SNPP CrIS Instrument Performance

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NOAA/STAR ICVS

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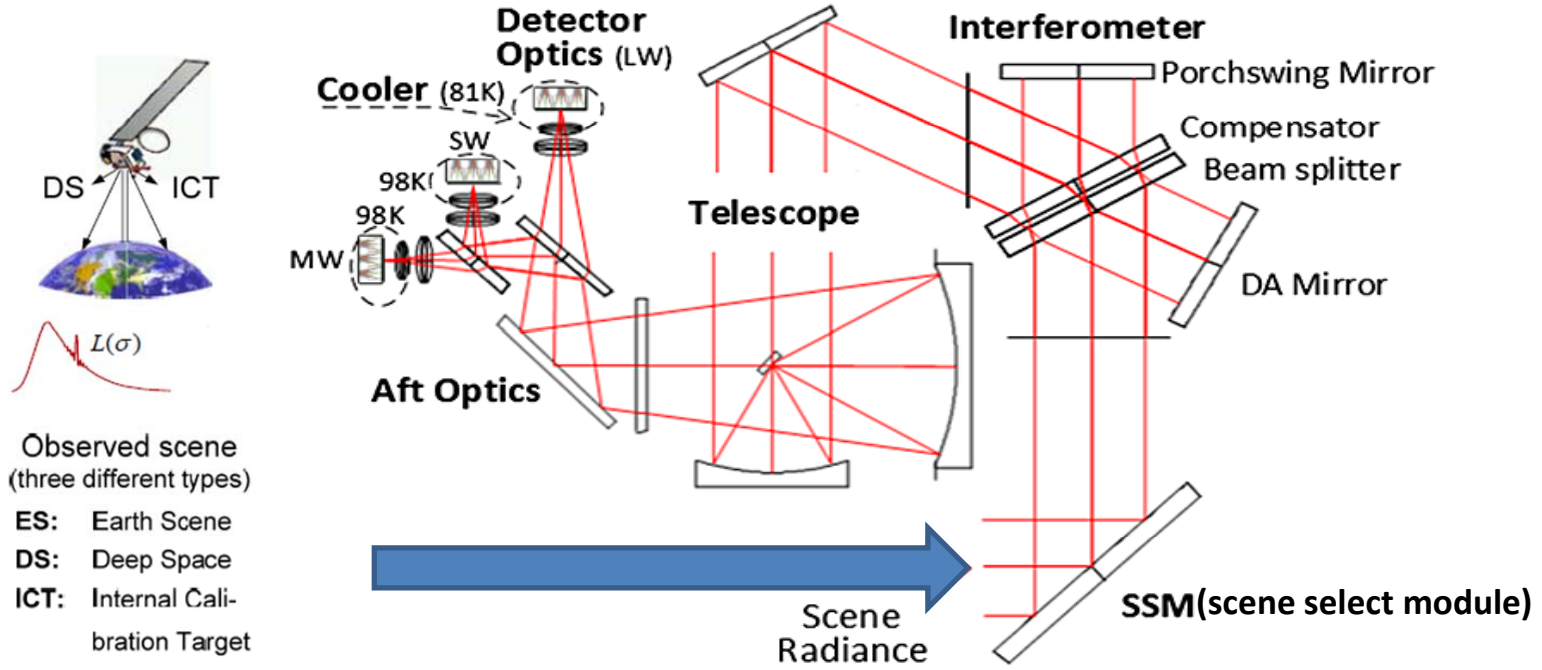
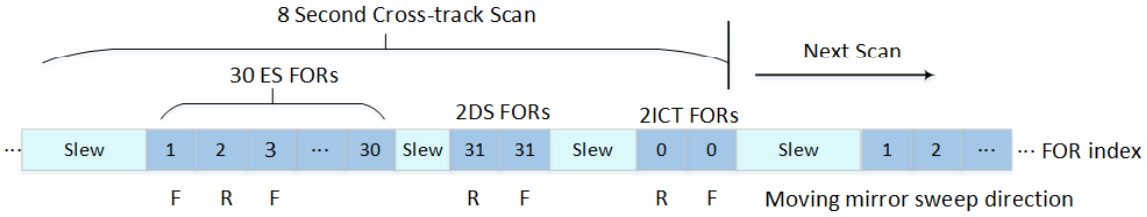
- Part 1: CrIS ICVS System Overview

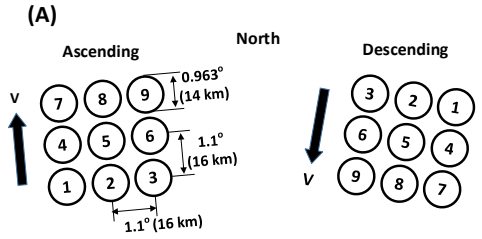
Housekeeping	• Fundamental hardware status parameters • Data source: RCRIT
RDR	• Interferogram quality, thermal environment parameters, laser diode status, spectral noise/gain/offset • Data source: RCRIS-RNSCA
SDR	• IDPS operational radiance product quality • Data source: SCRIS, GCRSO
Bias	• IDPS operational radiance bias • Data source: SCRIS/GCRSO, ECMWF
FSR SDR	• NOAA/STAR full-spectral resolution SDR radiance product quality • Data source: NOAA internal

