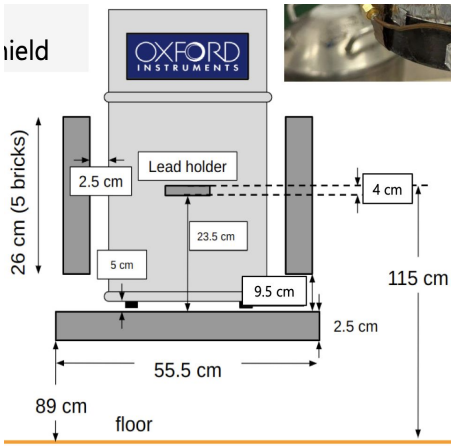
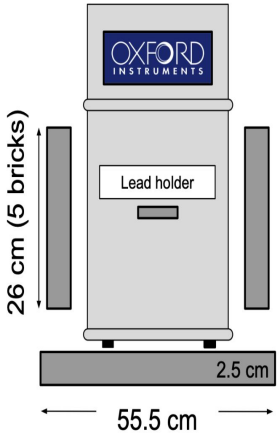
Simulations for BULLKID Sapienza setup

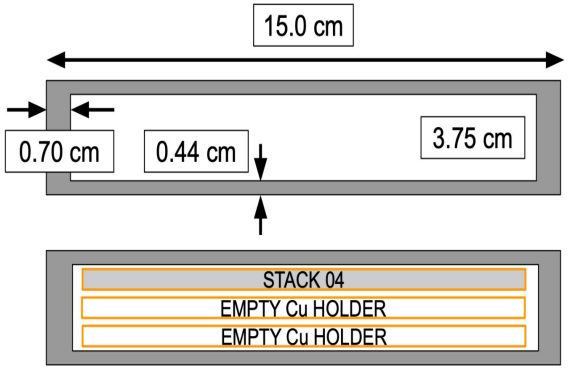
Alberto Acevedo-Rentería
Advised by Eric Vázquez-Jáuregui

- Experimental resolution implemented to the analysis code for the simulations
  - resolution and data from Matteo
    - three regions
      - low [2,21] keV
      - medium [21,60] keV
      - high [60,100] keV
  - simulations for
    - gammas
    - radiogenic (fast) neutrons
    - muons
    - ^{210}Pb
- No resolution is applied below 2 keV

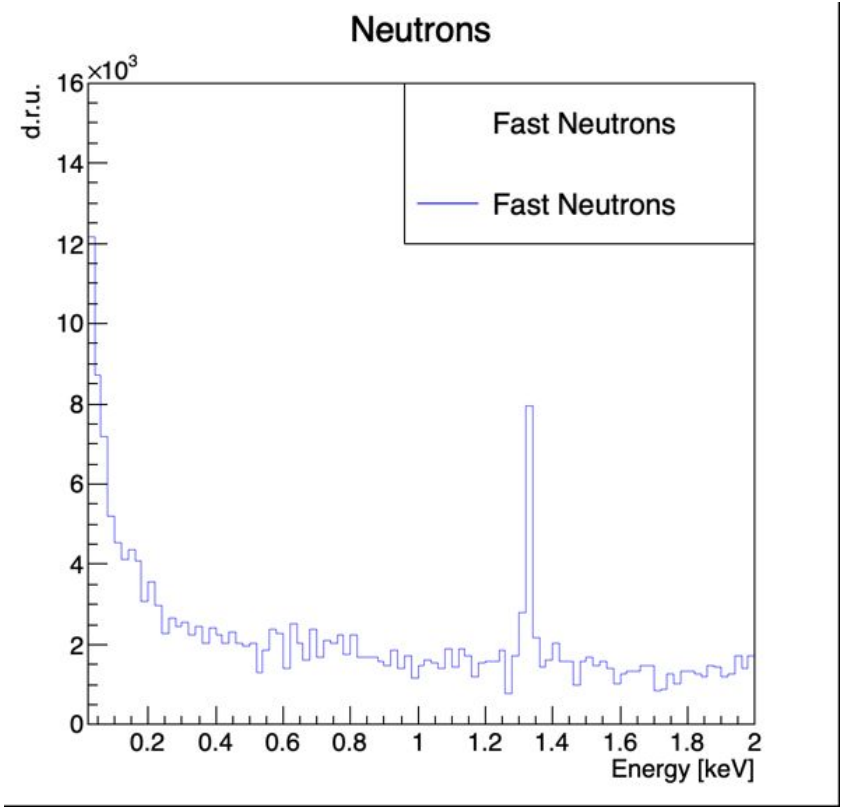
- Design according to diagrams from Danielle and Matteo (from the Collaboration meeting in Ferrara)
- A lead shield around the cryostat with bricks of 2.5 x 10 x 5 cm^3
- Lead holder with 3 rings of copper
    - one wafer

