EMC Forward Endcap software developments in Bonn

Ben William Salisbury

HISKP University Bonn

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1. EMC Refactorization

Status

2. CAD-based FwEndcap Geometry

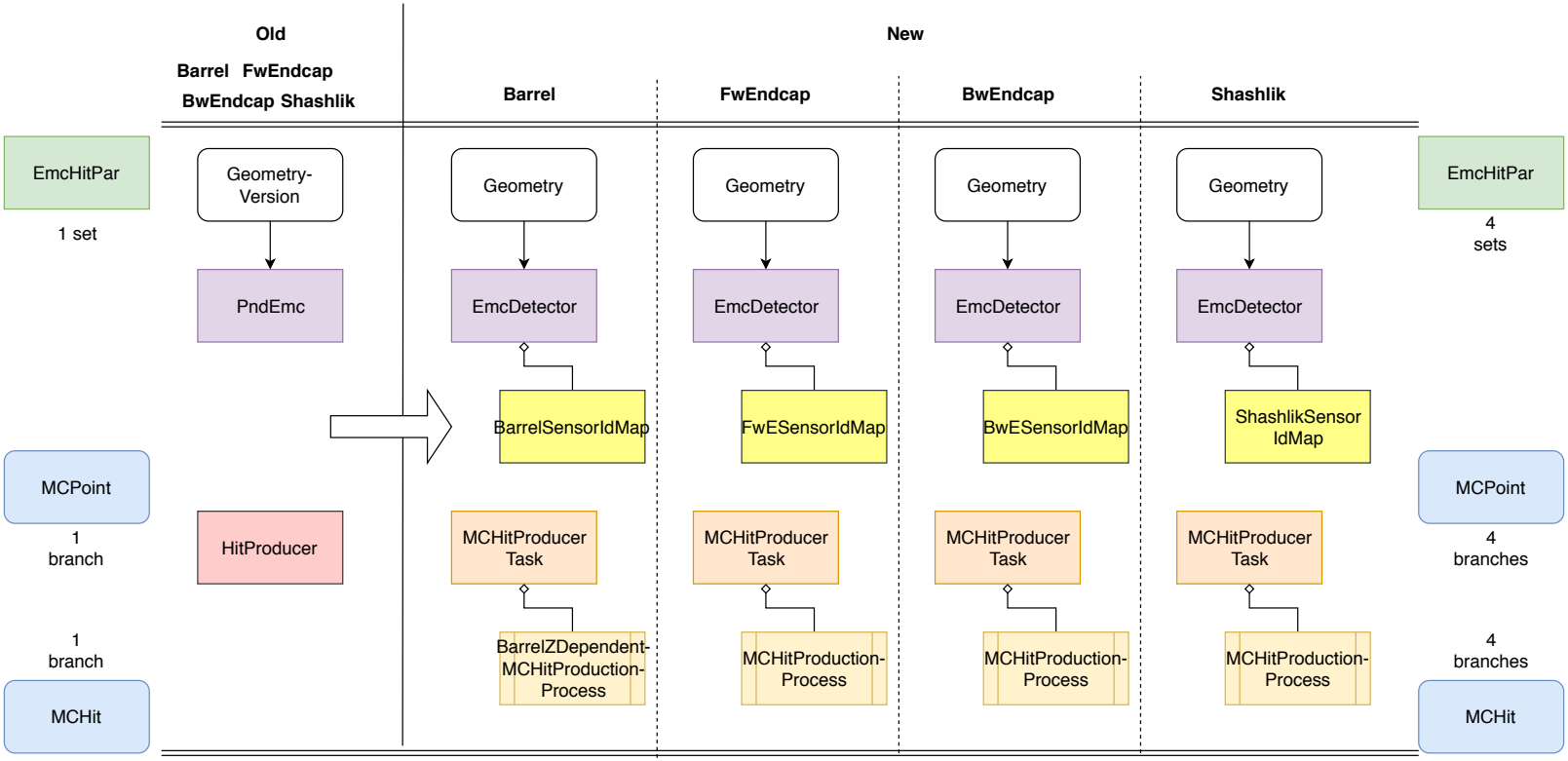
Is the simulation time acceptable?

