GK2A AMI
Lunar Calibration Results

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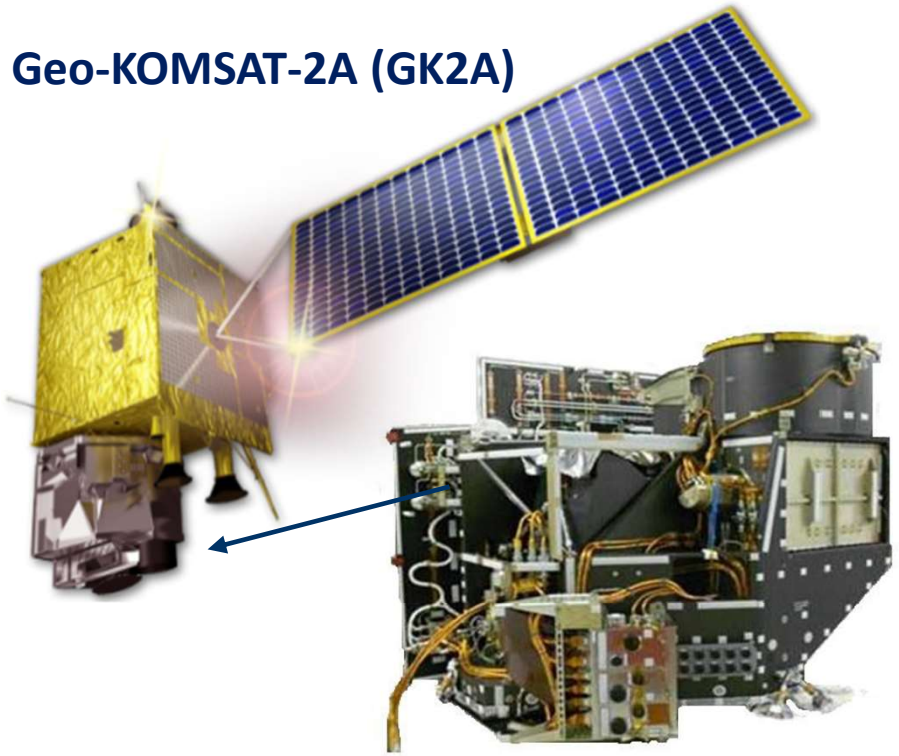
Tae-Hyeong Oh
(hyoung0203@korea.kr)

Korea Meteorological Administration (KMA)
National Meteorological Satellite Center (NMSC)

Geo-KOMSAT-2A (GK2A) AMI

Geo-KOMSAT-2A (GK2A)



AMI
(Advanced Meteorological Imager)

- GK2A was launched 4 December 2018
- The operation and public release started 25 July 2019
- Location : 128.2°E

- 16 channels (VIS 4, NIR 2 and IR 10)
- Radiometric Calibration Targets
  - Solar Diffuser for VIS/NIR channels and Blackbody for IR channel calibration

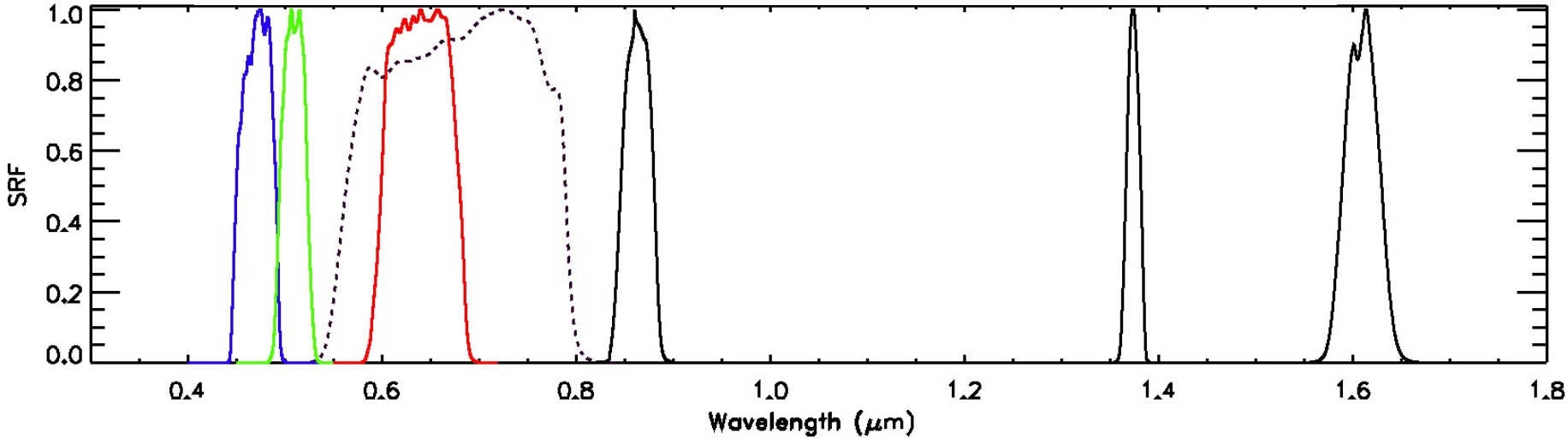
- In-orbit solar cal. validation & Instrument degradation trending of AMI VIS/NIR Channels
  - Vicarious calibration using ocean, desert, water cloud, DCC with RTM
  - Ray Matching method (MODIS and VIIRS)
  - and **Lunar Calibration** using GIRO

