DT Local Reco

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Joint DT-DPG MuonDet Pyhs
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Outline

1. Status od LocalReco
   - Hits
   - Segments
2. open issues
   - Possible solution
3. Conclusion

Note on Local reco

- A CMS Note on current status of DT Local Reco (Hit and Segment) has been submitted
- Reference point for studies on MC simulation
- Pending for approval

Available on CMS information server

CMS NOTE 2007/XXX

The Compact Muon Solenoid Experiment

CMS Note

Mailing address: CMS CERN, CH-1211 GENEVA 23, Switzerland

April 3, 2008

Local Muon Reconstruction in the Drift Tube Detectors

N. Amapane[1], R. Bellan[1,2], S. Bolognesi[1], G. Cerminara[1], S. Lacaprara[1].

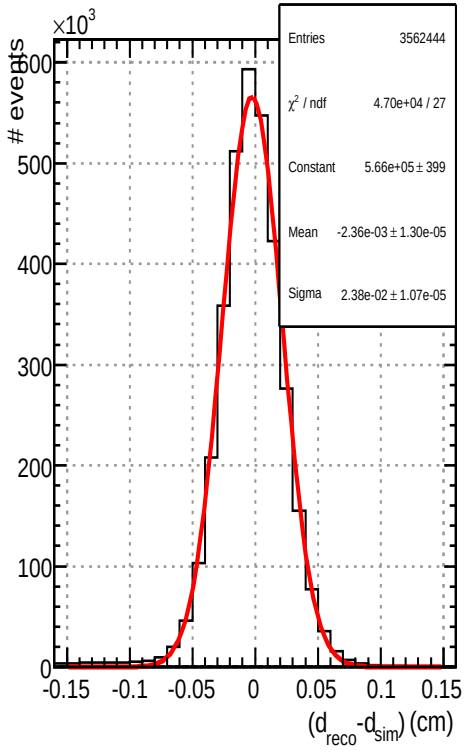
Abstract

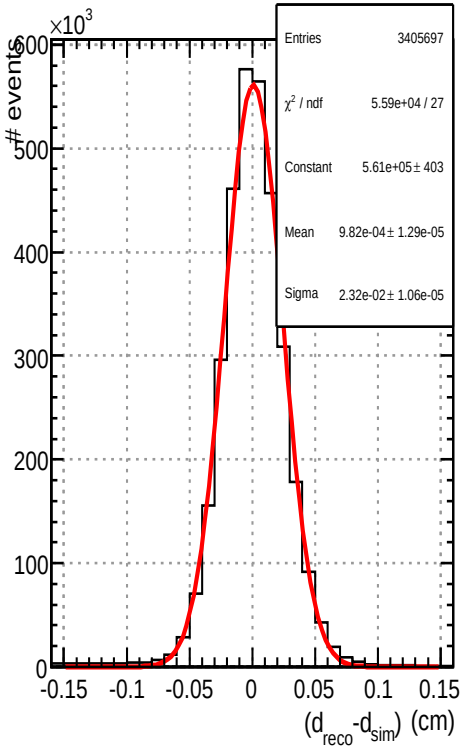
Hit reco status

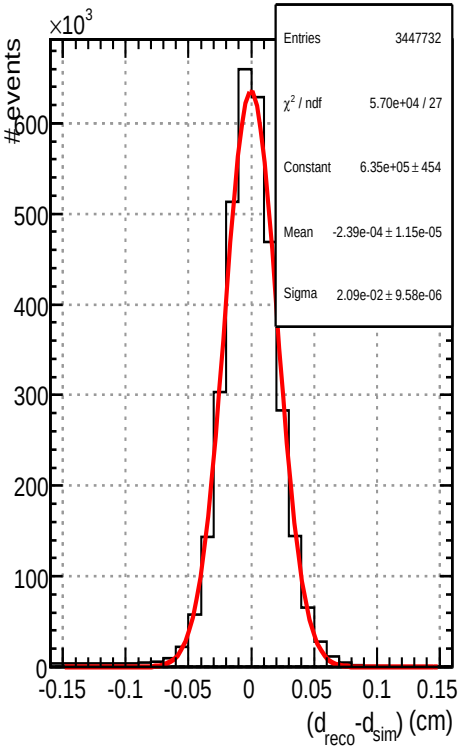
- Hit reconstruction is stable since some time
- Different reco algo are available:
  - one based on parametrized time-to-distance relationship, taking into account B field and impact angle, from detailed `GARFIELD` studies. Optimum results on MC studies, used for Note
  - a constant drift velocity, used for Cosmic Data reconstruction
- Resolution μm for different wheel at following step of reconstruction

