DE LA RECHERCHE À L'INDUSTRIE

MPGD Tracker for EIC

Simulation progress at CEA-Saclay

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EIC YR – Tracking WG

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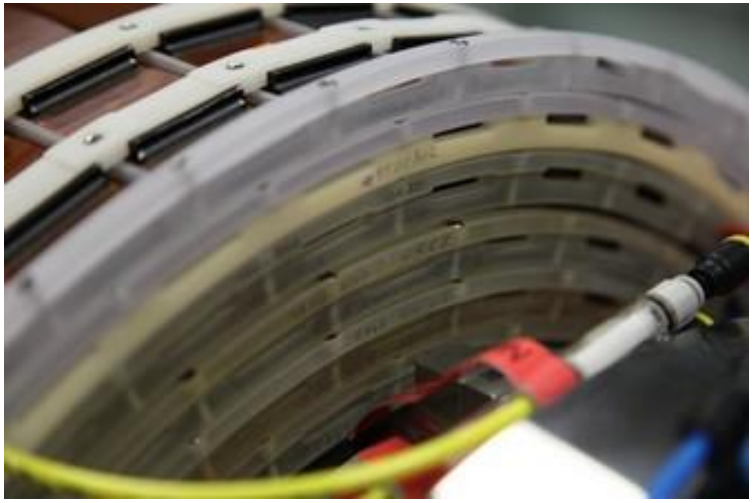
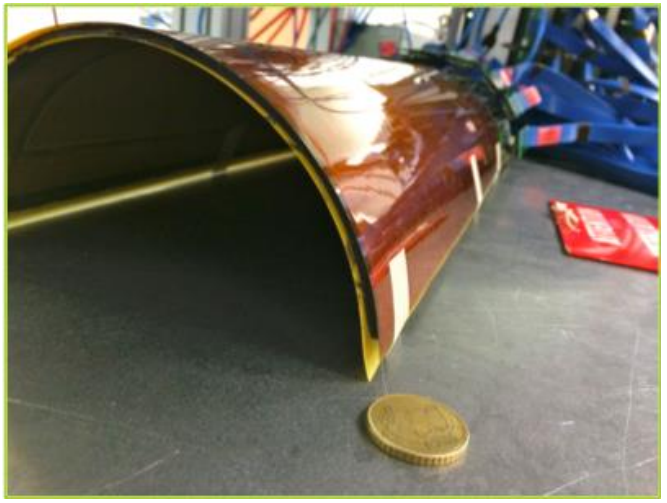
MPGD tracker simulation

- Current focus on the barrel tracker (as alternative of TPC):
  - Curved MPGD tiles with low material budget
  - Micromegas technology is being used in CLAS12
- A barrel tracker has been implemented with **Fun4All**
  - Realistic materials taken from CLAS12 BMT (missing only some carbon fiber structure elements)
  - Readout options: 1D (Z/φ double-layer) or 2D(u/v)
  - ePhenix detector design (beampipe + silicon vertex tracker + TPC)
  - TPC replaced by MPGD tracker

