MCST Briefing

- Calibration Group Agenda (2 May 1995)
- Publications and Major Deliveries
- Key Milestones and Schedule
- Key Sensor Characteristics
  - Scan Angle Effects
  - Near-field scatter

B. Guenther/ MCST Head
guenther@highwire.gsfc.nasa.gov
voice 6-5205/ fax 6-1616

CALIBRATION GROUP AGENDA

8:30 am	Welcoming Remarks - Slater and Guenther
9:00 am	MODIS status and schedule - Roberto and Knight
	» including waivers, SRCA and SRCA lamps
9:45 am	Transient response
	» GSFC ghosting model - S-Y Qiu
	» Status on Near-field Scatter studies - Godden
10:30 am	Break
10:45 am	Transient response continued
	» MTF studies of the Moon and point sources - McKay
11:15 am	TAC results: polarization and scan angle data of EM - Knight
12:00 noon	Lunch
1:15 pm	Dry Run of Logan, Utah iR conference paper - Godden
2:00 pm	Vicarious-instrument Workshop at WFF - Jones
2:30 pm	Level 1B algorithm and ATBD '95 schedule - Hopkins & Jones
3:15 pm	Break
3:30 pm	Round-robin status - Butler
4:00 pm	Dry Run of MCST briefing to Science Team - Guenther
4:30 pm	Calibration Chairman's Summary - Slater

