

The Lunar Dust EXperiment (LDEX) for the Lunar Atmosphere and Dust Environment Explorer (LADEE) Mission

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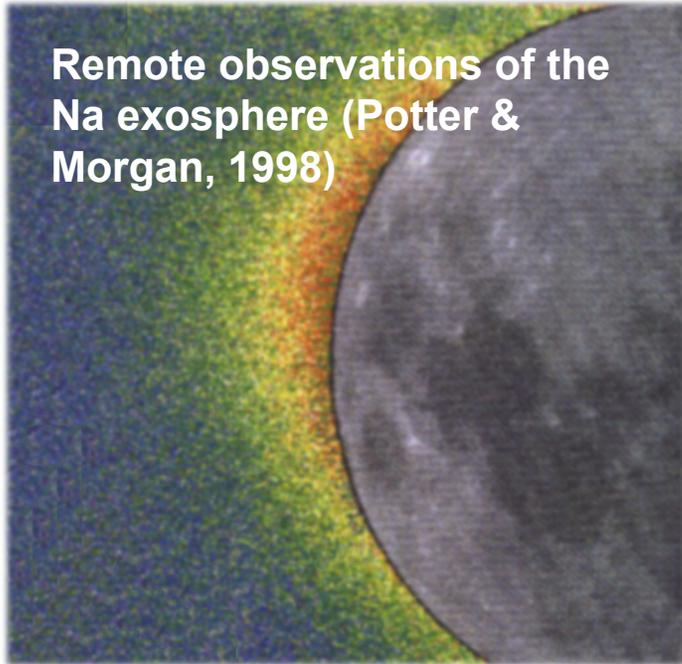


LADEE motivation

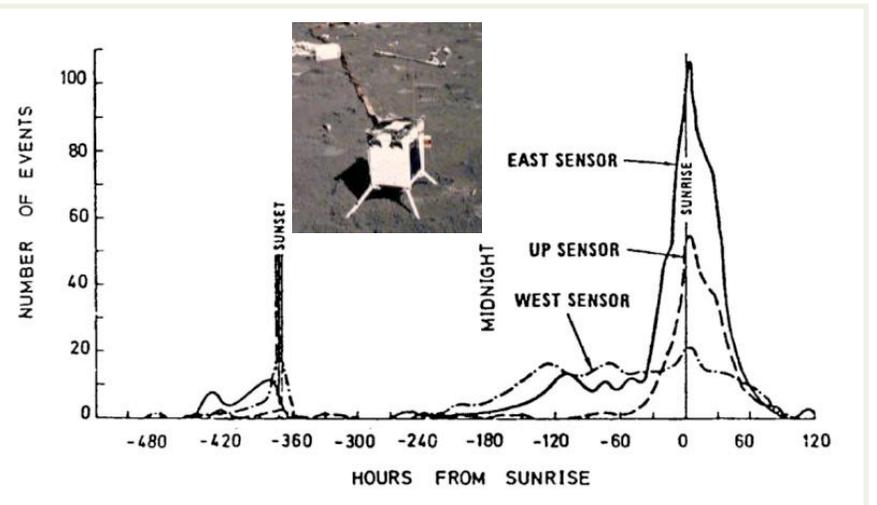
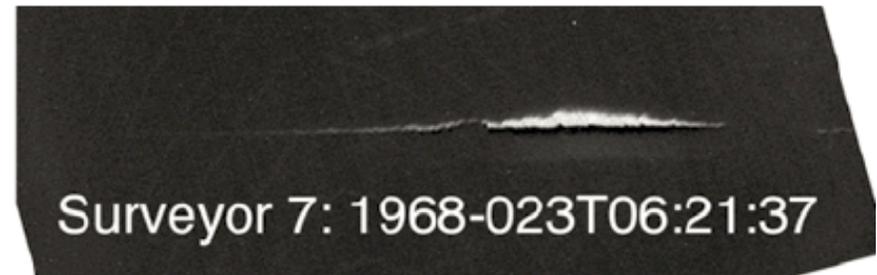


LADEE: Lunar Atmosphere and Dust Environment Explorer

Remote observations of the Na exosphere (Potter & Morgan, 1998)



- Identified species: ^{40}Ar , ^{36}Ar , He, Na, K, C, N, O, CO_2 , CH_4
- Measurements are not detailed enough
- Accurate composition measurements BEFORE disturbing by increased robotic and human activity



Is dust really lofting from the lunar surface?

