CRIS SDR OVERVIEW

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Outline

- Team Members
- J1 CrIS status
- S-NPP CrIS status
- Issues and ongoing work
- Summary and Path Forward

Team Members

PI	Organization
Yong Han	NOAA/STAR
Dave Tobin	U. of Wisconsin (UW)
Larrabee Strow	U. of Maryland Baltimore County (UMBC)
Deron Scott	Space Dynamic Lab (SDL)
Dan Mooney	MIT/LL
Dave Jonson	NASA Langley
Lawrence Suwinski	Harris
Joe Predina	Logistikos
Carrie Root	JPSS/AMP
Wael Ibrahim	Raytheon

J1 CrIS Readiness

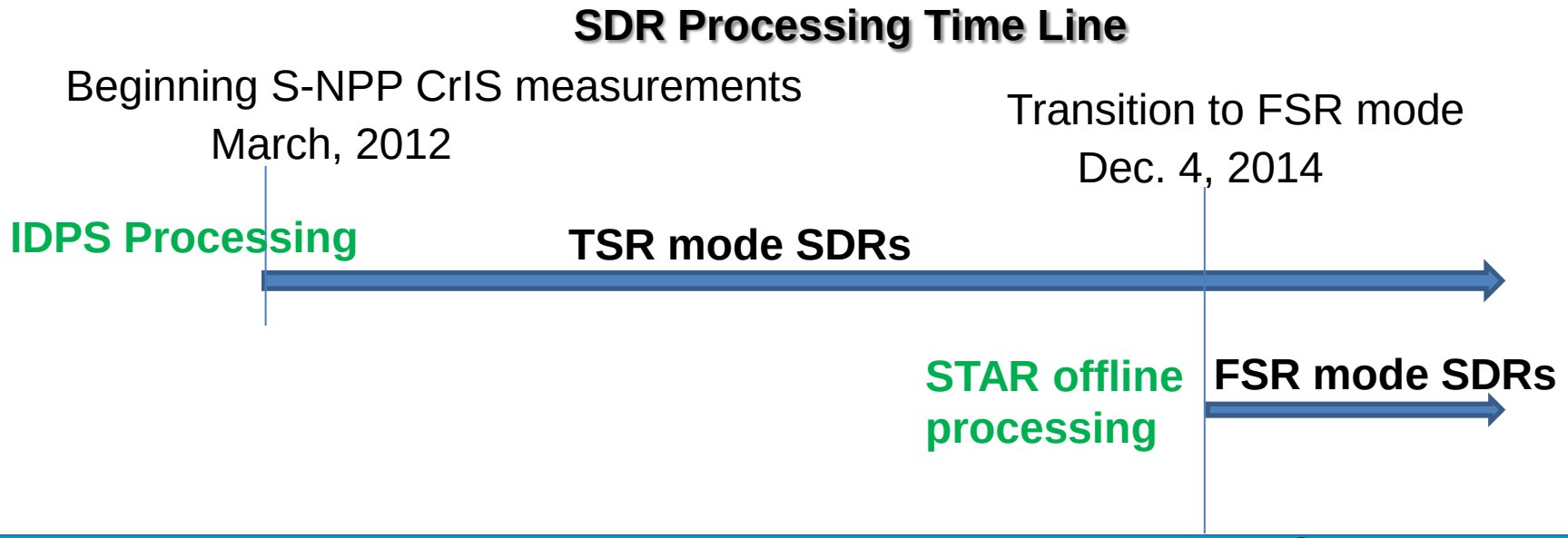
- J1 CrIS status at the 2015 annual meeting
  - Successfully completed environmental test campaign
  - Determined the pre-launch version of the calibration coefficients and parameters
  - Characterized the instrument performance with the pre-launch data
  - Delivered the first version of the J1 CrIS SDR processing algorithm
- J1 CrIS current status
  - The instrument is undergoing S/C level testing and has successfully completed the EMI testing
  - Mounting matrix for the SDR algorithm was computed and delivered
  - Improved SDR algorithm was delivered in July 2016
  - There is no critical issue

