

LUNAR CALIBRATION
A new method for the PLEIADES
radiometric absolute calibration

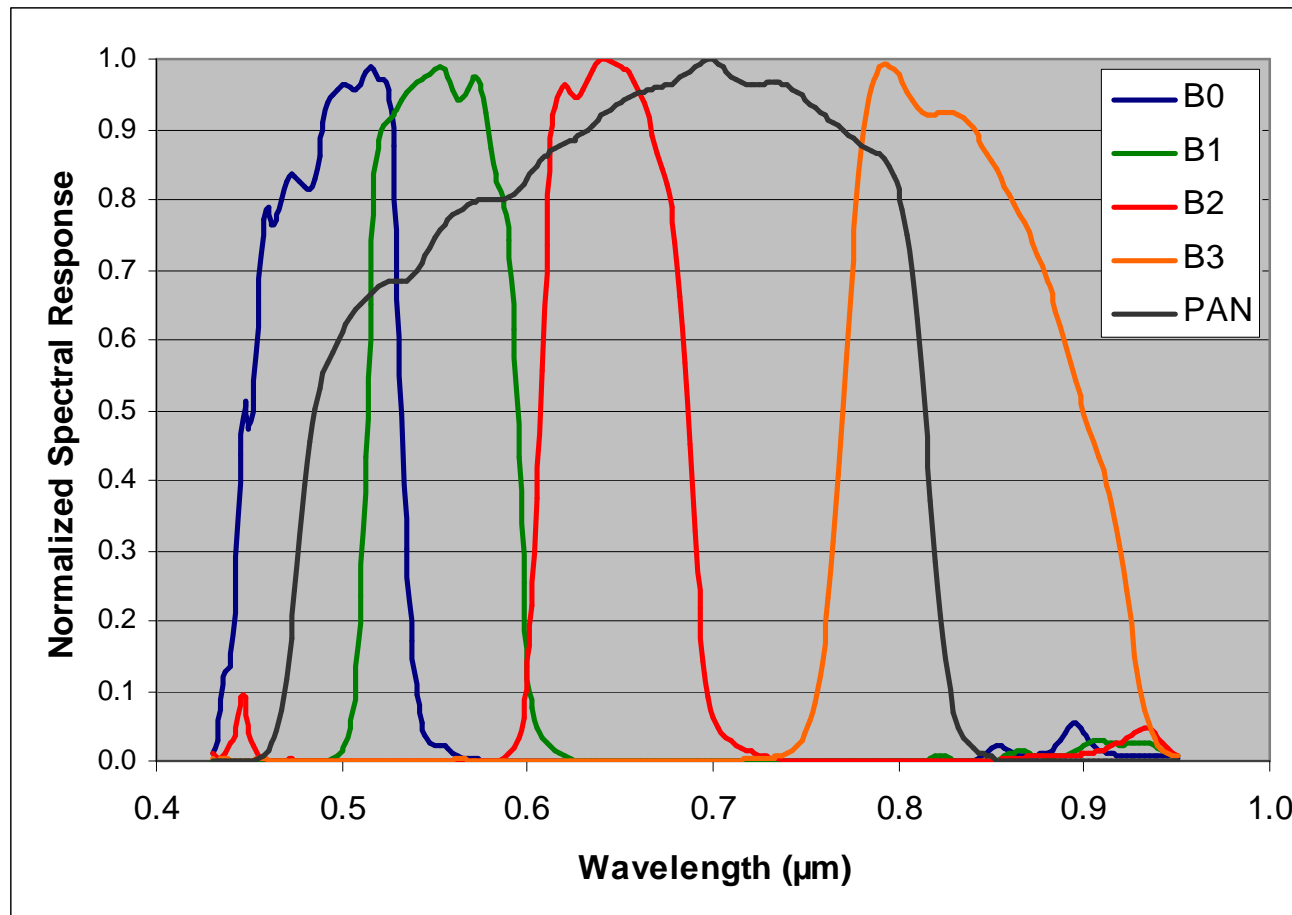
Sophie Lachérade
CNES

18/12/2012

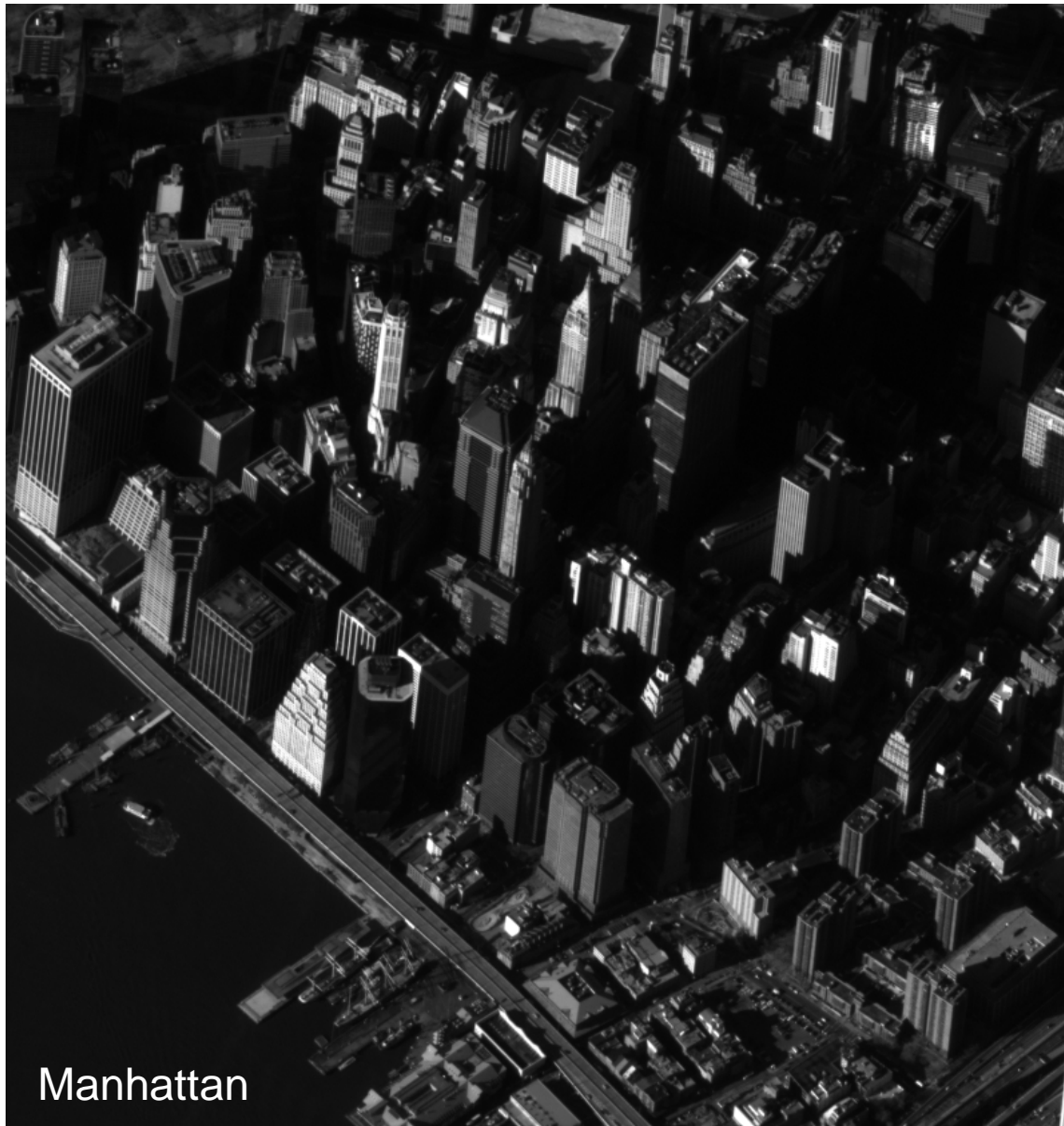
The PLEIADES system

2 satellites – Swath : 20km

Nadir ground resolution: 0.70 m in the panchromatic band
2.80 m in the multispectral bands



The PLEIADES system

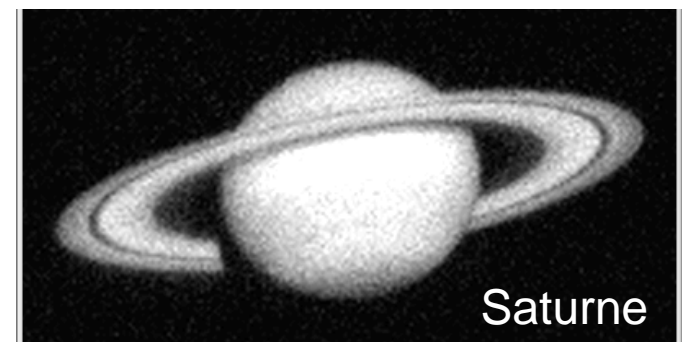


Manhattan

System with a very high level of agility !