Superlayer type	r-ϕ	r-z, **W** 0	r-z, **W** ± 1	r-z, **W** ± 2
Step 1	237	250	271	308
Step 2	231	250	271	305
Step 3	207	196	210	228

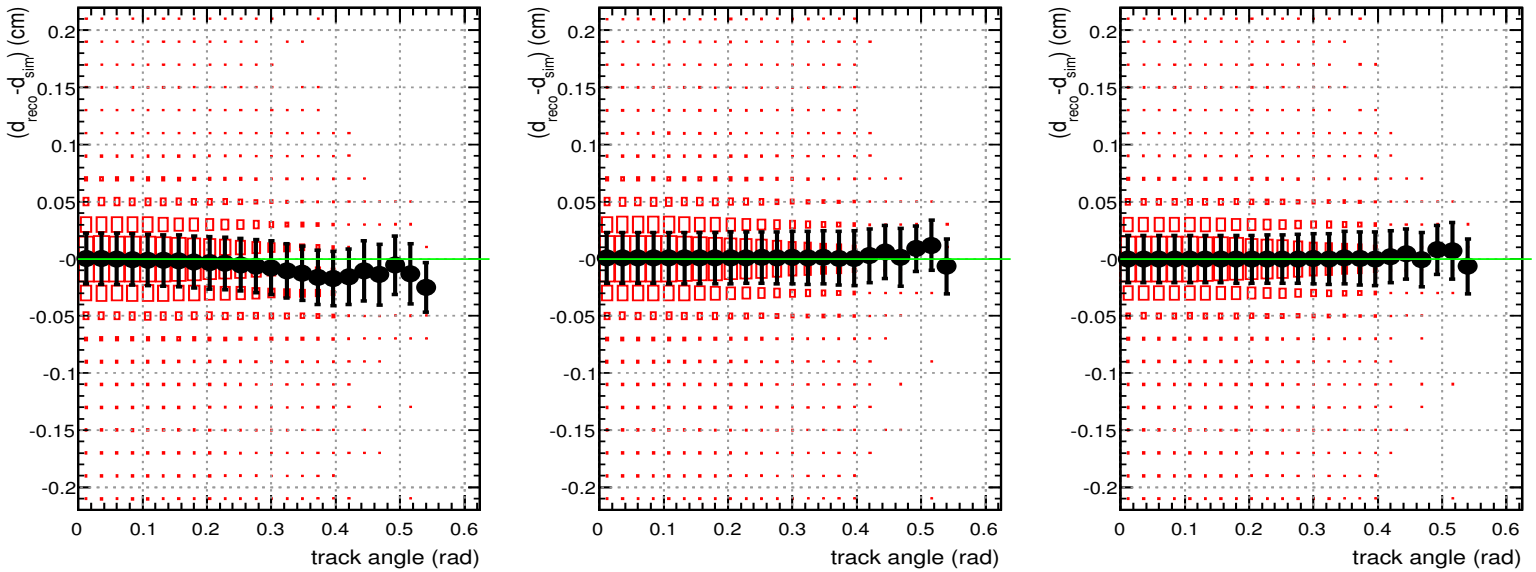
Hit resolution r-ϕprojection, different wheel





