



Drift Chambers

Reconstruction & Efficiency with SRC data

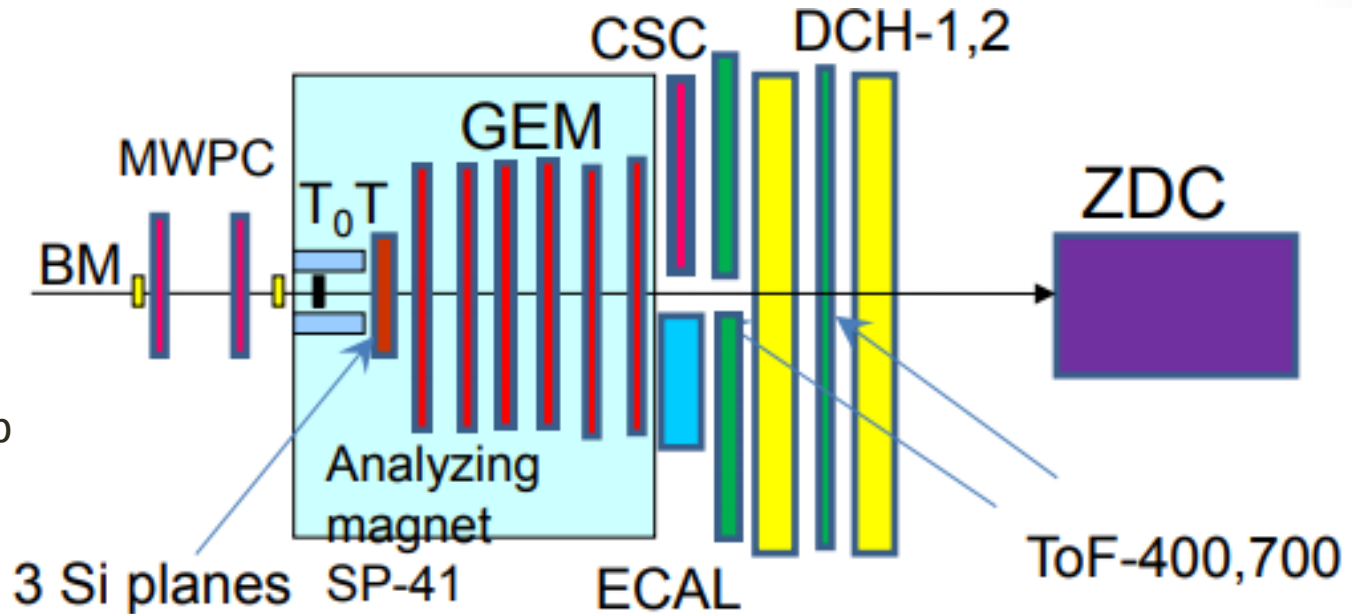
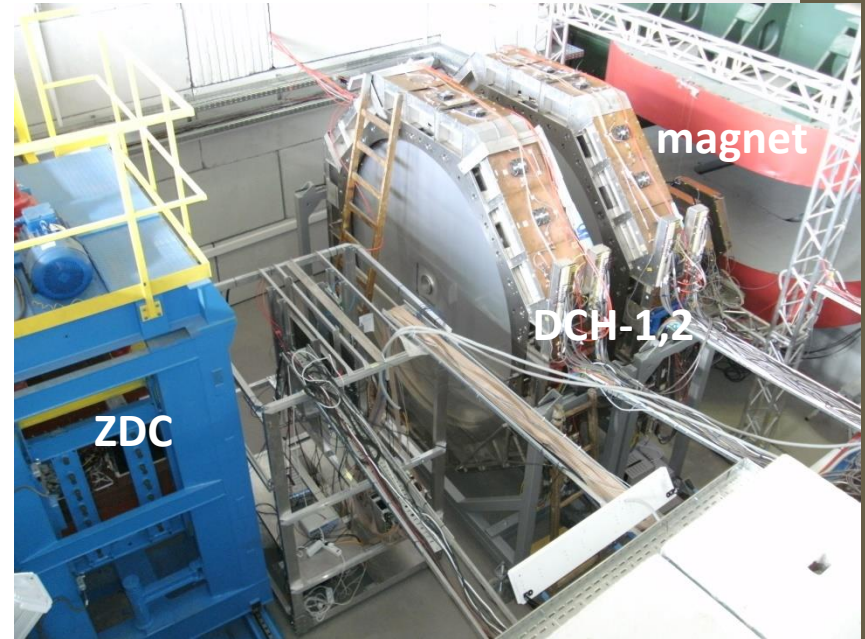
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JINR

4th NICA Collaboration Meeting
October 14 , 2019

Drift Chambers in the BM@N experimental setup

Together with CSCs form the outer tracker.

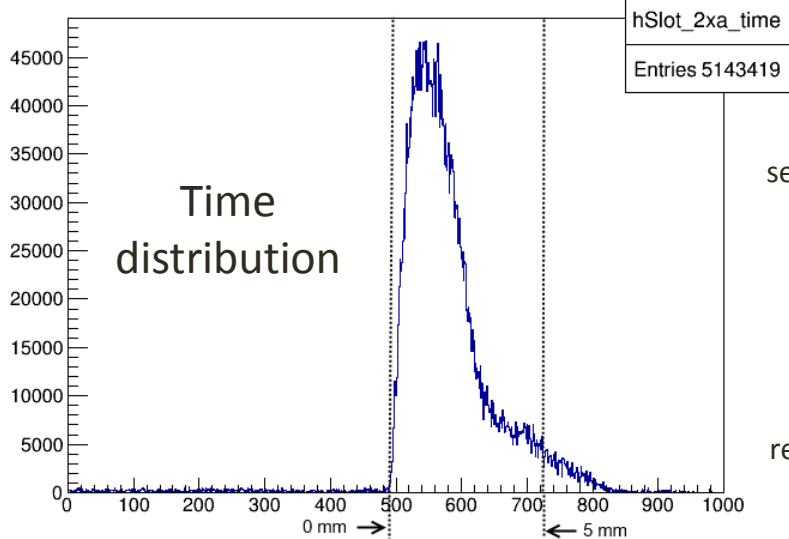
The DCH tracks are linked with ToF for further particle identification.



