3.0 Instrument Key Features, Requirements and Performance Summaries

Outline

3.1 Reference configuration charts

3.2 Requirements and Performance Summary Charts

3.3 Calibration temperature tanges

3.4 Scan mirror reflectivity vs AOI

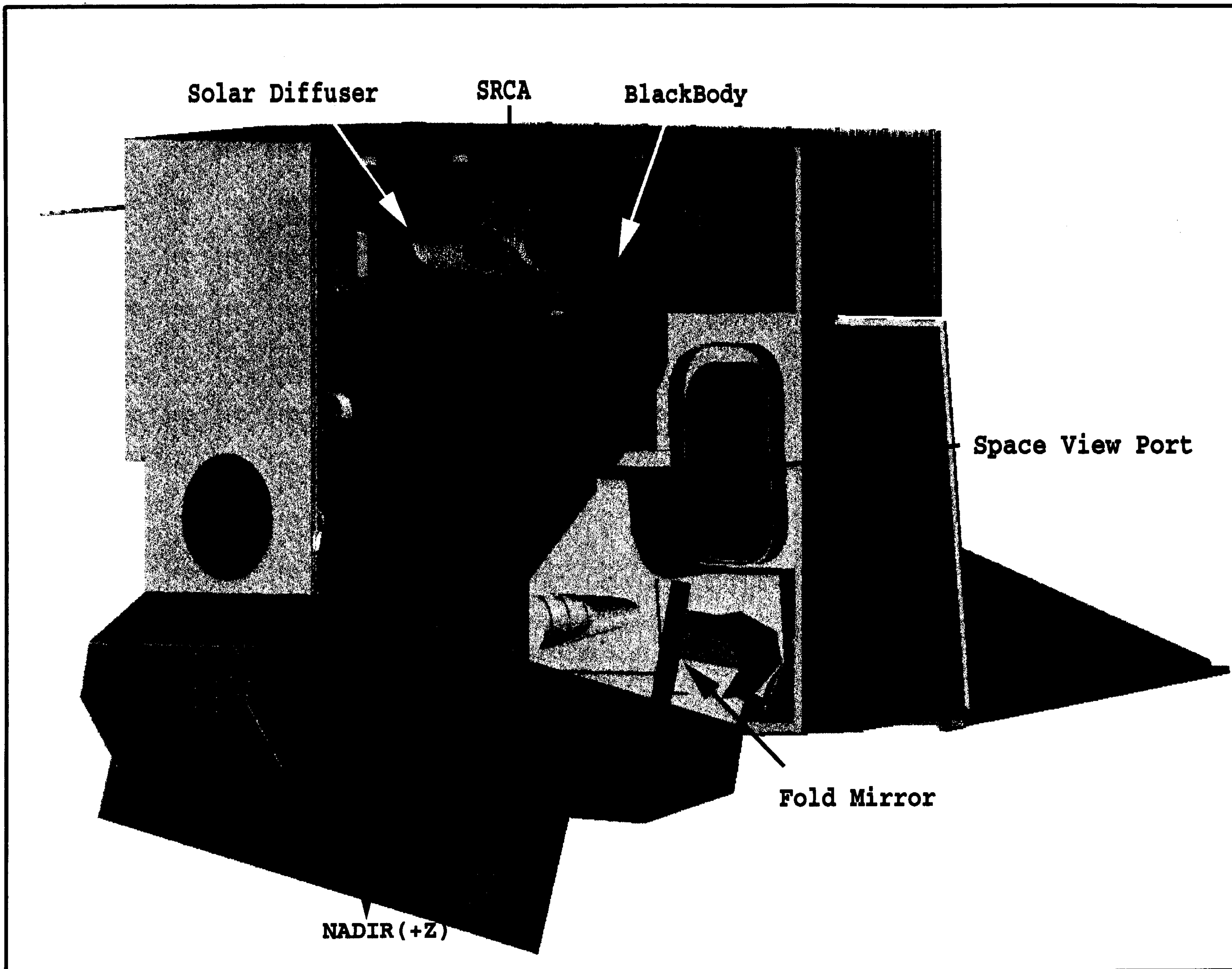
3.5 OBC blackbody performance

3.6 Predicted Lsat’s and Tsat’s

3.7 ADC Non-linearity and ECAL test results

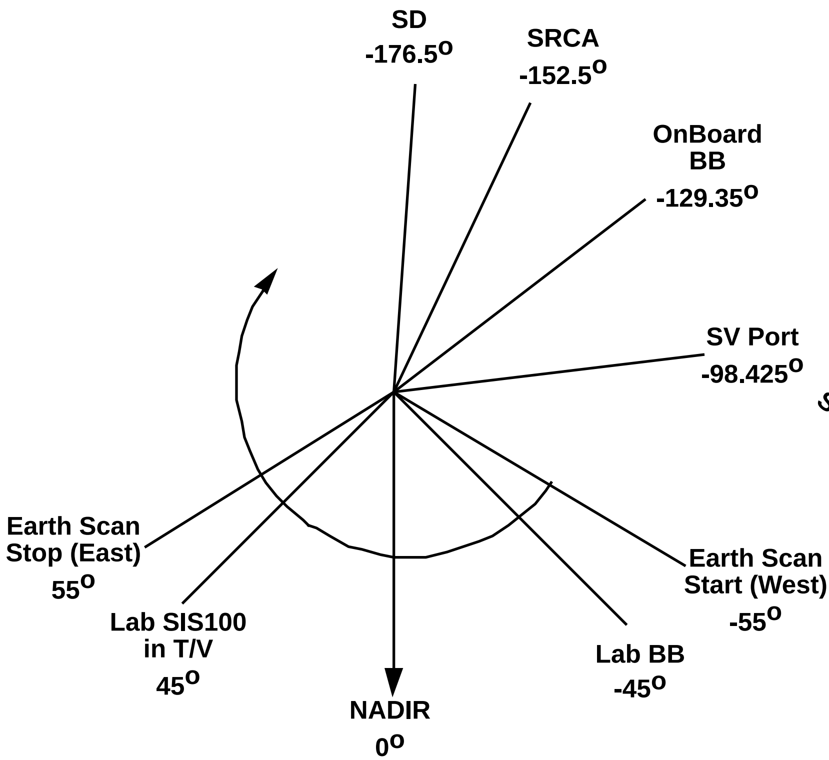
3.8 ECAL test results

Reference Configuration Charts

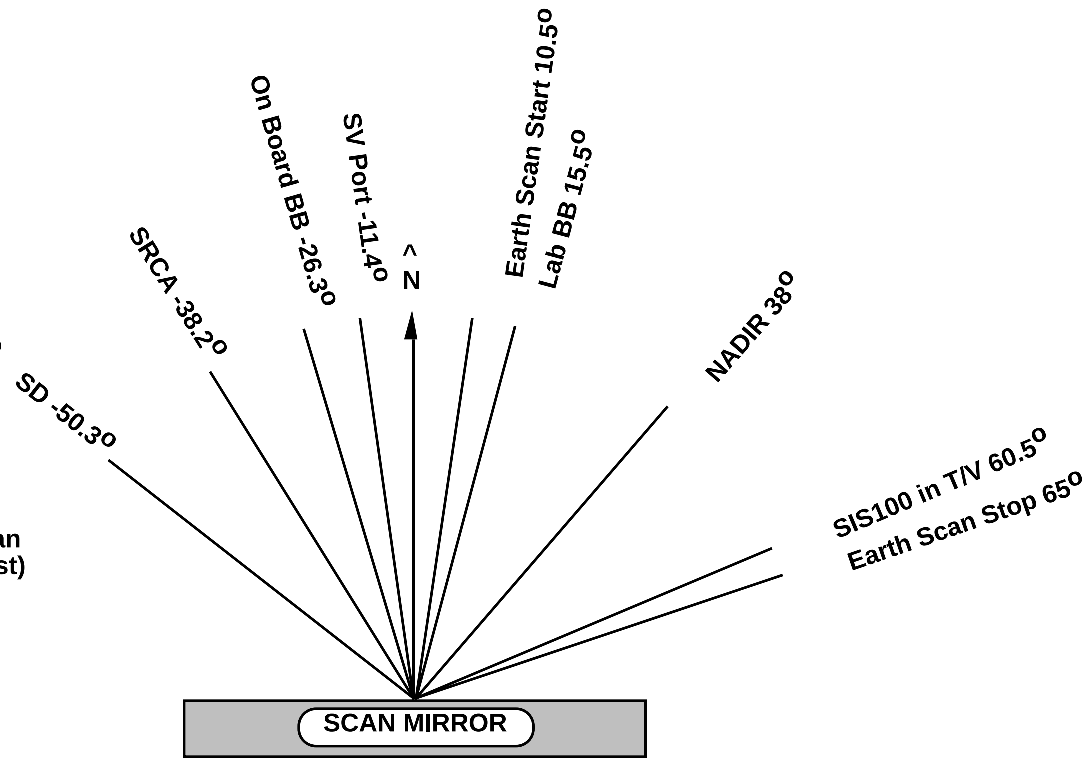

Solar Diffuser
SRCA
BlackBody
Space View Port
Fold Mirror
NADIR(+Z)

The MODIS ProtoFlight Model (PFM)

Principal Scan Angles Mapped to Scan Mirror Angles of Incidence



Principal Scan Angles



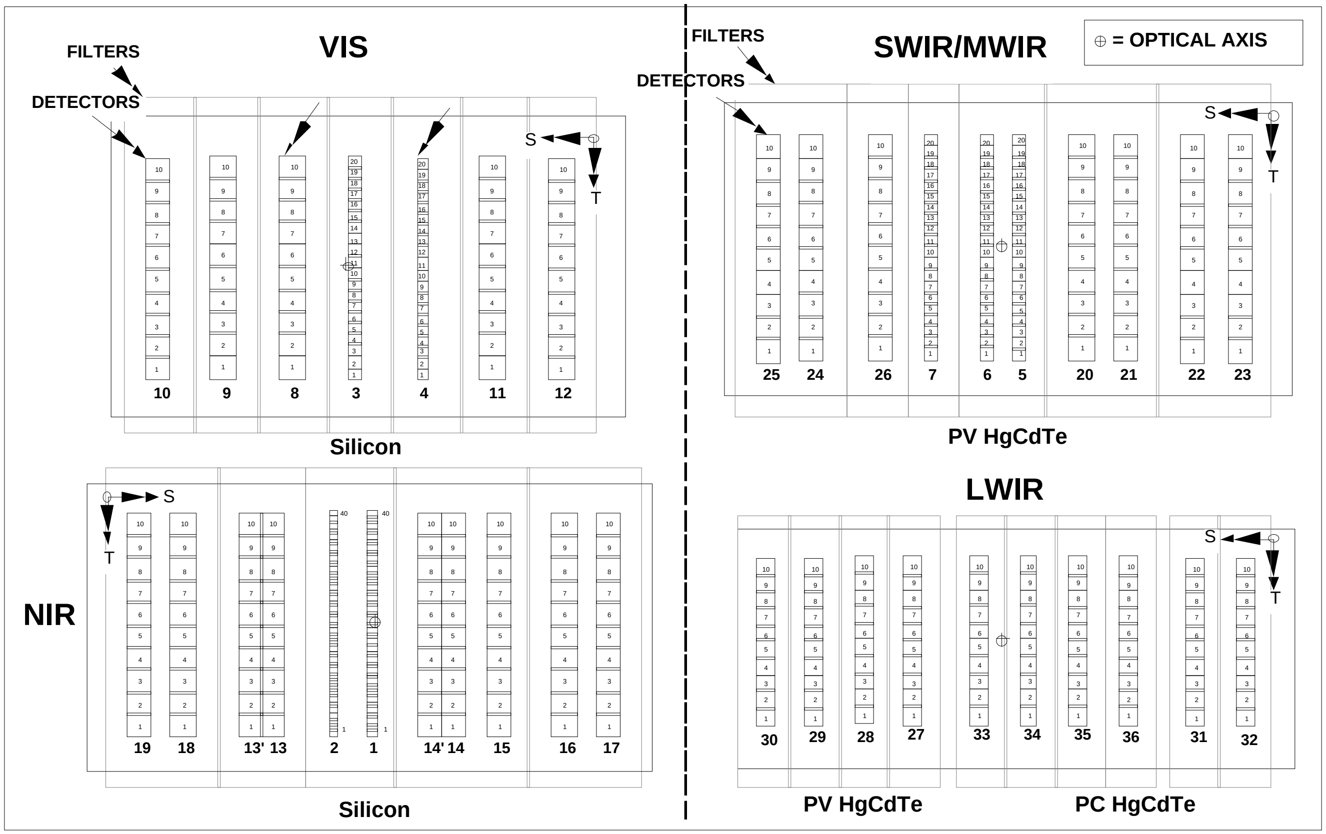
Angles of Incidence

Key Calibration Angles

From: MODIS Solar Reflection Band Calibration Algorithm, 9/19/96
(See also: G. Godden email to Waluschka, et al, 10/29/96;
and SBRS PL3095-M00211H, by Jim Bell, 2/18/96)

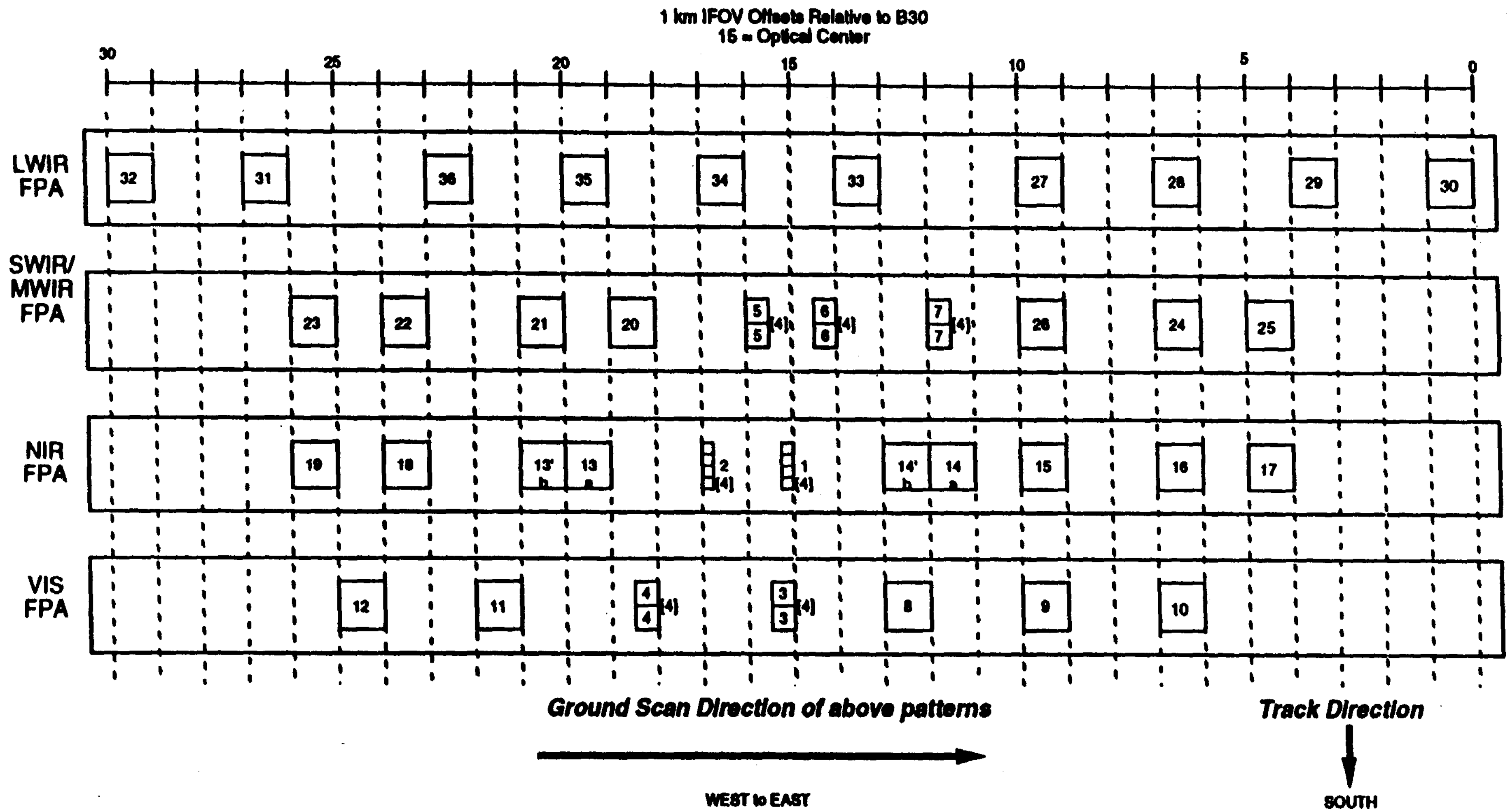
	Scan Angle	AOI	
Solar Diffuser			
start	182.25	50.875	AOI(OBC) = (360-SA_ev-2*38)/2
mid point	183.5	50.25	AOI_ev = 38 + SA_ev/2
end	184.75	49.625	
delta	2.5	-1.25	SA_ev = 2(AOI_ev-38)
SRCA			
start	207.297	38.3515	
mid point	207.5	38.25	
end	207.703	38.1485	
delta	0.406	-0.203	
OBC BB			
start	230	27	
mid point	230.65	26.675	
end	231.3	26.35	
delta	1.3	-0.65	
Space View Port			
start	260.9	11.55	
mid point	261.575	11.2125	
end	262.25	10.875	
delta	1.35	-0.675	
BCS in MCC (T/V)			
start	-45.675	15.1625	Note: BCS Angles based on nominal -45 degree
mid point	-45	15.5	scan angle in MCC and a delta scan angle
end	-44.325	15.8375	of 1.35 degrees cooresponding to 50 frames
delta	1.35	0.675	(same delta as for the Space View Port)
Earth View			
start	-55	10.5	
mid point (nadir)	0	38	
end	55	65.5	
delta	110	55	
SIS100 in MCC			
start	?	?	
mid point	45	60.5	
end	?	?	
delta	?	?	

MODIS Focal Plane Layouts



Instrument FPA Main Frame Temperature

Cold FPAs: (80. 83, 85k)



Notes:

1. Band single detector locations are shown in terms of 1 km IFOV offsets from Band 30, which is first band to see a scene. FPA optical center is at IFOV 15.
2. Ground scan direction of projected pattern is to the right (west to east). FPA's have false vertical separation to clarify individual FPA extent.
3. During one 1km sample, 250 m Bands 1 & 2 produce 16 samples/each and 500 m Bands 3-7 produce 4 samples/each.
4. The formatter assembles a science packet with bands aligned by the depicted offsets to view a common ground sample. This requires the collection of 30 frames of data before all bands have observed the same ground sample.
5. Science packet locations for TDI Bands 13, 13' and 14, 14' will be at first sample location of 13 and 14. High and low gain data is provided for Band 13 and Band14. Bands 27-30 are sampled 4X, but single sample is sent to ground.

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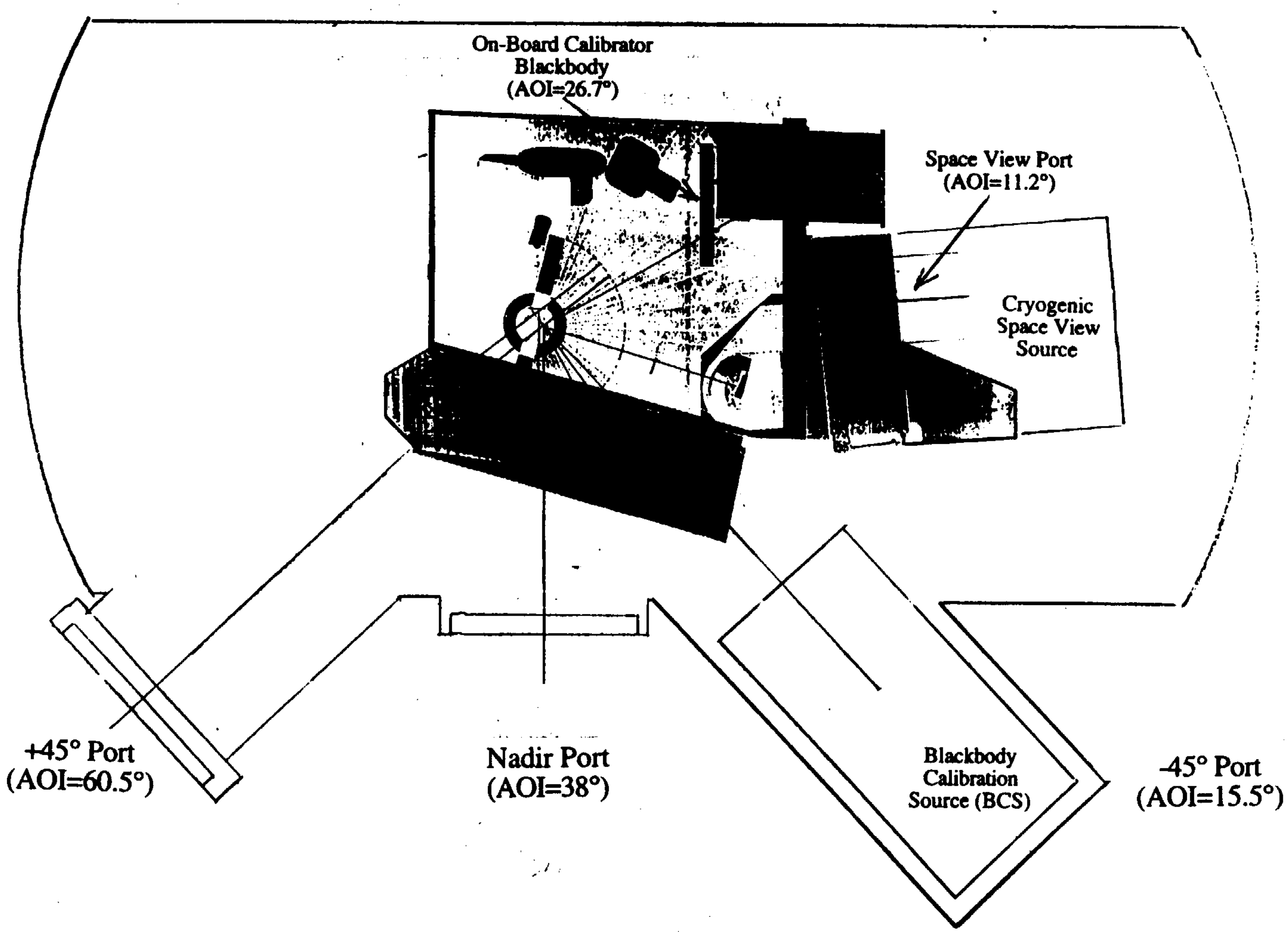
Figure 30-3. FPA Band Offsets Relative to Band 30

Calibration Methodology
(MODIS Thermal Vacuum Calibration Chamber)



Performance Summary Charts

(AKA: "Murphy Charts")

Performance Summary Charts Overview

- Chart 1- Spectral Response Parameters
  - Band averaged center wavelengths
  - Band averaged bandwidths
- Chart 2 - Radiance Levels
  - Ltyp/Typ
  - Lmax/Tmax
  - 0.3Ltyp →0.9Lmax
  - T(0.3Ltyp) →T(0.9Lmax)
- Chart 3 - NEdL's, NEdT's and SNR's

Thermal Bands Spectral Response Parameters

Wavelength Units (um)

Band No.	GSFC Specification: Center Wavelength (CWL) [nm] (specified)	GSFC Specification: Bandwidth (nm) (specified)	PFM Measured (nm): Average Center Wavelength (CWL) (measured&corrected	CWL Delta (=meas. - spec.)	Ave. Bandwidth (measured)	BW Delta (=meas. - spec.)	BW Delta (%)
20 PV	3750	180	**3788.2**	38.2	**190.8**	10.8	6%
21 PV	3959	59.4	**3992.1**	33.1	**84.0**	24.6	41%
22 PV	3959	59.4	**3971.9**	12.9	**87.4**	28.0	47%
23 PV	4050	60.8	**4056.7**	6.7	**87.2**	26.4	43%
24 PV	4465	65	**4473.2**	8.2	**91.4**	26.4	41%
25 PV	4515	67	**4545.4**	30.4	**92.5**	25.5	38%
27 PV	6715	360	**6765.4**	50.4	**241.2**	-118.8	-33%
28 PV	7325	300	**7336.7**	11.7	**325.4**	25.4	8%
29 PV	8550	300	**8540.7**	-9.3	**370.7**	70.7	24%
30 PV	9730	300	**9730.0**	0.0	**301.4**	1.4	0%
31 PC	11030	500	**11014.4**	-15.6	**522.0**	22.0	4%
32 PC	12020	500	**12028.2**	8.1	**524.4**	24.4	5%
33 PC	13335	300	**13361.2**	26.2	**311.5**	11.5	4%
34 PC	13635	300	**13679.5**	44.5	**327.7**	27.7	9%
35 PC	13935	300	**13910.8**	-24.3	**333.0**	33.0	11%
36 PC	14235	300	**14194.8**	-40.2	**288.0**	-12.0	-4%
31 Hi PC	11030	500	**11014.4**	-15.6	**522.0**	22.0	4%
32 Hi PC	12020	500	**12028.2**	8.1	**524.4**	24.4	5%

Wavenumber Units (cm-1)

Band No.	Note 4 Band Center (cm-1) (specified)	Note 5 Bandwidth (cm-1) (specified)	PFM Measured (cm-1): Ave.Band Center (cm-1) (measured & corrected)	CWL Delta (=meas. - spec.)	Ave.Bandwidth (cm-1) (measured)	BW Delta (=meas. - spec.)
20 PV	2666.67	128.07	**2639.76**	-26.91	**133.00**	4.93
21 PV	2525.89	37.90	**2504.93**	-20.96	**52.73**	14.83
22 PV	2525.89	37.90	**2517.66**	-8.23	**55.43**	17.53
23 PV	2469.14	37.07	**2465.08**	-4.05	**52.98**	15.91
24 PV	2239.64	32.61	**2235.54**	-4.10	**45.69**	13.09
25 PV	2214.84	32.87	**2200.05**	-14.79	**44.78**	11.91
27 PV	1489.20	79.90	**1478.12**	-11.09	**52.72**	-27.17
28 PV	1365.19	55.94	**1363.01**	-2.18	**60.49**	4.55
29 PV	1169.59	41.05	**1170.86**	1.27	**50.85**	9.80
30 PV	1027.75	31.70	**1027.75**	0.00	**31.84**	0.14
31 PC	906.62	41.12	**907.91**	1.29	**43.05**	1.93
32 PC	831.95	34.62	**831.38**	-0.56	**36.27**	1.64
33 PC	749.91	16.87	**748.44**	-1.47	**17.45**	0.58
34 PC	733.41	16.14	**731.02**	-2.39	**17.51**	1.37
35 PC	717.62	15.45	**718.87**	1.25	**17.21**	1.76
36 PC	702.49	14.81	**704.49**	1.99	**14.30**	-0.51
31 Hi PC	906.62	41.12	**907.91**	1.29	**43.05**	1.93
32 Hi PC	831.95	34.62	**831.38**	-0.56	**36.27**	1.64

Thermal Bands Specified and Measured Radiance Levels

Band No.	Band Ave. Center Wavelength (nm) (per MCST)	Radiances [W/(m2*sr*um)] Note 1: Ltyp (specified)	Note 1: Lmax_spec (specified)	Note 2: Lmax_set (>315K)	Calibration Range: 0.3*Ltyp	Calibration Range: 0.9*Lmax	L_sat at 4096 DN: L_sat (projected)	L_sat at 4096 DN: Lsat/Lmax per SBRS
20 PV	**3788.2**	0.45	1.71	1.82	0.14	1.54	**1.68**	1.06
21 PV	**3992.1**	2.38	86.00	87.06	0.71	77.40	**26.21**	0.69
22 PV	**3971.9**	0.67	1.89	1.93	0.20	1.70	**1.97**	1.06
23 PV	**4056.7**	0.79	2.16	2.18	0.24	1.94	**2.28**	1.07
24 PV	**4473.2**	0.17	0.34	2.45	0.05	0.31	**2.68**	7.63
25 PV	**4545.4**	0.59	0.88	2.65	0.18	0.79	**2.58**	3.11
27 PV	**6765.4**	1.16	3.21	9.84	0.35	2.89	**11.62**	3.52
28 PV	**7336.7**	2.18	4.46	11.11	0.65	4.01	**12.14**	2.74
29 PV	**8540.7**	9.58	14.54	14.55	2.87	13.09	**16.06**	1.12
30 PV	**9730.0**	3.69	6.34	12.61	1.11	5.71	**23.90**	2.81
31 PC	**11014.4**	9.55	13.25	13.27	2.87	11.93	**29.00**	1.06
32 PC	**12028.2**	8.94	12.10	12.09	2.68	10.89	**23.33**	0.99
33 PC	**13361.2**	4.52	6.56	9.47	1.36	5.90	**11.67**	1.82
34 PC	**13679.5**	3.76	5.02	9.14	1.13	4.52	**11.93**	2.27
35 PC	**13910.8**	3.11	4.42	8.91	0.93	3.98	**11.38**	2.47
36 PC	**14194.8**	2.08	2.96	8.62	0.62	2.66	**14.40**	4.09
31 HI PC	**11014.4**	29.08	29.08	29.16	8.72	26.17	**29.00**	1.06
32 HI PC	**12028.2**	25.07	25.07	25.04	7.52	22.56	**23.33**	0.99

