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The Hermes-III Gamma-Ray Facility at the Simulation Technology Laboratory—A Guide for Users

Gerald A. Zawadzkas

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The Hermes-III Gamma-Ray Facility
at the Simulation Technology Laboratory

A Guide for Users

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ABSTRACT

Hermes III is a 20-megavolt, 15-terawatt, pulsed accelerator which is available for gamma-ray effects testing. The purpose of this guide is to serve as a basic source of information for prospective users of Hermes III. Included is a brief discussion of the design and operation of the accelerator and a summary of gamma-ray environmental data. The guide also contains a description of experimental support facilities, data acquisition and analysis systems and general information for users.

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TABLE OF CONTENTS

	PAGE
Section 1. Introduction.....	7
Section 2. The Accelerator.....	9
Section 3. Gamma-Ray Environment.....	11
Section 4. Facilities.....	15
Section 5. Data Acquisition and Analysis Systems.....	19
5.1 Main Screen Room.....	19
5.2 Waveform Recorders.....	19
5.3 Computers.....	22
5.4 Cable Plant.....	24
5.5 Hermes III Local Screen Room.....	25
Section 6. General Information.....	27
6.1 Scheduling.....	27
6.2 Contract Procedures.....	27
6.3 Cost Information.....	28
6.4 Security and Visitor Control.....	28
6.5 Shipping Information.....	29
6.6 Travel Information.....	29
References.....	31
Figure Captions.....	33
Figures.....	35
Distribution.....	51

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INTRODUCING HERMES III

A Guide for Users

Section 1. Introduction

Hermes III is a new high-power, pulsed, gamma-ray simulator. It was designed to extend the capabilities of Hermes II which has been in operation for nearly 20 years. Hermes III was designed and constructed by Sandia National Laboratories and is located in the Simulation Technology Laboratory (STL) in Technical Area IV, Kirtland Air Force Base, Albuquerque, NM (Fig. 1). Hermes III became operational in October 1988.

The purpose of the facility is to provide an above-ground source for gamma-ray radiation effects experiments. This manual serves as a basic source of information for prospective users of Hermes III. Section 2 contains a brief discussion of the design and operation of the accelerator. A summary of environmental data is presented in Section 3. Section 4 describes the Hermes III facilities, including geometry of the test cell and user support areas. Specific information on screen rooms, instrumentation and data recording capabilities is provided in Section 5. The final section of this manual, Section 6, contains general information such as scheduling and contracting procedures for Department of Energy and Department of Defense organizations and contractors.

The depth of material is sufficient to allow the prospective user to determine the applicability of Hermes III to his proposed experiment and to permit irradiation calculations and planning. For the purposes of jointly ascertaining technical feasibility of experiments and providing additional information, as required, technical staff are available for test plan development.

Technician support is also available for assisting in setting up experiments. Initial contact and scheduling arrangements should be made with the Supervisor of the Simulation Operations Division (9343) at (505) 844-7483.

Section 2. The Accelerator

Hermes III (Fig. 2) utilizes technology developed in the joint DNA/SNLA High Energy Linear Induction Accelerator (HELIA) program. The HELIA concept uses modular pulsed power components to drive ferromagnetically isolated induction cavities. The outputs of these cavities are added on a magnetically insulated transmission line (MITL), and an electron beam is generated in a single anode-cathode gap diode at the end of this MITL. A tantalum bremsstrahlung converter on the anode side of the diode generates the gamma-ray output.

The HERMES III energy storage section consists of ten 2.4 MV, 156 kJ Marx generators. Each of the Marx generators charges two water dielectric intermediate storage capacitors. The twenty intermediate storage capacitors are discharged through laser-triggered gas switches to charge four water dielectric pulse-forming transmission lines to 2.2 MV. Each cavity is driven by four 5Ω pulse-forming transmission lines. Azimuthal transmission lines in each cavity further symmetrize the four-point feed to provide azimuthal symmetry of the power feed to the MITL adder. Each cavity supplies a 1 MV, 750 kA pulse to the MITL adder. Metglas cores are used for ferromagnetic isolation. The MITL adder is tapered to satisfy the minimum current condition for magnetic insulation and efficient pulse addition as the voltage is increased through the adder. A constant impedance (30Ω) MITL transports the power from the adder to the diode/converter in the exposure cell.

The accelerator is 21-m wide, 11-m long and 5-m high. HERMES III is a state-of-the-art accelerator which takes advantage of short pulse, low inductance pulsed-power technology to provide dose-rate area products which have not been previously available. Accelerator output parameters are given below.

Accelerator Parameters

Peak Diode Voltage	20 MV
Peak Diode Current	700 kA
Total Beam Energy	370 kJ
Power Pulsewidth (FWHM)	27 ns
Repetition Rate	7 Shots/Day

Representative waveforms for the diode voltage and current are illustrated in Fig. 3. The total current is monitored by current shunts in the outer MITL. Because of the high electric fields, harsh electron backgrounds, and long MITL, direct measurement of the Hermes-III diode voltage is difficult but several indirect methods have been used. One approach uses measurements of the total and boundary currents in the MITL together with parapotential flow theory to extract the voltage applied across the diode as a function of time. The voltage waveform in Fig. 3 was calculated in this manner.

From the measured current and inferred voltage waveforms, the time-integrated kinetic energy distribution at the anode can be extracted. The resulting electron energy spectrum is shown in Fig. 4. Peak electron energy is 20.5 MeV and average energy is 16.0 MeV.

Section 3. Gamma-Ray Environment

Diode development on Hermes III is an ongoing process, and new configurations are continually being investigated to meet changing user requirements. At present, our standard mode of operation uses an extended planar anode (Fig. 5). The AK gap can be varied to produce different radiation patterns. With a 42-cm AK gap, the following radiation specifications have been demonstrated.

Dose and dose rate characteristics:

Peak Dose	>100 kRads (Si)
Pulsewidth	20 nsec (FWHM)
Risetime (10-90)	12 nsec
Peak Dose Rate	>5 x 10 ¹² Rads (Si)

Radiation volume:

- 500 cm² front surface, with dose rate variation less than a factor of two.
- Dose rate varies less than a factor of four within a volume formed by extending front surface back 15 cm.

Both the indoor and outdoor test cells have been extensively mapped with thermoluminescent dosimeters (TLD's) for various AK gaps from 40 to 90 cm. Because of the cylindrical geometry of the cathode most of the electrons in the AK gap are spatially distributed within an annular region. At the shorter gaps, the electrons have steep angles of incidence at the anode and the resulting bremsstrahlung radiation focuses a few tens of centimeters in front of the faceplate. As the AK gap is increased, the radius of the annulus increases and the focal point moves further out from the faceplate. At an AK gap of 87 cm, the radius of the annulus is about 30 cm and the focal point

is meters from the faceplate. While the peak dose is higher for the shorter gaps, the dose-area product remains fairly constant for all settings.

The series of maps in Fig. 6 illustrate isodose contours for AK gaps of 53, 70 and 87 cm both in the indoor cell and the outdoor cell. The patterns are symmetrical about an axis perpendicular to the center of the faceplate (defined as the z-axis) and can be viewed as being in either a horizontal or vertical plane. The TLD data from which these maps were drawn, by a UNIRAS graphics software package, is stored in the STL Micro VAX-III and can be manipulated to illustrate the radiation contours in a variety of ways. For example, cross-sections at various z-axis locations, three-dimensional representations, and enlargements of any particular region can be generated. Representative illustrations of these possibilities are shown in the series of plots in Fig. 7.

A representative photon spectrum for Hermes III is shown in Fig. 8. This calculated spectrum is from a 120-mil tantalum converter for a typical shot. Average photon energy is approximately 1.9 MeV. If the tantalum is replaced by a graphite converter, the average photon energy drops to about 1.4 MeV.

Figure 9 compares the radiation pulse waveforms measured by a compton diode and a scintillator photodiode with that predicted by the scaling law $I(t) \propto V(t)^{2.2}$, where I is measured and V is estimated from parapotential flow theory. The monitors were located two meters from the faceplate, about 30° off axis. The pulse FWHM is about 21 ns with a 10 to 90% rise time of approximately 11 ns when averaged over several shots taken with a 70-cm AK gap.

Several other diode configurations have been or will be investigated. These include an indented anode, a B-theta lens diode, and a pinched-beam mode for very high dose rates. These configurations will provide additional flexibility in generating radiation fields, particularly in terms of increased uniformity over various volumes of interest.

Other future plans include development of an e-beam mode for TMS testing and an outdoor mode for irradiating very large targets in the Hermes III Outdoor Test Cell.

Section 4. Facilities

A layout of the Simulation Technology Laboratory (STL) building is shown in Fig. 10. STL houses several simulators, but Hermes III is the major facility in the building. A brief description of the various user-related facilities is given below.

Exposure Cell - The exposure cell is a concrete-shielded structure, 40' X 40' X 20' (Fig. 11). A 46" high platform (removable) extends throughout most of the test cell, and the center of the converter is 56" above the platform. The test cell is serviced by a 5-ton bridge crane with a 14'5" hook-height and a 2-ton jib crane. The cell has two entrances; one is 3'10" X 6'10", and the other is 14' X 14'. The larger door leads to the outdoor exposure cell. A wide variety of power outlets are available. Faraday cages of varying size are available for insulating test packages from EMP. Junction boxes for cable connections are located in a 4' X 6' trench running the length of the cell.

Outdoor Exposure Cell - The Hermes III baseline design includes provisions for transporting the beam through the test cell so that very large assemblies could be tested outside in the outdoor exposure cell. This area measures 66' X 95' and is shielded so that tests can be conducted during normal working hours.

Screen Rooms - STL is equipped with a large Main Screen Room and several smaller local screen rooms. Most of the facility's data acquisition equipment is located in the Main Screen Room. The smaller rooms are for users who will be using their own test equipment or need to be close to the test cell. The Main Screen

Room, the local screen rooms and the test cell are all tied together via cable conduits in the building's trench system. More information regarding the screen rooms, the data acquisition equipment and the cable system is provided in Section 5 of this guide.

Trailer Park - A trailer park with power hook-ups for two air conditioned instrumentation trailers is located just outside the Hermes III Test Cell as shown in Fig. 5. The Test Cell wall has two ports in it, one 18" in diameter and one 12" in diameter, for running user cables from the trailers into the Test Cell.

User Data Analysis Room - The User Data Analysis Room is an area where users can process and analyze test data. This RF-shielded room houses four work stations, each having a high resolution color graphics terminal and associated printer/plotter linked to the Micro VAX-III located in the Main Screen Room. A 20-page/minute laser printer is also available for quick bulk graphic output. This room is also tied into the facility intercom system.

Dosimetry Laboratory - The dosimetry lab is available to all Hermes III users. The laboratory uses the TLD-400 thermoluminescent detector as the standard dosimeter. It is a (0.125- X 0.125- X 0.035-in.) chip of calcium fluoride (manganese-activated) which measures doses from 1 rad (Si) to 10^5 rads (Si). When fielded, the TLD's are normally encased in 80-mil-thick aluminum jackets. For doses greater than 10^5 rads radiochromic dye film dosimetry is available.

Sandia provides and reads a limited number of dosimeters for the experimenter. The lab operates two computer-controlled Harshaw readers. It takes about 40 seconds to read a single TLD. If one should need a significant number of dosimeters, he should make his requirements known early in order to prepare for the experiment.

The STL dosimetry lab is a satellite of Sandia's Radiation Dosimetry Laboratory which provides dosimetry services to Sandia's accelerator, reactor and radioactive-source facilities. It supports development and characterization of the irradiation facilities and radiation exposure data for experiments. System calibrations are traceable to NBS.

User Test Preparation Bays - Several areas are available for STL users to prepare their equipment before irradiation. These bays are equipped with work benches, basic test equipment and tools. For preparation of very large assemblies the adjacent General Maintenance Area can also be used.

