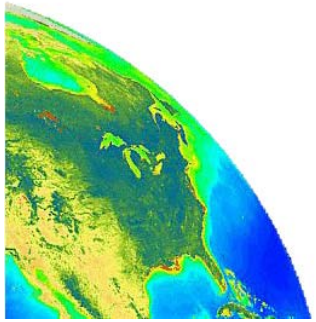
Main design features of SeaWiFS and MODIS

Gerhard Meister[a]

[a]: OBPG (Ocean Biology Processing Group; GSFC)

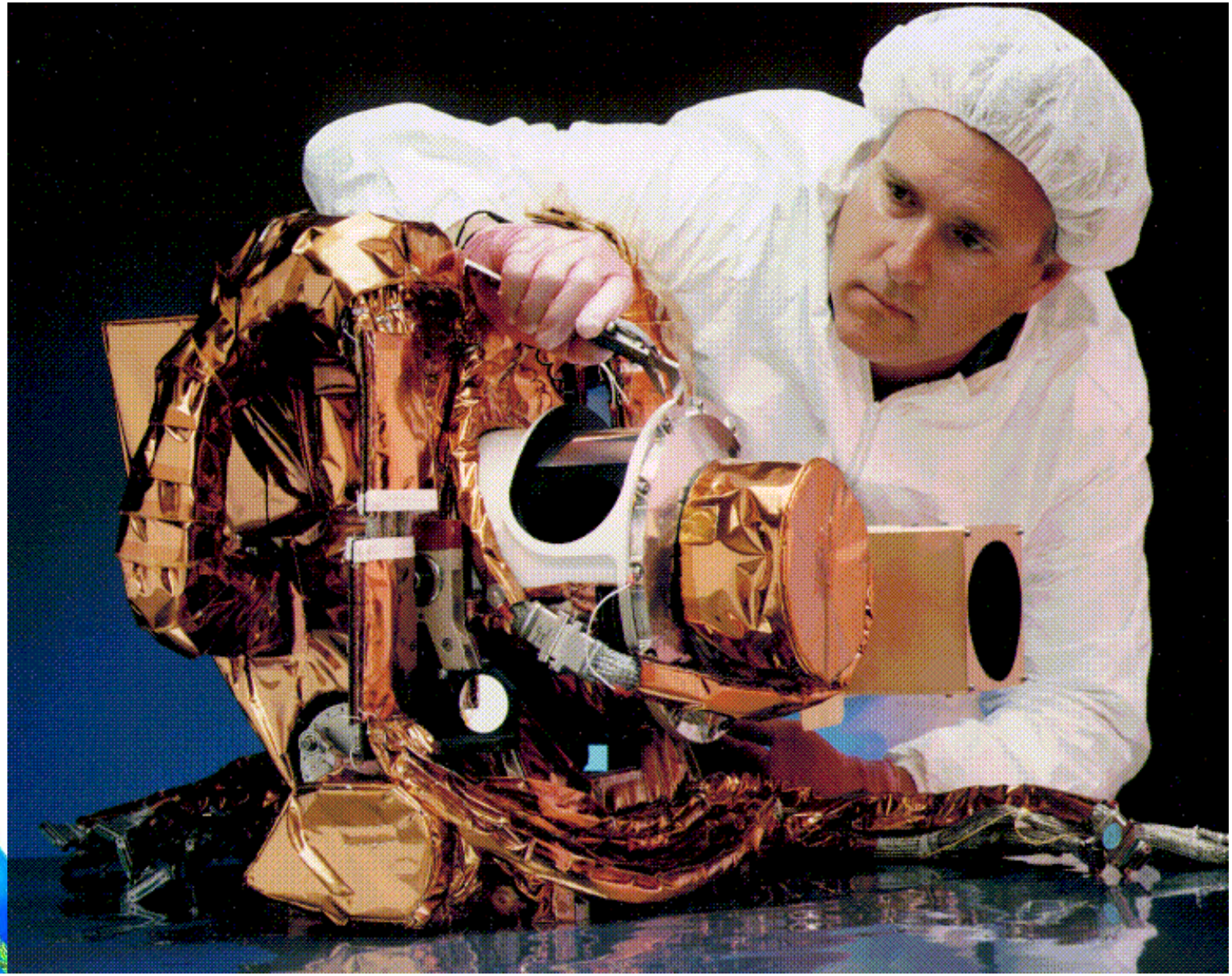
Acknowledgements: Fred Patt, Gene Eplee (OBPG)

