Solar Probe Plus

A NASA Mission to Touch the Sun

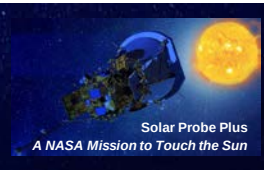
Integrated Science Investigation of the Sun
Energetic Particles

Preliminary Design Review
05 – 06 NOV 2013

Action Items

Nigel Angold

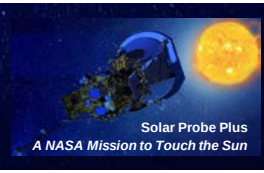
ISIS Action Items



- No actions assigned at the MDR
- None self-imposed by the team
- Actions from Peer Reviews
  EPI-Lo:

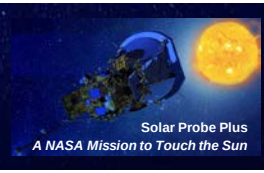
• EPI-Lo TOF and CFD ASIC peer review	???
• EPI-Lo Sensor Peer Review	5/22/13
• EPI-Lo Anode Board Peer Review	6/21/13
• EPI-Lo Sensor Peer Review	8/19/13 - 8/20/13
• EPI-Lo Event Board Peer Review	8/21/13
• EPI-Lo LVPS Peer Review	8/21/13
• EPI-Lo HVPS Peer Review	8/21/13
• EPI-Lo Energy Board Peer Review	8/26/13
• EPI-Lo Software Inheritance/Peer Review	9/11/13

ISIS Action Items



- No actions assigned at the MDR
- None self-imposed by the team
- Actions from Peer Reviews
  EPI-Hi:
  - EPI-Hi PHASIC and Housekeeping ASIC Peer Review 12/6/12
  - EPI-Hi LVPS Board Peer Review 5/22/13
  - EPI-Hi DPU Board Peer Review 9/9/13
  - EPI-Hi HET/LET Telescope Boards Peer Review 9/9/13
  - EPI-Hi SSD Bias Supply Peer Review 9/23/13
  - EPI-Hi Mechanical Peer Review 9/30/13
  - EPI-Hi Software Inheritance/Peer Review 10/11/13

ISIS Action Items



- EPI-Lo TOF and CFD ASIC peer review ???

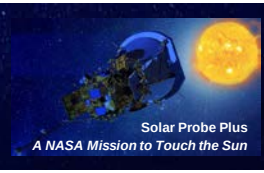
Actionee	Action Item	Status

ISIS Action Items

- EPI-Lo Sensor Peer Review 5/22/13

Actionee	Action Item	Status
Nelson	Make ground "targets" surrounding HV on a LV side of the PWB to protect LV circuitry from discharges.	Closed
Layman	Remove Ultem cover and associated spring washer on 3kV lug connection.	Closed
Layman	Make 900V guard washer out of plastic and eliminate Kapton spacer.	Closed
Layman	Vent all fasteners: 1) Vented Screws. 2) Vent trapped volume sideways by drilling in below threads.	Closed
Layman	Use aluminum tape to close the gaps between the wedges for UV purposes.	Open
Layman	Consider using bevel washer on screw for the 1000V to the side wall to avoid loss of contact due to material creep.	Closed

ISIS Action Items



- EPI-Lo Sensor Peer Review 5/22/13

Actionee	Action Item	Status
Nelson	Increase distance around the 3000V components on the anode board component side. Is the decoupling 3000V cap needed?	Closed
Nelson	If HV standoff is run at room temperature rather than our expected max temp in test/qual, we may need to increase the HV to compensate (e.g. 3600V ➔ 4000V).	Open
Layman	Reshape the 1kV and 2-9kV lug to provide more separation from the side wall, and open hole.	Closed
Nelson	Use blocking cap and CSA to look for discharges.	Closed
Weidner	Give identifier of Kapton sheet used in PWB stackup for IES	Closed
Layman	Shape the insulator between the cover and the 1kV volume so that the surface path along the insulator surface is at least 3mm. For example, "T" shaped or "U" shaped.	Closed

ISIS Action Items

- EPI-Lo Anode Board Peer Review 6/21/13

Actionee	Action Item	Status
Nelson	Verify that embedded capacitor will not fail. Consider looking at standard HV cap testing/temp cycling, testing at higher voltages, possibly looking at x-rays for voids, etc. Need to execute well documented test plan early in program.	Open
Nelson	Consider using Kapton 8525 (dielectric strength of ~6kV/mil.) or compare it with planned material.	Closed
Nelson	Time Constant of individual pads: can we make the resistor smaller to deal with higher rate situations? Need to look at capacitance to ensure it is ok.	Closed
Nelson	3x is not a lot of derating for materials. Consider changing or justifying.	Closed
Nelson	Determine how to test ground plane arcing. Look at the size of discharge as if you completely dissipated full bypass caps.	Open
Nelson	Investigate the plasma-etch step for in-house Parylene.	Closed

