

# PLASTIC Status Report to the STEREO SWG

2 May 2005 Hamburg Planetarium

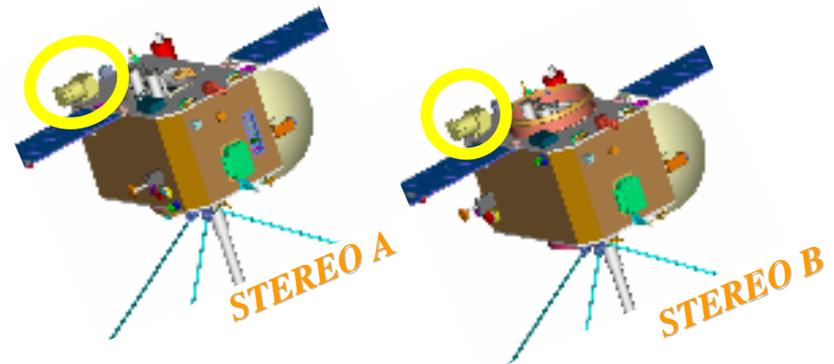
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# Previous Status Summary

At the time of the previous SWG (December 2004)

FM1 had completed:

- Full Integration

- UNH ion gun tests for functionality/performance

- IAPER

- Vibration

FM1 was midway through performance testing and calibration at the U. Bern. Issue with TOF resolution and minor coding and table changes identified.

FM2 had finished:

- Entrance System integration, TOF chamber integration

FM2 was midway through reassembly and functional testing (after board coatings) of power supplies and digital electronics

IDPU s/w 2.6 development and testing was ongoing at UNH/UCB

# Previously Reported Issue

## **NASA requested change of venue for TV/TB tests:**

Testing was being planned at UBern facility for late January 2005

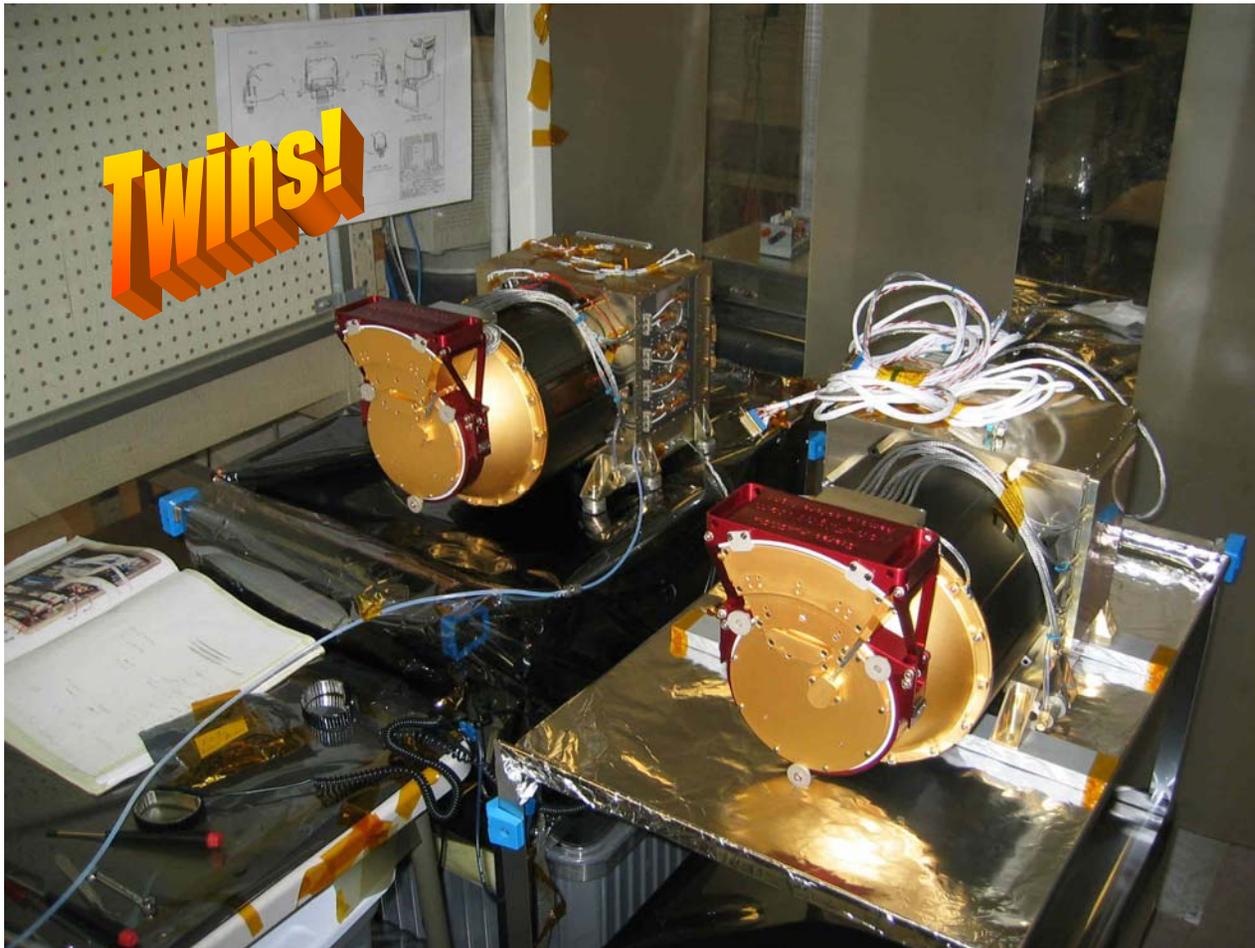
- To save about 2-3 weeks on the FM1 delivery schedule
- To provide additional personnel support (to inhibit US costs and collateral schedule erosion to FM2)
- To get early notice of any low temperature issues
- UBern was providing TV MGSE support, radioactive sources