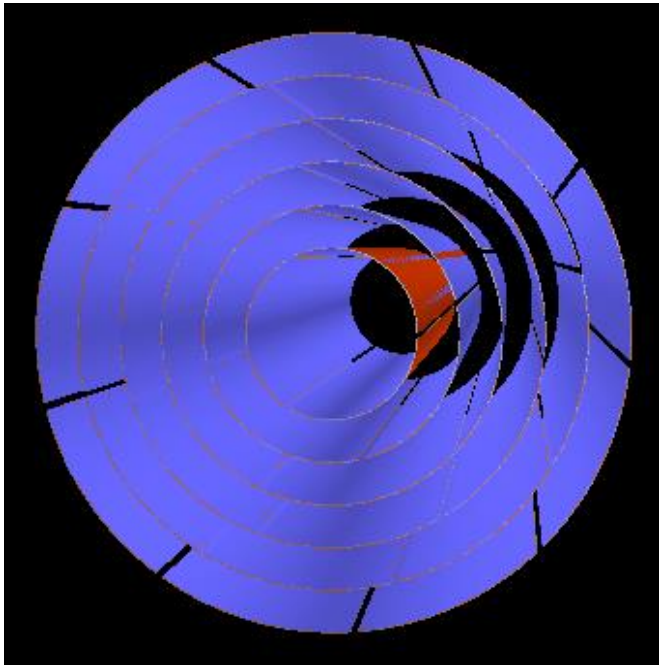




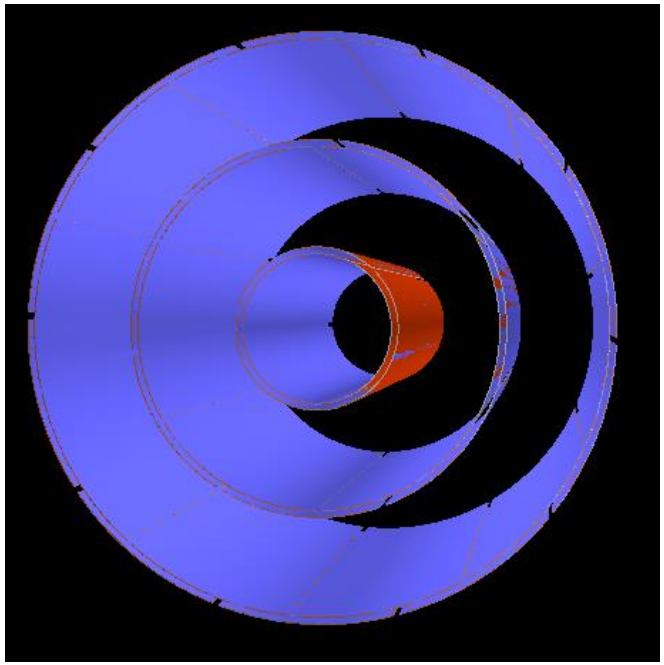
X/X0 ~ 0.3% per layer

MPGD tracker configurations

- R spans from 20 to 80 cm, with 6 measures
- Config 1: equally spaced
- Config 2: 3 super-layers (3×2 with 1.5cm gap)
- 1D readout → 12 layers, 2D readout → 6 layers



Config 1 (2D)

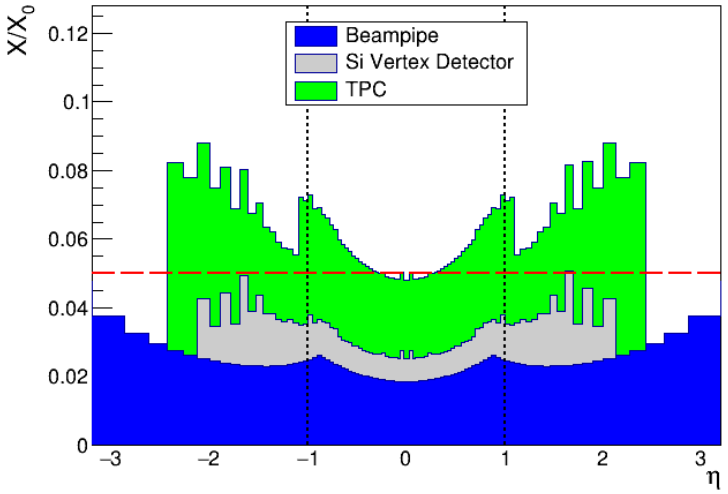


Config 2 (2D)

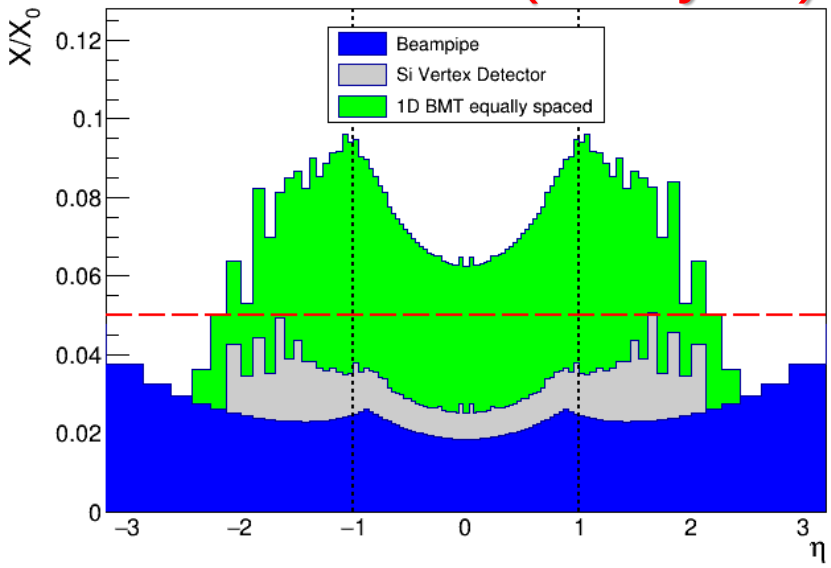
Material budget

- Material scan for TPC, 1D and 2D readout MPGD trackers
- N.B. Handbook requires a X/X0<5% for central tracker
- 2D readout can achieve this goal

