Global tracking

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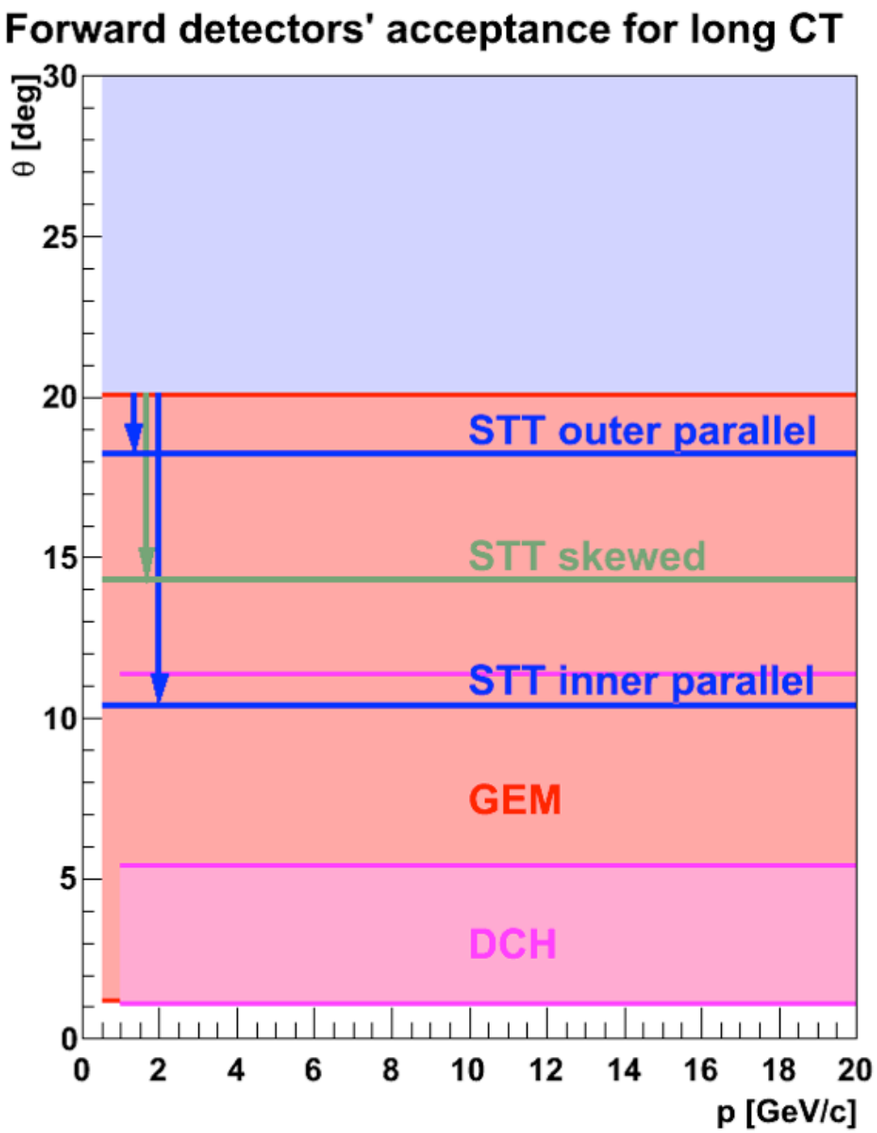
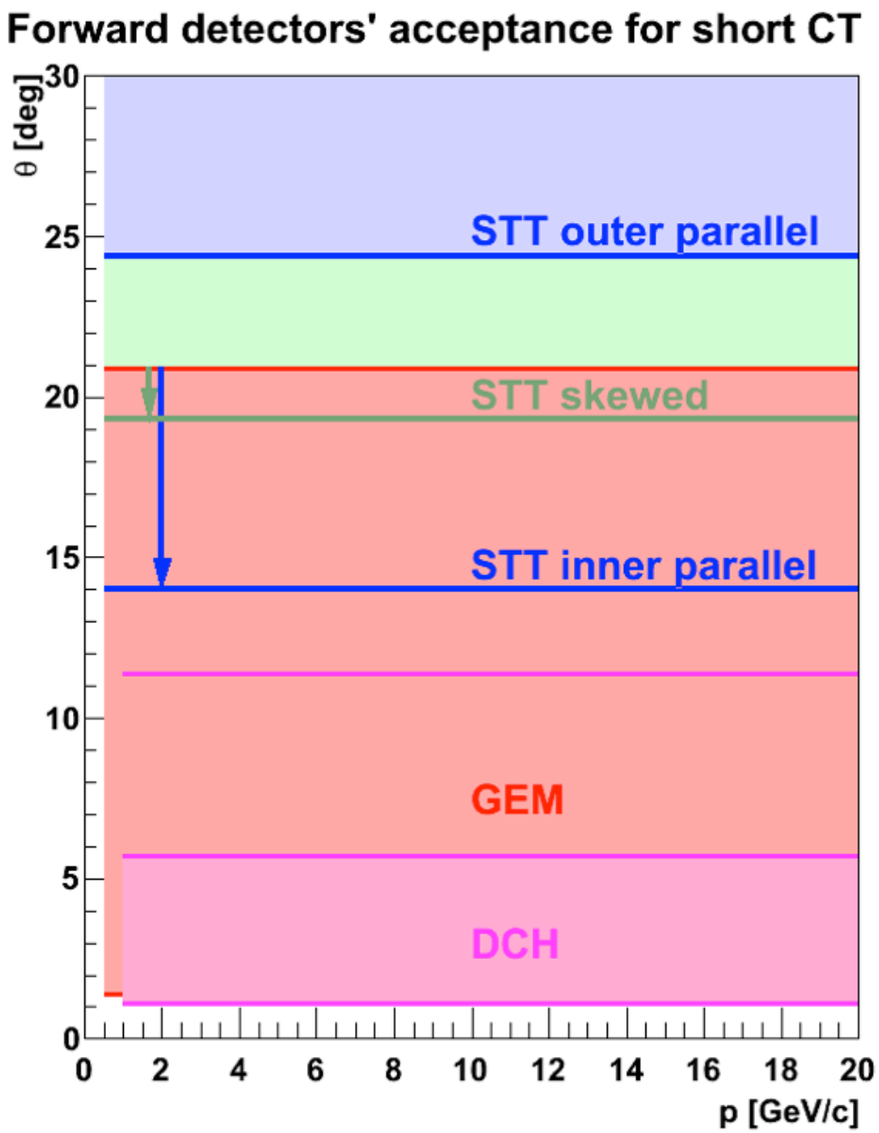
GSI

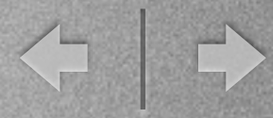
Acceptance maps presented on XXXII Panda Collaboration Meeting, March 2010





What about tracking?

- The acceptance being found, one needs to
- estimate the tracking performance, in particular:
  - track finding efficiency
  - accuracy of track fitting (f.e. momentum resolution)

Geometry

```
//------------------------  MVD       -----------------
 FairDetector *Mvd = new PndMvdDetector("MVD", kTRUE);
 Mvd->SetGeometryFileName("MVD_v1.0_woPassiveTraps.root");
 fRun->AddModule(Mvd);
 //------------------------  STT       -----------------
 FairDetector *Stt= new PndStt("STT", kTRUE);
 if ( nStations == 3 )
   Stt->SetGeometryFileName("NoPassive4Short_150cm.geo");
 if ( nStations == 4 )
   Stt->SetGeometryFileName("NoPassive4Short_120cm.geo");
 fRun->AddModule(Stt);
 //------------------------  GEM       -----------------
 FairDetector *Gem = new PndGemDetector("GEM", kTRUE);
 Gem->SetGeometryFileName(Form("gem_%dStationsShort.root",nStations));
 Gem->SetVerboseLevel(0);
 fRun->AddModule(Gem);
 //-------------------------------------------------------
```

