



FU1 Spatial Performance Test Data Analysis

NICSE (NPP SDS Instrument Calibration Support Element)
Geometric Calibration Group

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Spatial Performance Tests

- **FP4:** Along-Scan and Along-Track Band-to-Band Registration (BBR) by measuring Spectral Band Registration (SBR)
- **FP6:** A-Scan and A-Track Spatial Response:
 - HSI = Horizontal Sampling Interval (mechanical property)
 - LSF = Line Spread Function & its derived optical properties
 - FOV = Field of View (Dynamic for a-scan (**DFOV**), Instantaneous for a-track (**IFOV**)) → footprint size
 - MTF = Modulation Transfer Function → LSF shape
 - HSR = Horizontal Spatial Resolution → image resolution
- **FP5:** Pointing Knowledge
 - A-Scan: relative to Rotating Telescope Assembly (RTA) and Half Angle Mirror (HAM) encoder
 - A-Track: relative to scan plane



Ambient Test Result Summary

- **FP4: BBR pairs between M- and M-bands and pairs between I- and I-bands meet Spec**
 - BBR pairs between M-bands and nested I-bands **will** meet Spec after changing “I-sample delay”
- **FP6: FOVs and MTFs**
 - A-scan DFOV **>** Spec for the majority of all 432 detectors
 - A-track IFOV meets Spec for all detectors, except 3 smaller & 6 TBDs
 - A-scan MTF meets Spec for the majority of M-band detectors
 - A-track MTF meets Spec for all M-band detectors, except 6 TBDs
- **FP5: Pointing knowledge, errors meet Spec**

DNB not included

Thermal Vacuum tests may change the results



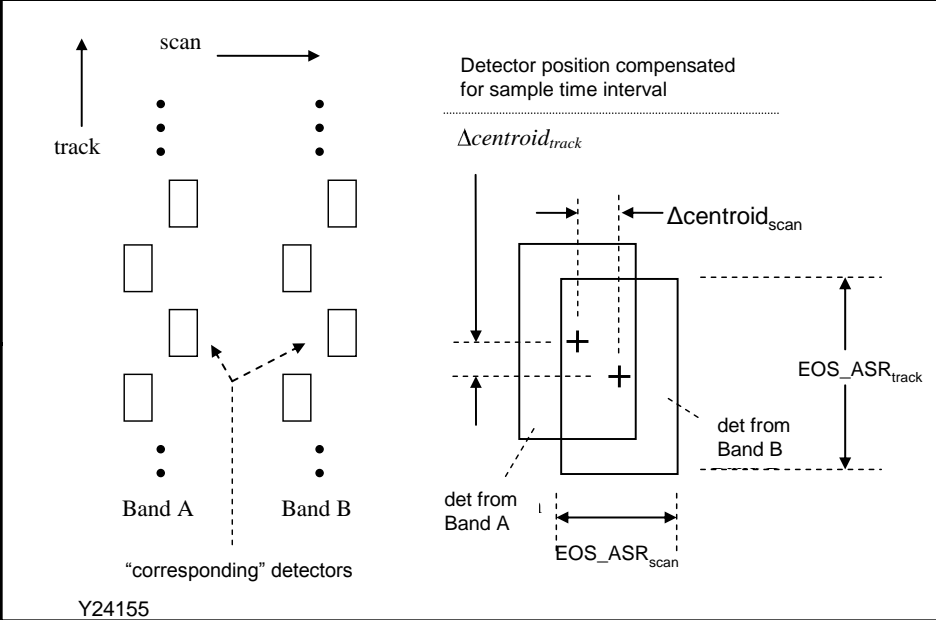
FU1 FP4 Ambient Tests A-Scan & A-Track Band-to-Band Registration Analysis



Band-to-Band Registration (BBR) Specification

“At least 99.7% of corresponding pixel samples”

	M1	M2	M3	M4	M5	M6	M7	M8	M9	M10	M11	M12	M13	M14	M15	M16	I1	I2	I3	I4	I5	
M1		0.64	0.64	0.64	0.64	0.64	0.64	0.64	0.64	0.64	0.64	0.64	0.64	0.64	0.64	0.64	0.64	0.64	0.64	0.64	0.64	
M2			0.64	0.64	0.64	0.64	0.64	0.64	0.64	0.64	0.64	0.64	0.64	0.64	0.64	0.64	0.64	0.64	0.64	0.64	0.64	
M3				0.64	0.7	0.64	0.64	0.64	0.64	0.64	0.7	0.64	0.64	0.64	0.64	0.64	0.64	0.64	0.64	0.64	0.64	
M4					0.64	0.64	0.64	0.64	0.64	0.64	0.64	0.64	0.64	0.64	0.64	0.64	0.64	0.64	0.64	0.64	0.64	
M5						0.64	0.8	0.64	0.64	0.64	0.7	0.64	0.64	0.64	0.64	0.64	0.64	0.64	0.64	0.64	0.64	
M6							0.64	0.64	0.64	0.64	0.64	0.64	0.64	0.64	0.64	0.64	0.64	0.64	0.64	0.64	0.64	
M7								0.64	0.64	0.64	0.64	0.64	0.64	0.64	0.64	0.64	0.64	0.64	0.64	0.64	0.64	
M8									0.64	0.64	0.64	0.64	0.64	0.64	0.64	0.64	0.64	0.64	0.64	0.64	0.64	
M9										0.64	0.64	0.8	0.8	0.8	0.8	0.8	0.64	0.64	0.64	0.64	0.64	
M10											0.64	0.64	0.64	0.64	0.64	0.64	0.64	0.64	0.64	0.64	0.64	
M11												0.64	0.64	0.64	0.64	0.64	0.64	0.64	0.64	0.64	0.64	
M12													0.8	0.8	0.8	0.8	0.64	0.64	0.64	0.64	0.64	
M13														0.8	0.8	0.8	0.64	0.64	0.64	0.64	0.64	
M14															0.8	0.8	0.64	0.64	0.64	0.64	0.64	
M15																0.8	0.64	0.64	0.64	0.64	0.64	
M16																	0.64	0.64	0.64	0.64	0.64	
I1																		0.8	0.8	0.8	0.8	
I2																			0.8	0.8	0.8	
I3																				0.8	0.8	
I4																					0.8	
I5																						0.8



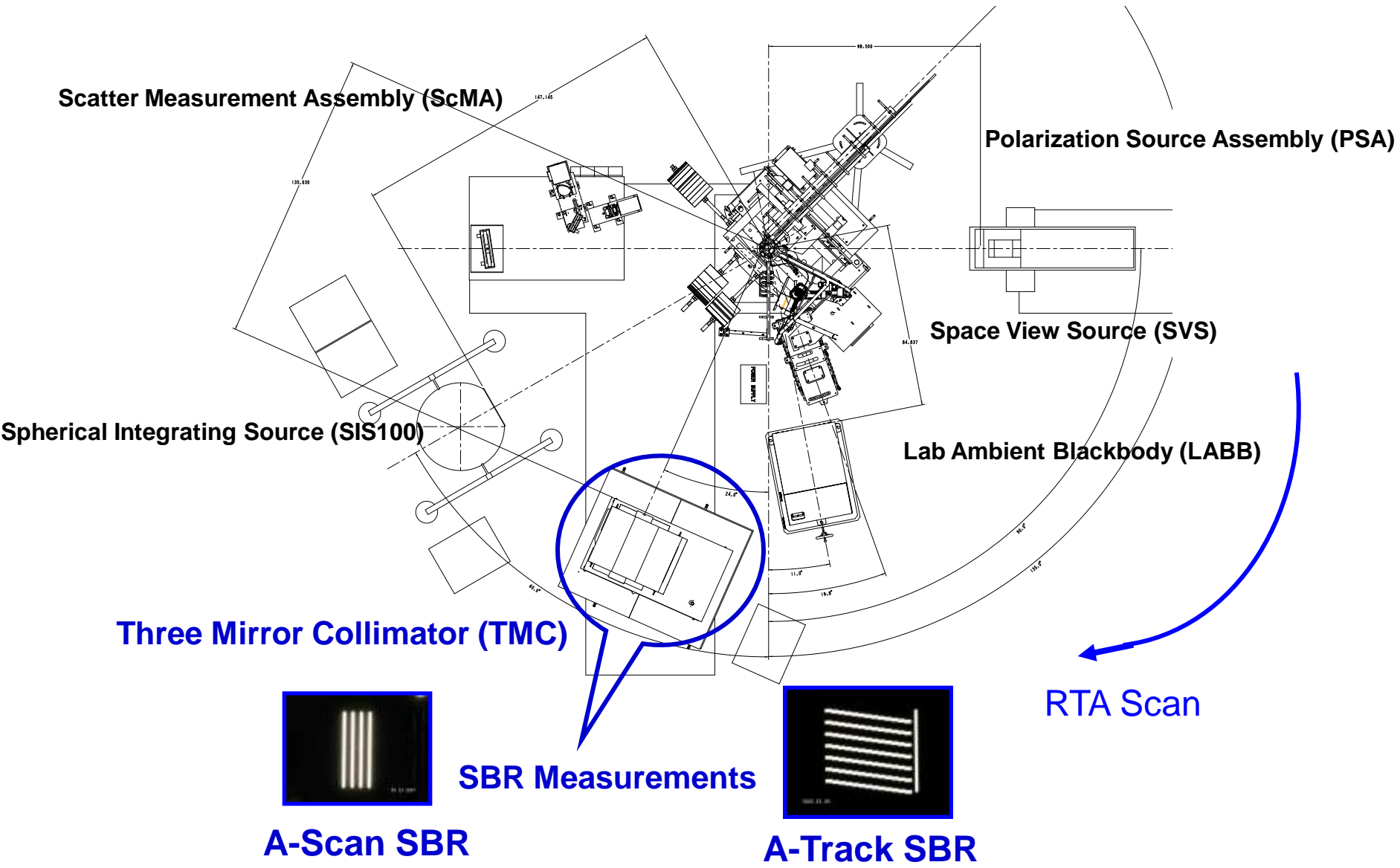
Source: VIIRS PRF PS154640-101B
 SRV0554, I to I bands;
 SRV0626/7/8/9, M to M bands;
SRV0579, M to nested I bands

DDR = (1-ΔCentroid_track) * (1-ΔCentroid_scan)
 for un-aggregated pixels except I band nested for I-M “DDR”.