April 21st, 2010



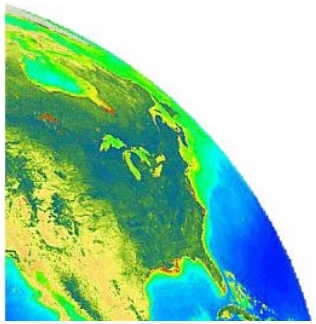
1st meeting of IOCCG WG 'L1 Requirements', April 2010

SeaWiFS Design

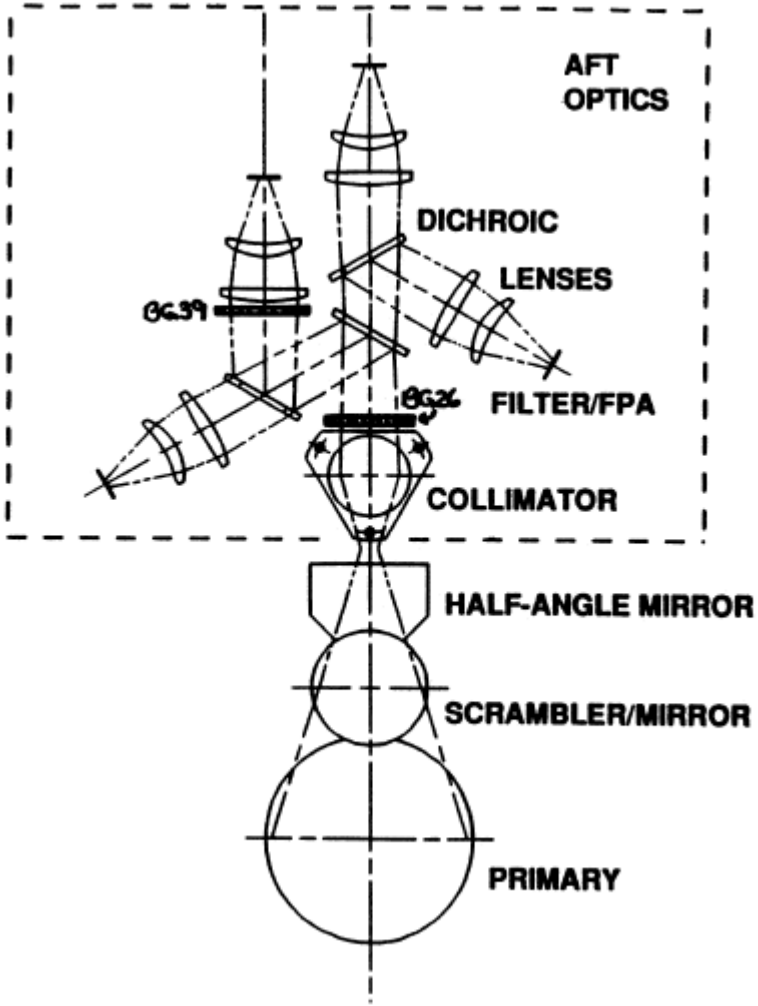


SeaWiFS Design

Band	Wavelength [nm] (BW)	Ltyp [W/ m^2 sr mm]	SNR at Ltyp (pl)
1	412 (20)	78.6	900
2	443 (20)	70.2	950
3	490 (20)	53.1	1000
4	510 (20)	45.8	1000
5	555 (20)	33.9	850
6	670 (20)	16.0	550
7	765 (40)	8.3	500
8	865 (40)	4.5	350



SeaWiFS Design



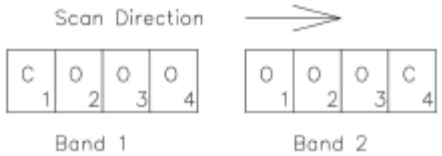
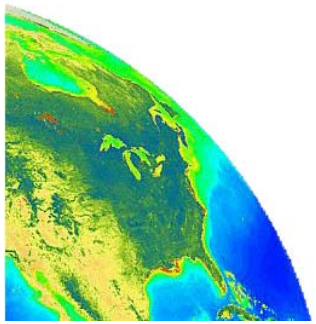


Fig. 2. Band 1/band 2 focal plane layout. The cloud (C) and ocean (O) detectors for each band are laid out as shown.



