ILD Muon System Simulation and Study
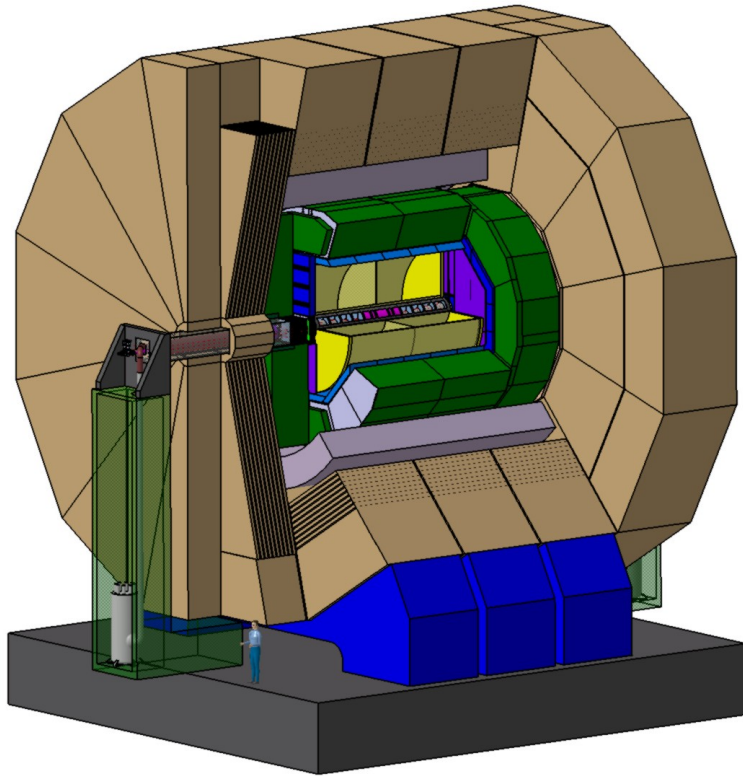
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V. Galkin, D.Ossetsky, V. Saveliev
National Research Nuclear University, Russia / DESY

U. Schneekloth
DESY

The Magnet and Muon System of ILD

ILD detector for the International Linear Collider

The task of the muon system in ILD is the identification of muons and tracking (PFA segment),
in addition as a Tail Catcher for HCAL

Yoke: *Detailed Geometry*
 - *Barrel: 10x(100+40) +3x(560 +40) mm*
 - *EndCup: 10x(100+40) +2x(560+40) mm*

Cryostat: *Detailed Geometry*

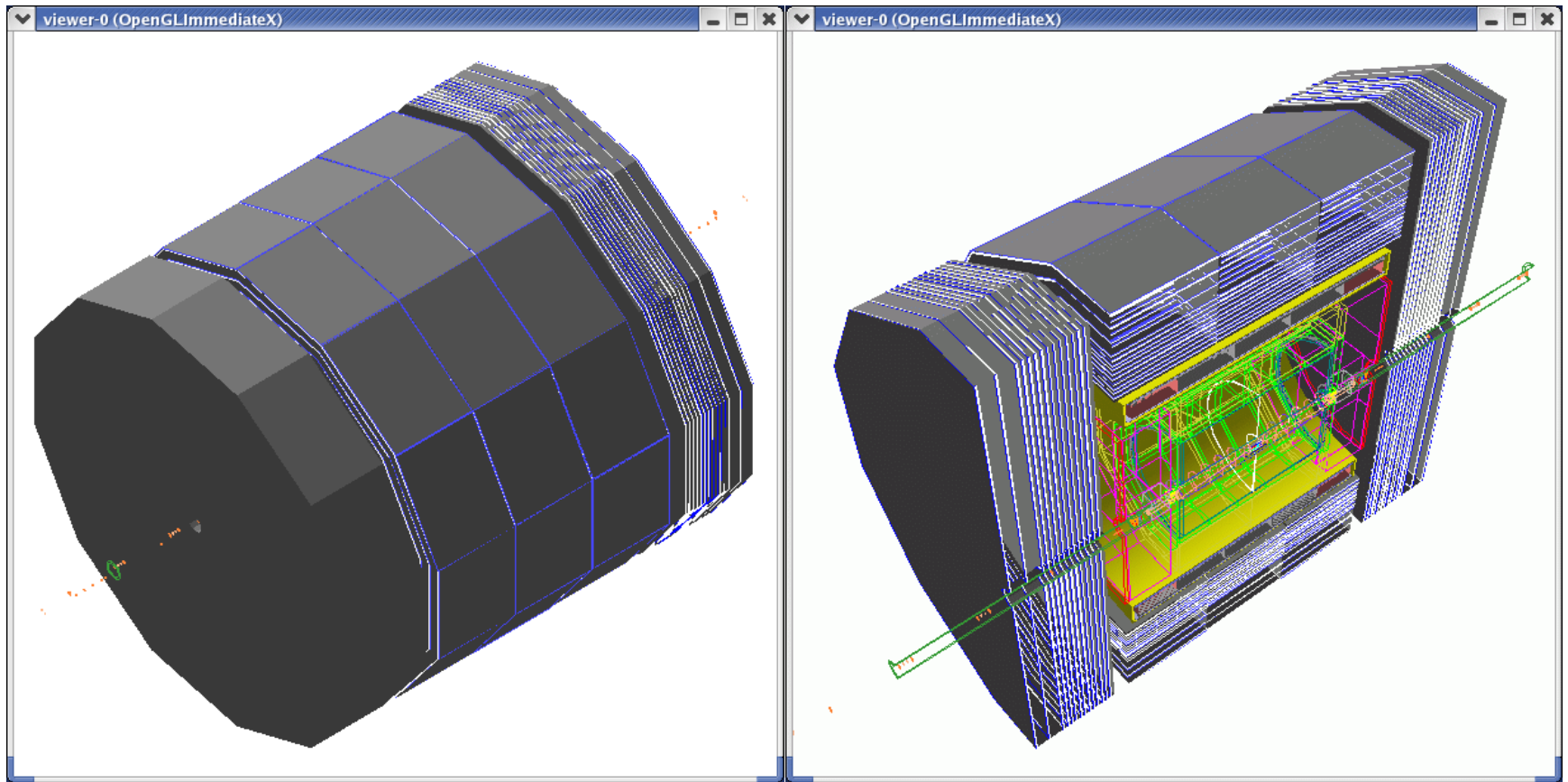 - *Instrumentation 2 double scintillator layers*