GK2A AMI VNIR Channel

VNIR Channel Configuration

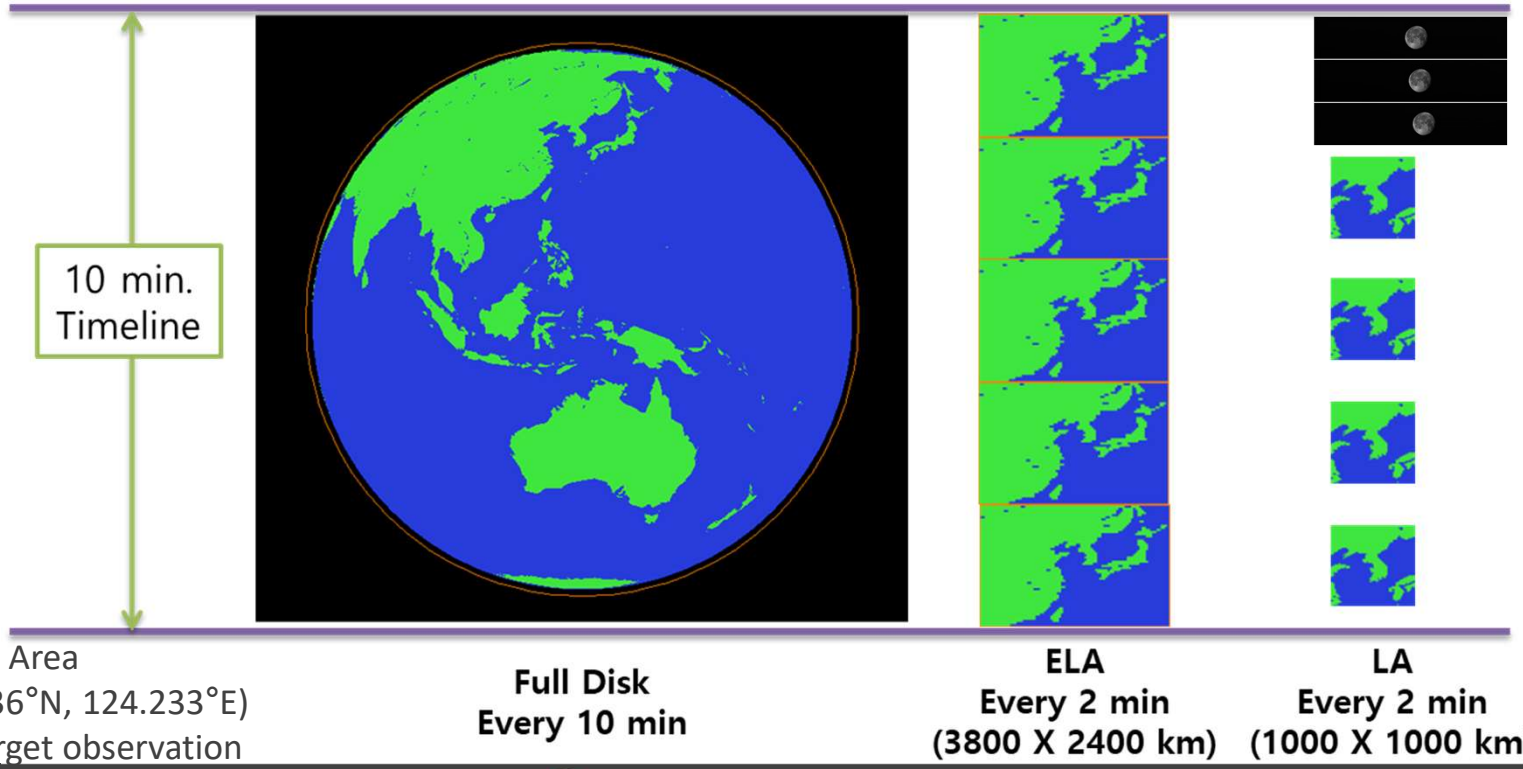
	VI004	VI005	VI006	VI008	NR013	NR016
Central Wavelength [μm]	0.47	0.51	0.64	0.86	1.3	1.6
Spatial Resolution [km]	1	1	0.5	1	2	2
# of Detector	632	632	1380	632	348	348

Spectral Response Functions of GK2A/AMI and COMS/MI (dashed line)



