

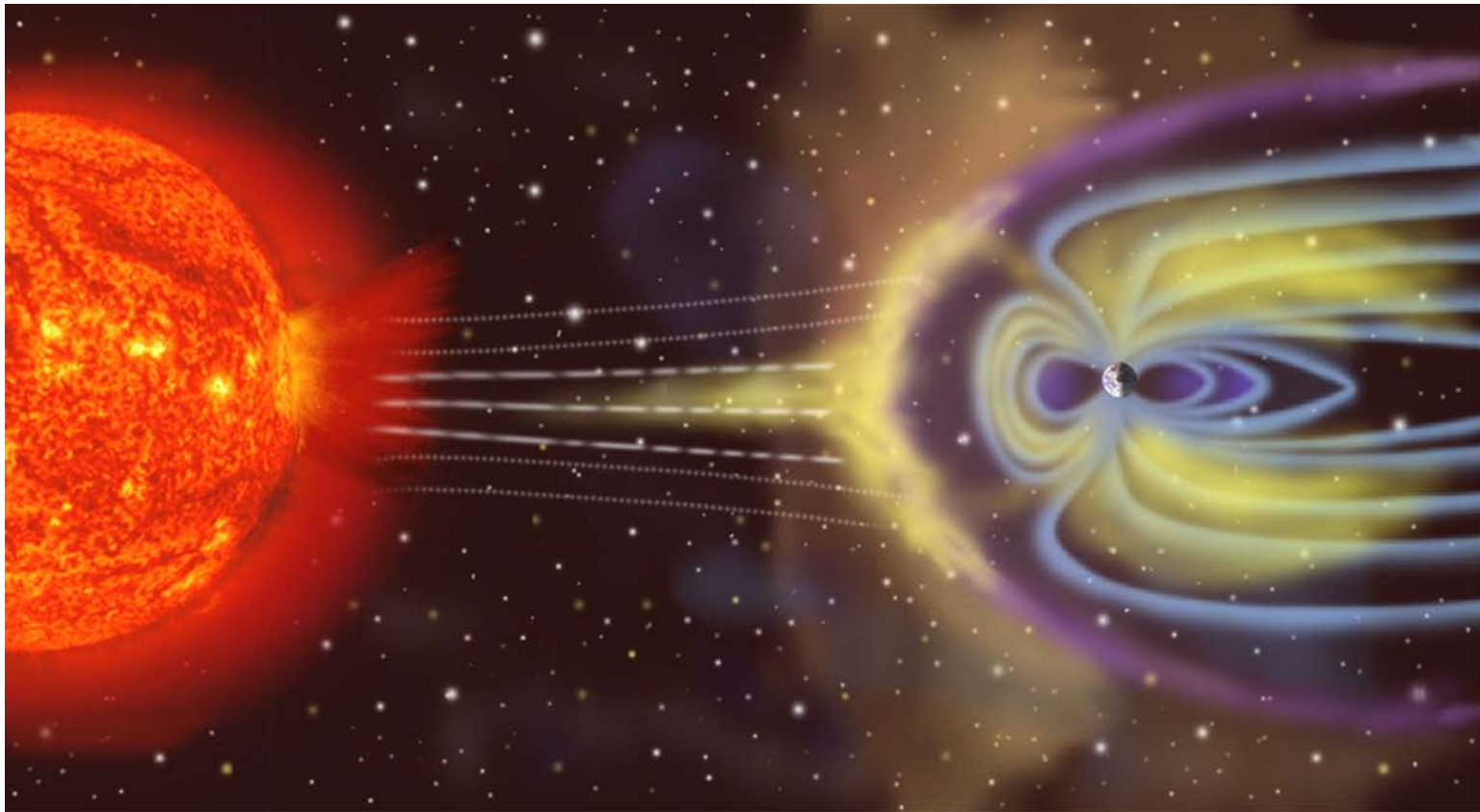


Particle Detectors in Harsh Radiation Environments

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Particle Detectors for in-situ Measurements



