
EO-1 ALI: What we've learned over the past two years (and one day) and how it affects SVT data

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EO-1 SVT Meeting

21 November 2002



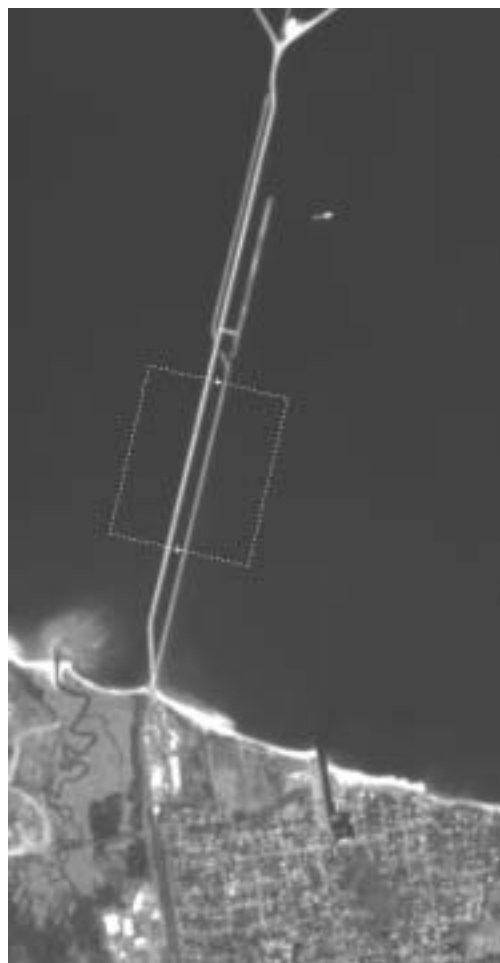


Outline

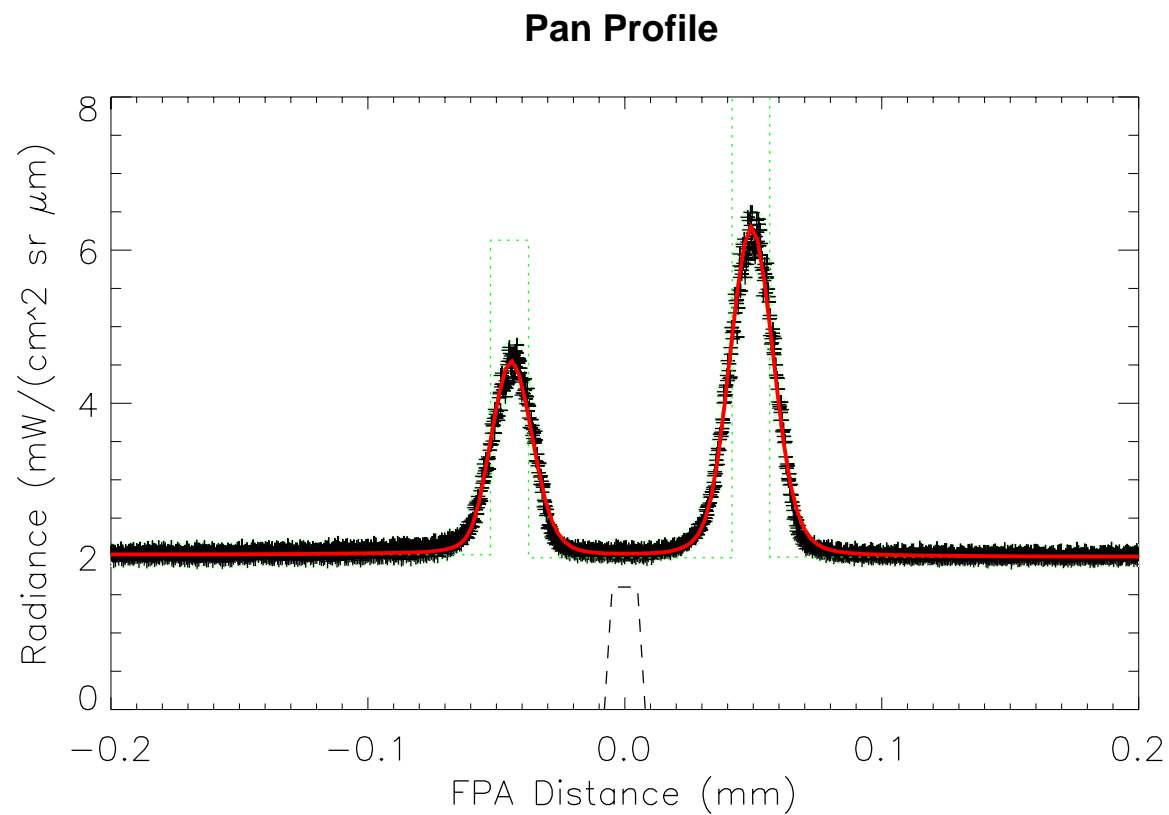
- **Spatial Performance**
- Radiometric Performance
- Summary



