PRS muon meeting

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Workplan for L2 reconstruction software

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Summary:

- DT Hits and Segment;
- L2 reconstruction speed-up;
- Actual status:

DT segment actual reconstruction:

- Quoting Stefano Villa *"... the code, as usual, is bad ..."!!*
- Hard to understand, debug, improve .
- For a linear fit of $8 + 4$ points a total of 19 classes are used.
- Goals:
  - ⋆ easier access to single hits;
  - ⋆ better error assignement;
  - ⋆ more robust code;
  - ⋆ better results in presence of showering.

DT hits

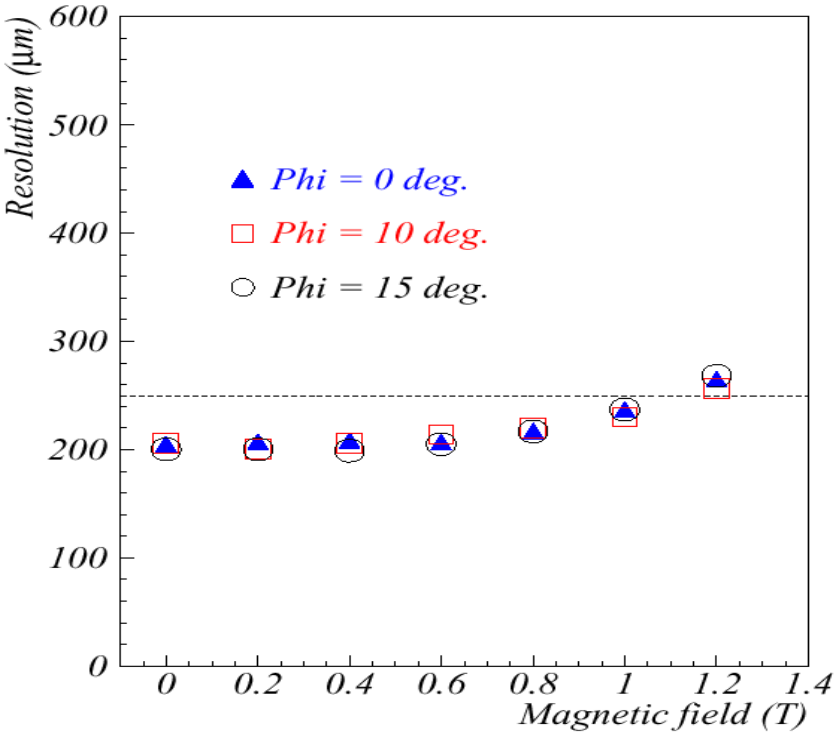
- Now it's possible to access them, but it's not easy;
- DT hits are NOT RecHits, only segments are;
- To understand segments pulls, need to check also hits pulls, i.e. error assignement;
- Actual error on DT hits, as used in the linear fit, $\sigma_x = 295\mu$m hardcoded.