Machine Shop - A fully-equipped machine shop is located in the low bay. It is operated by STL operations staff and will support minor jobs required by Hermes III users. Equipment includes: band saw, Series 1 Bridgeport Mill, Series 2 Bridgeport Mill, drill press, 13" lathe, 17" lathe, grinders, belt-sander, 10-ton press, and a small sheet-metal shear.

Conference Room - A 15' X 20' conference room located next to the Test Prep Bays is available to Hermes III users for technical discussions and meetings.

Section 5. Data Acquisition and Analysis Systems

STL has a Main Screen Room, where most of the data acquisition equipment is located, and several smaller "satellite" screen rooms located nearer the accelerators. Hermes III's local screen room is located just outside the Hermes III Exposure Cell.

5.1 Main Screen Room - The STL Main Screen Room is 36' X 62' (2230 sq. ft.) and is laid out as shown in Fig. 12. Electromagnetic interference shielding is above the following minimum levels:

Electric Field	14 kHz	110 dB
Plane Waves	450 MHz	110 dB
Microwave	1-10 GHz	110 dB
Magnetic Field	14 kHz	75 dB

5.2 Waveform Recorders - The Main Screen Room is organized into three separate groupings of waveform recorders (see Fig. 13). Each group is controlled separately by minicomputers to the extent of acquiring data. For cable compensation, data processing, and data analysis the waveforms are transferred to a Micro VAX-III also located in the Screen Room. Each group of recorders is essentially dedicated to a single accelerator or group of accelerators. However, if a particular experiment requires more than the dedicated number of channels, a switching matrix allows channels from the other systems to be utilized. The three groupings of recorders are listed below in Table 1.

Table 1
STL Data Acquisition Recorders

<u>Group</u>	<u>Facility</u>	<u>No. of Units</u>	<u>Type</u>	<u>No. of Channels</u>
DAS I	Hermes III	30	Tektronix R7912	30
		5	Tektronix 7D20	10
		5	LeCroy 9400	10
DAS II	Shared	26	Tektronix 7912AD	26
		5	Tektronix RTD710	10
DAS III	Proto II	30	Tektronix R7912	30
		5	Tektronix 7D20	10
		5	LeCroy 9400	10

High bandwidth capability exists with the R7912's in the Hermes III subsystem and the 7912ADs in DAS II. The requirement for long time-windows is met using various "slow" waveform recorders. These include LeCroy 9400's, TEK RTD 710's, and TEK 7D20 plugins in TEK R7903 mainframes, which can be used as single channel high bandwidth oscilloscopes without the plugins.

Recorders can be timed from 10 msec before to 10 msec after any event with 1 nsec accuracy. The "slow" recorders have a pre/post trigger capability which allows simple triggering setups.

Capabilities of the Main Screen Room recorders are summarized in Table 2.

Table 2

STL Waveform Recorder Summary

R7912

Single channel digitizer with 500 MHz mainframe, uses manual plugins
Sweep speeds of 10 ns/div to 10 μ s/div (10 division window)

7912AD

Single channel digitizer with 500 MHz mainframe, uses programmable/manual plugins
Sweep speeds of 10 ns/div to 20 μ s/div (10 division window)

Manual plugins -

7A19/7A29 - Single channel input @ 500 MHz (50 Ω)
7A24 - Dual channel input @ 350 MHz (50 Ω)
7A26 - Dual channel input @ 200 MHz (1M Ω)
7A13 - Dual channel input @ 100 MHz (1M Ω)

Programmable plugins -

7A29P - Single channel input @ 500 MHz (50 Ω)
7A16P - Single channel input @ 225 MHz (50 Ω /1M Ω)

7D20

Dual channel digitizer with 70 MHz bandwidth, analog add mode

Vertical resolution - 8 bits (1 M Ω)
Maximum sample rate - 25 ns/pt
Record length - 1K

RTD710

Dual channel digitizer with 100 MHz bandwidth, sample rate switching

Vertical resolution - 10 bits (1 M Ω)
Maximum sample rate - 10 ns/pt
Record length - 16K/32K optional

9400

Dual channel digitizer with 100 MHz bandwidth

Vertical resolution - 8 bits (50 Ω /1M Ω)
Maximum sample rate - 10 ns/pt
Record length - 16/32K optional

5.3 Computers - The Main Screen Room uses distributed data acquisition systems in order to provide fast turn-around time, redundancy and low software development cost. The system consists of a Digital Micro VAX-III computer for data analysis and Digital LSI-11 computers for data acquisition. The LSI-11's primary function is to control the instruments for a shot. They set up the instruments for a shot, arm the system and acquire the data from the instruments. After an accelerator shot has been taken, the LSI-11 off-loads the data to the VAX in order to allow the instrument control system to be turned around for the next shot. The off-loading of data from the micros to the mainframe is accomplished by using an Ethernet Network which links the LSI-11's to the VAX. The VAX then performs the more CPU intensive processing of data, which is mainly the restoration of high frequency signal components lost in transmission over the coax signal cables (software cable compensation), folding in of calibration data, etc. The data resides on the VAX's disk drives for further processing by interactive data analysis routines.

The software used on the VAX can be divided into two main categories: system and application software, and data analysis software. The VAX operates under the VMS operating system which includes various utilities and services. The Data Analysis System has both "off-the-shelf" software and Sandia-developed software. Several interactive waveform data analysis programs are available on the VAX so that users may choose the one they are most familiar with. In general, these programs provide the usual waveform math (integration, differentiation, least squares fit comparison, multiplication, division, FFT, X vs. Y, etc.) and graphics (windowing, labelling, output, etc.) functions.

Waveforms can be manipulated, read from previous shots, saved, deleted, etc., allowing maximum flexibility. Automated data processing which can be run in batch mode is also available.

Current in-house programs available are:

1) IDR (Interactive Data Reduction) This program supports waveform recorders with various record lengths. Waveforms are disk based and accessed by signal name or record number and placed into memory-based working arrays which can then be used for analysis.

2) DAMP (Data Analysis and Manipulation Program) This program is exclusively for 7912 waveforms with 512 point records. All waveforms are memory based and accessed by signal name.

3) IDL (Interactive Data Language) This is a data analysis package created by Research Systems, Inc., for DNA. To provide compatibility with DNA users the standard data formats can be translated to the IDL format.

Data can be taken from STL by the user in the following formats: TK50 tape, 9-track tape, 5-1/4" floppy disk, 8" floppy disk and RL02 disk.

The VAX also maintains a database and data analysis software which documents and analyzes accelerator performance history, single shot performance and comments about each accelerator shot.

The VAX is connected to the microcomputer data acquisition system, the terminals in the data analysis room and the Hermes III Local Screen Room (see Fig. 14).

5.4 Cable Plant - The Main Screen Room for STL acquires waveform data from the Hermes III exposure cell, the Hermes III accelerator, the Proto II accelerator and smaller accelerators in the High Bay. The cable system to the High Bay exits the screen room floor and is routed down to the trenches through a cable shaft, a drop of about 18'. The cables are routed to the accelerators in RFI tight conduits by means of a trench network. The connection from the cable system to experiments at the various accelerators is accomplished by means of junction boxes located in each exposure cell and RG-214 cable jumpers. Each jumper cable is double-shielded with flexible metal hose (breeze tubing) and has either "N" or "HN" type connectors. Other types of connectors can be provided upon request.

The cable plant was designed to meet or exceed the shielding, bandwidth and number-of-test-points requirements. A study of the types of signals to be routed to the Main Screen Room shows that the electrical performance of the cable plant, along with software cable compensation, provides adequate bandwidth to properly record fast transient signals. In fact, the bandwidth for the data acquisition system is limited only by the maximum bandwidth specifications for the vertical amplifiers used in the transient recorders in the Main Screen Room. The fastest recording instruments are the Tektronix 7912's which have a 500 MHz analog bandwidth (1 ns risetime) with certain plugins.

The low-loss cable which comprises the bulk of the cable run is 1/2" 50-w Heliax foam-dielectric coaxial cable (LDF4-50A). The connectors for the foam cable are both "N" and "HN" type self-flaring design. The cable runs from the exposure cell junction boxes to the top of the cable shaft are continuous with no intermediate splices.

The cable conduits are 12" X 8" square, which allows for a very large capacity of cables from the main screen room to each accelerator. The conduit has a "U"-shaped sectional configuration, capable of a total cable load of 50 pounds per linear foot. The conduits have a cadmium-plated "bolt-together" design with top loading access and a completely un-obstructed smooth interior. All mating surfaces have high quality, low resistance RFI gasketing.

Cable Tray Minimum Attenuation Levels

Electric Field	15 KHz - 10 GHz	>100 dB
Magnetic Field	15 KHz - 1 MHz	~75 dB
	1 MHz - 10 MHz	>100 dB

Eighty (80) 50 Ω coaxial cables are installed between the Main Screen Room and the Hermes Exposure Cell. The length of these cables is 287' (~400 ns) and are equalized in length to <0.5 ns. The bandwidth of the coaxial cable run is ~100 MHz without frequency-loss compensation applied. With frequency loss compensation applied the bandwidth is >500 MHz.

The locations of the junction boxes in the Hermes III Test Cell for the Main Screen Room, and the Hermes III Local Screen Room are shown in Fig. 6.

5.5 Hermes III Local Screen Room - The Hermes III Local Screen Room is a low-noise chamber immediately adjacent to the exposure cell. It was designed for users as a control site for experimental hardware and as a data acquisition site for low level and/or very high-speed signals.

The physical size of the screen room is approximately 9' X 28', with an 8' high ceiling. A double-wide access door provides a clear aperture of 60"W X 84"H.

Minimum electromagnetic shielding performance values are:

Electric field	14 kHz	120 dB
Plane waves	450 MHz-1 GHz	120 dB
Magnetic field	14 kHz	120 dB
	60 Hz	30 dB

The screen room features double-wall construction, with the inner wall fully isolated electrically except for a single ground "drain" connection. The double wall construction, when used in conjunction with an electrically-isolated input signal conduit, serves as a Faraday shield to reduce accelerator-induced electromagnetic noise on data lines carrying low-level signals from the exposure cell.

Three 6" diameter aluminum electrically-isolated conduits run from the front of the accelerator to a junction box covering the signal filtered feed-throughs on the wall of the screen room. The conduits run through the exposure cell trenches and under the radiation shield block wall of the exposure cell.

To allow entry of user cables into the screen room, 18 HN and 18 N type feed-throughs are available in the junction box. Additionally, two 2" and one 4" diameter waveguide penetrations are provided for control/signal cables, fiber optics, lasers, etc. All intercom, telephone and computer links are interfaced with the screen room via fiber optic modules.

Electrical power available in the Hermes III Local Screen Room consists of 115 VAC, 20A circuits and one 230V, 1 ϕ , 20A service.

Section 6. General Information

6.1 Scheduling - A Hermes III experiment should be scheduled well in advance and a test plan submitted at least 30 days prior to the scheduled date. This may be done by contacting the Simulation Operations Supervisor at (505) 844-7483. At the time of scheduling, the availability of required monitoring equipment should be determined, the environmental conditions required by the test should be discussed and any arrangements regarding the services mentioned in this manual should be concluded.

It is strongly suggested that prospective users of Hermes III make a preliminary visit to the facility to acquaint themselves with it and to gain first-hand information on the compatibility of experiment and machine.

6.2 Contract Procedure for Non-Sandia Users - The services of Hermes III are available to agencies of the Department of Energy (DOE) and the Department of Defense (DOD) and to private corporations having DOE or DOD contracts.