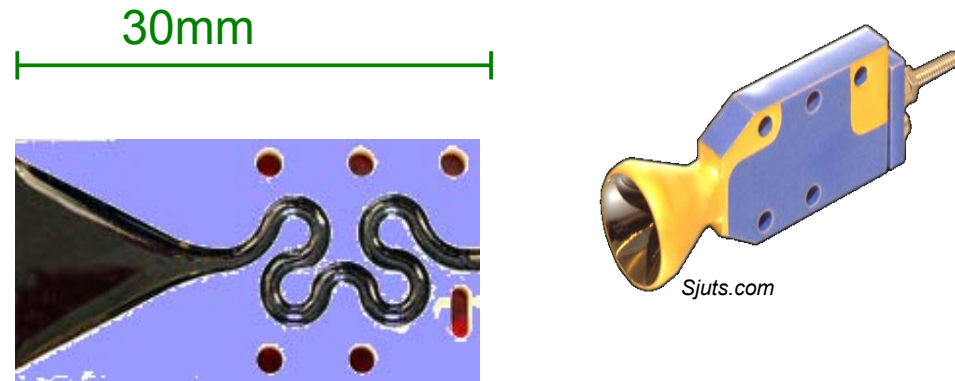
<http://sec.gsfc.nasa.gov/popscise.jpg>

Energies: ~ 5 eV to ~ 50 keV
Density: $< 10^5/\text{cm}^3$

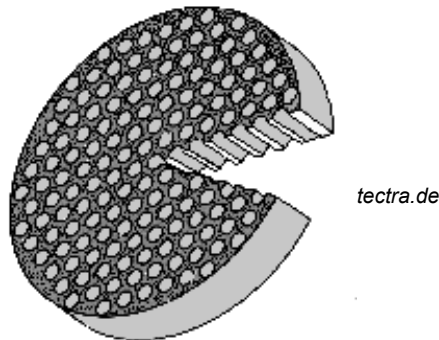
Particle Detectors



1 Channel Electron Multipliers



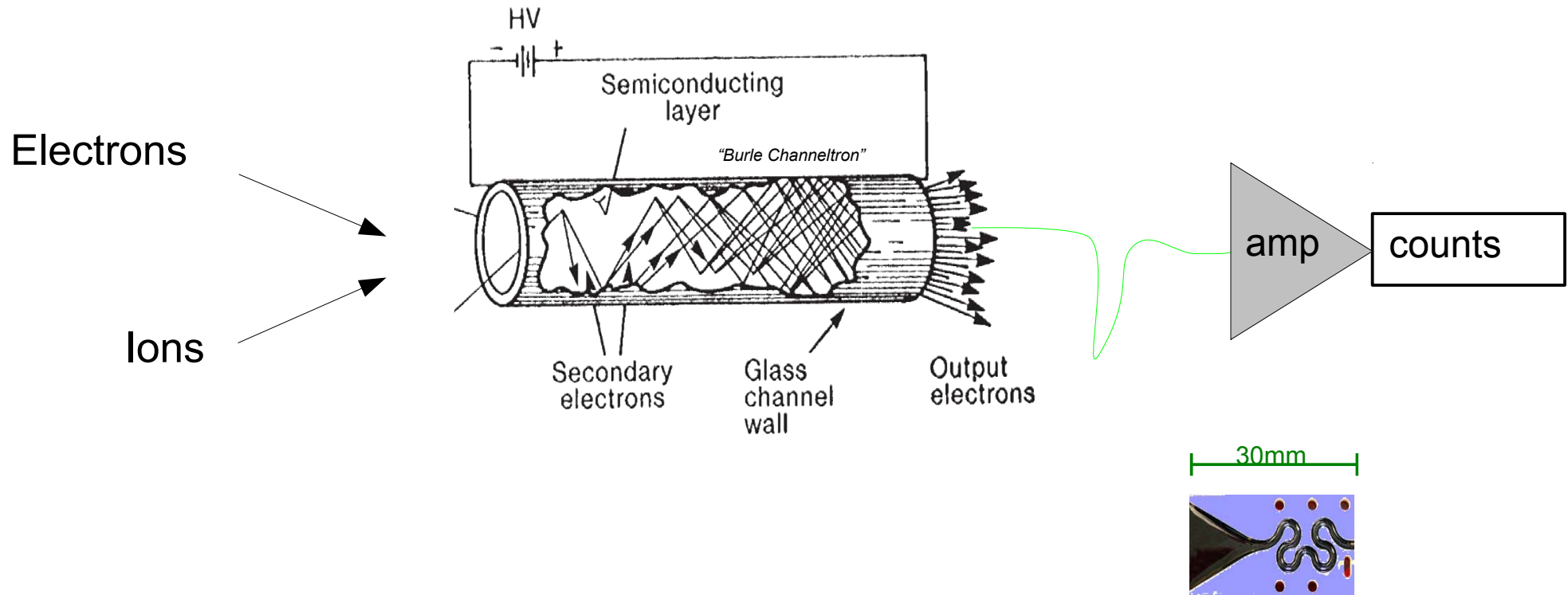
2 Micro Channel Plates



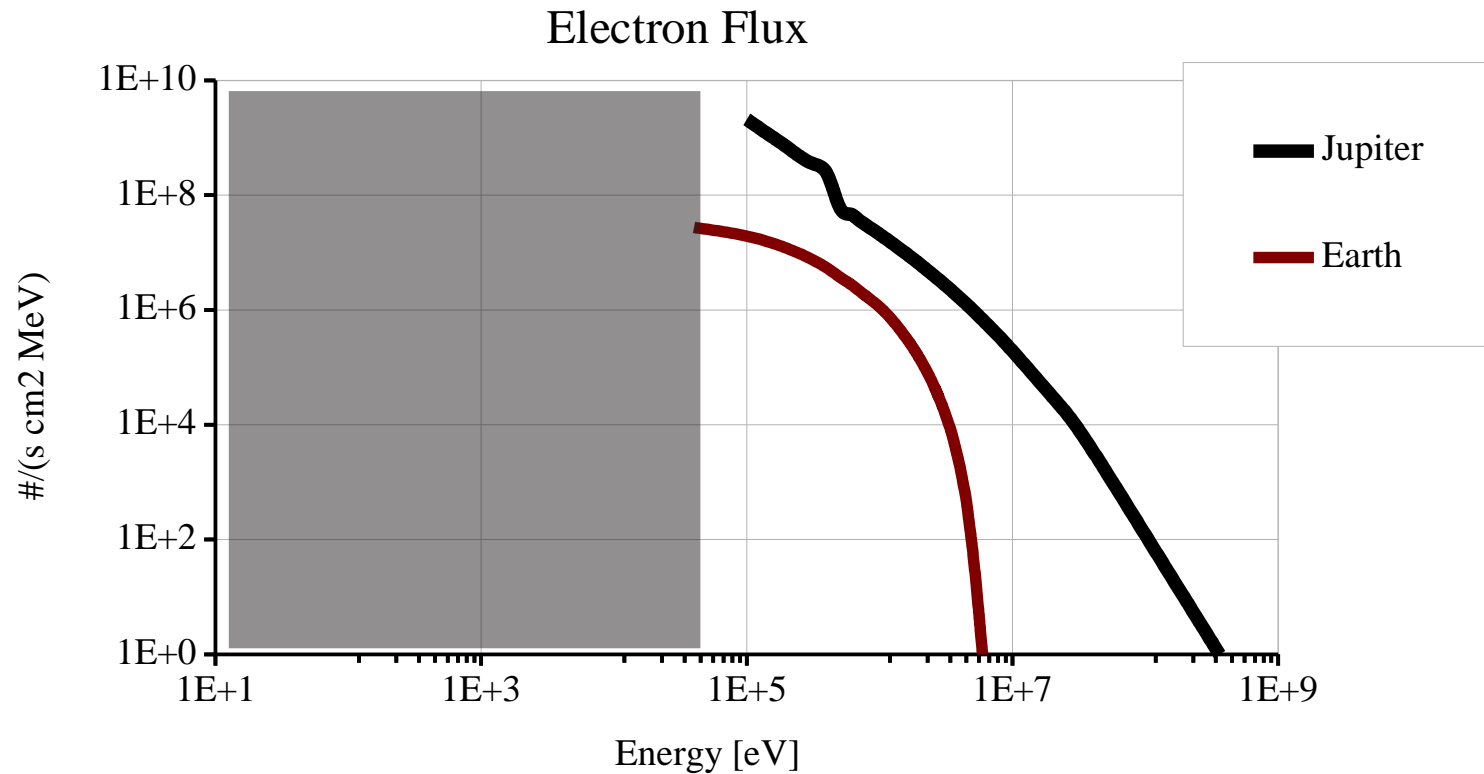