Algorithm Updates Delivered in July 2016

- On top of the J1 CrIS algorithm delivered on January 30, 2015, the following updates were delivered last month,
  - A4 algorithm implementation (spectral calibration prior to radiometric calibration) to improve calibration accuracy
  - Use of longer interferogram to reduce ringing artifacts
  - Use of wider post calibration filter to increase the usage of the guard band signals
  - Correction of the geolocation algorithm
  - Band-dependent lunar intrusion threshold added to the PCT file

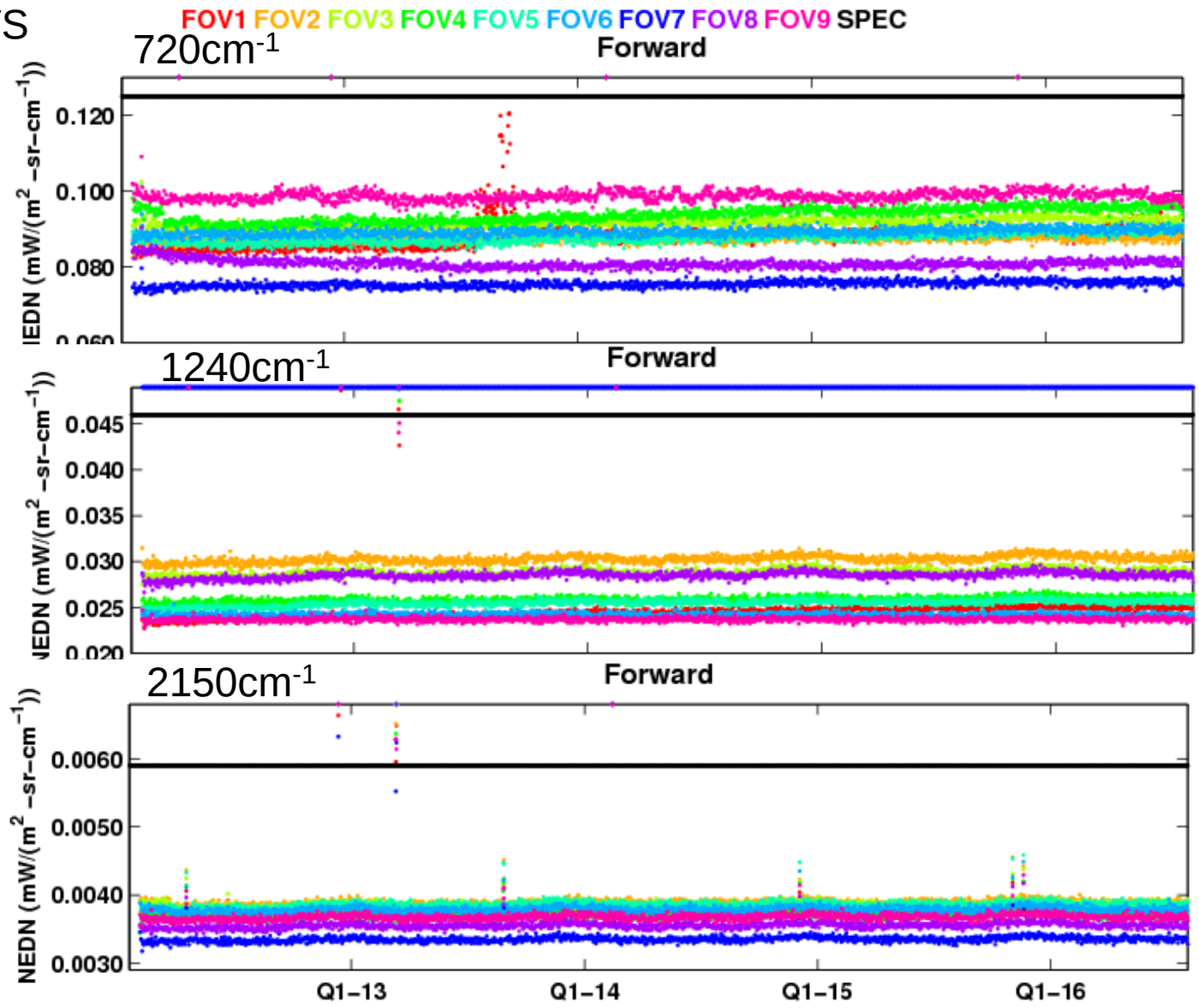
SNPP CrIS Status: SDR processing

- CrIS transition to extended FSR mode on 11/02/2015 (CrIS transition to FSR mode on 12/4/2014)
- NOAA operational TSR SDRs (IDPS)
- NOAA FSR SDRs (STAR)
  - IDPS SDR format
  - bufr format converted by Walter's team
- Both TSR and FSR performances are monitored with ICVS



