COS
Monthly Status Review
December 10, 2002
Ball

Agenda

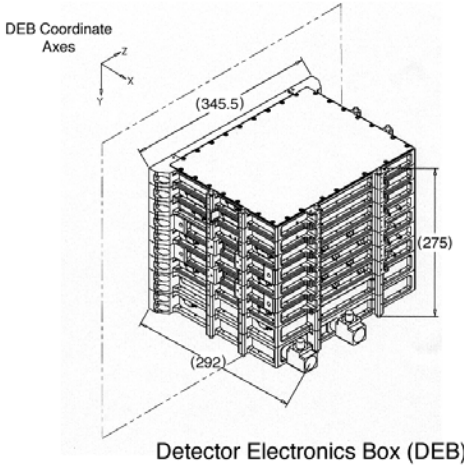
Progress Summary Since Last Monthly	J. Andrews
UCB FUV Detector Programmatic Status	J. Andrews
UCB FUV Detector Technical Status	O. Siegmund
Software/Ops	J. Andrews
Schedules	J. Andrews
Descope Report	J. Andrews
Upcoming Events/Activities	J. Andrews
CU Issues & Resolution Plan	J. Andrews
BATC Presentation	R. Higgins
Financial Splinter	GSFC/Ball/CU

Progress Summary Since Last MSR

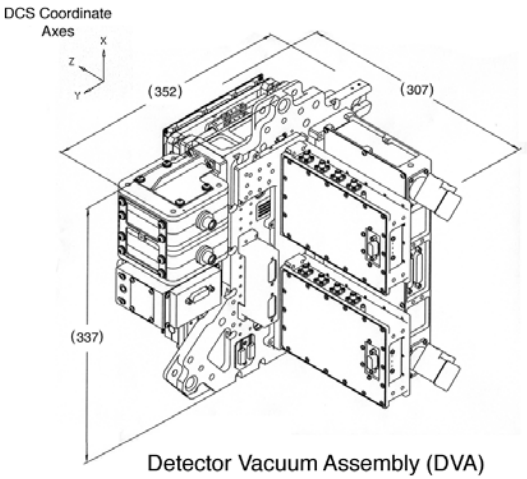
- Implemented O-ring "fix" to FUV-02 vacuum leak.
- Restarted FUV-02 acceptance flow.
- Continued COS TV and calibration planning and preparation and baselined early instrument ship to GSFC for acoustics, EMI, etc.

Overview of FUV Detector Assemblies

- **DEB** - (**D**etector **E**lectronics **B**ox)
  - **DCE** (**D**etector **C**ontrol **E**lectronics))
  - **TDCs** (**T**ime-**to**-**D**igital **C**onverters)
  - **HVPS** (**H**igh **V**oltage **P**ower **S**upply)
  - **LVPC**(**L**ow **V**oltage **P**ower **C**onverter)
- **DVA** - (**D**etector **V**acuum **A**ssembly)
  - **VHA** (**V**acuum **H**ousing **A**ssembly)
    - Detector Door Mechanism
    - Ion Pump Assembly
  - **DBA** (**D**etector **B**ackplate **A**ssembly)
    - **Amplifiers**
    - **HVFM (H**igh **V**oltage **F**ilter **M**odule)



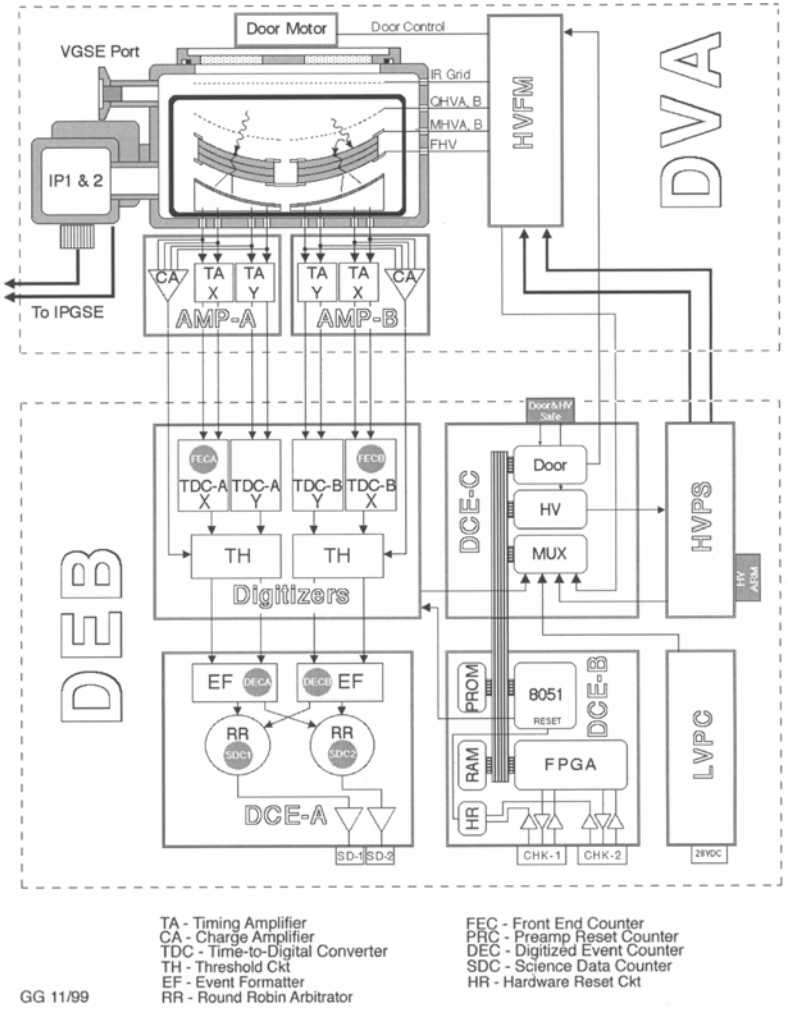
Detector Electronics Box (DEB)



Detector Vacuum Assembly (DVA)

FUV Detector Subsystem Block Diagram

- UCB is under contract to deliver 1 flight FUV detector subsystem (FUV-01) and 1 flight-spare detector subsystem (FUV-02).



FUV Detector Overview

- FUV-01 was delivered to Ball on Wednesday, July 31st.
- FUV-01 has operated flawlessly since its integration into the instrument and has accumulated > 72 hours of instrument level run-time (>50% of that time was with HV on).
- FUV-02 is in processing now at UCB:
  - Vacuum seal has been fixed with shaped o-ring.
  - Fix has been vibed with ETU assy. At qual levels, shortened duration.
  - 02 unit is back in processing at UCB now.

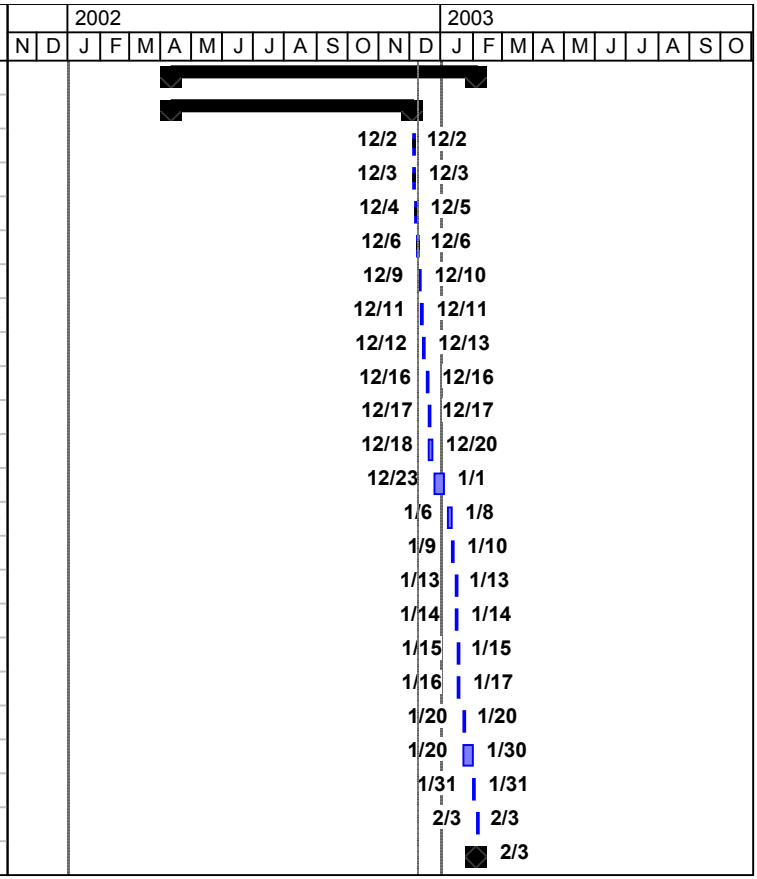
FUV Detector Verification Testing Summary

