IMPACT Instrument Suite

Science Summary

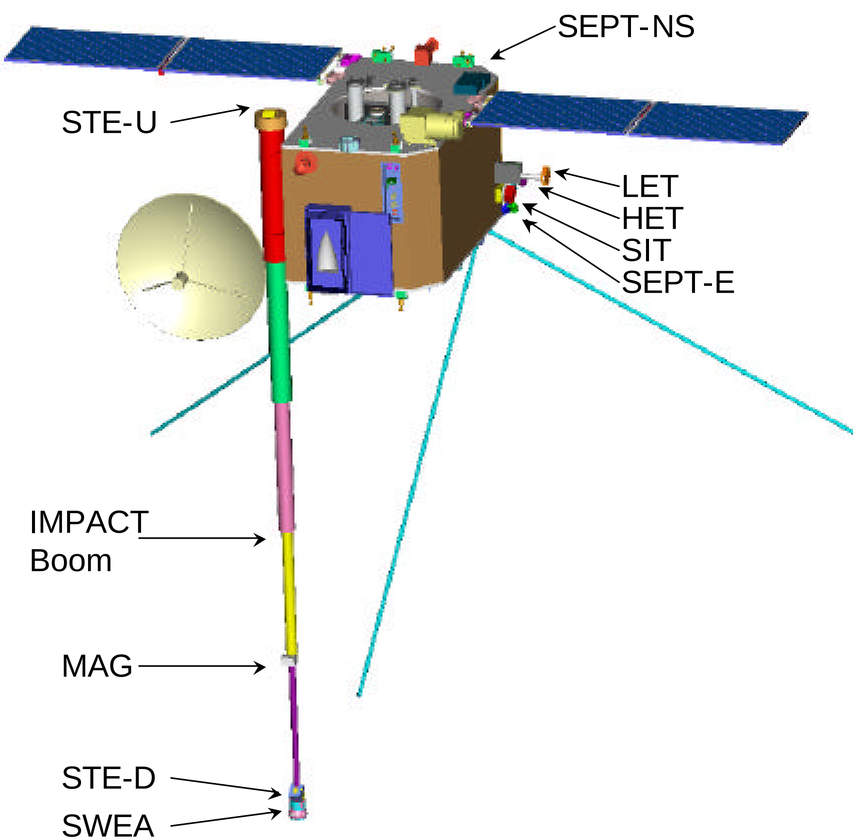
IMPACT Science Summary

Experiment	Instrument	Measurement	Energy or Mag. field range	Time Res.	Beacon Time Res. (*)	Instrument provider
SW	STE	Electron flux and anistropy	2-100 keV	16 s	2D x 3E, 60s	UCB (Lin)
	SWEA	3D electron distrib., core & halo density, temp. & anisotropy	~0-3 keV	3D=1 min 2D=8s Mom.=2s	Moments, 60s	CESR (Sauvaud) + UCB (Lin)
MAG	MAG	Vector field	±500nT, ±65536 nT	1/4 s	60s	GSFC (Acuna)
SEP	SIT	He to Fe ions	0.03-2 MeV/nuc	30 s	3S x 2E, 60s	U. of Md. (Mason) + MPAE (Korth) + GSFC (von Rosenvinge)
		^{3}He	0.15-0.25 MeV/nuc	30 s	----	
	SEPT	Diff. electron flux	20-400 keV	1 min	3E, 60s	U. of Kiel (Mueller-Mellin) + ESTEC (Sanderson)
		Diff. proton flux	20-7000 keV	1 min	3E, 60s	
		Anistropies of e,p	As above	15 min	----	
	LET	Ion mass 2-28 & anisotropy	1.5-40 MeV/nuc	1-15 min.	2S x 2E, 60s	Caltech (Mewaldt) + GSFC (von Rosenvinge) + JPL (Wiedenbeck)
		^{3}He ions flux & anistropy	1.5-1.6 MeV/nuc	15 min.	1E, 60s	
		H ions flux & anistropy	1.5-3.5 MeV	1-15 min.	1E, 60s	
	HET	Electrons flux	1-8 MeV	1-15 min.	1E, 60s	GSFC (von Rosenvinge) + Caltech (Mewaldt) + JPL (Wiedenbeck)
		H	13-100 MeV	1-15 min.	1E, 60s	
		He	13-100 MeV	1-15 min.	1E, 60s	
		^{3}He	15-60 MeV/nuc	15 min	----	
	SEP Common	----	----	----	----	Caltech (Mewaldt) + GSFC (von Rosenvinge)
IMPACT Common	IDPU (+Mag Analog)	----	----	----	----	UCB (Curtis)