ISIS Action Items

- EPI-Lo Sensor Peer Review 8/19/13 - 8/20/13

Actionee	Action Item	Status
Hill/Mitchell	Photo electron fluxes getting through pin holes created by dust. Could create a lot of false starts. Consider mitigations (e.g. -5V electric field).	Open
Nelson	Determine if the MCP count rate area density (counts/cm^2) exceeds 1 MHz/cm^2.	Open
Hill	Generate a table of expected rates for bounding assumptions of radical drop-off and for characteristic rates of electrons, protons, He, and heavy ions. Document the foil efficiency foreground and background calculations, including assumptions on pinholes, efficiencies, dust environment, etc. Document the overall rate calculations and their assumptions.	Open
Hill	Improve the GEANT modeling to more realistically represent the sensor shielding configuration and re-assess the S/N. Investigate trades between S/N and cover mass. Consdier adding a witness detector to decrease the uncertainty in background.	Open

ISIS Action Items

- EPI-Lo Sensor Peer Review 8/19/13 - 8/20/13

Actionee	Action Item	Status
Nelson	Develop a strategy for keying or identifying the coax cables to avoid incorrect connections.	Open
Westlake	Launch electrons at all possible locations inside sensor model and characterize possible e- backgrounds.	Open
Nelson	Use redundant information to reject false signals. Consider using STI1 vs. STOP, ST2 vs. STOP, ST1 vs. ST2 redundant information to calculate "golden events" that are self consistent and are probably not corrupted by multiple starts from H+ or penetrators.	Open
Stokes	Provide peer reviewed reference for continuous test pulser technique for rate correction.	Open
Layman/Nelson	Consider HV discharge effects.	Open
Layman	Examine all fasteners without locking feature and consider high torque. Make sure no plastics in the stackup.	Open

ISIS Action Items

- EPI-Lo Sensor Peer Review 8/19/13 - 8/20/13

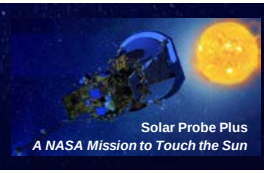
Actionee	Action Item	Status
Layman	Remove webbing, stabilize wishbone with tongue and grooves to cover, or screw through cover.	Open
Cooper	Consider collimator designs that do not require bonding.	Open
Hill	Address EPI-Lo/EPI-HI energy gap in the L3 requirements.	Open
	With the use of thicker foils on some openings, determine if one lookup table is sufficient. If not, change the baseline to multiple tables or an alternate approach.	Closed
Mitchell	Consider putting double foils on the look directions that are close to the sun and near the ram direction for better pinhole tolerance.	Open
Hill	Consider the background rate from neutrals that are rammed into the opening, photo electrons from the sun shield, or low energy plasma. Are there any concerns?	Open
Hill	Investigate sending extra raw data down in telemetry to “fill in” unused telemetry allocation.	Open

ISIS Action Items

- EPI-Lo Sensor Peer Review 8/19/13 - 8/20/13

Actionee	Action Item	Status
Gurnee	Consider building up full spare MCP assemblies. How many would be needed, how would they be matched to appropriate quadrant pair and how much testing would they have?	Open
Layman	Vent the back cover of the SSD assembly.	Open
Layman	Add holes/mounting interfaces to the structure to support red tag cover and handling fixture	Open
Layman	Detetermine to mark/serialize the foils.	Open
Layman	Consider the best way to route purge through the sensor, taking into account the need for launch pressure profile venting.	Open

ISIS Action Items



- EPI-Lo Event Board Peer Review 8/21/13

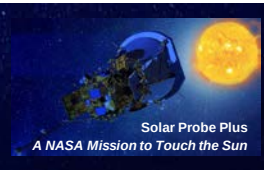
Actionee	Action Item	Status
Gurnee	Put 18pF caps directly between (-) and (out) pins on op-amps with complicated drive circuits. - Use 0.1 low temp co 10.0K for R768 - Make R89 ≈ R86 ıı R768	Closed
Gurnee	Global resets driven by FPGA and not the specially designed reset chips with guaranteed low voltage performance.	Open
Gurnee	Use 0.1%, low temperature coefficient, divider resistors on all ref circuit precision resistors.	Closed
Gurnee	Examine "design to min and max current" with respect to total line impedance and resistance. - Consider using a voltage sense line to the LVPS.	Closed
Gurnee	Consider using: 0603 0.1 uF, tantalum (small, yellow SMT) 220uF, 10V.	Closed
Gurnee	Evaluate if CKT guarantees VA ≥ VD for A128.	Open

