中国科学院高能物理研究所
Institute of High Energy Physics Chinese Academy of Sciences

Update on Geant4 Simulation of Scintillating Glass

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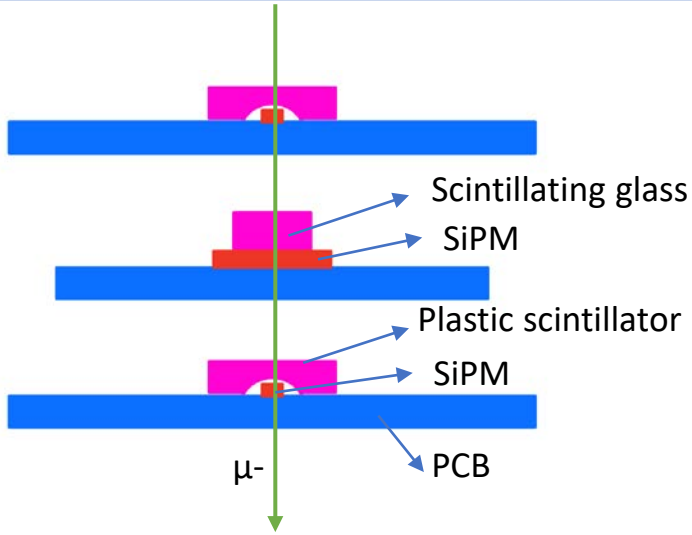
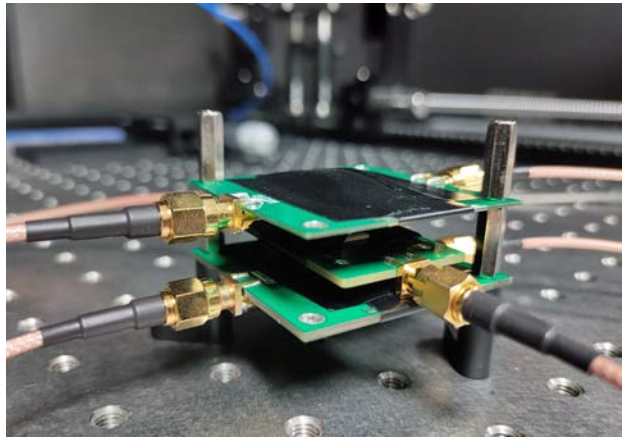
Part Ⅰ

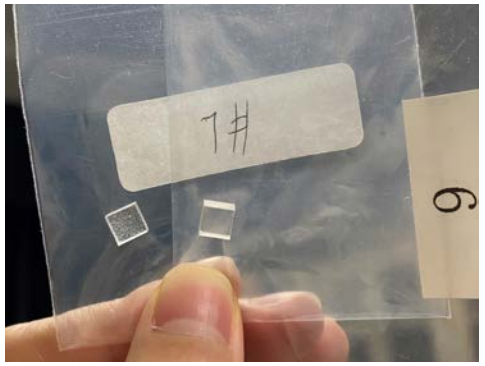
Optical Simulation of single scintillating glass tile

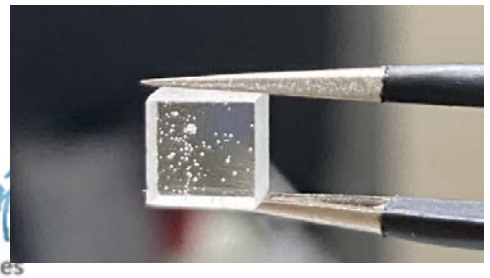
Cosmic ray measurements : setup

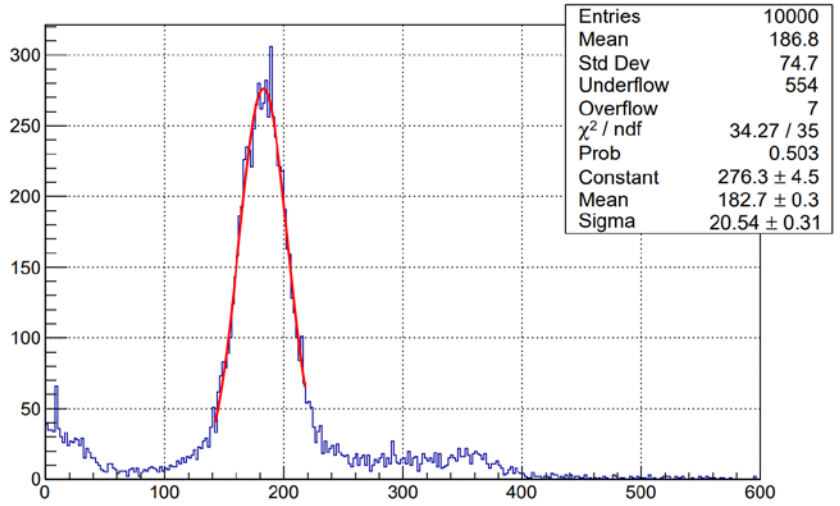


- Scintillating glass: #7
  - $4.5\times4.5\times3.5mm^3$, ESR wrapping
- SiPM: S13360-6025PE(HPK)
  - $6\times6\ mm^2$, 25μm pixel pitch
  - Bias voltage: 57.57V
- Coincidence with two plastic scintillator($1\times1\ cm^2$)







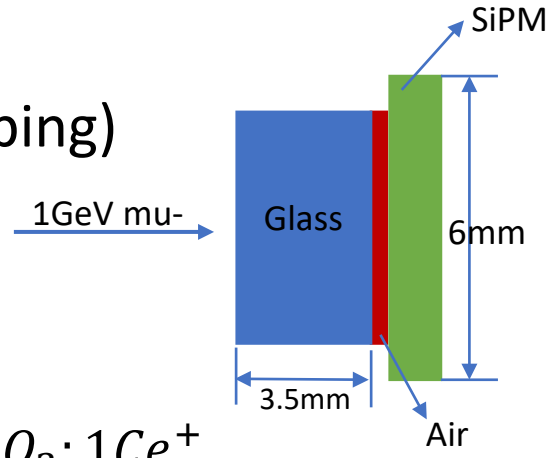


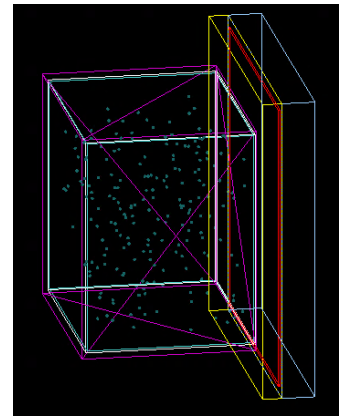
Single photon calibration
(dark noise)

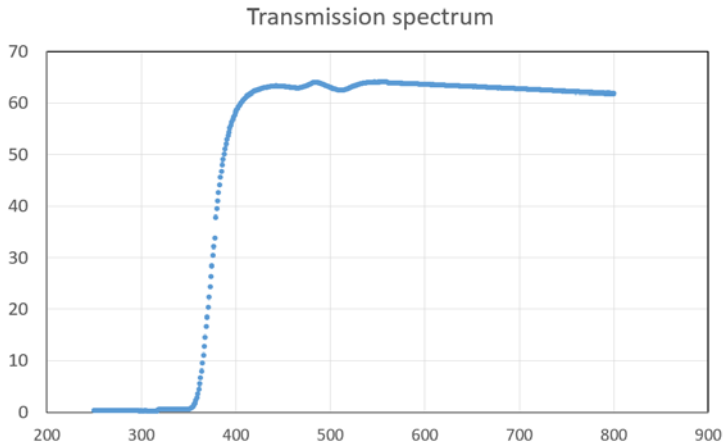
Optical simulation: setup in Geant4

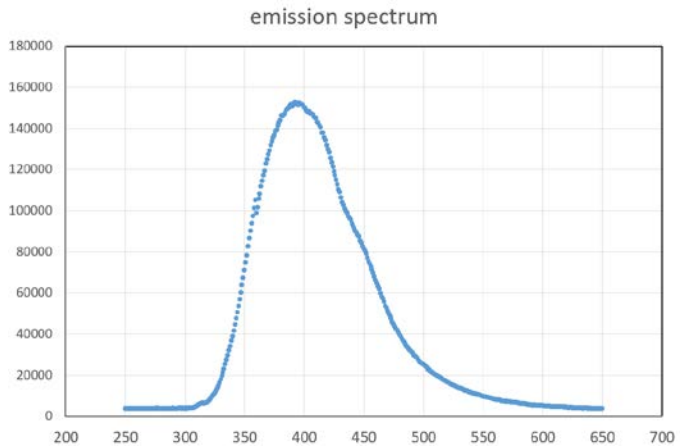
- Geometry setup
  - Scintillating glass(4.5×4.5×3.5mm^3, ESR wrapping)
  - Coupling agent: Air
  - SiPM(6×6 mm^2)
- Properties of scintillating glass
  - Component: $25SiO_2 - 30B_2O_3 - 10Al_2O_3 - 34Gd_2O_3 : 1Ce^+$
  - Density: 4.94 g/cm^3
  - Refractive index: 1.67
  - Transmission: 63%
  - Emission peak: 394 nm
  - Light yield: 881 ph/MeV

  (Based on the data of the measurements by Zhehao Hua)



