ILD simulation model

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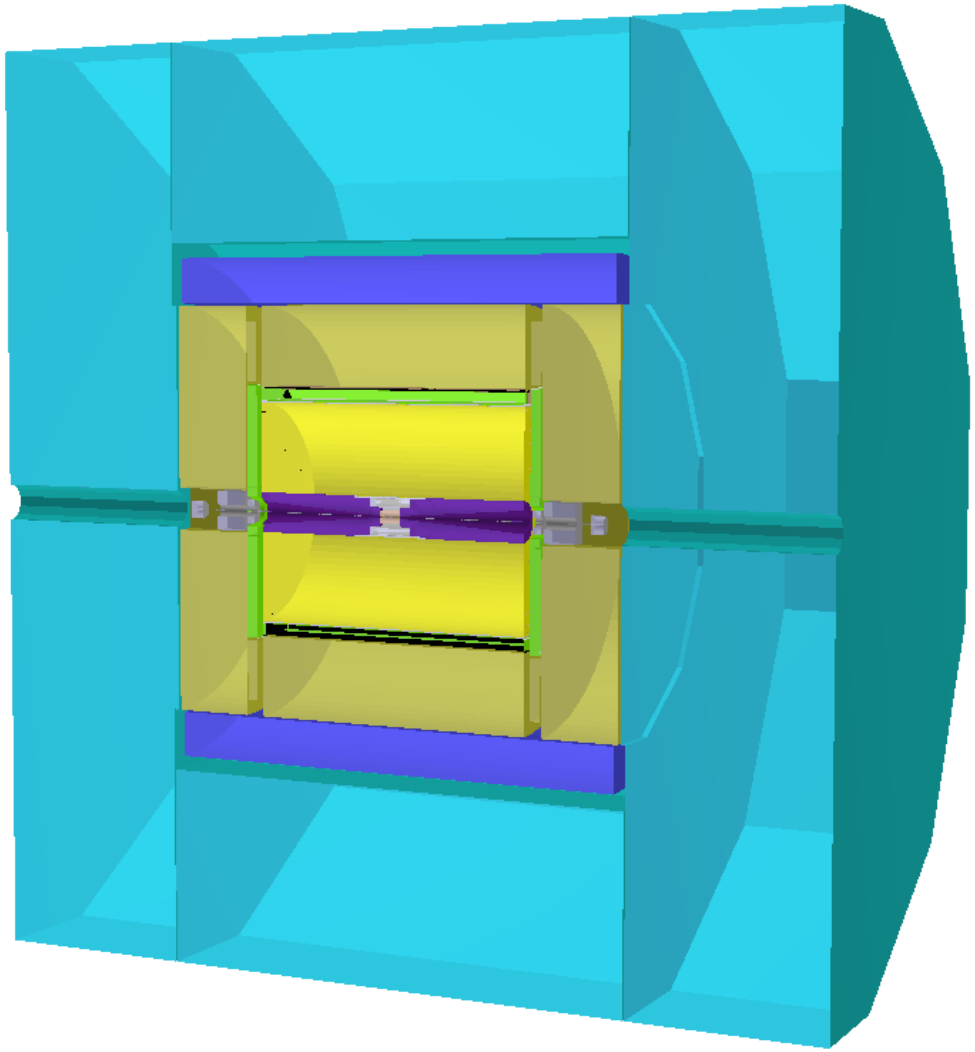
Outline

- Envelopes in ILD simulation model
- ILD_o1_v05 model in lcgeo
- Validating calorimeters of ILD_o1_v05
- Validating the new surface based tracking
- preliminary result from standard reconstruction
- Summary and outlook

Envelopes in ILD simulation model

- introduced ‘mandatory’ envelops into the ILD simulation model
- in order to
  - synchronize more easily with CAD models (place holder volumes)
  - have well defined ‘real estate’ for detectors
  - facilitates development of new detector drivers and models
  - eventually allow for some well defined scaling behaviour
  - speed up the simulation (navigation)

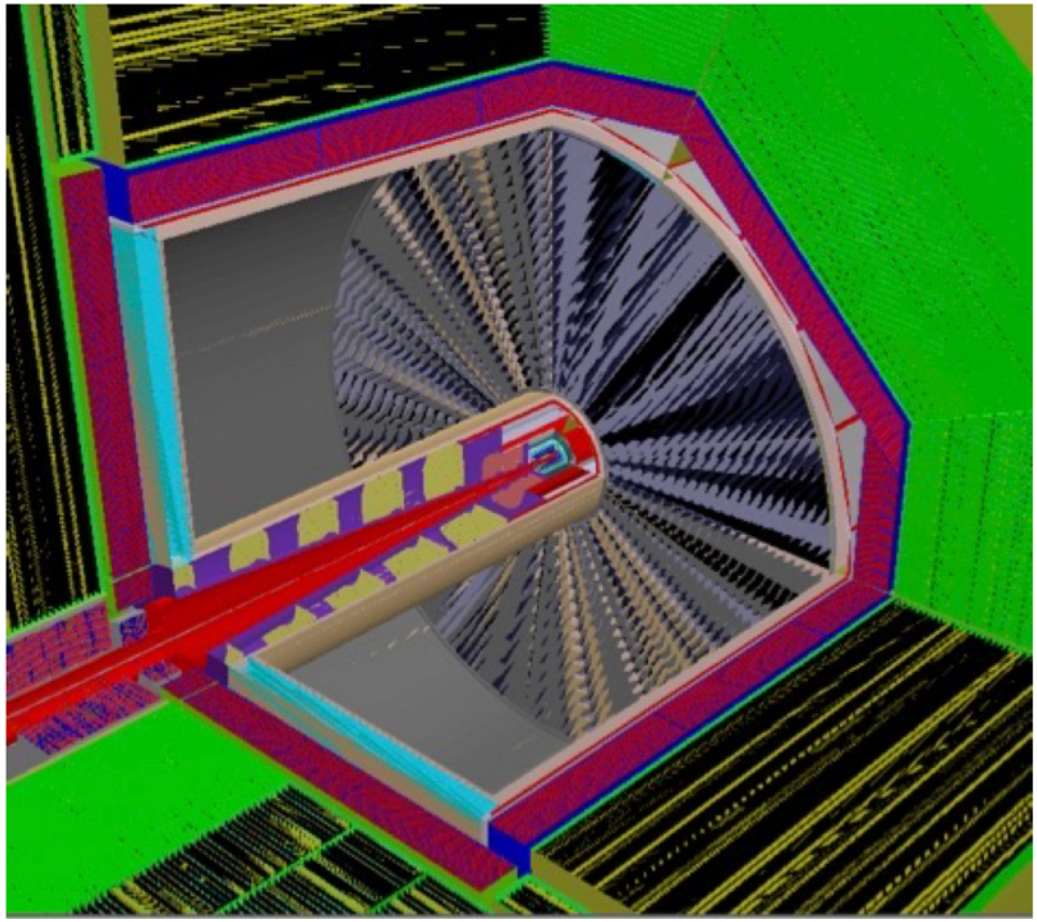


Envelopes in ILD_o1_v05

detector	inner radius	outer radius	half length min z, max z	additional parameters	
VXD	16.0	60.0	177.6	VXD_cone_min_z	80.0
				VXD_cone_max_z	150.0
				VXD_inner_radius_1	24.1
FTD	25.1	328.9	2350.0	FTD_outer_radius_1	152.8
				FTD_outer_radius_2	299.7
				FTD_min_z_0	177.7
				FTD_min_z_1	368.2
				FTD_min_z_2	644.2
				FTD_cone_min_z	230.0
				FTD_cone_radius	184.1
SIT	152.9	324.6	644.1	SIT_outer_radius_1	299.8
				SIT_half_length_1	368.1
TPC	329.0	1808.0	2350.0		
SET	1808.1	1827.9	2350.0		
Ecal	1843.0	2028.0	2350.0	Ecal_Hcal_symmetry	8.0
				Ecal_symmetry	8.0
EcalEndcap	400.0	2088.8	2450.0, 2635.0		
EcalEndcapRing	250.0	390.0	2450.0, 2635.0		
Hcal	2058.0	3395.5	2350.0	Hcal_inner_symmetry	8.0
HcalEndcap	350.0	3395.5	2670.7, 3957.7	EcalEndcap_symmetry	8.0
HcalEndcapRing	2138.8	3137.0	2450.0, 2635.0	HcalEndcapRing_symmetry	8.0
Coil	3425.0	4175.0	3872.0		
Yoke	4424.0	7725.0	4047.0	Yoke_symmetry	12.0
YokeEndcap	300.0	7725.0	4072.0, 7373.0	YokeEndcap_symmetry	12.0
YokeEndcapPlug	300.0	3395.5	3981.5, 4072.0	YokeEndcapPlug_symmetry	12.0
BeamCal	20.0	150.0	3475.0, 3695.0	BeamCal_thickness	220.0
				BeamCal_tubeIncoming_radius	15.0
LHCal	100.0	325.0	2680.0, 3200.0	LHCal_thickness	520.0
LumiCal	80.0	195.2	2500.0, 2630.7	LumiCal_thickness	130.7

