Status of Vertex Detector Layout Optimization

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2019/10/18

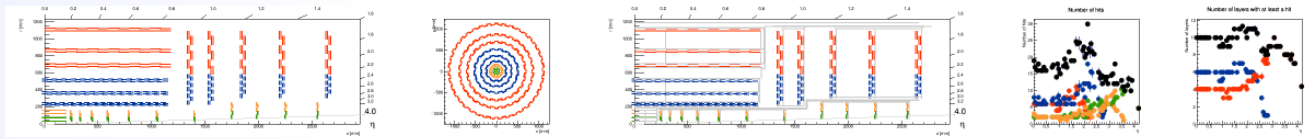
tkLayout

FlatTracker4026

layouts

info | geometry | geometry (pixel) | bandwidth | trigger cpus | irradiation (outer) | irradiation (pixels) | material (outer) | material (pixel) | material (total) | weights (outer) | weights (pixel) | resolution (pixel) | resolution (tracker) | resolution (trigger) | patternreco | trigger | log page

full layout geometry



simulation parameters

Command line arguments: FlatTracker4026.cfg -a
Minimum bias per bunch crossing: 140
Integrated luminosity: 3000 fb^{-1}
Number of tracks used for material: 100
Number of tracks used for geometry: 100
Irradiation α parameter (at reference temperature 20 °C): 4.28×10^{-17} A/cm

materials tables

Chemical elements: chemical_elements.csv
Chemical compounds: chemical_compounds.csv
Chemical mixtures: chemical_mixtures.csv

summary

ROOT file with all relevant plots: summary.root
DetId modules list with associated geometry info: DetId_modules_list.csv
DetId sensors list with associated geometry info: DetId_sensors_list.csv
Include structure (GraphViz): include_graph.gv

configuration files

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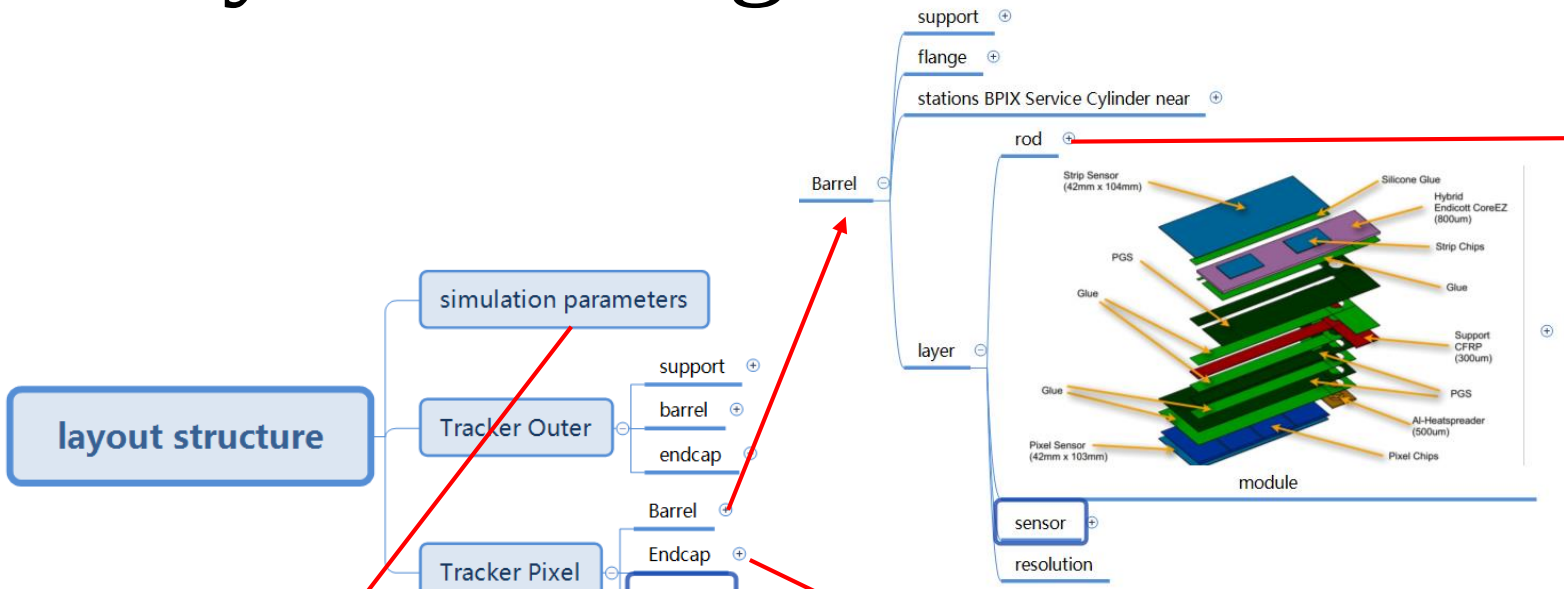
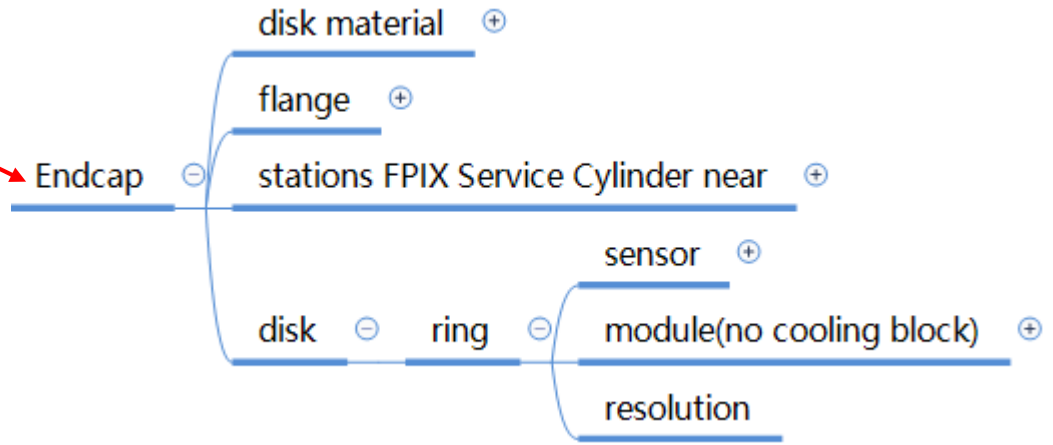
by tkLayout revision master-3086 on https://github.com/tkLayout/tkLayout.git