Earle Naval Pier, Sandy Hook Bay



Pan image

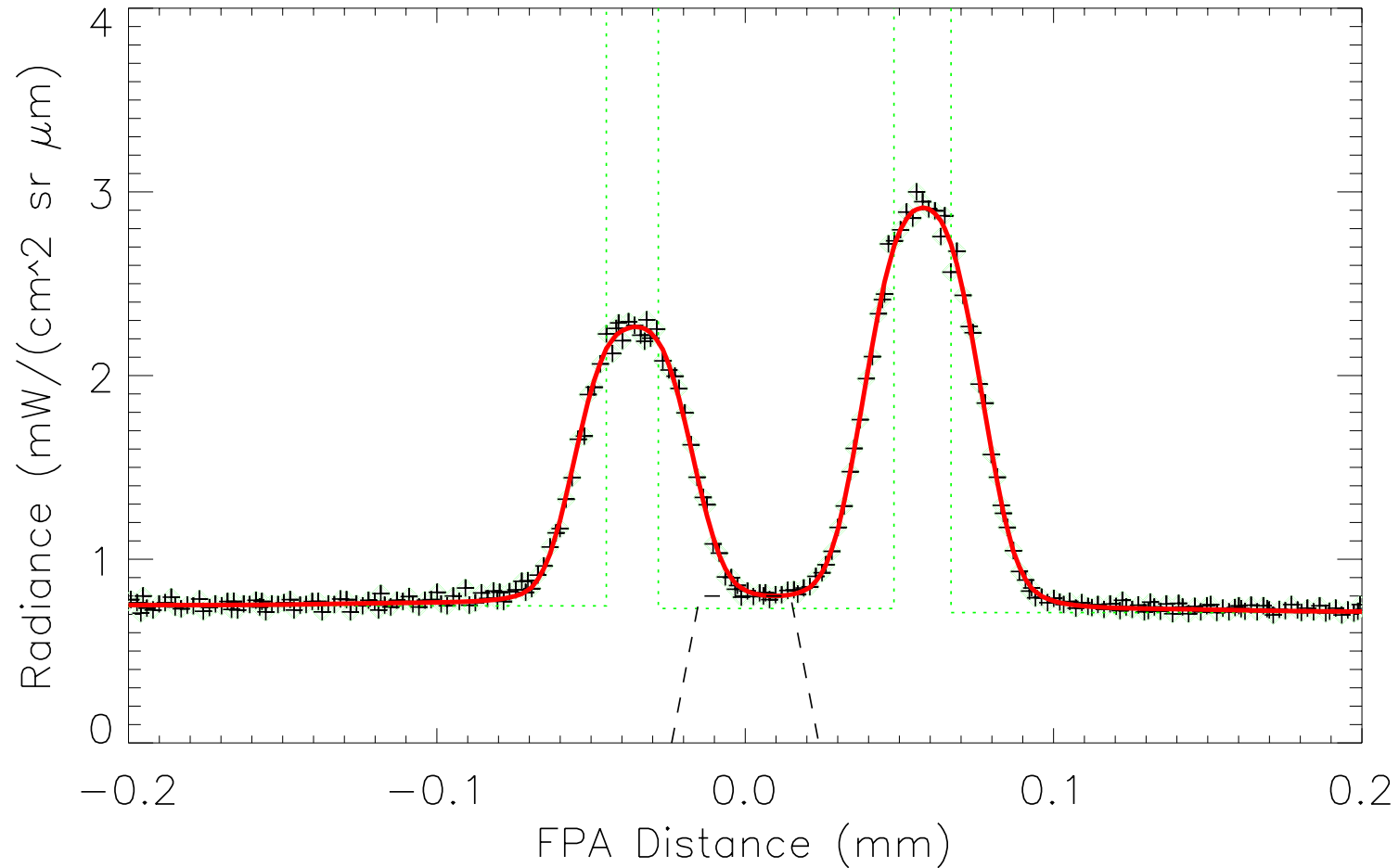


Angle from track = 13.24°

$\chi^2 = 2.75$, for 4,048 DOF



Earle Naval Pier, Band 4 Profile



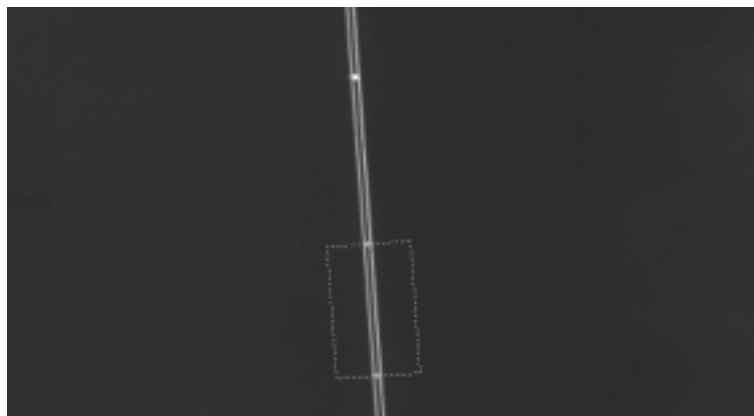
$\chi^2 = 1.59$, for 440 DOF



Lake Pontchartrain Causeway



Bascule bridge



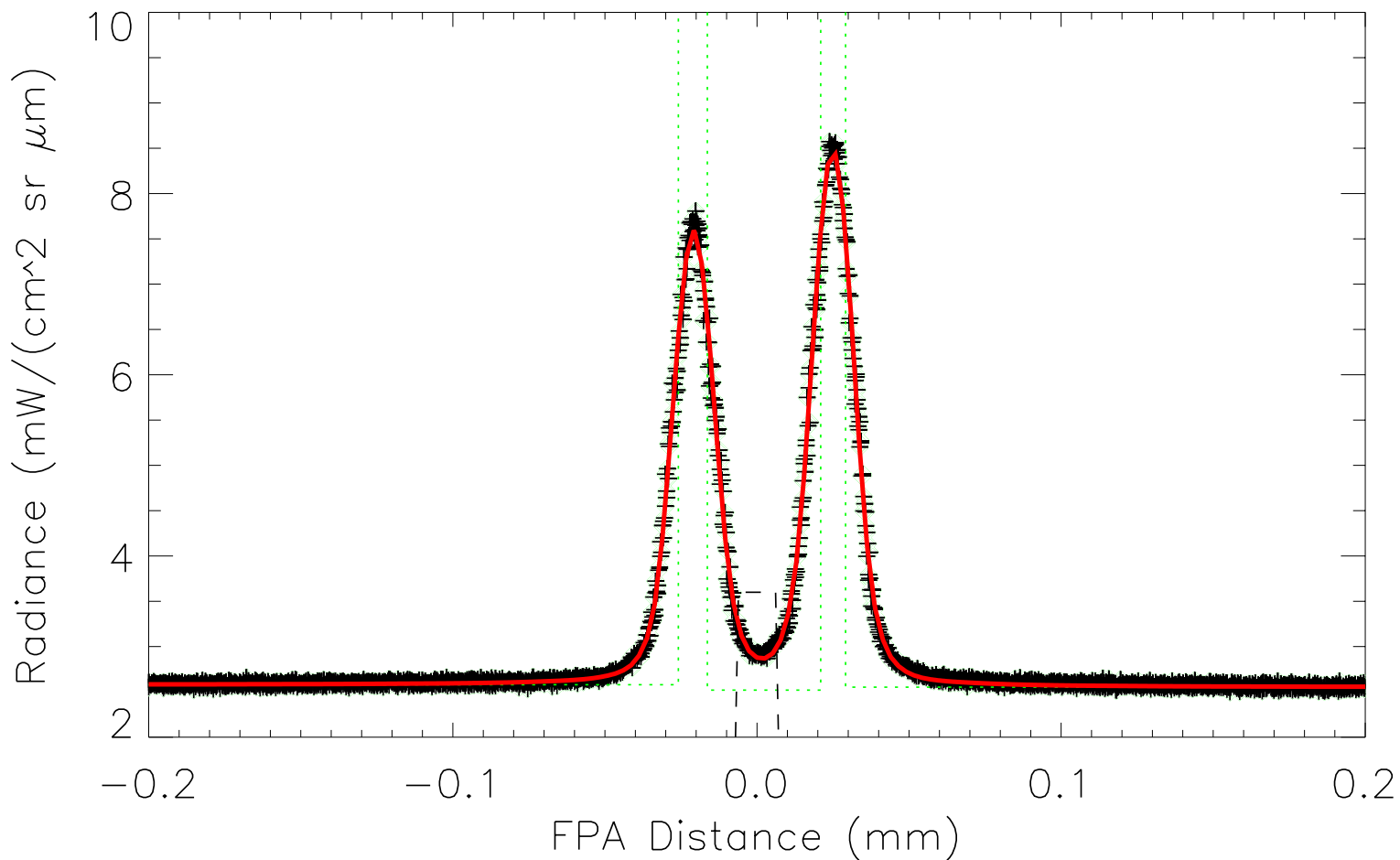
ALI Pan image (Level 1R)



ALI browse image (3-2-1)

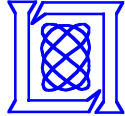


Lake Pontchartrain Causeway Profile



Panchromatic band

$\chi^2 = 1.50$, for 3,000 DOF



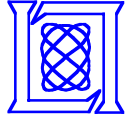
Spatial Performance

- **ALI spatial performance measured during preflight calibration verified on-orbit (David Hearn, Jim Storey)**
 - **Bridges**
 - **Lunar images**
 - **Stars**
- **No effects on spatial performance due to spacecraft jitter or solar array activities**
- **Level 1 R data have not been geometrically resampled**
- **Spatial performance degraded between December 5, 2000 and January 5, 2001 when FPA heavily contaminated.**



Outline

- **Spatial Performance**
- **Radiometric Performance**
 - **Stray Light**
 - **Contamination**
 - **Dark Current**
 - **Absolute Stability**
 - **Relative Stability**
- **Summary**