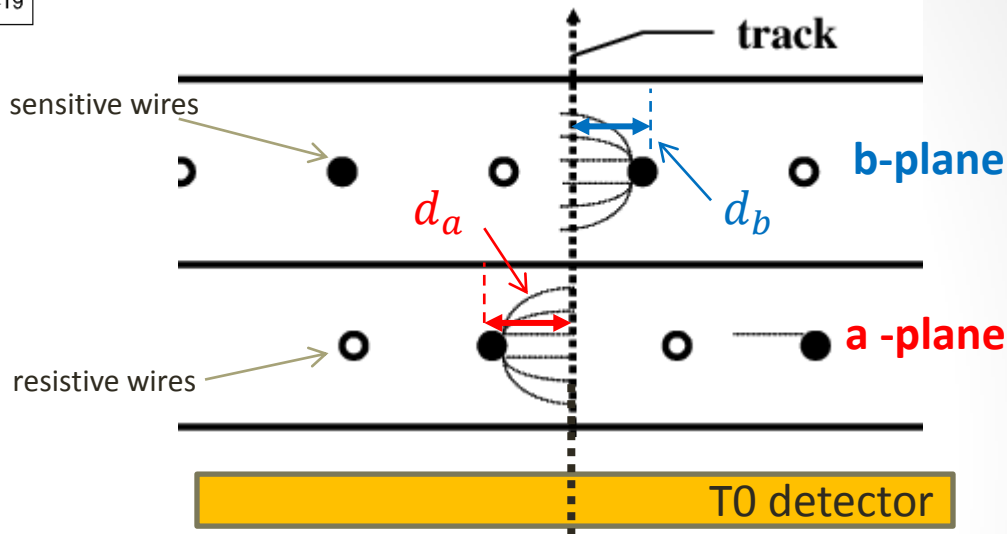
One of the BM@N experimental setup configurations

Drift Chambers coordinate reconstruction on a layer

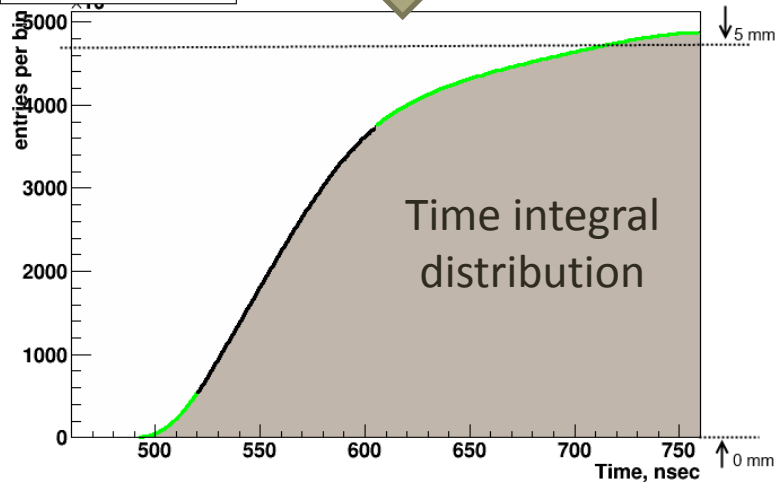
times_for_plane_DC2_xa



$$d_a + d_b - 5\text{mm} \rightarrow 0$$



time_cs_for_plane_DC2_xa



- 4 double coordinate planes: 2x; 2y, 2u, 2v;
- wire angles $0^\circ, 90^\circ, \pm 45^\circ$;
- wire pitch 10 mm;
- $Y_{out} \pm 1.35$ m, $X_{out} \pm 1.35$ m;
- $R_{hole} = 10$ cm;
- 2048 wires per chamber.

Drift Chambers Reconstruction & Performance

Hit reconstruction on a particular layer



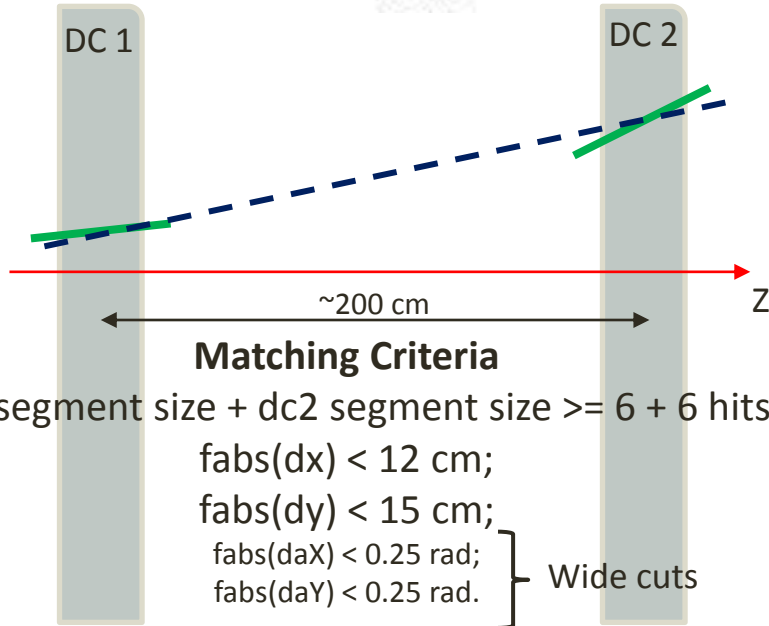
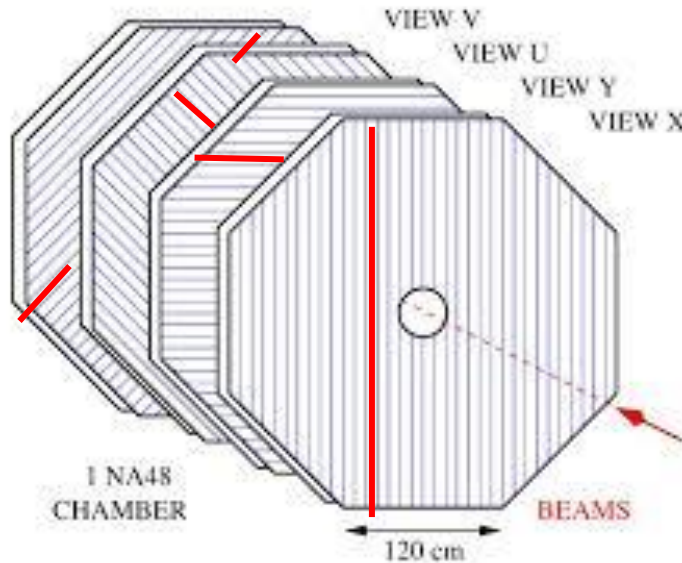
Pair hit assembly



