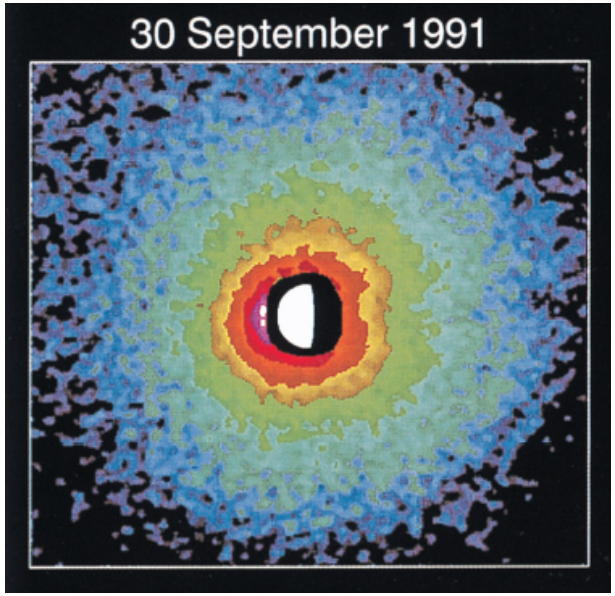
LADEE Science Status

HQ SMD
12/5/2013

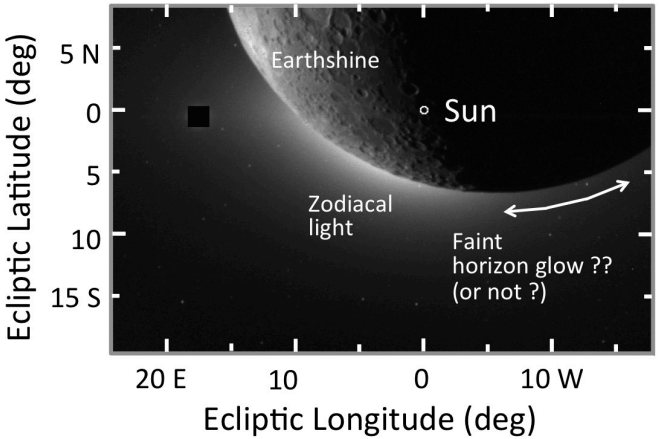
Project Level Science Objectives

- LADEE Objective 1:
  Determine the composition of the lunar atmosphere and investigate the processes that control its distribution and variability, including sources, sinks, and surface interactions.



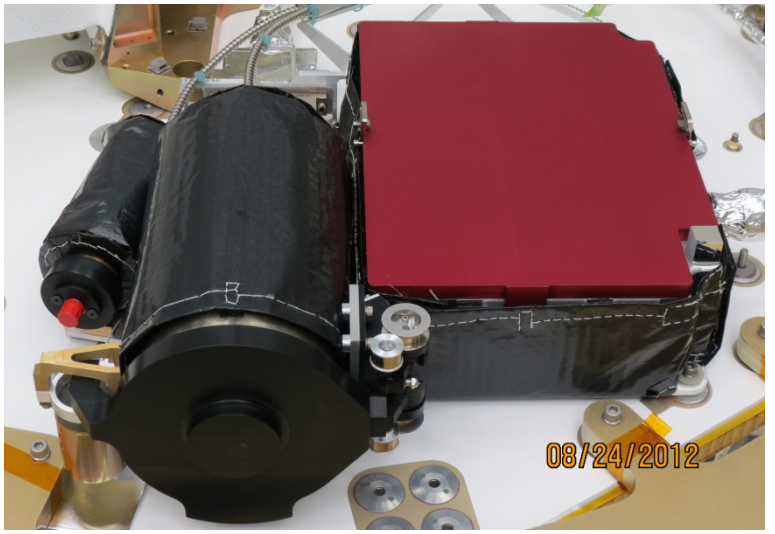
- LADEE Objective 2:
  Characterize the lunar exospheric dust environment and measure any spatial and temporal variability and impacts on the lunar atmosphere.

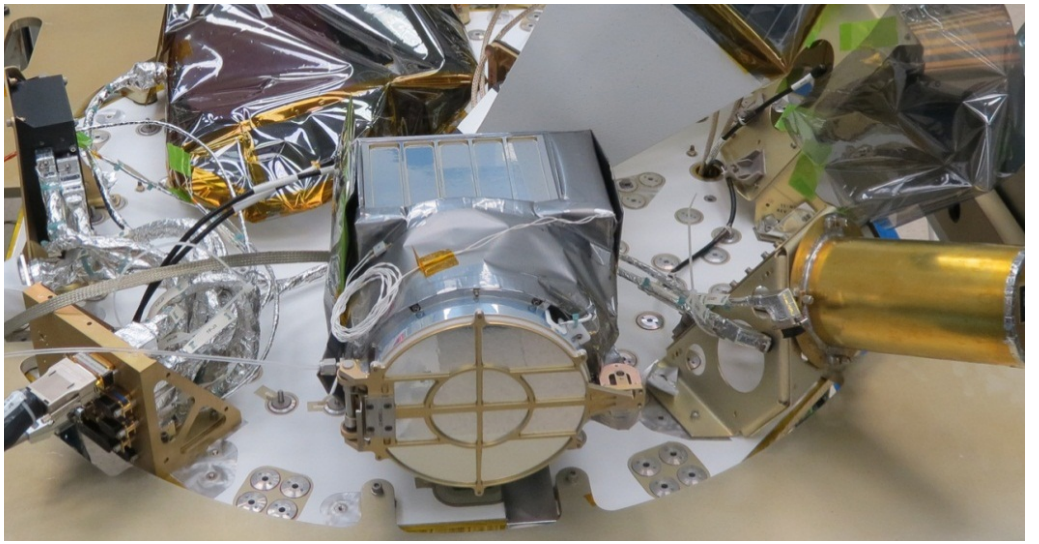
Sample Star Tracker Image – Orbit 193



LADEE Science Payload

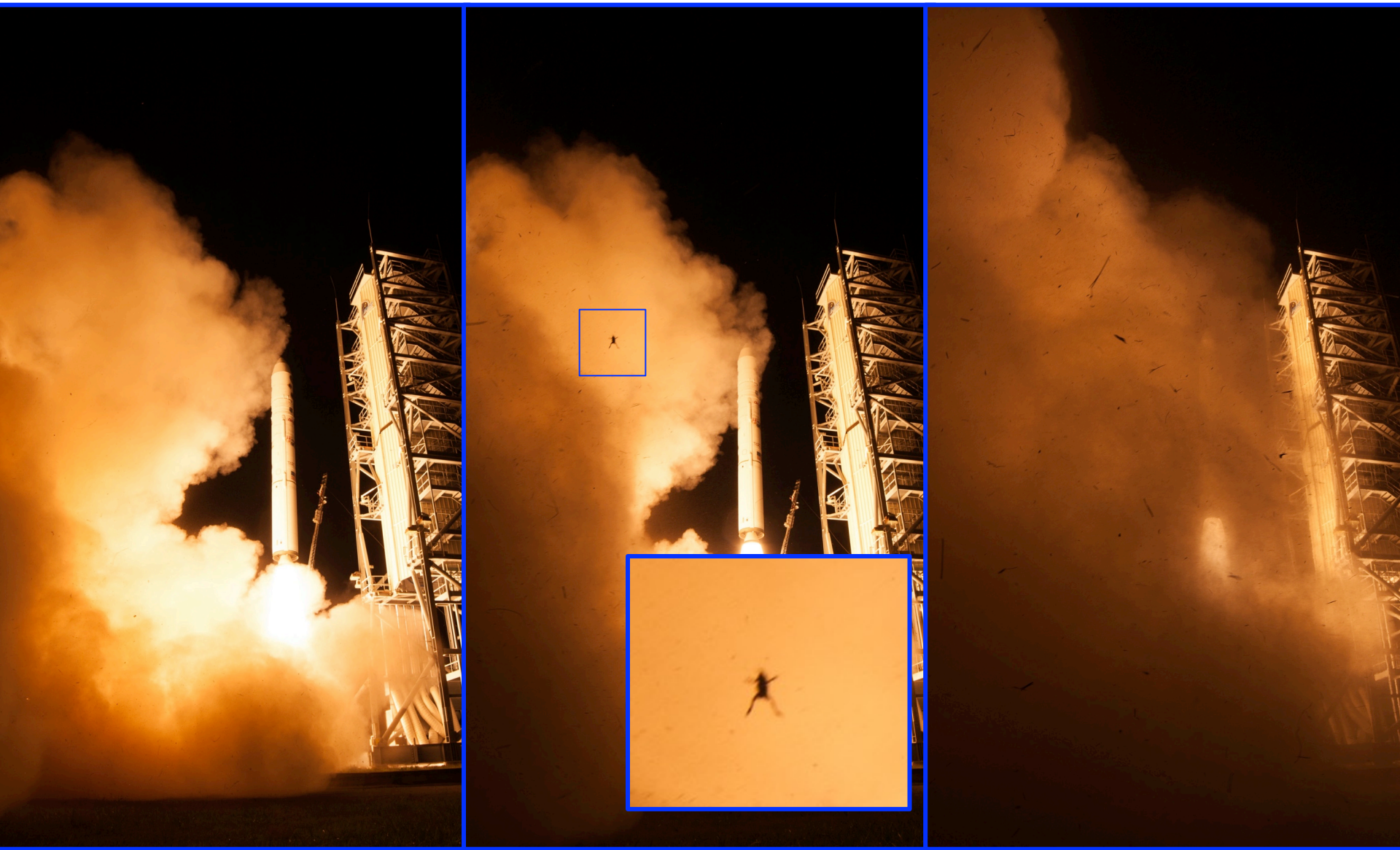
- Neutral Mass Spectrometer (NMS) measures in situ ambient lunar exospheric species (eg., Ar, He, Ne)
- Ultraviolet/Visible Spectrometer (UVS) measures emissions from exospheric species and scattered light from dust
- Lunar Dust Experiment (LDEX) measures in situ dust.