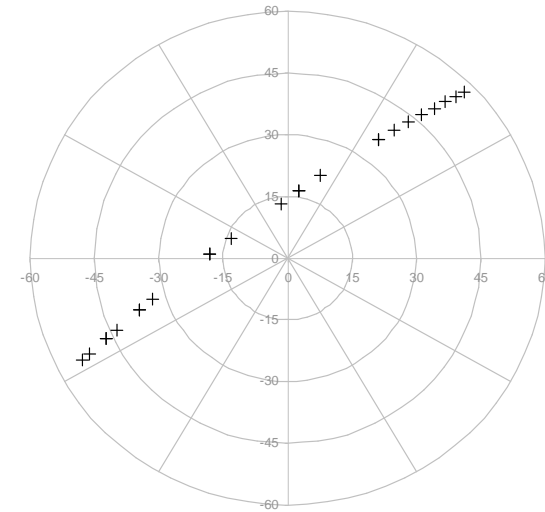
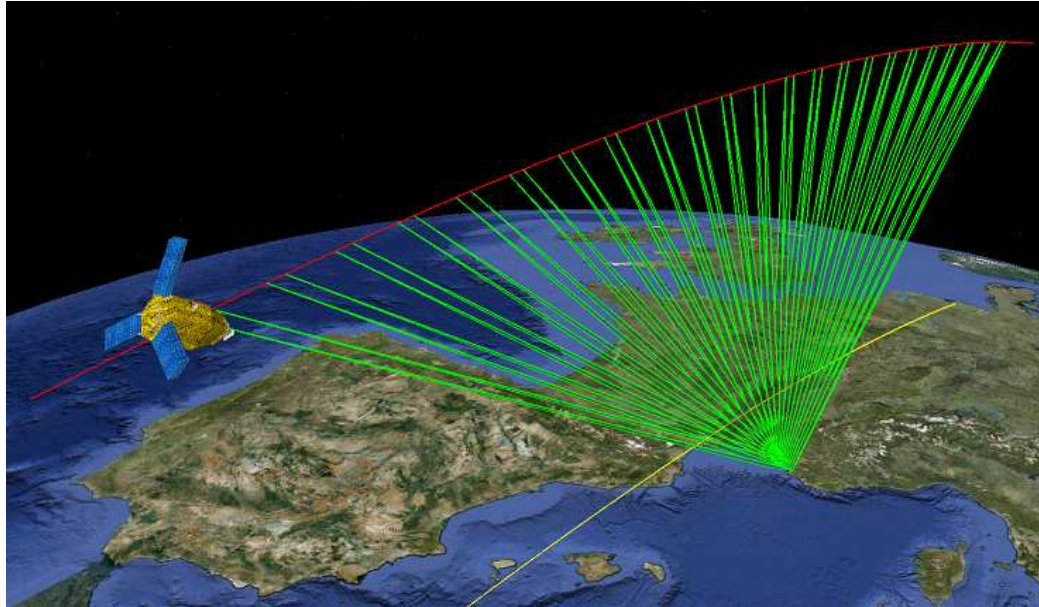


Jupiter and its moon



Saturne

The PLEIADES system

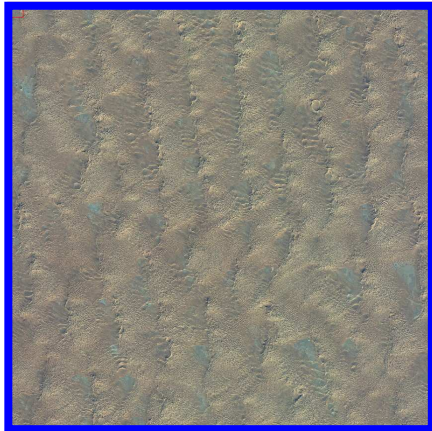


Exemple of video over Melbourne (Australia)

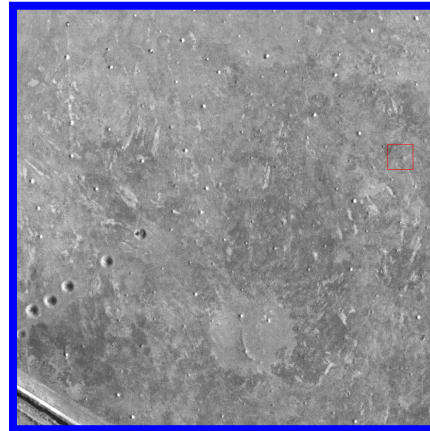
The PLEIADES absolute calibration

Goal: radiometric absolute calibration better than 5%

Methods:



African Desert sites



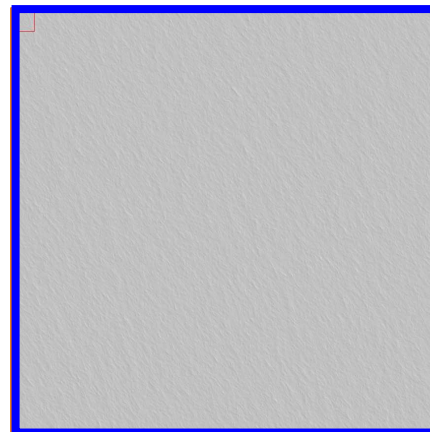
La Crau



Moon



Oceans



Dome

The PLEIADES absolute calibration

Lunar calibration is a multi-temporal calibration method

→ Based on ROLO *

→ Considering than the radio

$$I_{obs} = \frac{\sum_{i=1}^{N_p} L_i \cdot \Omega_i}{A_l(\alpha_l)} \cdot \left(\frac{D_{l-obs}}{384400}\right)^2 \left(\frac{D_{l-s}}{1AU}\right)^2$$

