

Alignment with beam halo MC

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CMS Tracker Alignment Meeting

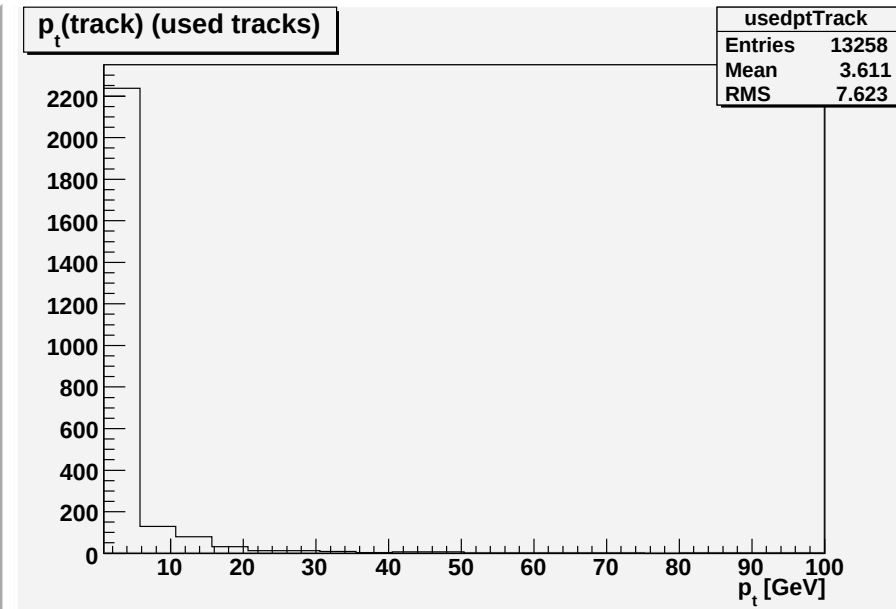
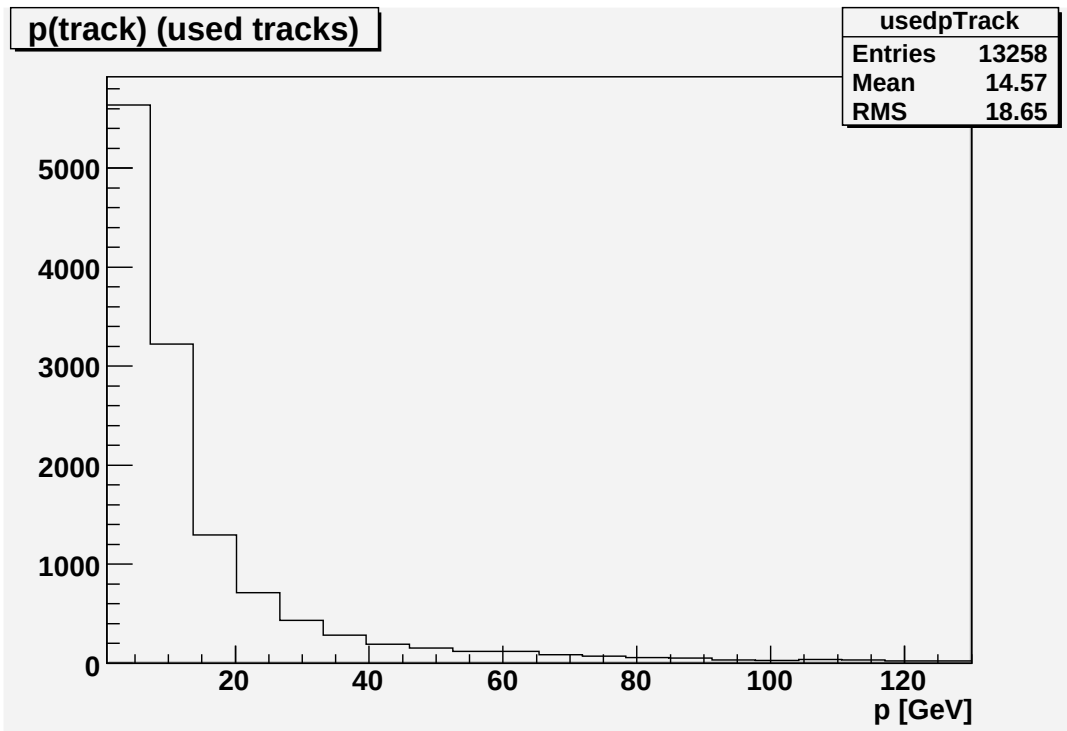
21/07/2009

Outline:

- New Beam Halo (BH) sample
 - Alignment with BH only
- Alignment with Minimum Bias (MB) only
 - Combination of BH & MB

New Beam Halo sample

- Produced with CMSSW 229 by Gaelle
 - ~3 millions events
- Recently transferred at CERN (CAF)
- Some distributions:



Initial geometry and parameters

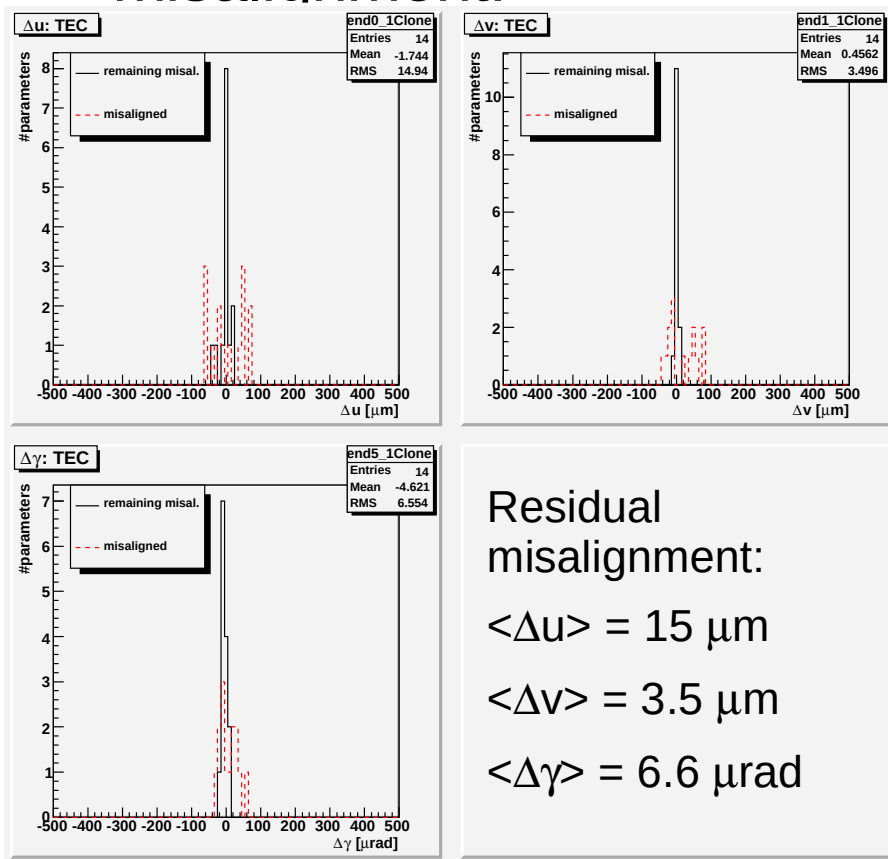
- Alignment is done of High level structures:
'TIDRingsLayers13,110001',
'TrackerTECDiskLayers11,cc000c',
'TrackerTECDiskLayers24,110001',
'TrackerTECDiskLayers55,cc000c',
'TrackerTECDiskLayers69,110001'
- Start from ideal geometry + custom misalignment
 - TIDRings & TECDisks as in 10pbScenario
 - TIDRings: 185 μm (u,v), 850 μrad (γ)
 - TECDisks: 70 μm (u,v), 30 μrad (γ)
 - no misalignment applied on smaller structures, and on the barrel sub-detectors

Alignment with beam halo

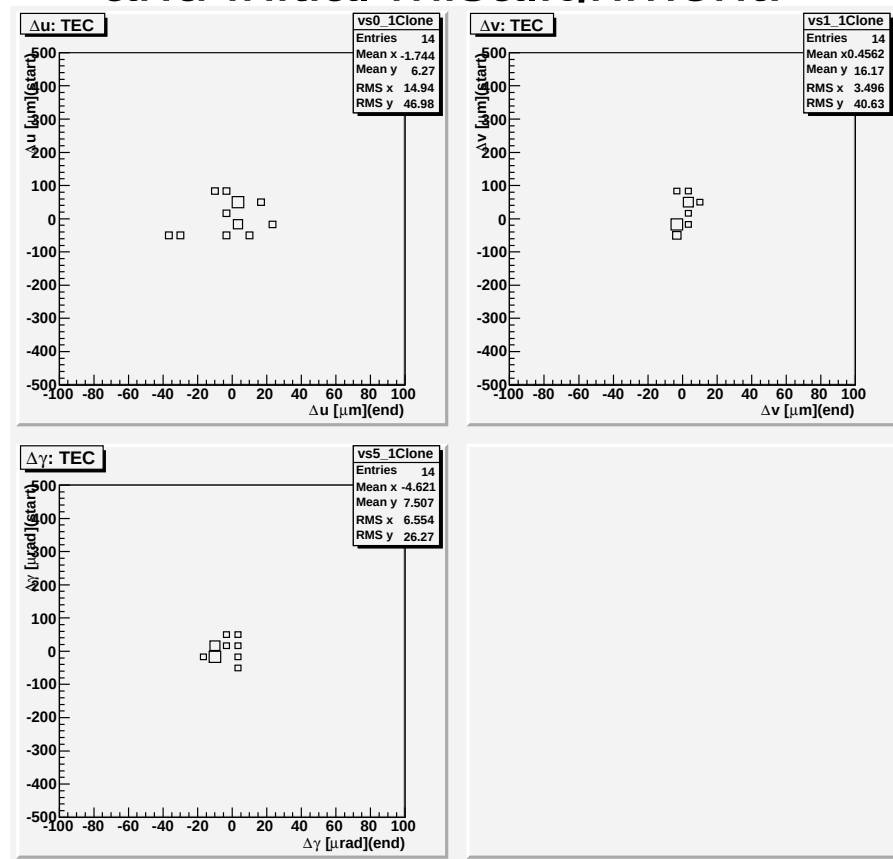
- Finally based on 229 beam halo Monte Carlo!
 - Try first to reproduce 20X results: ~80k events (was ~60k)
- Track collection: ALCARECOTkAlBeamHalo
- Track selection:
 - ptMin = 0. / pMin = 10. (was pMin = 0.)
 - etaMin = -8. / etaMax = +8. (was -999./+999.)
 - nHitMin = 6 / nHitMin2D = 2
 - chi2nMax = 100. (was 50.)
- Nb. of selected tracks: ~13k (was ~31k)

