FTKSim Status: Ghost Busting part. II The Hit Warrior

F. Crescioli, M. Dell'Orso, P. Gianetti
G. Punzi, **G. Volpi**

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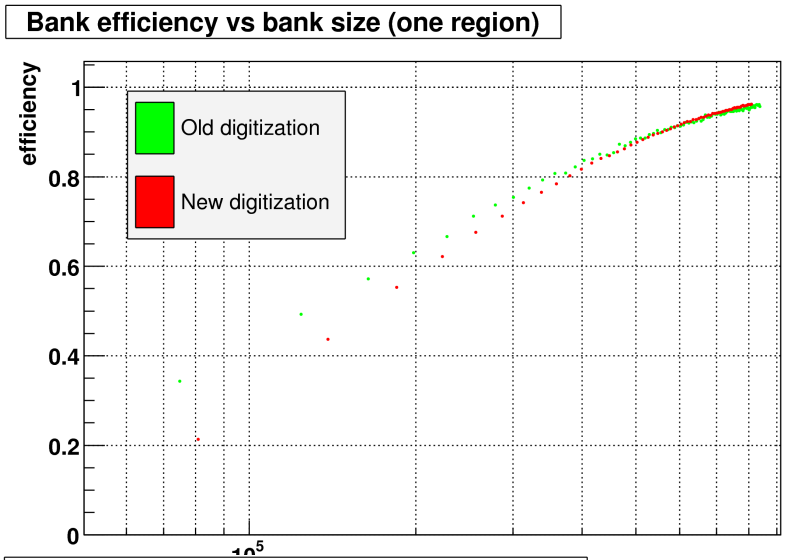
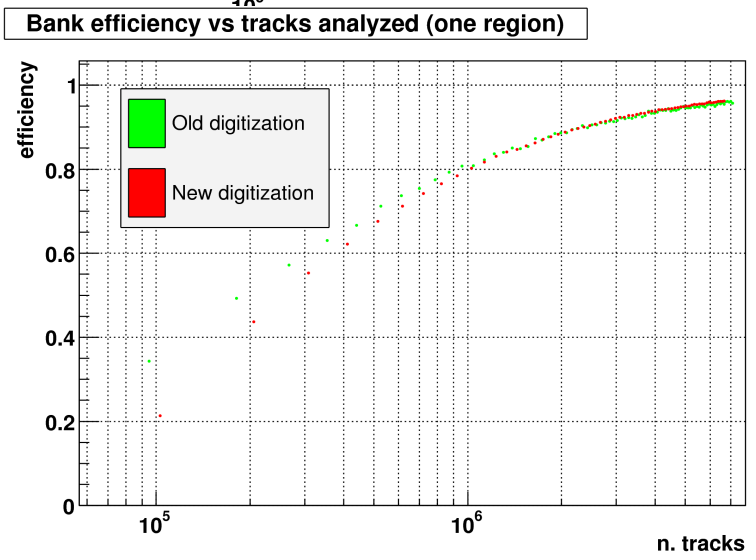
New digitization

- Francesco tried various digitization option combinations to obtain a training sample more clean than previous.
- Changes the criteria to accept a track for training.
- We re-digitized the old single tracks sample obtaining ~45M of tracks.
- We cannot re-digitize the data generated from Chicago but this is not a problem, only a test before the new production.
- Using this new ingredients we are able to generate:
  - New sectorization
  - New pattern banks
  - New constants set

New digitization performance

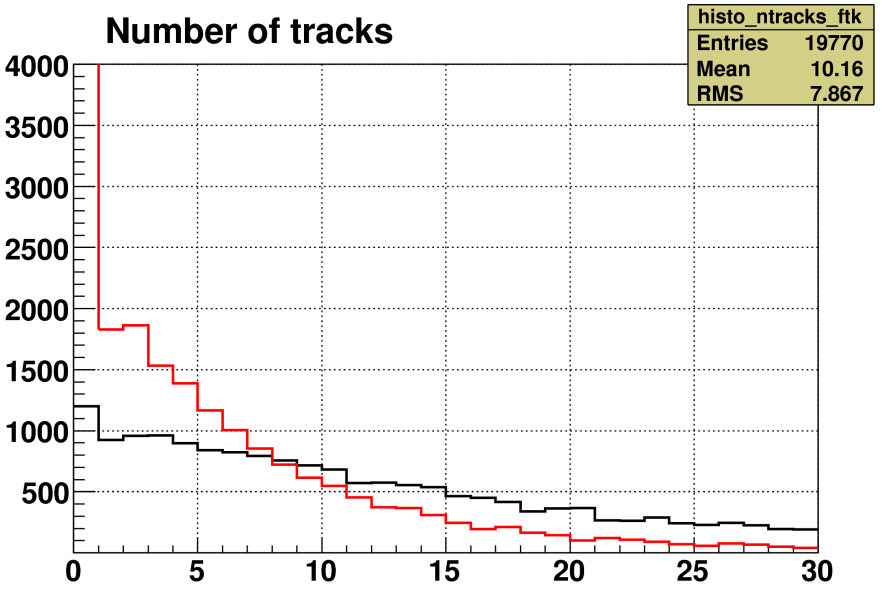
- Using a less number of track we reach a good effiency: ~93%
- We decrease the number of sectors: 128k instead of 157k.
- We decrease the number of patterns per bank: 880k instead of 1100k.
- We also chose to cut the pattern generated only by a single track using: 550k patterns instead of 880k.