is constant

Digital count of the instrument

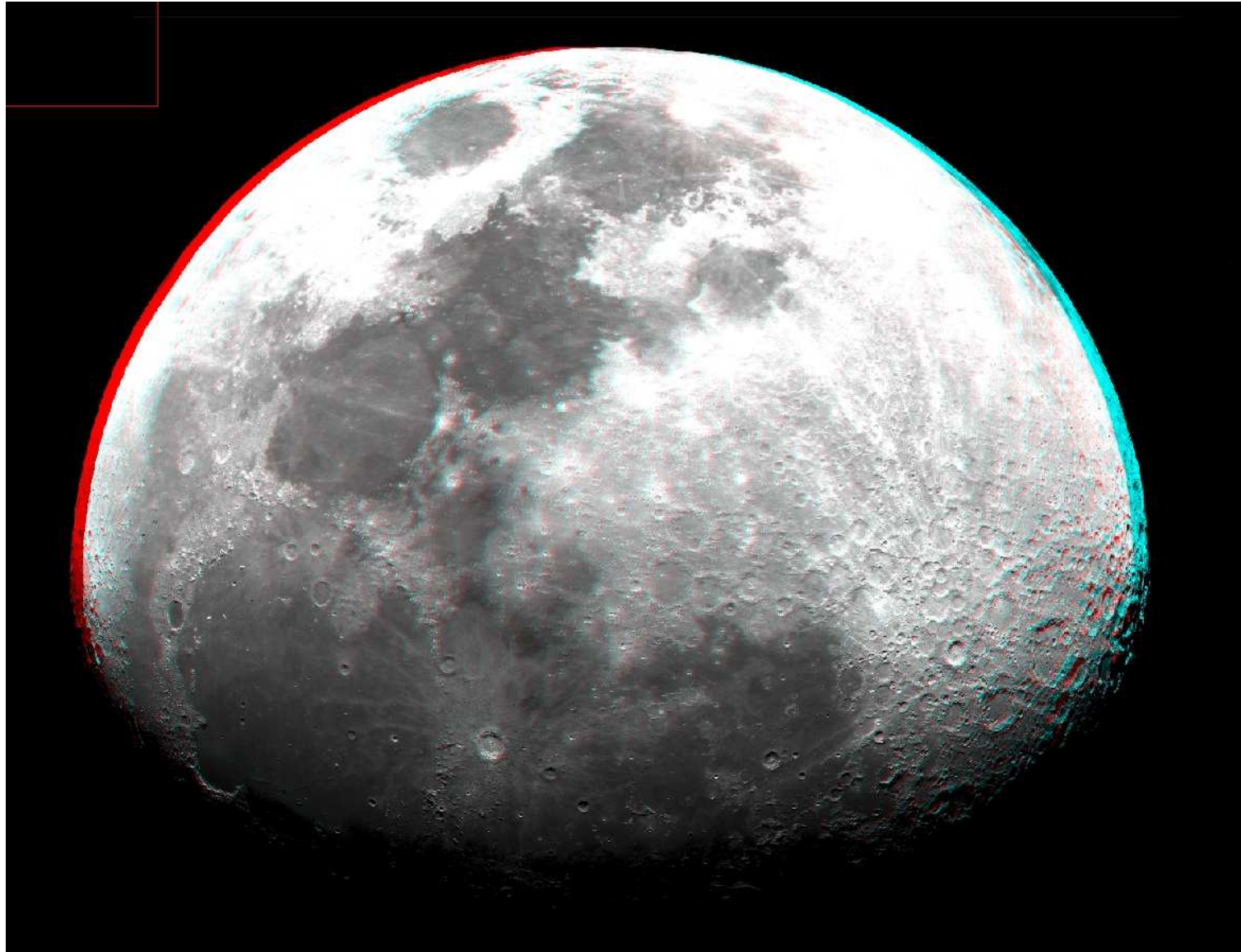
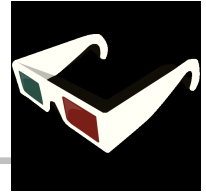
ROLO Albedo integrated in the PHR spectral bands

