CrIS SDR Overview

Yong Han

CrIS SDR Science Team

STAR JPSS Science Team Annual Meeting
August 24-28, 2015

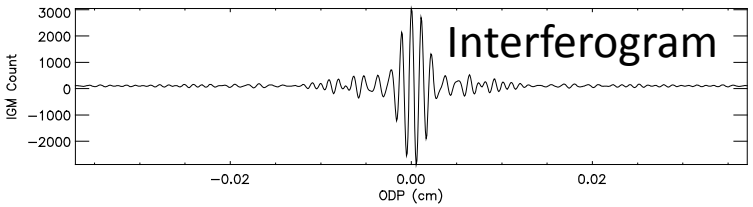
Outline

- SNPP/JPSS-1 Instrument and SDR Spec Overview
- Team Members
- S-NPP Product Overview
- JPSS-1 Readiness
- Summary
- Path Forward

CrIS System

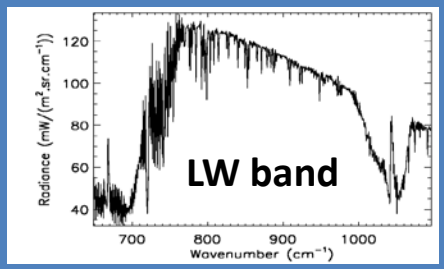
CrIS instrument provides interferograms & calibration data

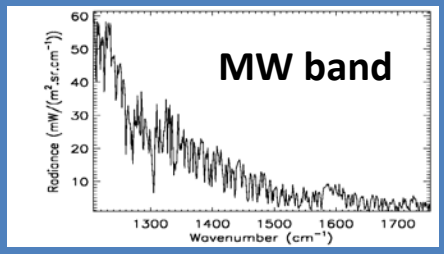


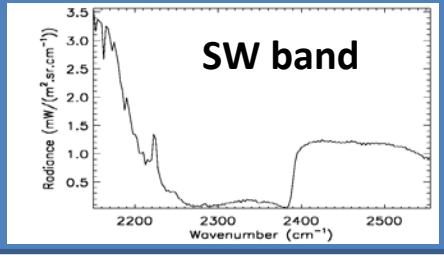


SDR Product

Radiance Spectra







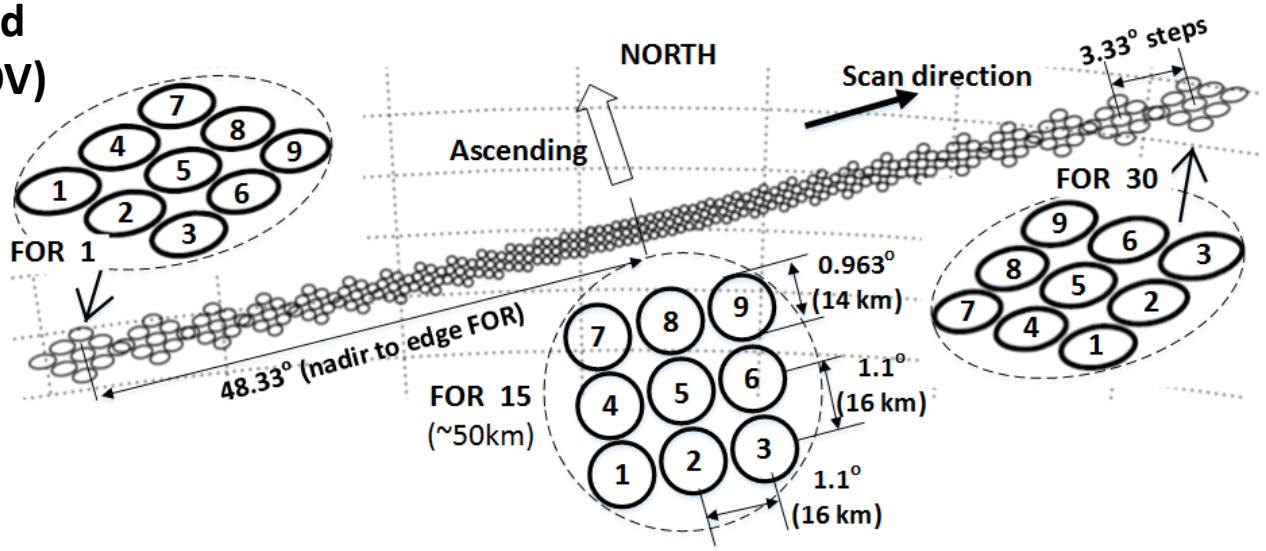
Science RDRs

SDR product

Ground SDR Processing

S-NPP/JPSS1 CrIS SDR Specifications

CrIS scan, field-of-regard (FOR), field-of-view (FOV)



CrIS SDR specifications. Black – normal spectral resolution (NSR); blue – full spectral resolution (FSR)

Band	Spectral Range (cm^{-1})	# of Chan.	Spectral Res. (cm^{-1})	NEdN @287K BB ($mW/m^2/sr/cm^{-1}$)	Radiometric Uncertainty @287K (%)	Frequency Uncertainty (ppm)	Geolocation Uncertainty (km)
LWIR	650-1095	713	0.625	0.14	0.45	10	1.5
	650-1095	713	0.625	0.14	0.45	10	1.5
MWIR	1210-1750	433	1.25	0.06	0.58	10	1.5
	1210-1750	865	0.625	0.085	0.58	10	1.5
SWIR	2155-2550	159	2.50	0.007	0.77	10	1.5
	2155-2550	633	0.625	0.014	0.77	10	1.5