New digitization performance (2)

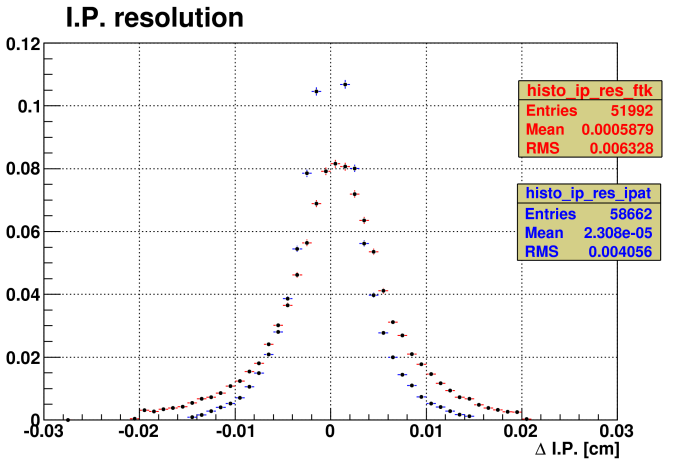
- Reduce the number of sectors
- Reduce the number of patterns.
- Using sectors and patterns from this digitization the events in FTK appear more clean.
- Help to reduce the and ghosts.

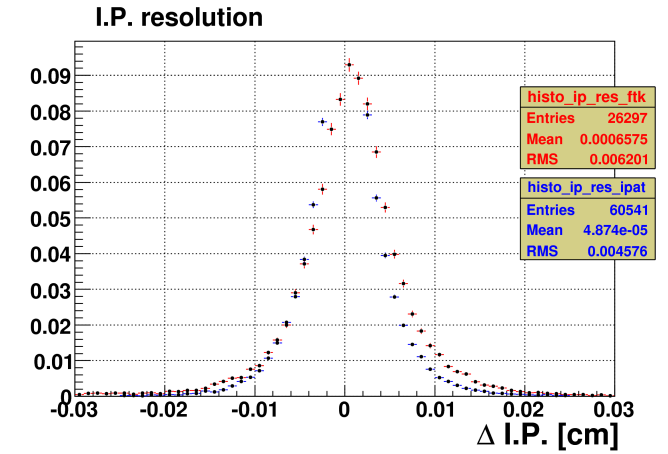


•Old digitization, soft RW
•New digitization, RW intersector

New match criteria: when to tracks can be defined “near”?

- Tracks now need one hit on the first layer.
- The I.P. parameters are not included in the track distance measurement used for match
- The number of sigma to state a match is increased: from 3 to 4 sigma (relaxed match).
- We divide the FTK tracks in 3 groups:
  - w/ match: track near a Truth track
  - Duplicated: track near a truth, but other FTK tracks match the same truth track.
  - w/o match: no truth track near the FTK track.



