Cluster Finder for STAR TPC

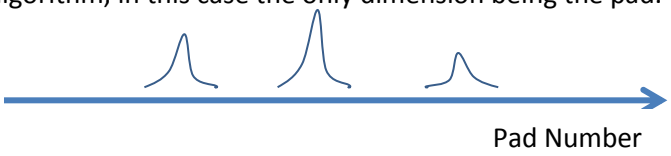
Cluster Finder (CF) is the piece of code that implements particular algorithm to reconstruct clusters of digital information read out from the readout system of the TPC (ALTRO chip for TPC and SAMPA chip for iTPC upgrade) in order to produce hit information that is fed into the track reconstruction procedure.

TPC readout has a particular structure, which is split into padrows, pads, and time bins. In current setup there are 45 padrows, each padrow consists of pads, from 80 to 182 pads depending on the padrow. Each pad reads out the hit information in time bins, up to 512 readouts.

Rough description of the current and new CFs is given below just to demonstrate the key difference between the two.

Current Cluster Finder

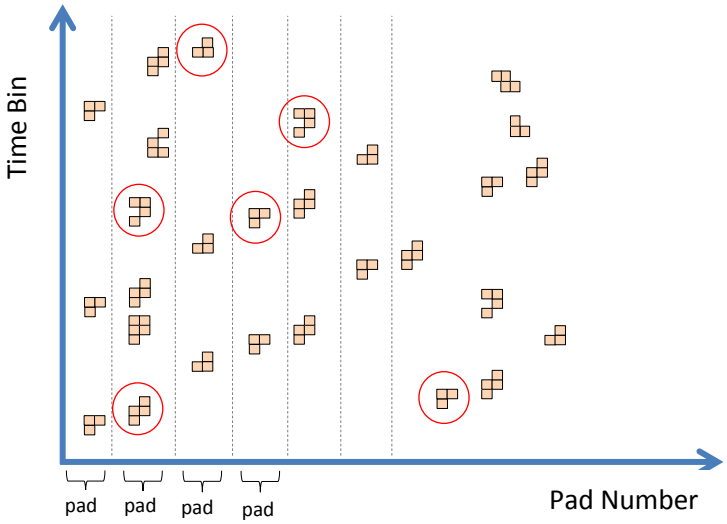
The algorithm used in the working version of the CF could be referred as one dimensional clustering algorithm, in this case the only dimension being the pad.



The information about the readout in pad being split in time buckets is, after initial smoothing and merging, averaged and the hit peaks are found in one dimension. This causes the drastic fall of cluster finding efficiency in the forward region of the TPC where the track traverses a small number of tracks due to its high inclination.

New Cluster Finder

The idea of the new CF is to use the full potential of the available information, which means to do the cluster finding in two dimensions. So in addition to the pad dimension it uses the time bin direction as well.



This diagram is only for illustration purposes and does not reflect the correct dimensions or clustering algorithm.

So in this case we have two dimensional clustering which is especially powerful when there are actually multiple clusters in one pad, as it is a case for high rapidity tracks.