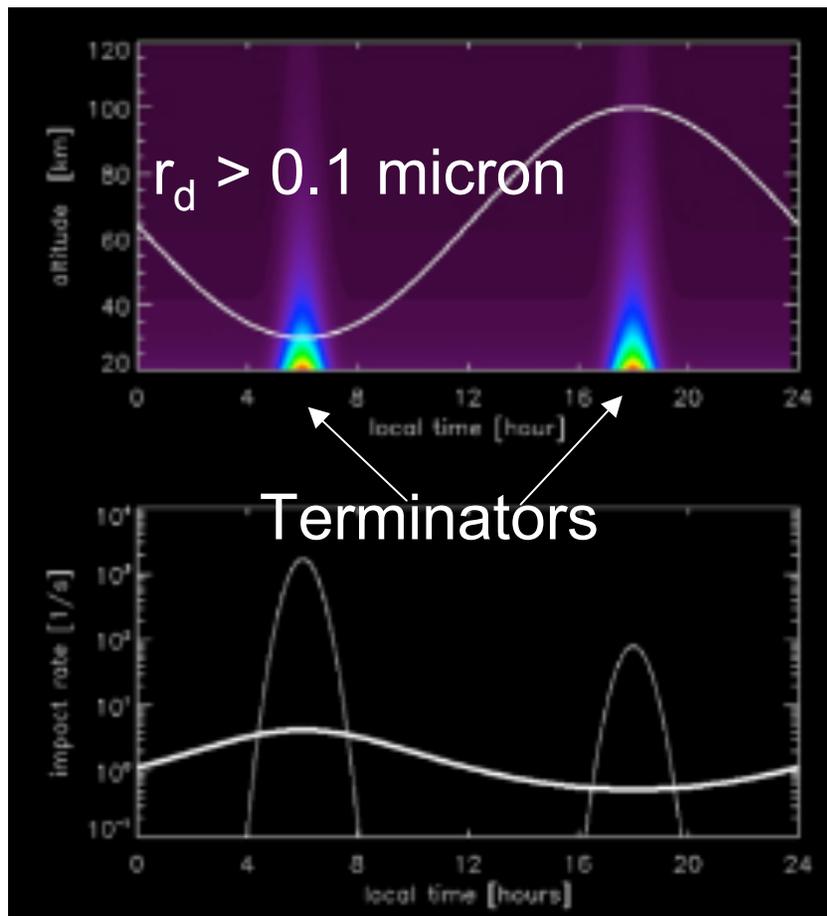


The lunar dust environment

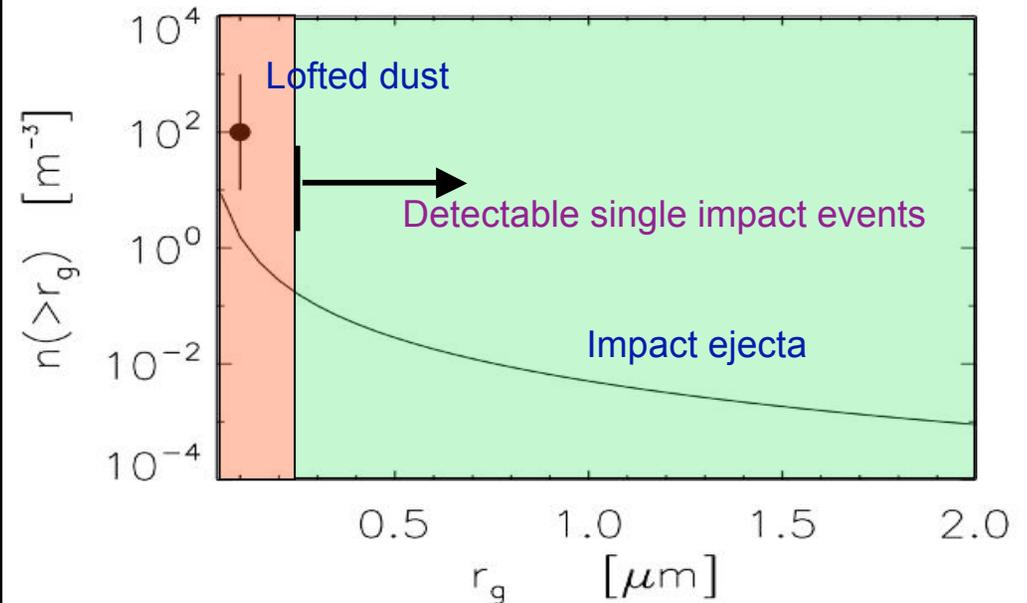


2 dust sources:

- a) Electrostatic lofting near the terminator region
- b) Secondary ejecta from micrometeoroid bombardment