- Part 2: SNPP/CrIS Instrument Performance

Instrument Introduction: optical system



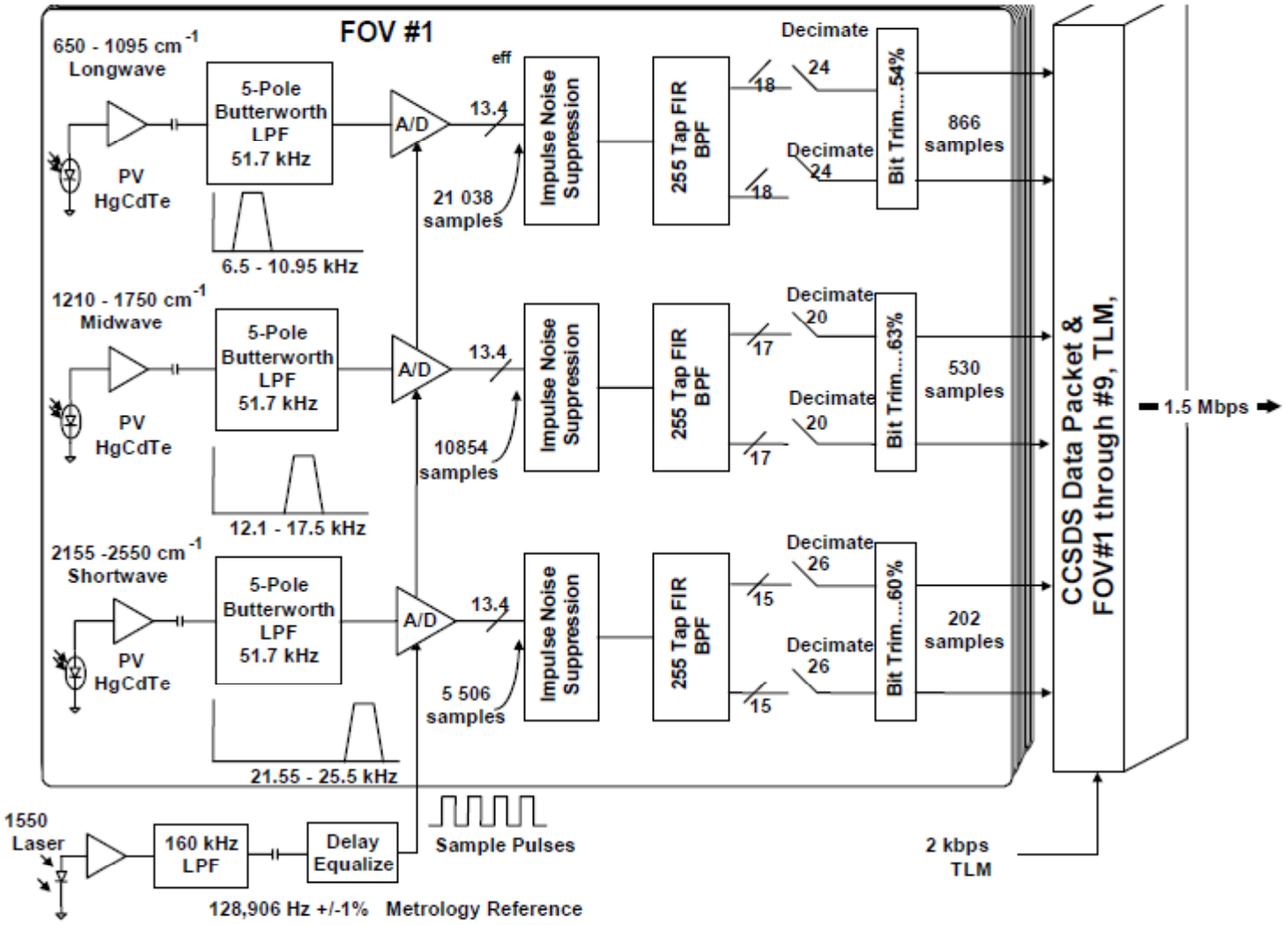




A cross-track scan sequence. F – forward direction; R – reverse direction.

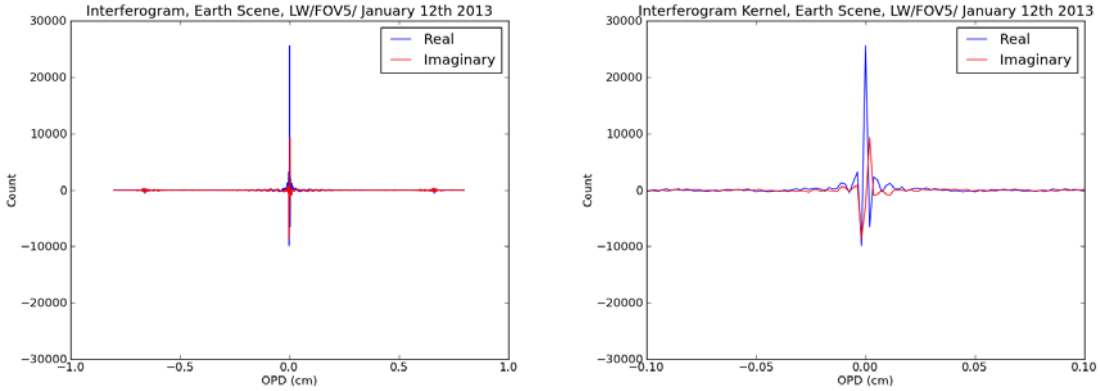
The status of all parts in the optical system are monitored

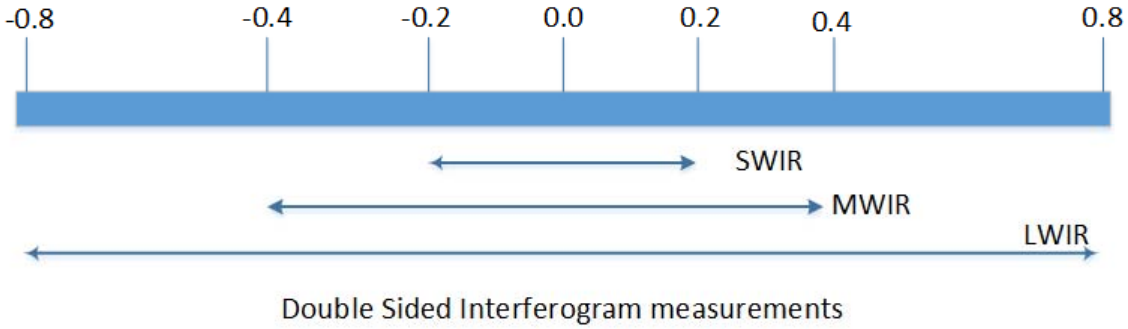
Instrument Introduction: digital sampling system



The status of all parts in the digital sampling system are monitored

Instrument Introduction: specification (normal mode)





Frequency Band	Number of samples before decimation	Effective OPD (cm)	Decimation Factor	Number of bins in the interferogram
LWIR	20738	0.8035	24	866
MWIR	10560	0.4092	20	530
SWIR	5200	0.2015	26	202