## **Resolution:**

Testing to take place at GSFC facilities

- Associated schedule erosion to FM1 accepted by Project
- UNH fabricated new TV MGSE (facility specific)
- FM1 refurbished for “noise reduction” prior to TV
- Project shall provide 3 people to supplement PLASTIC personnel support in the TV/TB round-the-clock 3 week test schedule
- Project will provide radioactive sources

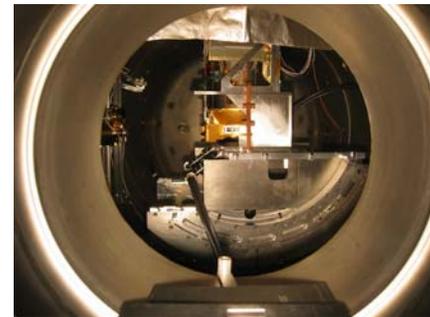
# Current Status



STEREO SWG May 2005

# FM1 Calibration at Bern Dec04-Jan05

- Deflection test - tipping instrument to known elevation angles and sweeping the deflectors on the Main and S channels with at selected energies
- ESA E/Q and Angle response (“fish”) scans at selected energies and species
- MCP efficiency for selected MCP bias, species, energies, PAC
- Energy (SSD) data for selected E/Q and species
- Test of ESA and DEFL sweeping in Main Channel
- Test of ESA and DEFL sweeping in Proton Channel
- Extended operation at -20 kV PAC
- Test of Main/Proton Chn switching by Digital Electronics (w/o IDPU) during sweeping
- Limited azimuthal scans
- Test of tables (SWEEP, RA, Classification)
- Test of ACTEL coding
- Quadrant 0 (Solar Wind Sector) fully covered. Quadrant 1, 2, 3 selectively covered
- Rate linearity tests
- Limited UV test in MEFISTO
- Not accomplished: planned IDPU s/w testing with real beams (S/W NR)