GK2A AMI Moon Observation

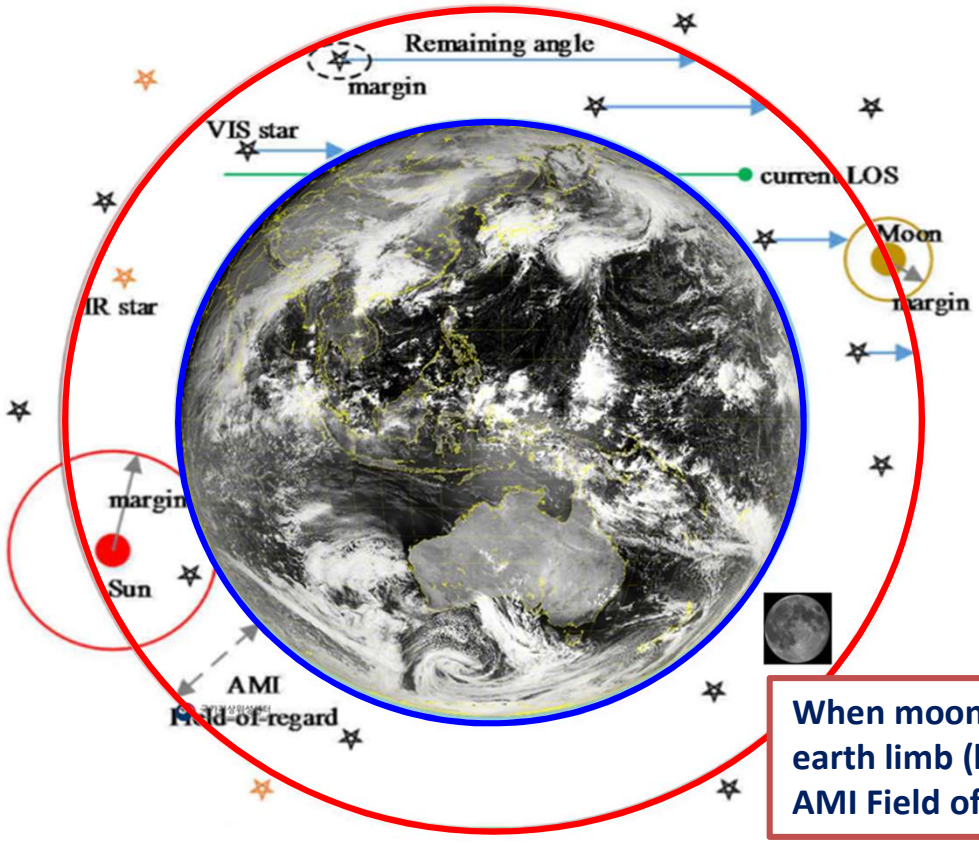
- **Normal Operation : FD 1 + ELA 5 + LA 5 (10 min.)**
- **Lunar observation : FD 1 + ELA 5 + LA 4 + Moon 3 (10 min.)**
  - **LA 1 time (3 swath) → Moon 3 times**



- ✓ FD : Full Disk
- ✓ ELA : Extended Local Area
  (scene center : 34.436°N, 124.233°E)
- ✓ LA : Local Area or Target observation

GK2A AMI Moon Observation

◆ GK2A AMI has observed the Moon about 40 times every month since May 2019

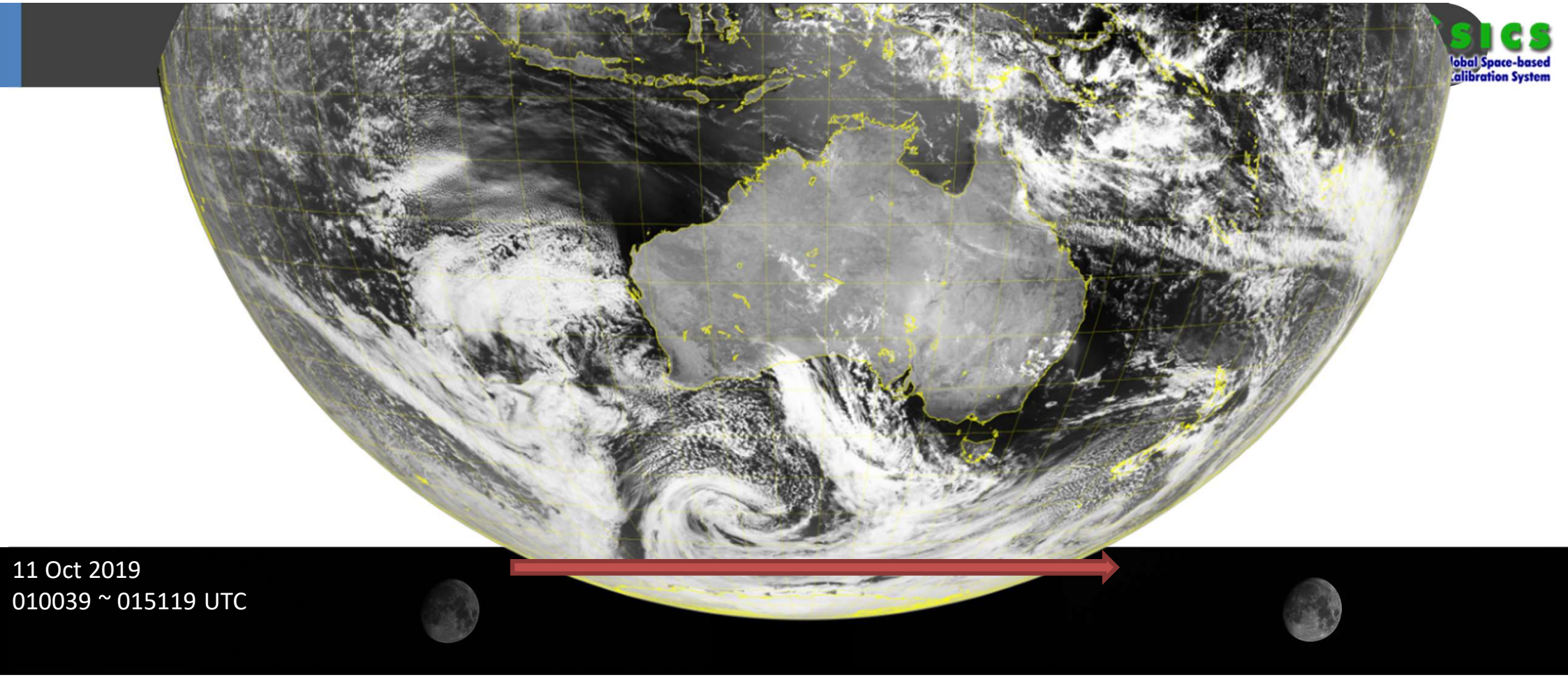


When moon locate between earth limb (blue circle) and AMI Field of Regards(red circle)

