Outline

1. Look at performance of LBNL configuration

   - Momentum resolution

   - Transverse DCA resolution

2. Modify MPGDs and look at performance impact within LBNL configuration

   - Implement angular dependence on resolution

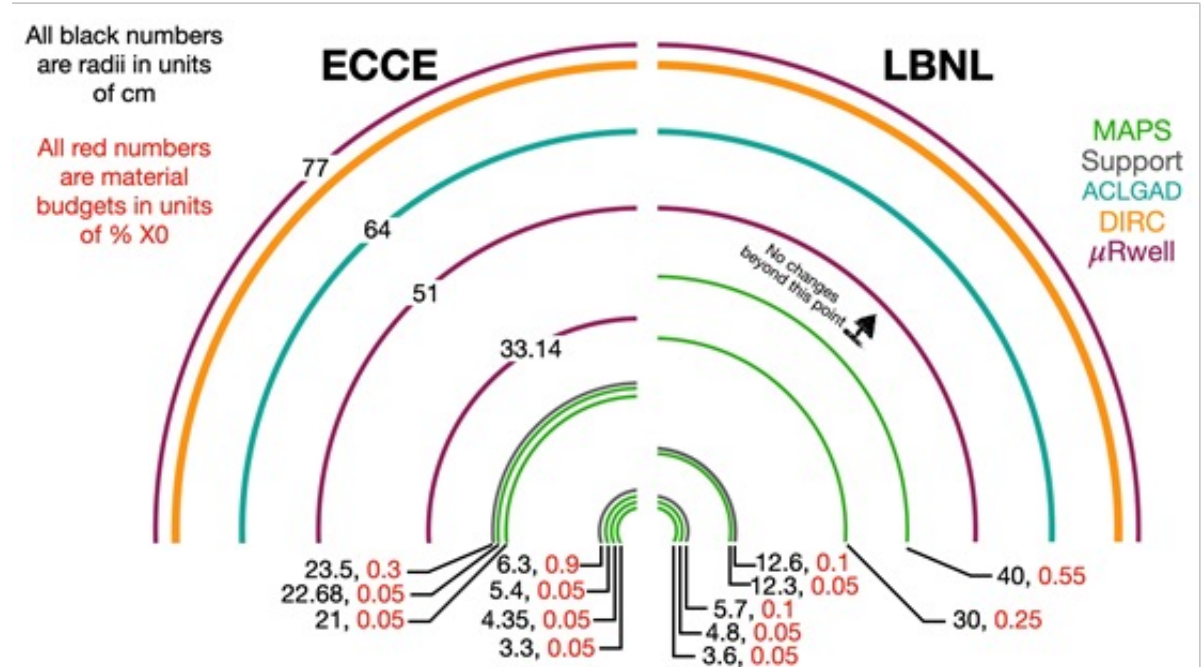   - Modify average material budget

Detector-1
Barrel Tracker Simulation Studies

M. Posik
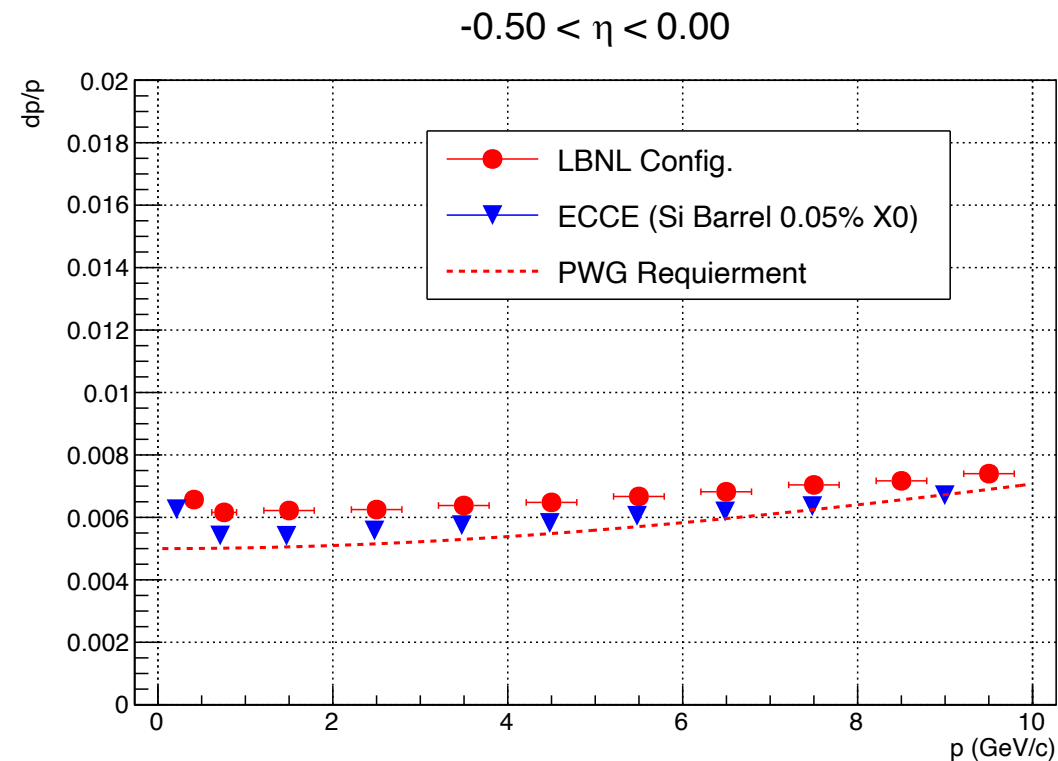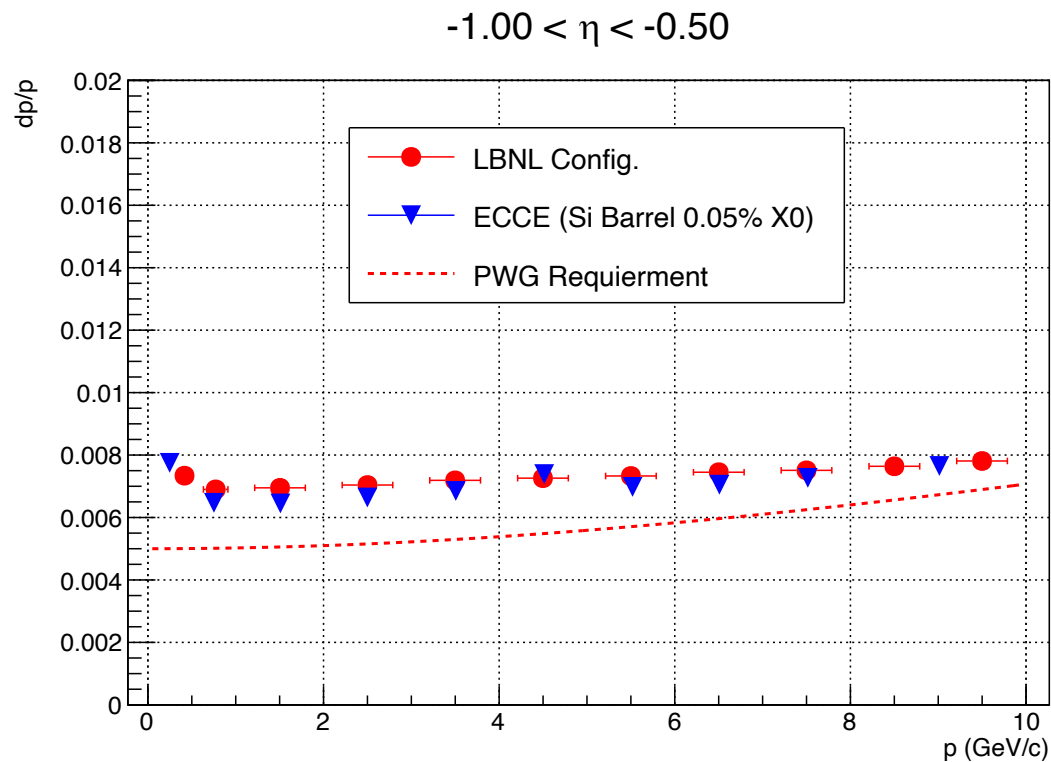
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LBNL Configuration

