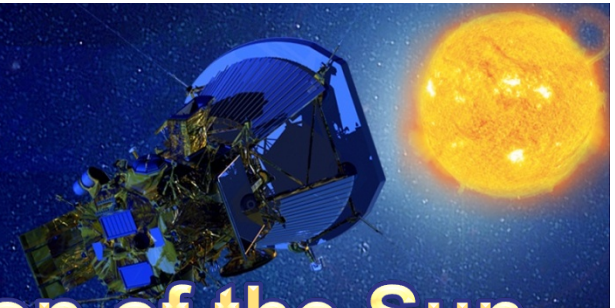
Solar Probe Plus

A NASA Mission to Touch the Sun



Integrated Science Investigation of the Sun
Energetic Particles

Preliminary Design Review

05 – 06 NOV 2013

Ground Support Equipment

Reid Gurnee

Outline

- Board Level GSE
- Spacecraft emulators
- GSEOS
- Safe / Arm plugs
- Calibration GSE
- Shipping Containers

Board-Level GSE

- Each EPI-Lo lead engineer is responsible for developing their own board-level GSE.
  - **Power Board**: Load board, active load, HV load, breakout box, breakout board, I2C stimulus
  - **Event Board**: energy and TOF preamp boards, test port box, breakout box, I2C slave, commercial pulsers
  - **Anode Board**: Commercial pulsers, scope, HV power supply
- All GSE is peer reviewed
- EPI-Hi engineering team develops a board-level GSE for Caltech-designed boards that can be shared between boards based on common subsystems (MISC, I/F to a PC)
- Test procedure written for each board, all GSE calibrated
- EPI-Hi subcontractors develop their own board-level GSE for LVPS and Bias Supply

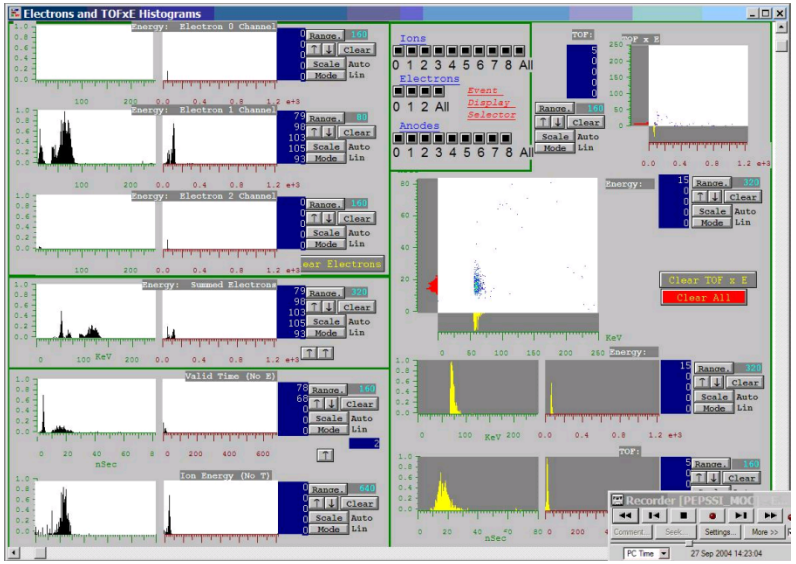
Spacecraft Emulator

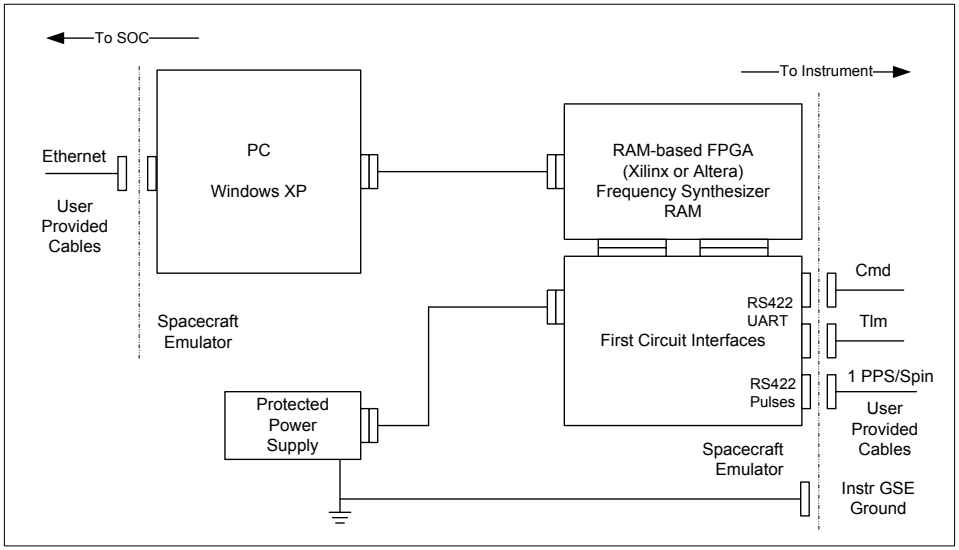
- Mini emulator
  - Provides Instrument Data Interfaces only, No Power Interfaces, No Temperature Interfaces
  - Provides virtual 1PPS
  - GSEOS Interface is fully compliant
  - Non-flight use only
- Full emulator
  - Provides Instrument Data, Power and Temperature Interfaces (no power supply)
  - Provides virtual 1PPS
  - Designed for use with Flight hardware
- GSE verification performed by Project
- 3 full, 3 mini emulators for ISIS