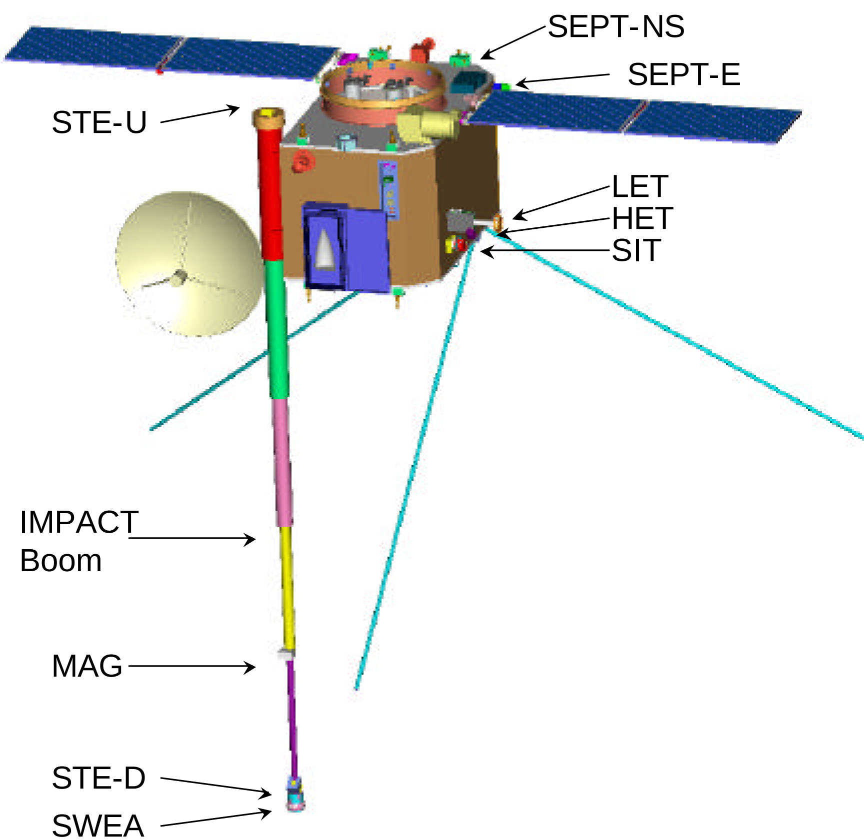
(*) E=Energies, S=Species, D=directions

IMPACT Instrument Locations on the Spacecraft

Ahead Spacecraft

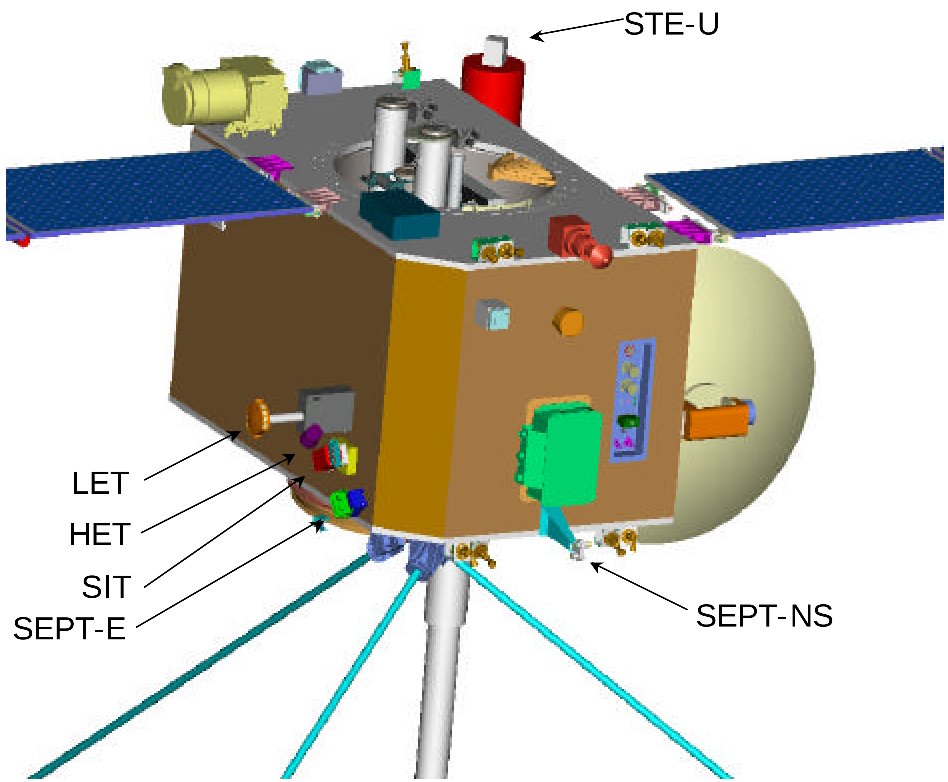


Behind Spacecraft

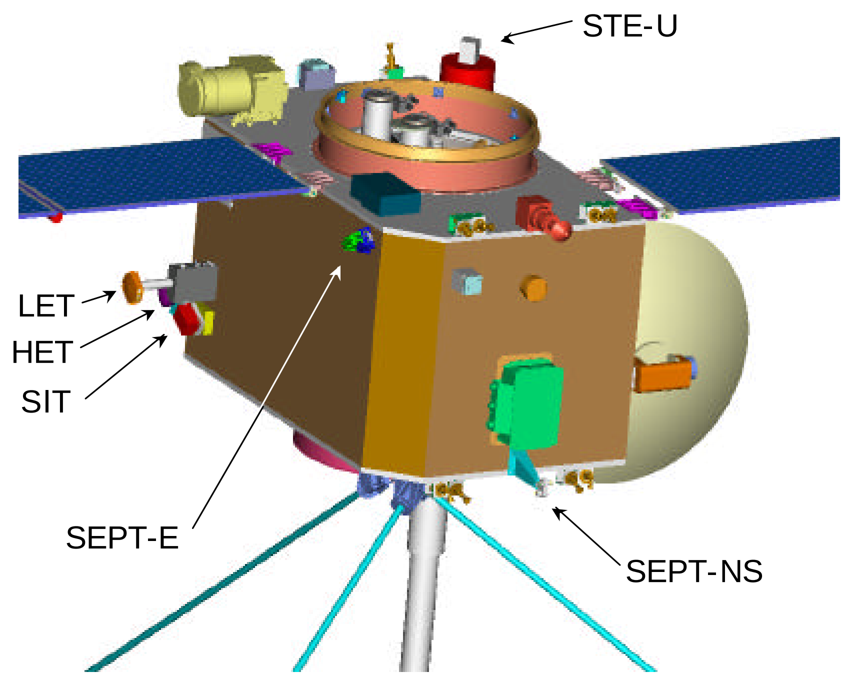


IMPACT Instrument Locations on the Spacecraft

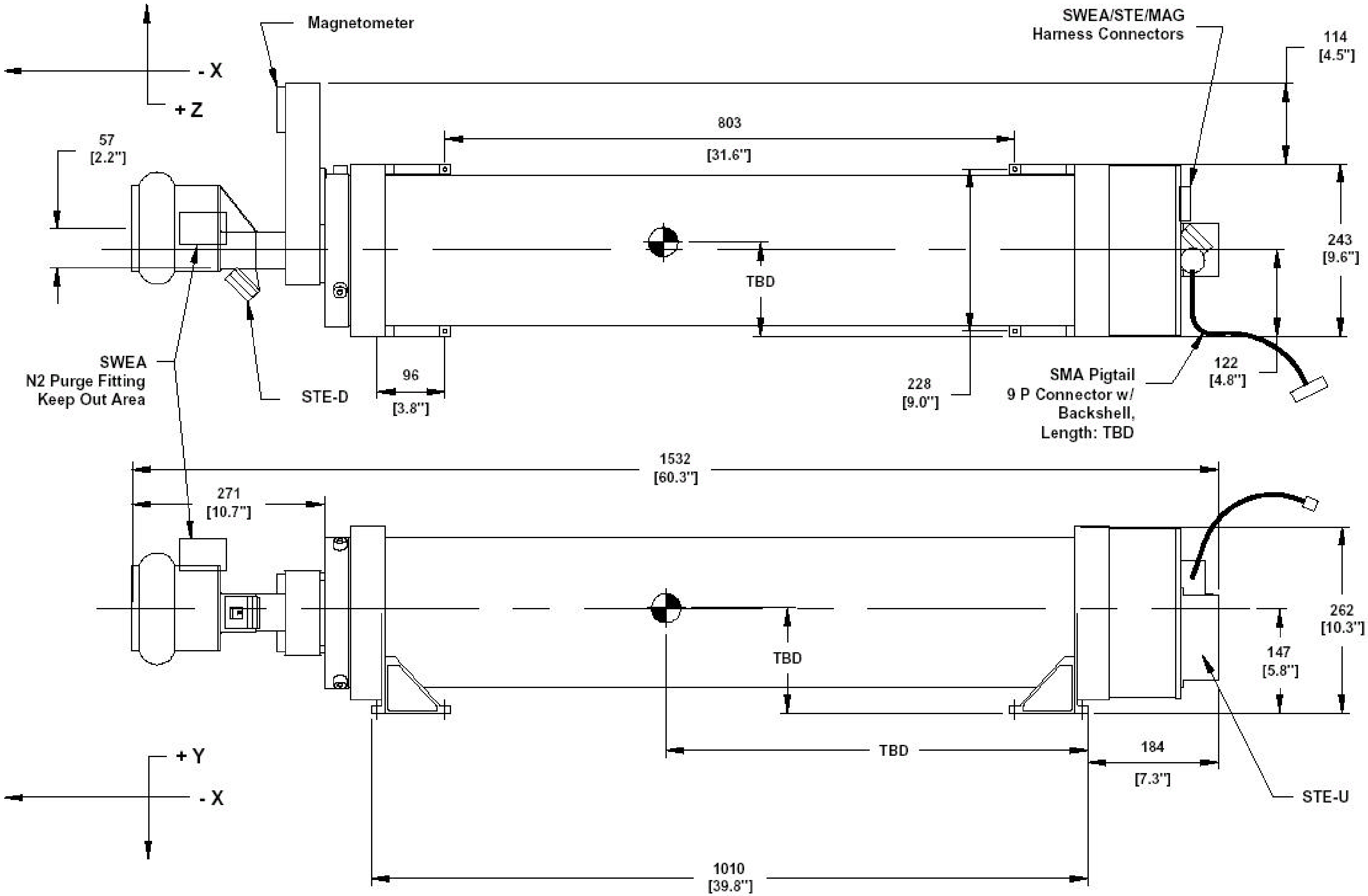
Ahead Spacecraft



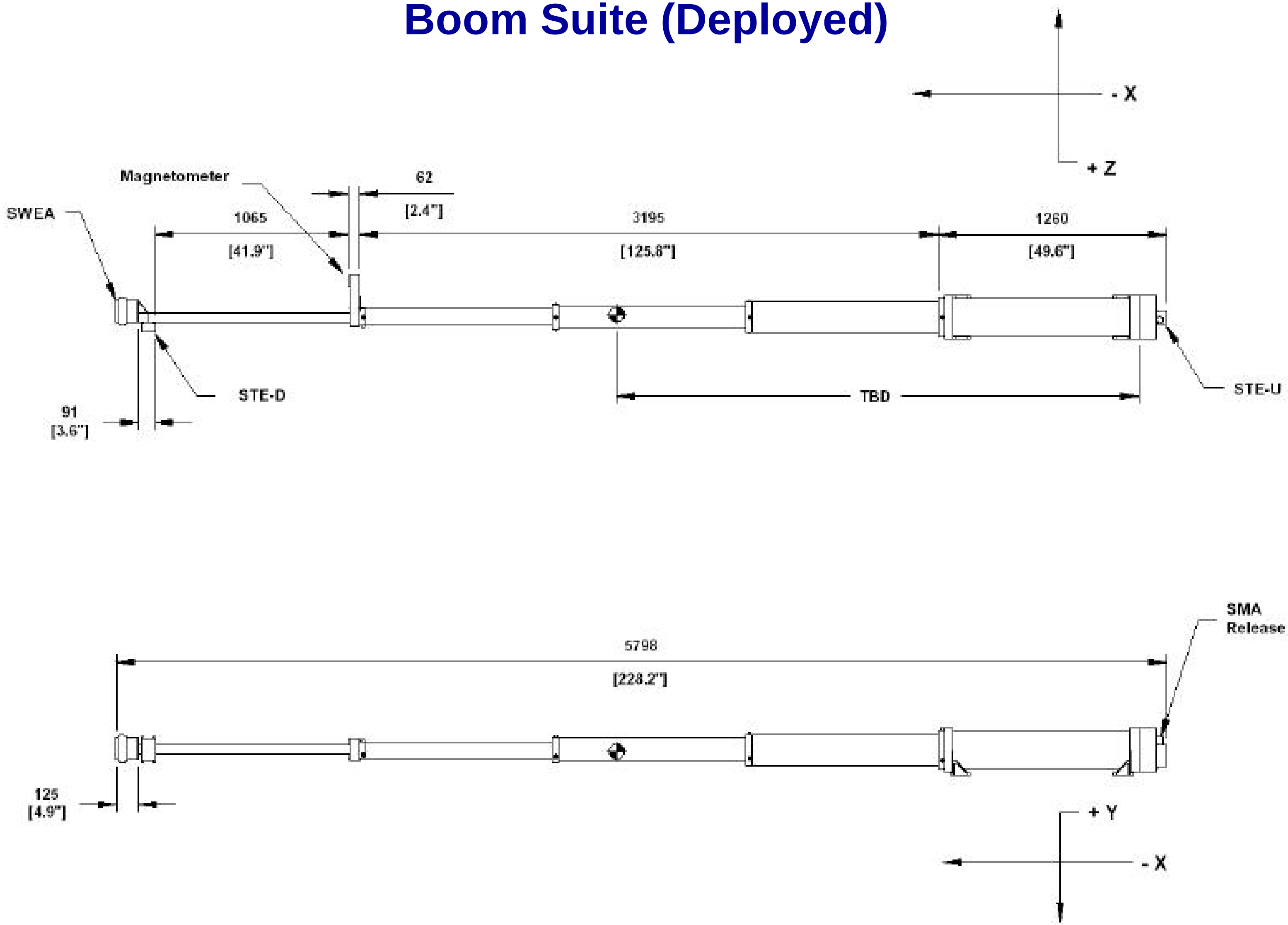
Behind Spacecraft



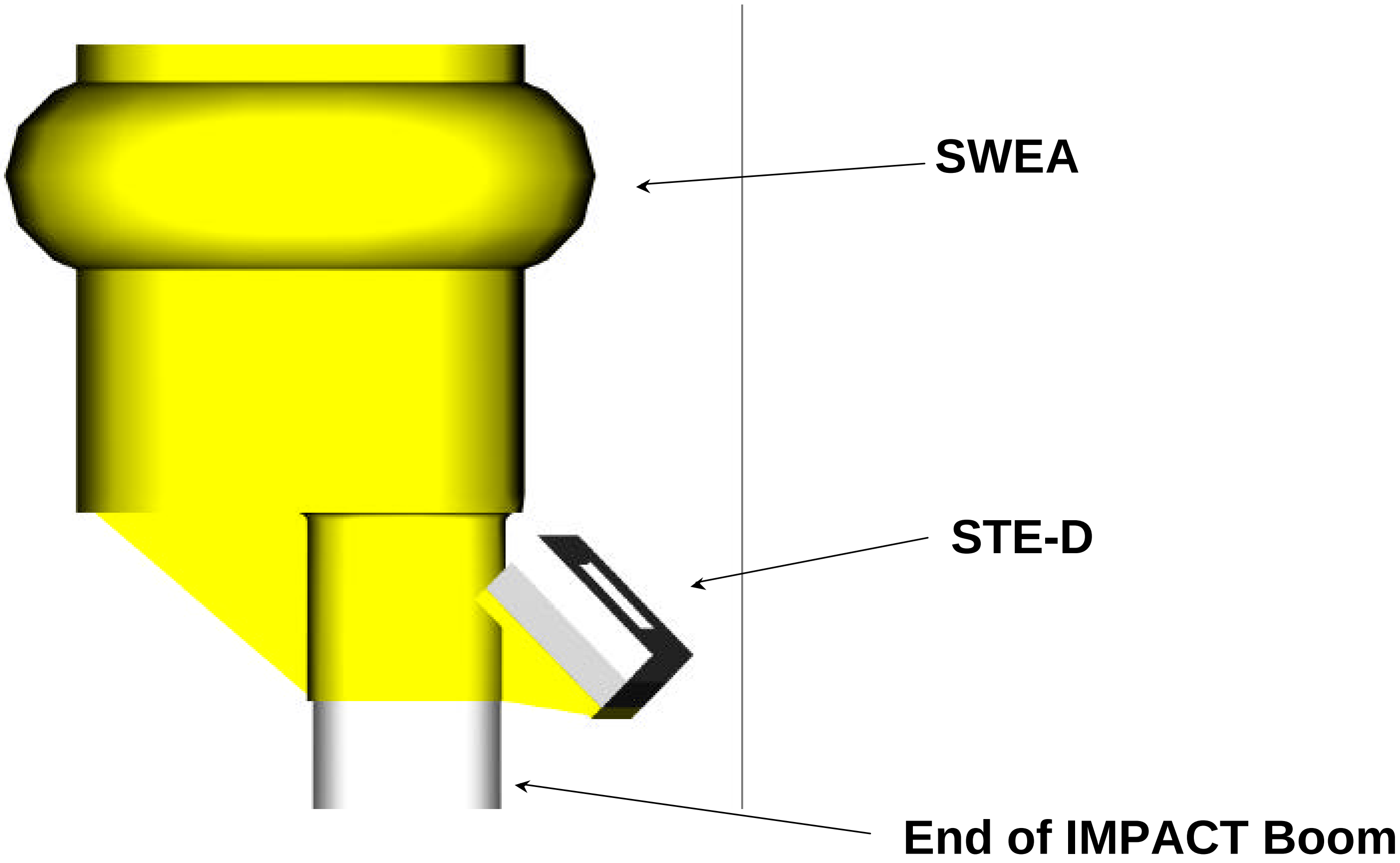
Boom Suite (Stowed)



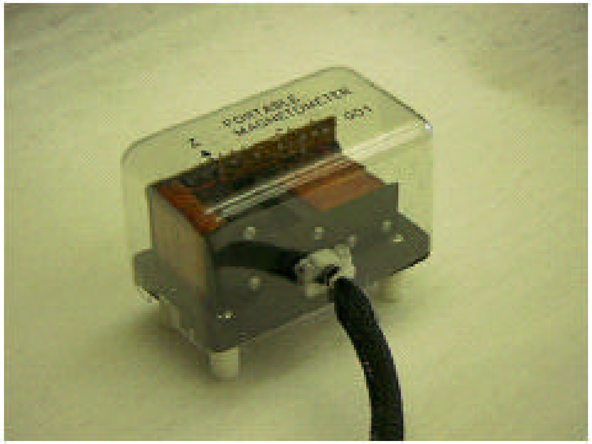
Boom Suite (Deployed)

