




HYBRID TRACKER REDESIGN

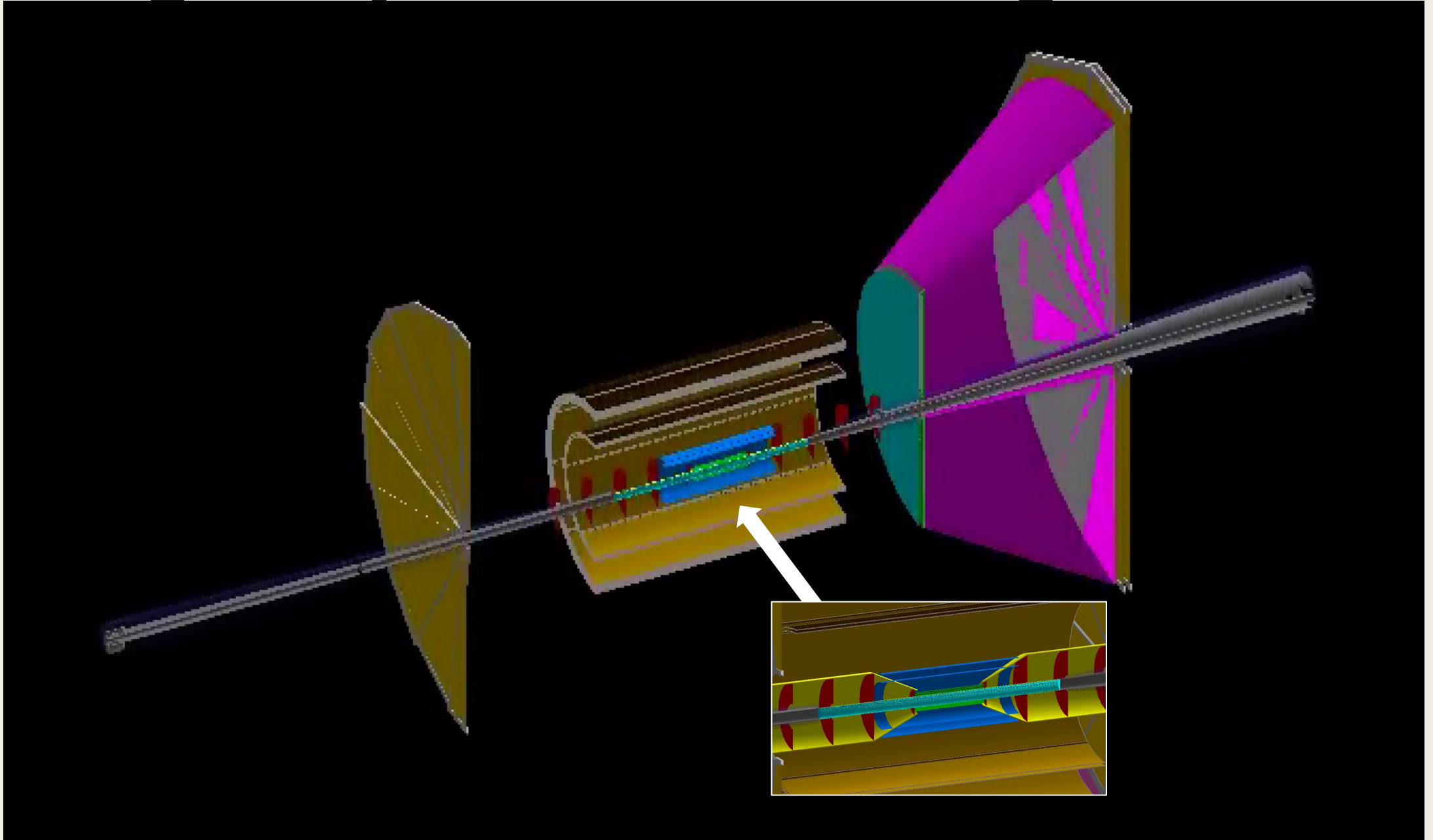
Nick Lukow on behalf of eRD6

August 17, 2021

ATHENA Tracking WG Meeting

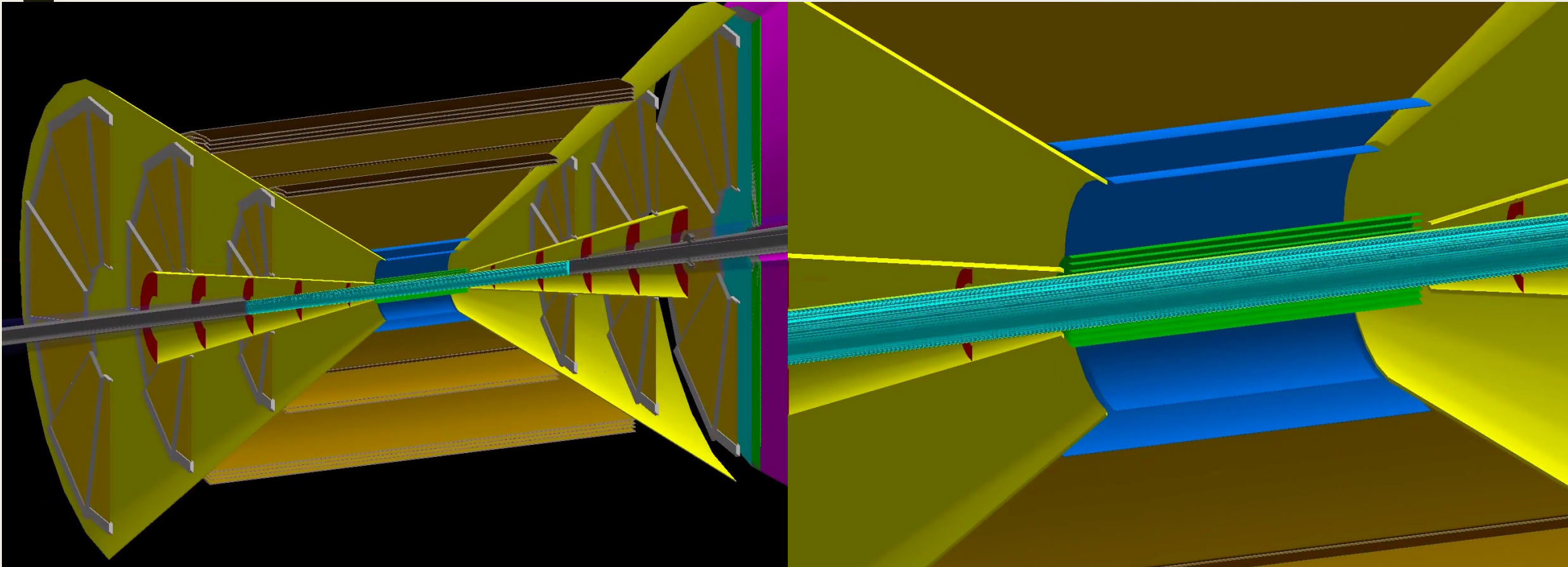
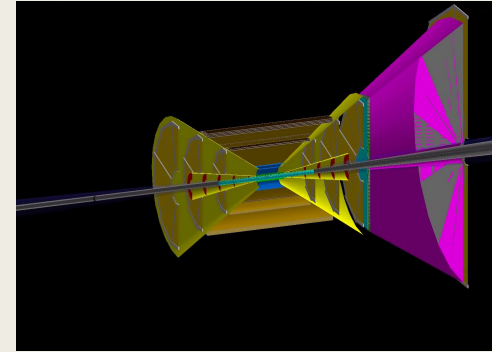


Original Hybrid Baseline Configuration

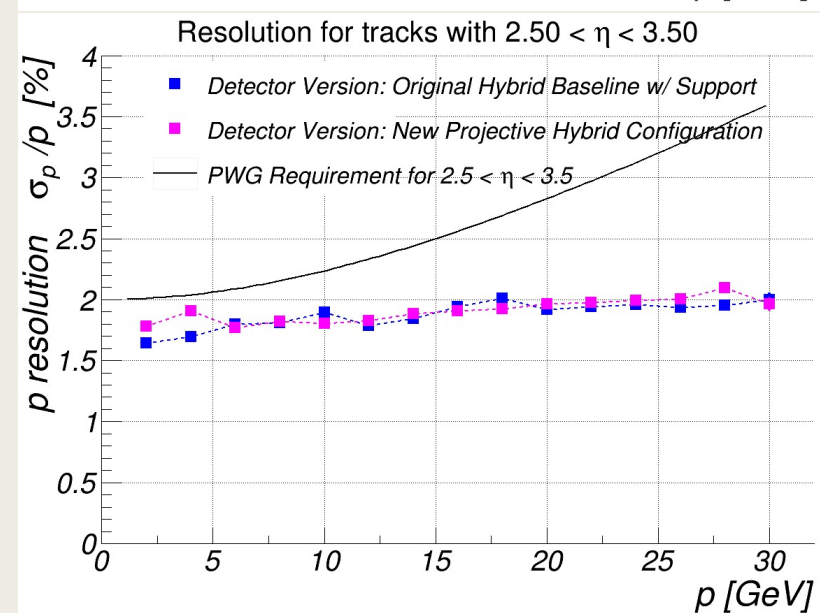
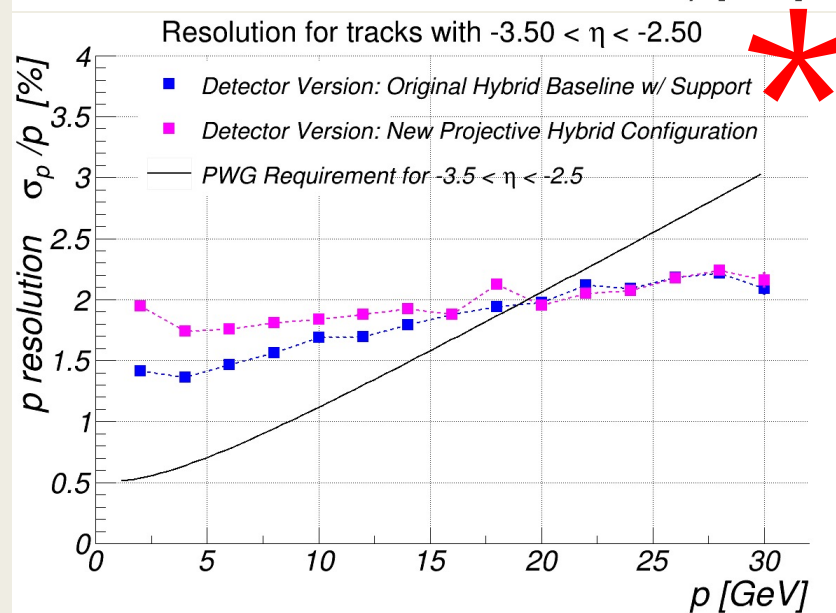
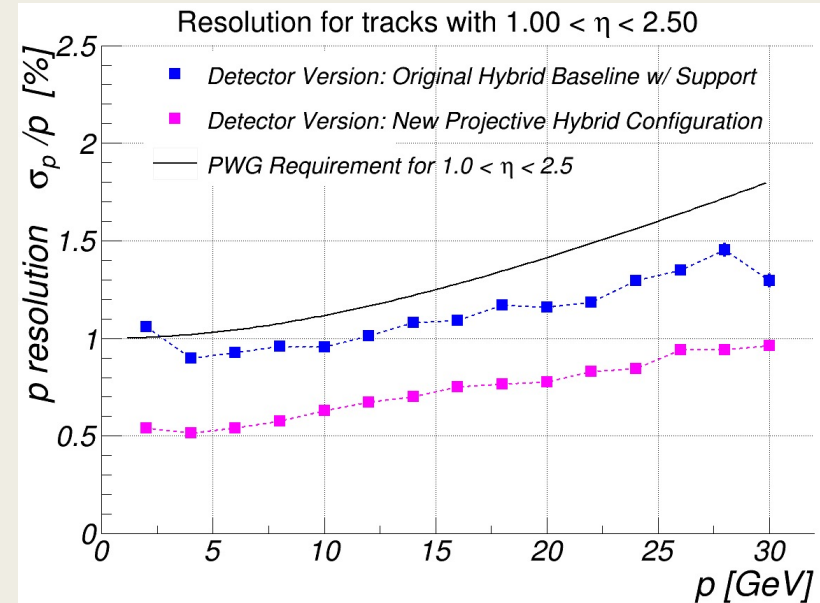
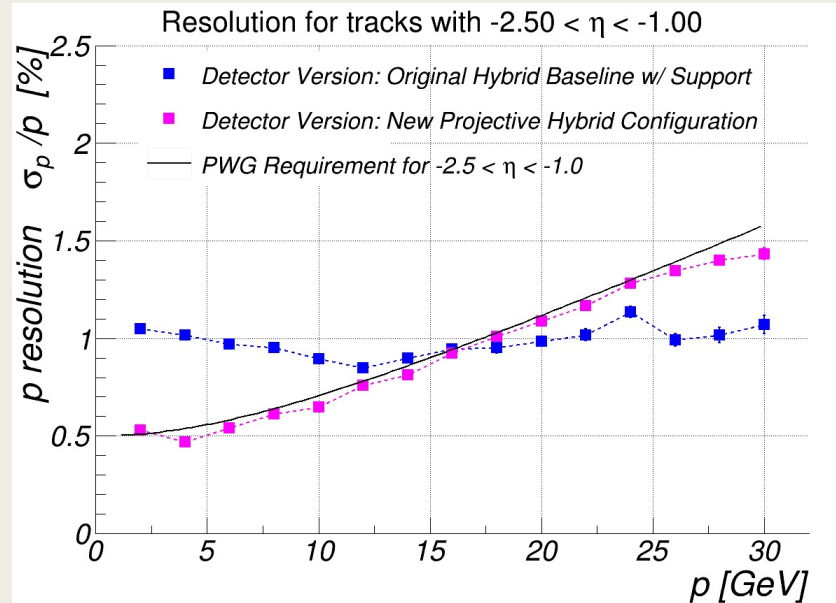


New Projective Hybrid Configuration

- New hybrid configuration designed to be projective with conical support/services along $\eta = \sim 1.1$ and ~ 2.5
 - Central detectors (not vertex tracker) were made projective along $\eta = \sim 1.1$
 - 3 projective inner GEM disks added on each side of the central detector
 - Removed outer rear GEM and one outer forward GEM disk



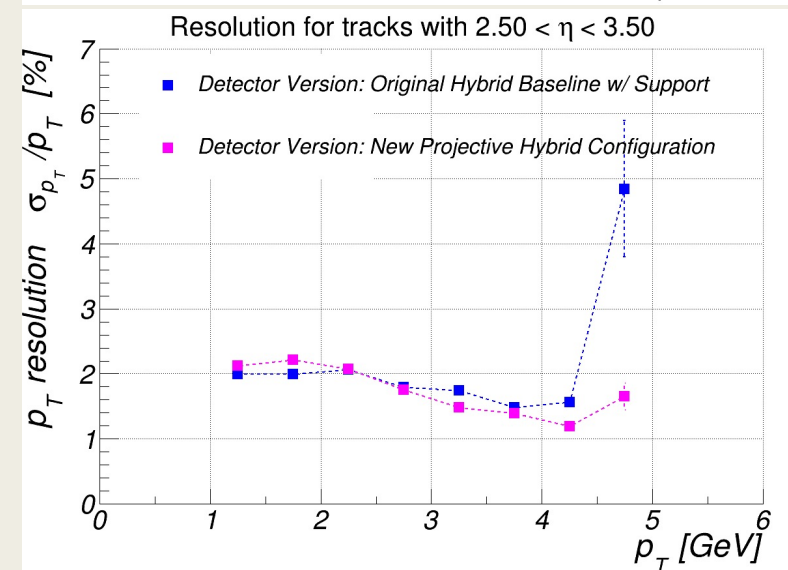
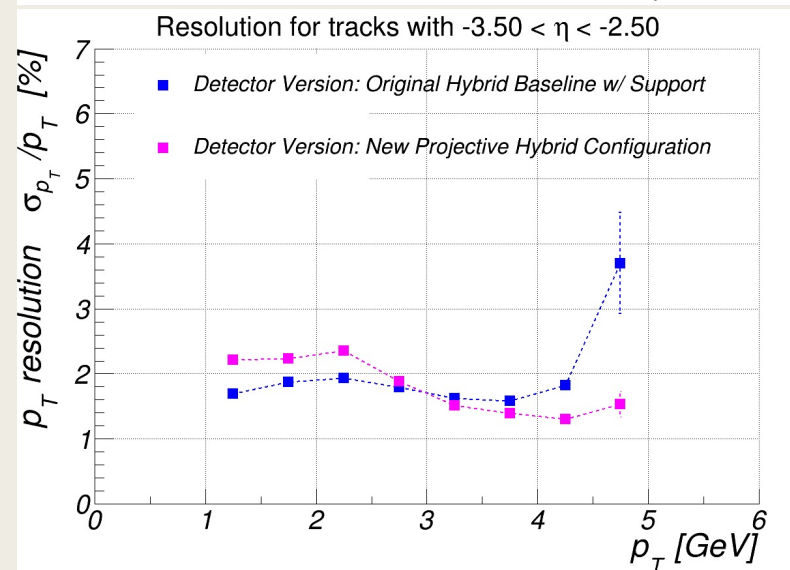
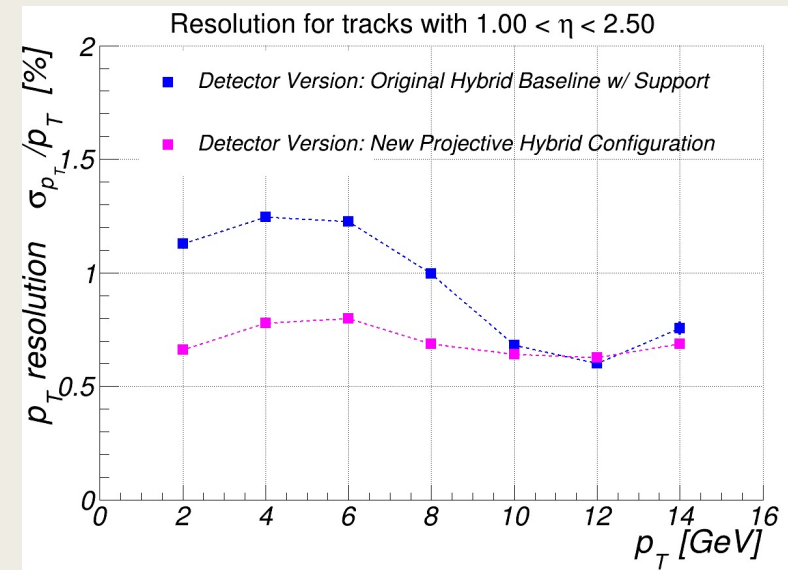
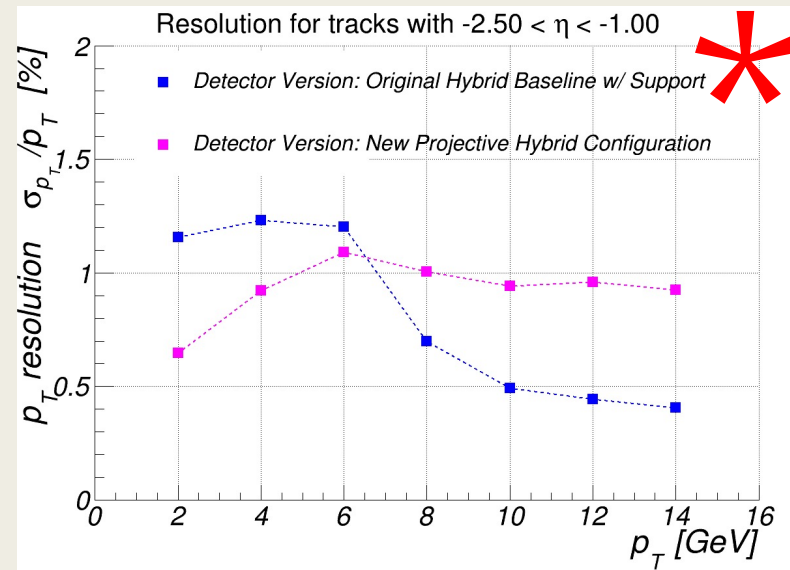
P Resolution vs P



