Towards a new/refined All-Silicon Tracker Configuration

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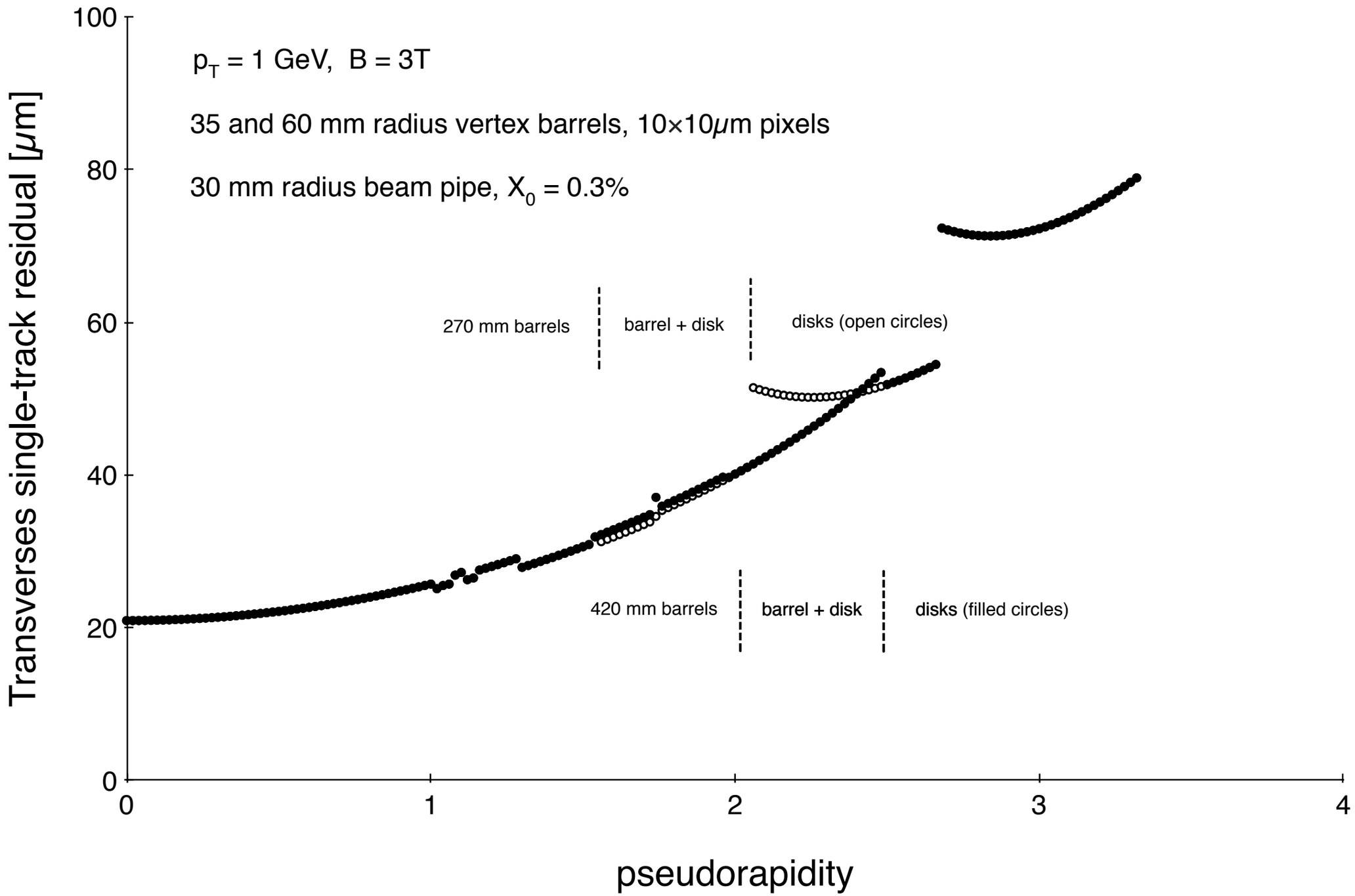
Why, what changed?

