Performance evaluation of the upgraded BM@N setup for the strangeness production studies

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This work was supported by the
Russian Foundation for Basic Research (RFBR):
grant No. 18-02-40036

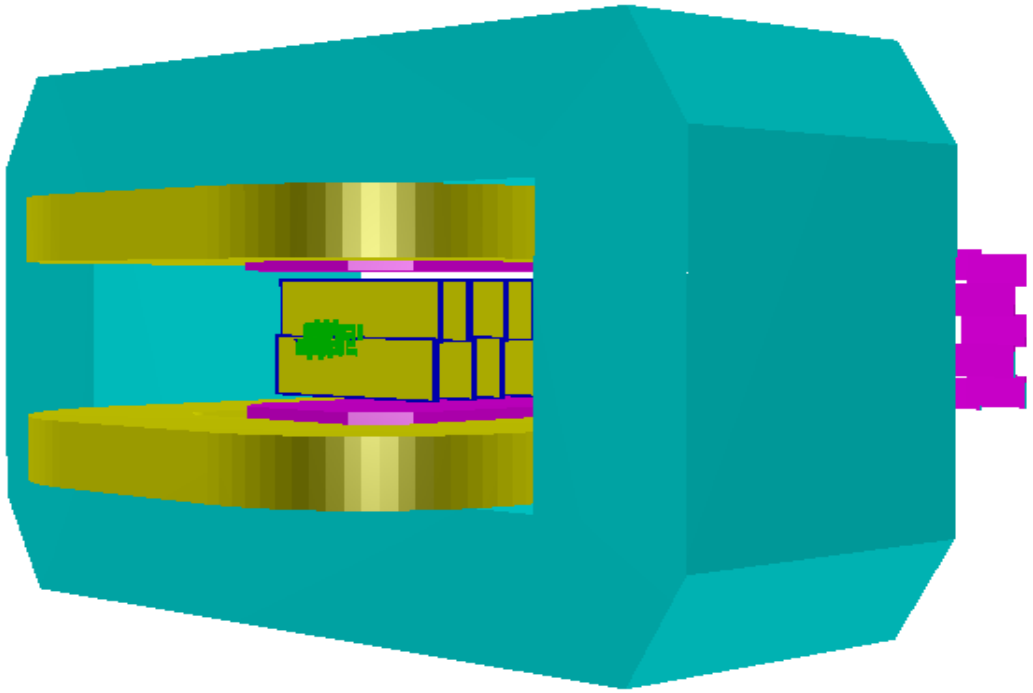
RFBR conference, JINR, Dubna, Russia
20-23 October 2020

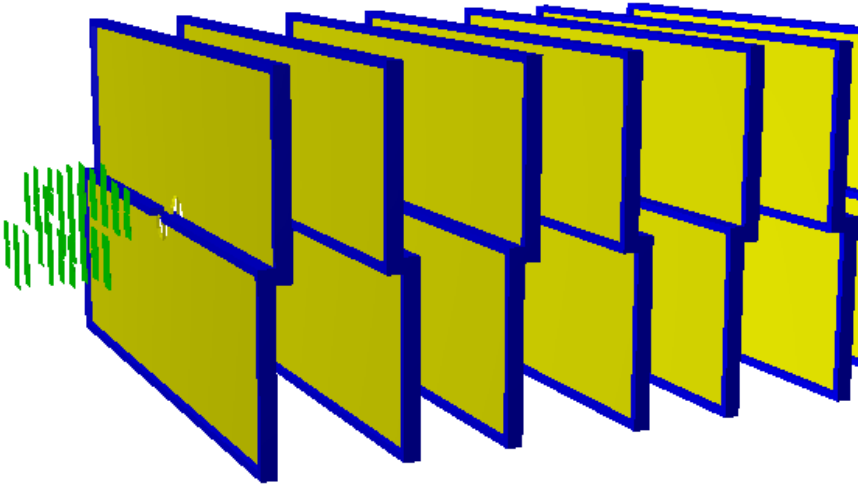
Outline

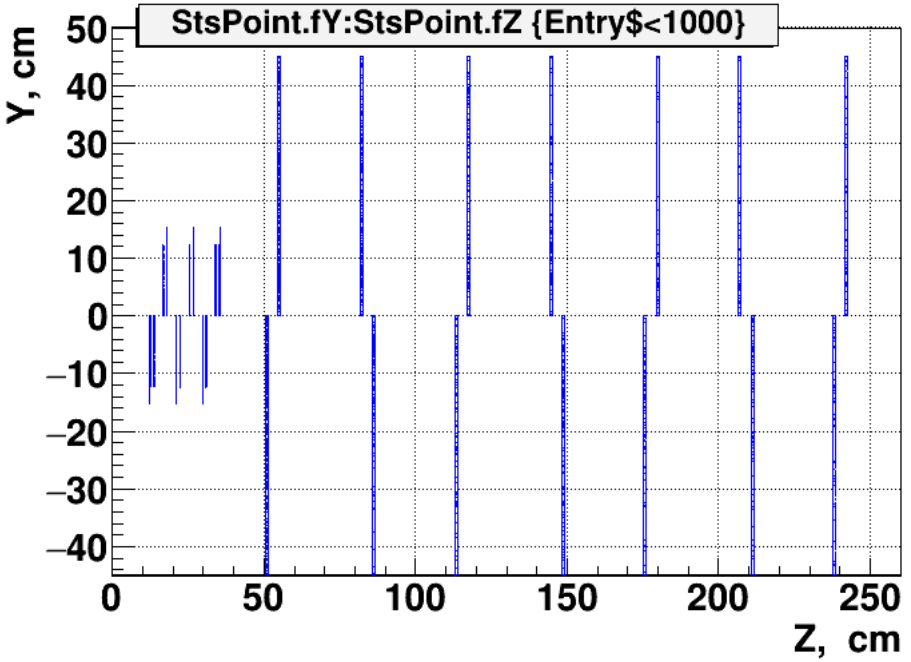
1. **BM@N tracker performance in future run 8 on *Kr* beam**
   - ✓ BM@N geometry and Tracker performance
   - ✓ Shifted configuration and Λ reconstruction
2. **BM@N tracker performance with large-acceptance STS**
   - ✓ BM@N configuration
   - ✓ Slow and fast digitizers in GEMs and Λ reconstruction
   - ✓ Matching GEMs with TOF
   - ✓ PID in TOF
   - ✓ Ξ^- and ${}_{\Lambda}H^3$ reconstruction and phase space

BM@N tracker performance in future run 8 on Kr beam

Detector geometry







Data set

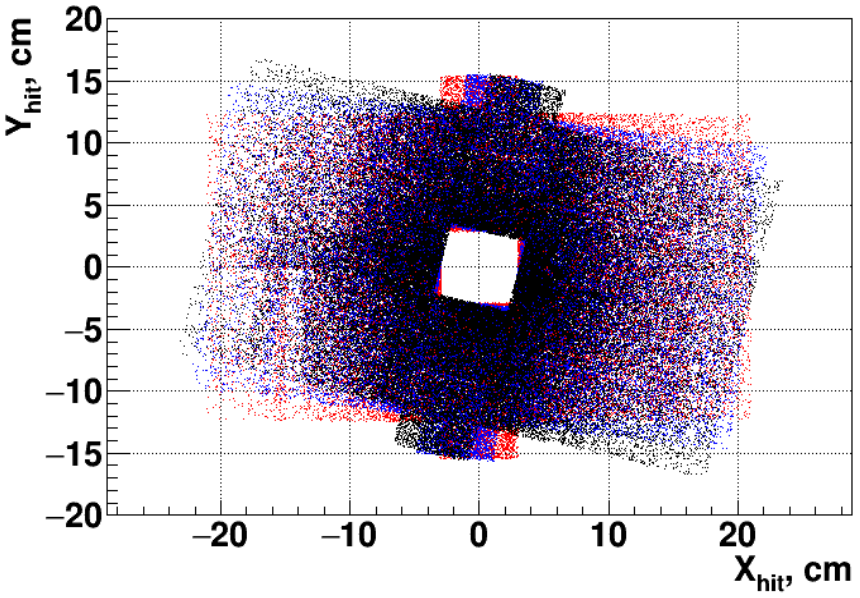
Detectors: Si (3 stations) + GEMs (7 stations)