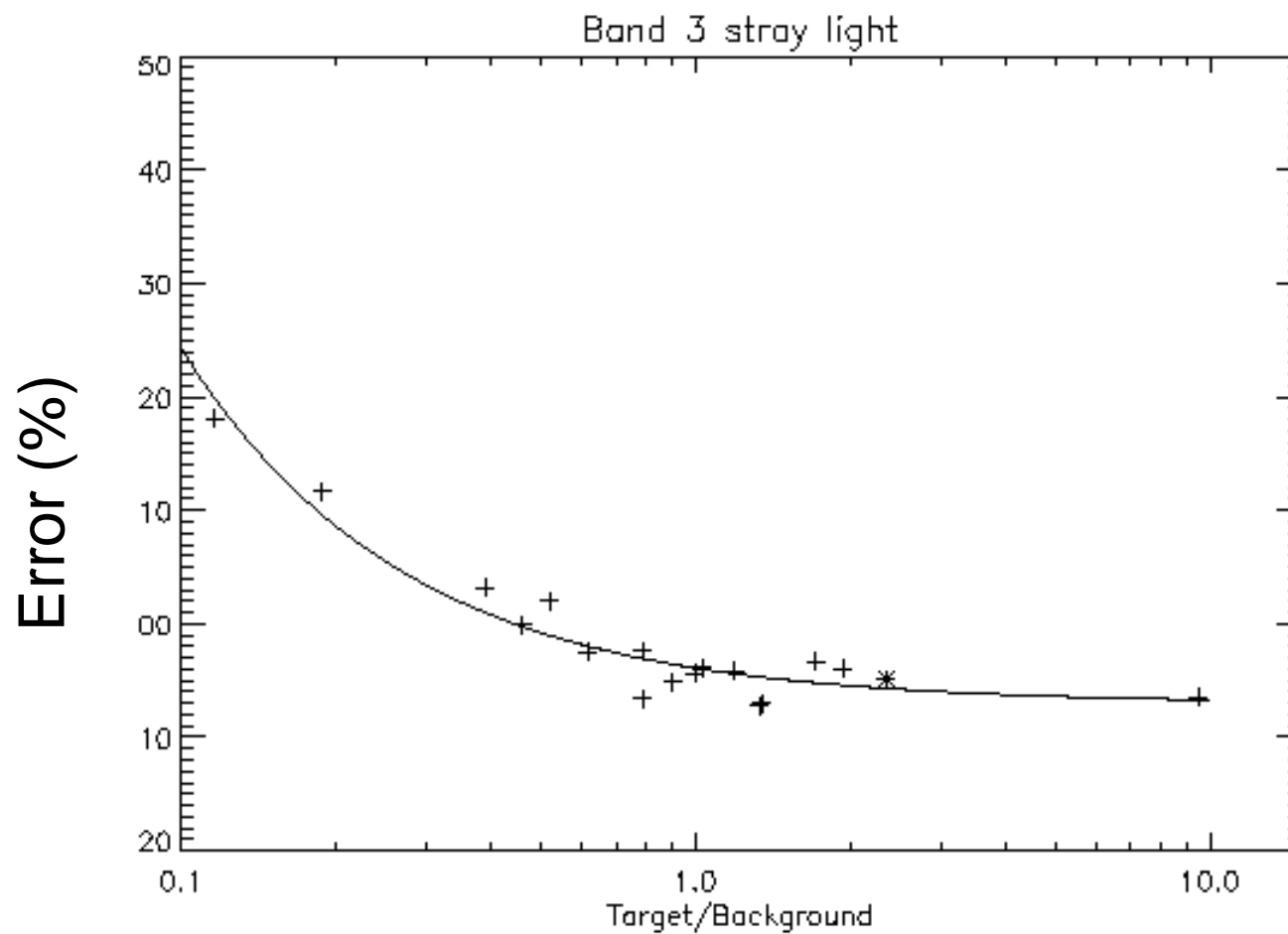


Stray Light

- **Three sources of stray light have been identified**
 - Reflected light from black structure and baffles
 - Mirror scatter
 - VNIR/SWIR Filter interface (local ghosting in SWIR)
- **Stray light modeling by Lambda Research and analysis of on-orbit scenes by MIT/LL verified only scenes with high contrast will be significantly affected by stray light**
 - Lakes
 - Coastlines
 - Holes in mostly cloudy scenes
 - Active lava flows
 - Lunar observations
 - Earth limb scans



