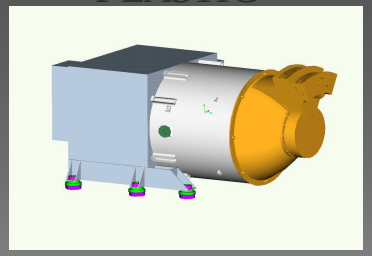
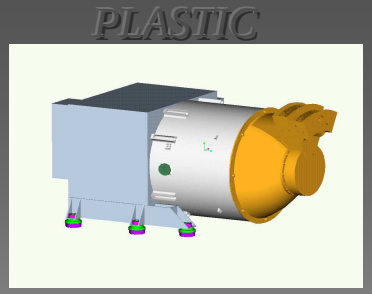
PLASTIC



PLASTIC Activities

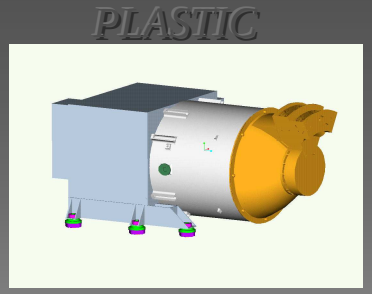
Presented by A.B. Galvin
STEREO SWG
NOAA
Boulder, Co
22 March 2004

Data Plan Activities

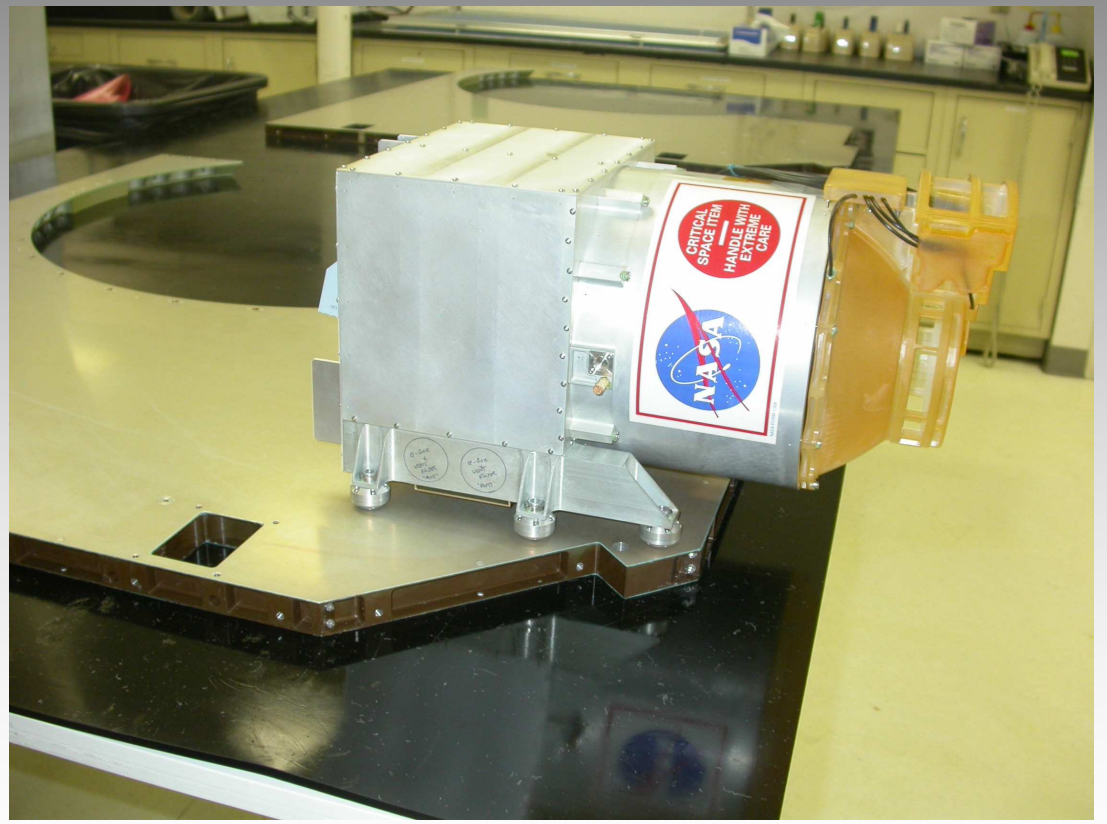


- Data file naming and formatting conventions are being formulated (graduate student available until May 2004)
- VHO, SSC and IMPACT representatives have been contacted
- Expected Beacon Mode Data contribution is unchanged from previous submissions

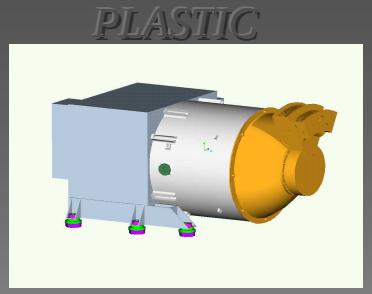
Structural Model



- Fit Check on S/C



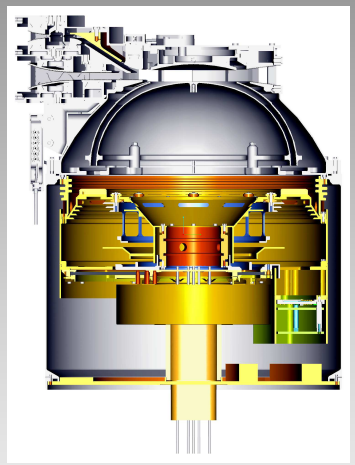
PLASTIC SUBSYSTEMS



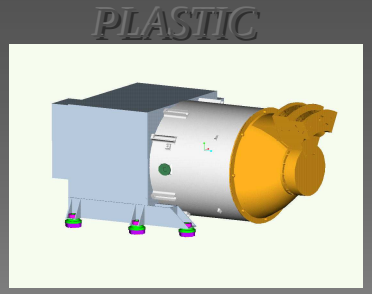
Entrance System

Time of Flight Chamber

Electronics Box



TOF Chamber and EBox



Flight Model TOF Chamber, EBox systems are still in fabrication.

