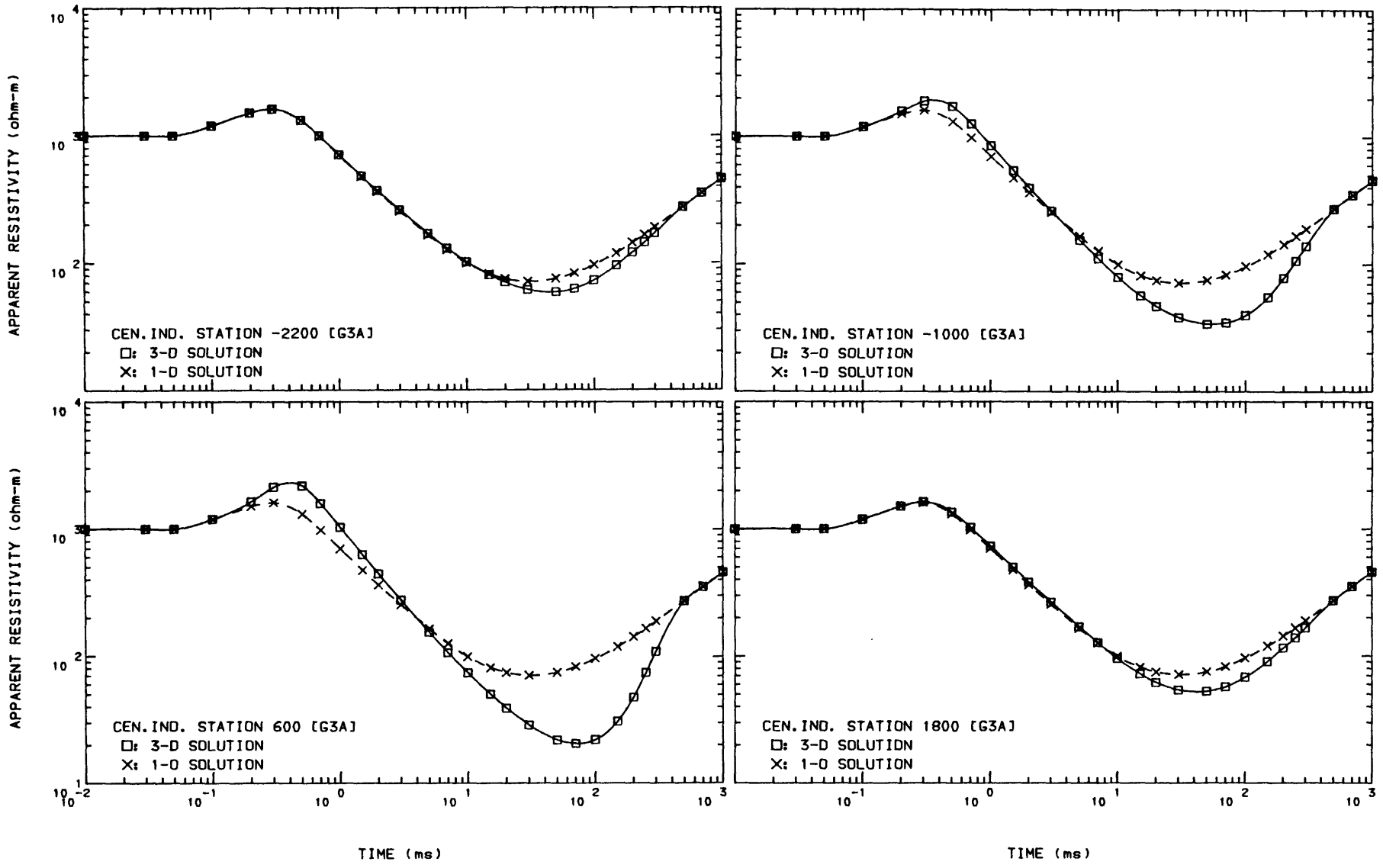

EM3D MODEL [G2P] (PLAN-VIEW)
3000.
2400.
1800.
1200.
600.
0.
-600.
-1200.
-1800.
-2400.
-3000.
Y (m)
BODY OUTLINE (DASHED LINE)
TRANSMITTERS (SOLID LINES)
RECEIVER POINTS (X)
CELL CENTERS (DIAMOND POINTS)
-3000.
-2400.
-1800.
-1200.
-600.
0.
600.
1200.
1800.
2400.
3000.
X (m)


EM3D MODEL [G2P]
CEN.IND. STATION -1000 [G2P]
□: 3-D SOLUTION
X: 1-D SOLUTION
CEN.IND. STATION 1800 [G2P]
□: 3-D SOLUTION
X: 1-D SOLUTION
CEN.IND. STATION -2200 [G2P]
□: 3-D SOLUTION
X: 1-D SOLUTION
CEN.IND. STATION 600 [G2P]
□: 3-D SOLUTION
X: 1-D SOLUTION
APPARENT RESISTIVITY (ohm-m)
APPARENT RESISTIVITY (ohm-m)
TIME (ms)
TIME (ms)

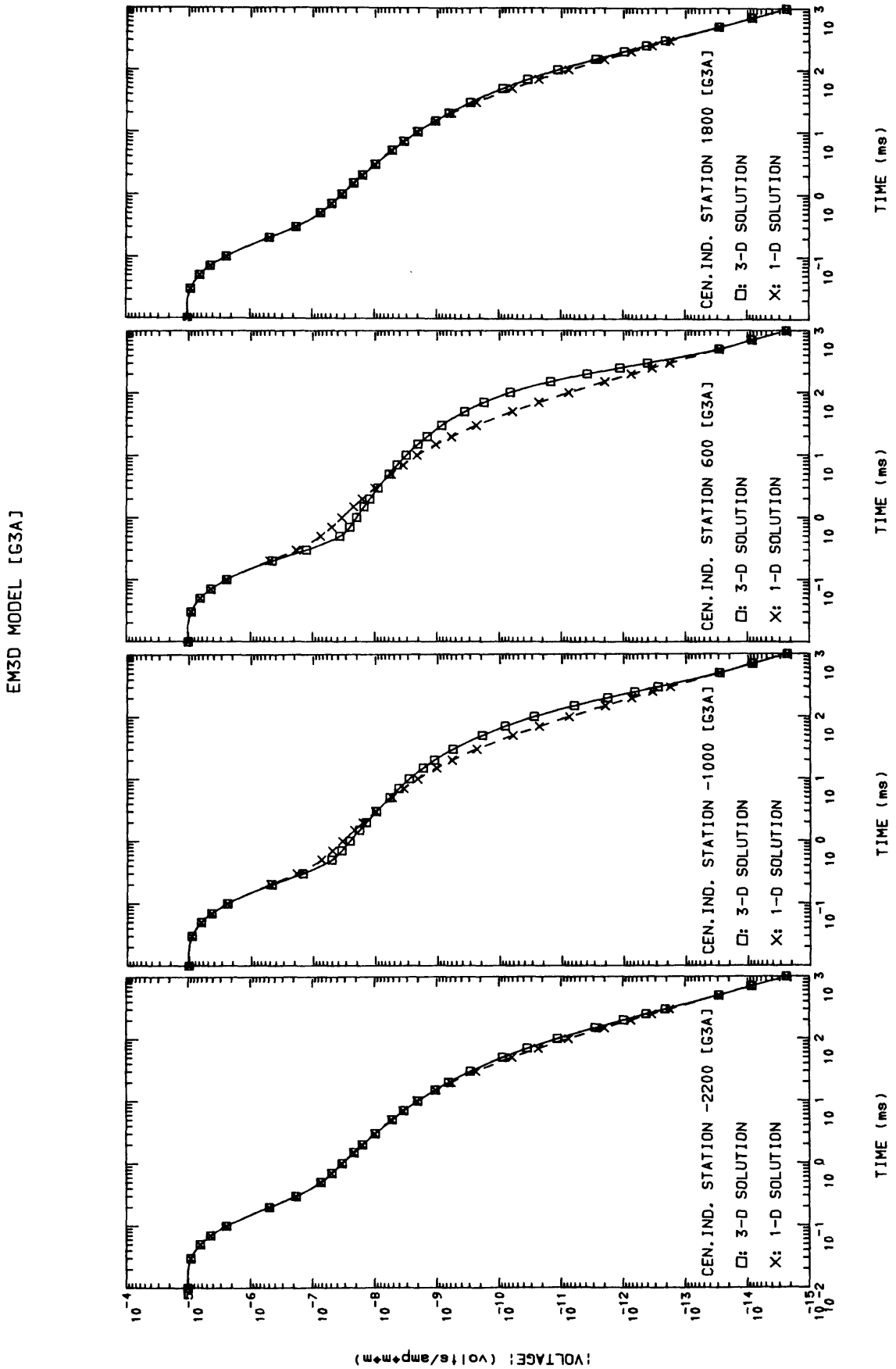

EM3D MODEL [G2P]
CEN.IND. STATION -2200 [G2P]
CEN.IND. STATION -1000 [G2P]
CEN.IND. STATION 600 [G2P]
CEN.IND. STATION 1800 [G2P]
□: 3-D SOLUTION
X: 1-D SOLUTION
TIME (ms)
VOLTAGE (volts/amp*m*m)

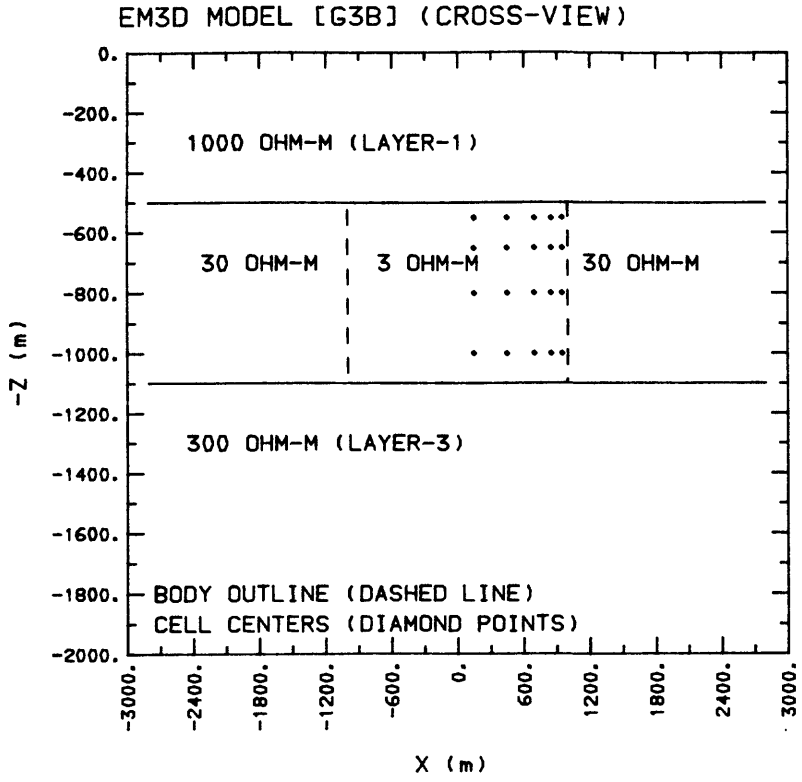

EM3D MODEL [G3A] (CROSS-VIEW)
1000 OHM-M (LAYER-1)
30 OHM-M
3 OHM-M
30 OHM-M
3000 OHM-M (LAYER-3)
BODY OUTLINE (DASHED LINE)
CELL CENTERS (DIAMOND POINTS)
-Z (m)
X (m)
0.
-200.
-400.
-600.
-800.
-1000.
-1200.
-1400.
-1600.
-1800.
-2000.
-3000.
-2400.
-1800.
-1200.
-600.
600.
1200.
1800.
2400.
3000.

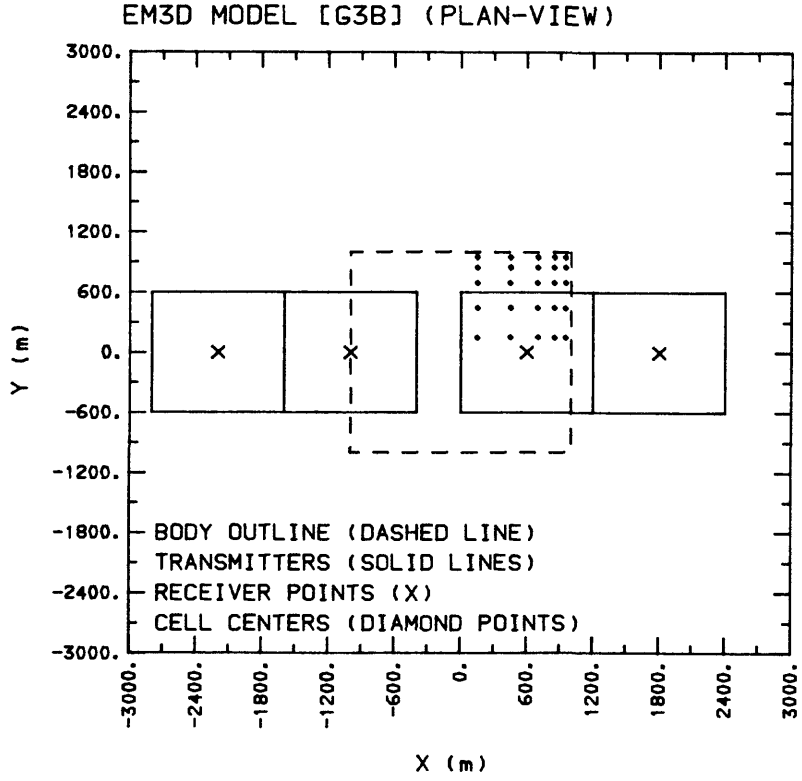

EM3D MODEL [G3A] (PLAN-VIEW)
BODY OUTLINE (DASHED LINE)
TRANSMITTERS (SOLID LINES)
RECEIVER POINTS (X)
CELL CENTERS (DIAMOND POINTS)
Y (m)
X (m)
3000.
2400.
1800.
1200.
600.
0.
-600.
-1200.
-1800.
-2400.
-3000.

