

DE LA RECHERCHE À L'INDUSTRIE



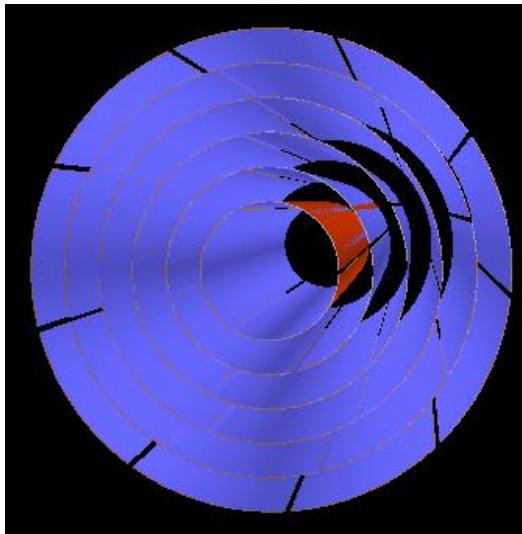
Update of MPGD Tracker

Simulation progress at CEA-Saclay

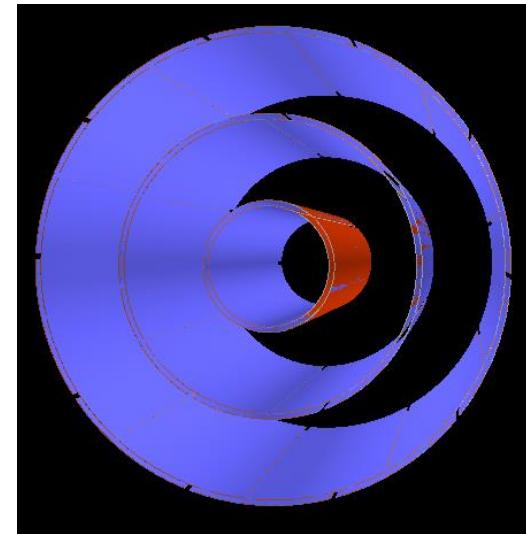
Qinhua Huang for CEA Saclay's EIC group
EIC YR – Tracking WG
27 August 2020

Current geometries

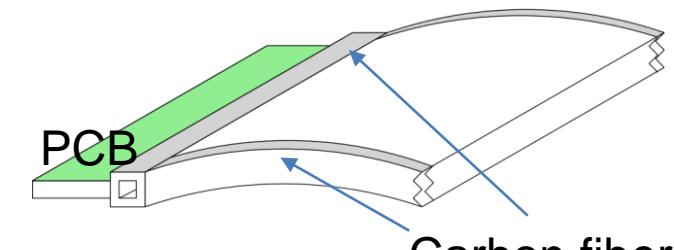
- Simulation based on Fun4All+ePhenix
 - But we remove all components but the 3-layer SVTX and the TPC
 - Replace the TPC with our MPGD tracker
- The tracker geometry is improved to be more realistic
 - Add the carbon fiber around the MPGD tracker (3mm)
 - Add the PCB board for readout of the strips in one direction, width of the PCB ~ 2cm
 - Each side has a 2mm dead zone on the MPGD



