ILD simulation and reconstruction in DD4hep framework (update)

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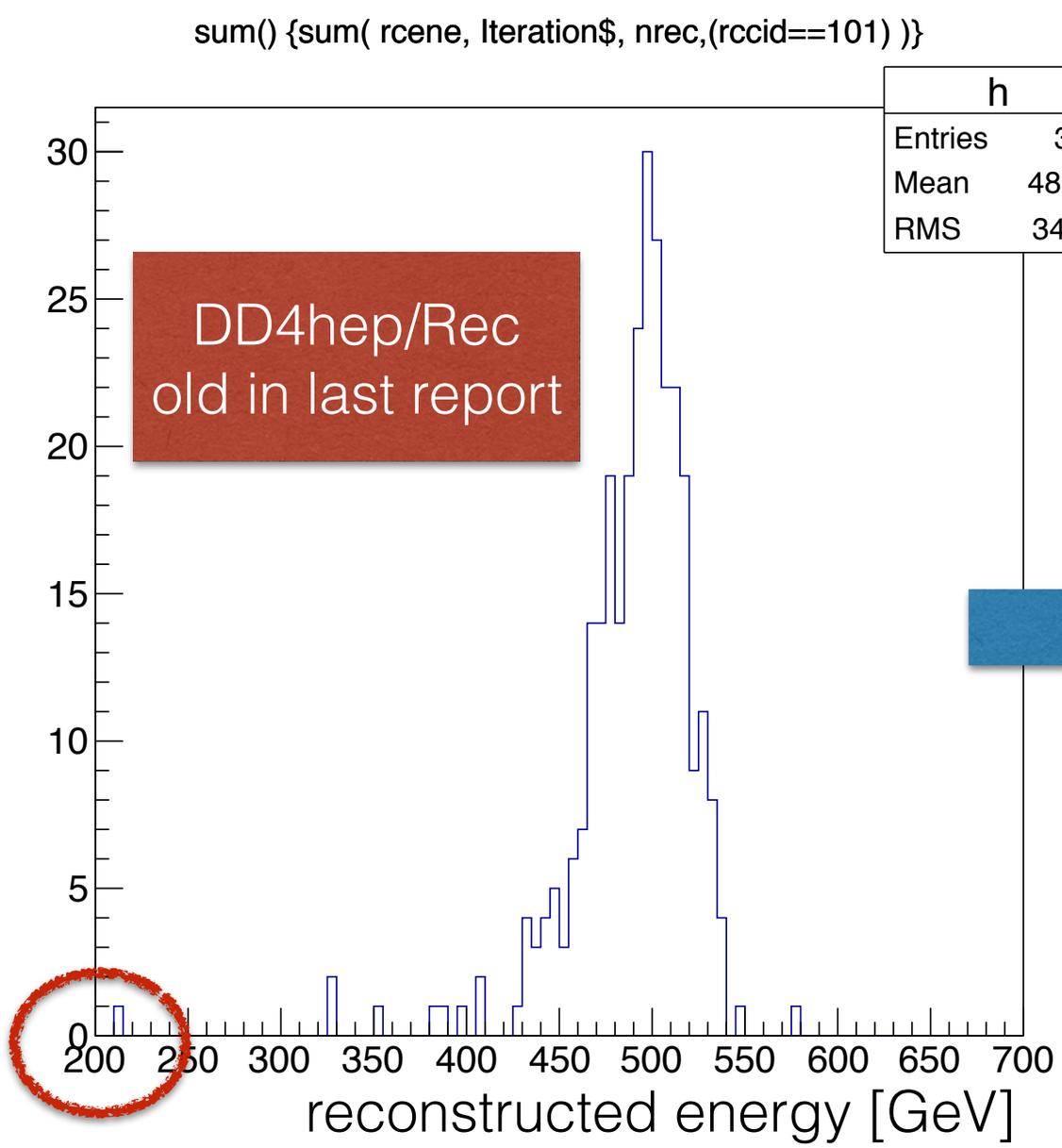
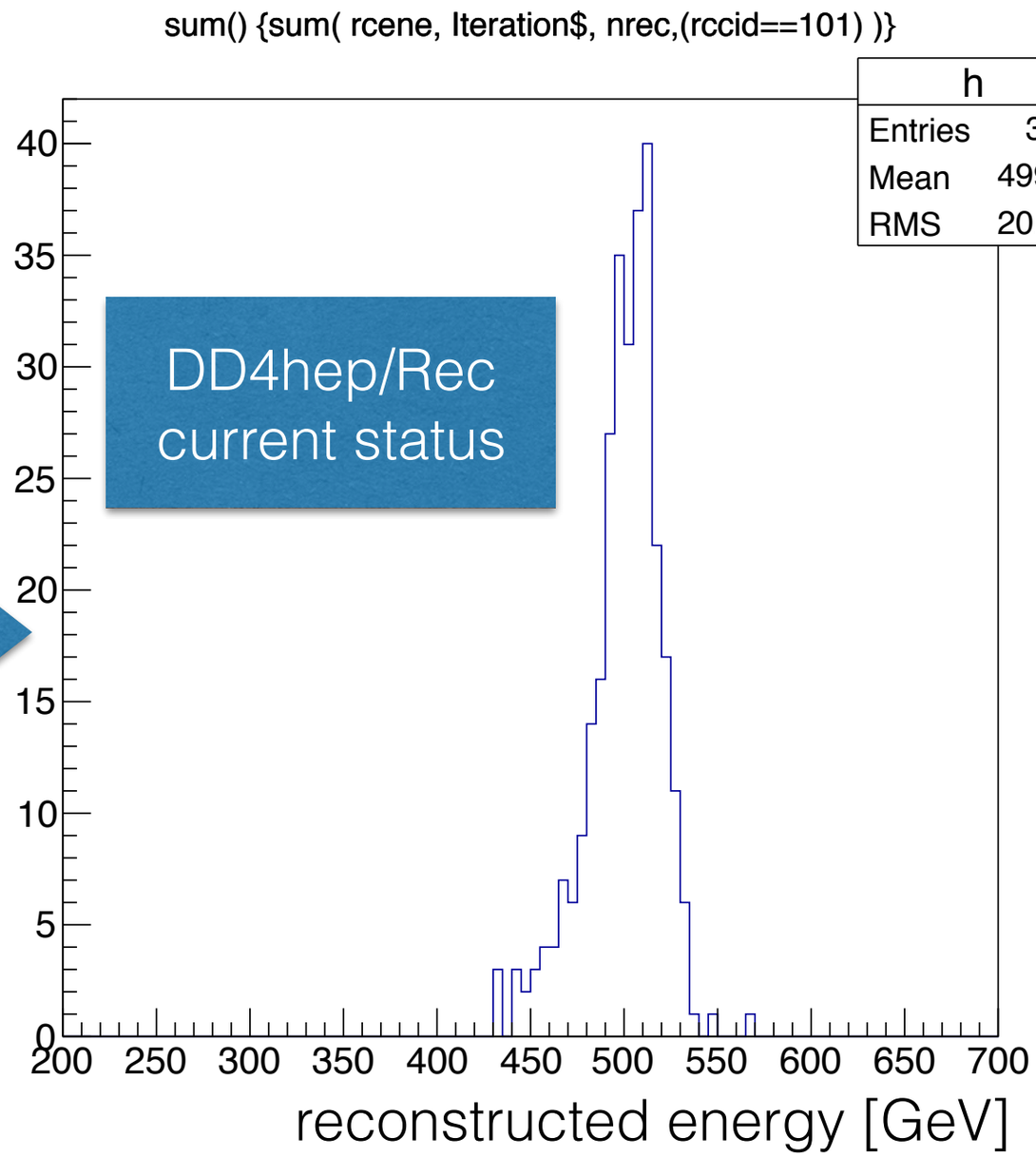
Outline