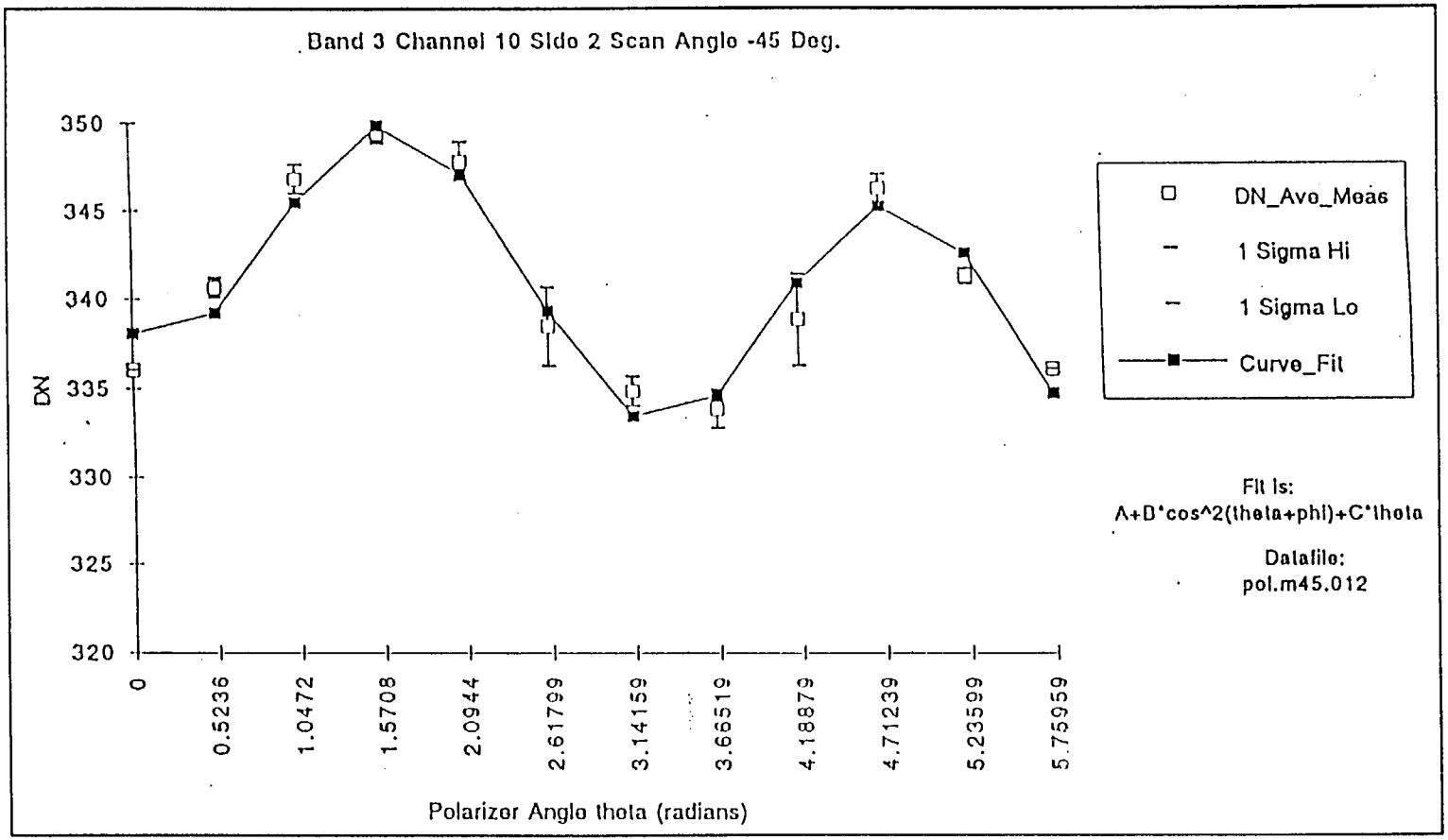
Publications and Major Deliveries

- MODIS Level 1B Algorithm Theoretical Basis Document
- MODIS Level 1B Algorithm, Beta-3 Delivery
- "MODIS Calibration: A brief review of the strategy for the at-launch calibration approach" -- accepted for publication in J Atmos Oceanic Tech, special EOS Calibration Issue
- "Scan angle dependence in infrared radiometric calibration" -- accepted for presentation to IR Radiometry Conference, Logan Utah 8-11 May 1995