Coil: *Detailed Geometry,*
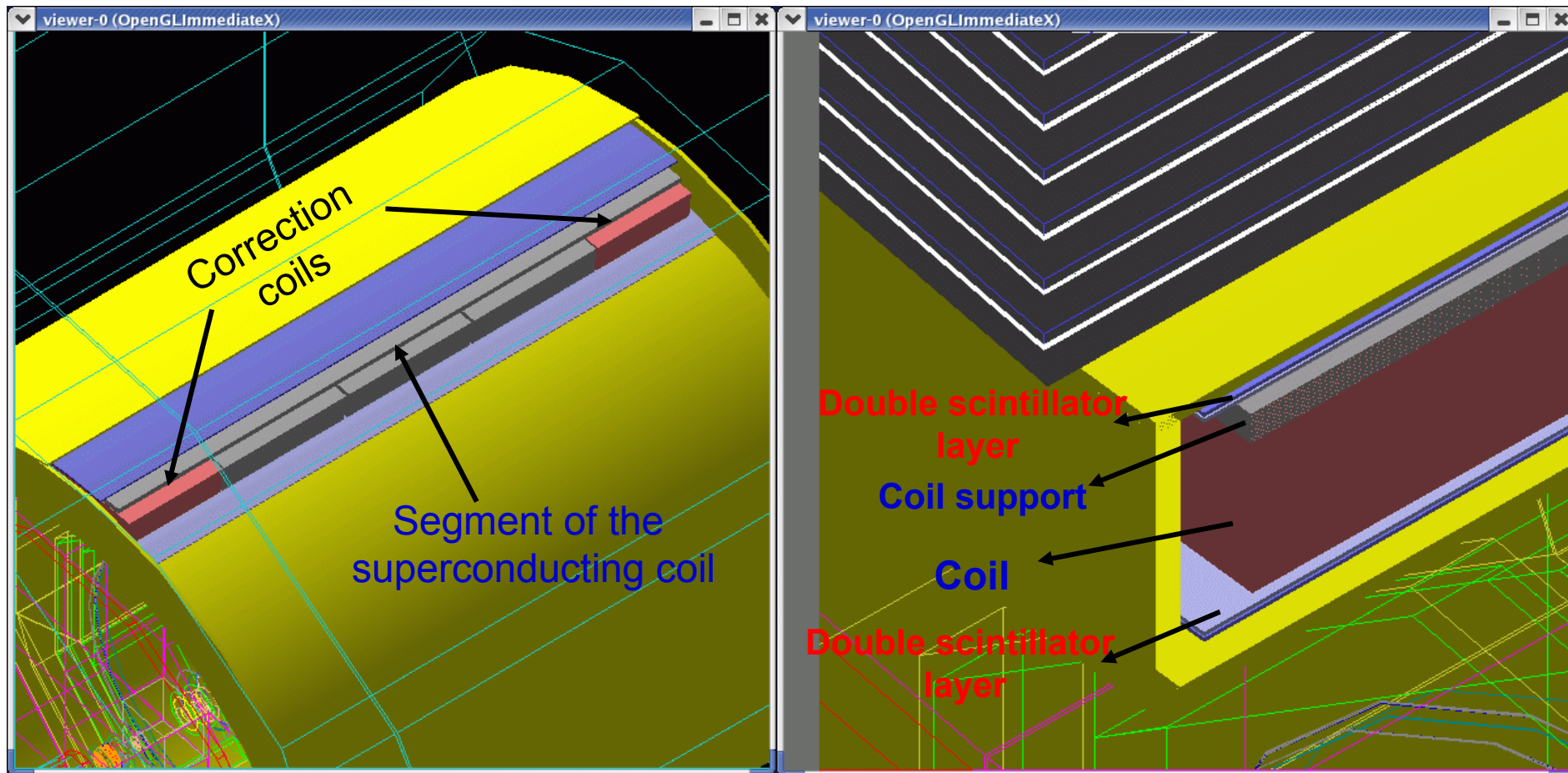 - *Coil Segmentation*