Normalization of the distances

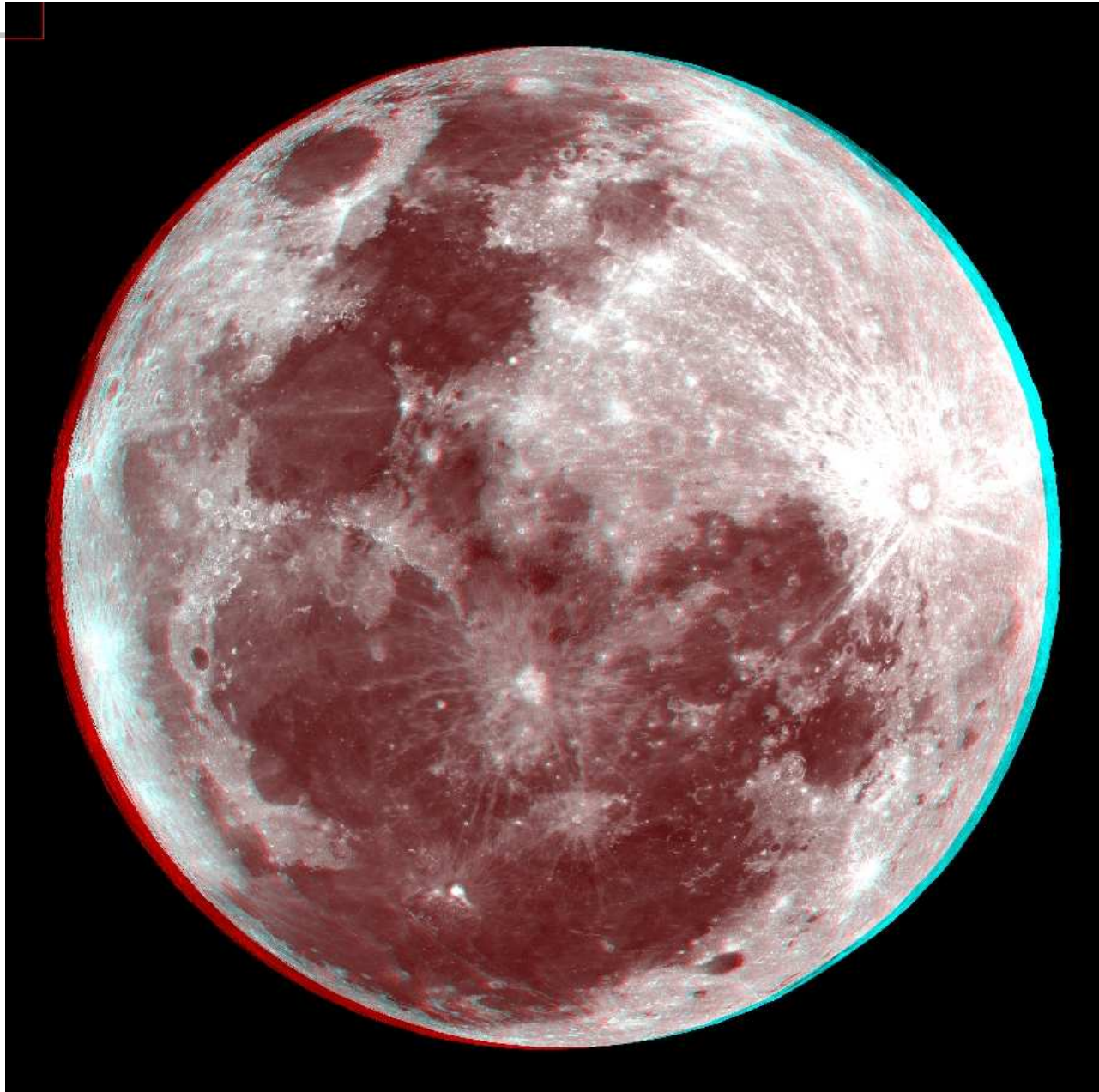
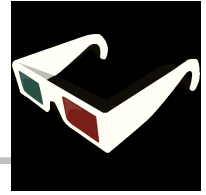
→ Regular acquisition of the moon – fixed phase of $\pm 40^\circ$ every month
2 views per day to allow stereoscopic acquisitions

* H.H. Kieffer, T.C. Stone, R.A. Barnes, S. Bender, R.E. Eplee, J. Mendenhall, L. Ong
On-orbit radiometric calibration over time and between spacecraft using the moon
SPIE 4881, pp. 287-298, 2003.