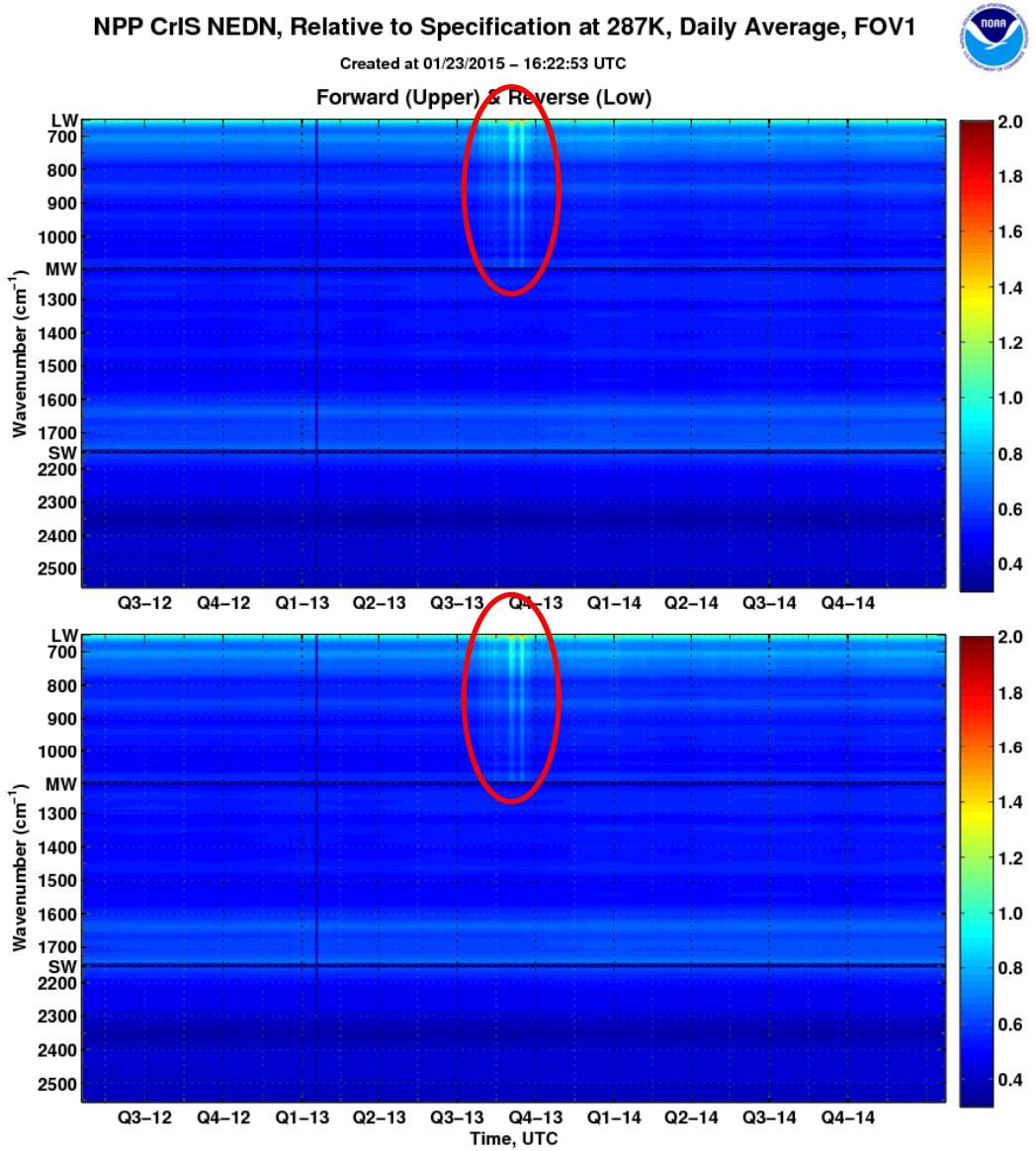
Since Dec 04, 2014, MW and SW interferogram are switched to full-spectral resolution mode, i.e. the MW&SW OPD are extended to 0.8 cm

Major anomalies: list

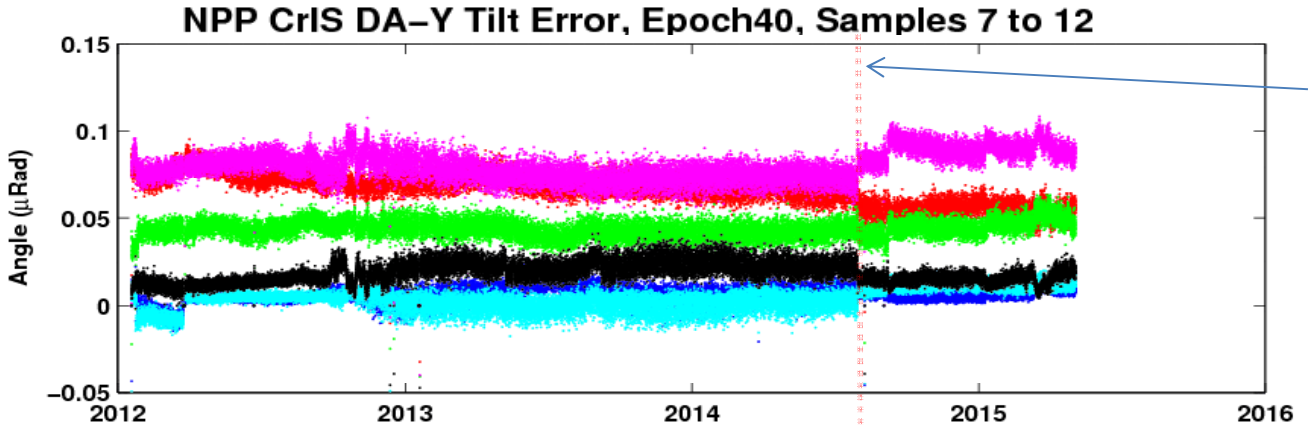
1. Long-wave FOV1 excessive noise
2. Dynamic Alignment (DA) mirror tilt error
3. Scene Select Module (SSM) position counter error
4. False Earth Scene impulse noise
5. ICT impulse noise
6. Single Bit Error Correction Control Error (CREECBIT)
7. IEEE 1394 Data BUS reset
8. RDR data stream contamination by Direct Broadcast (DB) data stream

