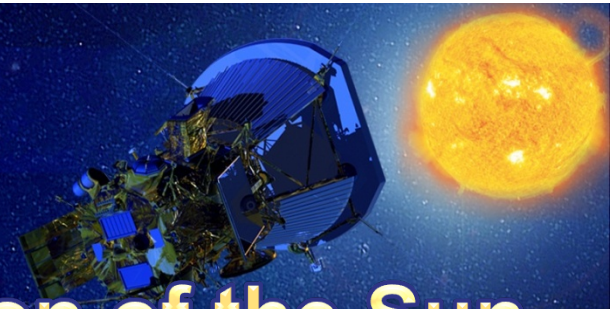
Solar Probe Plus

A NASA Mission to Touch the Sun



Integrated Science Investigation of the Sun
Energetic Particles

Preliminary Design Review

05 – 06 NOV 2013

EPI-Hi Mechanical

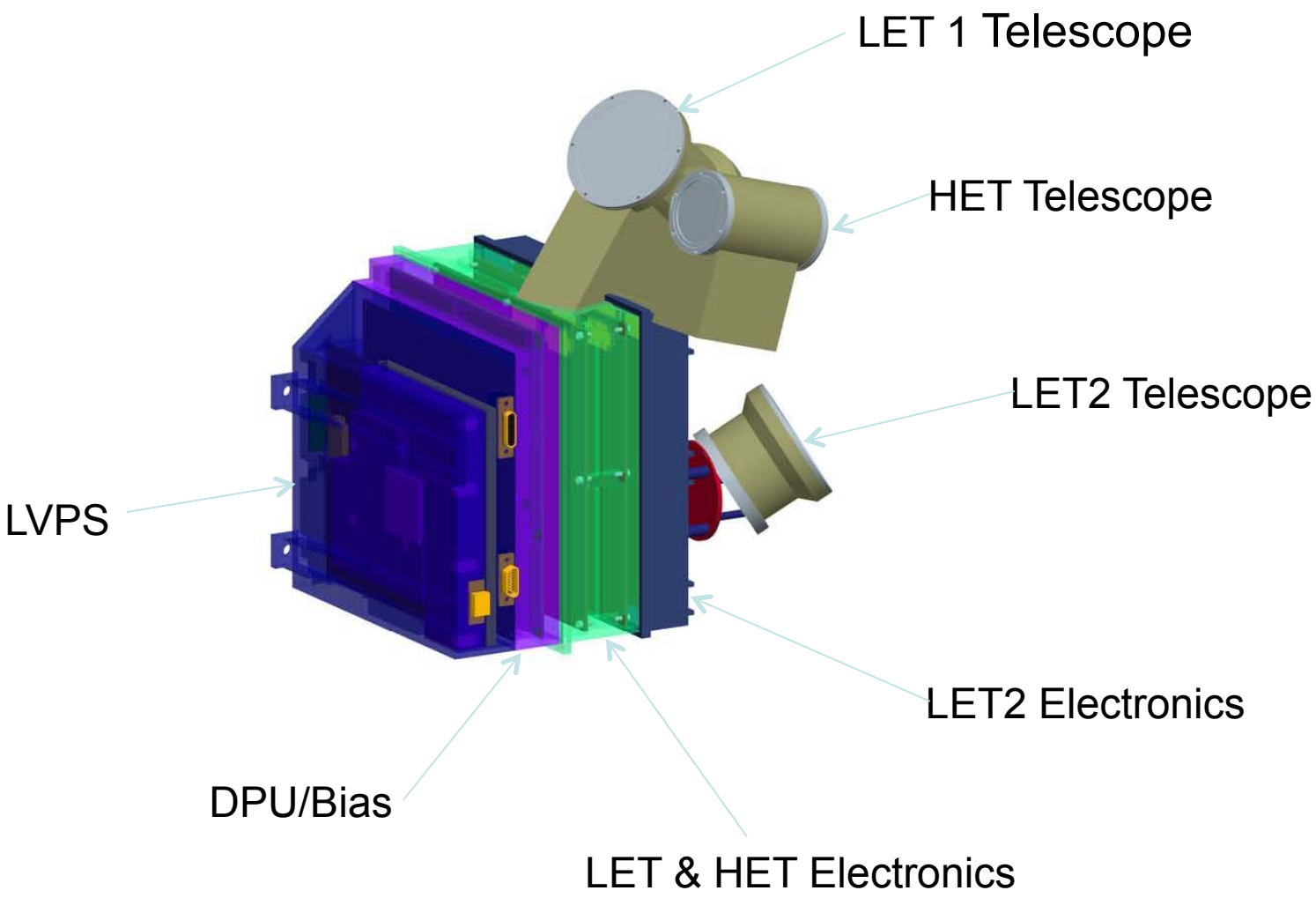
Sandy Shuman

EPI-HI Instrument

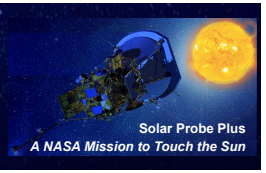
- Location of instrument on spacecraft

- Picture of FOV's on spacecraft x3

EPI-HI Component Configuration

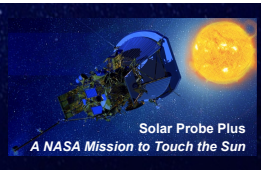


EPI-HI Enclosure Requirements



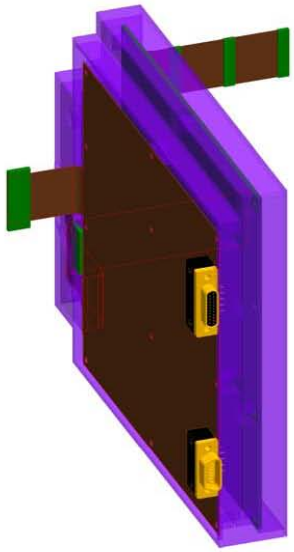
- Work within mass constraints.
- Package boards maintaining adequate parts clearance board to board.
- Provide needed interconnect means between boards and each other and boards to telescopes.
- Provide adequate RF and/or ground shielding board to board and through the enclosure.
- Provide thermal isolation from spacecraft bracket.

EPI-HI Electronics Enclosure

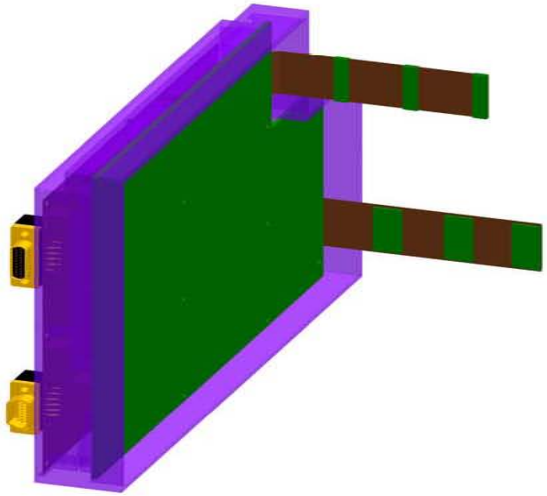


