Current status of hyperon and hypertriton analysis at MPD/NICA

V.Kolesnikov, V.Vasendina, A.Zinchenko

for the MPD collaboration VBLHEP, JINR, Dubna, Russia

Data set

- **Generators:**

  for hyperons: PHSD, Au+Au @ 11 GeV, min. bias, 8M events
  for hypernuclei: DCM-QGSM , Au+Au @ 5GeV, cerntral, 0.9M events

- **Detectors:** start version of MPD with up-to-date TPC & TOF

- **Cluster / hit reconstruction:** precluster finder *(group of adjacent pixels in time bin – pad space*) ; hit finder *("peak-and-valley" algorithm either in time bin – pad space (for simple topologies) or in time-transverse coordinate pixel space after Bayesian unfolding (for more complicated topologies))*→ COG around local maxima

- **Track reconstruction:** two-pass Kalman filter with track seeding using outer hits (*1st pass*) or leftover inner hits (*2nd pass*)

- **Track acceptance criterion:** $|\eta| < 1.3$, $N_{hits} \geq 10$

- **Particle Identification:** *dE/dx* in TPC & β in TOF

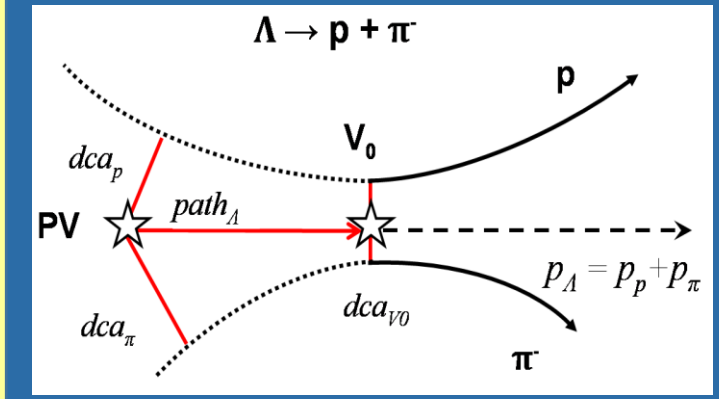
Analysis goals and Event topology

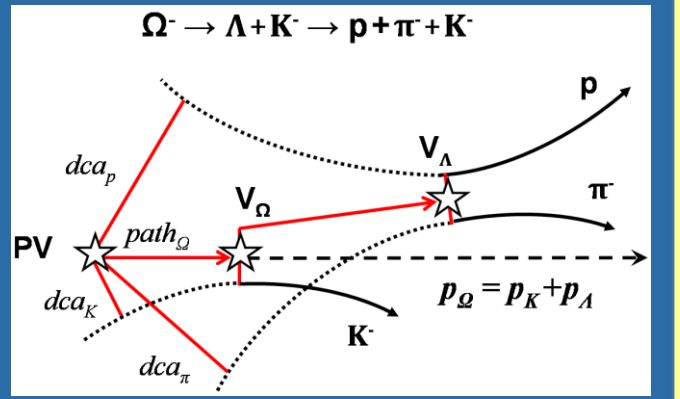
Goals:

- Secondary Vertex Reconstruction algorithms development for multistrangeness analysis
- Optimization of selection criteria in pT and centrality
- Analysis macros for invariant spectra reconstruction
- Estimates of MPD efficiency and expected event rates
- Publications with results of the study (supported by a RFBR Grant for 2019-21)

Analysis method:

Secondary Vertex Finding Technique

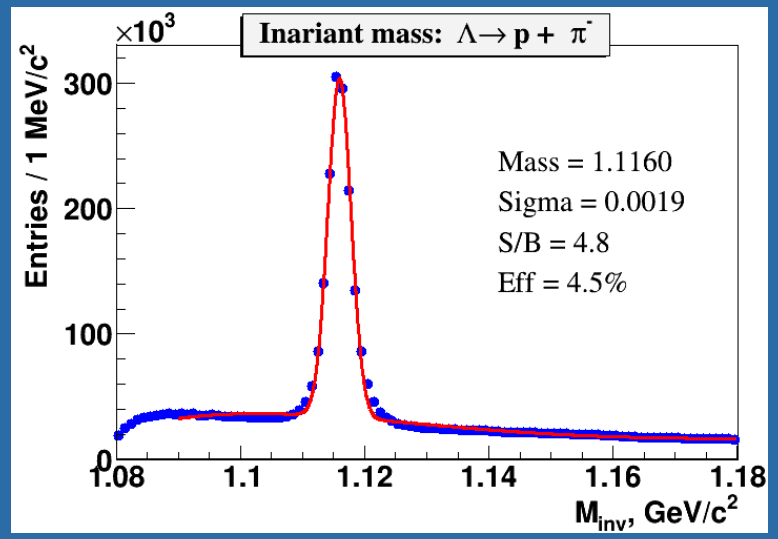


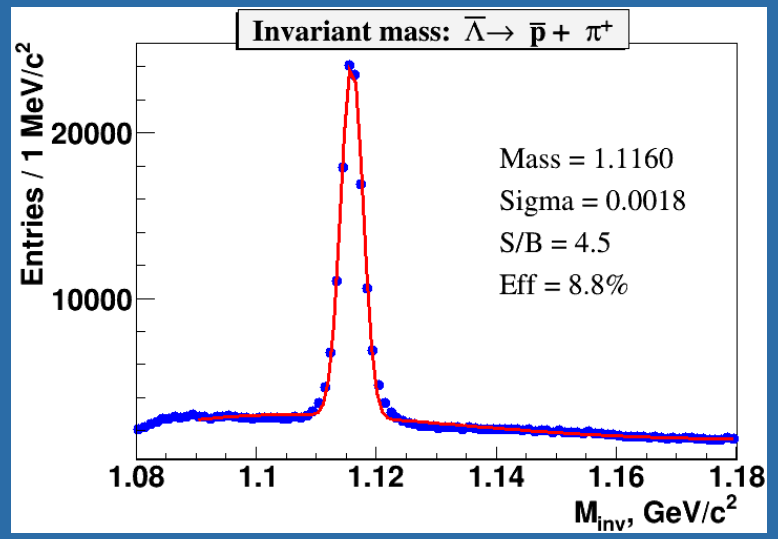


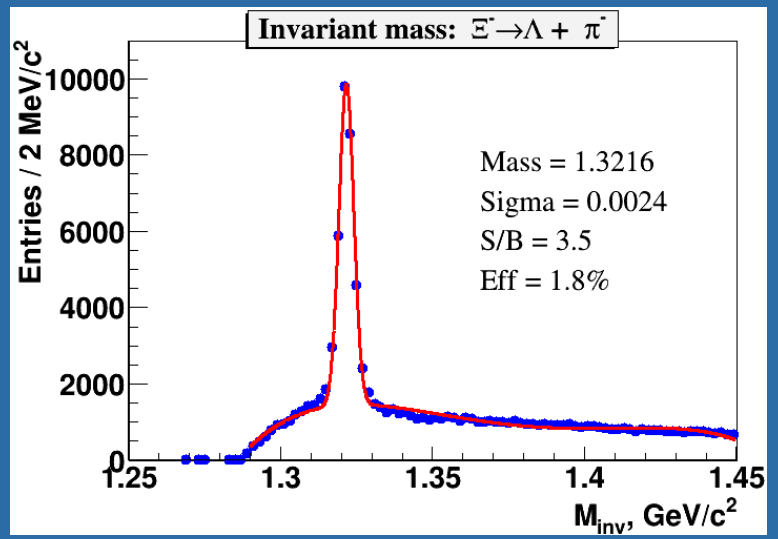
Event topology:

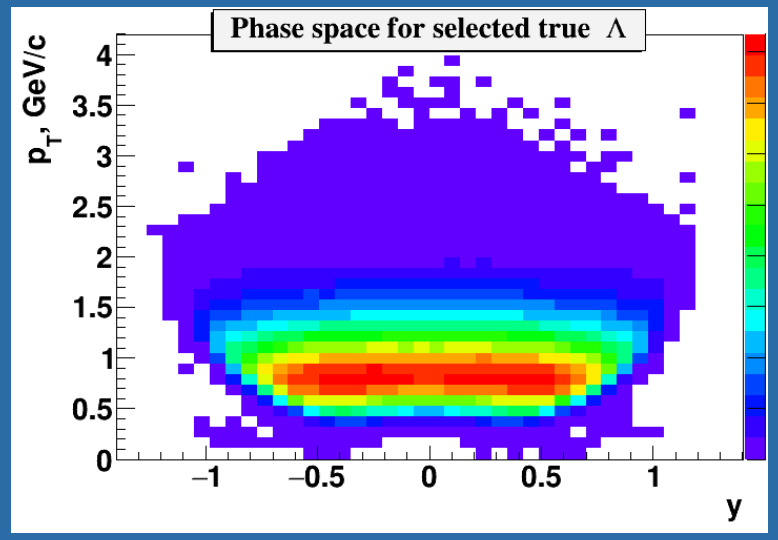
- PV – primary vertex
- V_0 – vertex of hyperon decay
- dca – distance of the closest approach
- path – decay length

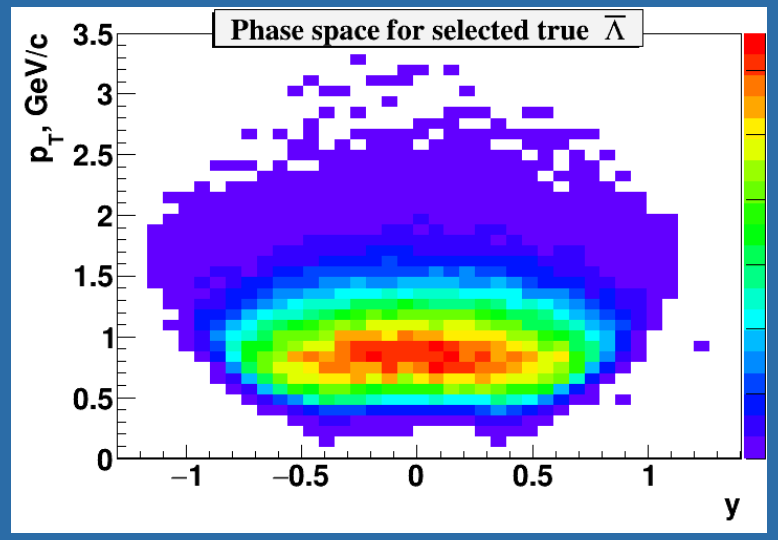
Λ, Λ_{bar}, Ξ^- reconstruction and Phase space

