

Alignment with beam halo MC

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Outline

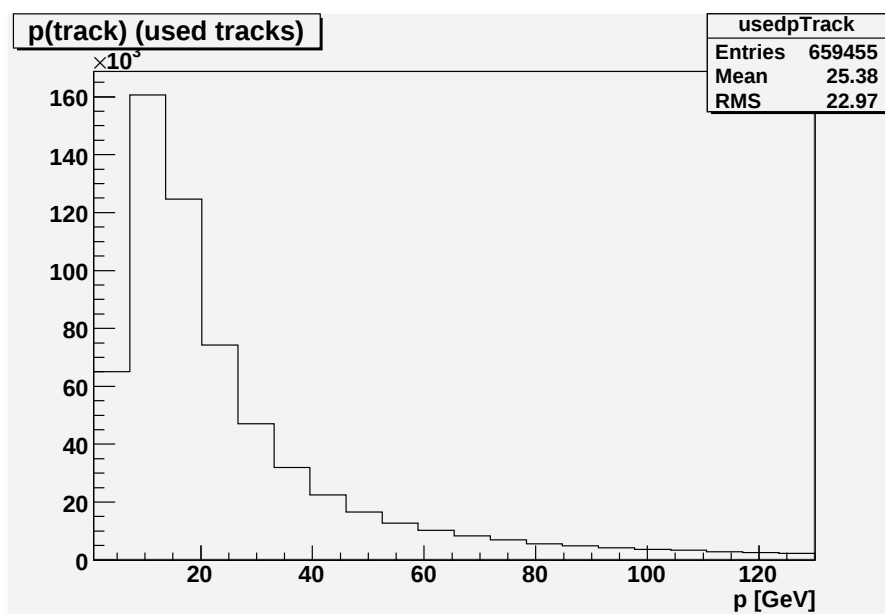
- Distributions from 229 Beam Halo (BH) events (3.4 M)
- Tracker alignment, to module level, with Minimum Bias (MB) events (u , w , γ parameters in endcaps)
- As above, also with Beam Halo tracks
- Tracker alignment, to module level, with Minimum Bias events (u , v , γ parameters in endcaps)
- Concluding remarks

Beam Halo: track selection

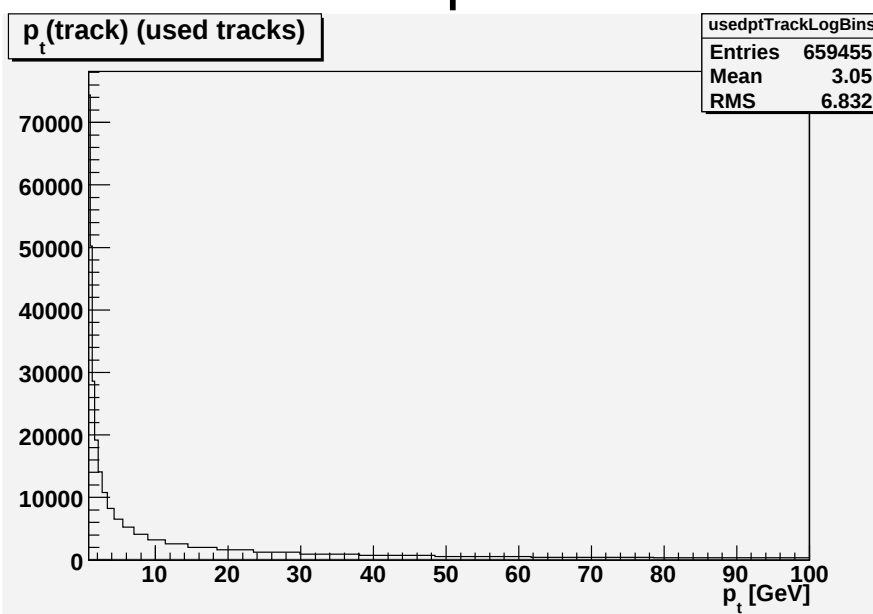
- New beam halo sample:
 - CMSSW 229
 - /store/mc/Winter09/TkAlBeamHalo/ALCARECO/STARTUP_V11_StreamALCARECOTkAlBeamHalo-v4/
 - 3.4M events
- Track selection:
 - $p_{\text{Min}} = 10.$ (no p_{TMin} cut)
 - $\eta_{\text{Min}} = -999.$ / $\eta_{\text{Max}} = +999.$
 - $n_{\text{HitMin}} = 6$ / $n_{\text{HitMin2D}} = 2$
 - $\chi^2_{\text{nMax}} = 50.$
- 660k selected tracks

