New alignments updates 2016 0.5 mm alignment

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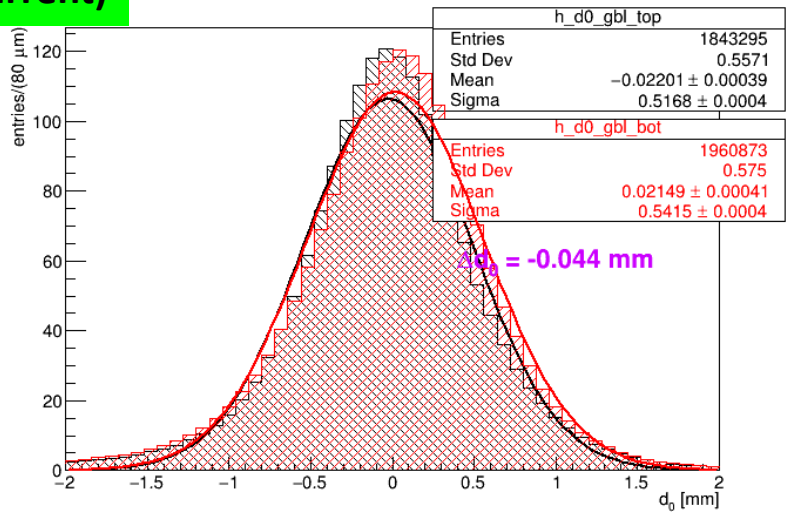
March 26, 2018

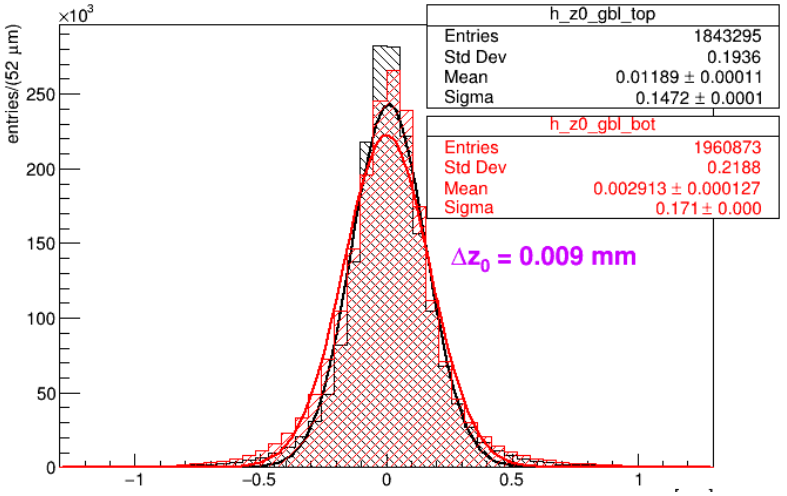
2016 data @ 0.5 mm alignment

- Need to improve currently available detector (v 5.3)
- Start from scratch following the steps used for 2015 data + additional sensors free to float (max 2 at a time)
  - Curved + straight tracks
  - Two independent versions: my own + Mariangela's
    - Merged to get the best of the two (Mariangela's works better for bottom tracks)
- 2-3 final versions to compare with current one
- Need to check final resolution to decide which is the best one
  - Still not perfect: sensor 4 problematic as ever

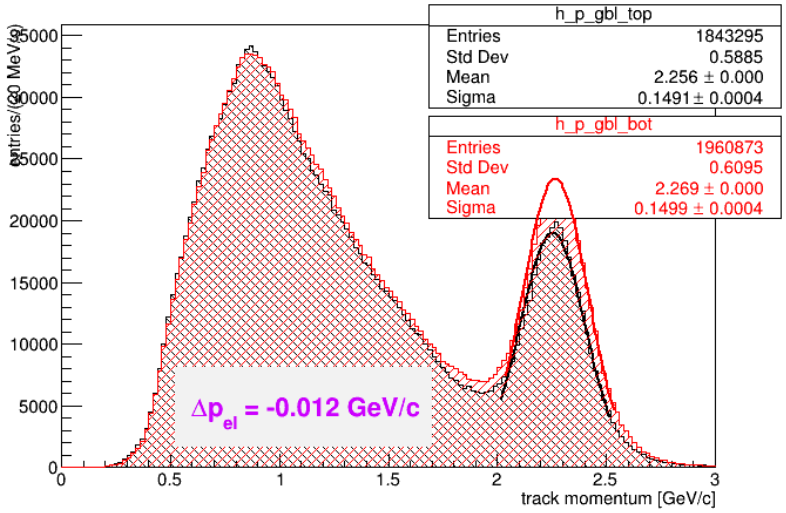
OLD
(current)

2016 current geometry (v5.3) w fieldmap, 0.5mm
curved + straight tracks + global alignment



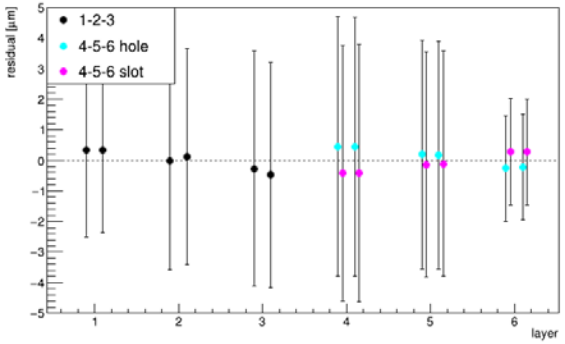


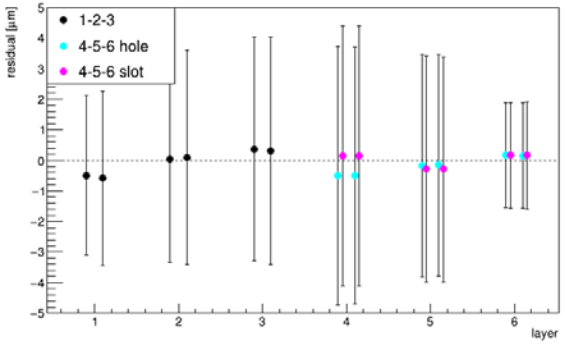
No cut on track χ^2



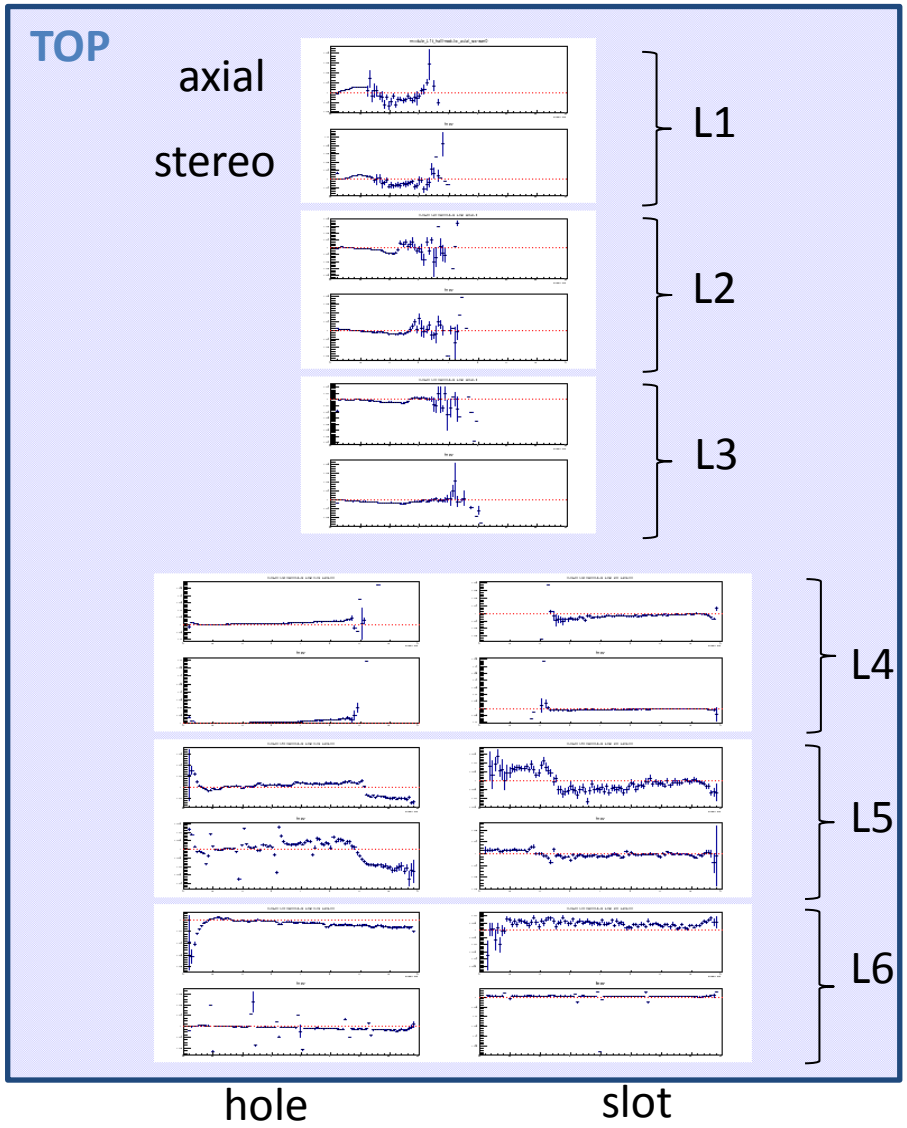
T/B diff
Δd_0 = 44 μm
Δz_0 = 9 μm
Δp = -12 MeV/c