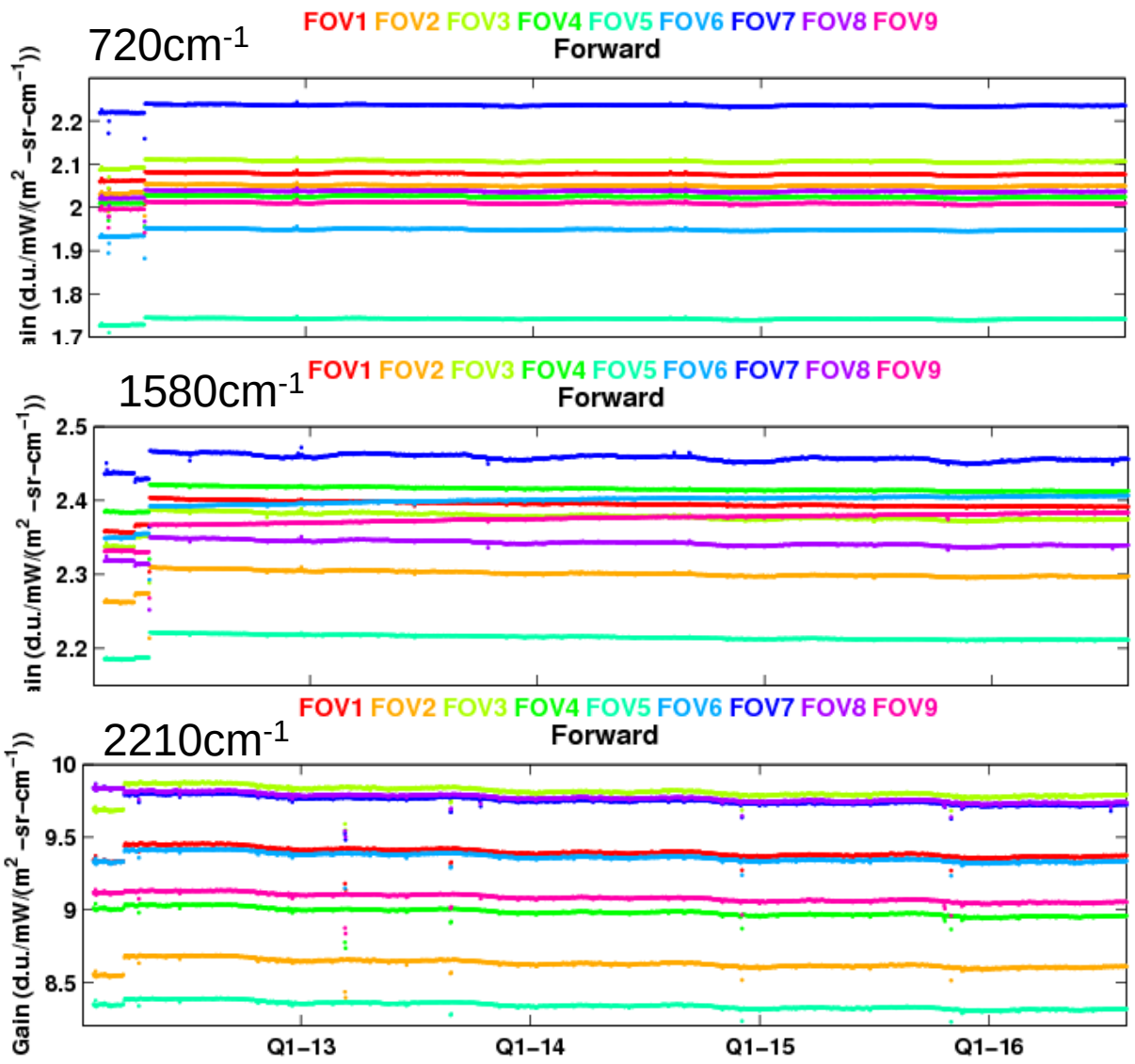
SNPP CrIS Status: stable NEdN

STAR ICVS



SNPP CrIS Status: stable Gain

STAR ICVS



STAR CrIS Data Reprocessing

- Engineering packet version 36 (the latest) with geolocation mapping parameter updates and new MW FOV7 NL a2 coefficient
- ADL with A4 calibration algorithm and improved geolocation algorithm
- SDR truncation spectral resolution (TSR) mode for the whole history
- SDR full spectral resolution (FSR) mode since December 4, 2014
- Latest RDR version
- Processing system capability: 1 year data / 6 days
- CrIS data reprocessing will be completed by the end of this month

Team Activities: Telecon Presentations

- 23 bi-weekly telecons (8/16/2015 – 8/3/2016)
- 51 telecon presentations