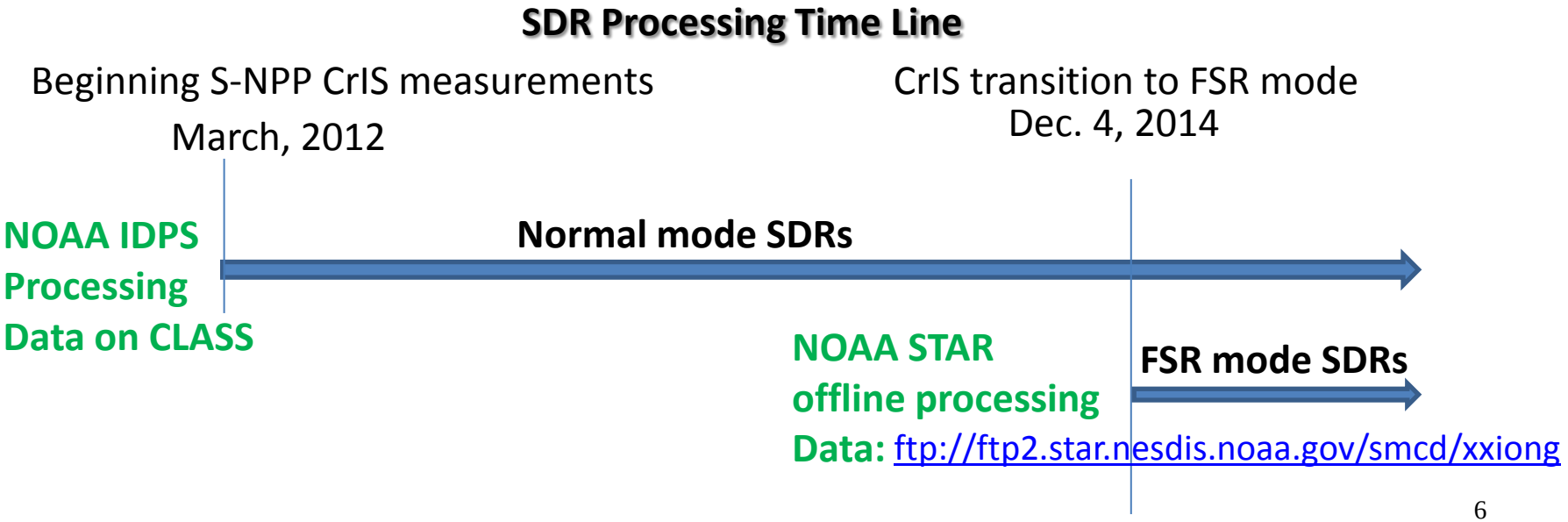
Number of FSR channels: 2211; Number of NSR channels: 1305

CrIS SDR Team Members

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

S-NPP CrIS SDR Product Overview 1/3

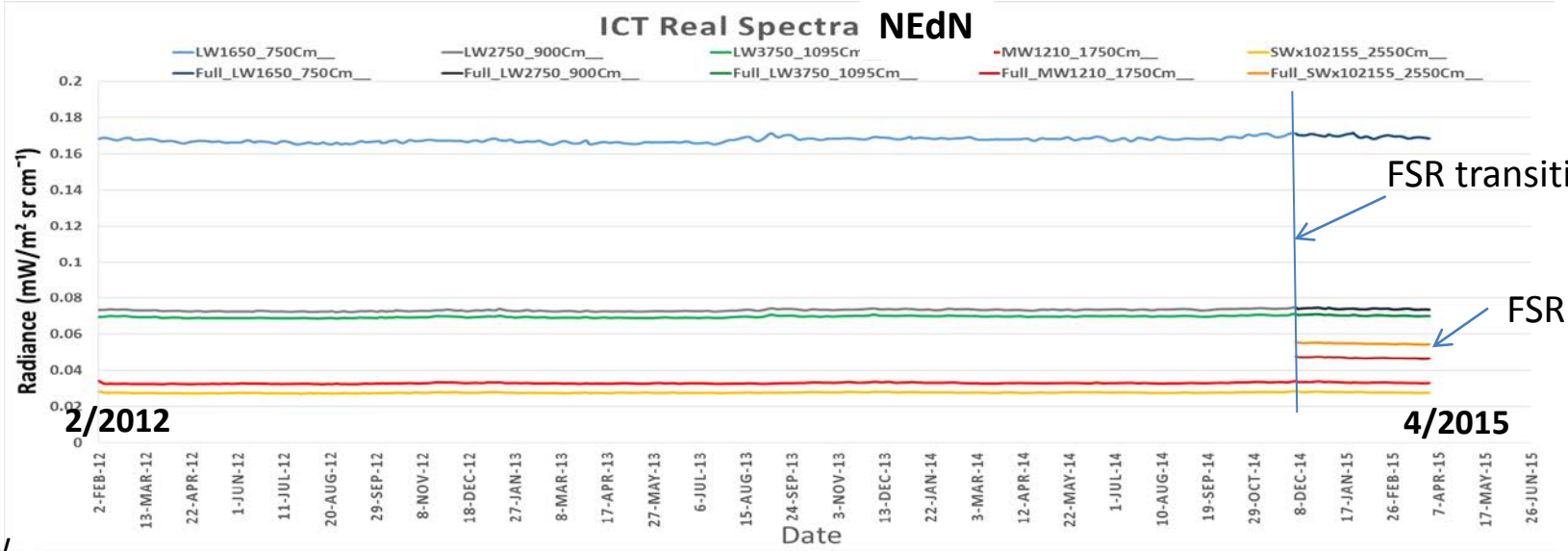
- Excellent instrument performances since the beginning of the mission
- Stable SDR product with radiometric and spectral calibration accuracies and noise performance exceeding requirements with large margins
- Successful transition normal spectral resolution (NSR) mode to full spectral resolution (FSR) mode on 12/4/2014
- Both NSR and FSR SDRs are routinely generated
- Both NSR and FSR SDRs are monitored with web-based ICVS



S-NPP CrIS SDR Overview 2/3 (Performance Stability)