Unit	Functional Testing	Performance Testing	EMI/EMC	Sine Burst	Random Vibe	Thermal-Vac	Contamination Certification
FUV-01 DVA	C	C	@SS	A - C	A - C	@SS	@SS
FUV-01 DEB	C	C	@SS	Q - C	Q - C	@SS	@SS
FUV-01 SS	C	C	C	@Comp	@Comp	8-cycles	C
FUV-02 DVA	P	P	N/R	Q - P	Q – P, C	@SS	@SS
FUV-02 DEB	C	C	N/R	A - P	A - P	@SS	@SS
FUV-02 SS	P	P	N/R	@Comp	@Comp	8-cycles	P
DVA Surrogate (1)	C	N/R	N/R	C	C	N/R	N/R
DVA Surrogate (2)	C	N/R	N/R	C	C	C	N/R

C Complete
@SS At Subsystem
A Acceptance Levels
Q Qualification Levels
N/R Not Required
P Planned
(1) Old Door Mechanism
(2) New Door Mechanism

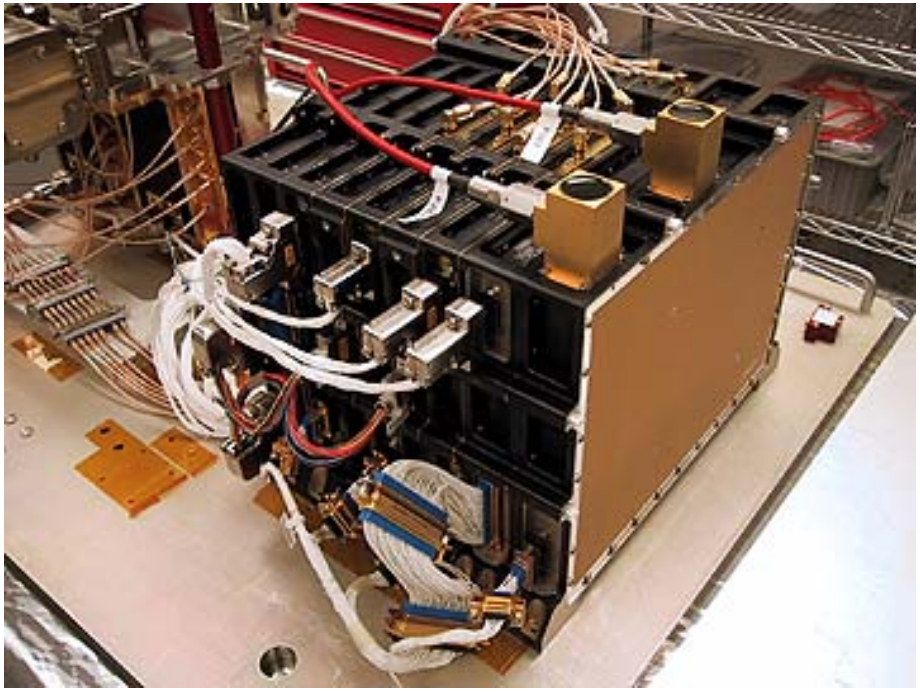
— ETU DVA w/shaped o-ring qual vibed at NASA Ames
— DVA-02 to see qual-level vibe at LMMS
— FUV-02 to see 8 cycle T/V at CU
— DEB-01 to see 1-axis workmanship vibe at Ball

ID	Task Name	Start	Finish
1	**QUALIFICATION OF FUV#2**	**Wed 4/10/02**	**Mon 2/3/03**
2	**FUV-02 Final Build-up**	**Wed 4/10/02**	**Mon 12/2/02**
27	FUV 02 QE check	Mon 12/2/02	Mon 12/2/02
28	Break vacuum and reconfigure system	Tue 12/3/02	Tue 12/3/02
29	Mini-scrub of FUV02	Wed 12/4/02	Thu 12/5/02
30	Break vacuum and reconfigure system	Fri 12/6/02	Fri 12/6/02
31	Final post scrub QE calibration	Mon 12/9/02	Tue 12/10/02
32	Break vacuum and reconfigure tank	Wed 12/11/02	Wed 12/11/02
33	Final flat field measurement	Thu 12/12/02	Fri 12/13/02
34	Pre-vibration functional testing	Mon 12/16/02	Mon 12/16/02
35	Fit check on BATC shake fixture	Tue 12/17/02	Tue 12/17/02
36	Final staking etc Close-outs on DVA and DEB	Wed 12/18/02	Fri 12/20/02
37	Xmas break	Mon 12/23/02	Wed 1/1/03
38	Qual Vibration testing of DEB#2 and DVA#2 at Lockheed with BA	Mon 1/6/03	Wed 1/8/03
39	Post-vibration functional check	Thu 1/9/03	Fri 1/10/03
40	Final System Functional testing	Mon 1/13/03	Mon 1/13/03
41	Pack detector for shipment	Tue 1/14/03	Tue 1/14/03
42	**Ship FUV02 detector system to UCo**	**Wed 1/15/03**	**Wed 1/15/03**
43	Install detector system into UCo T-V chamber	Thu 1/16/03	Fri 1/17/03
44	Pre-pump down functional testing	Mon 1/20/03	Mon 1/20/03
45	System T-V tests	Mon 1/20/03	Thu 1/30/03
46	System cleanliness certification - Location TBD	Fri 1/31/03	Fri 1/31/03
47	Remove flight system and pack	Mon 2/3/03	Mon 2/3/03
48	**Flight FUV#2 system ready for BATC**	**Mon 2/3/03**	**Mon 2/3/03**