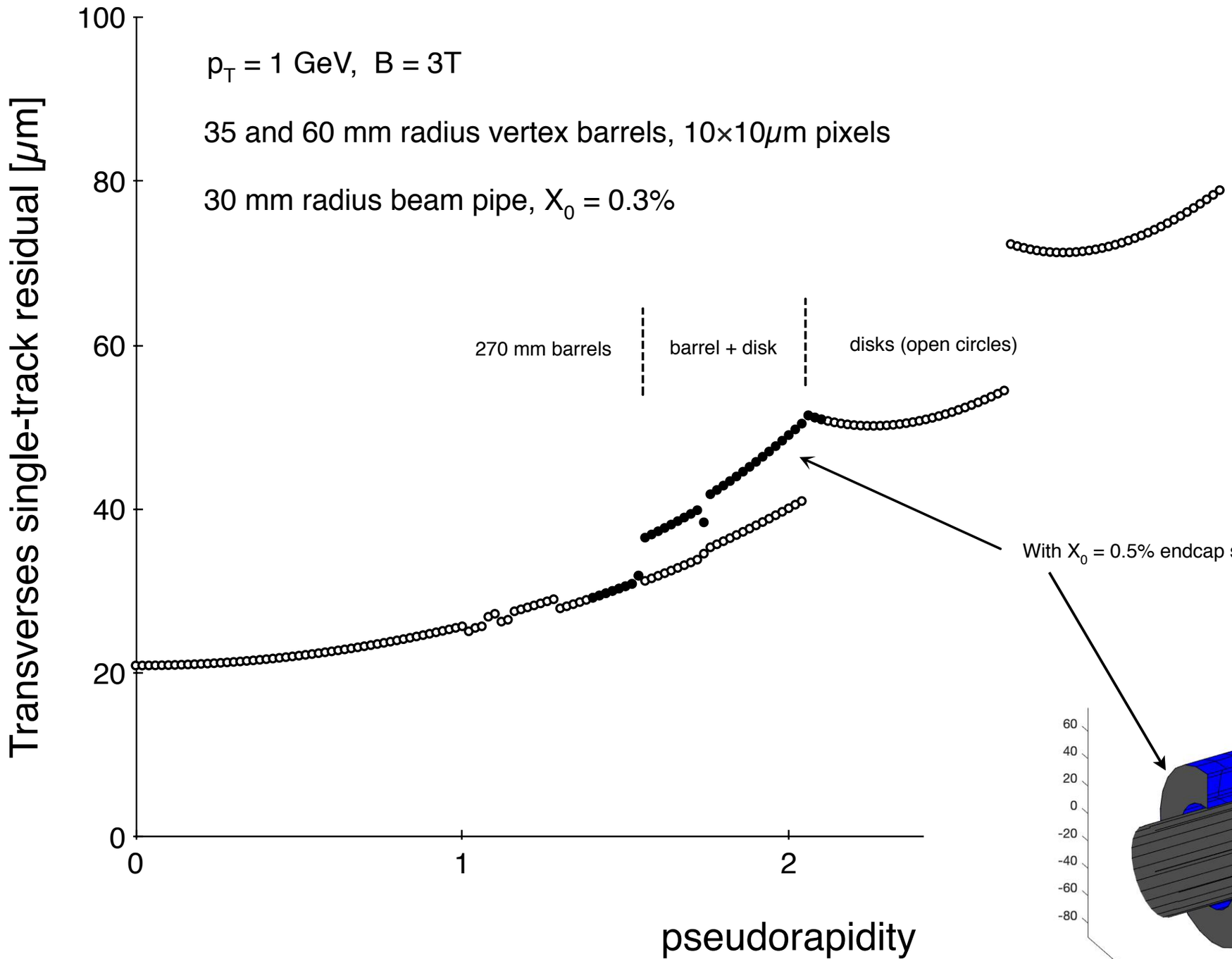
- the beam-pipe grew in radius,
- the intermediate barrel layers grew in X_0.
- increased understanding of services,
- 10x10 μm pixels.

