# MPGD Simulation Overview

❑ Increase person power since ePIC collaboration meeting from CEA-Saclay, INFN-Roma, and Temple U.

❑ Bi-weekly MPGD simulation meetings (Monday's 12PM ET)

❑ **Simulation Geometry Status:**

    ○ All MPGD subdetectors have reasonable material budgets

    ○ CyMBaL – detailed model nearing completion (in progress)

    ○ $\mu$RWELL-BOT – detailed model implemented in ePIC simulation

    ○ $\mu$RWELL-ECT – simple to detailed model work starting (in progress)

❑ **Detector Response (All MPGD detectors):**

    ○ Pixelated readout with fixed space point resolution of 150 $\mu m$

    ○ Implementation of detector response based on recent test beam data beginning (in progress)

μRWELL-BOT

CyMBaL

μRWELL-ECT
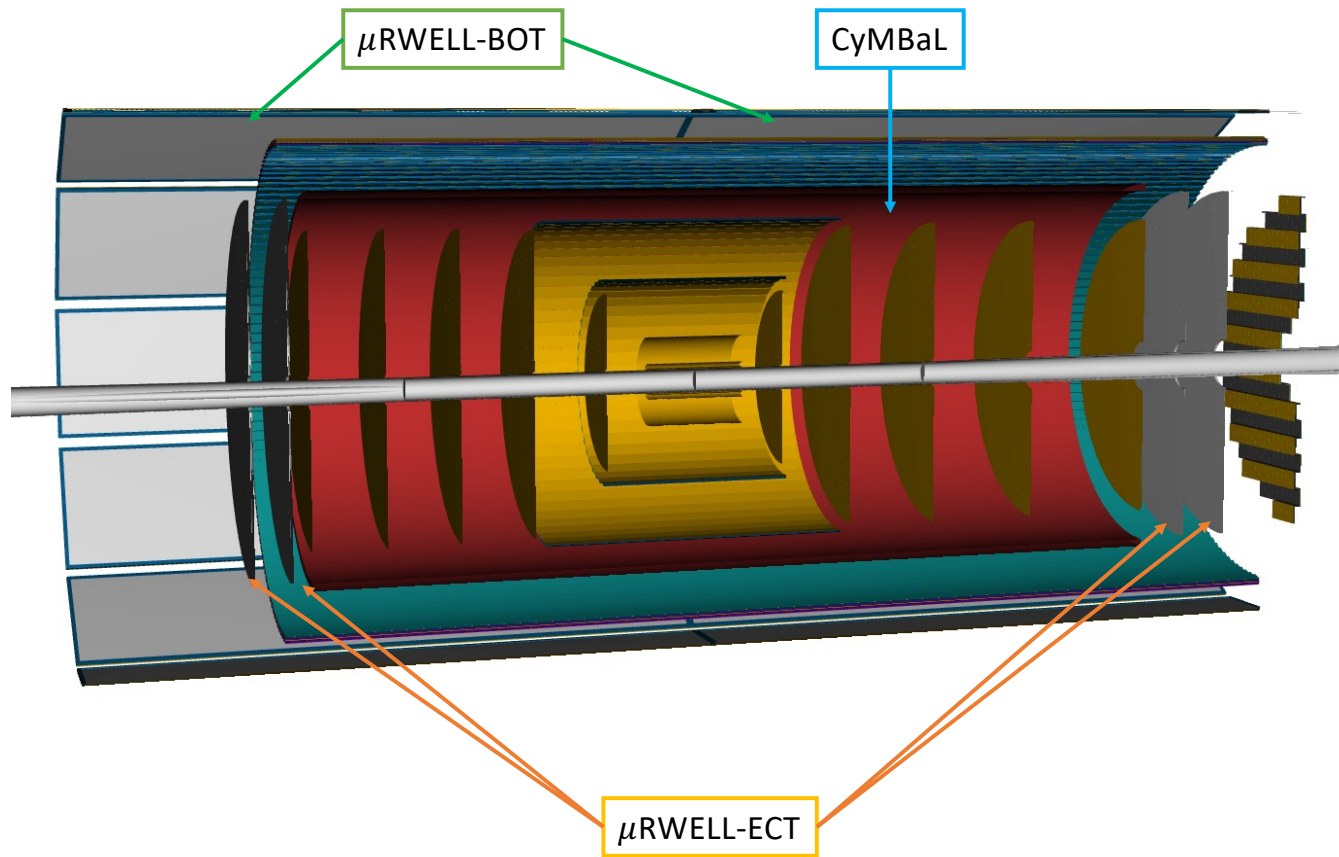
# ePIC Crater Lake 24.02.0: Detector Envelopes

