

MarlinTPC track reconstruction for a full modular end plate

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LCTPC Collaboration Meeting

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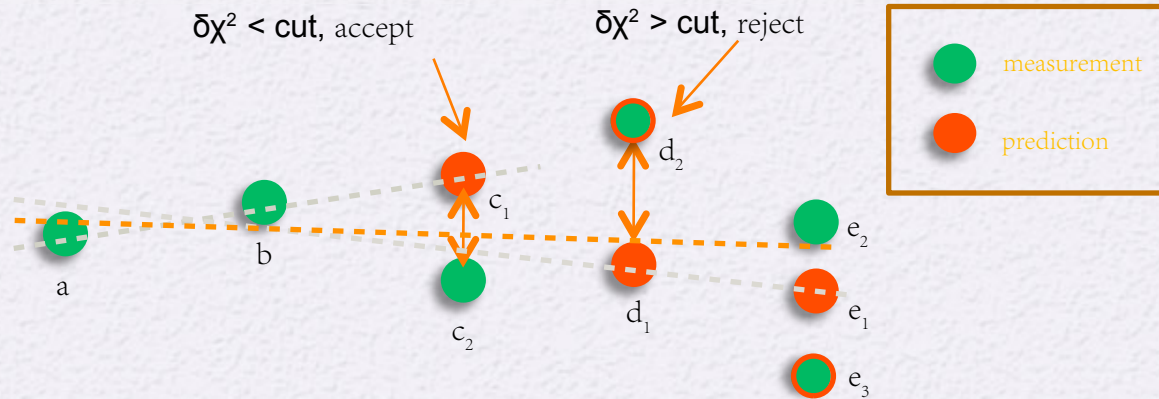
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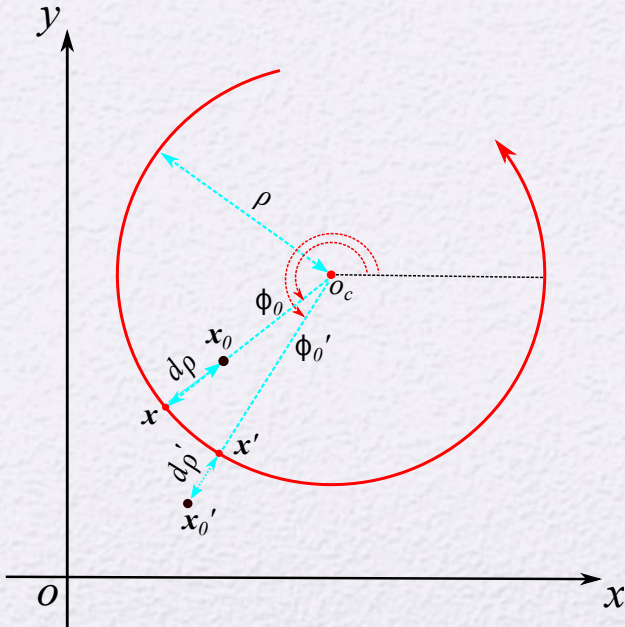
Tracking algorithm with Kalman filter

- Algorithm:

Track following
+ Kalman filter:



- Helix model in uniform magnetic field:



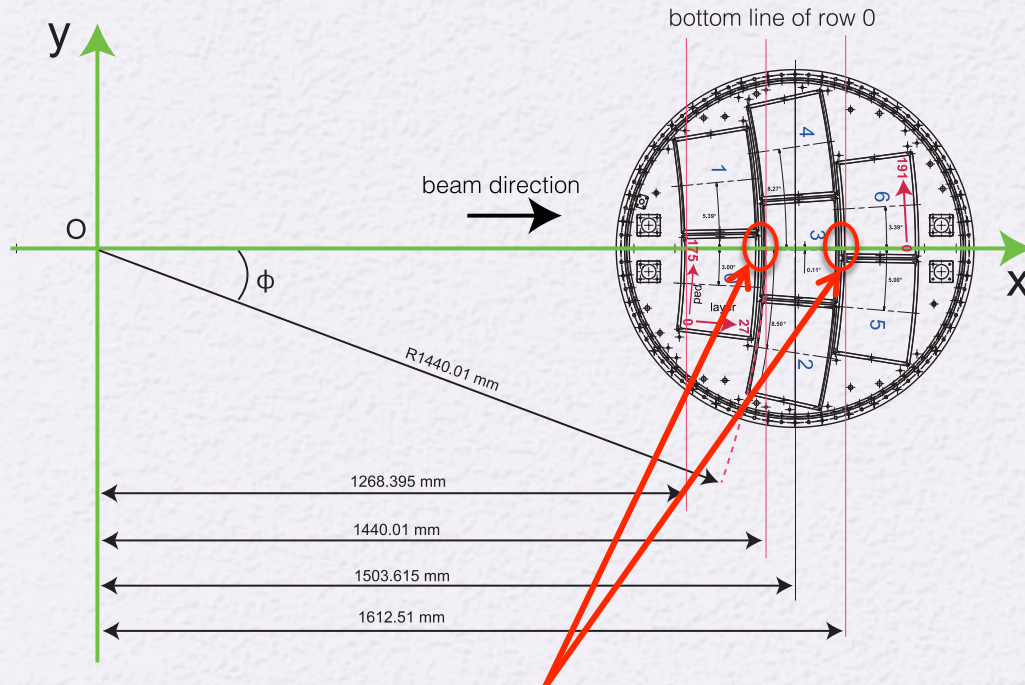
- The Kalman filter package, KalTest, is used for tracking. Helix parameterized in KalTest:

$$\begin{cases} x = x_0 + d_\rho \cos \phi_0 + \frac{\alpha}{\kappa} [\cos \phi_0 - \cos(\phi_0 + \phi)] \\ y = y_0 + d_\rho \sin \phi_0 + \frac{\alpha}{\kappa} [\sin \phi_0 - \sin(\phi_0 + \phi)] \\ z = z_0 + d_z - \frac{\alpha}{\kappa} \tan \lambda \cdot \phi \end{cases}$$

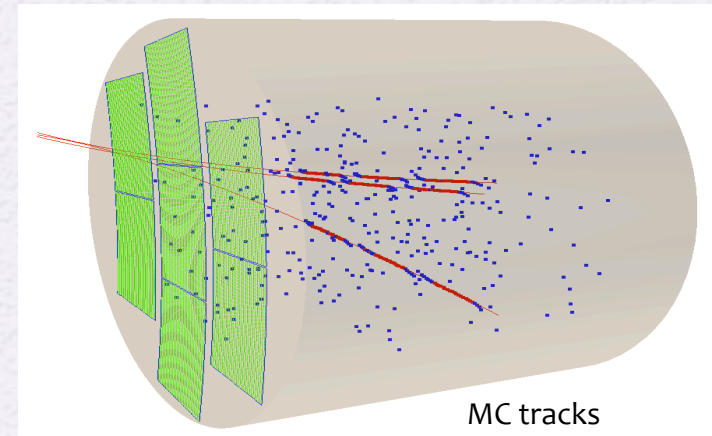
- KalDet, which is related to KalTest, handles the TPC geometry components(layers).

