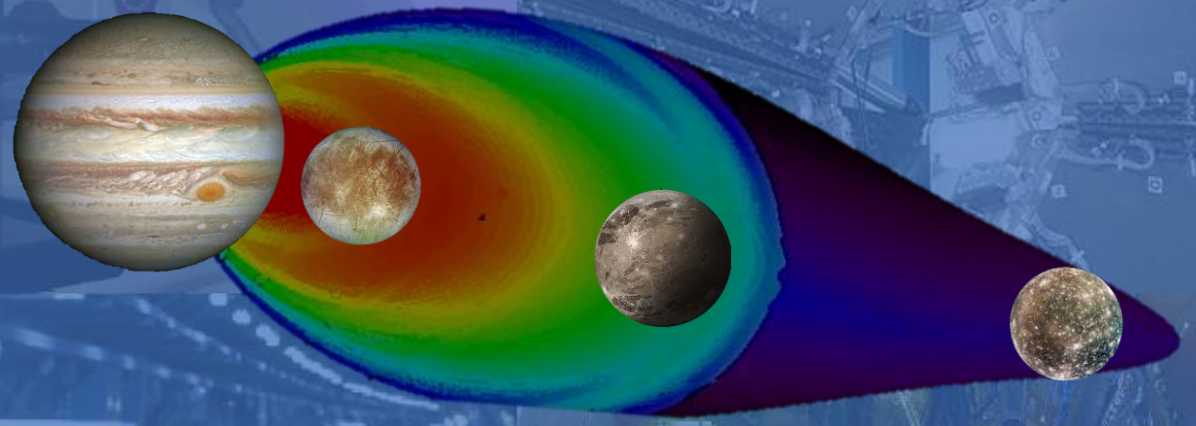


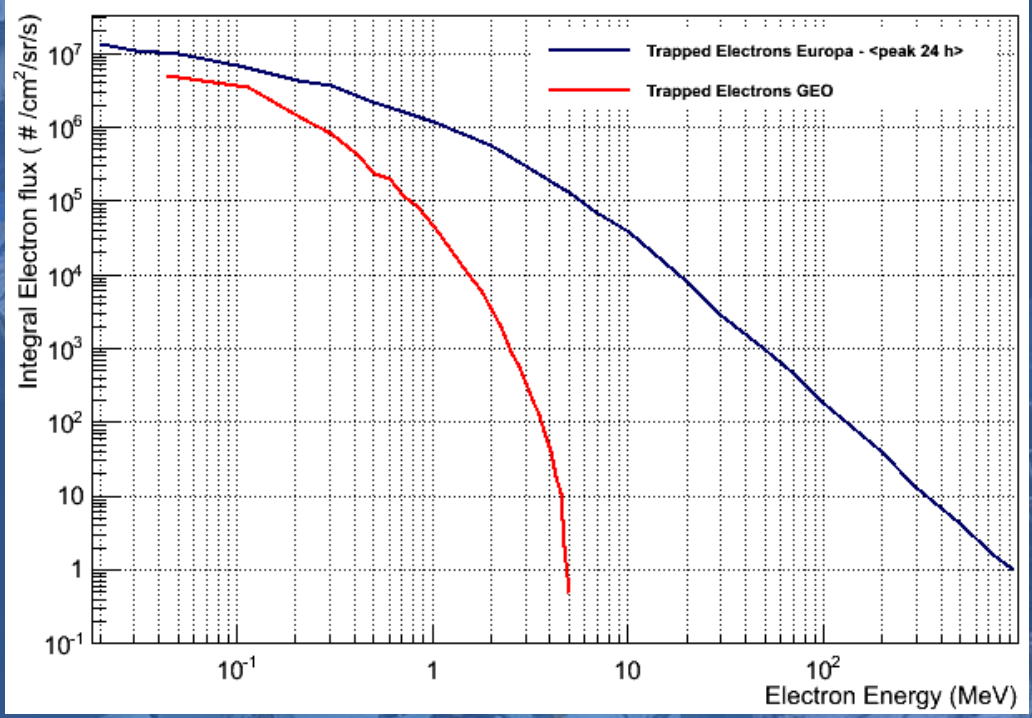
The RADiation hard Electron Monitor (RADEM) for the JUICE mission

