

Update on hits missing from track fits

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Motivation

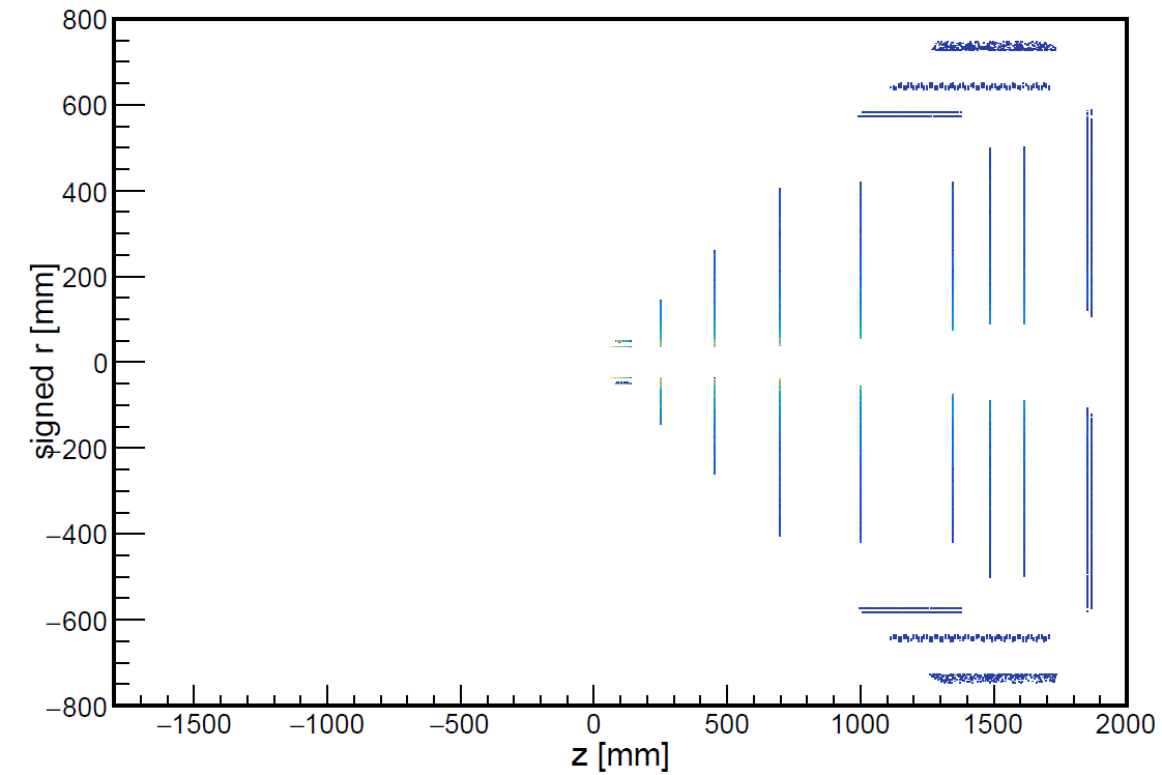
➤ Last week I showed the following:

1. For the barrel MPGD layers, we restored SVT-like digitization. The hits are now getting attached to the track as good measurement hits with a high efficiency.
2. For the Forward TOF layers, we see the hits getting attached to the track fit with high efficiency for the front layer, but almost zero efficiency for the back layer. We want to understand this more.

