

PROTOTYPE SPHERICAL TEPC DESIGN FOR DOSE MEASUREMENT IN ISS

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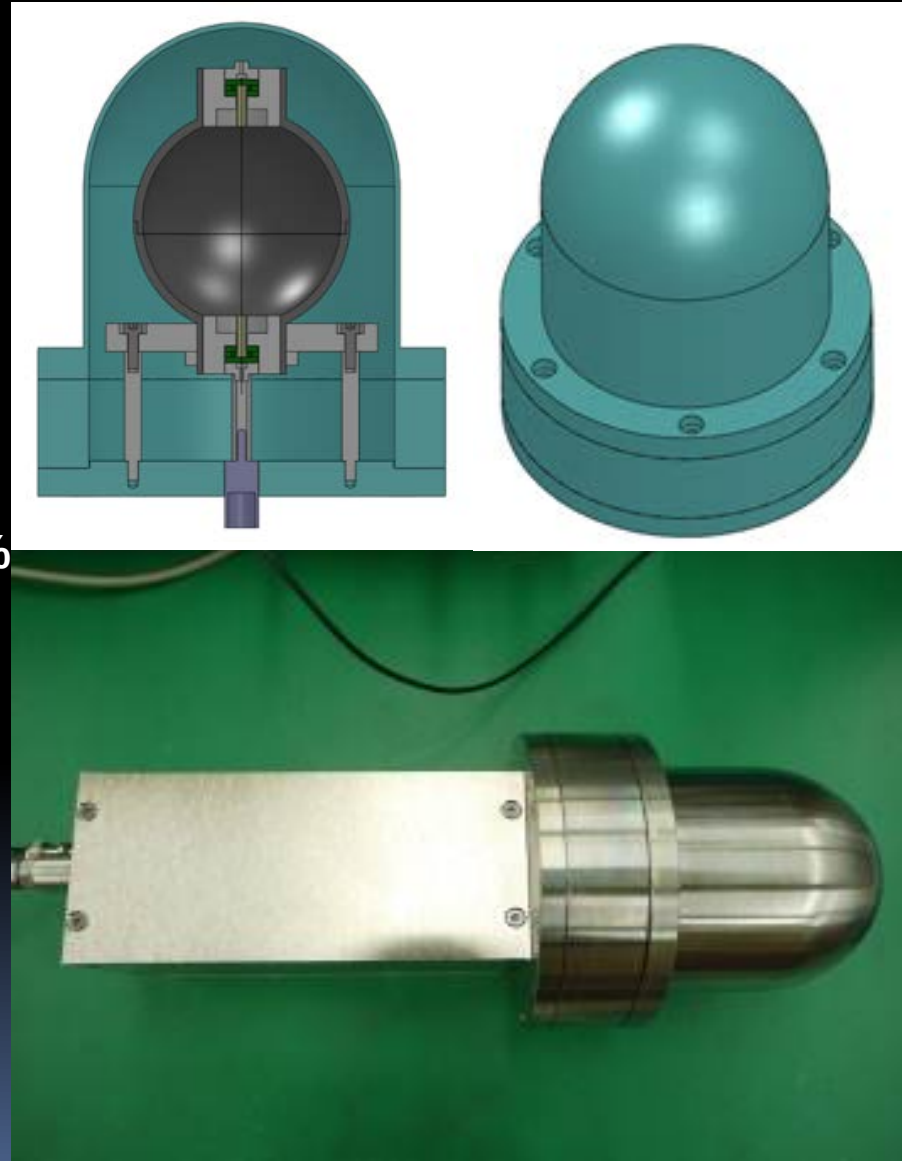
³*Korea Atomic Energy Research Institute*

Background

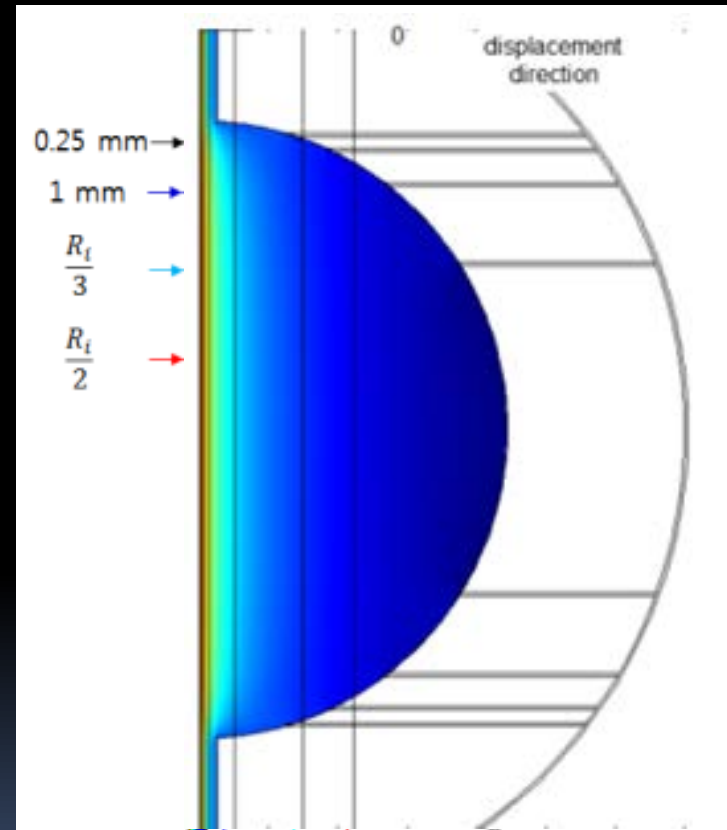
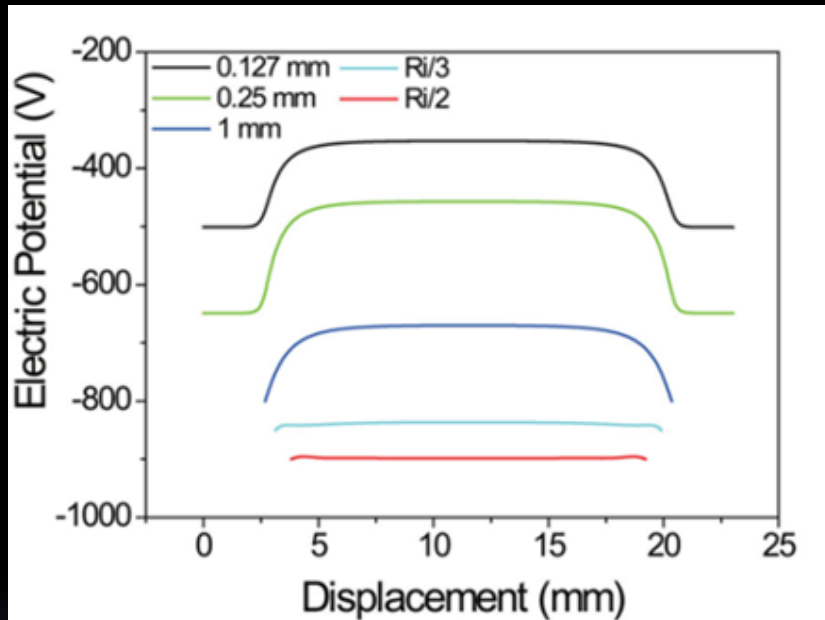
- NASA proposed radiation monitoring in ISS as a Korea-US cooperation program in 2009.
- KASI has been funded for developing a spherical type TEPC since 2011.
- Requirements
 - LET range: 0.2 – 300 keV/um
 - Mass: < 5kg
 - Volume : < 6000 cm³

