Vertex finding
with Projection Matching Algorithm

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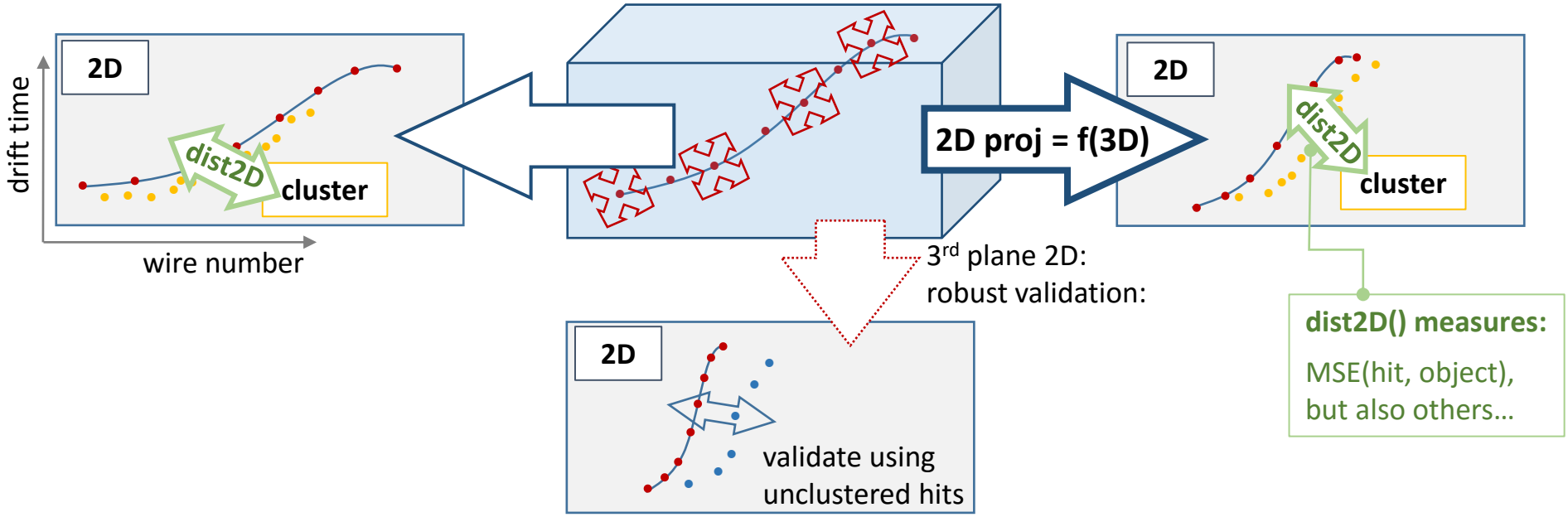
Projection Matching Algorithm – just a reminder

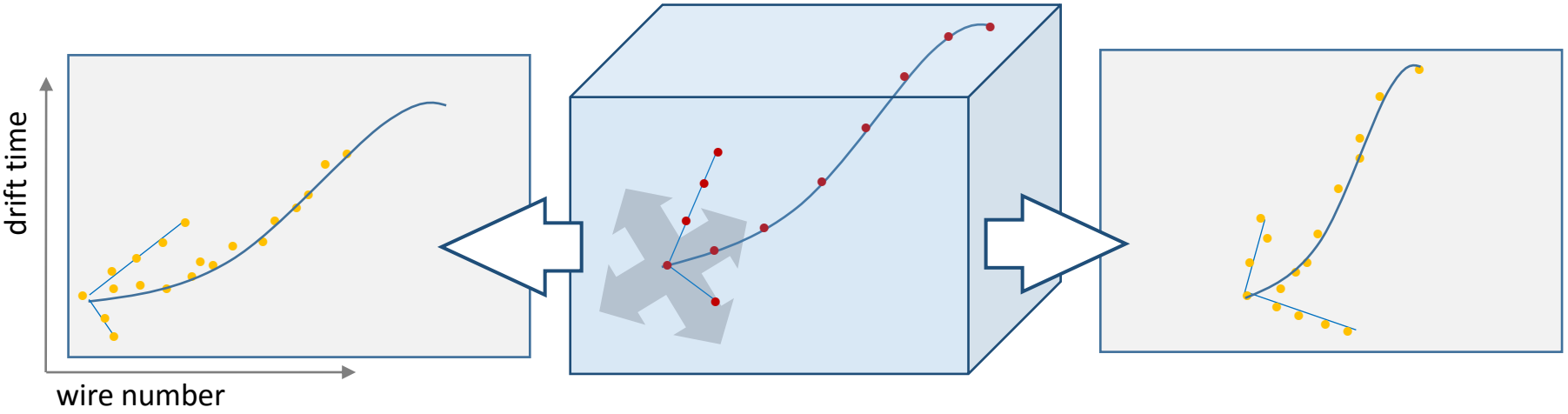
- works in 3D (on ***single track*** or ***full track structures***) to match the object's 2D projections to hits