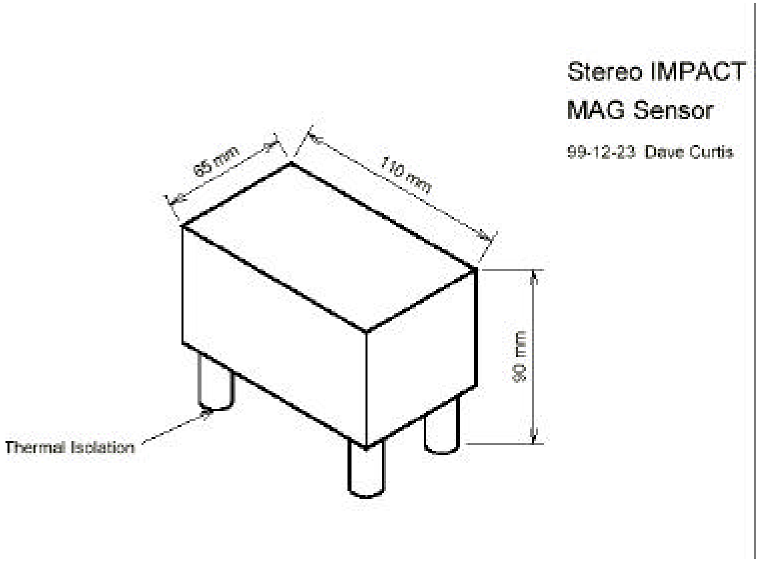


SWEA / STE

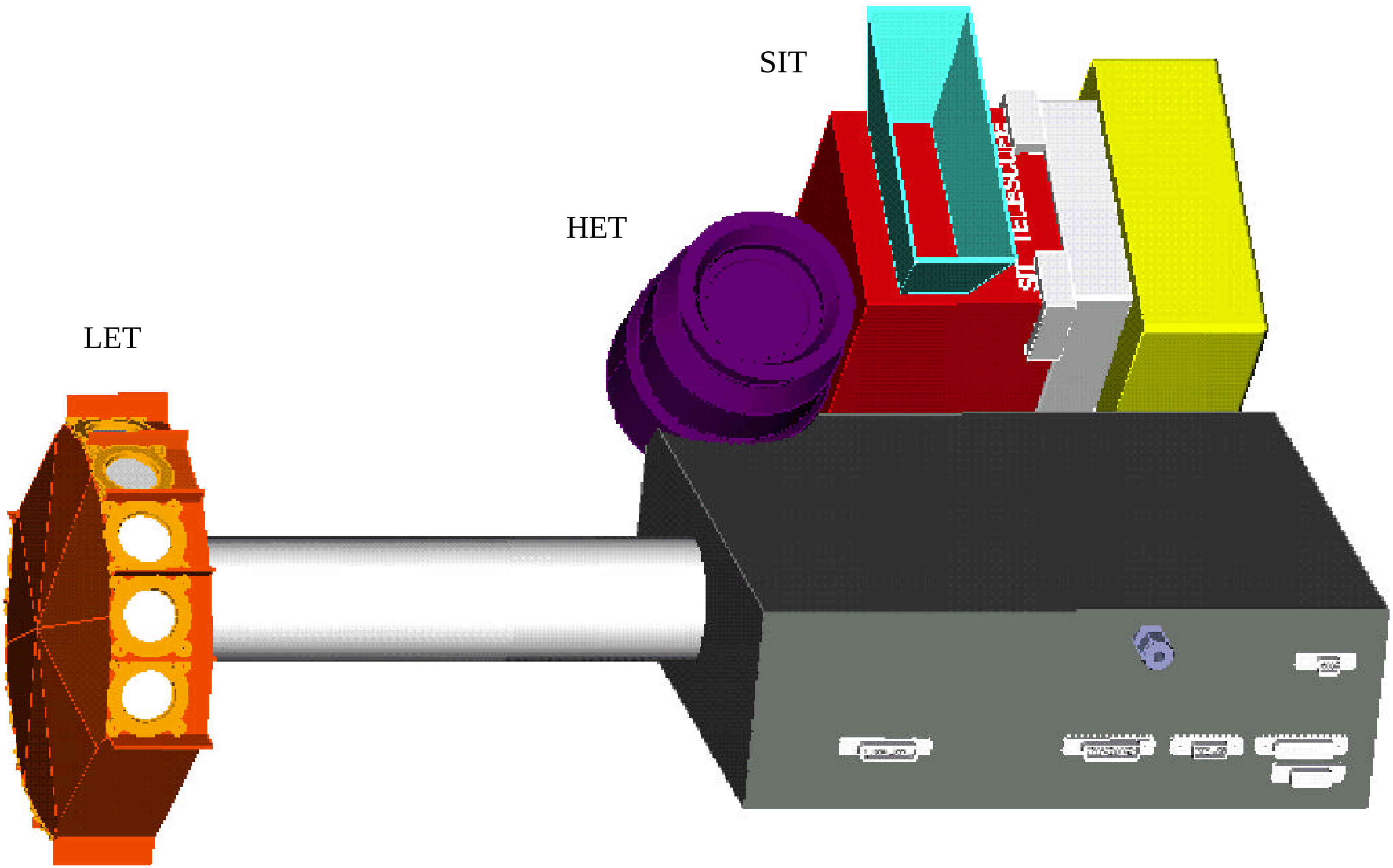


MAG


PORTABLE
MAGNETOMETER
001

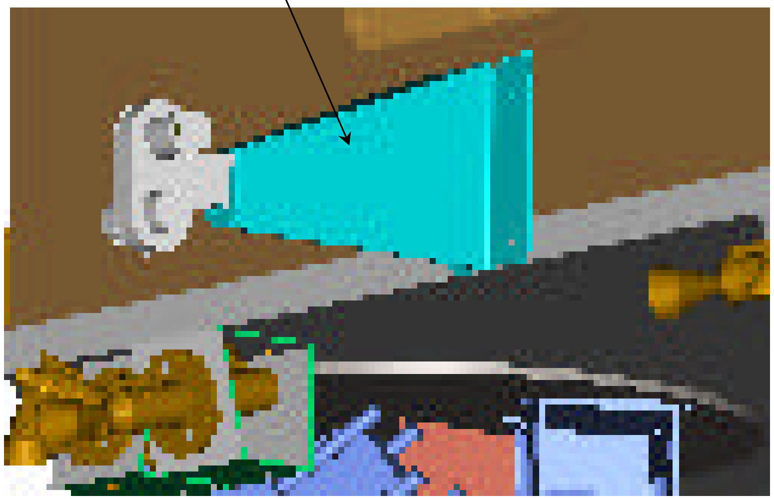

Stereo IMPACT
MAG Sensor
99-12-23 Dave Curtis
65 mm
110 mm
90 mm
Thermal Isolation