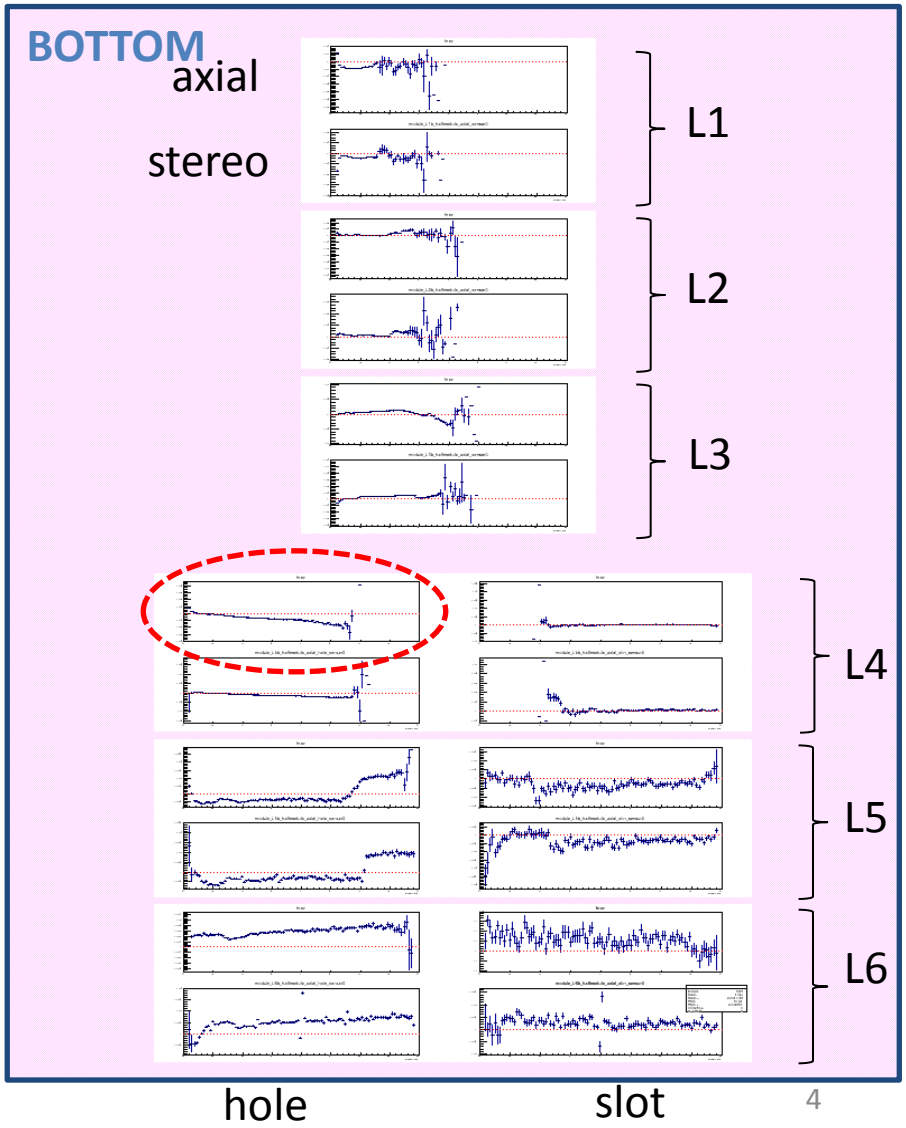
p_{top} = 2.256 MeV/c
p_{bot} = 2.269 MeV/c



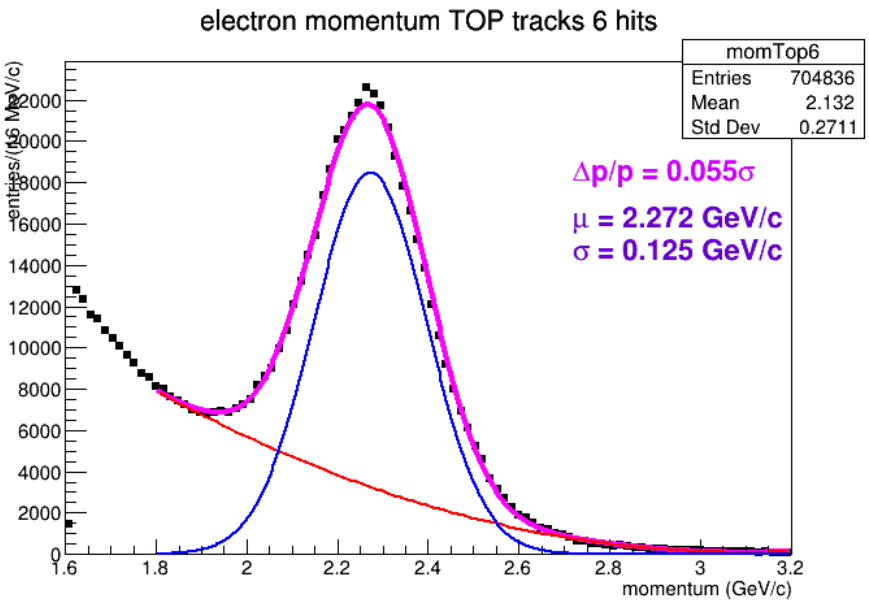


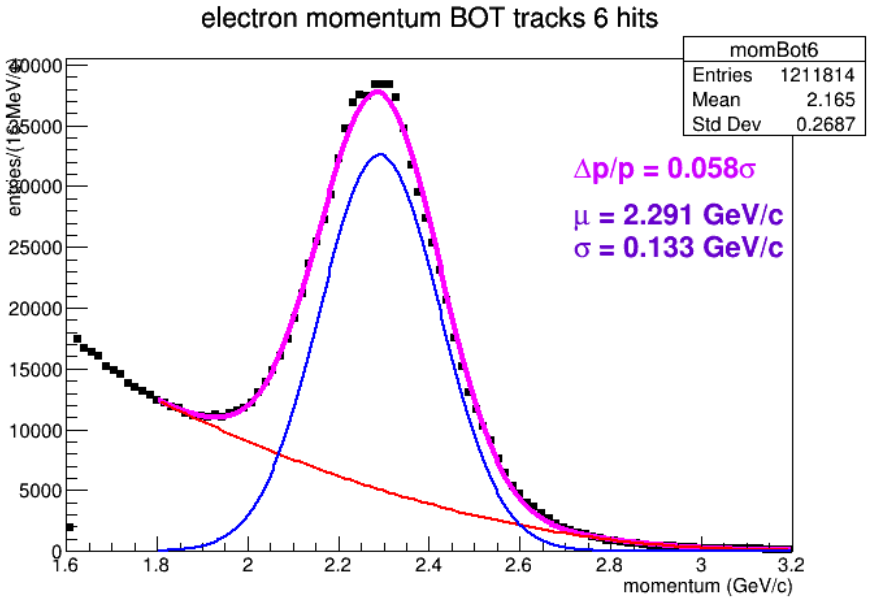
Current best geometry 2016 (v5.3)
GBL u residuals vs v position, curved tracks



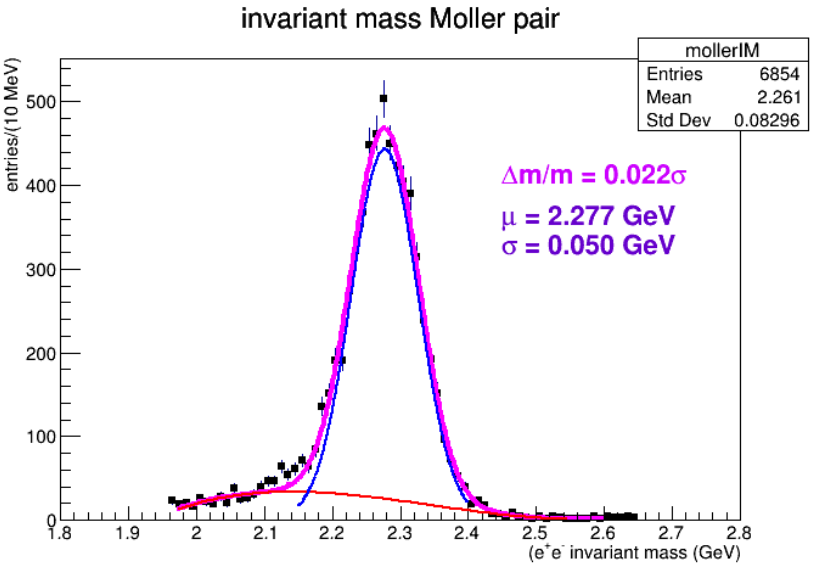


Current best geometry 2016 (v5.3)
Resolution on elastic events

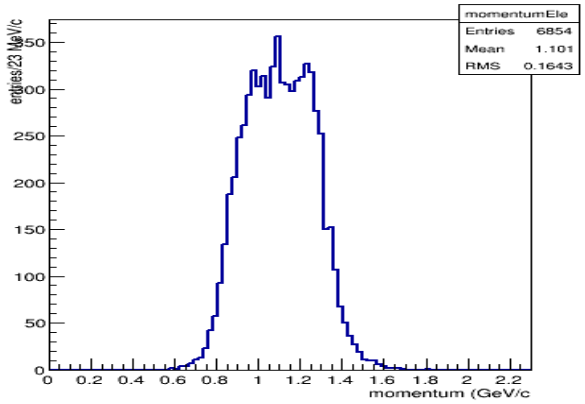




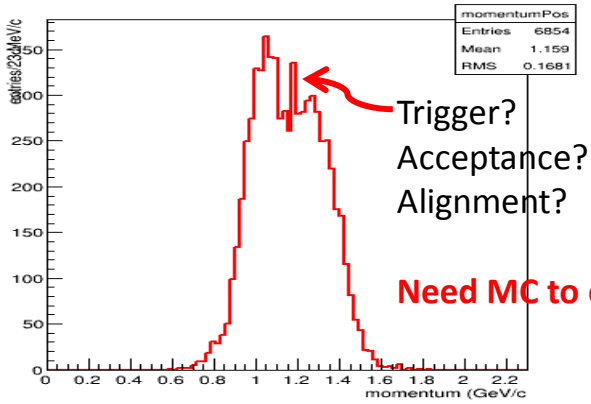
Current best geometry 2016 (v5.3) Resolution on Moller events