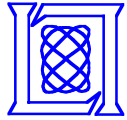
Stay Light Data - Band 3





Maricopa, 2001032

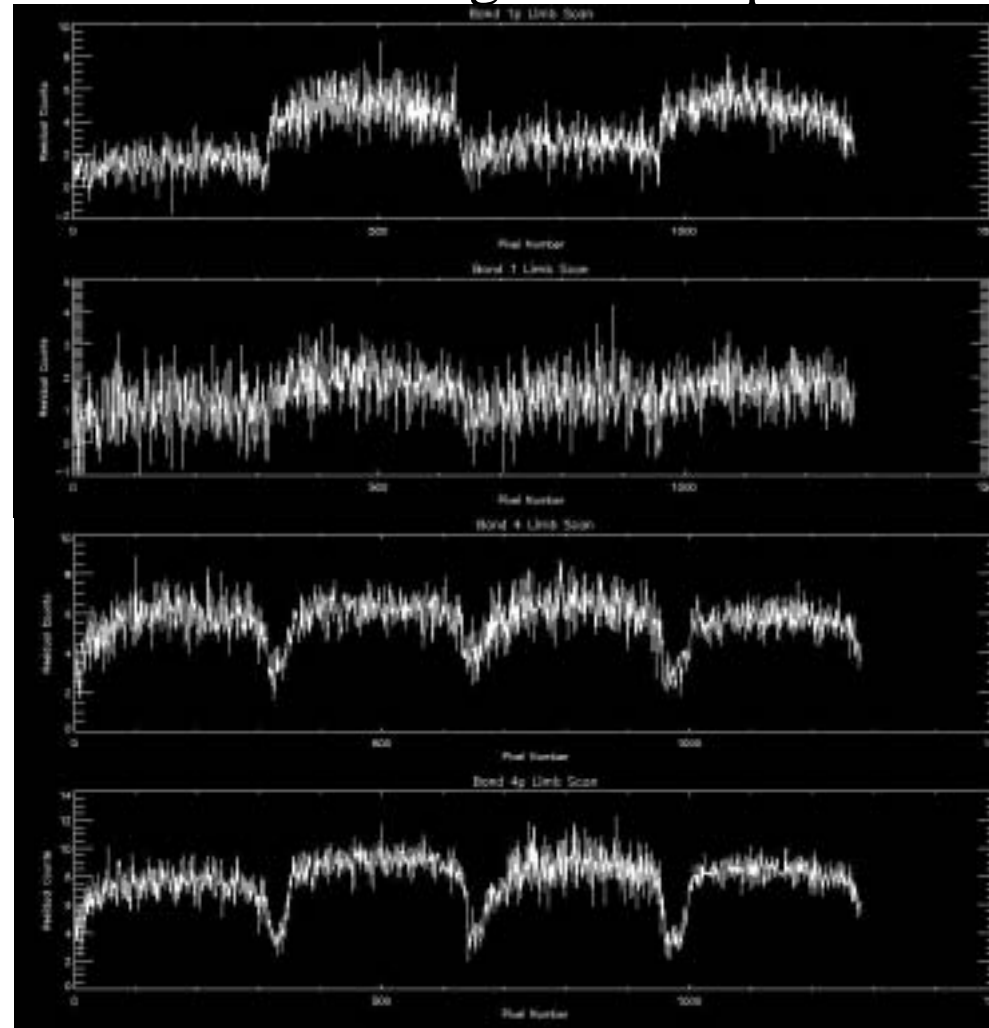




Black Paint Stray Light



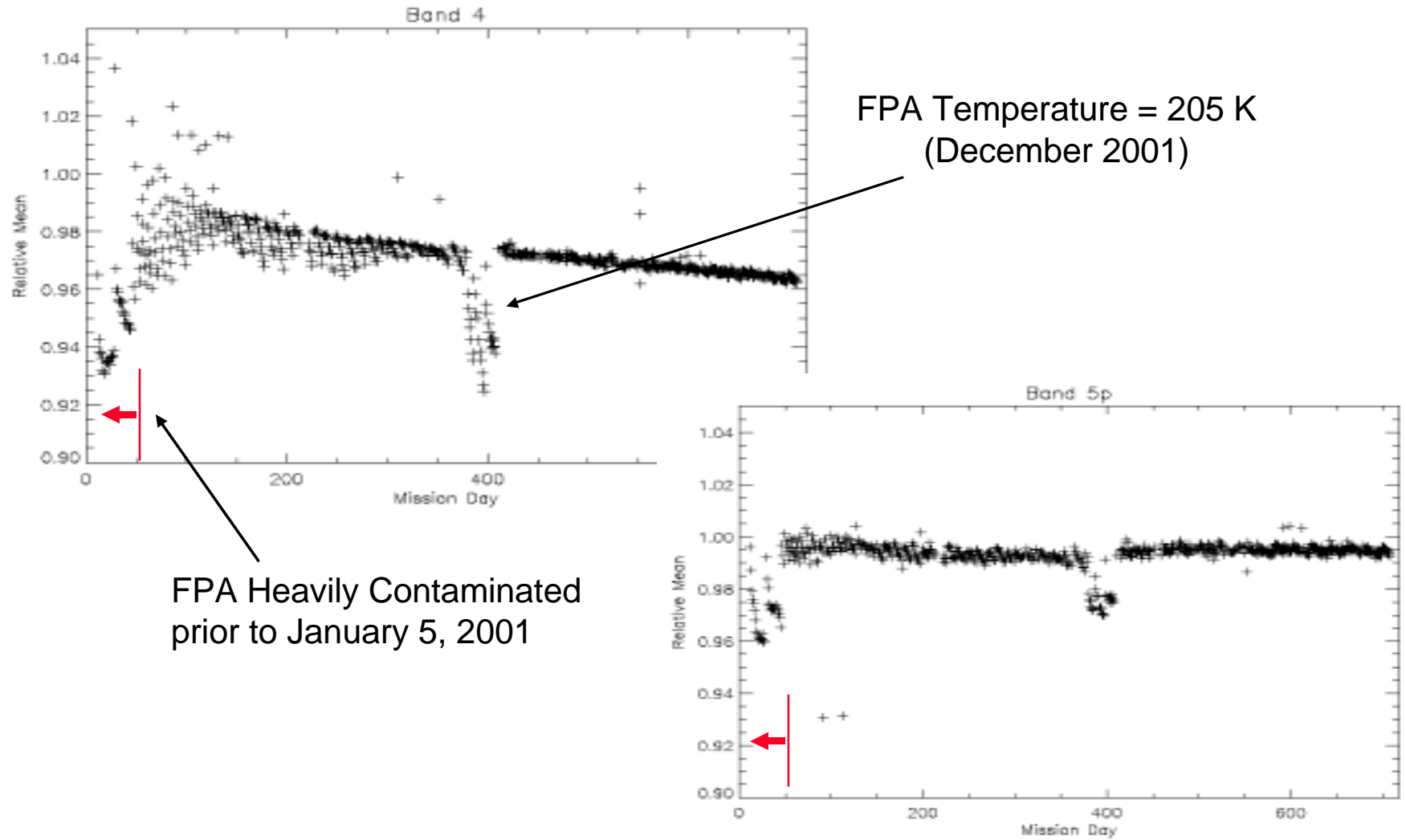
Observed Signal Examples



← No Signal Expected Here

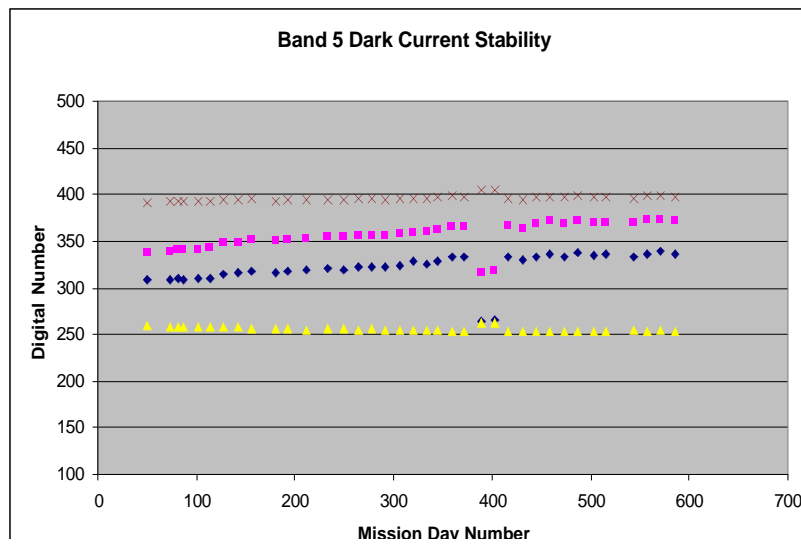
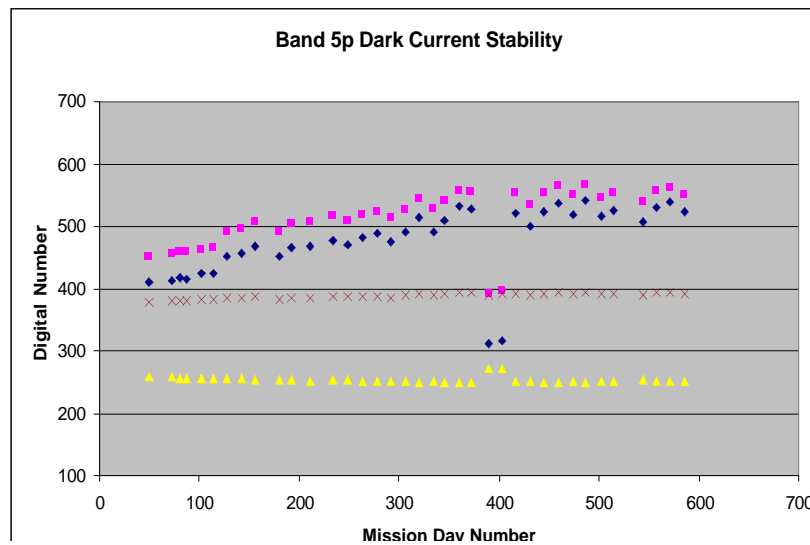
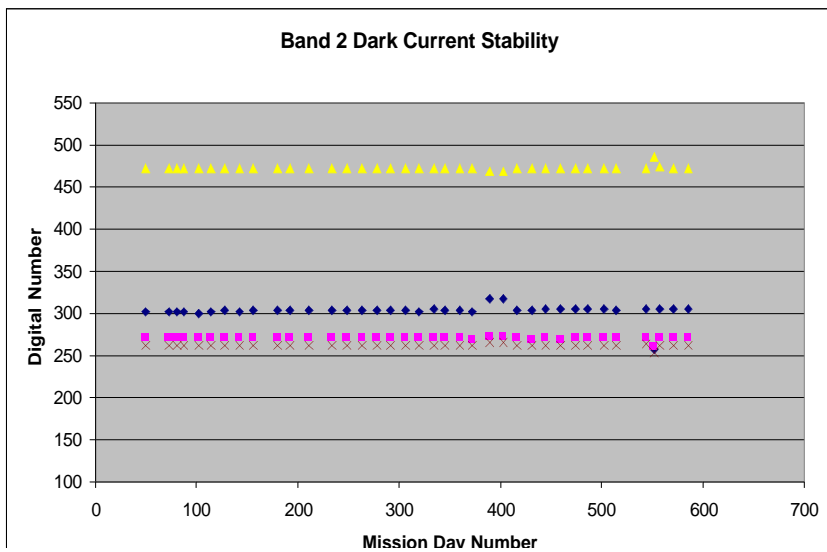