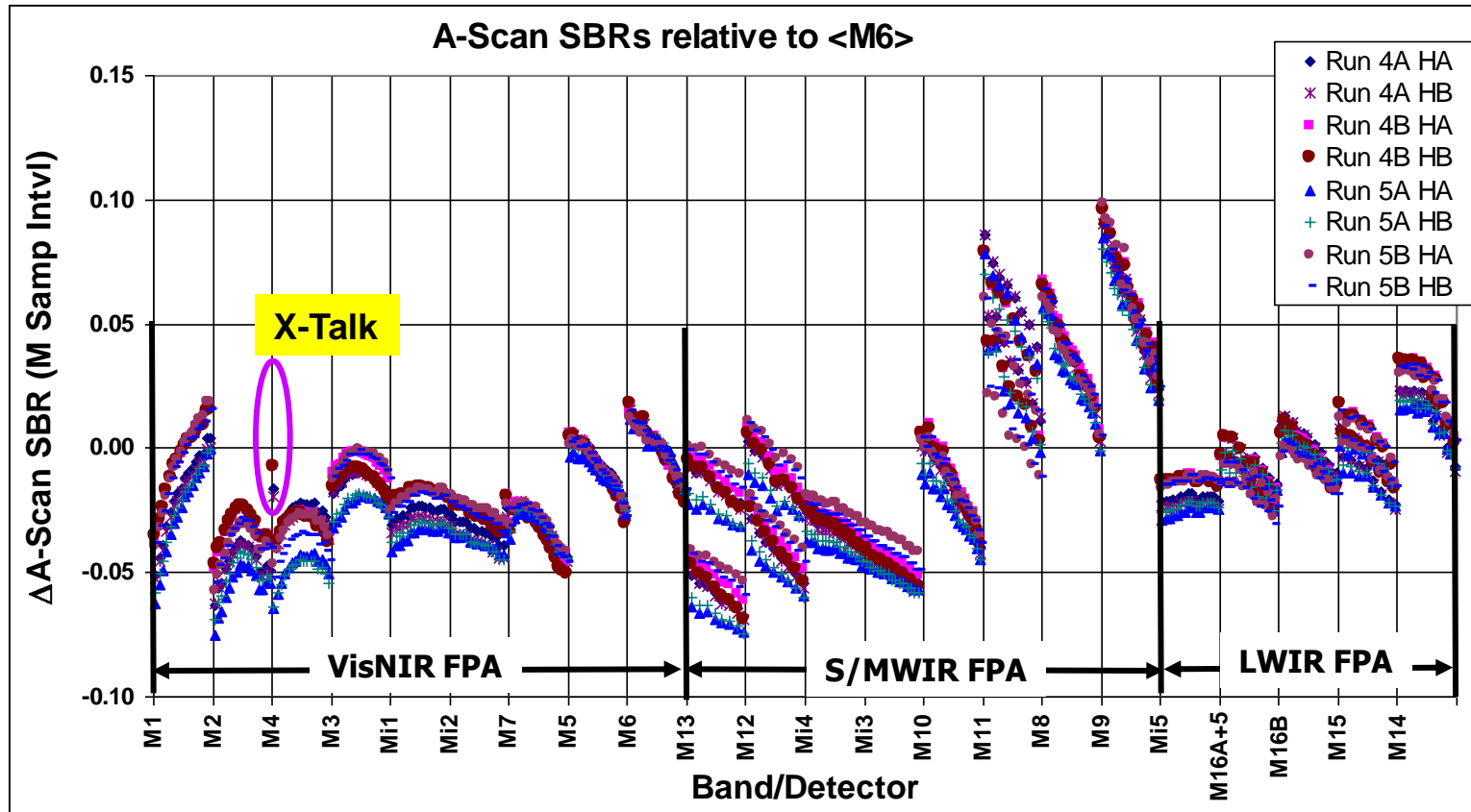
BBR_{99.7%} = “99.7%” of DDR pairs

Ambient Lab Setup for SBR Measurements

from Y16416



A-Scan SBR for Every Detector



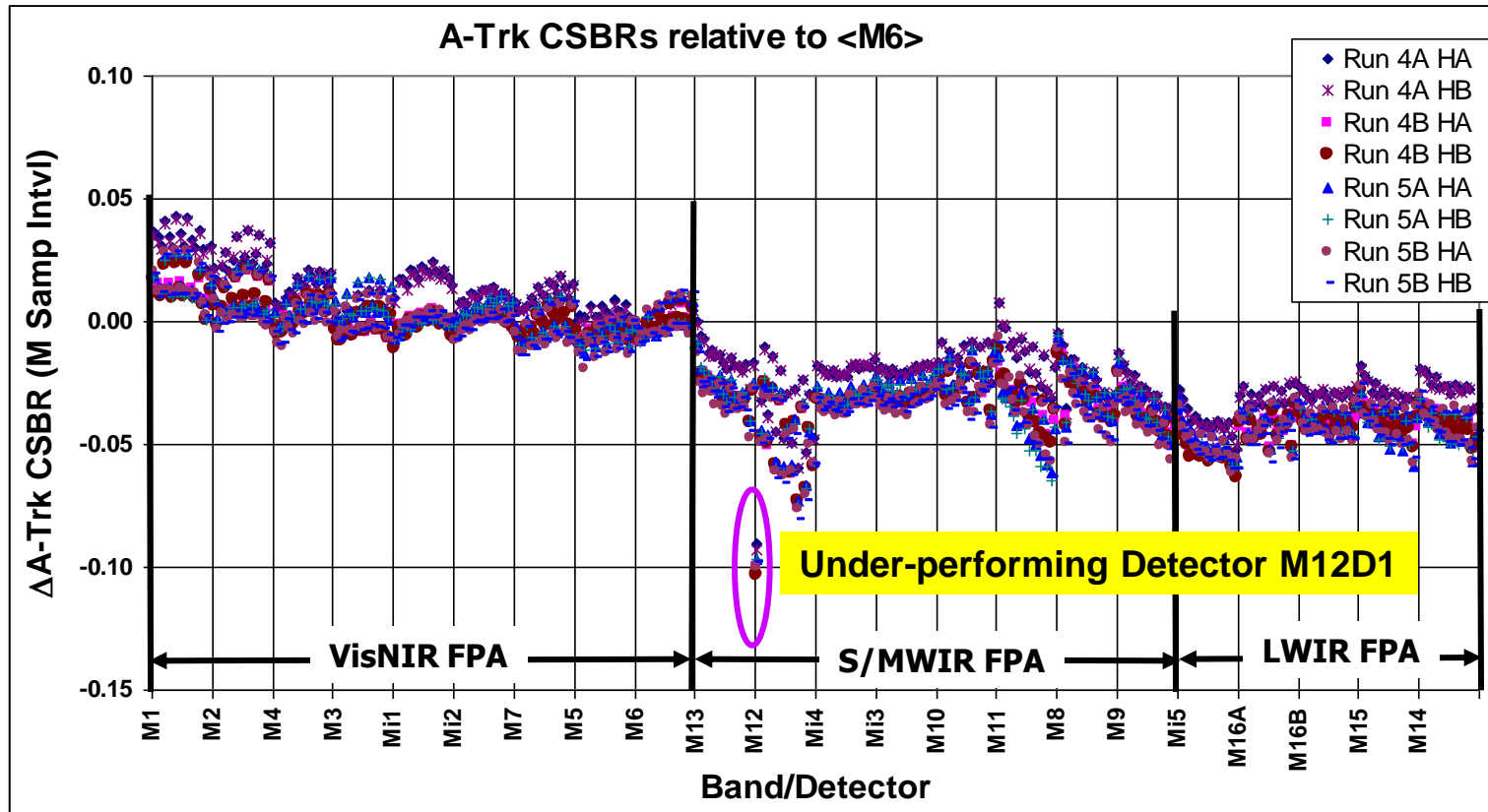
➤ All bands align each other pretty well, including I-Bands with M-bands after nesting

- Relative band (mis-)registration is repeatable, within $\sim \pm 5\%$ MSIs, in all test cases.
- Slopes indicate FPA rotation (to compensate for spacecraft forward motion)

Note: SBRs for Band M16A are shifted up 5 M band sampling intervals.



A-Track CSBR for Every Detector



➤ All bands align each other pretty well, including I-Bands with M-bands after nesting

- Relative band (mis-)registration is repeatable, within $\sim \pm 5\%$ MSIs, in all test cases.
- VisNIR FPA shifts ~ 0.04 MSIs from S/MWIR and LWIR FPAs.



BBR Margin/Spec Matrix

Scan distance measures from the beginning of the 2nd “EV” sample integration

$$BBR_{margin} = BBR_{99.7\%} - BBR_{spec}$$

	M1	M2	M3	M4	M5	M6	M7	M8	M9	M10	M11	M12	M13	M14	M15	M16A	M16B	I1	I2	I3	I4	I5
M1		0.29	0.29	0.29	0.26	0.25	0.28	0.20	0.17	0.25	0.19	0.18	0.23	0.23	0.24	0.24	0.23	0.29	0.29	0.25	0.25	0.24
M2	0.64		0.29	0.31	0.27	0.25	0.30	0.19	0.17	0.26	0.18	0.21	0.27	0.23	0.24	0.25	0.24	0.30	0.30	0.25	0.28	0.25
M3	0.64	0.64		0.31	0.25	0.30	0.31	0.25	0.22	0.29	0.16	0.23	0.26	0.27	0.28	0.28	0.28	0.32	0.32	0.30	0.28	0.28
M4	0.64	0.64	0.64		0.28	0.28	0.32	0.22	0.19	0.28	0.20	0.23	0.28	0.24	0.26	0.26	0.25	0.32	0.32	0.27	0.30	0.26
M5	0.64	0.64	0.70	0.64		0.33	0.15	0.27	0.24	0.31	0.19	0.25	0.27	0.27	0.29	0.30	0.31	0.30	0.31	0.32	0.29	0.29
M6	0.64	0.64	0.64	0.64	0.64		0.30	0.27	0.24	0.29	0.25	0.23	0.25	0.27	0.29	0.28	0.30	0.29	0.30	0.30	0.27	0.27
M7	0.64	0.64	0.64	0.64	0.80	0.64		0.23	0.21	0.30	0.23	0.23	0.28	0.25	0.26	0.28	0.27	0.33	0.33	0.29	0.30	0.26
M8	0.64	0.64	0.64	0.64	0.64	0.64	0.64		0.31	0.27	0.30	0.20	0.23	0.29	0.27	0.25	0.27	0.23	0.24	0.27	0.24	0.25
M9	0.64	0.64	0.64	0.64	0.64	0.64	0.64	0.64		0.25	0.29	0.03	0.05	0.11	0.10	0.07	0.08	0.21	0.22	0.25	0.22	0.23
M10	0.64	0.64	0.64	0.64	0.64	0.64	0.64	0.64	0.64		0.25	0.27	0.30	0.28	0.31	0.31	0.30	0.30	0.31	0.33	0.31	0.30
M11	0.64	0.64	0.70	0.64	0.70	0.64	0.64	0.64	0.64	0.64		0.20	0.24	0.27	0.25	0.23	0.25	0.22	0.22	0.24	0.22	0.21
M12	0.64	0.64	0.64	0.64	0.64	0.64	0.64	0.64	0.80	0.64	0.64		0.09	0.10	0.11	0.11	0.12	0.23	0.23	0.28	0.27	0.28
M13	0.64	0.64	0.64	0.64	0.64	0.64	0.64	0.64	0.80	0.64	0.64	0.80		0.10	0.12	0.12	0.11	0.28	0.28	0.29	0.31	0.28
M14	0.64	0.64	0.64	0.64	0.64	0.64	0.64	0.64	0.80	0.64	0.64	0.80	0.80		0.16	0.14	0.15	0.25	0.25	0.30	0.27	0.29
M15	0.64	0.64	0.64	0.64	0.64	0.64	0.64	0.64	0.80	0.64	0.64	0.80	0.80	0.80		0.16	0.17	0.27	0.27	0.31	0.28	0.31
M16A	0.64	0.64	0.64	0.64	0.64	0.64	0.64	0.64	0.80	0.64	0.64	0.80	0.80	0.80	0.80		0.17	0.28	0.28	0.32	0.30	0.31
M16B	0.64	0.64	0.64	0.64	0.64	0.64	0.64	0.64	0.80	0.64	0.64	0.80	0.80	0.80	0.80	0.80		0.27	0.27	0.32	0.29	0.31
I1	0.64	0.64	0.64	0.64	0.64	0.64	0.64	0.64	0.64	0.64	0.64	0.64	0.64	0.64	0.64	0.64	0.64	0.16	0.06	0.08	0.00	
I2	0.64	0.64	0.64	0.64	0.64	0.64	0.64	0.64	0.64	0.64	0.64	0.64	0.64	0.64	0.64	0.64	0.64	0.80		0.08	0.08	0.00
I3	0.64	0.64	0.64	0.64	0.64	0.64	0.64	0.64	0.64	0.64	0.64	0.64	0.64	0.64	0.64	0.64	0.64	0.80	0.80		0.13	0.06
I4	0.64	0.64	0.64	0.64	0.64	0.64	0.64	0.64	0.64	0.64	0.64	0.64	0.64	0.64	0.64	0.64	0.64	0.80	0.80	0.80		0.02
I5	0.64	0.64	0.64	0.64	0.64	0.64	0.64	0.64	0.64	0.64	0.64	0.64	0.64	0.64	0.64	0.64	0.64	0.80	0.80	0.80	0.80	

All BBR pairs meets specification, w/ non-negative margins, including I-Bands with M-bands after nesting.

Two BBR pairs (I5&I1, I5&I2) have no more room for errors.

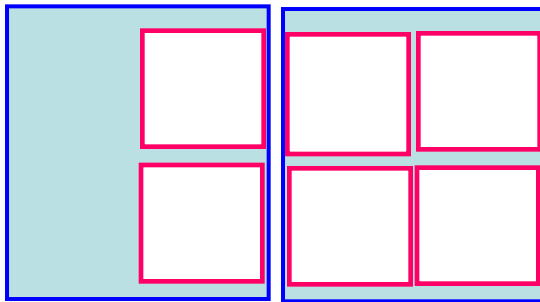
BBR_{spec} for (M16A,M16B) pair is assumed to be 0.8.

BBR_{spec}



Ambient Issue: Footprint Mismatch between M-bands and Nested I-Bands

I Band Sample# 0, 1, 2

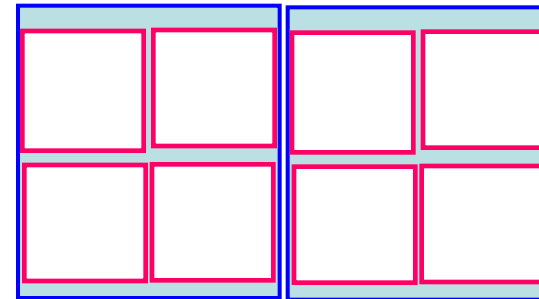


Detector 1

M Band Sample# 0, 1

Current I-bands nesting with M-bands
(Sample#0 ignored)

Sample# 0, 1, 2, 3



Detector 2

Detector 1

Sample# 0, 1

Future I-bands nesting with M-bands
(Sample#0 considered)

➤ “I-Bands align well with M-bands after nesting” w/ this **trick**

SBRS has a solution →



SBRS Solution

SBRS Doc# Yxxxxx
VIIRS Flight Unit 1
Band to Band Registration
I band Sample Nesting Issue
May 5th, 2008

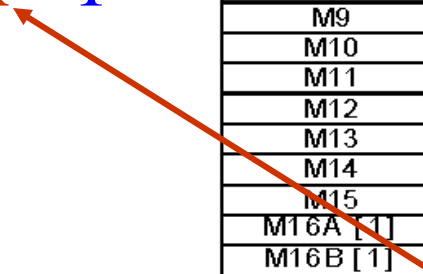


I-sample Delay Change

Table 52. "Uploadable table ID 7" description table

Spectral Band	Samples Dropped Internally To Align With Band M1 [2]		Sample time Delay Relative to Band 1 (sec)	
	Odd # Dets	Even # Dets	Odd # Dets	Even # Dets
M1	3	3	2.648E-04	2.648E-04
M2	6	6	5.296E-04	5.296E-04
M3	12	12	1.059E-03	1.059E-03
M4	9	9	7.943E-04	7.943E-04
M5	21	21	1.853E-03	1.853E-03
M6	24	24	2.118E-03	2.118E-03
M7	18	18	1.589E-03	1.589E-03
M8	35	38	3.089E-03	3.354E-03
M9	41	44	3.619E-03	3.883E-03
M10	23	26	2.030E-03	2.295E-03
M11	29	32	2.560E-03	2.824E-03
M12	9	12	7.943E-04	1.059E-03
M13	3	6	2.648E-04	5.296E-04
M14	37	40	3.266E-03	3.530E-03
M15	31	34	2.736E-03	3.001E-03
M16A [1]	19	22	1.677E-03	1.942E-03
M16B [1]	25	28	2.206E-03	2.471E-03
I1	29	29	1.280E-03	1.280E-03
I2	33	33	1.456E-03	1.456E-03
I3	38	41	1.677E-03	1.809E-03
I4	29	32	1.280E-03	1.412E-03
I5	29	32	1.280E-03	1.412E-03
DNB	Not Applicable - DNB Timing Different From Other Bands			

$$X_{fix} = X - 1$$



Notes:

[1] The transmitted data for Band M16 is the average of the data from two detectors that sample the data at slightly different times, as shown.

[2] All bands are offset by 3 mod res samples to allow for electronic settling before earth view sampling.