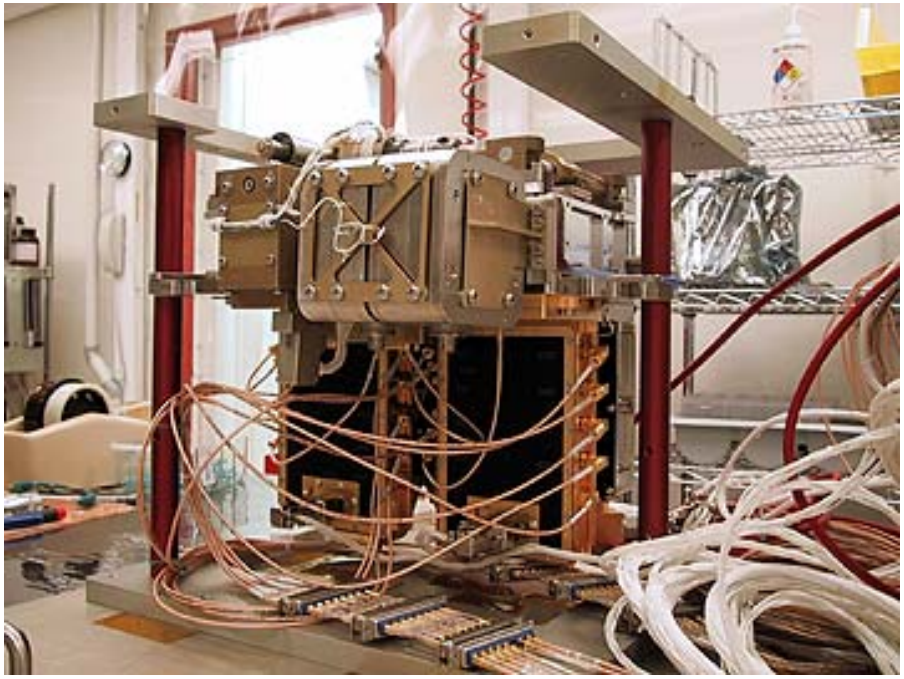


COS FUV Detector Systems

- Detector DEB



- Detector Head



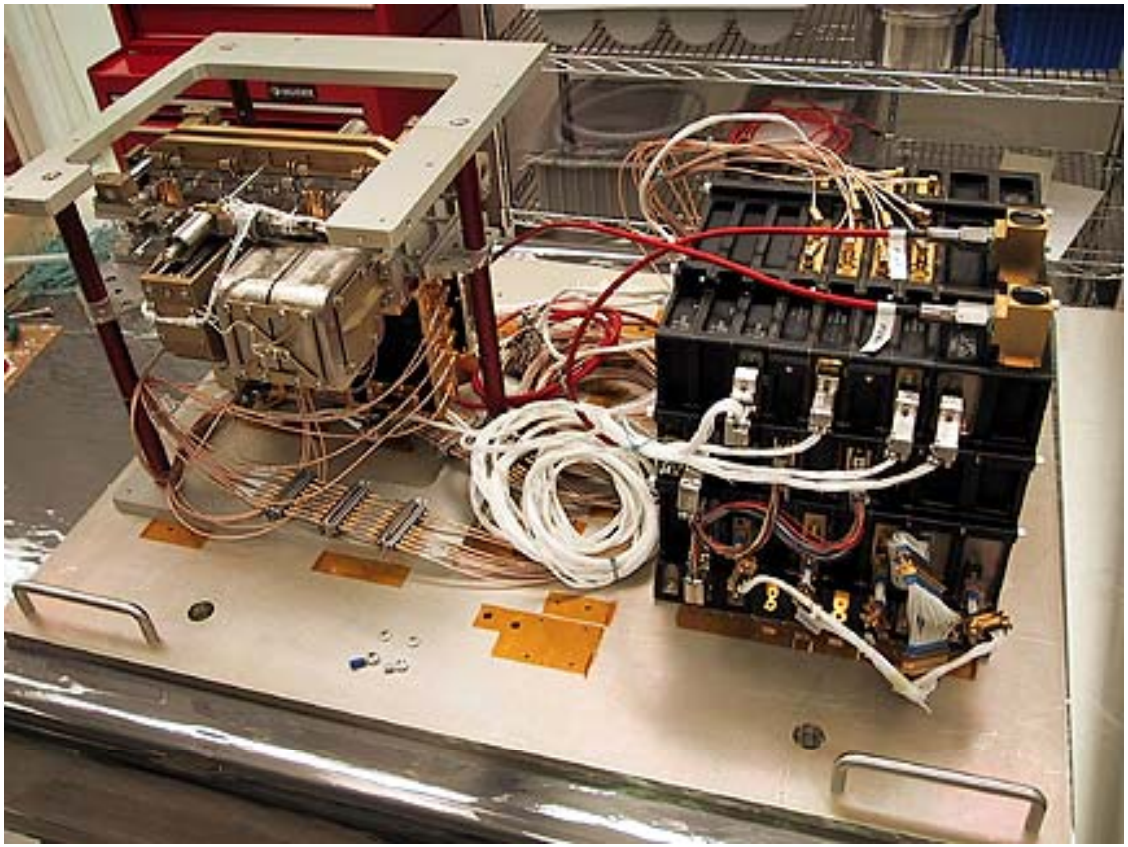
Flight FUV01 Detector System

Completed thermal vacuum at CU, delivered to Ball 7/31.

Post delivery functional tests nominal.

Cleanliness certification at Ball completed successfully.

Alignment tests done.



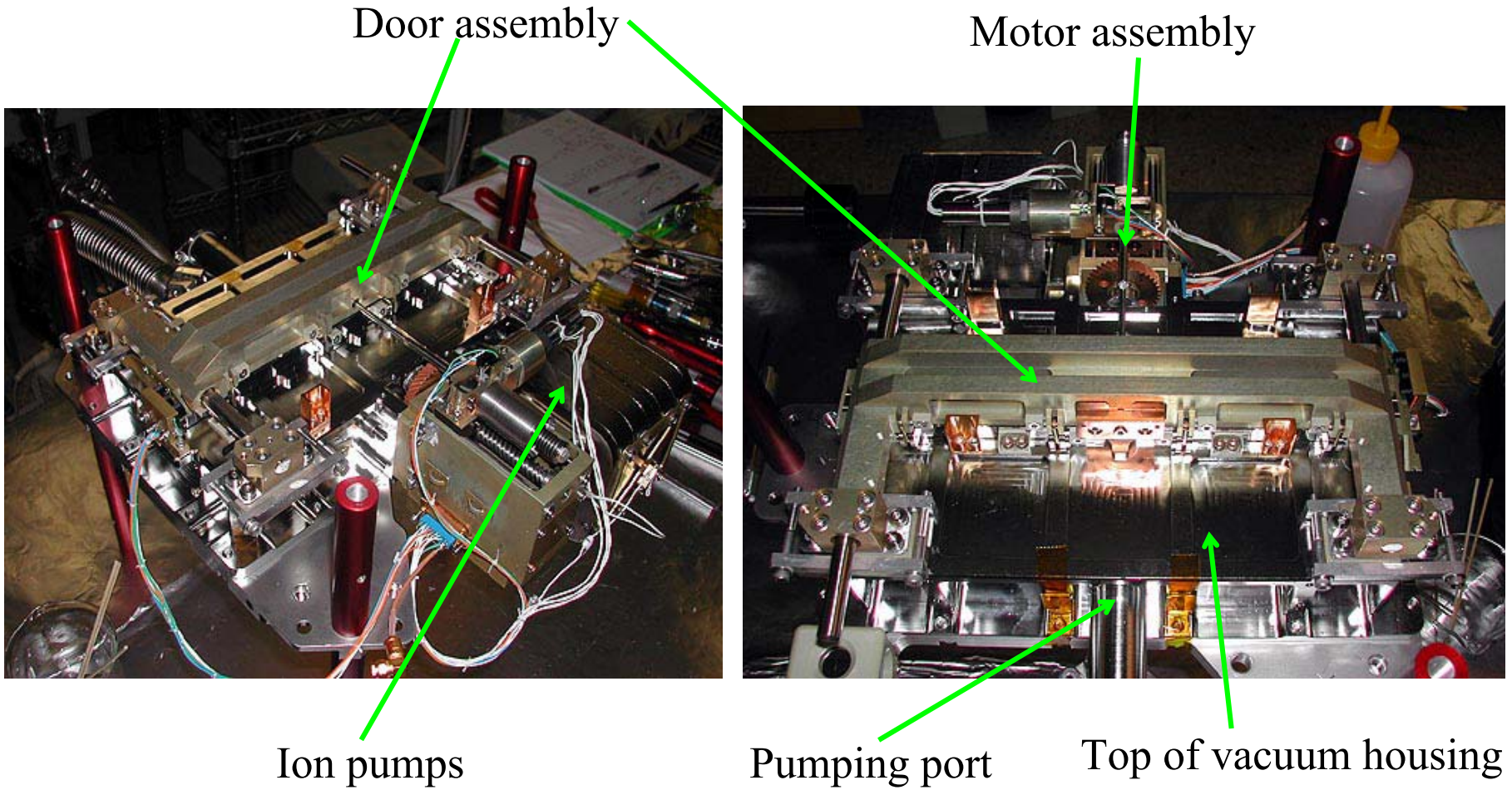
Status for FUV01

- Ship to CU -- Arrived 7/19, Thermal vacuum test -, begun 7/23
- Thermal vacuum finished successfully
- Delivered to Ball - 7/31, functional test completed - OK
- Repeated cleanliness certification at Ball - OK
- Alignment tests completed at Ball
- Two minor DEB repairs done,
  - Replaced torn HVFM connector socket rubber boot
  - Replaced rotating jack post on one “D” connector on DCE
- One axis acceptance shake of DEB done successfully at Ball
- Harnesses were routed and connected in flight configuration

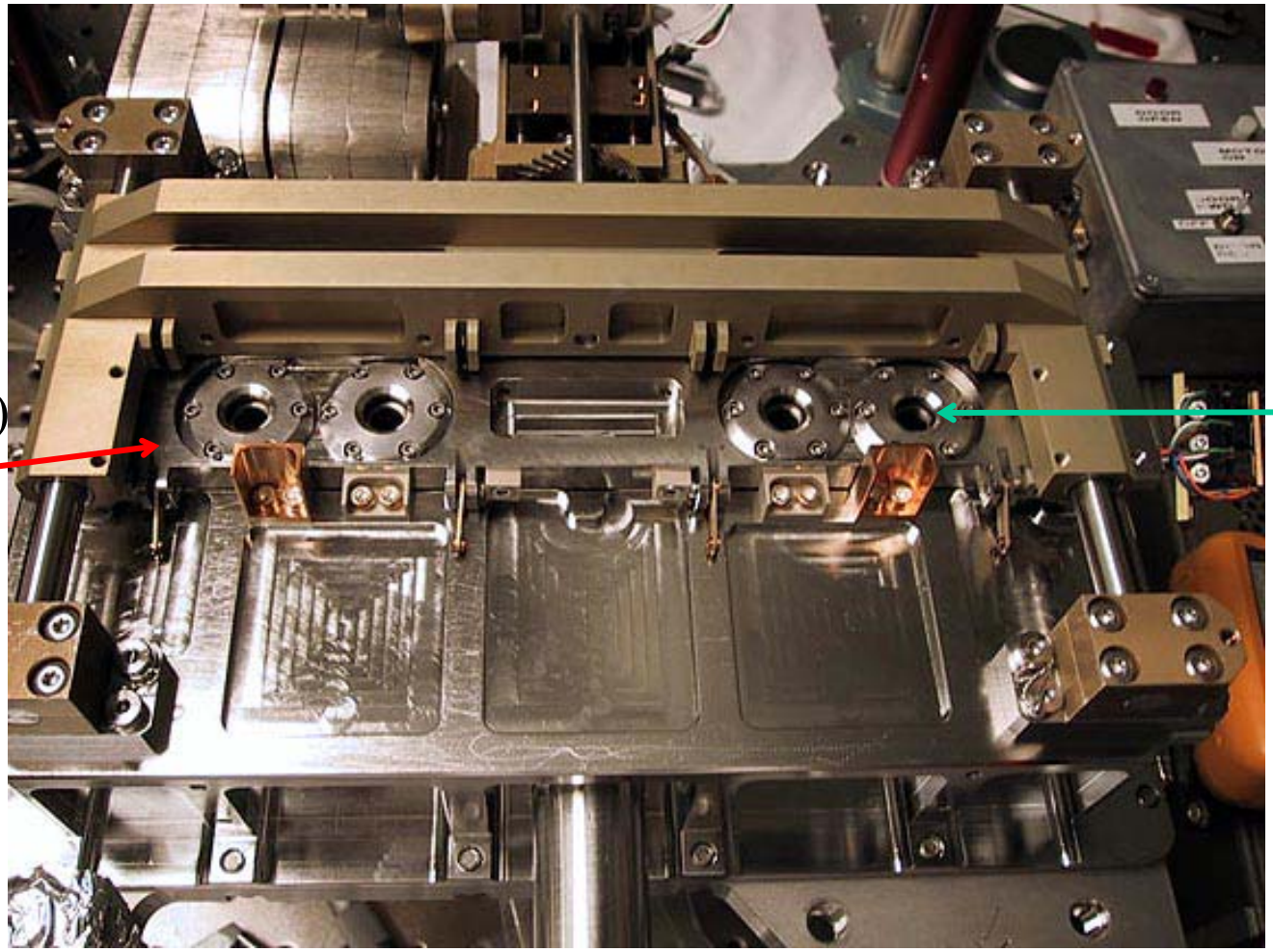
UCB FUV02, Flight Backup Detector, Status

