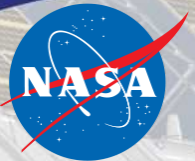


# NICER

Neutron star Interior Composition Explorer

## Soyuz Gamma-Ray Altimeter Contribution to NICER Background



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## Soyuz gamma-ray altimeter



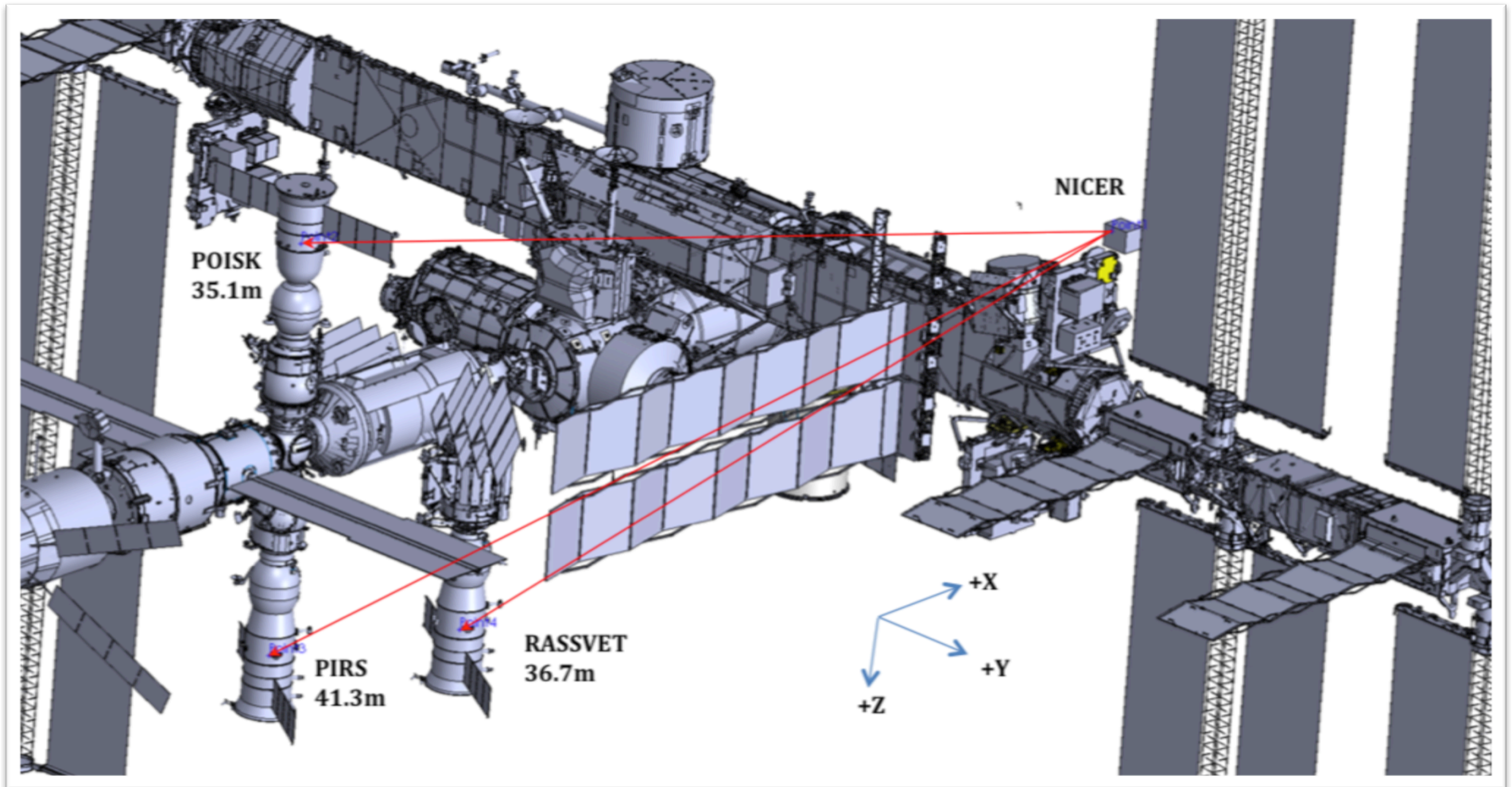
The Soyuz re-entry module's gamma-ray altimeter is used to trigger retro-boosters just before ground impact.