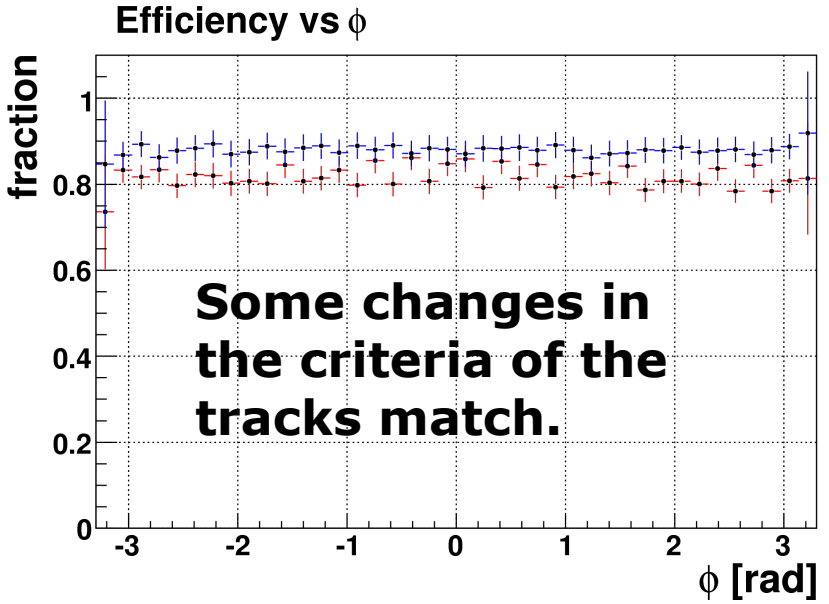


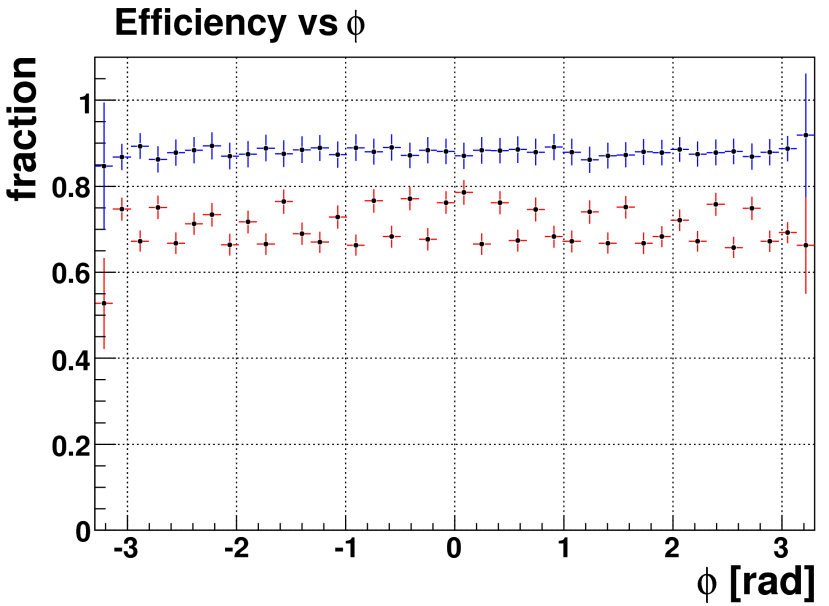
The resolution comparisons now is done only using FTK tracks with a single match.

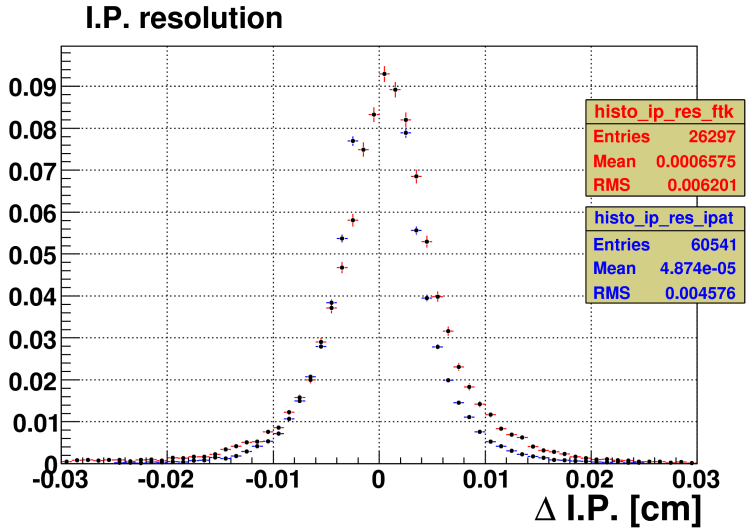
Current status: good things

Test over Bs->mumu data

- Good efficiency:
  - ~80% w/o the request of 1st layer
  - >70% w/ the request of 1st layer
- Good resolution on main parameters