Table listing detector envelopes. *Hit Location* column shows location of simulation hits

| Detector | Zmin [cm] | Zmax [cm] | Rmin [cm] | Rmax [cm] | Hit Location ~R/Z [cm] |
|----------|-----------|-----------|-----------|-----------|------------------------|
| CyMBaL | -105 | 135 | 50.25 | 52.25 | 51 |
| $\mu$RWELL-BOT | -164.5 | 174.5 | 72.5 | 75 | 73 |
| $\mu$RWELL-ECT 1 (Forward) | 148 | 150.5 | 7.01 | 50 | 148.5 |
| $\mu$RWELL-ECT 2 (Forward) | 161 | 163.5 | 7.01 | 50 | 161.5 |
| $\mu$RWELL-ECT 1 (Backward) | -112.5 | -110 | 4.65 | 50 | -110.5 |
| $\mu$RWELL-ECT 2 (Backward) | -122.5 | -120 | 4.65 | 50 | -120.5 |

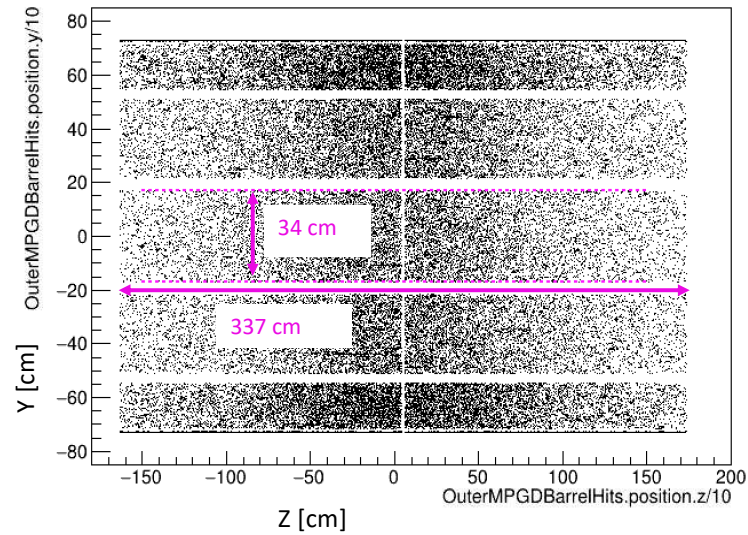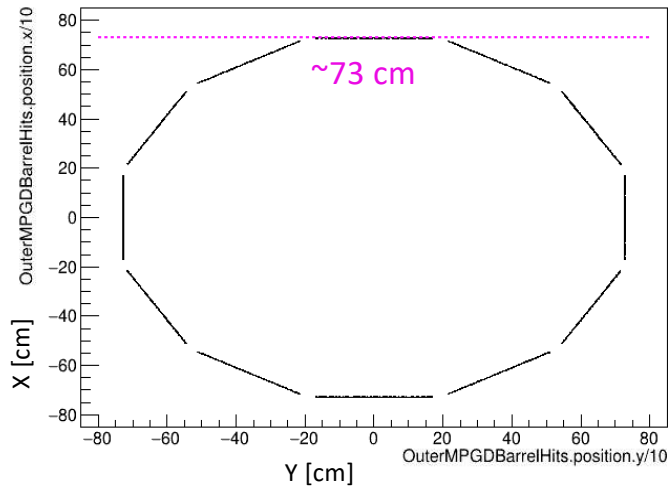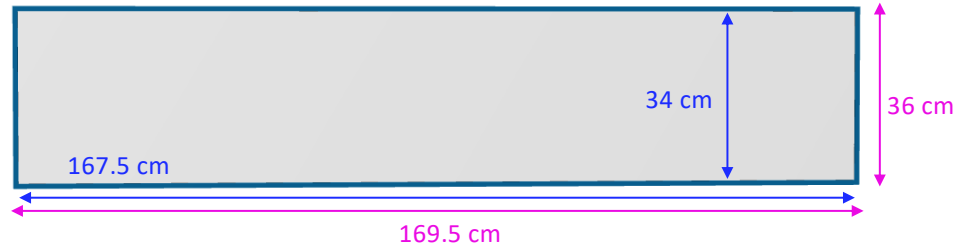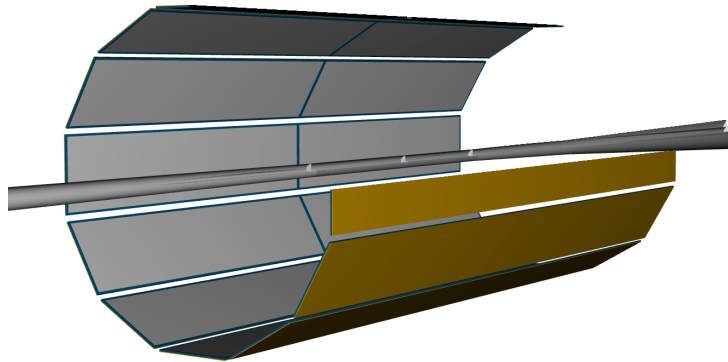# CyMBaL Geometry (ePIC Crater Lake 24.2.0)

