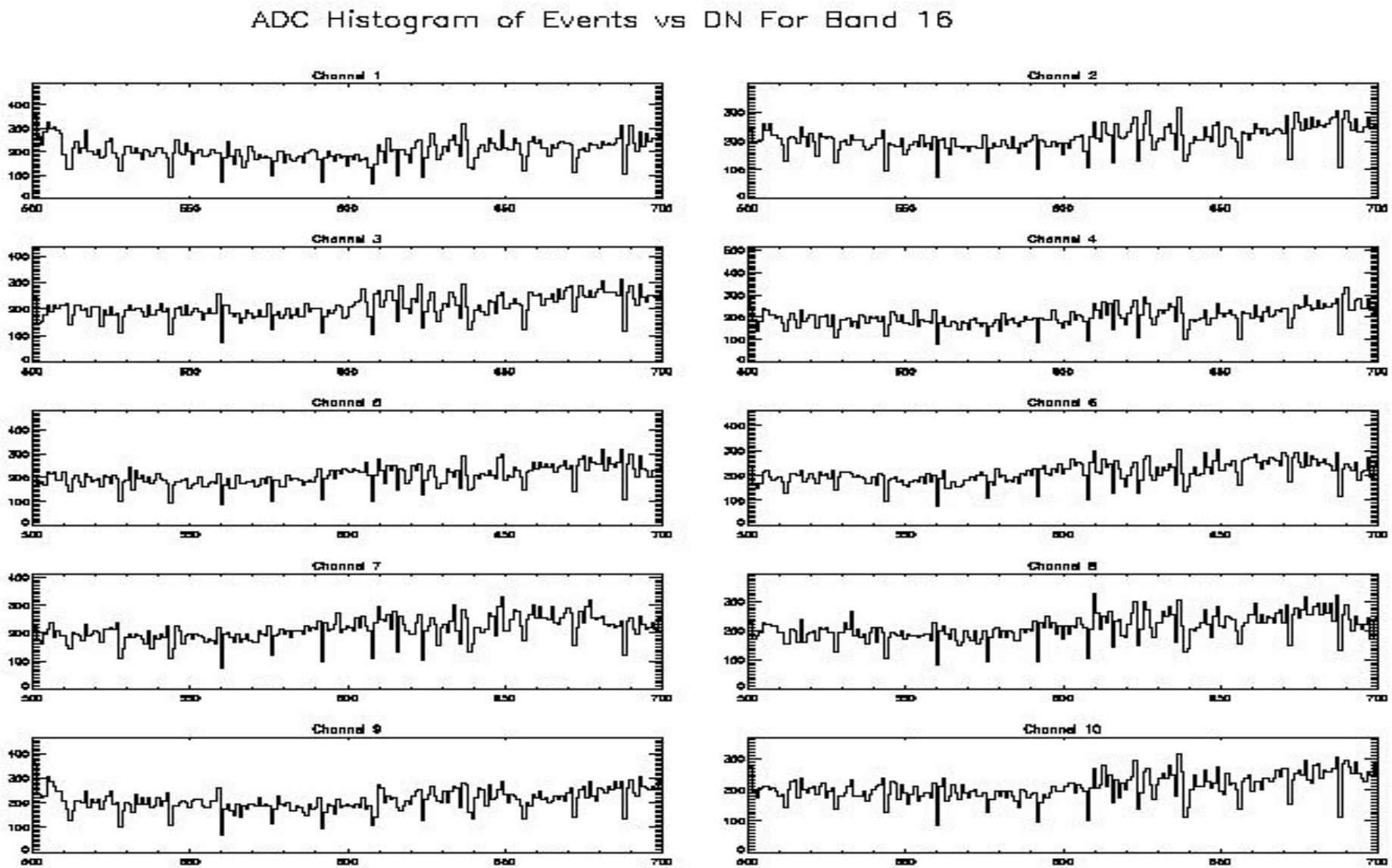
Section 12
Concerns for Best Science, data days beyond 2000305

Concerns for Days Beyond 200030.

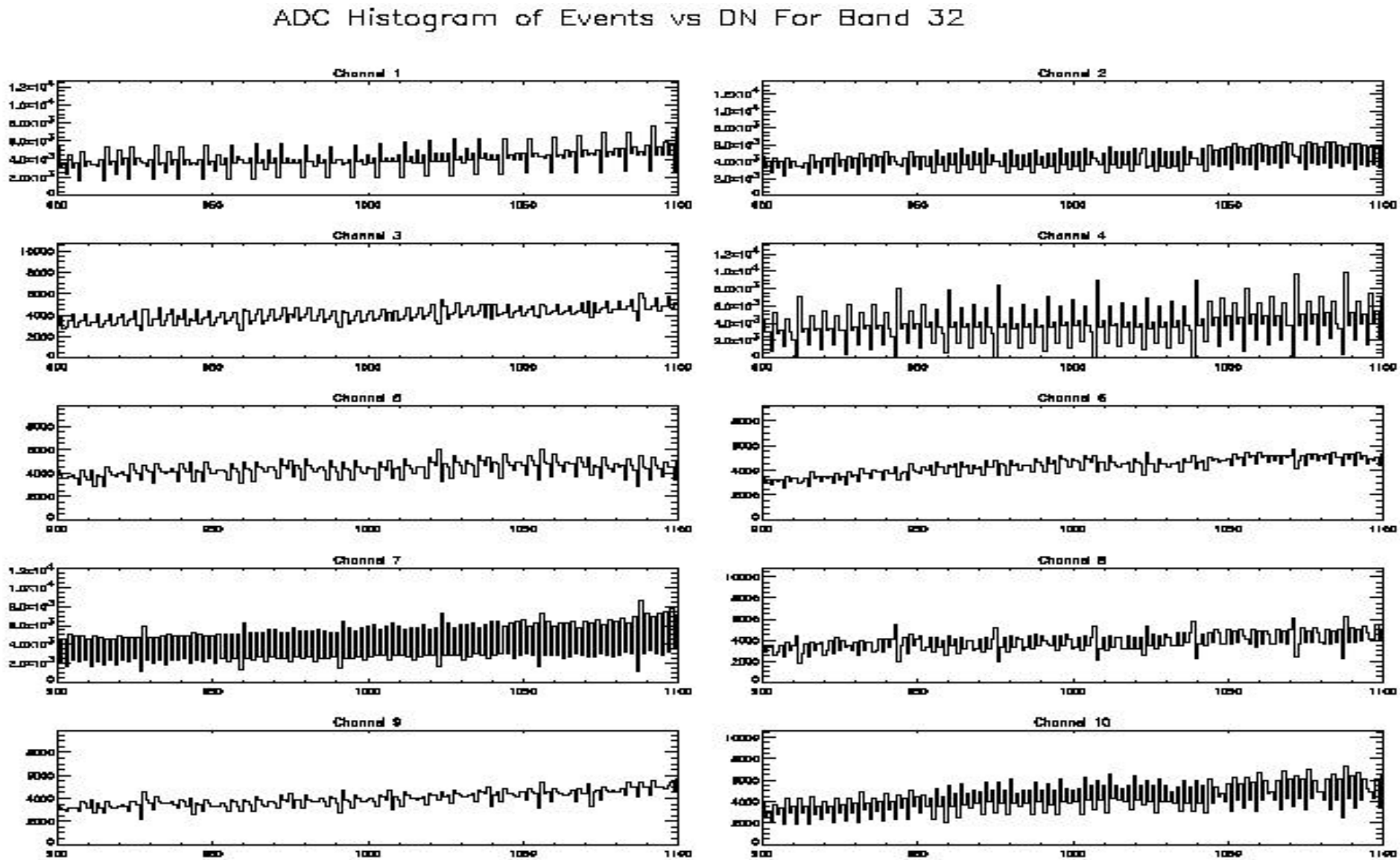
- B-side performance (ADC bin-fill)
- V_{det} = 110 (Residual Electronic Cross-talk)
- Direct Surface Smoothing for de-striping
- Mirror rotation correlated noise
- Stability within an orbit

B-side performance (ADC bin-fill)

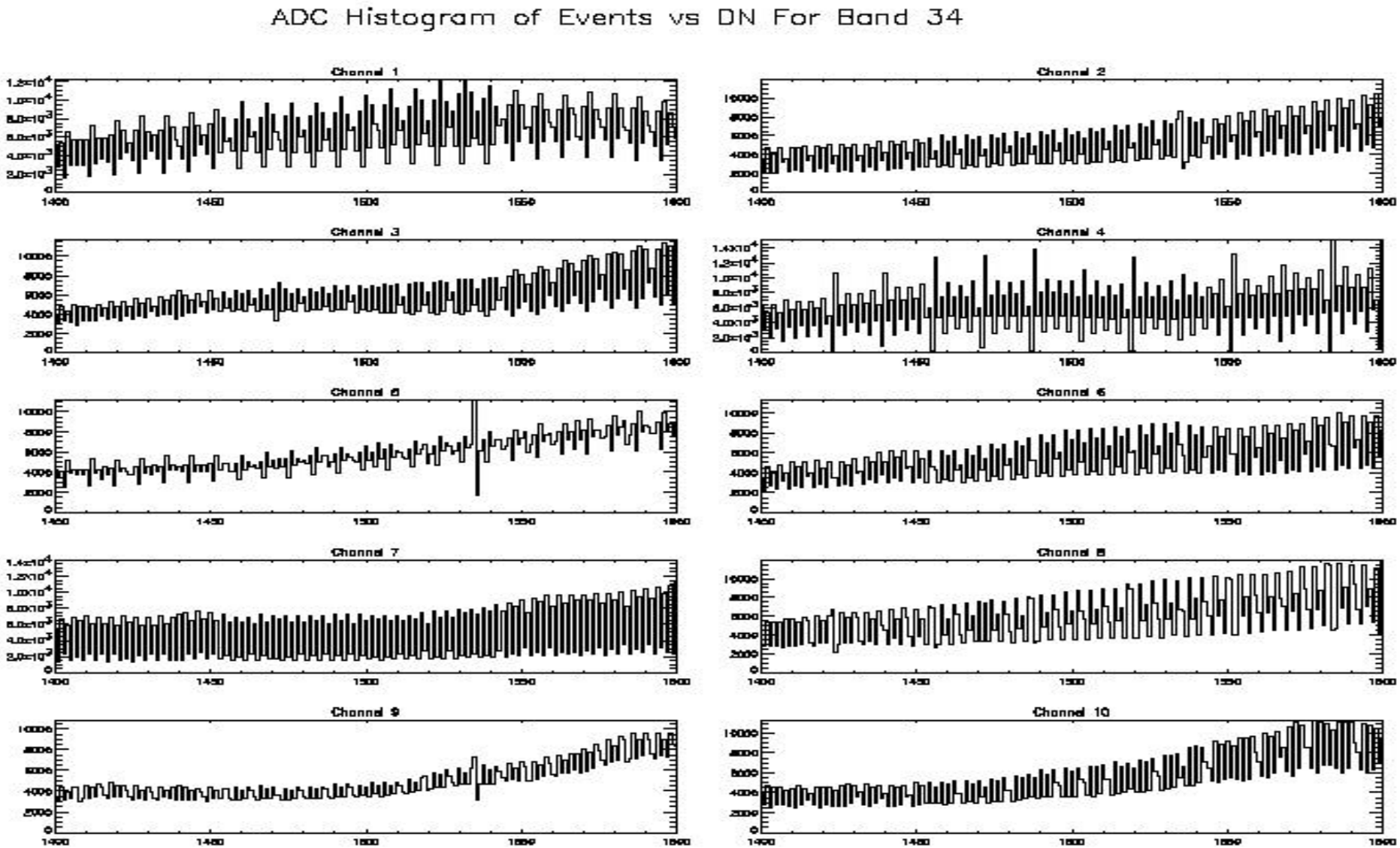
A-Side


ADC Histogram of Events vs DN For Band 16
Channel 1
Channel 2
Channel 3
Channel 4
Channel 5
Channel 6
Channel 7
Channel 8
Channel 9
Channel 10

A-Side

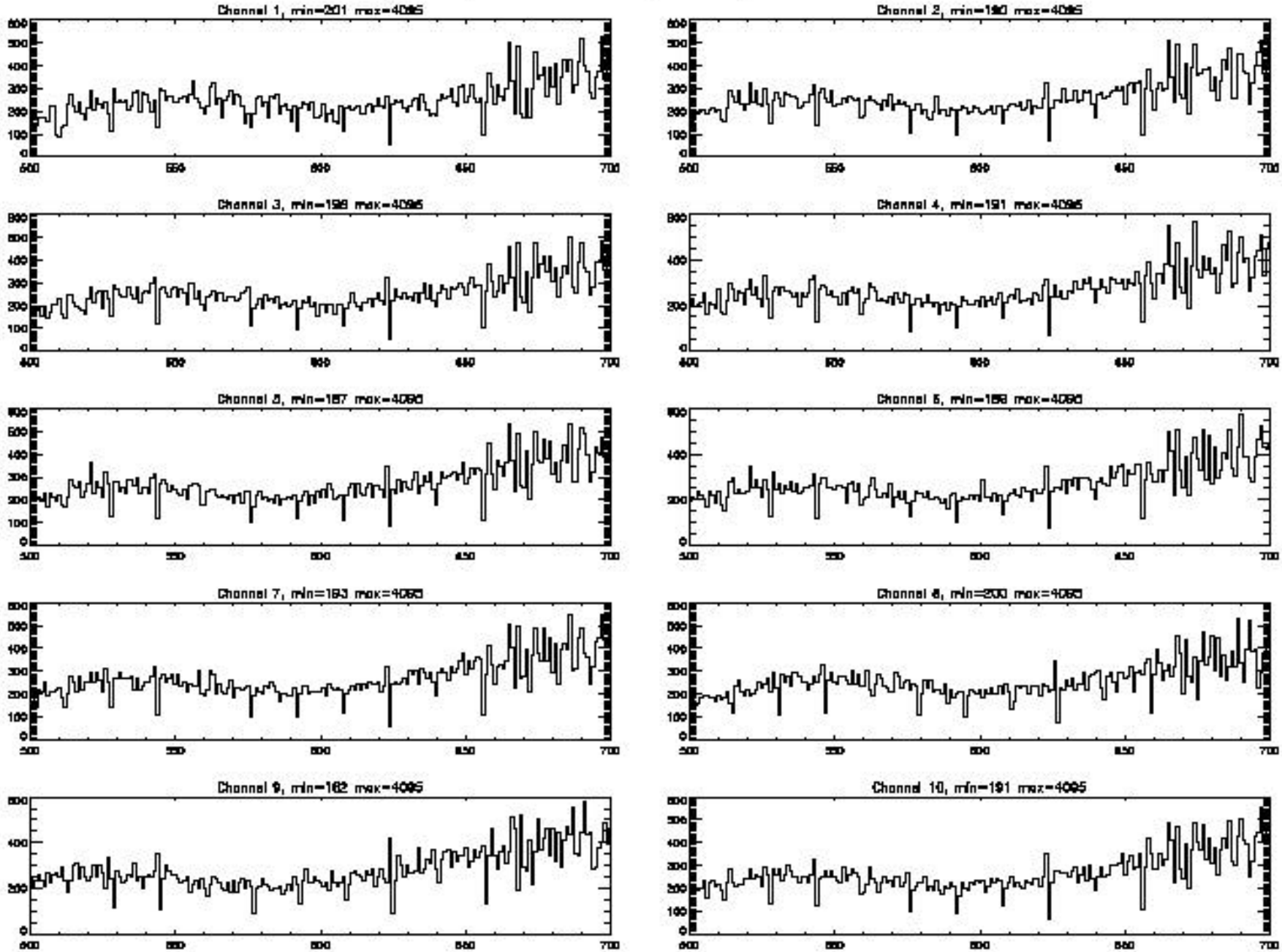

ADC Histogram of Events vs DN For Band 32
Channel 1
Channel 2
Channel 3
Channel 4
Channel 5
Channel 6
Channel 7
Channel 8
Channel 9
Channel 10

A-Side


ADC Histogram of Events vs DN For Band 34
Channel 1
Channel 2
Channel 3
Channel 4
Channel 5
Channel 6
Channel 7
Channel 8
Channel 9
Channel 10

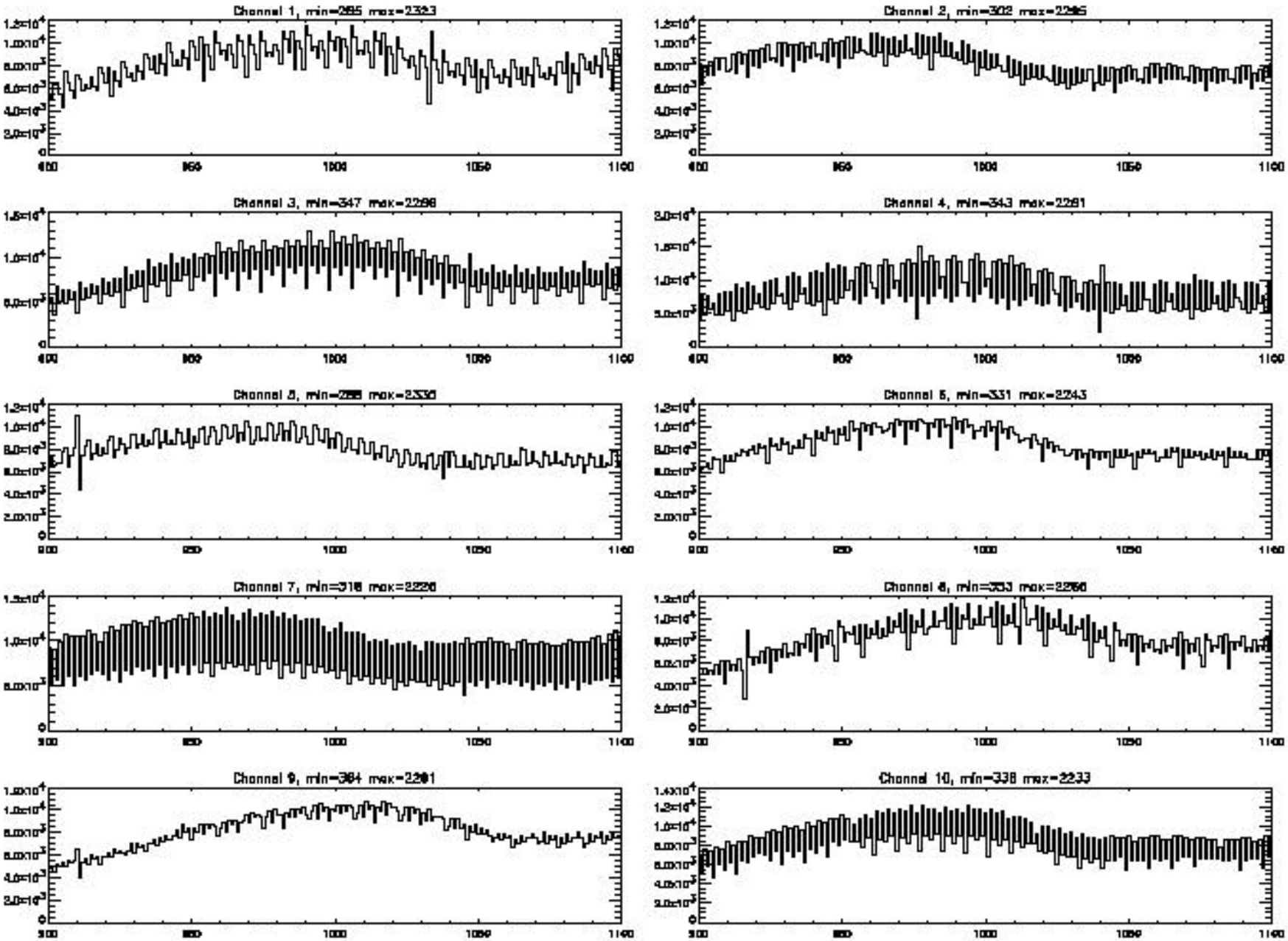
MODIS ADC vs Events for Band 16

Bside, Day313(08:20–10:20), Itwk/Vedt=79/110



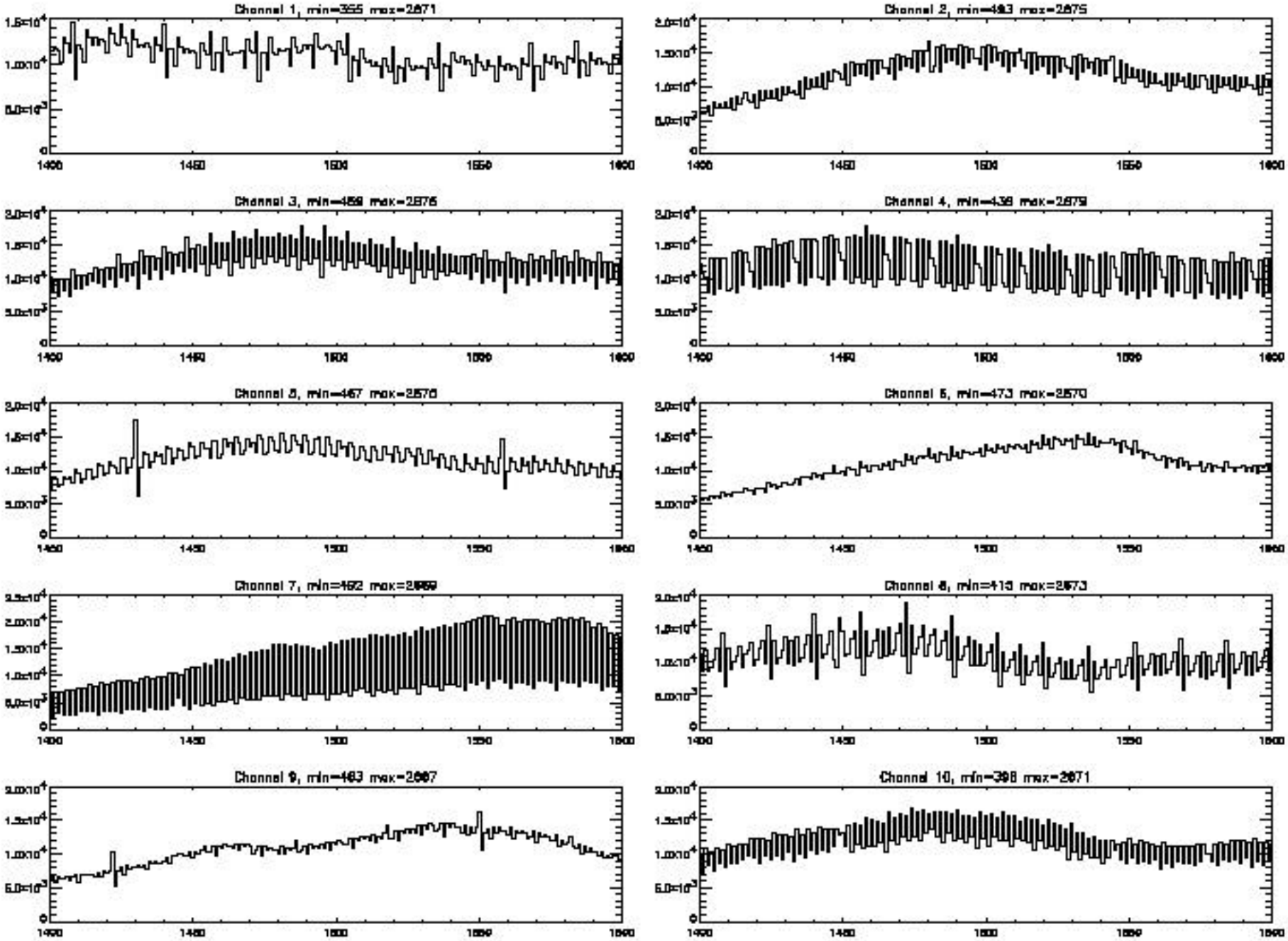
MODIS ADC vs Events for Band 32

Bside, Day313(08:20–10:20), Itwk/Vedt=79/110



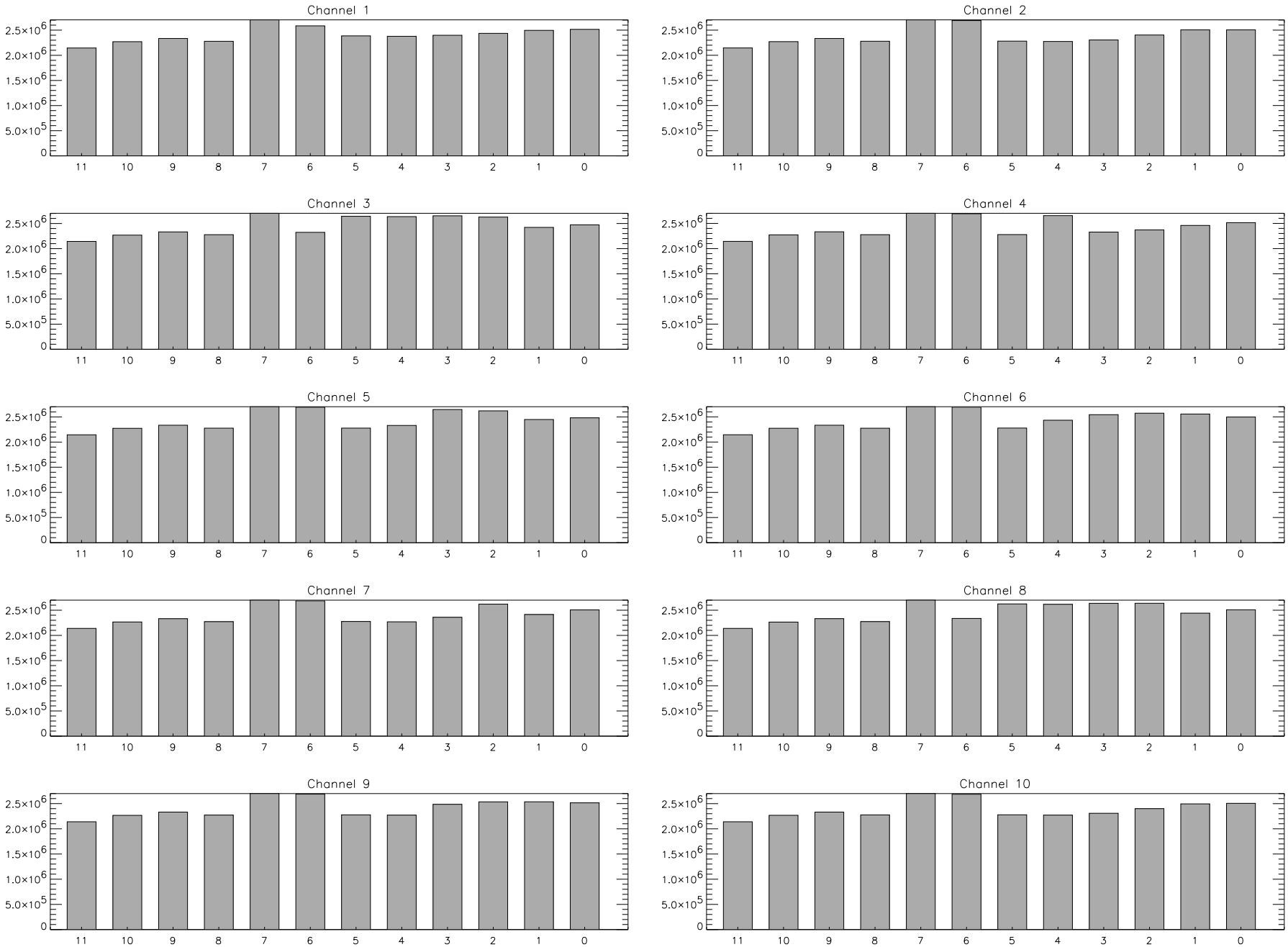
MODIS ADC vs Events for Band 34

Bside, Day313(08:20–10:20), Itwk/Vedt=79/110



MODIS PFM ADC Bit Histogram on A−side

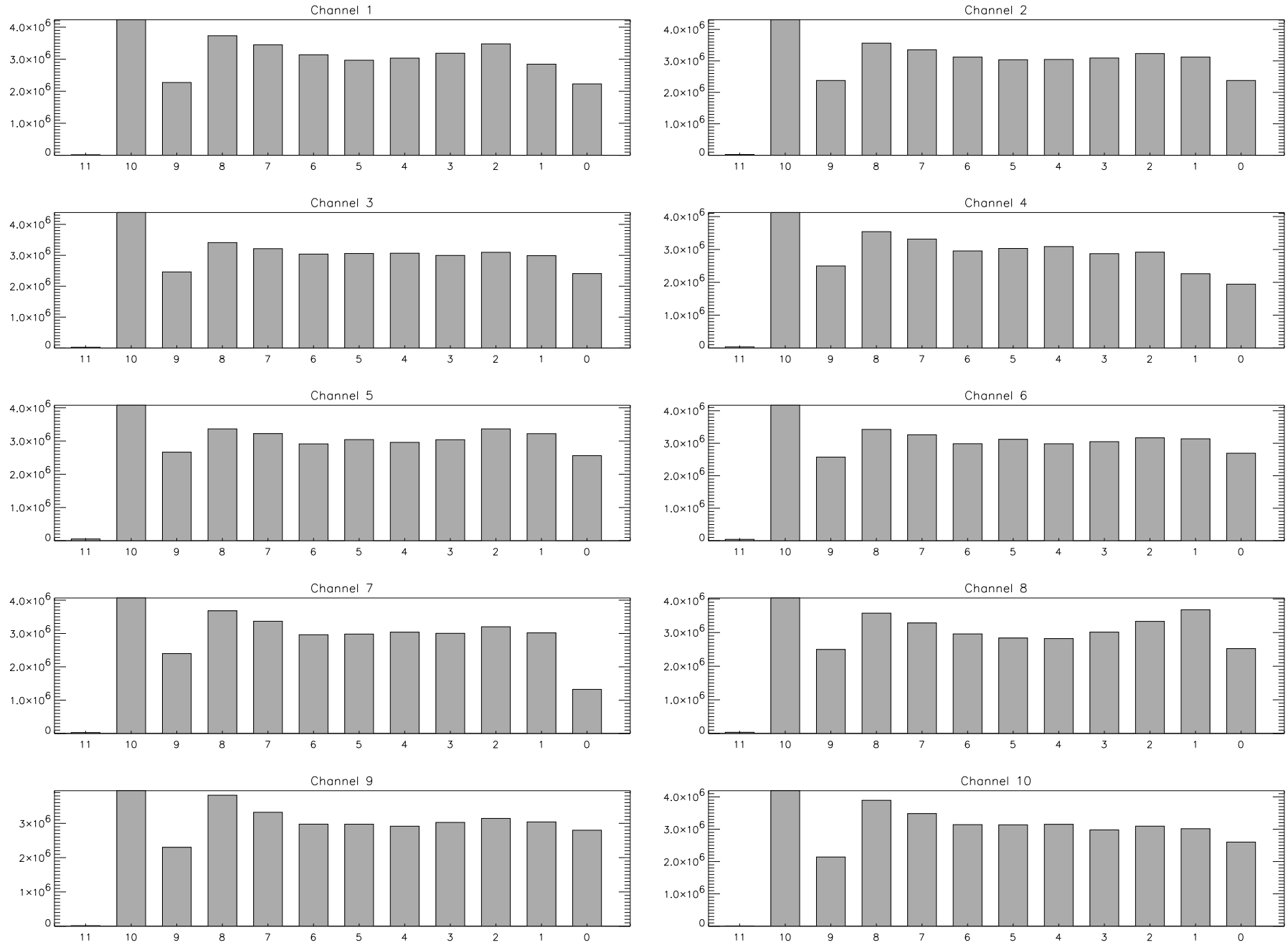
Band 16, Day242(11:35−13:10), ltwk/Vedt=110/226



Detector in SBRS Order

MODIS PFM ADC Bit Histogram on A−side

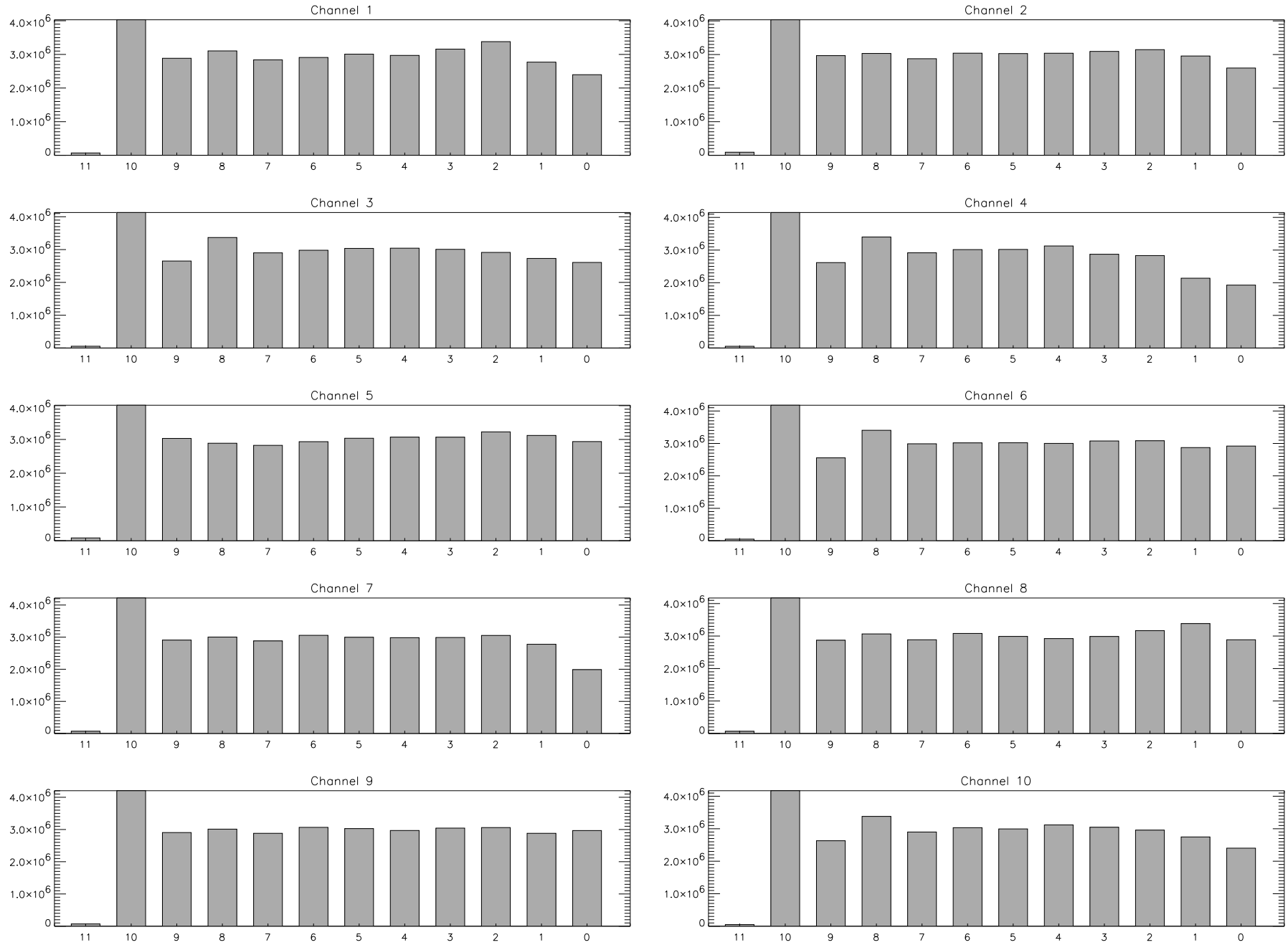
Band 31, Day242(11:35−13:10), ltwk/Vedt=110/226



Detector in SBRS Order

MODIS PFM ADC Bit Histogram on A−side

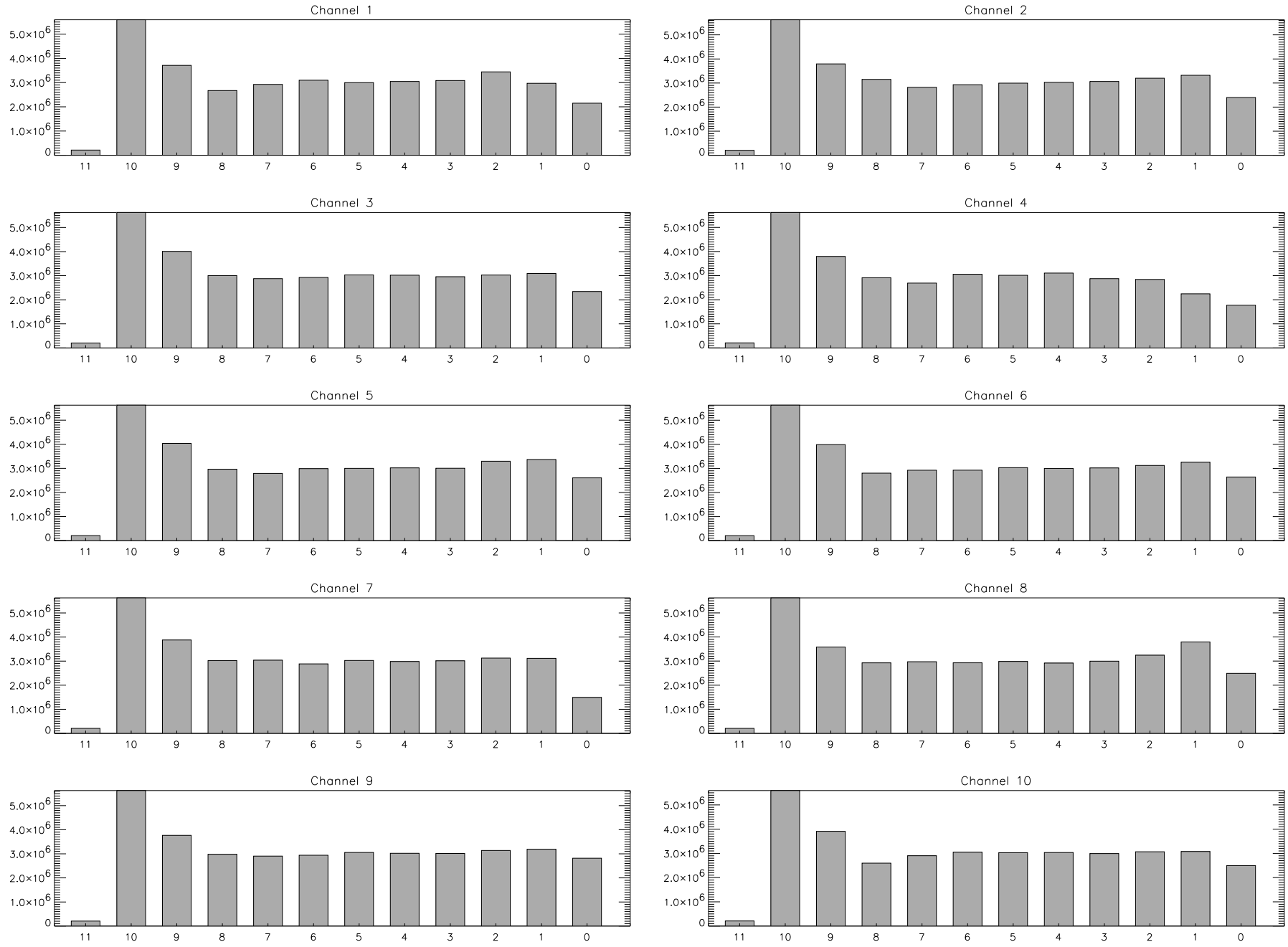
Band 32, Day242(11:35−13:10), ltwk/Vedt=110/226



