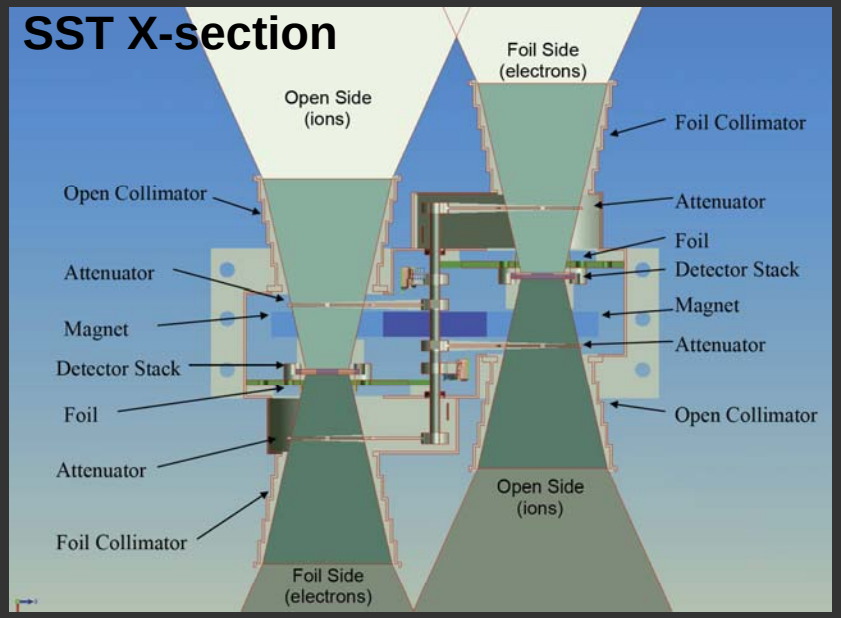
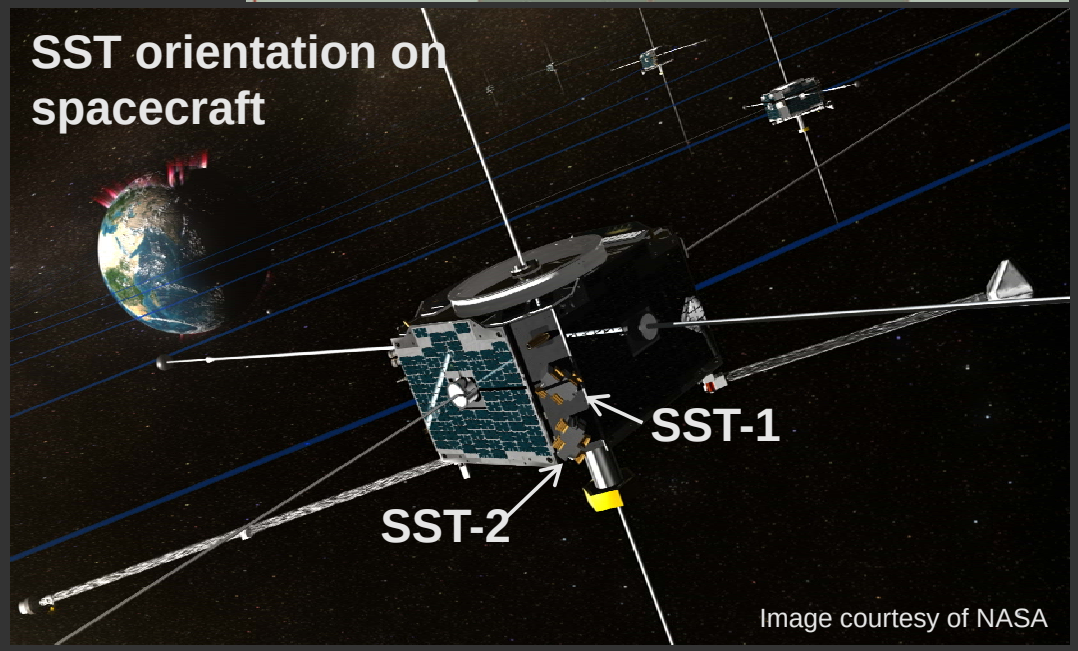
# THEMIS-SST