Band No.	Band Ave. Center Wavelength (nm) (per MCST)	Temperatures (K): T_typ (K) (specified)	T_max_spec (specified)	T_max_set (>315K)	T @ 0.3Ltyp	T @ 0.9Lmax	T_sat (projected)
20 PV	3788.2	300	335	335	272.48	330.12	**333**
21 PV	3992.1	335	500	500	300.07	491.98	**429** fire band
22 PV	3971.9	300	328	328	272.28	324.35	**329**
23 PV	4056.7	300	328	328	272.12	324.52	**329**
24 PV	4473.2	250	264	315	228.42	261.73	**318**
25 PV	4545.4	275	285	315	248.14	281.16	**314**
27 PV	6765.4	240	271	315	210.73	266.64	**323**
28 PV	7336.7	250	275	315	216.55	270.79	**320**
29 PV	8540.7	300	324	324	247.13	317.57	**330**
30 PV	9730.0	250	275	315	207.72	269.73	**364**
31 PC	11014.4	300	324	324	235.33	315.75	**399**
32 PC	12028.2	300	324	324	230.99	315.26	**391**
33 PC	13361.2	260	285	315	201.88	277.60	**335**
34 PC	13679.5	250	268	315	194.77	261.25	**341**
35 PC	13910.8	240	261	315	187.86	254.21	**339**
36 PC	14194.8	220	238	315	174.58	232.26	**371**
31 HI PC	11014.4	400	400	400	293.86	387.64	**399** fire range
32 HI PC	12028.2	400	400	400	287.72	387.17	**391** fire range

3.74E+08 14387.69

Band No.	Band Ave. Center Wavelength (cm-1) (per MCST)	Wavenumber Radiances [Watts/(m2*sr*cm-1)] Note 6: Ltyp (specified)	Note 6: Lmax_spec (specified)	Lmax_set (>315K)	0.3*Ltyp	0.9*Lmax	L_sat (projected)
20 PV	2639.76	6.458E-04	2.454E-03	2.612E-03	1.937E-04	2.209E-03	**2.411E-03**
21 PV	2504.93	3.793E-03	1.371E-01	1.387E-01	1.138E-03	1.234E-01	**4.177E-02** fire band
22 PV	2517.66	1.057E-03	2.982E-03	3.039E-03	3.171E-04	2.684E-03	**3.108E-03**
23 PV	2465.08	1.300E-03	3.555E-03	3.592E-03	3.900E-04	3.199E-03	**3.752E-03**
24 PV	2235.54	3.402E-04	6.803E-04	4.893E-03	1.020E-04	6.123E-04	**5.363E-03**
25 PV	2200.05	1.219E-03	1.818E-03	5.484E-03	3.657E-04	1.636E-03	**5.330E-03**
27 PV	1478.12	5.309E-03	1.469E-02	4.503E-02	1.593E-03	1.322E-02	**5.319E-02**
28 PV	1363.01	1.173E-02	2.401E-02	5.978E-02	3.520E-03	2.161E-02	**6.535E-02**
29 PV	1170.86	6.988E-02	1.061E-01	1.061E-01	2.096E-02	9.545E-02	**1.171E-01**
30 PV	1027.75	3.493E-02	6.002E-02	1.194E-01	1.048E-02	5.402E-02	**2.263E-01**
31 PC	907.91	1.159E-01	1.607E-01	1.610E-01	3.476E-02	1.447E-01	**3.518E-01**
32 PC	831.38	1.293E-01	1.751E-01	1.750E-01	3.880E-02	1.576E-01	**3.375E-01**
33 PC	748.44	8.069E-02	1.171E-01	1.691E-01	2.421E-02	1.054E-01	**2.083E-01**
34 PC	731.02	7.036E-02	9.394E-02	1.711E-01	2.111E-02	8.455E-02	**2.232E-01**
35 PC	718.87	6.018E-02	8.553E-02	1.724E-01	1.805E-02	7.698E-02	**2.202E-01**
36 PC	704.49	4.191E-02	5.964E-02	1.737E-01	1.257E-02	5.368E-02	**2.901E-01**
31 HI PC	907.91	3.528E-01	3.528E-01	3.537E-01	1.058E-01	3.175E-01	**3.518E-01** fire range
32 HI PC	831.38	3.627E-01	3.627E-01	3.622E-01	1.088E-01	3.264E-01	**3.375E-01** fire range

Thermal Bands Sensitivities and SNRs

Wavelength Units (um)

Band No.	Center Wavelength (nm) (per MCST)	Ltyp W/(m2-sr-um) (specified)	NEdL W/(m2-sr-um) (specified)	**NEdL W/(m2-sr-um) (measured)**	NEdL (%of Ltyp) (specified)	NEdL (%of Ltyp) (measured)	NEdT (K) (specified)	**NEdT (K) (from meas. NEdL)**	SNR@Ltyp = Ltyp/NEdL (specified)	**SNR@Ltyp = Ltyp/NEdL (measured)**	SNR@Ltyp meas./spec. %
20	3788.2	0.45	0.000957	**0.0005**	0.21%	0.11%	0.05	**0.026**	470.2	**900.0**	191.40%
21	3992.1	2.38	0.015000	**0.0117**	0.63%	0.49%	2.00	**0.151**	158.7	**203.4**	128.21%
22	3971.9	0.67	0.001900	**0.0008**	0.28%	0.12%	0.07	**0.030**	352.6	**837.5**	237.50%
23	4056.7	0.79	0.002170	**0.0008**	0.27%	0.10%	0.07	**0.026**	364.1	**987.5**	271.25%
24	4473.2	0.17	0.002180	**0.0012**	1.28%	0.71%	0.25	**0.137**	78.0	**141.7**	181.67%
25	4545.4	0.59	0.006200	**0.0013**	1.05%	0.22%	0.25	**0.052**	95.2	**453.8**	476.92%
27	6765.4	1.16	0.010800	**0.0046**	0.93%	0.40%	0.25	**0.107**	107.4	**252.2**	234.78%
28	7336.7	2.18	0.017200	**0.0034**	0.79%	0.16%	0.28	**0.050**	126.7	**641.2**	505.88%
29	8540.7	9.58	0.008990	**0.0036**	0.09%	0.04%	0.05	**0.020**	1065.6	**2661.1**	249.72%
30	9730.0	3.69	0.021900	**0.0083**	0.59%	0.22%	0.25	**0.095**	168.5	**444.6**	263.86%
31	11014.4	9.55	0.007010	**0.0034**	0.07%	0.04%	0.05	**0.024**	1362.3	**2808.8**	206.18%
32	12028.2	8.94	0.006060	**0.0049**	0.07%	0.05%	0.05	**0.040**	1475.2	**1824.5**	123.67%
33	13361.2	4.52	0.018300	**0.0100**	0.40%	0.22%	0.25	**0.137**	247.0	**452.0**	183.00%
34	13679.5	3.76	0.016100	**0.0126**	0.43%	0.34%	0.25	**0.196**	233.5	**298.4**	127.78%
35	13910.8	3.11	0.014100	**0.0141**	0.45%	0.45%	0.25	**0.249**	220.6	**220.6**	100.00%
36	14194.8	2.08	0.015400	**0.0195**	0.74%	0.94%	0.35	**0.442**	135.1	**106.7**	78.97%
31 Hi	11014.4	29.08	0.247000		0.85%		1.00		117.7		
32 Hi	12028.2	25.07	0.198000		0.79%		1.00		126.6		

Wavenumber Units (cm-1); [W/(m2*sr*cm-1)]

Band No.	Note 4 Band Center(cm-1) (per MCST)	Note 6 Ltyp (specified)	Note 6 NEdL (specified)	**NEdL (measured)**
20	2639.76	0.000646	1.37E-06	**7.18E-07**
21	2504.93	0.003793	2.39E-05	**1.86E-05**
22	2517.66	0.001057	3.00E-06	**1.26E-06**
23	2465.08	0.001300	3.57E-06	**1.32E-06**
24	2235.54	0.000340	4.36E-06	**2.40E-06**
25	2200.05	0.001219	1.28E-05	**2.69E-06**
27	1478.12	0.005309	4.94E-05	**2.11E-05**
28	1363.01	0.011734	9.26E-05	**1.83E-05**
29	1170.86	0.069880	6.56E-05	**2.63E-05**
30	1027.75	0.034934	2.07E-04	**7.86E-05**
31	907.91	0.115857	8.50E-05	**4.12E-05**
32	831.38	0.129341	8.77E-05	**7.09E-05**
33	748.44	0.080692	3.27E-04	**1.79E-04**
34	731.02	0.070361	3.01E-04	**2.36E-04**
35	718.87	0.060181	2.73E-04	**2.73E-04**
36	704.49	0.041910	3.10E-04	**3.93E-04**
31 Hi	907.91	0.352787	3.00E-03	
32 Hi	831.38	0.362704	2.86E-03	

Chart 3

PFM Measured NEdL's are per SBRS PL3095-N06540, July, 18, 1997

Thermal Bands Radiometric Calibration Requirements

Band Number	Center Wavelength (nm)	Band Width (nm)	NEdT (K)	Typical (K)	Tmax (K)	Allowed Radiometric Uncertainty at 0.3 Ltyp (%)	**Allowed Radiometric Uncertainty at Ltyp (%)**	Goal: Radiometric Uncertainty at Ltyp (%)	Allowed Radiometric Uncertainty at 0.9 Lmax (%)
20	3750	180.0	0.05	300	335	1.75	0.75	0.50	1.75
21	3959	59.4	2.00	335	500		10.0		
22	3959	59.4	0.07	300	328	2.0	1.0		2.0
23	4050	60.8	0.07	300	328	2.0	1.0		2.0
24	4465	65.0	0.25	250	264	2.0	1.0		2.0
25	4515	67.0	0.25	275	285	2.0	1.0		2.0
27	6715	360.0	0.25	240	271	2.0	1.0		2.0
28	7325	300.0	0.28	250	275	2.0	1.0		2.0
29	8550	300.0	0.05	300	324	2.0	1.0		2.0
30	9730	300.0	0.25	250	275	2.0	1.0		2.0
31	11030	500.0	0.05	300	324	1.5	0.5	0.25	1.5
31hi	11030	500.0	1.00	400	400		10.0		
32	12020	500.0	0.05	300	324	1.5	0.5	0.25	1.5
31hi	12030	500.0	1.00	400	400		10.0		
33	13335	300.0	0.25	260	285	2.0	1.0		2.0
34	13635	300.0	0.25	250	268	2.0	1.0		2.0
35	13935	300.0	0.25	240	261	2.0	1.0		2.0
36	14235	300.0	0.35	220	238	2.0	1.0		2.0

Bands 21, 31 hi and 32 hi are Fire Detection and Measurement Bands

PRELIMINARY Radiance Uncertainty Estimates at 0.3 Ltypical

(not all contributors are independent; perturbation analysis required)

	Radiance and Temperature Uncertainties at 0.3 Ltypical															
Band Number	20	21	22	23	24	25	27	28	29	30	31	32	33	34	35	36
Radiance Error Due to OBC Temperature Error (%) (dT=50 mK)	0.26	0.20	0.24	0.24	0.31	0.26	0.24	0.21	0.14	0.17	0.12	0.11	0.13	0.14	0.15	0.17
Radiance Error Due to Center Wavelength Error ($d\lambda/\lambda$=0.025%)	0.35	0.30	0.33	0.33	0.35	0.32	0.25	0.23	0.17	0.18	0.14	0.13	0.13	0.14	0.14	0.15
Radiance Error Due to OBC Emissivity Error	0.60	0.60	0.60	0.70	0.75	0.75	0.80	0.70	0.70	0.15	0.80	0.80	0.55	0.35	0.35	0.15
Radiance Error Due to Scan Mirror Relative Reflectance Error	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50
Single Measurement Noise (1/SNR) %	0.21	0.63	0.28	0.27	1.28	1.05	0.93	0.79	0.09	0.59	0.07	0.07	0.40	0.43	0.45	0.74
Radiance Error Due to ADC Non-linearity (%) @ Δ DN=2	0.66	3.71	0.52	0.51	2.71	0.78	1.76	0.98	0.30	0.10	0.52	0.44	0.49	0.61	0.73	1.34
Radiance Error Due to Fitting Error (%)	0.75	4.00	0.50	0.50	3.00	1.00	1.00	0.30	0.20	0.50	0.20	0.20	0.20	0.50	0.20	0.50
RSS Radiance Error (%)	1.36	5.56	1.17	1.22	4.36	1.92	2.44	1.58	0.96	0.97	1.11	1.08	1.01	1.10	1.09	1.71
Eff. Temp. Error (K)	0.30	1.65	0.28	0.31	0.87	0.44	0.64	0.50	0.51	0.41	0.75	0.80	0.63	0.65	0.60	0.81
Eff. Temp. Error/NEdT	6.39	8.82	4.14	4.44	3.40	1.83	2.62	2.01	10.27	1.64	15.13	15.90	2.51	2.58	2.40	2.31
T@0.3 Ltyp (K)	272	300	272	272	228	248	211	217	247	208	235	231	202	195	188	175

PRELIMINARY Radiance Uncertainty Estimates at Ltypical

(not all contributors are independent; perturbation analysis required)

	Radiance and Temperature Uncertainties at Ltypical															
Band Number	20	21	22	23	24	25	27	28	29	30	31	32	33	34	35	36
Radiance Error Due to OBC Temperature Error (%) (dT=50 mK)	0.21	0.16	0.20	0.20	0.26	0.21	0.19	0.16	0.09	0.12	0.07	0.07	0.08	0.09	0.09	0.11
Radiance Error Due to Center Wavelength Error ($d\lambda/\lambda$=0.025%)	0.32	0.27	0.30	0.30	0.32	0.29	0.22	0.20	0.14	0.15	0.11	0.10	0.10	0.11	0.11	0.11
Radiance Error Due to OBC Emissivity Error	0.60	0.60	0.60	0.70	0.75	0.75	0.80	0.70	0.70	0.15	0.80	0.80	0.55	0.35	0.35	0.15
Radiance Error Due to Scan Mirror Relative Reflectance Error	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50
Single Measurement Noise (1/SNR) %	0.21	0.63	0.28	0.27	1.28	1.05	0.93	0.79	0.09	0.59	0.07	0.07	0.40	0.43	0.45	0.74
Radiance Error Due to ADC Non-linearity (%) @ Δ DN=2	0.20	1.11	0.15	0.15	0.81	0.23	0.53	0.29	0.09	0.03	0.15	0.13	0.15	0.18	0.22	0.40
Radiance Error Due to Fitting Error (%)	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.40	0.40	0.50	0.20	0.20	0.30	0.30	0.50	0.50
RSS Radiance Error (%)	1.05	1.61	1.05	1.10	1.88	1.53	1.54	1.29	0.97	0.95	0.99	0.98	0.92	0.84	0.95	1.12
Eff. Temp. Error (K)	0.23	0.48	0.25	0.28	0.38	0.35	0.41	0.41	0.52	0.40	0.67	0.73	0.57	0.49	0.52	0.53
Temp. Error/NEdT	4.92	2.55	3.69	4.01	1.47	1.46	1.65	1.64	10.36	1.61	13.46	14.51	2.27	1.95	2.09	1.51
T@Ltyp (K)	300	335	300	300	250	275	240	250	300	250	300	300	260	250	240	220

$i := 1$

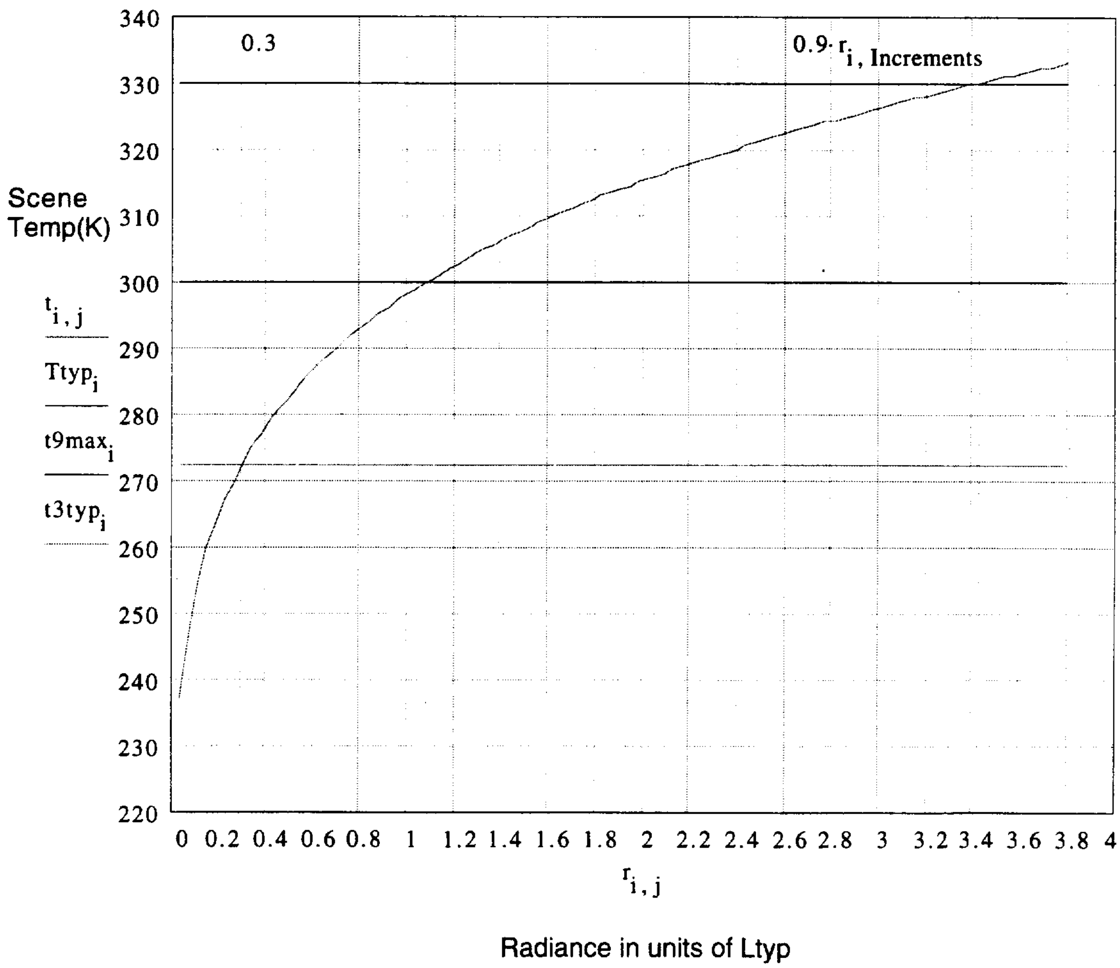
For Band $B_i = 20$ at $\lambda c_i = 3.788$ micrometers

$Ltyp_i = 0.45$ Watts/(m2*sr*um) Ltyp= $wnLtyp_i = 1.70469 \cdot 10^{-4}$ Watts/(m2*sr*cm-1)

$Lmax_i = 1.71$ Watts/(m2*sr*um) Lmax= $wnLmax_i = 6.47782 \cdot 10^{-4}$ Watts/(m2*sr*cm-1)

$Ttyp_i = 300$ K T@0.3Ltyp= $t3typ_i = 272.484$ K

$Tmax_i = 335$ K T@0.9Lmax= $t9max_i = 330.122$ K



$r_{i,2} = 0.076$ Ltyp $t_{i,2} = 248.049$ K

$r_{i,3} = 0.114$ Ltyp $t_{i,3} = 254.797$ K

$r_{i,4} = 0.152$ Ltyp $t_{i,4} = 259.811$ K

$r_{i,5} = 0.19$ Ltyp $t_{i,5} = 263.838$ K

$r_{i,6} = 0.228$ Ltyp $t_{i,6} = 267.223$ K

$i := 2$

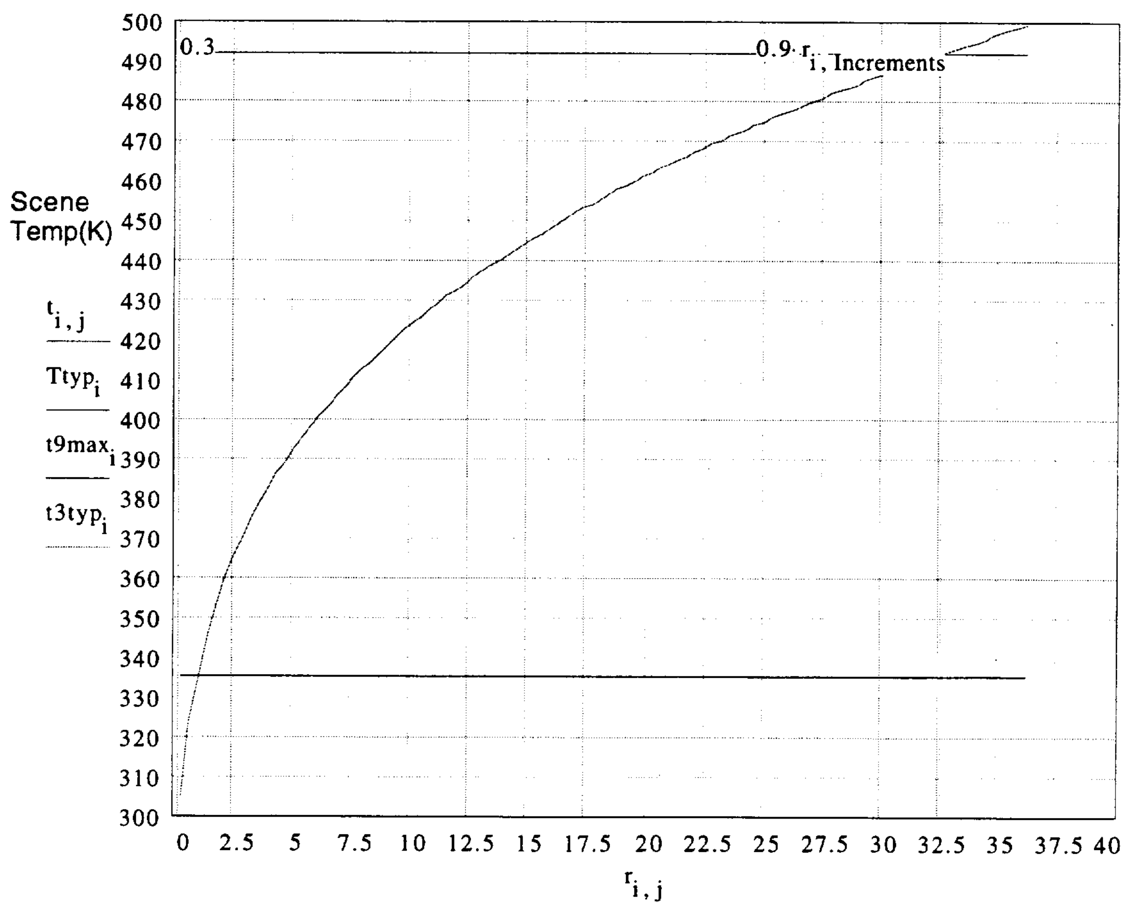
For Band $B_i = 21$ at $\lambda c_i = 3.992$ micrometers

$Ltyp_i = 2.38$ Watts/(m2*sr*um) Ltyp= $wnLtyp_i = 9.5012 \cdot 10^{-4}$ Watts/(m2*sr*cm-1)

$Lmax_i = 86$ Watts/(m2*sr*um) Lmax= $wnLmax_i = 0.03433$ Watts/(m2*sr*cm-1)

$Ttyp_i = 335$ K T@0.3Ltyp= $t3typ_i = 300.067$ K

$Tmax_i = 500$ K T@0.9Lmax= $t9max_i = 491.979$ K



$r_{i,2} = 0.723$ Ltyp $t_{i,2} = 323.766$ K

$r_{i,3} = 1.084$ Ltyp $t_{i,3} = 336.005$ K

$r_{i,4} = 1.445$ Ltyp $t_{i,4} = 345.265$ K

$r_{i,5} = 1.807$ Ltyp $t_{i,5} = 352.807$ K

$i := 3$

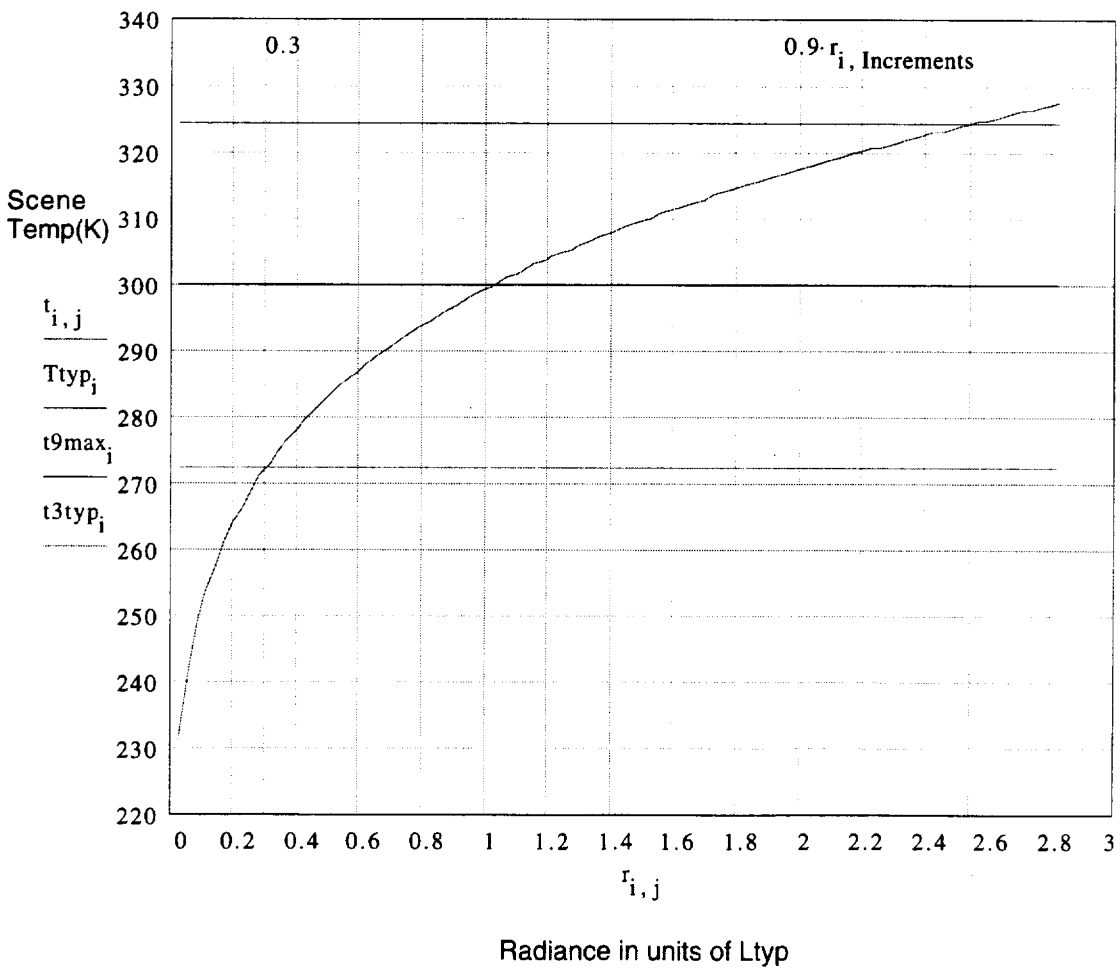
For Band $B_i = 22$ at $\lambda c_i = 3.972$ micrometers

