16941 - Cycle 30 COS NUV Detector Recovery after Anomalous Shutdown

Cycle: 30, Proposal Category: CAL/COS
(Availability Mode: RESTRICTED)

INVESTIGATORS

<table>
<thead>
<tr>
<th>Name</th>
<th>Institution</th>
<th>E-Mail</th>
</tr>
</thead>
<tbody>
<tr>
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VISITS

<table>
<thead>
<tr>
<th>Visit</th>
<th>Targets used in Visit</th>
<th>Configurations used in Visit</th>
<th>Orbits Used</th>
<th>Last Orbit Planner Run</th>
<th>OP Current with Visit?</th>
</tr>
</thead>
<tbody>
<tr>
<td>01</td>
<td>DARK</td>
<td>S/C</td>
<td>1</td>
<td>15-Jul-2022 10:00:53.0</td>
<td>yes</td>
</tr>
<tr>
<td>02</td>
<td>DARK</td>
<td>COS/NUV S/C</td>
<td>1</td>
<td>15-Jul-2022 10:00:55.0</td>
<td>yes</td>
</tr>
<tr>
<td>03</td>
<td>DARK</td>
<td>COS/NUV S/C</td>
<td>1</td>
<td>15-Jul-2022 10:00:56.0</td>
<td>yes</td>
</tr>
<tr>
<td>04</td>
<td>DARK DEUTERIUM</td>
<td>COS/NUV S/C</td>
<td>1</td>
<td>15-Jul-2022 10:00:57.0</td>
<td>yes</td>
</tr>
</tbody>
</table>

4 Total Orbits Used

ABSTRACT
This proposal is designed to permit a safe and orderly recovery of the NUV-MAMA detector after an anomalous shutdown. This is accomplished by using slower-than-normal MCP high-voltage ramp-ups and diagnostics. Anomalous shutdowns can occur because of bright object violations which trigger the Global Hardware Monitor or the Global Software Monitor. Anomalous shutdowns can also occur because of MAMA hardware anomalies or failures. The cause of the shutdown should be thoroughly investigated and understood prior to recovery. Twenty-four hour wait intervals are required after each test for MCP gas desorption and data analysis. Event flag 2 is used to prevent inadvertent MAMA usage.

The recovery procedure consists of four separate tests (i.e. visits) to check the MAMA’s health after an anomalous shutdown: 1) signal processing electronics check, 2) slow, intermediate voltage high-voltage ramp-up, 3) ramp-up to full operating voltage, and 4) fold analysis test (See COS TIR 2010-01). Each must be successfully completed before proceeding onto the next. This proposal executes the same steps as Cycle 29 proposal 16541. Adjustments were made the Software Global Monitor (SGM) to account for an increase in the dark counts due to window glow and to align the SGM to previously obtained Fold Analysis event data.

OBSERVING DESCRIPTION
Anomalous shutdowns can occur because of bright object violations, which trigger the Global Hardware Monitor or the Global Software Monitor. Anomalous shutdowns can also occur because of MAMA hardware anomalies or failures. The cause of the shutdown should be thoroughly investigated and understood prior to recovery. Twenty-four hour wait intervals are required after each test for MCP gas desorption and data analysis. Event flags are used to prevent inadvertent MAMA usage.

The recovery procedure consists of four separate tests (i.e. visits) to check the MAMA's health after an anomalous shutdown. Each must be successfully completed before proceeding onto the next.

(1) Signal processing electronics check. The amplifier threshold voltage is reduced from 0.48V to 0.28V; ORCOUNTS rates are monitored (MAMA HV is off during this procedure).

(2) Slow, intermediate voltage high-voltage ramp-up. The MCP HV is slow-ramped to a voltage 300V below nominal. A dark time-tag exposure is taken during this partial ramp. A second dark time-tag exposure is taken where the event counter is cycled through W, X, Y, Z, OR, EV and VE.

(3) Ramp-up to full operating voltage. As before, a dark time-tag exposure is taken during this ramp-up. A second dark time-tag exposure is taken where the event counter is cycled through W, X, Y, Z, OR, EV and VE.

(4) Fold analysis test (See COS TIR 2010-01).

In order for a recovery to be initiated the following conditions have to have been met:
(1) MAMA HV shut down anomalously.
(2) A minimum of 24 hours must have elapsed since the initial shutdown and the intermediate HV ramp-up (step two above).
(3) The COS external shutter must be closed.