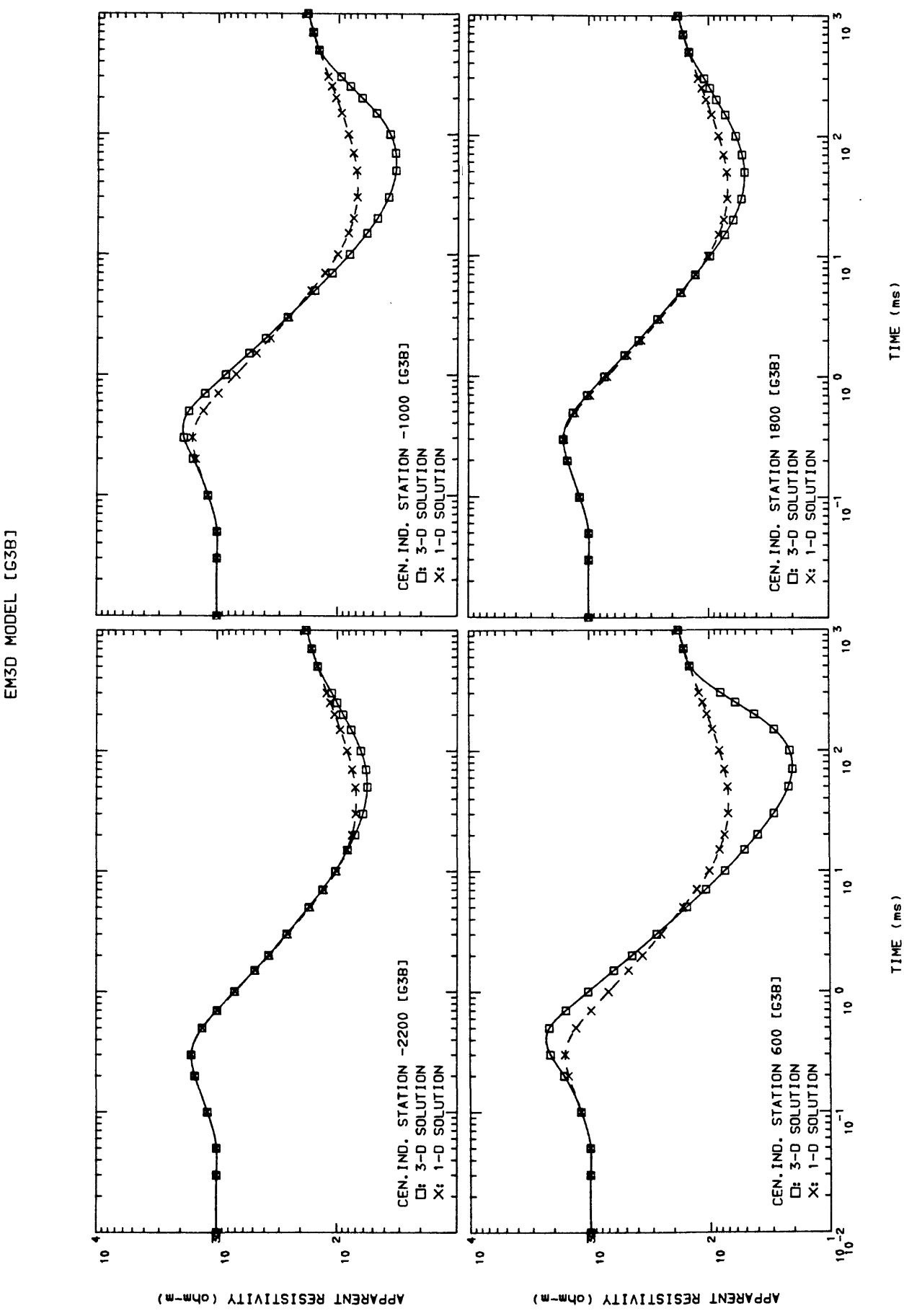


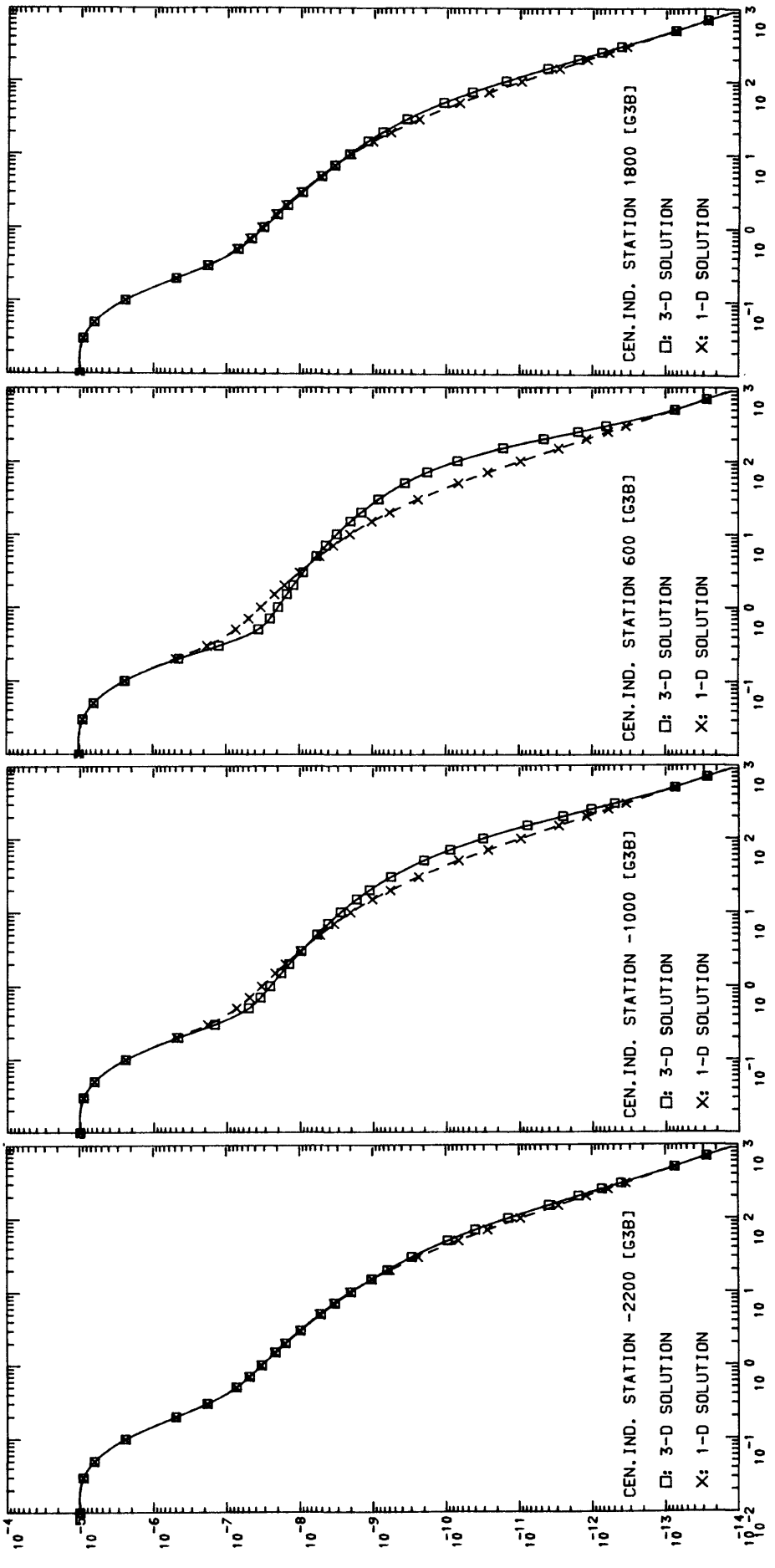
EM3D MODEL [G3A]

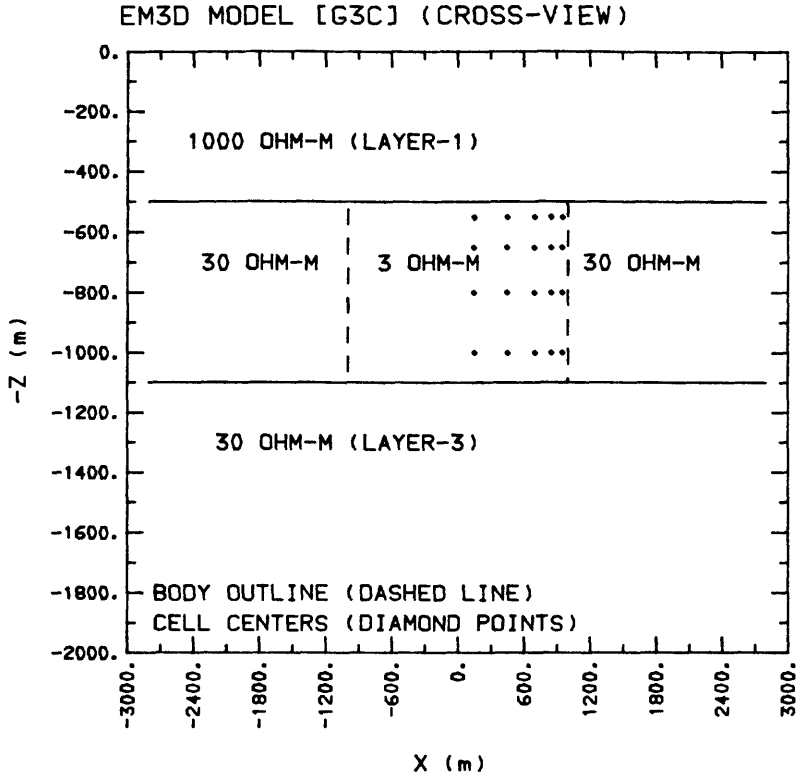

EM3D MODEL [G3A]
CEN.IND. STATION 1800 [G3A]
CEN.IND. STATION 600 [G3A]
CEN.IND. STATION -1000 [G3A]
CEN.IND. STATION -2200 [G3A]
□: 3-D SOLUTION
X: 1-D SOLUTION
TIME (ms)
VOLTAGE (volts/amp•m•m)

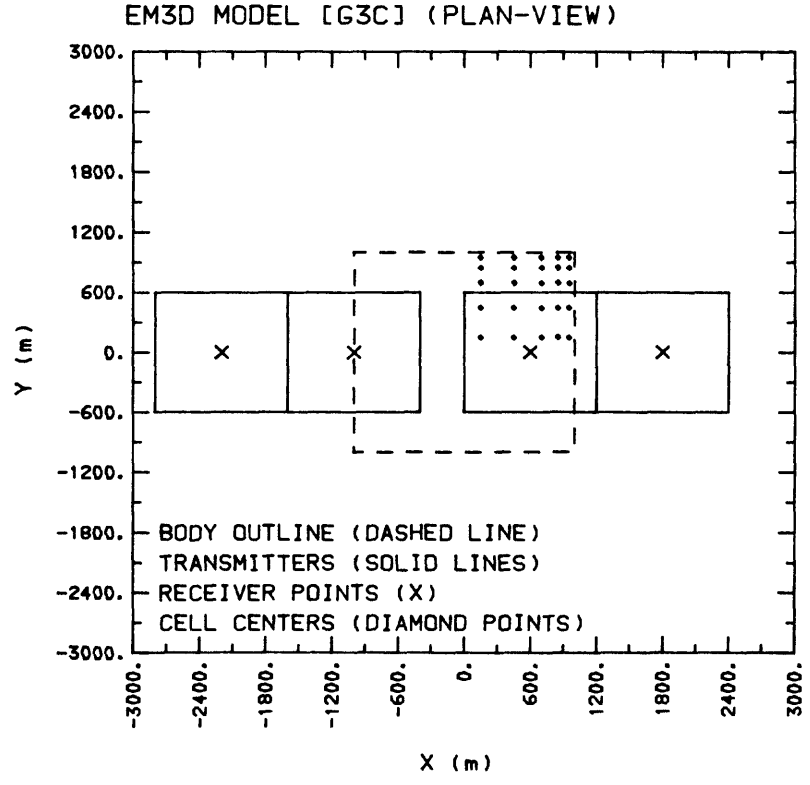

EM3D MODEL [G3B] (CROSS-VIEW)
1000 OHM-M (LAYER-1)
30 OHM-M
3 OHM-M
30 OHM-M
300 OHM-M (LAYER-3)
BODY OUTLINE (DASHED LINE)
CELL CENTERS (DIAMOND POINTS)
-Z (m)
X (m)
0.
-200.
-400.
-600.
-800.
-1000.
-1200.
-1400.
-1600.
-1800.
-2000.
-3000.
-2400.
-1800.
-1200.
-600.
600.
1200.
1800.
2400.
3000.