$Ltyp_i = 0.67$ Watts/(m2*sr*um) Ltyp= $wnLtyp_i = 2.66117 \cdot 10^{-4}$ Watts/(m2*sr*cm-1)

$Lmax_i = 1.89$ Watts/(m2*sr*um) Lmax= $wnLmax_i = 7.50689 \cdot 10^{-4}$ Watts/(m2*sr*cm-1)

$Ttyp_i = 300$ K T@0.3Ltyp= $t3typ_i = 272.282$ K

$Tmax_i = 328$ K T@0.9Lmax= $t9max_i = 324.35$ K



$r_{i,2} = 0.056$ Ltyp $t_{i,2} = 241.899$ K

$r_{i,3} = 0.085$ Ltyp $t_{i,3} = 248.631$ K

$r_{i,4} = 0.113$ Ltyp $t_{i,4} = 253.639$ K

$r_{i,5} = 0.141$ Ltyp $t_{i,5} = 257.665$ K

$r_{i,6} = 0.169$ Ltyp $t_{i,6} = 261.051$ K

$i := 4$

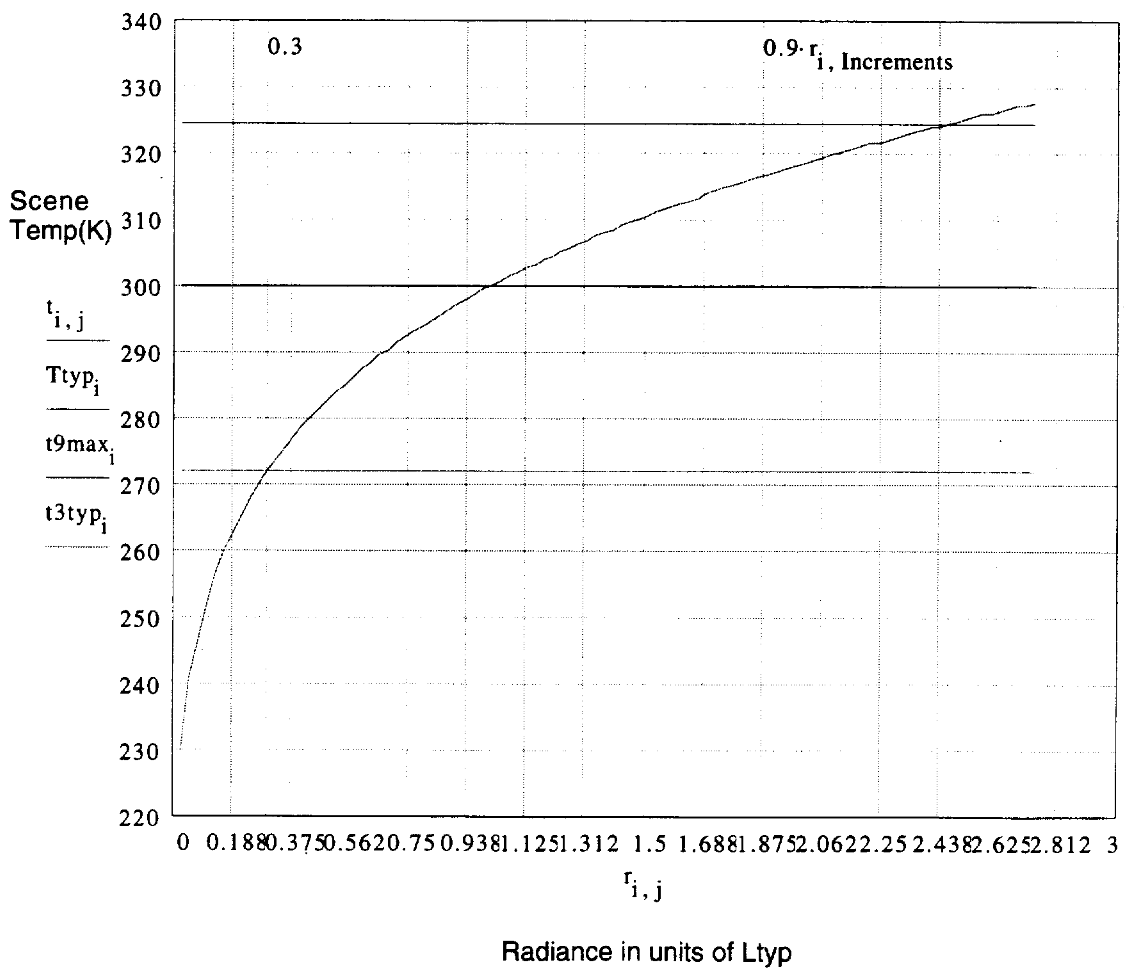
For Band $B_i = 23$ at $\lambda c_i = 4.057$ micrometers

$Ltyp_i = 0.79$ Watts/(m2*sr*um) Ltyp= $wnLtyp_i = 3.20479 \cdot 10^{-4}$ Watts/(m2*sr*cm-1)

$Lmax_i = 2.16$ Watts/(m2*sr*um) Lmax= $wnLmax_i = 8.76247 \cdot 10^{-4}$ Watts/(m2*sr*cm-1)

$Ttyp_i = 300$ K T@0.3Ltyp= $t3typ_i = 272.121$ K

$Tmax_i = 328$ K T@0.9Lmax= $t9max_i = 324.519$ K



$r_{i,2} = 0.055$ Ltyp $t_{i,2} = 240.686$ K

$r_{i,3} = 0.082$ Ltyp $t_{i,3} = 247.496$ K

$r_{i,4} = 0.109$ Ltyp $t_{i,4} = 252.567$ K

$r_{i,5} = 0.137$ Ltyp $t_{i,5} = 256.645$ K

$r_{i,6} = 0.164$ Ltyp $t_{i,6} = 260.076$ K

$i := 5$

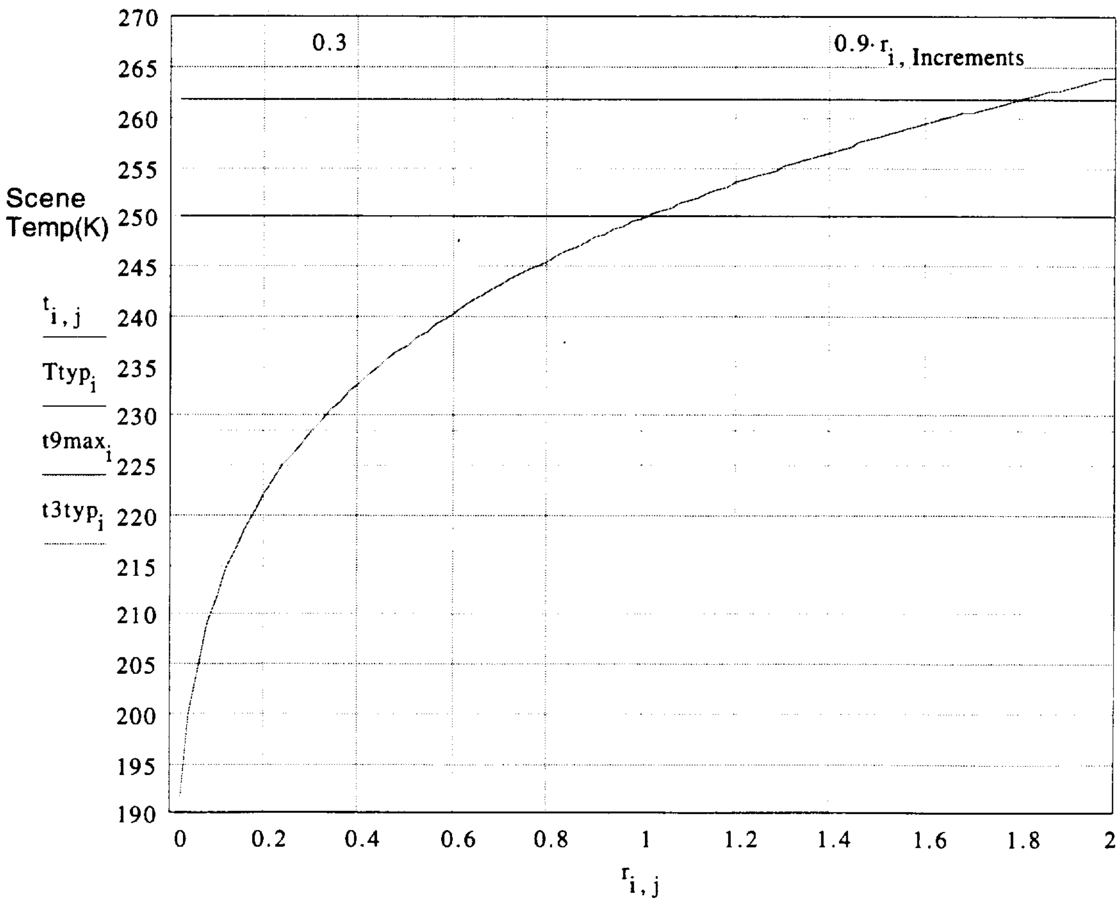
For Band $B_i = 24$ at $\lambda c_i = 4.473$ micrometers

$Ltyp_i = 0.17$ Watts/(m2*sr*um) Ltyp= $wnLtyp_i = 7.60444 \cdot 10^{-5}$ Watts/(m2*sr*cm-1)

$Lmax_i = 0.34$ Watts/(m2*sr*um) Lmax= $wnLmax_i = 1.52089 \cdot 10^{-4}$ Watts/(m2*sr*cm-1)

$Ttyp_i = 250$ K T@0.3Ltyp= $t3typ_i = 228.424$ K

$Tmax_i = 264$ K T@0.9Lmax= $t9max_i = 261.728$ K



Radiance in units of Ltyp

$r_{i,2} = 0.04$ Ltyp $t_{i,2} = 199.829$ K

$r_{i,3} = 0.06$ Ltyp $t_{i,3} = 204.993$ K

$r_{i,4} = 0.08$ Ltyp $t_{i,4} = 208.822$ K

$r_{i,5} = 0.1$ Ltyp $t_{i,5} = 211.892$ K

$r_{i,6} = 0.12$ Ltyp $t_{i,6} = 214.468$ K

$i := 6$

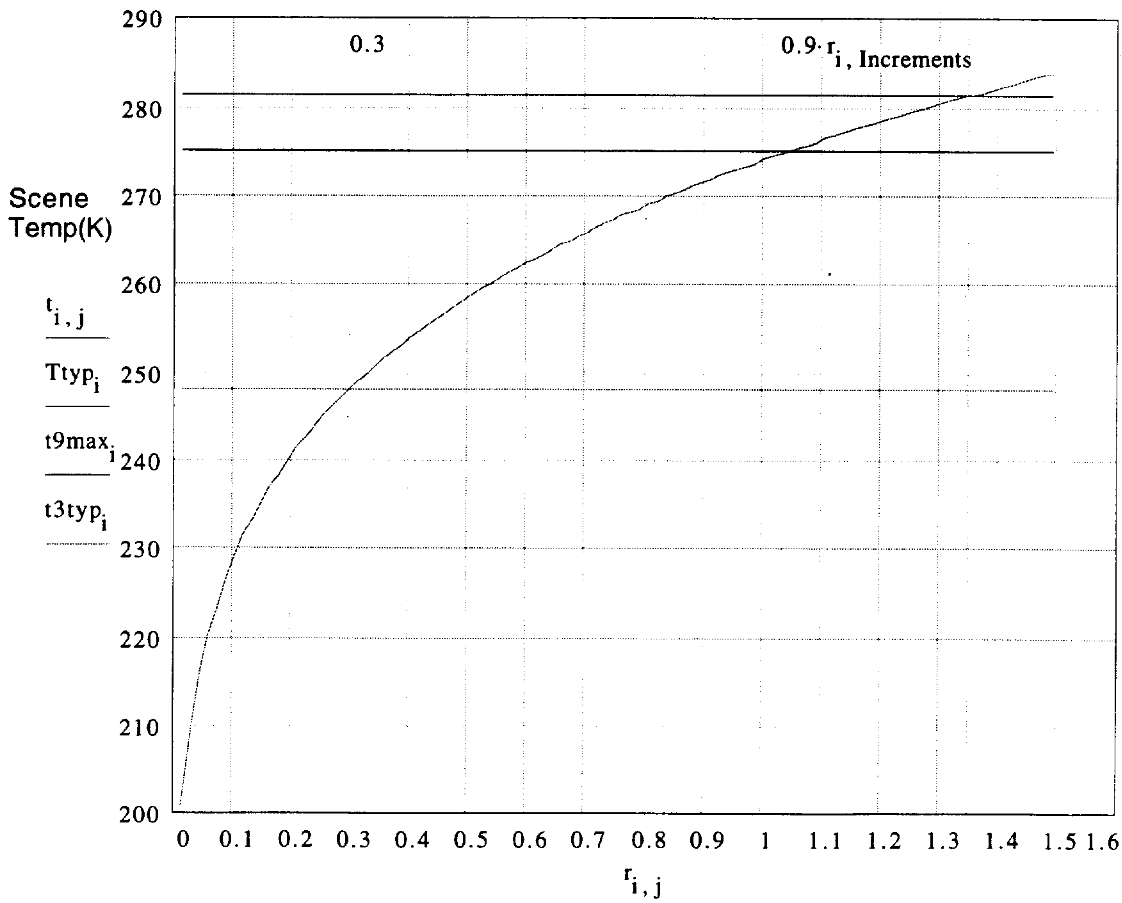
For Band $B_i = 25$ at $\lambda c_i = 4.545$ micrometers

$Ltyp_i = 0.59$ Watts/(m2*sr*um) Ltyp= $wnLtyp_i = 2.68179 \cdot 10^{-4}$ Watts/(m2*sr*cm-1)

$Lmax_i = 0.88$ Watts/(m2*sr*um) Lmax= $wnLmax_i = 3.99995 \cdot 10^{-4}$ Watts/(m2*sr*cm-1)

$Ttyp_i = 275$ K T@0.3Ltyp= $t3typ_i = 248.134$ K

$Tmax_i = 285$ K T@0.9Lmax= $t9max_i = 281.159$ K



Radiance in units of Ltyp

$r_{i,2} = 0.03$ Ltyp $t_{i,2} = 210.114$ K

$r_{i,3} = 0.045$ Ltyp $t_{i,3} = 215.926$ K

$r_{i,4} = 0.06$ Ltyp $t_{i,4} = 220.248$ K

$r_{i,5} = 0.075$ Ltyp $t_{i,5} = 223.722$ K

$r_{i,6} = 0.089$ Ltyp $t_{i,6} = 226.643$ K

$i := 6$

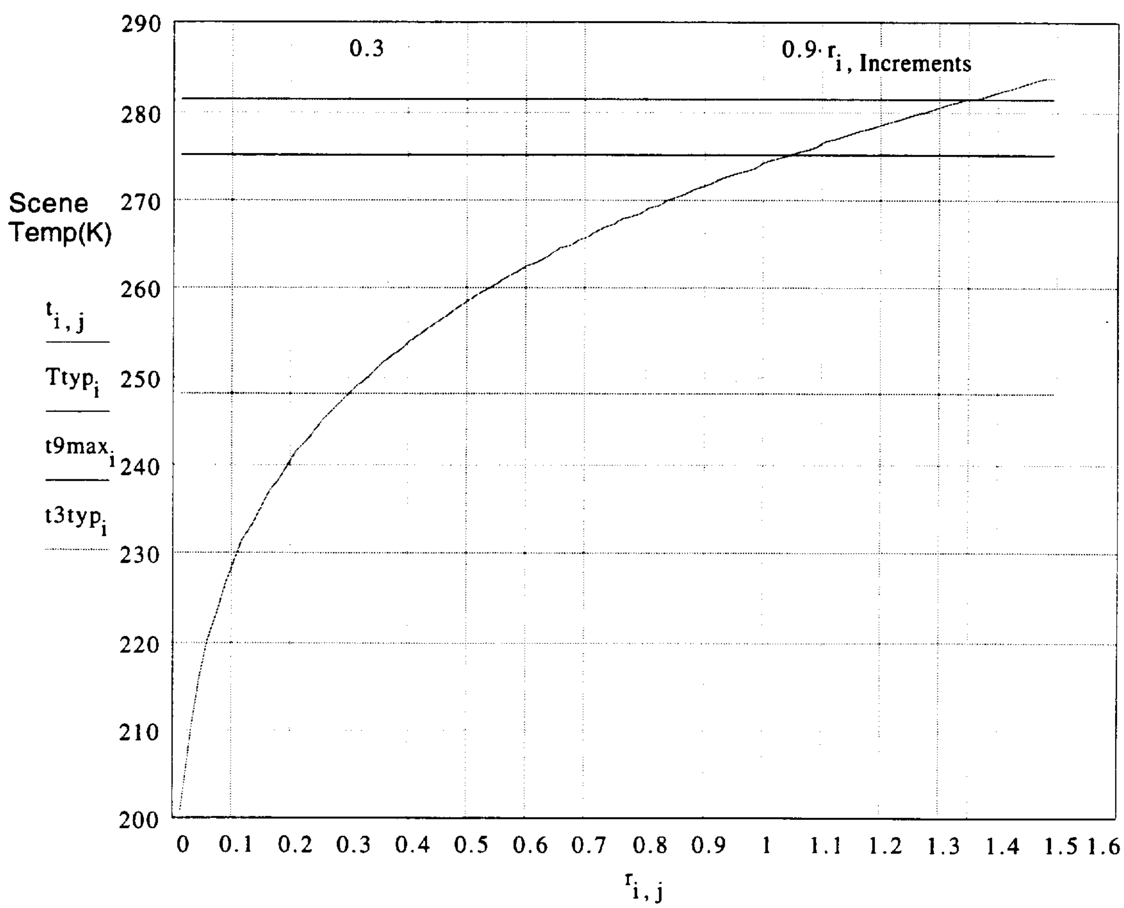
For Band $B_i = 25$ at $\lambda c_i = 4.545$ micrometers

$Ltyp_i = 0.59$ Watts/(m2*sr*um) Ltyp= $wnLtyp_i = 2.68179 \cdot 10^{-4}$ Watts/(m2*sr*cm-1)

$Lmax_i = 0.88$ Watts/(m2*sr*um) Lmax= $wnLmax_i = 3.99995 \cdot 10^{-4}$ Watts/(m2*sr*cm-1)

$Ttyp_i = 275$ K T@0.3Ltyp= $t3typ_i = 248.134$ K

$Tmax_i = 285$ K T@0.9Lmax= $t9max_i = 281.159$ K



Radiance in units of Ltyp

$r_{i,2} = 0.03$ Ltyp $t_{i,2} = 210.114$ K

$r_{i,3} = 0.045$ Ltyp $t_{i,3} = 215.926$ K

$r_{i,4} = 0.06$ Ltyp $t_{i,4} = 220.248$ K

$r_{i,5} = 0.075$ Ltyp $t_{i,5} = 223.722$ K

$r_{i,6} = 0.089$ Ltyp $t_{i,6} = 226.643$ K

$i := 7$

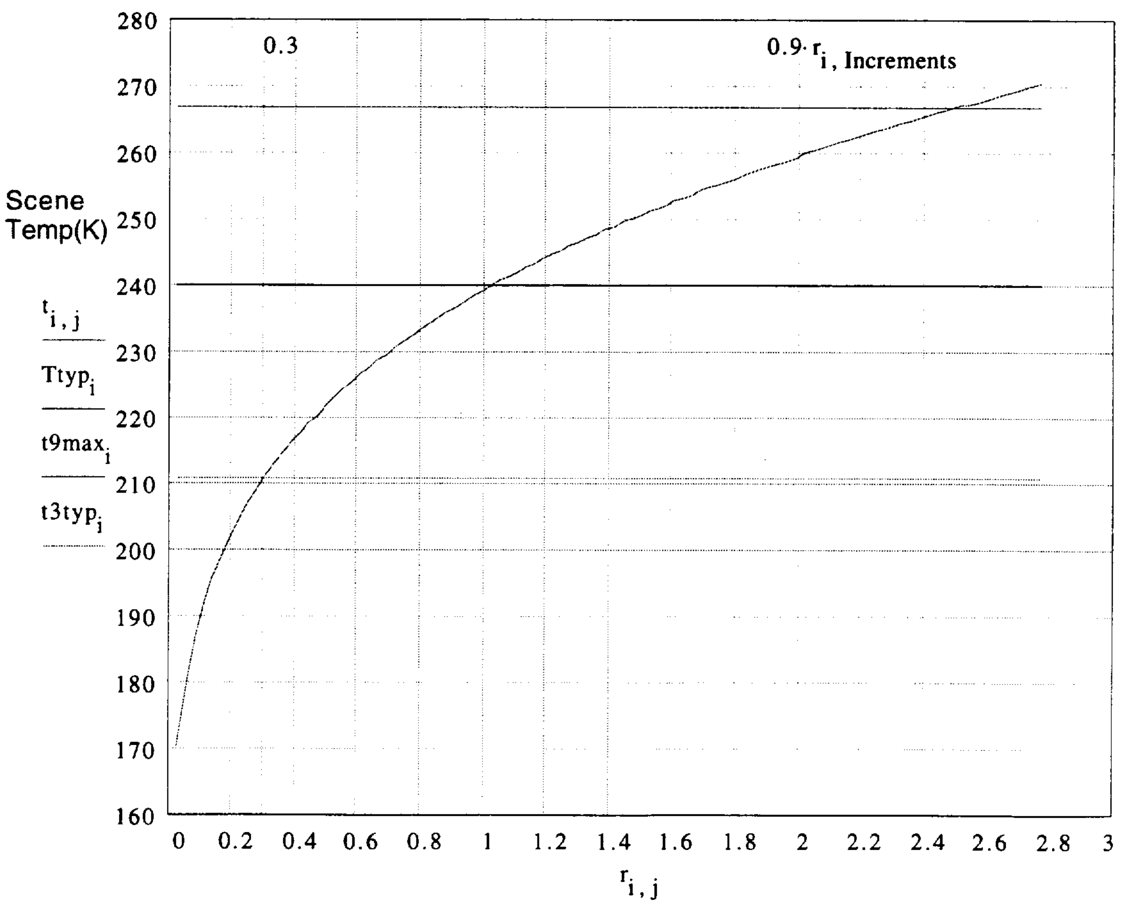
For Band $B_i = 27$ at $\lambda c_i = 6.765$ micrometers

$Ltyp_i = 1.16$ Watts/(m2*sr*um) Ltyp= $wnLtyp_i = 7.84786 \cdot 10^{-4}$ Watts/(m2*sr*cm-1)

$Lmax_i = 3.21$ Watts/(m2*sr*um) Lmax= $wnLmax_i = 0.00217$ Watts/(m2*sr*cm-1)

$Ttyp_i = 240$ K T@0.3Ltyp= $t3typ_i = 210.727$ K

$Tmax_i = 271$ K T@0.9Lmax= $t9max_i = 266.638$ K



Radiance in units of Ltyp

$r_{i,2} = 0.055$ Ltyp $t_{i,2} = 180.498$ K

$r_{i,3} = 0.083$ Ltyp $t_{i,3} = 186.931$ K

$r_{i,4} = 0.111$ Ltyp $t_{i,4} = 191.78$ K

$r_{i,5} = 0.138$ Ltyp $t_{i,5} = 195.719$ K

$r_{i,6} = 0.166$ Ltyp $t_{i,6} = 199.059$ K

$i := 8$

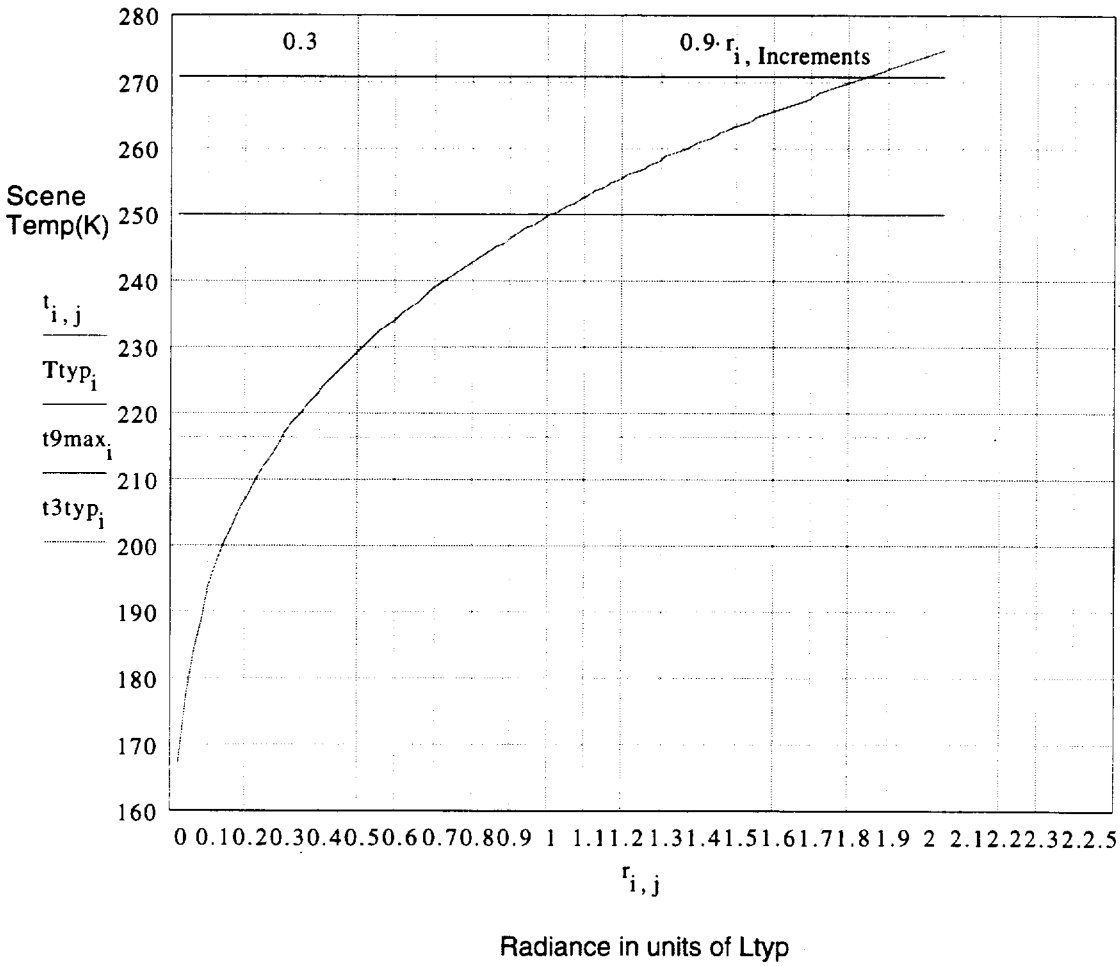
For Band $B_i = 28$ at $\lambda c_i = 7.337$ micrometers

$Ltyp_i = 2.18$ Watts/(m2*sr*um) Ltyp= $wnLtyp_i = 0.0016$ Watts/(m2*sr*cm-1)

$Lmax_i = 4.46$ Watts/(m2*sr*um) Lmax= $wnLmax_i = 0.00327$ Watts/(m2*sr*cm-1)