Prototype TEPC

- TE material : A-150
- A-150 sphere inner diameter : 58 mm
- A-150 Thickness : 2.7 mm
- TE Gas : 55% C_3H_8 , + 39.6% CO_2 + 5.4% N_2
- Gas Pressure : 20 Torr
- Detector Housing: SUS304
- Housing diameter : 93 mm
- Thickness : 1.6 mm



Electric field in the sphere

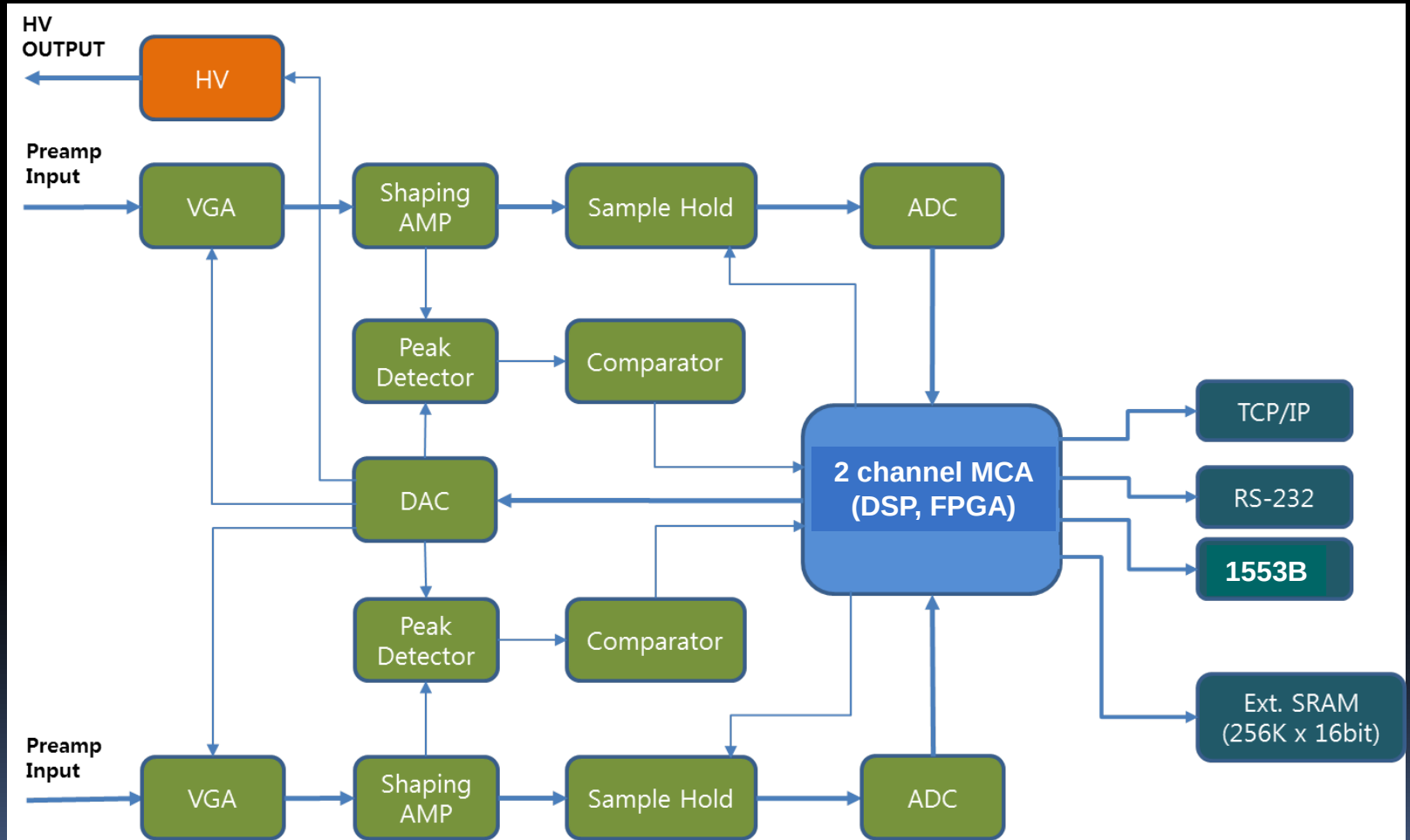


Wall of sphere : -1,000 V

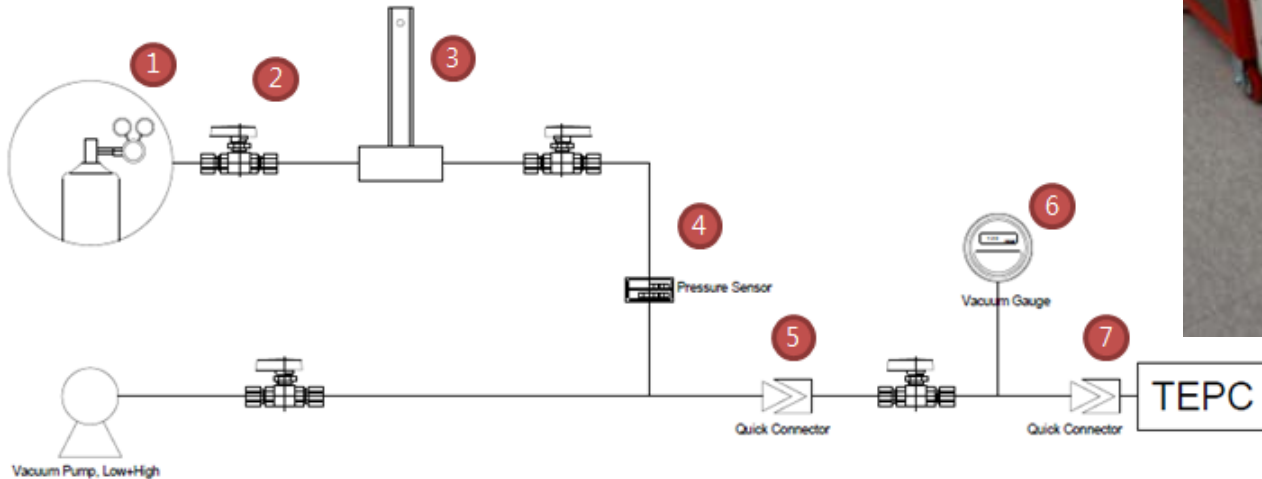
Center Wire : 0 V

Code : COMSOL ver 4.2

Signal Processing



Gas Filling System

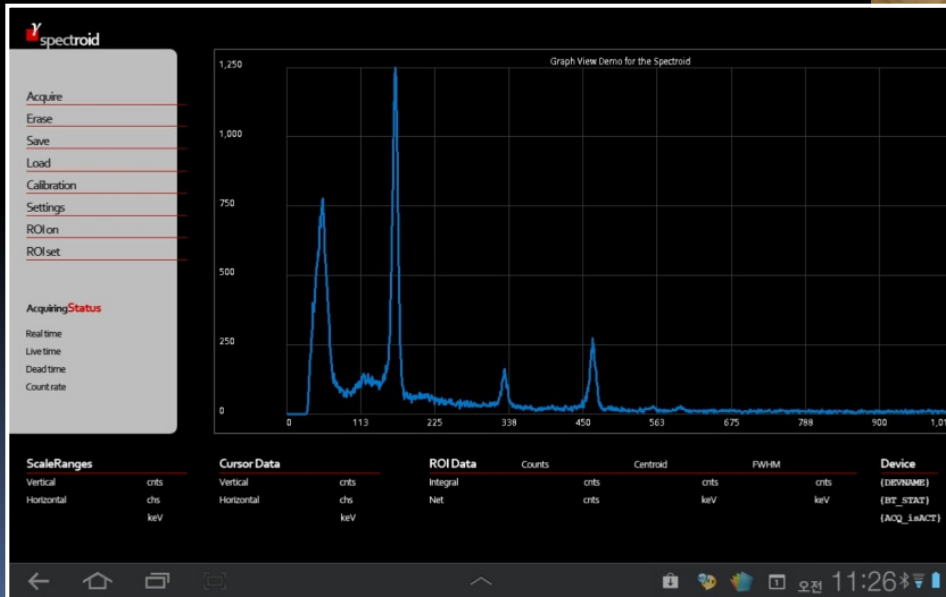


① Prophan TE gas □ Valve □ Flow meter