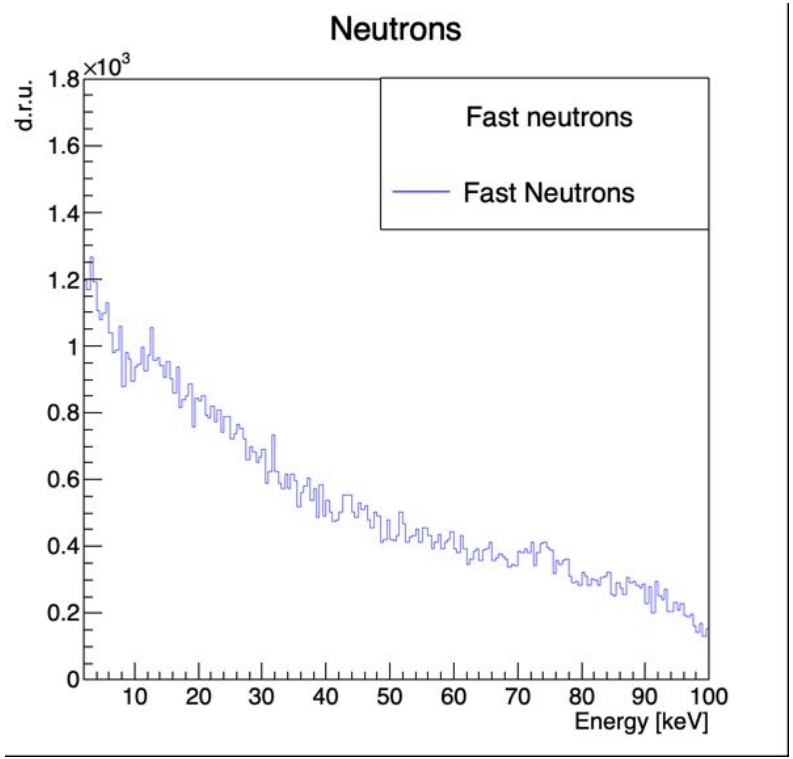




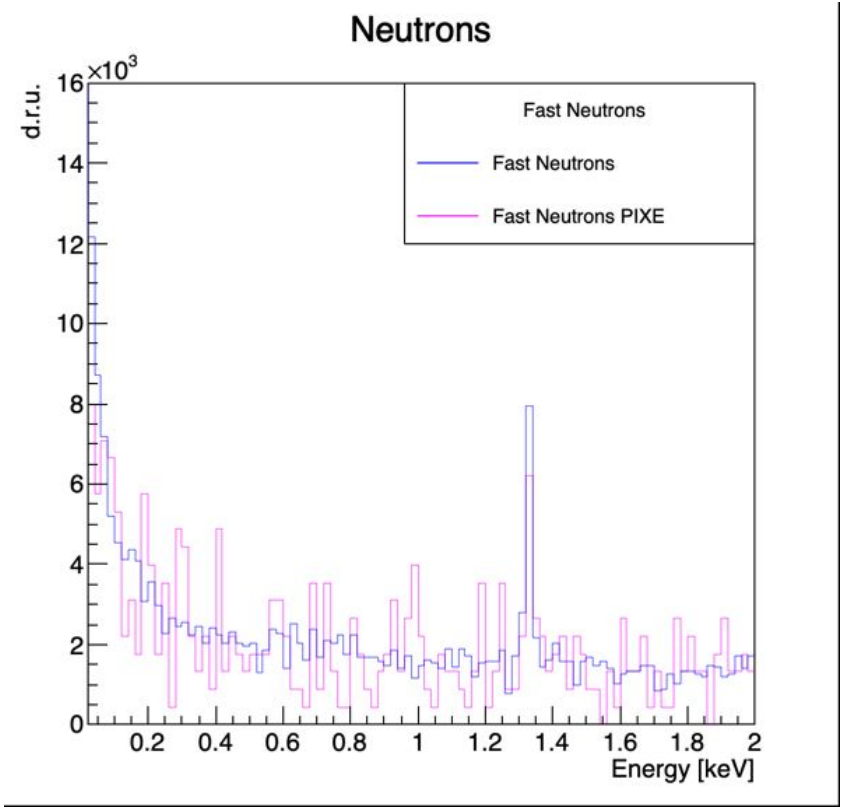


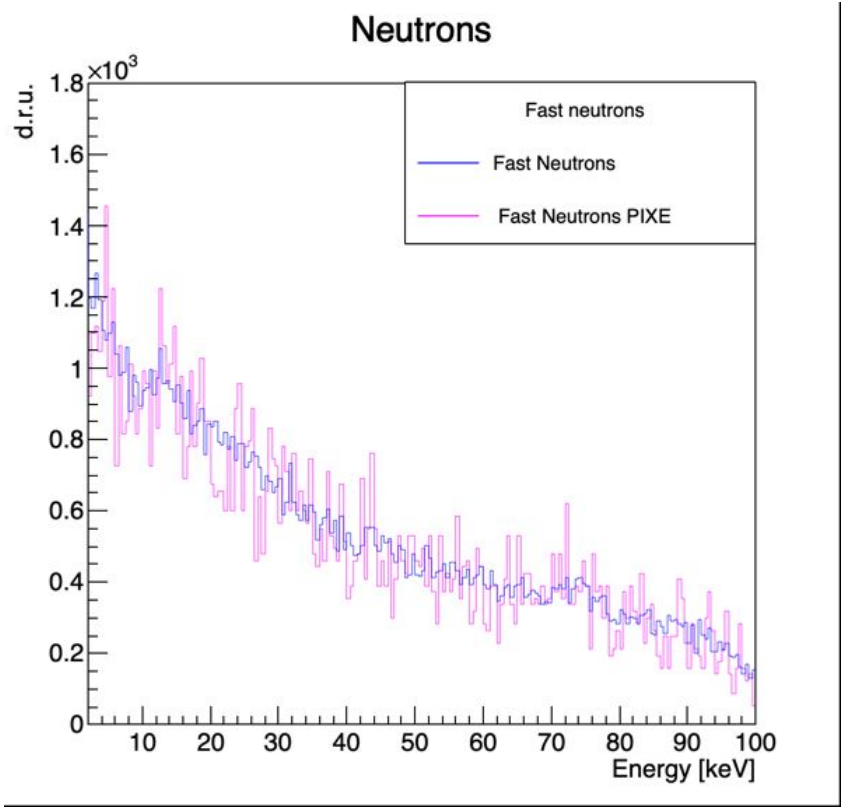
- Radiogenic, fast neutrons
- Flux 0.0034 $cm^{-2}s^{-1}$ from Claudia Tomei (Simulations: DANAE setup at Sapienza, Eric march 19 2024)



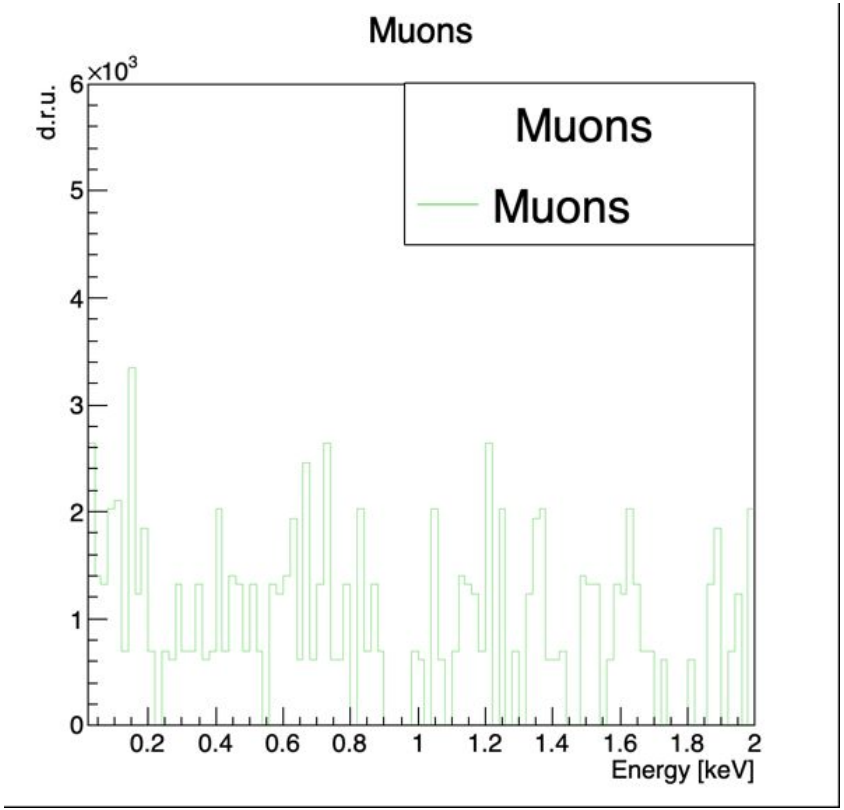


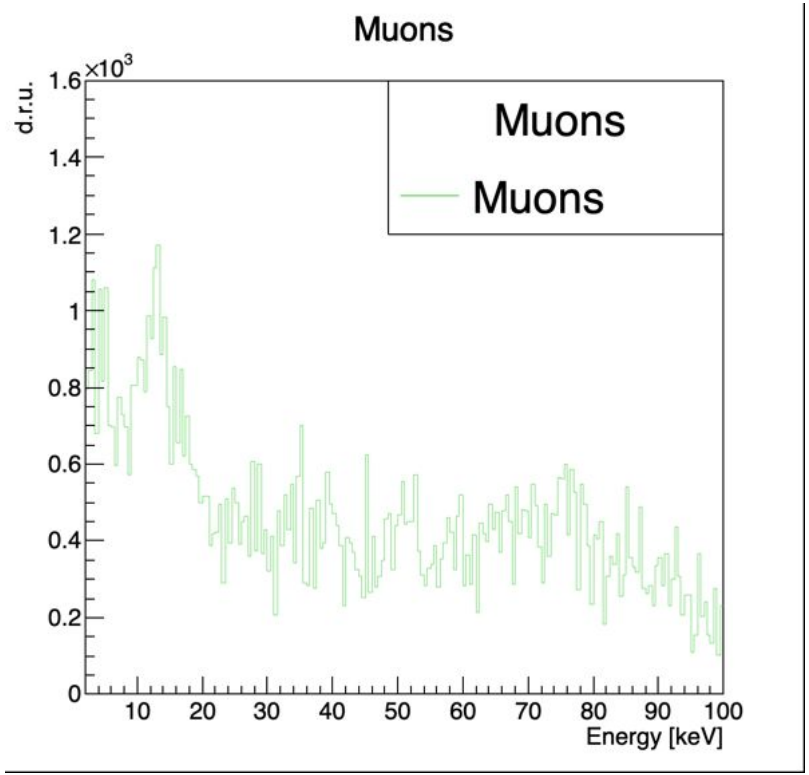
- Radiogenic, fast neutrons with PIXE
- Flux 0.0034 $cm^{-2}s^{-1}$