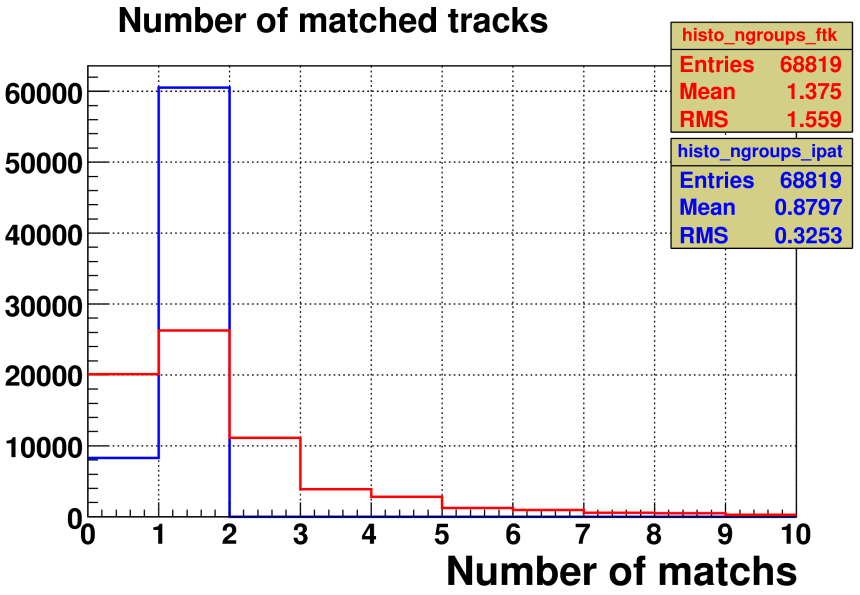


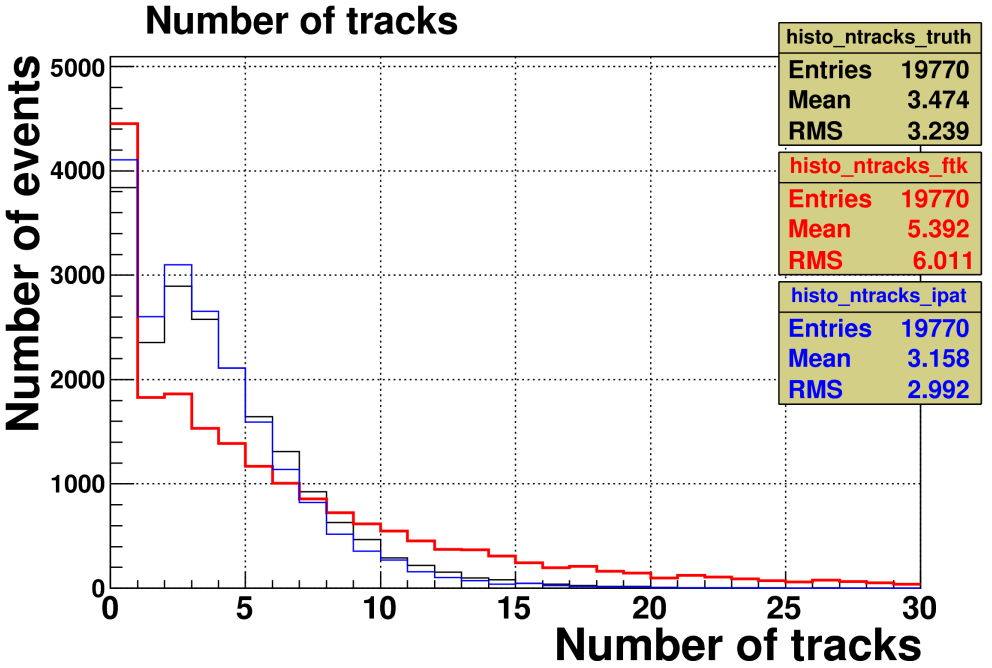


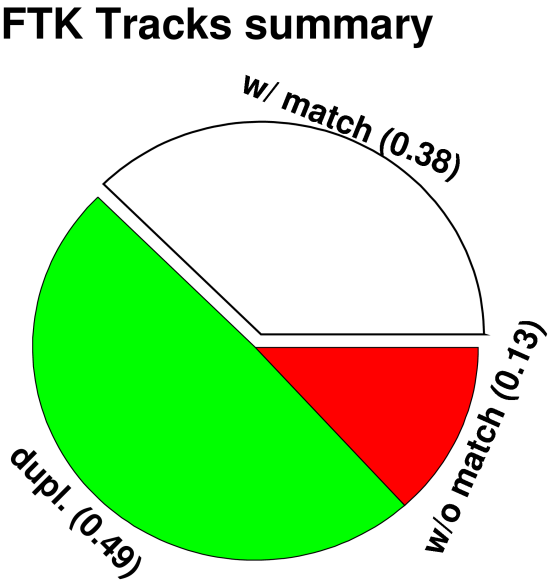
Current status: the bad thing

- Too many tracks found by FTKSim.

Usually around a real tracks there many FTK tracks with similar parameters.



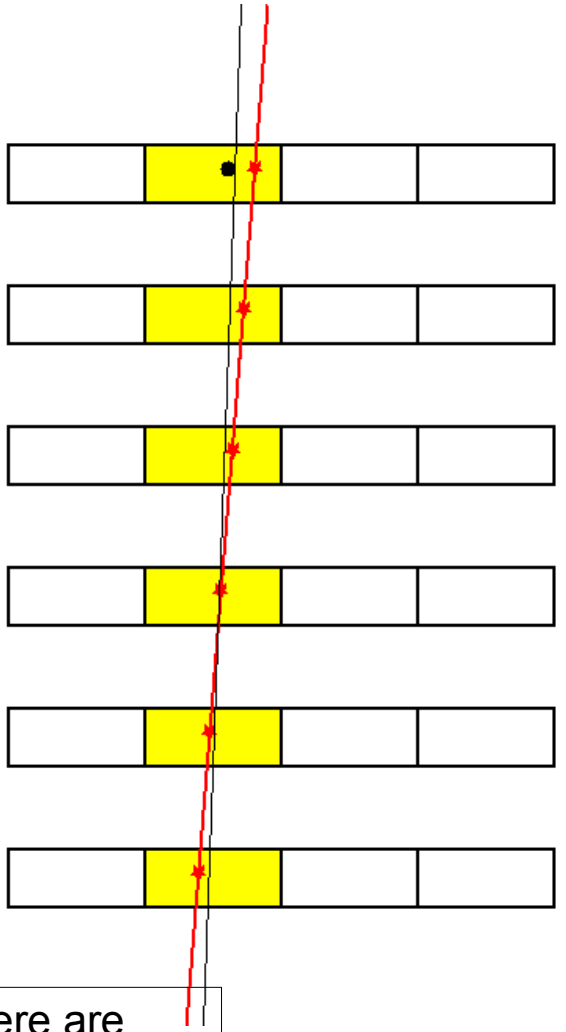




FTK alghoritms and the duplicated tracks

Tracks seek:

- The hits within a road are combined and for each combination a linear fit is done.
- All the fitted tracks satisfying the quality cuts are accepted.
- The same hits can be shared by multiple tracks.
- Some tracks have similar parameters and use almost the some points.



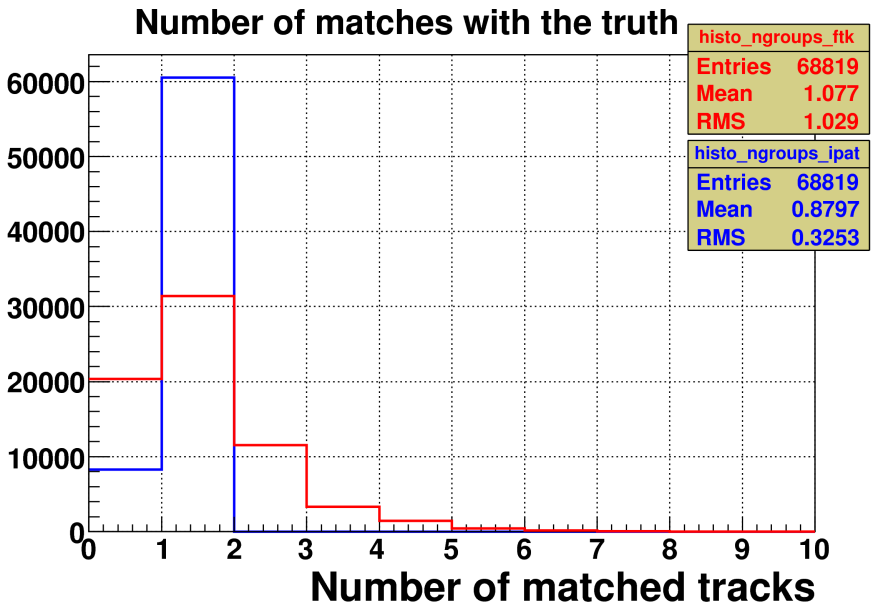
The figure shows a simple case, there are combinations of hits with the same result.