Selected tracks: distributions

- Track momentum p :

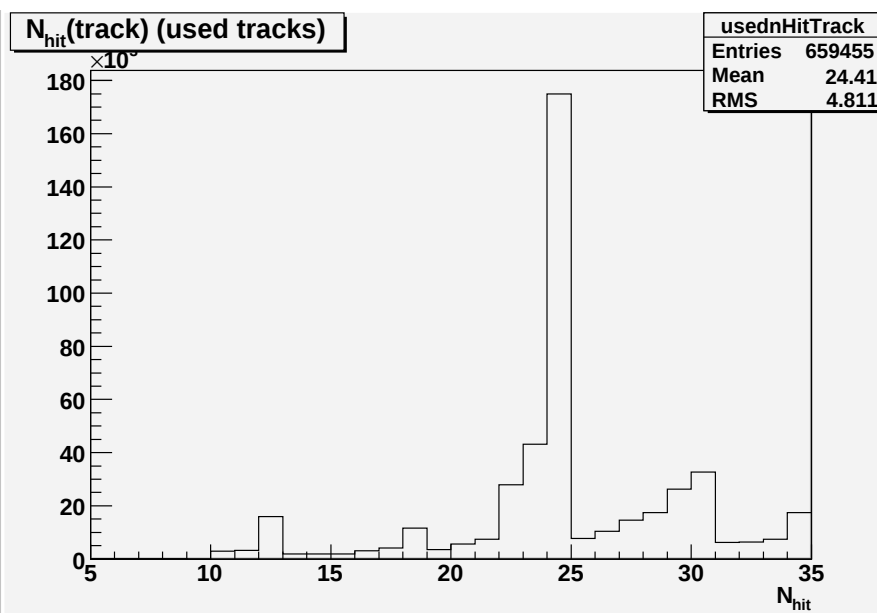
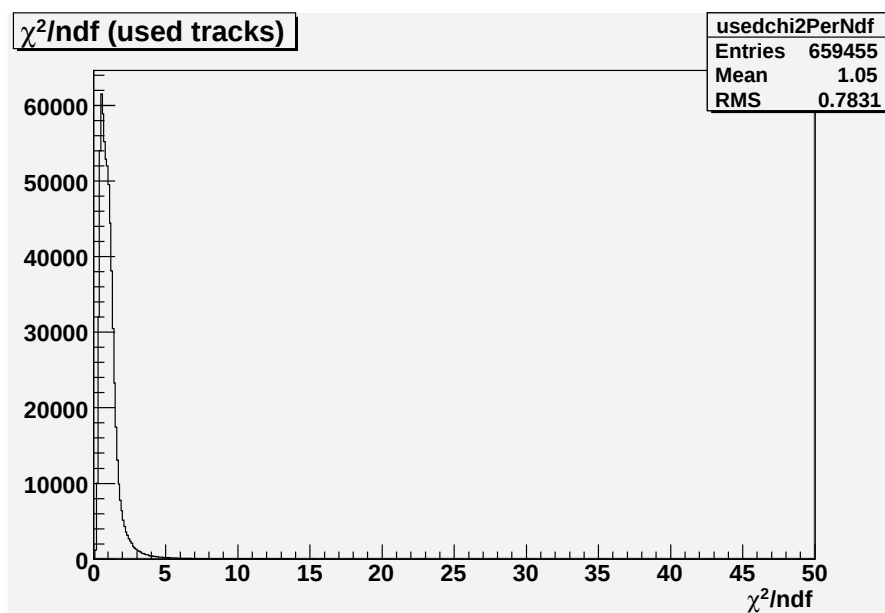


- Track transverse momentum p_t :



Selected tracks: distributions

- Track reduced χ^2 :
- Track # of hits:



Minimum bias: track selection

- Minimum bias production by Gaelle:
 - CMSSW 22X
 - `/castor/cern.ch/user/b/boudoul/221/TkAlMinBias/`
 - 5.3M events
- Track selection:
 - $ptMin = 2.5$
 - $etaMin = -999.$ / $etaMax = +999.$
 - $nHitMin = 9$ / $nHitMin2D = 3$
 - $chi2nMax = 50.$
- 4.9M selected tracks

Configuration file

Tracker parameters:

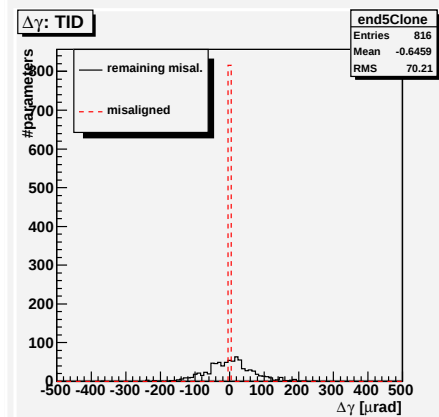
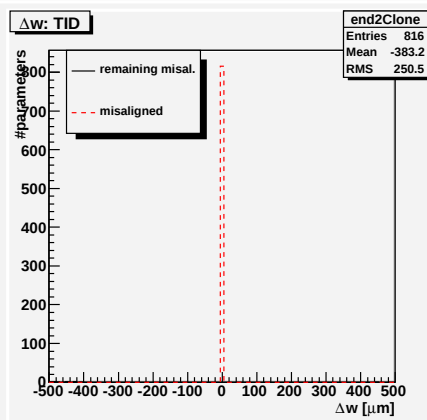
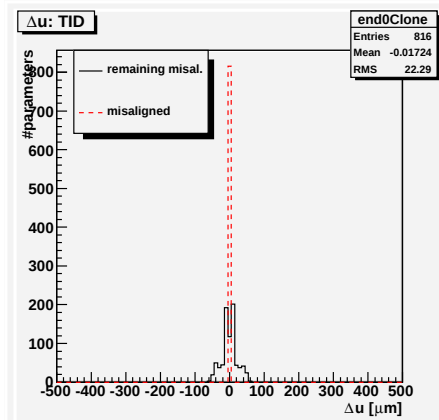
```
#--- Pixel
'PixelHalfBarrelDets,rrr00r',
'TrackerTPEModule,111001',
#--- TIB
'TIBSSDets,101111',
'TrackerTIBModuleUnit,101111',
#--- TOB as reference
'TOBSSDets,101001',
'TrackerTOBModuleUnit,101001',
#--- TID/TEC
'TIDDets,101001,endCapSS',
'TrackerTIDModuleUnit,101001',
'TECDets,101001,endCapSS',
'TrackerTECModuleUnit,101001'
```

(Thanks to Gero for providing it!)

Starting geometry: IDEAL_V12::All

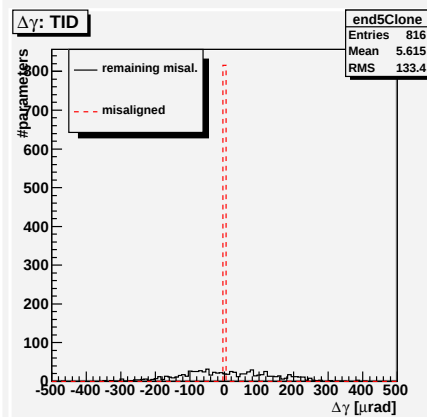
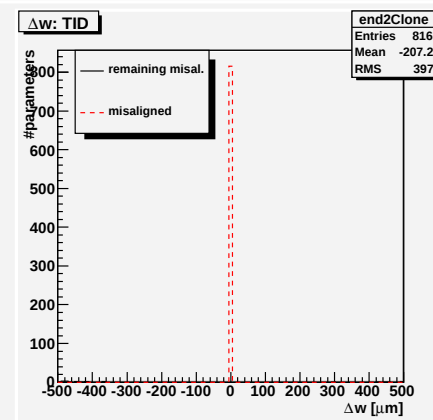
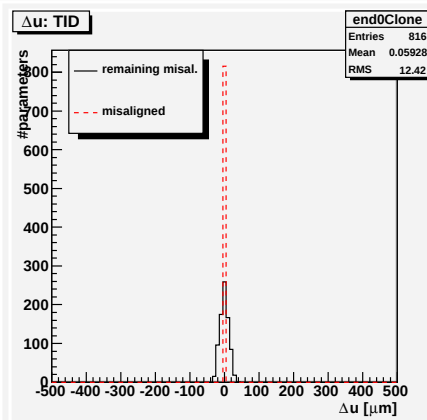
Alignment: TID

- MB only:



$$\begin{aligned}\Delta u &= 22 \mu\text{m} \\ \Delta w &= \text{syst mov's} \\ \Delta \gamma &= 70 \mu\text{rad}\end{aligned}$$

