COS
Monthly Status Review
November 6, 2002
NASA/GSFC

Agenda

Progress Summary Since Last Monthly	J. Andrews
GN2 Alignment Update	J. Green
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
STScI Presentation	K. Sembach
BATC Presentation	R. Higgins
Financial Splinter	GSFC/Ball/CU

Progress Summary Since Last MSR

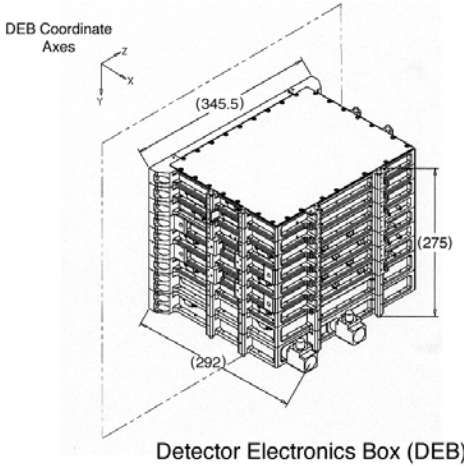
- Supported and completed GN2 alignment check.
- Continued COS TV and calibration planning.
- Initiated assembly of FUV-02 at UCB.
- Held Science Team Meeting on 10/31 – 11/1.

Nitrogen Testing of COS

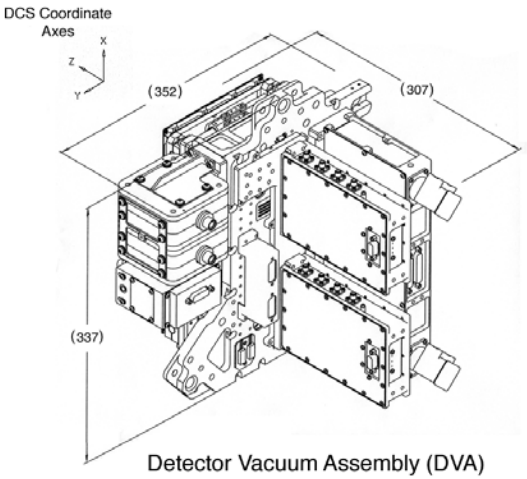
- Under N_2 purge and with FUV detector door closed, end-to-end testing of COS with RASCAL was performed.
- RASCAL spectra in NUV channels indicated residual aberrations in end-to-end system and input misalignments.
- Several small misalignments within COS were identified and corrected.
- System is performing nominally.

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)



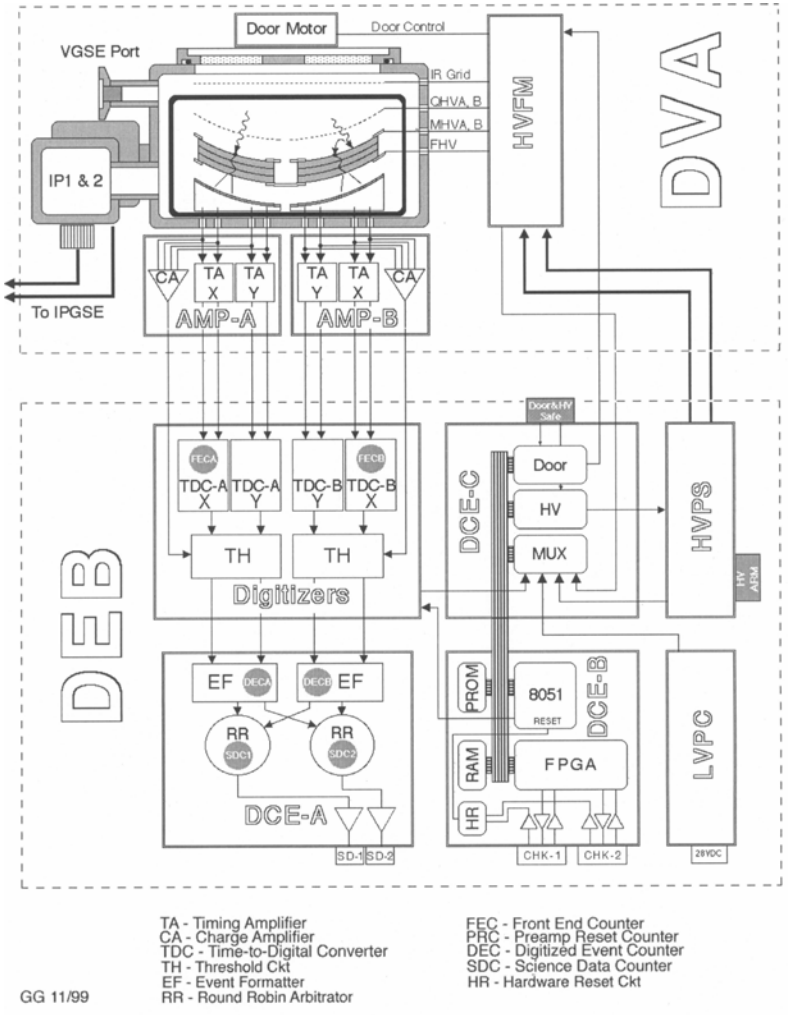
Detector Electronics Box (DEB)



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 and upon completing environmentals it will go into storage at CU.

FUV Detector Verification Testing Summary

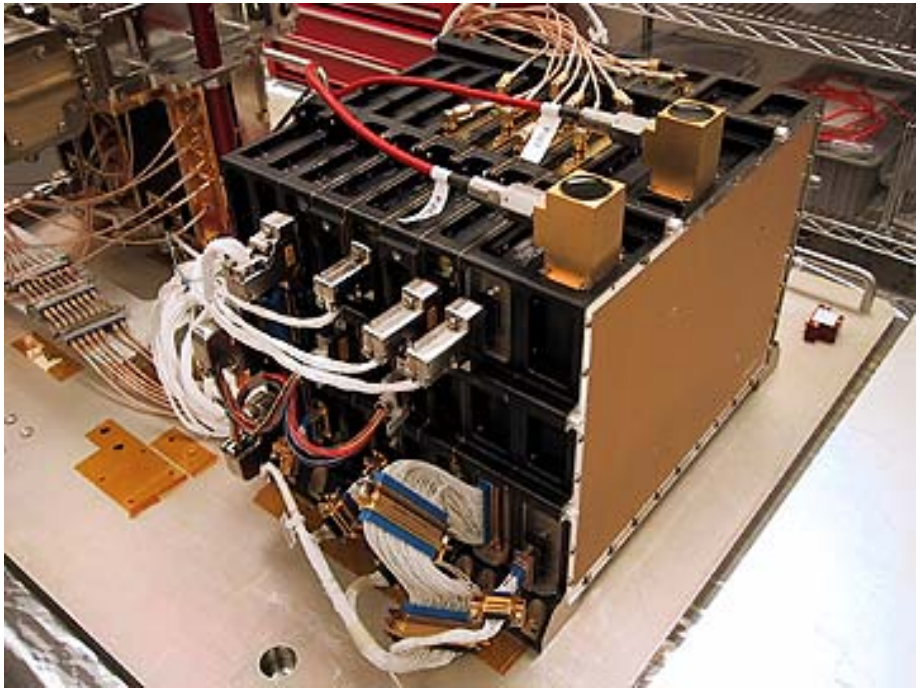
Unit	Functional Testing	Performance Testing	EMI/EMC	Sine Burst	Random Vibe	Thermal-Vac	Contamination Certification
FUV-01 DVA	C	C	@SS	A - C	A - C	@SS	@SS
FUV-01 DEB	C	C	@SS	Q - C	Q - C	@SS	@SS
FUV-01 SS	C	C	C	@Comp	@Comp	8-cycles	C
FUV-02 DVA	P	P	N/R	Q - P	Q - P	@SS	@SS
FUV-02 DEB	C	C	N/R	A - P	A - P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