From EDD154640-104G SHEET 278



Conclusions



- BBR pairs between M- and M-bands and pairs between I- and I-bands meet Spec
 - small margin for pairs between I5 and I1, I2 and I4 bands
- BBR pairs between M-bands and nested I-bands **will** meet specification after implementing “I-sample delay change”
- These results are from ambient tests. The results from thermal vacuum tests are expected to change.
- We have not looked into focal plane rotation (to compensate for satellite forward motion) effects on BBR.



FU1 FP-6 Spatial Response Test Results



Specifications – FOVs



- A-Scan Instantaneous Field of View (IFOV)
 - Dynamic FOV given by Full Width Half Maximum (FWHM) of Line Spread Function (LSF) curve
 - I-bands (SRV0462):
 - I1, I2: 114 μ rad
 - I3: 108 μ rad
 - I4: 109 μ rad
 - I5: 102 μ rad123 μ rad (102 m Nadir),
spec waiver (RDW-047A)
 - M-bands (SRV0039)
 - M1 to M11: 382 μ rad
 - M12, M13: 379 μ rad
 - M14, M15: 362 μ rad
 - M16: 364 μ rad393 μ rad (327 m nadir)
spec waiver (RDW-047A)
- A-Track IFOV
 - Given by FWHM of LSF curve
 - I-bands (SRV0462): IFOV = 445 μ rad (371 m nadir)
 - M-bands (SRV0039): IFOV = 891 μ rad (742 m nadir)

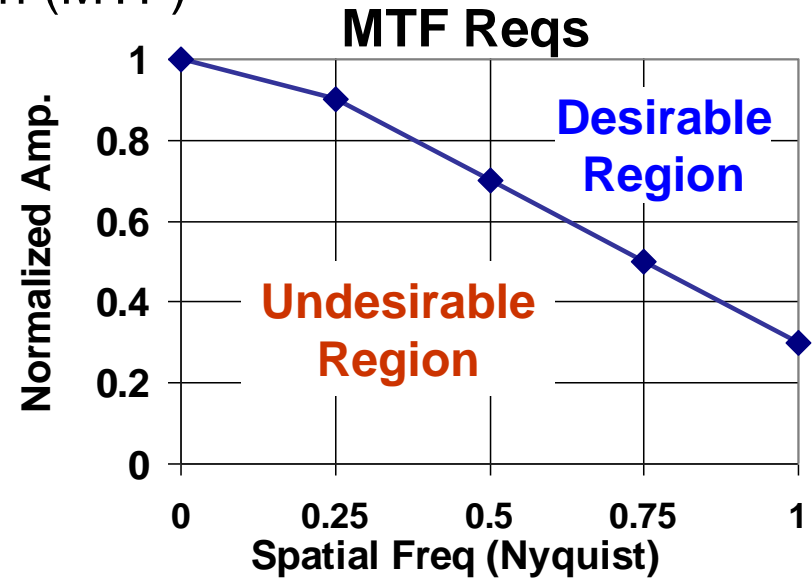


Specifications – MTF, HSR, HSI



- M-band Modulation Transfer Function (MTF) (SRV0043): equal or exceed values specified for spatial frequency relative to Nyquist:

Nyquist Freq. Fraction	MTF
0.00	1.0
0.25	0.9
0.50	0.7
0.75	0.5
1.00	0.3



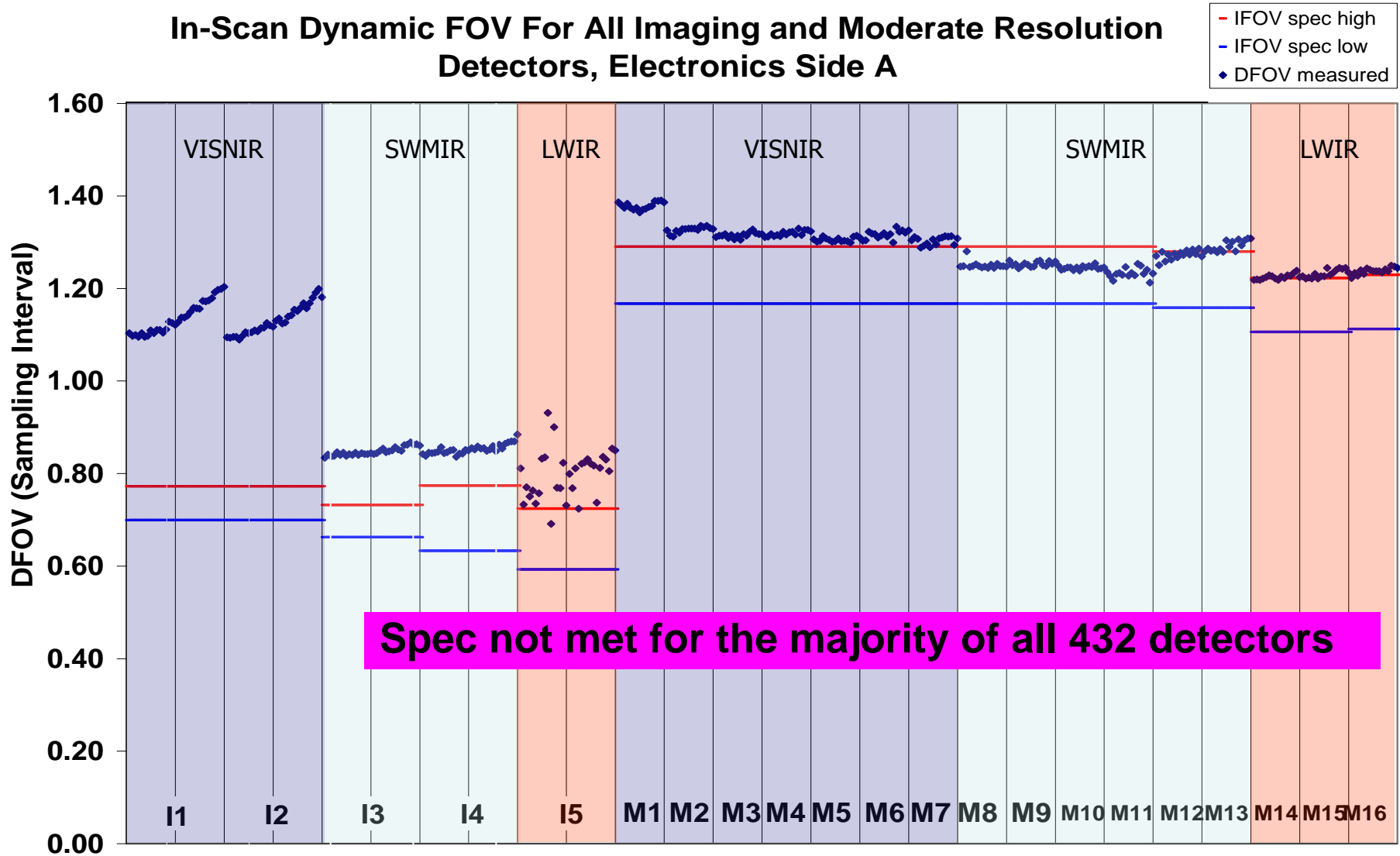
- I-band Horizontal Spatial Resolution (HSR) (SRV049): ≤ 0.4 km at nadir and ≤ 0.8 km worse case
- A-Scan Horizontal Sampling Interval (HSI)
 - I-bands: 129 m (1-Agg @ nadir) [155 μ rad @ 833 km altitude]
 - M-bands: 259 m (1-Agg @ nadir) [311 μ rad @ 833 km altitude]
- A-Track HSI
 - I-bands: 371 m (nadir) [445 μ rad @ 833 km altitude]
 - M-bands: 742 m (nadir) [891 μ rad @ 833 km altitude]



A-Scan DFOV



In-Scan Dynamic FOV For All Imaging and Moderate Resolution Detectors, Electronics Side A

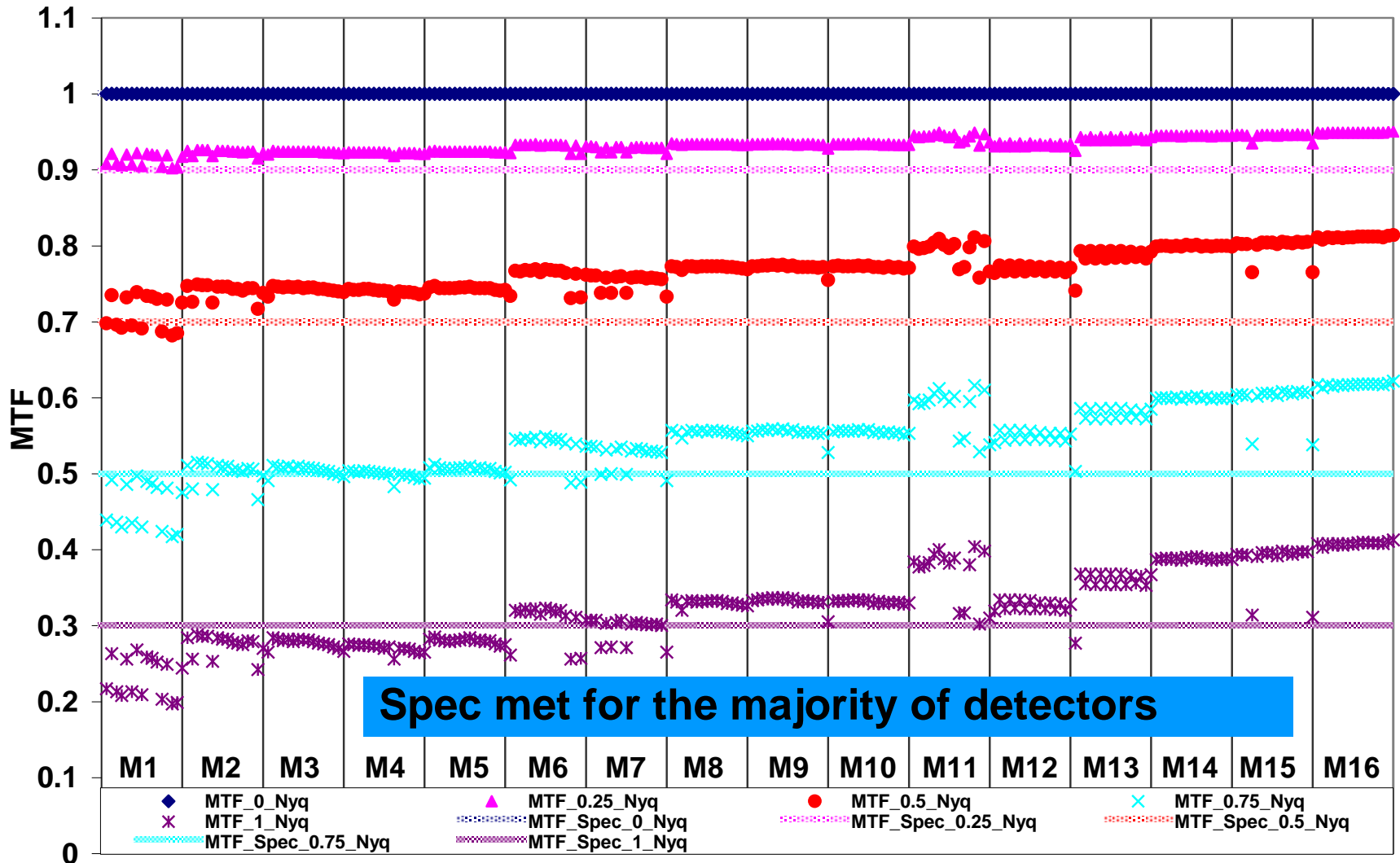


Spec not met for the majority of all 432 detectors



A-Scan MTFs for M-bands

In-Scan M-Band MTF Values for Electronics Side A



Spec met for the majority of detectors



A-Track IFOV (μrad)



Det	I1	I2	I3	I4	I5
1	450	450	442	436	430
2	439	439	448	447	439
3	448	449	452	449	435
4	453	453	449	444	437
5	452	451	449	445	448
6	453	452	454	451	441
7	446	447	453	451	449
8	450	445	445	441	450
9	450	440	430	428	440
10	453	440	446	443	448
11	445	448	448	444	447
12	432	431	441	439	435
13	448	449	441	438	432
14	445	445	437	436	448
15	442	442	448	445	441
16	450	450	449	445	442
17	451	452	444	441	448
18	455	455	447	445	443
19	450	449	447	446	449
20	437	453	444	441	450
21	441	446	451	427	452
22	444	450	438	439	447
23	441	444	435	444	438
24	439	437	432	428	443
25	440	442	445	441	436
26	444	445	435	432	444
27	447	447	439	436	446
28	445	445	447	445	444
29	445	449	451	443	434
30	454	454	450	447	422
31	451	451	439	437	434
32	439	439	433	442	421

I-bands

Det	M1	M2	M3	M4	M5	M6	M7	M8	M9	M10	M11	M12	M13	M14	M15	M16
1	896	894	890	891	889			898	894	892	887	731	872	887	882	887
2	894	895	899	900	903	904	900	901	888	900	888	876	889	885	892	889
3	906	906	905	906	903	908	907	861	898	904	897	891	889	906	896	889
4	908	886	888	889	900	891	888	900	895	902	894	872	896	896	903	895
5	897	895	878	879	907	880	878	877	873	903	872	897	902	905	896	889
6	882	880	875	898	878	897	896	896	890	885	885	866	874	878	875	870
7	884	887	892	891	892			879	876	884	875	867	873	890	874	863
8	895	891	891	891	897	894	891	897	885	904	884	867	895	880	890	872
9	903	904	906	906	909	909	907	894	886	898	888	883	889	887	887	876
10	899	885	885	905	887	889	888	888	878	895	881	861	896	885	903	897
11	903	901	886	899	888	886	884	874	867	875	865	894	900	901	893	887
12	876	877	889	880	892	889	887	886	868	899	861	851	887	879	878	874
13	879	880	882	880	892			873	868	878	865	867	878	871	869	857
14	898	897	896	897	892	895	896	889	881	894	877	863	888	886	897	879
15	895	894	898	897	906	903	899	894	883	896	881	887	892	898	896	891
16	891	896	905	895	893	899	897	878	873	885	868	864	884	885	885	873