- ILD Reconstruction
  - Current status about DD4hep and reconstruction
- ILD simulation model
  - Detail SiW Ecal geometry and segmentation validation at wafer level
- Summary and outlook

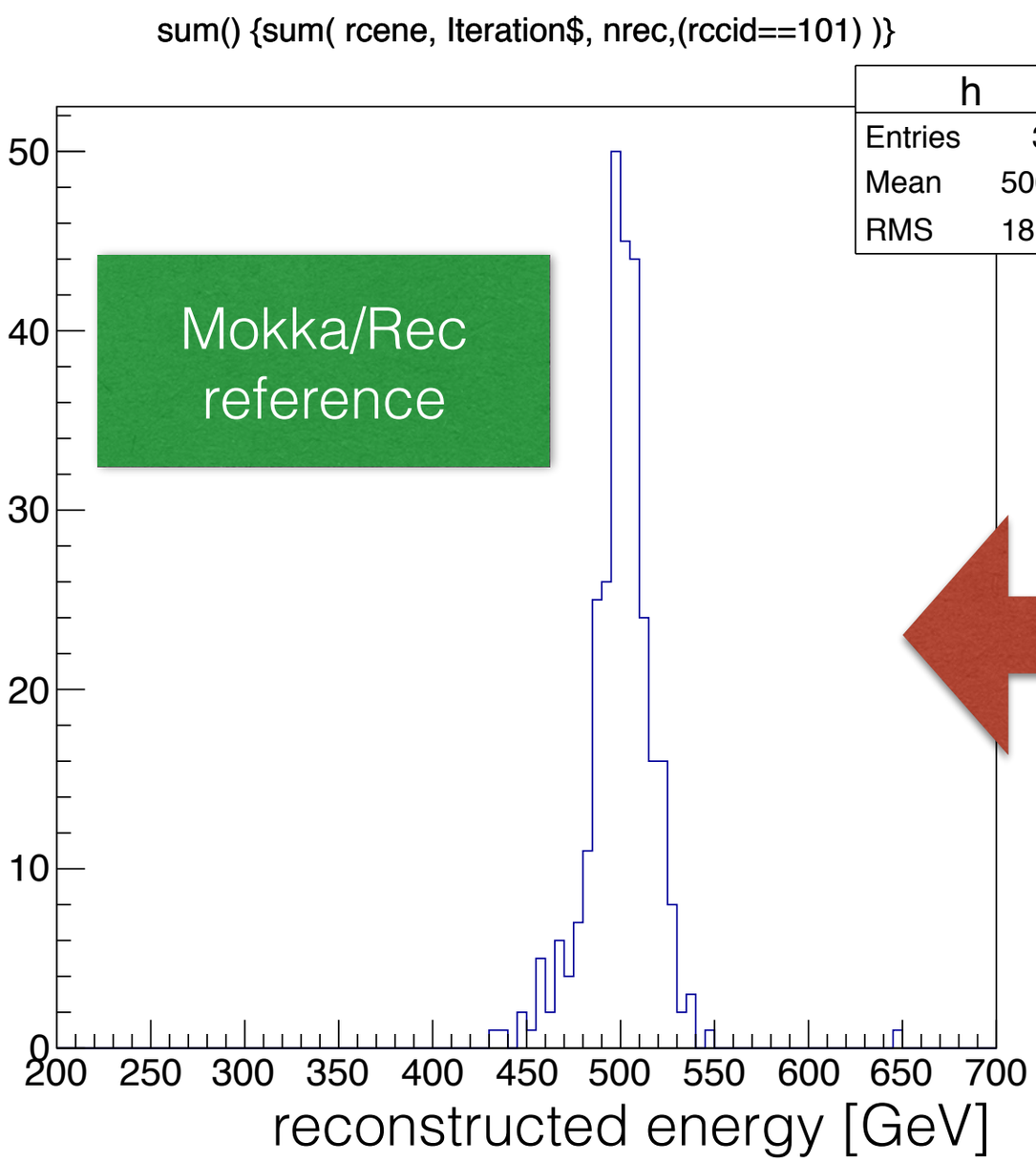
Validating Reconstruction

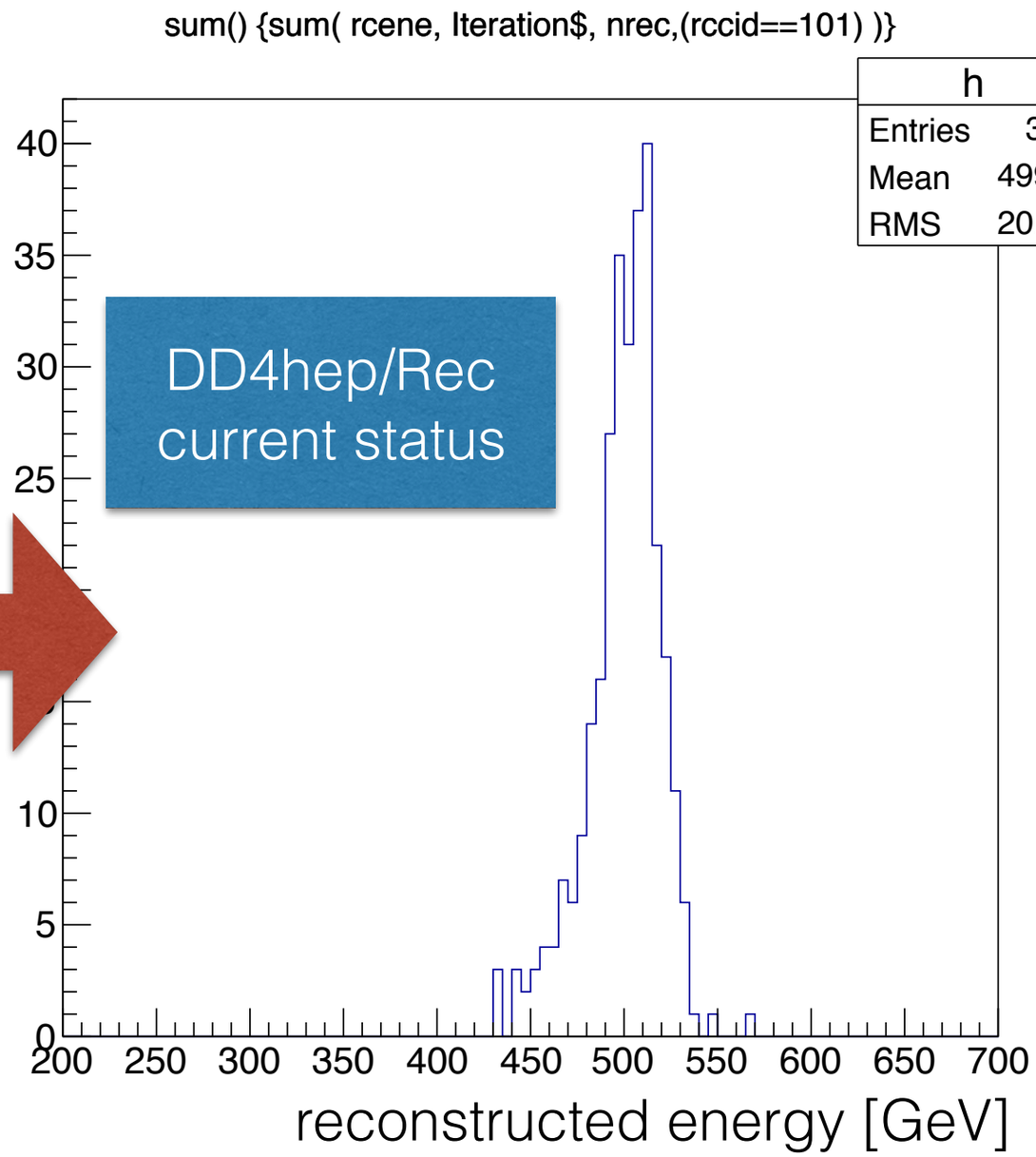




- same input ucam 500 GeV, GEANT4.10
- DD4hepREC: Fixed large reconstructed energy by fixing SiWEcal gap correction in REC, and fixed small reconstructed energy by fixing the missing collection name of the shared forward driver.
- not including the LHCal collection has significant effect on total reconstructed energy => the LHCal is important!