3. Out-of-cluster energy-depositions

Quick addition to last times Split-Off part

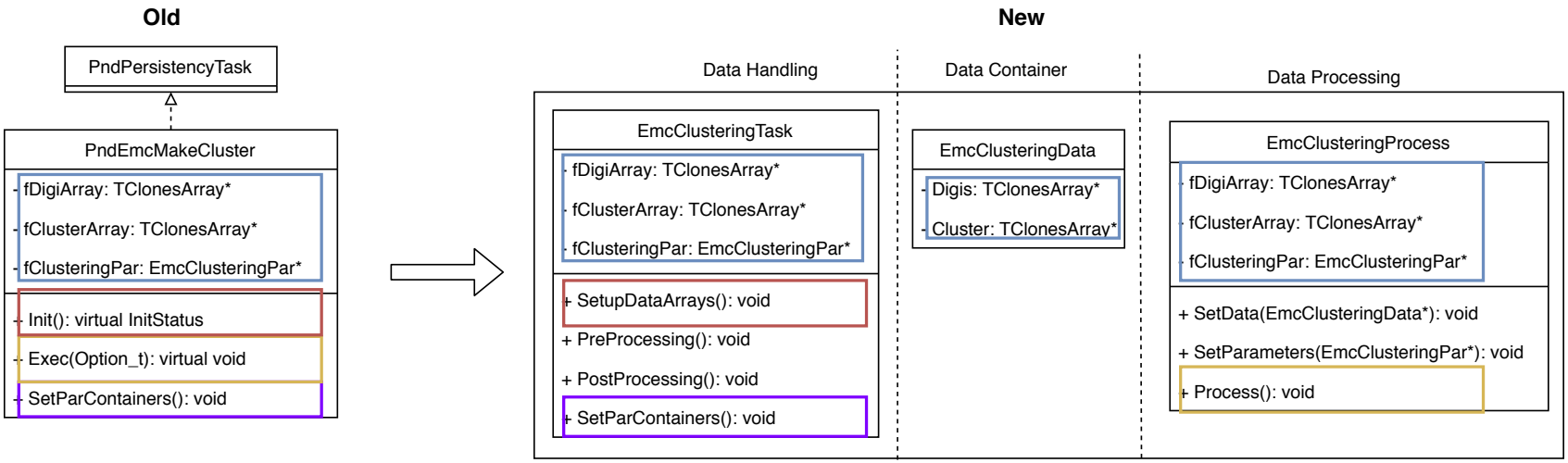
EMC Refactorization: Reminder

- Overall goal of the refactorization is to split up the EMC-code so that we have for each subdetector an own reconstruction chain



EMC Refactorization: Reminder

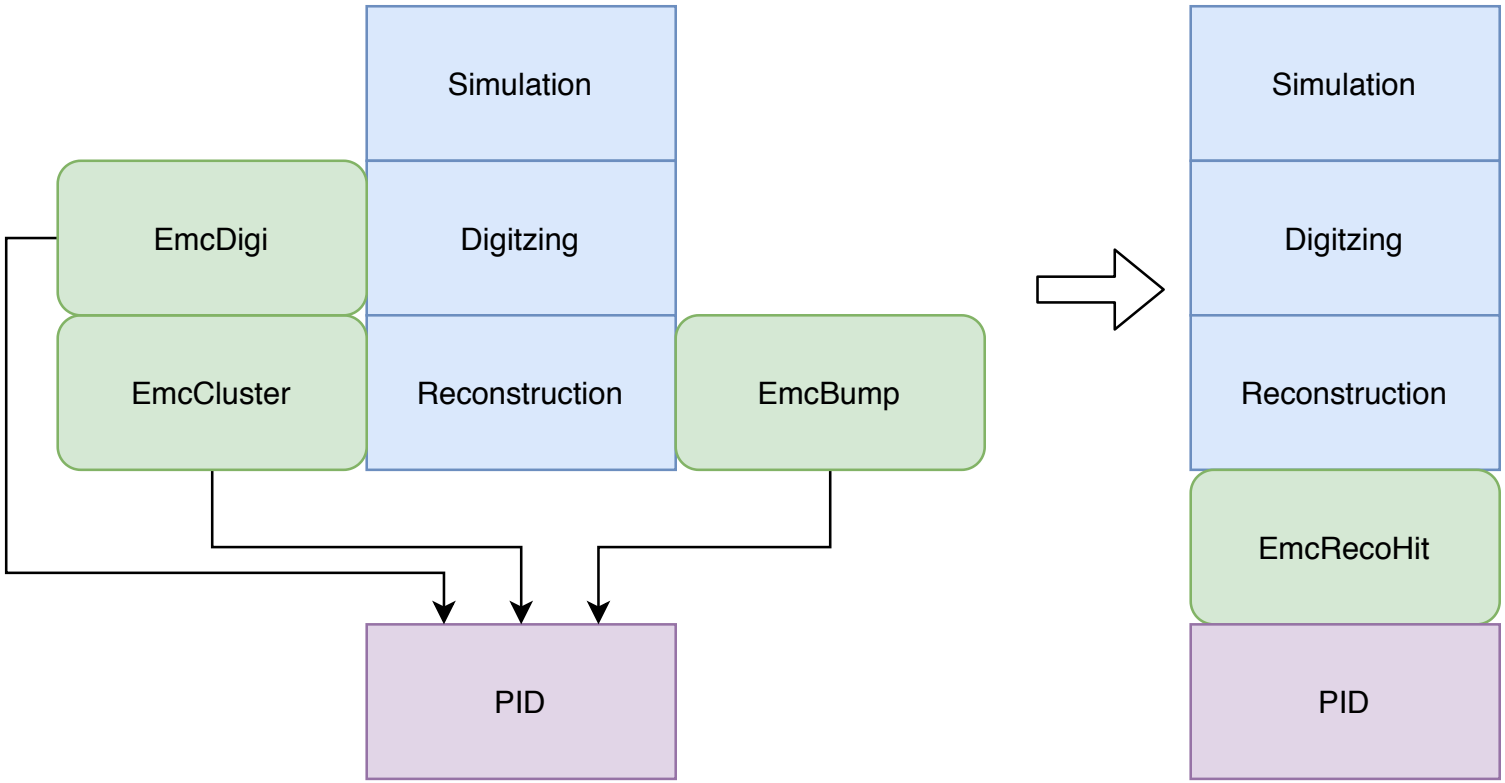
- We have separated original "Task" into Data-access("Task") and Algorithms("Process") for reuse of Algorithms in different infrastructure