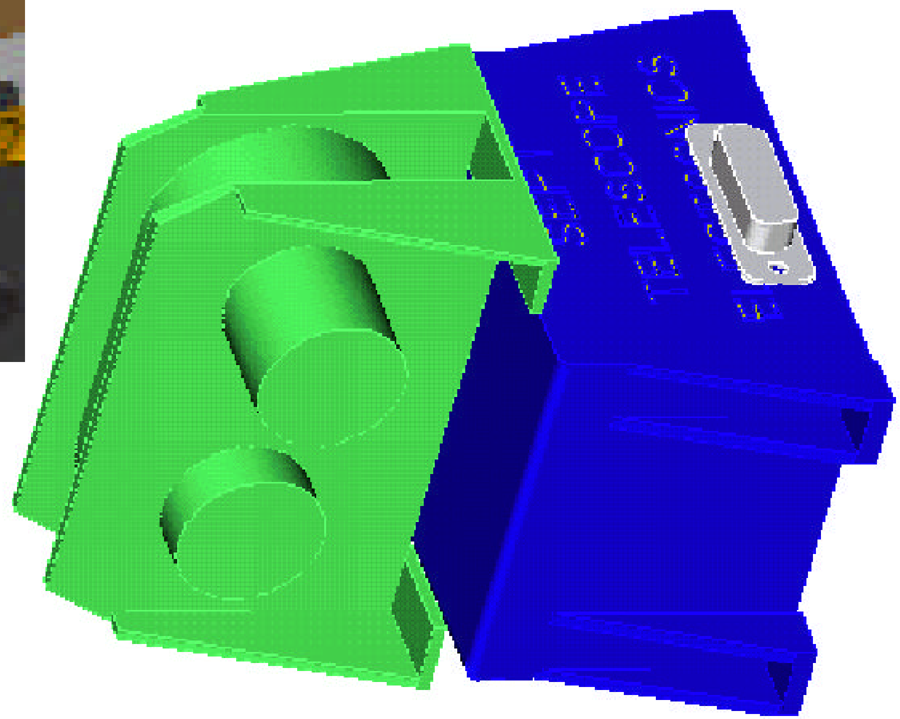
SEP HET/LET/SIT/Common Electronics



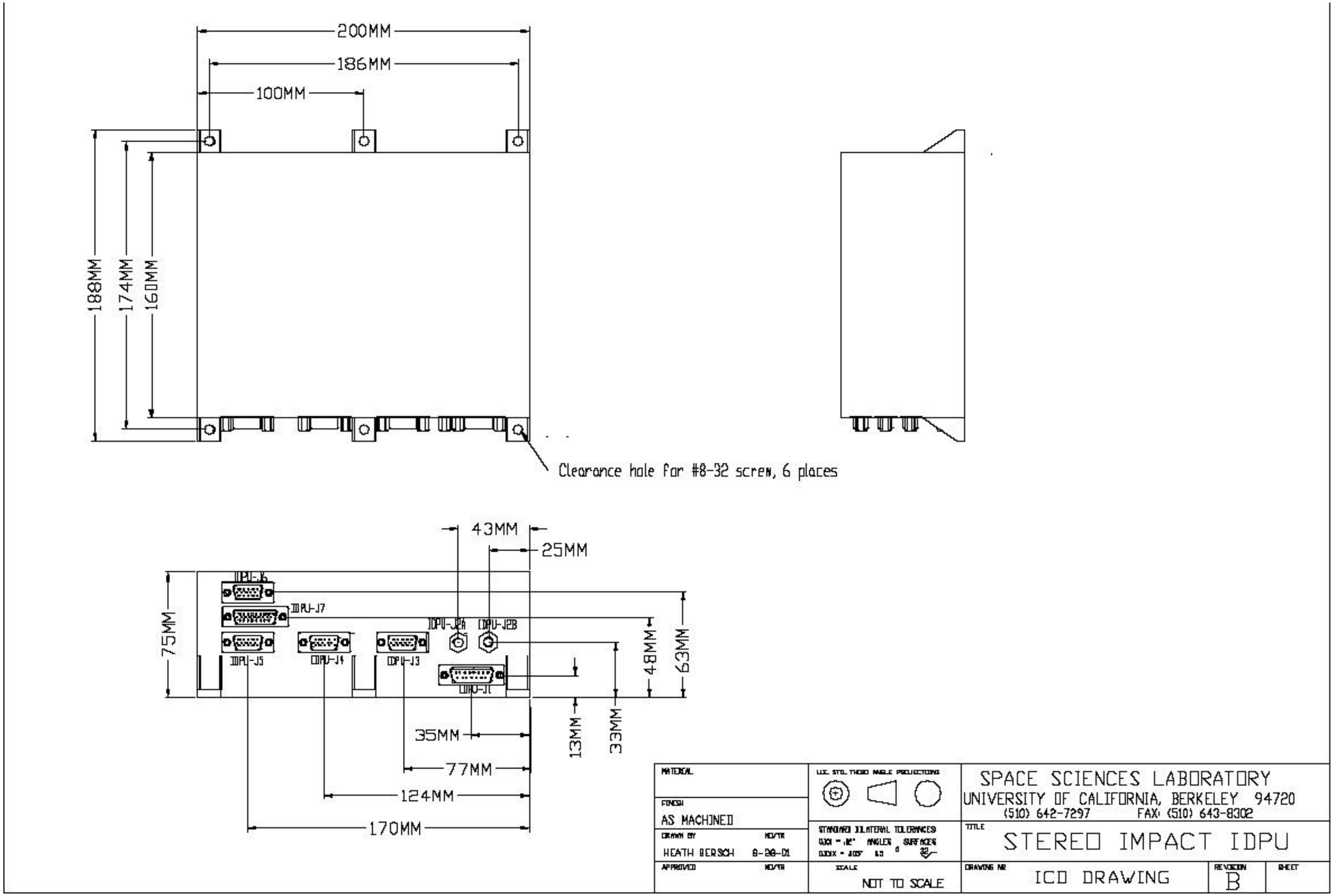
SEP/SEPT

SEPT-NS
Bracket

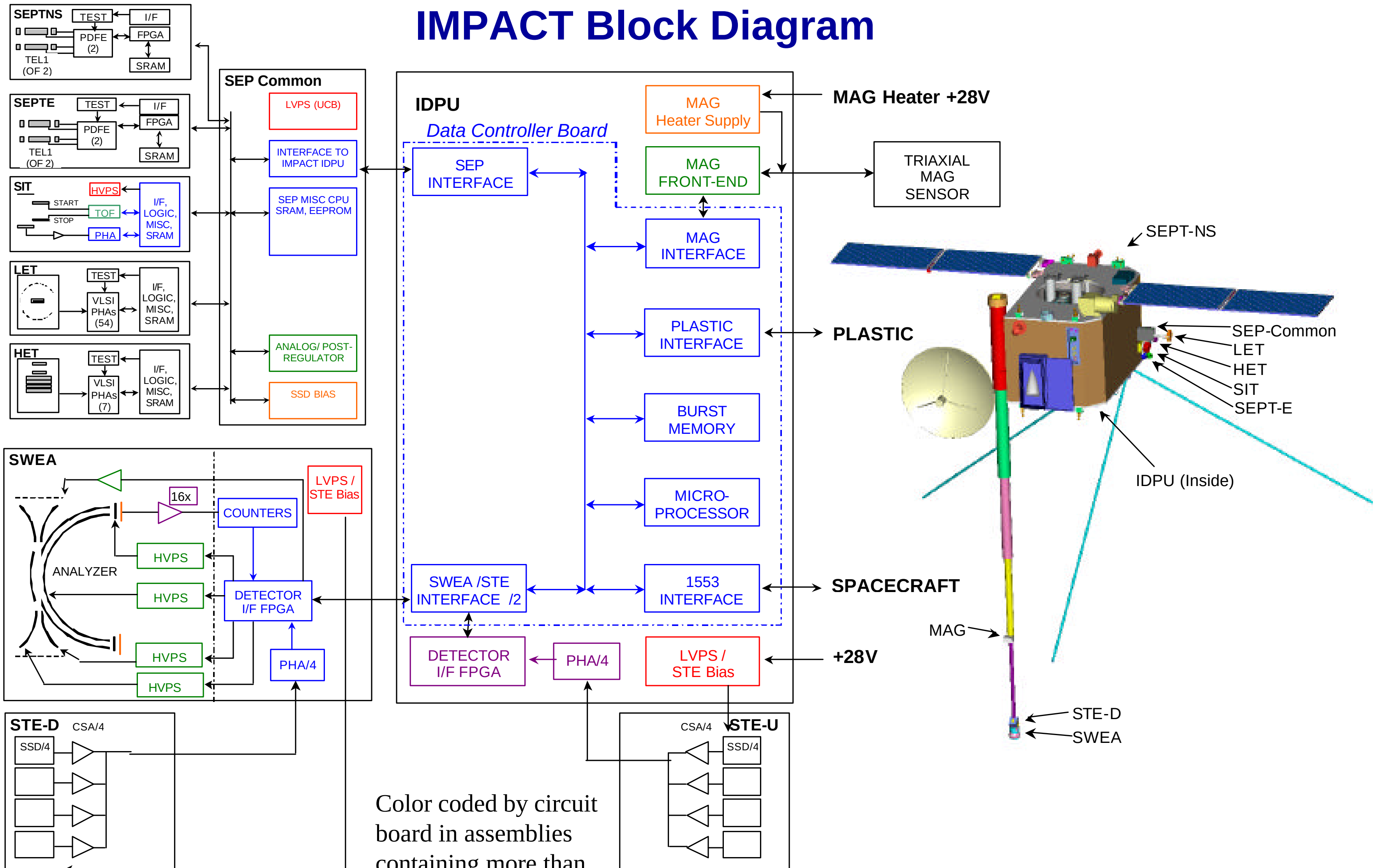




IDPU


200MM
186MM
100MM
188MM
174MM
160MM
Clearance hole for #8-32 screw, 6 places
43MM
25MM
75MM
IDPU-J6
IDPU-J7
IDPU-J2A
IDPU-J2B
IDPU-J5
IDPU-J4
IDPU-J3
IDPU-J1
48MM
63MM
35MM
77MM
124MM
170MM
13MM
33MM
MATERIAL
FINISH
AS MACHINED
DRAWN BY
HEATH BERSCH
8-28-01
APPROVED
SCALE
NOT TO SCALE
SPACE SCIENCES LABORATORY
UNIVERSITY OF CALIFORNIA, BERKELEY 94720
(510) 642-7297 FAX: (510) 643-8302
TITLE
STEREO IMPACT IDPU
DRAWING NO
ICD DRAWING
REVISION
B
SHEET

IMPACT Block Diagram



Color coded by circuit board in assemblies containing more than one board.

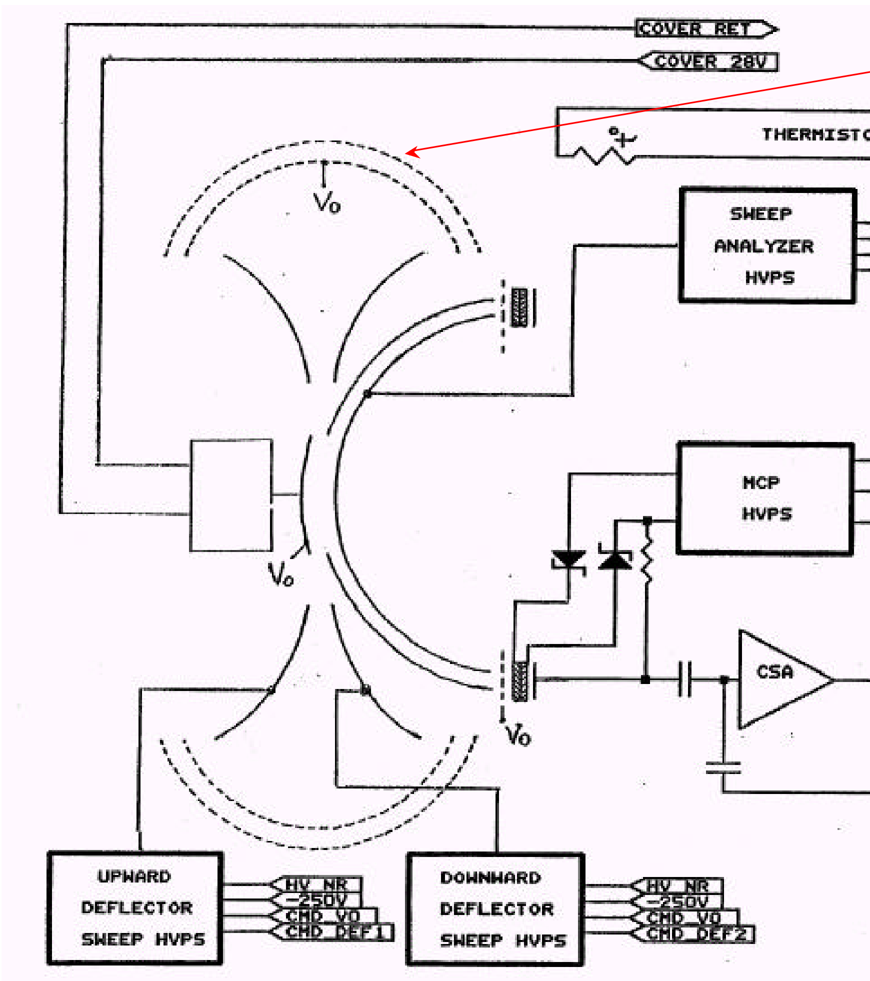
Resource Allocations

Instrument	Mass CBE, kg	Mass NTE, kg	Mass Margin, %	Power CBE, W	Power NTE, W	Power Margin, %	bps
SEP:							
LET	0.75			0.77			320
LET Bracket	0.60						
HET	0.66			0.35			120
SEP Common Elec.	1.92			0.53			
SEP LVPS	0.20			2.12			
SEP Main Total	4.13			3.77			440
SIT	1.23			1.27			240
SEPT-E	0.52			0.50			30
SEPT-NS	0.52			0.50			30
SEP-NS Bracket	0.27						
SEP Blankets	0.15						
SEP Grand Total	6.82	8.09	16%	6.05	7.40	18%	740
BOOM:							
SWEA:							
SWEA (CESR)	1.21			0.54			394
SWEA/STE I/F	0.30			0.30			
SWEA/STE LVPS	0.20			0.63			
SWEA Total	1.71			1.47			394
STE (STE-D)	0.35			0.10			64
SWEA Op Htr				0.50			
STE Op Htr				0.25			
MAG Sensor	0.25						192
Mag Op Htr				0.50			
SWEA/STE/MAG Blankets	0.10						
Sunward STE (STE-U)	0.35			0.10			
Boom Harness	0.83						
Boom	8.00						
Boom Totals	11.59	14.20	18%	2.32	3.50	34%	650
IDPU:							
Mag Card	0.30			0.38			
DIB Card (STE)	0.30			0.20			
DPU Card	0.30			0.80			
S/C Interface (on DPU card)				0.50			
IDPU LVPS	0.20			1.07			
Mag Heater Control	0.07						
BOX	0.96						
IDPU Total:	2.12	2.54	17%	3.55	4.30	18%	164
Burst Telemetry							546
Harness (average of A&B)	1.24	1.47	16%				
TOTAL	21.76	26.30	17%	11.91	15.20	22%	2100

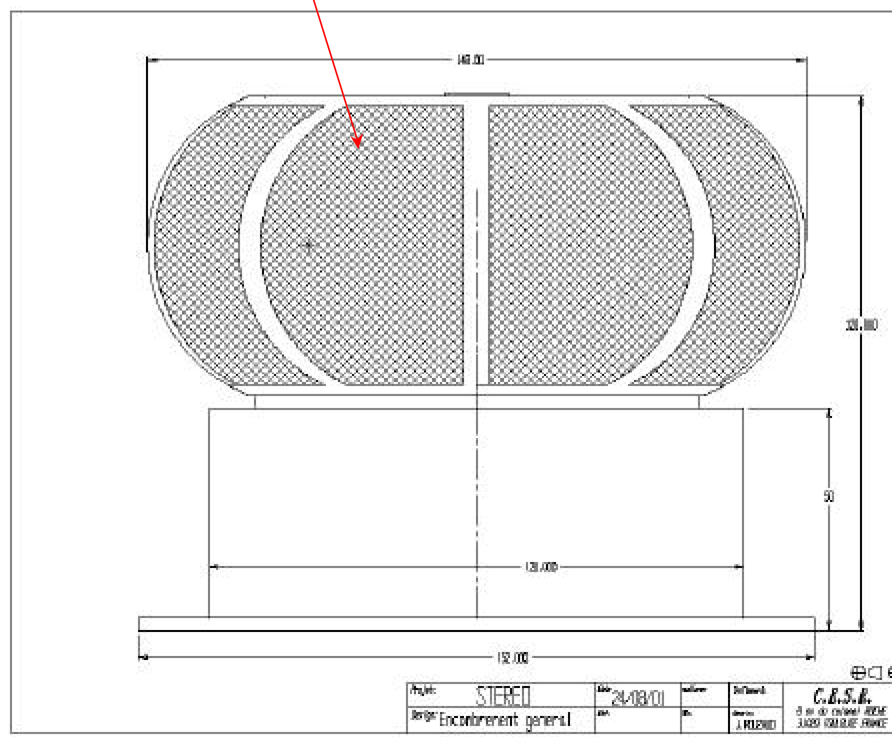
Other Resource Issues

Actuator Firing Current	**Type**	**Current@28V**	**Time**
SWEA Cover	TiNi P5-403	.75A	<100ms
SIT Cover	TiNi P5-403	.75A	<100ms
SEPT Covers	TiNi P5-403	.75A	<100ms
STE Cover	SMA	350mA	2s
BOOM Release	TiNi P5-405	.75A	<100ms
Survival Heaters			
Circuit	**Location**	**Power**	
IDPU/MAG	MAG	0.2W	TBR
SWEA/STE	SWEA/STE	1.3W	TBR
SEP/SEPT-NS/SEPT-E	SEP/SEPT-NS/SEPT-E	3.5W	TBR