ILD_o1_v05 model in lcgeo

- Geometry ported from Mokka ILD_o1_v05 model
- Sensitive digitisation transferred into DDSegementation
- Detector layout, more flexible
- Material and thickness of active layer, steerable with xml file

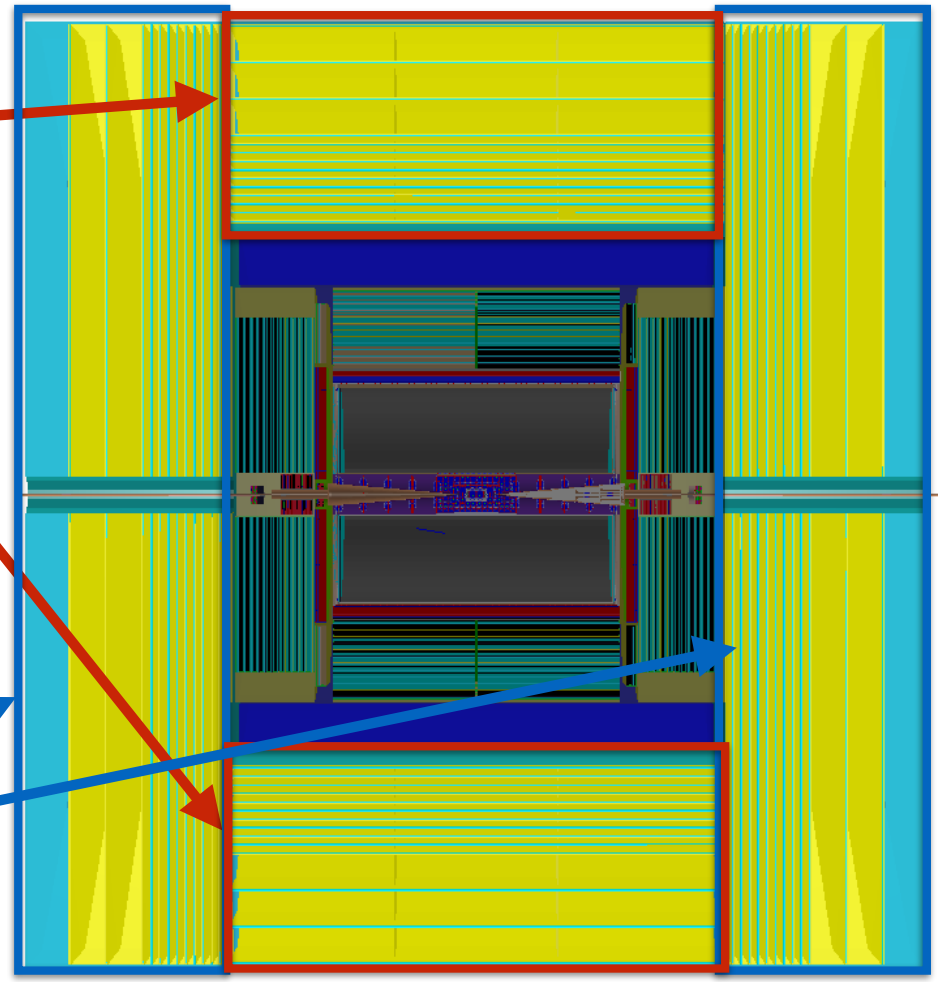


Yoke of ILD_o1_v05 in lcgeo

Yoke Barrel

- There is three modules in Barrel
- 12 folds Endcaps

Yoke Endcaps

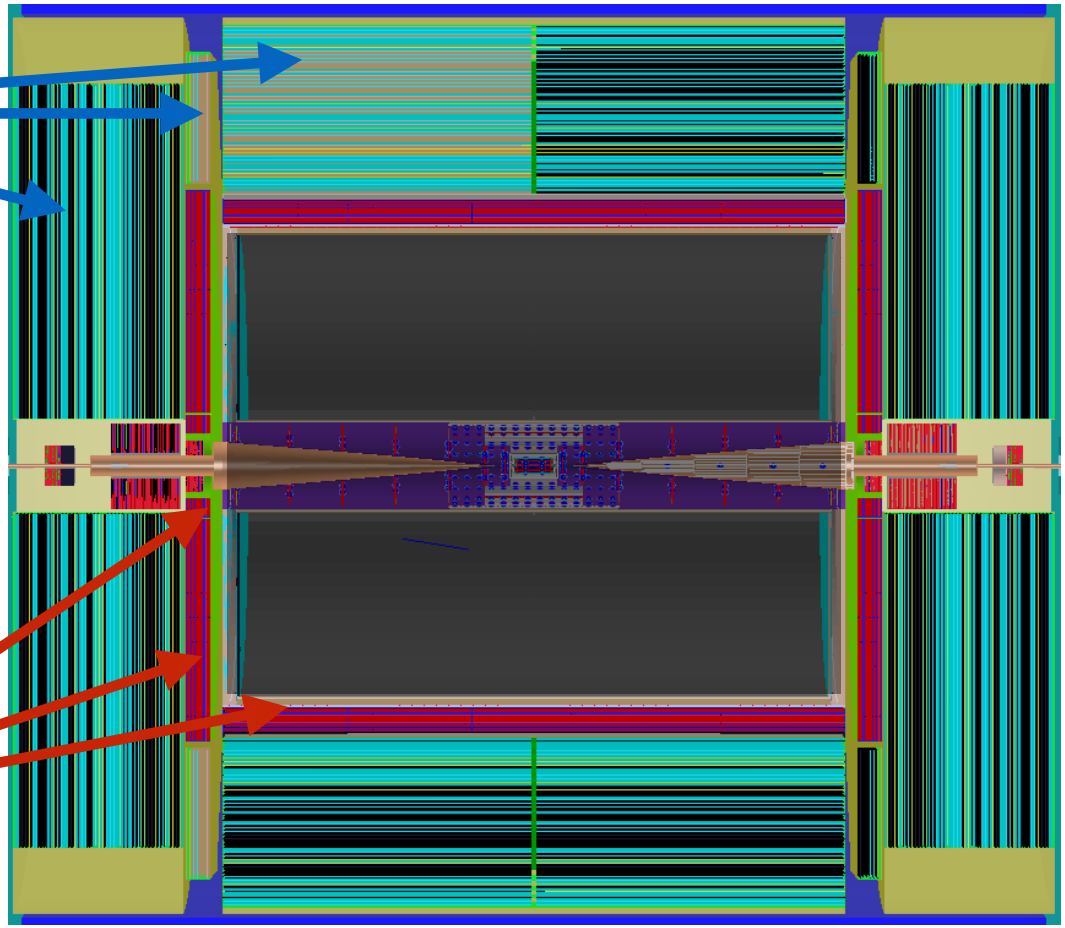


