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Update on Environments Definition and Testing

- *L2 Micrometeoroid Model Development*
- *Impact Testing of Thin Films*
- *“Combined Effects” Testing Plans*



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L2 Sporadic Meteoroid Model

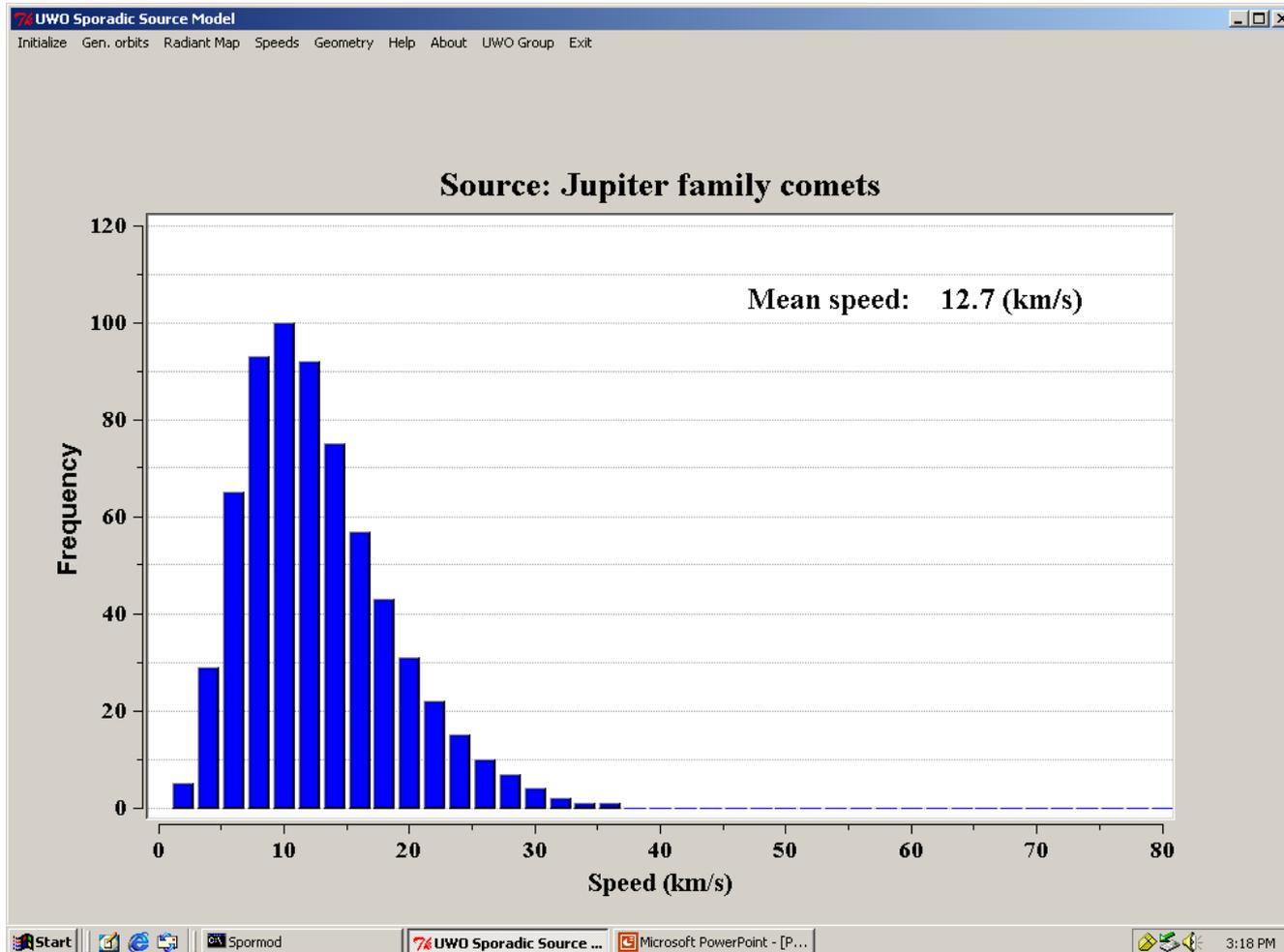
- Developed by University of Western Ontario*
 - *under funding by MSFC/Space Environments and Effects Office*
- *Includes components from short-period comets, long-period comets, and asteroids*
- Accounts for particle orbit evolution due to*
 - *solar radiation pressure and Poynting-Robertson drag*



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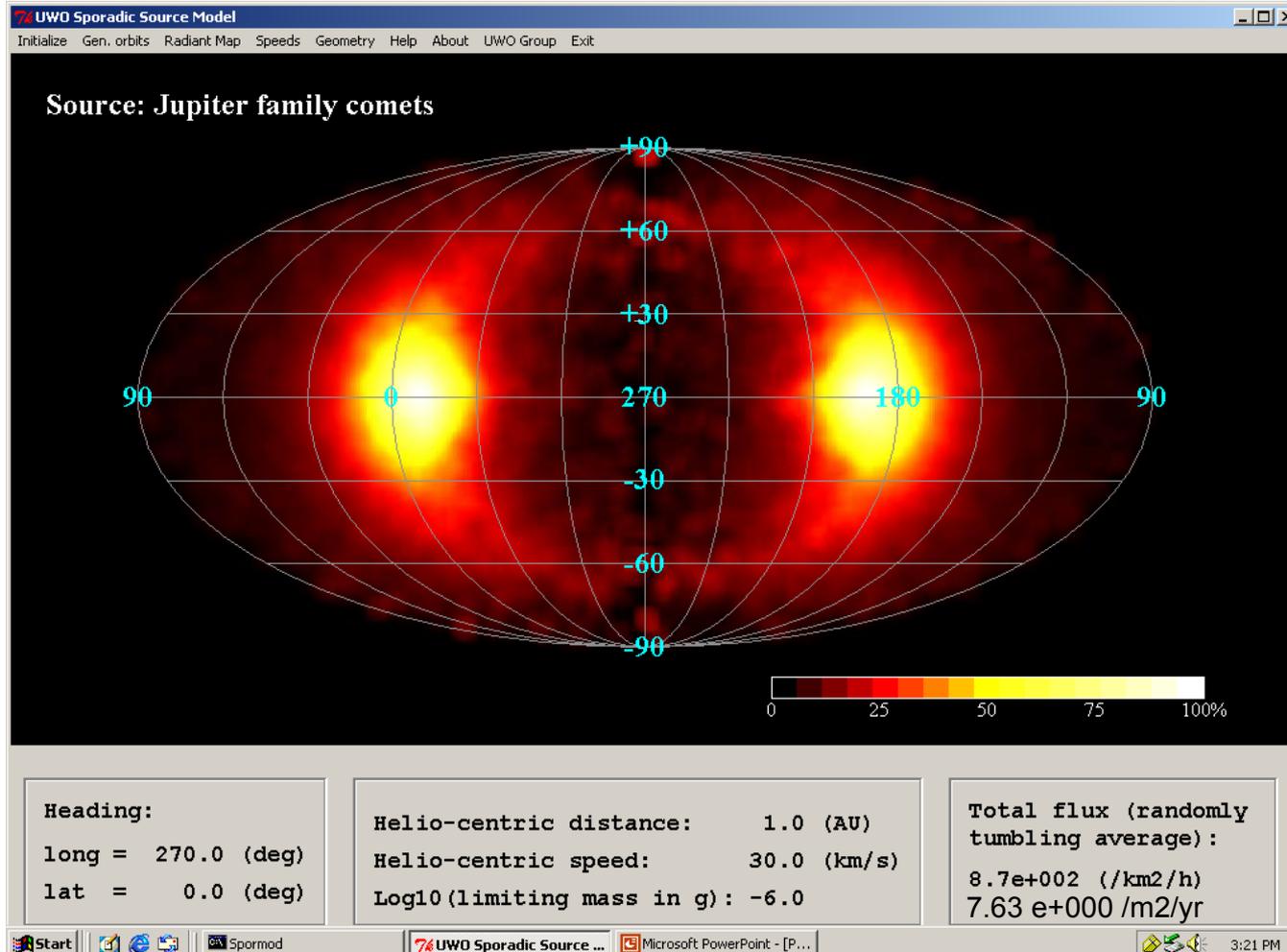