* Rear GEM disk at $z = -190$ plays significant role

Pt Resolution vs Pt

- Restricted to total momentum less than 30 GeV/c

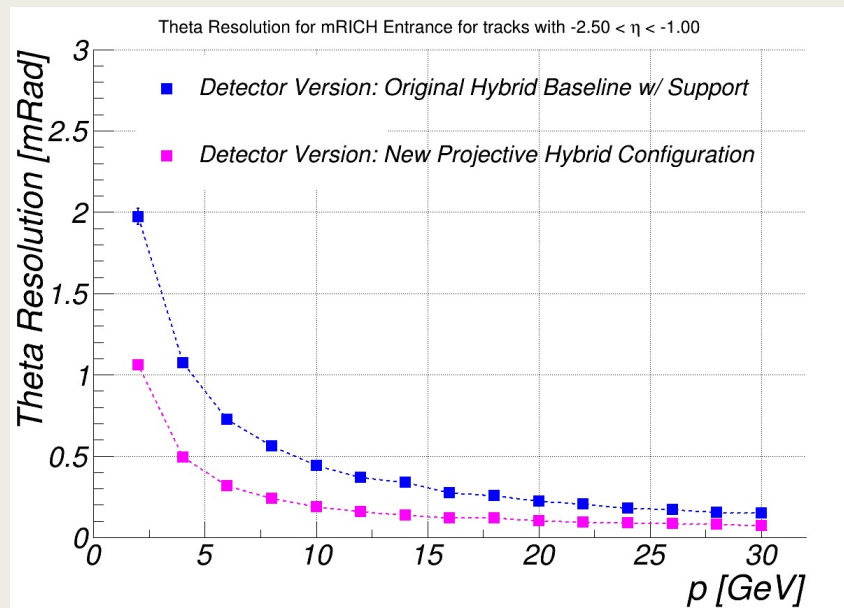


* Rear GEM disk at $z = -190$ plays significant role

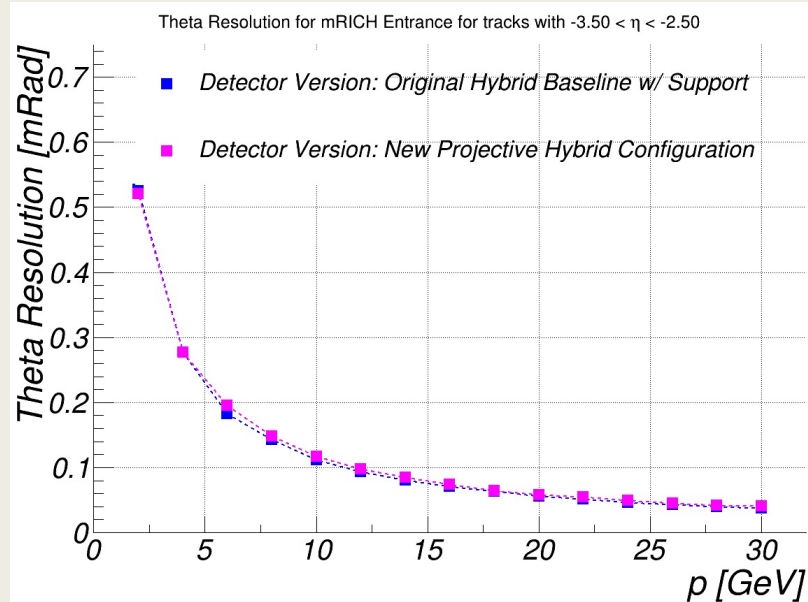
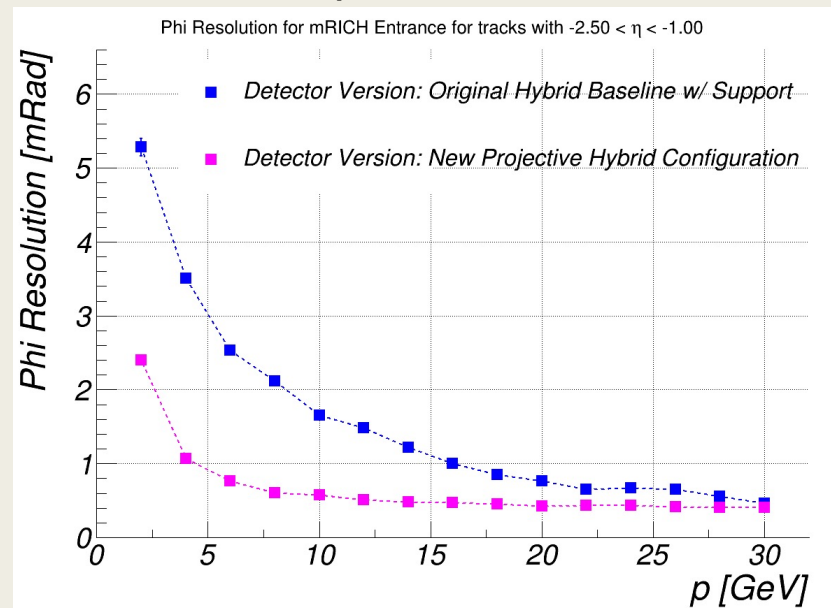
mRICH Angular Resolution ($z = -146$ cm)

θ Resolutions

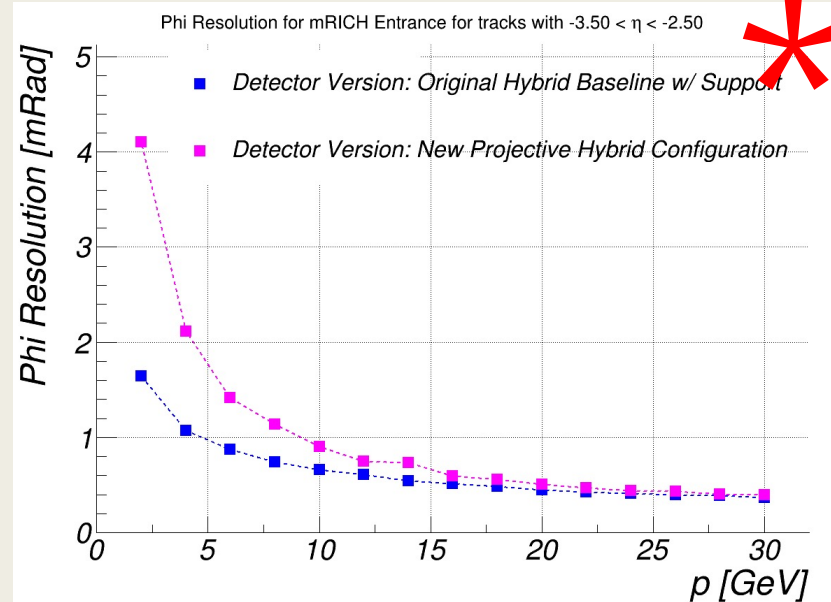
ϕ Resolutions



$-2.5 < \eta < -1.0$



$-3.5 < \eta < -2.5$

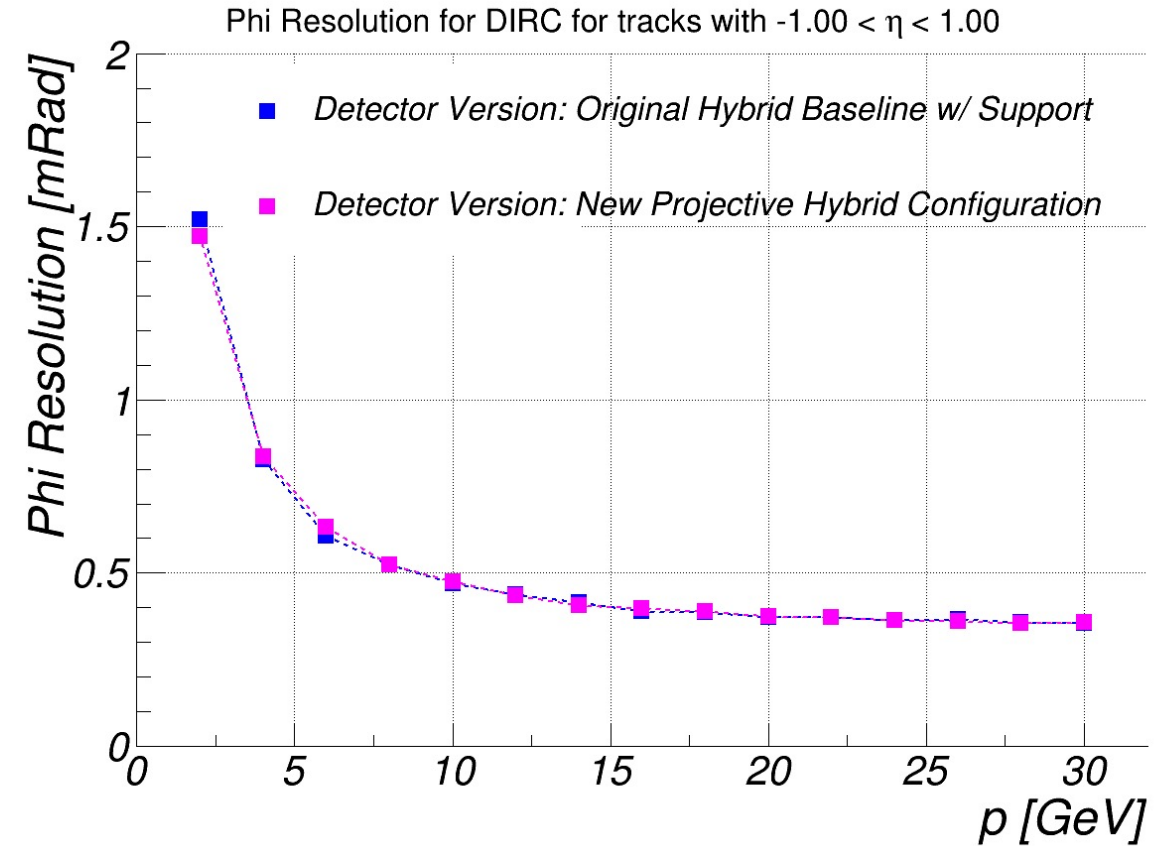
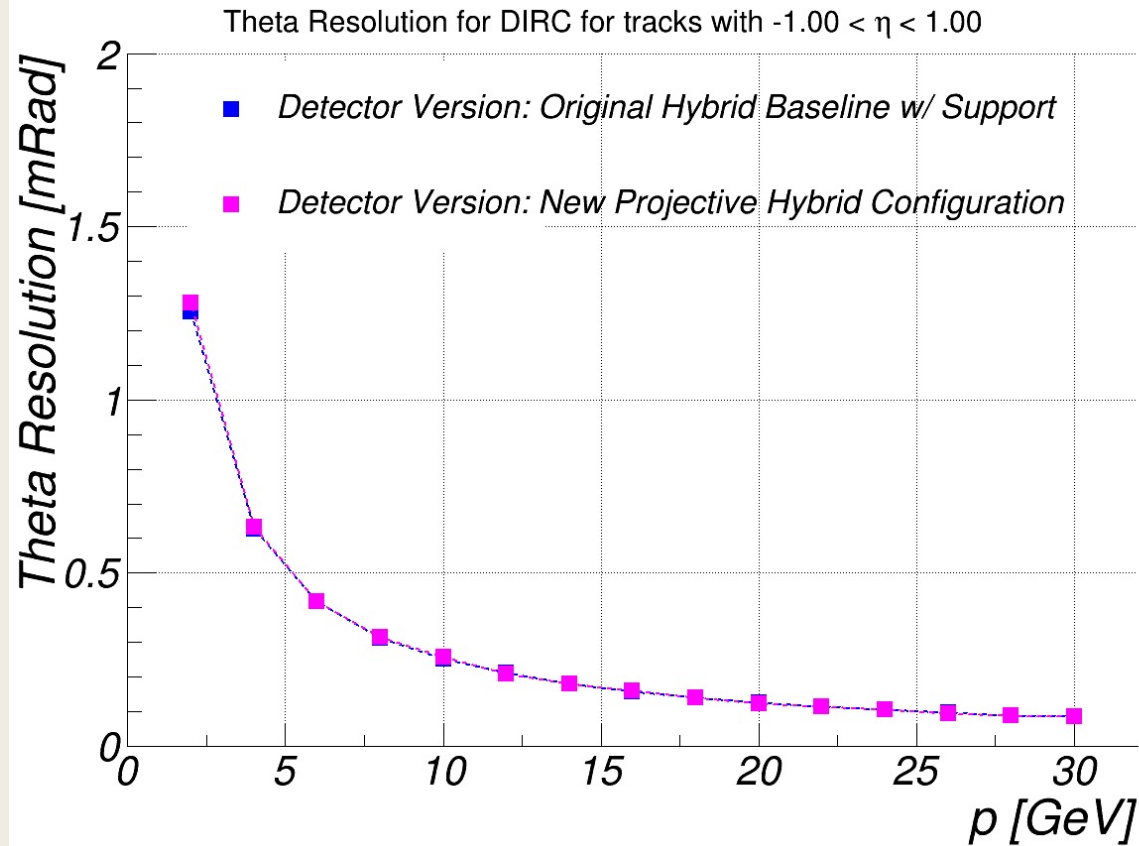


* Rear GEM disk at $z = -190$ plays significant role

DIRC Angular Resolution ($r = 100$ cm)

θ Resolutions

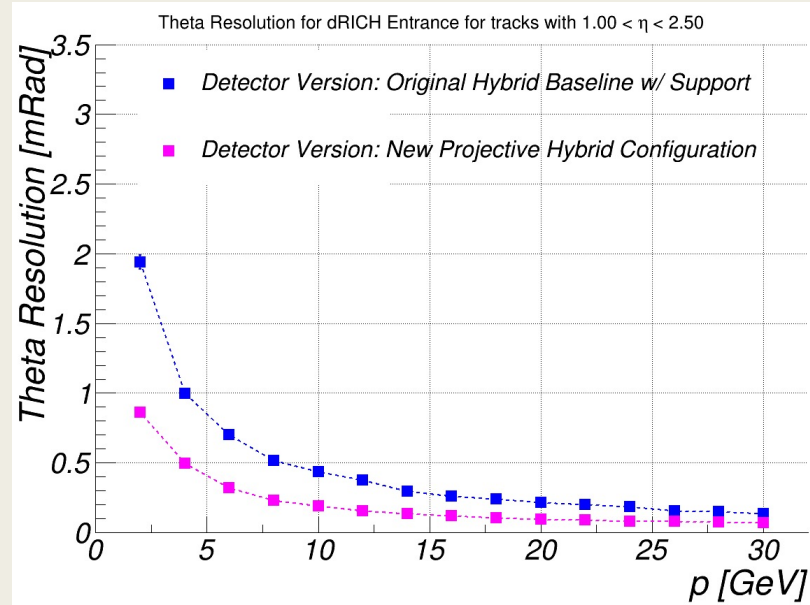
ϕ Resolutions



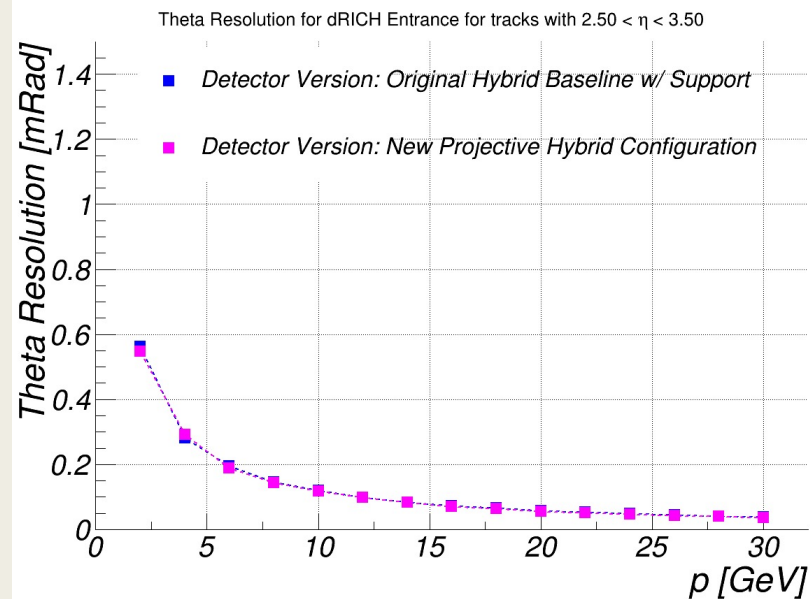
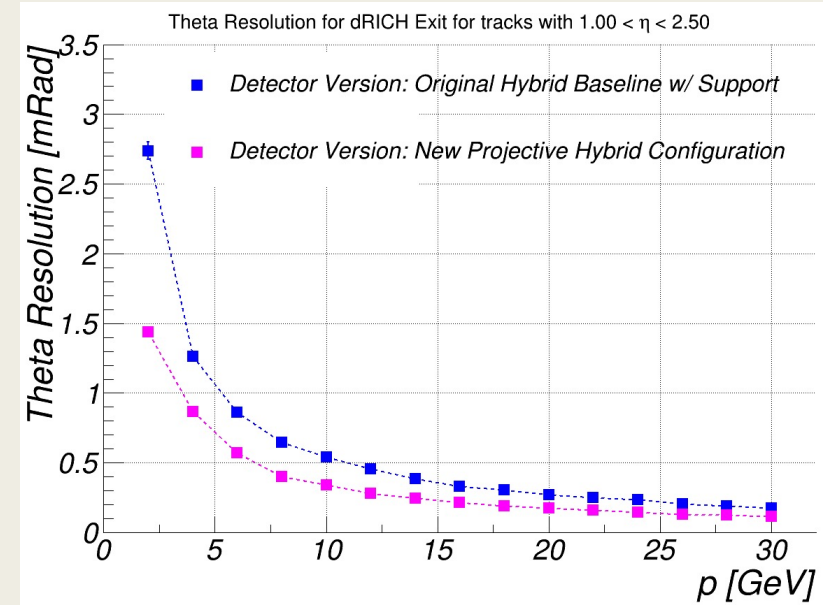
dRICH Polar Angle Resolution

dRICH Entrance Resolutions ($z = +146$ cm)

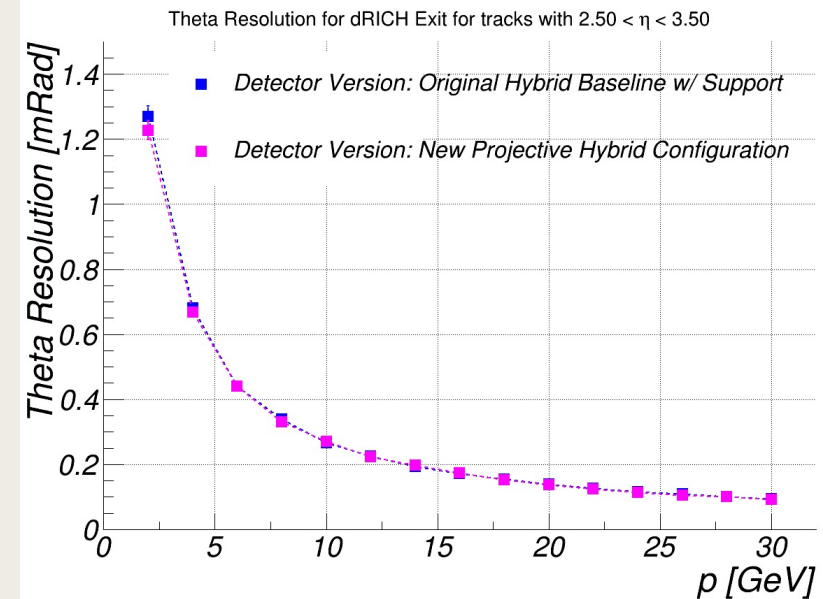
dRICH Exit Resolutions ($z = +301$ cm)