Hcal/Ecal of ILD_o1_v05 in lcgeo

AHcal

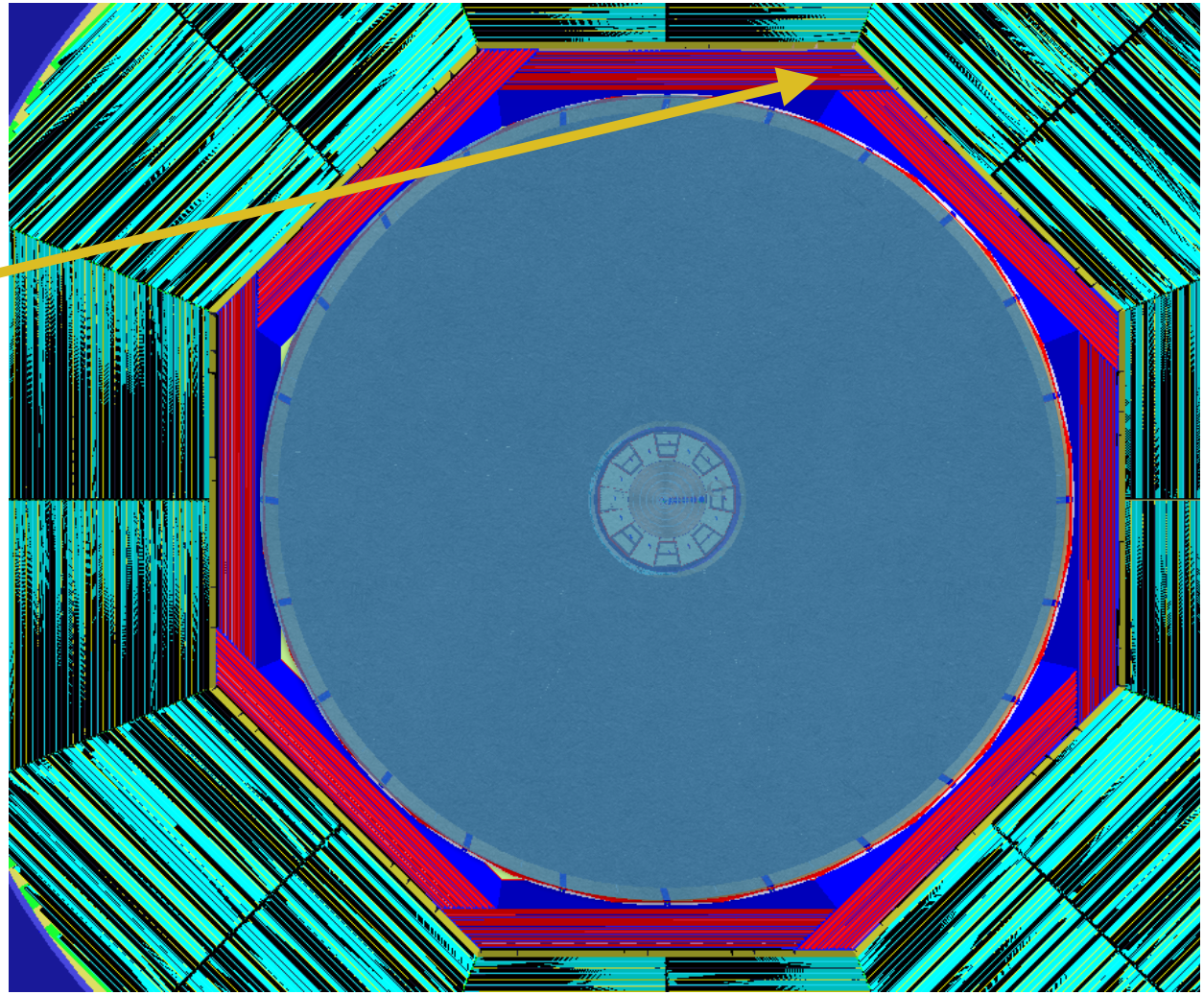
- AHcal has two modules in Barrel
- Ecal has five modules in Barrel
- Both have 8 folds

Ecal



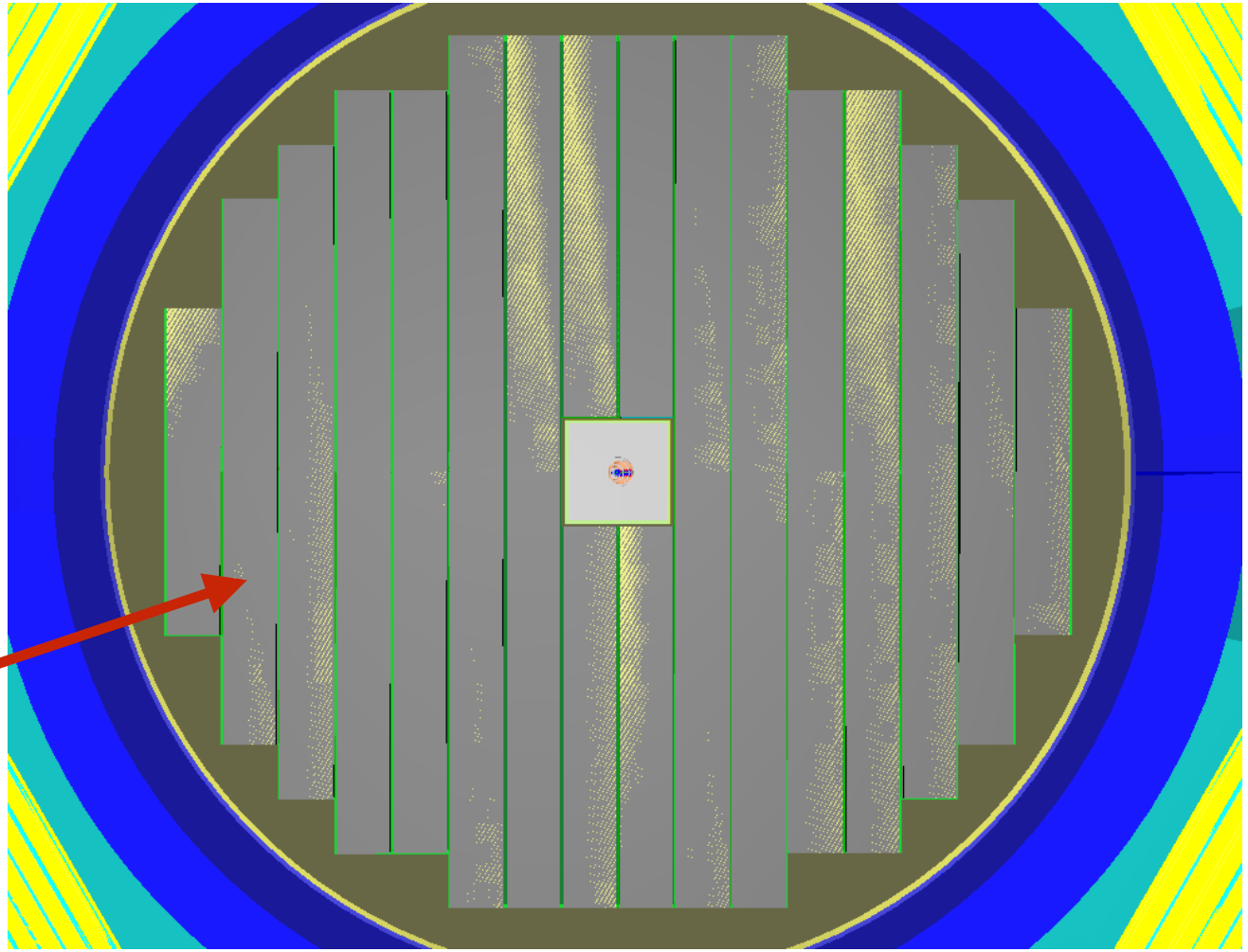
Ecal Barrel in ILD_o1_v05

- Clear Ecal layer structure could be seen here.
- Ecal has a double layers structure where could be seen clearly in the event display later.