3 Solid State Detectors

“Block of Silicon”

Channel Electron Multiplier



Harsh Environment



Energetic particles 0.1 MeV to 100 MeV
penetrating particles → unwanted counts

Particle Detectors & Harsh Radiation



Penetrating particle

Range for 1 MeV in Aluminium:

Electron ~2 mm

Proton ~0.01 mm

Gamma ~60 mm

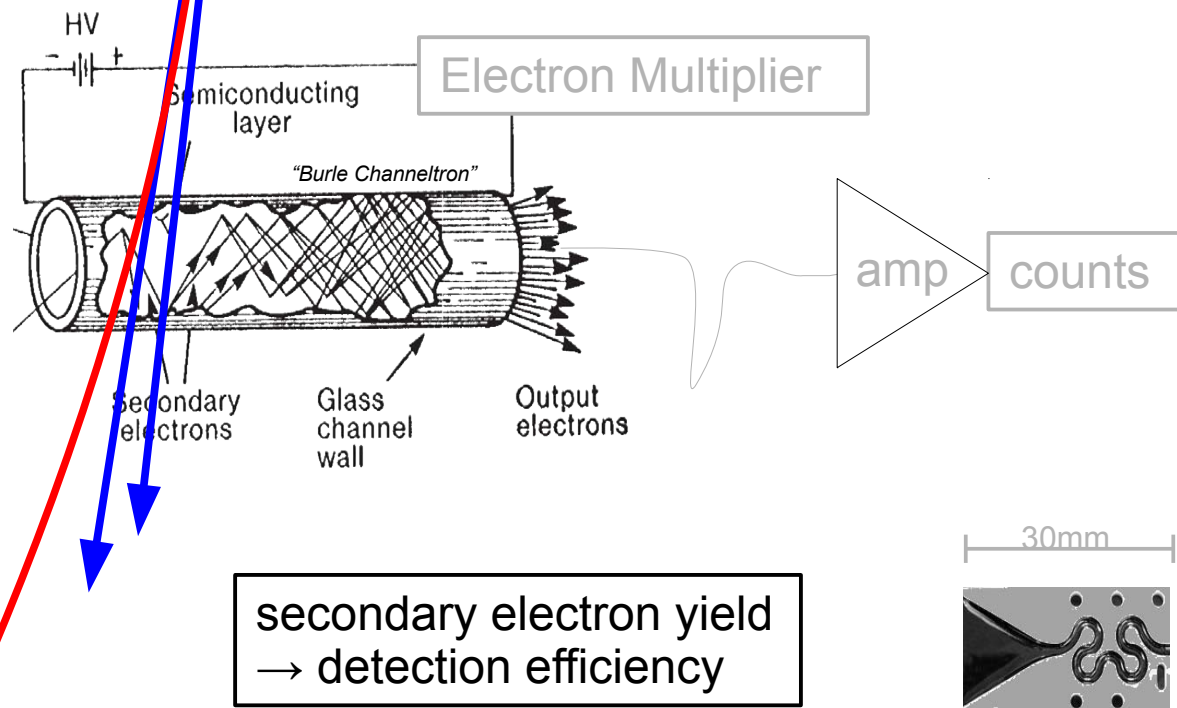
(NIST)