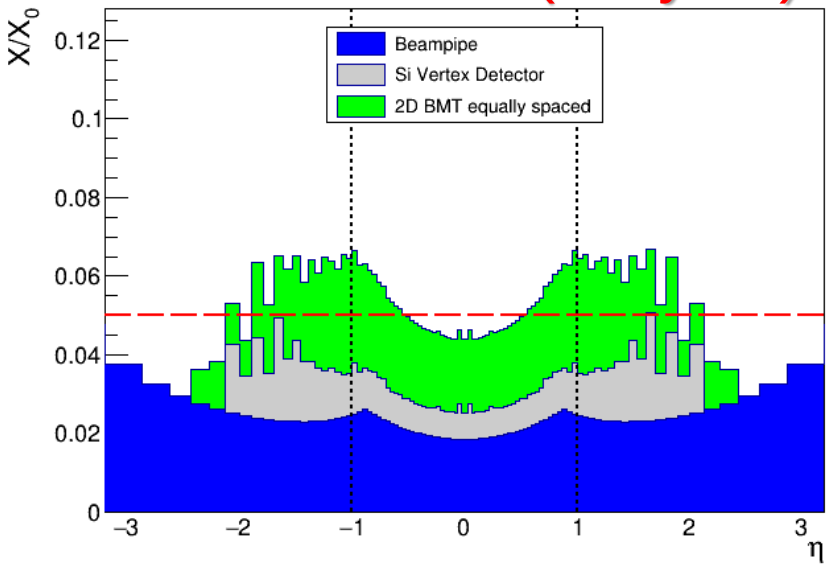
TPC



MPGD 1D RO (12 layers)

