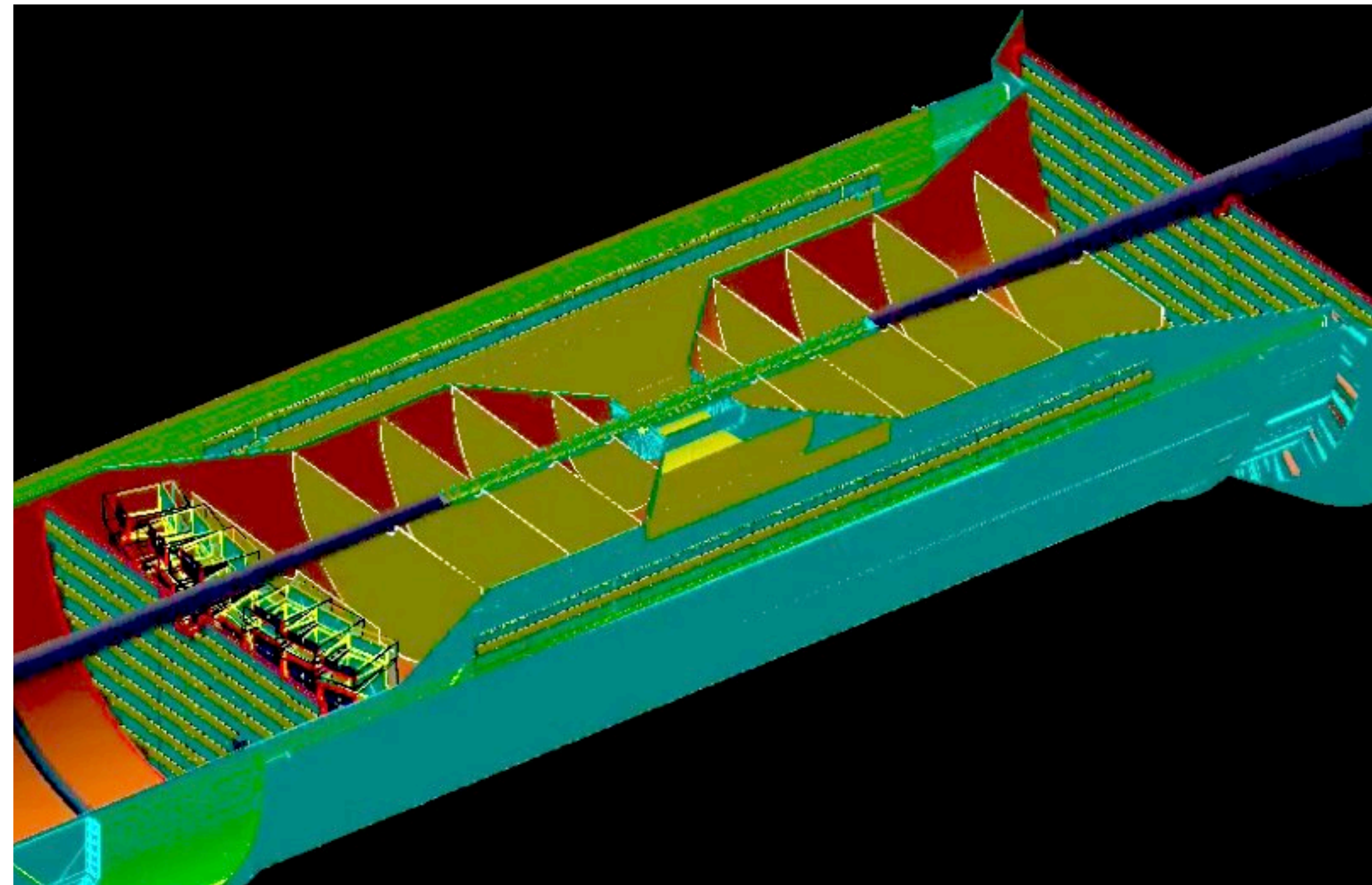


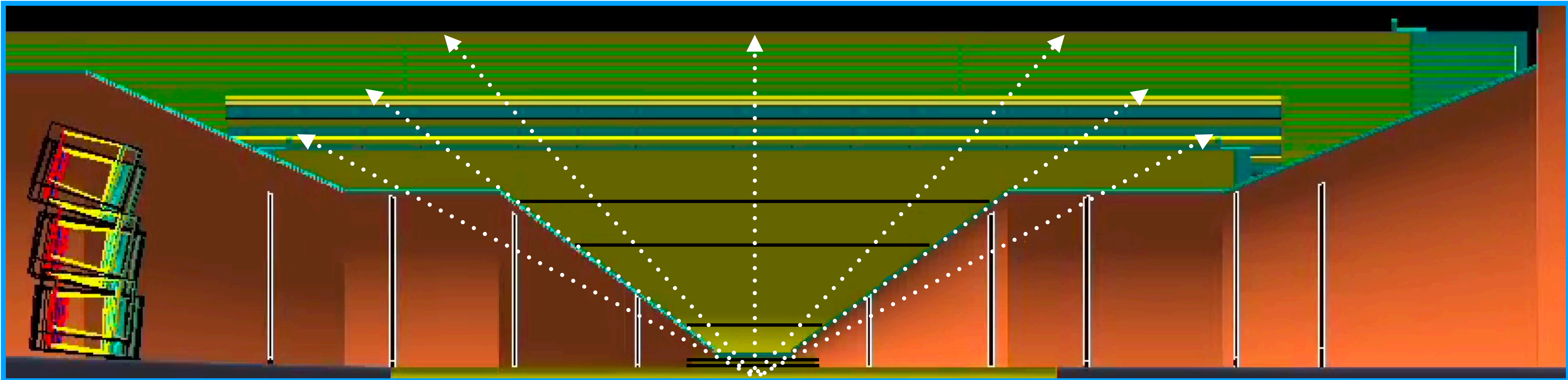
Fun4All tracking studies



Rey Cruz-Torres
Sept 1st, 2022



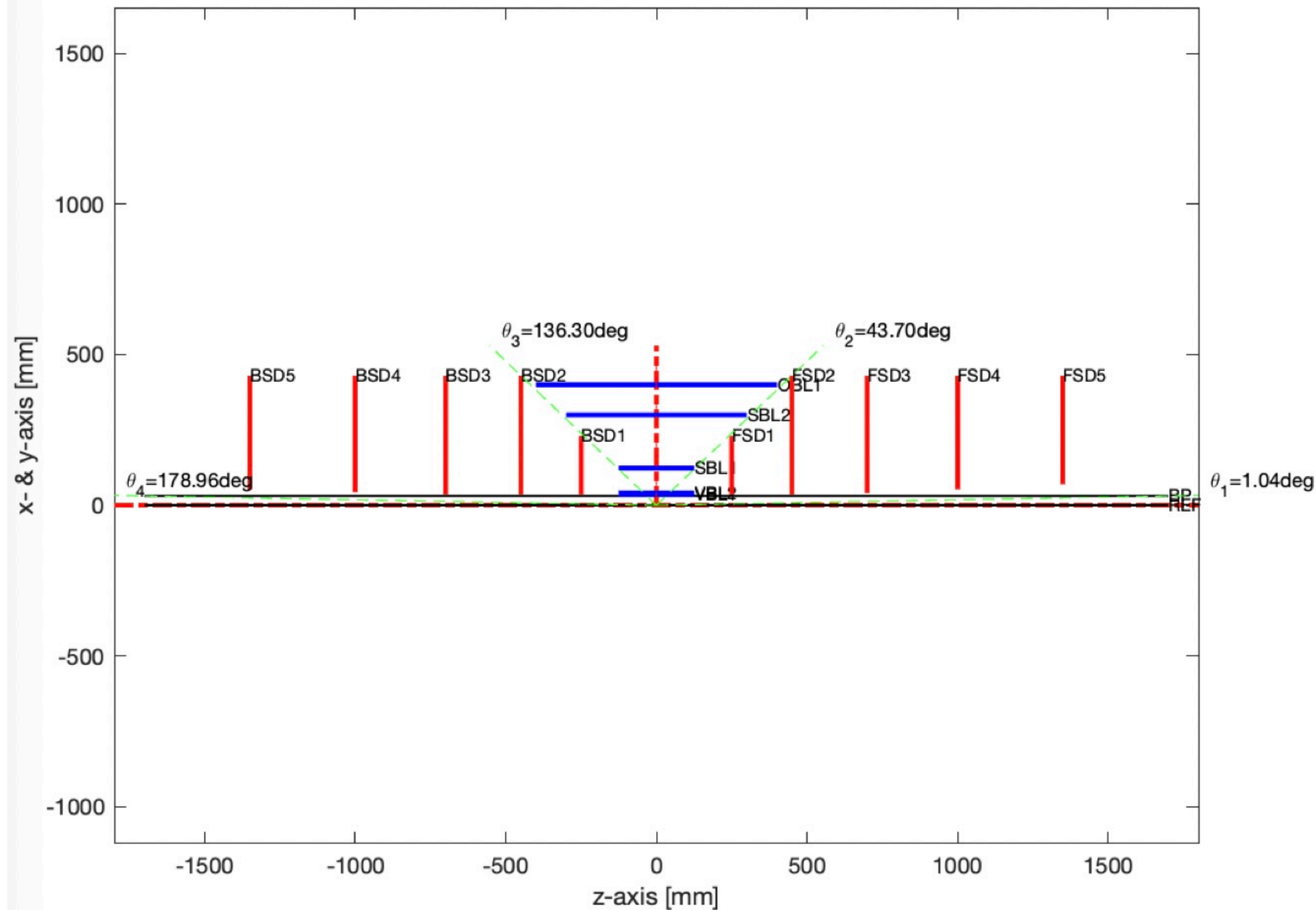
Barrel in last simulation campaign



There are no acceptance holes anywhere in this geometry
(except for the inner radii of the disks and the unavoidable dead region at $\eta \sim 1.1$)

New LBNL / EPIC geometry

This path to recovering YR mid-rapidity performance in 1.7 T with ePIC



Barrel:

- $\sim 45^\circ$ degree projective cone,
- Outermost barrel layer at $r = 420$ mm, $l = 840$ mm,
- Single “conventional” sagitta layer with $r = 270$ mm, $l = 540$ mm, $X/X_0 \sim 0.25\%$,
- Outer (third) vertex barrel layer with increased radius to $r = 120$ mm while preserving $l = 270$ mm and $X/X_0 \sim 0.05\%$,
- Two inner vertex barrel layers with $r = 36, 48$ mm and $l = 270$ mm and $X/X_0 \sim 0.05\%$ per layer,

Disks:

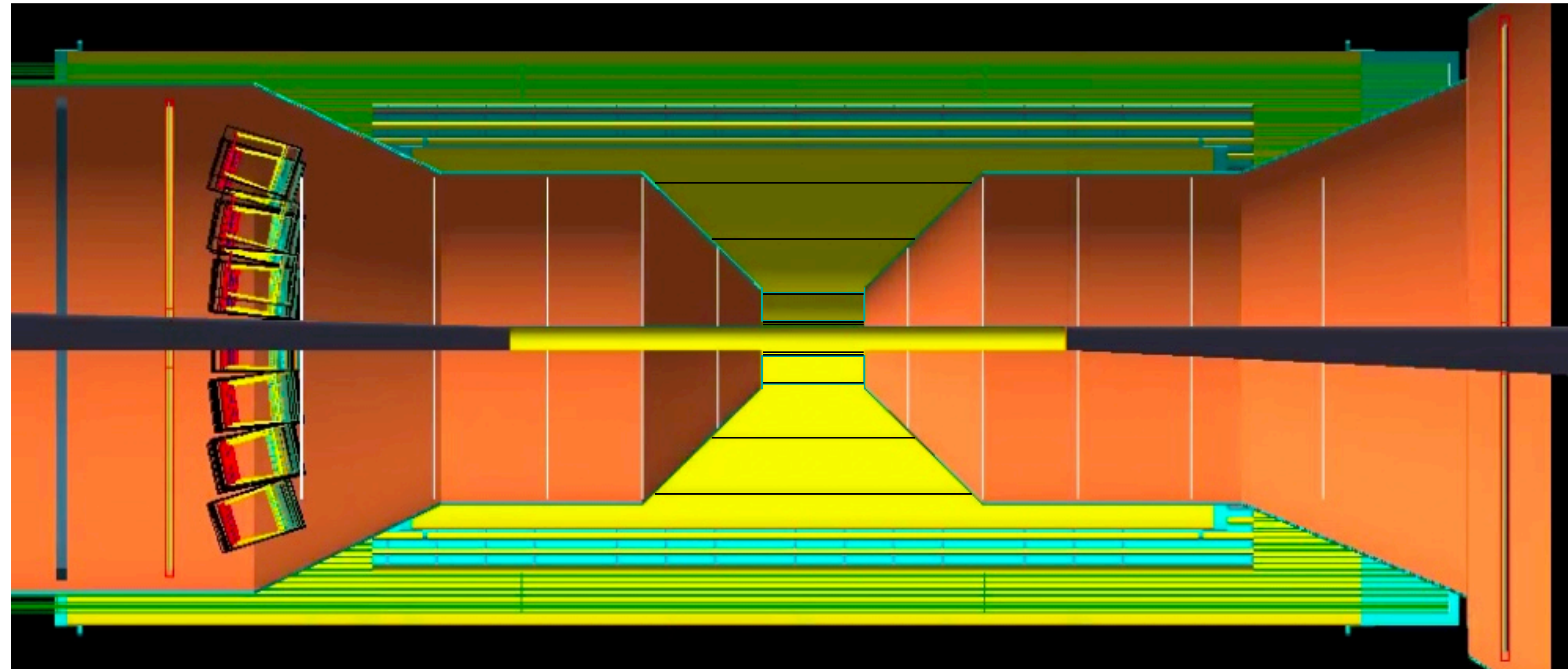
- Suggest $|z| = 250, 450, 700, 1000, 1350^*$ mm,
- $r_{out} = 430$ mm at $|z| > 430$ mm, ~ 230 mm at $|z| = 250$ mm
- $X/X_0 \sim 0.24\%$ per disk,
- $r_{in} \sim 5$ mm away from beam pipe,
- Outer support / service cylinders for $450 < |z| < 1350^*$ mm

* 1350mm will “butt up” right to the mRICH volume according to the menagerie / geometry DB; GD/I considerations may reduce this, e.g. to 1300 mm, but my suggestion is to request this — otherwise empty (!) — space now.