Simulation

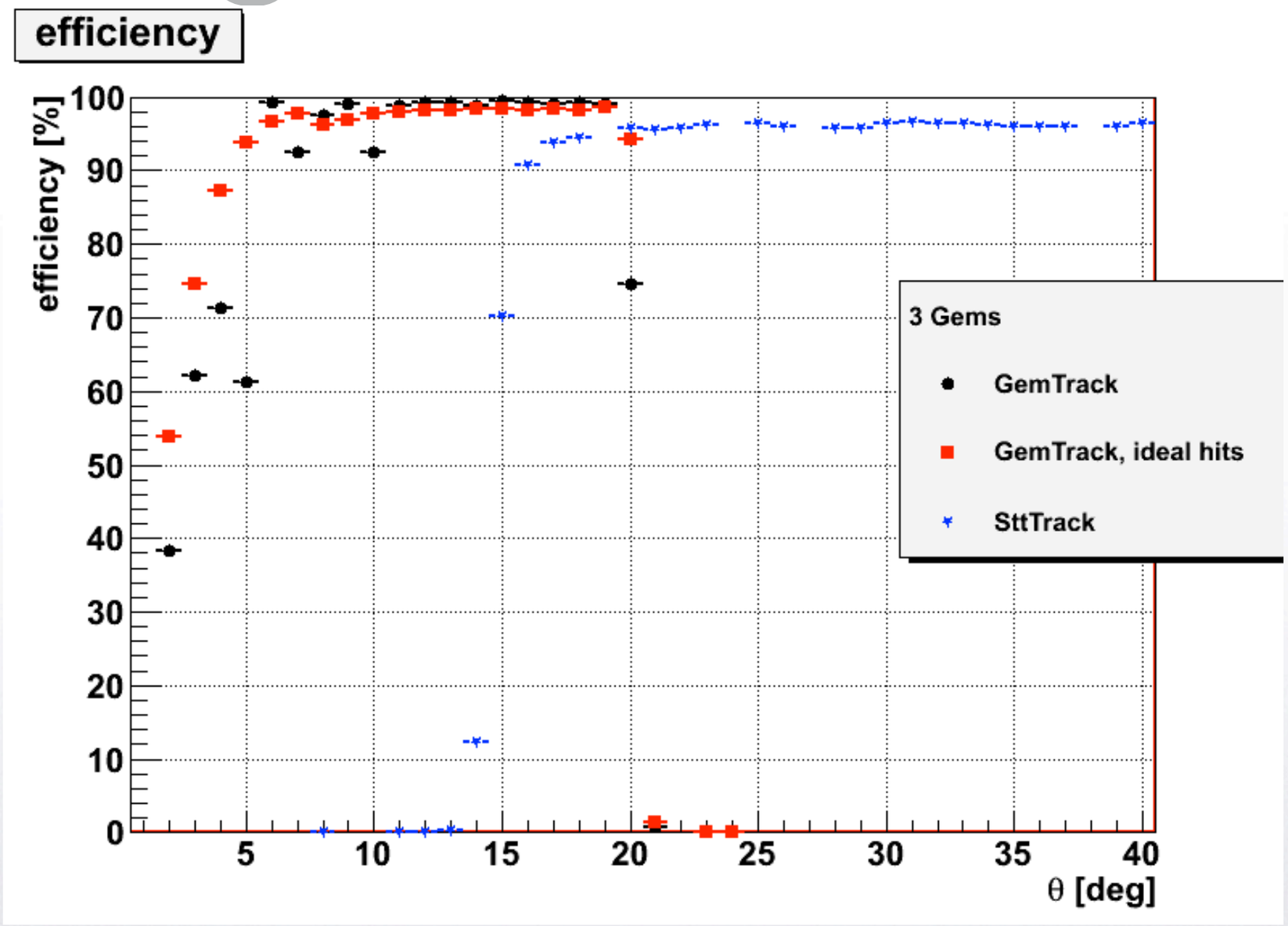
```
FairBoxGenerator* boxGen = new FairBoxGenerator(13,1);
boxGen->SetThetaRange(thetaAng,thetaAng);
boxGen->SetPtRange   (0.5,0.5);
boxGen->SetPhiRange  (110.,250.);
primGen->AddGenerator(boxGen);
fRun->SetBeamMom(15);
fRun->Run(10000);
```

- Plotting vs theta, each point is 10000 muons (1 per event) shot at a given theta angle, with transverse momenta of 0.5 GeV/c, into phi from 110 to 250 degrees

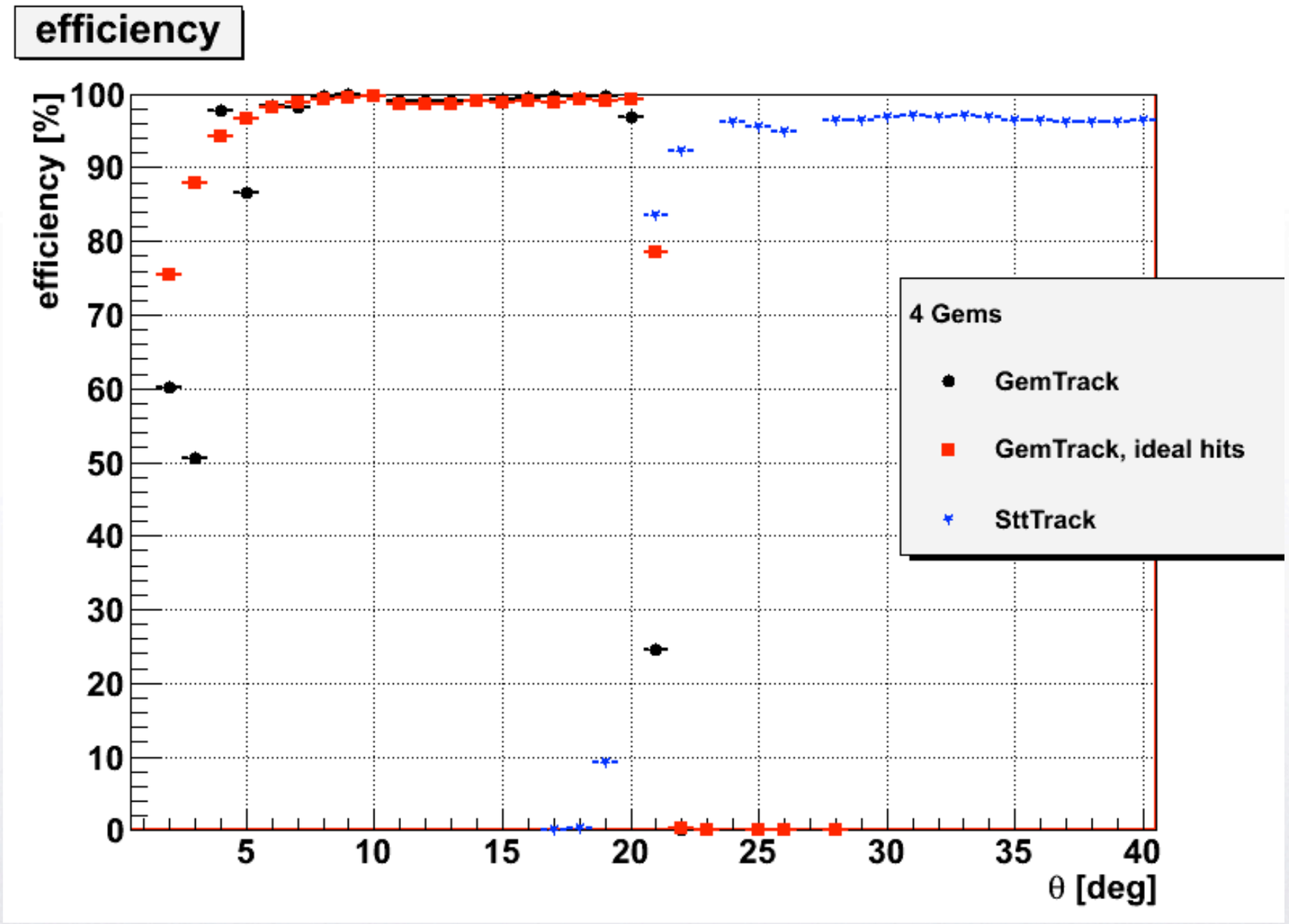
Track finding efficiency

- Not easy to compare different detectors, due to lack of good track finder working reliably in whole theta range
- Different track finders for different detectors (STT or GEM)
- “Independent”, general track finder: LHE