Simulation Details

➢ Modifies barrel configuration based on LBNL suggestion
  - Inner most MPGD layer from ECCE was removed.
  - Silicon vertex and barrel layers spread out and materials modified (mainly for barrel layers)
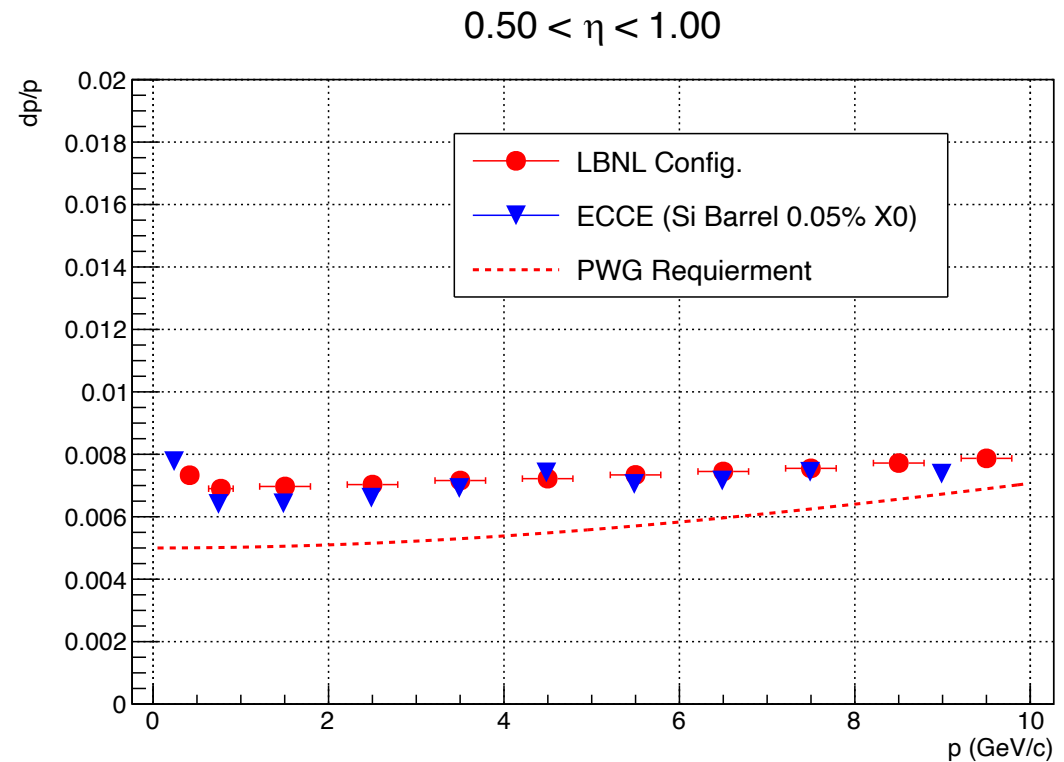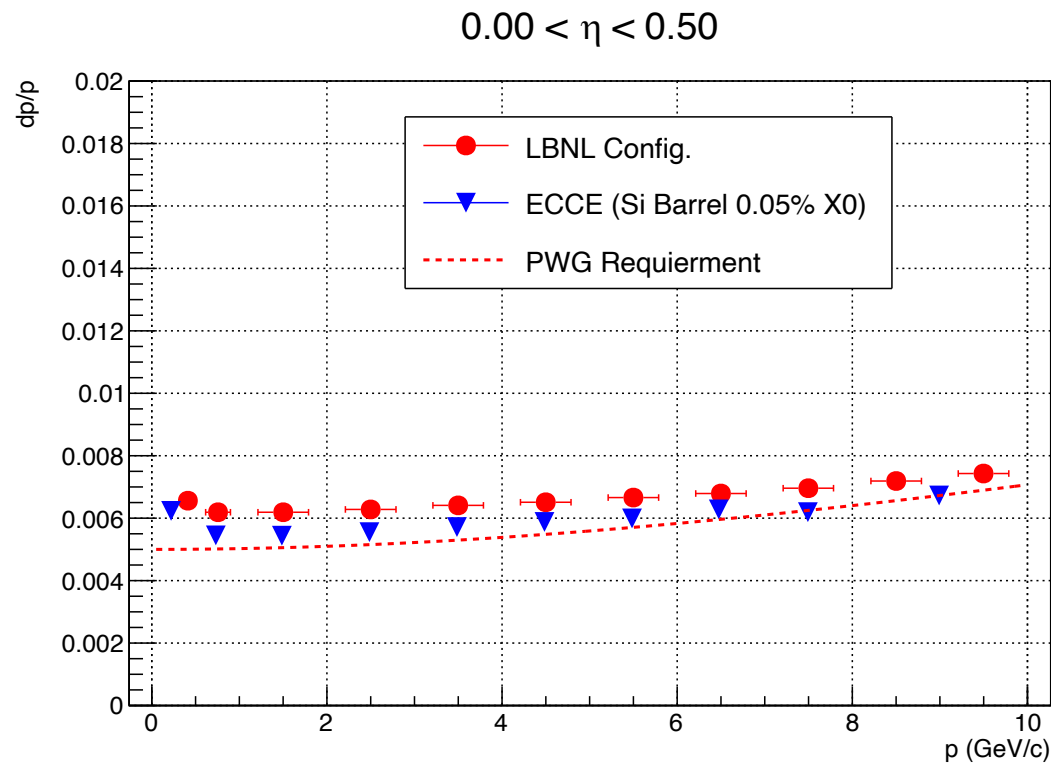 - Configuration presented by Ernst to tracking working group

LBNL Configuration Momentum Performance ($\eta < 0$)

$-1.00 < \eta < -0.50$

$-0.50 < \eta < 0.00$

- o LBNL configuration brings momentum resolution performance to a level comparable to ECCE's performance
- o Tracking system alone still does not meet PWG requirements

ECCE data points taken from presentation by Stephen Maple

LBNL Configuration Momentum Performance ($\eta > 0$)

0.00 < η < 0.50

0.50 < η < 1.00

- LBNL Config.
- ECCE (Si Barrel 0.05% X0)
- PWG Requierment

o LBNL configuration brings momentum resolution performance to a level comparable to ECCE's performance
o Tracking system alone still does not meet PWG requirements
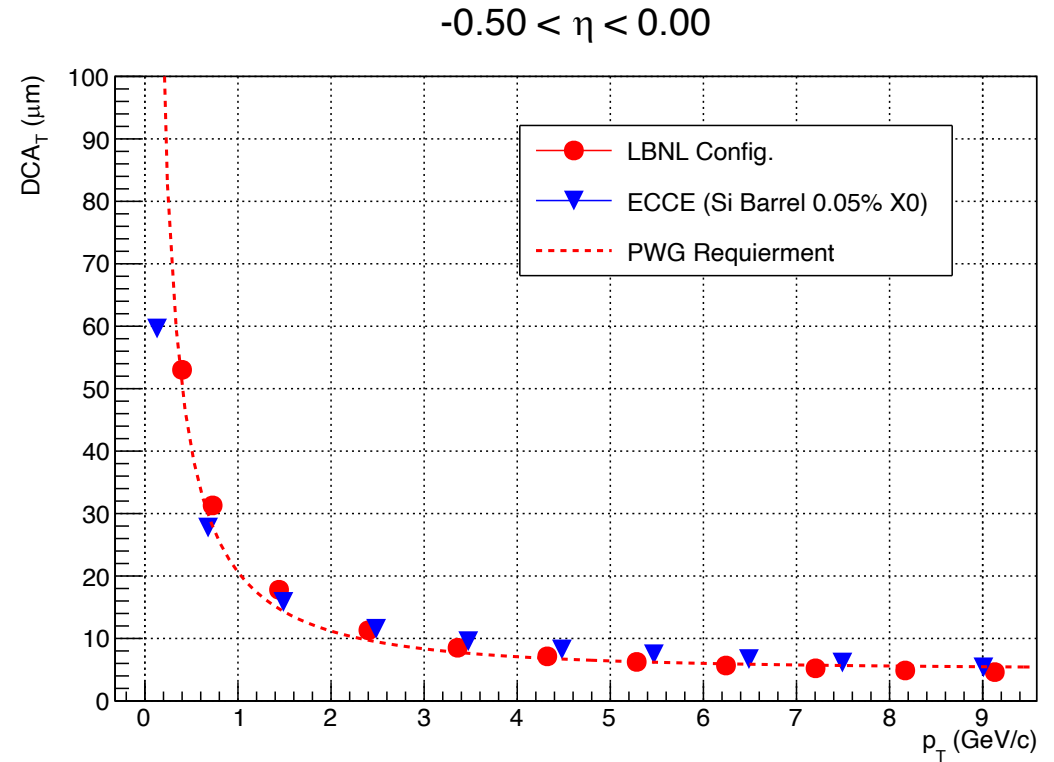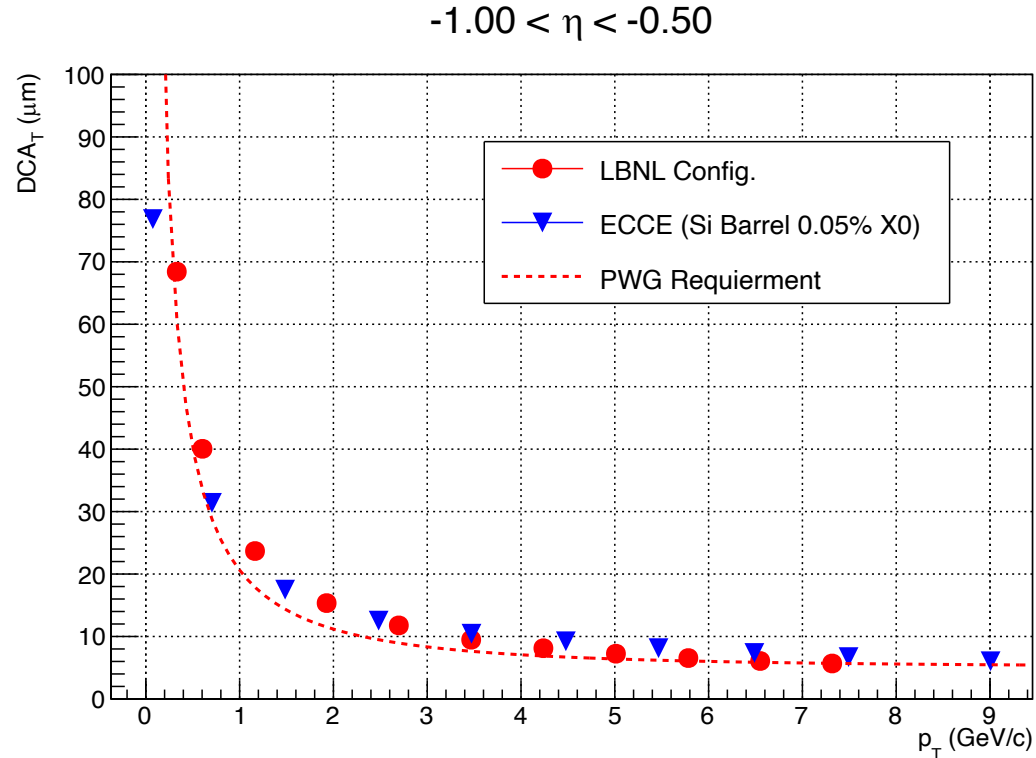
ECCE data points taken from presentation by Stephen Maple

