Design and simulation of a cost-affordable Cosmic Ray Muon Tomographer

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CIENCIACTIVA
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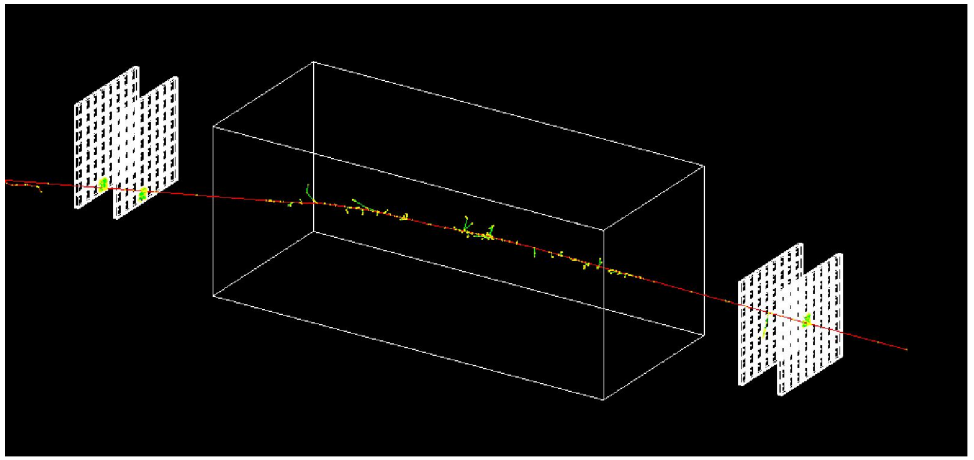
Simulation in GEANT4 of a prototype muon tomographer

- Based on new and cost-affordable technology (plastic scintillators and silicon photomultipliers)