- Electronics box is made up of 4 major components, the LVPS Assembly, the DPU/HV Bias Assembly, the HET1/LET1 Electronics Assembly and the LET2 Electronics Assembly
- Each Electronics Assembly is mounted in a perimeter style frame.
- All “frames” when assembled together will provide a continuous RF shield for internal electronics.
- Internal shielding between critical components will create separate shielded areas as necessary for proper electronics function.
- Board interconnect is achieved using rigid/flex boards w/ built in cables terminating to individual nanonics/microstrip connectors on mating boards.
- Connections to the S/C will be via standard D Subminiature connectors

EPI-HI Electronics Enclosure

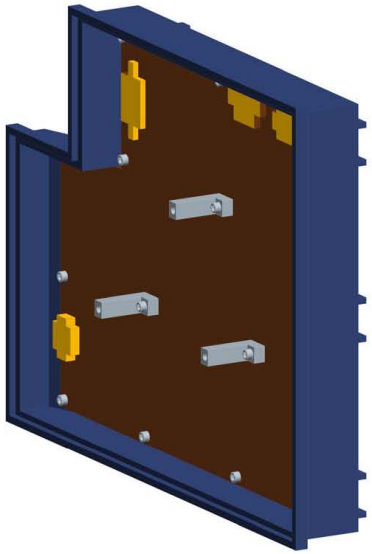


- DPU Board (mounted in one side of frame)
  - Flex connection to Telescope Boards
  - Flex connection to LVPS
  - S/C connectors (PCB mount)
  - PCB's mounted to machined in posts in chassis