Presentation subjects	Presenter (# of presentations)
Calibration equation	STAR(3), UMBC(2), MIT/LL(4), Logistikos(2), SDL(2)
Extended IFG & FIR convolution correction	SDL(1), STAR(1), UW(2), MIT/LL (2), UMBC (1)
LW FOV5 cold scene anomaly	SDL(1), UW(2)
Polarization	UW(3), Harris(1), STAR(1)
Geolocation	STAR(2)
J1 S/C level data analysis	SDL(3), STAR(2), MIT/LL(1)
SNPP anomaly analysis	STAR(2)
FIR, a2 & FOV size optimizations	UW(4), STAR (2), Logistikos(2), UMBC(1)
SNPP & J1 environmental models	SDL(2), UW(1)
Noise & O-B correlation	SDL(1), UMBC(1)

Issues and Ongoing Work

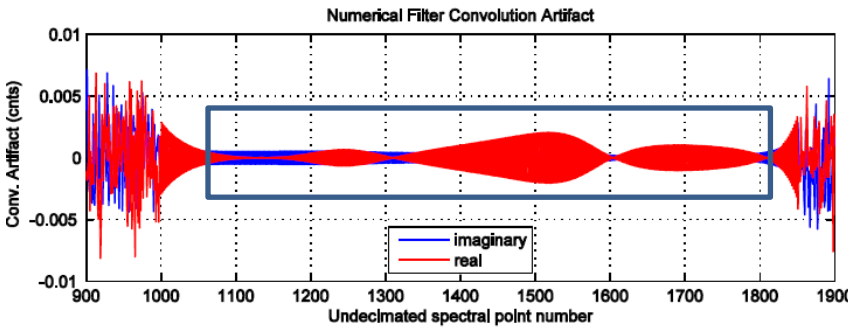
- FIR convolution correction
- LW FOV-5 cold radiance anomaly
- Channel SRF consistency
- Polarization signals and correction
- FCE correction module efficiency