Muon Detector System:
 - *Scintillator Double Sensitive Layers in the Yoke Gaps*
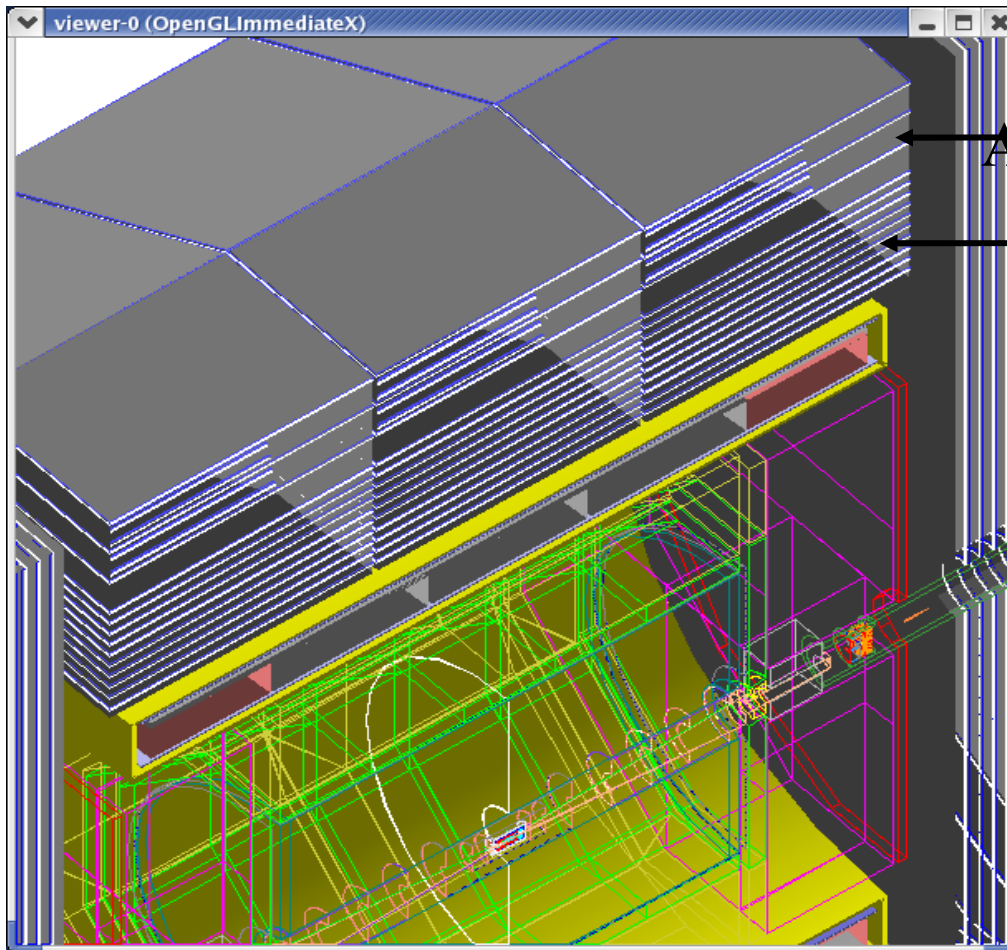
New Geometry of the ILD Muon System

New geometry of the ILD detector in MOKKA.

The New Geometry of the Coil

New geometry of the ILD detector in MOKKA:
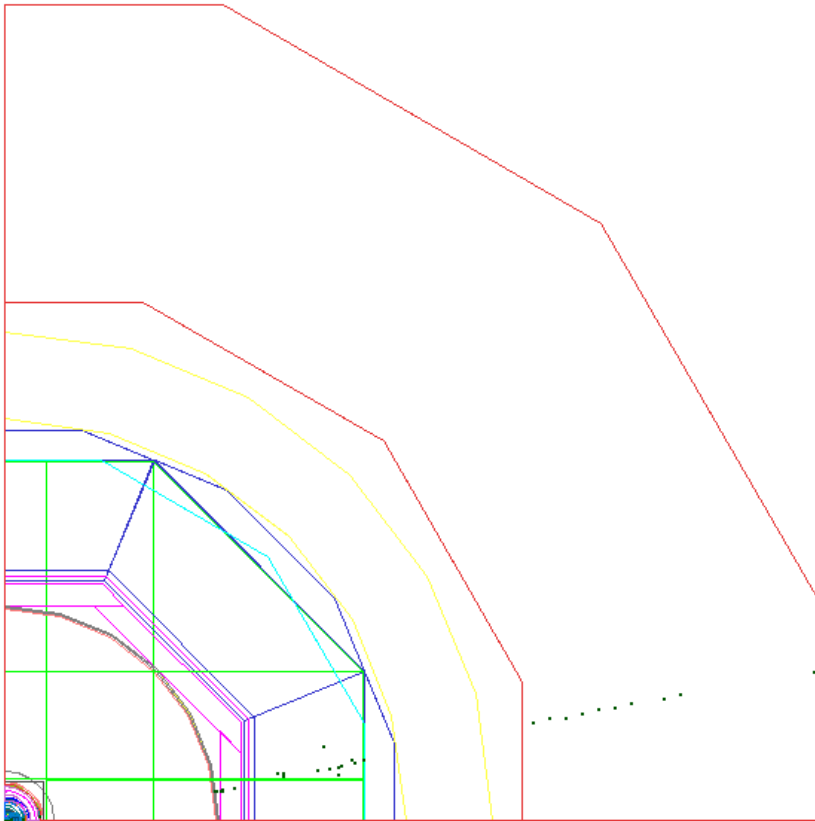*Zoom inside the cryostat*
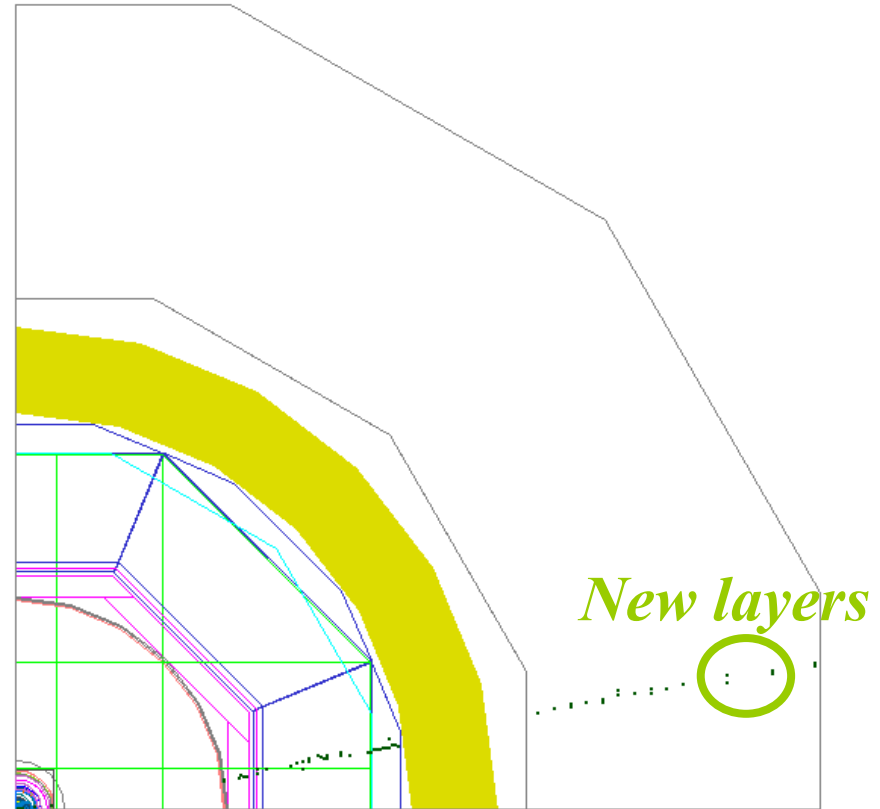
The muon system