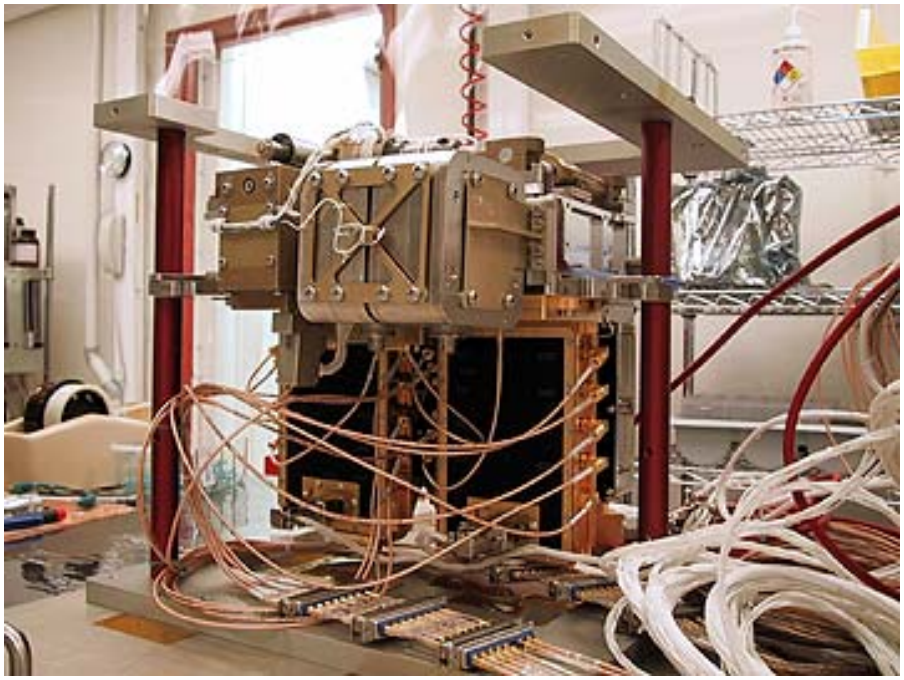
— DVA-02 to see qual-level vibe at LMMS
— FUV-02 to see 8 cycle T/V at CU
— DEB-01 to see 1-axis workmanship vibe at Ball

COS FUV Detector Systems

- Detector DEB



- Detector Head



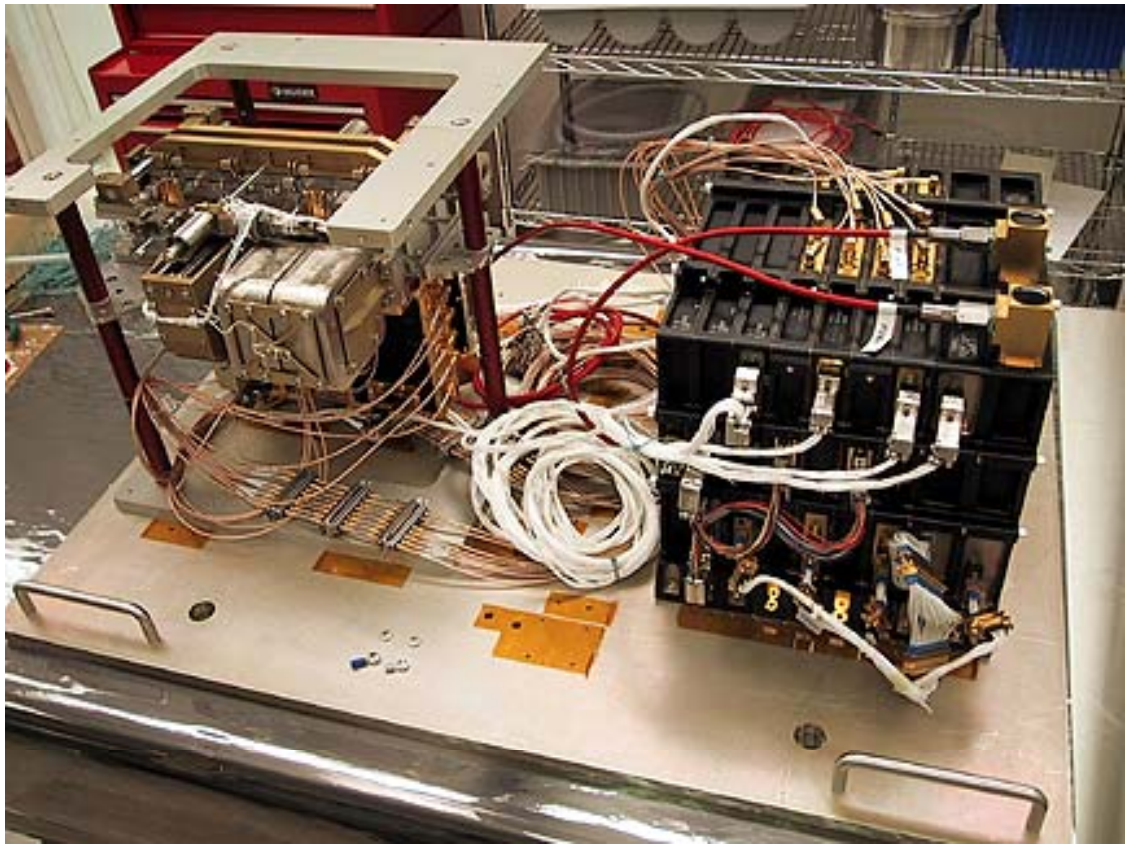
Flight FUV01 Detector System

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

Post delivery functional tests nominal.

Cleanliness certification at Ball completed successfully.

Alignment tests in done.



Status for FUV01

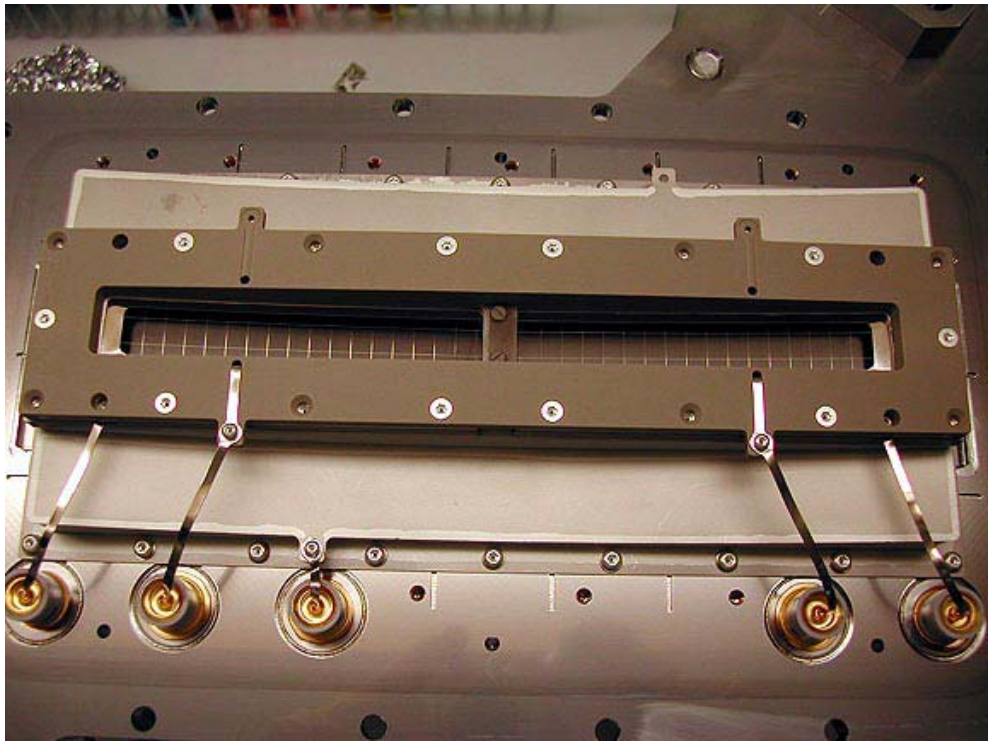
- Ship to CU -- Arrived 7/19, Thermal vacuum test -, begun 7/23
- Thermal vacuum finished successfully 7/29, including
- Cleanliness certification at CU
- Delivered to Ball - 7/31, functional test completed - OK
- Repeated cleanliness certification at Ball - OK
- Alignment tests completed at Ball
- Two minor repairs to be done next week,
  - Replace torn HVFM connector socket rubber boot
  - Replace rotating jack post on one “D” connector on DEB
  - Workmanship shake of DEB planned at Ball

UCB FUV02, Flight Backup Detector, Status

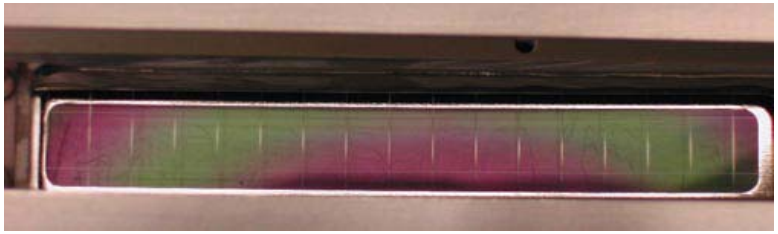
- **DEB & Harnesses**
  - Completed and tested successfully.
- **Detector integrated with Vacuum Housing Assembly** .
  - Completed functional test and MCP "deep" scrub
  - New cathode deposition done, QE's measured better than FUV01.
  - Completed post cathode mini-scrub & QE check (minor drop, ~7%)
  - Experienced strong QE grid field emission during QE test
  - Removed and completed "grid wash", field emission now gone
  - QE remeasured - no changes - but need to repeat mini-scrub
  - 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 is OK - But investigating cause/remedy
  - Initial evaluation shows known sag of VHA (0.005") at atmosphere but also indicates a small (0.007") bowing of the VHA seal at one specific area - we have proposed remedies to the project.