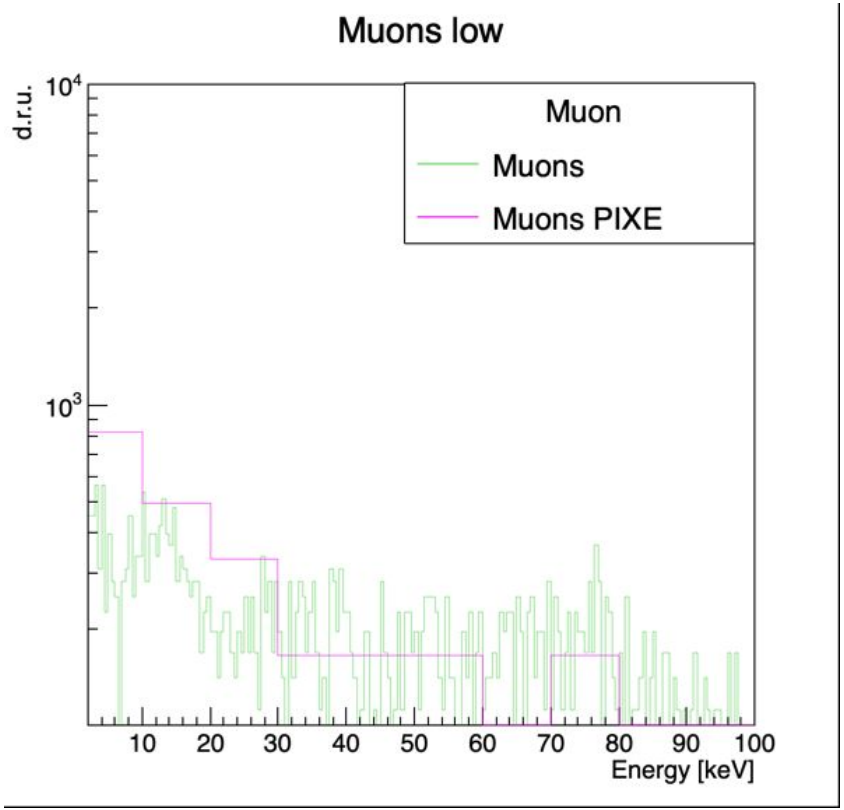


- Muons
- 5 GeV < 68% flux 0.007 $cm^{-2}s^{-1}$
- 5 GeV > 32% flux 0.003 $cm^{-2}s^{-1}$

