

Mahmoud Ali

FULL SIMULATION OF IDEA MUON SYSTEM

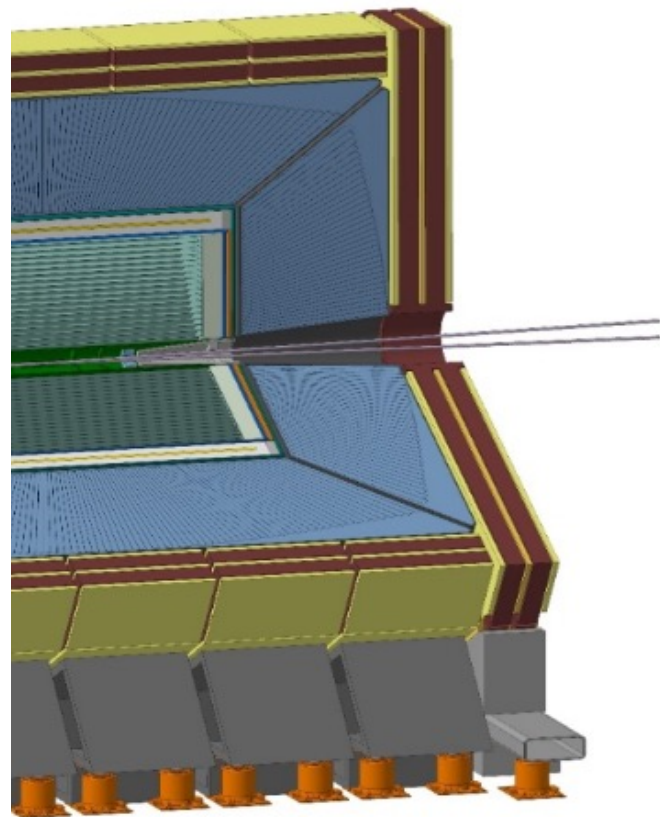
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ALMA MATER STUDIORUM
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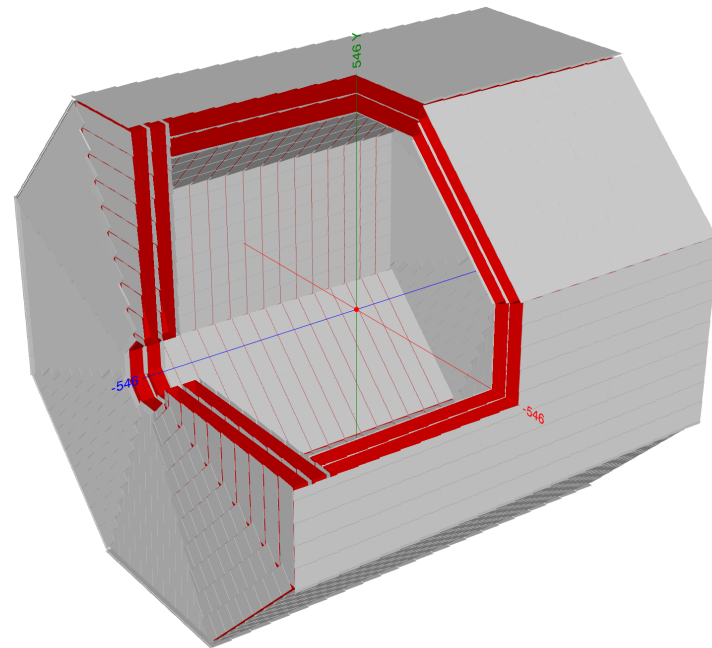


FUTURE
CIRCULAR
COLLIDER



Current status of IDEA Muon System Full-SIM:

- A detailed description of the muon system geometry and μ RWELL material is finished.
- A complete check of the geometry overlap has been done.
- A PR has been opened to merge this implementation within k4geo repository.
- A simple digitization algorithm is under development, and so far we can smear the hit position in the μ RWELL chamber plan in 2D, with the space resolution of the chamber $\sim 400 \mu\text{m}$.