Shielding

“Bremsstrahlung”

Electrons

Ions

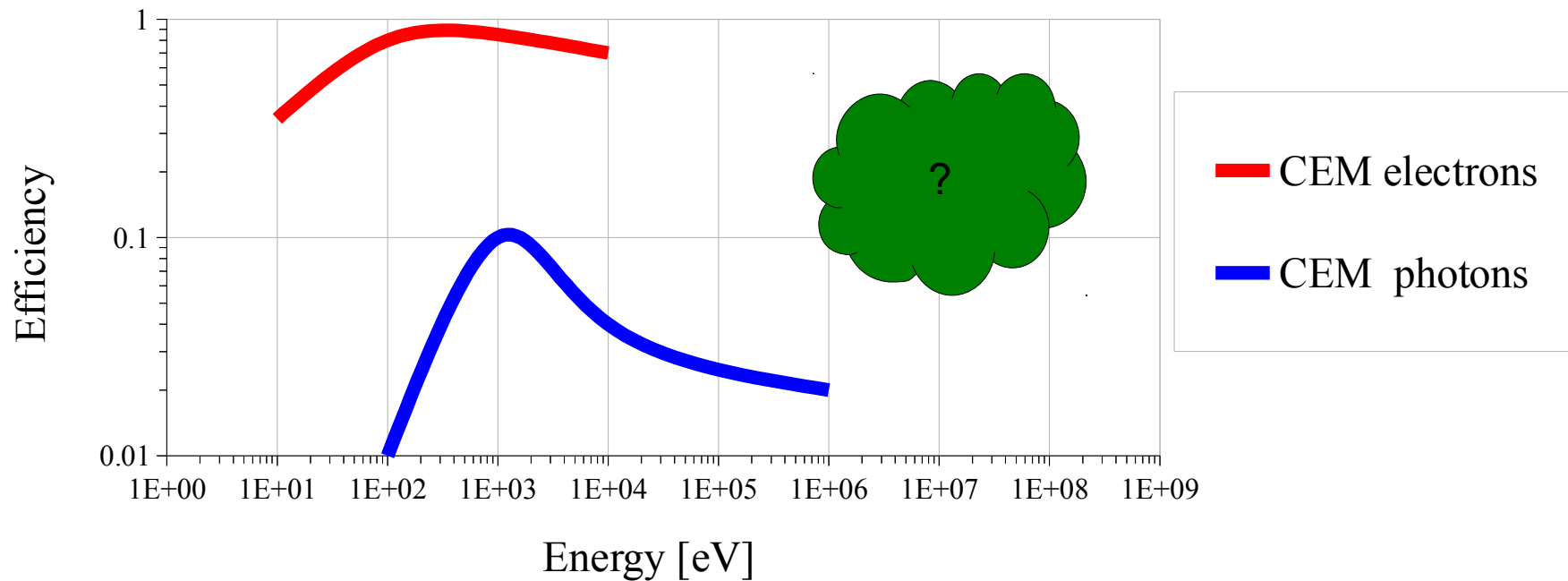


secondary electron yield
→ detection efficiency

Detection Efficiency of CEM



Efficiencies of Channel Electron Multipliers

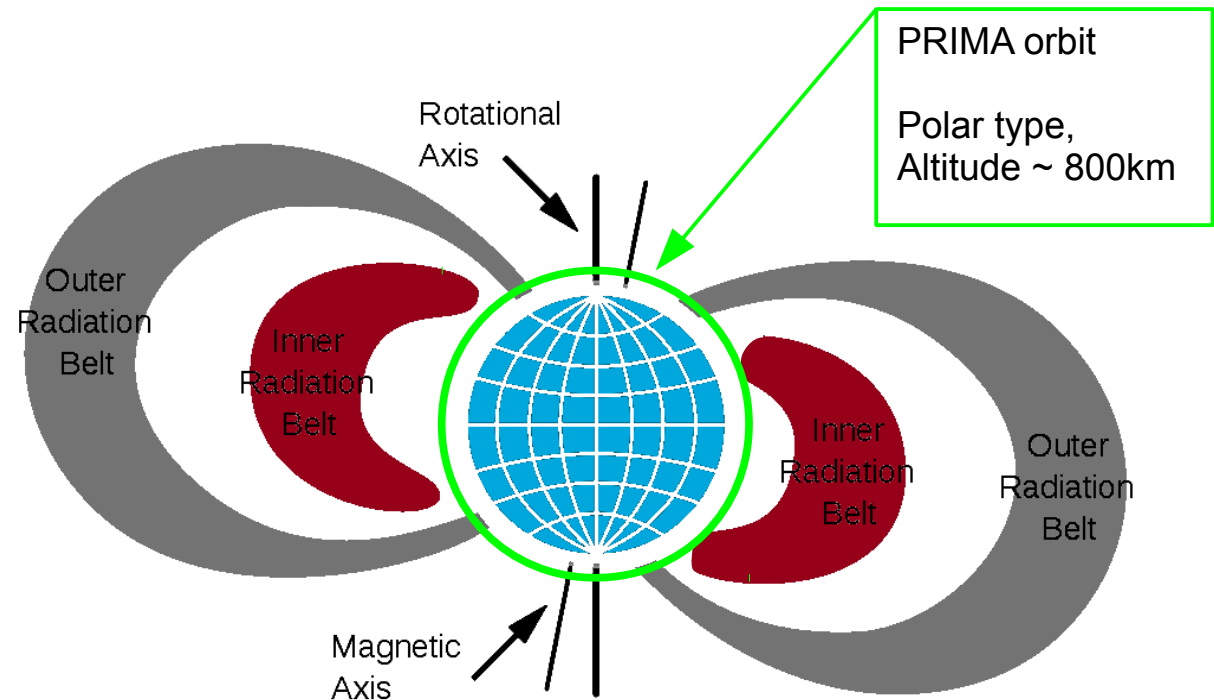
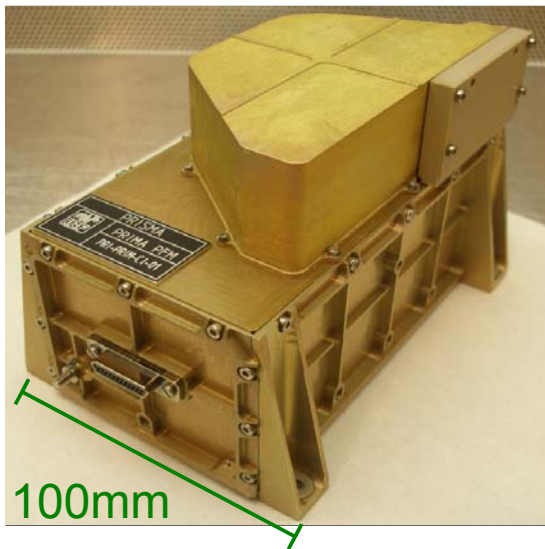