- We also try to separate different concerns (within Processes):
  - Clustering separate to Cluster-Merging or MCTruthPropagation
  - ...

EMC Refactorization: Reco to PID

- At the end of the reconstruction stage, we provide a new dataobject: `EmcRecoHit`
  - PID does not need to handle EMC data by itself
  - Clean EMC reconstruction to PID "interface"



Remaining problem: The PID

`PndPidCorrelator`

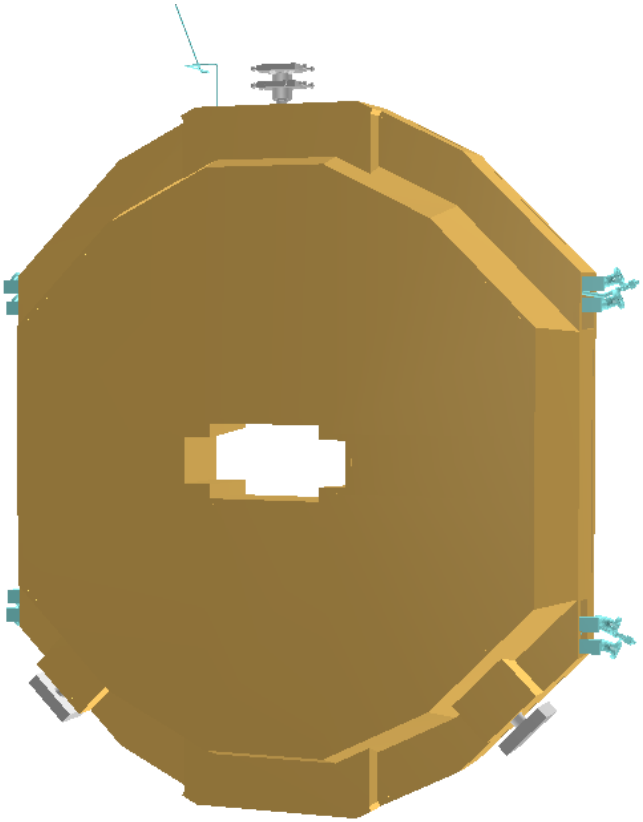
- Matches Tracks created by the tracking systems (target and forward) with reconstructed hits of the other detectors
- It works BUT its monolithic, none-modular implementation prevents us from easily adjusting detector specific code

- I started restructuring `PndPidCorrelator`
- However, a master-student will "take on" the PndPidCorrelator-restructuring as thesis-project

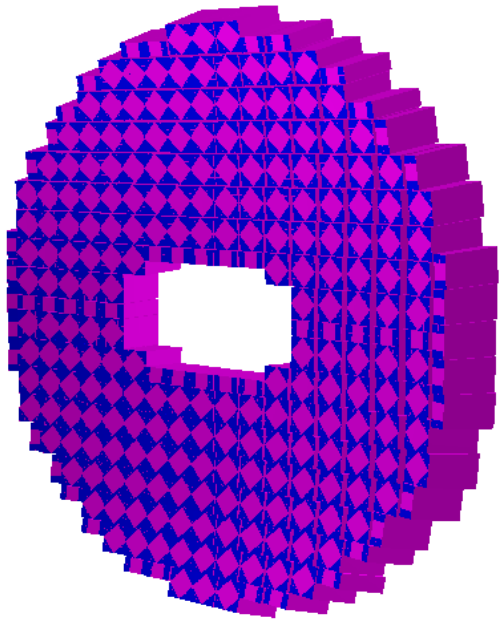
EMC Refactorization: Summary

- I restructured EMC code upto PID-stage
- Presently cross-checking our EMC code for problems and ease of usage
- I want to push to the EMCRefactorization soon

Forward Endcap: New and Original

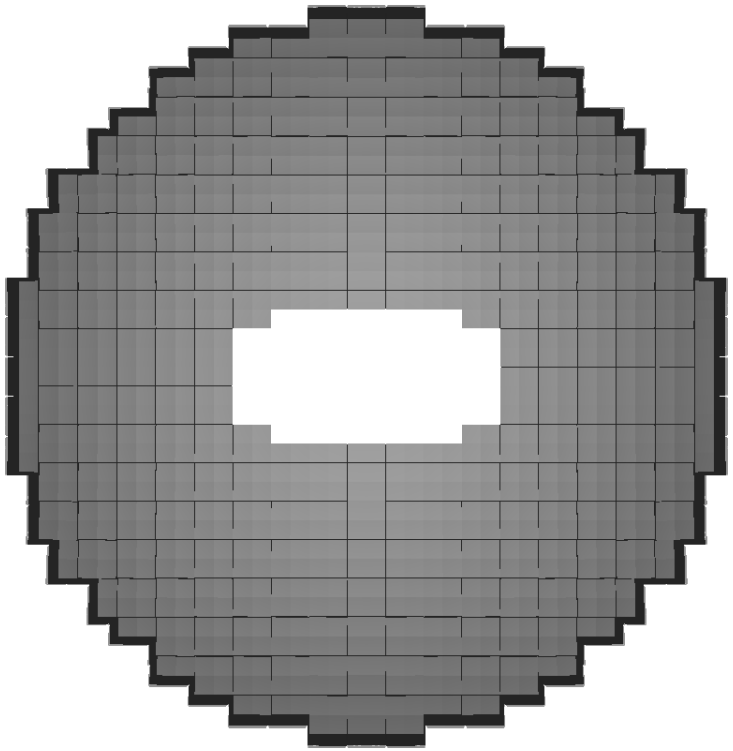


Based on CAD-drawings using TGeoArbN

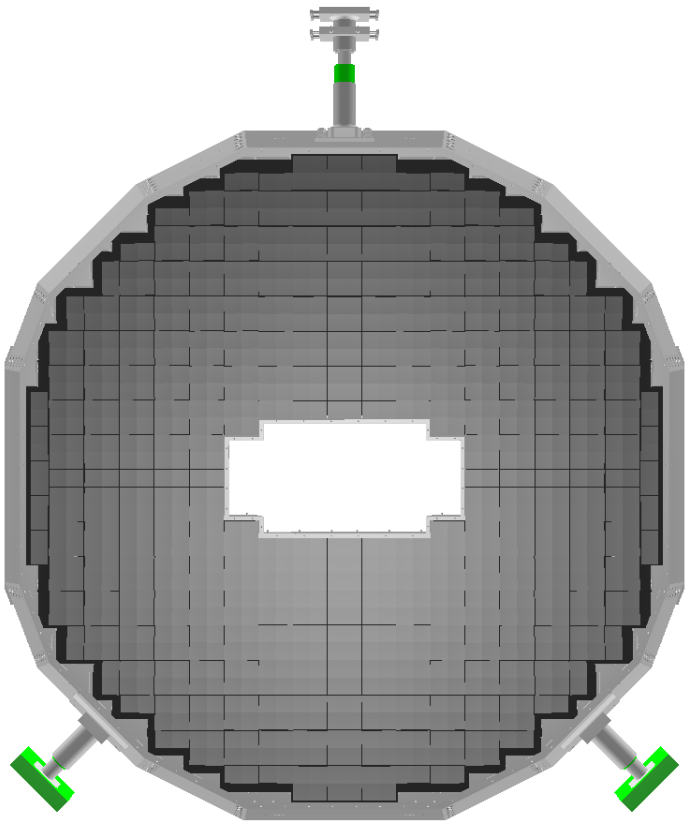


Original FwEndcap

Forward Endcap: New



Forward Endcap: New



