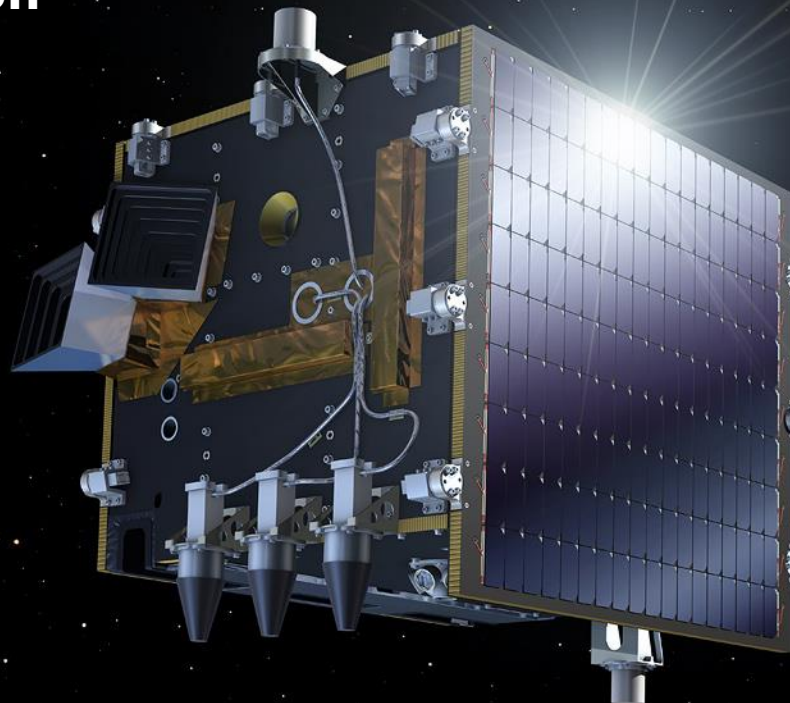


Energetic Particle Telescope (EPT) Data Exploitation



Petteri Nieminen

*Space Environments
and Effects Section
European Space Agency
ESTEC*



QinetiQ



Credits to the EPT team:

- UCL/ CSR (Mathias Cyamukungu, Sylvie Benck, Stanislav Borisov, Ghislain Grégoire, Joseph Lemaire)
- QinetiQ Space (Bart Desoete, Christophe Semaille)
- BISA (Viviane Pierrard, Emil van Rensbeeck, Jeroen Maes, Sabrina Bonnewijn)
- ASRO (Eino Valtonen, Risto Punkkinen)
- B.USOC (Anuschka Helderweirt)
- ESA (Hugh Evans, Alessandra Menicucci, Giovanni Santin, Karim Mellab)

European Space Agency

- EPT top-level requirements
- EPT concept and design
- Proba-V flight & commissioning first results
- Ongoing data analysis activities under PRODEX
- Outlook
- Further information

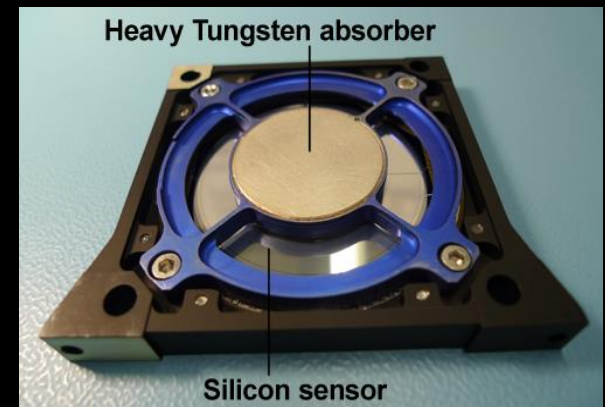
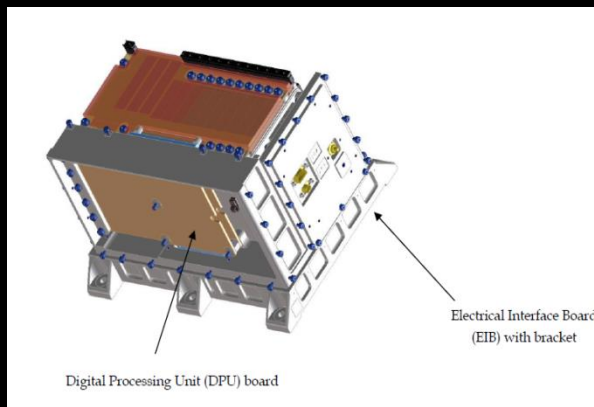
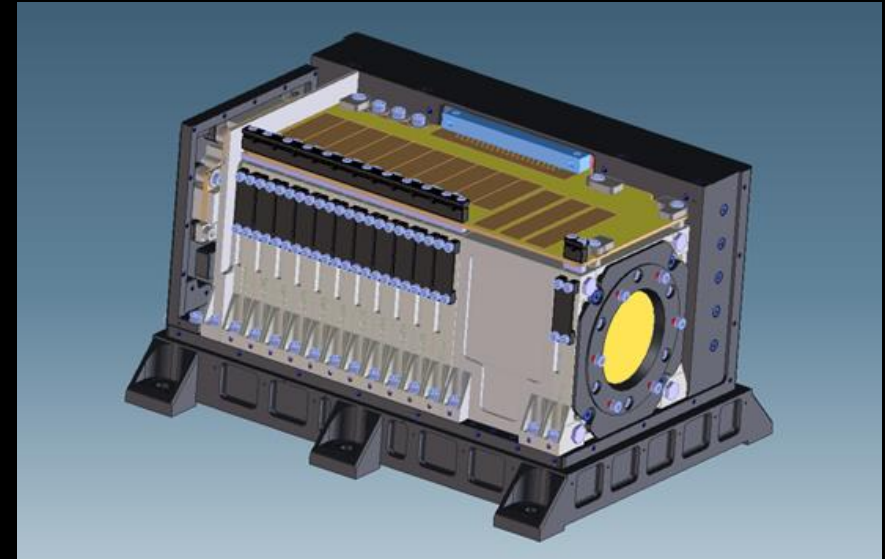
EPT top-level requirements