- SSTs provide the energetic ion and electron measurements for THEMIS and ARTEMIS
- Solid-state detector stack, collimated telescope design with Al shielding
- 2 SST instruments per spacecraft
- 4 ion and 4 electron “sides” per spacecraft
- Binning logic uses pulse-height analysis and coincidence logic
- SST is known to suffer from significant contamination in the inner magnetosphere



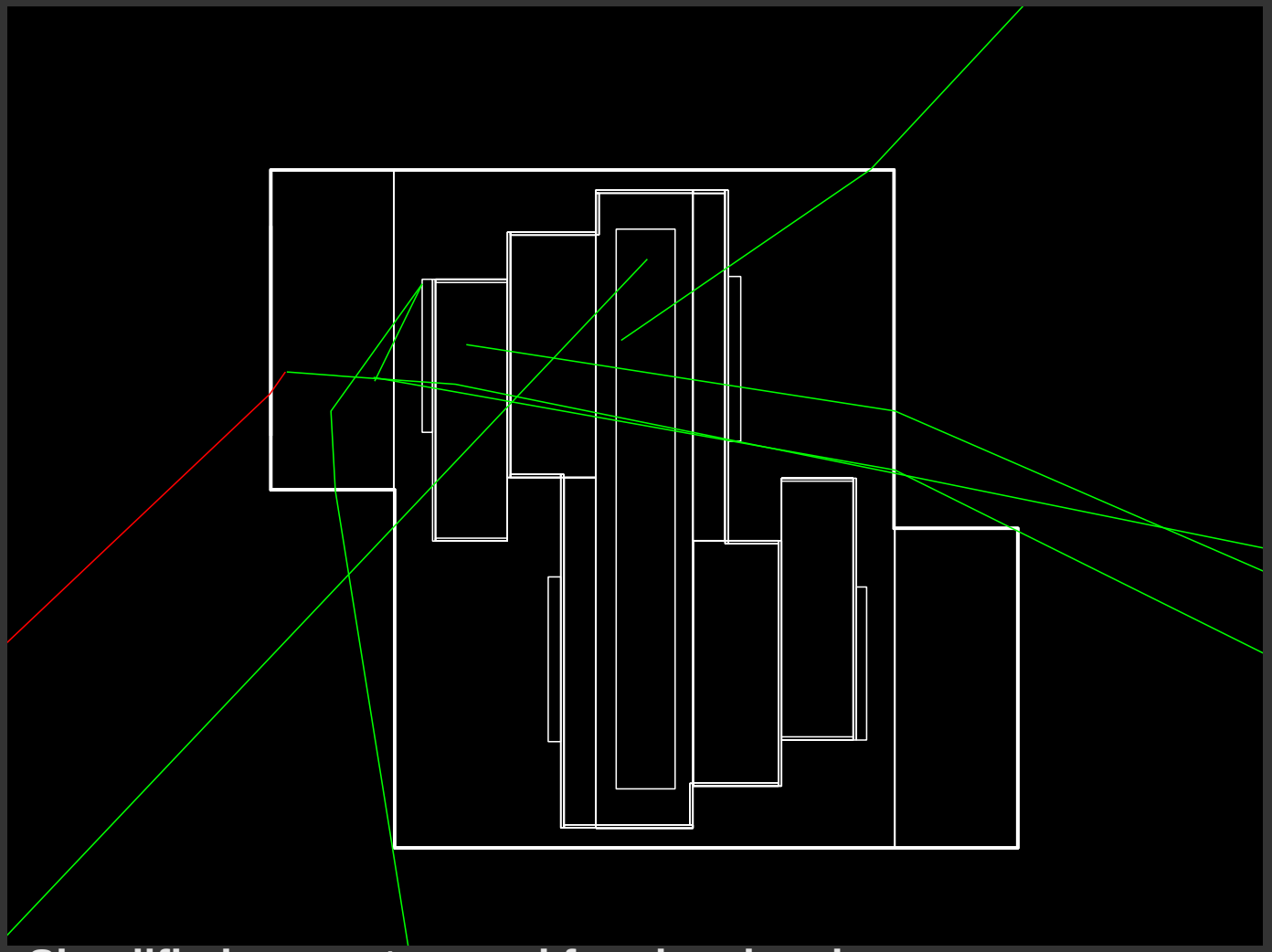



# SST Challenges

- Saturation in channels at count rates >20 kHz
- Cross-contamination
- Shield- and attenuator-penetrating particles
- Sunlight contamination (Open sides)
- Dead layers on detectors
- Channel cross-talk (electronics)
- ***SSTs were never fully characterized or calibrated, but we have recently made great progress towards fully understanding this important dataset!***