- "Spectral characteristics of the Earth Observing System (EOS) Moderate Resolution Imaging Spectroradiometer (MODIS)" -- presented at April 1995 SPIE, Orlando meeting

Key Accomplishments

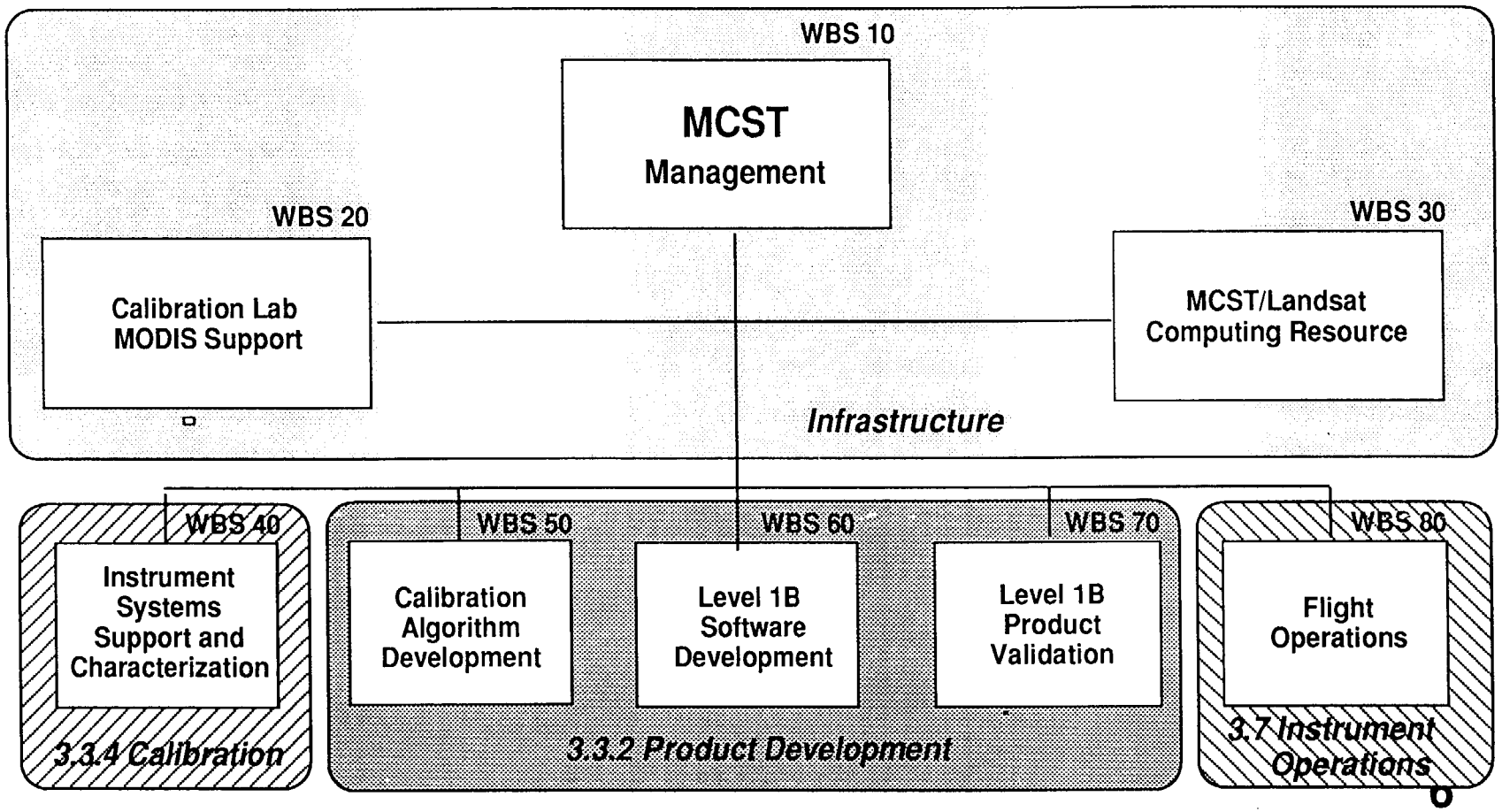
- Transition to new prime support contractor -- General Sciences Corp - GSC
- Established GSFC Test and Anaylsis Computer (TAC) for processing MODIS test data sets
- Established Risk Management Board to identify, track and control risks
- Continued to refine and focus MCST management and activites to delivery requirements