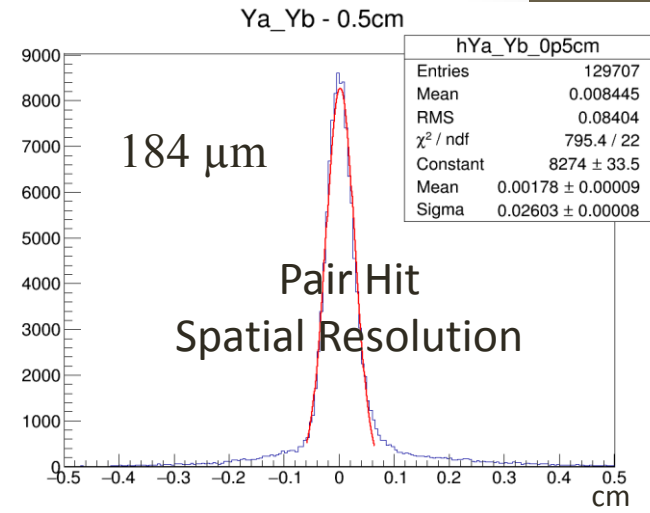
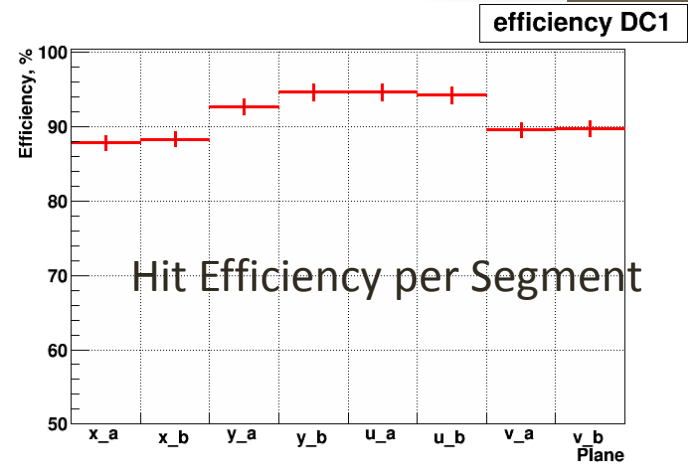
DC1/2 Segment building



DC1-2 track reconstruction



Run3 data

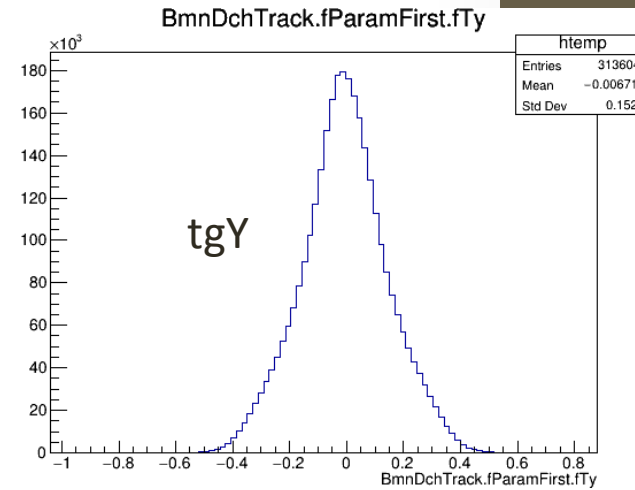
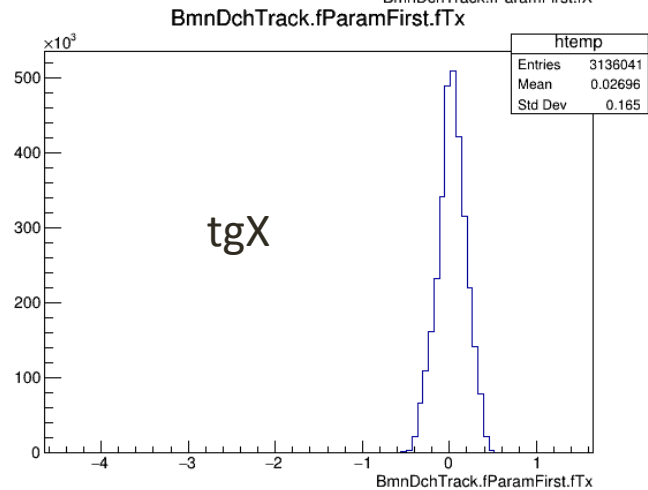
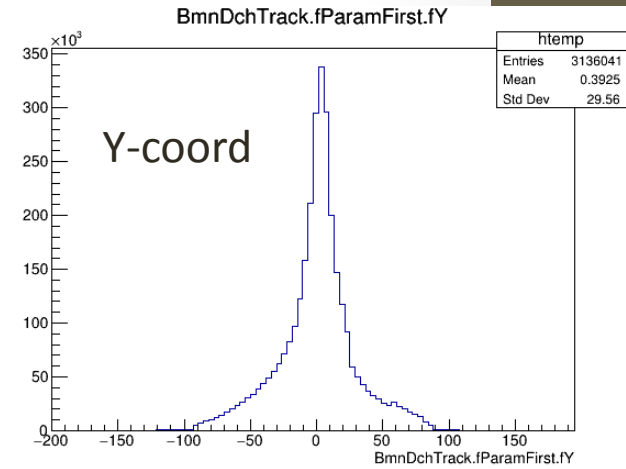
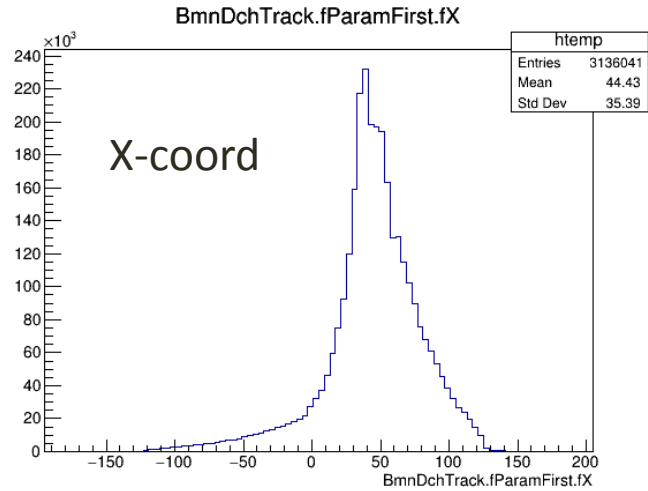