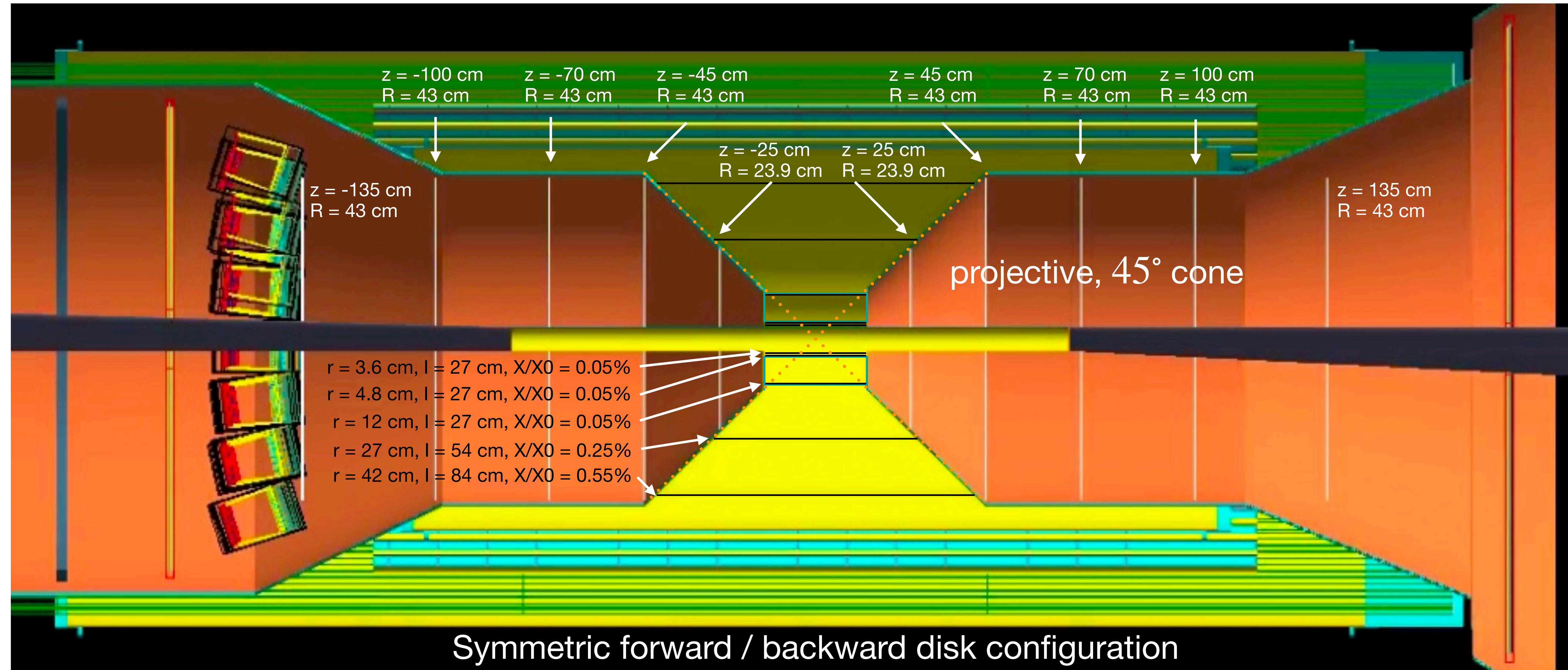
Yes, there are other aspects, many of which require further study and further optimizations — a straightforward example would be z-extent / a 6th disk in the hadron-direction.

Material on the essential service cylinders is being worked out. This is, in my opinion, absolutely essential to incorporate soon and optimize — especially further routing.