GSFC TAC EM Data Analysis Polarization Results

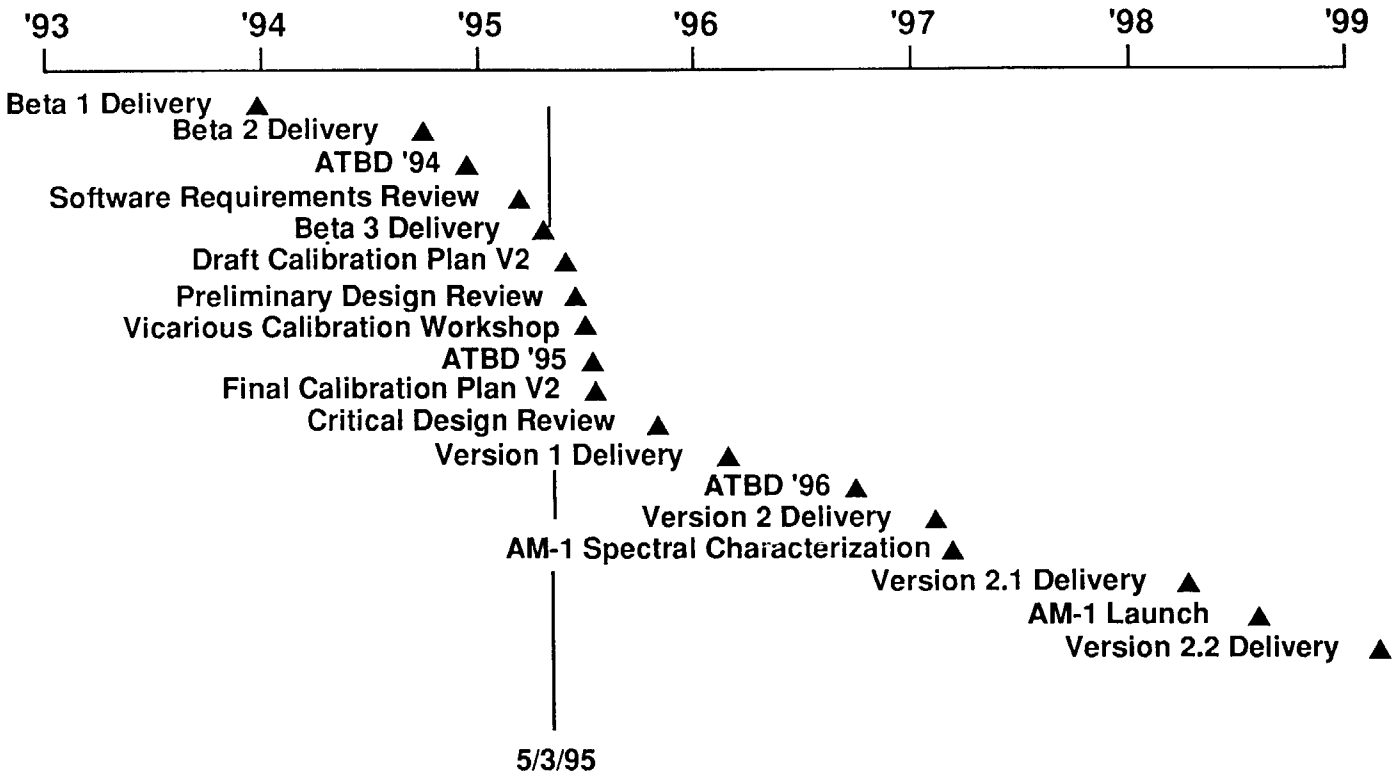


- Test is to rotate polarization analyzer in front of sensor
- Residual sensor polarization is (Imax-Imin)/(Imax+Imin)

Team Leader Working Agreement Mapped to Level 2 WBS



Key Milestones and Schedule



MODIS Level 1B Milestones

Vicarious-Instrument Calibration Workshop

- Goal: Focused on MODIS L-1B Data Products
  - Identify vicarious calibration data sets
  - Review the instruments that produce them
  - Consider ways to use the data sets in developing L-1B data products
- Working Meeting (cloistered at WFF *, 7-11 August)
  - Critical evaluation of candidate sensors and derived data sets for procedure and error budgets
  - Proceedings published as MODIS Technical Report

Understanding the Uncertainties is Critical

* - Chosen as most cost effective for doing this Retreat; only time available in 1995

Vicarious-Instrument Calibration Workshop

Discussion topics

- Summaries of instruments and techniques
- Traceability to NIST or SI units
- Calibration Round-robins
- Atmospheric correction algorithms
  - Aerosol corrections