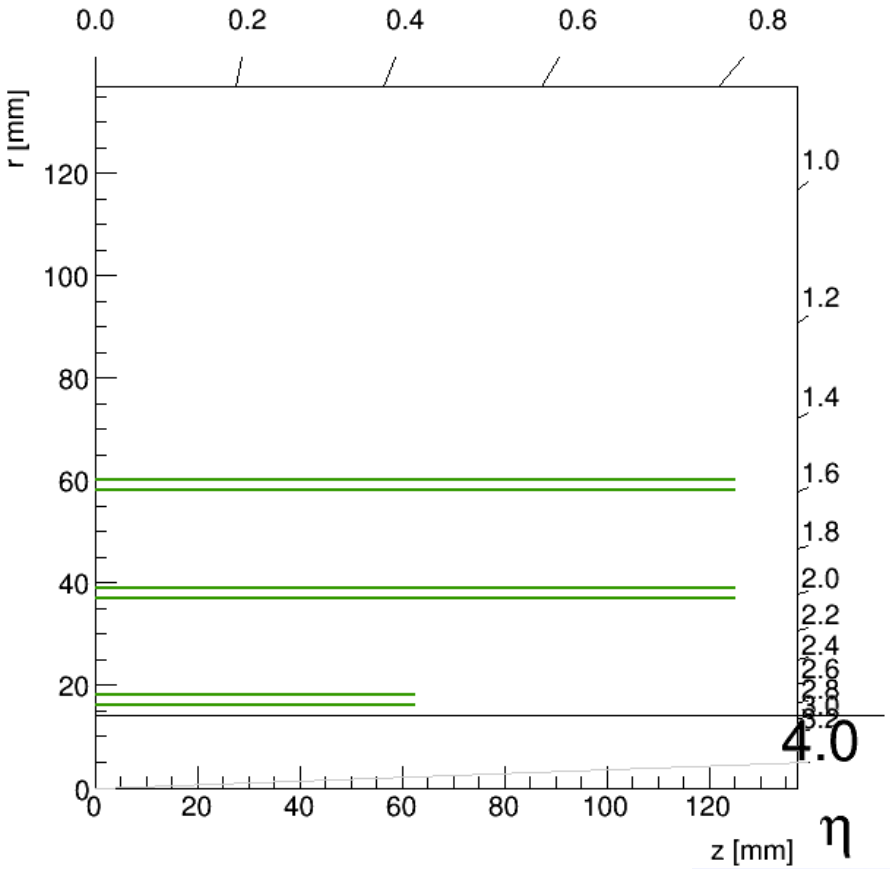
Layout Configuration Structure



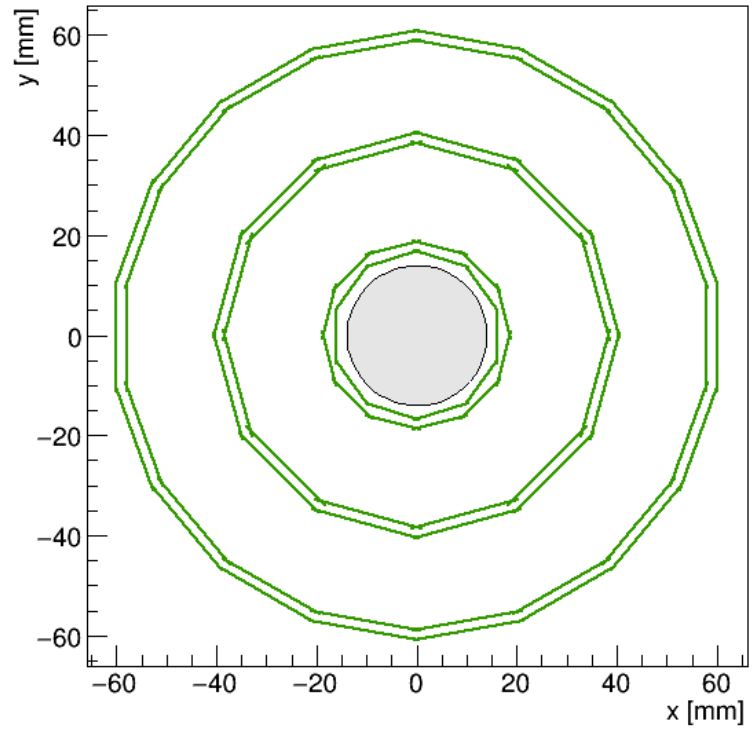

```
numMinBiasEvents 140      // Number of pile-up events
bunchSpacingNs 25

// Luminous region used in analysis (IP always on (Z) axis, with Z centered around 0)
lumiRegZError                  70     // mm
lumiRegShape                   flat   // Choose among { spot, flat, gaussian }
lumiRegShapeInMatBudgetAnalysis spot
```



Pixel Geometry



RZ positions of the barrel modules. - (png) - (pdf) - (root)