FUV02, New Cathode Deposition

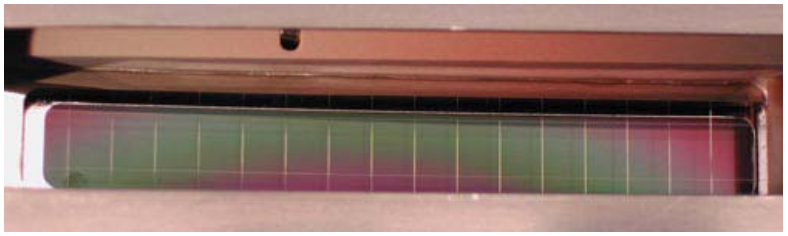
FUV02 detector with QE grid installed



New CsI cathode, A side



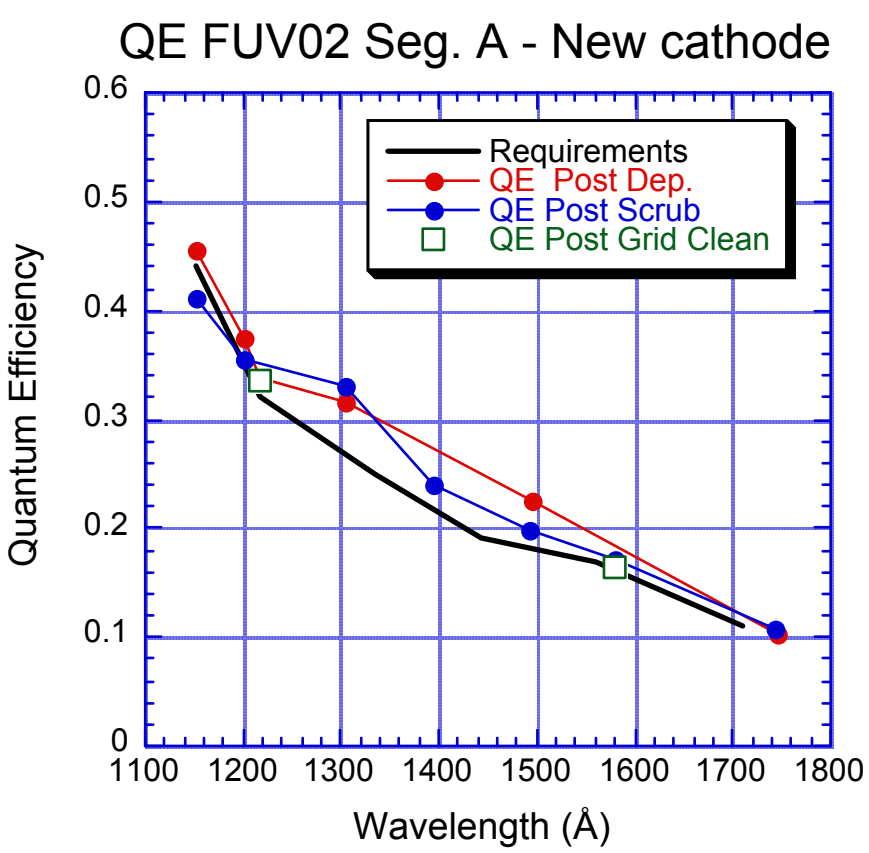
New CsI cathode, B side

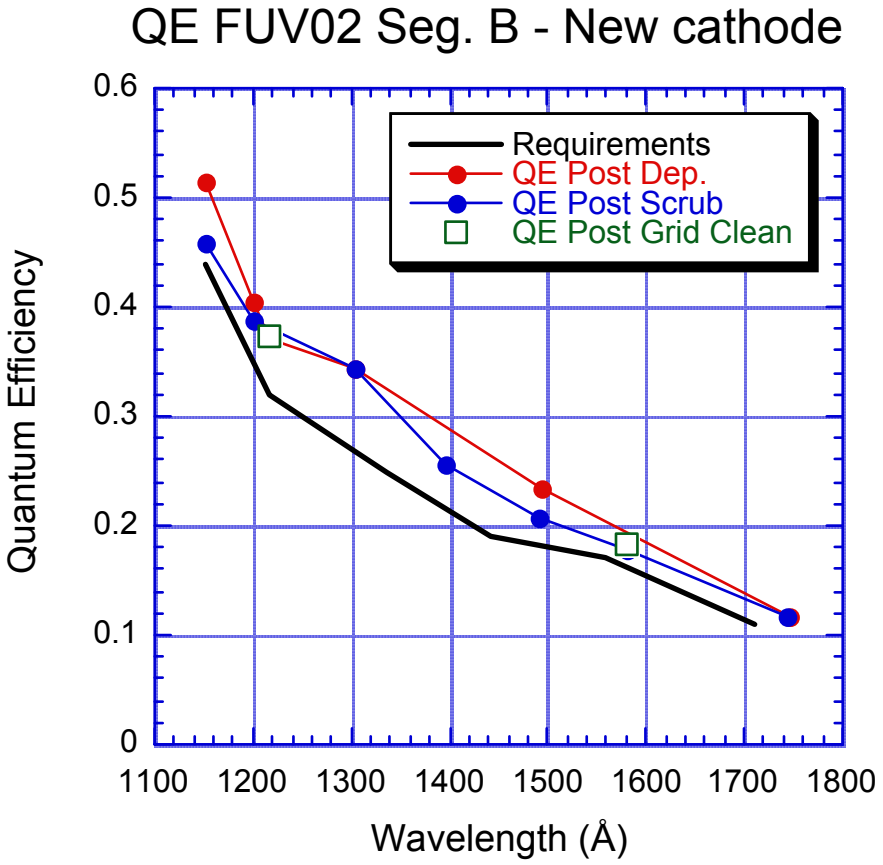


New cathode is in accord with the best CsI we have previously done on COS microchannel plates

FUV02 New Photocathode QE measurements

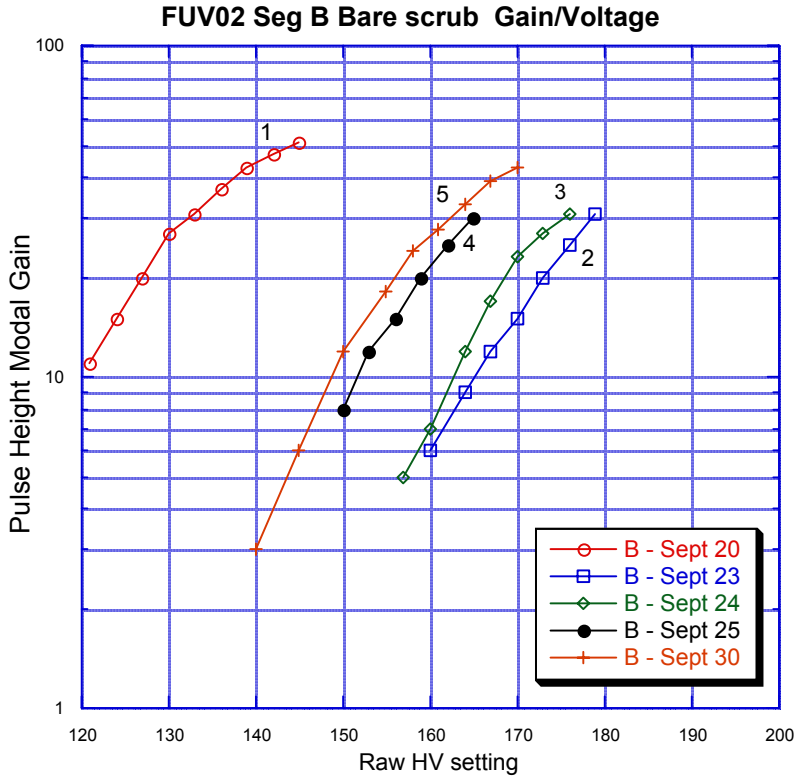
QE for FUV02 is ~20% better than FUV01 on <u>average</u>