The expected dust density at 50 km altitude as a function of dust size (M. Horanyi)





LADEE Payload

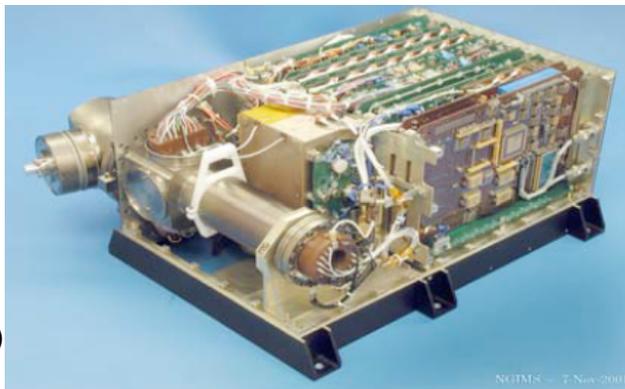


Neutral Mass Spectrometer (NMS)

MSL/SAM Heritage *SMD - Directed instrument*

In situ
measurement of
exospheric
species

P. Mahaffy
NASA GSFC
(Directed – SMD)

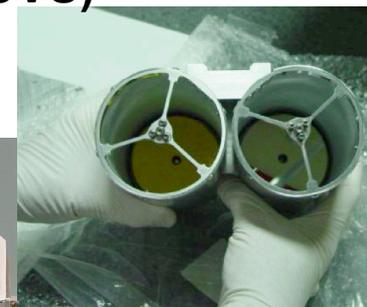


300 Dalton range/unit mass resolution

UV Spectrometer (UVS)

LCROSS heritage

SMD - Directed instrument



Dust and exosphere
measurements

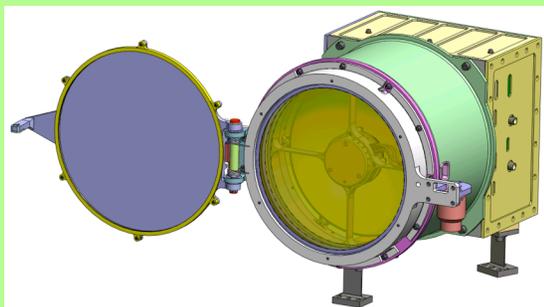
A. Colaprete
NASA ARC
(Directed – SMD)

Lunar Dust EXperiment (LDEX)

Impact ionization dust detector

HEOS 2, Galileo,
Ulysses and Cassini
Heritage

M. Horányi
LASP
(Competed – SMD)



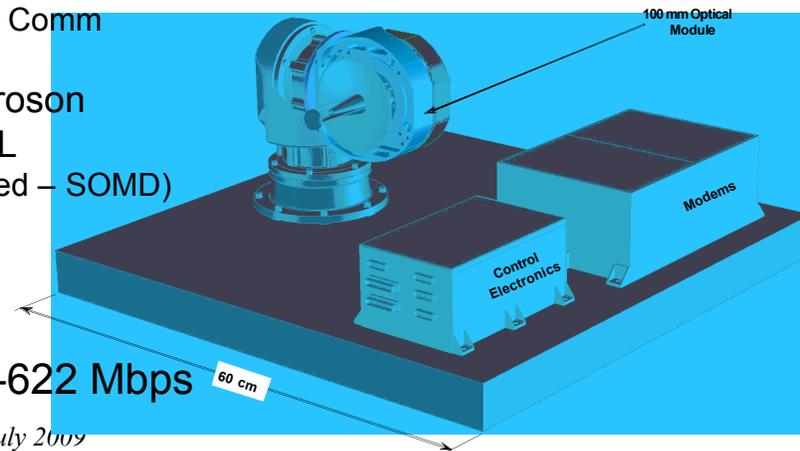
SMD - Competed instrument

Lunar Laser Com Demo (LLCD)