$1.0 < \eta < 2.5$

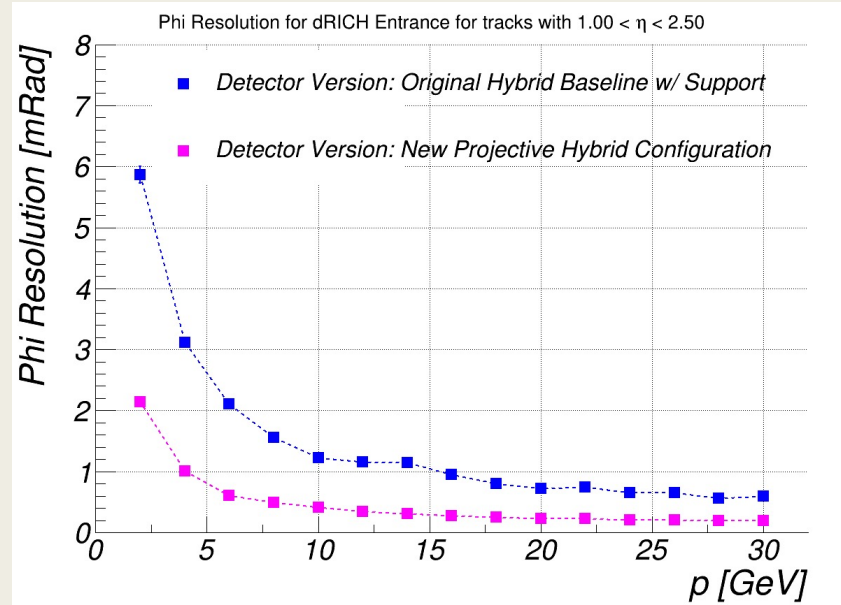


$2.5 < \eta < 3.5$



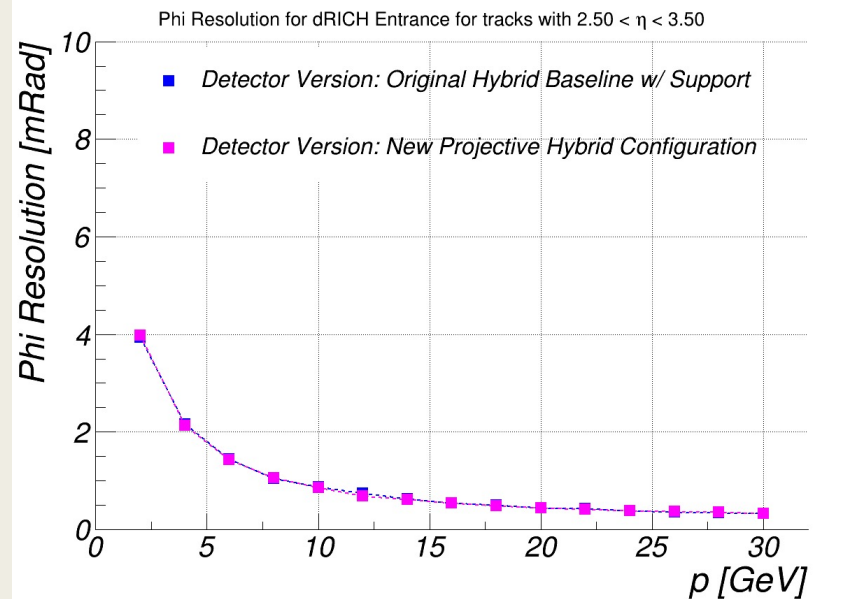
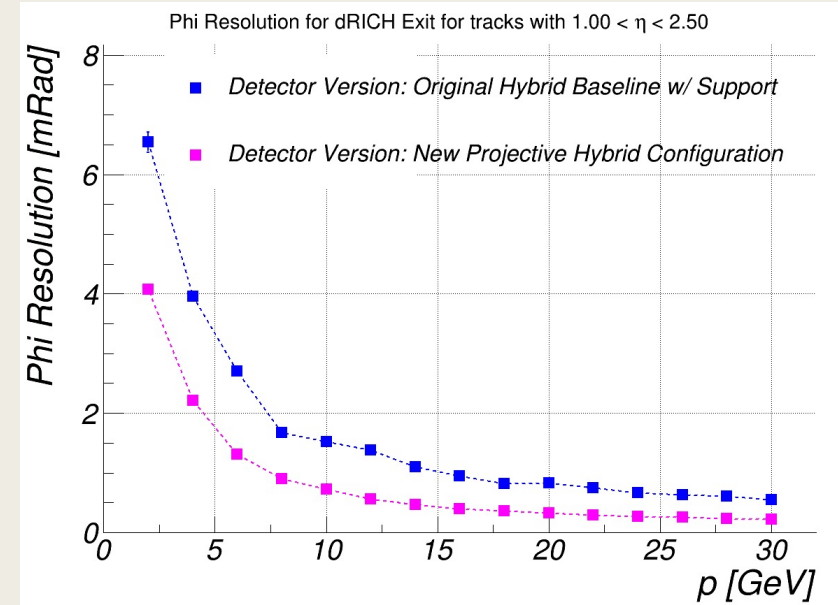
dRICH Azimuthal Angle Resolution

dRICH Entrance Resolutions ($z = +146$ cm)

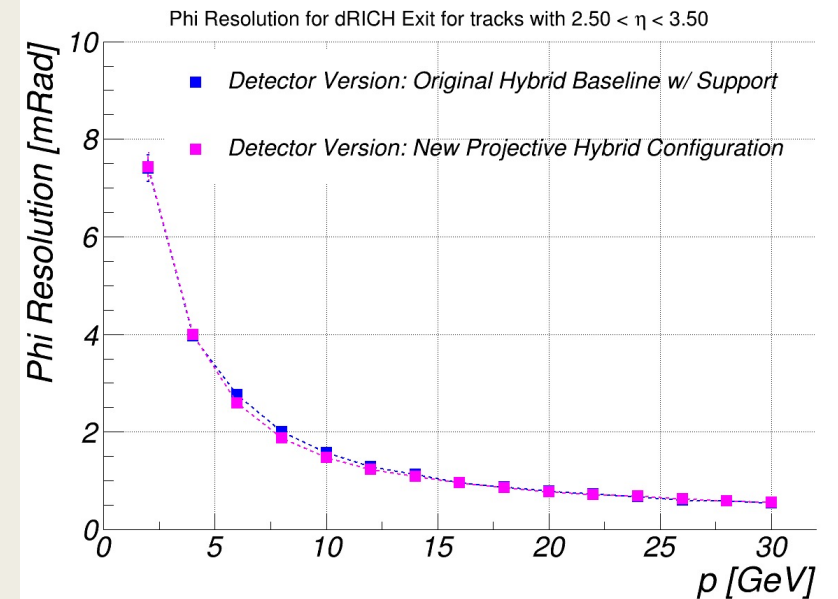


$1.0 < \eta < 2.5$

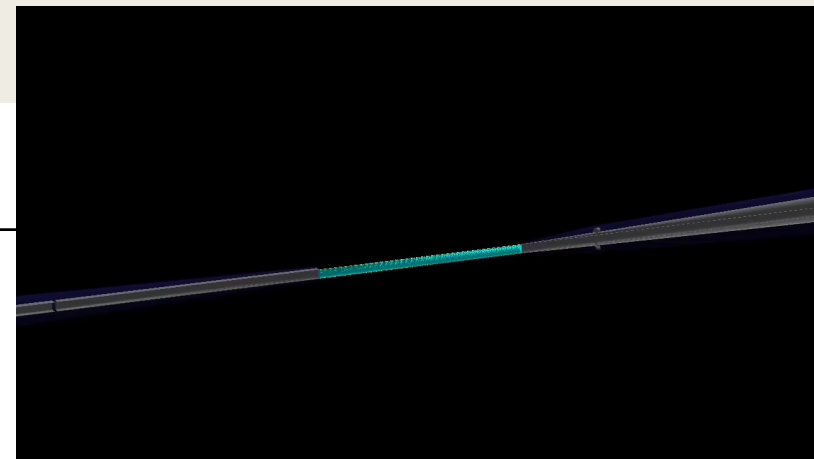
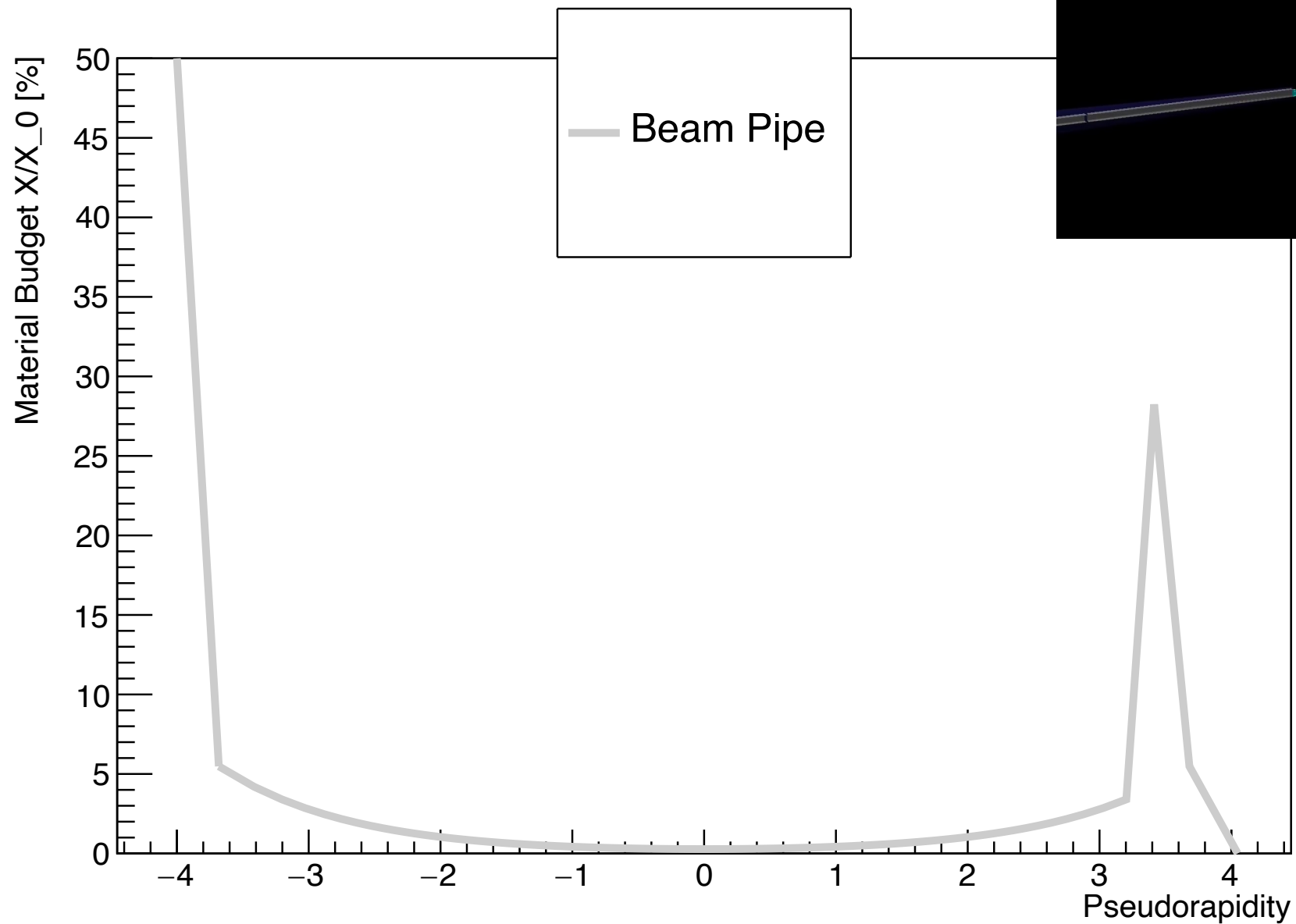
dRICH Exit Resolutions ($z = +301$ cm)



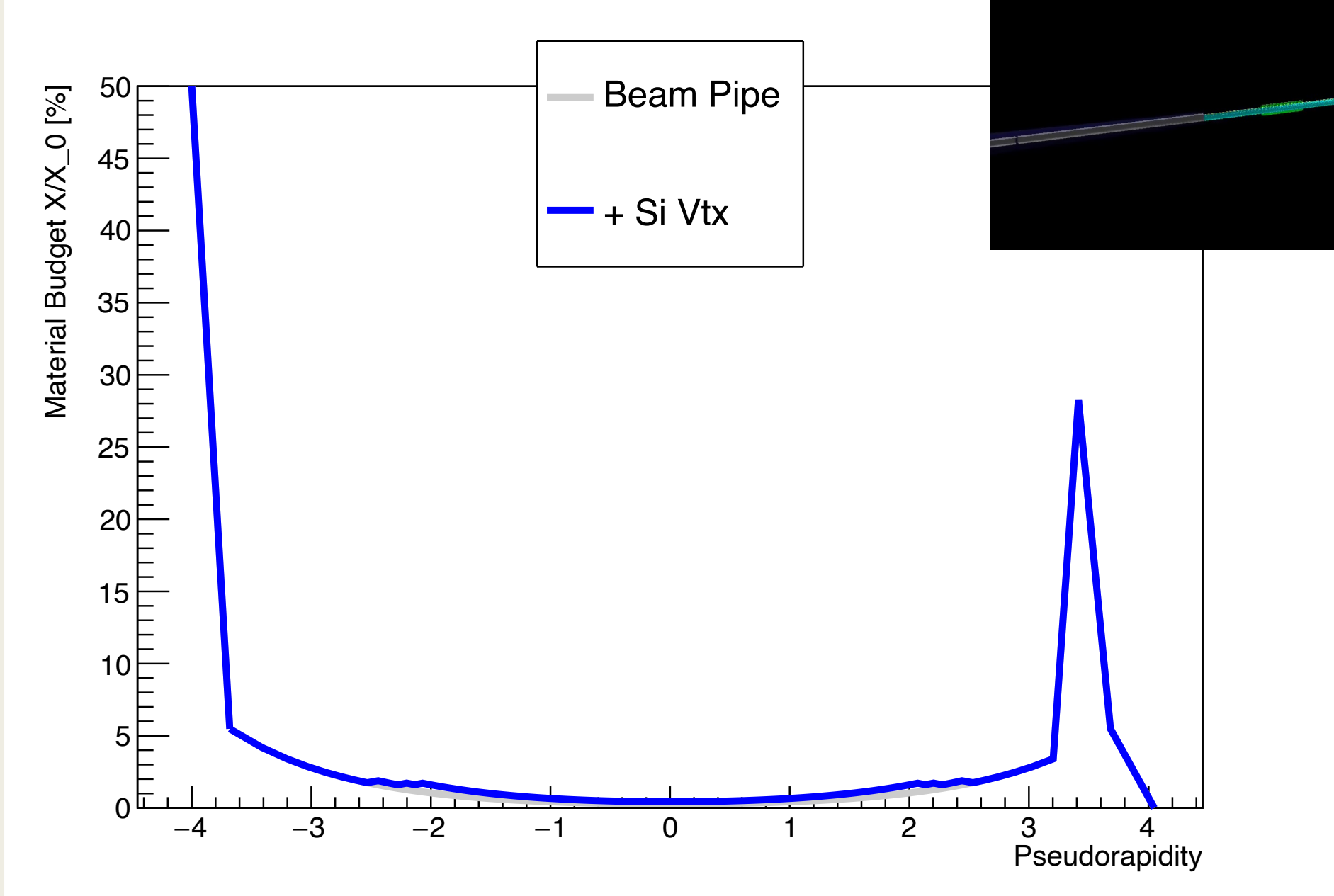
$2.5 < \eta < 3.5$



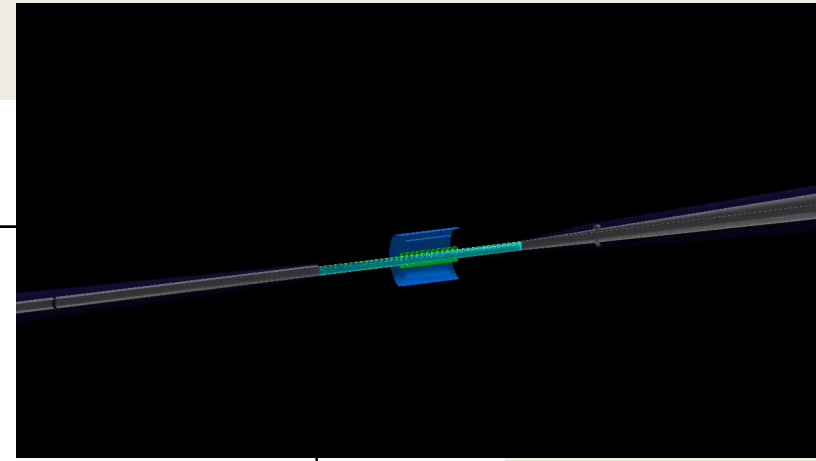
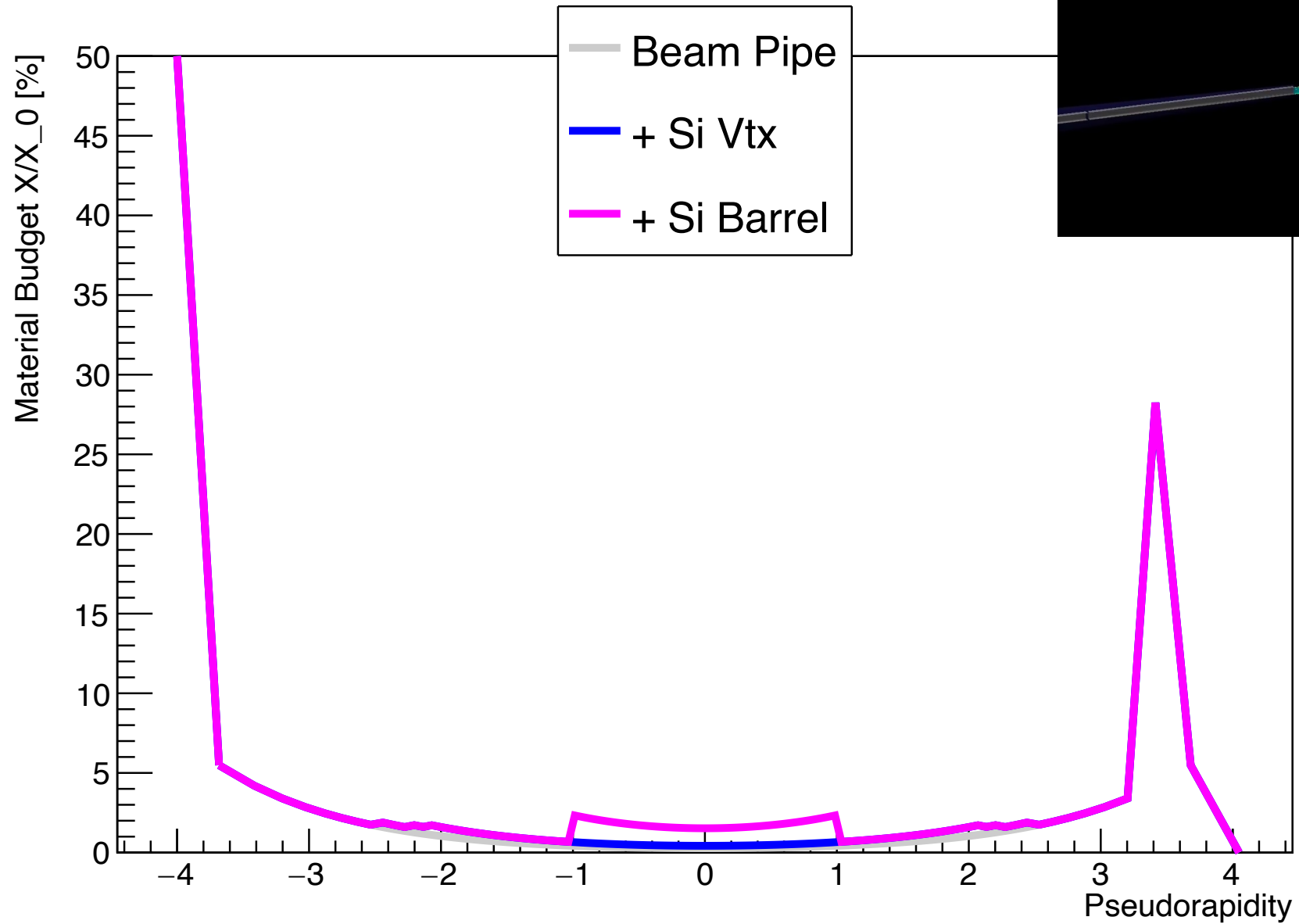
Stacked Material Scan