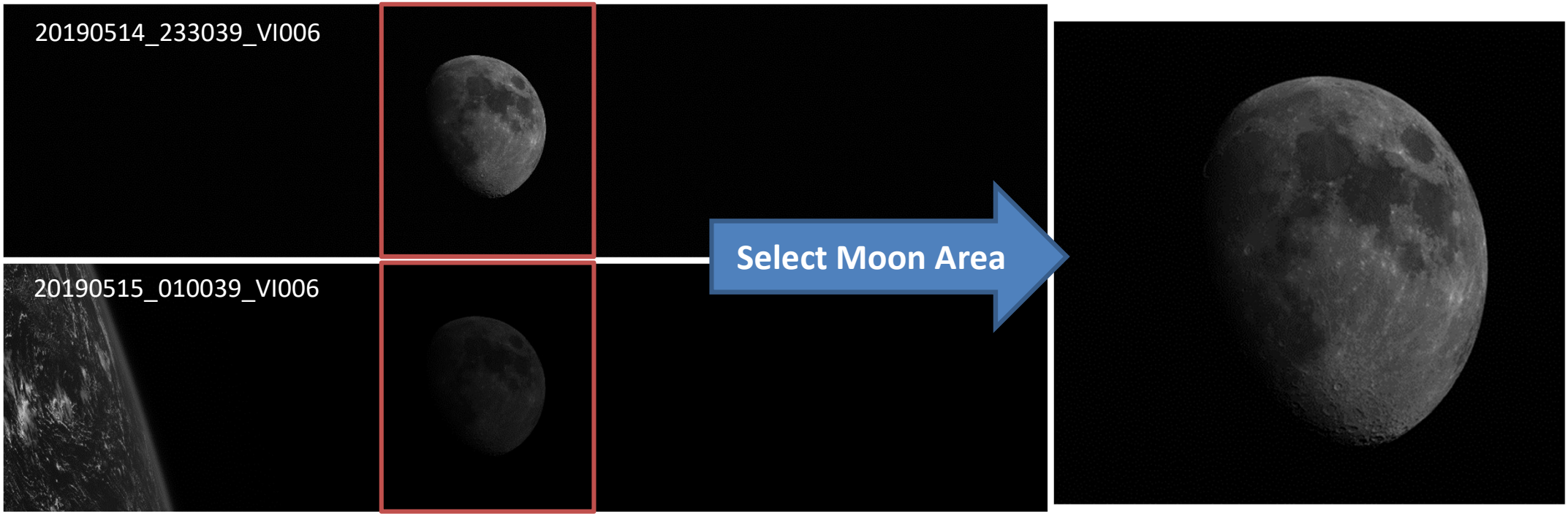
- AMI Moon observation condition
  - Moon Brightness > 50 (half moon)

Period	No. of Moon Observation	No. of Moon Calibration Data set	Phase Angle Range	No. of Data Set
May 2019 ~ April. 2021	1132	936	|PA| ≤ 30	319
			30 < |PA| ≤ 60	338
			60 < |PA|	279

- Not use Moon data set when moon locate near earth or moon phase angle > ±92°


11 Oct 2019
010039 ~ 015119 UTC
06 Aug 2020
051039~055039 UTC

AMI Moon Data Set



Channel	VI004	VI005	VI006	VI008	NR013	NR016
Moon data set (pixel size)	600*632	600*632	1200*1380	600*632	300*348	300*348

✓ Phase Angle (absolute value) Range of observed Data set : min : 3.73 deg. / max : 91.82 deg.

GK2A AMI Lunar Irradiance

Lunar Irradiance Calculation

$$I = \Omega \sum_{i}^{row} \sum_{j}^{col} Radiance_{i,j} \cdot \frac{1}{Oversampling\ Factor}$$

- Ω: Sample solid angle = sr(EW_ASD * NS_ASD)=EW_ASD*NS_ASD
- NS_ASD = NS IFOV
- $\mathrm{Radiance}_{i,j}$: calibrated radiance at (i,j) image coordinate

Channel Name	ASD (μrad)	IFOV (μrad)		Solid Angle (EW_ASD*NS_ASD) (rad)
		NS	EW	
VI004	22	22.9	22.9	5.038E-10
VI005	22	22.9	22.9	5.038E-10
VI006	11	10.5	12.4	1.155E-10
VI008	22	22.9	22.9	5.038E-10
NR013	44	42	51.5	1.848E-09
NR016	44	42	51.5	1.848E-09

GK2A AMI Oversampling Factor

Calculate oversampling factor

- Using the NOAA Proposed Calculation Method

✓ Reference : GOES-16 ABI Lunar Data Preparation to GIRO, Fangfang Yu, 2nd Lunar Calibration Workshop, Xi'an, China, Nov. 13-17, 2017