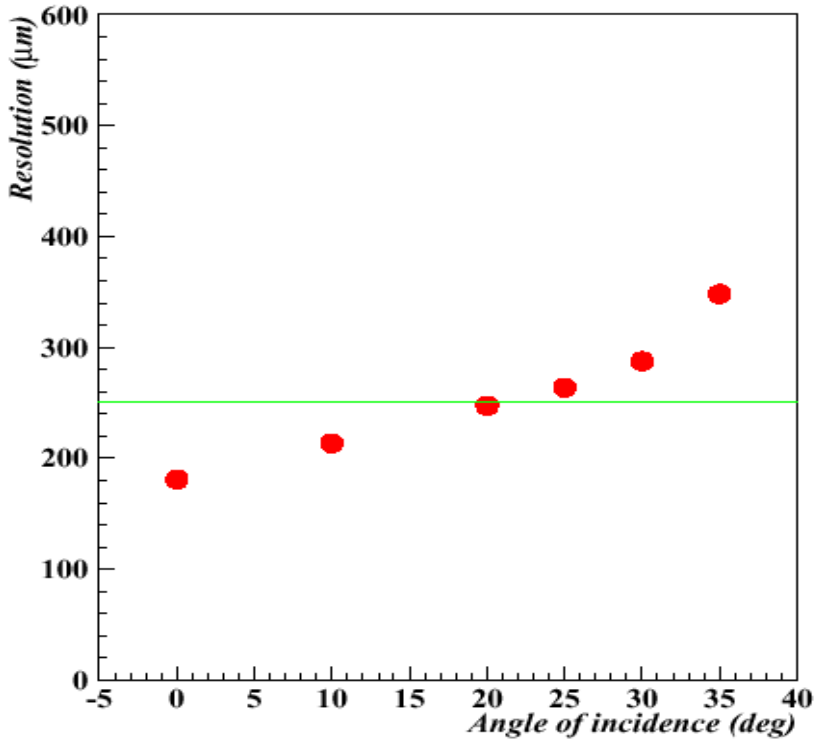
Plan

- DT hits will become RecHit:
  - ⋆ easier access;
  - ⋆ can use hits inside segments in the filtering (as for the CSC);
  - ⋆ DT Layer must be DetUnit, so they could be mis-aligned easily;

⋆ some complication for the left/right ambiguities, needed a “RecHitPair”.

- Error depends on $\vec{B}$, incidence angle: parametrization based on Test Beam results (available e.g. **CMS NOTE-2001/41**).
- Very important for wheels ± 2, big $\vec{B}$ and big incidence angle (expecially for η projection).





Robust algorithm

- Preliminary results on true DT chambers show weakness of the algorithm in a real DT chamber;
- Misalignement, not perfect drift velocity, ...
- Need to test the algorithm in the real chambers, and compare with MC results (e.g. number of used hits);