FIR Convolution Correction

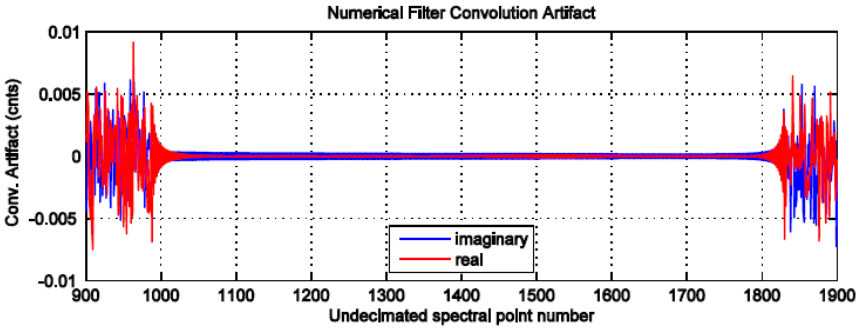
- Issue: FIR digital filtering (convolution) is not performed circularly and consequently the FIR gains can not completely removed from the spectra, causing ringing artifacts
- The team has been working on methods to correct the non-circular convolution error
- Two correction methods were implemented in the ADL code, delivered in July 2016 (neither turned on yet).
- The remaining work: compare and validate the methods

Raw spectrum difference from truth

Ringing artifacts



Ringing reduction by truncating IFG

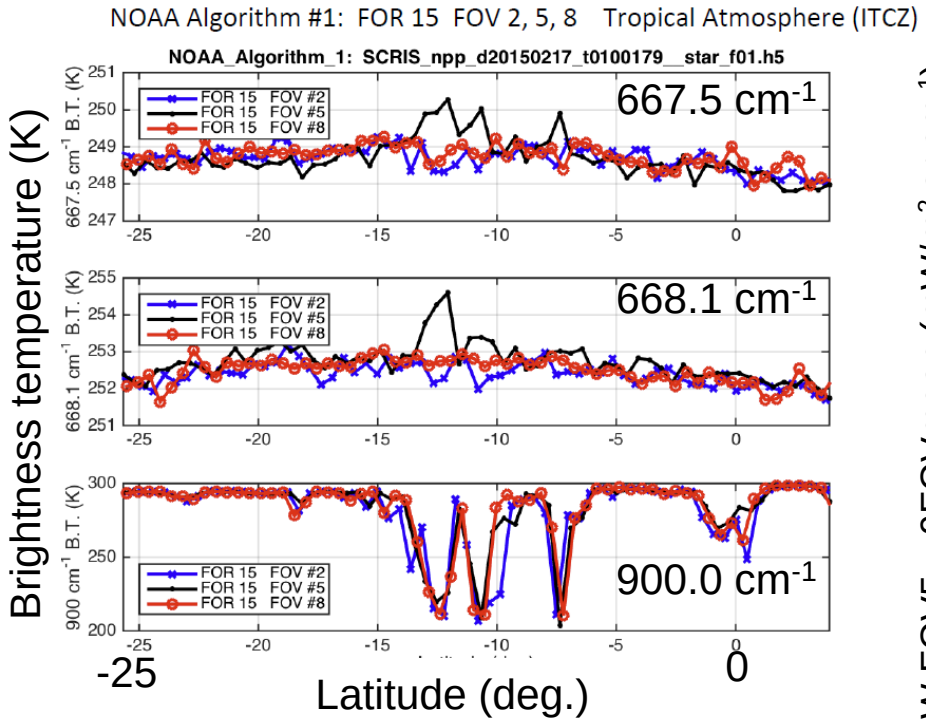


UW

LW FOV-5 Cold Scene Anomaly (1/2)