Detector in SBRS Order

MODIS PFM ADC Bit Histogram on A−side

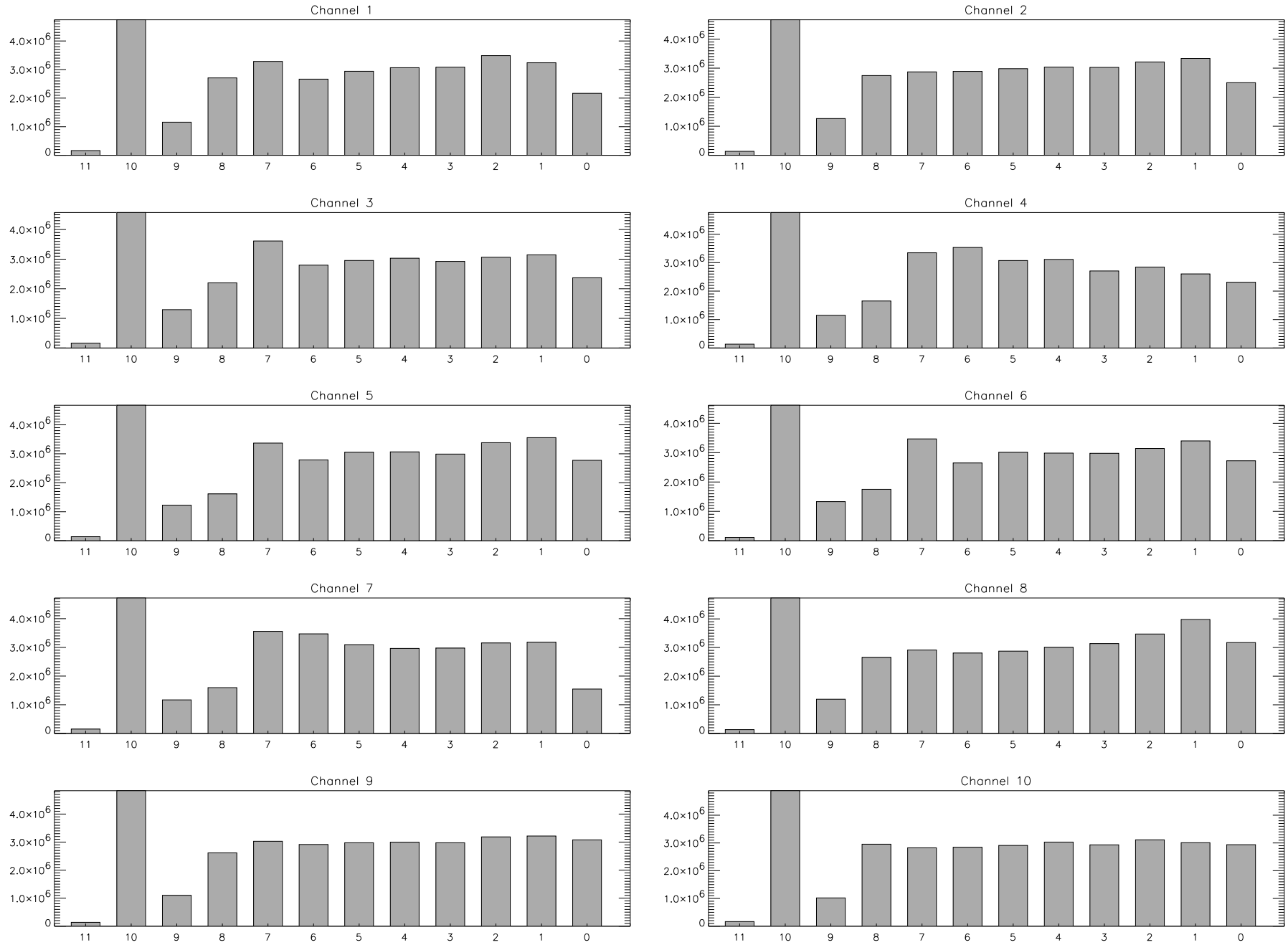
Band 34, Day242(11:35−13:10), ltwk/Vedt=110/226



Detector in SBRS Order

MODIS PFM ADC Bit Histogram on A−side

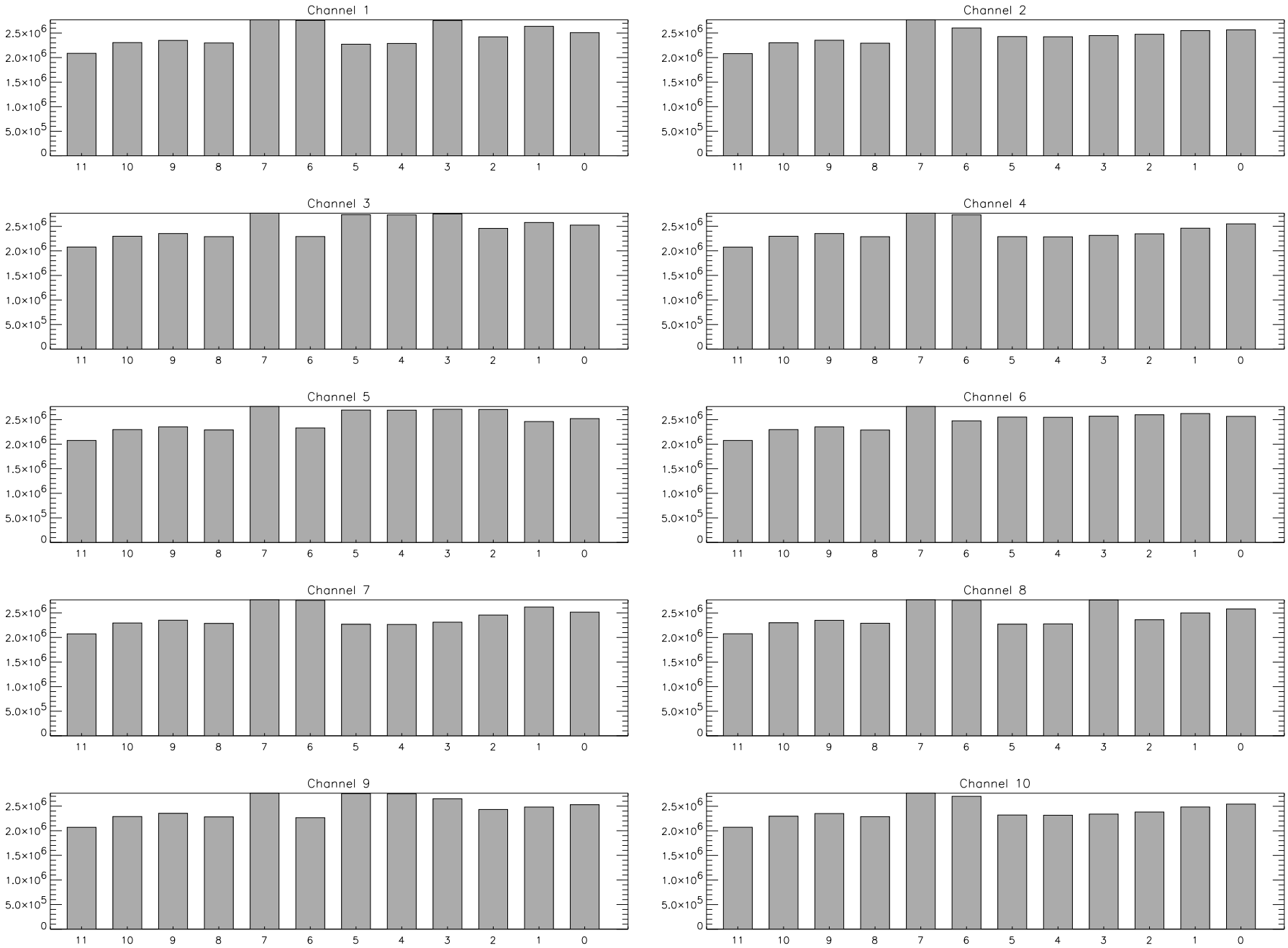
Band 36, Day242(11:35−13:10), ltwk/Vedt=110/226



Detector in SBRS Order

MODIS PFM ADC Bit Histogram on B−side

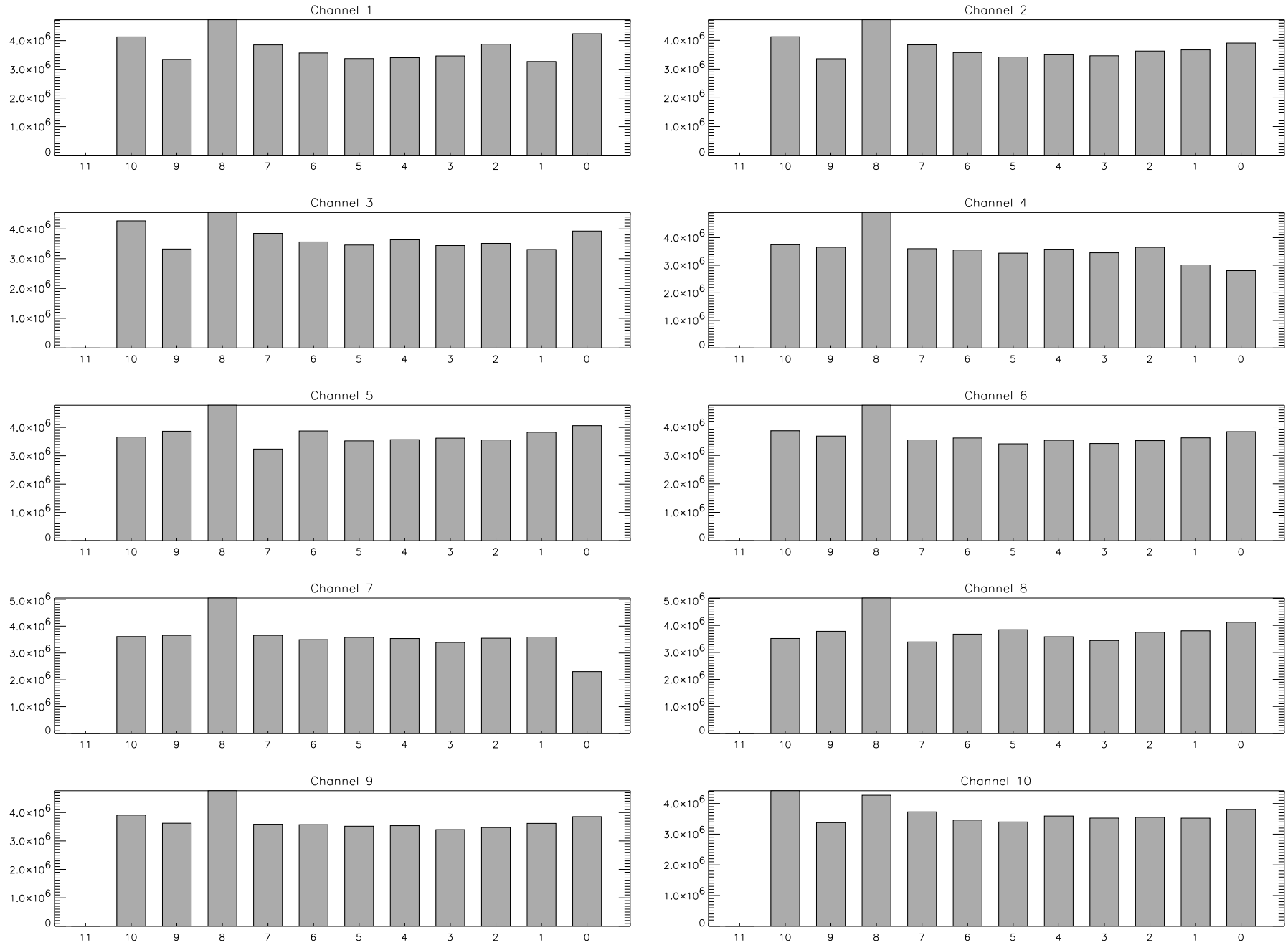
Band 16, Day333(05:50−07:45), ltwk/Vedt=79/110



Detector in SBRS Order

MODIS PFM ADC Bit Histogram on B−side

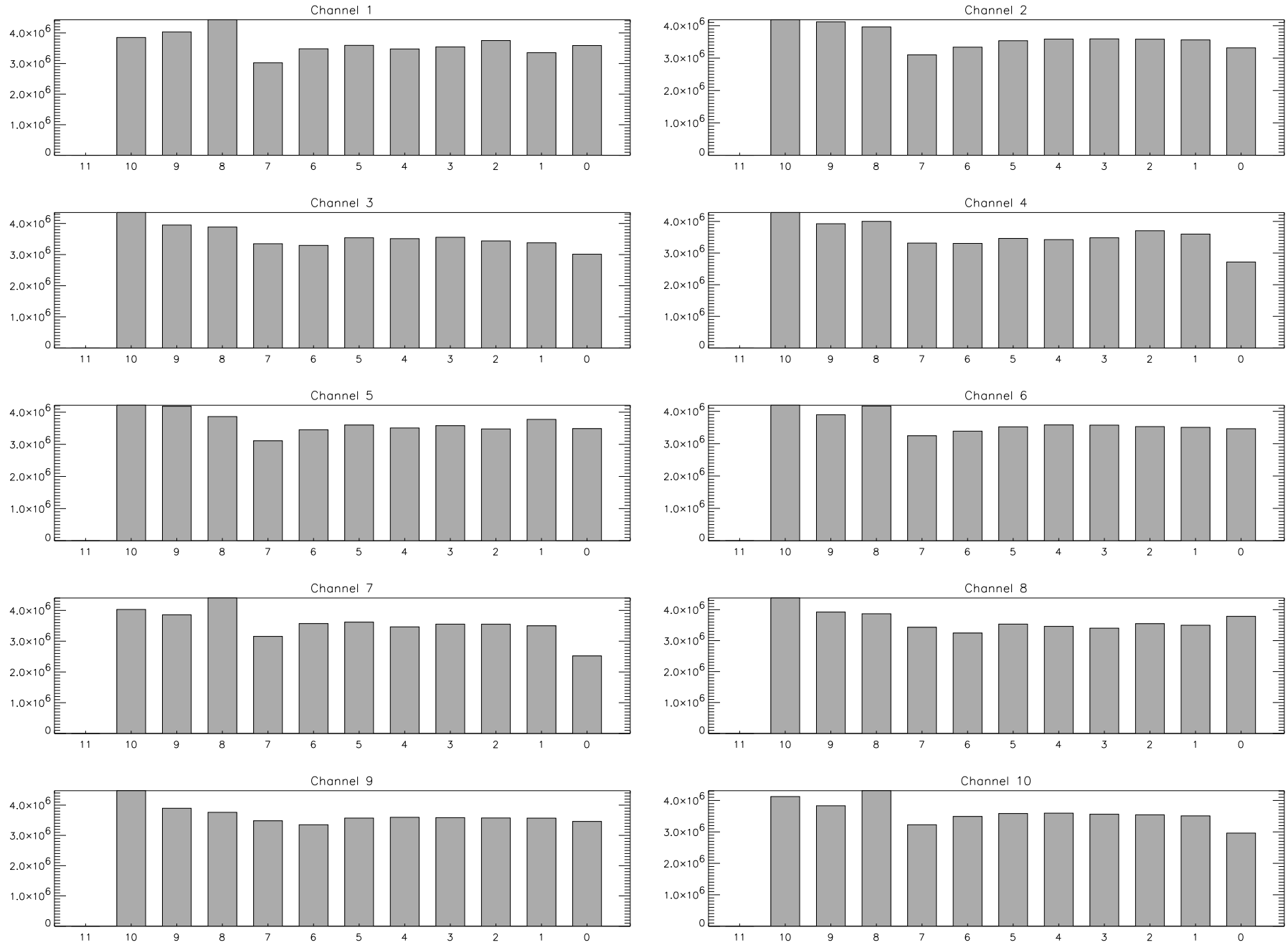
Band 31, Day333(05:50−07:45), ltwk/Vedt=79/110



Detector in SBRS Order

MODIS PFM ADC Bit Histogram on B−side

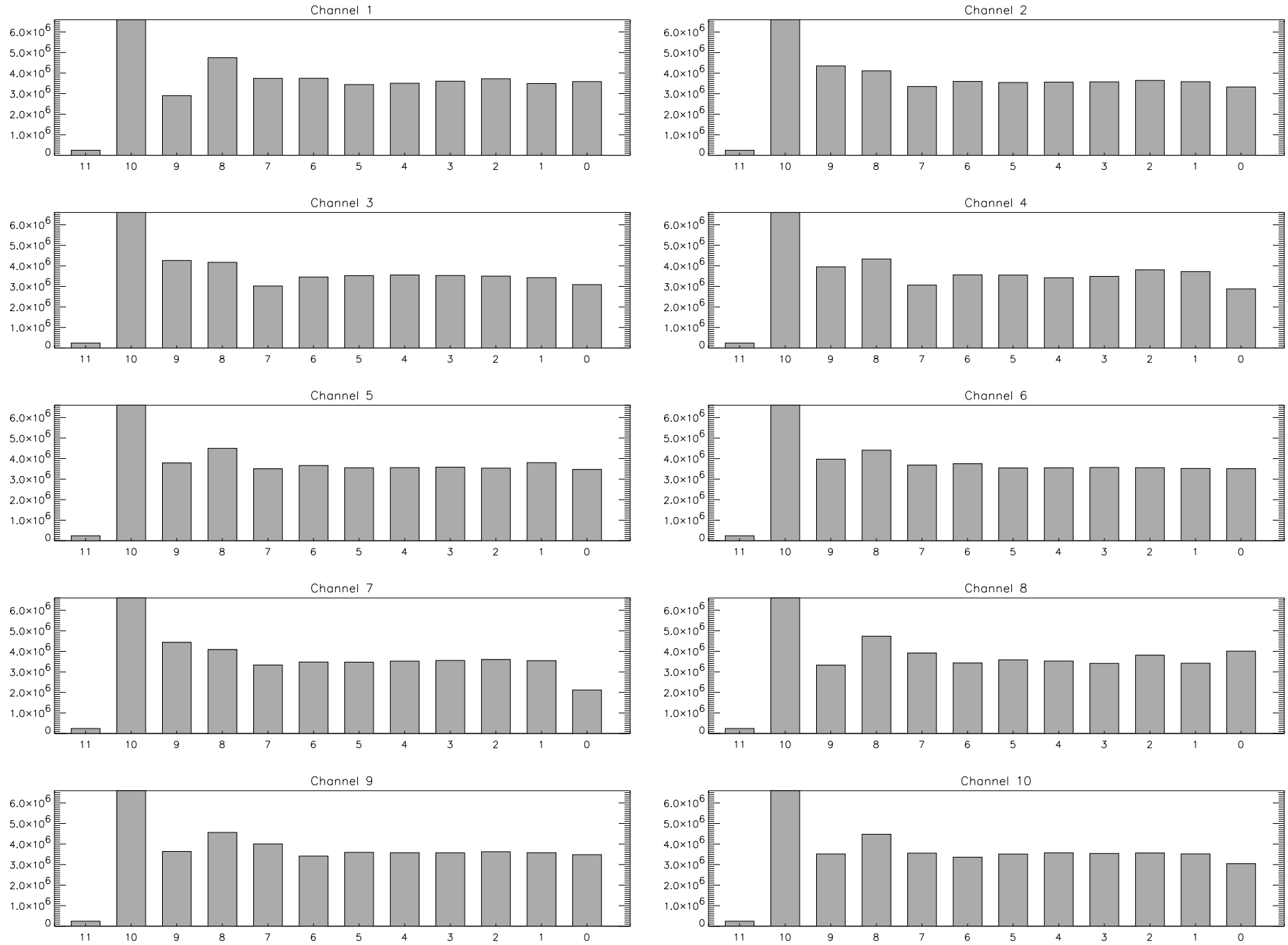
Band 32, Day333(05:50−07:45), ltwk/Vedt=79/110



Detector in SBRS Order

MODIS PFM ADC Bit Histogram on B−side

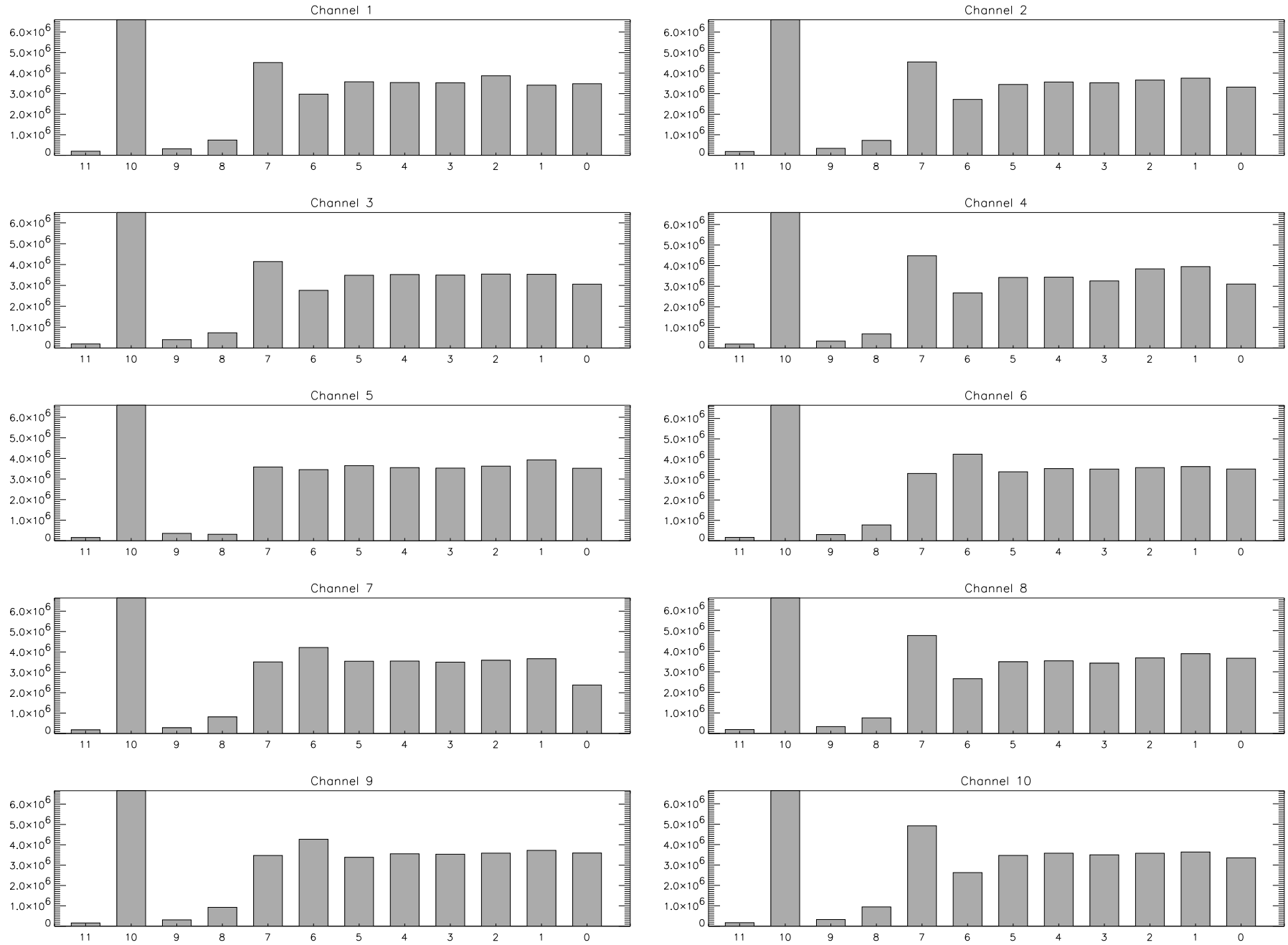
Band 34, Day333(05:50−07:45), ltwk/Vedt=79/110



Detector in SBRS Order

MODIS PFM ADC Bit Histogram on B−side

Band 36, Day333(05:50−07:45), ltwk/Vedt=79/110

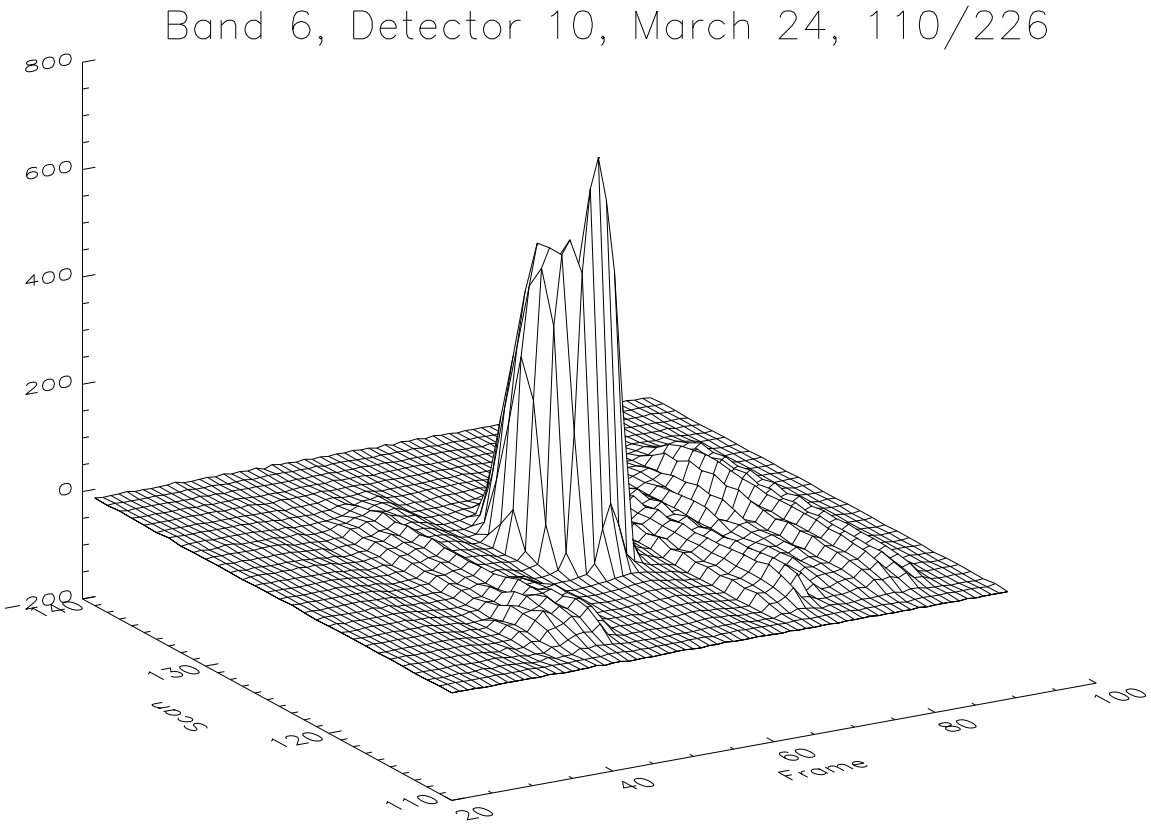


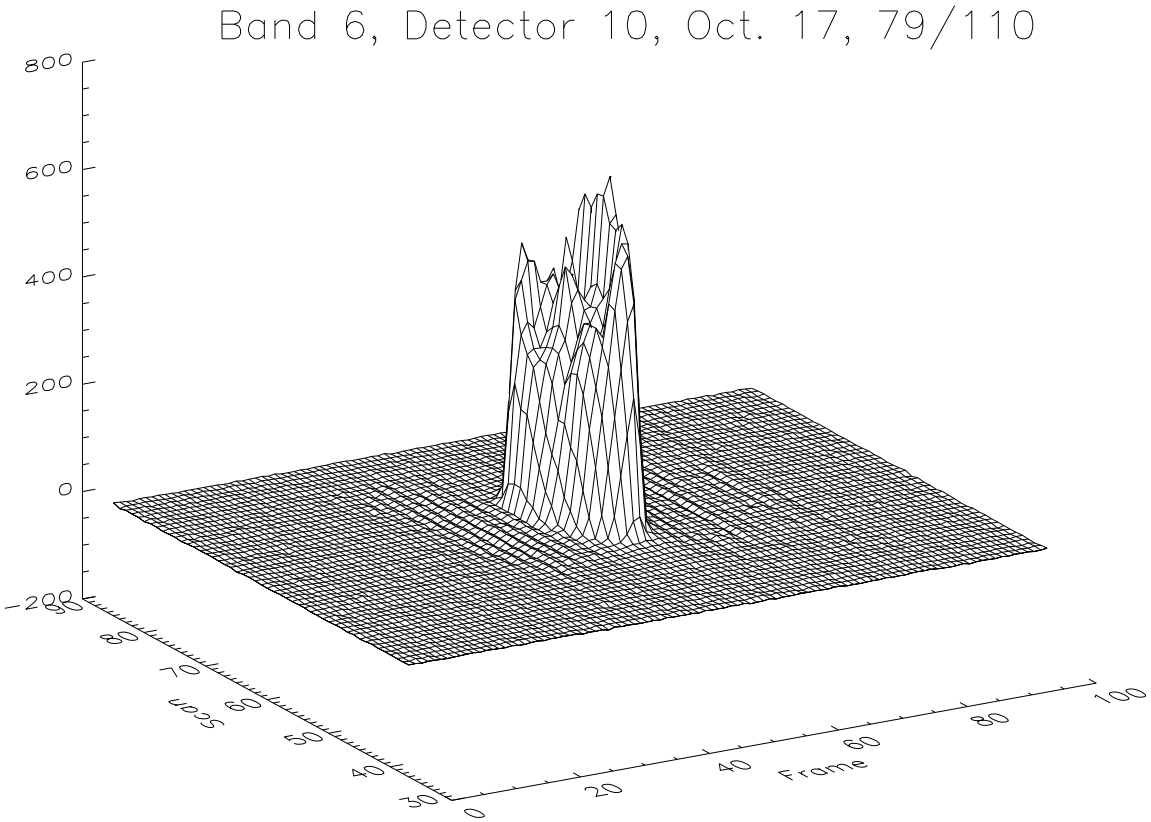
Detector in SBRS Order

Conclusion on B-Side

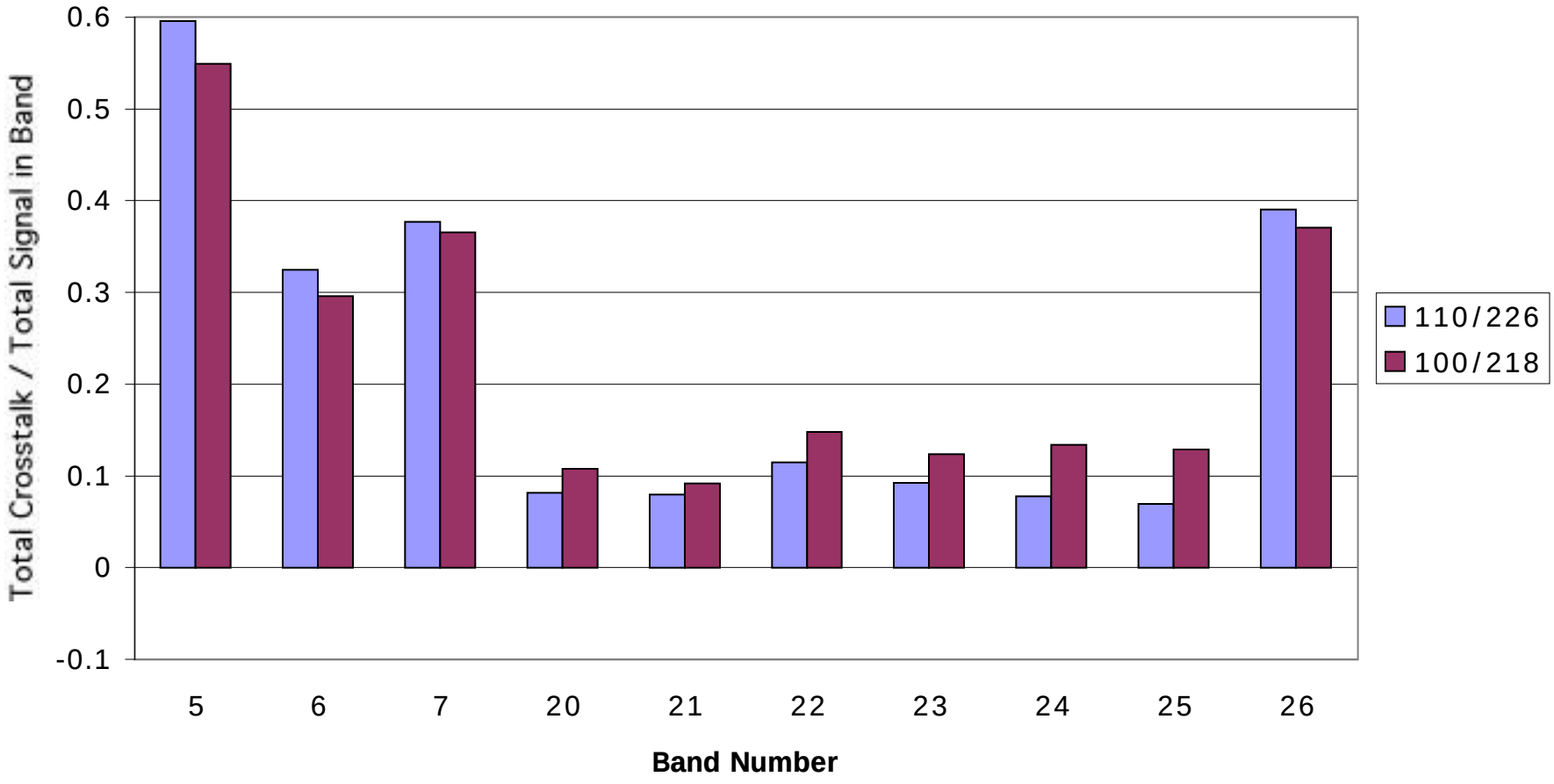
- See improvements on Band 34 charts
- Miami reported some improvements in data sets for Bands 31 and32
- PV Reflected Solar Bands (Band 16) showed little to no improvement

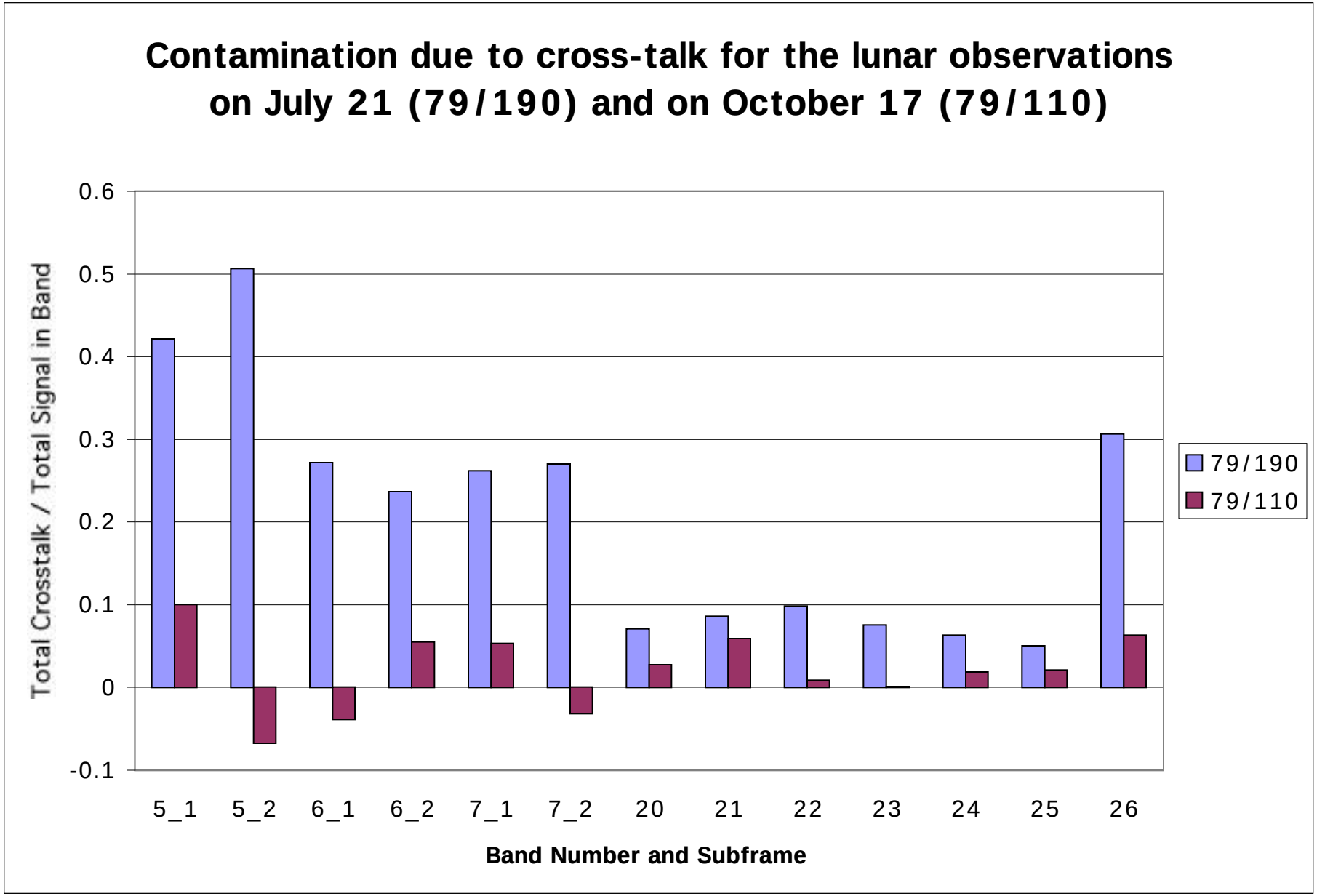
V_{det} = 110 (Residual Electronic Cross-talk)


Band 6, Detector 10, March 24, 110/226
800
600
400
200
0
-200
140
130
120
110
Scan
20
40
60
80
100
Frame


Band 6, Detector 10, Oct. 17, 79/110
800
600
400
200
0
-200
Scan
Frame
0
20
40
60
80
100

Contamination due to cross-talk for the two lunar observations on March 24 (The subframe difference for bands 5-7 is small)




Contamination due to cross-talk for the lunar observations
on July 21 (79/190) and on October 17 (79/110)
Total Crosstalk / Total Signal in Band
0.6
0.5
0.4
0.3
0.2
0.1
0
-0.1
5_1
5_2
6_1
6_2
7_1
7_2
20
21
22
23
24
25
26
Band Number and Subframe
79/190
79/110

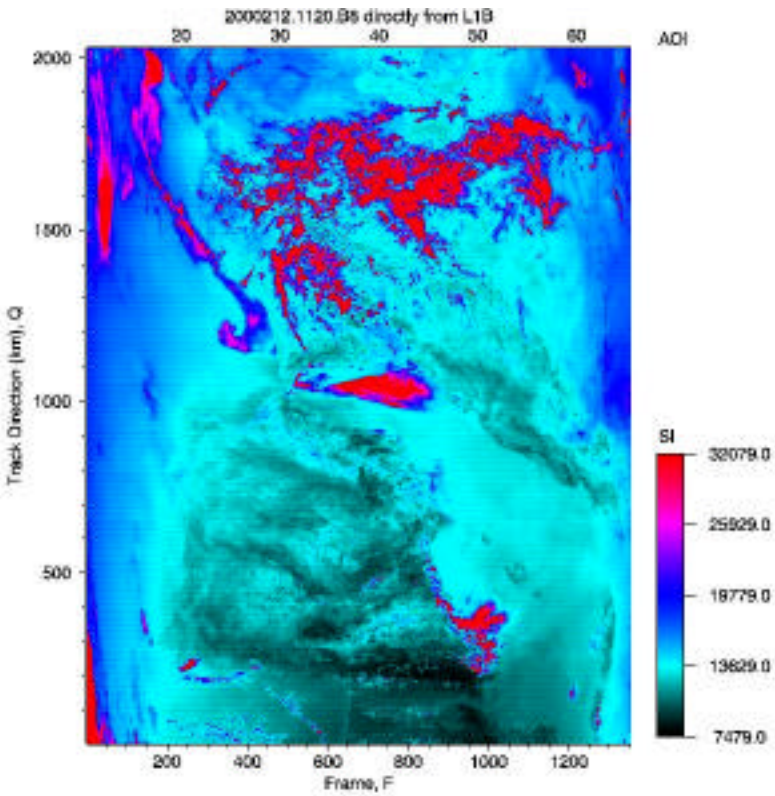
Direct Surface Smoothing for de-striping

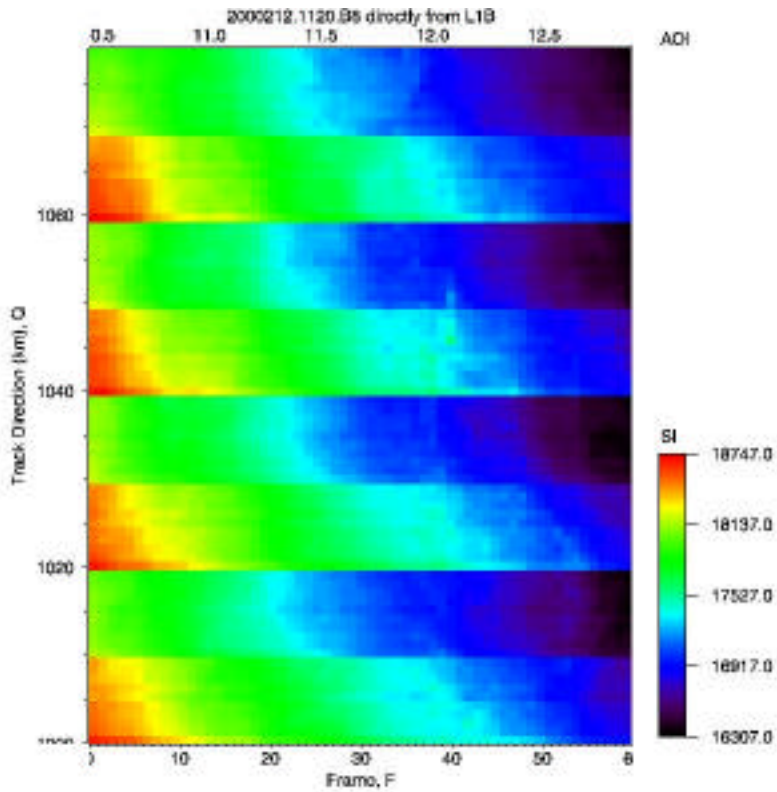
Section

Reduction of Striping by Direct Surface Smoothing

MCST now believes that scenes may have apparent stripes by mirror side due to polarization differences between first and last detector in track, and so direct smoothing techniques such as discussed in the following Section may not be useful. For the present MCST are not intending to implement these approaches.

I. Observation





II. Method

- Correction to m1 and RVS $f_{M,D}(F)$
- Define

$$U(F) = \sum_{Q,F} [SI_{Q+1,F} f_{M,D}(F)\delta(M_{Q+1}D_{Q+1}, MD)$$

$$-SI_{Q,F} f_{M,D}(F)\delta(M_Q D_Q, MD)]^2$$

$$where \quad Q = N \times N_D + D$$

- Take derivatives

$$\partial U(F) / \partial f_{M,D}(F) = 0$$

- Evaluate $f_{M,D}(F)$ with $f_{1,1}(F) = 1$ for a given *F*

- Quadratic Form

$$f_{M,D}(F) = c^0_{M,D} + c^1_{M,D}(F/1353) + c^2_{M,D}(F/1353)^2$$

- Correction to M1

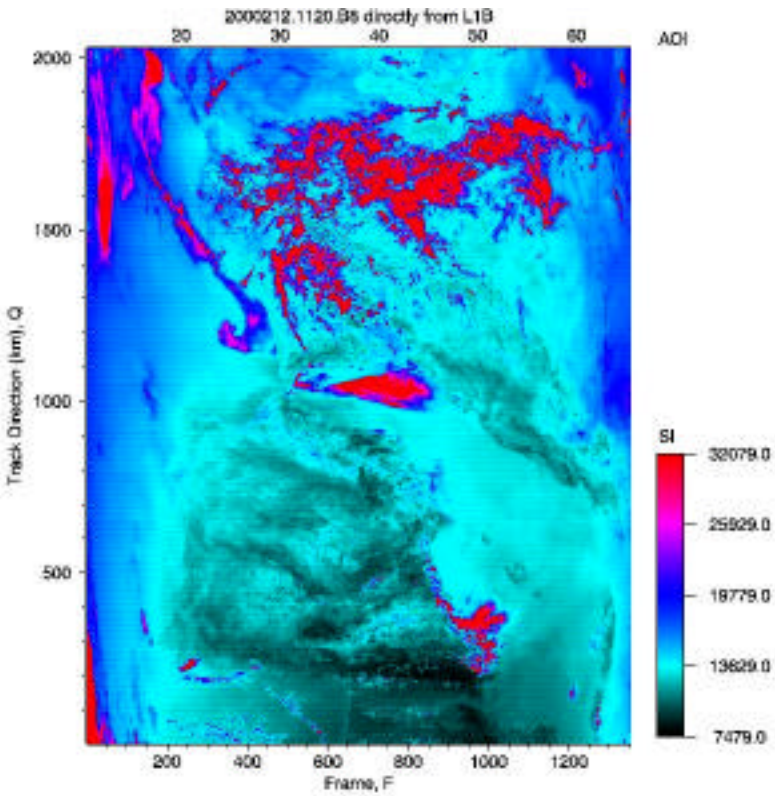
$$m1^{corr}_{M,D} = 2N_D f_{M,D}(979) / \sum_{M,D} f_{M,D}(979)$$

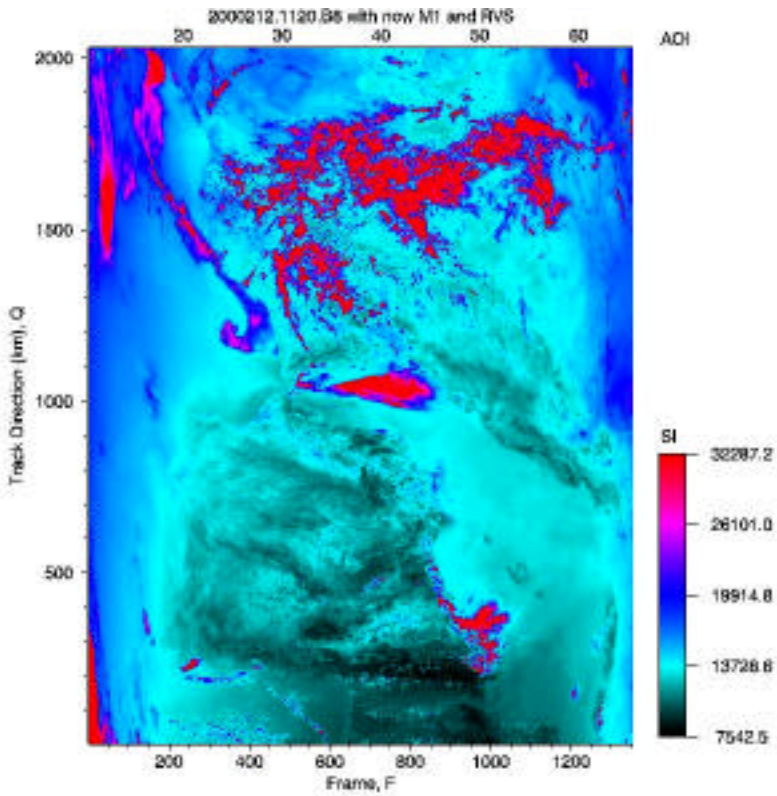
- Correction to RVS

$$RVS^{corr}_{M,D}(F) = [\sum_{M,D} \bar{f}_{M,D}(F)] / [2N_D \bar{f}_{M,D}(F)]$$

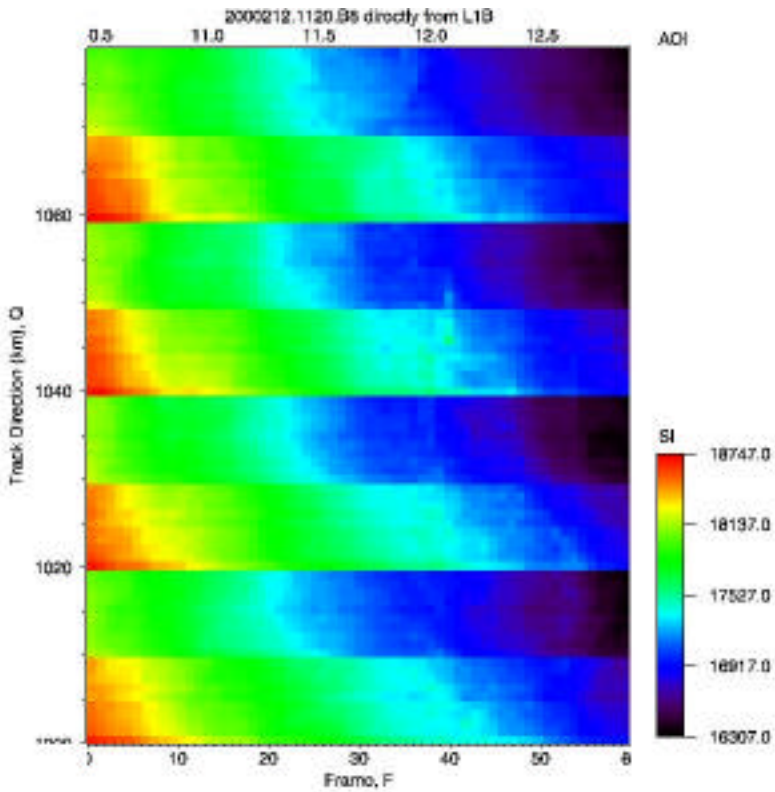
Where $\bar{f}_{M,D}(F) = f_{M,D}(F) / f_{M,D}(979)$

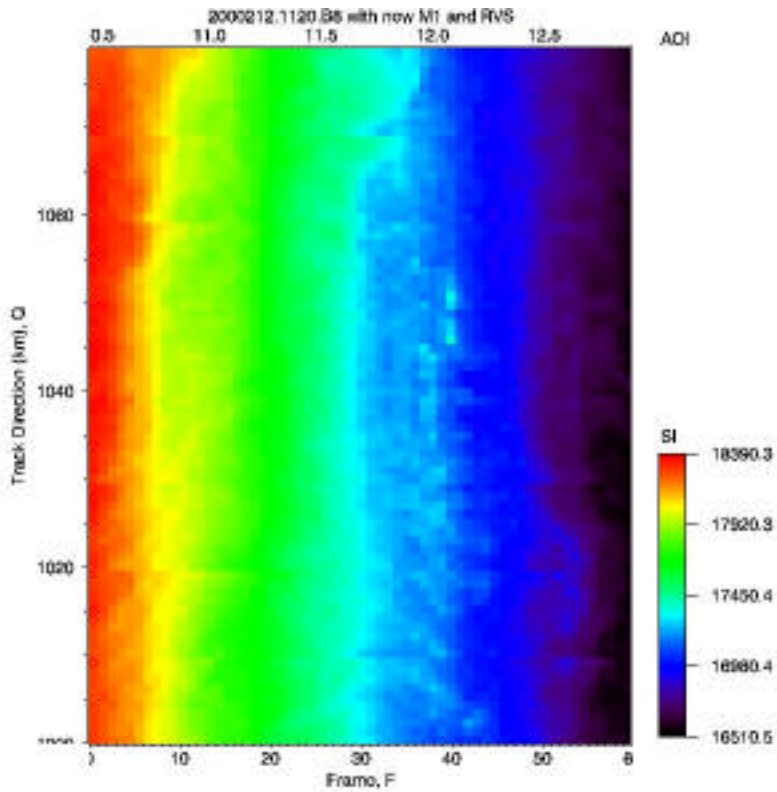
III. Applied to Band 8 (A side) 2000212.1120



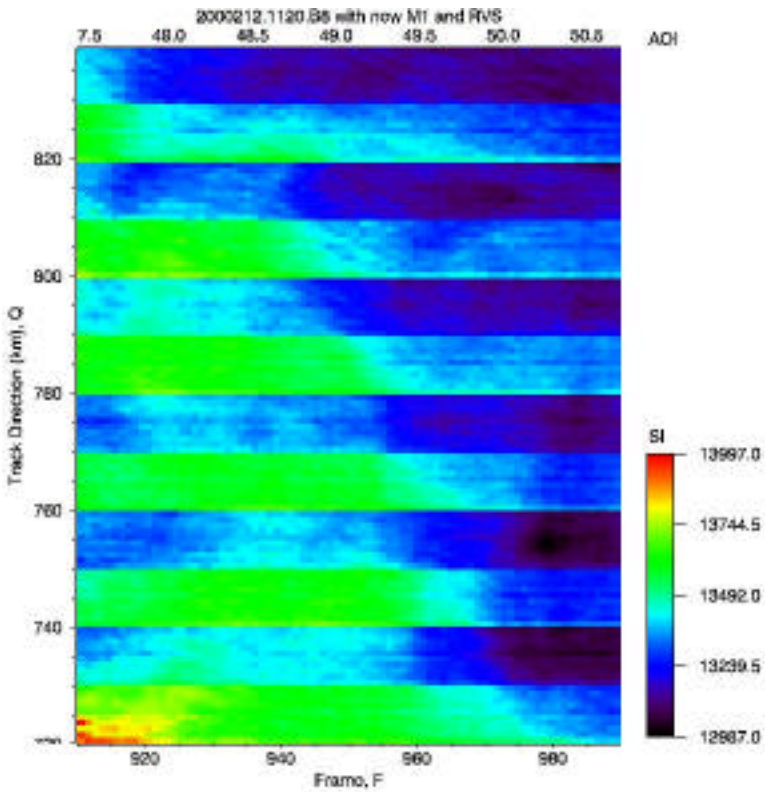


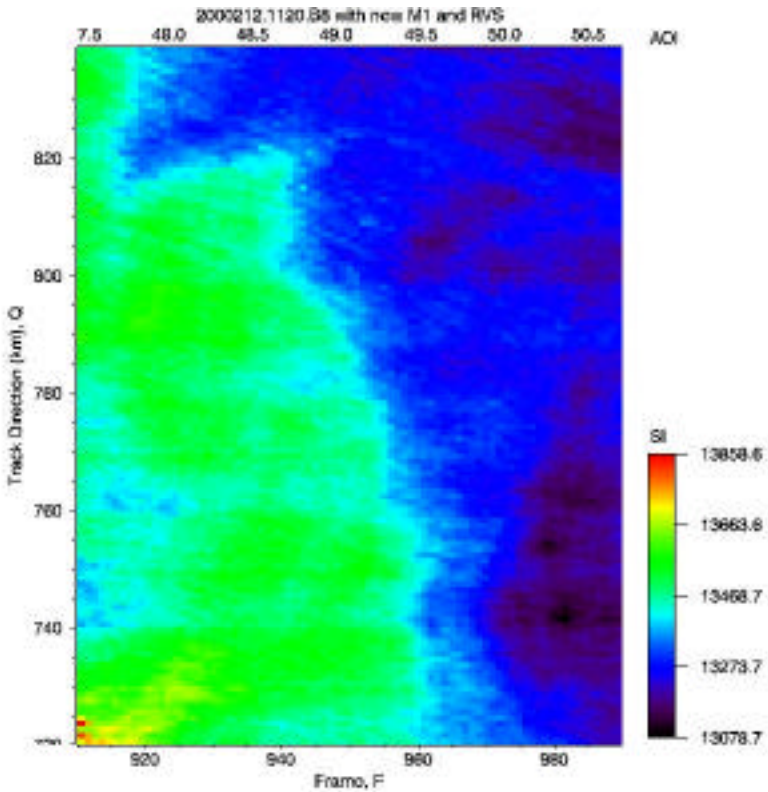
2000212.1120 (left)
Stretched



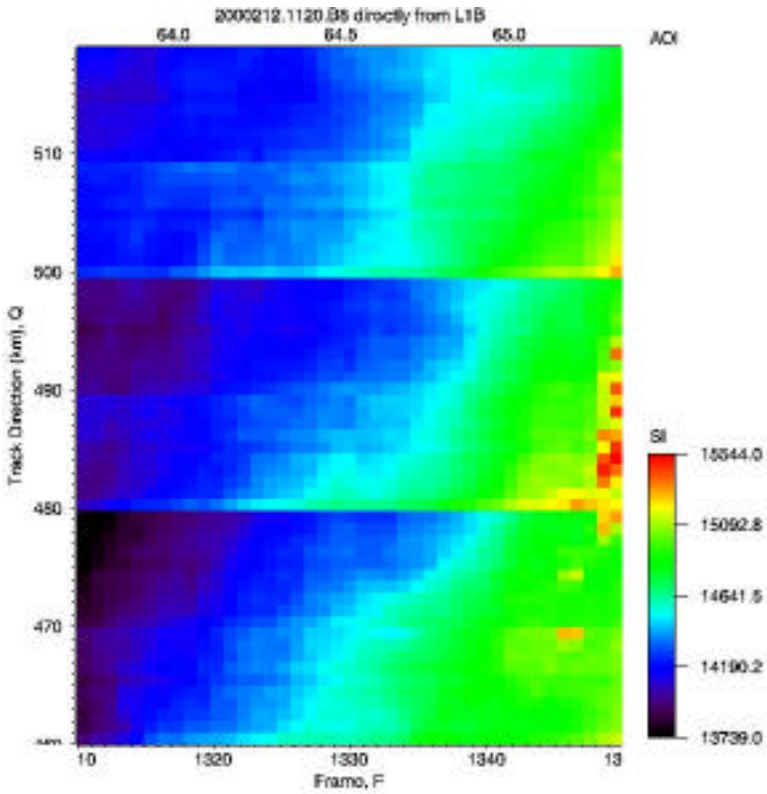


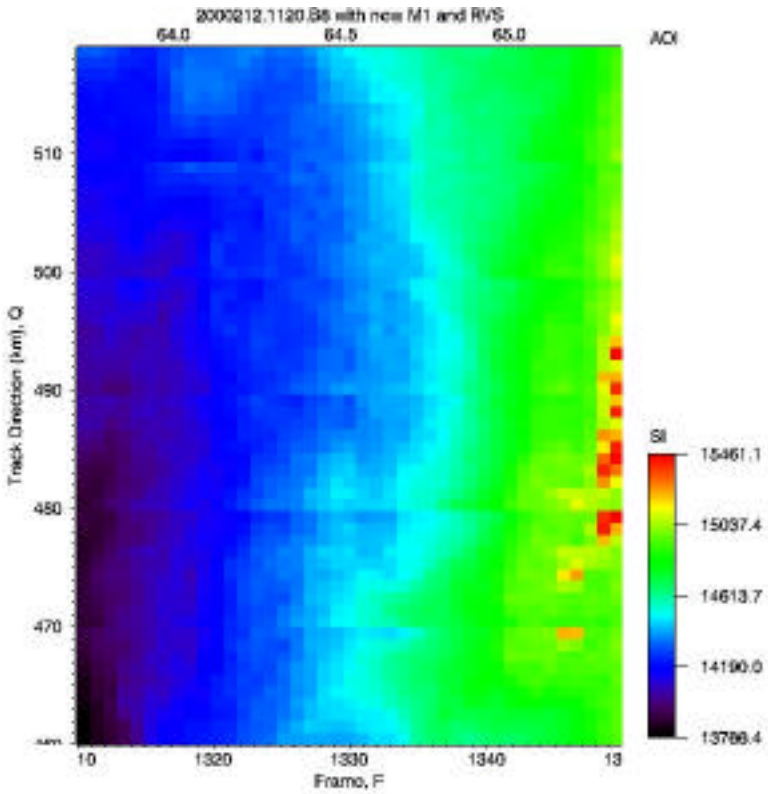
2000212.1120 (center) Stretched



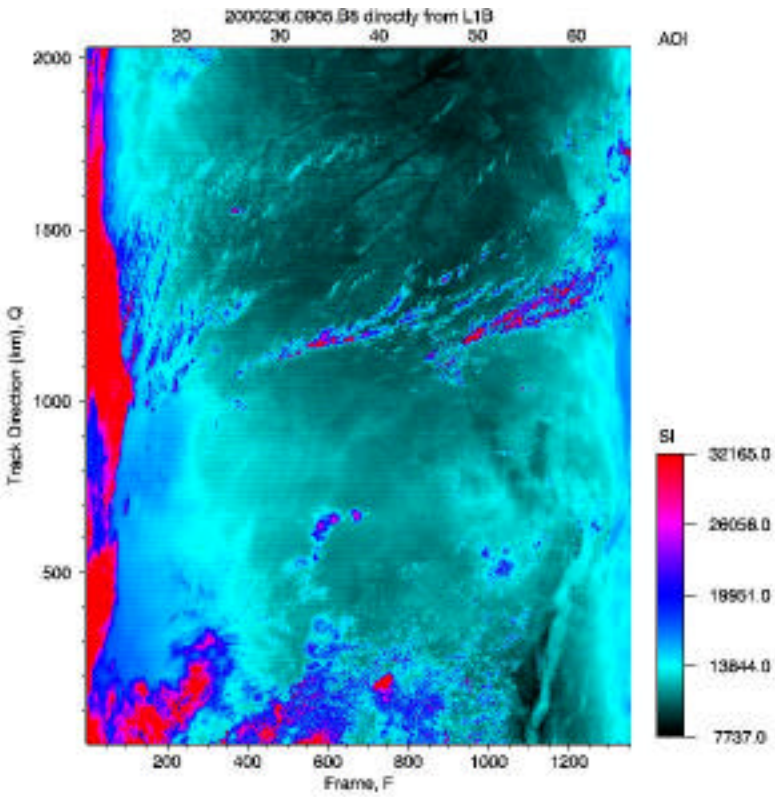


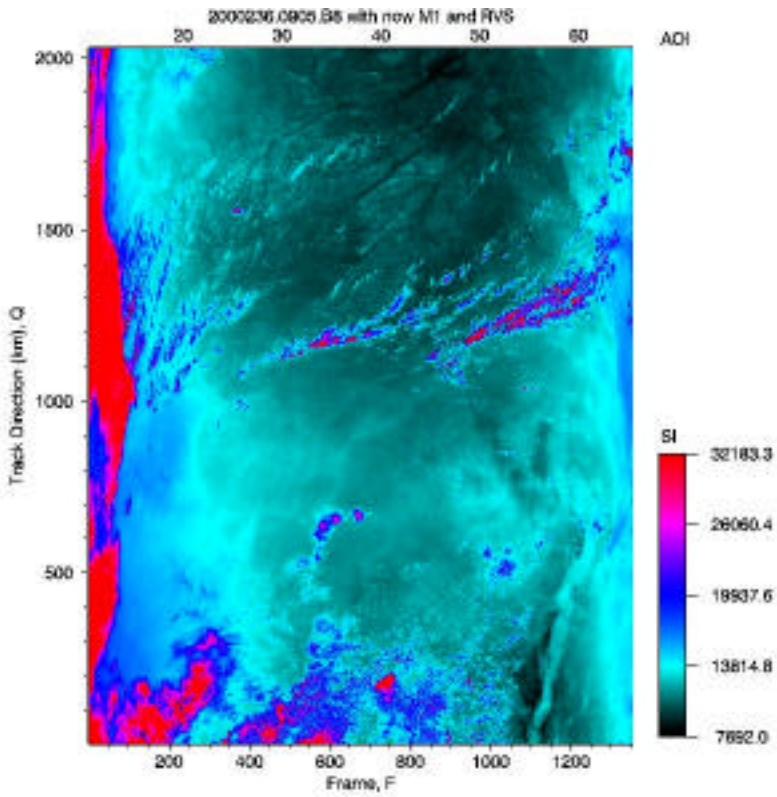
2000212.1120 (right) Stretched





2000236.0905 using 2000212.1120 corrections



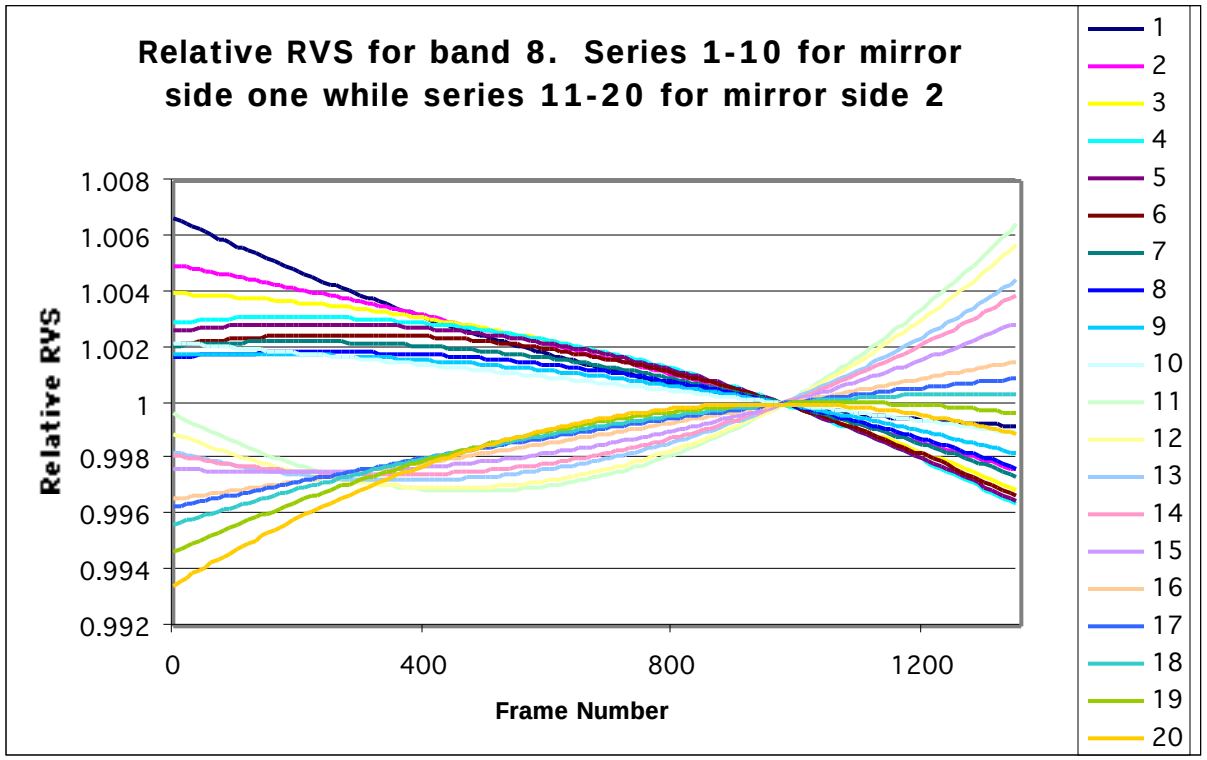


Correction Terms

- $m1^{corr}_{M,D}$

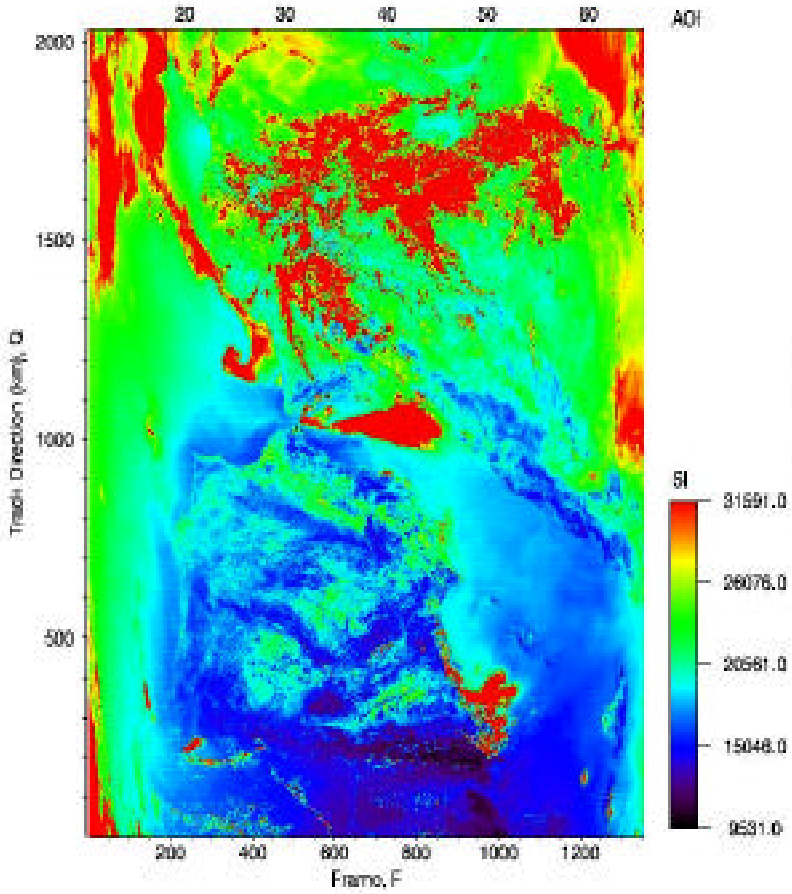
D	M =1	M=2
1	0.98589	1.00552
2	0.99019	1.00801
3	0.99041	1.00777
4	0.99062	1.00908
5	0.99072	1.00902
6	0.99337	1.01026
7	0.99195	1.00900
8	0.99381	1.00823
9	0.99418	1.00836
10	0.99523	1.00838

- $RVS^{corr}_{M,D}$

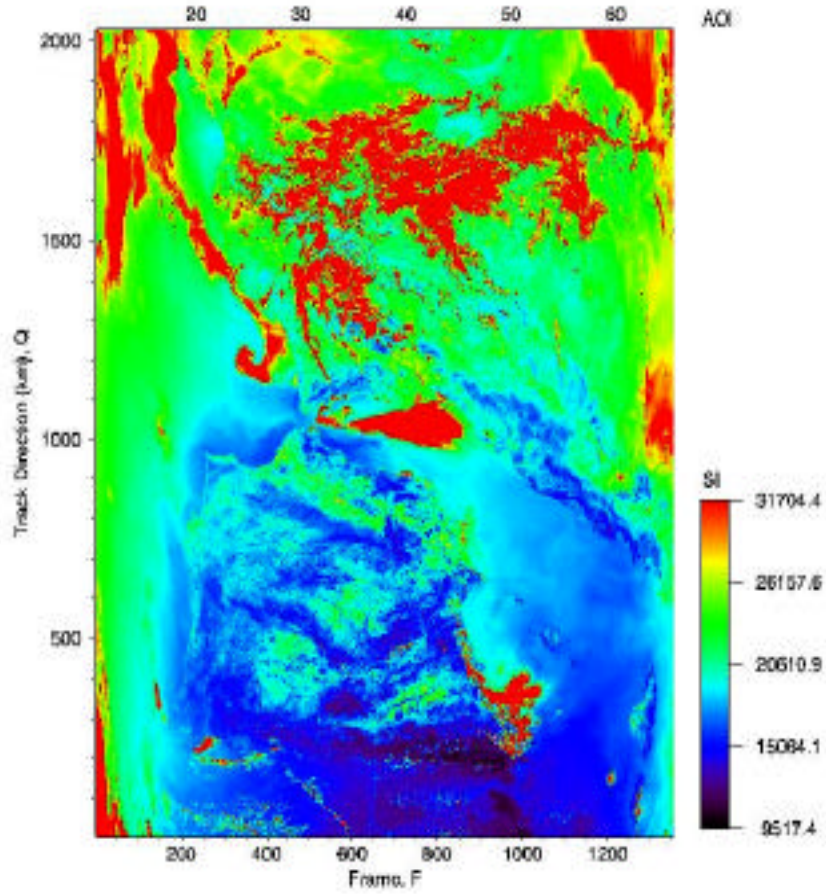


IV. Applied to Band 9 (A side) 2000212.1120

2000212.1120 B9 directly from L1B

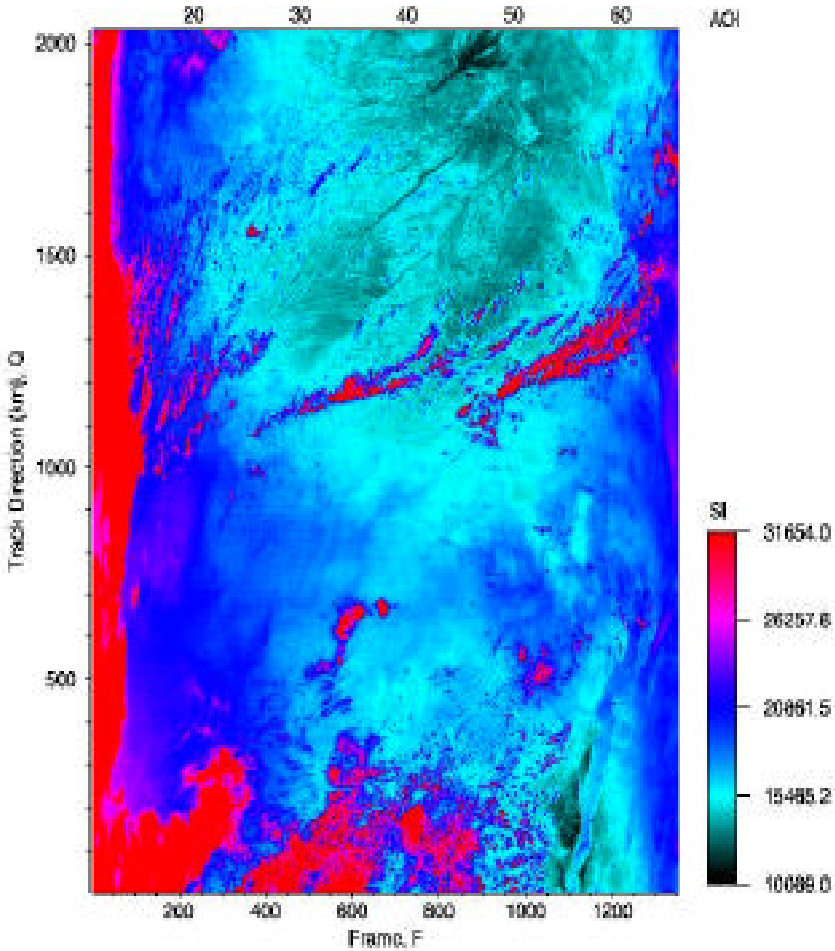


2000212.1120 B9 with new m1 and RVS

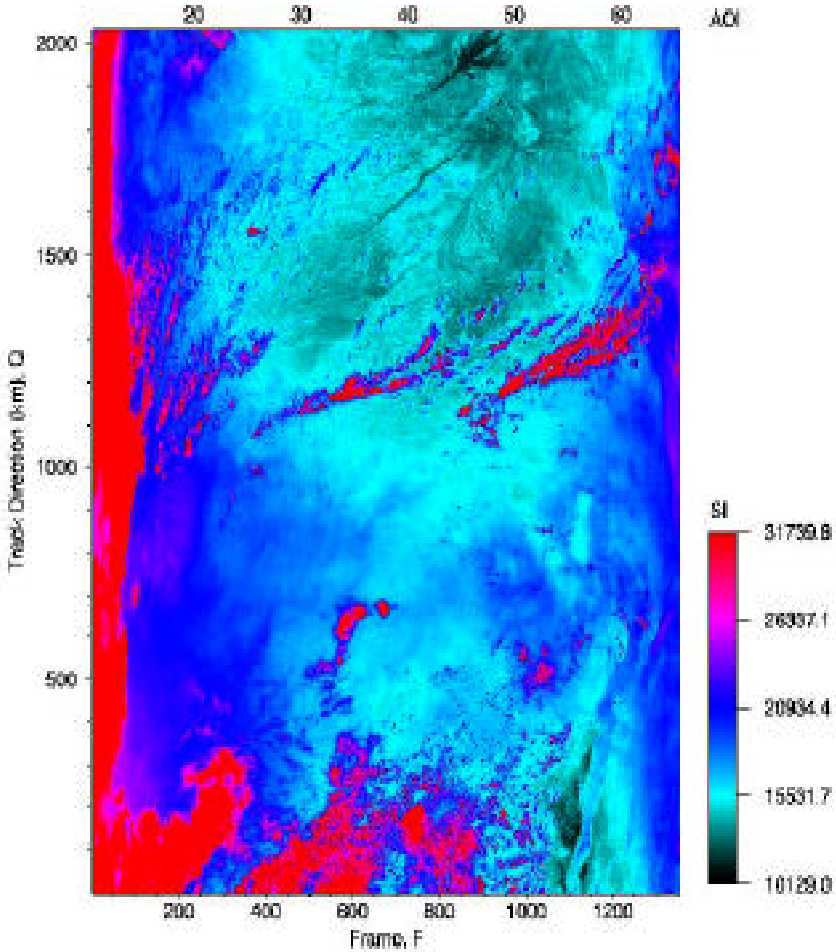


Corrections from 2000212.1120

2000236.0905 B9 directly from L1B

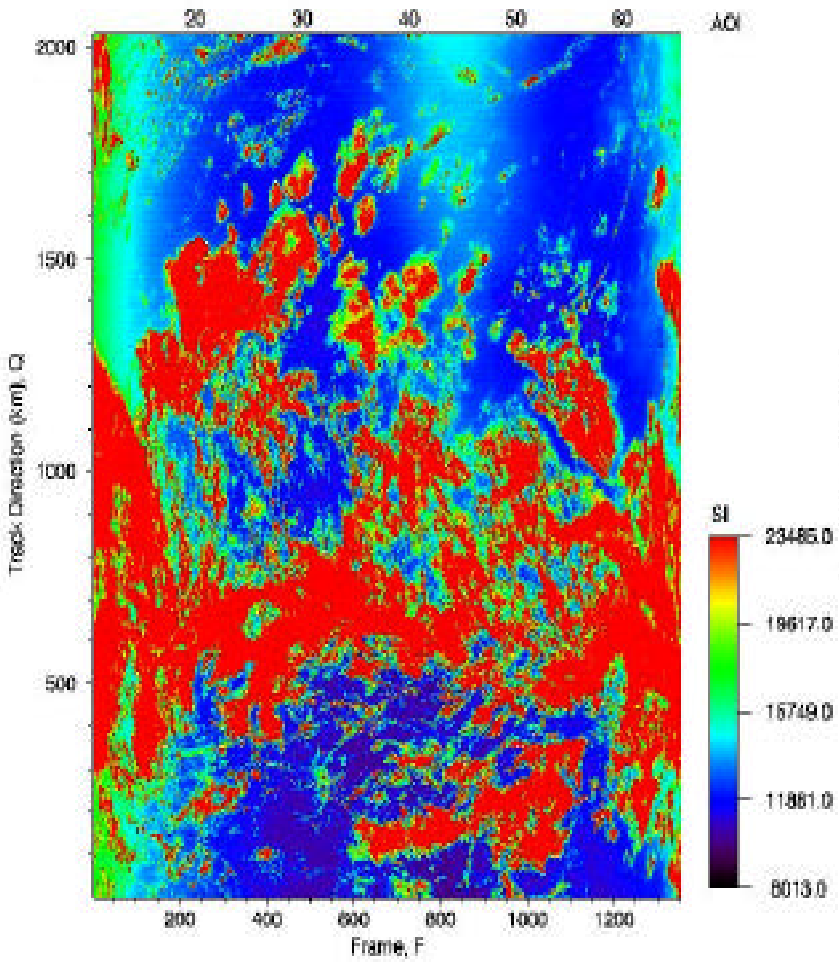


2000236.0905 B9 with new m1 and RVS

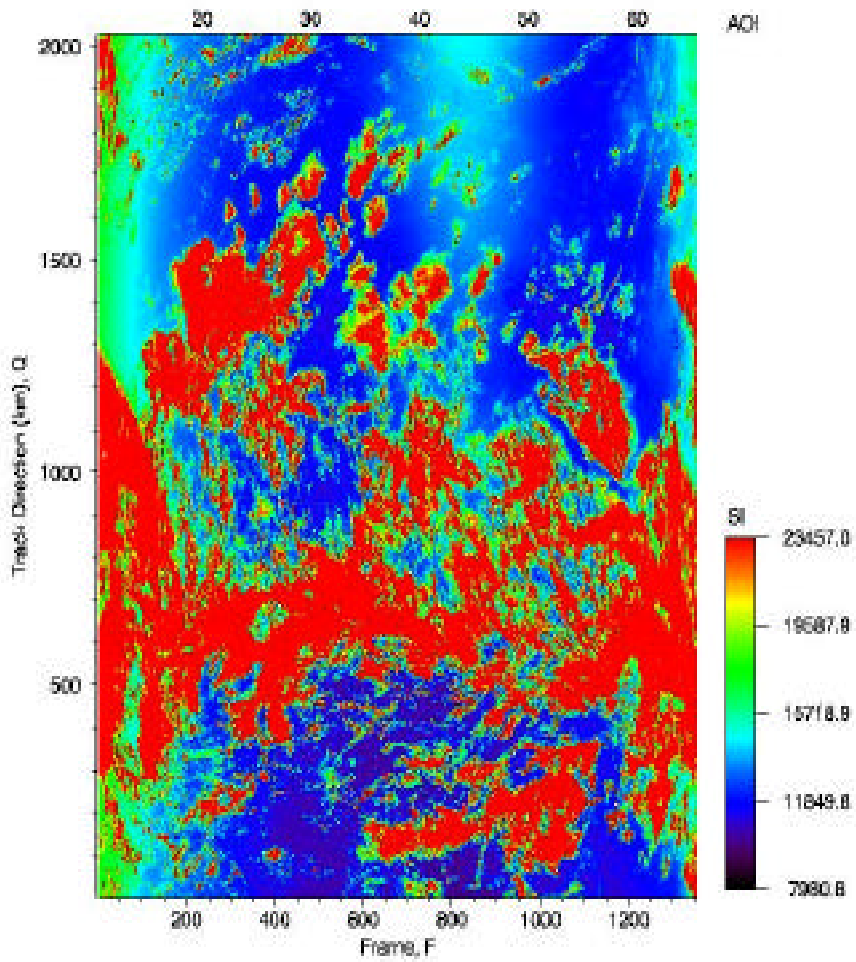


V. Applied to Band 8 (B side) 2000323.1720

2000323.1720 B8 directly from L1B

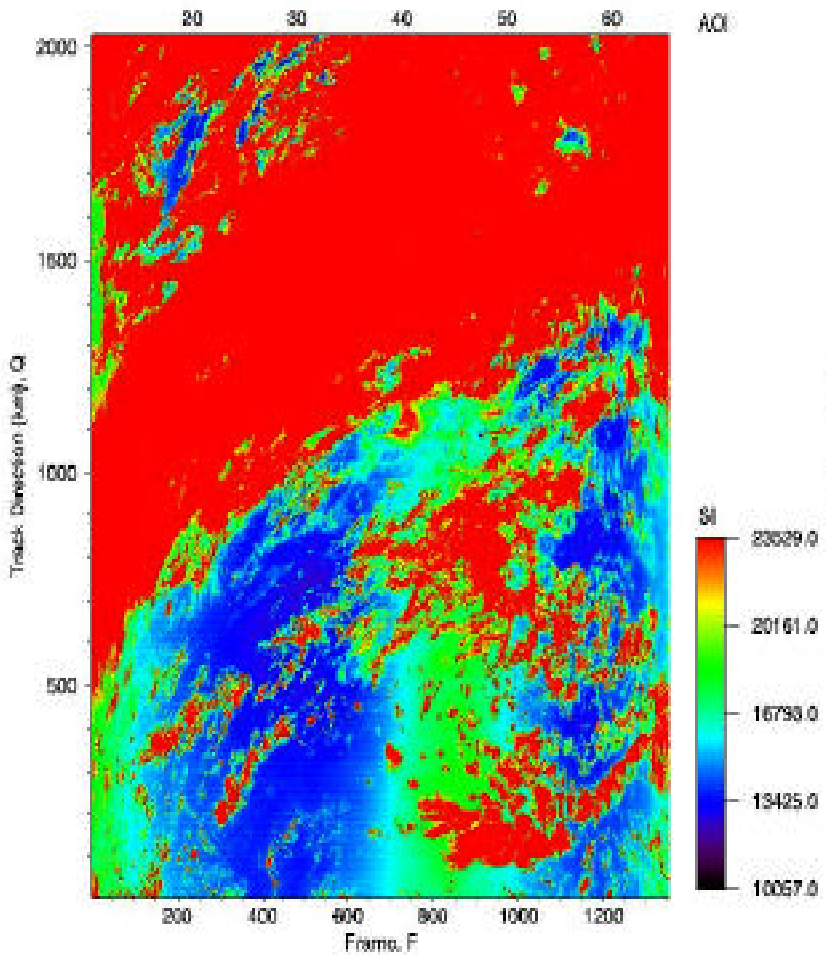


2000323.1720 B8 with new m1 and RVS

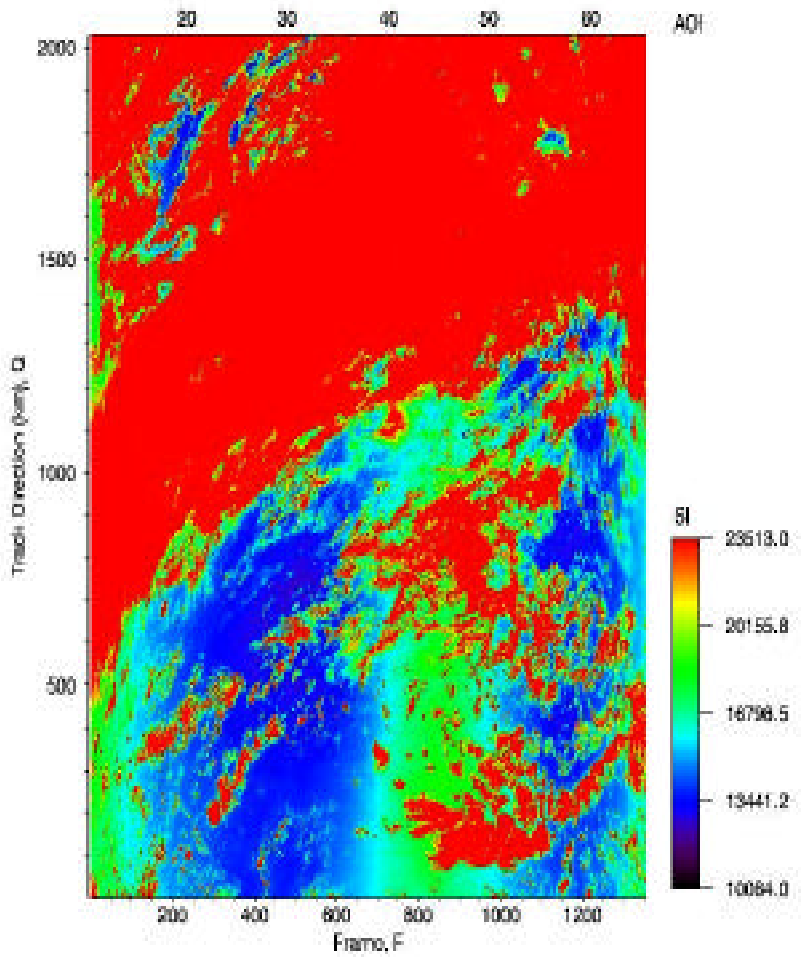


Using corrections from 2000323.1720

2000325.1220 B8 directly from L1B



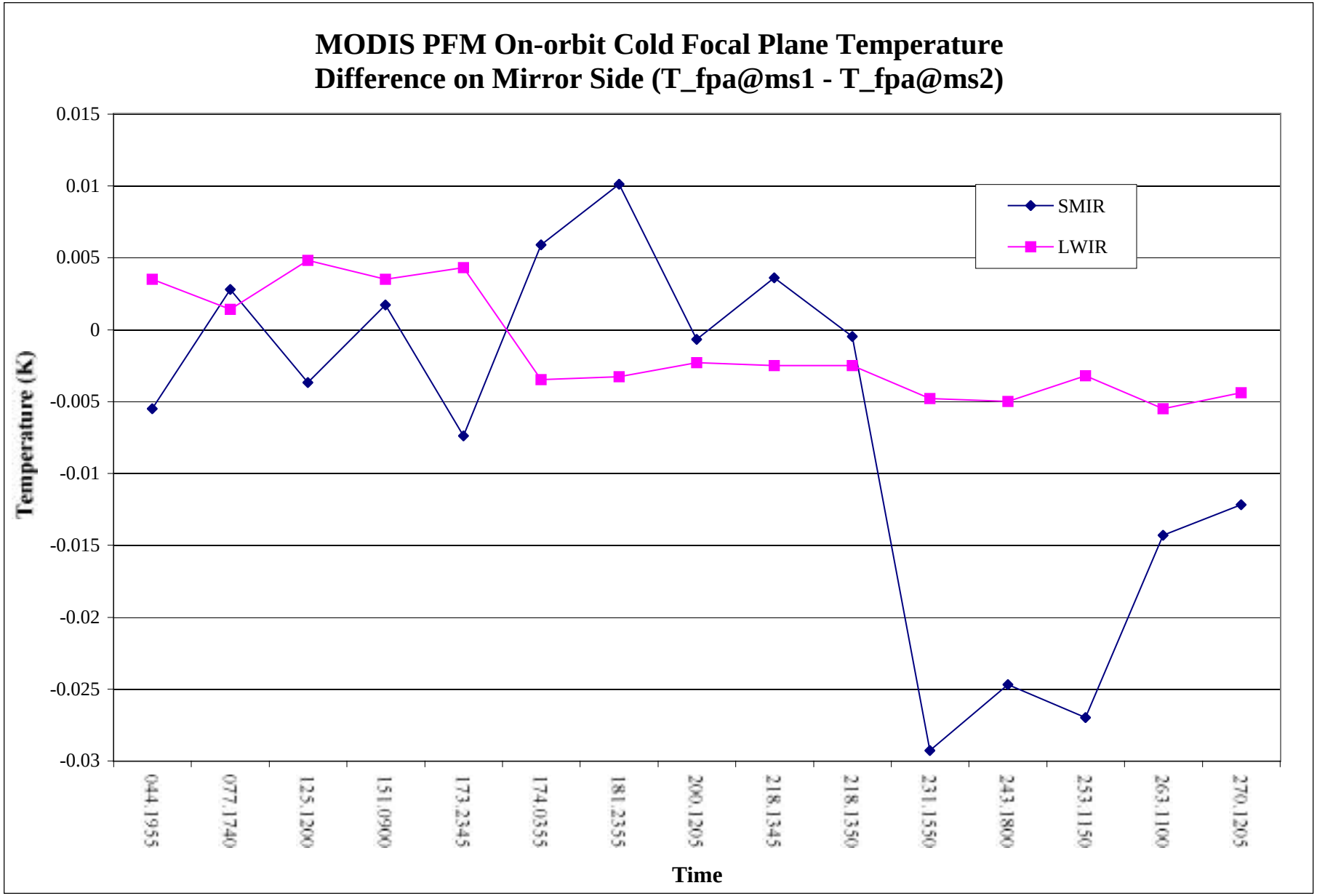
2000325.1220 B8 with new m1 and RVS



VI. Summary and future work

- The current method works only if the striping is mainly induced by inaccuracy in m1 and/or RVS.
- MCST now believes that scenes may have apparent stripes by mirror side due to polarization differences between first and last detector in track, and so direct smoothing techniques such as discussed in the following Section may not be useful. For the present MCST are not intending to implement these approaches.

Mirror rotation correlated noise

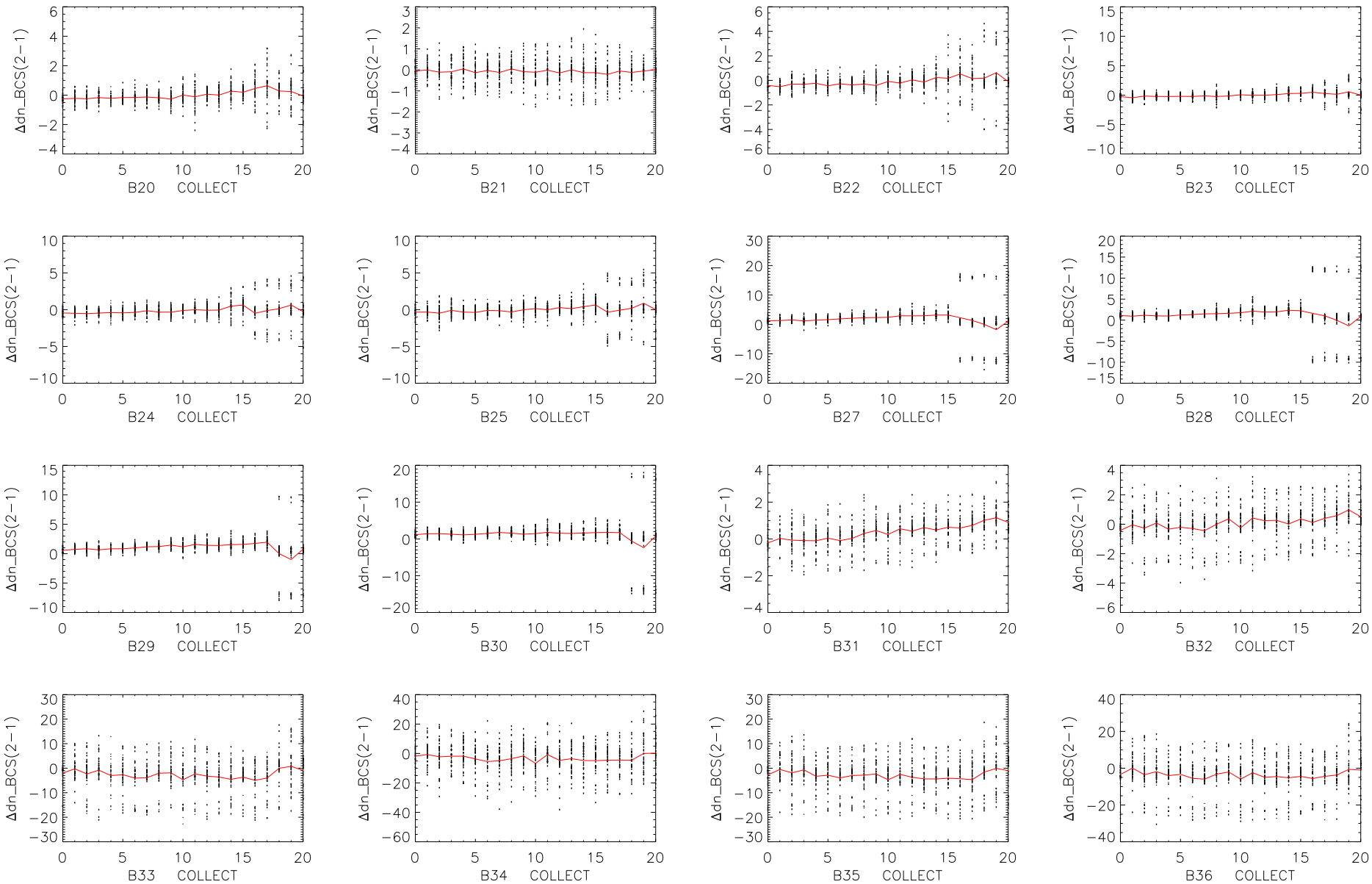

MODIS PFM On-orbit Cold Focal Plane Temperature
Difference on Mirror Side (T_fpa@ms1 - T_fpa@ms2)
Temperature (K)
0.015
0.01
0.005
0
-0.005
-0.01
-0.015
-0.02
-0.025
-0.03
SMIR
LWIR
044.1955
077.1740
125.1200
151.0900
173.2345
174.0355
181.2355
200.1205
218.1345
218.1350
231.1550
243.1800
253.1150
263.1100
270.1205
Time

Day	B8					B20					B29					B35				
	DN_SD	DN_BB	DN_SV	dn_BB	dn_EV	DN_SD	DN_BB	DN_SV	dn_BB	dn_EV	DN_SD	DN_BB	DN_SV	dn_BB	dn_EV	DN_SD	DN_BB	DN_SV	dn_BB	dn_EV
66		2>1	2<1	2>1		2>1	2>1	2<1	2>1	2≈1	2>1	2>1	2<1	2>1		2≤1	2≤1	2≈1	2<1	P1
72		2>1	2<1	2>1		2>1	2>1	2<1	2>1	2≈1	2>1	2>1	2<1	2>1		2≤1	2≤1	2≈1	2<1	P1
78						2>1	2>1	2<1	2>1		2>1	2>1	2<1	2>1		2≤1	2≤1	2≈1	2<1	
80		2>1	2<1	2>1		2>1	2>1	2<1	2>1	2≈1	2>1	2>1	2<1	2>1		2≤1	2≤1	2≈1	2<1	P1
87		2>1	2<1	2>1		2>1	2>1	2<1	2>1	2≈1	2>1	2>1	2<1	2>1		2≤1	2≤1	2≈1	2<1	P1
94		2>1	2<1	2>1		2>1	2>1	2<1	2>1	2≈1	2>1	2>1	2<1	2>1		2≤1	2≤1	2≈1	2<1	P1
101		2>1	2<1	2>1		2>1	2>1	2<1	2>1	2≈1	2>1	2>1	2<1	2>1		2≤1	2≤1	2≈1	2<1	P1
106		2>1	2<1	2>1		2>1	2>1	2<1	2>1	2≈1	2>1	2>1	2<1	2>1		2≤1	2≤1	2≈1	2<1	P1
112		2>1	2<1	2>1		2>1	2>1	2<1	2>1	2≈1	2>1	2>1	2<1	2>1		2≤1	2≤1	2≈1	2<1	P1
120		2>1	2<1	2>1		2>1	2>1	2<1	2>1	2≈1	2>1	2>1	2<1	2>1		2≤1	2≤1	2≈1	2<1	P1
125		2>1	2<1	2>1		2≥1	2≥1	2≤1	2≥1		2>1	2>1	2<1	2>1		2≤1	2≤1	2≈1	2<1	
125						2≥1	2≥1	2≤1	2≥1		2>1	2>1	2<1	2>1		2≤1	2≤1	2≈1	2<1	
129		2>1	2<1	2>1		2>1	2>1	2<1	2>1	2≈1	2>1	2>1	2<1	2>1		2≤1	2≤1	2≈1	2<1	P1
136		2>1	2<1	2>1		2>1	2>1	2<1	2>1	2≈1	2>1	2>1	2<1	2>1		2≤1	2≤1	2≈1	2<1	P1
143		2>1	2<1	2>1		2>1	2>1	2<1	2>1	2≈1	2>1	2>1	2<1	2>1		2≈1	2≈1	2≈1	2≈1	P1
150		2>1	2<1	2>1		2>1	2>1	2<1	2>1	2≈1	2>1	2>1	2<1	2>1		2≈1	2≈1	2≈1	2≈1	P1
158		2>1	2<1	2>1		2>1	2>1	2<1	2>1	2≈1	2>1	2>1	2<1	2>1		2≈1	2≈1	2≈1	2≈1	P1
164		2>1	2<1	2>1		2>1	2>1	2<1	2>1	2≈1	2>1	2>1	2<1	2>1		2≈1	2≈1	2≈1	2≈1	P1
171		2>1	2<1	2>1		2>1	2>1	2<1	2>1	2≈1	2>1	2>1	2<1	2>1		2≈1	2≈1	2≈1	2≈1	P1
178	2<1	2<1	2>1	2<1		2<1	2<1	2>1	2<1	2≈1	2<1	2<1	2>1	2<1		2≈1	2≈1	2≈1	2≈1	P1
181						2<1	2<1	2>1	2<1		2<1	2<1	2>1	2<1		2≈1	2≈1	2≈1	2≈1	
185	2<1	2<1	2>1	2<1		2<1	2<1	2>1	2<1	2≈1	2<1	2<1	2>1	2<1		2≈1	2≈1	2≈1	2≈1	P1
192	2<1	2<1	2>1	2<1		2<1	2<1	2>1	2<1	2≈1	2<1	2<1	2>1	2<1		2≈1	2≈1	2≈1	2≈1	P1
200	2<1	2<1	2>1	2<1		2<1	2<1	2>1	2<1	2≈1	2<1	2<1	2>1	2<1		2≈1	2≈1	2≈1	2≈1	P1
206	2<1	2<1	2>1	2<1		2<1	2<1	2>1	2<1	2≈1	2<1	2<1	2>1	2<1		2≈1	2≈1	2≈1	2≈1	P1
212	2<1	2<1	2>1	2<1		2<1	2<1	2>1	2<1	2≈1	2<1	2<1	2>1	2<1		2≈1	2≈1	2≈1	2≈1	P1
212						2<1	2<1	2>1	2<1		2<1	2<1	2>1	2<1		2≈1	2≈1	2≈1	2≈1	
218	2<1	2<1	2>1	2<1		2<1	2<1	2>1	2<1	2≈1	2<1	2<1	2>1	2<1		**2≥1**	**2≥1**	**2≈1**	**2≥1**	**P2**
231	2<1	2≤1	2≥1	2≤1		2≥1	2≥1	2≤1	2≥1	2≈1	2≈1	2≈1	2≈1	2≈1		2>1	2>1	2≈1	2>1	P3
238	2<1	2≤1	2≥1	2≤1		2≥1	2≥1	2≤1	2≥1	2≈1	2≈1	2≈1	2≈1	2≈1		2>1	2>1	2≈1	2>1	P3
243						2≥1	2≥1	2≤1	2≥1		2≈1	2≈1	2≈1	2≈1		2>1	2>1	2≈1	2>1	
245	2<1	2≤1	2≥1	2≤1		2≥1	2≥1	2≤1	2≥1	2≈1	2≈1	2≈1	2≈1	2≈1		2>1	2>1	2≈1	2>1	P3
253	2<1	2≤1	2≥1	2≤1		2≥1	2≥1	2≤1	2≥1	2≈1	2≈1	2≈1	2≈1	2≈1		2>1	2>1	2≈1	2>1	P3
260	2<1	2≤1	2≥1	2≤1		2≥1	2≥1	2≤1	2≥1	2≈1	2≈1	2≈1	2≈1	2≈1		2>1	2>1	2≈1	2>1	P3
263						2≥1	2≥1	2≤1	2≥1		2≈1	2≈1	2≈1	2≈1		2>1	2>1	2≈1	2>1	
267	2<1	2≤1	2≥1	2≤1		2≥1	2≥1	2≤1	2≥1	2≈1	2≈1	2≈1	2≈1	2≈1		2>1	2>1	2≈1	2>1	P3
270	2<1	2<1	2≥1	2<1		2≈1	2≈1	2≈1	2≈1		2≈1	2≈1	2≈1	2≈1		2>1	2>1	2≈1	2>1	
273	2<1	2≤1	2≥1	2≤1		2≥1	2≥1	2≤1	2≥1	2≈1	2≈1	2≈1	2≈1	2≈1		2>1	2>1	2≈1	2>1	P3
280	2<1	2≤1	2≥1	2≤1		2≥1	2≥1	2≤1	2≥1	2≈1	2≈1	2≈1	2≈1	2≈1		2>1	2>1	2≈1	2>1	P3
287	2<1	2≤1	2≥1	2≤1		2≥1	2≥1	2≤1	2≥1	2≈1	2≈1	2≈1	2≈1	2≈1		2>1	2>1	2≈1	2>1	P3
294	2<1	2≤1	2≥1	2≤1		2≥1	2≥1	2≤1	2≥1	2≈1	2≈1	2≈1	2≈1	2≈1		2>1	2>1	2≈1	2>1	P3
304	2<1	2≤1	2≥1	2≤1		2≥1	2≥1	2≤1	2≥1	2≈1	2≈1	2≈1	2≈1	2≈1		2>1	2>1	2≈1	2>1	P3
305	2<1	2≈1	2≈1	2≈1		2≤1	2≤1	2≥1	2≤1	2≈1	2≈1	2≈1	2≈1	2≈1		2<1	2<1	2≈1	2<1	P1
306	2<1	2≈1	2≈1	2≈1		2≤1	2≤1	2≥1	2≤1	2≈1	2≈1	2≈1	2≈1	2≈1		2<1	2<1	2≈1	2<1	P1

Δdn_BCS(2−1) = dn_BCS2(sc,ch)−dn_BCS1(sc,ch)

COLD PLATEAU

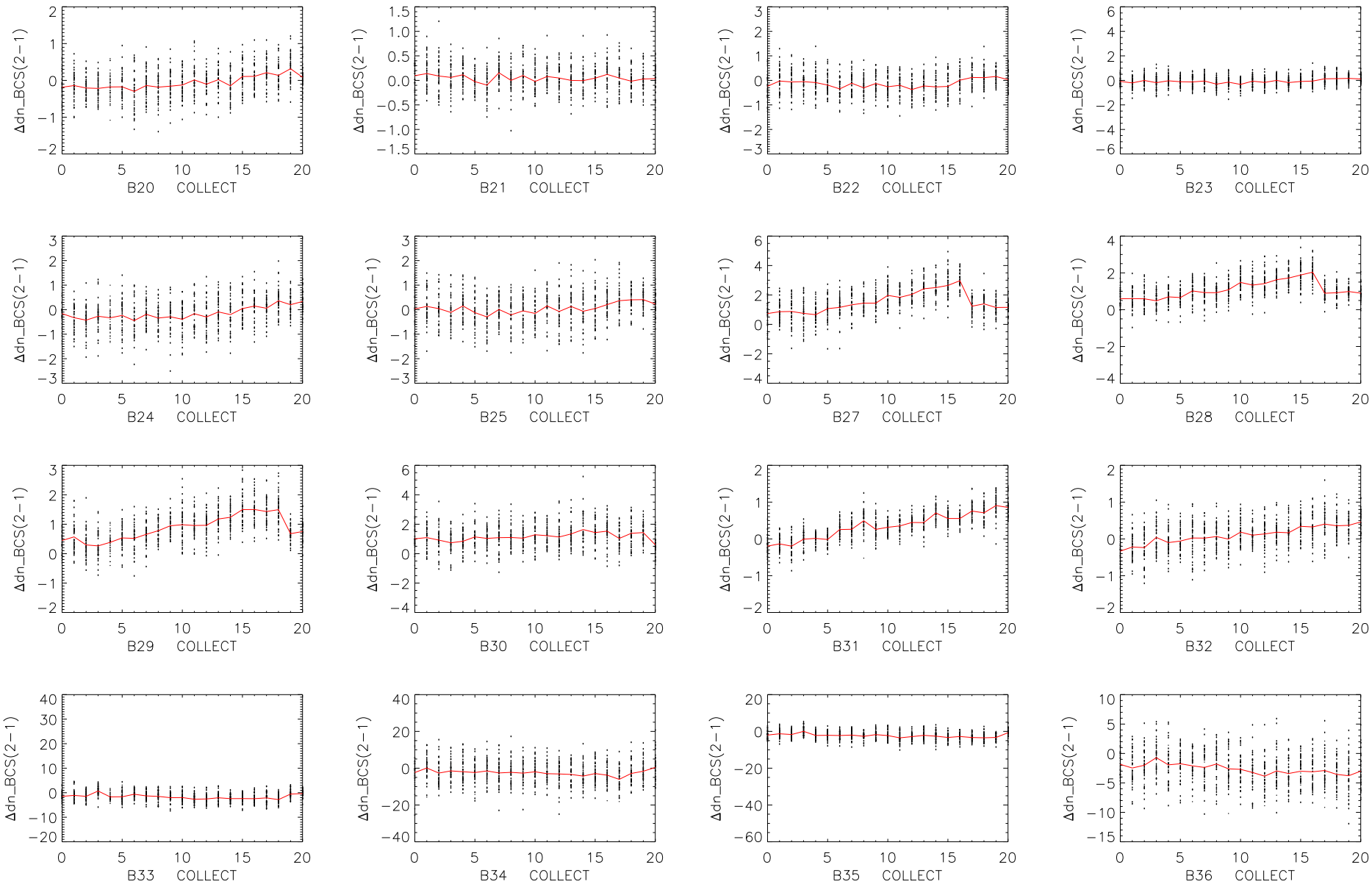
CHANNEL 5



Δdn_BCS(2−1) = dn_BCS2(sc,ch)−dn_BCS1(sc,ch)

HOT PLATEAU

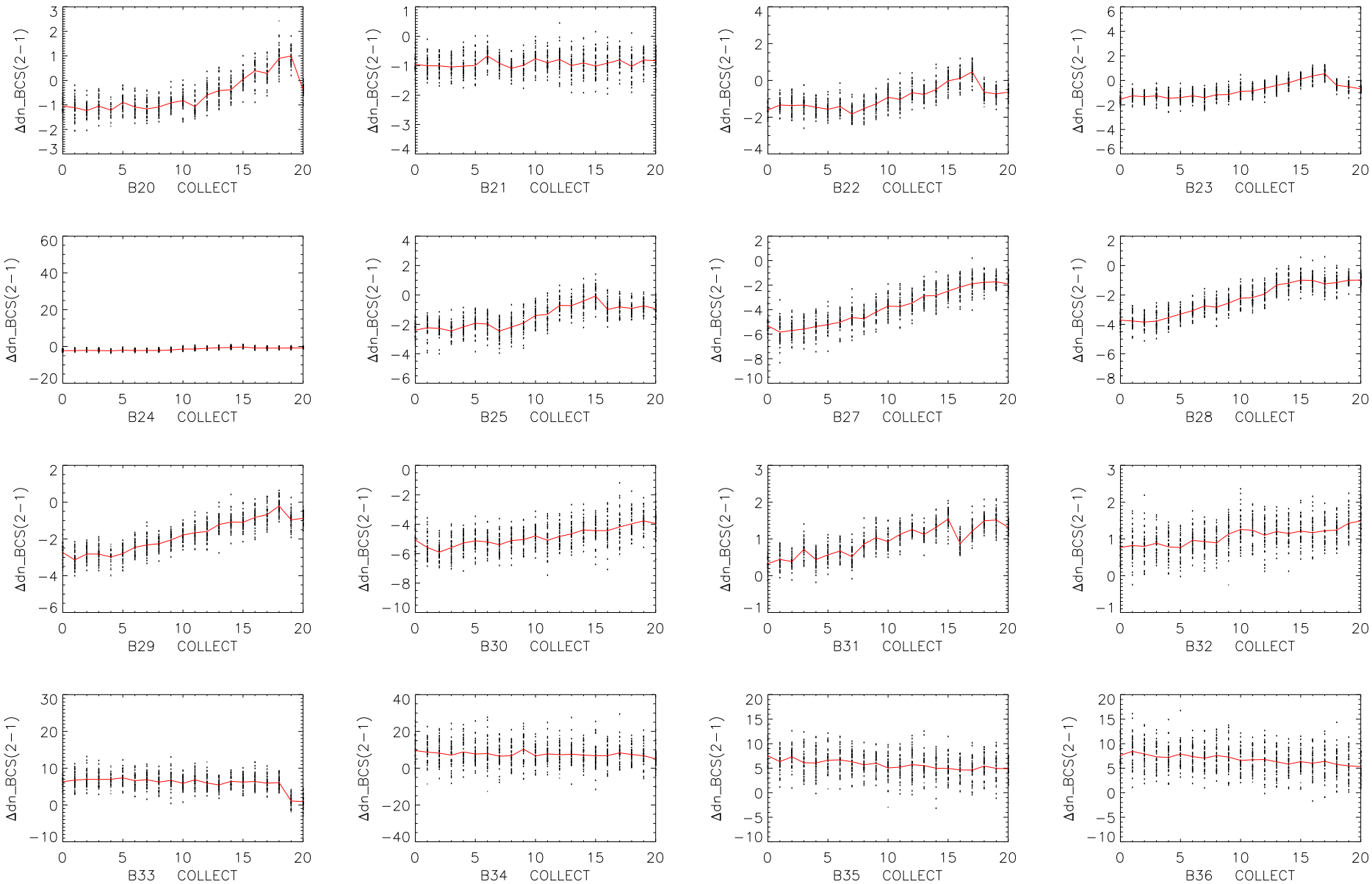
CHANNEL 5



Δdn_BCS(2−1) = dn_BCS2(sc,ch)−dn_BCS1(sc,ch)

NOMINAL1 PLATEAU

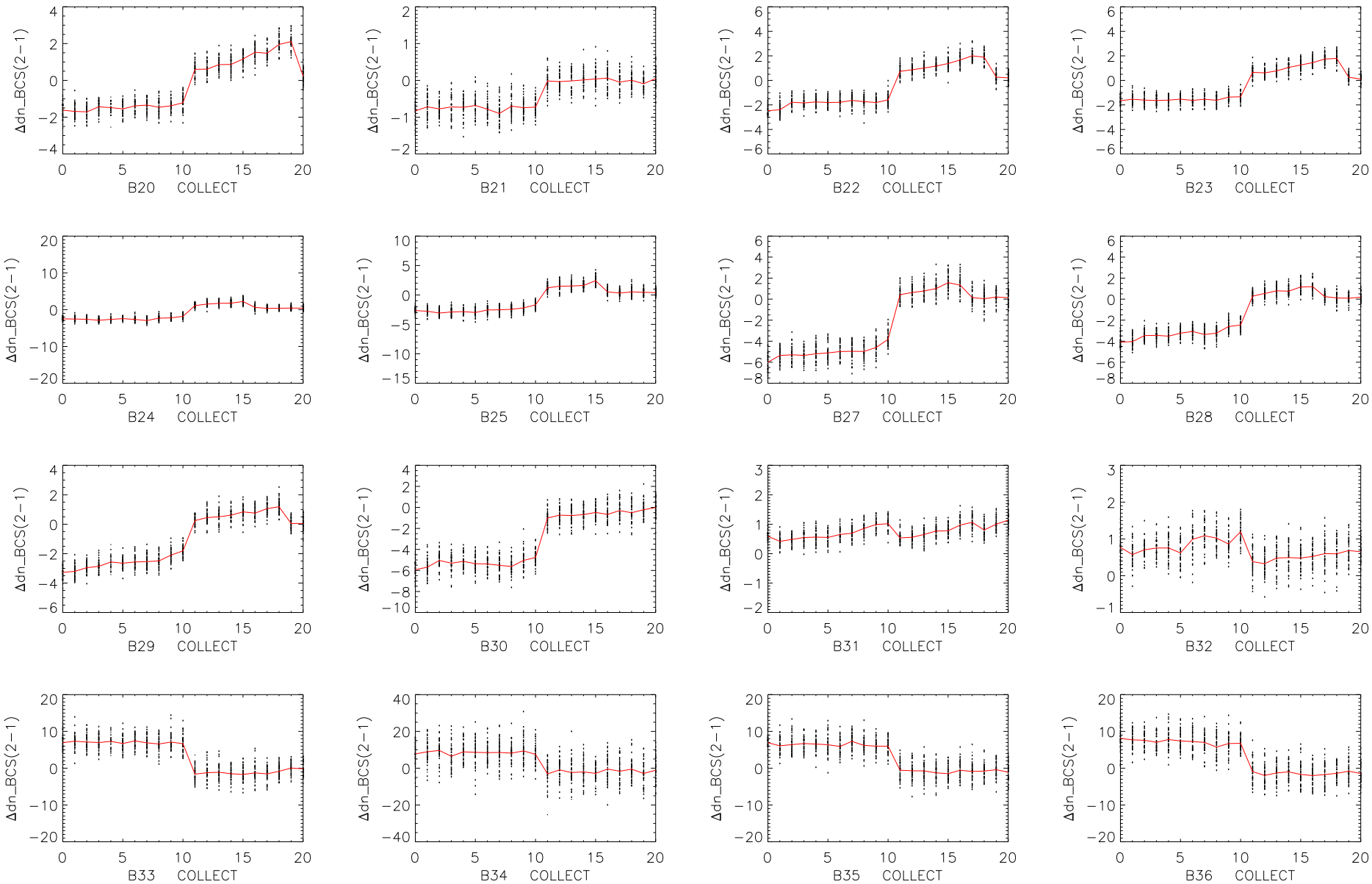
CHANNEL 5



Δdn_BCS(2−1) = dn_BCS2(sc,ch)−dn_BCS1(sc,ch)

