Initial Analysis of Lunar Intrusion Events in AWS Deep-Space Views

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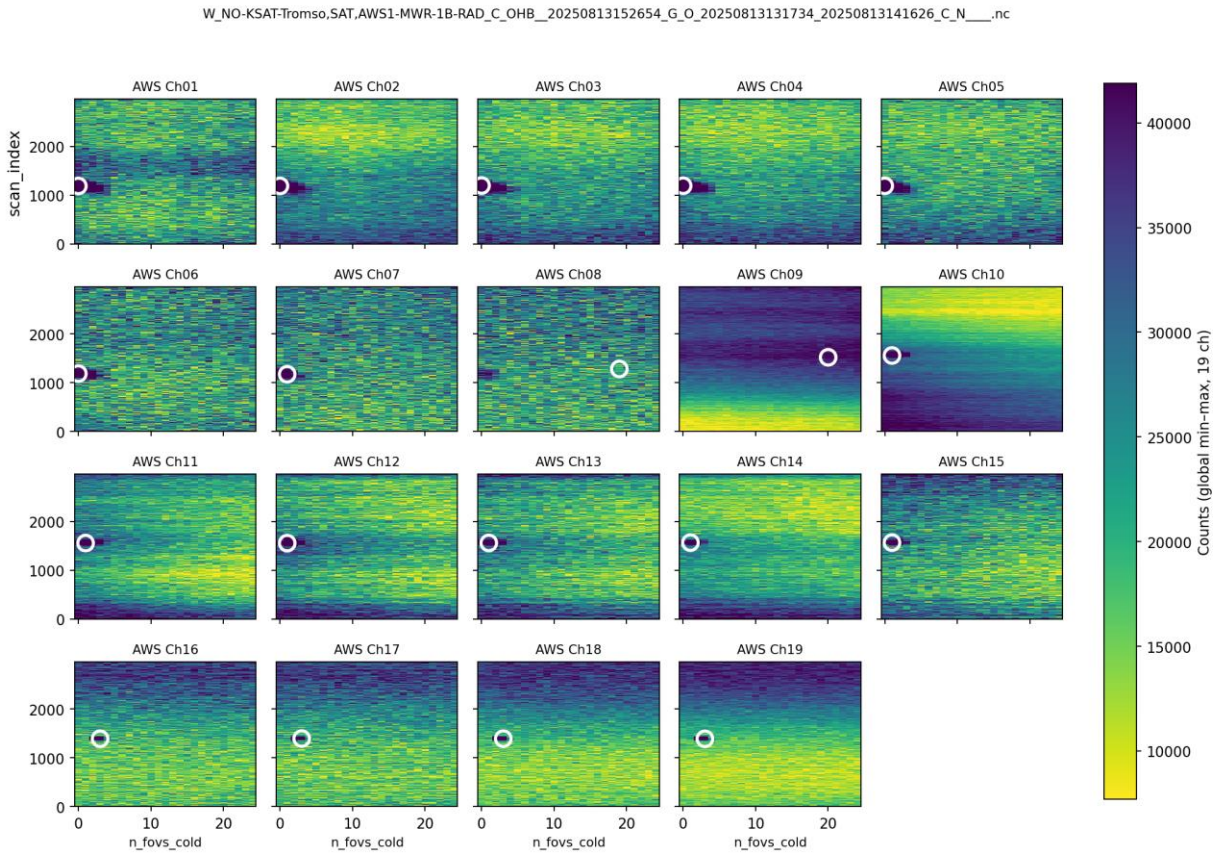
Background

- AWS deep-space views used for calibration reference
- Cold-view contamination may affect Earth-view brightness temperatures
- Abnormal cold-view count enhancements found in some cases
- Possible cause: lunar intrusion into view

Acknowledgement： Sincere thanks are extended to Tim Hewison for kindly providing the data used in this study.