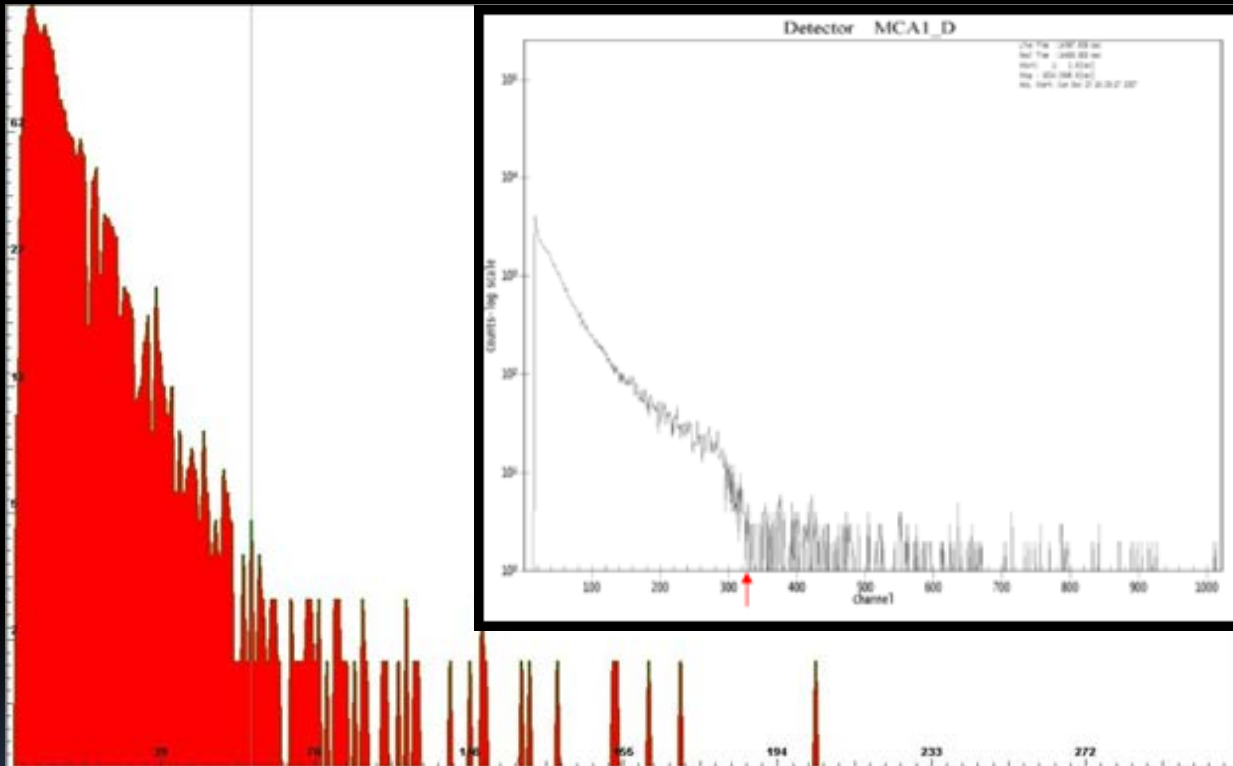
□ Pressure sensor □ Quick connector

□ Vacuum Gauge □ Quick connector

Interface with Tablet

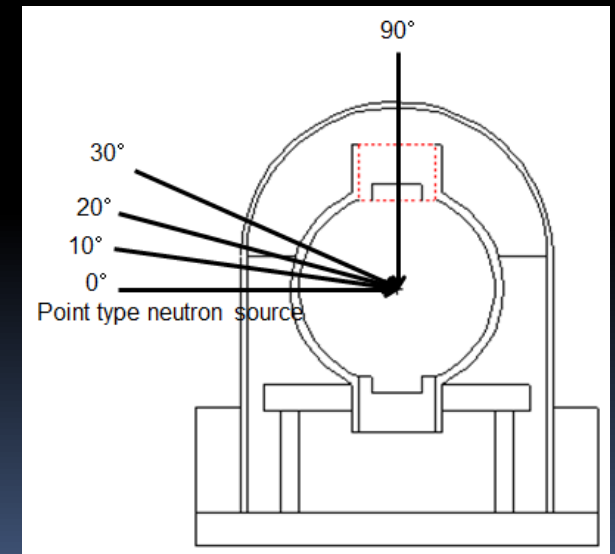
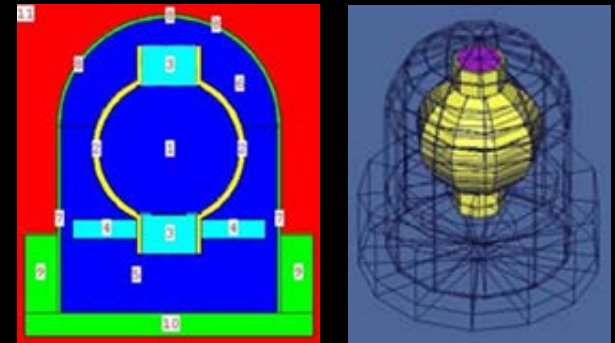
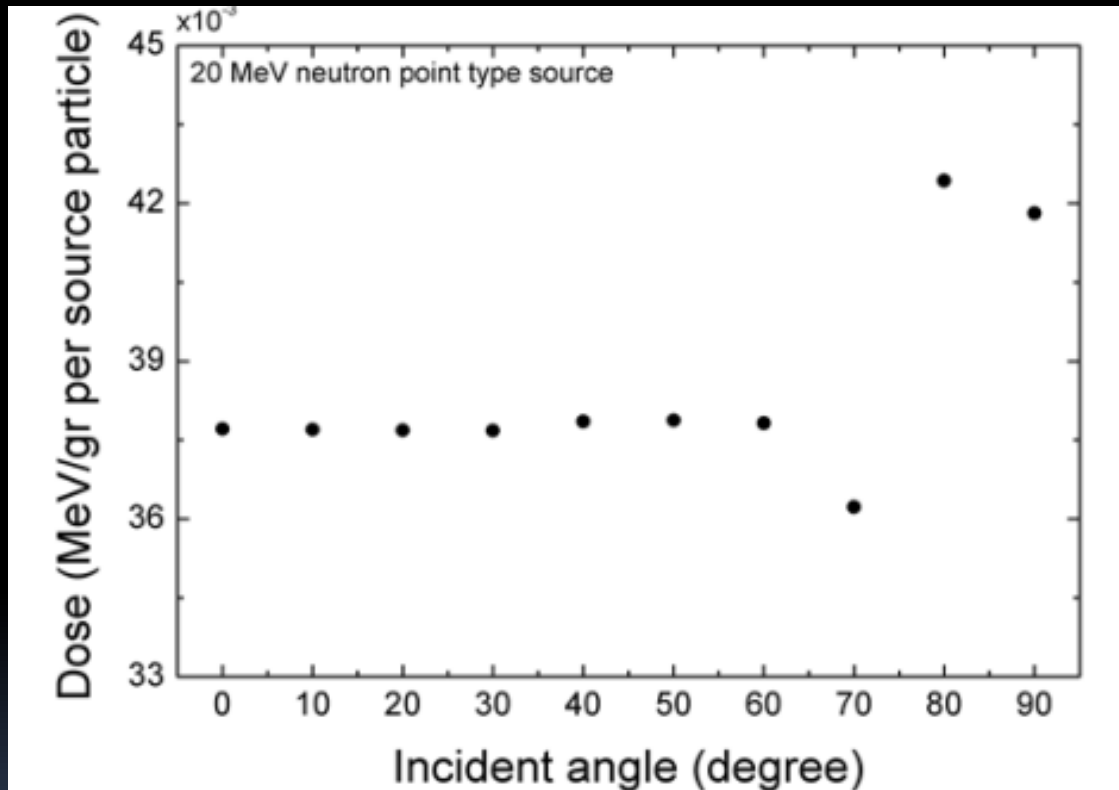