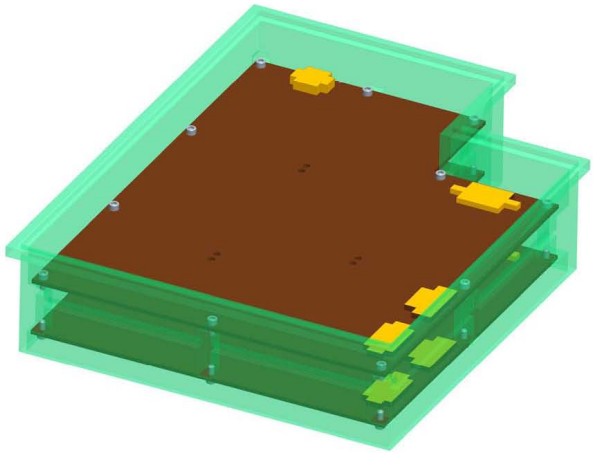


- Bias Supply Board (mounted in one side of frame)
  - Flex connection to 3 Detector Boards
  - Flex connection to DPU Board
  - R/F shielding
  - PCB's mounted to machined in posts in chassis

EPI-HI Electronics Enclosure

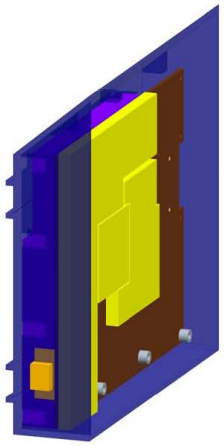


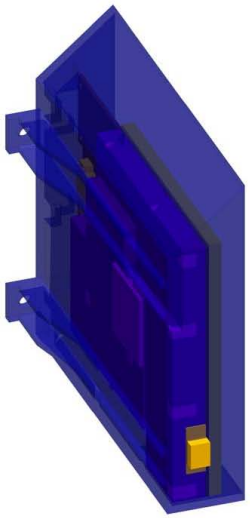
- LET2 Telescope Electronics Assembly
  - Receives flex connection from Bias Board
  - Receives flex connection from DPU Board
  - Receives 2 flex connections from Telescope
  - Housing provides feet for Instrument to bracket mounting.



- HET1 & LET1 Electronics Assembly (each board)
  - Flex connection from Bias Board
  - Flex connection from DPU Board
  - 2 Flex connections fromTelescope
  - PCB's mounted to machined in posts in chassis