Channel Name	ASD (μrad)	IFOV (μrad)		Solid Angle (EW_ASD*NS_ASD) (rad)	Oversampling Factors
		NS	EW		
VI004	22	22.9	22.9	5.038E-10	**1.0056809602**
VI005	22	22.9	22.9	5.038E-10	**1.0055607934**
VI006	11	10.5	12.4	1.155E-10	**1.0028090287**
VI008	22	22.9	22.9	5.038E-10	**1.0057331638**
NR013	44	42	51.5	1.848E-09	**1.0049463375**
NR016	44	42	51.5	1.848E-09	**1.0051906216**

GK2A AMI Moon Results

AMI Lunar Irradiance vs. GIRO

- Moon pixel select based on L1A DC thresholds for each channel
- Set the thresholds to remove bright pixel in space area
  (e.g. star, or Contaminated pixel by Earth limb)

	VI004	VI005	VI006	VI008	NR013	NR016
Thresholds	30	30	70	120	70	50
mean counts of dc_offet	19.8	19.8	39.7	79.6	39.7	19.5

➢ dc_offset : The digital count offset from the ith Moon observation of the channel k derived as the average value over the deep space portion of the image

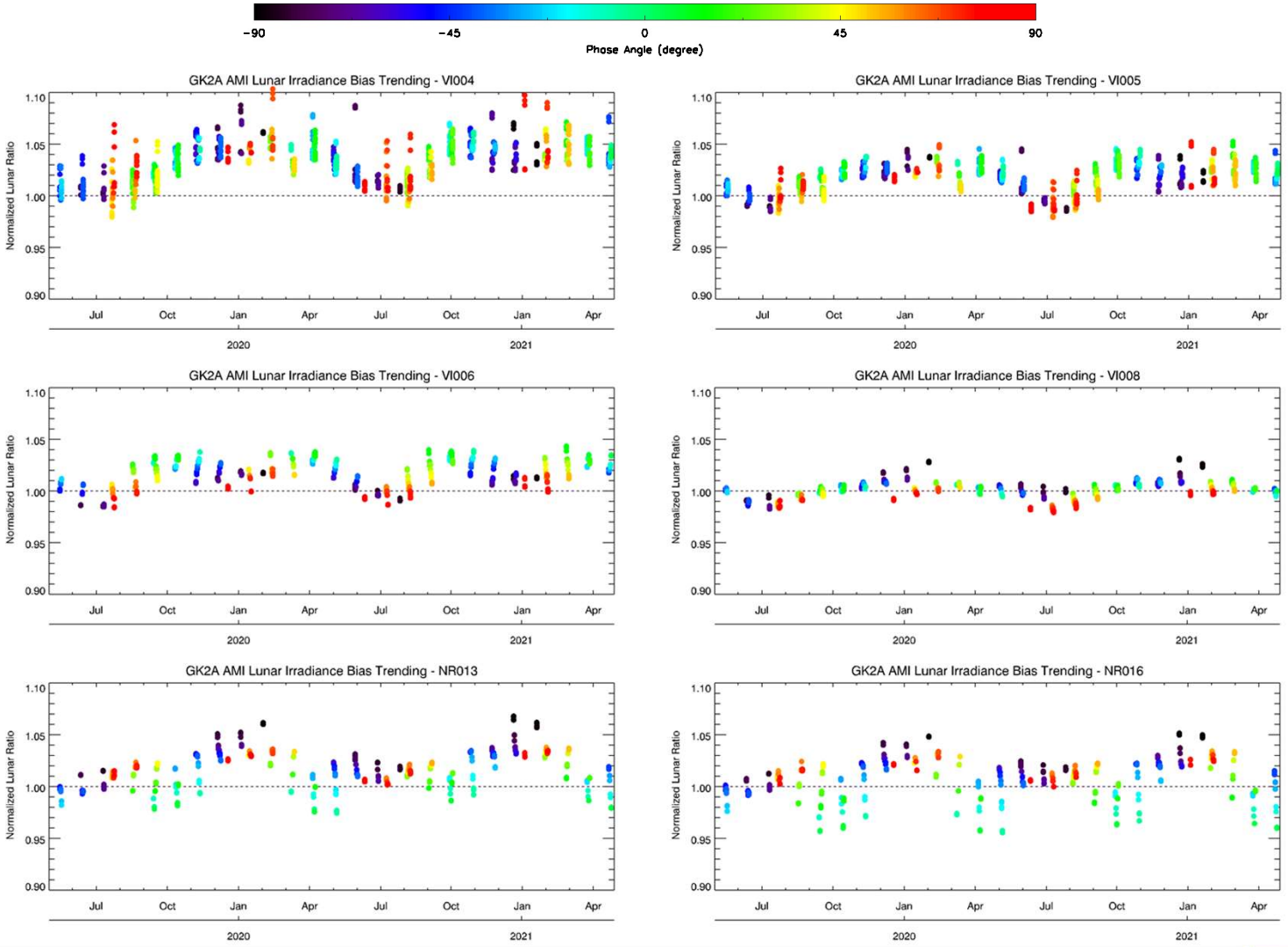
GK2A AMI Lunar Results (May 2019. 5 ~ April 2021)

➢ **Normalized Lunar Ratio**

$$R_{nor} = \frac{Ratio_t}{Ratio_{t0}}$$

$$Ratio_t = \left(\frac{Irr_{Obs,t}}{Irr_{GIRO,t}} - 1\right) \cdot 100$$

Difference of lunar irradiance between the observation and GIRO



✓ Note :