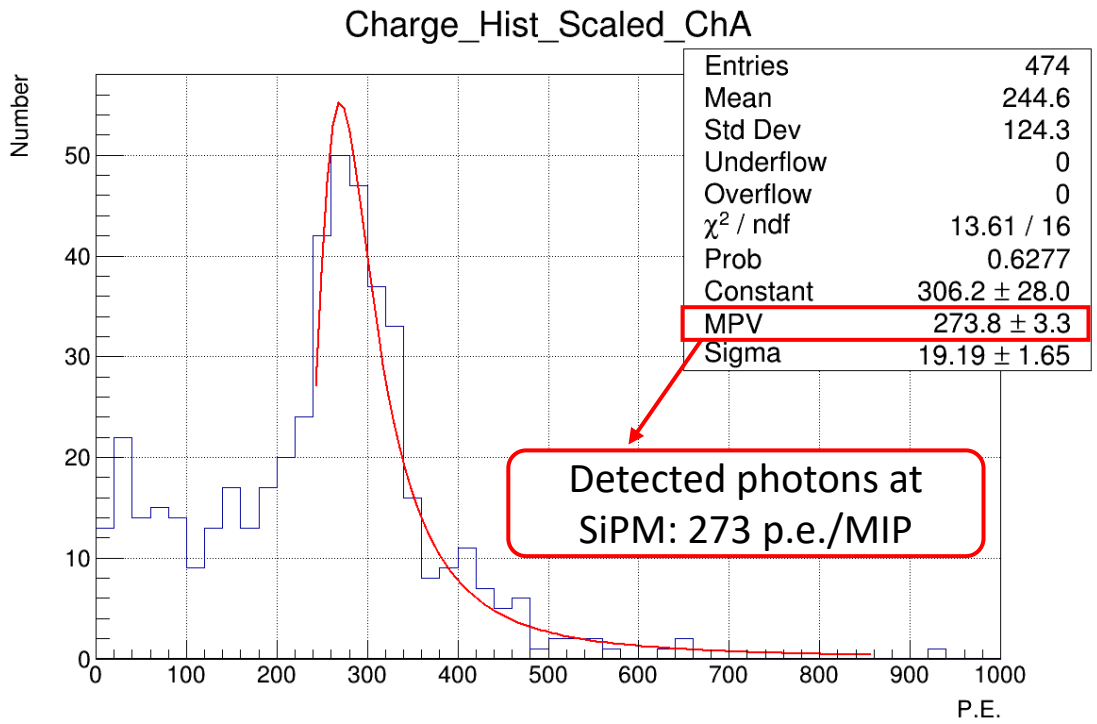




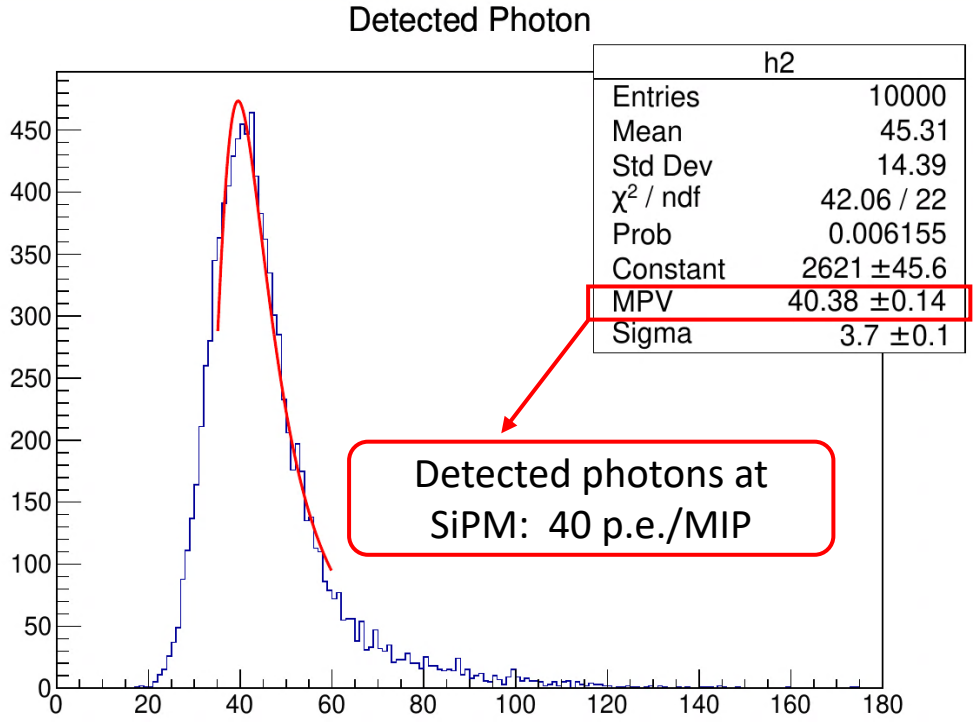


MIP response: measurements vs simulation

measurements



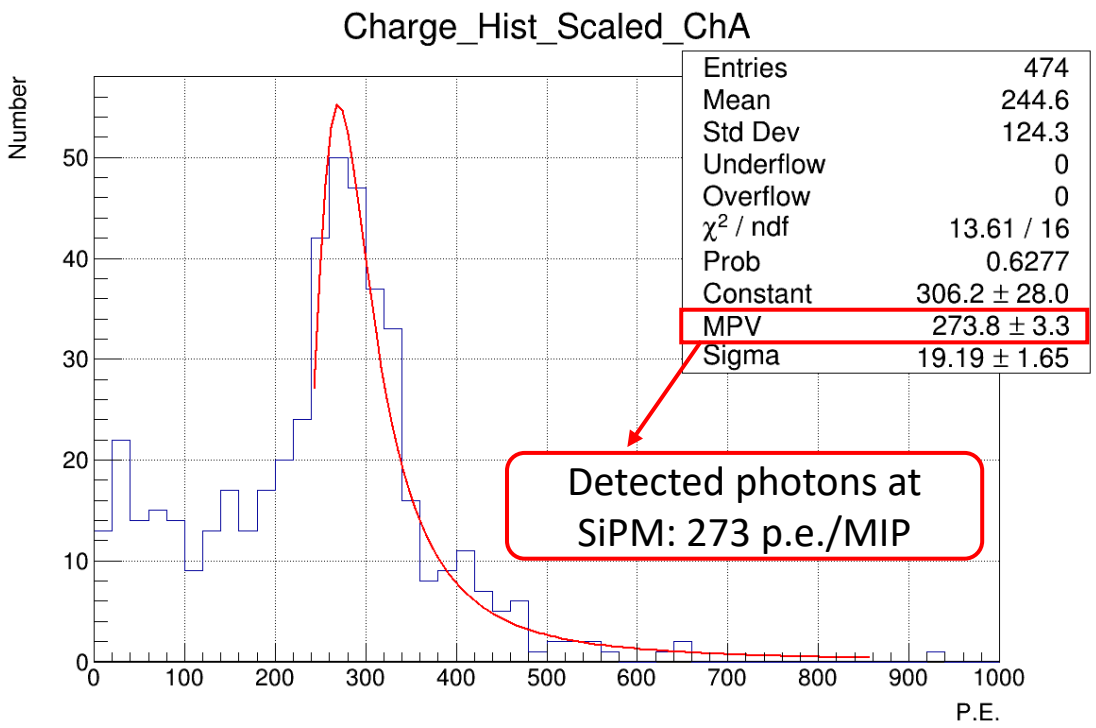
simulation



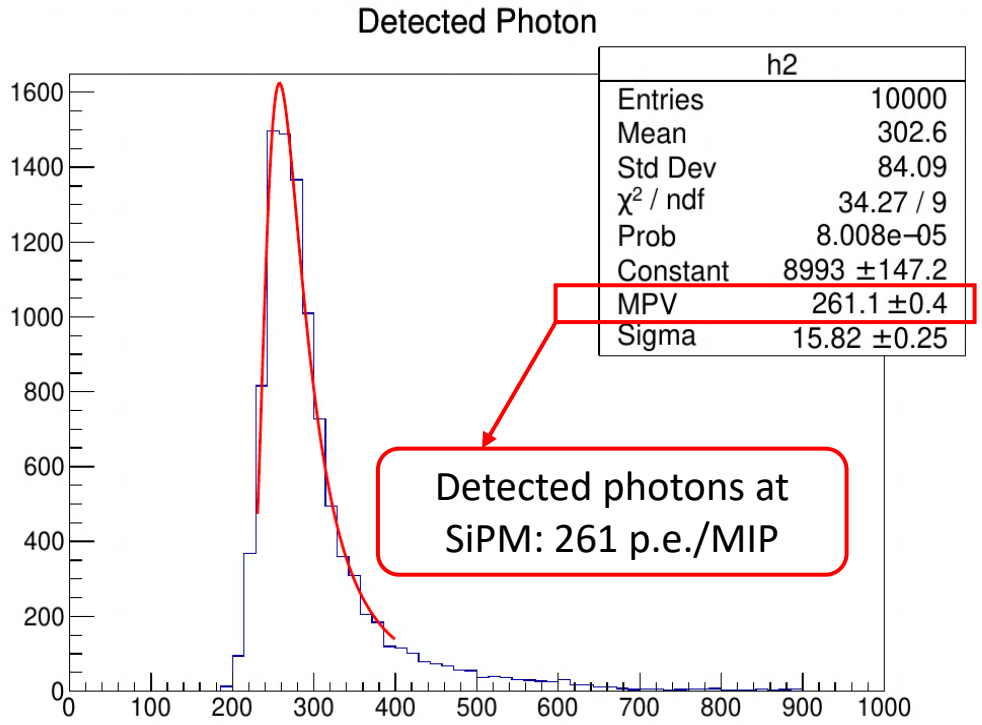
MIP response: measurements vs simulation