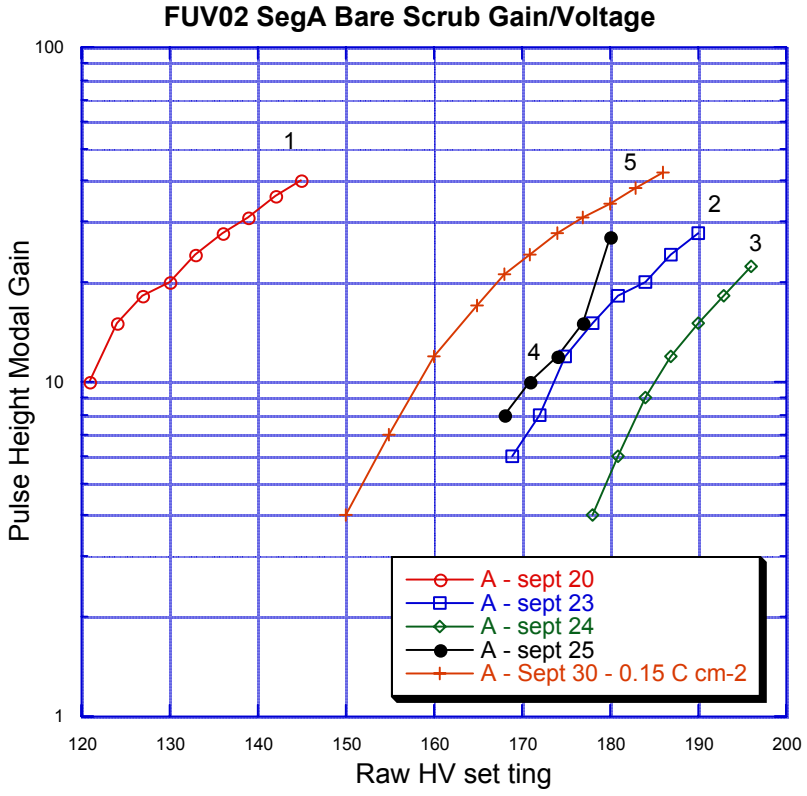




FUV02 Deep Scrub Gain Curve History

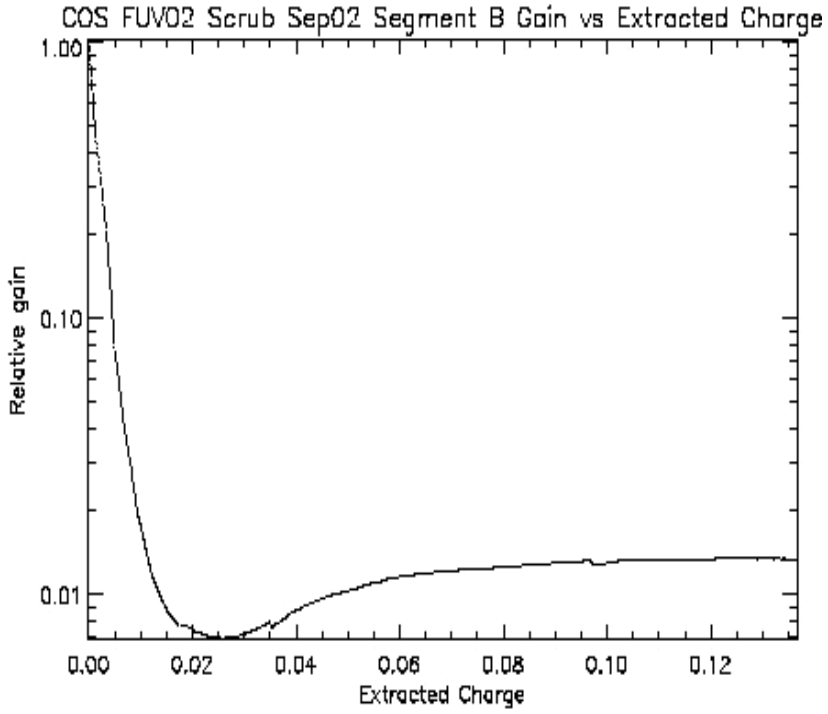
Gain decreases due to scrub which is compensated by increasing the MCP voltage
We accomplished the scrub before a cathode deposition to avoid QE degradation!

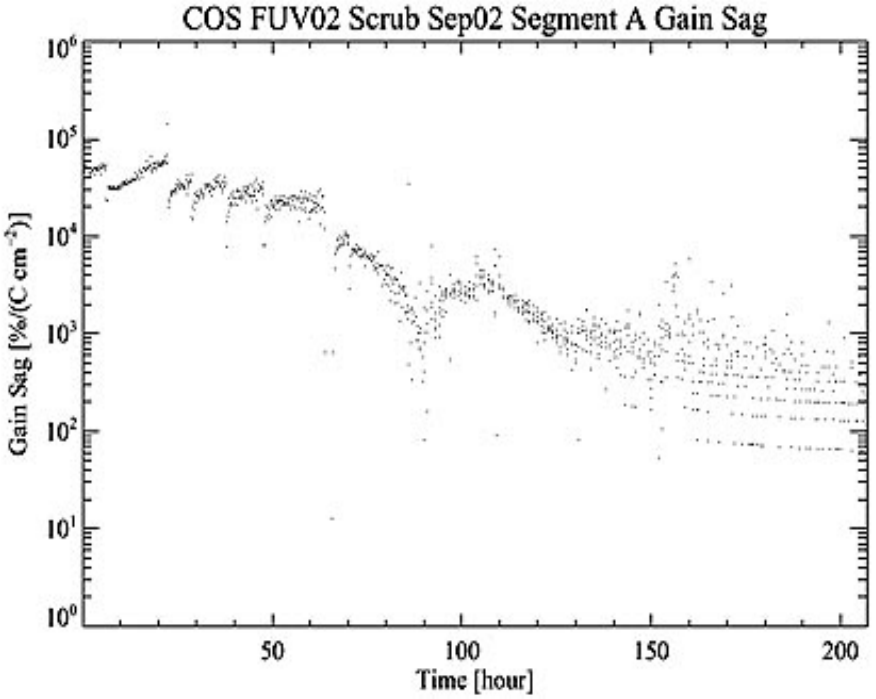




FUV02 Deep Scrub Gain Curve History

**The gain decreased as a function of extracted charge then increased and stabilized,
We expect less than x2 gain change per coulomb (COS spec)**

