

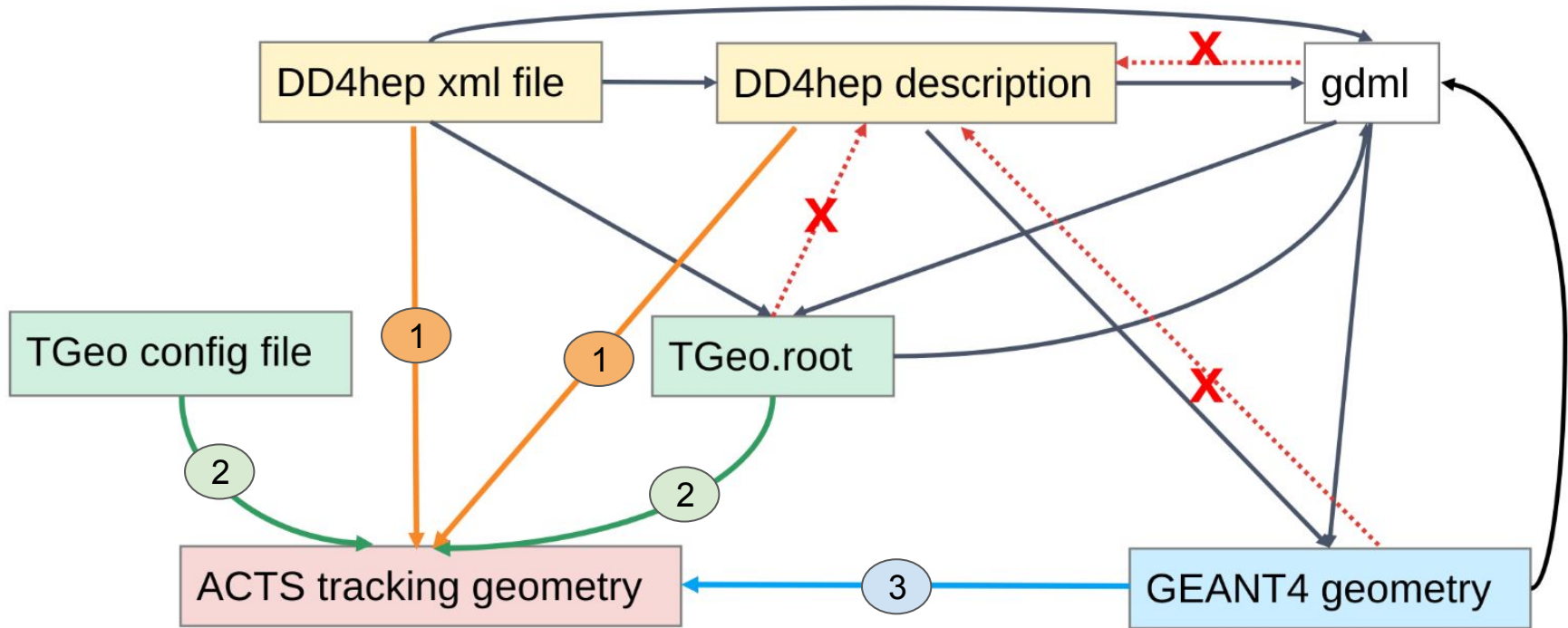
ACTS for drift chamber

What's there and what's to come ...