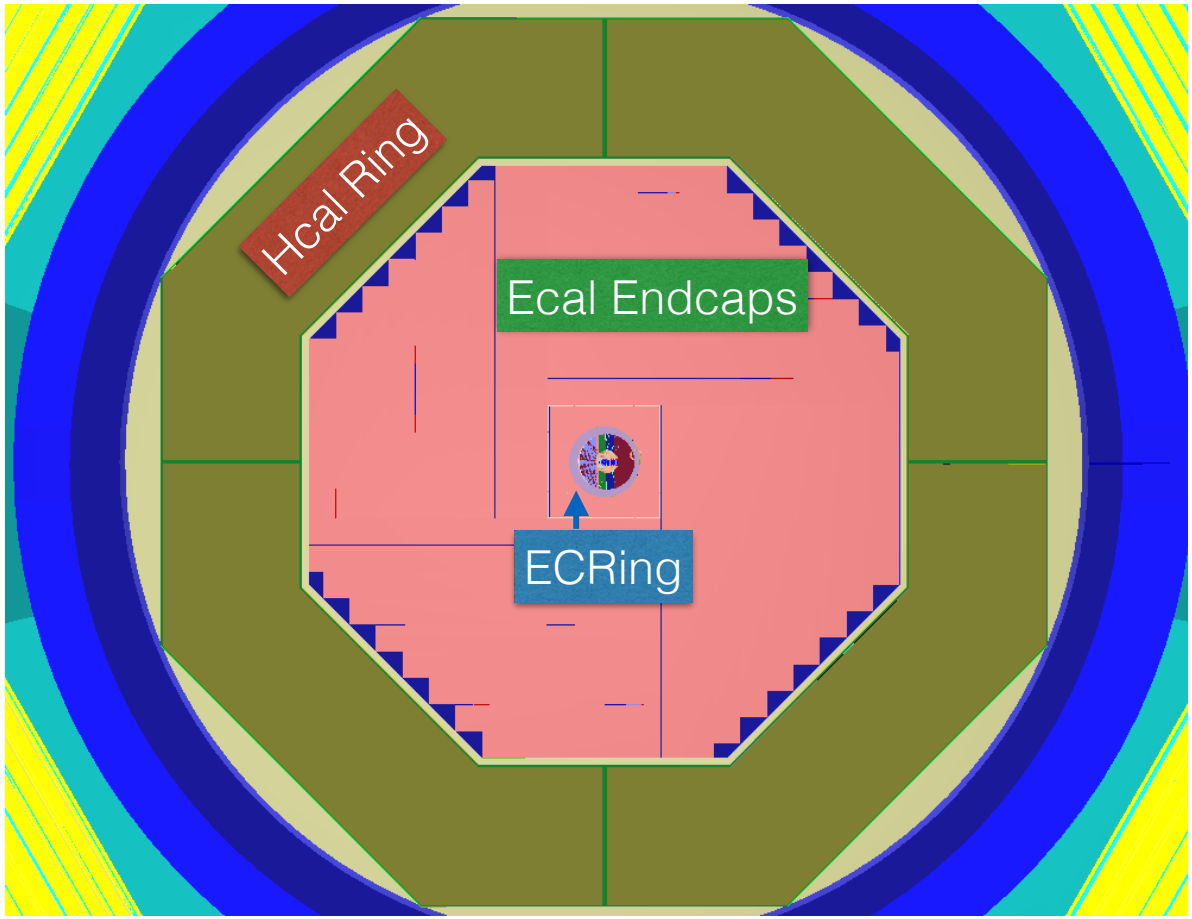
AHcal Endcaps in ILD_o1_v05

- Hcal Endcaps, the lastest HBU engineer design model has been implemented in the lcgeo.
- It include 16 towers, which has the HBU type size.



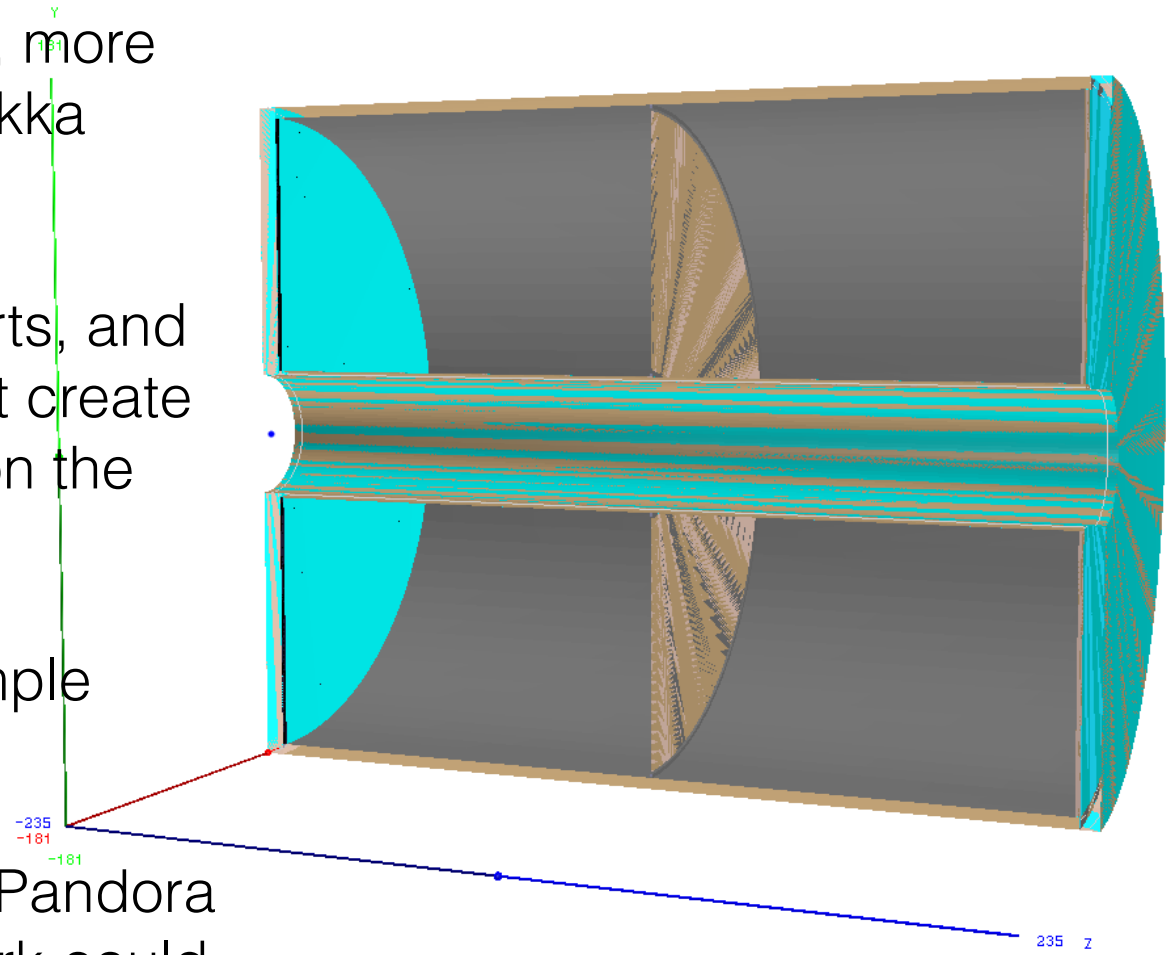
Endcaps of ILD_o1_v05 in lcgeo

- Simple Hcal Ring, which ported from Mokka
- The EcalEndcap and EcalECRing, which ported from Mokka