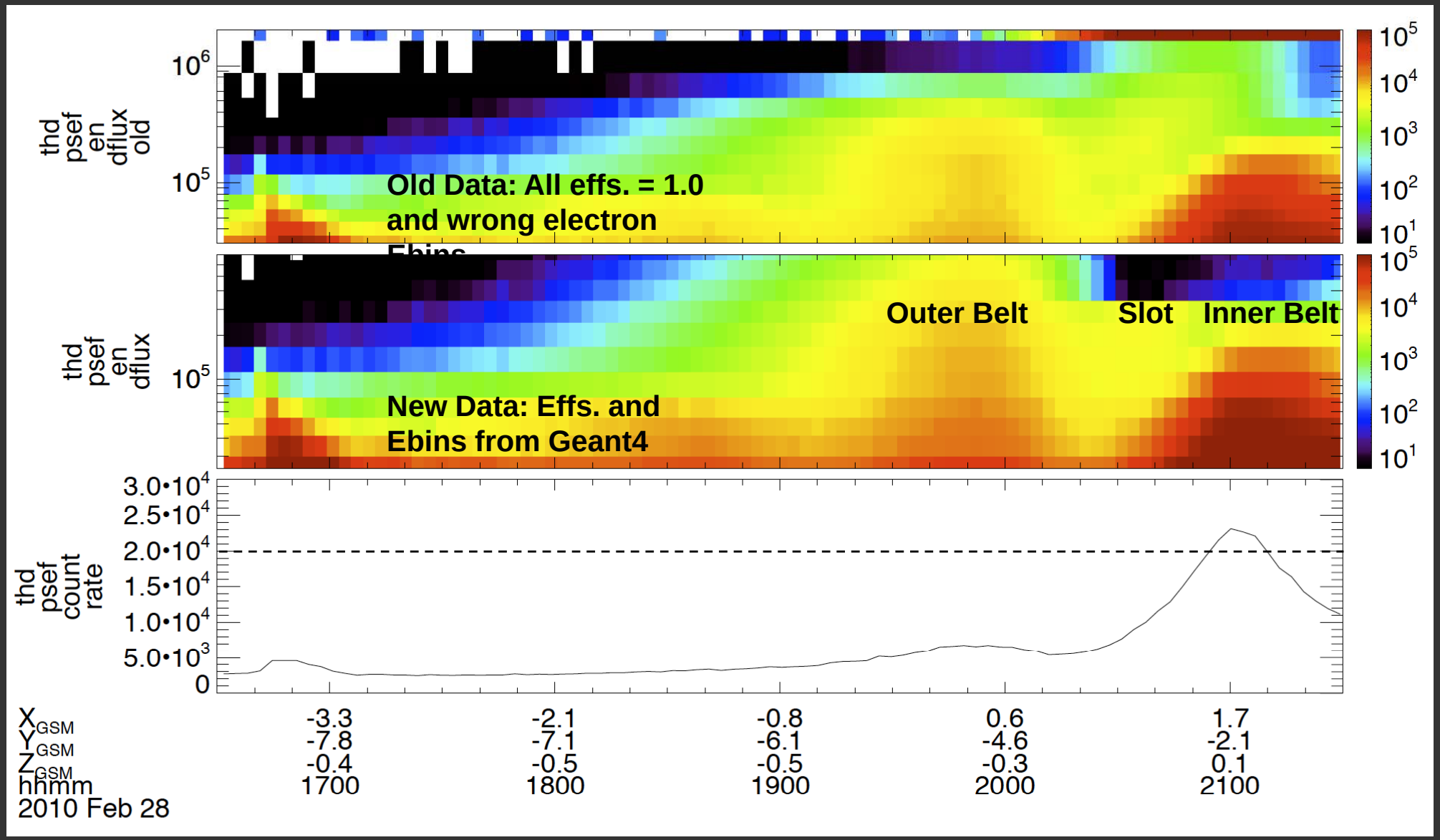
# SST Characterization

- SST has been modeled in Geant4
- Results simulate beam tests, providing bin efficiencies (most important for electrons and noise estimates)