Momentum top electron



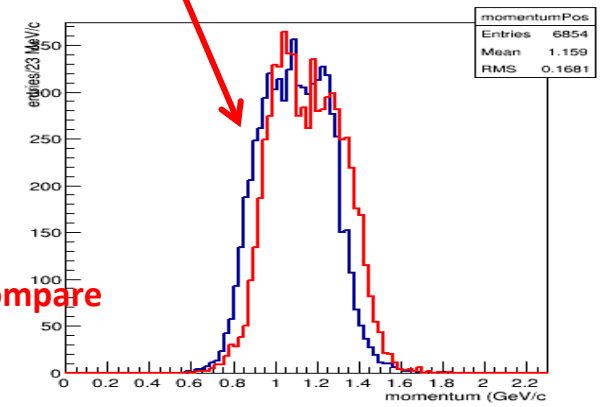
Momentum bottom electron



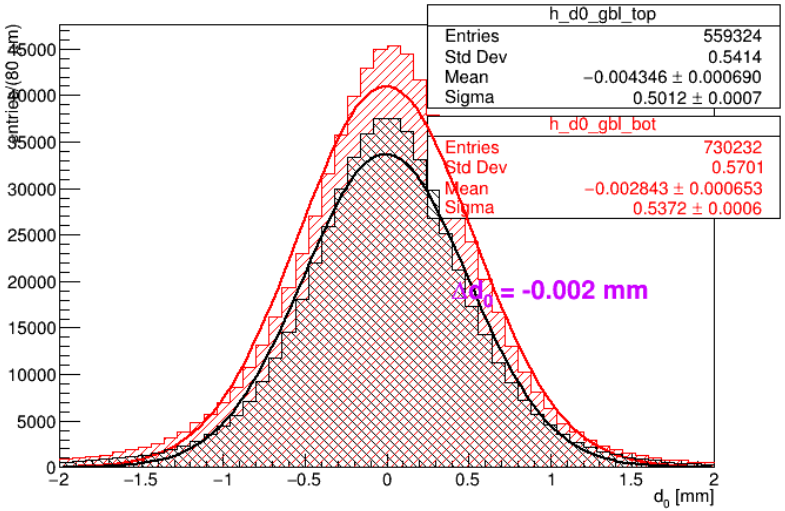
Trigger?
Acceptance?
Alignment?

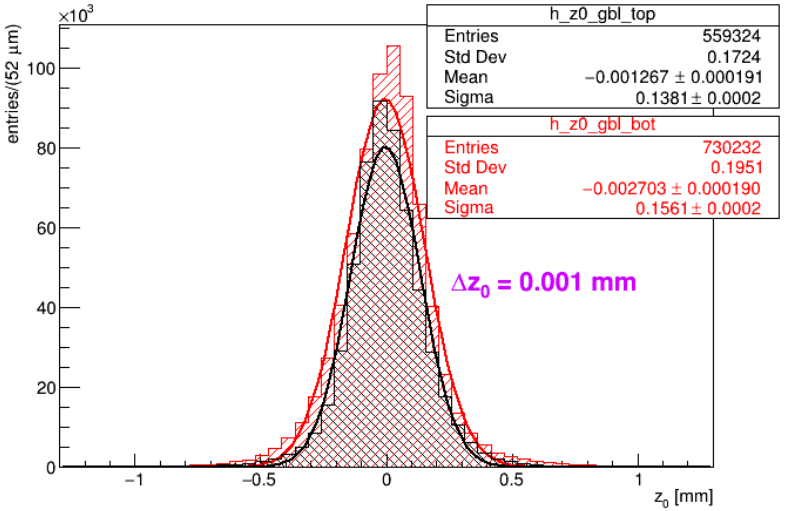
Need MC to compare

This must be alignment, still



v5.7 detector w fieldmap, 0.5mm
curved + straight tracks + global alignment

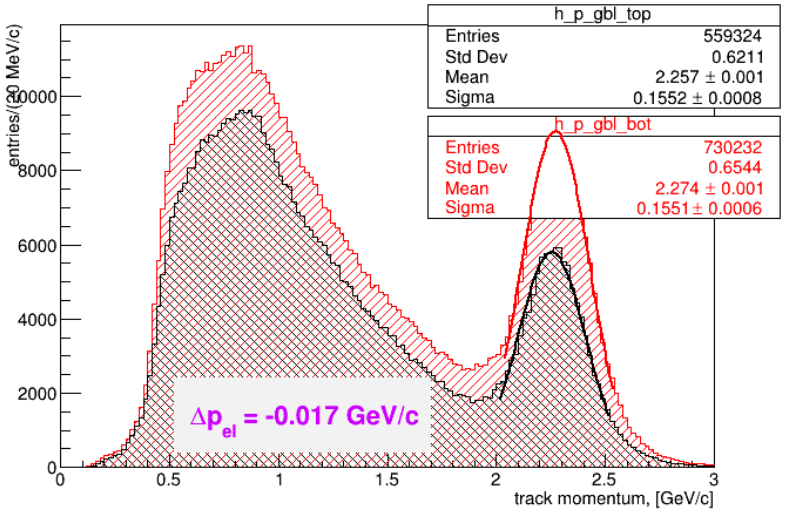


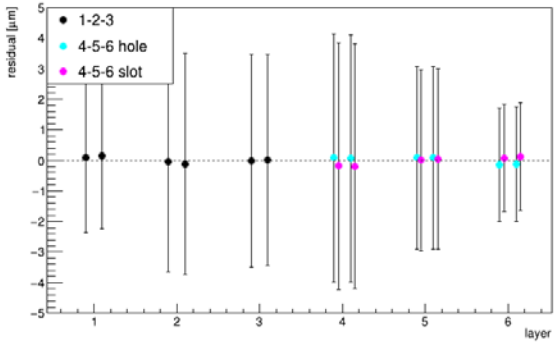


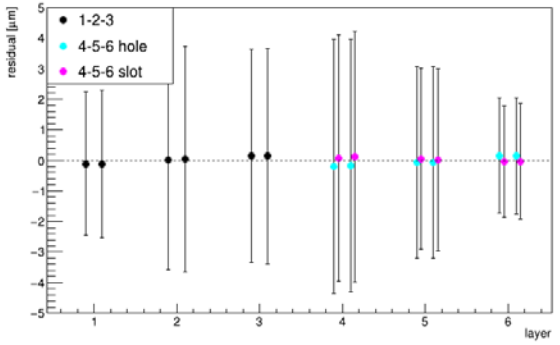
Cut on track χ^2 (<40)

T/B diff
Δd_0 = 2 μm
Δz_0 = 1 μm
Δp = -17 MeV/c

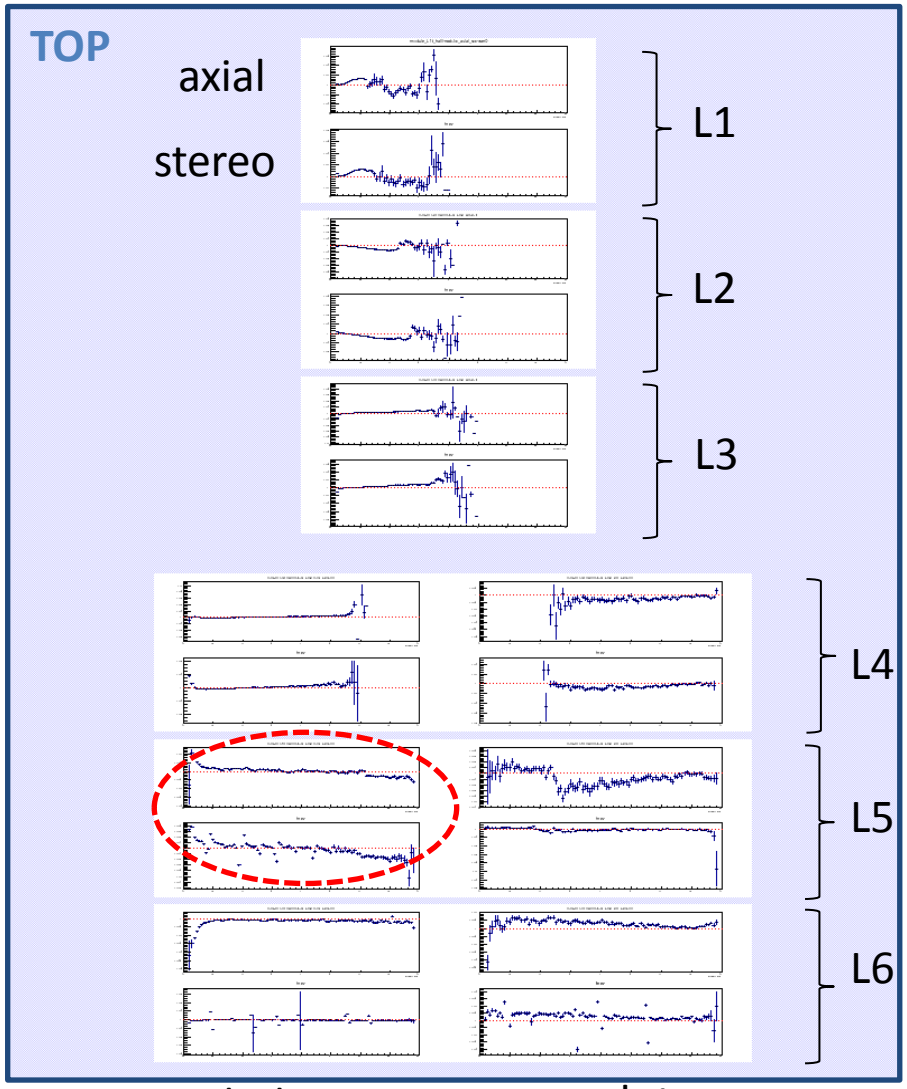
p_{top} = 2.257 MeV/c
p_{bot} = 2.274 MeV/c