- ❑ Curved layer based on MicroMegas technology
- ❑ Approximate cylinder using 128 staves
  - ➢ Width = 2.47cm
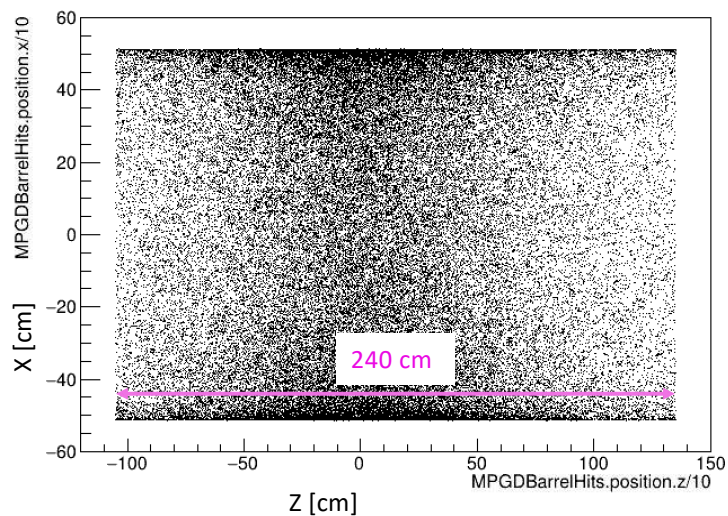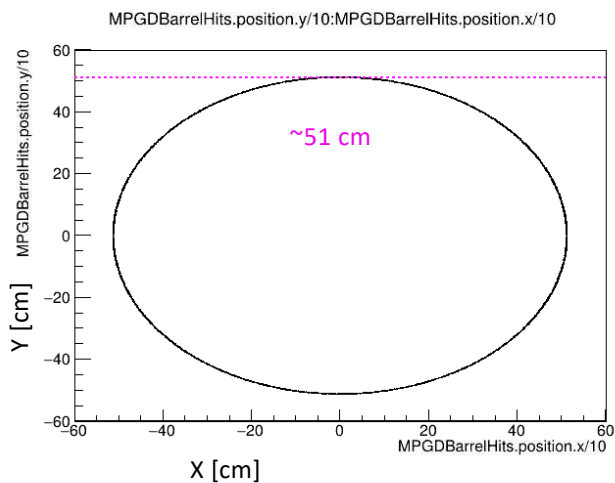
# CyMBaL Material (ePIC Crater Lake 24.2.0)



InnerMPGDBarrelSubAssembly

0.5%
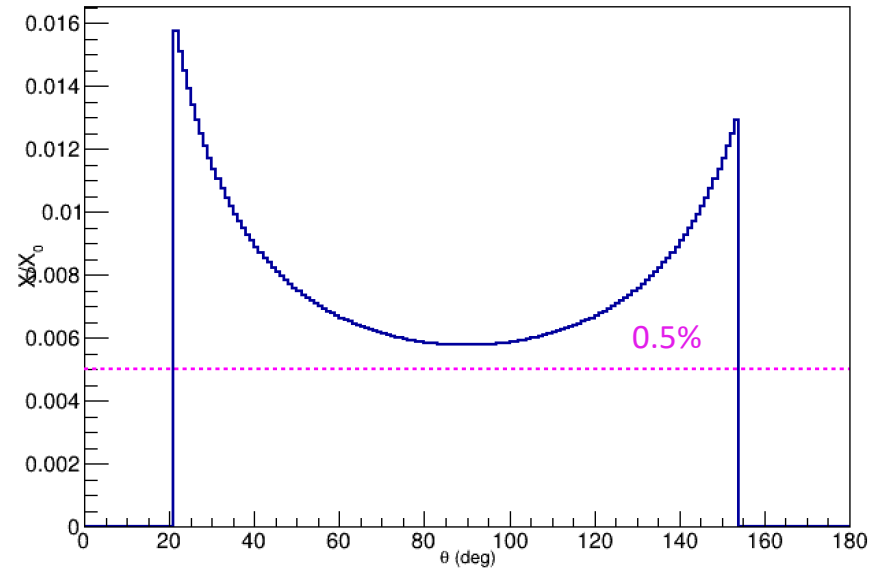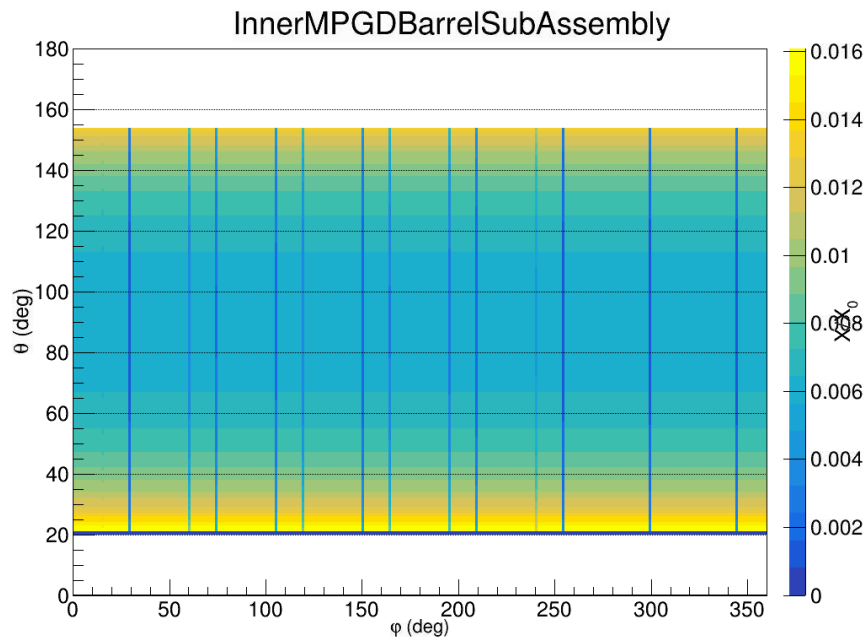
# $\mu$RWELL-BOT Geometry (ePIC Crater Lake 24.2.0)