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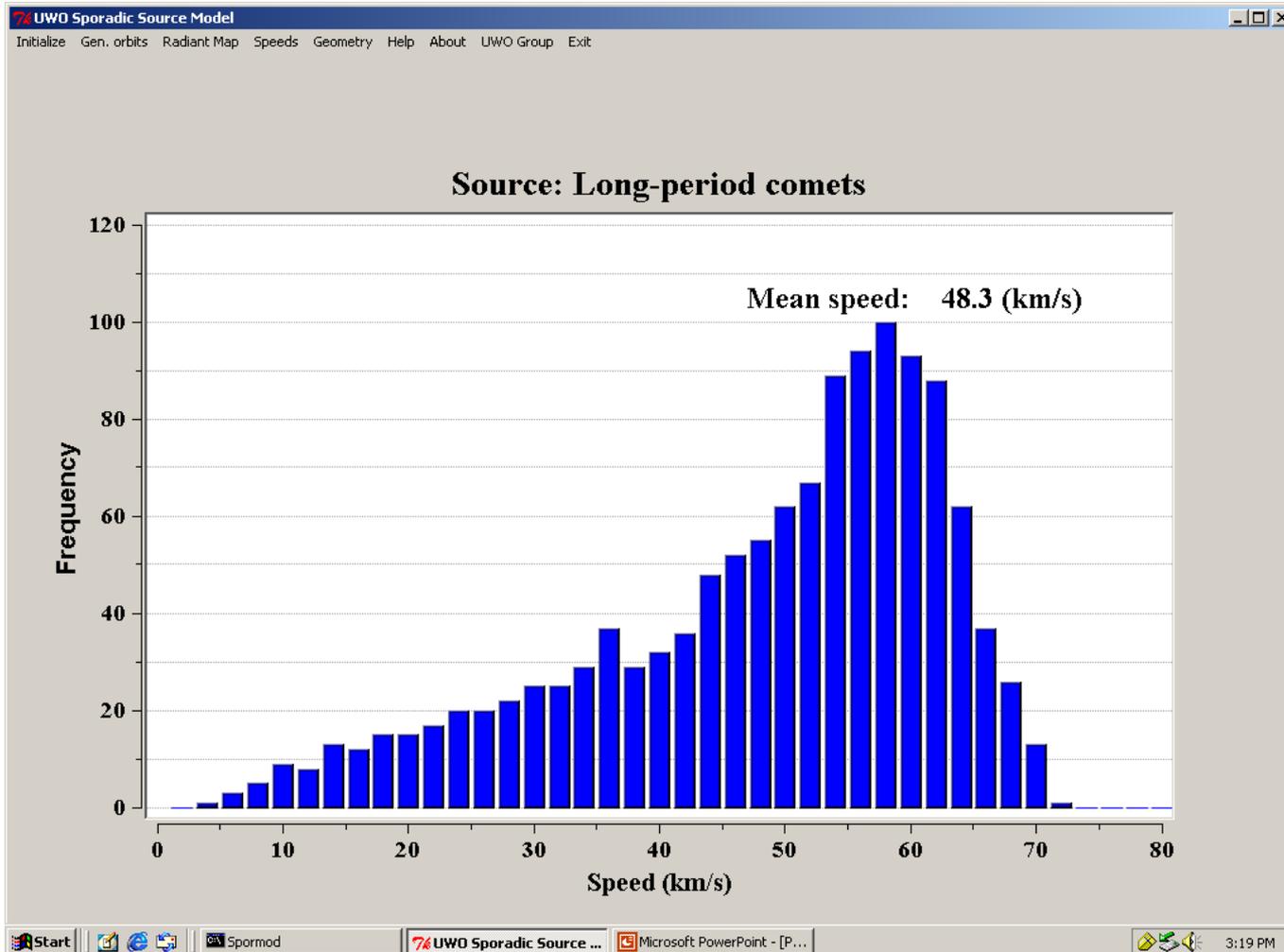
Assuming $\rho = 1 \text{ g/cm}^3$,
 $d = 124 \mu\text{m}$
Mean KE > 0.08 joule



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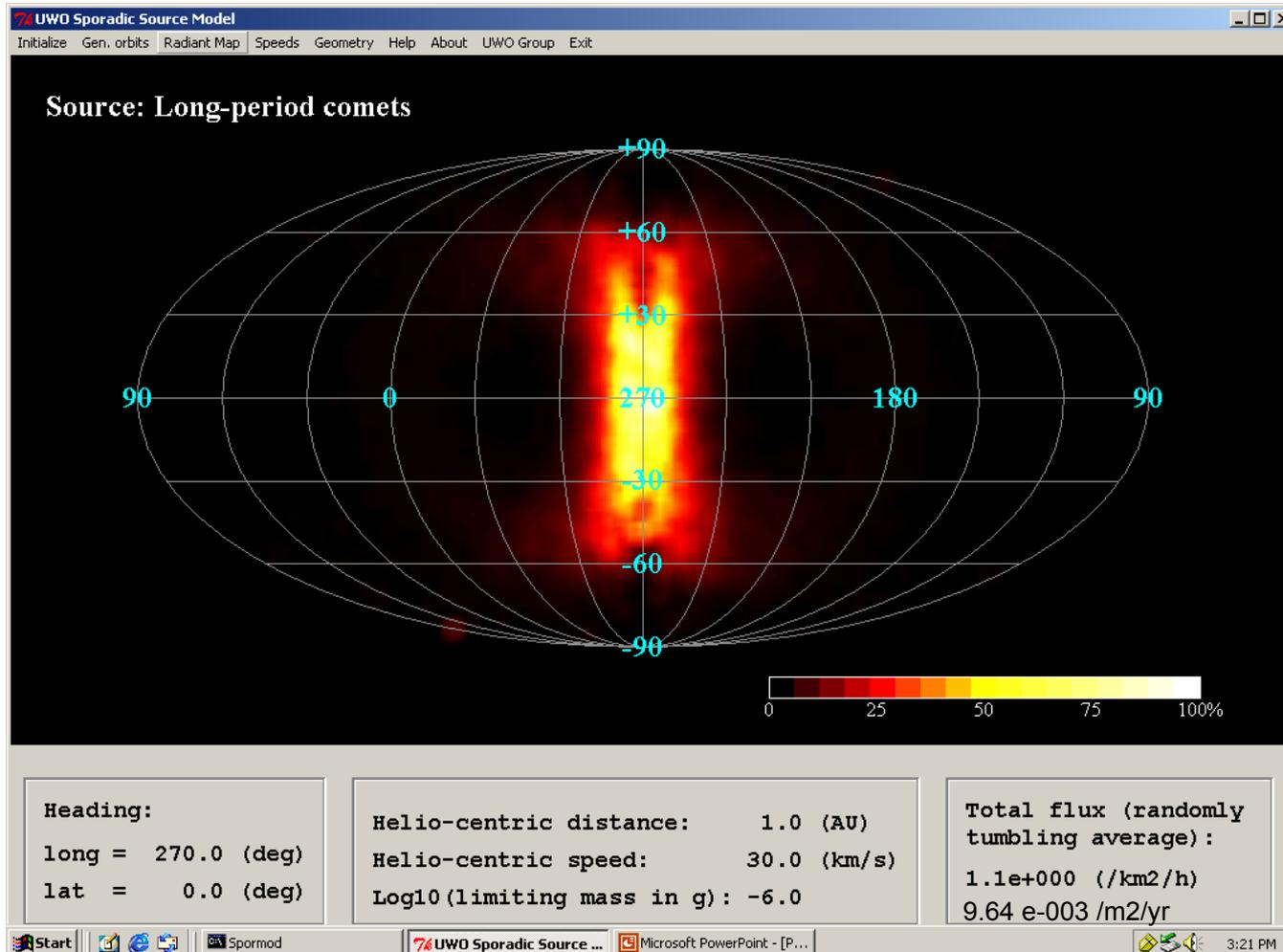