Thus far, the *decision* was to *not* change the 430 mm outer radius

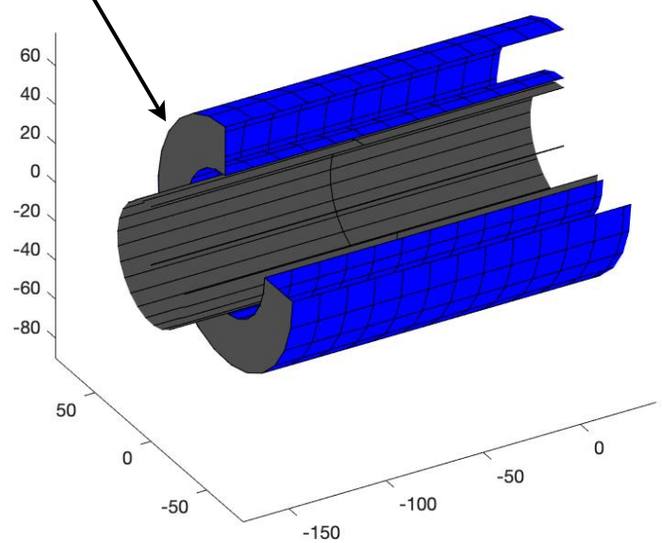
Beam-pipe - extending the barrel inner vertex layers