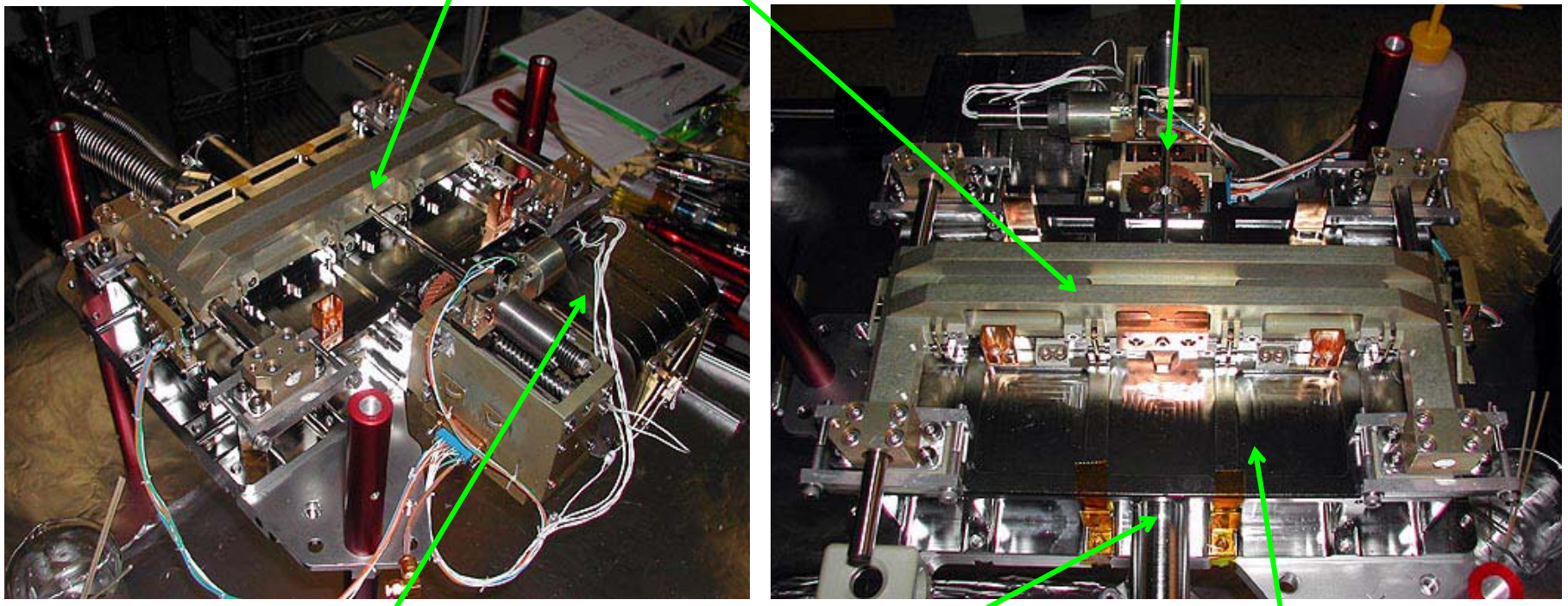




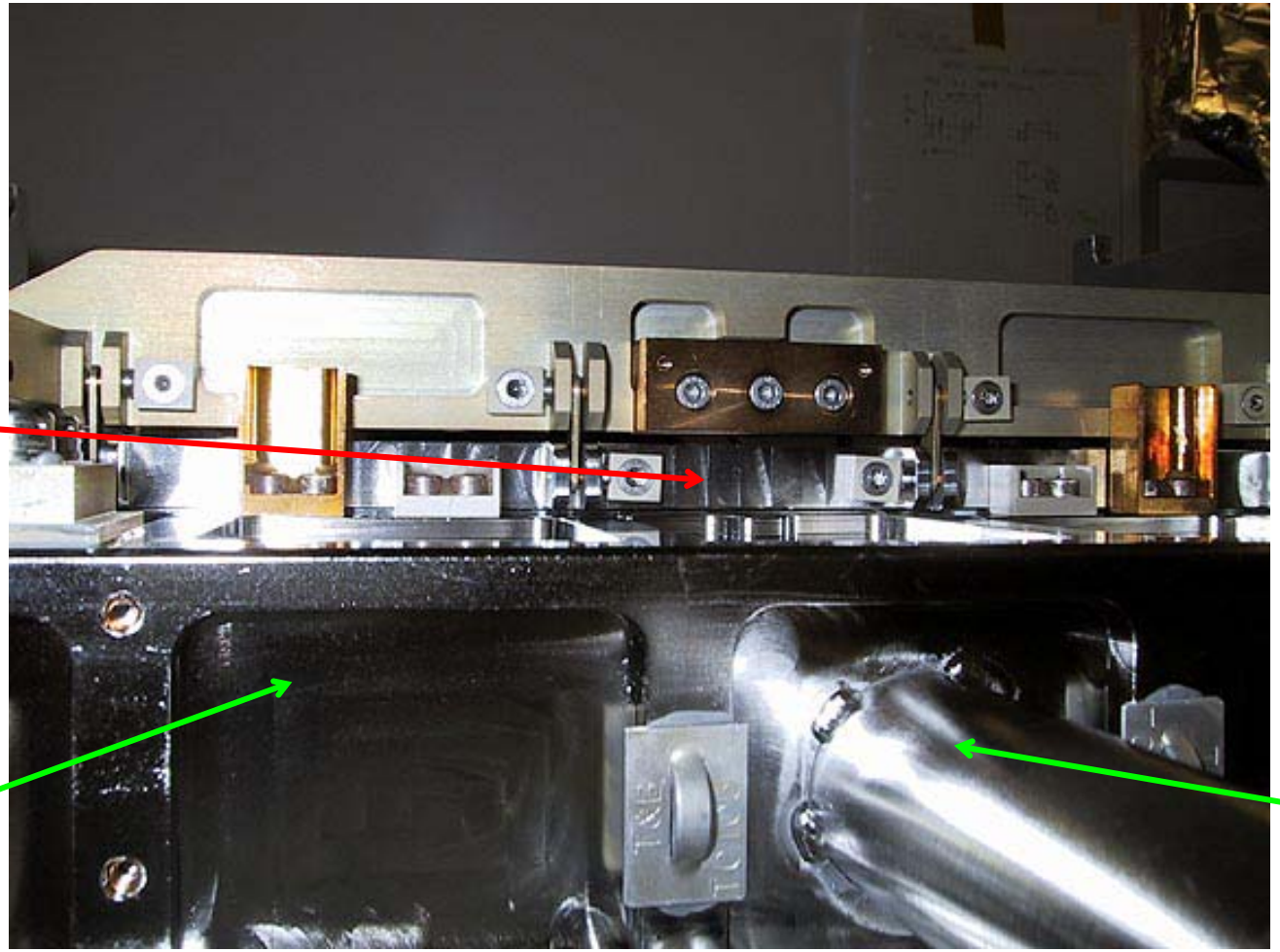
FUV02, Flight Backup Detector Actions

- **Resolve VHA seal leak issue**
- **Re-install in test chamber, perform QDE test**
- **Mini scrub**
- **QDE calibration and full functional test,**
- **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**