ISIS Action Items

- EPI-Lo LVPS Peer Review 8/21/13

Actionee	Action Item	Status
Do	Input CM range goes to gnd, but must be 50mV above negative rail. Consider powering op-amp from - voltage or re-design circuit.	Closed
Do	Add over-voltage protection Zener. Evaluate transistor choice and if we need CR10 on puck LVPS.	Closed
Do	Demonstrate single fault conditions on 3.3V and verify it is ok (thermal, part stress, etc.). 1) Transformer winding short 2) Loss of control loop - full duty cycle 3) Add voltage monitor before 3.3 linear regulator and software can request a power off on fault 4) Look at what SPP DPU does	Open

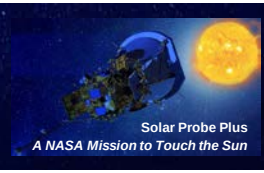
ISIS Action Items



- EPI-Lo HVPS Peer Review 8/21/13

Actionee	Action Item	Status
Dickinson	Coordinate selection of HV safe connector with bracket and spacecraft.	Open
Do	Review effect of Zener temp coefficient. - Review effect of feedback division resistors temp coefficient - Consider additional HV monitor that would allow long term temperature adjustments. - Check to detemrine how stable it must be.	Open

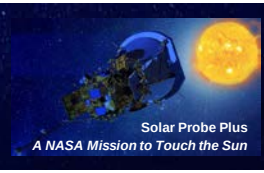
ISIS Action Items



- EPI-Lo Energy Board Peer Review 8/26/13

Actionee	Action Item	Status
Gurnee	Determine the need/want/history of conformal coating.	Open
Nelson	Add filter to pam board on bias supply output. Look at puck Anode board for filter values.	Open
Gurnee	Ensure ground place on rigid-flex is on outside of rigid-flex (side away from center hole).	Closed
Goldsten	Consider pull-down resistors on SEL0 and SEL1 inputs to energy chip to protect from possible ESD damage during handling.	Closed

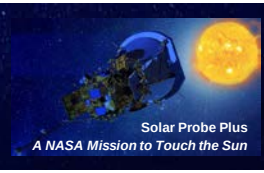
ISIS Action Items



- EPI-Lo Software Inheritance/Peer Review 9/11/13

Actionee	Action Item	Status

ISIS Action Items



- EPI-Hi PHASIC and H/K ASIC Peer Review 12/6/12

Actionee	Action Item	Status

ISIS Action Items

- EPI-Hi LVPS Board Peer Review 5/22/13

Actionee	Action Item	Status
Dickinson	Determine whether the redundant primary side power signals from the spacecraft can be tied together on the LVPS.	Closed
Dickinson	Work with Project to determine how Op Heater power is received by instrument.	Open
Do	Look into using freewheeling diodes around the normal mode inductors to reduce conducted emissions in EMI.	Open
Do	Consider fuses or series diodes across D8/D9 diodes to reduce single point failures.	Open
Do	Consider thermal analysis and part packaging for Q20.	Open
Do	Consider fast-and-soft Schottky across the switching FET (Q20).	Open
Do	Consider ferrite bead/small inductor for differential mode noise rejection on low voltage outputs.	Open

ISIS Action Items

- EPI-Hi LVPS Board Peer Review 5/22/13

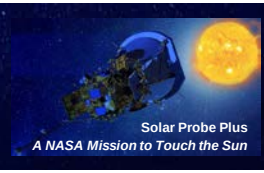
Actionee	Action Item	Status
Do	Perform a short-circuit analysis for safety purposes on low-voltage outputs.	Open
Do	Verify that the resistance/capacitance between primary to secondary is within SPP EMI Spec.	Open
Do	Fix note "GNDP is tied to GND at U1-18”.	Open
Do	Add a page/key that indicates how grounds are connected.	Open
Do	Linear Regulator (U4) is positive feedback; it should be negative.	Open
Do	Determine what happens to other voltages when a voltage rail is shorted.	Open
Do	Consider active current limiting on the output of the linear regulators to prevent going to cycle-by-cycle limiting on the switcher.	Open
Do	Refine the output loads and provide capability table to EPI-Hi for review.	Open