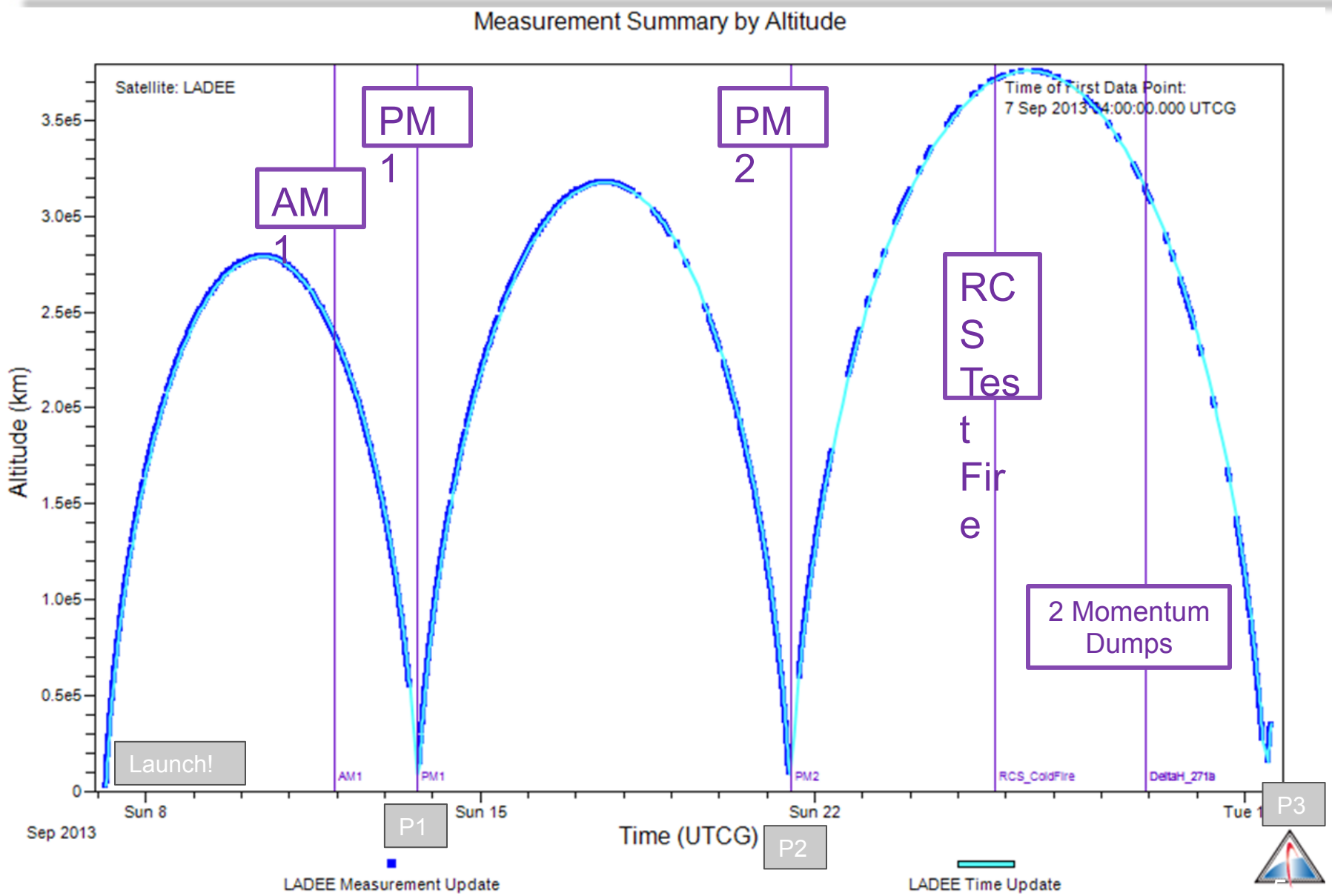


LADEE Launch Frog

6 Sept 2013



Tracking Received by Earth Altitude: Phasing Loops



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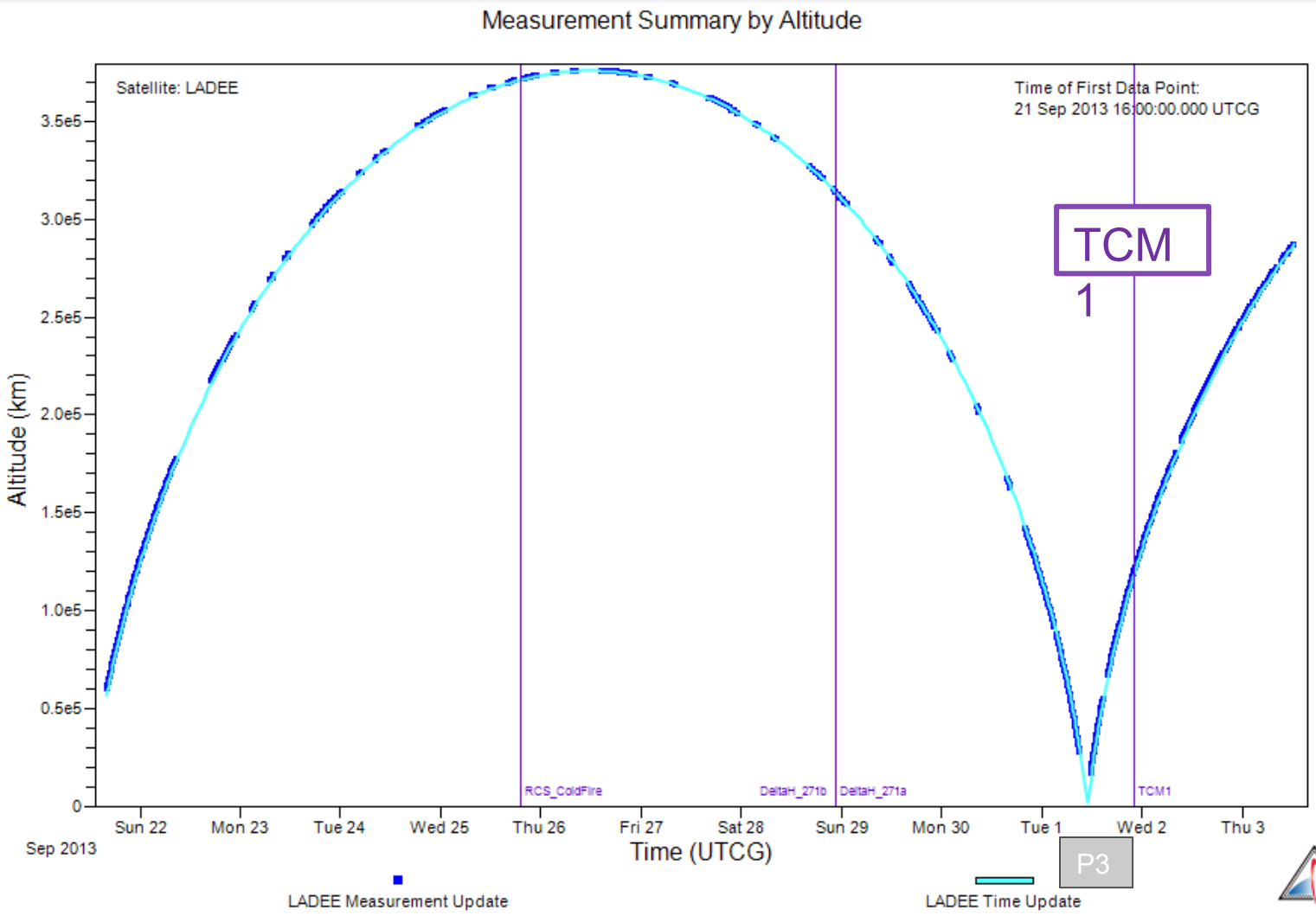
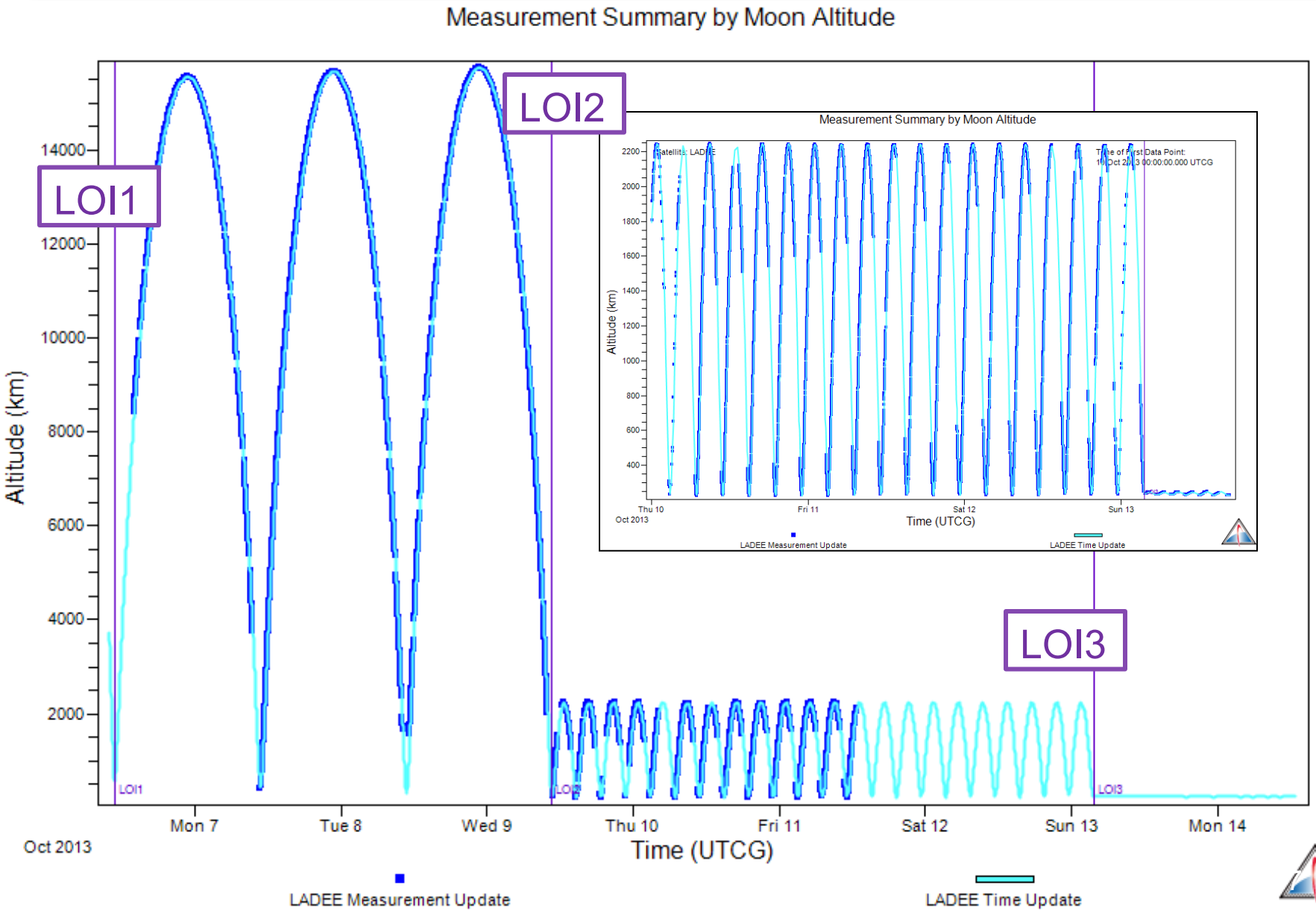
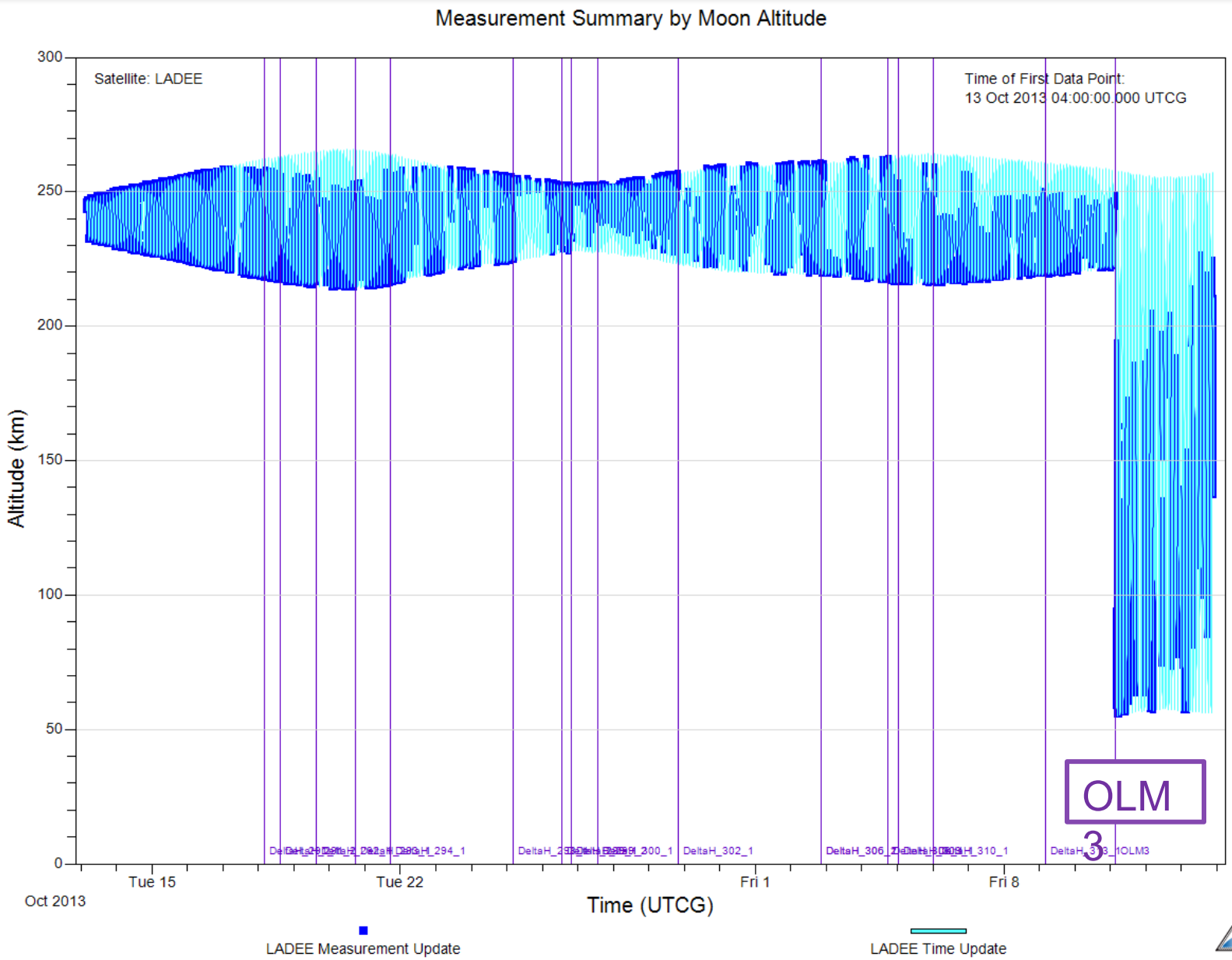

Measurement Summary by Altitude
Satellite: LADEE
Time of First Data Point:
21 Sep 2013 16:00:00.000 UTCG
TCM
1
Altitude (km)
3.5e5
3.0e5
2.5e5
2.0e5
1.5e5
1.0e5
0.5e5
0
RCS_ColdFire
DeltaH_271b
DeltaH_271a
TCM1
Sun 22
Mon 23
Tue 24
Wed 25
Thu 26
Fri 27
Sat 28
Sun 29
Mon 30
Tue 1
Wed 2
Thu 3
Sep 2013
Time (UTCG)
LADEE Measurement Update
LADEE Time Update