Generator: DCM-QGSM, Kr+Pb at T_0 = 2.36A GeV, min. Bias

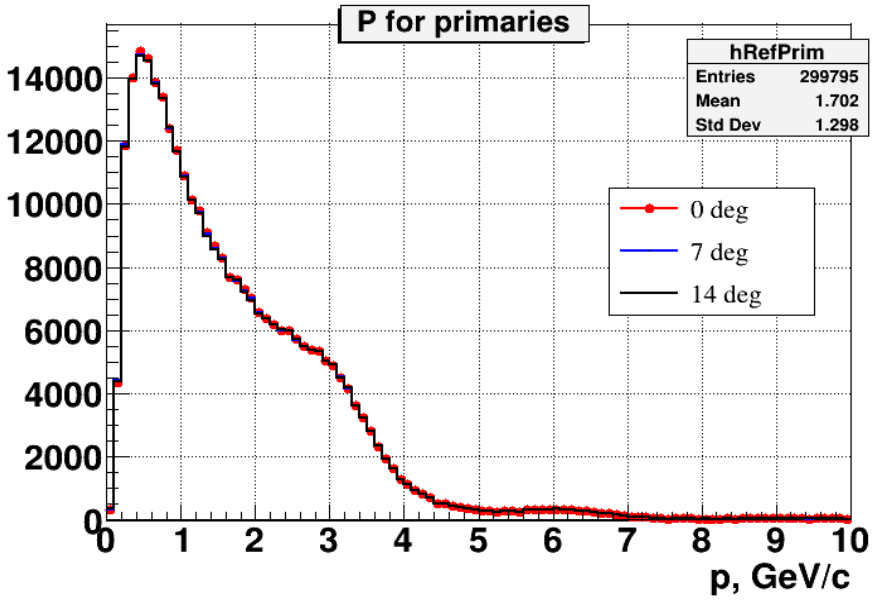
Magnetic field: B = 0.57 T

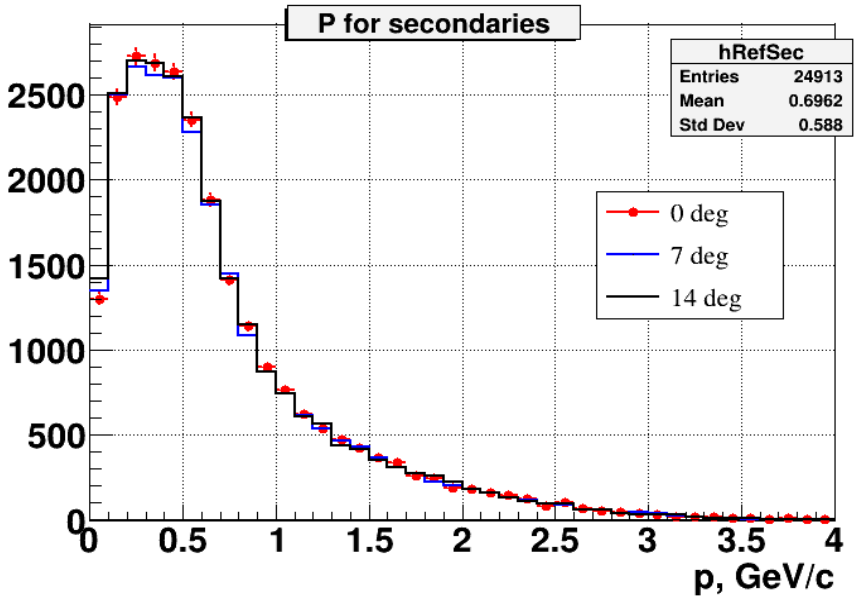
Production rate: Λ – 4883 within 50 cm of primary vertex,
Ξ^- – 30 (10k events)

Tracker performance

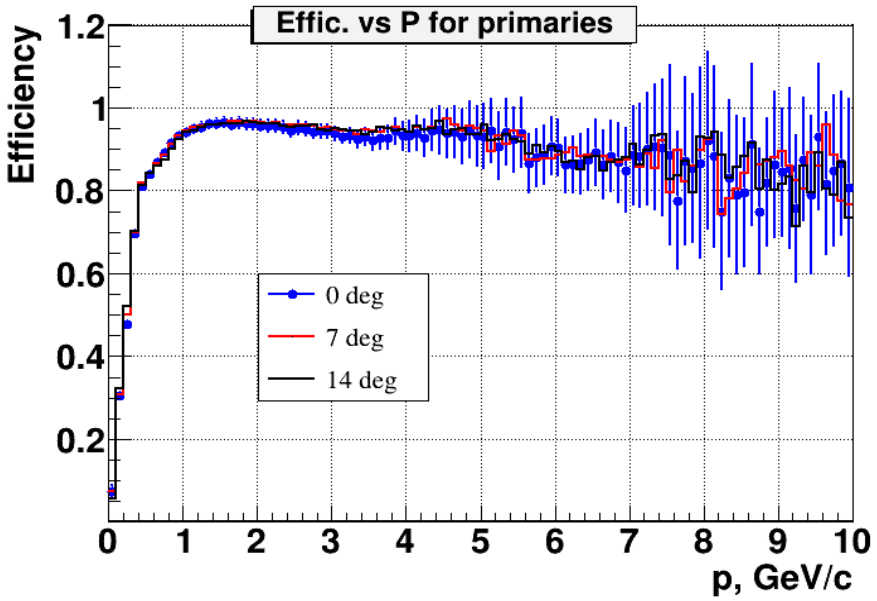


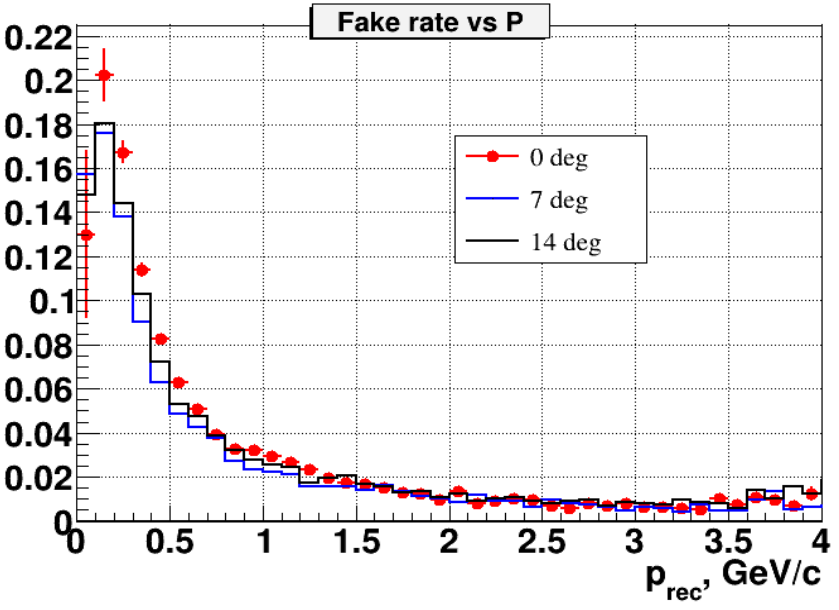
Reconstructable tracks: ≥ 4 hits in sequence





Tracker performance

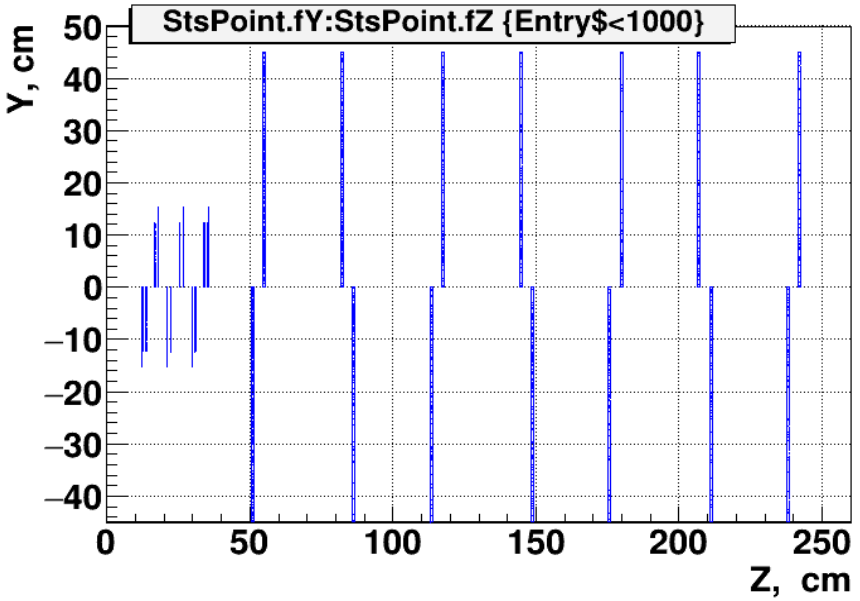


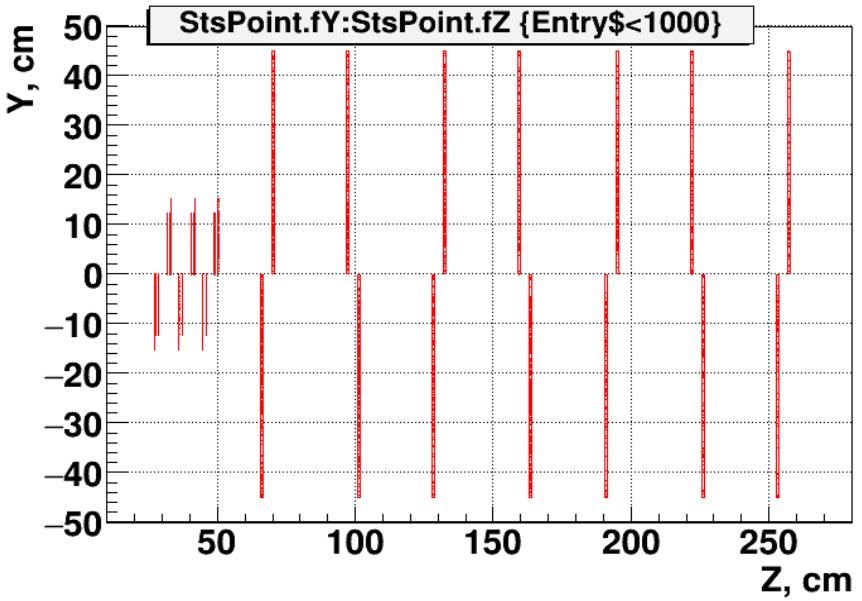


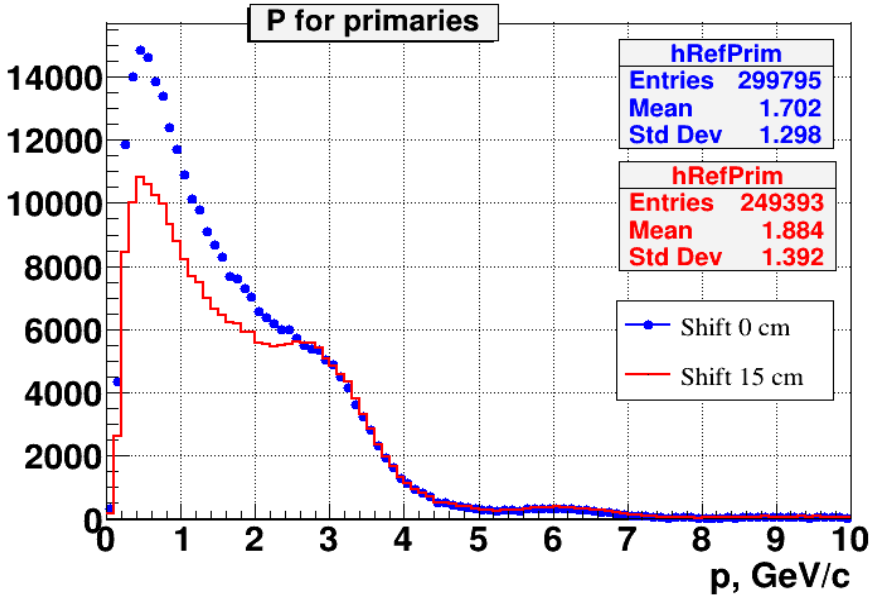
Reconstructable tracks: ≥ 4 hits in sequence