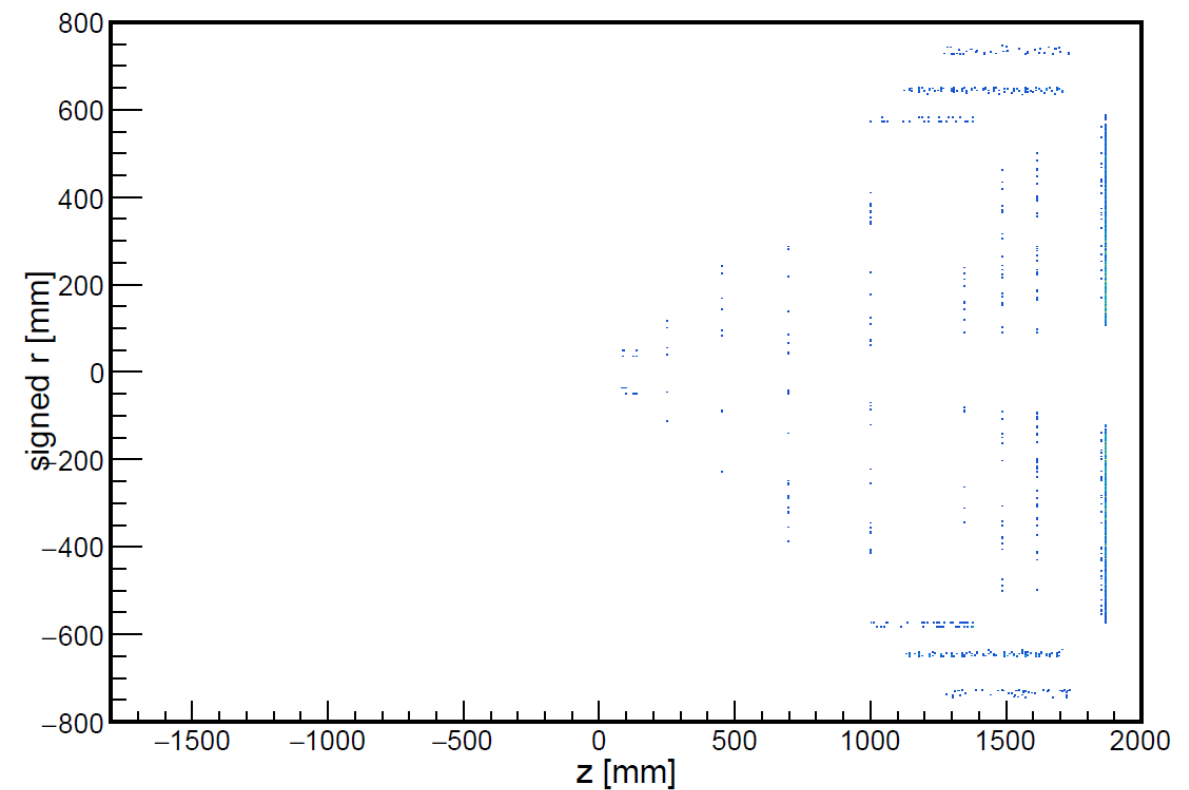
Location of hits not used in track fit

Single-particle simulation with particle
generated towards forward endcap

All associated digitized hits



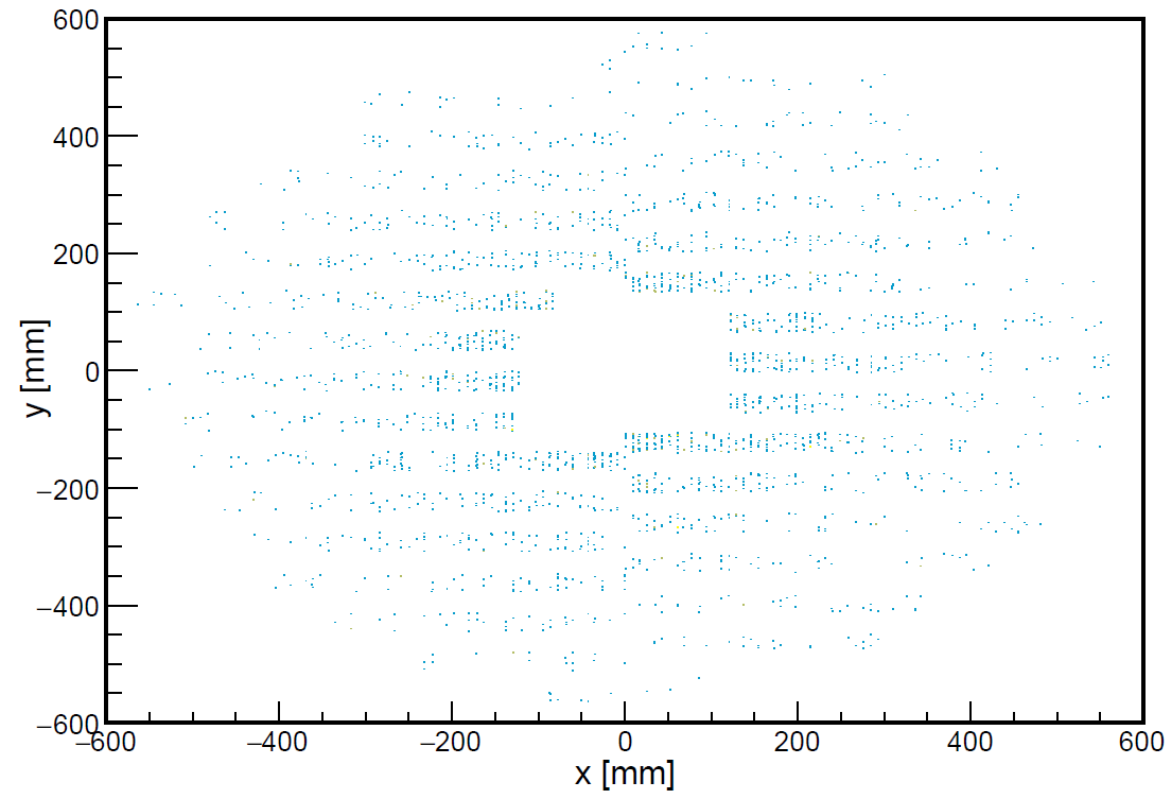
Associated digitized hits missing from track