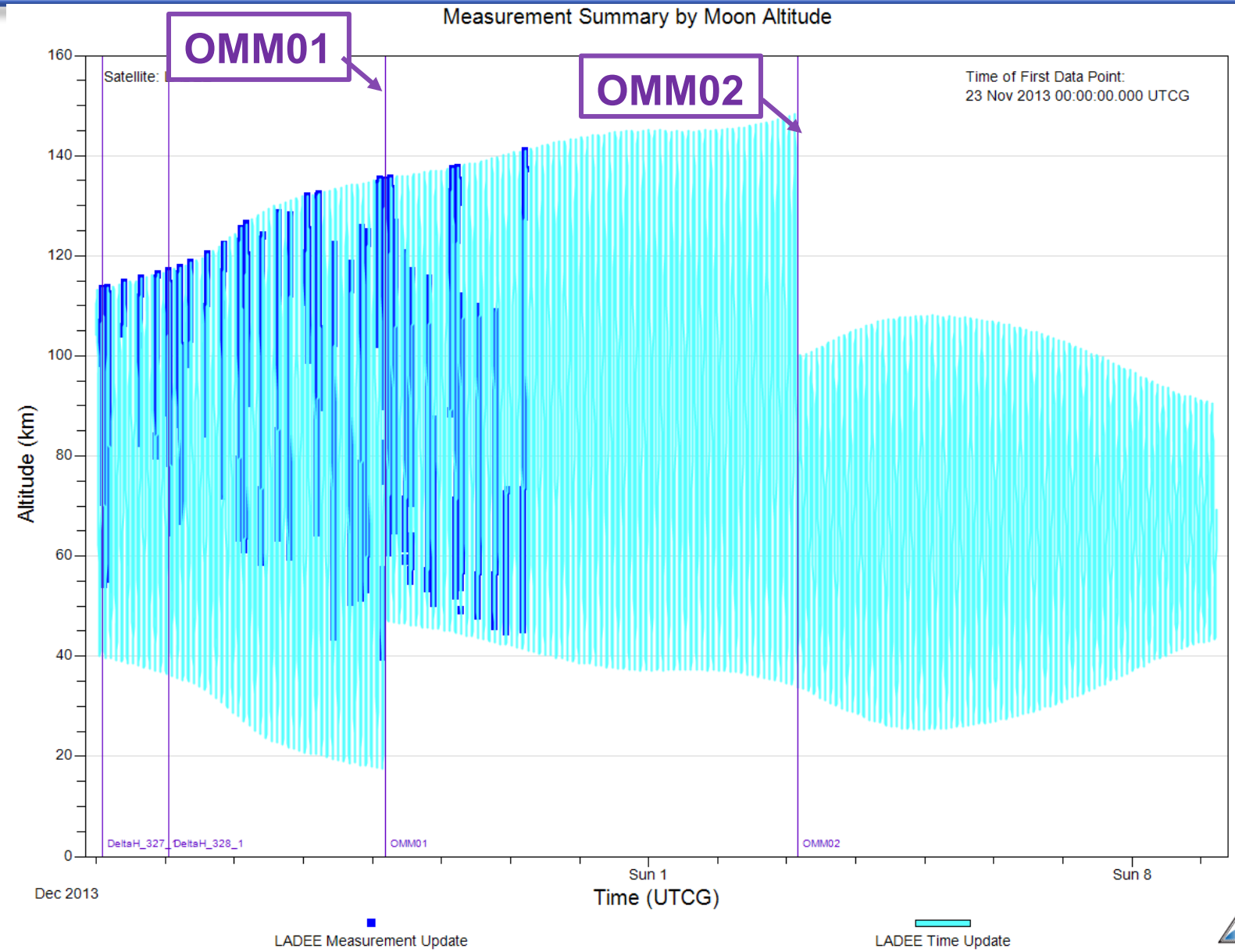
Tracking Received by Lunar Altitude LOI1 until Commissioning



Tracking by Lunar Altitude in Commissioning Orbit



Tracking by Lunar Altitude in Commissioning Orbit

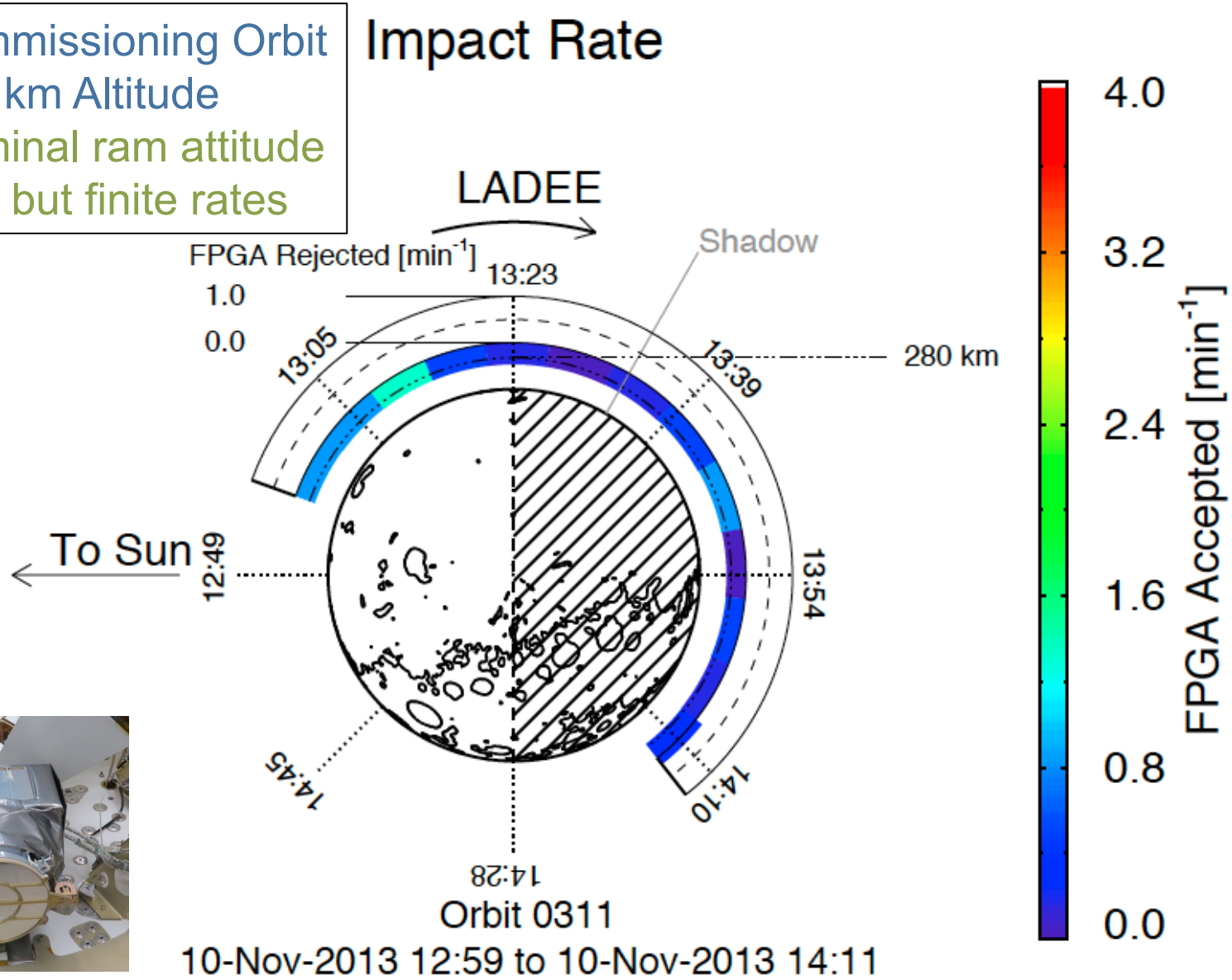


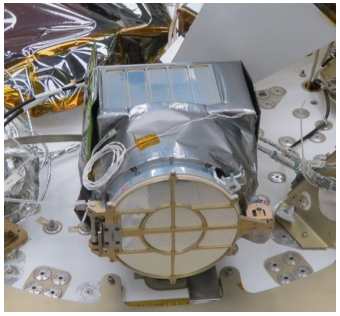
LADEE Operations Achievements and Status

- Science instruments (NMS, UVS, LDEX) are in good health
- Fully checked out in commissioning
- OLM-4 Science Orbit: 20-50 km by 75-150 km.
- Have completed many science observations since final orbit lowering on 20 Nov.
- Currently operating at nominal science cadence.
- Strategic and tactical science planning going smoothly.