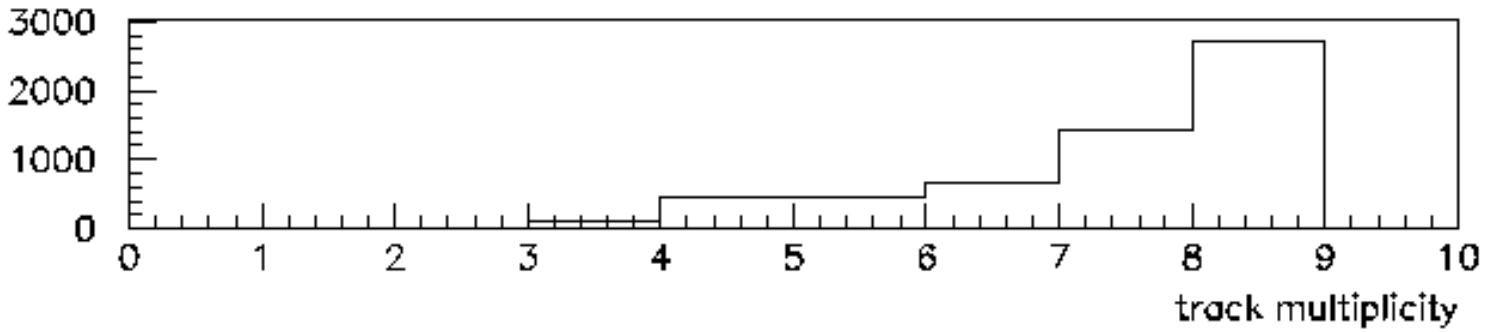
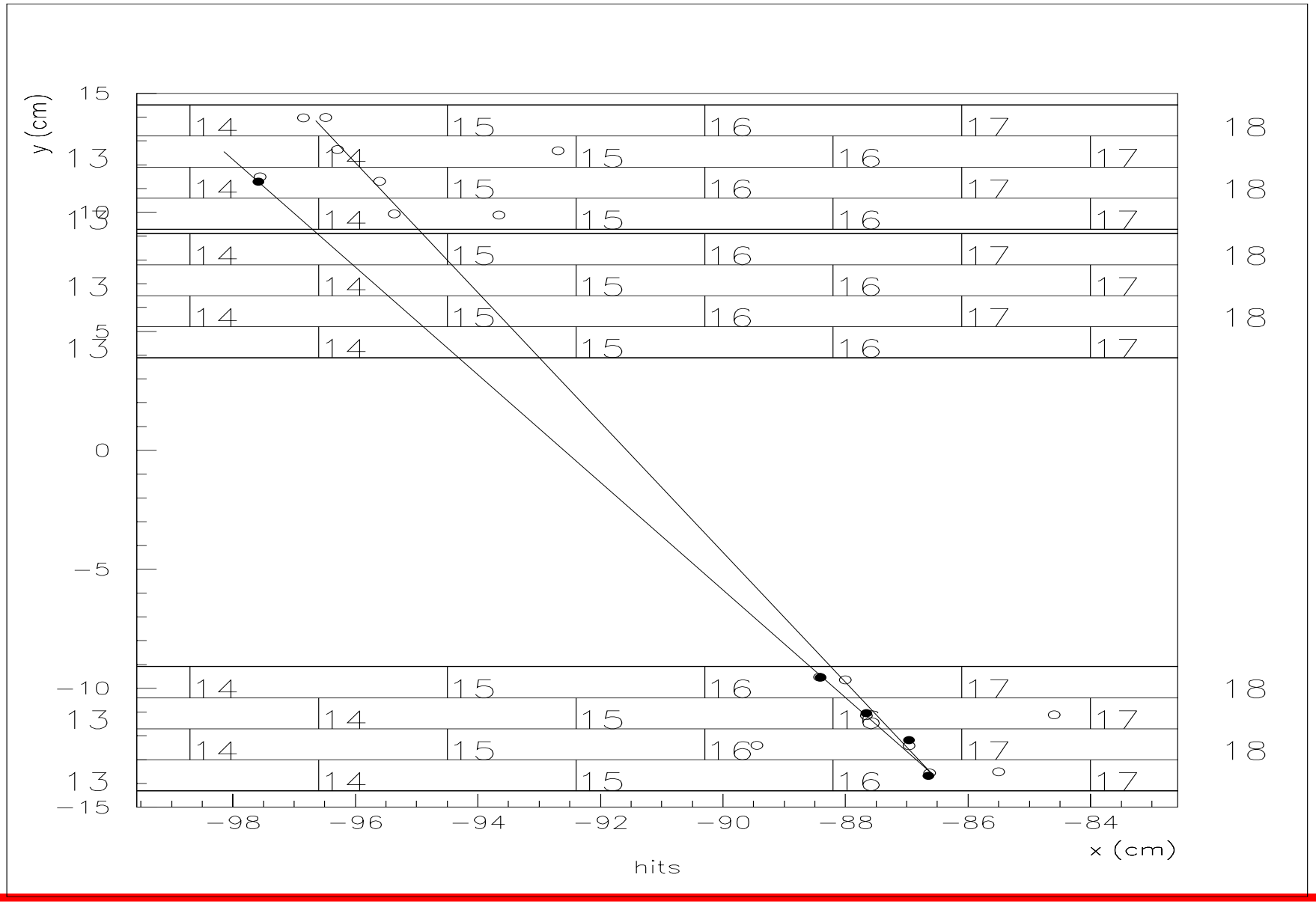


Figure 1: Number of hits used: TB results

- Sometime wrong choice of Hits, even for clean tracks (no shower)