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Mean KE > 1.16 joule

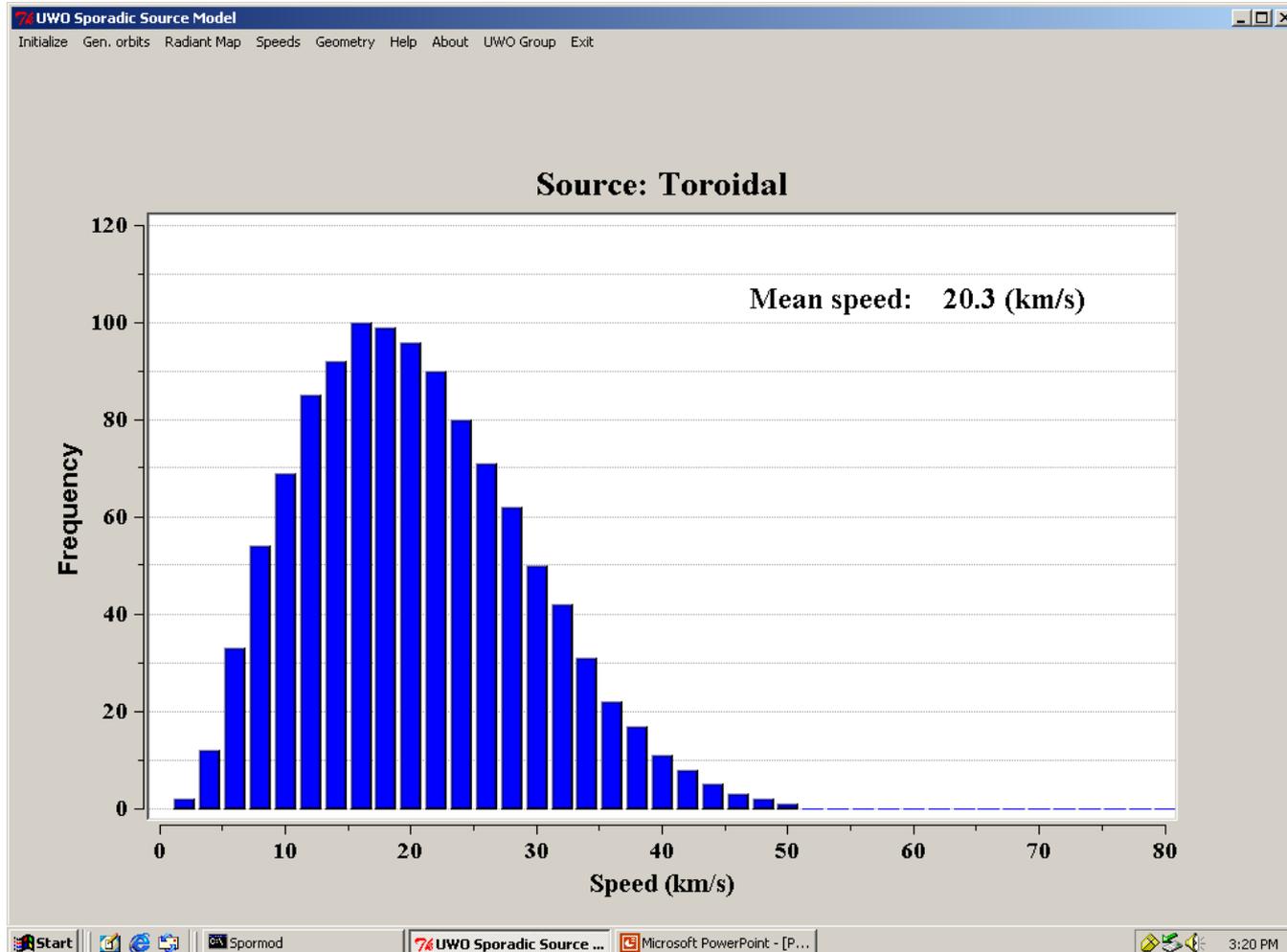
1 /m2 in 104 yr



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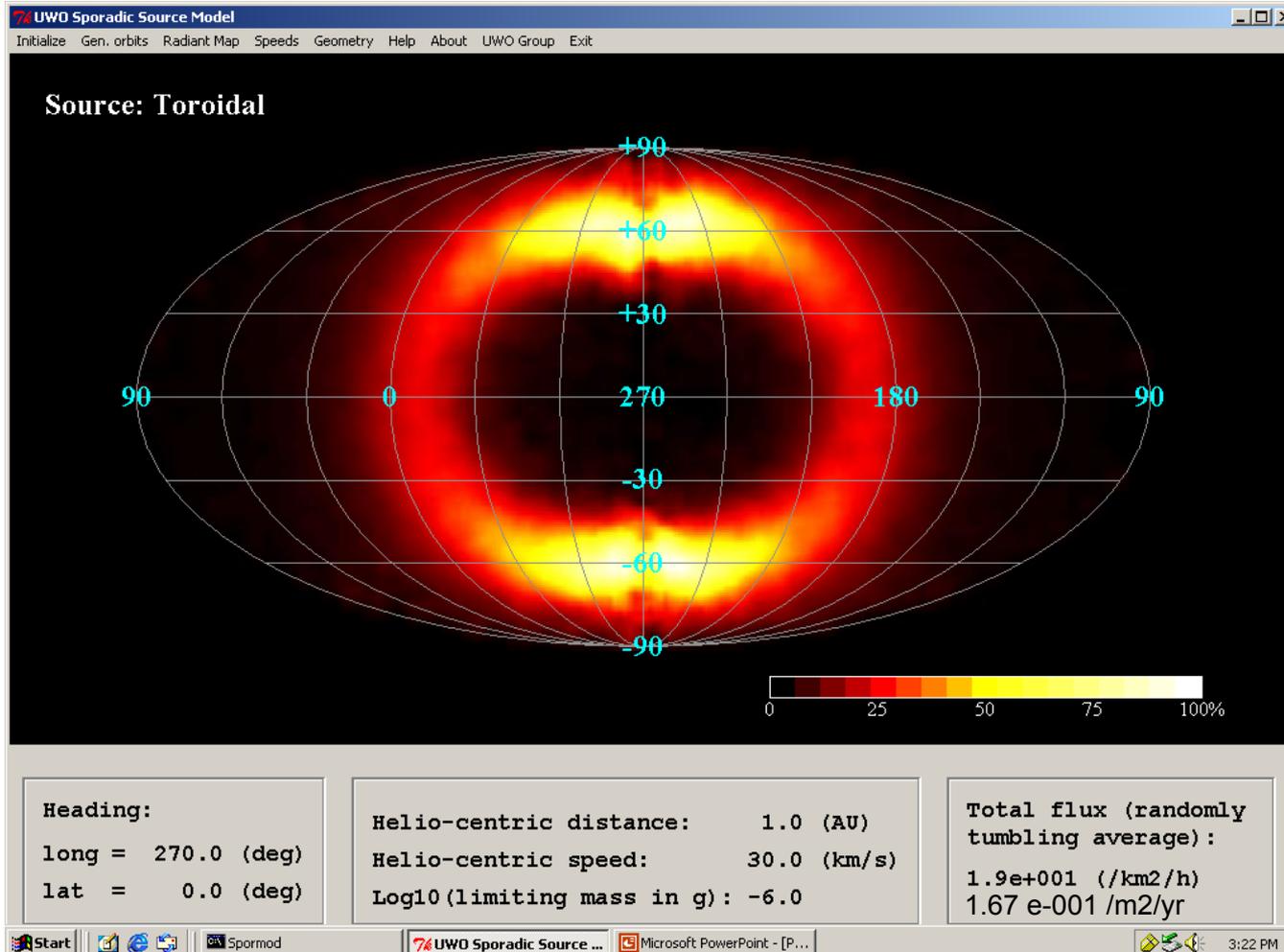




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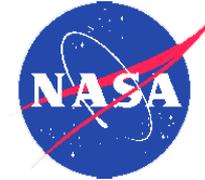