Validating Reconstruction

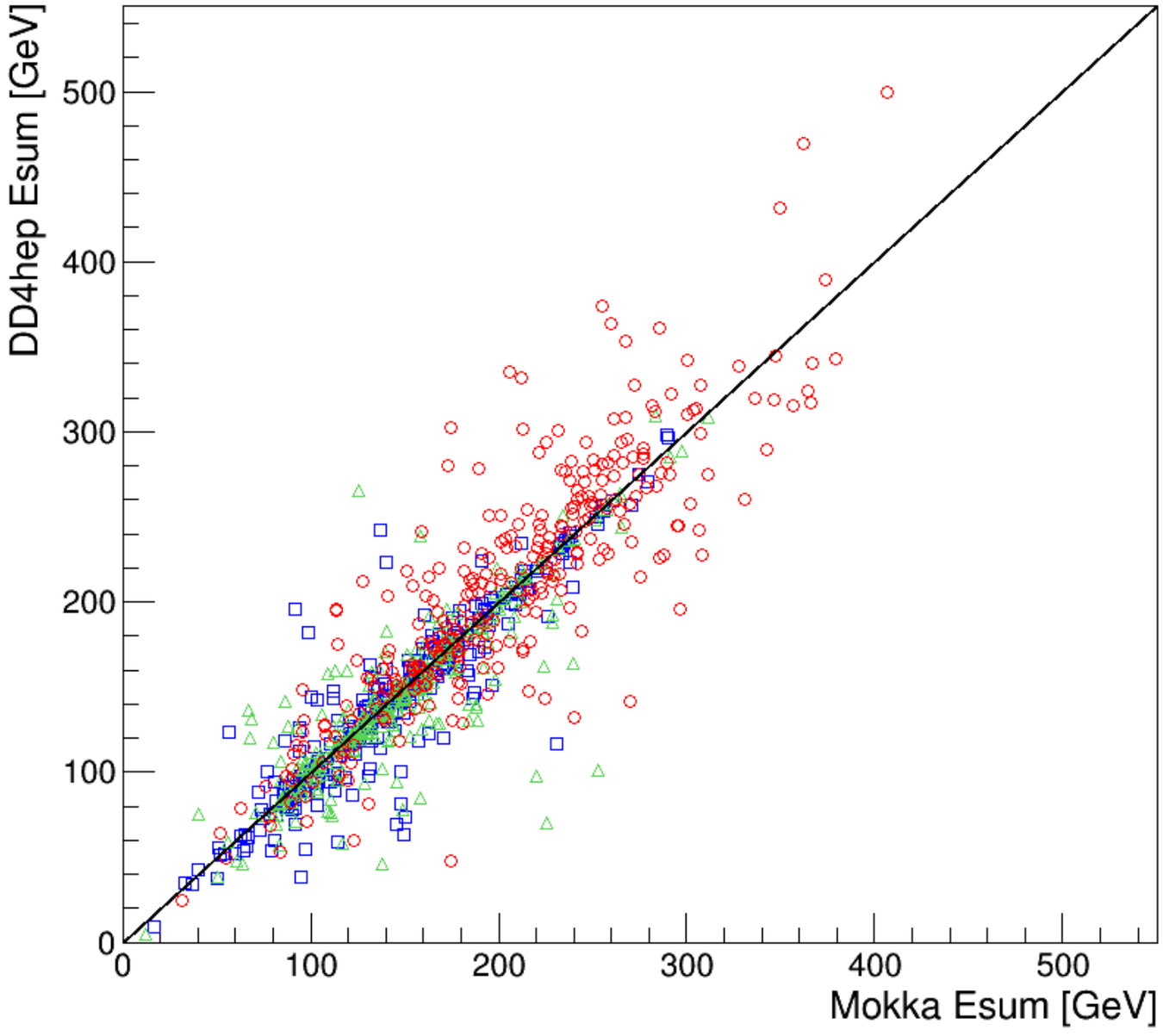




- Mokka+REC (ilcsoft DBD), DD4hep+REC (ilcsoft HEAD).
  - same input ucam 500 GeV uds

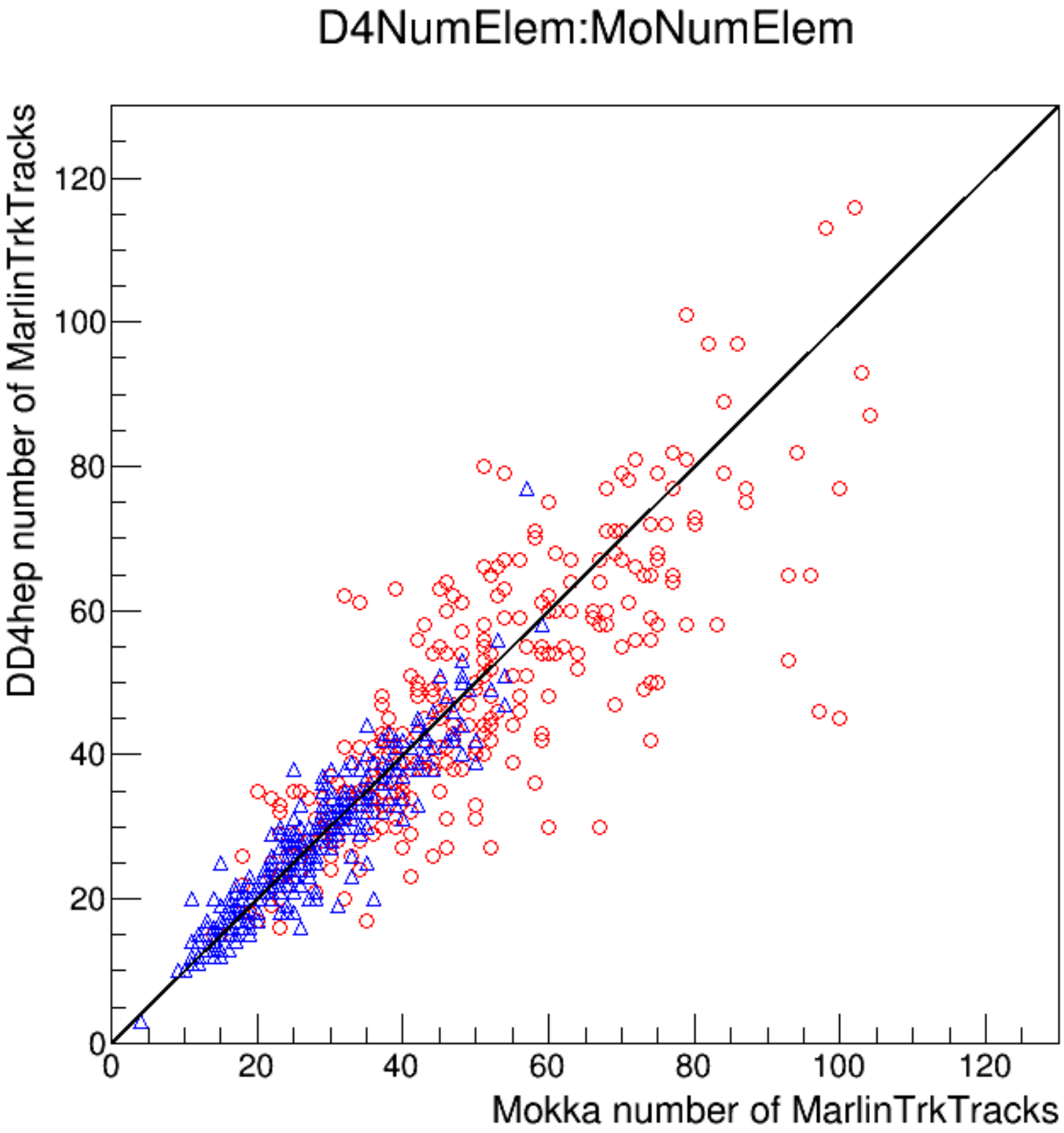
REC: Charged and neutral particles in PFOs

- Reconstruction with DD4hep/DDRec
- Final PFOs collection from pandoraPFA
- Trajectory (Tracking): (green for “+”, Blue for “-”), strong correlation.
- EM/hadron shower (Calorimeter): (red for “neutral”)