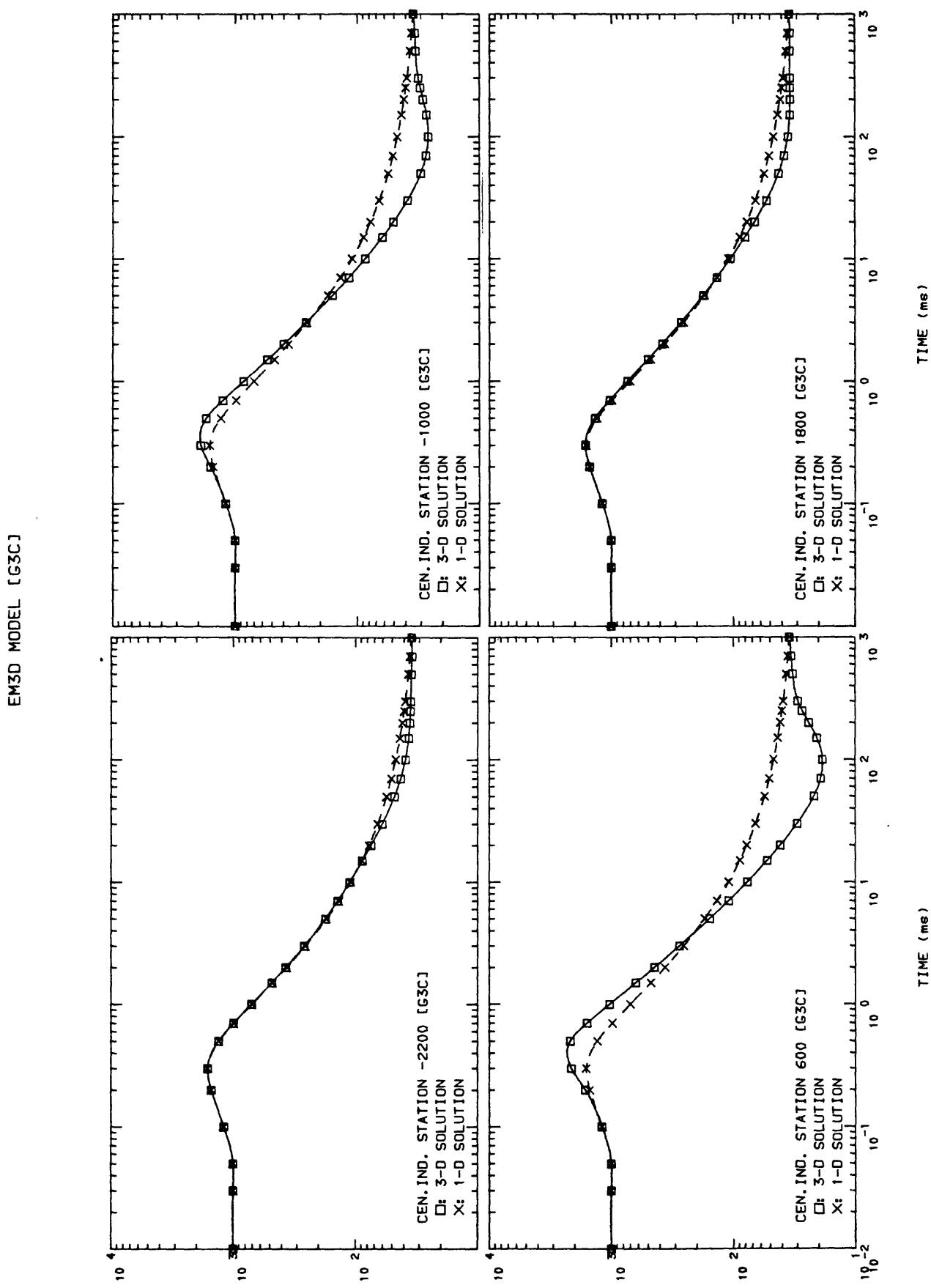

EM3D MODEL [G3B] (PLAN-VIEW)
BODY OUTLINE (DASHED LINE)
TRANSMITTERS (SOLID LINES)
RECEIVER POINTS (X)
CELL CENTERS (DIAMOND POINTS)
Y (m)
X (m)
3000.
2400.
1800.
1200.
600.
0.
-600.
-1200.
-1800.
-2400.
-3000.

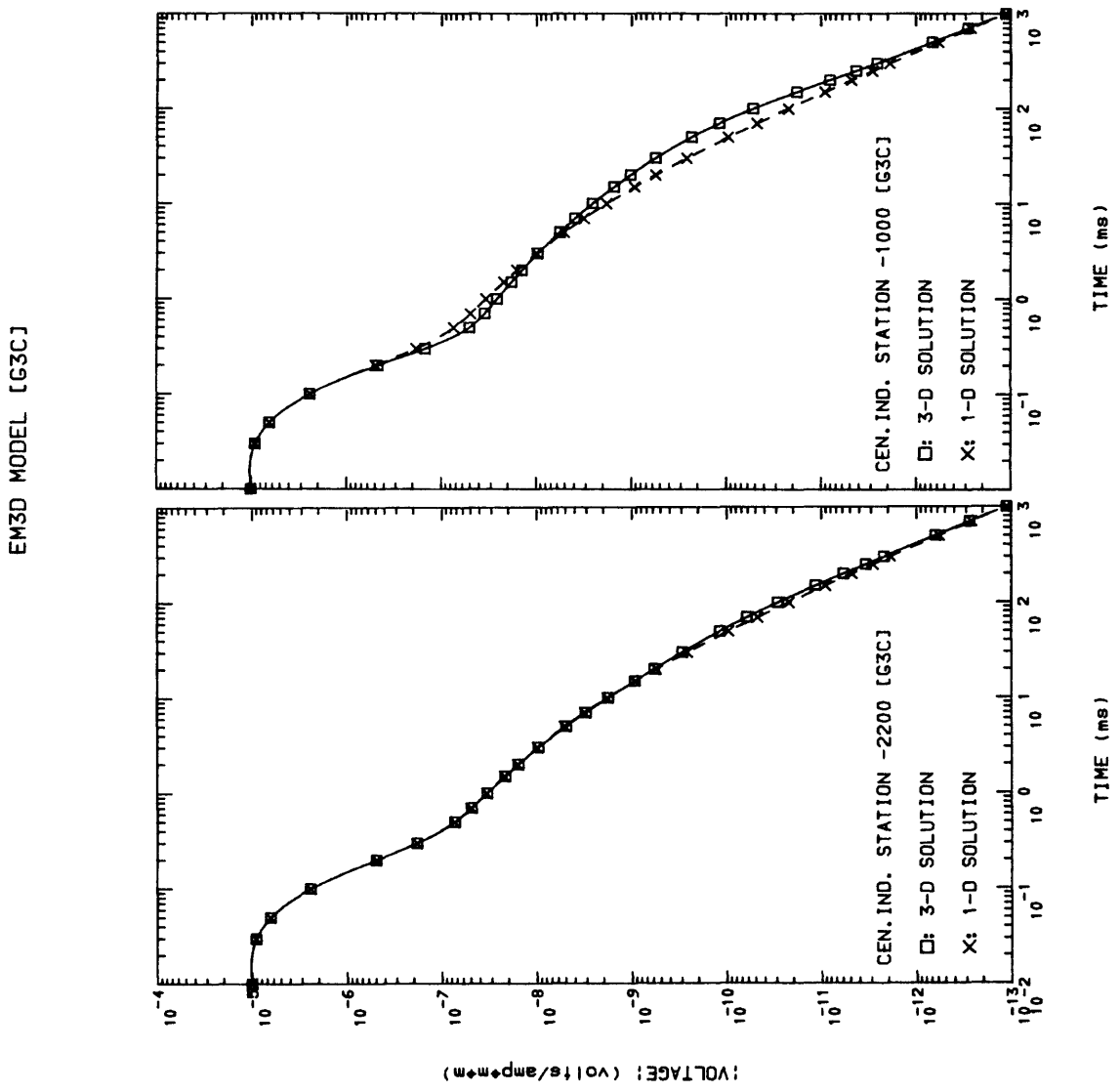

EM3D MODEL [G3B]
CEN.IND. STATION -1000 [G3B]
□: 3-D SOLUTION
X: 1-D SOLUTION
CEN.IND. STATION 1800 [G3B]
□: 3-D SOLUTION
X: 1-D SOLUTION
CEN.IND. STATION -2200 [G3B]
□: 3-D SOLUTION
X: 1-D SOLUTION
CEN.IND. STATION 600 [G3B]
□: 3-D SOLUTION
X: 1-D SOLUTION
APPARENT RESISTIVITY (ohm-m)
APPARENT RESISTIVITY (ohm-m)
TIME (ms)
TIME (ms)

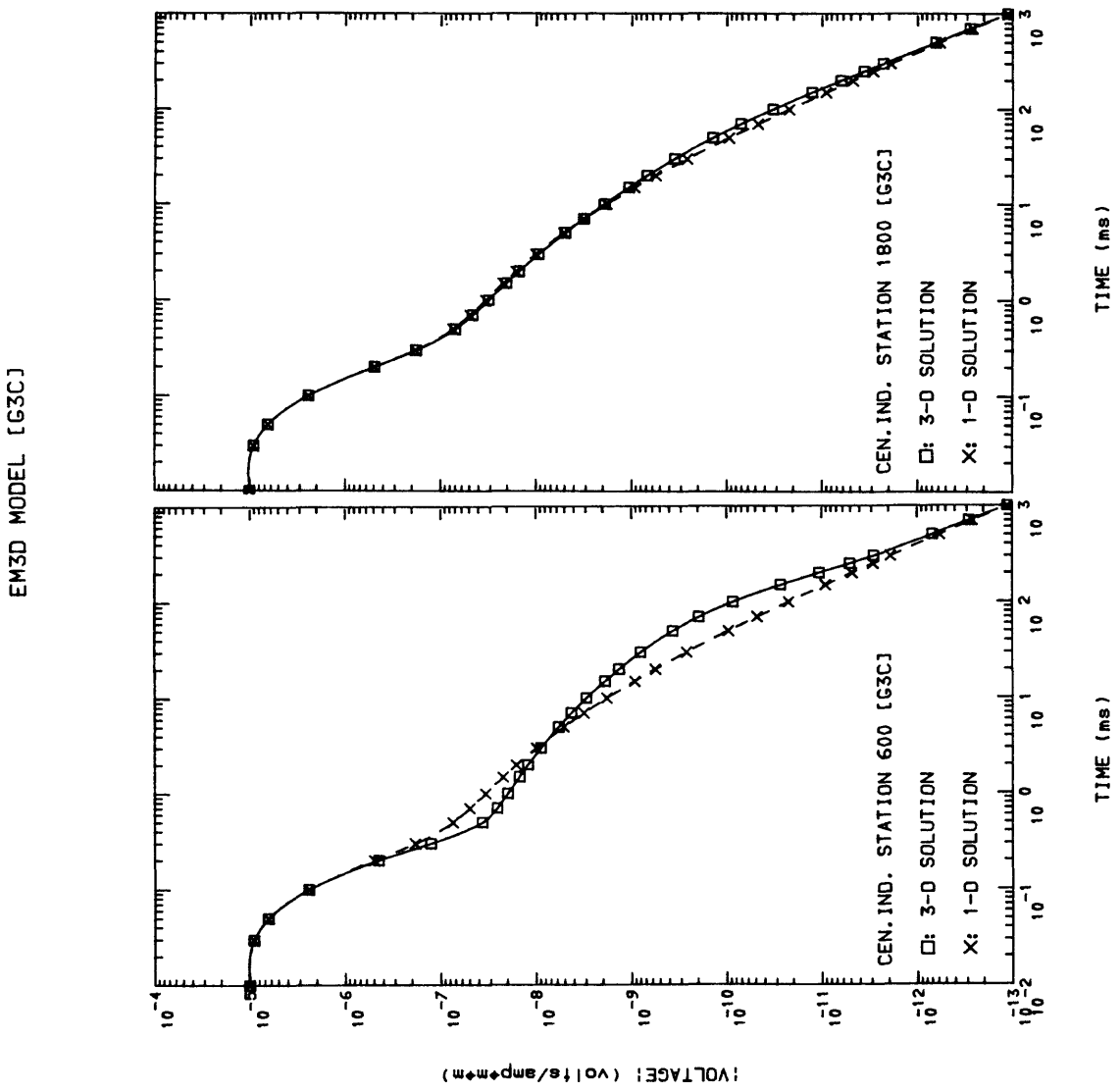

EM3D MODEL [G3B]
CEN.IND. STATION 1800 [G3B]
CEN.IND. STATION 600 [G3B]
CEN.IND. STATION -1000 [G3B]
CEN.IND. STATION -2200 [G3B]
□: 3-D SOLUTION
X: 1-D SOLUTION
TIME (ms)
VOLTAGE (volts/amp•m•m)

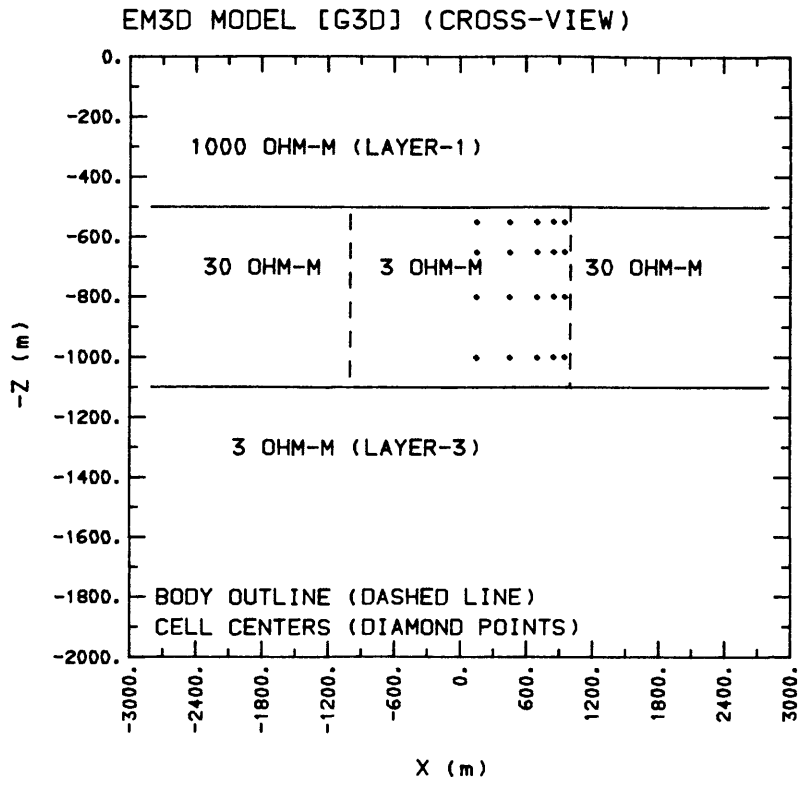

EM3D MODEL [G3C] (CROSS-VIEW)
1000 OHM-M (LAYER-1)
30 OHM-M
3 OHM-M
30 OHM-M
30 OHM-M (LAYER-3)
BODY OUTLINE (DASHED LINE)
CELL CENTERS (DIAMOND POINTS)
-Z (m)
X (m)
0.
-200.
-400.
-600.
-800.
-1000.
-1200.
-1400.
-1600.
-1800.
-2000.
-3000.
-2400.
-1800.
-1200.
-600.
600.
1200.
1800.
2400.
3000.