Additional scintillator layers

T0 scintillator layers

Geometry of the ILD detector in MOKKA.
Details of the muon system – barrel

Muons in the New Geometry

20 GeV muon simulated in the
LOI - *ILD detector geometry*
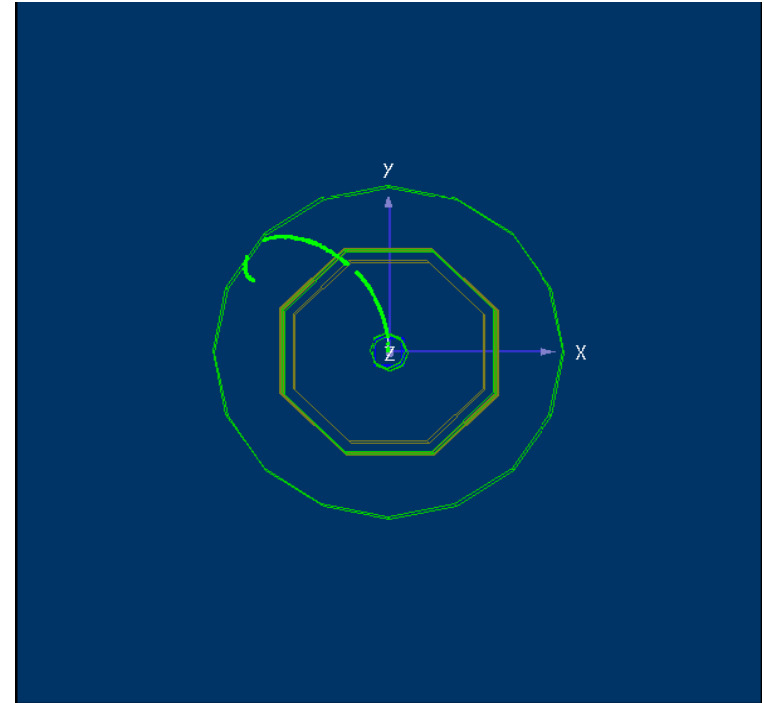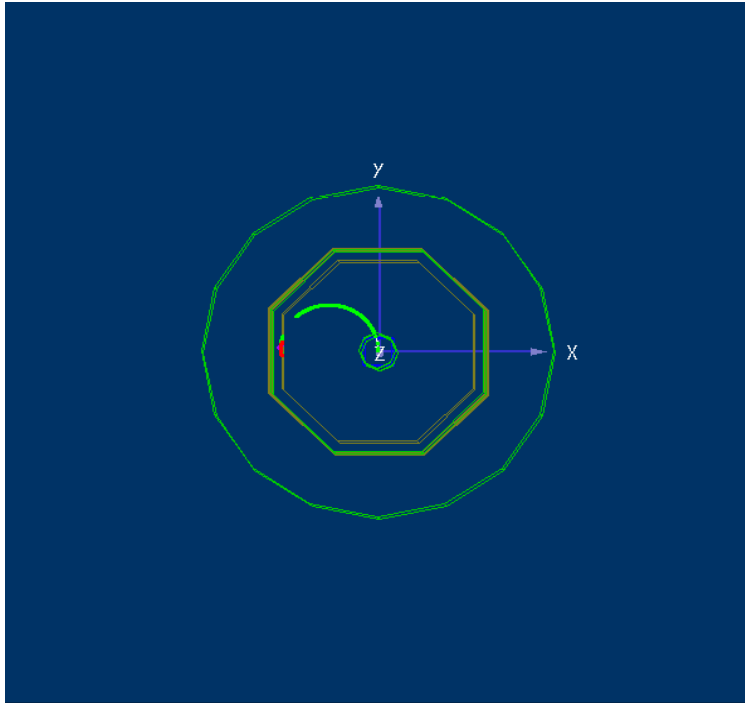