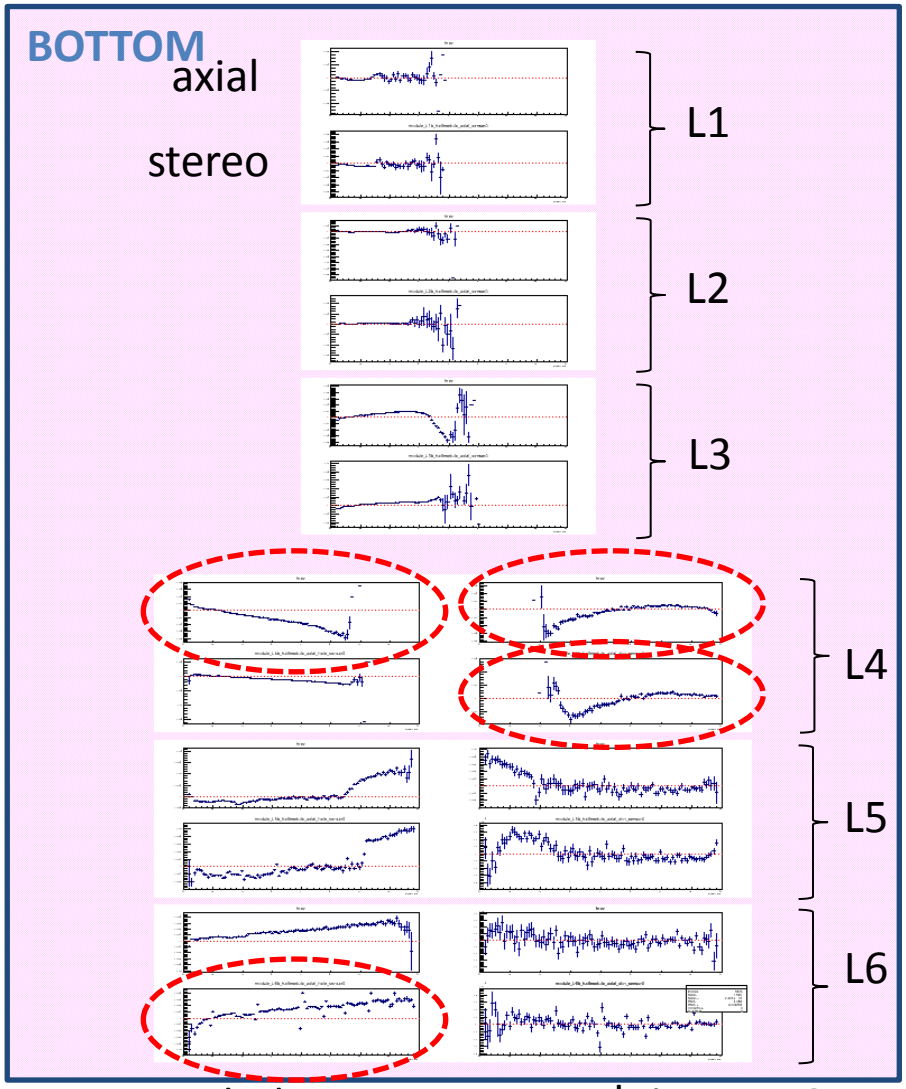




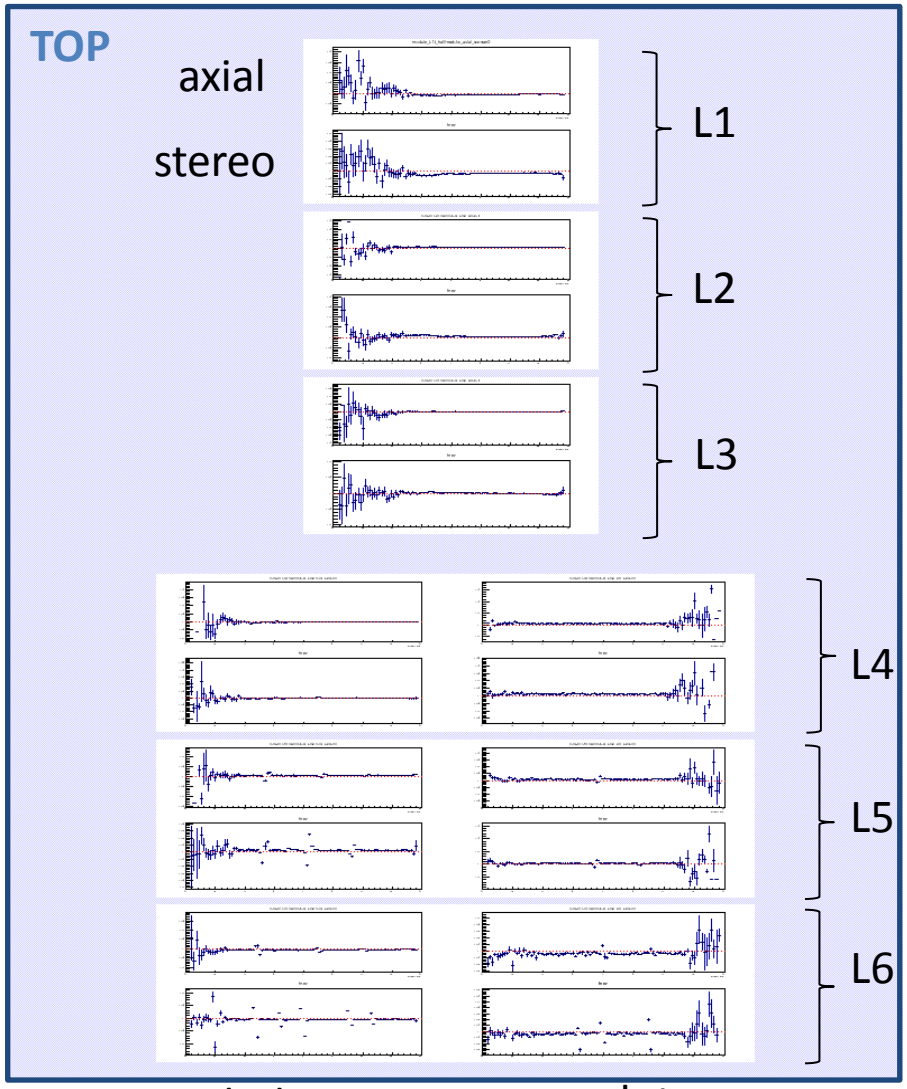


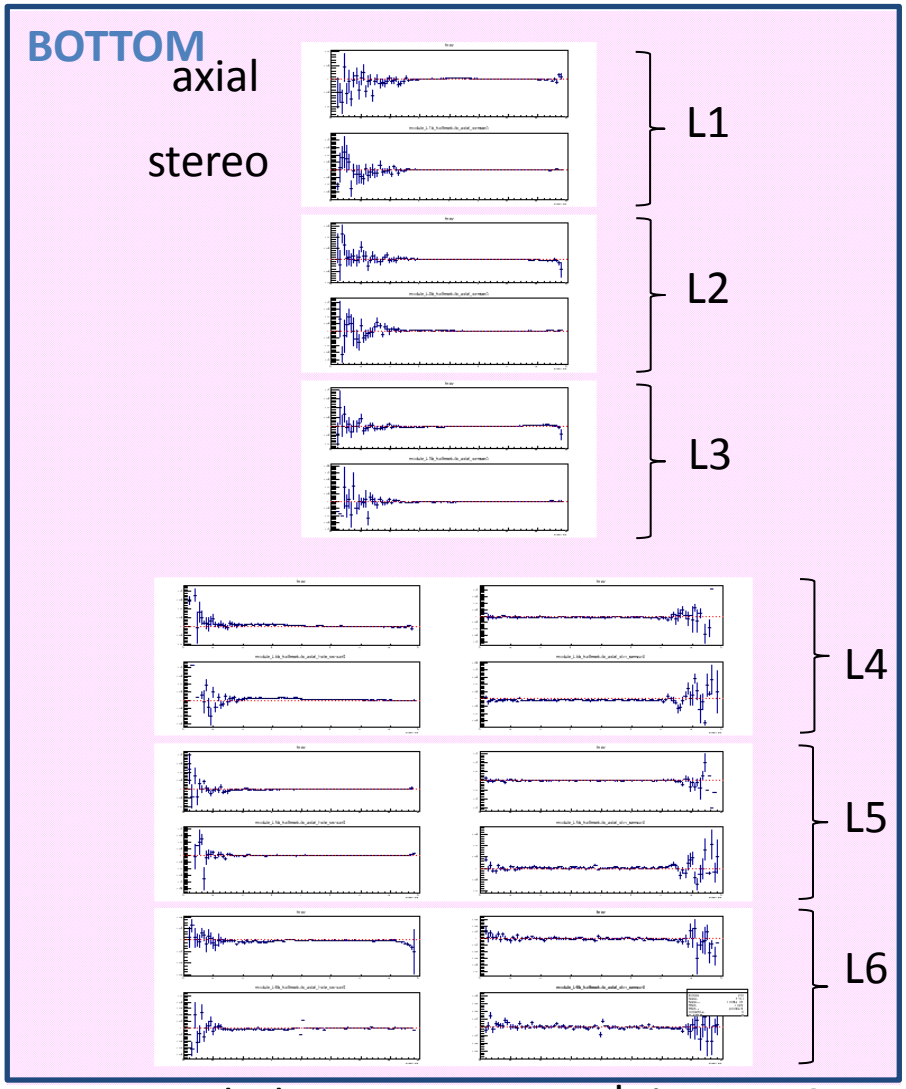
V5.7 detector 2017
GBL u residuals vs v position, curved tracks