Mechanical parts (UNH, MPE, U Kiel):

- **> 1200 machined parts required**
- **94% of parts have been fabricated/plated**
- **EM calibration results incorporated into ion optics**

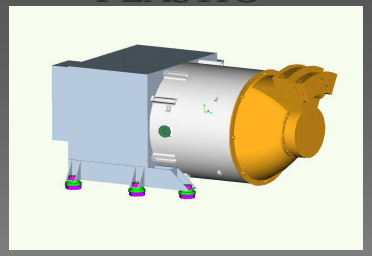
Electrical Assembly (UNH, MPE):

- **Continued population of PWBs**
- **ASIC packaging looking at alternative company**

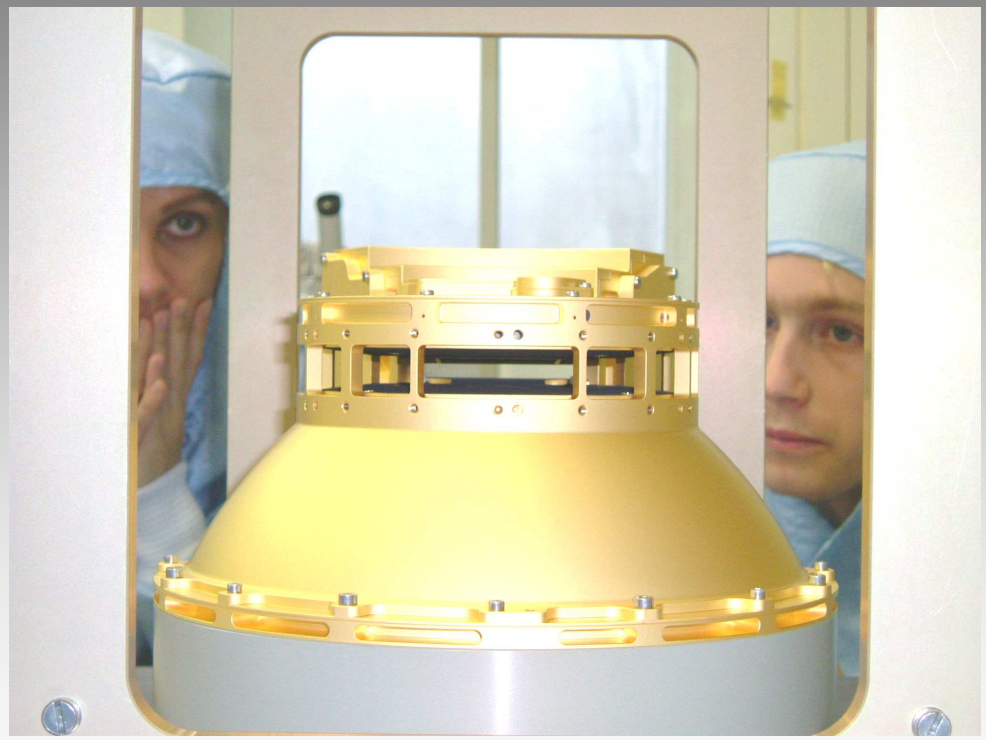
ACTEL programming

- **All updates from EM testing completed**
- **Currently checking SWEEP table implementation**

Entrance System



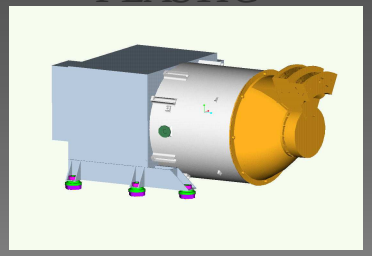
- Construction contract (Contraves Space) nearing completion
- FM1 & FM2 delivered to University of Bern (Nov 2003 & Jan 2004, respectively)
- Entrance System FM1 & FM2 testing underway at UBern