- **DEB & Harnesses**
  - Completed and tested successfully.
- **Detector integrated with Vacuum Housing Assembly** .
  - Completed functional test and MCP "deep" scrub
  - New cathode deposition done, QE's measured better than FUV01.
  - While preparing for mini-scrub noticed small VHA leak at full atmosphere
- **Vacuum Housing Assembly (VHA)**
  - Small, intermittent, leak discovered at door/VHA seal
  - Re-greased "O" ring and seal was OK
  - Initial evaluation showed known sag of VHA (0.005") at atmosphere but also indicated a small (0.007") bowing of the VHA seal at one specific area.
  - Proposed two main solutions, "shaped" O ring, and match machining of door.
  - EDM match machined prototypes proceeding, but slower than "O" ring effort.
  - Shaped "O" rings were received and tested successfully.
  - Shaped "O" ring has been installed in FUV02 and test sequence is proceeding

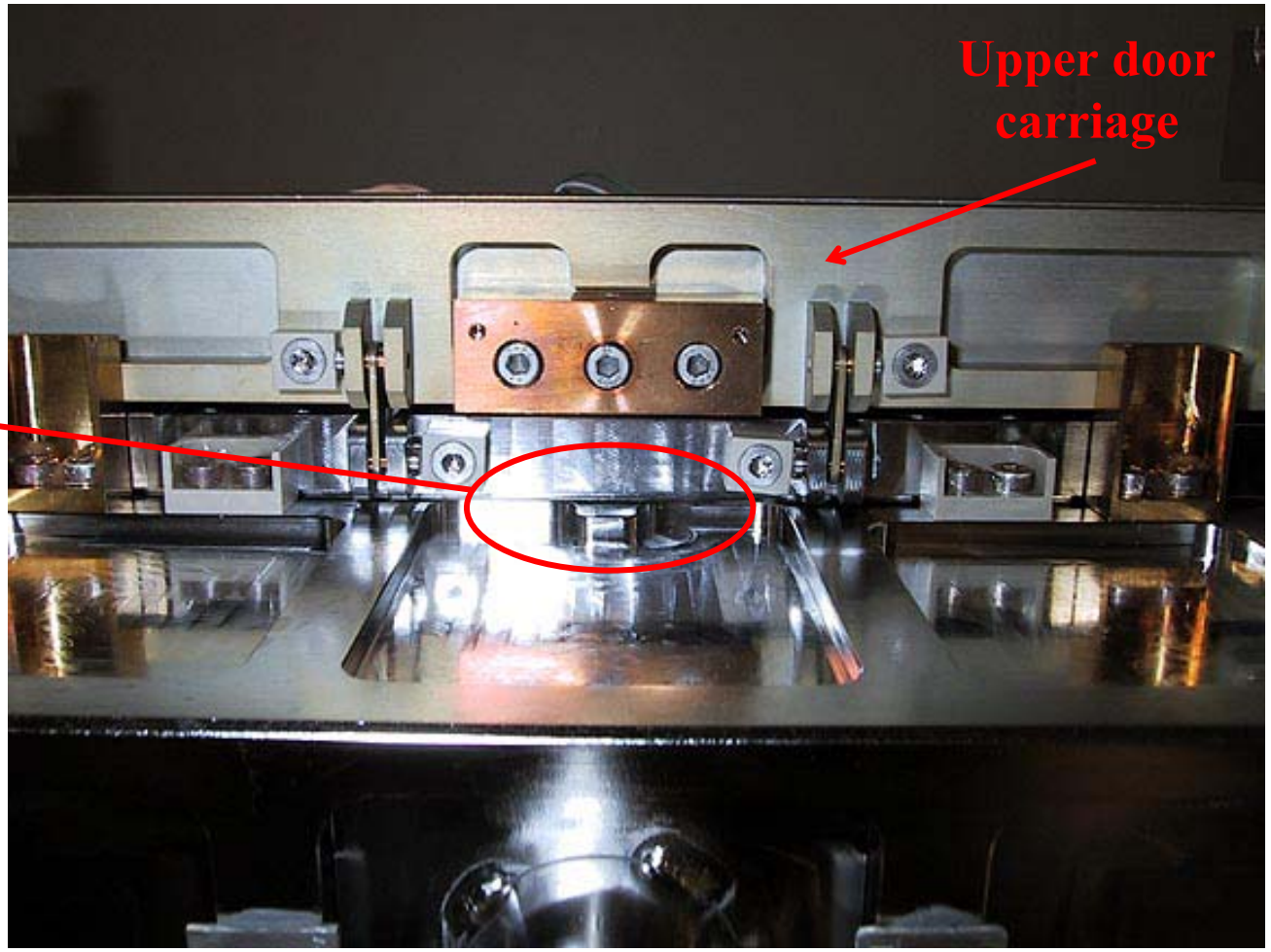
FUV02 VHA completed assembly

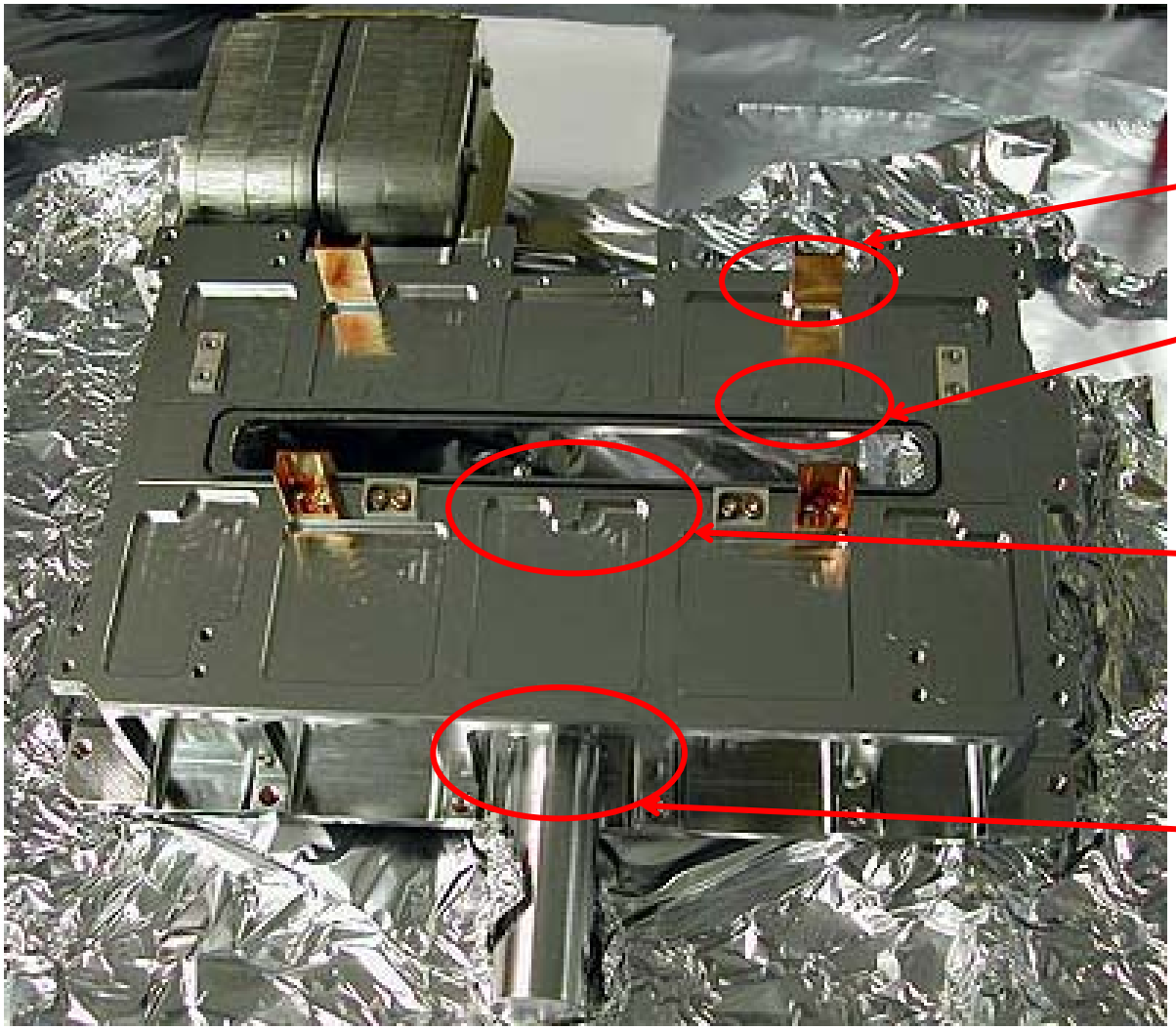


Lower door detached from upper door (links disconnected)



Door assembly attached to VHA





FUV02 VHA with ion pumps, showing metrology

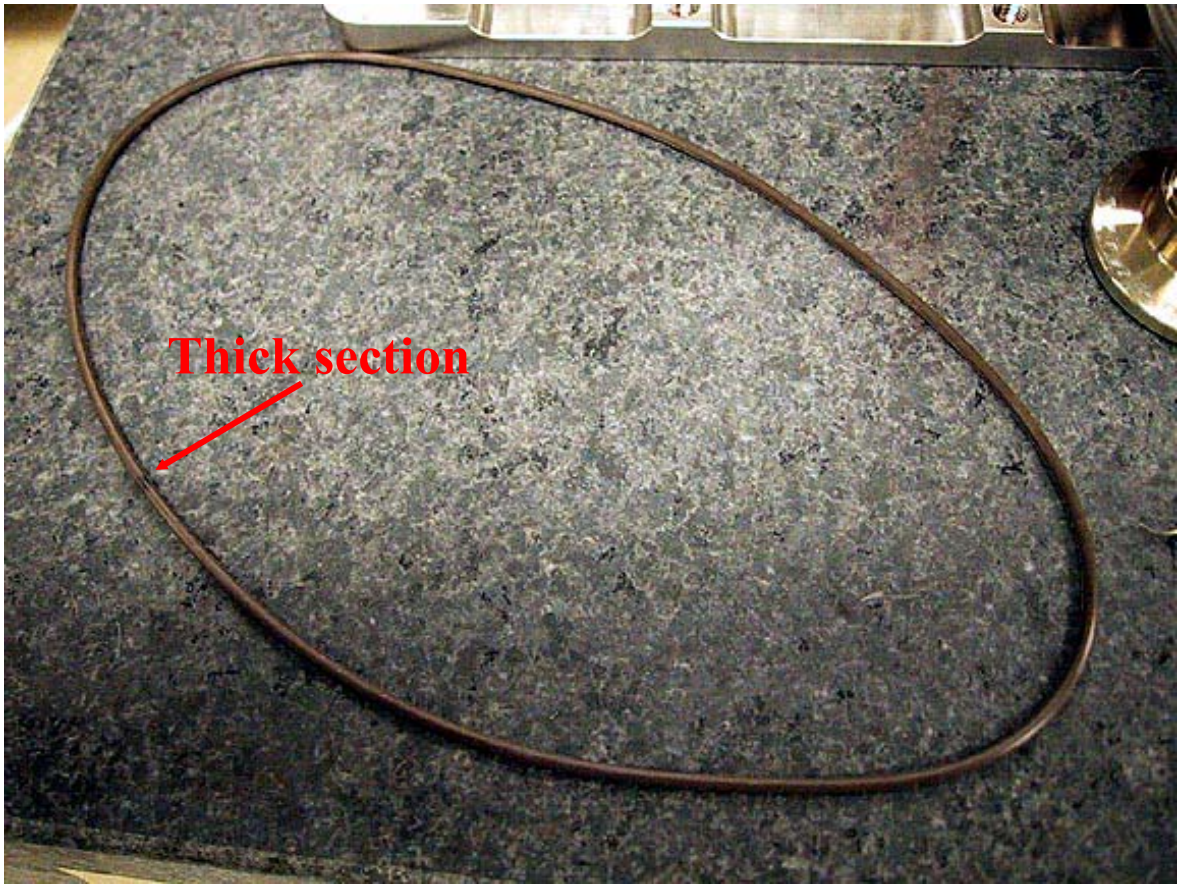
Ion grid SMA location

~0.0015” dip

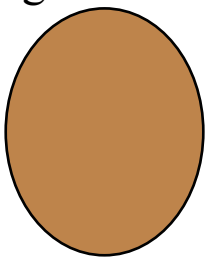
~0.007” dip

Pumping port weld area

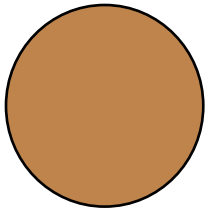
FUV02, New "O" ring design



IER, custom, viton.
0.070" diam, with
0.077" section in one
axis graded over 7"



Parker 2-050,
Standard, viton



0.070" diam

FUV02, VHA Seal Leak, Status

- We have two doors, FUV01 and FUV02 both flat to better than ~0.001”