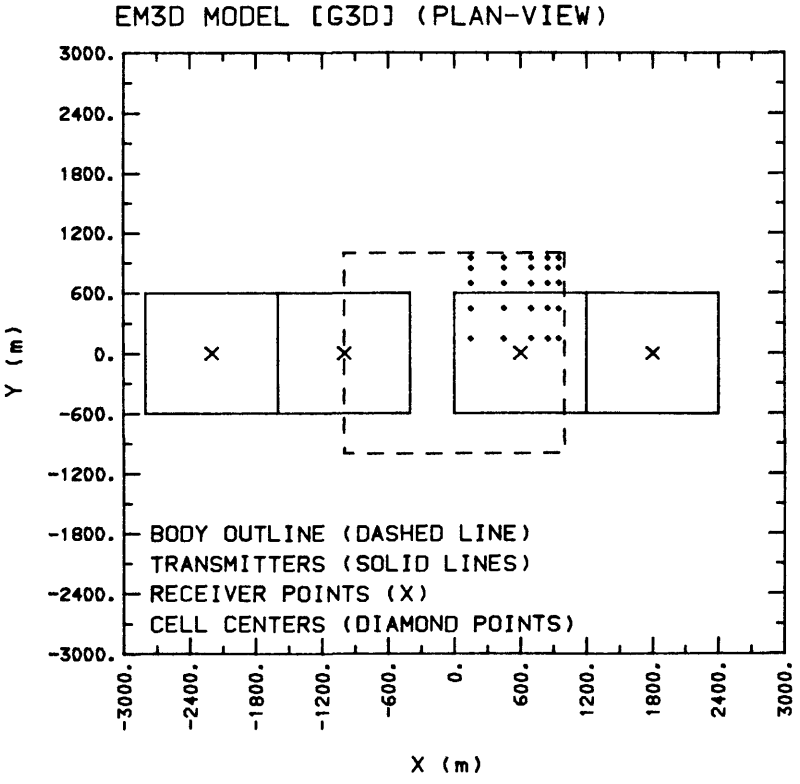

EM3D MODEL [G3C] (PLAN-VIEW)
BODY OUTLINE (DASHED LINE)
TRANSMITTERS (SOLID LINES)
RECEIVER POINTS (X)
CELL CENTERS (DIAMOND POINTS)
Y (m)
X (m)
3000.
2400.
1800.
1200.
600.
0.
-600.
-1200.
-1800.
-2400.
-3000.
-2400.
-1800.
-1200.
-600.
600.
1200.
1800.
2400.
3000.

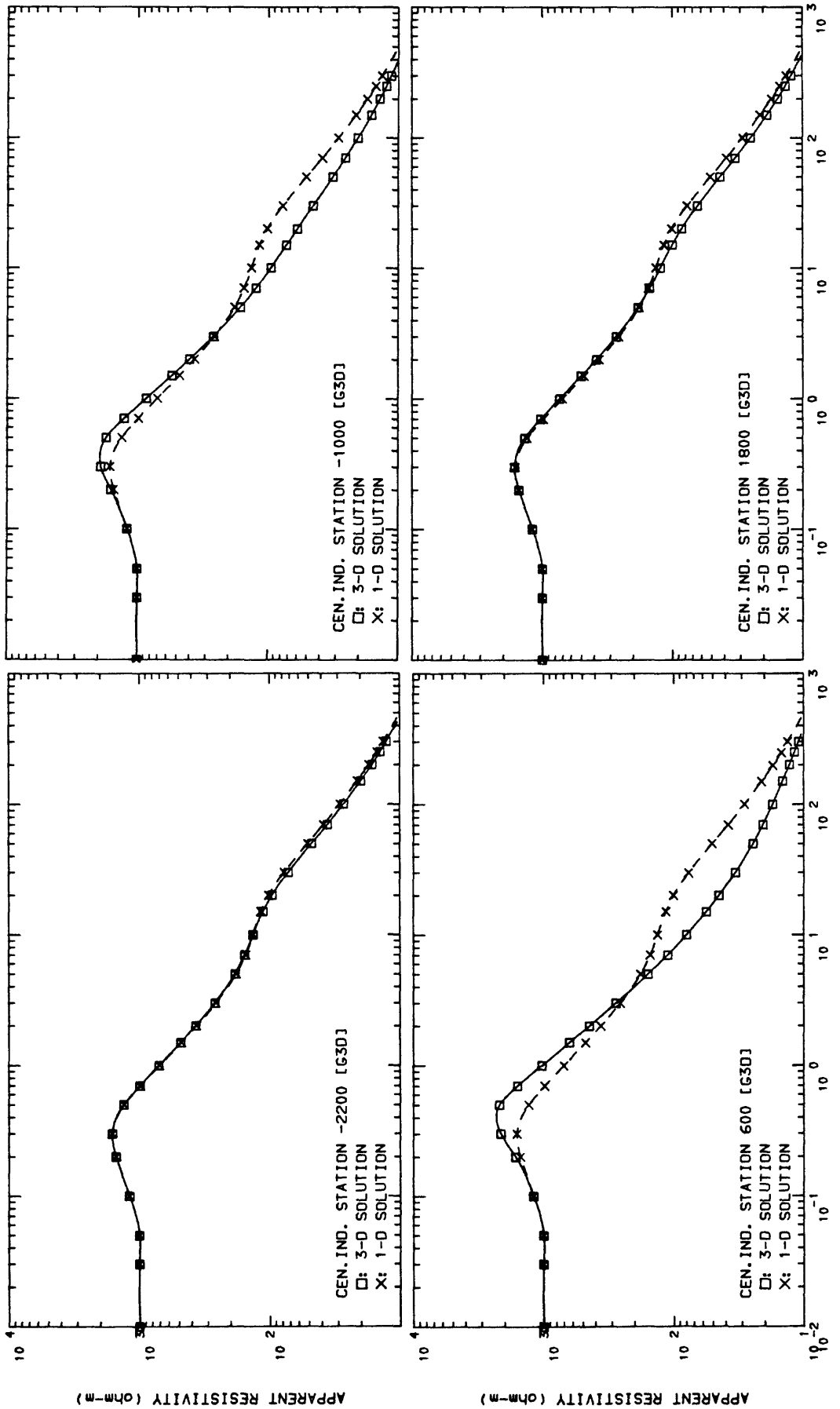

EM3D MODEL [G3C]
CEN.IND. STATION -1000 [G3C]
□: 3-D SOLUTION
X: 1-D SOLUTION
CEN.IND. STATION 1800 [G3C]
□: 3-D SOLUTION
X: 1-D SOLUTION
CEN.IND. STATION -2200 [G3C]
□: 3-D SOLUTION
X: 1-D SOLUTION
CEN.IND. STATION 600 [G3C]
□: 3-D SOLUTION
X: 1-D SOLUTION
APPARENT RESISTIVITY (ohm-m)
APPARENT RESISTIVITY (ohm-m)
TIME (ms)
TIME (ms)

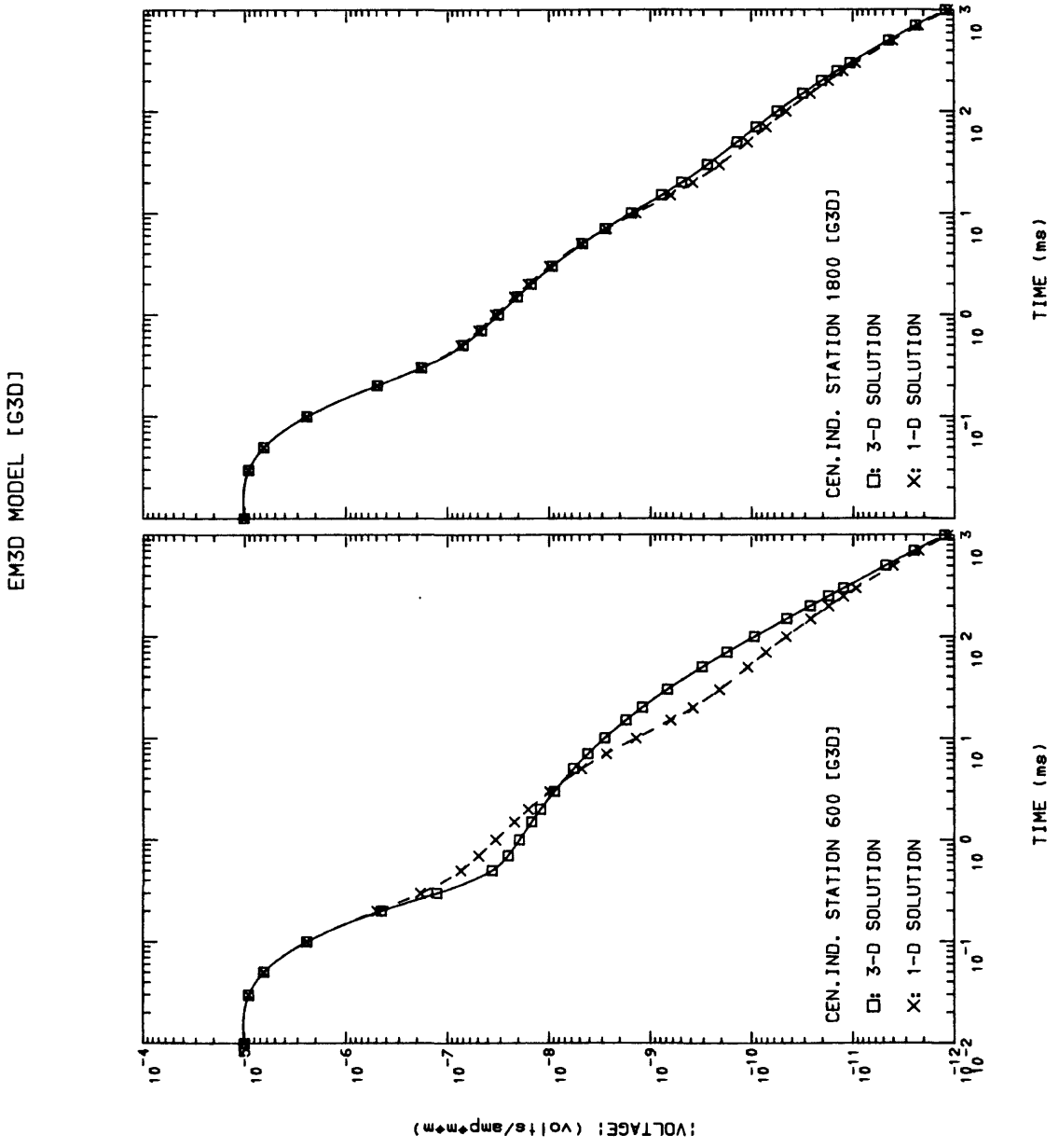

EM3D MODEL [G3C]
CEN.IND. STATION -1000 [G3C]
□: 3-D SOLUTION
X: 1-D SOLUTION
CEN.IND. STATION -2200 [G3C]
□: 3-D SOLUTION
X: 1-D SOLUTION
TIME (ms)
TIME (ms)
VOLTAGE (volts/amp*m*m)

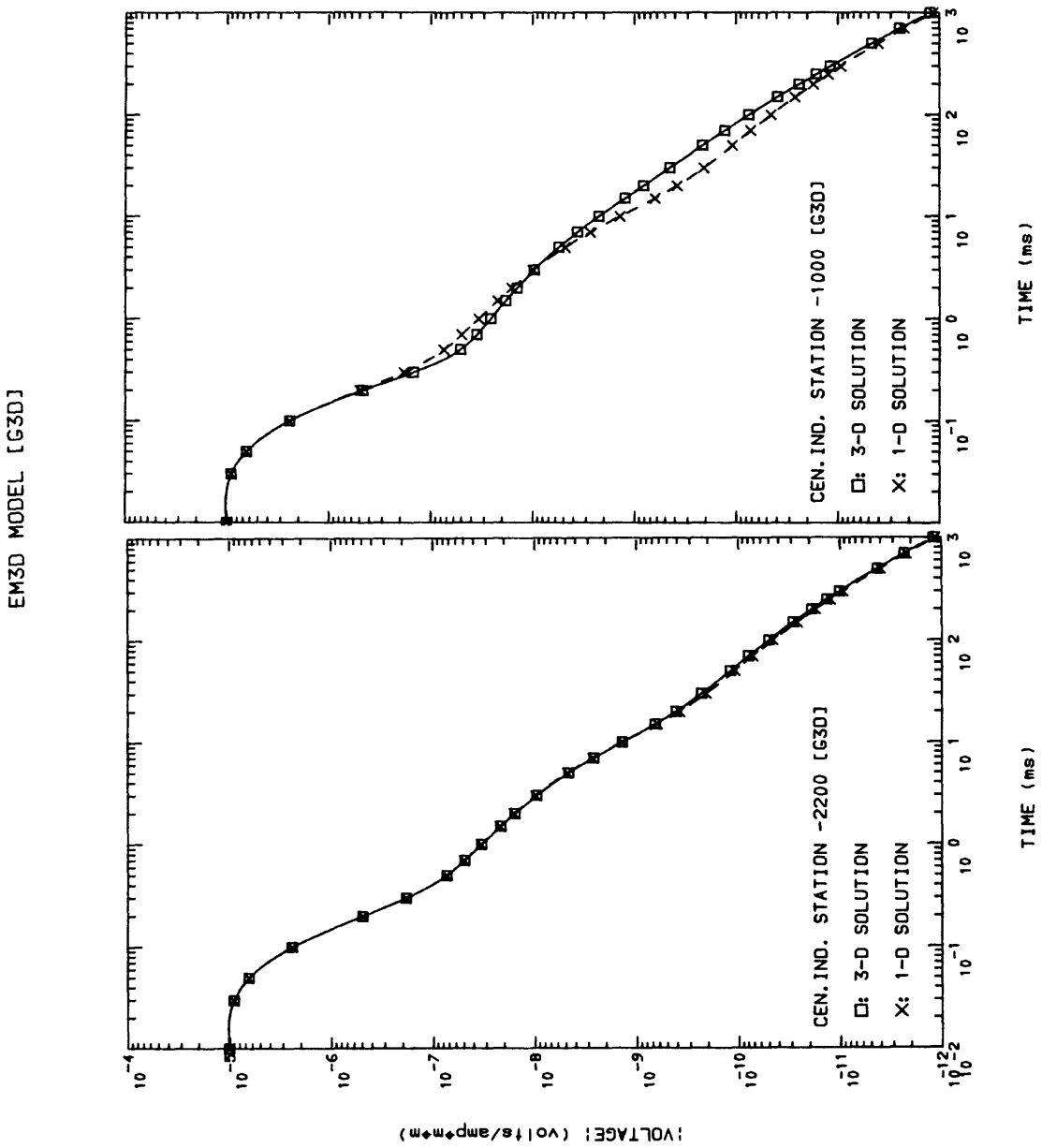

EM3D MODEL [G3C]
CEN.IND. STATION 1800 [G3C]
□: 3-D SOLUTION
X: 1-D SOLUTION
CEN.IND. STATION 600 [G3C]
□: 3-D SOLUTION
X: 1-D SOLUTION
TIME (ms)
TIME (ms)
VOLTAGE (volts/amp*m*m)