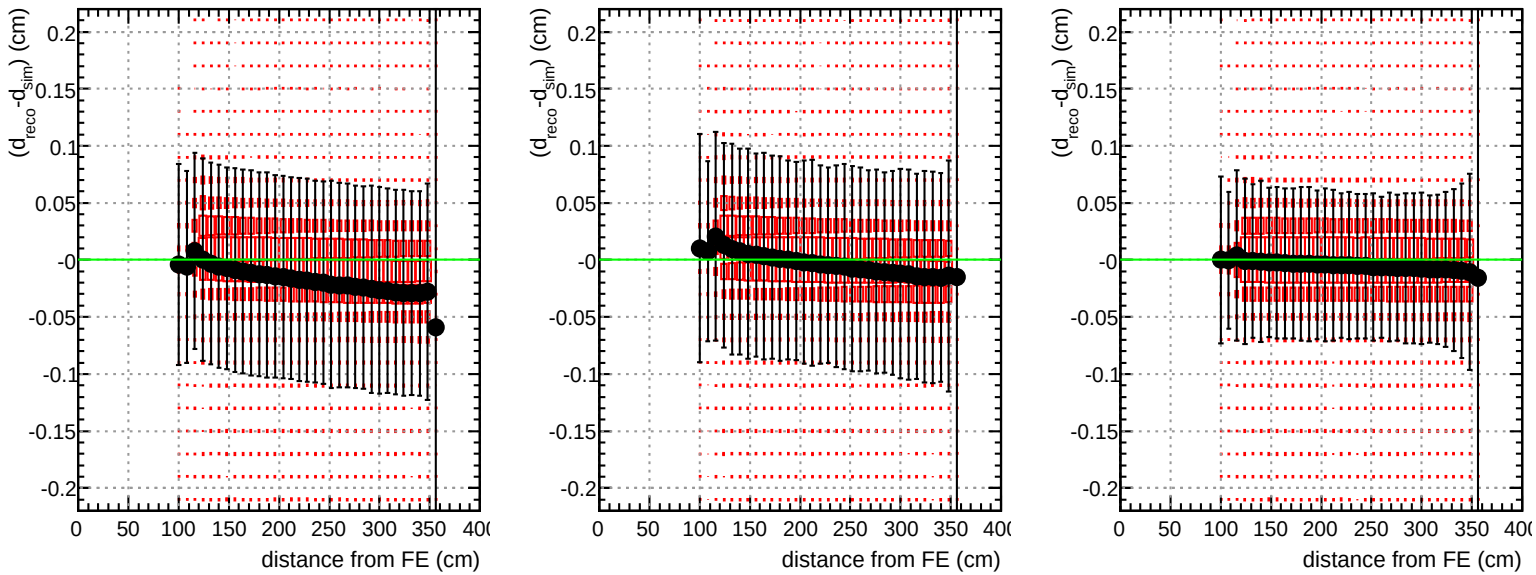


Hit resolution r-ϕprojection vs impact angle



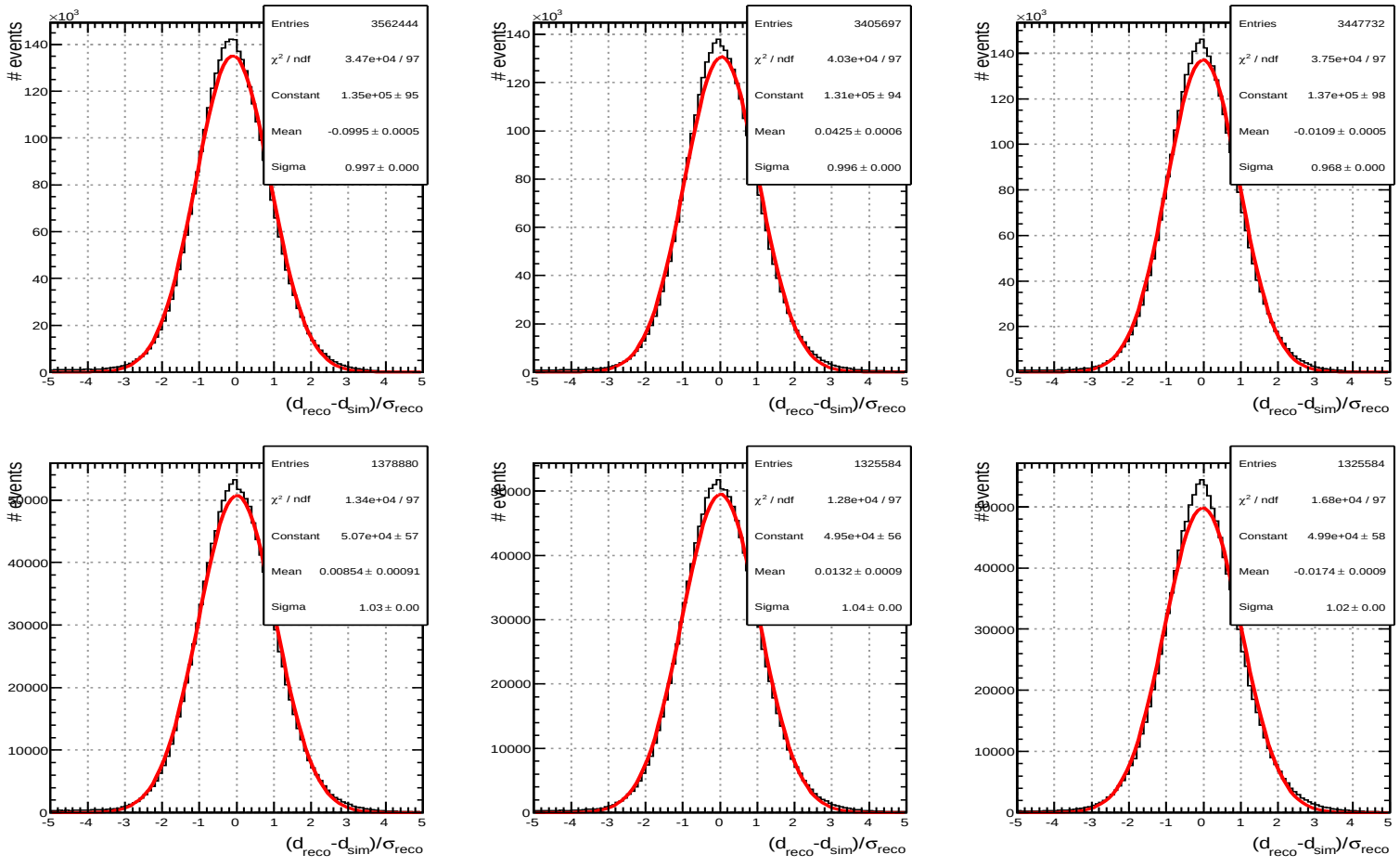
After step 2, when impact angle effect is taken into account by reconstruction *SL* segments, angle effect is removed