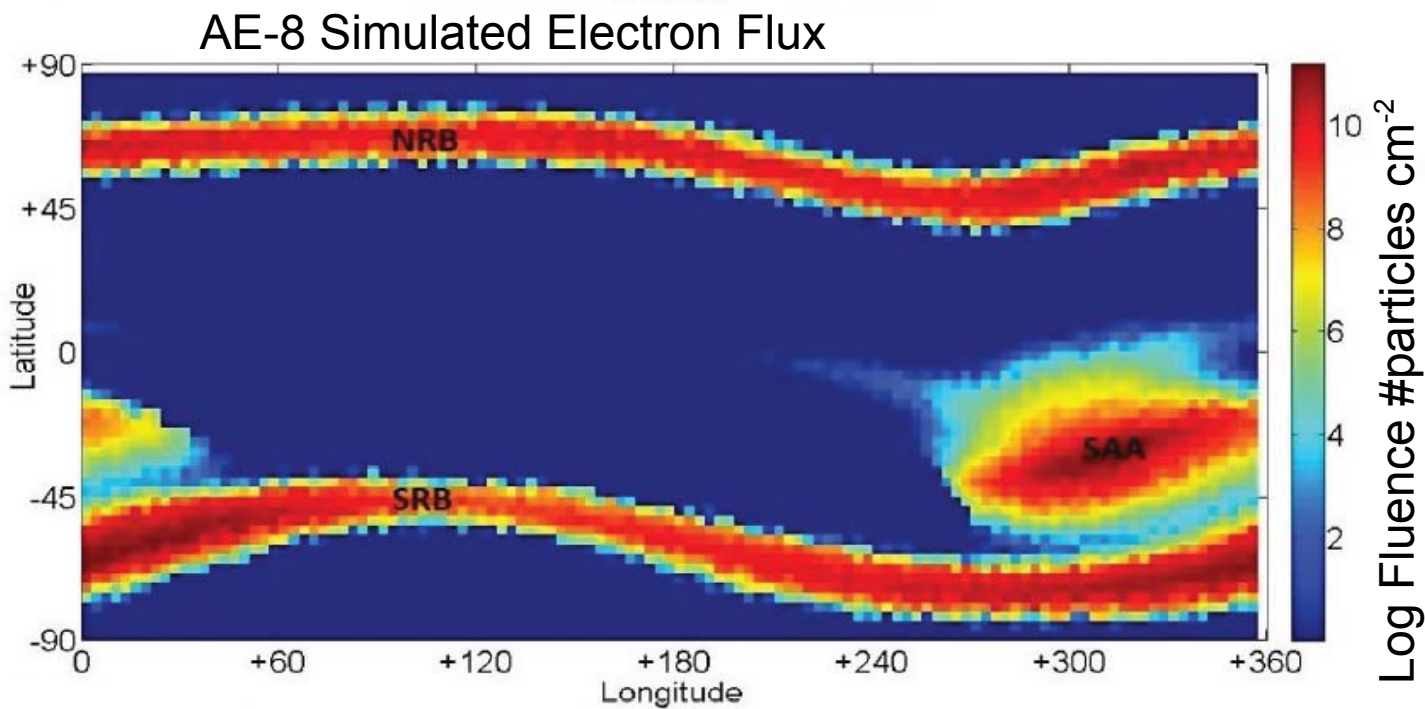
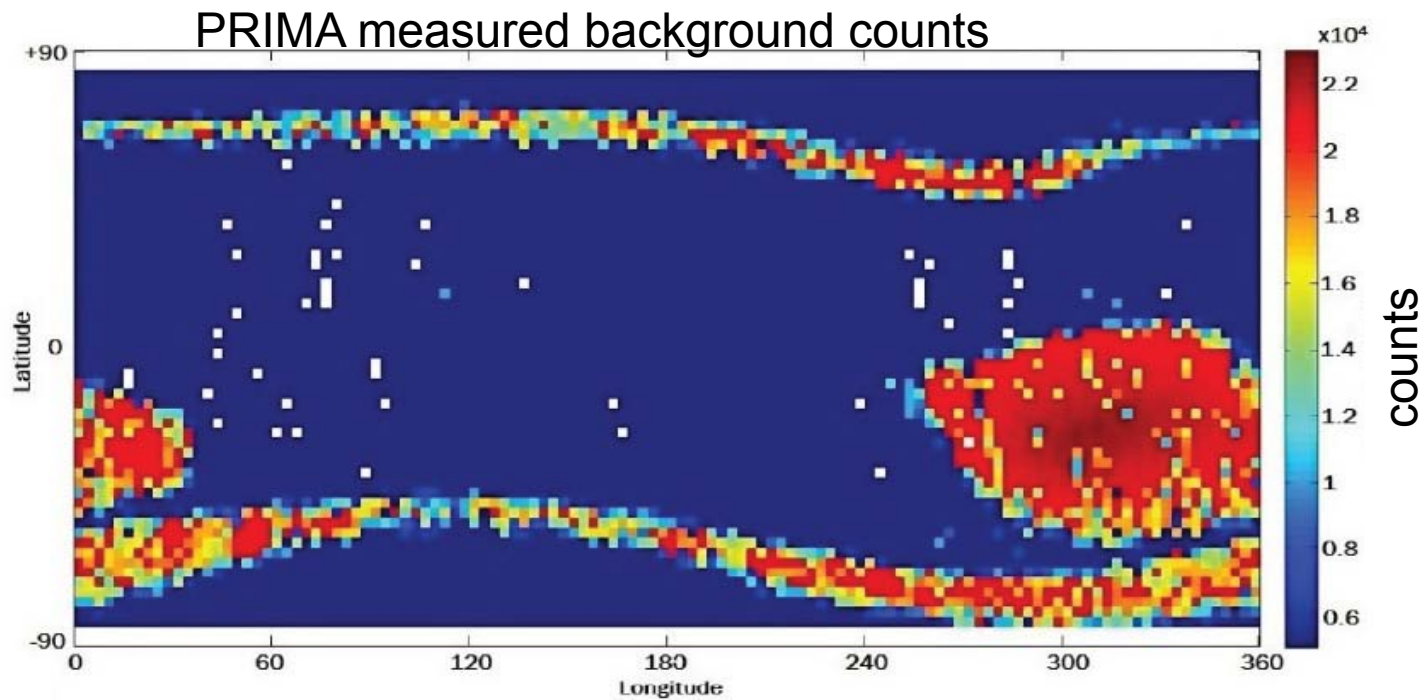
PRIMA – Method