DCH reconstruction is implemented into bmnroot

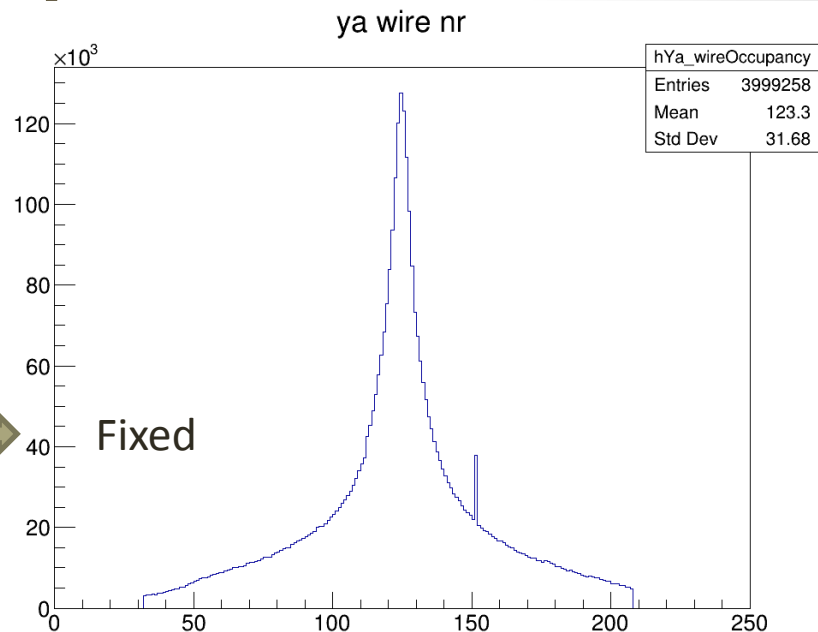
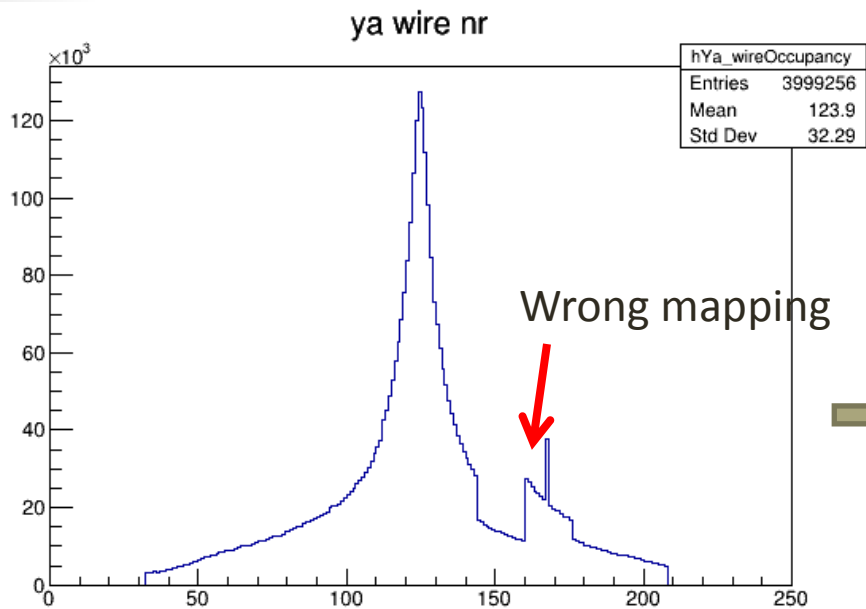
Output tree

Run 2332
B = 1200A, Empty target

- BmnDchTrack
- BmnDchTrack.fUniqueID
- BmnDchTrack.fBits
- BmnDchTrack.fHits
- BmnDchTrack.fParamFirst.fUniqueID
- BmnDchTrack.fParamFirst.fBits
- BmnDchTrack.fParamFirst.fX
- BmnDchTrack.fParamFirst.fY
- BmnDchTrack.fParamFirst.fZ
- BmnDchTrack.fParamFirst.fTx
- BmnDchTrack.fParamFirst.fTy
- BmnDchTrack.fParamFirst.fQp
- BmnDchTrack.fParamFirst.fCovMatrix[15]
- BmnDchTrack.fParamLast.fUniqueID
- BmnDchTrack.fParamLast.fBits
- BmnDchTrack.fParamLast.fX
- BmnDchTrack.fParamLast.fY
- BmnDchTrack.fParamLast.fZ
- BmnDchTrack.fParamLast.fTx
- BmnDchTrack.fParamLast.fTy
- BmnDchTrack.fParamLast.fQp
- BmnDchTrack.fParamLast.fCovMatrix[15]
- BmnDchTrack.fFlag
- BmnDchTrack.fChi2
- BmnDchTrack.fNDF
- BmnDchTrack.fB
- BmnDchTrack.fLength
- BmnDchTrack.fNhits
- BmnDchTrack.fUsing
- GetNHits()
- @size