Beam-pipe - extending the barrel inner vertex layers

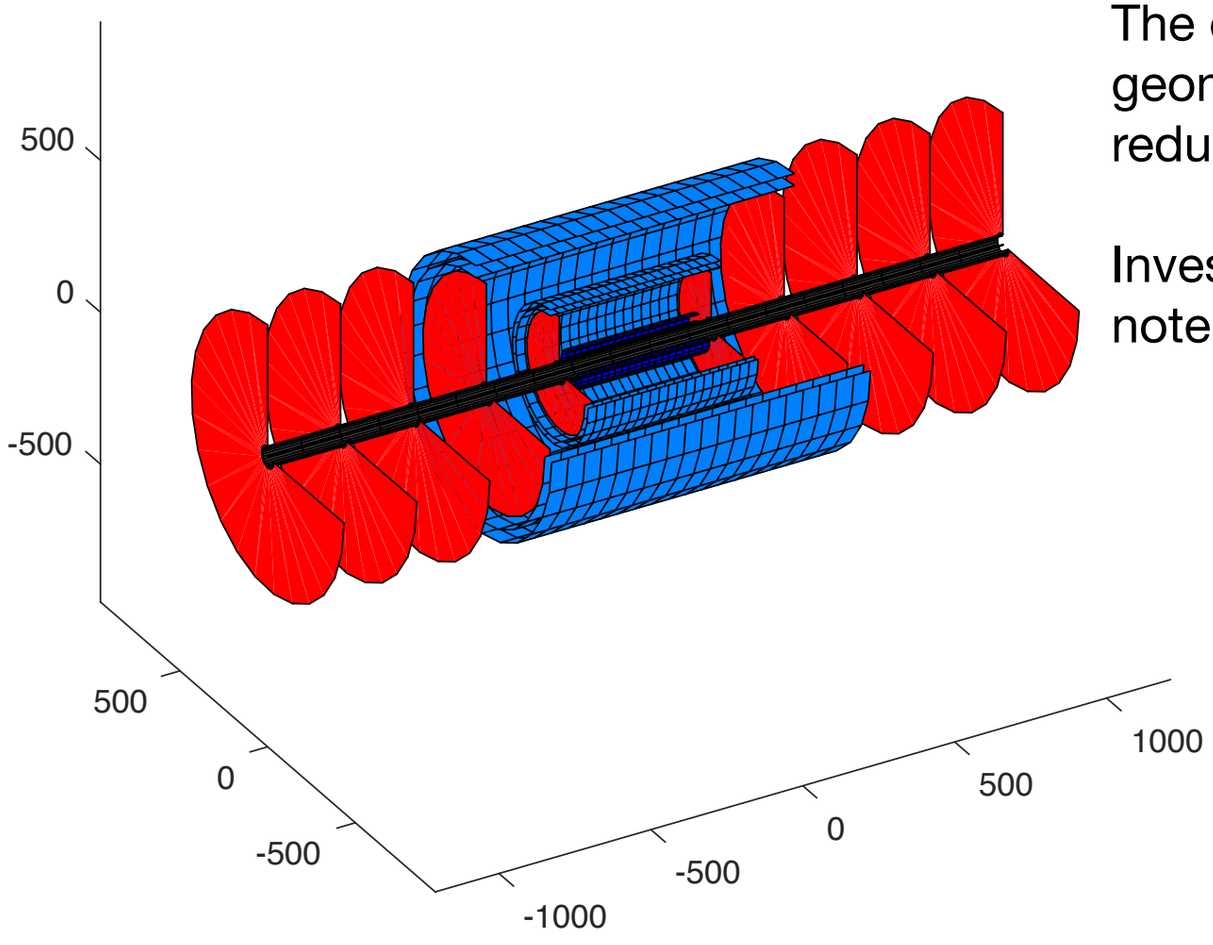


Note the scale; this shows the innermost vertex barrels



Vertexing across barrel and disks presents additional concerns; material, alignment, stability, …
not usually captured in (fast) simulations

Tracking across barrel and disks

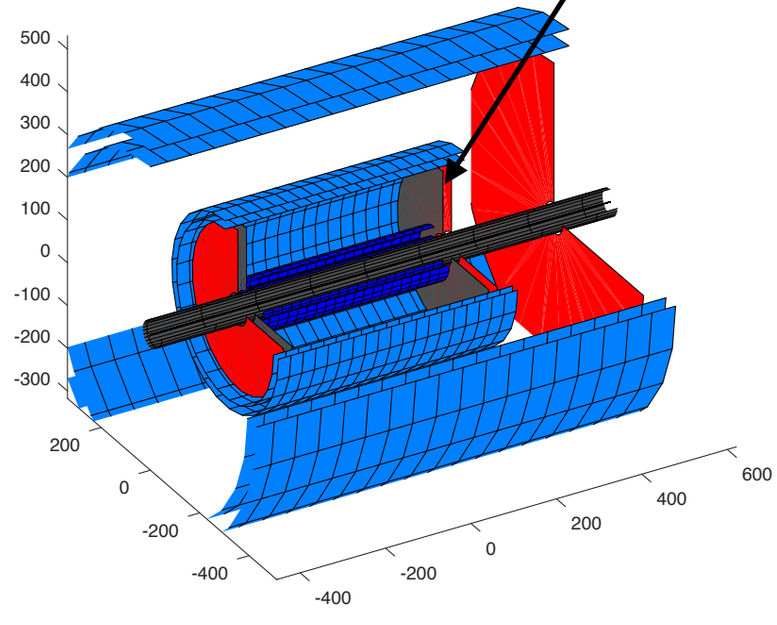


With increased inner barrel length, support and services on both sides appear inevitable,

This presents additional concerns when tracking across barrel and disks, not usually modeled in simulation,