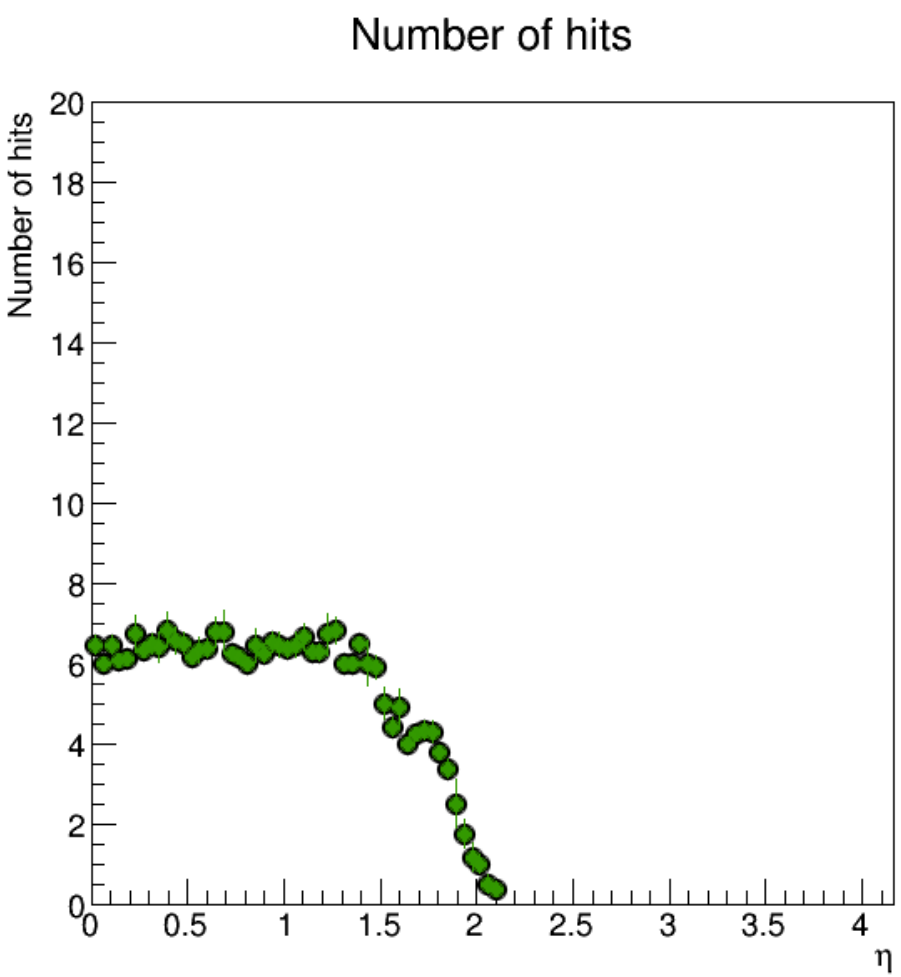
XY Section of the tracker barrel. - (png) - (pdf) - (root)

Barrel : PXB1							Total
Layer	1	2	3	4	5	6	
r	16.000	18.000	37.000	39.000	58.000	60.000	
z_max	62.500	62.500	125.000	125.000	125.000	125.000	
# rods	10	12	12	12	18	18	
# mods	40	48	96	96	144	144	568