LBNL Configuration – Transverse DCA Resolution ($\eta < 0$)

-1.00 < η < -0.50

-0.50 < η < 0.00

- LBNL configuration achieves DCA resolution performance comparable to ECCE's performance
- Transvers DCA resolution at or near PWG requirements

ECCE data points taken from presentation by Stephen Maple
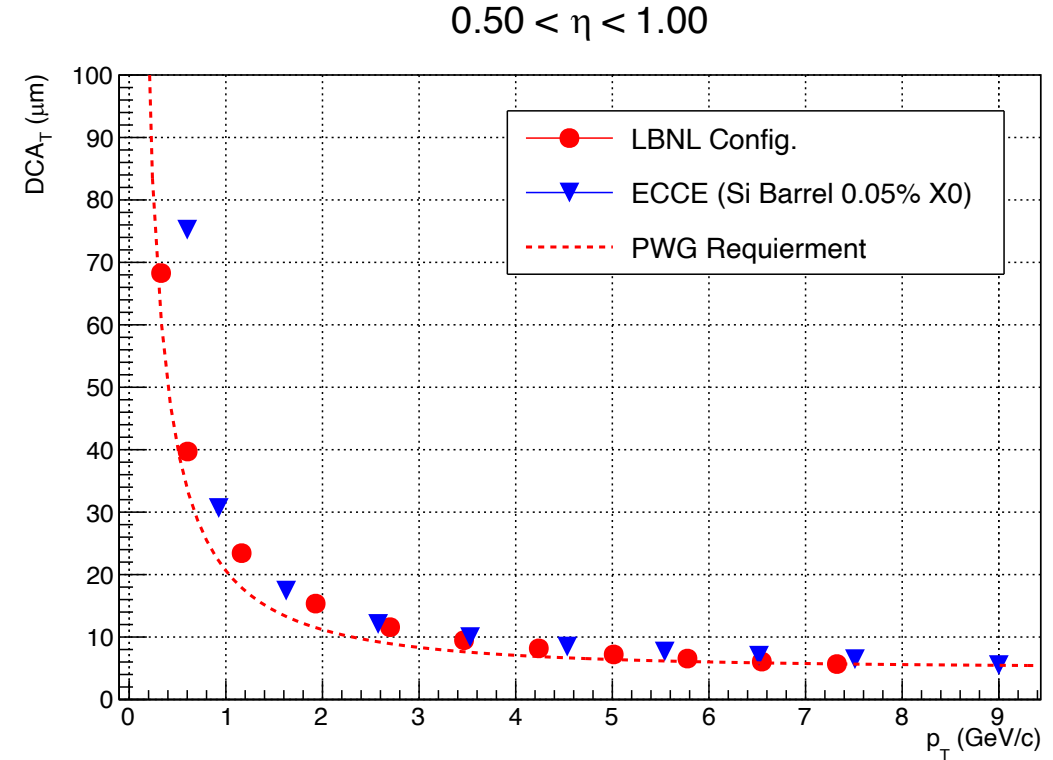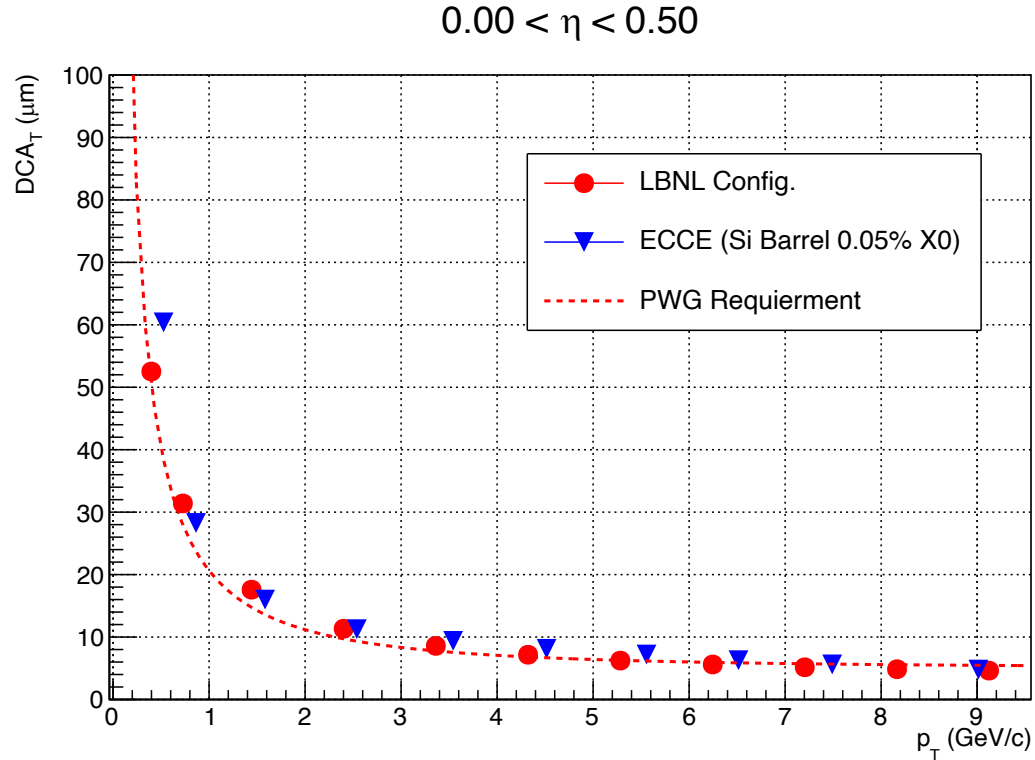
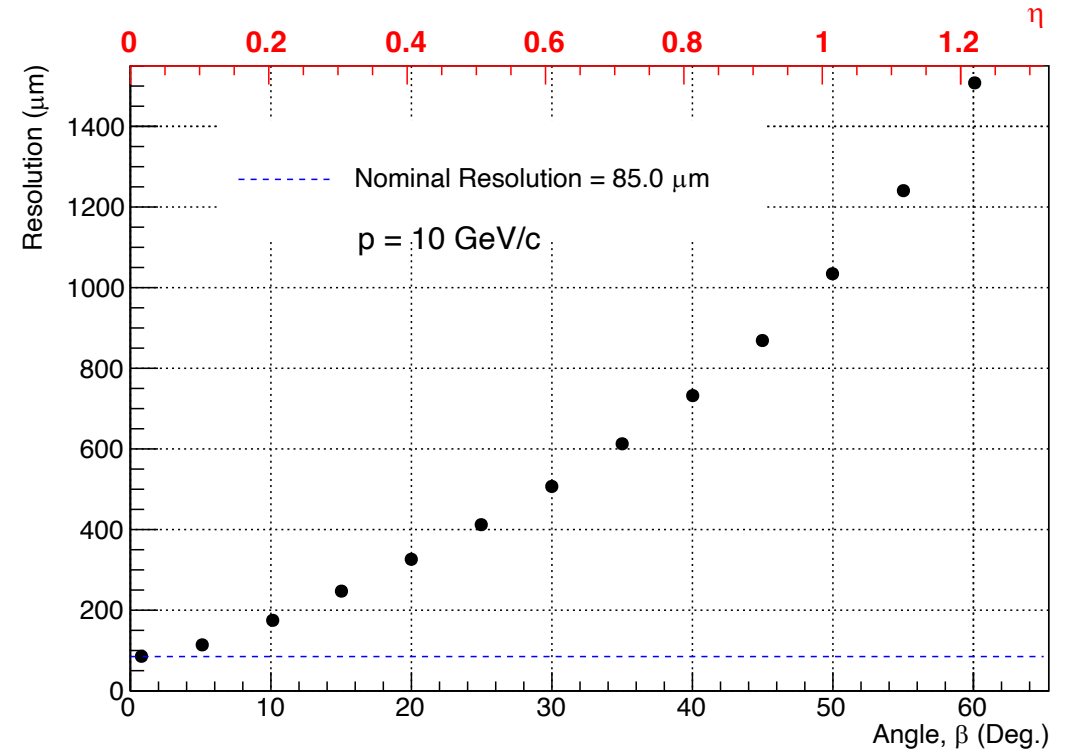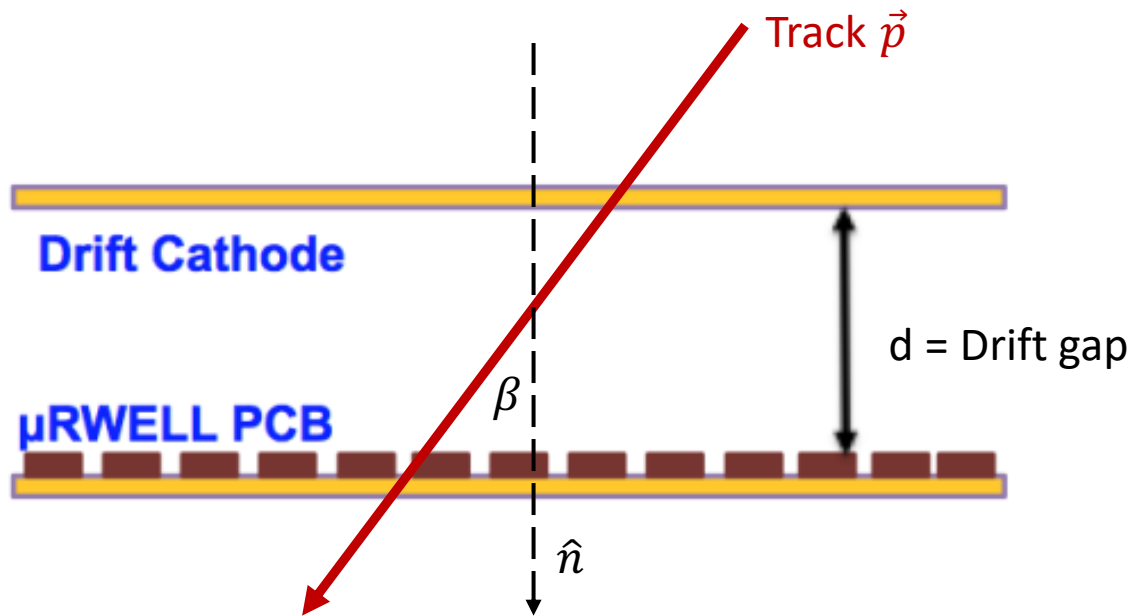# LBNL Configuration – Transverse DCA Resolution ($\eta > 0$)