--------- Additional Comments ---------

This is not a requirement but it is desirable to have real-time engineering telemetry (MA return) during the execution of the first three visits.
Visit

**Proposal 16941 - LV Signal Processing Check (01) - Cycle 30 COS NUV Detector Recovery after Anomalous Shutdown**

**Visit**

- **Diagnostic Status:** No Diagnostics
- **Scientific Instruments:** S/C
- **Special Requirements:** ON HOLD ; PARALLEL

**Comments:** NUV-MAMA recovery from anomalous shutdown signal processing electronics checkout procedure - Part 1.

Must clear event flag 2 for the commanding to execute. Since no high voltage is involved, this visit may be scheduled within the 24 hour period following an anomalous HV shutdown providing that the reason for the shutdown is well understood. There are no exposures taken in this visit; only engineering telemetry is required. Refer to ISR STIS 98-03.

**On Hold Comments:** To be used only after an anomalous shutdown of the NUV high voltage.

**Exposures**

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</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>LV and Signal Processing Check</td>
<td>DARK</td>
<td>S/C, DATA, NONE</td>
<td>SAA CONTOUR 32;</td>
<td>Same Alignment in LV Signal Processing Check (01)</td>
<td>1005.0 Secs (1005 Secs)</td>
<td>[1]</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>LV Off</td>
<td>DARK</td>
<td>S/C, DATA, NONE</td>
<td>SAA CONTOUR 32;</td>
<td>Same Alignment in LV Signal Processing Check (01)</td>
<td>30.0 Secs (30 Secs)</td>
<td>[1]</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>Set Flag 2</td>
<td>DARK</td>
<td>S/C, DATA, NONE</td>
<td>SAA CONTOUR 32;</td>
<td>Same Alignment in LV Signal Processing Check (01)</td>
<td>1.0 Secs (1 Secs)</td>
<td>[1]</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Comments:** Special NUV LV turn on and check.

Switch on LV power supply. Set nominal decode configuration. Set amplifier threshold to default (0.48V). Set software global monitor to nominal values. Collect a minimum of one minute of OR events. Set amplifier threshold to 0.28V. Collect a minimum of five minutes of OR events.

**Comments:** Turn NUV LV off.

Use the nominal reconfiguration instruction.

**Comments:** Set COS event flag 2.
<table>
<thead>
<tr>
<th>Visit</th>
<th>Proposal 16941, Intermediate HV Ramp (02), implementation</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Diagnostic Status: Warning</td>
</tr>
<tr>
<td></td>
<td>Scientific Instruments: S/C, COS/NUV</td>
</tr>
<tr>
<td></td>
<td>Special Requirements: AFTER 01 BY 1.0 D TO 30.0 D; ON HOLD; PARALLEL</td>
</tr>
<tr>
<td></td>
<td>Comments: NUV-MAMA recovery from anomalous shutdown intermediate voltage checkout procedure - Part 2.</td>
</tr>
<tr>
<td></td>
<td>Must clear event flag 2 for the commanding to execute. Minimum wait of 24 hours following the anomalous shutdown. Goal: 1) Ramp NUV-MAMA to intermediate MCP voltage; 2) obtain dark count telemetry. Refer to ISR STIS 98-03.</td>
</tr>
<tr>
<td></td>
<td>On Hold Comments: To be used only after an anomalous shutdown of the NUV high voltage.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Diagnostics</th>
<th>Proposal 16941 - Intermediate HV Ramp (02) - Cycle 30 COS NUV Detector Recovery after Anomalous Shutdown</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Diagnostics (Intermediate HV Ramp (02)) Warning (Orbit Planner): MAXIMUM DURATION EXCEEDED FOR INTERNAL OR EARTH CALIB SU</td>
</tr>
<tr>
<td>---</td>
<td>---</td>
</tr>
<tr>
<td>1</td>
<td>LV On</td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>Ramp HV to (-1750/50)</td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>Cycle SGM</td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>HV Off</td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Comments: Special NUV HV turn on and slow, partial HV ramp. The MCP and PC Voltage partial Ramp-ups will be performed in stages. The ramp-up within a stage is by increments of \(-50\)V. The final MCP voltage will be \(-1750\)V, 300V shy of the nominal value of \(-2050\)V. The final PC Voltage will be \(-50\)V, rather than the nominal \(-800\)V setting. Use the nominal yellow and red limits for ramping. At the end of each stage, reset the SGM to a Threshold = 100 and an Integration Period = 0.1 sec, and collect telemetry samples of OR Counts for 4 minutes.

Stage 1 - MCP ramp-up (0 to \(-500\)V).
Stage 2 - MCP ramp-up (\(-500\)V to \(-1000\)V).
Stage 3 - MCP ramp-up (\(-1000\)V to \(-1500\)V).
Stage 4 - MCP ramp-up (\(-1500\)V to \(-1750\)V).
Stage 5 - PC Voltage ramp-up (+20 to \(-50\)V).