- **input:** 2D clusters
- **initial matching of clusters, growing 3D tracks, stitching TPCs…**
- **output:** collection of independent 3D tracks (+ dQ/dx, some classiffication)

One of possible extensions of PMA

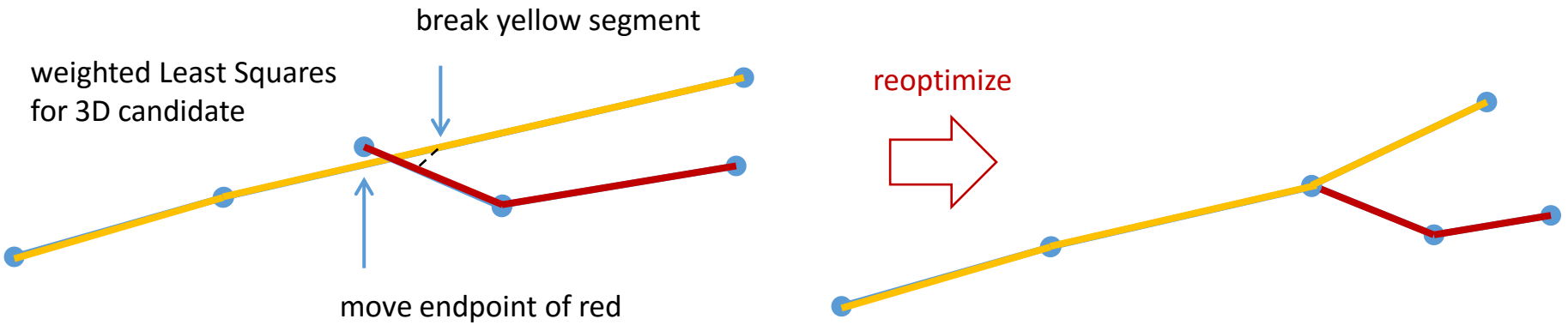
- mutli track structures → **vertex position + track directions** using full information available in the vertex region