- LBNL configuration achieves DCA resolution performance comparable to ECCE's performance
- Transvers DCA resolution at or near PWG requirements

ECCE data points taken from presentation by Stephen Maple

Angle Dependent Resolution: Z Resolution

Angle Dependent Resolution (σ_β)

- Simplified implementation. The angle should be the angle in the plane perpendicular to the direction that the readout strips run along.
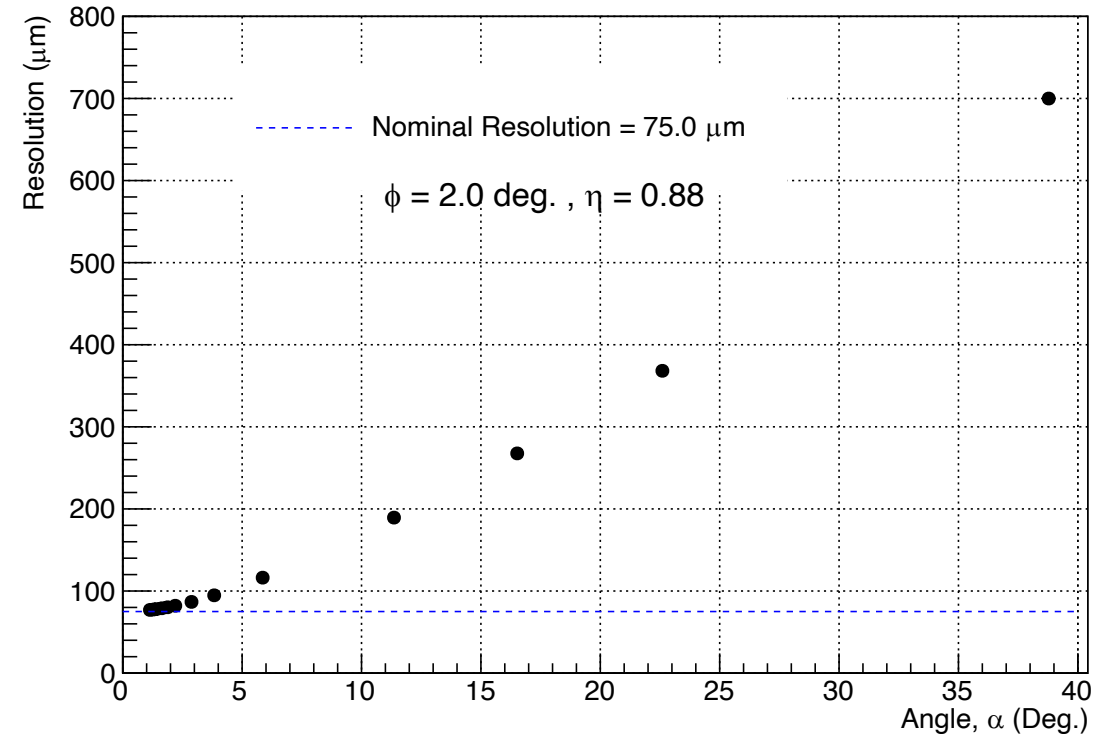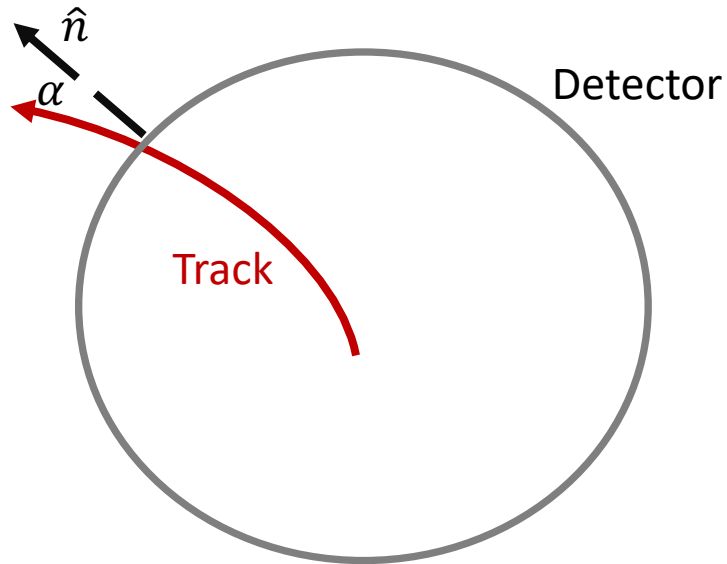