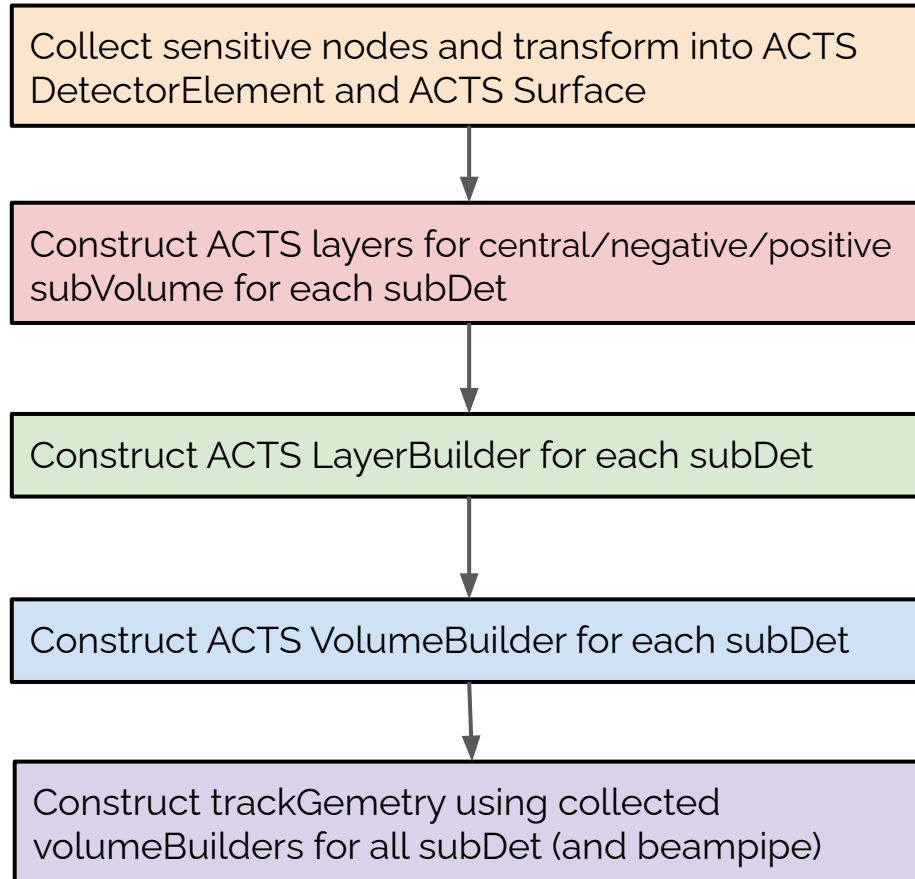
Xiaocong Ai (ZZU)