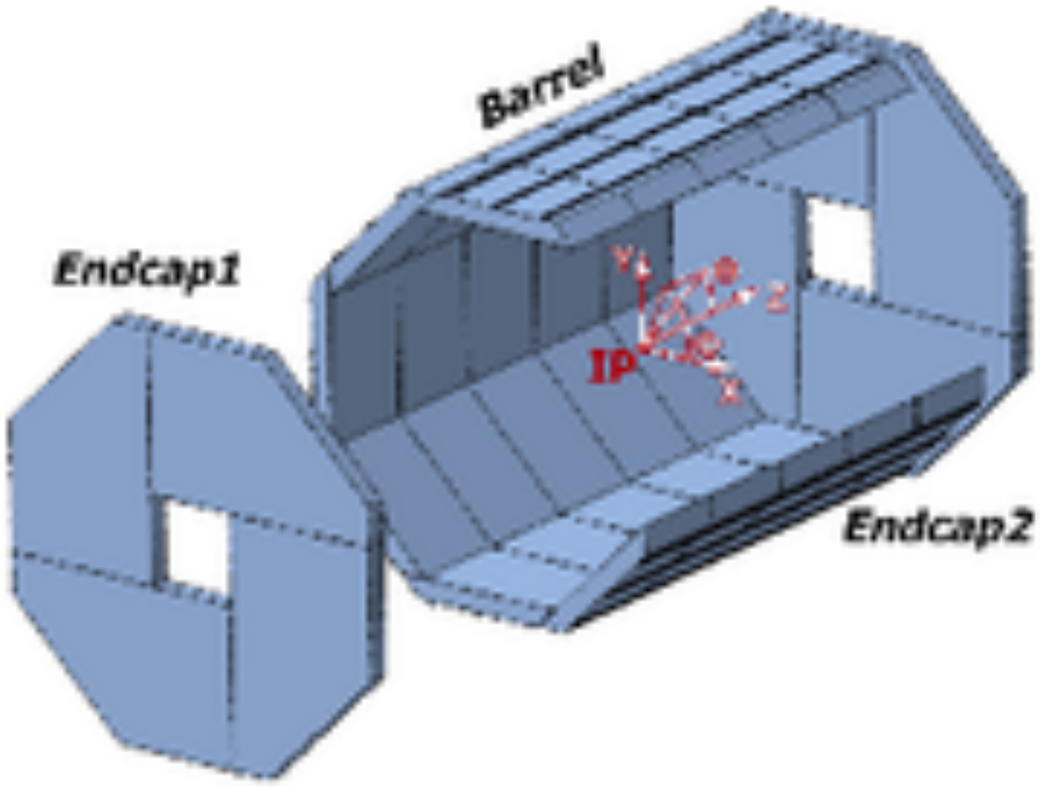


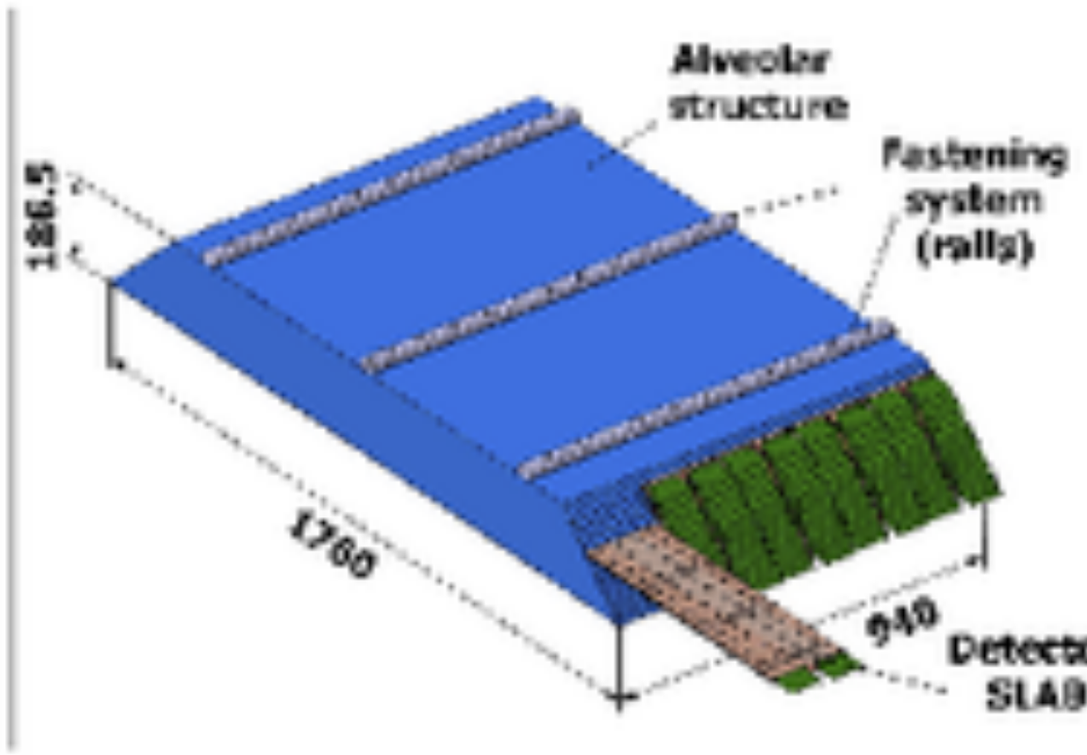
REC: Tracking in MarlinTrk

- The number of trajectory has been found by MarlinTrk processor.
- They are the input for MarlinPandora.
- Trajectory in MarlinTrk:
  - All (red)
  - Pt > 1 GeV (blue)
- DD4hep/Mokka:
  - different drivers
  - different random numbers in simulation
  - different GEANT4 version