Hardware anomaly: LW NEDN

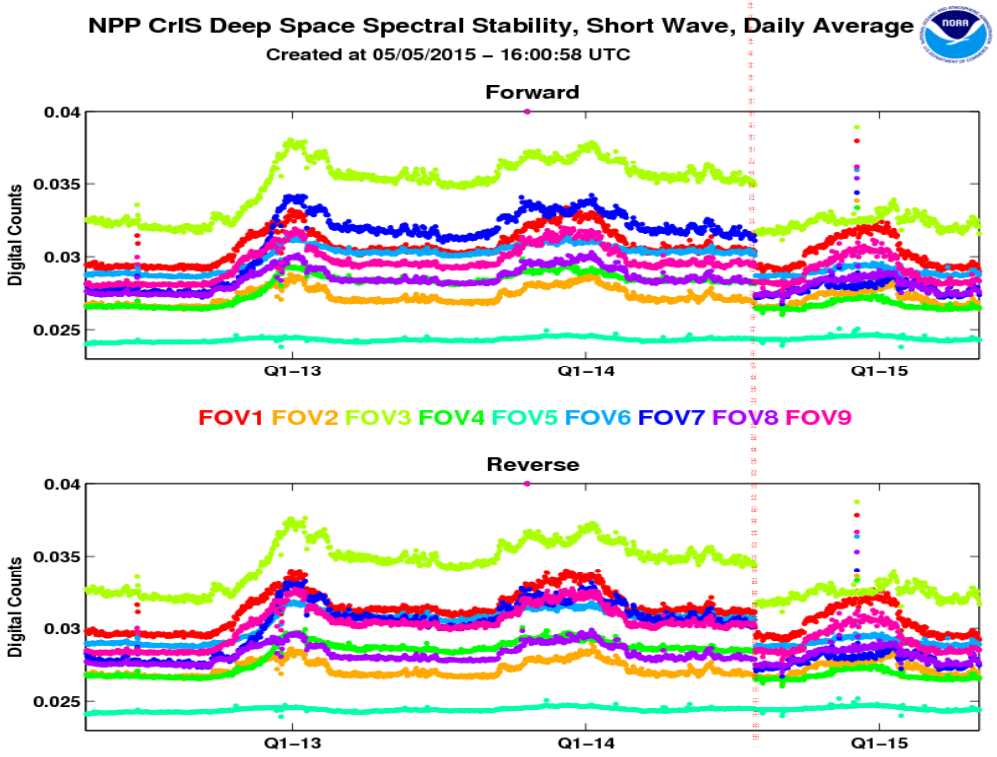
- **LW FOV1 spectral noise anomaly between July and September of 2013**