Master Thesis by Zahra Vaziri Zanjani



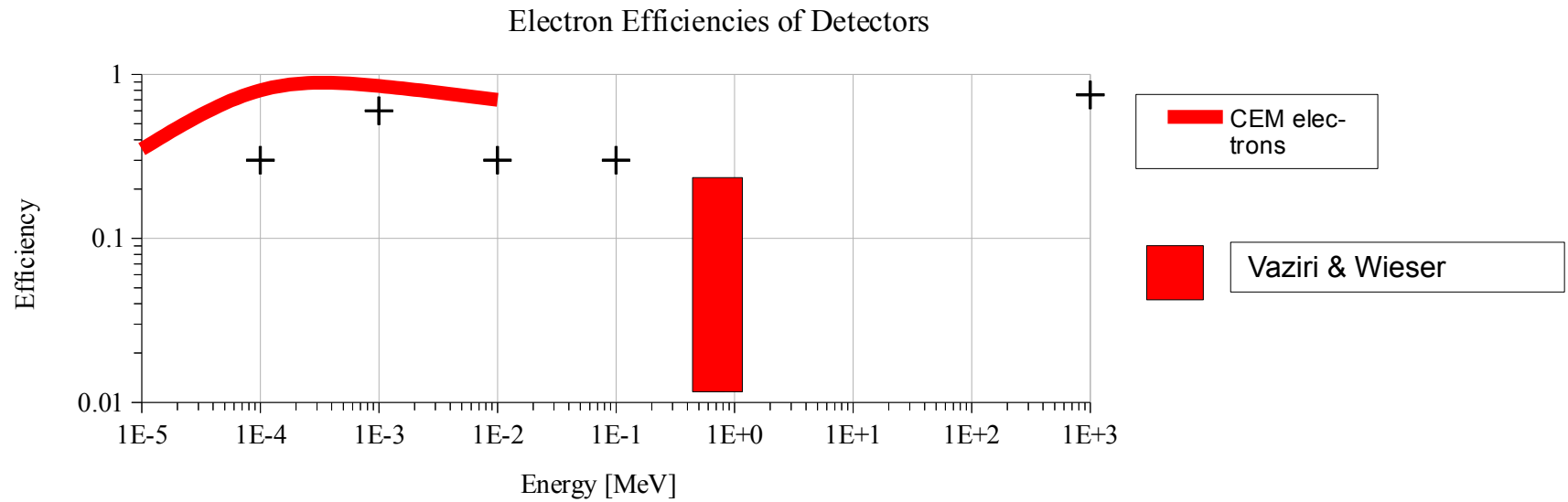
IRF Instrument PRIMA
on
SSC Mission PRISMA