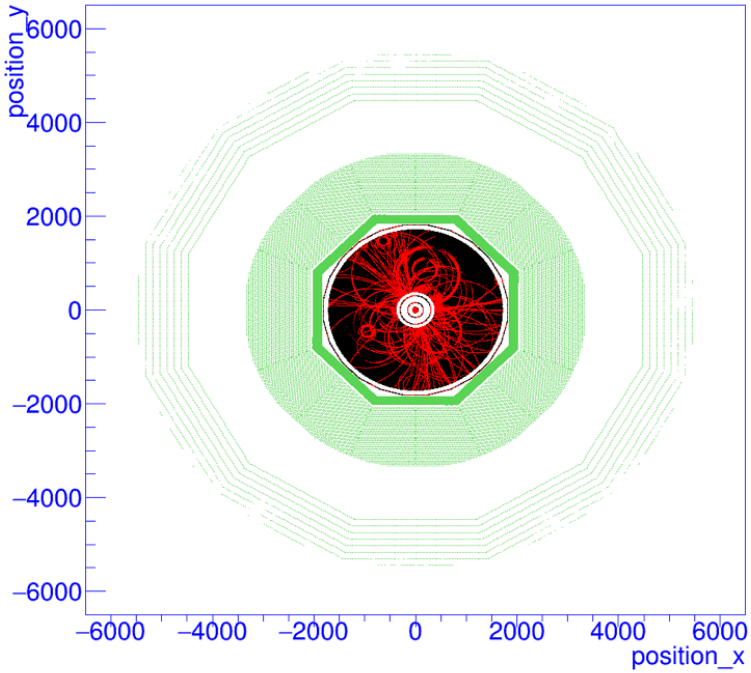


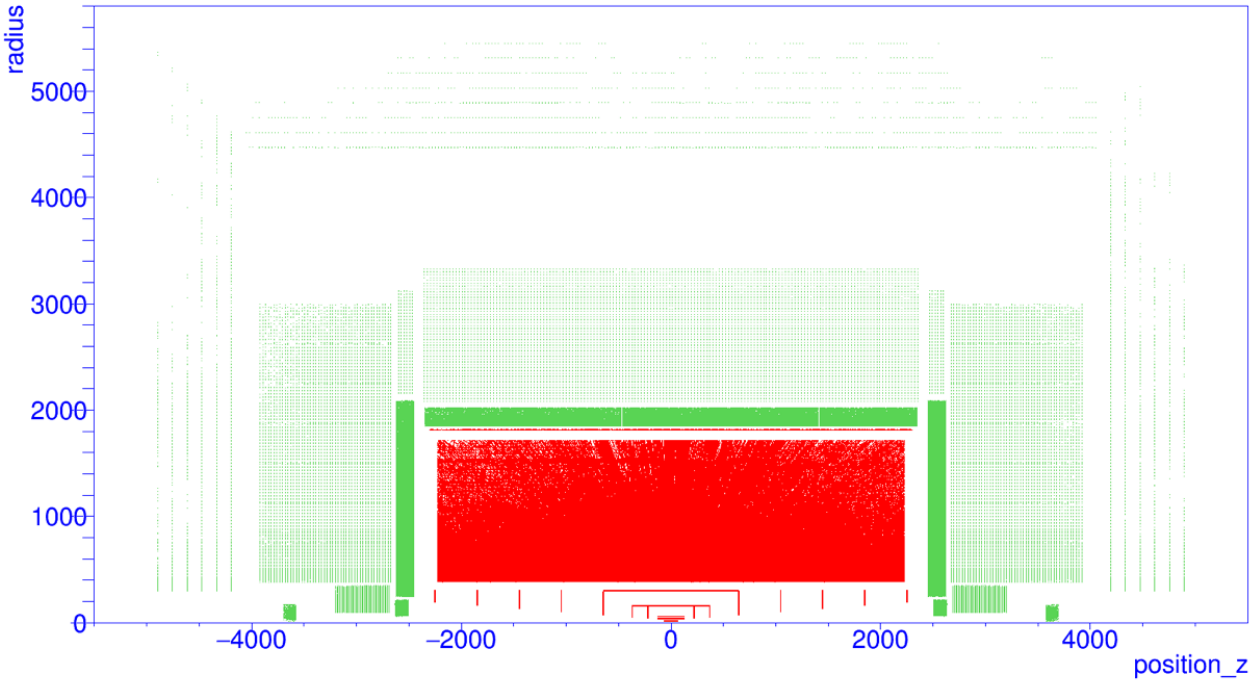
TPC of ILD_o1_v05 in lcgeo

- TPC has been updated, more realistic compare to Mokka DBD version.
- The volume has two parts, and the TPC digitiser will not create TPC hits in the middle on the cathode.
- Mokka has only one simple volume.
- New DD4hep/DDMarlinPandora reconstruction framework could handle this.



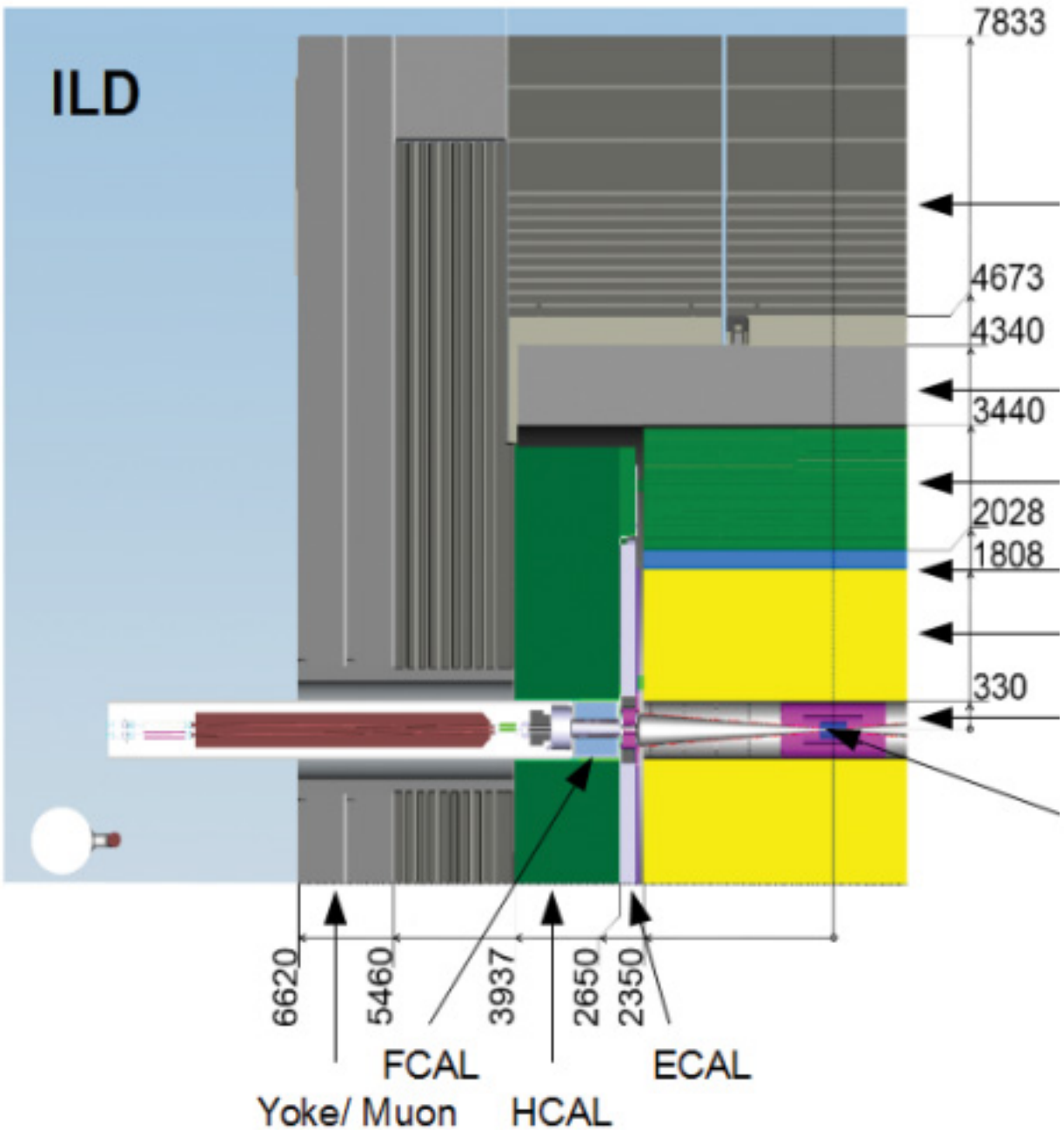
Hits map of ILD_o1_v05

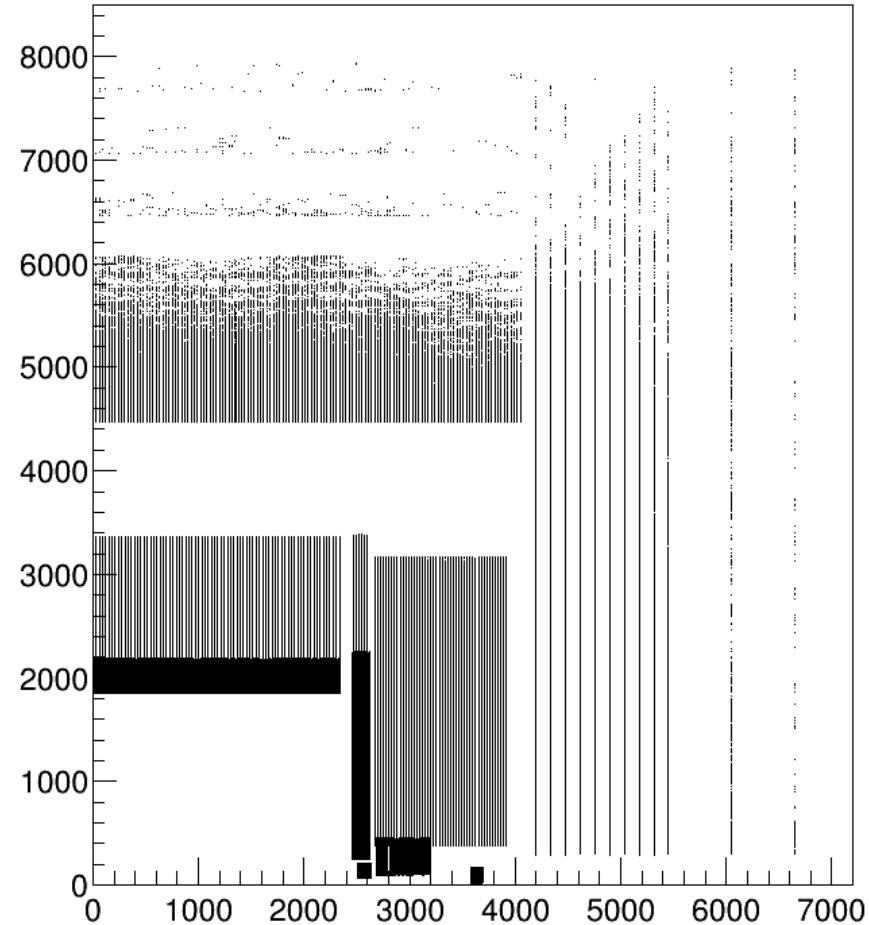




- quite some validation done by software experts, e.g. using hit maps, hit energy distributions, hit positions,.....
  - a detailed validation will have to be done by sub-detector experts.

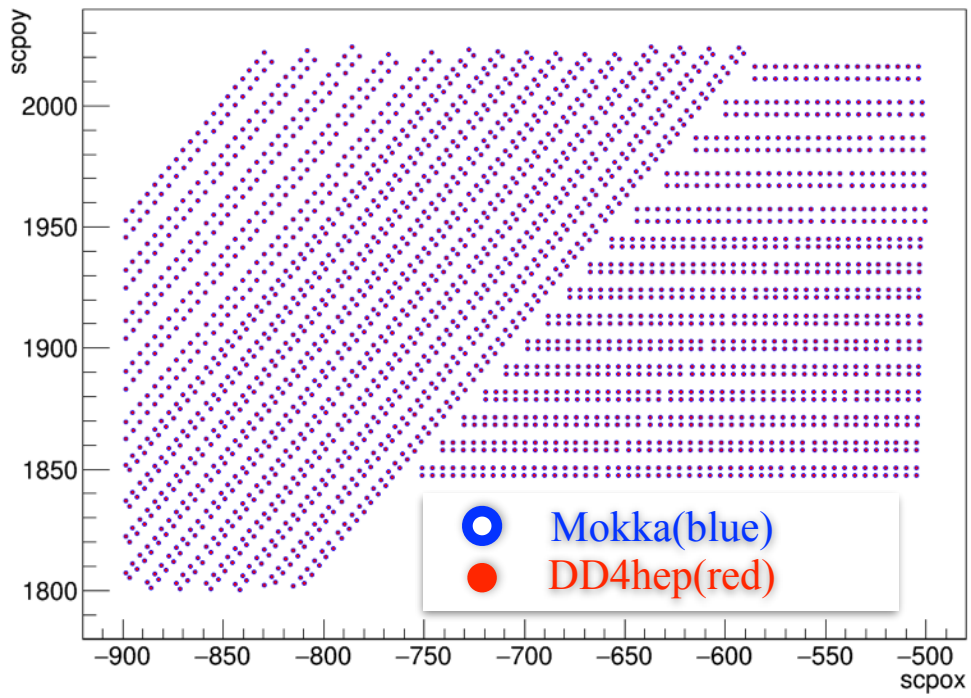
Engineering design and Hits map

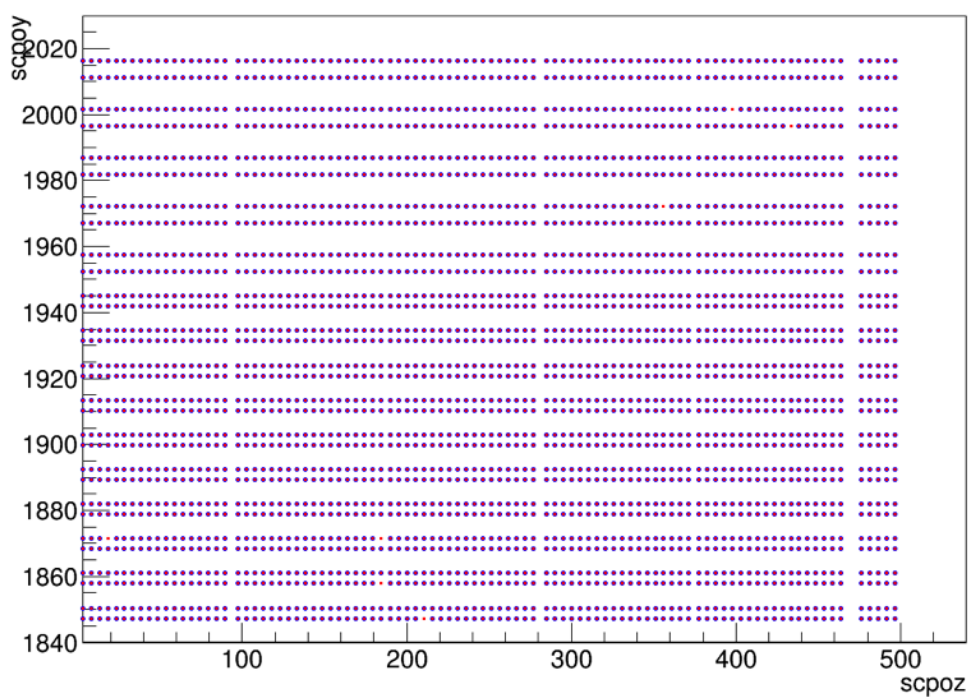




Only calorimeters have been shown

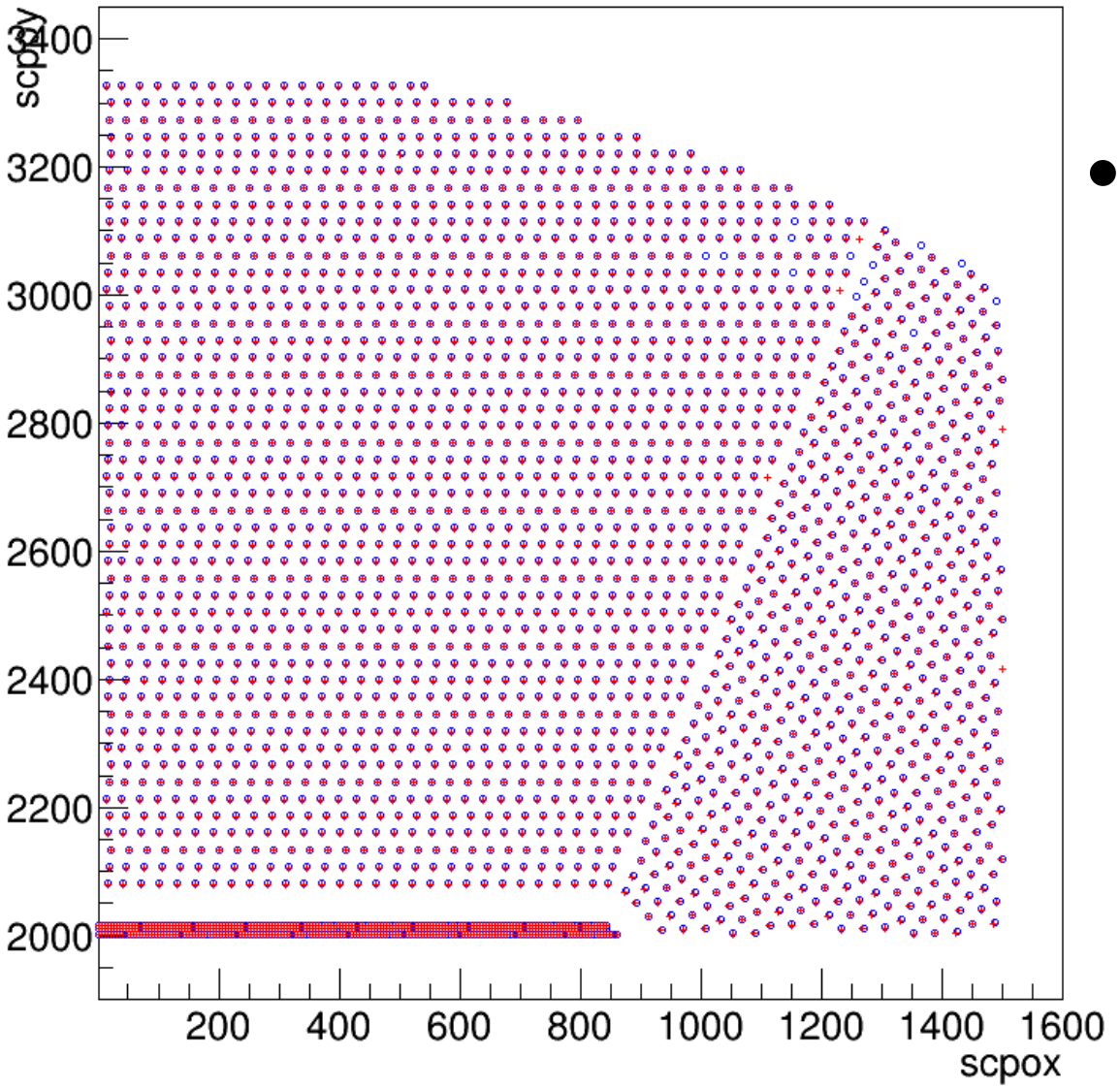
Hits map of SiWEcal Barrel





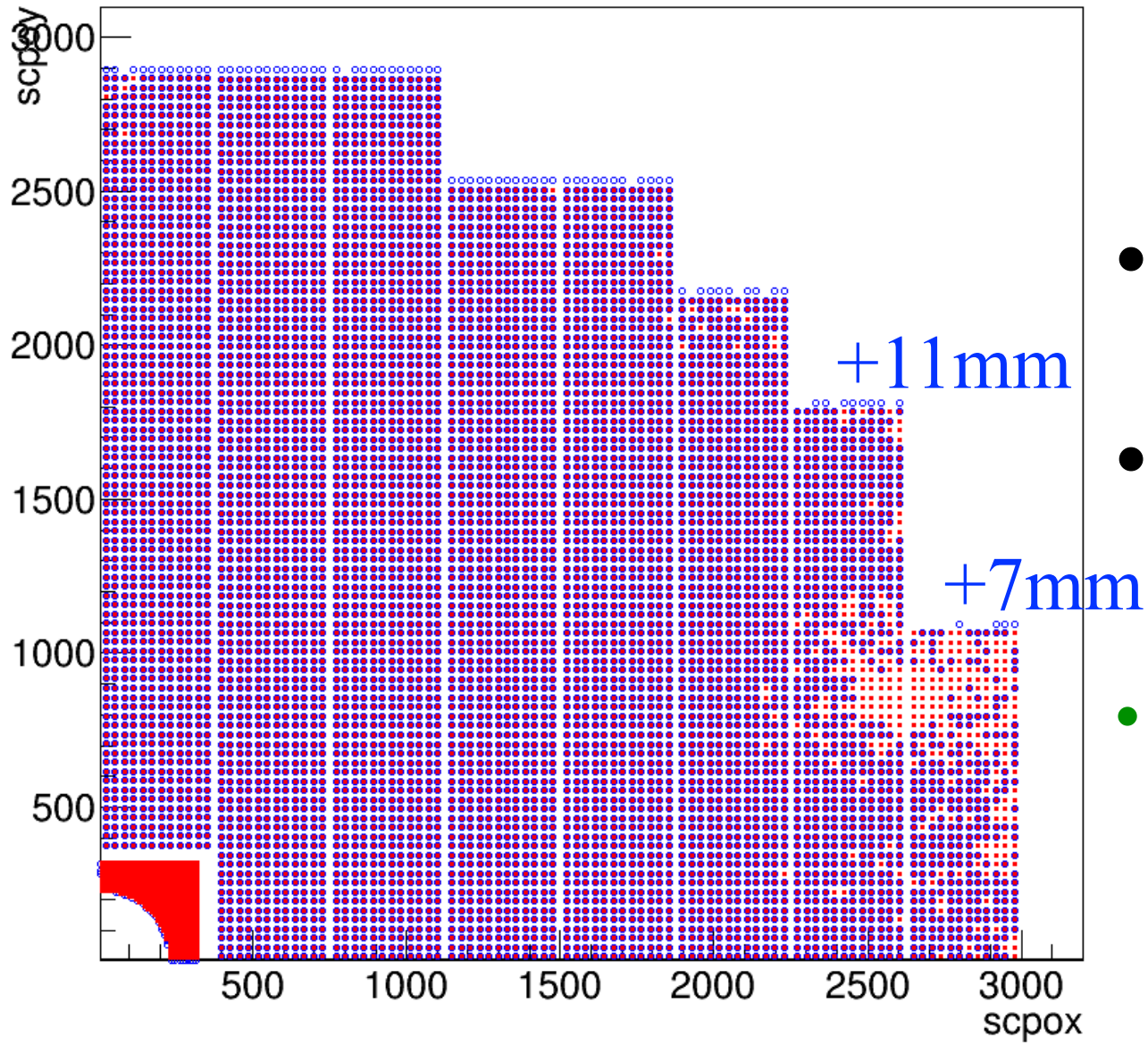
- Validation (Mokka as reference)
  - geometry
    - ported from Mokka
    - is identical to SEcal04
  - sensitive digitisation
    - wafer segmentation implemented recently
    - works also for MagicWafer at the boundary
- same status for endcaps