- Electrons 0.5 – 20 MeV
- Protons 9 – 300 MeV
- Alpha particles 36 MeV – 1.2 GeV
- Heavier ions collected in one channel
- Flux max 10^7 particles/cm²/s
- Integration time 0.1 – 10 seconds
- Geant4 efficiency matrices used to derive virtual energy channels (from 152 physical channels):

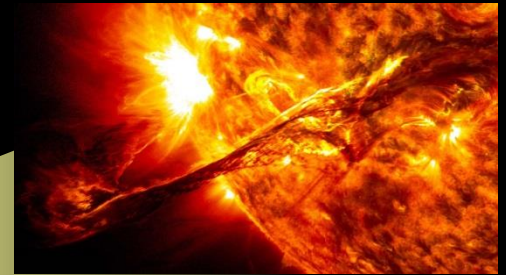
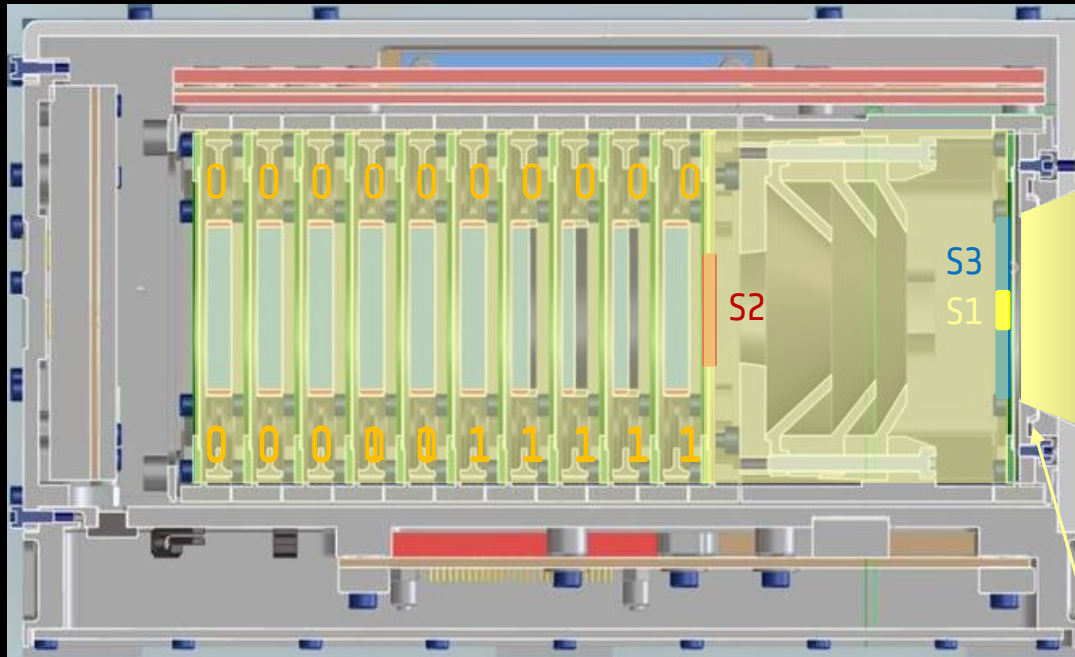
Energy channels	Electrons (MeV)	Protons (MeV)	Helium ions (MeV)
1	0.5-0.6	9.5-13	38-51
2	0.6-0.7	13-29	51-116
3	0.7-0.8	29-61	116-245
4	0.8-1.	61-92	245-365
5	1 - 3	92-126	365-500
6	3-20	126-155	500-615
7		155-182	615-720
8		182-205	720-815
9		205-227	815-900
10		227-248	900-980
11		248-300	980-1600

EPT Concept and Design: Main characteristics

- Proba-V EPT total mass 4.6 kg
- Dimensions 210 x 162 x 128 cm³
- Power ~ 6 W
- Interface RS422
- Compact design
- DAM concept: High modularity
- Nominal time resolution 2 seconds