$Ttyp_i = 250$ K T@0.3Ltyp= $t3typ_i = 216.552$ K

$Tmax_i = 275$ K T@0.9Lmax= $t9max_i = 270.79$ K



$r_{i,2} = 0.041$ Ltyp $t_{i,2} = 177.504$ K

$r_{i,3} = 0.061$ Ltyp $t_{i,3} = 184.267$ K

$r_{i,4} = 0.082$ Ltyp $t_{i,4} = 189.386$ K

$r_{i,5} = 0.102$ Ltyp $t_{i,5} = 193.557$ K

$r_{i,6} = 0.123$ Ltyp $t_{i,6} = 197.104$ K

$i := 9$

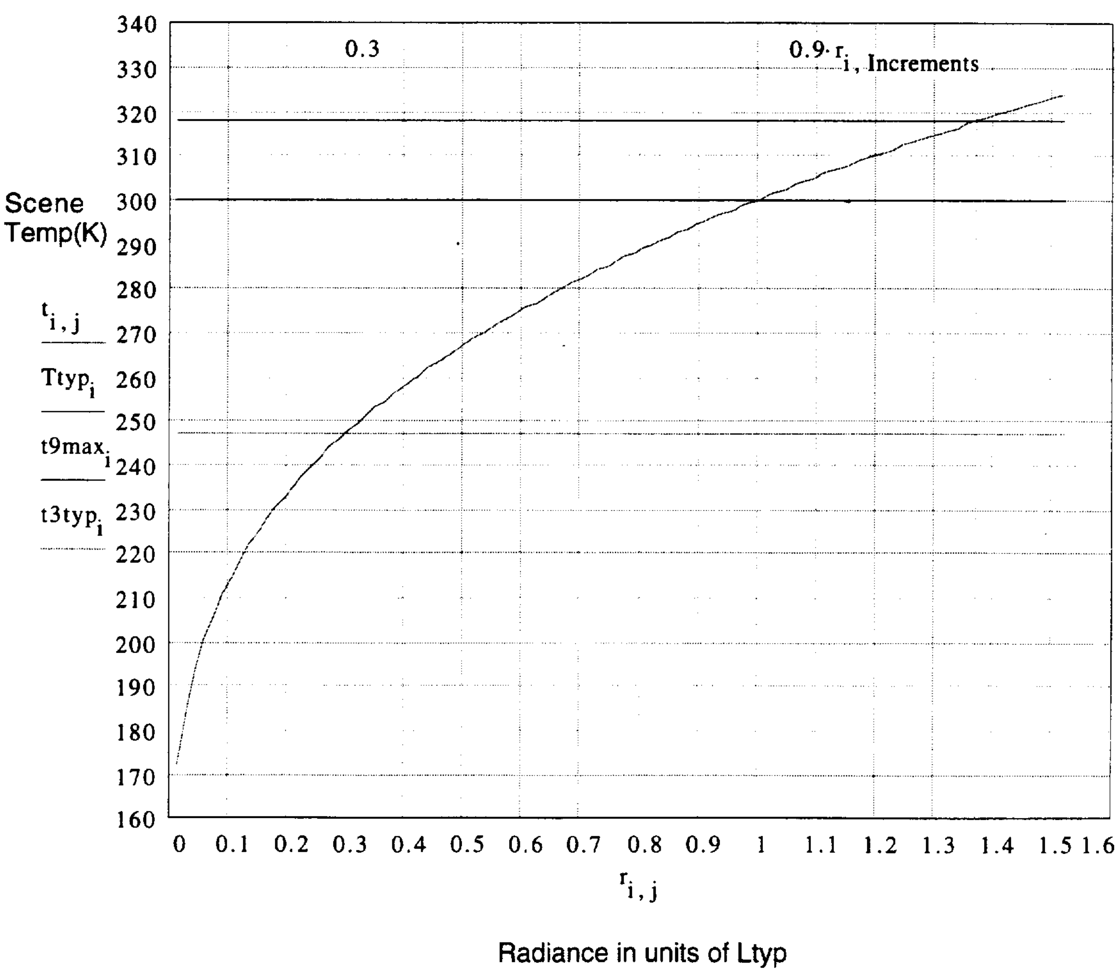
For Band $B_i = 29$ at $\lambda c_i = 8.541$ micrometers

$Ltyp_i = 9.58$ Watts/(m2*sr*um) Ltyp= $wnLtyp_i = 0.00818$ Watts/(m2*sr*cm-1)

$Lmax_i = 14.54$ Watts/(m2*sr*um) Lmax= $wnLmax_i = 0.01242$ Watts/(m2*sr*cm-1)

$Ttyp_i = 300$ K T@0.3Ltyp= $t3typ_i = 247.129$ K

$Tmax_i = 324$ K T@0.9Lmax= $t9max_i = 317.566$ K



$r_{i,2} = 0.03$ Ltyp $t_{i,2} = 184.989$ K

$r_{i,3} = 0.046$ Ltyp $t_{i,3} = 193.608$ K

$r_{i,4} = 0.061$ Ltyp $t_{i,4} = 200.226$ K

$r_{i,5} = 0.076$ Ltyp $t_{i,5} = 205.68$ K

$r_{i,6} = 0.091$ Ltyp $t_{i,6} = 210.361$ K

$i := 10$

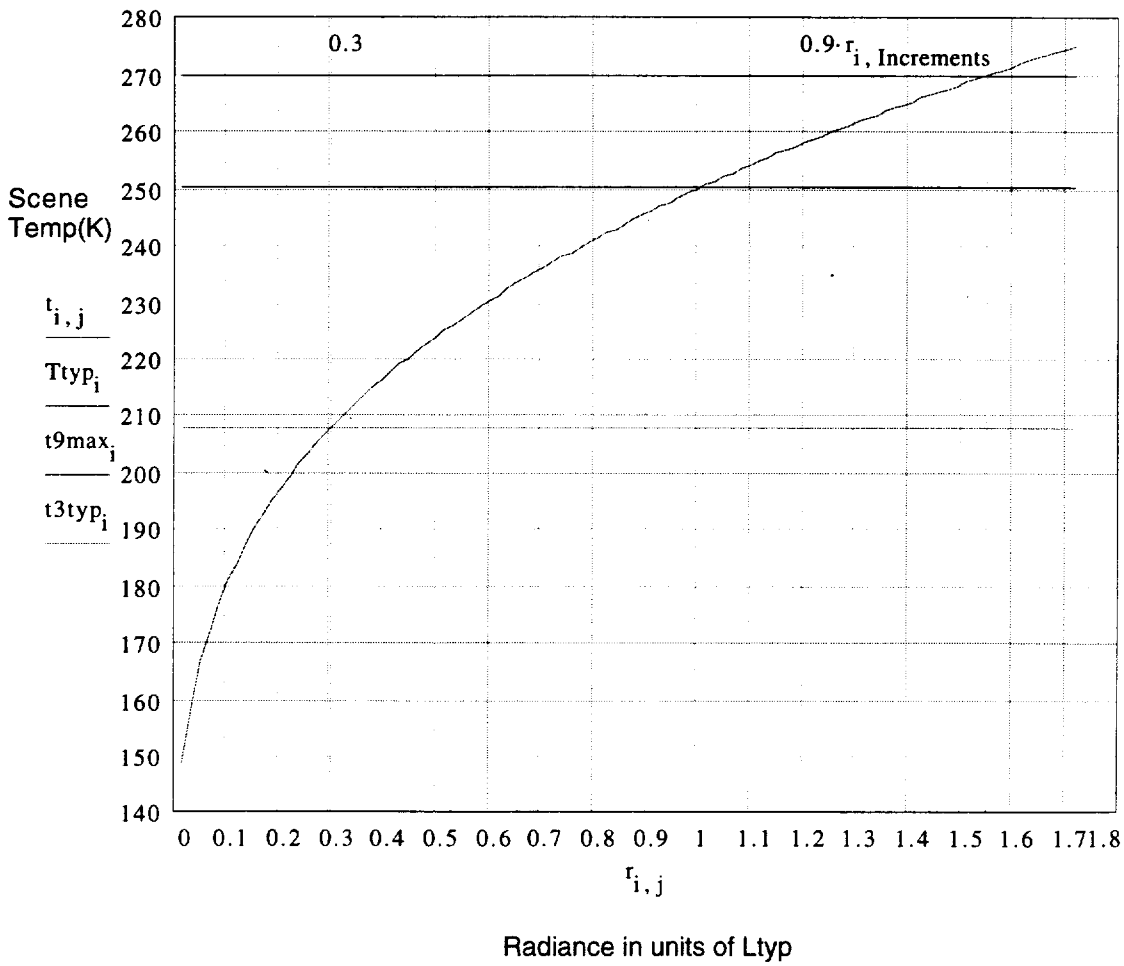
For Band $B_i = 30$ at $\lambda c_i = 9.73$ micrometers

$Ltyp_i = 3.69$ Watts/(m2*sr*um) Ltyp= $wnLtyp_i = 0.00359$ Watts/(m2*sr*cm-1)

$Lmax_i = 6.34$ Watts/(m2*sr*um) Lmax= $wnLmax_i = 0.00617$ Watts/(m2*sr*cm-1)

$Ttyp_i = 250$ K T@0.3Ltyp= $t3typ_i = 207.723$ K

$Tmax_i = 275$ K T@0.9Lmax= $t9max_i = 269.732$ K



$r_{i,2} = 0.034$ Ltyp $t_{i,2} = 159.262$ K

$r_{i,3} = 0.052$ Ltyp $t_{i,3} = 166.533$ K

$r_{i,4} = 0.069$ Ltyp $t_{i,4} = 172.109$ K

$r_{i,5} = 0.086$ Ltyp $t_{i,5} = 176.697$ K

$r_{i,6} = 0.103$ Ltyp $t_{i,6} = 180.631$ K

$i := 11$

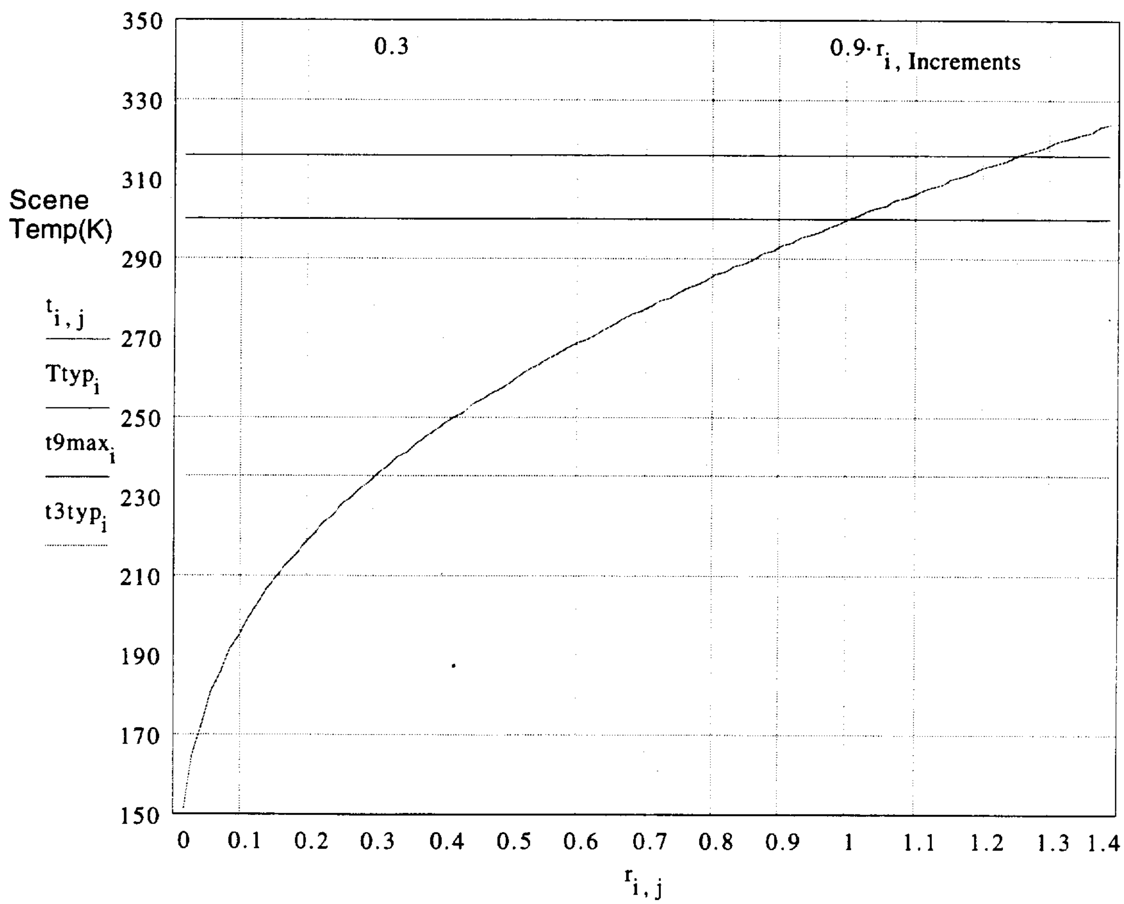
For Band $B_i = 31$ at $\lambda c_i = 11.014$ micrometers

$Ltyp_i = 9.55$ Watts/(m2*sr*um) Ltyp= $wnLtyp_i = 0.01052$ Watts/(m2*sr*cm-1)

$Lmax_i = 13.25$ Watts/(m2*sr*um) Lmax= $wnLmax_i = 0.01459$ Watts/(m2*sr*cm-1)

$Ttyp_i = 300$ K T@0.3Ltyp= $t3typ_i = 235.328$ K

$Tmax_i = 324$ K T@0.9Lmax= $t9max_i = 315.754$ K



Radiance in units of Ltyp

$r_{i,2} = 0.028$ Ltyp $t_{i,2} = 164.768$ K

$r_{i,3} = 0.042$ Ltyp $t_{i,3} = 173.645$ K

$r_{i,4} = 0.055$ Ltyp $t_{i,4} = 180.545$ K

$r_{i,5} = 0.069$ Ltyp $t_{i,5} = 186.286$ K

$r_{i,6} = 0.083$ Ltyp $t_{i,6} = 191.254$ K

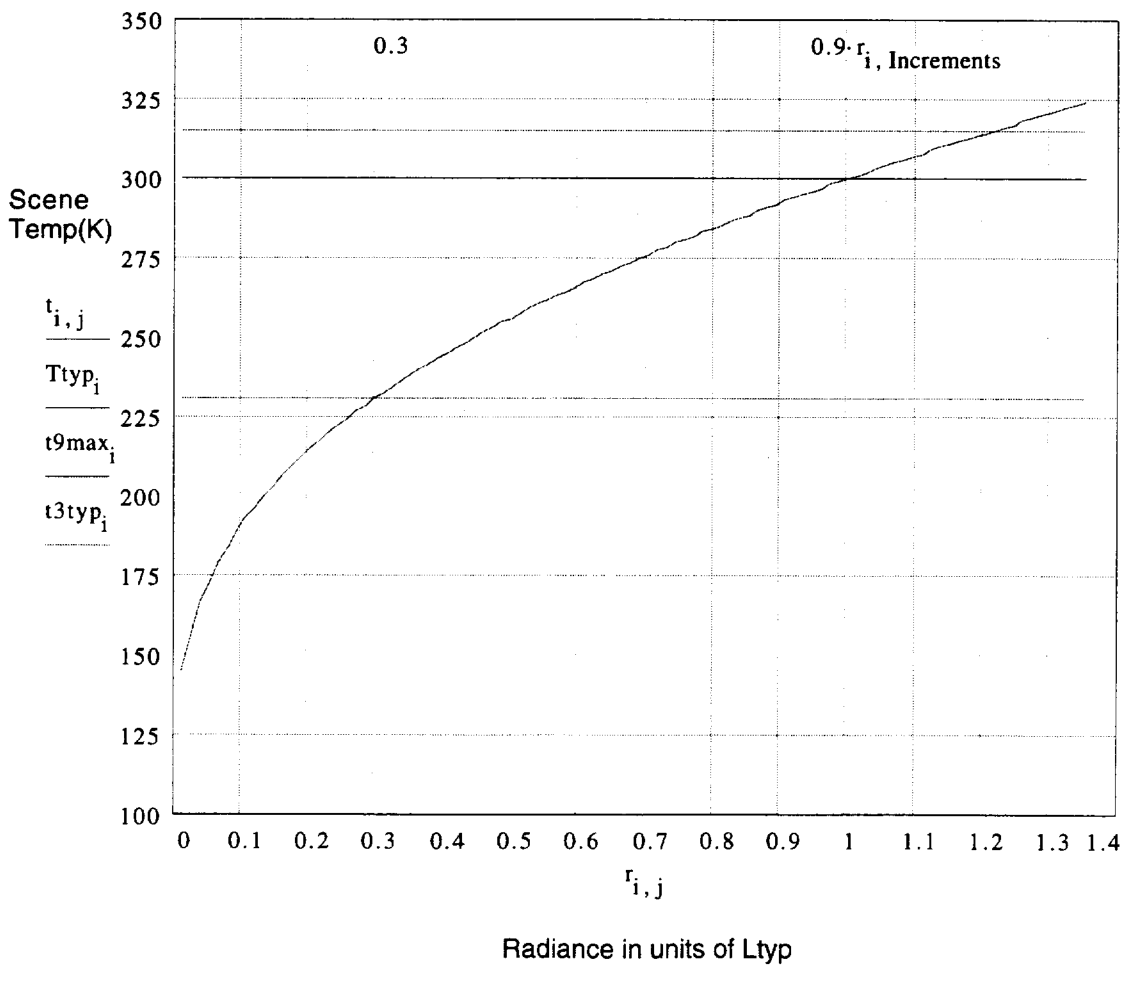
$i := 12$

For Band $B_i = 32$ at $\lambda c_i = 12.028$ micrometers

$Ltyp_i = 8.94$	Watts/(m2*sr*um)	Ltyp= $wnLtyp_i = 0.01075$	Watts/(m2*sr*cm-1)
$Lmax_i = 12.1$	Watts/(m2*sr*um)	Lmax= $wnLmax_i = 0.01455$	Watts/(m2*sr*cm-1)

$Ttyp_i = 300$ K T@0.3Ltyp= $t3typ_i = 230.994$ K

$Tmax_i = 324$ K T@0.9Lmax= $t9max_i = 315.265$ K



$r_{i,2} = 0.027$ Ltyp $t_{i,2} = 157.835$ K

$r_{i,3} = 0.041$ Ltyp $t_{i,3} = 166.751$ K

$r_{i,4} = 0.054$ Ltyp $t_{i,4} = 173.711$ K

$r_{i,5} = 0.068$ Ltyp $t_{i,5} = 179.522$ K

$r_{i,6} = 0.081$ Ltyp $t_{i,6} = 184.565$ K

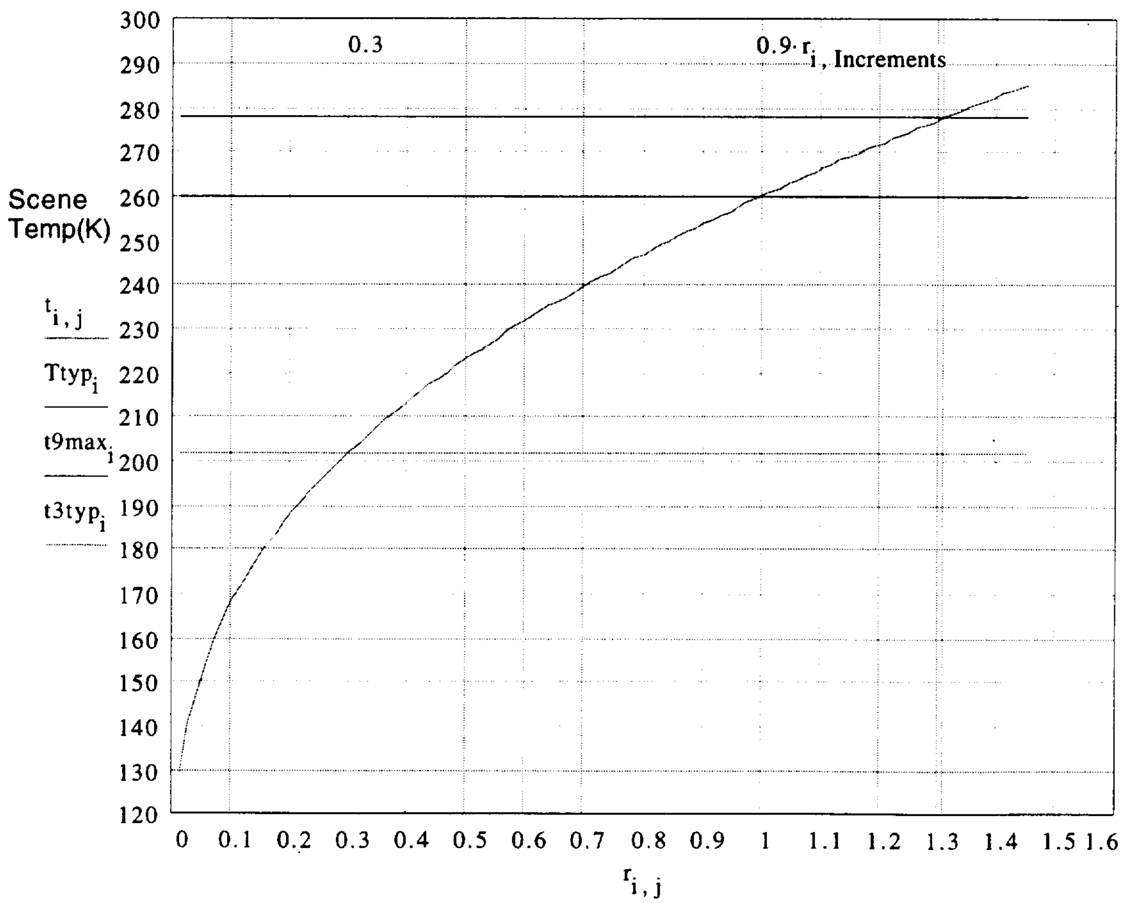
$i := 13$

For Band $B_i = 33$ at $\lambda c_i = 13.361$ micrometers

$Ltyp_i = 4.52$	Watts/(m2*sr*um)	Ltyp= $wnLtyp_i = 0.00604$	Watts/(m2*sr*cm-1)
$Lmax_i = 6.56$	Watts/(m2*sr*um)	Lmax= $wnLmax_i = 0.00876$	Watts/(m2*sr*cm-1)

$Ttyp_i = 260$ K T@0.3Ltyp= $t3typ_i = 201.878$ K

$Tmax_i = 285$ K T@0.9Lmax= $t9max_i = 277.604$ K



Radiance in units of Ltyp

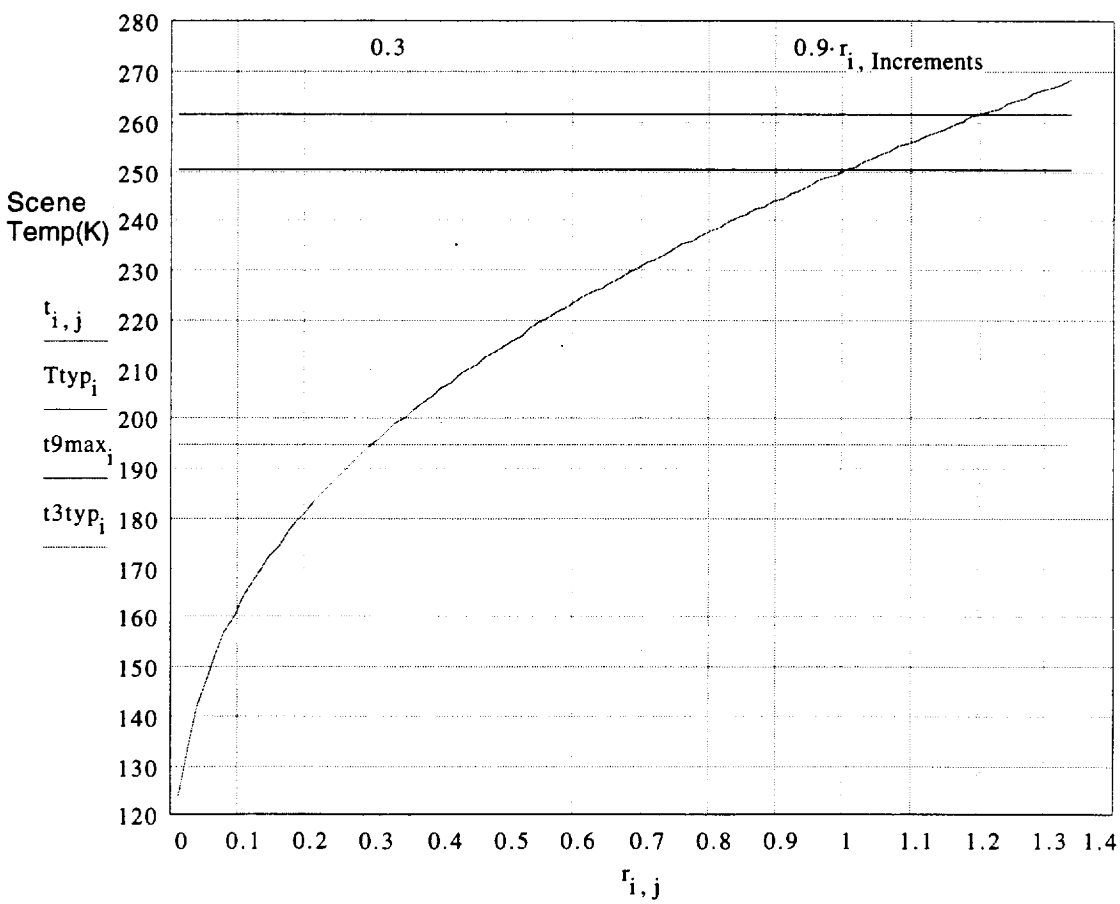
$r_{i,2} = 0.029$	Ltyp	$t_{i,2} = 140.482$	K
$r_{i,3} = 0.044$	Ltyp	$t_{i,3} = 148.323$	K
$r_{i,4} = 0.058$	Ltyp	$t_{i,4} = 154.438$	K
$r_{i,5} = 0.073$	Ltyp	$t_{i,5} = 159.538$	K
$r_{i,6} = 0.087$	Ltyp	$t_{i,6} = 163.961$	K

$i := 14$

For Band $B_i = 34$ at $\lambda c_i = 13.68$ micrometers

$Ltyp_i = 3.76$	Watts/(m2*sr*um)	Ltyp=	$wnLtyp_i = 0.00514$	Watts/(m2*sr*cm-1)
$Lmax_i = 5.02$	Watts/(m2*sr*um)	Lmax=	$wnLmax_i = 0.00687$	Watts/(m2*sr*cm-1)

$Ttyp_i = 250$ K	T@0.3Ltyp=	$t3typ_i = 194.769$	K
$Tmax_i = 268$ K	T@0.9Lmax=	$t9max_i = 261.247$	K



$r_{i,2} = 0.027$	Ltyp	$t_{i,2} = 134.583$	K
$r_{i,3} = 0.04$	Ltyp	$t_{i,3} = 141.944$	K
$r_{i,4} = 0.053$	Ltyp	$t_{i,4} = 147.673$	K
$r_{i,5} = 0.067$	Ltyp	$t_{i,5} = 152.445$	K
$r_{i,6} = 0.08$	Ltyp	$t_{i,6} = 156.578$	K

$i := 15$

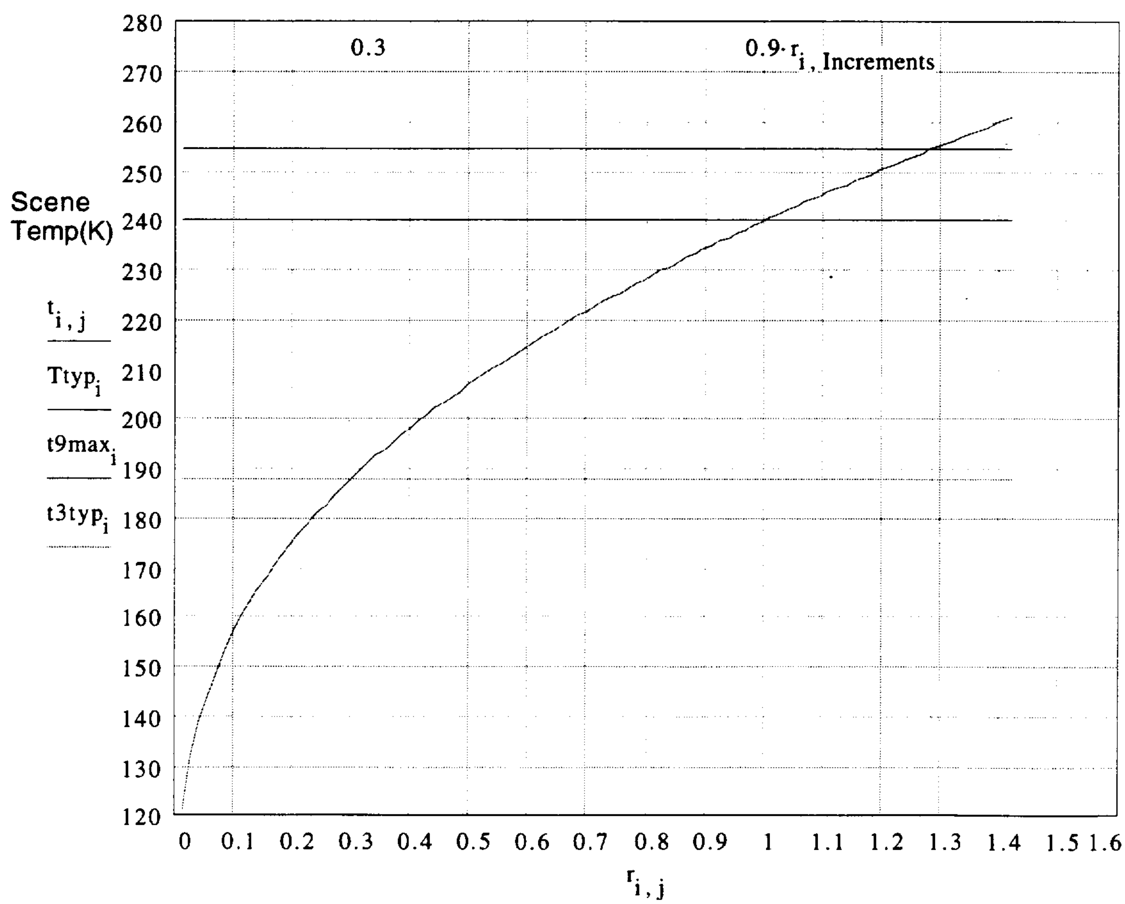
For Band $B_i = 35$ at $\lambda c_i = 13.911$ micrometers