ACTS Developers Workshop 2024, Nov 20, 2024

Full Simulation geometry → ACTS tracking Geometry interface

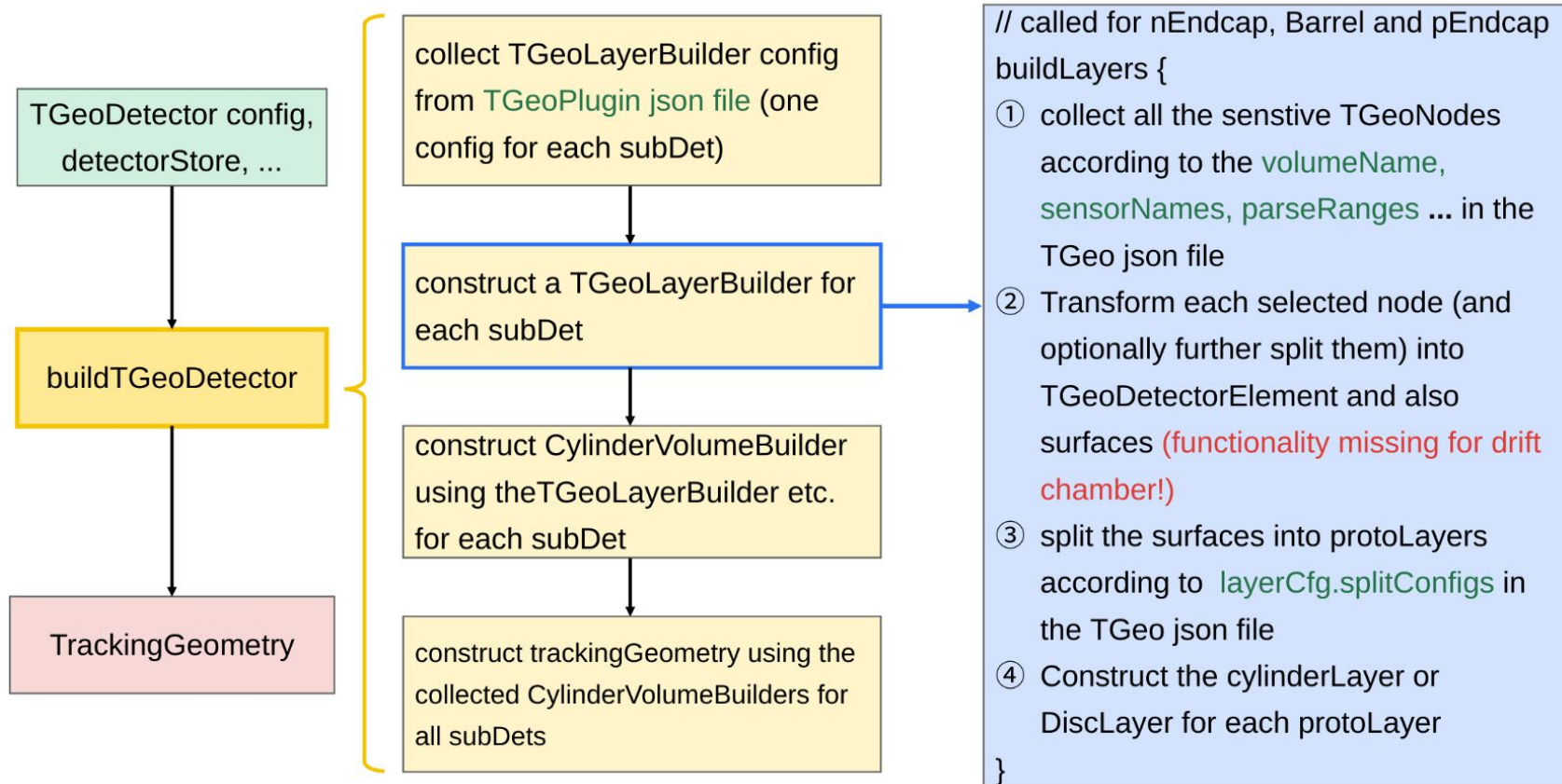


Full Simulation geometry → ACTS tracking Geometry workflow

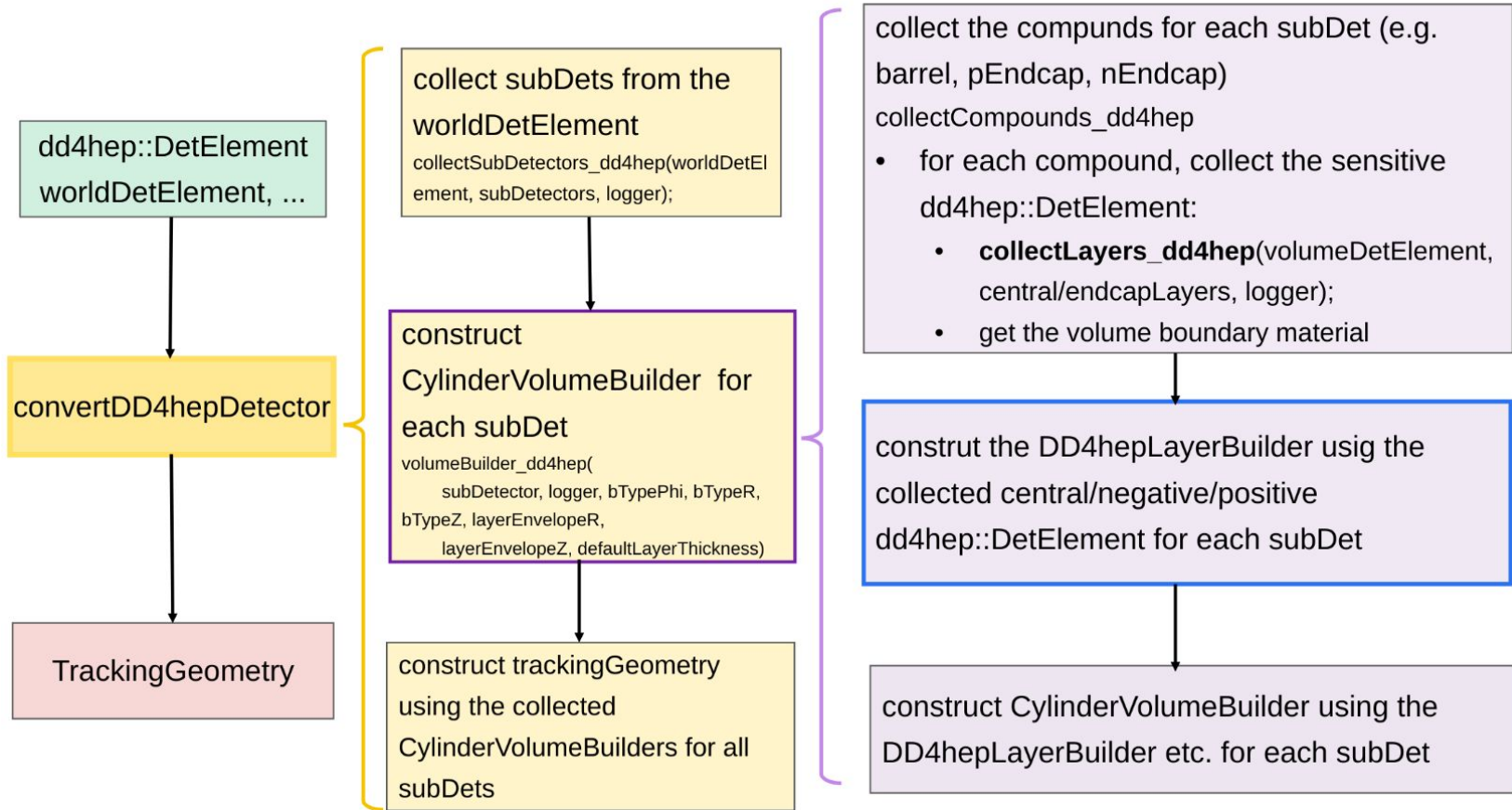


Functionality still missing for drift chamber with straws in the main branch

TGeo → ACTS trackingGeometry




DD4hep → ACTS trackingGeometry



DD4hep → ACTS trackingGeometry

construct the DD4hepLayerBuilder using the collected central/negative/positive dd4hep::DetElement for each subDet

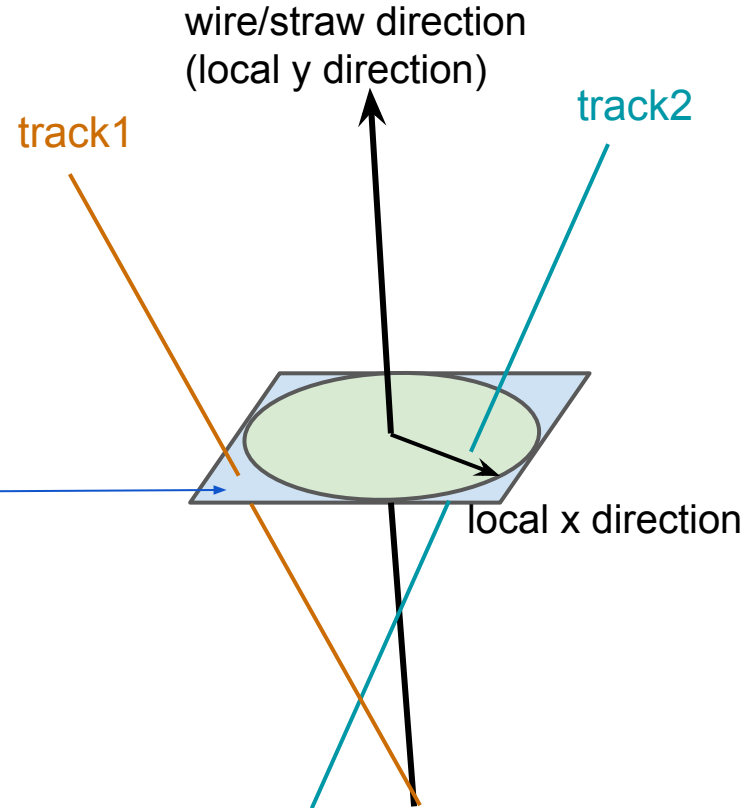


```
Acts::DD4hepLayerBuilder::centralLayers/positiveLayers/negativeLayers {  
    For each DD4hep::DetElement (corresponding to a physical layer) {  
        ① collect all the sensitive DetElements in this layer  
        ② transform each sensitive DetElement into Acts::DD4hepDetectorElement (inherited from TGeoDetectorElement) and surface (functionality missing for drift chamber!)  
        ③ construct a protoLayer using all the surfaces for this layer  
        ④ Construct the cylinderLayer or DiscLayer for each protoLayer  
    }  
}
```