ISIS Action Items

- EPI-Hi LVPS Board Peer Review 5/22/13

Actionee	Action Item	Status
EPI-Hi	Review min/max voltage and determine where error budget is bookept	Open
Do	If operational heater is added to primary power bus, do not include heater power in primary current sense circuit.	Open
EPI-Hi	Supply a thermistor (made to GSFC spec).	Open
Dickinson	Ensure Do has a contact for the thermal analysis.	Closed
Do	Perform a follow-up layout review.	Open
Dickinson	Determine when EPI-Hi need the LVPS in the schedule.	Closed
Do	Indicate on schematic which portions should have primary vs. secondary side EMI shielding to leave room on parts placement for gold-plated footprint.	Open
Do	Investigate putting electrostatic isolation between the primary and secondary transformer windings.	Open
Do	Look at using a reset winding.	Open

ISIS Action Items



- EPI-Hi DPU Board Peer Review 9/9/13

Actionee	Action Item	Status
Caltech	Provide mask for review.	Open
Caltech	Describe detector screening and what they will do to avoid leakage.	Open
Caltech	Leave adequate time for coupon testing.	Open
Crain (Aerospace)	Provide details of Aerospace Actel Lifetime testing configuration.	Open
Dickinson	Does Actel require 33 Ohm series resistor on every I/O? Does the FPGA core regulation have to be at the FPGA? Is a Hyperlynx analysis required? Check with Rick Conde.	Open
Caltech	Demonstrate that there is a 0.1 uF ceramic next to every power supply pin on the FPGA.	Open
Caltech	Provide series resistor at all clock drivers; consider snubber termination at source.	Open
Dickinson	Double check the control signal termination scheme matches HIS/EPI-Lo.	Open

ISIS Action Items

- EPI-Hi DPU Board Peer Review 9/9/13

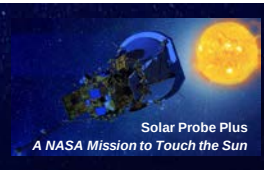
Actionee	Action Item	Status
Caltech	Provide information on MRAM memory mapping in MISC.	Open
Caltech	Terminate unused inputs to the drivers (U6,U5).	Open
Caltech	Move the brackets on sheet 3 on the right.	Open
Caltech	Add series resistors on LVDS inputs.	Open
Caltech	Justify brown-out conditions for HK POR function.	Open
Caltech	Explore the power-supply sequencing/monitoring problem with LVPS; avoid failure modes.	Open
Caltech	Clocks need to be stable XX amount of time prior to CPU operation. Perform an analysis - required at CDR.	Open
Caltech	Prepare FPGA, memory, code utilization numbers for PDR.	Open
Caltech	Check on the full range of the current monitor provided by the LVPS.	Open
Caltech	Consider high-side switching on the operational heaters.	Open

ISIS Action Items

- EPI-Hi HET/LET Telescope Boards Peer Review 9/9/13

Actionee	Action Item	Status
Caltech	Provide detector noise analysis and worst case threshold/noise ratios. Provide expected livetime vs. deadtime.	Open
Caltech	Evaluate the need to use LVDS on telescope-DPU data line.	Open
Caltech	Investigate potential case of a failure in one telescope causing failure in others.	Open
Crain (Aerospace)	Provide details of regulator with FPGAs that resulted in no failures over millions of hours of testing.	Open
Caltech	Change R61 resistor value from 20k ohm to 10k ohm.	Open
Caltech	Are we implementing autonomous of balancing of the leakage current? If so, provide a description.	Open
Caltech	Consider connecting HV bias bypass capacitor to pre-amp 5V rather than to ground.	Open

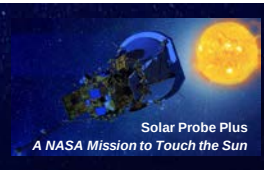
ISIS Action Items



- EPI-Hi HET/LET Telescope Boards Peer Review 9/9/13

Actionee	Action Item	Status
Caltech	Provide table 3 in PHASIC handbook.	Open
Caltech	After low noise setup is complete, is the 0.2% crosstalk spec met and under what input and threshold conditions?	Open

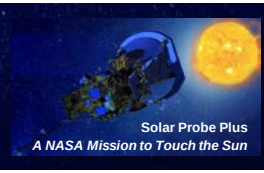
ISIS Action Items



- EPI-Hi SSD Bias Supply Peer Review 9/23/13

Actionee	Action Item	Status

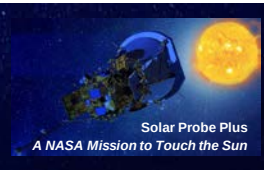
ISIS Action Items



- EPI-Hi Mechanical Peer Review 9/30/13

Actionee	Action Item	Status

ISIS Action Items



- EPI-Hi Software Inheritance/Peer Review 10/11/13

Actionee	Action Item	Status