New layers

*20 GeV muon simulated in the **new** ILD detector geometry*

Muon System Performance Study

- Muon System **Efficiency - simple muon id:** Identify hits in muon system

- The **muon momentum** is measured by the trackers (PFA).
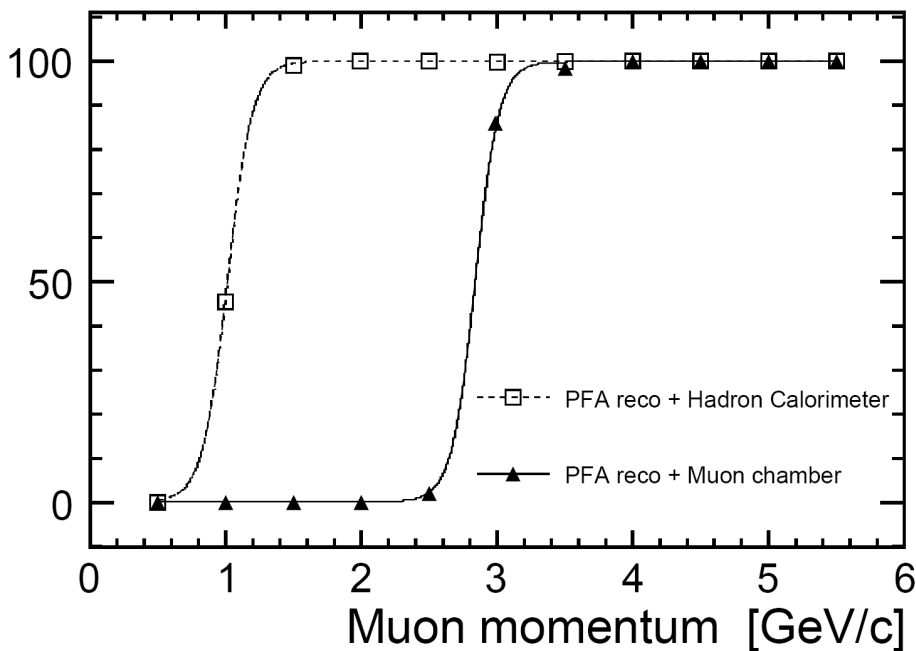
- Tail Chatcher (Hadron Calorimeter)
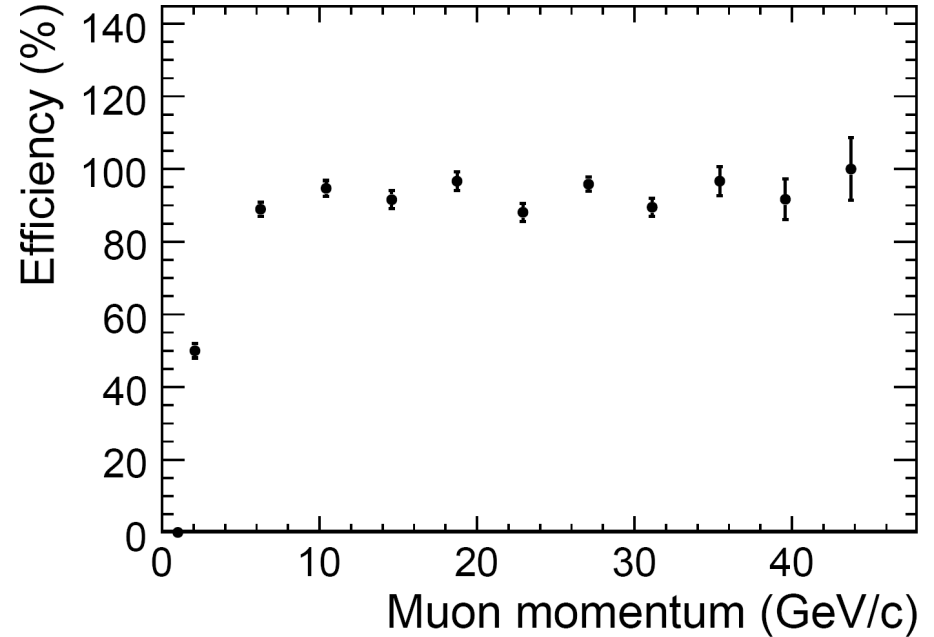
Efficiency of Muon System Study