- SiWEcal experts have been informed (Daniel Jeans and Vincent Boudry)

Hits map of AHCAL Barrel



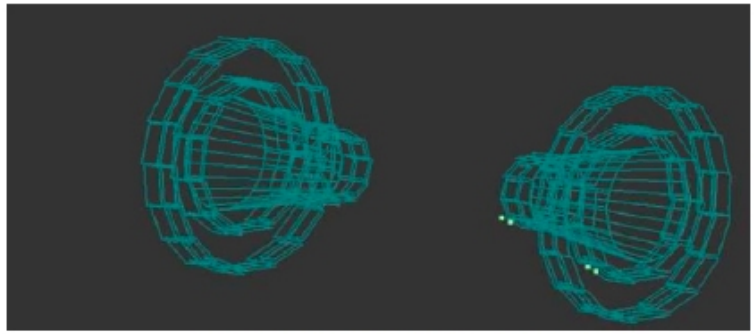
- Validation (Mokka as reference)
  - geometry
    - ported from Mokka
    - is identical to SHcalSc04
  - sensitive digitisation
    - works also for fraction tile at the boundary

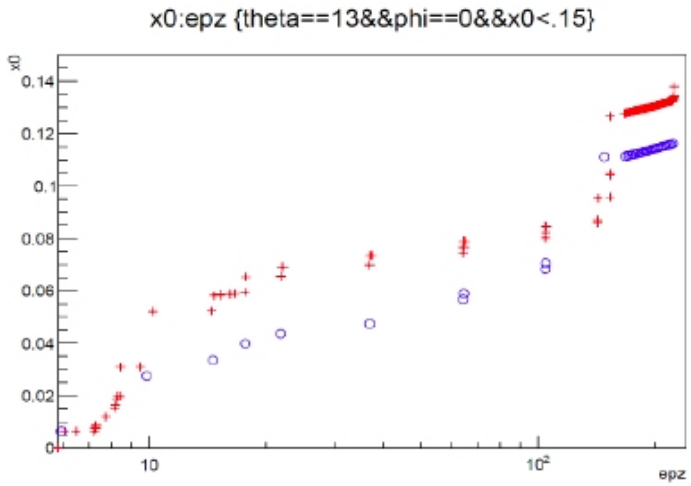
Hits map of AHCAL Endcaps

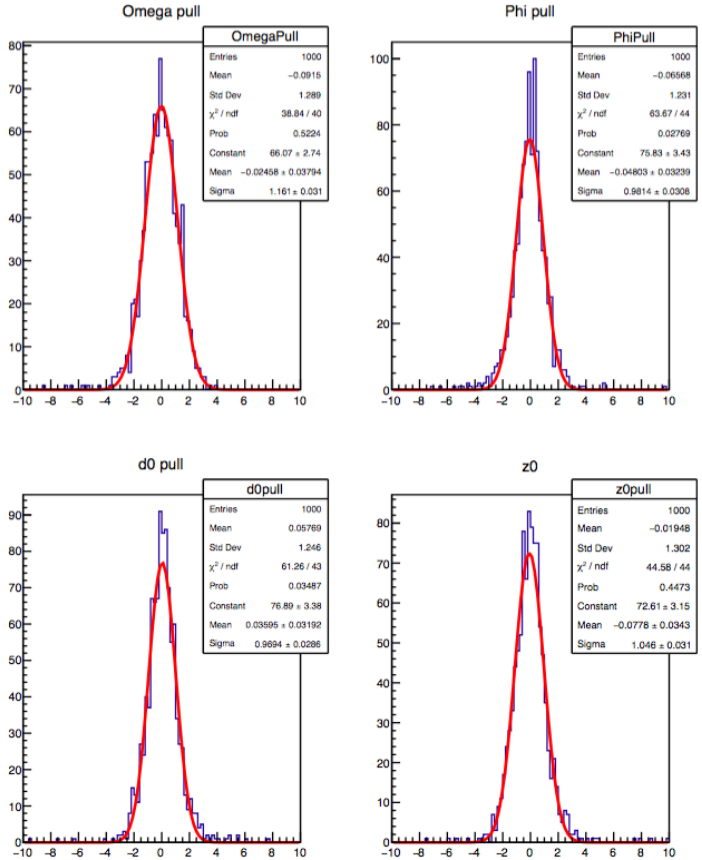


- Geometry HBU or 1/2HBU used in DD4hep
- sensitive digitisation works with generic segmentation for HBU or 1/2HBU
- reported to AHCAL group.