Mean KE > 0.20 joule

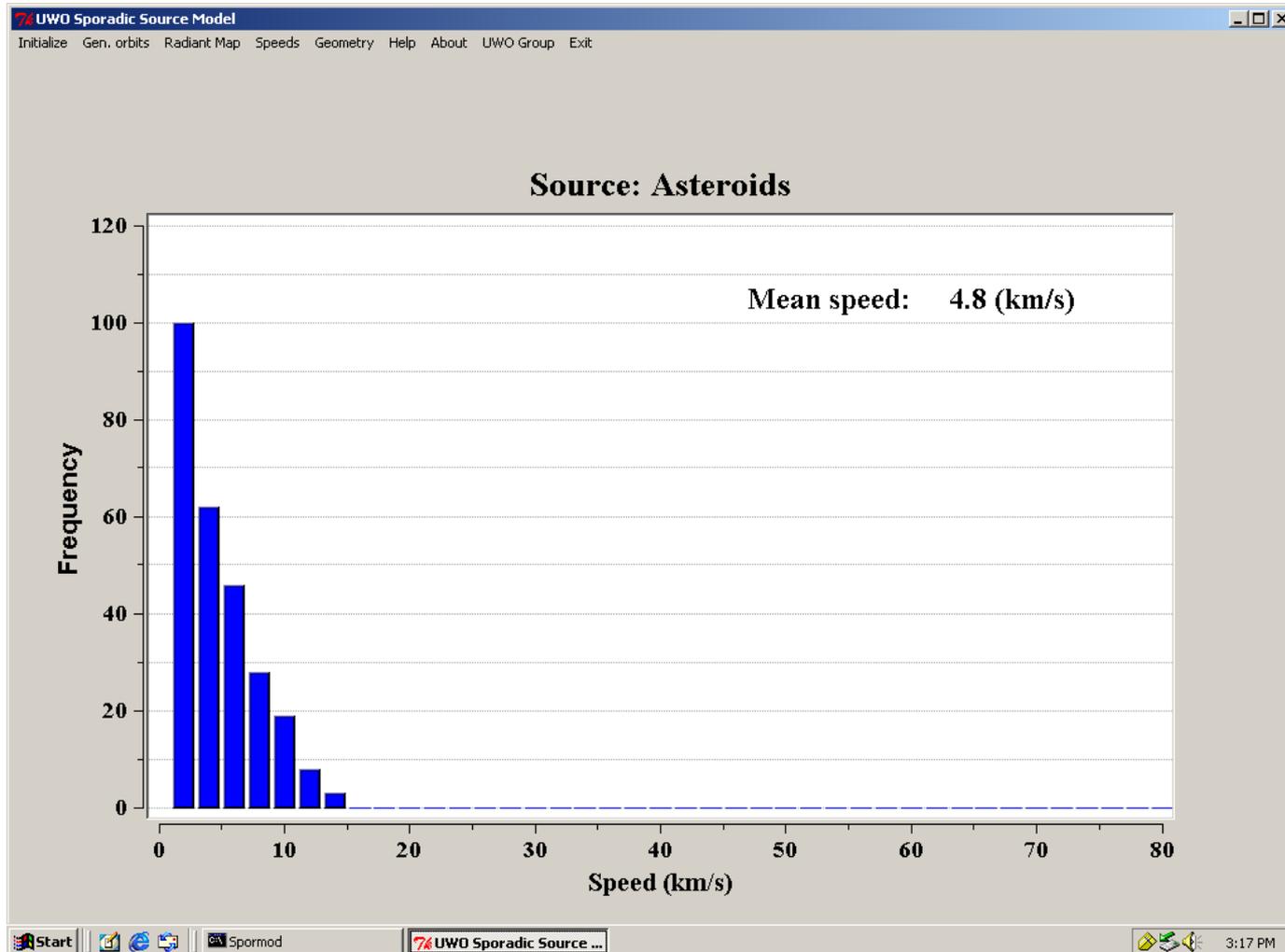
1 /m2 in 6 yr



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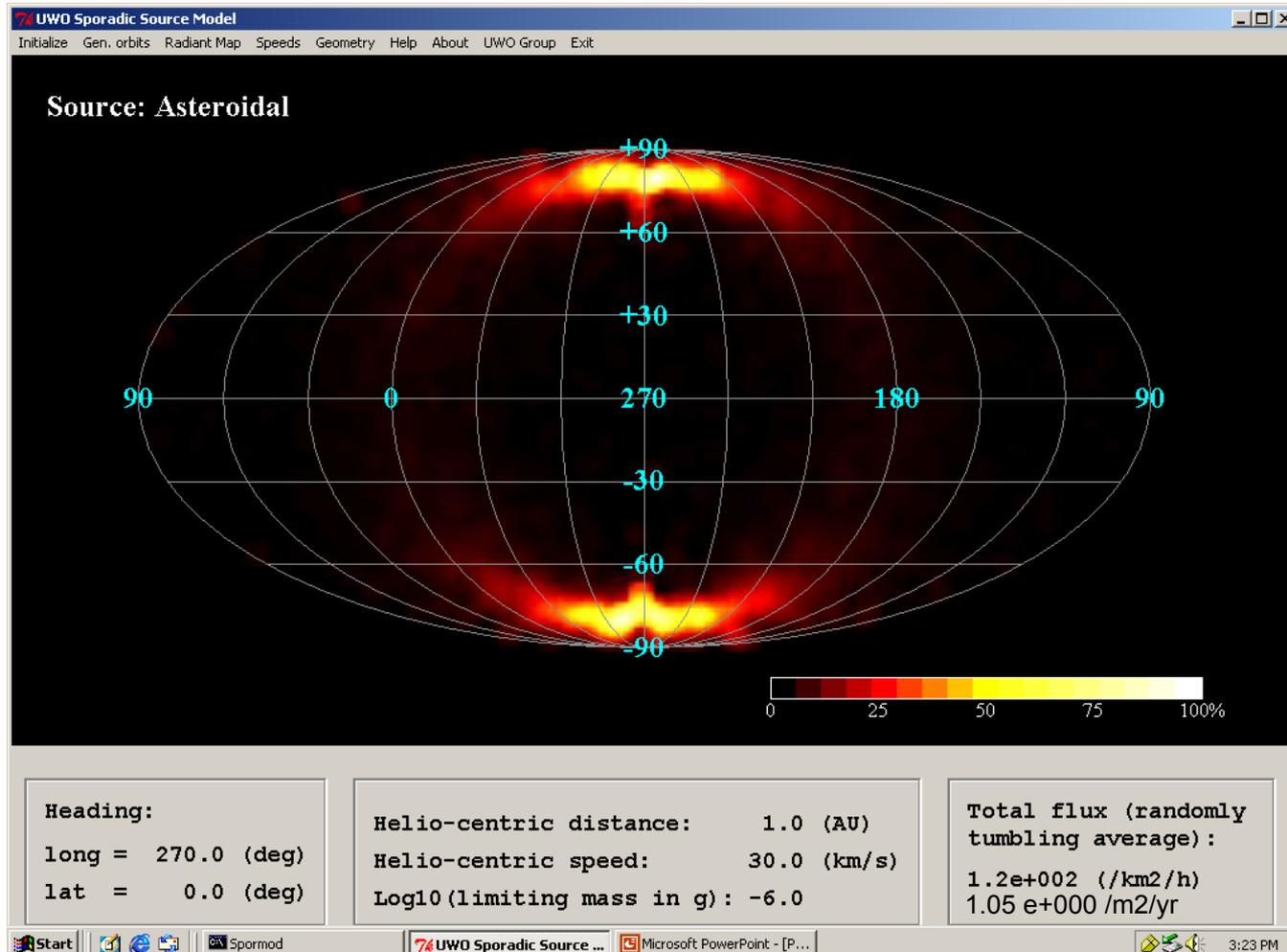




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