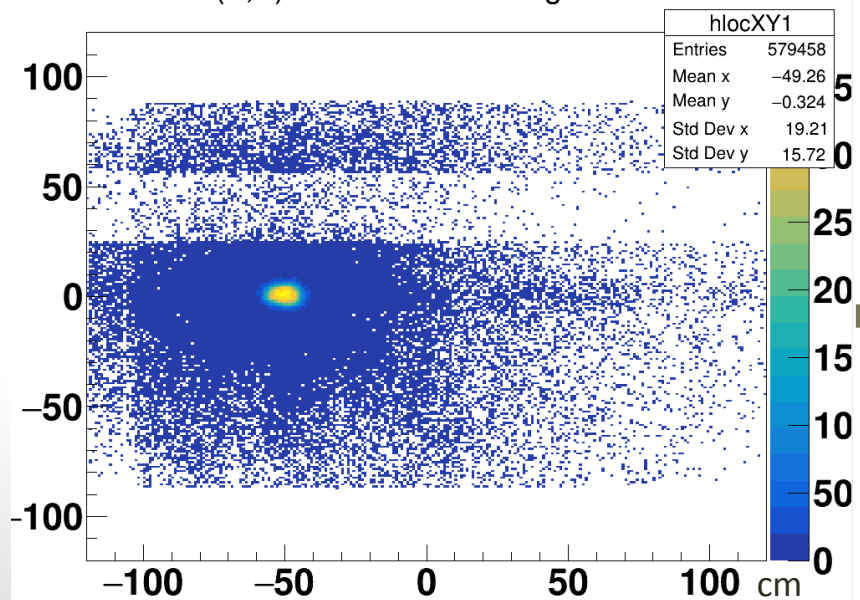


Y wire occupancy problem

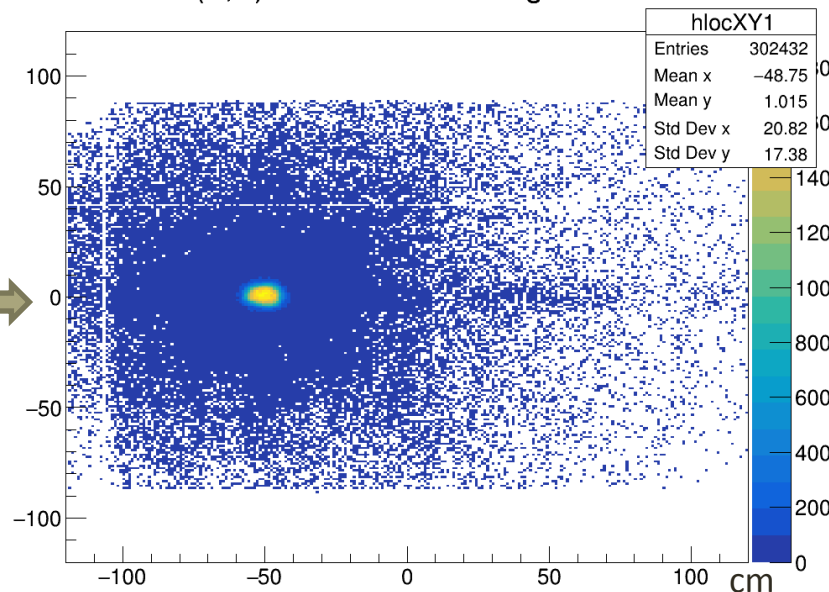


Run 2332

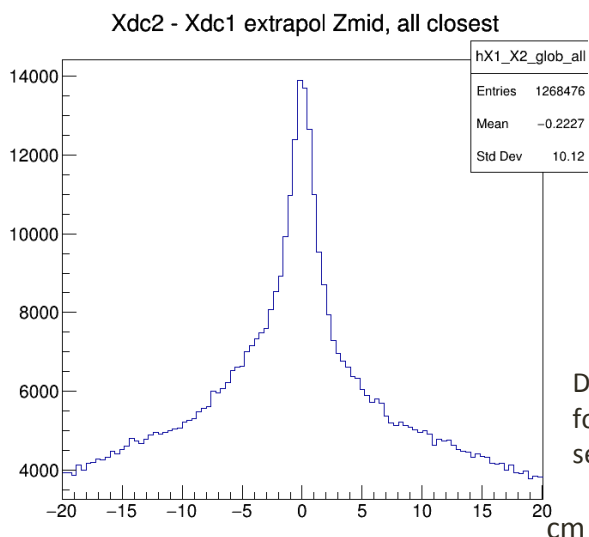
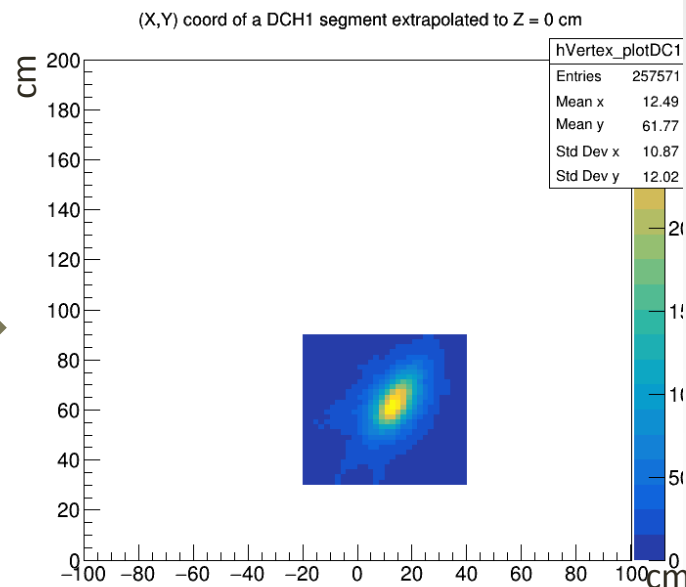
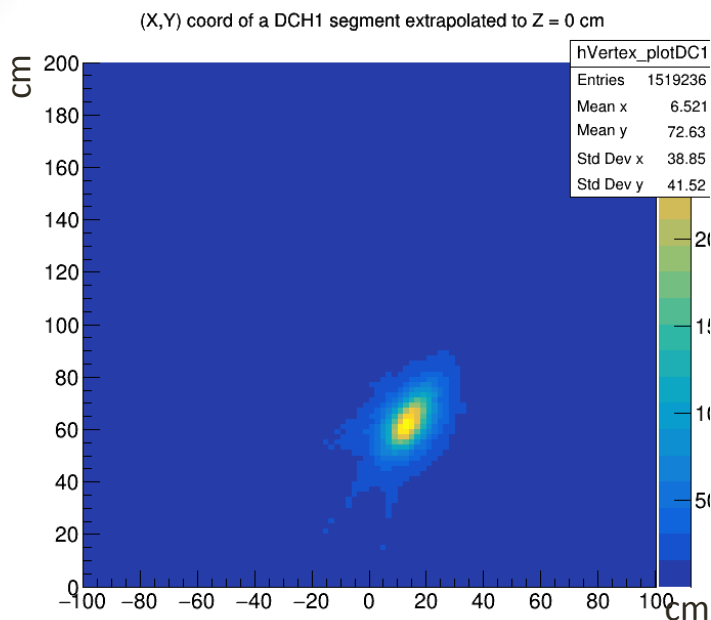
(X,Y) local coord of a seg in dc1



(X,Y) local coord of a seg in dc1

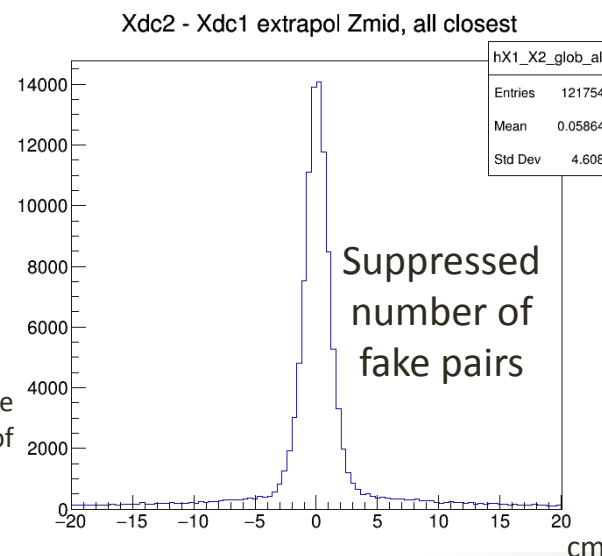


Vertex Cut Usage (RUN 2332, Magnetic field B = 1800A, Empty target)