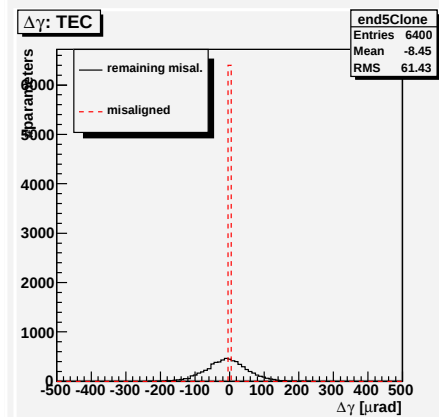
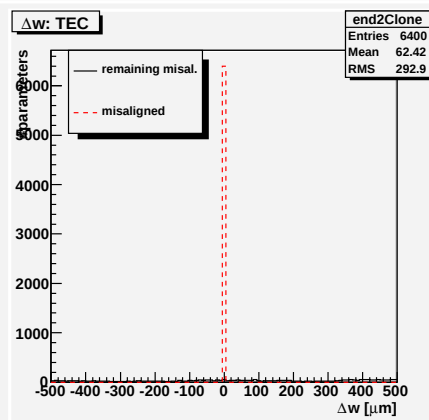
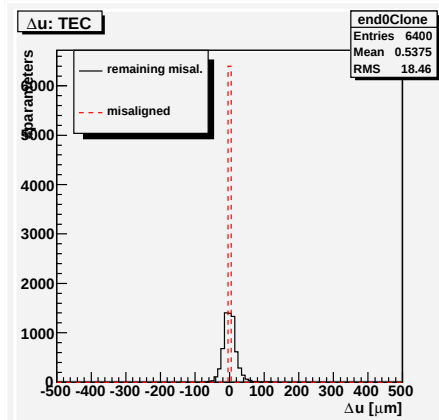
- MB + BH:



$$\begin{aligned}\Delta u &= 12 \mu\text{m} \downarrow \\ \Delta w &= \text{syst mov's} \\ \Delta \gamma &= 130 \mu\text{rad} \uparrow\end{aligned}$$

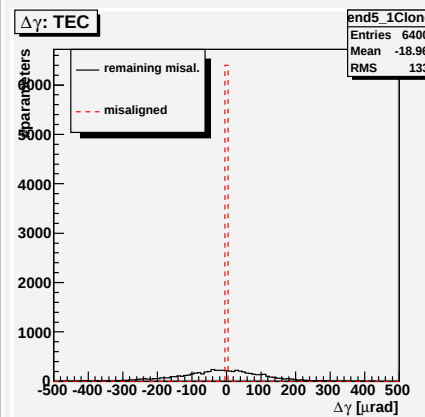
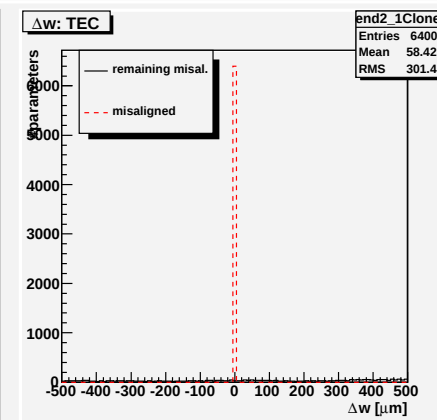
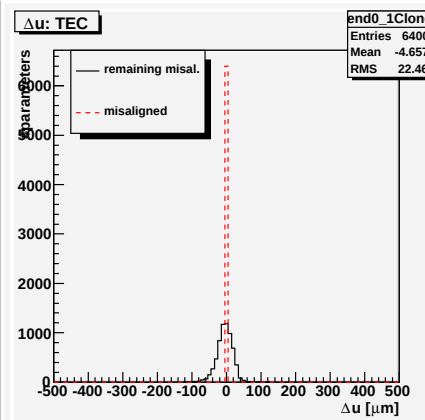
Alignment: TEC

- MB only:



$$\begin{aligned}\Delta u &= 18 \mu\text{m} \\ \Delta w &= \text{syst mov's} \\ \Delta \gamma &= 61 \mu\text{rad}\end{aligned}$$

- MB + BH:



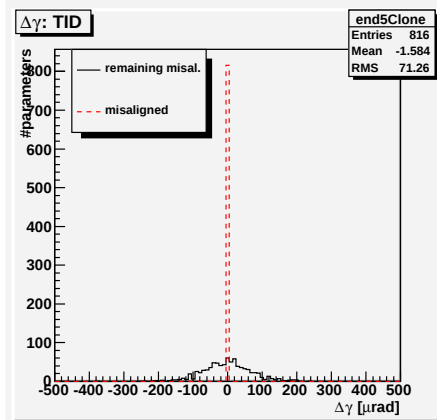
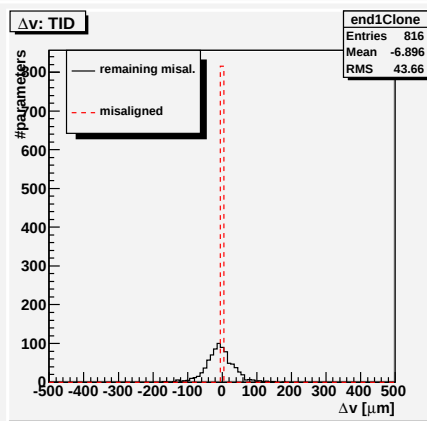
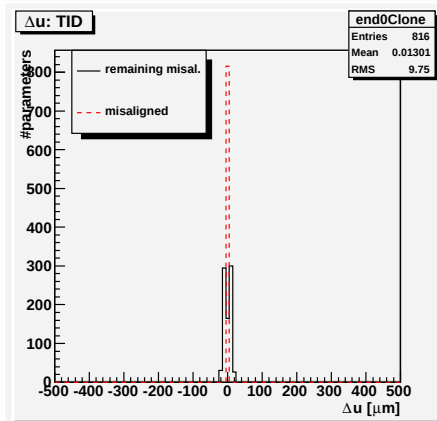
$$\begin{aligned}\Delta u &= 22 \mu\text{m} \leftrightarrow \\ \Delta w &= \text{syst mov's} \\ \Delta \gamma &= 130 \mu\text{rad} \uparrow\end{aligned}$$

Some remarks

- By using Minimum Bias:
 - Δw is not well constrained
- By using Beam Halo:
 - Δu gets better in TID, changes a little in TEC
 - No change in Δw structure
 - $\Delta \gamma$ got worse
- Next try: align u , v , γ parameters in TID/TEC
 - tried on Minimum Bias only, for the time being (see next slides)

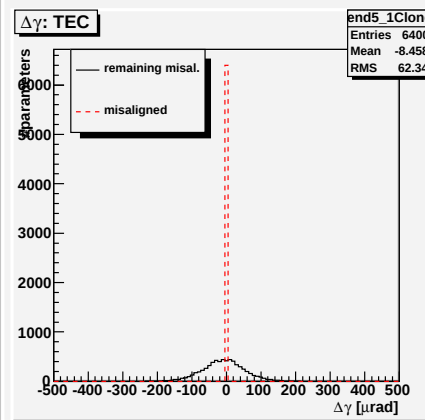
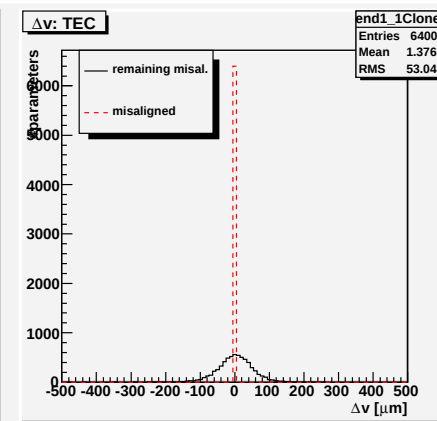
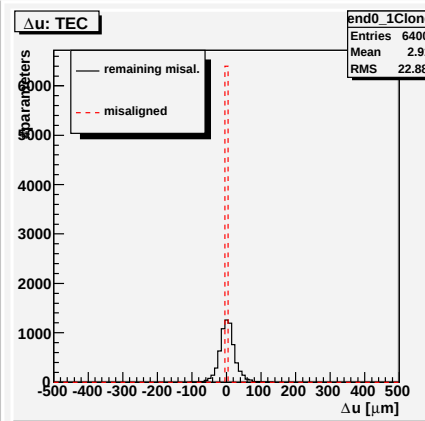
Alignment: TID & TEC

- MB only, TID:



$$\begin{aligned}\Delta u &= 10 \mu\text{m} \\ \Delta v &= 44 \mu\text{m} \\ \Delta \gamma &= 71 \mu\text{rad}\end{aligned}$$