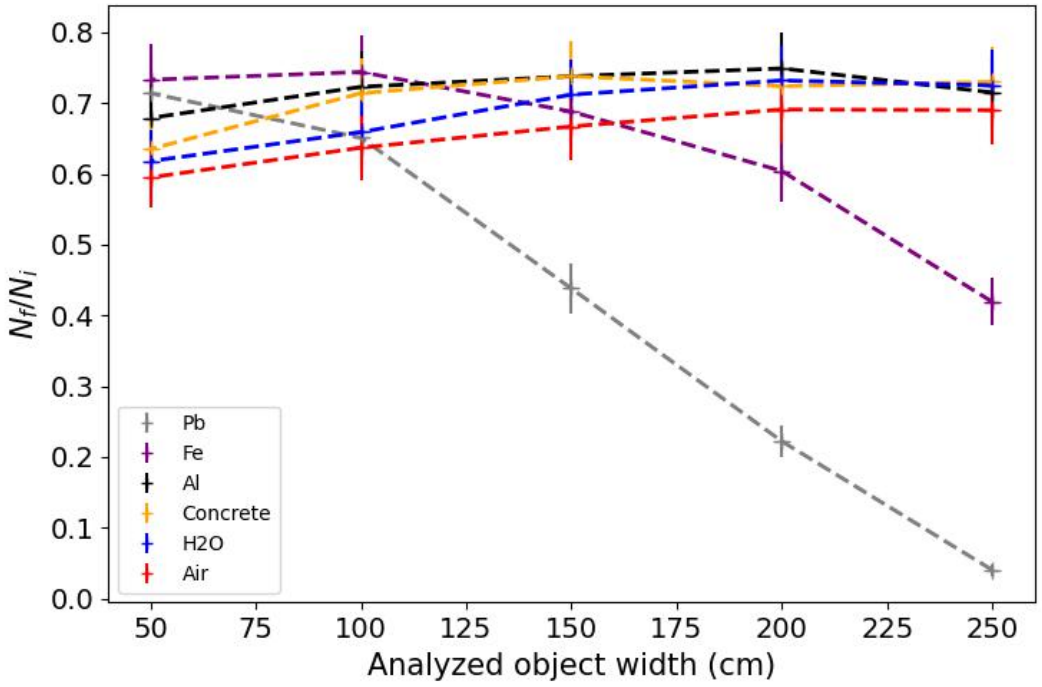


4 GeV muon event through the tomographer - BLOCK Pb

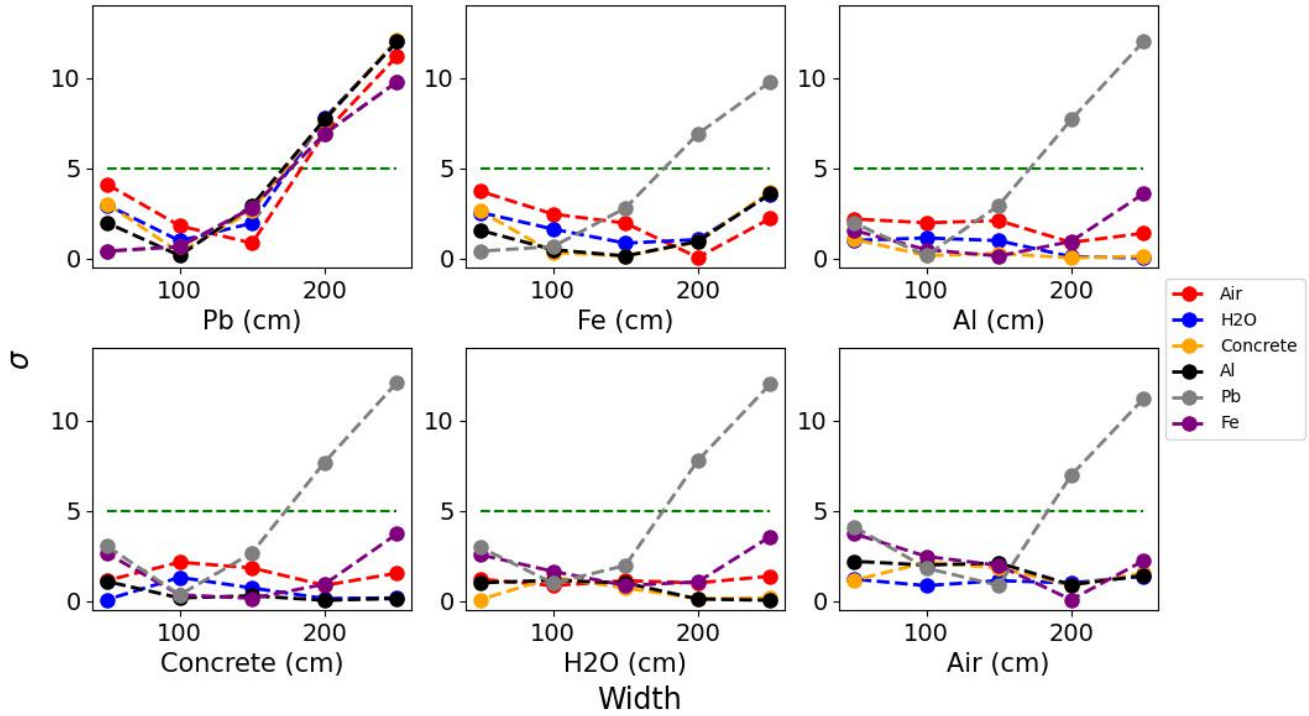
Geometrical parameters to optimize.