(1 ea for EPI-Lo, 2 ea for EPI-Hi)

GSEOS

- Common GSE software for all instruments
- Display screens and instrument customizations can be used through all development cycles from bench testing, I&T deployment, to flight operations
- Same platform used for EM, Flight, and Spacecraft operations
  - Test scripts can be developed by individual teams, tested on EMs, and then executed at the S/C level
- Software verification performed by project



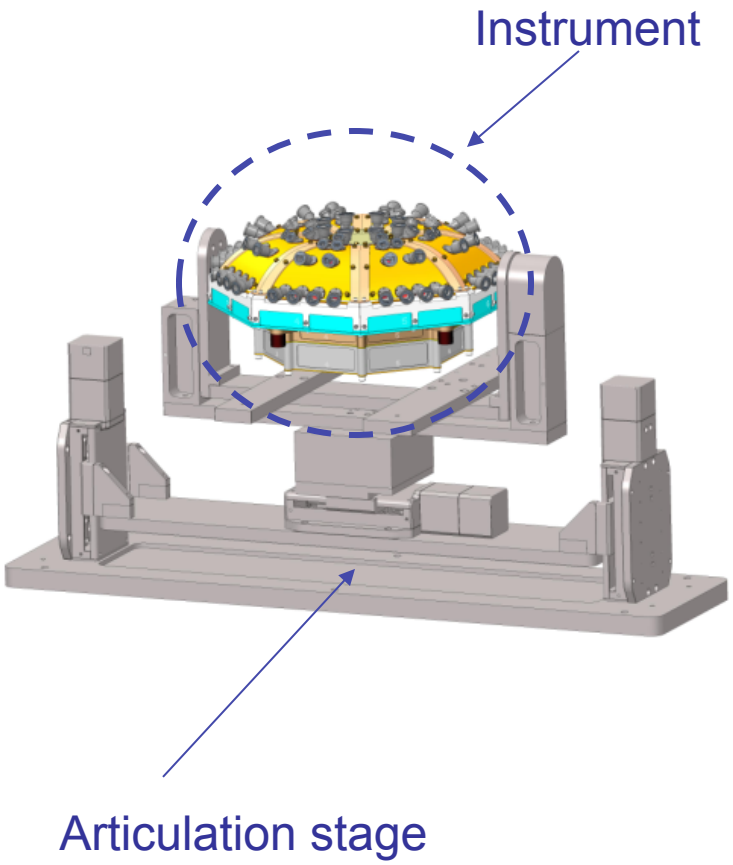


Safe / Arm plugs

- EPI-Lo has a HV air-safe plug
  - When installed HV is limited to air safe levels (hardware and software limited)
  - Plug will be removed for S/C TV testing
  - Plug will be permanently removed during final closeout
- Instrument covers
  - ISIS instruments will have red-tag covers to protect the apertures
  - Covers will be temporarily removed for S/C TV testing
  - Covers will be permanently removed during final closeout