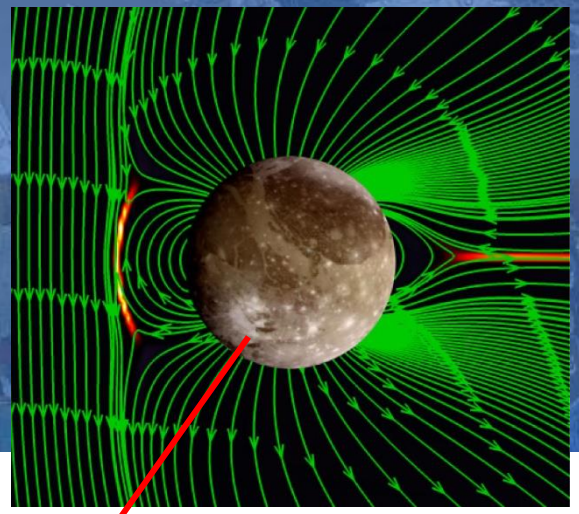
M. Pinto, P. Gonçalves, W. Hajdas, P. Socha
mpinto@lip.pt

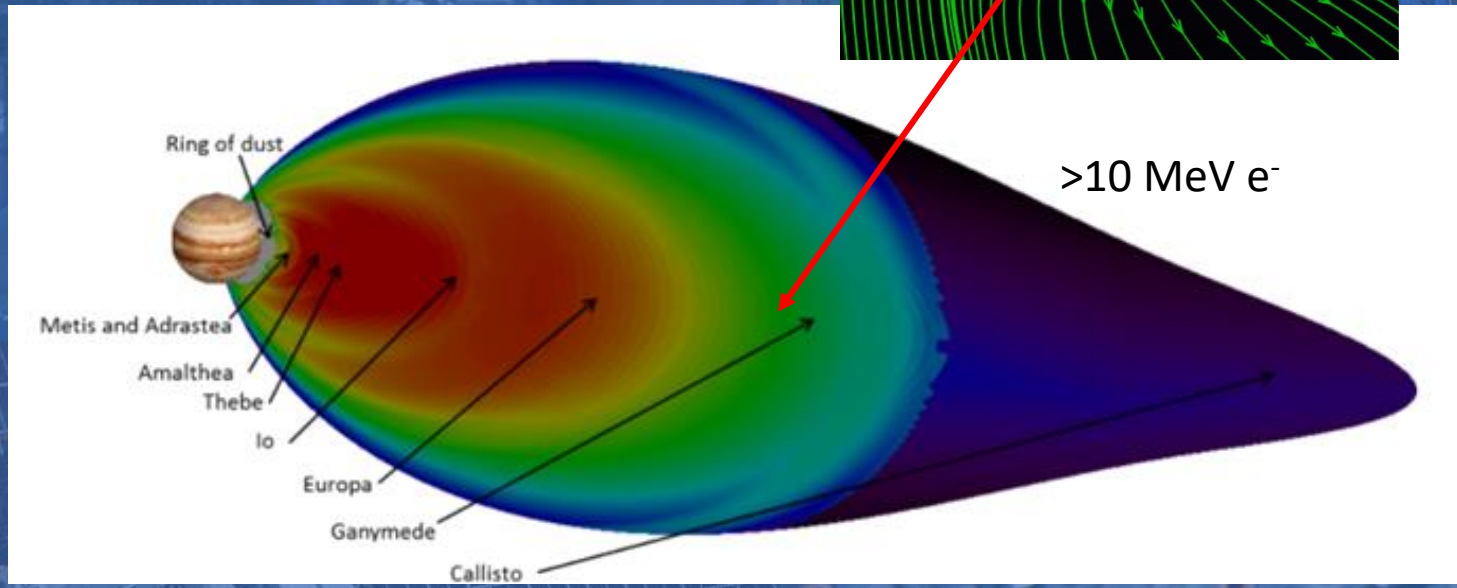
Outer planet moon - magnetosphere interaction workshop
Virtual Meeting 5-6 November 2020

Jovian Trapped Particles

- ❑ Large fluxes of electrons with E>10 MeV
- ❑ Only long-term measurements made by Galileo S/C
- ❑ JOSE Model – developed for the JUICE mission
  - L<9.5 – purely theoretical
  - Electron data up to 11 MeV
  - Long-term proton data up to 1.25 MeV only