Boundary description/check for LineSurface

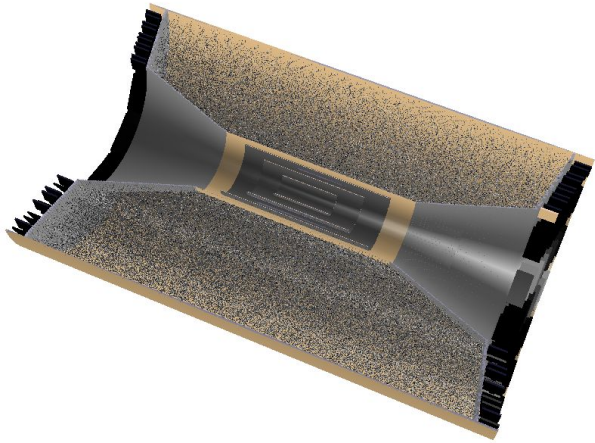
TGeoSurfaceConverter has been extended for LineSurface (PR is being prepared):

- Is there a generic way of knowing the boundary of each drift cell/straw tube from the provided TGeoNode?
- We need to extend the boundary of line surface to allow **square drift cell**
- For a square drift cell, need to know the global position for the boundary check.
 - Shall we extend the methods of BoundaryCheck to take the **global position of the track** as a parameter?

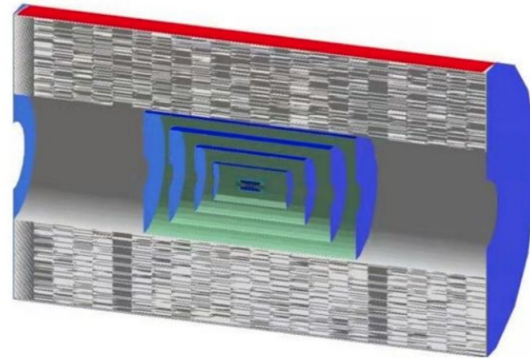


What's done

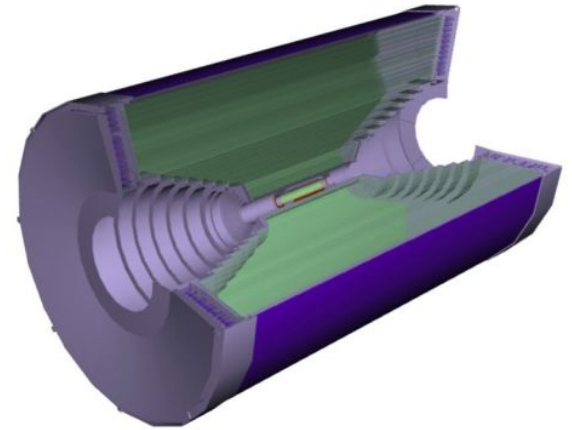
- ACTS (with some extension not in the main branch yet) has already been used for **STCF drift chamber**, **CEPC drift chamber**, **BESIII drift chamber** and **ATLAS TRT!**



STCF detector with
drift chamber



CEPC 4th concept
with drift chamber



BESIII drift chamber

What's done

More details in Zhiliang Chen's ATLAS QT
Note : [Implementing Tracking Geometry of ATLAS TRT in Standalone ACTS](#)