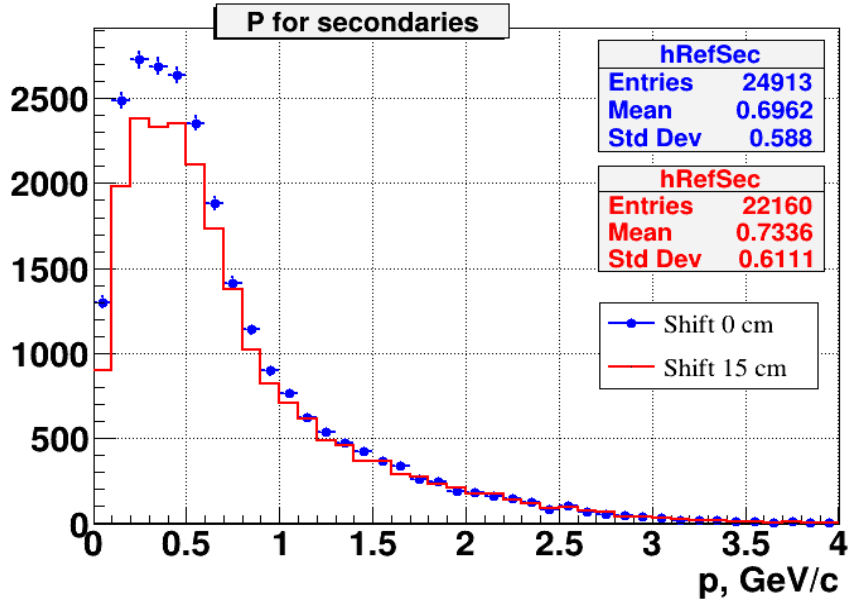
Shifted configuration

Reconstructable tracks: ≥ 4 hits in sequence



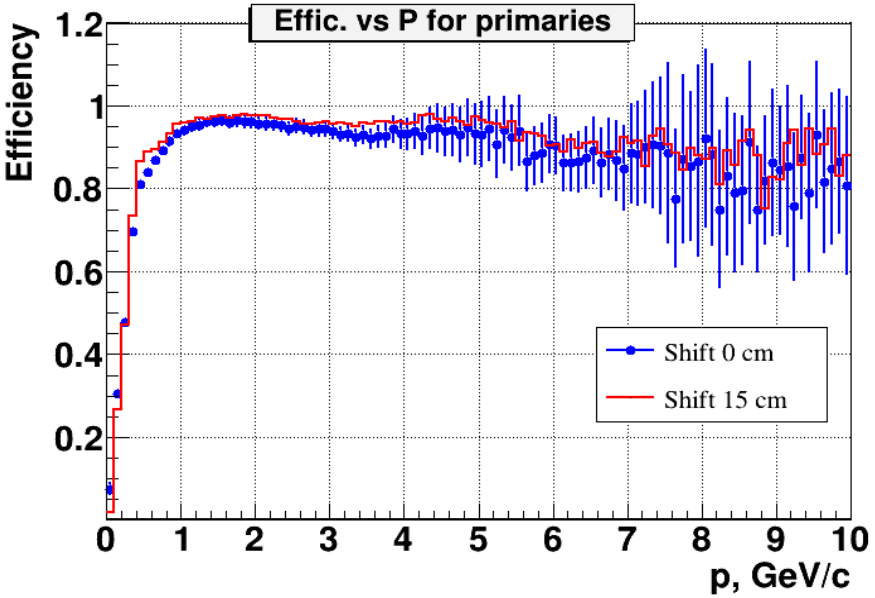


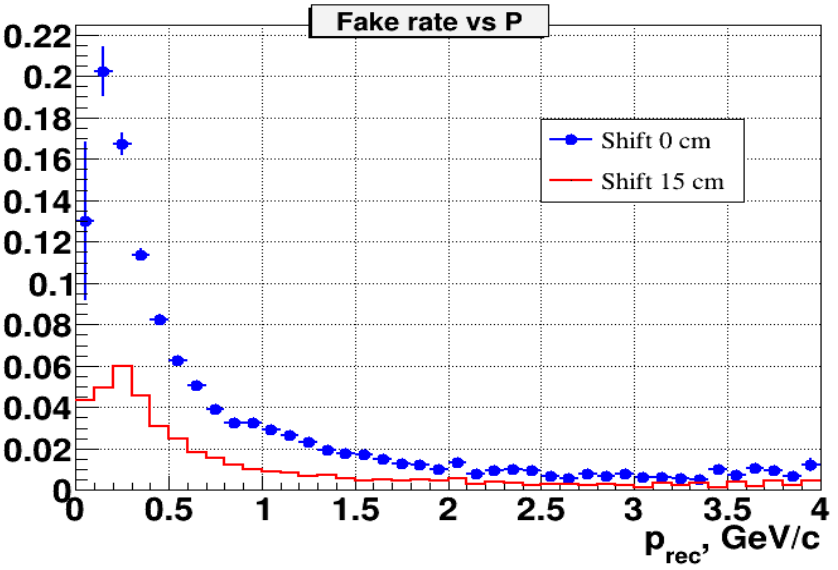


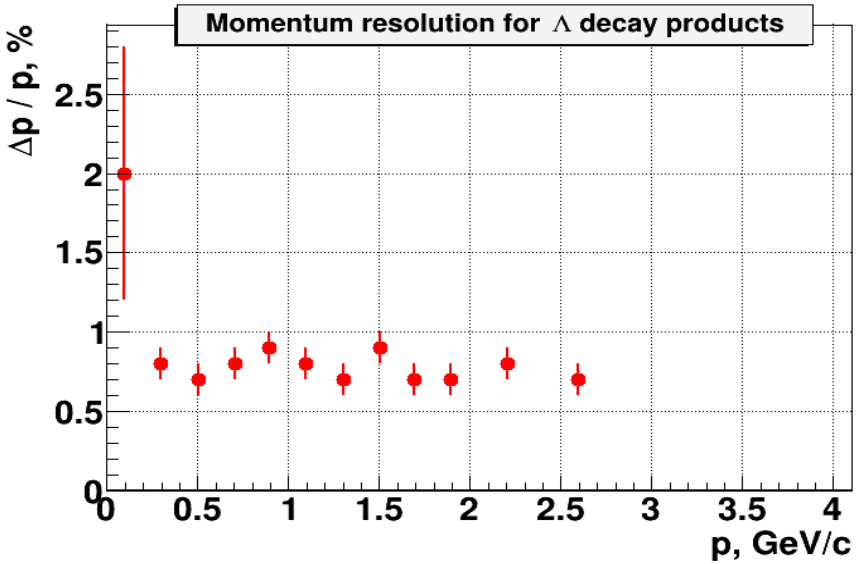


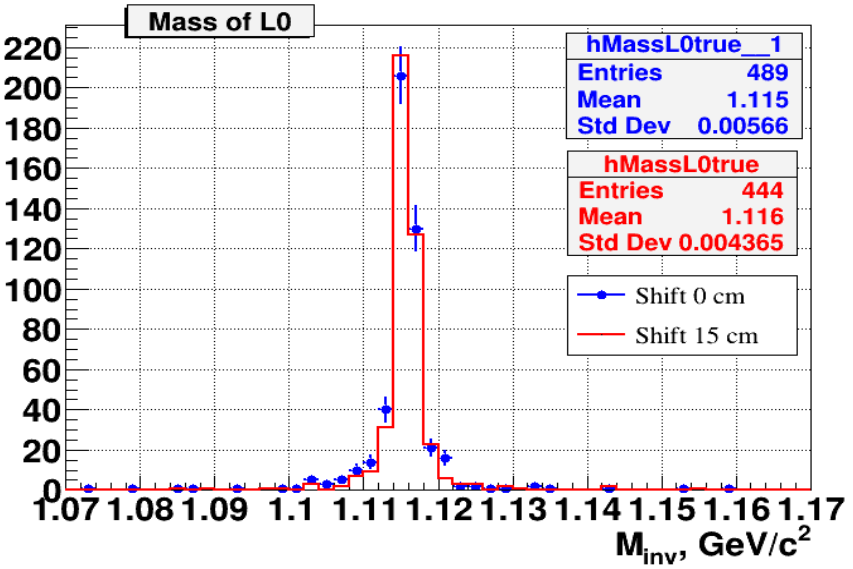
Shifted configuration

Reconstructable tracks: ≥ 4 hits in sequence



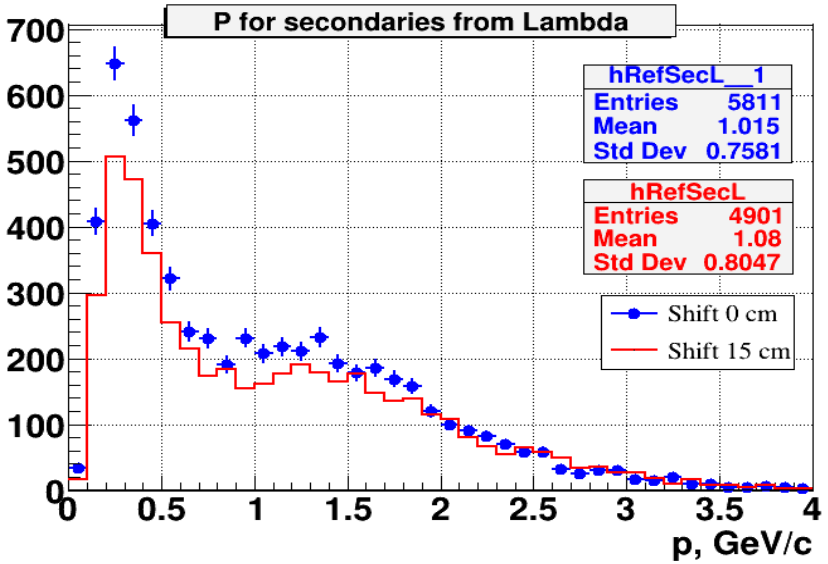


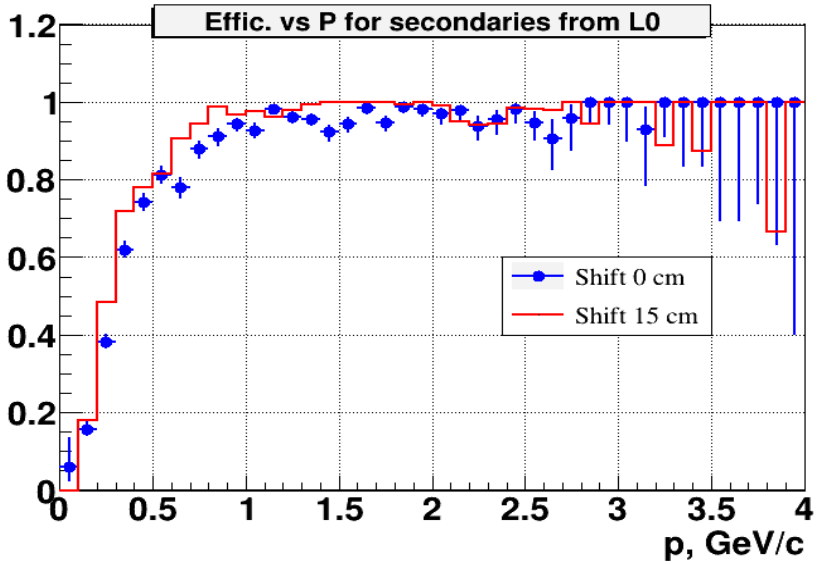


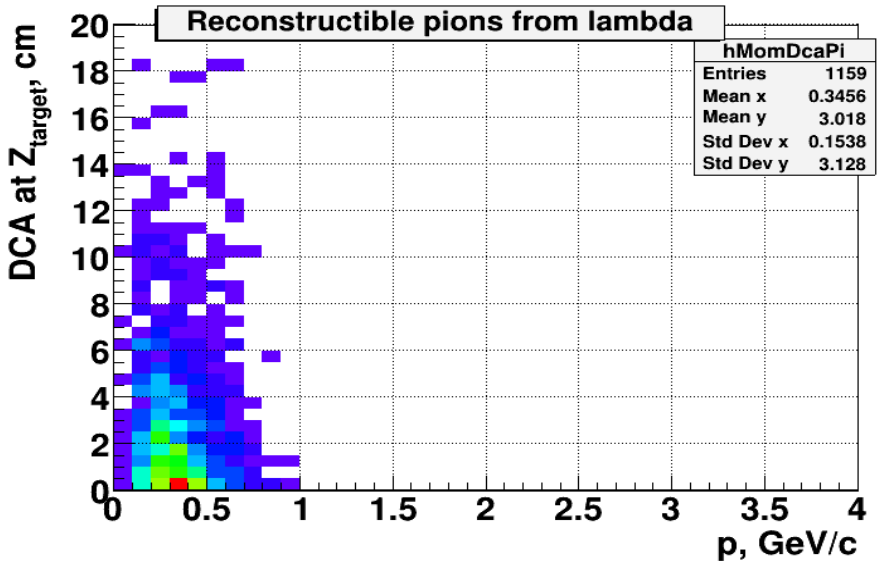


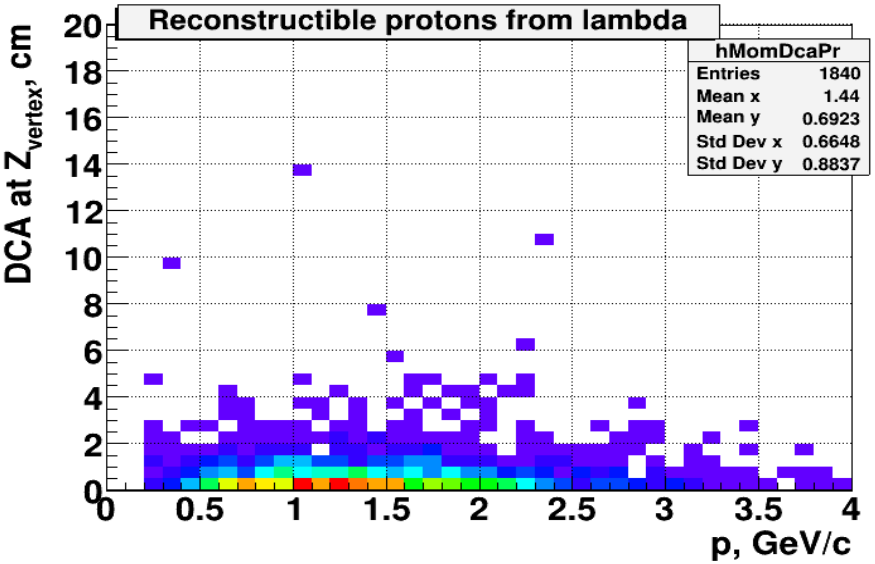