vertex cut applied

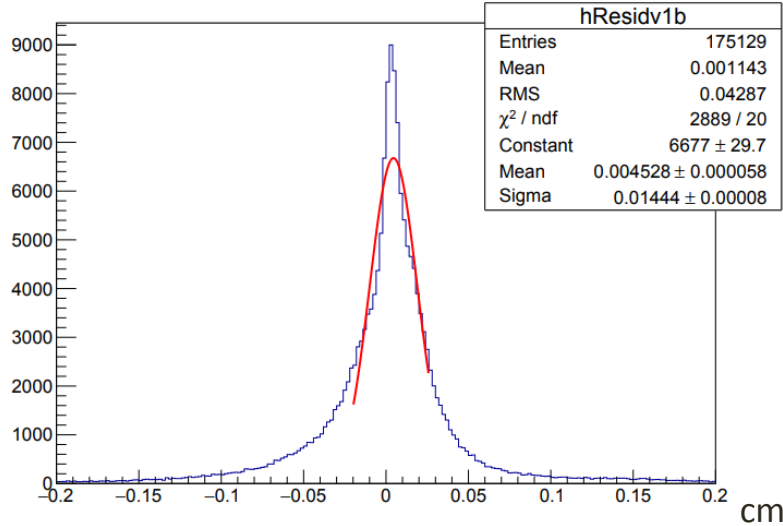
Difference in X coordinate for the matching pair of segments



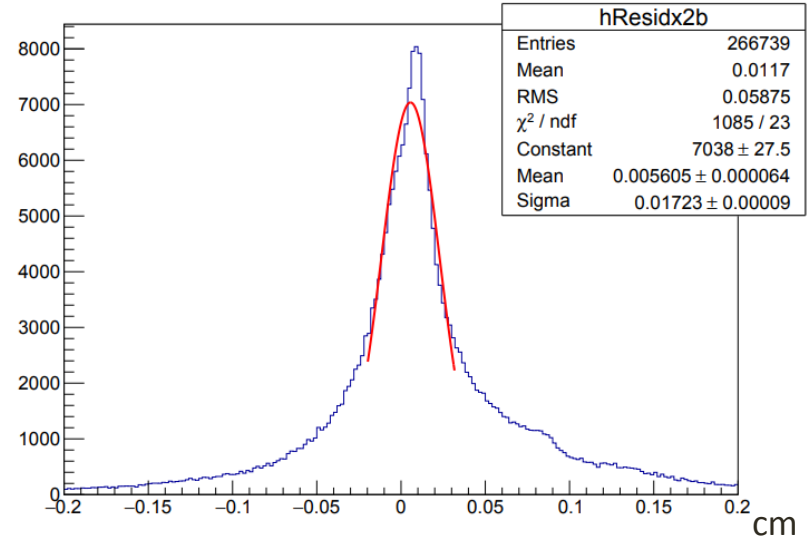
Remark: Vertex cut usage essential for Ar and Kr beam data.

Some selected residuals [Measurement – segmentFit]

