• 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

Old Data: All effs. = 1.0 and wrong electron Ebins

New Data: Effs. and Ebins from Geant4

2010 Feb 28

15 September 2011

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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.

NOTE: These results are not calibrated and use the new SST efficiencies and energy limits.
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 observations beyond GEO

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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

NOTE: Peak in PSD at ~5.5 RE!
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!