FM1 Entrance System Testing
University of Bern

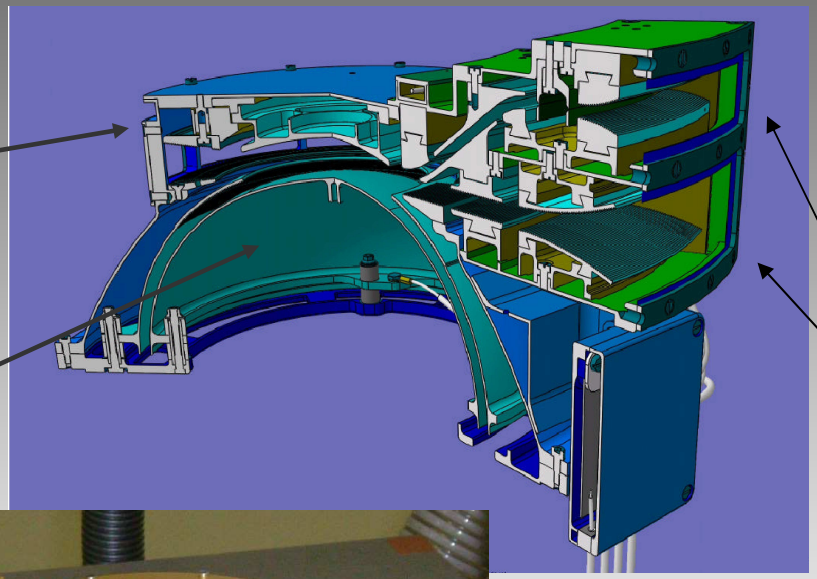
Entrance System Sections

PLASTIC



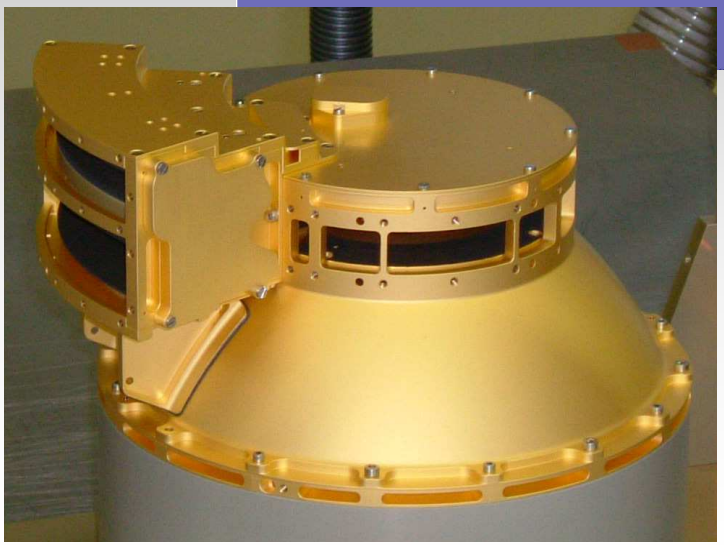
Wide Angle Partition (Suprathermal Ions)

Electrostatic Analyzer (E/Q selection, UV suppression)

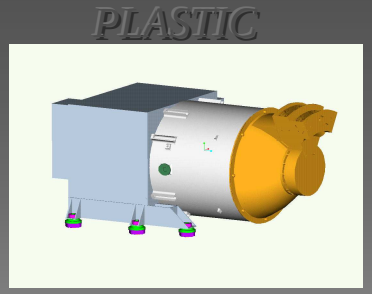


Solar Wind Sector:

Proton Channel
Main Channel
(Polar Angle Deflectors)



Entrance System Characterization



- Analyzer Constants:

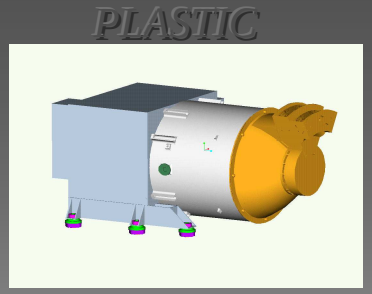
Ø Main Channel

Ø WAP

Ø Proton (S-Channel)

- Deflection Constants
- UV Suppression
- Main Gating Capability
- HV Capacity

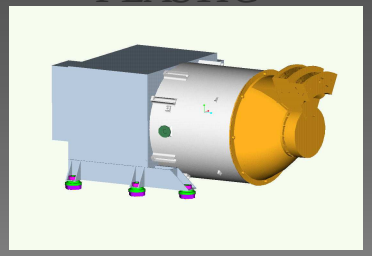
Entrance System FM 1

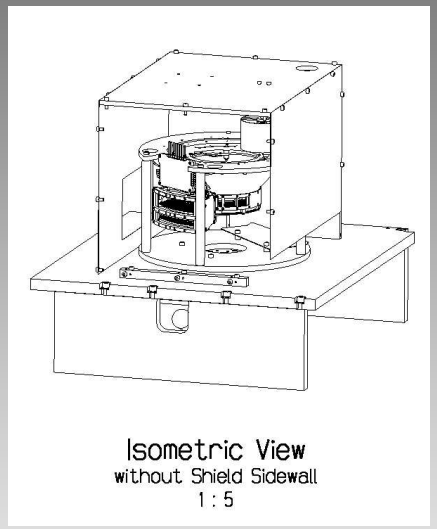


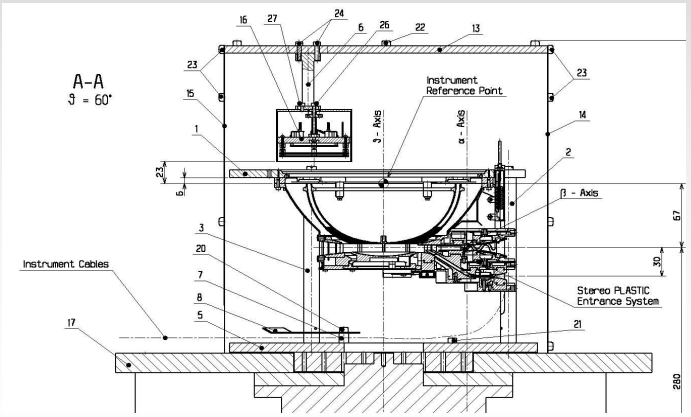
- UV Suppression verified
- Partial discharge tests successfully completed
- Thermal vacuum and vibration tests successfully completed
- Preliminary ion optics calibrations give expected results
- Cable harness rebuilt

PLASTIC Entrance System
CASYMS Test Set-Up (UBern)