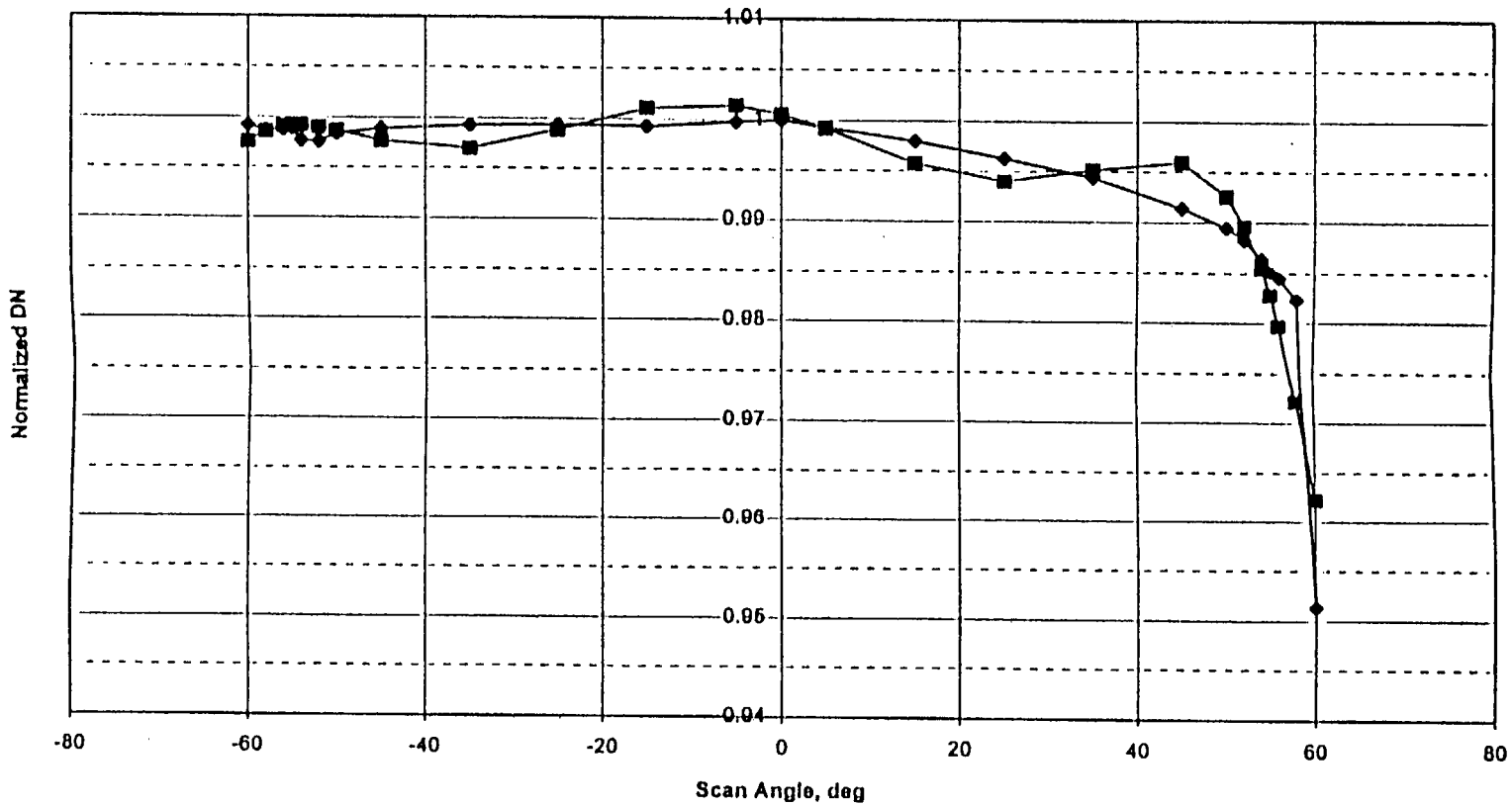
Products

- Critical reviews of error budgets for each vicarious calibration technique
- Techniques to incorporate data sets with pre-launch and post-launch data to derive calibration parameters

Key Sensor Characteristics Scan Angle Effects

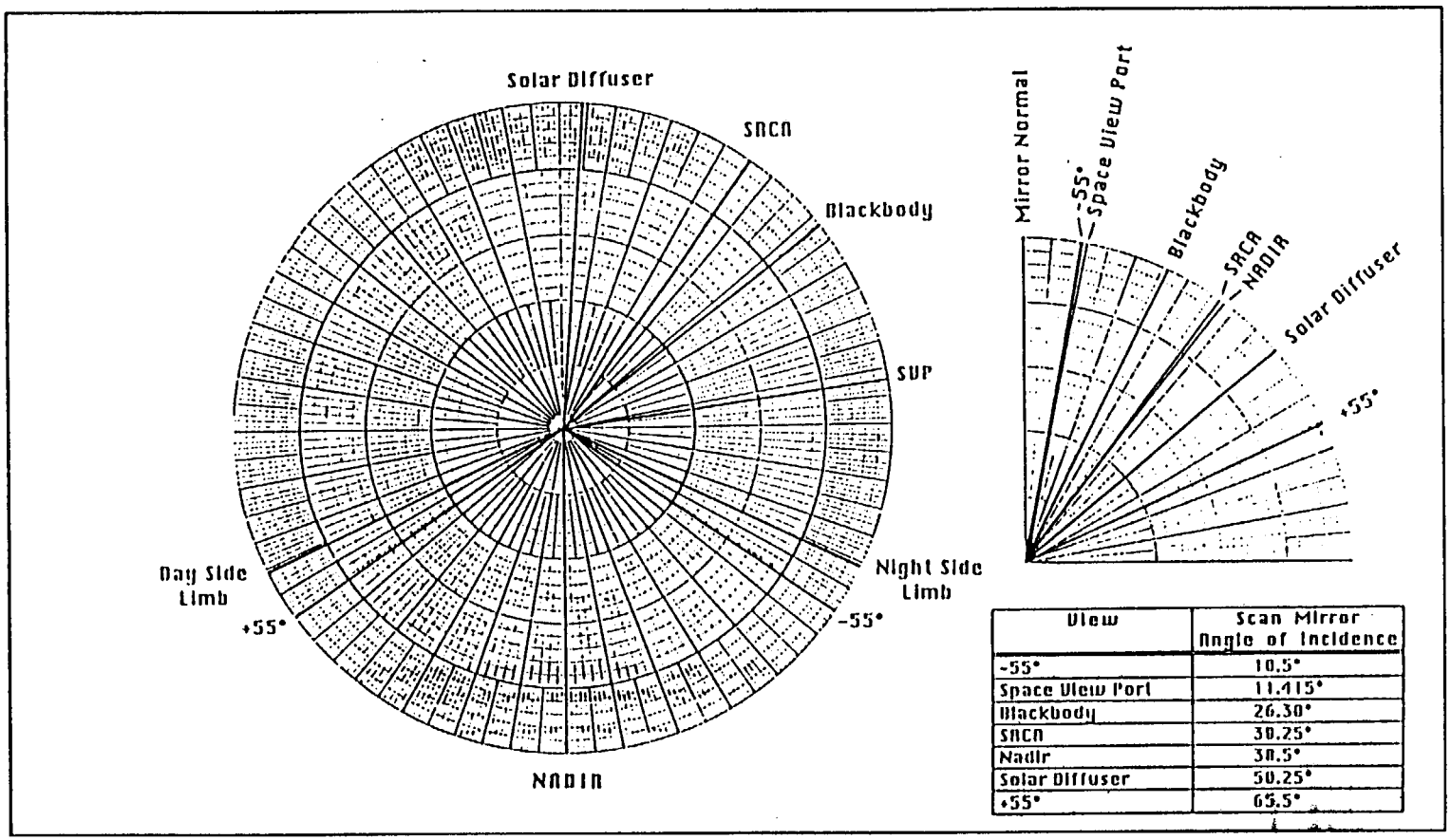
- Engineering Model GSFC TAC Analysis results (Zukowski and Knight)
- Witness Sample measurements by Lincoln Labs and Logan Conference Paper
- On-orbit strategies
  - Scan cavity "2nd blackbody"
  - Maneuvers

