

Proposed ECCE Tracker – now reference for Detector 1

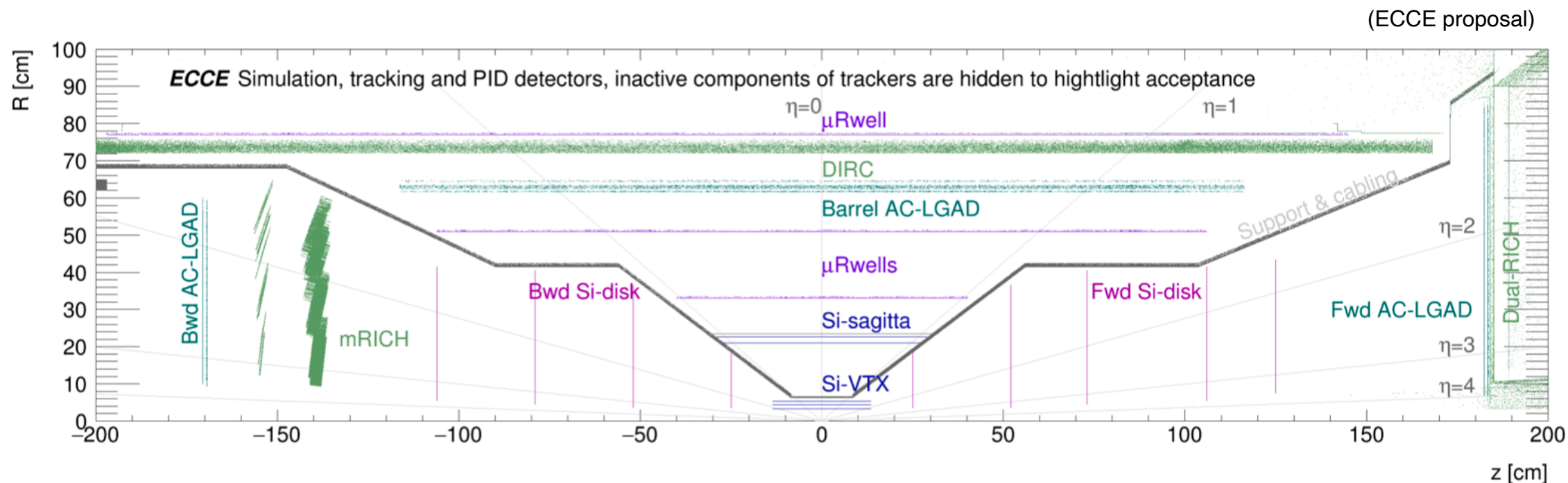
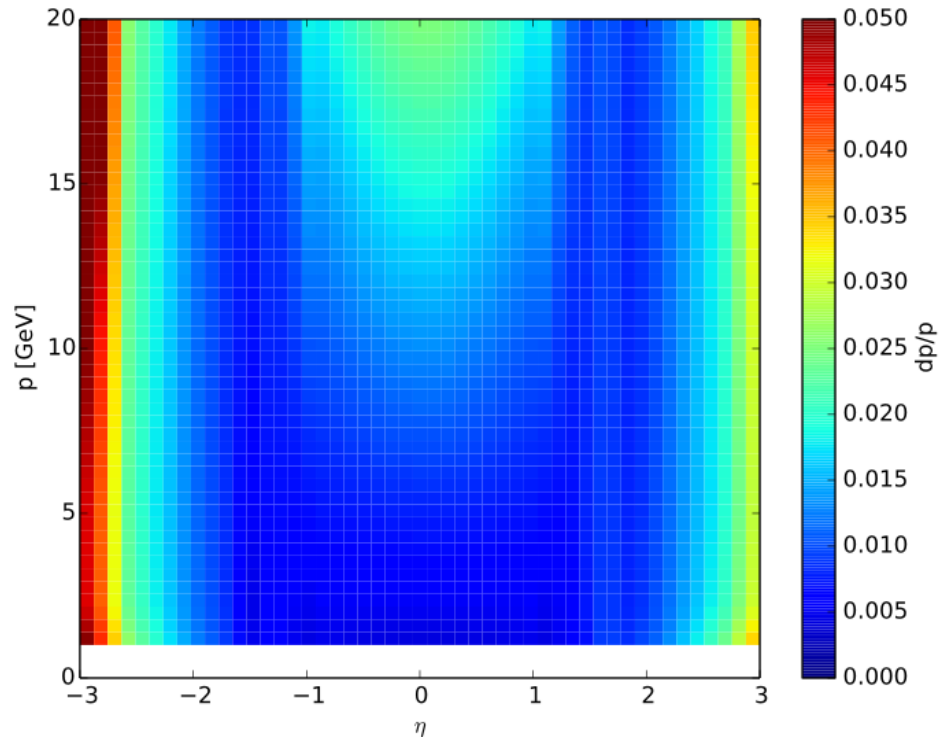


Figure 2.5: Schematic view of the ECCE tracker, including silicon, μ RWELL, AC-LGAD, DIRC, mRICH and dRICH detector systems.

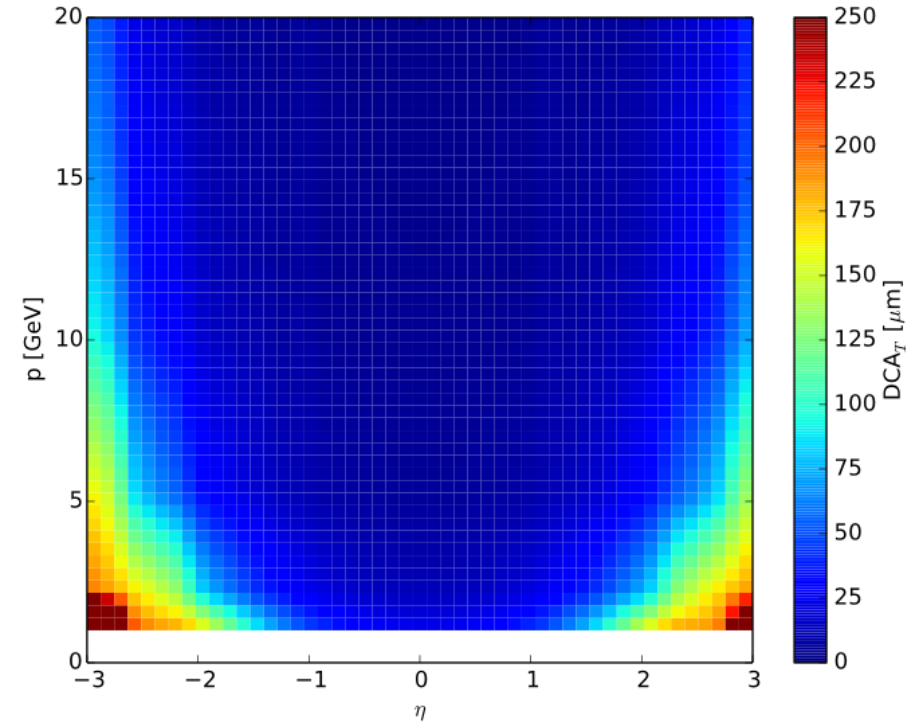
- We discussed this a few times here already and the notion “it has to be better” appears now more broadly shared,
- How to “make it better” is either now rather trivial or just more involved — timely to consider taking up a group role (?),