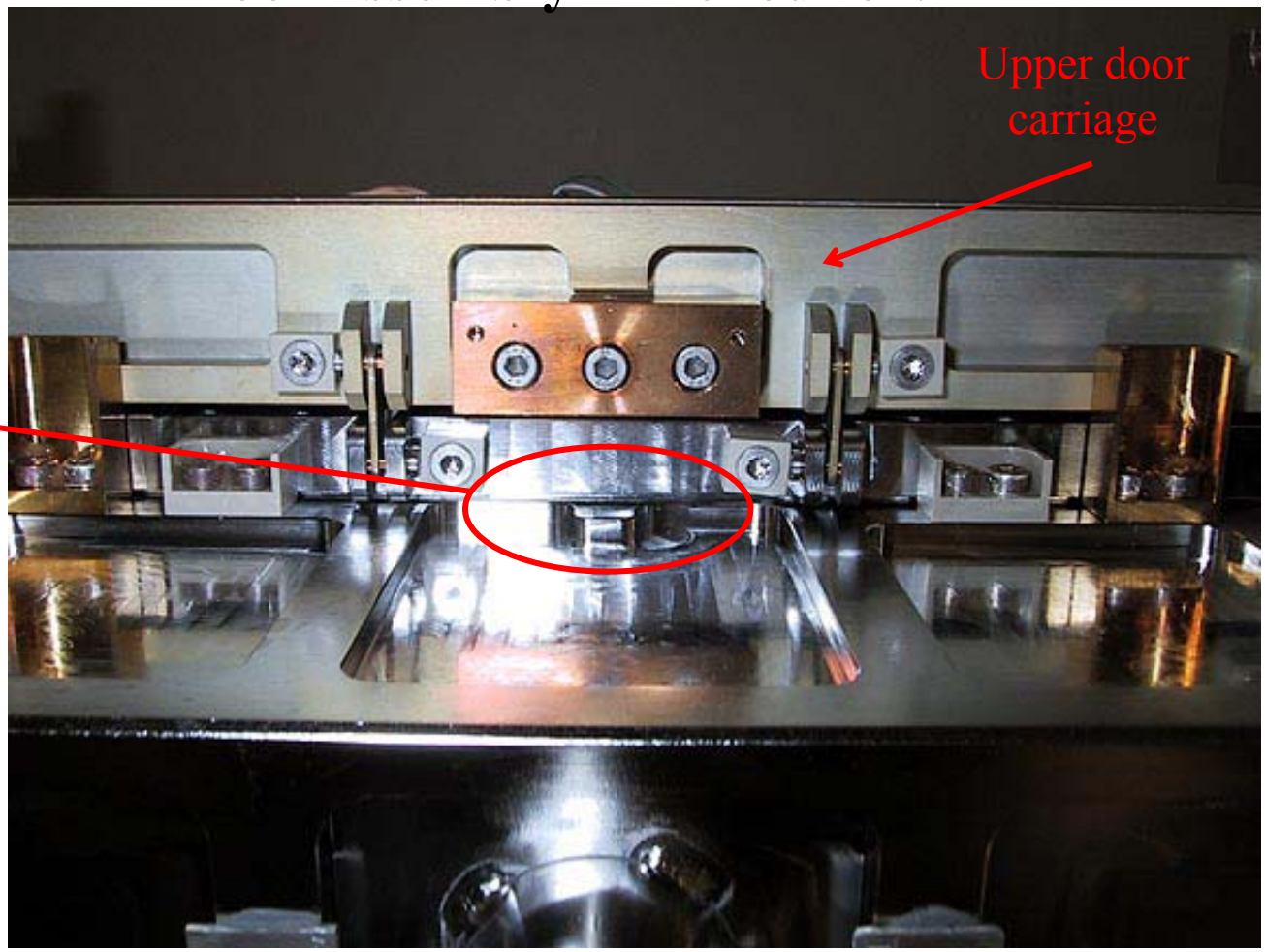
FUV02 VHA completed assembly



FUV02 Door assembly attached to VHA

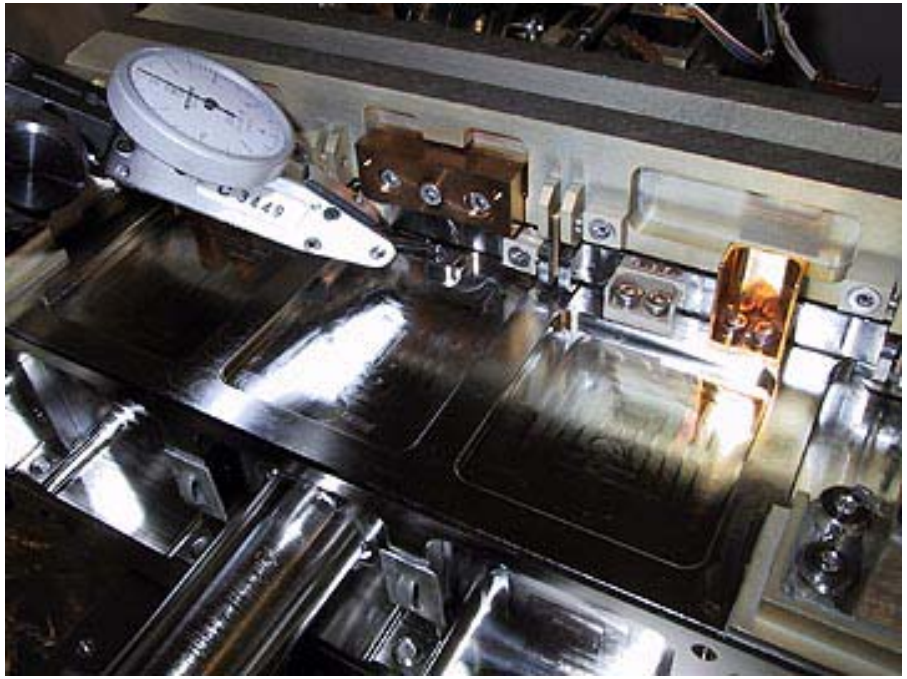


Door assembly attached to VHA



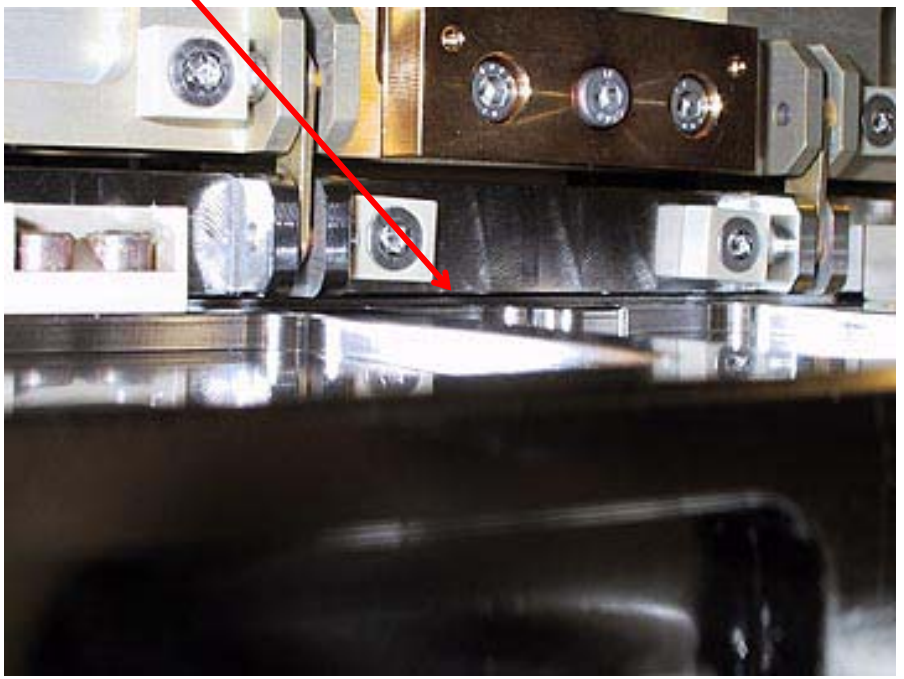
Door assembly attached to VHA - inspection and metrology

Measurement of VHA surface with & without atmosphere differential



Pumping port

VHA seal area, compressed "O" ring gap



FUV02, VHA Seal Leak, Status

Vacuum Housing Assembly (VHA)

- While preparing for mini-scrub noticed small VHA leak (via ion pump current) only at full atmosphere pressure differential
- First leak check showed no leak
- After additional door operation at vacuum, small, intermittent, leak discovered at door/VHA seal.
- Inspected and re-greased "O" ring and now seal is OK - But we have investigated cause/remedy for the leak
- Initial evaluation confirms known sag of VHA (0.005") at atmosphere differential, but also indicates a (0.007") bowing of the VHA seal at one specific area - center of VHA seal area across from pump port.