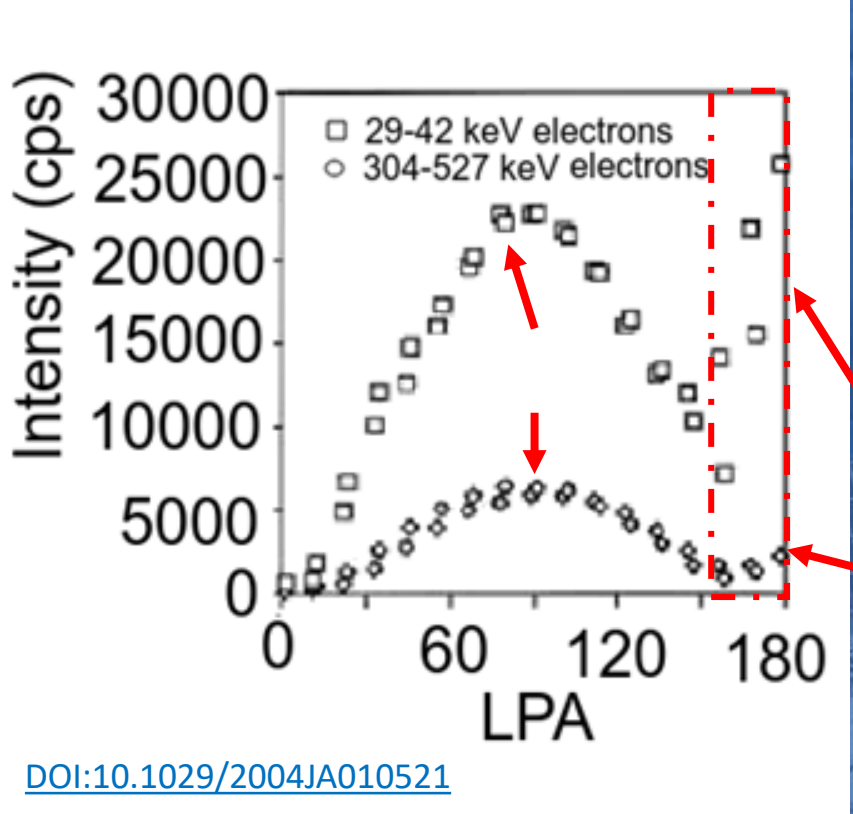




Credit: S. Bourdarie @ 2014 NSREC course

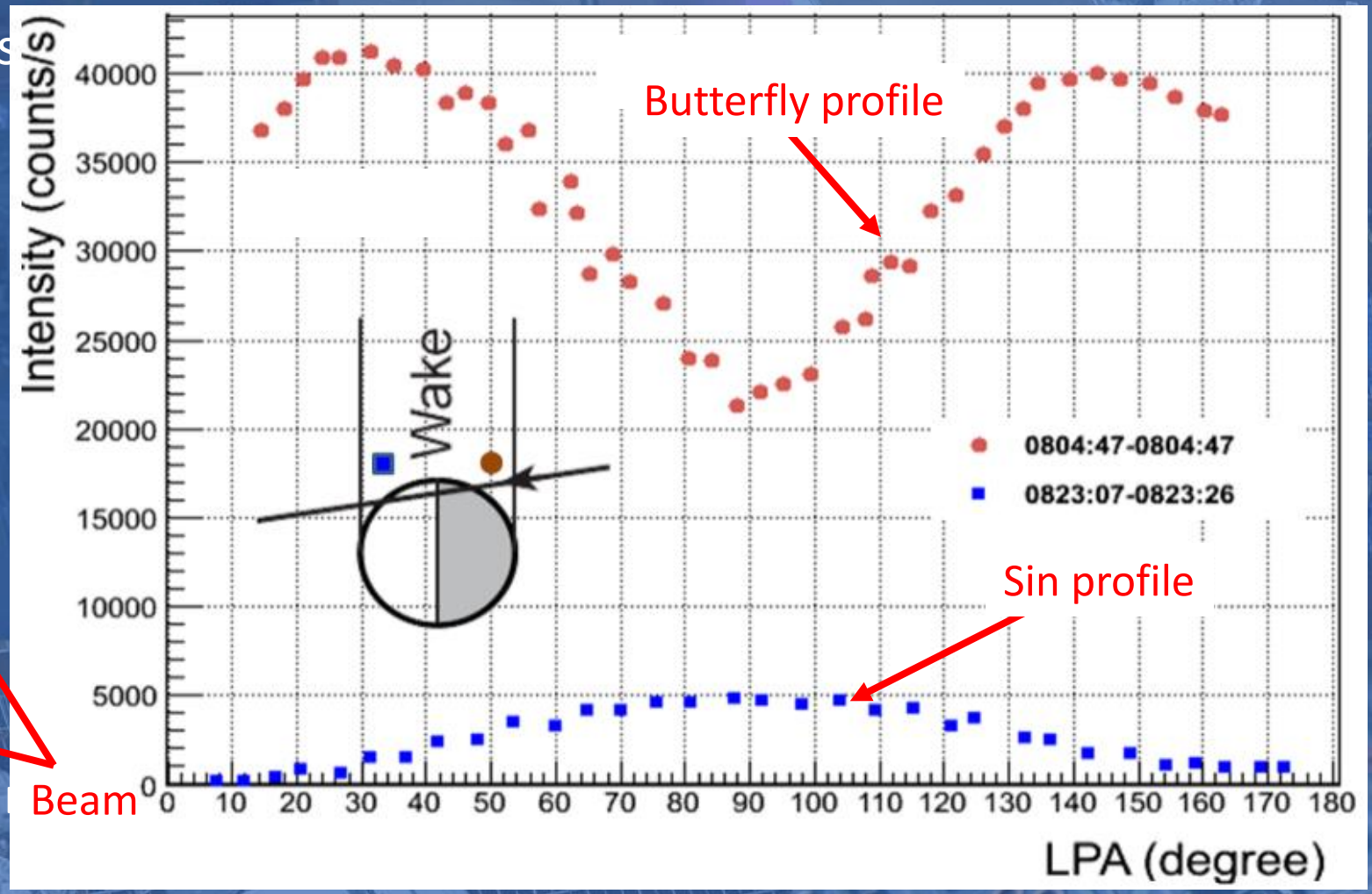
Ganymede – Angular Variability

- Region dependent angular variability
- Consequence of particle dynamics
- Implications in RHA