LDEX Dust Impact Measurements

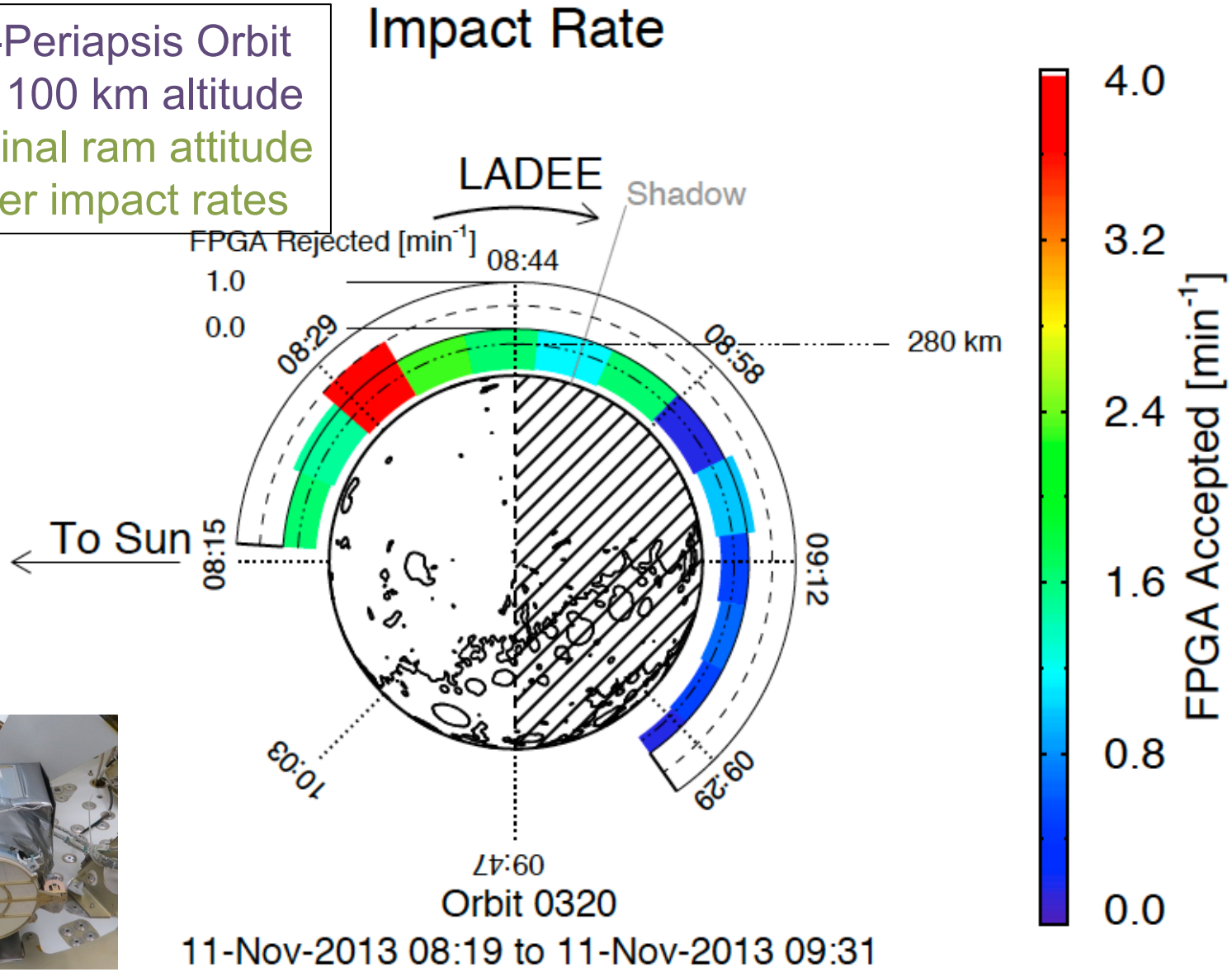
- Commissioning Orbit
- 250 km Altitude
- Nominal ram attitude
- Low but finite rates

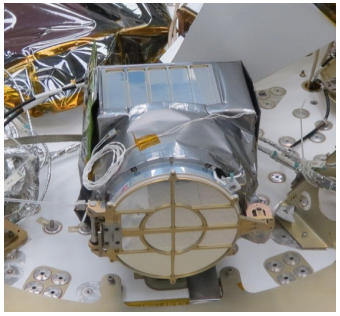




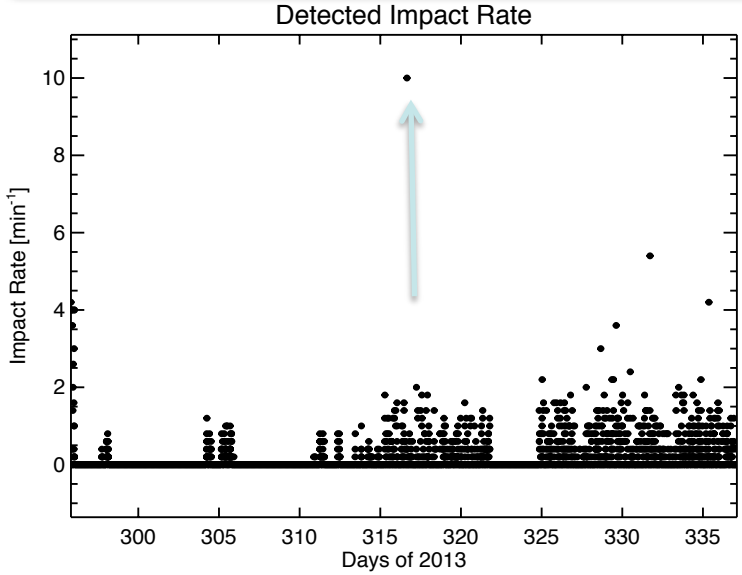
LDEX Dust Impact Measurements

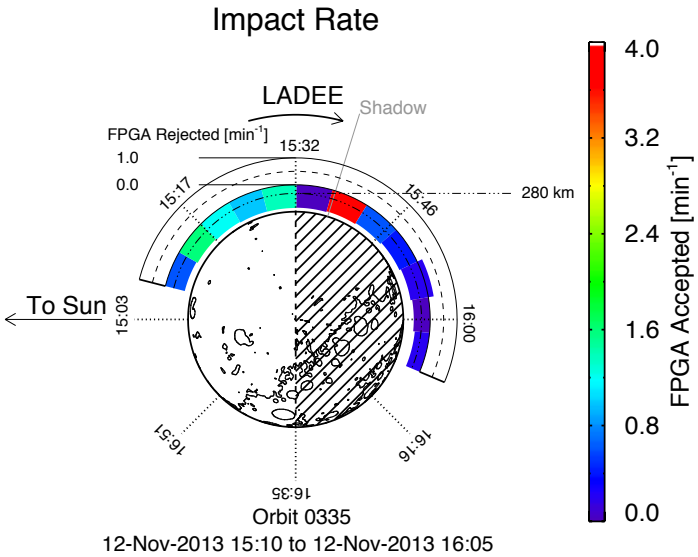
- Low-Periapsis Orbit
- 20 – 100 km altitude
- Nominal ram attitude
- Higher impact rates