The PLEIADES absolute calibration



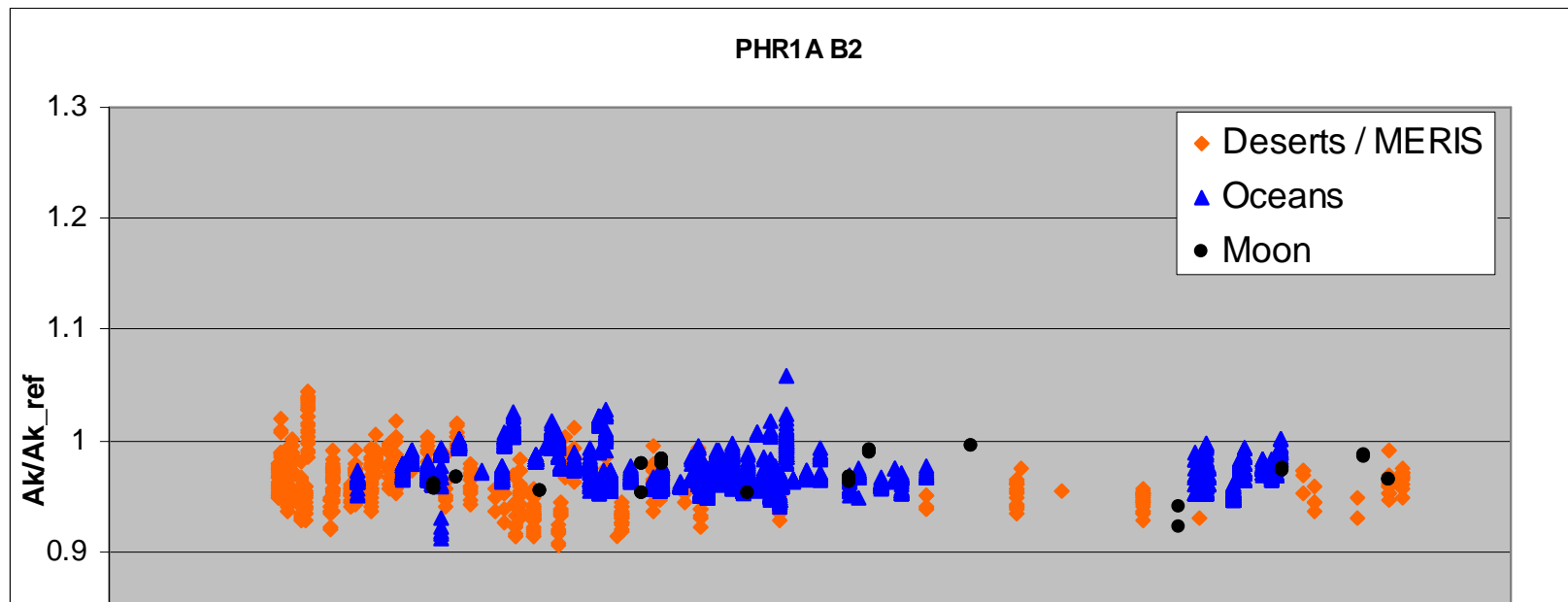
The PLEIADES absolute calibration



The PLEIADES absolute calibration

Focus on the LUNAR acquisitions

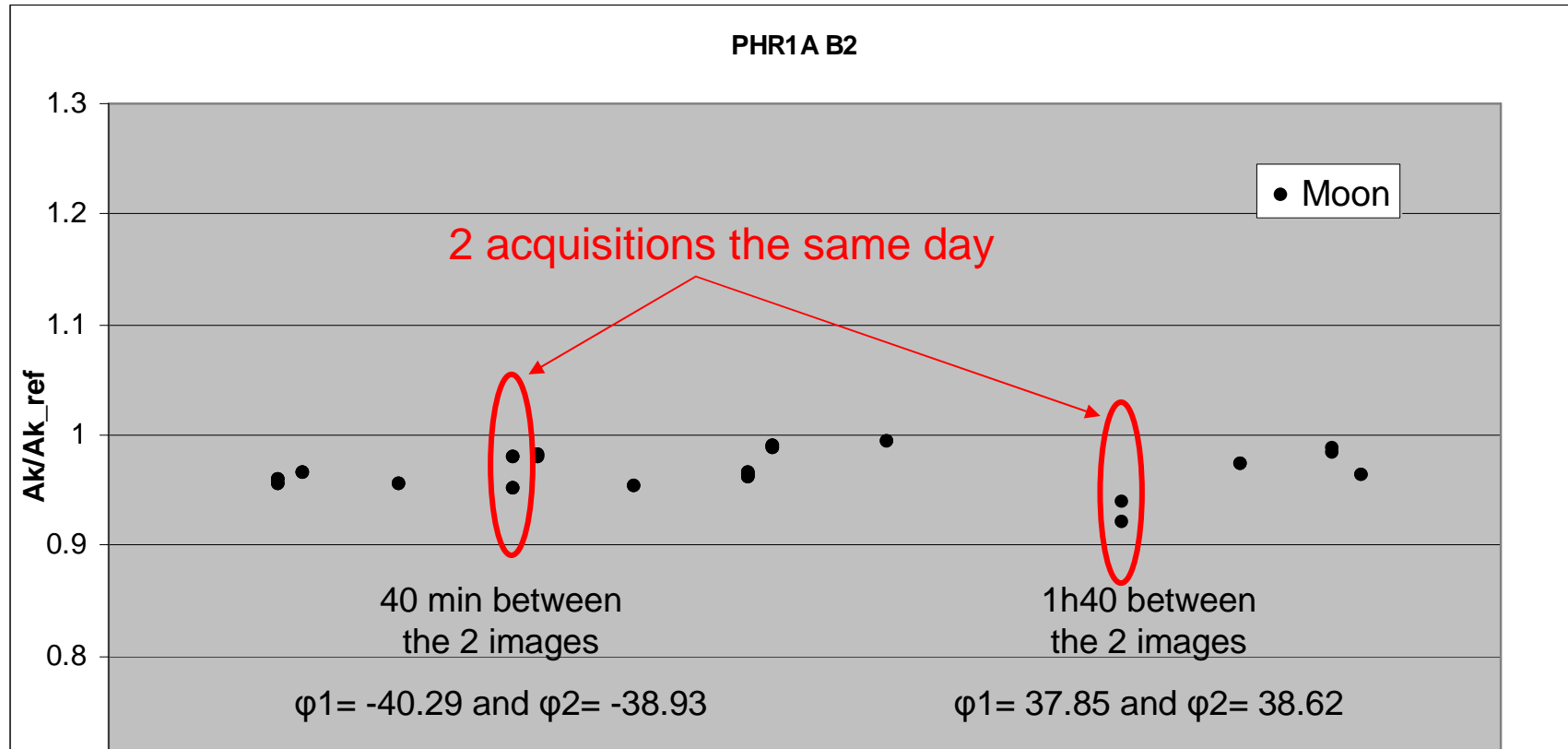
→ Multi-temporal calibration based on Moon with a phase of 40°