Scan Angle Effect
GSFC TAC Analysis of EM Data



Band 10, Channel 1
Normalized DN: diamond , Calculated from fit: square

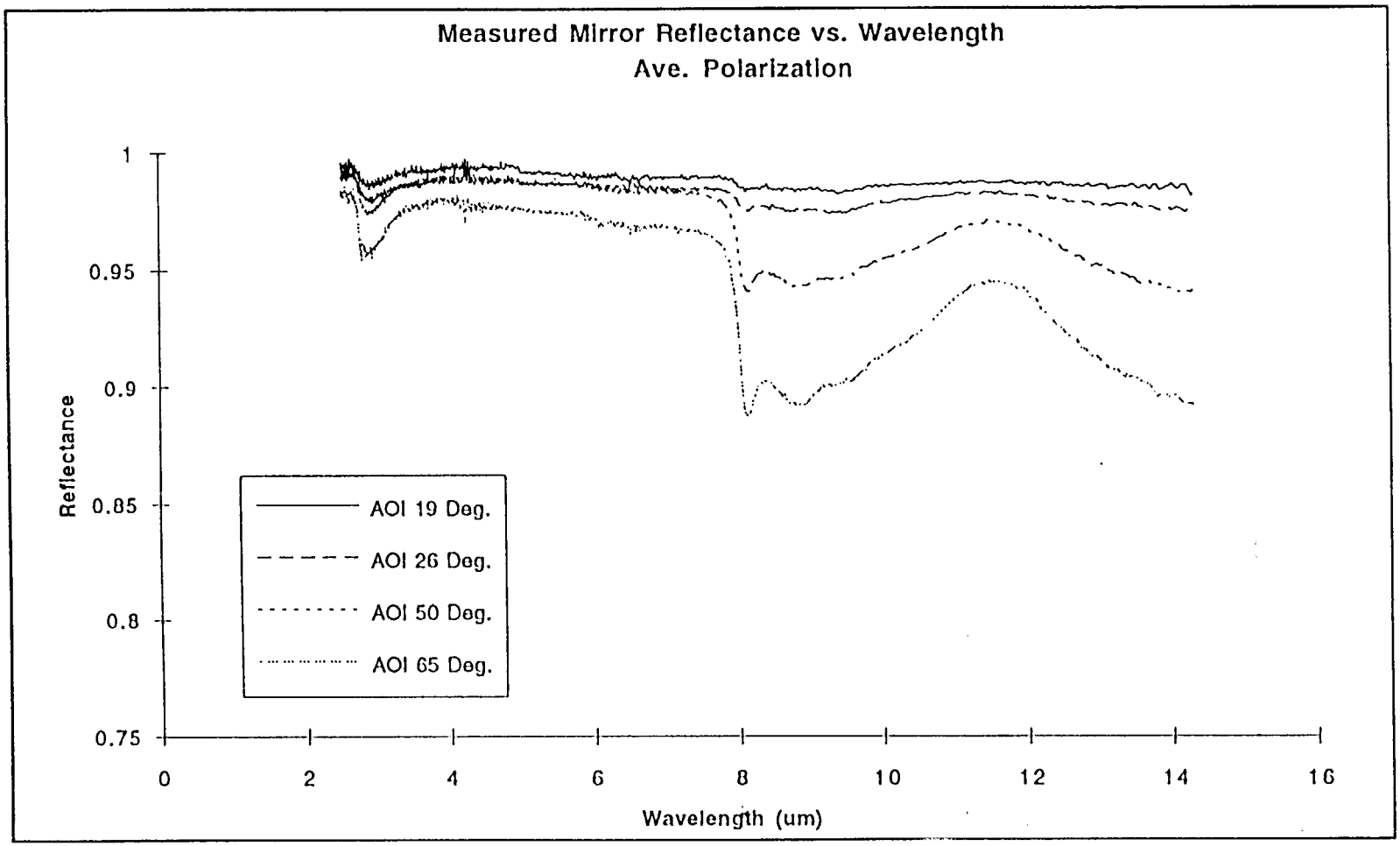
Relationship Between MODIS Scan Angle and Scan Mirror AOI