Simple muon id: Muon Hits in connection to the track in the tracker

AHCAL muon id: Muon Hits in connection to the track in the tracker and the mip-like clusters in the AHCAL
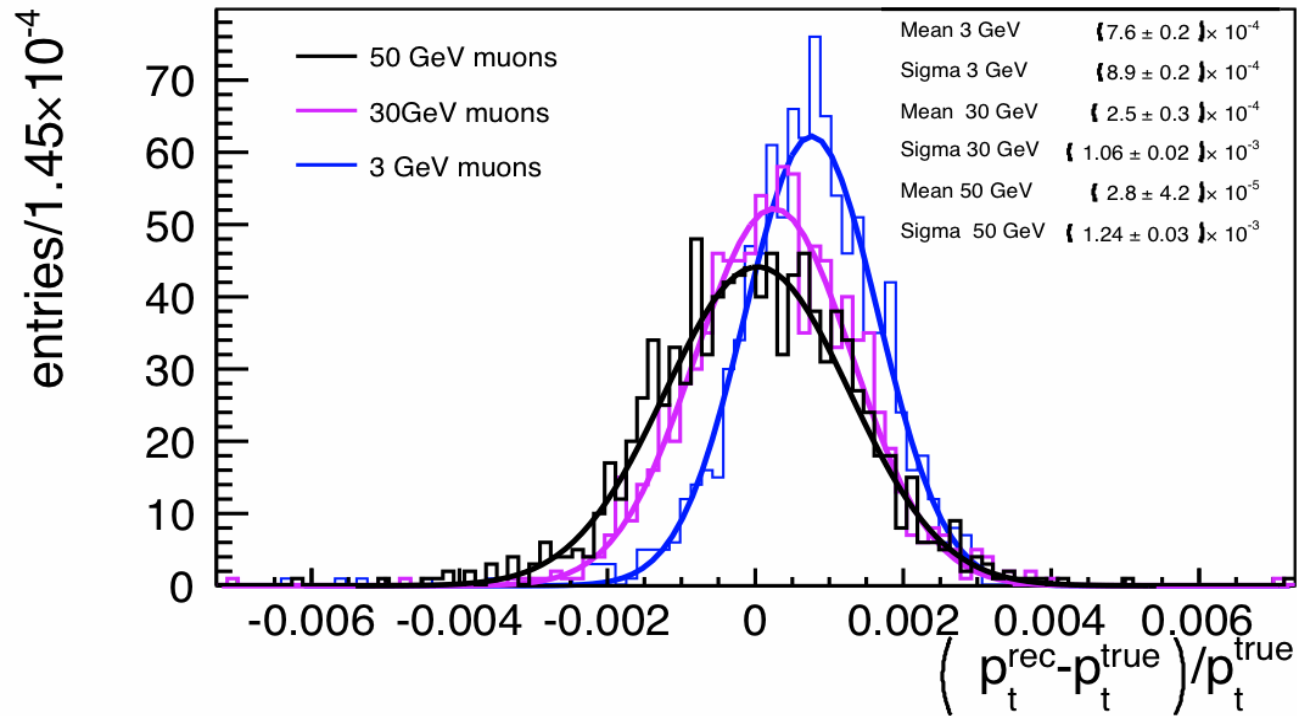
Efficiency of Muon System Study

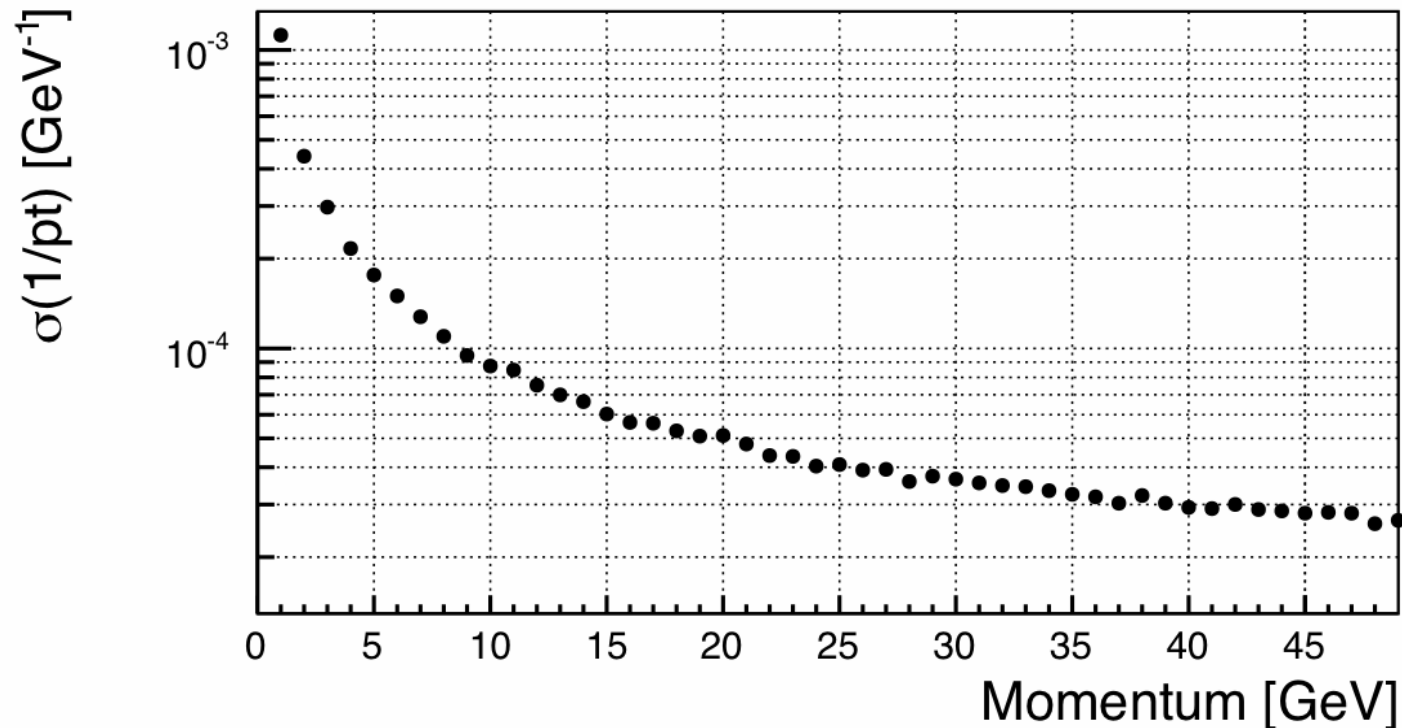*Single muon detection efficiency in the ILD detector (LOI geometry).*