EPI-HI Electronics Enclosure

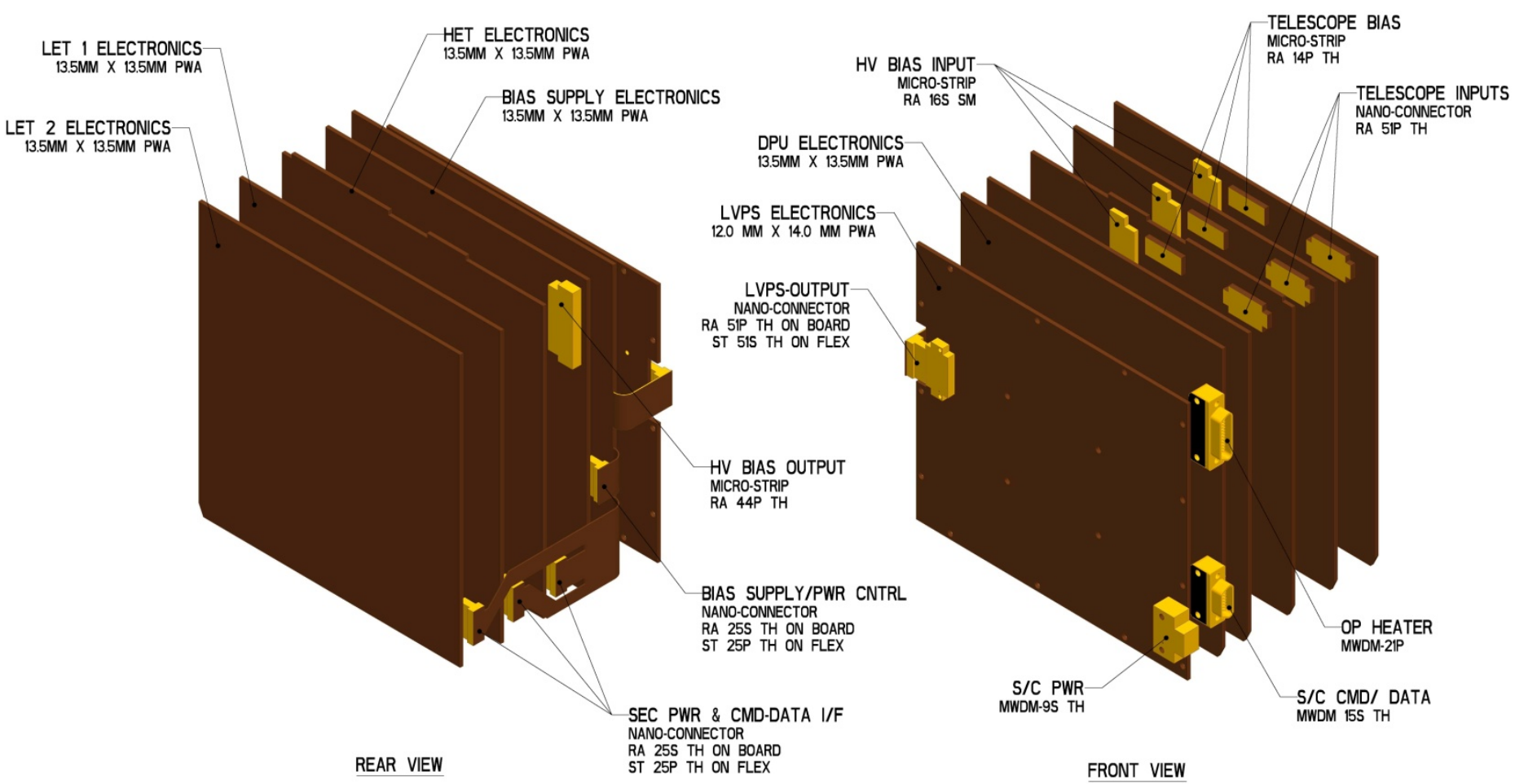




- Low Voltage Power Supply
  - Receives flex connection from DPU Board
  - S/C connectors (PCB mount)
  - Individually shielded primary/secondary circuits top and bottom.
  - Housing is tapered to avoid HET Telescope FOV
  - Housing provides feet for Instrument to bracket mounting.
  - PCB's mounted to machined in posts in chassis

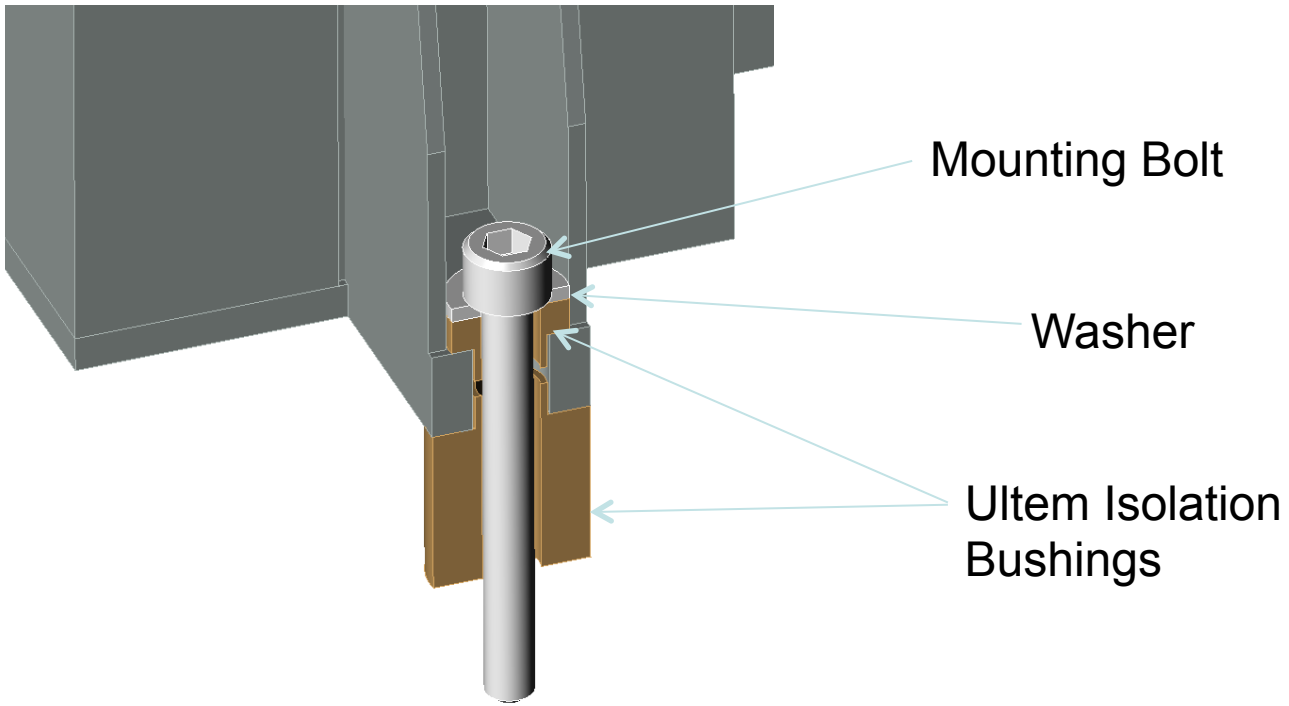
*LVPS Board provided by APL
*Chassis and shields designed/provided by GSFC

EPI-HI Interconnect



EPI-HI Thermal Isolation

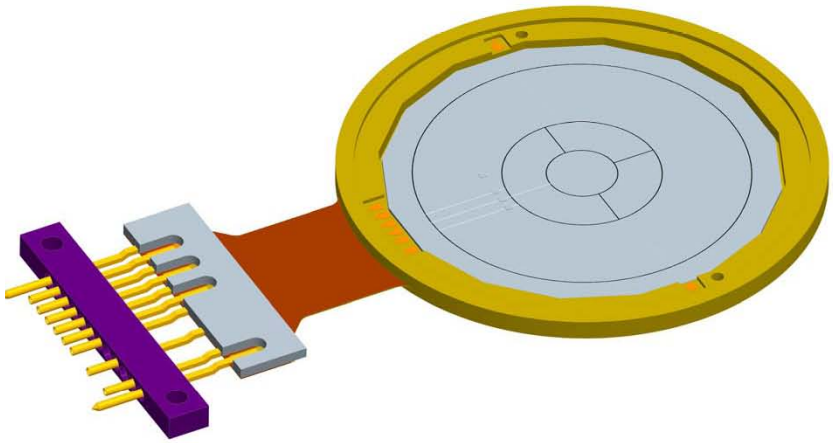
Typical Mounting Foot Showing Thermal Isolation



Mount Design Requirements

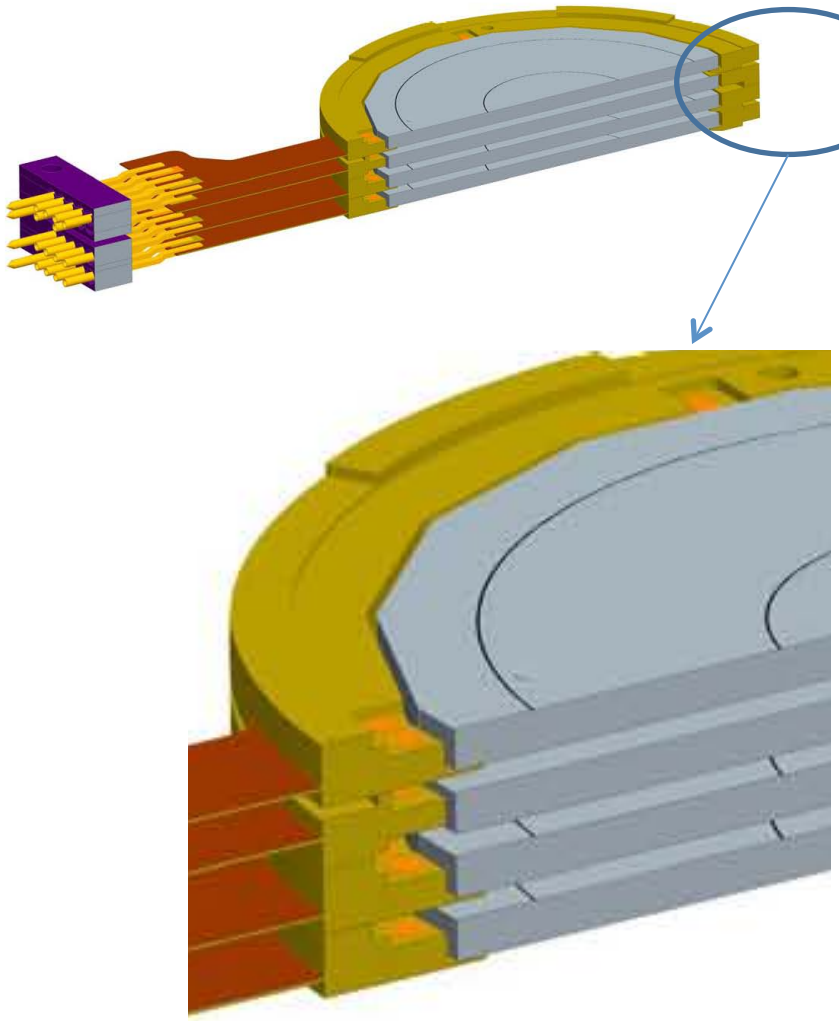
- Detector Mounts
  - Able to transmit signals from silicon detectors, via wirebond connections to output connector
  - Allows the stacking of detectors maintaining 0,5mm spacing surface to surface between thickest detectors (1,0mm)
  - Allows any detector to be stacked face up or face down with any other detector
  - Allows for the protection of wire bonds from being crushed on either side when placed on flat surface during storage and/or test
  - Provides electrical breakdown protection to next detector, when stacked, of up to 200V differential between crown of HV wirebonds to conductive surface of opposing detector

EPI-HI Detector Mount



- Recessed detector shelf for silicon detector installation.
- Micro-strip connector output
- Flex stiffener to rigidize the area where connector is mounted.
- Alignment achieved with alignment pins and concentric stacking shelves on mount and connector.
- Tolerancing for mounts will be tightly constrained, but within current CNC machining capabilities.
- Detector alignment will be verified through measurement and testing on assembled flight detectors.

EPI-HI Detector Mount

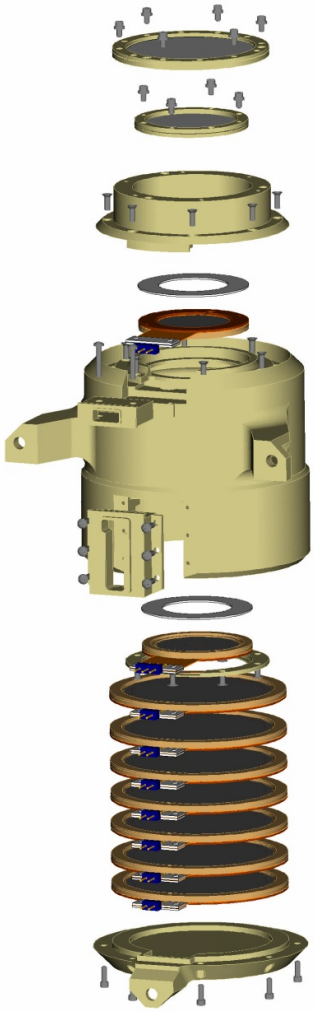


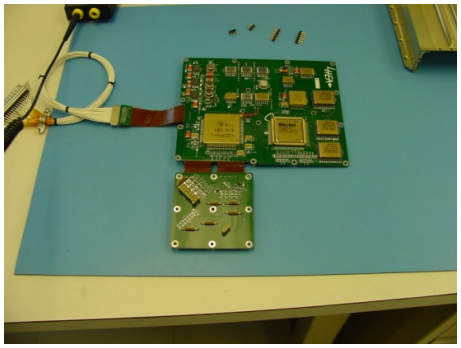
- Mount design allows stacking of detectors face to face, face to back and back to back while maintaining same spacing.
- Mounts are spaced 1,5mm apart when stacked allowing for 0,5mm separation between thickest detectors.
- Detector Voltage ranges from ~2V up to ~200V
- Mounts provide adequate spacing/protection for wirebond clearance.

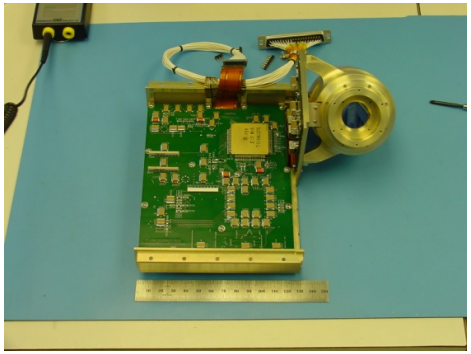
EPI-HI Telescope Design

- 3 Telescope comprised of silicon wafer detectors.
- Telescope body provides ~6,0mm of aluminum shielding to block unwanted particles from entering through the housing body.
- Foils will have TBD coating to achieve proper thermal characteristics.
- Telescopes are mounted directly to the top of the enclosure allowing the flex interconnect cable to be routed internally to provide proper RF shielding.
- Telescopes will all have red-tag covers over aperture openings.