Calibration with Isotope



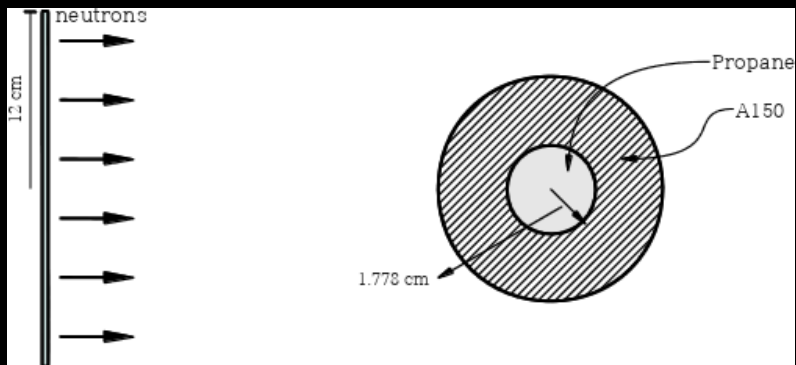
Source: Be-Ra

Monte Carlo simulation

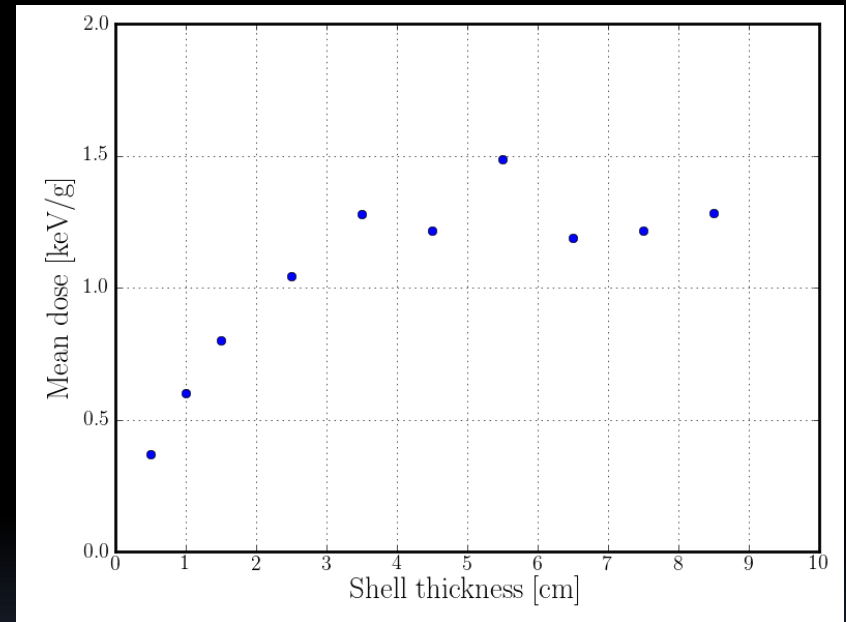


Deposit energy depending on the incident angle of neutron

TEPC Simulation

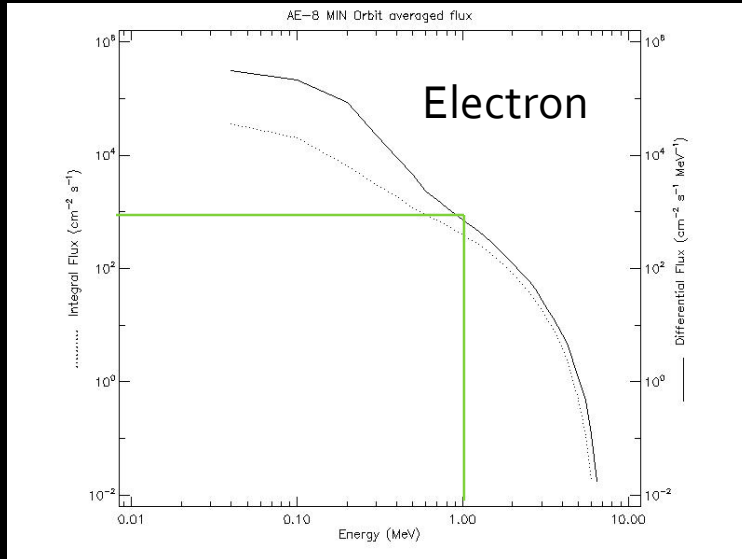


Simulate energy deposition on TEPC
by 100 MeV neutron