Track reconstruction for LP1

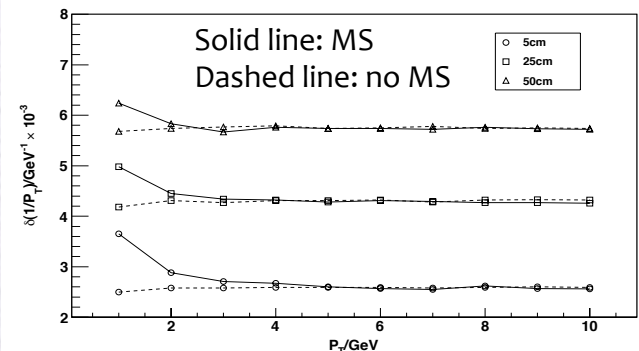
- Reconstruction algorithm is implemented as a MarlinTPC processor.
- It aims for Large Prototype to some degree:



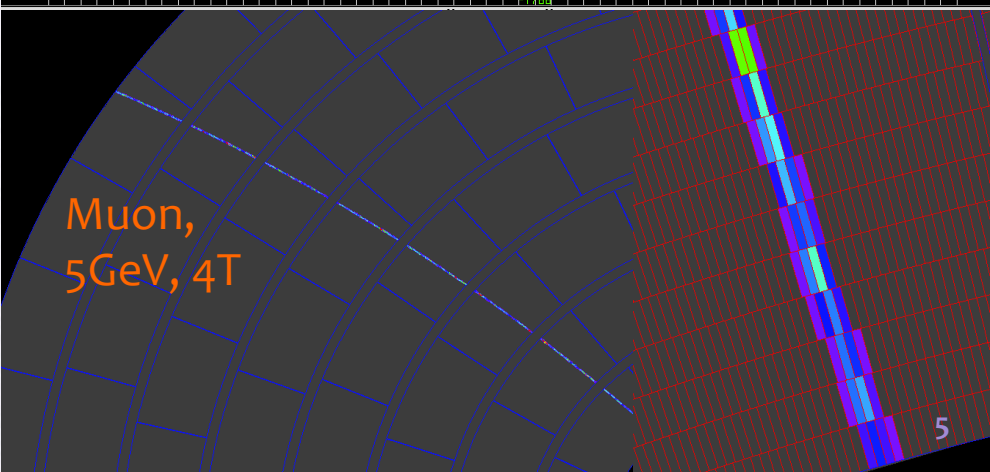
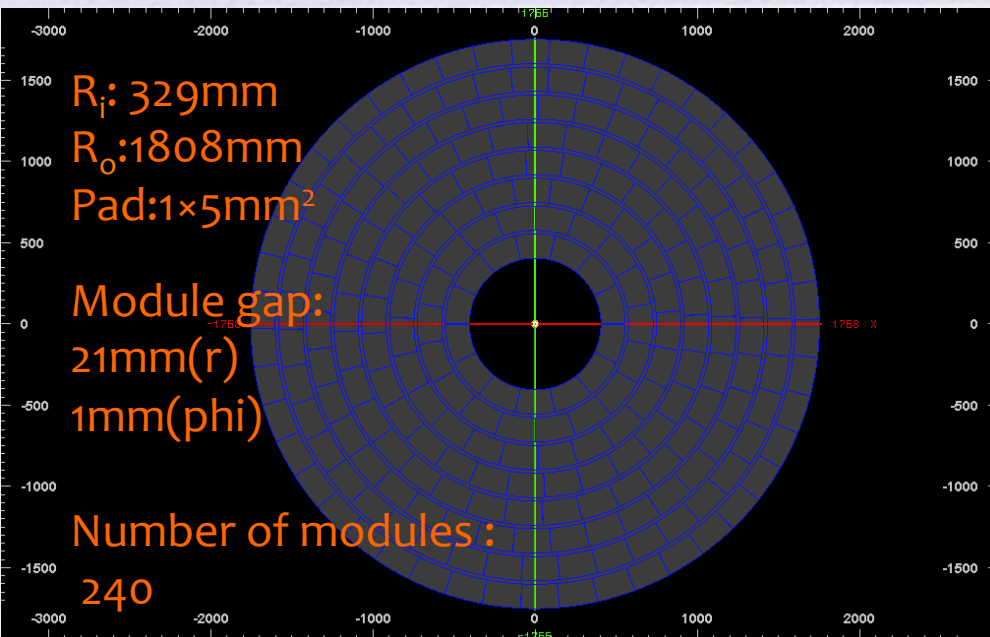
- The processor is tested for tracking:



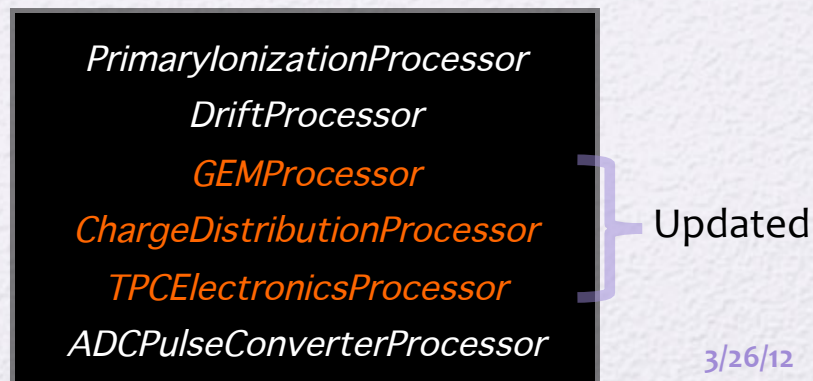
- Determine the next layer crossed by the track .
- In LP1 the propagation to the next module is done as a step in x direction.



Modular full end plate

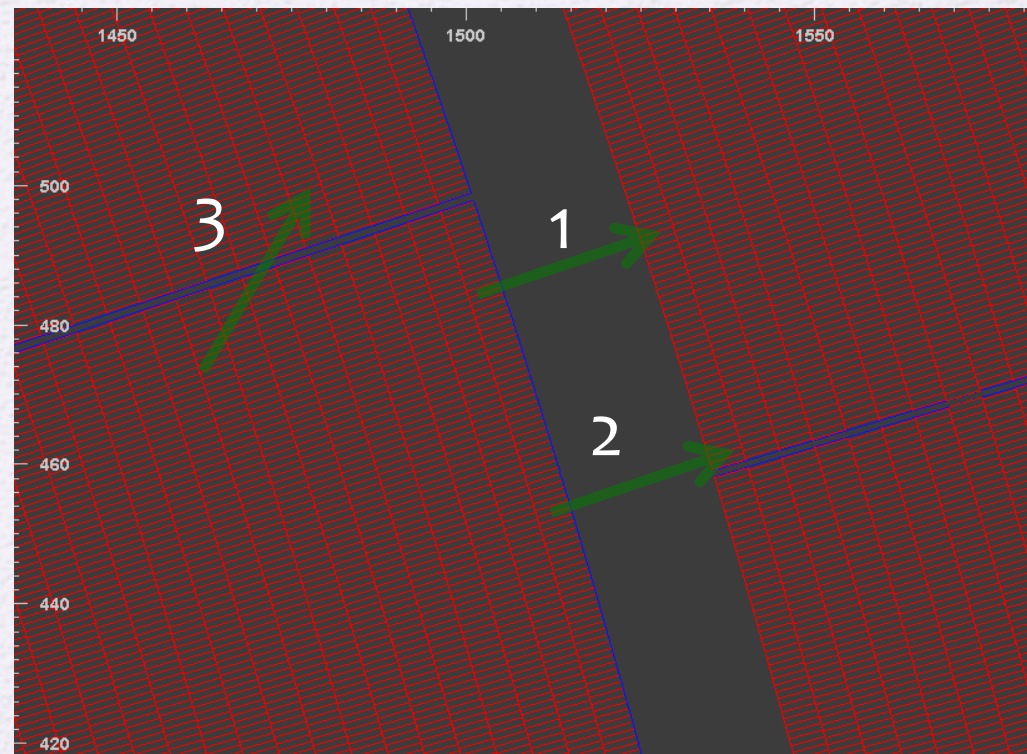


- The geometry parameters are based on the TPC design in the CLIC CDR.
- The digitisation code in MarlinTPC has been updated to handle multiple modules.
- Simulation and digitization include ionization, electron drift, amplification, and charge deposition:



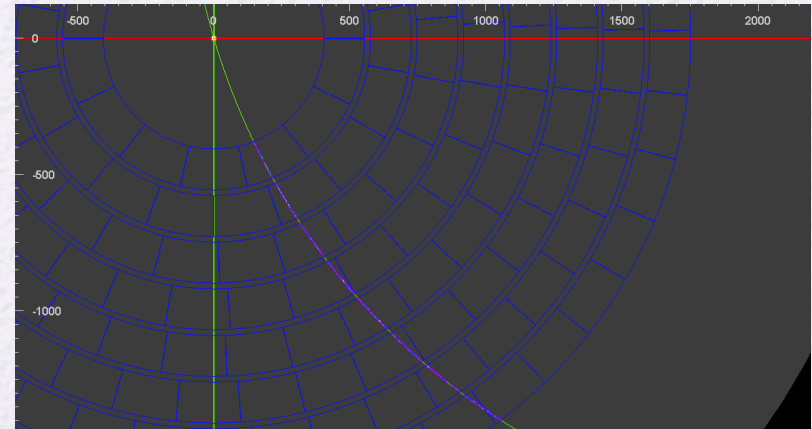
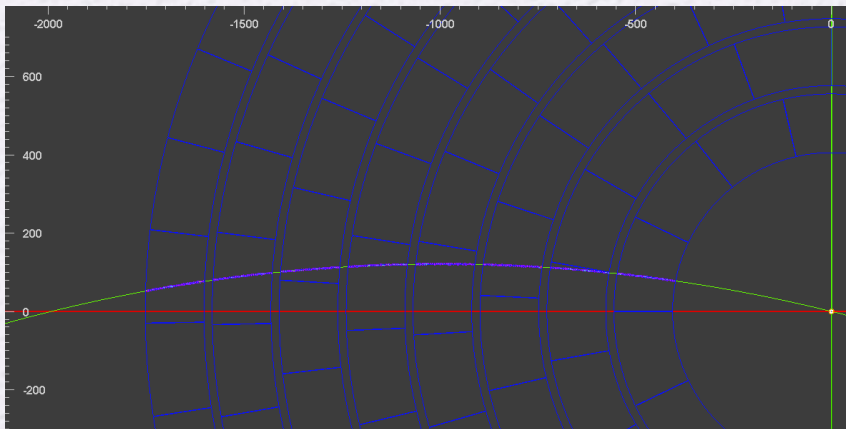
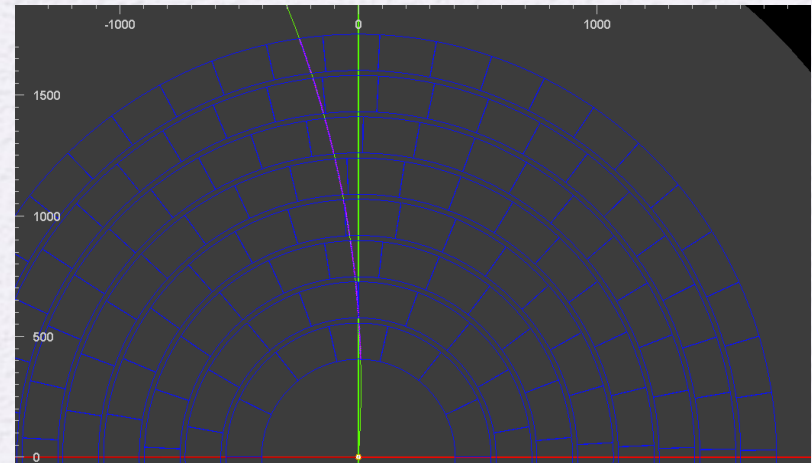
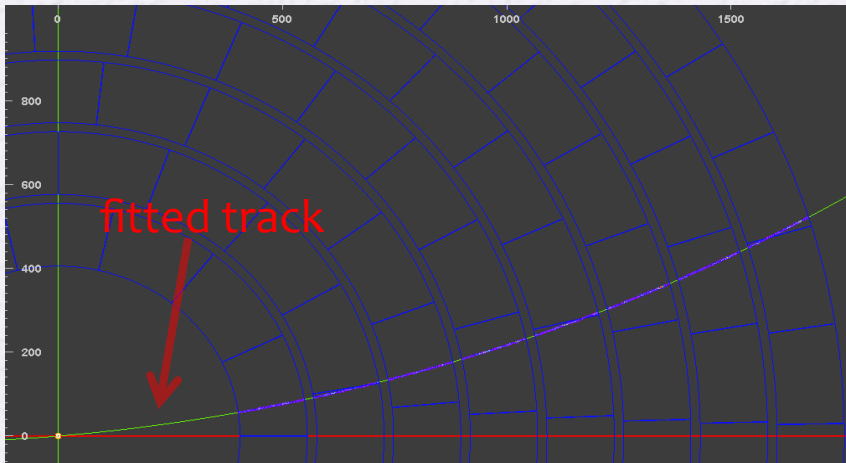
Update of the tracking algorithm