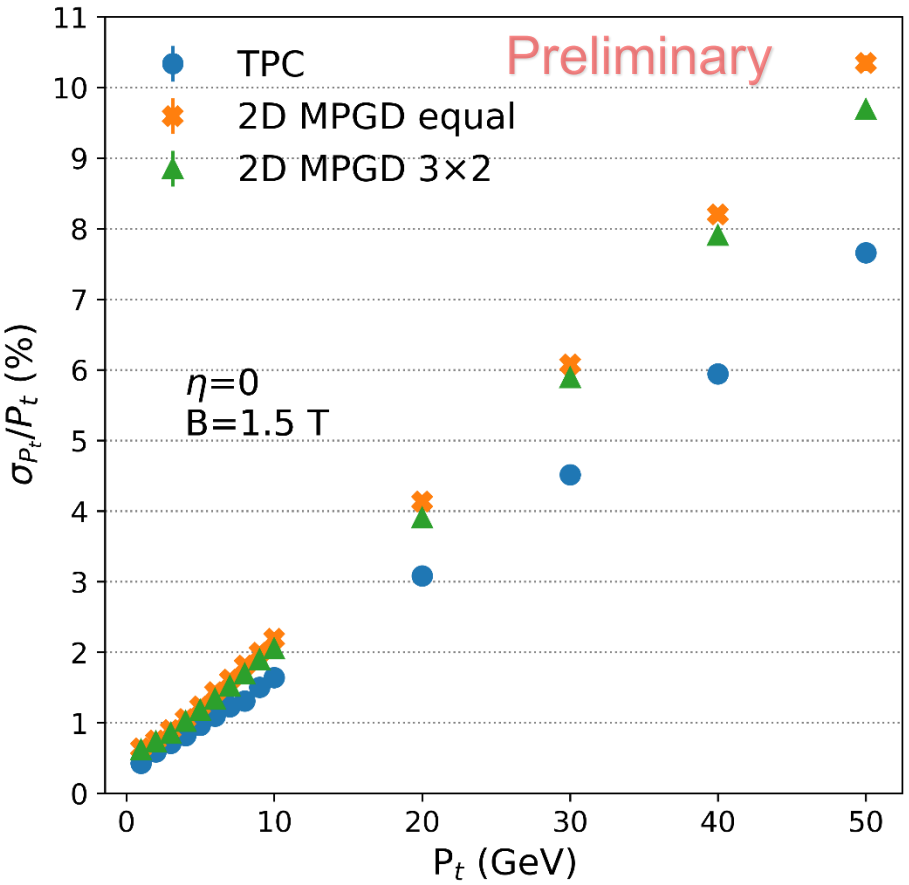


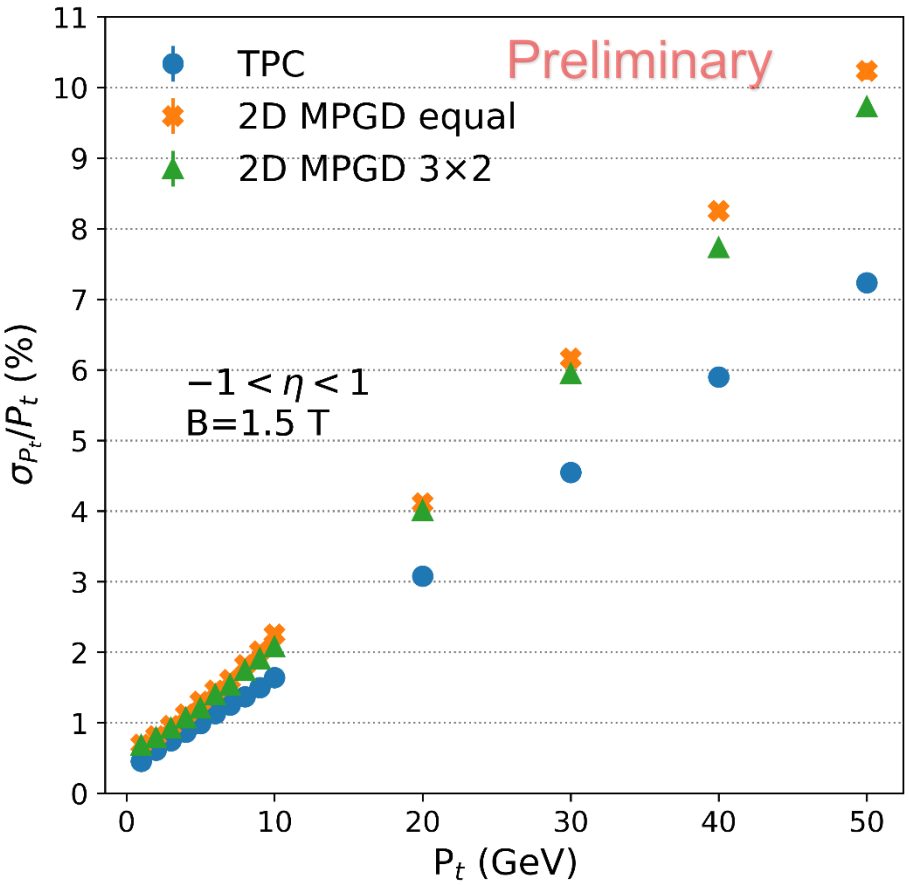
MPGD 2D RO (6 layers)



Momentum resolution (σ_{p_T}/p_T)

