Scientific Operations and Data Processing for Wide-Angle Polarimetric Camera (PolCam) onboard Danuri

Kilho Baek[1], Minsup Jeong[2], Sungsoo S. Kim[1], Young-Jun Choi[2], Chae Kyung Sim[2]
[1] Kyung Hee University (KHU), [2] Korea Astronomy and Space Science Institute (KASI)
kilho.baek@khu.ac.kr

You can download this poster & more info.

Introduction

- **Danuri**: South Korea's first lunar orbiter was launched on Aug. 5, 2022.
- **PolCam**: The wide-angle **Pol**arimetric **Cam**era is the first payload to measure the polarimetric properties of the Moon.
- It operated in high-resolution mode (about 34 m/pixel) from 1 Apr. to 30 Nov., 2023.
- We introduce
  (1) a brief overview of the operational progress until November this year,
  (2) the overall procedure of data processing software, and
  (3) data formats for the upcoming public release.

Public Data Release

- The data is available from 1 Apr.
  (We operated test observation before Apr.)
- Format: PDS4
- Included 2D information
  - ✓ Raw data
  - ✓ Longitude & Latitude
  - ✓ Incidence angle
  - ✓ Emission angle
  - ✓ Phase angle

Future Work

- Radiometric calibration
- Photometric calibration with lunar topography
- Maximum polarization (P_{max}) measurement
- Grain size distribution using P_{max} and albedo

AGU23 San Francisco, CA & Online Everywhere 11-15 December 2023
Abstract 1323525
P11B-2720

Routine Operations

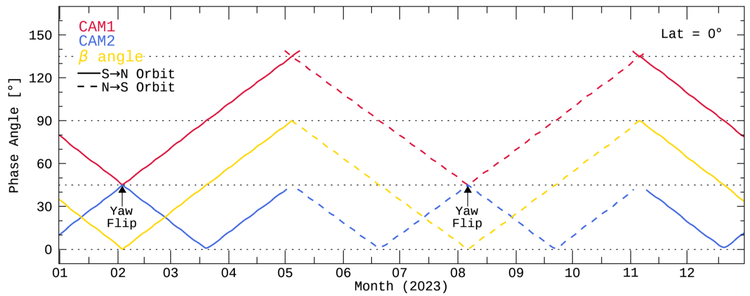


Fig. 1. Phase angle of the PolCam and sun-beta angle for one year.

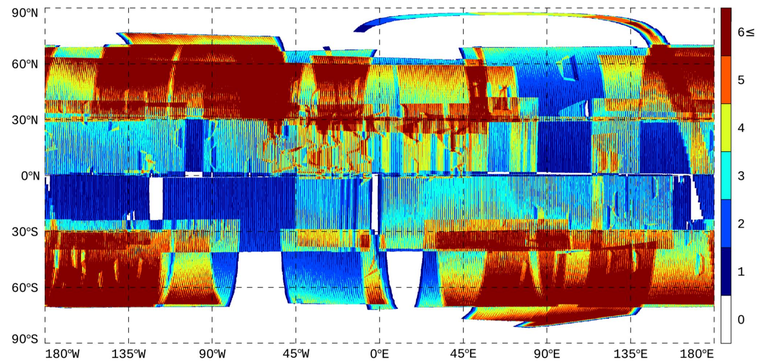


Fig. 2. The number of the PolCam observation on the lunar surface from 1 Apr. to 30 Nov., 2023.

Frame & Instrument Kernels Adjustment

Tilted angle

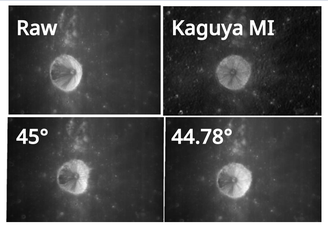


Fig. 3. Results of geometric correction (a) before and (b) after adjusting tilted angle from 45° (designed value) to 44.78° (estimated value)

Field of View (FoV)

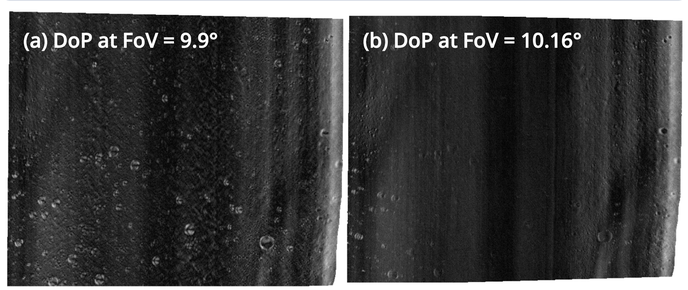
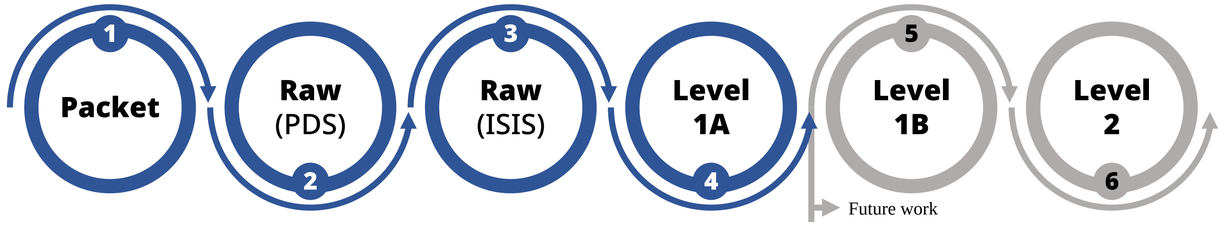


Fig. 4. Degree of polarization (a) before and (b) after adjusting FoV from 9.9° (designed value) to 10.16° (estimated value).

Data Processing Pipeline (with SPICE kernels)



- Pipeline = [IDL or Python] programs
  + the SPICE toolkit
  + the ISIS applications

4 Geometric Correction

(with Digital Shape Kernel)

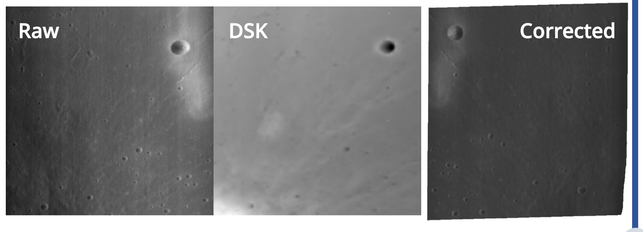


Fig. 6. Raw, elevation from Digital Shape Kernel (DSK), and geometric corrected data.

2 Flat-field Correction

- Flats were generated with reference to the ISIS application, `lromakeflat`.

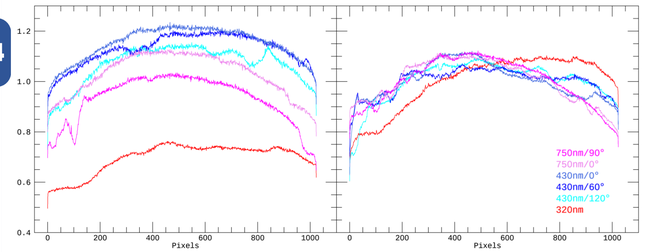


Fig. 5. Flats for each channel (Left) measured in a ground laboratory and (Right) created by observation data.

5

- On developing the ISIS application…
  `polcam2isis` & `Camera model class` of the PolCam

Global Mapping

Fig. 7. Low resolution (32 ppd) map of channel 4 (430 nm band & 0° polarizer)