Parameterization: $\sigma_\beta = \sqrt{\dfrac{d^2}{12}\tan^2\beta}$

- Total resolution: $\sigma_{MPGD} = \sqrt{\sigma_\beta^2 + \sigma_0^2}$, $\sigma_0 =$ nominal resolution

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Angle Dependent Resolution (σ_α)

o Simplified implementation. The angle should be the angle in the plane perpendicular to the direction that the readout strips run along.
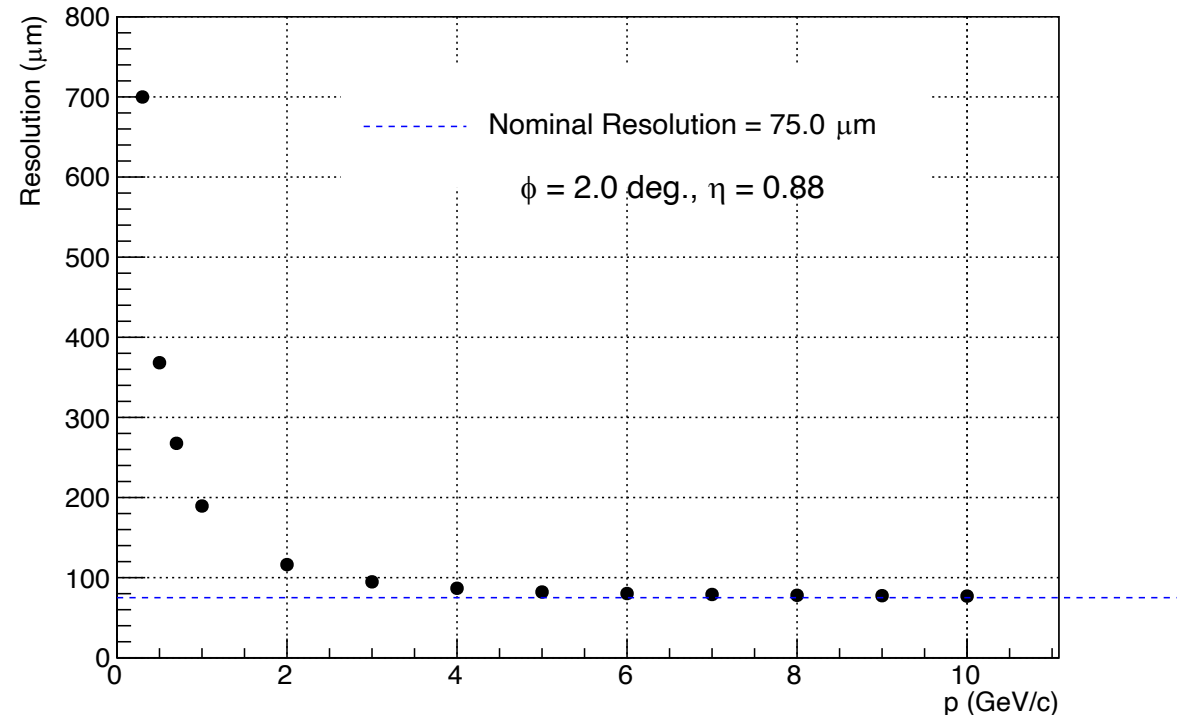

Parameterization: $\sigma_\alpha = \sqrt{\dfrac{d^2}{12}\tan^2\alpha}$

o Total resolution: $\sigma_{MPGD} = \sqrt{\sigma_\alpha^2 + \sigma_0^2}$, $\sigma_0 =$ nominal resolution

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Angle Dependent Resolution: R-Phi Resolution

Angle Dependent Resolution (σ_α)

o Simplified implementation. The angle should be the angle in the plane perpendicular to the direction that the readout strips run along.
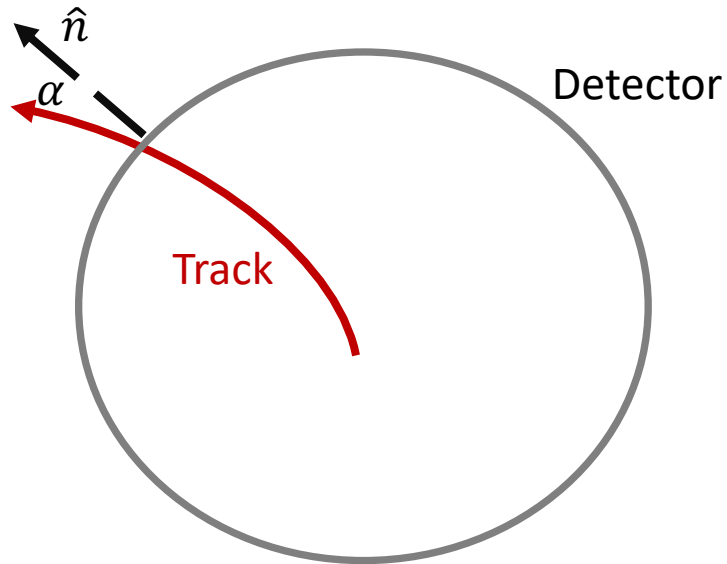

Parameterization: $\sigma_\alpha = \sqrt{\dfrac{d^2}{12}\tan^2\alpha}$

o Total resolution: $\sigma_{MPGD} = \sqrt{\sigma_\alpha^2 + \sigma_0^2}$, $\sigma_0 =$ nominal resolution