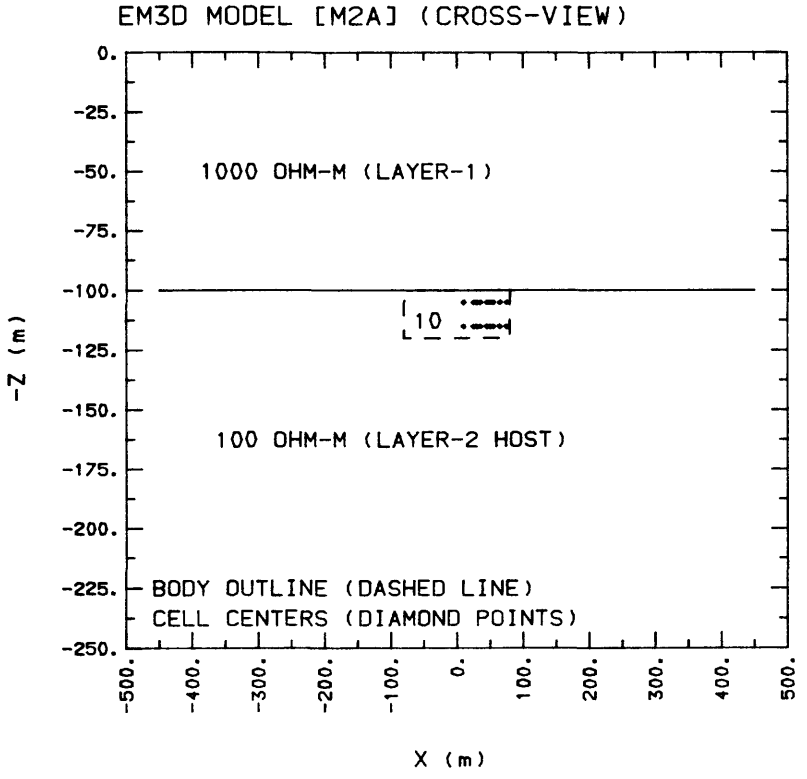

EM3D MODEL [G3D] (CROSS-VIEW)
1000 OHM-M (LAYER-1)
30 OHM-M
3 OHM-M
30 OHM-M
3 OHM-M (LAYER-3)
BODY OUTLINE (DASHED LINE)
CELL CENTERS (DIAMOND POINTS)
-Z (m)
X (m)
0.
-200.
-400.
-600.
-800.
-1000.
-1200.
-1400.
-1600.
-1800.
-2000.
-3000.
-2400.
-1800.
-1200.
-600.
600.
1200.
1800.
2400.
3000.

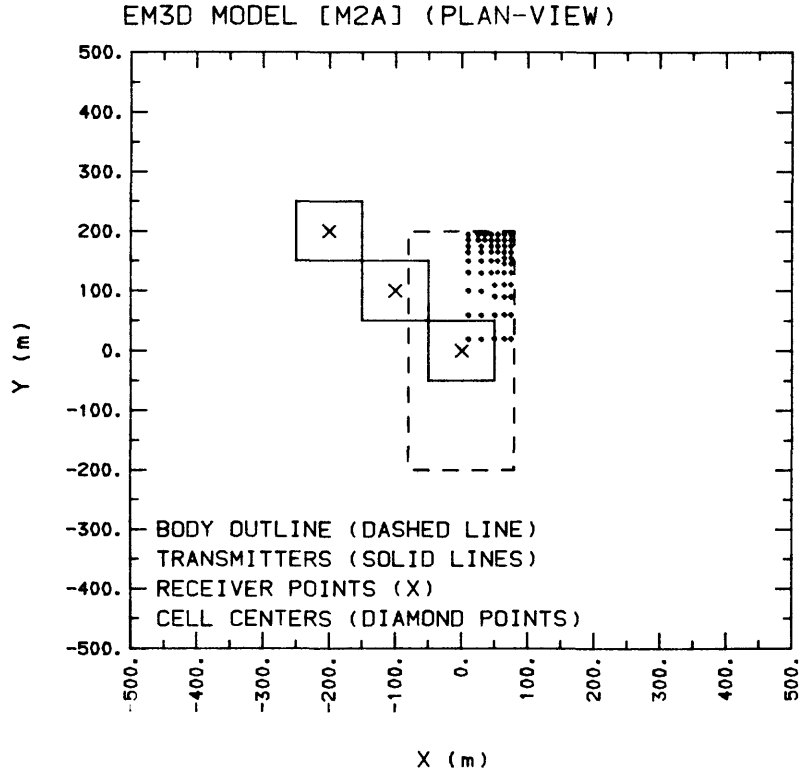

EM3D MODEL [G3D] (PLAN-VIEW)
BODY OUTLINE (DASHED LINE)
TRANSMITTERS (SOLID LINES)
RECEIVER POINTS (X)
CELL CENTERS (DIAMOND POINTS)
Y (m)
X (m)
3000.
2400.
1800.
1200.
600.
0.
-600.
-1200.
-1800.
-2400.
-3000.

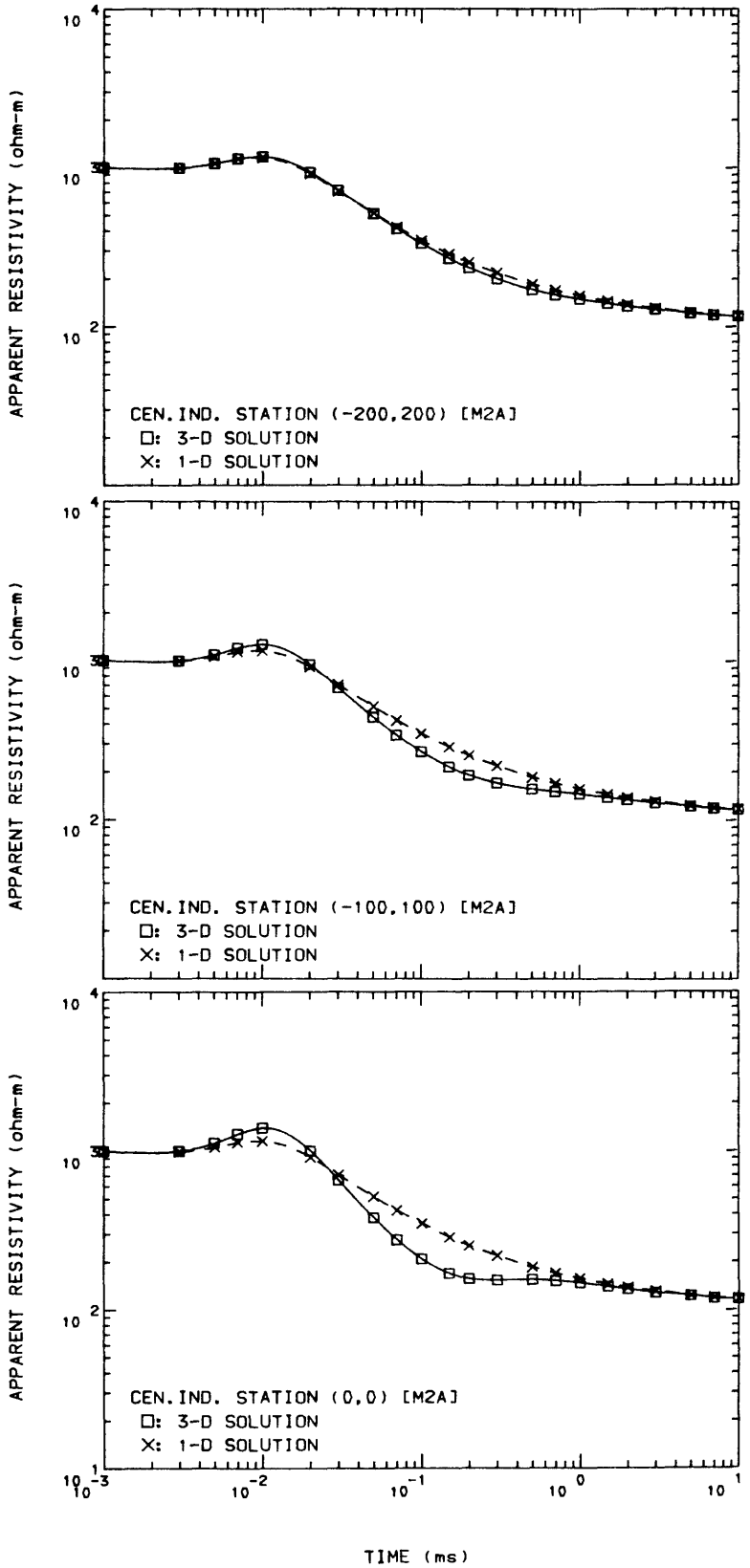

EM3D MODEL [G3D]
CEN.IND. STATION -1000 [G3D]
□: 3-D SOLUTION
X: 1-D SOLUTION
CEN.IND. STATION 1800 [G3D]
□: 3-D SOLUTION
X: 1-D SOLUTION
CEN.IND. STATION -2200 [G3D]
□: 3-D SOLUTION
X: 1-D SOLUTION
CEN.IND. STATION 600 [G3D]
□: 3-D SOLUTION
X: 1-D SOLUTION
APPARENT RESISTIVITY (ohm-m)
APPARENT RESISTIVITY (ohm-m)
TIME (ms)
TIME (ms)

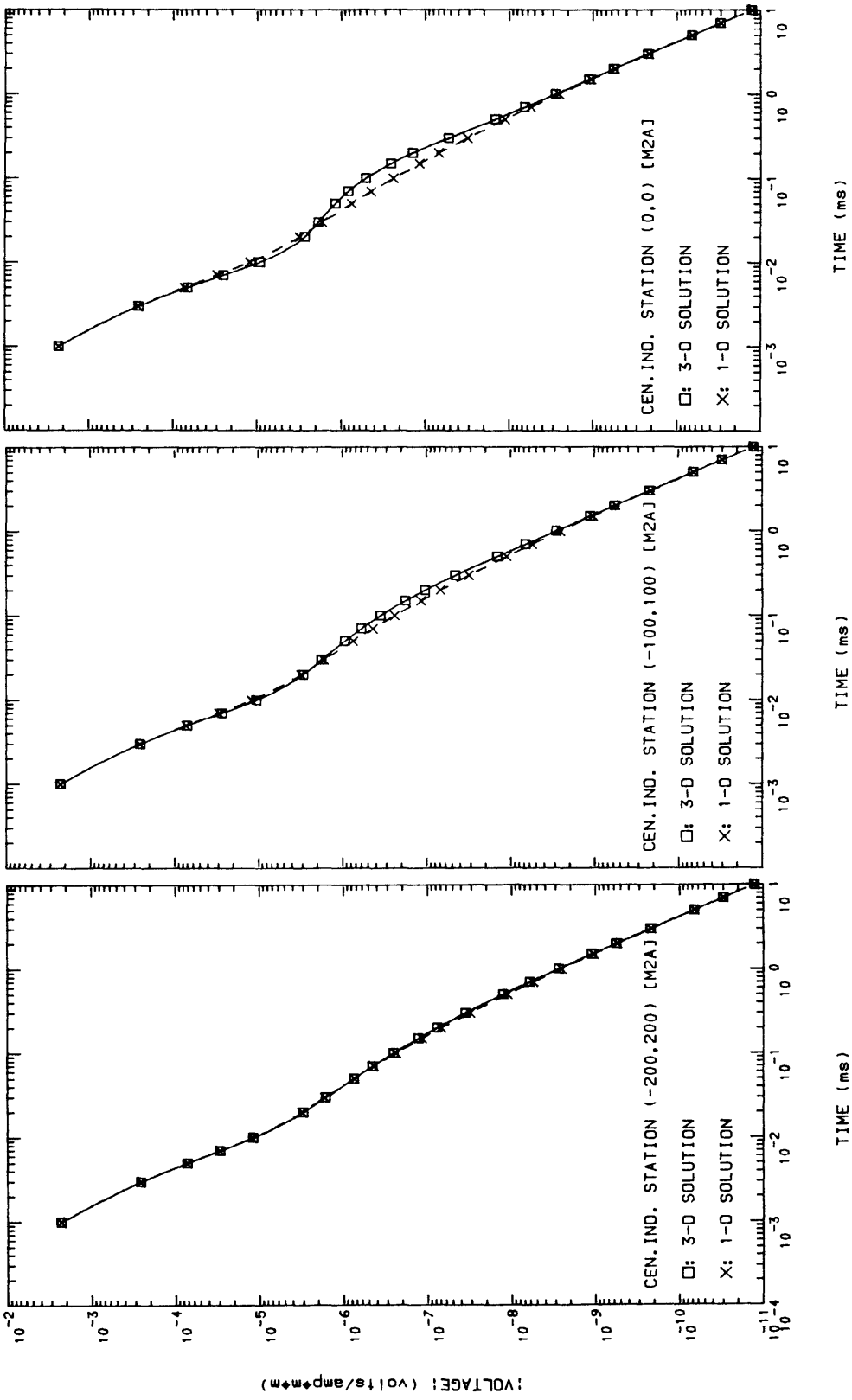

EM3D MODEL [G3D]
CEN.IND. STATION 1800 [G3D]
□: 3-D SOLUTION
X: 1-D SOLUTION
CEN.IND. STATION 600 [G3D]
□: 3-D SOLUTION
X: 1-D SOLUTION
TIME (ms)
TIME (ms)
VOLTAGE: (volts/amp*m*m)