Towards fast simulations of the detector 1 reference (ECCE)

Relative momentum resolution



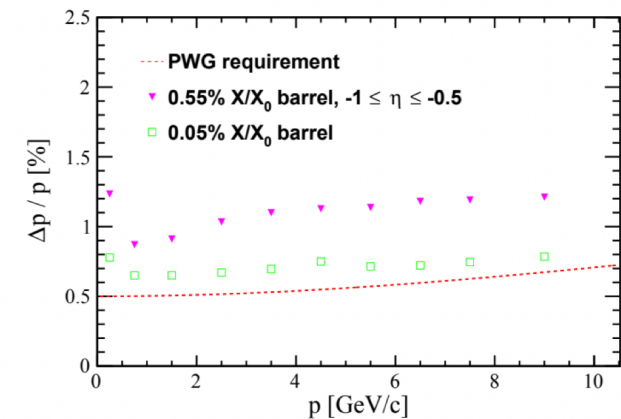
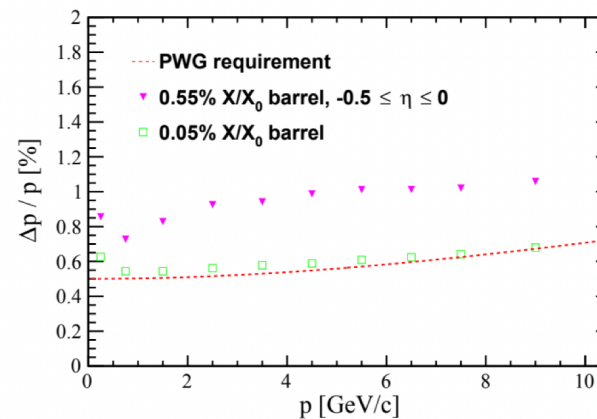
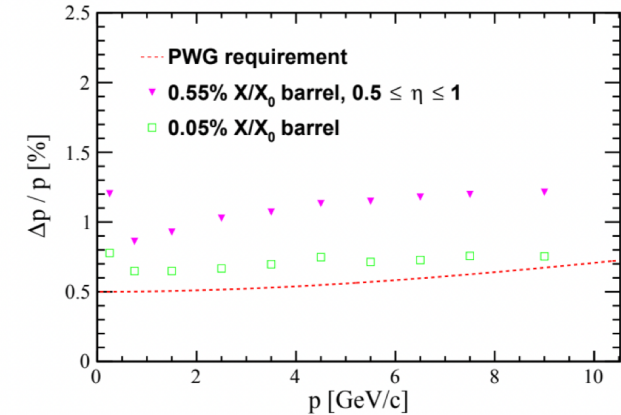
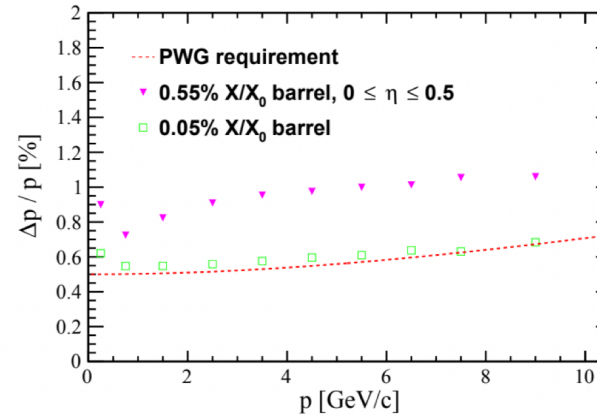
Transverse DCA resolution



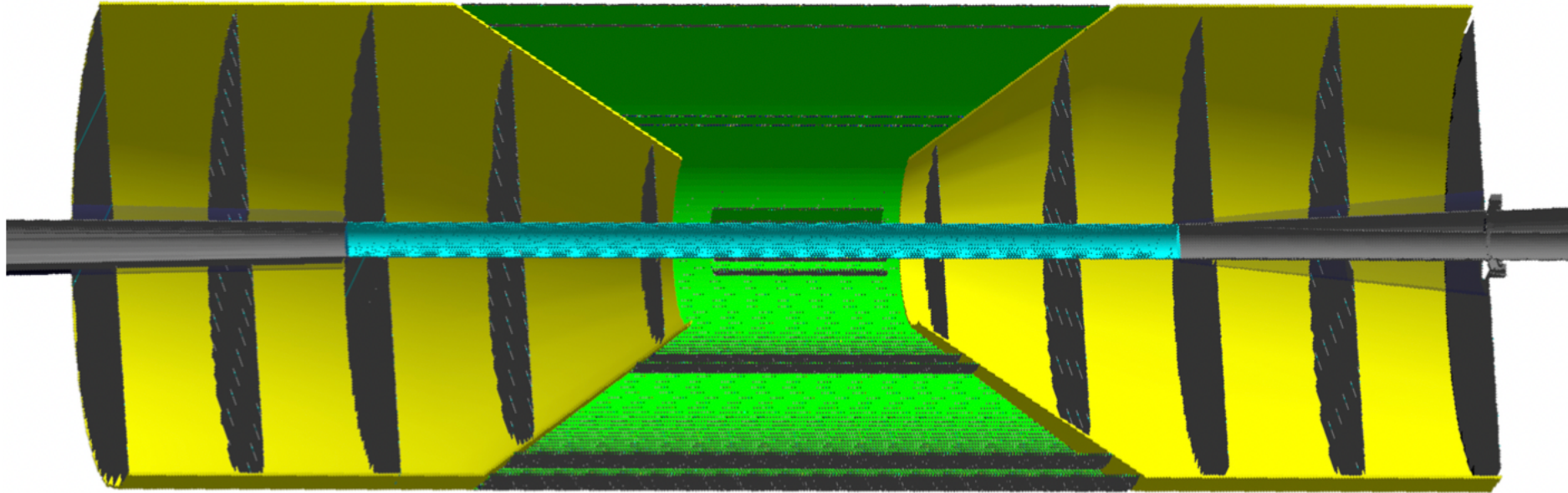
- Early (= pre-preliminary) performance from fast simulations,
- High-momentum mid-rapidity dp/p performance is worse than in the proposal; likely **because of uRWELL resolutions**,
- dp/p in the forward and backward regions appear in reasonable agreement,
- DCA-T appears in reasonable agreement (not too surprising),
- Preparing for fast-simulation studies e.g. of **material thickness in Sagitta layers** and disks, lever arms (!), etc.