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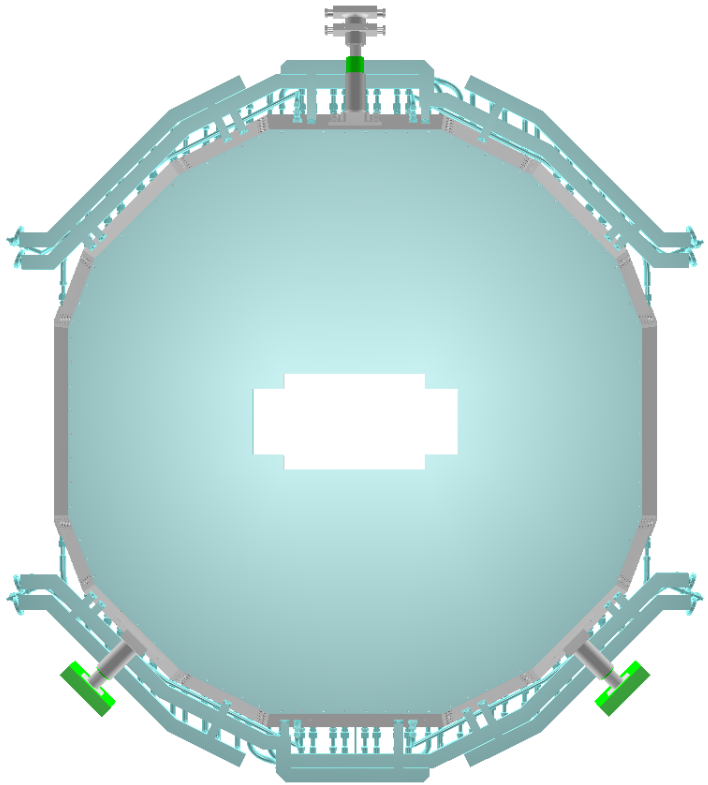

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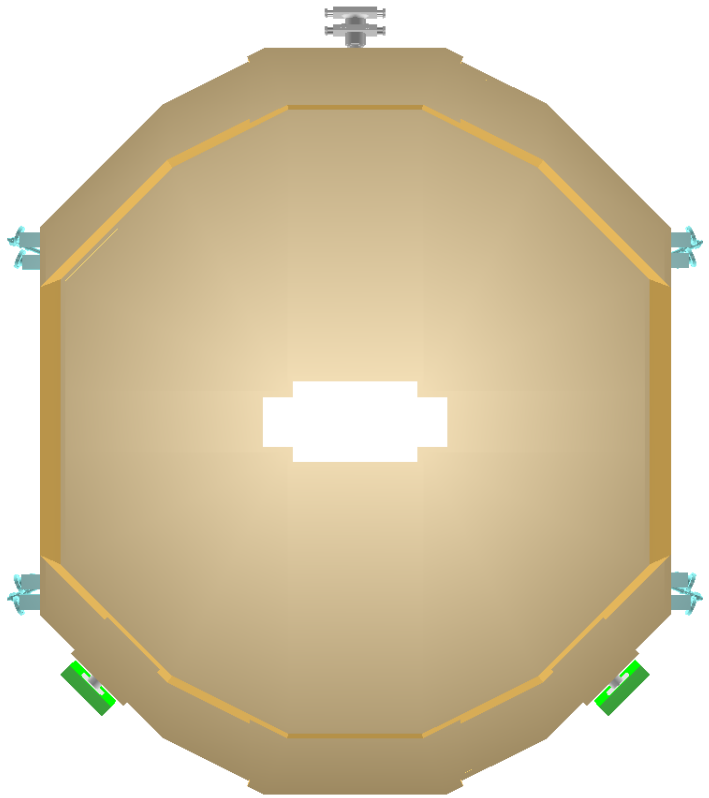
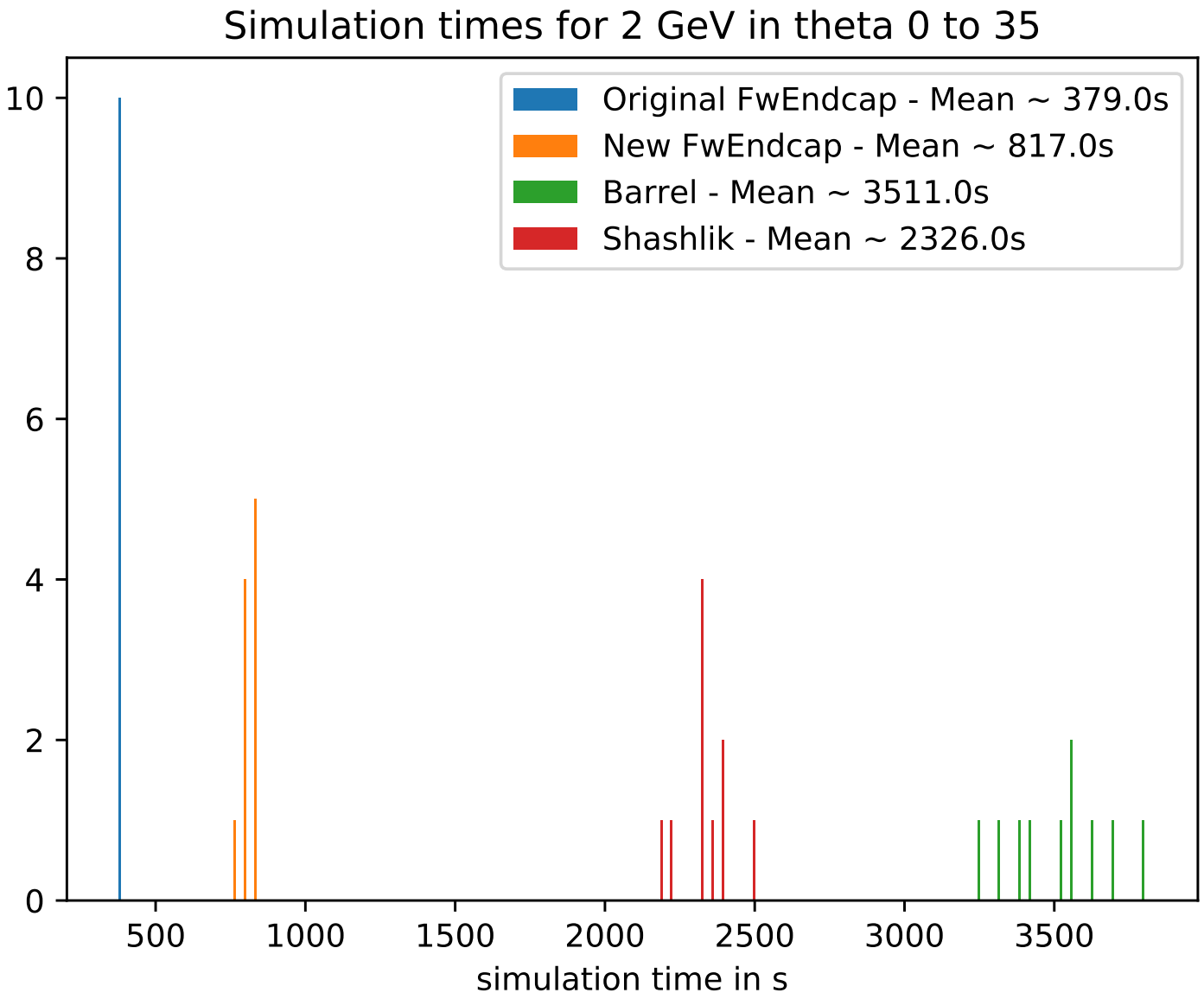