- Still assume that the layer index is increasing when track goes through TPC.
- There are three cases for module transition :
- The new strategy for determining the layer:
 - ① Step a row. If it is at the module boundary, go forward a distance (modular gap) in r direction;
 - ② Then check if there is side layer.



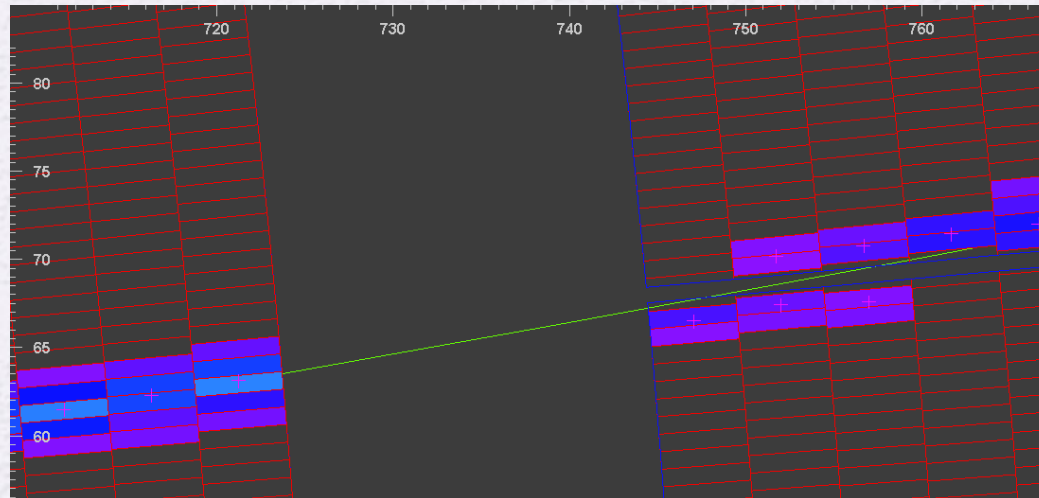
Reconstruction

Now helices from different direction can be reconstructed correctly:



Some issues

- The reconstructed track parameters slightly depend initial value in Kalman filter.
- Low momentum tracks may not be reconstructed correctly without further improving the algorithm.
- Cartesian and polar coordinates are mixed in the code.
- Hits on the module boundary have to be calculated more carefully:



Summary

- MarlinTPC digitization and track reconstruction based on Kalman filter is updated for full modular end plate.
- Several issues also need to be solved. And performance of the updated algorithm should be studied more.