DOE or DOD agencies or contractors desiring to use the Hermes III facility are required to establish a contract with the Director of Energy Technologies Division of the Albuquerque Operations Office of the DOE. The complete mailing address is:

Director, Reimbursable & Defense Technologies Division
Department of Energy
Albuquerque Operations Office
P. O. Box 5400
Albuquerque, NM 87115

This contract should be requested only after making full technical arrangements with Sandia National Laboratories.

Preliminary arrangements, including technical information, schedule availability and procedural requirements, are made directly with the Simulation Operations Division (9343) of Sandia National Laboratories. The complete mailing address is:

Supervisor, Simulation Operations Division (9343)
Sandia National Laboratories
P. O. Box 5800
Albuquerque, NM 87185

Telephone contact may be made by calling (505) 844-7483. Following this contact, negotiations with the DOE Albuquerque Operations Office should begin.

6.3 Cost Information - Preliminary cost information can be obtained from the Simulation Operations Supervisor. Firm cost information for non-Sandia users is obtained from the Albuquerque Operations Office of DOE.

Usage of Hermes III is charged by the hour. The user is only charged for time when the facility is operational. Set-up time is not charged to the user if it is done outside the test cell, but set-up time in the test cell is charged to the user. Normal hours for users is from 8:00 AM to 4:00 PM, Monday through Thursday. However, other arrangements can be made if required.

6.4 Security and Visitor Control - Unless a user holds a DOE "Q" or DOD "SRD" clearance, it will be necessary for him to be escorted to and from the Hermes III facility, and his movements will be restricted. Security arrangements should be

completed at the earliest convenient time but not less than two weeks before any preliminary visit or use of the Hermes III machine.

Security arrangements are to be made through Sandia National Laboratories at the following address:

Visitor Access and Administration Section
Division 3437-1
Sandia National Laboratories
P. O. Box 5800
Albuquerque, NM 87185
Telephone: (505) 845-8362
FAX: 846-0274 (to verify, call 845-8140)

6.5 Shipping Information - To avoid any delays in shipment, users are urged to ship materials at least two weeks in advance of the date they will be needed. Address shipments to:

Hermes III Facility
Building 970, Tech Area IV
Simulation Operations Division 1236
Sandia National Laboratories
P. O. Box 5800
Albuquerque, NM 87185

6.6 Travel Information - Figure 15 shows the location of Tech Area IV on the Kirtland Air Force Base. Figure 16 indicates the location of the Simulation Technology Laboratory (Building 970) within Area IV.

Note that all non-Sandia visitors, before entering Area IV must receive Sandia badges in Area I, Bldg. 802. Upon arrival in Area IV visitors must check in at the Guard Desk in Bldg. 980 or Bldg. 960.

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Figure Captions

- Fig. 1 Simulation Technology Laboratory in Tech Area IV.
- Fig. 2 The Hermes-III Accelerator.
- Fig. 3 Measured total current and parapotential voltage.
- Fig. 4 Electron kinetic energy distribution.
- Fig. 5 Standard extended planar-anode diode.
- Fig. 6 Radiation Maps.
- Fig. 6a Isodose contour map for planar-anode diode, 53 cm AK gap.
- Fig. 6b Isodose contour map for planar-anode diode, 70 cm AK gap.
- Fig. 6c Isodose contour map for planar-anode diode, 87 cm AK gap.
- Fig. 6d Isodose contour map for portion of H-III Outdoor Test Cell using planar-anode diode, 87 cm AK gap (5 ft. above ground level).
- Fig. 7 Radiation Maps.
- Fig. 7a Enlargement of 4-m² area in front of faceplate for Shot #830.
- Fig. 7b Three-dimensional presentation of Fig. 7a.
- Fig. 7c Vertical-plane isodose contour map for Shot #830 at Z=130 cm.
- Fig. 7d X-Y plot of TLD data for Shot #830 at Z=130 cm.
- Fig. 8 Calculated radiation spectrum.
- Fig. 9 Typical waveform for radiation pulse, showing comparison between measured and calculated results.
- Fig. 10 High-Bay layout.
- Fig. 11 Hermes-III exposure bay.
- Fig. 12 Main Screen Room layout.
- Fig. 13 Photograph of Main Screen Room.
- Fig. 14 Ethernet network.
- Fig. 15. Map of Kirtland AFB.
- Fig. 16 Map of Tech Area IV.