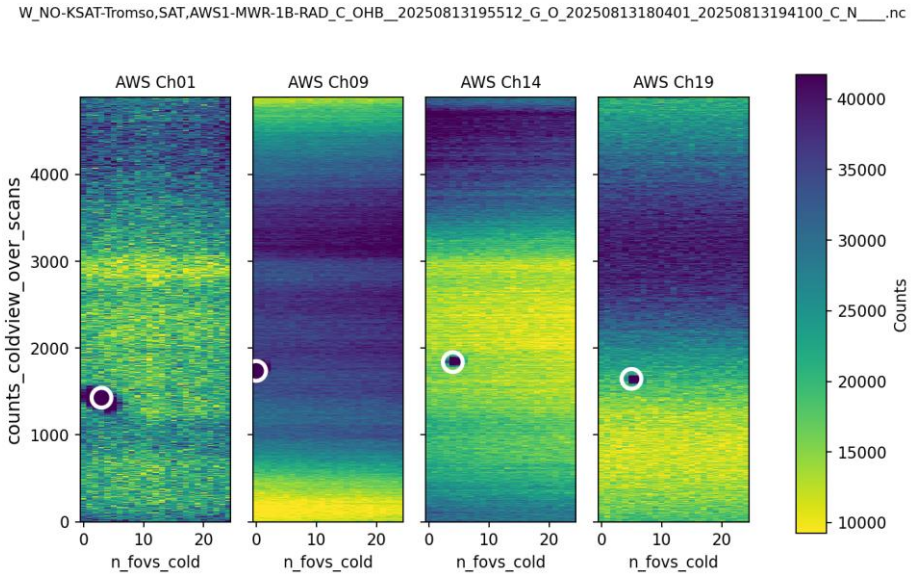
Lunar Intrusion Event Detection

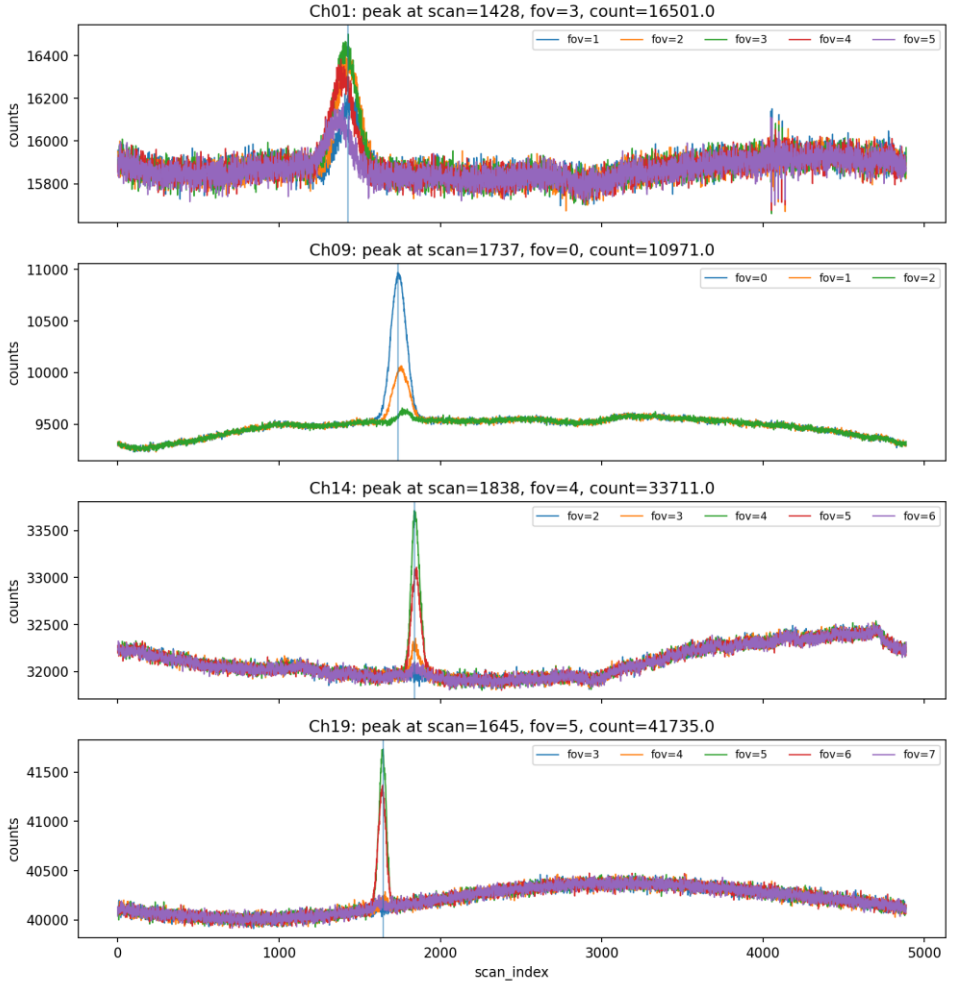


2D Count Map Screening

- Cold-view counts displayed in **scan × cold-space FOV** space
- One panel for each AWS channel
- White circle: **global maximum count** in each channel
- Purpose: identify **event timing, affected FOV, channel dependence**