Geometry "performance"

- Simulated 10 "jobs" (each a different seed) for different geometry setups
  1. Original FwEndcap
  2. New FwEndcap
  3. Barrel
  4. Shashlik
- a "job": Simulation of 10000 2 GeV photons in a θ range of 0°to 35°

Geometry “performance”



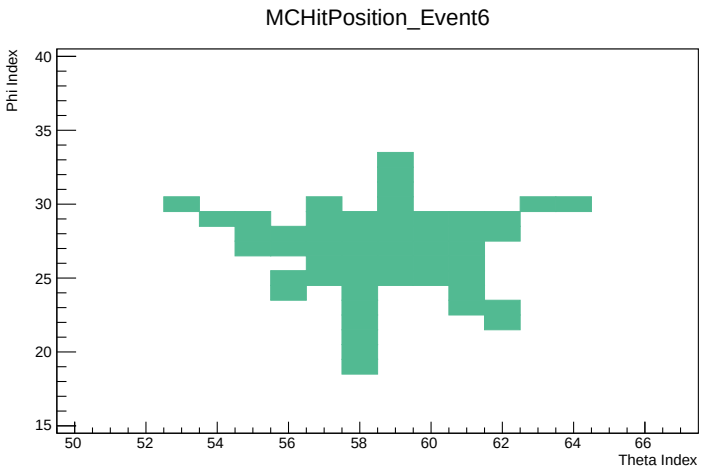
Geometry "performance"

- New FwEndcap geometry only takes $\sim 2\times$ as long as the original FwEndcap in these test simulations
  $\rightarrow$ **very** pleased with this outcome