- Cross-contamination and shield-penetrating electrons are correctable challenges
- Coincident channels are not sensitive to cross-contamination



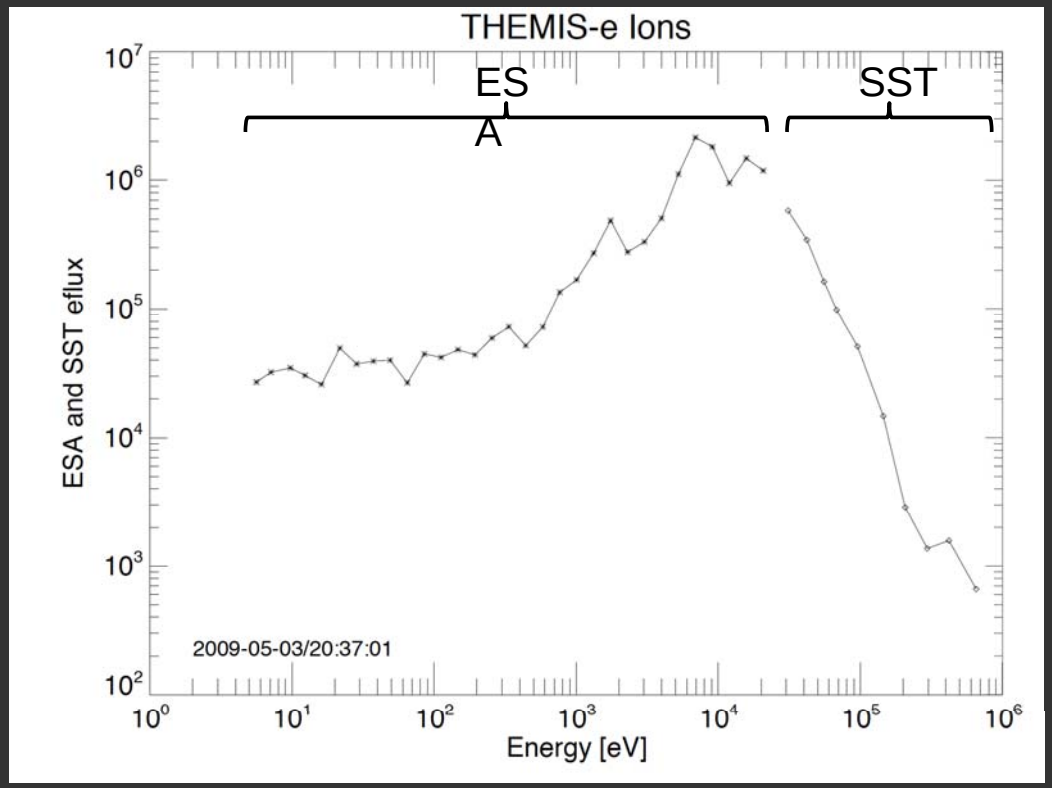
**Simplified geometry used for signal and cross-contamination efficiencies**