Technology demonstration

High Data Rate
Optical Comm

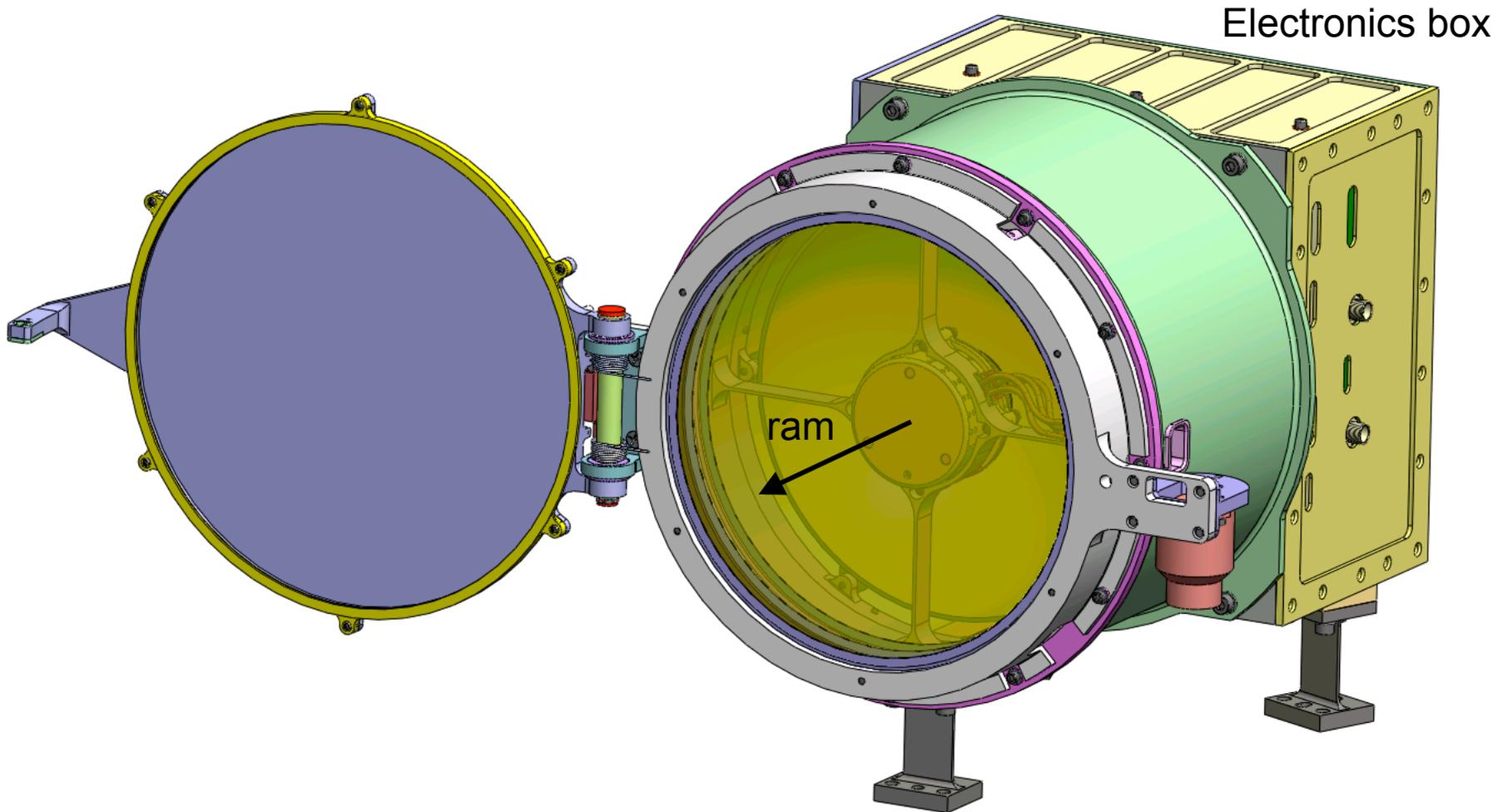
D. Boroson
MIT-LL
(Directed – SOMD)