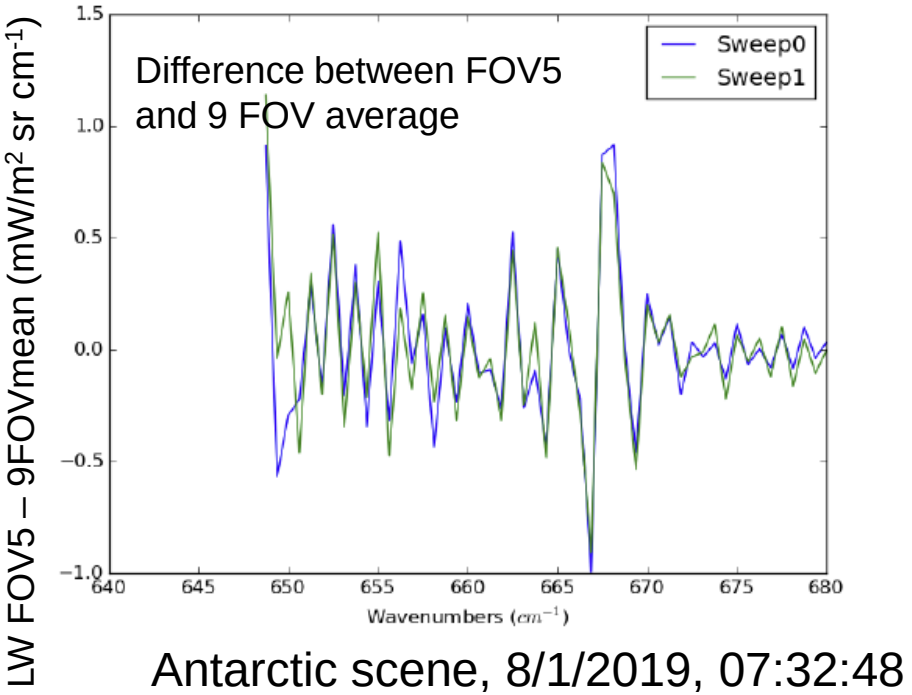
- It was noticed a year ago that SNPP CrIS LW FOV5 radiance near 668 cm-1 is out-of-family with the other 8 FOVs over tropical high cold cloud or over Greenland and Antarctica