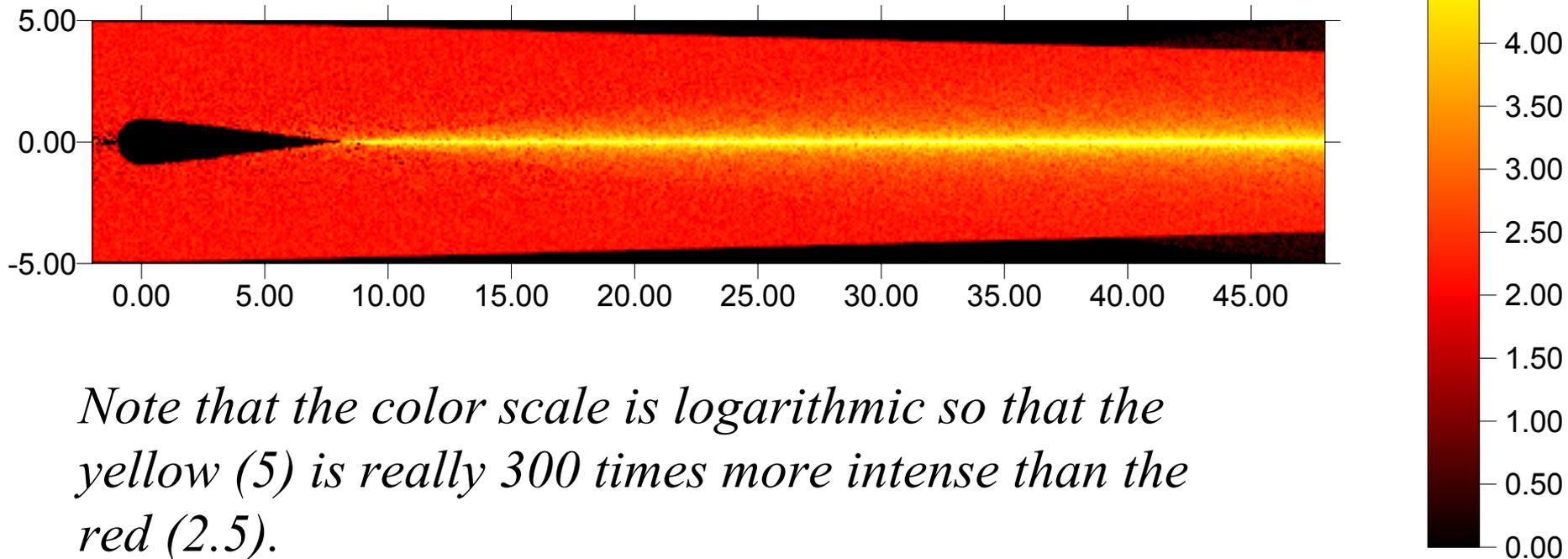


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$V_{\text{inf}} = 30 \text{ km/s}$ with a perfectly collimated beam coming from the left. The dimensions are in units of Earth radius.