NOMINAL2 PLATEAU

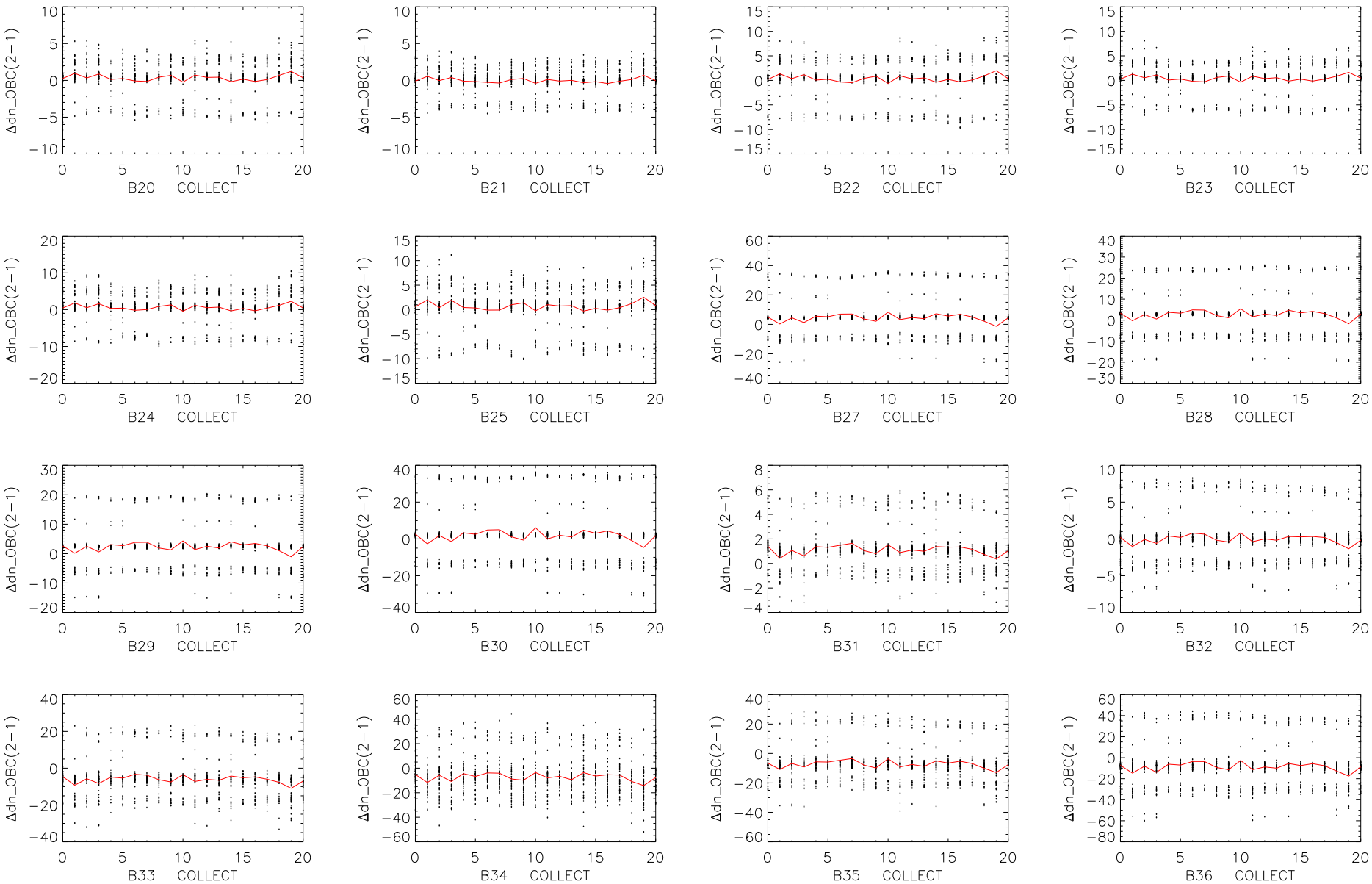
CHANNEL 5



Δdn_OBC(2−1) = dn_OBC2(sc,ch)−dn_OBC1(sc,ch)

COLD PLATEAU

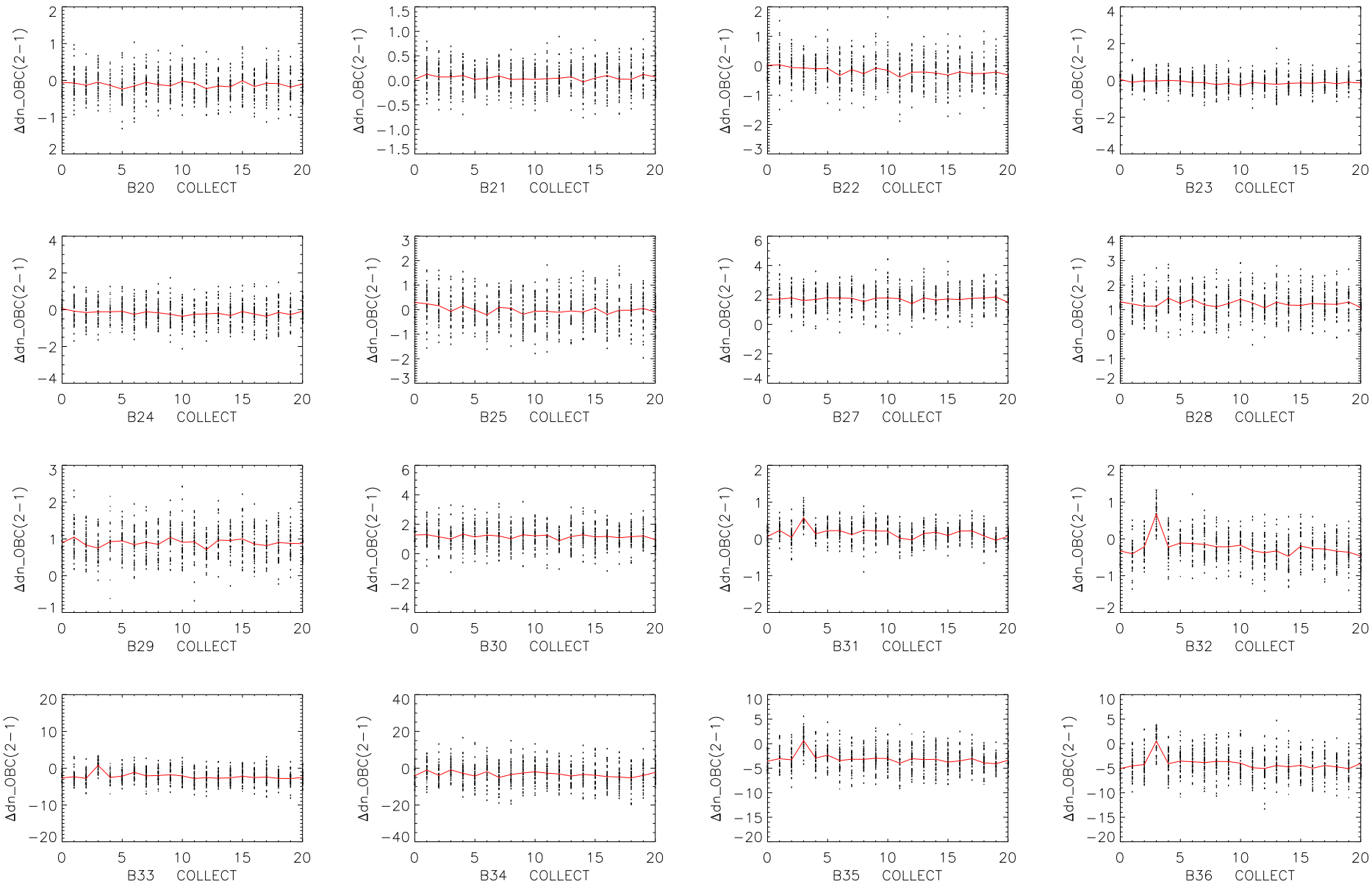
CHANNEL 5



Δdn_OBC(2−1) = dn_OBC2(sc,ch)−dn_OBC1(sc,ch)

HOT PLATEAU

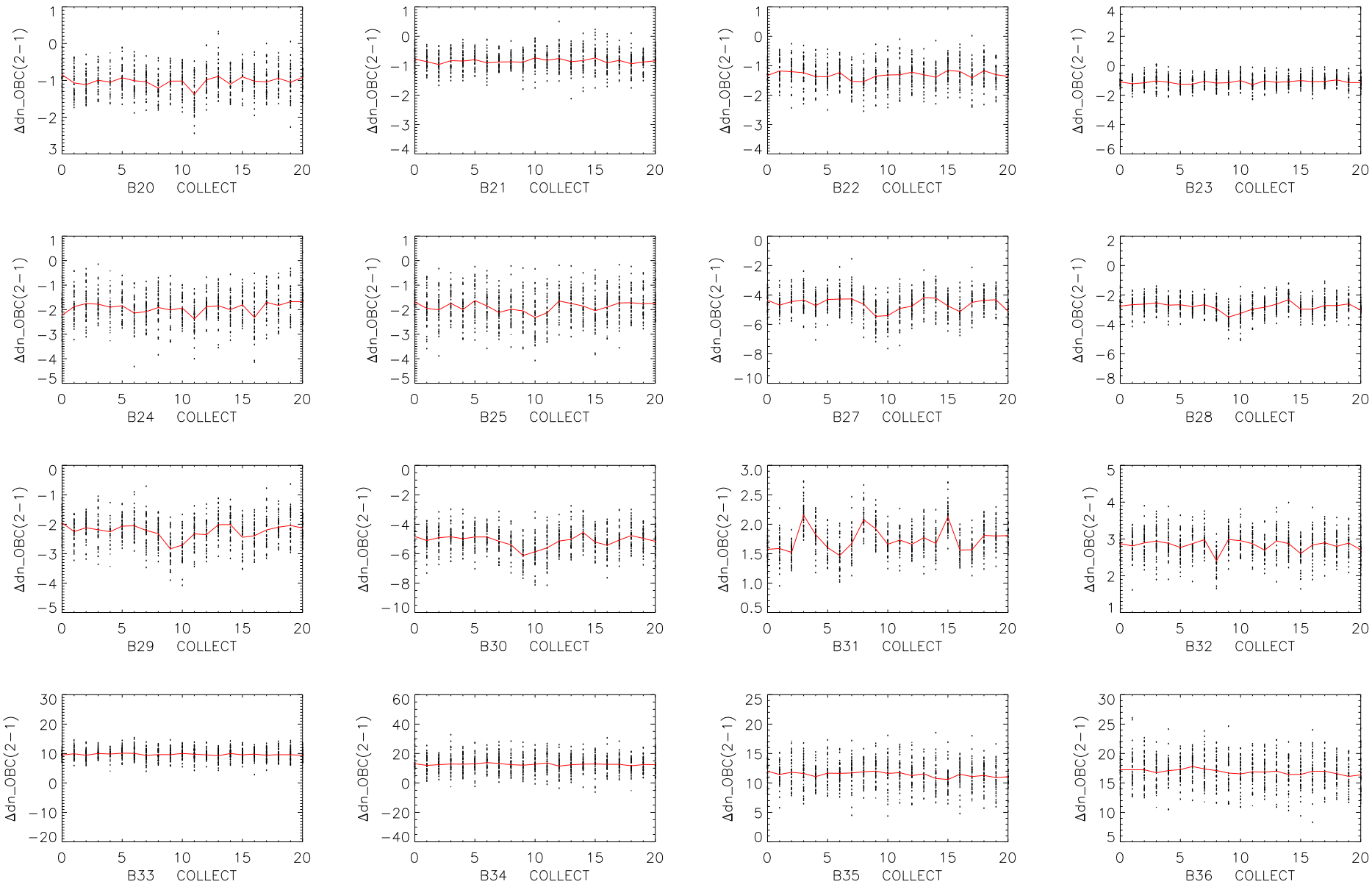
CHANNEL 5



Δdn_OBC(2−1) = dn_OBC2(sc,ch)−dn_OBC1(sc,ch)

NOMINAL1 PLATEAU

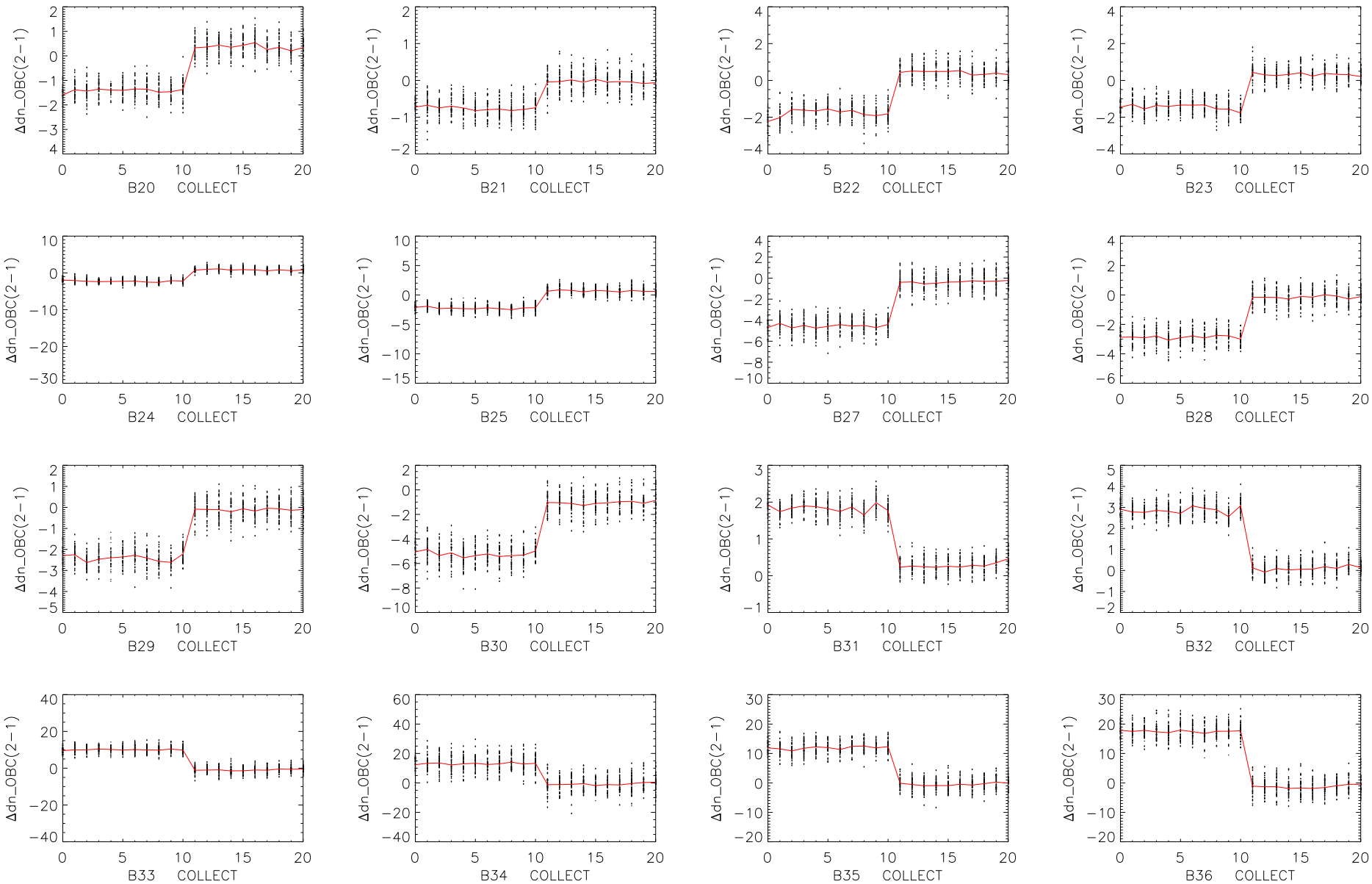
CHANNEL 5

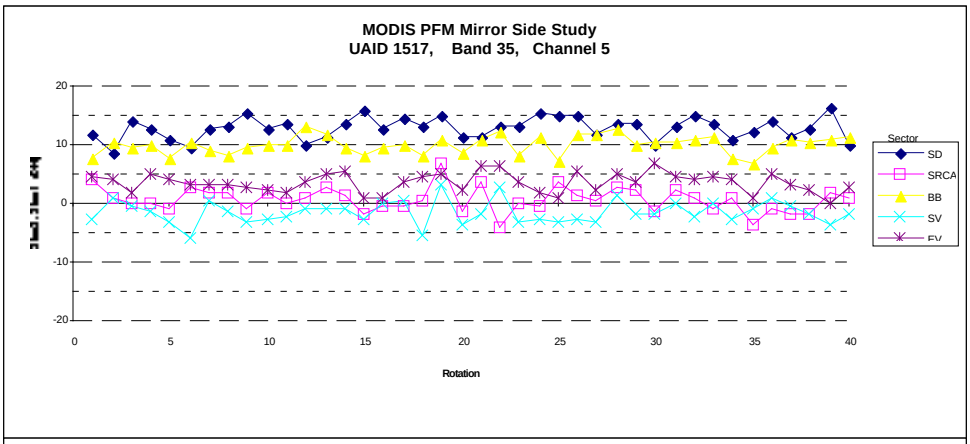


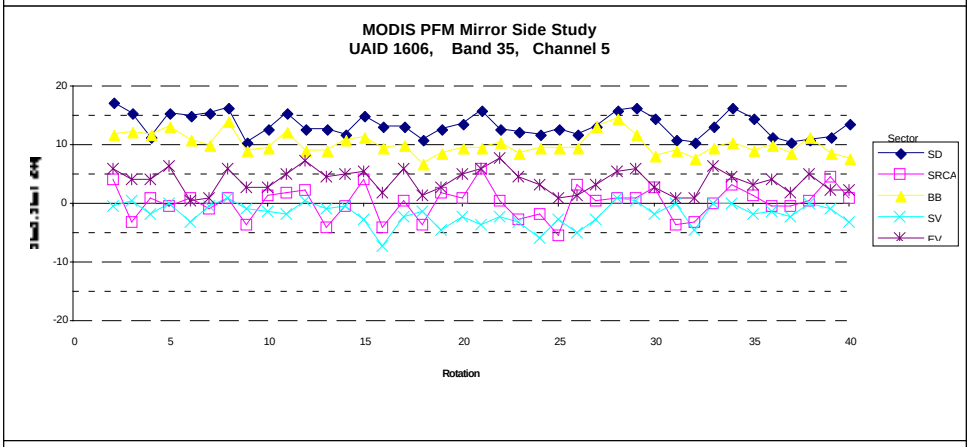
Δdn_OBC(2−1) = dn_OBC2(sc,ch)−dn_OBC1(sc,ch)

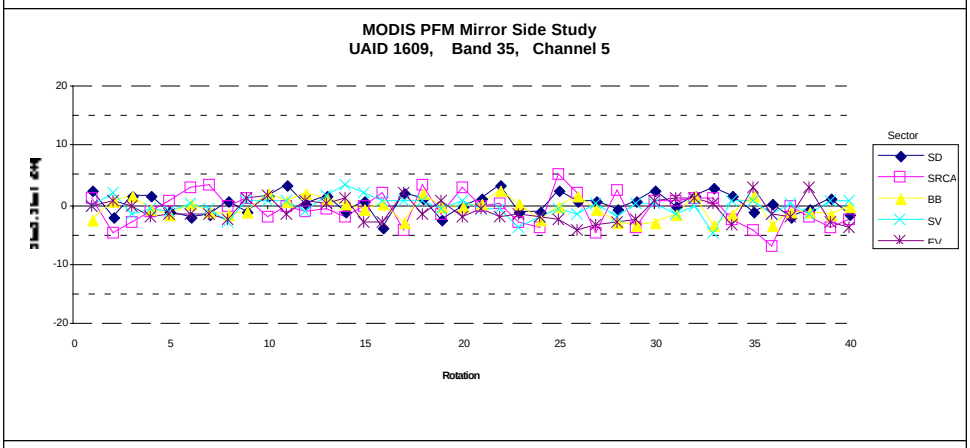
NOMINAL2 PLATEAU

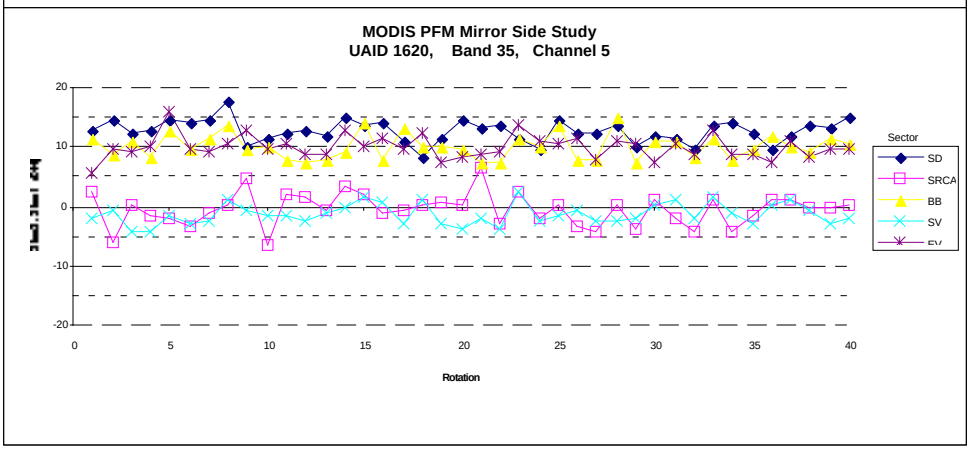
CHANNEL 5

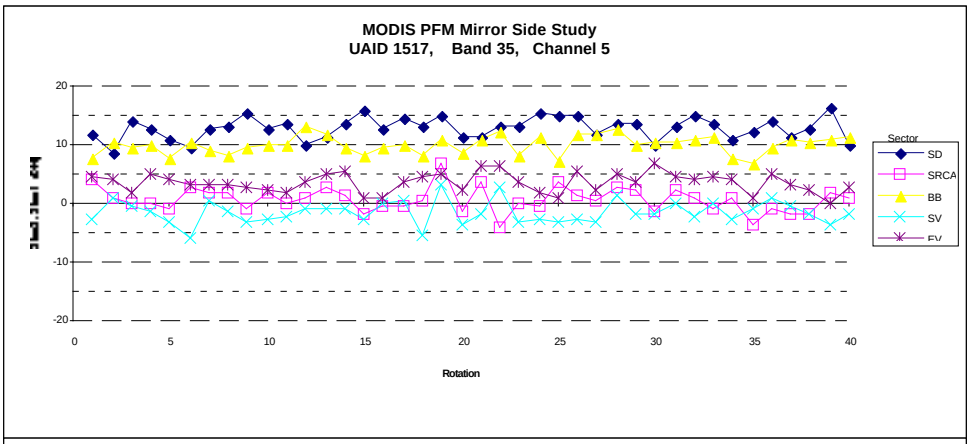


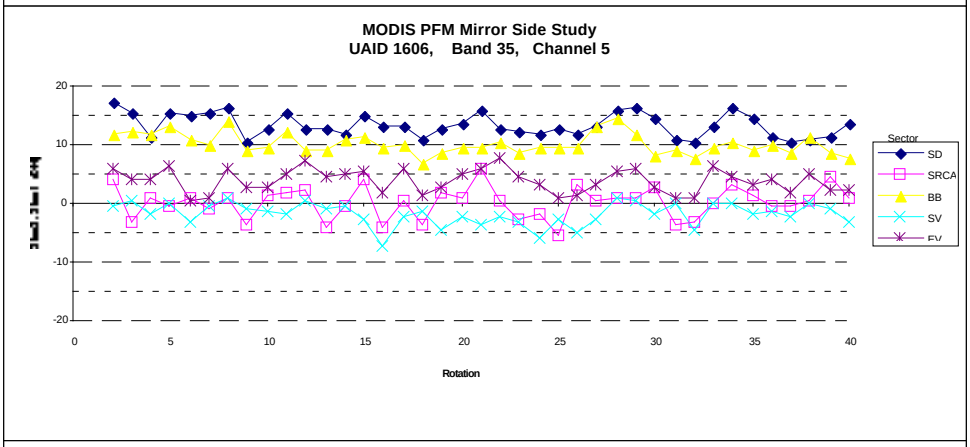

MODIS PFM Mirror Side Study
UAID 1517, Band 35, Channel 5
Rotation
Sector
SD
SRCA
BB
SV
EV

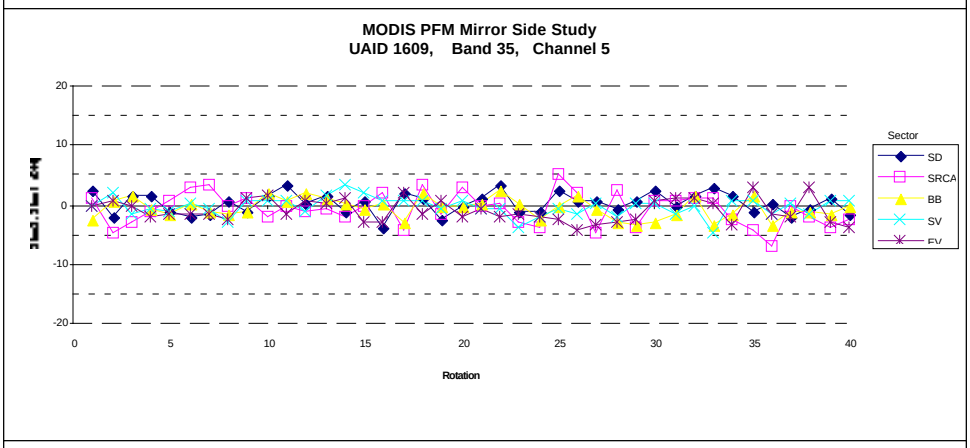

MODIS PFM Mirror Side Study
UAID 1606, Band 35, Channel 5
Rotation
Sector
SD
SRCA
BB
SV
EV

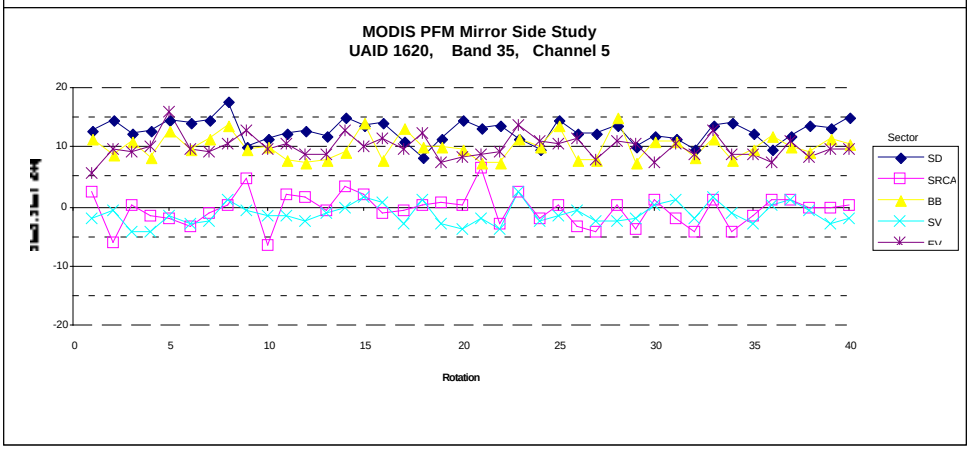

MODIS PFM Mirror Side Study
UAID 1609, Band 35, Channel 5
Rotation
Sector
SD
SRCA
BB
SV
EV


MODIS PFM Mirror Side Study
UAID 1620, Band 35, Channel 5
Rotation
Sector
SD
SRCA
BB
SV
EV

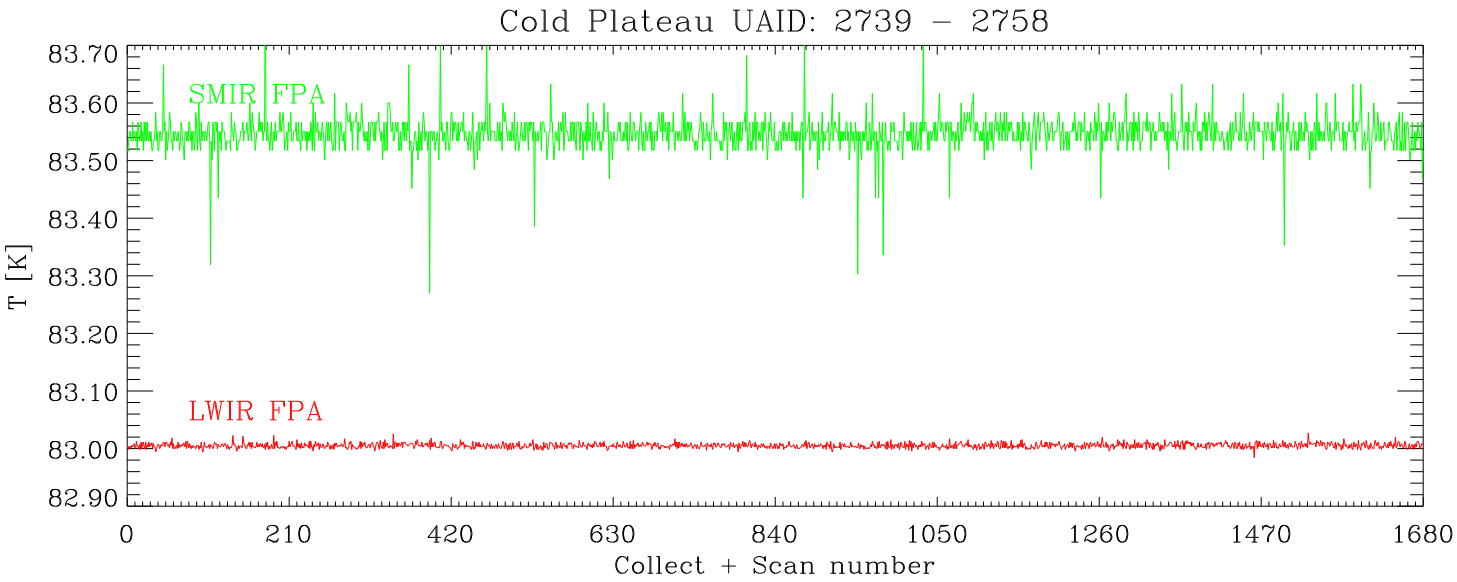

MODIS PFM Mirror Side Study
UAID 1517, Band 35, Channel 5
Rotation
Sector
SD
SRCA
BB
SV
EV

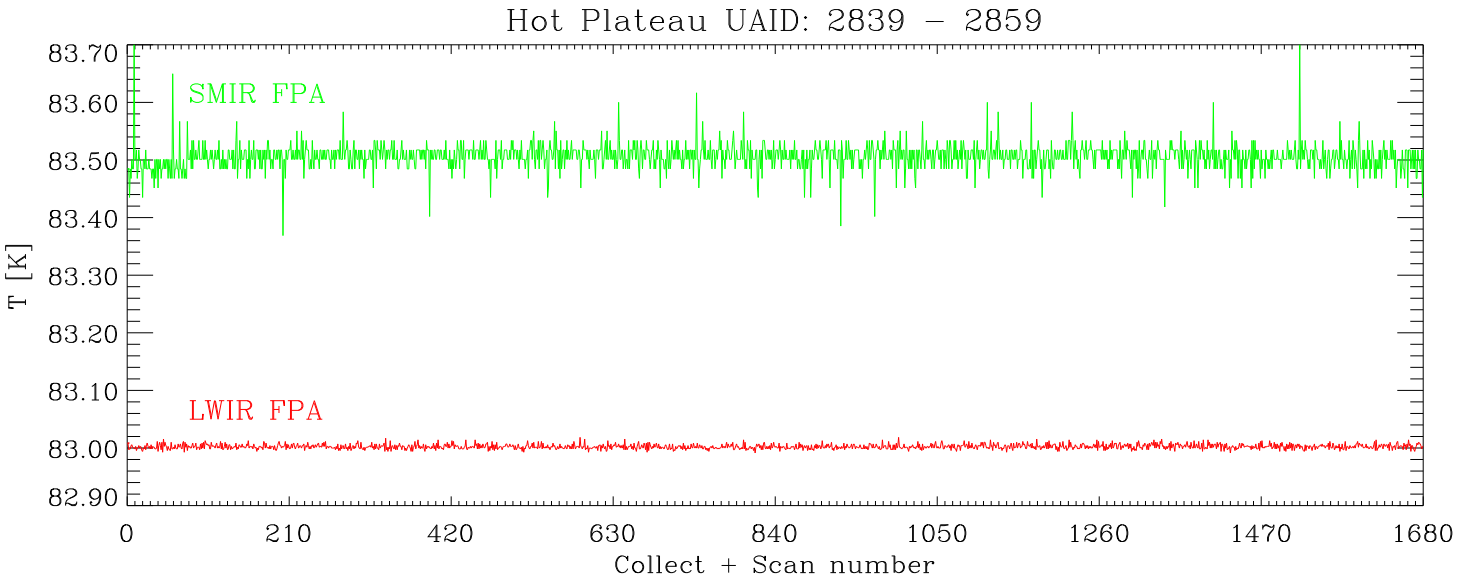

MODIS PFM Mirror Side Study
UAID 1606, Band 35, Channel 5
Rotation
Sector
SD
SRCA
BB
SV
EV

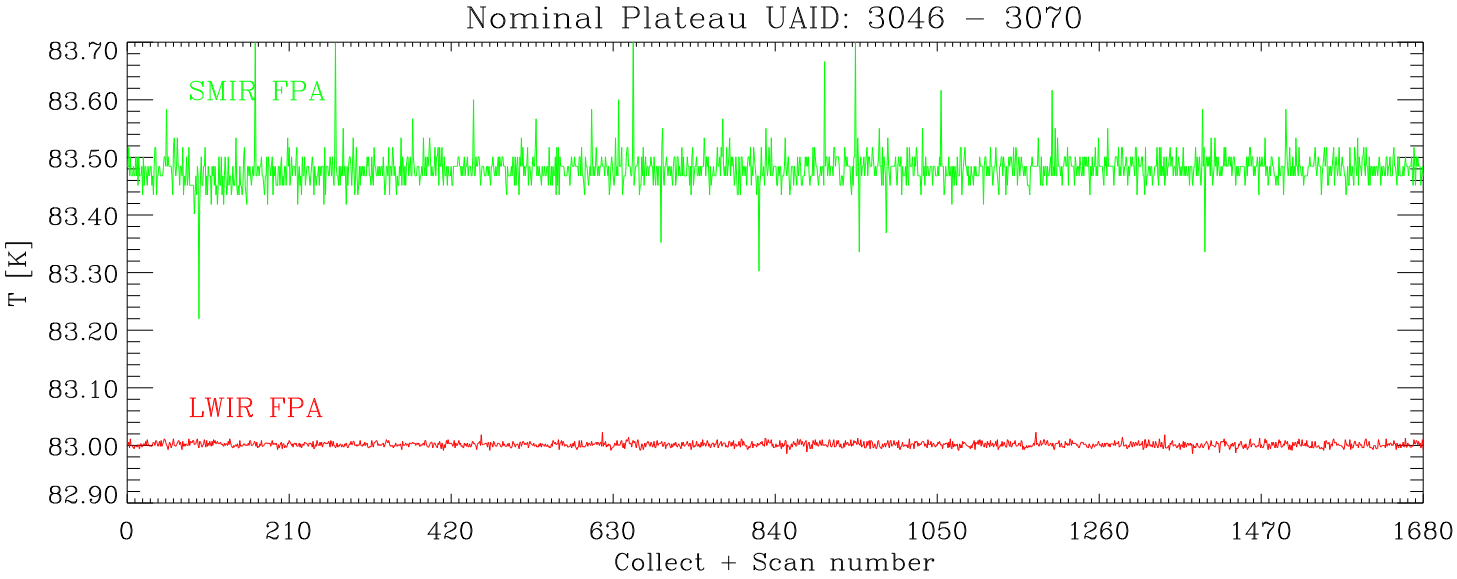

MODIS PFM Mirror Side Study
UAID 1609, Band 35, Channel 5
Rotation
Sector
SD
SRCA
BB
SV
EV


MODIS PFM Mirror Side Study
UAID 1620, Band 35, Channel 5
Rotation
Sector
SD
SRCA
BB
SV
EV

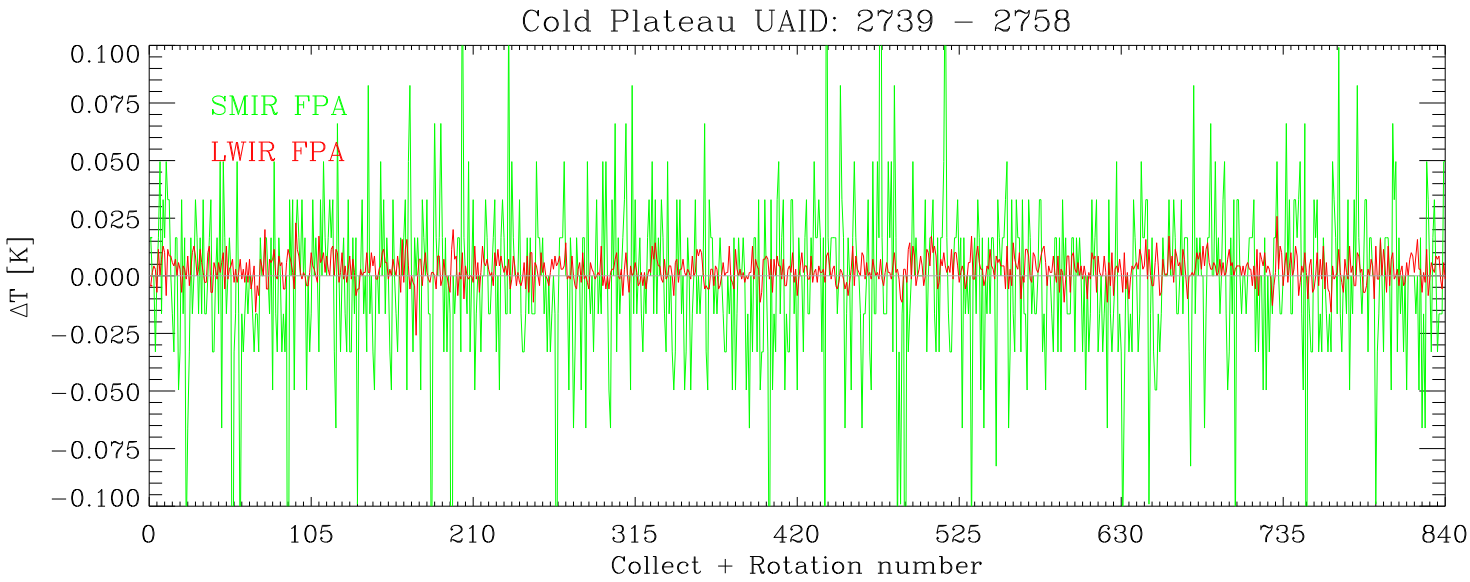
FM1 RC02 Primary/Comprehensive Test
SMIR/LWIR Focal Plane Temperatures