$Ltyp_i = 3.11$ Watts/(m2*sr*um) Ltyp= $wnLtyp_i = 0.00433$ Watts/(m2*sr*cm-1)

$Lmax_i = 4.42$ Watts/(m2*sr*um) Lmax= $wnLmax_i = 0.00615$ Watts/(m2*sr*cm-1)

$Ttyp_i = 240$ K T@0.3Ltyp= $t3typ_i = 187.86$ K

$Tmax_i = 261$ K T@0.9Lmax= $t9max_i = 254.208$ K



Radiance in units of Ltyp

$r_{i,2} = 0.028$ Ltyp $t_{i,2} = 131.614$ K

$r_{i,3} = 0.043$ Ltyp $t_{i,3} = 138.771$ K

$r_{i,4} = 0.057$ Ltyp $t_{i,4} = 144.338$ K

$r_{i,5} = 0.071$ Ltyp $t_{i,5} = 148.973$ K

$r_{i,6} = 0.085$ Ltyp $t_{i,6} = 152.986$ K

$i := 16$

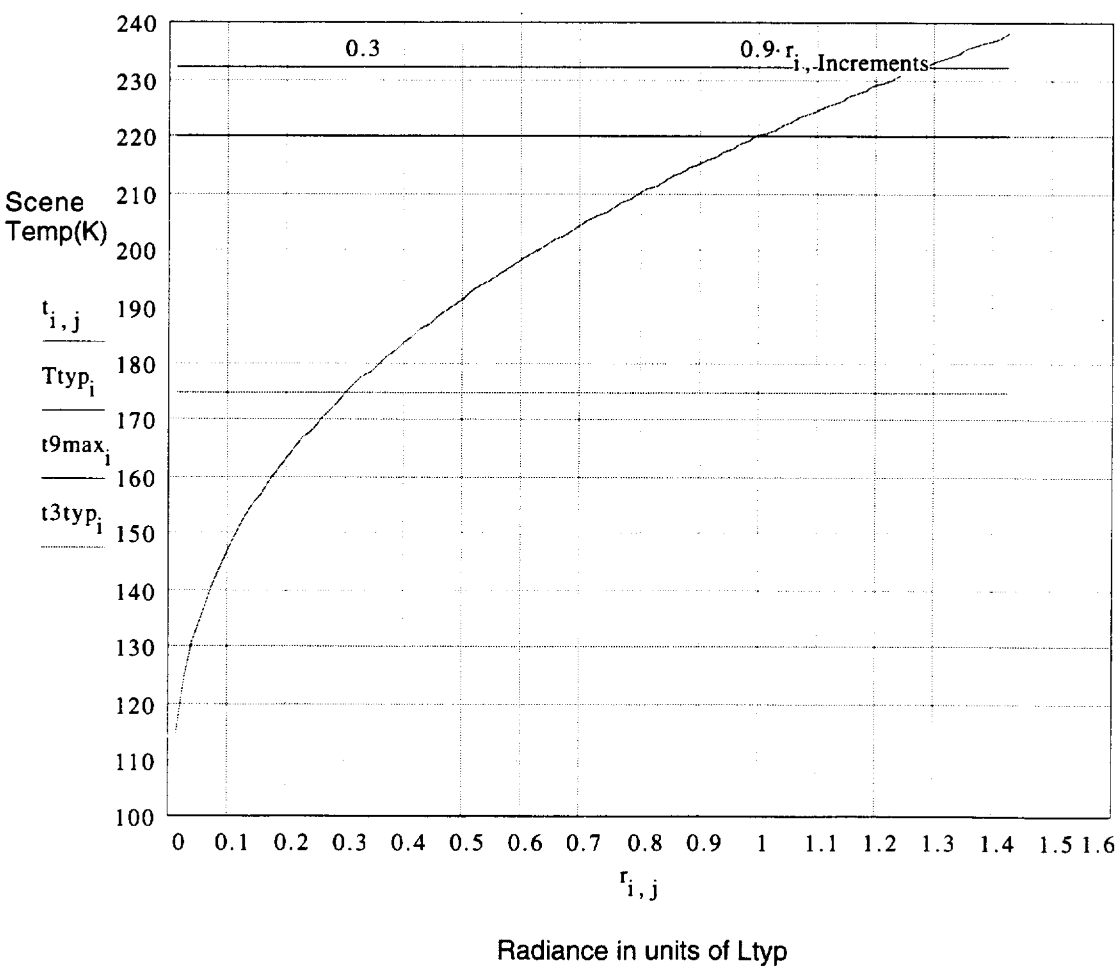
For Band $B_i = 36$ at $\lambda c_i = 14.195$ micrometers

$Ltyp_i = 2.08$ Watts/(m2*sr*um) Ltyp= $wnLtyp_i = 0.00295$ Watts/(m2*sr*cm-1)

$Lmax_i = 2.96$ Watts/(m2*sr*um) Lmax= $wnLmax_i = 0.0042$ Watts/(m2*sr*cm-1)

$Ttyp_i = 220$ K T@0.3Ltyp= $t3typ_i = 174.584$ K

$Tmax_i = 238$ K T@0.9Lmax= $t9max_i = 232.255$ K



$r_{i,2} = 0.028$ Ltyp $t_{i,2} = 124.241$ K

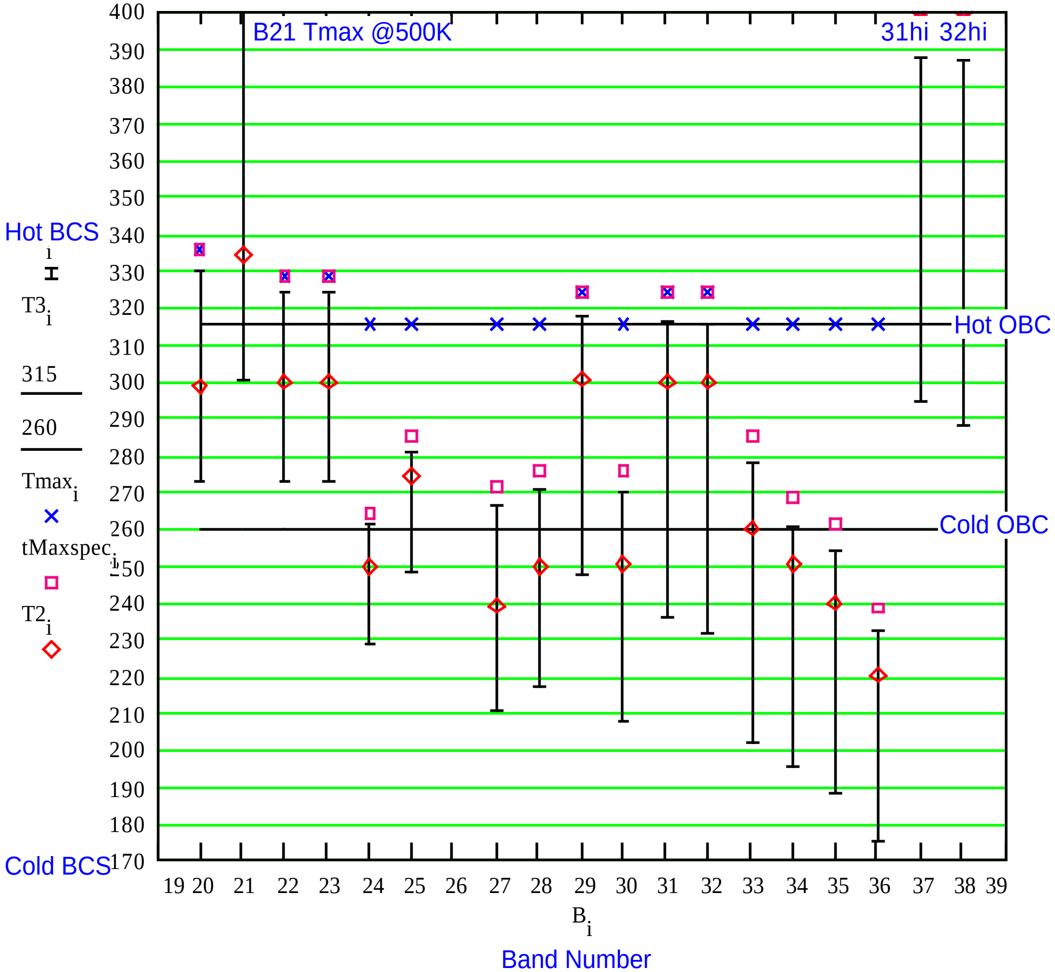
$r_{i,3} = 0.043$ Ltyp $t_{i,3} = 130.736$ K

$r_{i,4} = 0.057$ Ltyp $t_{i,4} = 135.772$ K

$r_{i,5} = 0.071$ Ltyp $t_{i,5} = 139.952$ K

$r_{i,6} = 0.085$ Ltyp $t_{i,6} = 143.563$ K

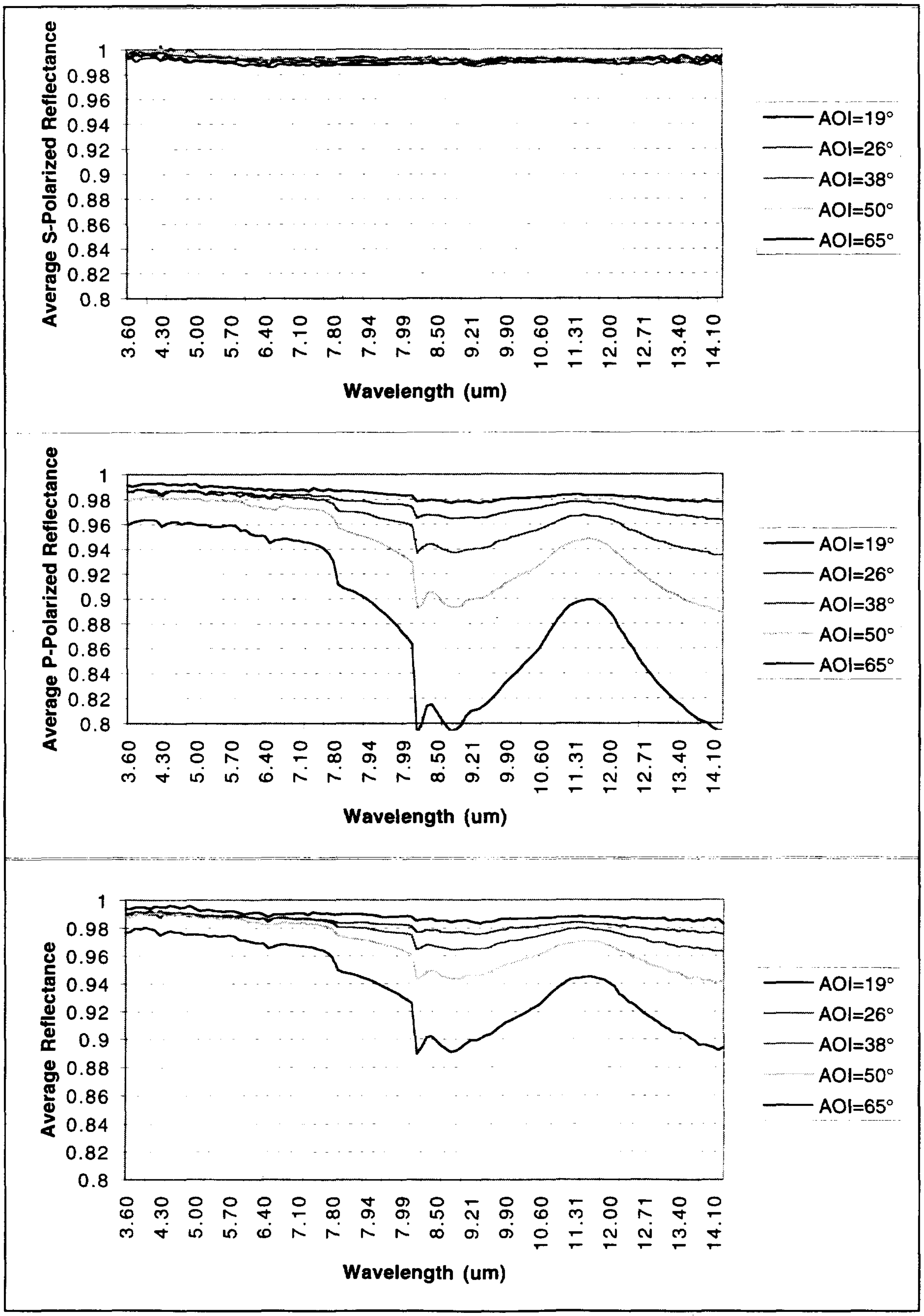
MODIS Operational and Calibration Ranges



Vertical bars represent temperatures of 0.3Ltyp and 0.9 Lmax. Box symbols represent Tmax_spec, X symbols represent the value of Tmax_set (the higher of tMaxspec or 315K), and the diamond symbols represent the temperature of Ltyp.

MODIS

Scan Mirror Reflectivity vs Angle of Incident (AOI) Model



Average of SN03 and SN04 Samples; Measurement #1

Scan Mirror Reflectivity Data Analysis and Fitting Procedure

- 3 of 4Lincoln Laboratory measurements selected to determine average in-band reflectivity
  - SN#4; measurement#2 data appeared anormalory.
- Average RSR weighted reflectivity determined for 19^0, 26^0, 38^0, 50^0 and 65^0 AOIs.

$$\overline{\rho_{19}(B)} = \frac{\int_{-1\%}^{+1\%} \left[\rho_{19}^{\#1}(\lambda) + \rho_{19}^{\#2}(\lambda) + \rho_{19}^{\#3}(\lambda)\right] RSR(\lambda)\, d\lambda}{\int_{-1\%}^{+1\%} RSR(\lambda)\, d\lambda}$$

- $\overline{\rho_{19}(B)}, \overline{\rho_{26}(B)}, \overline{\rho_{38}(B)}, \overline{\rho_{50}(B)}, \overline{\rho_{65}(B)}$ fitted to quadratic and lorentz

ScM Reflectivity Data Analysis (continue)

- Quadratic Function

$$\rho(B, AOI) = a_0^B + a_1^B \; AOI + a_2^B \; AOI^2$$

where AOI = Angle-of-Incident [Degree]

- Lorentz Function

$$\rho(B, AOI) = \rho_0 \frac{(HW)^E}{(2 \; AOI)^E + (HW)^E}$$

where the three parameters, ρ_0,HW,E, are band dependent

- For Fitting: $\rho_{s-pol}(AOI = 0) = 0.99$ for all bands

$$\rho_{p-pol}(AOI = 0) = \rho_{s-pol}(AOI = 0)$$

$$\bar{\rho}(AOI = 0) = 0.99$$

RSR Weighted Scan Mirror Reflectances

Band 20	AOI=19	AOI=26	AOI=38	AOI=50	AOI=65
Rho_rsr_wtd(Old SNO3)	0.9926	0.9883	0.9903	0.9897	0.9793
Rho_rsr_wtd(New SNO3)	0.9815	0.9861	0.9900	0.9859	0.9728
Rho_rsr_wtd(Old SNO4)	0.9951	0.9908	0.9916	0.9887	0.9792
Average of 3 measured	0.9897	0.9884	0.9906	0.9881	0.9771

Band 21	AOI=19	AOI=26	AOI=38	AOI=50	AOI=65
Rho_rsr_wtd(Old SNO3)	0.9942	0.9892	0.9905	0.9913	0.9802
Rho_rsr_wtd(New SNO3)	0.9843	0.9869	0.9896	0.9855	0.9745
Rho_rsr_wtd(Old SNO4)	0.9971	0.9925	0.9920	0.9892	0.9796
Average of 3 measured	0.9918	0.9895	0.9907	0.9887	0.9781

Band 22	AOI=19	AOI=26	AOI=38	AOI=50	AOI=65
Rho_rsr_wtd(Old SNO3)	0.9934	0.9890	0.9923	0.9900	0.9798
Rho_rsr_wtd(New SNO3)	0.9846	0.9869	0.9893	0.9866	0.9728
Rho_rsr_wtd(Old SNO4)	0.9959	0.9923	0.9919	0.9894	0.9788
Average of 3 measured	0.9913	0.9894	0.9911	0.9886	0.9771

Band 23	AOI=19	AOI=26	AOI=38	AOI=50	AOI=65
Rho_rsr_wtd(Old SNO3)	0.9942	0.9878	0.9915	0.9905	0.9802
Rho_rsr_wtd(New SNO3)	0.9839	0.9863	0.9888	0.9879	0.9737
Rho_rsr_wtd(Old SNO4)	0.9977	0.9913	0.9920	0.9901	0.9785
Average of 3 measured	0.9920	0.9885	0.9908	0.9895	0.9775

RSR Weighted Scan Mirror Reflectances

Band 24	AOI=19	AOI=26	AOI=38	AOI=50	AOI=65
Rho_rsr_wtd(Old SNO3)	0.9940	0.9880	0.9905	0.9897	0.9774
Rho_rsr_wtd(New SNO3)	0.9832	0.9851	0.9880	0.9862	0.9741
Rho_rsr_wtd(Old SNO4)	0.9970	0.9910	0.9907	0.9893	0.9766
Average of 3 measured	0.9914	0.9880	0.9897	0.9884	0.9760
Band 25	AOI=19	AOI=26	AOI=38	AOI=50	AOI=65
Rho_rsr_wtd(Old SNO3)	0.9947	0.9881	0.9912	0.9899	0.9767
Rho_rsr_wtd(New SNO3)	0.9840	0.9856	0.9880	0.9852	0.9744
Rho_rsr_wtd(Old SNO4)	0.9969	0.9913	0.9911	0.9895	0.9765
Average of 3 measured	0.9918	0.9883	0.9901	0.9882	0.9759
Band 27	AOI=19	AOI=26	AOI=38	AOI=50	AOI=65
Rho_rsr_wtd(Old SNO3)	0.9905	0.9853	0.9861	0.9842	0.9684
Rho_rsr_wtd(New SNO3)	0.9826	0.9846	0.9856	0.9829	0.9722
Rho_rsr_wtd(New SNO4)	0.9871	0.9872	0.9812	0.9825	0.9758
Average of 3 measured	0.9867	0.9857	0.9843	0.9832	0.9721
Band 28	AOI=19	AOI=26	AOI=38	AOI=50	AOI=65
Rho_rsr_wtd(Old SNO3)	0.9889	0.9852	0.9861	0.9828	0.9669
Rho_rsr_wtd(New SNO3)	0.9827	0.9836	0.9855	0.9809	0.9691
Rho_rsr_wtd(Old SNO4)	0.9907	0.9877	0.9861	0.9830	0.9656
Average of 3 measured	0.9874	0.9855	0.9859	0.9822	0.9672

RSR Weighted Scan Mirror Reflectances

Band 29	AOI=19	AOI=26	AOI=38	AOI=50	AOI=65
Rho_rsr_wtd(Old SNO3)	0.9844	0.9766	0.9663	0.9471	0.8982
Rho_rsr_wtd(New SNO3)	0.9790	0.9757	0.9671	0.9446	0.8962
Rho_rsr_wtd(Old SNO4)	0.9861	0.9787	0.9664	0.9461	0.8975
Average of 3 measured	0.9832	0.9770	0.9666	0.9459	0.8973

Band 30	AOI=19	AOI=26	AOI=38	AOI=50	AOI=65
Rho_rsr_wtd(Old SNO3)	0.9846	0.9768	0.9680	0.9512	0.9066
Rho_rsr_wtd(New SNO3)	0.9811	0.9785	0.9687	0.9458	0.8992
Rho_rsr_wtd(Old SNO4)	0.9850	0.9786	0.9676	0.9500	0.9065
Average of 3 measured	0.9836	0.9780	0.9681	0.9490	0.9041

Band 31	AOI=19	AOI=26	AOI=38	AOI=50	AOI=65
Rho_rsr_wtd(Old SNO3)	0.9872	0.9825	0.9772	0.9673	0.9380
Rho_rsr_wtd(New SNO3)	0.9844	0.9845	0.9761	0.9621	0.9267
Rho_rsr_wtd(Old SNO4)	0.9879	0.9831	0.9776	0.9676	0.9384
Average of 3 measured	0.9865	0.9834	0.9769	0.9657	0.9344

Band 32	AOI=19	AOI=26	AOI=38	AOI=50	AOI=65
Rho_rsr_wtd(Old SNO3)	0.9870	0.9817	0.9780	0.9666	0.9394
Rho_rsr_wtd(New SNO3)	0.9846	0.9852	0.9764	0.9618	0.9248
Rho_rsr_wtd(Old SNO4)	0.9877	0.9826	0.9766	0.9672	0.9389
Average of 3 measured	0.9864	0.9832	0.9770	0.9652	0.9344

RSR Weighted Scan Mirror Reflectances

Band 33	AOI=19	AOI=26	AOI=38	AOI=50	AOI=65
Rho_rsr_wtd(Old SNO3)	0.9856	0.9777	0.9672	0.9477	0.9045
Rho_rsr_wtd(New SNO3)	0.9809	0.9765	0.9645	0.9445	0.8909
Rho_rsr_wtd(Old SNO4)	0.9862	0.9784	0.9659	0.9472	0.9047
Average of 3 measured	0.9842	0.9775	0.9658	0.9465	0.9000

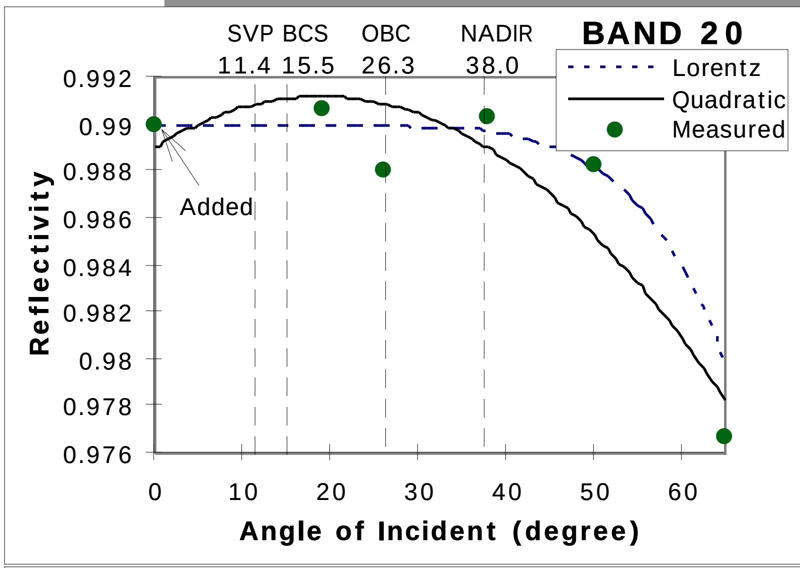
Band 34	AOI=19	AOI=26	AOI=38	AOI=50	AOI=65
Rho_rsr_wtd(Old SNO3)	0.9853	0.9768	0.9663	0.9441	0.9006
Rho_rsr_wtd(New SNO3)	0.9785	0.9762	0.9621	0.9415	0.8854
Rho_rsr_wtd(Old SNO4)	0.9853	0.9779	0.9656	0.9437	0.8995
Average of 3 measured	0.9830	0.9769	0.9647	0.9431	0.8952

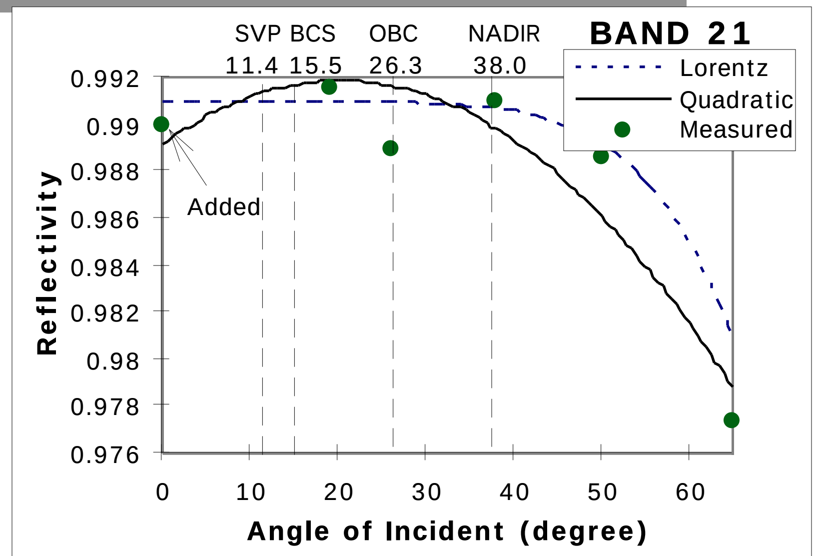
Band 35	AOI=19	AOI=26	AOI=38	AOI=50	AOI=65
Rho_rsr_wtd(Old SNO3)	0.9850	0.9757	0.9650	0.9425	0.8960
Rho_rsr_wtd(New SNO3)	0.9808	0.9767	0.9617	0.9366	0.8799
Rho_rsr_wtd(Old SNO4)	0.9851	0.9768	0.9636	0.9420	0.8949
Average of 3 measured	0.9836	0.9764	0.9634	0.9403	0.8902

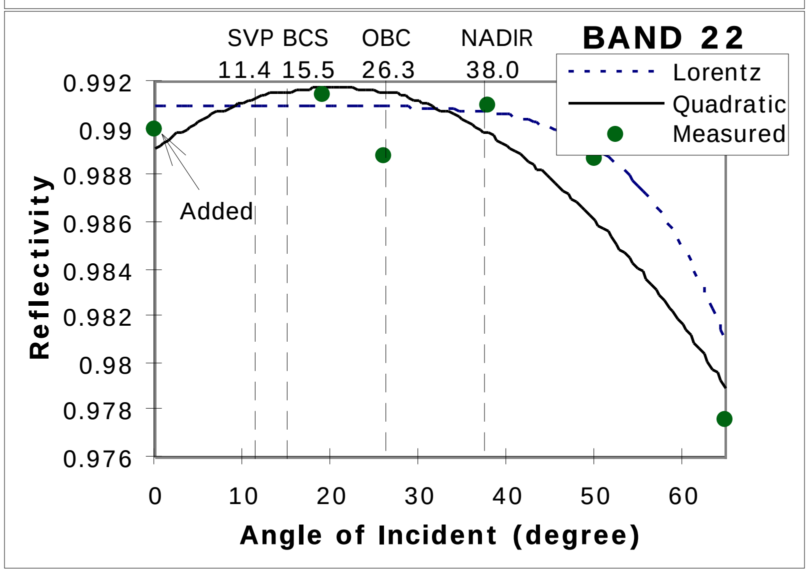
Band 36	AOI=19	AOI=26	AOI=38	AOI=50	AOI=65
Rho_rsr_wtd(Old SNO3)	0.9852	0.9753	0.9643	0.9408	0.8925
Rho_rsr_wtd(New SNO3)	0.9777	0.9757	0.9592	0.9384	0.8752
Rho_rsr_wtd(Old SNO4)	0.9855	0.9763	0.9621	0.9409	0.8932
Average of 3 measured	0.9828	0.9758	0.9618	0.9400	0.8870