FUV02, VHA Seal Leak, Status

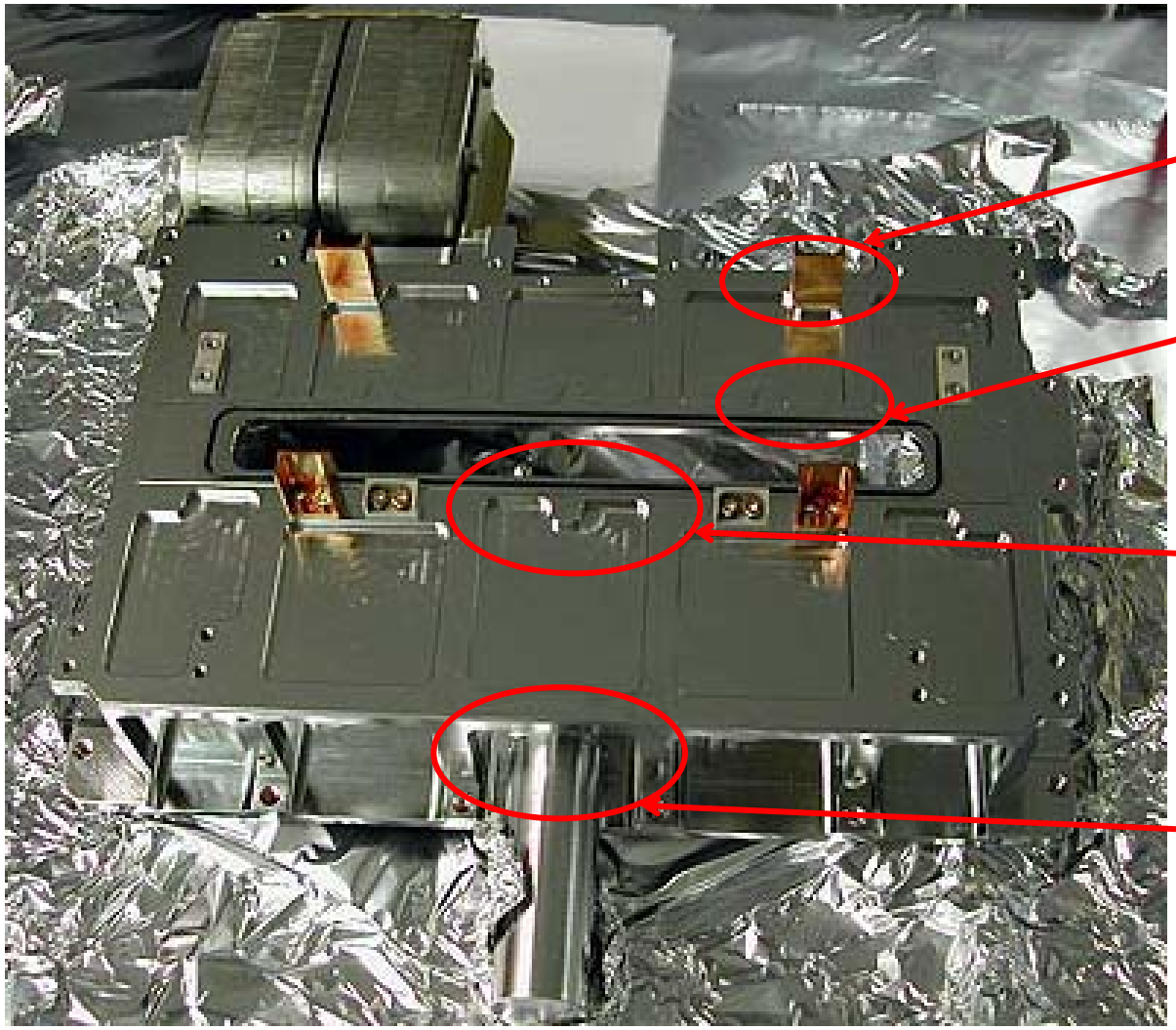
- Door seal gap is set at ~0.007" during door installation
- We have four Vacuum Housings
    - FUV01 - records indicate door seal gap is ~0.007" and uniform
    - FUV02 - seal surface shows extra dip of ~0.007" at center/port side
    - ETU - seal surface shows extra dip of ~0.003" at center/port side
    - 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.
- Specification for Vacuum Housings is <0.002" seal flatness
- Measurements of Spare shows flat top surface everywhere
- Measurements of ETU and FUV02 show dips at center/port side
  – 0.007" for FUV02, 0.003" for ETU
  – Also 0.0015" dip at SMA connector side for FUV02
- Measurements of 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

FUV02, VHA Seal Leak, Status

- We have two doors from Ball, FUV01 and FUV02
- Both were measured 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.
- After “o”ring regrease the VHA now seals and there is no leak
- **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**

Current Situation

- FUV02 DBA (detector) is currently stored separately under vacuum
- FUV02 VHA is fully assembled and under vacuum with ETU DBA
- We have investigated many different ways of resolving the problem with emphasis on maintaining the FUV02 integrity
- Our preferred resolution involves re-surfacing of the seal door to match the VHA shape