Contamination





Dark Current Stability



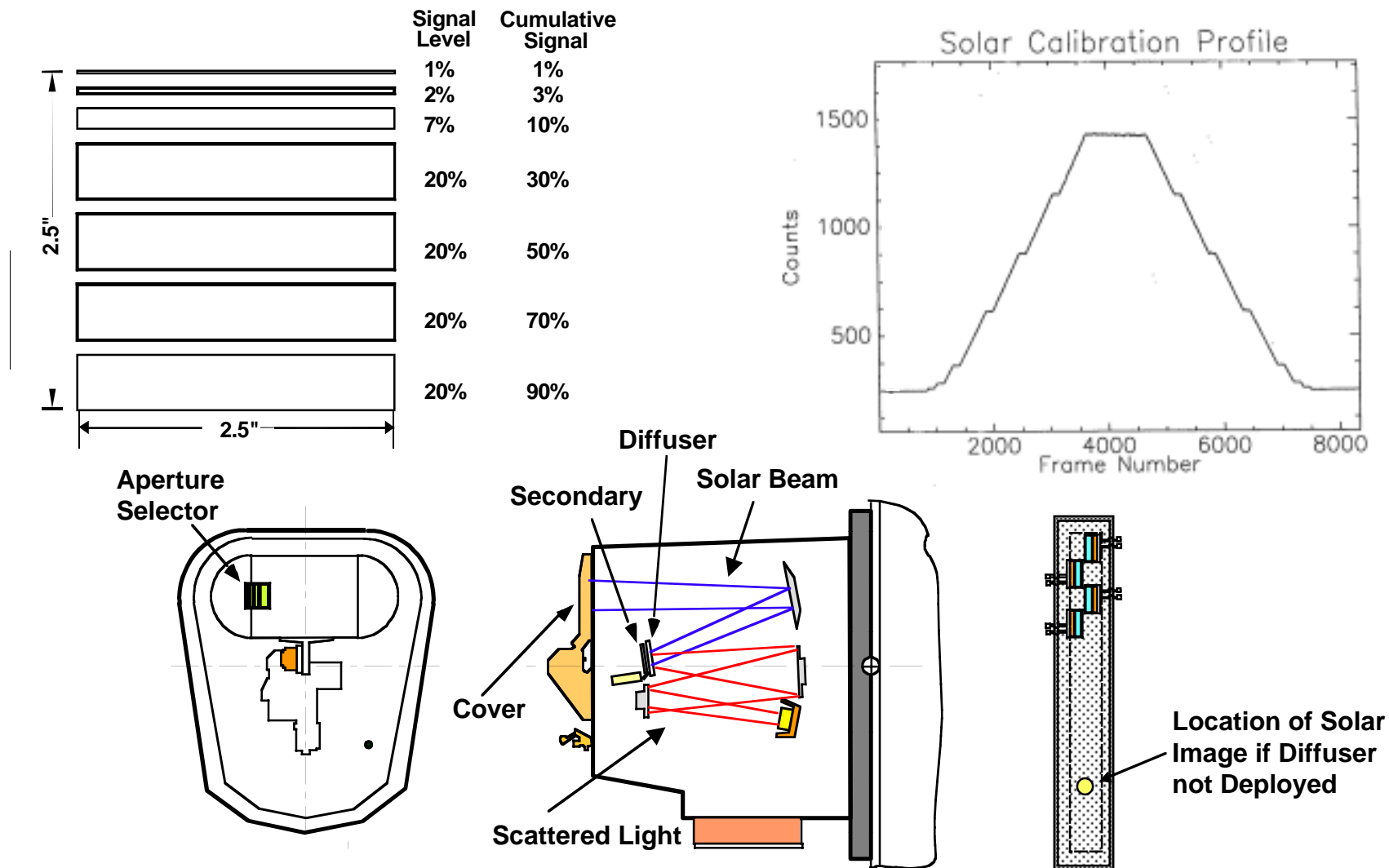


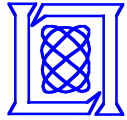
Absolute Radiometry

- **ALI calibration coefficients updated December 2001**
 - **Solar**
 - Lunar (Kieffer)
 - **Ground truth (UofA)**
 - **ETM+ comparison**
 - Internal lamp
- **Changes include 18% decrease in Band 1p, 2-5% decrease in Bands 1-3, 10% increase in Band 5 (relative to preflight calibration)**
- **Data processed before December 2001 will only be reprocessed by EO-1 Science Office on request**

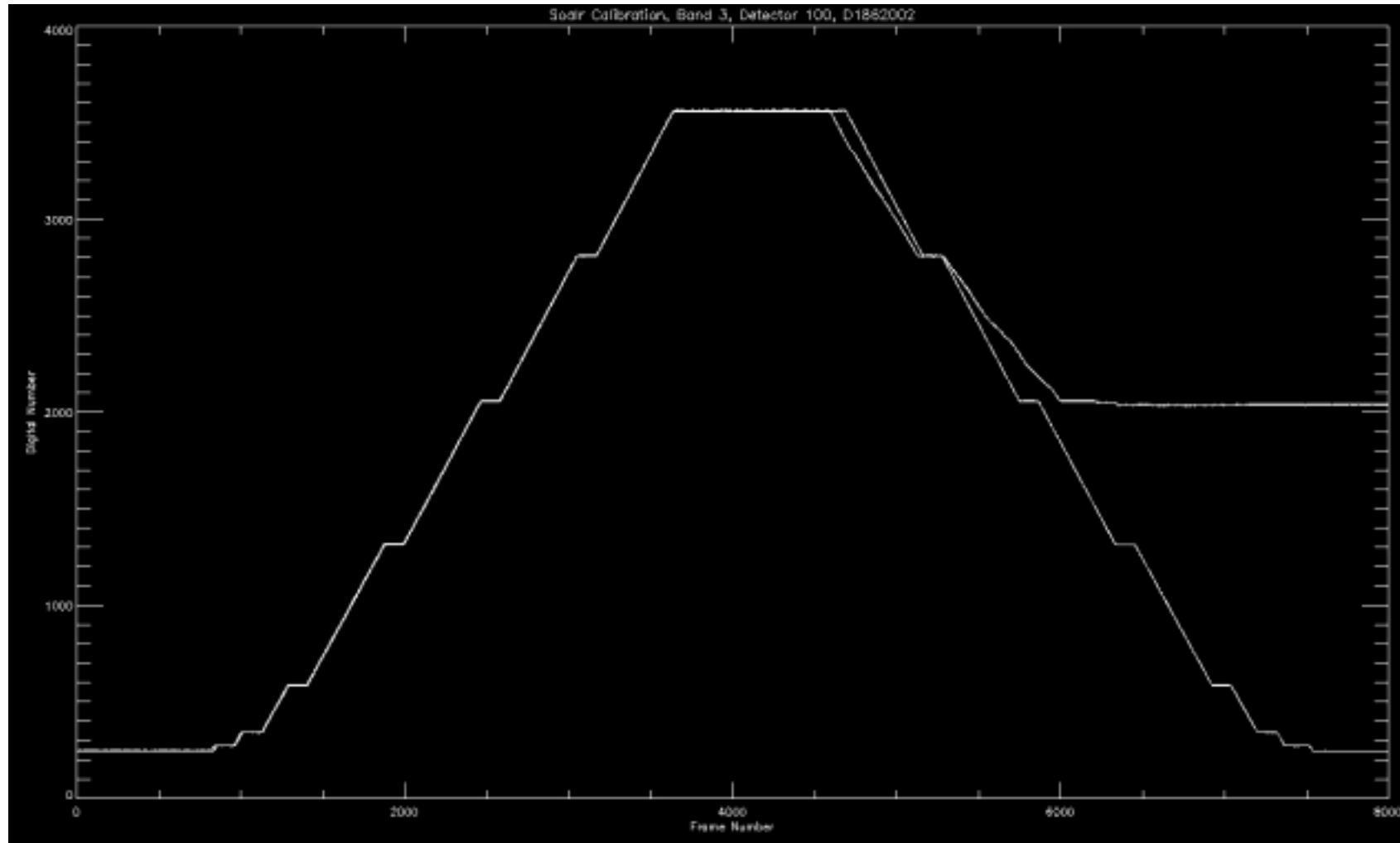


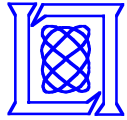
Absolute Stability - Solar Calibration Mechanism Failure