EPT Concept and Design: Sensor system



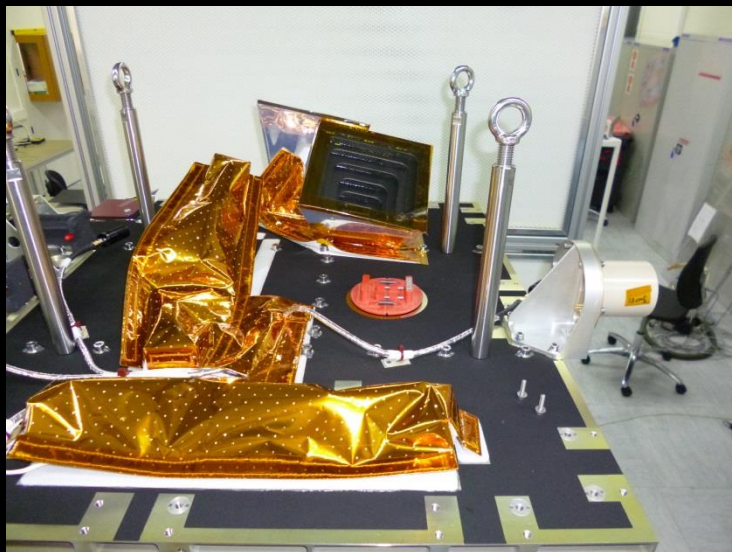
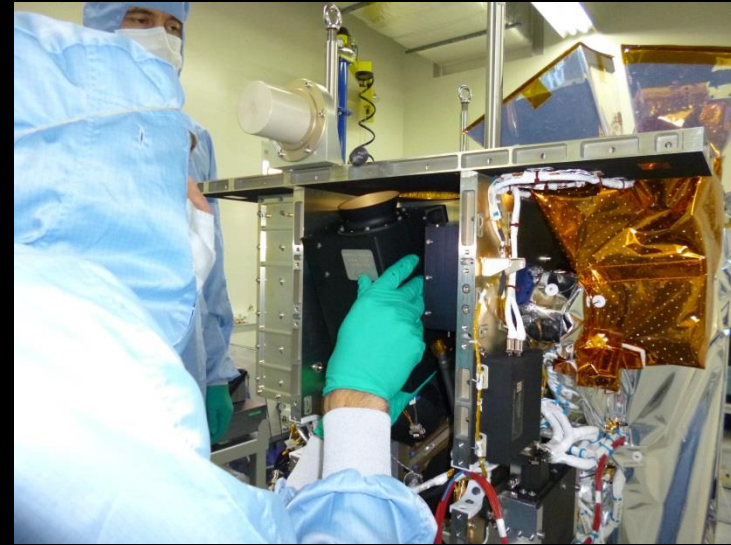
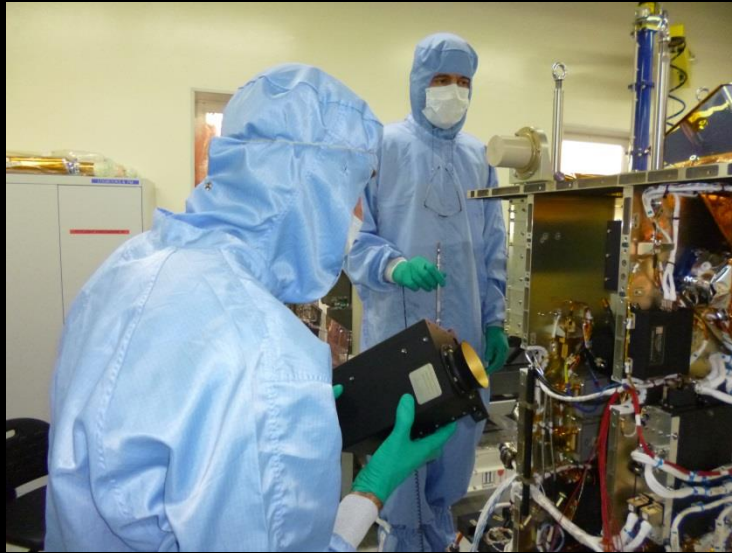
Entrance cone
52° FoV

Aperture window
150 μm Al + 78 μm Kapton

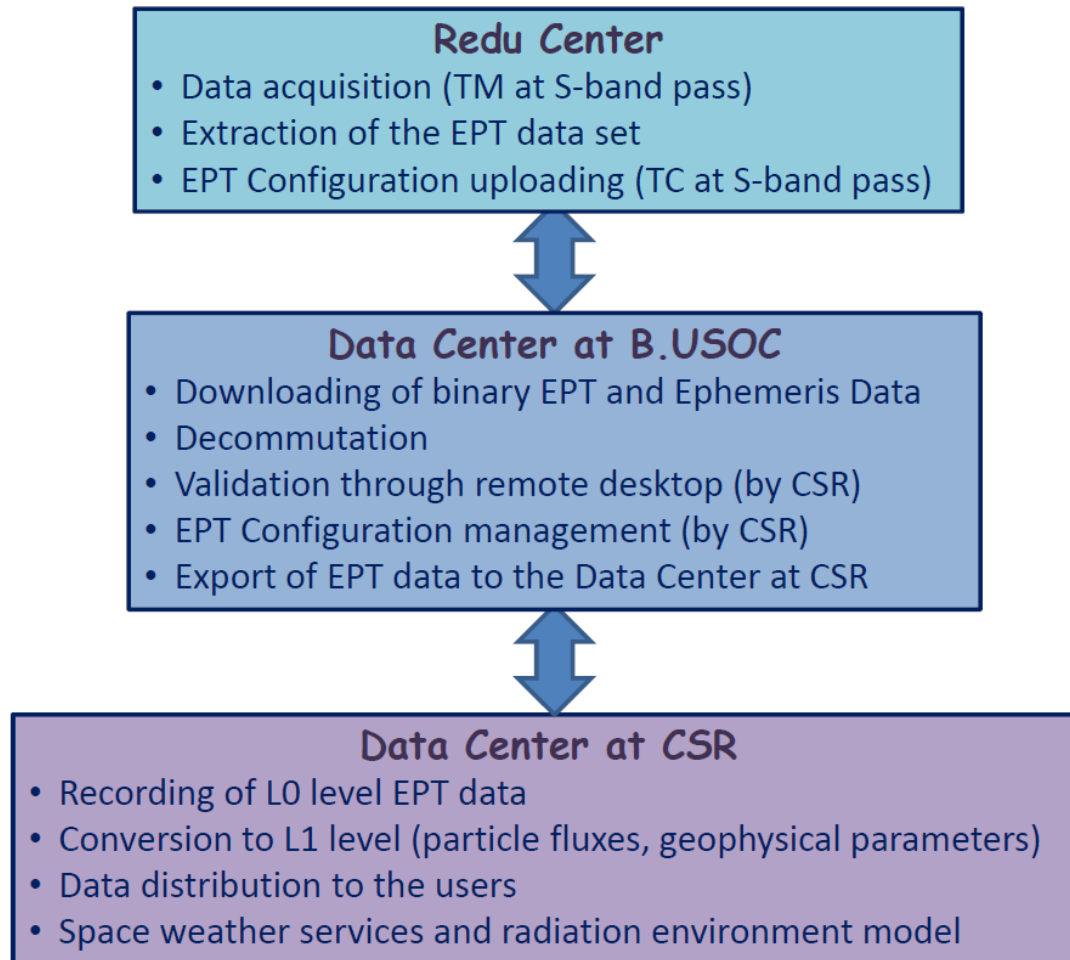
High-energy
section ($\Delta E-R$)