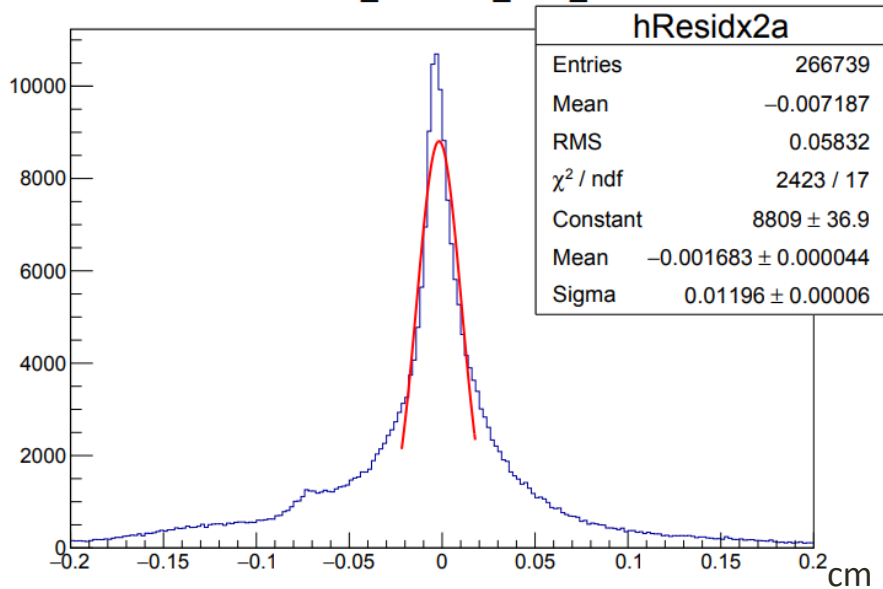
dc1 vb_mes - vb_from_fit



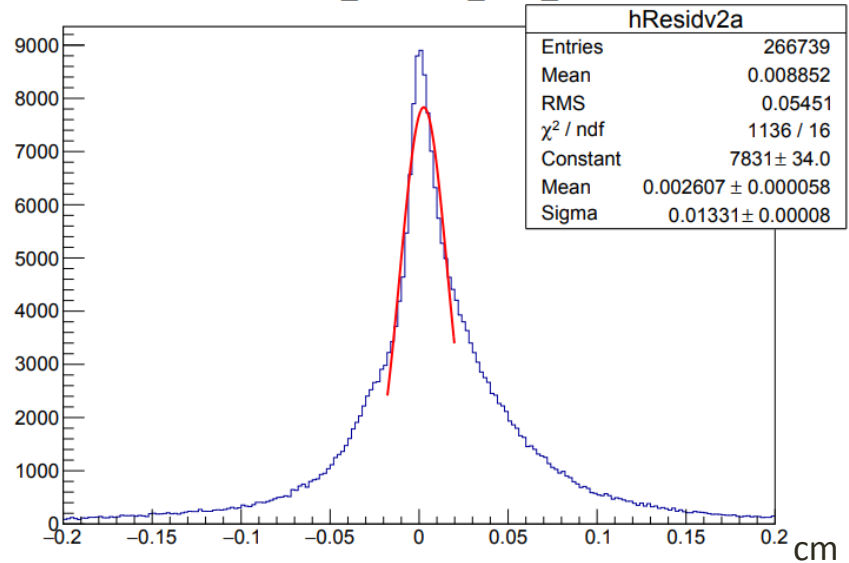
dc2 xb_mes - xb_from_fit



dc2 xa_mes - xa_from_fit



dc2 va_mes - va_from_fit



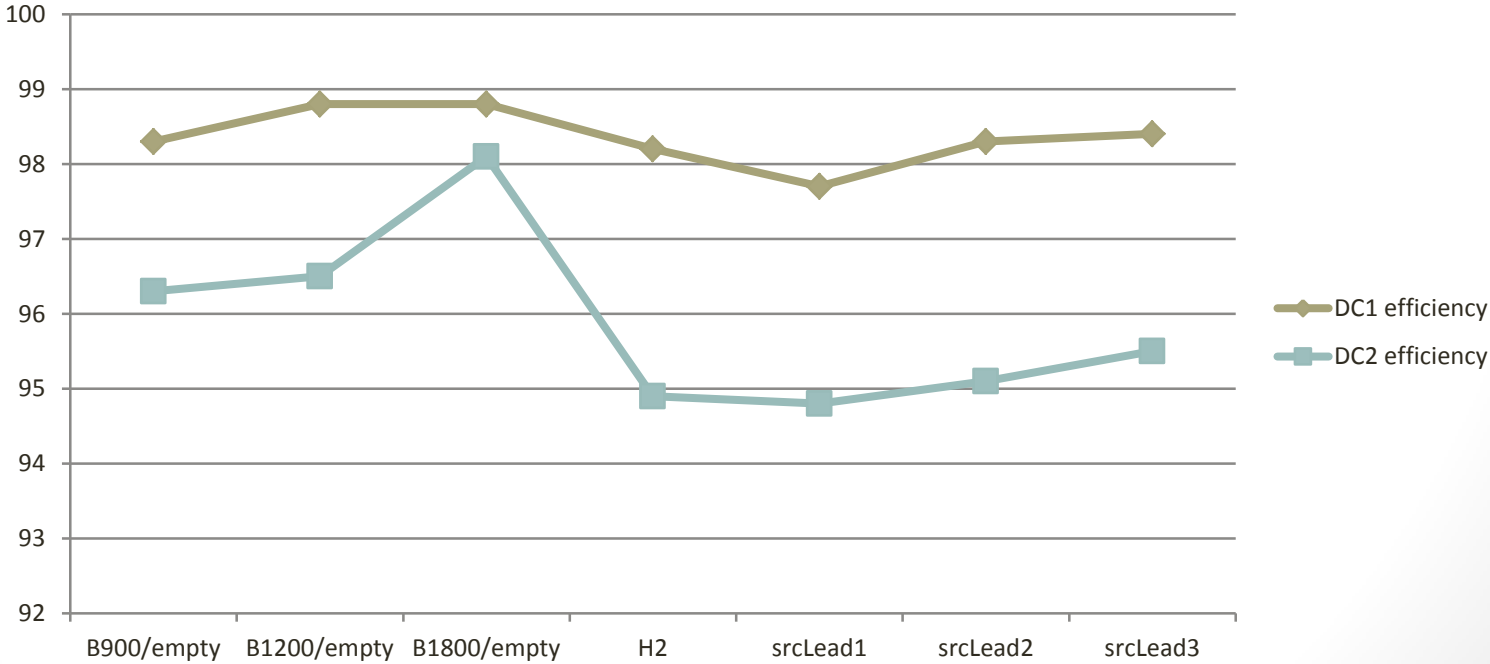
Resolution < ~200 μ m

DCH Segment Efficiency vs. GEM track + adjacent DCH

$$DC1_Efficiency = \frac{DC1_{segment}}{GEM_{track} + DC2_{segment}} * 100\%$$

$$DC2_Efficiency = \frac{DC2_{segment}}{GEM_{track} + DC1_{segment}} * 100\%$$

conditions	DC1 efficiency	DC2 efficiency
B900/empty	98.3	96.3
B1200/empty	98.8	96.5
B1800/empty	98.8	98.1
H2	98.2	94.9
srcLead1(9mm)	97.7	94.8
srcLead2(2x9mm)	98.3	95.1
srcLead3(3x9mm)	98.4	95.5



Conclusions

- Full reconstruction chain for DCH was developed and implemented into bmnroot;
- DCH spatial resolution is about 200 μm ;
- The segment reconstruction efficiency for DCH1 vs. GEM+DCH2 is $\sim 98\%$ and for DCH2 vs. GEM+DCH1 is $\sim 95-96\%$.

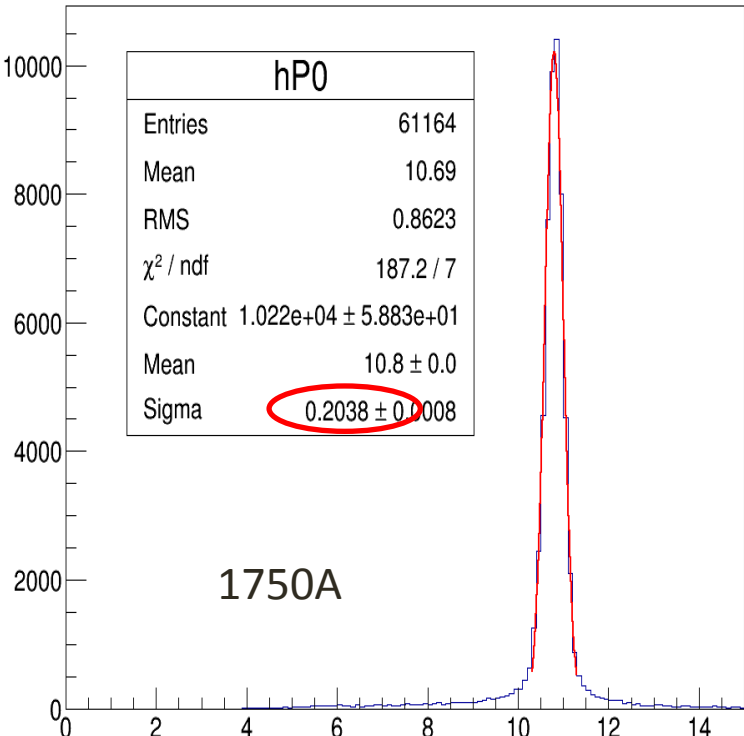
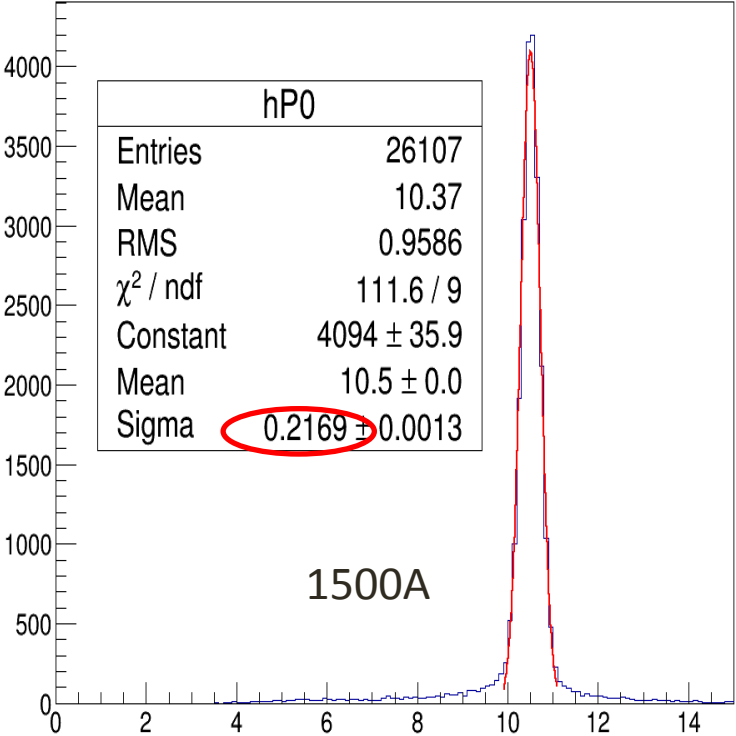
Thank you for your attention!