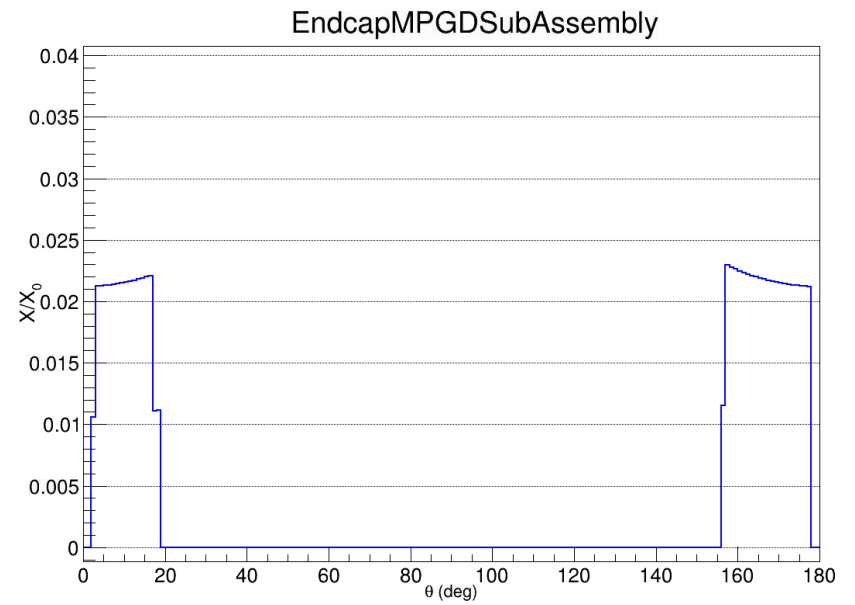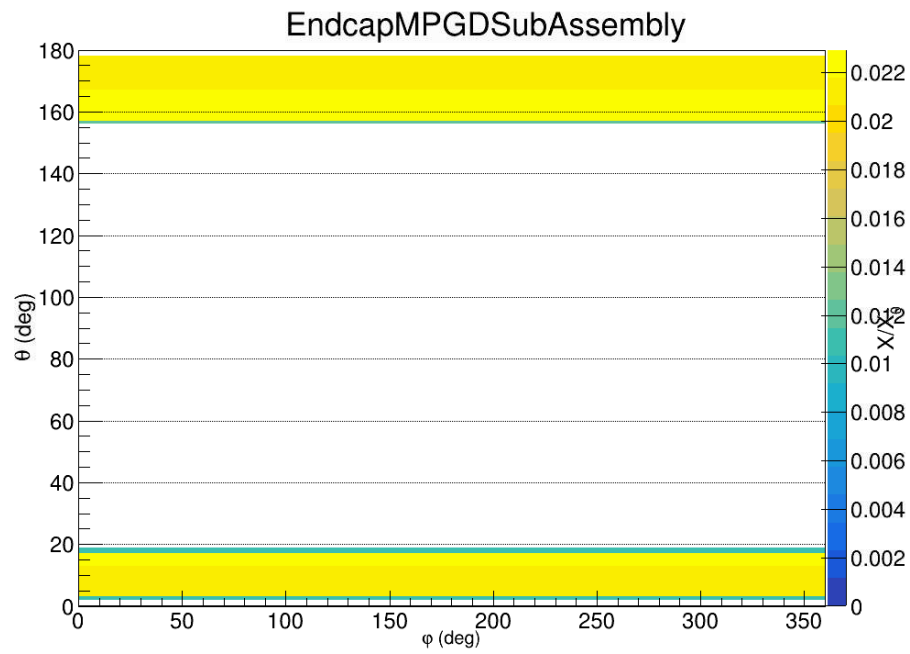# μRWELL-BOT Material (ePIC Crater Lake 24.2.0)
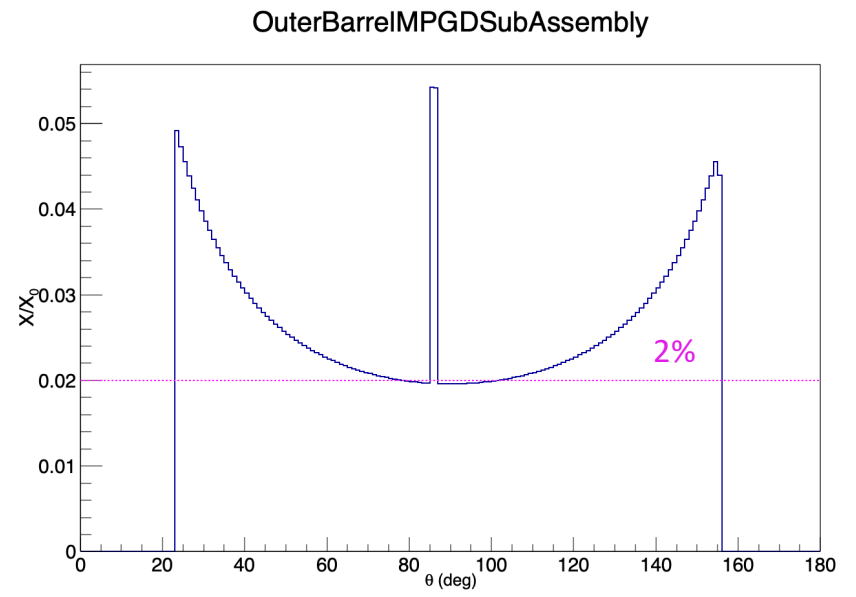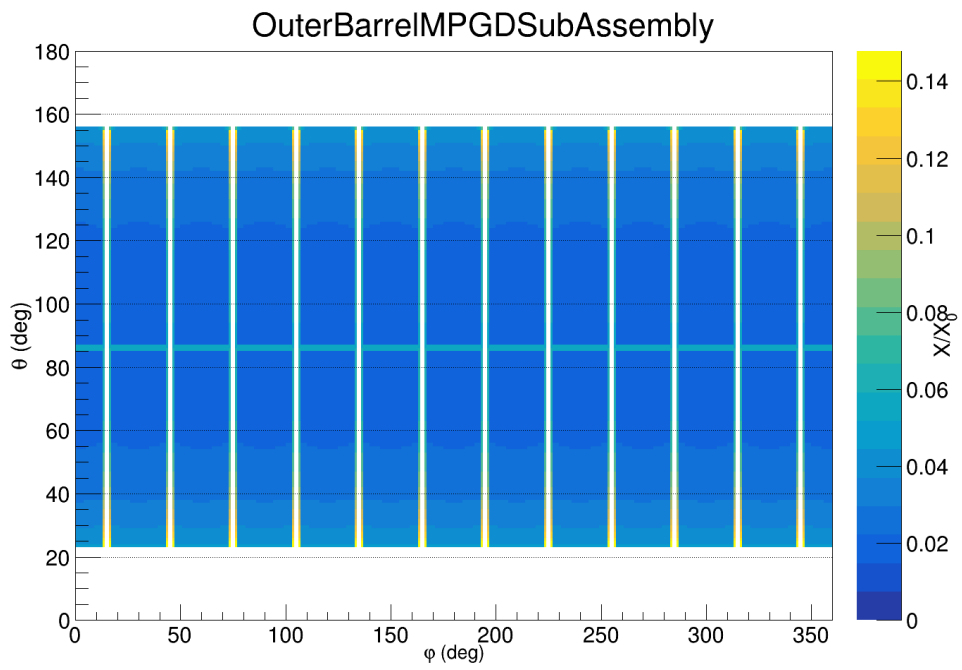
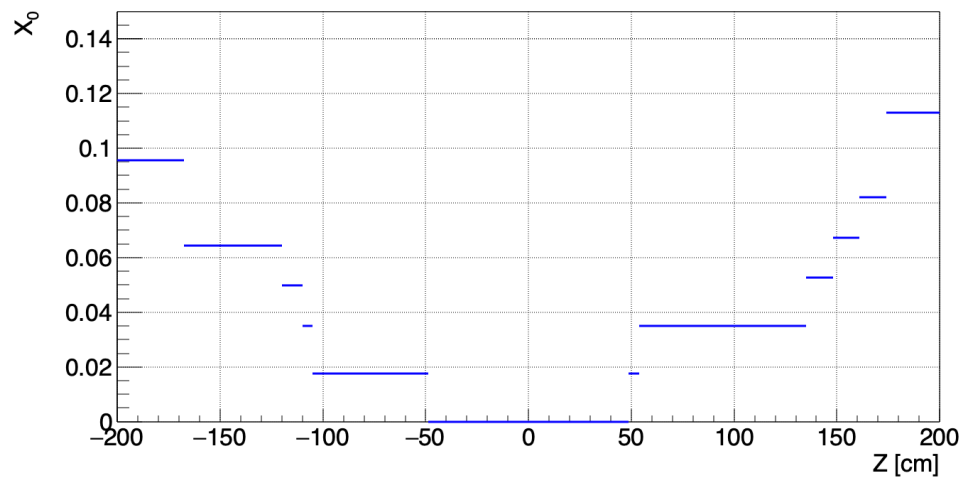# $\mu$RWELL-ECT (Forward) Geometry (ePIC Crater Lake 24.2.0)
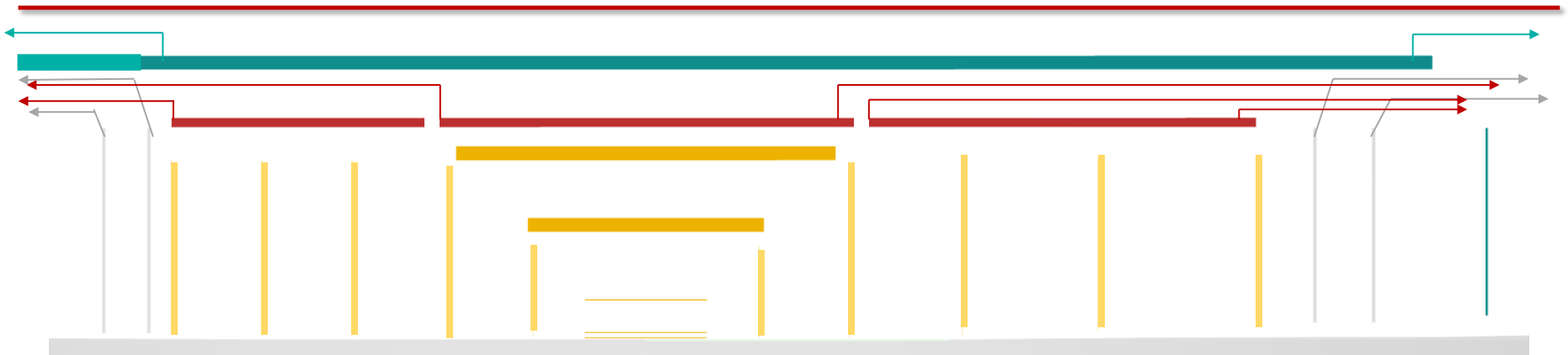
- ❑ Pairs of disks in electron and hadron endcaps based on $\mu RWELL$ technology
- ❑ Approximate disk using 48 trapezoid shapes
- ❑ Currently no overlaps or module segmentations