Comments: Special NUV DARK.
Obtain an NUV DARK while at \(-1750\)V. During the exposure, set the SGM Threshold = 200 and an Integration Period = 0.1 secs. Collect a minimum of 5 samples of W, X, Y, Z, OR, EV, and VE events. Because this is a COS exposure, the obset will end with a HOME Alignment. That HOME must have its COS NUV qasi states reset via ISQL to have start_state = end_state = HOLD.

Comments: Special NUV HV turn off.
Ramp down PC & MCP high voltage, and turn the HV off.
### Proposal 16941 - Intermediate HV Ramp (02) - Cycle 30 COS NUV Detector Recovery after Anomalous Shutdown

<table>
<thead>
<tr>
<th>Sequence</th>
<th>Event</th>
<th>Duration</th>
<th>Instructions</th>
</tr>
</thead>
<tbody>
<tr>
<td>5</td>
<td>LV Off DARK S/C, DATA, NONE</td>
<td>30.0 Secs (30 Secs)</td>
<td>SAA CONTOUR 32; SPEC COM INSTR RLLVTHDN; NEW ALIGNMENT; QASISTATES COS SI OBSERVE OBSE RVE; QASISTATES COS NUV LV ON HOLD</td>
</tr>
<tr>
<td>6</td>
<td>Set Flag 2 DARK S/C, DATA, NONE</td>
<td>1.0 Secs (1 Secs)</td>
<td>SPEC COM INSTR ELFLAG2; NEW OBSET</td>
</tr>
</tbody>
</table>

**Comments:**

- **Sequence 5:** Turn NUV LV off. Use the nominal reconfiguration instruction.
- **Sequence 6:** Set COS event flag 2. The NEW OBSET special requirement forces the HOME alignment to occur before this activity.

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**Orbit Structure**

- **Orbit 1:**
  - Unused Orbital Visibility = 3142
  - Exp. 1
  - Exp. 2
  - Exp. 3
  - Exp. 4
  - Exp. 5
  - Home
  - Occultation
  - Exp. 6

**Server Version:** 20220516
| Visit | Proposal 16941, Full HV Ramp (03), implementation  
Diagnostic Status: Warning  
Scientific Instruments: S/C, COS/NUV  
Special Requirements: AFTER 02 BY 1.0 D TO 30.0 D; ON HOLD; PARALLEL  
Comments: NUV-MAMA recovery from anomalous shutdown nominal high voltage checkout procedure - Part 3.  
NSSC-I COS event flag 2 must be clear for the commanding to execute.  
On Hold Comments: To be used only after an anomalous shutdown of the NUV high voltage. |
<table>
<thead>
<tr>
<th></th>
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</thead>
<tbody>
<tr>
<td>Diagnostics</td>
<td>(Full HV Ramp (03)) Warning (Orbit Planner): MAXIMUM DURATION EXCEEDED FOR INTERNAL OR EARTH CALIB SU</td>
</tr>
<tr>
<td>---</td>
<td>---</td>
</tr>
<tr>
<td>1</td>
<td>LV On</td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>Ramp HV to -2050/-800 (Nominal HV)</td>
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<td></td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>Cycle SGM</td>
</tr>
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<td></td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>HV Off</td>
</tr>
</tbody>
</table>

Comments: Special NUV LV turn on. Switch on LV power supply. Set nominal decode configuration. Set amplifier threshold to default (0.48V). Set SGM to nominal values. Enable SDF.

Comments: Special NUV HV turn on and slow full ramp up. The MCP and Field Voltage Ramp-ups will be performed in stages. The ramp-up within a stage is by increments of 50V. Use the nominal yellow and red limits for ramping. At the end of each stage for stages 1 - 5, reset the SGM to a Threshold = 100 and an Integration Period = 0.1 sec. At the end of each stage for stages 6 and above, set the SGM to Threshold 400 and an Integration Period of 0.1 sec. At the end of each stage, collect telemetry samples of OR Counts for 4 minutes.