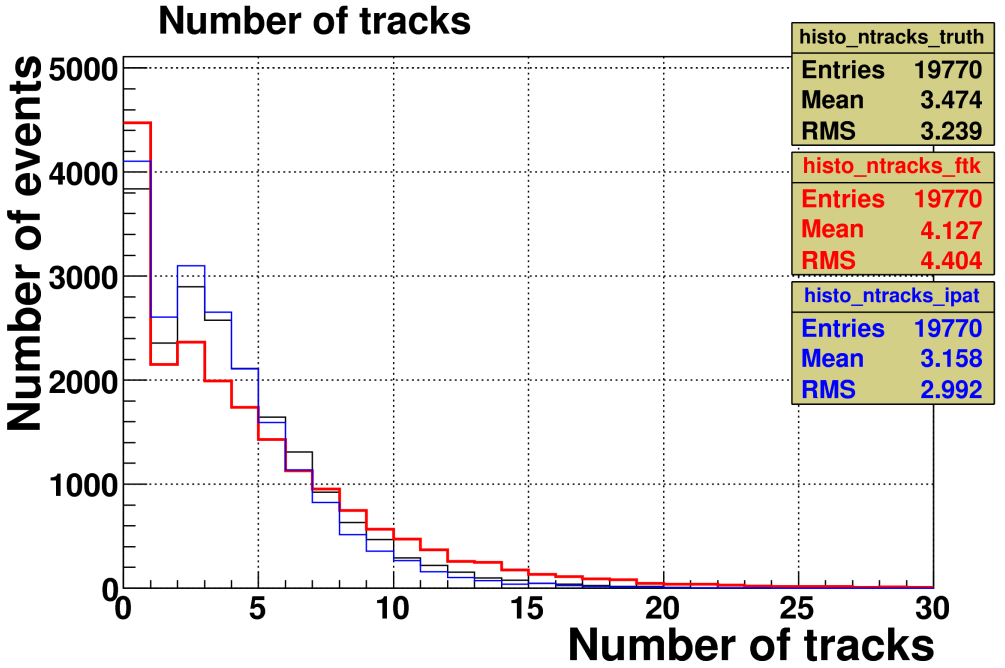
Hit warrior basic idea

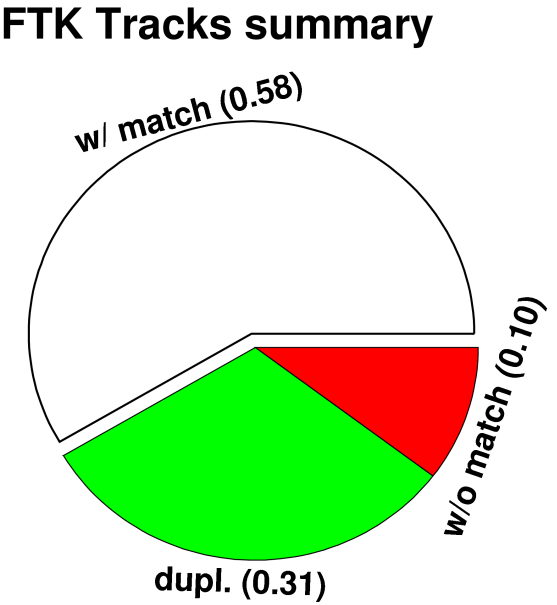
- Before adding a track in the list of FTK tracks, check the list of previous tracks.
- Uses a criteria, hit based, to decide if two tracks are too similar:
  - For any tracks 12 coordinates: (x1,x2,...x6,z1,z2...,z6)
  - Two tracks match if differ only of one coordinate: association problems, usual there are tracks with same (xi) but different (zi)
  - Two tracks match if differ for the a pair of coordnates on the same plane or a pair of coordinates and a single coordinates: a noisy hit+association problem
  - If one the tracks use the majority the points on the missing layer are not counted in the match.
- When two tracks match:
  - If one is 6/6 and the other 5/6 the **6/6 track is preferred**
  - if the two tracks are both 6/6 or 5/6 the track with the **minimum Chi2 is preferred**.

Using the hit warrior

- Less tracks: -29%
- Less fake tracks: -3%.
- Less duplicated tracks: -17%.
- Don't cut all the duplicated tracks.