SWEA Aperture

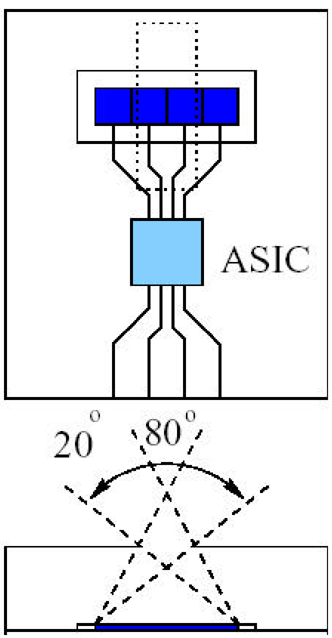


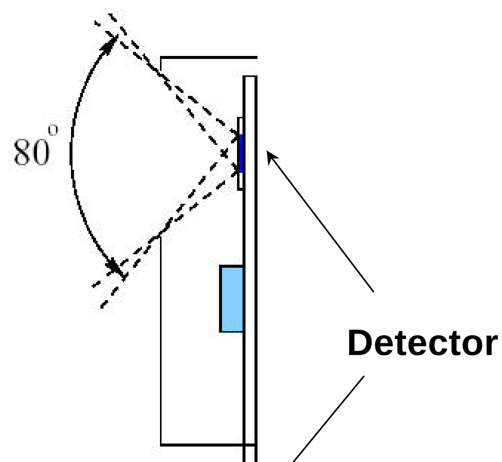
Outer aperture high transmission grid connected to chassis ground

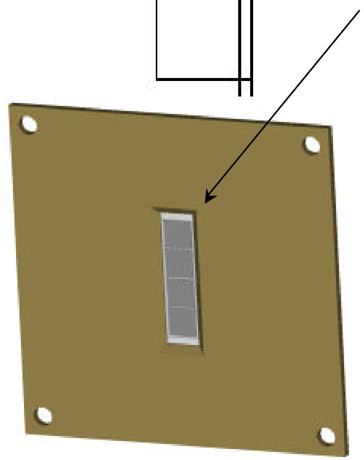


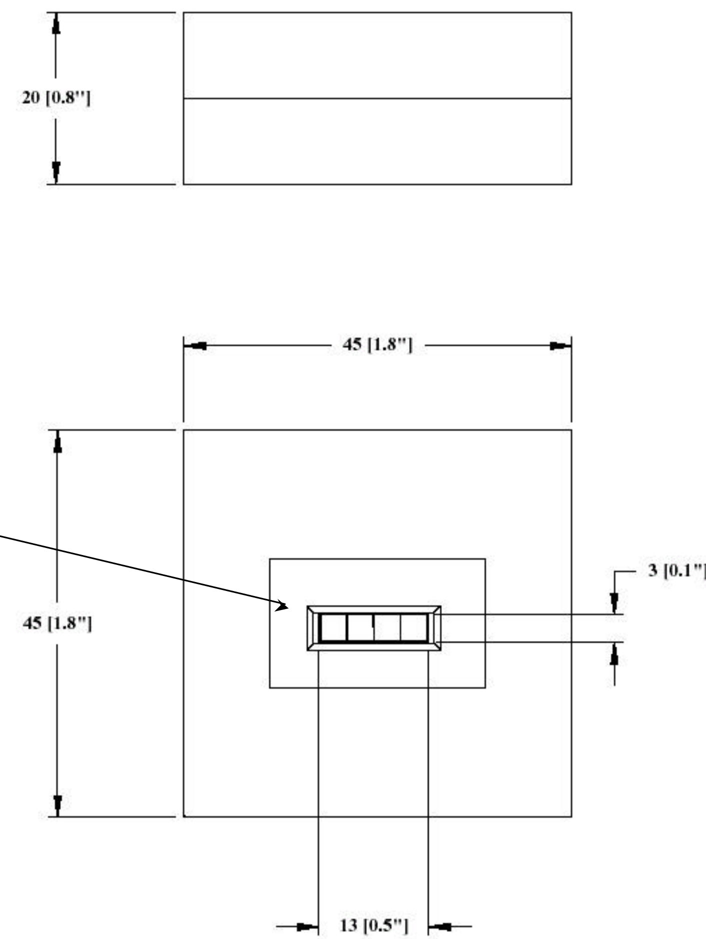
STE Aperture

- **Exposed surface of detector at Bias voltage (100-200V, capacitively coupled to ground)**
- **EMC & Radiation shielding inside aperture TBD.**



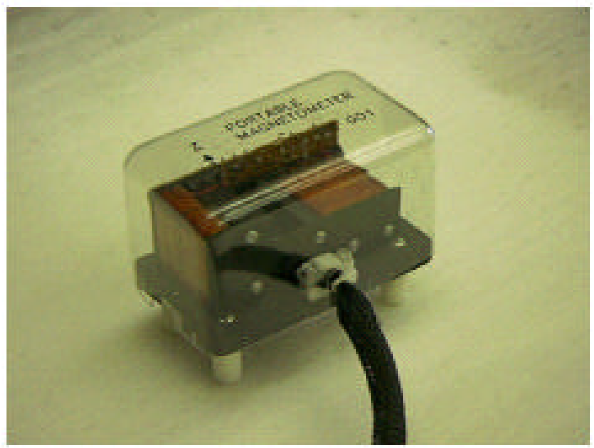




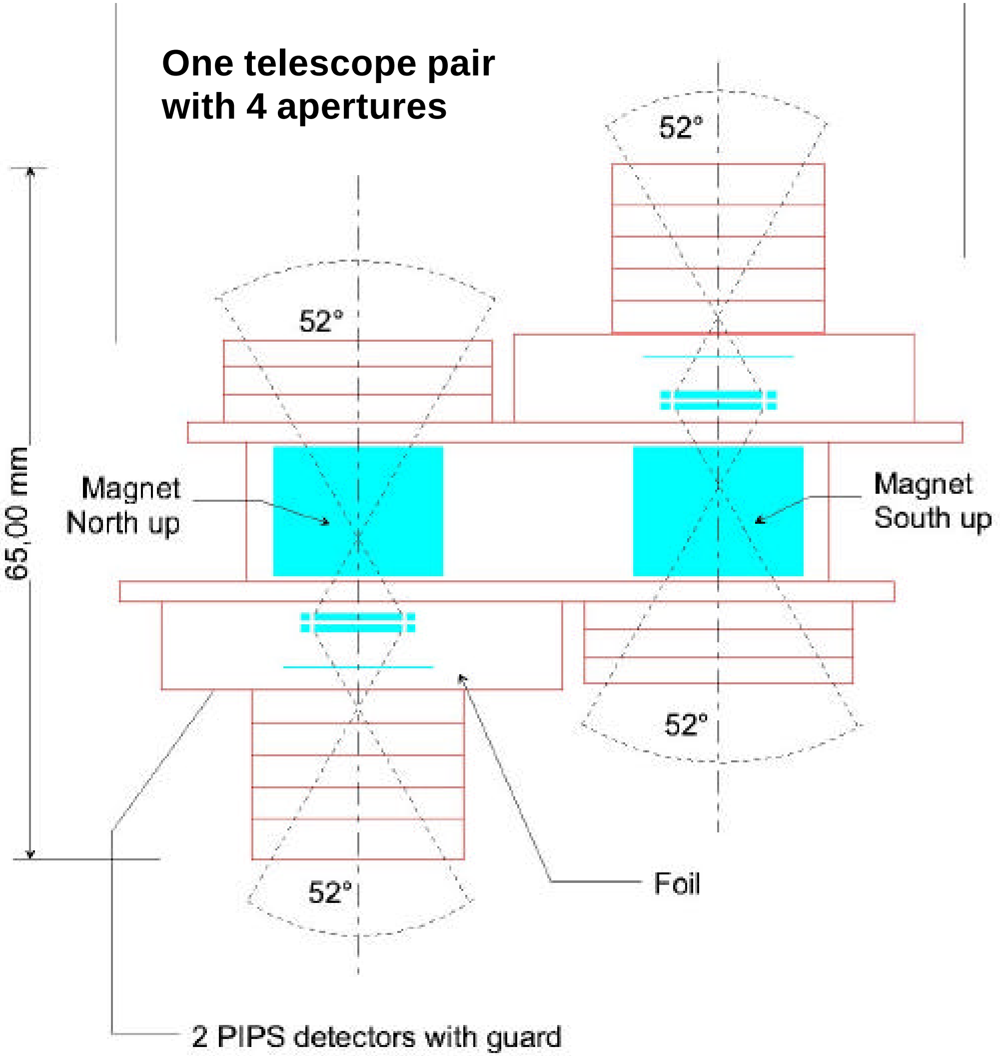


MAG

- **While MAG has no aperture, it has a non-metallic case**
- **EMC shielding provided by thermal blankets tied to chassis ground**