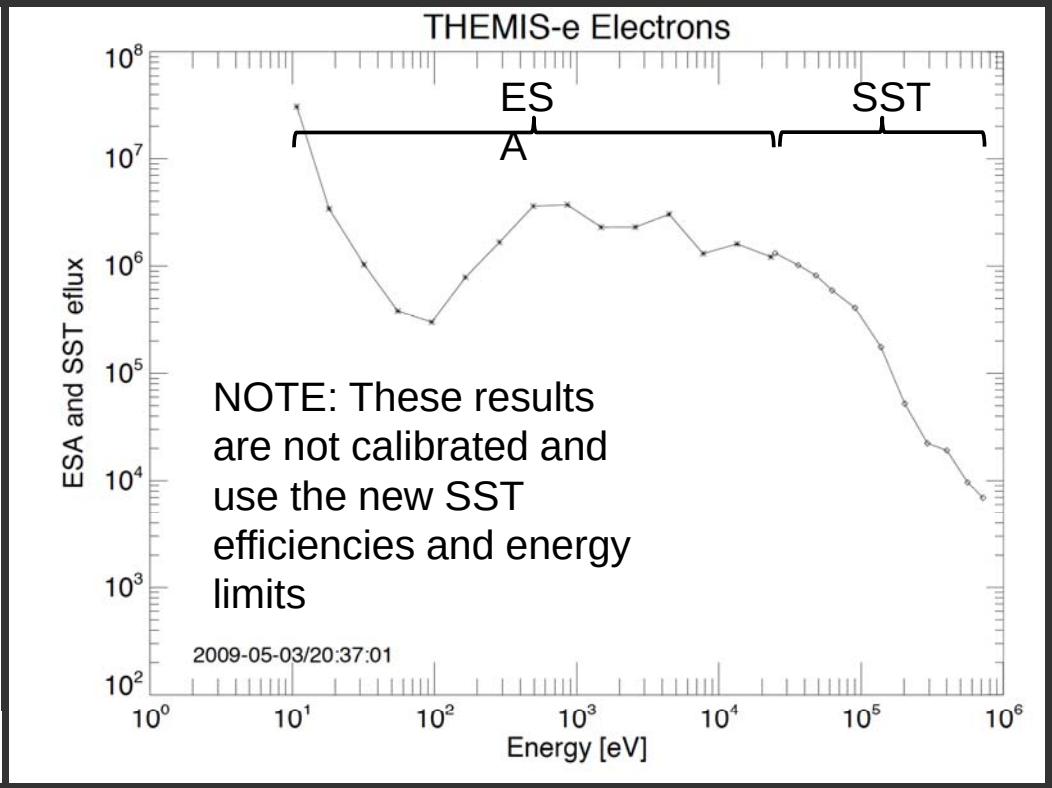
# Efficiencies Applied to Data



# Absolute Calibrations

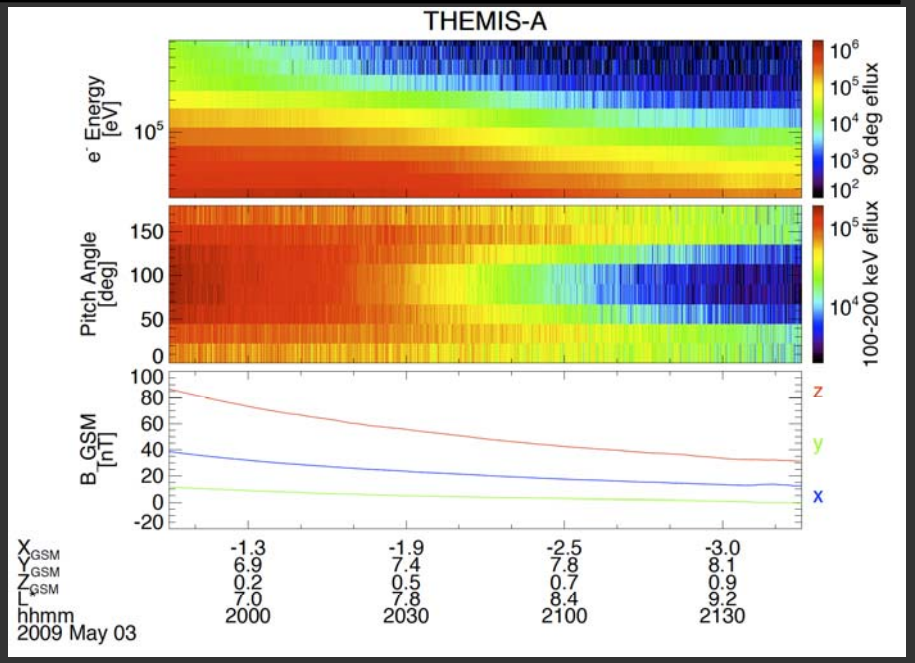
- We are developing a technique to get absolute calibration factors for the SST fluxes from each spacecraft
- SST will be calibrated to ESA, which have been inter-calibrated amongst spacecraft
- Ongoing work; this requires fully decontaminated data