College of
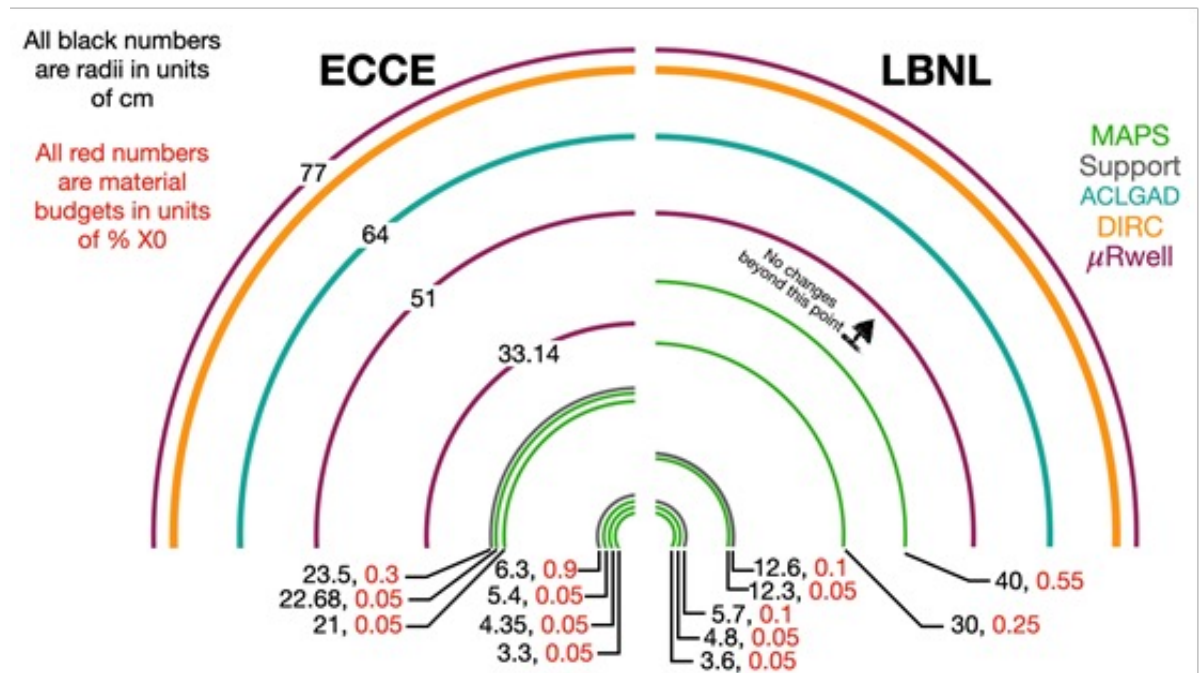Science and Technology
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LBNL Configuration – Modified MPGDs
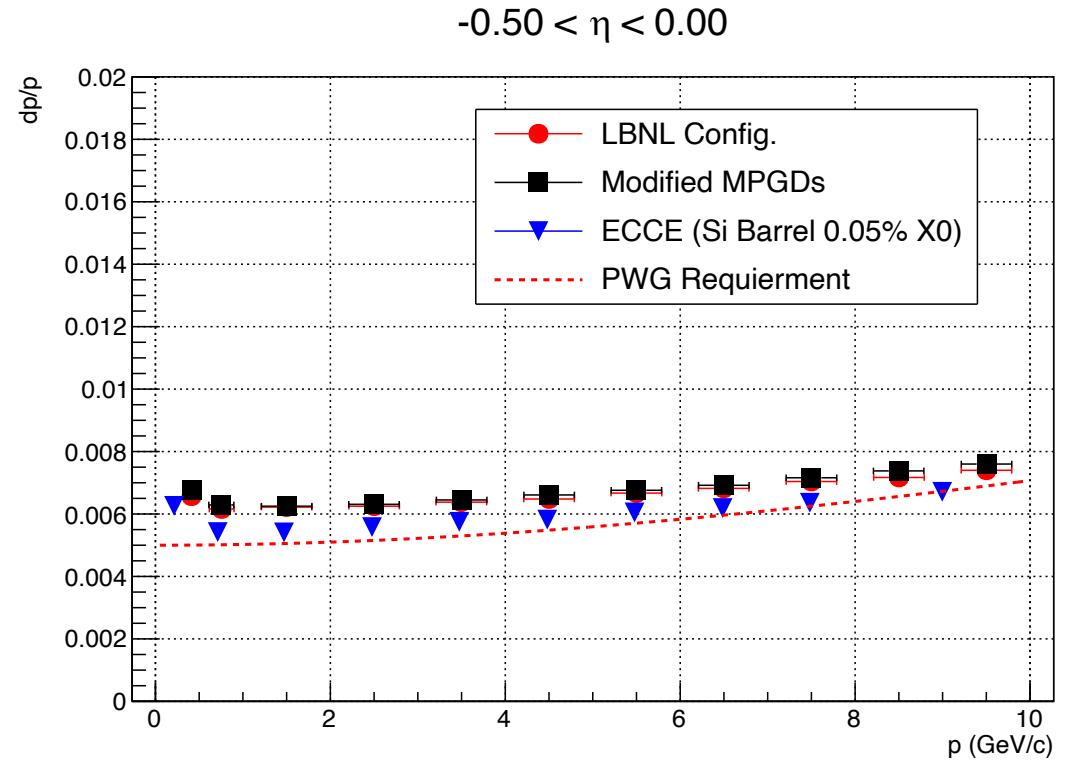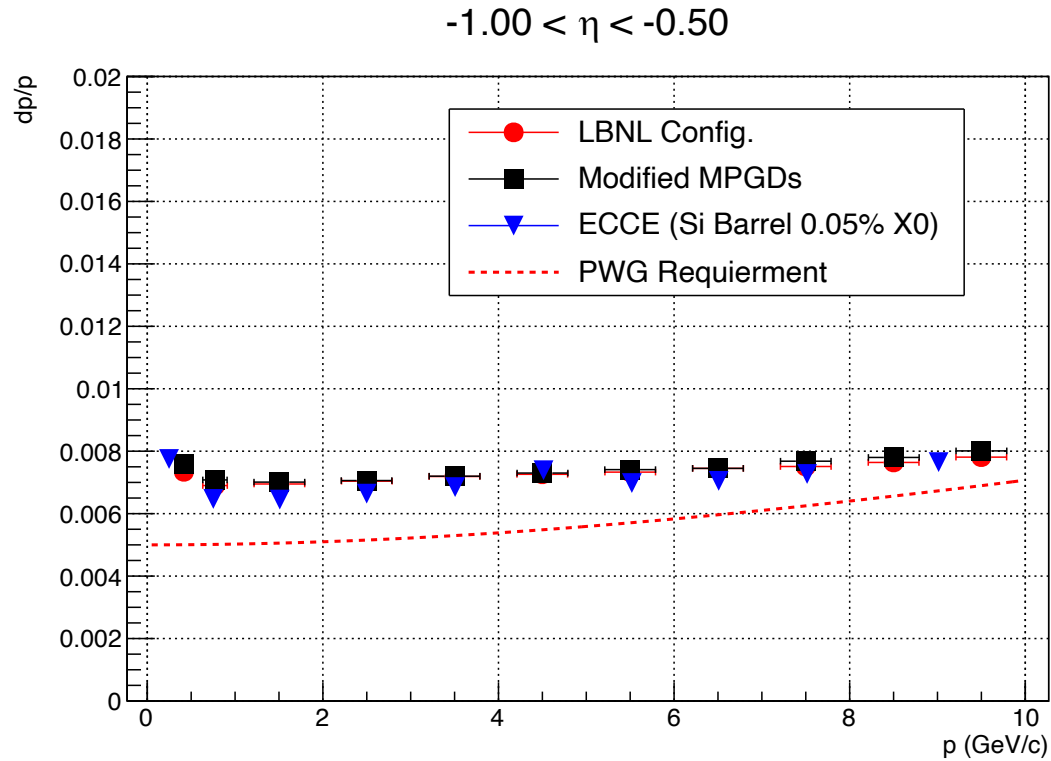
➢ **MPGD Modifications**
  o MPGD R-Phi and Z resolutions parameterized based on angle
  o Nominal resolutions at $75\ \mu m\ (\sigma_0)$
  o 3mm Drift gap
  o Modified MPGD material budget to be 1% X0 + gas (drift gap)

➢ **MPGD layers**
  o Layer at R = 51 cm ➔ Barrel MPGD meant for tracking
  o Layer at R = 77 cm
    • Not part of formal tracking system
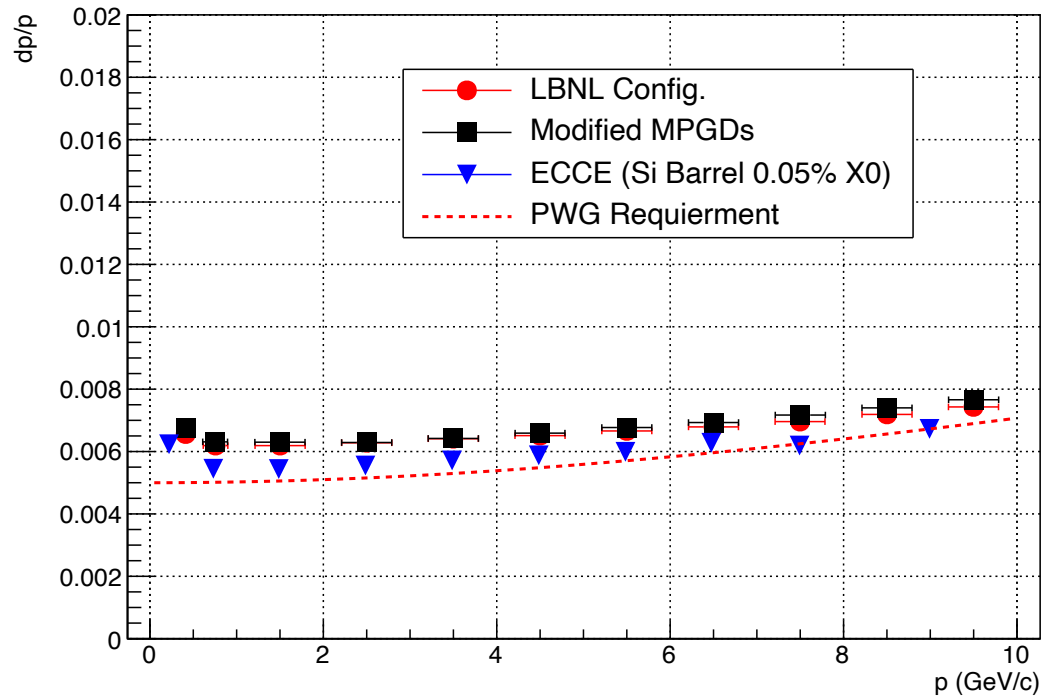   • Part of hpDIRC system meant to aid in its PID reconstruction

All black numbers are radii in units of cm

All red numbers are material budgets in units of % X0

ECCE

LBNL

77
64
51
33.14

No changes beyond this point

MAPS
Support
ACLGAD
DIRC
μRwell

23.5, 0.3
22.68, 0.05
21, 0.05

6.3, 0.9
5.4, 0.05
4.35, 0.05
3.3, 0.05

12.6, 0.1
12.3, 0.05
5.7, 0.1
4.8, 0.05
3.6, 0.05

40, 0.55
30, 0.25

LBNL Configuration – Modified MPGD Momentum Performance ($\eta < 0$)