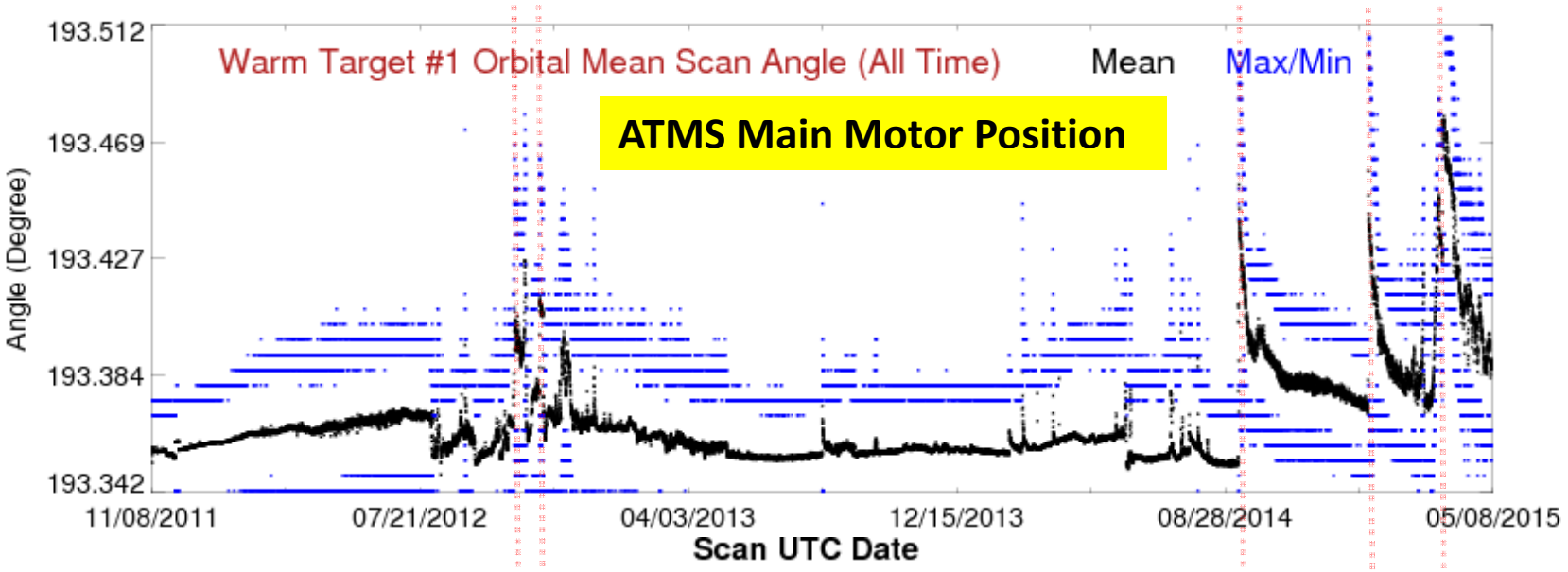
Hardware anomaly: DA Mirror Tilt Error

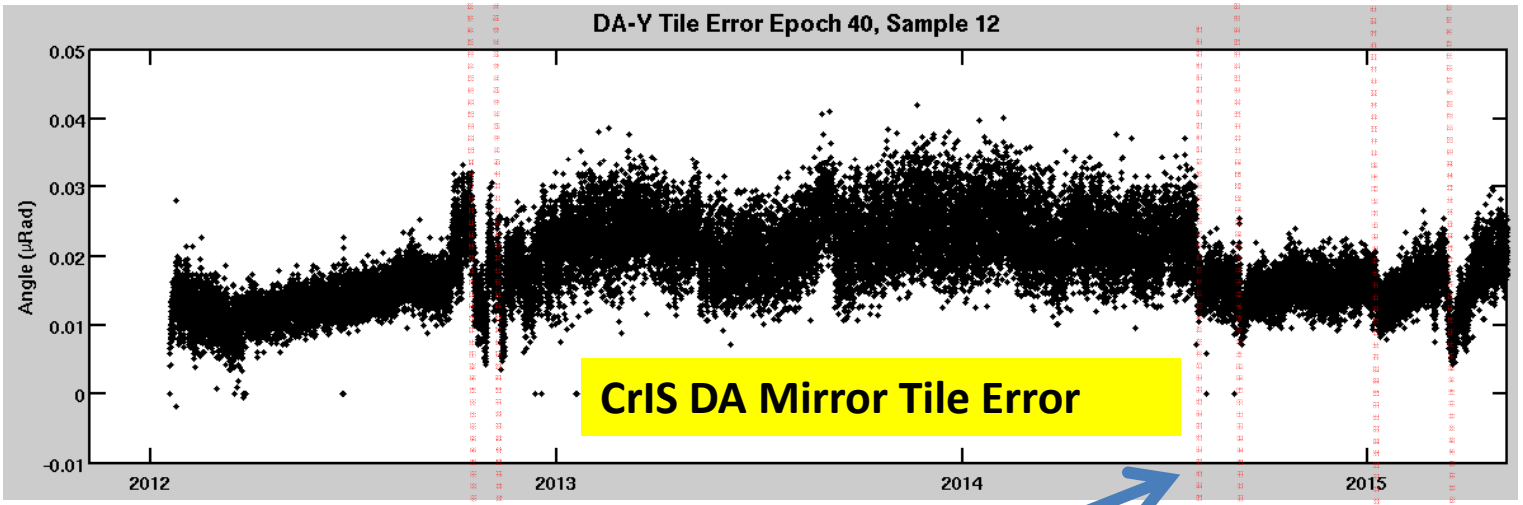


Inclination angle maneuver 20140730



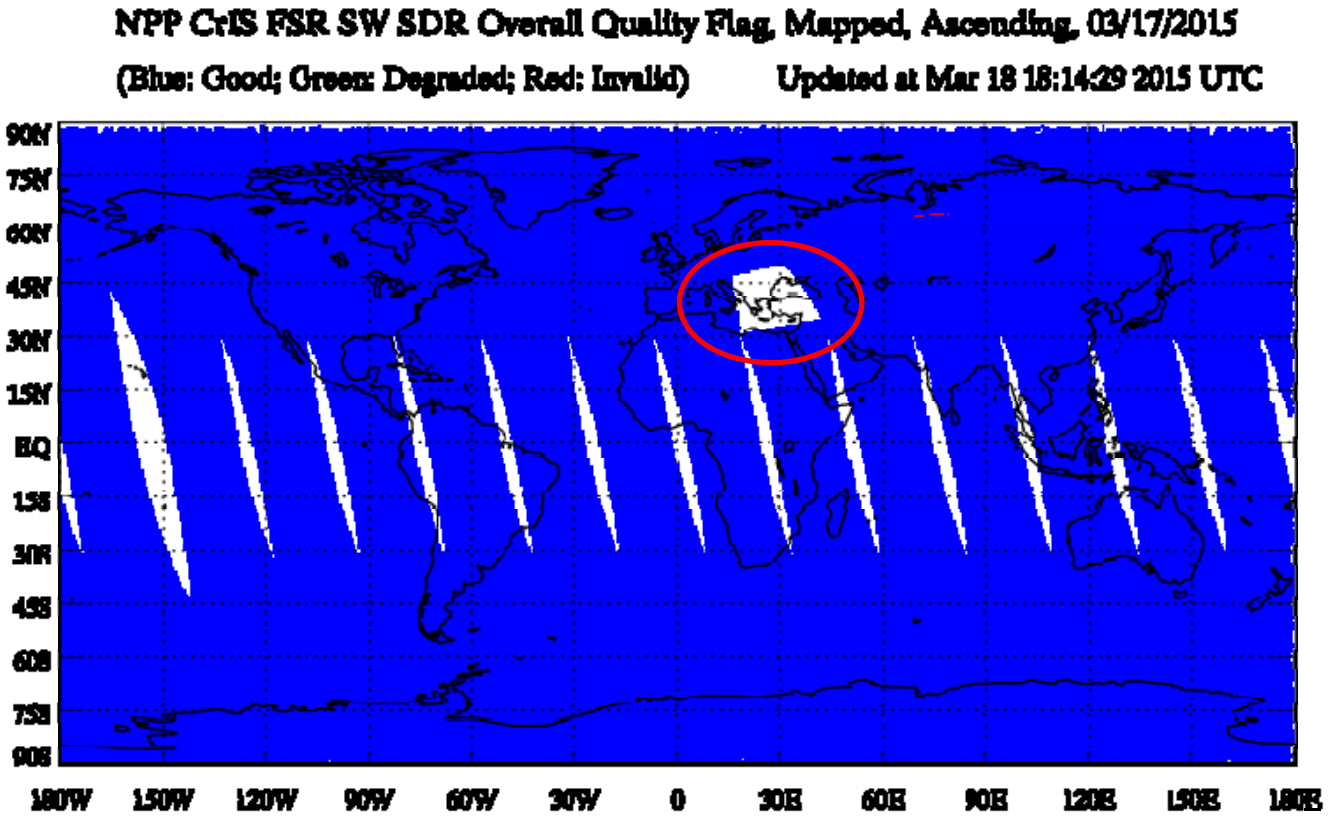
Hardware anomaly: DA Mirror Tilt Error (con'd)