Increased material in sagitta layers

- Updated the material of layer 4 and 5 of the barrel MAPS to reflect estimated material budget from SC
 - Barrel layer 4 and 5 go from 0.05% X/X_0 $\rightarrow$ 0.55% X/X_0 per layer
- Note: both sets of results are produced using the 1.5T field map

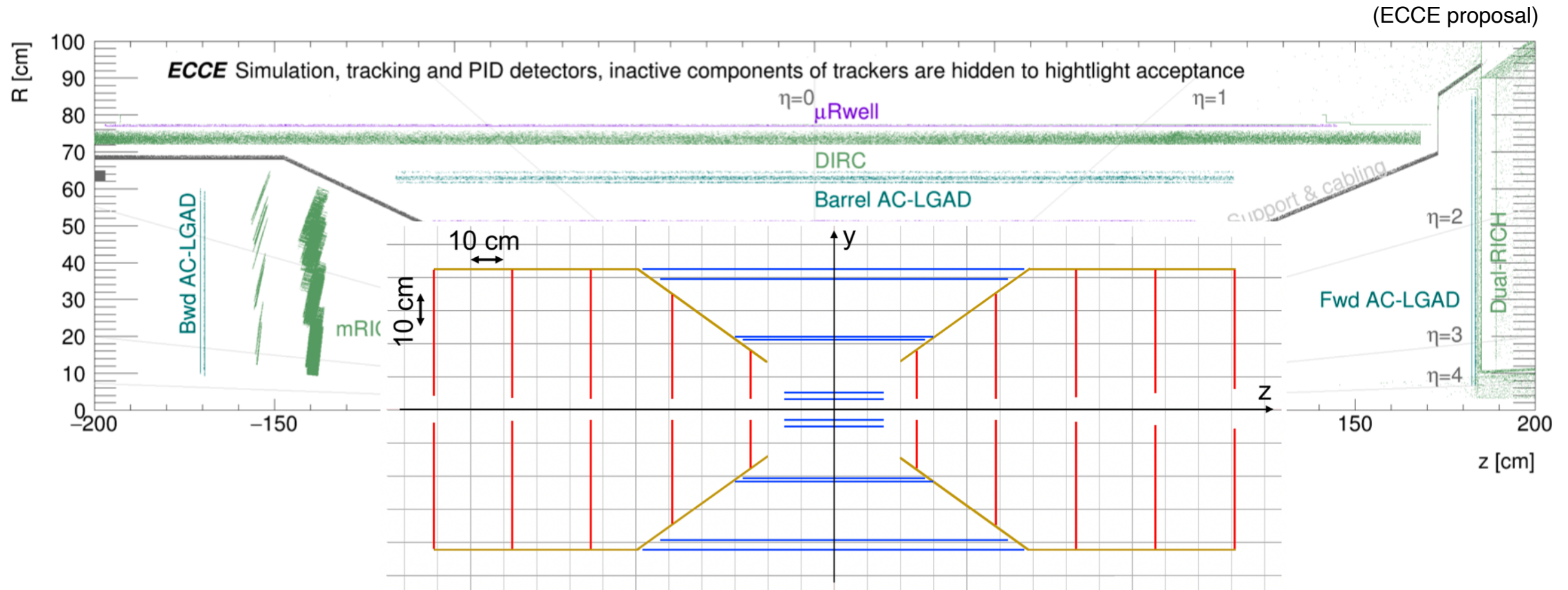


It has to be better — the straightforward way



- [arXiv:2102.08337](#) - we kind of know that 1.4T YR report performance is achievable in this universe,
- It would actually even fit in ECCE (doh).

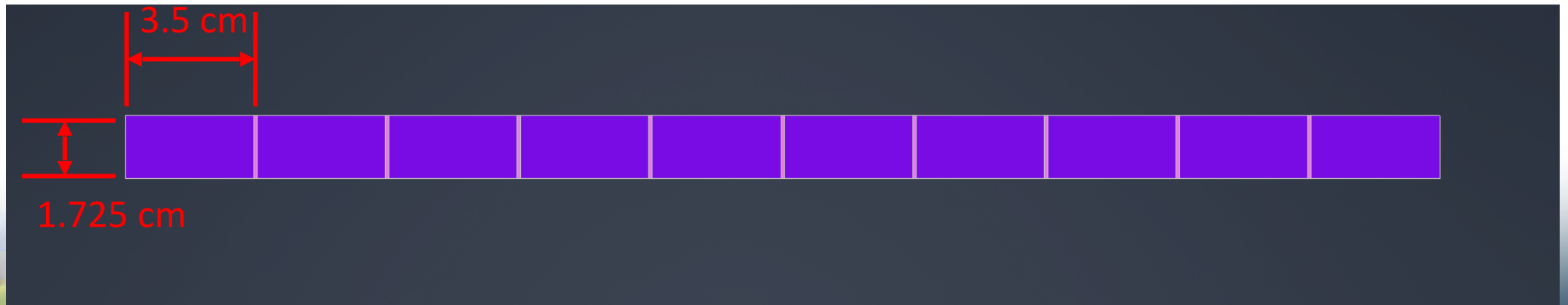
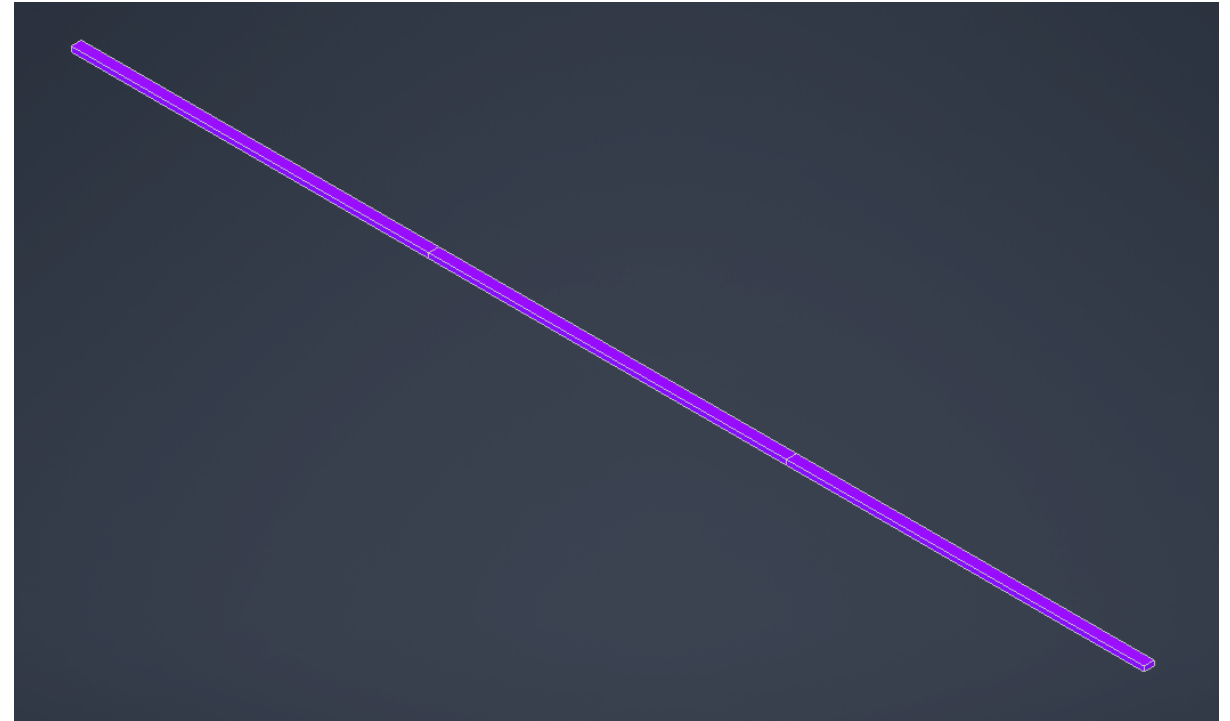
Better ECCE Tracker – towards an adequate baseline for Detector 1