New LBNL / EPIC geometry

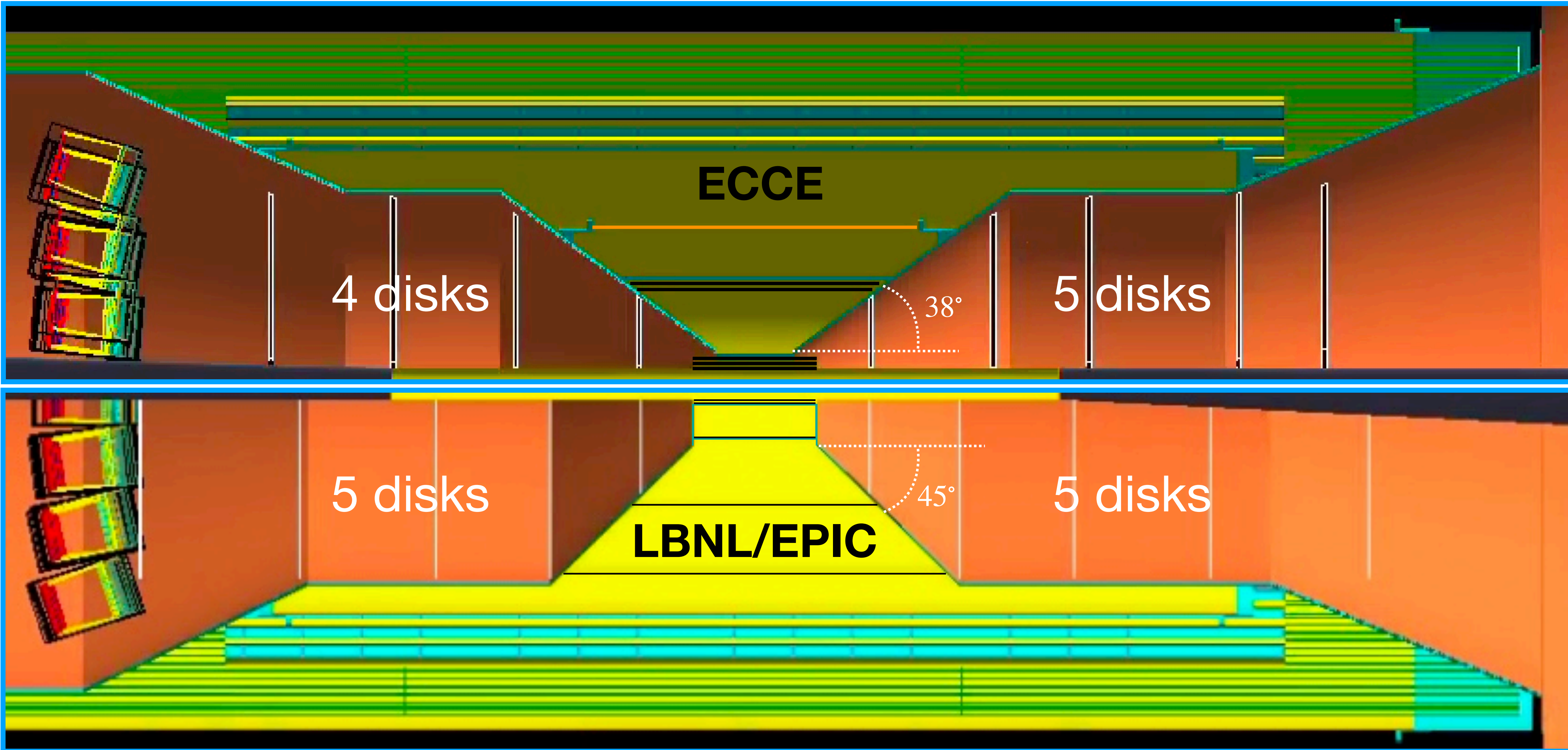


New LBNL / EPIC geometry



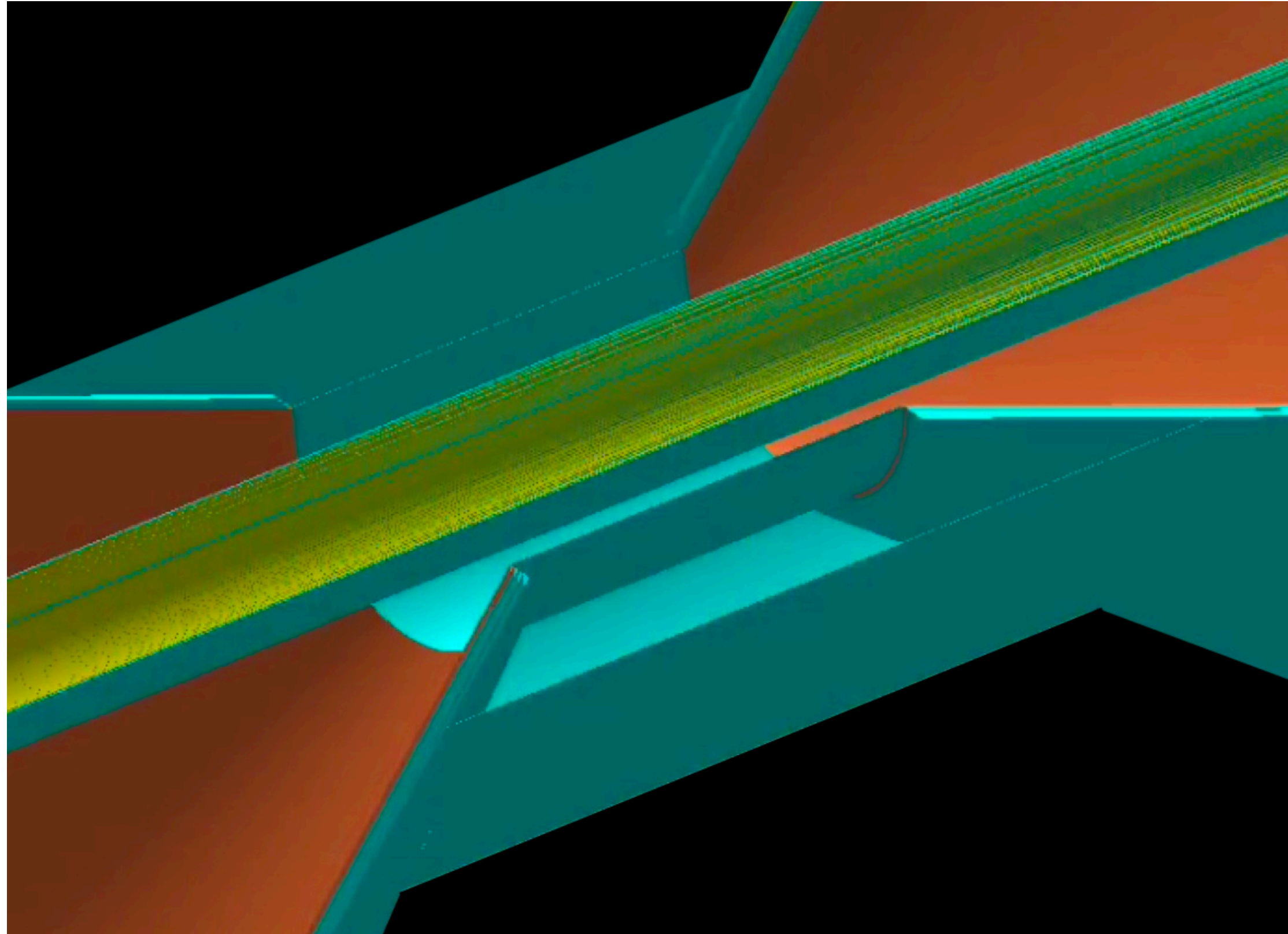
This geometry was implemented in Fun4All prior to the last simulation campaign