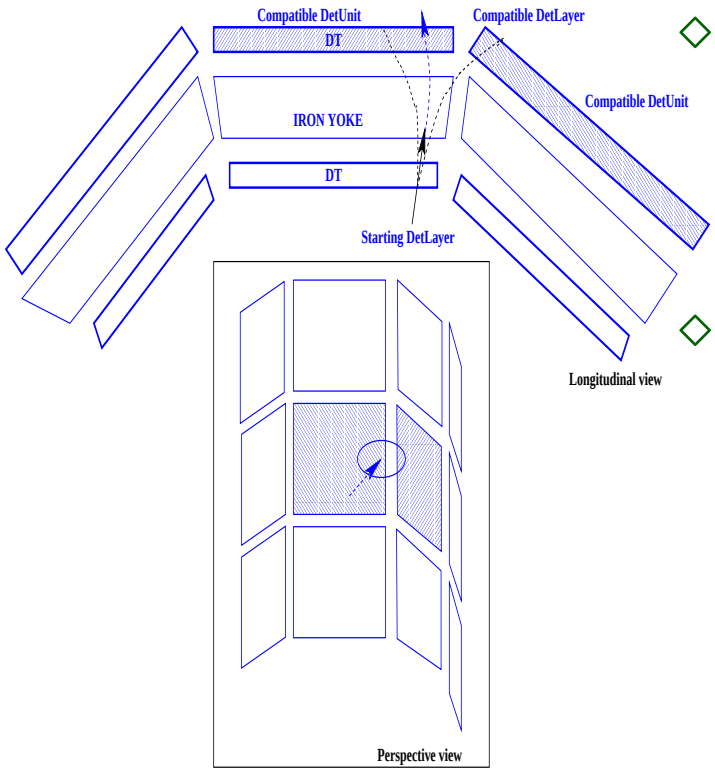
- Improve the “best candidate choice”, the present one is probably not optimized;
- when a segment is built, all its hits cannot be used by other segments: if the first segment built uses hits from muon and from shower, the muon hits cannot be used after to get the right μ segment;
- if the first segment built is “wrong” likely that the “right” one is not built;
- probably the full combinatorial cannot be afforded: try to start from distant layers and/or “clean” ones (few hits)

Chamber with showers

- In general harder to get the right segment;
- Recognize showering chambers (or super-layers), e.g. by hits density and use only position NOT direction, which is doubtfull;
- For η projection only 4 hits, small lever arm: easy to find 3 or 4 aligned hits in a crowded environment: position is $\sim$ ok direction is not:
- Check η direction with position: if off increase error and/or use position only.

L2 reconstruction workplan

- Fulfill code clean-up and re-use in MuonTrackFinder;
- Add flexibility in parameters choice (.orcarc);
- Speed-up by improving navigation inside DetLayer;
  - ◇ NOW: for each DL, 9 DetUnits are always tested for compatible RecHits: Central+8 neighbours, regardless to the DetUnit dimension and trajectory errors;
  - ◇ each test of a DetUnit require an extrapolation from the previous TrajectoryMeasurements, in the Muon means tipically across IRON;



◇ First optimization: test only the DetUnits compatible with trajectory extrapolation within errors.

◇ Preliminary results:

⋆ no efficiency loss in Muon system;

⋆ algorithm faster by a factor $\sim 6 \div 7$;

⋆ no/small eff. loss in the tracker (L3).

◇ Actual L2 performances on $W \longrightarrow 1\mu$ sample:

$\sim$ $0.5\ s/ev$ on ATHLON AMD $1800+$, 1600 MHz.

- ◇ Further optimization if just one propagation from previous DetLayer to next DetLayer, and from here to DetUnit (expected futher reduction of $\sim 1.5 \div 2$)
- ◇ Working prototype already tested: require changes in CommonDet, so modifications affects also Tracker. Carefull test of efficiency on both system!!
- ◇ Better coding and Tracker test needed before releasing;
- ◇ CPU-time still dominated by propagation!

Status:

- DT hits as RecHit: some code already prototyped and written, still to do
  DT layer as DetUnit (needs to get geometry info from GEANT3);
- Segment building: preliminary work (by Paolo R. and Ugo G.) on Test Beam and cosmic ray analisys on true chamber
- L2 reconstruction: in good shape, need code rewritting (actual implementation relies on static...) and Tracker eff test.
- In the TODO/WISH list:
  - Muon Track persistency;
  - Documentation;
  - Internal seed generation (low priority);