6 equidistant layers



6 layers arranged as 3x2

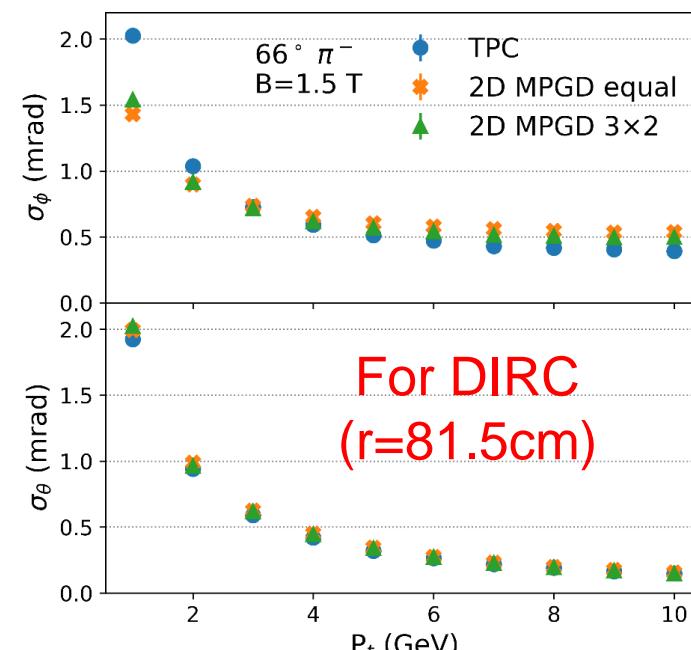
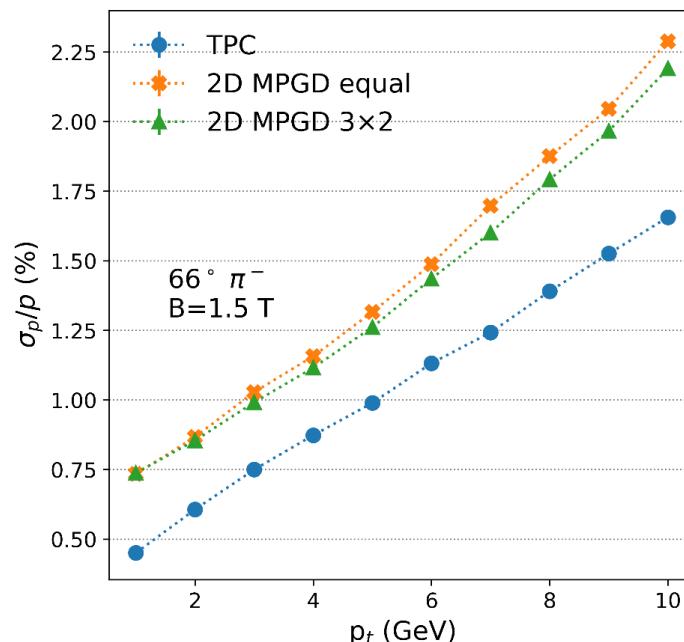
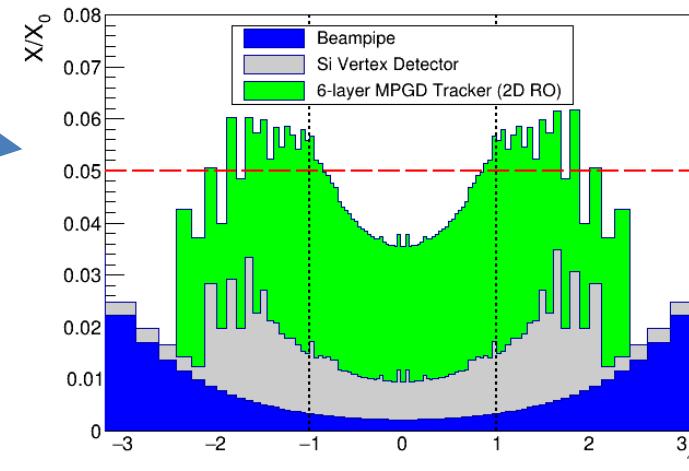