Hardware anomaly: SSM position counter error

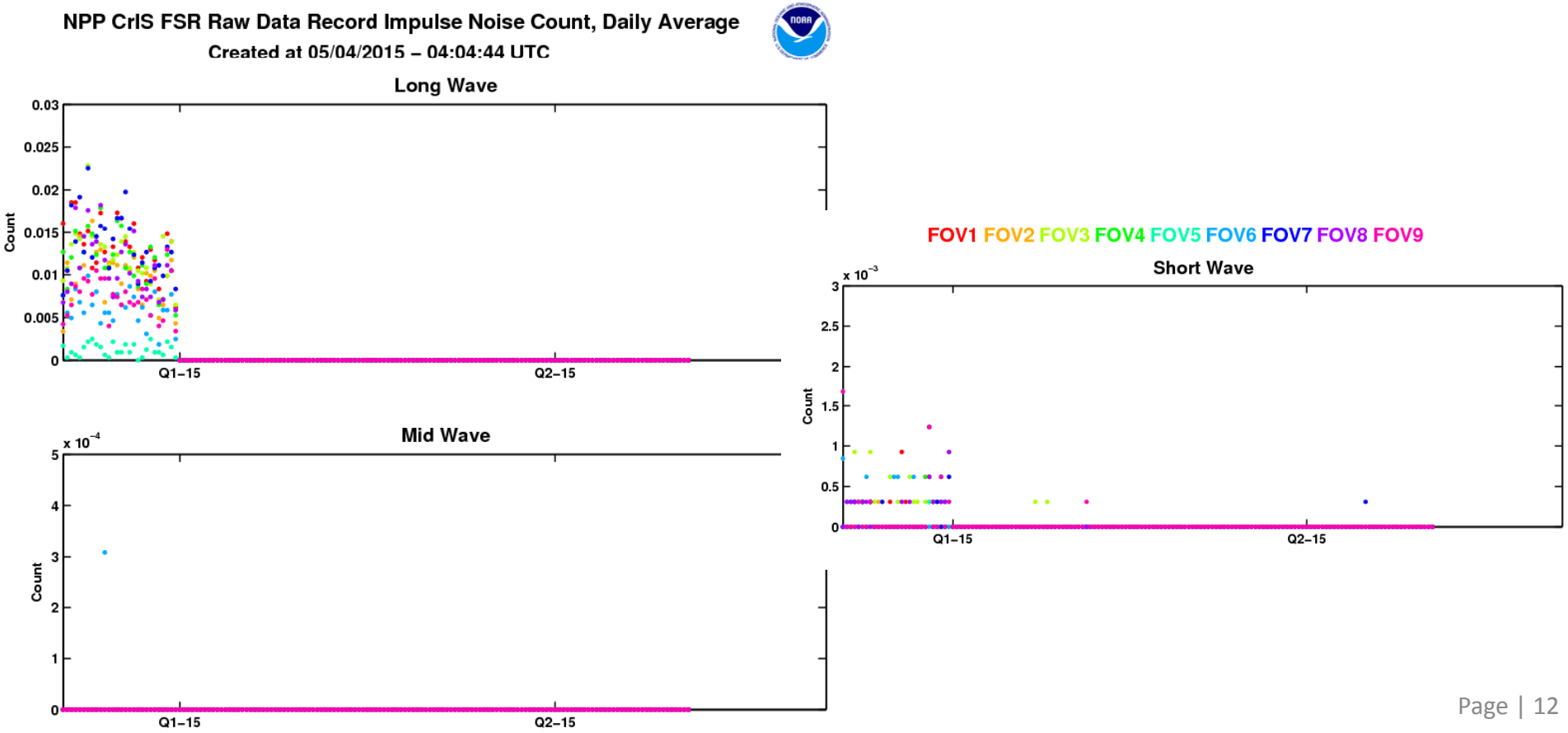
- Scene select module position counter error
  - FOR position is lost and the whole 30 scans in the sliding window containing this FOR are skipped without processing. When the SSM servo motor ages, this type of anomaly could happens more frequently



To be fixed in DR 7571:
Set the contaminated scan as missing

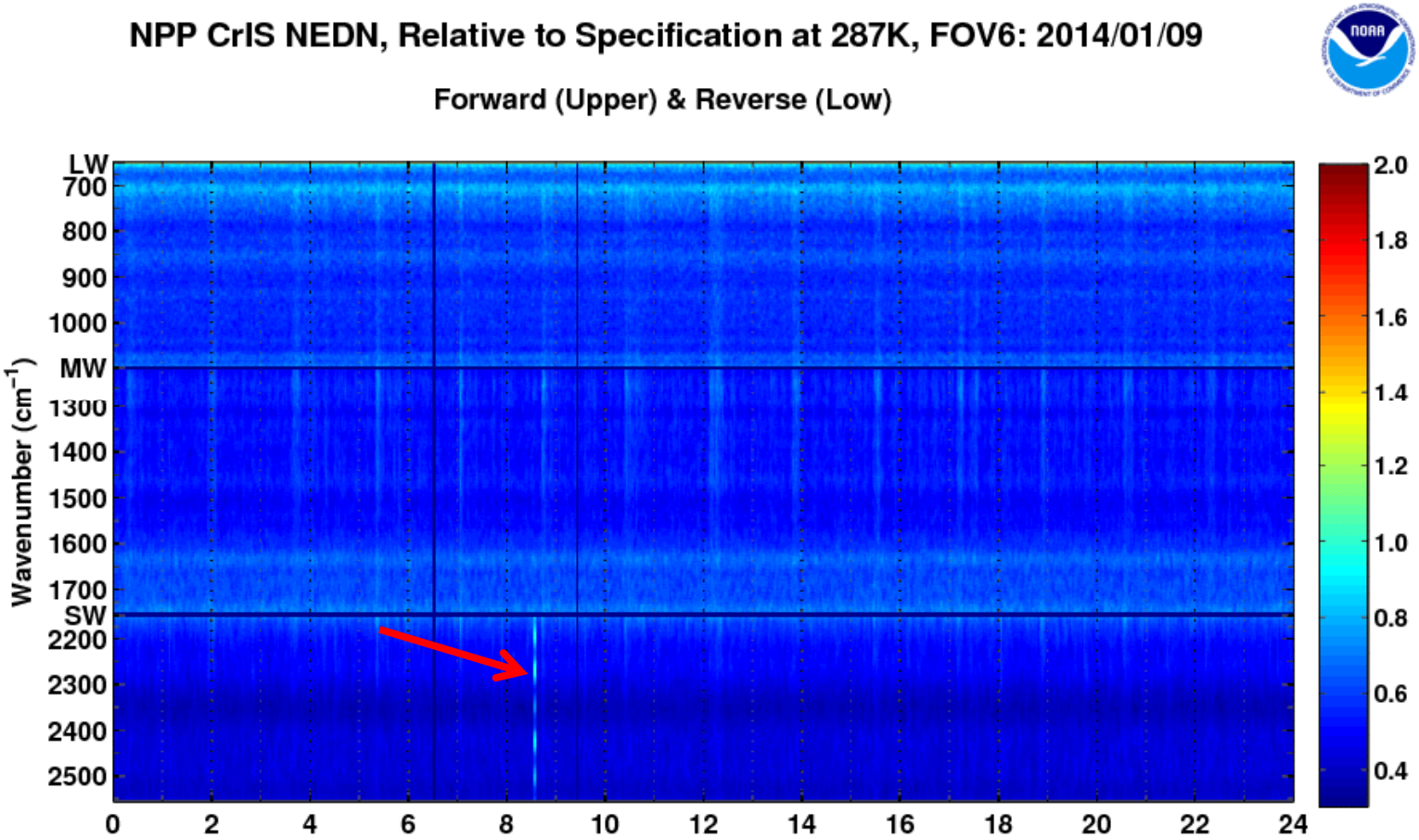
Hardware anomaly: Earth Scene Impulse Noise