- The all-silicon concept, inserted in the ECCE magnetic field, will simply perform better. From my personal point of view, too much has been made of not particularly relevant details such as the number of vertexing layers (which was simply a choice for the YR). Extending the concept in IZL would have seemed better use of time than the current (sub-)optimization,
- This said, more is known or being learned about integration. We could/should consider this in moving towards a baseline. DIRC plays an important role in this.

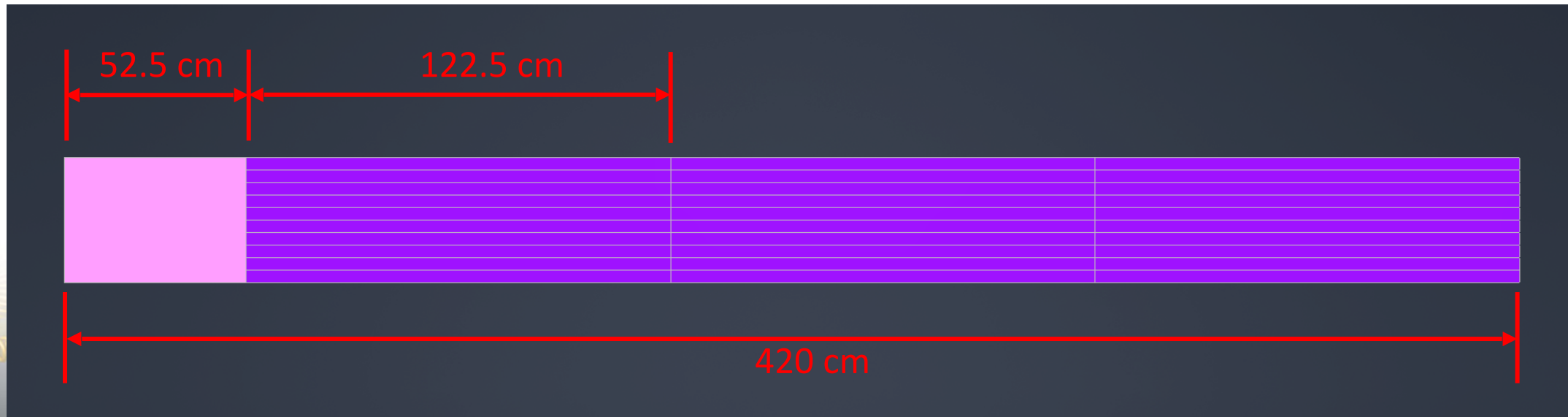
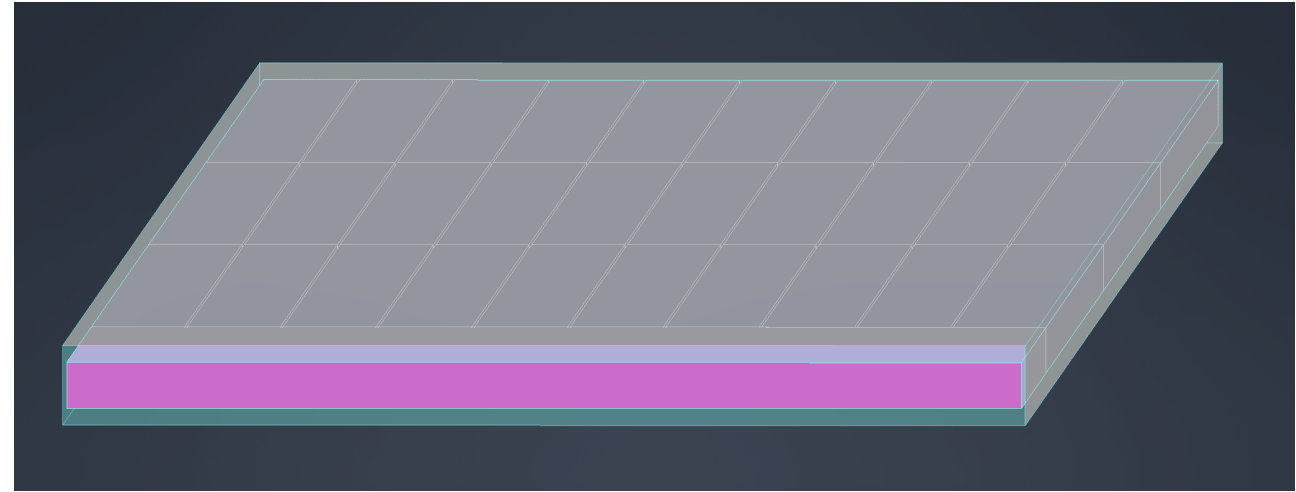
DIRC Bars

- Reusing bars from BaBar
- Each DIRC bar is 3.5 cm wide, 1.725 cm tall and 122.5 cm long
- 3 bars are fused end to end to make 1 'long' bar totaling 367.5 cm in length