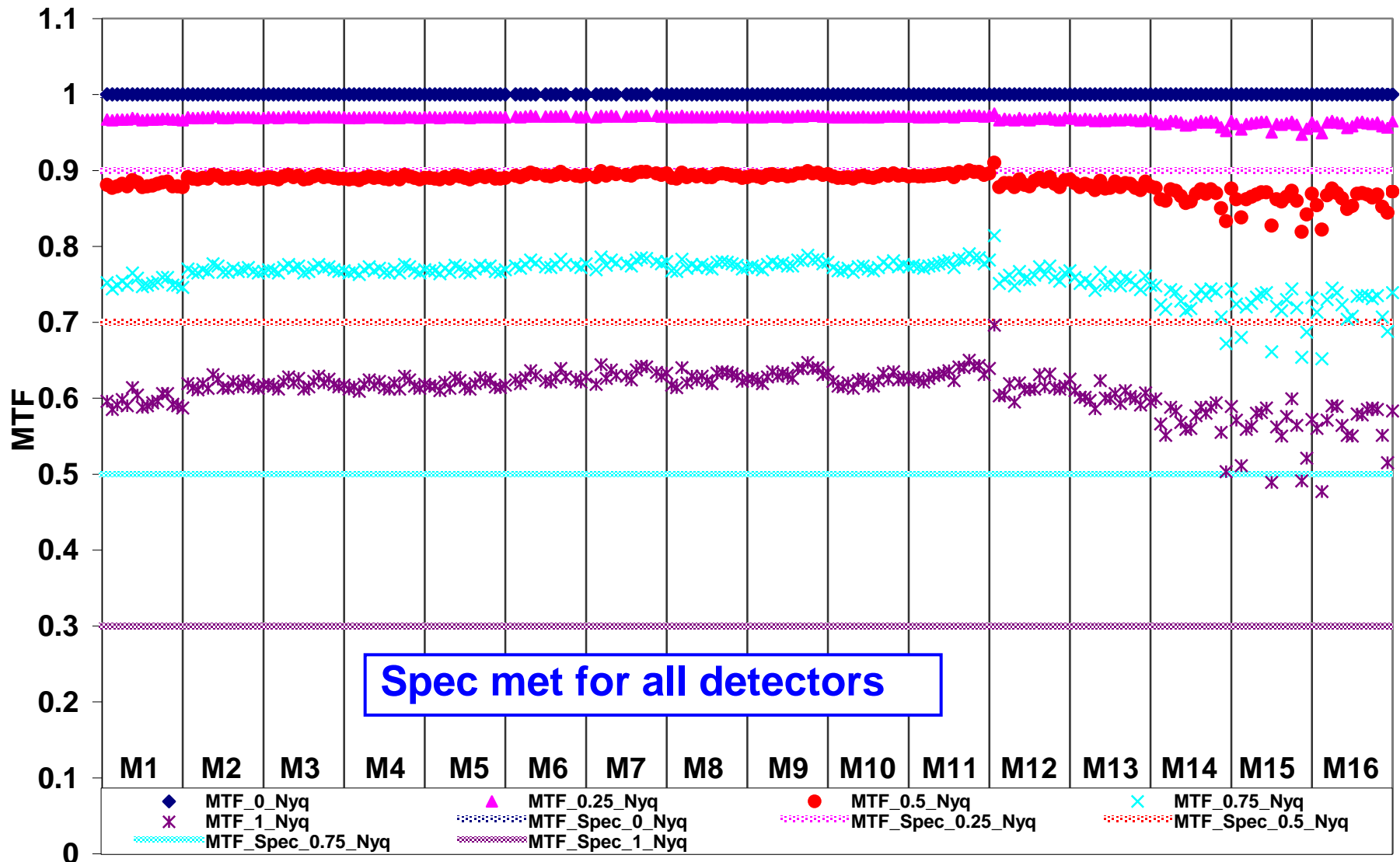
M-bands

- I-band Spec: $423 < \text{IFOV} < 467 \mu\text{rad}$
- M-band Spec: $846 < \text{IFOV} < 936 \mu\text{rad}$
- All detectors meet specification, except
 - I5, d30 and d32, smaller ■ Exceed Spec?
 - M12 D1, underperforming, smaller ■ Exceed Spec?
 - M6 and M7, d1, d7 and d13 – TBD ■

Spec met for almost all detectors



A-Track MTF for M-bands





Test Result Summary



- For FOVs – footprint size
 - A-scan DFOV Spec is not met for the majority of all 432 detectors
 - A-track IFOV Spec is met for all detectors, except:
 - M12 d1 – underperforming detector, smaller
 - I5: d30 and d32, smaller
 - M6 and M7: d1, d7 and d13 – TBD
- For MTFs – M-band image quality required
 - A-scan MTF Spec is met for the majority of M-band detectors
 - A-track MTF Spec is met for all M-band detectors
- Change expected in TVAC as focal length changes with temperature
 - model indicates an improvement
 - but I bands a-scan DFOV may not meet original spec
 - also, a-scan DFOV may not meet proposed spec waiver (RDW-047A)
I-band 123 μ rad, M-band 393 μ rad



FP5 Pointing Knowledge



Outline of FP5 Testing



- Measures the Half Angle Mirror (HAM) and Rotating Telescope Assembly (RTA) pointing in relationship to encoder
- Measures scan plane relative to instrument reference cube and produces angle of Earth View start encoder location
- Also, measurements are made of TMC reticles (and relationship to VIIRS reference frame) and some focal plan locations
- Use theodolites with ~ 1 arcsec accuracy



Test Result Summary

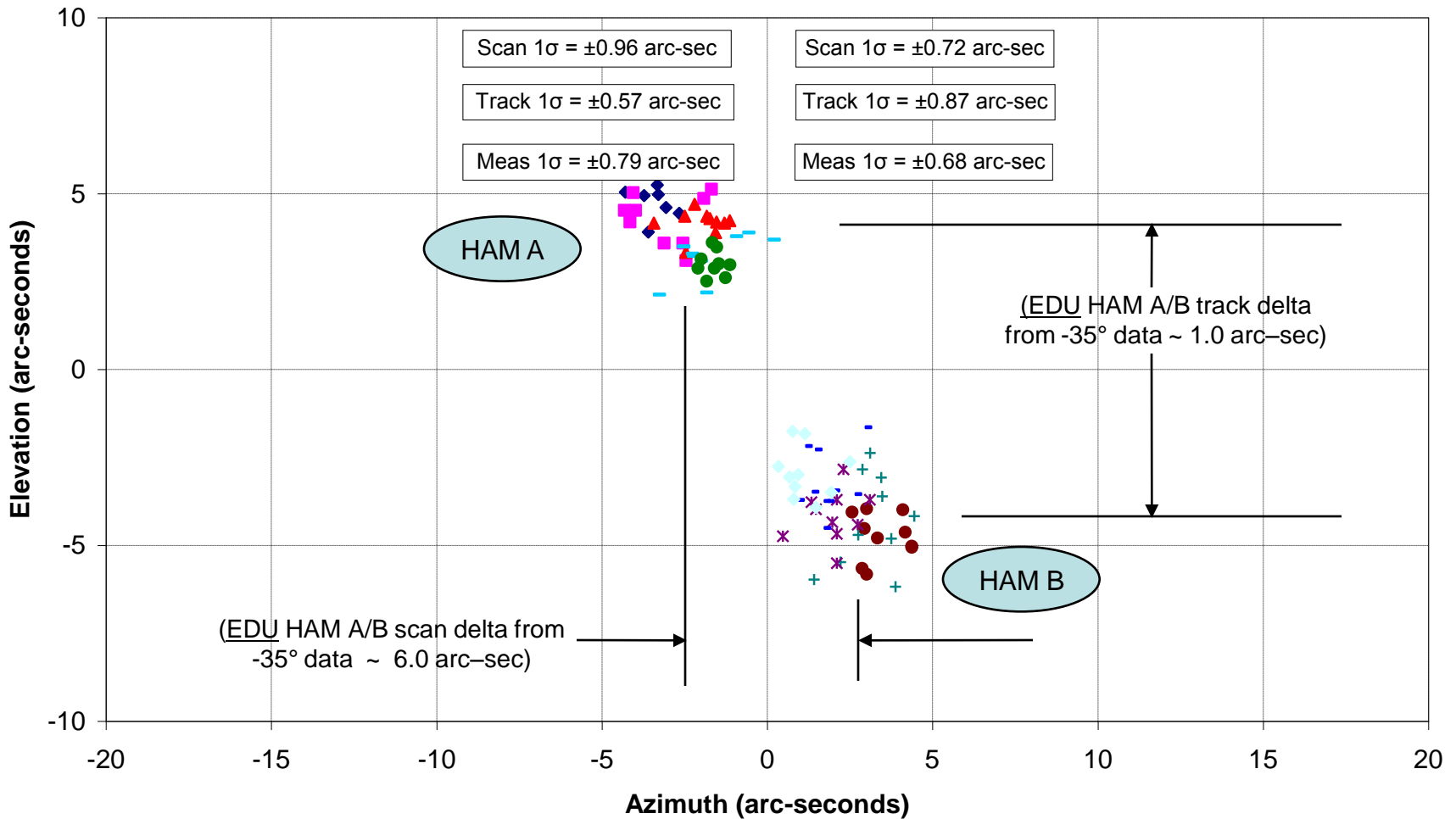
- Instrument meets specifications
- Measurements agree with EDU – also within specification
- Expect changes due to on-orbit conditions (i.e. gravity release, temperature)
 - STOP modeling indicates that there should be no temperature problems – but no ground based TVAC pointing measurements are being made that will explicitly verify the model



FU1 FP-05 repeatability (HAM alone)