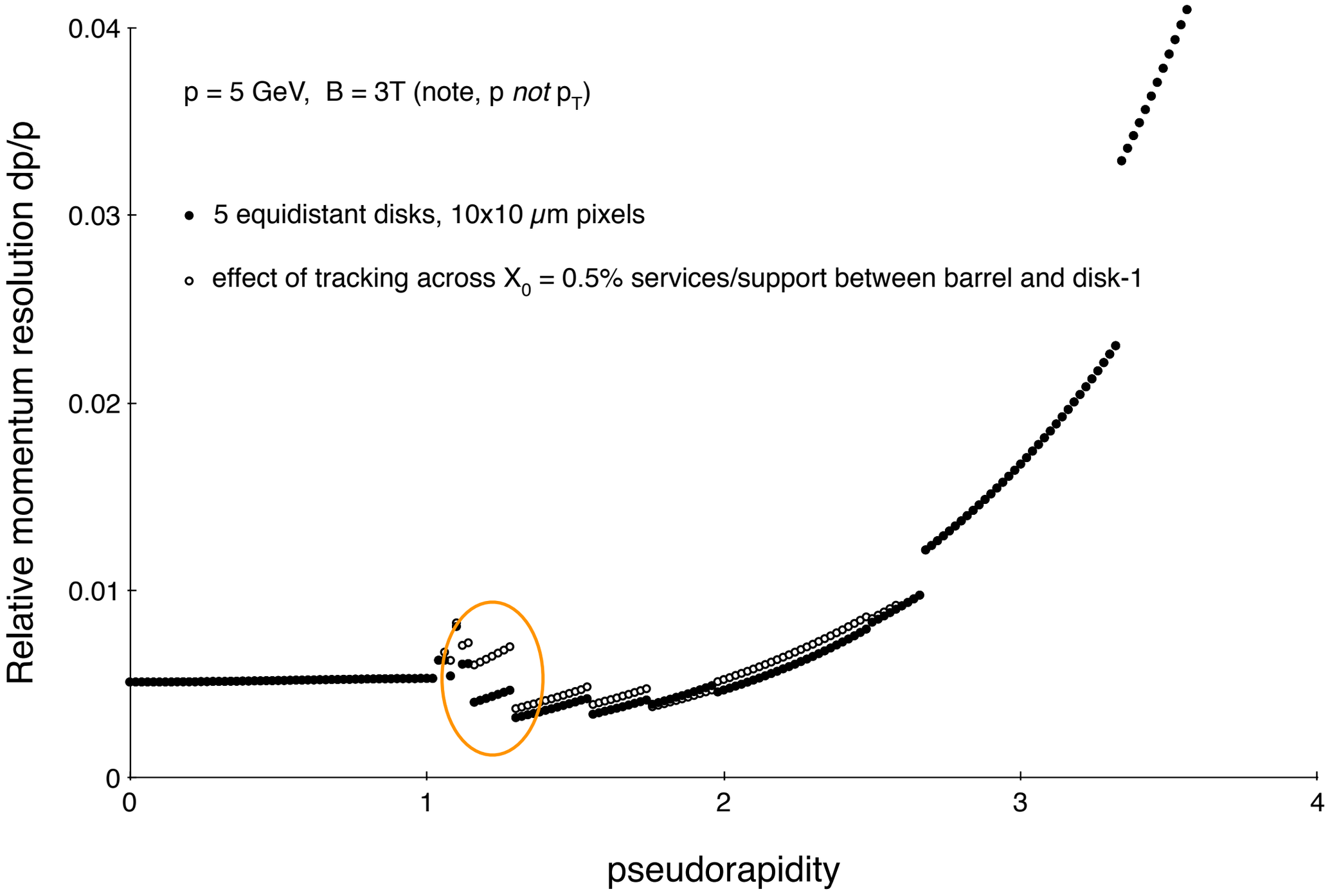
The eta-region from ~1.1 to ~1.3 is a concern in a 5-disk geometry, since it tracks across barrel and disks without redundancy.

Investigate by adding a X_0 = 0.5% layer of dead material; note that it sits at the sagitta (-measurement),
0.5% is obviously uncertain,