- MB only, TEC:



$$\begin{aligned}\Delta u &= 23 \mu\text{m} \\ \Delta v &= 53 \mu\text{m} \\ \Delta \gamma &= 62 \mu\text{rad}\end{aligned}$$

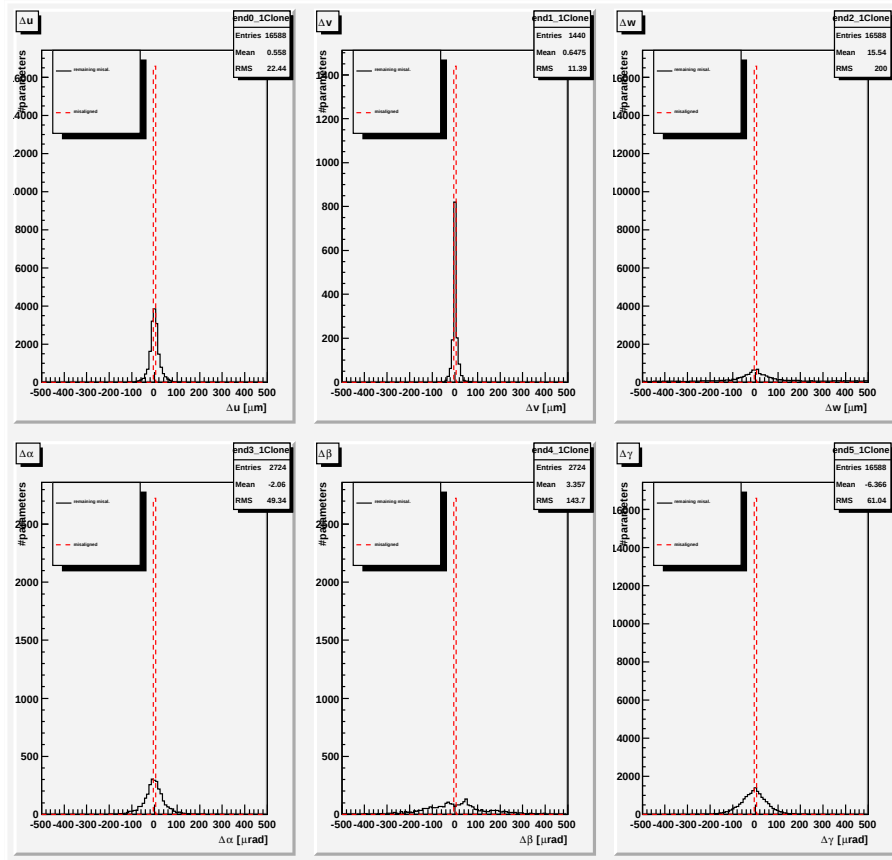
Concluding remarks

- Performed an alignment of tracker to module level, with minimum bias and beam halo, starting from ideal geometry
 - some parameters slightly better, other worse...
- Next steps:
 - decrease pMin in beam halo (eg $10 \rightarrow 5$) to get more tracks
 - align u, v, γ in TID/TEC with MB and BH events
 - if results are encouraging, start from misaligned geometry