51-622 Mbps

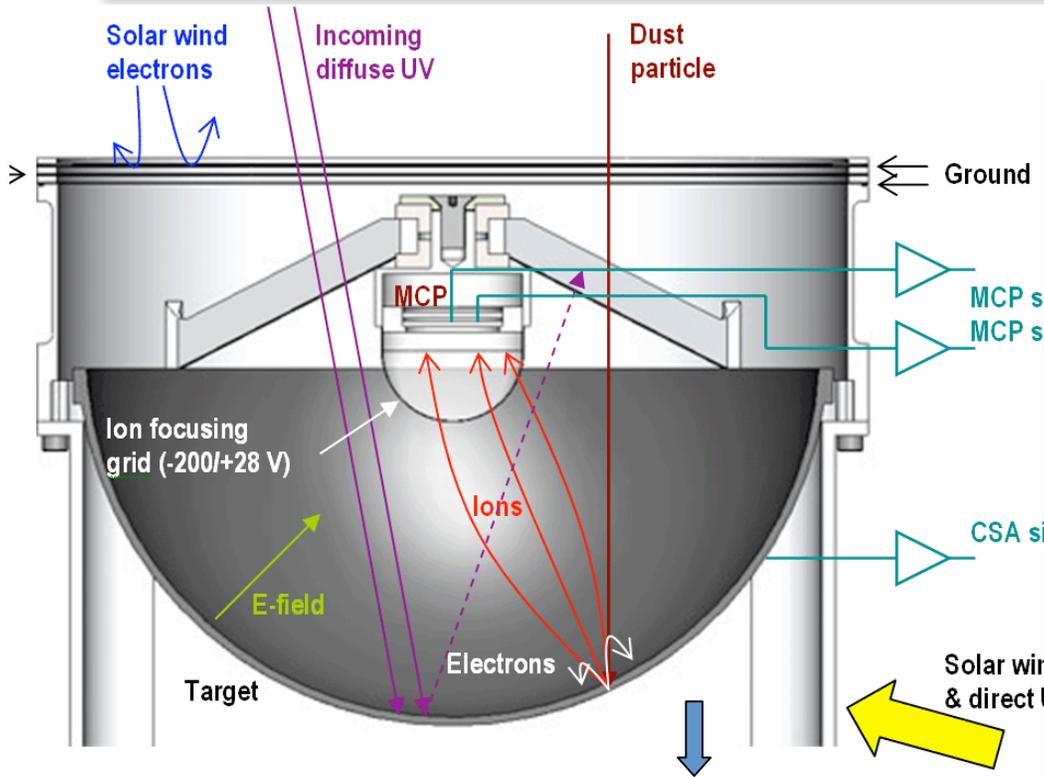
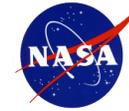


LDEX



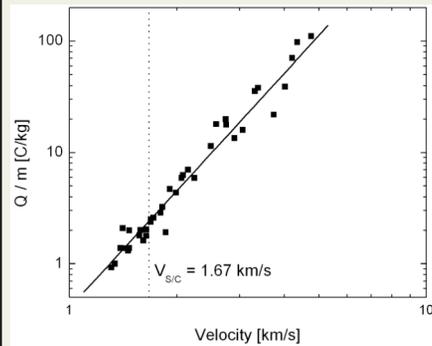
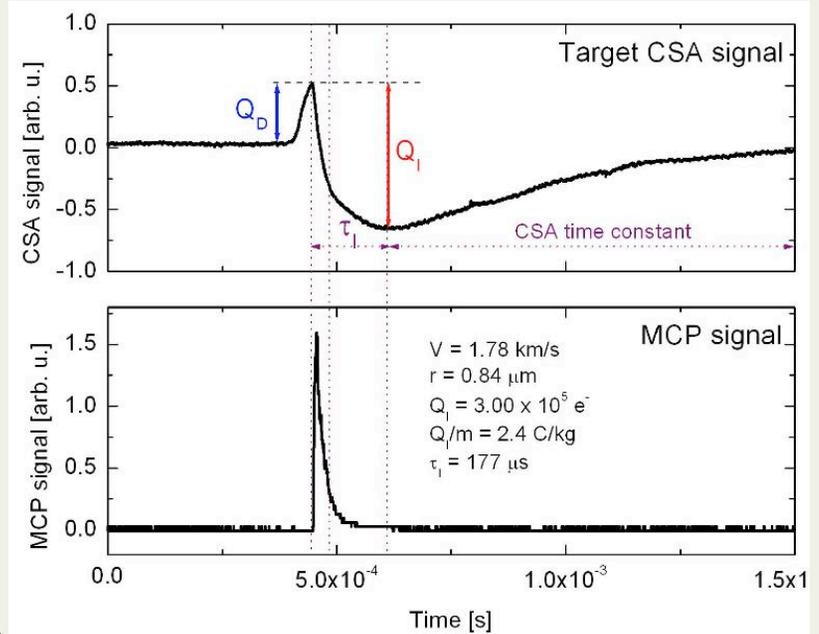


LDEX operation: impact detection



Detectors:

- target charge sensitive amp (e^-)
- Microchannel plate (ions)