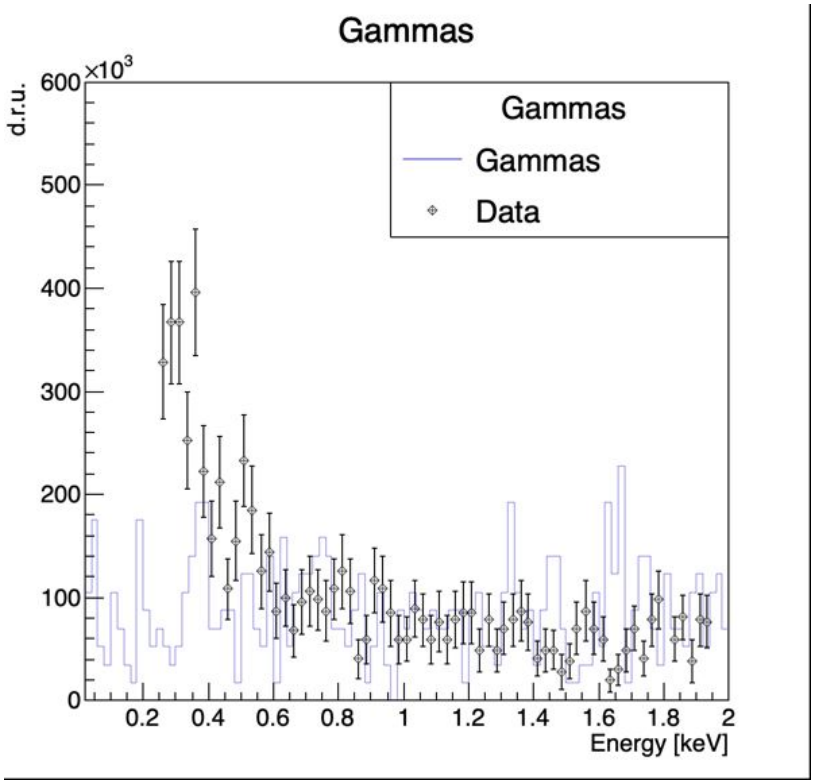


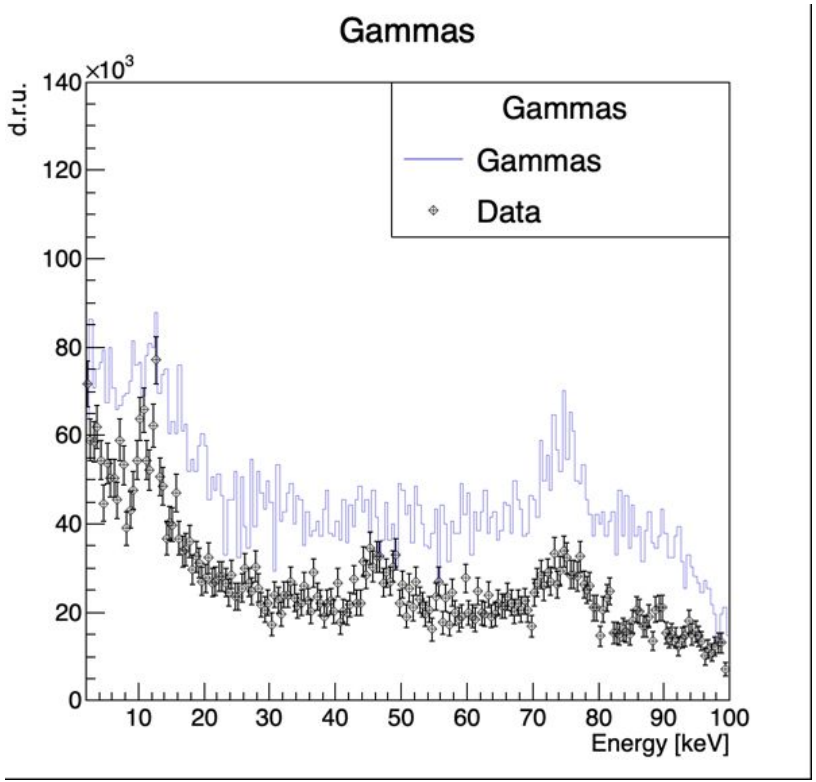


- Muons with PIXE (low)
- 5 GeV < 68% flux 0.007 $cm^{-2}s^{-1}$
- 5 GeV > 32% flux 0.003 $cm^{-2}s^{-1}$

