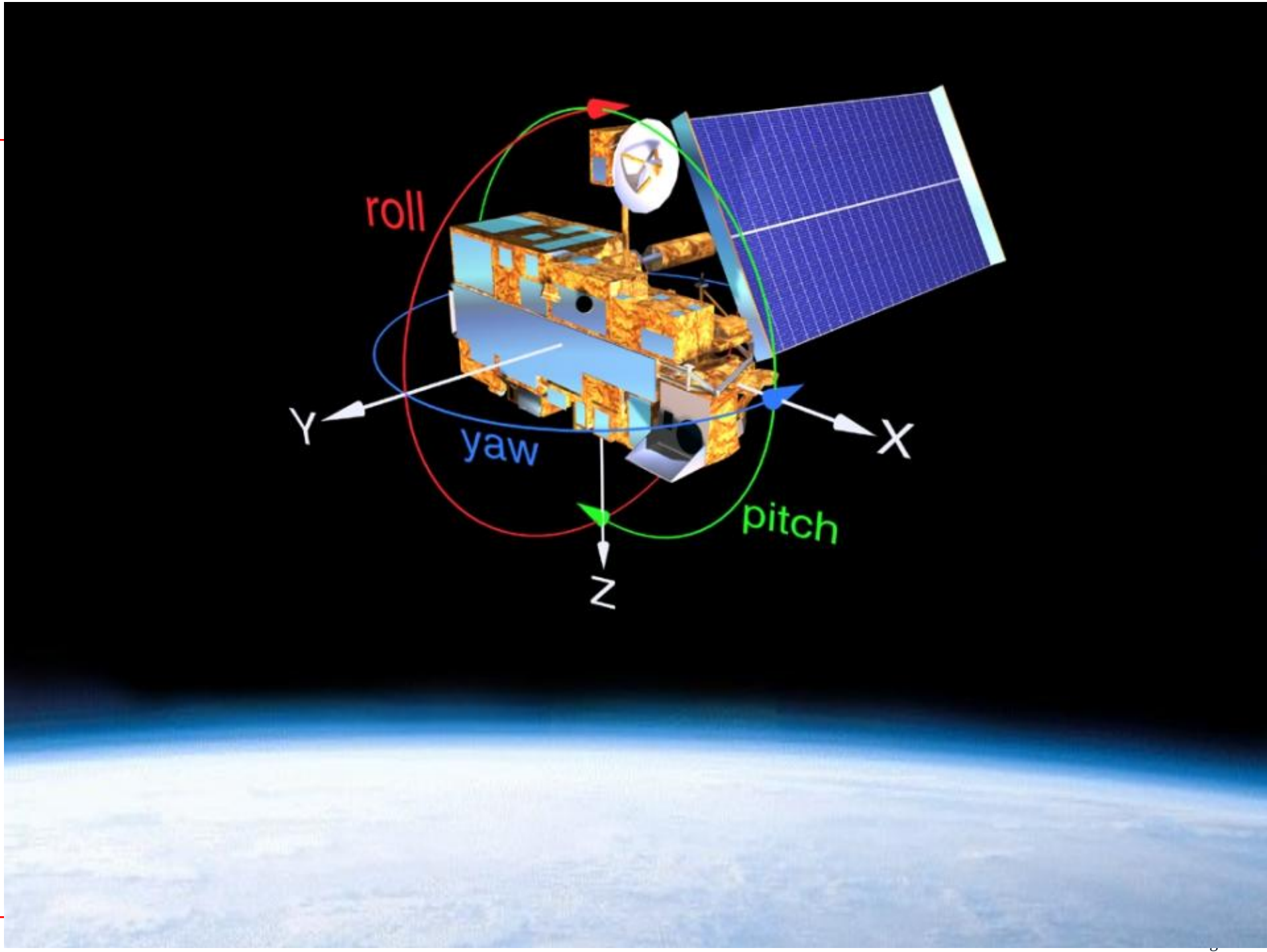
NPOESS Preparatory Project (NPP)
VIIRS Calibration Maneuvers