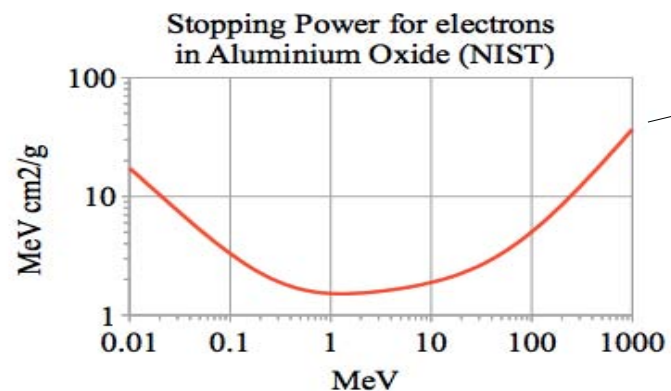
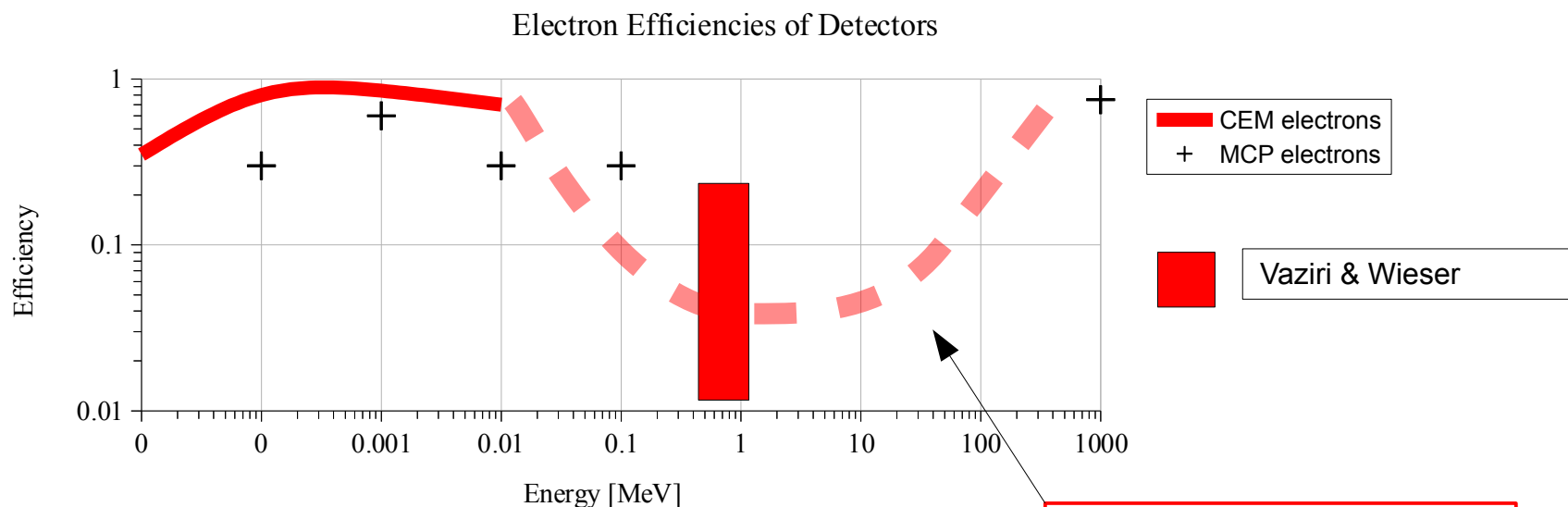