- Add bubbles to the simulation
- Adjust light attenuation length(50LAL) and roughness(0.0001)

measurements

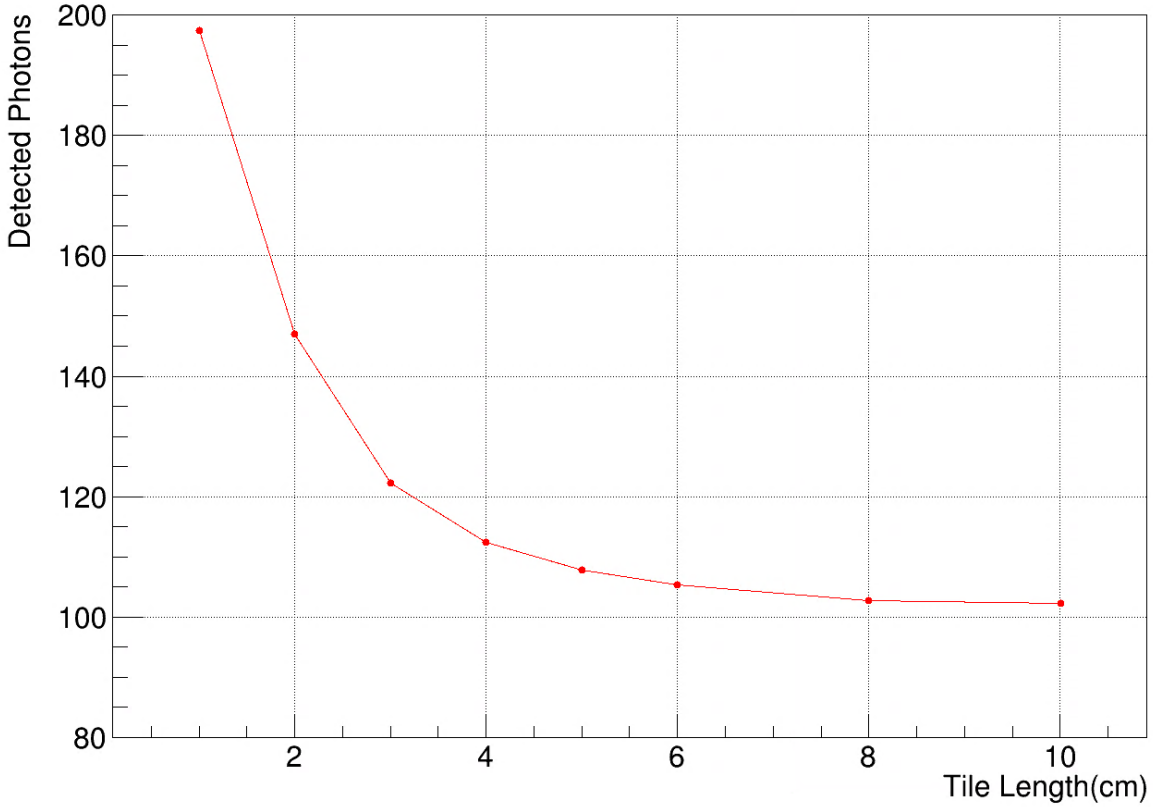


simulation



Optical simulation: vary tile length

- 50LAL, roughness = 0.0001
- With bubbles
- Tile thick = 0.3cm

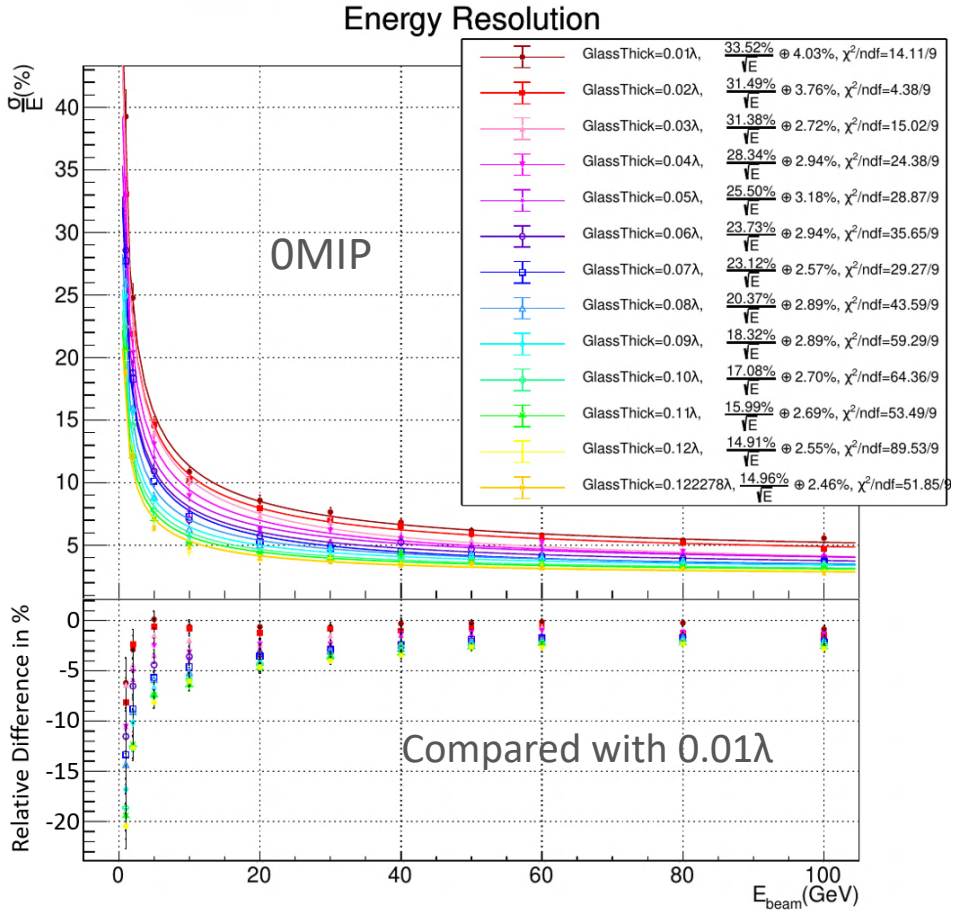


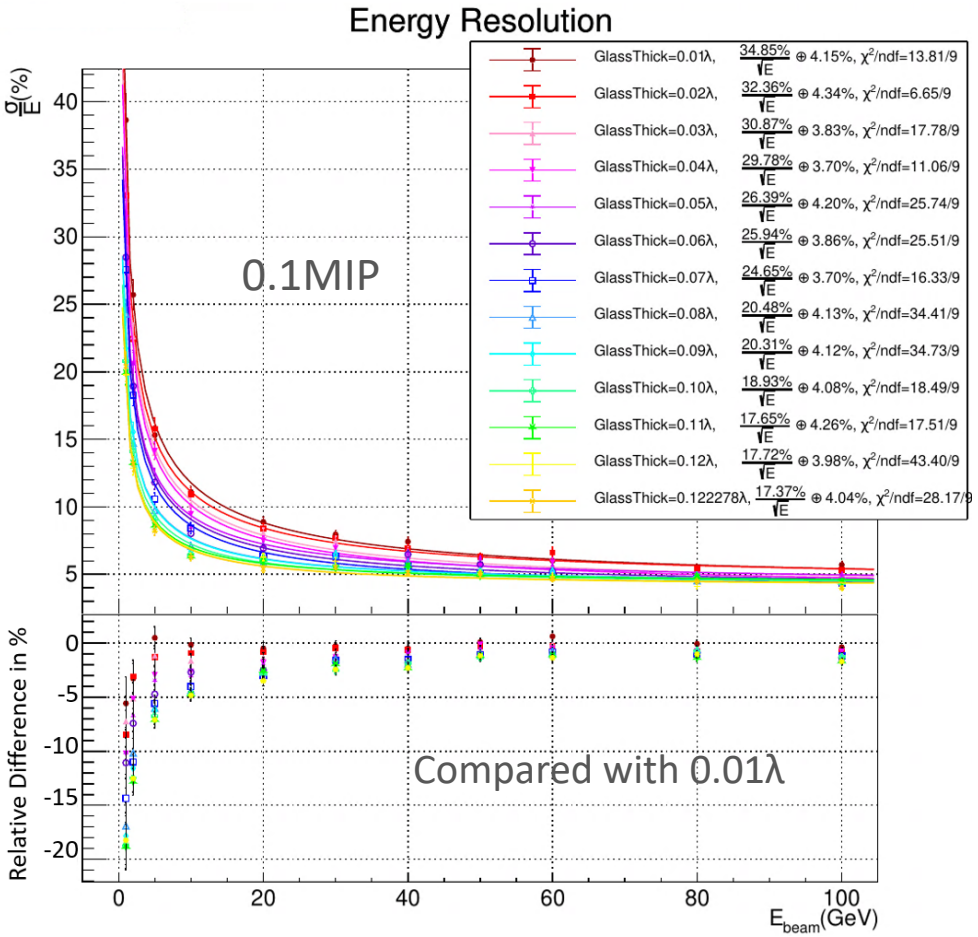
Part II

Simulation of scintillating glass for HCAL

Impact of sampling ratio

- Fixed nuclear interaction length
  - Scintillating Glass: λ=22.437cm, Steel: λ=16.945cm
- Incident particle: kaon0L(1-100GeV)

