Kratos XPS/EELS History of Startup Failures:

**Analyzer Control Unit Board Shorting**

**First Observed:** 08/20/10, resolved: 09/15/10

**Description**: During scan intensity would suddenly plummet creating blips in the spectra, blips would not align on repeated scans. Isolated problem to voltage drop in the lens mechanism of the detector.

**Solution**: V7 card in the analyzer control unit was reseated (it had wobbled loose during shipping and occasionally lost electrical contact).

**Stage Control Unit Failure**

**First Observed:** 10/04/10, resolved: 11/02/10

**Description**: Stage motors failed, no movement of stage. Replacement was sent, but first replacement would not engage on restart of software. Temp workaround used both stage control units. No known cause of failure.

**Solution**: Replacement sent and installed but it did not work, third stage control unit sent and installed.

**TSP Remote Controller Failure**

**First Observed:** 04/28/11, resolved: 06/16/11

**Description**: During the degassing of the (titanium sublimation pump) TSP, it stopped working. We had been degassing it by taking the degas current up in steps from 30A to 48A b/c it has been shutting itself off during a normal degas due to high pressures triggering the protected mains. At 44A which should be below its titanium sublimation point, the controller went from operational to "burned out" on all three filaments in one degas cycle. We tried restarting the TSP controller with no effect. Replacement filaments were sent, but when filaments were checked they appeared in tact. TSP remote controller was inspected and was fried.

**Solution**: Replacement TSP remote controller sent and installed.

**Wide Range Gauge Temporary Fault**

**First Observed:** 09/26/10, resolved: 09/29/10

**Description**: Load lock pressure unstable and in high E-6 T range. Initially suspected turbo pump, but problem was with the gauge.

**Solution**: Restart the gauge (unplug and replug), think might have condensed water on it during a bakeout.

**Transfer Arm Interlock Fail**

**First Observed:** 10/15/10, resolved: 11/19/10

**Description**: While the interlock was overridden during a bakeout, the electronics were shorted and fried. We were able to bypass it, while waiting for the replacement.

**Solution**: New transfer arm interlock from Kratos.

**TPD Stage Cable**

**First Observed:** From installation

**Description**: there is a cable that was not installed during instrument installation of the TPD. Cable shipped but never installed.

**Solution**: Install cable (to be resolved).

**Magnet Flow Meter Replaced**

**First Observed:** 06/13/11, resolved: 06/16/11

**Description**: count rate intensity dropped by an order of magnitude in the middle of a scan. Checked VME, measured flow to magnet dropped, as did the magnet lens voltage. B/c measured flow was inconsistent; we suspected meter fault rather than a blockage.

**Solution:** Replaced flow meter.

**O-ring Shearing**

**First Observed:** 10/26/10, resolved: 03/03/11

**Description**: O-ring on flat valve would shear, tear, and pucker out of slot leaving the instrument inoperable.

**Solution**: Replaced O-ring multiple times be after short period each o-ring failed. Kratos sent smaller o-ring (240) that was installed.

**O-ring Outgassing**

**First Observed:** 03/03/11, resolved: 05/10/11

**Description**: When first smaller o-ring of size 240 was installed (see above), adventitious carbon in the analysis chamber became noticeably worse.

**Solution**: New 240 o-ring sent from different manufacturer, adventitious carbon is lower and declining, though still present.

**Load Lock Transfer Arm Movement Slowed/Slipping**

**First Observed:** 09/27/10, resolved: 10/14/10

**Description**: The load lock transfer arm was moving very slowly and at times completely unresponsive due to the gear mechanism slipping. We believe this was caused by the forceful turning of the mechanism while the arm was extended and in contact with the magazine done by the Kratos engineer.

**Solution**: Tightened the set screw in the interior of the load lock mechanism.

**Flat Valve Noise**

 **First Observed:** 3/2011

**Description:** The electronic motor for the gate between chambers is starting to whine very loudly, as if not providing sufficient torque. It is possible that bits of o-ring might have gotten into the push/pull mechanism causing some increased friction.

**Solution:** Problem does not impact operation, so is being ignored.

**Transfer Arm to EELS not Working**

**First Observed:** At installation, resolved: 01/2011

**Description:** Can not pick up sample from magazine in preparation chamber to move to EELS.

**Solution:** Discussions with Kratos, and engineer visit to redo alignment of transfer arms. Also, the alignment ramp in the STC had to be bent in order to allow the EELS transfer arm to retract properly without sticking.

**EELS Vertical Transfer Arm Misaligned**

**First Observed:** 01/2011, resolved: 01/2011

**Description:** There is a metal cuff that holds up the EELS transfer arm at the top of the instrument. During a bake the metal had relaxed and caused the arm to drop downward a couple centimeters in its mount. This put the arm's throw out of range of the Kratos transfer arm.

**Solution**: We fixed it by loosening the cuff, lifting the arm and bellows assembly up, and retightening it. The problem was diagnosed by comparing photos of the properly installed EELS to its postbake condition and noticing the cuff.

**EELS Camera not Present**

**First Observed:** At installation, resolved 05/2011

**Description:** The position of sample in the EELS chamber cannot be monitored in order to correctly place the sample in the spectrometer, due to presence of Kratos system.

**Solution:** Two remote cameras were installed on the EELS chamber.

**EELS Vertical Arm Theta Rotation not Functioning**

 **First Observed:** 07/22/2011, resolved: 07/22/2011

**Description:** EELS vertical arm not responding to rotation commands.

 **Solution:** The o-ring on the motor had become worn and snapped after a bake, likely due to the heat. The o-ring was replaced with a viton o-ring.

**E-beam Heater not Functioning**

**First Observed:** 01/31/2011, resolved: 06/2011

**Description:** We have had issues with the e-beam heater assembly (Kratos) in the EELS, with the HV fuse in the power supply blowing, and no bias applied to the e beam gun.

**Solution:** The power supply was replaced on this unit and is now functional.

**Vertical Arm Thermocouple for E-beam Heating**

**First Observed:** From installation

**Description:** The temperature read by the thermocouple on the EELS arm is reading a 'non-reality.' The puck can be glowing, and the thermocouple still reads 120 C, indicating bad thermal contact between the thermocouple and the arm, or between the arm and the puck. Either way, this is a non-functional way to read the temperature when using the ebeam gun.

**Solution:** Purchase an optical pyrometer (not yet resolved).

**E-beam Heater cannot heat samples on Kratos Stub**

**First Observed:** at installation, resolved: pending

**Description:** The design of the Kratos Stub does not allow correct heating of the sample. The issue requires both a new design of the stub and new method to attach the sample to the stub..

**Solution:** Pending.