Discriminate materials - ABSORPTION

N_i : Number incoming muons
N_f : Muons number that have traversed the structure

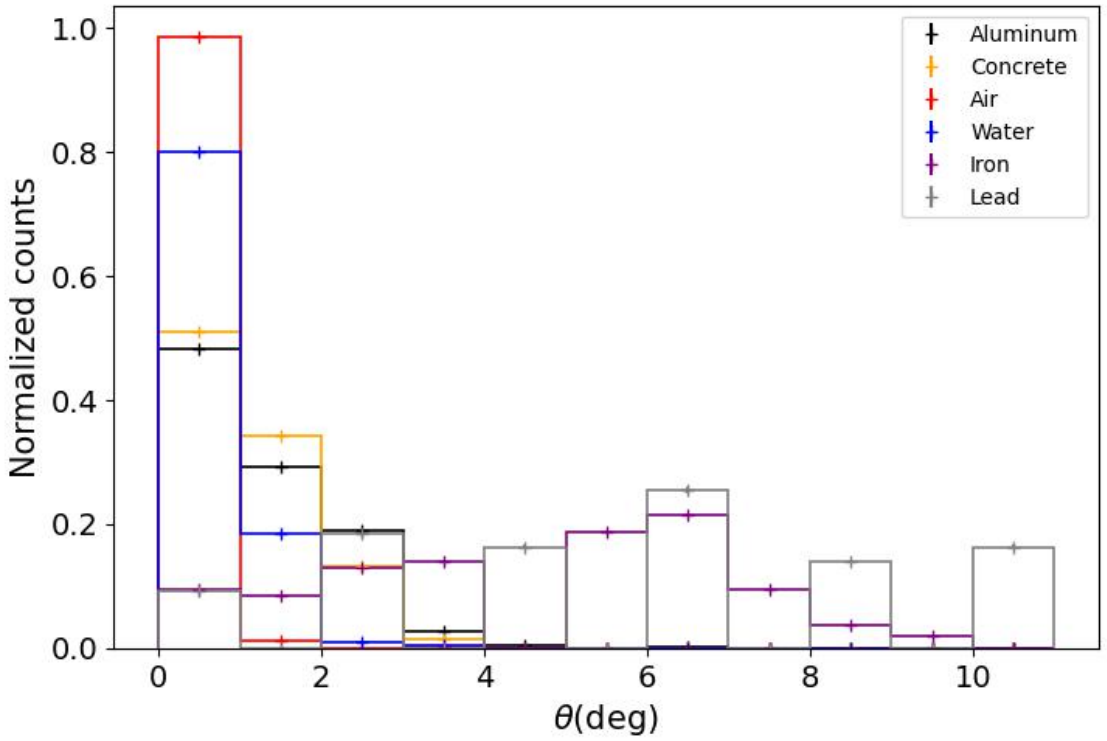


Number of sigma to find differences

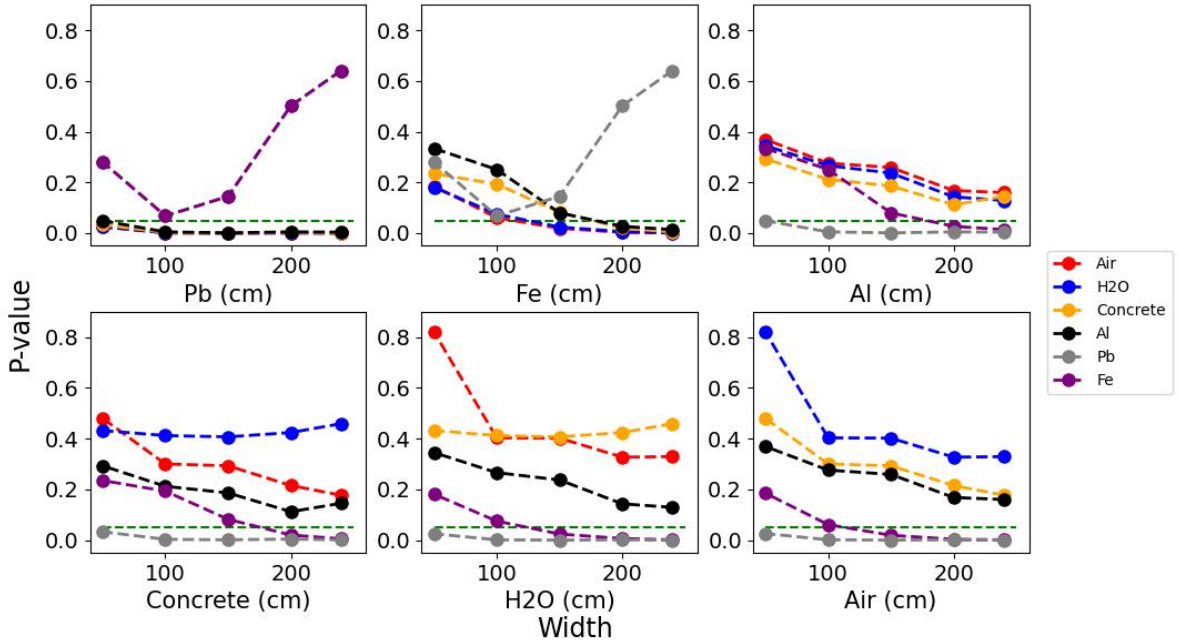


Discriminate materials - SCATTERING ANGLE

We calculated a vector with the position of the plane's detector before and after the object



T-Test to Compare Histograms (distributions)



RESULTS

- Best geometrical parameters to differentiate materials
  d = 20 cm, W = 200 cm
  D = 100 cm for the absorption method
  D = 60 cm for the scattering angle method.
- We can identify Pb at 5σ when W = 150 cm and Fe for W = 250 cm.
- P-value between angular distributions of Pb and Al is 0.005, but for Pb and Fe 0.502.
- Time of exposure needed: 3 hours for 1000 events at 1° of angular resolution for D = 280 cm.