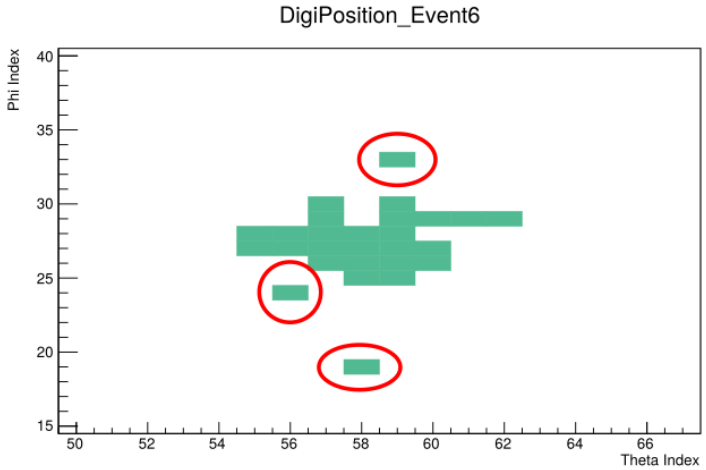
- In a setup including FwEndcap, Shashlik and Barrel the exchange of the FwEndcap geometry adds $\sim 10\%$ additional simulation time (for this simplified simulation scenario)

Out-of-cluster energy-depositions

- Last time: Alternative way of assigning reduced set of MCTracks to clusters to match local cluster-maxima to entering MCTracks
- This time: Added "pairing" of out-of-cluster depositions with main cluster



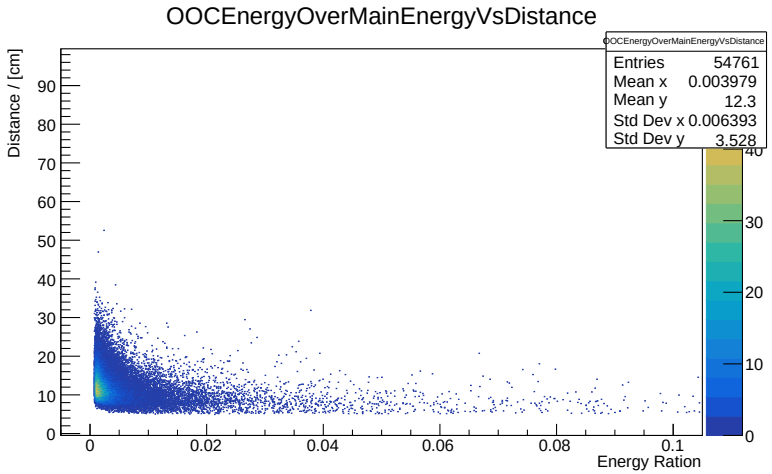
MCHit Cluster



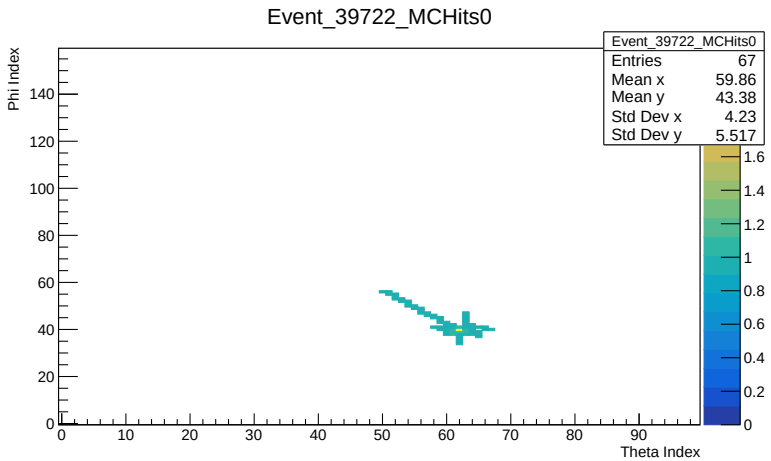
Digi Clusters

Out-of-cluster energy-depositions

- Instead of justing trying to find tracks for maxima, we can also have a look a "out of cluster" depositions



Distance of cluster center to ooc-deposition position vs ooc-deposition energy / cluster energy



Cluster using EmcMCHits

Out-of-cluster energy-depositions

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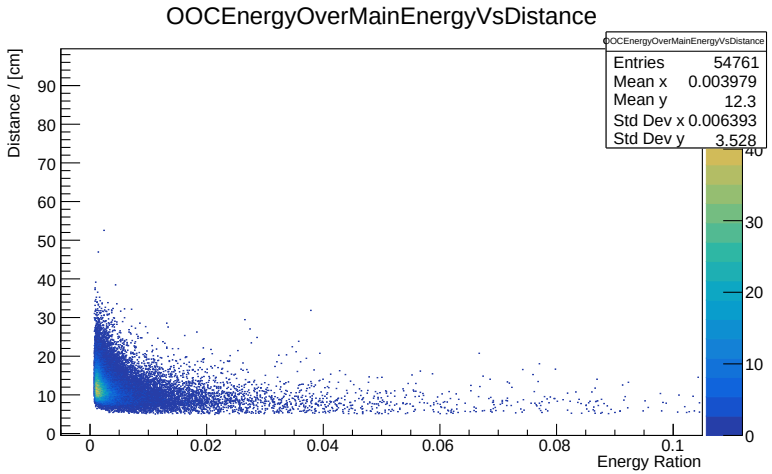