PLASTIC

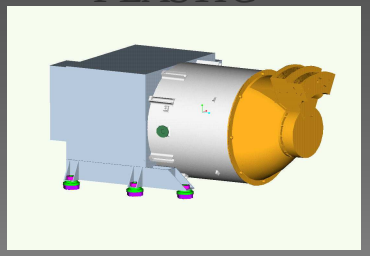


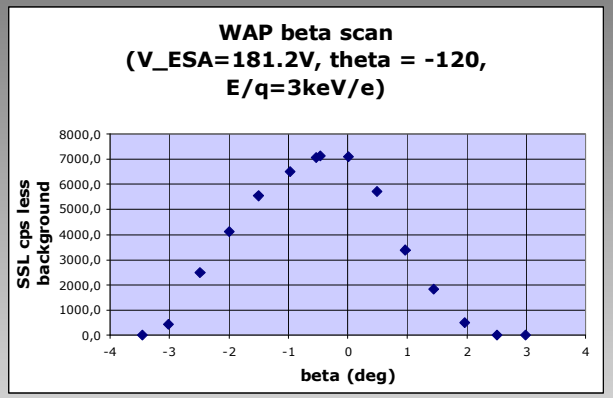


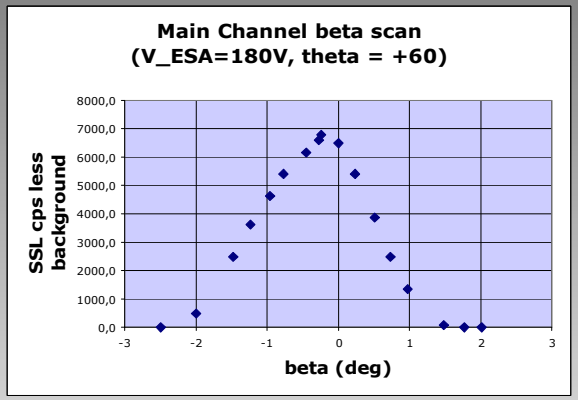


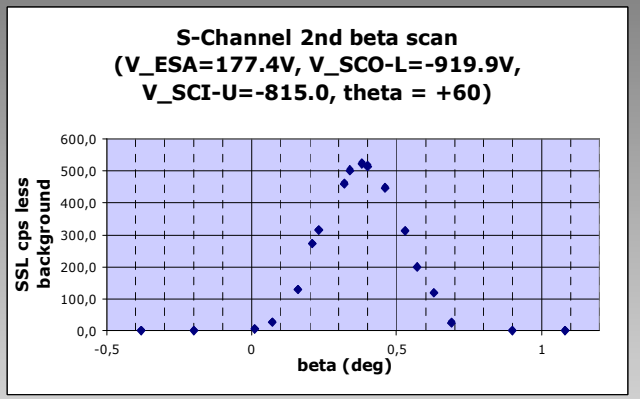
Polar Angle
WAP, Main and Proton-Channel

PLASTIC

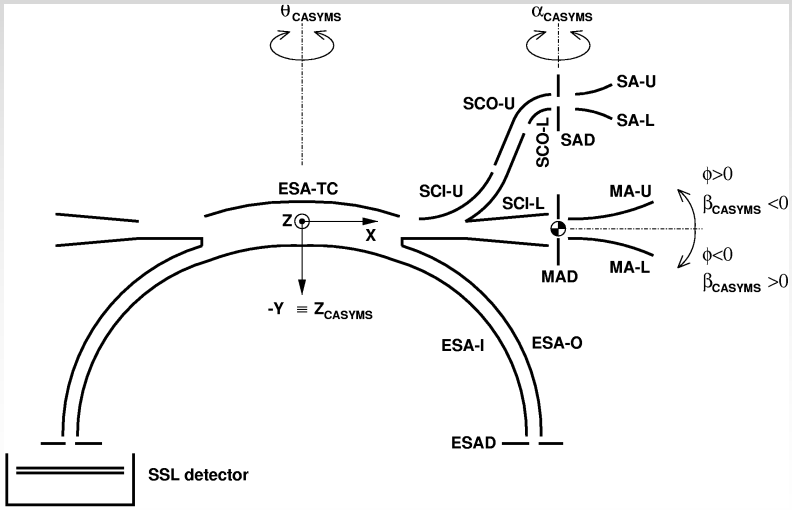






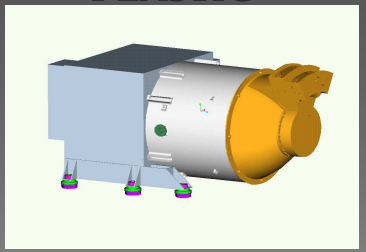


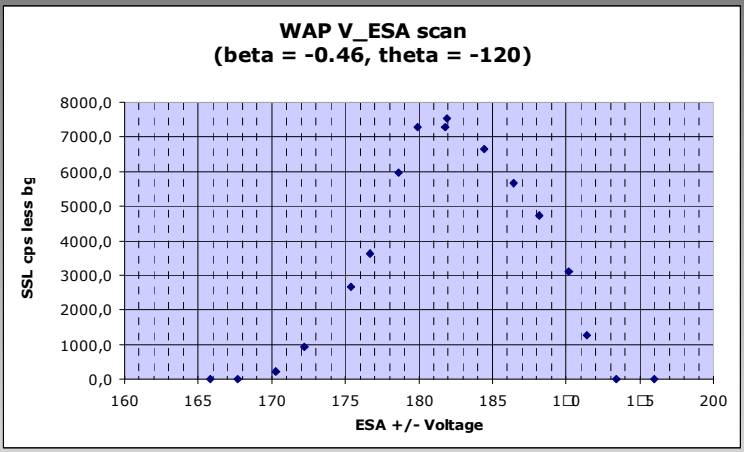
	Beta center (°)	Beta FWHM (°)
WAP	+0.5	3.2
Main Channel	-0.25	1.9
Proton - Channel	+0.37	0.37