- Happened in December 2014 after switching to full-resolution mode by implementing new bit-trim mask and new impulse noise mask
- Root cause: residual signal hit the impulse noise mask after switching from a hot scene to a cold scene
- Fixed on Dec 31, 2014 after implementing a wide open impulse noise mask



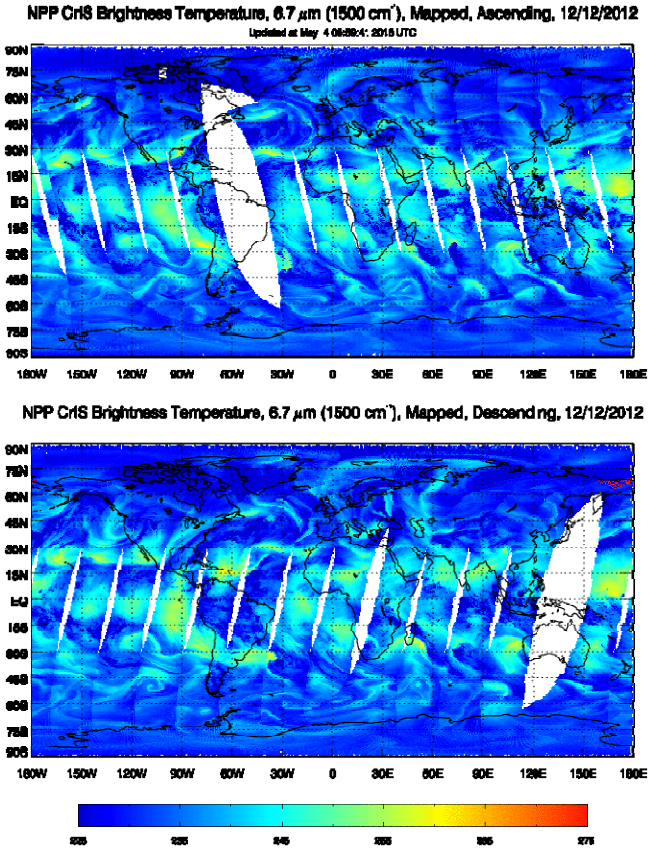
Hardware anomaly: ICT Impulse noise

- Impulse noise occasionally seen on ICT scene



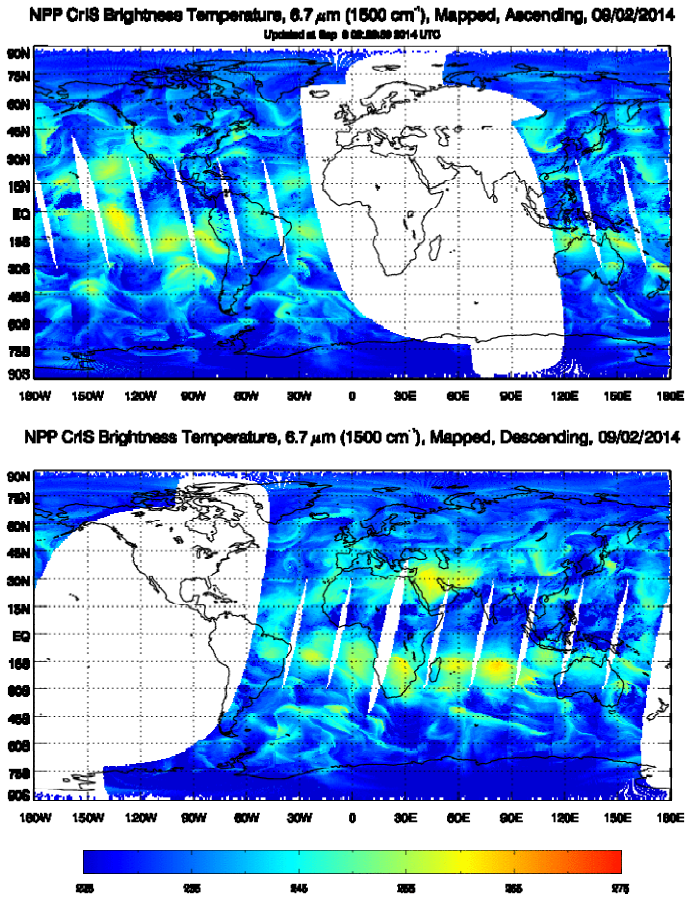
Hardware Performance: CREECBIT

- Description:
  - CREECBIT, aka, Single Bit Error Correction Control Error
  - Single bit error: Value of a single bit in the onboard computer memory is shifted unexpectedly
  - Occurred several times since launch
- Root cause:
  - Cosmic rays or chip flaws
- Solution:
  - Re-start the system
- Impact:
  - Losing data permanently
- Mitigation:
  - Report it as soon as possible



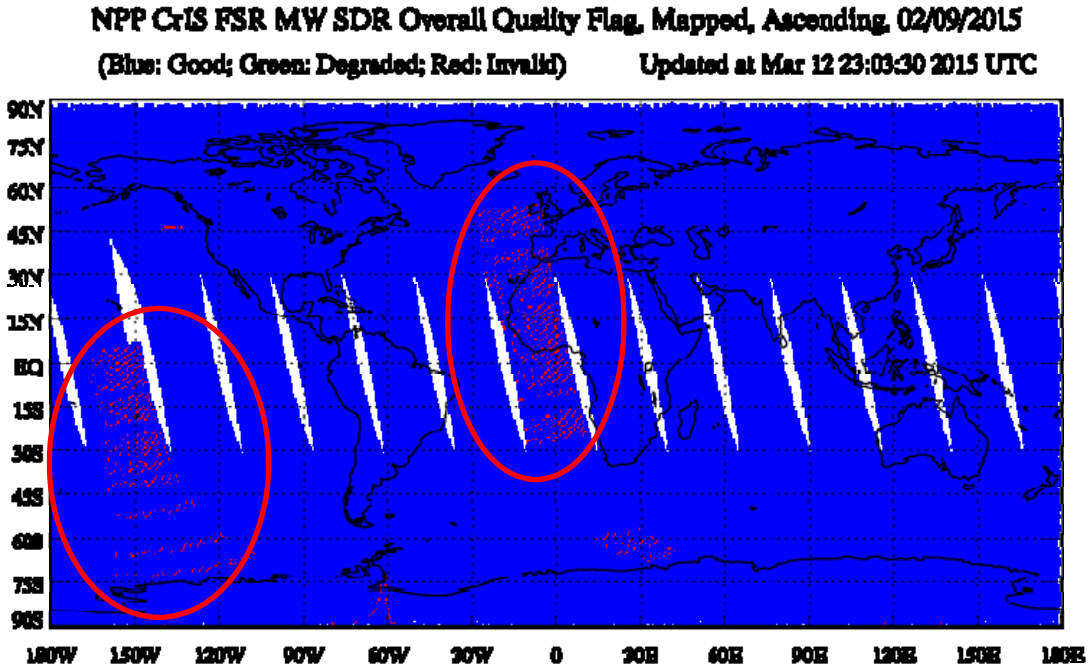
Hardware Performance: Firewire BUS (IEEE 1394) Reset