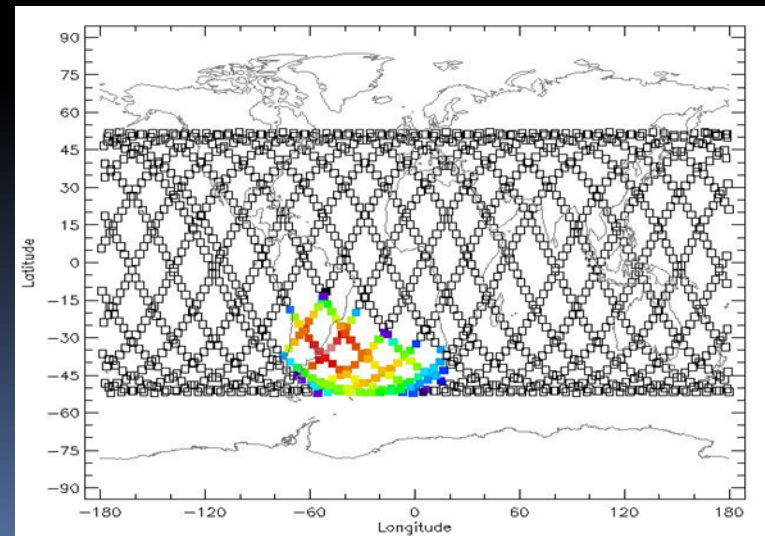
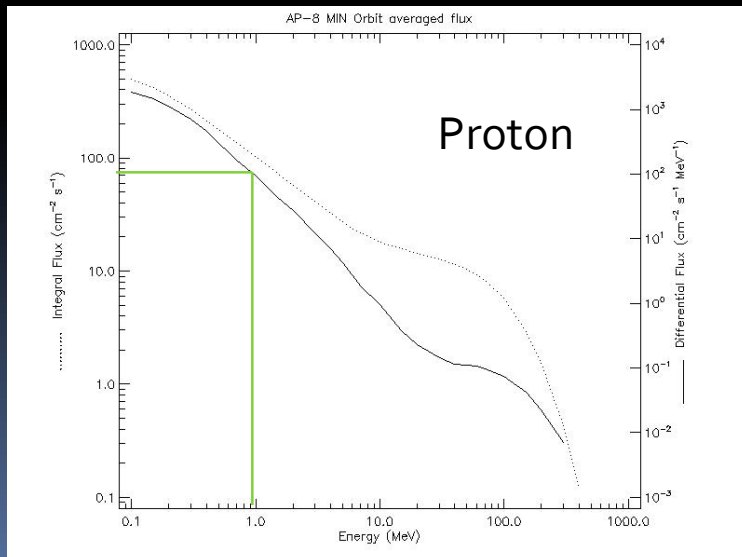
TEPC energy deposition depends on
shell thickness

Radiation Environment outside ISS

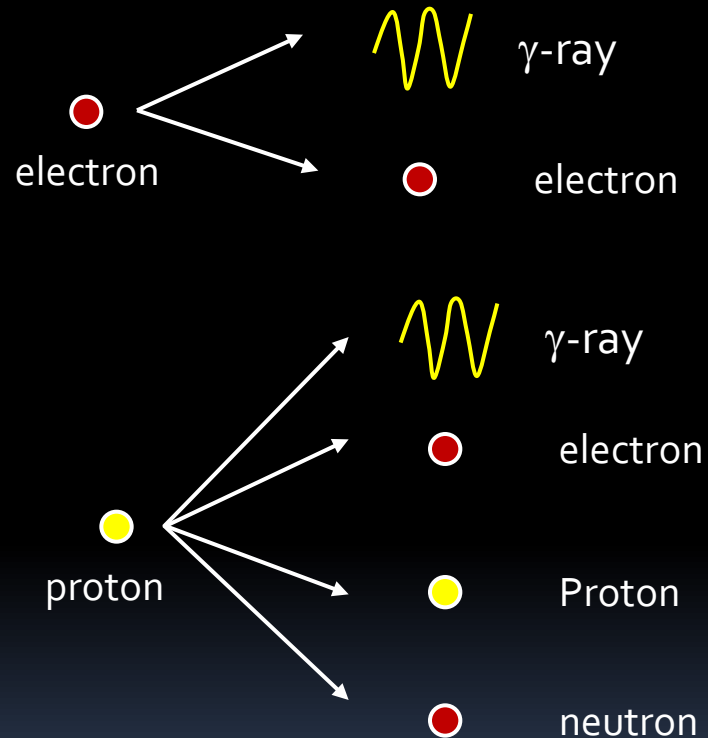
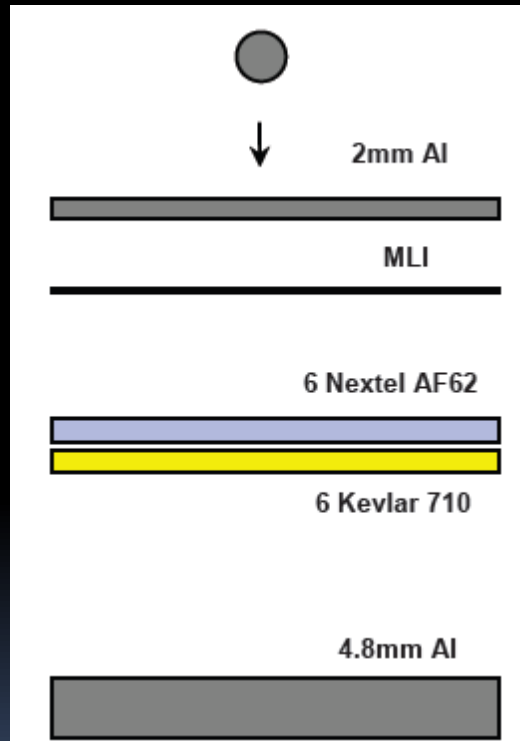


On the orbit of ISS

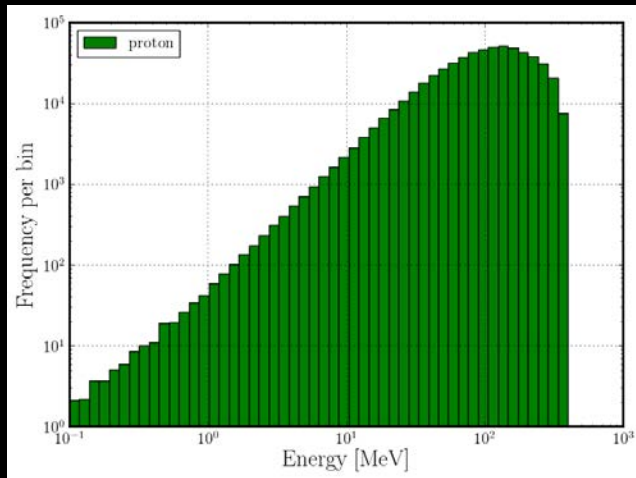
Calculate particle flux with AE/AP-8 model