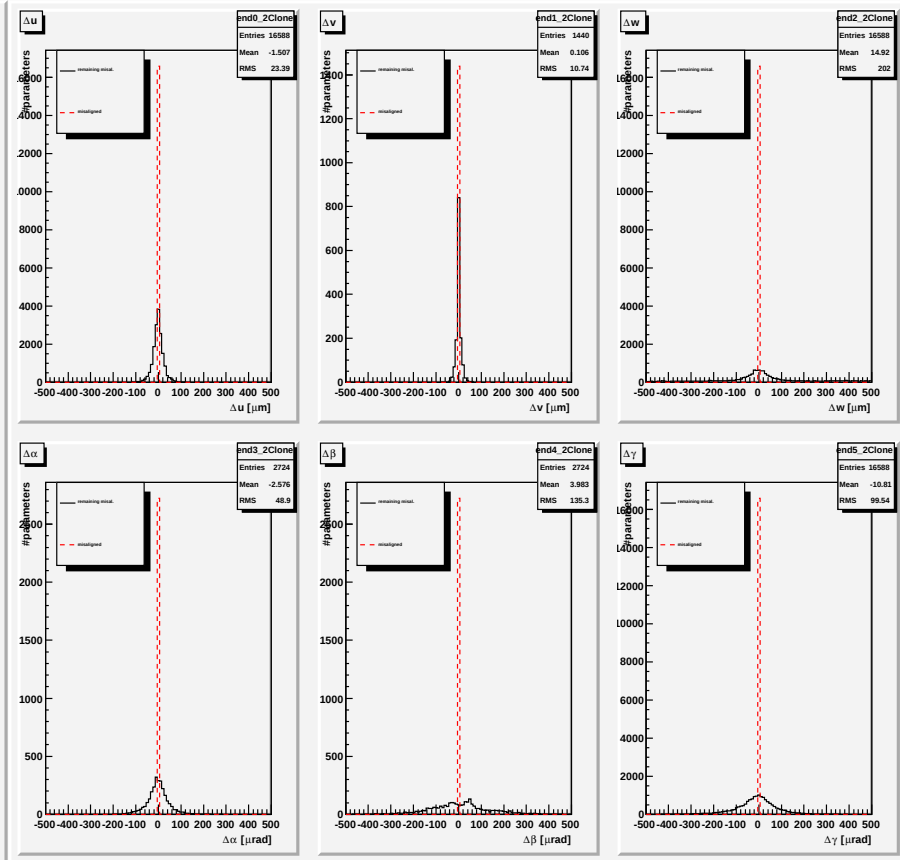
Additional slides

Alignment: all tracker

- MB only:

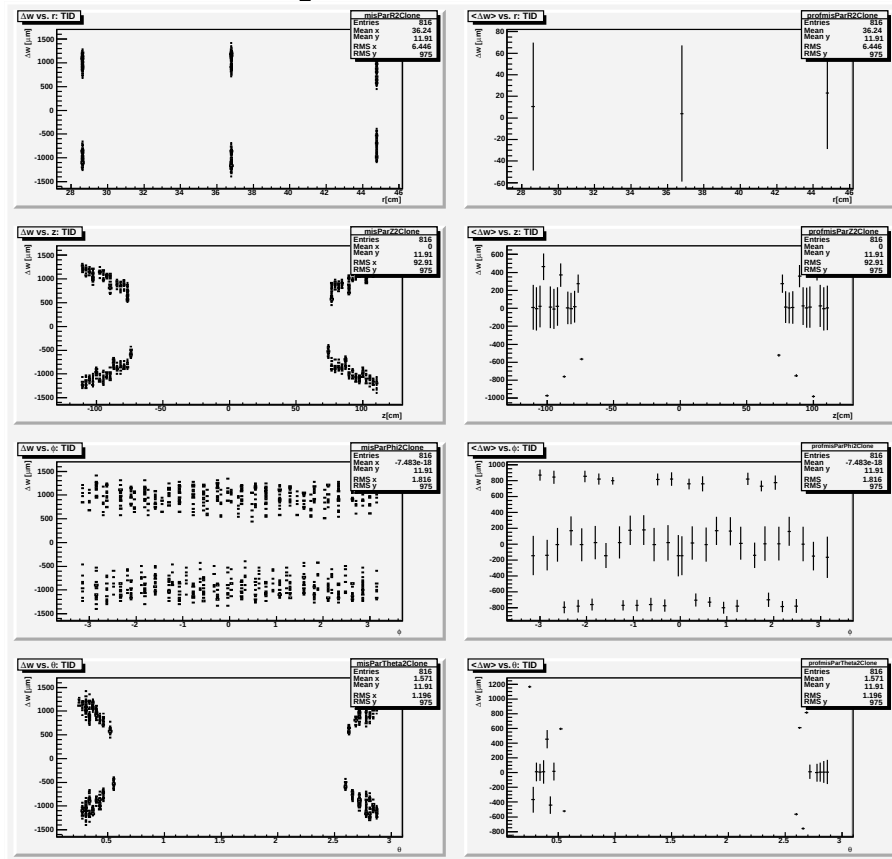


- MB + BH:

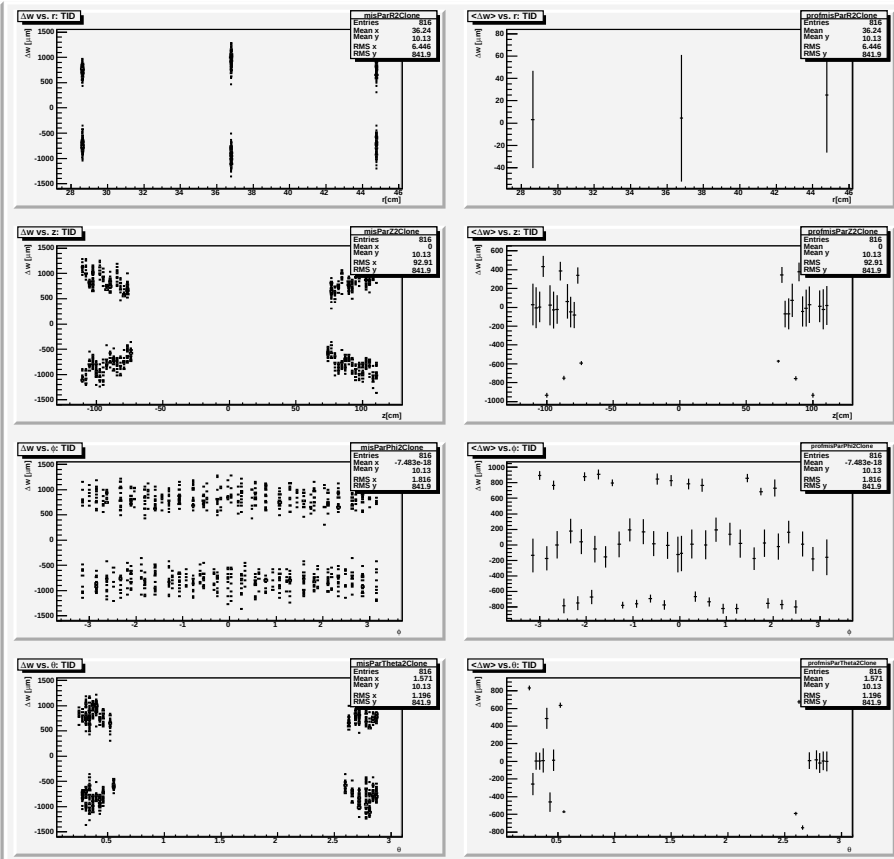


Alignment: TID

- MB only:

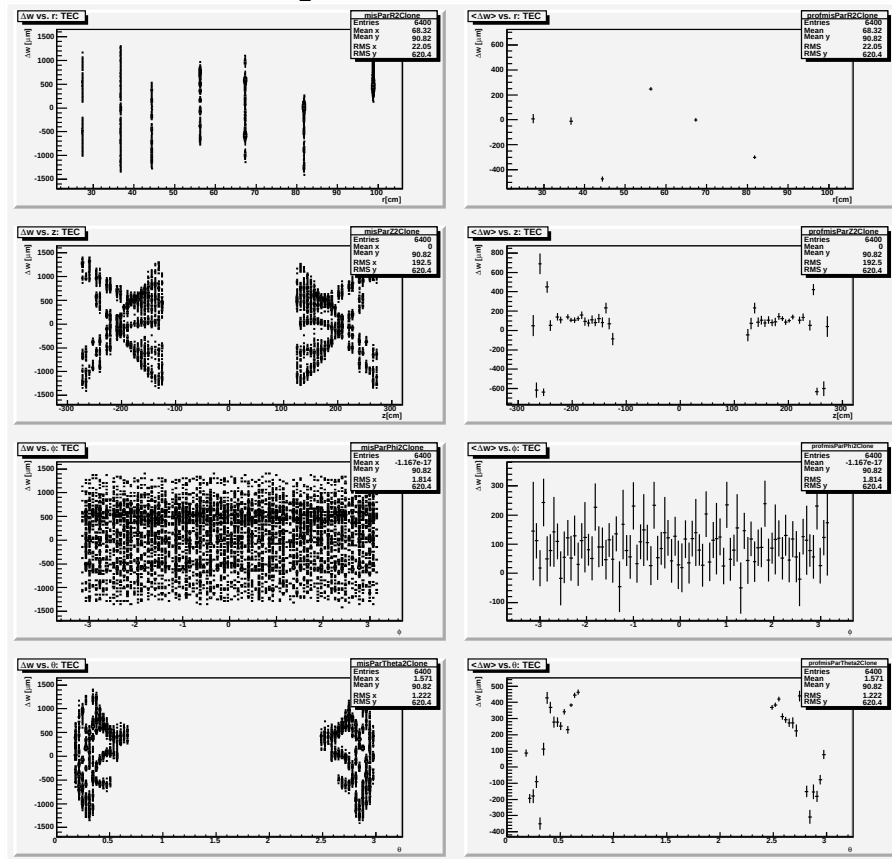


- MB + BH:



Alignment: TEC

- MB only:



- MB + BH:

