Alignment issues

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Barrel Muon WS
Aachen 29 April 2004

Summary

- Brief reminder of concept
- Available code in ORCA for misalignment
- First ideas and some preliminary results on alignment with tracks.

Code for alignment

- Study the effect of misalignment on muon trigger L1, L2 and L3
- Use modified ORCA (already adapted to ORCA 7_7_1) to perform misalignments
  - Big advantage: Already existing MC is used, without being necessary to simulate distorted geometries.
- Based on existing Tracker 'misalignment tools'
  - Modify through ORCA cards de geometry in CommonDet
  - read Digis
  - Packages in Reco use CommonDet.
  - Digis appear as moved in global frame
- Existing Internal Note: CMS IN 2002/049

Code for alignment

- Different kind of movements –traslations and rotations- can be applied over single subdetectors –down to superlayers-.
- For simplicity some collective movements have been coded , grouping chambers in Rings, MBarrels or Endcap Layers:
  - Gravity movements:
    - According to magnet TDR Central Ring will fall ~15mm after installation
  - Compression:
    - Magnetic forces will compress in z the detector
  - Ring rotations
    - Positioning of rings and endcaps at □0.5 mrad
  - Barrel rotations
    - Relative positions of different stations in the same ring are not ideal.

Practical issues

- **Check out from Head Muon/MuonAlignment**
- **Create libMuonAlignment.so library**
- **Compile with your favourite code!**
- **Add inside .orcarc the needed Cards**
- **needs documentation!**

MuonAlignBM:rotbarrel = 0
MuonAlignBM:rotring = 0
MuonAlignBM:dispbarrel = 0
MuonAlignBM:compbarrel = 0
MuonAlignBM:dispring = 0
MuonAlignBM:dispgrav = 1
MuonAlignBM:endcap = 0
MuonAlignBM:dispx = 0.0
MuonAlignBM:dispy = -2.0
MuonAlignBM:dispz = 0.0
MuonAlignBM:rotEM1Phi = -0.003
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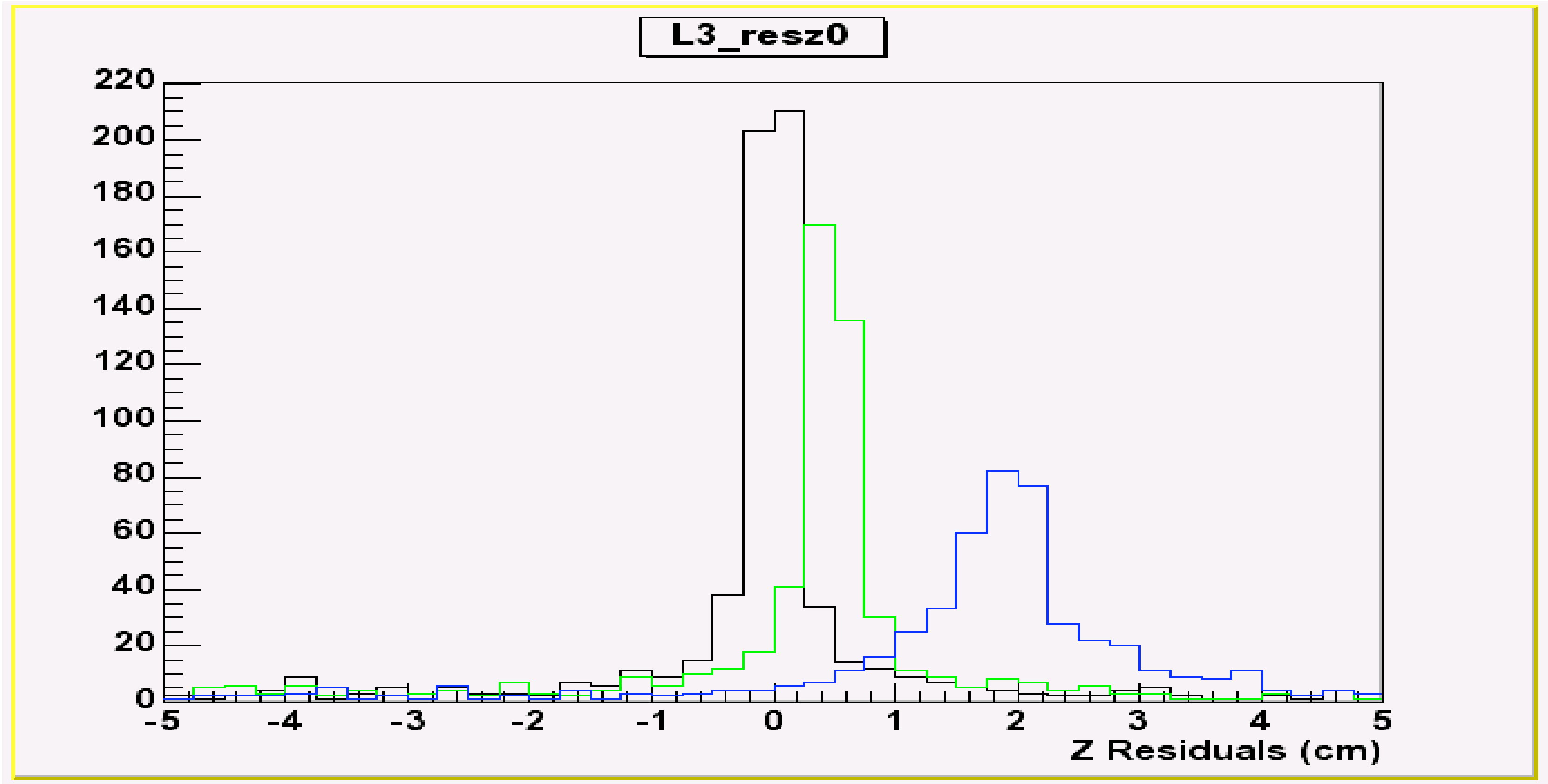
MuonAlignBM:rotEM10Phi = 0.003
MuonAlignBM:rotBM1Phi = 0.003
…………………………………………
MuonAlignBM:rotBM5Phi = 0.003