EPI-HI Telescope Design



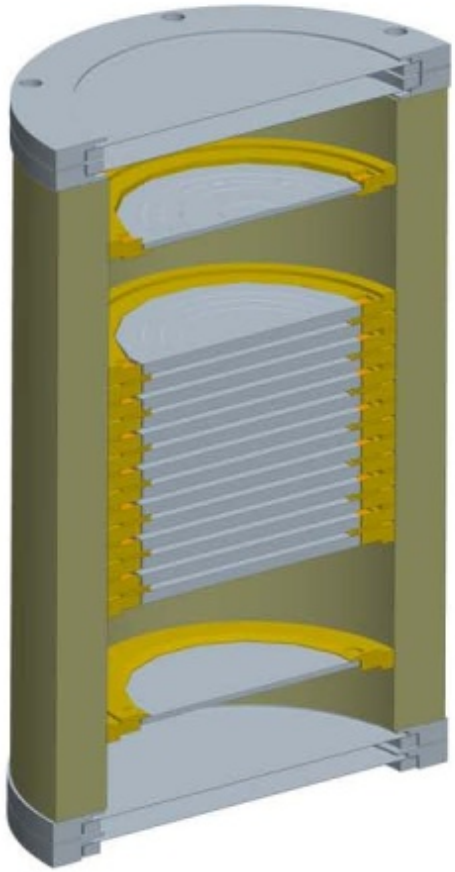




- Heritage design
- Uses alignment pins to stack detectors in telescope body.
- Mounting bracket designed into telescope body.
- Output signal cable will be completely enclosed in assembly providing proper shielding.

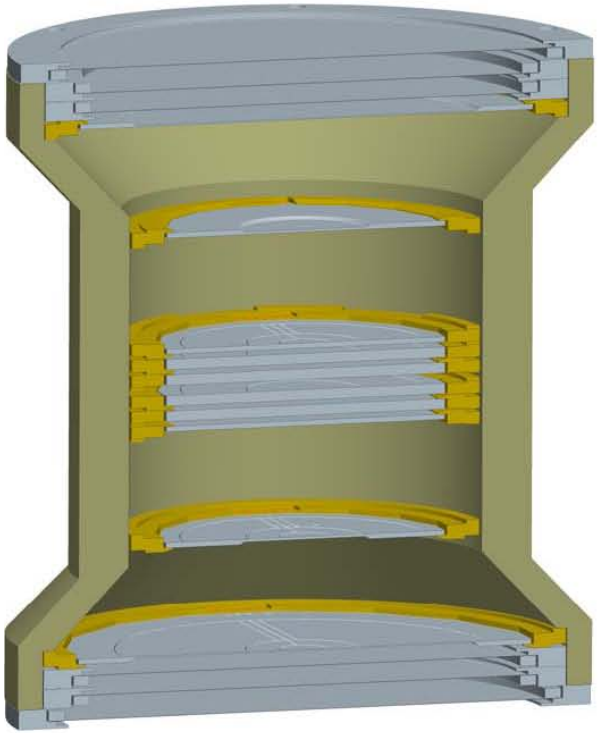
- Pictures shown are of STEREO\HET Telescope

EPI-HI HET Telescope



- 2- ~130um (5 mil) Foils for micro-meteorite /light protection on each end.
- Comprised of 16 silicon wafer detectors mounted in flex-rigid mounts.
- The front two detectors at each end are spaced apart in order to set a 90 degree FOV angle.