Hit resolution r-ϕprojection vs distance from FE



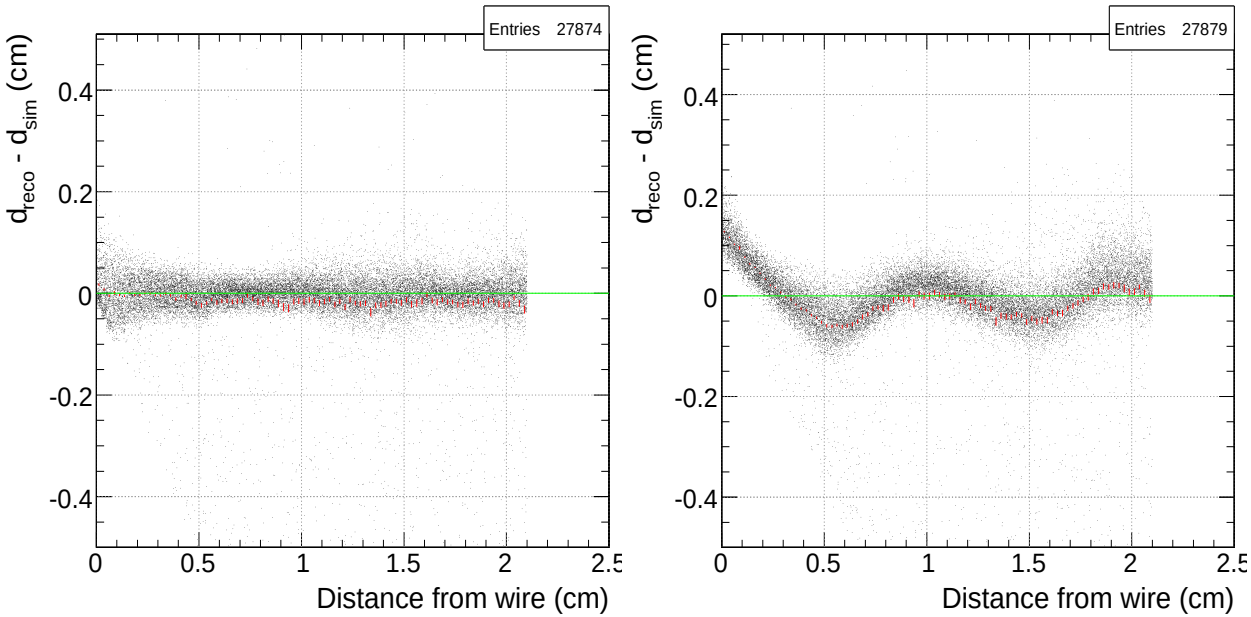
After step 3, when coordinate along the wire is reconstructed with $3D$ segments, sistematic shift due to wire propagation time is cured.