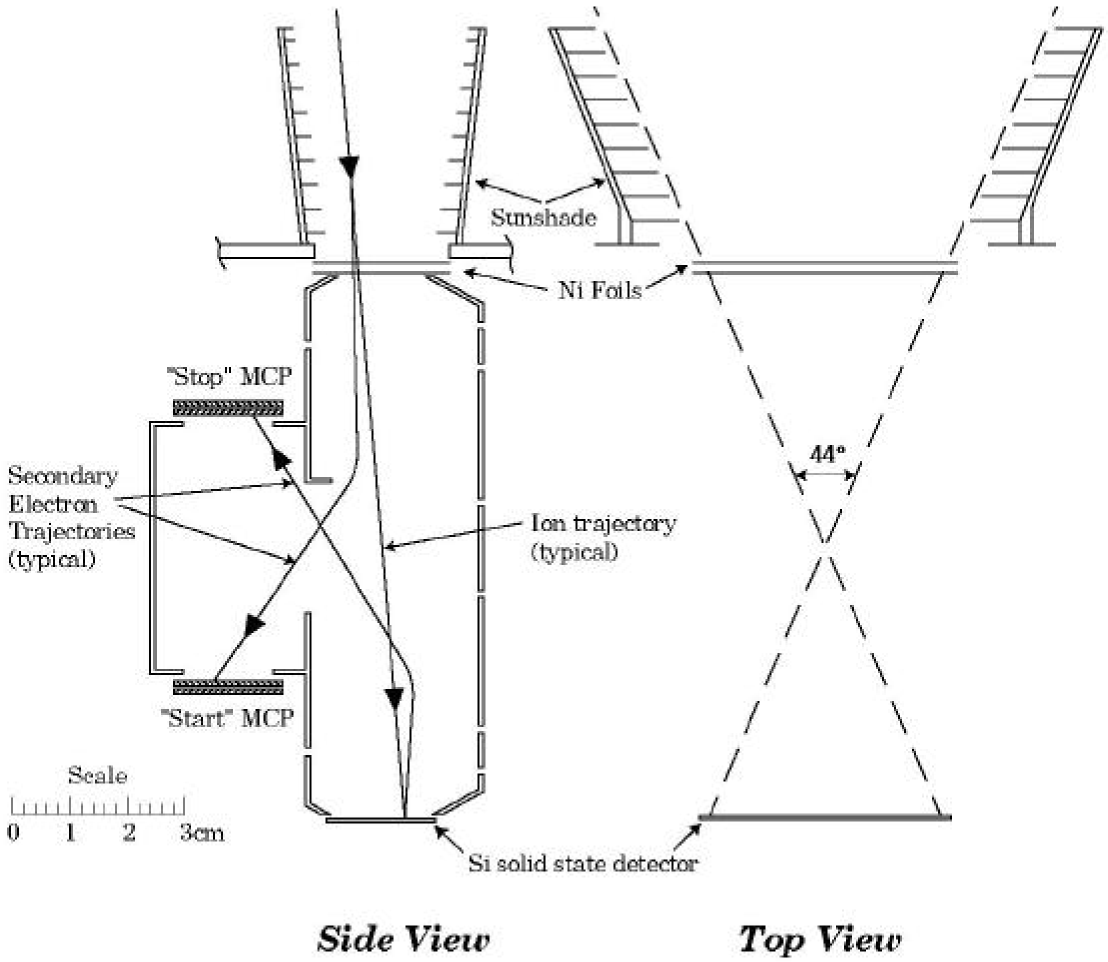


SEPT Apertures



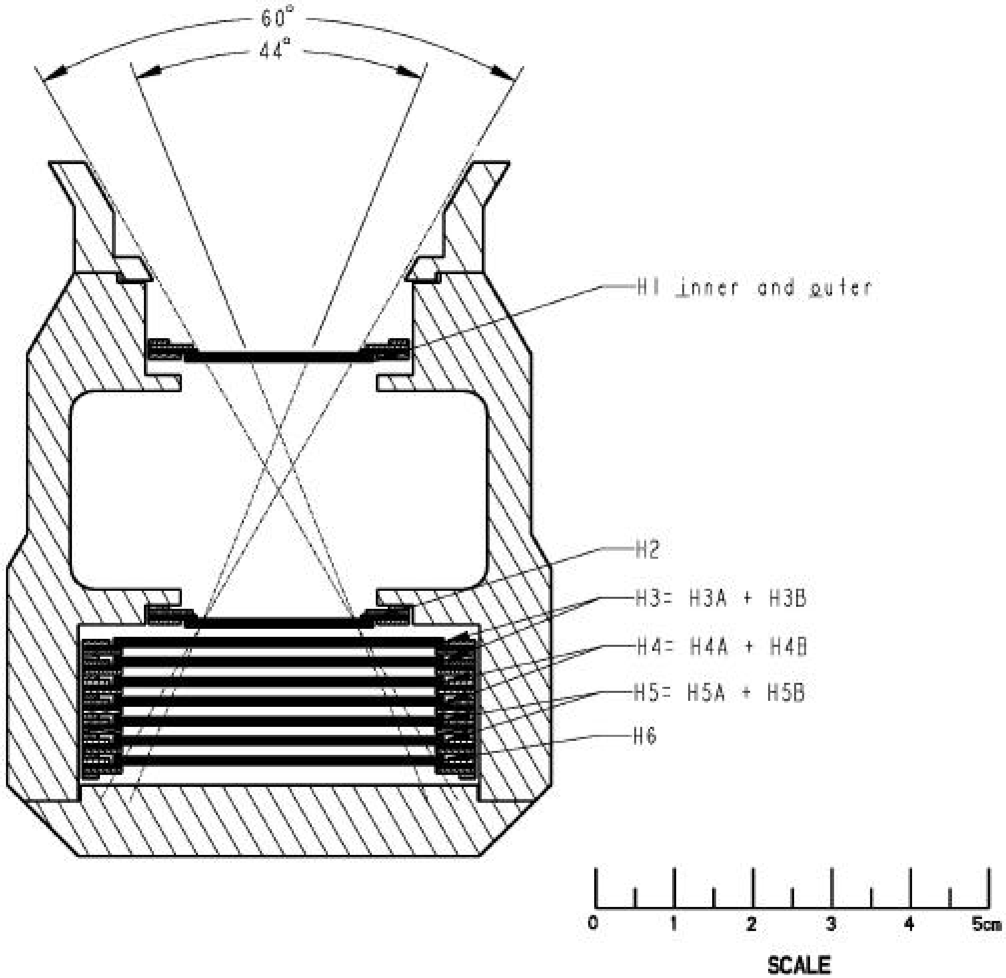
- **A total of 8 apertures per spacecraft**
- **One aperture of each pair is covered by an aluminized parylene foil**
- **The other aperture of each pair is open, with the ohmic (signal) side of the detector exposed.**

SIT Aperture



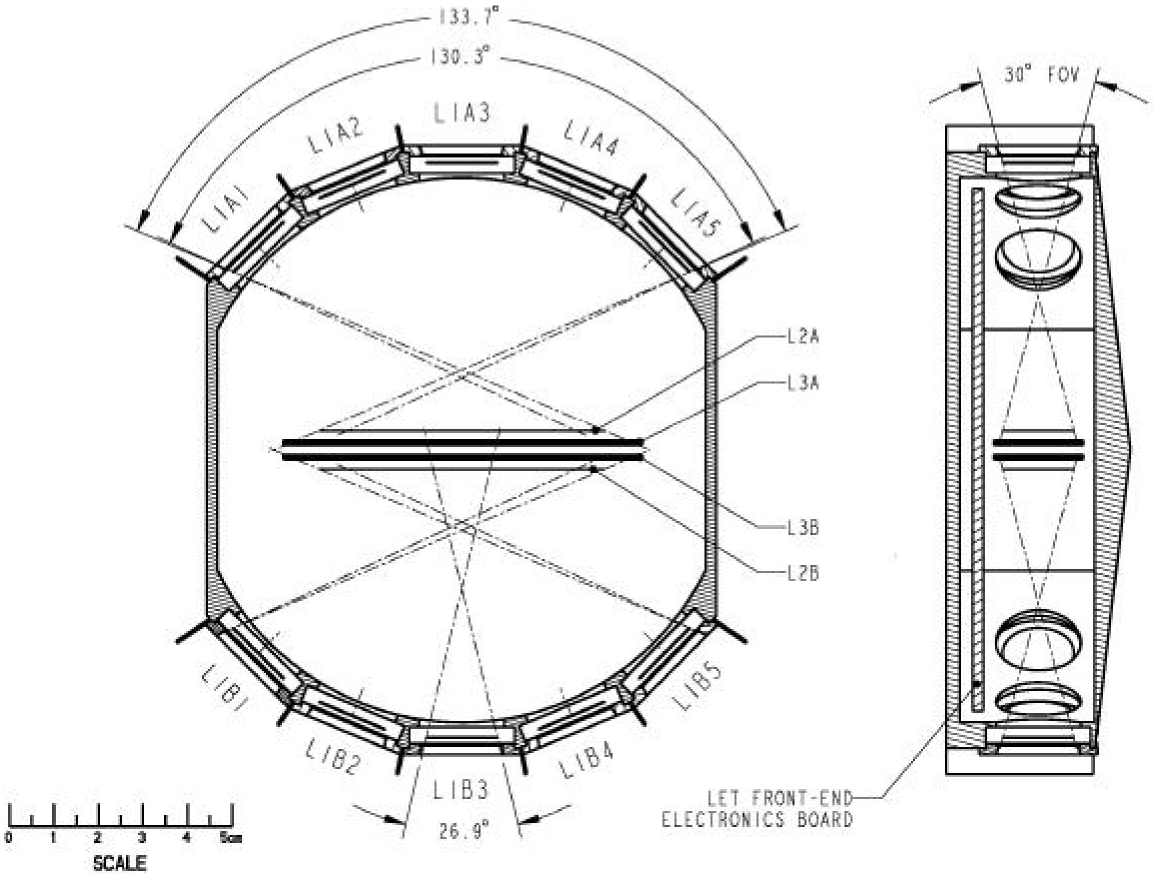
Aperture covered by a pair of 1000ÅNickel foils, on a grid, at chassis ground

HET Aperture



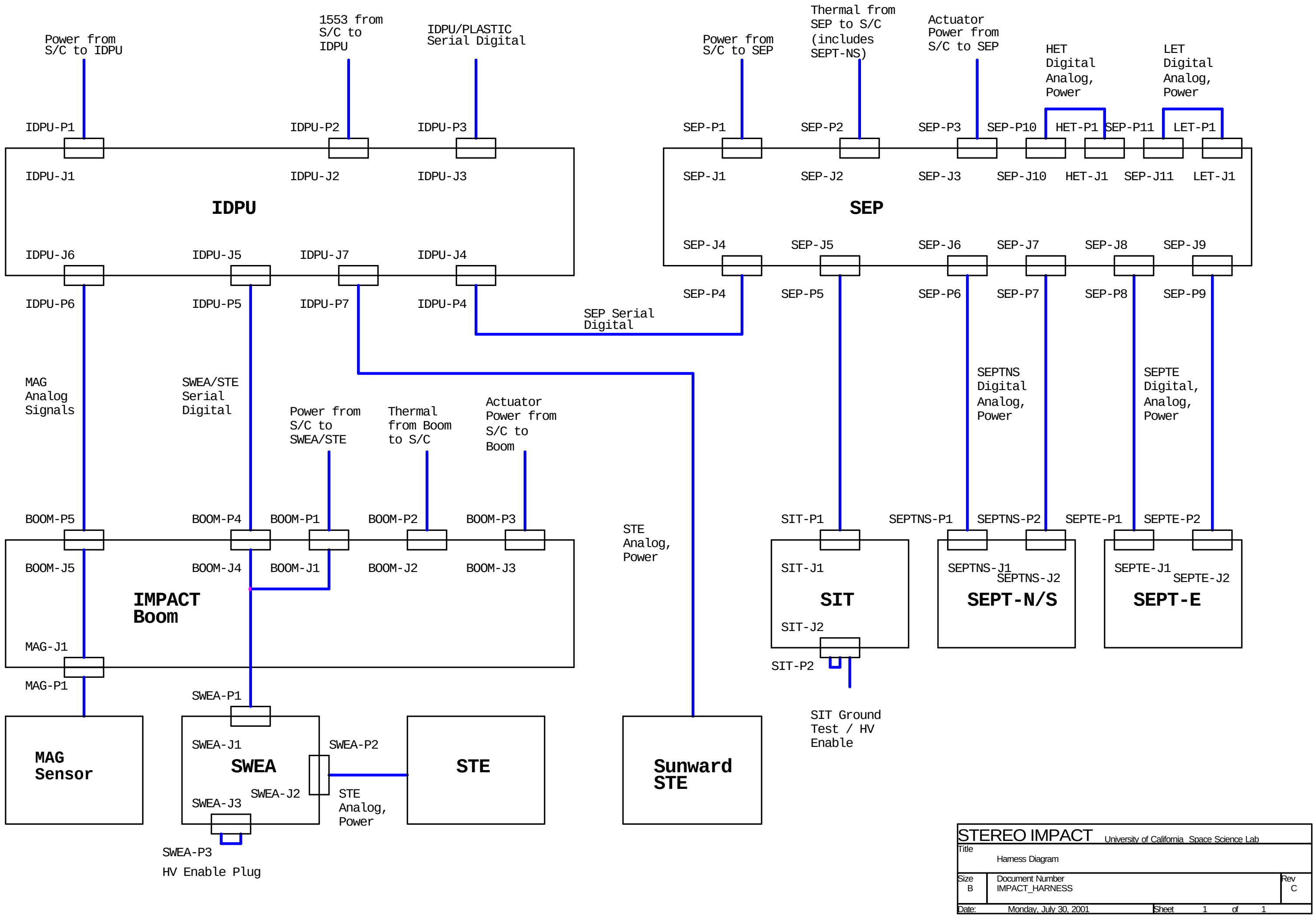
Exposed surface of H1 detector, TBD side out.

LET Apertures



Apertures covered by thin Mylar foils.

IMPACT Harness Diagram



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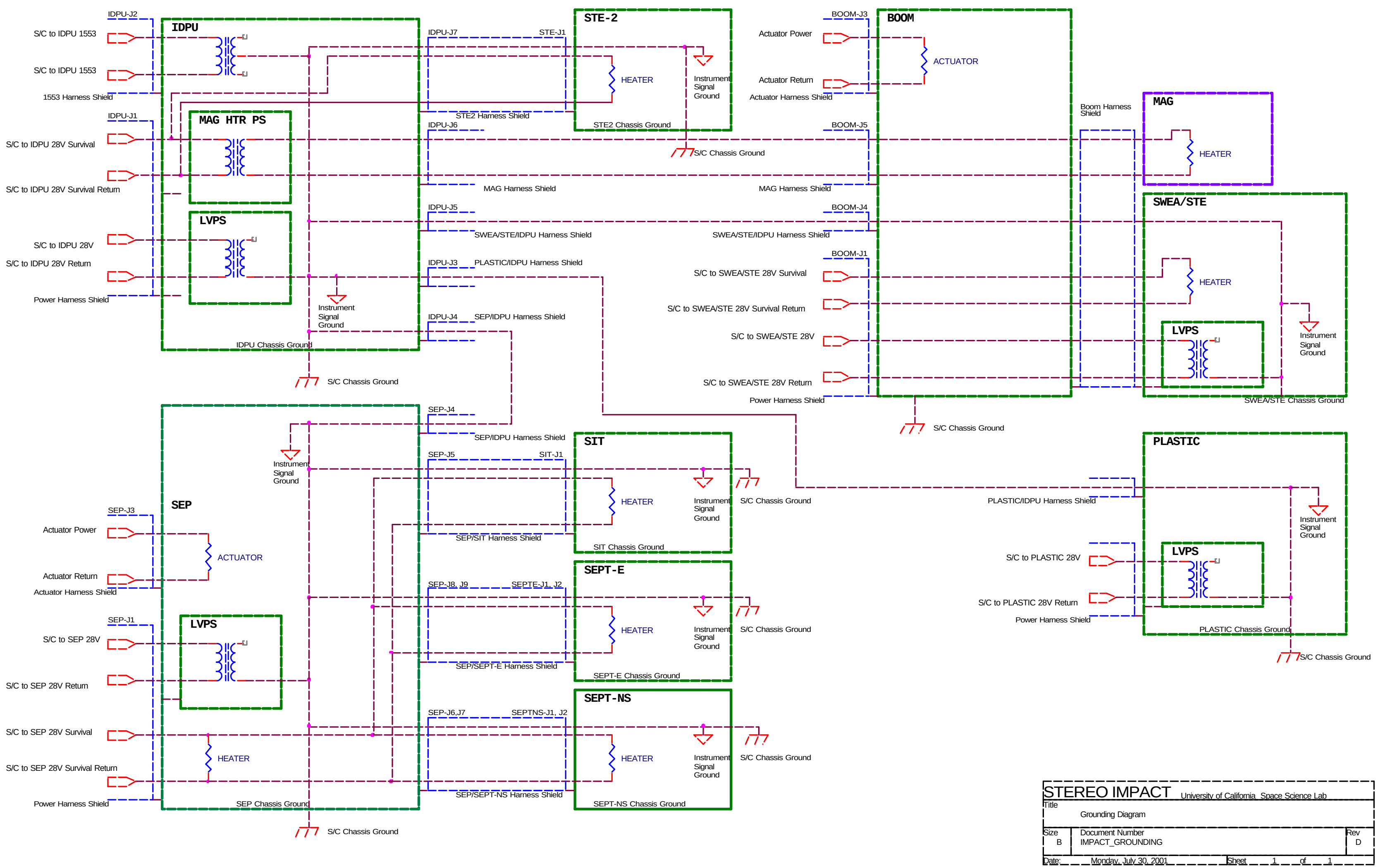
IMPACT Grounding