- We suspect that the FUV02/ETU VHA distortions were incurred when the pumping ports and SMA feedthroughs were welded in.
- Door/VHA has accumulated >40 successful operations,
  - There is probably a re-distribution of grease on the “o” ring with ops
  - Leak appears only at 1 Atm differential, after many operations
- After “o”ring regrease the VHA sealed and there was no leak
  - But - requires 20 lb force to create leak after re-grease
- Blanks of door with weight relief were made and sent for EDM reshaping as part of door re-work solution, EDM blanks completed but after “O” ring solution was complete.
- Shaped “O” rings with a fat section where the leak occurs were ordered
- IER shaped “O” rings were used for test, measurement and qualification

FUV02, VHA Seal Leak, Progress

- Proceeded with "o" ring replacement
  - Metrology gives detailed measure of shape of the seal surface & gaps
  - Removed FUV02 "O" ring seal and substituted new "O" ring
  - Checked the gap measurements & tested the vacuum seal - OK
  - Ran door operation tests (40 cycles) re-verifying seal and metrology
  - Did Qual level shake test with FUV02 DVA and ETU DBA at AMES
    - Under vacuum with ion pump pressure monitored
    - Showed no anomalies compared to expected behavior
  - Checked the gap measurements & tested the vacuum seal - OK
  - Re-installed detector/DBA and continued with FUV02 completion plan
  - This minimized disassembly of VHA (none on DBA) and risk to assy
  - Door did not need reshimming, door was only removed/reinsalled
  - Achieves desired uniform seal "o"ring compression