PCB
Carbon fiber

Results of current geometries

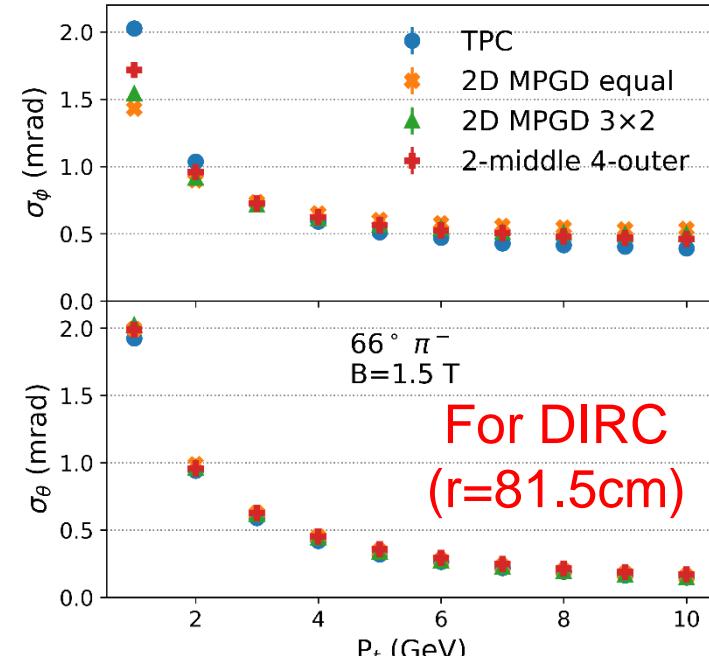
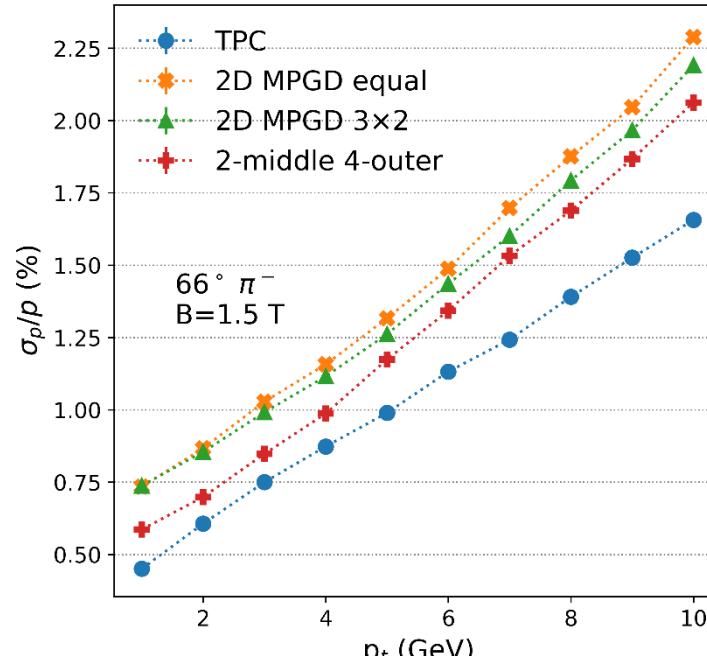
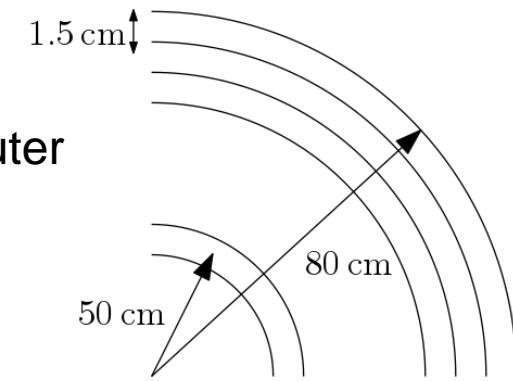
Material buget