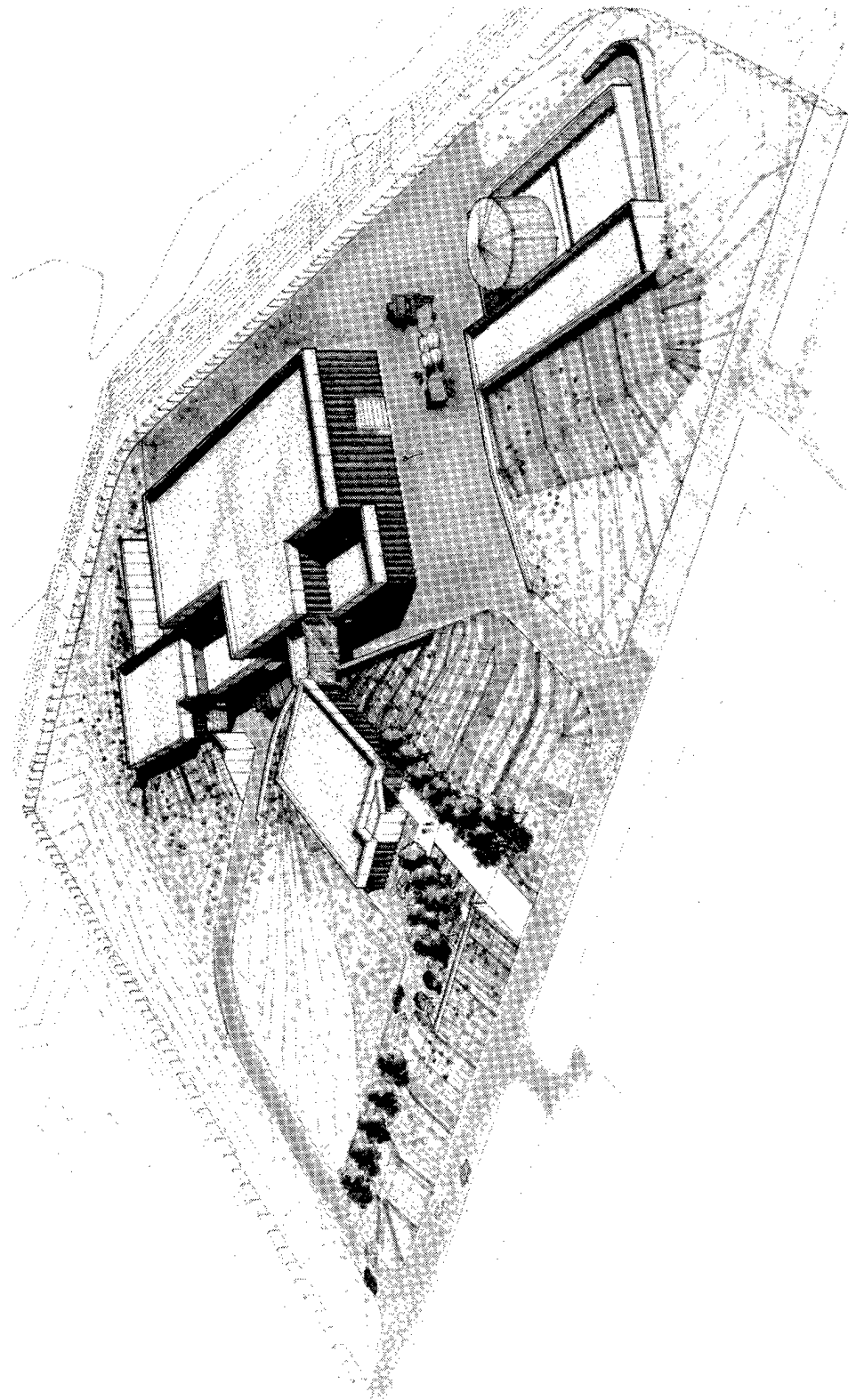


Fig. 1 - The Simulation Technology Laboratory in Tech Area IV

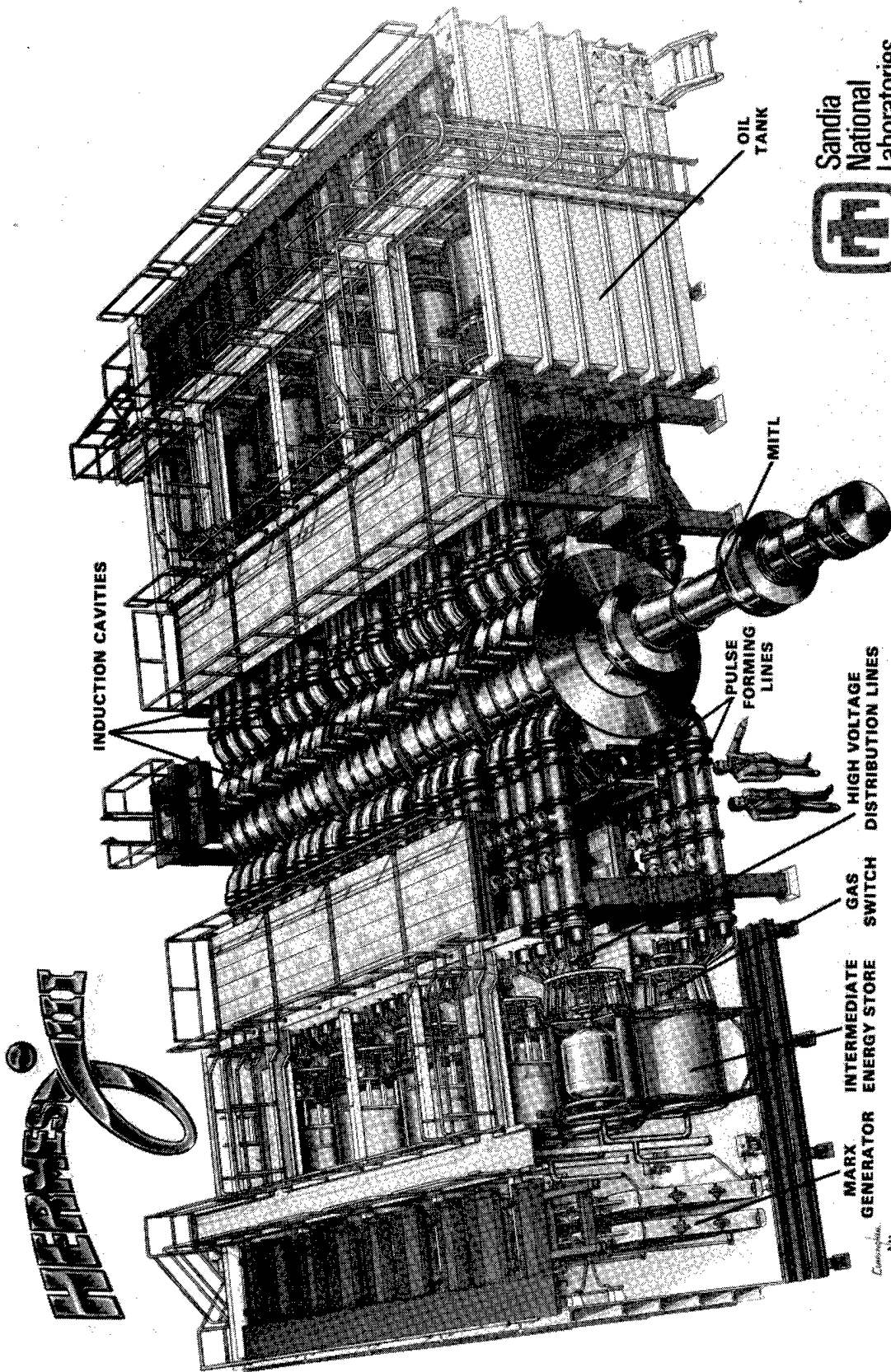


Fig. 2 - Hermes III

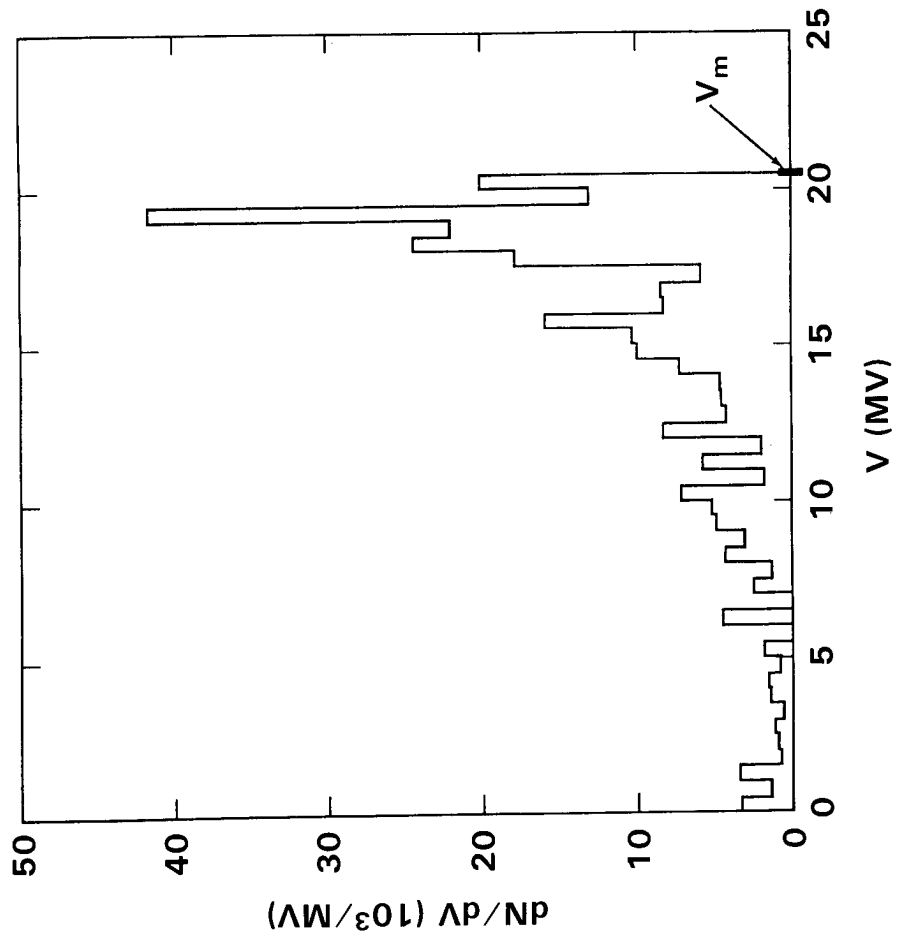


Fig 4.- Hermes III Electron Kinetic Energy Distribution

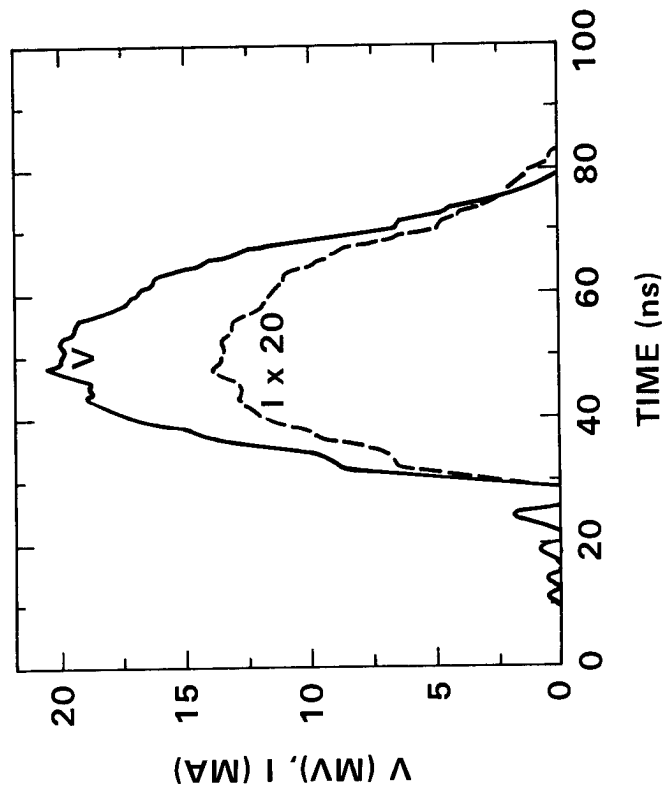


Fig 3.- Hermes III Measured Total Current, I, and Parapotential Voltage, V, for 70 cm AK Gap