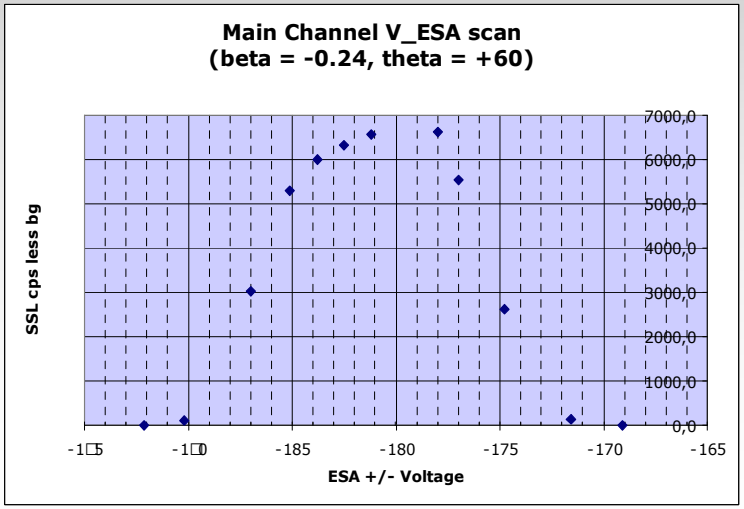


ESA Voltage Scan
WAP and Main Channel

PLASTIC







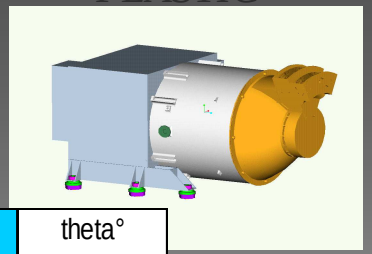
ESA Voltage	Voltage 3keV/e (Volts)	Energy Res. (FWHM)	Analyzer constant (eV/e V^{-1})	Active Area (cm^2)
WAP	182	7 %	8.24	0.891
Main Channel	180	6 %	8.33	0.548

$$k_{electrode} = \frac{\textbf{Energy per Charge}}{\textbf{Voltage difference Electrodes}} = \frac{E_{kin}/q}{V_{electrodes}}$$

$$A_{active} = \frac{n}{\Phi t} = \frac{n_{SSL}}{\Phi t \varepsilon_{SSL}}$$

Φ: Beam Flux (Hz/cm^2)

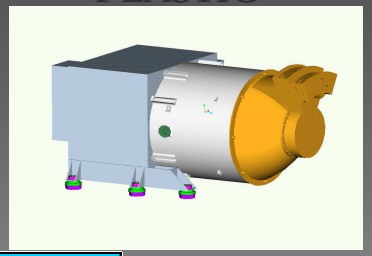
Summary of Entrance FM1 ion beam measurements



Energy Tuning	electrode	Voltage for 3keV/e (Volts) FM1 Measurement	EQM Measurement		Energy Resolution (Voltage FWHM) FM1 Measurement	EQM Measurement	Simulations	theta°
S-Channel	SCO-L	-920	-870	N/A	10%	11%		
	SCI-U	-815	-815		13,5%	12%		
	ESA ±	177,4	177		6,2%	5,8%	9,8%	
Main Channel	ESA ±	180	179,7	N/A	6%	5,8%	6,5%	60
WAP	ESA ±	182	182,3	N/A	7% (-120°)	6.3% (-120° 6.7% (-30°)	7%	-120 -30

	electrode	Analyzer Constant (eV/e V^{-1}) FM1 Measurement	EQM Measurement	Simulations	Active Area (cm^2) FM1 Measurement	EQM Measurement	Simulations
S-Channel	SCO-L	3,26	3,45	3,329	2,15E-03	3,07E-03	
	SCI-U	3,68	3,68	3,803	2,10E-03	4,05E-03	
	ESA ±	8,46	8,47	8,344	1,51E-03	3,27E-03	6,00E-04 estimation
Main Channel	ESA ±	8,33	8,35	8,127	0,548	0,715	1,400
WAP	ESA ±	8,24	8,23	8,127	0,891	0,944	1,680

Summary of Entrance FM1 ion beam measurements

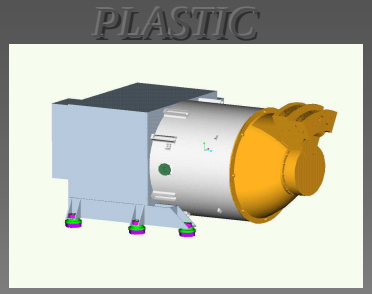


Taken for Ar^+ beam 3 keV/e		beta center (°)			beta FWHM (°)		
		FM1 Measurement	EQM Measurement	Geometry	FM1 Measurement	EQM Measurement	Geometry
S-Channel		**+0.37°**	**+0.47°**	**-0.039 (FM1) 0.0 (EQM)**	**+0.37°**	**0.4°**	**0.36° (FM1) Simulations 0.55°**
Main Channel		**-0.25°**	**+0.86°**	**N/A**	**1.9°**	**1-2 °**	**2.9°**
WAP		**0.5°**	**-0.4°**	**N/A**	**3.2°**	**3.5°**	**-5°/+6°**

		slope (V) ($° V^{-1}$)			duckbill deflection constant ($° keV/e V^{-1}$)		
		FM1 Measurement	EQM Measurement	Simulations	FM1 Measurement	EQM Measurement	Simulations
S-Channel		**0,0389**	**0,0384**	**-**	**0,1167**	**0,1152**	**0,0981**
Main Channel		**0,0426**	**0,0429**	**-**	**0,1278**	**0,127842**	**0,125**
WAP		**N/A**	**N/A**	**N/A**	**N/A**	**N/A**	**N/A**