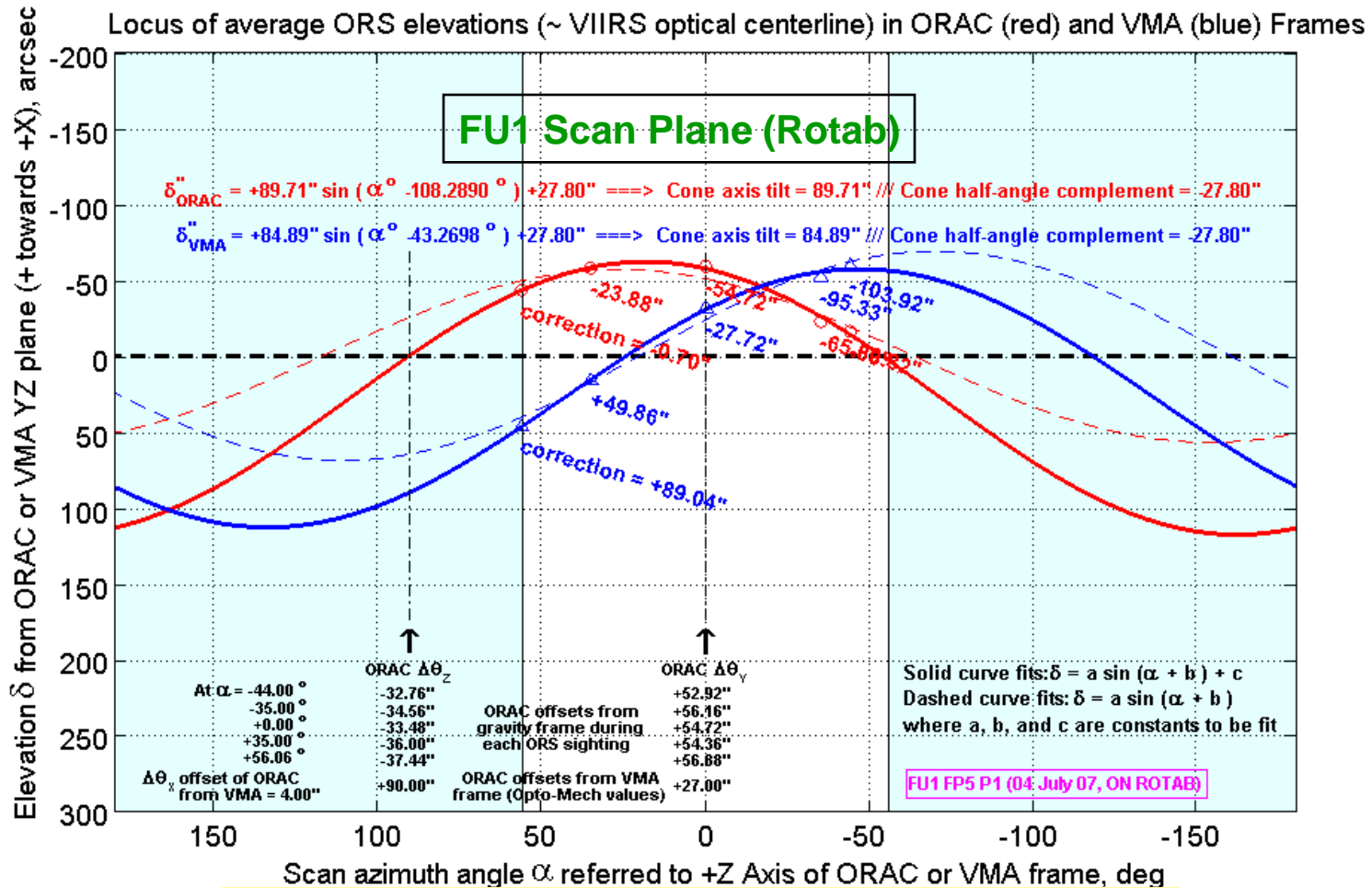
HAM Repeatability using ETSC 7/4/2007

◆ +56A ■ +35A ▲ ZeroA - -35A ● -44A ● +56B + +35B × ZeroB - -35B ● -44B





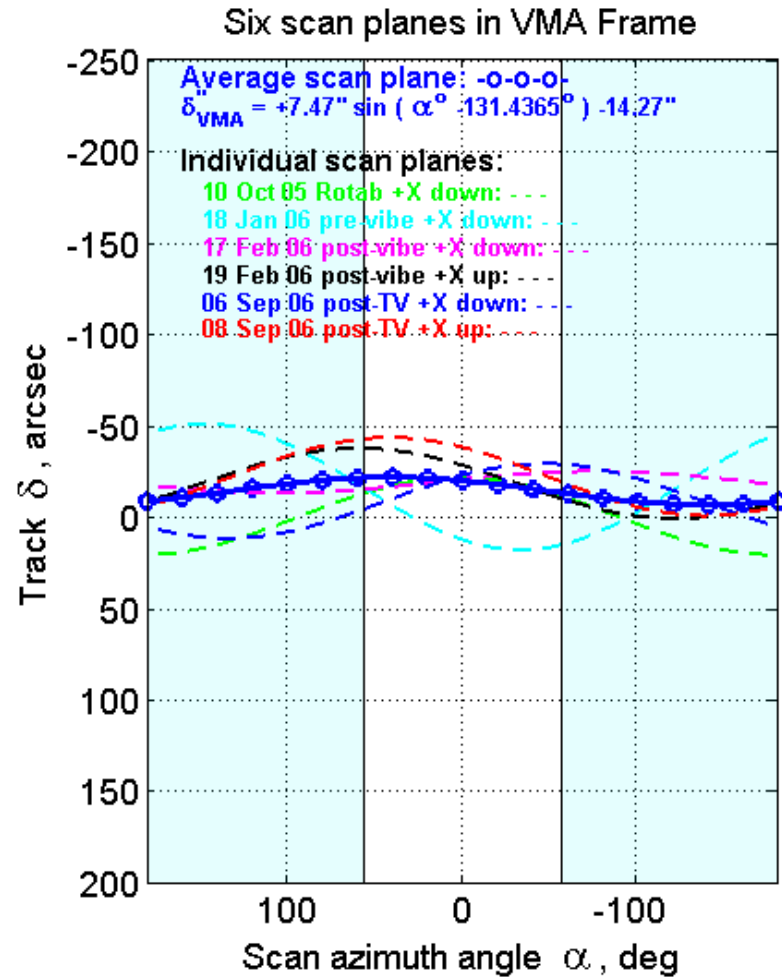
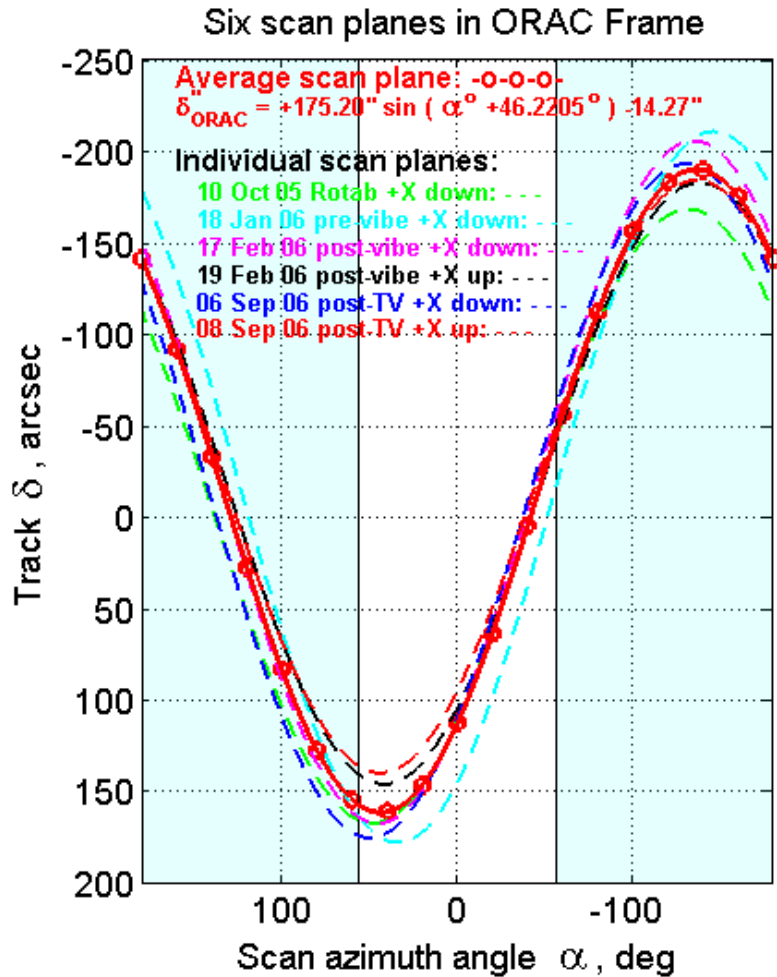
FU1 scan plane tilts (Ambient phase 1, VIIRS on Rotab)



Red - Relative to Optical Ref. Assembly Cube (ORAC)
Blue - Relative to VIIRS Mech. Axis (VMA)



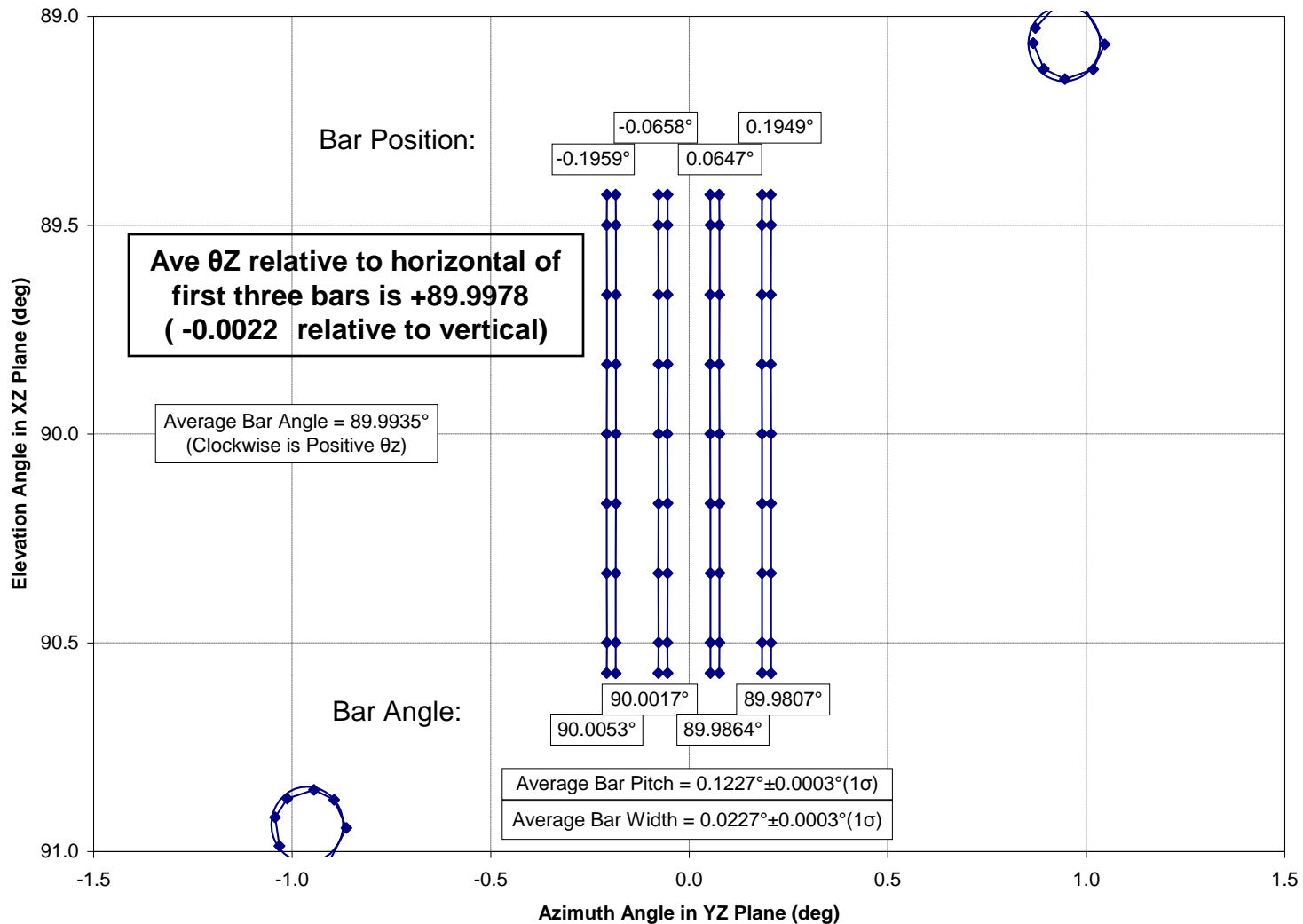
Six EDU scan plane measurements through post-TV





Bar angles of scan SBR reticle wrt gravity for FU1

TMC ATP - Reticle 8 - 4/29/07 viewed looking into TMC - wrt Gravity

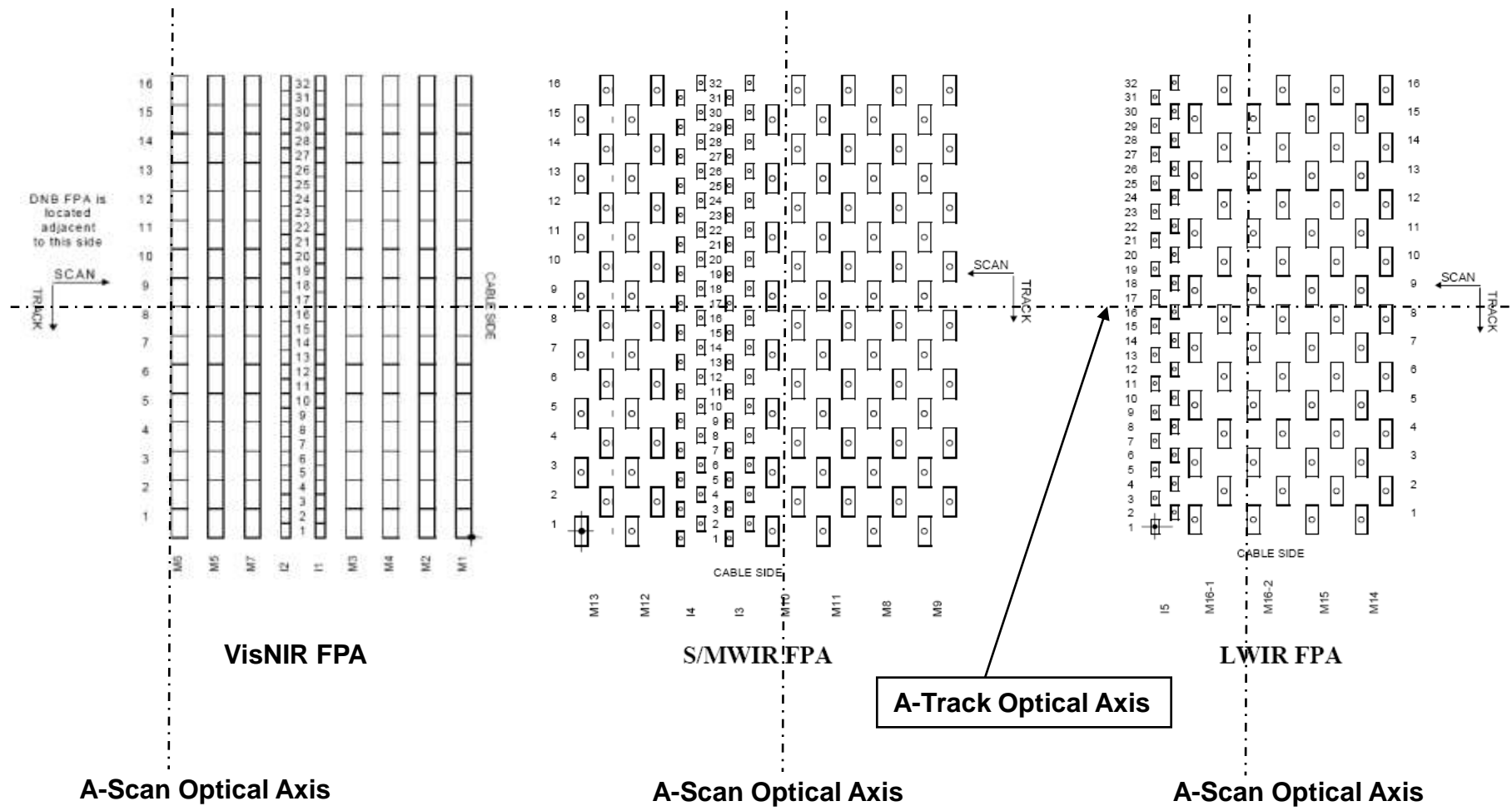




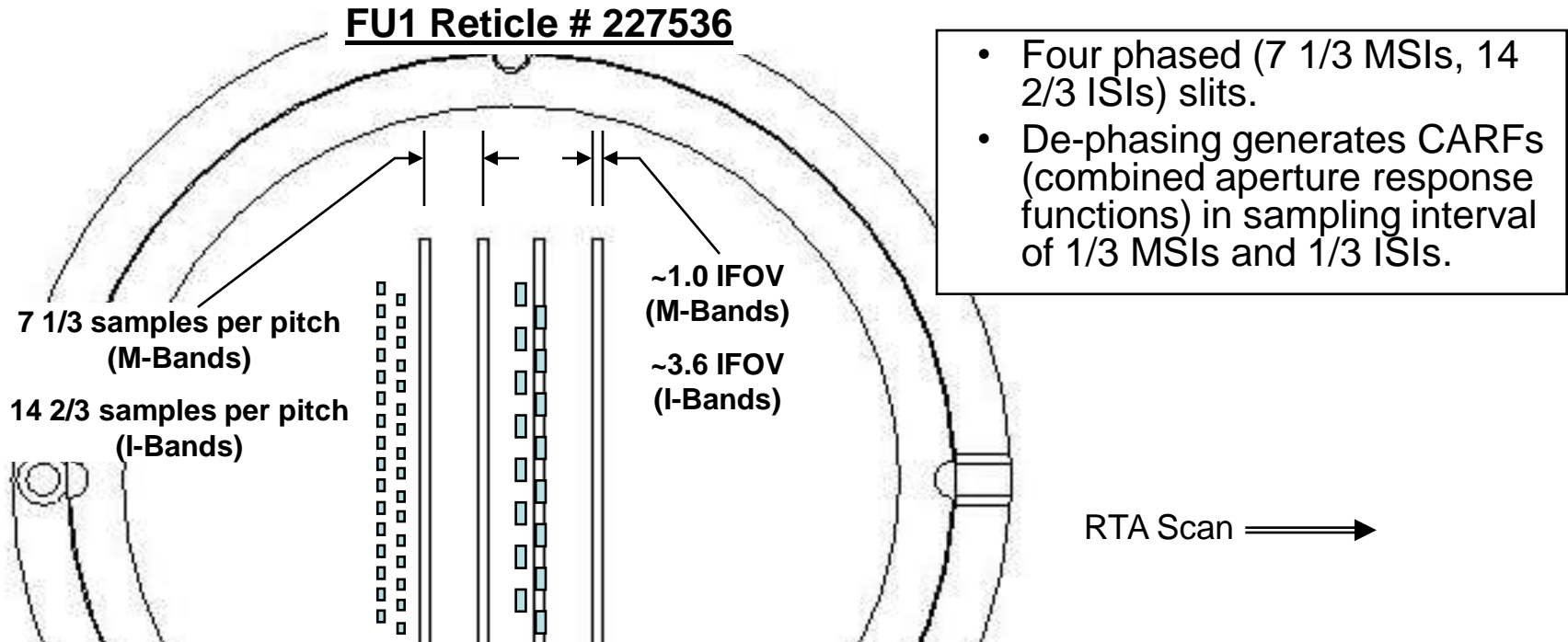
Backup Slides



VIIRS Band/Detector Physical Layout



A-Scan BBR (FP-4 Part 2) Test Device



Assumption:

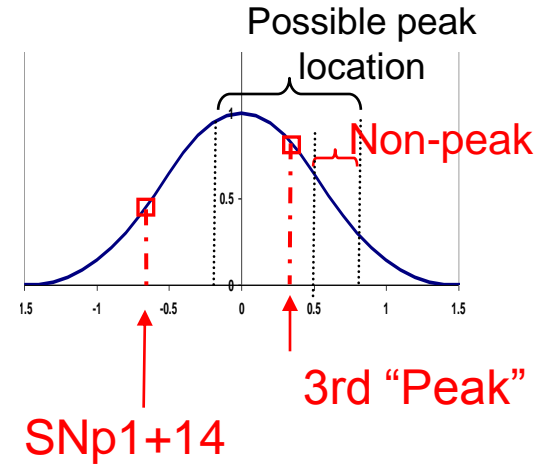
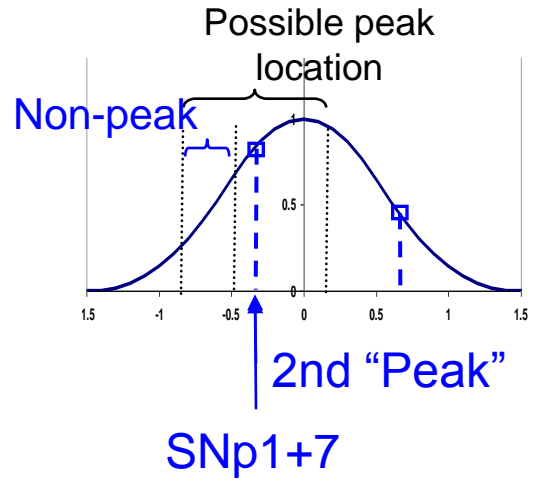
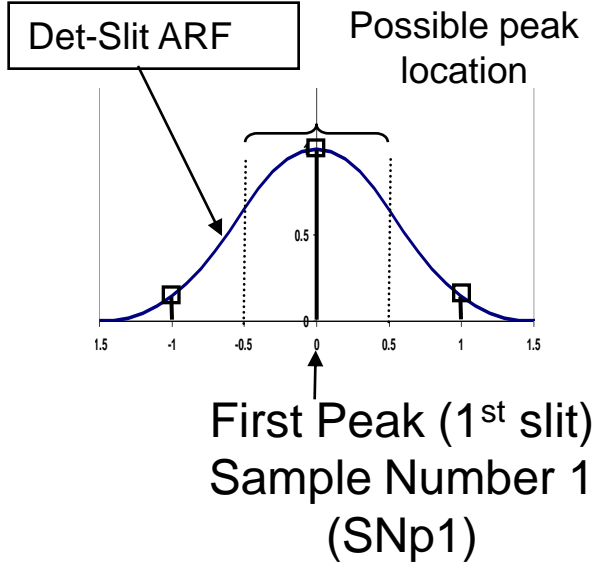
1 nominal A-Scan IFOV (optical property, variable among bands)
 = 1 A-Scan Sampling Interval (SI) (known design parameter)

Defined as Angular distance the telescope travels during 1 sampling time
 (=integration + reset) in the A-Scan direction

MSI (M Band SI) & ISI (I Band SI) are used in this presentation

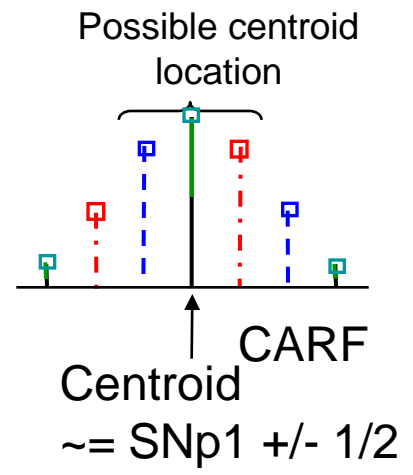
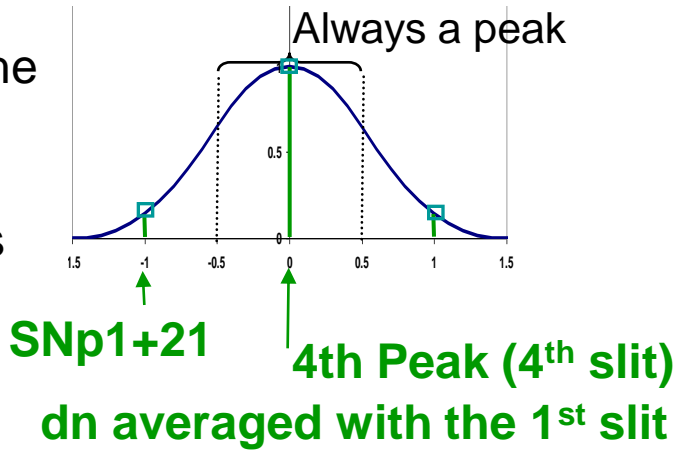


Slit Target Discretization by M Band Combined ARF Construction



Margin of error in locating the 1st Digitized peak to the ideal CARF peak
= [-.5, .5) sampling intervals

Samples used for CARF
= [ith peak-3, ith peak+3]x4

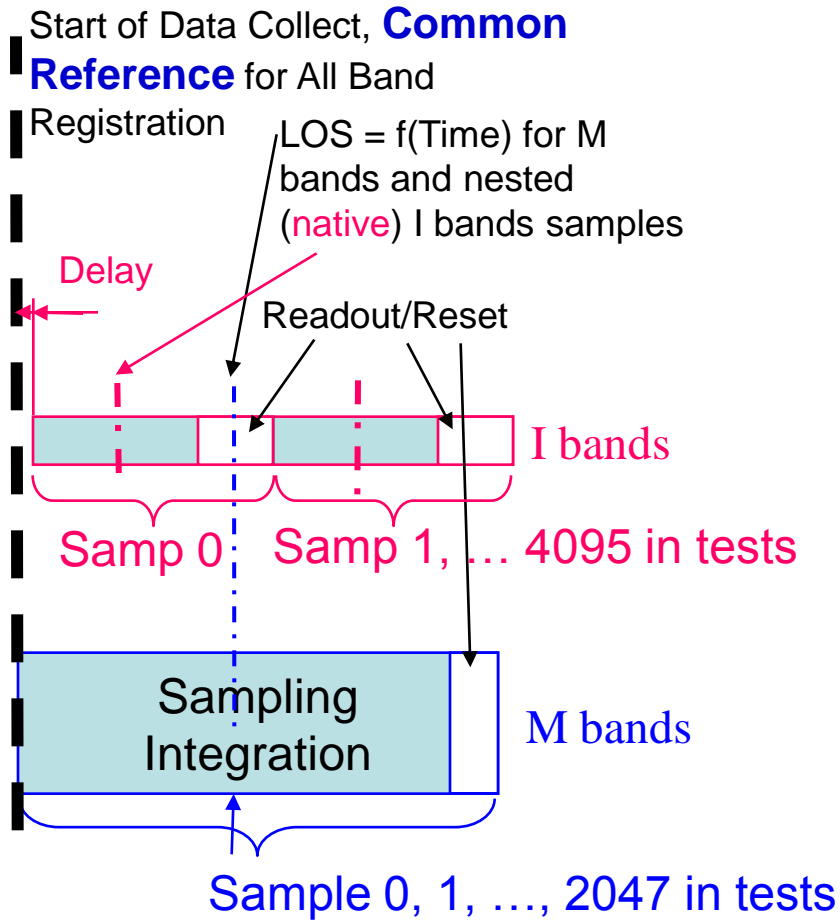


Discretization by I Band is in a similar way.



Definitions of SBR as/and Scan Distance

Spectral Band Registration (SBR) is Defined as the Scan Distance from the Beginning of Data Collect



Scan Distance (SD) for the data collect is defined as the distance from the line of sight (LOS) at the beginning of the sampling integration time for the 1st M band sample. The 1st sample is **sample number 0 (SN(0))** in the tests.

SD for M band $SN(0) = 0 + 0.5 = 1/2$ M band sampling interval (MSIs)

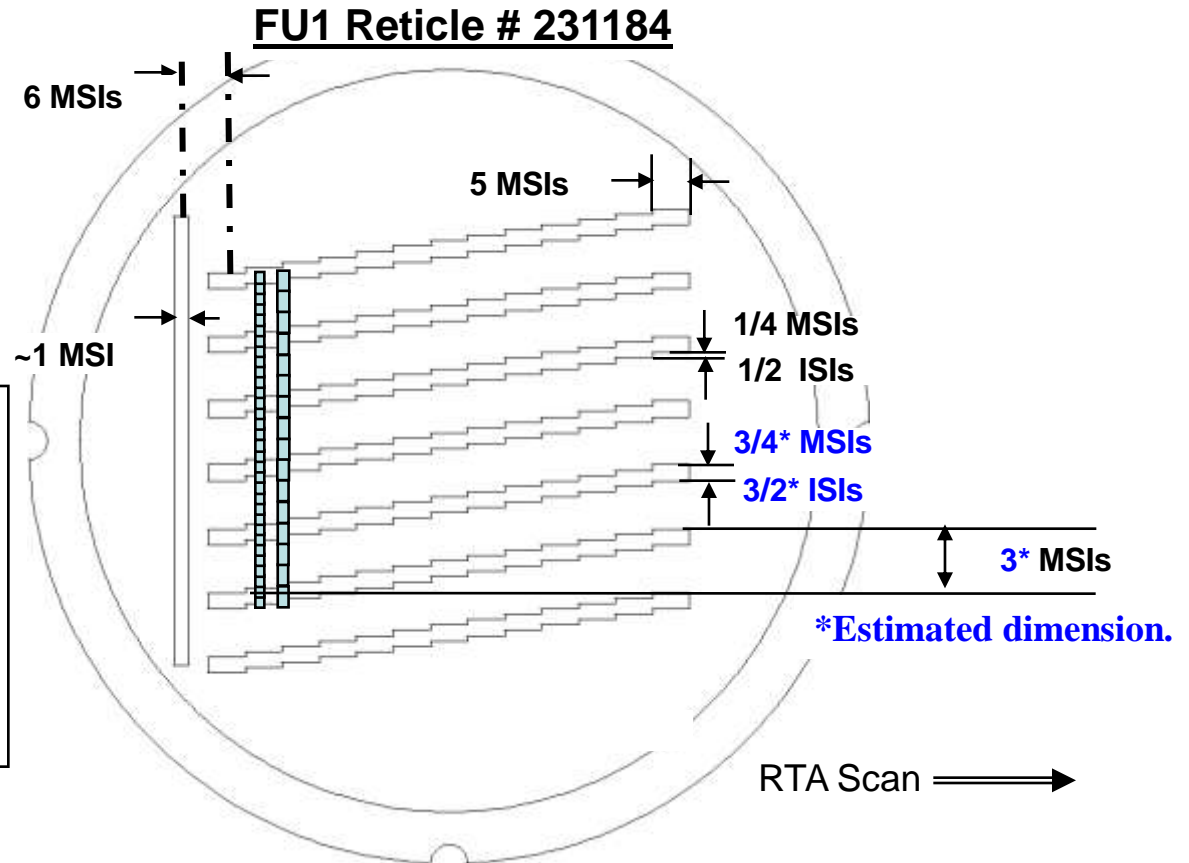
$$\rightarrow SD(SN(m)) = m + 1/2 \text{ MSIs}$$

SD for I band $SN(0) = (0 + 0.5) = 1/2$ I band sampling interval (ISIs) = $1/4$ MSIs

$$\rightarrow SD(SN(i)) = (i + 0.5) \text{ ISI} = i/2 + 1/4 \text{ MSIs}$$

Readout/reset time is neglected since it does not affect band-to-band registration.

A-Track BBR (FP-4 Part 1) Test Device



- 13 phased (1/4 MSIs, 1/2 ISIs) stairsteps & 7 staircases.
- De-phasing generates CARFs in sampling interval of 1/4 MSIs and 1/2 ISIs.