... under development, not yet in the mode

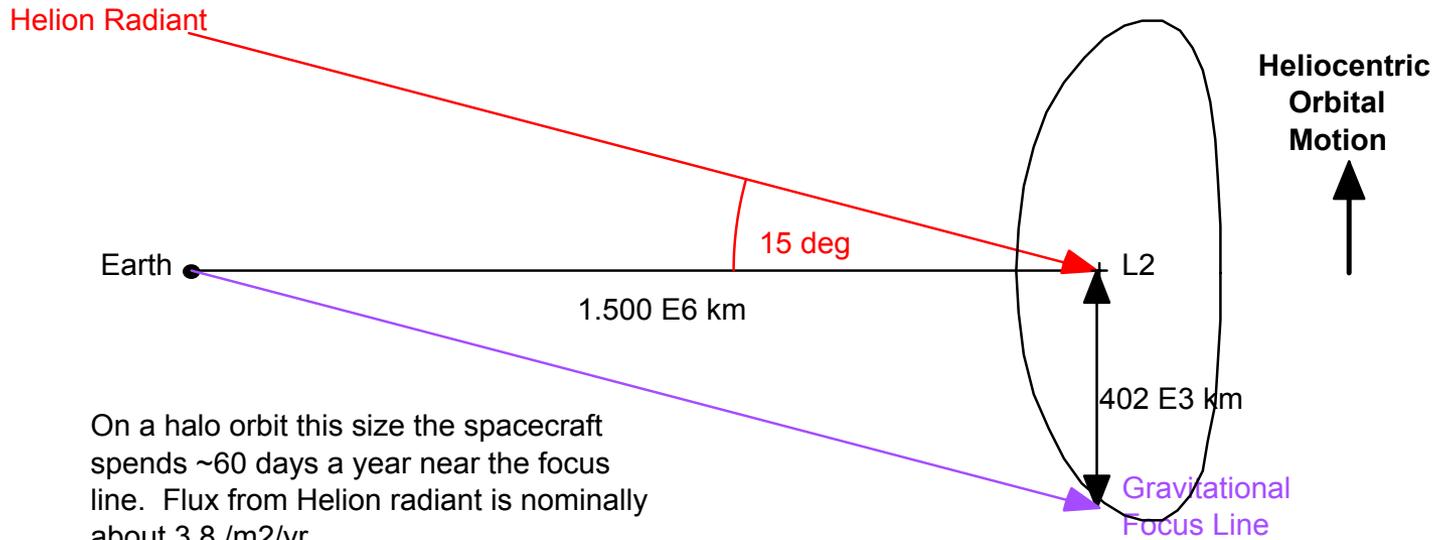


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GRAVITATIONAL FOCUSING OF METEOROID FLUX

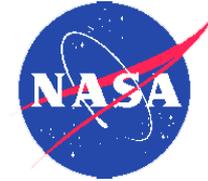


On a halo orbit this size the spacecraft spends ~60 days a year near the focus line. Flux from Helion radiant is nominally about 3.8 /m²/yr.

If enhancement factor is	flux becomes
10	9.4
100	66



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GUN TESTING OF ALUMINIZED THIN-FILMS

Film Materials: Mylar, MLI, CP-1

Shot Types:

High Obliquity, Low Velocity - 0.093" (2.36 mm) Nylon Spheres

Normal Incidence, High Velocity - 0.093" Aluminum Sphere

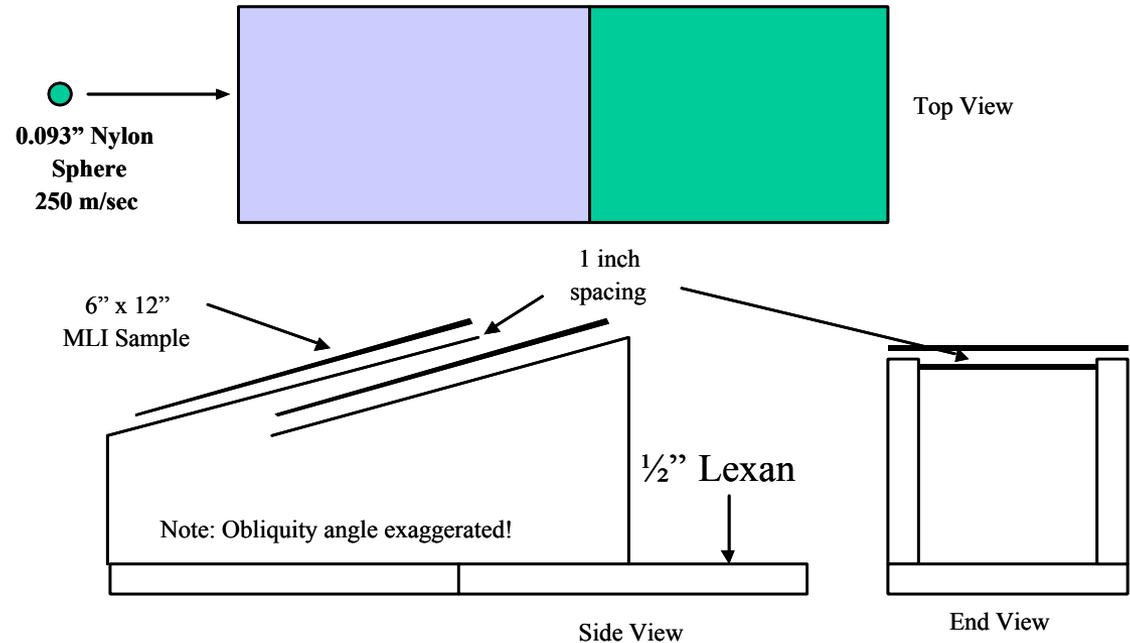


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High-obliquity, low velocity test shots on aluminized Mylar and aluminized CP-1



- Two tests at 85 degree obliquity using 2 sheets aluminized mylar at each layer
- One test at 87.5 deg obliquity using 1 sheet of One mil aluminized CP1

Nitrogen powered air gun at DRI Ballistics Test Facility



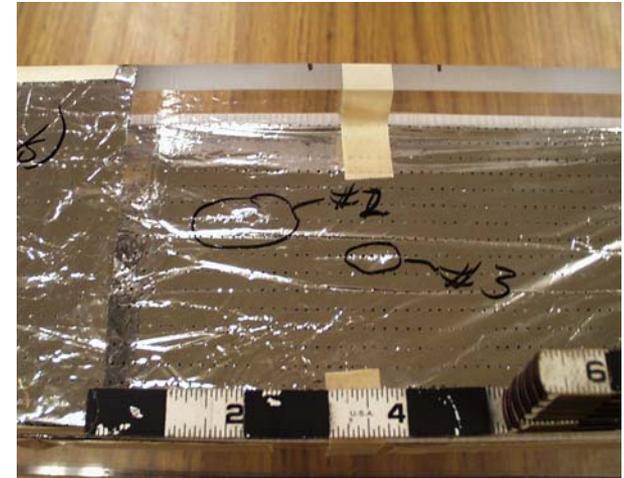
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Aluminized Mylar:
1st layer - penetrated
2nd layer - no penetration