IMPACT Grounding

- All chassis are tied to both Spacecraft Chassis Ground and Secondary (Signal) Ground
- IMPACT & PLASTIC instruments share a common signal ground via their harnesses
- The current IMPACT grounding scheme violates the EMC guidelines:
  - SEPT-NS, SEPT-E, and SIT are powered from the LVPS is SEP. This provides a ground loop that may carry secondary ground currents through the chassis ground
  - Likewise the Sunward STE is powered from the LVPS in the IDPU
  - SEPT-NS has had this configuration for a while, but was deemed acceptable due to the small value of the currents involved and the distance from the Magnetometer
  - This issue must be re-opened now that the breaking up of SEP and STE cause still more loops, though all carry small currents
  - The alternative is more or more complex power converters, which will cost mass, power, and $.

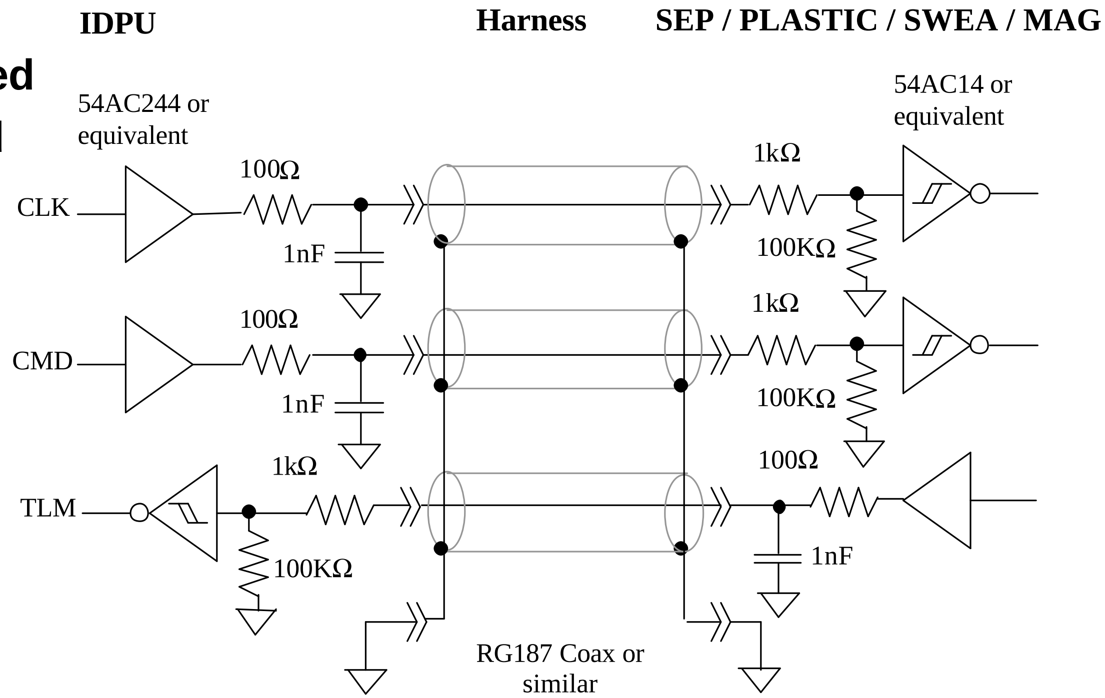
IMPACT Grounding

Instrument	LVPS	Distance	Power
SEPT-NS	SEP	2m	0.5W
SEPT-E	SEP	1m	0.5W
SIT	SEP	0.1m	1.4W
STE-U	IDPU	<2m	0.1W

To estimate current conservatively use the power divided by 5 volts.

IDPU Digital Interfaces

- **Interfaces between IDPU and SEP, SWEA, and PLASTIC uses a 3-wire serial digital interface**
  - **Single-ended interface with high impedance receiver**
  - **1.000MHz clock**
  - **Coax harness**
  - **RC Bandwidth limited**
  - **Common overshield**



STE Interface

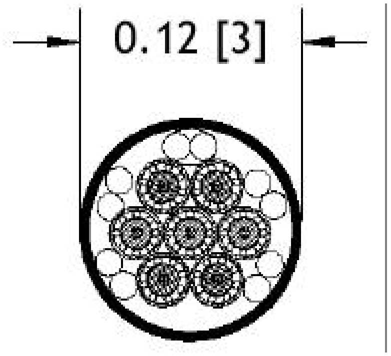
- **STE-D has a very short harness to SWEA**
- **STE-U has a harness to the IDPU**
  - **Mostly inside bus?**
- **Interface includes:**
  - **DC voltages capacitively coupled to secondary ground**
  - **Heater and Cover Actuator supplies (28V primary), in twisted-shielded pairs**
  - **Signal pulses, in coax**
  - **Common over-shield at chassis ground**

MAG Harness

- The MAG harness includes a 32KHz (TBR) drive signals and three sense signals. These are carried in 50 ohm Coax
- The MAG harness also includes a temperature sensor and a heater supply
  - The heater supply is AC pulse-width modulated, synchronized to a multiple of 50KHz
  - The heater service is carried on a twisted-shielded pair
- The MAG harness has a common over-shield connected to chassis ground.

Boom Harness

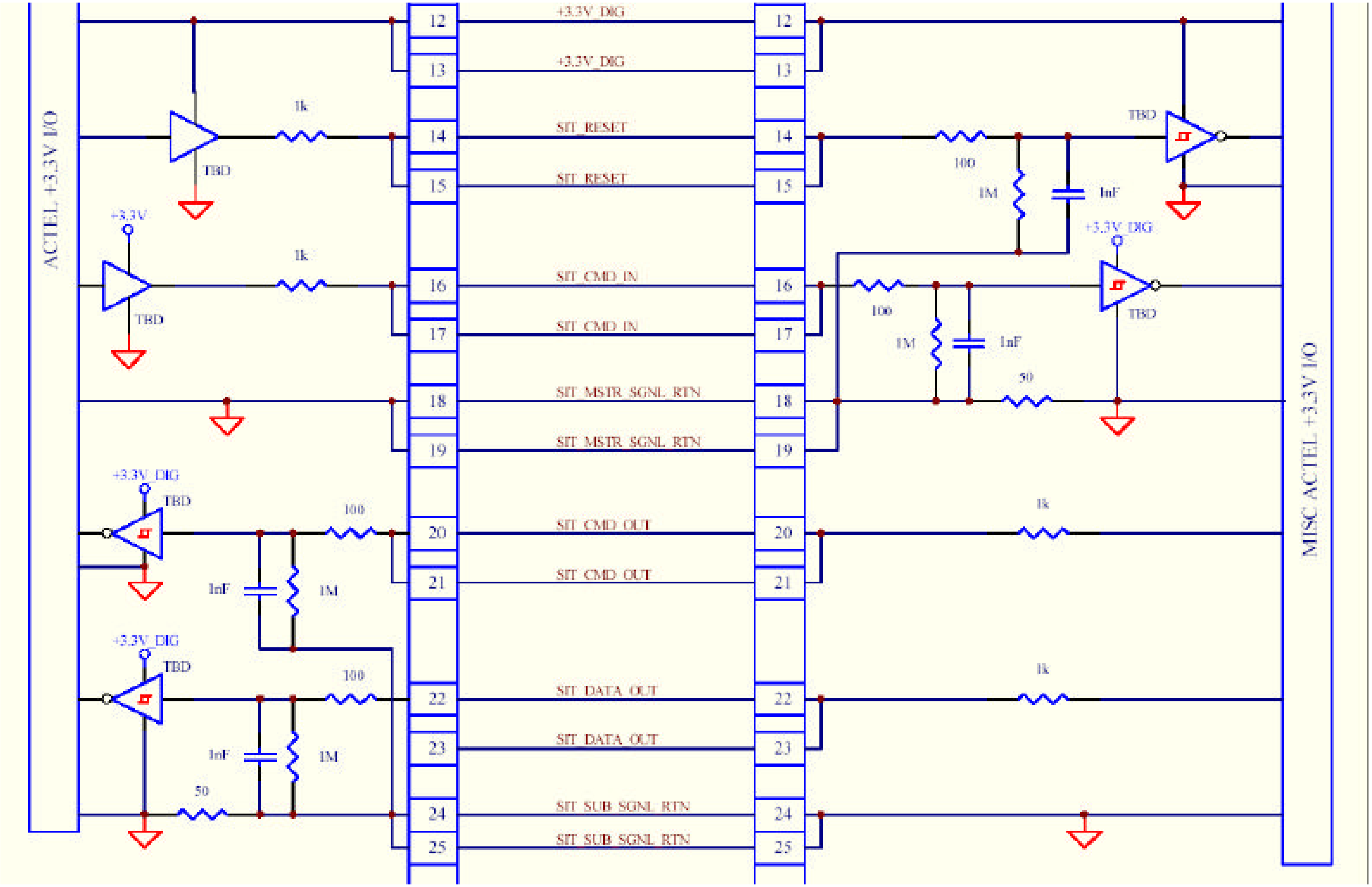
- Boom harness includes IDPU to SWEA serial digital interface, MAG interface, and 28V primary power.
- Harness must be flexible to allow smooth boom deployment
- MAG drive & Serial Digital use ultra small 50 ohm coax
- Primary power, survival power, and temp sensors use twisted pairs
- MAG AC Heater power uses twisted shielded pair
- Tape-wrap overshield (with drain wires) tied to chassis ground
- Elgiloy Stacer provides a second shield
- A braid shield is used where the harness extends past the stacer



SEP Harnesses

- **SEP Interfaces include**
  - **Secondary power**
  - **Survival heater power (?)**
  - **Temperature Sensors**
  - **Serial Digital Signals**
    - **Similar to IDPU design except semi-isolated ground and capacitive receiver (see next chart)**
  - **Details of internal shielding TBD.**
- **Harness includes a common over-shield connected to spacecraft chassis ground at both ends**