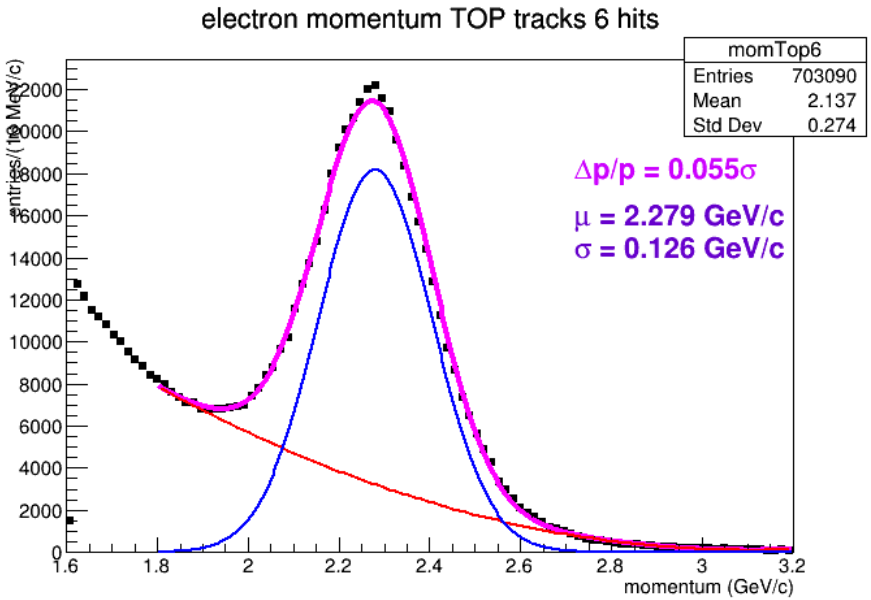


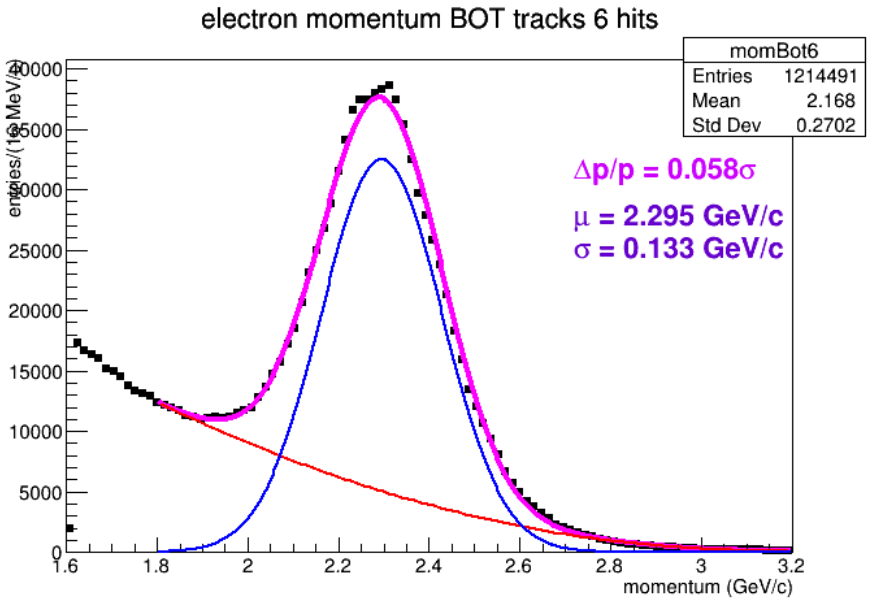
V5.7 2016 detector
GBL u residuals vs v position, straight tracks



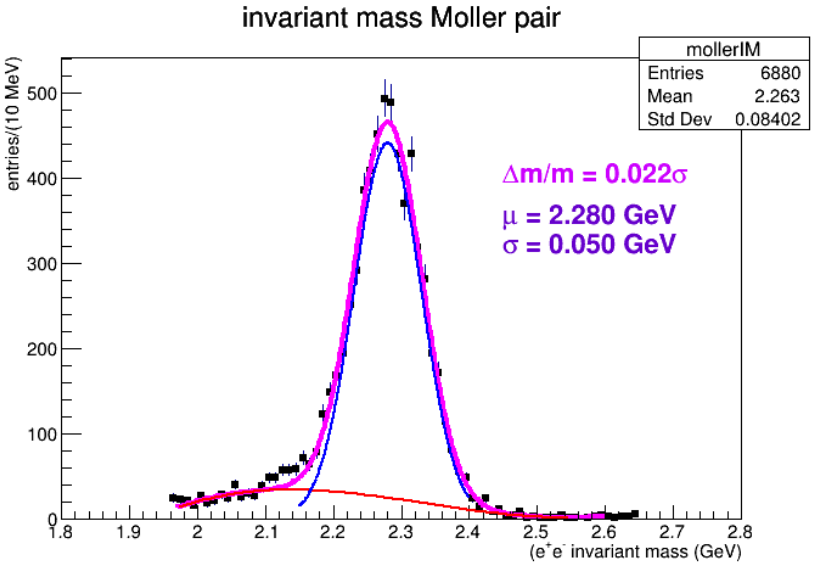


New detector 2016 v5.7
Resolution on elastic events



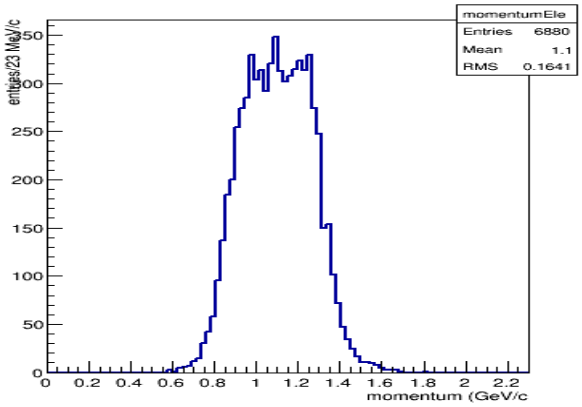


Current best geometry 2016 (v5.7) Resolution on Moller events

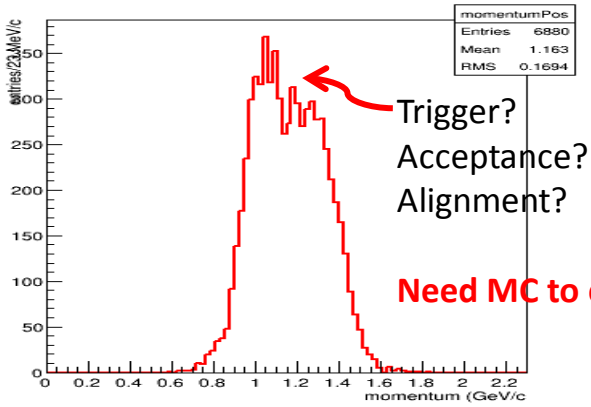


This must be alignment, still

Momentum top electron

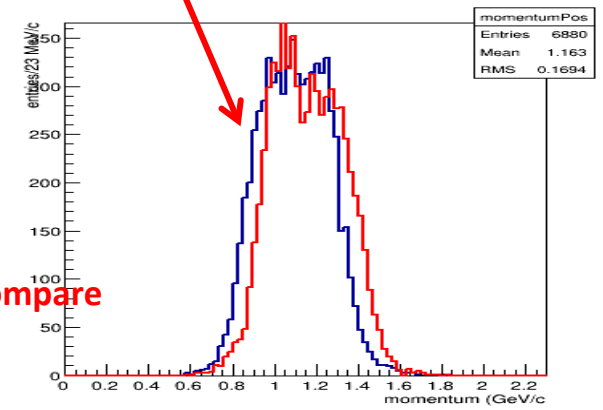


Momentum bottom electron

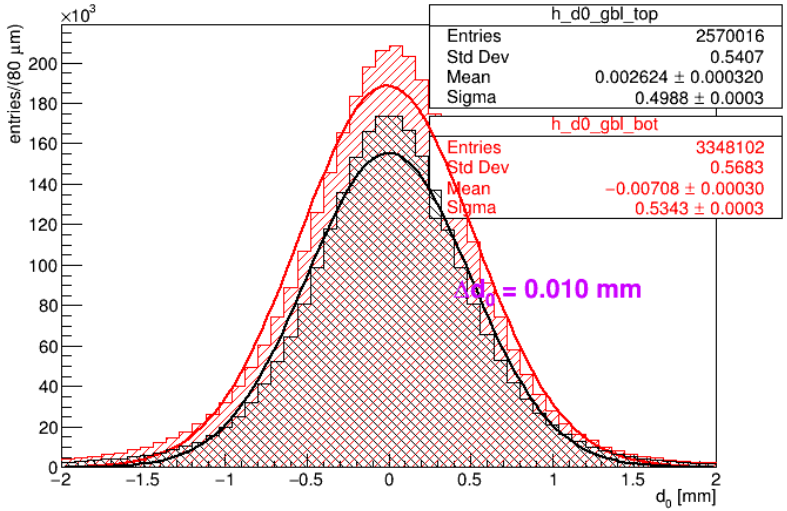


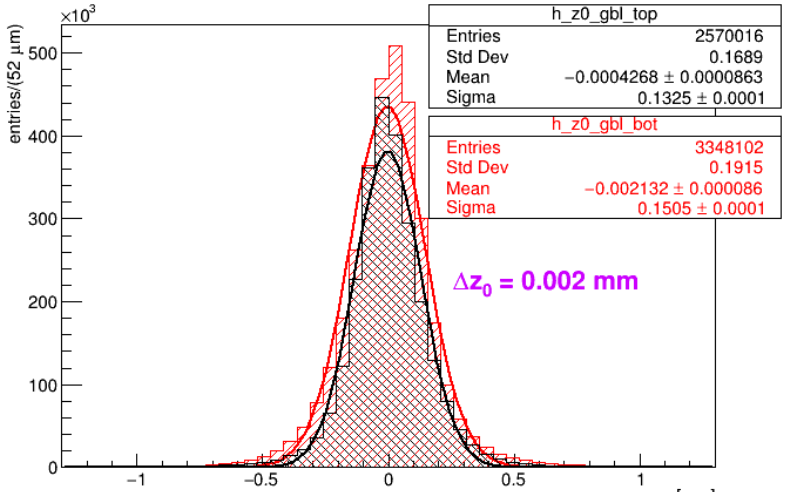
Trigger?
Acceptance?
Alignment?

Need MC to compare



V5.11 2016 detector w fieldmap, 0.5mm
curved + straight tracks + global alignment

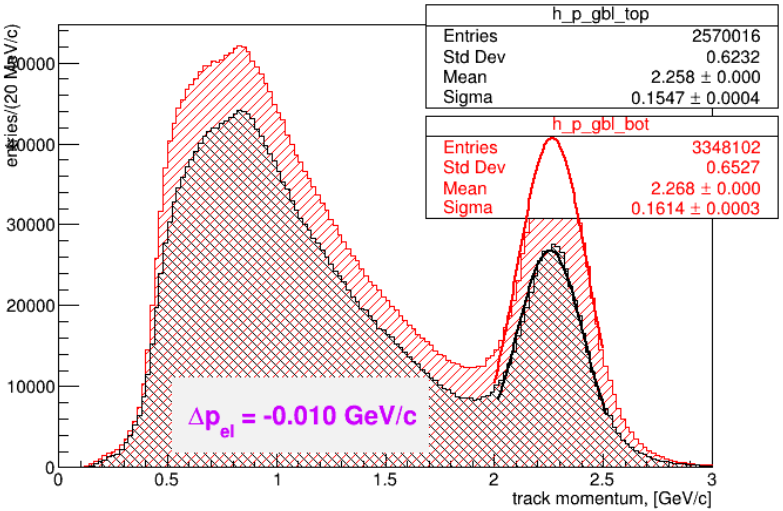


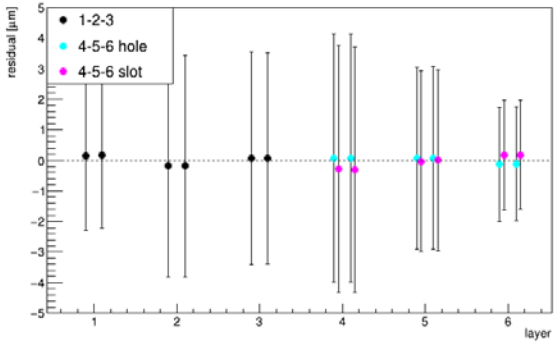


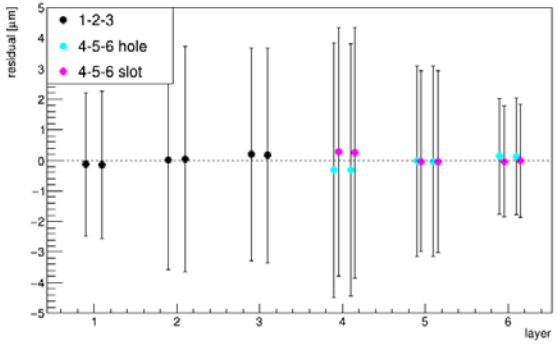
Cut on track χ^2 (<40)
Global alignment can be easily
Improved with one more iteration