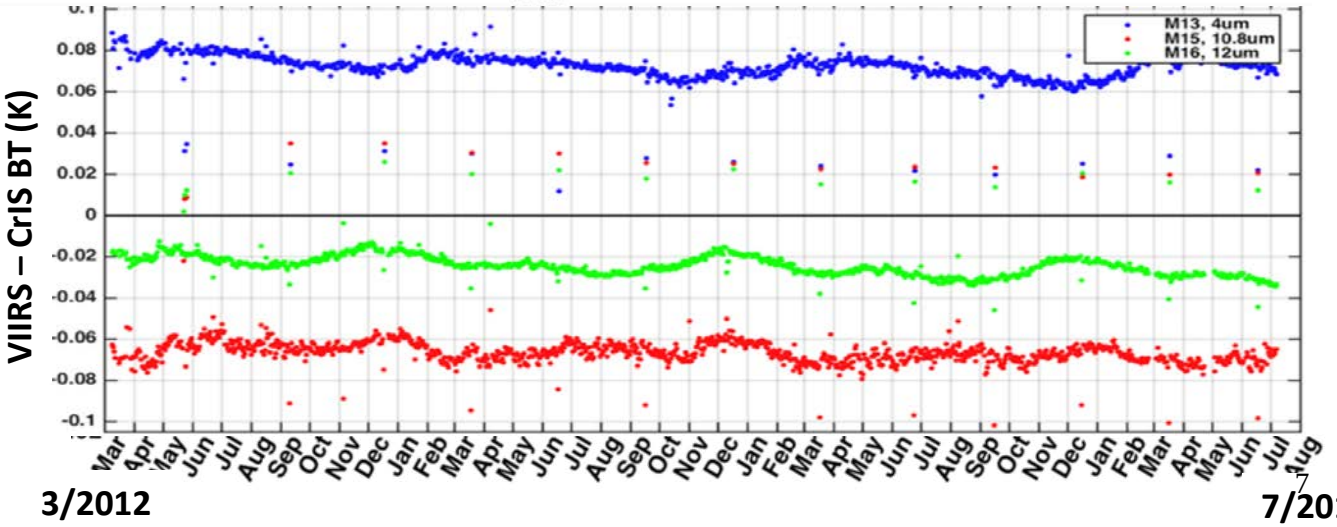
- **Excellent instrument performances since the beginning of the mission**

From SDL



From UW

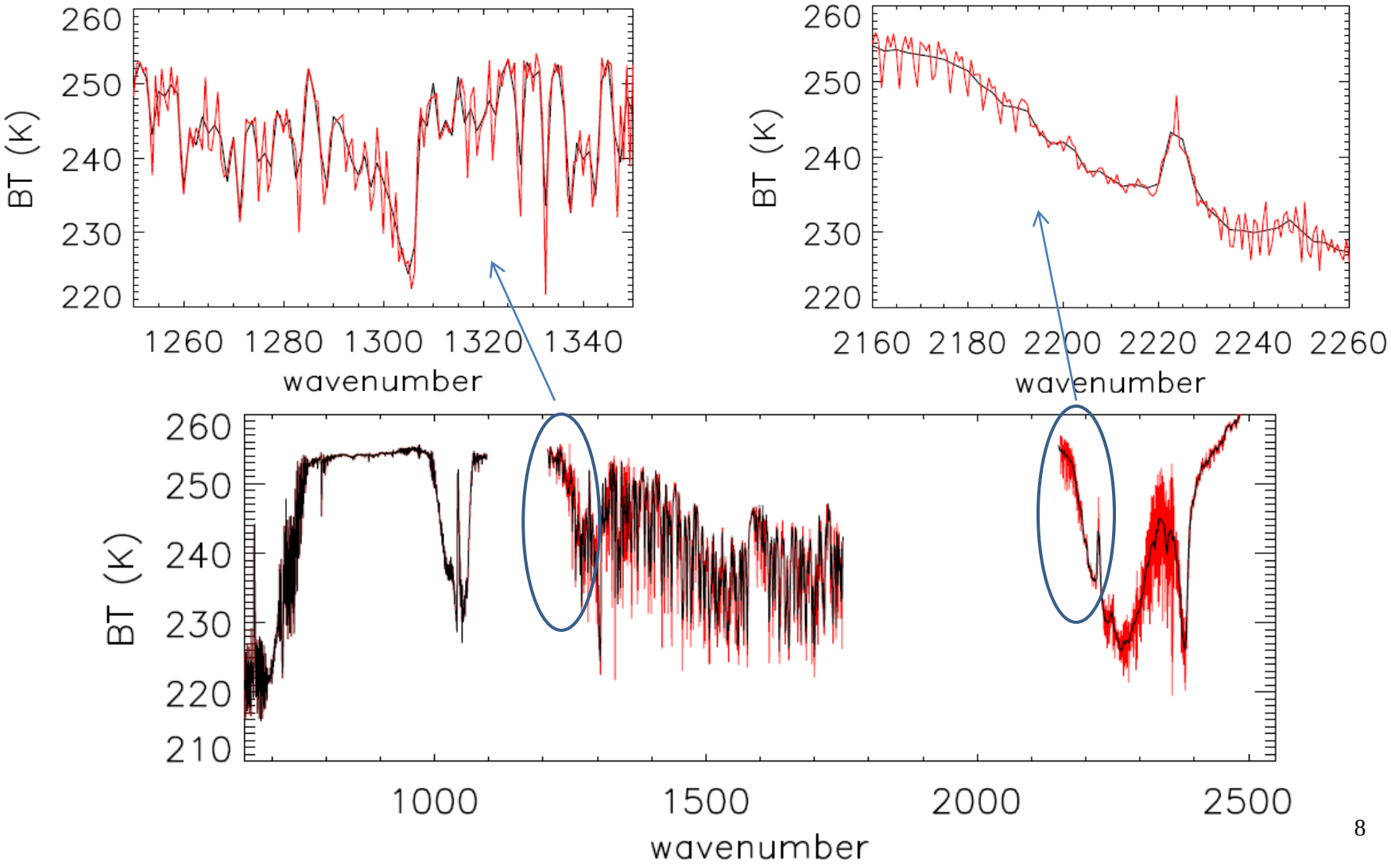
- Variation of the difference is less than ±0.01
- Large outliers are due to VIIRS quarterly nonlinearity tests



S-NPP CrIS SDR Overview 3/3 (NSR and FSR SDR Products)