Shifted configuration

Reconstructable tracks from Λ: ≥ 4 hits in sequence



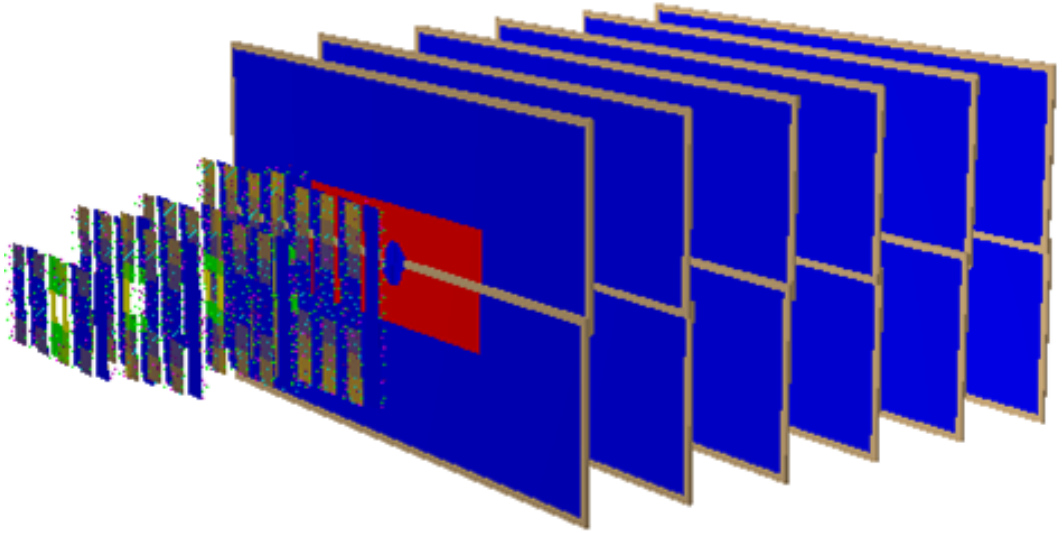


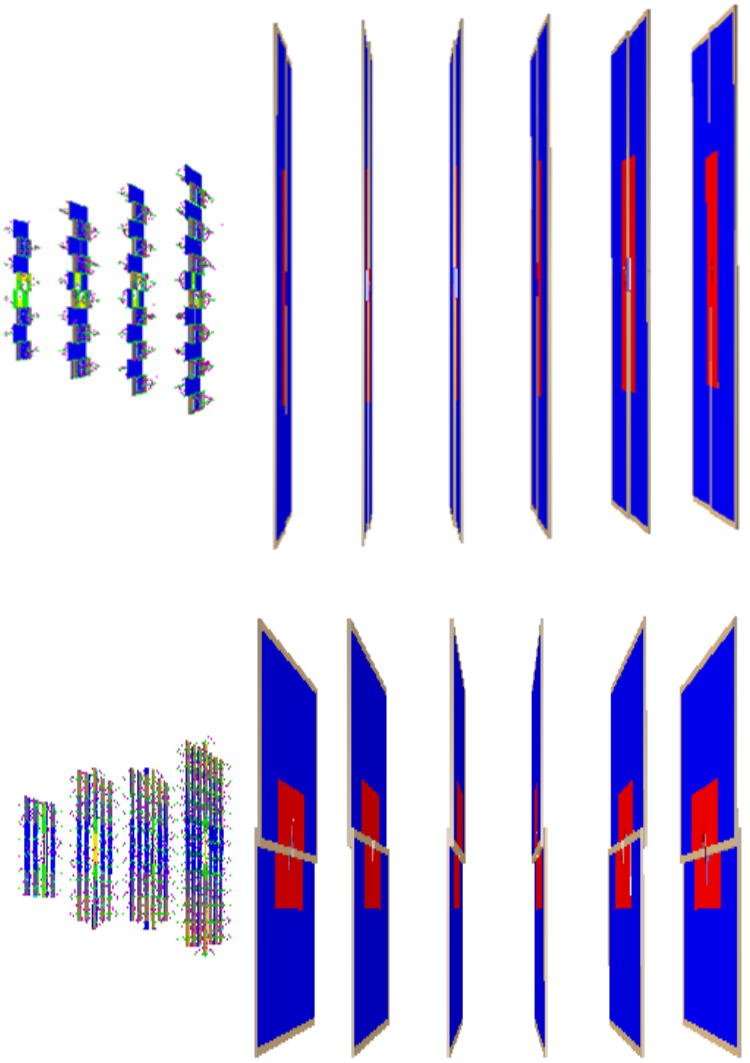




BM@N tracker performance: future configuration with large-acceptance STS

Central detector: STS+GEMs



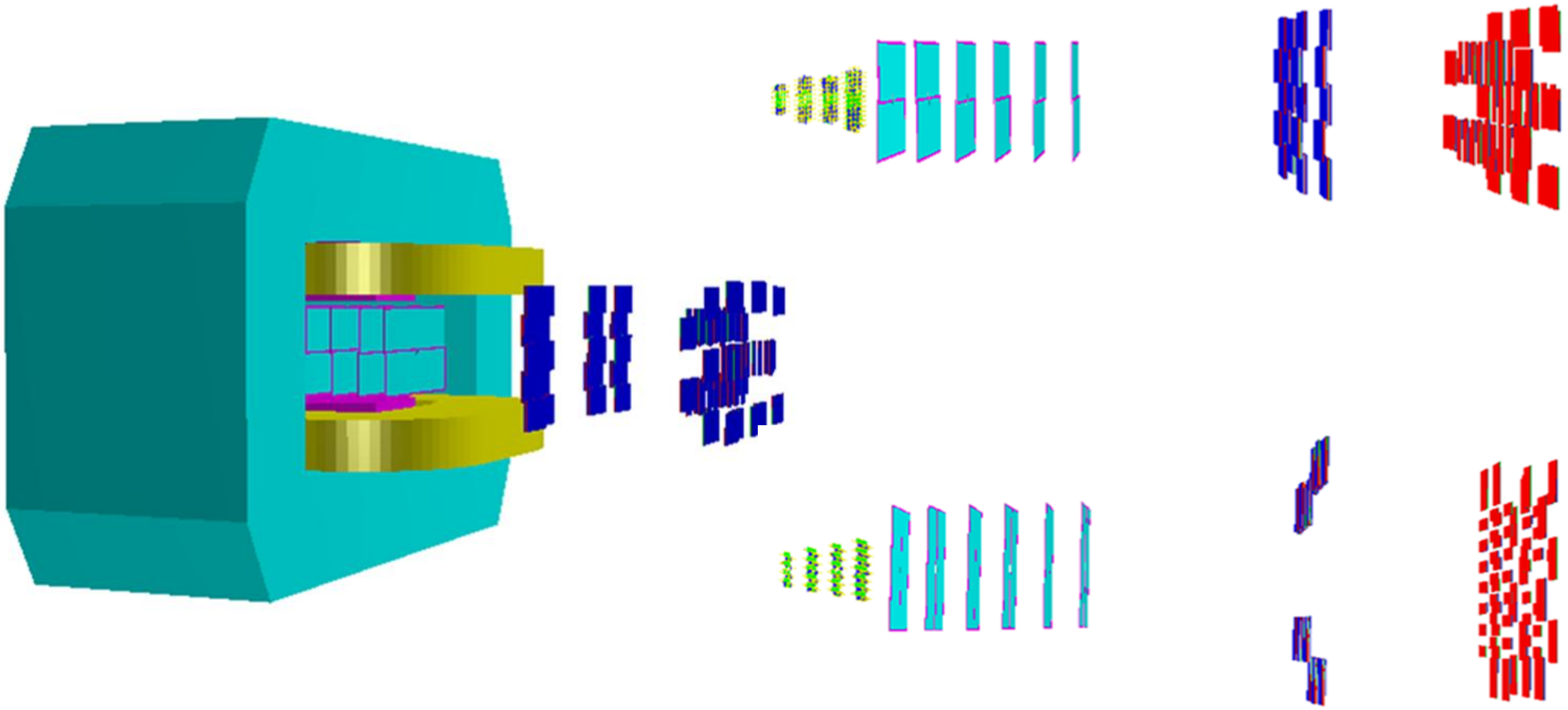


Field: ~0.8 T

Stations (target at 0):

Si	30 cm	50 cm	70 cm	90 cm	(version “f” from E.Lavrik)		Beam hole 6x8 cm
GEMs	120 cm	150 cm	180 cm	210 cm	240 cm	270 cm	Beam hole R = 5.75 cm

Detector geometry with TOF