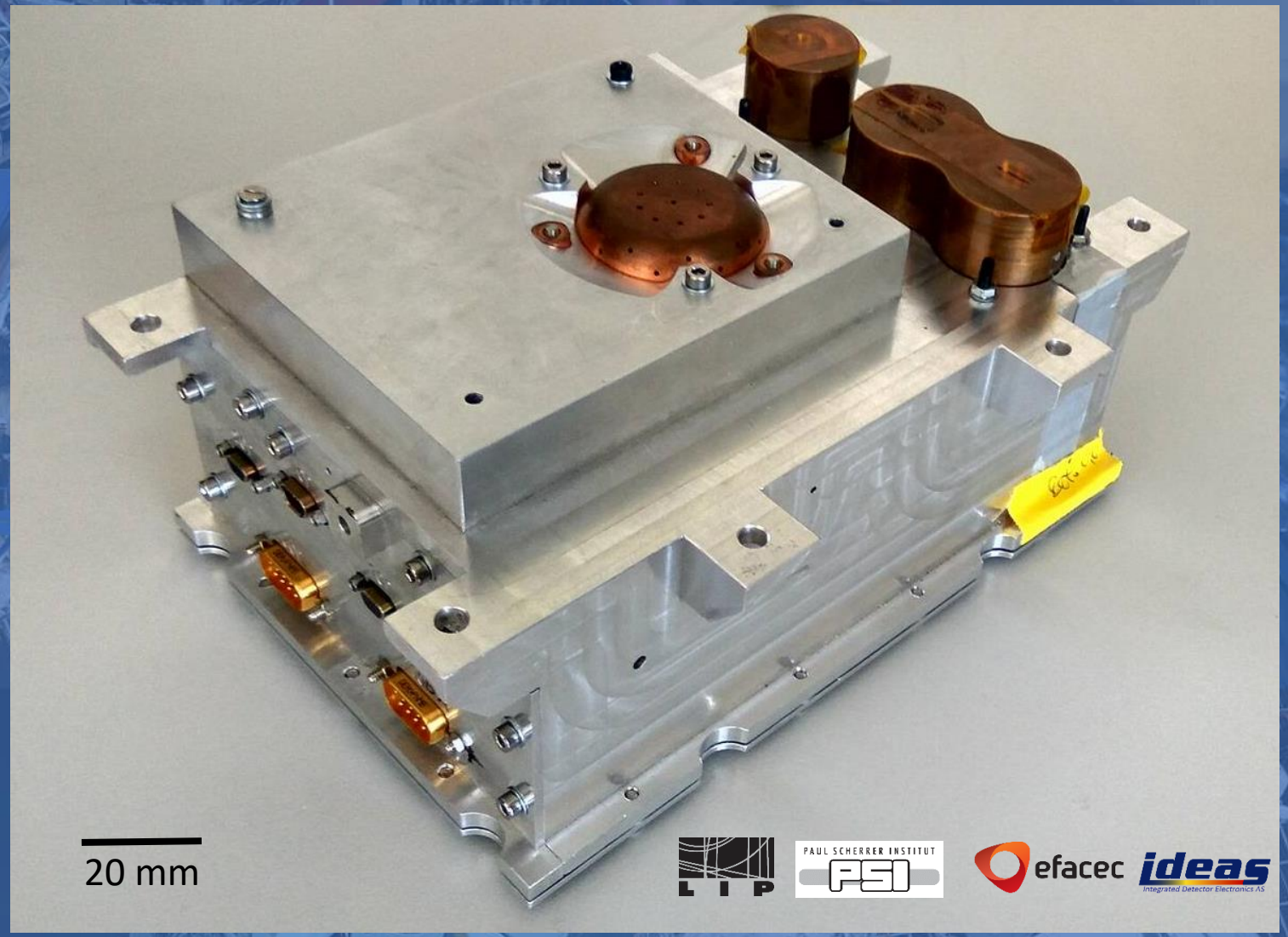


DOI:10.1029/2004JA010521

Local Pitch Angle (LPA)