Tracking performance



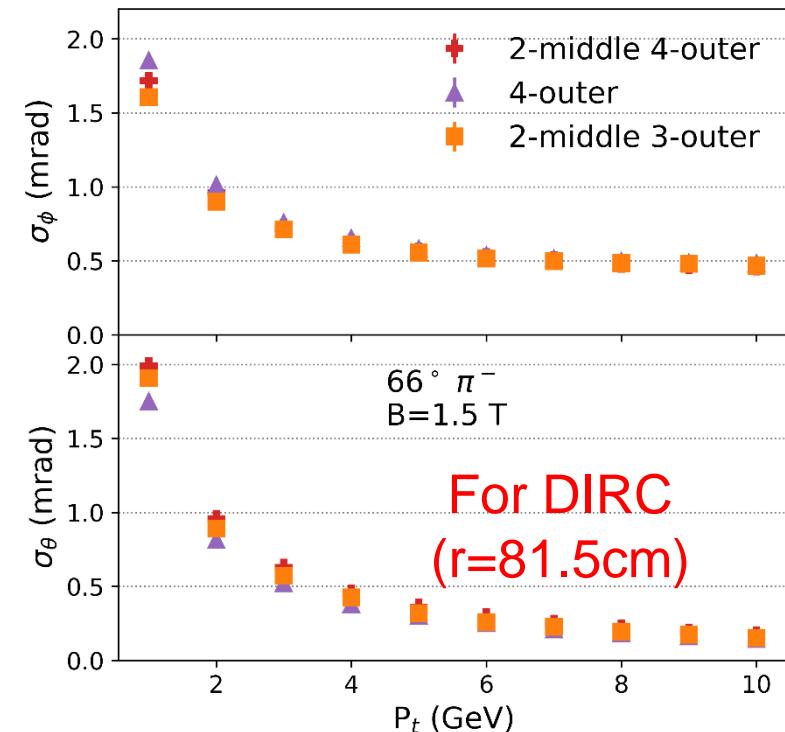
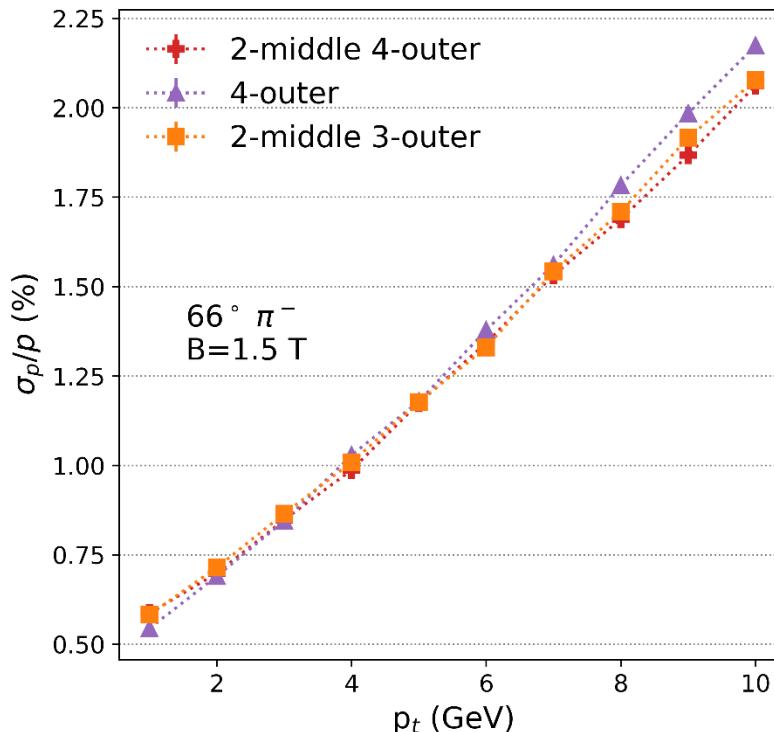
New geometries

- Since the SVTX has a much better spatial resolution, the inner MPGD layers may not be necessary
- We can choose to rearrange the layers: 2 middle and 4 outer
- Resolutions used in the simulation (same as before):
 - 20 μm for SVTX pixel size, and for MPGD, $\sigma(R\phi)=150\mu\text{m}$, $\sigma(Z)=150\mu\text{m}$
- Better performance on p-resolution** and similar angular resolution