Low-energy
section ($\Delta E-E$)

EPT on Proba-V

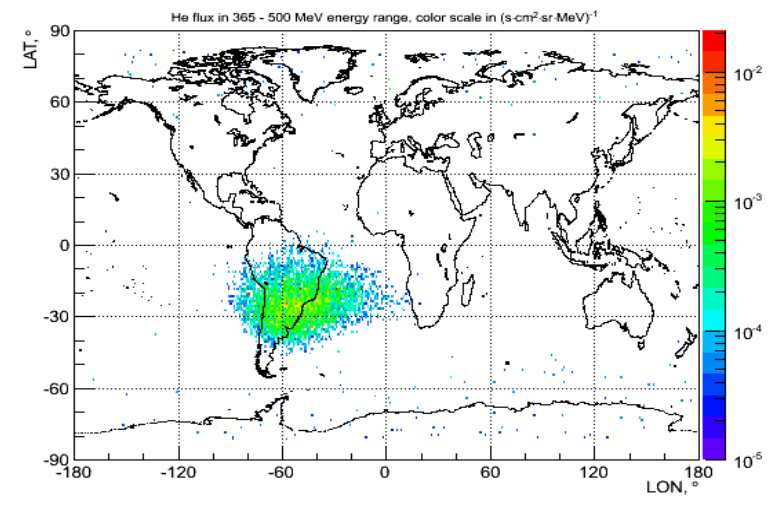
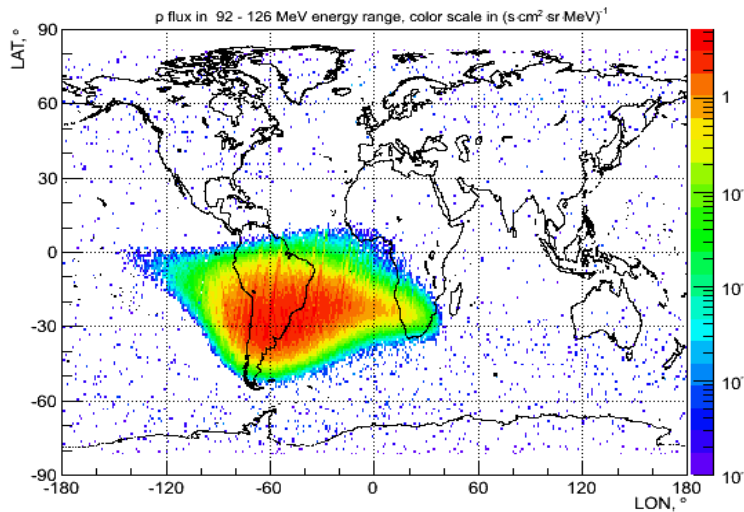
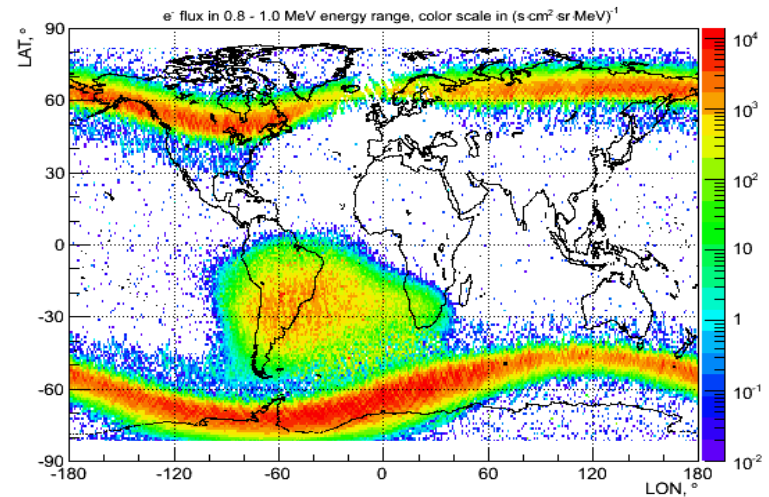
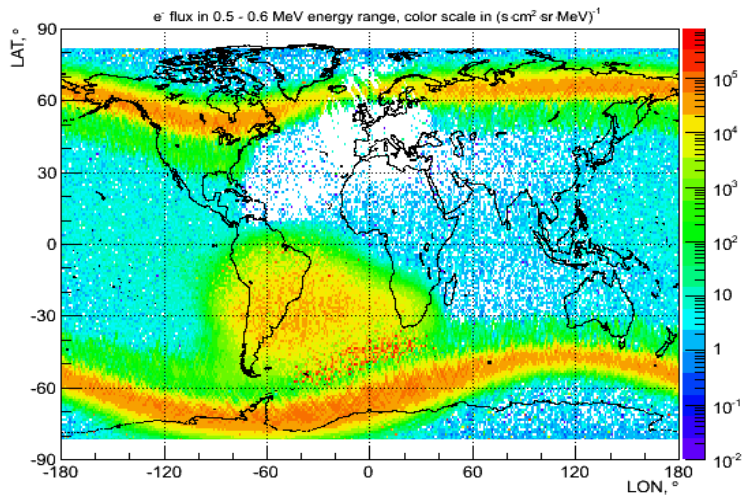