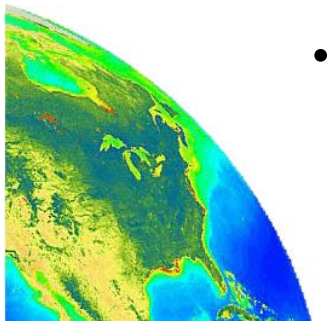
SeaWiFS Design

Strengths:

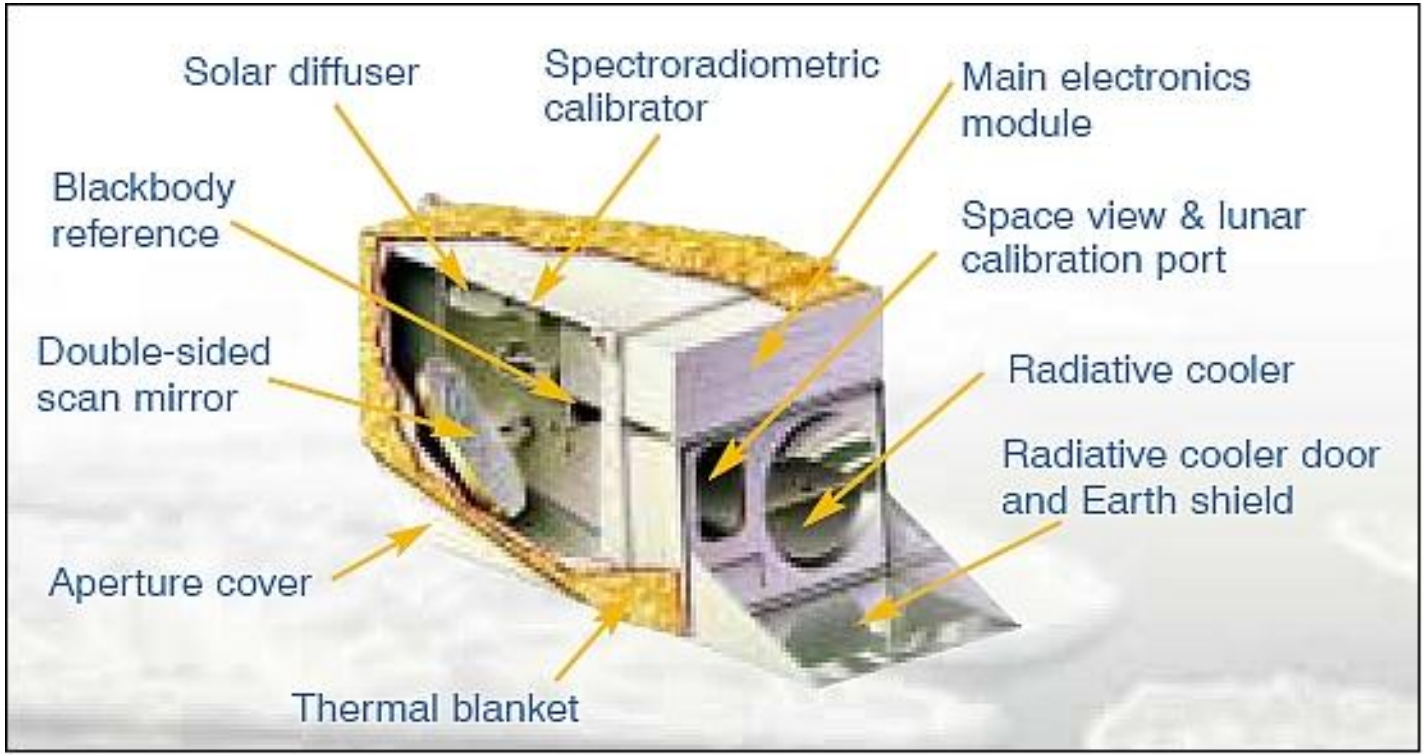
- Single set of optical components for all observations
- Rotating telescope
- Sensor tilt to minimize Sun glint
- Bilinear gain for extended dynamic range
- Lunar calibration within Earth view
- Polarization scrambler

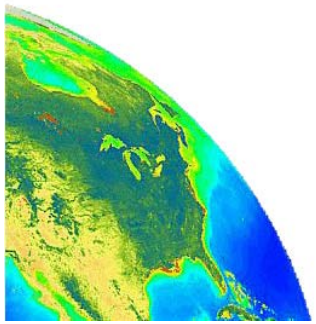
Weaknesses:

- Radiometric resolution
  - 10-bit digitization
- Stray light performance
- 4-km subsampling for global data collection
- No orbit maintenance