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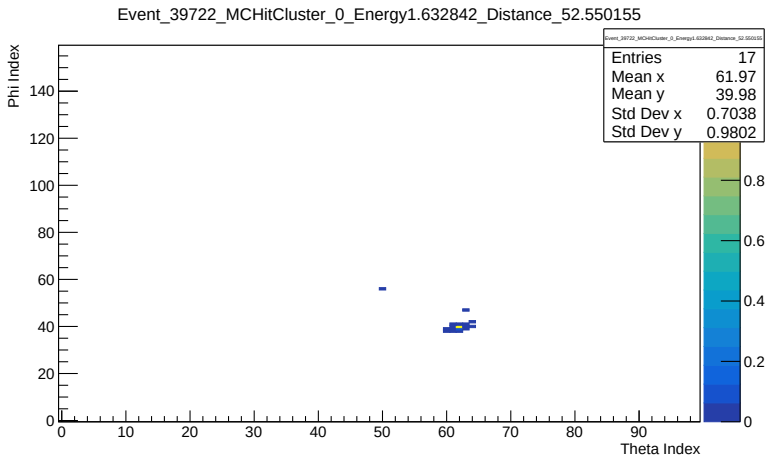


Cluster using Digis

Out-of-cluster energy-depositions

- Our approach of clustering EmcMCHits does allow us to identify stray energy depositions and the cluster they originated from
- Again, we are going to get a master student soon who will look into split-offs (mainly into in-cluster split-offs)

Summary and outlook

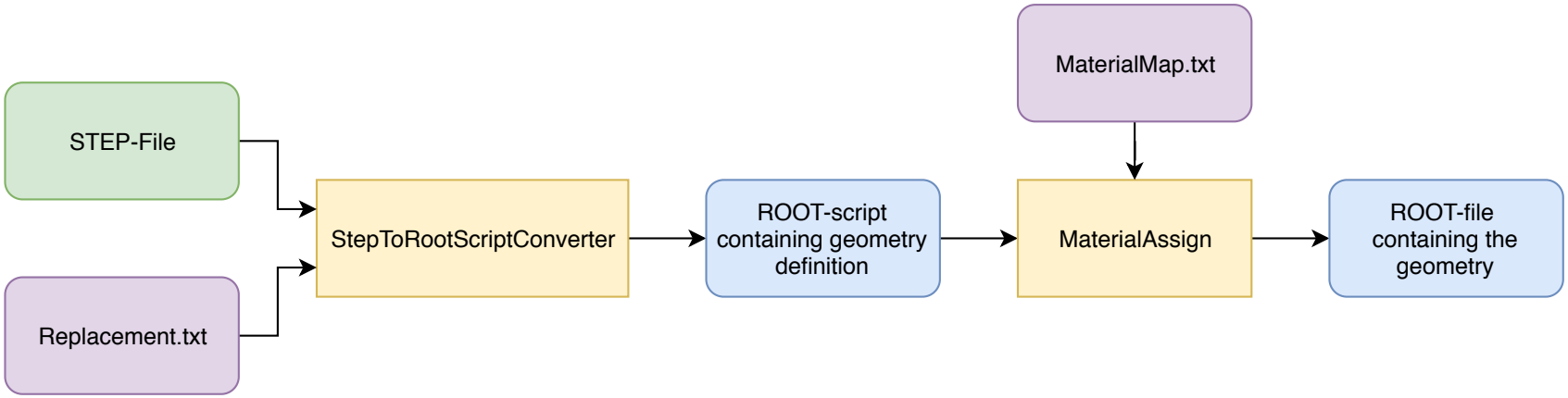
Summary

- EMC Refactorization (almost) ready up to PID
- FwEndcap Geometry "maturing" and usable, also concerning its performance
- 2 new master-students:
  1. PndPidCorrelator-restructuring
  2. Split-offs

Outlook

- EMC Refactorization should be pushed soon

Process to create our geometry



- CADConverter maps CAD-parts to ROOT-geometries, or recreates them with TGeoArbN (tesselation based geometry)
- CAD-drawing must be set up appropriately.
- Tesselation can be increased to increase accuracy

Geometry "performance"