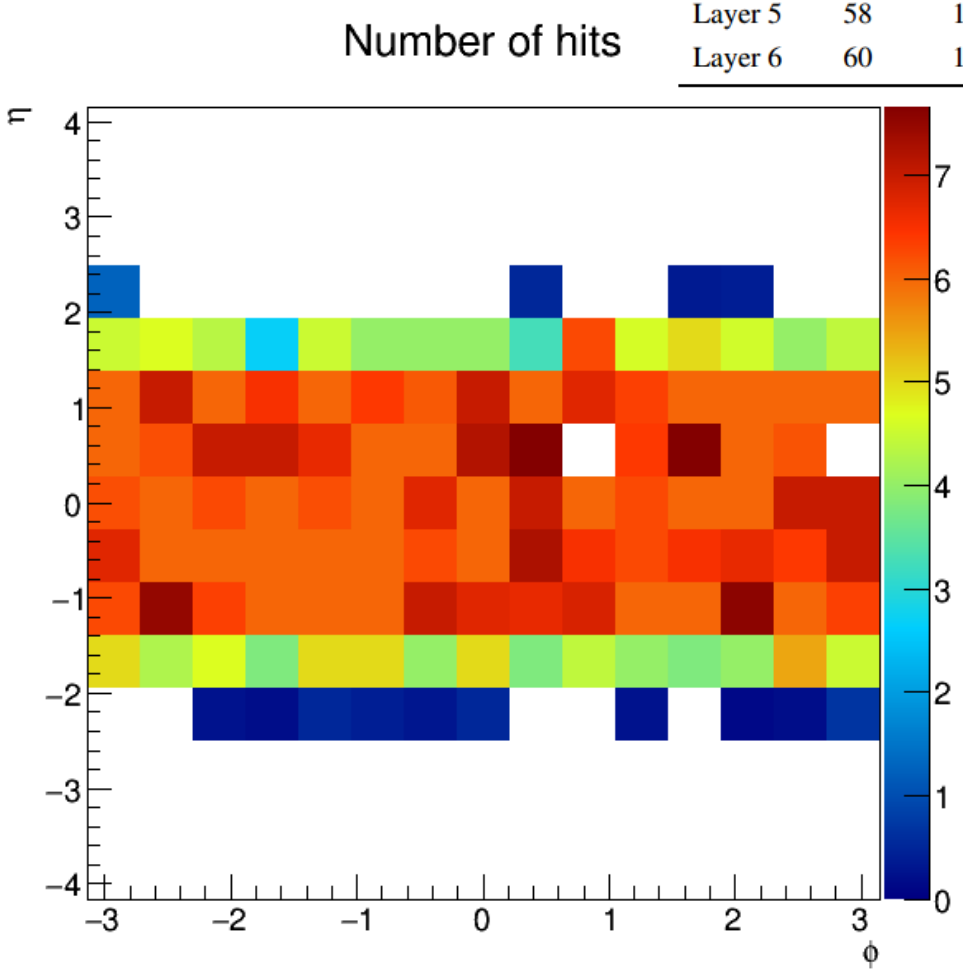
Module size copied from gear.xml

Hit Coverage

	R (mm)	$\lvert z\rvert$ (mm)	$\lvert\cos\theta\rvert$	$\sigma(\mu\text{m})$	η
Layer 1	16	62.5	0.97	2.8	2.09
Layer 2	18	62.5	0.96	6	1.95
Layer 3	37	125.0	0.96	4	1.95
Layer 4	39	125.0	0.95	4	1.83
Layer 5	58	125.0	0.91	4	1.53
Layer 6	60	125.0	0.90	4	1.47