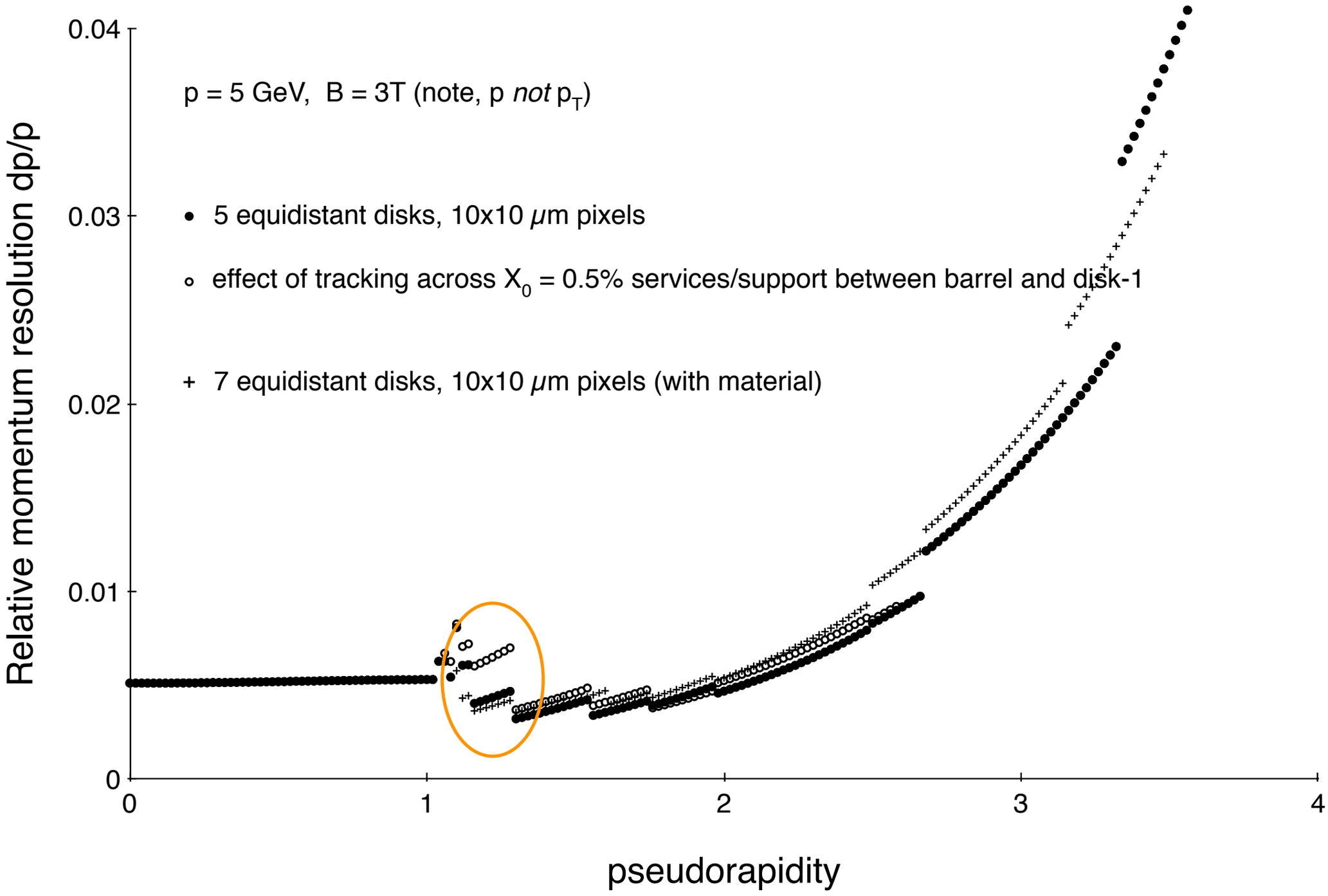
Note the scale; the dead material here covers radii between the beam-pipe and the intermediate barrels

Tracking across barrel and disks



The η-region from ~1.1 to ~1.3 is a concern in a 5-disk geometry; tracks cross barrel and disks without redundancy. X_0 = 0.5% layer of dead material at the sagitta (-measurement) impacts performance.