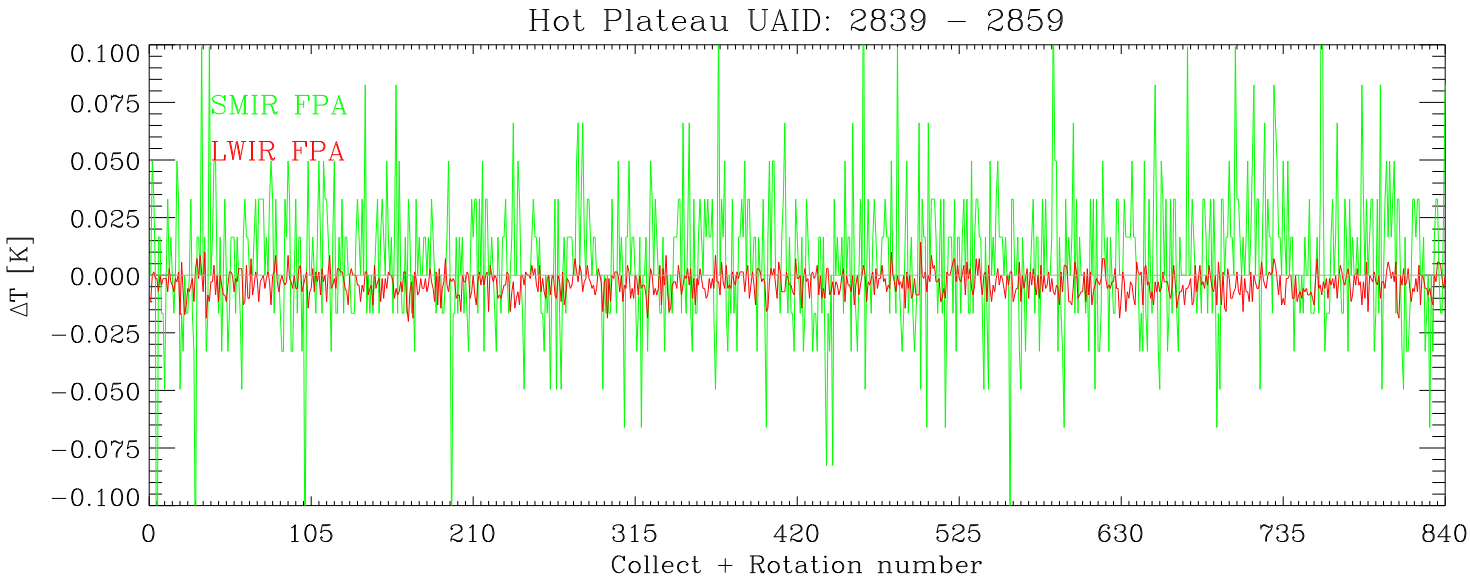


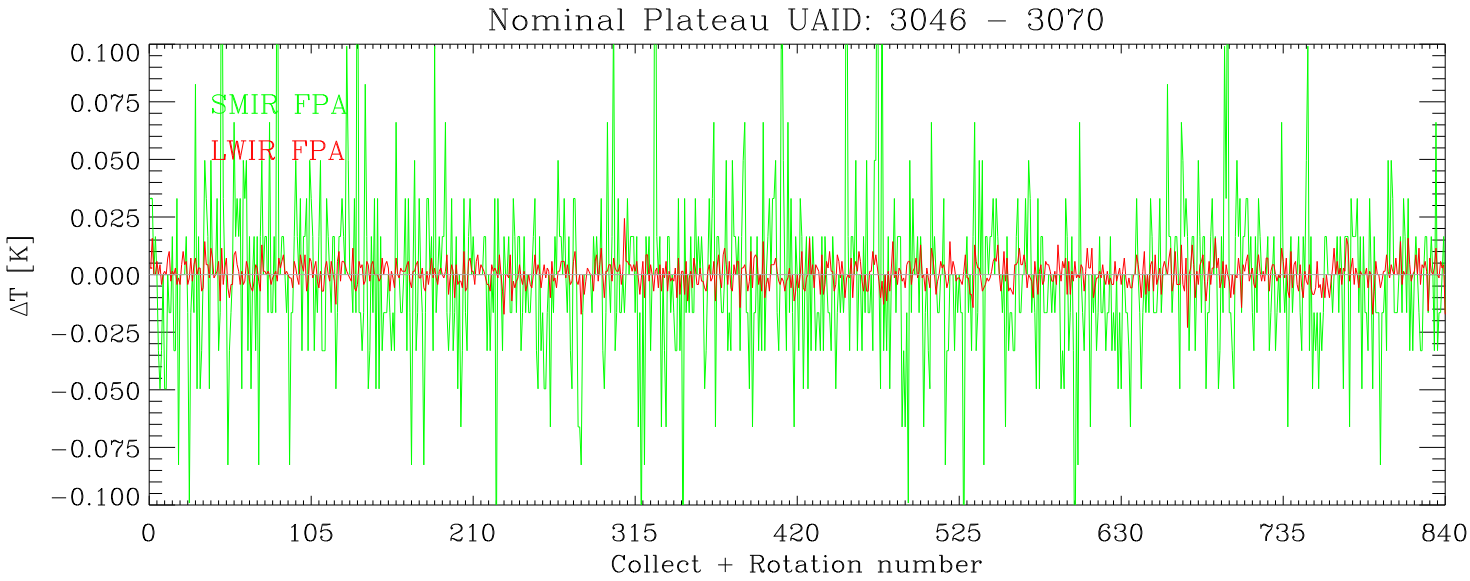




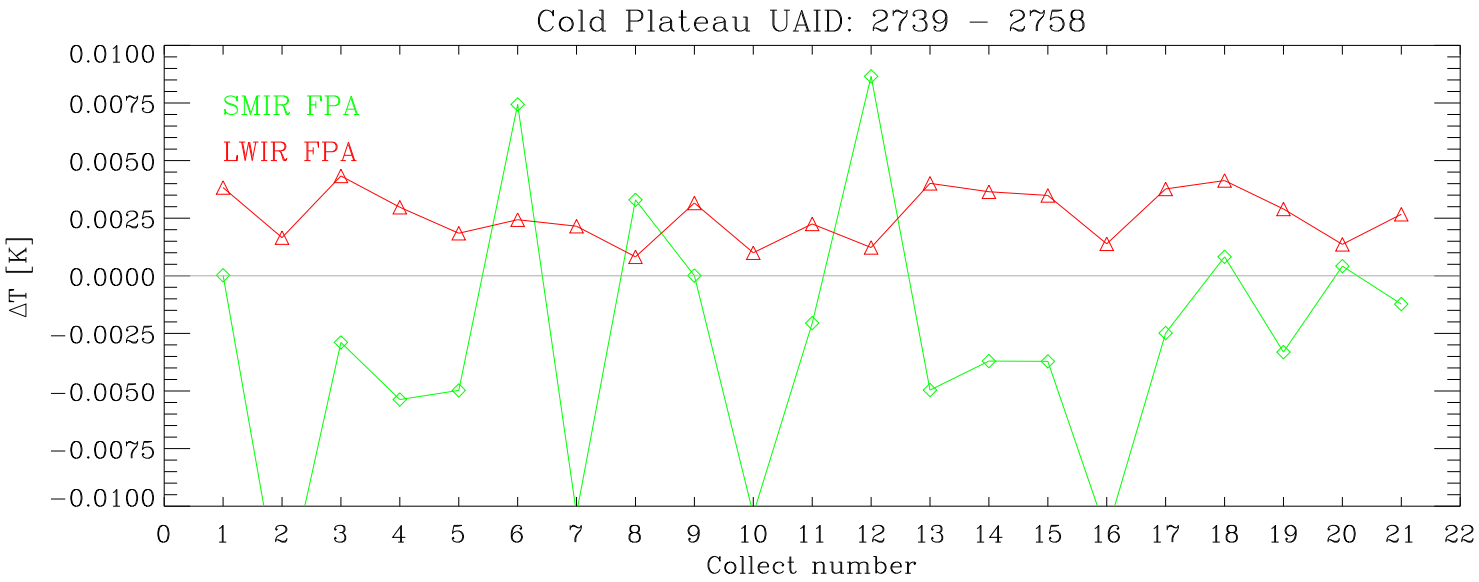
FM1 RC02 Primary/Comprehensive Test
SMIR/LWIR Focal Plane Temperature Differenc $T_{MS2}-T_{MS1}$

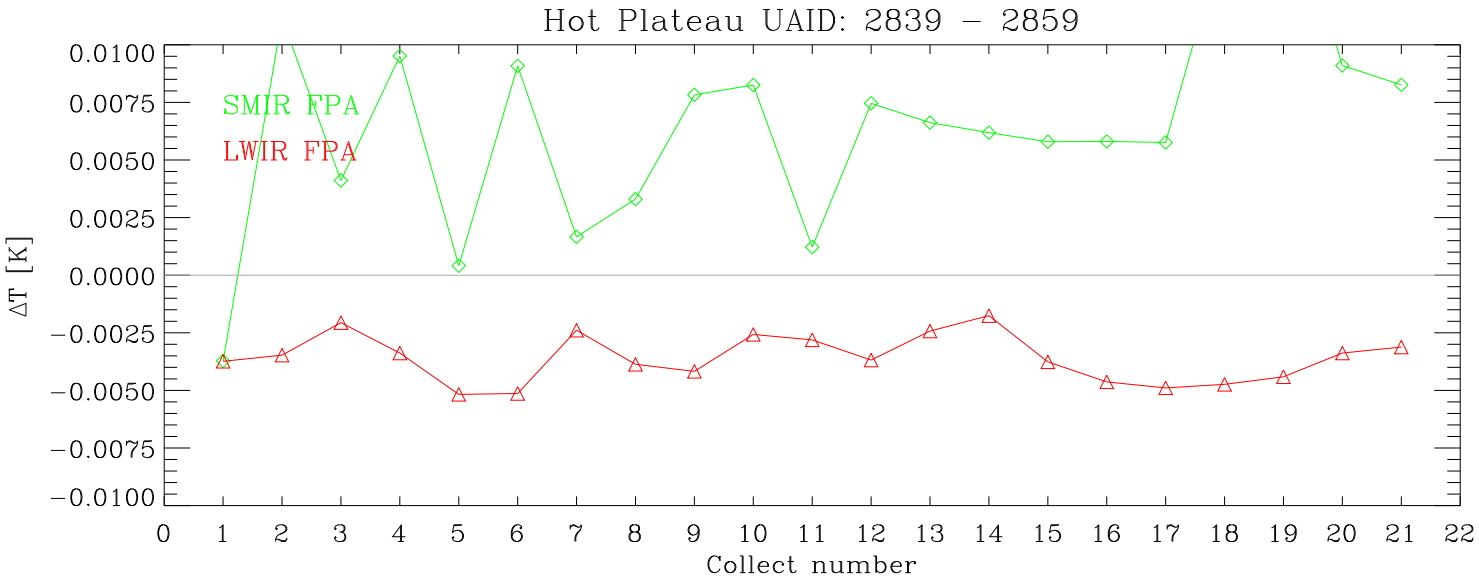


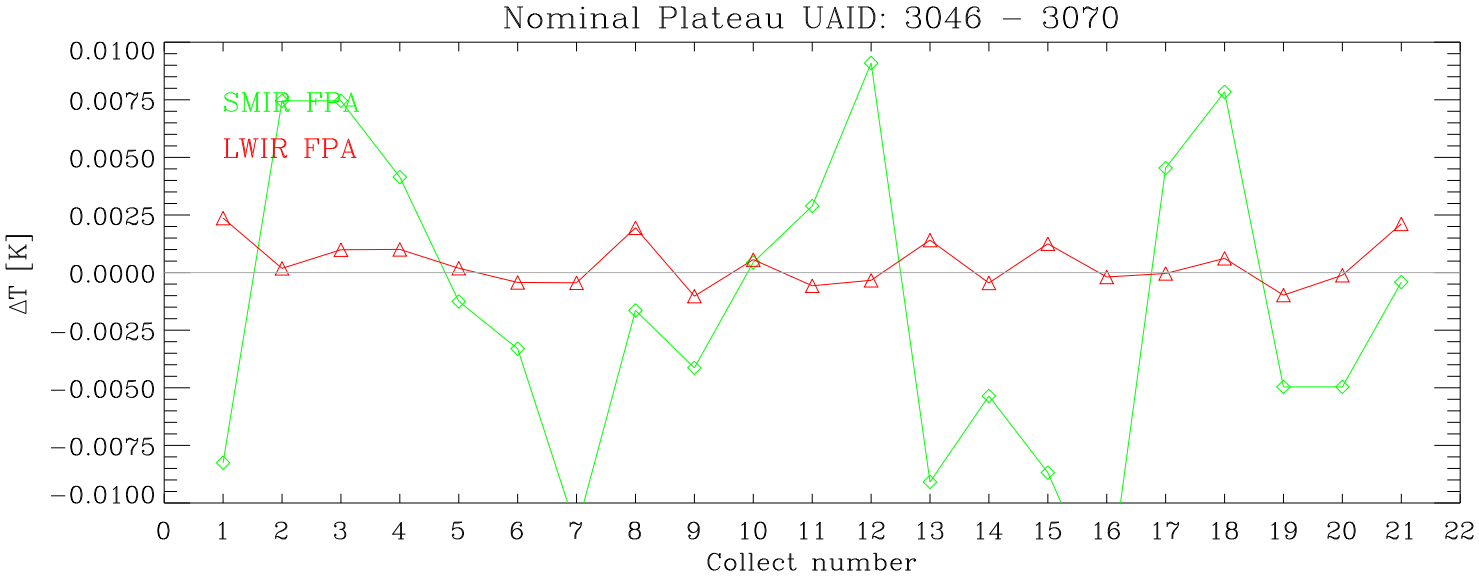




FM1 RC02 Primary/Comprehensive Test
SMIR/LWIR Focal Plane Temperature Differenc $T_{MS2}-T_{MS1}$ Collect Average



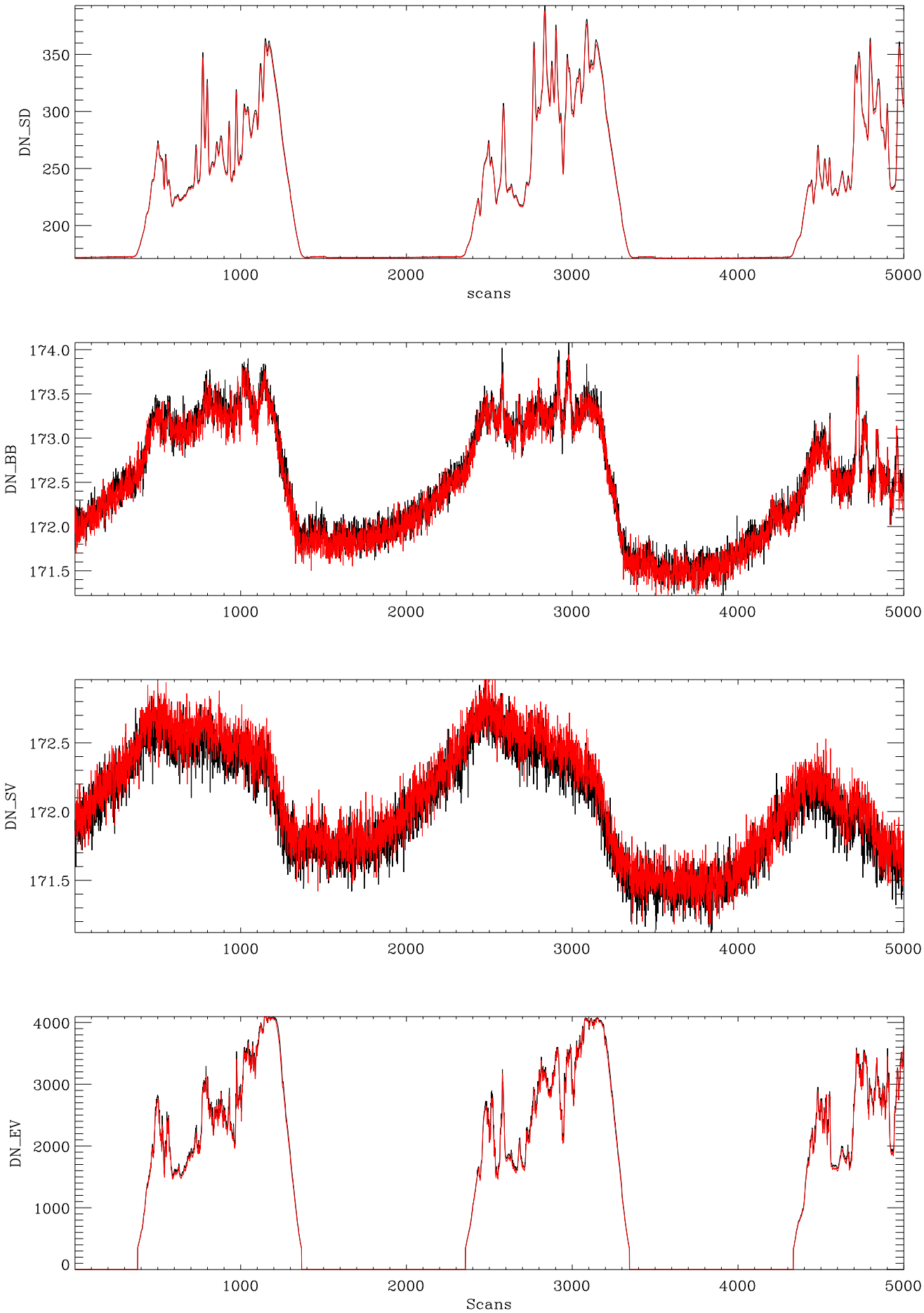




Stability within an orbit

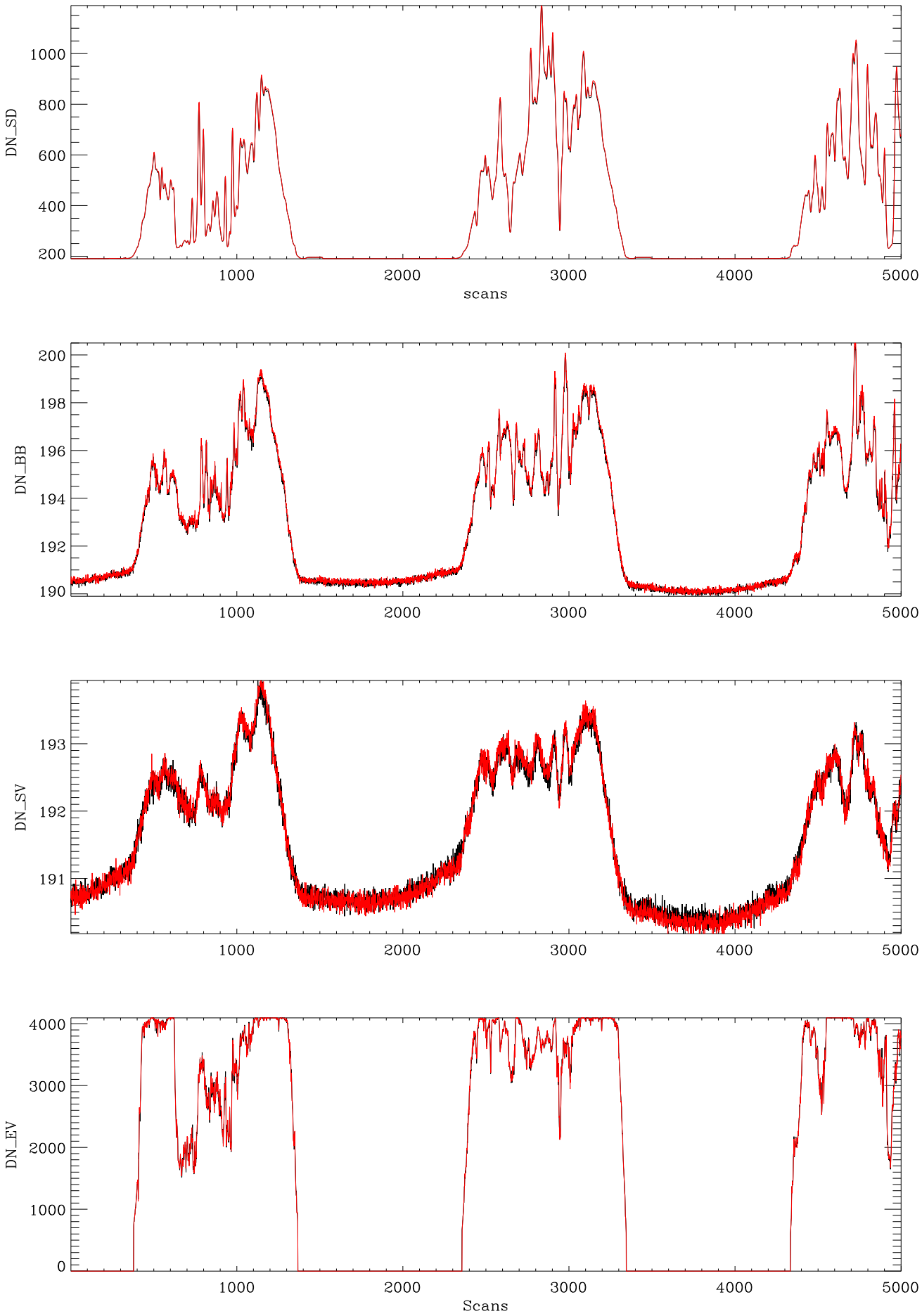
PFM Day 2000333(05:50 to 09:55) DN MS[1&2] for Band 8 Detector 5

Black: side1 Red: side2



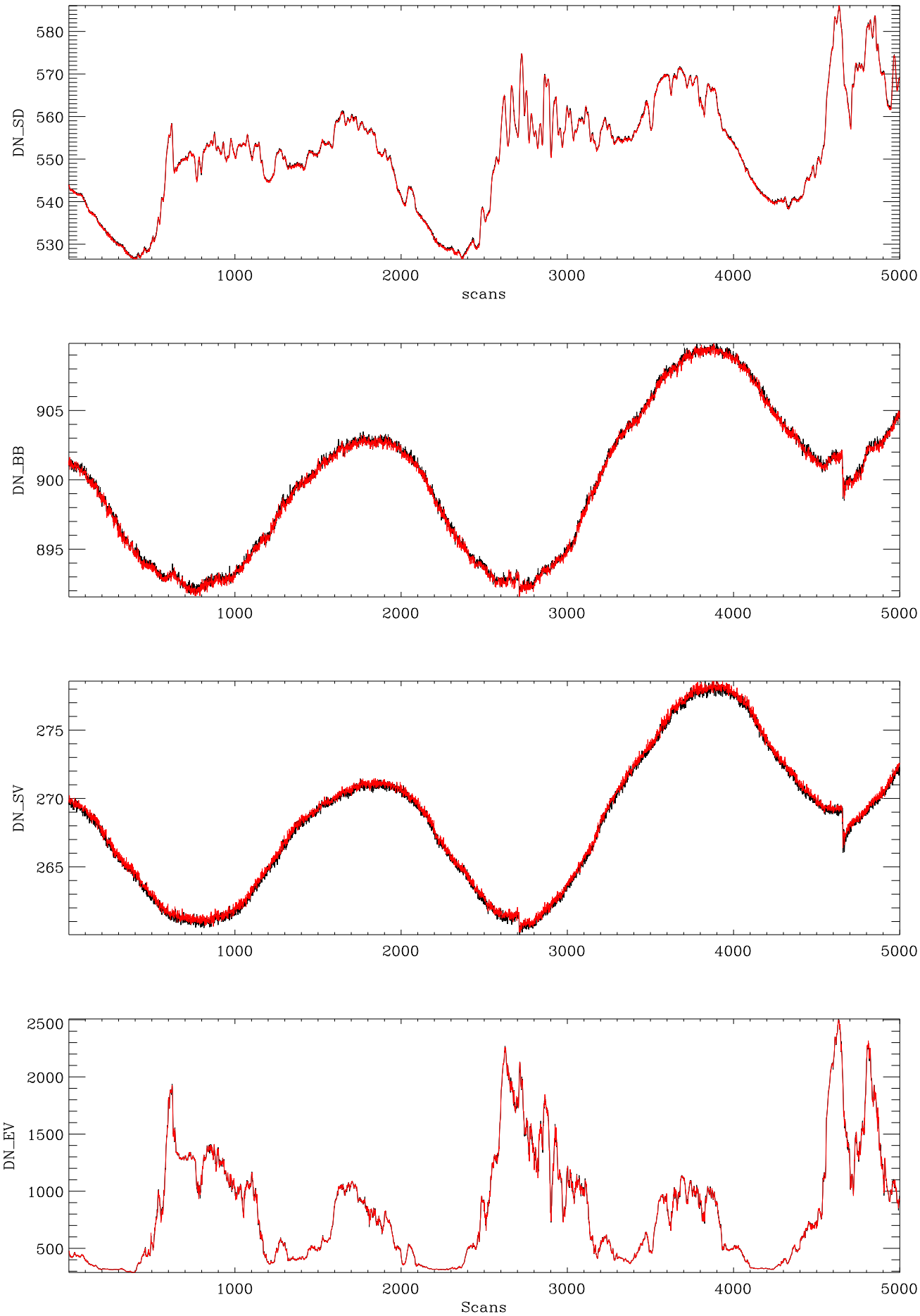
PFM Day 2000333(05:50 to 09:55) DN MS[1&2] for Band 16 Detector 5

Black: side1 Red: side2



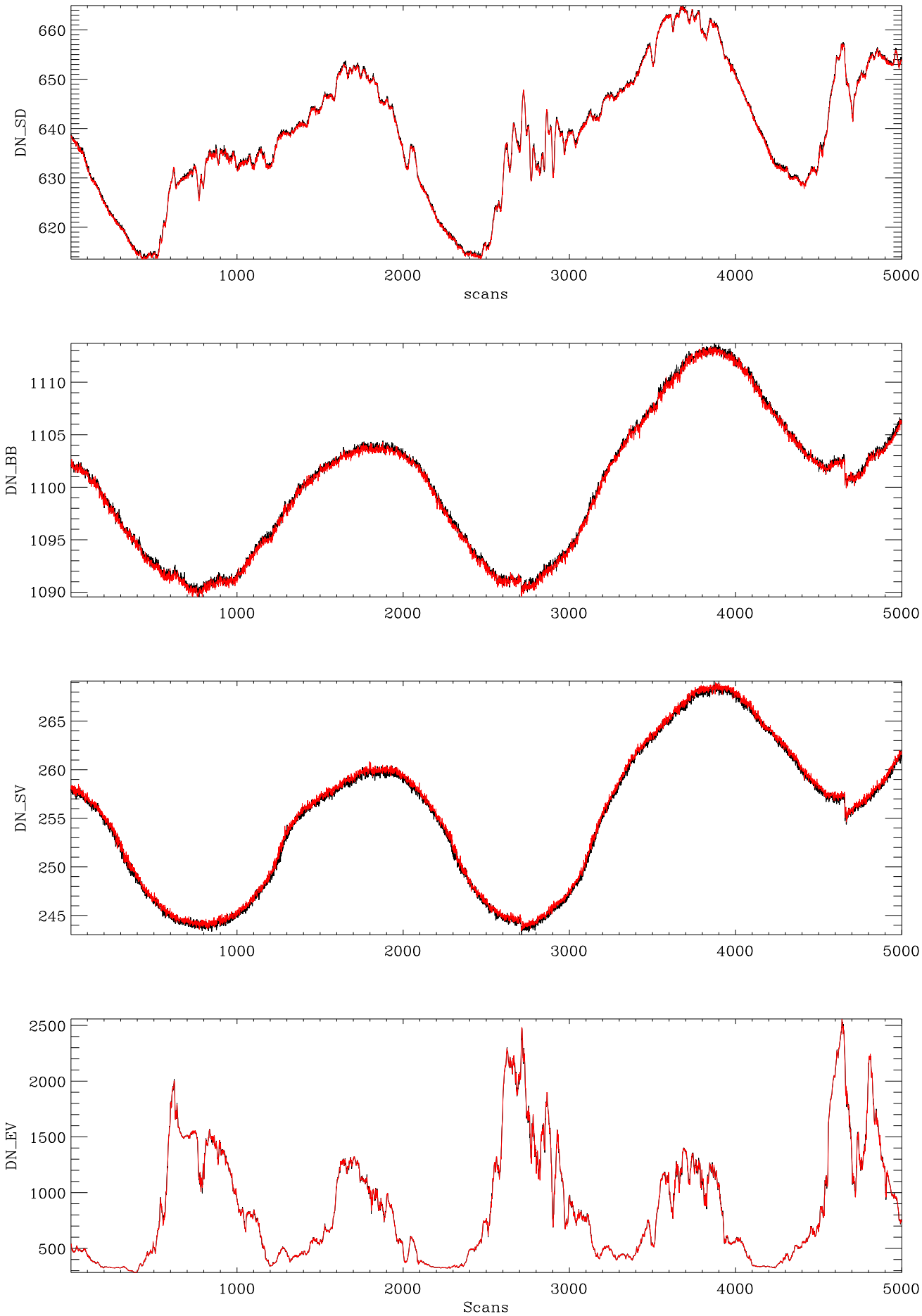
PFM Day 2000333(05:50 to 09:55) DN MS[1&2] for Band 20 Detector 5

Black: side1 Red: side2



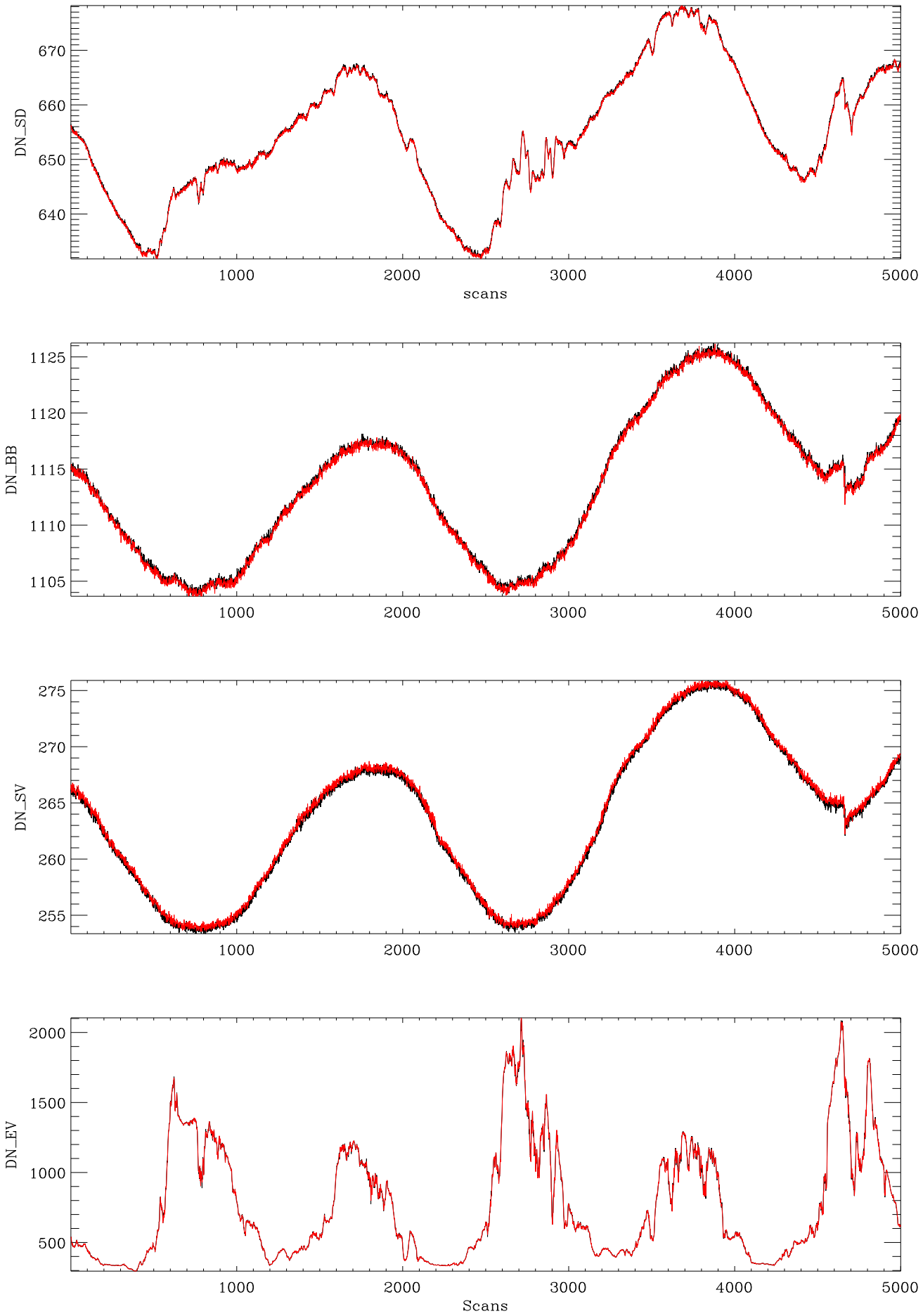
PFM Day 2000333(05:50 to 09:55) DN MS[1&2] for Band 22 Detector 5

Black: side1 Red: side2



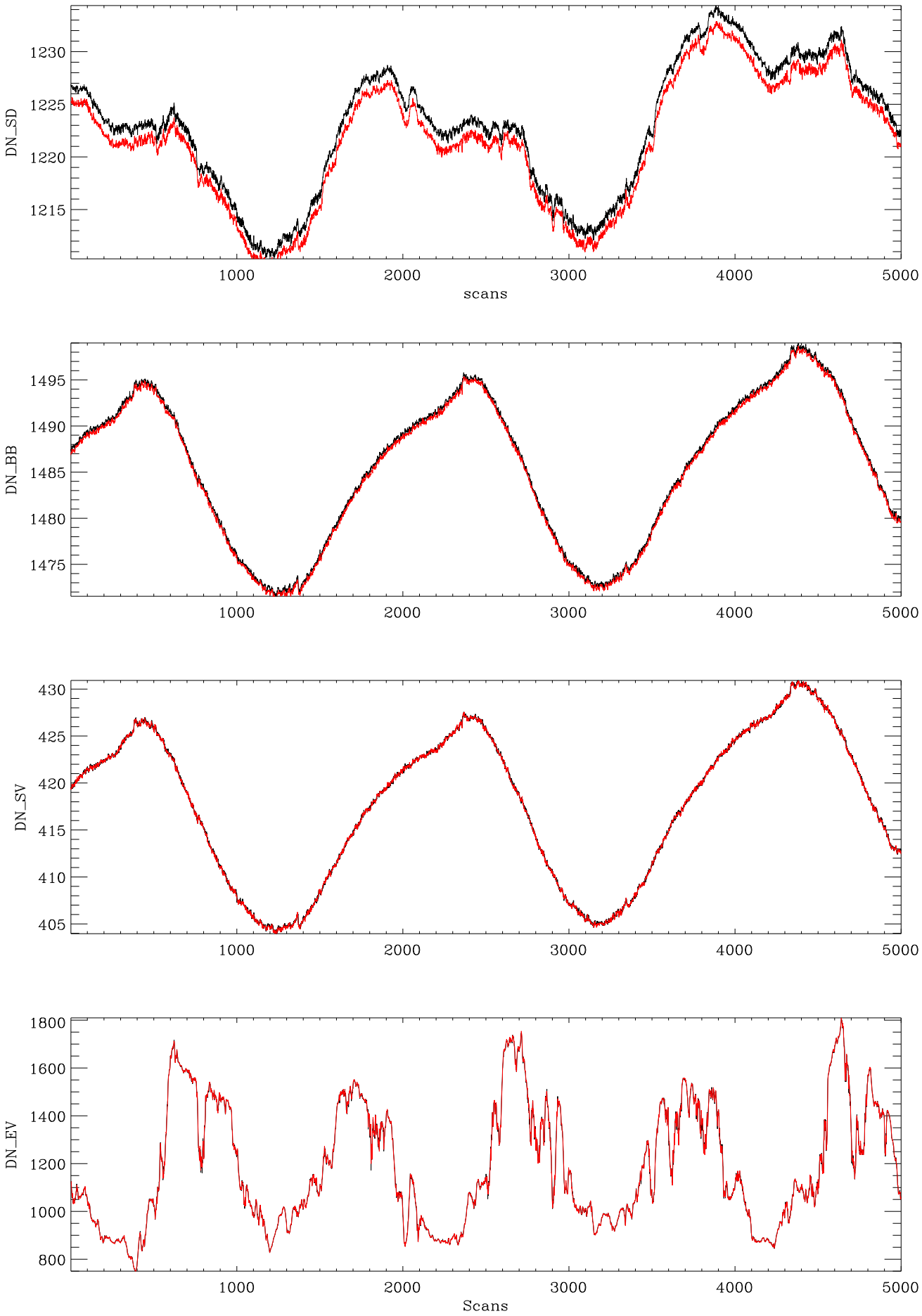
PFM Day 2000333(05:50 to 09:55) DN MS[1&2] for Band 23 Detector 5

Black: side1 Red: side2



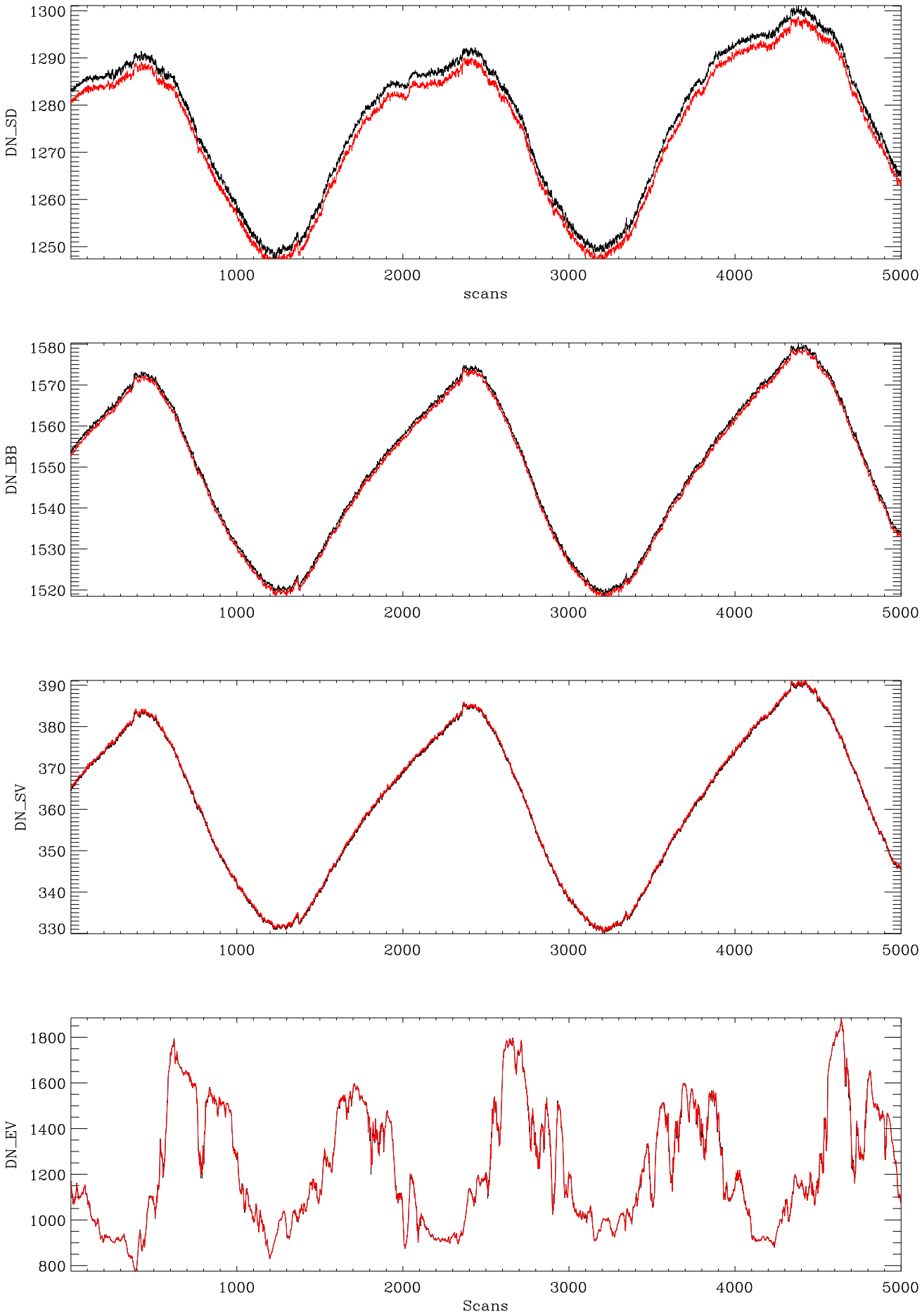
PFM Day 2000333(05:50 to 09:55) DN MS[1&2] for Band 31 Detector 5