Hit Pulls r-ϕ and r-z



Pull under control at all three steps

Hit residuals for param and constant drift time

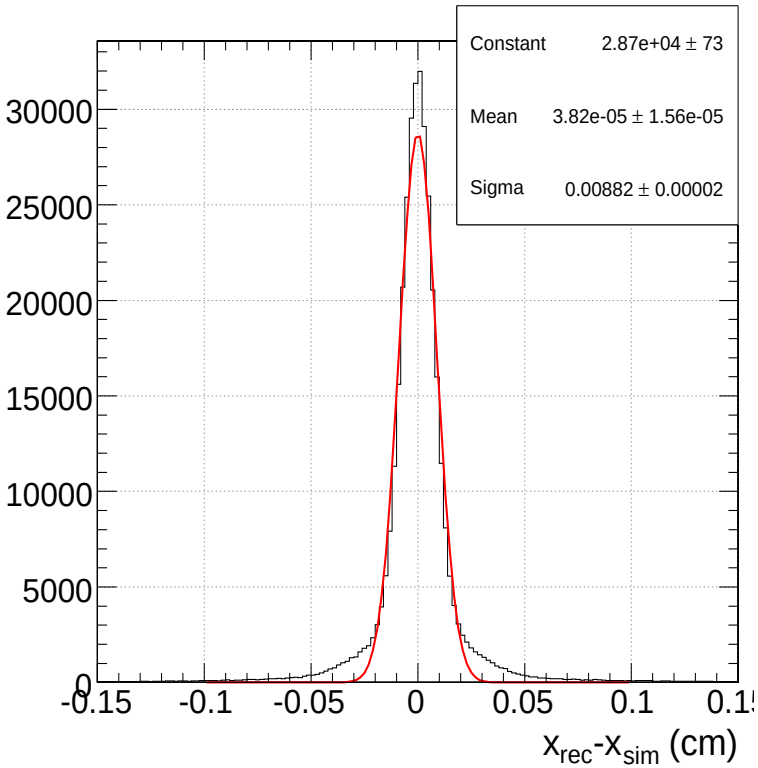


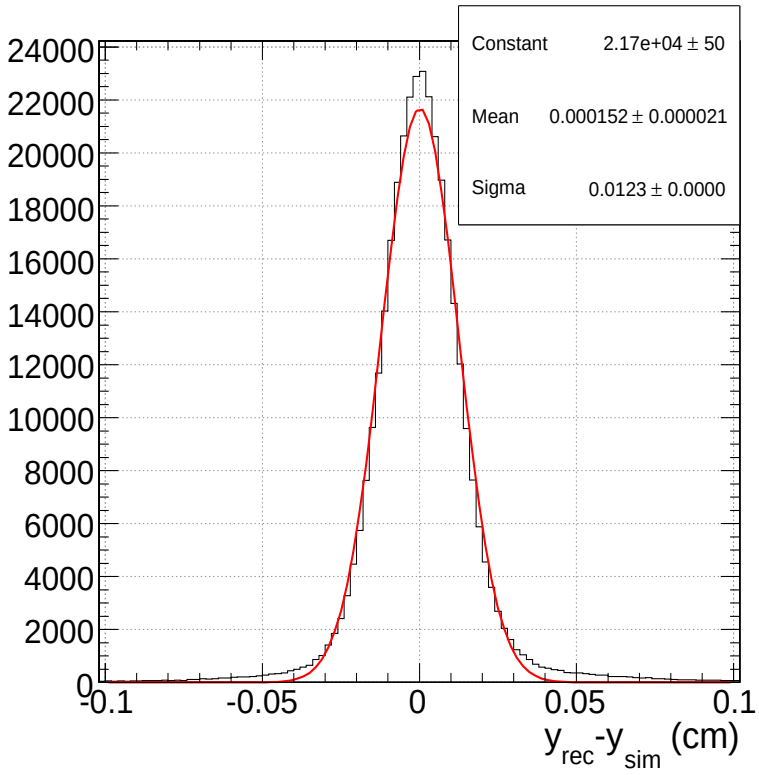
Of course, cell non lineary affects constant drift time reconstruction