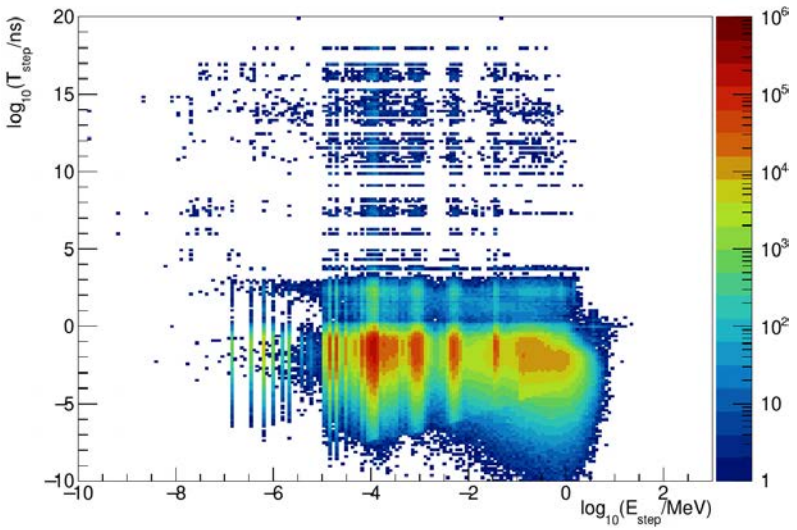


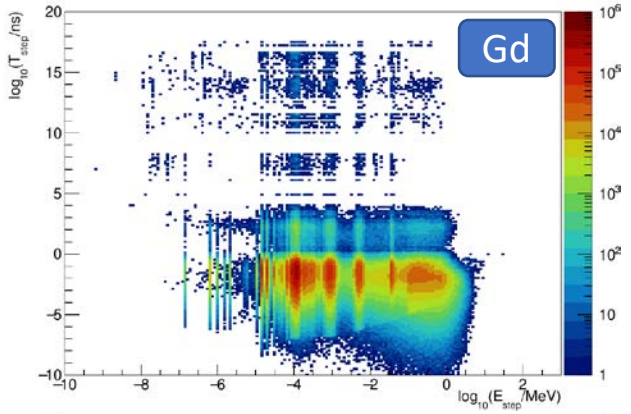


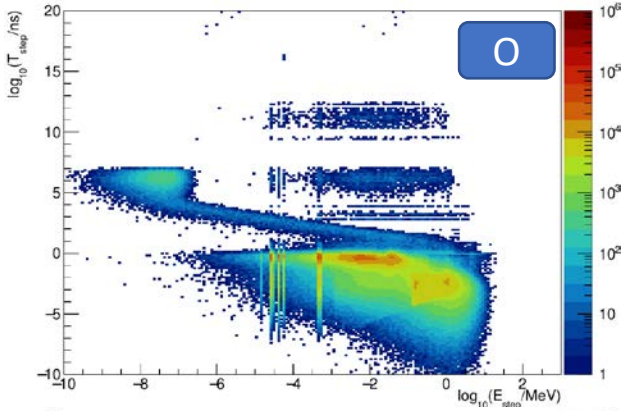
Step profile: scintillating glass vs simple substance

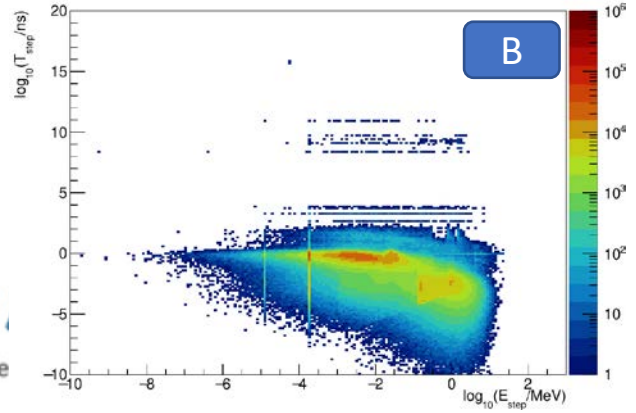
- Homogeneous
- 40*40*40mm3 cube
- Incident particle: 10 GeV, gamma

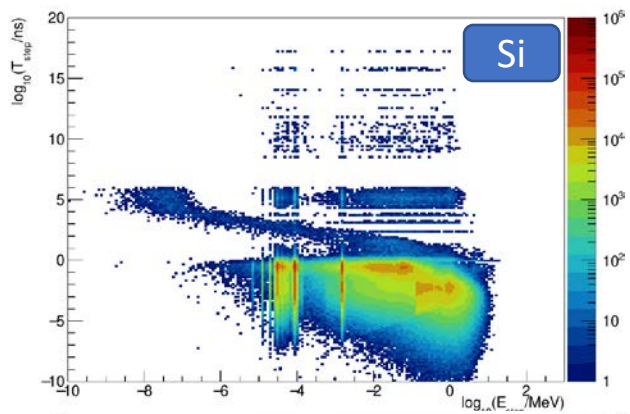
Scintillating Glass

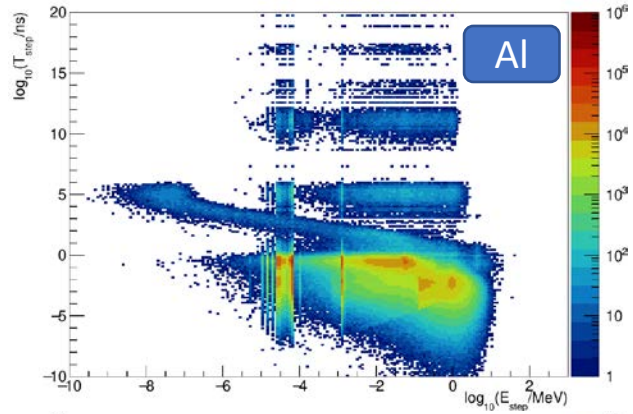


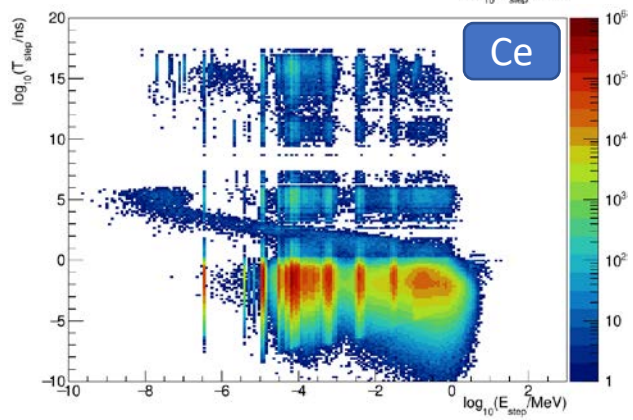












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- 40*40*40mm3 cube
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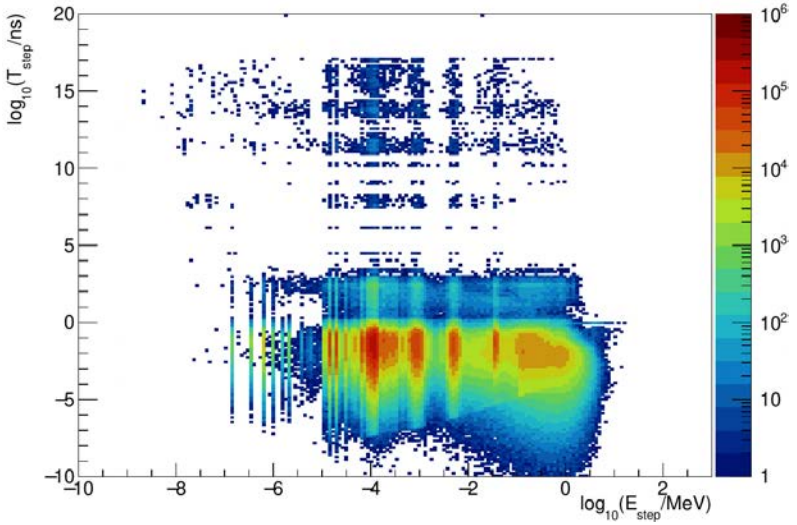
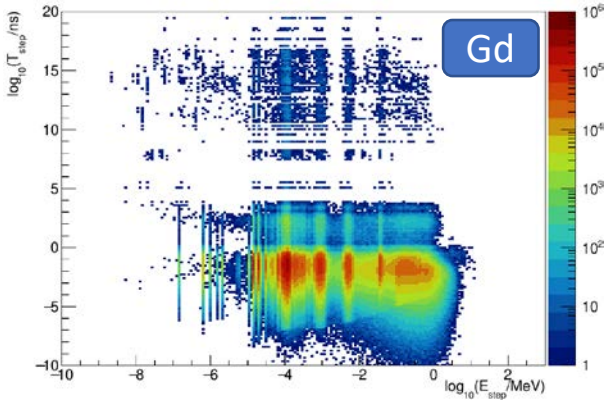
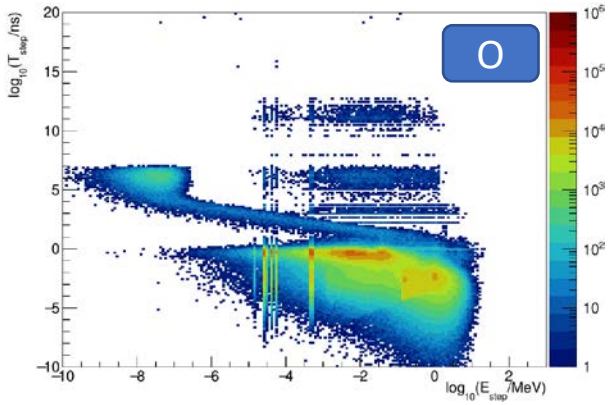
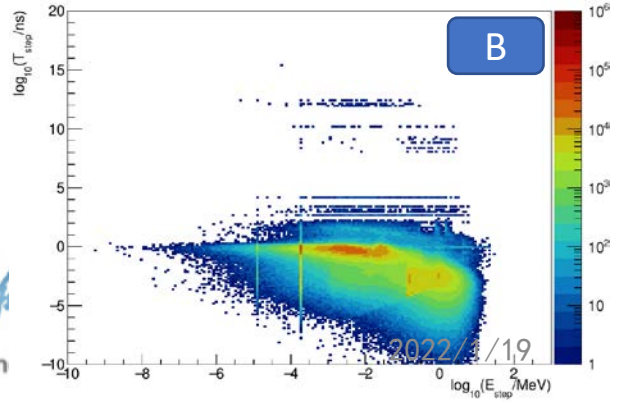
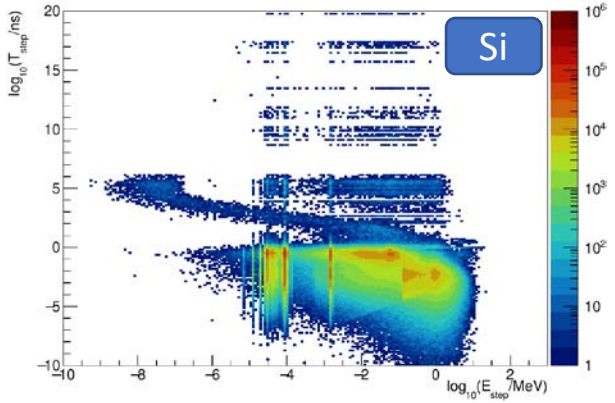
Scintillating Glass