Anomaly over high cold clouds



UW

Anomaly over Antarctic scene in both sweep direction



Antarctic scene, 8/1/2019, 07:32:48

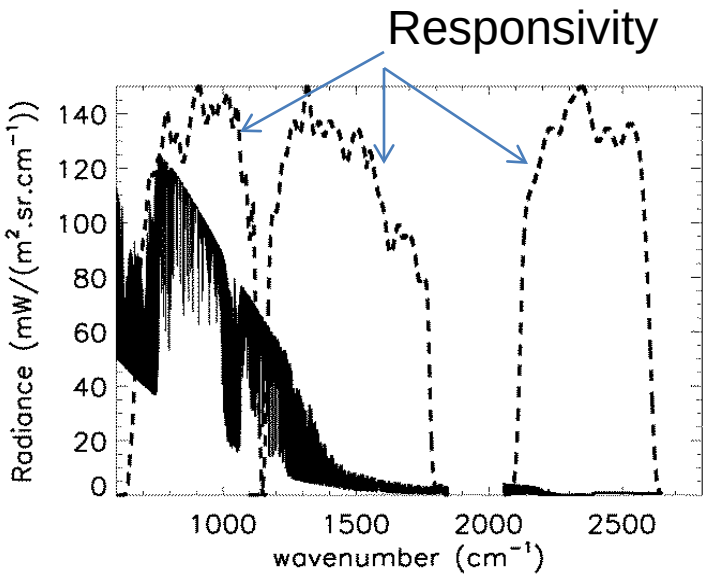
SDL

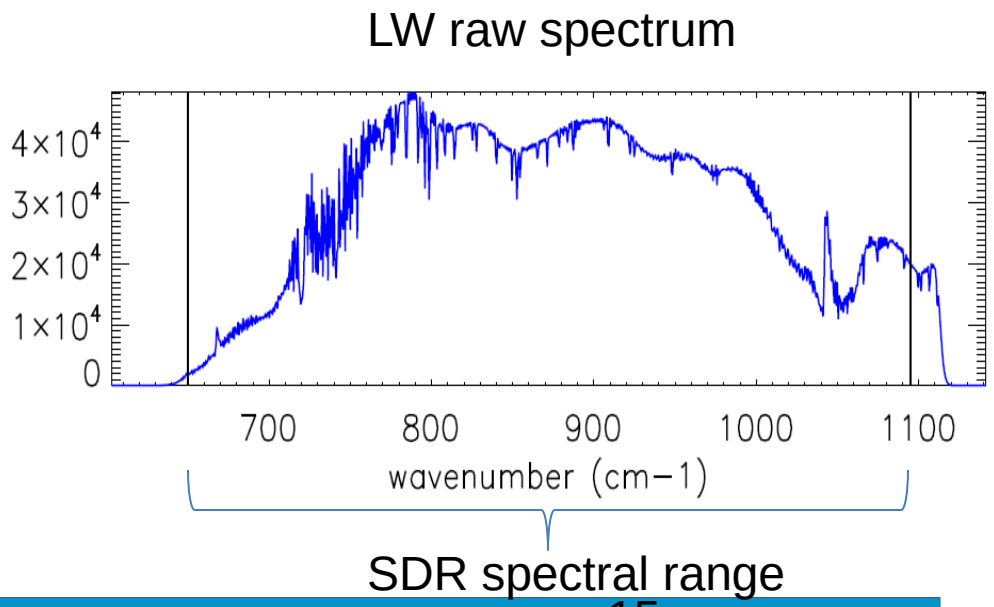
LW FOV-5 Cold Scene Anomaly (2/2)

- The team has been working to understand the cause and developing mitigation solutions
- Unresolved channeling from beamsplitter as the mechanism was investigated by UW and SDL
- Results:
  - both of beamsplitter /componsator ZnSe substrates and air gap could give unresolved channeling from internal reflection
  - Simulation results qualitatively fit the symptoms; however, the simulated artifact magnitude is much smaller than the observed
- Investigation is ongoing

Channel SRF Consistency

- Due to the band limiting by the sensor responsivity, the SDR edge channels have slightly different spectral response function (SRF) from the defined Sinc function
- An RT model built with the CrIS responsivity functions can accurately model the channel SRFs
- However, since the responsivity may differ slightly among different CrIS instruments, the channel SRFs may also differ slightly across different CrIS sensors
- The team has been working to assess the impact of the responsivity variations and possibly develop calibration methods to address the SRF consistency issue