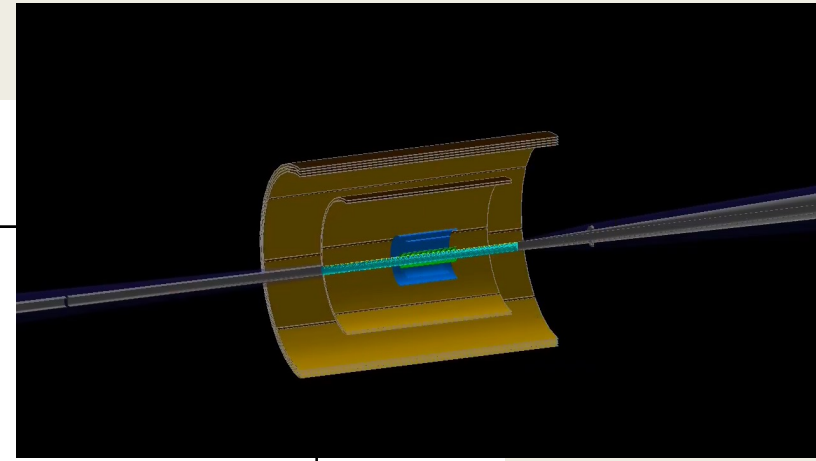
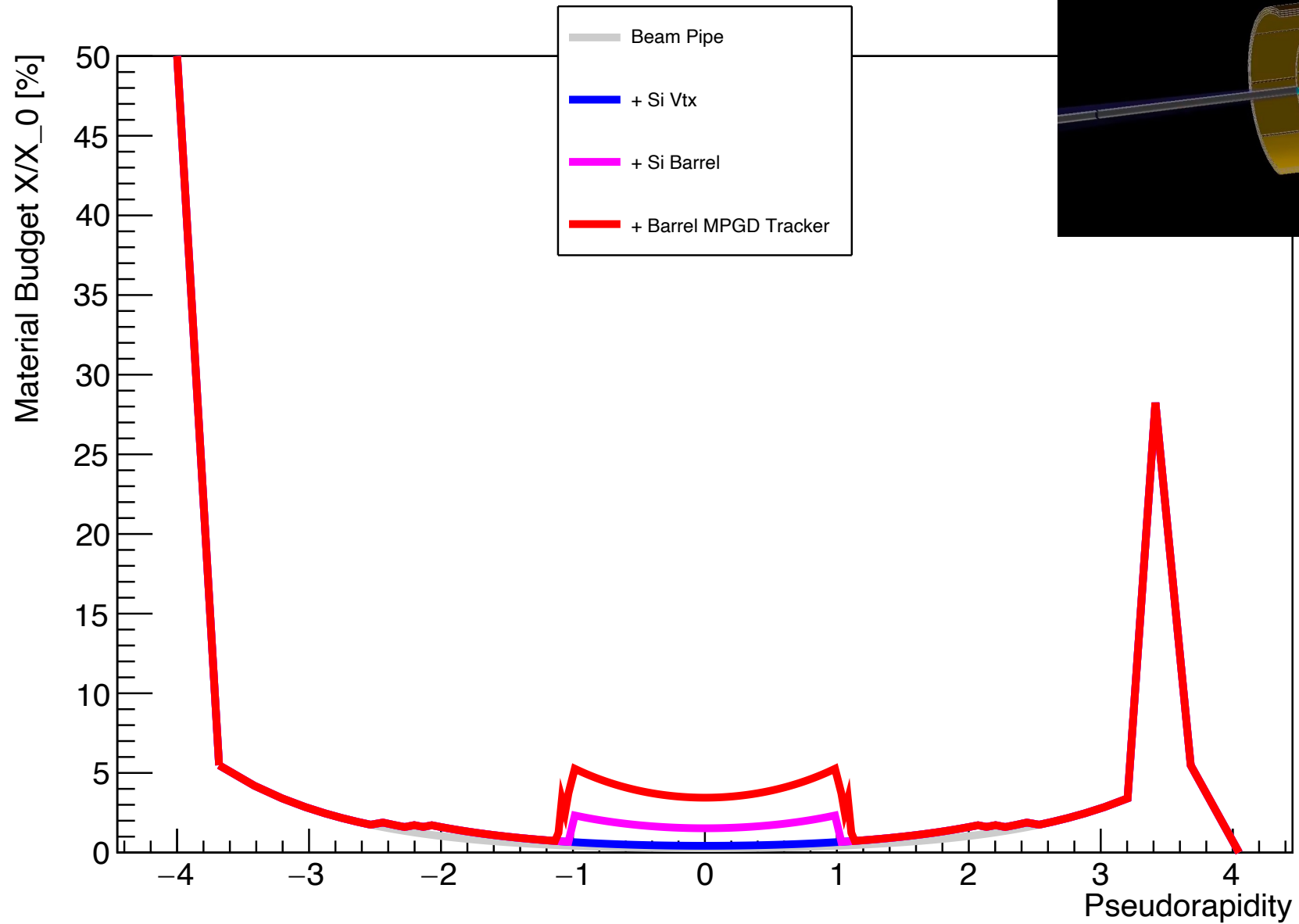
Stacked Material Scan



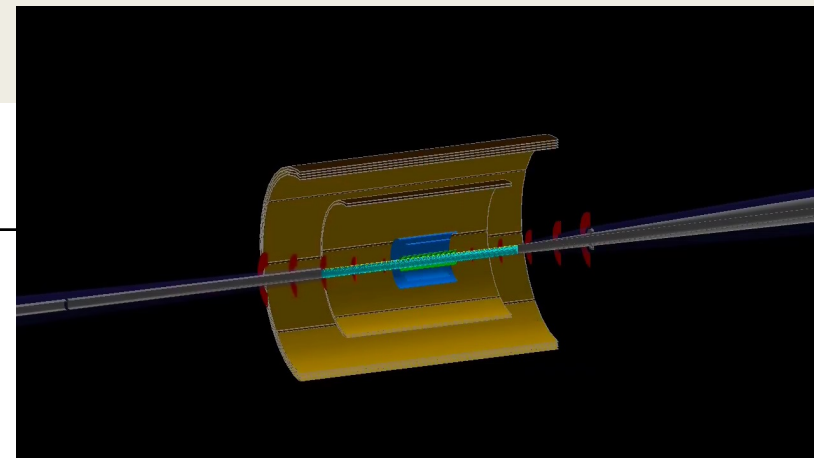
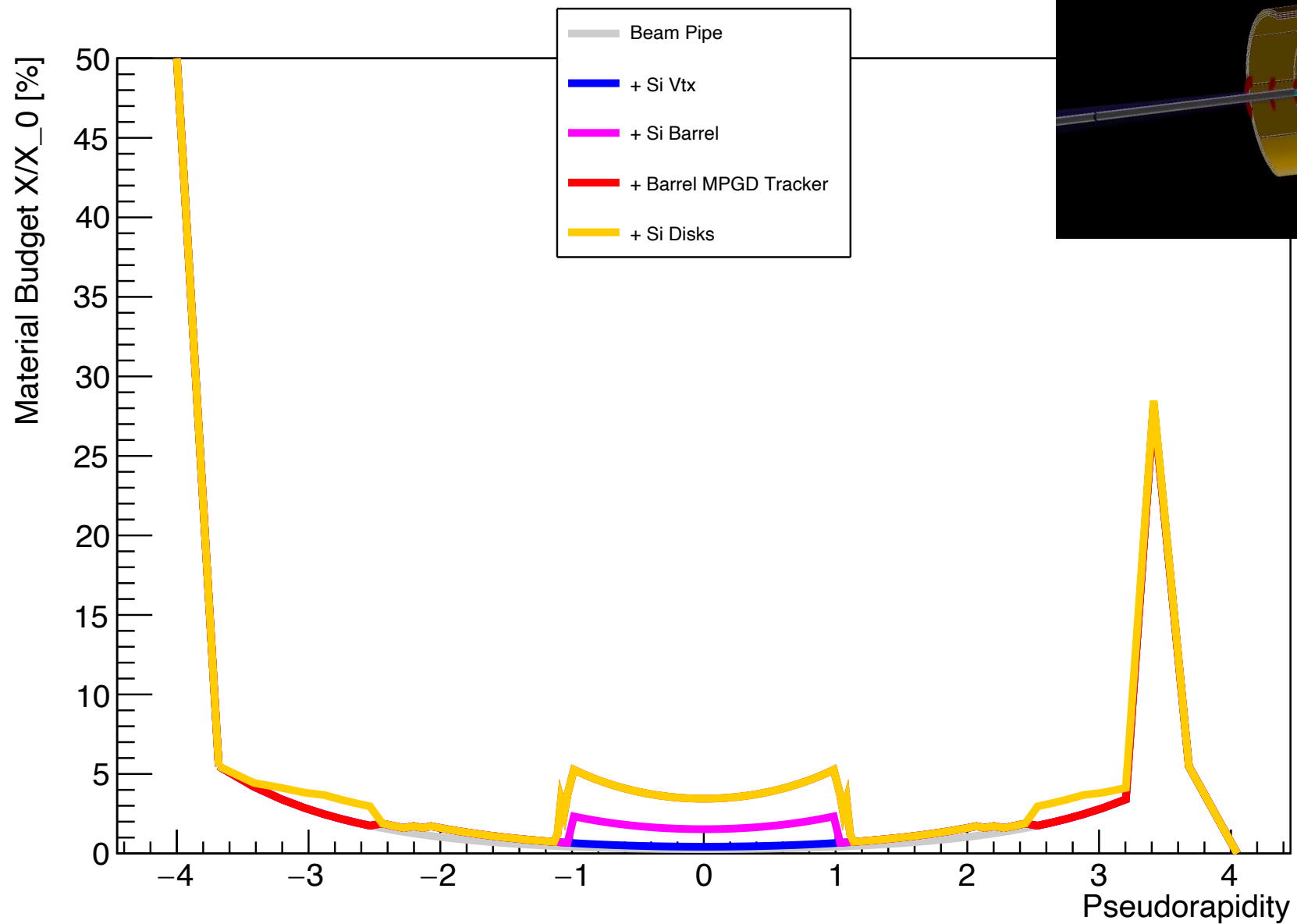
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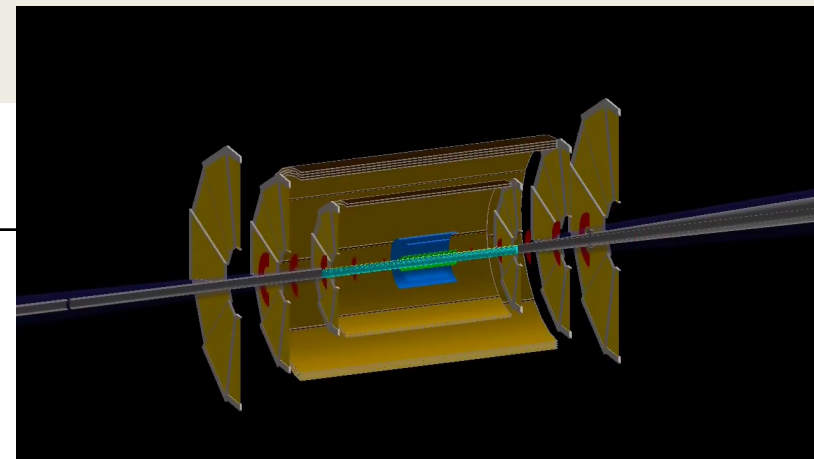
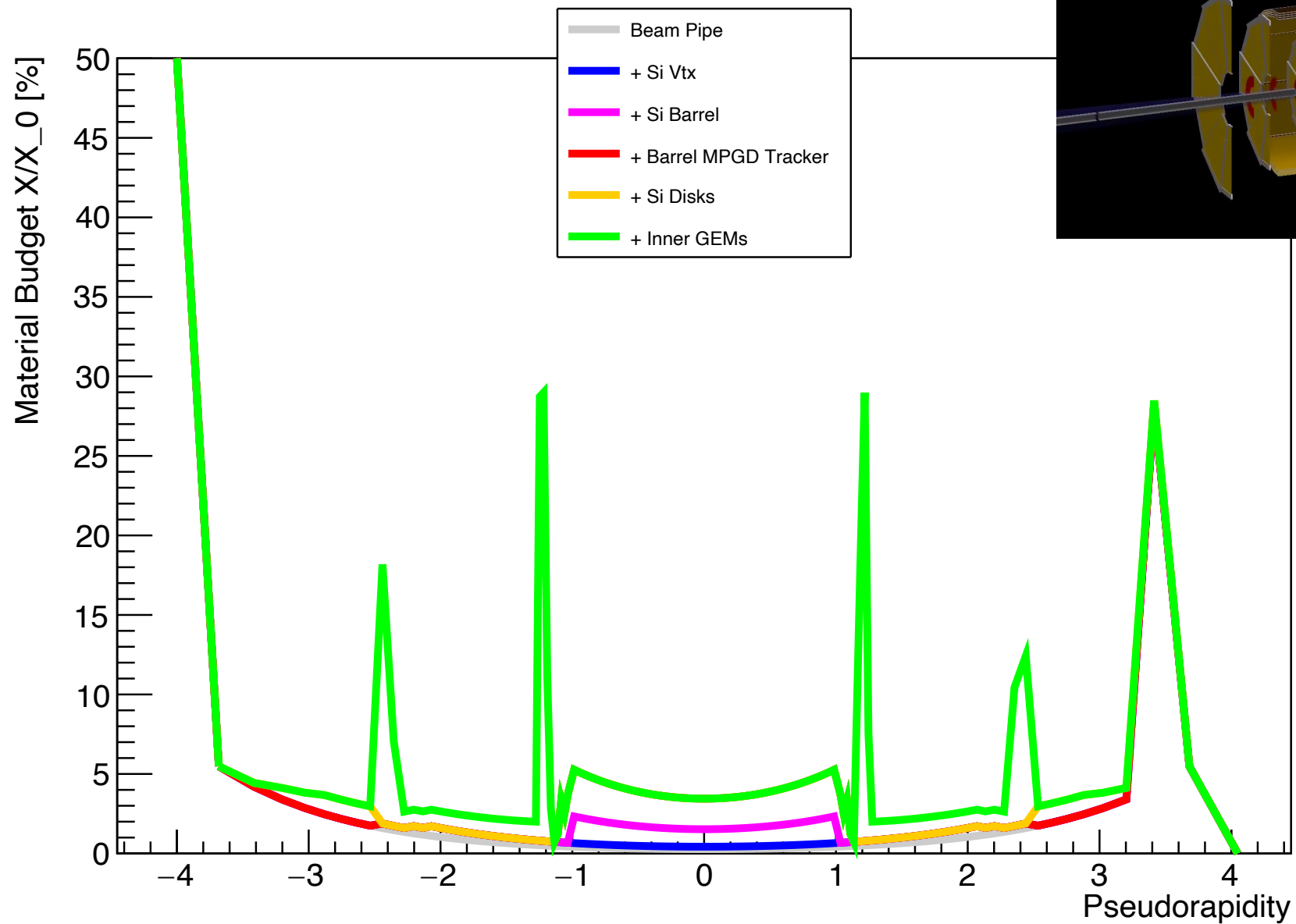
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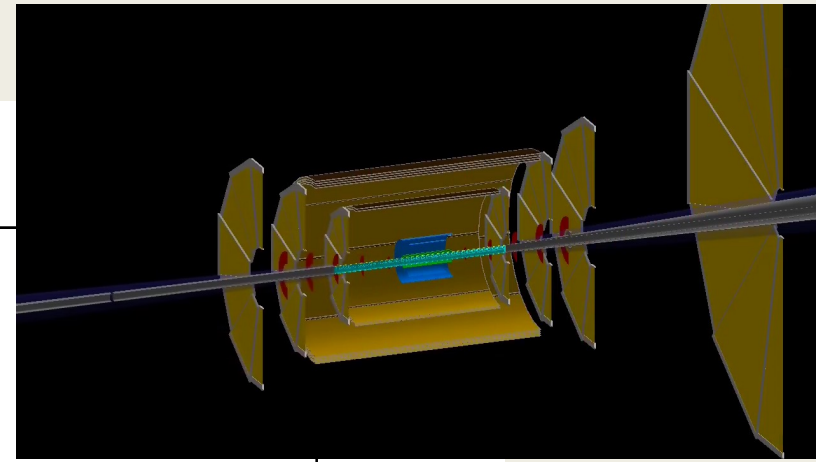
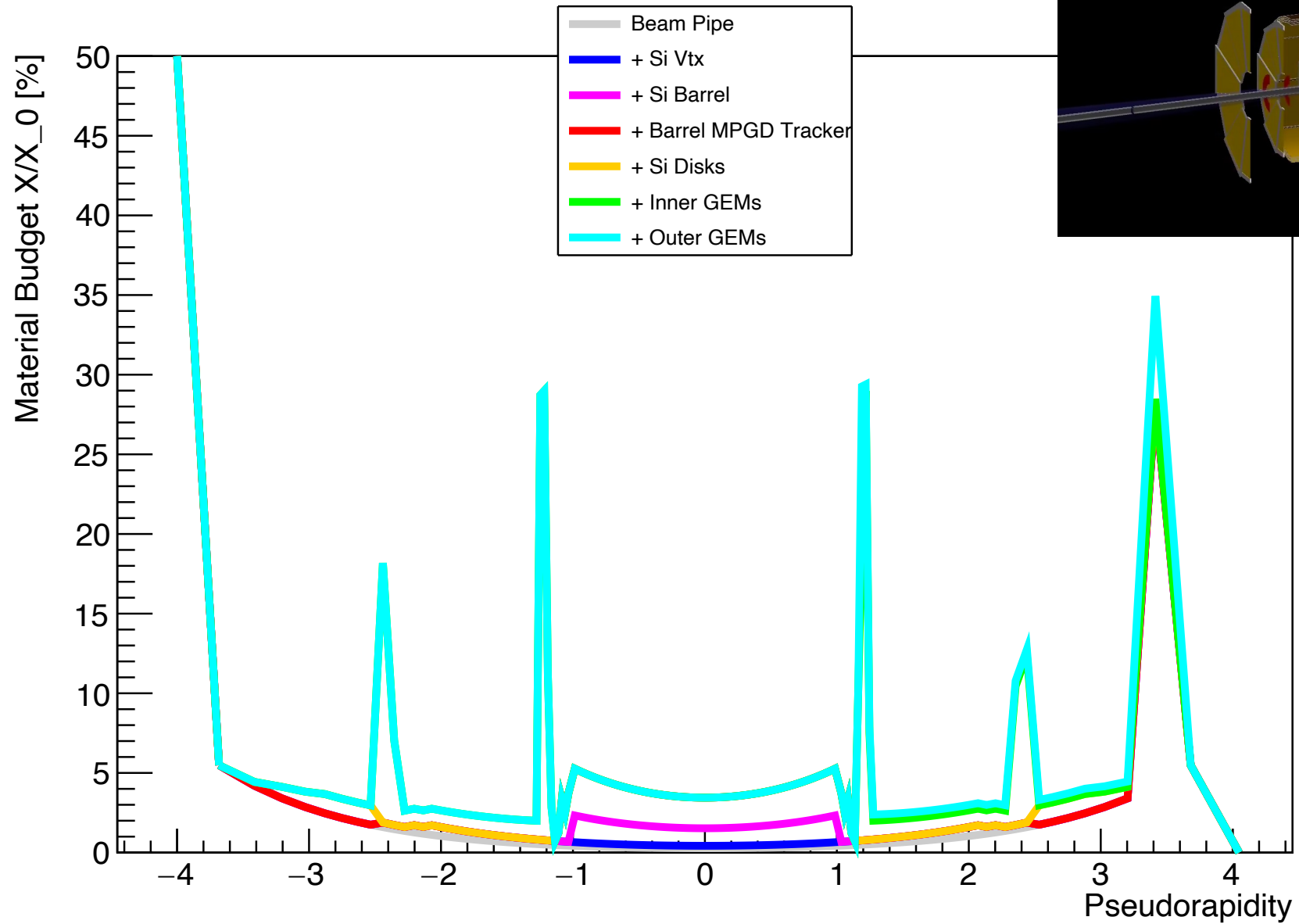
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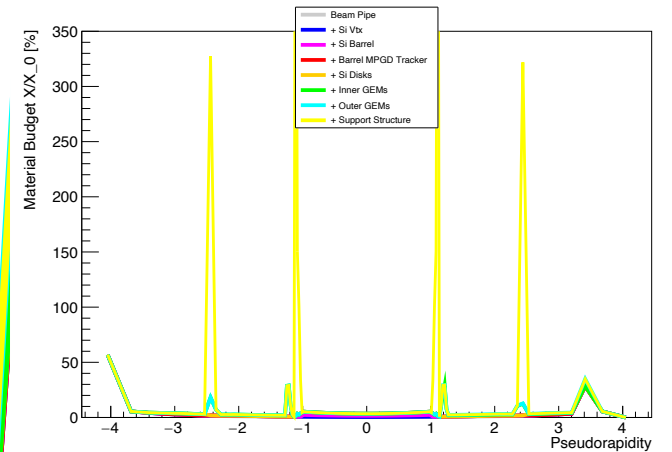
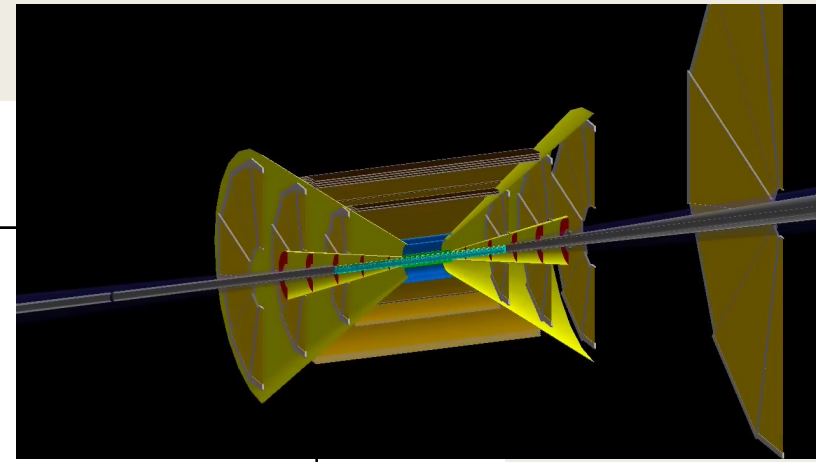
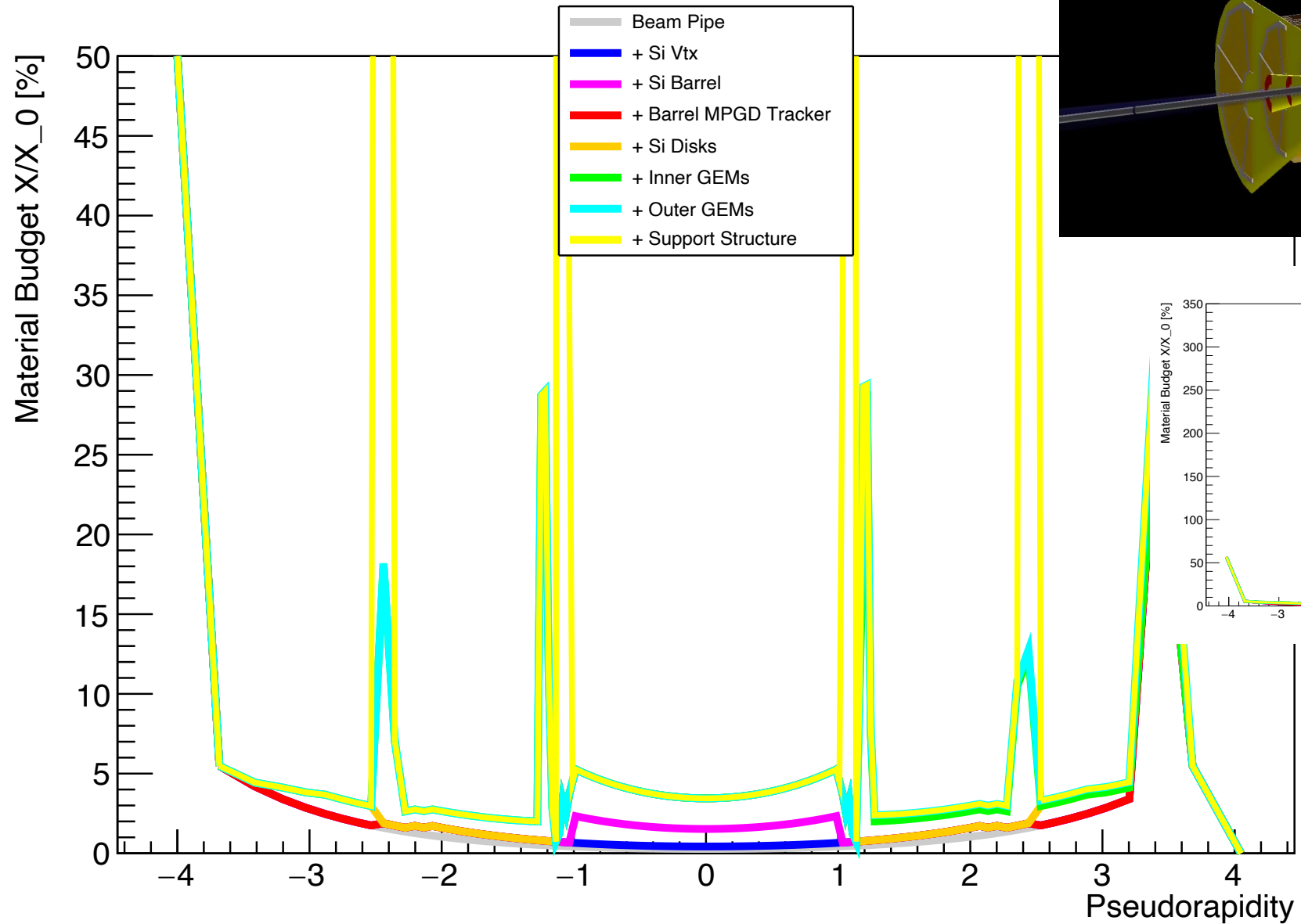
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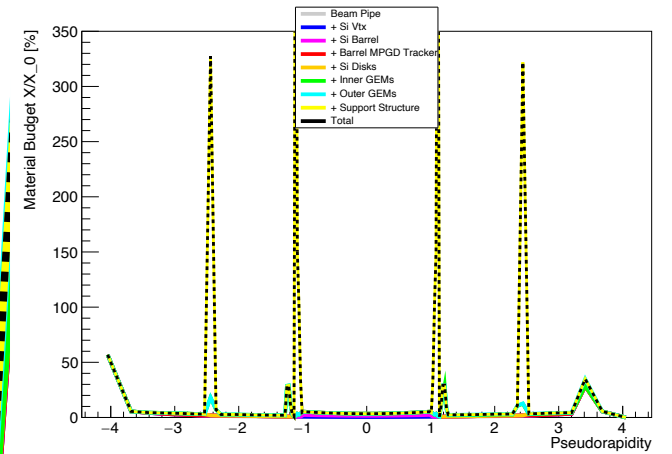
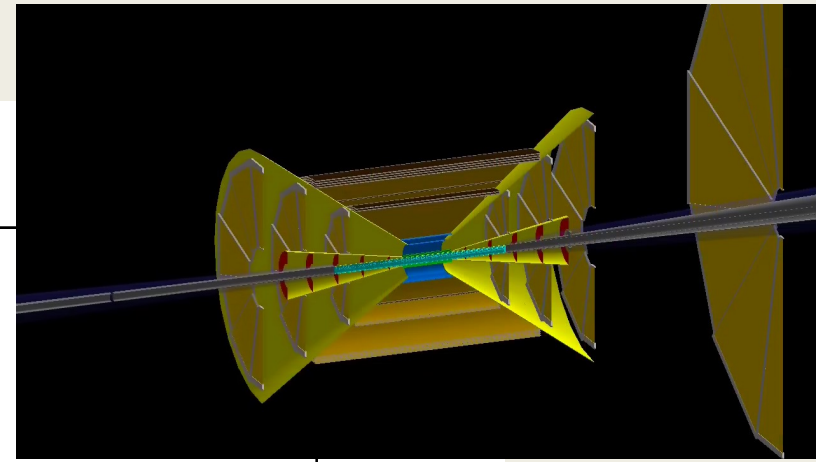
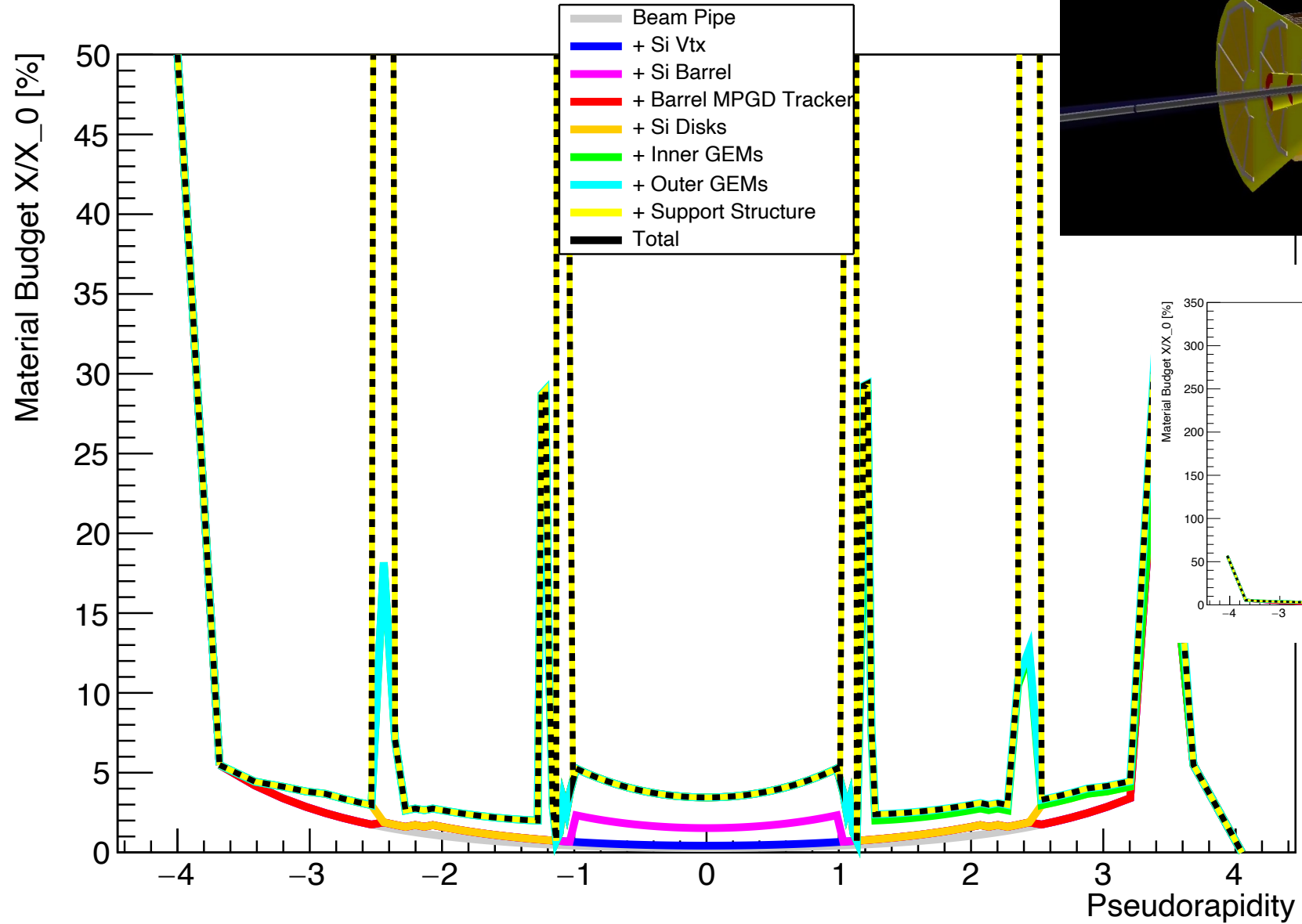
Stacked Material Scan