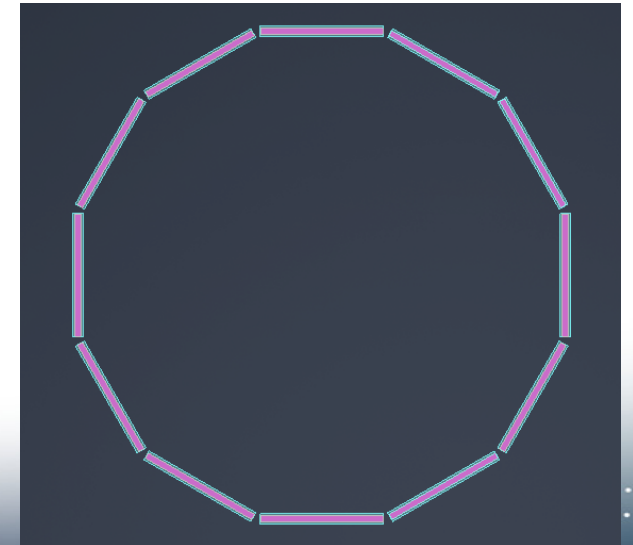
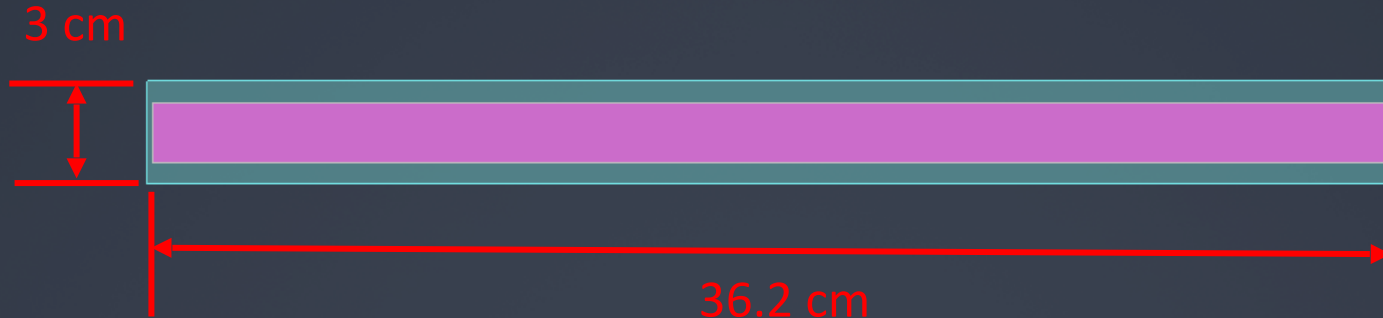
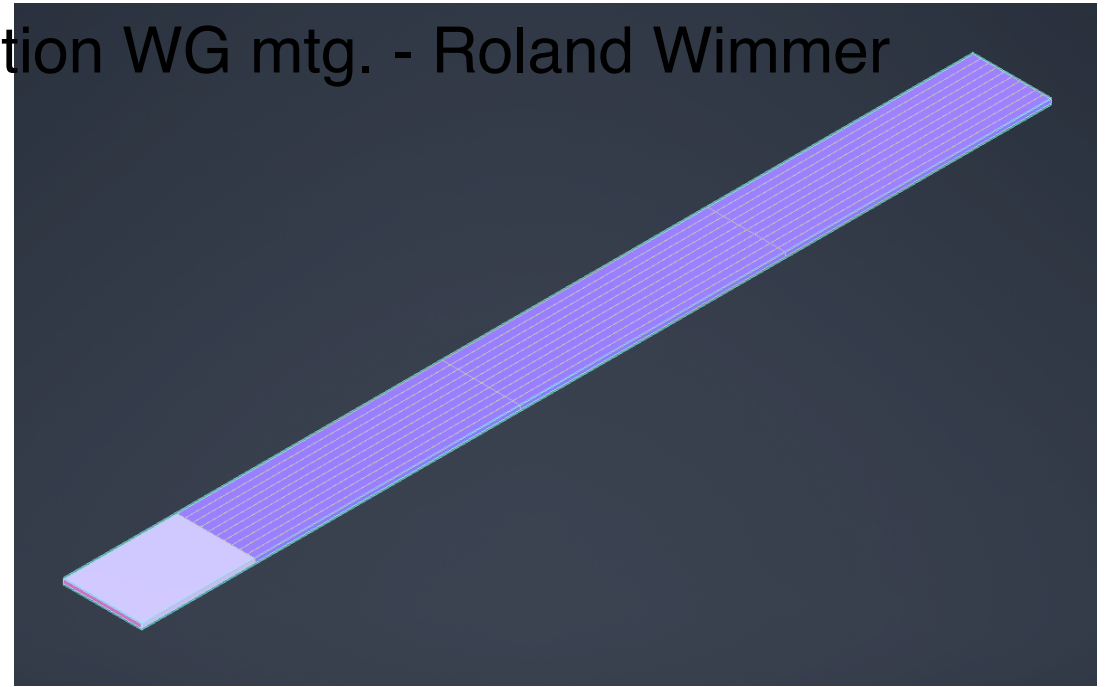
DIRC Bar Box

- 10 'long' bars are used to make 1 bar box
- 52.5 cm adapter (shown in pink) is needed for each bar box
- Bar boxes are 420 cm in length



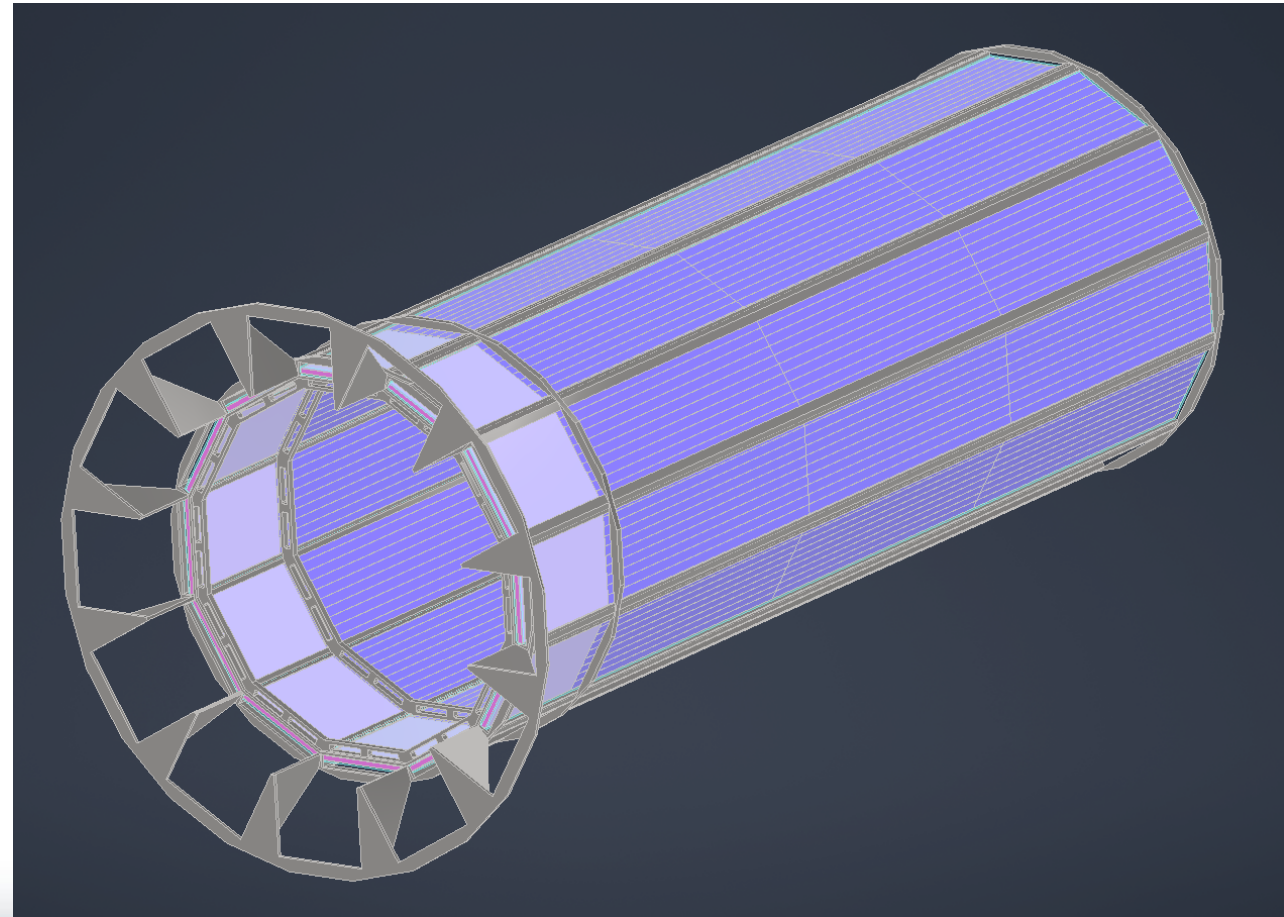
DIRC Bar Boxes

- 12 Bar boxes totals
- Bar boxes are 36.2 cm wide, 3 cm tall and 420 cm long
- Made up of 30 bars, 1 adapter and the box shell