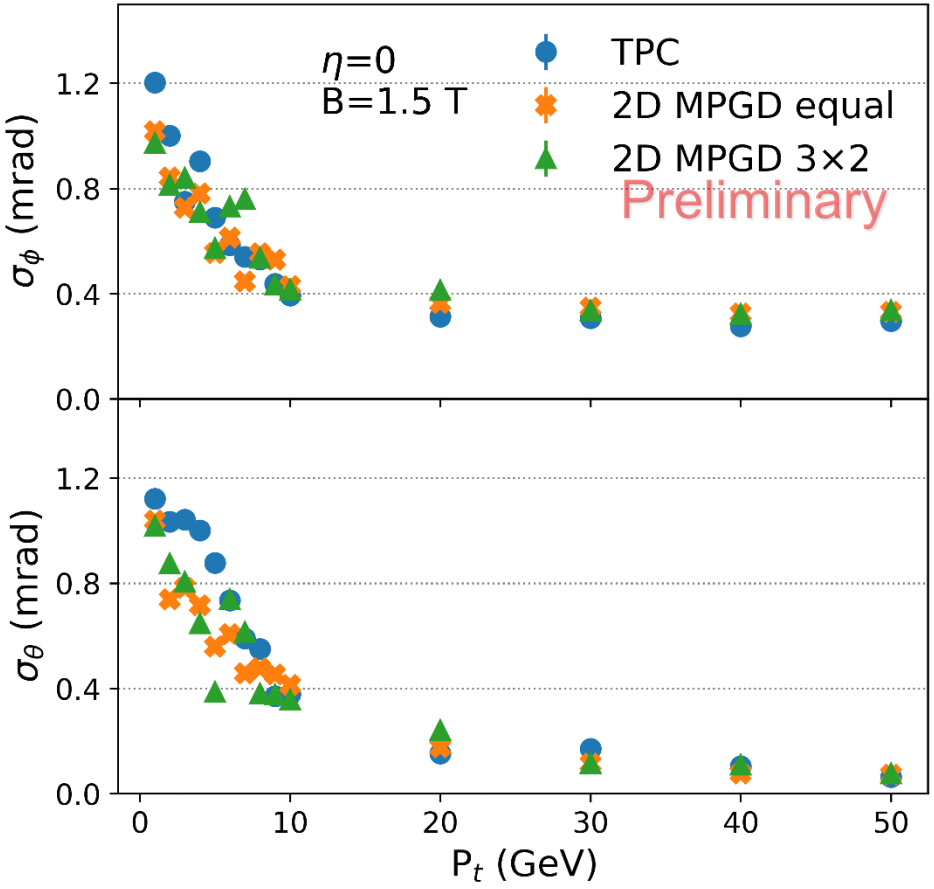
- Compare momentum resolutions of different central trackers
  - Tracks reconstructed with the ePhenix SVTX: σ(R/φ/Z)=5μm
  - For TPC: σ(φ)=200μm, σ(Z)=500μm (default in Fun4All)
  - For MPGD: σ(φ)=150μm, σ(Z)=150μm
  - Each point obtained from 10k π^- events

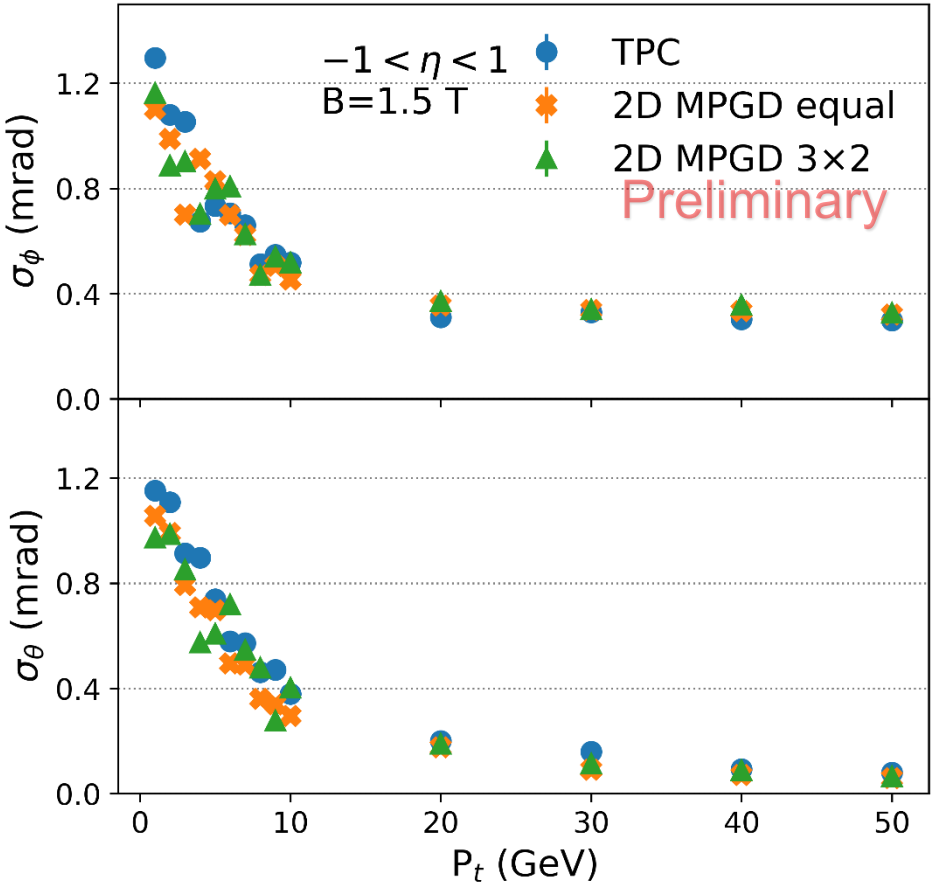




Angular resolution (σ_ϕ and σ_θ)