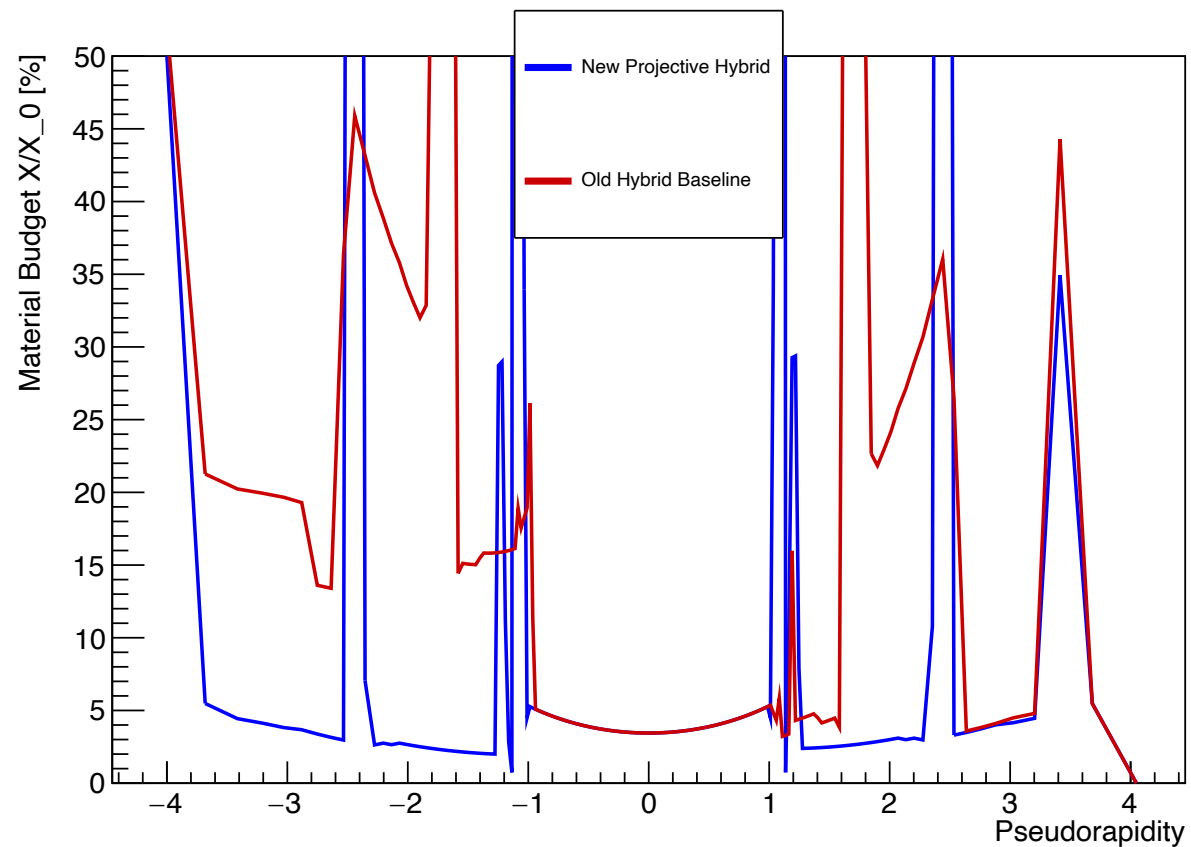
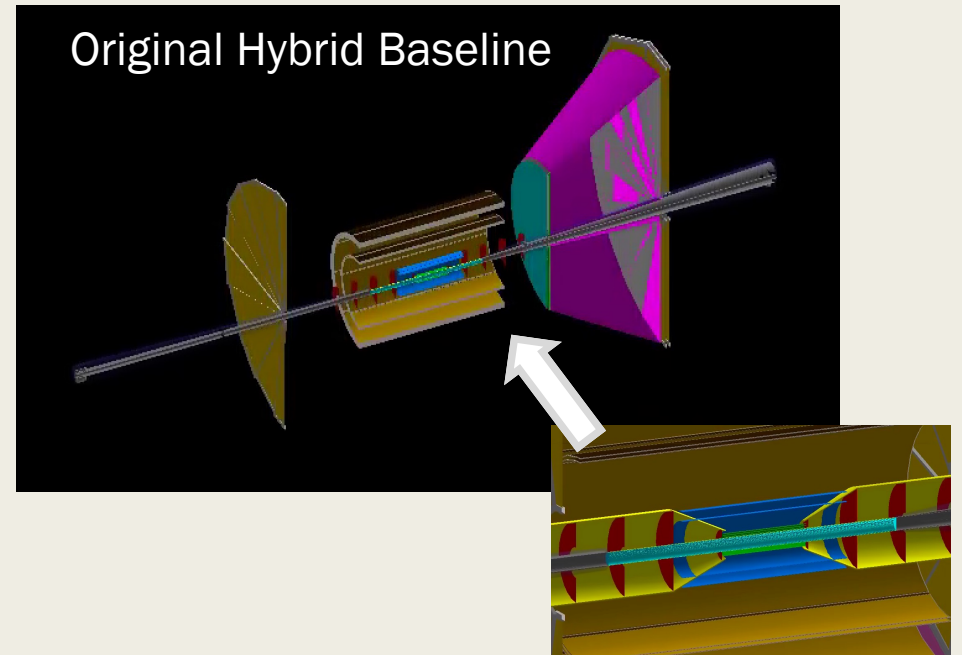
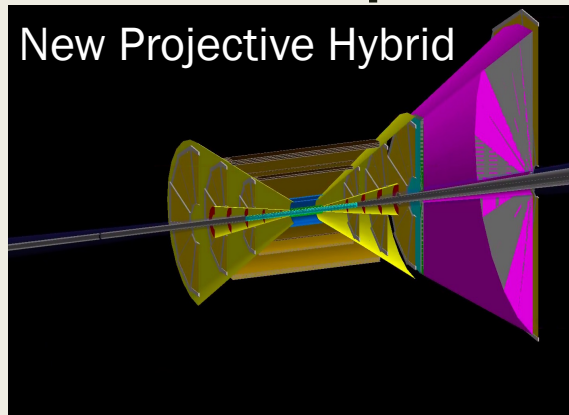
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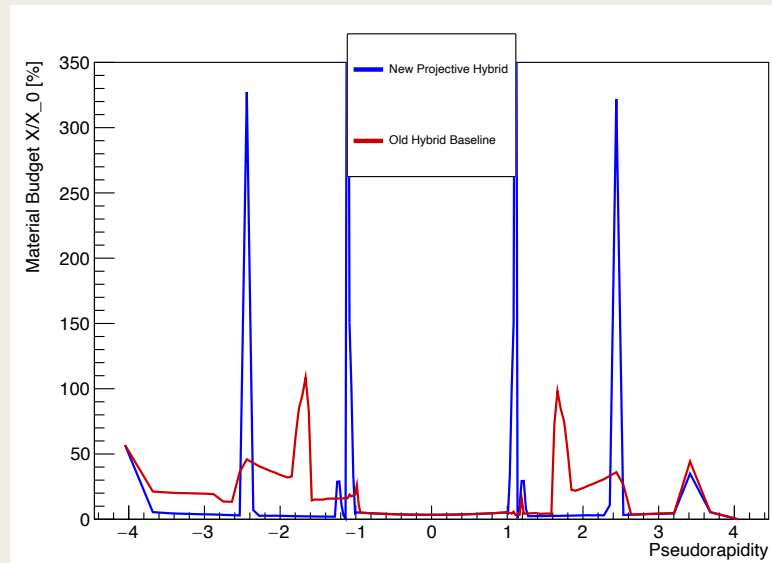
Stacked Material Scan