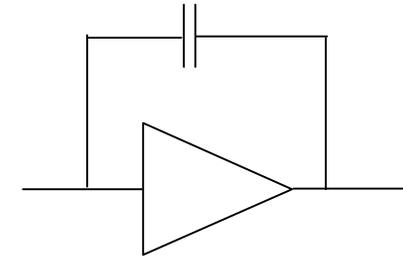
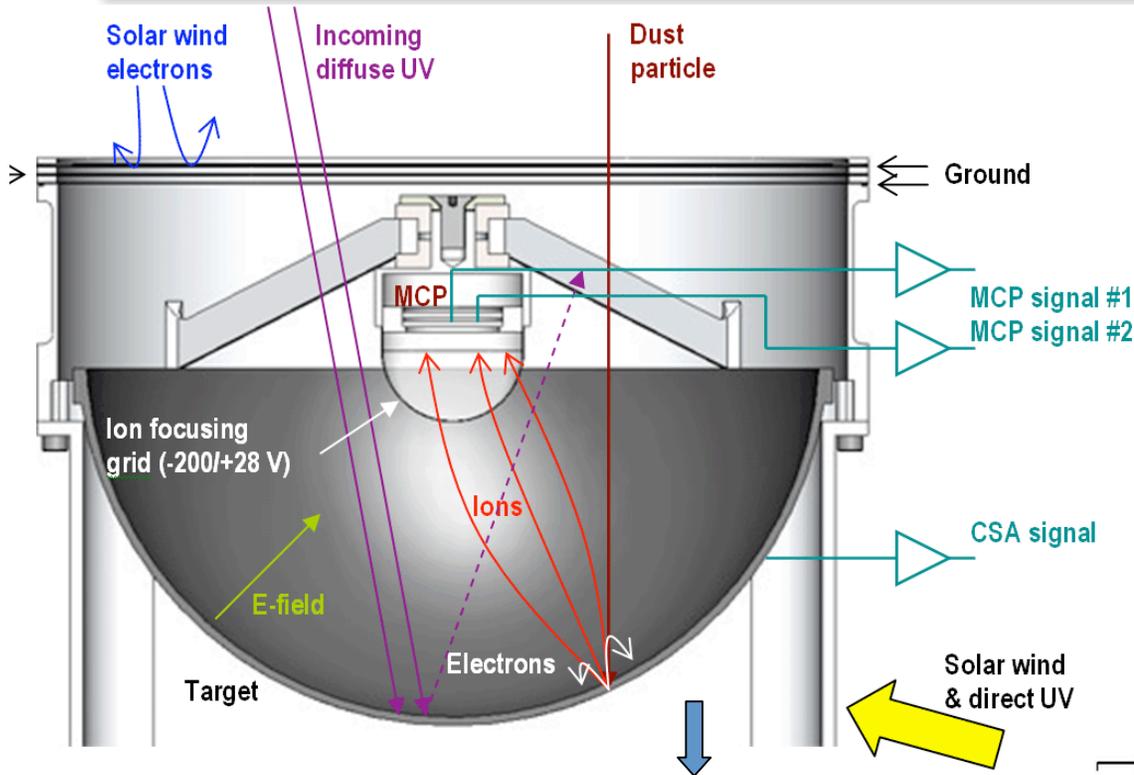
Impact ionization

$$Q/m \approx 2 \text{ C/kg}$$

(3,000 e^- for $r = 0.25 \text{ micron}$)

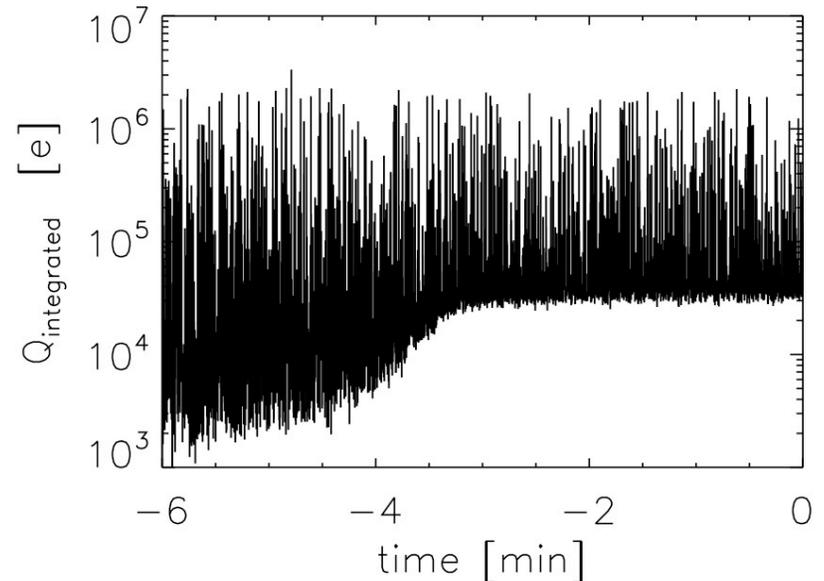


LDEX operation: collective charge



Charge integration over 100 ms

Integration mode: measuring the collective charge of ~0.1 micron particles impacting at high rate.