T/B diff
Δd_0 = 10 μm
Δz_0 = 2 μm
Δp = -10 MeV/c

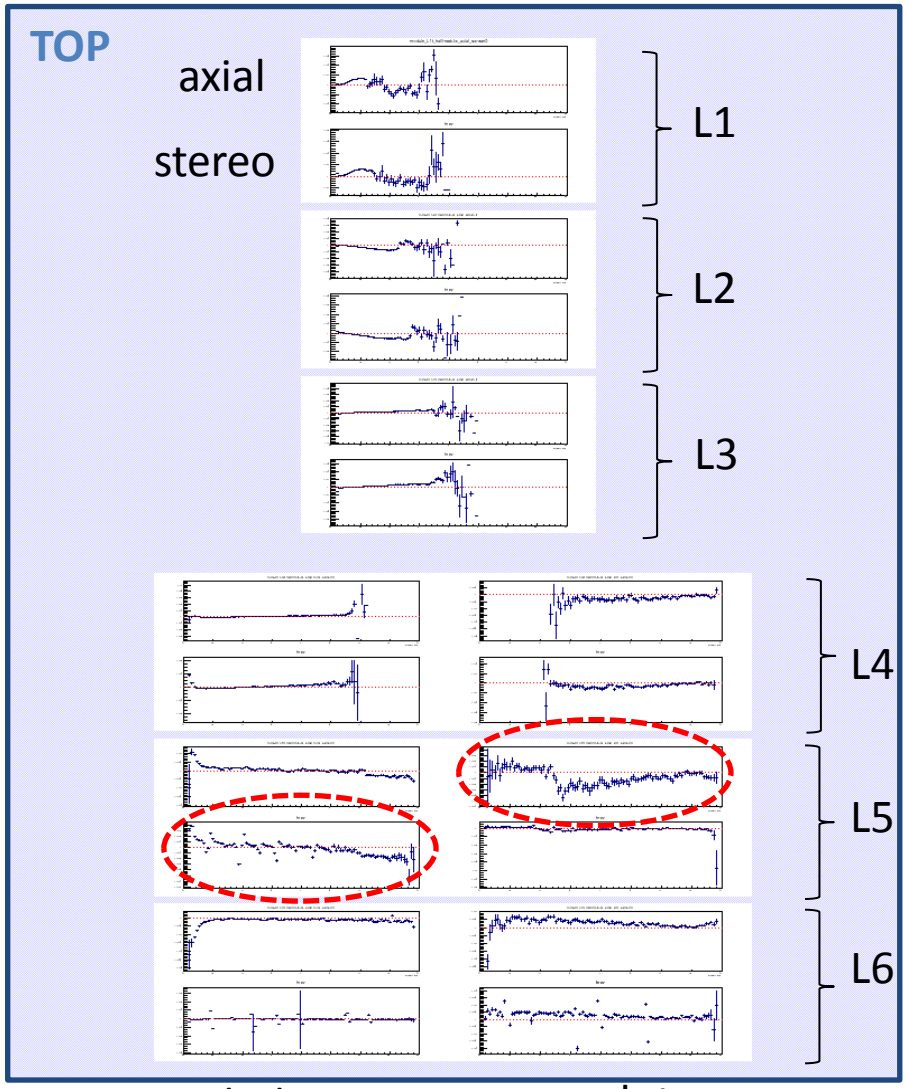
p_{top} = 2.258 MeV/c
p_{bot} = 2.268 MeV/c