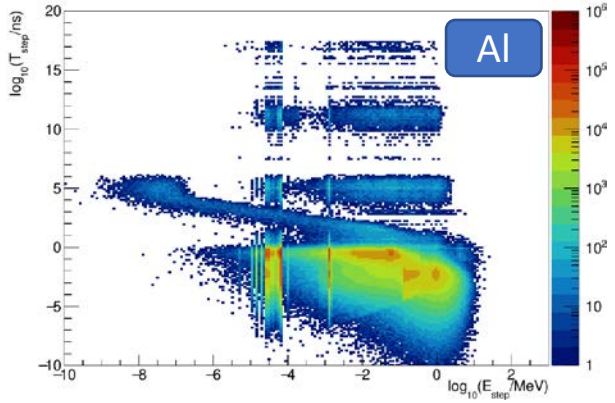


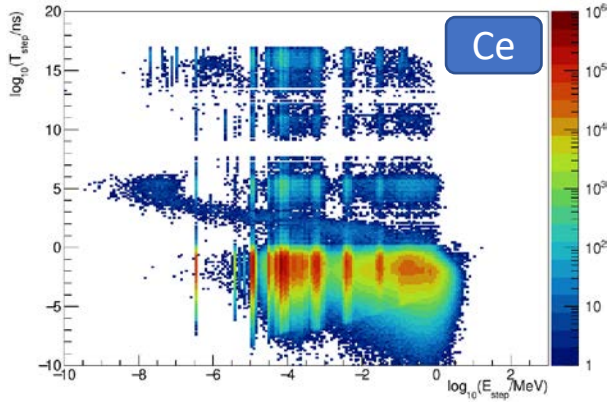












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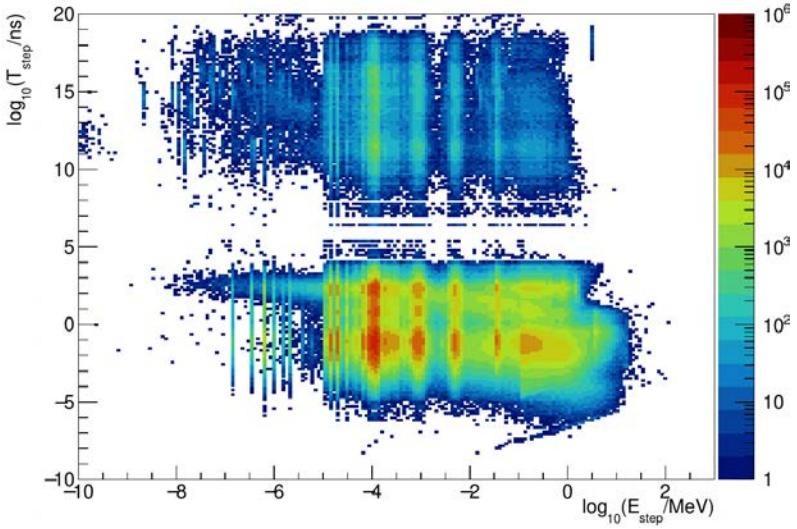
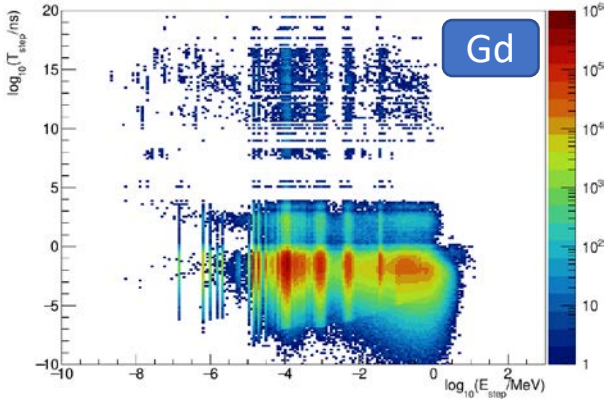
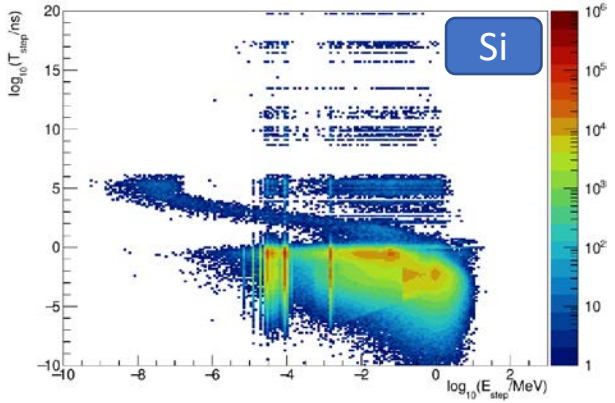
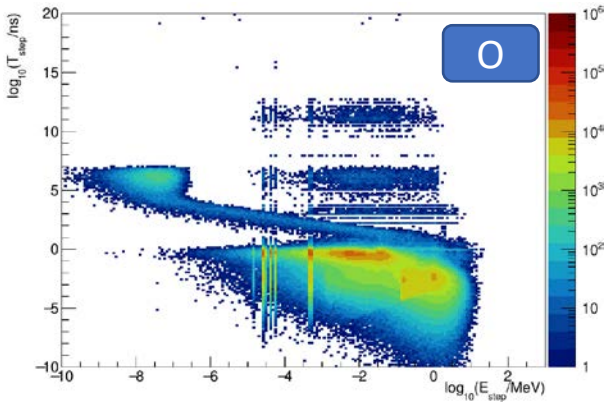
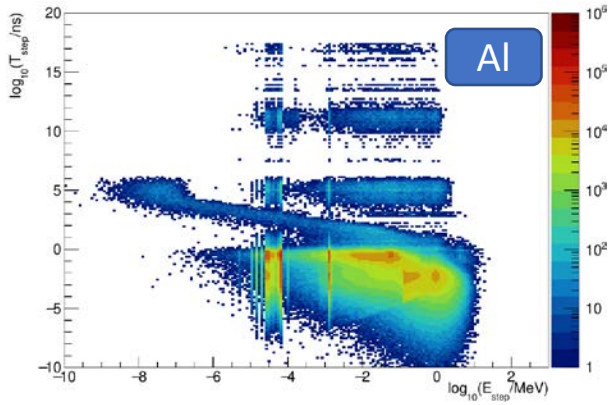
Scintillating Glass