Stage 1 - MCP ramp-up (0 to -500V)
Stage 2 - MCP ramp-up (-500V to -1000V)
Stage 3 - MCP ramp-up (-1000V to -1500V)
Stage 4 - MCP ramp-up (-1500V to -1750V)
Stage 5 - PC Voltage ramp-up (+20 to -50V)
Stage 6 - MCP ramp-up (-1750V to -1850V)
Stage 7 - MCP ramp-up (-1850V to -1950V)
Stage 8 - Final MCP ramp-up (-1950V to -2050V)
Stage 9 - Final PC Voltage ramp-up (-2050V to -800V)

Comments: Special NUV DARK. Obtain an NUV DARK while ramped up. During the exposure, set Software Global Monitor to an SGM Threshold = 400 and an Integration Period = 0.1 sec. Collect a minimum of 5 samples of W, X, Y, Z, OR, EV, and VE events. Because this is a COS exposure, the exposure will end with a HOME Alignment. That HOME must have its COS NUV qasistates reset via ISQL to have start_state = end_state = HOLD.

Comments: Special NUV HV turn off. Ramp down PC & MCP high voltage, and turn the HV off.
### Proposal 16941 - Full HV Ramp (03) - Cycle 30 COS NUV Detector Recovery after Anomalous Shutdown

<table>
<thead>
<tr>
<th>Sequence 1-6 Non-In</th>
<th>30.0 Secs (30 Secs)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sequence 1-6 Non-In</td>
<td>1.0 Secs (1 Secs)</td>
</tr>
</tbody>
</table>

#### Comments:
- **5** LV Off DARK S/C, DATA, NONE
  - Turn NUV LV off.
  - Use the nominal reconfiguration instruction.

- **6** Set Flag 2 DARK S/C, DATA, NONE
  - Set COS event flag 2.
  - The NEW OBSET special requirement forces the HOME alignment to occur before this activity.

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**Orbit Structure**

Unusual Orbital Visibility = 3142

- **Exp. 1**
- **Exp. 2**
- **Exp. 3**
- **Exp. 4**
- **Exp. 5**
- **Exp. 6**

Server Version: 20220516
**Proposal 16941 - NUV Fold Test (04) - Cycle 30 COS NUV Detector Recovery after Anomalous Shutdown**

**Visit**

- **Proposal 16941, NUV Fold Test (04), implementation**
- **Diagnostic Status:** Warning
- **Scientific Instruments:** S/C, COS/NUV
- **Special Requirements:** AFTER 03 BY 1.0 D TO 30.0 D; ON HOLD; PARALLEL
- **Comments:** NUV-MAMA recovery from anomalous shutdown Fold Distribution procedure - Part 4.
- **On Hold Comments:** To be used only after an anomalous shutdown of the NUV high voltage.

**Diagnostics**

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<thead>
<tr>
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</thead>
<tbody>
<tr>
<td>1</td>
<td>Fold Test Setup</td>
<td>DARK</td>
<td>S/C, DATA, NONE</td>
<td>SAA CONTOUR 32; SPEC COM INSTR ELFOLDSET</td>
<td>Same Alignment in NUV Fold Test (04)</td>
<td>[20.0 Secs (20 Secs)]</td>
<td><img src="attachment" alt="1" /></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td><strong>Comments:</strong> Special setup for NUV Fold Analysis Test. Set the Software Global Monitor to 15,000 ORCOUNTS per sec (sufficient to allow for spike at lamp turn-on).</td>
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</tr>
<tr>
<td>2</td>
<td>Fold Test DEUTERIUM</td>
<td>COS/NUV, TIME-TAG, FCA</td>
<td>G185M 1850 A</td>
<td>CURRENT=MEDIUM; BUFFER-TIME=2700</td>
<td>SPEC COM INSTR ELFOLDSTST; QESIPARM TARG TYPE FOLD</td>
<td>Same Alignment in NUV Fold Test (04)</td>
<td>[2300.0 Secs (2300 Secs)]</td>
<td><img src="attachment" alt="1" /></td>
<td></td>
</tr>
<tr>
<td></td>
<td><strong>Comments:</strong> The NUV Fold Analysis will be conducted during a deuterium lamp time-tag exposure. The exposure specification will ensure that the FCA aperture will be used, that the OSMs will be positioned at NCMIFLAT and G185M/1850, and that the lamp current is set to MEDIUM. Qesiparm TARGTYPE must be specified as FOLD so that the instructions will command the proper lamp. Note that the commanding will turn the lamp off during the exposure, and the exposure commanding will issue a redundant lamp off command after the exposure.</td>
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</table>