Segment reco status

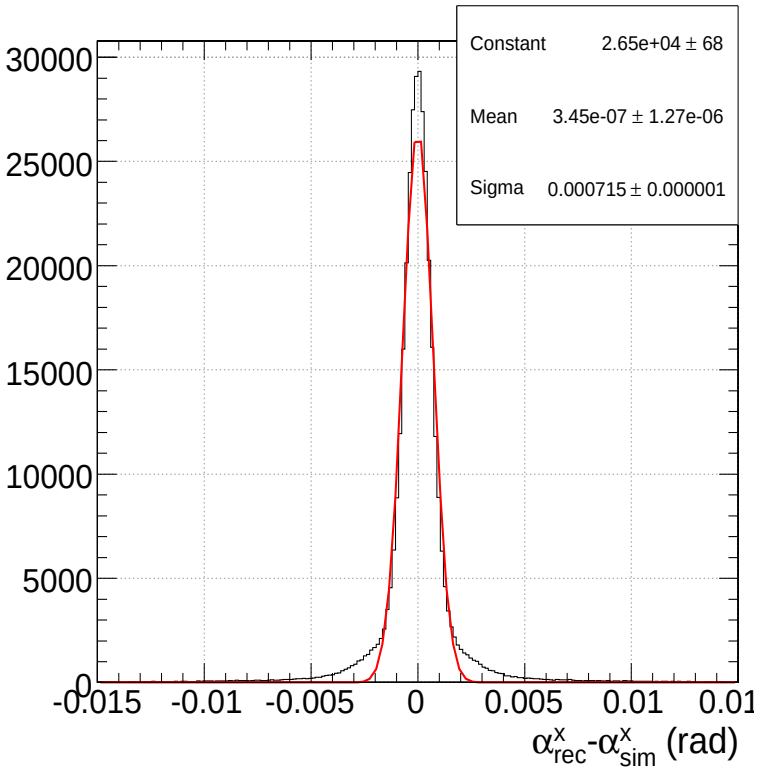
- Segment reconstruction is stable as well;
- still some open issues (see later)
- Different reco algo are available/proposed:
  - Standard combinatorics reconstruction (described in note)
  - Addition to compute v_{drift} and t_0 from the fit itself (Anna M.)
  - *MeanTimer* tecnique: being developed for low β particle studies (Piotr T.)
  - *noDrift* fast reco using just wire position (Martijn M.)
- 3 steps reconstruction:
  1. pattern reco for hits, with L/R ambiguity
  2. refit using track angle
  3. refit with B and position along wire known by combinig two SL