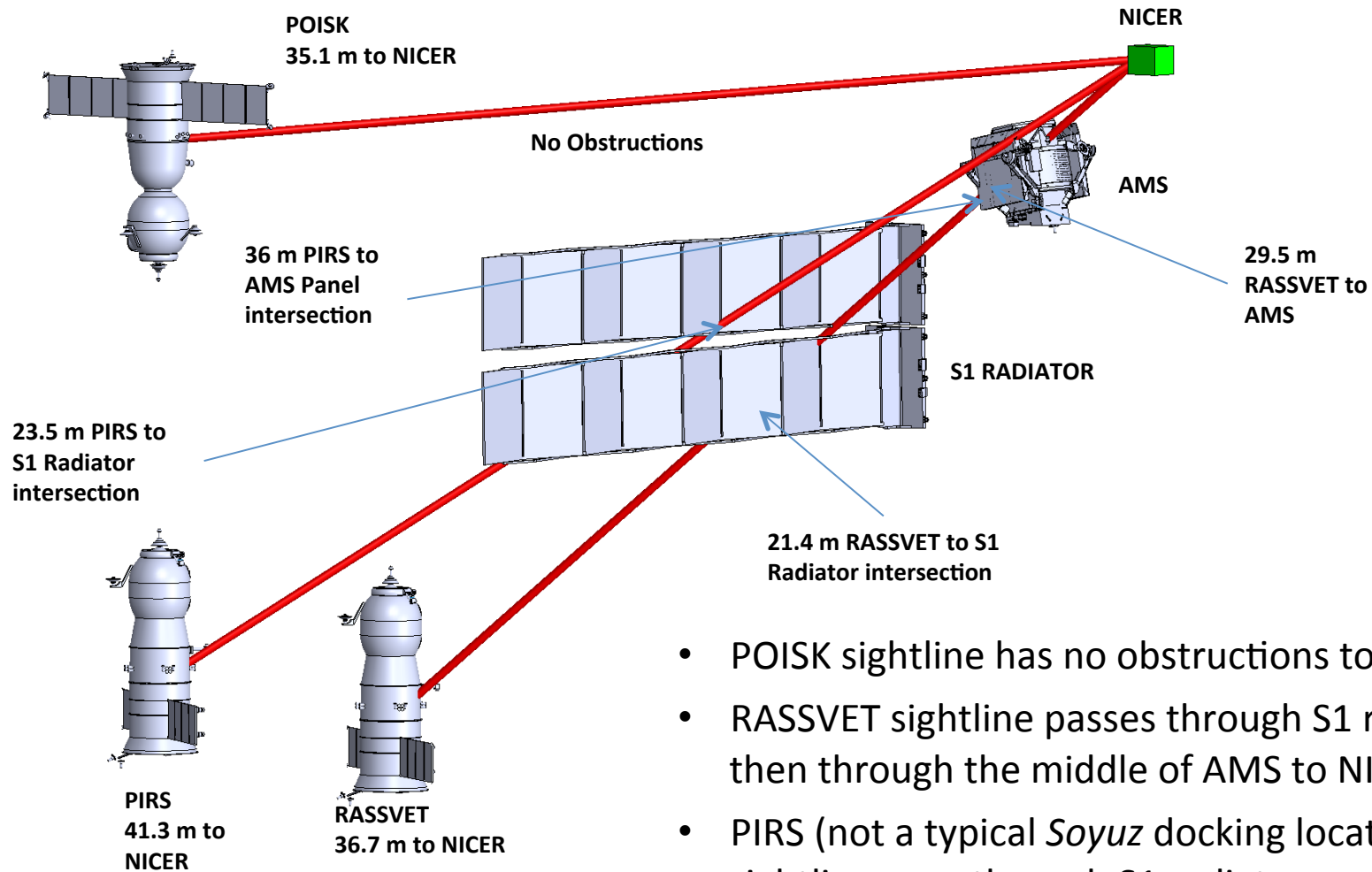
# Soyuz docking locations on ISS

Typically, two Soyuz vehicles are docked, at POISK and RASSVET locations.