- **Stability of the instrument since the Launch**
- **Consistency of the 3 methods for the temporal evolution of the sensor**

The PLEIADES absolute calibration

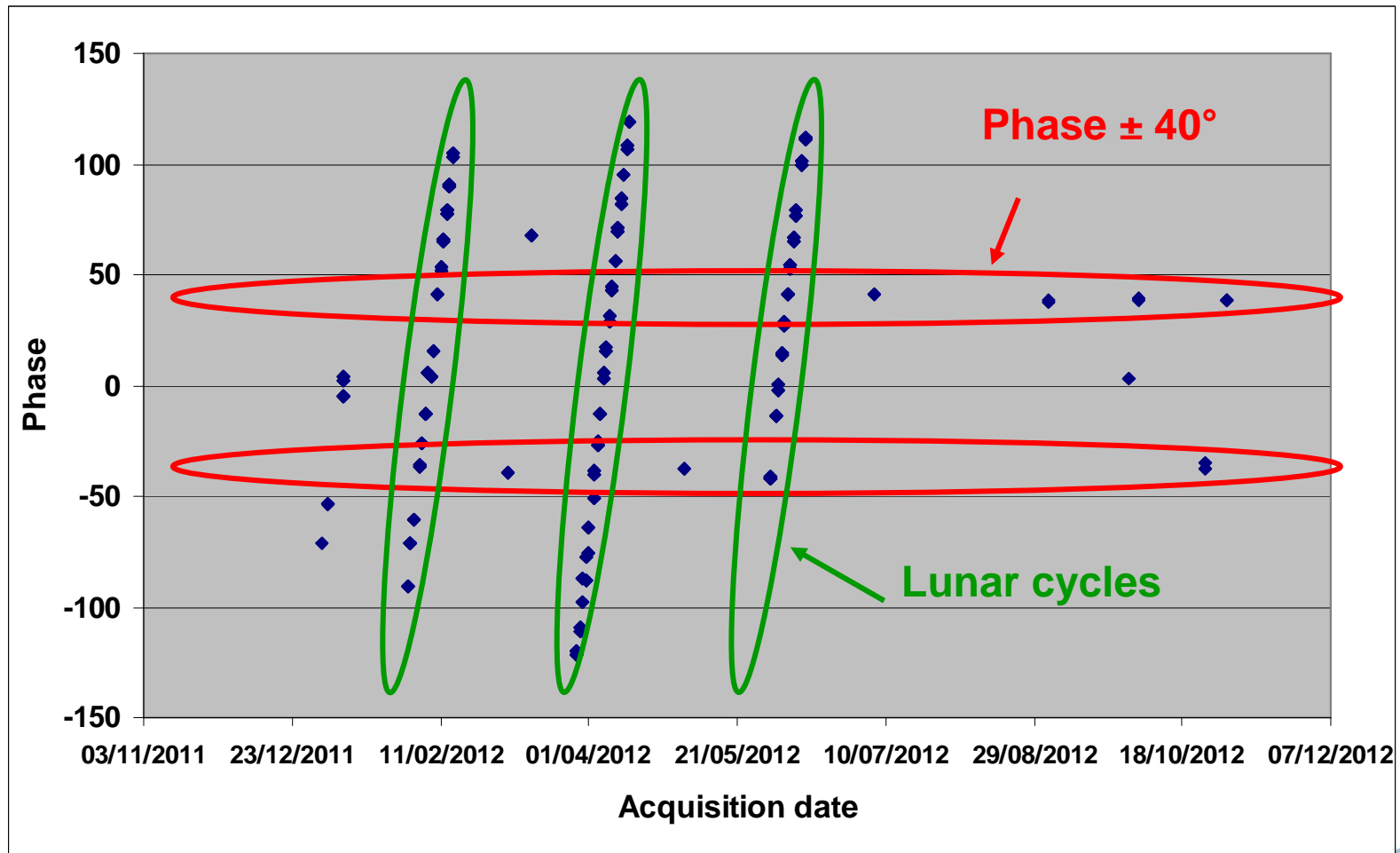
BUT how to explain the dispersion of the lunar acquisitions ($\pm 4\%$) ?