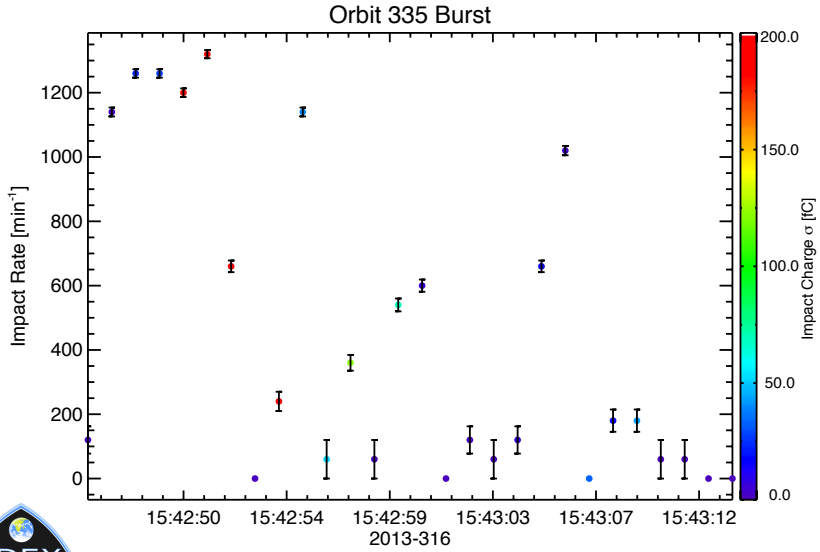


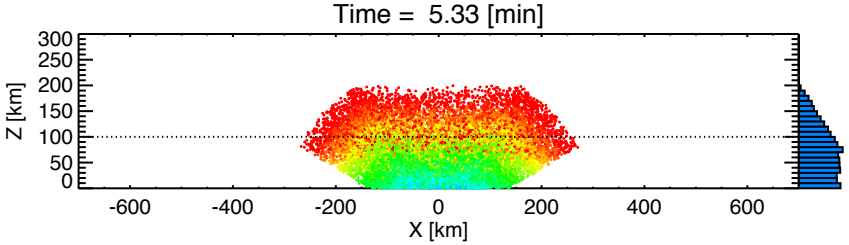


Impact Bursts



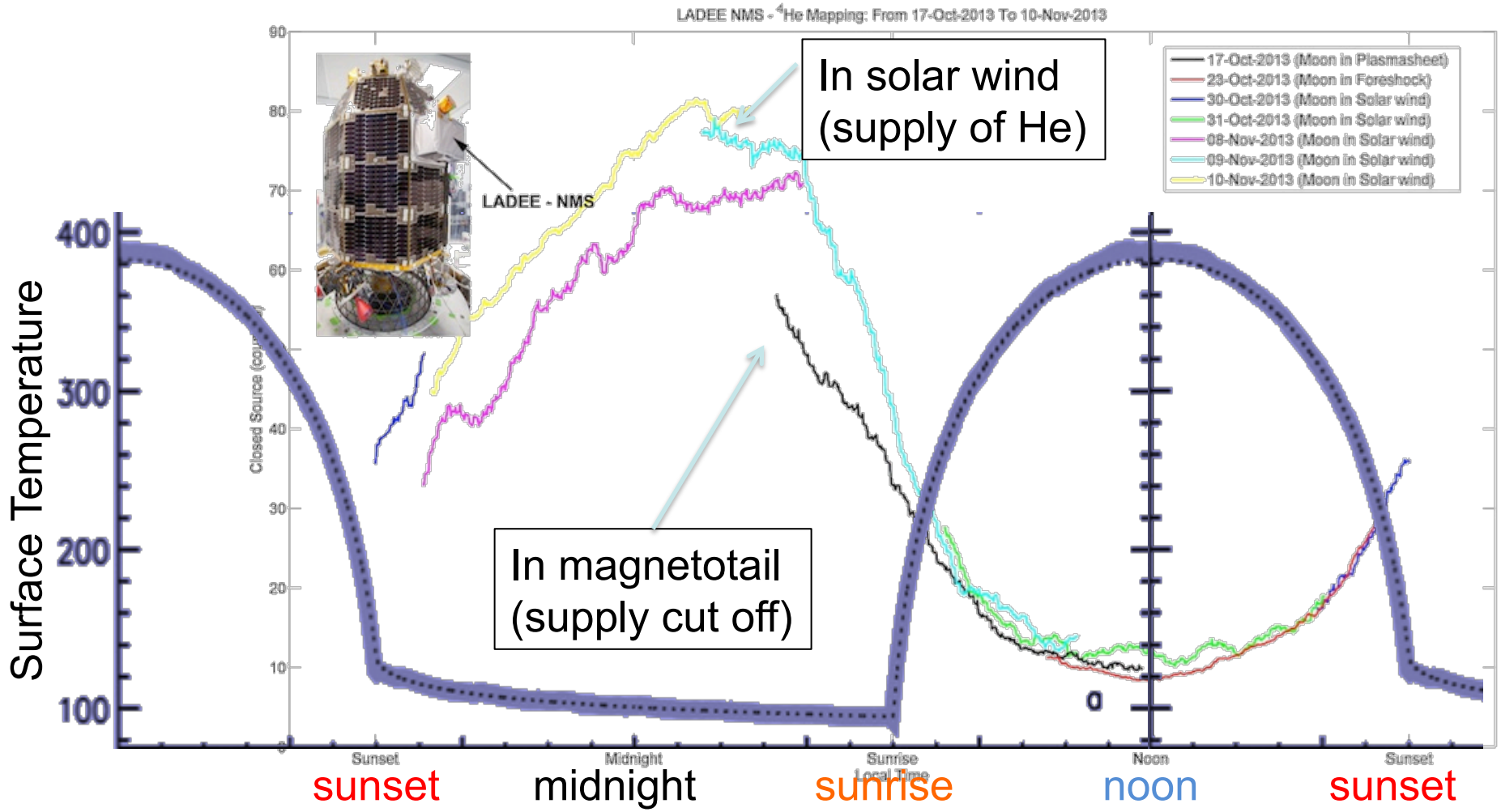






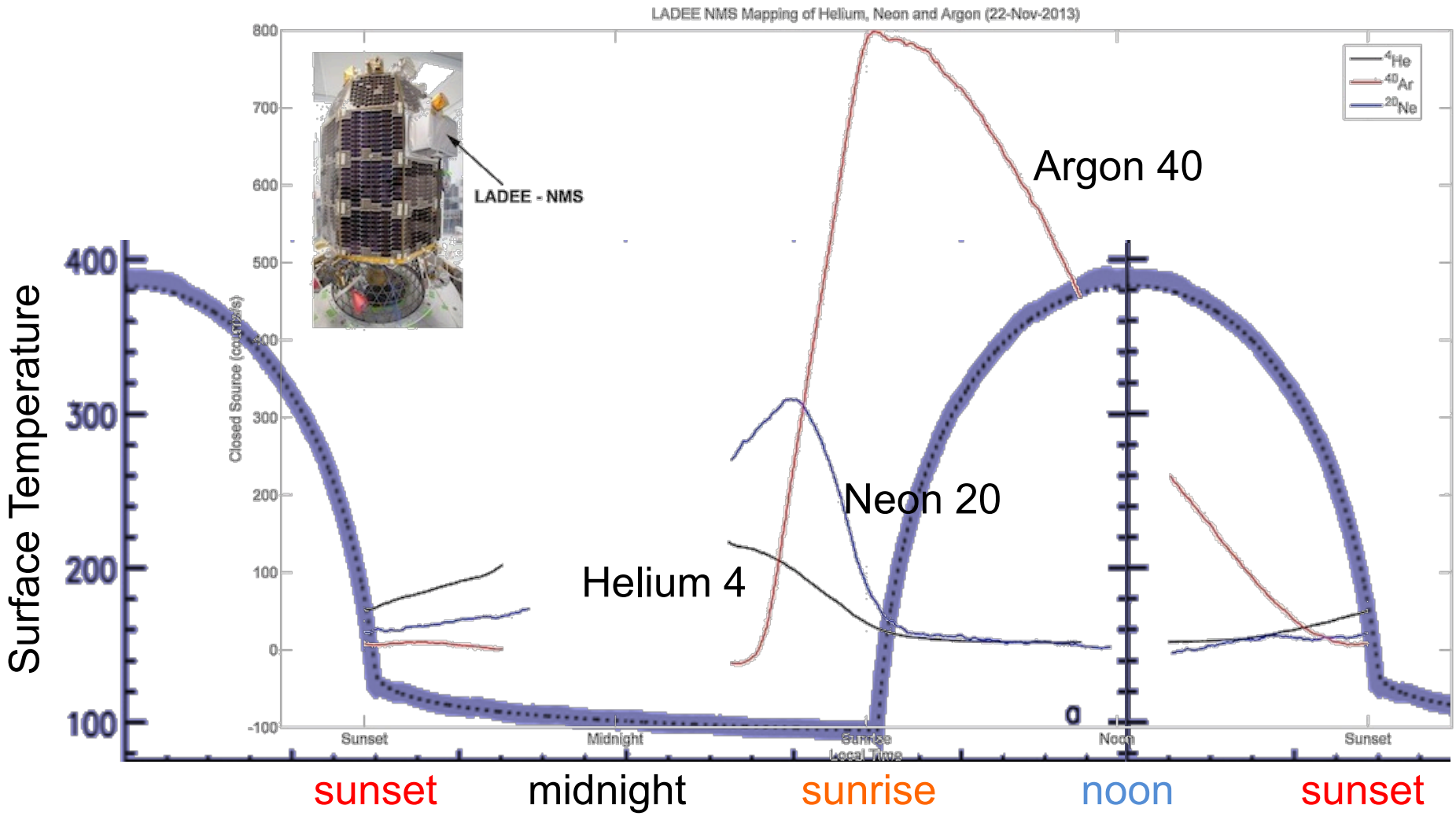
LDEX sees occasional “bursts” of dust impacts; may indicate LADEE flying through “flak” of meteoroid impact ejecta from lunar surface.

NMS Helium mapping



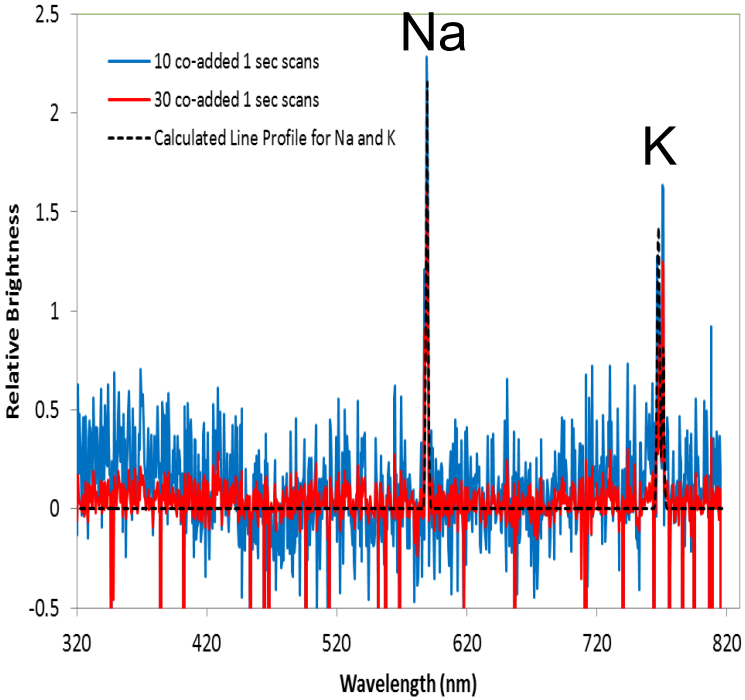
NMS observes helium dependence on (1) surface temperature and (2) solar wind He supply.