Red lines – FSR spectrum; black lines – IDPS NSR spectrum

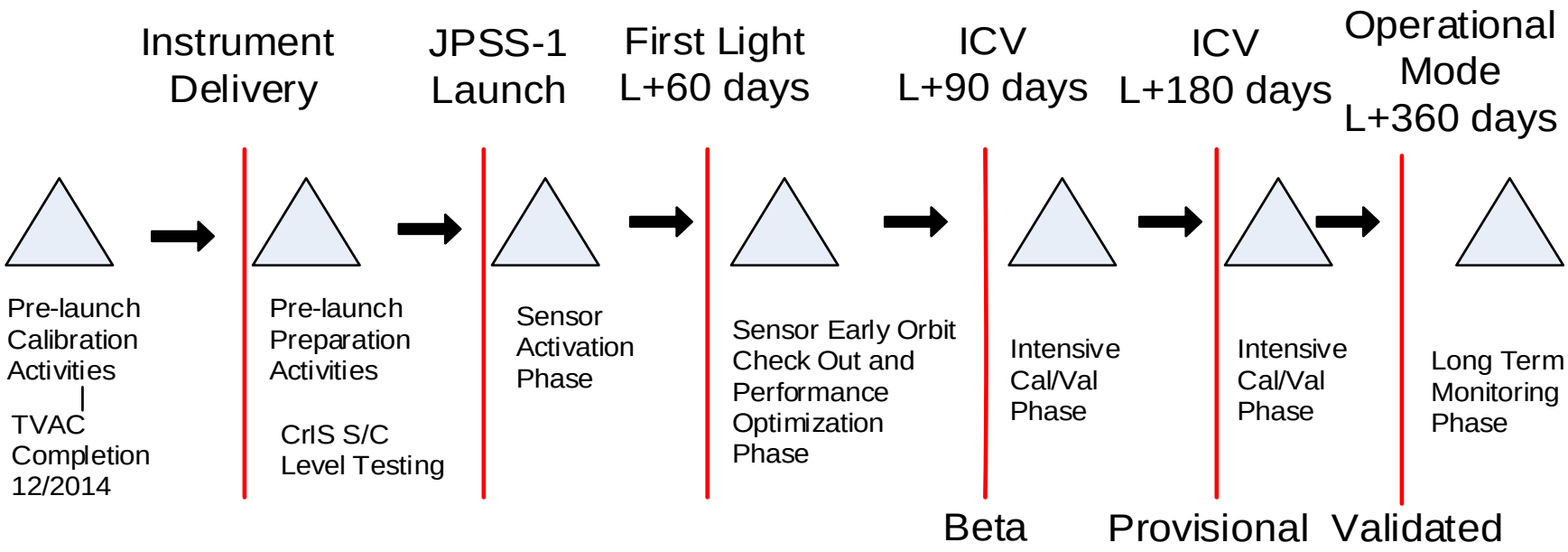
From STAR



J1 CrIS Pre-launch CalVal Status

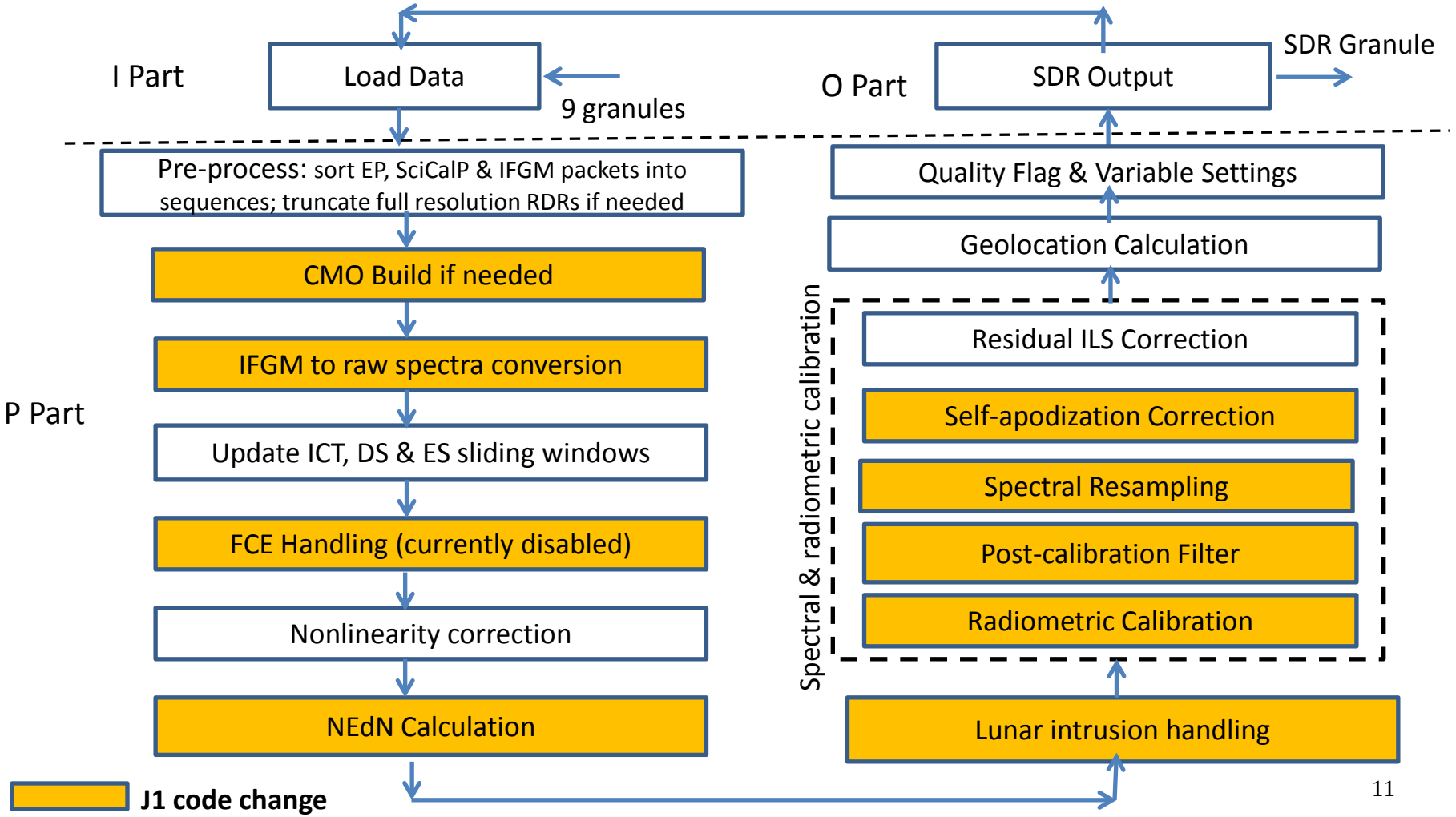
- Successfully completed environmental test campaign (instrument currently at BATC for spacecraft level testing)
- Determined the pre-launch version of the calibration coefficients and parameters
- Developed and delivered the first version of the J1 CrIS SDR algorithm/software
- Characterized the instrument performances with the pre-launch test data
- Addressed the only instrument science waiver for the LW FOV8 partial obscuration
- Made significant progress in improving SDR algorithm to reduce radiance ringing artifacts (updates to be delivered in December 2015)
- Completed initial version of J1 CalVal plan