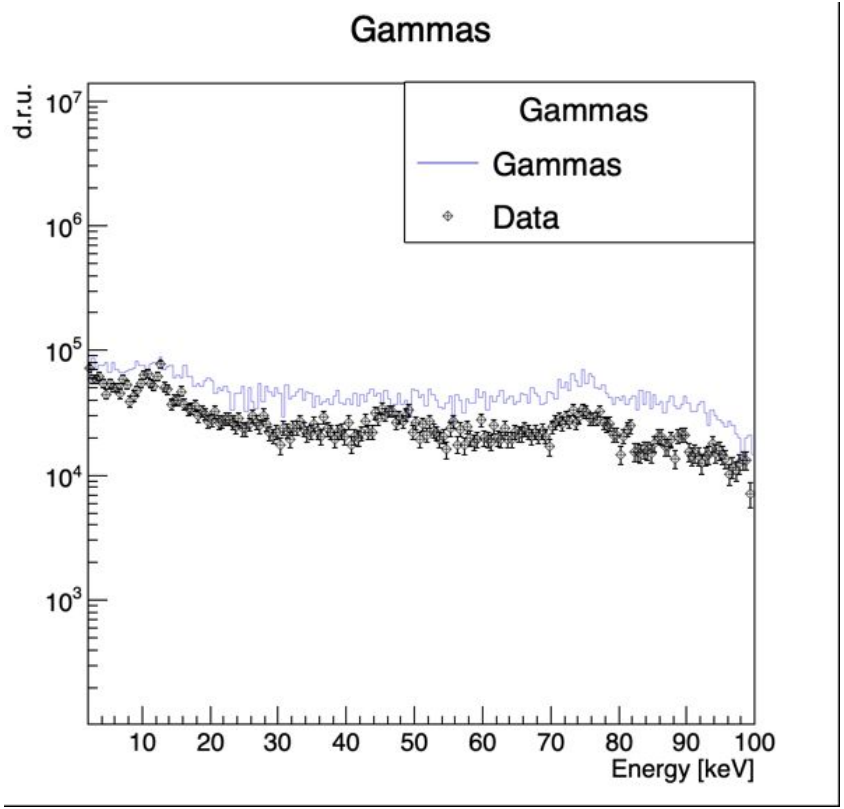


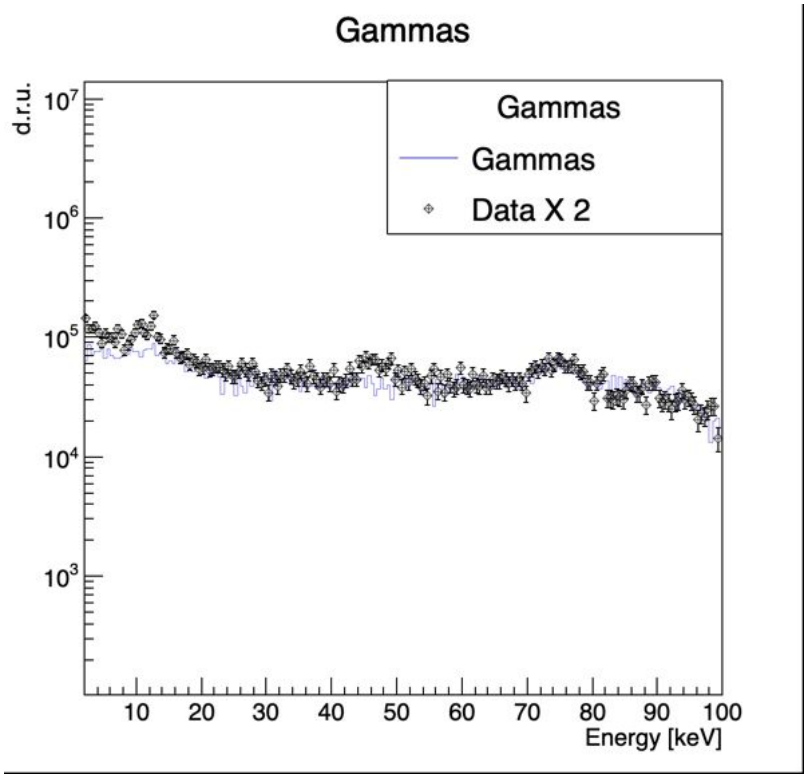
- Gammas
- Flux 13.47 $cm^{-2}s^{-1}$
- From 0.2 to 2 keV simulation and data seem to agree, but for higher energies the simulation predicts a major contribution