FUV02, VHA Seal Leak, Status

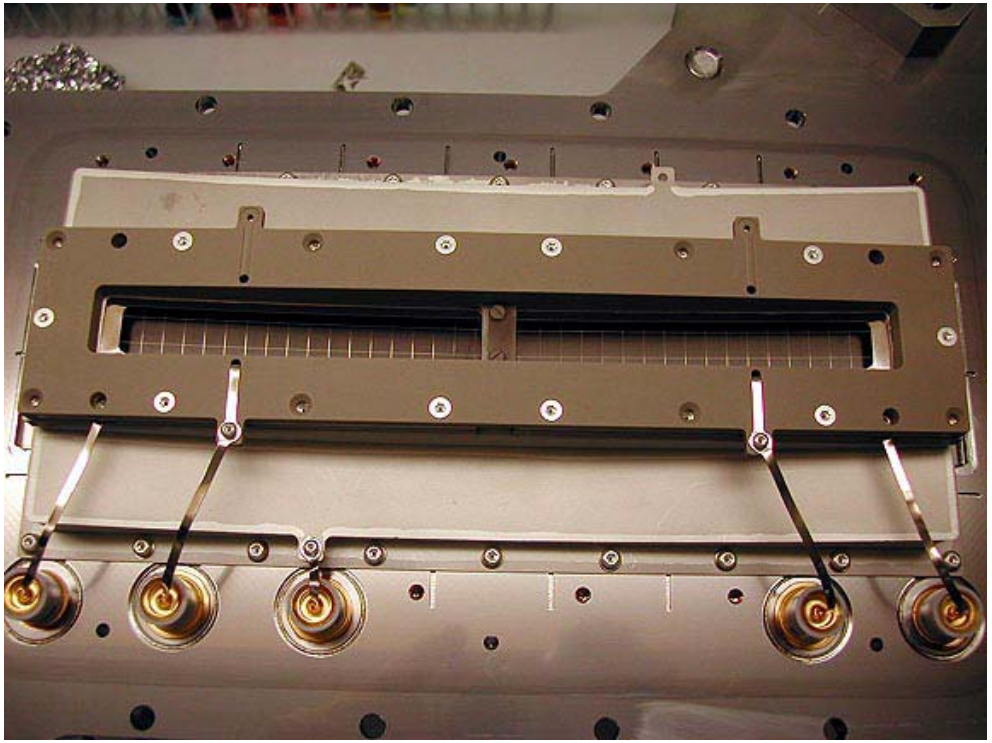
- Door seal gap is set at ~0.007" during door installation
- We have four Vacuum Housings (Spec is <0.002" seal flatness)
  - FUV01 - records indicate door seal gap is ~0.007" and uniform
  - FUV02 - seal surface shows extra dip of ~0.007" at center/port side
  - ETU - seal surface shows extra dip of ~0.003" at center/port side
  - Spare - seal surface is flat to 0.001"
- FUV01, FUV02, & ETU all have SMA connectors and pump ports welded on. Spare has not been welded.
- FUV02 also shows small dip 0.0015" dip at SMA connector side
- Measurements of original FUV02 seal gap
  - At air, 0.008" at corners, 0.013" at center /port side
  - At vacuum differential, 0.007" at corners, 0.014" at center /port side
- Measurements of new "O" ring FUV02 seal gap after 40 cycles
  - At air, 0.008" at corners, 0.014" at center /port side
  - At vacuum differential, 0.006" at corners, 0.016" at center /port side
- Result - greater "o ring" compression & better seal with new "o ring"

FUV02, Flight Backup Detector Status/Actions

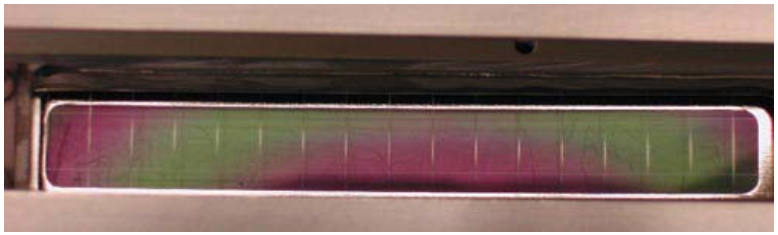
- **Resolved VHA seal leak issue using shaped "O" ring**
- **Performed 40 successful door/motor open close cycles**
- **Vibration on DVA confirmed solution**
- **Installed detector into DVA**
- **Re-installed in test chamber, performed QDE test**
- **Detector Mini scrub completed**
- **QDE calibration and full functional test in progress**
- **Deep flat field test**
- **Vibration test and post vibration functional**
- **Pack and ship to CU**
- **Thermal vacuum test at CU**
- **Cleanliness certification and delivery to Ball**

FUV02, Cathode

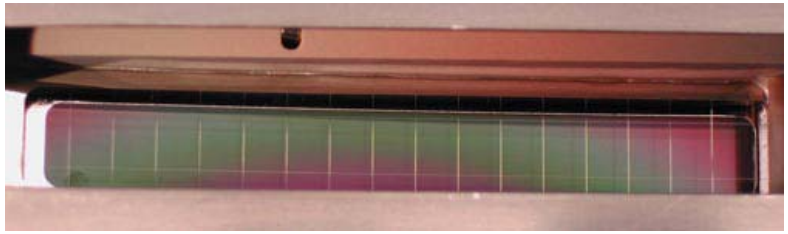
FUV02 detector with QE grid installed



New CsI cathode, A side



New CsI cathode, B side

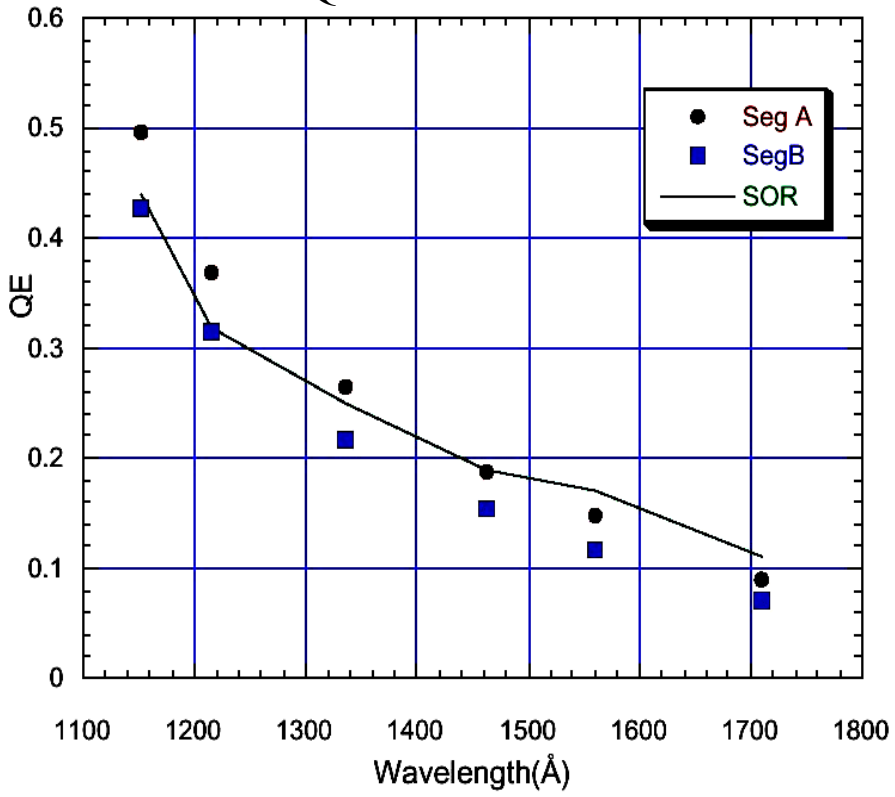


New cathode is in accord with the best CsI we have previously done on COS microchannel plates