New geometries

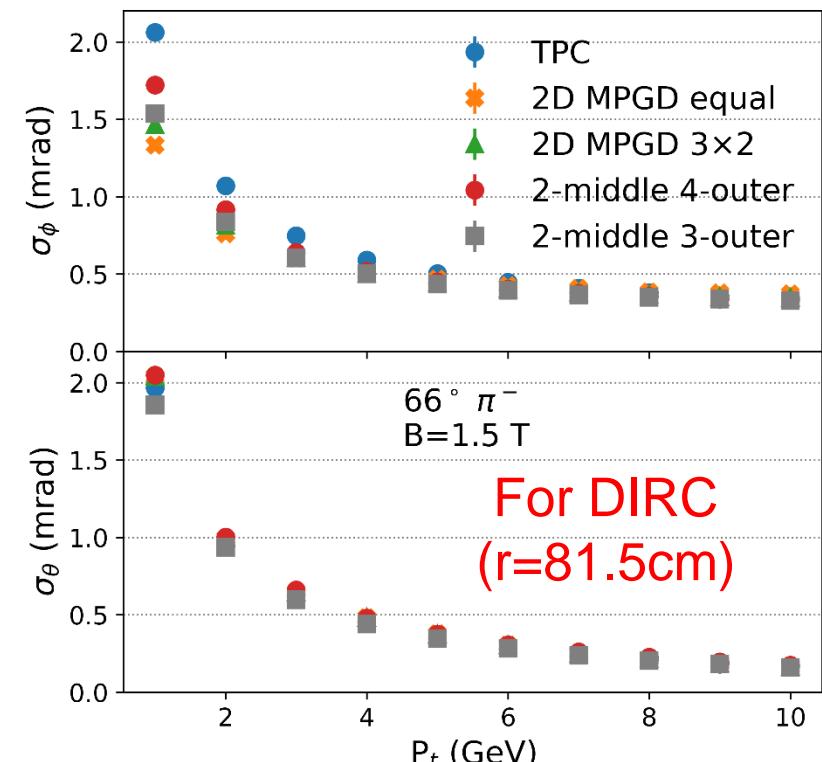
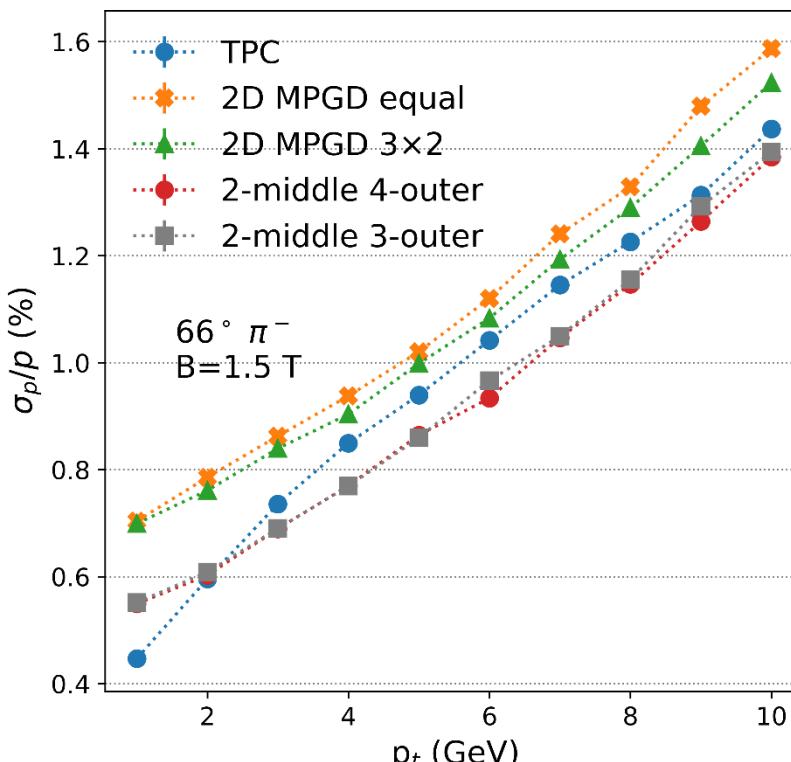
- Though the material budget for a 6-layer tracker is good, removing a few layers can improve the feasibility of the tracker
 - Even less material budget, smaller impact of MS
 - Lower number of electronic channels
 - Simplify the mechanics
- So far two configurations are tested: **tracking performance preserved**