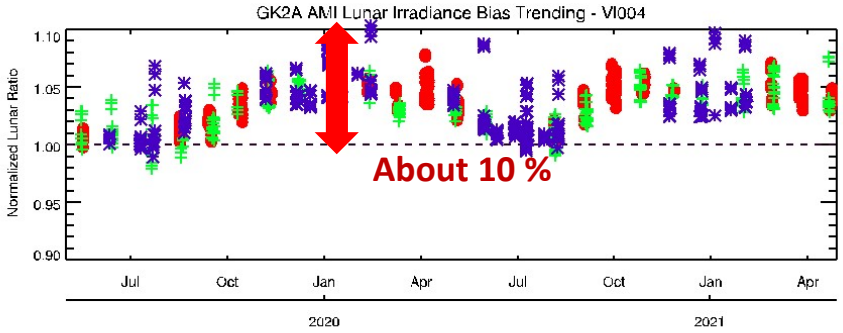
- Sub-sampled lunar observations (#936) are shown
- Ratio is normalized by $Ratio_{t0}$ (t0; 14 May 2019)

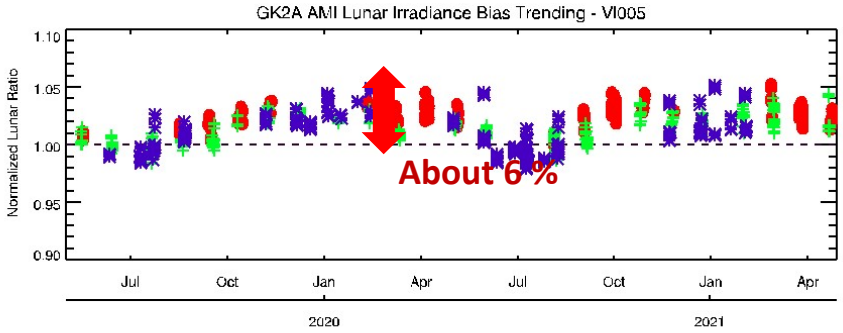
GK2A AMI Lunar Results (May 2019. 5 ~ April. 2021)

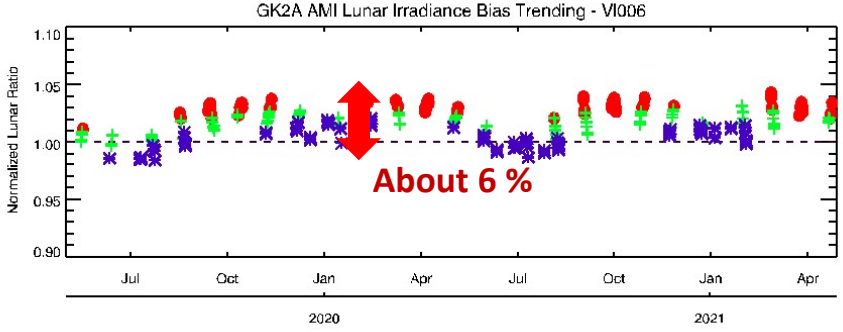
Red dot :
absolute PA ≤ 30°
(192 data set)

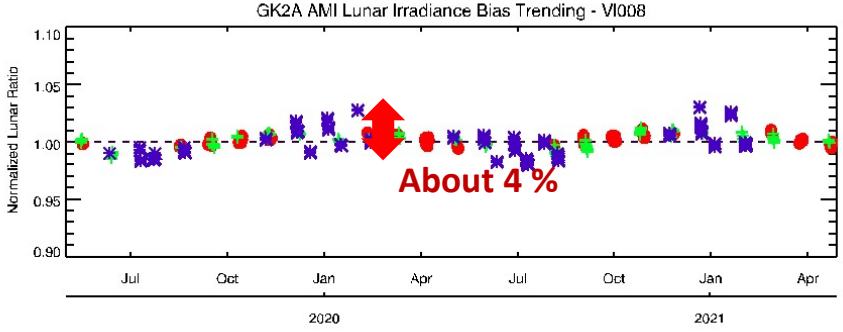
Green + sign :
30° < absolute PA ≤ 60°
(228 data set)

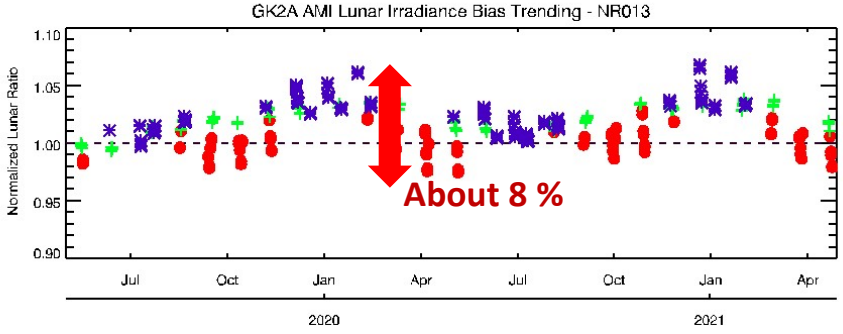
Purple Asterisk (*) :
absolute PA > 60°
(224 data set)