RADiation hard Electron Monitor

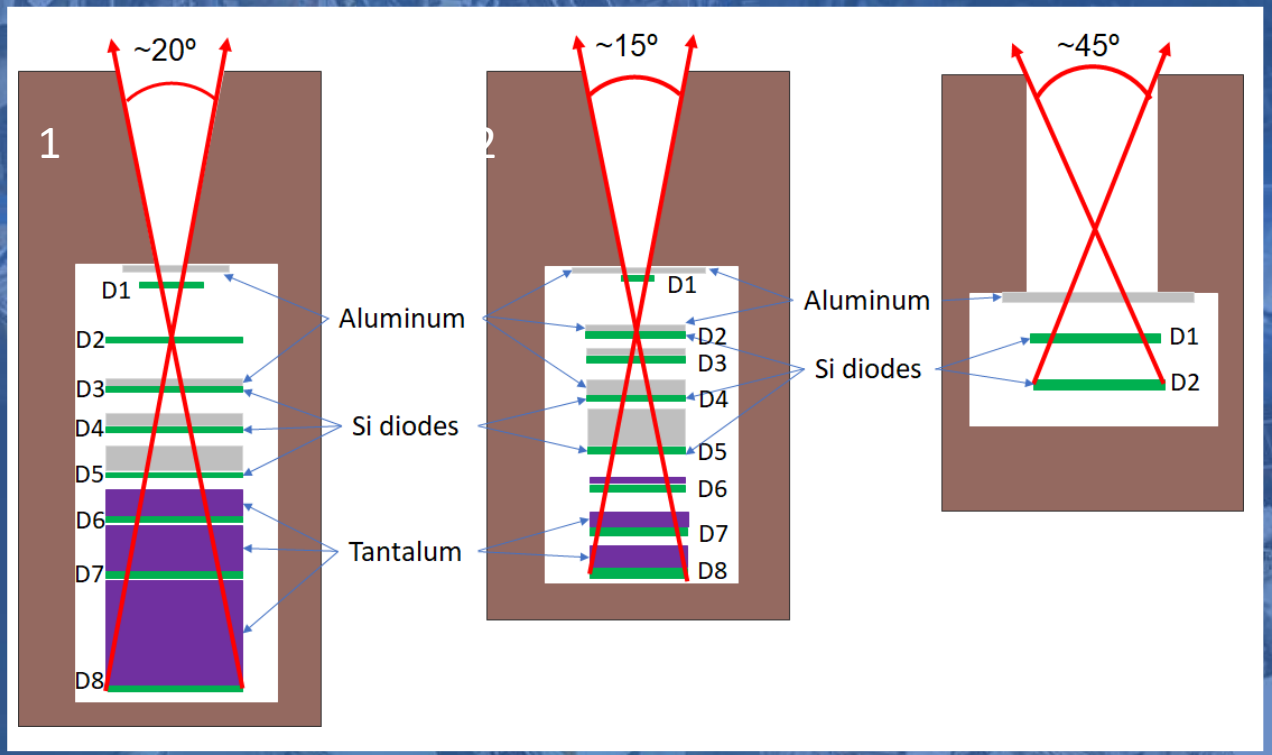


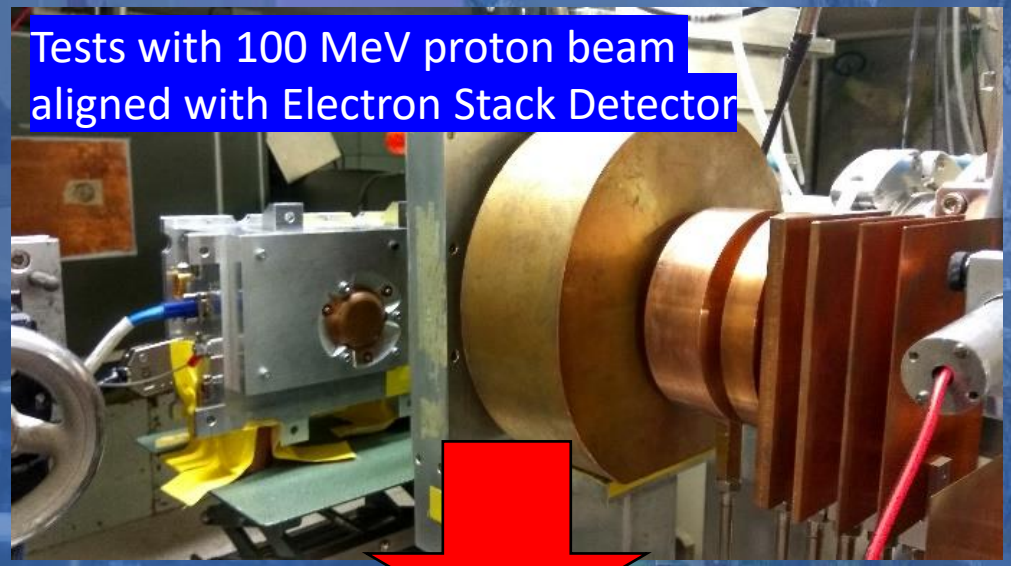
Requirements:

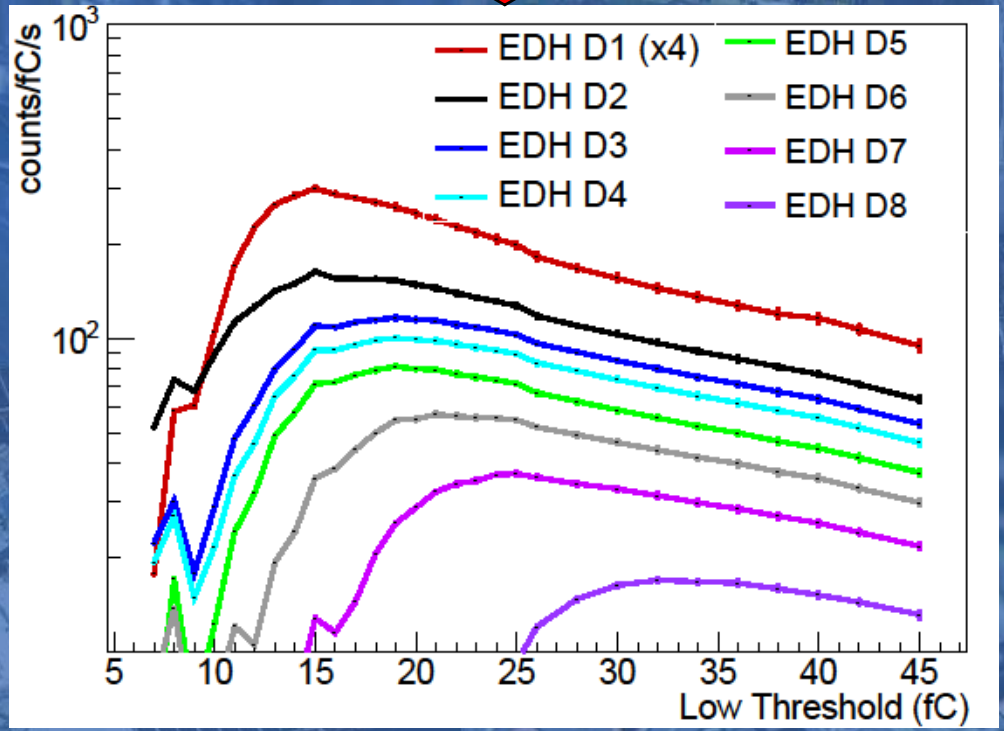
- ❑ Measure electron flux
  - Spectral range 300 keV – 40 MeV
  - Peak Flux 10^9 e/cm^2/s
  - Electron Directional Distribution
- ❑ Measure proton flux
  - Spectral range 5 MeV– 250 MeV
  - Peak Flux 10^8 p/cm^2/s
- ❑ Measure Heavy Ion population
  - From Helium to Oxygen
- ❑ Dose determination
- ❑ Low mass (~3 kg currently)
- ❑ Low power