NMS: Diurnal Variations in Ar, Ne, He

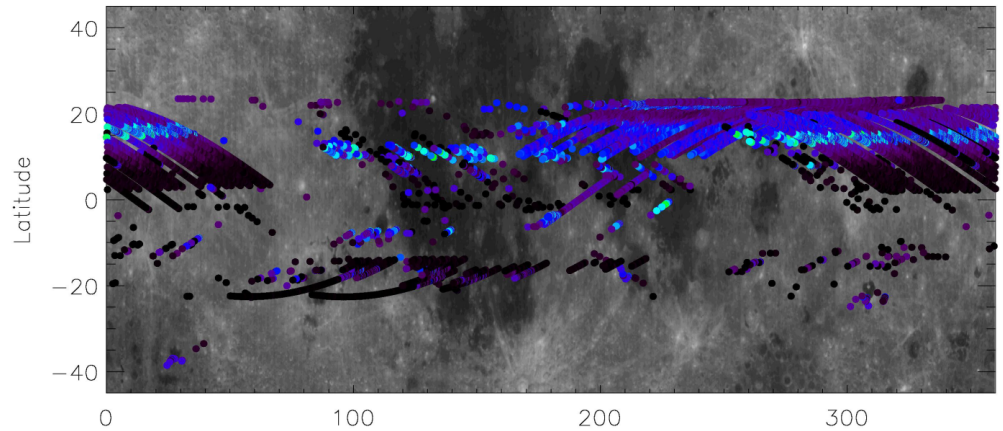


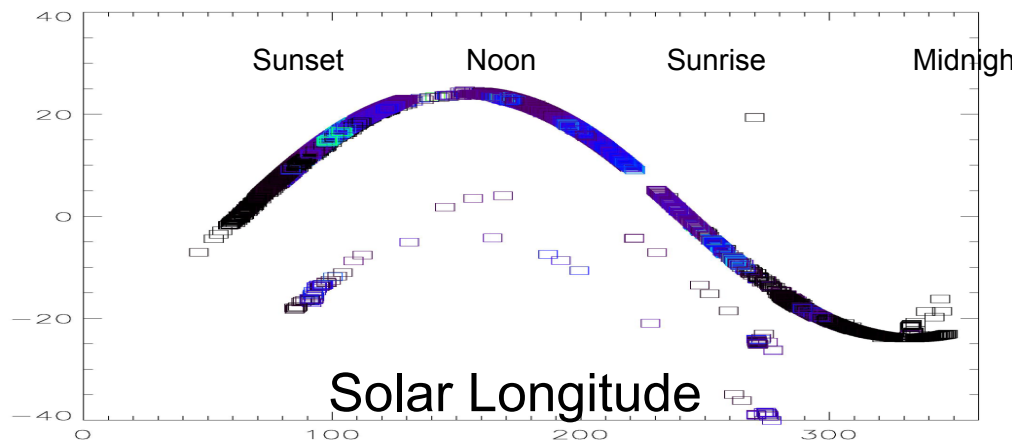
NMS: diurnal variations of the 3 noble gases is different – controlled by surface temperature and ballistic trajectories of different masses.

UVS: Exospheric Alkali Detection



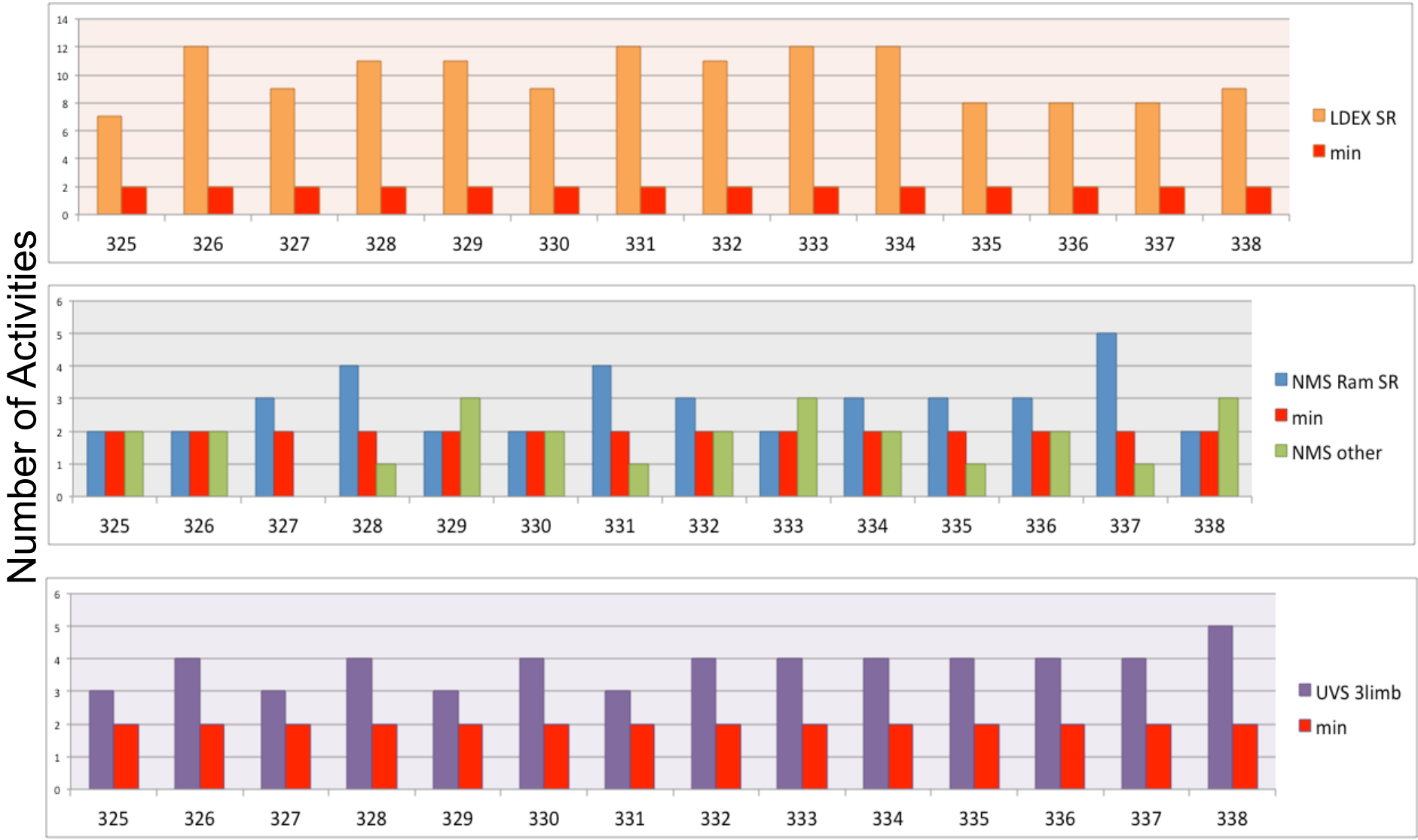
Sodium column density and selenographic location



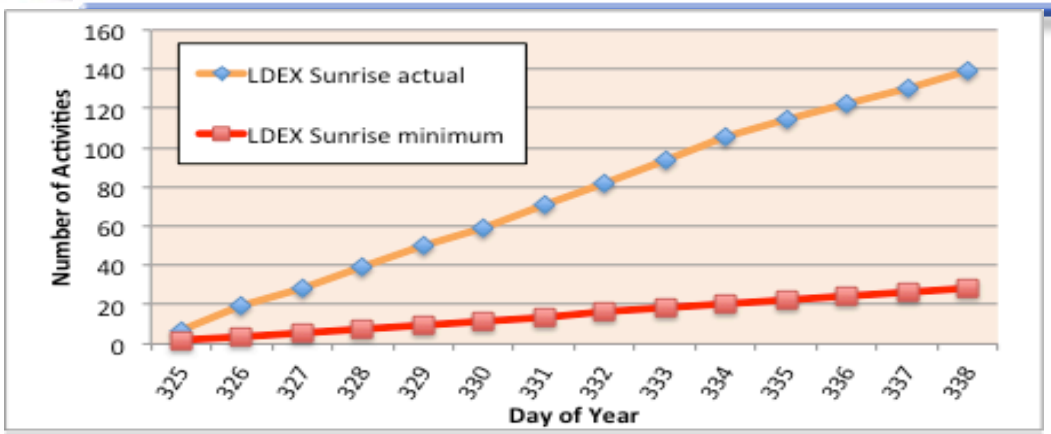


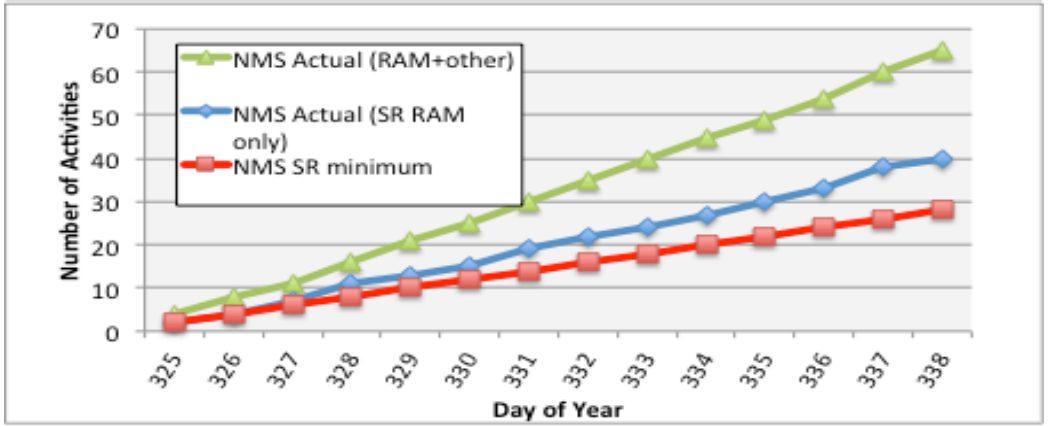
UVS has observed exospheric sodium and potassium, and is monitoring how they change with position and time.