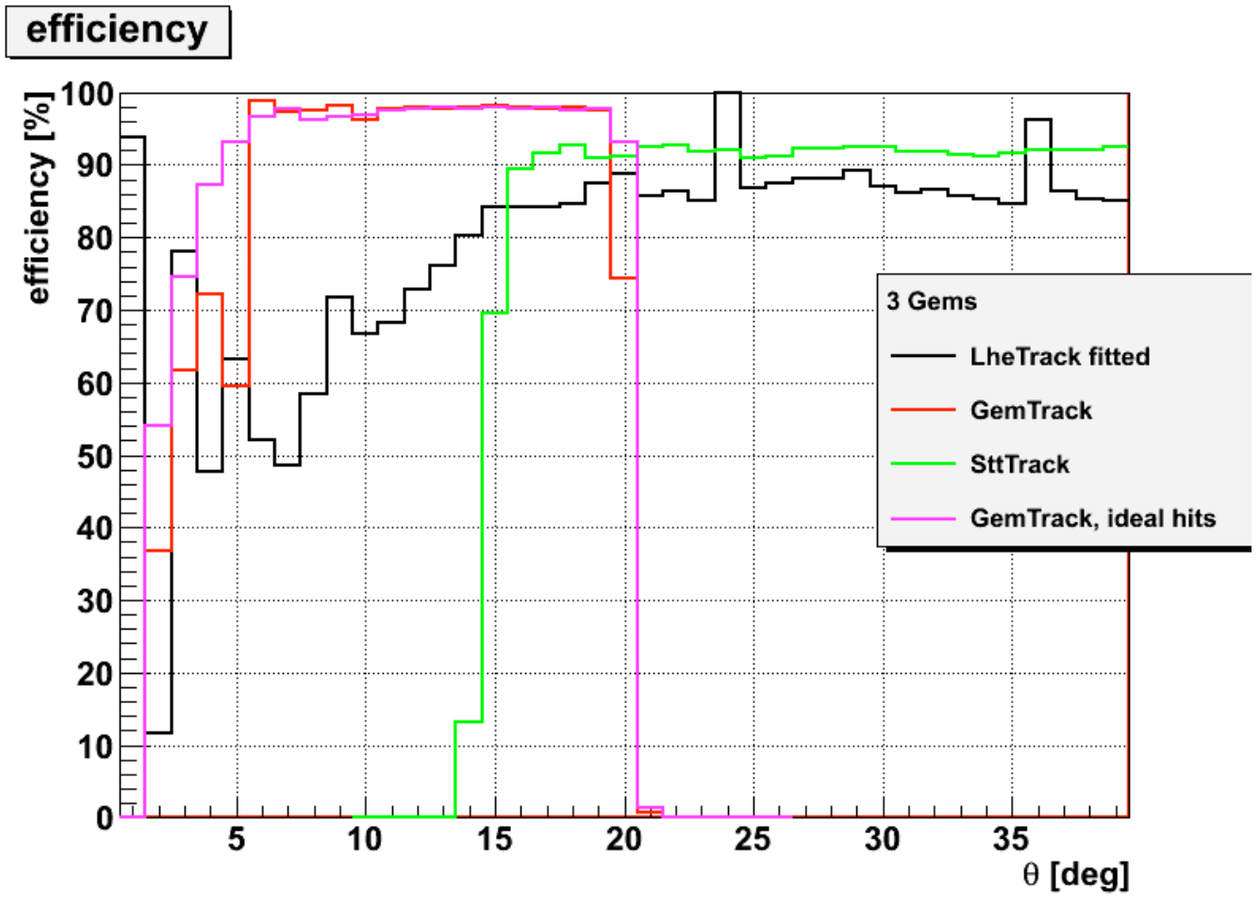
Long central tracker

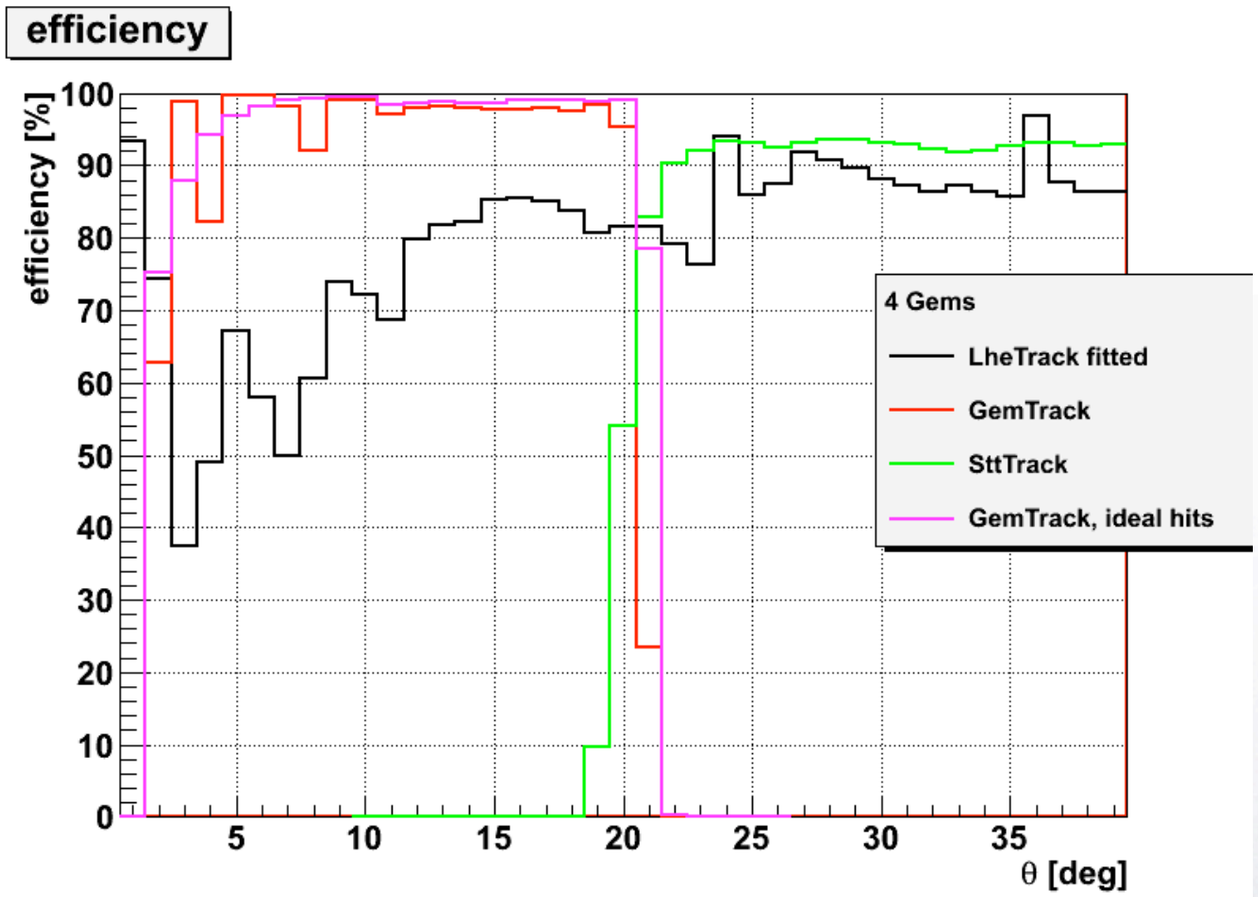


Short central tracker

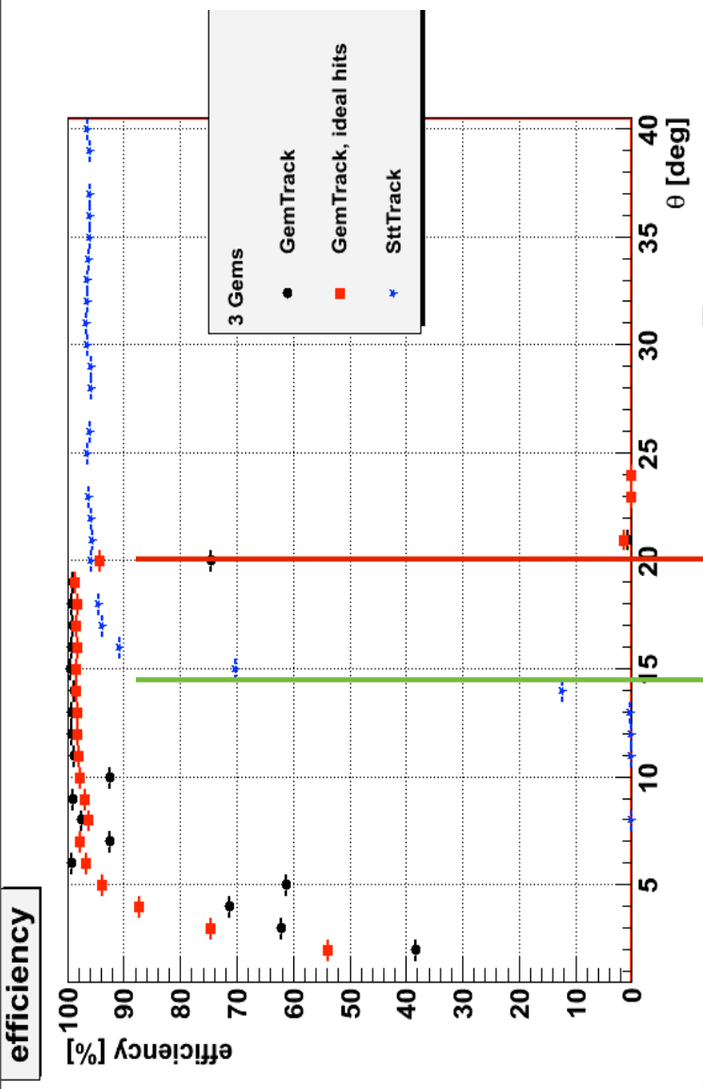


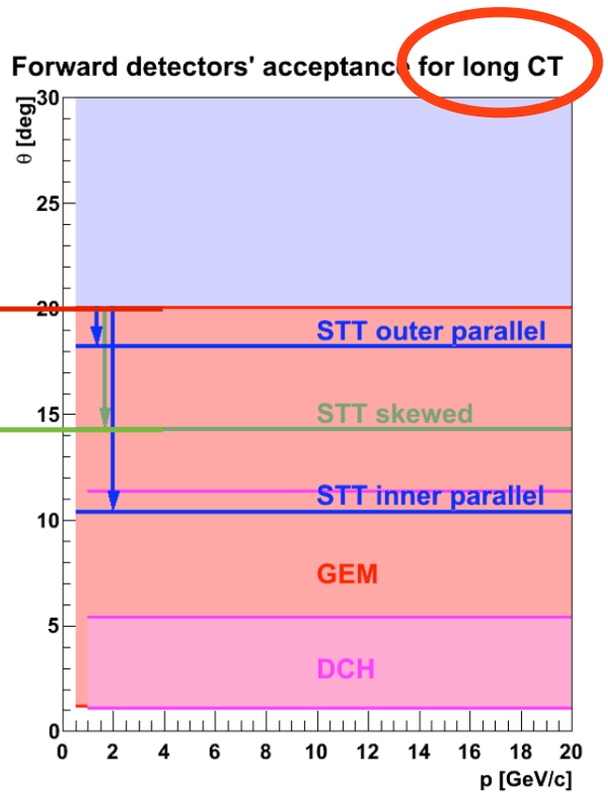
long CT vs short CT

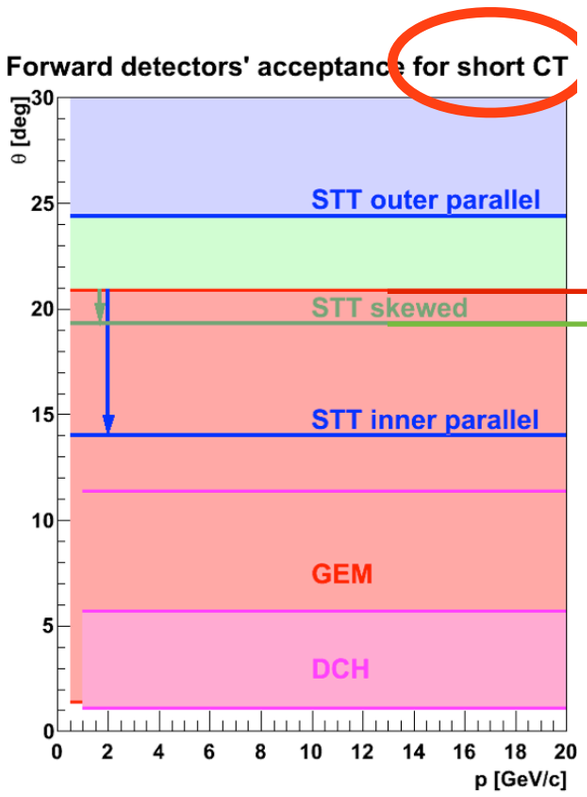


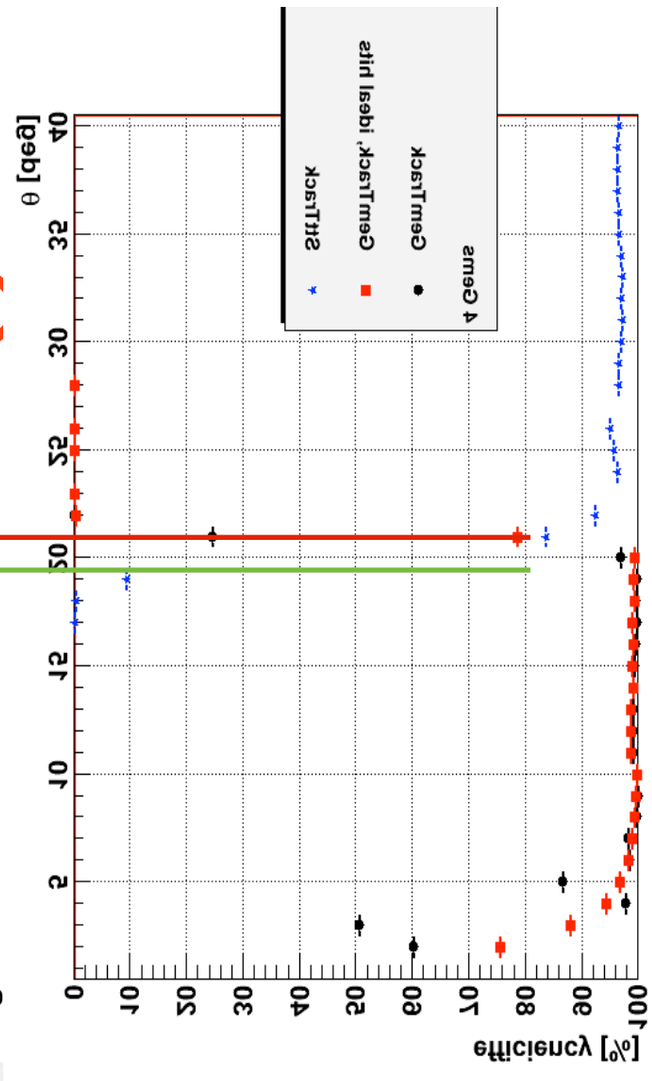


Comparison


3 Gems
GemTrack
GemTrack, ideal hits
SttTrack
efficiency [%]
θ [deg]


Forward detectors' acceptance for long CT
θ [deg]
STT outer parallel
STT skewed
STT inner parallel
GEM
DCH
p [GeV/c]


Forward detectors' acceptance for short CT