May 15, 2008

Ocean PEATE Team

Background

- NPP Deputy Project Scientist for Sensors (Butler) is coordinating instrument requests for calibration maneuvers for the NPP Project Office.
- VIIRS requests were presented by McClain (lunar roll) and Xiong (solar diffuser yaw and deep space pitch) in February. These slides are excerpted from those presentations.
- All instrument requests are currently being reviewed by Project and spacecraft engineers.
- NPOESS platforms will not perform calibration maneuvers.


roll
Y
yaw
X
pitch
Z

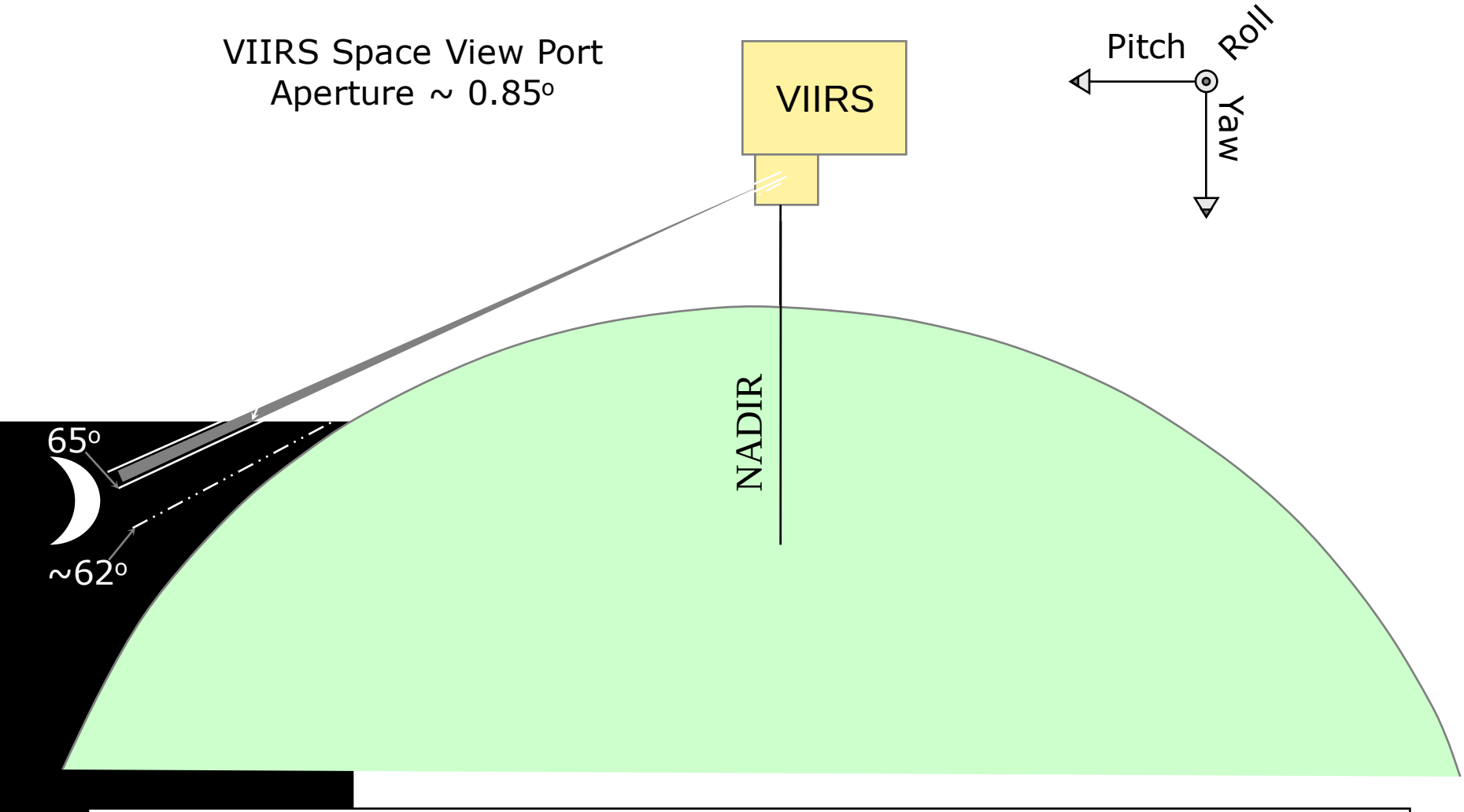
Maneuvers Proposed for VIIRS

- Lunar Roll Maneuvers
  - Near monthly
- Solar Diffuser Yaw Maneuvers
  - One early in the mission and repeat as needed
  - Each set consists of 12-16 yaws (in consecutive orbits)
- Deep Space Pitch Maneuvers
  - Two pitch maneuvers: early and late in the mission

