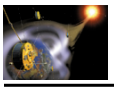

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Inter-calibration of electron detectors on Cluster II

PEACE and RAPID IES

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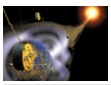

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Two electron instruments

- PEACE
  - Plasma Electron And Current Experiment
  - Top hat electrostatic analyzer
  - Measures electrons in range ~ few eV - 20 keV
- RAPID IES
  - Research with Adaptive Particle Imaging Detector, Imaging Electron Spectrometer
  - Solid state detector
  - Measures electrons in range ~35 – 400 keV

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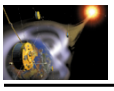

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Inter-calibration approach

- PEACE density calibrated with other instruments (CIS, WHISPER, EFW)
  - Assures us that PEACE geometric/efficiency factors are realistic
- Want to test if high energy electrons also have correct efficiency factors
  - Without overlap in energy a direct comparison is difficult
  - Rely on comparison using fits to a model distribution (Maxwellian, kappa/Lorentzian)

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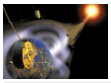

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Kappa function

- In space plasmas the velocity distribution often assumes the shape of a kappa-function
  - Maxwellian at low energies, power law tail at high energies
  - Weak theoretical foundation (but some refs):
    - Collier, M. R. (1993), On Generating Kappa-Like Distribution Functions Using Velocity Space Lévy Flights, Geophys. Res. Lett., 20(15), 1531–1534
    - Leubner, M. P. (2002) A Nonextensive Entropy Approach to Kappa-Distributions Adv. Space Res., *282*, 573-579

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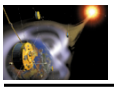

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Plasma Region

- Cluster pass through regions of vastly different temperature, density
  - Magnetotail plasma sheet is sufficiently hot, dense to have significant count rates in both instruments (sometimes)
    - » Make sure count rates are well above background noise rates when doing inter-calibration
  - Magnetotail velocity distributions are known to show kappa-function velocity distributions (Sarris et al., 1981, Christon et al., 1989)

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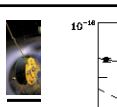

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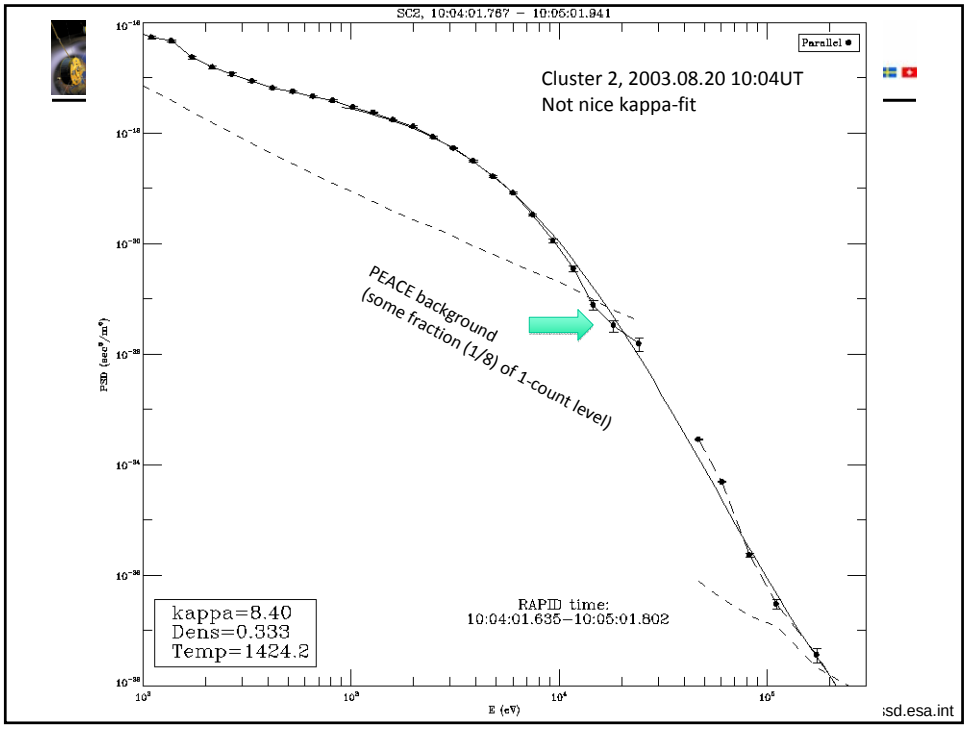

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Results

- Visual inspection of large number (thousands) of joined PEACE/RAPID IES velocity distribution fits shows:
  - Velocity Distribution is only sometimes “simple” enough for a simple kappa-fit
    - Makes use of automated procedures complicated
  - When spectral shape is “nice” both PEACE and RAPID IES energy ranges are well fit by a single kappa-function → inter-calibration is good! But:
    - Lowest energy channel in RAPID is less efficient than previously assumed
      - outside linear response range of solid state detector
    - Highest energy channel in PEACE is “noisy”

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