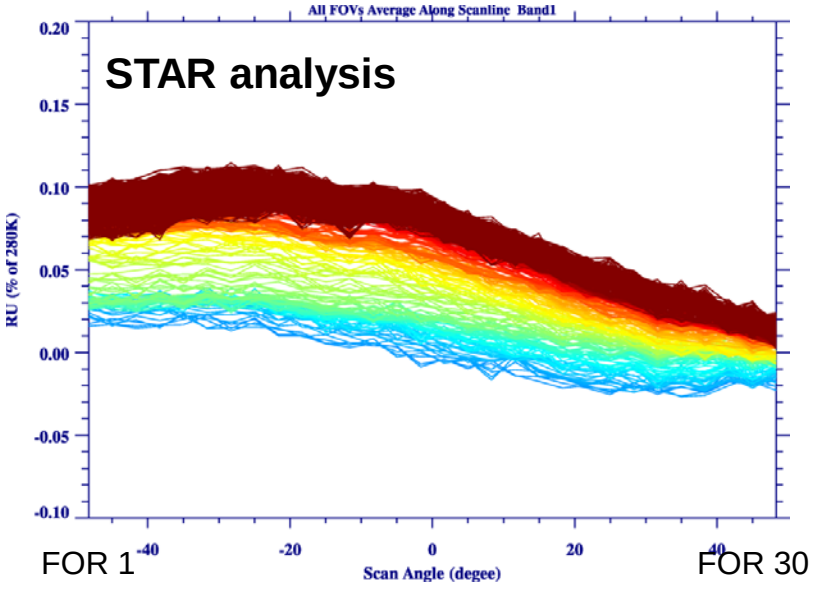




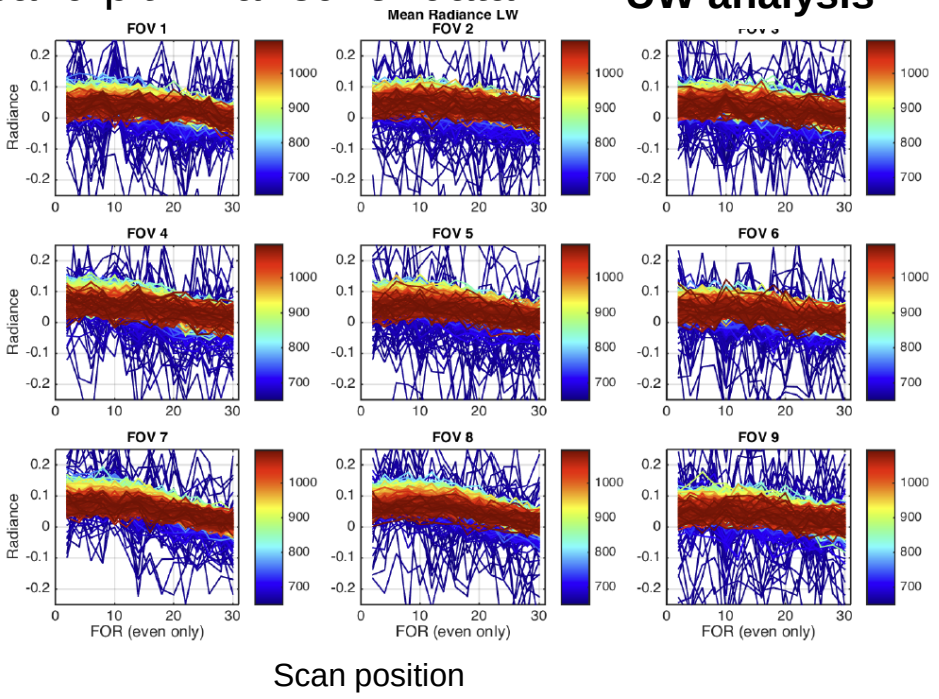
Polarization Signals & Correction

- On 9/16/2015, UW presented an analysis showing scan dependent difference between CrIS and VIIRS, possibly due to CrIS SSM and sensor polarization
- Subsequently, two investigation reports were provided by STAR and UW on the analysis of SNPP pitch maneuver data (deep space scan observations)
- Polarization correction has been formulated
- The team will further characterize the impact of the polarization and validate the benefit of polarization effect correction

Polarization signals in LW band pith maneuver data



UW analysis



FCE Correction Latency

- Fringe Count Error (FCE) correction module has been turned off so far for SNPP due to software errors and the inability to work for cold scenes
- Fortunately, there has been no FCE event detected so far from SNPP CrIS data
- A new FCE module based on an iteration process to minimize the imaginary part of the calibrated spectrum was implemented and delivered in March 2016 for the J1 SDR processing software
- Unfortunately, the latency of the SDR processing with the FCE module does not meet IDPS requirement
- Since the improvement of the FCE module latency requires a large effort, the solution of latency issue will depend on the following considerations:
  - Whether there will be any FCE events seen from the S/C level TVAC
  - Whether IDPS can increase the number of parallel processing jobs
- The team will make a decision before the end of this year on the need to improve the FCE correction module

Summary

- The J1 CrIS SDR algorithm/software is ready for J1 mission
- SNPP CrIS performance is stable and there is no significant SDR performance degradation
- FSR SDRs are routinely generated for the NWP and retrieval communities
- Great progress was made in advancing CrIS SDR science, including calibration algorithm, digital filtering, FOV size optimization, and polarization

Path Forward

- For the J1 mission, the team will
  - analyze the S/C TVAC data
  - support validation of the operational SDR software
  - execute post-launch CalVal plan
  - Provide the Beta, Provisional and Validated SDR products on schedule
- The team will continue working to address the issues: FIR convolution correction, LW FOV5 cold scene anomaly, polarization, and FCE latency
- SNPP CrIS observation approaches 5 years; the team will
  - analyze the history of the data
  - continue monitoring its performance and SDR health