Forward

100 cm/100 cm

~7 cm/5 cm

Forward
Backward

Backward

Forward

EndcapMPGDSubAssembly
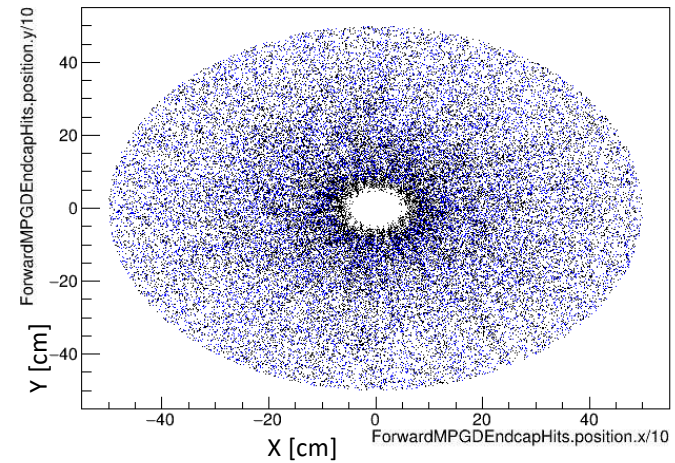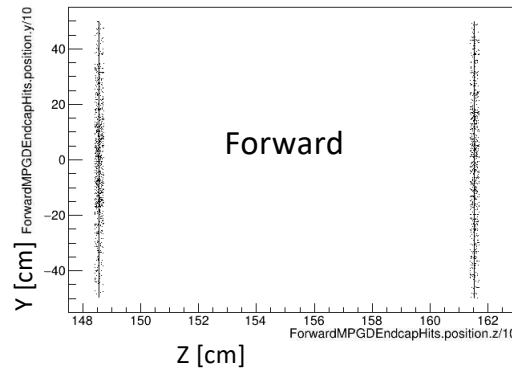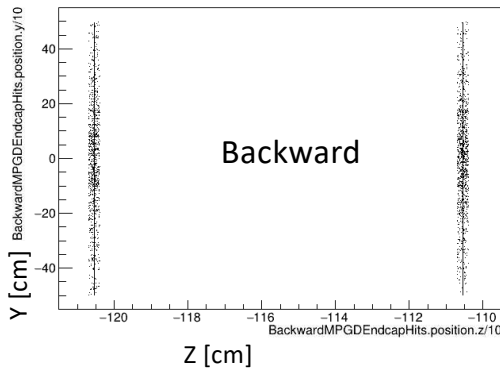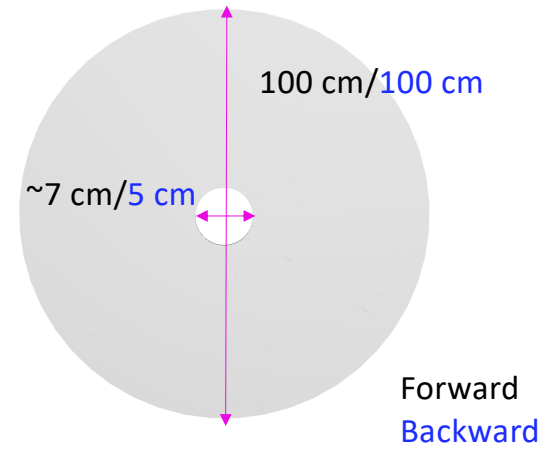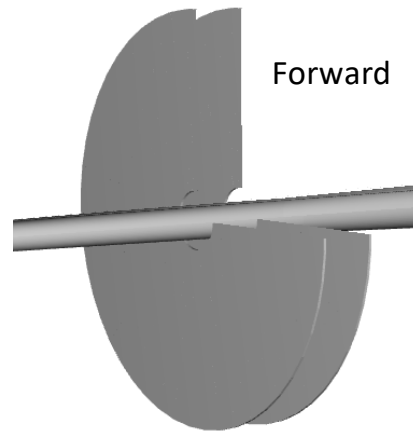
# MPGD Service Materials



*Based on early design concepts to estimate services and includes gas, LV, HV cables

# Current Detector Response
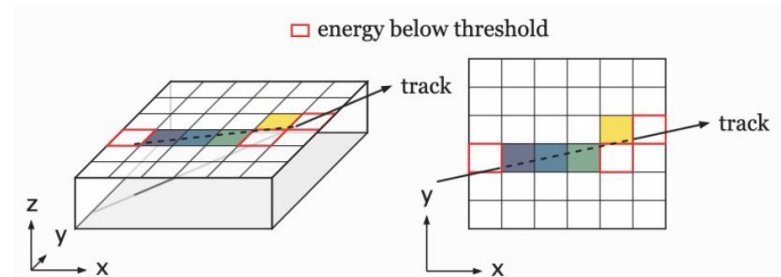
❑ Setup segmentation in geometry xml file. Each SimHit has a cell ID on the detector surface

```
<readouts>
  <readout name="ForwardMPGDEndcapHits">
    <segmentation type="CartesianGridXZ" grid_size_x="sqrt(12)*150*um" grid_size_z="sqrt(12)*150*um" />
    <id>system:8,layer:2,module:6,sensor:16,x:32:-16,z:-16</id>
  </readout>
</readouts>
```