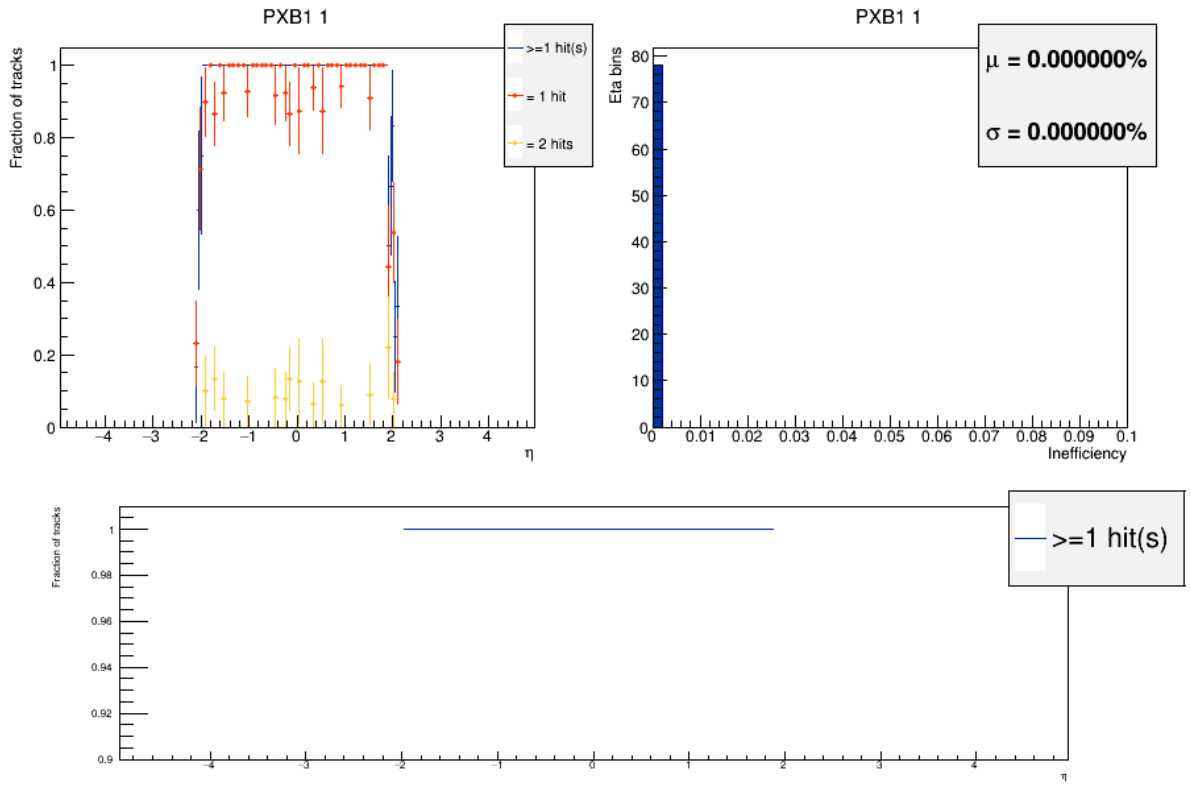


Hit coverage across eta. - (png) - (pdf) - (root)

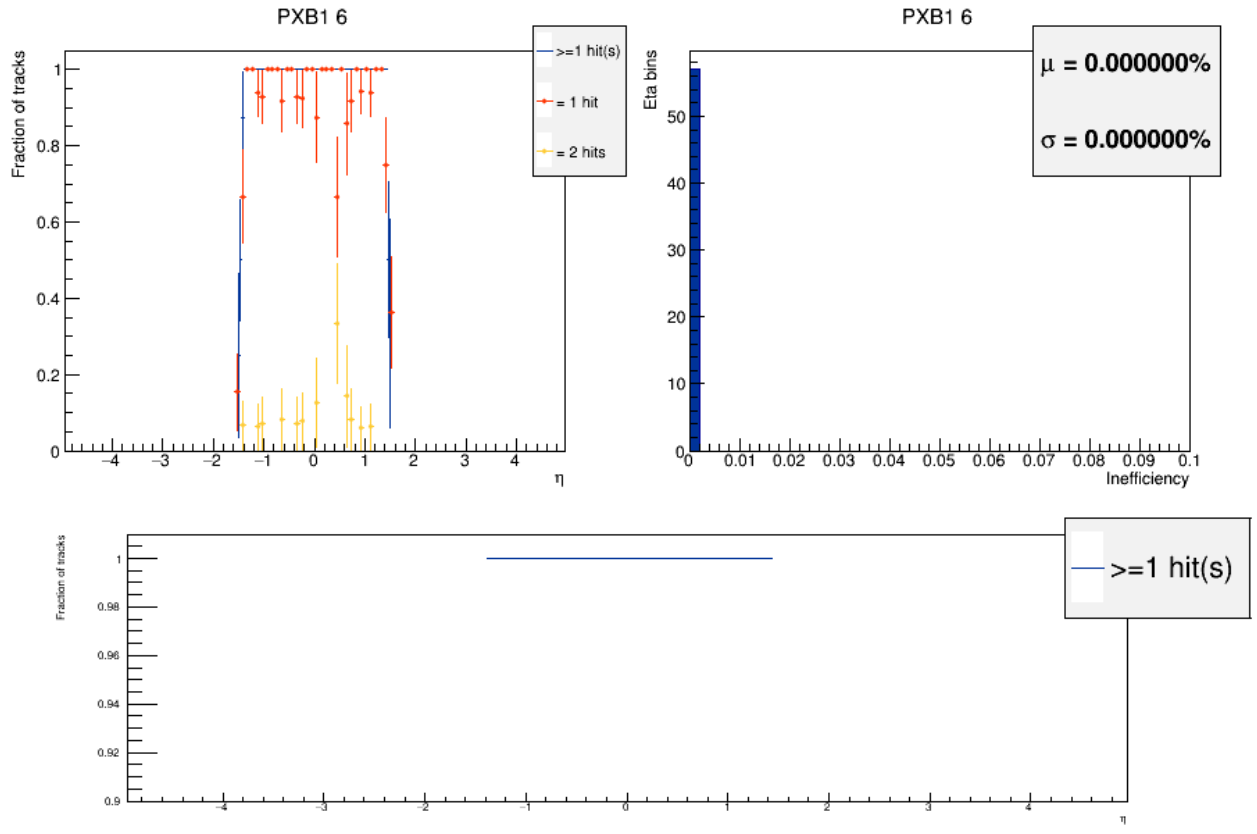


Hit coverage in eta, phi - (png) - (pdf) - (root)