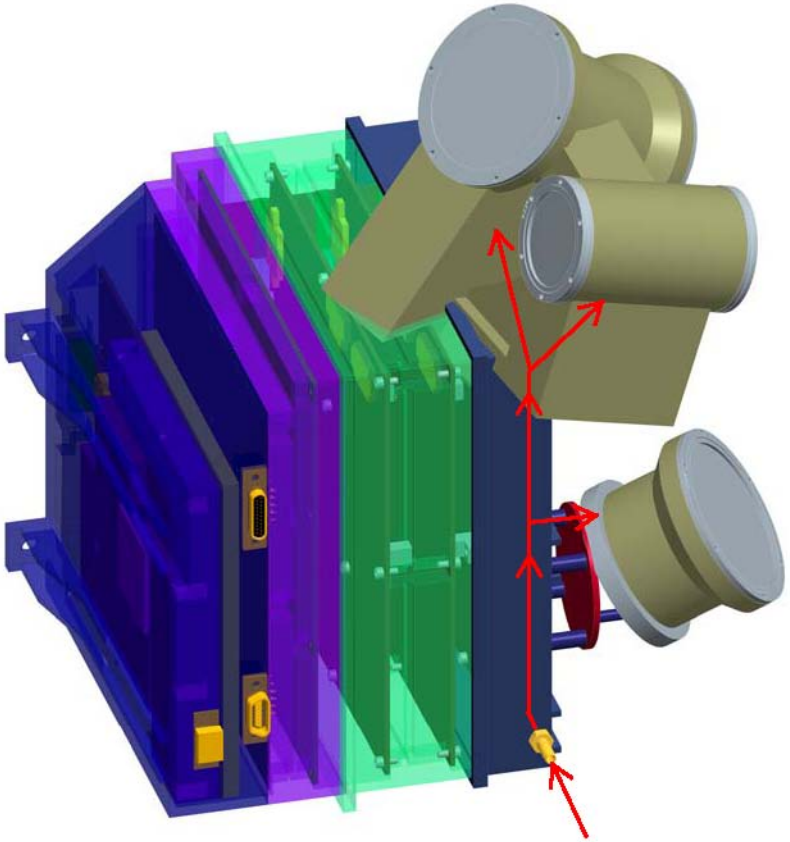
EPI-HI LET Telescopes



LET1 Telescope shown

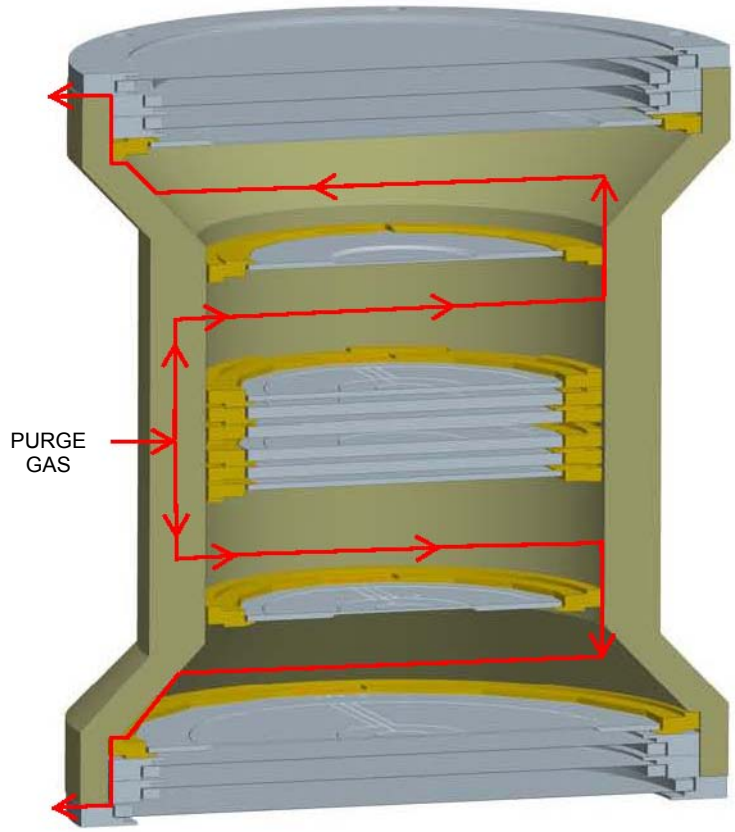
- LET1 Telescope
  - 3 Foils for micro-meteorite/light protection on each end.
    - Outer foil to be 2um polyimide.
    - Inner 2 foils to be 1um polyimide.
  - Comprised of 10 silicon wafer detectors mounted in flex-rigid mounts.
  - The front 3 detectors at each end are spaced apart in order to set a 90 degree FOV angle.
- LET2 Telescope
  - Comprised of one half of a LET1 Telescope.
  - 3 Foils for micro-meteorite/light protection
    - Outer foil to be 4um polyimide.
    - Inner 2 foils to be 2um polyimide.

EPI-HI Telescope Purge



- Purge will be established to the individual telescopes with a single purge fitting on the outside of the instrument.
- Purge will be distributed internally through a manifold that will send the purge gas into the center volume of each telescope.

EPI-HI Telescope Venting



- Heritage venting strategy that was used on several prior missions
- Purge gas enters thru housing into open center volumes
- Gas then flows outwards thru vent slots in housing shelves, detector mounts and foil rings
- Gas exits each end of the telescope thru vent slots below outer foil