Lunar Fiber Particles detected with approximately 20kV test system working.

Angular/velocity distribution of particulate debris?

Angular/energy distribution of vapor?

Solar wind and UV sputtering: 
- Composition of sputtered material?
- Na preferentially removed from rock surfaces by sputtering?
- Conditions where sputtered Helium have sub-escape velocities?
- Solar wind hydrogen and carbon escape mechanism from Moon?

Laboratory investigation can provide input to analysis / interpretation of LADEE measurements.

### Scientific Questions

**Micrometeoroid impact effects:**
- Composition of impact-generated vapor?
- Dependence of vapor composition on impact energy or soil grain size distribution?
- Angular/energy distribution of vapor?
- Angular/velocity distribution of particulate debris?

**Solar wind and UV sputtering:**
- Composition of sputtered material?
- Na preferentially removed from rock surfaces by sputtering?
- Conditions where sputtered Helium have sub-escape velocities?
- Solar wind hydrogen and carbon escape mechanism from Moon?

### Electrostatic Dust Accelerator

- Pelletron 3 MV Electrostatic Generator
- Particle charging to surface electric fields of \( \sim 3 \times 10^9 \) V/m (\( \sim 30\%\) of field emission limit)
- Particle velocities: \( \leq 100 \) km/s
  - Similar to lunar surface
- Particles detected with multiple image-charge detectors: charge, velocity
  - Mass
- 20 cm detector \( \rightarrow \) 2-200 \( \mu \)s square pulse (SNR=2.5)
- Active selection of particles (size/velocity)
- Particle materials: Fe, Ag, Latex, ???
- Particle sizes: 0.2 - 2.5 \( \mu \)m

### Target Chambers

Large lunar environment simulation chamber, Can have UV lamps, solar wind simulator, regolith simulant floor, plasma and field probes, and dust detectors.

Schematic of UHV test chamber for \( \theta \)-resolved measurements of gaseous and particulate ejecta.

### FPGA Filtering

Filtering process done on FPGA
- Use multiple filter widths
- Filter width - variable
- Plot max of correlation vs. filter width to determine knee

**Scientific Questions**

The lunar atmosphere is a surface-bound exosphere (SBE) similar to that found on Mercury, icy satellites, the rings of Saturn, large asteroids, and Kuiper Belt objects. Its constituents arise from a dynamic balance between sources that may be sporadic (solar wind, sputtering, micrometeoroid impacts, outgassing) and loss mechanisms (escape, ionization). In an SBE, the atoms and molecules released from the surface follow approximately ballistic orbits, either returning to the surface or escaping to space without collisions. The mechanisms by which the lunar atmosphere is formed, in particular the role of constant micrometeoroid bombardment of the lunar surface, are subject to ongoing debate.

**Introduction**

**Current Status: Working Test System**

- Small Accelerator
- Complete 20kV test system working
- First dust detected!
- Detector Electronics
  - Clean square pulse down to 2us (~100 km/s)
  - Can select mass, charge, velocity
- High Voltage Control Circuitry of Dust Head
  - Fiber-optic control of pulsing characteristics completed and tested

**Schematic of Accelerator and Pickup Detectors**

- Dust Head
- Image-Charge Detector
- Target Chamber