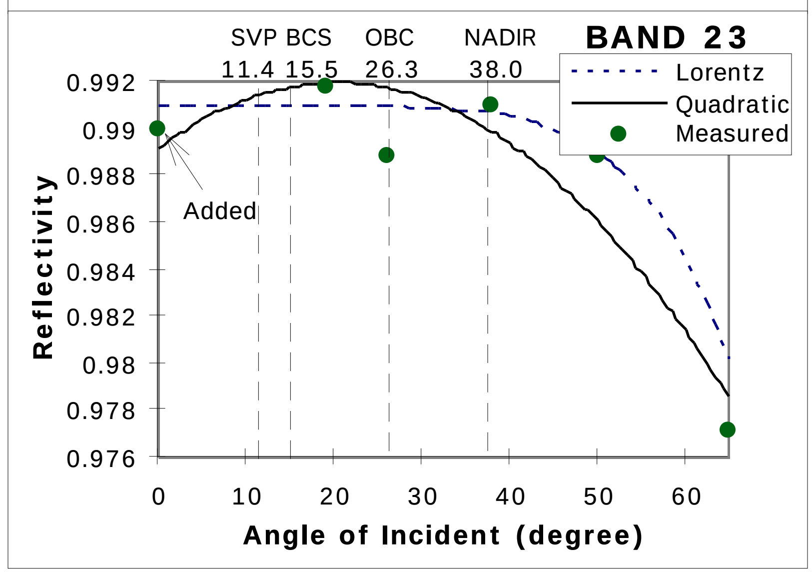
	Measured Band Averaged Reflectances						Quadratic Coefficients			Lorentz Coefficients		
Band	AOI=0 deg	AOI=19 de	AOI=26 de	AOI=38 de	AOI=50 de	AOI=65 de	a0	a1	a2	rho_0	E	HW
20	0.99	0.99060	0.98799	0.99026	0.98820	0.97665	9.89E-01	2.30E-04	-6.08E-06	0.991	6.6	260.
21	0.99	0.99156	0.98892	0.99102	0.98858	0.97739	9.89E-01	2.66E-04	-6.55E-06	0.991	6.6	260.
22	0.99	0.99143	0.98884	0.99096	0.98866	0.97757	9.89E-01	2.59E-04	-6.39E-06	0.991	6.5	260.
23	0.99	0.99176	0.98885	0.99095	0.98876	0.97708	9.89E-01	2.74E-04	-6.73E-06	0.991	5.5	290.
24	0.99	0.99126	0.98814	0.99000	0.98830	0.97581	9.89E-01	2.52E-04	-6.62E-06	0.991	5.5	290.
25	0.99	0.99142	0.98809	0.99004	0.98808	0.97581	9.89E-01	2.50E-04	-6.63E-06	0.988	5.0	280.
27	0.99	0.98779	0.98559	0.98568	0.98185	0.96663	9.89E-01	1.61E-04	-7.29E-06	0.987	5.2	275.
28	0.99	0.98783	0.98558	0.98583	0.98212	0.96722	9.89E-01	1.57E-04	-7.09E-06	0.984	3.2	270.
29	0.99	0.98358	0.97703	0.96647	0.94617	0.89728	9.88E-01	4.19E-04	-2.72E-05	0.983	3.3	275.
30	0.99	0.98382	0.97787	0.96816	0.94901	0.90414	9.88E-01	3.77E-04	-2.51E-05	0.987	3.2	330.
31	0.99	0.98657	0.98334	0.97716	0.96533	0.93393	9.89E-01	3.43E-04	-1.77E-05	0.986	3.2	335.
32	0.99	0.98634	0.98291	0.97659	0.96490	0.93345	9.89E-01	3.22E-04	-1.75E-05	0.987	2.7	320.
33	0.99	0.98384	0.97758	0.96592	0.94621	0.89987	9.88E-01	3.64E-04	-2.60E-05	0.988	2.6	320.
34	0.99	0.98317	0.97685	0.96475	0.94280	0.89473	9.88E-01	3.73E-04	-2.73E-05	0.987	2.6	315.
35	0.99	0.98339	0.97640	0.96343	0.94088	0.89057	9.88E-01	3.93E-04	-2.86E-05	0.987	2.6	315.
36	0.99	0.98250	0.97626	0.96271	0.94125	0.88715	9.88E-01	4.43E-04	-2.99E-05	0.987	2.6	315.

Lorentz and Quadratic Fitting to the Lincoln Lab Data for B20-23

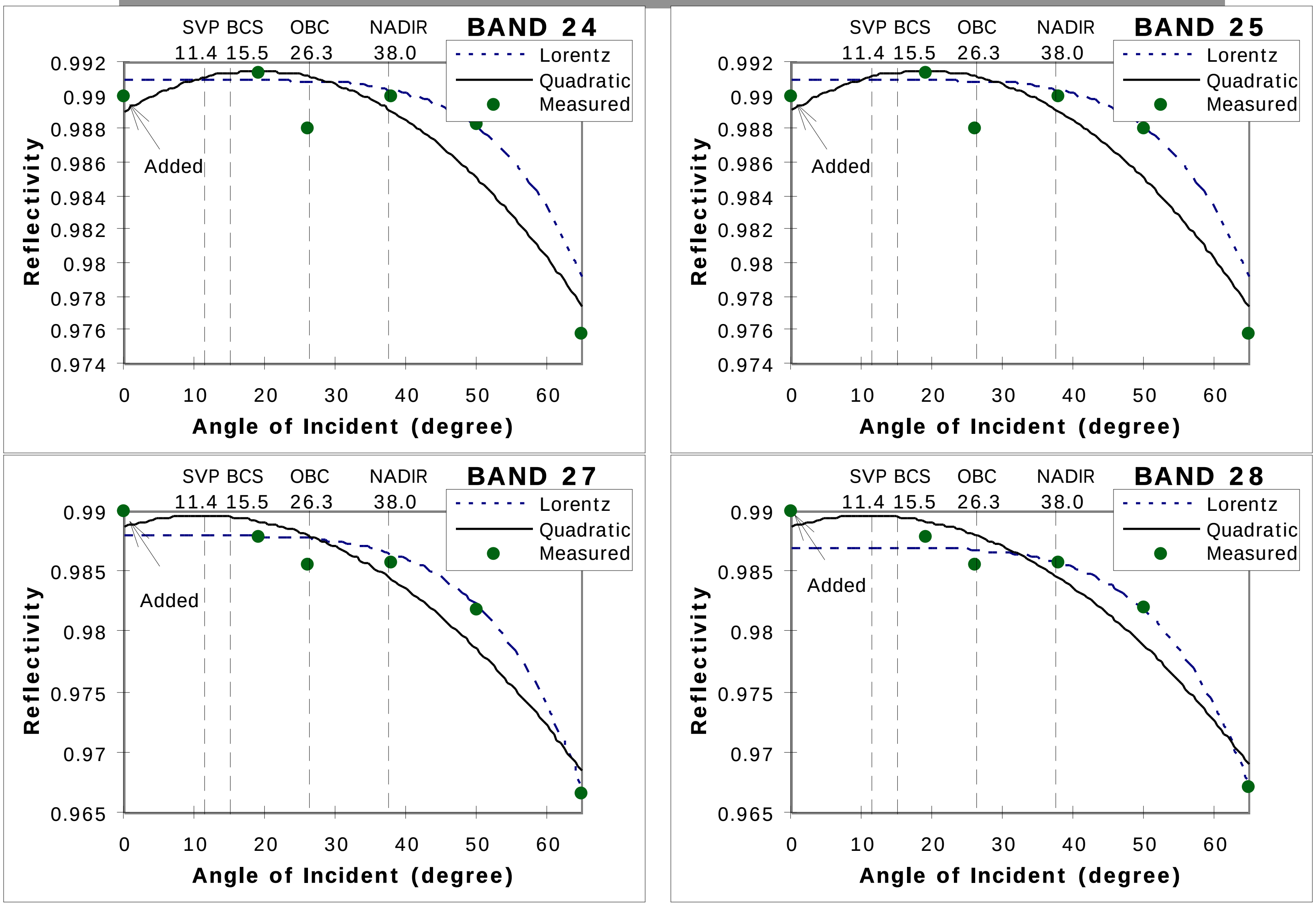




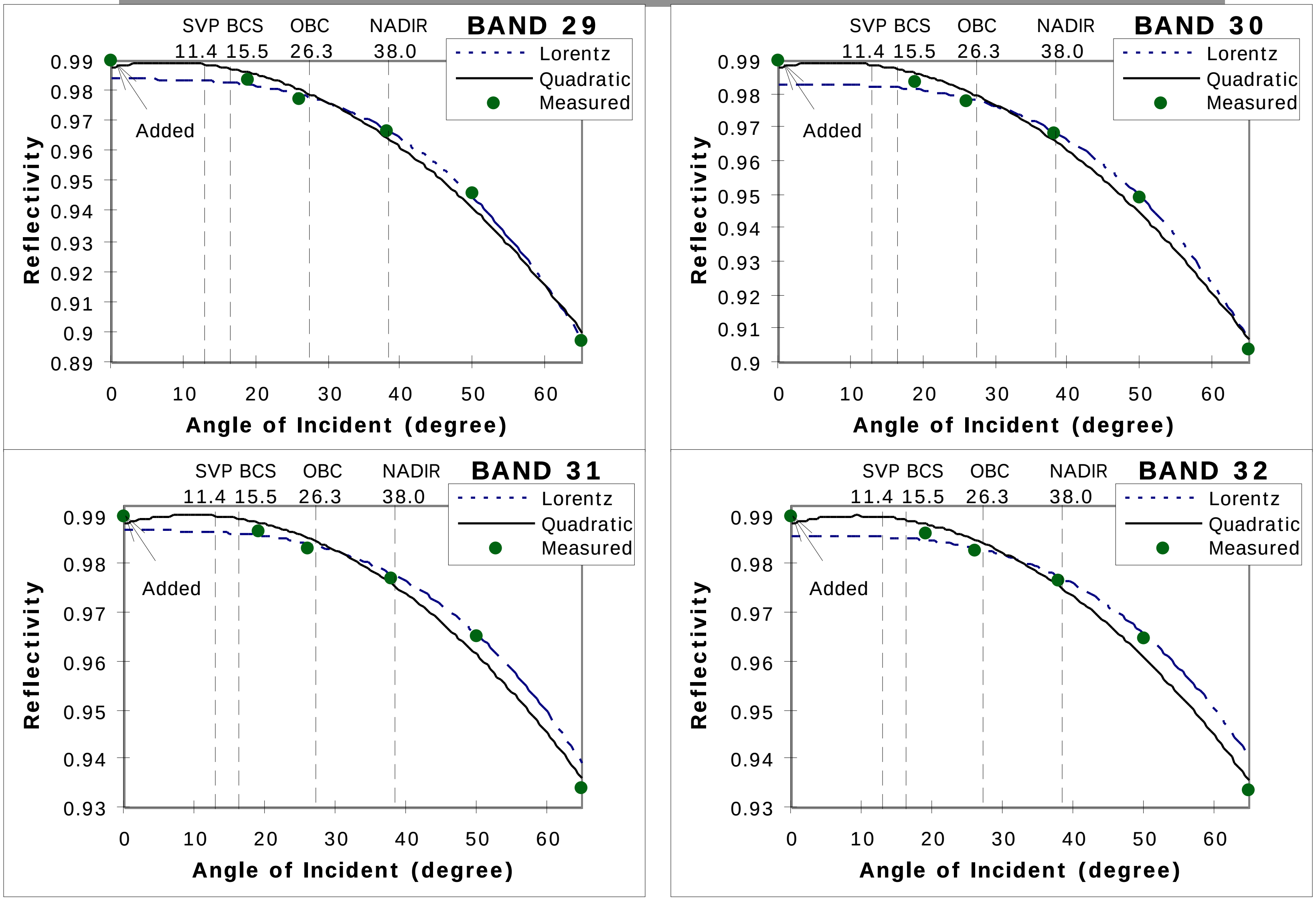




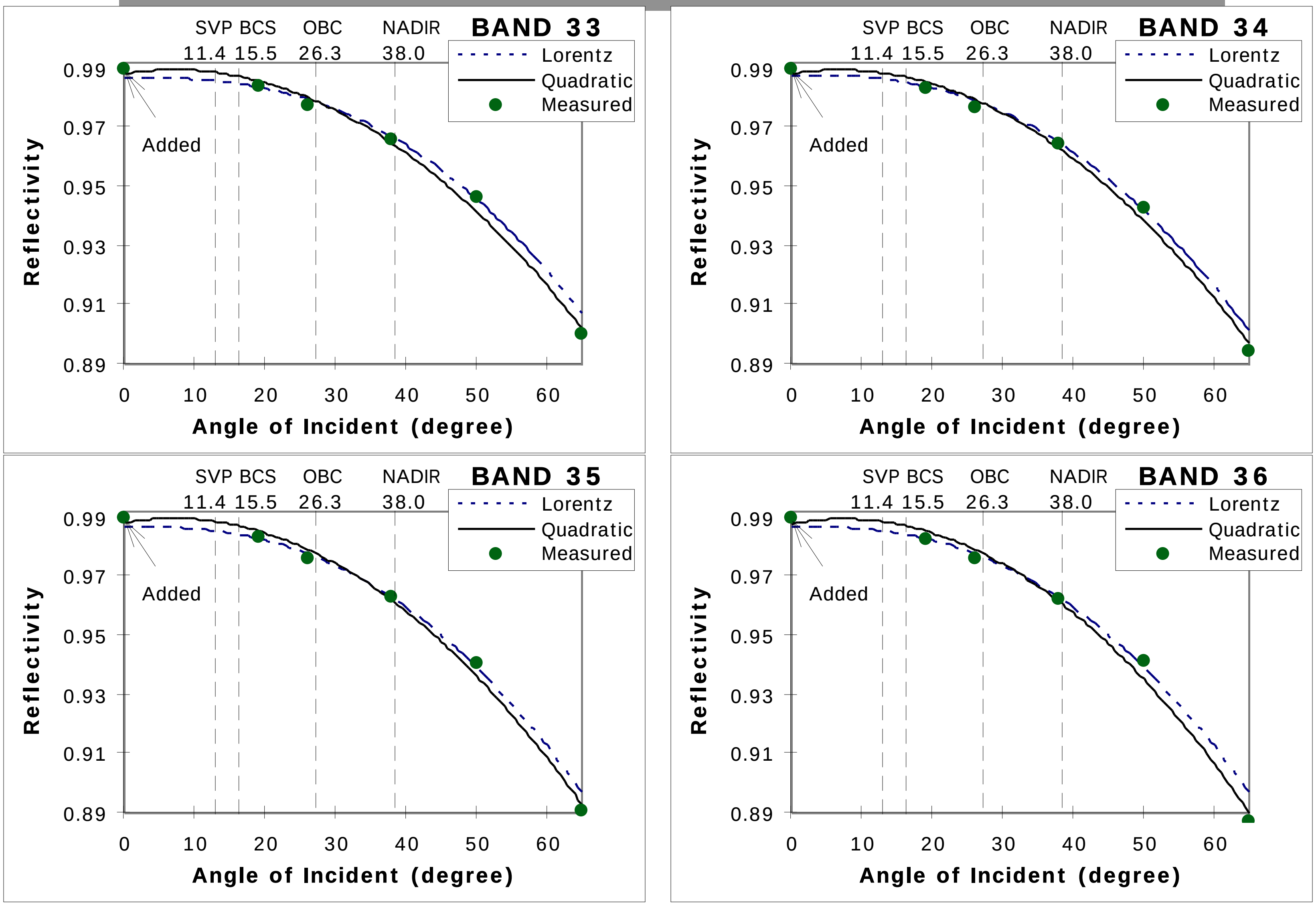
Lorentz and Quadratic Fitting to the Lincoln Lab Data for B24-28



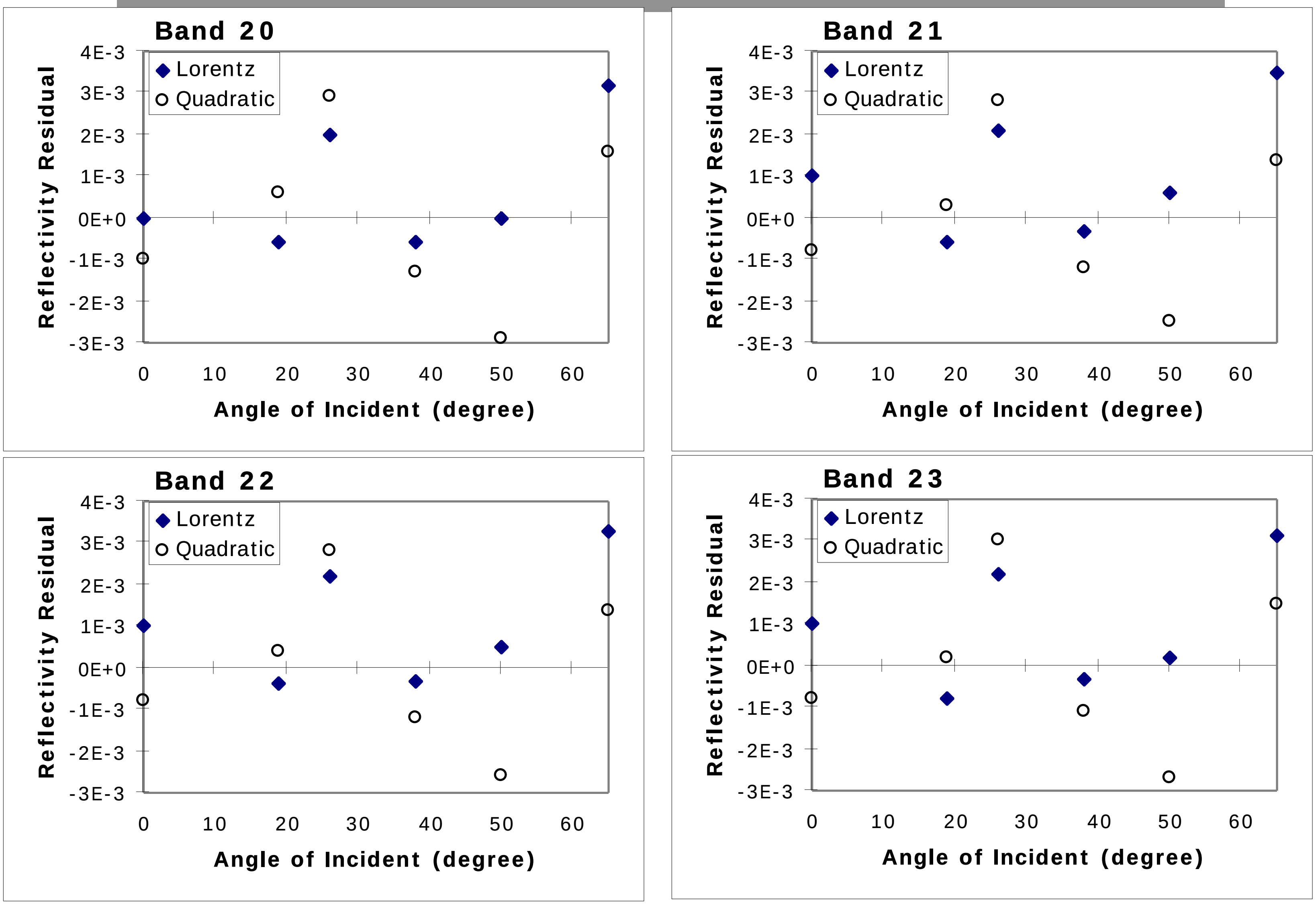
Lorentz and Quadratic Fitting to the Lincoln Lab Data for B29-32



Lorentz and Quadratic Fitting to the Lincoln Lab Data for B33-36



Residual Errors of the Lorentz and Quadratic Fitting for B20-23



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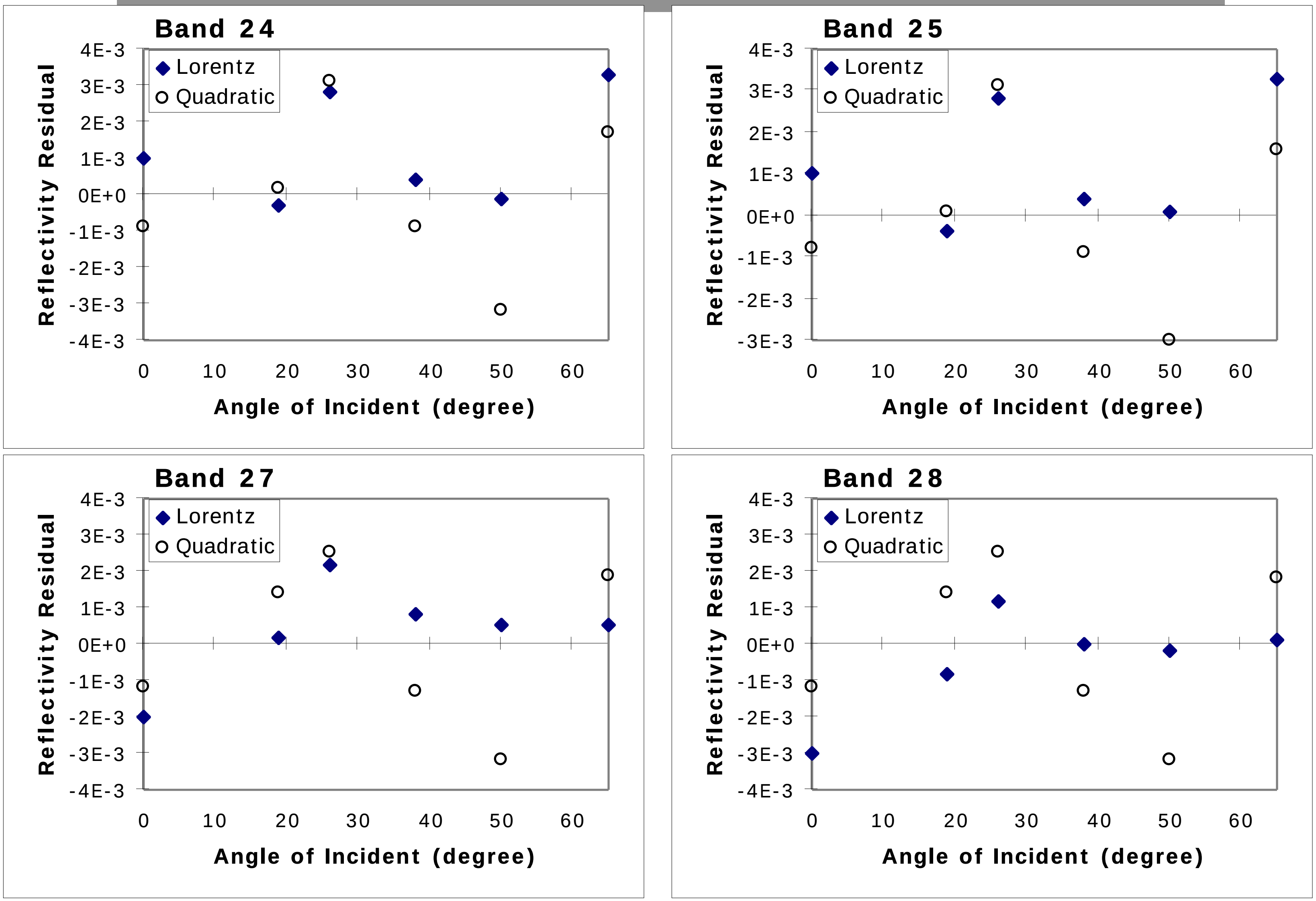
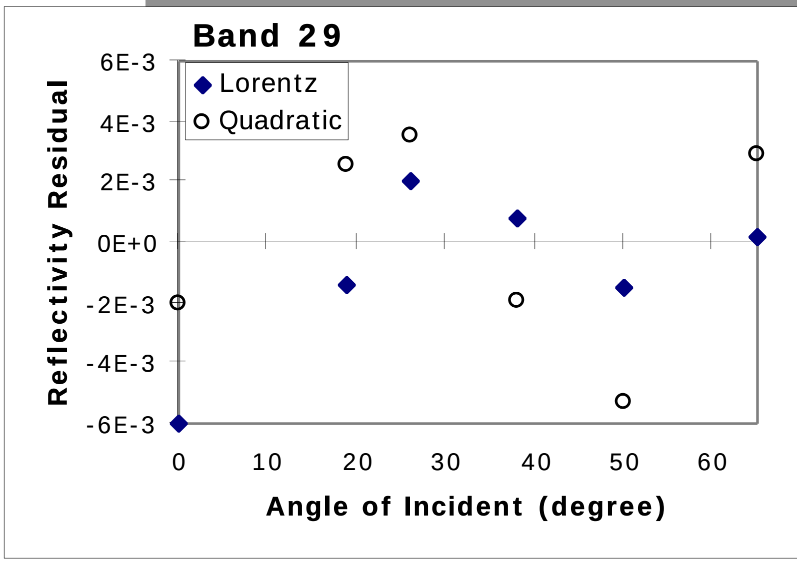
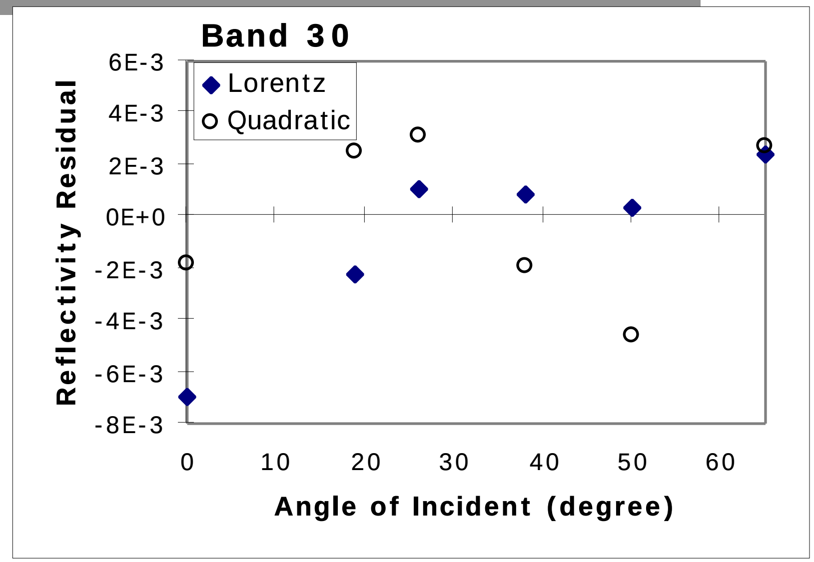
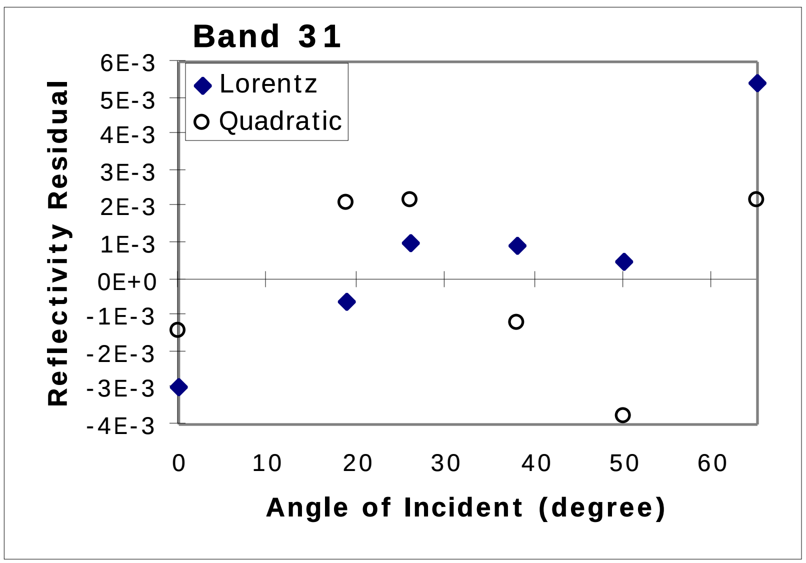
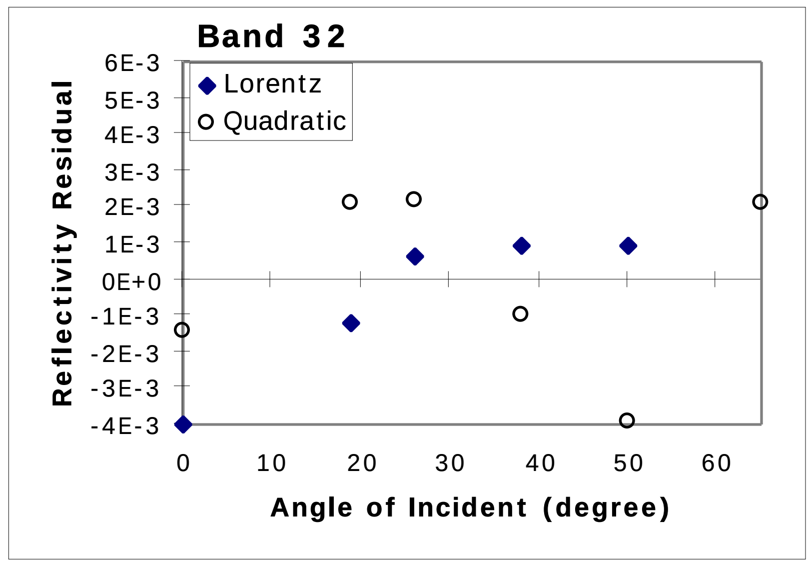