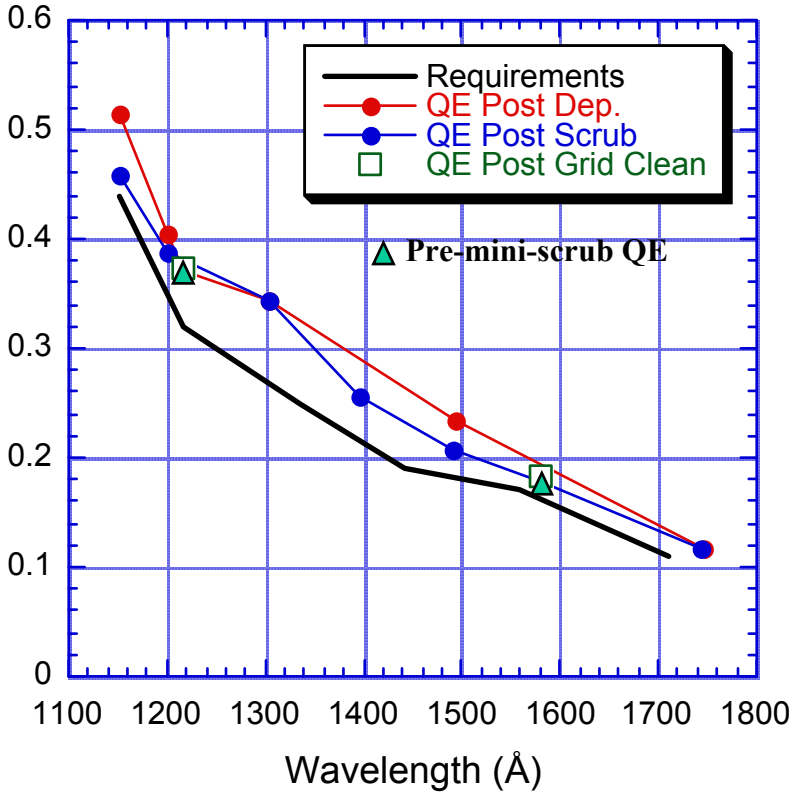
FUV02 New Photocathode QE measurements

QE for FUV02 is better than FUV01

QE for FUV01

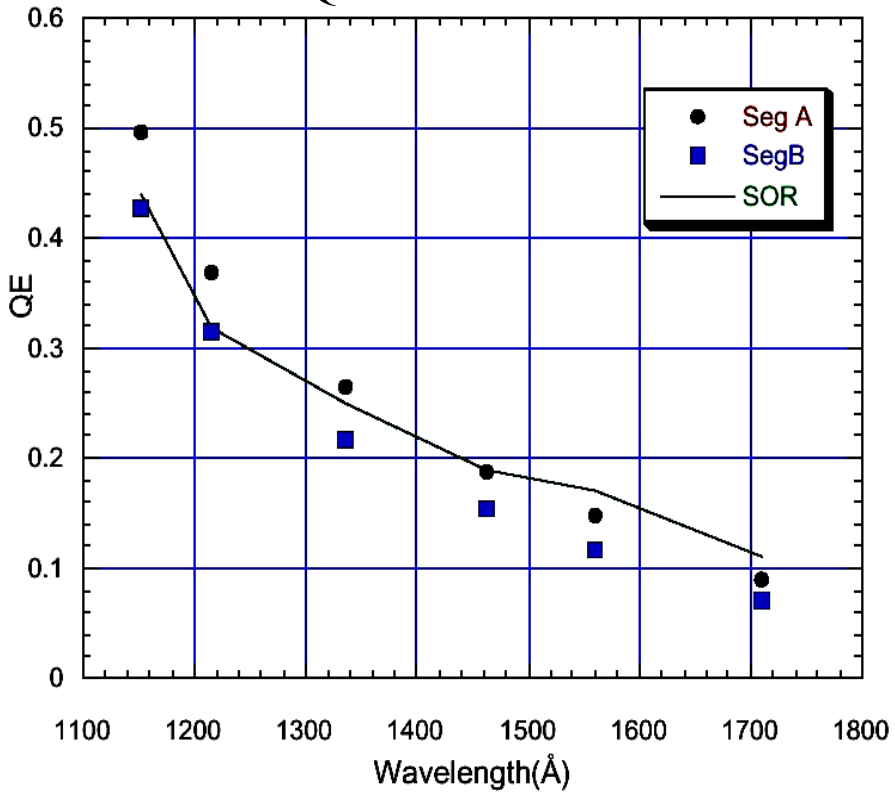


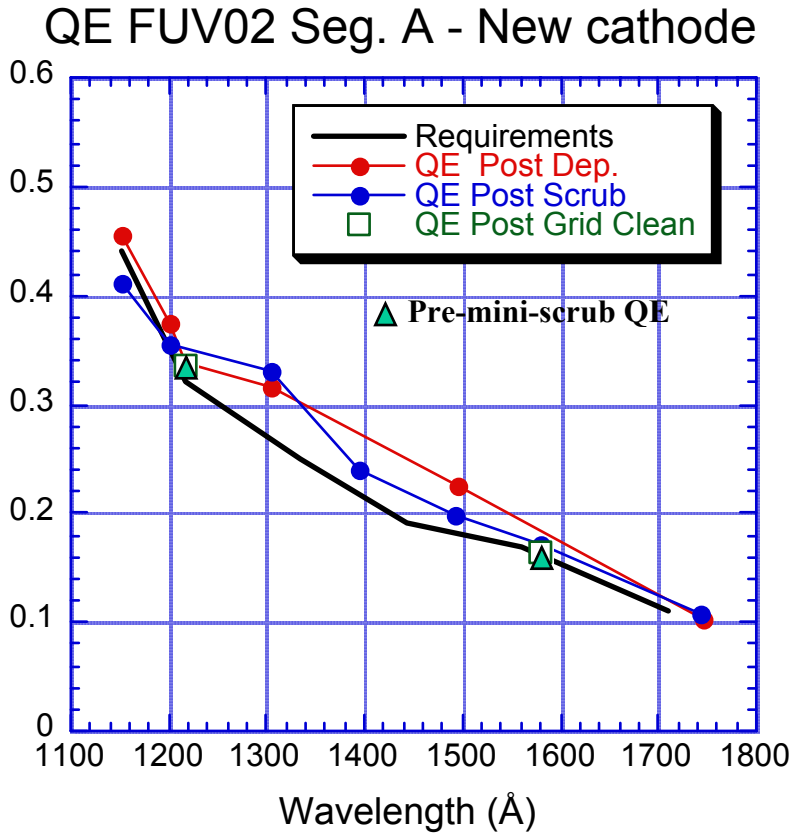
QE FUV02 Seg. B - New cathode



FUV02 New Photocathode QE measurements

QE for FUV02 is better than FUV01

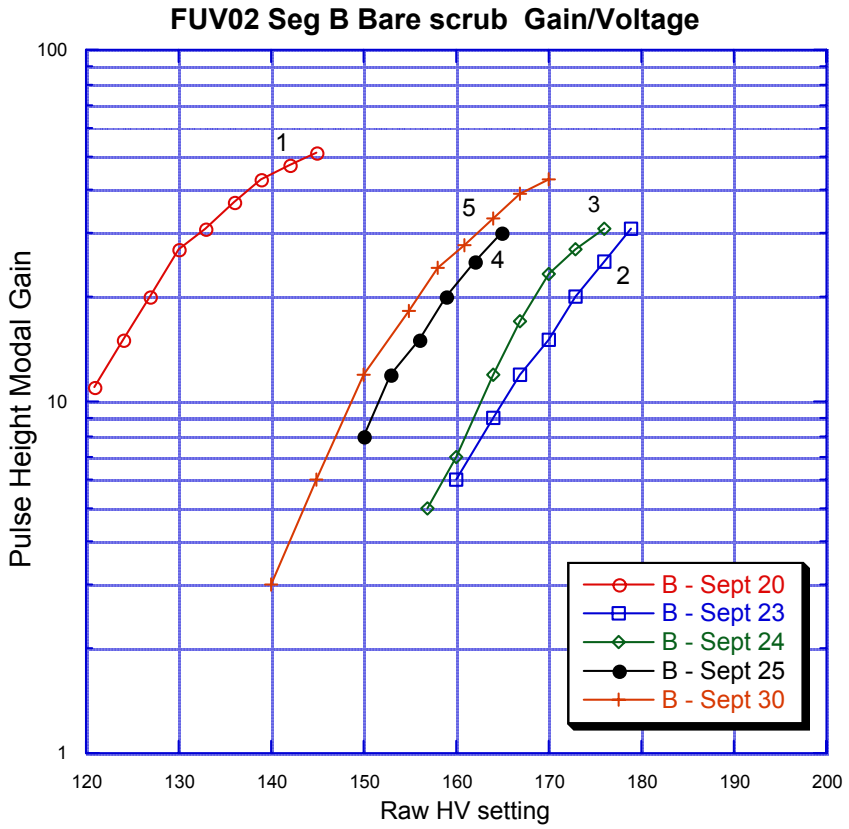




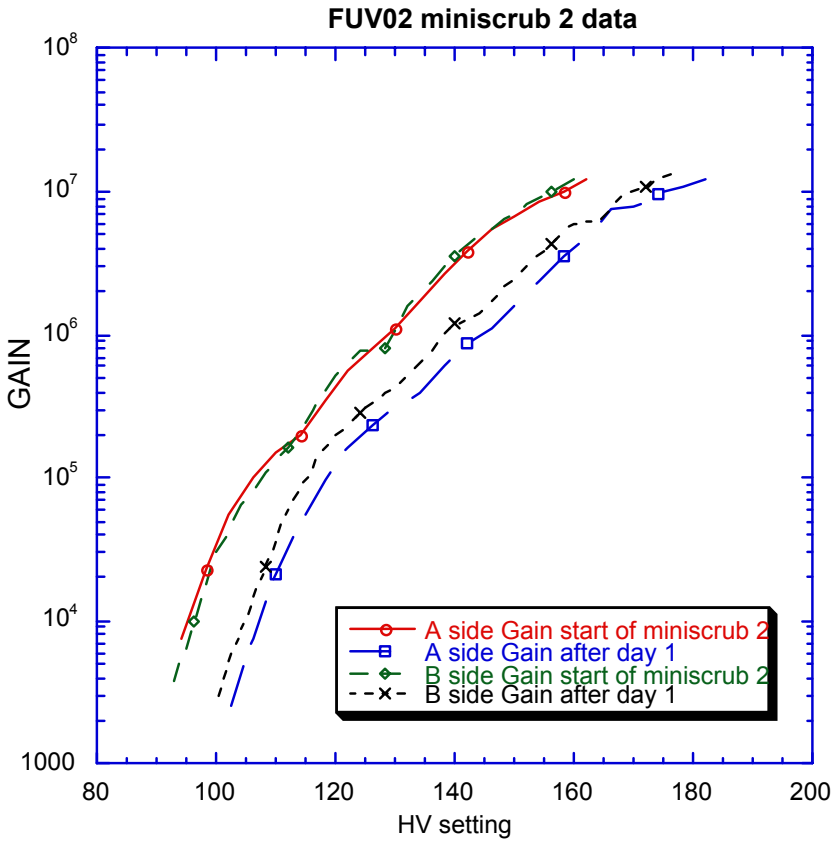
FUV02 MiniScrub2 Gain Curve History

Gain decreases due to scrub which is compensated by increasing the MCP voltage
We accomplished the deep scrub before a cathode deposition to avoid QE degradation!