EPT ground segment data flow



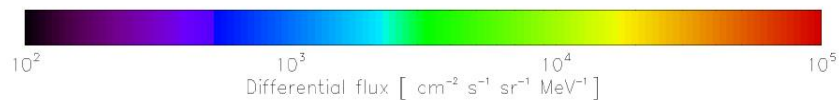
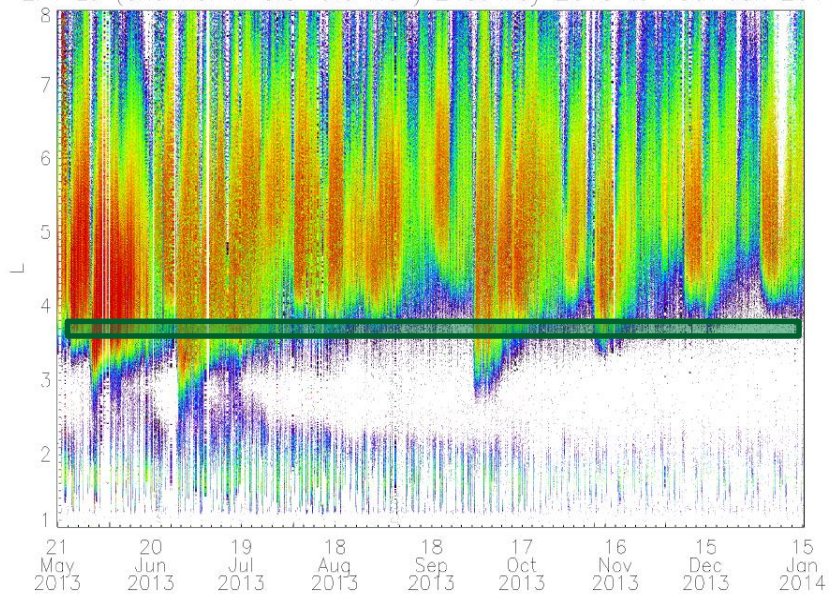
EPT first results

29 May – 20 August 2013

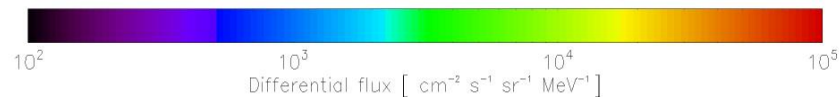
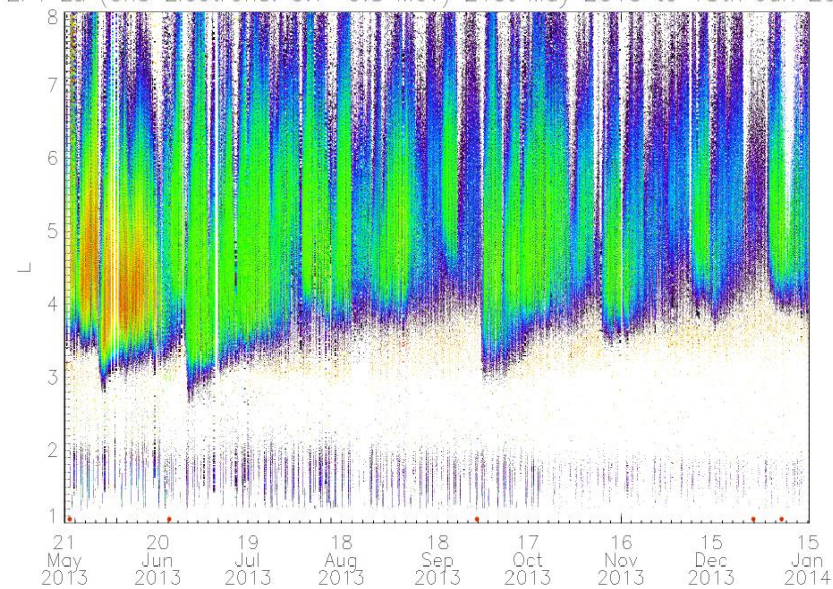