Black: side1 Red: side2



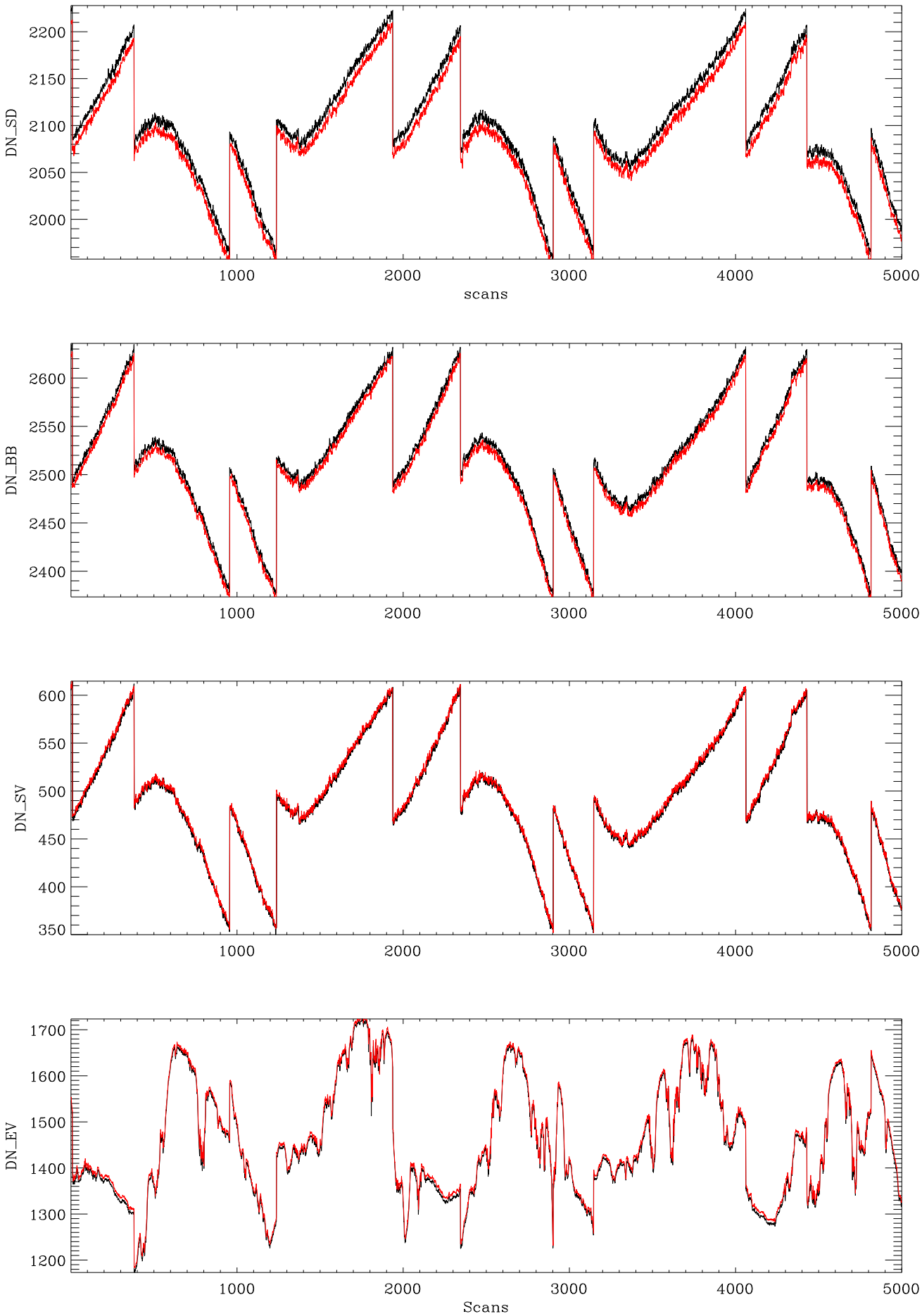
PFM Day 2000333(05:50 to 09:55) DN MS[1&2] for Band 32 Detector 5

Black: side1 Red: side2



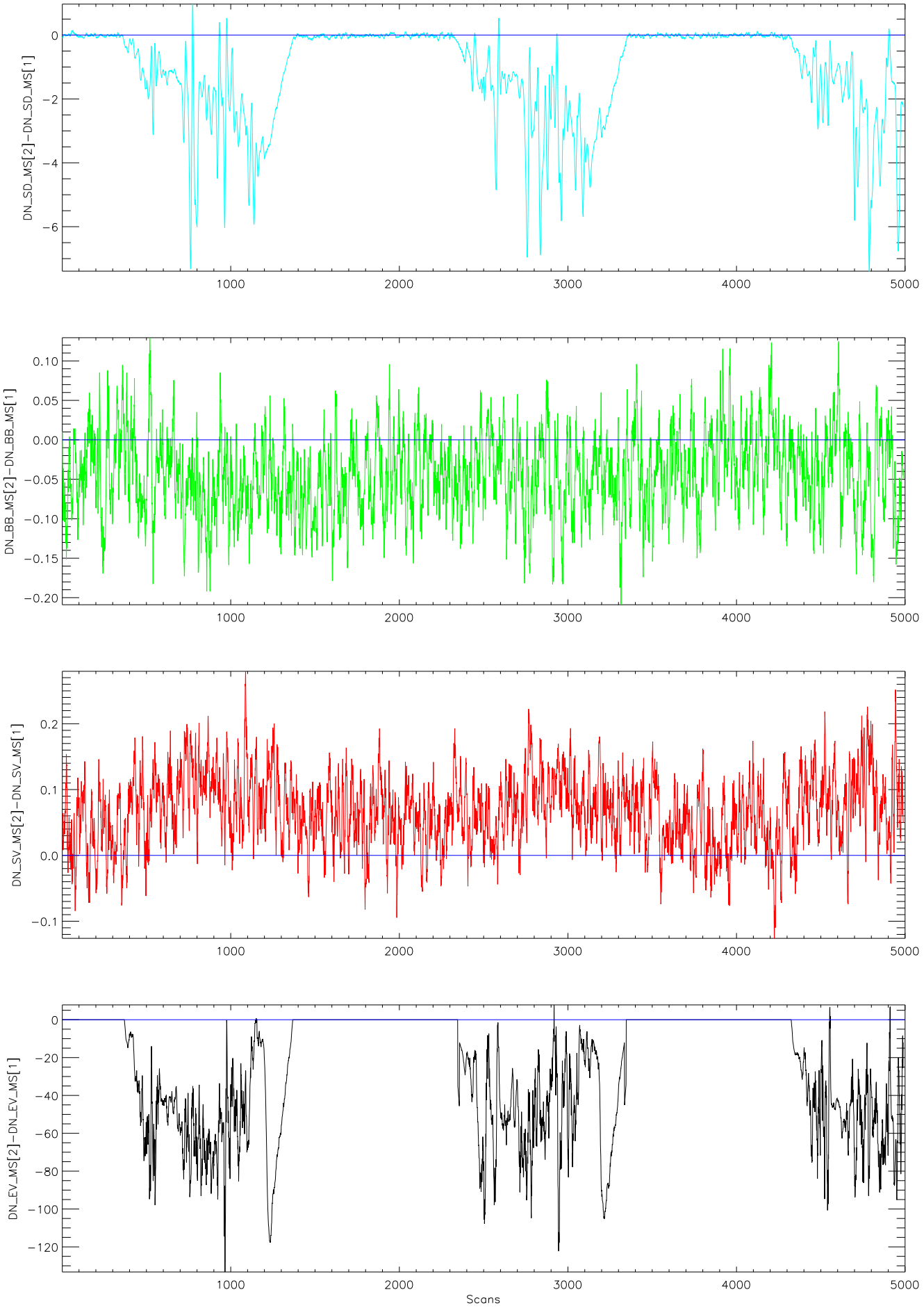
PFM Day 2000333(05:50 to 09:55) DN MS[1&2] for Band 35 Detector 5

Black: side1 Red: side2



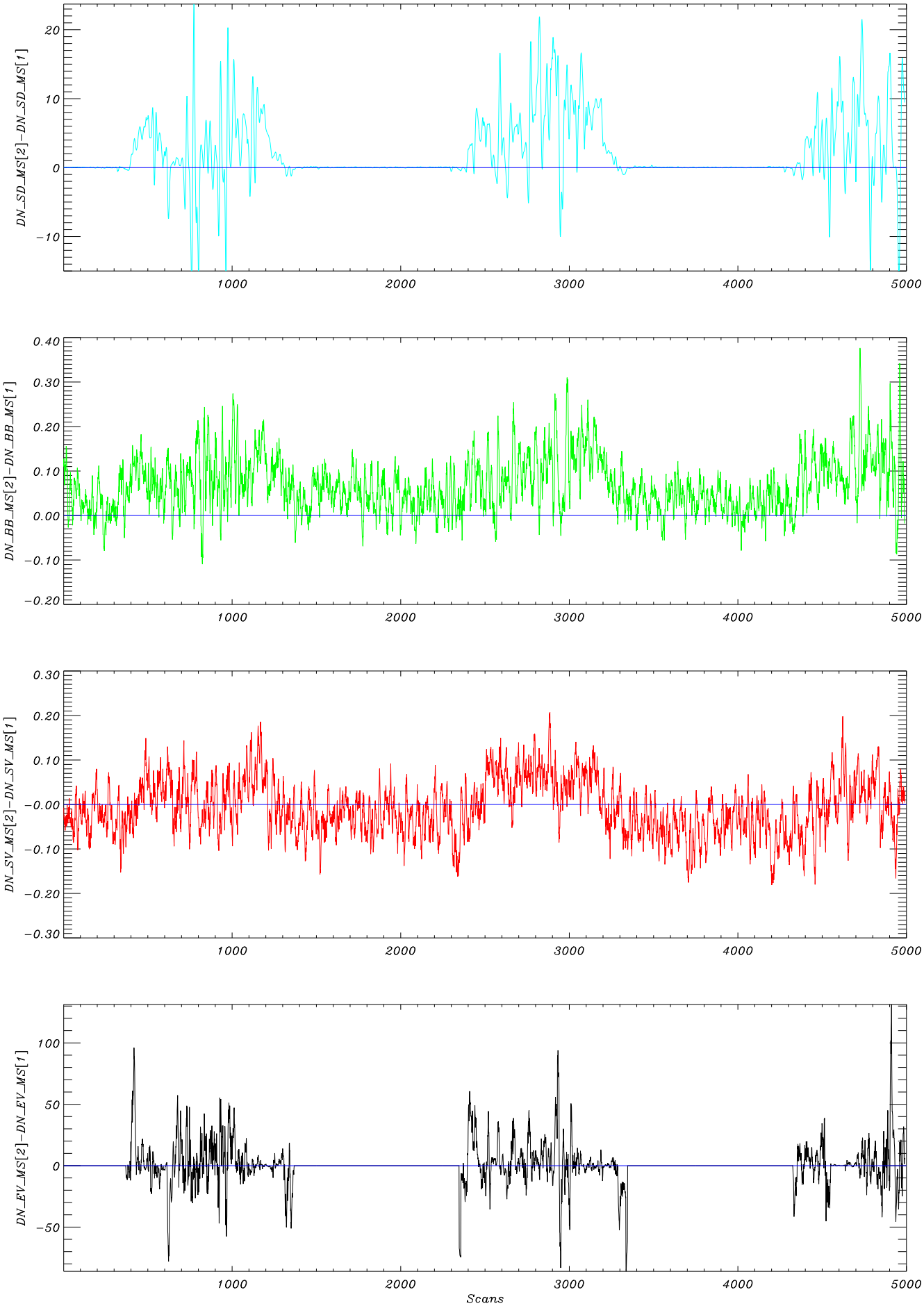
PFM Day 2000333(05:50 to 09:55) DN MS Difference for Band 8 Detector 5

Running Average for Every 10 Scans



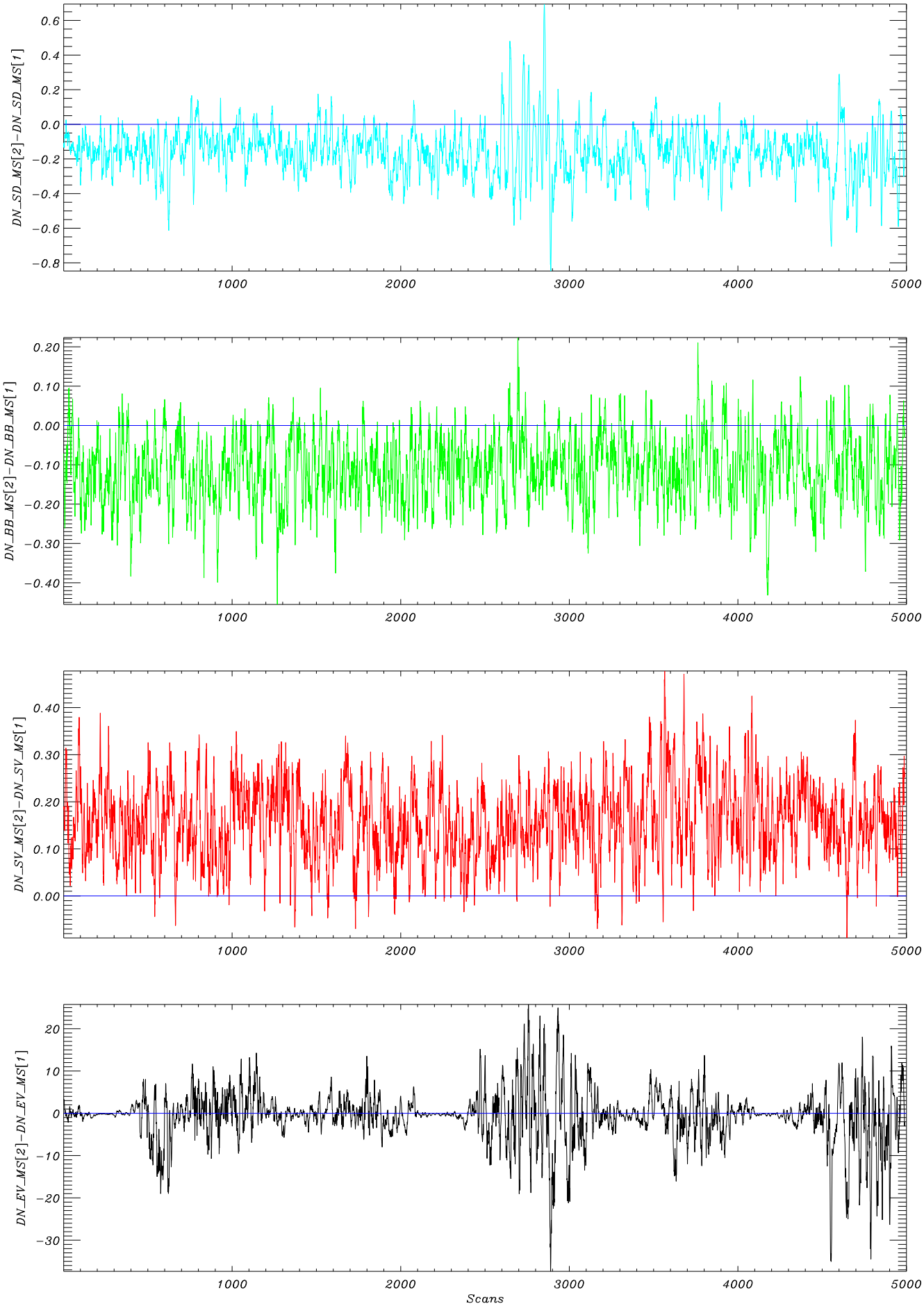
PFM Day 2000333(05:50 to 09:55) DN MS Difference for Band 16 Detector 5

Running Average for Every 10 Scans



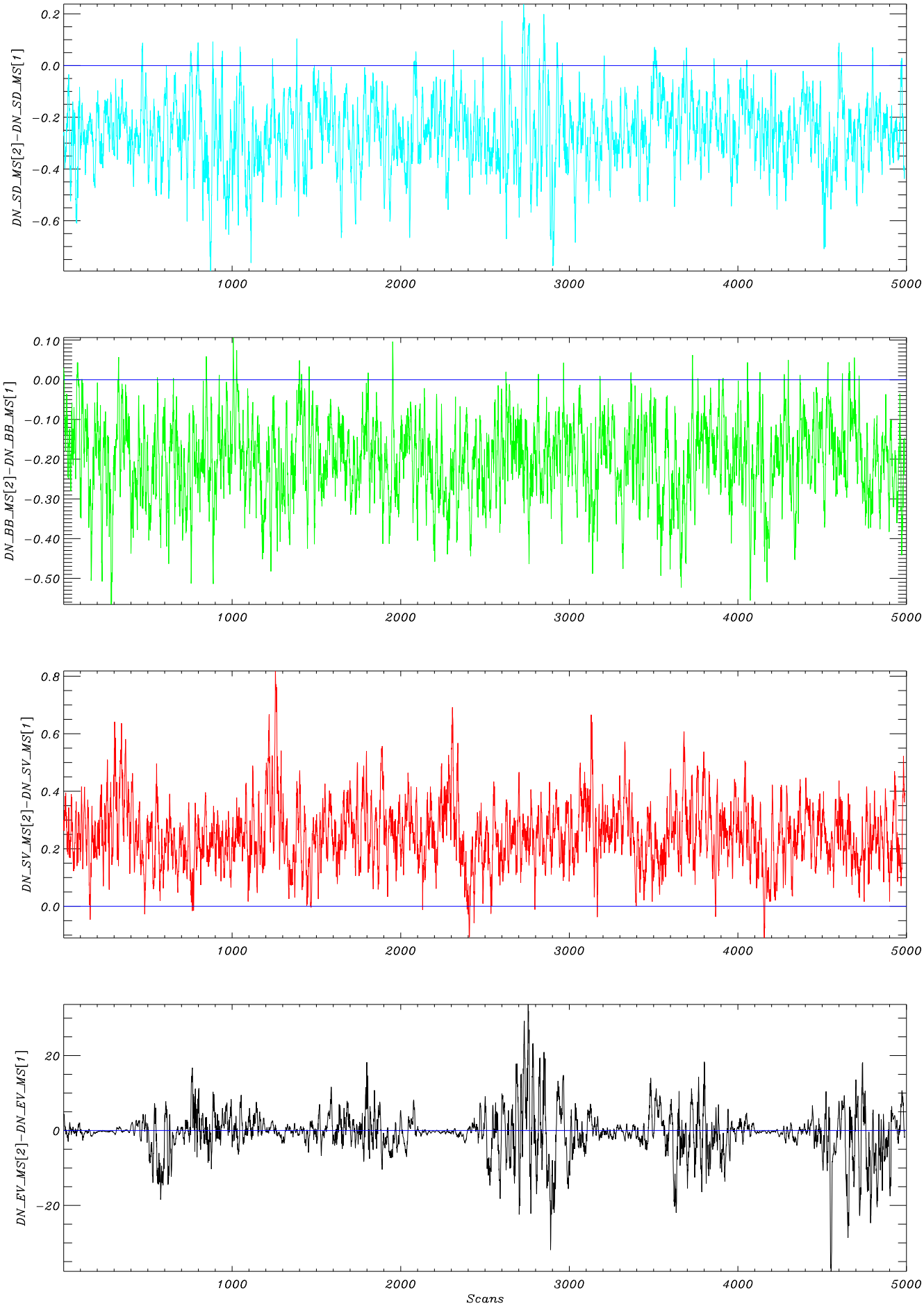
PFM Day 2000333(05:50 to 09:55) DN MS Difference for Band 20 Detector 5

Running Average for Every 10 Scans



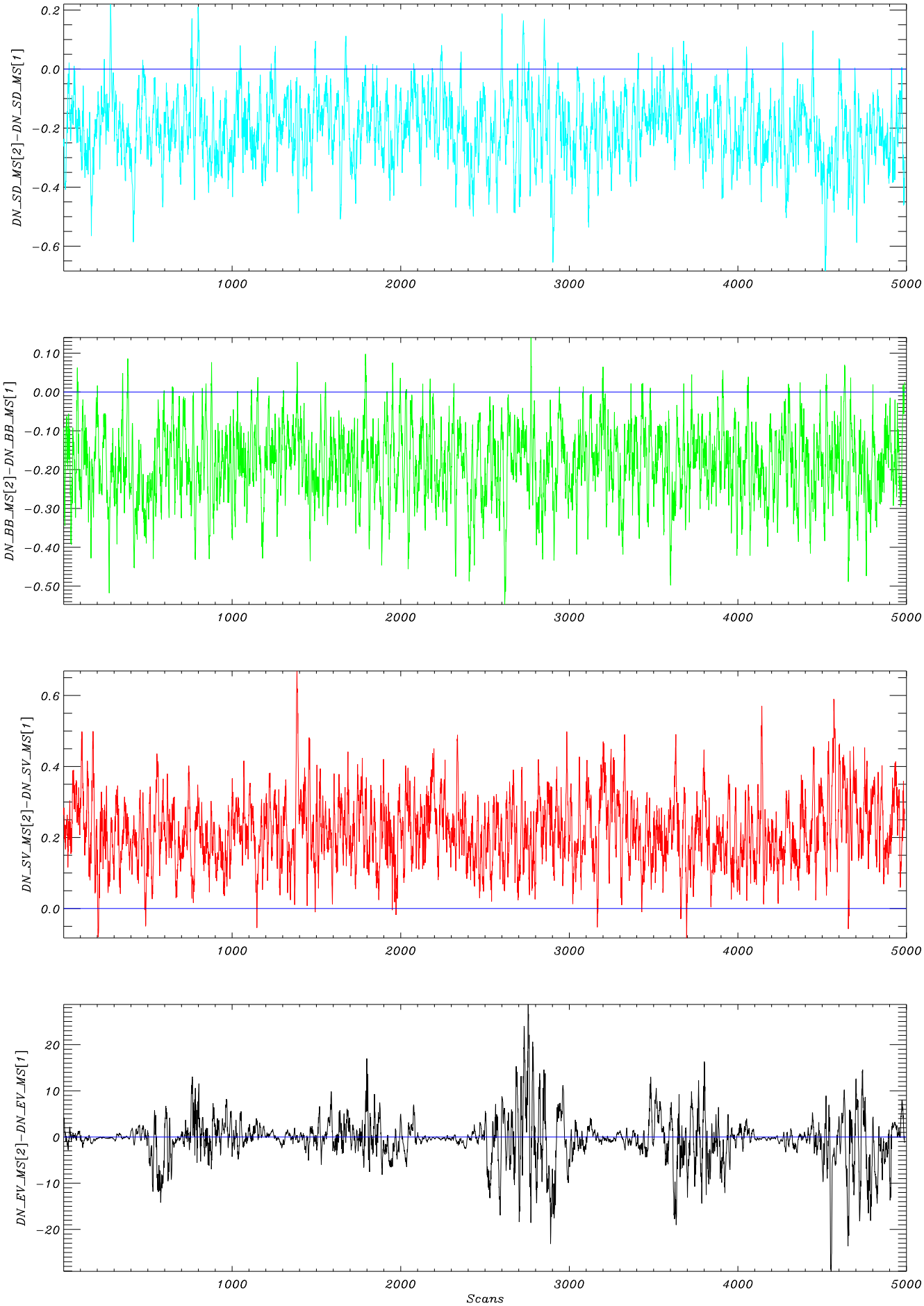
PFM Day 2000333(05:50 to 09:55) DN MS Difference for Band 22 Detector 5

Running Average for Every 10 Scans



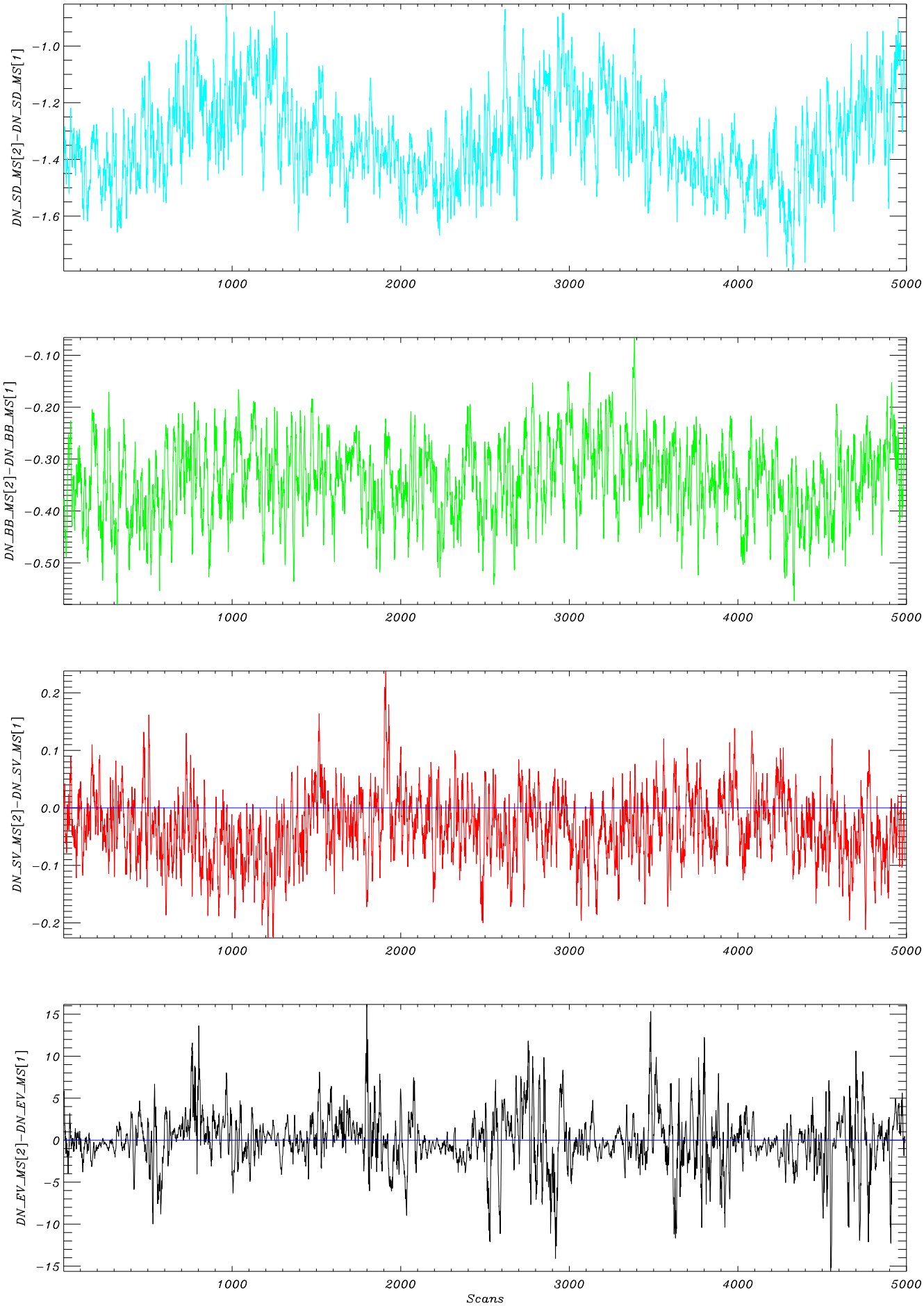
PFM Day 2000333(05:50 to 09:55) DN MS Difference for Band 23 Detector 5

Running Average for Every 10 Scans



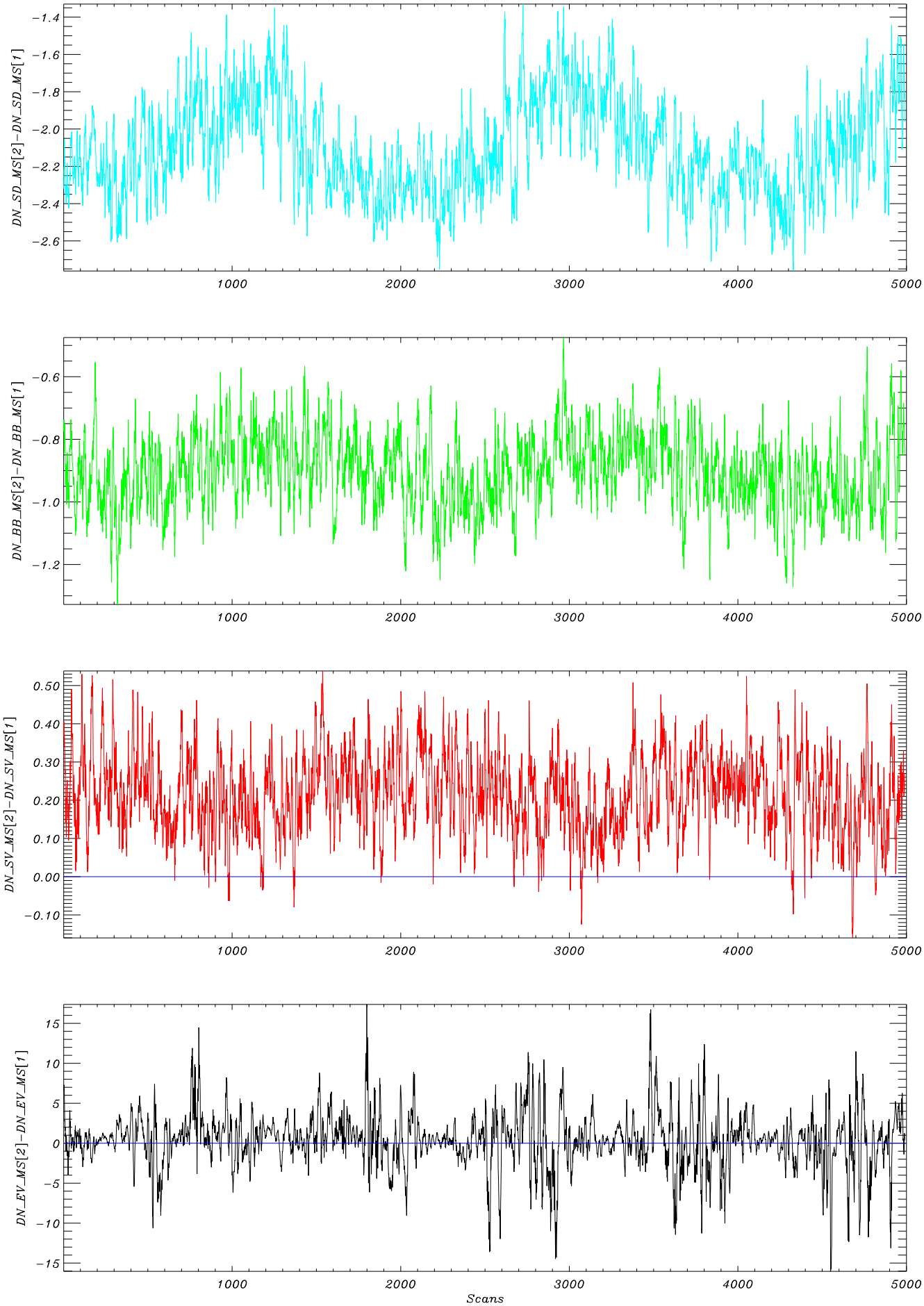
PFM Day 2000333(05:50 to 09:55) DN MS Difference for Band 31 Detector 5

Running Average for Every 10 Scans



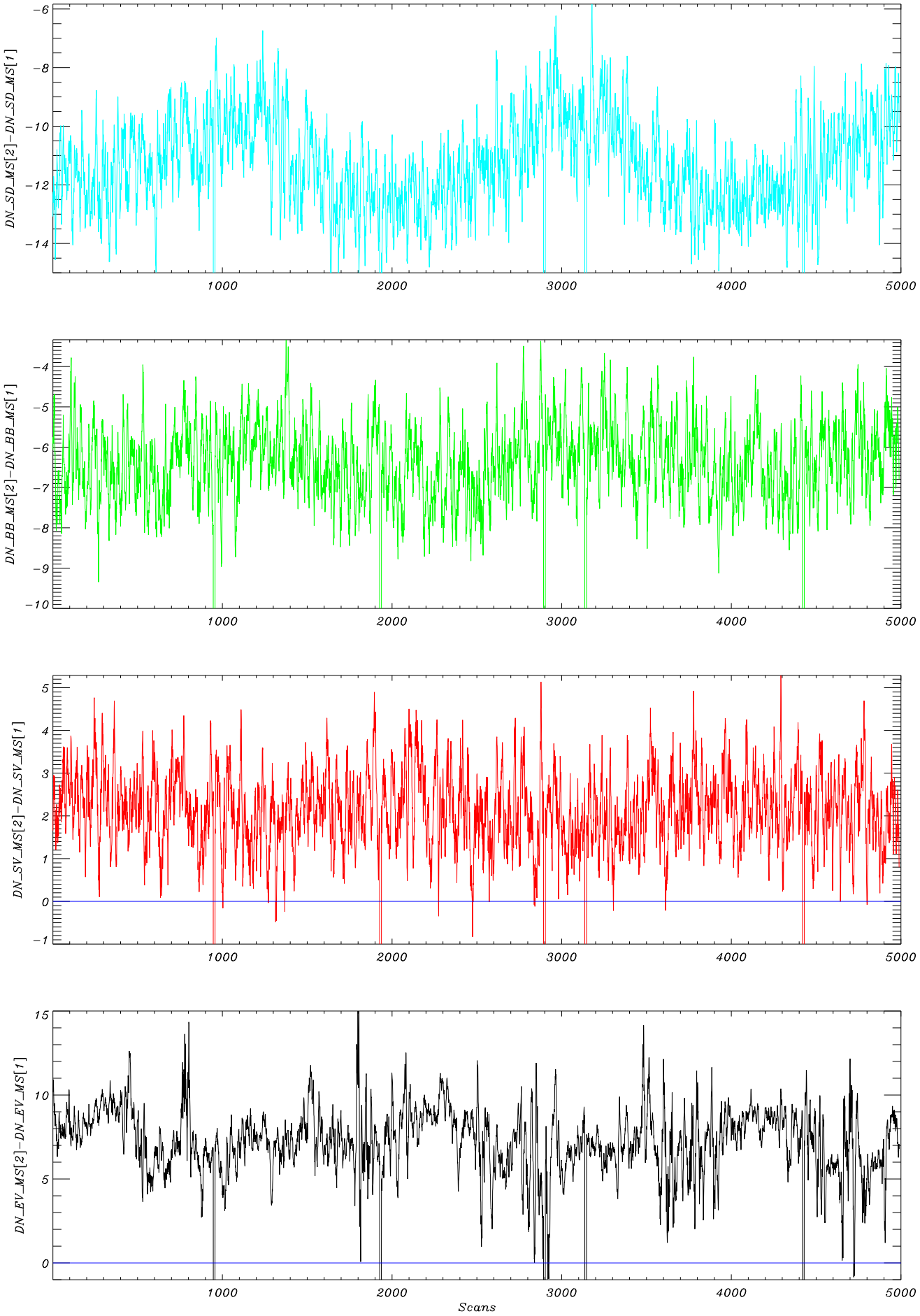
PFM Day 2000333(05:50 to 09:55) DN MS Difference for Band 32 Detector 5

Running Average for Every 10 Scans



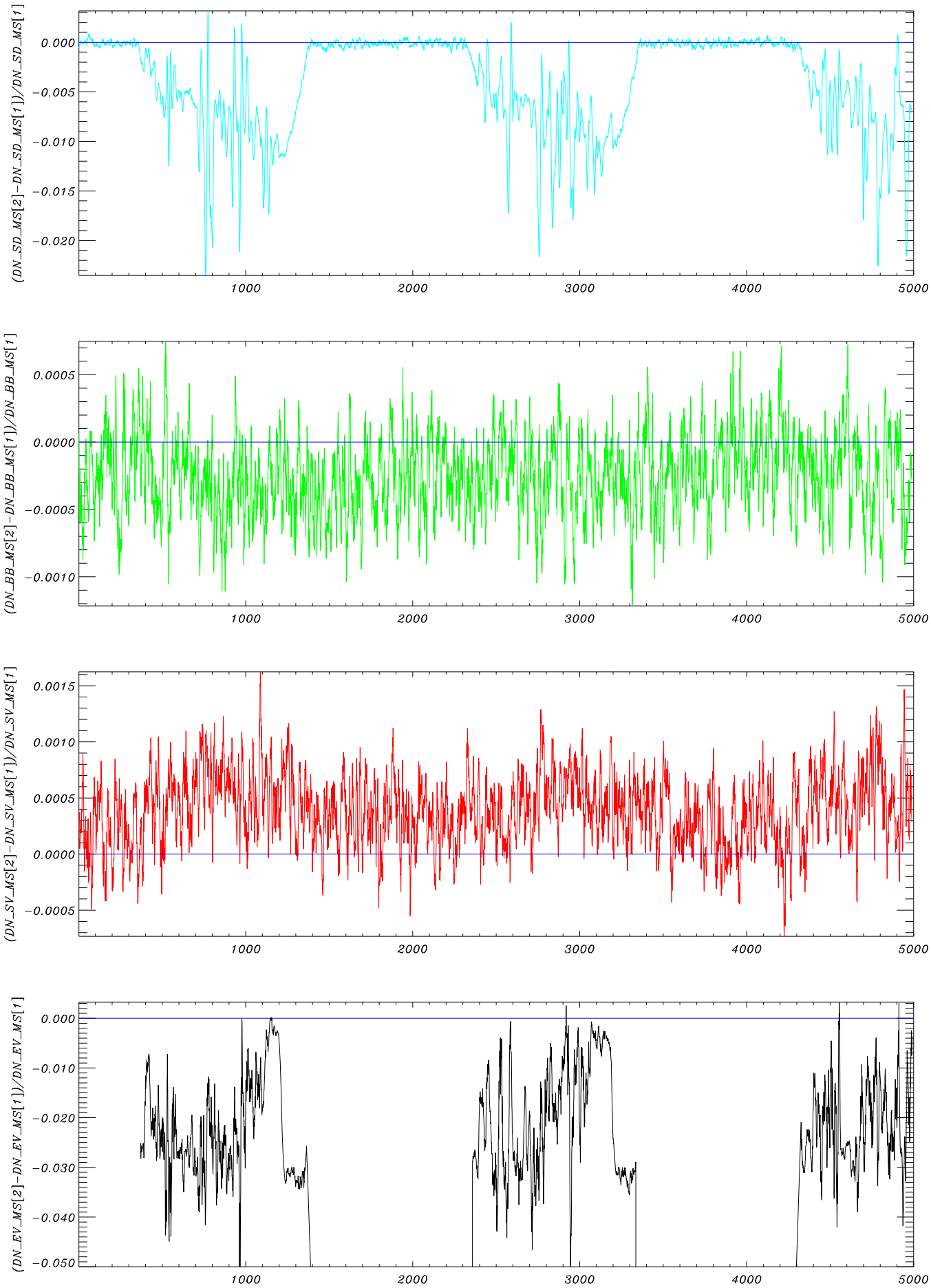
PFM Day 2000333(05:50 to 09:55) DN MS Difference for Band 35 Detector 5