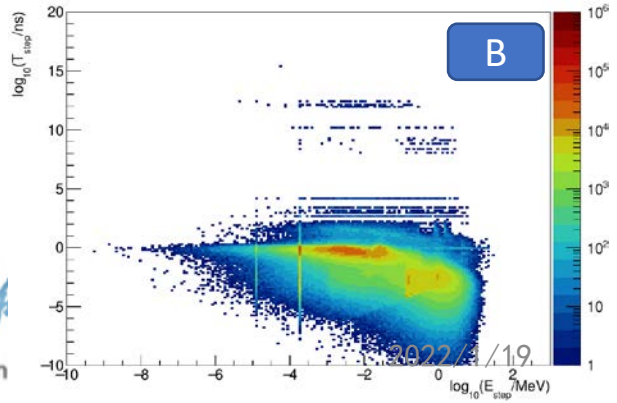


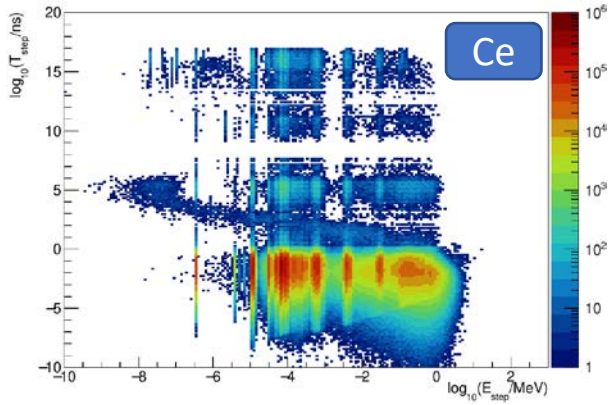








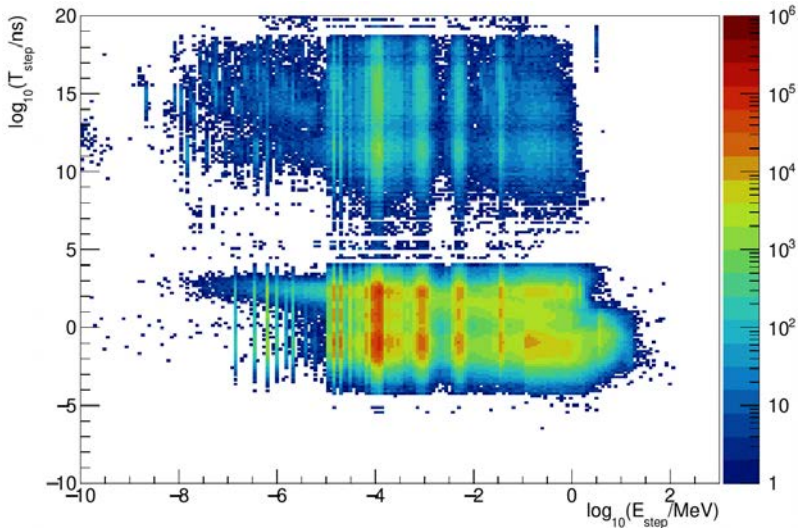


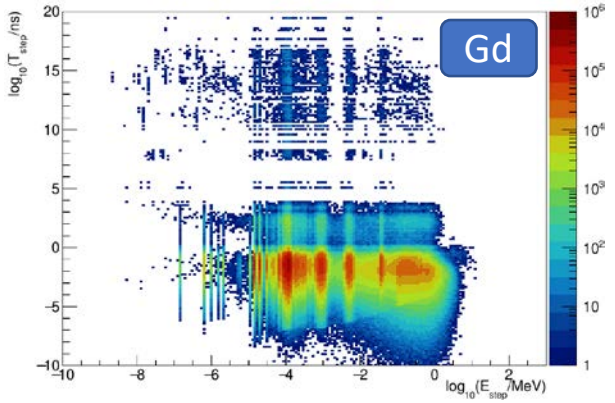


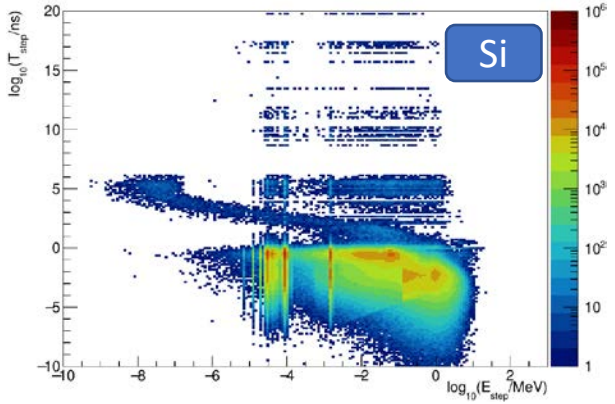
Step profile: scintillating glass vs simple substance

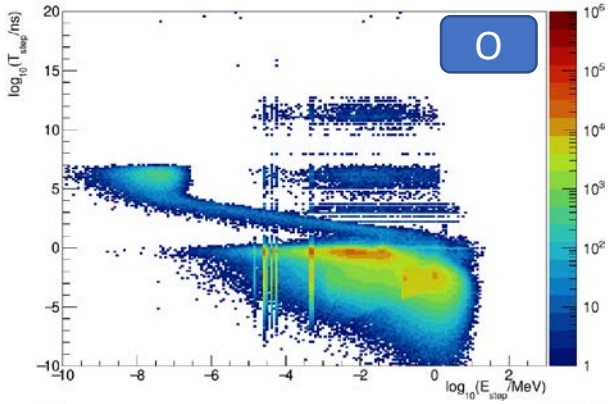
- Homogeneous
- 40*40*40mm3 cube
- Incident particle: 10 GeV, neutron

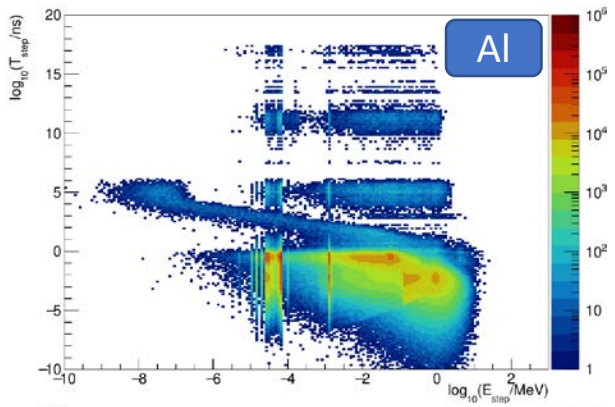
Scintillating Glass

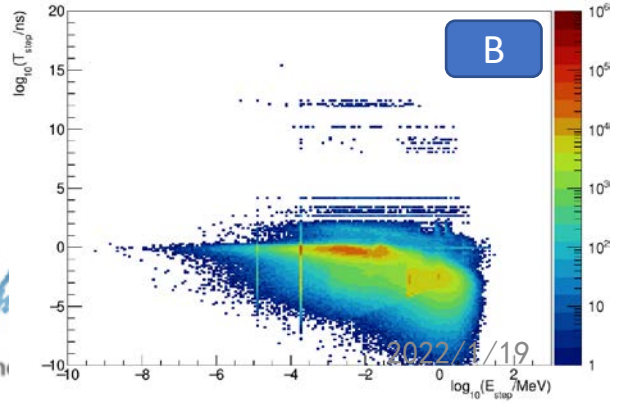


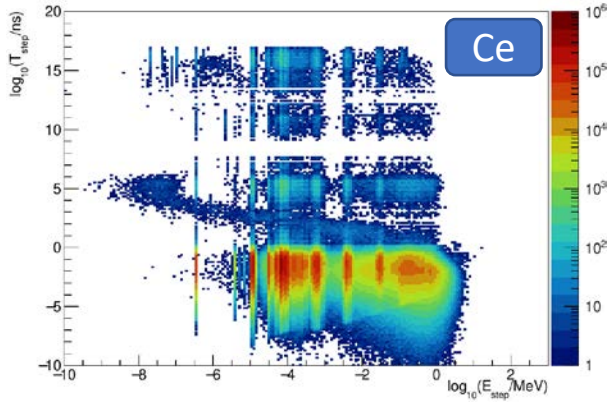






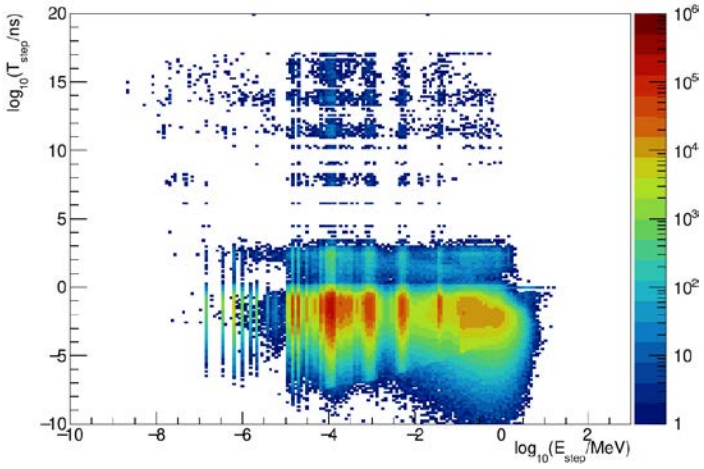


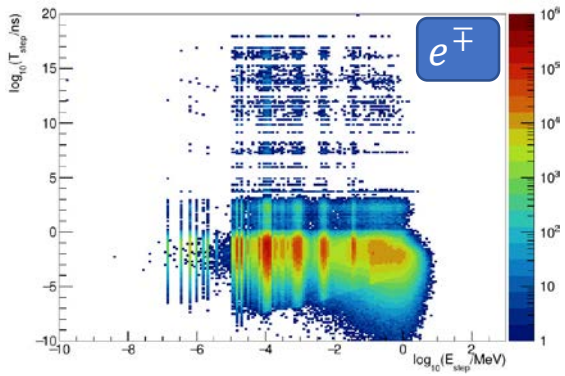


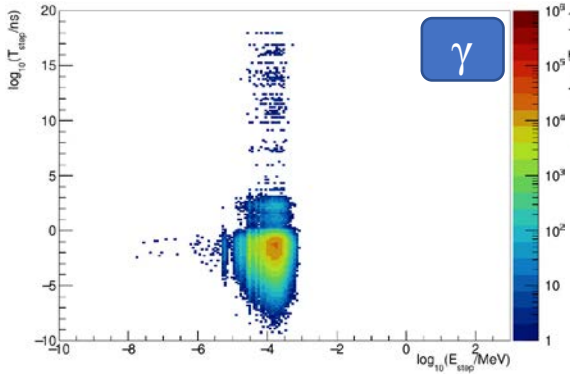


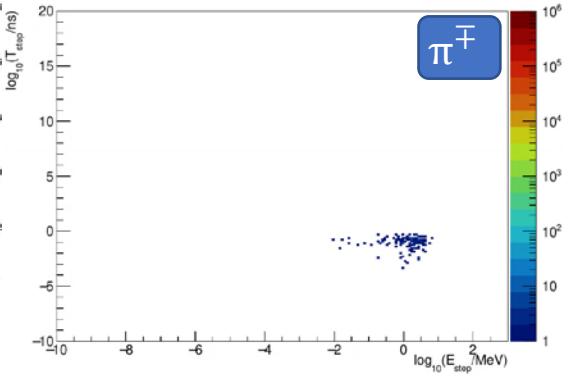
Step contribution: scintillating glass

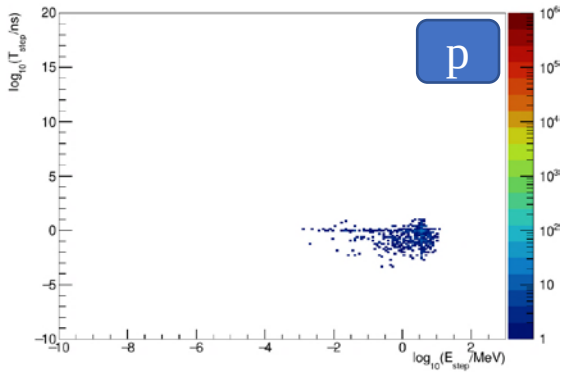
- Homogeneous
- 40*40*40mm3 cube
- Incident particle: 10 GeV, gamma