Note that beam position is known to ~1°

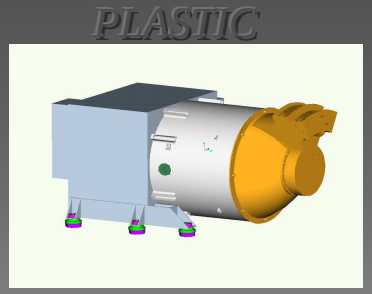
Ion Beam Test Summary



- Analyzer constants according to simulations
- E/q selection according to simulations
- Angle selection according to simulations
- Active Area according to simulations

Ø Entrance System achieves the required values and constants

Entrance System Test - Partial Discharge



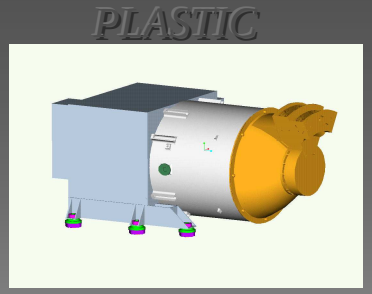
Flight Model 1

- All electrodes verified to 130% flight operational level
- Exception ESA-I to 125%
- Entrance System HV operation verified
- Remaining task to verify re-built and mounting cable harness

Flight Model 2

- All electrodes verified to 130% flight operational level!!
- Entrance System HV operation verified

Entrance System UV Suppression

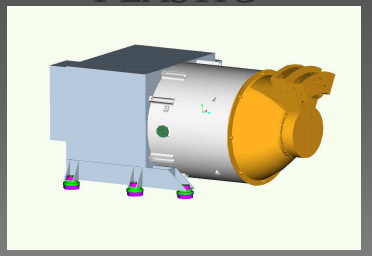


- Solar UV can generate spurious detector counts.
  - Carbon-foil
  - MCPs

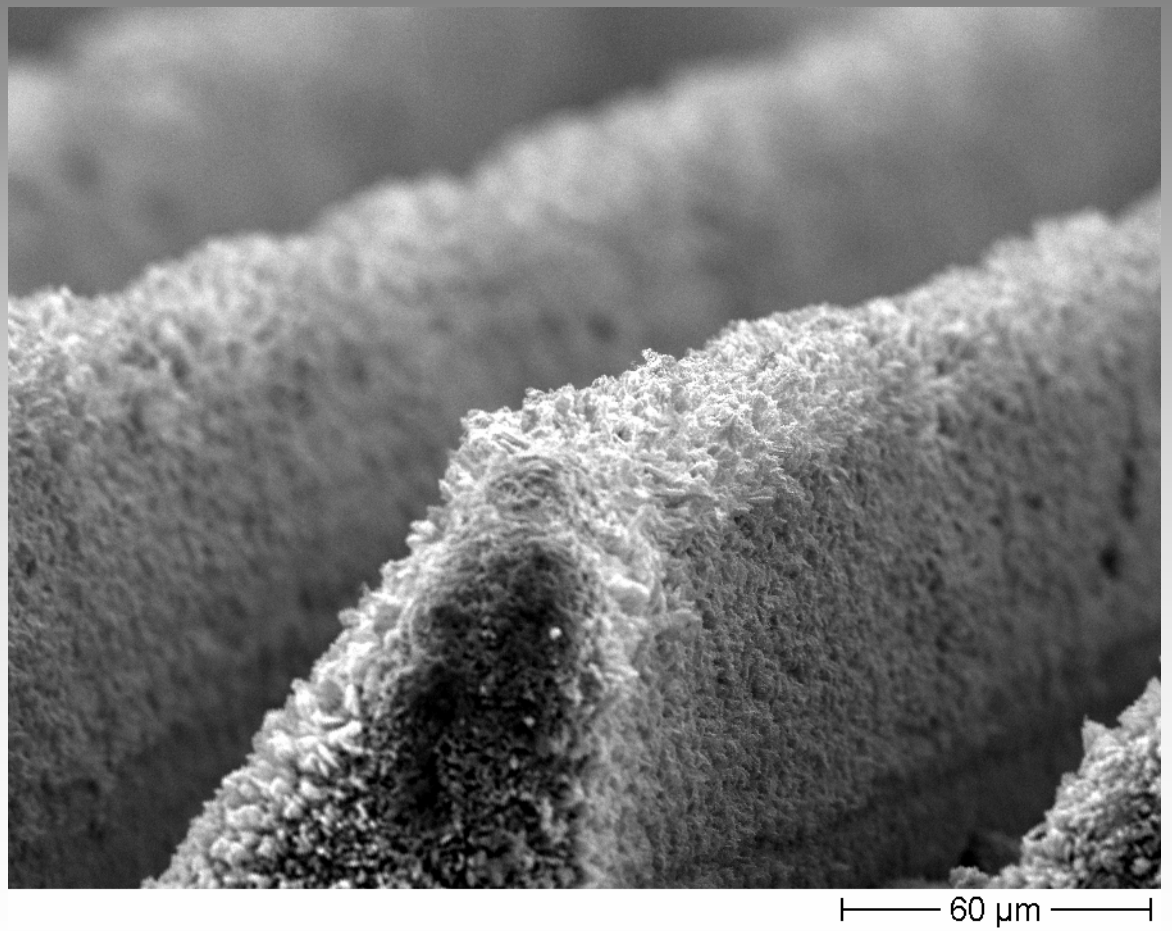
F PLASTIC requires a suppression factor SF ~ 10^8-10^9 in order to limit the detector UV noise to ~ 1 count/s