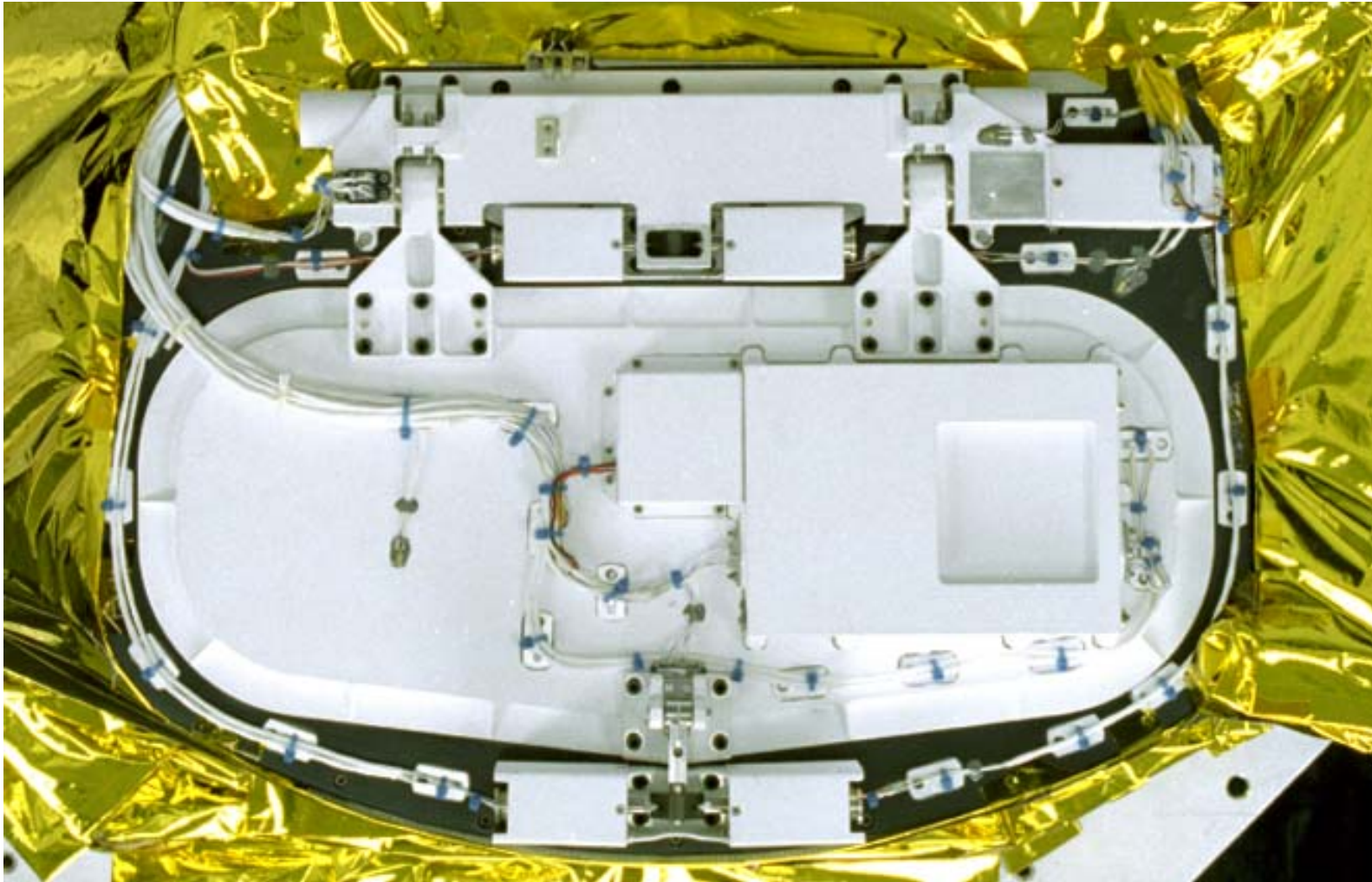


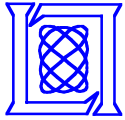
Comparison



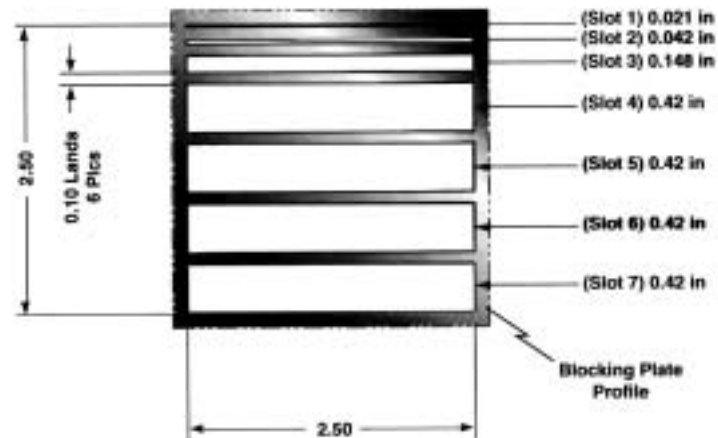
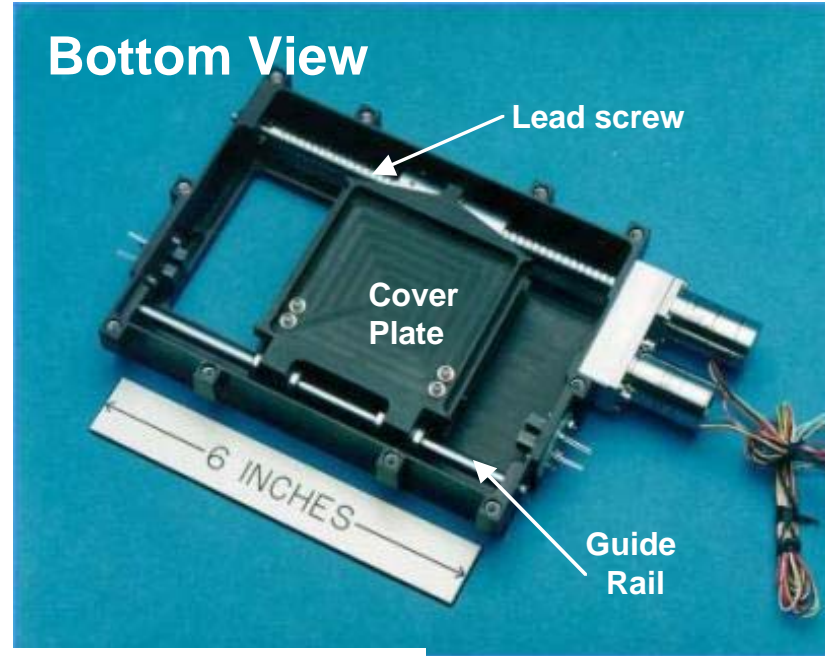
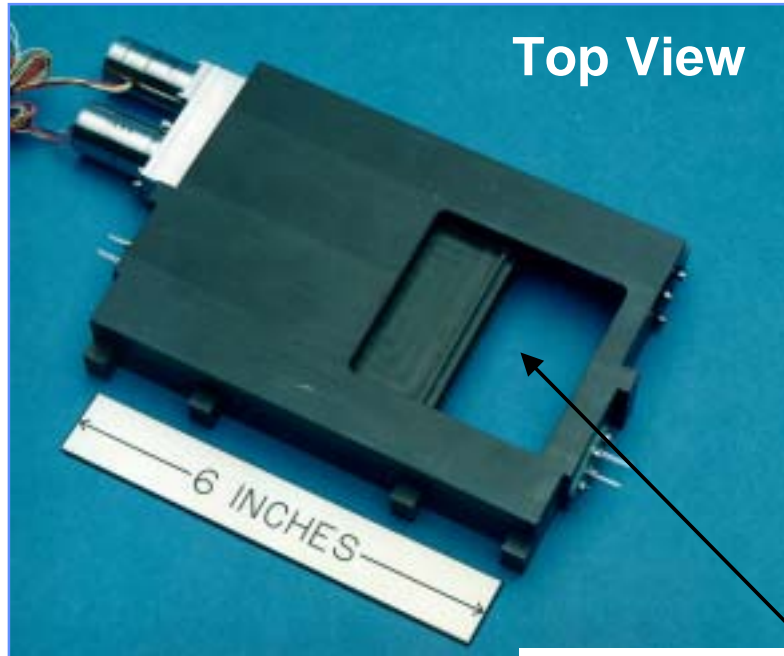