Residual Errors of the Lorentz and Quadratic Fitting for B29-32

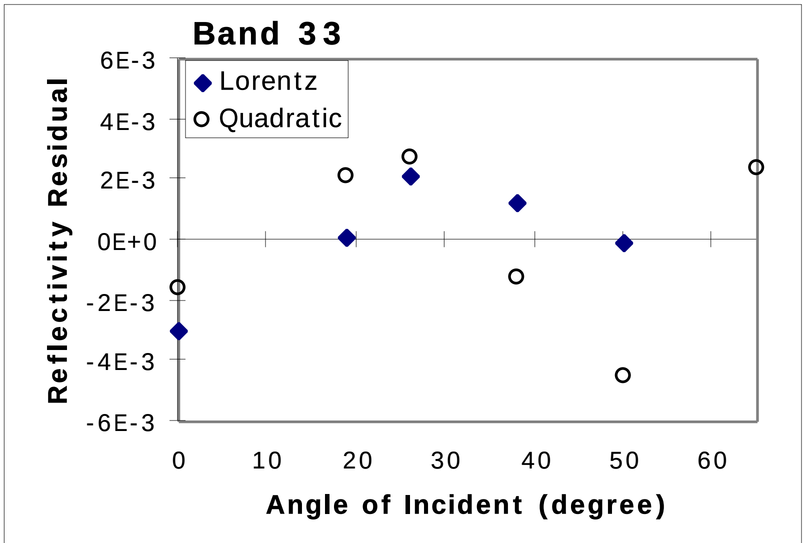


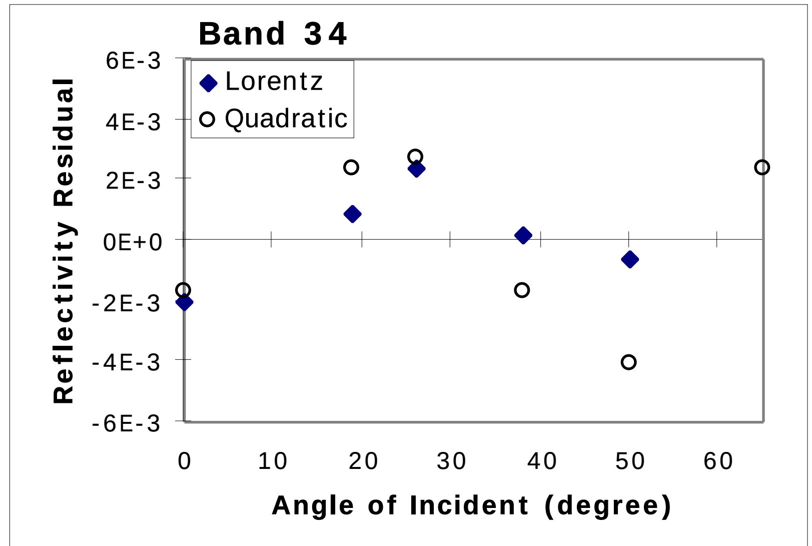


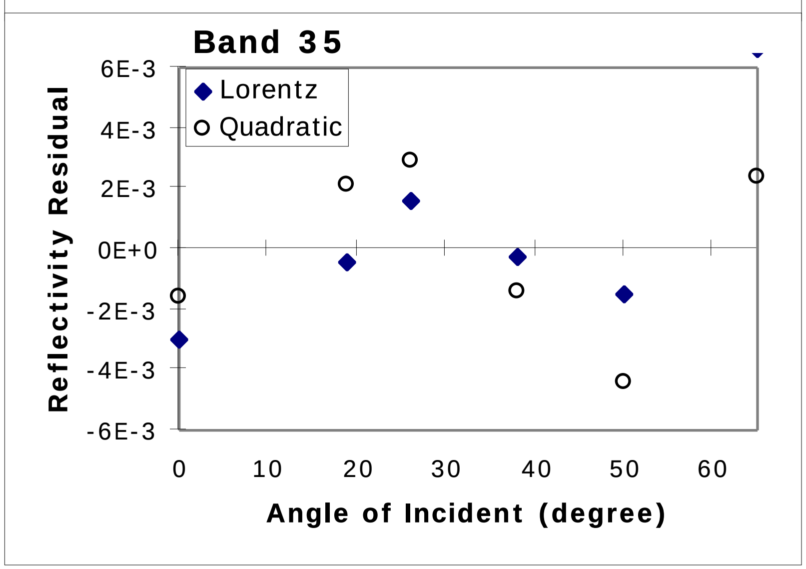


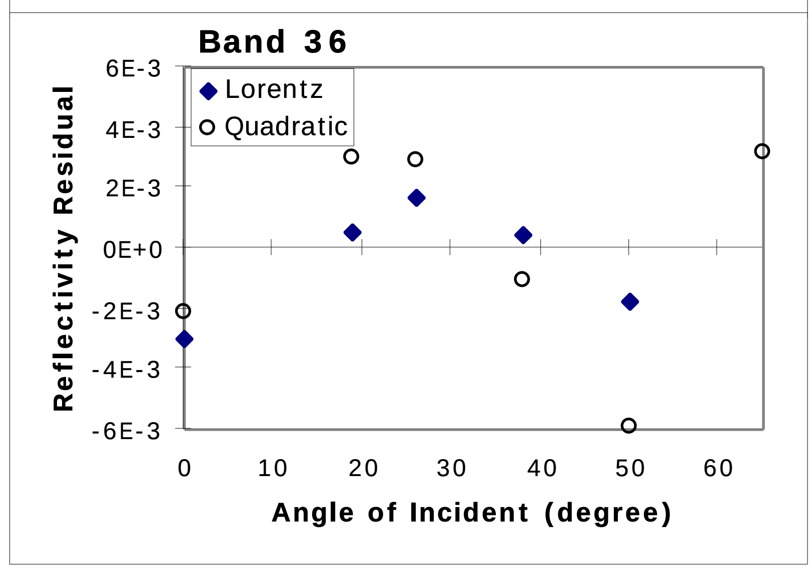


Residual Errors of the Lorentz and Quadratic Fitting for B33-36

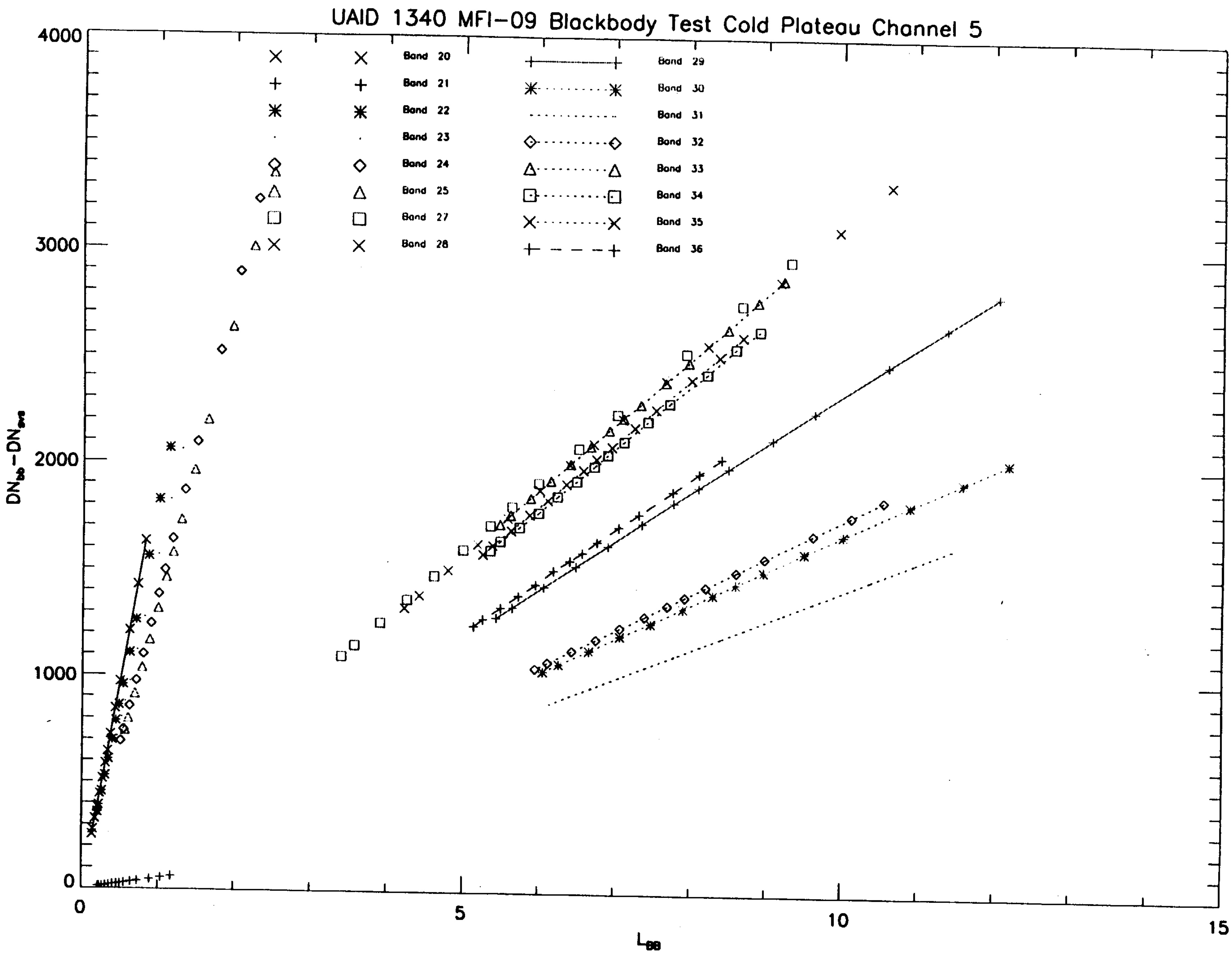




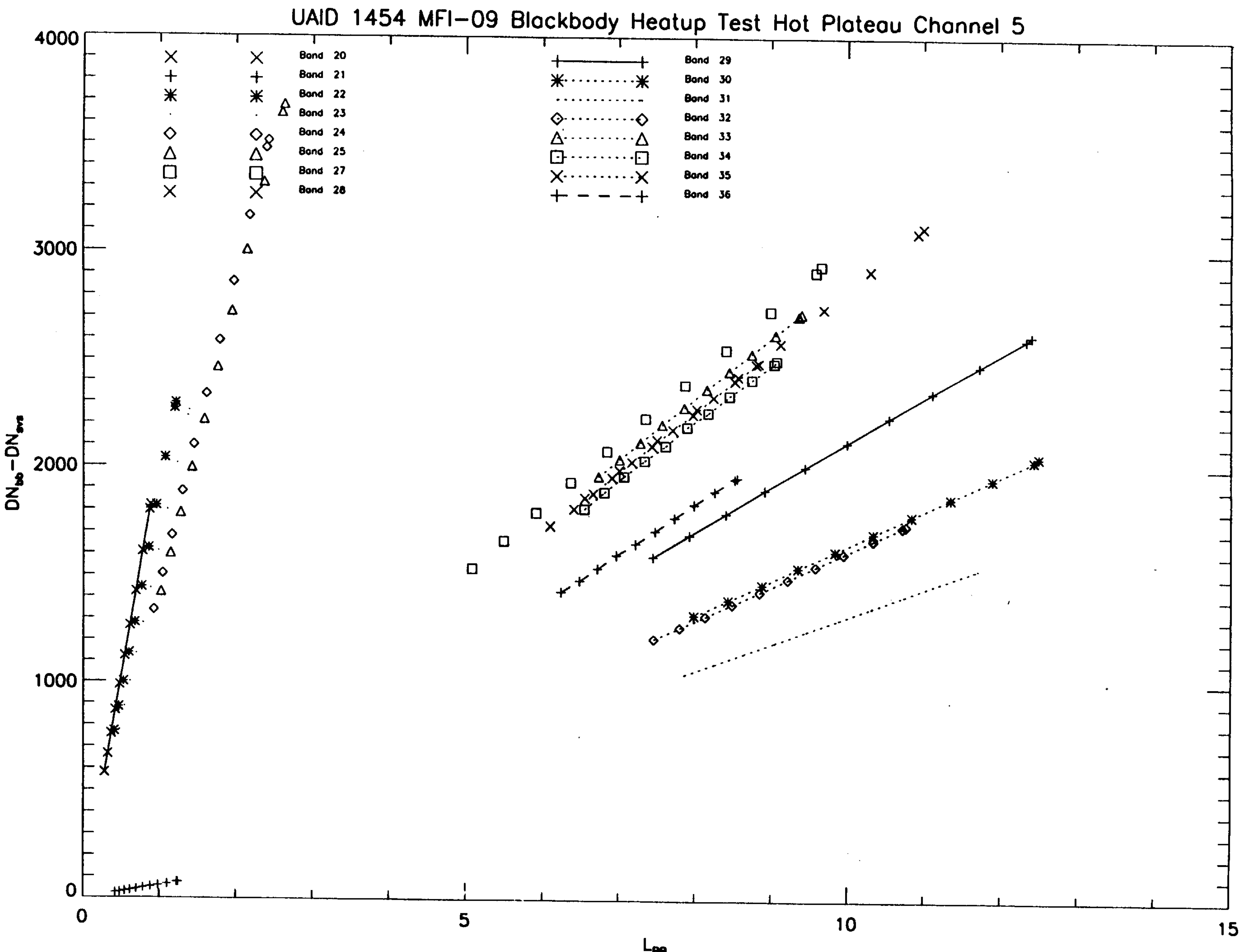




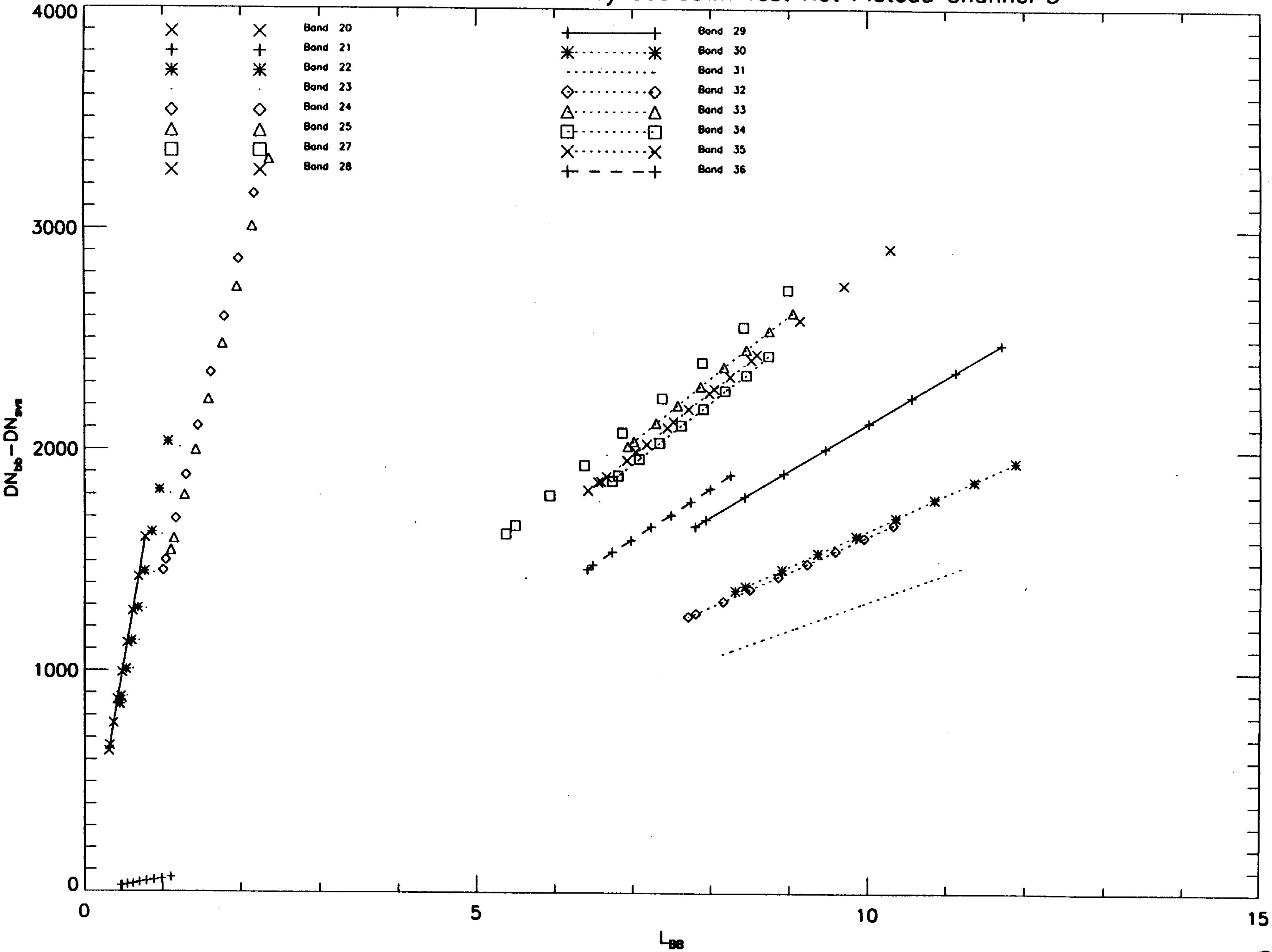
OBC Blackbody Performance



UAID 1340 MFI-09 Blackbody Test Cold Plateau Channel 5
4000
3000
2000
1000
0
5
10
15
$DN_{bb}-DN_{sv}$
L_{BB}
Band 20
Band 21
Band 22
Band 23
Band 24
Band 25
Band 27
Band 28
Band 29
Band 30
Band 31
Band 32
Band 33
Band 34
Band 35
Band 36


UAID 1454 MFI-09 Blackbody Heatup Test Hot Plateau Channel 5
Band 20
Band 21
Band 22
Band 23
Band 24
Band 25
Band 27
Band 28
Band 29
Band 30
Band 31
Band 32
Band 33
Band 34
Band 35
Band 36
DN_bb - DN_avs
L_BB
0
1000
2000
3000
4000
5
10
15

UAID 1455 MFI-09 Blackbody Cooldown Test Hot Plateau Channel 5

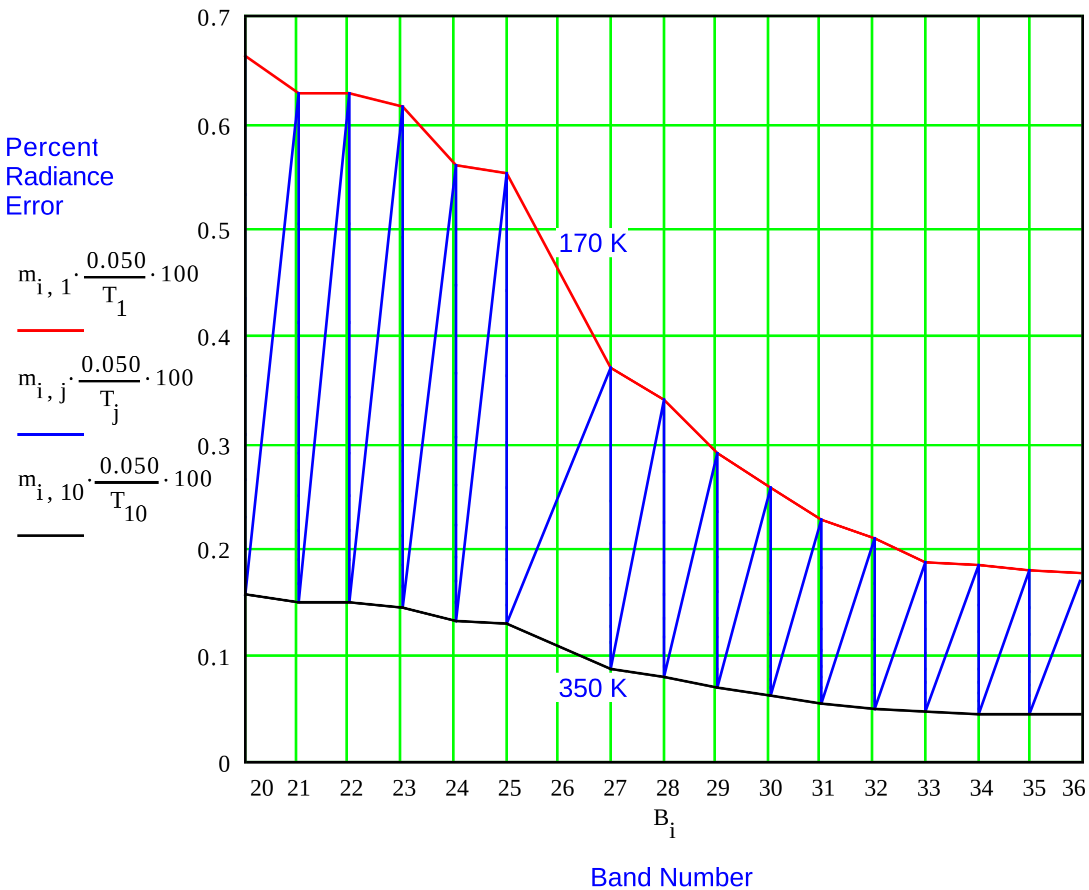


3-53

OBC Blackbody Temperature Measurement at Hot Plateau (283K)

Thermistor #	Heater Off			Heater On		
	ave_DN	σ_DN	ave_T(K)	ave_DN	σ_DN	ave_T(K)
1	2068	3.22	282.02	167	2.00	314.57
2	2022	1.95	281.99	154	1.71	314.51
3	2025	1.70	282.00	161	1.38	314.54
4	2031	1.80	281.99	160	1.79	314.49
5	2026	1.72	282.00	159	1.83	314.42
6	2024	2.61	281.99	157	2.00	314.41
7	2057	1.90	282.01	165	1.99	314.57
8	2048	2.91	282.00	163	2.21	314.53
9	2047	1.64	282.00	161	1.30	314.53
10	2025	2.87	282.04	155	2.54	314.50
11	2018	1.79	282.00	156	2.18	314.42
12	2049	2.05	282.00	165	2.61	314.43
	Averages	2.18	282.00	Averages	1.96	314.49
		Stdev (T) =	0.021		Stdev (T) =	0.078

Radiance Error Due to Uncertainty in BCS Temperature Knowledge (ΔT= 50 mK; Δλ=0.0%)



The effect of 50 mK error in temperature knowledge on dL/L. Saw tooth pattern represents variation of error for temperatures between 170K (tops) and 350K (bottoms) for each band.

Predicted Lsat's and Tsat's

Equations Used to Estimate Lsat's and Tsat's

$$DN_{bcs} - DN_{svs} = a_0 + a_1 * L + a_2 * L^2$$

at saturation

$$4095 - DN_{svs} = a_0 + a_1 * L + a_2 * L^2$$

then

$$a_2 L_{sat}^2 + a_1 L_{sat} + a_0 - 4095 + DN_{svs} = 0$$

and thus

$$L_{sat} = \frac{-a_1 \pm -\sqrt{a_1^2 - 4 a_2 \left(a_0 - 4095 + \overline{DN}_{svs}\right)}}{2 a_2}$$

and

$$T_{sat} = \frac{C2}{\lambda_i * \ln\left(\frac{C1}{\pi * \lambda_i^5 * L_{sat}} + 1 \right)}$$

where:

$$\overline{DN_{svs}} = \frac{1}{30} \sum_{j=1}^{30} DN_{svs}(j)$$

$$C1 = 3.7417749 * 10^8$$

$$C2 = 1.438769 * 10^4$$

Maximum Measurable Radiance Estimates (Nominal Plateau)

LSATS by Channel for Each Band

LSATs	CH_1	CH_2	CH_3	CH_4	CH_5	CH_6	CH_7	CH_8	CH_9	CH_10	Lmax-set		Band Ave
20	1.66	1.69	1.68	1.70	1.69	1.68	1.68	1.68	1.67	1.69	**1.71**		1.68
21	26.27	27.24	26.04	25.59	26.43	26.11	27.10	26.56	24.80	25.92	**85.45**		26.21
22	1.95	1.95	2.06	1.96	1.95	1.94	1.96	1.96	1.97	1.97	**1.89**		1.97
23	2.39	2.27	2.27	2.27	2.27	2.27	2.26	2.26	2.24	2.28	**2.16**		2.28
24	2.68	2.60	2.46	2.37	2.75	3.03	2.41	2.87	2.89	2.76	**2.42**		2.68
25	2.63	2.55	2.59	2.59	2.56	2.60	2.57	2.59	2.55	2.59	**2.57**		2.58
27	10.56	10.83	10.44	11.14	11.28	11.53	11.79	13.00	12.66	13.00	**9.71**		11.62
28	12.33	12.27	11.92	12.02	12.14	11.93	12.27	12.20	12.28	12.06	**11.08**		12.14
29	16.13	16.08	16.21	16.05	16.17	15.98	15.97	15.81	16.19	16.01	**14.55**		16.06
30	23.73	24.71	24.06	23.59	22.68	23.47	23.81	23.94	25.28	23.69	**12.61**		23.90
31	30.12	29.70	30.07	28.84	27.61	28.08	28.79	28.24	28.50	30.08	**29.09**	Lmax for 31h	29.00
32	22.95	22.82	23.66	23.73	22.45	23.32	23.46	23.44	23.69	23.76	**25.03**	Lmax for 32h	23.33
33	10.63	11.13	11.02	10.97	11.16	10.99	10.93	11.14	11.49	17.22	**9.5**		11.67
34	11.75	12.10	11.82	11.70	11.93	12.07	12.16	12.11	11.81	11.84	**9.19**		11.93
35	11.59	11.28	11.31	11.71	11.55	11.03	11.20	11.25	11.55	11.34	**8.88**		11.38
36	14.58	15.18	14.47	14.96	14.43	14.18	14.35	13.55	14.00	14.27	**8.58**		14.40
								Lmax-set=higher of Lmax and L(t=315K)					
Lsat/Lmax-set											**average Lsat/Lmax-set**		
20	0.97	0.99	0.98	0.99	0.99	0.98	0.98	0.98	0.98	0.99	**0.98**		
21	0.31	0.32	0.30	0.30	0.31	0.31	0.32	0.31	0.29	0.30	**0.31**		
22	1.03	1.03	1.09	1.04	1.03	1.03	1.04	1.04	1.04	1.04	**1.04**		
23	1.11	1.05	1.05	1.05	1.05	1.05	1.05	1.05	1.04	1.06	**1.05**		
24	1.11	1.07	1.02	0.98	1.14	1.25	1.00	1.19	1.19	1.14	**1.11**		
25	1.02	0.99	1.01	1.01	1.00	1.01	1.00	1.01	0.99	1.01	**1.00**		
27	1.09	1.12	1.08	1.15	1.16	1.19	1.21	1.34	1.30	1.34	**1.20**		
28	1.11	1.11	1.08	1.08	1.10	1.08	1.11	1.10	1.11	1.09	**1.10**		
29	1.11	1.10	1.11	1.10	1.11	1.10	1.10	1.09	1.11	1.10	**1.10**		
30	1.88	1.96	1.91	1.87	1.80	1.86	1.89	1.90	2.00	1.88	**1.89**		
31	1.04	1.02	1.03	0.99	0.95	0.97	0.99	0.97	0.98	1.03	**1.00**		
32	0.92	0.91	0.95	0.95	0.90	0.93	0.94	0.94	0.95	0.95	**0.93**		
33	1.12	1.17	1.16	1.16	1.18	1.16	1.15	1.17	1.21	1.81	**1.23**		
34	1.28	1.32	1.29	1.27	1.30	1.31	1.32	1.32	1.28	1.29	**1.30**		
35	1.30	1.27	1.27	1.32	1.30	1.24	1.26	1.27	1.30	1.28	**1.28**		
36	1.70	1.77	1.69	1.74	1.68	1.65	1.67	1.58	1.63	1.66	**1.68**		