Running Average for Every 10 Scans



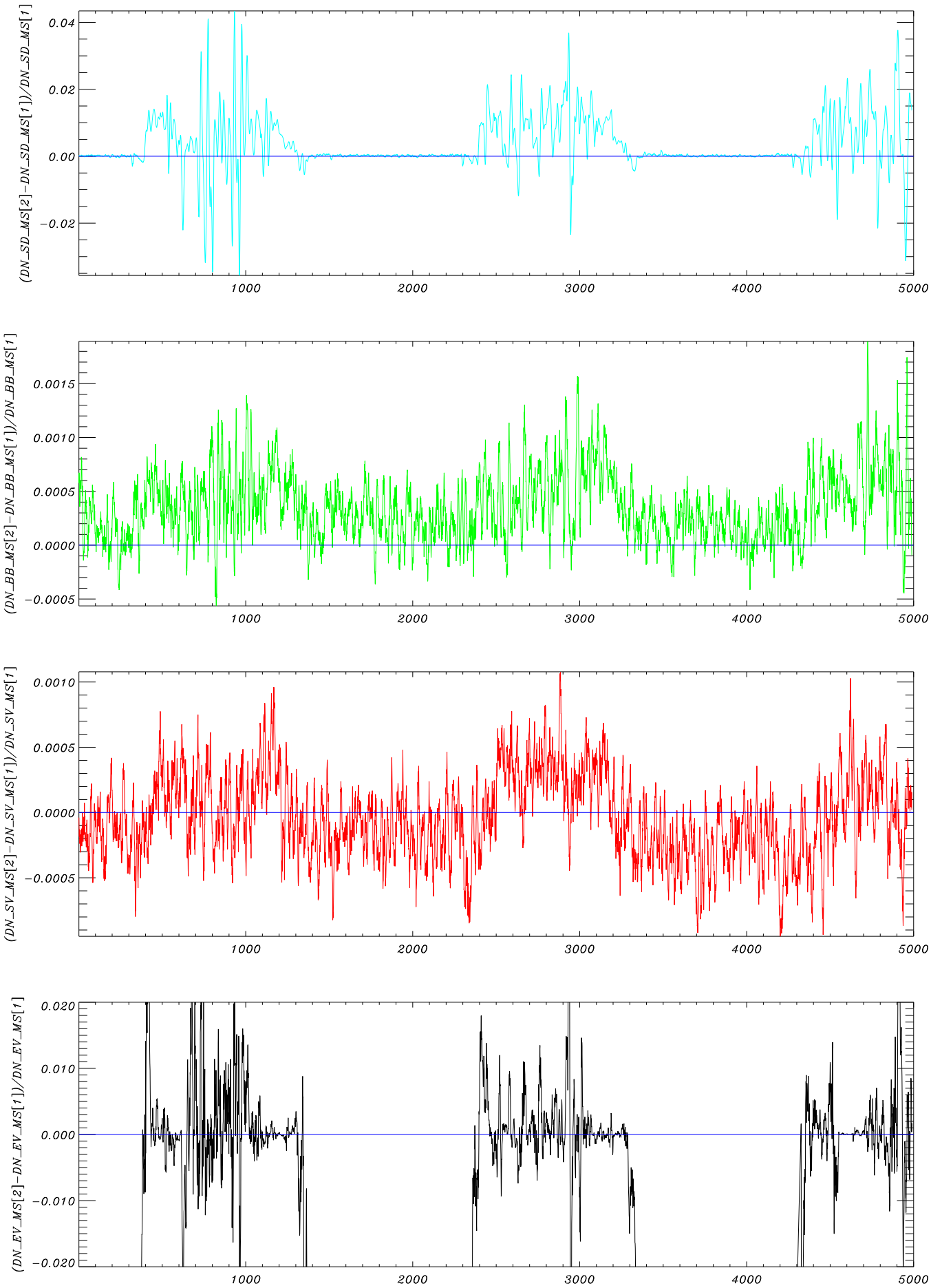
PFM Day 2000333(05:50 to 09:55) DN MS Difference Ratio for Band 8 Detector 5

Running Average for Every 10 Scans



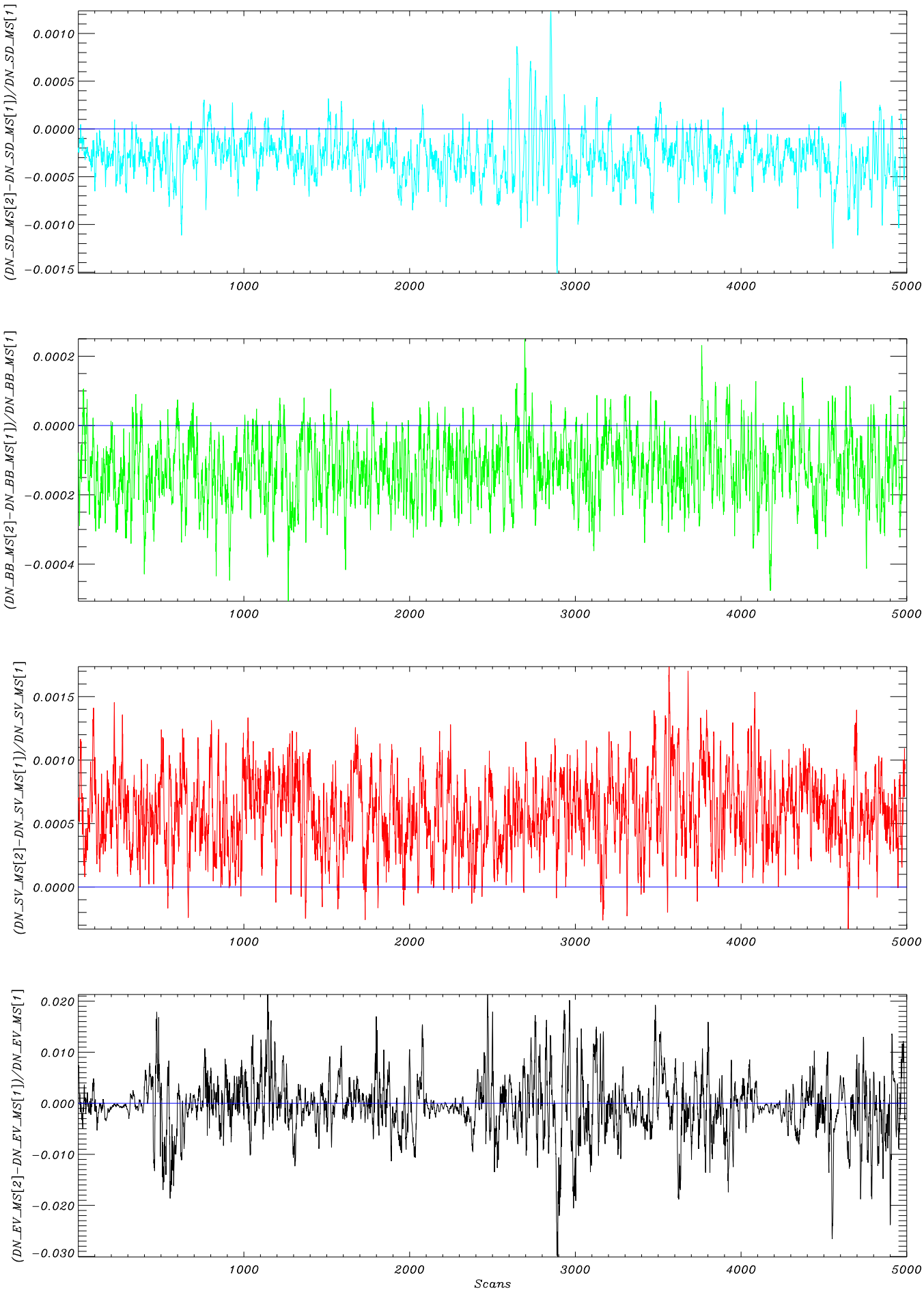
PFM Day 2000333(05:50 to 09:55) DN MS Difference Ratio for Band 16 Detector 5

Running Average for Every 10 Scans



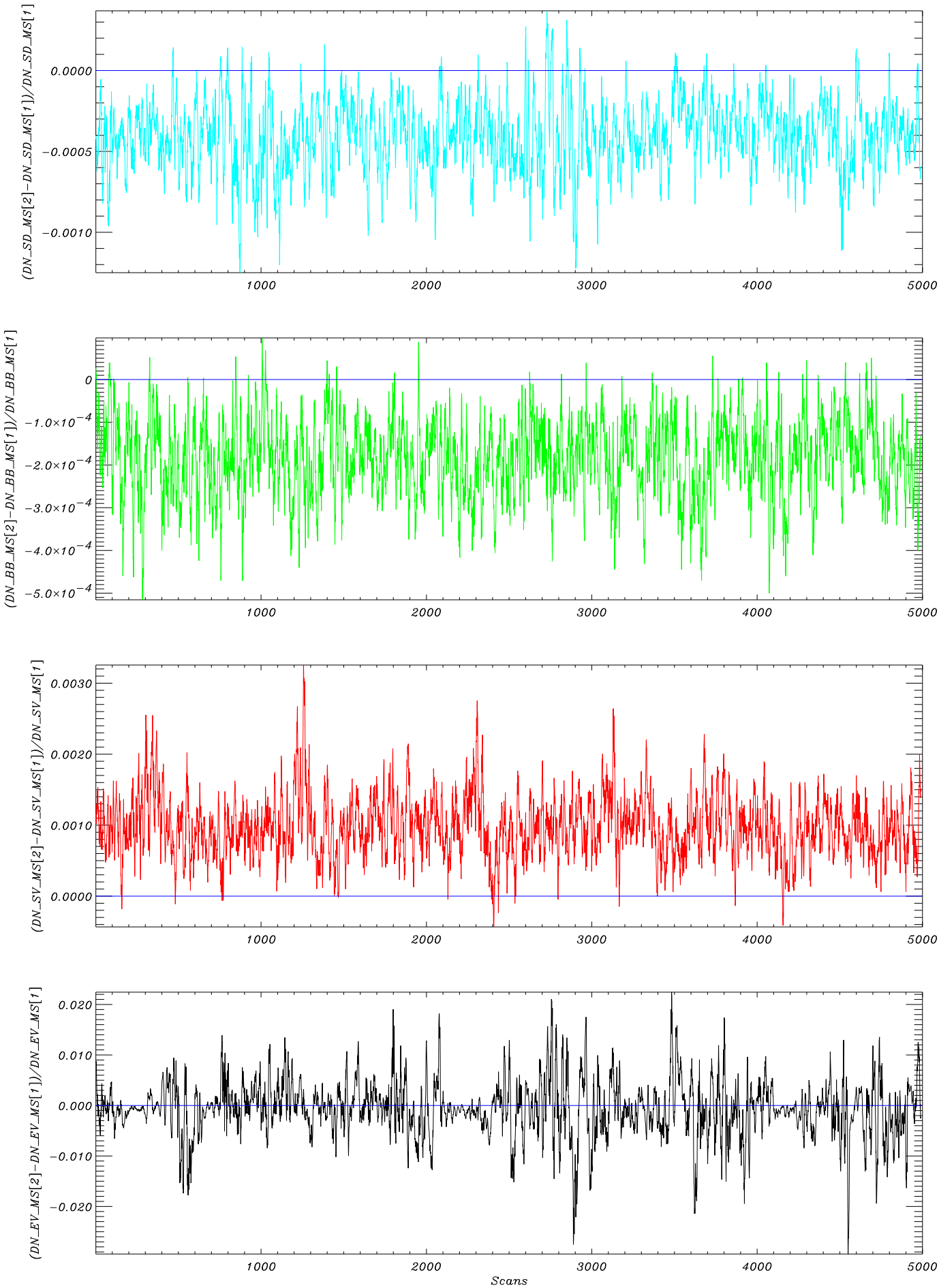
PFM Day 2000333(05:50 to 09:55) DN MS Difference Ratio for Band 20 Detector 5

Running Average for Every 10 Scans



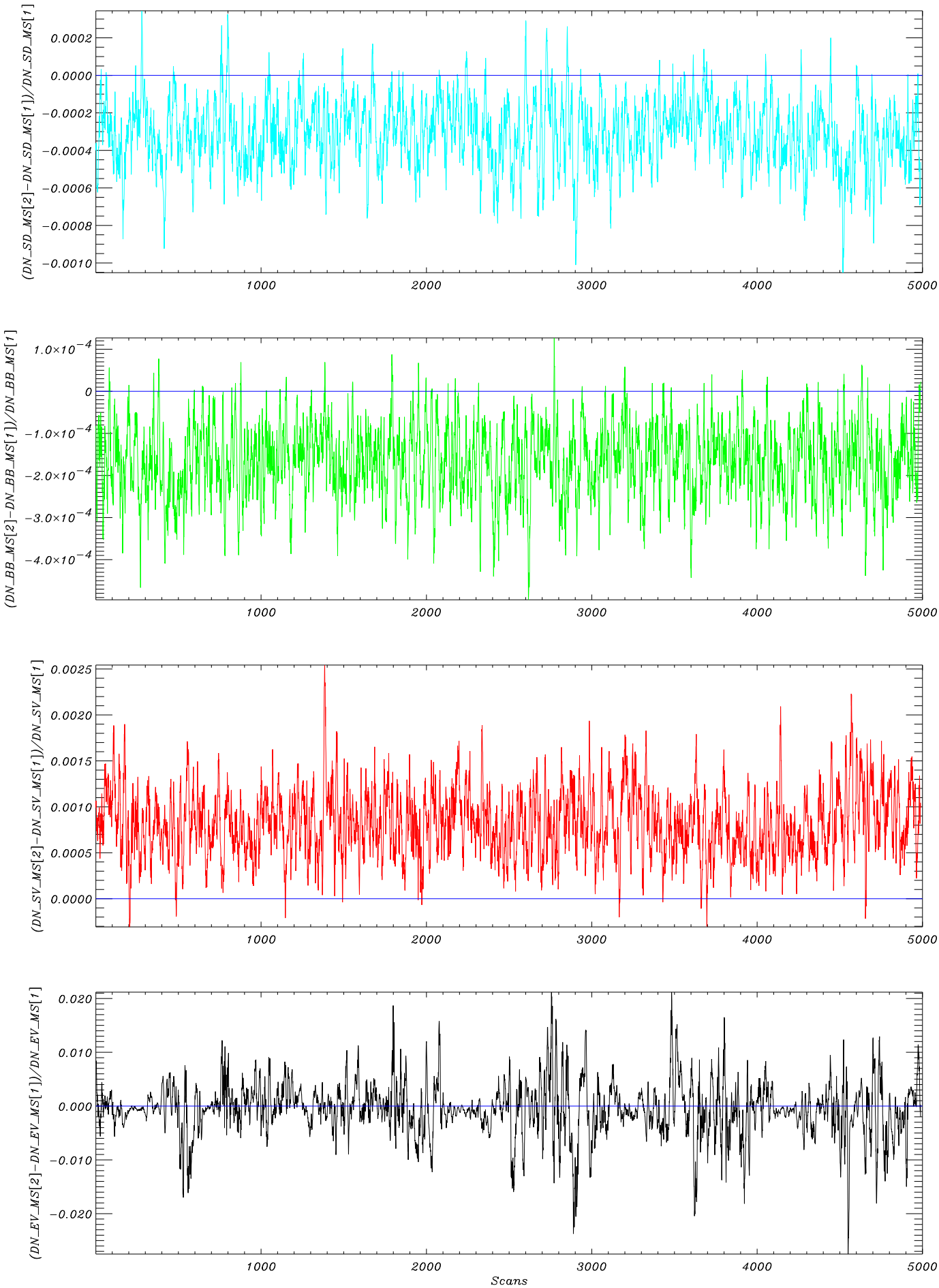
PFM Day 2000333(05:50 to 09:55) DN MS Difference Ratio for Band 22 Detector 5

Running Average for Every 10 Scans



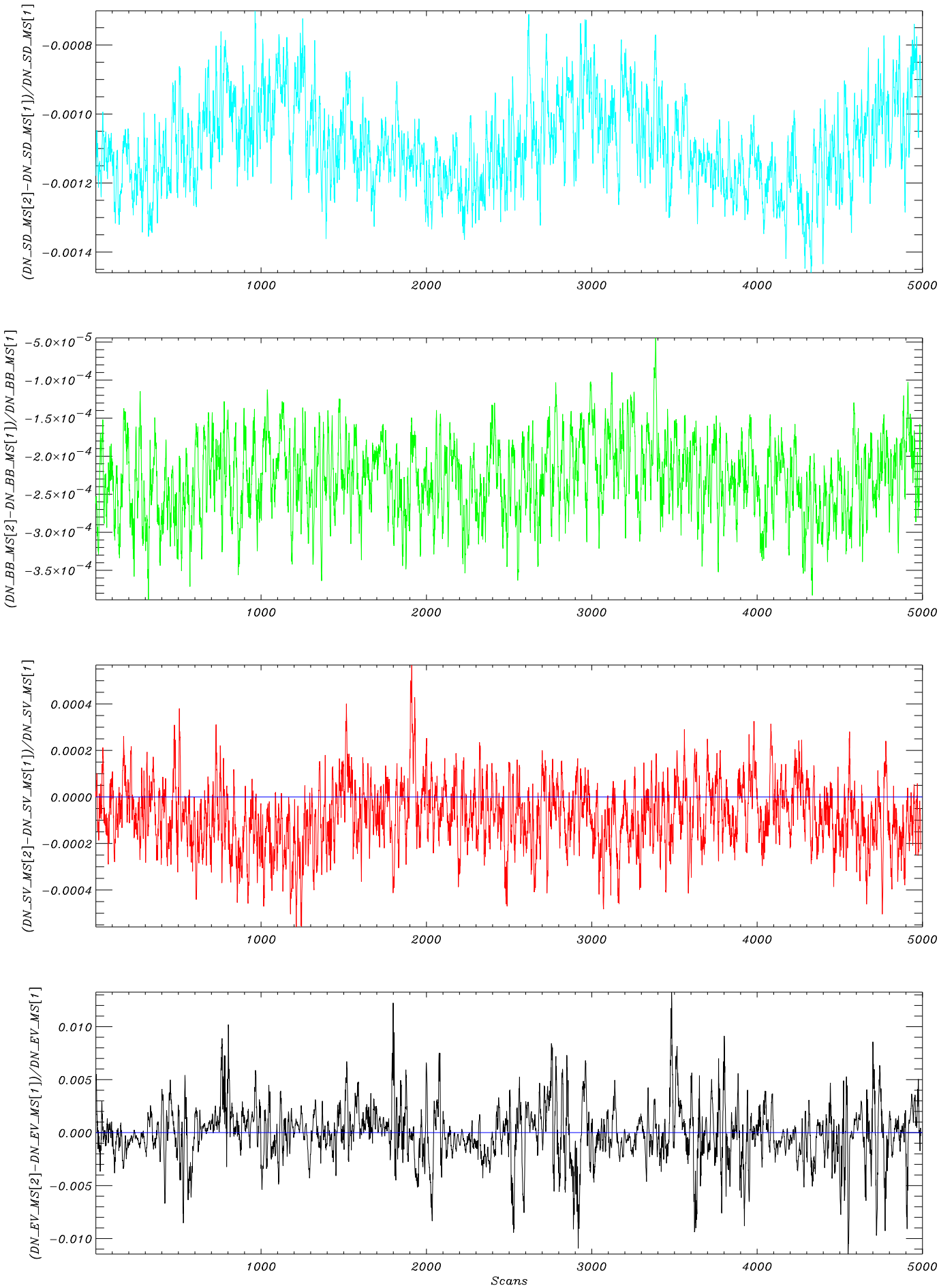
PFM Day 2000333(05:50 to 09:55) DN MS Difference Ratio for Band 23 Detector 5

Running Average for Every 10 Scans



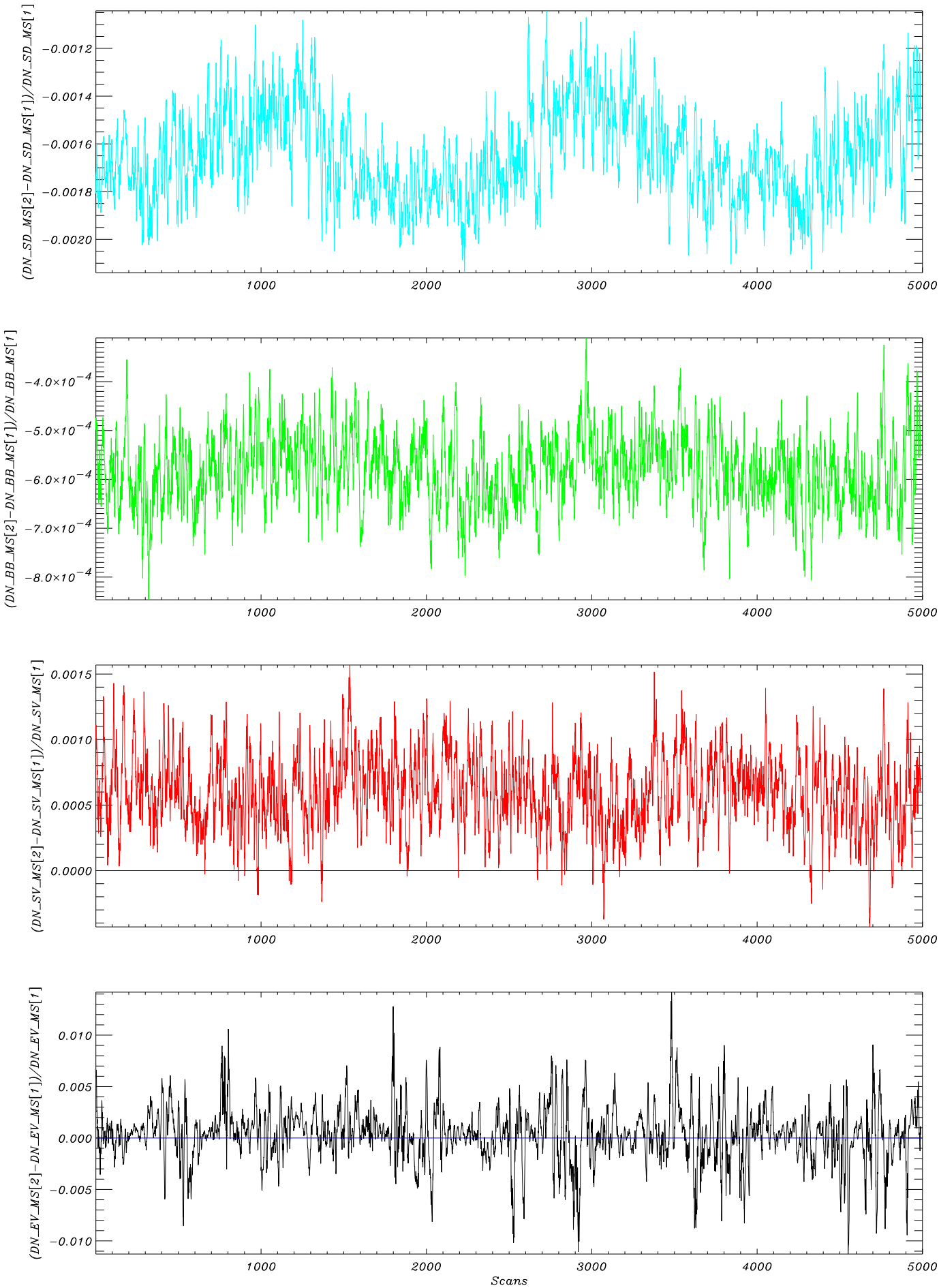
PFM Day 2000333(05:50 to 09:55) DN MS Difference Ratio for Band 31 Detector 5

Running Average for Every 10 Scans



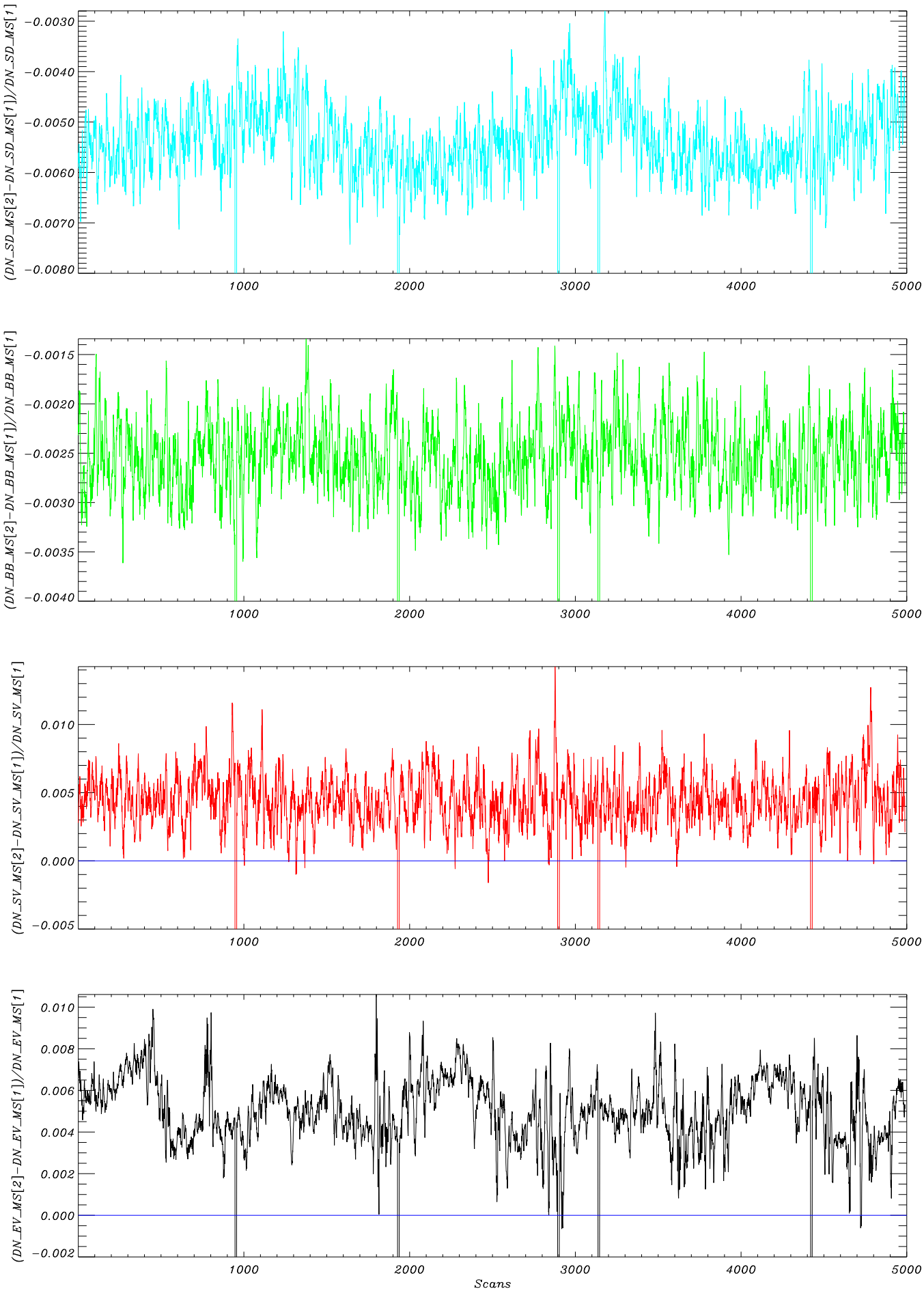
PFM Day 2000333(05:50 to 09:55) DN MS Difference Ratio for Band 32 Detector 5

Running Average for Every 10 Scans



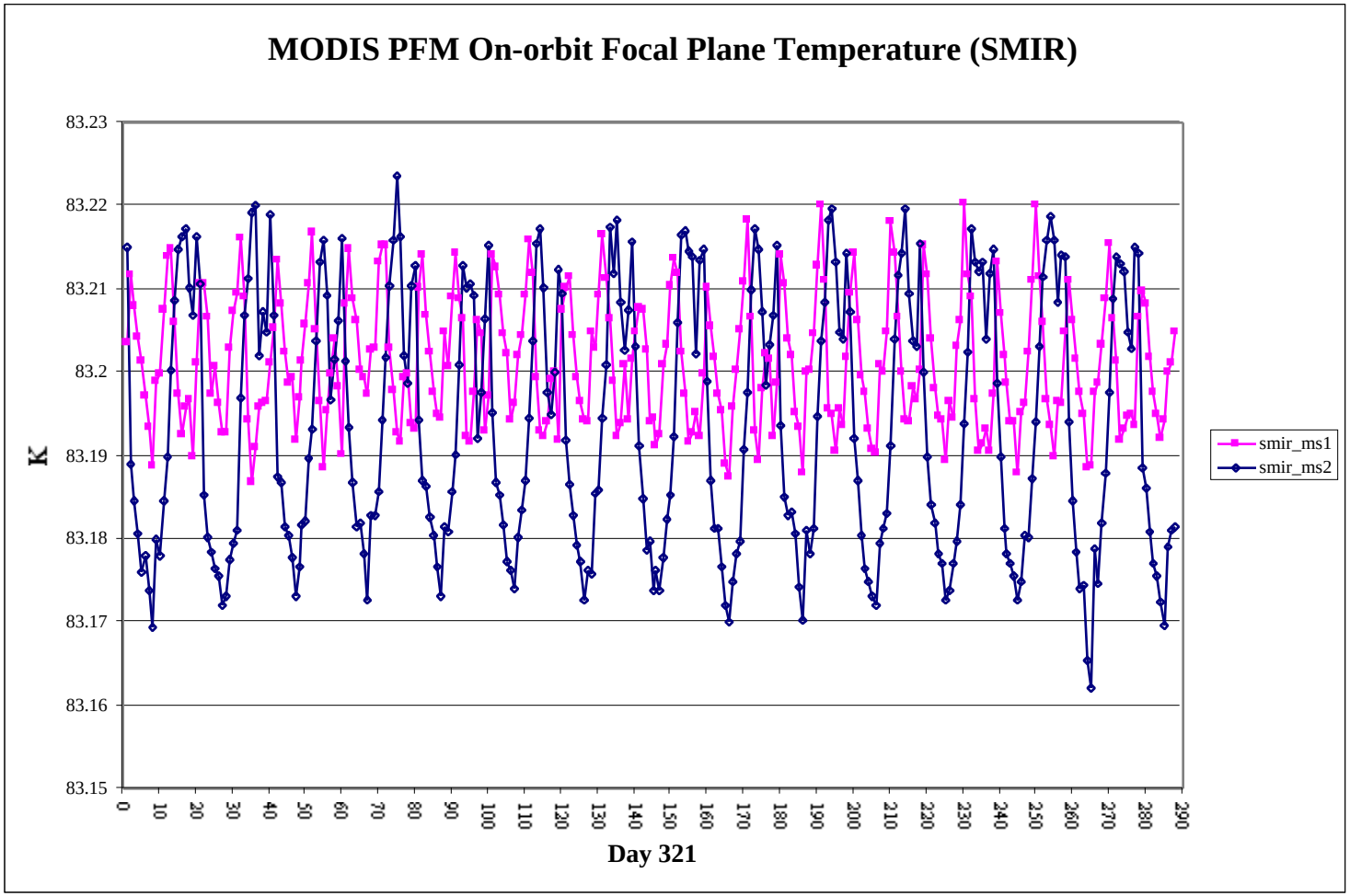
PFM Day 2000333(05:50 to 09:55) DN MS Difference Ratio for Band 35 Detector 5

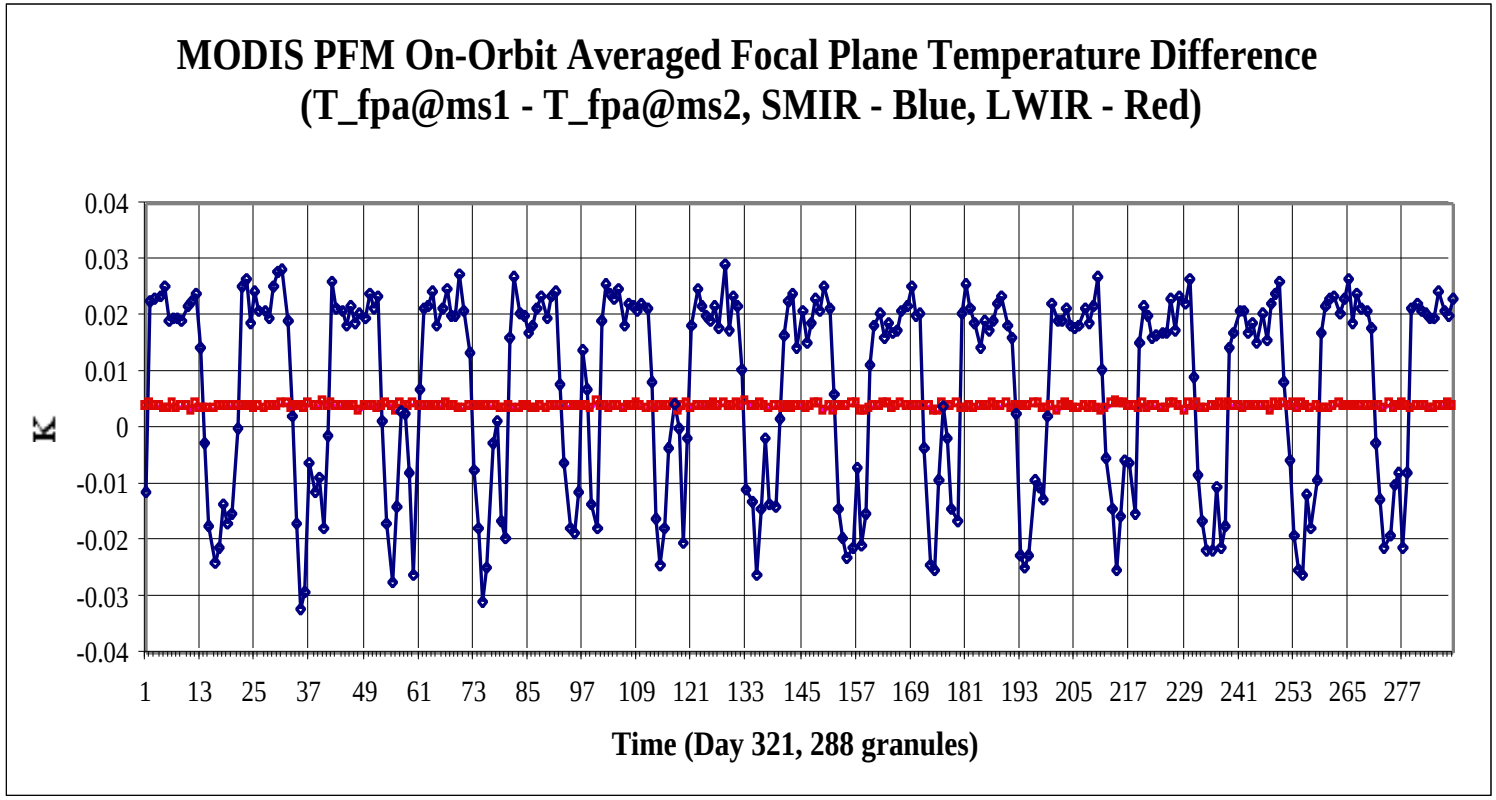
Running Average for Every 10 Scans

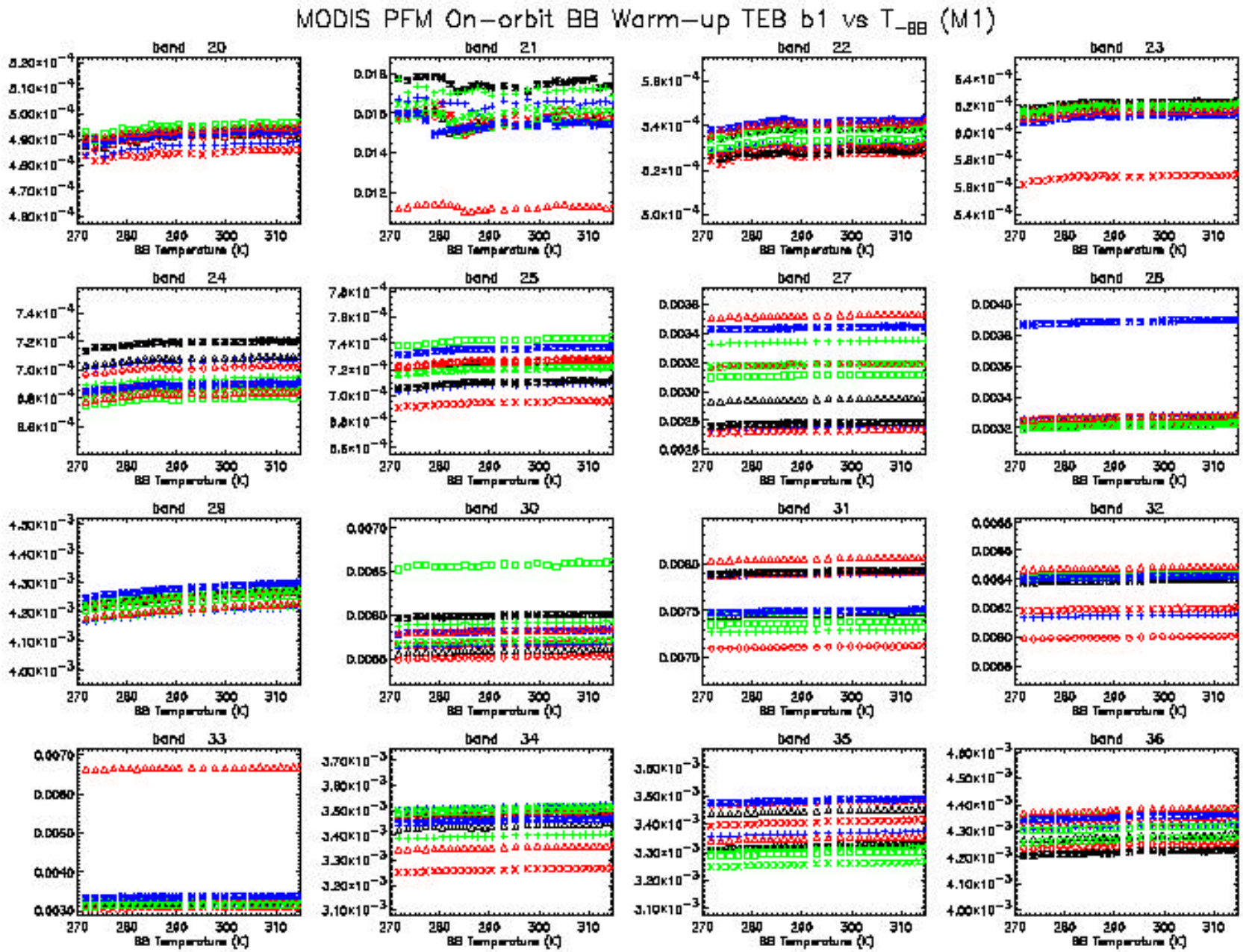


Preliminary Conclusions for Stability Within an Orbit - B Side

- Patterns within an orbit for DNs difficult to interpret
- In RSB
  - When looking at SD sector, we are seeing reflected sun light
    - Would expect same patterns by MS-diff in EV and SD sectors, and we find that
  - When looking at BB and SV sectors, expect no signal
    - Would expect same patterns by MS-diff in BB and SV, but evidence of reversal in Band 8
- In TEB
  - Would expect similar patterns by sector in Bands 31 and 32, but see some differences in SV sector
  - Do not know if this is significant within orbit variation in BB sector; could be real signal in SD sector


MODIS PFM On-orbit Focal Plane Temperature (SMIR)
83.23
83.22
83.21
83.2
83.19
83.18
83.17
83.16
83.15
K
0
10
20
30
40
50
60
70
80
90
100
110
120
130
140
150
160
170
180
190
200
210
220
230
240
250
260
270
280
290
Day 321
smir_ms1
smir_ms2


MODIS PFM On-Orbit Averaged Focal Plane Temperature Difference
(T_fpa@ms1 - T_fpa@ms2, SMIR - Blue, LWIR - Red)
K
0.04
0.03
0.02
0.01
0
-0.01
-0.02
-0.03
-0.04
1 13 25 37 49 61 73 85 97 109 121 133 145 157 169 181 193 205 217 229 241 253 265 277
Time (Day 321, 288 granules)



B_side Itwk/Vdet = 79/110