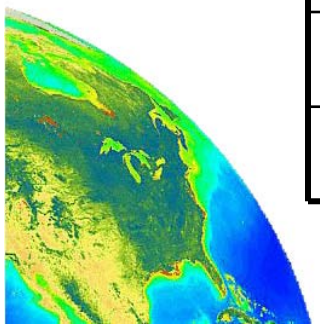
MODIS Design



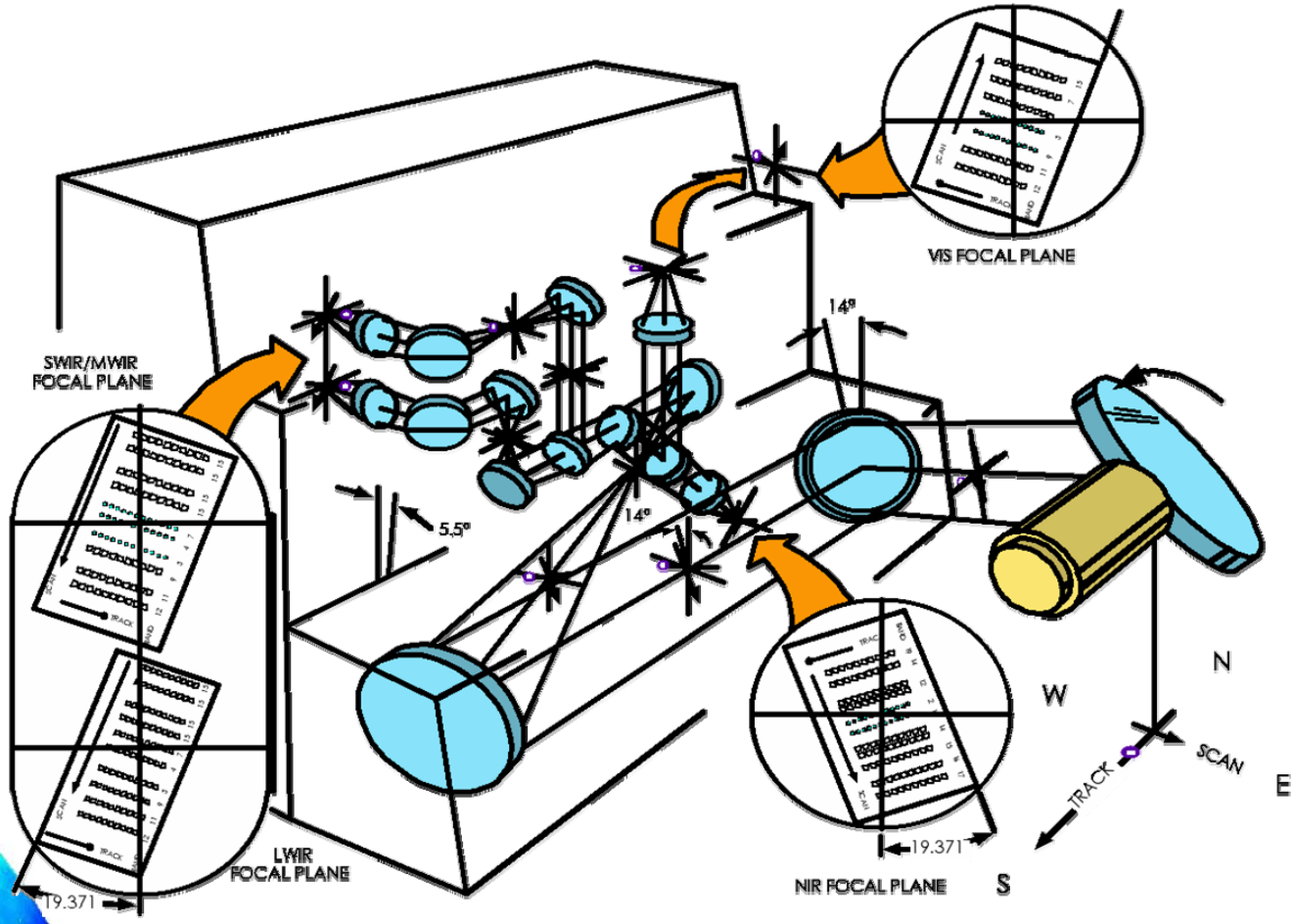


MODIS Design

Band	Wavelength [nm] (BW)	Ltyp [W/ m^2 sr nm]	SNR at Ltyp (pl, scaled)
8	412 (15)	78.4	1650
9	443 (10)	69.9	2200
10	488 (10)	53.8	2150
11	530 (10)	38.7	1900
12	547 (10)	35.0	1850
13	667 (10)	14.7	1800
14	678 (10)	13.8	2000
15	748 (10)	8.9	950
16	870 (15)	4.6	750

