



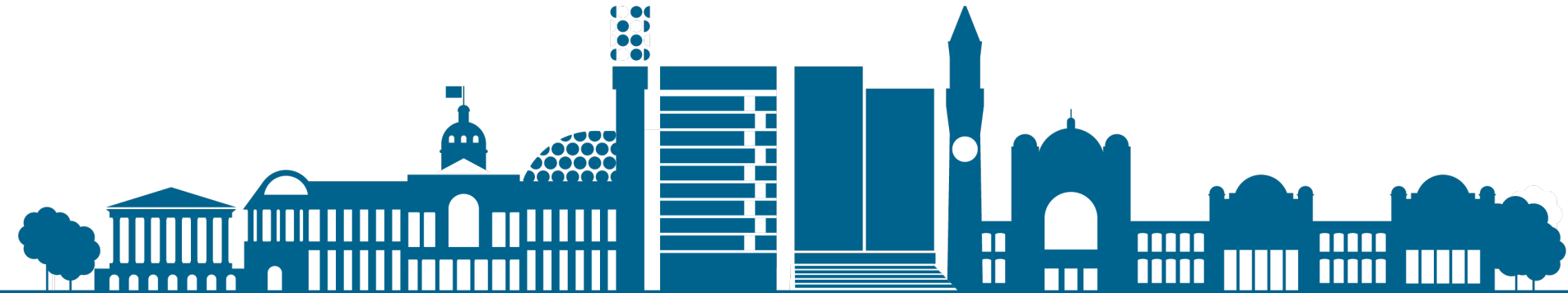
UNIVERSITY OF
BIRMINGHAM

Silicon layers and disks configuration for simulations – Part 1

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Tracking WG meeting

25 August 2022



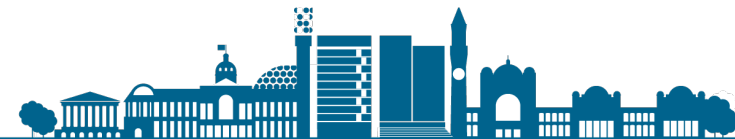
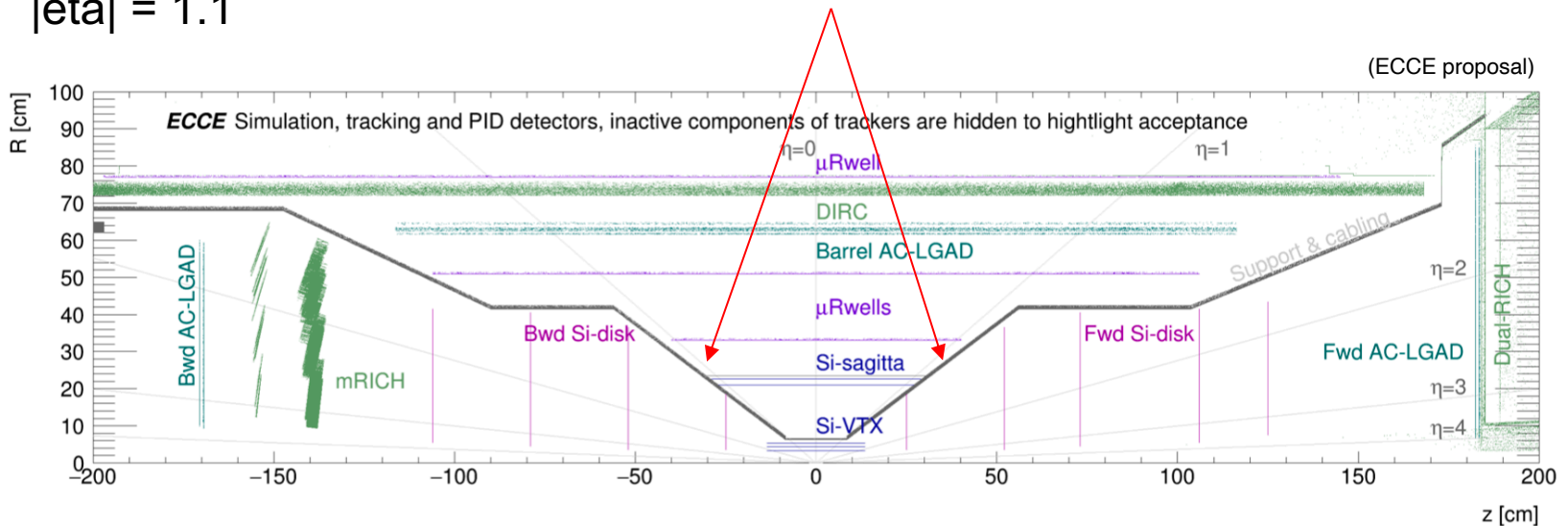
Introduction

- The optimisation of the silicon vertex and tracker is ongoing and layers and disks radii, length, etc. will probably be optimised further.
- However, it would be important at each point in time that we agree on a common configuration that is what everyone uses for further optimisation.
- When an optimisation is accepted within this group then the configuration can be updated and we all simulate further optimisations with that one.
 - As it happened for example after the talks of Stephen, Ernst and Nicholas on 23 June.
- At the moment there are different numbers going around.
 - Information is also inconsistent on the EPIC tracking TWIKI...
- Let's try to agree what is the current configuration we use to simulate further optimisations in this WG.



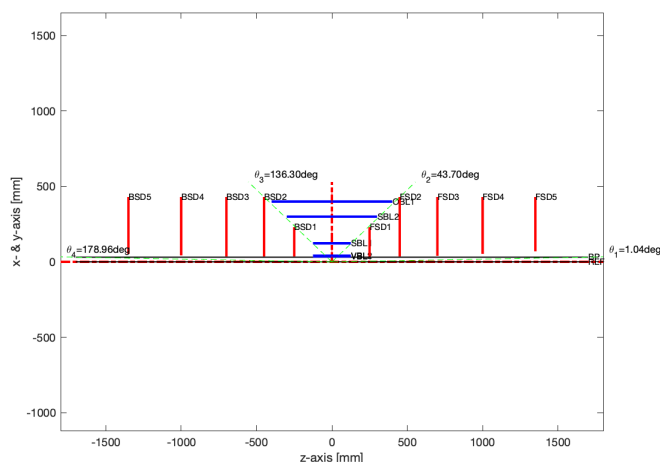
Reference design – just a reminder

- This is just a reminder, we are now beyond this configuration.
- I believe nobody is simulating this anymore for tracking related studies.
 - If you are, please move to the latest configuration (that is what we will agree on today).
- I just want people to note the angle of the first cone that is around ~ 38 degrees, $|\eta| = 1.1$



Optimisation of the barrel region

- ❑ First vertex layer moved at $r = 36$ mm to accommodate beam pipe bake out and ITS3 sensor size.
- ❑ Second vertex layer moved at $r = 48$ mm to improve vertex resolution and be at a radius compatible with ITS3 sensor size.
- ❑ Third vertex layer and two sagitta layers moved at larger radii to improve momentum resolution (that was the goal of this optimisation).
- ❑ Inner cone at ~ 45 degrees angle.



Following the previous steps, consider:

- Outer barrel layer at $r = 420$ mm, $L = 840$ mm, $X/X_0 = 0.55\%$
- ~ 45 degree cone,
- Single sagitta layer with $r \leq 270$ mm, $X/X_0 \sim 0.25\%$ $L = 540$ mm
- Outer (third) vertex barrel layer with increased radius to $r = 120$ mm while preserving its length, $L = 270$ mm, $X/X_0 = 0.05\%$

To achieve this material, this layer needs to be made of two sensors only with services coming in from the sides, not running on the stave, i.e. $\max l = 540$ mm

Notes:

The lengths assume reticle lengths of 30 mm.

Services and service routing will need further attention; it is not for today, but I have concerns over the “double-cone” and otherwise consider a single projection angle determined by the DIRC length impractically shallow. Not for today.

See all details in Ernst’s talk at <https://indico.bnl.gov/event/16261/>

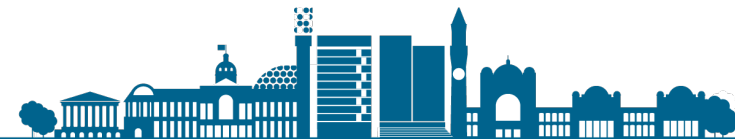
This optimisation was discussed at this meeting on 23 June and we decided to implement it in the first simulation campaign.