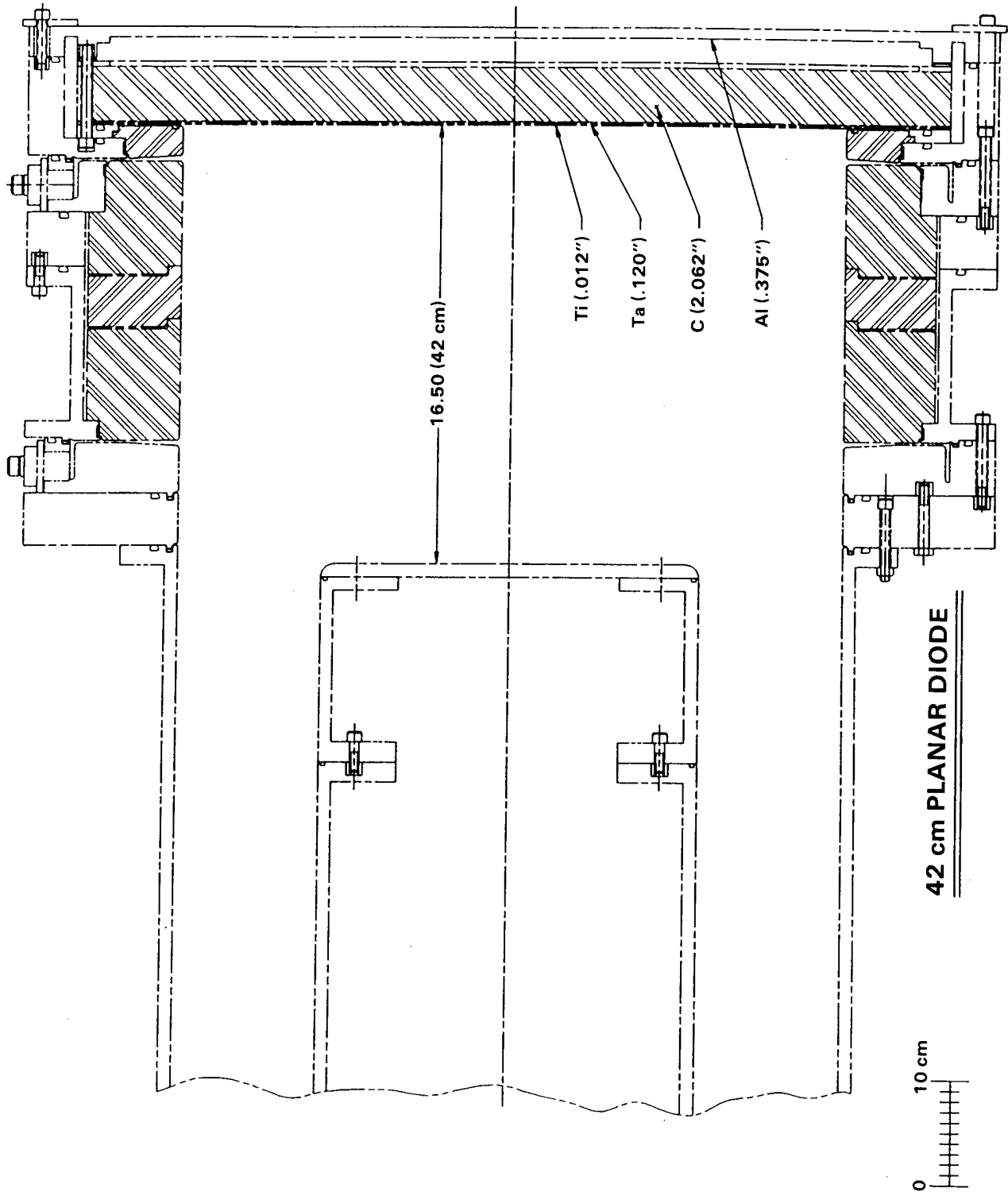


Fig. 5 - Hermes III Planar Diode

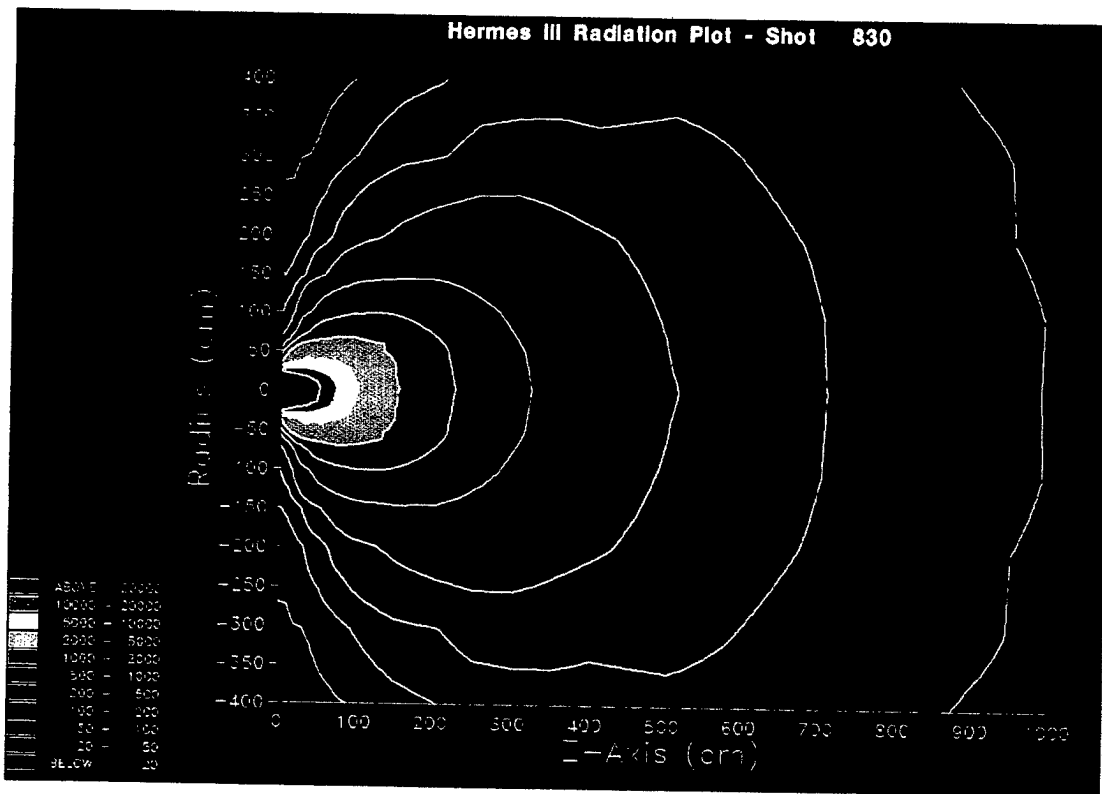


Fig. 6a - Isodose Contour Map for Planar-Anode Diode, 53 cm AK GAP

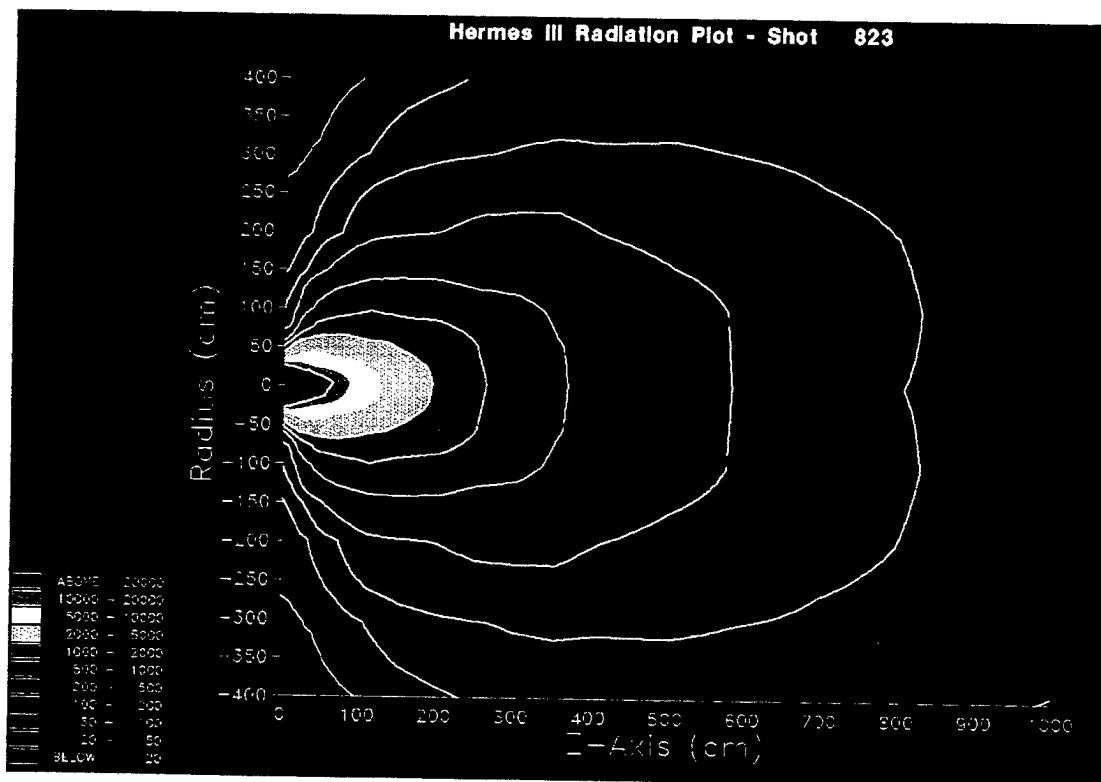


Fig. 6b - Isodose Contour Map for Planar-Anode Diode, 70 cm AK GAP

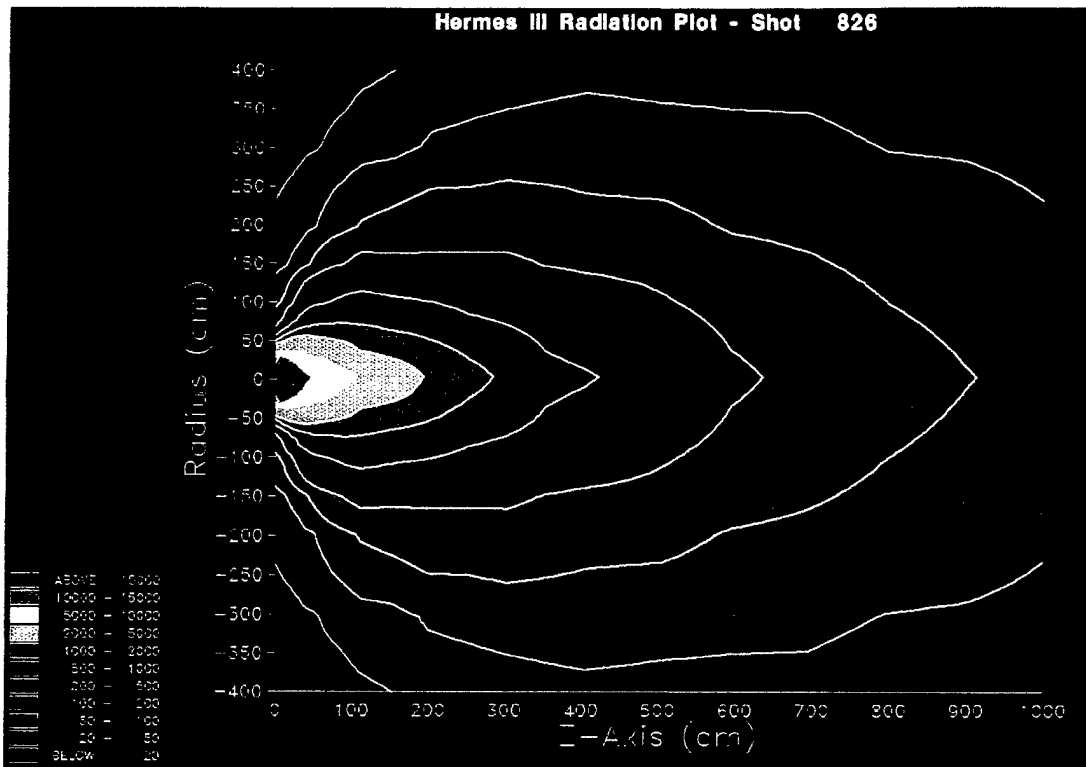


Fig. 6c - Isodose Contour Map for Planar-Anode Diode, 87 cm AK GAP

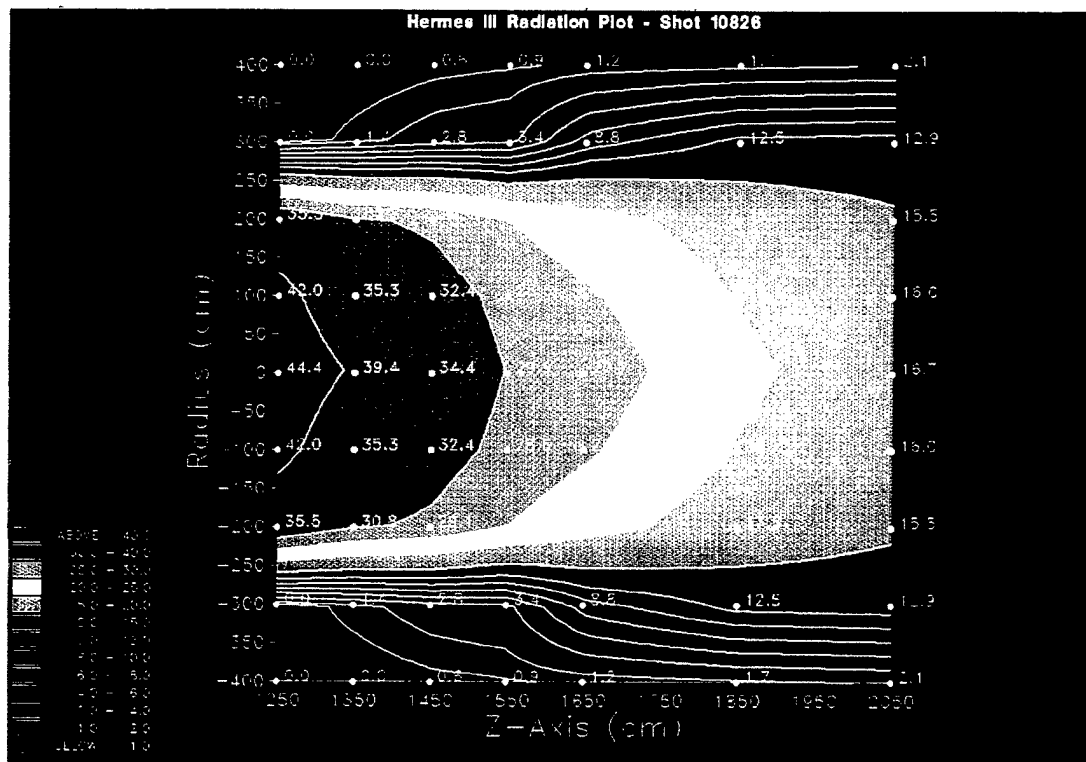


Fig. 6d - Isodose Contour Map for Portion of H-III Outdoor Test Cell Using Planar-Anode Diode, 87 cm AK GAP (5 ft. Above Ground Level)