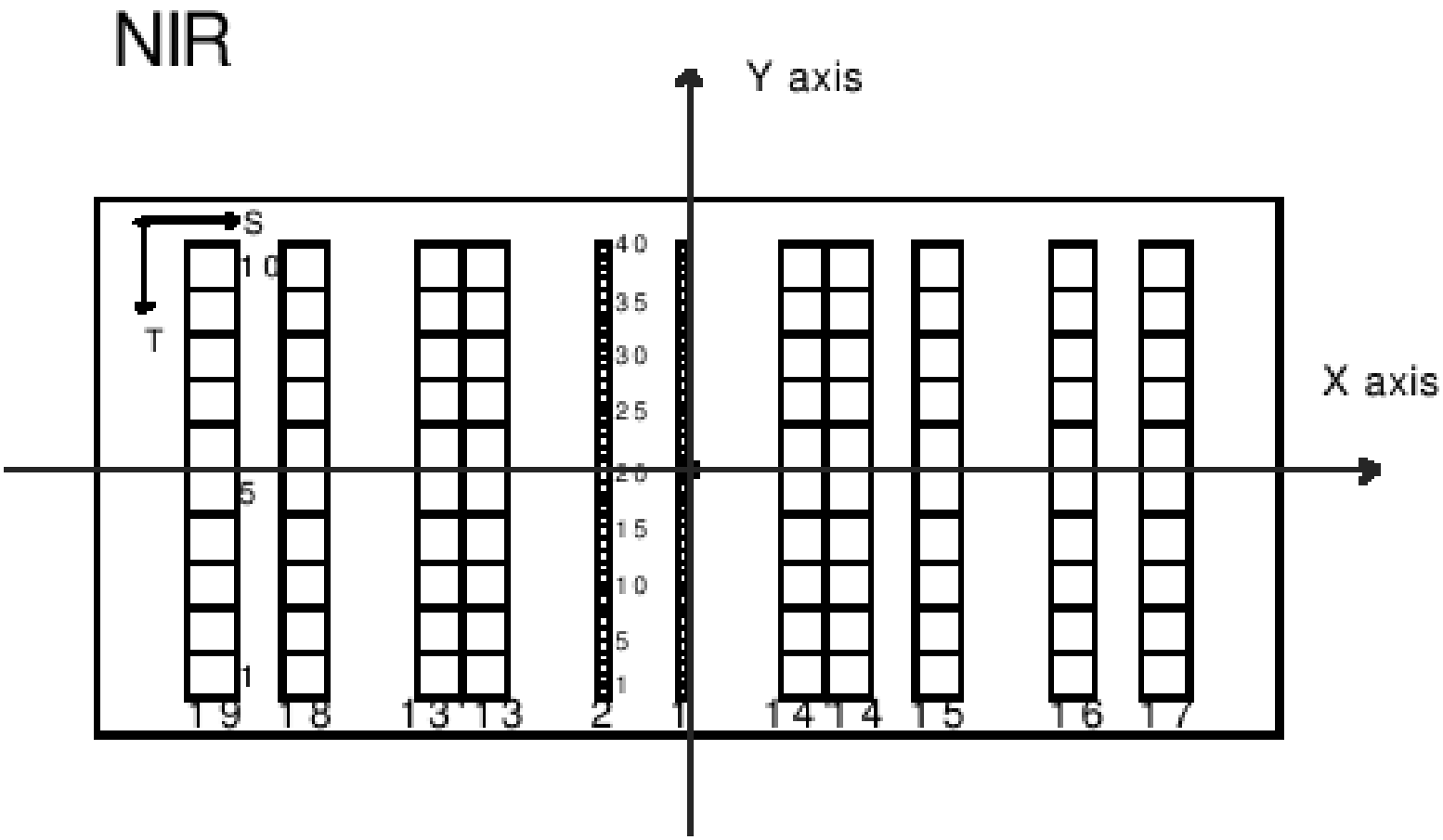


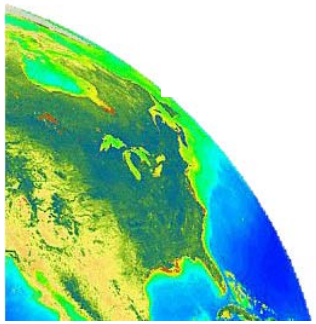
MODIS Optical System



+/-55deg scan angles

MODIS NIR focal plane

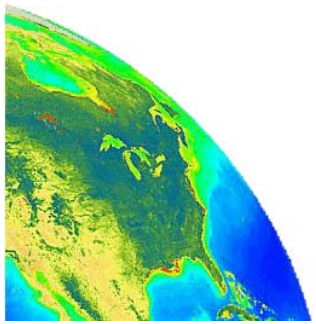




MODIS Design

Strengths:

- 1-km global 2-day coverage
- High SNR in Vis/NIR
- 12 bit digitization
- Fluorescence bands
- Orbit maintenance



Weaknesses:

- Focal plane design
  - Multiple detectors per band result in striping
- No tilt
- Exposed paddle mirror
  - Degradation in blue bands
- Radiometric saturation
- Low SNR in SWIR (<25)
- Polarization sensitivity
- 530nm band instead of 510nm

MODIS SD Measurement Setup

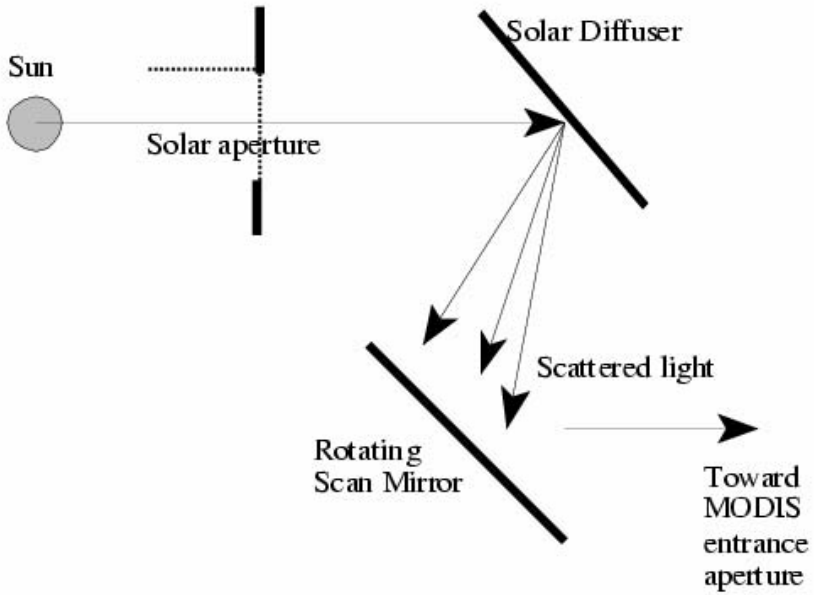


Fig. 4: Light path

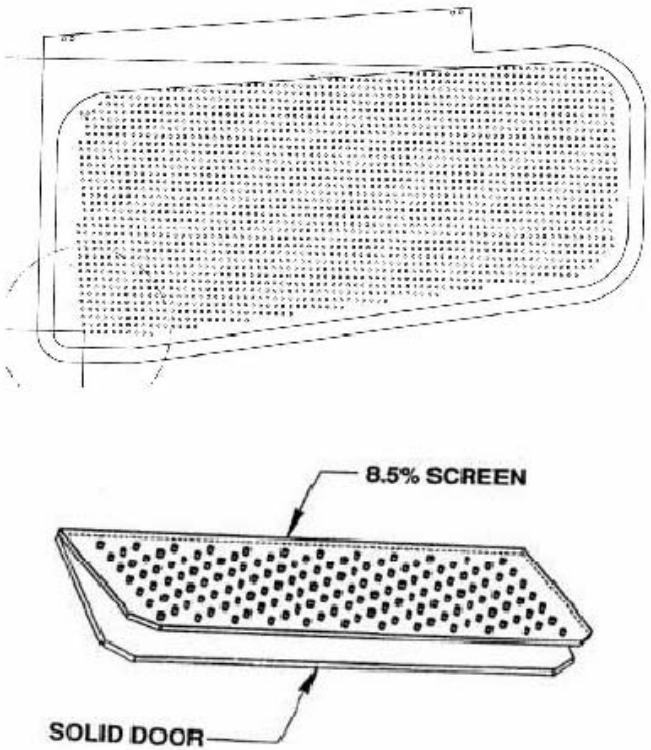


Fig. 5: Attenuation screen

From: Waluschka et al, 2004.