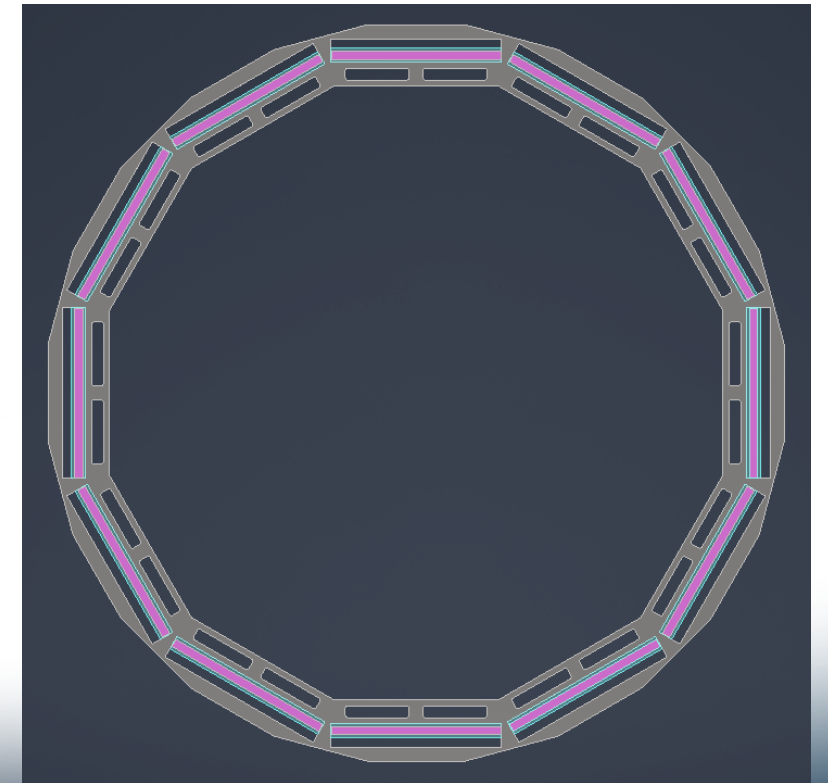
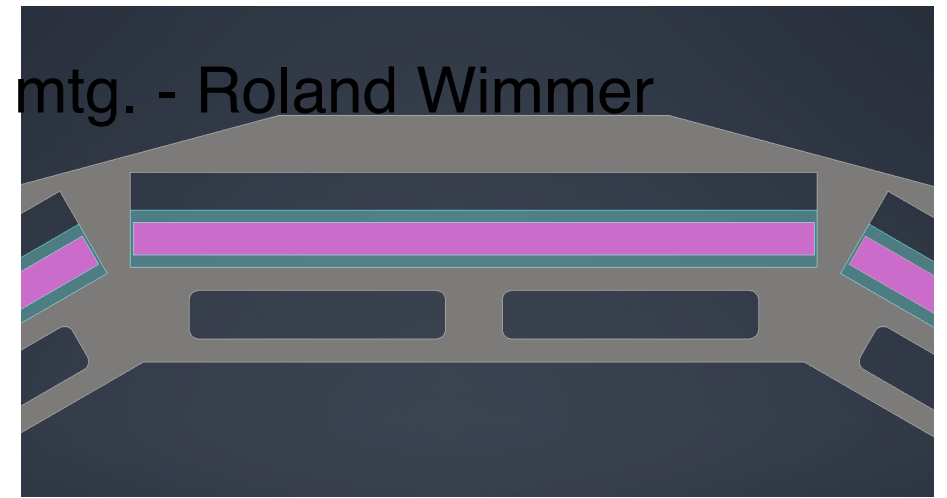
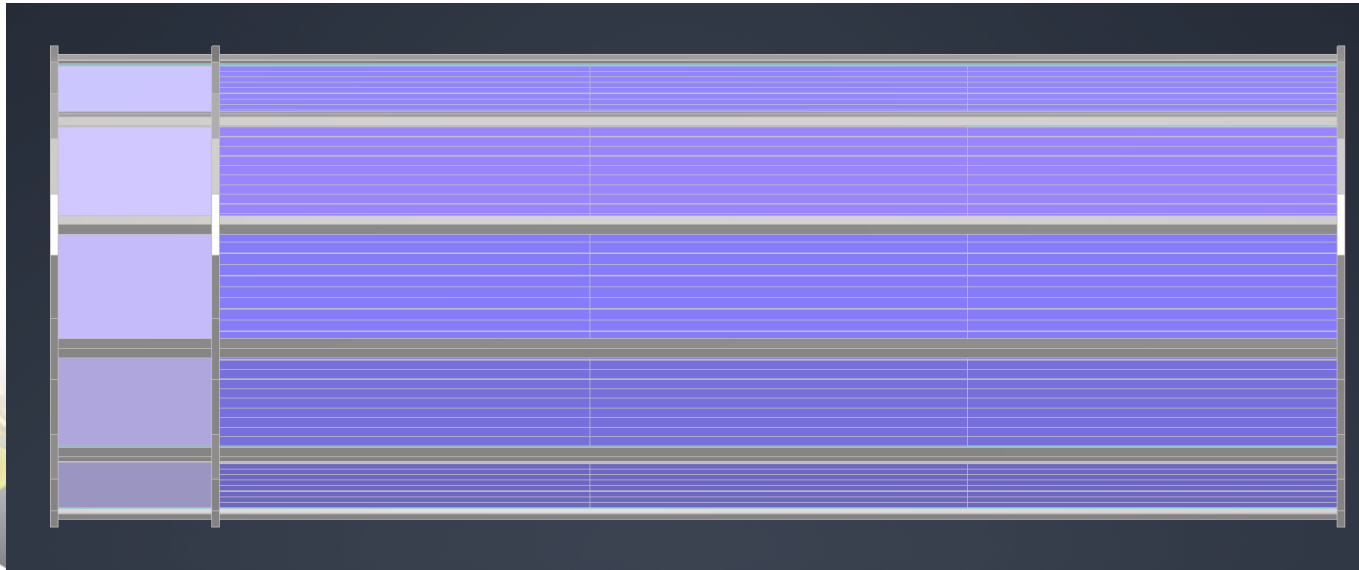
DIRC & Barrel GEM Support