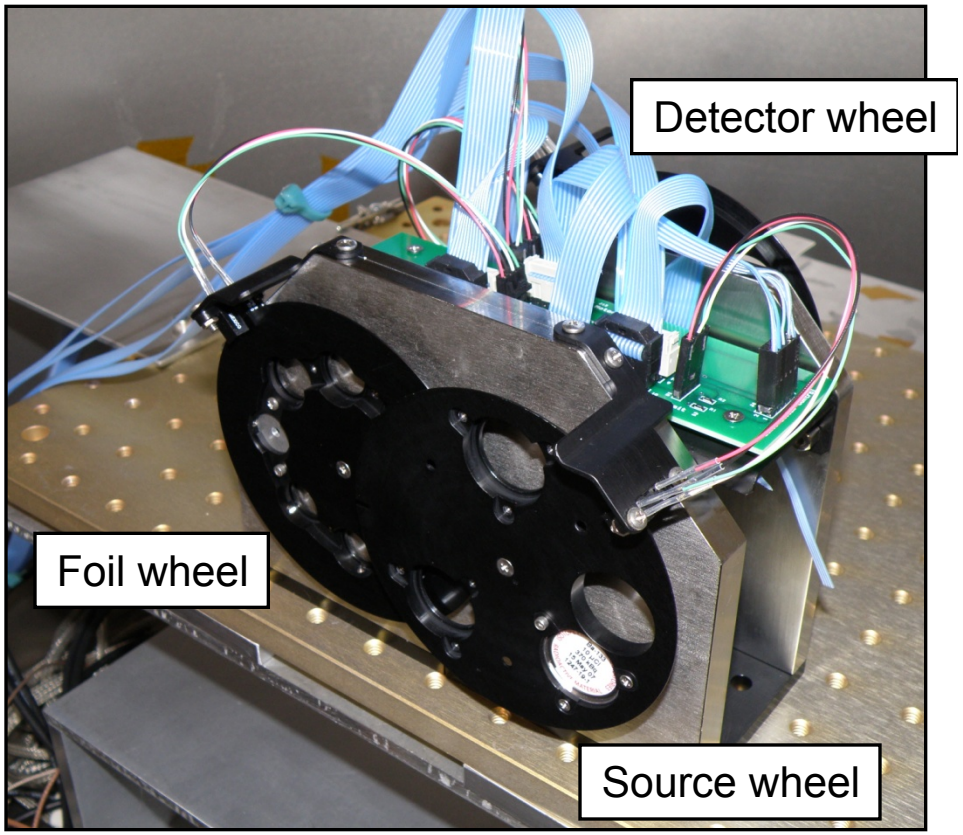
Calibration GSE for Instrument Articulation

- Requirements
  - Use in APL accelerator facility
    - Vacuum compatible (low outgassing)
  - Cover full FOV for one octant
- Status
  - Specified and purchased custom system from Newmark Systems
  - Received January ‘09
  - Re-furbished in ’12 at Newmark. Added additional controller and position sensor feedback on all motors.
  - Fully set up in vacuum chamber with all feed-throughs and control software
- Future Work
  - Build adaptor plate for EPI-Lo
  - Test with mass prototype



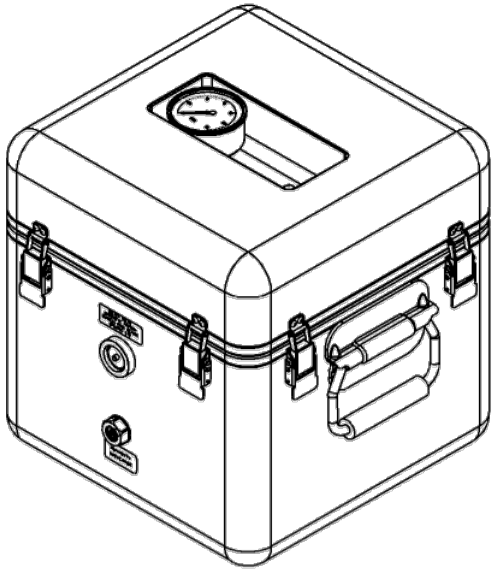
Calibration GSE for Beam Generation

- Requirements
  - Use in APL calibration facility with particle accelerator
    - Vacuum compatible (low outgassing)
  - Allow user to select ion or electron calibration source and intensity
  - No stray light from optical switches
- Status
  - Designed and built custom system
    - Three-wheel implementation
    - Optical switches off when not homing
  - Installed and in use in APL facility



Mechanical GSE

- Shipping Container
  - Requirements
    - N2 purged, humidity controlled and monitored
    - Low outgassing
    - Shock mounted and monitored
    - Hermetically sealed with pressure relief valve
- Environmental Test Fixtures
  - Thermal Vacuum Fixture
  - Vibration Plate Fixture
- Purge Suitcase
- EPI-Hi mechanical GSE holds the rigid-flex board stack in binder style, allowing individual boards to “open” like book pages for testing before installation into the flight E-box.



Summary

- GSE highly leveraged from previous programs
- Most GSE is built and ready for instrument testing
- EPI-Hi mechanical GSE not designed yet