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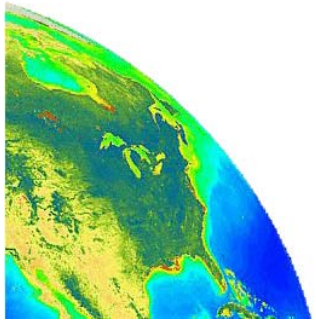
Backup



MODIS Focal Planes

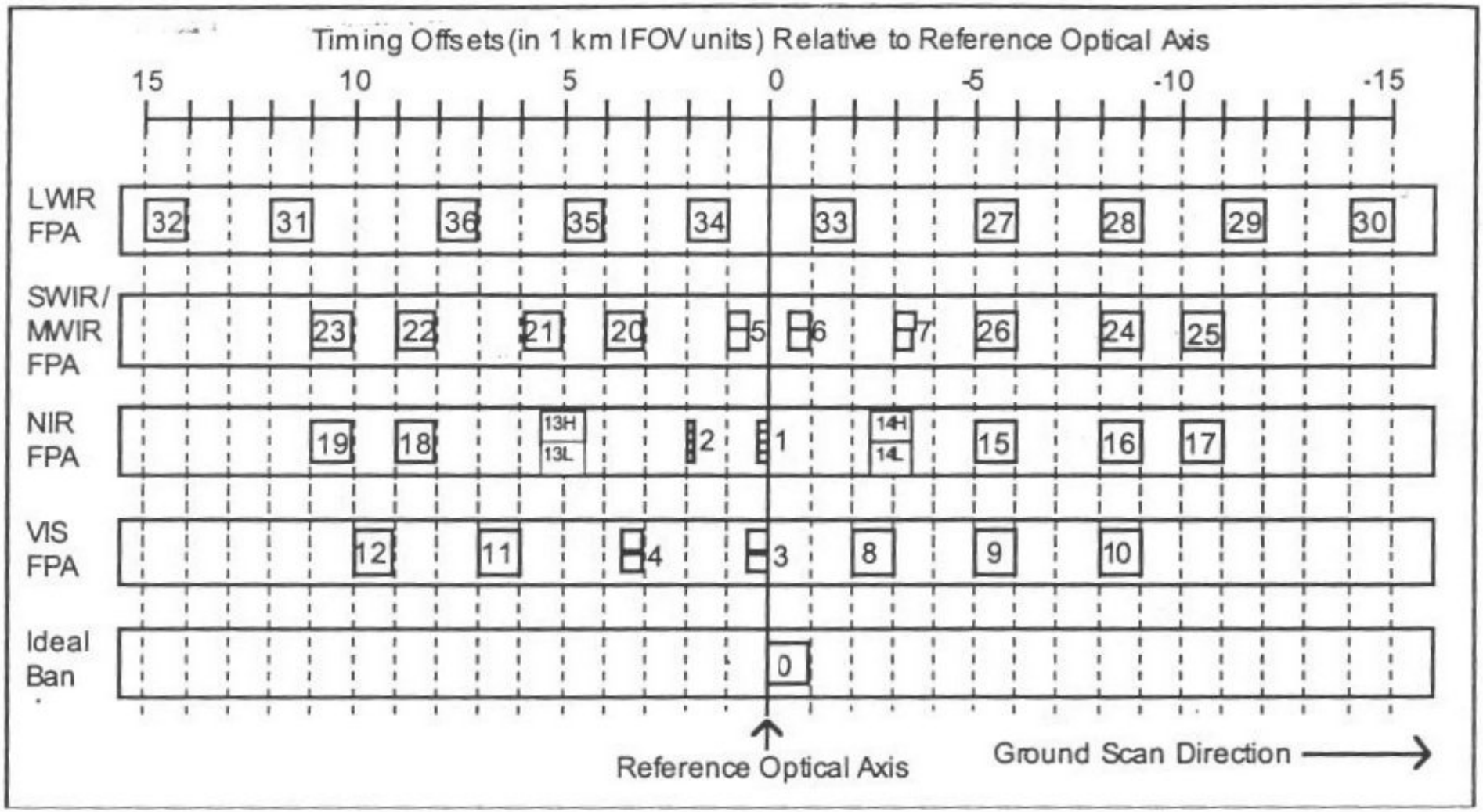


Figure 3-11. Offset of Each Band Relative to the Reference Optical Axis

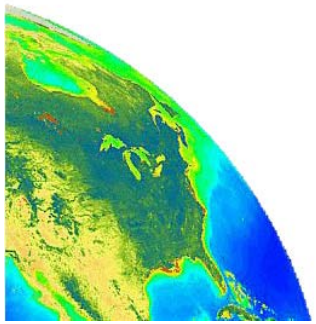
VIIRS Design

Strengths:

- 750m global resolution
- Rotating telescope
- Good SNR in Vis/NIR
  - 12-bit digitization
- Low polarization sensitivity
- Orbit maintenance