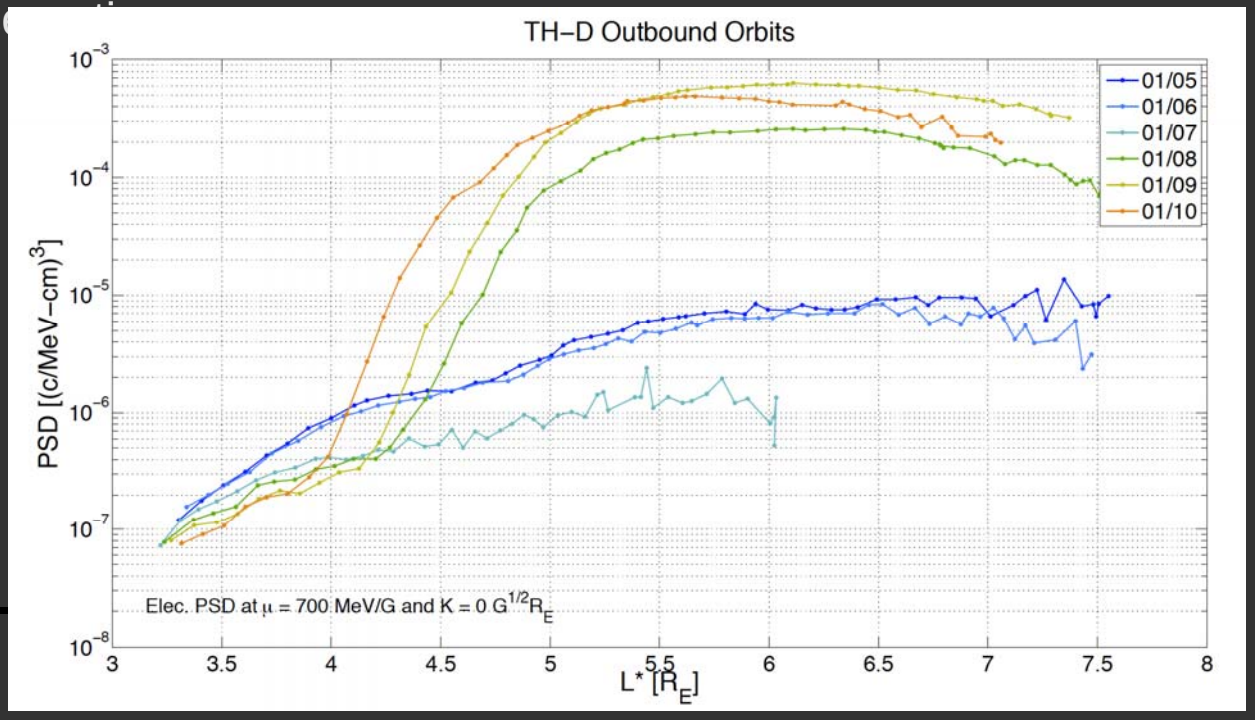


# Science with SST

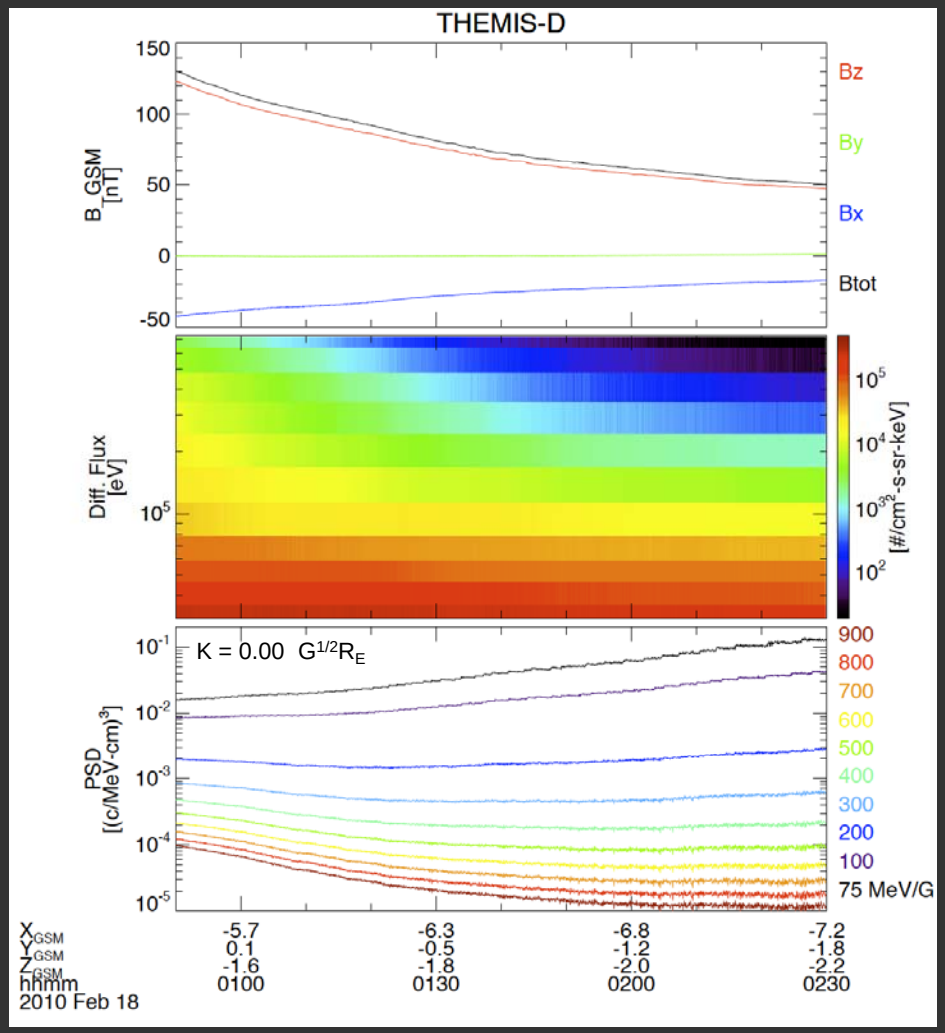
- THEMIS, with newly calibrated SSTs, will allow for complementary science with RBSP
  - PSD for fixed 1st and 2nd invariants beyond GEO
  - Radial and pitch angle distributions throughout the outer belt at higher time cadence (think multiple strings of pearls)
  - Magnetic local time variations
  - Plus additional wave obse beyond GEO