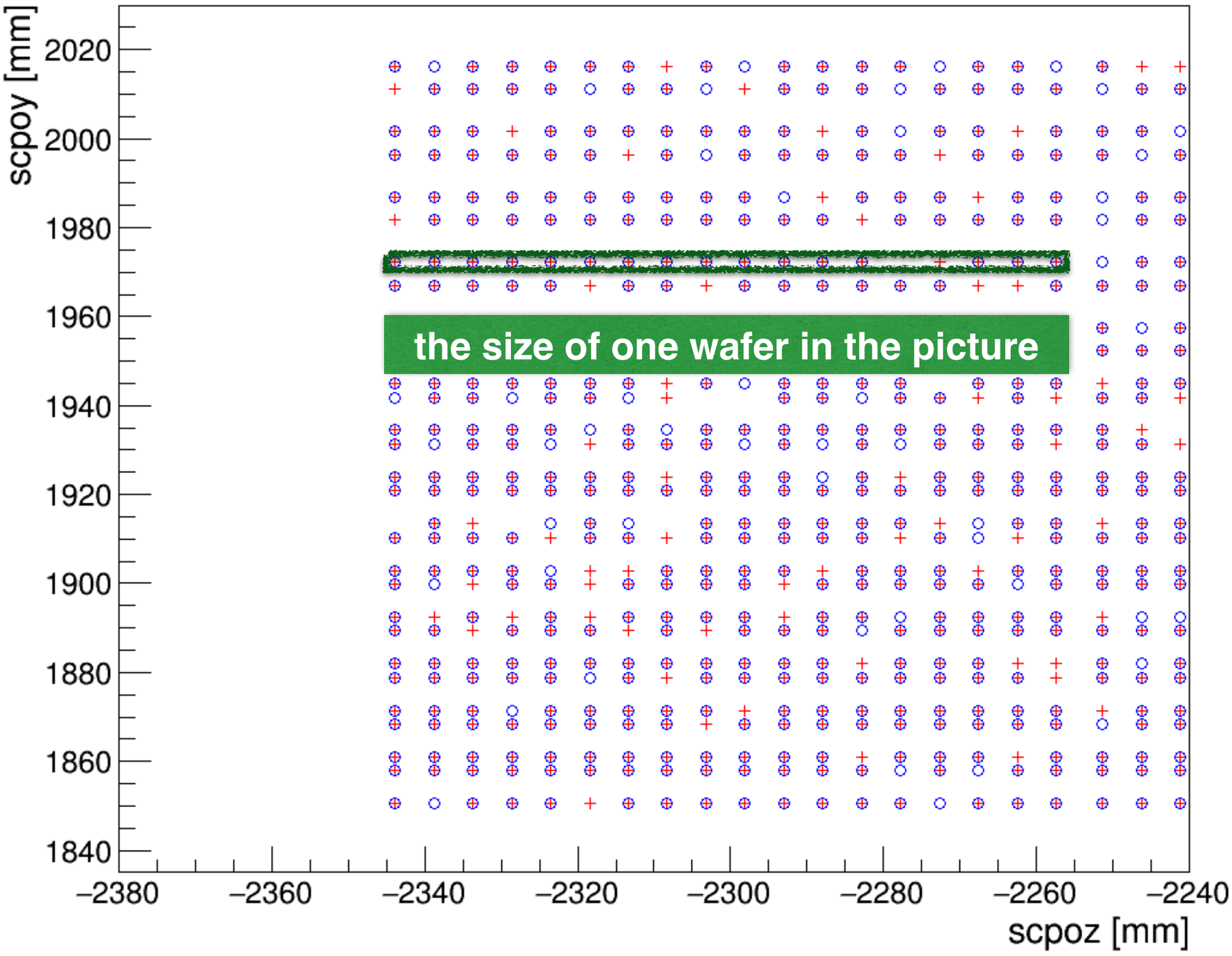
The Si wafer Geometry in Ecal





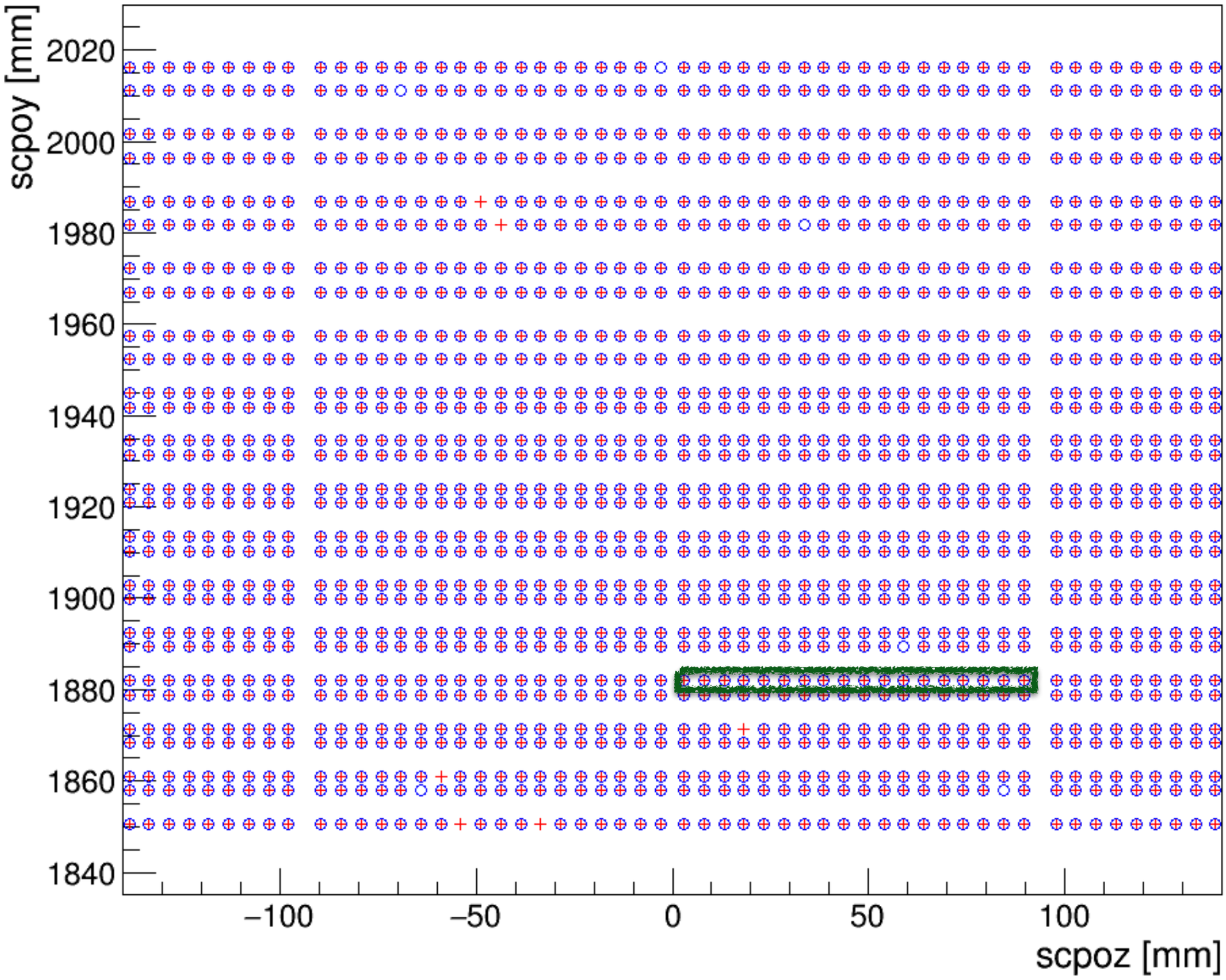
- SiWEcal Barrel has **5** modules in z direction, and each module has **8** staves in phi.
  - each stave has **29** layers, and each layer has **5** slabs in Z direction.
  - each layer slab has **~40** wafers (number variety depends on layer) + **1 Magic** wafer at one outer end slab.