-1.00 < η < -0.50

-0.50 < η < 0.00

o Modified MPGDs maintain similar momentum performance as the non-modified MPGDs

$0.00 < \eta < 0.50$ $0.50 < \eta < 1.00$

Legend:
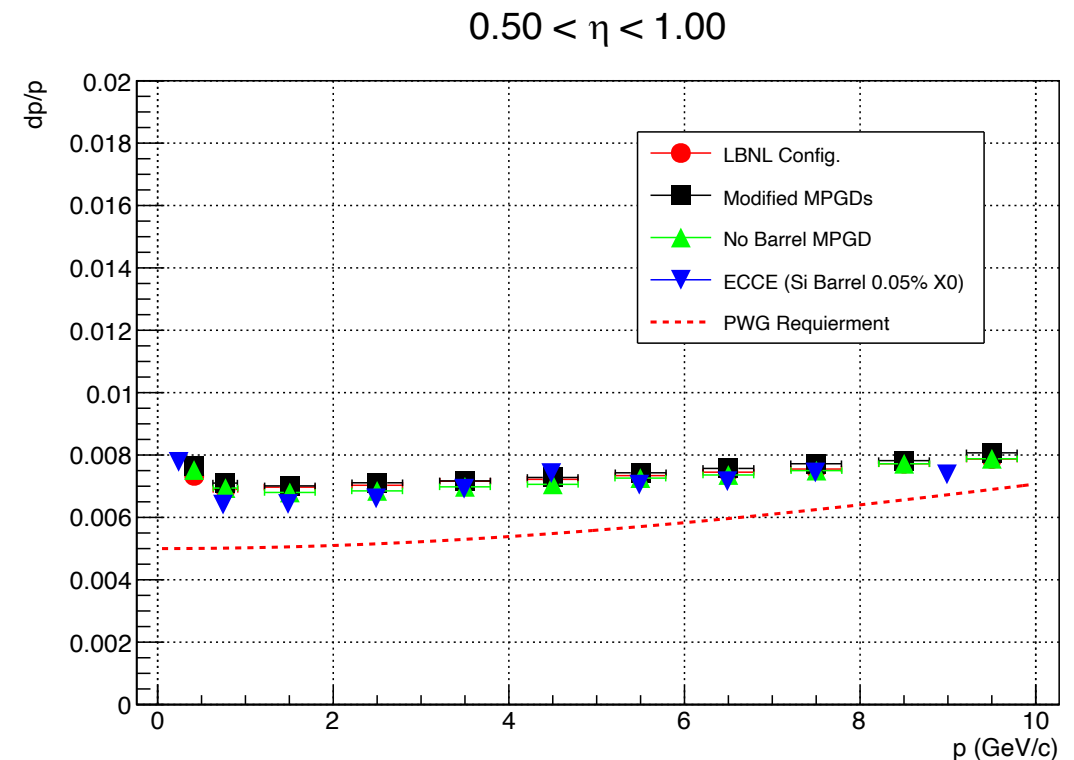- LBNL Config.
- Modified MPGDs
- ECCE (Si Barrel 0.05% X0)
- PWG Requierment
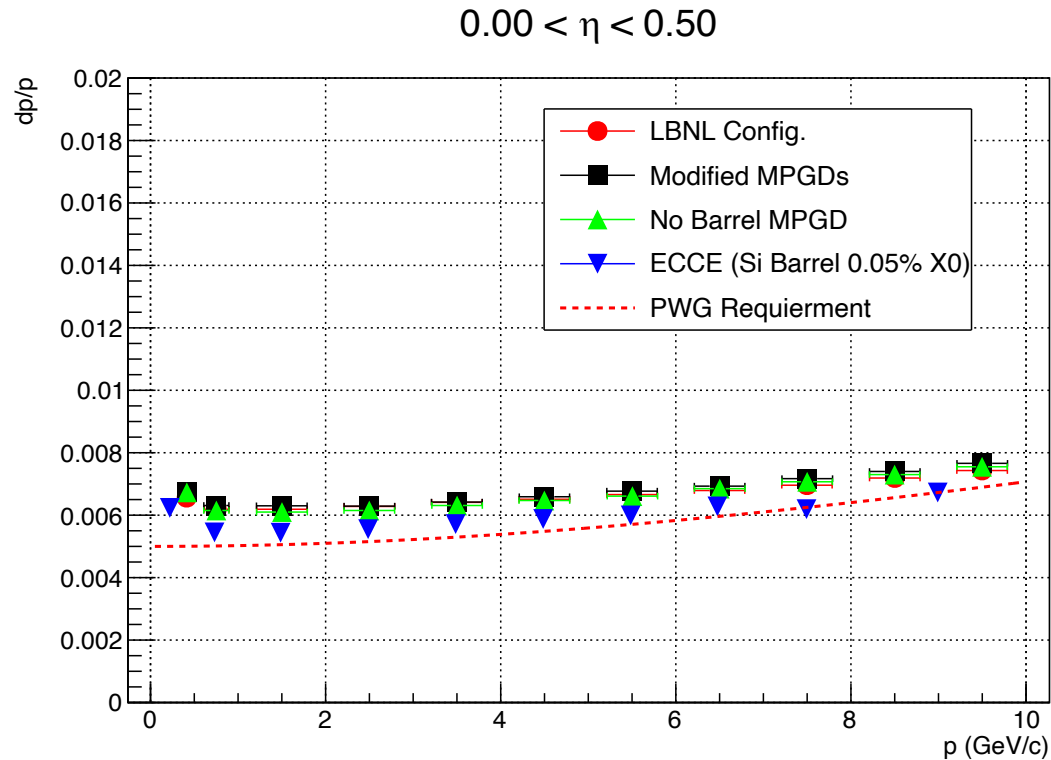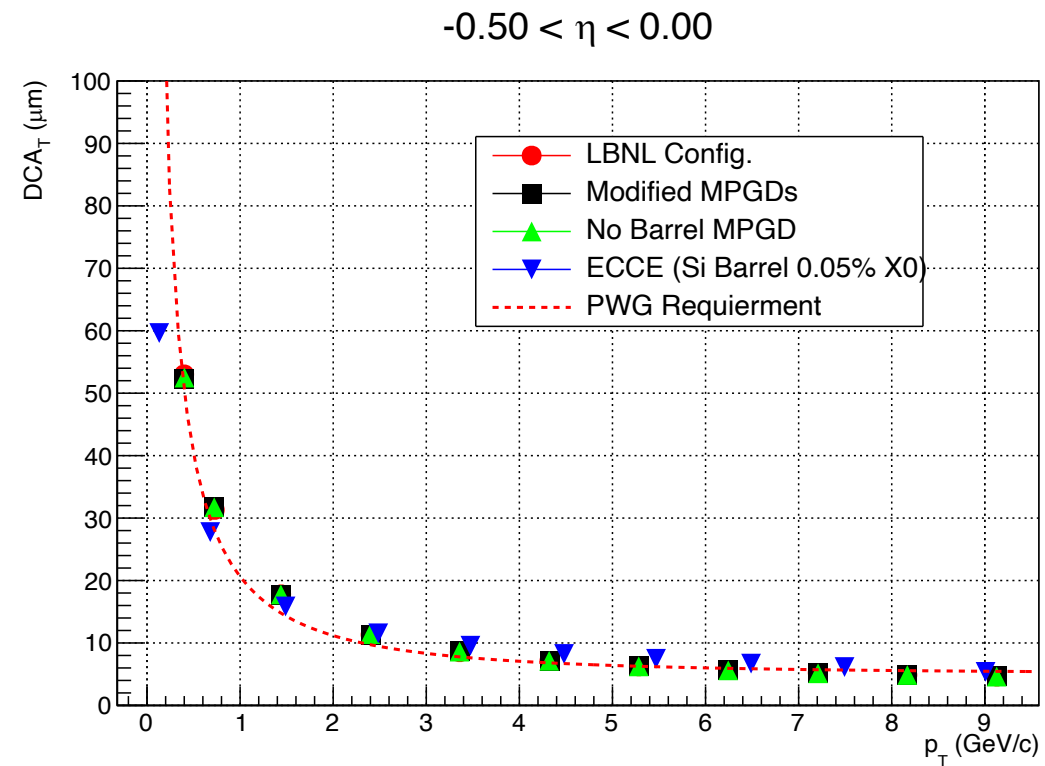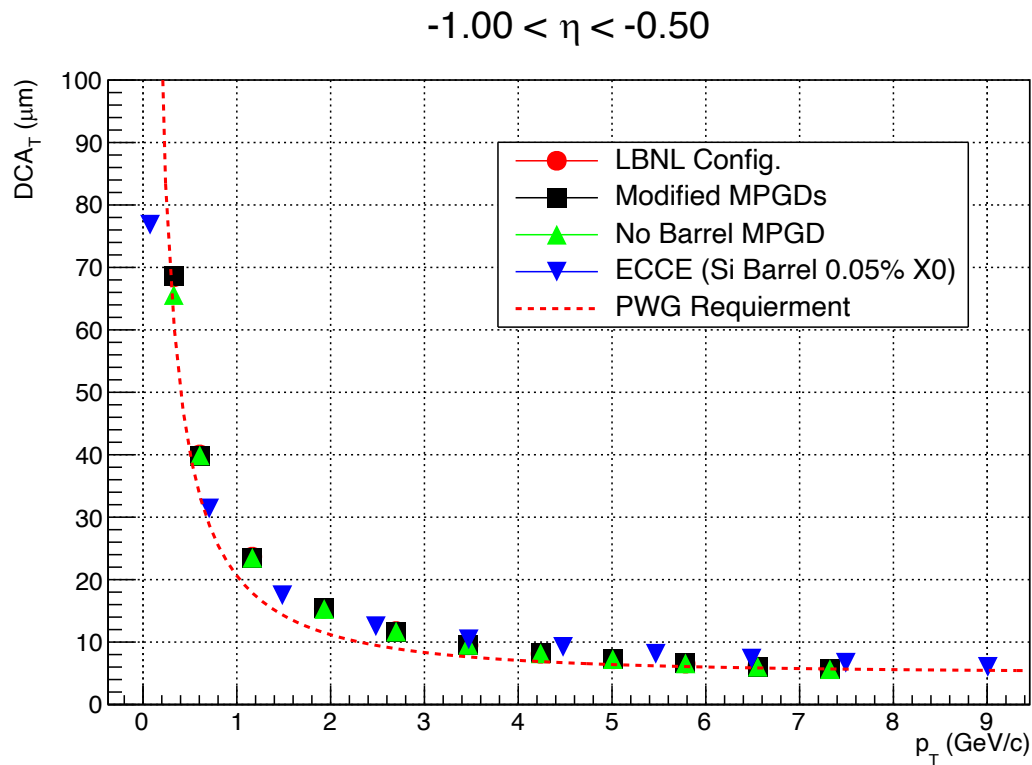
○ Modified MPGDs maintain similar momentum performance as the non-modified MPGDs