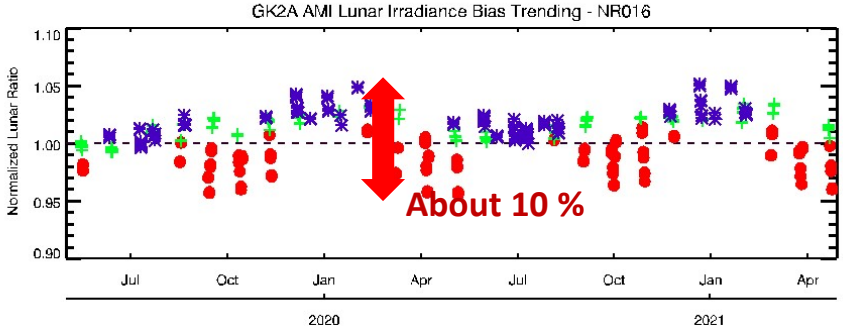




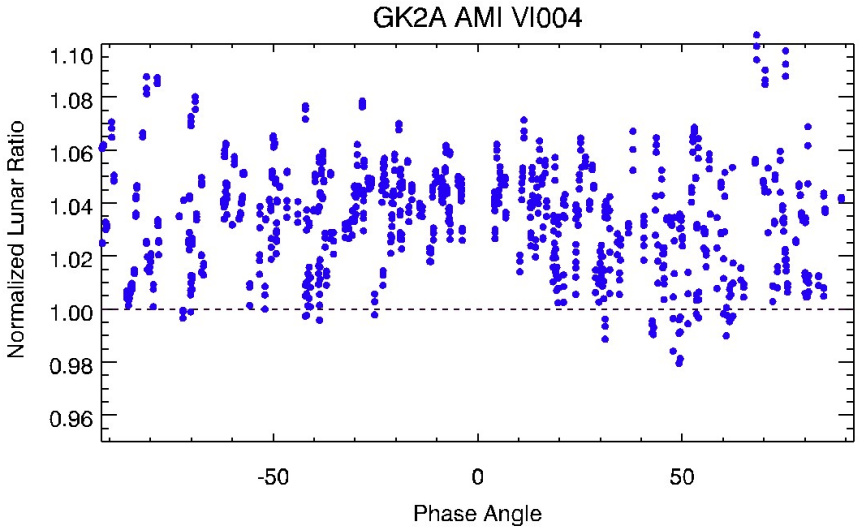


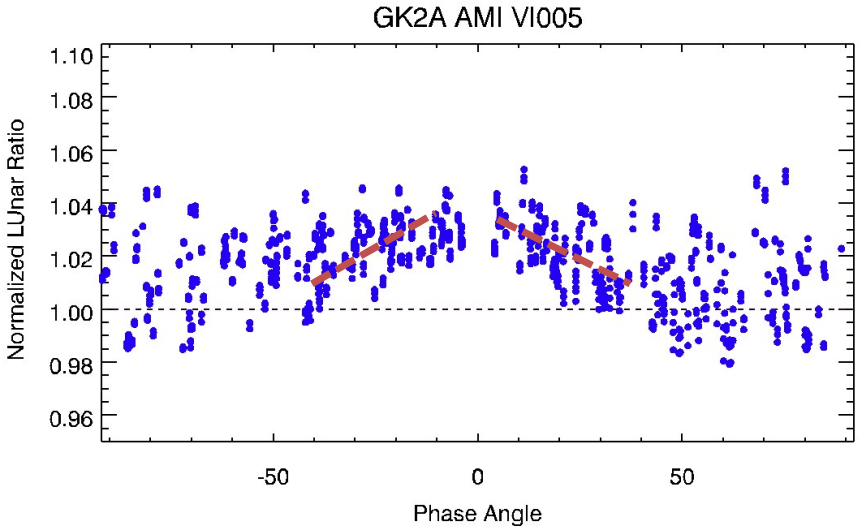


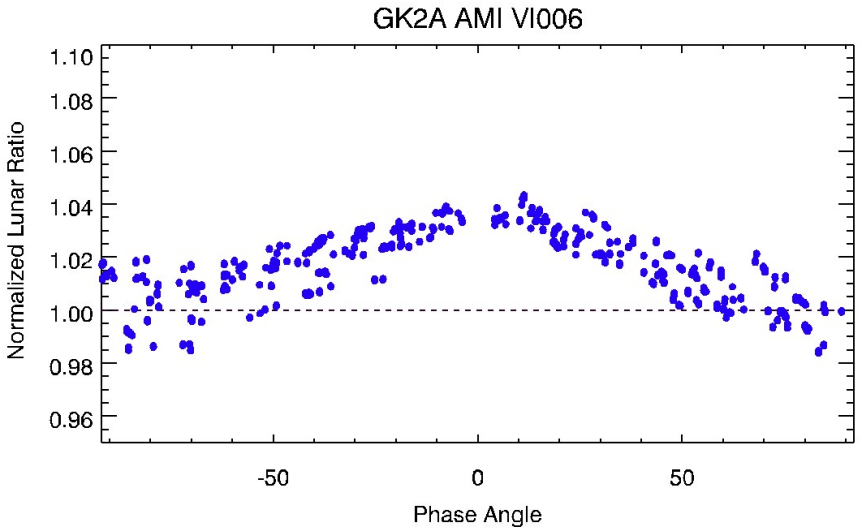




GK2A AMI Lunar Results (Ratio$_{nor}$ vs. Phase Angle)