Comparison ECCE - LBNL/EPIC geometry

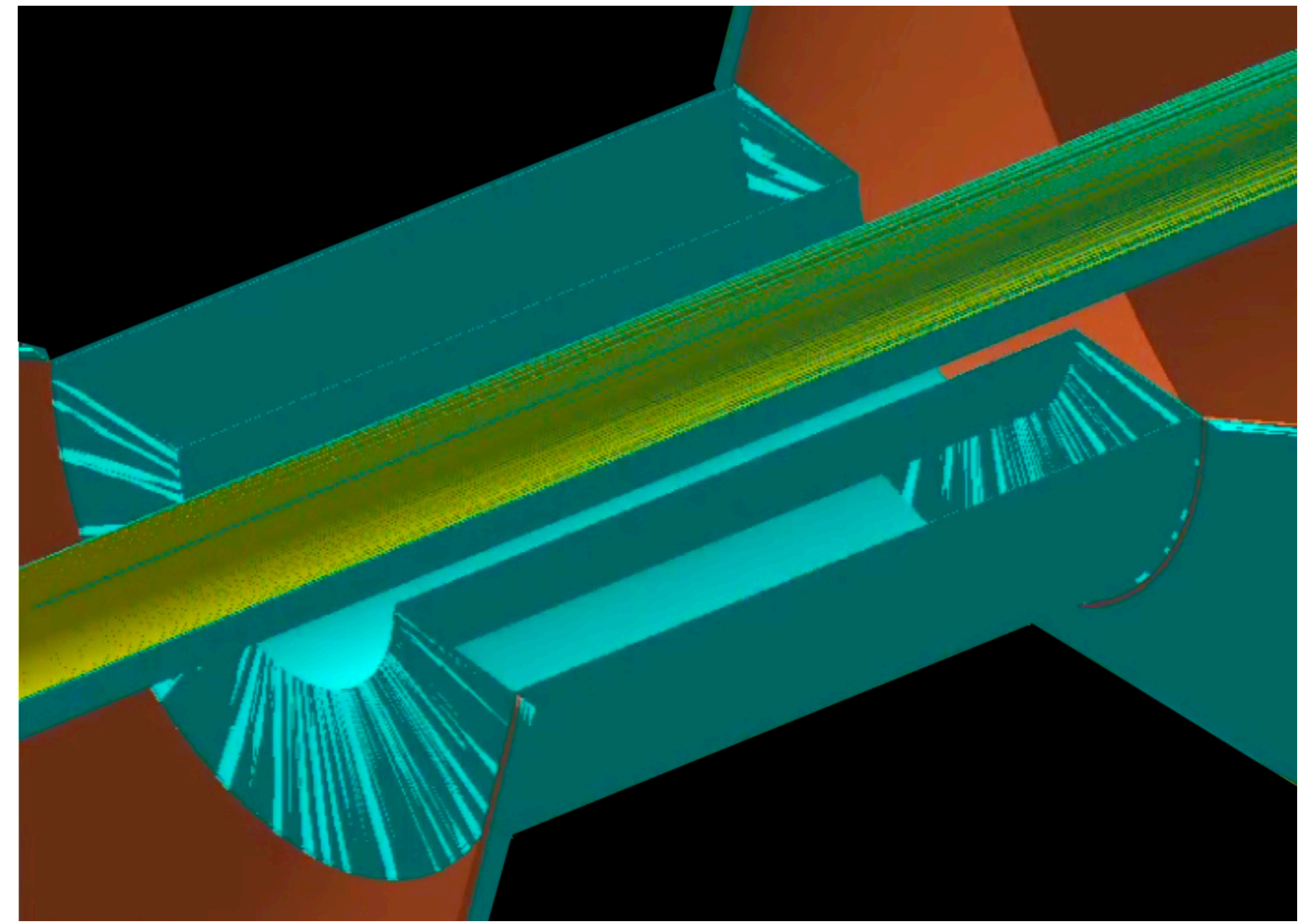


Comparison ECCE - LBNL/EPIC geometry

ECCE

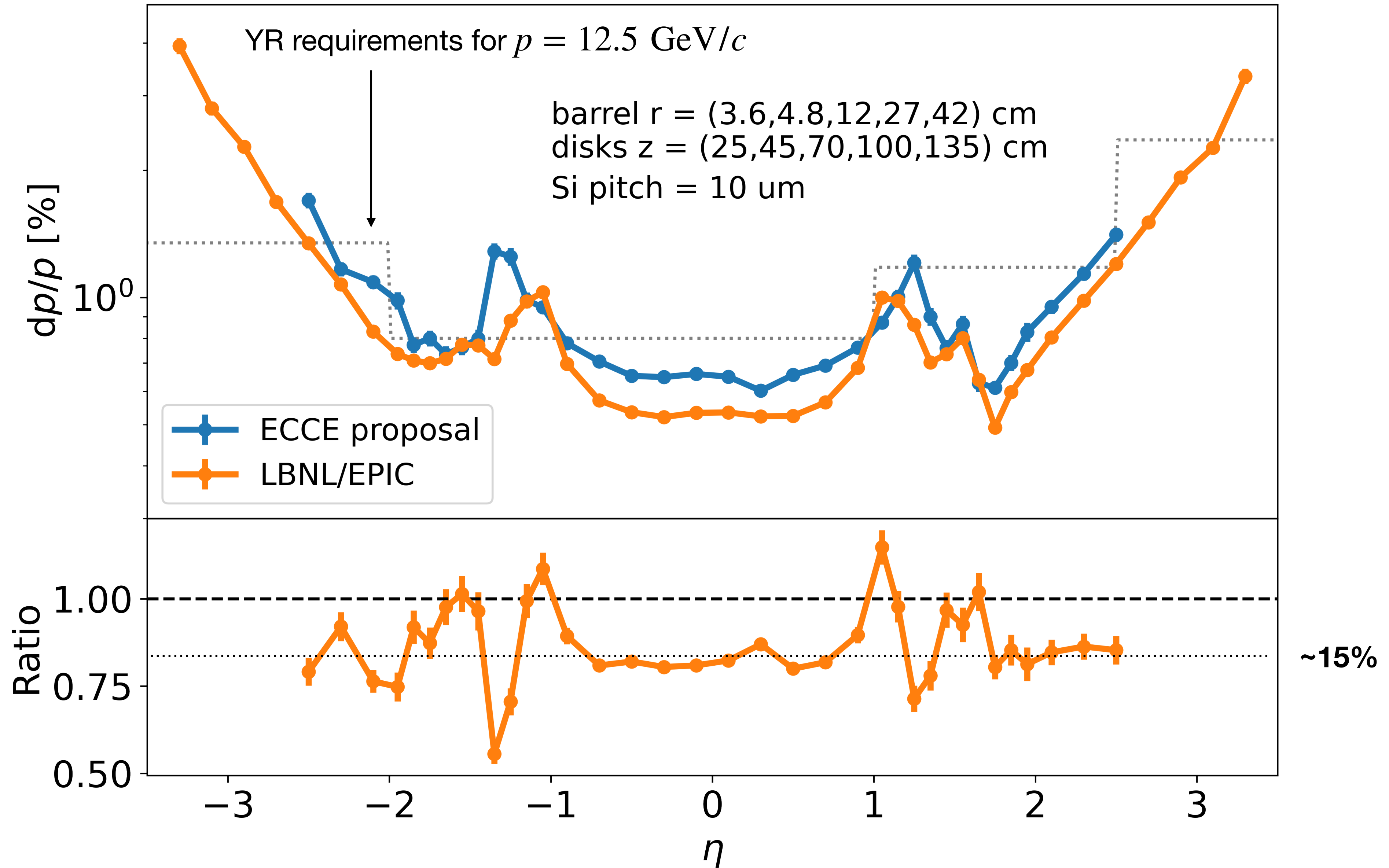


LBNL