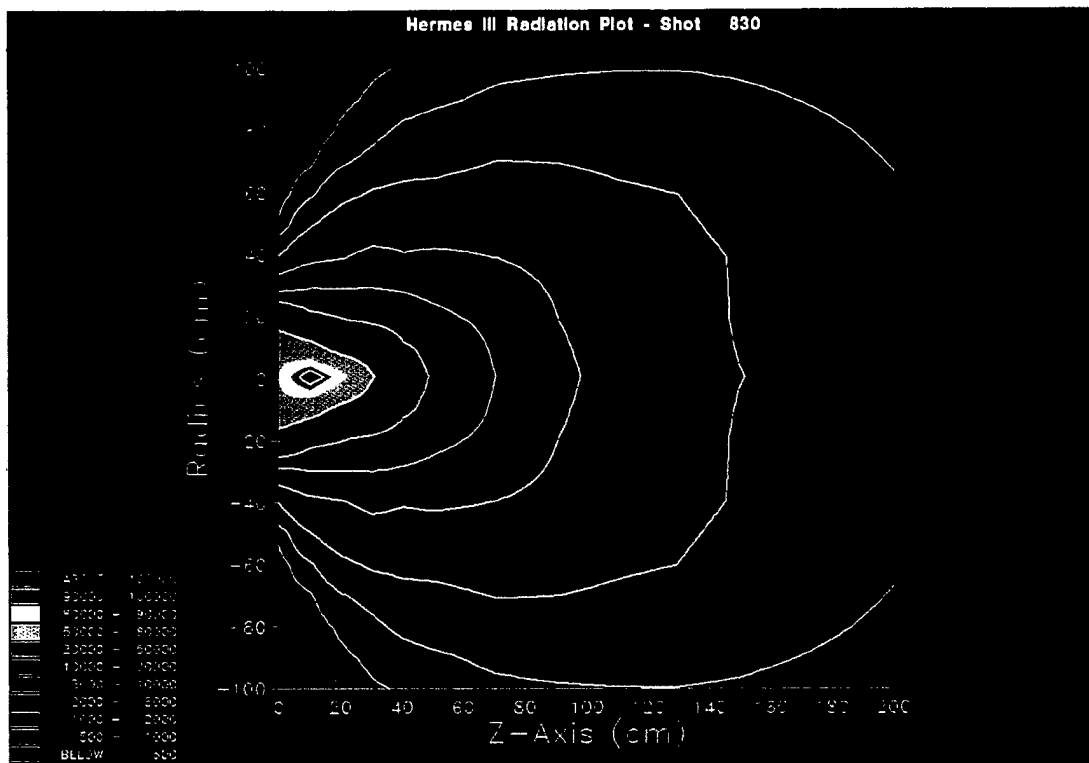


Fig. 7a - Enlargement of 4m² Area in Front of Faceplate for Shot # 830

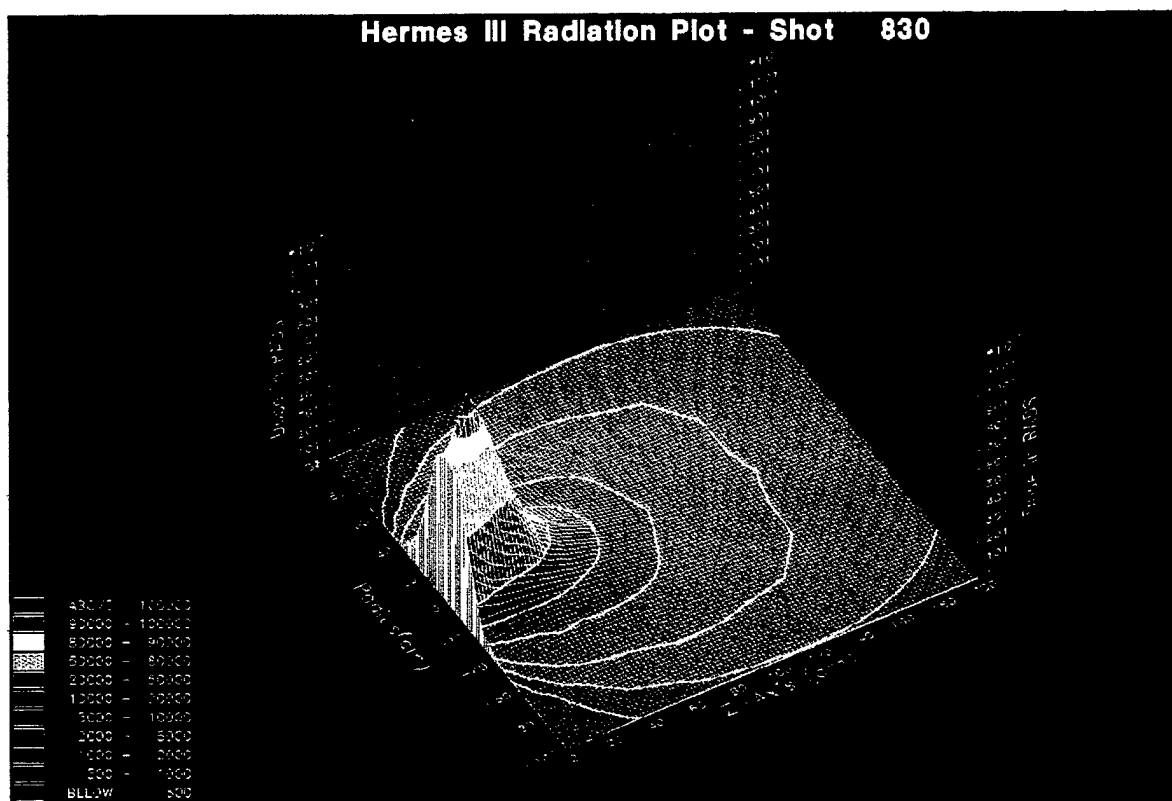


Fig. 7b - Three-Dimensional Presentation of Fig. 7a

Hermes III Radiation Plot - Shot 830
Z = 130 cm

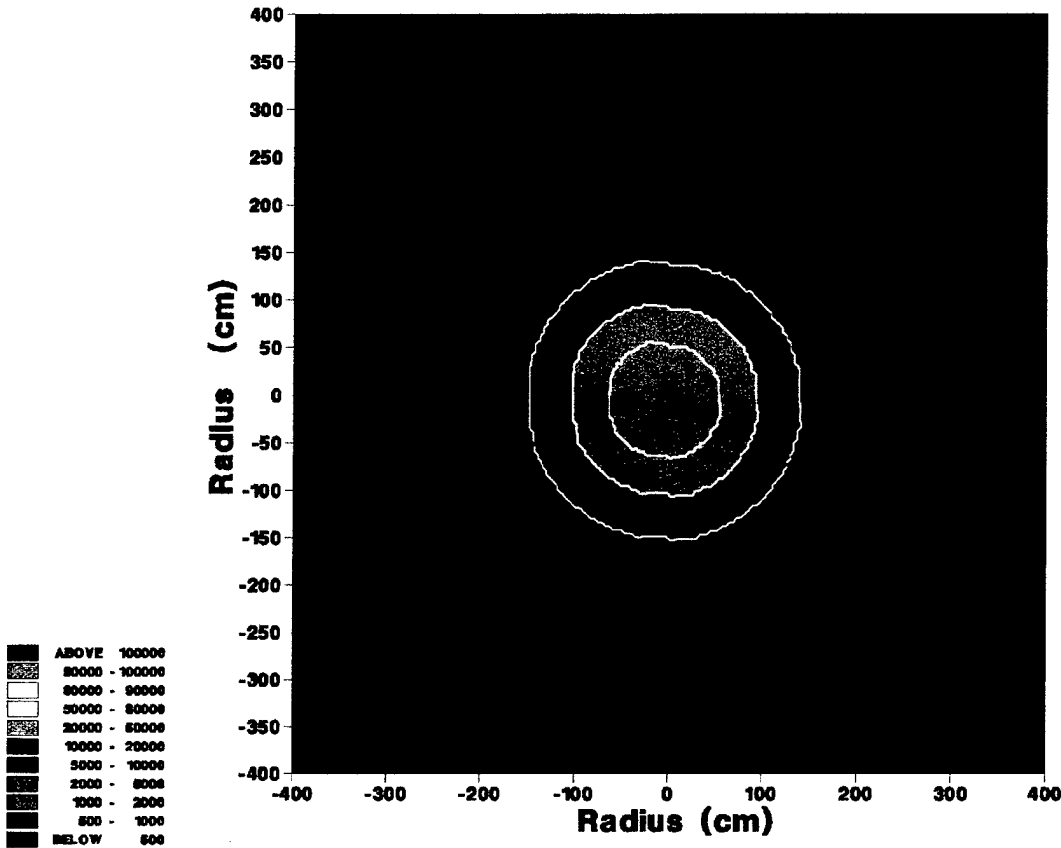


Fig. 7c - Vertical-Plane Isodose Contour Map for Shot # 830 at Z = 130 cm

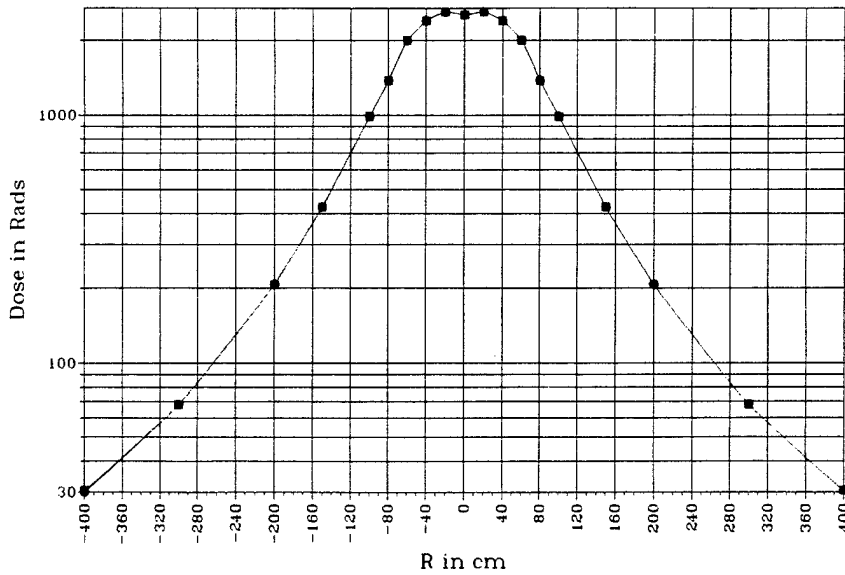


Fig. 7d - X-Y Plot of TLD Data for Shot #830 at Z = 130 cm

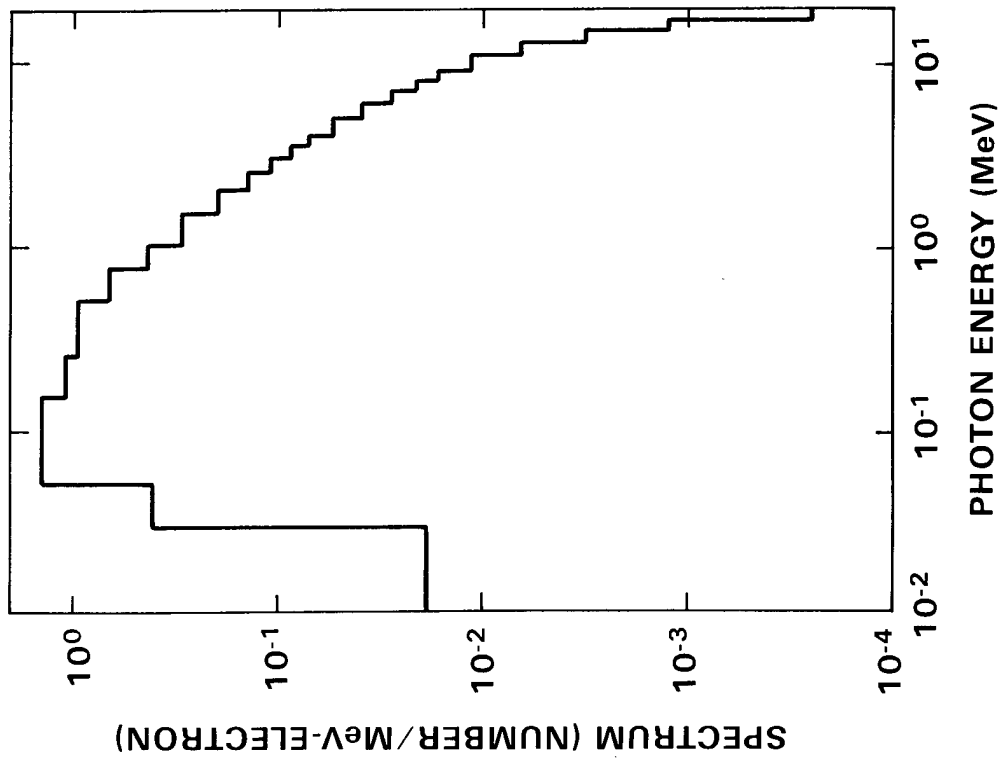


Fig 8.- Hermes III Calculated Radiation Spectrum from a Tantalum Converter. Average Photon Energy is ~ 1.9 MeV

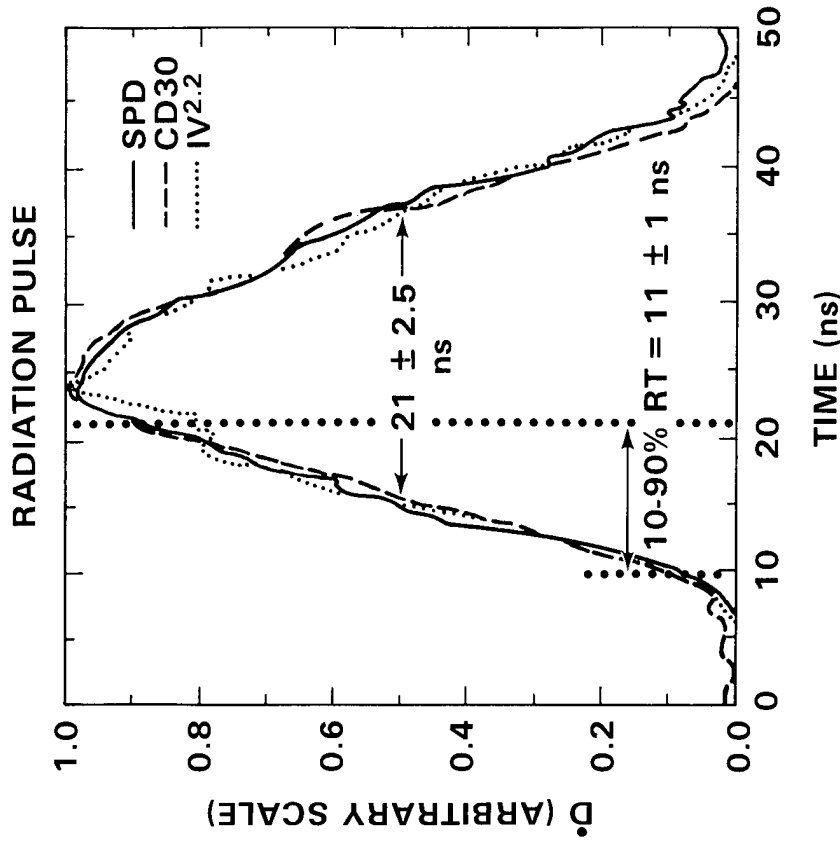


Fig 9.- Typical Waveform for Hermes III Radiation Pulse, Showing Comparison Between Measured and Calculated Results