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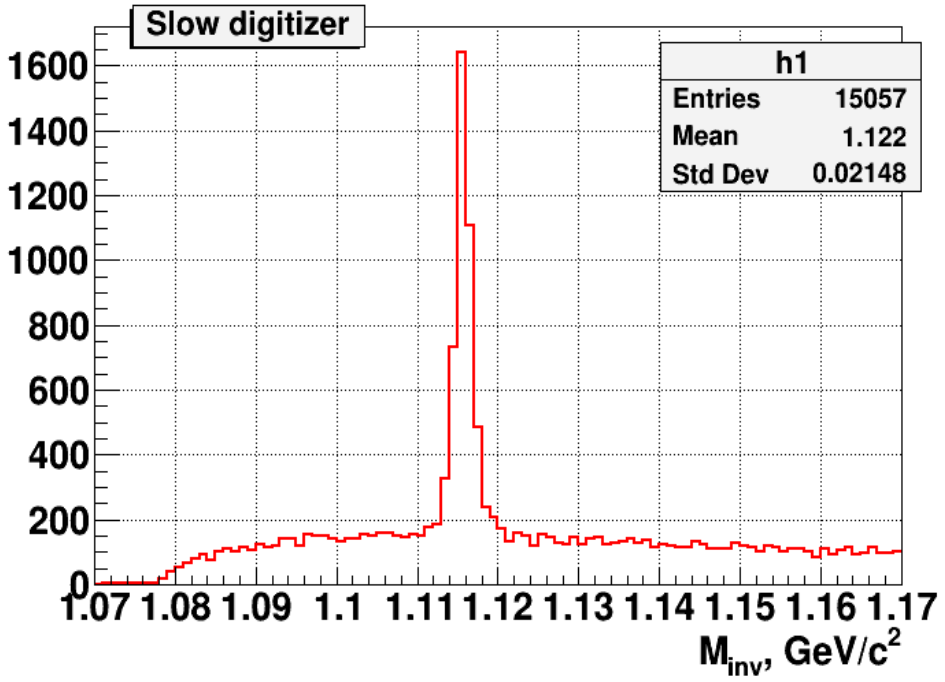
Data set

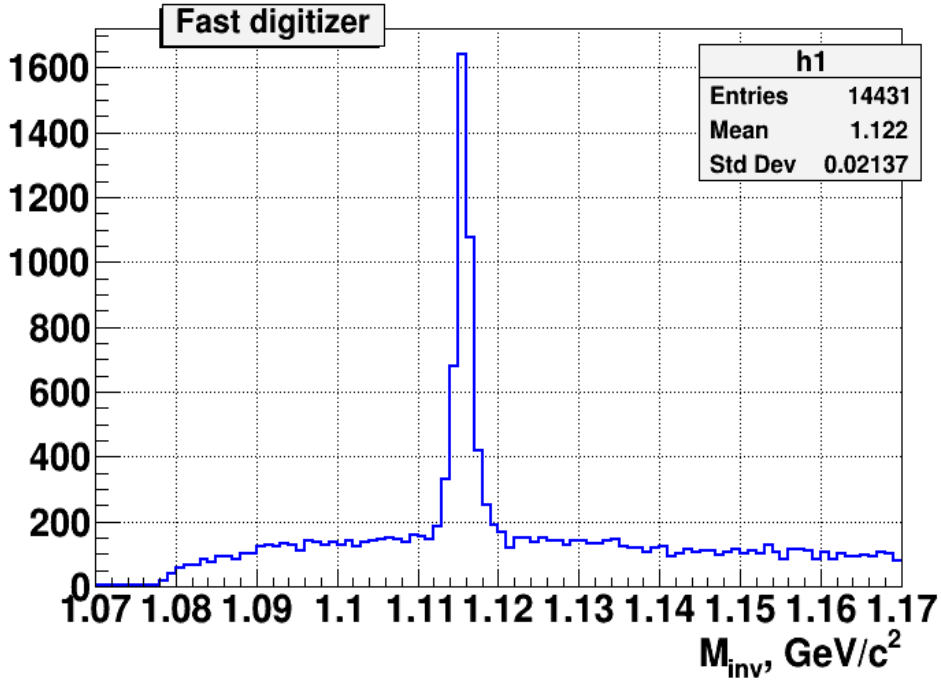
Detectors:	STS + GEMs + TOF
Magnetic field:	B = 0.8 T
PID:	*beta* in TOF
Generator:	PHQMD (from V.Kireyeu), 0.5M events, Au+Au at T_0 = 4A GeV, b = 0-5 fm
Production rate :	Ξ^- – 529, ${}_{\Lambda}H^3$ – 1689 (per 10k events)

Λ reconstruction

with slow and fast digitizers in GEMs

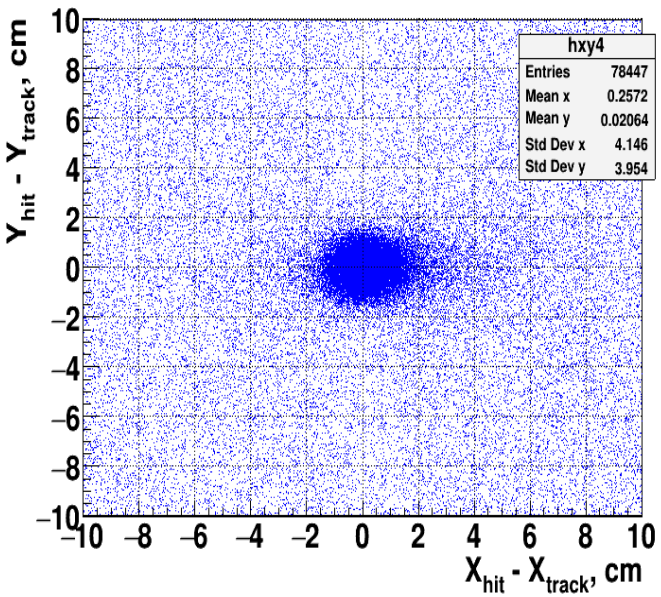
(Factor of 3.9 decrease in processing time)