Maximum Measurable Temperatures (Tsat's)

TSATs by Channel for each Band

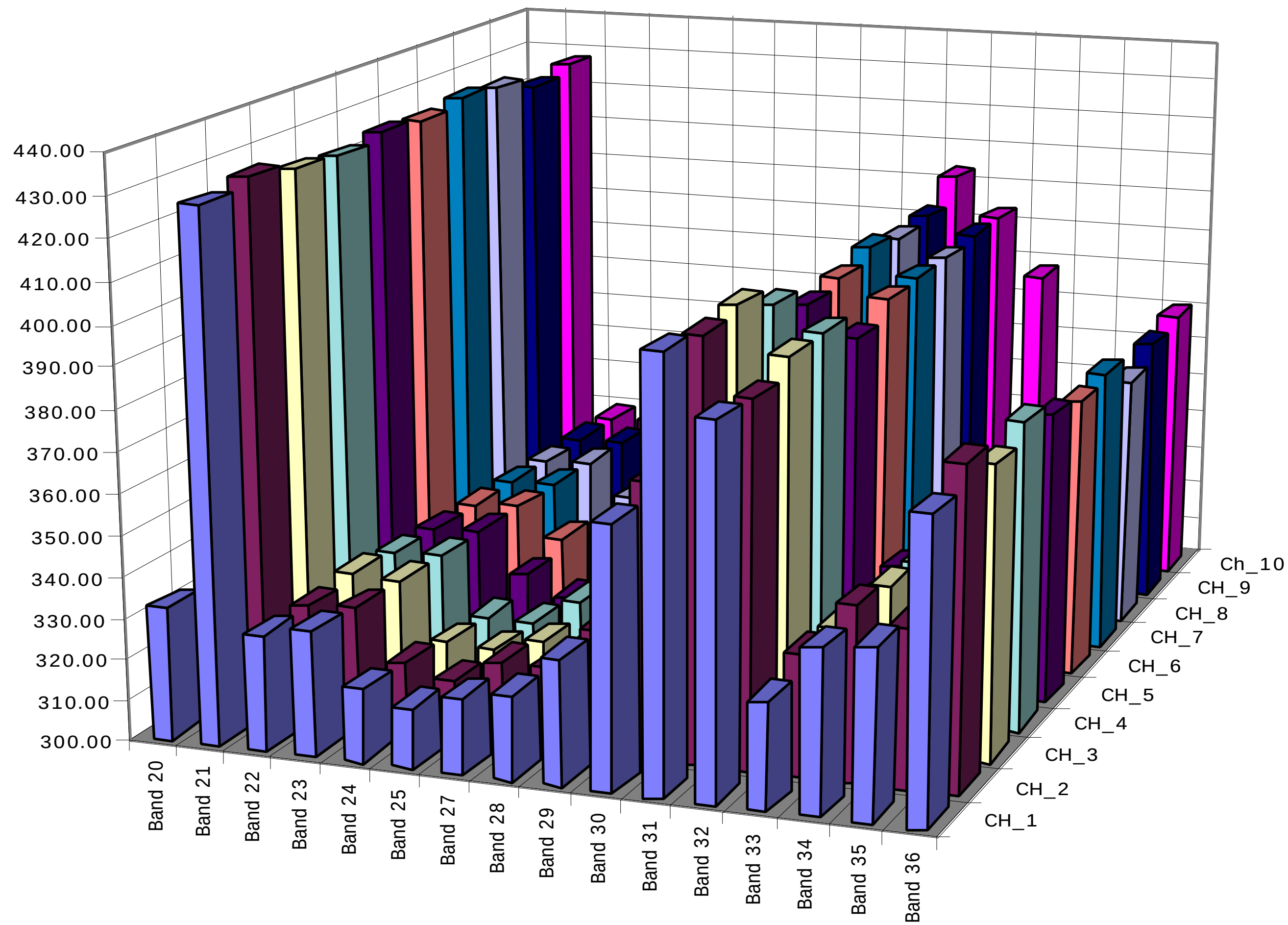
	CH_1	CH_2	CH_3	CH_4	CH_5	CH_6	CH_7	CH_8	CH_9	Ch_10
Band 20	332.26	332.88	332.66	332.92	332.76	332.64	332.66	332.60	332.48	332.75
Band 21	428.75	430.62	428.31	427.43	429.07	428.45	430.35	429.32	425.84	428.07
Band 22	328.41	328.38	330.06	328.56	328.39	328.27	328.51	328.51	328.61	328.67
Band 23	330.82	329.19	329.25	329.13	329.13	329.18	329.05	329.09	328.79	329.35
Band 24	317.87	316.85	315.23	314.09	318.68	321.78	314.54	320.07	320.20	318.74
Band 25	314.66	313.80	314.28	314.26	313.84	314.31	314.04	314.21	313.75	314.21
Band 27	318.35	319.54	317.79	320.92	321.51	322.55	323.67	328.53	327.20	328.55
Band 28	320.37	320.14	318.59	319.05	319.54	318.67	320.10	319.81	320.15	319.22
Band 29	330.54	330.31	330.84	330.22	330.67	329.91	329.88	329.22	330.75	330.03
Band 30	363.33	366.91	364.53	362.82	359.40	362.34	363.61	364.10	368.95	363.16
Band 31	403.86	402.17	403.67	398.72	393.66	395.61	398.52	396.27	397.31	403.68
Band 32	389.21	388.51	392.91	393.27	386.57	391.18	391.87	391.78	393.08	393.46
Band 33	325.58	330.00	329.04	328.63	330.30	328.80	328.26	330.13	333.13	378.14
Band 34	339.50	342.55	340.08	339.02	341.09	342.27	343.11	342.67	339.96	340.23
Band 35	341.16	338.32	338.56	342.32	340.81	335.99	337.54	338.05	340.78	338.89
Band 36	372.72	377.94	371.73	376.00	371.34	369.16	370.69	363.50	367.58	369.95

Summary of TSAT Variation with Channels for each Band

	ave_TSAT	std	TSAT_min	TSAT_max	Max - min	ave_TSAT (except highest ch.)	Tmax-set	aveTsat-Tmax-set	
Band 20	**332.66**	0.19	332.26	332.92	0.66	332.63	335	**-2.37**	
Band 21	**428.62**	1.39	425.84	430.62	4.78	428.40	500	**-71.60**	Tsat=470K per SBRS
Band 22	**328.64**	0.51	328.27	330.06	1.79	328.48	328	**0.48**	
Band 23	**329.30**	0.55	328.79	330.82	2.03	329.13	328	**1.13**	
Band 24	**317.80**	2.59	314.09	321.78	7.68	317.36	315	**2.36**	
Band 25	**314.14**	0.28	313.75	314.66	0.90	314.08	315	**-0.92**	
Band 27	**322.86**	4.04	317.79	328.55	10.75	322.23	315	**7.23**	
Band 28	**319.56**	0.65	318.59	320.37	1.78	319.47	315	**4.47**	
Band 29	**330.24**	0.50	329.22	330.84	1.62	330.17	324	**6.17**	
Band 30	**363.91**	2.58	359.40	368.95	9.55	363.35	315	**48.35**	
Band 31	**399.35**	3.75	393.66	403.86	10.20	398.84	400	**-1.16**	
Band 32	**391.18**	2.34	386.57	393.46	6.88	390.93	400	**-9.07**	
Band 33	**334.20**	15.56	325.58	378.14	52.56	329.32	315	**14.32**	
Band 34	**341.05**	1.49	339.02	343.11	4.09	340.82	315	**25.82**	
Band 35	**339.24**	1.95	335.99	342.32	6.34	338.90	315	**23.90**	
Band 36	**371.06**	4.07	363.50	377.94	14.44	370.30	315	**55.30**	

Maximum Measurable Temperatures (Tsat's)

(Band 21 extrapolated from 0.03Lmax measurement; SBRS predicts 472 K from detector-level measurements)



ADC Non-linearity and ECAL Test Results

ADC Architecture

- Emissive bands use two types of ADCs placed on the Analog Conditioning Electronics (ACE) cards:
  - **AD1671A:** 12 Bits, 800 ns conversion time

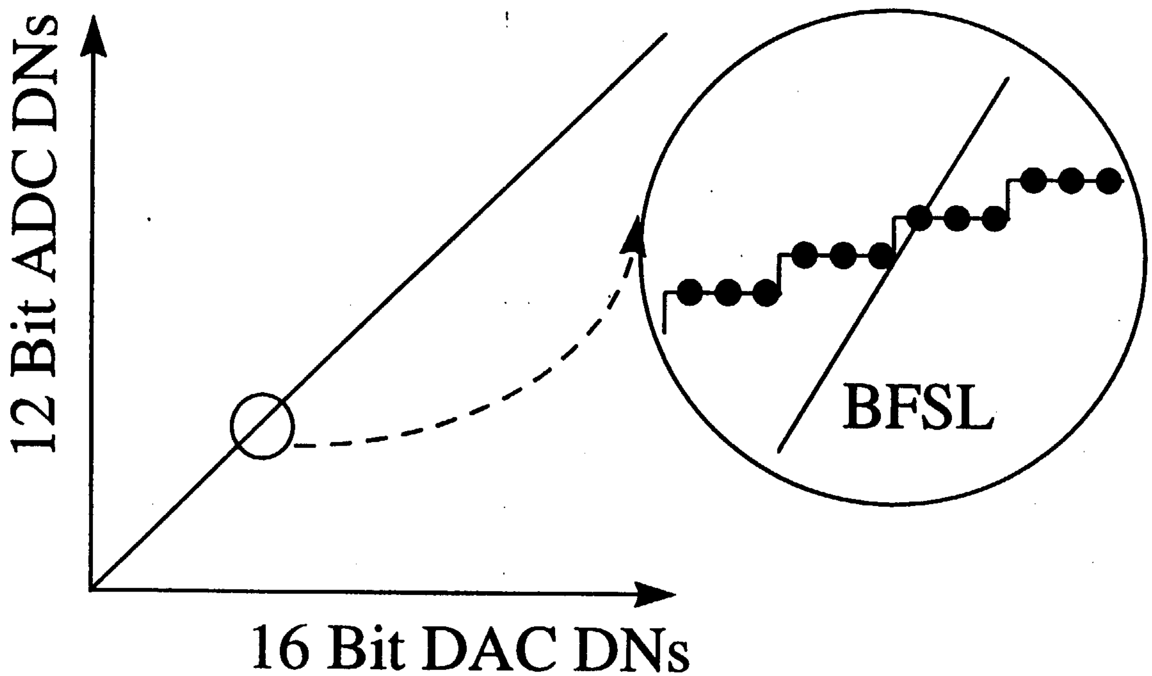
    MWIR: 1 ACE card serving Bands 20-25

    PV-LWIR: 1 ACE card serving Bands 27-30
  - **AD674A:** 12 Bits, 15 μs conversion time

    PC-LWIR: 6 ACE cards for Bands 31-36
- Key Issues:
  - Linearity Data only exists for AD1671A; no data exists to verify linearity of PC-LWIR bands.

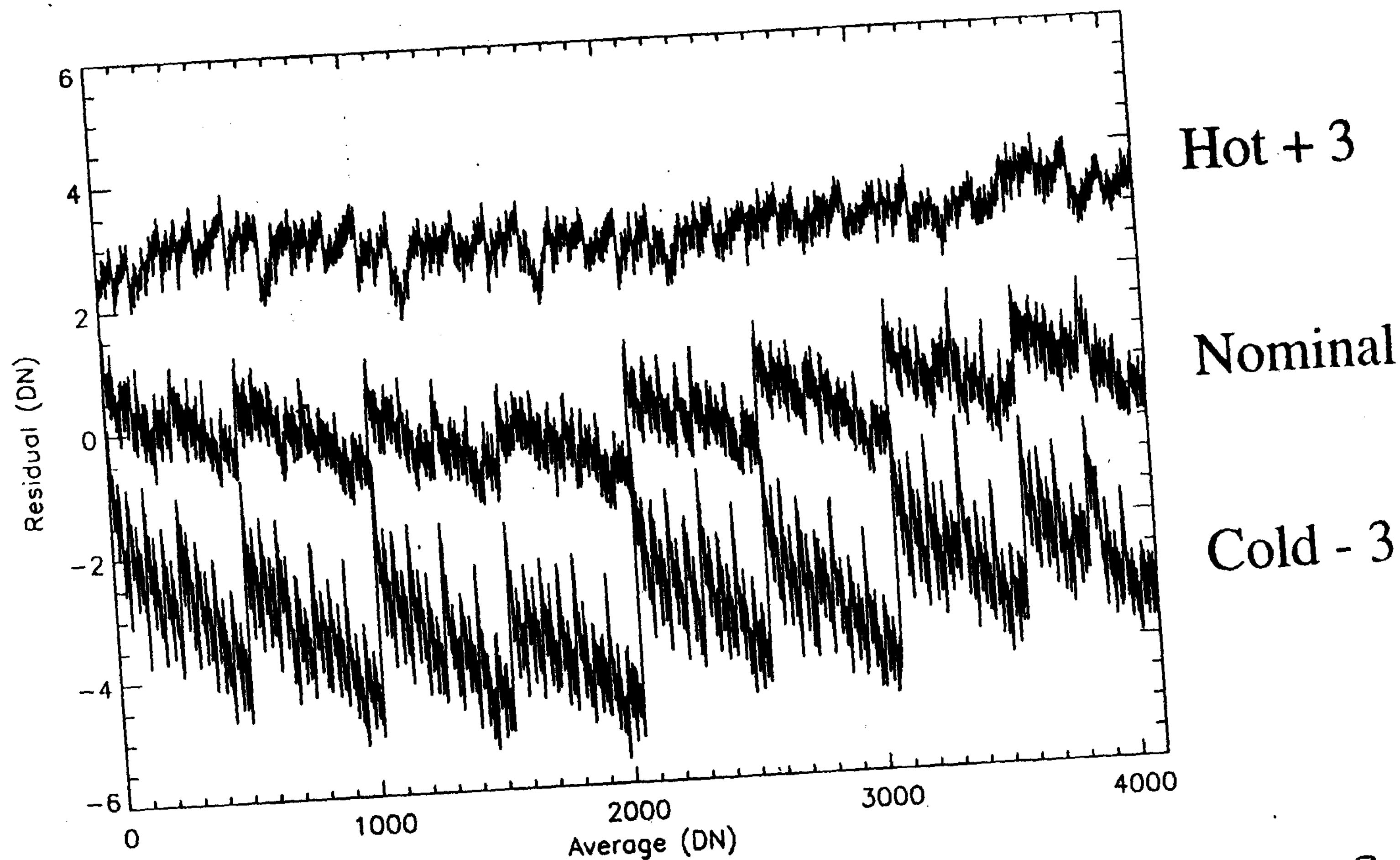
Ground Based ADC Linearity Characterization

- 16 Bit DAC used as calibrator of 12 Bit ADC.
  Compare with best-fit-straight-line (BFSL) across the entire data set.

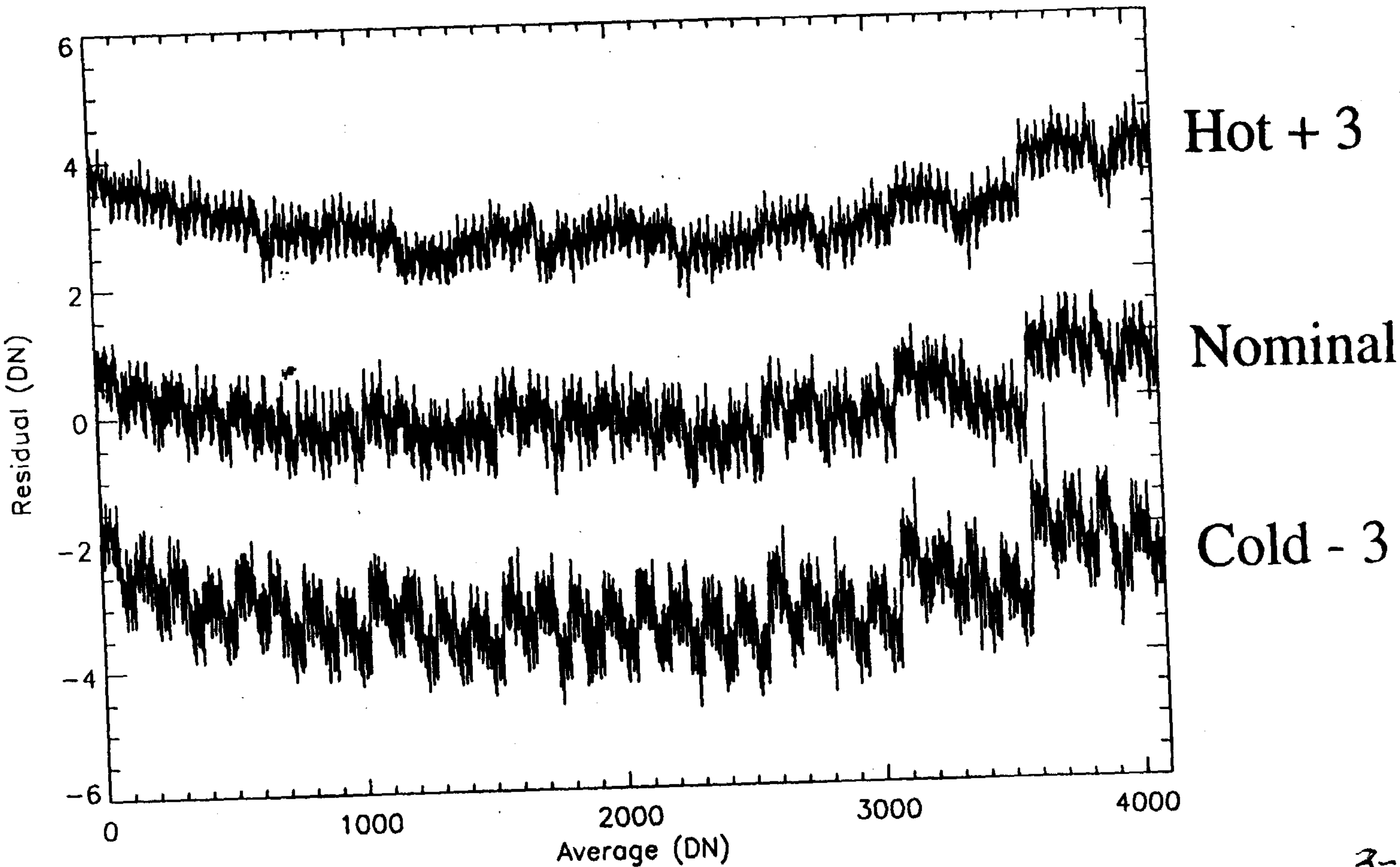


- Minimum 2 DAC steps per ADC DN step
- 400 sample averages per DAC step

ADC Characterization
Linearity of MWIR Bands

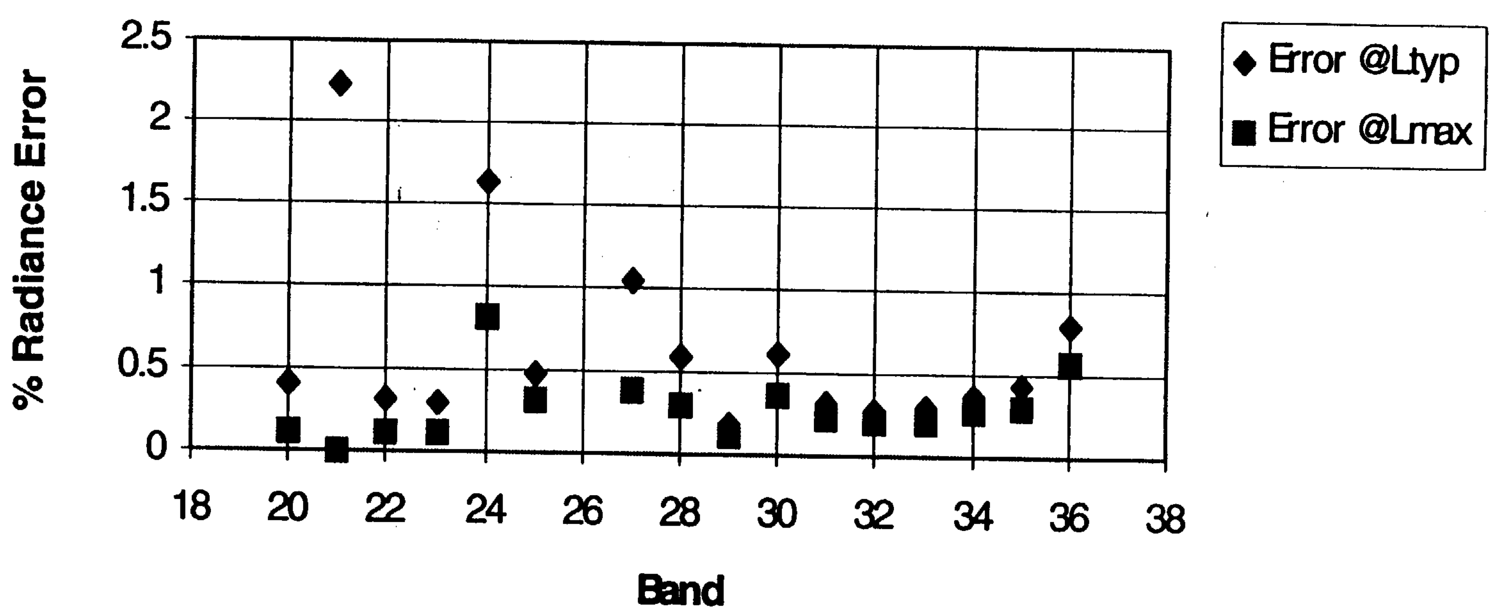


ADC Characterization
Linearity of PV-LWIR Bands



ADC Characterization Error Estimates

Estimated Percent Radiance Error Corresponding to a 4DN Systematic Digitization Deviation. Channel = 5



ADC Characterization Error Estimates

Estimation of errors based on a polynomial representation of DN.vs.L

Errors in polynomial fitting procedure not included in this estimate.

$$\mathrm{dn}_{ev} = \mathrm{DN}_{ev} - \mathrm{DN}_{sv} = a_0 + a_1 L_{ev} + a_2 L_{ev}^2$$

$$\Delta \mathrm{dn}_{ev} \approx \Delta L_{ev} \left(\frac{\delta \mathrm{dn}_{ev}}{\delta \mathrm{L}_{ev}} \right)$$

$$\frac{\Delta L_{ev}}{L_{ev}} \approx \frac{\Delta \mathrm{dn}_{ev}}{a_1 L_{ev} + 2 a_2 L_{ev}^2}$$

ADC Characterization Error Estimates at L_{typ}

Estimated percent error in *L* for channel 5 of each band.

Estimate does not include errors associated with polynomial fit coefficients.

BAND	L_{typ}	$\Delta DN_{signal}=1$	$\Delta DN_{signal}=2$	$\Delta DN_{signal}=3$	$\Delta DN_{signal}=4$	$\Delta L/L_{spec}$	$\Delta L/L_{goal}$
20	0.45	0.099612	0.199225	0.298837	0.398449	0.75	0.5
21	2.38	0.555872	1.111745	1.667617	2.22349	10.0	10.0
22	0.67	0.077253	0.154507	0.23176	0.309014	1.0	1.0
23	0.79	0.076618	0.153236	0.229853	0.306471	1.0	1.0
[redacted]							
25	0.59	0.117292	0.234585	0.351877	0.469169	1.0	1.0
[redacted]							
28	2.18	0.146709	0.293417	0.440126	0.586834	1.0	1.0
29	9.58	0.045389	0.090778	0.136167	0.181556	1.0	1.0
30	3.69	0.15503	0.310061	0.465091	0.620122	1.0	1.0
31	9.55	0.077244	0.154487	0.231731	0.308974	0.5	0.25
32	8.94	0.066696	0.133392	0.200089	0.266785	0.5	0.25
33	4.52	0.073171	0.146341	0.219512	0.292683	1.0	1.0
34	3.76	0.091875	0.18375	0.275625	0.3675	1.0	1.0
35	3.11	0.109102	0.218203	0.327305	0.436407	1.0	1.0
36	2.08	0.201678	0.403356	0.605034	0.806712	1.0	1.0

ADC Characterization Error Estimates at L_{max}

Estimated percent error in *L* for channel 5 of each band.

BAND	L_{max}	$\Delta DN_{signal}=1$	$\Delta DN_{signal}=2$	$\Delta DN_{signal}=3$	$\Delta DN_{signal}=4$
20	1.71	0.02622	0.05244	0.078659	0.104879
21	86	0.001811	0.003621	0.005432	0.007242
22	1.89	0.026919	0.053838	0.080757	0.107676
23	2.16	0.027537	0.055075	0.082612	0.110149
24	0.34	0.204645	0.40929	0.613935	0.81858
25	0.88	0.077799	0.155597	0.233396	0.311195
27	3.21	0.095515	0.19103	0.286545	0.382059
28	4.46	0.071978	0.143956	0.215933	0.287911
29	14.54	0.030314	0.060627	0.090941	0.121254
30	6.34	0.092184	0.184368	0.276552	0.368736
31	13.25	0.056628	0.113257	0.169885	0.226514
32	12.1	0.049745	0.09949	0.149235	0.198979
33	6.56	0.050478	0.100957	0.151435	0.201914
34	5.02	0.068388	0.136775	0.205163	0.273551
35	4.42	0.07627	0.152539	0.228809	0.305079
36	2.96	0.141851	0.283703	0.425554	0.567406

ADC Ground Based Look-Up Table (LUT) Corrections

- No correction planned for FAM ADCs (no data).
- Correction for SAM ADCs systematic digitization error, $\Delta(B,T,DN)$, is obtained using the deviation from a BFSL through the entire 16 Bit DAC data set:

$$DN'(B,T) = DN(B,T) + \Delta(B,T,DN)$$

B= Band, T= Temperature

Intermediate temperature points to be linearly interpolated.

This correction algorithm assumes Δ is reproducible over time.

- **LUT Format:**

Separate Tables for Cold, Nominal and Hot Operating Temperatures

Δ(B,T,DN)

RAW DN	MWIR ACE Bands 20, 21, 22, 23, 24, 25	PV-LWIR ACE Bands 27, 28, 29, 30
0		
1		
2		
3		
4		
5		
6		
7		
.		
.		
.		
4093		
4094		
4095		

ADC Characterization Summary

- 16 Bit DAC data will be used (where available) to remove fixed pattern and systematic ADC non-linearity.
- Correction lookup tables are constructed from ground based data.
- Correction algorithm assumes that the fixed pattern ADC non-linearity does not change over time, and is the same when the instrument is in orbit.

On-Board ECAL: Electronic Calibration

- 8 Bit DAC used to inject constant charge immediately after the detectors on the FPA Read Out Electronics Chip (ROIC).
- Dynamic range of ADC covered in ~10 equal charge injections; one injection step per frame in space view sector.
- During ECAL cycle, PV detectors removed from circuit; PC detectors remain part of circuit.
- ECAL data collected over preset number of mirror scans (typically 2 in T/V PFM).
- Scan averaged data obtained on-board to be used to monitor gross linearity variations over time and temperature by comparing to earlier or ground based measurements.

Electronic Calibration Status and Key Issues

- Status:
  - T/V PFM data analyzed show a linear ECAL response given the 8 Bit resolution of DAC supply.
  - Typically less than 5% variation for the linear slope term over full operating temperature range of instrument.
- Key Issues:
  - Additional data at spacecraft level at Valley Forge will be requested in a new STR to compare to existing T/V data at cold, hot and 5 intermediate temperature regions.
  - Data to be obtained over ~300 mirror scans (~7.5 minutes) to increase ECAL resolution from 8 Bits to ~12 Bits by statistical analysis.
  - Relation between ECAL and radiometric transfer functions TBD.