θ [deg]
STT outer parallel
STT skewed
STT inner parallel
GEM
DCH
p [GeV/c]

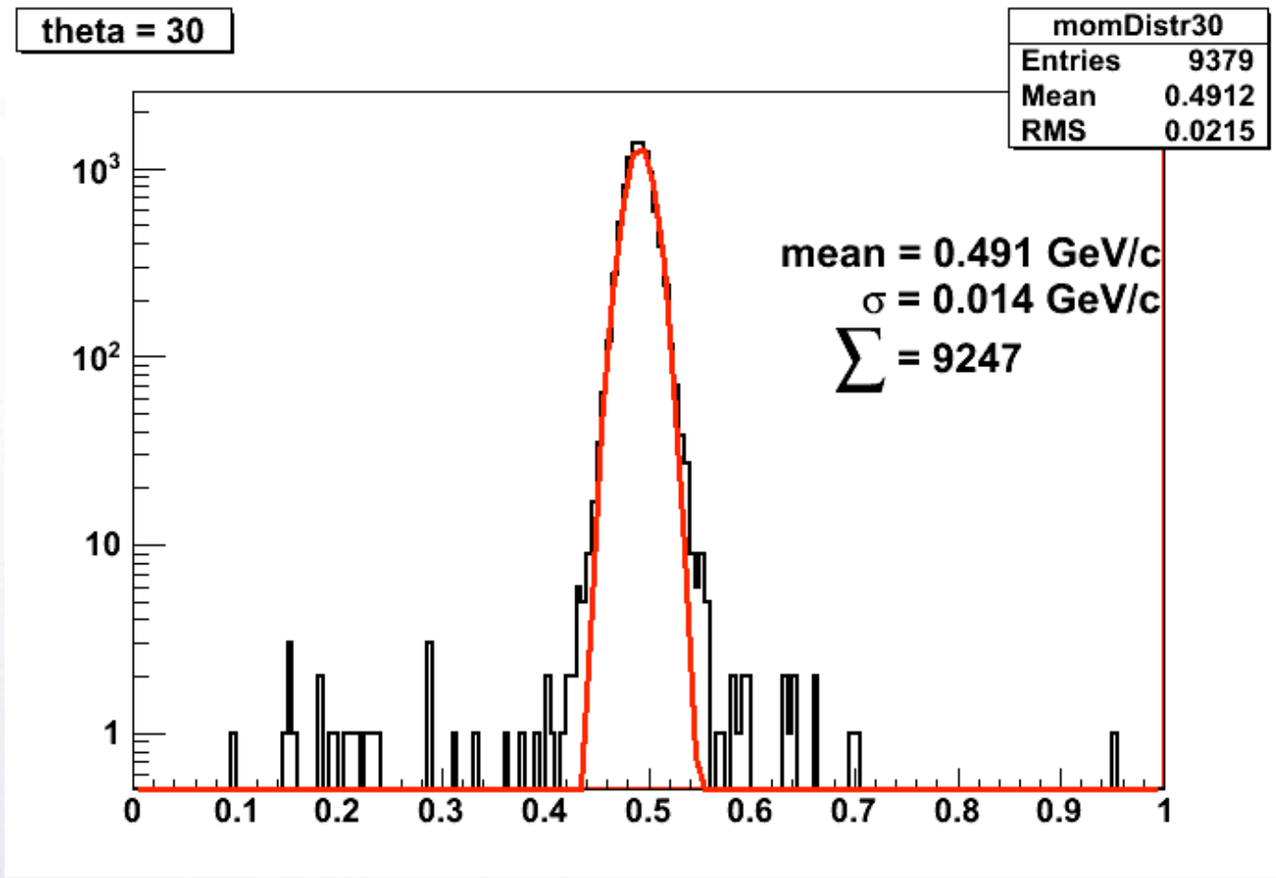

4 Gems
GemTrack
GemTrack, ideal hits
SttTrack
θ [deg]
efficiency [%]
efficiency

Methodology

- 10000 pions with p_T=0.5GeV/c in phi∈(110°,250°) at a given theta angle simulated
- Digitization, hit finding, track finding, track fitting run
- Plot reconstructed tracks p_T
- Fit Gaussian
- Efficiency = $\sum_{mean \pm 3\sigma} bins$ / 10000 · 100%
- Resolution = σ / mean · 100%

Methodology cont'd

Example: STT fit tracks at 30°



Problem:

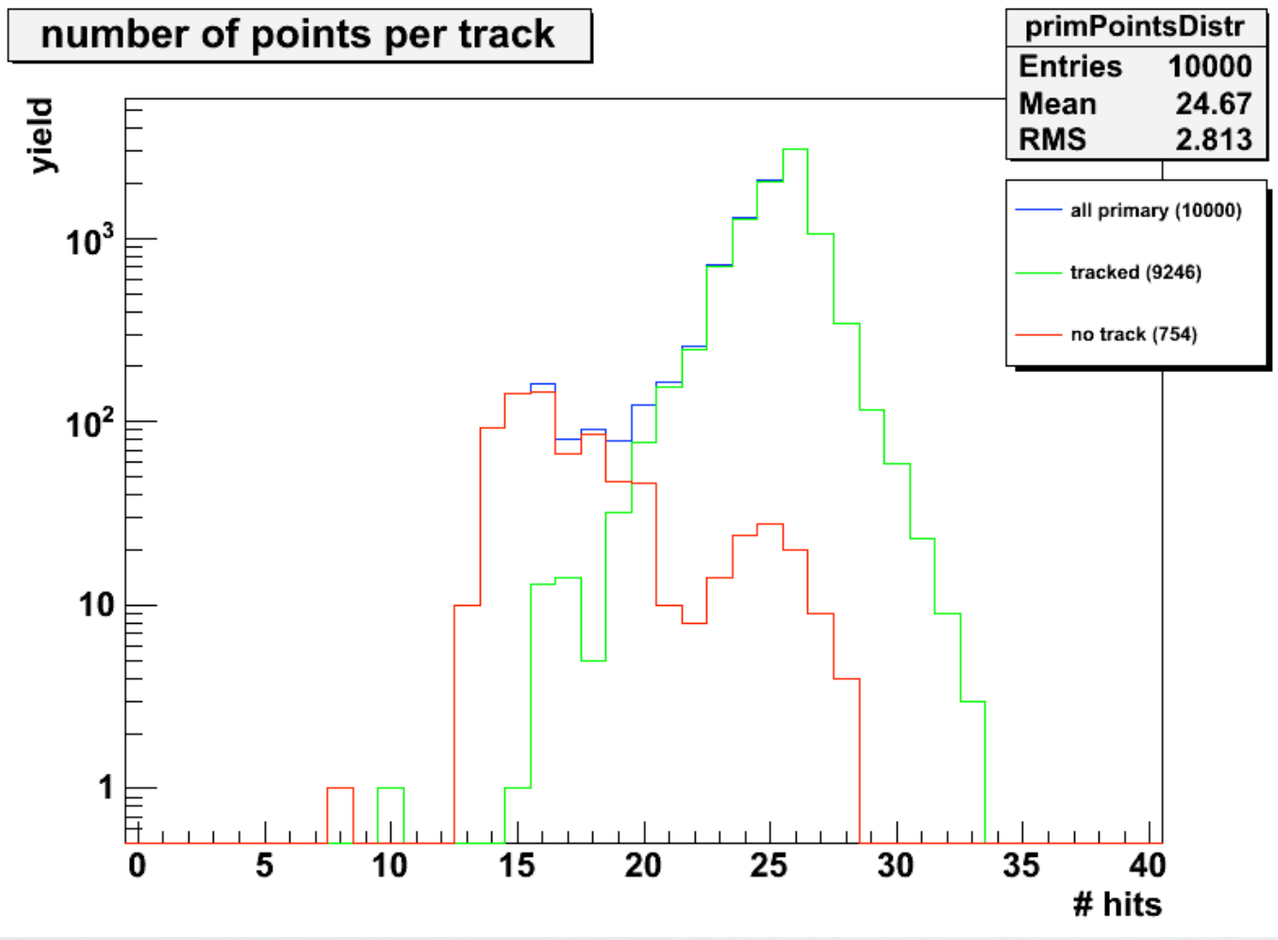
In fact it is not only efficiency, but also acceptance in combined here...

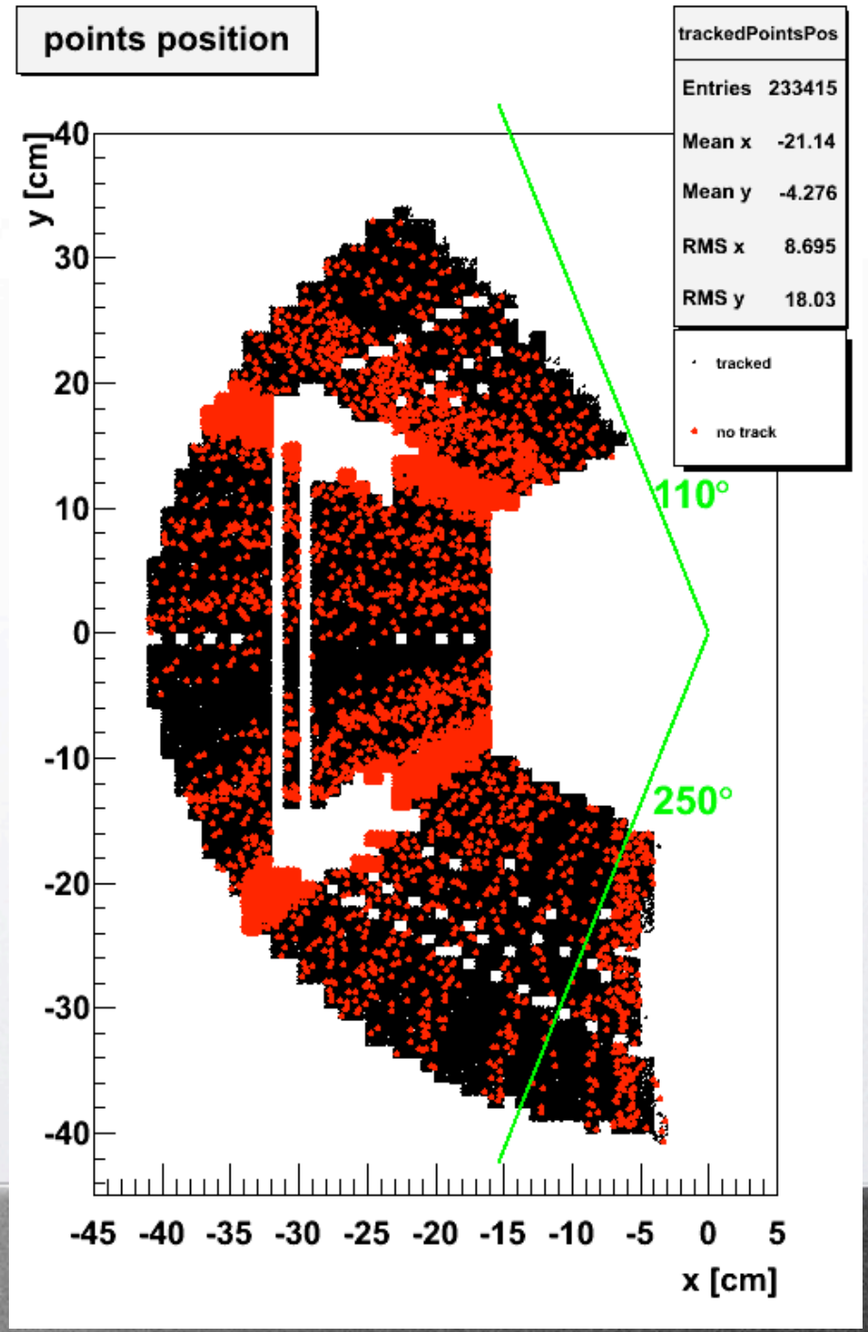
Original thought:

phi∈(110°,250°) takes care of acceptance

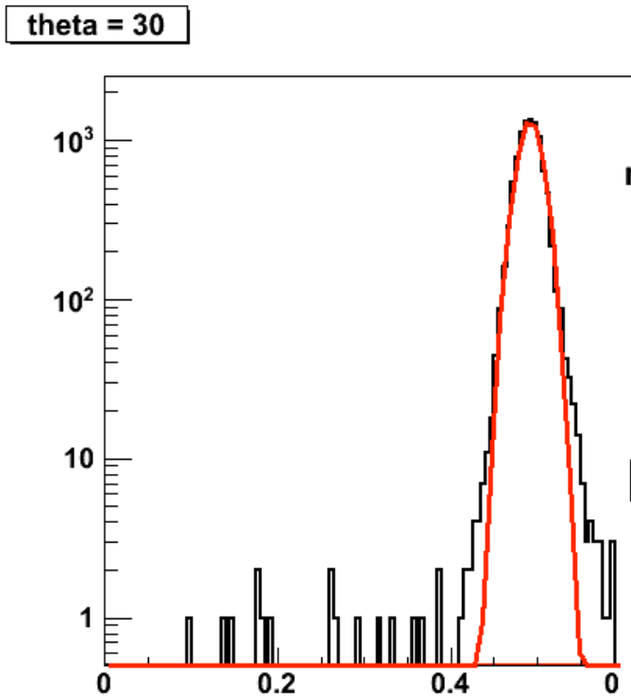
Methodology cont'd

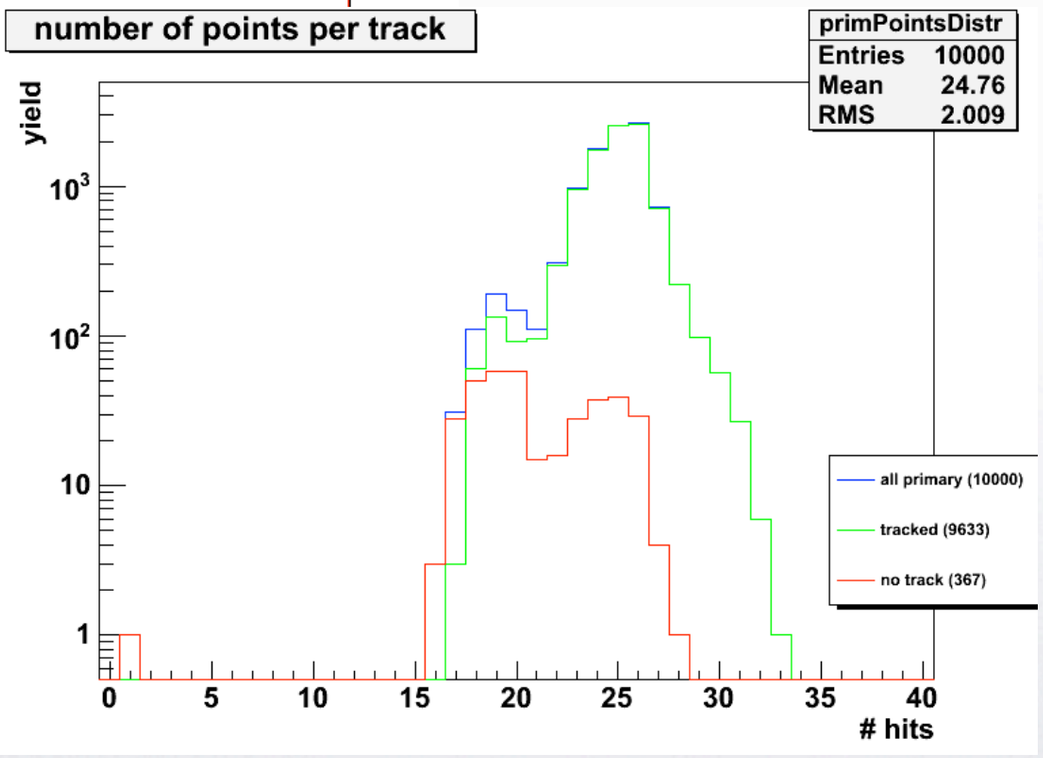
Example: STT fit tracks at 30°

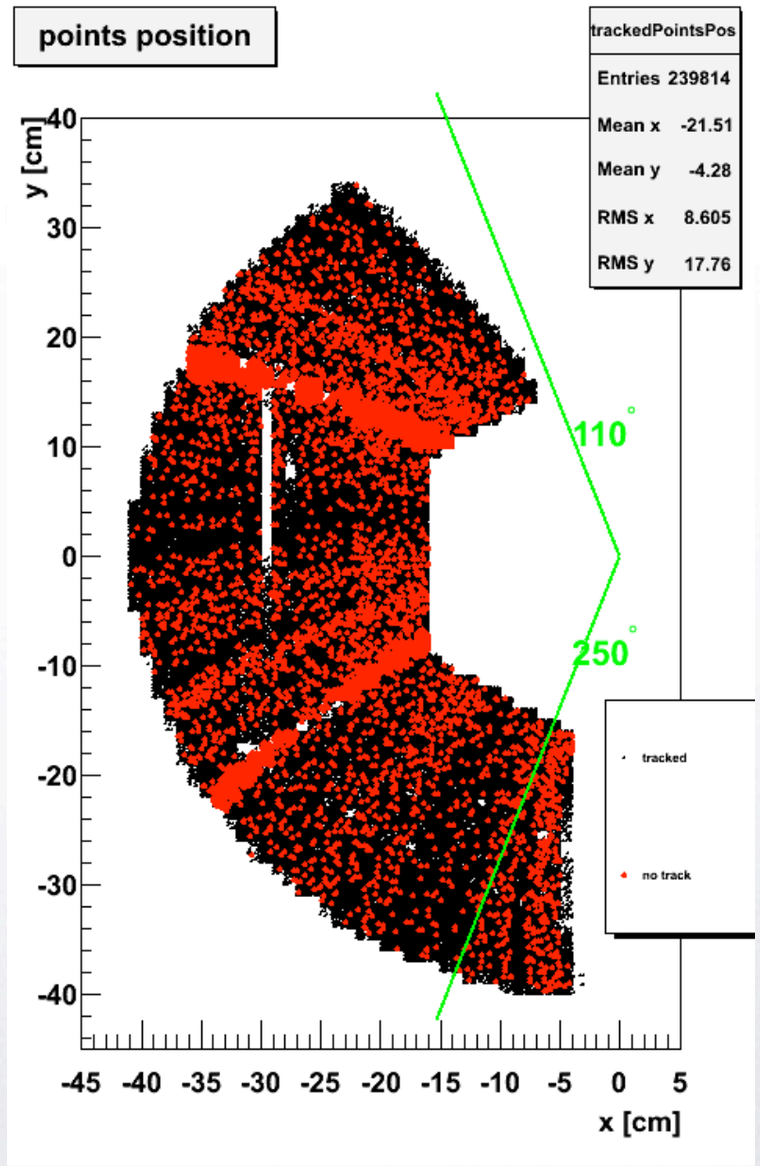




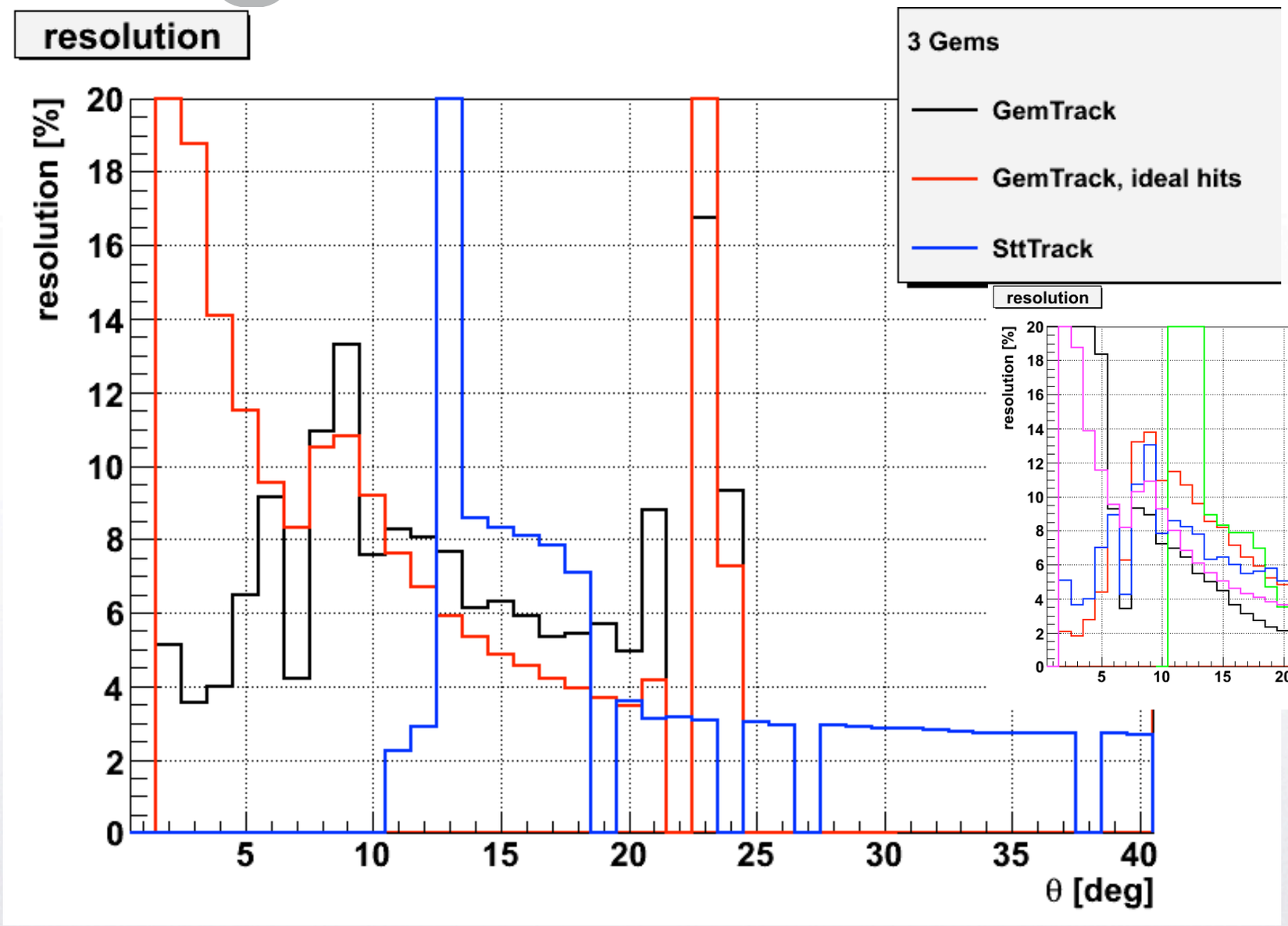
Different geometry



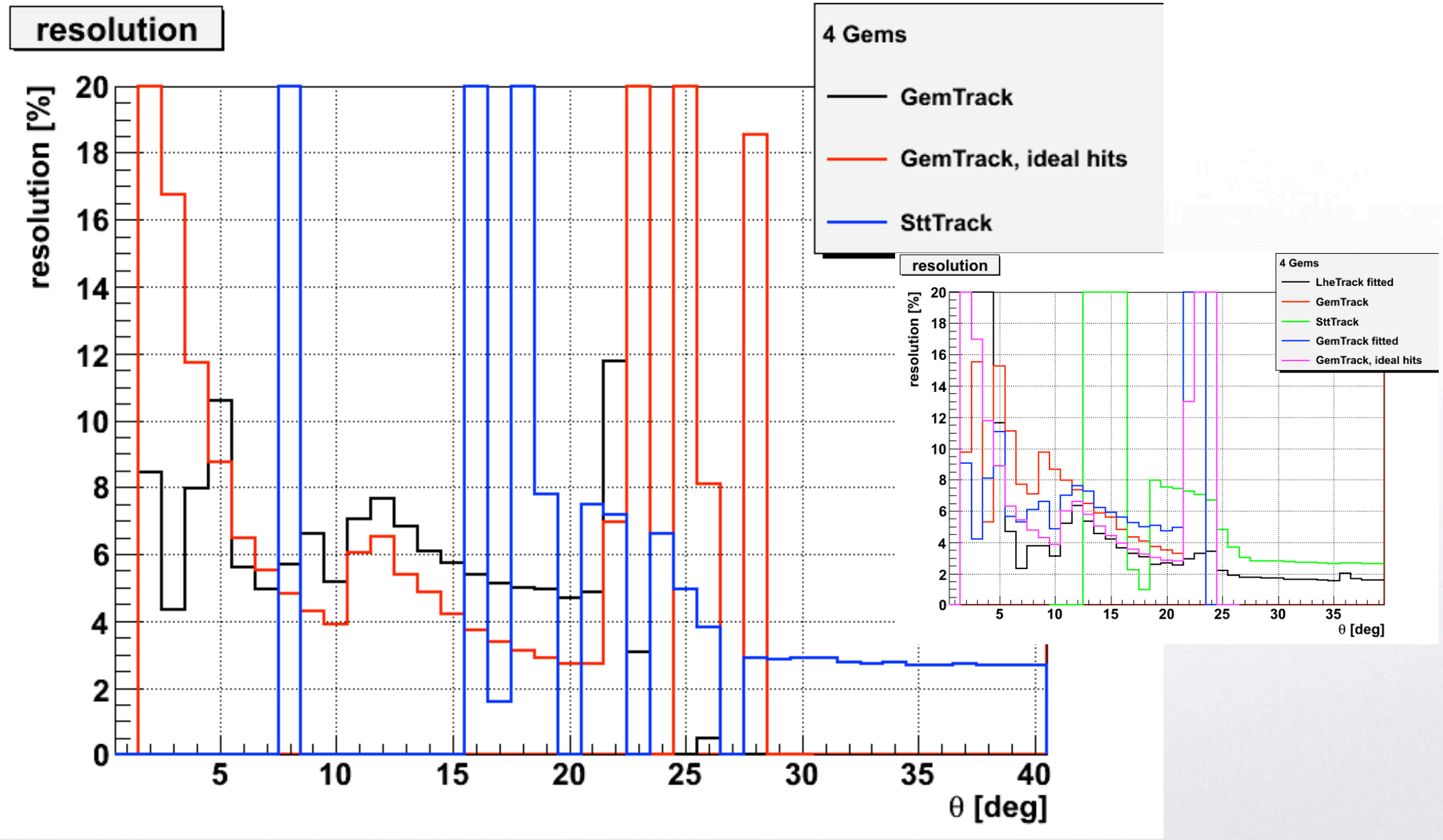