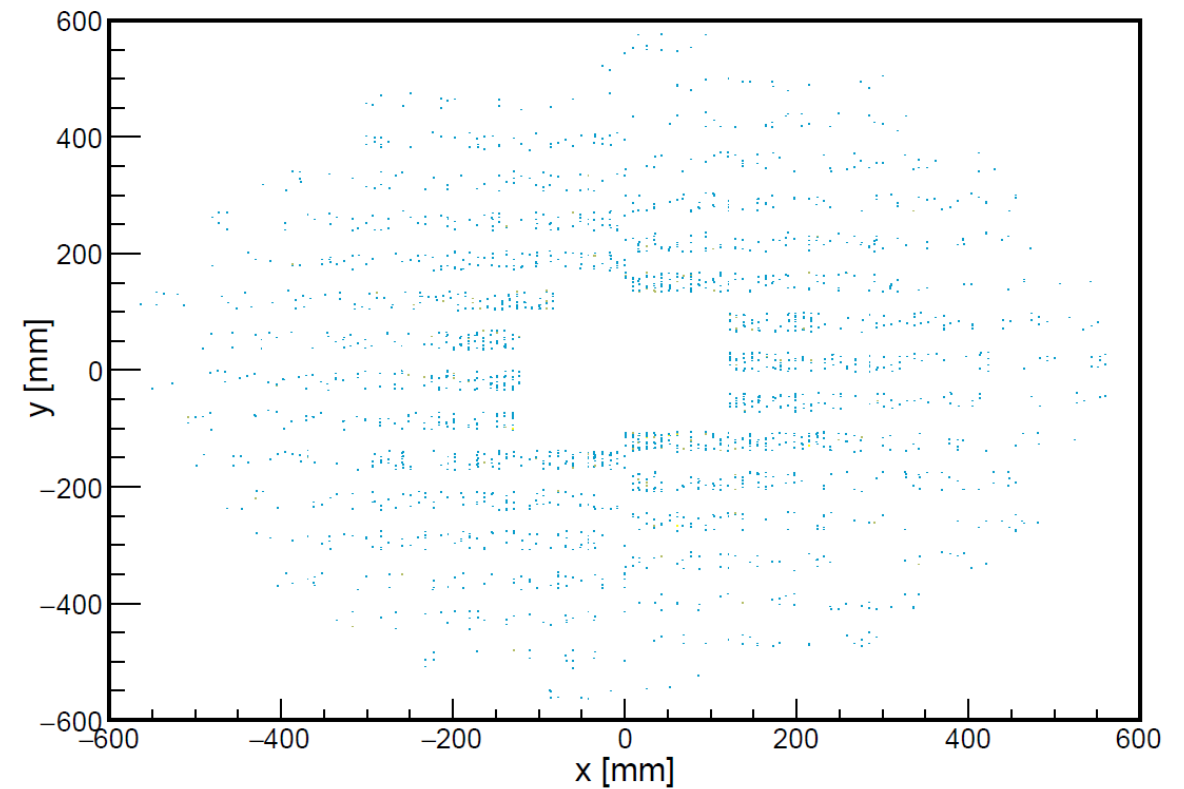
Location of hits not used in track fit

Single-particle simulation with particle
generated towards forward endcap

All associated digitized hits



Associated digitized hits missing from track

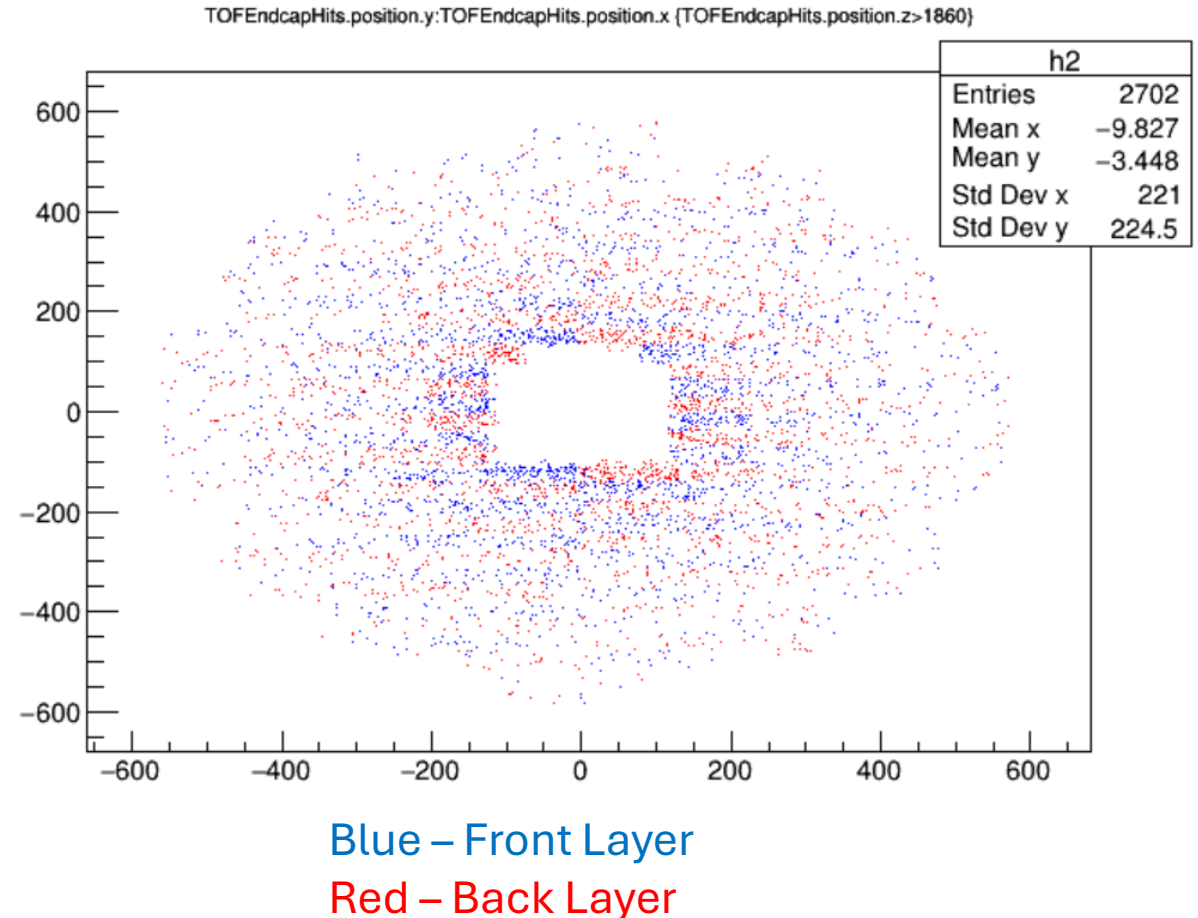


**y vs. x hit distribution on Forward TOF back
layer. No pattern is seen in missing hits.**

Forward TOF acceptance

The geometry of the Forward TOF is such that, for a given charged particle, we rarely get hits in both the front layer (at $z = 1849\text{mm}$) and the back layer (at $z = 1870\text{mm}$).

Since the two layers have a similar geometry, an identical readout scheme, and are only 20mm apart in z , it is strange that the front layer hits are getting used by the track fit with high efficiency, but the back layer hits are not.