Layer Coverage

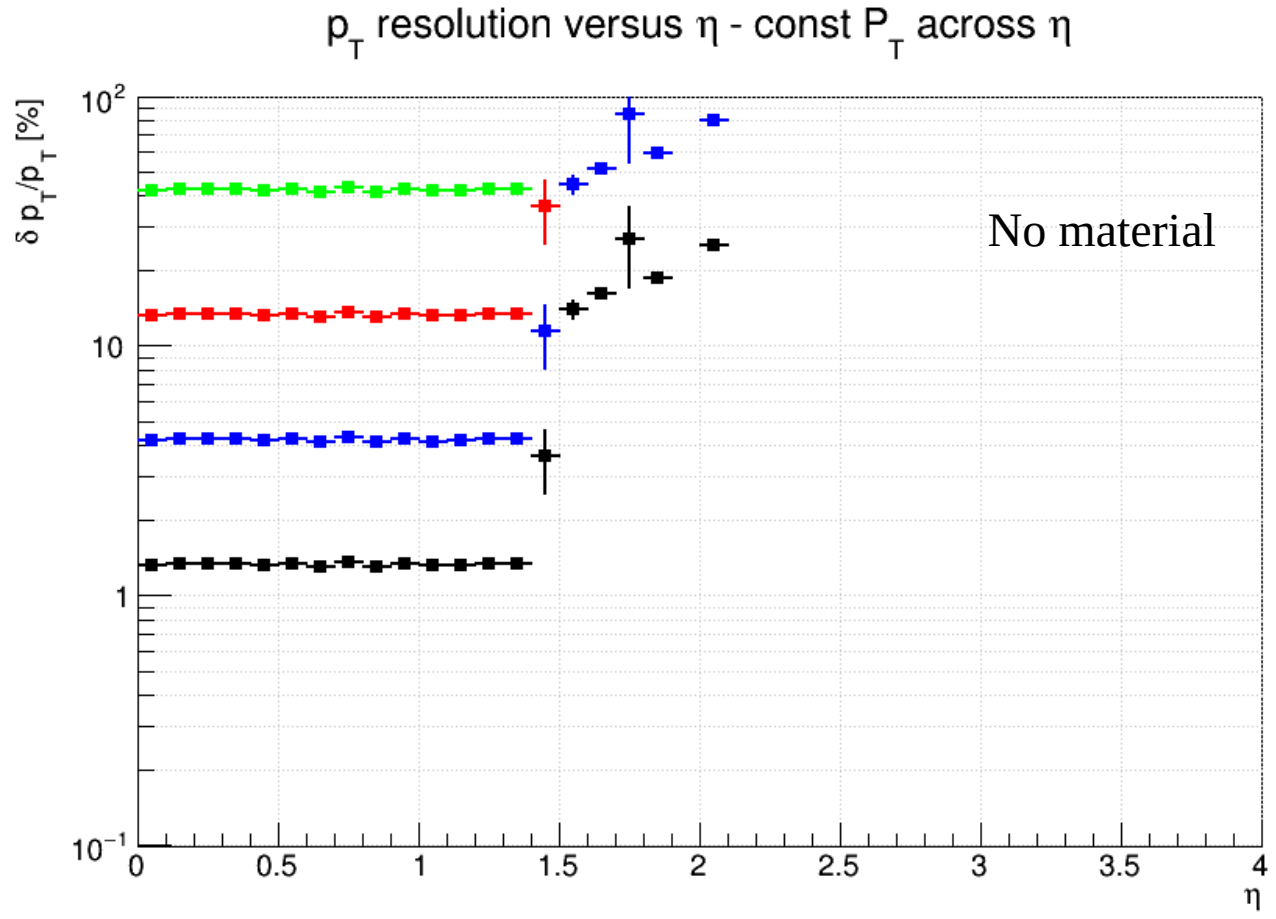


Layer coverage in eta for hits. - (png) - (pdf) - (root)



Layer coverage in eta for hits. - (png) - (pdf) - (root)