Projectile: 2.36 mm
Nylon sphere; ~250 m/s;
Mylar: 85 deg; CP-1: 87.5 deg



Aluminized CP-1:
1st layer - no penetration





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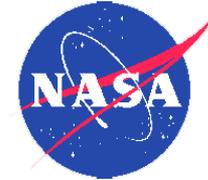
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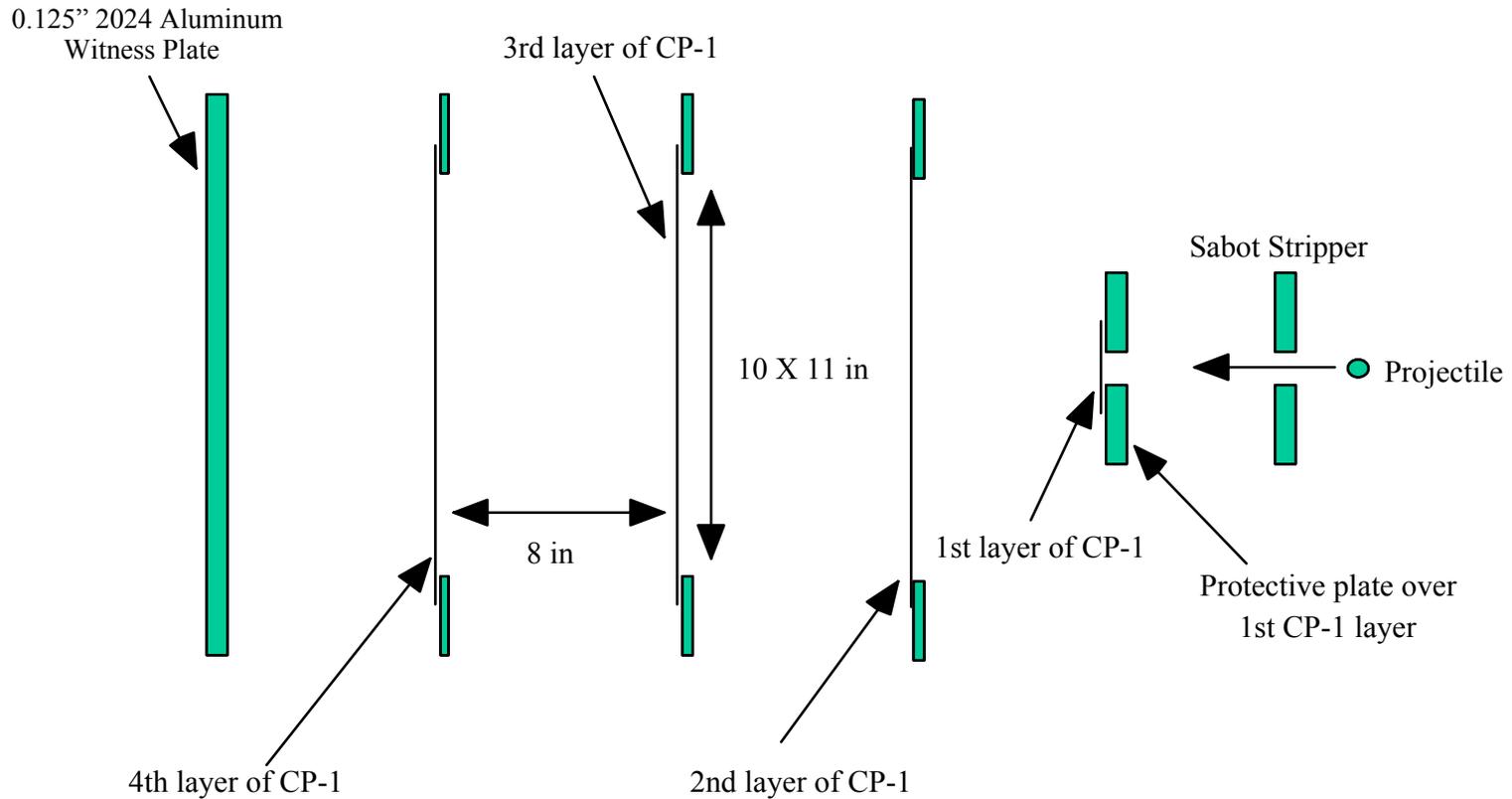
Light gas gun at DRI East Test Range facility



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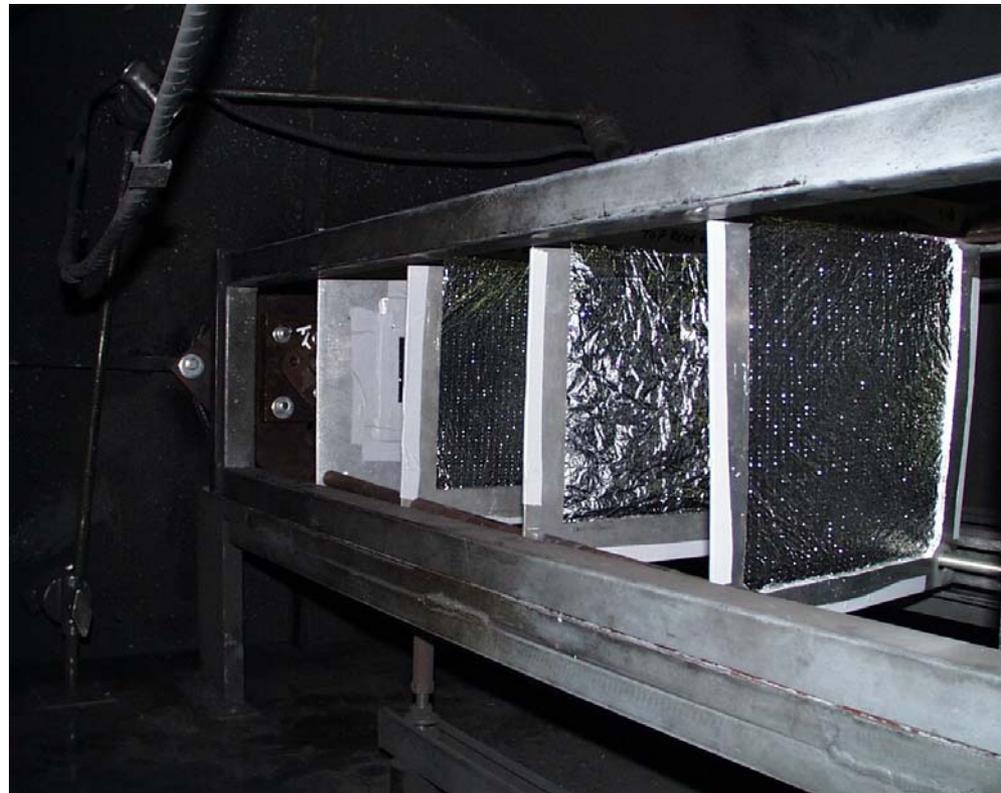




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Test article in vacuum chamber