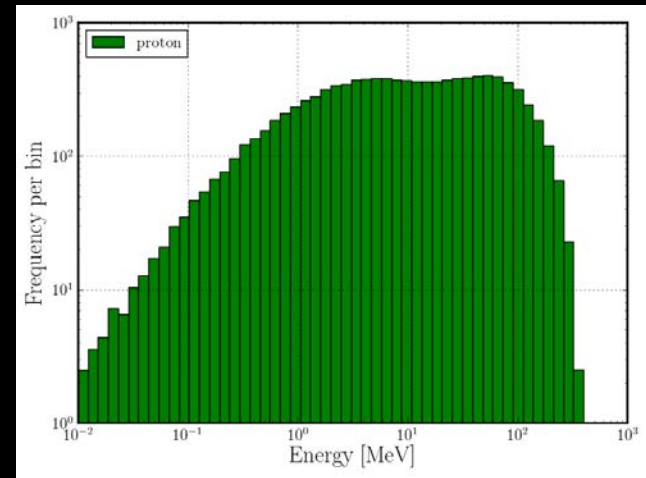
Particle interaction with ISS wall



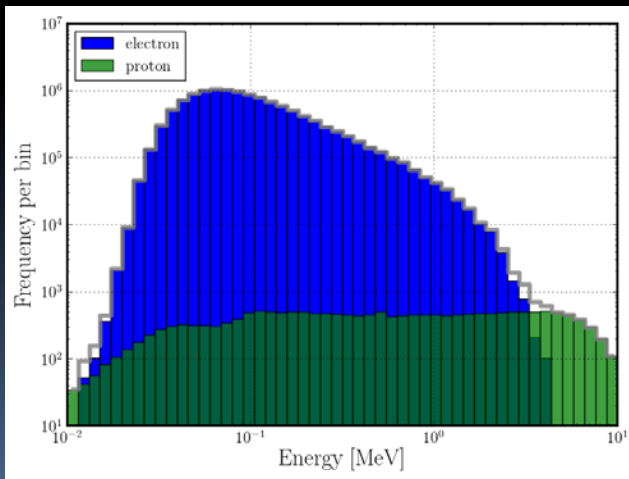
Radiation Environment inside ISS



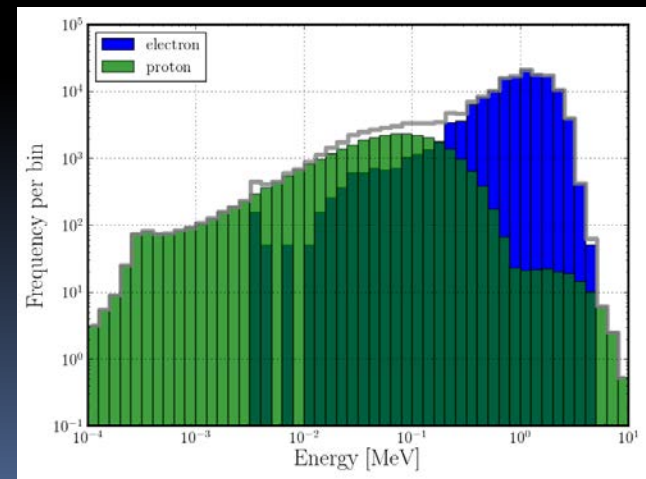
proton



neutron

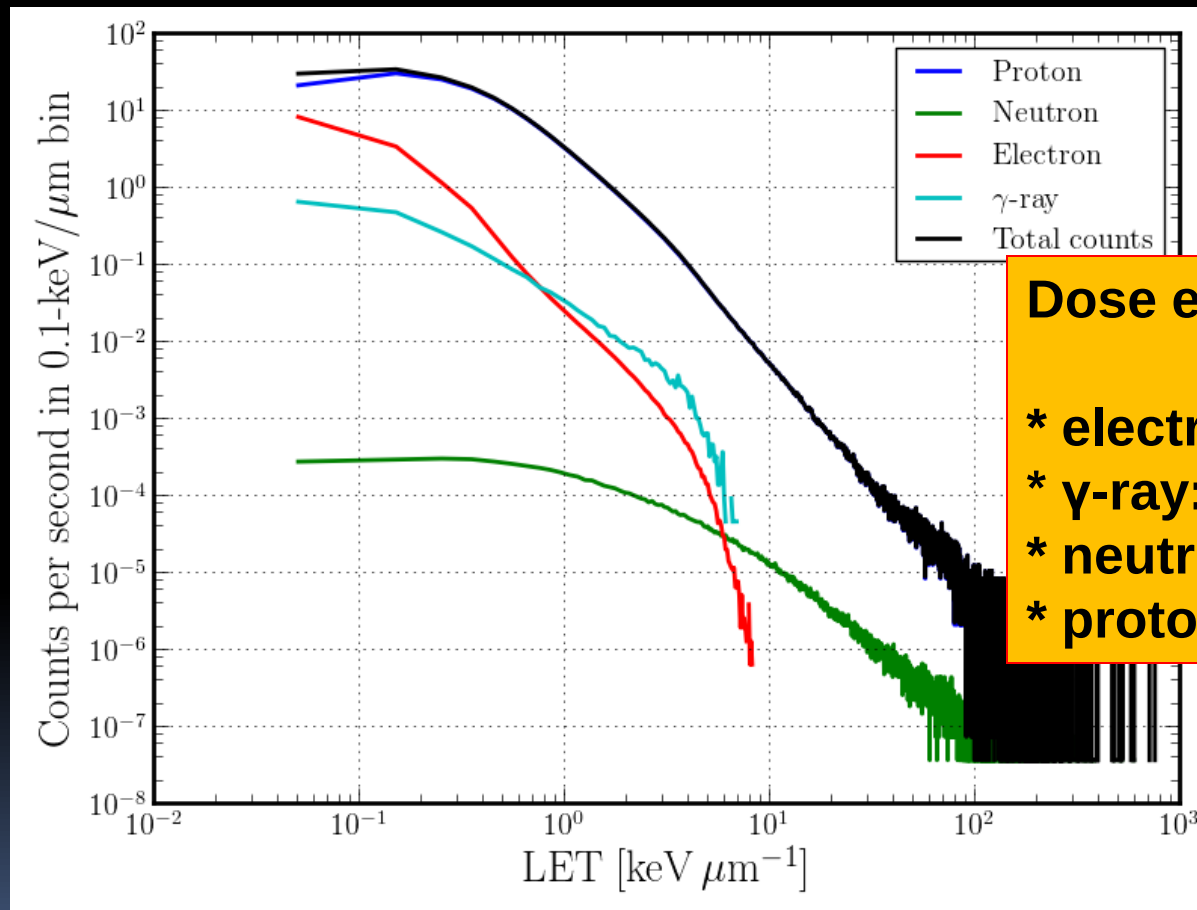


γ -ray



electron

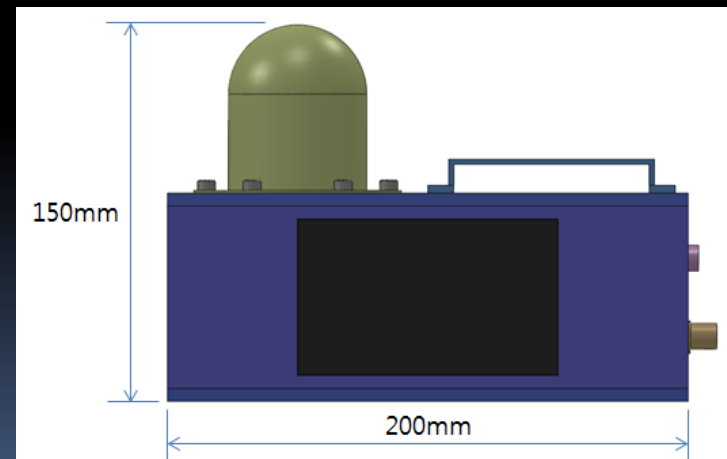