Initial Analysis

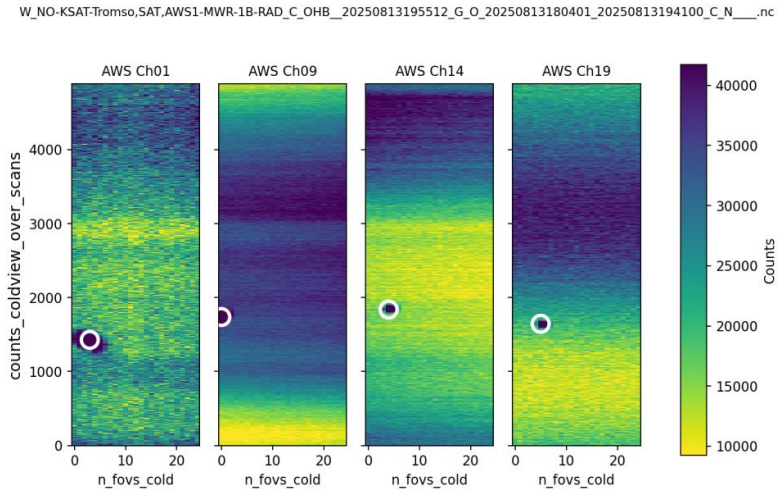




Peak Structure Along Scan

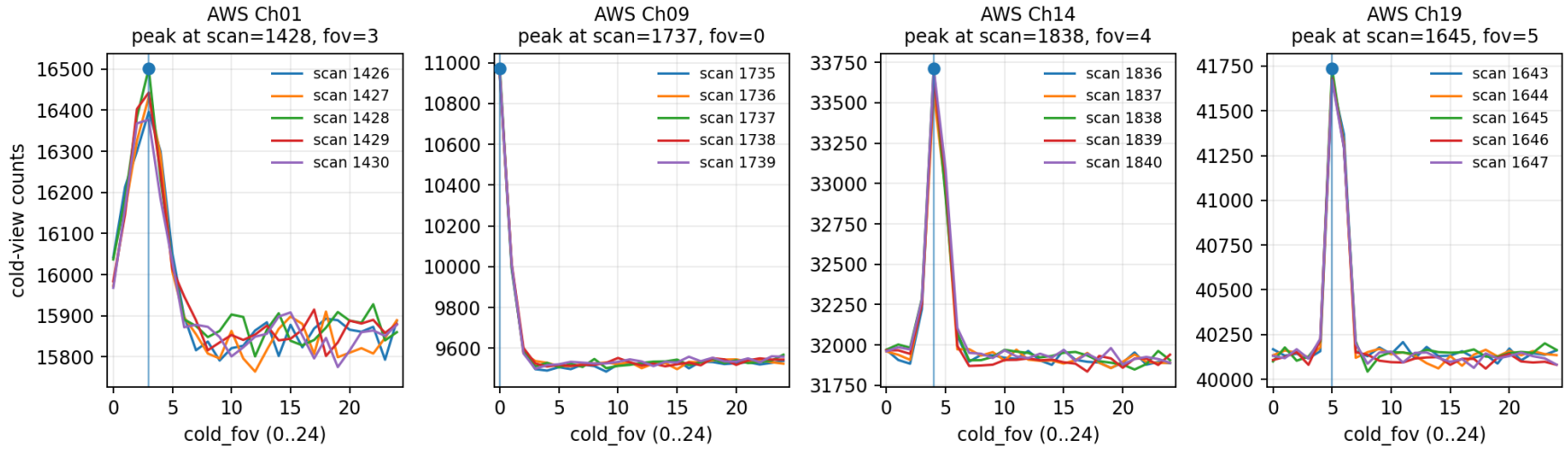
- Peak location first identified from 2D count map
- Count series plotted versus **scan index**
- Peak FOV and neighboring FOVs compared
- Result: **sharp, localized, transient** count peaks