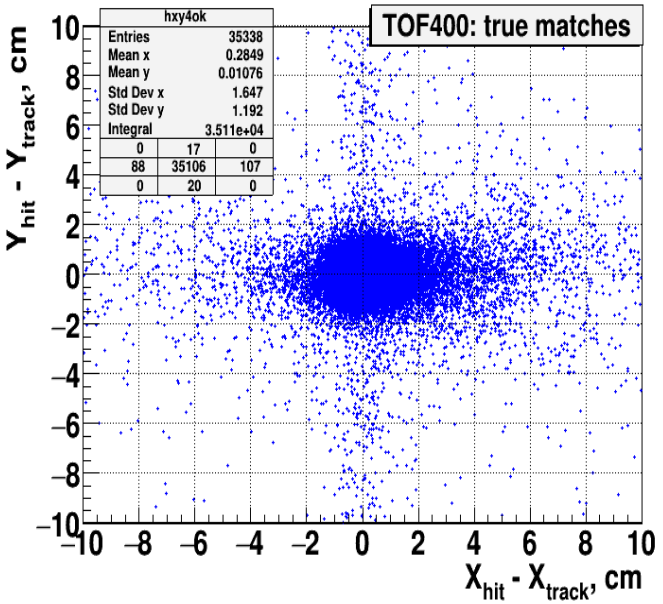


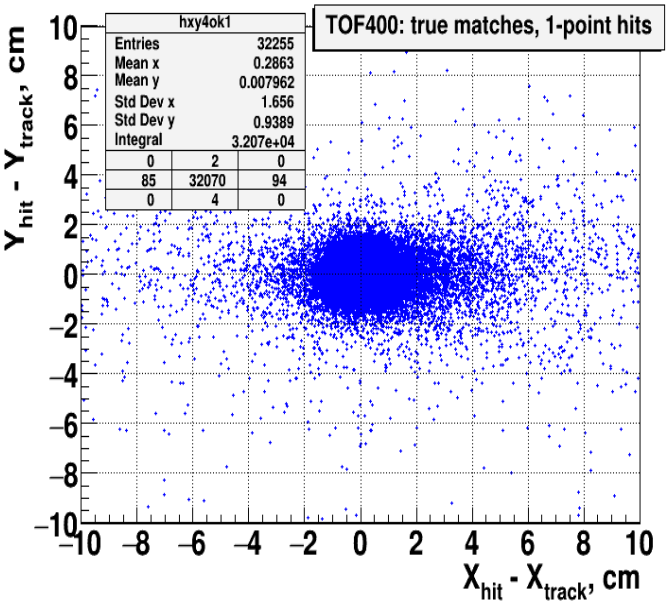


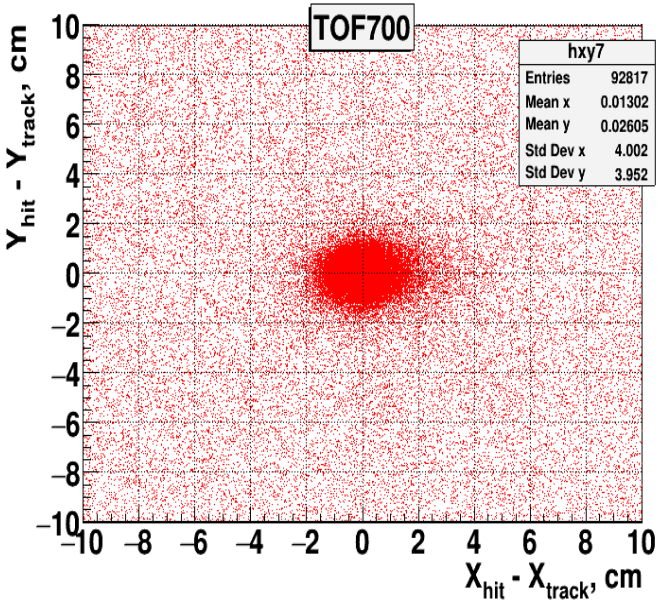
Cuts: $\chi^2_p > 5$, $\chi^2_\pi > 5$, path > 5 cm, $\chi^2_\Lambda < 20$, $\text{angle}_\Lambda < 0.1$