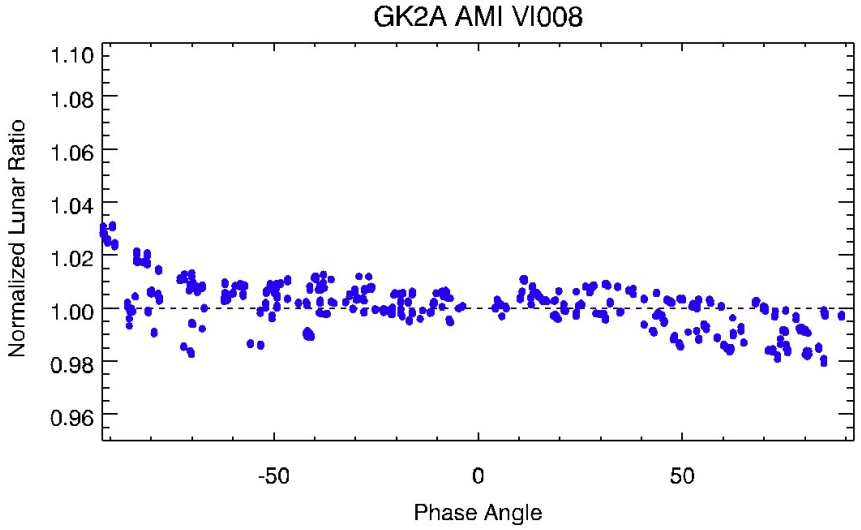


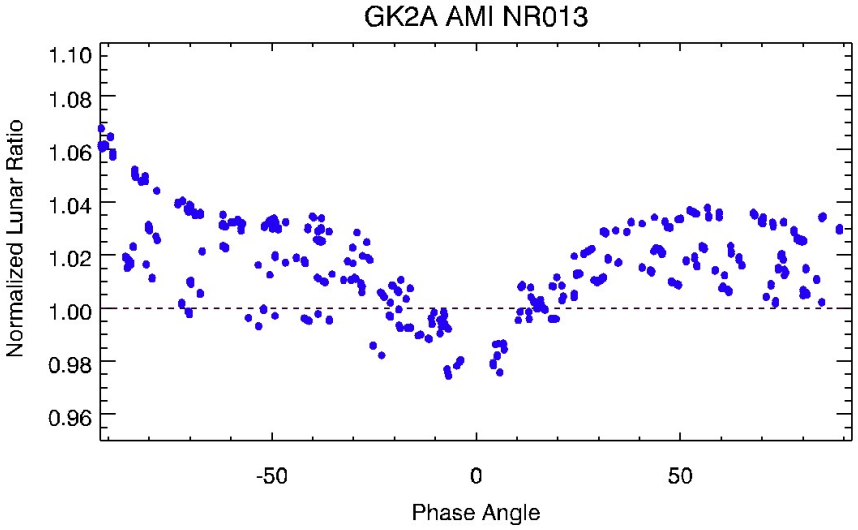


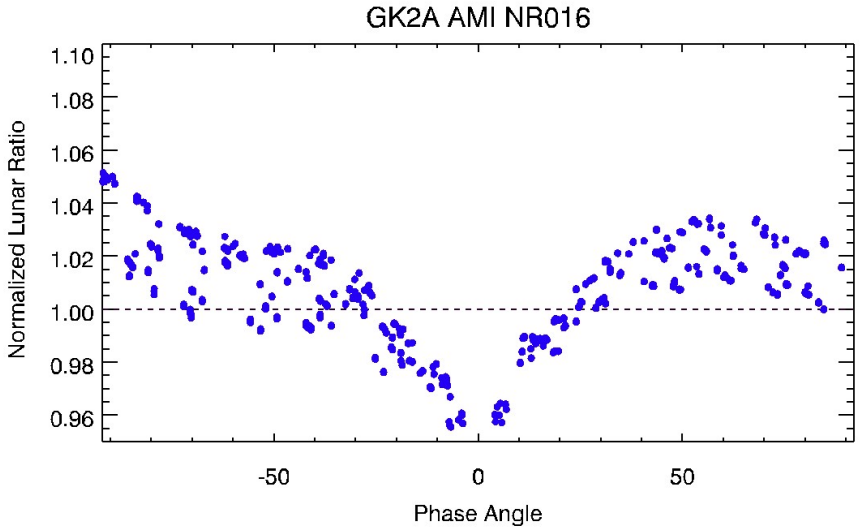


- Date : May 2019 – April 2021
  - VI004: Much scattered, no strong apparent phase angle dependent ratio
  - VI005: Phase angle dependent at relatively small absolute phase angles, but > 40° and <-40°?
  - VI006: Phase angle dependent appears

GK2A AMI Lunar Results (Ratio$_{nor}$ vs. Phase Angle)







- VI008 : Phase angle dependent bias appears
- NR013 and NR016 : Strong phase angle dependent calibration accuracy and Magnitude Increases with the wavelength

Summary and Future Plan

GK2A AMI lunar observation

- 6 VNIR bands (0.47, 0.51, 0.64, 0.86, 1.3, 1.6 μm) and available since May 2019
- Lunar observation: the quality is under checking

GK2A AMI Lunar calibration Results

- Show unexpected **seasonal variation about 5~10%** depend on channel (SRF)
  - Also VNIR DCC calibration (GSICS and Ray matching method) →10 June 2021 webmeeting

  → **Need Long Term Monitoring and further investigation**
- Need revisit of oversampling factor and pixel IFoV
- Update moon pixel selection (e.g. use of new DC threshold and lunar shape fitting)

Plan : Reprocess Lunar data

- Will re-process the lunar data without the updates of solar calibration coefficients to de-couple the SCT from the instrument performance

감사합니다.

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