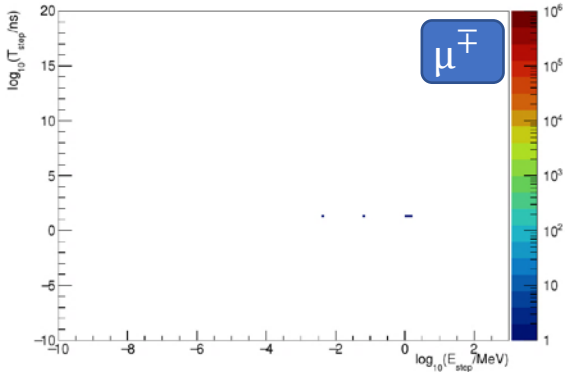


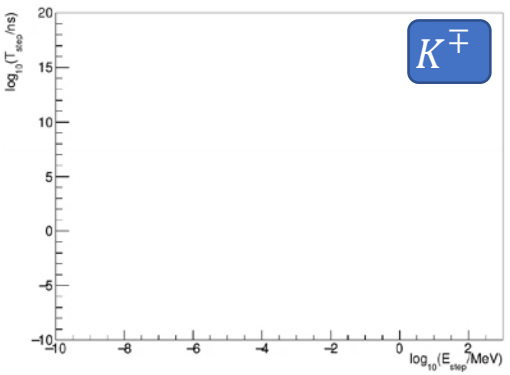


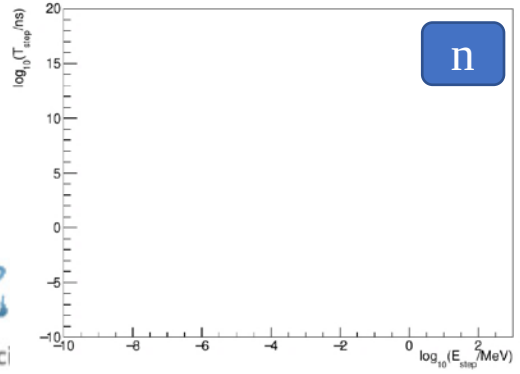


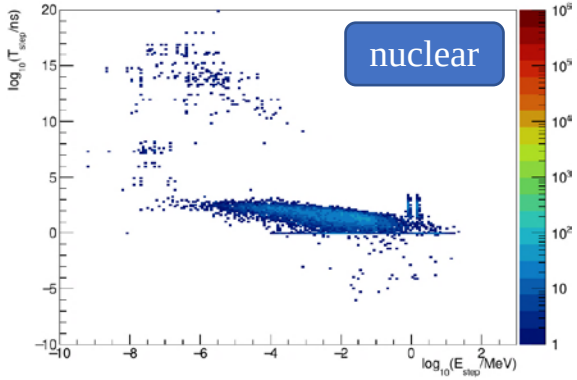


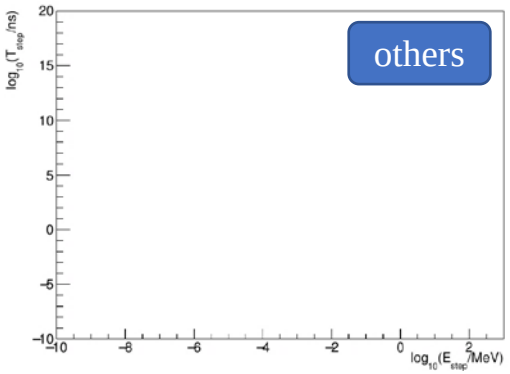












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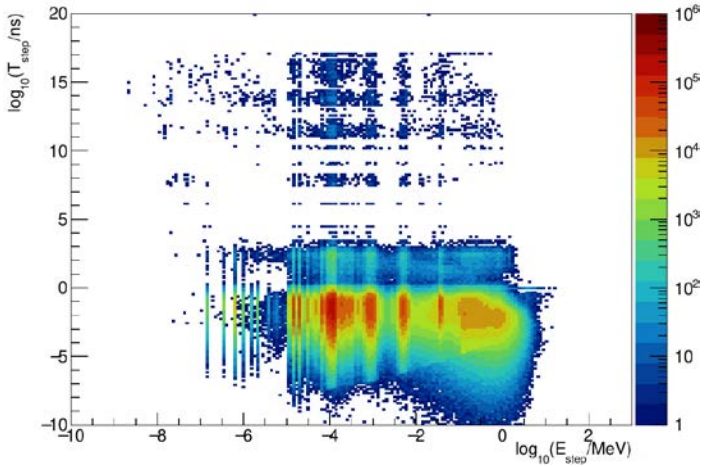
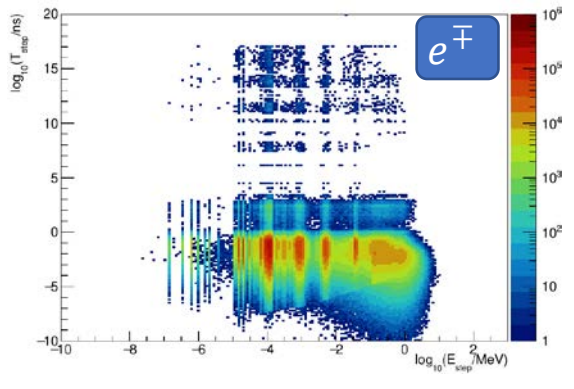
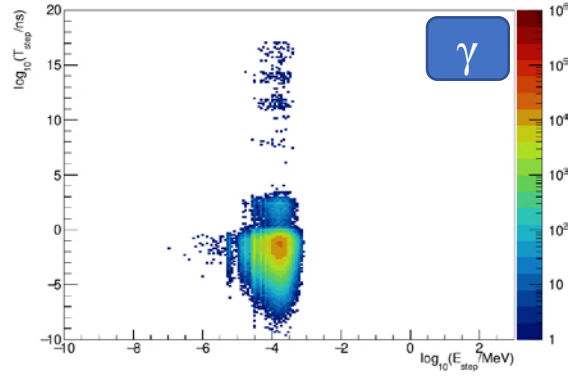
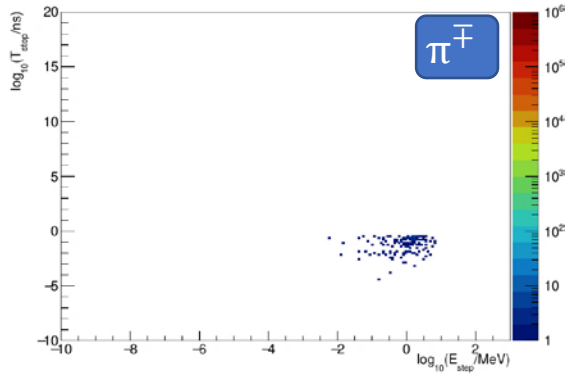
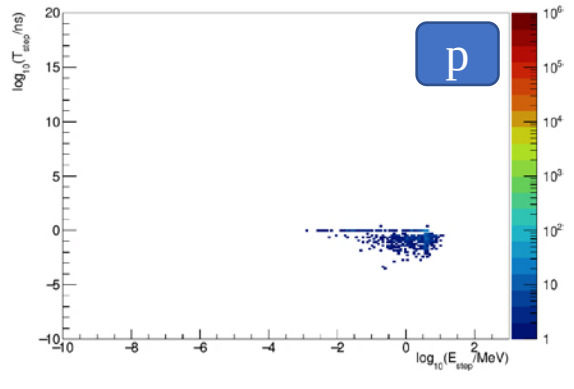
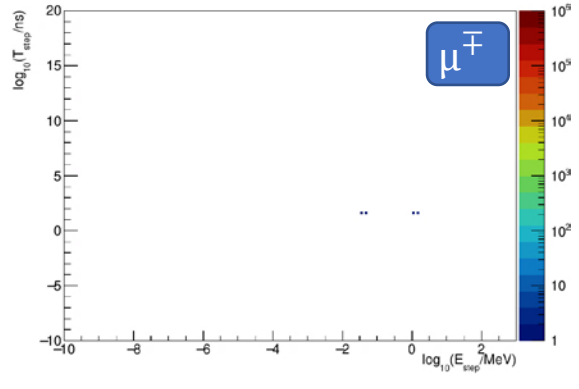