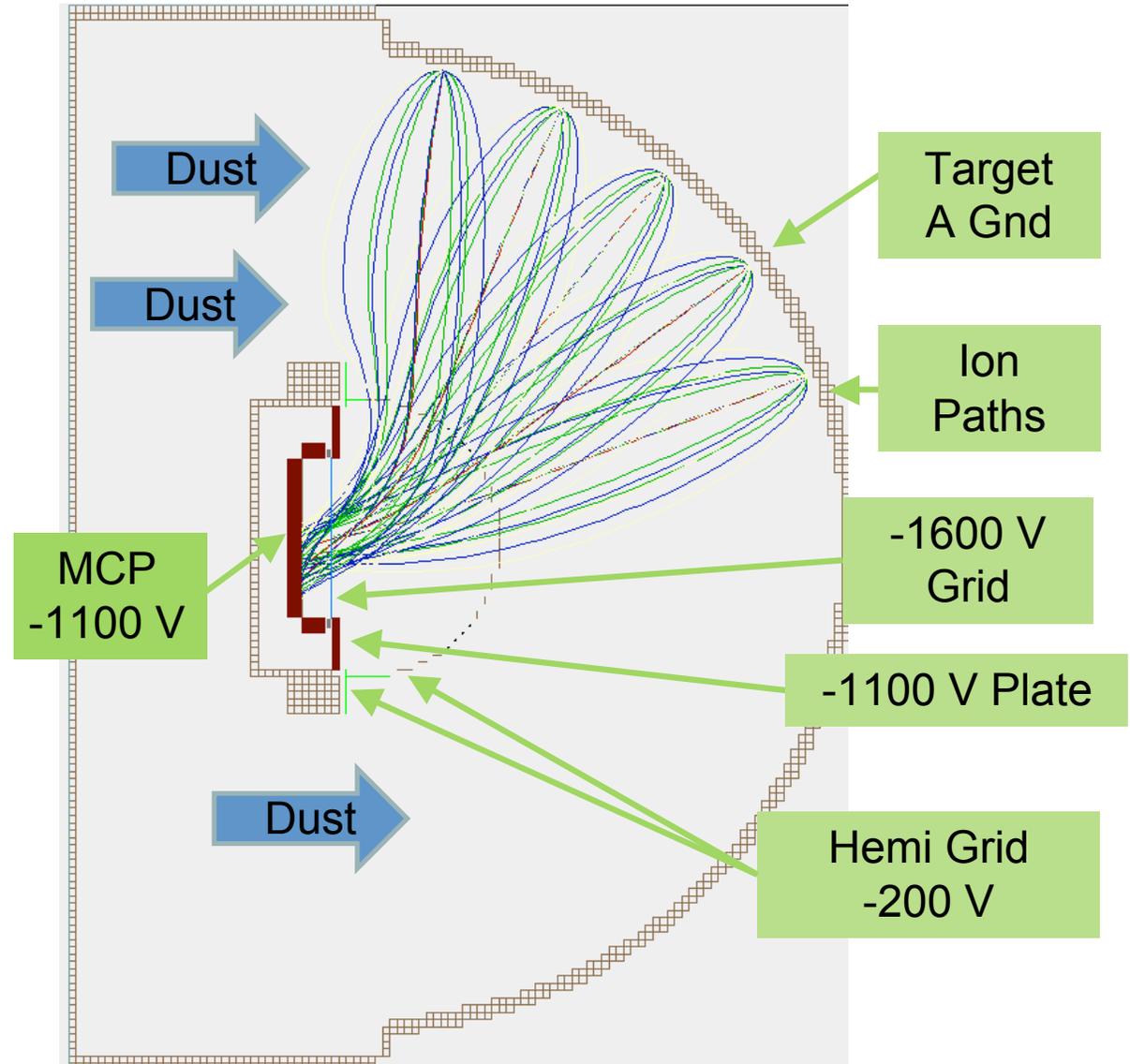
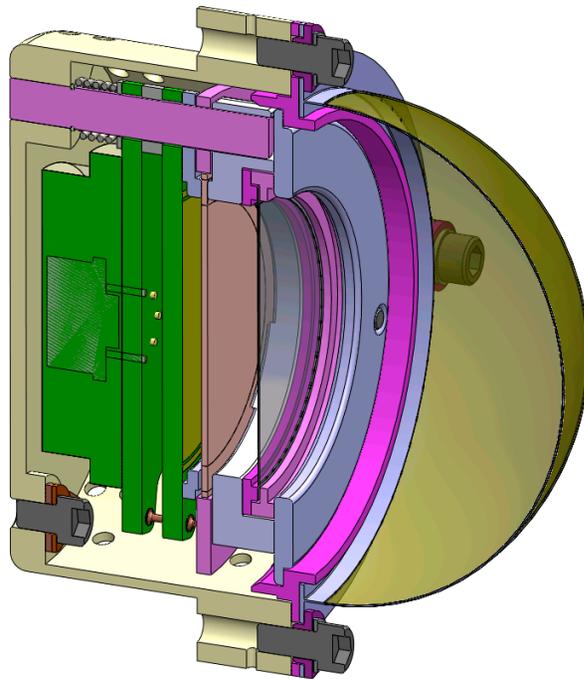