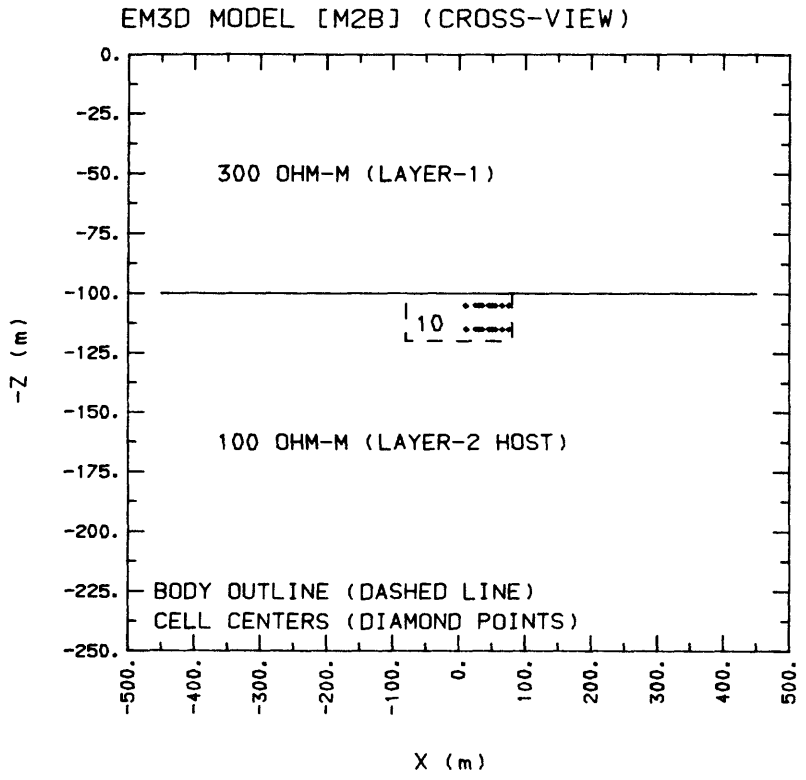

EM3D MODEL [G3D]
CEN.IND. STATION -1000 [G3D]
□: 3-D SOLUTION
X: 1-D SOLUTION
CEN.IND. STATION -2200 [G3D]
□: 3-D SOLUTION
X: 1-D SOLUTION
TIME (ms)
TIME (ms)
VOLTAGE (volts/amp*m*m)

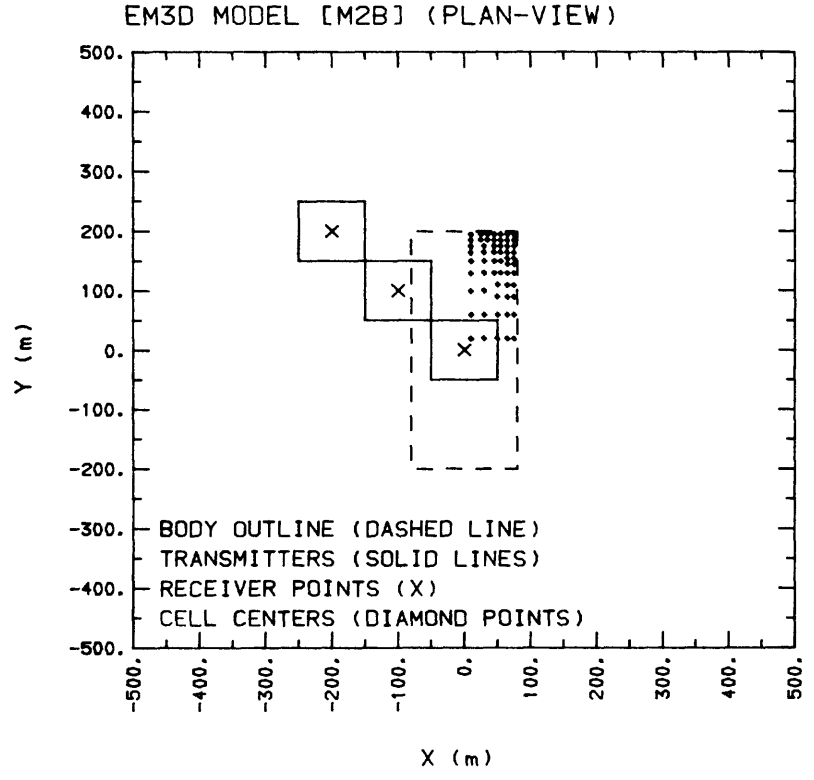

EM3D MODEL [M2A] (CROSS-VIEW)
1000 OHM-M (LAYER-1)
10
100 OHM-M (LAYER-2 HOST)
BODY OUTLINE (DASHED LINE)
CELL CENTERS (DIAMOND POINTS)
-Z (m)
X (m)
0.
-25.
-50.
-75.
-100.
-125.
-150.
-175.
-200.
-225.
-250.
-500.
-400.
-300.
-200.
-100.
0.
100.
200.
300.
400.
500.

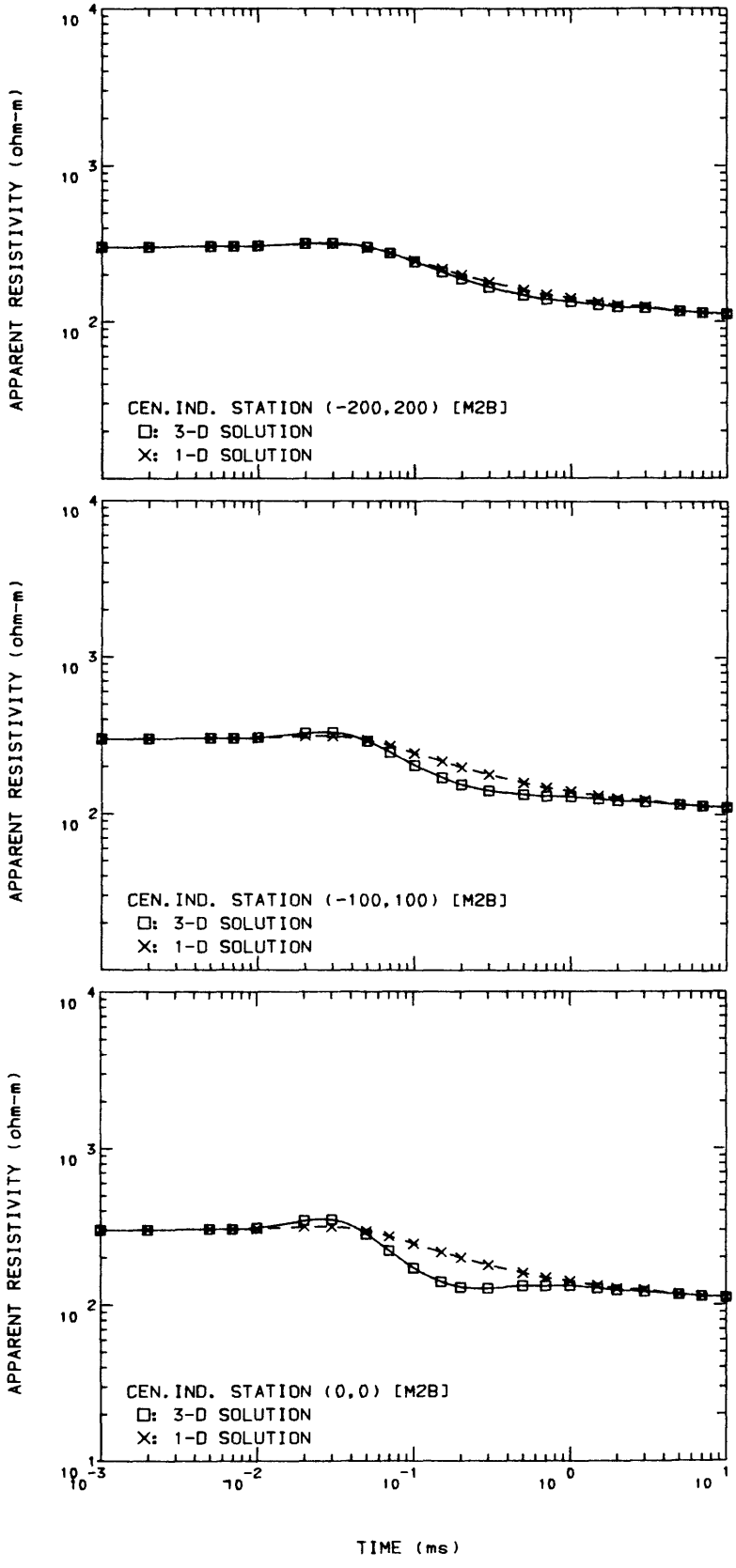

EM3D MODEL [M2A] (PLAN-VIEW)
BODY OUTLINE (DASHED LINE)
TRANSMITTERS (SOLID LINES)
RECEIVER POINTS (X)
CELL CENTERS (DIAMOND POINTS)
Y (m)
X (m)
500.
400.
300.
200.
100.
0.
-100.
-200.
-300.
-400.
-500.

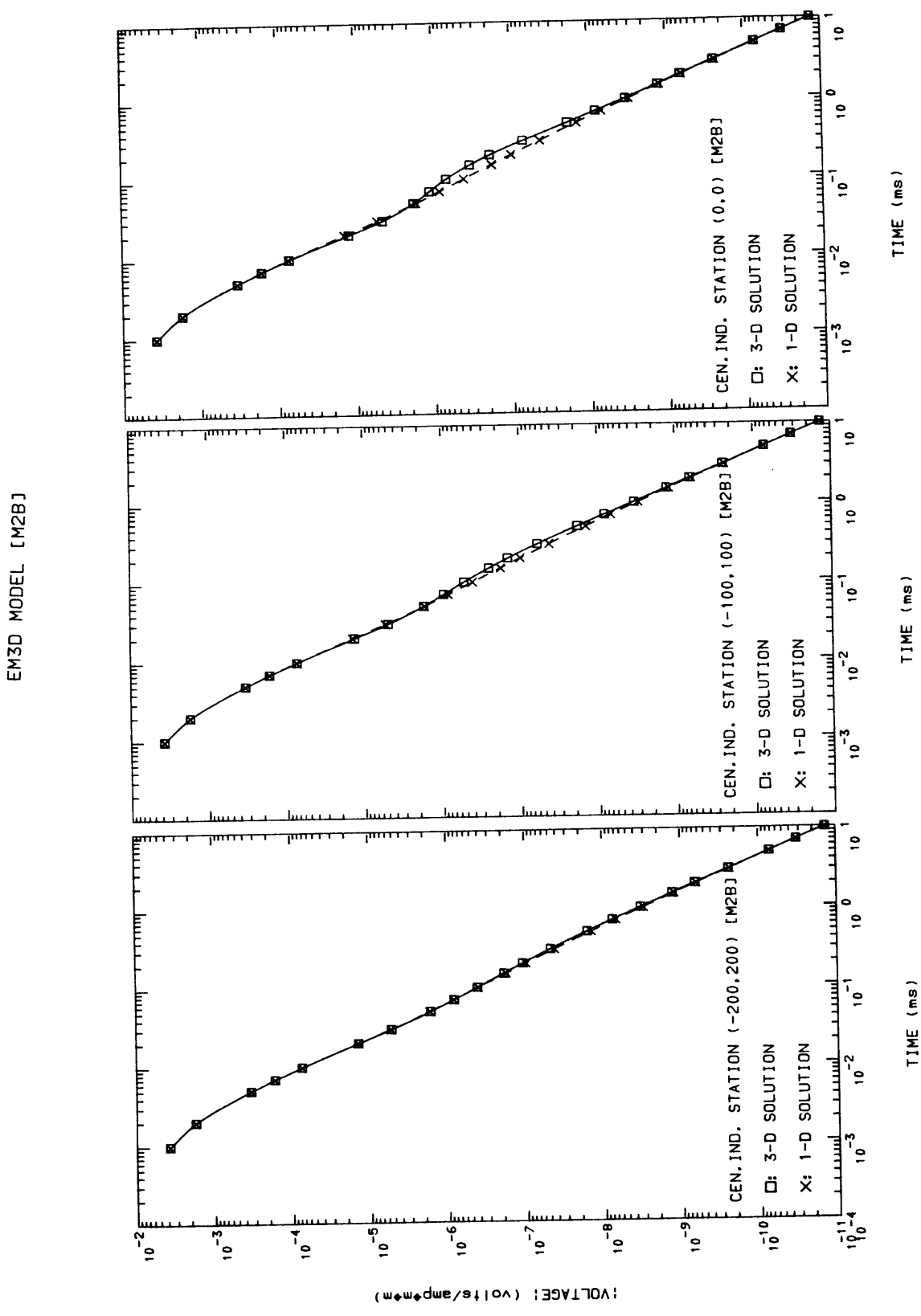

EM3D MODEL [M2A]
APPARENT RESISTIVITY (ohm-m)
CEN.IND. STATION (-200,200) [M2A]
□: 3-D SOLUTION
×: 1-D SOLUTION
CEN.IND. STATION (-100,100) [M2A]
□: 3-D SOLUTION
×: 1-D SOLUTION
CEN.IND. STATION (0,0) [M2A]
□: 3-D SOLUTION
×: 1-D SOLUTION
TIME (ms)