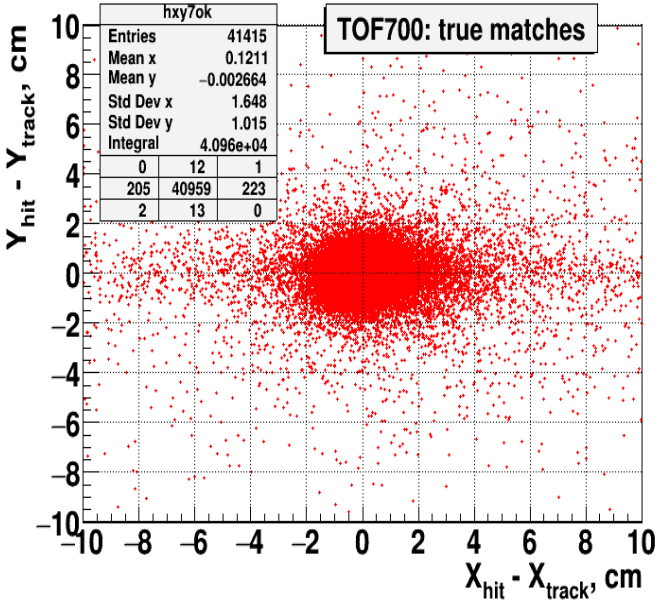
Matching with TOF



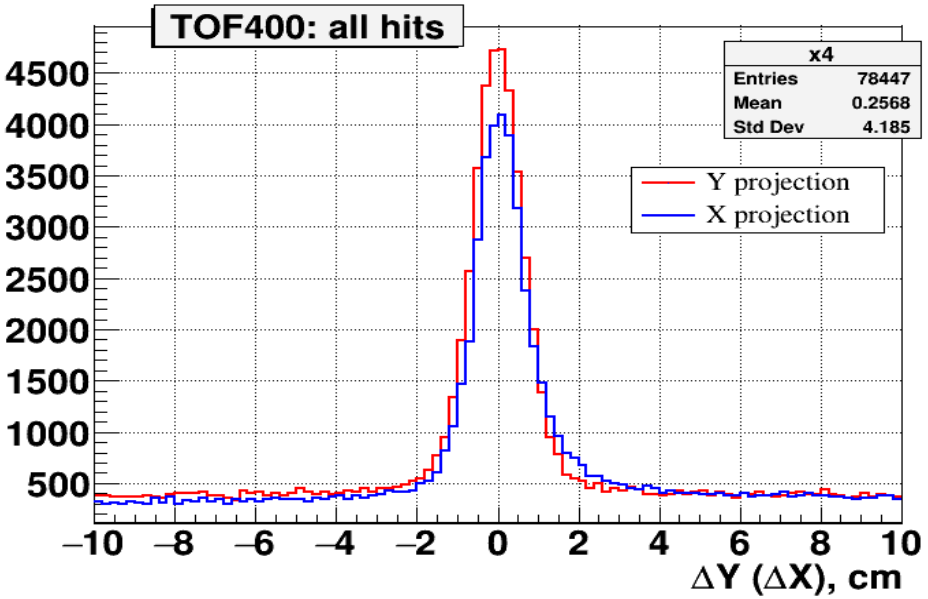


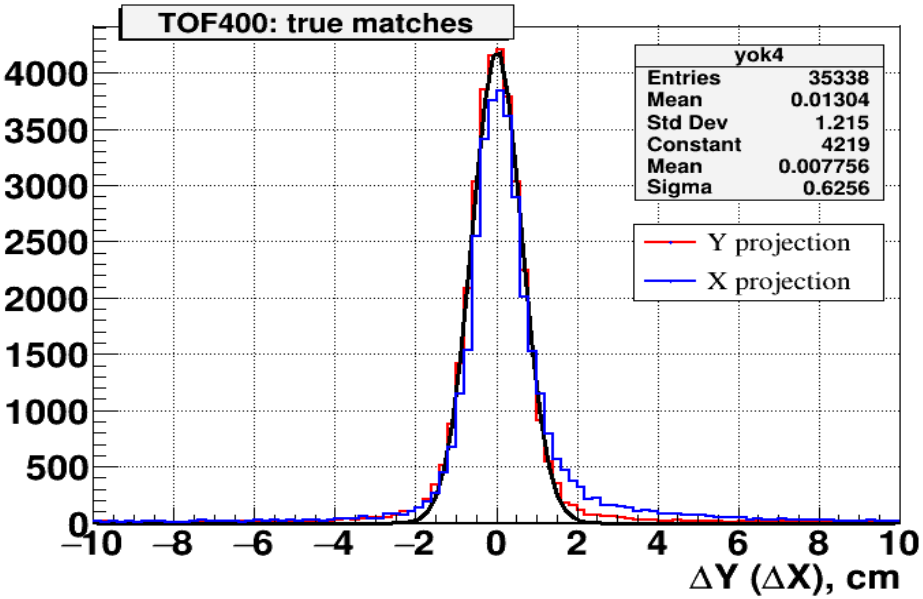


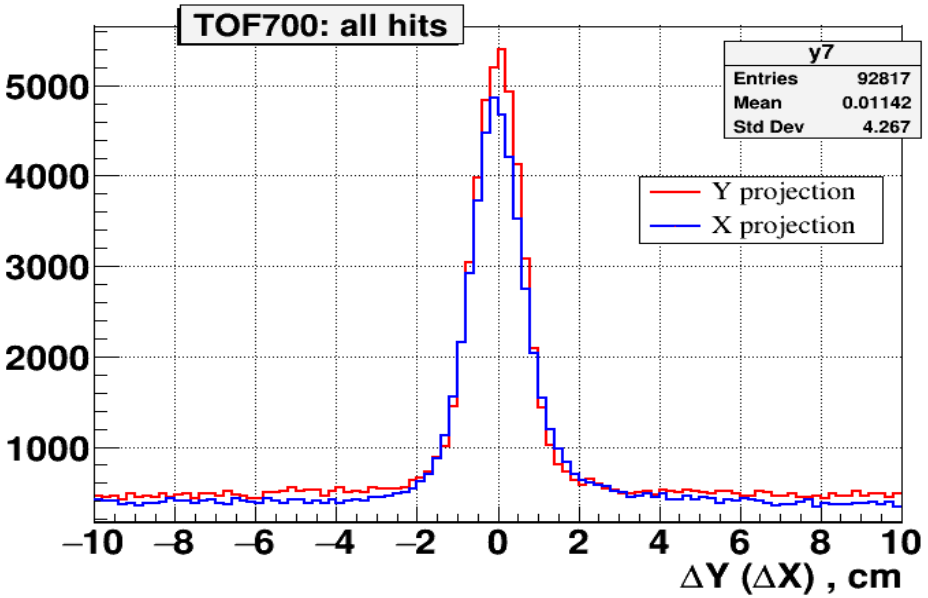


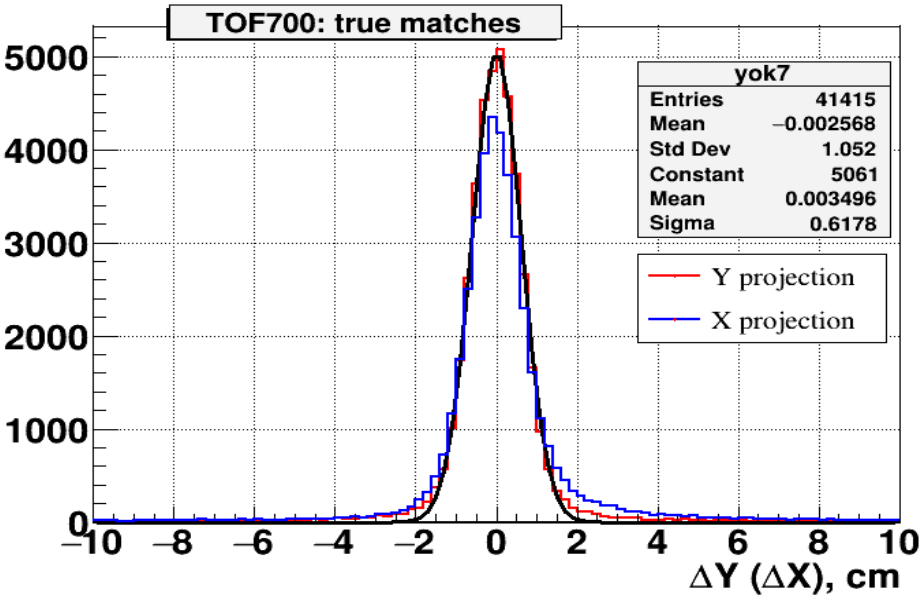


Matching with TOF

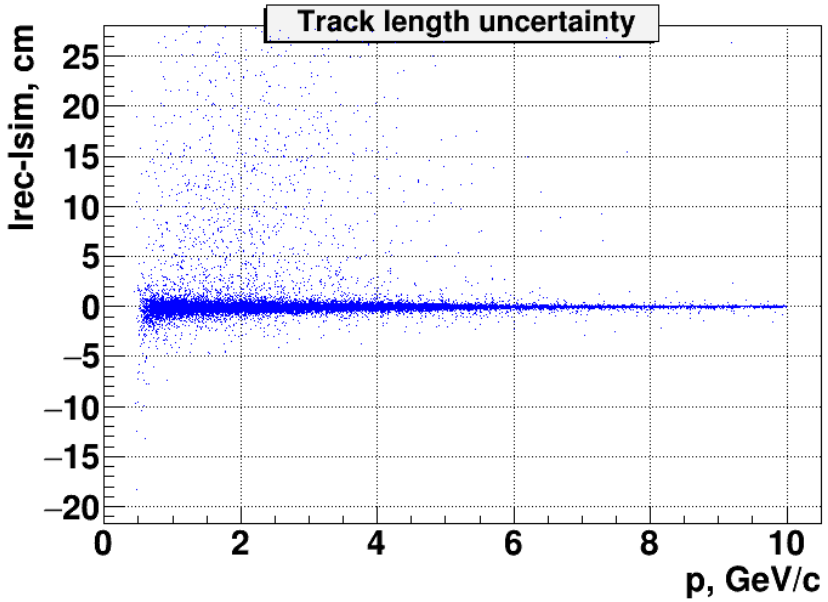


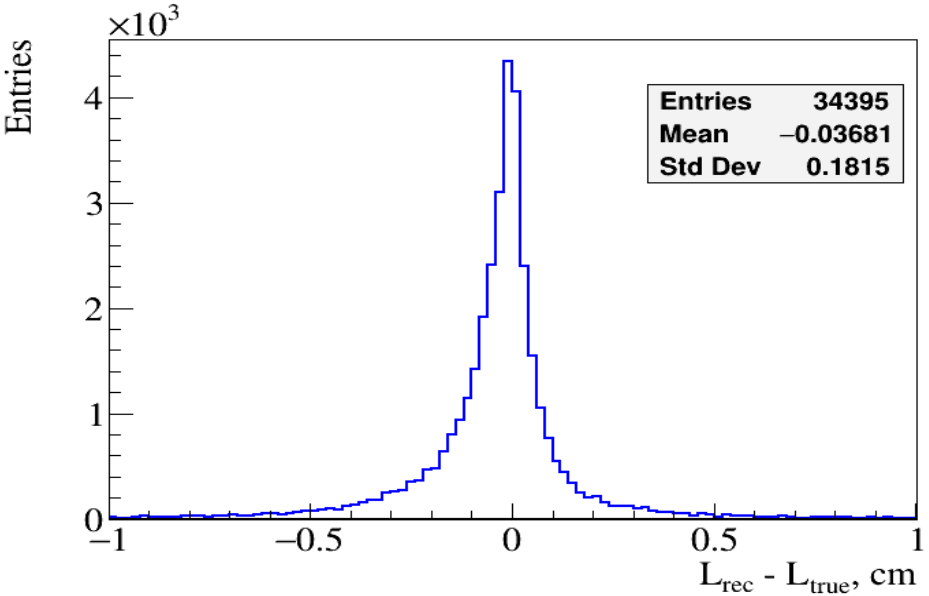


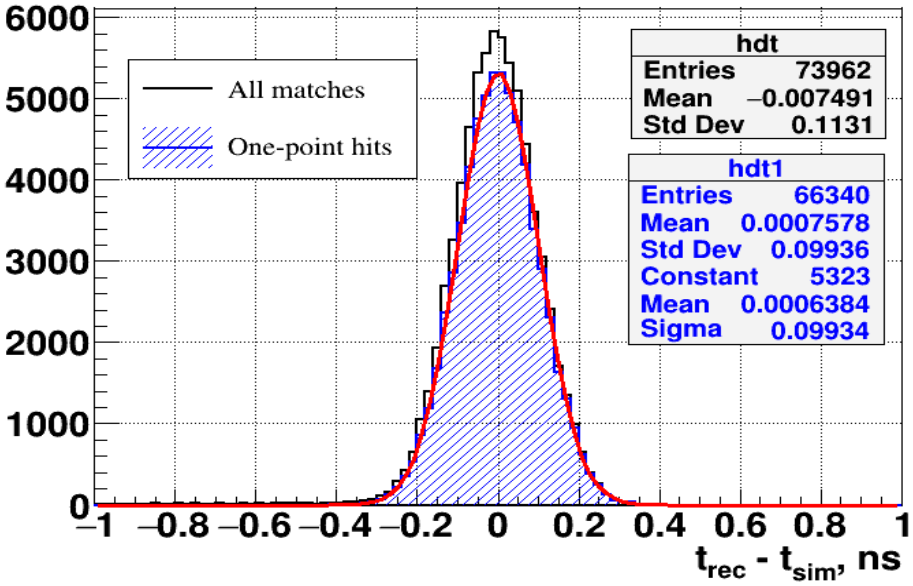


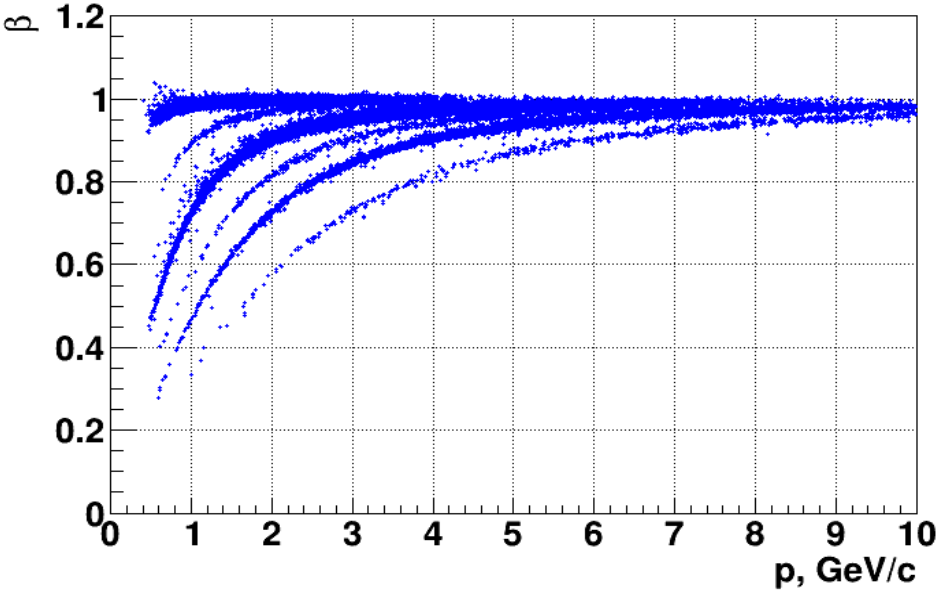


Matching with TOF

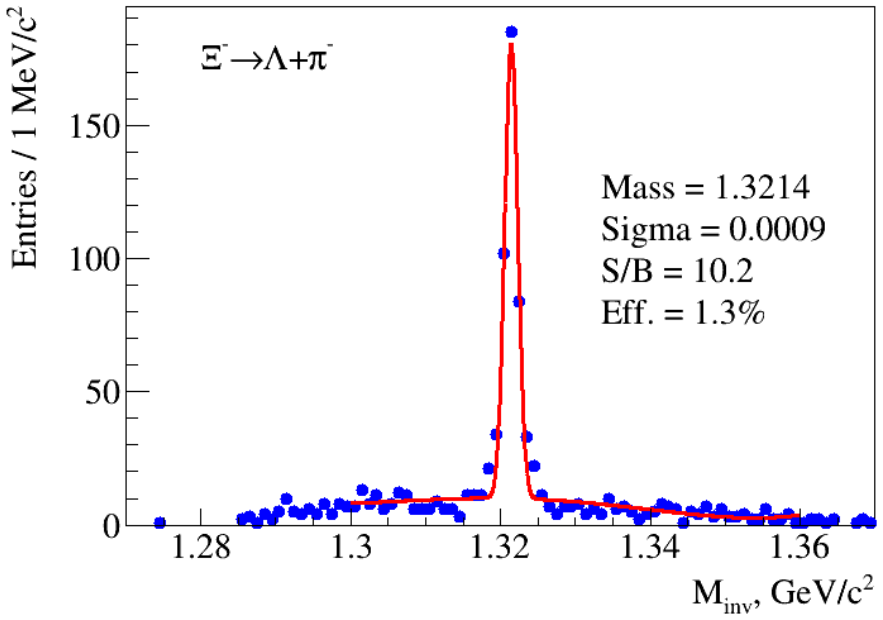


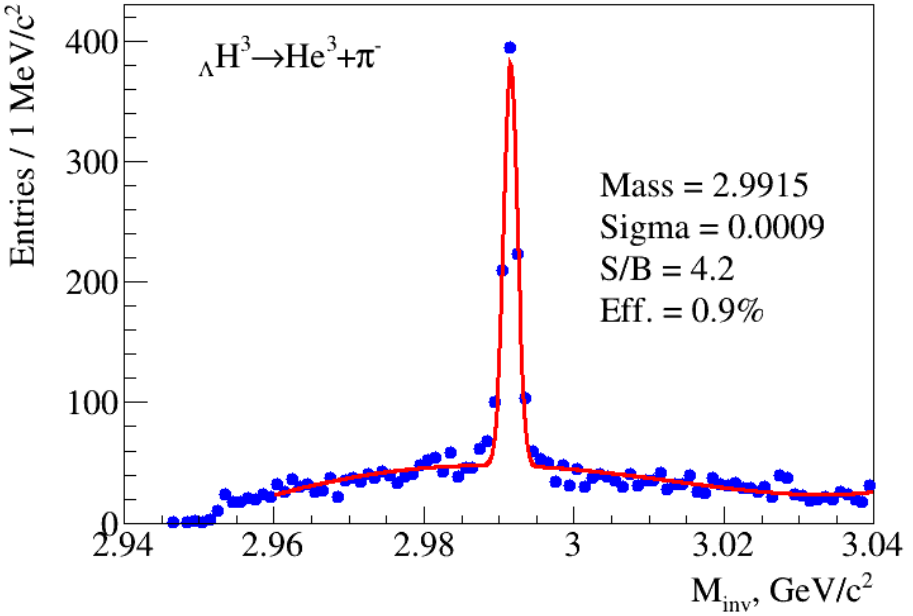


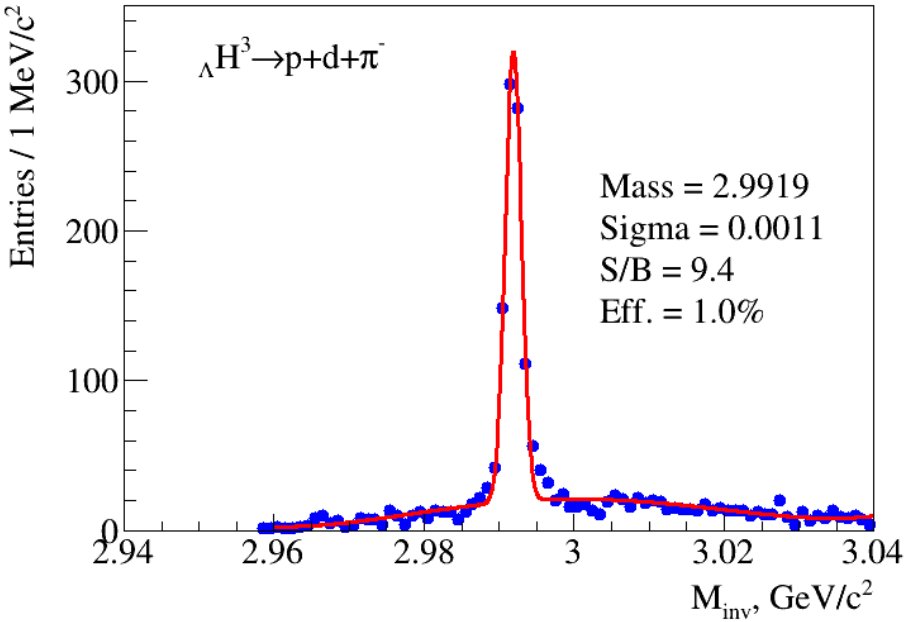




Ξ^- and ${}_{\Lambda}H^3$ reconstruction

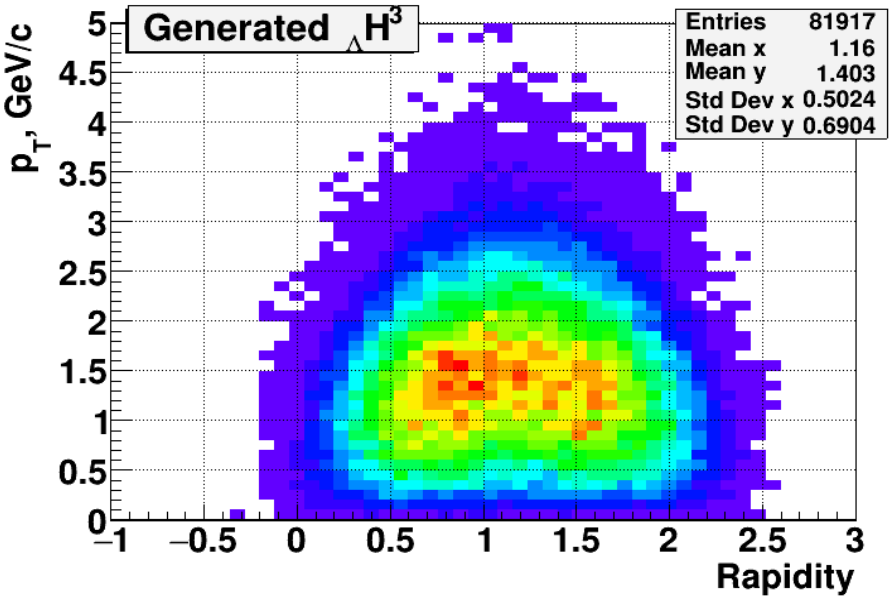


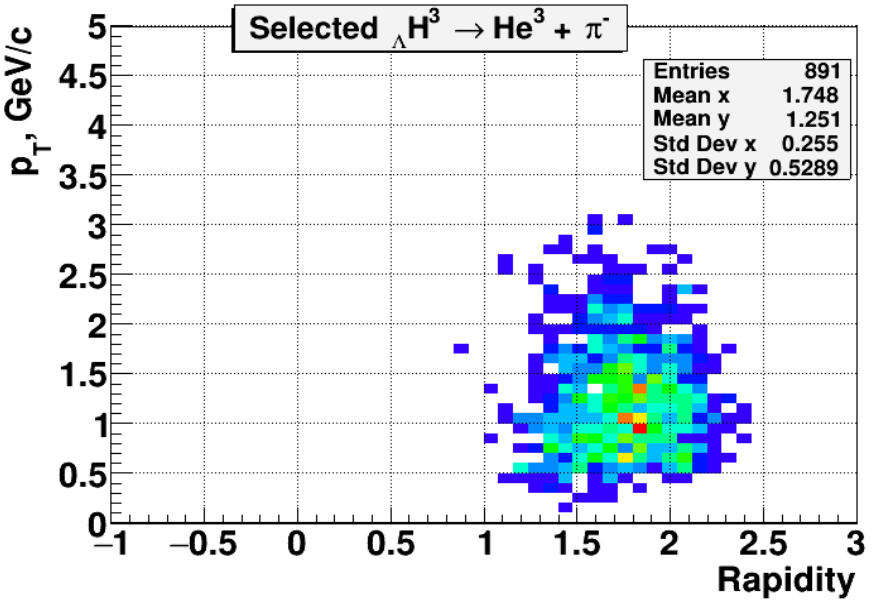