Barrel optimisation implemented in the 1st sim campaign

- However, we were late to push this through so the implementation, and this resulted in slightly different design than what Ernst proposed.

Layer	X/X0	R [cm]	L [cm]
layer 1	0.05%	3.60	27
layer 2	0.05%	4.8	27
layer 3	0.05%	12.3	27
layer 4	0.25%	30.0	77
layer 5	0.55%	40.0	104

- This configuration keeps the radii close to what Ernst proposed which is good as it keeps the improvement to momentum resolution.
- There wasn't time to change the cone angle from ~38 to ~45 degrees so the two sagitta layers are longer than 54 and 84 cm.
 - These lengths not compatible with ITS3 sensor size.
 - The material of these layers would be higher as more sensors would be needed (i.e. more services).

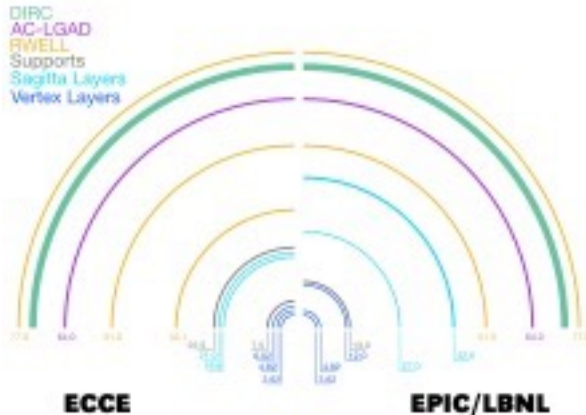


Recent studies

- Work by Nicholas presented at the combined TOF-PID & tracking meeting on 22 August.
- Uses Ernst's suggested radii and X/X0 for the barrel and disk positions in z.

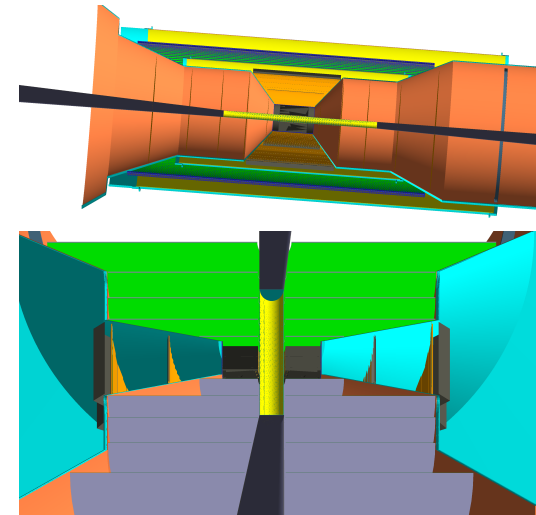
https://indico.bnl.gov/event/16685/contributions/66971/attachments/42898/72063/2022_08_EPIC_BST.pdf

Barrel



Disks

- Added new disk class to allow for asymmetric pipe cutout
- Service cone adjusted for new layer positions and other detectors
- Modification of E/FST positions to Ernst suggestions
→ E/FST z positions: 25.0, 45.0, 70.0, 100.0, 135.0 (cm)
- EST radii and cutout offsets:
→ r_{inner} : 3.6, 3.6, 3.6, 3.9, 4.5 (cm)
→ r_{outer} : 19.0, 43.0, 43.0, 43.0, 59.0 (cm)
→ x_{offset} : 0.0, 0.0, 0.0, 0.2, 0.7 (cm)
- FST radii and cutout offsets:
→ r_{inner} : 3.6, 3.6, 3.6, 4.5, 5.4 (cm)
→ r_{outer} : 19.0, 43.0, 43.0, 43.0, 53.0 (cm)
→ x_{offset} : 0.0, 0.0, 0.0, -0.8, -1.7 (cm)



Are these the ECCE numbers from the proposal? They are different from what shown here <https://indico.bnl.gov/event/15489/>



Summary

- The configuration in the 1st simulation campaign (shown here on slide 4) remains valid for PWG studies.
- Within this working groups we need to define a common configuration we all use at this point in time for further optimisations.
 - We will use the TWIKI to store the configuration to be used.