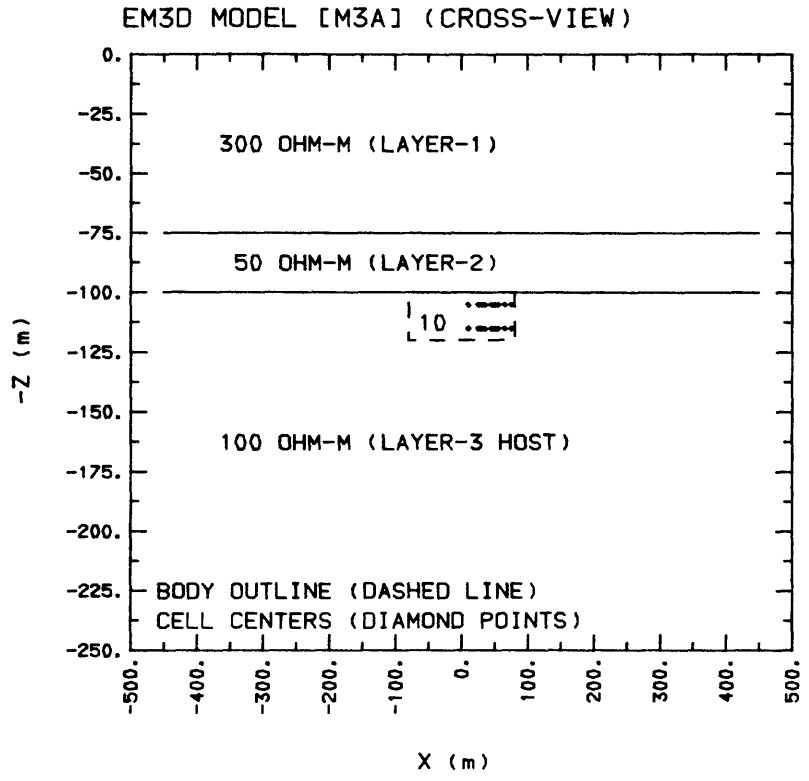

EM3D MODEL [M2A]
CEN.IND. STATION (0,0) [M2A]
□: 3-D SOLUTION
X: 1-D SOLUTION
CEN.IND. STATION (-100,100) [M2A]
□: 3-D SOLUTION
X: 1-D SOLUTION
CEN.IND. STATION (-200,200) [M2A]
□: 3-D SOLUTION
X: 1-D SOLUTION
TIME (ms)
TIME (ms)
TIME (ms)
:VOLTAGE: (volts/amp•m•m)

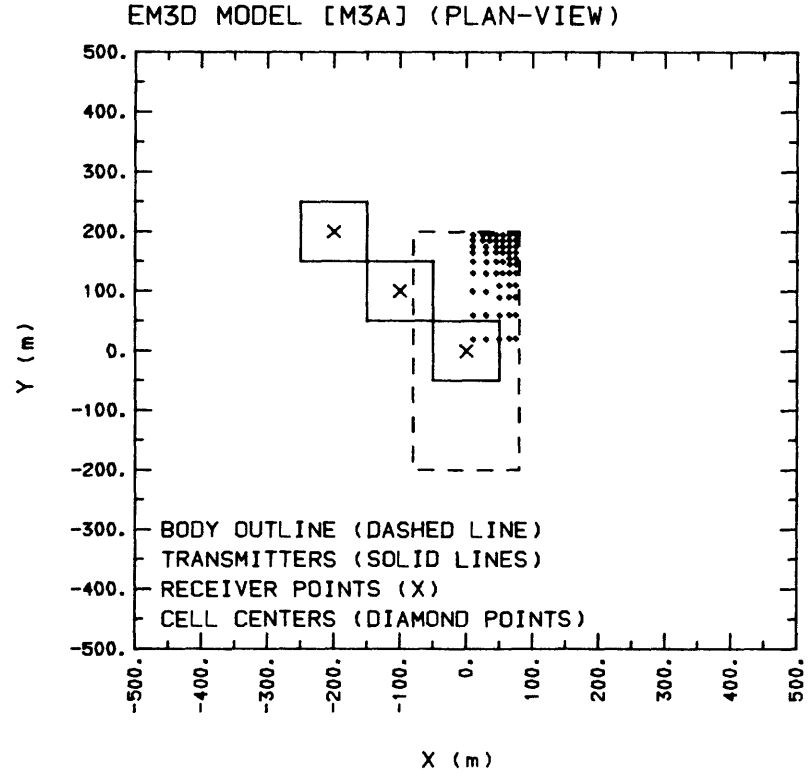

EM3D MODEL [M2B] (CROSS-VIEW)
300 OHM-M (LAYER-1)
10
100 OHM-M (LAYER-2 HOST)
BODY OUTLINE (DASHED LINE)
CELL CENTERS (DIAMOND POINTS)
-Z (m)
X (m)
0.
-25.
-50.
-75.
-100.
-125.
-150.
-175.
-200.
-225.
-250.
-500.
-400.
-300.
-200.
-100.
0.
100.
200.
300.
400.
500.

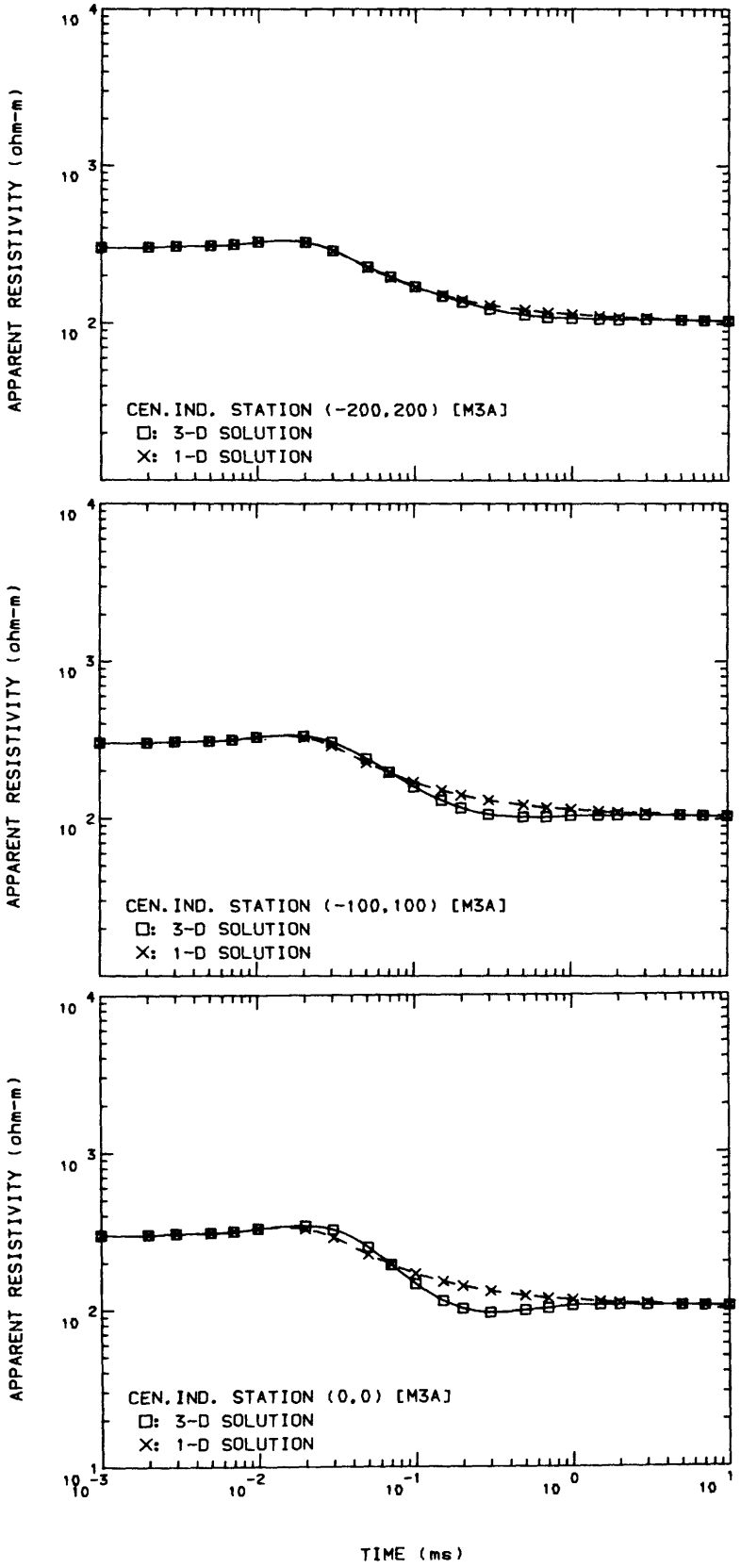

EM3D MODEL [M2B] (PLAN-VIEW)
BODY OUTLINE (DASHED LINE)
TRANSMITTERS (SOLID LINES)
RECEIVER POINTS (X)
CELL CENTERS (DIAMOND POINTS)
Y (m)
X (m)
500.
400.
300.
200.
100.
0.
-100.
-200.
-300.
-400.
-500.

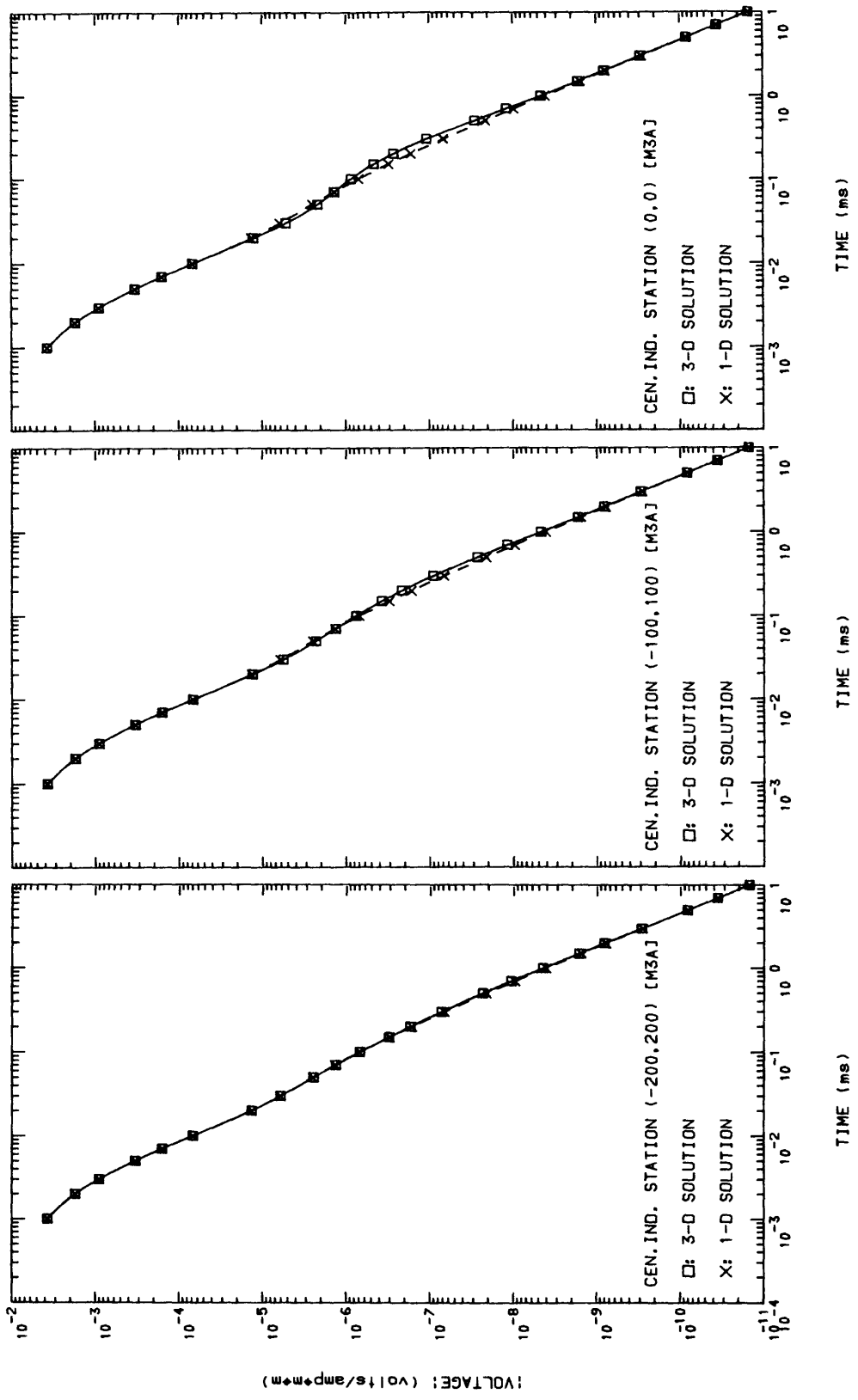

EM3D MODEL [M2B]
APPARENT RESISTIVITY (ohm-m)
CEN.IND. STATION (-200,200) [M2B]
□: 3-D SOLUTION
×: 1-D SOLUTION
APPARENT RESISTIVITY (ohm-m)
CEN.IND. STATION (-100,100) [M2B]
□: 3-D SOLUTION
×: 1-D SOLUTION
APPARENT RESISTIVITY (ohm-m)
CEN.IND. STATION (0,0) [M2B]
□: 3-D SOLUTION
×: 1-D SOLUTION
TIME (ms)

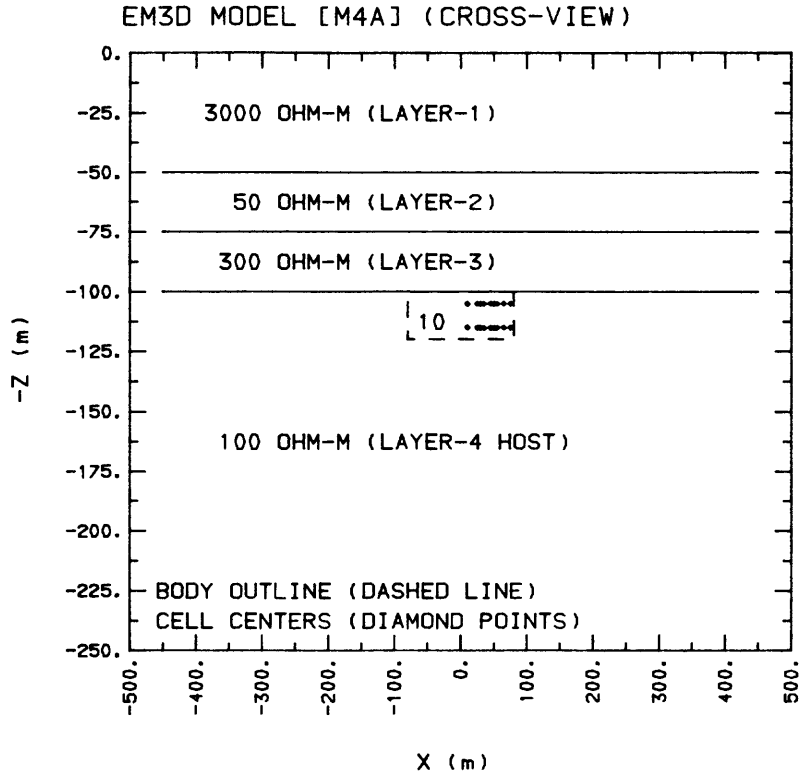

EM3D MODEL [M2B]
CEN.IND. STATION (-200,200) [M2B]
CEN.IND. STATION (-100,100) [M2B]
CEN.IND. STATION (0,0) [M2B]
□: 3-D SOLUTION
X: 1-D SOLUTION
TIME (ms)
VOLTAGE: (volts/amp*m*m)