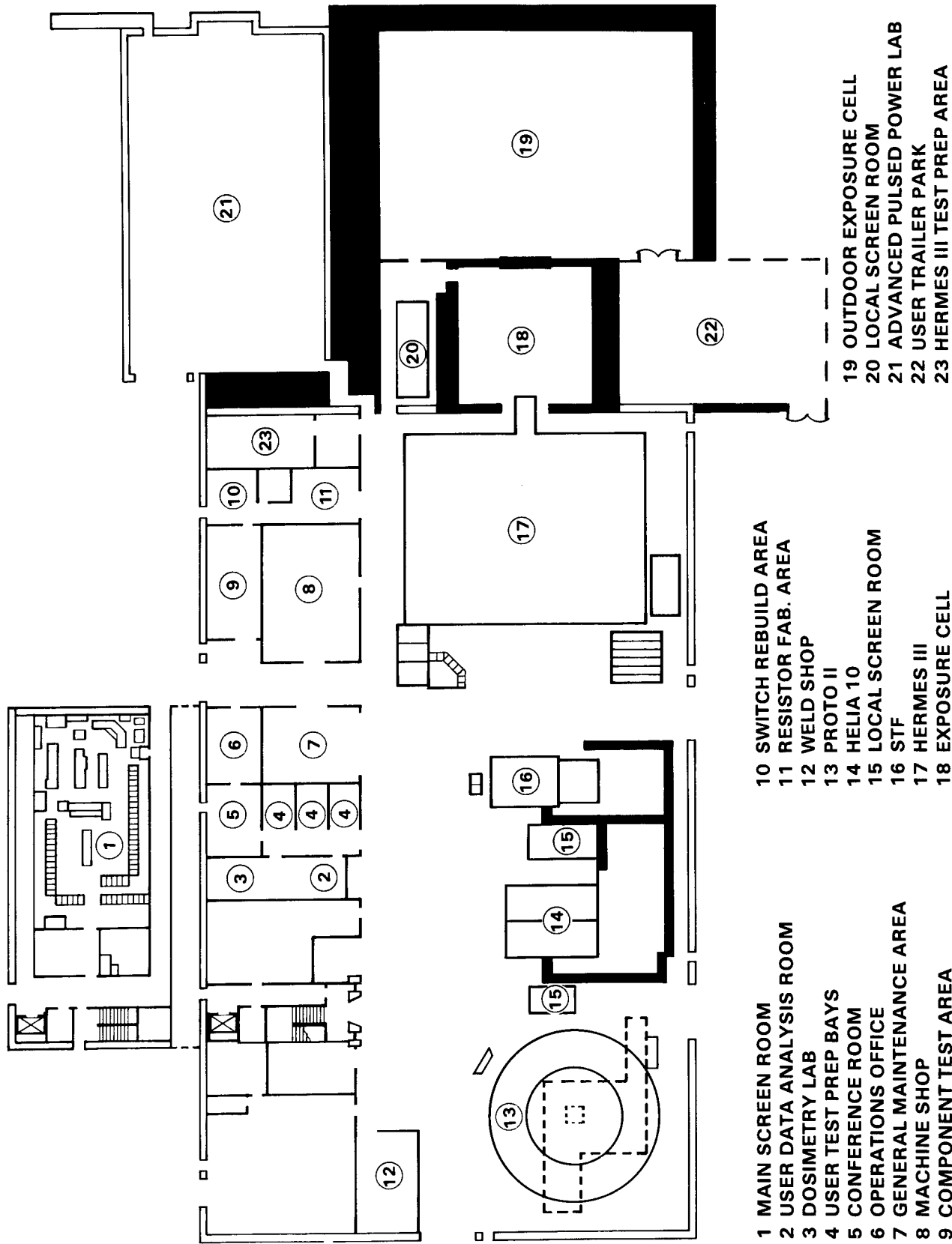


Fig. 10 - Layout of the Simulation Technology Laboratory, Building 970

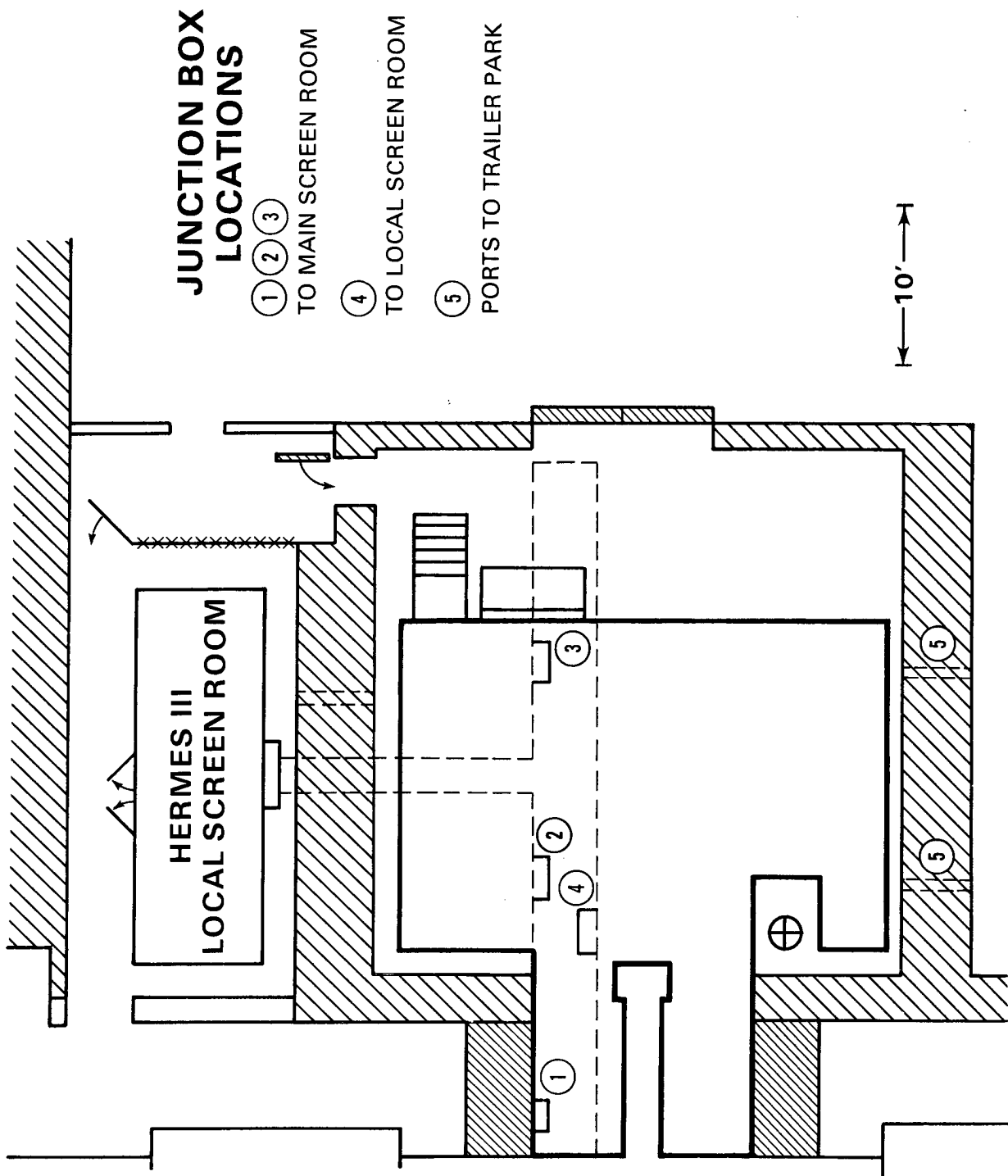


Fig. 11 - Location of Junction Boxes in Hermes III Exposure Bay

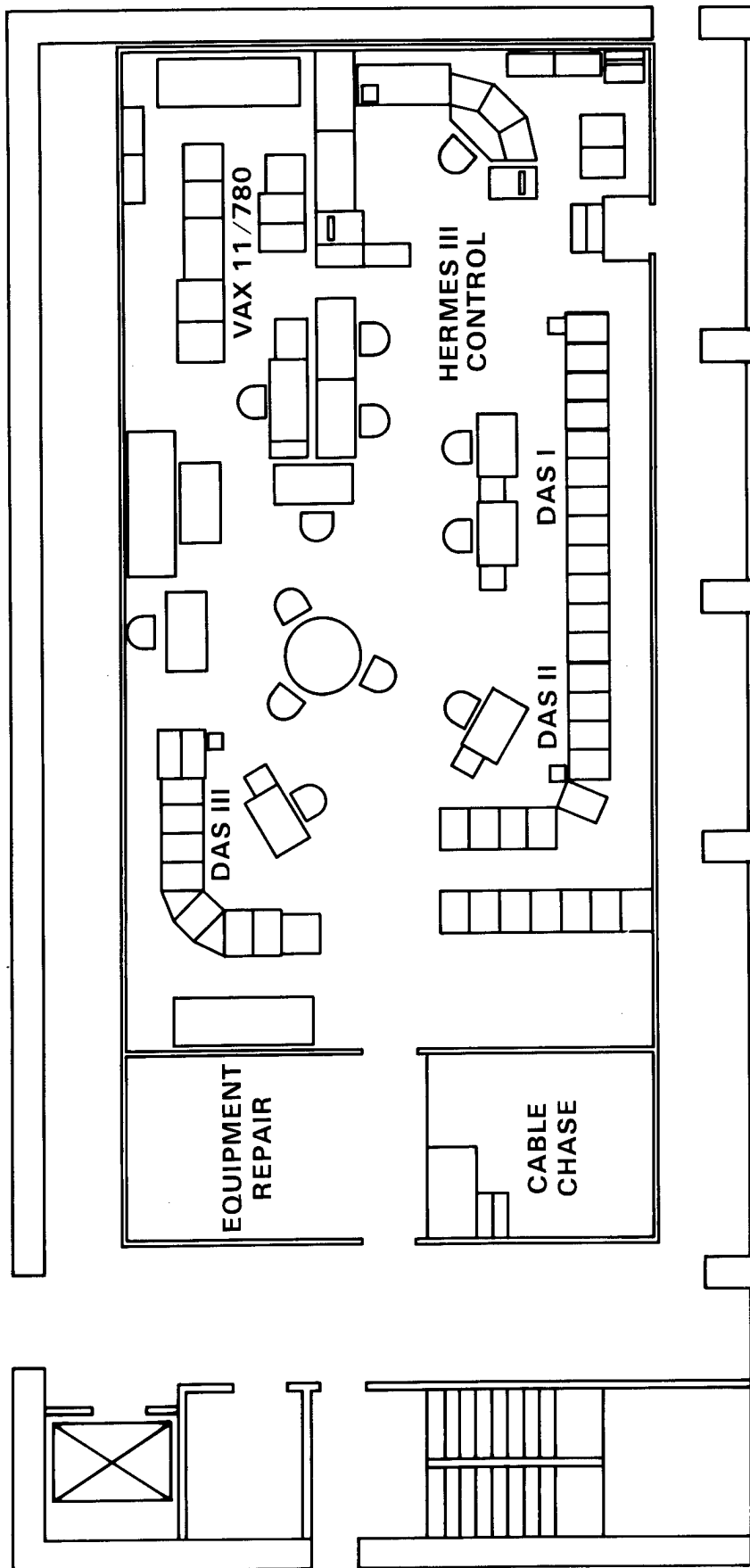


Fig. 12 - Layout of STL Main Screen Room



Fig. 13 - STL Main Screen Room