UV Suppression

PLASTIC

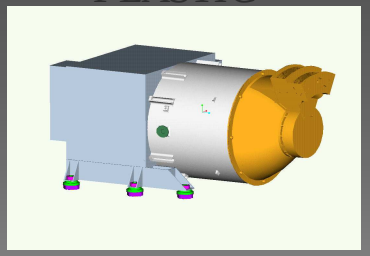


- Ø Serration
- Ø Multiple Bounce
- Ø CuS surface
  - Ø Isotropic scattering
  - Ø absorption

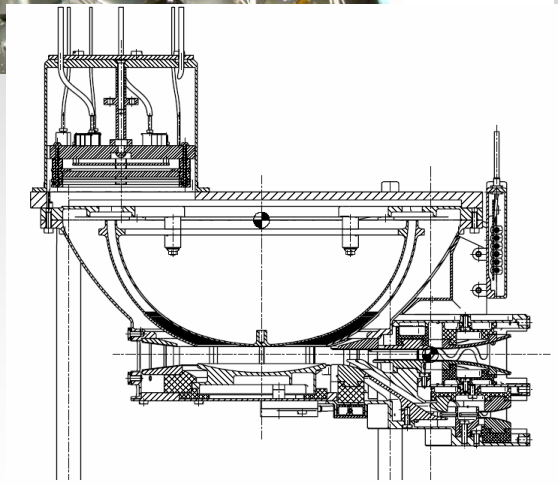


UV Suppression

PLASTIC

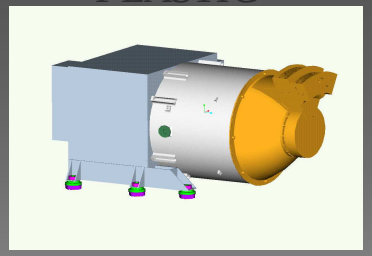


- Calibrations
  - Mefisto laboratory (University of Bern)
  - 9/9/2003 - 27/2/2004
  - UV source
  - SSL detector: 3 MCPs
  - vacuum chamber

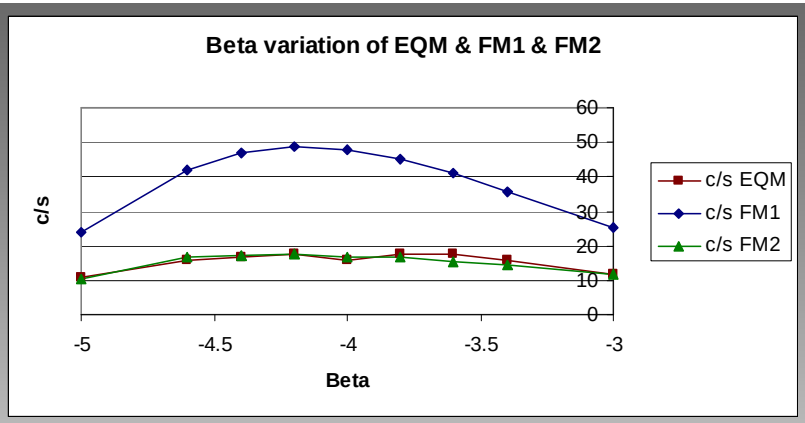


UV calibration results

PLASTIC

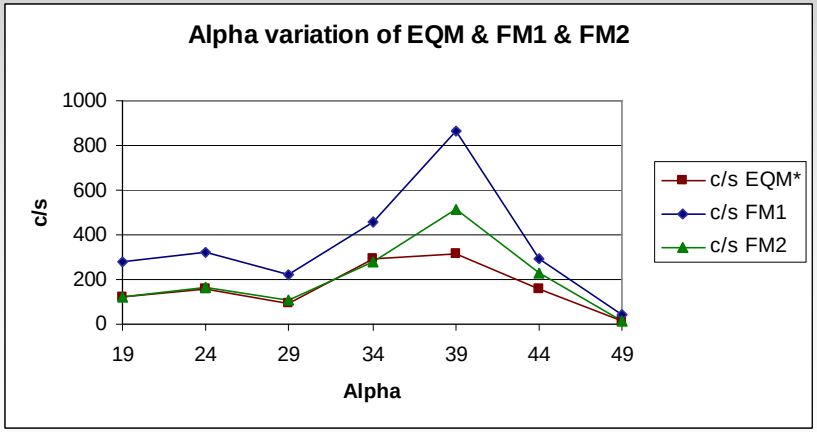


β-angle variation
all at α = 49°



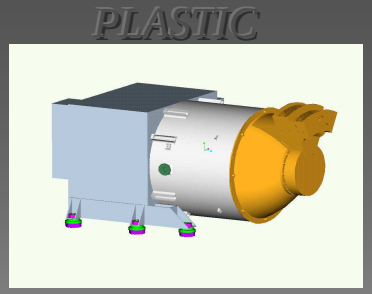
- **FM1 count rate higher by 2.1 – 3.0 than EQM count rate.**
- **FM2 count rate is approx. the same as EQM count rate.**

α-angle variation
EQM at β = -3.8°
FM1 at β = -4.0°
FM2 at β = -4.0°



- **FM1 count rate higher by 1.6-2.8 than EQM count rate.**
- **FM2 count rate is approx. the same as EQM count rate.**

UV Suppression Summary



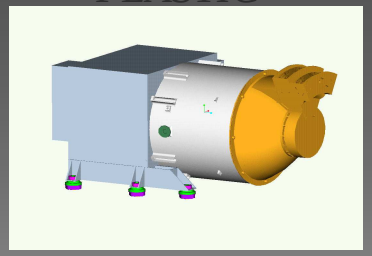
Flight Model 1

- CuS exhibited imperfections - accepted pending PD & UV tests
- Suppression factor 1.3×10^9 (SF_{EQM} 4×10^9)