Temporal variability: Electrons

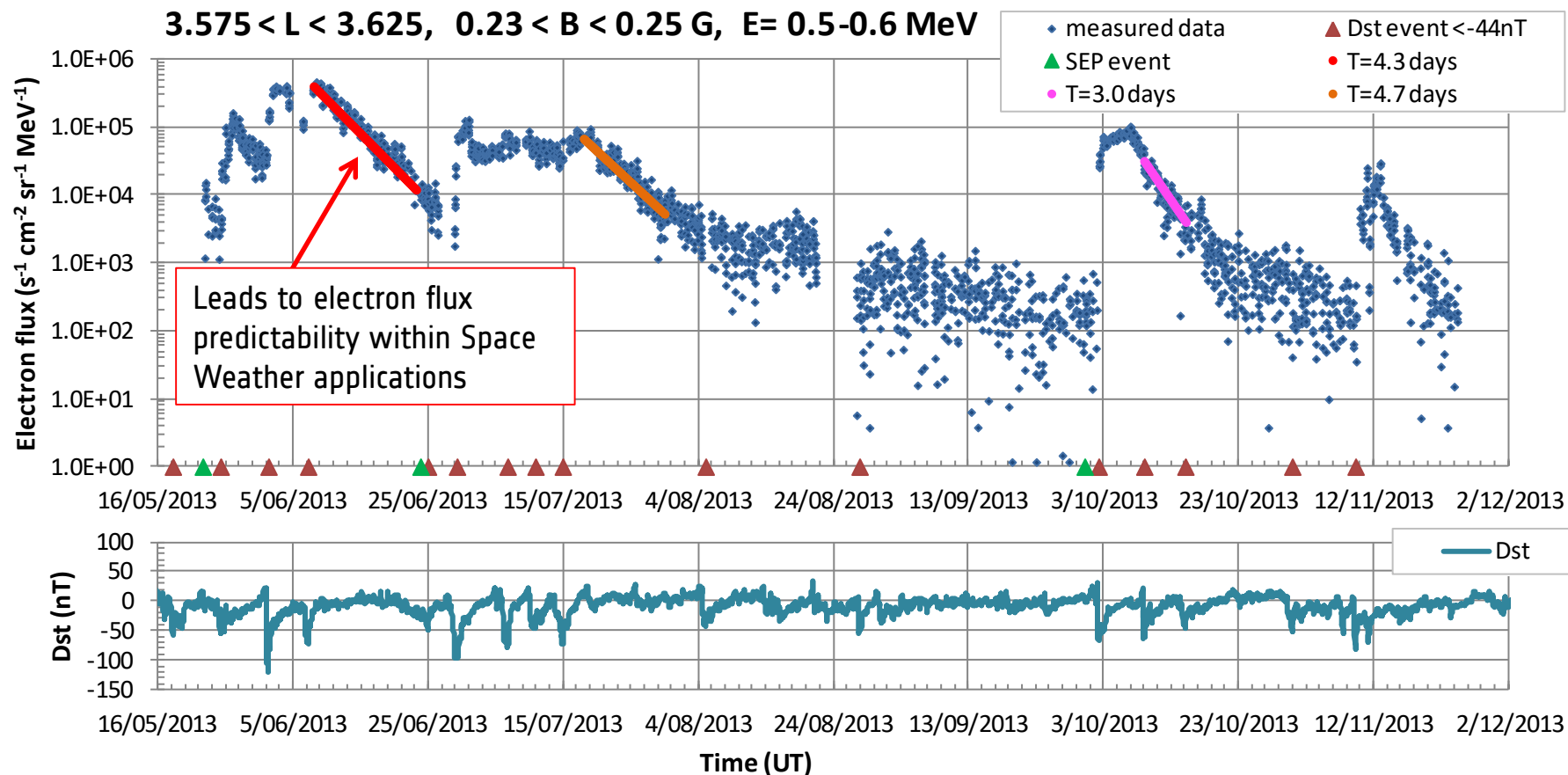
EPT Lu (channel 1: 0.5–0.6 MeV) 21st May 2013 to 15th Jan 2014



EPT Lu (ch3 Electrons: 0.7–0.8 MeV) 21st May 2013 to 15th Jan 2014



Temporal variability: Electrons

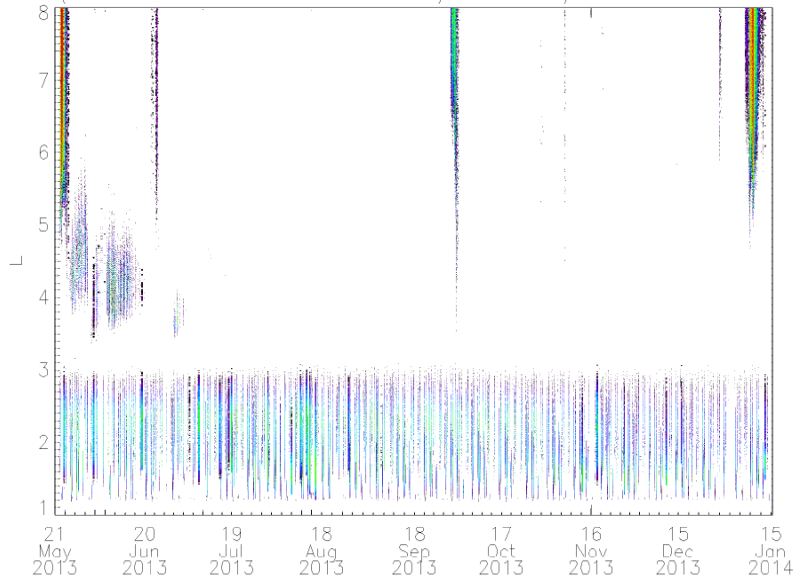


➔ Determination of flux decay time values; to be compared to previous results i.e. Benck et al. , Low altitude energetic electron lifetimes after enhanced magnetic activity as deduced from SAC-C and DEMETER data, Ann. Geophys., 28, 849–859, 2010
L=3.6-3.8, B=0.22-0.46 G, E=0.52-0.61 MeV, T=4.9±1.1 days