View	Scan Mirror Angle of Incidence
-55°	10.5°
Space View Port	11.415°
Blackbody	26.30°
SRCA	30.25°
Nadir	30.5°
Solar Diffuser	50.25°
+55°	65.5°

-55 degree Earth View and the Space View port have nearly equal Scan Mirror Angles of Incidence

Scan Angle Effect
Witness Sample Measurements
by Lincoln Labs



Scan Angle Effect
On-orbit Strategies

- Use of scan cavity near diffuser as "second blackbody"
- Use of deep space for emissive infrared wavelengths
- Use of moon for reflected solar wavelengths (TBR)

Key Sensor Characteristics
Near-field Scatter

- Ghosting effects seem to be understood and well-corrected
- Detector cross-talk measurements at focal plane assembly level have been promised
- Preliminary results of Breault Models
- Modulation Transfer Function (MTF) measurements on-orbit from Moon and point sources
- MTF for natural sources not yet understood

Near-Field Scatter
Preliminary Results of Breault Models

Dichroic #1: H-S 24.0 -2.535

PERCENT CONTRIBUTION BY EACH OBJECT AS A FUNCTION OF OFF AXIS ANGLE

OFF AXIS ANGLE	.10	~~.20~~ .16	.20	.40	.80
AZIMUTH ANGLE	.00	.00	.00	.00	.00
# NAME	1	2	3	4	5
70 SCAN_MIR	.00	.00	.00	.00	56.38
80 FOLD_MIR	.00	.00	.00	.00	22.46
140 PRIMARY	.00	.00	.00	.00	21.01
170 BS1_MIR	90.11	91.25	91.63	88.93	.15
230 NIR_E2S1	4.86	4.26	4.03	5.34	.00
240 NIR_E2S2	5.03	4.49	4.34	5.72	.00
TOTAL POWER	1.9E+03	2.1E+03	2.2E+03	1.4E+03	3.8E+00