J1 CrIS Pre- & Post-launch CalVal Schedule



J1 CrIS SDR Algorithm/Software Changes

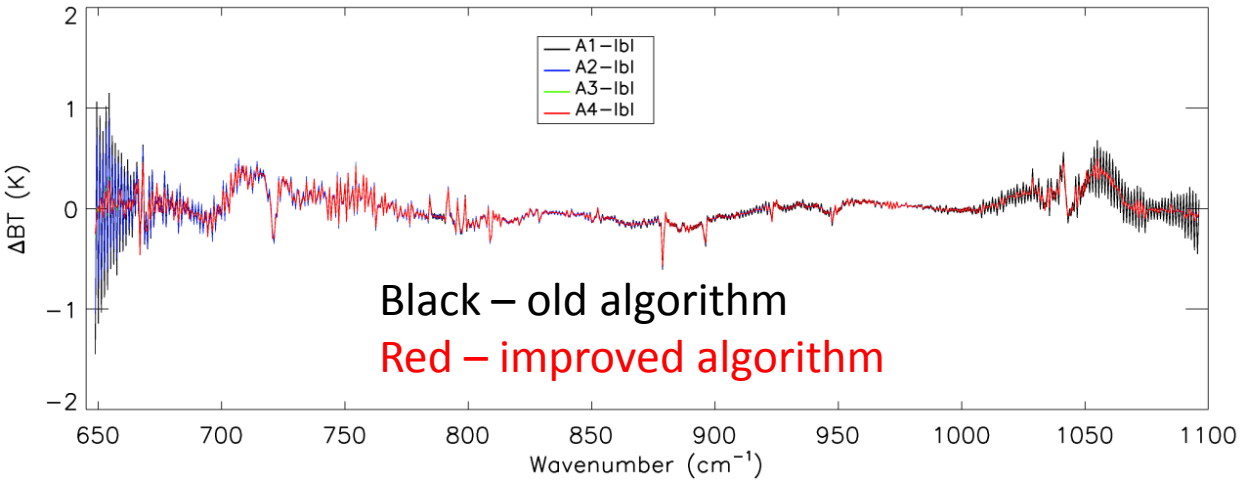
- J1 SDR code & LUTs delivered in January, 2015, able to process both NSR and FSR SDRs
- An update will be delivered in December 2015



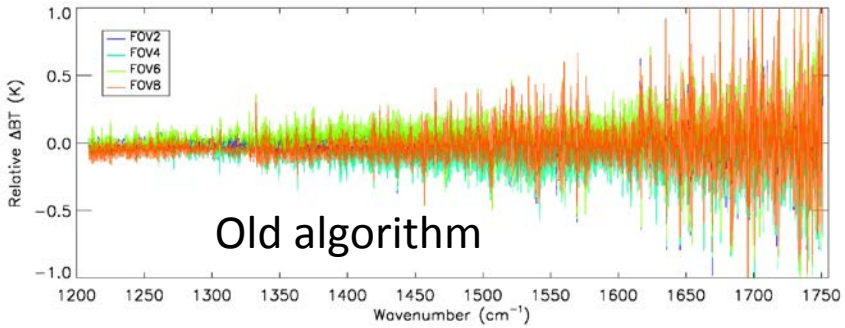
J1 Algorithm Improves Calibration Uncertainty

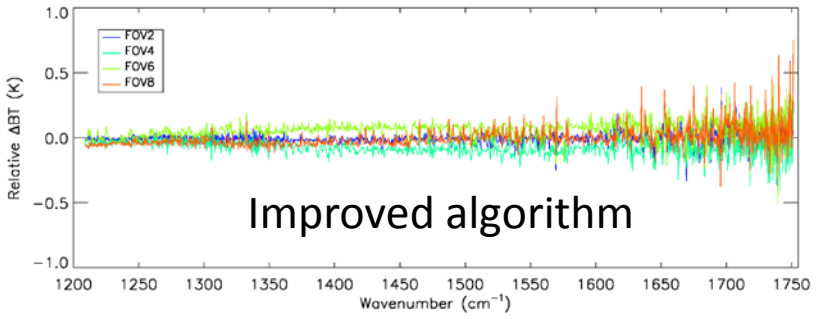
From STAR

Observed - simulated



FOV-to-FOV difference



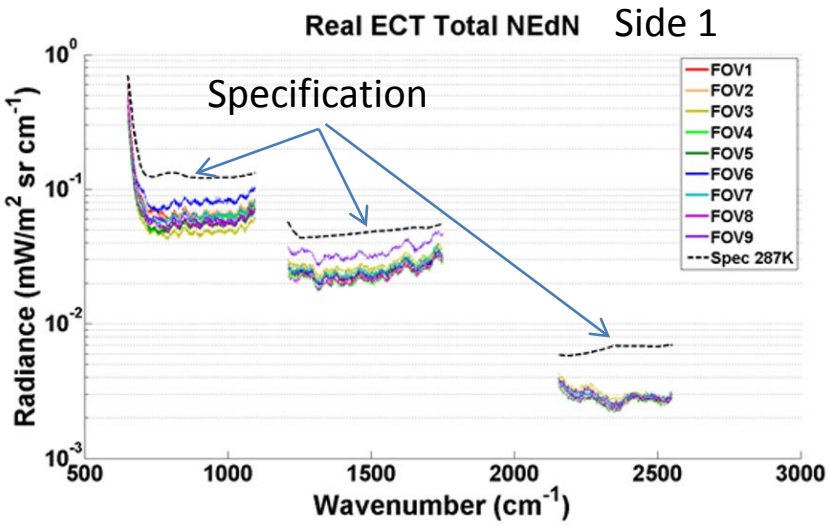


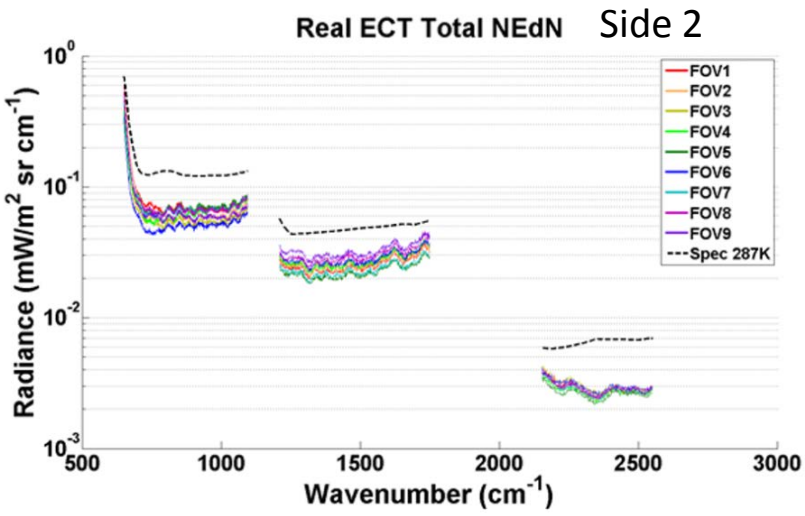
Ringing artifacts are significantly reduced