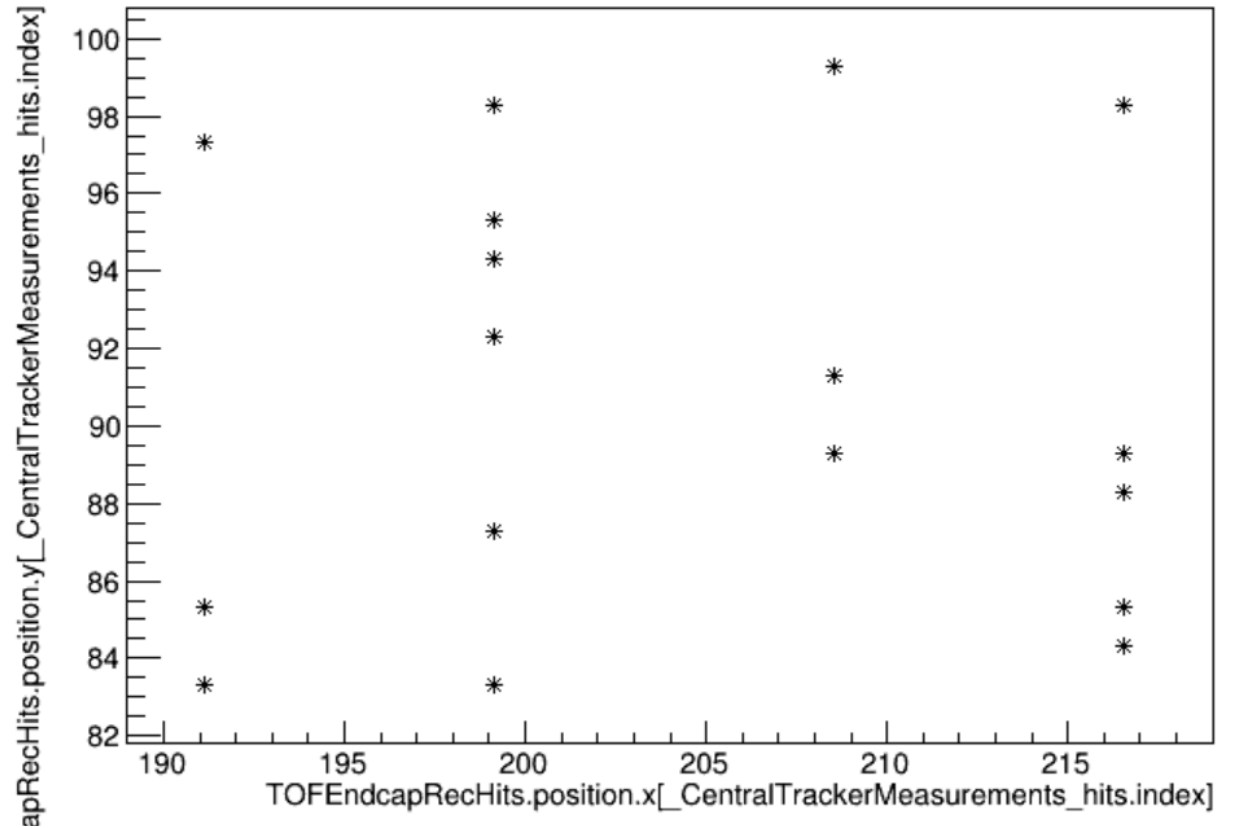


Forward TOF readout grid

Right plot: digitized hit y vs. x for Forward TOF back layer on a single Acts surface.

Note that the hit spacing in x is 8mm, and the hit spacing in y is 1mm. This is consistent with the readout grid shown below, with the grid defined in local coordinates. (The global coordinates shown on the right are rotated by 90 degrees with respect to the local coordinates.)

With this readout grid, the TOF position resolution is much larger than the 30um mentioned in the PTDR.



```
659 <readouts>
660   <readout name="TOFEndcapHits">
661     <segmentation type="CartesianGridXY" grid_size_x="1*mm" grid_size_y="0.8*cm" />
662     <id>system:8,layer:4,module:2,idx:5,idy:5,ids:6,x:36:-12,y:-16</id>
663   </readout>
664 </readouts>
```

Some checks on the efficiency of reconstructed hits being used in the track fit

1. Does restoring the old readout grid of (0.1mm,0.1mm) change the track hit efficiency for the Forward TOF? **No, we still see good efficiency for the front layer and poor efficiency for the back layer.**
2. Does significantly increasing the covariance errors on the initial (i.e. seed) parameters have any effect? **No, the results appear similar.**

➤ Next step is to study the covariance matrix of the predicted track states in more detail. One challenge is that the CentralCKFTrackSegments collection only saves the track state up to the last layer with a measurement. Since no tracking layer is behind the last Forward TOF layer, we currently have some difficulty accessing the predicted track state there.