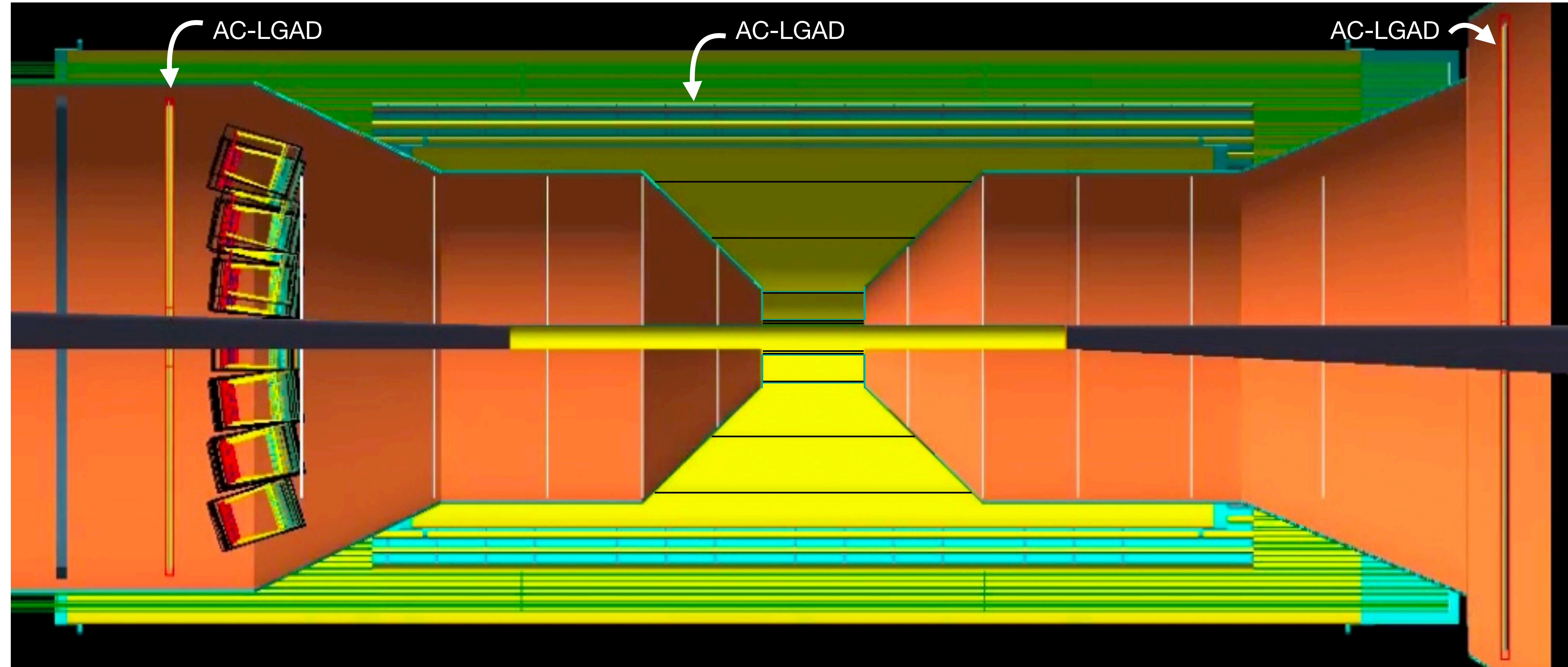


Comparison ECCE - LBNL/EPIC geometry

$B = 1.7 \text{ T}, 10 < p < 15 \text{ GeV}/c$

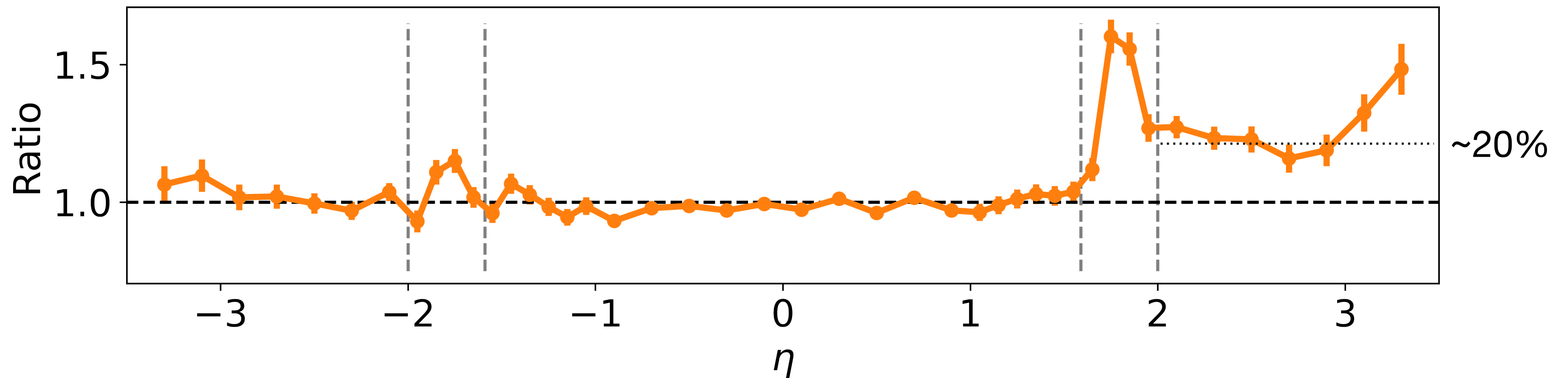
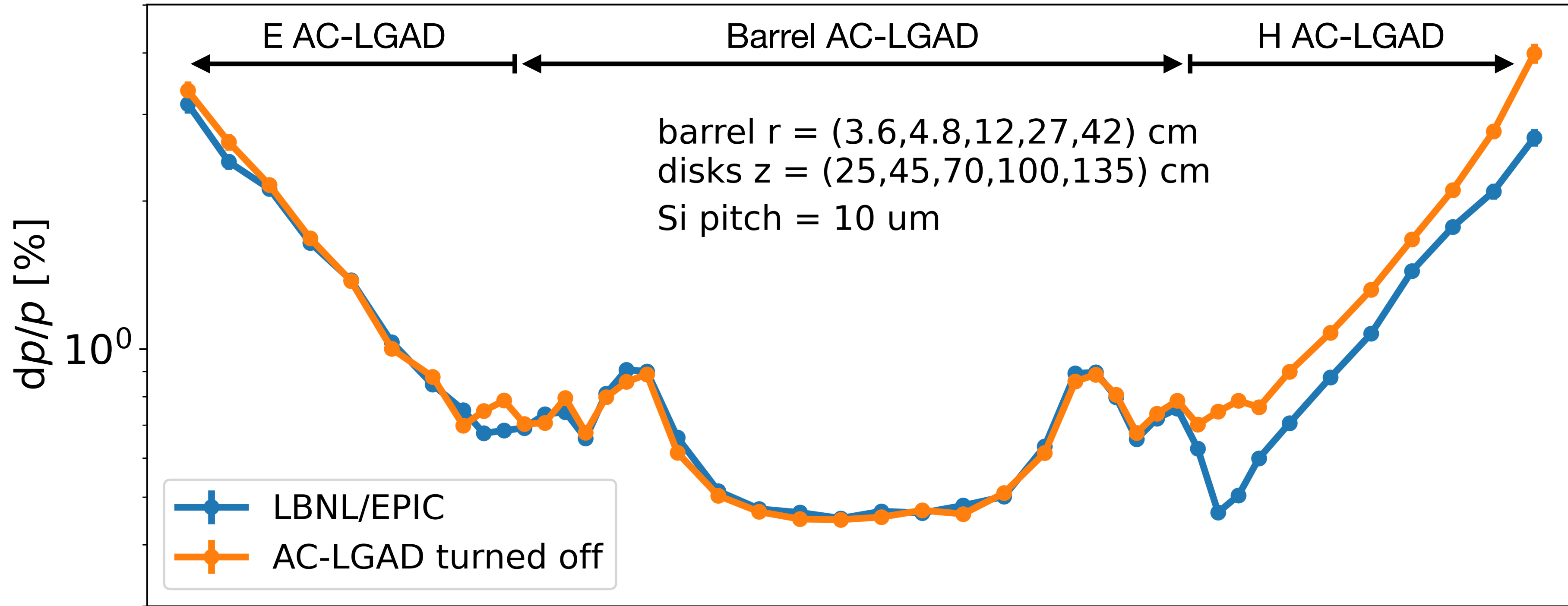