- Angles are calculated with momenta at vertices (0,0,0)
- Plots showing angular resolutions at the last layer of the MPGD tracker are in progress



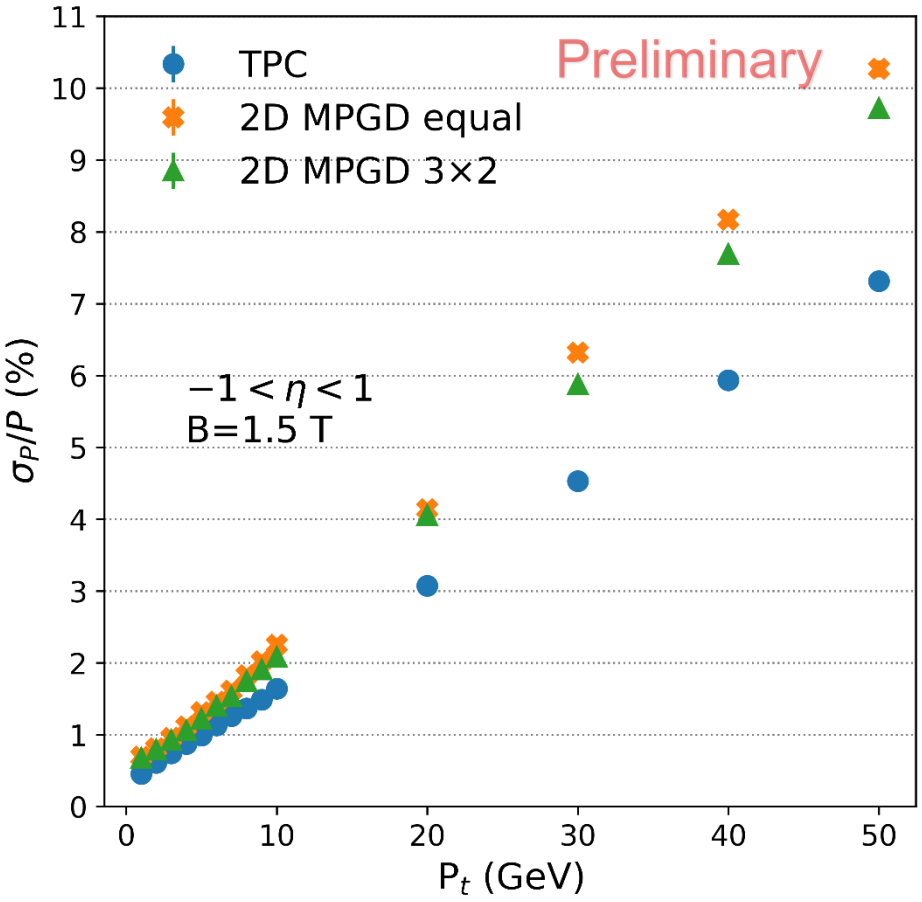


Conclusions

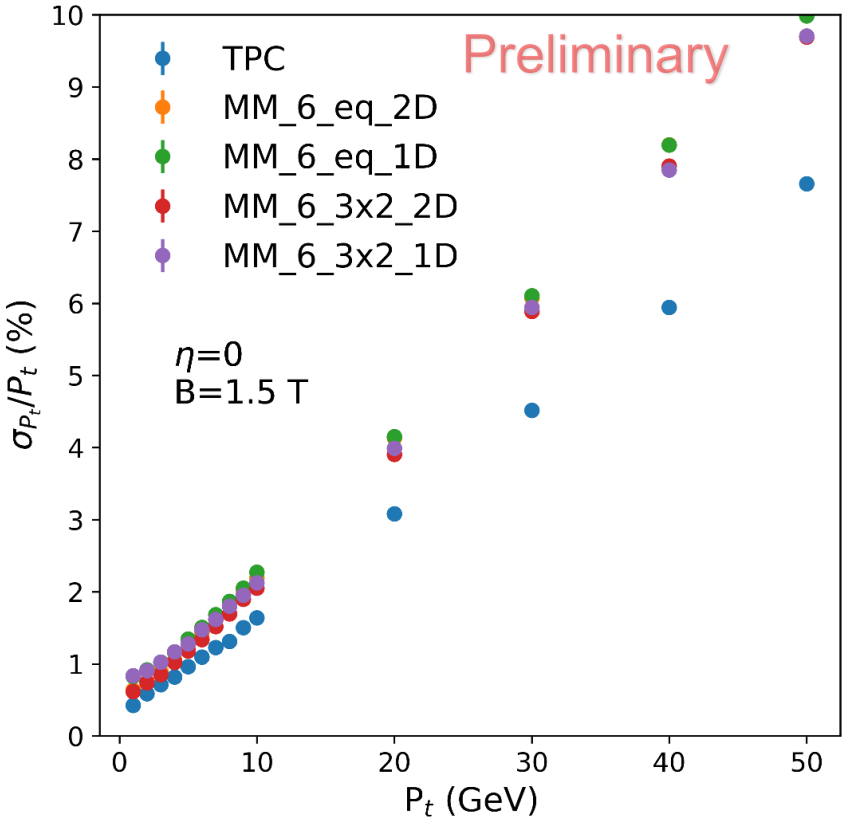
- Objective: performance of MPGD tracker as the TPC's alternative
- Different configs for a 6-layer MPGD tracker have been studied:
  - Material budget (Readout: ☹1D ☺2D)
  - Momentum resolution is worse (but well expected) than TPC's, 3x2 config gives slightly better results