Weaknesses:

- Focal plane design
  - Multiple detectors per band result in striping
- No tilt
- Dual gains for most Vis/NIR bands
  - Discontinuities at transitions
- Saturation in 746nm band
- Fewer visible bands
- Low SNR in SWIR



SeaWiFS Design

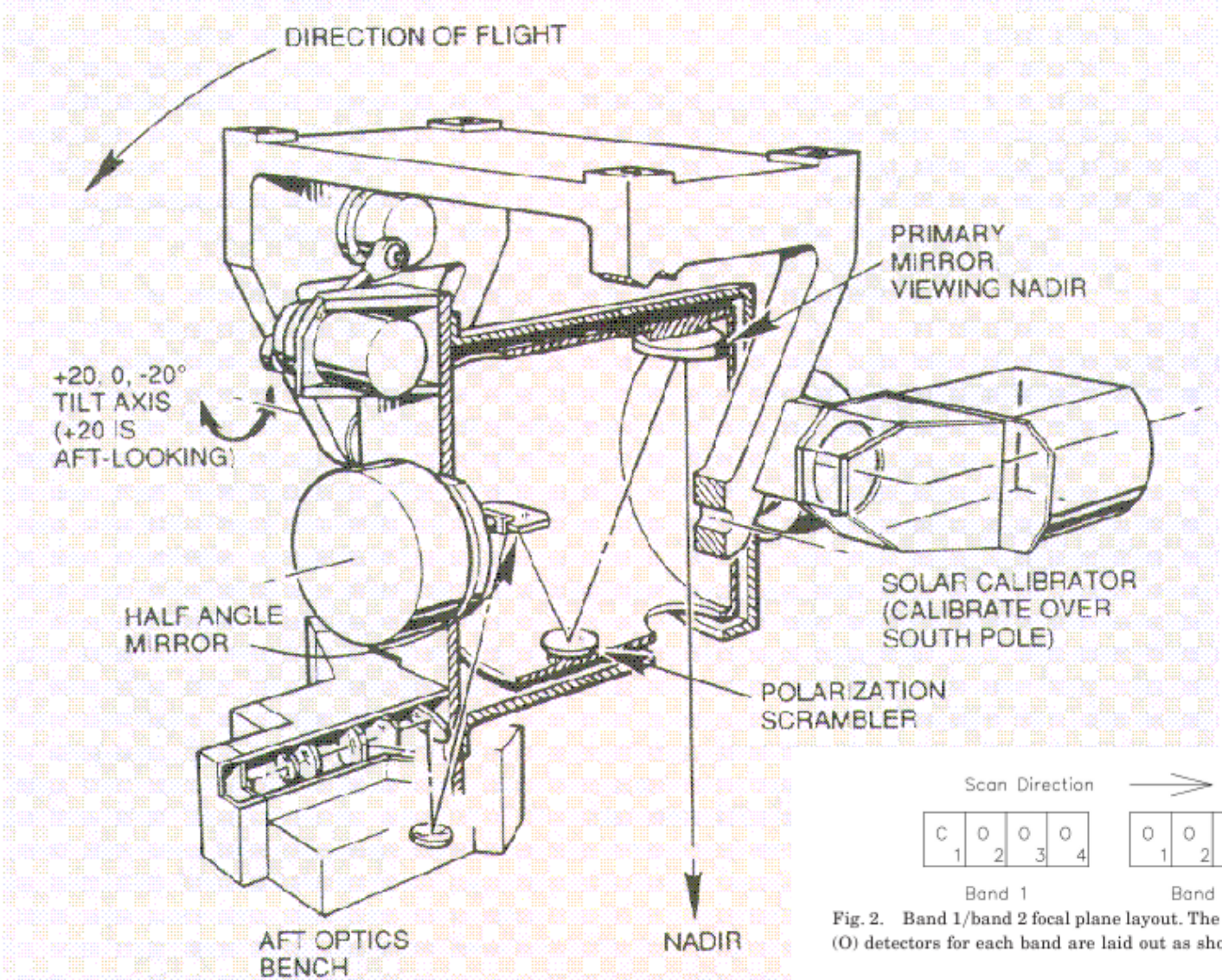
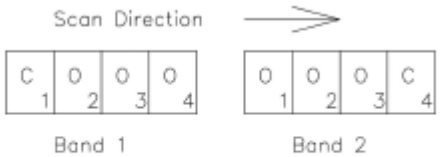


Fig. 7. Schematic of the SeaWiFS scanner assembly which scans from west to east.



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