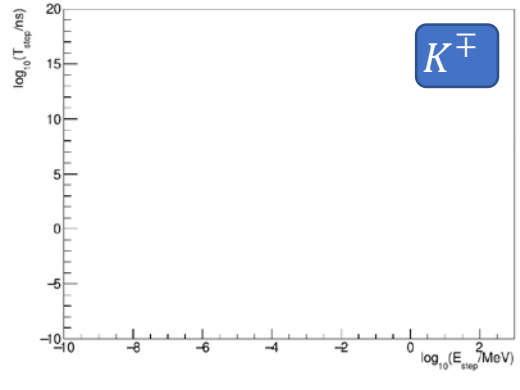


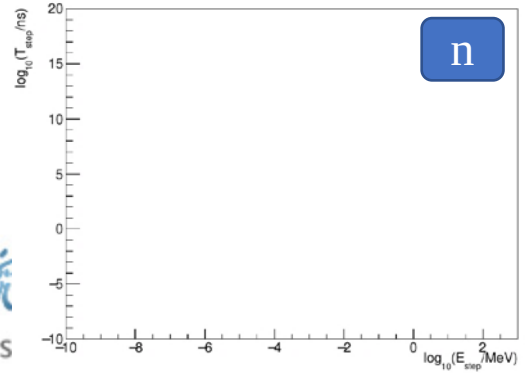


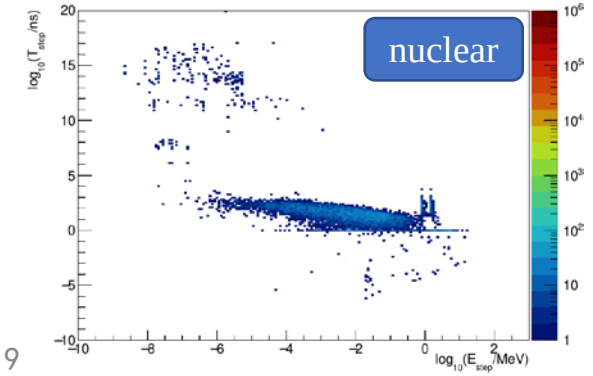


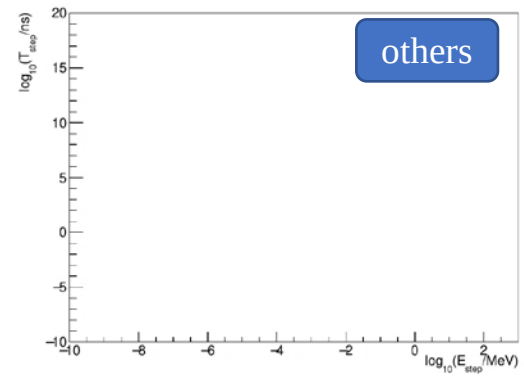






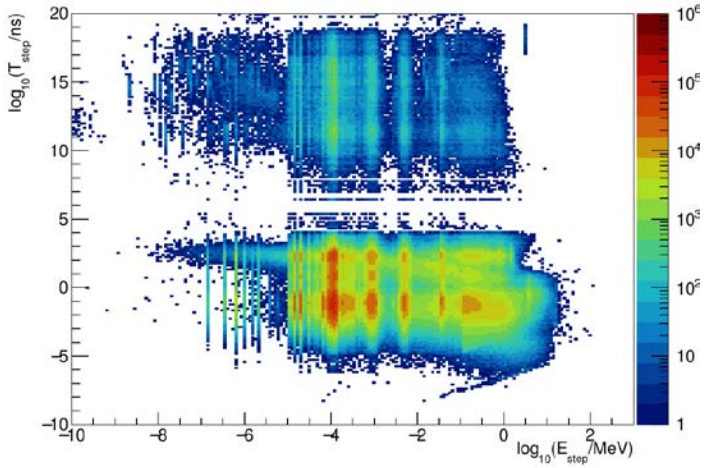


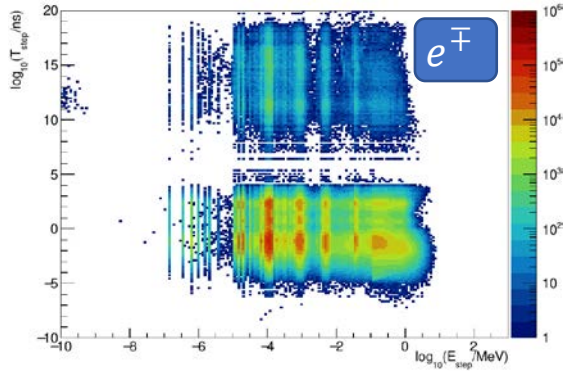


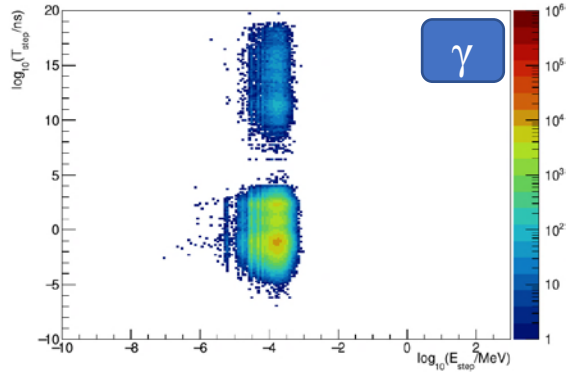


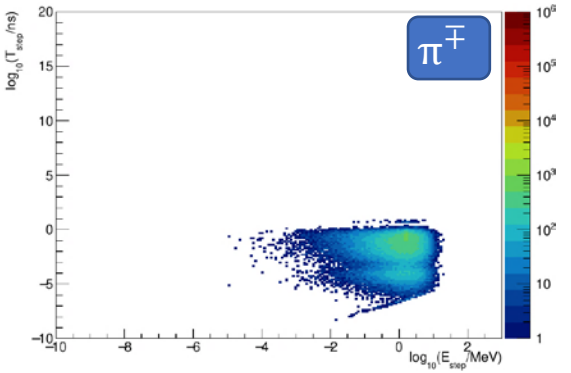
Step contribution: scintillating glass

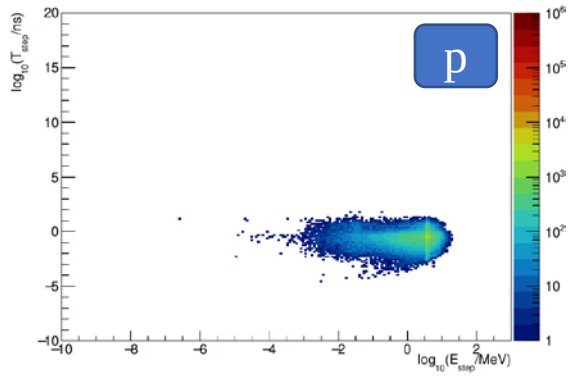
- Homogeneous
- 40*40*40mm3 cube
- Incident particle: 10 GeV, pi-

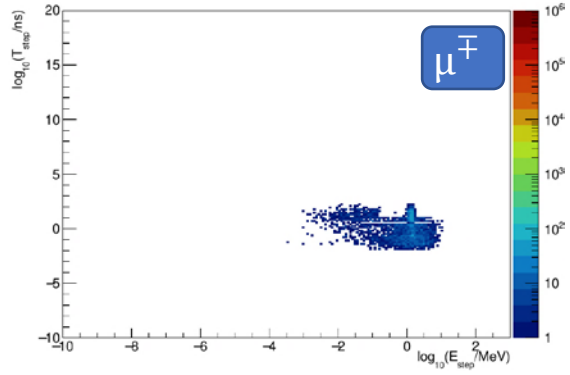


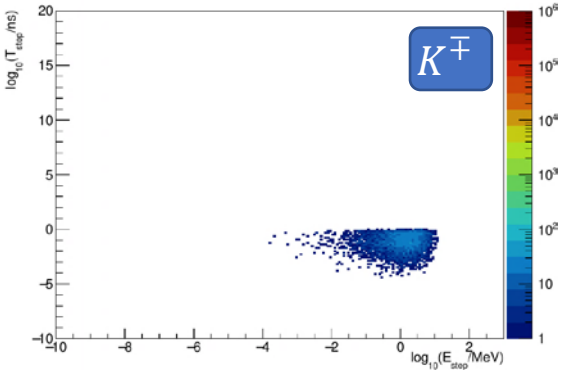


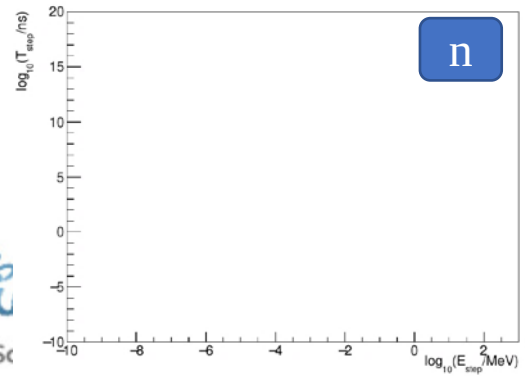


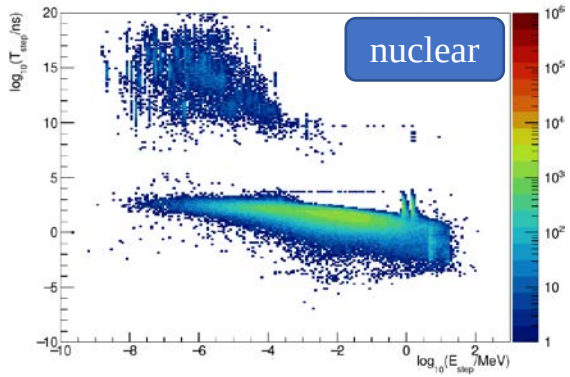


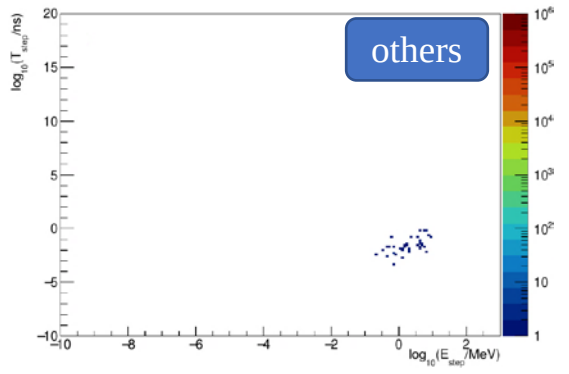












Step contribution: scintillating glass

- Homogeneous
- 40*40*40mm3 cube
- Incident particle: 10 GeV, neutron