- Description:
  - The state of any node changed
  - Occurred several times since launch
- Root cause:
  - Cosmic rays
- Solution:
  - Re-start the system
- Impact:
  - Losing data permanently
- Mitigation:
  - Report it as soon as possible



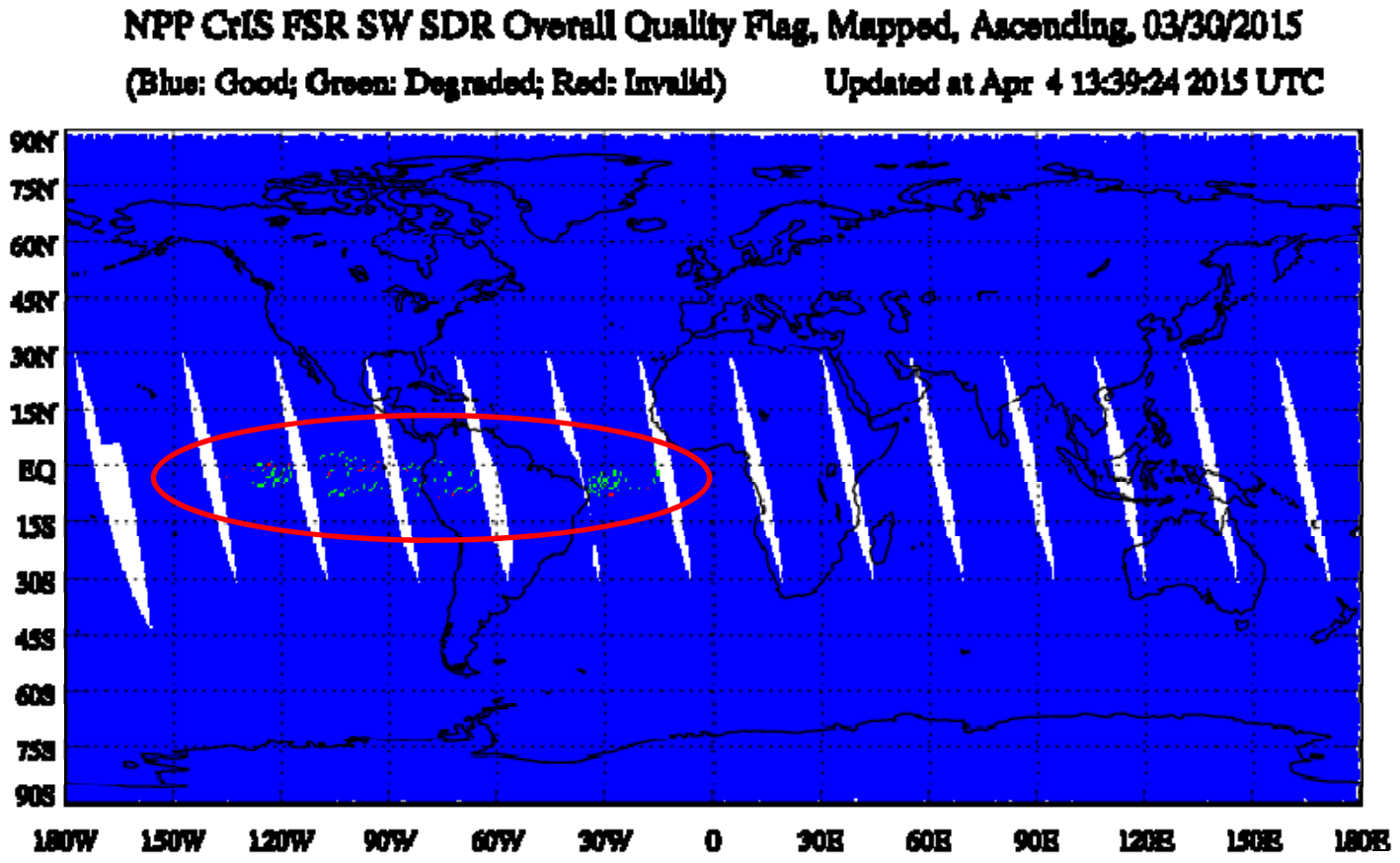
Other anomalies caught by ICVS: FOV4 data missing

- Description:
  - FOV4 data packets were missing since CrIS is in full-spectral resolution mode
- Root cause:
  - IDPS RDR data stream contaminated by the Direct Broadcasting (DB) data stream which intentionally dropped FOV4 for data rate concern.
- Impact:
  - losing data in IDPS operational SDR products
- Solution:
  - Fixed? Not seen since April 2015



Other anomalies caught by ICVS: Lunar intrusion event on FSR SDR

- The lunar event detection threshold is not updated accordingly in the FSR SDR algorithm, resulting in overdropping of valid calibration scene.



Conclusions

- The instrument status of SNPP CrIS has been comprehensively trended & monitored through the ICVS system.
- All parts are still in good shape after three years of operation and most SDR product anomalies are caused at the ground system.
- The biggest negative impact comes from CREECBIT and 1394 BUS reset, both of which result in permanent data loss. The suggestion is to improve our system so that we can report it as soon as possible.
- We will keep recording any anomalies and trying to fix them or mitigate their negative impact on SDR data quality.