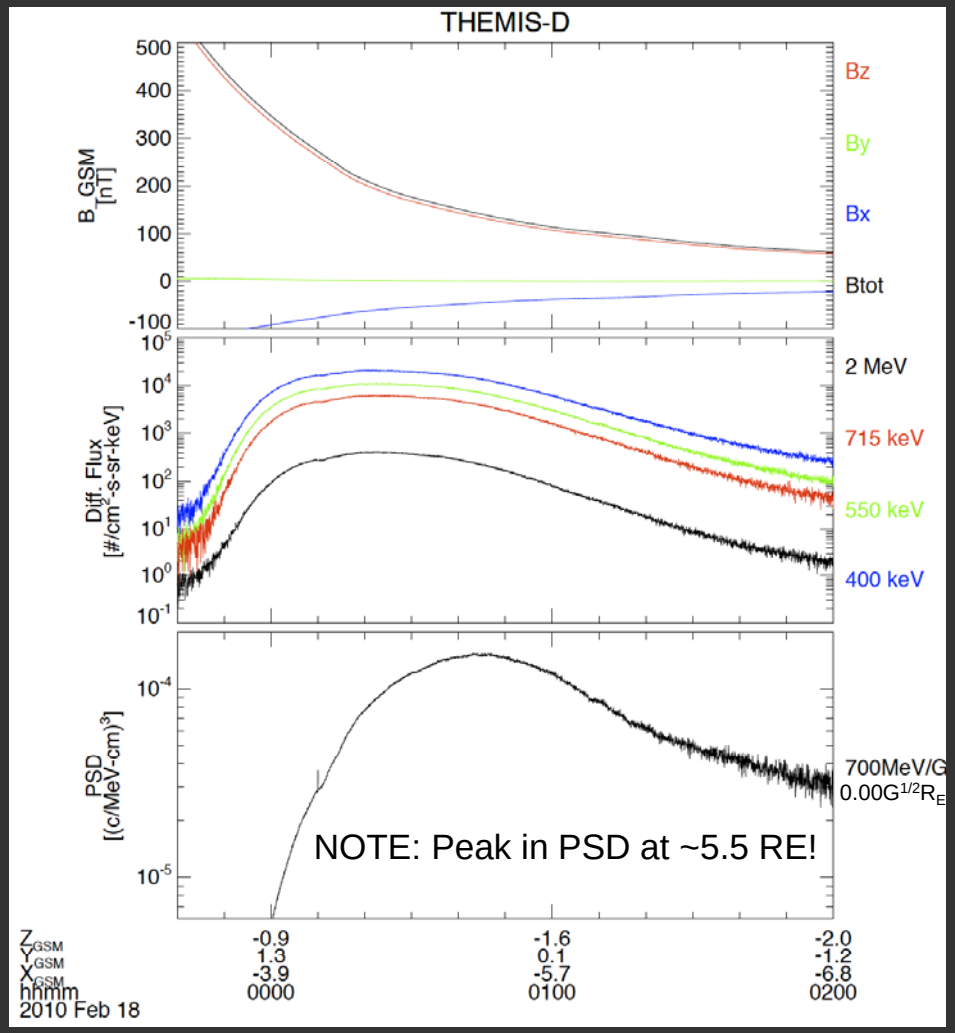


# Science with SST

- THEMIS-SST is already confirming observations from previous studies
  - PSD gradients are most often Mu-dependent
  - PSD distributions are most often peaked for relativistic electrons



# Preparing for RBSP

- Moving ahead: THEMIS, *with newly calibrated SSTs*, will allow for complementary science with RBSP:
  - Fields and waves
  - Thermal plasma
  - *Energetic particles, incl. relativistic electrons*
- RBSP/GEO/THEMIS covers full range of the belts *and into the source region*
- THEMIS-SST will provide key, energetic particle measurements to address RBSP science objectives!