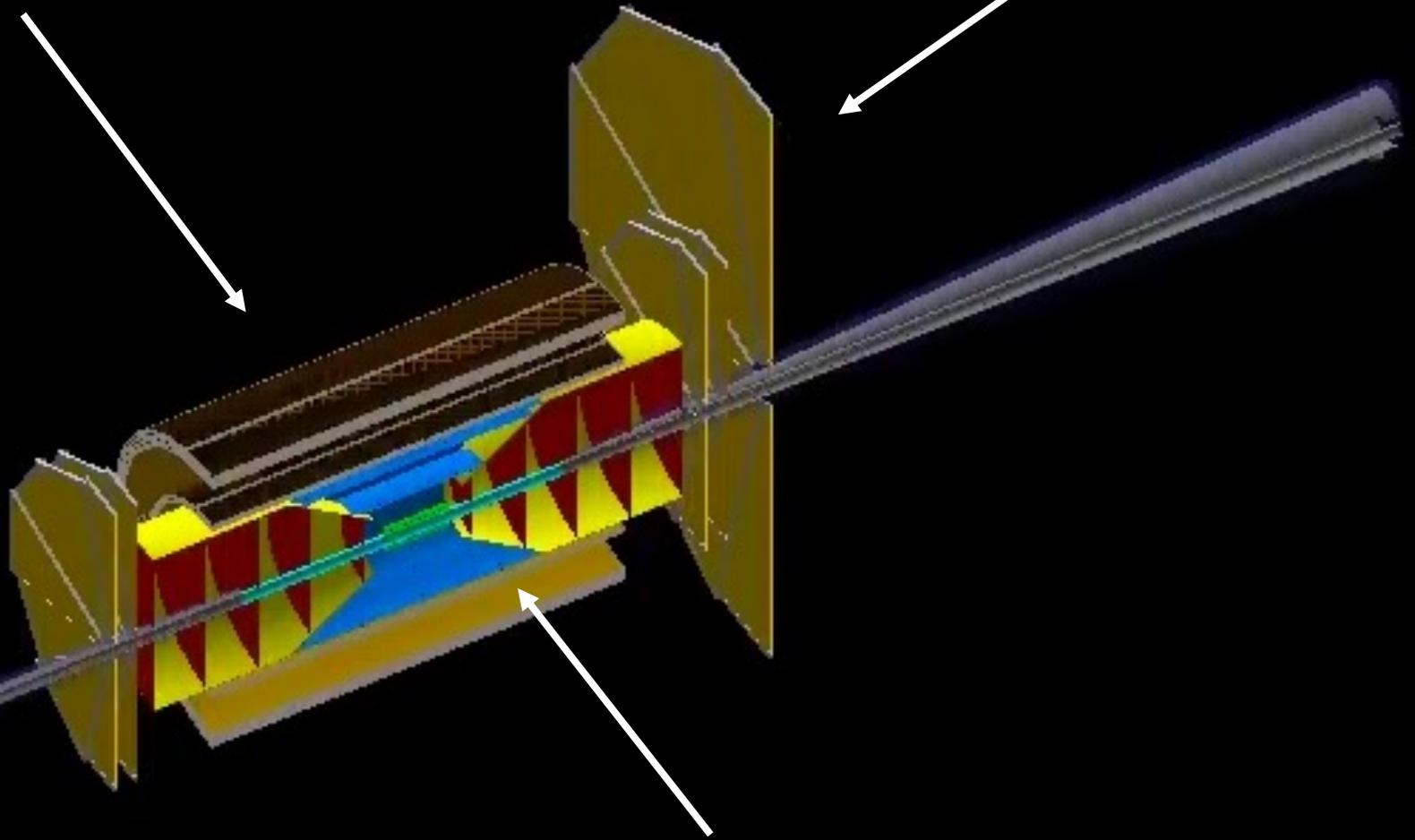# Implementation of GEM Disks in Hybrid Detector Concept in Fun4All

Nick Lukow and Athira Vijayakumar

Temple University

May 25, 2021

GEM Disks as implemented in the Eic Toy Model

Barrel MPGD Tracker implemented by the Saclay group

Simplified Si Tracker as implemented by Rey

GEM Modifications: GemGeoParData.cxx

- ❑ Drift Foil
  - o Cu thickness = 5 um
- ❑ GEM foils
  - o Cu thickness = 5 um
  - o Kapton thickness = 50 um
- ❑ Readout Foil
  - o Kapton thickness = 50 um
- ❑ Readout Support thickness (nomex honeycomb) = 0
- ❑ GEM Frames
  - o Top Width = 50 mm
  - o Bottom Width = 30 mm
  - o Side width = 15 mm
  - o Frame thickness = 3 mm + 7*2 mm = 17 mm
- ❑ Windows
  - o Entrance Window Thickness = 25 um
  - o Exit window thickness = 25 um (can just place a copy of entrance window here)
  - o Eventually switch from Kapton to Al-mylar