# Results from FM1 Calibration

## Solar Wind Sector Flow Angle Measurement:

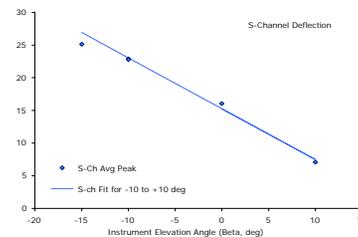
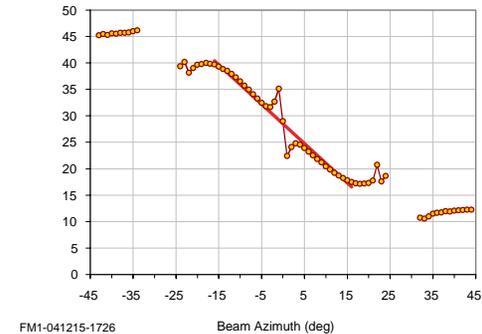
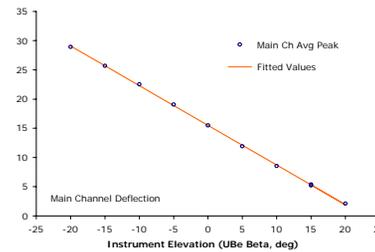
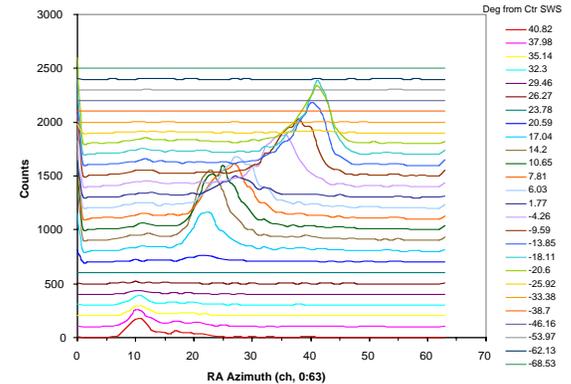
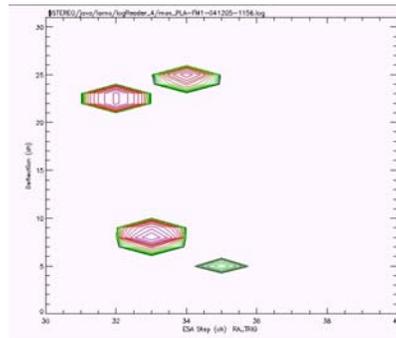
STEREO L1 requirement:  
Proton solar wind bulk flow angle determination to within  $\pm 10^\circ$

Polar Angle by electrostatic deflection:

- $10^\circ$  to  $+15^\circ$  FOV tested
- Main Chan  $1.5^\circ$  /step
- Proton Chan  $1.3^\circ$  /step

Azimuthal Angle by Resistive Anode:

- Full SWS  $45^\circ$  FOV tested
- $0.5^\circ$  peak angle determination for FOV  $\pm(2^\circ-15^\circ)$ . Peak determination better than a couple degrees inside FOV  $\pm 2^\circ$  requires PHA.



# Results from FM1 Calibration

## Solar Wind Sector intensity measurement:

STEREO L1 requirement:

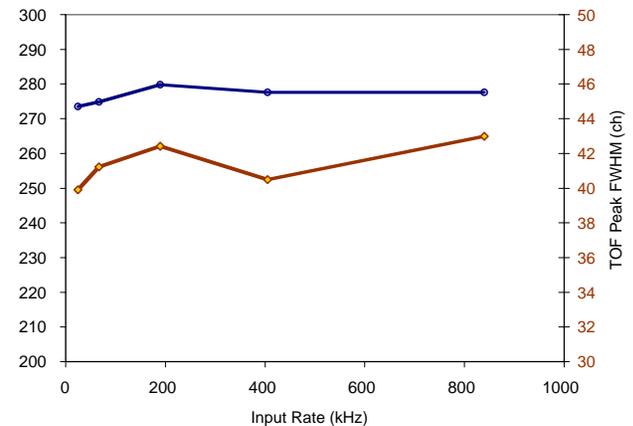
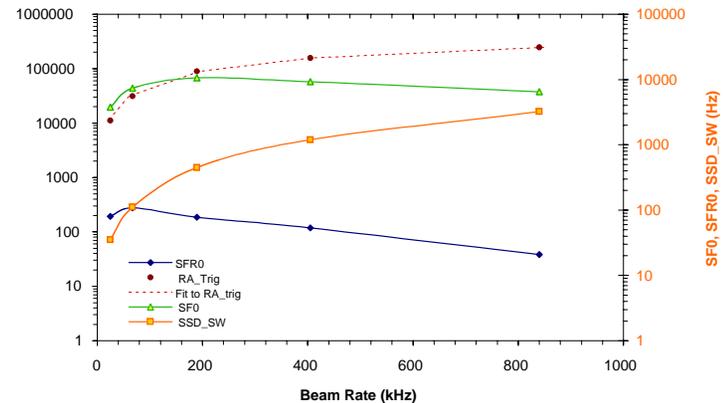
Proton solar wind density to +/-10 [30]%

High Rate Limits and Linearity:

Required: 625 kHz for a single rate

Measured: PHA data obtained at rates up to 840 kHz.

Resistive anode rate counter exhibits monotonic increase up to 840 kHz.



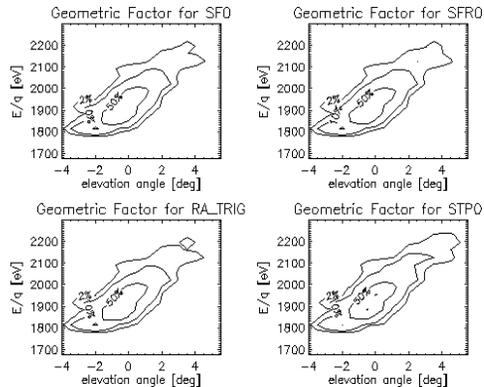
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## Solar Wind Sector intensity measurement:

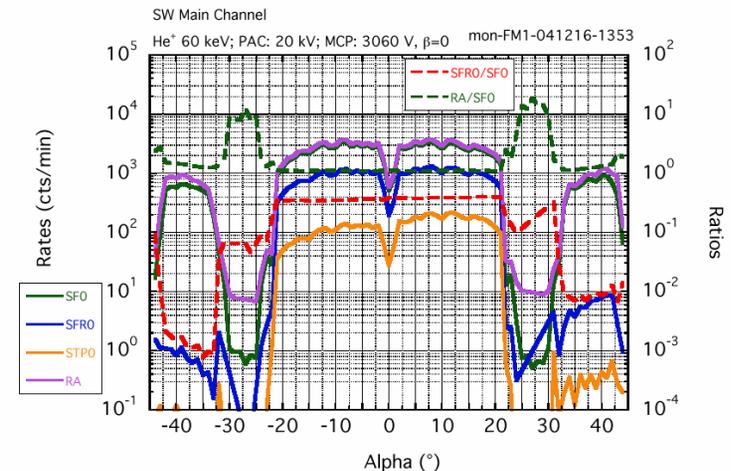
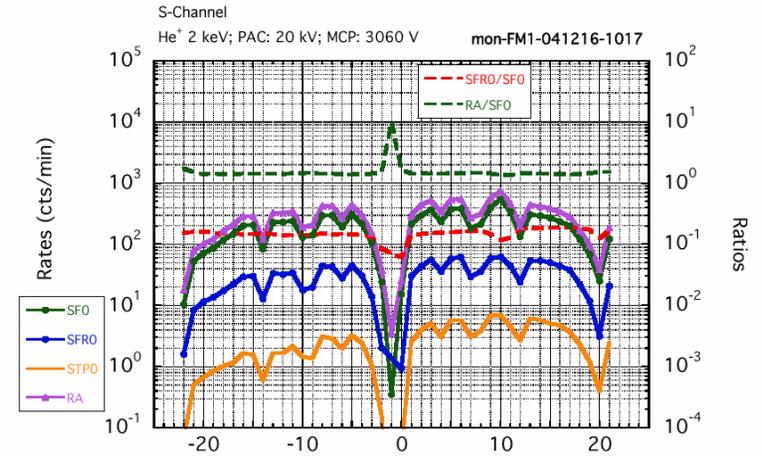
STEREO L1 requirement:

Proton solar wind density to +/-10 [30]%

Measurement of Efficiency as a function of azimuthal angle



Main Channel Solar Wind Sector Response for Integrated instrument 2keV He+ PAC: 20 kV at -14 deg azim.



# Results from FM1 Calibration

## Solar Wind Sector E/Q measurement:

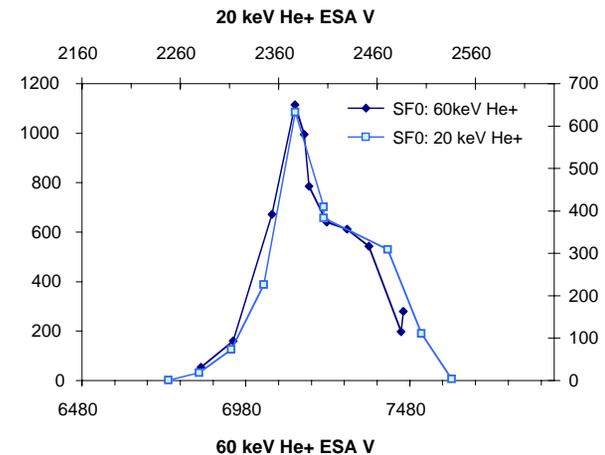
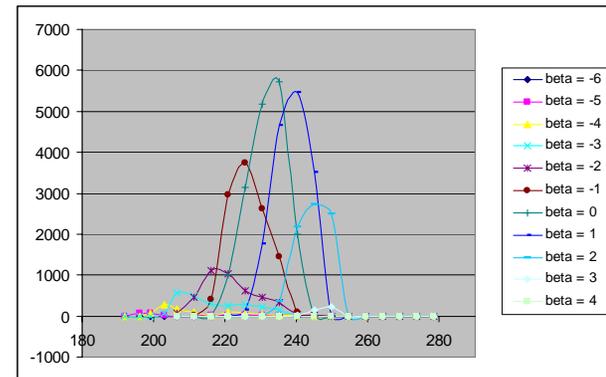
STEREO L1 requirement:

Proton solar wind speed to  $\pm 10$  [30] %,  
temperature  $\pm 10$  [30]%

Measurement of response over incident  
E/Q and incident angles

Measured from 300 eV/e to 60,000 eV/e

Channel	Electrode	Ana.Con.	FWHM	FM1		FM2	
S-Channel	SCO-L	3.19	10.40%	3.23	10.40%	3.25	10.64%
	SCHU	3.59	13.80%	3.68	13.20%	3.64	10.76%
	ESA	8.35	6.10%	8.46	6.34%	8.47	6.26%
MC	ESA	8.26	6.10%	8.24	6.12%	8.26	6.48%
WAP	ESA	8.32	6.70%	8.25	6.77%	8.29	7.30%



# Results from FM1 Calibration

## Solar Wind Sector Species measurement:

STEREO L1 requirement:

Species resolution for protons, alphas and selected major charge groups

Requires good E/Q, good Time-of-flight and reasonable E resolution

Species Measured at Bern facility:

H+, He+, He2+, O+, O2+, Ar+, Ar2+, Ar3+, Ar4+, Ar5+, Ar6+

Solid State Detector Energy:

Measured 30-420 keV ions  
(Higher ion energies were not obtainable given E/Q limit and available charge states of beam)