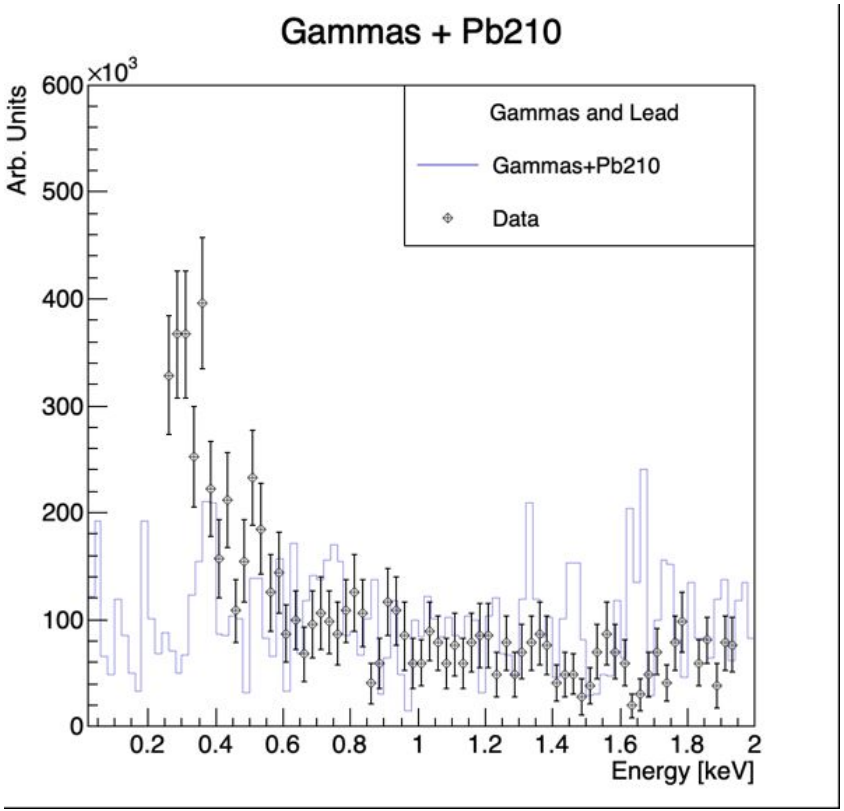


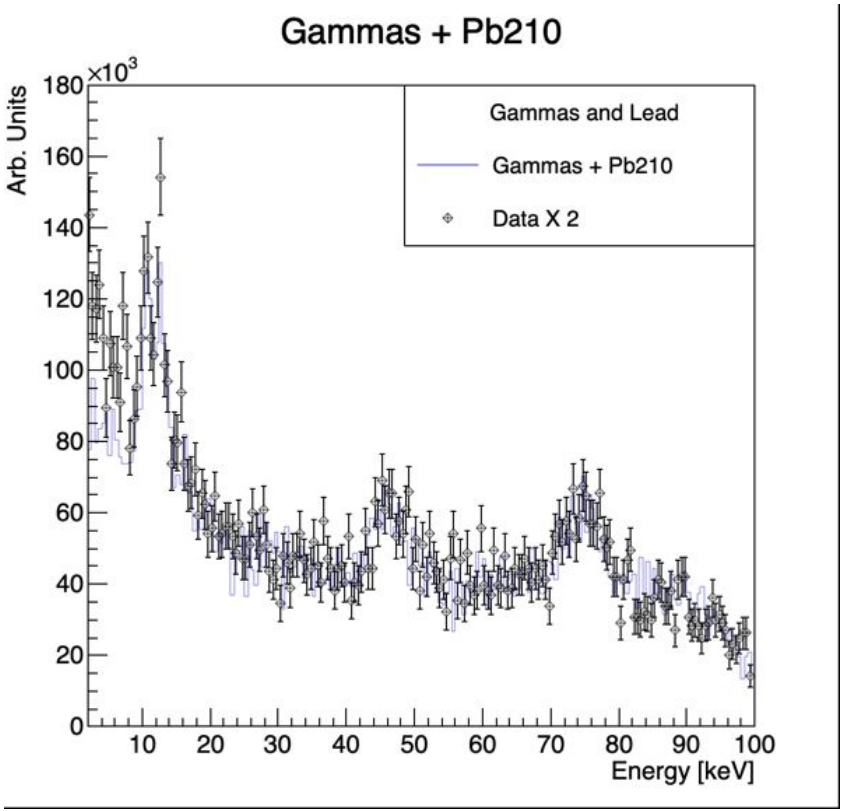
- A factor of 2 could be the difference



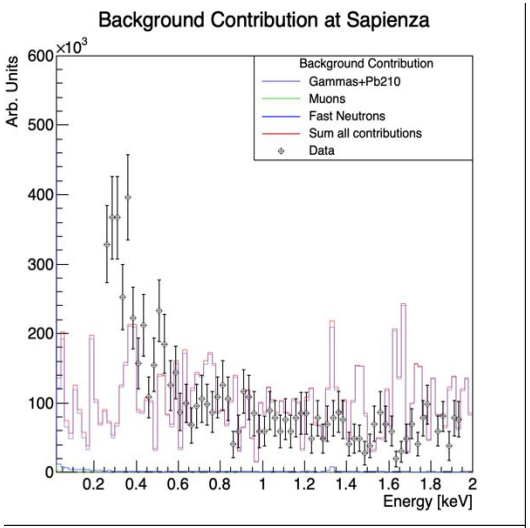


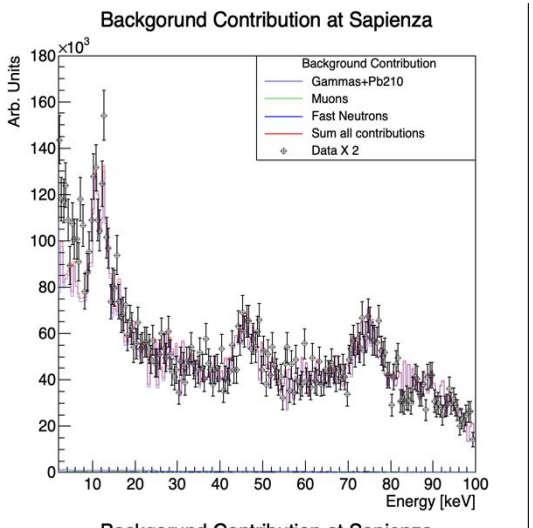
- Gammas and ^{210}Pb, to estimate the purity from lead the data was scaled by 2