**Exposures**

1. Set Software Global monitor (SGM Threshold = 10,000, SGM Integration period = 1 sec.)
2. Disable MAMA Folds: C2, C3, C4, C5, C6, R2, R3, R4, R5, R6
3. Conduct fold analysis. Collect one minute of VE data for following 19 combinations of MAMA folds:
   - Enabled: C2, R2; Disabled: C3, C4, C5, C6, R3, R4, R5, R6
   - Enabled: C2, R3; Disabled: C3, C4, C5, C6, R2, R4, R5, R6
   - Enabled: C3, R2; Disabled: C2, C4, C5, C6, R3, R4, R5, R6
   - Enabled: C2, R4; Disabled: C3, C4, C5, C6, R2, R3, R5, R6
   - Enabled: C3, R3; Disabled: C2, C4, C5, C6, R2, R4, R5, R6
   - Enabled: C4, R2; Disabled: C2, C3, C5, C6, R3, R4, R5, R6
   - Enabled: C3, R4; Disabled: C2, C4, C5, C6, R2, R3, R5, R6
   - Enabled: C4, R3; Disabled: C2, C3, C5, C6, R2, R4, R5, R6
   - Enabled: C5, R2; Disabled: C2, C3, C4, C6, R2, R3, R4, R6
   - Enabled: C2, R5; Disabled: C3, C4, C5, C6, R2, R3, R4, R6
   - Enabled: C5, R3; Disabled: C2, C3, C4, C6, R2, R4, R5, R6
   - Enabled: C4, R5; Disabled: C2, C3, C4, C5, C6, R2, R3, R5, R6
   - Enabled: C5, R5; Disabled: C2, C3, C4, C6, R2, R4, R5, R6
   - Enabled: C6, R5; Disabled: C2, C3, C4, C5, R2, R3, R4, R6
   - Enabled: C5, R6; Disabled: C2, C3, C4, C5, R2, R4, R5, R6
   - Enabled: C6, R6; Disabled: C2, C3, C4, C5, R2, R4, R5, R6
   - Enabled: C6, R6; Disabled: C2, C3, C4, C5, R2, R4, R5, R6
   - Enabled: C7, R6; Disabled: C2, C3, C4, C5, R2, R4, R5, R6
   - Enabled: C8, R6; Disabled: C2, C3, C4, C5, R2, R4, R5, R6
   - Enabled: C9, R6; Disabled: C2, C3, C4, C5, R2, R4, R5, R6
   - Enabled: C10, R6; Disabled: C2, C3, C4, C5, R2, R4, R5, R6
   - Enabled: C11, R6; Disabled: C2, C3, C4, C5, R2, R4, R5, R6
   - Enabled: C12, R6; Disabled: C2, C3, C4, C5, R2, R4, R5, R6
   - Enabled: C13, R6; Disabled: C2, C3, C4, C5, R2, R4, R5, R6
   - Enabled: C14, R6; Disabled: C2, C3, C4, C5, R2, R4, R5, R6
   - Enabled: C15, R6; Disabled: C2, C3, C4, C5, R2, R4, R5, R6
   - Enabled: C16, R6; Disabled: C2, C3, C4, C5, R2, R4, R5, R6
   - Enabled: C17, R6; Disabled: C2, C3, C4, C5, R2, R4, R5, R6
   - Enabled: C18, R6; Disabled: C2, C3, C4, C5, R2, R4, R5, R6
   - Enabled: C19, R6; Disabled: C2, C3, C4, C5, R2, R4, R5, R6
   - Enabled: C20, R6; Disabled: C2, C3, C4, C5, R2, R4, R5, R6
   - Enabled: C21, R6; Disabled: C2, C3, C4, C5, R2, R4, R5, R6
   - Enabled: C22, R6; Disabled: C2, C3, C4, C5, R2, R4, R5, R6
   - Enabled: C23, R6; Disabled: C2, C3, C4, C5, R2, R4, R5, R6
   - Enabled: C24, R6; Disabled: C2, C3, C4, C5, R2, R4, R5, R6
   - Enabled: C25, R6; Disabled: C2, C3, C4, C5, R2, R4, R5, R6
   - Enabled: C26, R6; Disabled: C2, C3, C4, C5, R2, R4, R5, R6
   - Enabled: C27, R6; Disabled: C2, C3, C4, C5, R2, R4, R5, R6
   - Enabled: C28, R6; Disabled: C2, C3, C4, C5, R2, R4, R5, R6
   - Enabled: C29, R6; Disabled: C2, C3, C4, C5, R2, R4, R5, R6
   - Enabled: C30, R6; Disabled: C2, C3, C4, C5, R2, R4, R6

(4) Enable MAMA Folds C2, C3, C4, C5, C6, R2, R3, R4, R5, R6
(5) Check lamp stability by checking EV and VE: Collect 60 sec. of data for EV and VE event types.
(6) Turn off the deuterium lamp.
(7) Collect event data for detector dark count rate. Collect 60 sec. of data for the following event types: W, X, Y, Z, OR, EV, and VE.
(8) At completion of the test, reset SGM to nominal operating level.