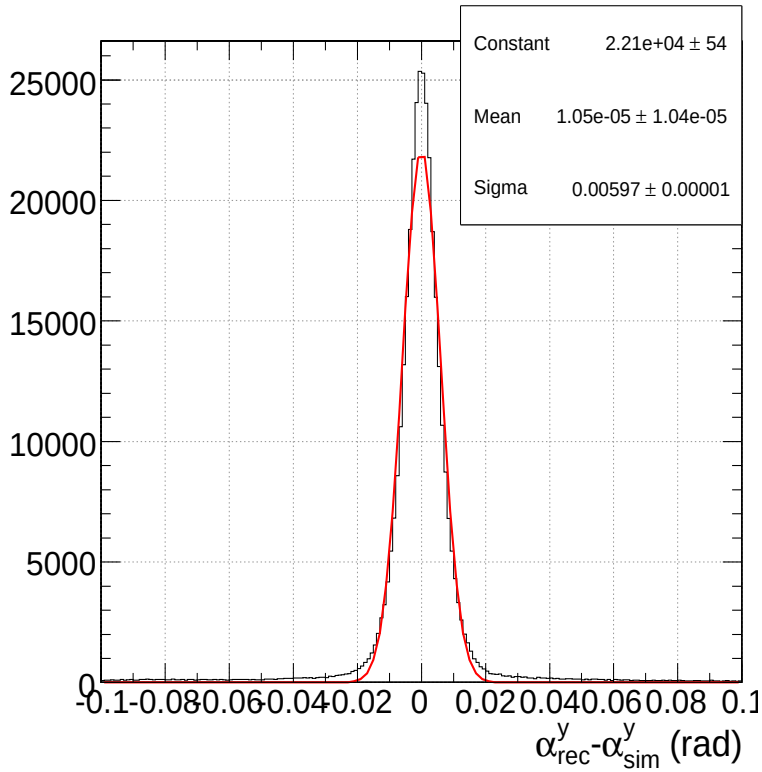
Segment reco position resolution



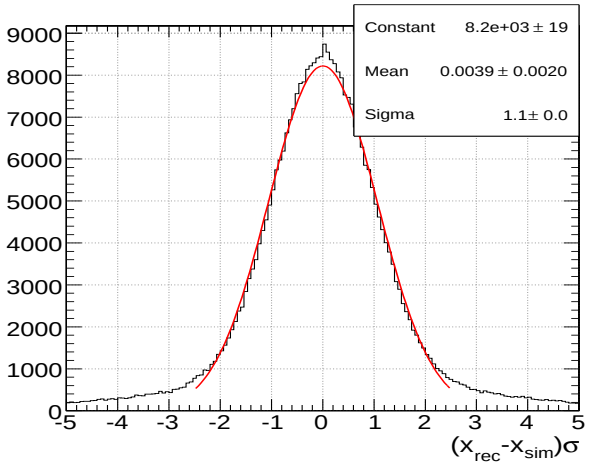


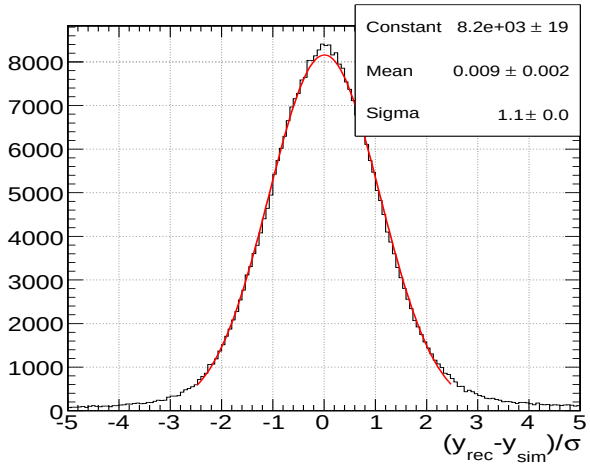
Segment reco angle resolution

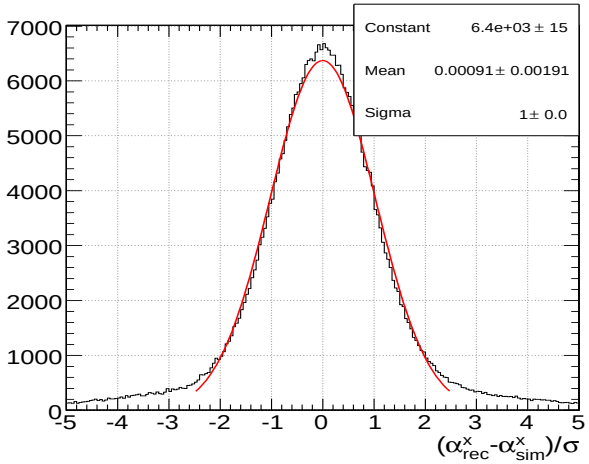


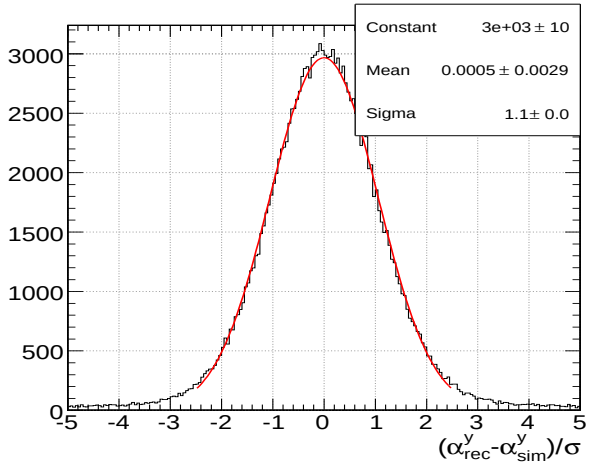


Segment reco Pulls

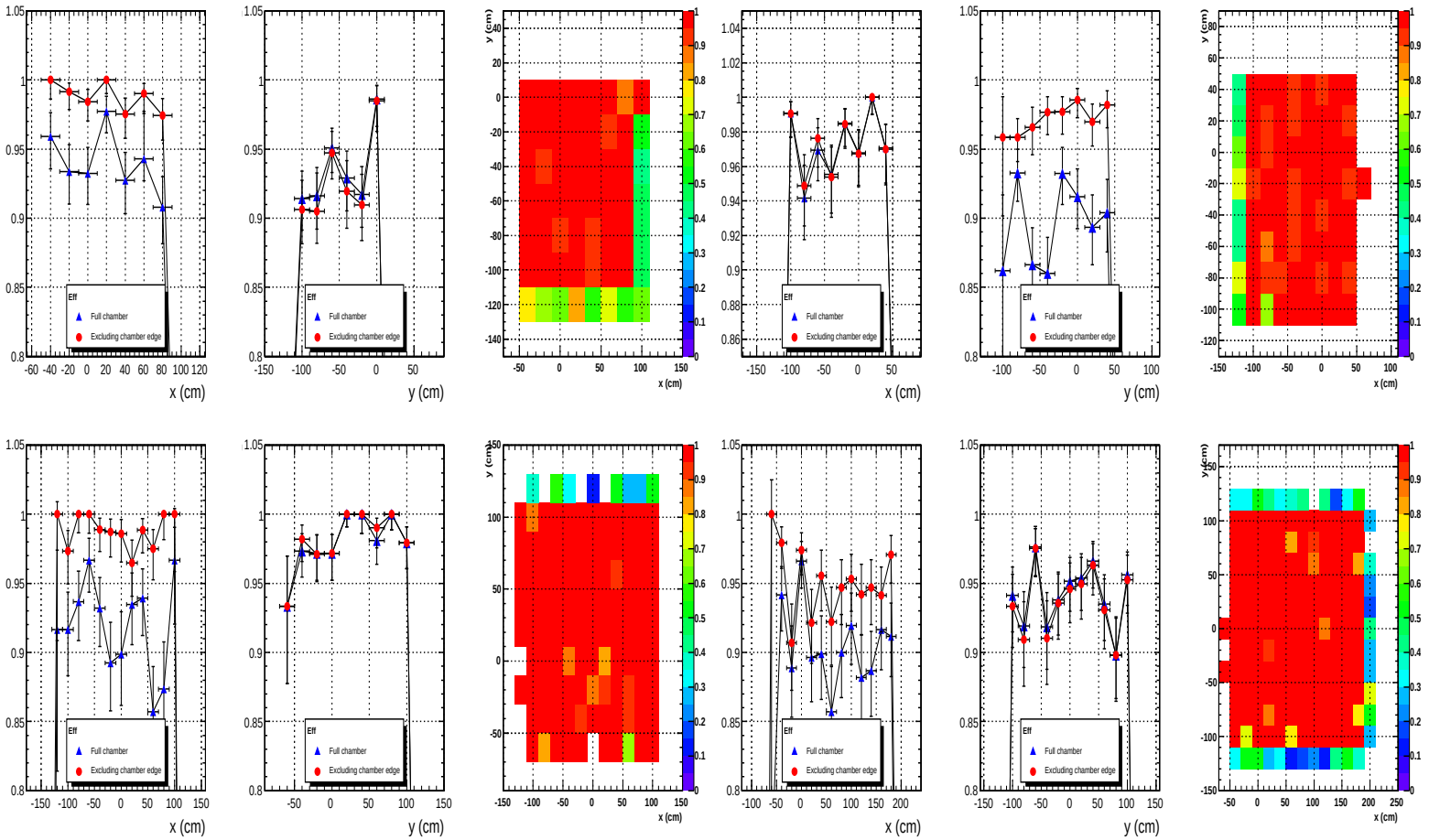








Segment reco Efficiency



Estimated from GREN Data (not MC) by using a *sandwitch* of chambers

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- Still problem in pattern recongition for *r*-*z*SL, where, sometime, a wrong pattern is selectd resulting in wrong direction of segments
- Affects seed generation as well as StandAlone/Global reconstruction
- If a "wrong" *r*-*z*segment is used, other correct segment can be rejected as incompatible with track candidate
- More serius on Cosmic data than on $p - p$ (MC) data due to lack of IP constraint
- Code optimization for speed and memory footprint

Task force

A dedicated task force (4 people) is being setup in order to study and possible solve these problems.

Possible Solution being discussed

- The problem is not in pattern reco (which does find correct segments) but in segment cleaning, where sometime we reject the right segments and retain the bad one
- difficult to fine tune cleaner...

in *r*-*z*the track are straight!
Try a reconstruction using simultaneously more than one station in order to increase the lever arm

- Prototype algo using hits from layers of different station
- first results are promising but there are several issues to be addressed
  - which chambers to consider
  - combinatoric increase and can be problematics
  - how to use these multi SL segments in track reconstruction

Other approach

- reconstruct *clusters* of hits in each SL
- can be useful also for high Pt Muons with large showering, where segment parretrn reco is hard/impossible
- Use hits from a SL in a station (as now) plus a clusters "large hit" from close by SL in other station
- much less combinatorics, still longer lever arm, avoid problem in tuning error for track propagation in magnet-joke
- can reuse much of the current code, need a "clusterer" for DT
- ...

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Conclusion

Reconstruction Status

- hit and segment reconstruction is rather stable
- other recon algos are beeing developed and are under test
- still issues on *r*-*z*reconstruction, important mostly for cosmic reconstruction
- dedicated task force to cope with these issues setup: some possible smart idea are available.