Material Scan Comparison



Full Scale

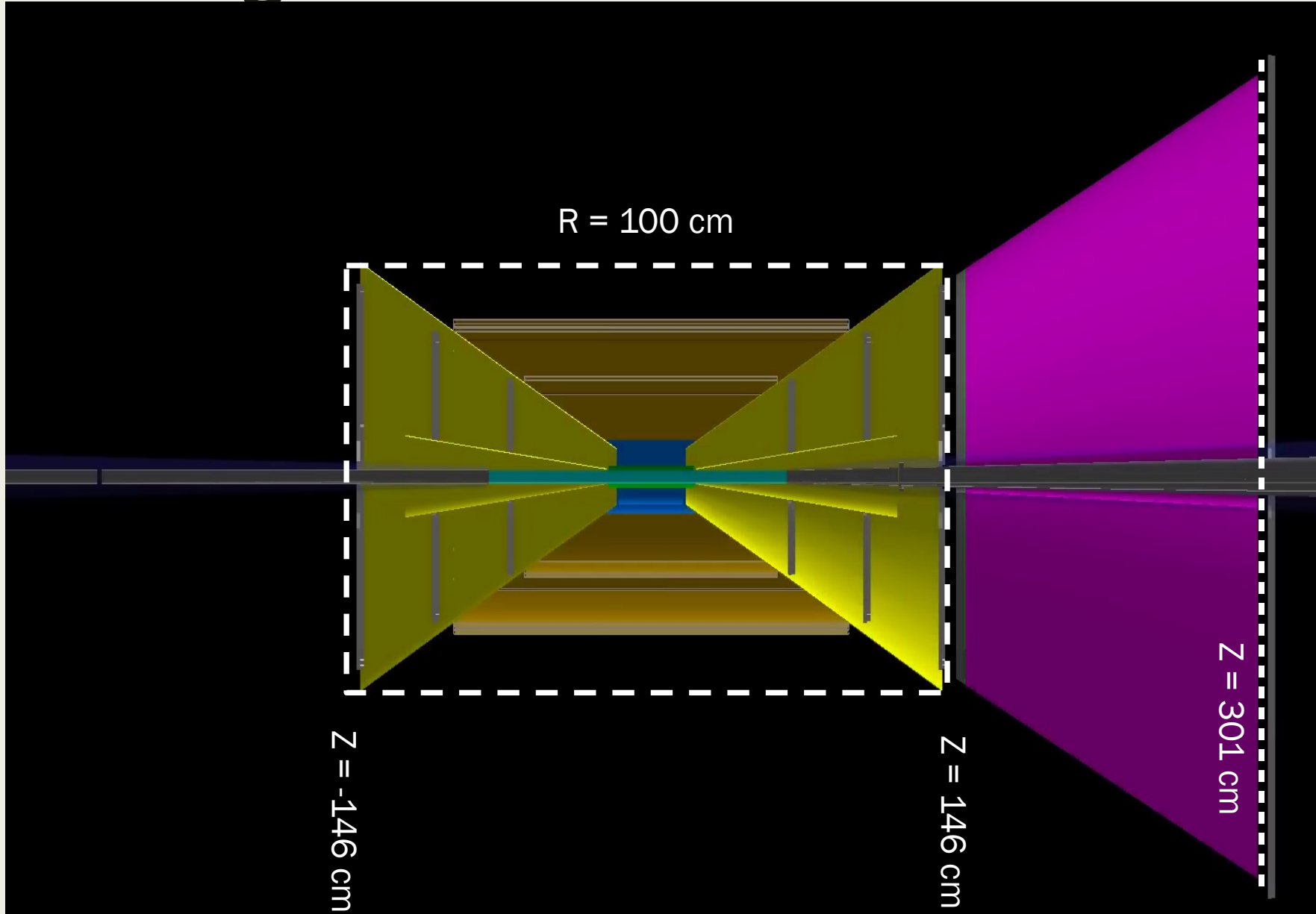


Conclusion

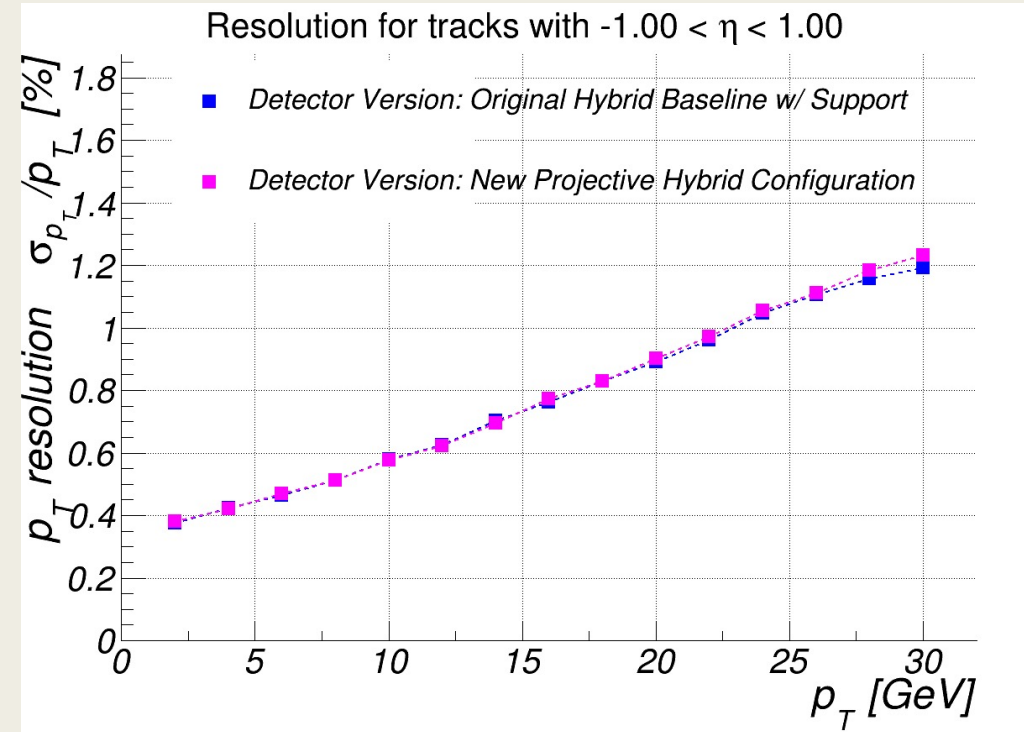
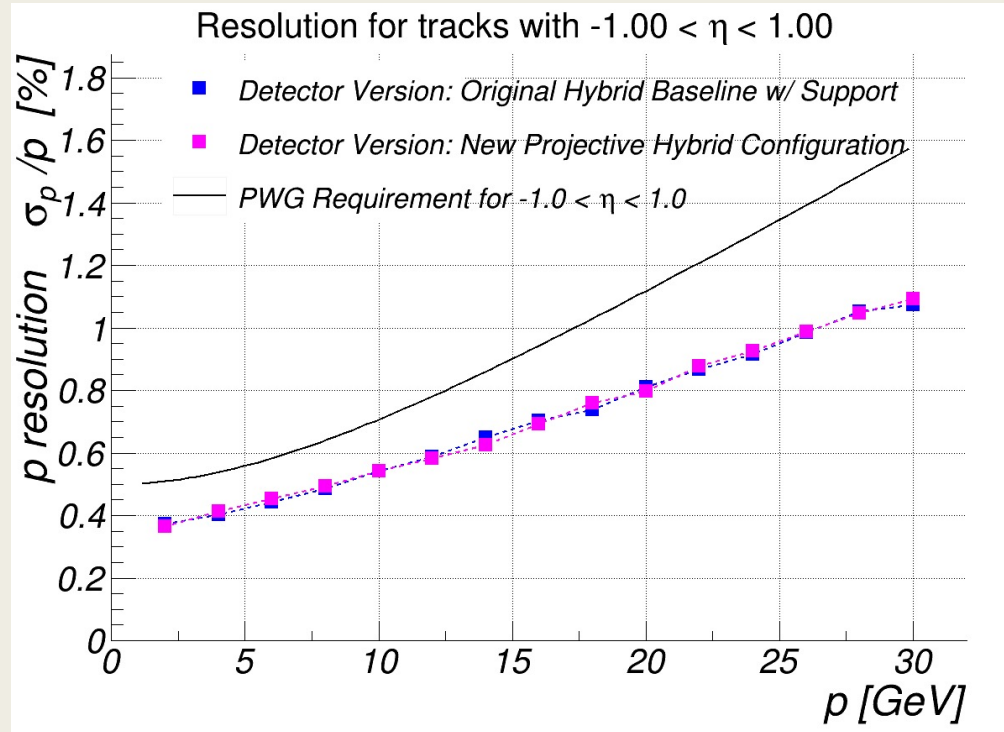
- New projective configuration for the hybrid detector outperforms the original hybrid baseline configuration in nearly every metric.
- Less material in regions $1.3 < |\eta| < 2.3$ and $|\eta| > 2.6$
- Propose using this new configuration as the hybrid baseline going forward
- To Do:
 - *Simulate low transverse momentum pions for vertex pointing resolutions*
 - *Optimization of the configuration*

BACKUP SLIDES

Angular Resolution Locations

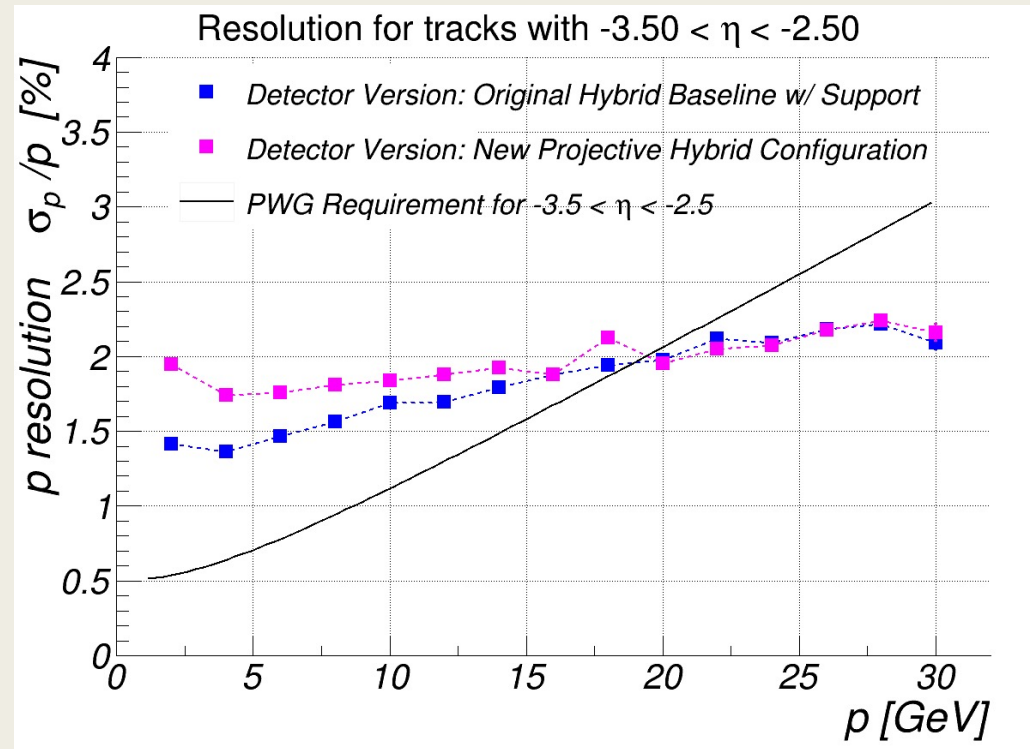


Central Region Comparisons

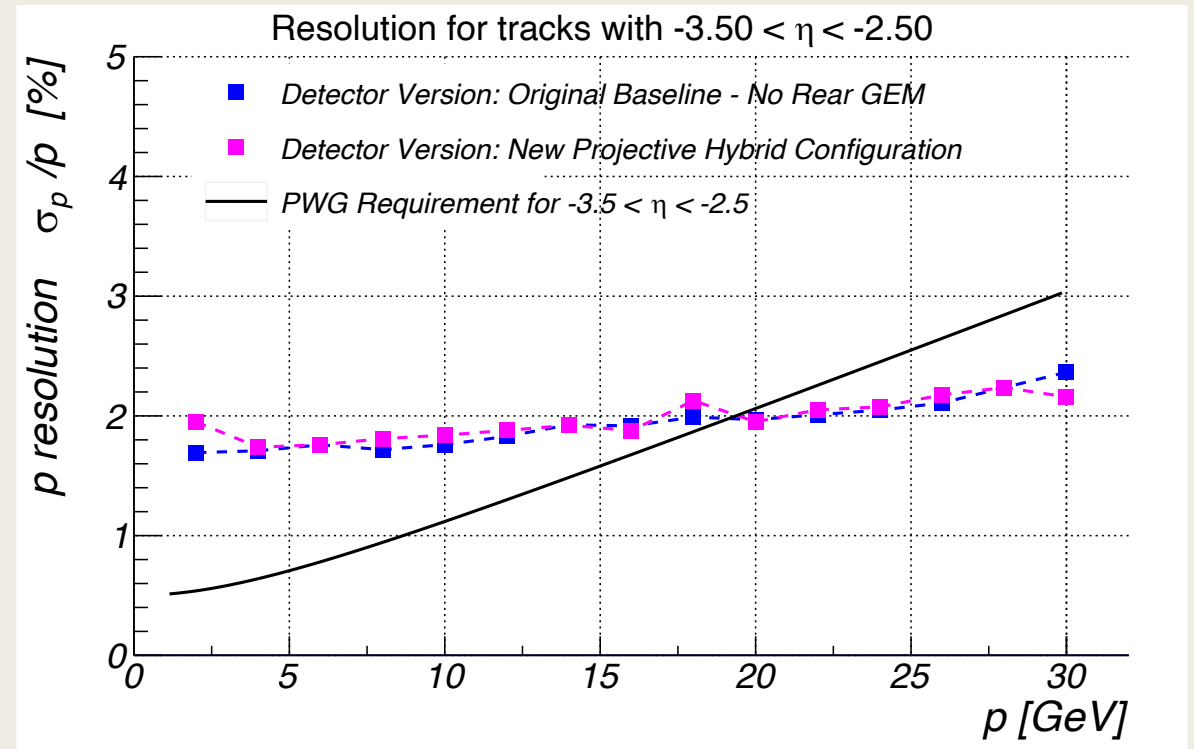


Rear GEM in Baseline Effect on Resolution – P Res.

With rear GEM at $z = -190$ cm in Baseline

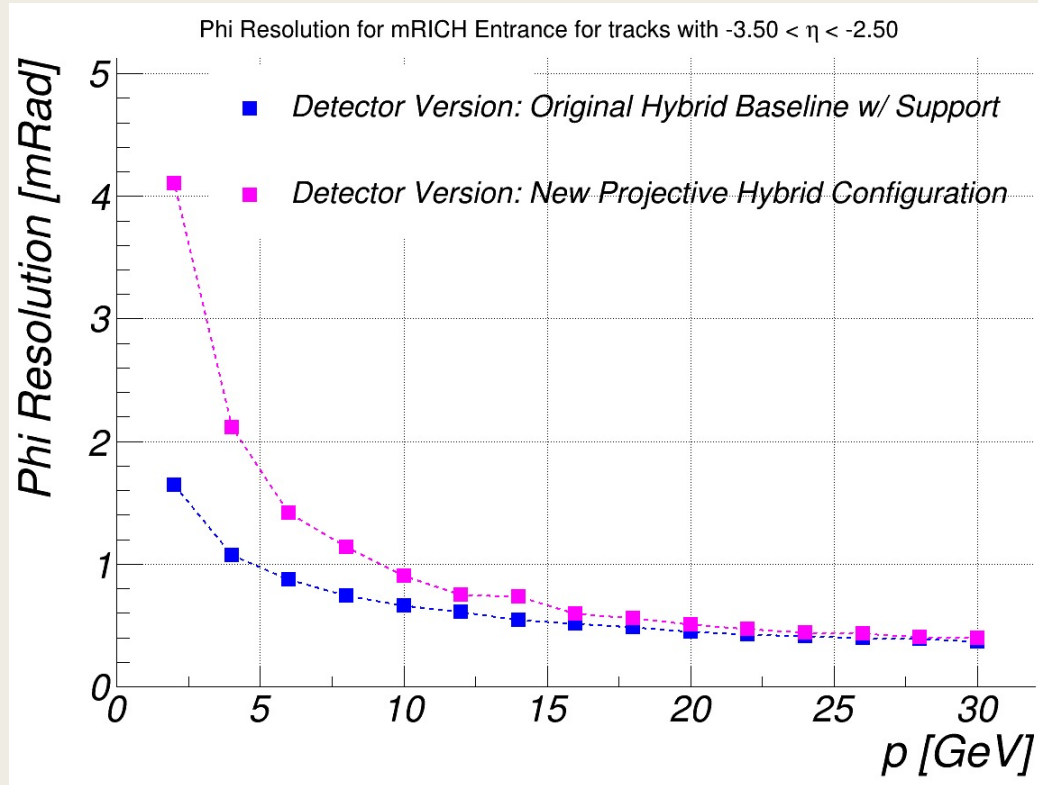


Without rear GEM at $z = -190$ cm in Baseline

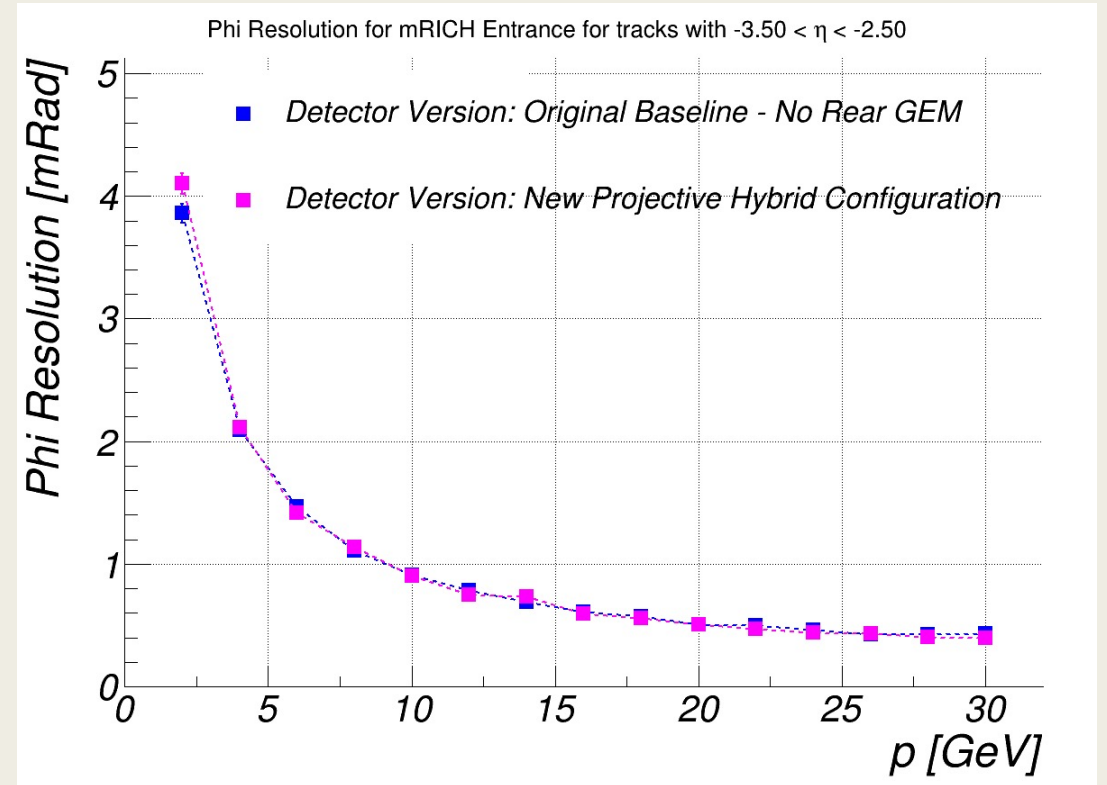


Rear GEM in Baseline Effect on Resolution – Phi Res.

With rear GEM at $z = -190$ cm in Baseline

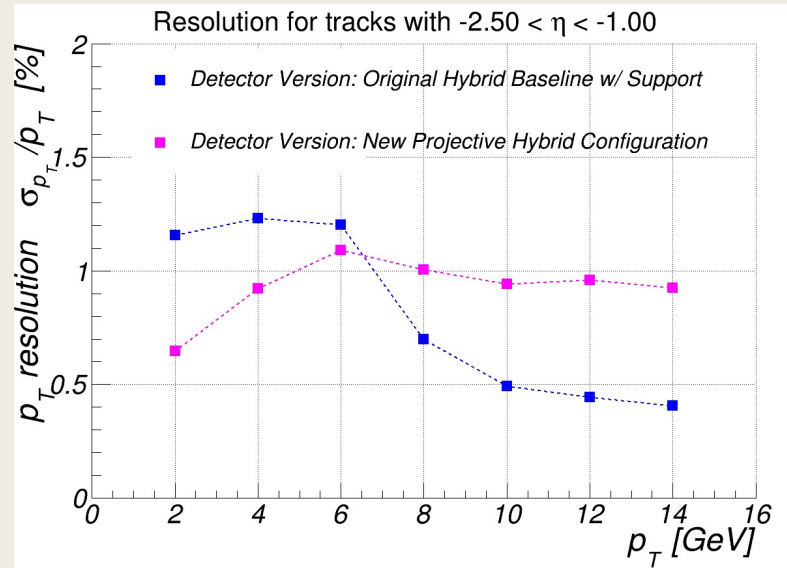


Without rear GEM at $z = -190$ cm in Baseline

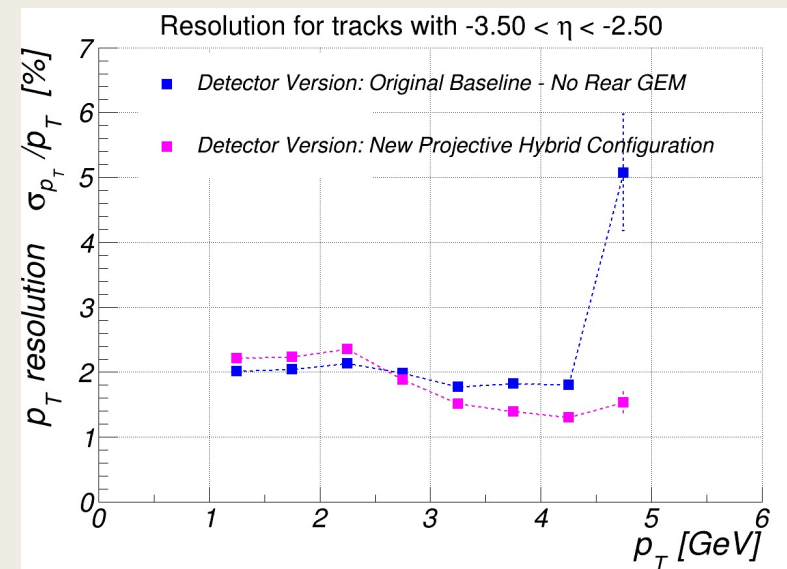
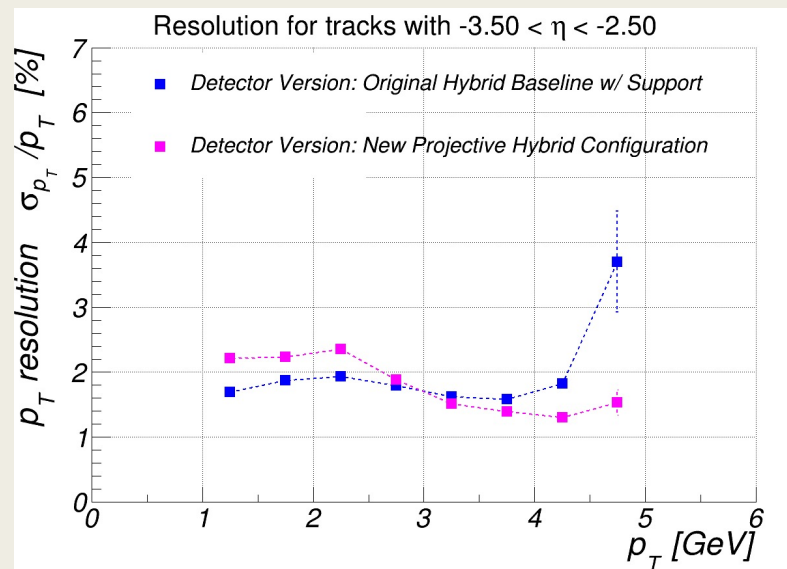
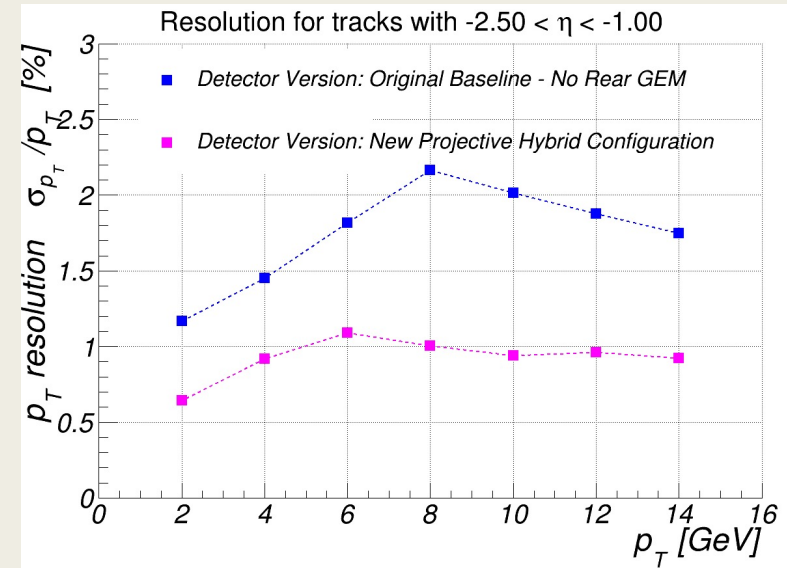


Rear GEM in Baseline Effect on Resolution – Pt Res.