Simulation with better spatial resolution

- So far, we use 20 μm for SVTX pixel size, and for MPGD, $\sigma(R\phi)=150\mu\text{m}$, $\sigma(Z)=150\mu\text{m}$
- Possible to have 10 μm pixel size, and 100 μm MPGD spatial resolution
- **MPGD has a performance overtaking the TPC's**
 - $\sigma(pt) = 0.09\% pt + 0.4\%$ (2-middle 3-outer)
 - $\sigma(pt) = 0.1\% pt + 0.4\%$ (TPC)

Default TPC: 48 pts, $\sigma(R\phi)=200\mu\text{m}$, $\sigma(Z)=500\mu\text{m}$

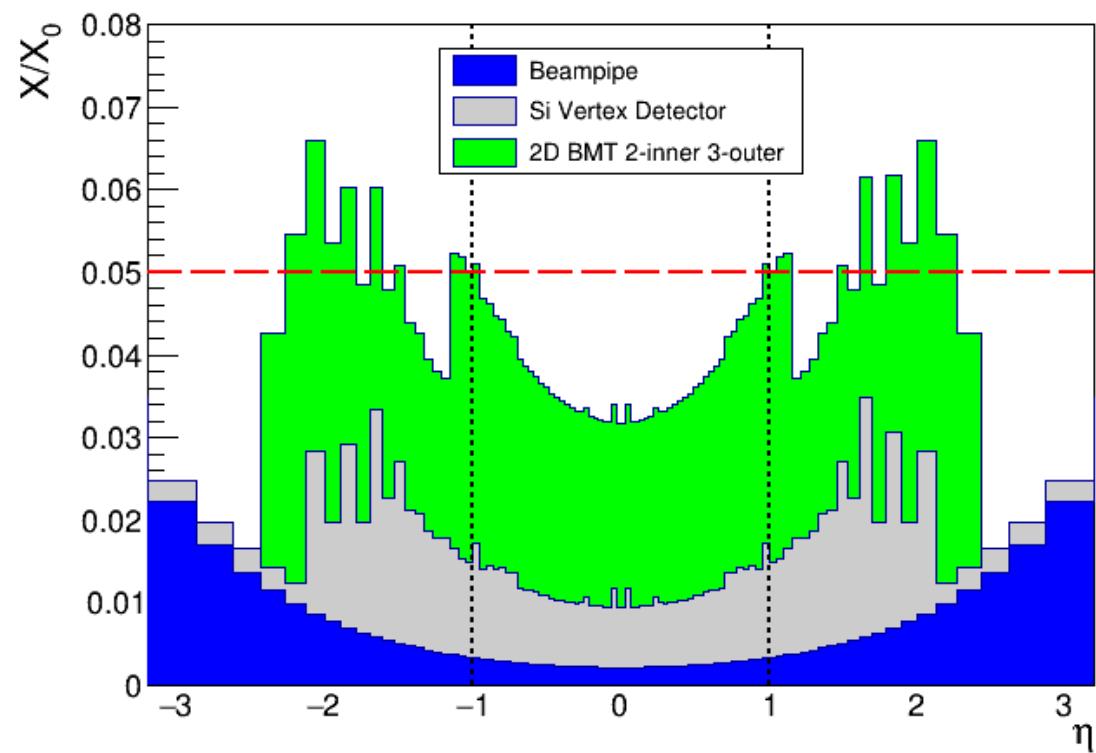


Summary

- The MPGD tracker simulation has been improved
 - More realistic geometry
 - Material budget increased but still <5%
- Rearranging/removing MPGD layers can improve the tracking performance
- With better MPGD spatial resolution, the performance can be competitive wrt the TPC option
- Next steps:
 - Investigating the MPGD tracker in the context of newest SVTX and beampipe designs
 - Testing a MPGD tracker based on flat detector elements, instead of cylindrical tiles

BACKUP

Material scan for 5 layers



Material scan of the TPC and MPGD without dead material