SEP Serial Digital Interfaces

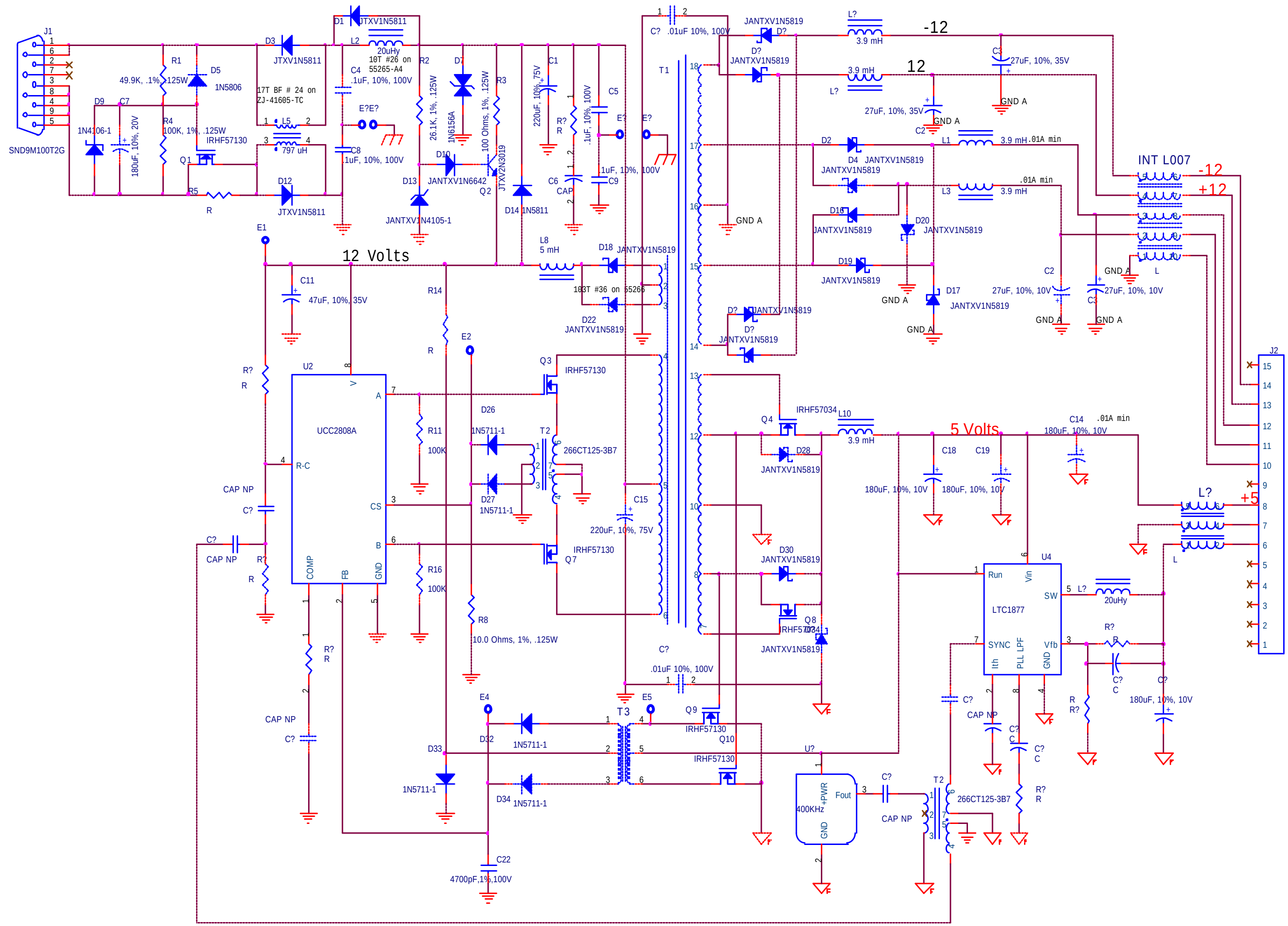


LVPS

- INPUT IS SPACECRAFT 28 VOLTS (22-35 VOLTS NOMINAL)
- COMPLIES WITH 7381-9030 GUIDELINES
- DEDICATED SUPPLIES PER SUBSYSTEM (IDPU, SEP, SWEA/STE, PLASTIC)
- TOPOLOGIES CHOSEN TO PROMOTE EFFICIENCY
- ALL SUPPLIES SYNCHRONIZED TO CRYSTAL CONTROLLED 100KHZ MULTIPLES
- SUPPLIES ARE SOFT STARTED TO MINIMIZE TURN-ON STRESSES – INPUT CURRENT CONTROLLED
- TRANSFORMERS FARADAY SHIELDED TO REDUCE ELECTROSTATIC NOISE
- INPUT TO SUPPLIES EMPLOYS BOTH COMMON MODE AND DIFFERENTIAL MODE FILTERS TO IMPROVE NOISE SUPPRESSION
- OUTPUTS EMPLOY COMMON MODE FILTERS TO IMPROVE NOISE SUPPRESSION

STEREO IMPACT

LVPS



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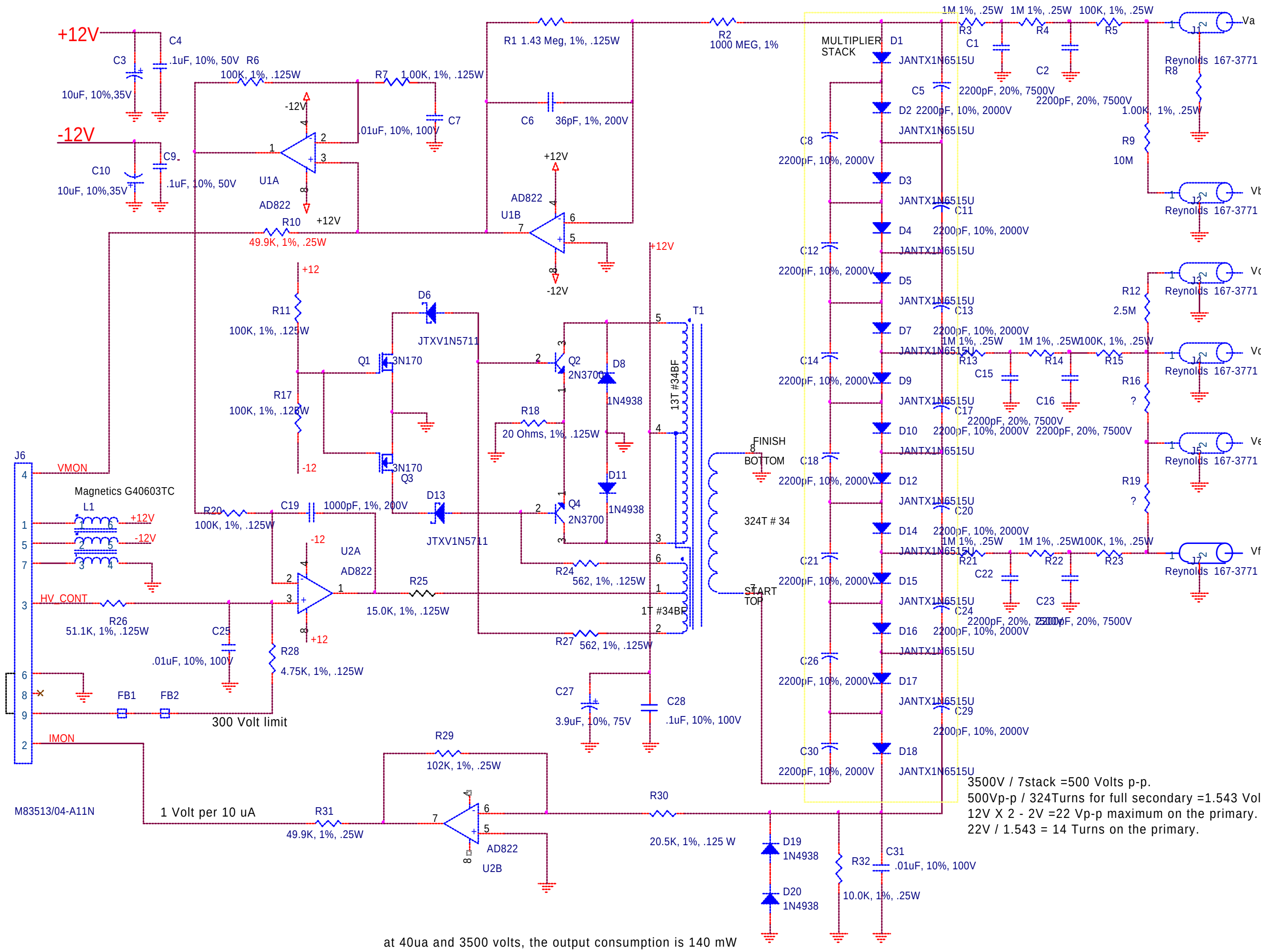
HVPS

- UCB builds the SIT HVPS
- CESR Builds the SWEA HVPS
- Supplies are unsynchronized sine-wave supplies running at about 65kHz off LVPS secondary supplies, up to 3500V.
- Low power (microamps)

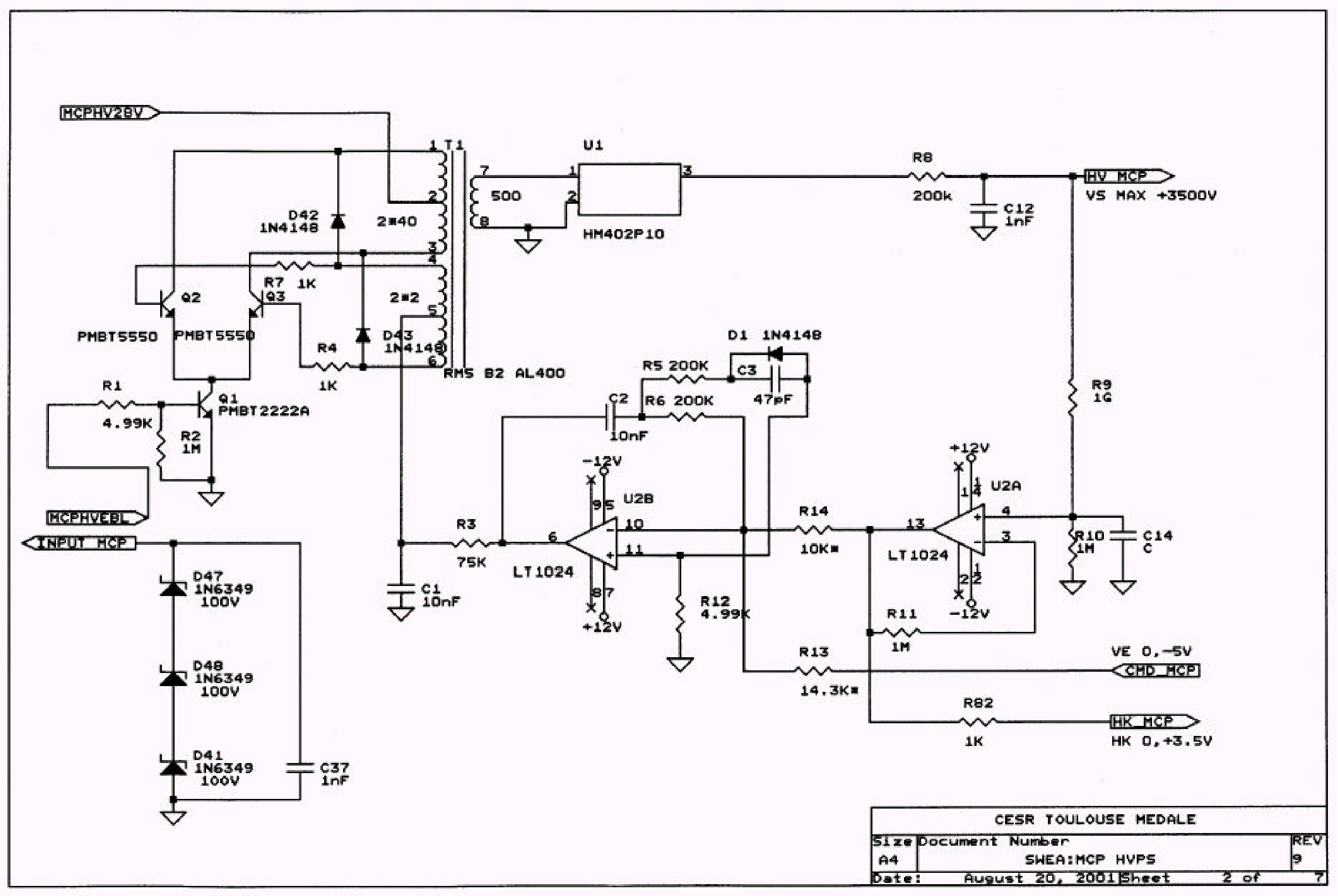
SIT HVPS



3500V / 7stack =500 Volts p-p.
500Vp-p / 324Turns for full secondary =1.543 Volts
12V X 2 - 2V =22 Vp-p maximum on the primary.
22V / 1.543 = 14 Turns on the primary.

at 40ua and 3500 volts, the output consumption is 140 mW

SWEA MCP HVPS



Frequency Usage

- **LVPS run a TBD multiple of 100KHz**
- **The MAG Heater runs at a TBD multiple of 50KHz**
- **IDPU Serial Digital Interfaces and Processors run at multiples of 1MHz**
- **SEP Serial Digital Interfaces run at 9600 baud**
- **MAG runs at 30KHz (TBR)**
  - **MAG is a receiver in a narrow band at this frequency**