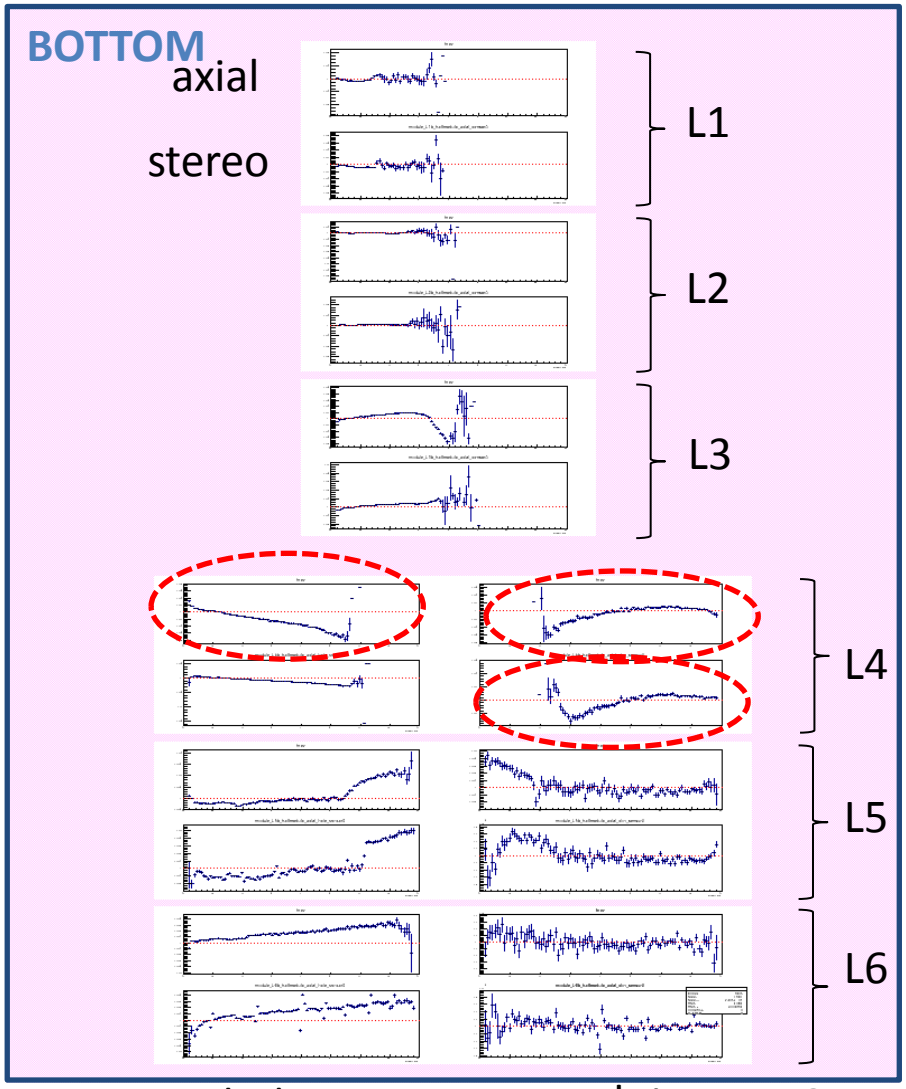




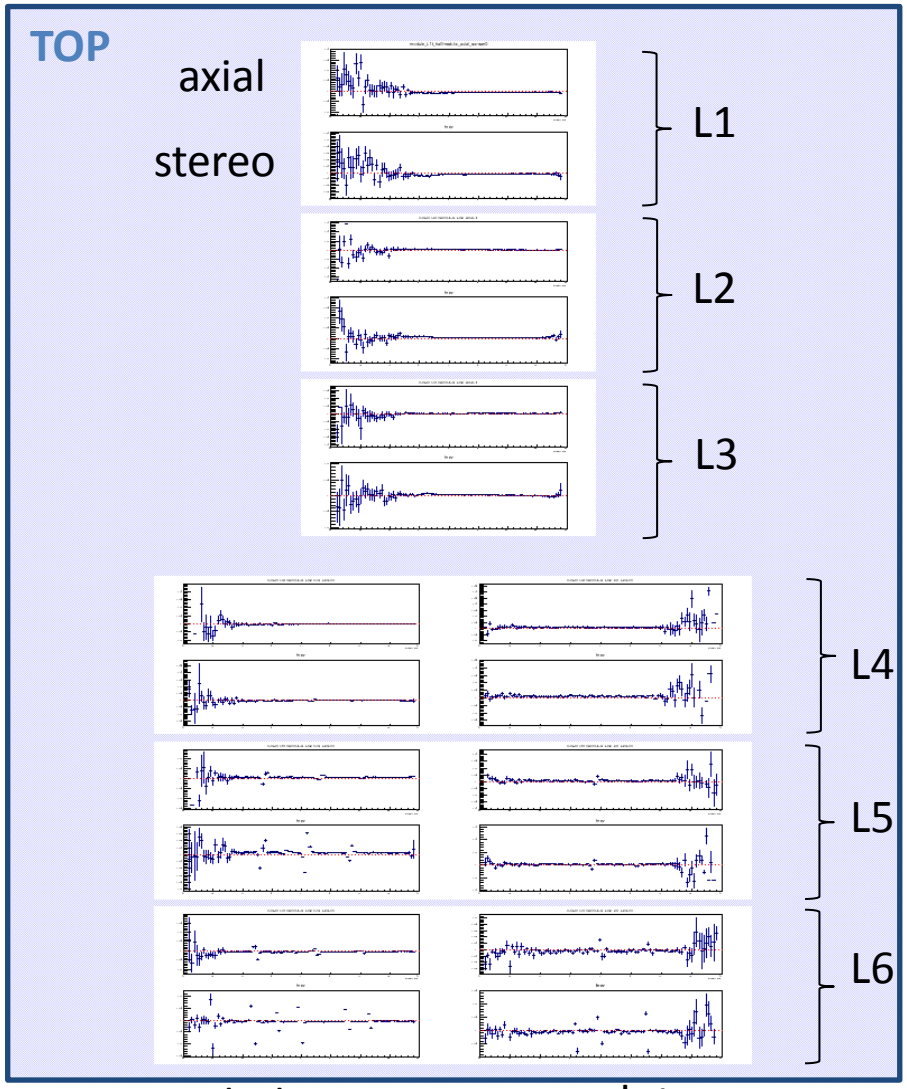


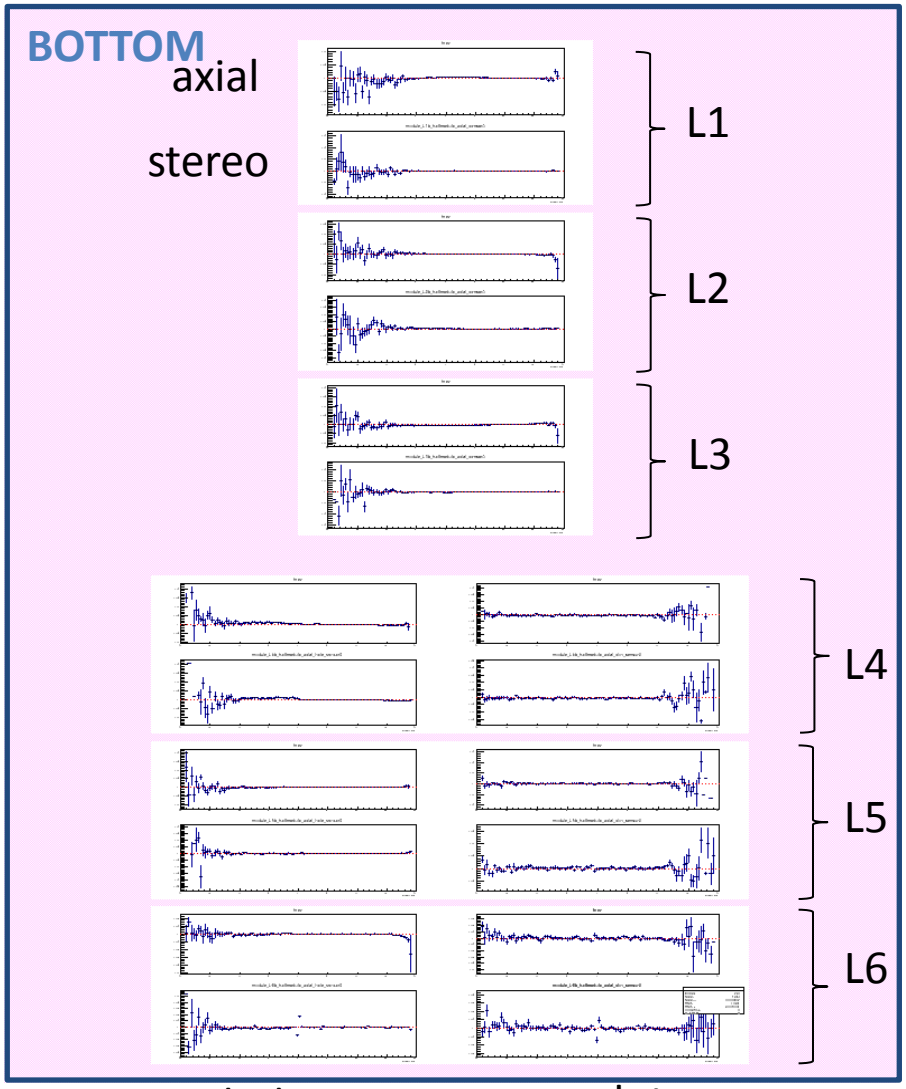
V5.11 2016 detector
GBL u residuals vs v position, curved tracks



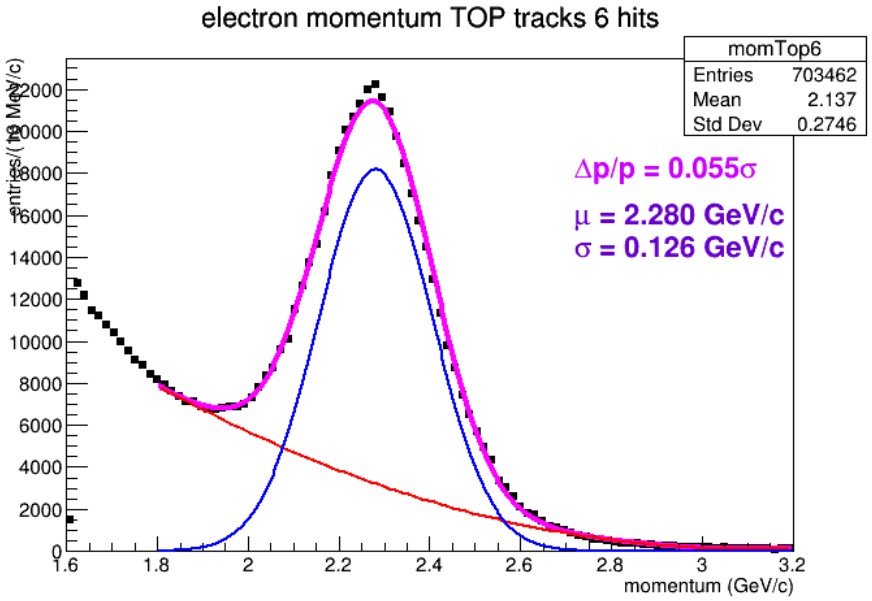


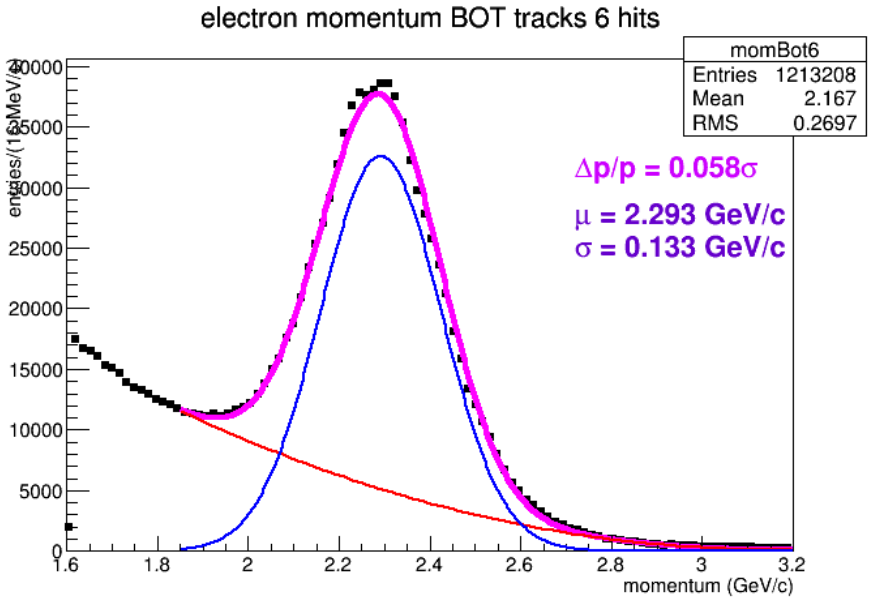
v.11 2016 detectors
GBL u residuals vs v position, **straight tracks**



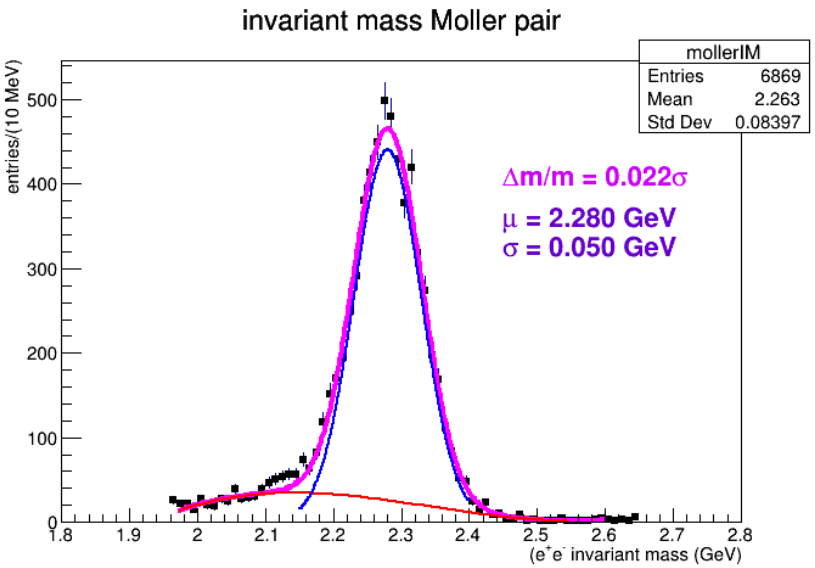


New detector 2016 v5.11
Resolution on elastic events

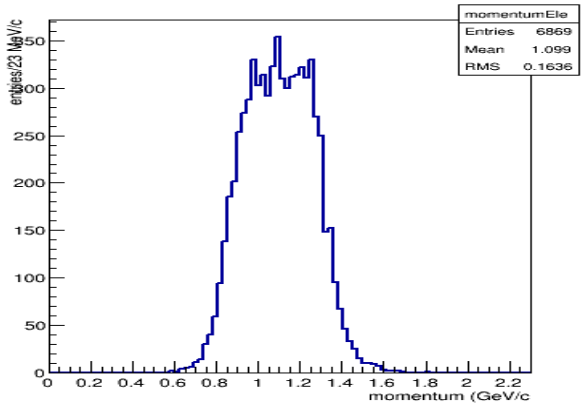




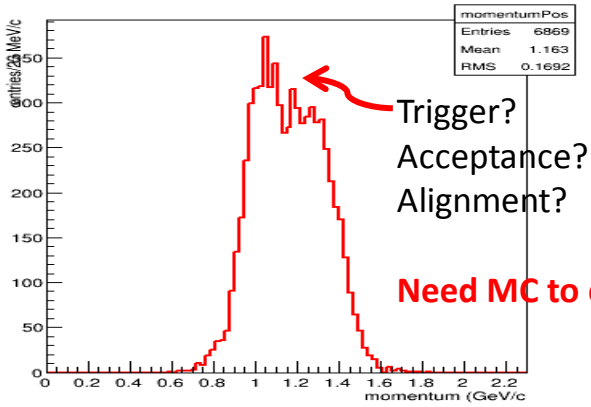
Current best geometry 2016 (v 5.11) Resolution on Moller events