Backup slides

Momentum estimation for particular magnetic field values

$$\text{momentum} = .3 * \text{Int}(\text{BL}) / [\sin(\alpha X_{\text{out}}) + C]$$

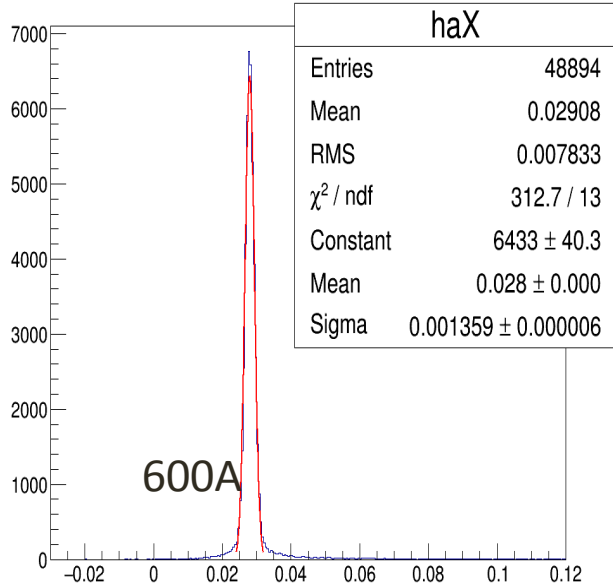
$$\text{momentum} = .3 * \text{Int}(\text{BL}) / [\sin(\alpha X_{\text{out}}) + C]$$



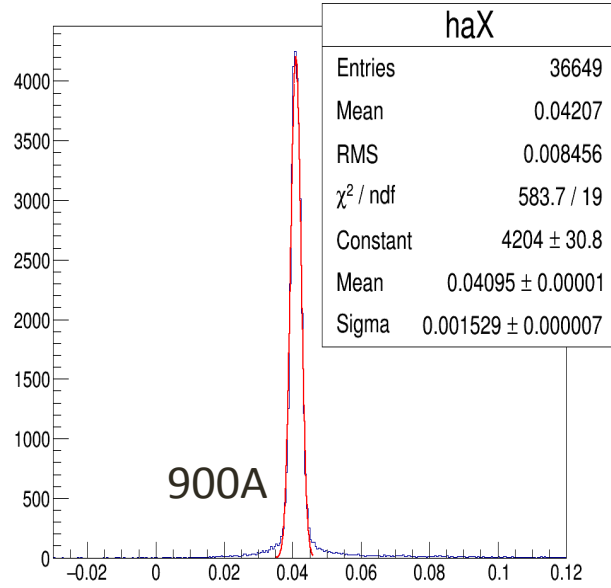
Remark. Beam momentum value calculated correctly only for runs with **B ON** and **Empty target**.

ax slope for beam – C 4.5 GeV/nucl

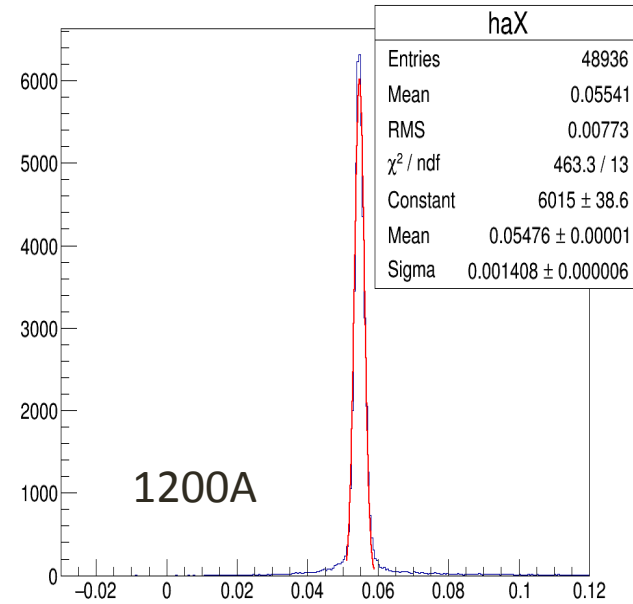
aX 16p segment



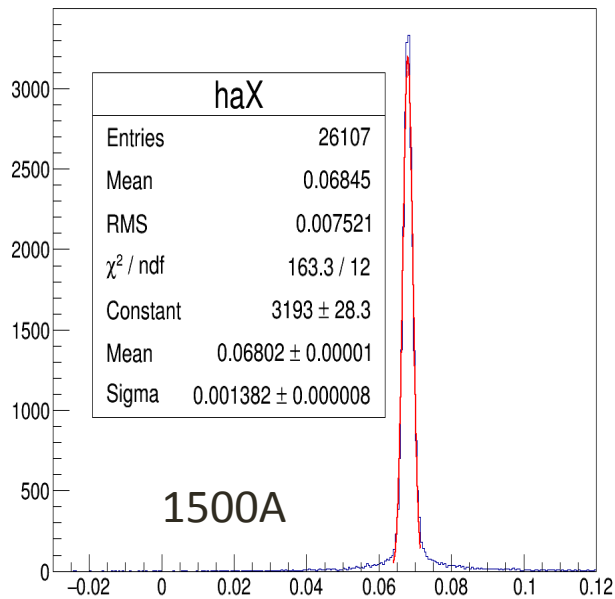
aX 16p segment



aX 16p segment



aX 16p segment



aX 16p segment