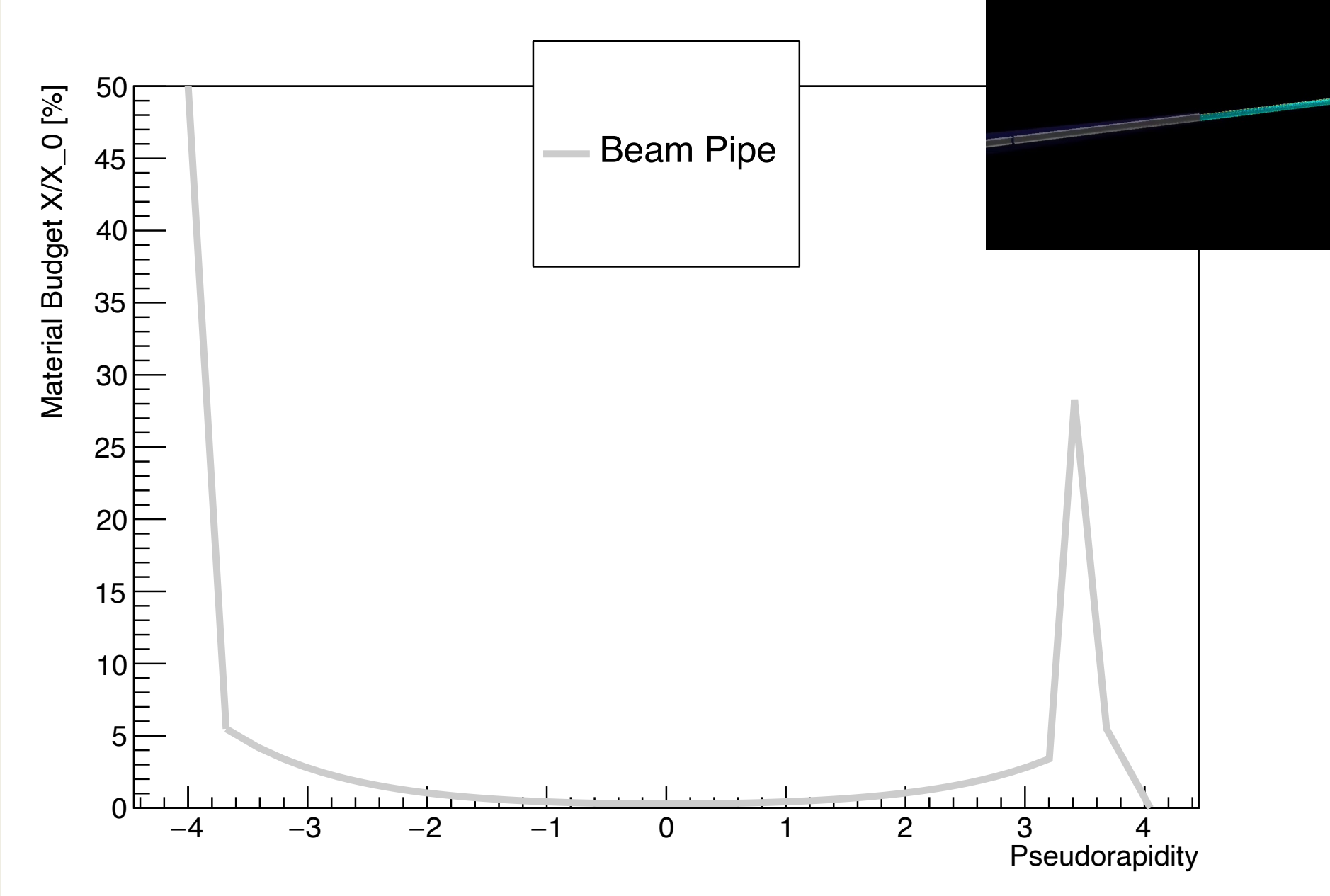
With rear GEM at $z = -190$ cm in Baseline



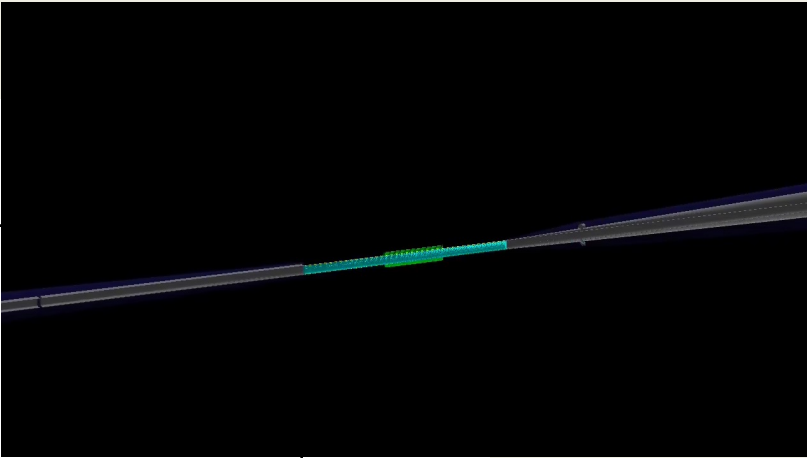
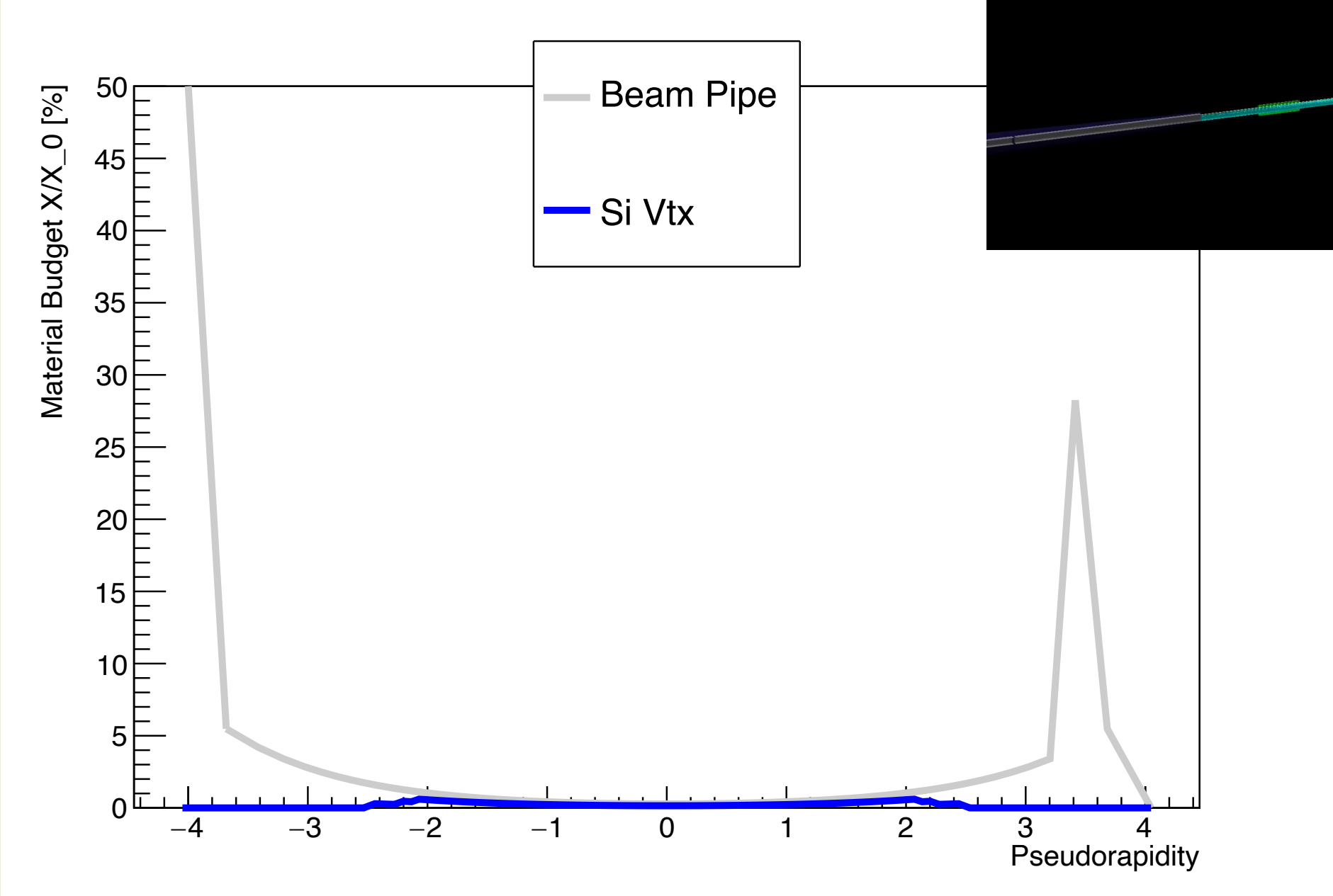
Without rear GEM at $z = -190$ cm in Baseline



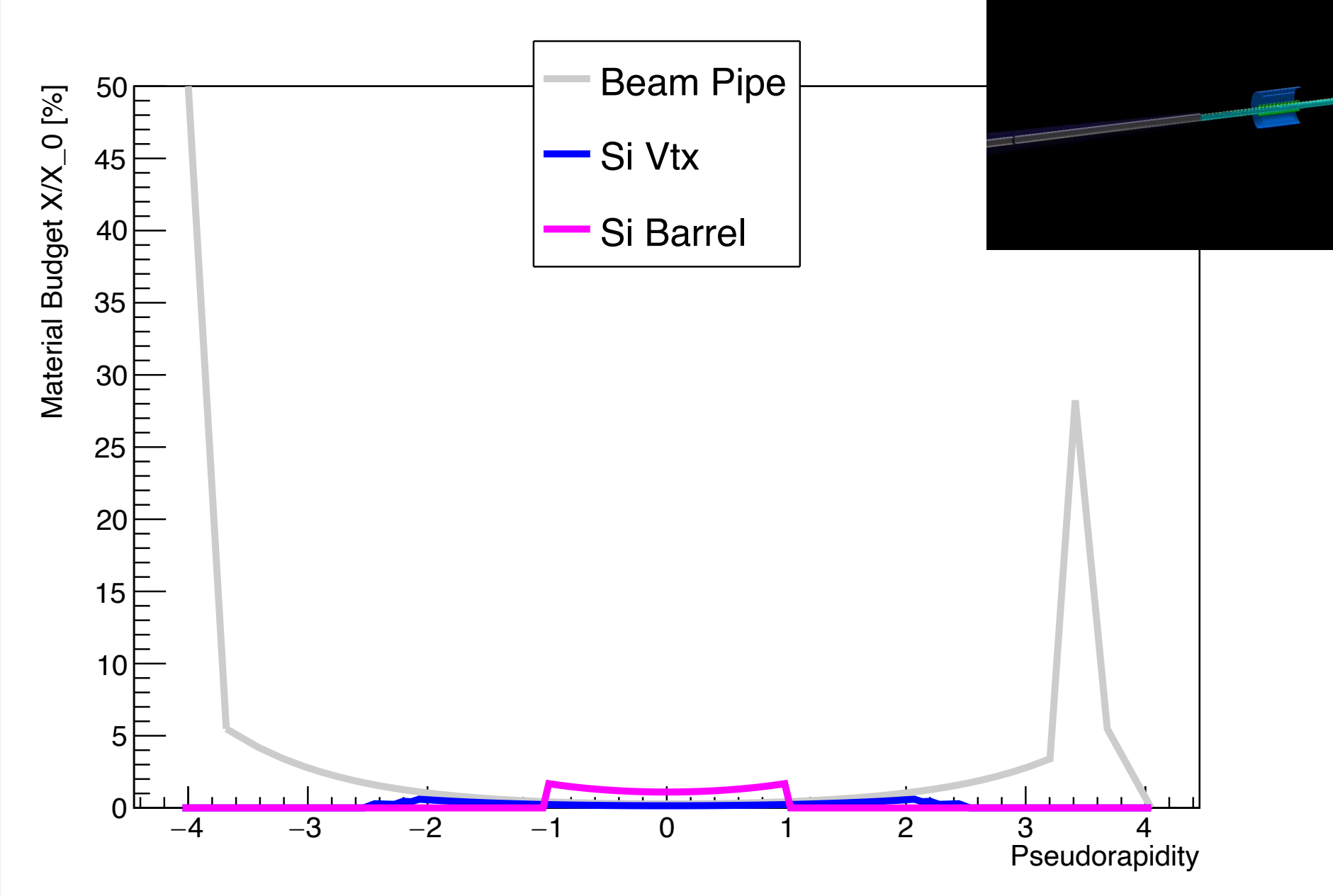
Material Scan



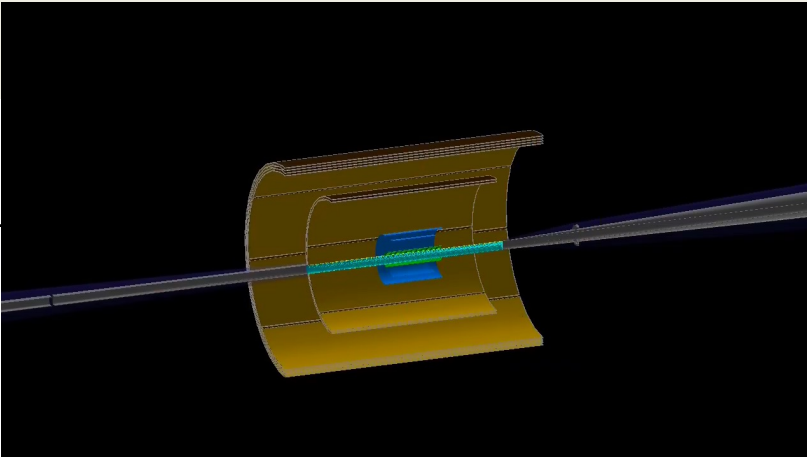
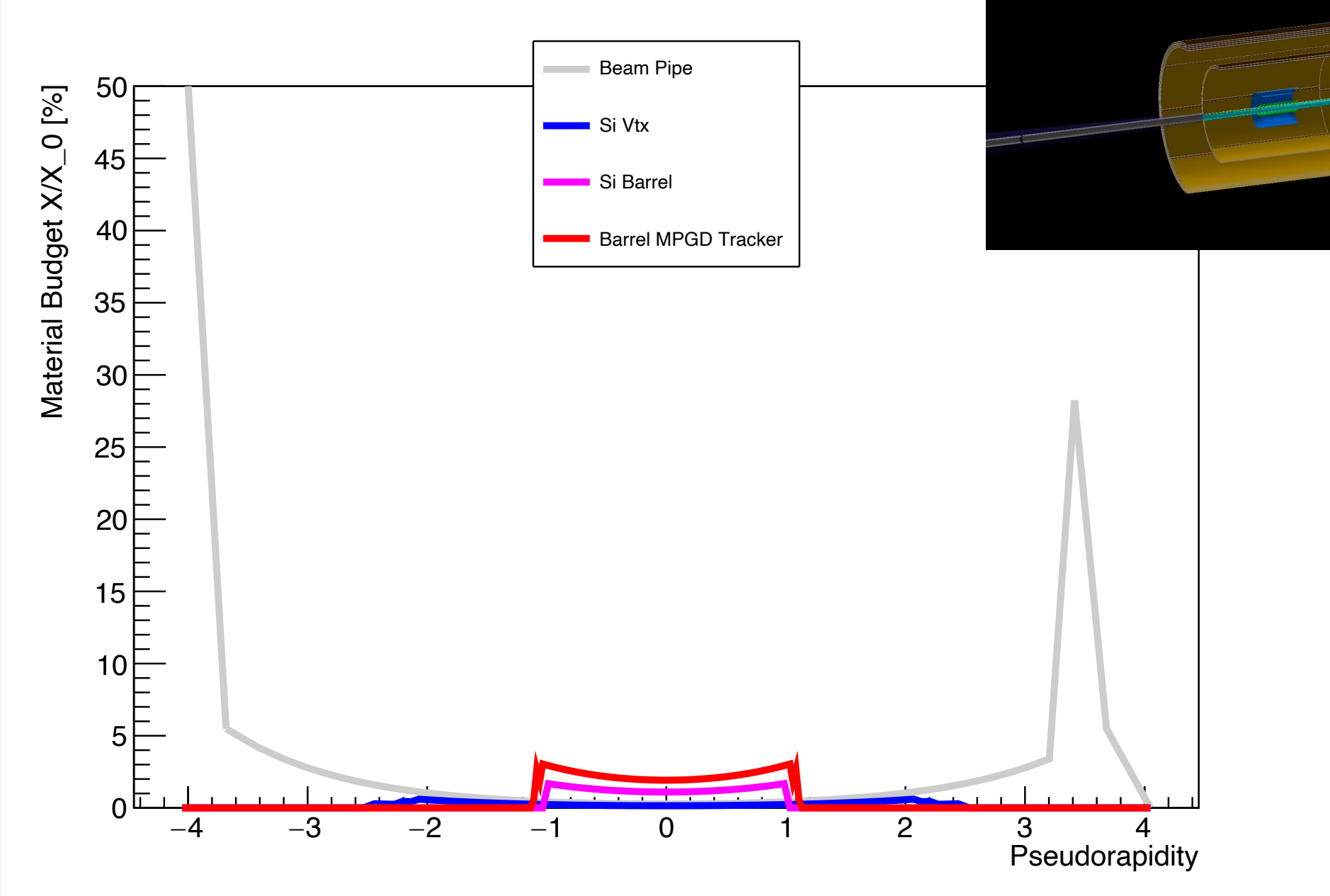
Material Scan