  - Angular resolution is comparable with TPC's
- Possible methods to improve tracker's momentum resolution:
  - Large drift space (~3cm) gives access to more measures (tracklets by μTPC)
  - Combine different types of detectors (e.g. TPC+MPGD)
- More studies are foreseen
  - Optimize the tracker's layout (# layers, radii and gaps)
  - Study the performance of μTPC mode

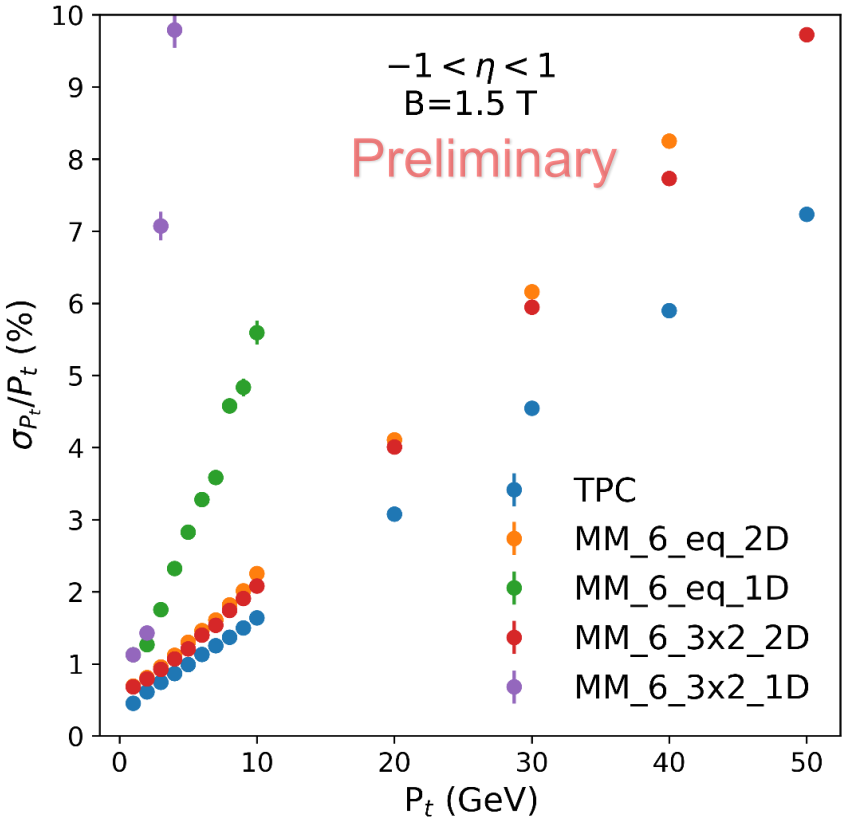
BACKUP

Momentum resolution p



Momentum resolution (p_T)





Momentum resolution p