Validating the new DD4hep model



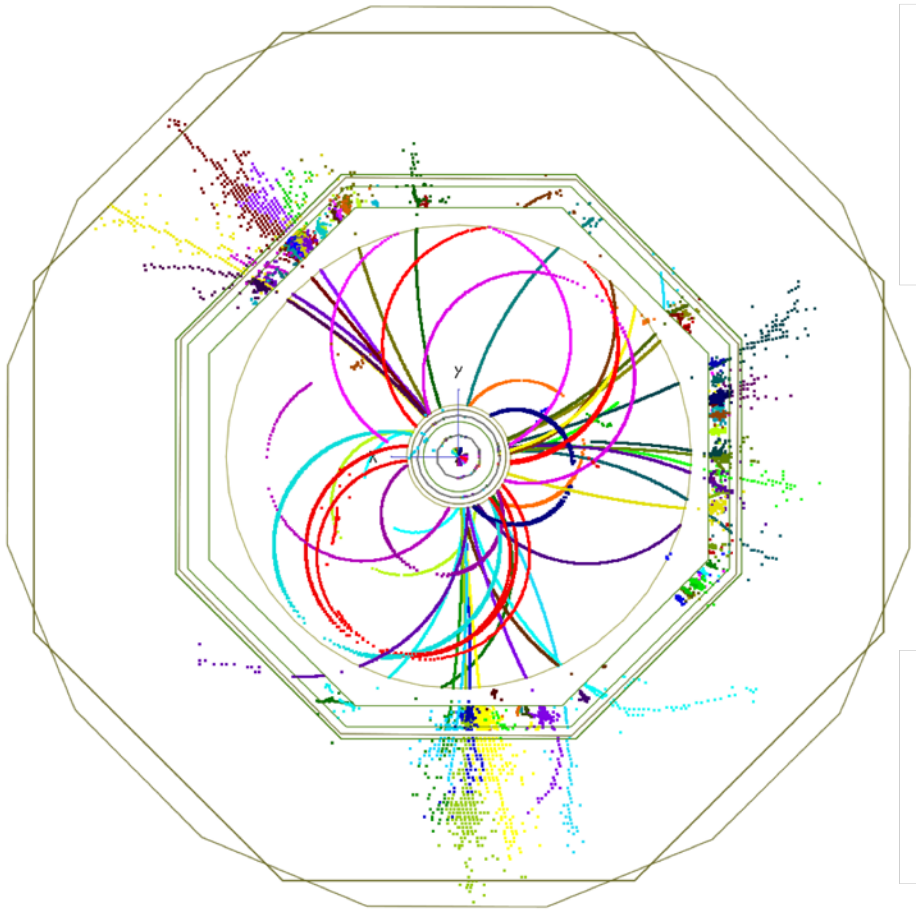




- Tracking surfaces for VXD, support structures added
- For tracking check: (Done by Y.Voutsinas)
  - material budget, track parameter pulls, …

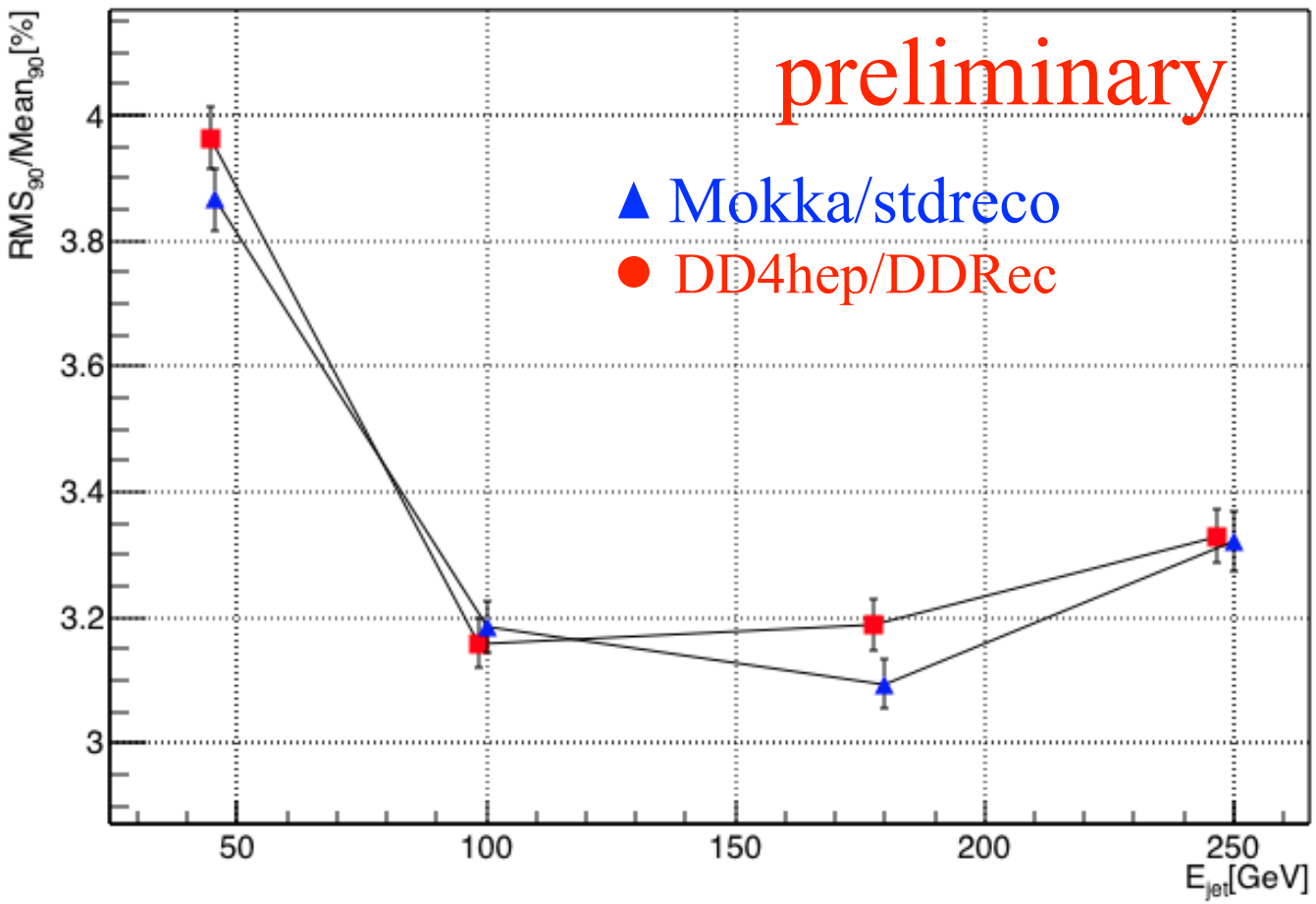
Details in Frank talk “Status of MarlinTrk”

Reconstruction - all together



- The lcgeo is a new DD4hep based detector geometry description and simulation package has a complete simulation model ILD_o1_v05.
- ddsim simulation use DDG4 the DD4hep build-in Geant4 gateway.
- DDMarlinPandora uses the DDRec and lcgeo as input, and provide the output for PandoraPFANew.
- The standard reconstruction works out of the ILDConfig.

JER results



- Very preliminary result, 10,000 events samples for each point.
- The output obtained with the LCPandoraAnalysis trunk version.
- Thanks L. Tran, F. Gaede, K. Früger S. Green for the help and discussion on calibration constants used by (DD)CaloDigi and (DD)PandoraPFANewProcessor.

Summary and outlook

- The simulation/reconstruction chain in the new framework now starts to achieve the similar performance as the “old” one .
- We will continue the validation process and eventually use for next round of ILD detector optimization.
  - need input from sub-detecters experts and engineering design.
  - stay tuned - or even better: contribute!
- The detector layout is more flexible in the new framework.
  - material and thickness of active layers are steerable with xml file.
- To achieve the best performance need proper calibration.