Results were nominal

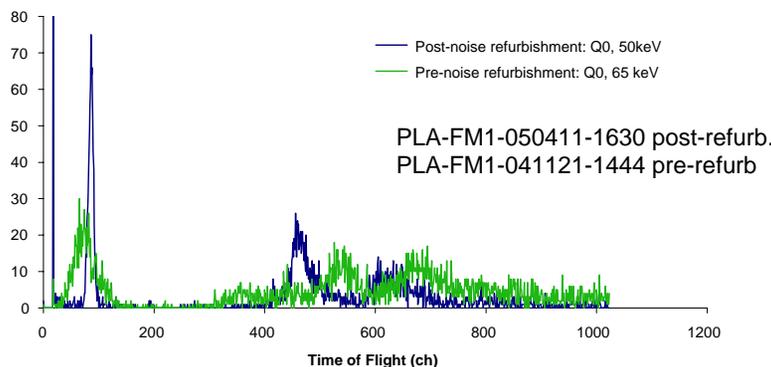
Time-of-Flight:

Measured from 10 – 250 ns  
Time of Flight determination nominal, but resolution was not acceptable. Proton efficiency also suffered.

Further testing at UNH determined that TOF inputs were picking up the 200 kHz syncing of the power supplies (nX50kHz EMC Plan requirement). Shielding, filtering, and thresholds have been added to FM1 and FM2.

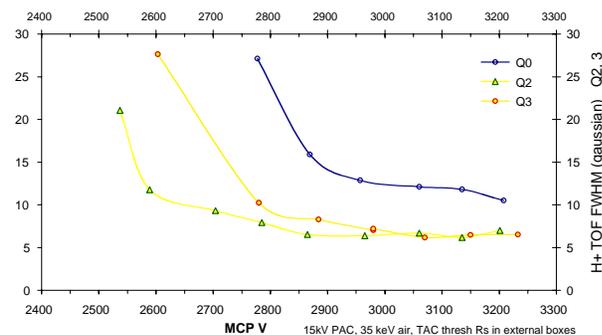
# Improvement in TOF Resolution after Noise Reduction

- Noise reduction efforts improved time of flight resolution
- Lower noise allows lower threshold – improved proton efficiency
- Quadrant 0 spectra shown (solar wind sector)
- Data from UNH ion gun – ambient air beam

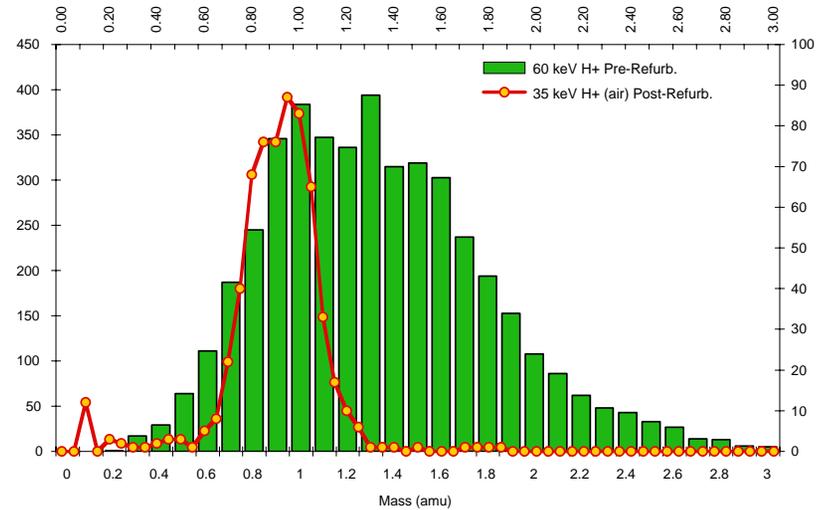
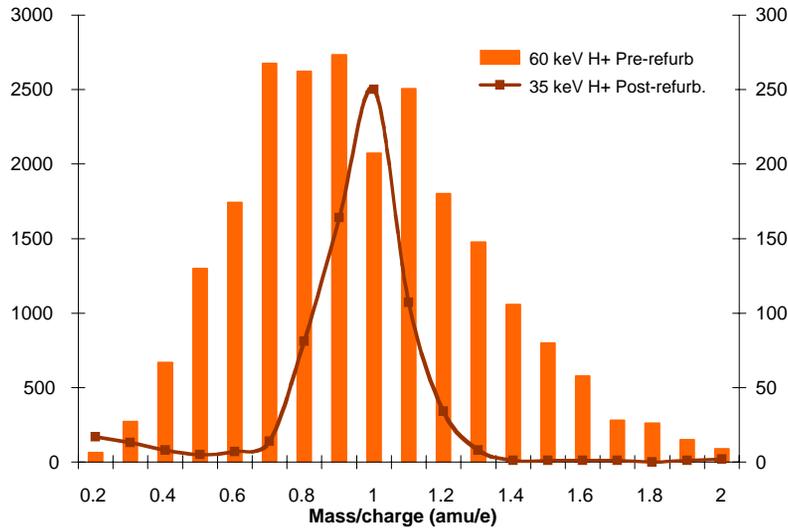