LBNL Configuration – Only Outer (PID) MPGD Momentum Performance ($\eta > 0$)

0.00 < η < 0.50

0.50 < η < 1.00

- o Modified MPGD and no Barrel MPGD give comparable performances as non-modified setup
- o No Barrel MPGD = Only MPGD layer behind DIRC is included (modified MPGD)
- o Similar results for negative eta

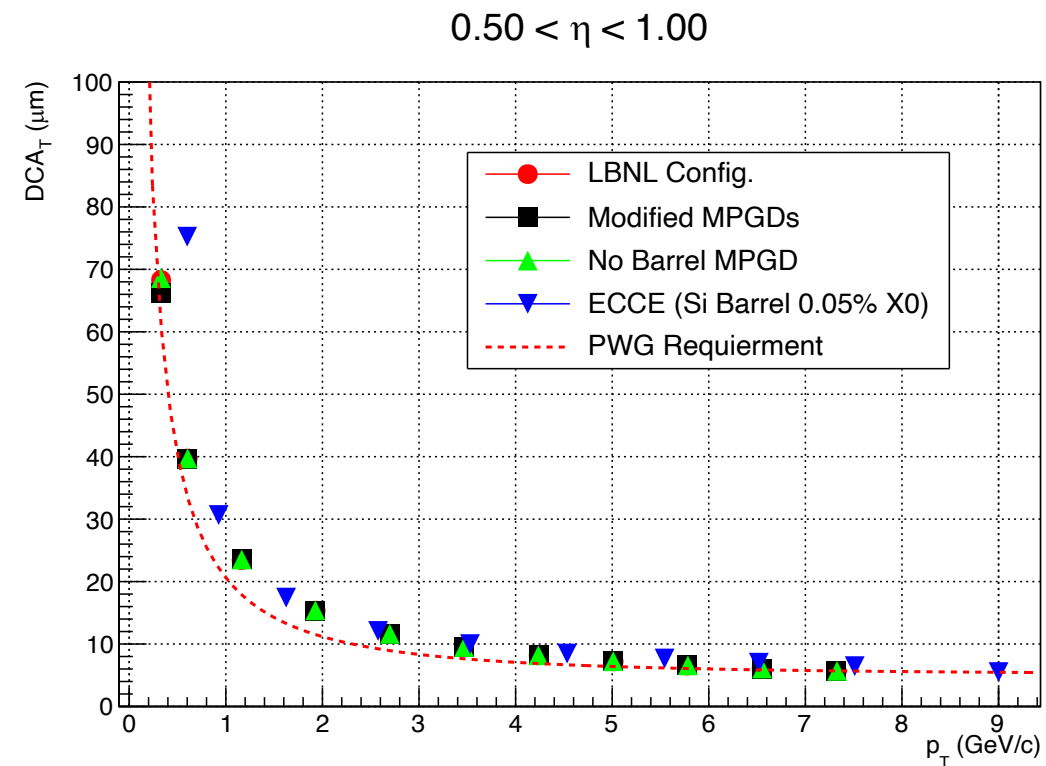# LBNL Configuration – MPGD Modified Transverse DCA Resolution ($\eta < 0$)
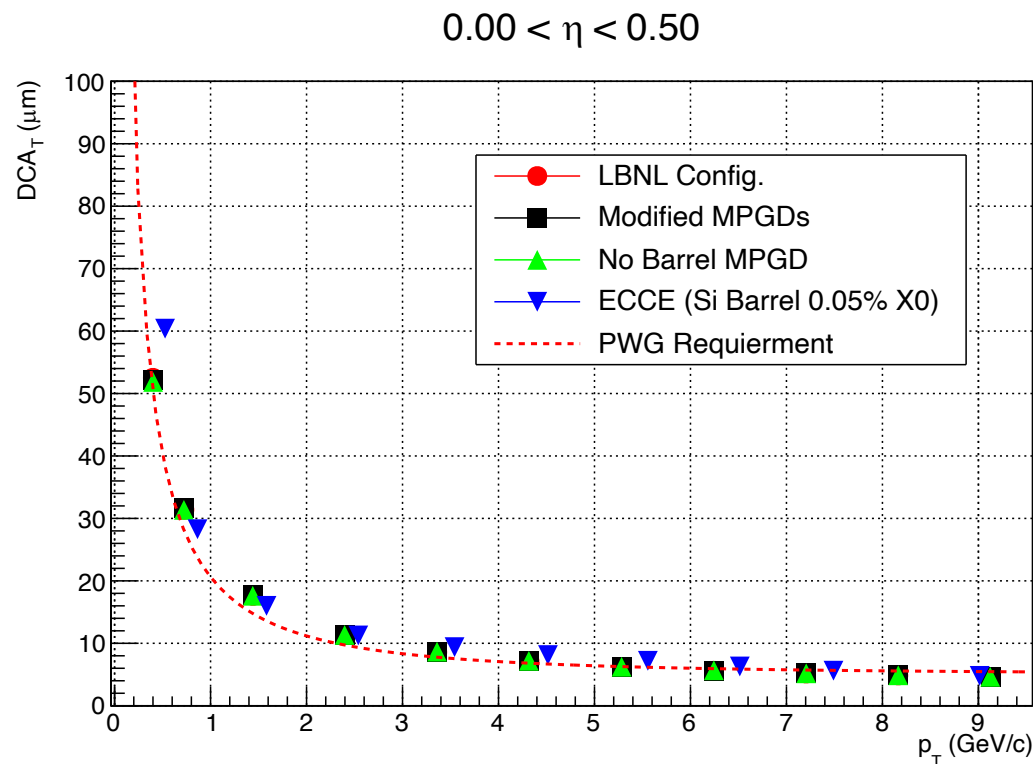

- o Modified MPGD and no Barrel MPGD give comparable performances as non-modified setup
- o No Barrel MPGD = Only MPGD layer behind DIRC is included (modified MPGD)

LBNL Configuration – MPGD Modified Transverse DCA Resolution ($\eta > 0$)

- o Modified MPGD and no Barrel MPGD give comparable performances as non-modified setup
- o No Barrel MPGD = Only MPGD layer behind DIRC is included (modified MPGD)

Summary

o LBNL configuration recovers much of the performance seen in the barrel region of the ECCE proposal

o Momentum resolution still falls short of PWG requirement

o MPGD barrel layer (R = 51 cm) has no significant impact on momentum resolution