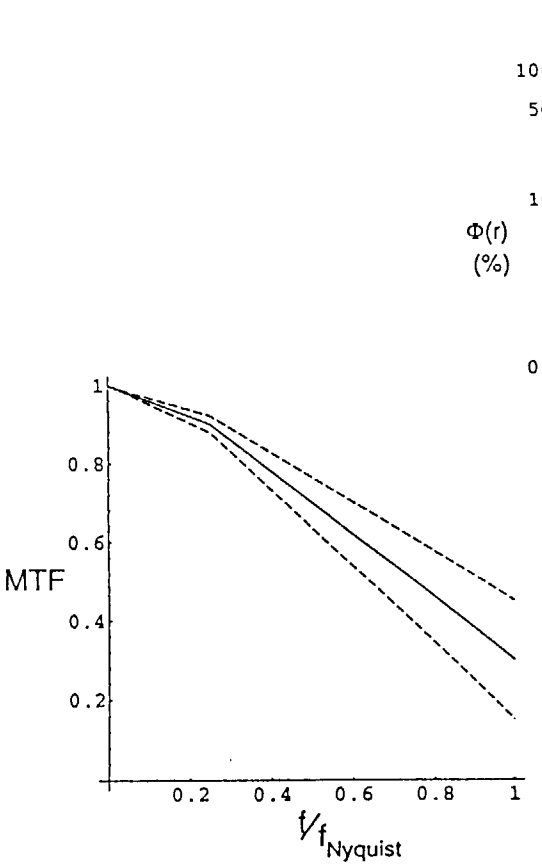
Dichroic #1: H-S 1 -2.535

PERCENT CONTRIBUTION BY EACH OBJECT AS A FUNCTION OF OFF AXIS ANGLE

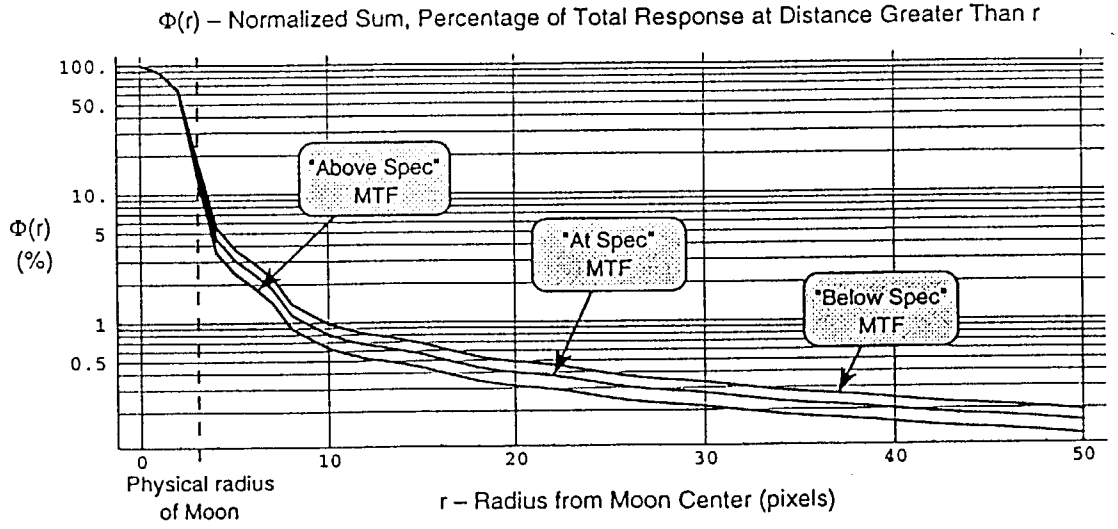
OFF AXIS ANGLE	.10	~~.20~~ .16	.20	.40	.80
AZIMUTH ANGLE	.00	.00	.00	.00	.00
# NAME	1	2	3	4	5
70 SCAN_MIR	2.53	2.39	1.19	2.19	56.46
80 FOLD_MIR	.00	.00	.00	.00	22.49
140 PRIMARY	.00	.00	.00	.00	21.04
170 BS1_MIR	26.81	29.56	64.08	24.54	.01
230 NIR_E2S1	34.71	33.11	16.72	35.39	.00
240 NIR_E2S2	35.95	34.94	18.00	37.88	.00
TOTAL POWER	2.6E+02	2.7E+02	5.3E+02	2.2E+02	3.8E+00

Total Scattered Power Reduced By: 0.14 0.13 0.24 0.16 1.0

Near-Field Scatter MTF using the Moon



MTF required by the MODIS specification (solid line) and variations ("above spec" and "below spec" MTFs—shown with dashed lines).



Integrated response to the Moon—percentage of total response lying outside radius r.

Summary of MCST Briefing

- Presented major accomplishments for past six months
- Provided analysis from GSFC processed data for EM test data sets to complement SBRC analysis
- Described Team organization in terms of meeting our major products
- Invited interested Science Team Members to a V-C Workshop at WFF