J1 CrIS Noise Performance

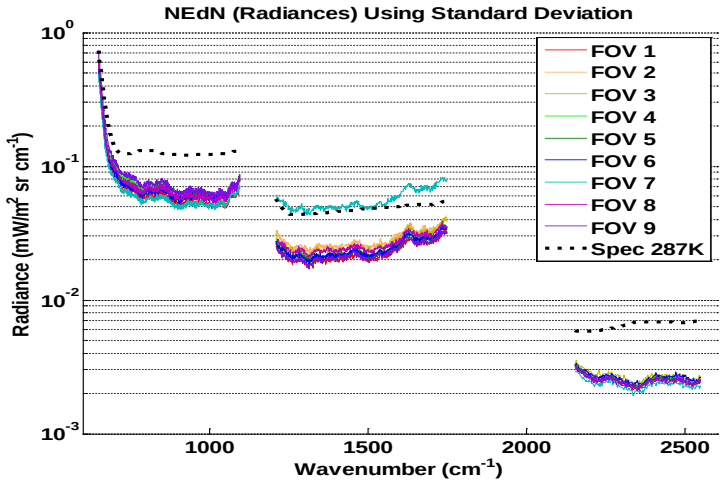
From SDL

J1





S-NPP

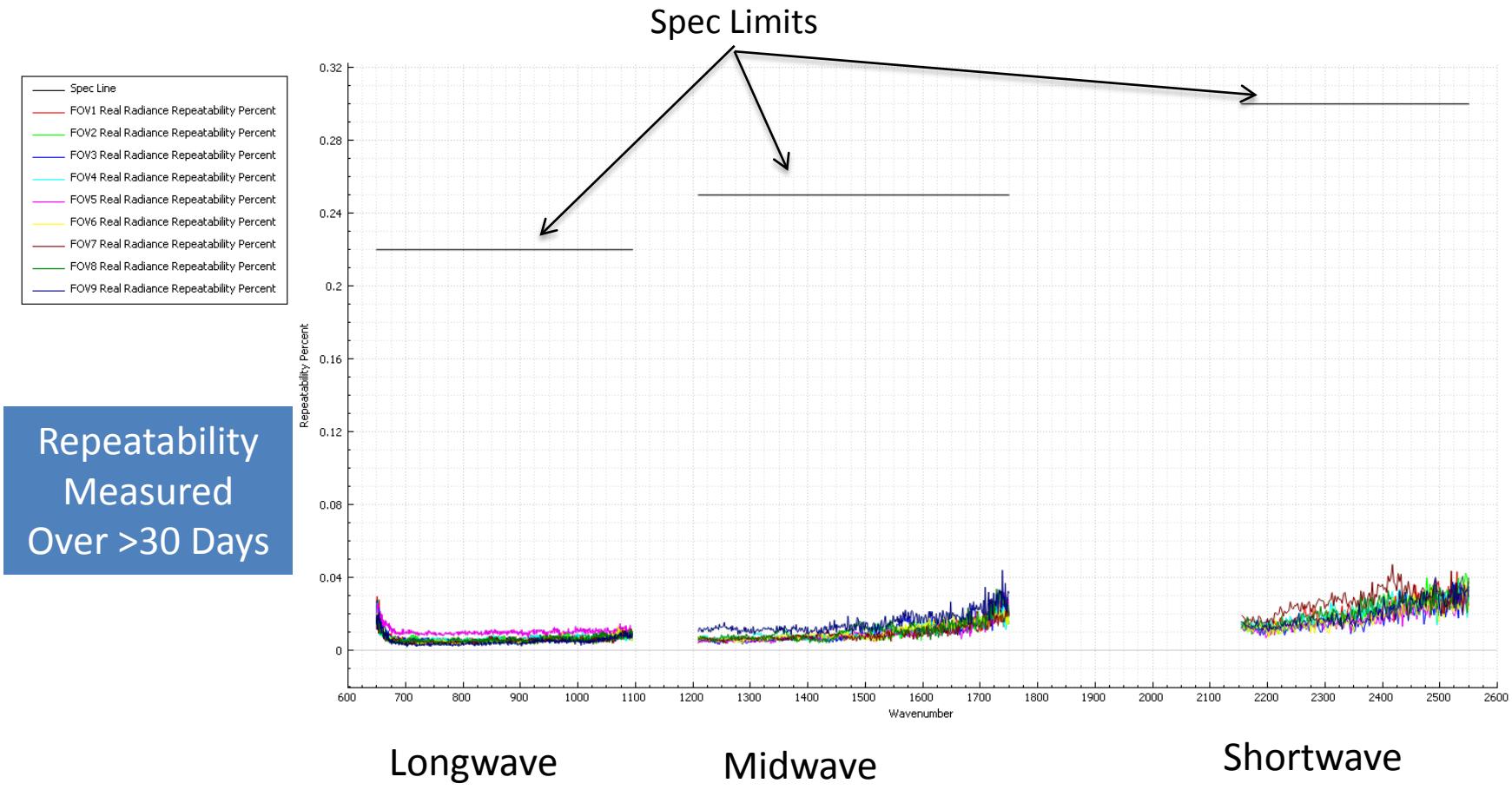


Similar to S-NPP:

noise performance significantly better than specification

Long Term Repeatability Performance

From Exelis

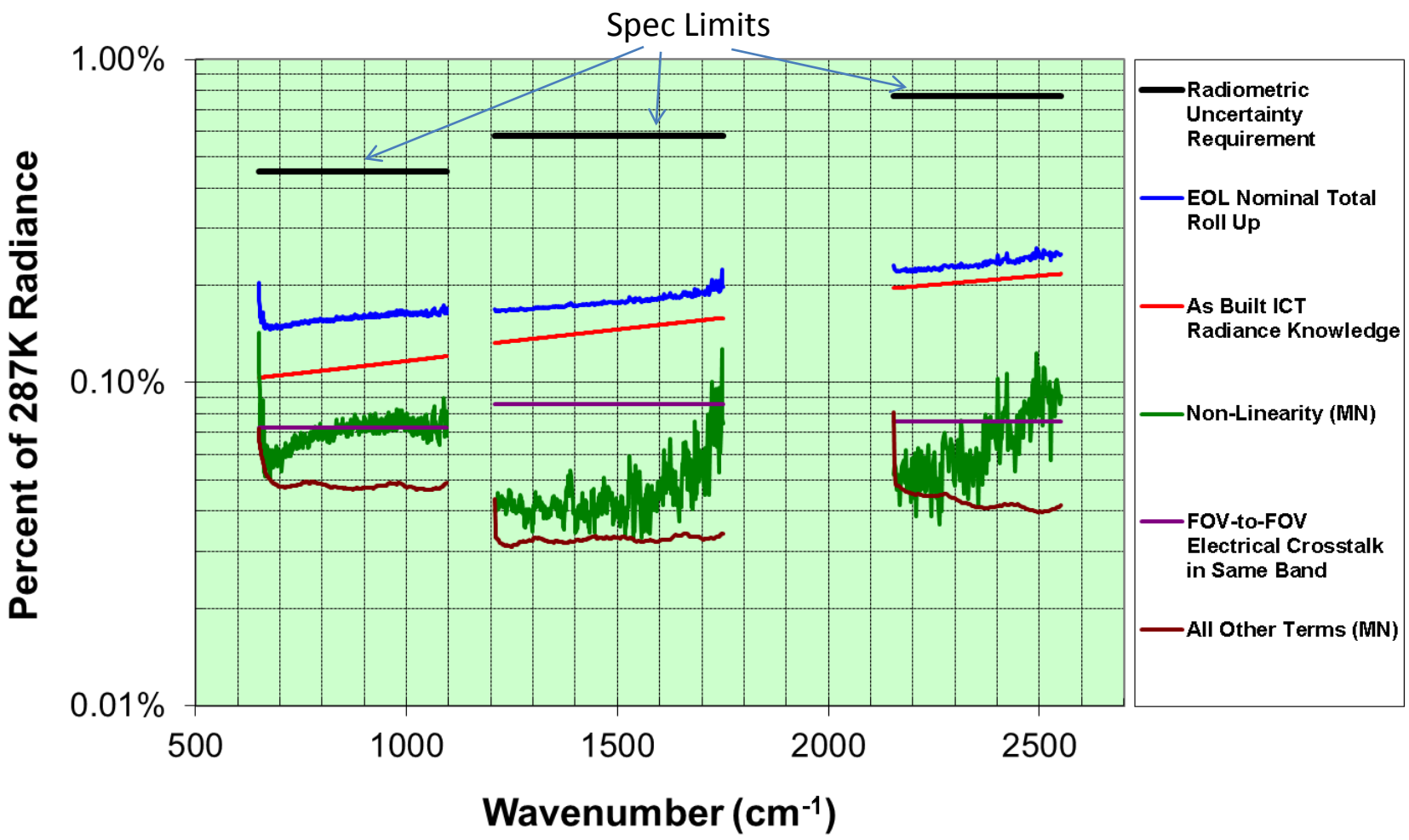


Repeatability Measured Over >30 Days

Excellent long term repeatability

Radiometric Uncertainty Performance

From Exelis



Excellent Radiometric Uncertainty Performance

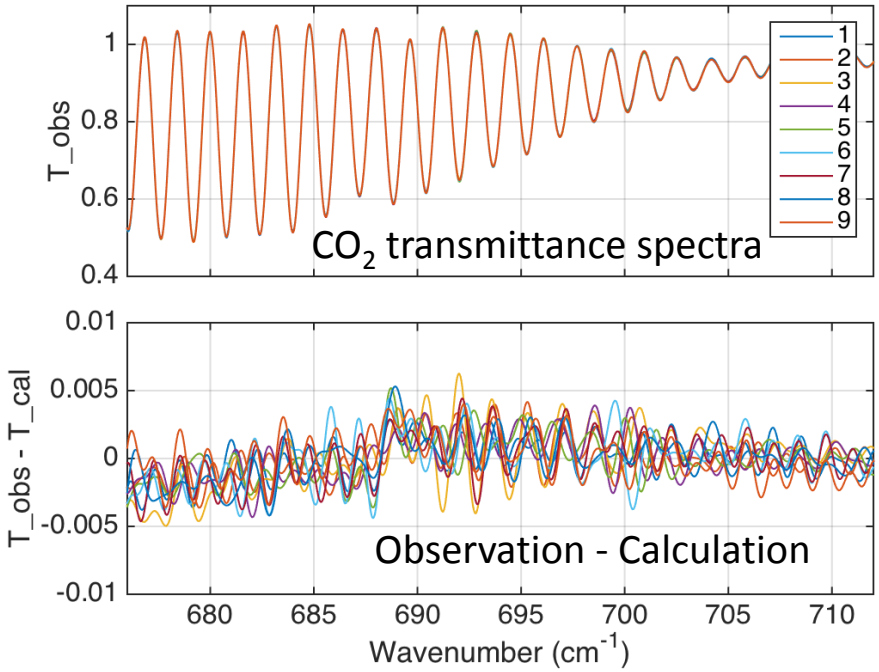
Instrument Line Shape Parameters Derived for Spectral Calibration

Instrument Line Shape parameters derived from TVAC data (UMBC):

	LW Y	LW X	MW Y	MW X	SW Y	SW X
FOV 1	19266	19266	19173	19173	19125	19125
FOV 2	0	19313	0	19205	0	19209
FOV 3	-19209	19209	-19181	19181	-19141	19141
FOV 4	19261	0	19174	0	19177	0
FOV 5	0	0	0	0	0	0
FOV 6	-19219	0	-19142	0	-19167	0
FOV 7	19282	-19282	19184	-19184	19149	-19149
FOV 8	0	-19084	0	-19168	0	-19172
FOV 9	-19287	-19287	-19189	-19189	-19136	-19136