Aperture Cover





Aperture Selector Mechanism



Slit Arrangement

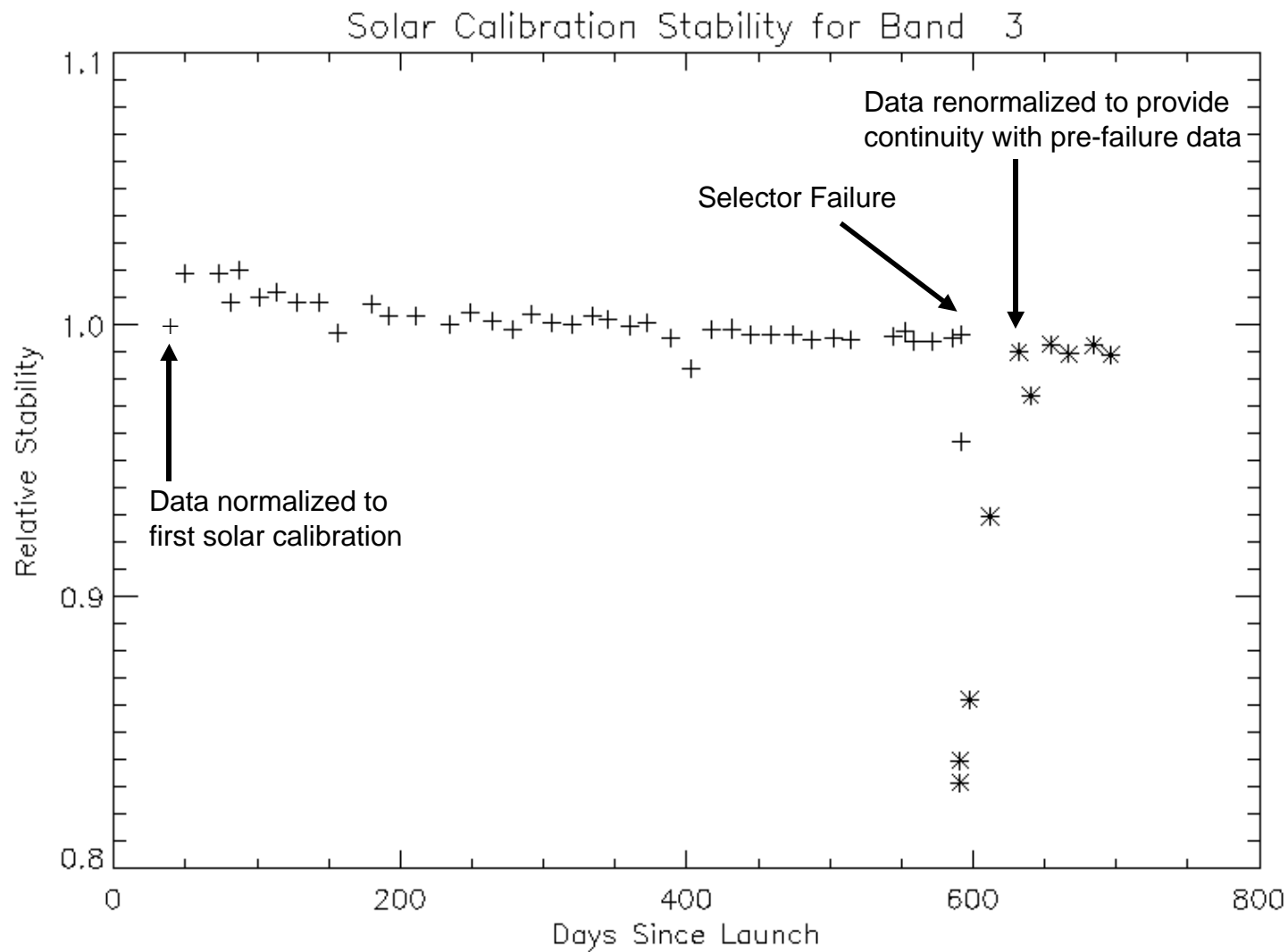


Solar Calibration Failure

- **No impact on DCEs**
- **No impact on special dark collections**
- **No impact on lunar calibrations**
- **Solar calibrations impacted**
 - **Multiple illumination levels lost**
 - **Stability monitoring may continue if slide position remains fixed**
 - **Solar calibration script changed to eliminate aperture selector commands**
- **Instrument safehold impacted**
 - **Safehold script changed to eliminate aperture selector commands**



EO-1 ALI Band 3 Solar Calibration Stability



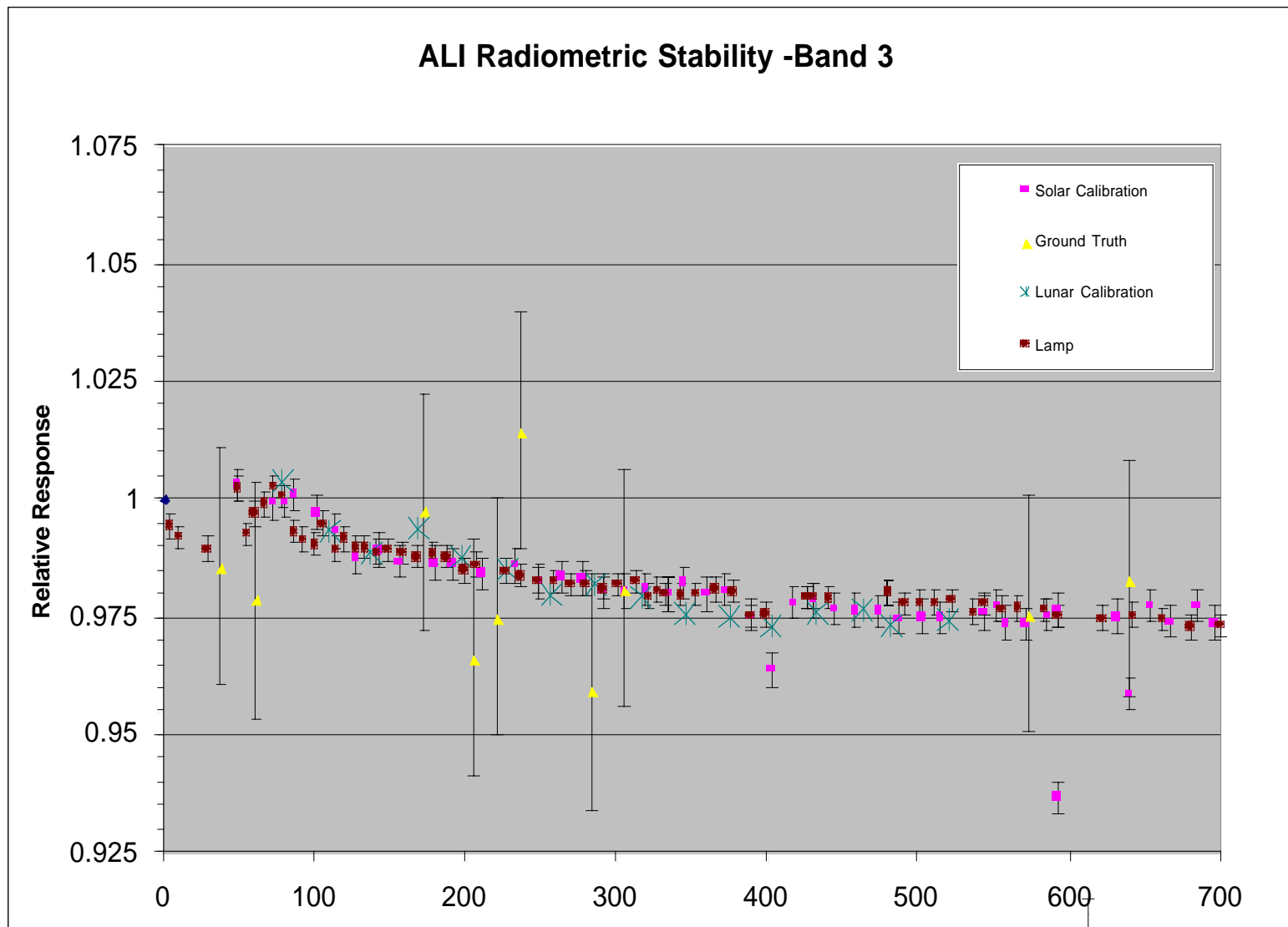


Absolute Stability

- **Internal Lamp – Daily**
- **Solar – 14 days**
- **Lunar – 30 days**
- **Ground Truth – Periodically**



Radiometric Stability - SCA Level



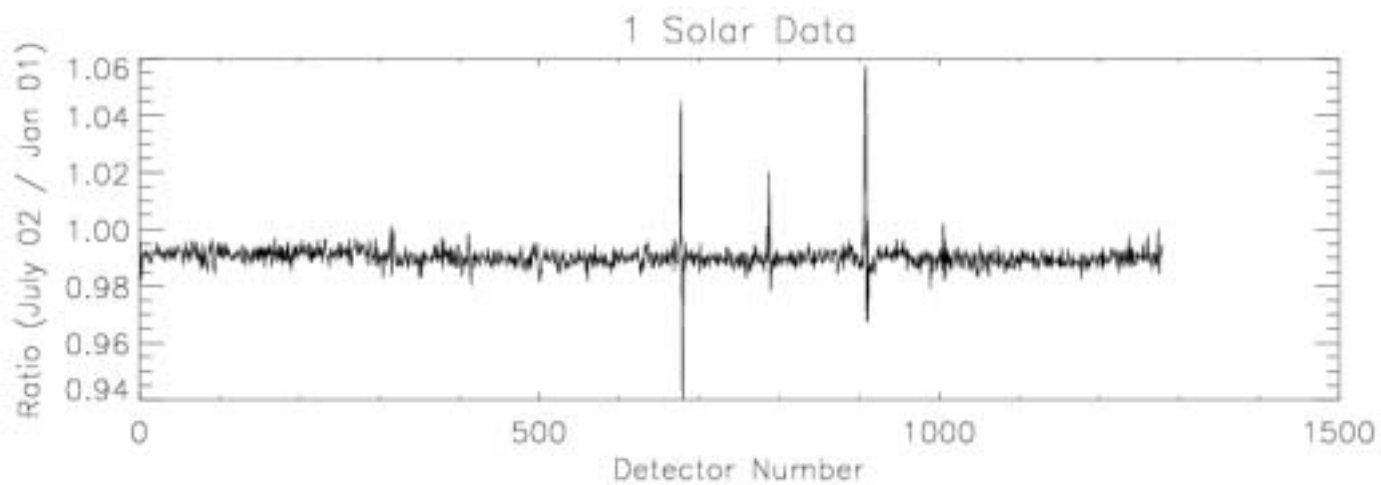
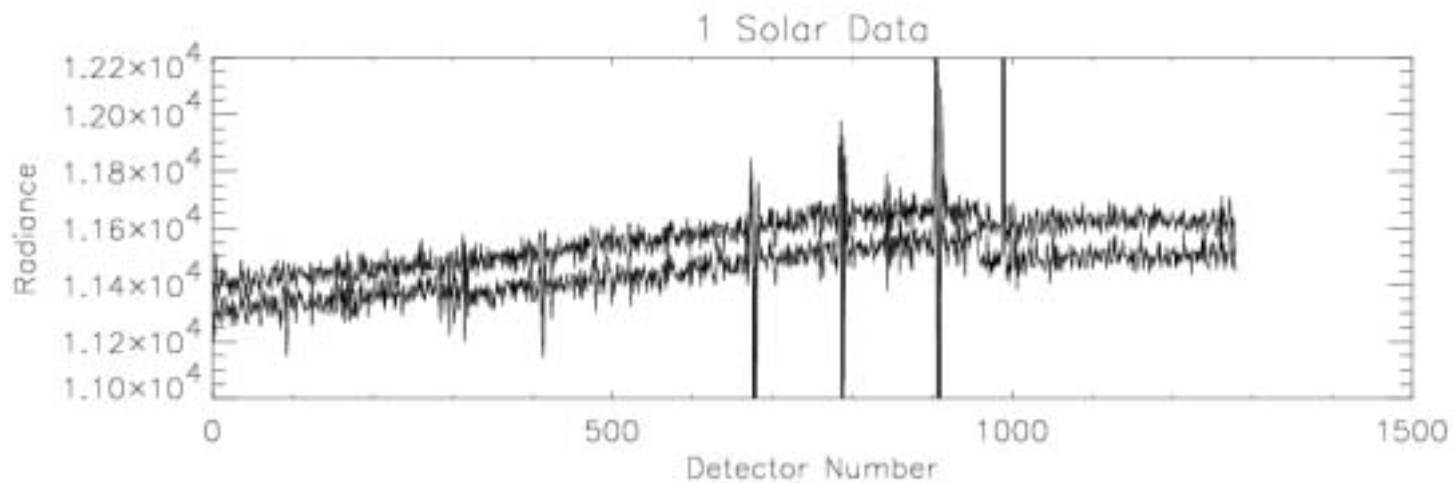