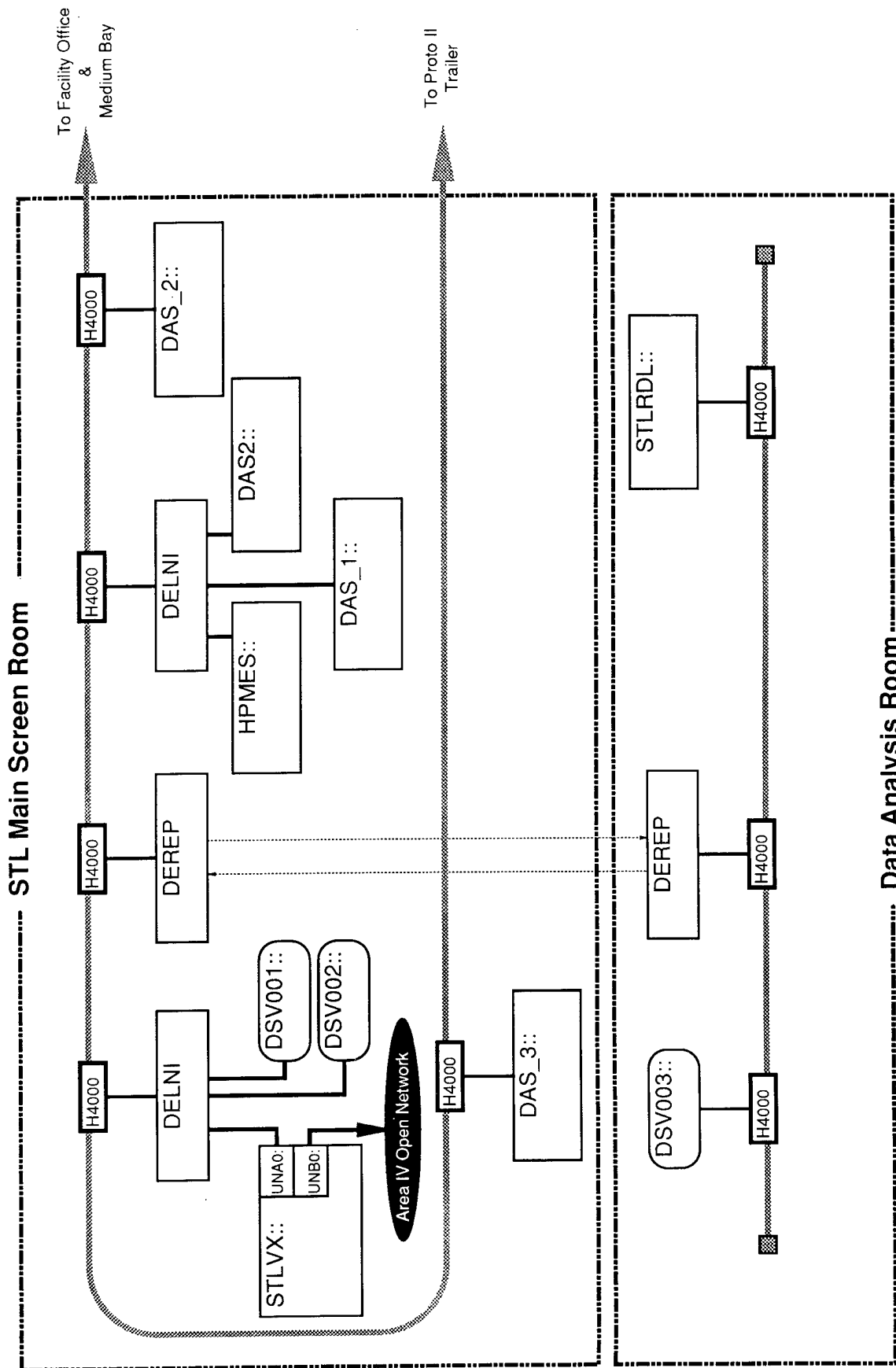


Fig. 14 - STL Ethernet Network

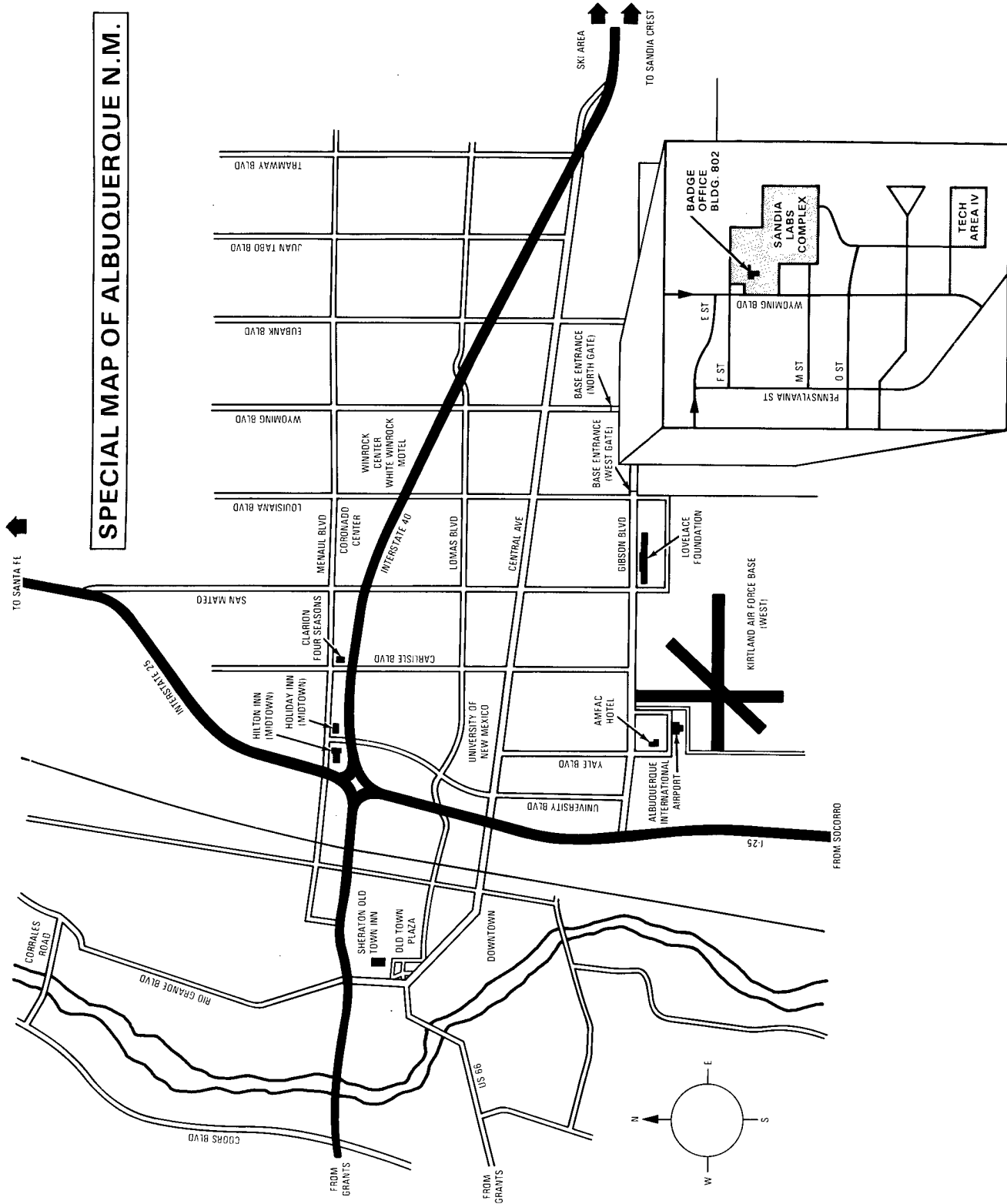


Fig. 15 - Location of Area IV on Kirtland Air Force Base

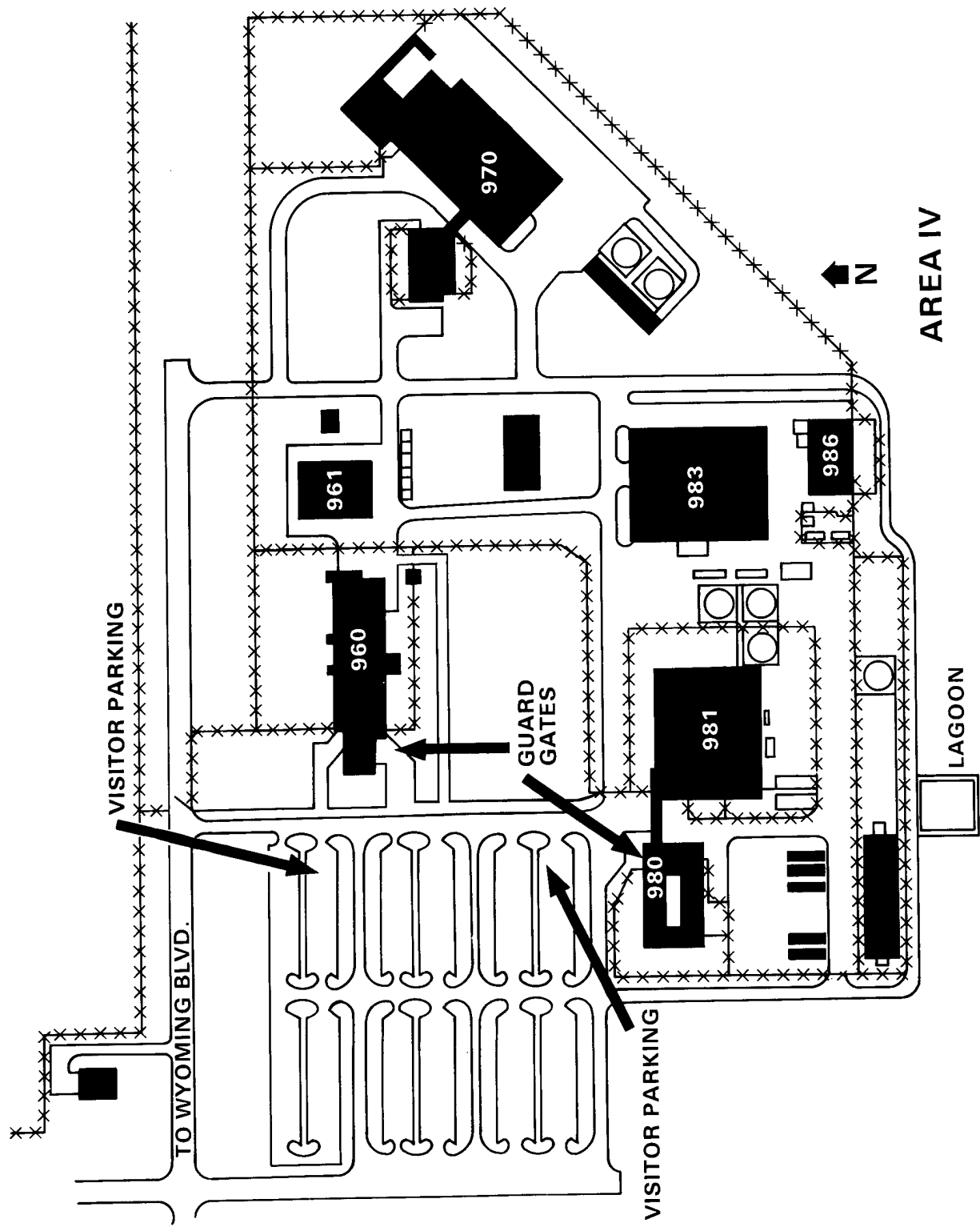


Fig. 16 - Tech Area IV, Showing Location of Building 970, STL

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