Lunar Calibration Roll Maneuvers

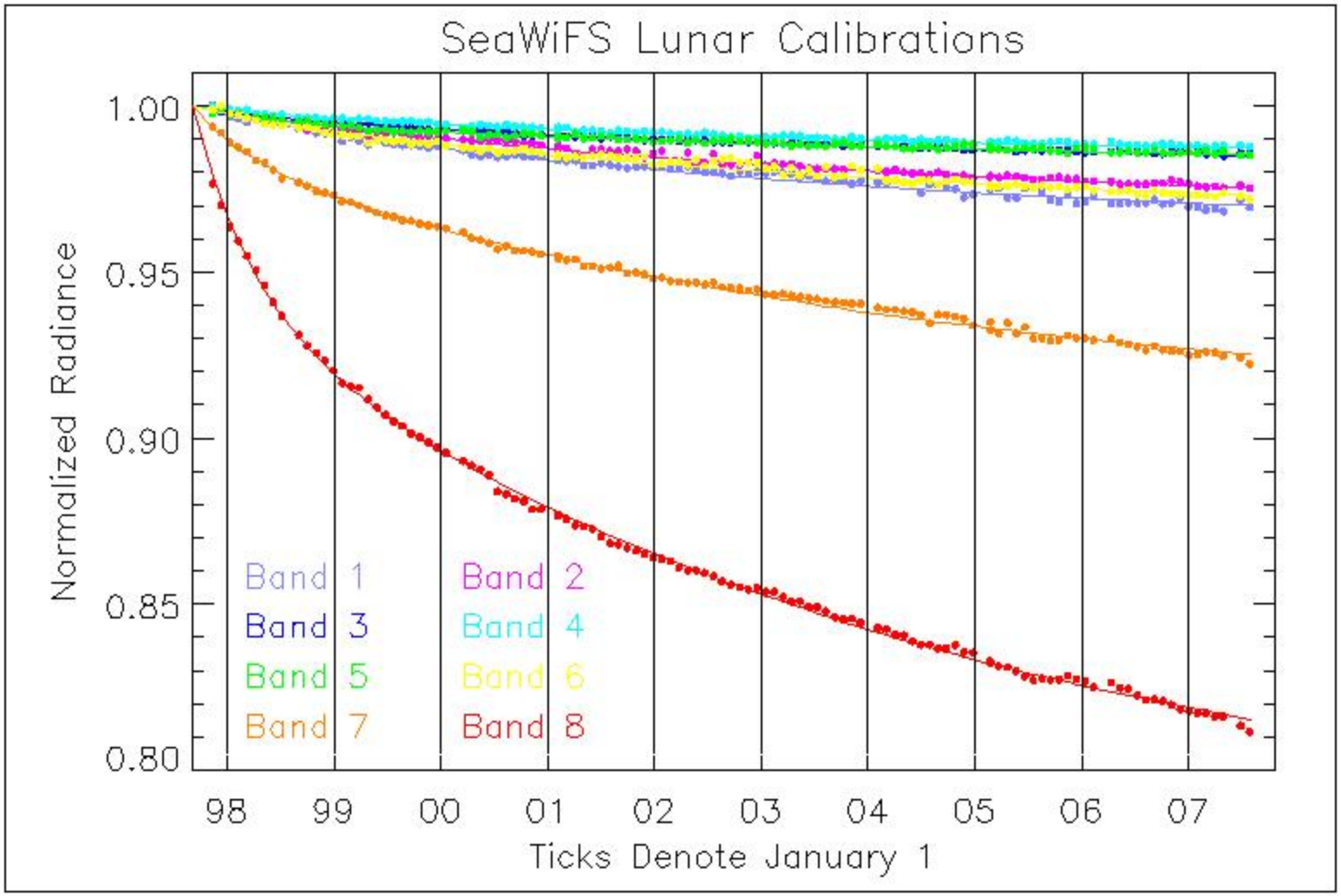
- Moon is the most reliable calibration source
  - Observations at constant phase angle most optimal
  - Provided unprecedented stability (~0.1 %) for SeaWiFS (7° phase angle).
  - MODIS performs monthly roll maneuvers to maintain 55° phase for operational calibration (optimal given viewing & maneuver limitations).
- VIIRS lunar calibration considerations (10:30 am or 1:30 pm orbits):
  - Without roll maneuvers, only 4-5 monthly lunar views through SV port capture entire moon (but not at constant phase).
  - 9 potential views/yr with phases between 40°-70° (daylight side of orbit) with ≤0.5° roll.
  - 8 views/yr at 55° with roll maneuvers up to 15°.
  - No lunar views during 3 consecutive months each year even with roll maneuvers.
- Benefits all EDRs that use VIIRS RSB (VIS/NIR/SWIR)