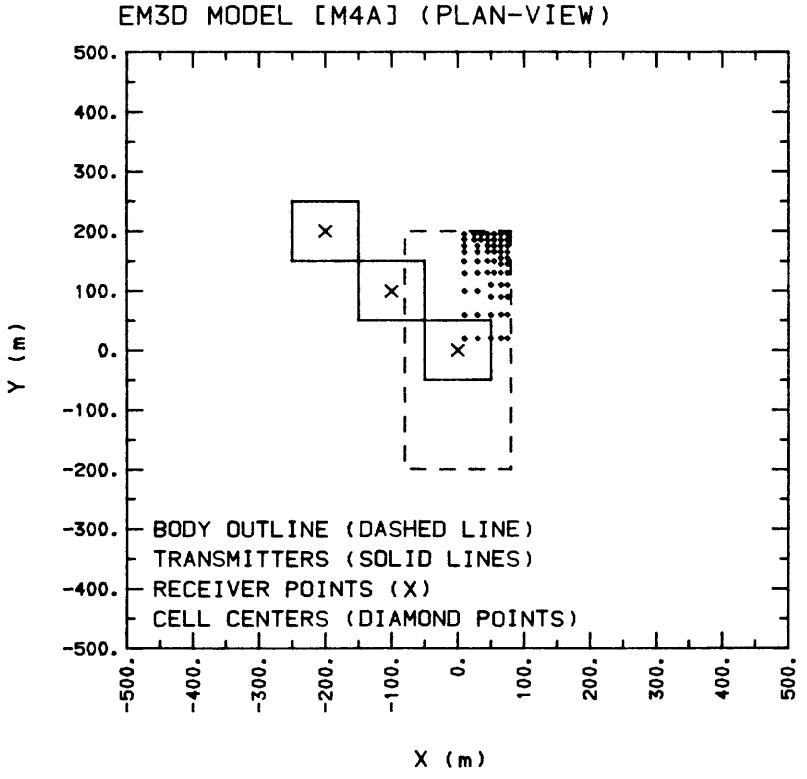

EM3D MODEL [M3A] (CROSS-VIEW)
300 OHM-M (LAYER-1)
50 OHM-M (LAYER-2)
10
100 OHM-M (LAYER-3 HOST)
BODY OUTLINE (DASHED LINE)
CELL CENTERS (DIAMOND POINTS)
-Z (m)
X (m)
0.
-25.
-50.
-75.
-100.
-125.
-150.
-175.
-200.
-225.
-250.
-500.
-400.
-300.
-200.
-100.
0.
100.
200.
300.
400.
500.

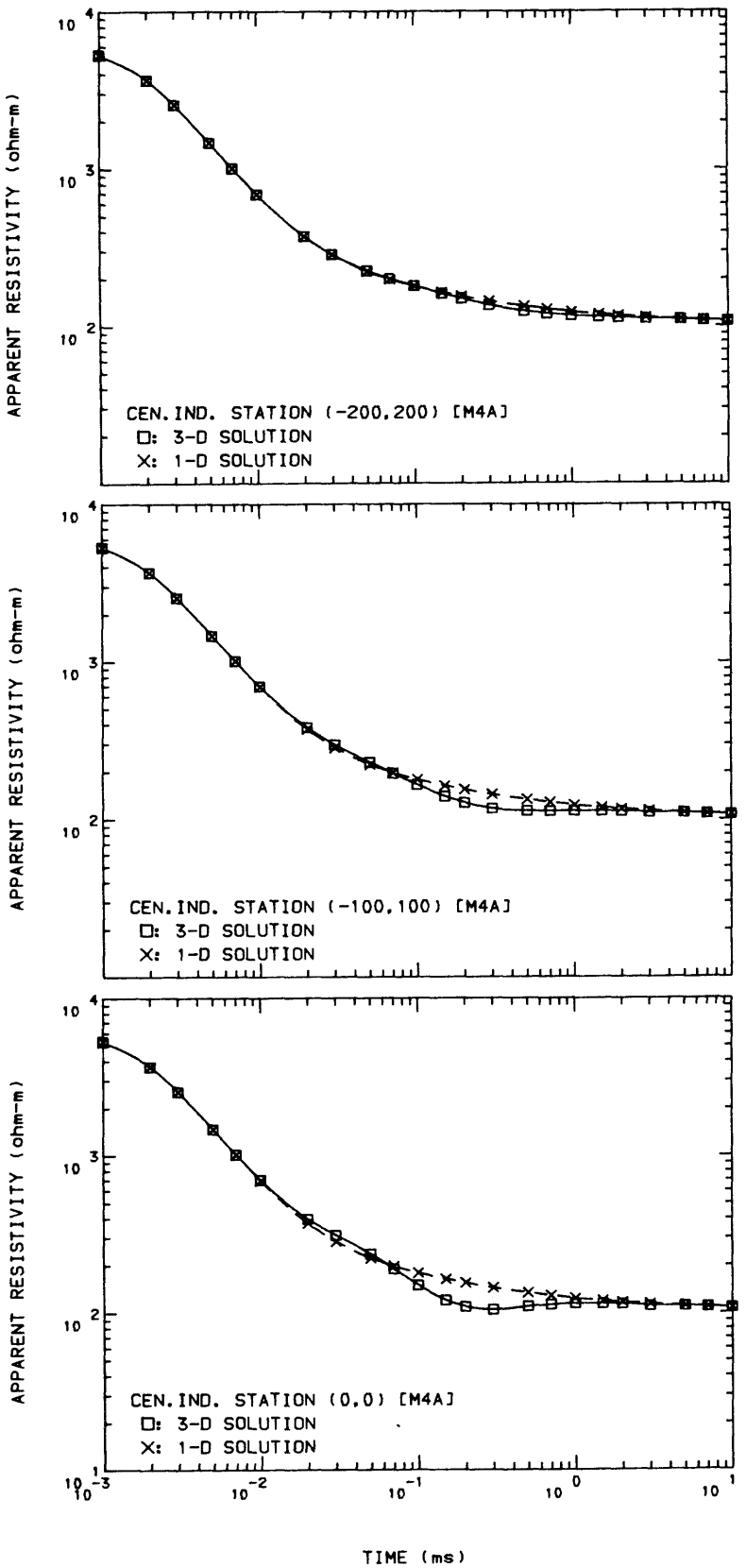

EM3D MODEL [M3A] (PLAN-VIEW)
BODY OUTLINE (DASHED LINE)
TRANSMITTERS (SOLID LINES)
RECEIVER POINTS (X)
CELL CENTERS (DIAMOND POINTS)
Y (m)
X (m)
500.
400.
300.
200.
100.
0.
-100.
-200.
-300.
-400.
-500.
-500.
-400.
-300.
-200.
-100.
0.
100.
200.
300.
400.
500.

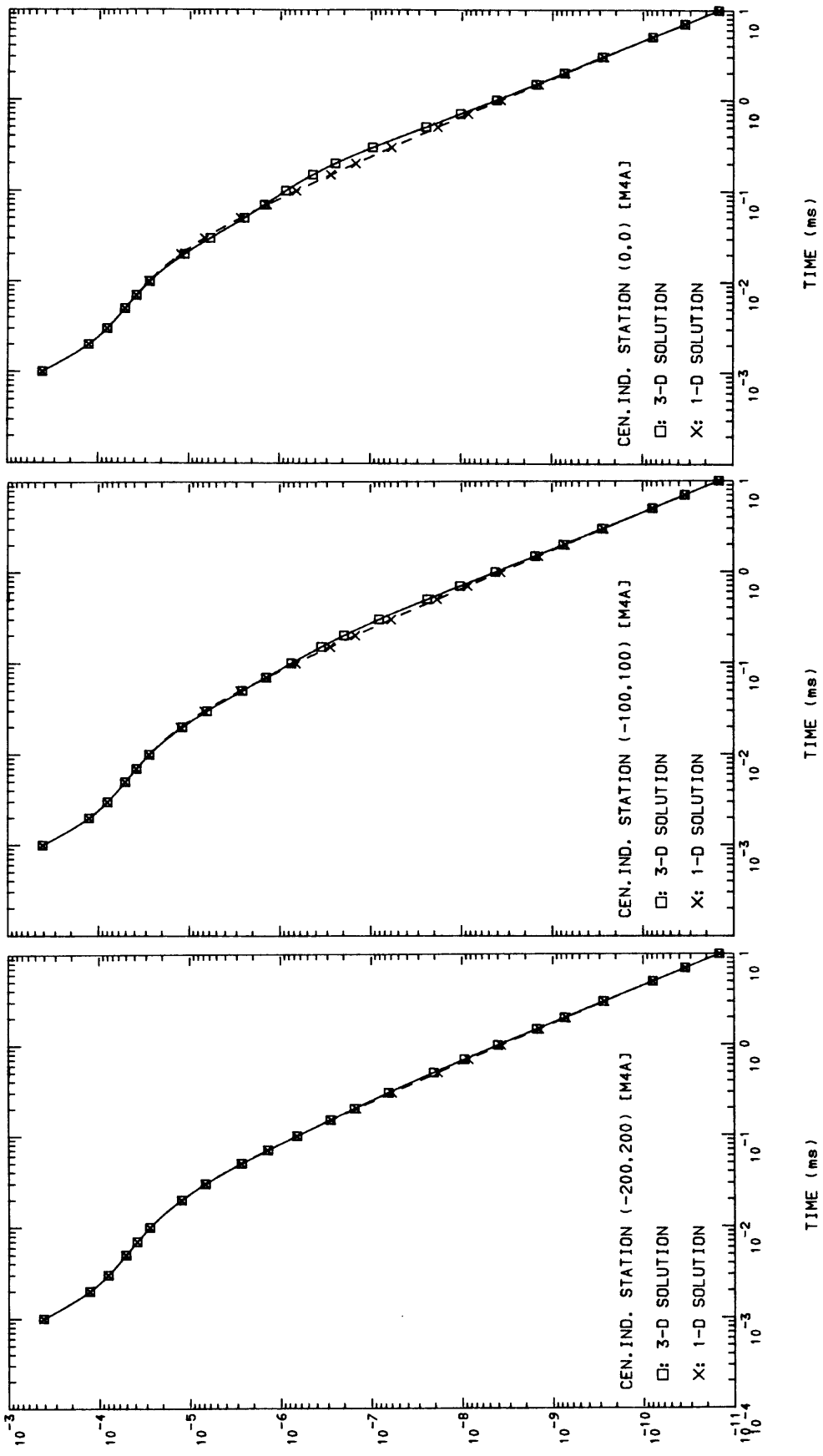

EM3D MODEL [M3A]
APPARENT RESISTIVITY (ohm-m)
CEN.IND. STATION (-200,200) [M3A]
□: 3-D SOLUTION
×: 1-D SOLUTION
APPARENT RESISTIVITY (ohm-m)
CEN.IND. STATION (-100,100) [M3A]
□: 3-D SOLUTION
×: 1-D SOLUTION
APPARENT RESISTIVITY (ohm-m)
CEN.IND. STATION (0,0) [M3A]
□: 3-D SOLUTION
×: 1-D SOLUTION
TIME (ms)


EM3D MODEL [M3A]
CEN.IND. STATION (0,0) [M3A]
□: 3-D SOLUTION
X: 1-D SOLUTION
CEN.IND. STATION (-100,100) [M3A]
□: 3-D SOLUTION
X: 1-D SOLUTION
CEN.IND. STATION (-200,200) [M3A]
□: 3-D SOLUTION
X: 1-D SOLUTION
TIME (ms)
TIME (ms)
TIME (ms)
VOLTAGE: (volts/amp*m*m)


EM3D MODEL [M4A] (CROSS-VIEW)
3000 OHM-M (LAYER-1)
50 OHM-M (LAYER-2)
300 OHM-M (LAYER-3)
10
100 OHM-M (LAYER-4 HOST)
BODY OUTLINE (DASHED LINE)
CELL CENTERS (DIAMOND POINTS)
-Z (m)
X (m)
0.
-25.
-50.
-75.
-100.
-125.
-150.
-175.
-200.
-225.
-250.
-500.
-400.
-300.
-200.
-100.
0.
100.
200.
300.
400.
500.


EM3D MODEL [M4A] (PLAN-VIEW)
BODY OUTLINE (DASHED LINE)
TRANSMITTERS (SOLID LINES)
RECEIVER POINTS (X)
CELL CENTERS (DIAMOND POINTS)
Y (m)
X (m)
500.
400.
300.
200.
100.
0.
-100.
-200.
-300.
-400.
-500.
-500.
-400.
-300.
-200.
-100.
0.
100.
200.
300.
400.
500.


EM3D MODEL [M4A]
APPARENT RESISTIVITY (ohm-m)
CEN.IND. STATION (-200,200) [M4A]
□: 3-D SOLUTION
×: 1-D SOLUTION
CEN.IND. STATION (-100,100) [M4A]
□: 3-D SOLUTION
×: 1-D SOLUTION
CEN.IND. STATION (0,0) [M4A]
□: 3-D SOLUTION
×: 1-D SOLUTION
TIME (ms)


EM3D MODEL [M4A]
CEN.IND. STATION (-200,200) [M4A]
□: 3-D SOLUTION
X: 1-D SOLUTION
CEN.IND. STATION (-100,100) [M4A]
□: 3-D SOLUTION
X: 1-D SOLUTION
CEN.IND. STATION (0,0) [M4A]
□: 3-D SOLUTION
X: 1-D SOLUTION
TIME (ms)
TIME (ms)
TIME (ms)
VOLTAGE: (volts/amp•m•m)