Track Resolution for Const pt across η

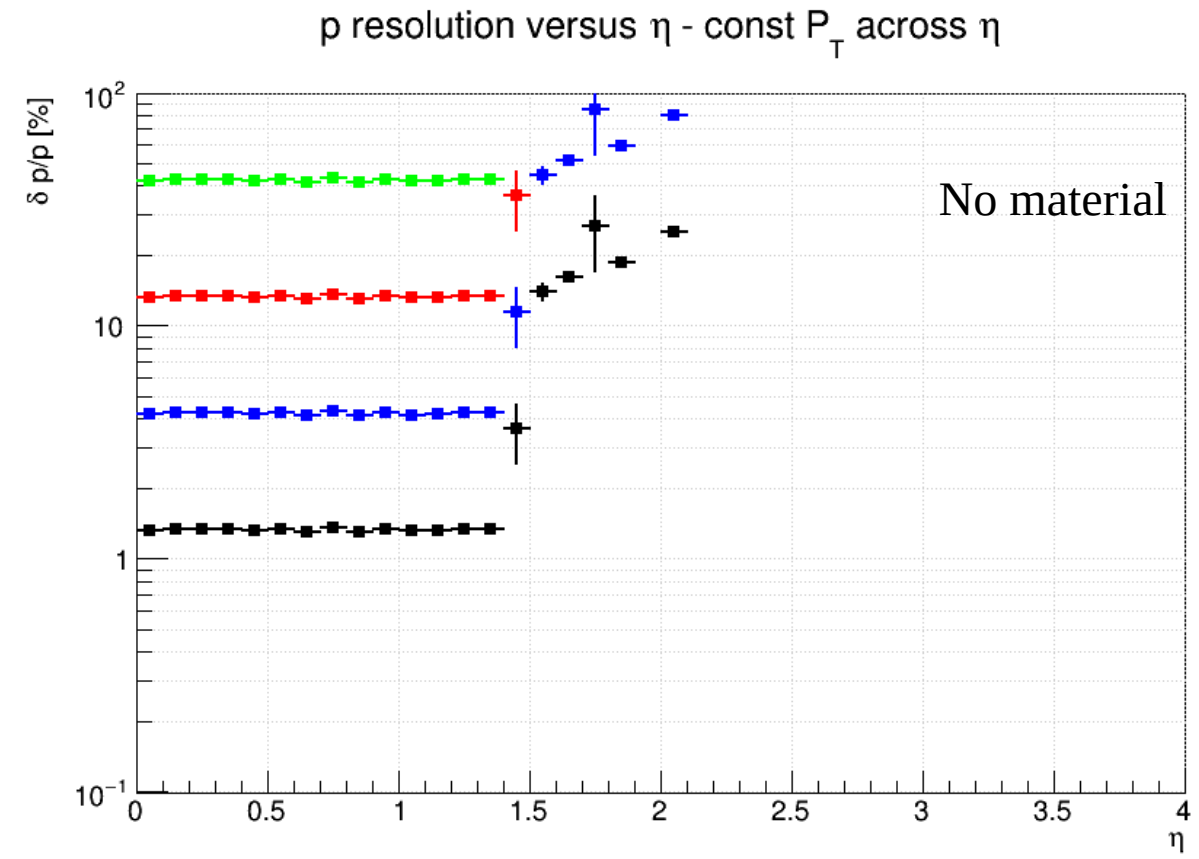


Transverse momentum resolution vs. η (log scale) - const Pt across η - (png) - (pdf) - (root)

Particle momenta in GeV:
1(10^0)(Black),
3.16 (10^0.5)(Bright Blue),
10 (10^1)(Red),
31.62 (10^1.5)(Bright Green).

Each layer resolution is 4um

Track Resolution for Const pt across η



Momentum resolution vs. η - const Pt across η - (png) - (pdf) - (root)

Particle momenta in GeV:
1(10^0)(Black),
3.16 (10^0.5)(Bright Blue),
10 (10^1)(Red),
31.62 (10^1.5)(Bright Green).

Each layer resolution is 4um

Next Step

- Try more layouts: single layer, double layer + single layer
- Adjust module size and positioning to cancel unnecessary overlap
- Add material(rod, sensor)
- Suggestion?

Thank you!