Initial Analysis

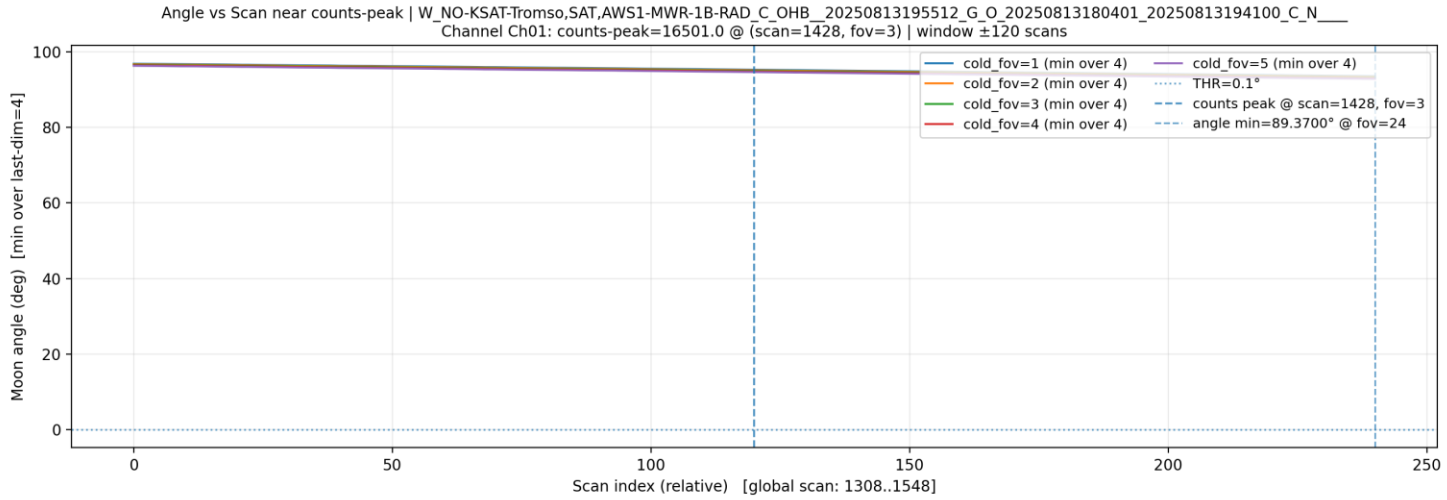


Cross-FOV Profiles Near Peak Scan

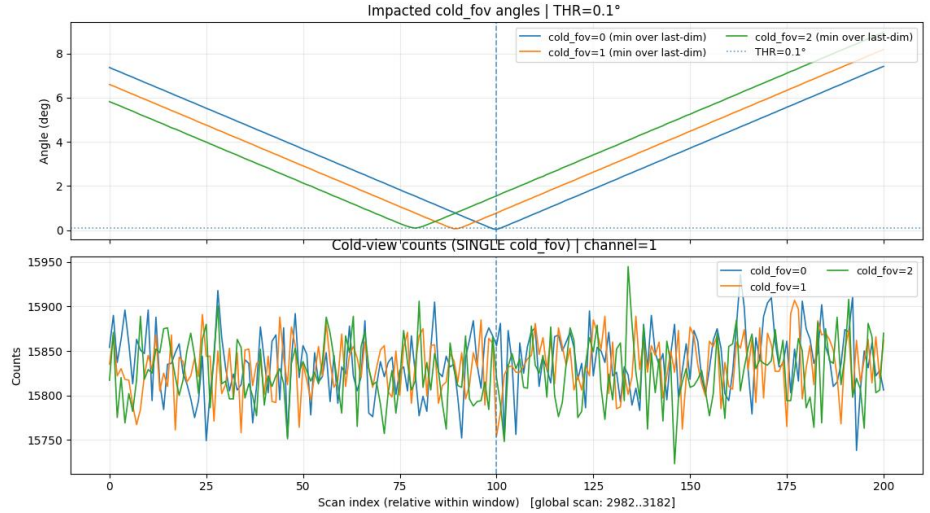
- Several scans extracted around the peak scan
- Count profiles plotted versus **cold-space FOV**
- Enhancement concentrated in a **narrow FOV range**
- Nearby scans show similar but weaker spatial profiles



Question



aws_moon_angles	(4983, 25, 4)	3uint16	Angle between moon and individual space views



- Count peak suggests an intrusion-like event
- But no Moon-angle minimum is seen near the count peak
- When Moon angle drops below **0.1°**, no clear cold-view count peak is observed
- **Mismatch：** Small Moon angles do not consistently correspond to count peaks