AC-LGAD momentum-resolution impact

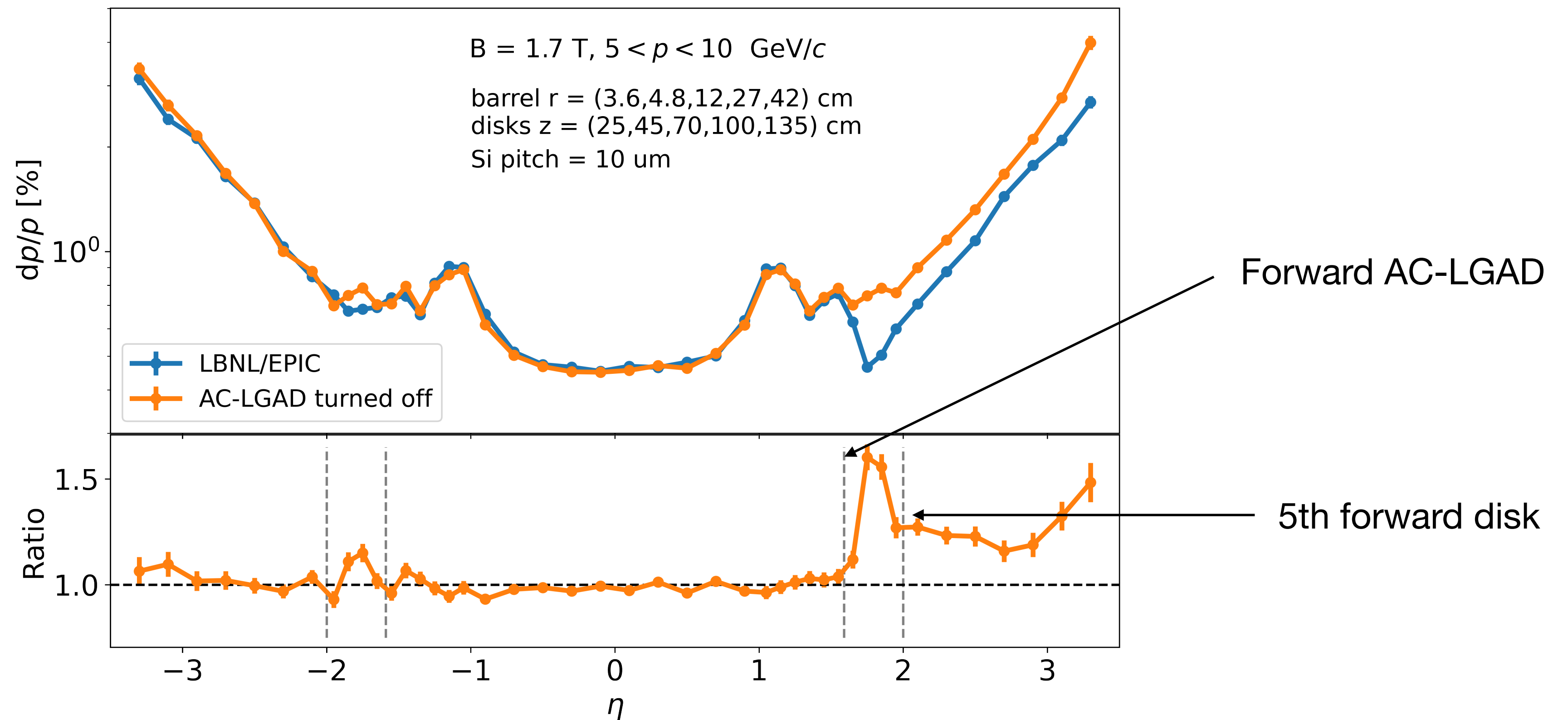
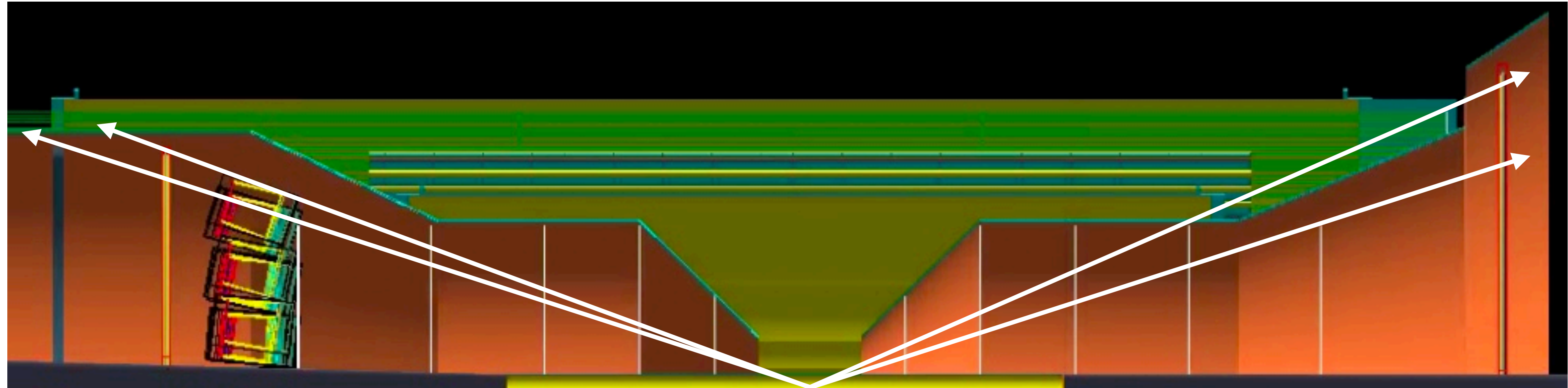


AC-LGAD momentum-resolution impact

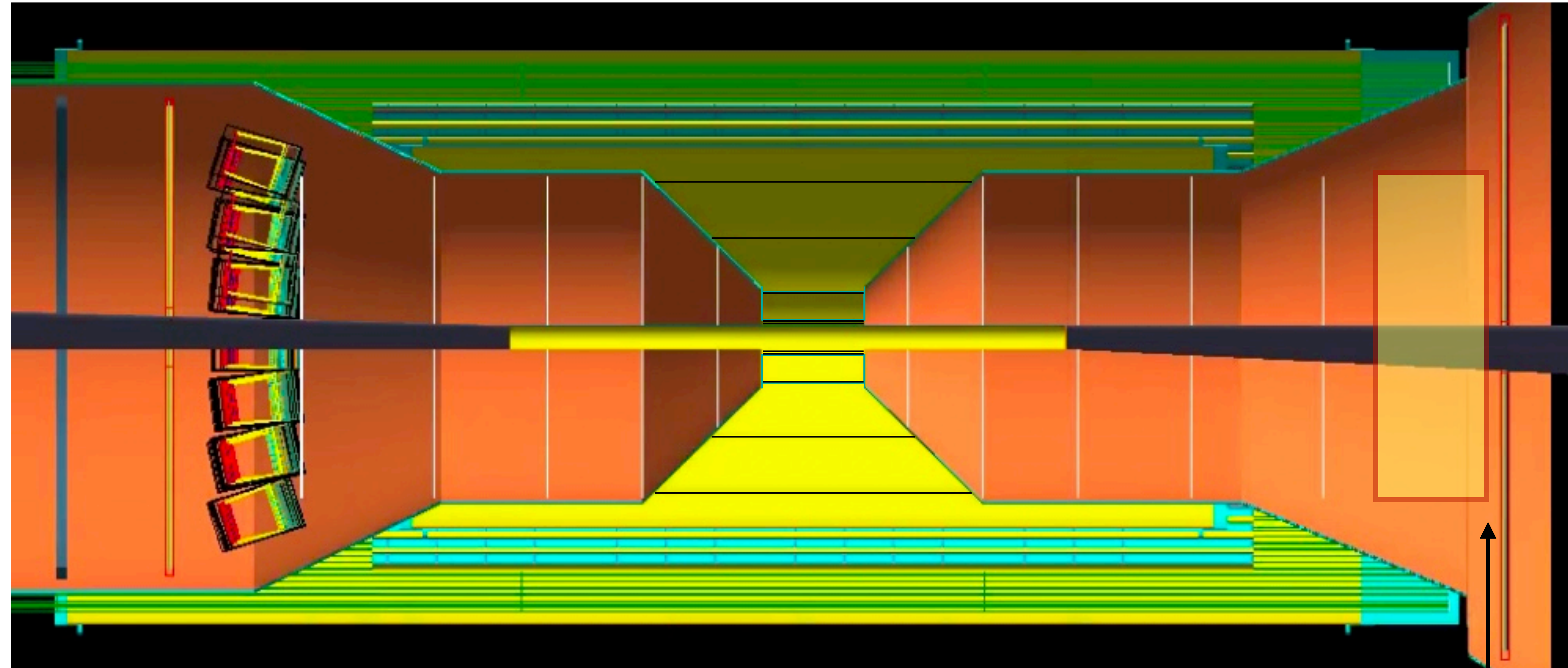
$B = 1.7 \text{ T}, 5 < p < 10 \text{ GeV}/c$