Proton peak      Water Group

$\Delta t \sim 3\text{ns}$  FWHM in SSD section  
 $\Delta t \sim 2\text{ns}$  FWHM in non-SSD section



# Then and Now Species Determination



L1 Species Requirement now met.

# FM1 Current Status

- All issues identified from performance testing corrected  
(noise reduction, actel code changes for science product)
- Passed vibration
- More than 500 hours of trouble free testing in vacuum  
at operational voltages

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at operational voltages

Almost made it out the door in late March ...

Flight board re-inspection in March 2005 raised QA issues regarding component placement on “SSD C” board. Board is part of the solid state detector electronics. Component placement on original flight boards was primarily motivated by crosstalk and LED response issues.

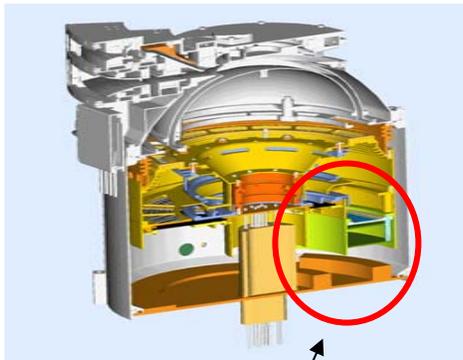
New boards “SSD C-3” and “SSD-4” built to replace “SSD C-1” (FM1) and “SSD C-2” (FM2) respectively. Components mounted differently. NASA inspectors very helpful. Additional board and flight parts purchased for SSD-4. Three week minimum turn around per board.

# Replacement Board Status

Replacement board SSD C-3 integrated into FM1 almost two weeks ago.

New C-3 board does not respond properly in the integrated instrument.

Trouble shooting is continuing this week. Requires major disassembly and reassembly activities.



SSD Electronics



Access to board requires removal of entrance system, power supplies, and electronics box. Retest requires re-assembly.

This process has been done several times in past week. Concern about mechanical fatigue. Designing and fabricating new testing jig to allow more “lifelike” testing outside of instrument.

# Other Status

FM2 has been fully assembled and gone through initial functional testing.

- performance looks good
- noise reduction looks good
- no sensor problems identified, except for LVC voltage regulation behavior at low (near zero) temperatures
- LVC returned to UCB for troubleshooting
- FM2 waiting in queue behind FM1 for SSD C board exchange

Project has put into place major resources to assist in the PLASTIC portion of the IMPACT/PLASTIC IDPU. Flight s/w build 2.7 is in “beta testing”. Build 2.8 may be ready to start beta testing later this week. Build 2.8 could potentially be validated by end of May. Build 3.0 (science) may be ready and partially validated by end of June. Can proceed with electrical integration of PLASTIC on the spacecraft with a validated build 2.8.

All testing with IDPU flight s/w thus far is with PLASTIC EM electronics. There may not be an opportunity to fully validate science product section of s/w with actual FM beam calibrations.