Deep scrub data

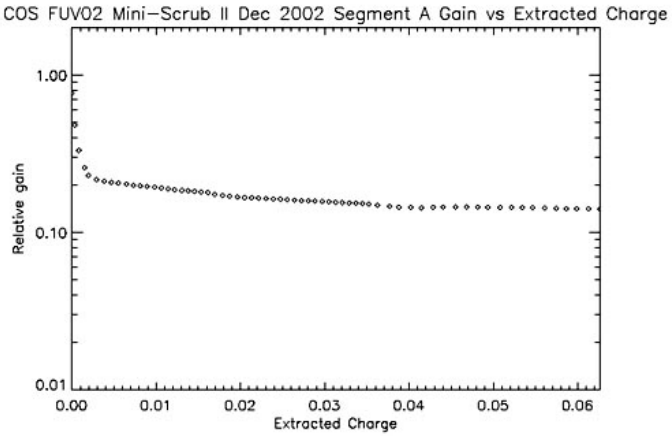


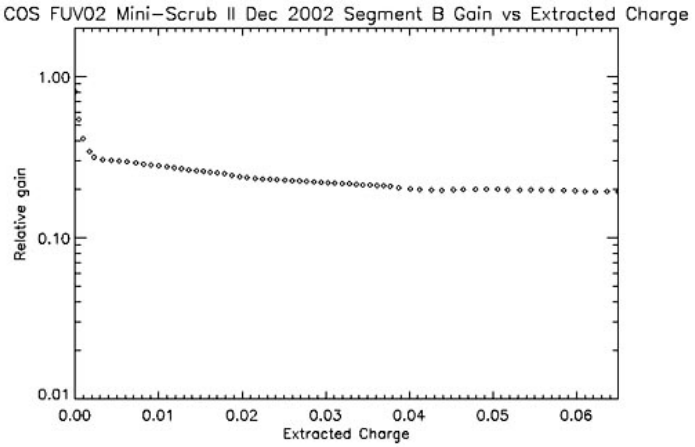
Miniscrub2 data

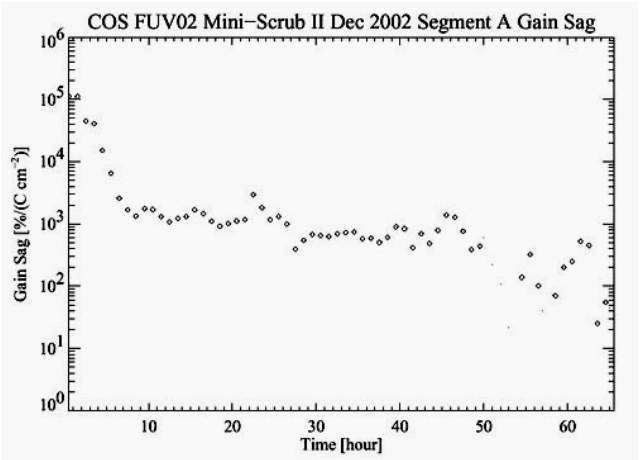


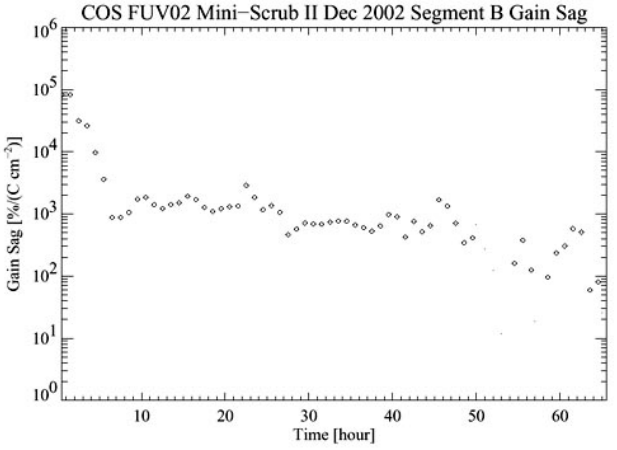
FUV02 MiniScrub2 Gain Curve History

The gain decreased then stabilized to levels required for flight









FUV02, Flight Backup Detector Next Actions

- QDE calibration and full functional test in progress
  - Post mini-scrub QE values by tomorrow
- Deep flat field test will be done by early next week
- Vibration test and post vibration functional
  - Need minor shake fixture mods to accommodate potted shims
  - Will do this mid next week
  - Cannot get Lockheed facility until Jan 6-8
- Pack and ship to CU
- Thermal vacuum test at CU
- Cleanliness certification and delivery to Ball

Software/Ops Update

- Brownsberger and Beland continue their presence at Ball supporting the SW/OPS efforts.
  - Brownsberger is working CS/DCE activities
  - Beland is working Target Acquisition component testing.
- CEDAR has been stable for some months and is supporting GN2 alignments at Ball.

COS Schedule Milestones for CU/UCB

Task	Status
CALCOS Software Development	On-going. Completion by ~ TV-2 mos
Cal/FF SS Retest	1/03
Deliver FUV-02	2/03
Complete COS TV/TB Plan	1/03

COS Descope Issues (No Changes Since Last MSR)

- The COS IDT has been asked to develop and track a descope plan which, if implemented, can be used to control future cost growth and/or schedule difficulties.
- At the beginning of the COS development effort, late CY97 and early CY98, we prepared and presented several descope options. At that time we descoped the following:
  - Reduced the MEB SRAM buffer memory
  - Fewer NUV/FVU optics/grating spares
  - No parallel technology path for NUV gratings
  - Reduced I&T/calibration effort
  - Baselined environmentals at GSFC

COS Descope Tracking List

Candidate De-Scope	Trigger Date	Resource Saved*	Impacts
Eliminate FUV Detector detailed resolution tests	**Implemented**	2 weeks	Knowledge of detector
Eliminate FUV Detector detailed QE tests	**Implemented**	2 weeks	Knowledge of detector
Eliminate FUV Detector deep FF tests	**Implemented**	3 weeks	Knowledge of detector
Make DCE Op Code non-uploadable	**Too late**	---	Higher risk, Ops
Early transition of FSW to Code 582	**Too late**	---	Ops
Remove Redundant Cal/FF Elements	**Too late**	---	Higher risk, Ops
Remove/reduce memory	**Too late**	---	Ops
Remove NUV gratings from OSM2	**Too late**	---	Degraded science
Drop NUV channel	**Too late**	---	Degraded science
Remove NCM3 optics	**Too late**	---	Degraded science, Ops
Eliminate Aperture Mechanism	**Too late**	---	Ops, Obs. Efficiency, higher risk
Drop all Accum mode processing w/ Doppler	**Too late**	---	Degraded science
Drop spare FUV detector	**Too late**	---	Higher risk
Drop OSM1 capability (don't cover λ gap)	**Too late**	---	Degraded science
Reduce S/N requirement to 30 (no FF lamp)	**Too late**	---	Degraded science
Relax NUV resolution requirements below 20k	**Too late**	---	Degraded science
Remove on-orbit change-out capability	**Too late**	---	Higher risk
Drop dispersed light TA	**Too late**	---	Ops
No Ion Gauge	**Too late**	---	Higher risk, Ops
No external shutter	**Too late**	---	Ops
Change MSRs to QSRs	TBD	$	Save trees
Eliminate Mechanism Lifetime tests	**Too late**	---	Higher risk
Reduce CDRLs	TBD	$	Unknown
Drop G140L blazed effort	**Implemented**	---	Missed opportunity for improved science
Reduce G160M image testing	**Too late**	---	Higher risk

*The IPT has not yet done a detailed analysis to quantify actual $ or time to be saved.

Upcoming Events/Activities

- Vibe FUV-02 at LMMS (1/03)
- Ship FUV-02 to CU and perform T-V (1/03)
- Complete TV/TB test procedure (1/03)
- Support COS PER
- Compete Cal/FF sub-system characterization (1/30)

Issues

- None