Modifications to the GEM Module Material   *Slide from Matt*
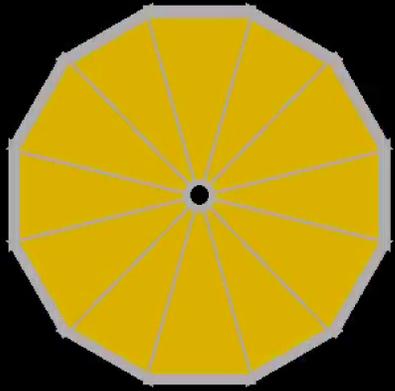
All changes *except* the exit window have been implemented (within the fun4all macro, so no need for recompilation)

Addition of exit window will require changing the code and recompiling

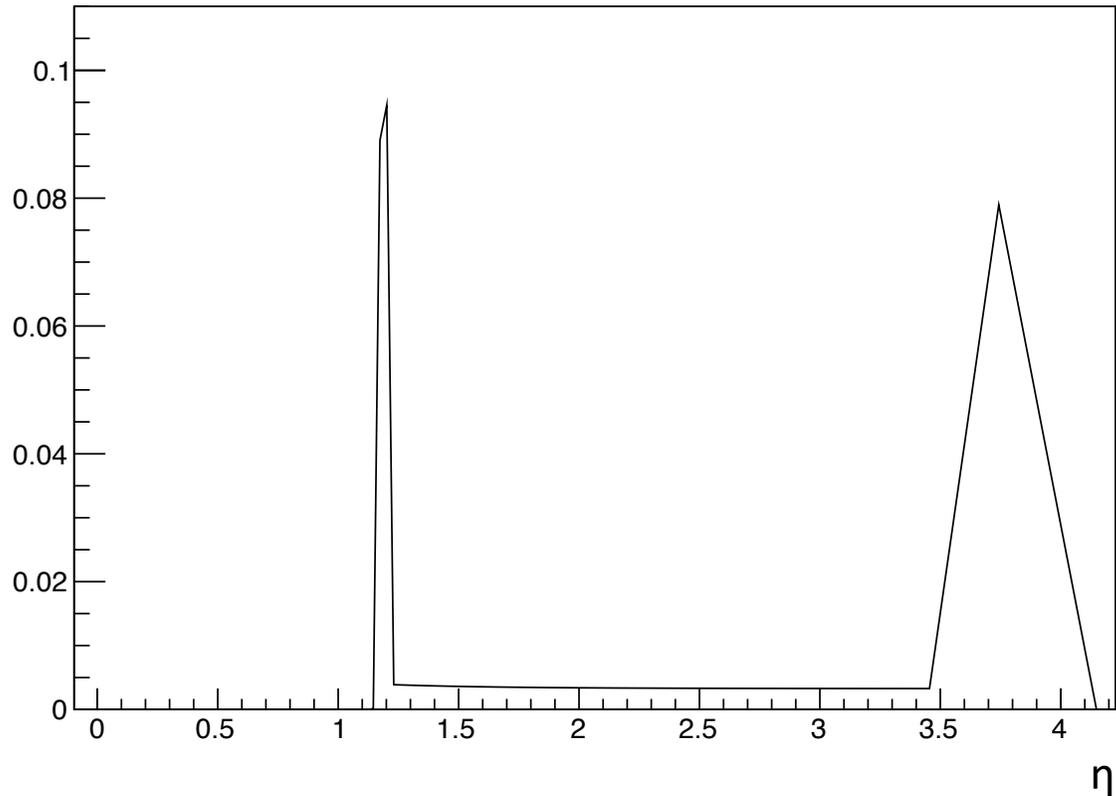GEM module sizes can also be changed within the macro

