Exploration of the Viability of HEEET as a TPS for Saturn, Neptune, & Uranus Entries

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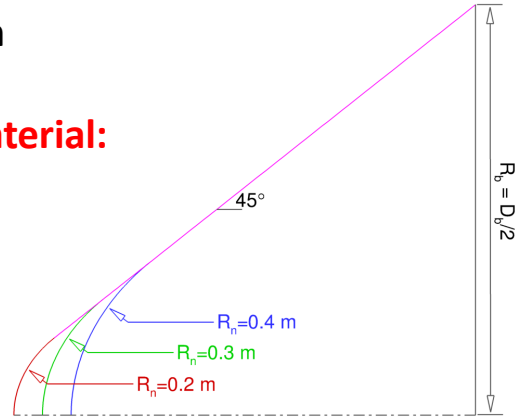
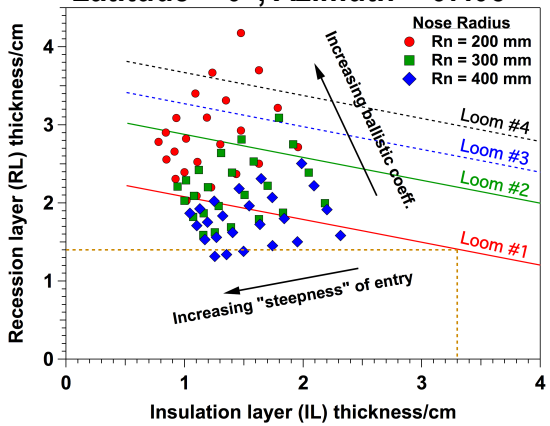
- HEEET, a dual-layer, 3D woven material which is nearly at TRL 6, has been developed for missions to Saturn & the Ice Giants, *i.e.*, for missions which experience extreme entry heating environments
- Need to determine *margined* thicknesses of HEEET & see whether the material:
  - Can be woven with existing looms, or
  - Requires upgrade(s) to the loom infrastructure
- Parameter space (for ballistic entries & representative entry velocities)
  - Entry mass range: 240 kg to 420 kg (for 1.2 m base diameter)
  - Entry flight path angle range: g loads between 50 and 200
  - Nose radii: 0.2, 0.3, and 0.4 m (Galileo: 0.22 m)
- HEEET can meet the requirements for many missions to Saturn & the Ice Giants *within the existing loom infrastructure*



SATURN

Velocity = 35.66 km/s

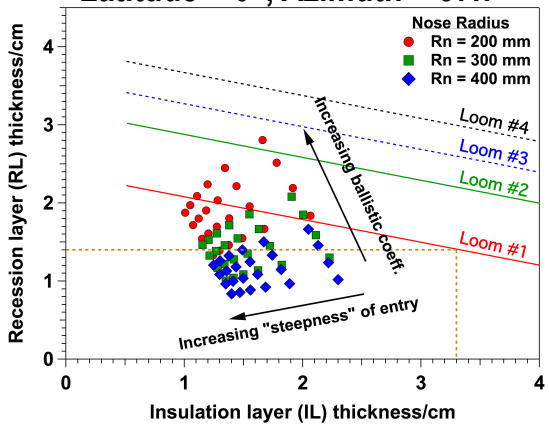
Latitude = 0°, Azimuth = 67.05°



URANUS

Velocity = 22.34 km/s

Latitude = 0°, Azimuth = 37.7°



NEPTUNE

Velocity = 24.73 km/s

Latitude = -10°, Azimuth = 76.9°