POLO
Pleiades Orbital Lunar Observations
- Intensive Study of the Moon and Comparison to ROLO Model
from SPOT to PLEIADES

swath 60 km, 2 instruments
East/West tilt +/- 27°
SPOT 1-4: 10m PA, 20m XS
SPOT 5: 2.5m PA, 10m XS

swath 20 km, 1 instrument
agile Satellite
70 cm PA, 2.80 XS
Moon  (spatial resolution: 380m)
The Moon seen by PLEIADES

What does the Moon seen by PLEIADES look like?

Before ground processing

The Moon: more than 4 Million of pixels!

Equalization

After ground processing
The PLEIADES lunar calibration

Lunar calibration is a multi-temporal calibration method

→ Based on ROLO *

→ Considering than the radio

Using the ROLO Albedo integrated in the PHR spectral bands

Normalization of the distances

Radiance of the instrument

is constant

→ Regular acquisition of the moon – fixed phase of ±40° every month

\[ s(t) = \frac{l_{obs}(t)}{l_{obs}(to)} \]

* 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

The Moon seen by PLEIADES

→ **153 images** acquired by PLEIADES1A since its launch (12/2011)
→ **832 images** acquired by PLEIADES1B since its launch (12/2012)

Phase ± 40°

Two images per day

Lunar cycles

One moon every orbit (1h40 between each image)

→ **246 images in 17 days**!
The Moon seen by PLEIADES

Overview of the images:
(the yaw angle is not constraint during lunar acquisitions)
The Moon seen by PLEIADES: results

Dense lunar cycles acquired with PLEIADES 1B (one image every 1h40) → more than 700 images in 3 months!

Calibration results obtained for the red band:
Very few dispersion of the measurements but → important dependency of results to the lunar phase!

Variation of the calibration results: ~ 4%
The Moon: a powerful calibration site

BUT are we very confident in the results?

Is the implemented method the best one? In term of:

< 0.05%  - computation of the integrated Moon signal
           (u/o sampling) – consideration of the background signal
The Moon: a powerful calibration site
BUT are we very confident in the results?

Is the implemented method the best one? In term of:

< 0.15% - consideration of the solid angle variation within the field of view of the instrument?

< 0.5%
The PLEIADES lunar calibration

The Moon: a powerful calibration site
BUT are we very confident in the results?

Is the implemented method the best one? In term of:

- computation of the integrated Moon signal
  \((u/o\ sampling)\) – consideration of the background signal

- consideration of the solid angle variation within the field of view of the instrument?

- are the observed effects due to ancillary variables
  \((body-fixed\ coordinates)\)?

- due to ROLO?
Lunar calibration – New experiments

Check if the calibration results are sensitive to the position of the sensor on its orbit

Acquisition of 1 « Moon » every 2.5s in two different configurations

- orbit parallel to the direction Earth-Moon
- orbit perpendicular to the direction Earth-Moon
Lunar calibration

-> orbit parallel to the direction Earth-Moon: every 14 days
-> orbit perpendicular to the direction Earth-Moon: only once a year

Opportunity on July 2013

Processings in progress!
Cross-calibration on the Moon

Two important elements involved in the cross-calibration:

- difference of the spectral responses to be cross-calibrated
- spectral knowledge of the Moon response (given by ROLO)
Cross-calibration on the Moon

First results for the cross calibration between PLEIADES 1A and PLEIADES 1B (limitation to phase ±40°):

Reference: PLEIADES 1A images acquired in December 2012 (phase 40°)

→ Very good agreement with the other calibration methods
This method seems to be very efficient with very few dispersion!
CONCLUSIONS:

The commissioning phase of PLEIADES-1A and PLEIADES-1B

→ opportunity to acquire a unique dataset of Moon images with a very high spatial resolution (~300m)

→ more than 800 images of the Moon in only 6 months (guaranty of the stability of the instrument over this time slot).

→ lot of analysis performed to determine the sensitivity of the method to the different parameters: precision better than 0.5%

Next step: The use of this POLO dataset to improve the ROLO model?
Where to get some PLEIADES images?

- http://smsc.cnes.fr/PLEIADES/premieres_images.htm
- http://image-cnes.fr/tag/pleiades/
- http://www.flickr.com/photos/pkpro/sets/72157628743311535/