Momentum top electron



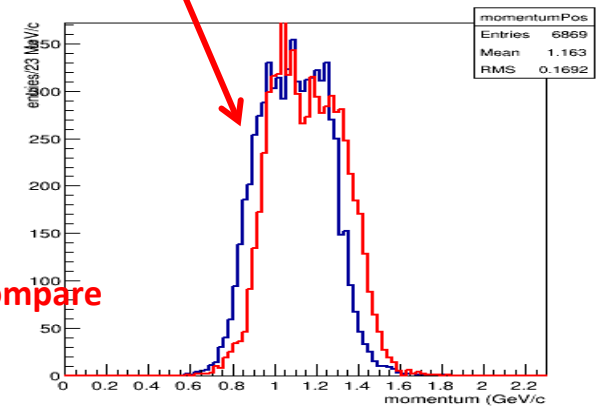
Momentum bottom electron



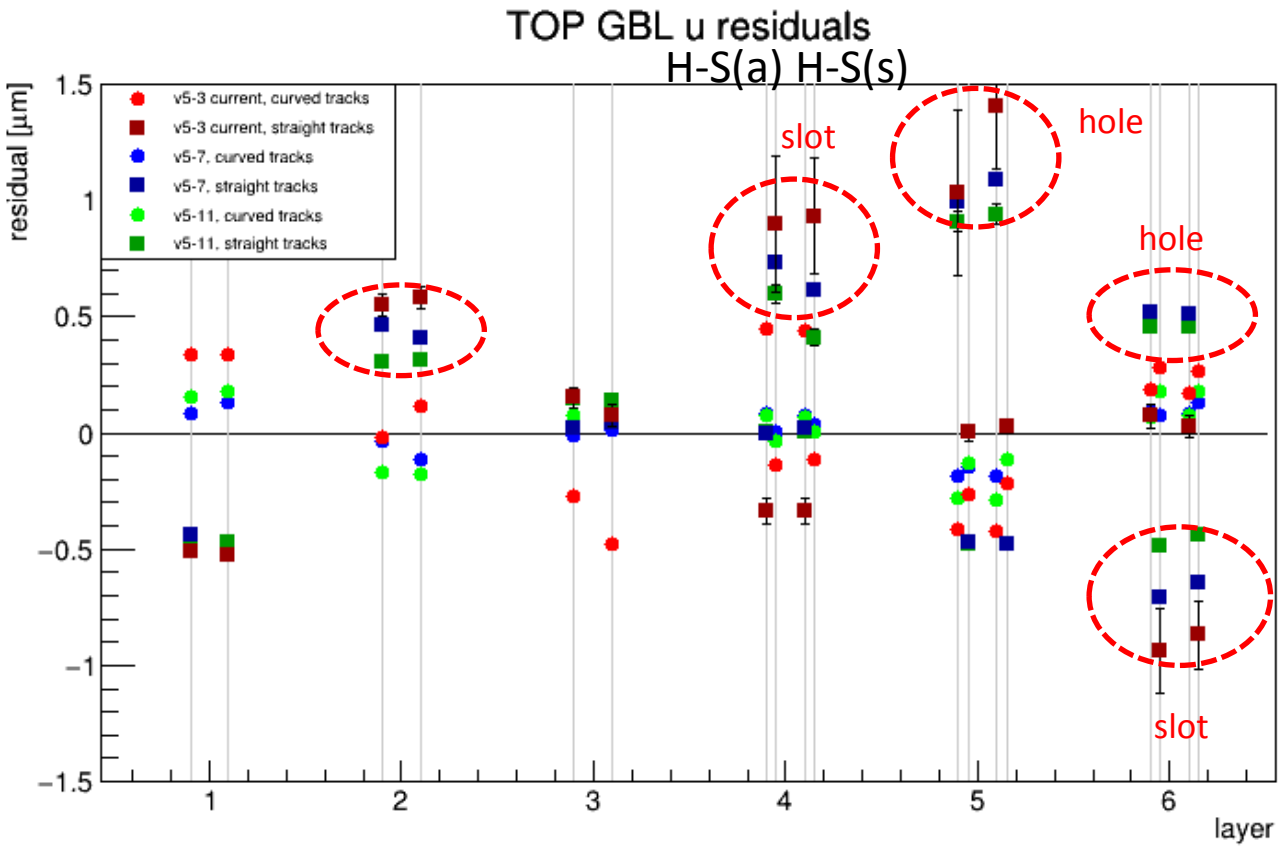
Trigger?
Acceptance?
Alignment?

Need MC to compare

This must be alignment, still



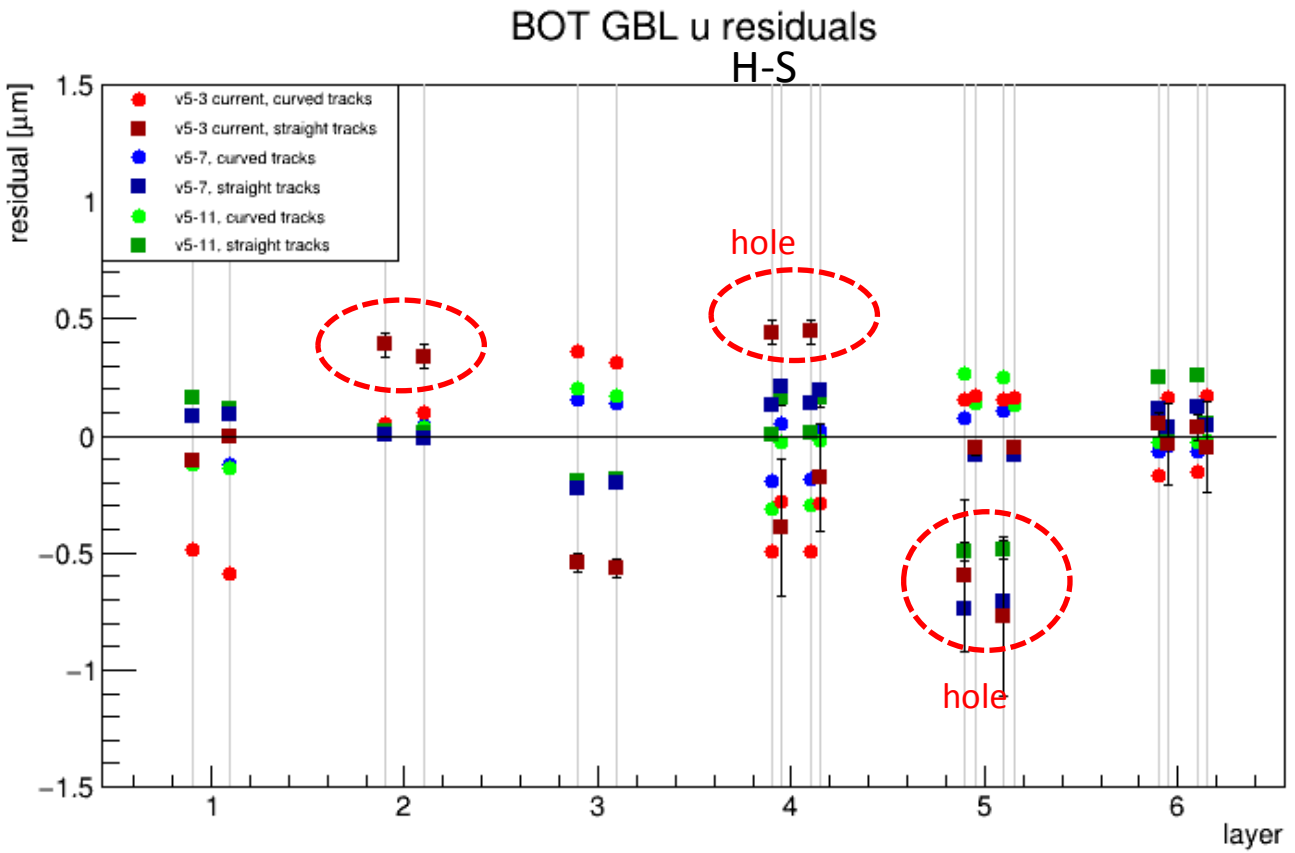
Comparison of u residuals TOP (GBL) curved & straight tracks



Current detector: red points
Squares: straight tracks
Circles: curved tracks
Errors: residual σ

General improvement with new detectors
Straight tracks always worse

Comparison of u residuals TOP (GBL) curved & straight tracks



Current detector: red points
Squares: straight tracks
Circles: curved tracks
Errors: residual σ

General improvement with new detectors
Better as compared to top spread
Straight tracks always worse, exp. Hole side

Figures of merit – summary

- Straight tracks u residuals
  - could be better, worse than with curved tracks in general
- Straight tracks u residuals vs v
  - ALL OK
- Curved tracks u residuals
  - Satisfactory, largely within 1 um
- Curved tracks u residuals vs v
  - sensor 4 slot worst of all (as usual)
- Impact parameters not really relevant – they can be adjusted with global alignment (2-3 iterations max) without sensible effects on momentum and resolution

- Elastic peak momentum
  - Top tracks: same for all, 5.5%σ
  - Bottom tracks: same for all, 5.8%σ
- Moller resolution (invariant mass or total momentum)
  - Same for all: 2.2%σ

	N evts top	N evts bot	Res elastic peak top (σ)	Res elastic peak bot (σ)	N events Moller	Res Moller invariant mass (σ)
V 5.3	704836	1211814	5.5%	5.8%	6854	2.2%
V 5.7	703090	1214491	5.5%	5.8%	6680	2.2%
V 5.11	703462	1213208	5.5%	5.8%	6869	2.2%

- Do we have some references to compare? A set of standard cuts? A comparison with MC data?
- … no easy way to choose the best detector (and this is almost likely a -fake- relative minimum)