Long central tracker



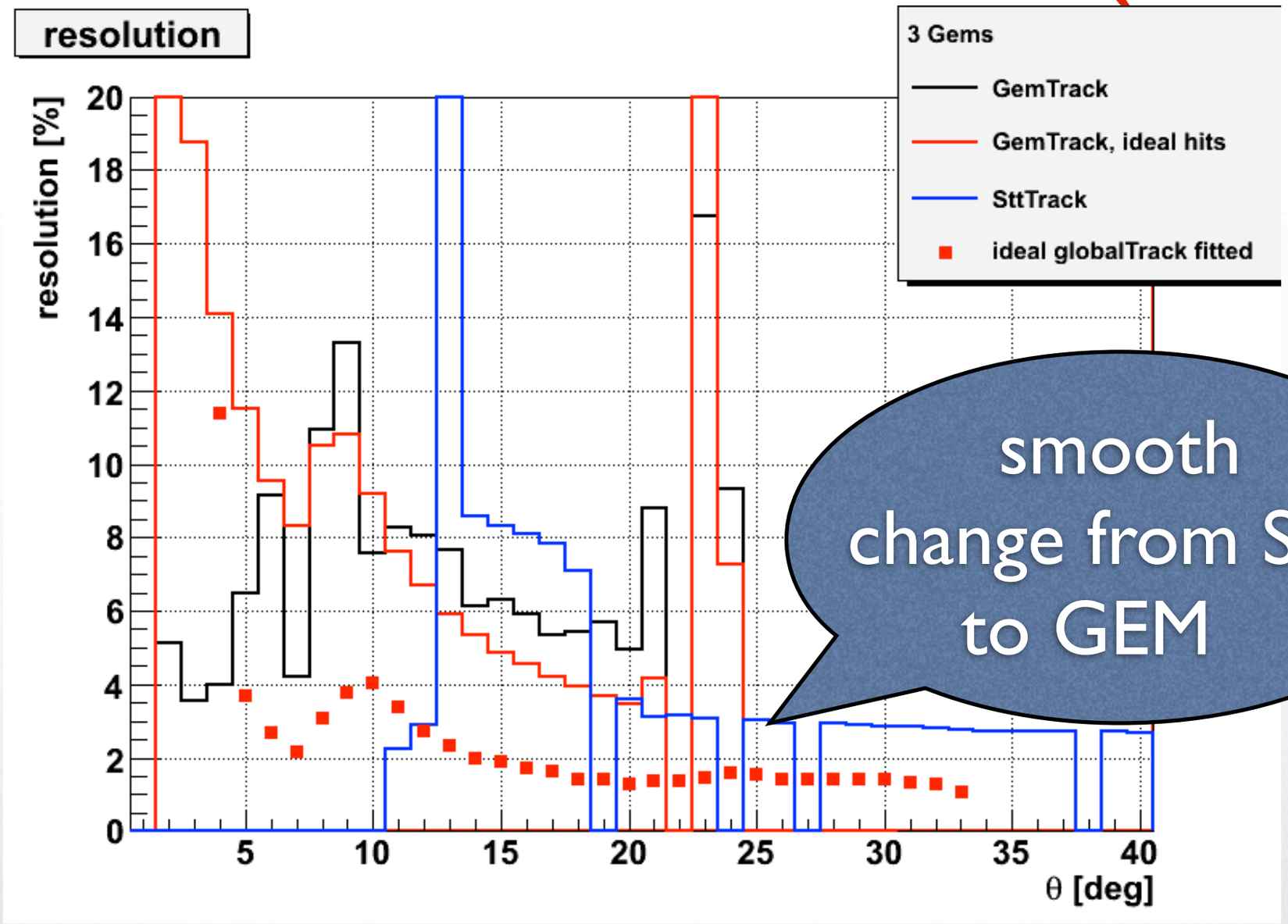
Short central tracker



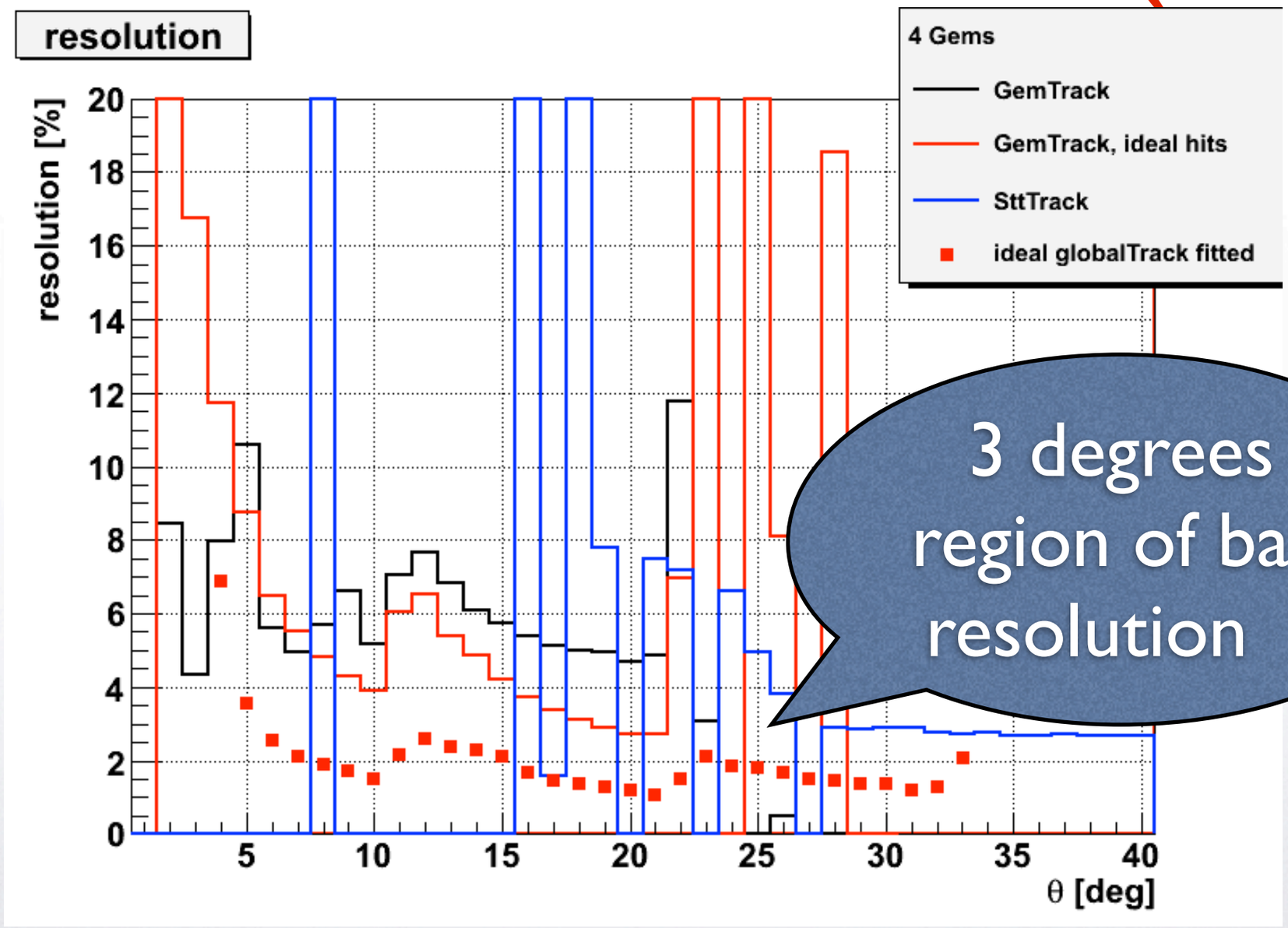
Ideal tracking

- Ideal tracking in various detectors
- PndGlobalIdealTrackMerger merges the ideal tracks into global track
- genfit track fitting is then performed