Tracking across barrel and 7 disks

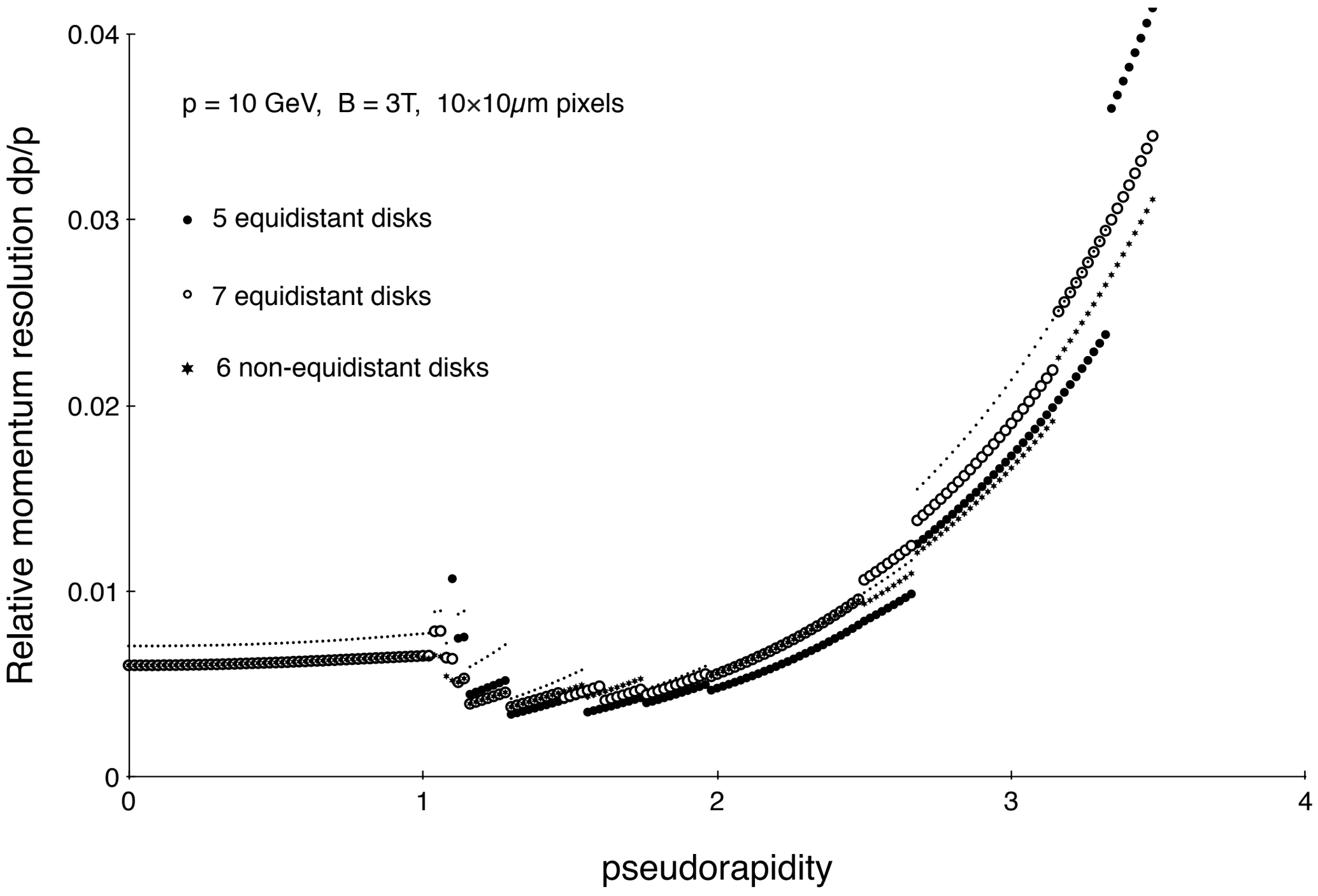


Same figure, with a 7 disk-configuration that offers redundancy; 3 disks are available for *p*-measurement for the η-region from ~1.1 to ~1.3 without tracking across material.

7-disk configuration is of course *not* a uniform win, but the losses are less uncertain than services/support,

The region of large η depends crucially on the detail of the beam-pipe and will not be azimuthally symmetric.