Alignment with tracks

- Baseline:
  - full L3 tracks of high momentum muons (>50 GeV?)
  - tracker only track extrapolated to MB1/ME1
  - compare local reco with extrapolations
  - 6 d.o.f of each chamber can be fitted independently
  - same procedure with MB2/ME2, etc.
- Alternative:
  - above method relies too much on tracker, what if not working or not aligned?
  - same procedure starting from MB1/ME1 and progress outwards
  - iterations may be needed
  - later the whole muon system can be compared with tracker as a *rigid* body
- Document in preparation to be circulated

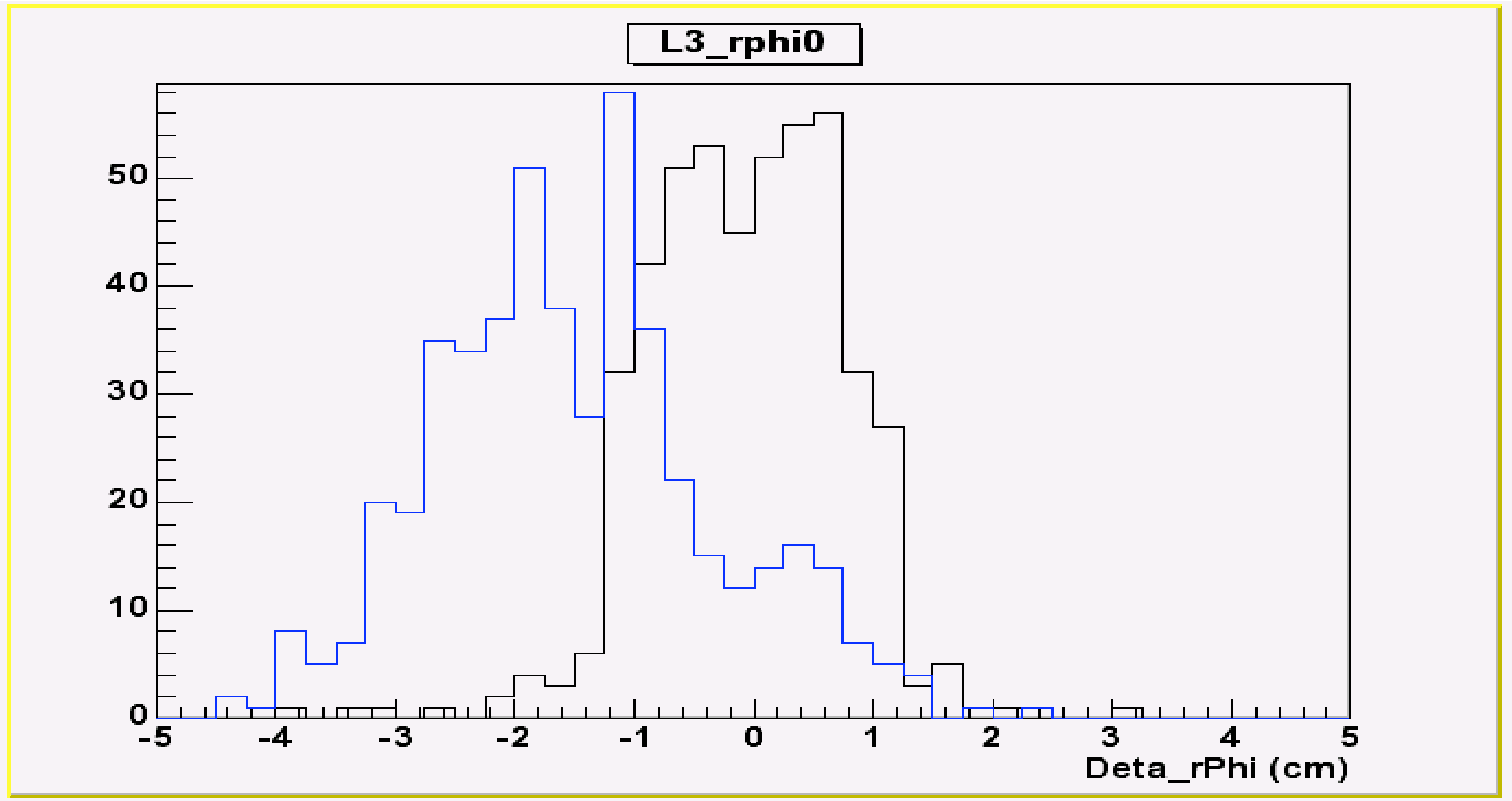
MB1 +z=0.5 and 2cm

Example: MB1 Z displacement of 0.5 and 2 cm. Residuals



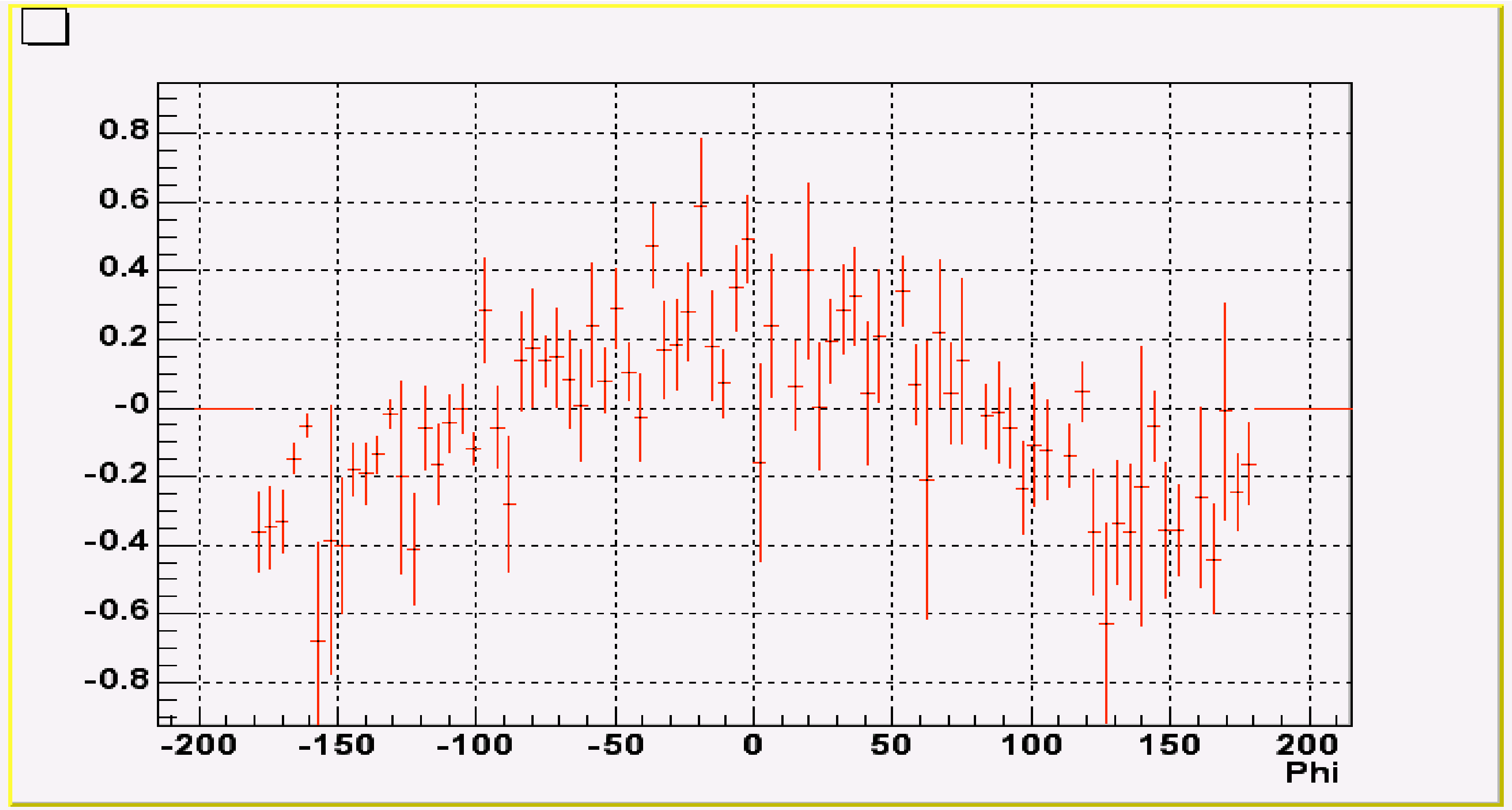
MB1 rotation of 5 mrad

Example: MB1 Z rotation of 5mrad. Residuals in RPhi



MB gravity fall of 5mm

Example: Full MB gravity fall of 5mm. Residuals in RPhi



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Output of alignment

- the output of the alignment with tracks will be the positions of each chamber
  - could go down to superlayer if needed
  - global position or displacement w.r.t ideal
- results compared, checked and combined with the equivalent from hardware alignment
  - a single output will be produced

Alignment/misalignment

- at reconstruction level one can use the code to introduce the latest modification to the geometry without having to use a full new geometry file
  - useful to check updates of geometry
  - probably the best solution if the geometry has to be updated often
  - the interface will be certainly different, not with ORCA cards
- when (and if) the geometry is stable for long periods an update of the production geometry file will be desirable
  - no need further alignment

Active/passive volumes

- Alignment of active volumes
- ...but movements mostly of the iron
- this package does not take that into account
  - could move a chamber into an unphysical region
- change full geometry when things are stable?
  - is it feasible to move passive layers?
- what about magnetic field:
  - if iron moves, the field will be different
    - move it with the iron is something but not the end of the story
  - is 1 cm movement in the iron relevant for our measurements?