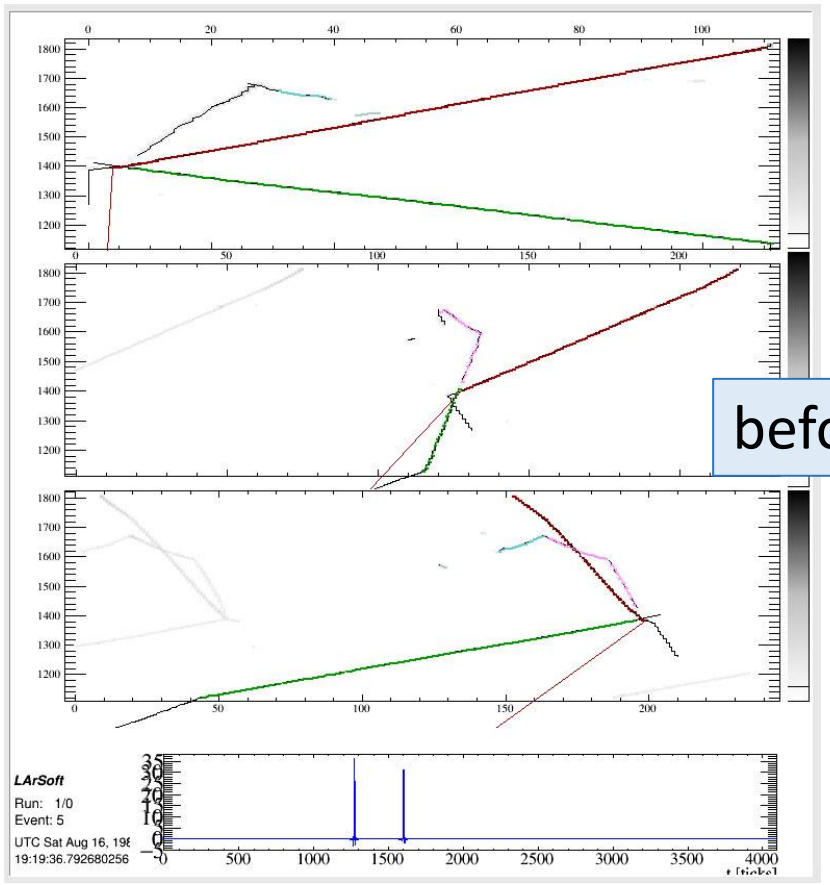


- select track segments approximately pointing to the same 3D position (two or more tracks)
- create vertex, split tracks if needed, attach to vertex
- *reoptimize all tracks+vertex simultaneously*
- reassign hits between tracks (can correct some mistakes of 2D)

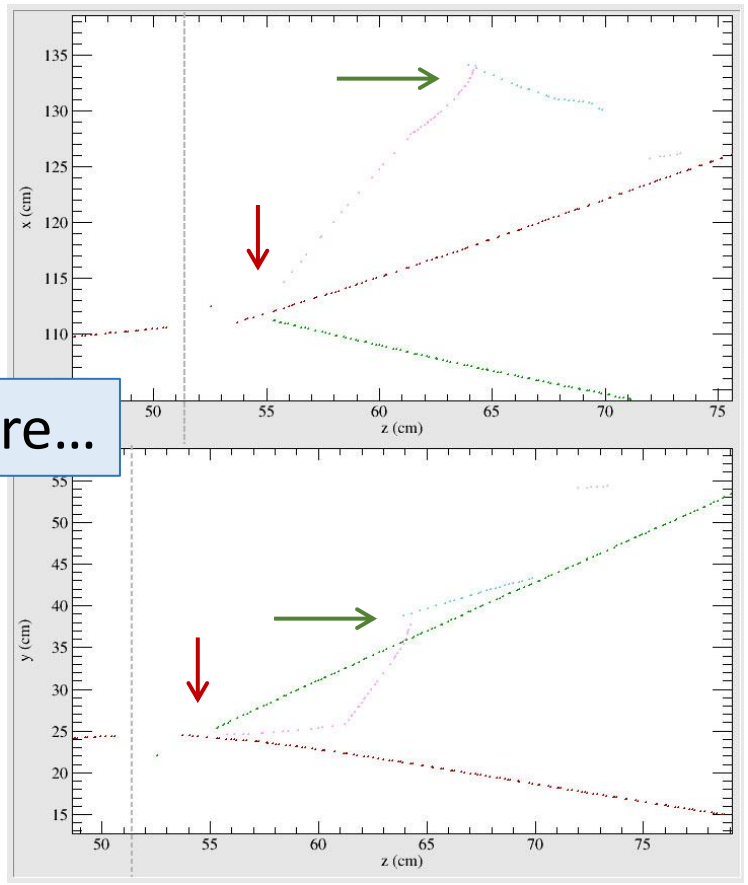
- just implemented, several ways to improve performance spotted