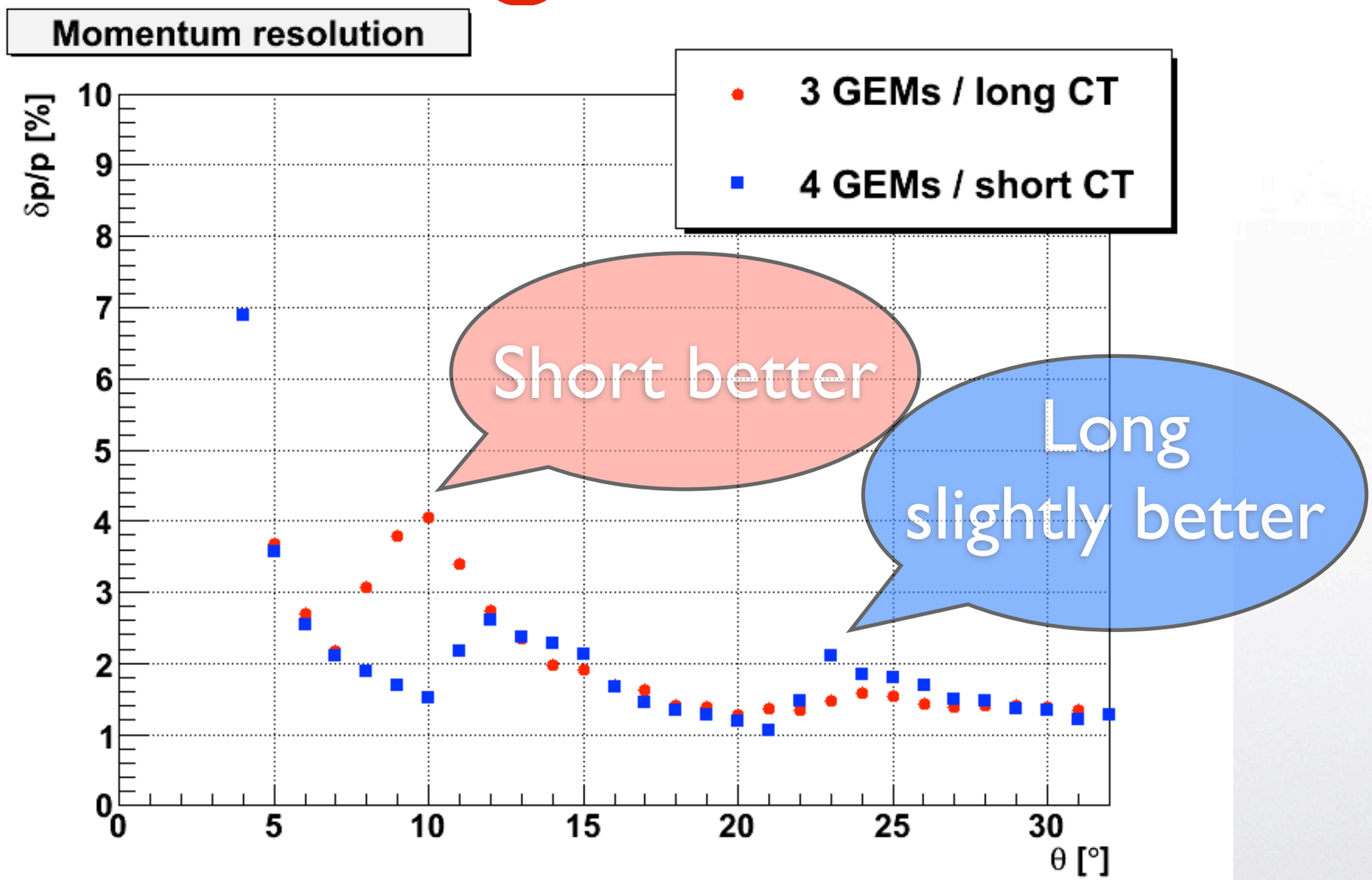
Long central tracker (3GEM)



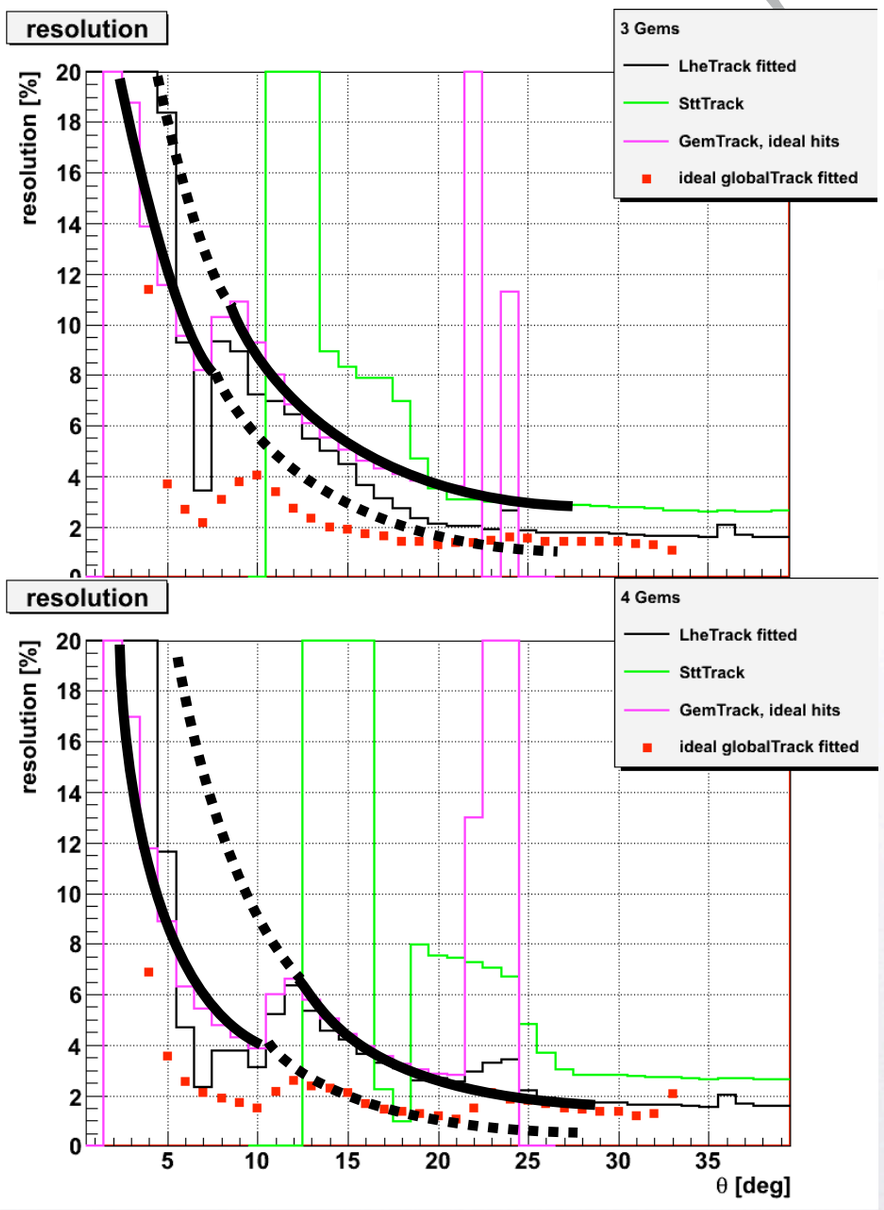
Short central tracker (4GEM)



Again...


Momentum resolution
δp/p [%]
θ [°]
3 GEMs / long CT
4 GEMs / short CT
Short better
Long
slightly better

Θ=7(10)° problem



- Resolution gets worse by about 3% at a certain Θ angle

Summary

- 4 GEMs (with short CT) perform better at small theta angles (better efficiency below 5deg, better resolution from 7 to 12 deg)
- Long CT (with 3 GEMs) perform better at intermediate region of 17-22 degrees (no hole in efficiency dependence on theta, slightly better resolution around 23 degrees)