Flight Model 2

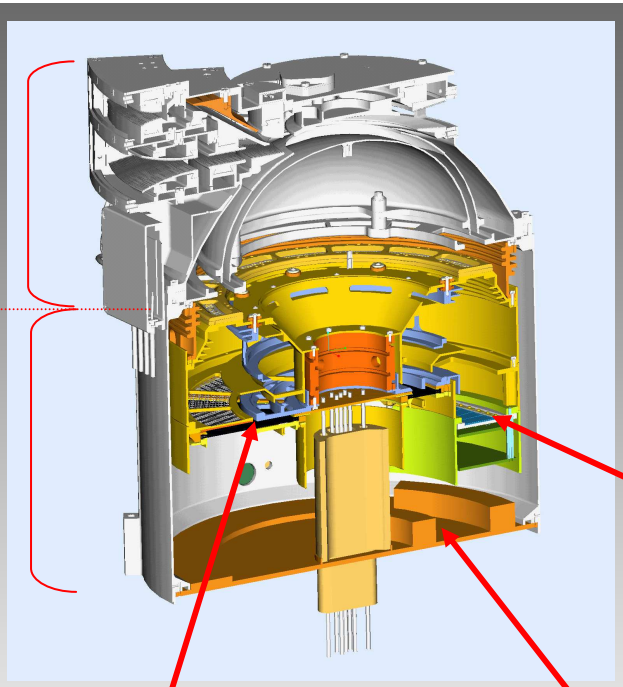
- High quality CuS coating
- Suppression factor 2.4×10^9

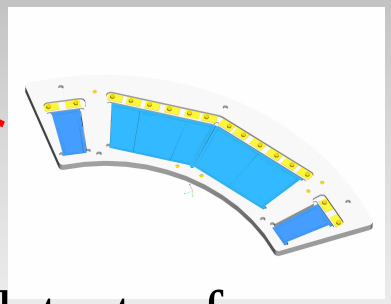
Detectors in the PLASTIC Instrument



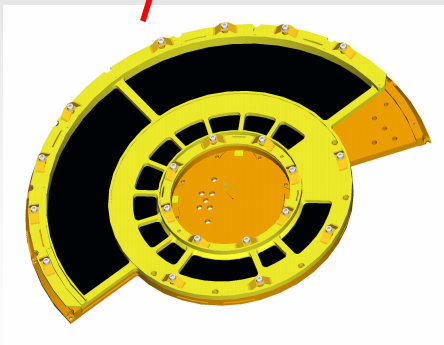
Entrance System

Time of Flight Section





SSD detector frame

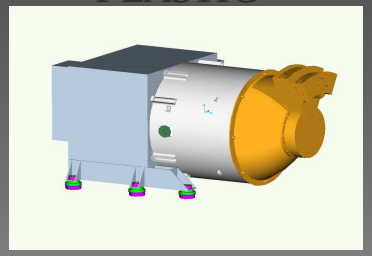


Signal Board (Anodes)

MCP detector mounting

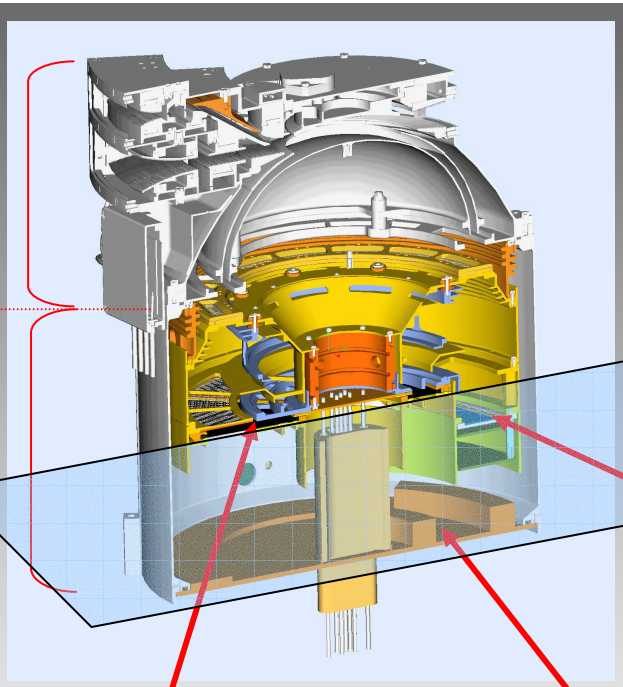
PLASTIC

Detectors in the PLASTIC Instrument

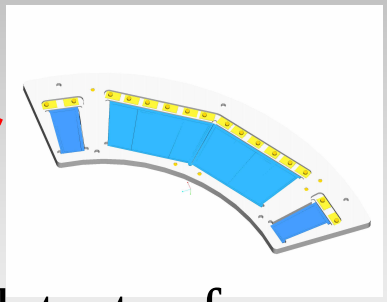


Entrance System

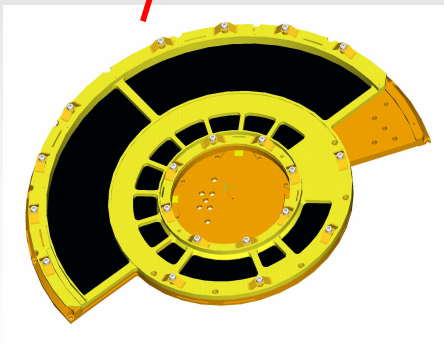
Time of Flight Section



MCP Detection Plane



SSD detector frame



Signal Board (Anodes)

MCP detector mounting