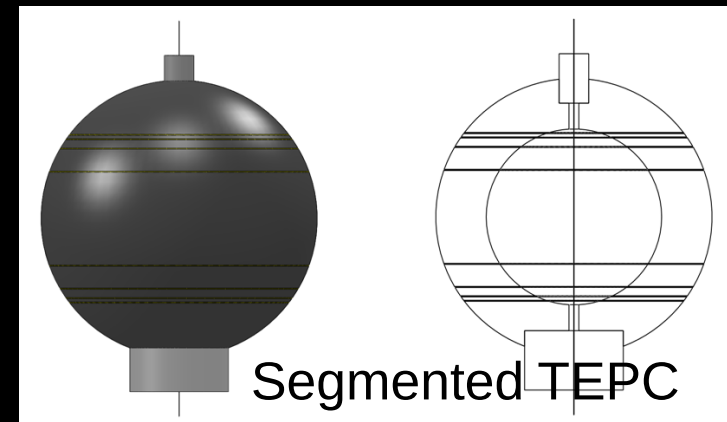
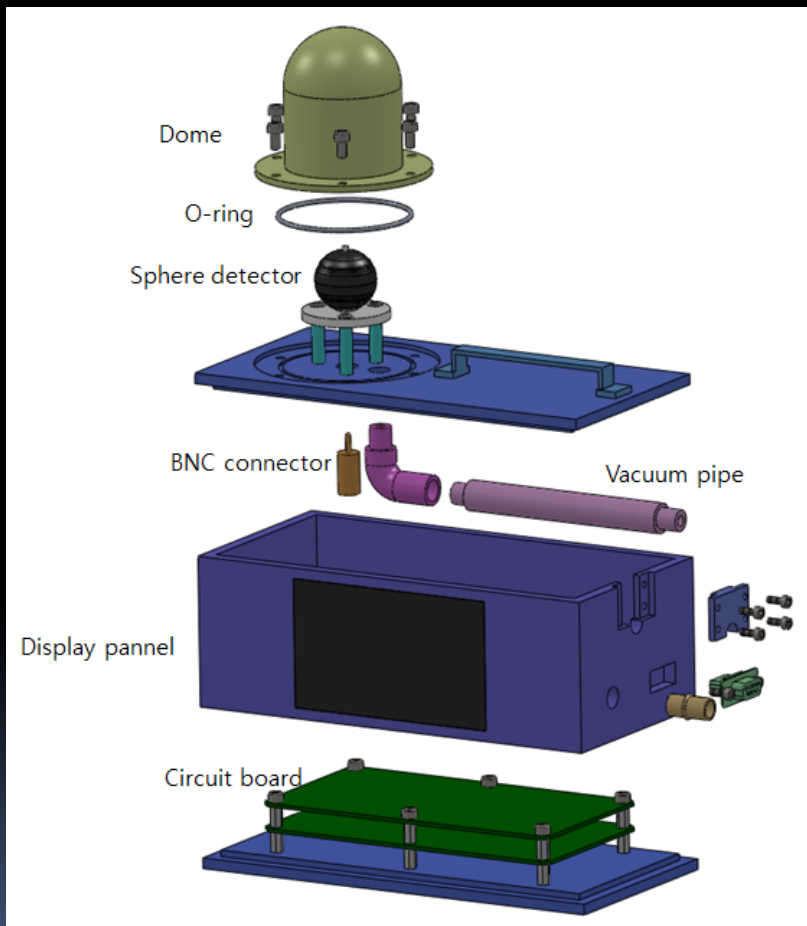
LET Spectra and Equivalent Dose



Dose equivalent

- * electron: 23.93 $\mu\text{Sv/day}$
- * γ -ray: 8.837 $\mu\text{Sv/day}$
- * neutron: 3.347 $\mu\text{Sv/day}$
- * proton: 1,070 $\mu\text{Sv/day}$

Engineering model TEPC



Thank You for Your
Attention !