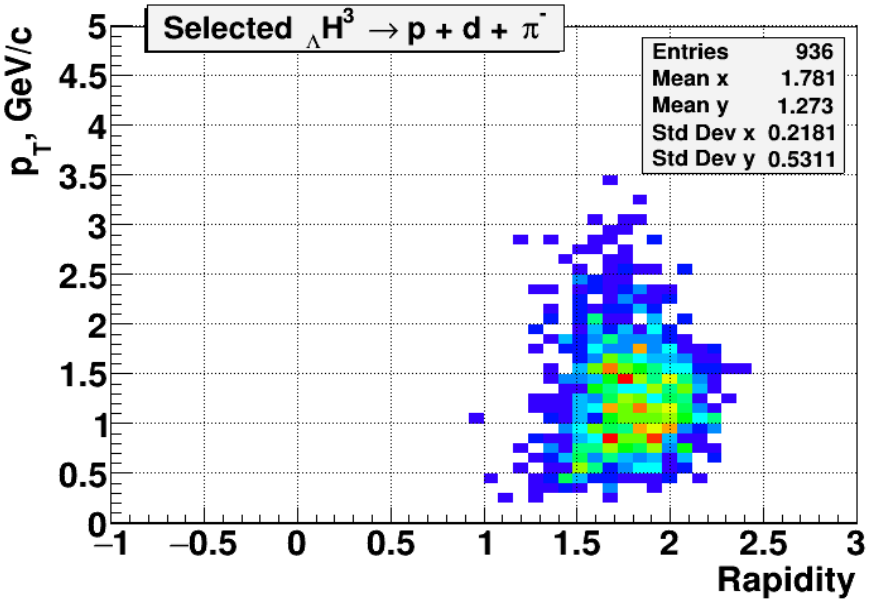


Efficiency = (reconstructed, identified and selected *Hyp*) / (all generated *Hyp* after GEANT within 50 cm of PV)
– ***includes branching ratios, detector acceptance and reconstruction efficiency***

${}_{\Lambda}H^{3}$ phase space







Summary

- ✓ BM@N central tracker configuration in future run8 was tested for simulated events in order to do some optimization.
- ✓ BM@N central tracker performance with wide-aperture silicon tracker was checked for central Au+Au simulated events in order to see its capability for rare probe reconstruction.
- ✓ Both configurations could benefit from track reconstruction improvement for low-pt tracks.