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C. Perrygo

Reports on Shot Tests
at Auburn University

June 2000



**Site 1 - Layer 2
Debris Field**



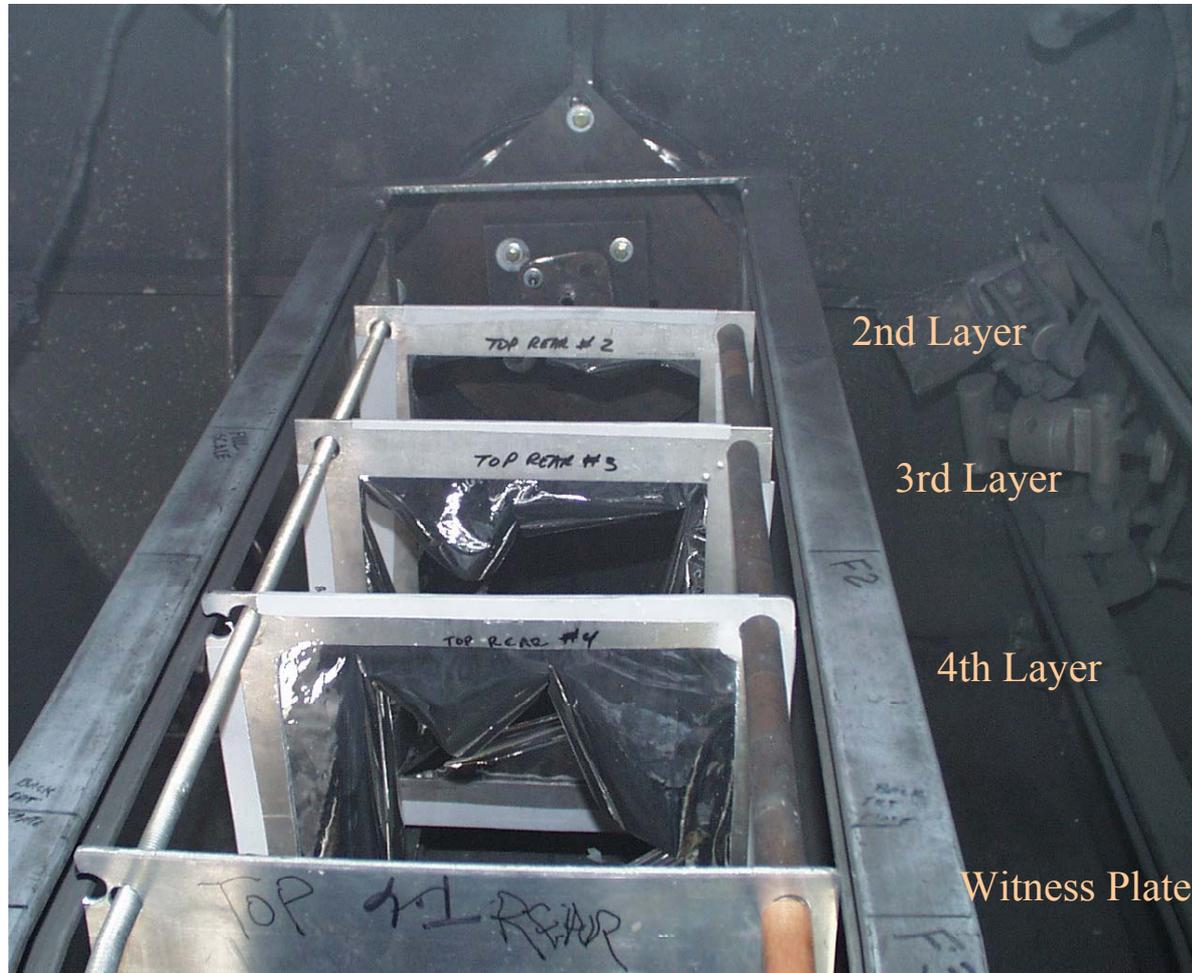
**Site 1 - Layer 3
Debris Field**



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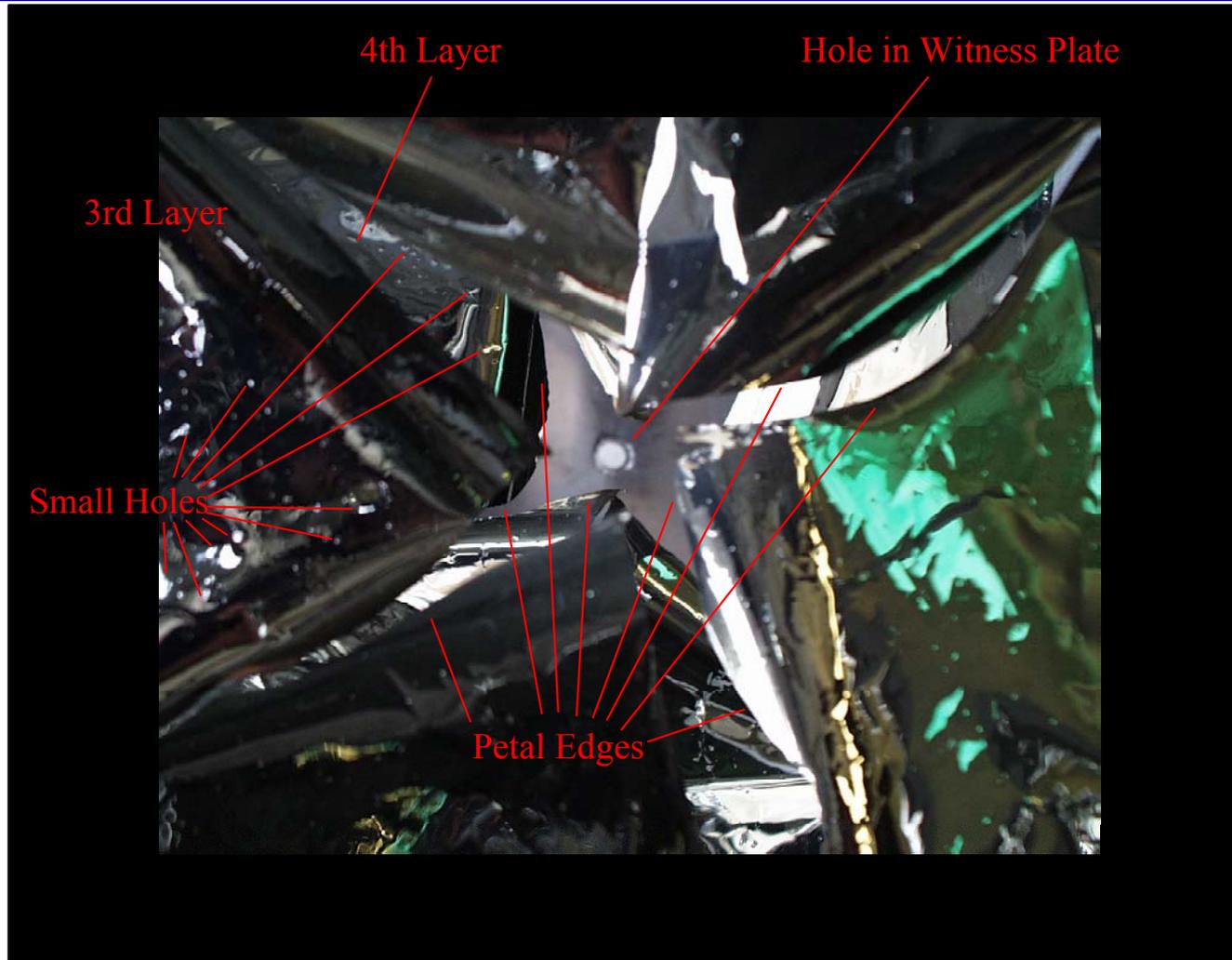




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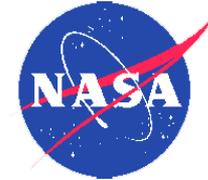


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PROPOSED “COMBINED EFFECTS” TESTING at MSFC/ED31 Environmental Test Facility

Expose sunshield and mirror samples to electron & proton fluxes.
Expose sunshield samples to Vacuum Ultraviolet flux.
Shoot exposed sunshield and mirror samples to characterize damage.

Sunshield Samples: Spaced Layers of Kapton HN

Mirror Samples: Fused Silica, ULE, Beryllium Coupons

Projectiles: 0.127 - 0.400 mm Aluminum Spheres

Shot Types:

Normal Incidence, 7+ km/s

High Obliquity, 500 m/s - 7+ km/s

0.127 mm => 3 e-6 g => at 7 km/s, KE = 0.07 joule

0.400 mm => 9 e-5 g => at 7 km/s, KE = 2.30 joule



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Kapton HN Exposure - to test for optical/thermal property change, embrittlement, and impact damage susceptibility

Mirror Sample Exposure - to test for compaction, surface deformation, and change in impact damage susceptibility