LDEX: Ion optics design

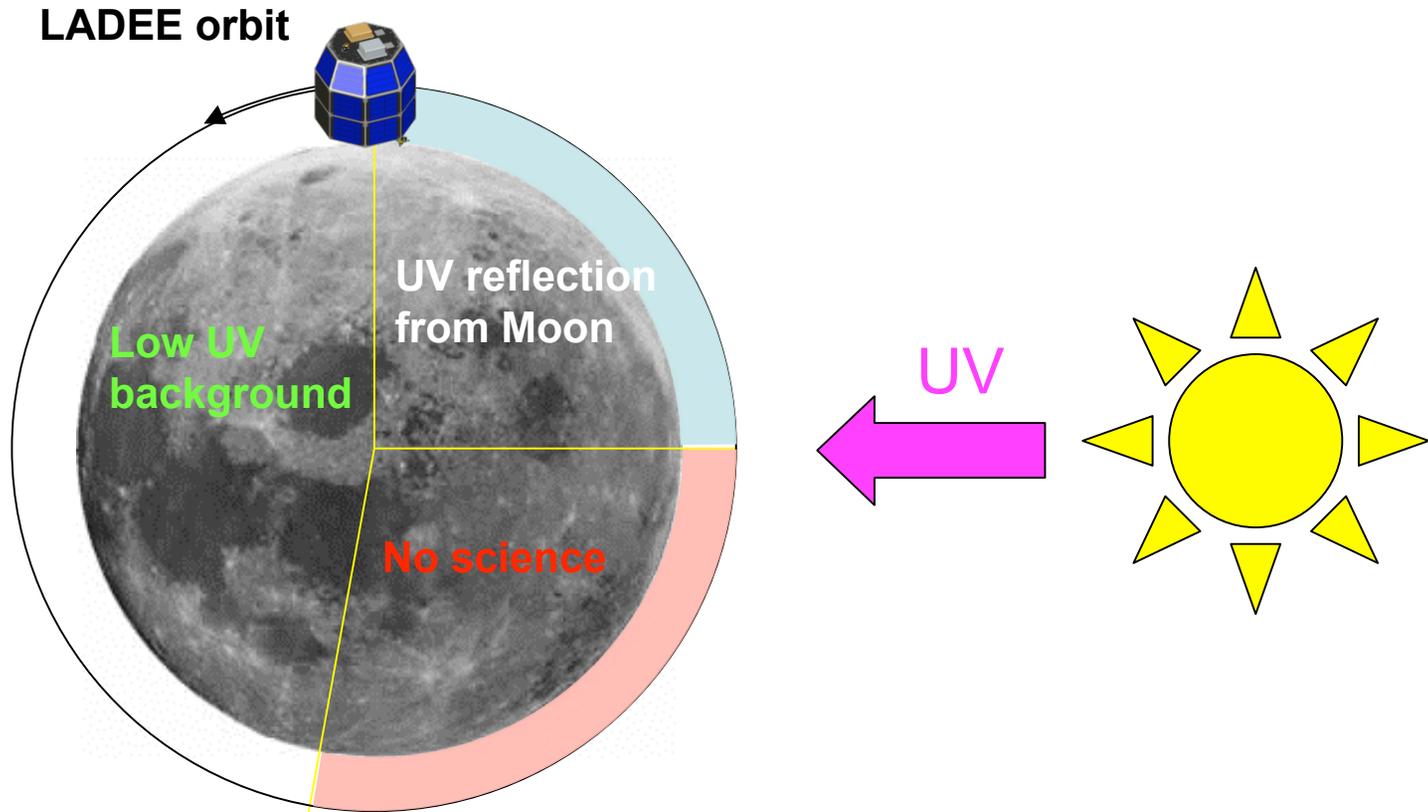


MCP detector housing





UV environment





Summary and conclusions



- LDEX can detect individual particles $r > 0.3$ micron
- Smaller particles measured collectively
- Design optimized to work in the UV environment
- Current status:
 - Prototype electronics boards in production
 - PDR in September 2009
- Launch in 2012