Muon detection efficiency in b jets, the ILD detector (LOI geometry).
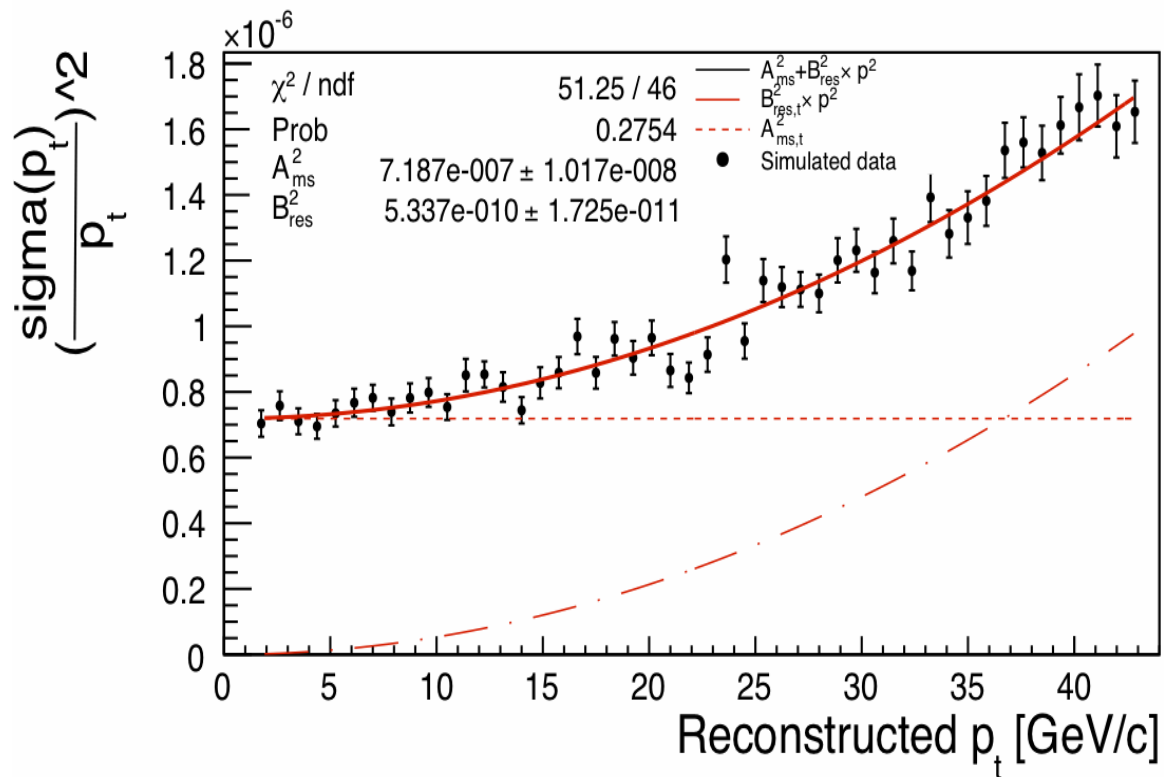
Muon Momentum Resolution Study

Pool Distribution for 3, 30, 50 GeV muons   (PANDORA PFA)