Ecal segmentation in Z direction (-)



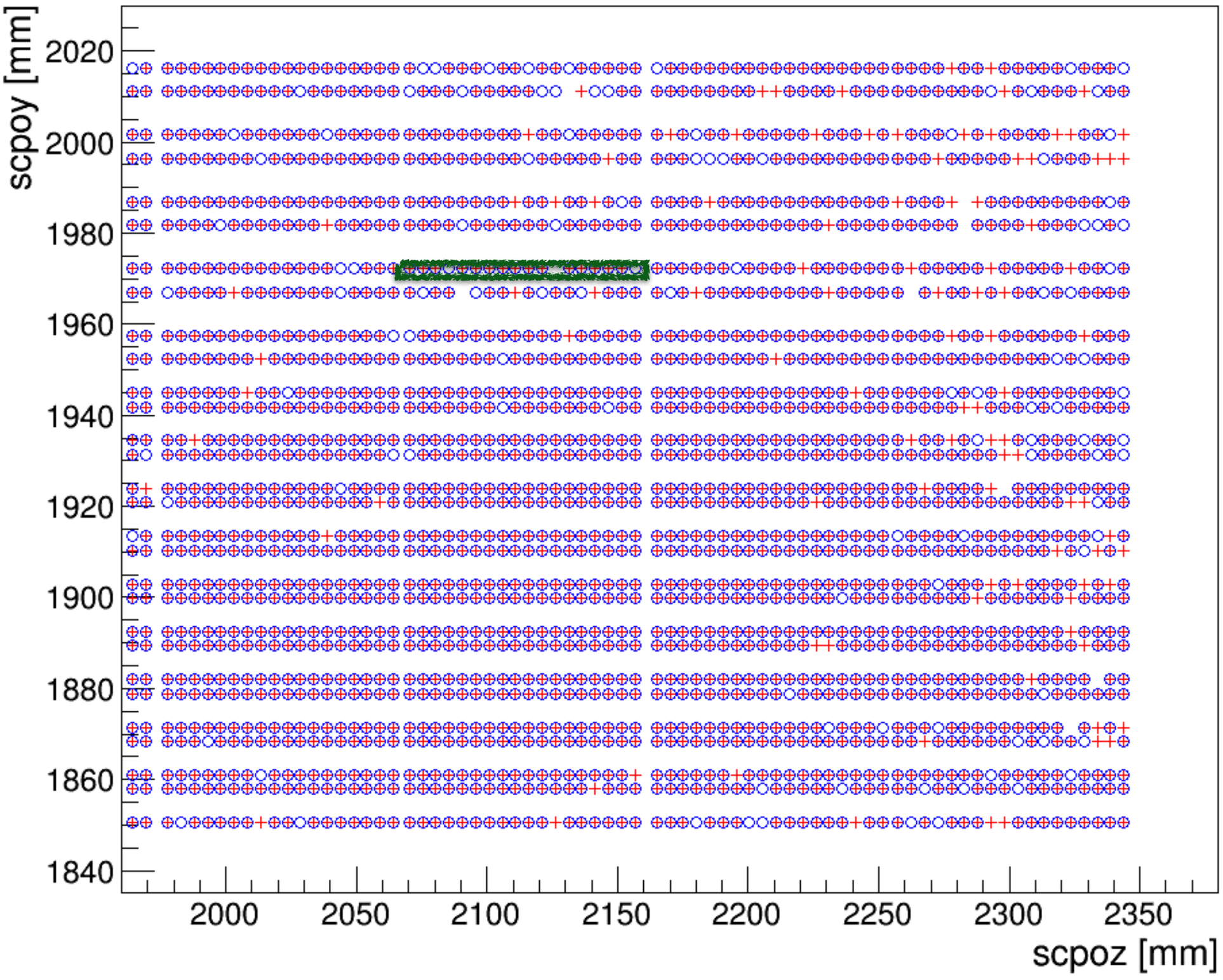
- SiWEcal segmentation is the same as Mokka in Z direction

Ecal segmentation in Z direction (0)



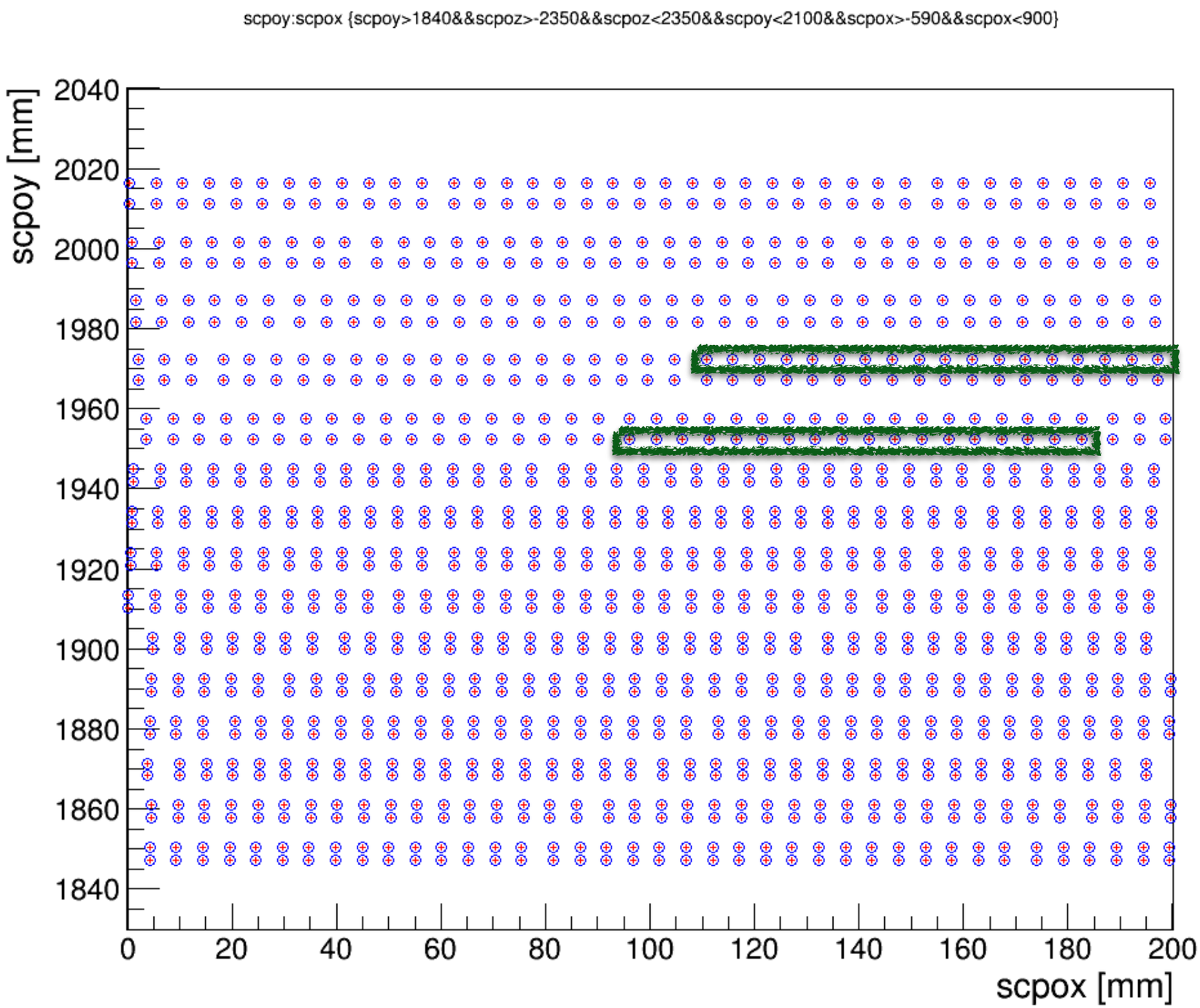
- SiWEcal segmentation is the same as Mokka in Z direction