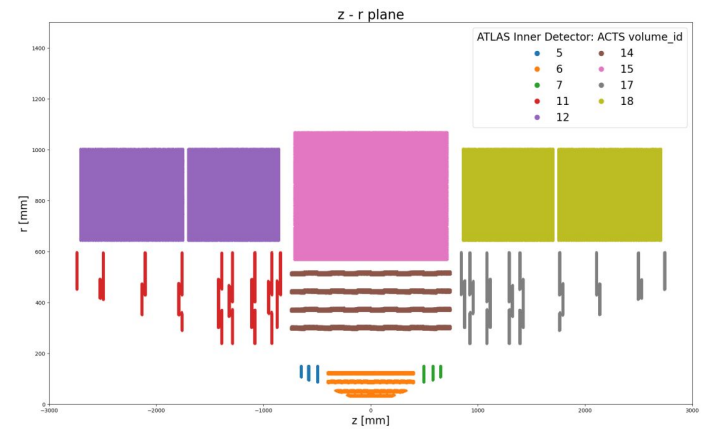
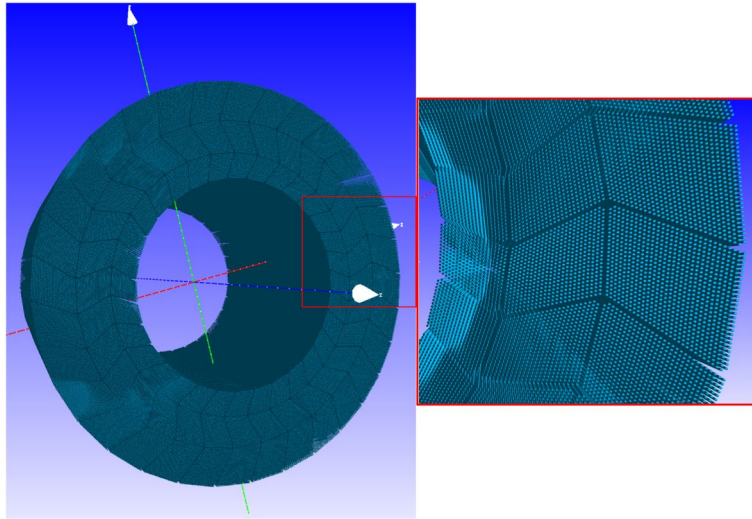