Stack Detectors

Detector Head	Energy Range
Proton Detector (1)	5 MeV– 250 MeV
Electron Detector (2)	0.3 MeV – 40 MeV
Heavy Ion Detector (3)	8 MeV - 670 MeV

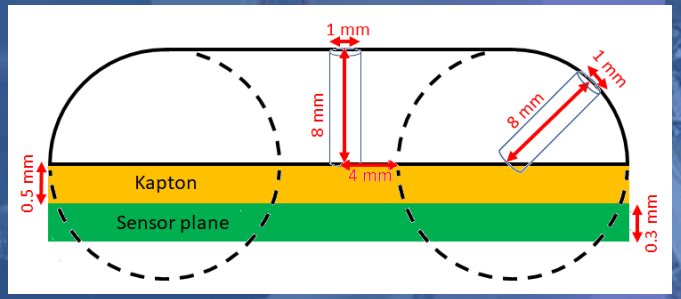


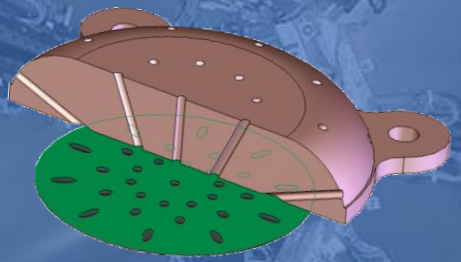


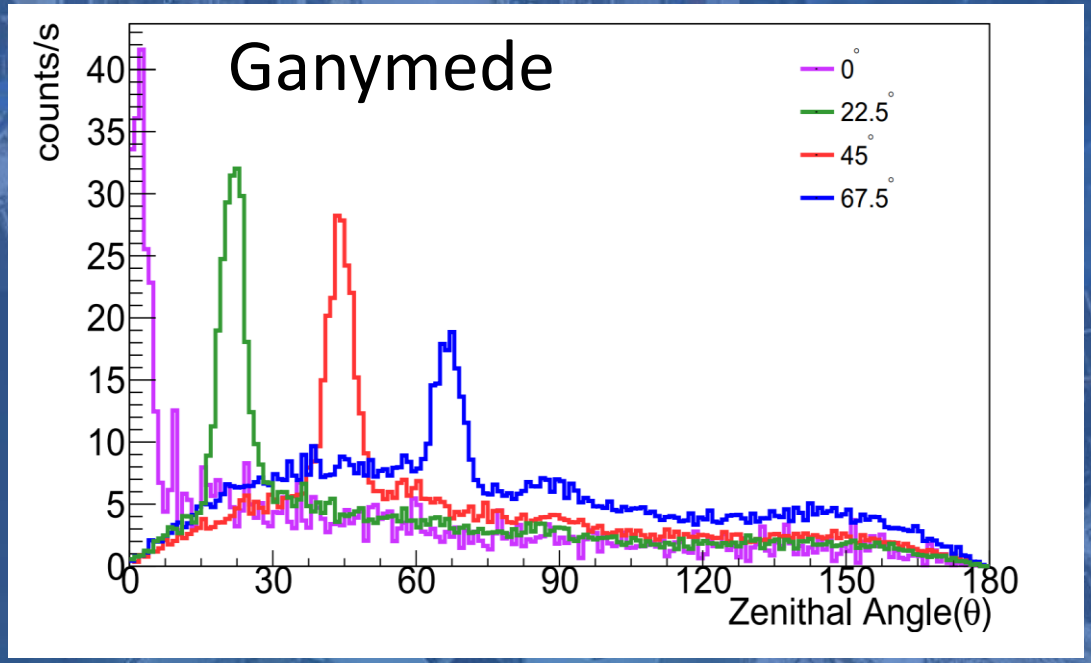


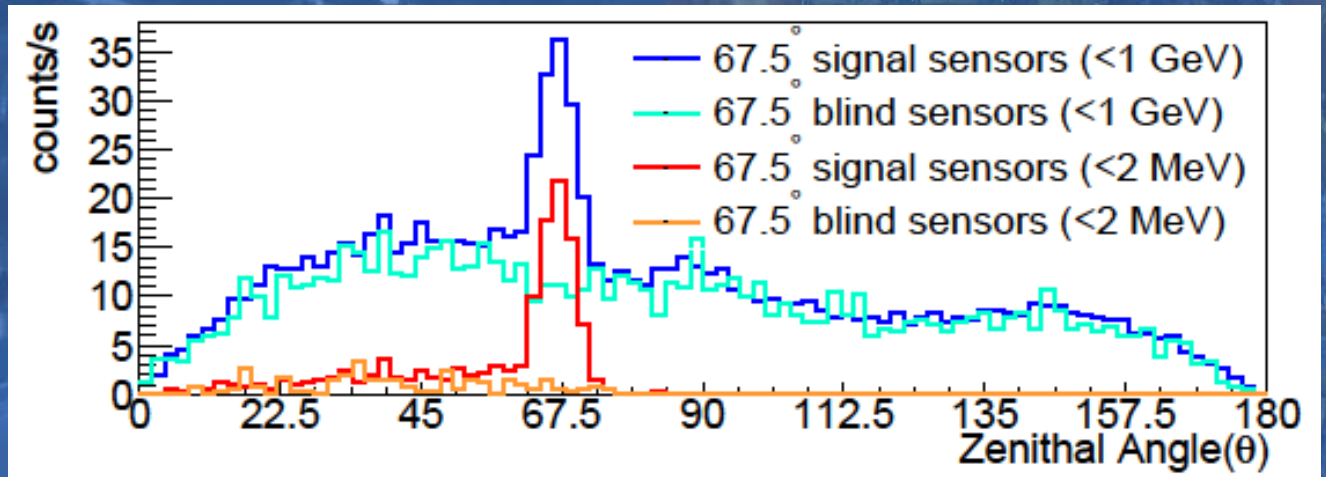
Directional Detector

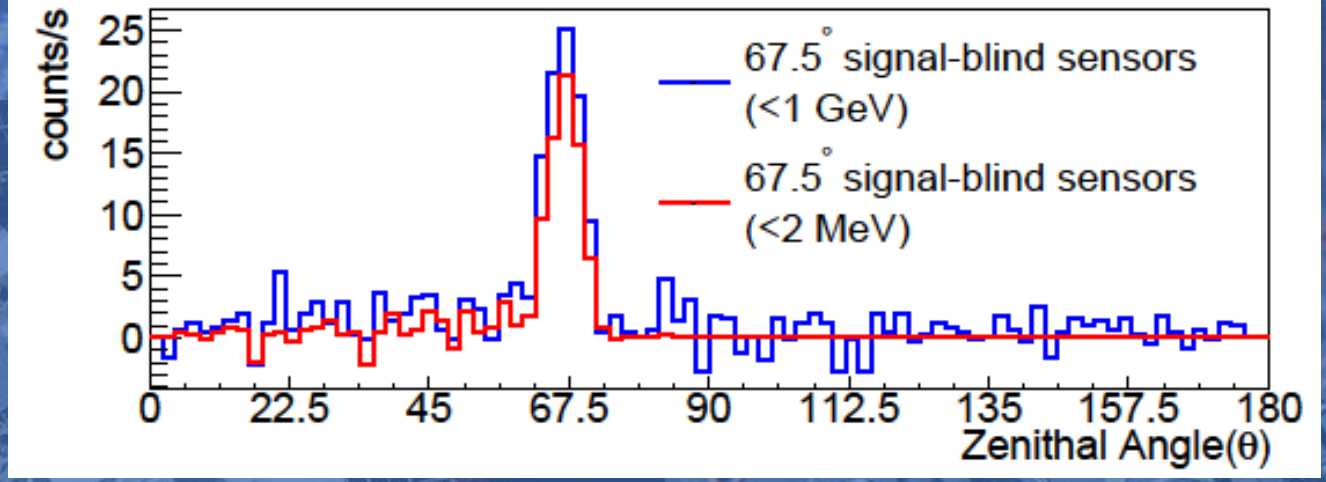
- Electrons ~0.3 – 2 MeV
- 28 directions
  - 4 zenithal directions
  - 9 azimuthal directions
- 3 background sensors











Current Status

Engineering Model

Radiation tests and integration with spacecraft approved

- All detectors performed as expected
- Readout fully functional
- Detector alignment showed good results

ProtoFlight Model

Calibration will take place at the beginning of 2021

Construction of the data pipeline is on-going

Currently developing algorithms to obtain high-level products