AC-LGAD momentum-resolution impact



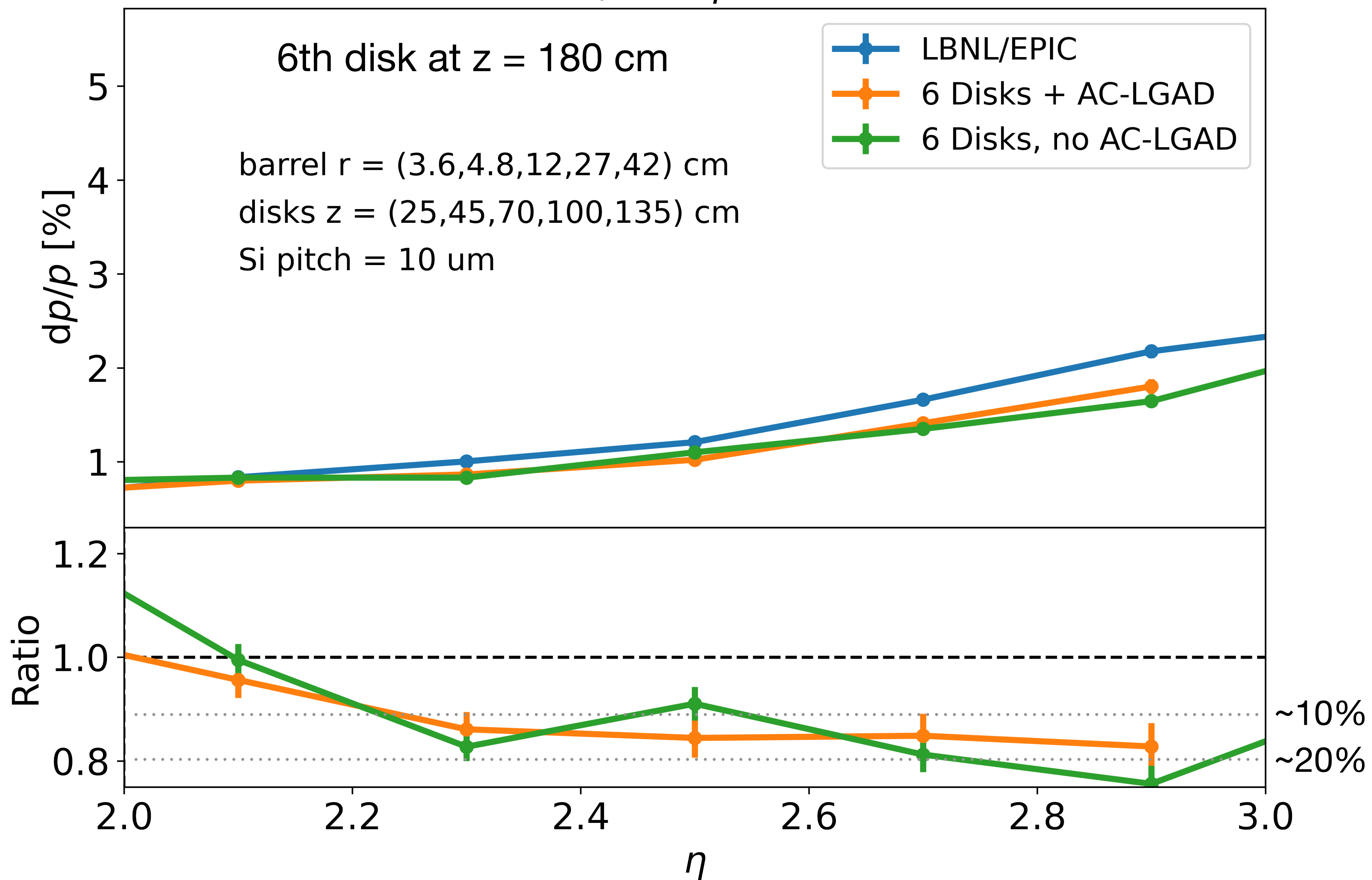
Disk layout in the forward region



Plenty of space for a 6th disk
in the hadron-going direction

6th disk in the hadron-going direction

$B = 1.7 \text{ T}, 15 < p < 20 \text{ GeV}/c$



6th disk in the hadron-going direction

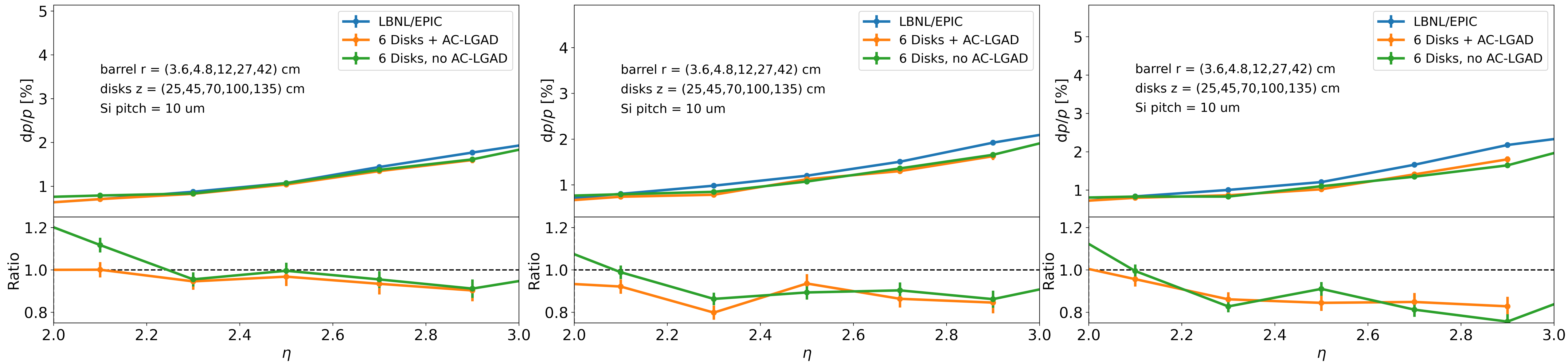
$$B = 1.7 \text{ T}$$

6th disk at $z = 180 \text{ cm}$

$5 < p < 10 \text{ GeV}/c$

$10 < p < 15 \text{ GeV}/c$

$15 < p < 20 \text{ GeV}/c$



Impact larger at higher momenta

Summary

- Fully implemented new geometry in Fun4All (disks and details of support newly implemented)
 - Also propagated this info to Shujie for DD4HEP implementation
- Compared to the ECCE configuration, the new geometry improves dp/p by $\sim 15\%$ on average
- Studied impact of AC-LGADs on dp/p :
 - Central and backward AC-LGADs have negligible impact on dp/p
 - Forward AC-LGAD improves performance
- A 6th disk in the hadron-going direction improves dp/p by $\sim 10-20\%$ at higher momenta

Backup

YR requirements

https://docs.google.com/spreadsheets/d/1ynU7Cu7NlwRvMtbtdlp_B5xXkw8yBAAtWJbenMf-P3U/edit#gid=368031287
[https://wiki.bnl.gov/eicug/index.php/Yellow Report Physics Common](https://wiki.bnl.gov/eicug/index.php/Yellow_Report_Physics_Common)

New proposed barrel configuration

black numbers
are radii in units
of cm

ECCE

EPIC/LBNL

MAPS
Support
ACLGAD
DIRC
 μ Rwell