VIIRS Lunar View through SV



Recommendation: Optimize lunar calibrations by rolling the spacecraft to collect data at constant 55° phase angle.

SeaWiFS Lunar Calibration Time Series



Solar Diffuser Yaw Maneuvers

- Characterize system-level SD BRF and SD screen transmission
  - SD BRF characterization uncertainty (1.3-1.5%) is the largest component for the VIIRS RSB calibration uncertainty (2%)
  - Pre-launch BRF characterization is performed at limited wavelengths, viewing geometry, and beam size
  - The SD screen is characterized at a component-level, not coupled with the SD panel or integrated with the sensor for a system-level characterization
  - Yaw maneuvers enable a system-level BRF and SD screen characterization using sensor spectral bands and detectors under full on-orbit illumination conditions (stray light impact analysis)

Solar Diffuser Yaw Maneuvers (cont)

- Characterize SD degradation uniformity
  - SDSM views the SD at a fixed angle while the sunlight incident angles to the SD vary with observations
  - Using observations from repeated yaws (with each performed in a short period time) enables characterization of SD on-orbit degradation uniformity, thus improve RSB on-orbit calibration quality
- Benefits all EDRs that use VIIRS RSB (VIS/NIR/SWIR)

Deep Space Pitch Maneuvers

- Make deep space observations through the Earth View with sensor in its nominal operation mode
- Characterize thermal emissive band (TEB) system-level response versus scan angle (RVS)
  - Pre-launch measurements were made at ambient conditions with limited angle of incidence
  - Repeated pitch maneuvers track TEB RVX changes on-orbit
- Benefits all EDRs that use VIIRS TEB (MWIR/LWIR)
  - SST benefits the most

Conclusion

- The combined VIIRS teams (NICST and VOST) have proposed a comprehensive program of calibration maneuvers
- All maneuvers have substantial heritage (MODIS and SeaWiFS) and have proven to be essential to achieving the radiometric consistency and stability required for climate quality Ocean products.