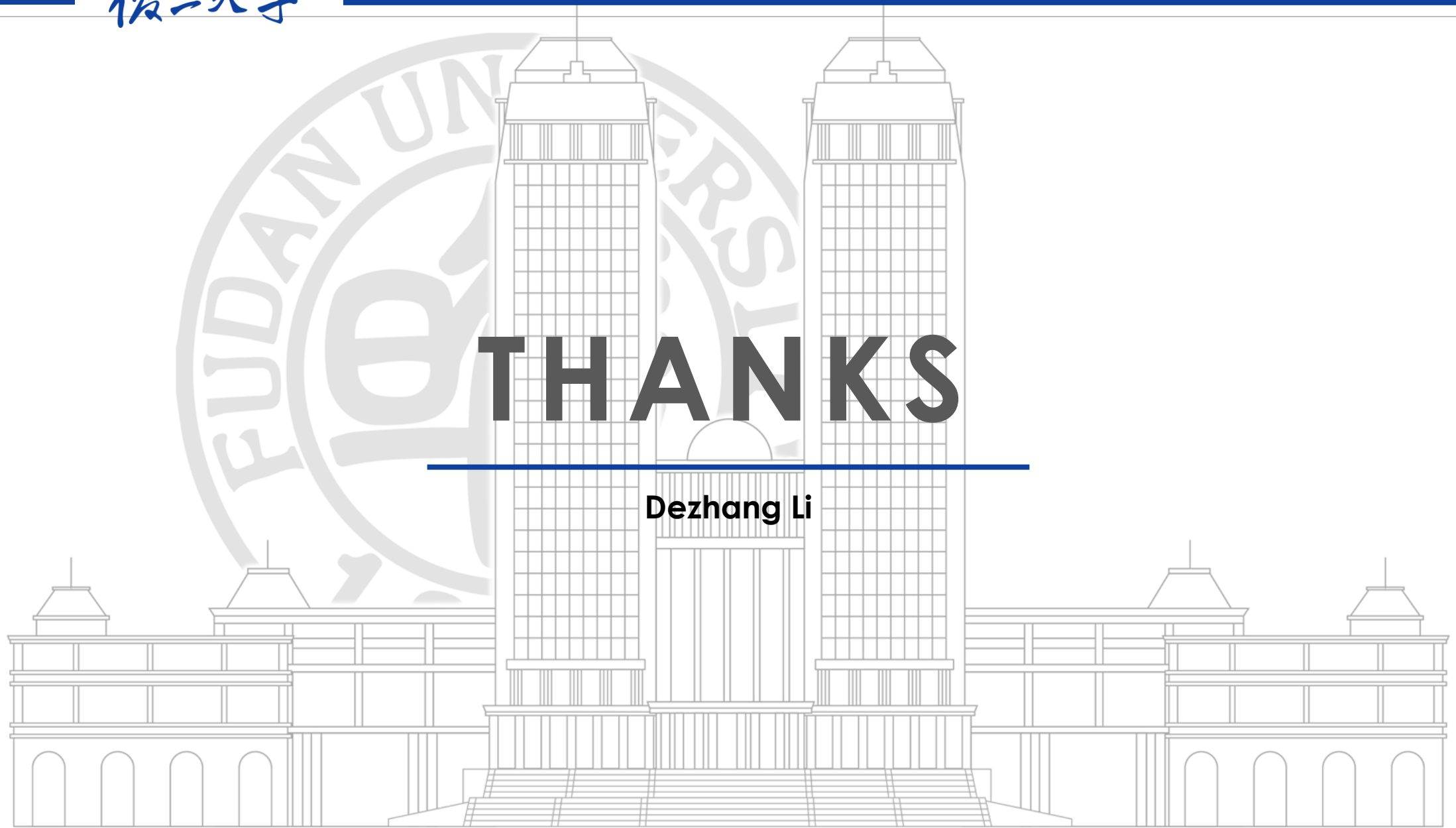
References

[1] P. Eriksson, A. Emrich, K. Kempe, J. Riesbeck, A. Aljarosha, O. Auriacombe, J. Kugelberg, E. Hekma, R. Albers, A. Murk, S. M. Pedersen, L. John, J. Stake, P. McEvoy, B. Rydberg, A. Dybbroe, A. Thoss, A. Canestri, C. Accadia, P. Colucci, D. Gherardi, and V. Kangas, "The Arctic Weather Satellite radiometer," *Atmospheric Measurement Techniques*, vol. 18, pp. 4709–4729, 2025, doi: 10.5194/amt-18-4709-2025.

[2] Omnisys Instruments AB, *Algorithm Theoretical Basis Document*, Document No. AWS-OMN-TN-0003, Issue 5.0, Mar. 4, 2025.

[3] M. J. Burgdorf, S. A. Buehler, I. Hans, and M. Prange, "Disk-Integrated Lunar Brightness Temperatures between 89 and 190 GHz," *Advances in Astronomy*, vol. 2019, Art. no. 2350476, Jun. 2019, doi: 10.1155/2019/2350476.

[4] EUMETSAT, "MWR Level 1B – Arctic Weather Satellite Proto-Flight Model," *EUMETSAT Data Store*, Product EO:EUM:DAT:0905. [Online]. Available: https://data.eumetsat.int/data/map/EO:EUM:DAT:0905. [Accessed: Mar. 6, 2026].



THANKS

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