→ **Decision to enlarge the moon acquisitions to cover the entire Moon cycle (from -115° to 115°) to better understand the method**

The PLEIADES absolute calibration

→ 138 images acquired by PLEIADES1A since its launch (12/2011)



The PLEIADES absolute calibration

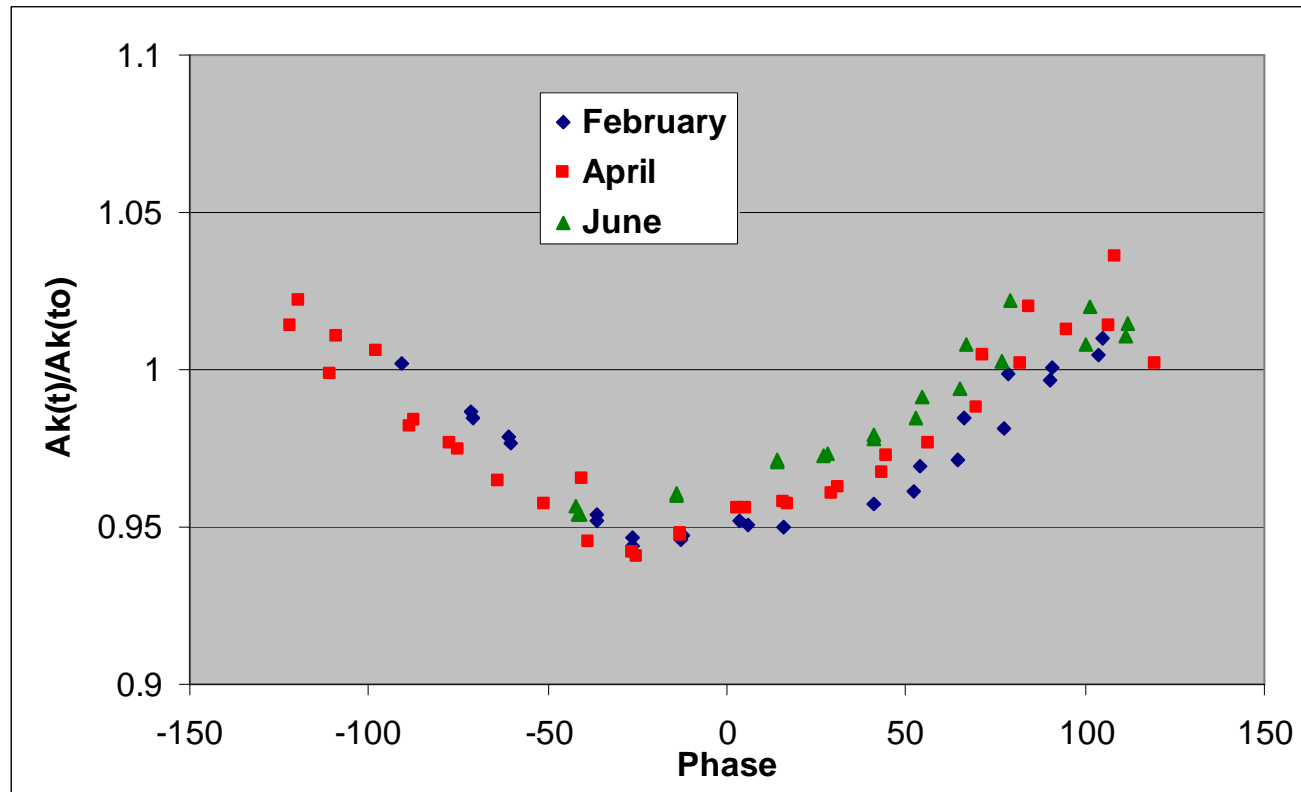
Focus on the LUNAR acquisitions

→ Evolution of the moon with the phase

Movie “Moon_PHR1A_April.exe”

The PLEIADES absolute calibration

Influence of the phase on the calibration results



→ Sensitivity of the method with the phase of the moon

The PLEIADES absolute calibration

Analysis in progress

- Use of PLEIADES_1B satellite launched two weeks ago to perform two acquisitions per day per cycle from -115° to 115° during the commissioning phase
 - to be able to better understand the influence of the phase and maybe to better modelise it
 - to analyse the impact of the sensor geometry on the calibration results (the yaw angle is not constraint) – impact on the resampling ?
- Cross-calibration of PLEIADES_1B with PLEIADES_1A on the moon