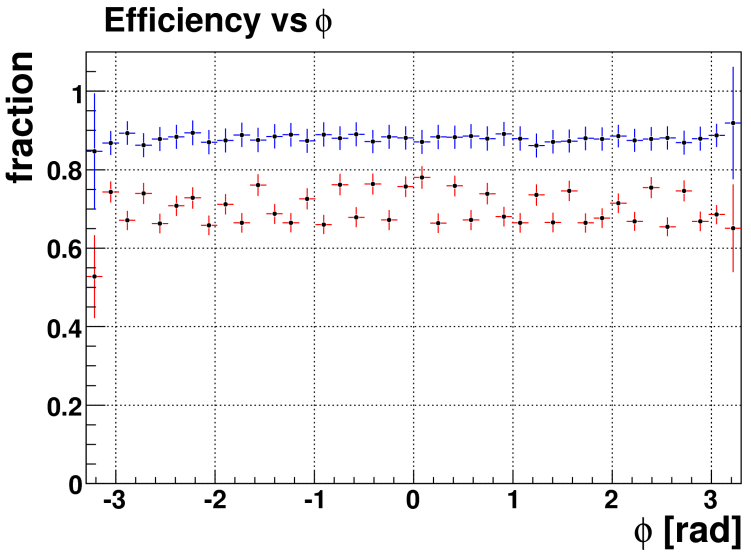


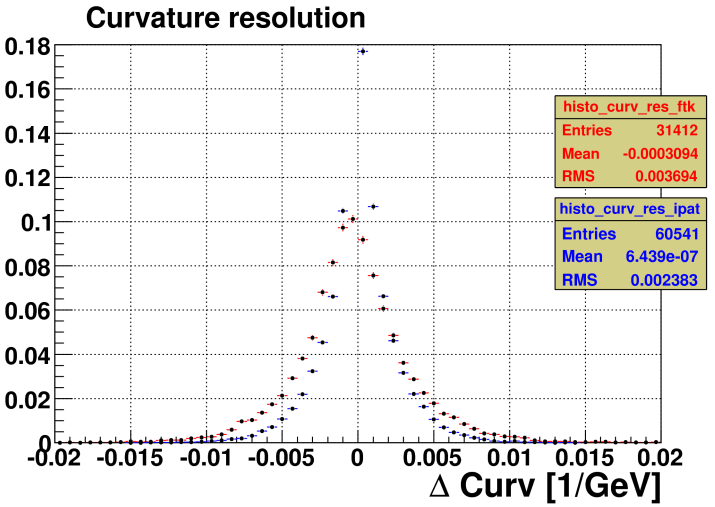


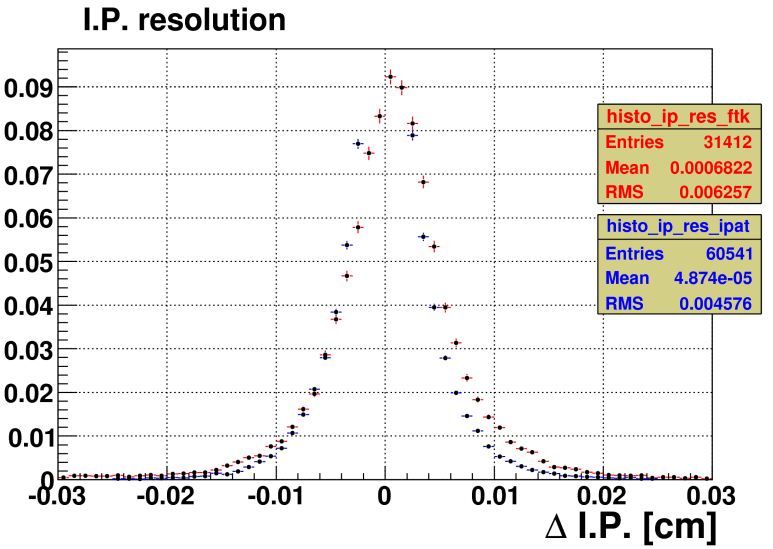


Tracks quality and efficiency using the Hit Warrior

- The parameters quality don't change.
- The efficiency don't change.



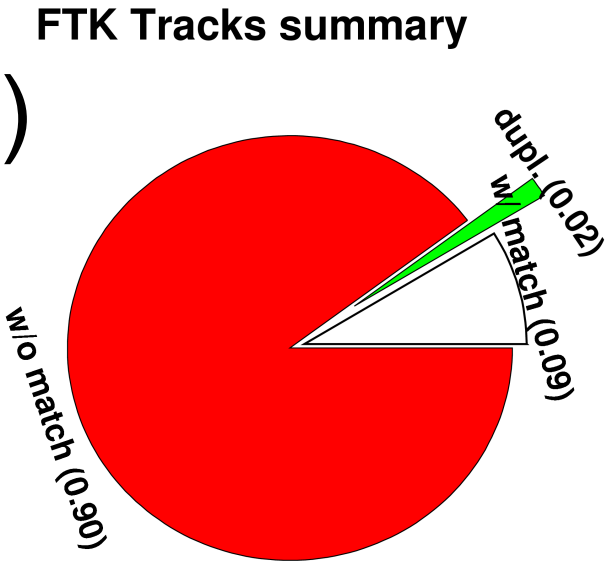


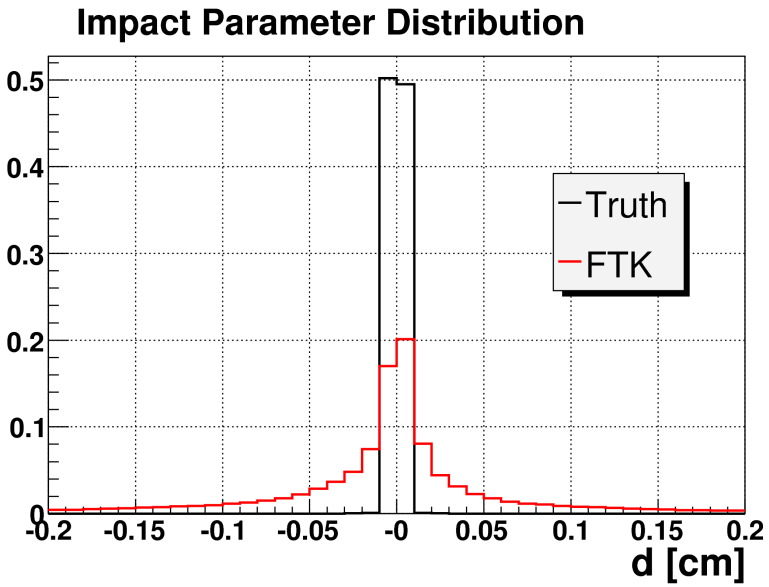


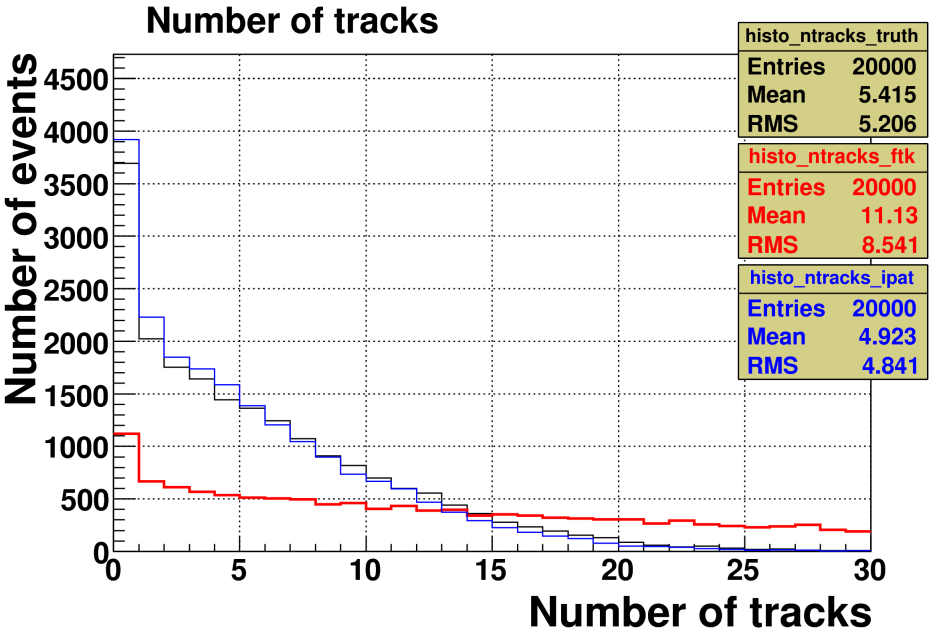
H->uu sample (old method)

Using old method on this sample the result were bad:

- Great number of tracks
- Very large I.P. distribution

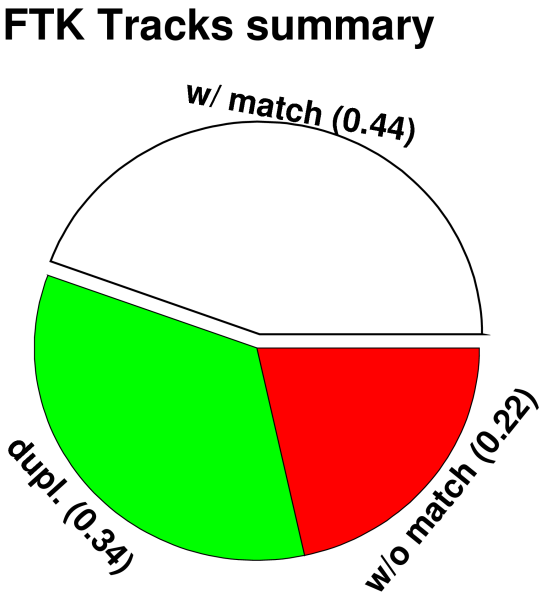


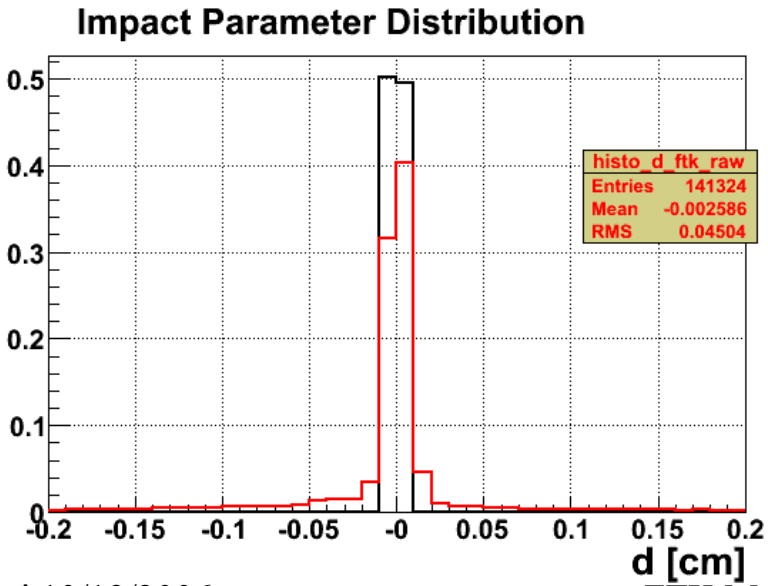


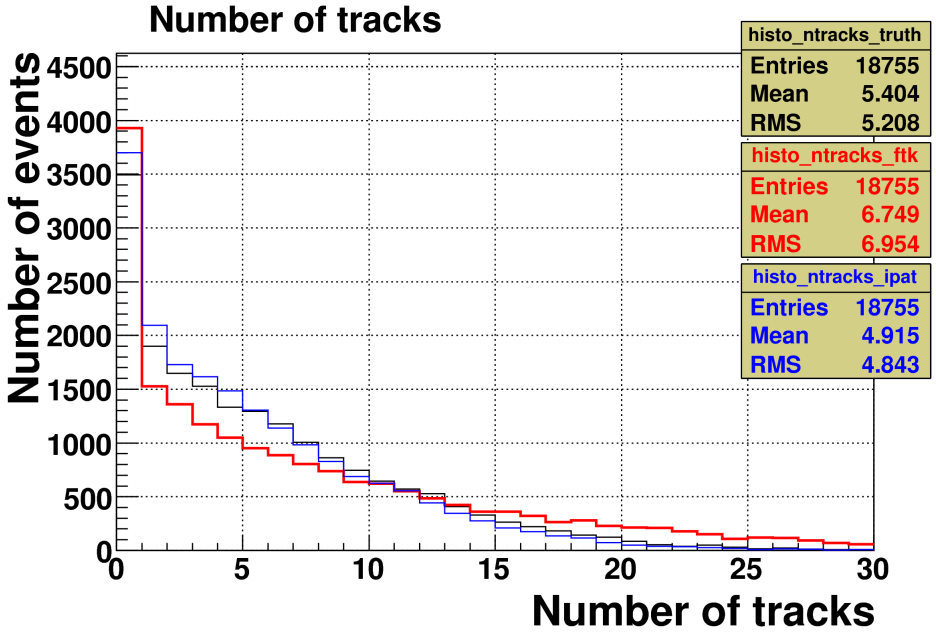


H->uu sample

- We try to use the FTKSim with hit-warrior alghoritm on the Meena' sample of H->uu.
- The results are still not perfect:
  - In this sample remain some ghosts, but their number decreases.
  - The raw IP from FTK tracks: still larger respect the truth, but less than previous.

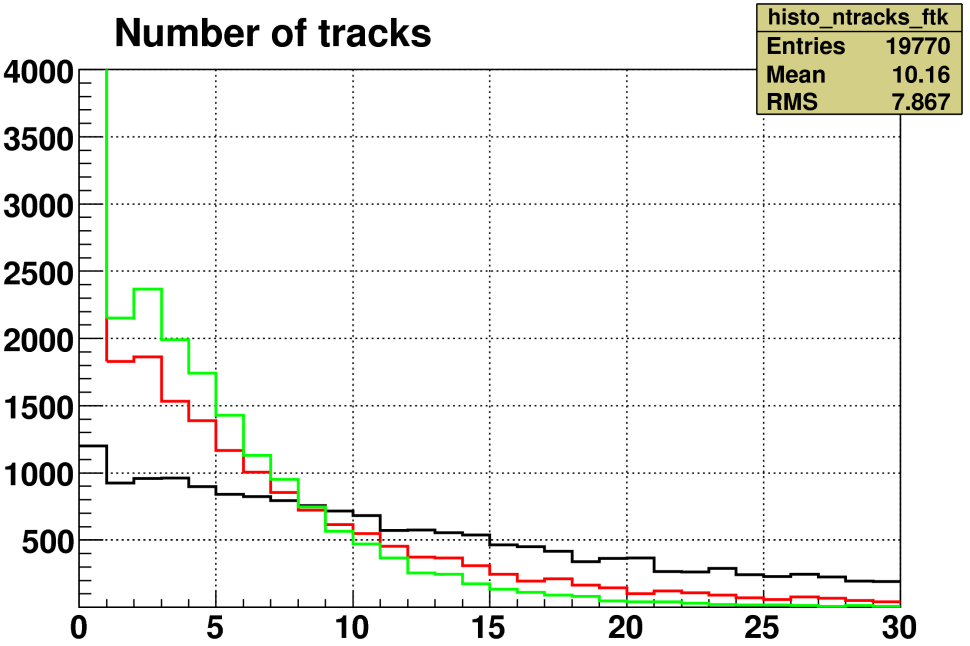






Hit Warrior results

- The algorithm of hit-warrior, like is written now, can be done in hardware.
- Don't remove all type of duplicated tracks:
  - Don't remove tracks that use same points but are in different roads.
  - Don't remove tracks when there are many noisy hits near real hits, many cases.
- The match criteria can be improved:
  - To work between tracks of different roads.
  - To reconize near hits



•Old digitization, soft RW
•New digitization, RW intersector
•New digitization, RW intersctor, soft Hit-Warrior.