Neon Calibration: 703.45036

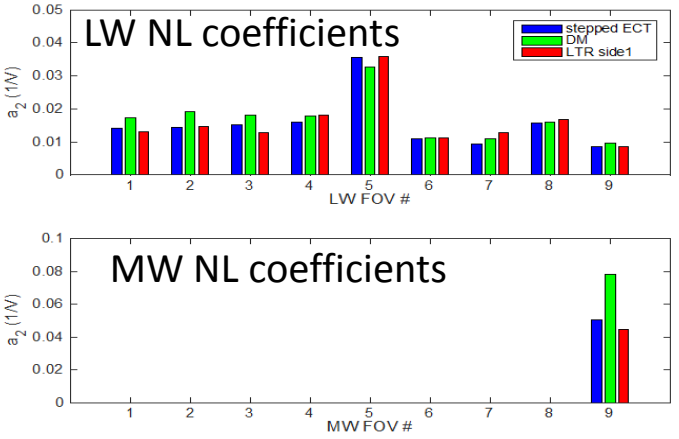
Band	Y offset	X offset	dR
LW	-601	-22	99
MW	-658	-10	-25
SW	-605	6	-63



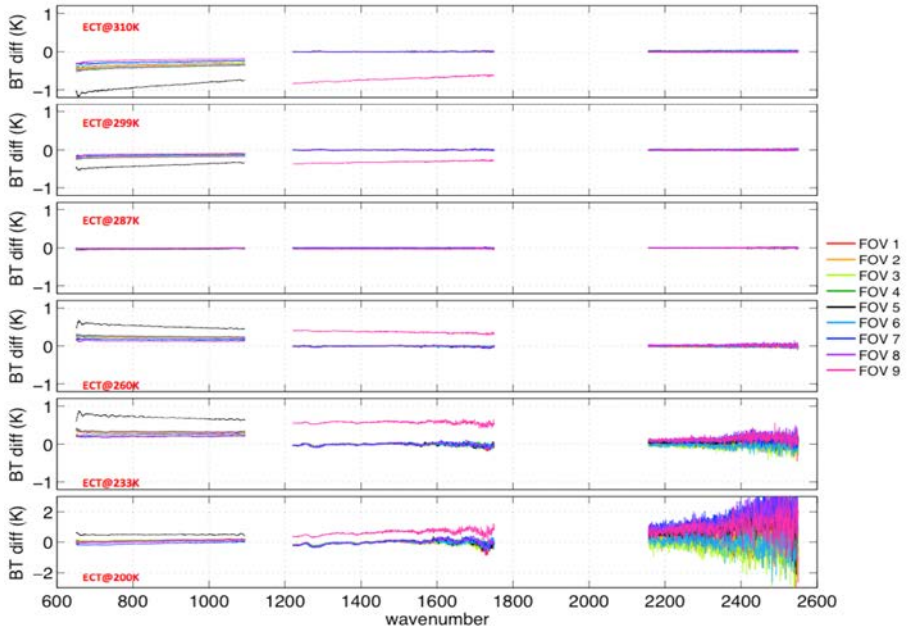
The ILS parameters minimize the difference between observed and calculated spectra

Non-linearity (NL) Correction Coefficients Derived for Radiometric Calibration

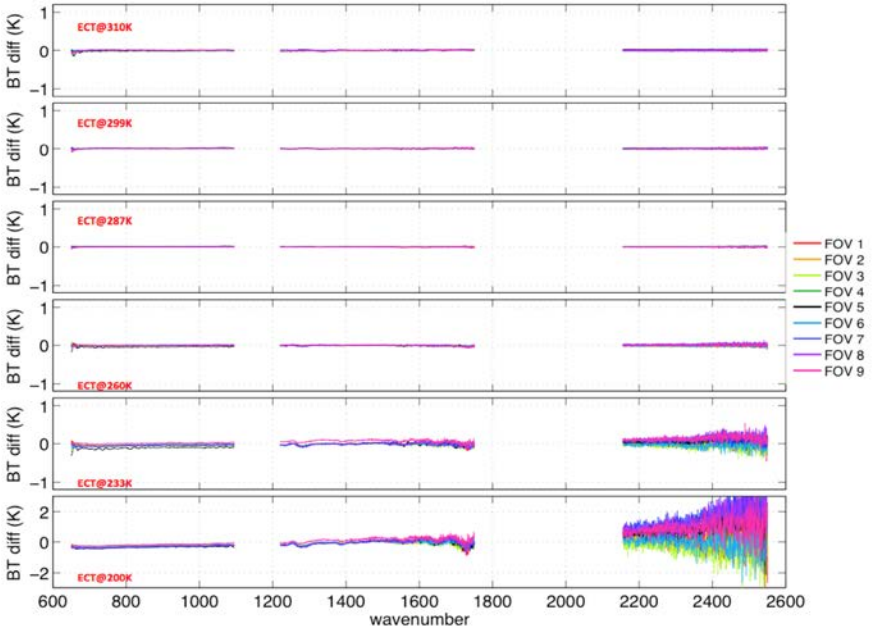
- NL correction coefficients derived from different methods (UW)
- NL correction is a critical step to reduce radiance errors and FOV-to-FOV difference



ECT view residuals without NL correction



ECT view residuals with NL correction



Summary

- S-NPP CrIS instrument and SDR performances have been in excellent status; no significant degradations have been detected so far
- Both normal and full spectral resolution SDR products are routinely generated, available to public
- J1 CrIS pre-launch performance exceeds specifications
- J1 SDR algorithm/software is a significant improvement over S-NPP's
- There is no critical unresolved issue in both S-NPP and J1 CrIS missions

Path Forward

- S-NPP
  - Continuation of S-NPP CrIS FSR SDR processing
  - Continuation of CalVal; assessment of 5 years of CrIS instrument and SDR performances
  - SDR reprocessing
- JPSS-1
  - Algorithm improvement updates (to be delivered in Dec. 2015)
  - Further TVAC data analysis; ECT characterization (2015-2016)
  - Preparation of post-launch CalVal activities (2015-2016)
- JPSS-2 and beyond
  - Full spectral coverage (650 – 2760 cm^{-1}; no gaps)
  - Smaller FOV size and larger FOV grid (e.g. 8 km FOV size and 5 x 5 FOV grid)