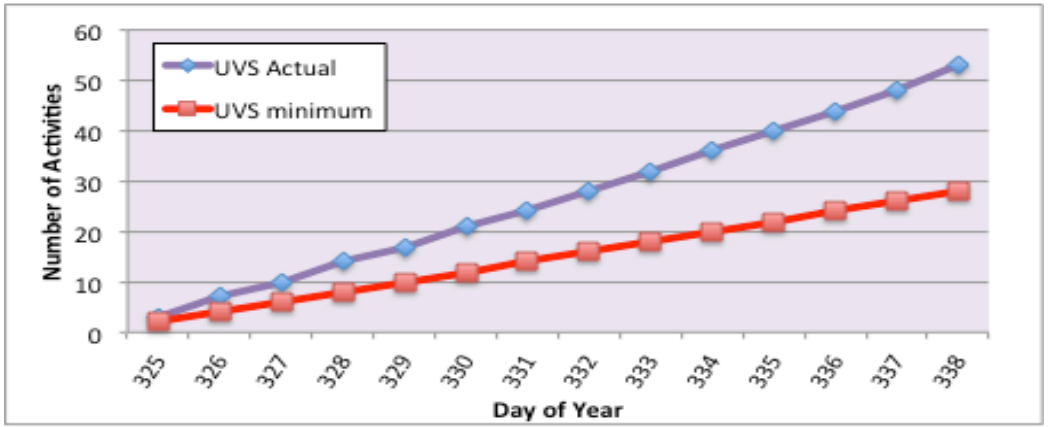
LADEE Instrument Operations Performance Against Minimums



LADEE Instrument Operations Performance Against Minimums



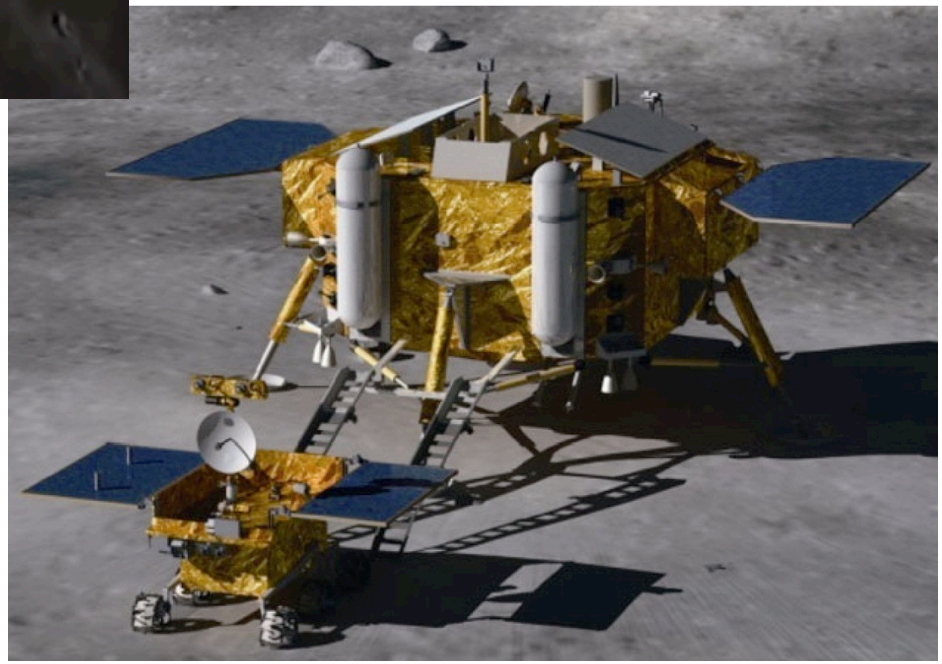


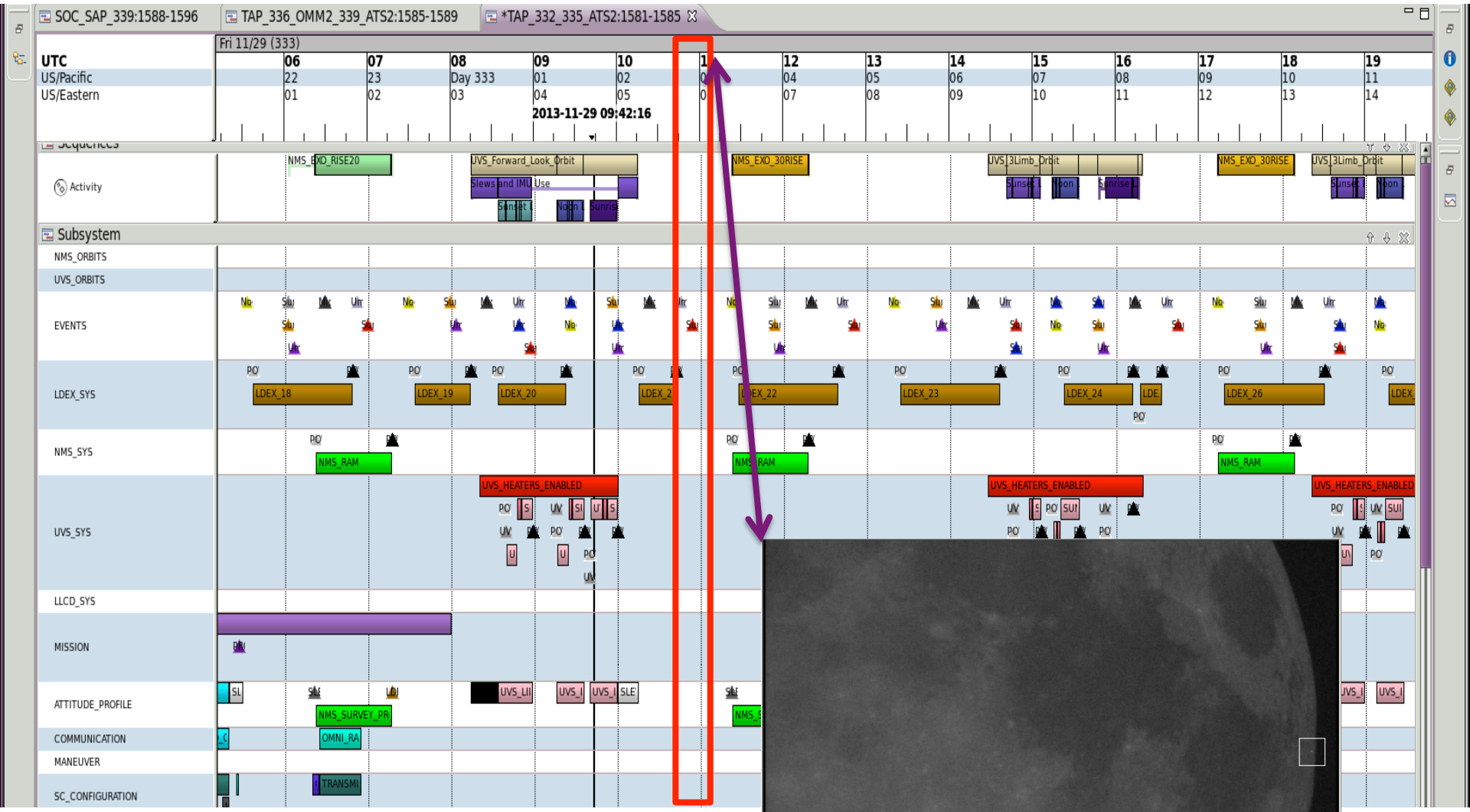


- LDEX is automatically populated in tactical plan – many opportunities!
- NMS runs several kinds of activities, some ram some not.
- UVS usually captures sunrise, noon and sunset
- All exceeding required mins

LADEE Will Monitor Effects of Chang'e 3 LOI and Powered Descent

- LADEE *may* detect additional species.
- Propulsion products for Unsymmetrical Dimethyl Hydrazine and N_2O_4



- H_2O, N_2, CO and CO_2, perhaps OH
- H_2O interesting – since it's part of lunar water cycle, and sequestration in polar cold traps.

LADEE Activities Near 29 Nov. 2013 Impact Events