- Support structure will hold the DIRC bar boxes, DIRC readout, GEM trackers, and all other systems inside of the DIRC
- Will allow for cooling and cables to be brought out from the inner detectors
- DIRC readout will be a separate piece capable of being detached
- Support was designed around both the barrel Emcal and the EEEEmcal

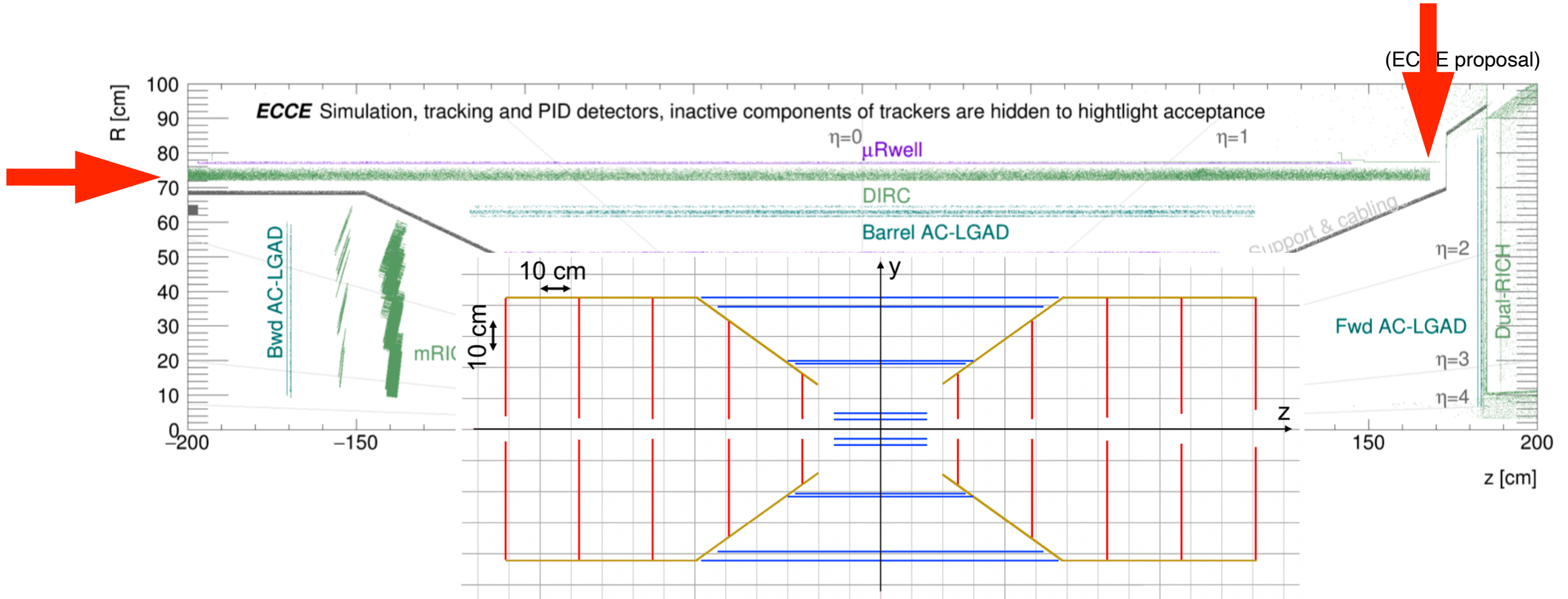


DIRC Support

- Top cutout is 36.2 cm wide and 5 cm tall, 3 cm for DIRC bar box and 2 cm for GEM tracker (DIRC shown in pic)
- Bottom cutouts are 13.5 cm wide and 2.54 cm tall for cables and cooling to be routed out



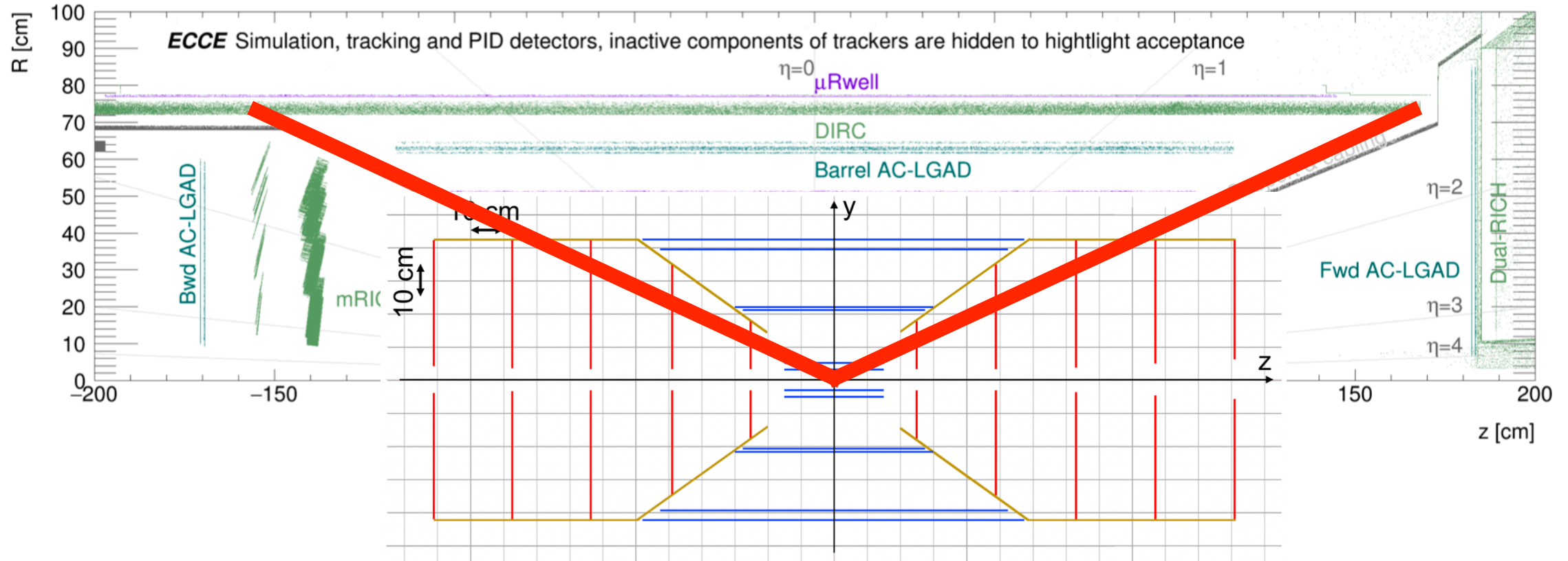
Better ECCE Tracker – towards an adequate baseline for Detector 1



- Approx. 70 cm radius is realistic and so is the +170 cm end position,
- This corresponds to an angle of approx. 22 degrees and, hence, a pseudo-rapidity of approx. 1.6
- This angle is *not* optimal for tracking.