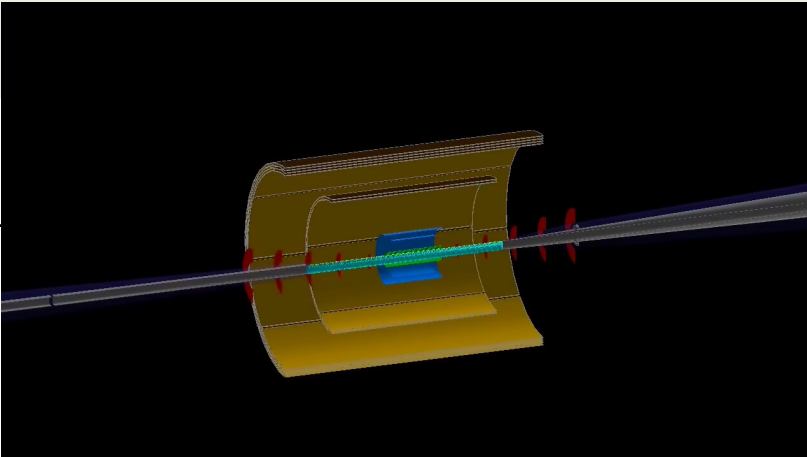
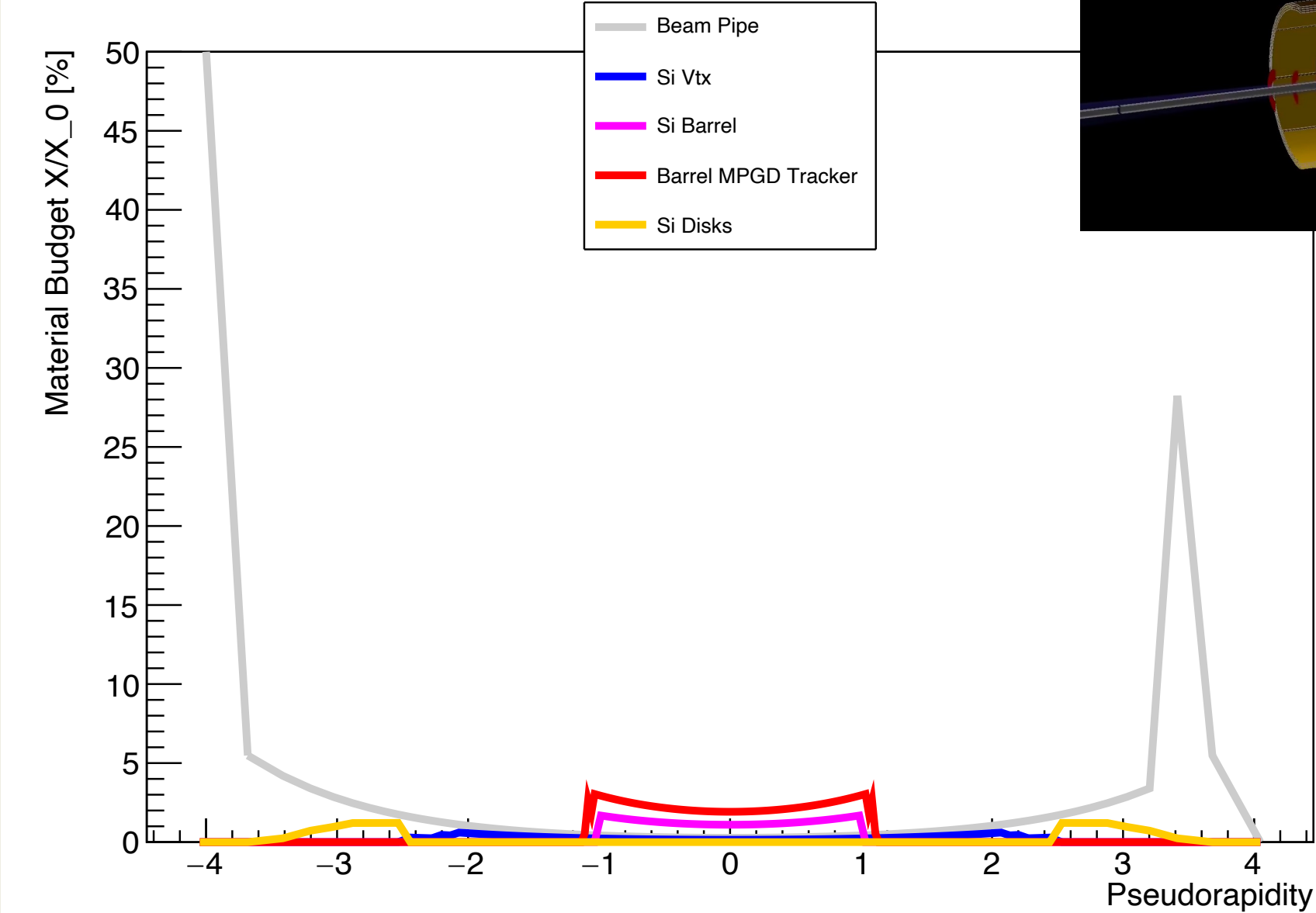
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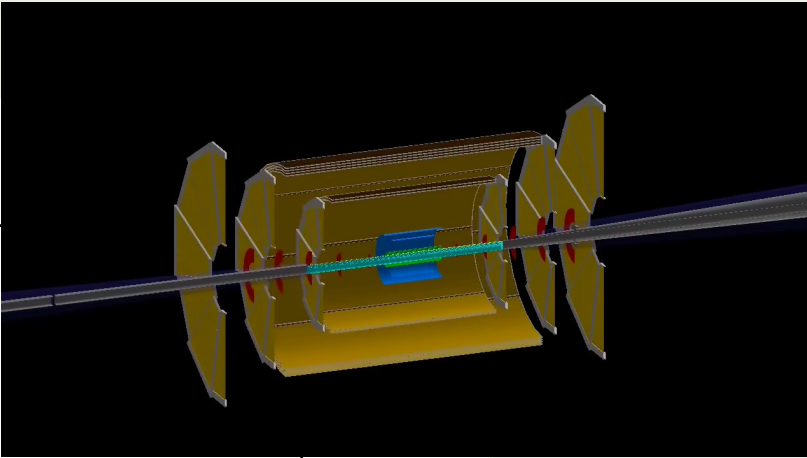
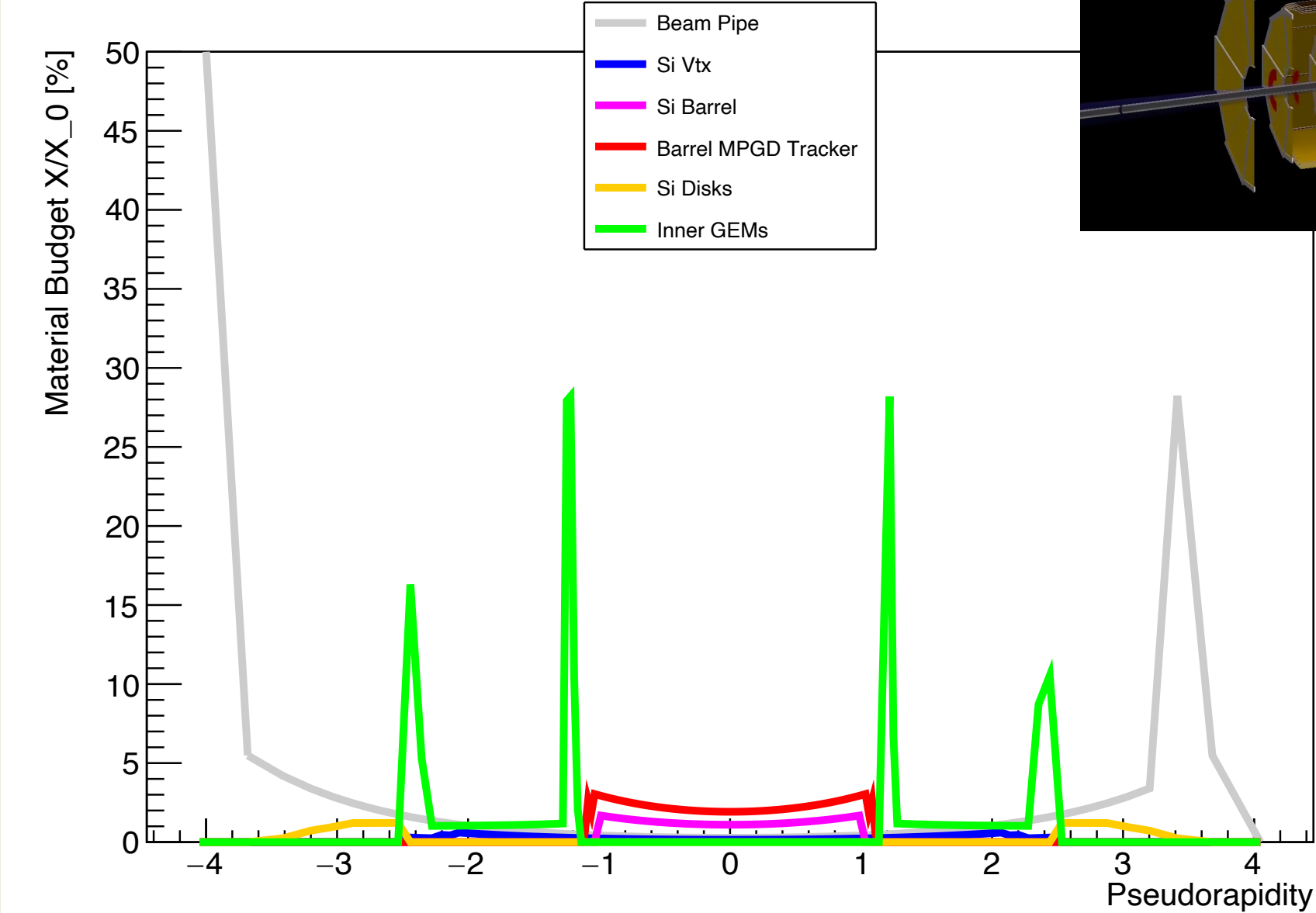
Material Scan



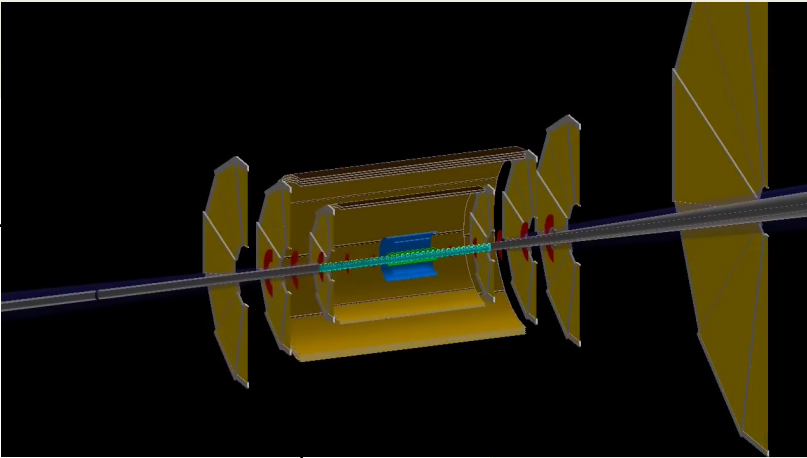
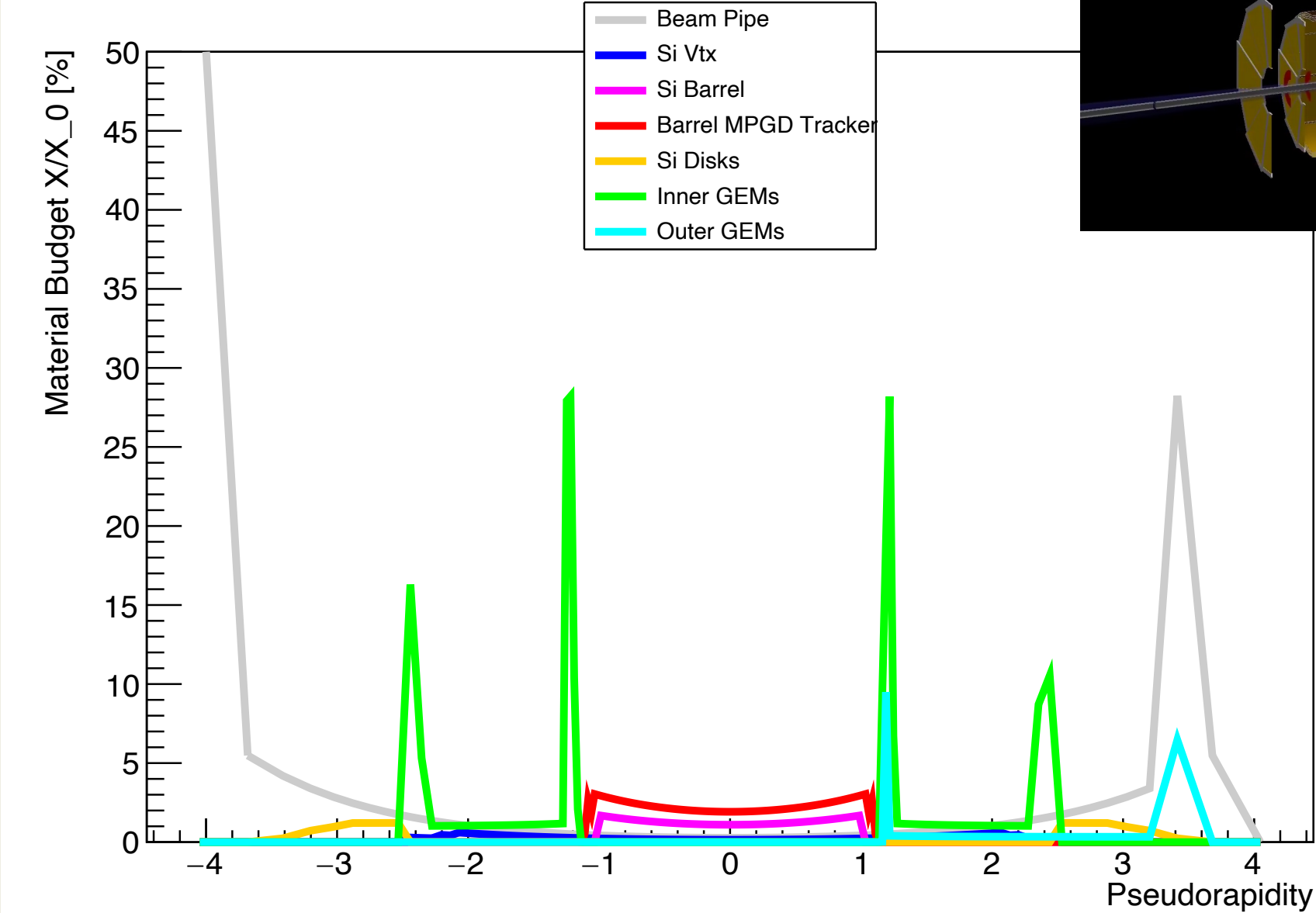
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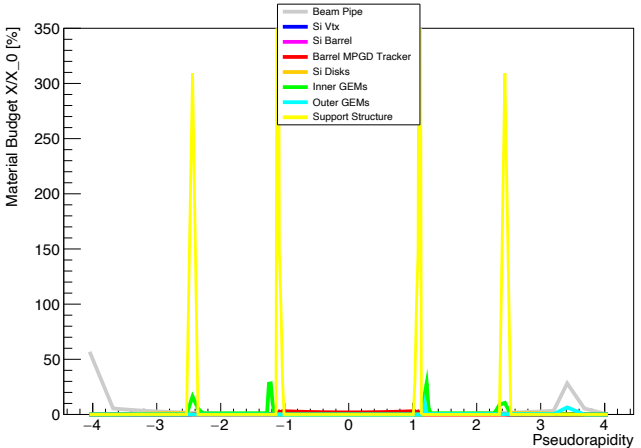
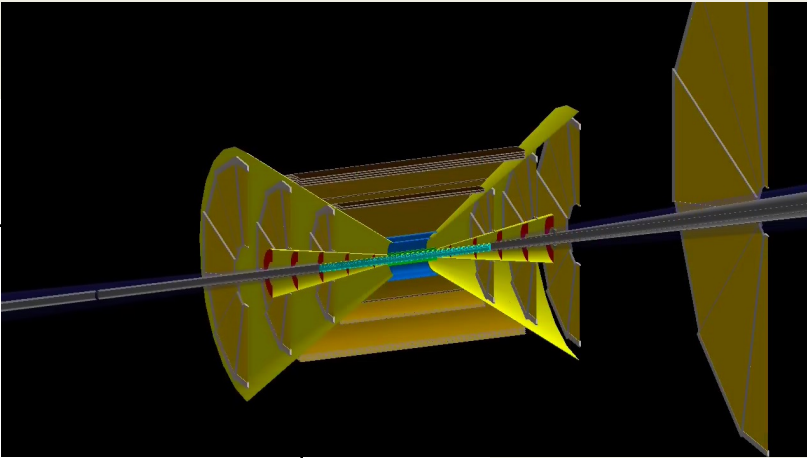
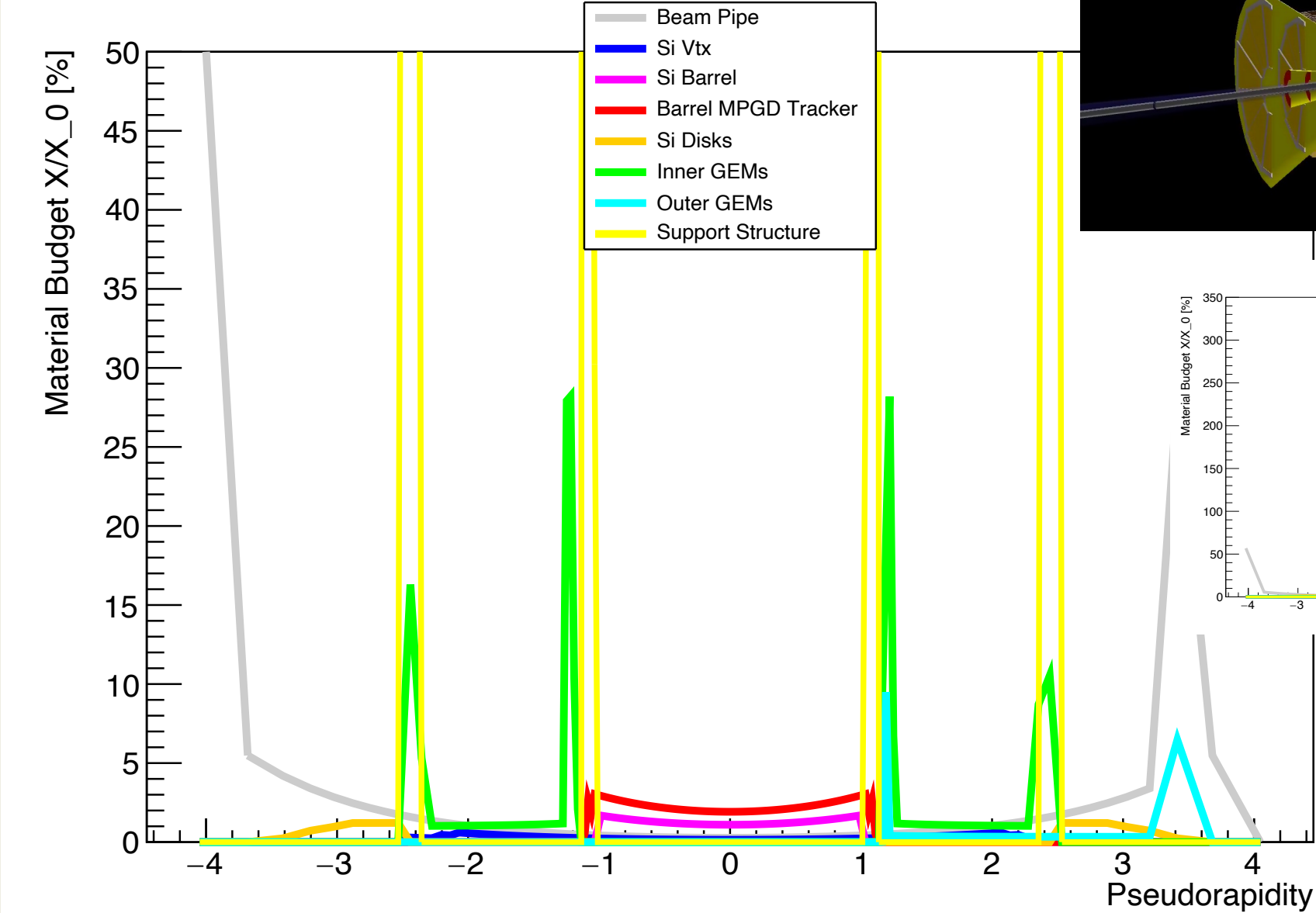
Material Scan



Material Scan



Material Scan



Material Scan