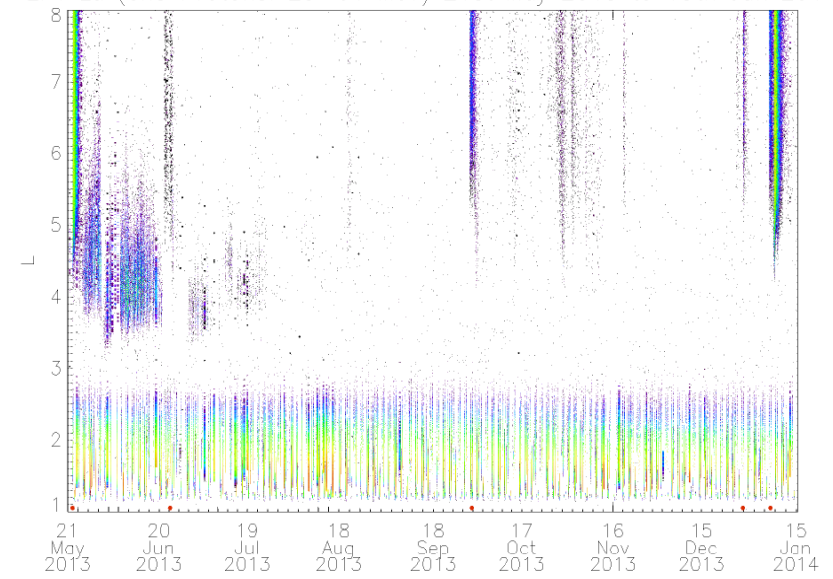
Temporal variability: Protons



EPT Lu (channel 1 Protons: 9.5–13 MeV) 21st May 2013 to 15th Jan 2014

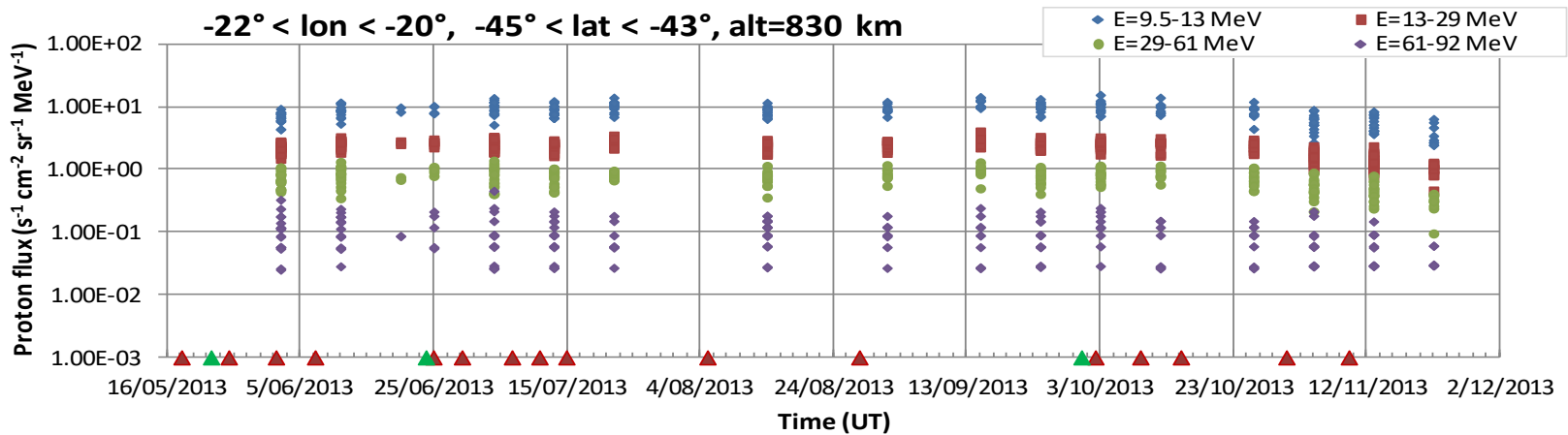


EPT Lu (ch3 Protons: 29–61 MeV) 21st May 2013 to 15th Jan 2014

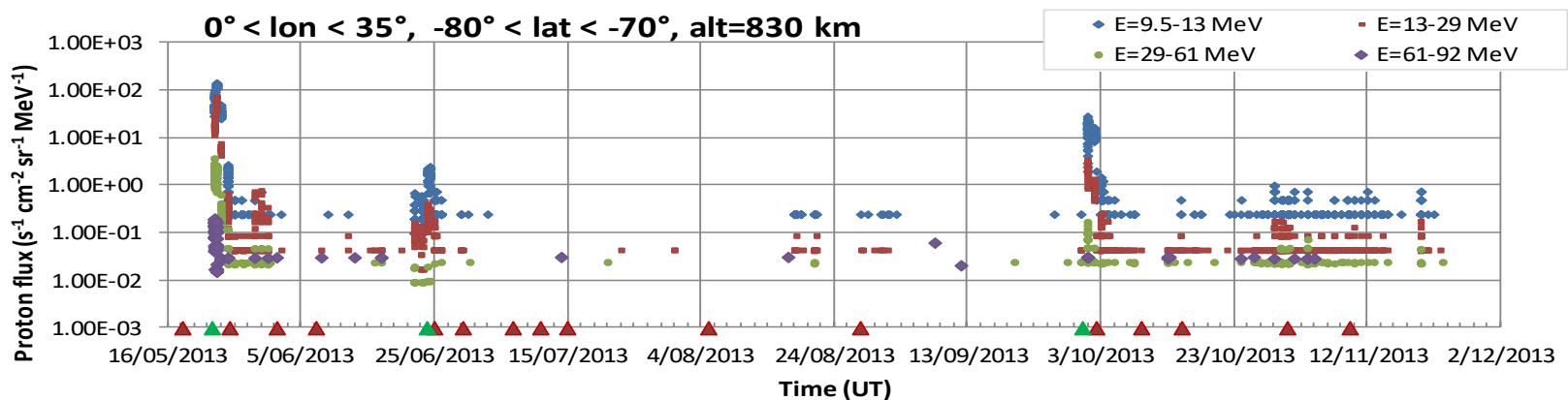


Temporal variability: Protons

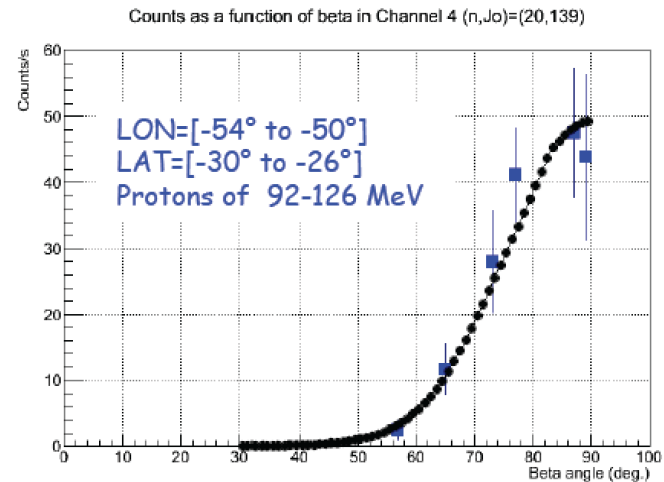
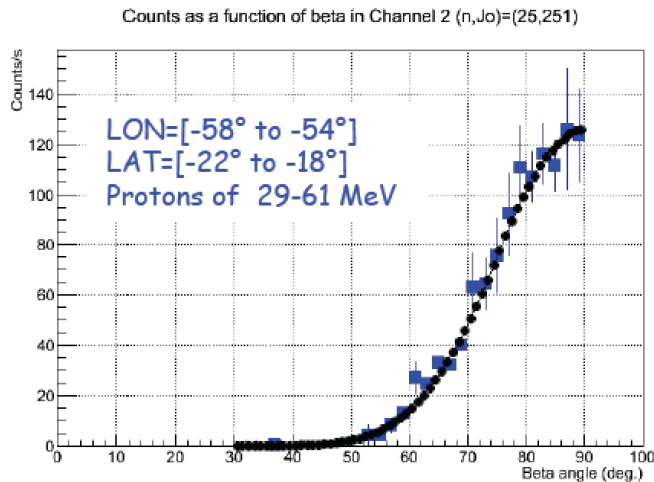
→ In the SAA the proton fluxes are quite stable



→ At high latitude protons appear during SEP events



Proton angular distribution measurement



- Off-pointing measurement campaign from June 25th to December 10th 2013
- Proba-V rotation northwards from its nominal attitude before flight in the SAA
- Rotation angles from 0° to 45° to cover pitch angles from 30° to 90°

- Study the flux variations during SPEs and geomagnetic storms
- Study the precipitation fluxes and their effects on the atmosphere
- Study the South Atlantic Anomaly and polar horns evolution
- Study the source and loss mechanisms
- Fit the spectra to obtain the density-energy distribution
- Compare with Van Allen Probe and CLUSTER observations at other orbits
- Support radiation monitor observations and cross-calibration
- Contribute to radiation environment model improvements
- Provide a quick-look Space Weather facility
- Local Proba-V comparisons between EPT and SATRAM

- http://csrsrv1.fynu.ucl.ac.be/csr_web/ept/eptinfos.php
- <http://ept.aeronomie.be/en/index.htm>
- <http://www.qinetiq.com/services-products/space/Pages/satellite-payloads-ept.aspx>
- <http://www.busoc.be/projects/ept/>
- http://space-env.esa.int/index.php/ESA-ESTEC-Space-Environment-TEC-EES/articles/EPT_first_results.html
- http://www.esa.int/Our_Activities/Technology/Proba_Missions/Overview2

EPT PI: Mathias Cyamukungu (Mathias.Cyamukungu@uclouvain.be)

EPT Phase A/B/C/D development was funded under ESA GSTP contracts 20294/06/NL/JD and 4200022582

EPT Data Exploitation project is funded under ESA PRODEX arrangement 4000107617