FUV02 VHA with ion pumps

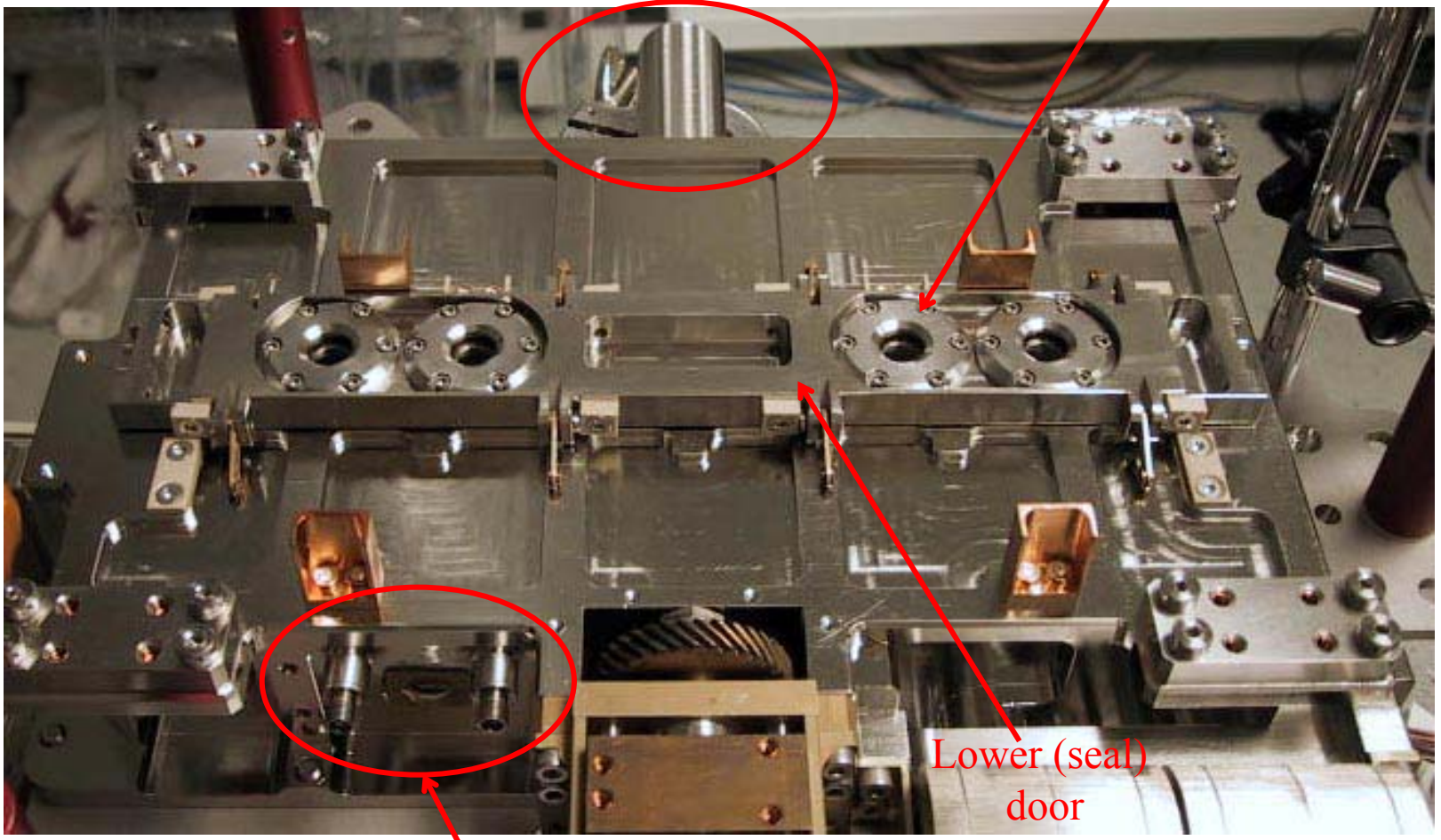
Ion grid SMA location

~0.0015” dip

~0.007” dip

Pumping port weld area

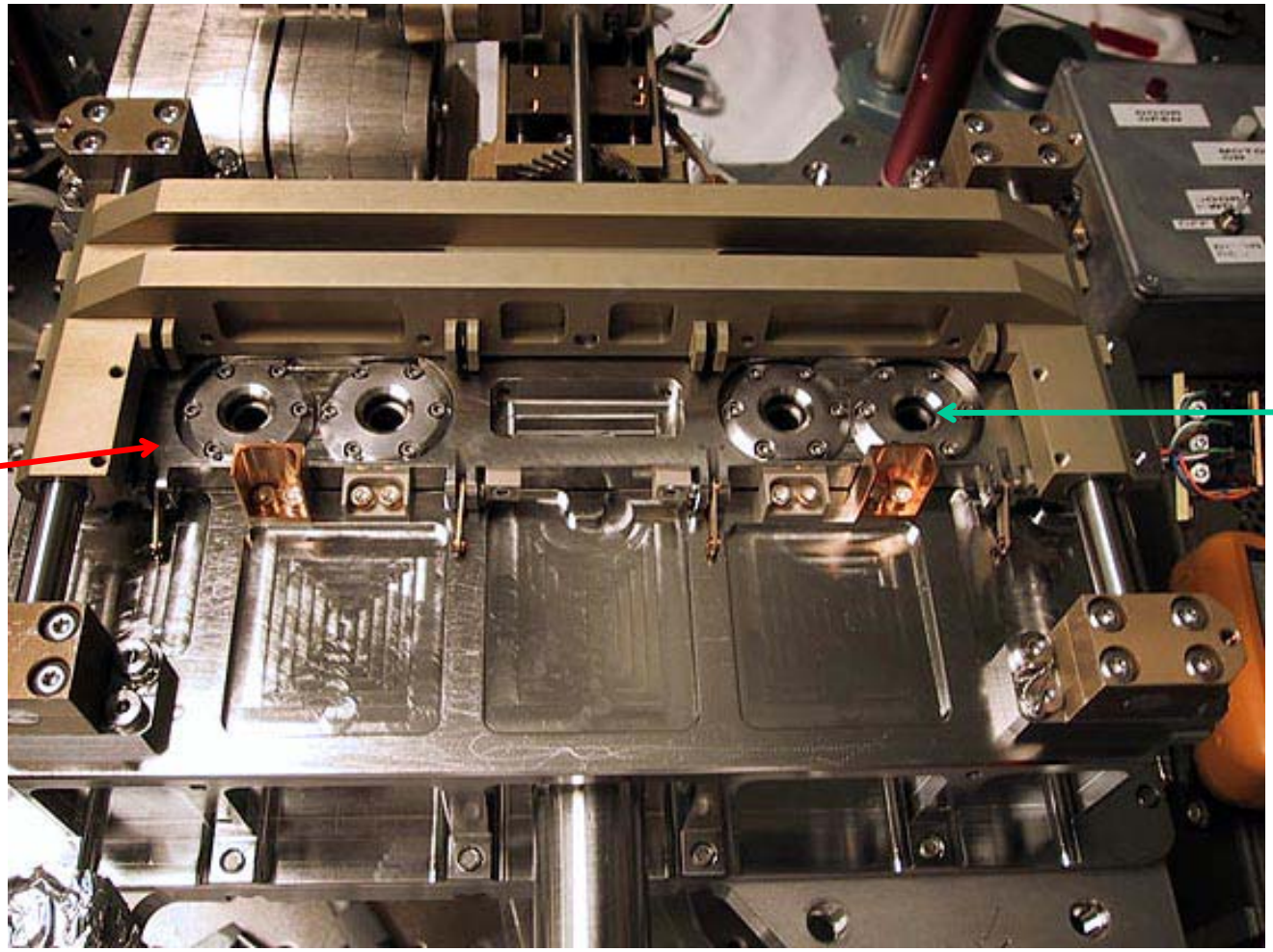
VHA with door mechanism removed



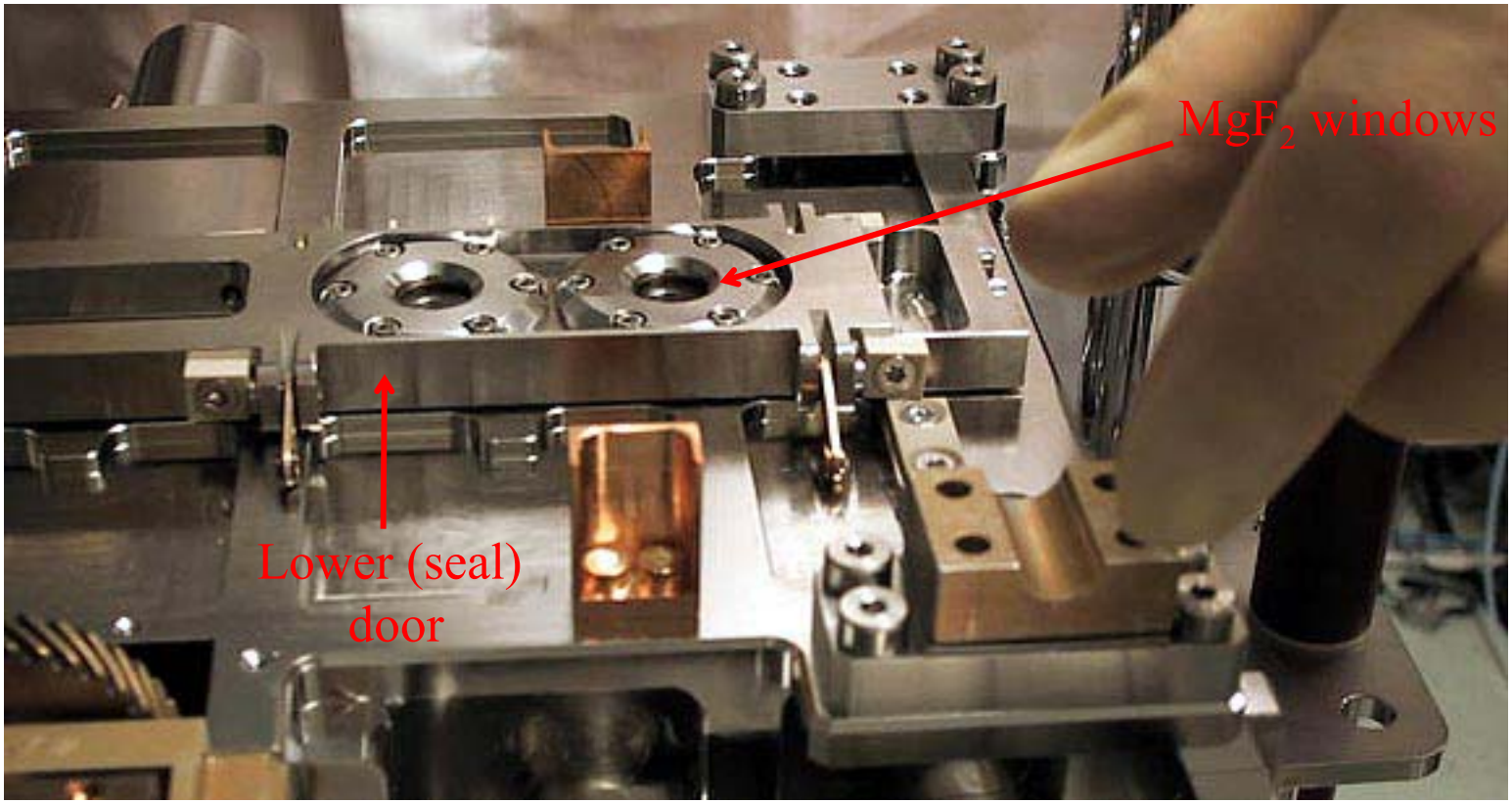
FUV02, VHA Seal Leak, Plan

- Metrology gives us a detailed measure of the shape of the seal surface
- Remove FUV02 seal door and substitute ETU to maintain vacuum
- Make door blanks and resurface them using EDM + polish
- Check the measurements & seal with blanks + FUV02 VHA
- Resurface the FUV02 seal door using EDM + polish
- Re-install the FUV02 seal door and re-shim the door mechanism to achieve the correct seal gap, and measure with Atm differential
- Run door operation tests and re-verify seal and metrology
- Re-install detector/DBA and continue with FUV02 completion plan
- This minimizes disassembly of VHA (none on DBA) and risk to assy
- Achieves desired uniform seal gap/"o"ring compression
- Minimizes time & cost to effect the resolution
- Also obtain "profiled" "O" rings to "accommodate" gap (backup)
- Make spare door to accommodate AU options

Lower door detached from upper door (links disconnected)



VHA with door mechanism removed



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	12/02
Complete FUV-02	TBD – pending vacuum seal fix
Complete COS TV/TB Plan	12/02

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

- Resolve FUV-02 vacuum leak.
- FUV-02 environmental testing.
- Continued COS TV and calibration planning and preparation.

Issues

- None