GEM Material

Material scan of GEM disk at fixed phi = 0

Active area material less than ~0.4%
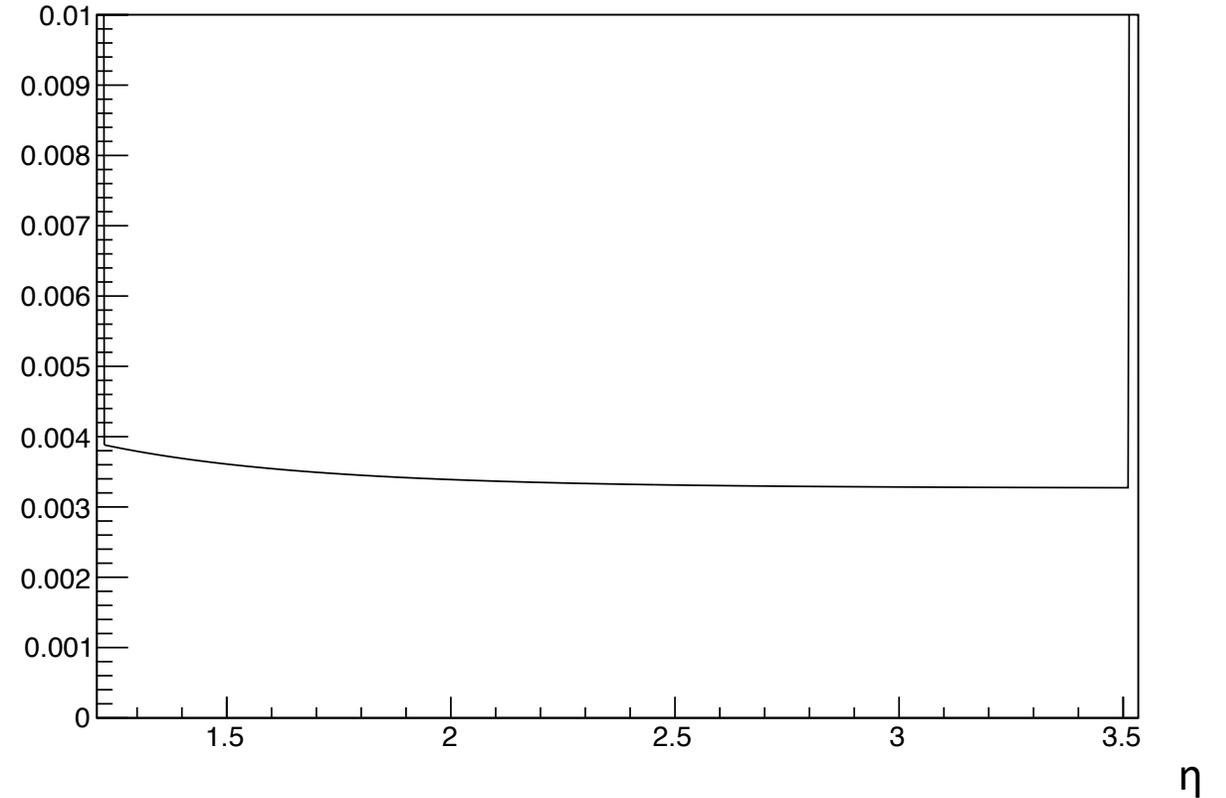Large material at η=~1.2 and η=~3.8 due to the GEM frames

Zoomed-in y-axis

X/X0 vs η

X/X0 vs η

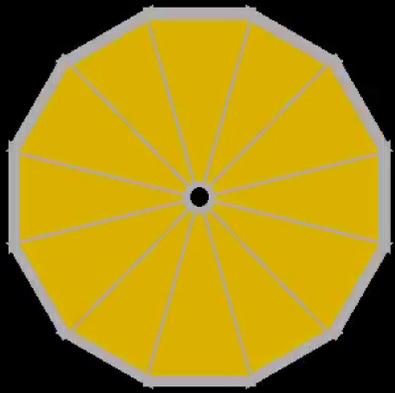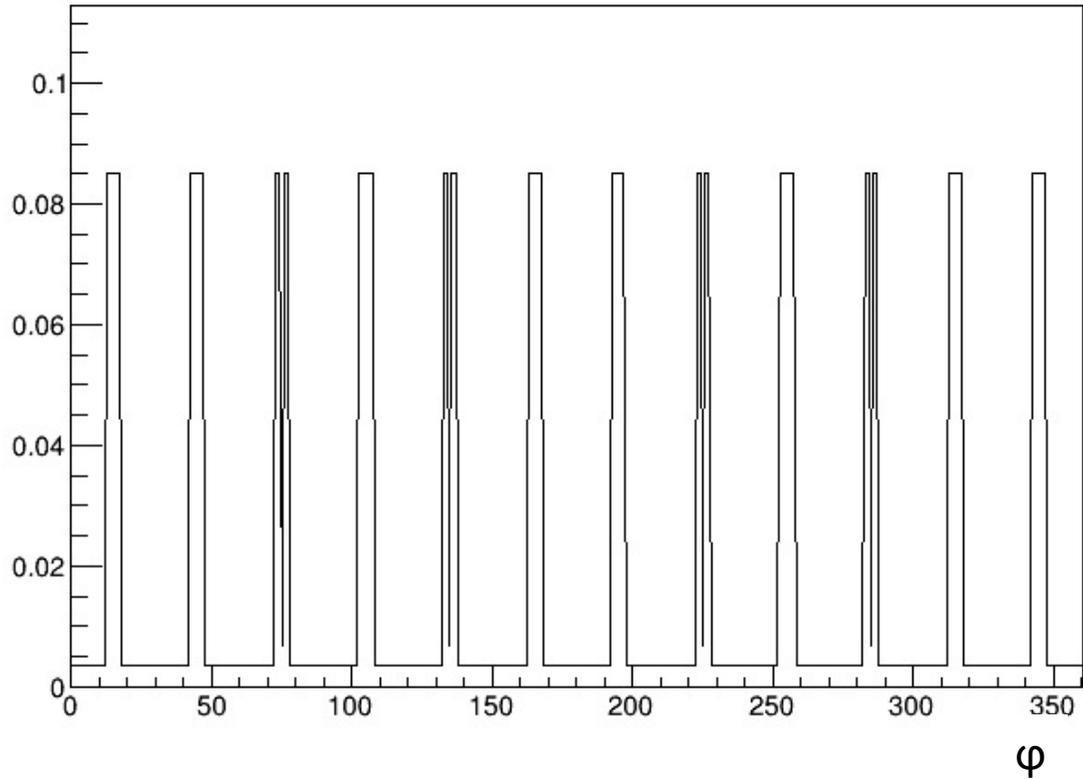# GEM Material

Material scan of GEM disk at fixed eta = 2

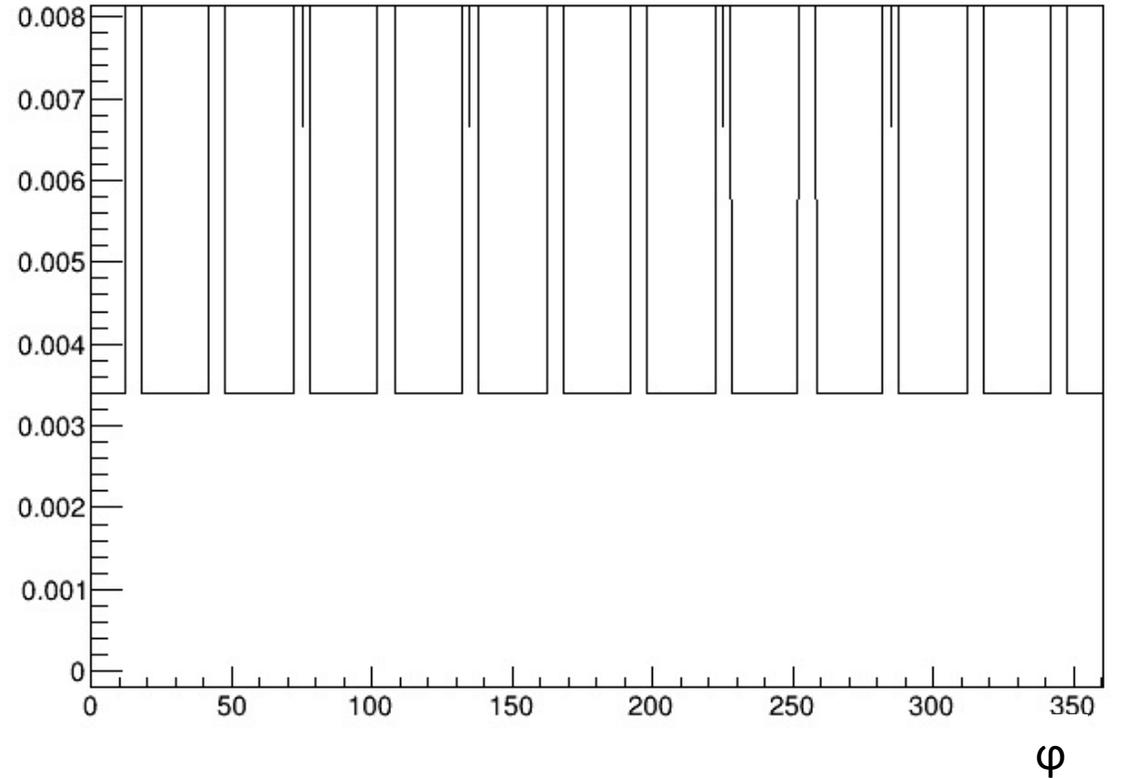Active area material less than ~0.4%
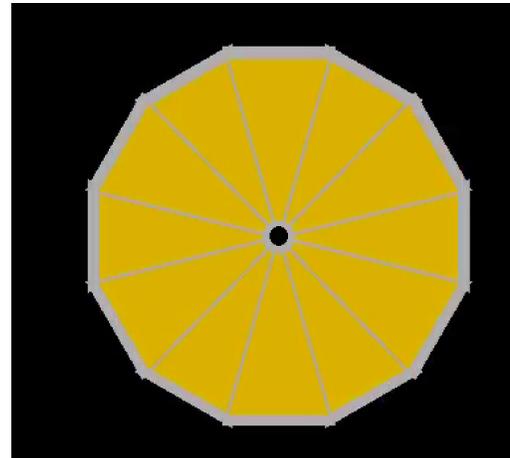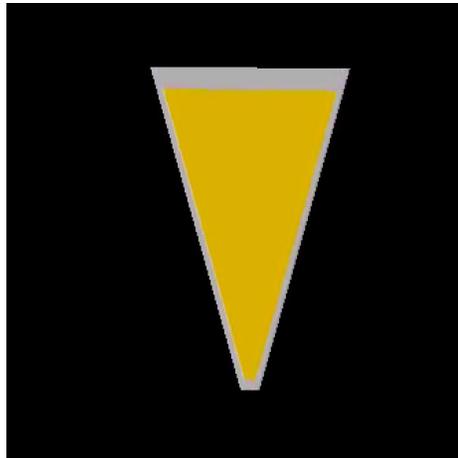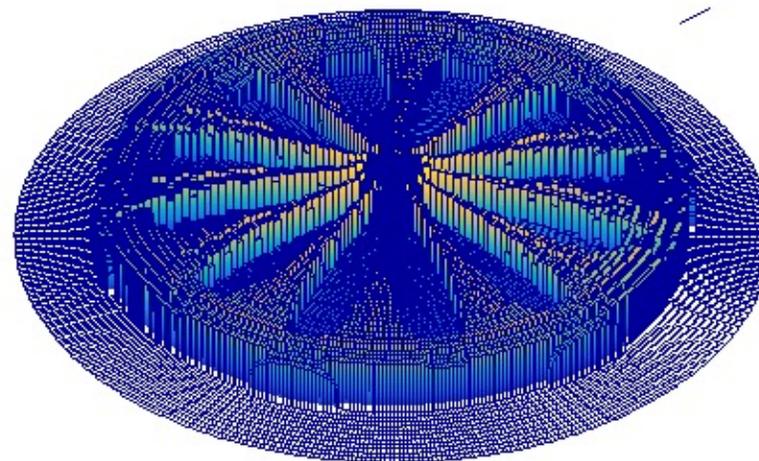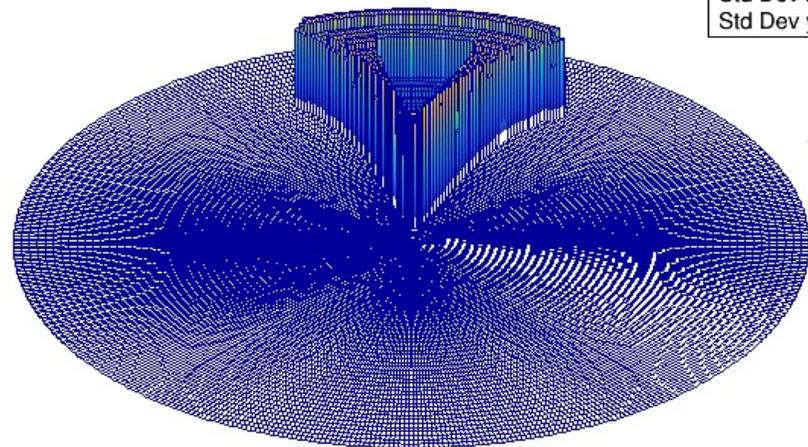Large material every ~30° due to GEM frames

X/X0 vs φ

φ

Zoomed-in y-axis

X/X0 vs φ

φ

2D Material Scan

2D Material Scan

h2d_mat	
Entries	100000
Mean x	92.07
Mean y	2.366
Std Dev x	25.94
Std Dev y	0.9643

| h2d_mat	
Entries	100000
Mean x	179.9
Mean y	2.374
Std Dev x	103.8
Std Dev y	0.9682

Material Scan of Barrel MPGD Tracker

As a sanity check of the material scans, I tried to recreate the material scan from the Yellow Report

Setup is composed of:

      -Simplified Si vertex tracker from Rey's code

      -Simplified mid-rapidity Beryllium beam pipe from Rey's code
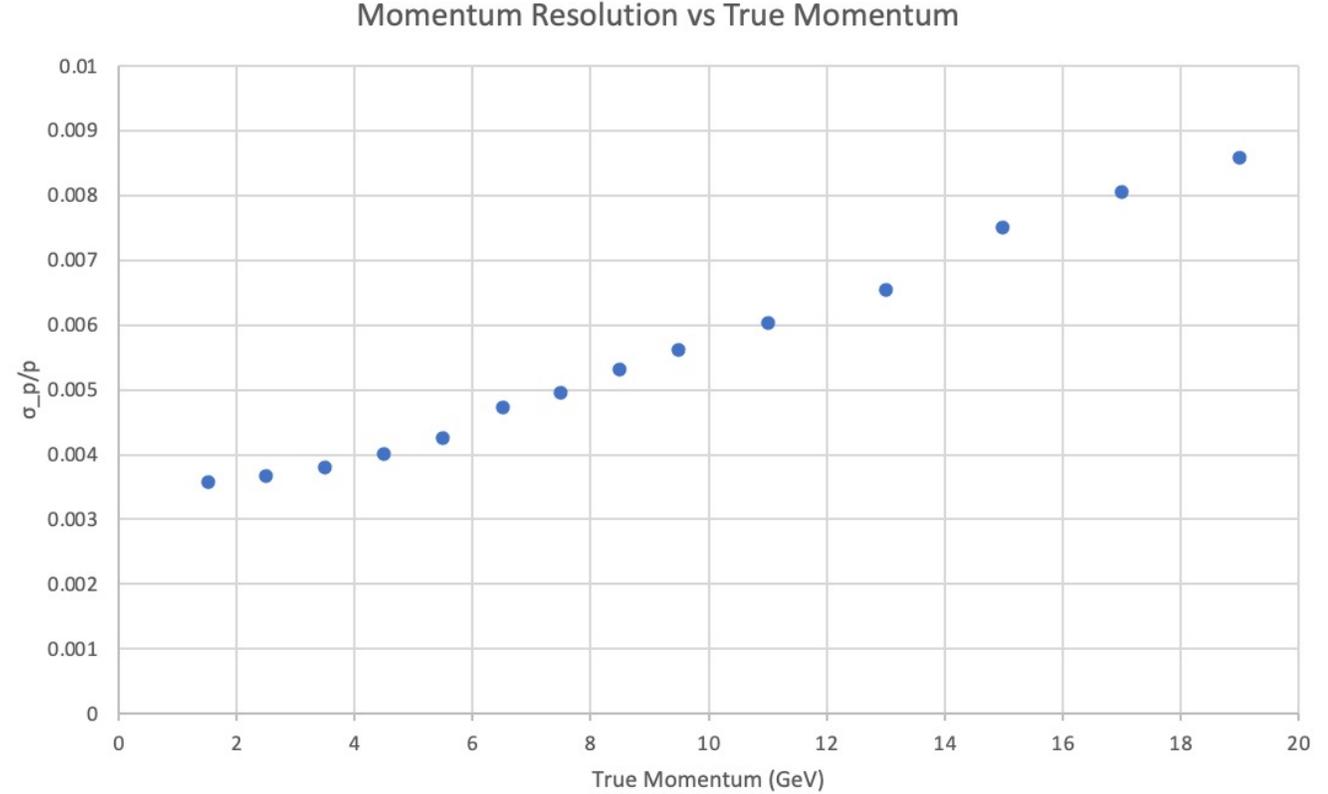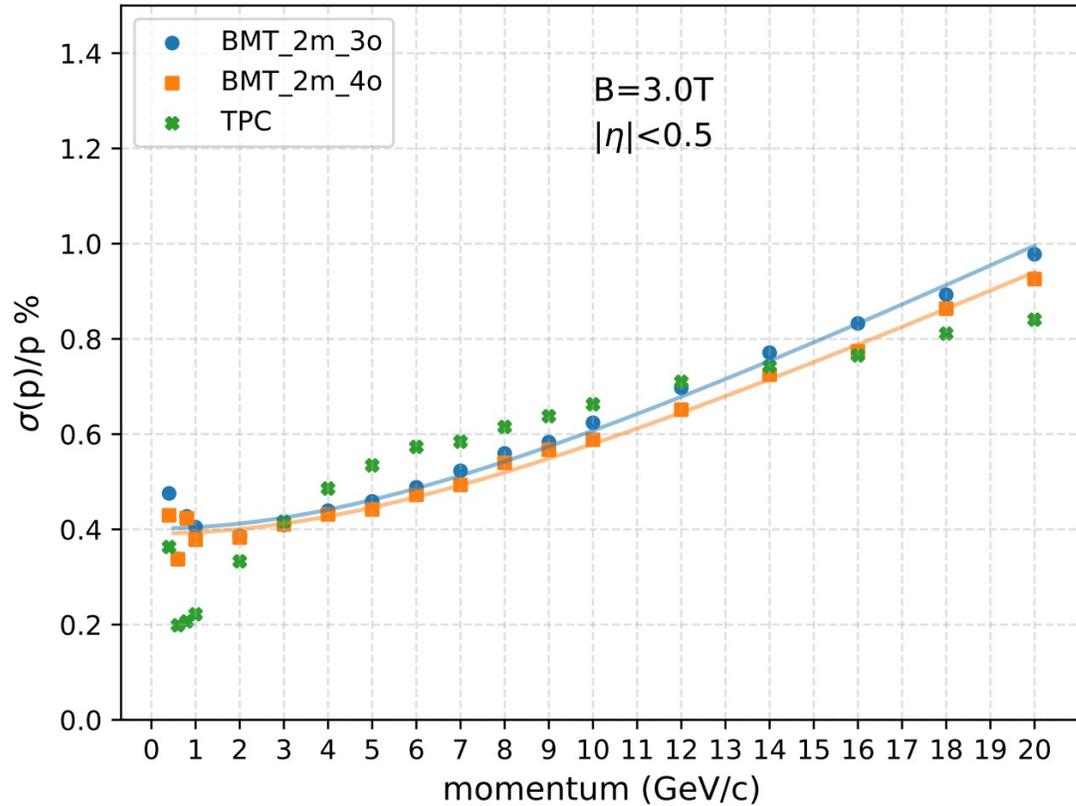
      -Barrel MPGD Tracker layers (2 and 4)

MicroMegas Barrel
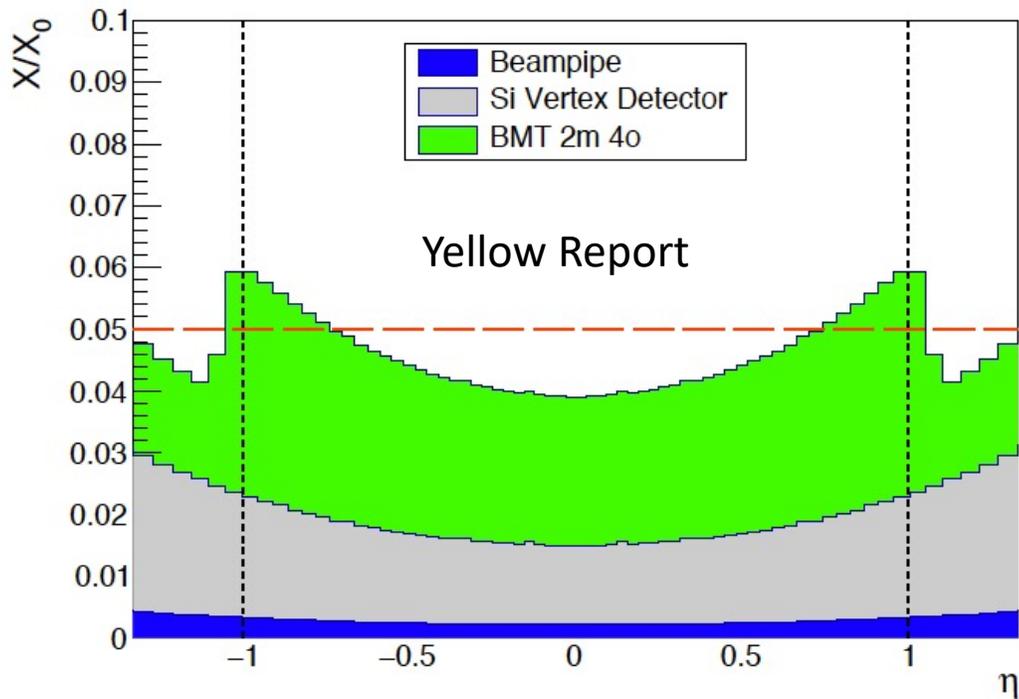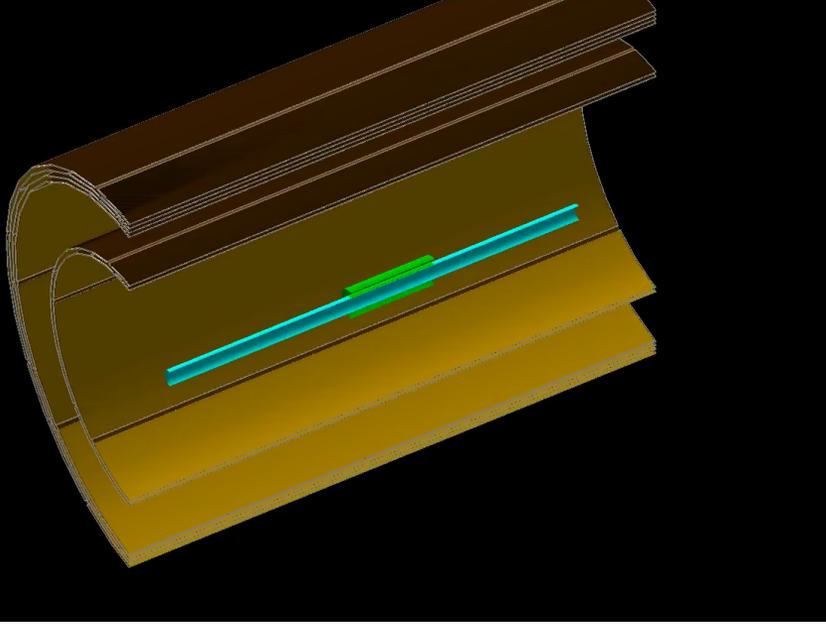
Yellow Report

Using hybrid in Fun4All
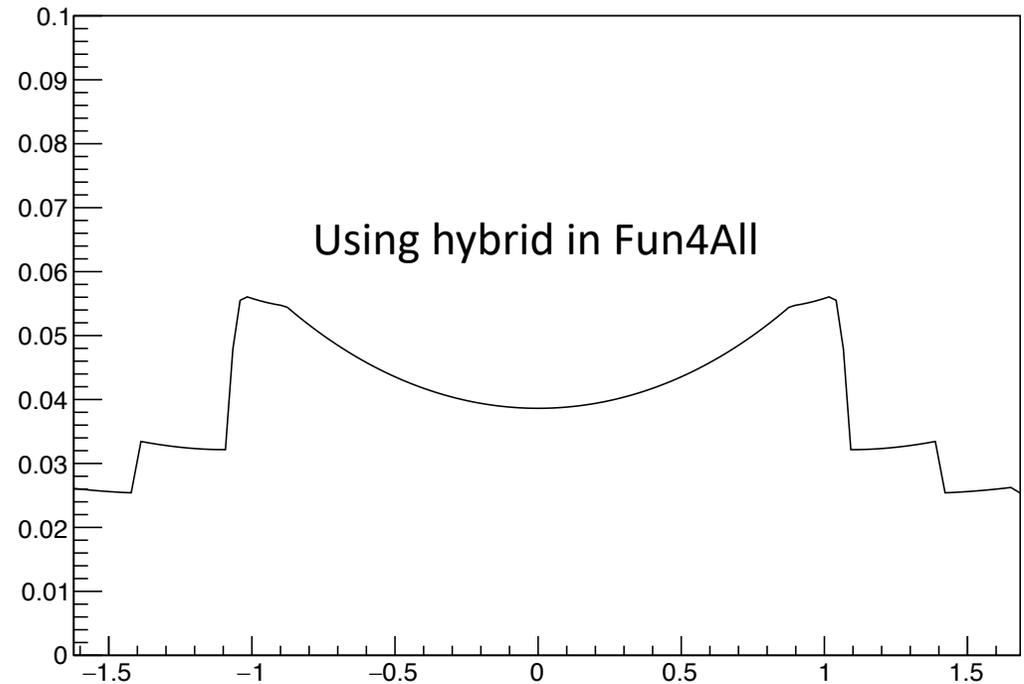
Replicating Momentum Resolution Study

Yellow Report

Replicated

Replicated the study in Fun4All (except for below 1GeV). 5000 pi- per bin, thrown with |eta|<0.5 in a 3T BeAST magnetic field map. In both cases the resolution for the MPGD layers in 150 um x 150 um and Si tracker has pixel size of 10 um.