Radiometric Stability - SCA Level

<u>Band</u>	<u>Year 1 Drift (%)</u>	<u>Year 2 Drift (%)</u>
1p	<1.0	<1.0
1	<1.0	<1.0
2	<1.0	<1.0
3	-2	-1
4	-2	-1
4p	-2	-1
5p	<1.0	<1.0
5	<1.0	1
7	<1.0	1
8	<1.0	<1.0

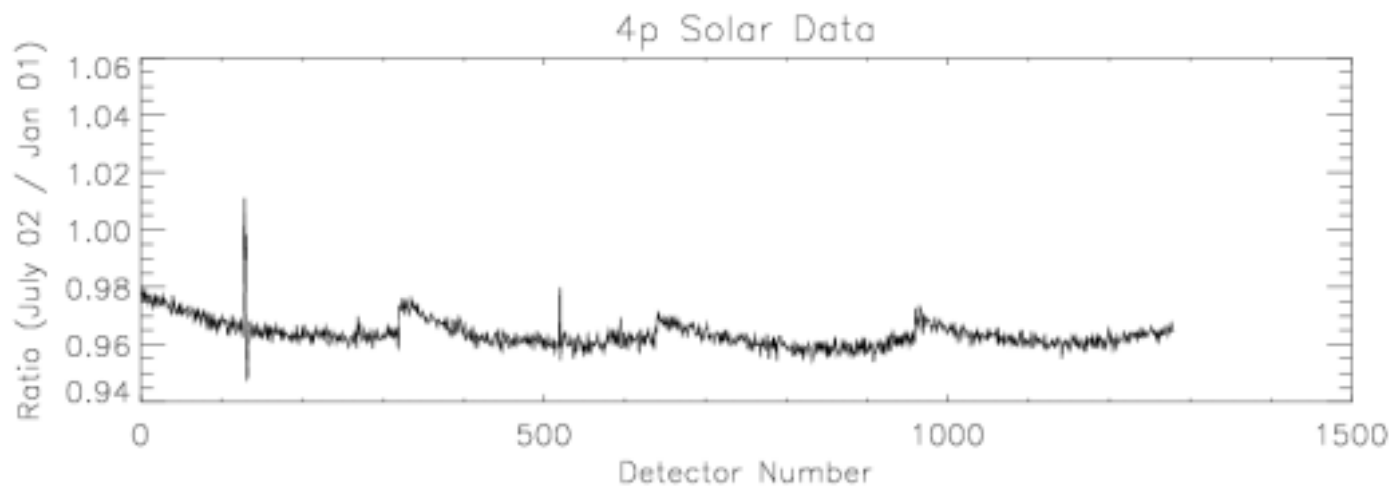
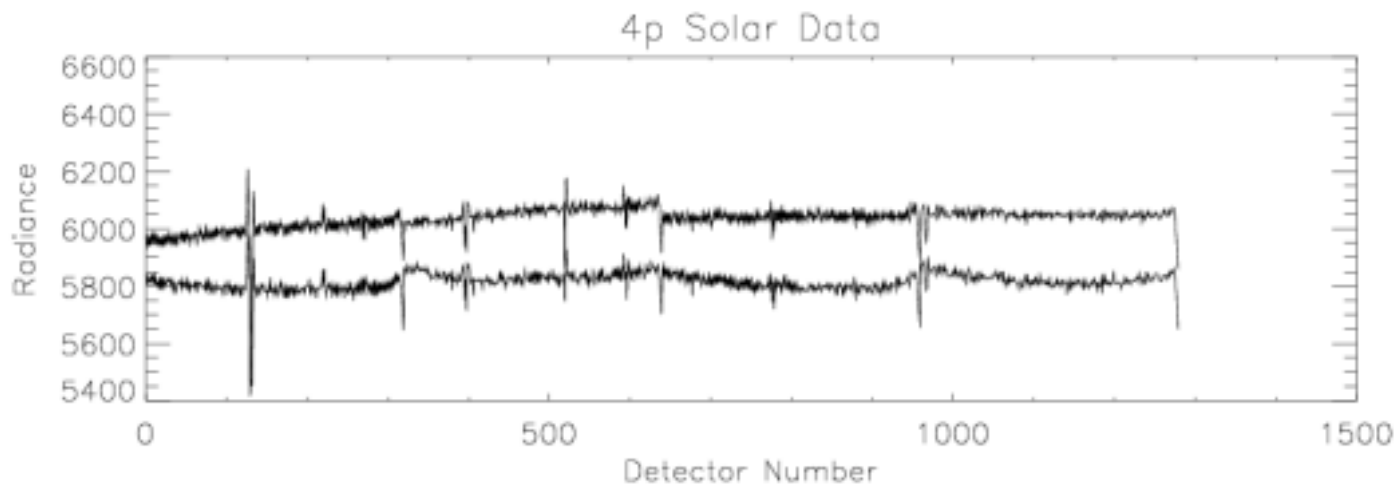


Radiometric Stability - Relative





Radiometric Stability - Relative





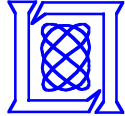
Outline

- **Spatial Performance**
- **Radiometric Performance**
- **Summary**



Summary

- **Spatial performance**
 - Nominal on-orbit
 - Degraded during Dec 5, 2000 to Jan 5, 2001 when FPA contaminated
 - Level 1R data are not resampled
- **Radiometric performance**
 - Stray light could be significant for dim targets in high-contrast scenes
 - FPA heavily contaminated during Dec 5, 2000 to Jan 5, 2001 period.
 - Contamination virtually eliminated after Nov 2001
 - Current bakout interval is 20 days
 - SWIR detectors saturated during bakout periods
 - Dark current levels have been very stable in VNIR but have increased by up to 50 DN/year in some SCAs for Bands 5p, 7
 - Calibration coefficients updated Dec 2001
 - Significant response change during FPA operation at 205 K during Dec 2001
 - Absolute radiometry for Bands 3, 4, 4p have decreased ~3% in two years
 - Drifts in relative calibration coefficients are evident in Bands 3, 4, 4p and need to be addressed before striping occurs in imagery



Appreciation

- **Lawrence Ong for continued friendship and support in the analysis of ALI data**
- **Steve Ungar for allowing the instrument teams to interact fully with the SVT and attend all meetings**
- **Valued discussions and feedback from SVT members**