1 A-Track Sampling Interval (SI) (known design parameter)

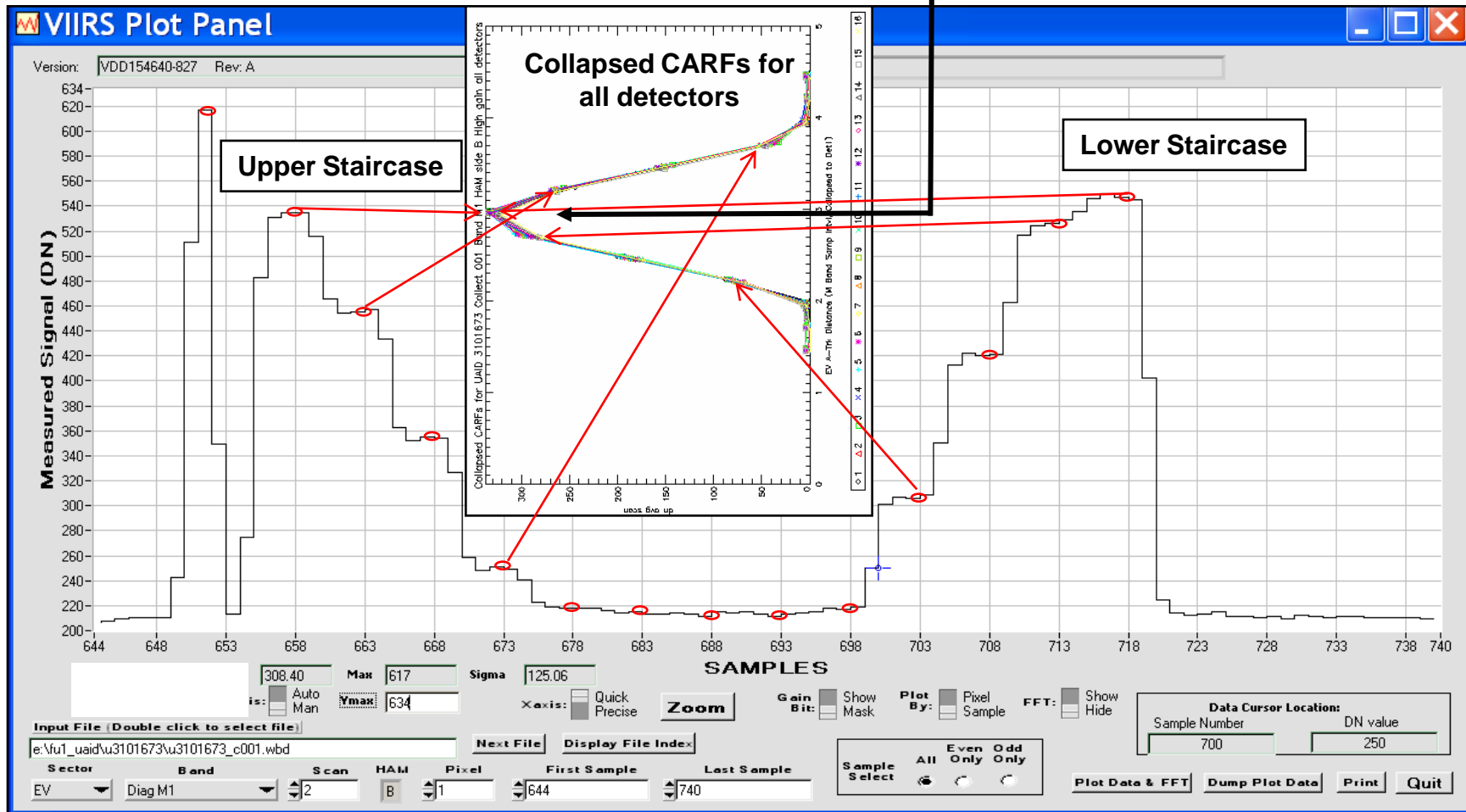
Defined as Angular distance btwn neighboring detector centers in the A-T direction

MSI (M Band SI) & ISI (I Band SI) are used in this presentation



A-Track Slit Image and SBR

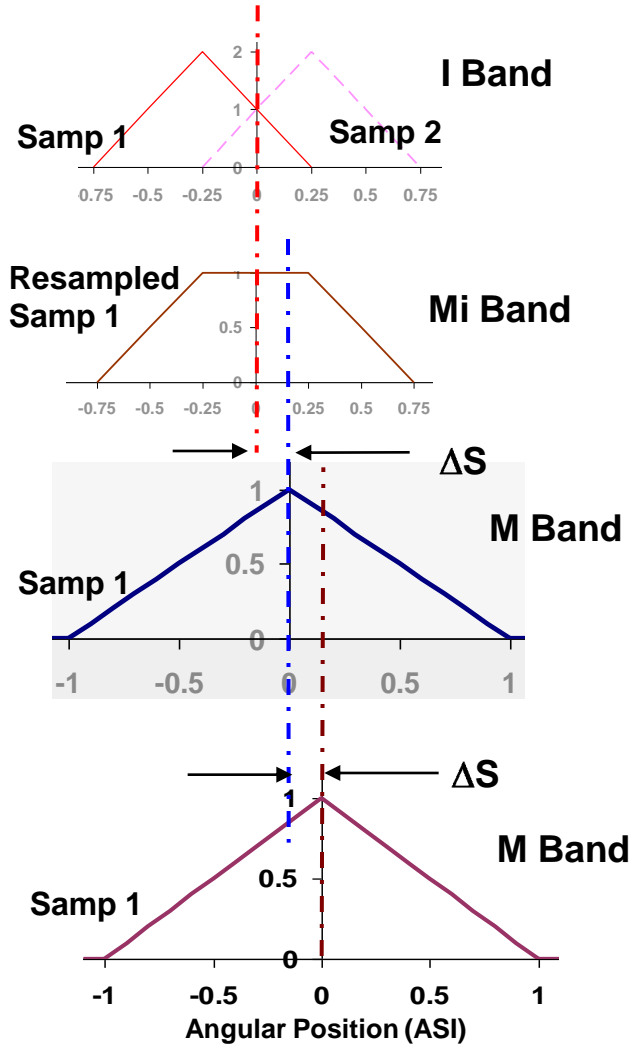
A-Track SBR is defined by the centroid of slit image (collapsed into the center of M-band detector 1).





Detector-to-Detector Registration (DDR)

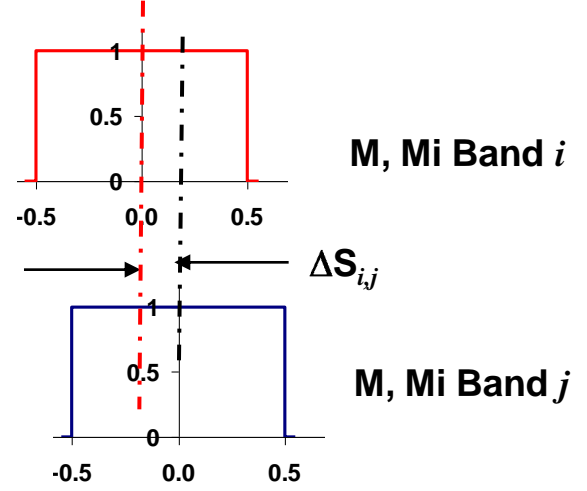
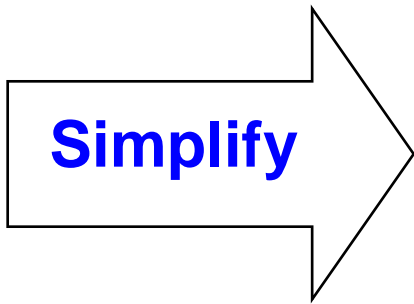
≡ Overlap between Detector Gain Functions (PSFs)



DDR Definition:

Normalization

$$DDR_{i,j} = 1 - \frac{\iint_{A_ground_EOS} |PSF_i - PSF_j| / 2 \, dA}{\iint_{A_ground_EOS} PSF_k \, dA} \equiv 1$$



Simplified:

$$DDR_{i,j} = \left(1 - \frac{\Delta t_{i,j}}{ASI_t}\right) \left(1 - \frac{\Delta s_{i,j}}{ASI_s}\right)$$

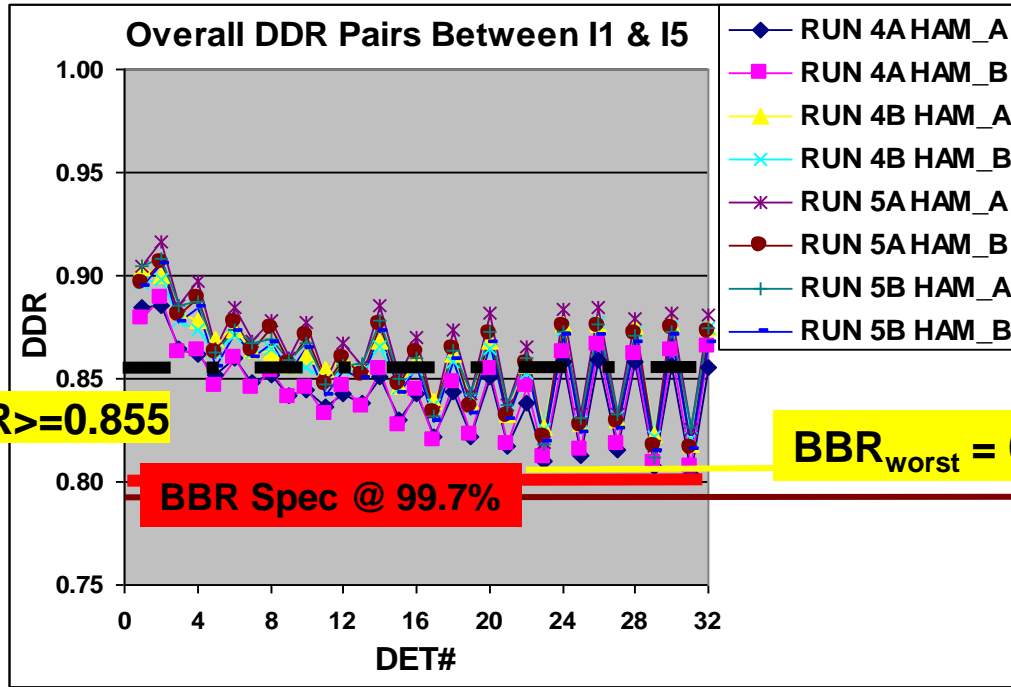
BBR = <DDR> within band pairs in all test cases

BBR_{99.7%} = some statistical value of DDR pairs

Schematics of A-Scan Dynamic LSFs



An Example BBR Pair (I1&I5) and Some Statistical Terms

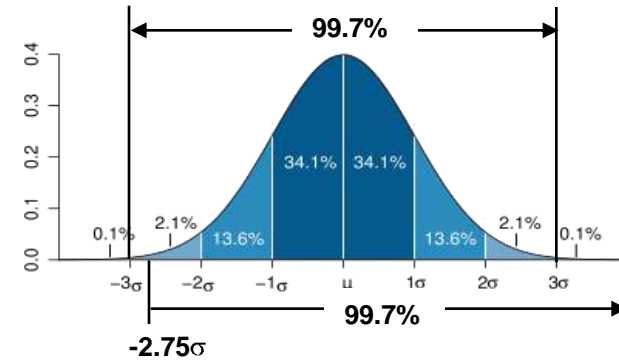


$\langle \text{DDR} \rangle = 0.855$

$\text{BBR}_{\text{worst}} = 0.803$

BBR Spec @ 99.7%

$\langle \text{DDR} \rangle - 2.75\sigma = 0.792$



How to interpret "At least 99.7% of corresponding pixel samples"?

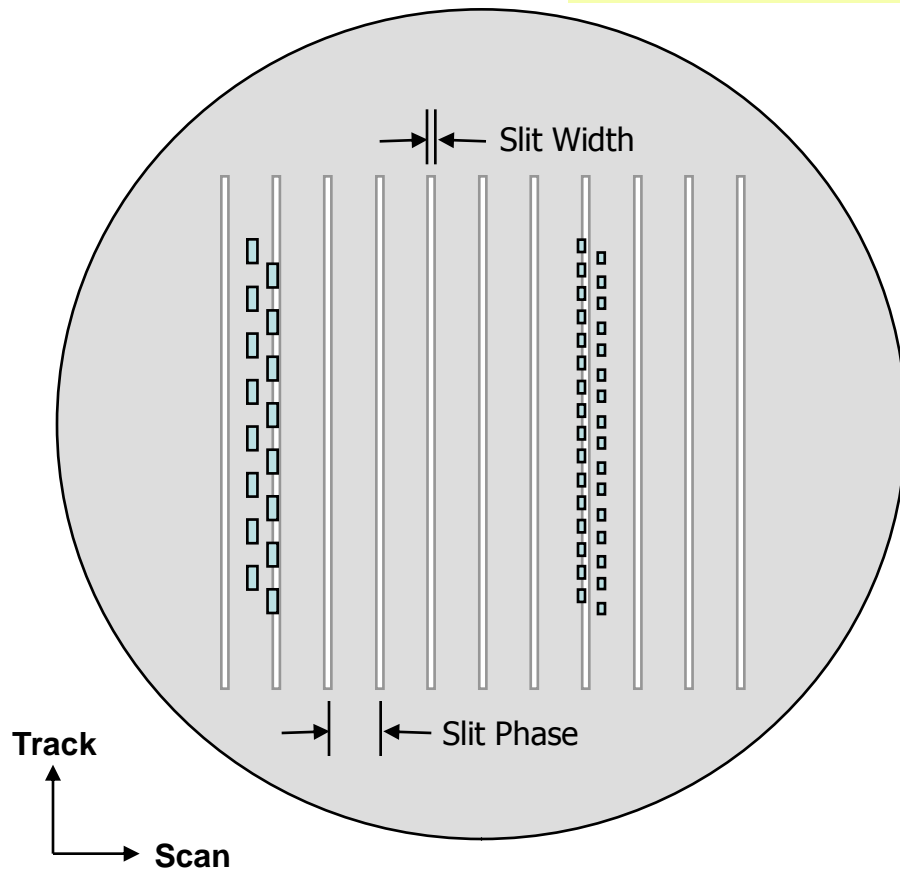
Definitions:

$\text{BBR}_{99.7\%} = \text{greater} (\text{BBR}_{\text{worst}}, \langle \text{DDR} \rangle - 2.75\sigma) = 0.803$

$\text{BBR}_{\text{variability}} = \text{lesser} (\langle \text{DDR} \rangle - \text{BBR}_{\text{worst}}, 2.75\sigma) = 0.052$

➤ For I1&I5 BBR pair itself, DDRs pretty much repeat themselves among test cases.

Phased Reticles with
11 I-band Slits (227537) and
10 M-band Slits (227538)



I-band 11 Slit Reticle 227537

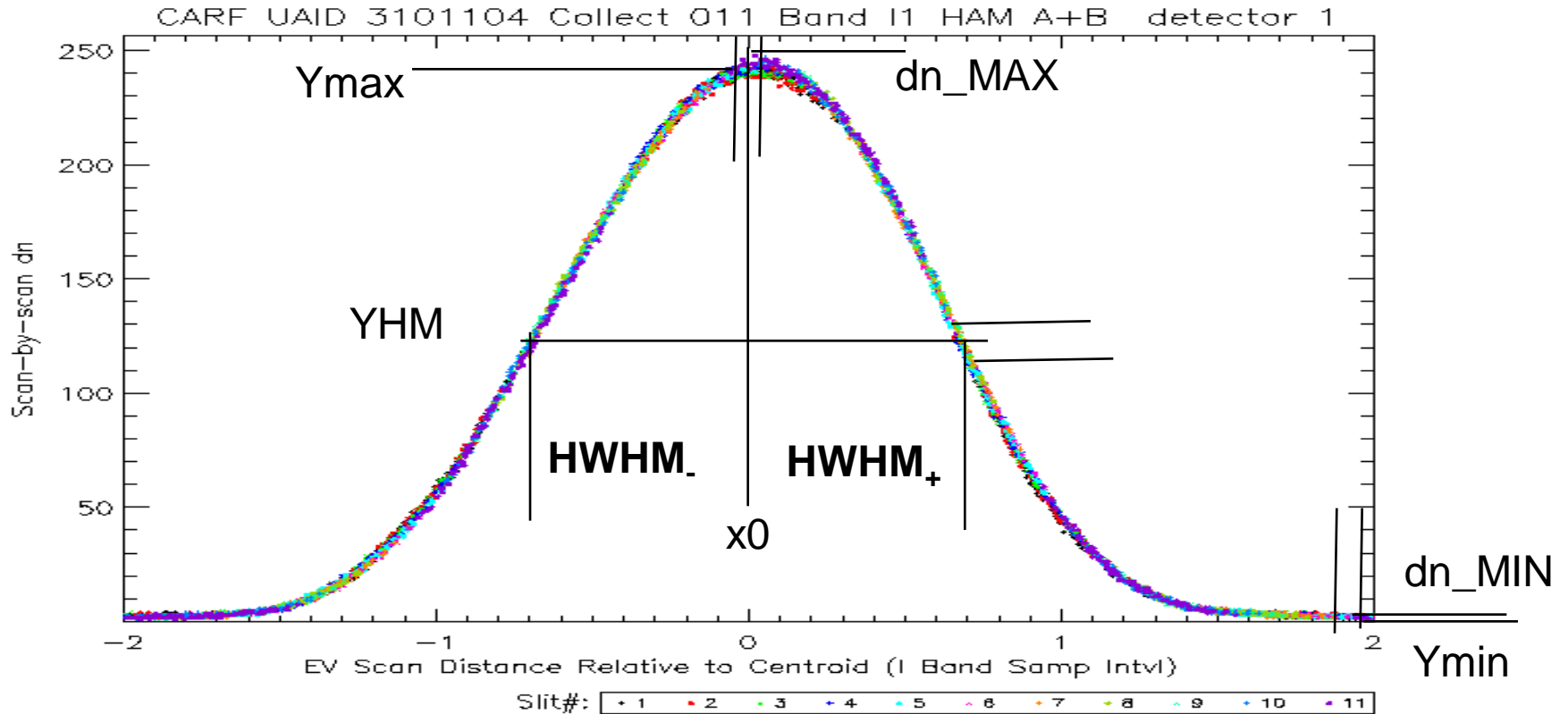
- I-band HSI is 155 μ rad at nominal scan rate of 3.1545 rad/sec
- Measured slit width is $33.2 \pm 1.8 \mu$ rad (0.214 I-band HSI)
- Measured slit phase (center to center) is $1256 \pm 1.5 \mu$ rad (8.10 I-band HSI)

Some through-focus tests use "remanufactured" reticles 227537-1 and 227538-1 for higher scan rate (+0.5%)



FP6: Response Function & FWHM

After Phase, Slit Width/Src Strength, and "pinch" Corrections
An example for I1 D1 from U3101104_C011



DFOV \approx FWHM = $HWHM_- + HWHM_+$

MTF = Normalized (A=1 @ freq=0) Fourier Transfer of LSF

HSR = Distance @which freq MTF = 0.5

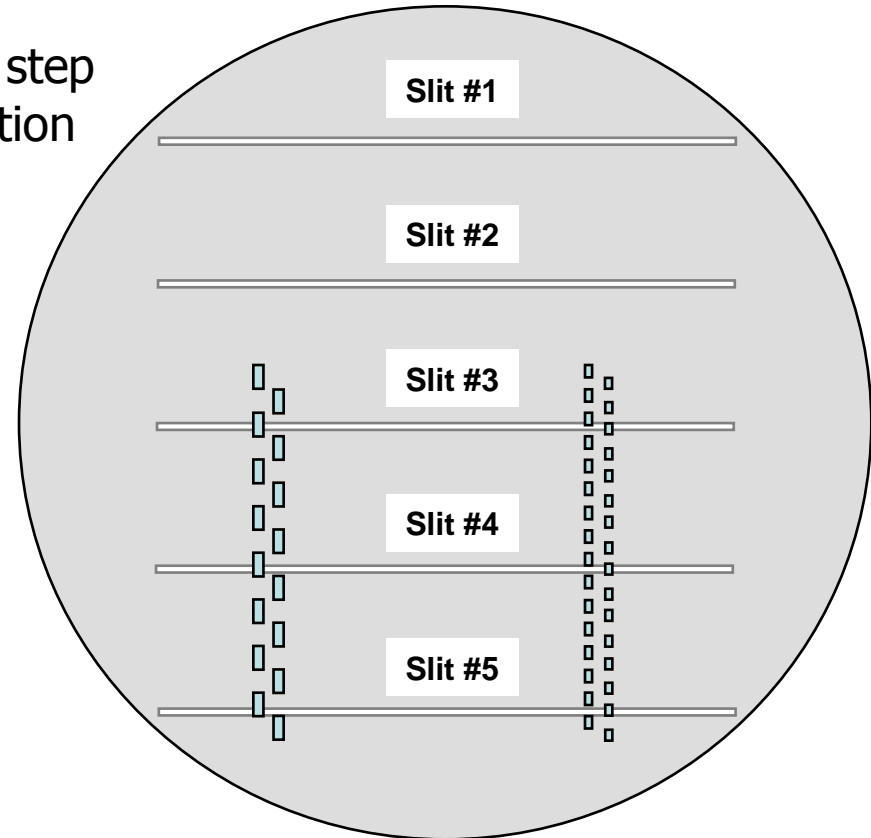
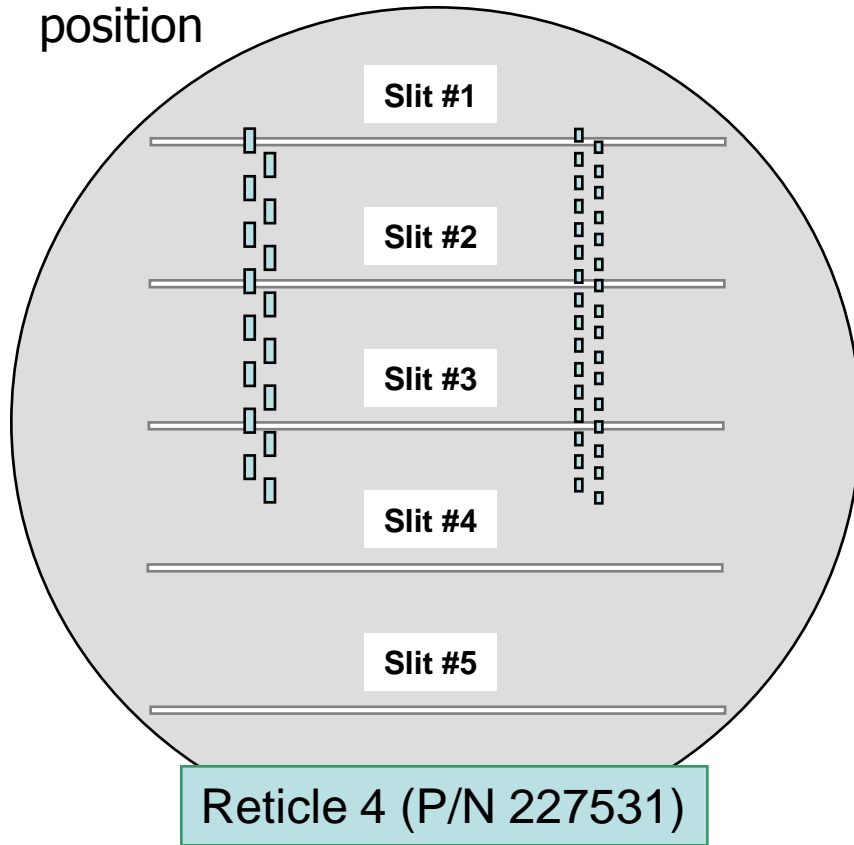


A-Track ILSF Generated by 5 Slits

End step position

Start step position

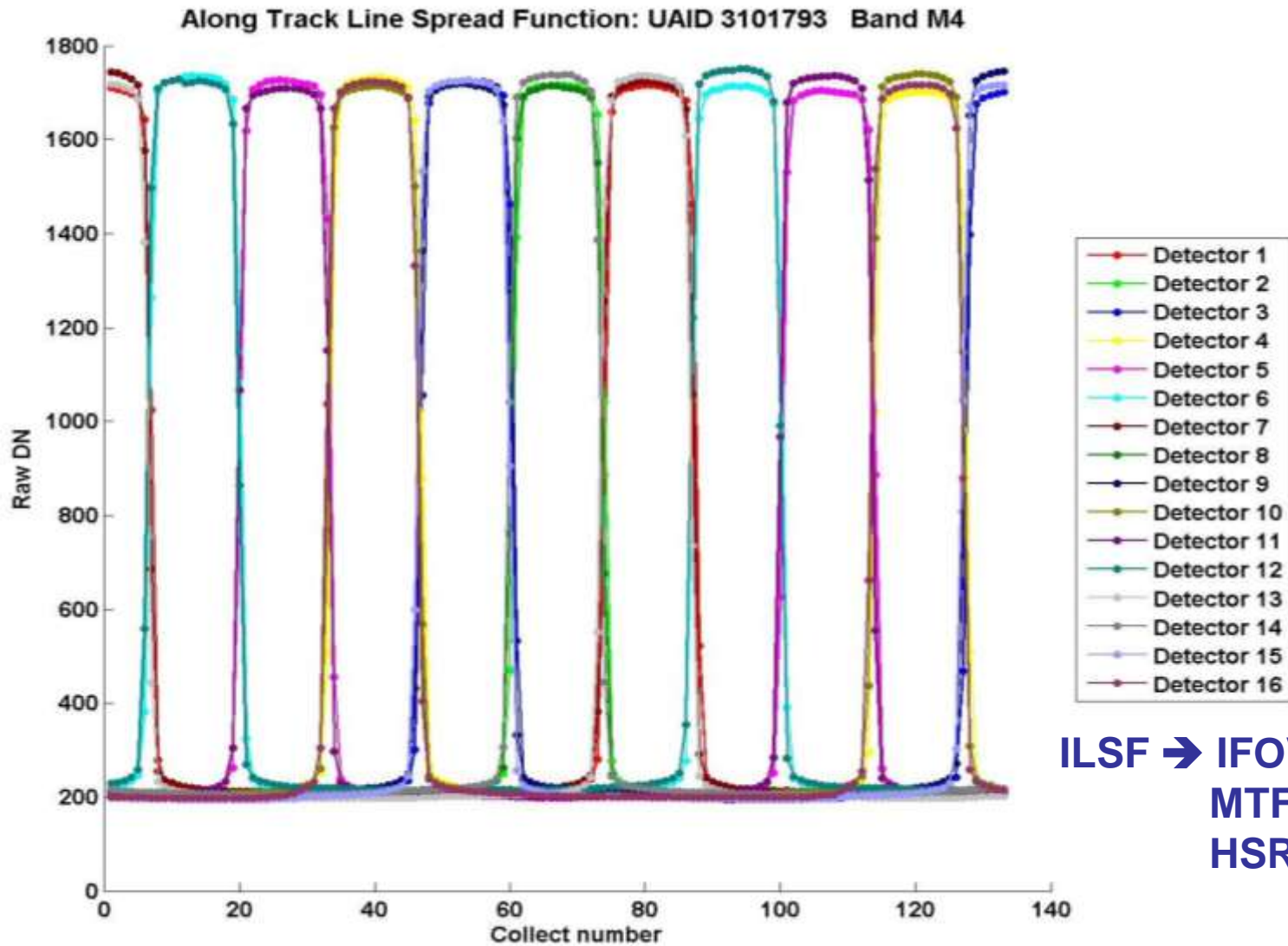
RTA Scan →



- Range of reticle steps is 10 M-Band IFOVs or 8.91 mrad (134 positions total) (**dwell** ... step ... **Dwell** ...)
- A common detector between adjacent slits is used to tie data sets together for HSI evaluation



A-Track LSF Example (M4 Band)



ILSF → IFOV
MTF and
HSR