Alignment with BH: TEC results

- Initial and remaining misalignment:

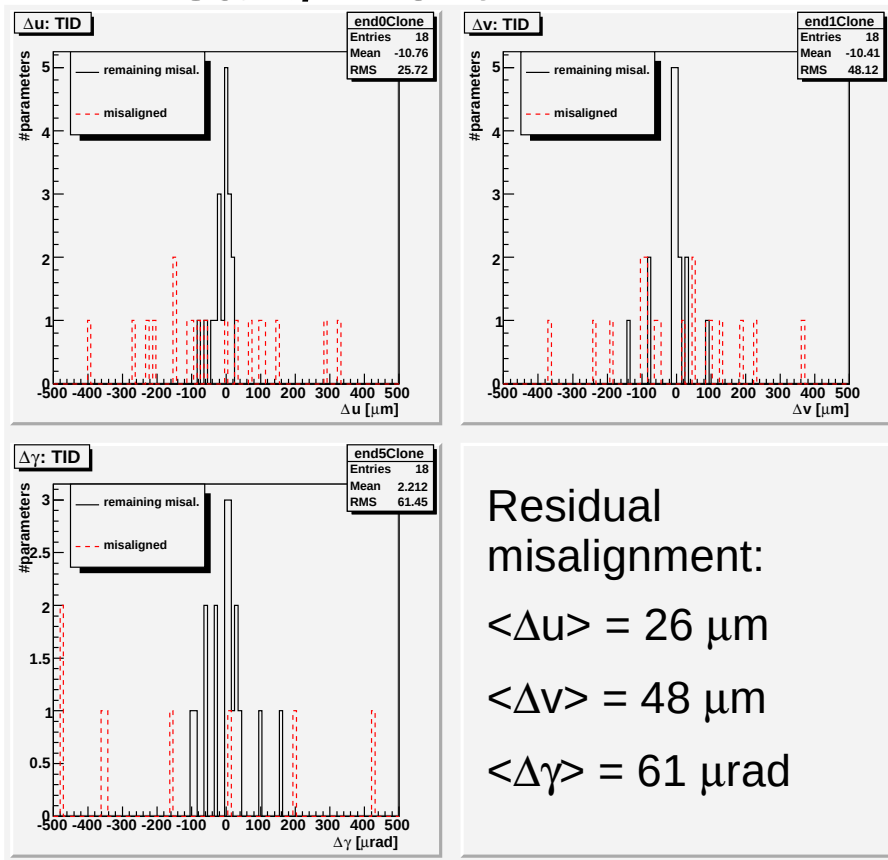


- Correlation of remaining and initial misalignment:



Alignment with BH: TID results

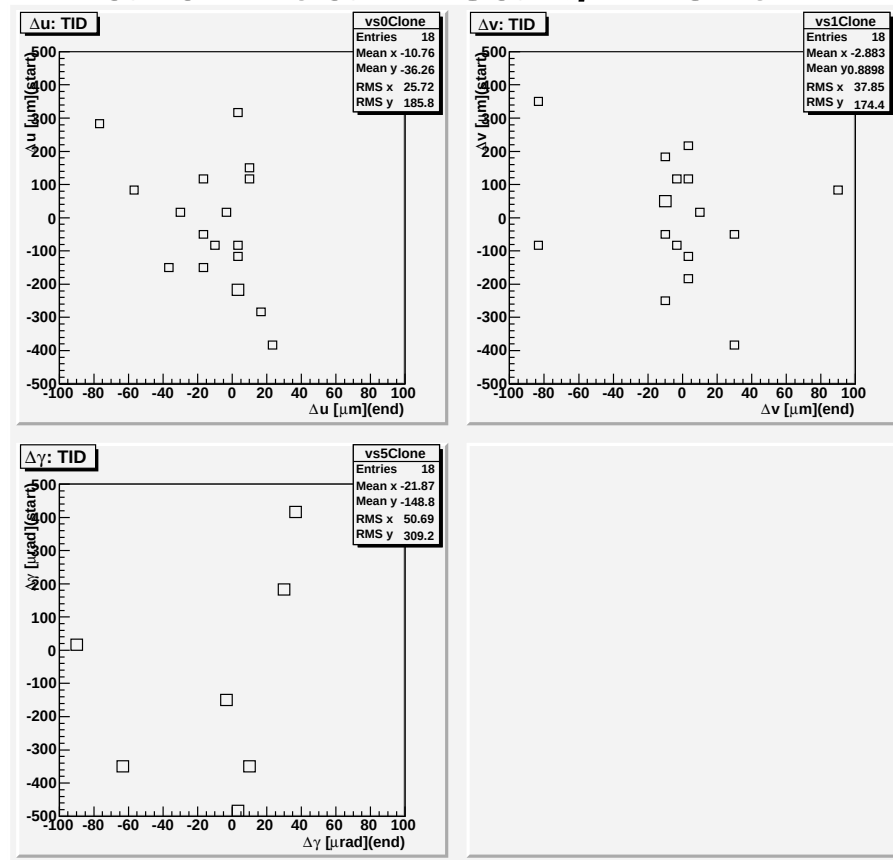
- Initial and remaining misalignment:



Residual misalignment:

$$\begin{aligned}\langle \Delta u \rangle &= 26 \mu\text{m} \\ \langle \Delta v \rangle &= 48 \mu\text{m} \\ \langle \Delta \gamma \rangle &= 61 \mu\text{rad}\end{aligned}$$

- Correlation of remaining and initial misalignment:

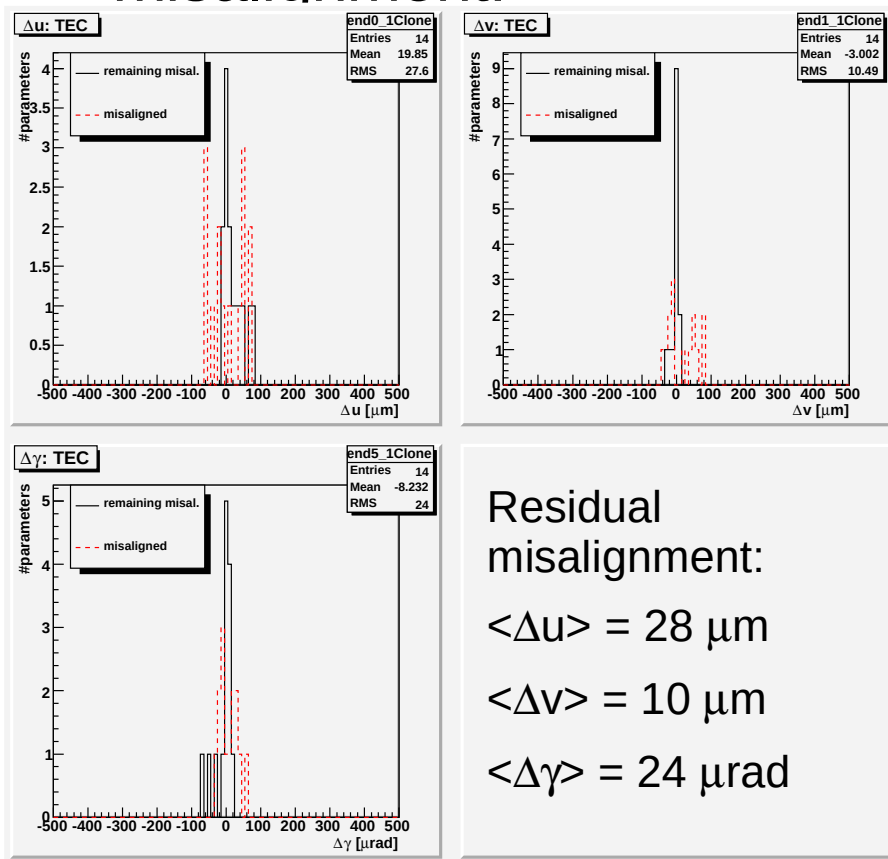


Alignment with Minimum Bias

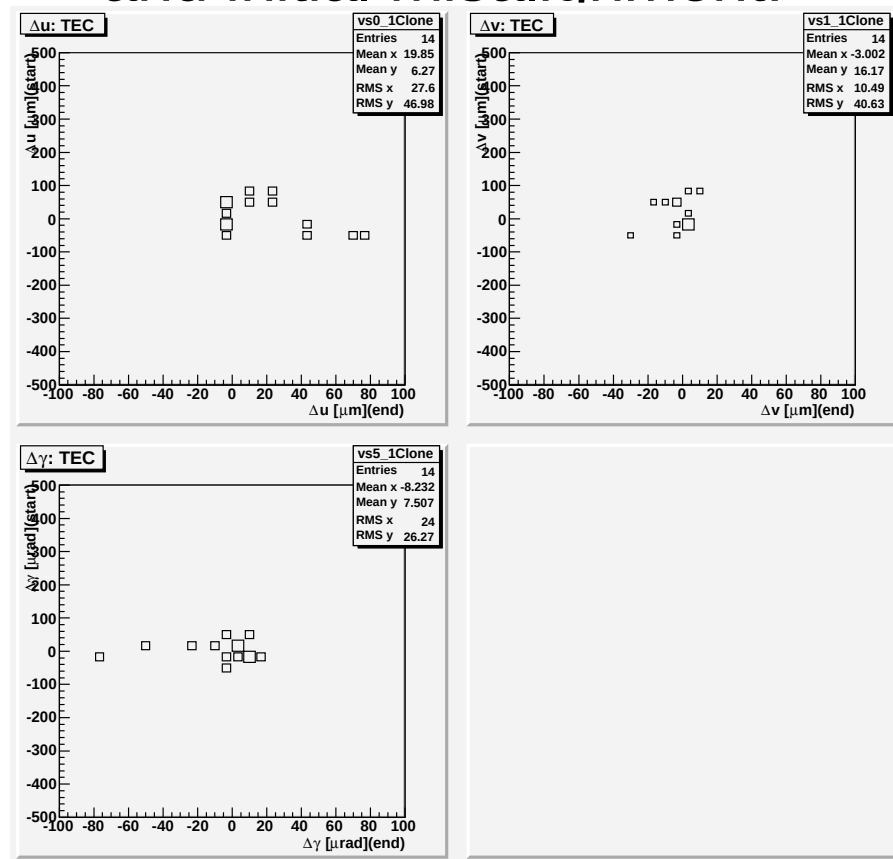
- Based on 22X Monte Carlo
 - expected similar rate as Beam Halo... using 320k events (was 175k)
- Track collection: ALCARECOTkAlMinBias
- Track selection:
 - $pt_{Min} = 1.5$
 - $eta_{Min} = -10.$ / $eta_{Max} = +10.$
 - $nHit_{Min} = 8$ / $nHit_{Min2D} = 2$
 - $chi2n_{Max} = 100.$ (was 50.)
- Nb. of selected tracks: $\sim 325k$ (25x beam halo tracks)

Alignment with MB: TEC results

- Initial and remaining misalignment:

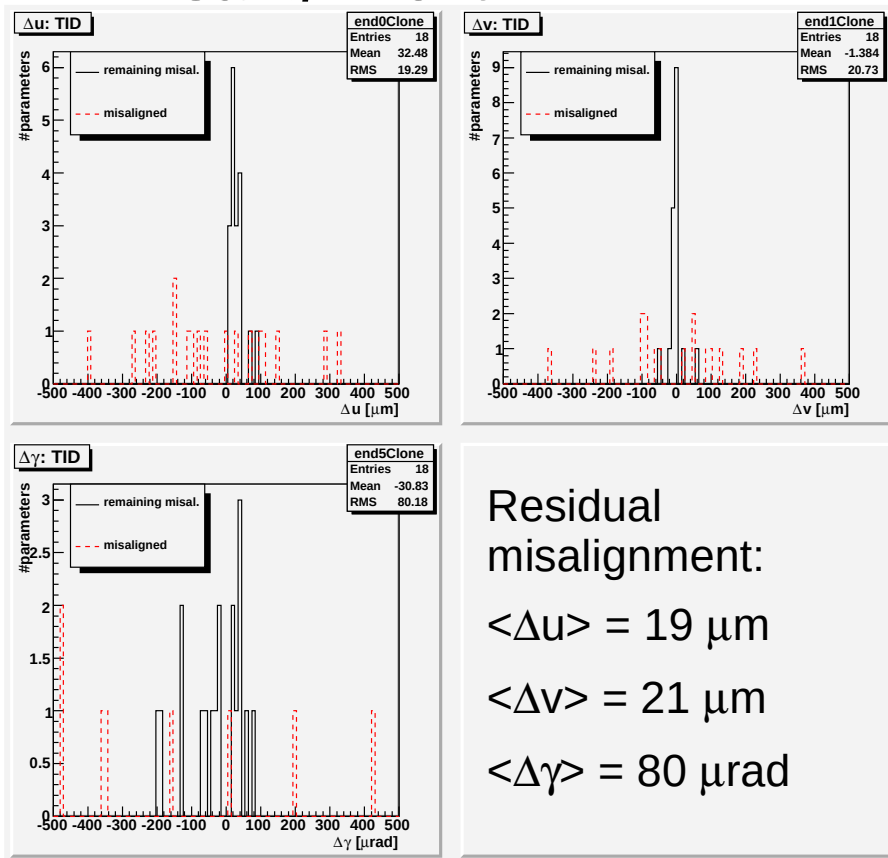


- Correlation of remaining and initial misalignment:



Alignment with MB: TID results

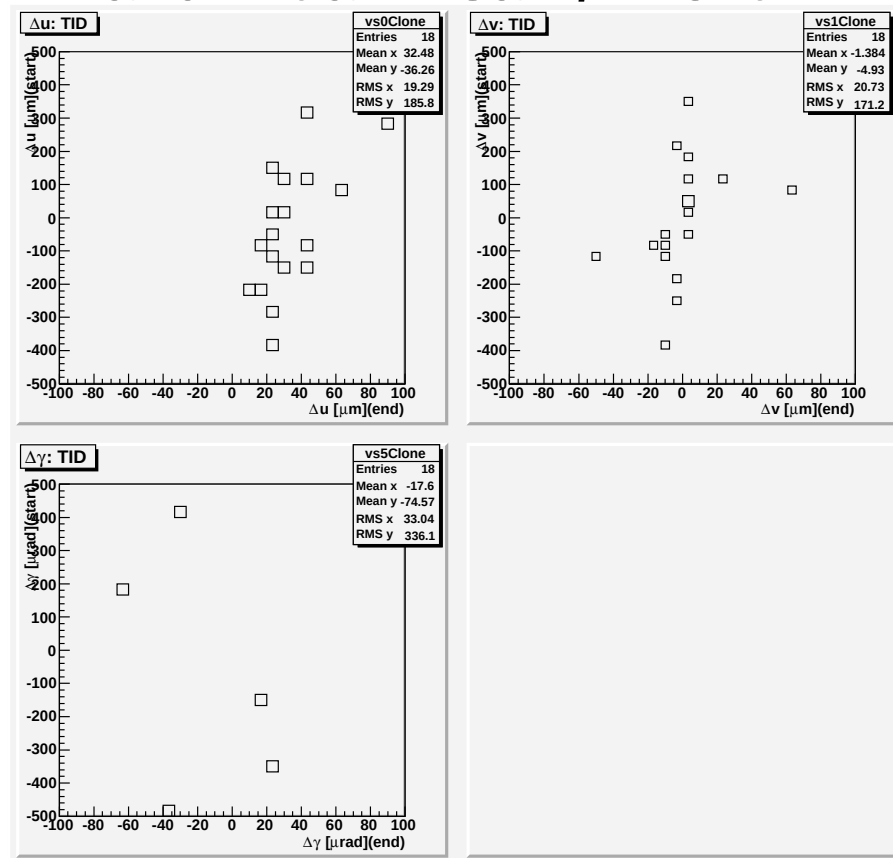
- Initial and remaining misalignment:



Residual misalignment:

$$\begin{aligned}\langle \Delta u \rangle &= 19 \mu\text{m} \\ \langle \Delta v \rangle &= 21 \mu\text{m} \\ \langle \Delta \gamma \rangle &= 80 \mu\text{rad}\end{aligned}$$

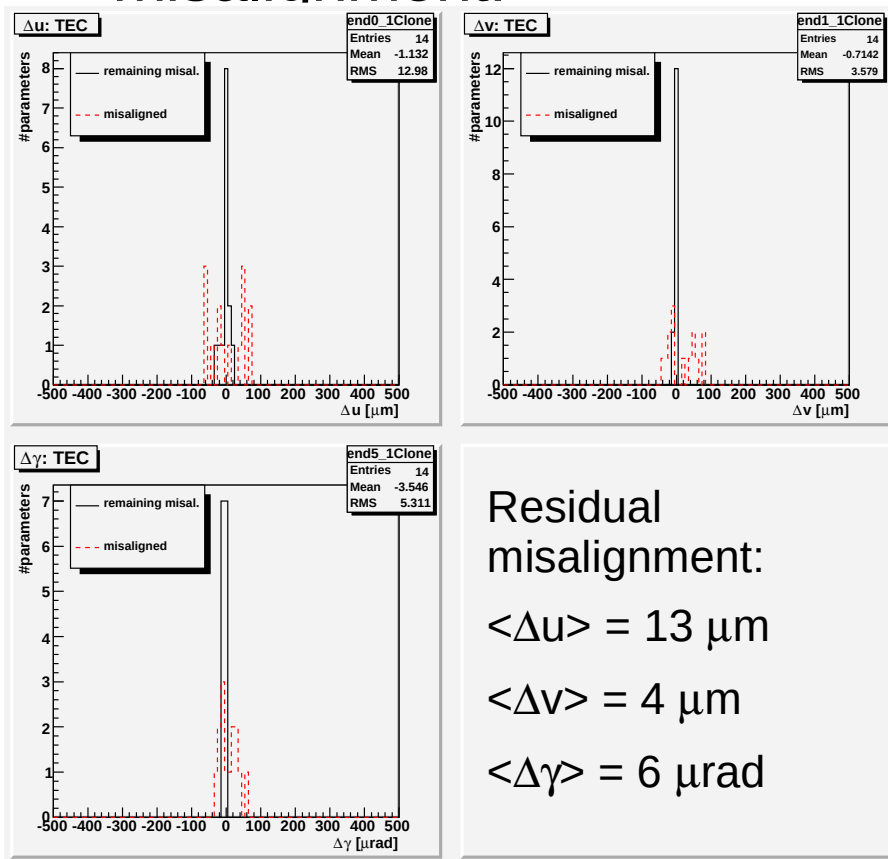
- Correlation of remaining and initial misalignment:



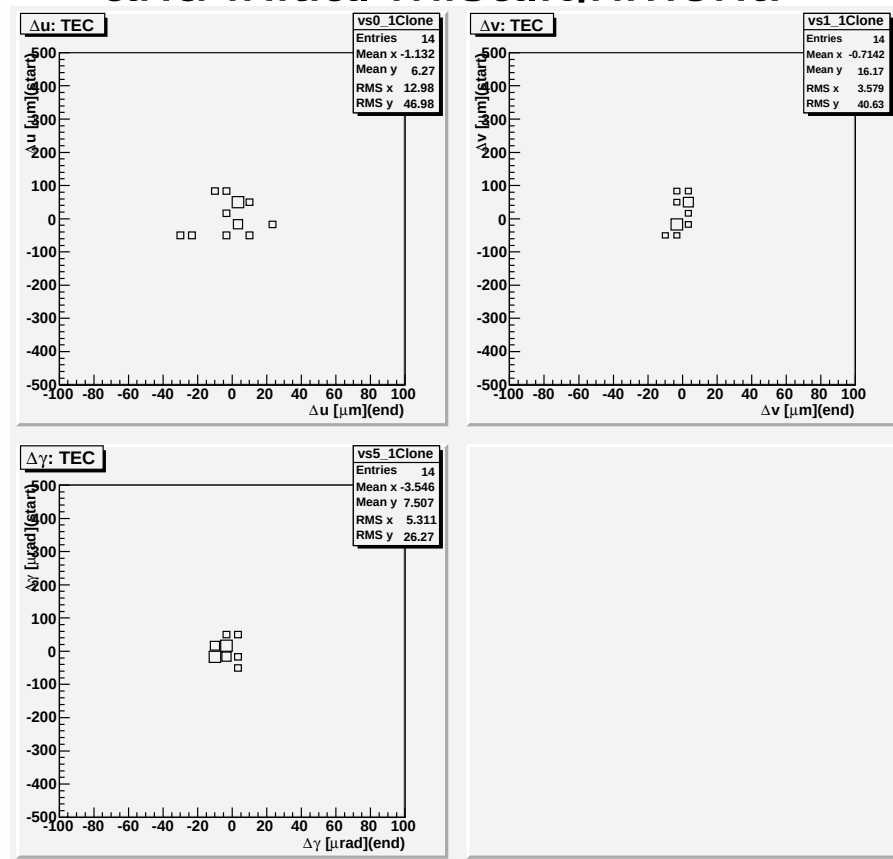
Alignment with Beam Halo + Minimum Bias

Alignment with BH+MB: TEC results

- Initial and remaining misalignment:

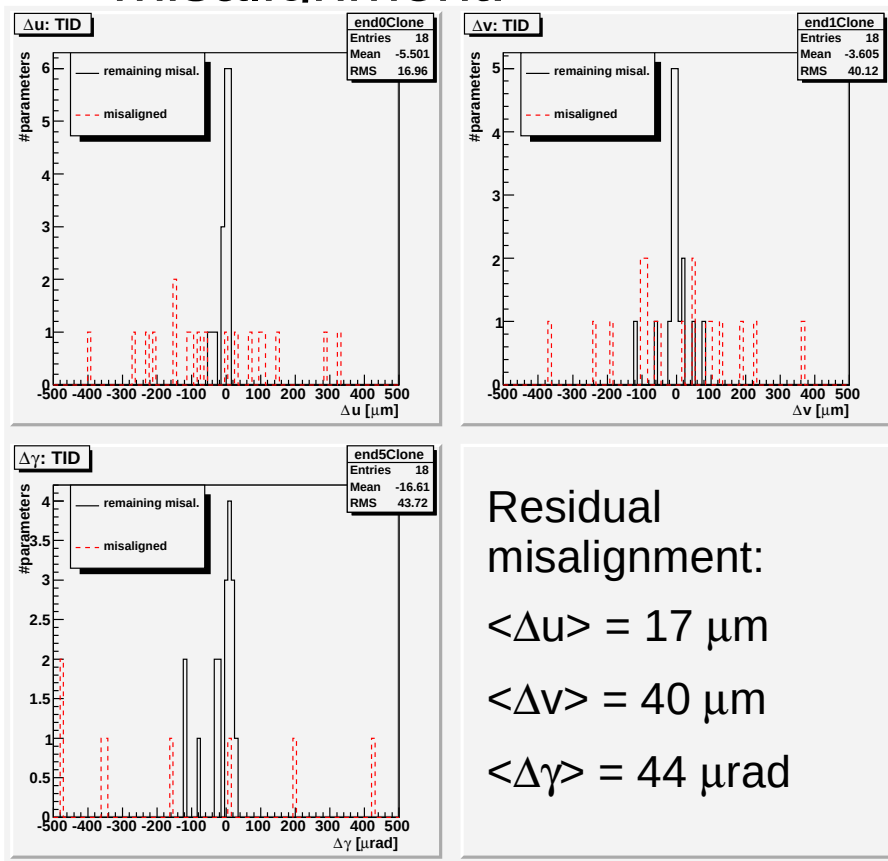


- Correlation of remaining and initial misalignment:

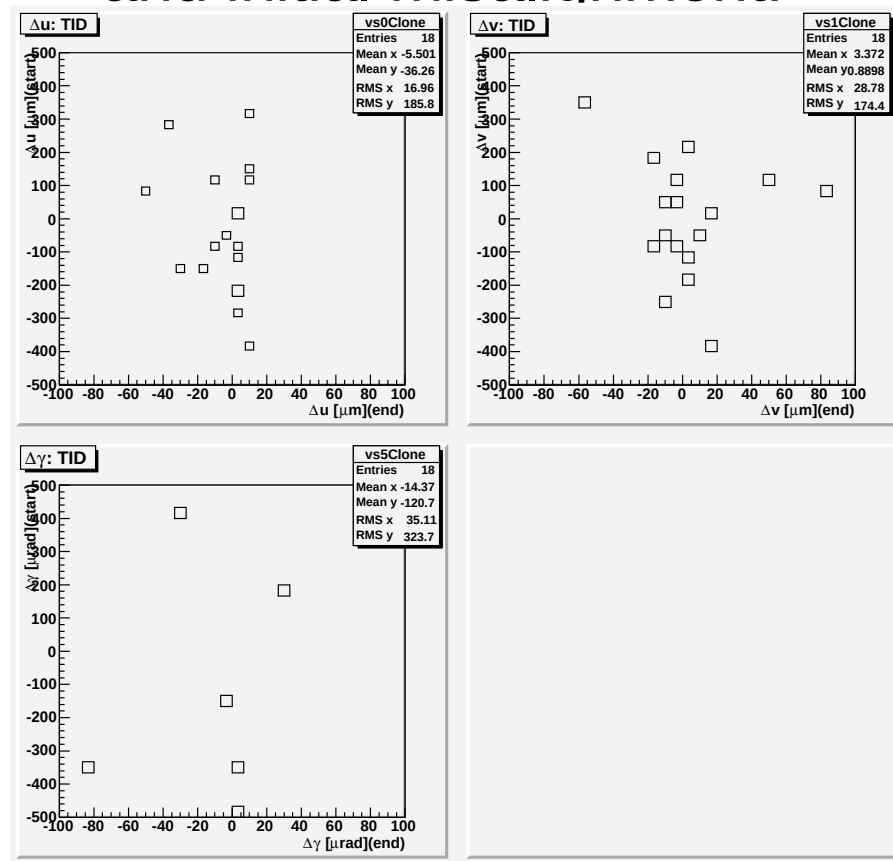


Alignment with BH+MB: TID results

- Initial and remaining misalignment:



- Correlation of remaining and initial misalignment:



Comparison of the results

	$\langle \Delta u \rangle$ TID	$\langle \Delta v \rangle$ TID	$\langle \Delta \gamma \rangle$ TID	$\langle \gamma \rangle$ TID	$\langle \Delta u \rangle$ TEC	$\langle \Delta v \rangle$ TEC	$\langle \Delta \gamma \rangle$ TEC
Starting	185	185	850	-	70	70	30
BH only	26	48	61	2	15	3.5	6.6
MB only	19	21	80	-31	19	21	80
BH+MB	17	40	44	-17	13	4	6

NEW
(229)

	$\langle \Delta u \rangle$ TID	$\langle \Delta v \rangle$ TID	$\langle \Delta \gamma \rangle$ TID	$\langle \gamma \rangle$ TID	$\langle \Delta u \rangle$ TEC	$\langle \Delta v \rangle$ TEC	$\langle \Delta \gamma \rangle$ TEC
Starting	185	185	850	-	70	70	30
BH only	59	20	107	67	2	11	10
MB only	12	13	141	148	10	11	17
BH+MB	7	2	13	-	2	10	4

OLD
(20X)

- Similar results for TEC (dominated by BH)
- Somehow worse results for TID

Conclusions

- Finally a big sample is available of beam halo MC events (~3 millions) in CMSSW 229.
- Minimum bias and beam halo MC events have been used for tracker end-cap alignment (mixed according to the expected rate).
- As in the studies with 20X samples, beam halo events improve a alignment of end-caps with respect to minimum bias only.
- The study has been done on high-level structures only, now I will try with lower-level structures.