❑ Digitization in EICrecon

- Reads in SimHit (cell ID, edep, time)

- Apply threshold (0.25 keV)

- Put hit at center of each cell, resolution is

  grid_size/sqrt(12) = 150 $\mu m$

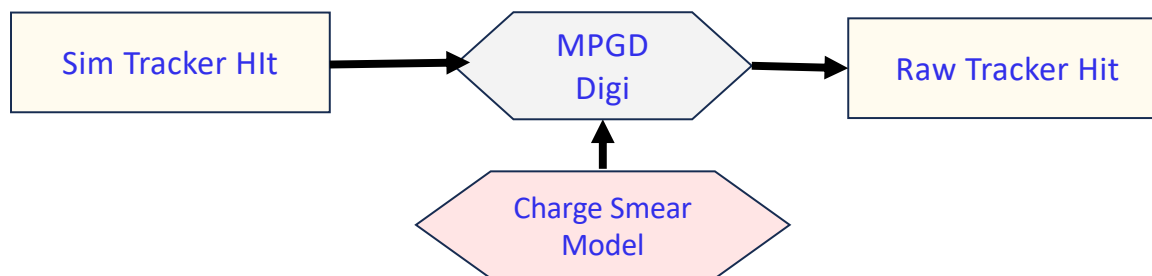- Digitized Hit → track measurement



energy below threshold · track

# MPGD Detector Response: In Progress

❑ Defining a MPGD digitization algorithm that uses a charge smearing model to determine space point resolution

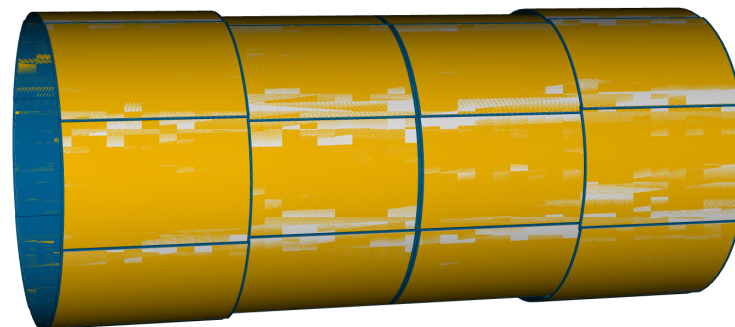❑ Charge model will be derived from recent test beam results
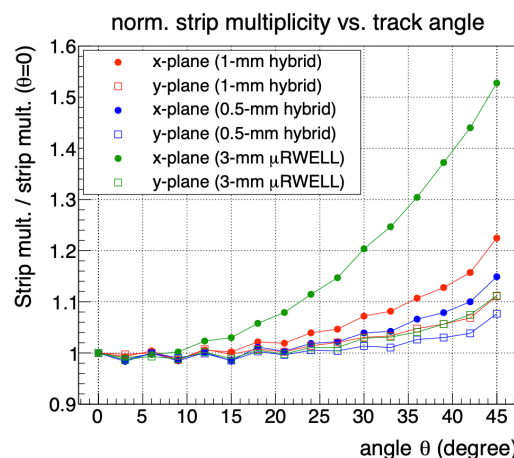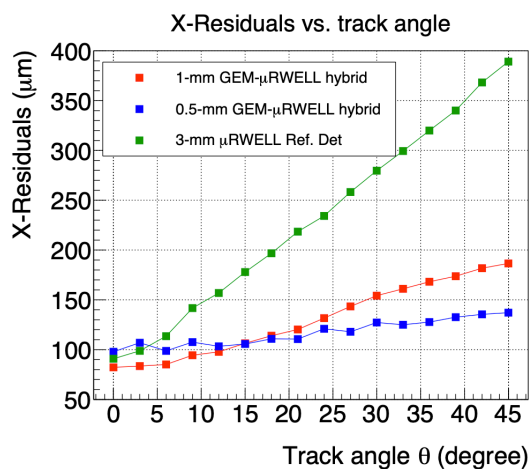


Thin-Gap MPGD
Test beam data

# CyMBaL: In Progress

☐ Current design implemented into DD4HEP

☐ Implemented into ACTS (thanks S&C)

☐ In progress:

  ▪ Verifying material budget

  ▪ ACTS correctly interprets 2D hit

    ➢ First (to my knowledge) ePIC detector to
      use curved ACTS surface

DD4HEP CyMBaL



Tracker Hits (reconstructed hits)