Ecal segmentation in Z direction (+)



- SiWEcal segmentation is the same as Mokka in Z direction

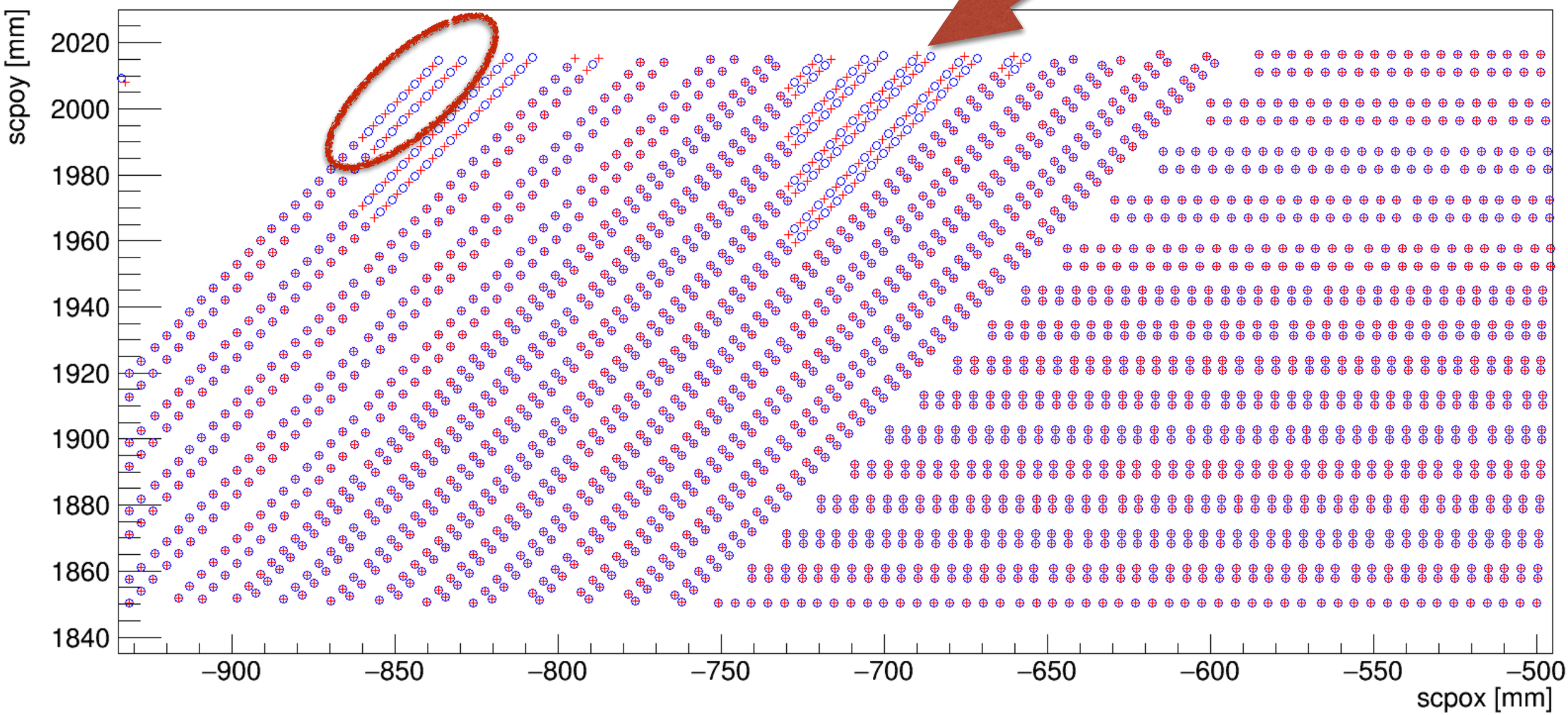
Ecal segmentation within layer x direction



- SiWEcal segmentation is the same as Mokka for wafers within layers (in x direction here).

- **Magic wafers**: are not always the same as Mokka at the end of each layer (in x direction here).
- need individual segmentation offset

- **Magic wafers**: are not always the same as Mokka at the end of each layer (in x direction here).
- could be seen in the same situation in other stave too



New thinking for the silicon layer

- During the intensive validation test, we find that the wafers (few hundred thousands GEANT4 volumes) do take a lot of CPU time.
- To remove the detail wafer information from geometry driver.
- To build one slab (was ~40 GEANT4 volumes of wafer) in a layer.
- In the sensitive segmentation driver, to do a virtual wafer (18x18 virtual cells) and gap (guard ring).
- These geometry drivers have been implemented for both Barrel and Endcap in the lcgeo HEAD version.
- A quick test shows that it could improve the performance by reduce ~8% CPU time.
- Currently working on the sensitive segmentation driver

Summary and outlook

- The reconstruction validation is ongoing.
- To understand and improve the performance in the same realistic description level.
- If necessary, reimplement/improve the geometry and sensitive drivers, for whatever — more realistic, new framework requirement, and performance.