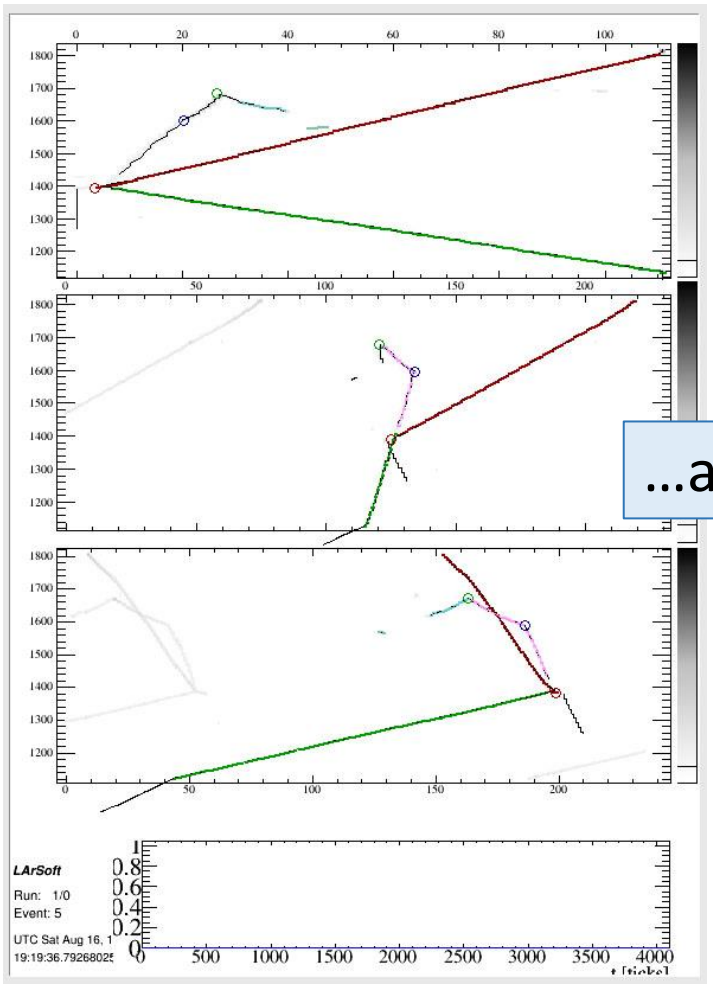
How it works:





before…




LArSoft
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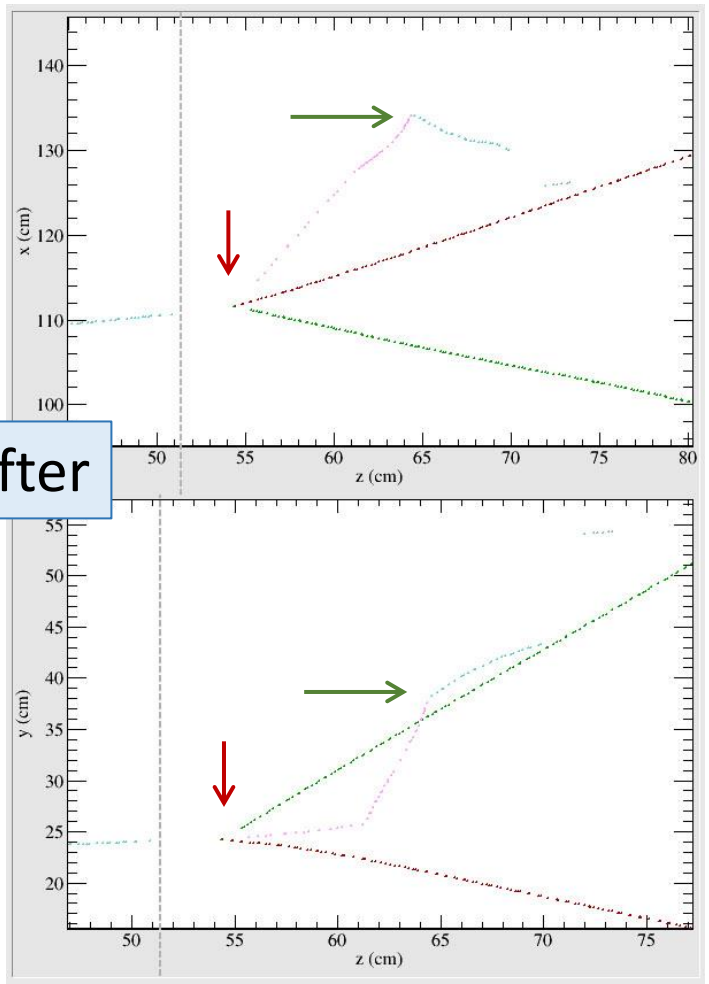
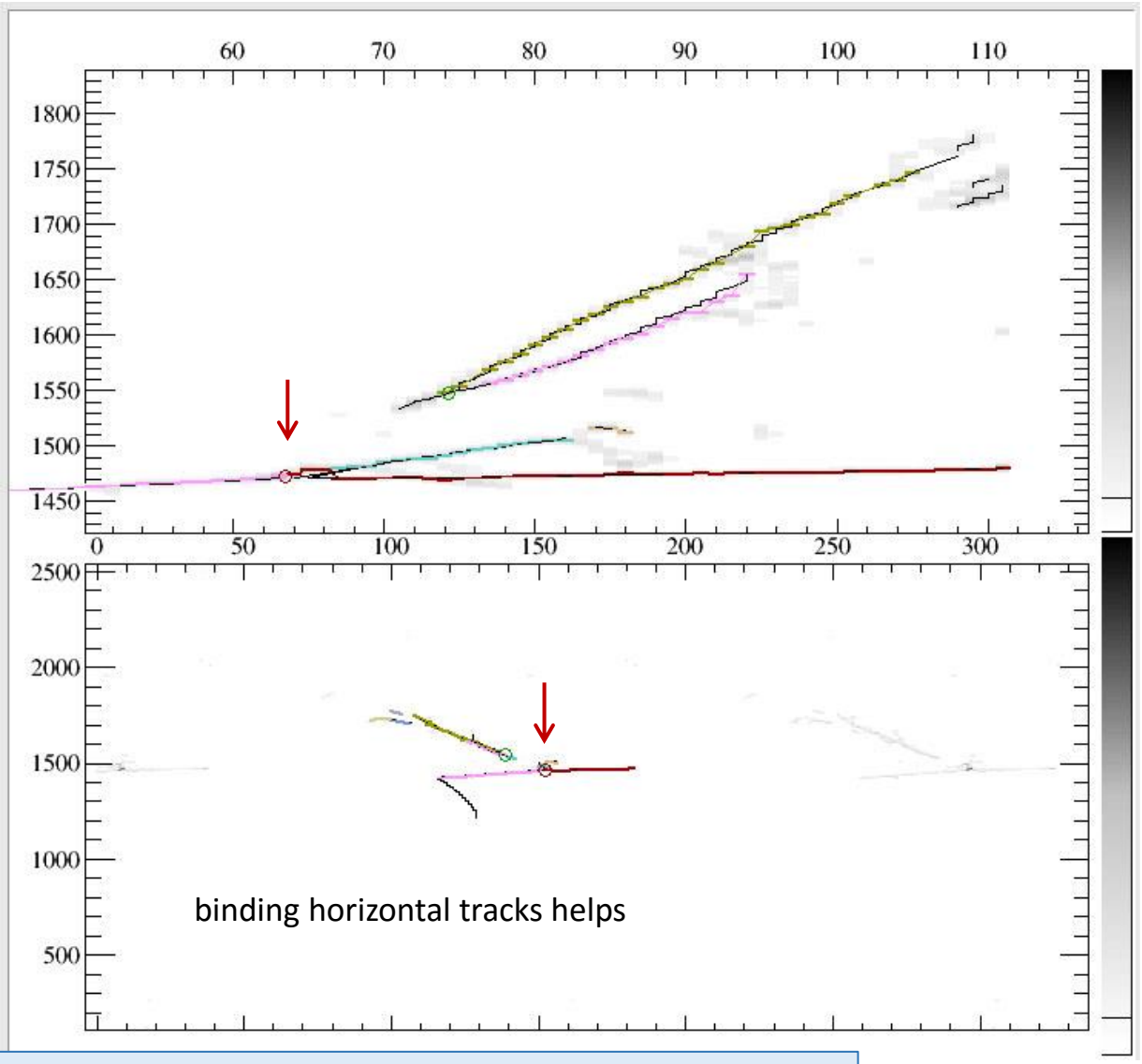
…after


x (cm)
z (cm)
y (cm)
z (cm)



just another example: π^-, charge exchange

- now **in feature branch**, need at least some days to prepare testing methods, optimize, debug
- **to be complement** with other vertex hints – dQ/dx behaviour, track endpoint surrounding, …
- finally enables reliable residual hit-track assignment from unmatched clusters
- use of vertex candidates from external module/algorithm can be implemented

- **one of π^0 ingredients**,
- but also endless other applications (neutrino vertex, decay chains, …)

- **target:** present on the next LArSoft coordination meeting
- (and Collaboration meeting)