Efficiency +
shielding

Results of PRIMA - Method

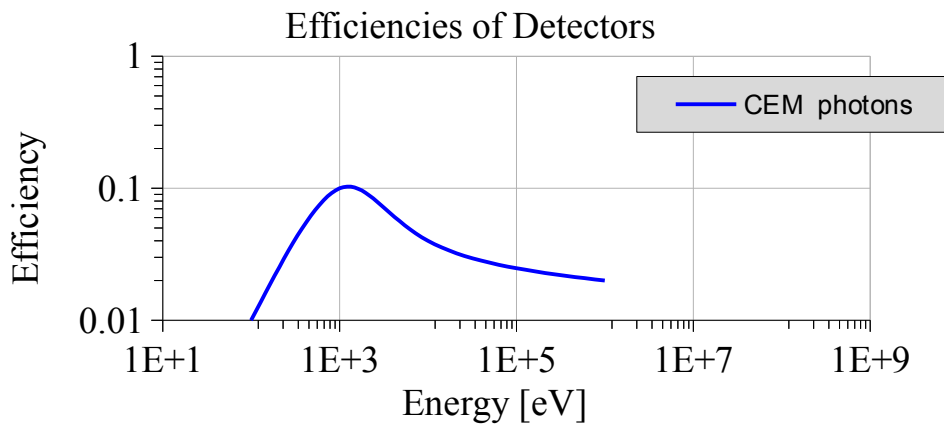
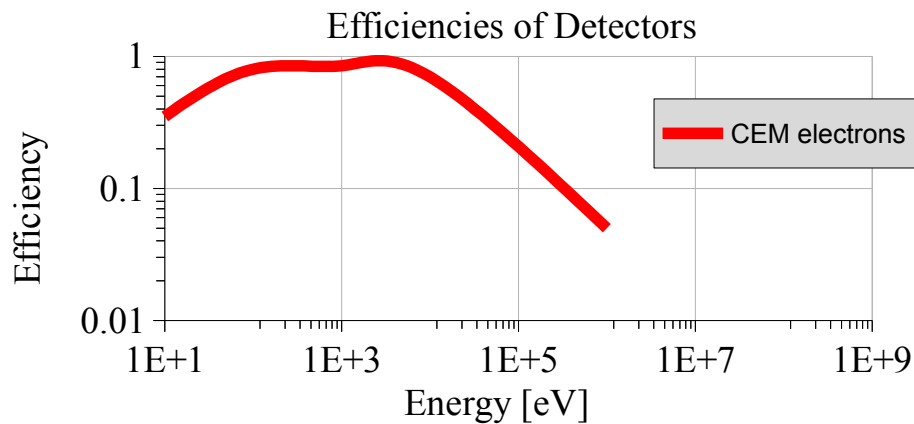
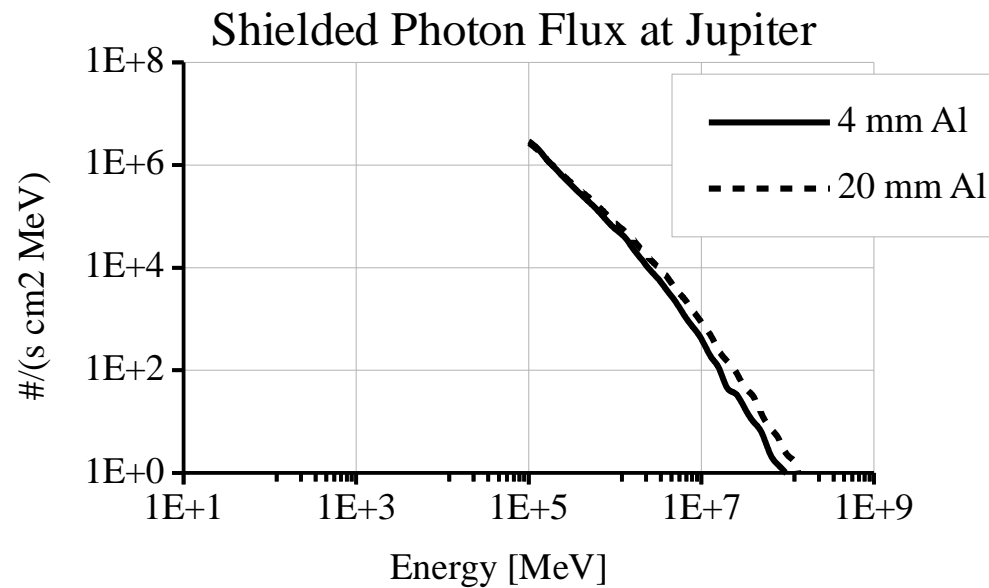
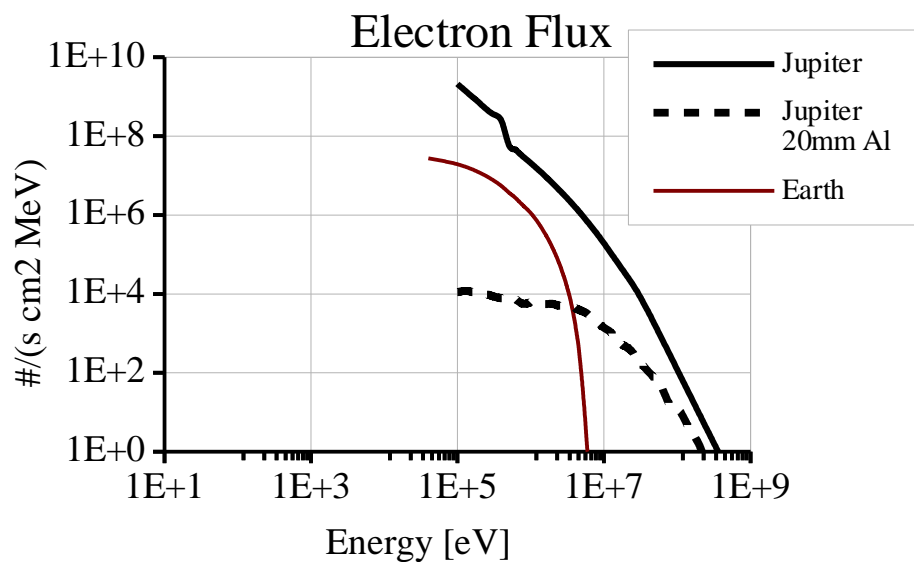


Results of PRIMA - Method



possible trend for electron efficiency of CEM

Shielding, harsh & HARSH



Summary

- Efficiency of detecting penetrating background radiation is important to know
- Little to nothing is published (efficiency) above 1 MeV
- PRIMA – Method was able to give 1 more data point (range)

Outlook

- Fill data gaps for upcoming missions like JUICE / ESA
- Apply PRIMA – Method to other Instruments?
ex. PLS on Galileo Mission?
Galileo did 2 Earth fly-by before reaching Jupiter.
- Real tests with Electron Multipliers
in radiation laboratories? → contact me

joan@irf.se