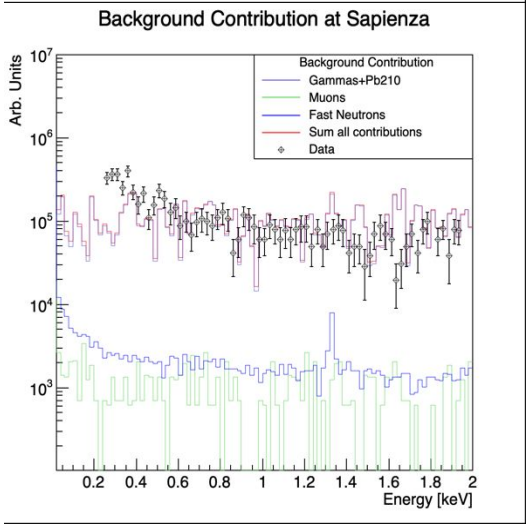


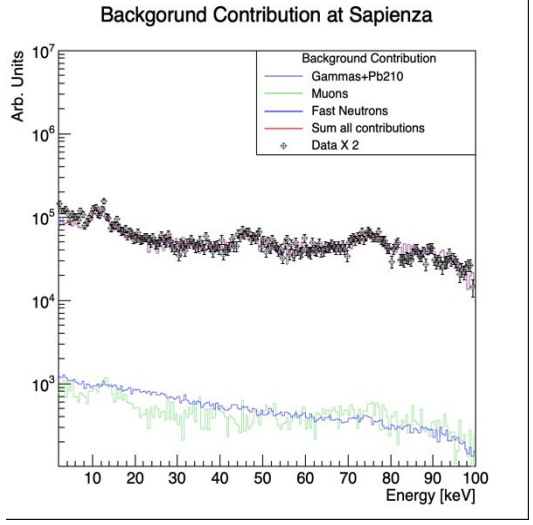


- All contributions

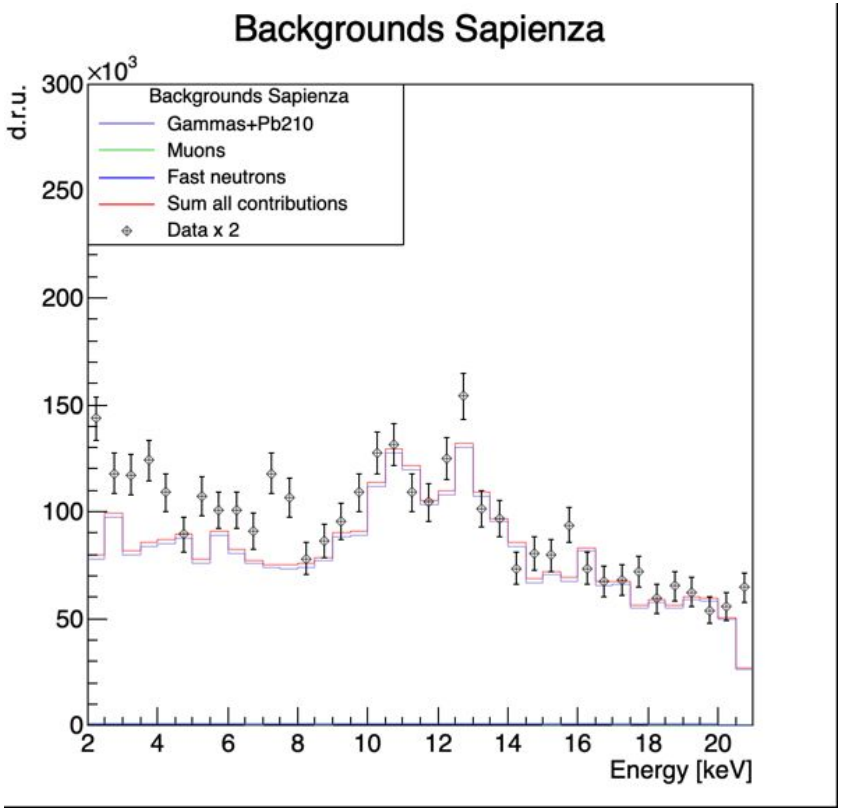


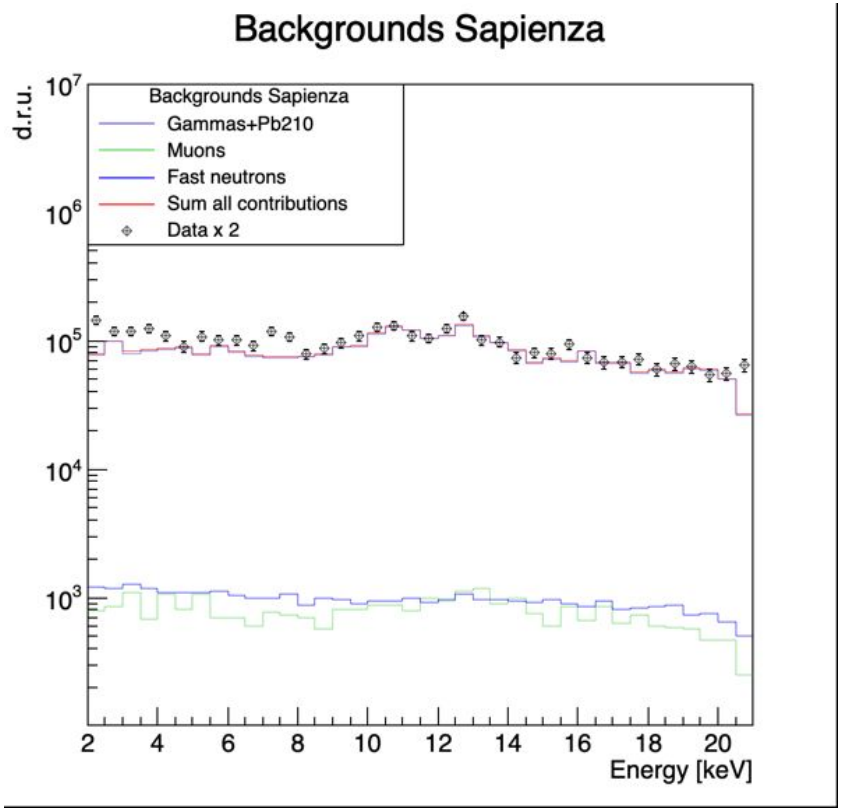






- Even after the rescaled, there is a contribution missing in the simulations below 8 keV





Summary

- The geometry in the simulation includes the lead shielding around the cryostat and the dimensions and distances match with data
- The difference between simulation and data in most of the regions seems to be a factor of 2
  - From 2 to 8 keV the difference is not a factor of 2, there is a contribution missing
- Running simulations for muons with different cut value of secondaries and with PIXE