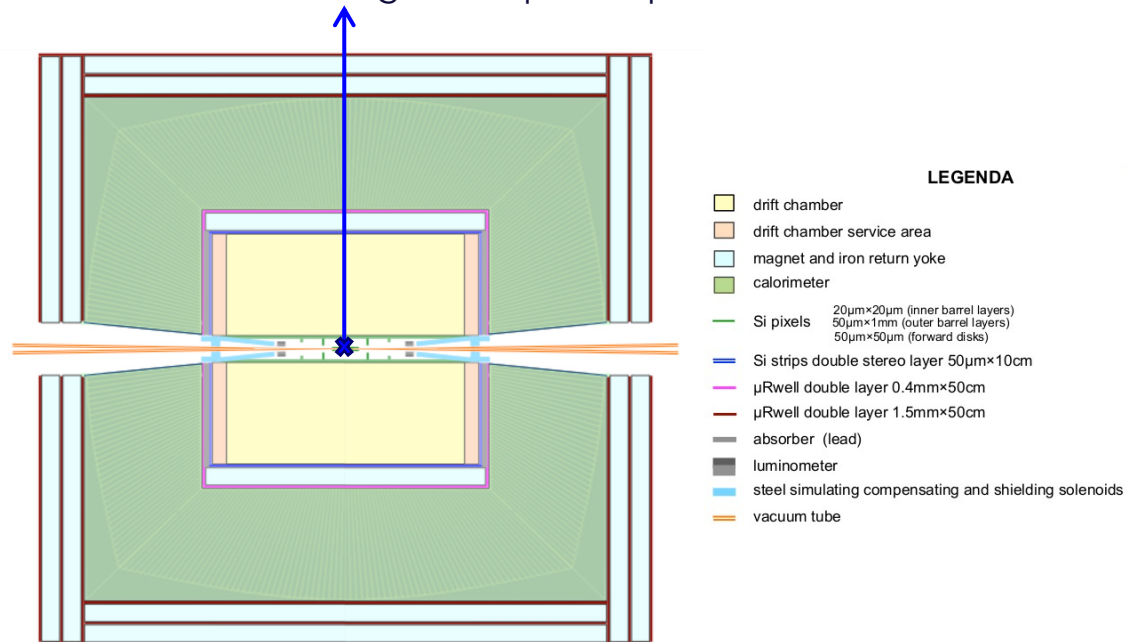
Muon system geometry

Study of the Muon Track Deflection at IDEA

As performing simulation tuning with test beam data. The calculation of the effect of multiple scattering as a function of the momentum of muons caused by their interaction with the IDEA implemented material (all sub-detectors before the muon system) is crucial. This analysis aids in understanding the deviation of particle tracks and determining the required space resolution for muon detector.

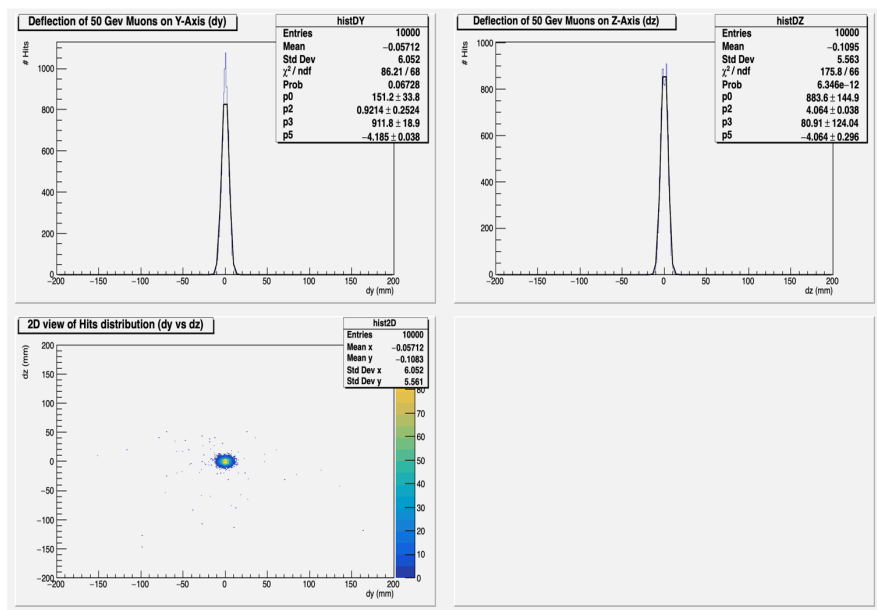
There are several ways to do the study, but the simplest way is:

- Shoot muons from the interaction point in the X-axis perpendicular to the beam-pipe. Direction $(1, 0, 0)$, and monitor the hits in 2D (Y & Z) at the muon first barrel station.

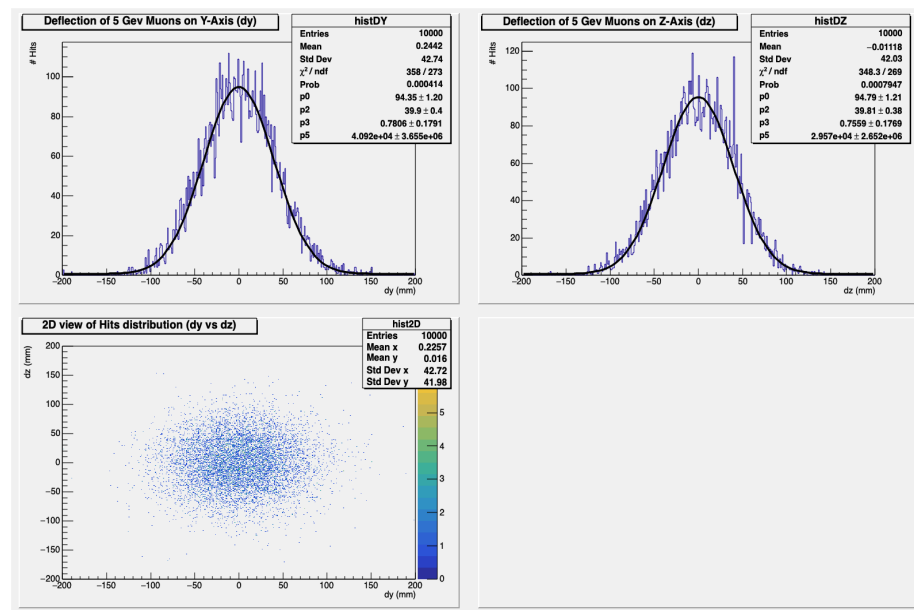


IDEA detector layout

Study Multiple scattering effect on muon tracks at IDEA Detector environment within DD4hep:



50-GeV muons

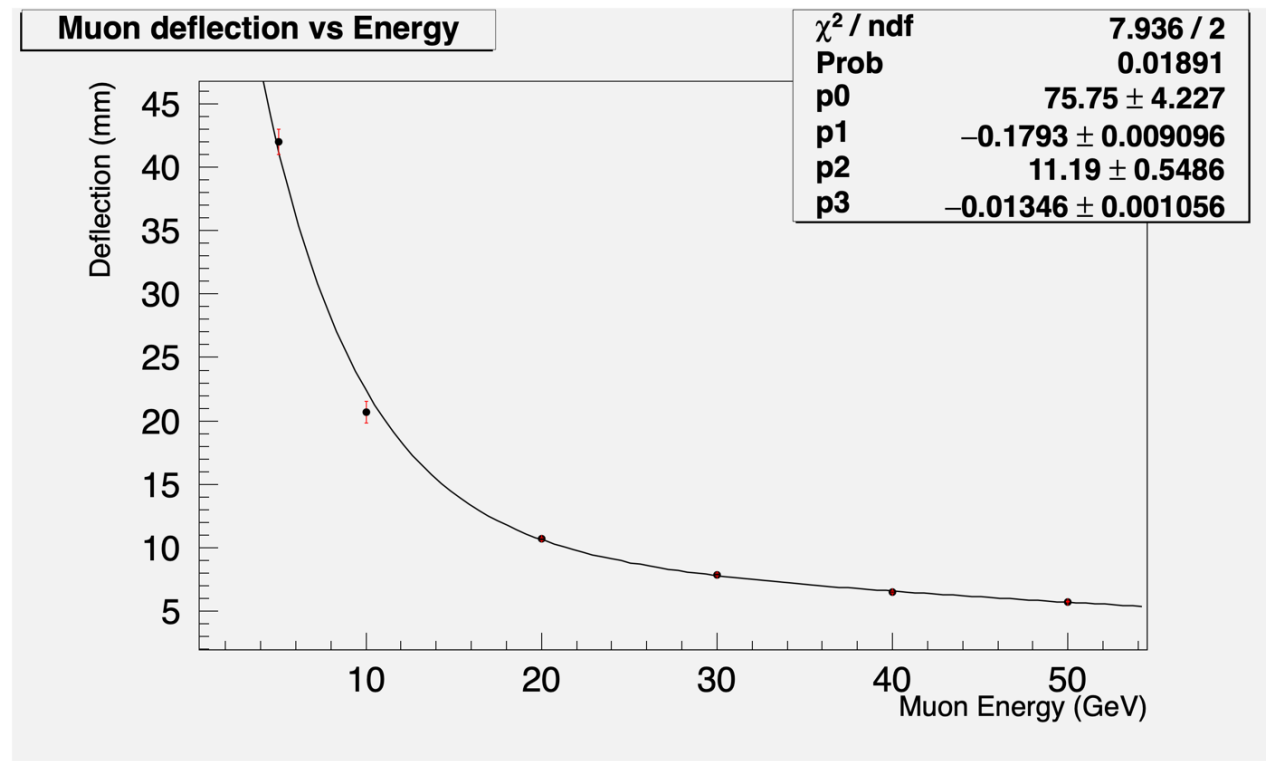


5-GeV muons

Overall, The energy function against the standard deviation of the track deflection for the first layer:

Further developments:

- Repeat the same study for the second and the third layer of the muon system.
- Shoot from different places, especially just after the calorimeter to study the deflection just due to muon yokes.



Plans for Muon detector requirements studies:

- 1) Delphes study with the addition of a tracking description of the muon system (standalone in the muon chambers) to study with varying number of layers, and resolutions how the signal reconstruction and vertex fitting is impacted.

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This study can be done in Full-SIM within IDEA now, since we almost have a first complete description of IDEA ([With the Korean version of the Dual Readout Calorimeter](#)). The plan is to start with writing a standalone reconstruction algorithm for the muon system.

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- 3) Study with CLD Full-Sim and shooting pions to study as a function of energy the rate of punch through muons or actual pions reaching the muon chambers. Might want to extrapolate in particular the number of events with 2 muons only to compare with the model of LLP having 2 muons in the final decay.



THANK YOU
FOR YOUR ATTENTION.