Better ECCE Tracker – towards an adequate baseline for Detector 1

(ECCE proposal)

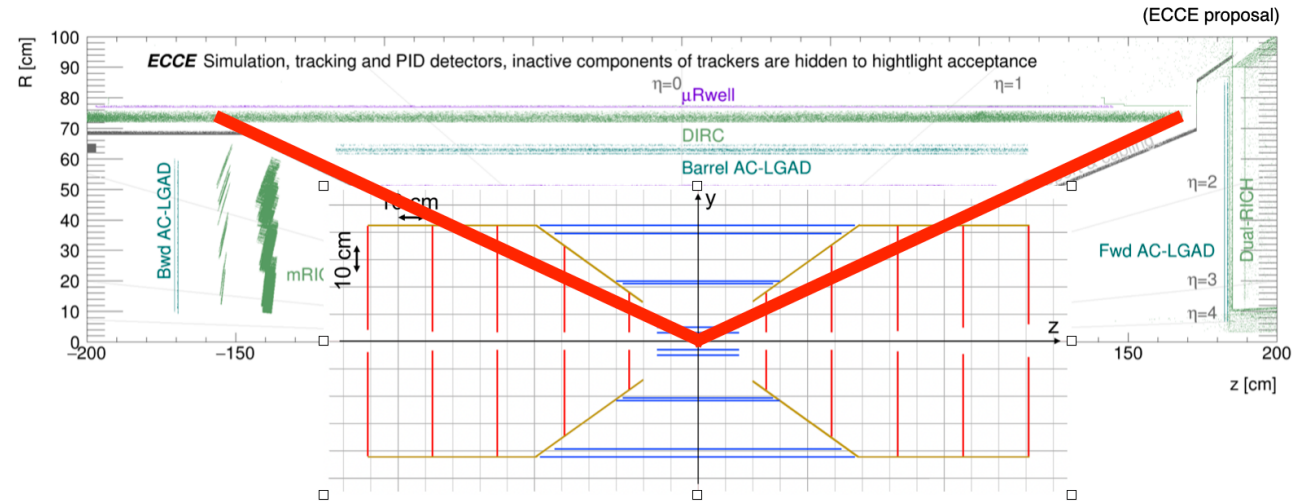


- Approx. 70 cm radius is realistic and so is the +170 cm end position,
- This corresponds to an angle of approx. 22 degrees and, hence, a pseudo-rapidity of approx. 1.6
- This angle is *not* optimal for tracking. However, it is useful to consider (unlike several of the other projective angles).

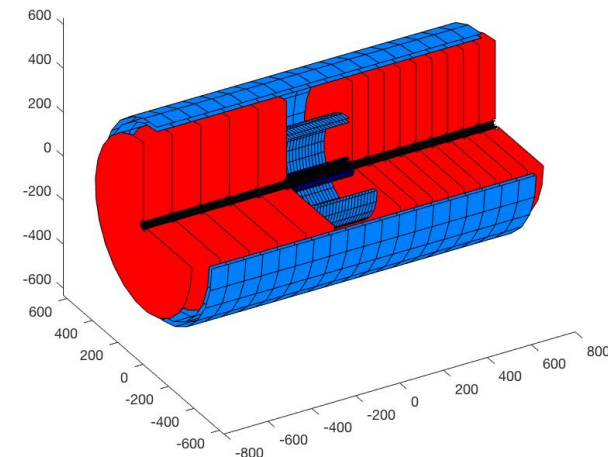
Towards an adequate baseline for Detector 1

One possible approach going forward:

- Adopt 5 disks in the electron going direction, likely simply stretched in a first pass; the radius of the/a disk at $z \sim -65\text{cm}$ would otherwise be somewhat small,
- Likewise, in the hadron direction,
- Consider also the ATHENA routing “trick,”
- A 43 cm outer radius, as in the all-silicon concept, corresponds to a ~ 1 m half-length at this projection angle; this radius can be revisited, but dp/p goes as r^2 so that the performance loss would need to be regained by reduced material in the sagitta layers,
- A half-length of ~ 25 cm would be reached at a radius of 10.3 cm for this projection angle; probably not viable to consider full sagitta silicon-only layers in a projective layout even if the yield would turn out sufficient,
- An outer radius of ~ 10 cm for the innermost disks would almost certainly “challenging” from a layout point of view,
- Consider moving away from a projective layout *outside* of the innermost vertexing layers — where we already did this —; this tends to favor dp/p for $\sim 1 < |\eta| \sim 2$



Detector Arrangement:
geom/FPHENIX-si-short.bgeom
geom/FPHENIX-si-short.fgeom



Towards an adequate baseline for Detector 1

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In practice — parallel effort

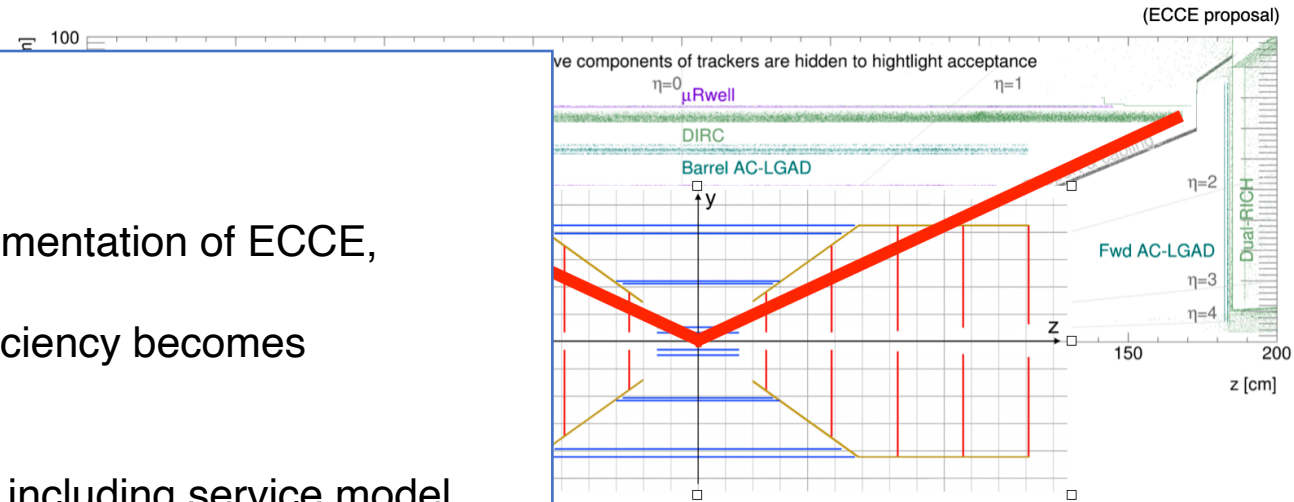
- Complete the DD4hep implementation of ECCE,
- Finalize track finding so sufficiency becomes quantifiable,
- Optimize in fast simulations, including service model and including a role for MPGDs,

Subsequently,

- Cross-validate Fun4all and DD4hep to pre-empt the usual,

Timeline is “now,” obviously. “Just do it” will need some volunteers, obviously.

Revisit also the cost-estimates to pre-empt other usual.



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geom/FPHENIX-si-short.bgeom
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