Figure 18: Visualization of simulation hits for z-r plane

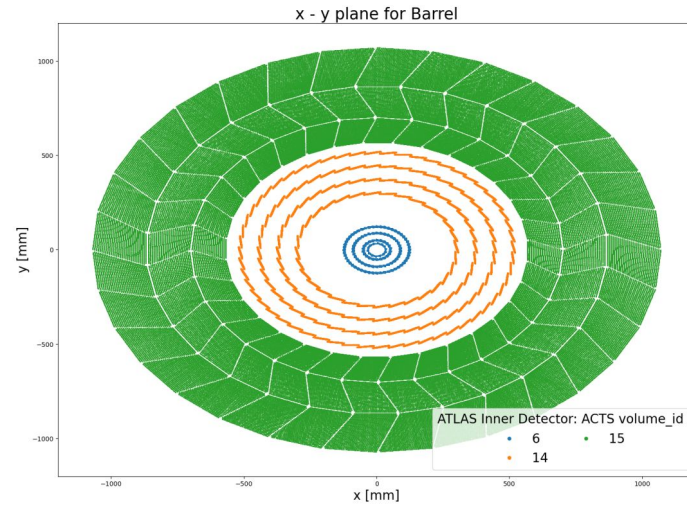


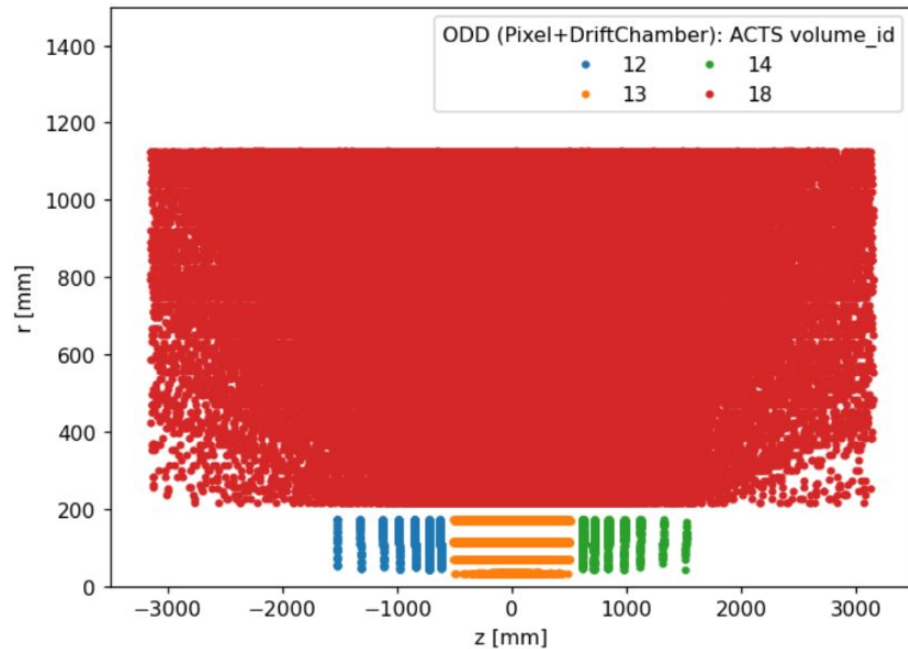
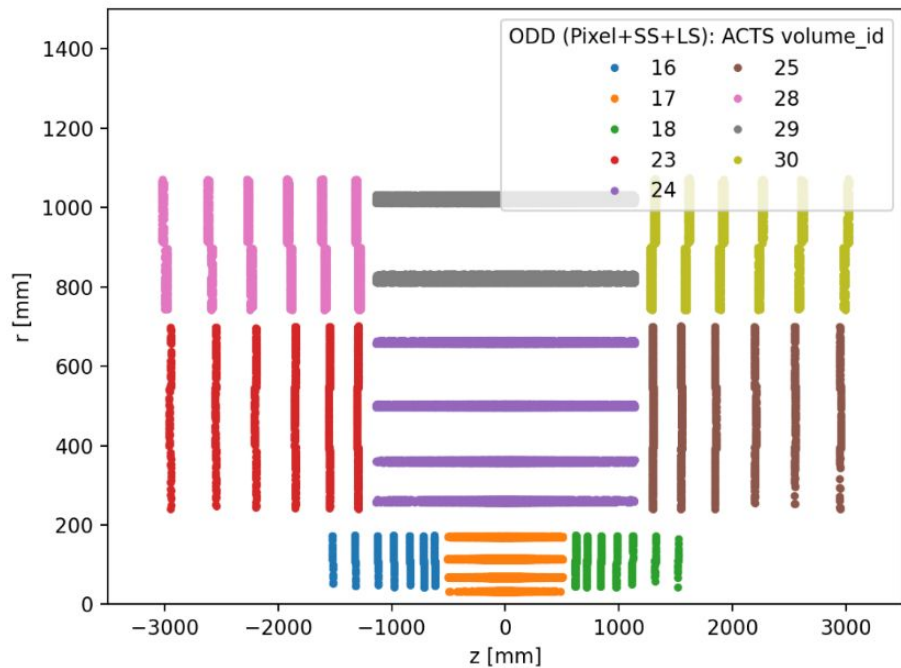
Figure 19: Visualization of simulation hits for x-y plane

What's coming

- A preliminary version of an Open Drift chamber (DD4hep description) is designed and supposed to be placed outside ODD pixel
 - DD4hep plugin to transform this into ACTS geometry works!
 - PR to get this in soon

#SuperLayer	Type	nLayers	rMin [mm]	rMax [mm]	nCells	Stereo Angle (mrad)
0	A	8	209	290	1120	
1	U	6	290	375	834	45
2	A	6	375	460	1068	
3	V	6	460	545	1308	-55
4	A	6	545	641	1362	
5	U	6	641	737	1596	65
6	A	6	737	833	1830	
7	V	6	833	930	2046	-75
8	A	6	930	1032	2166	
9	A	6	1032	1135	2376	

Another version of ODD?



Summary

- ACTS works well for drift chamber and TRT
 - Still, a few extensions need to be merged into ACTS main branch
- A preliminary version of an Open Drift Chamber is available
 - Hopefully can get into OpenDataDetector soon as a demonstrator of application of ACTS for drift chamber
- Recently contacted by guys from INFN/BNL/Michigan about ACTS for **Belle-II/EIC/FCC-ee** (with a wire/straw chamber design)
 - An ACTS subgroup dedicated to discussion on drift chamber/TPC application will be formed (please get in touch if you are interested!)