# Soyuz to NICER sightlines

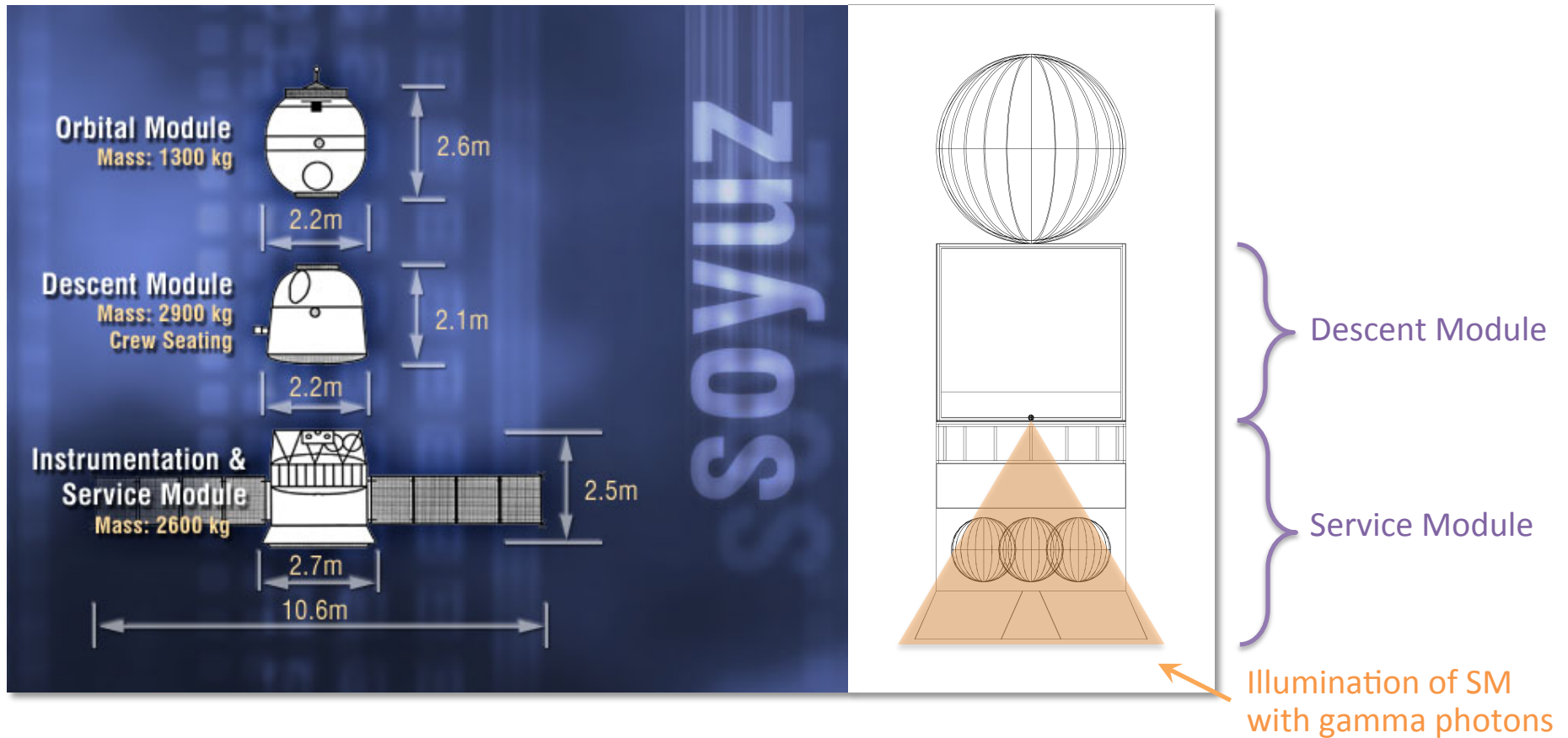


- POISK sightline has no obstructions to NICER
- RASSVET sightline passes through S1 radiator then through the middle of AMS to NICER
- PIRS (not a typical *Soyuz* docking location) sightline goes through S1 radiator and a thin panel on the AMS exterior to NICER