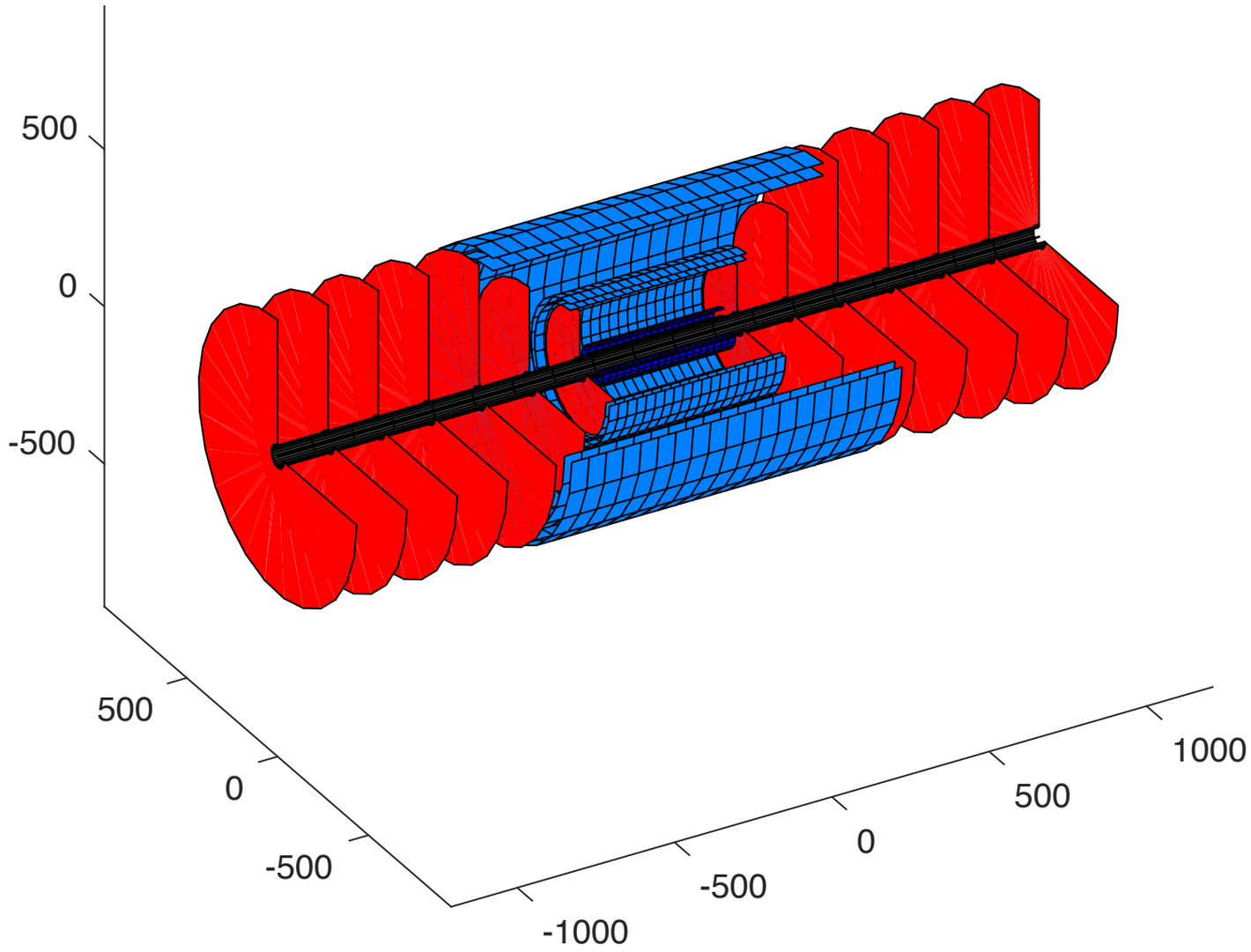
A (very) busy slide…



6-disk configuration uses 3 disks at smallest |z| from the 7 disk configuration and
3 disks at largest |z| from the 5 disk configuration

Thin-dotted line shows 5-disk results with 20x20 μm pixels and X_0 = 0.3% layers

A few further comments…



The inner vertex layers are 420 mm in length and X_0 = 0.05%,

The now radially centered intermediate layers are just slightly longer and have X_0 = 0.55% (x10!),

Clearly, there are serious trade-offs; centering, yield

Radius to be revisited… (it is *not* as simple as scaling 20 μm to 10 μm pixels.