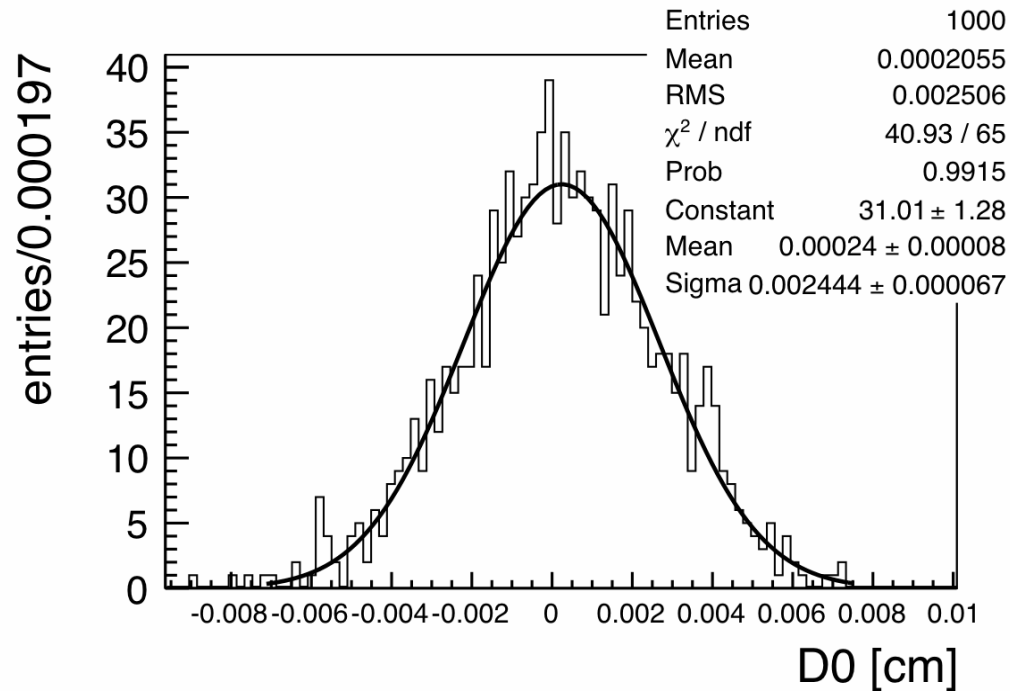# Muon Momentum Resolution Study

Muon momentum resolution of the ILD detector

Muon Momentum Resolution Study
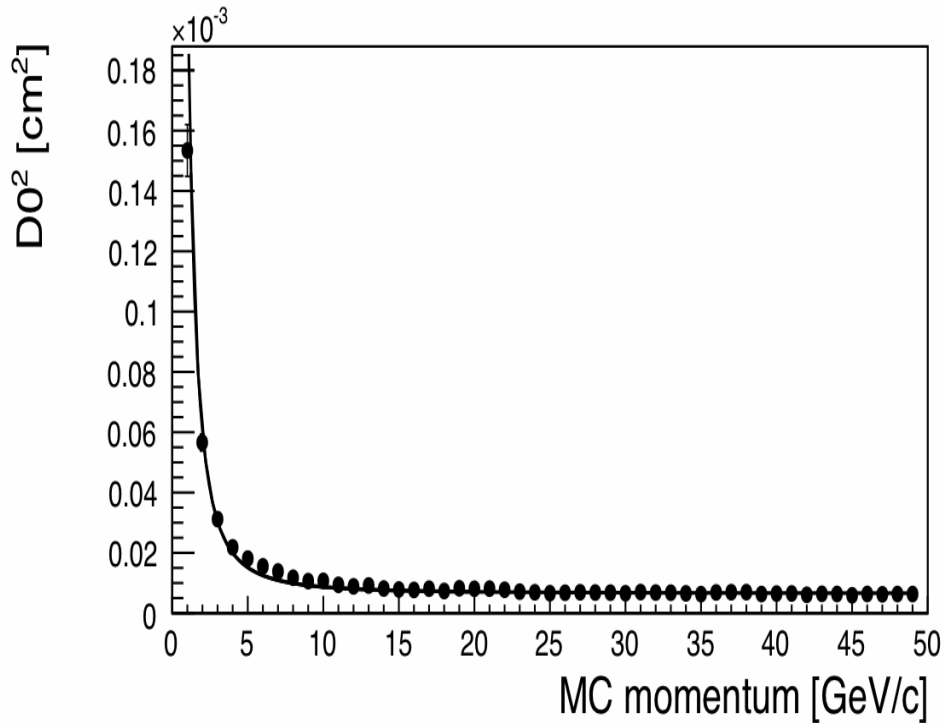

Muon momentum resolution of the ILD detector
Glukstern fit (red) *on simulated data (black)*
(sigma/p_t)^2=(A_ms)^2+(B_res/p)^2

Impact Parameter Resolution Study

Impact Parameter resolution 20 GeV muons(PANDORA PFA)
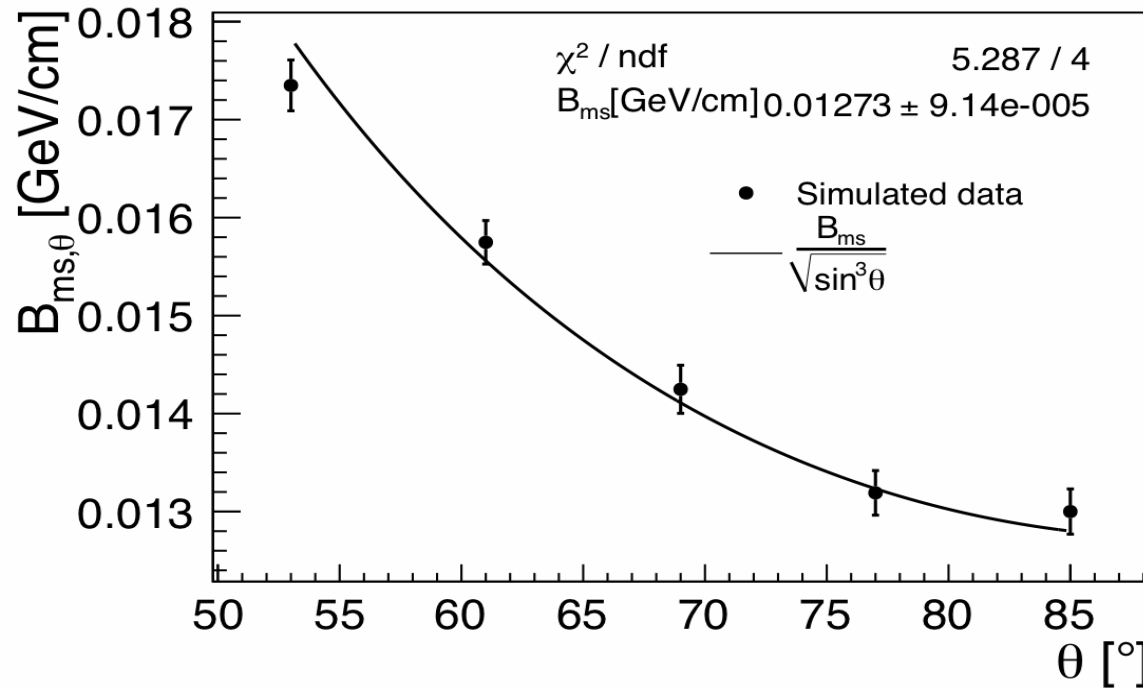
Impact Parameter Resolution Study

Impact Parameter resolution 20 GeV muons(PANDORA PFA)
(D0)^2=(A_0)^2 +(B_ms/p)^2
A_0 =2.5 microns, B_ms = 15.0 microns

Impact Parameter Resolution Study

Impact Parameter resolution 20 GeV muons(PANDORA PFA)
(B_ms/p)^2 =sqrt(sin^3(theta))
A_0 =2.5 microns, B_ms = 12.0 microns

Summary

- A new Geometry of the Magnet Yoke and Coils, and Muon System is developed and implemented in MOKKA,

- Optimization of the design of the Muon System and Magnet under study,

- Simulation studies of Muon identification and Momentum Resolution - first results is promising,

- Study of Muon System as Tail Cacher is planned,

- Algorithm of the muons track segment reconstruction in Muon System and Possibility of Including in the common fit is under development