# Soyuz on-orbit configuration

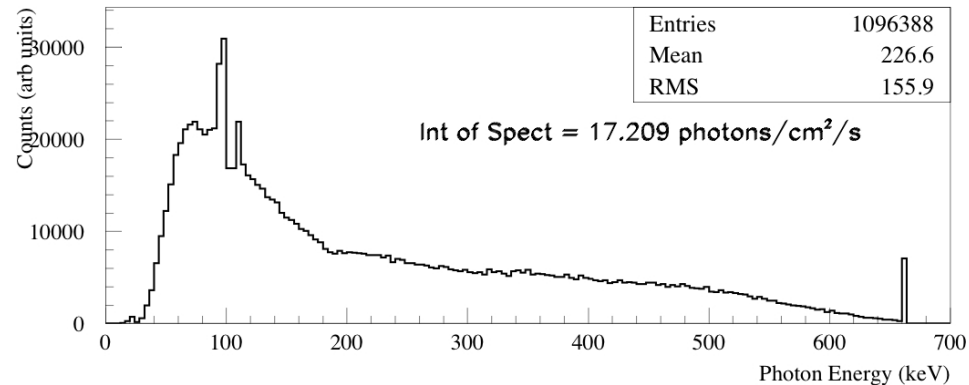
Radiation incident on NICER due to the *Soyuz* gamma-ray source is dominated by scattering in the Service Module.



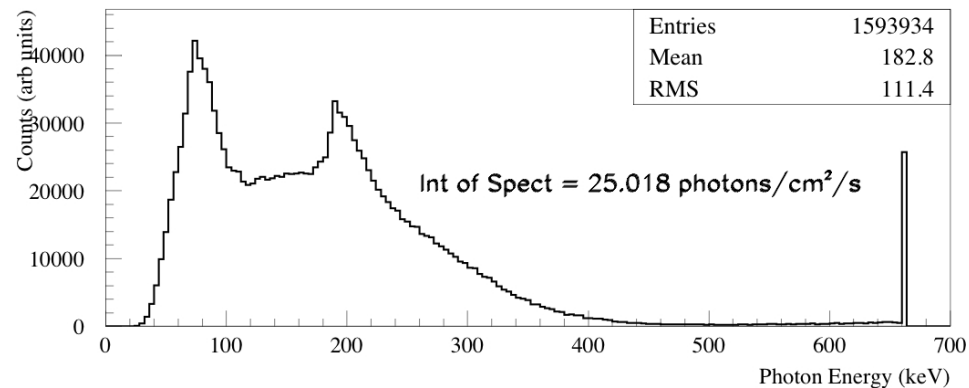


# Unshielded Soyuz spectra at NICER

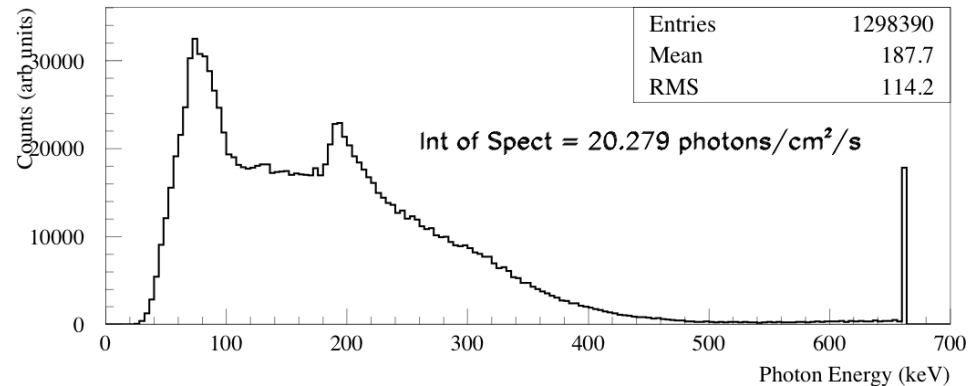
Right: Models of unshielded radiation spectra at NICER's location due to Soyuz gamma-ray altimeters. PIRS is typically occupied by a Progress vehicle, which does not have a gamma-ray altimeter, and NICER is shielded from the RASSVET Soyuz by AMS—thus, POISK is the dominant contributor to NICER's Soyuz-related background. The net effect is a (worst-case NICER orientation) factor of 3 increase in incident radiation across the NICER energy band over ambient levels. The NICER development team has added shielding to mitigate the total background.



POISK



RASSVET



PIRS