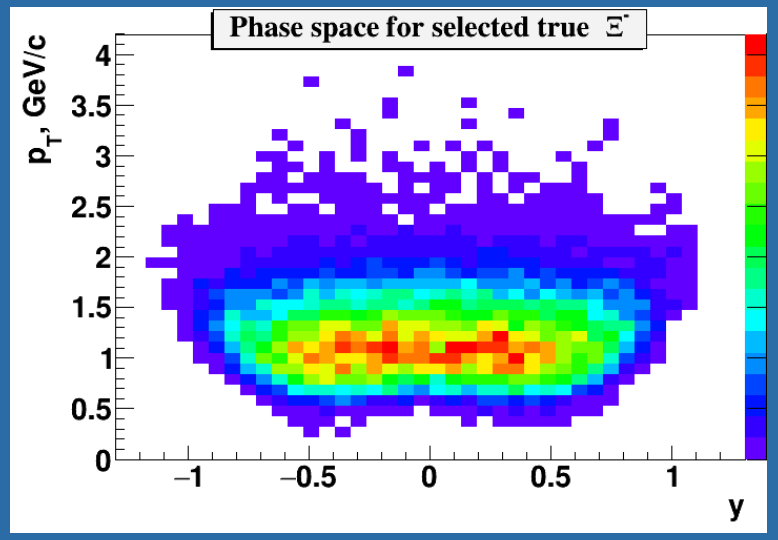




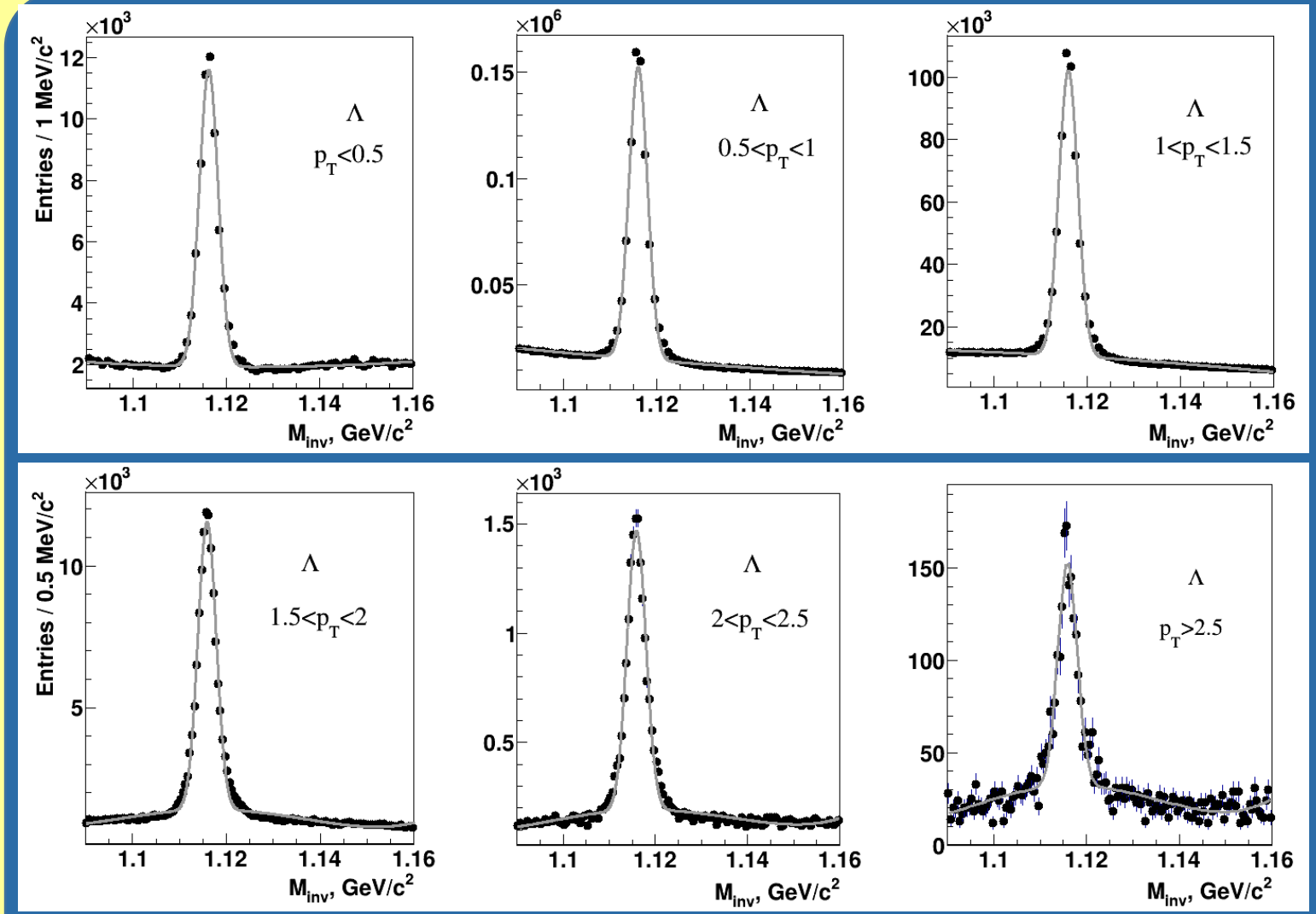






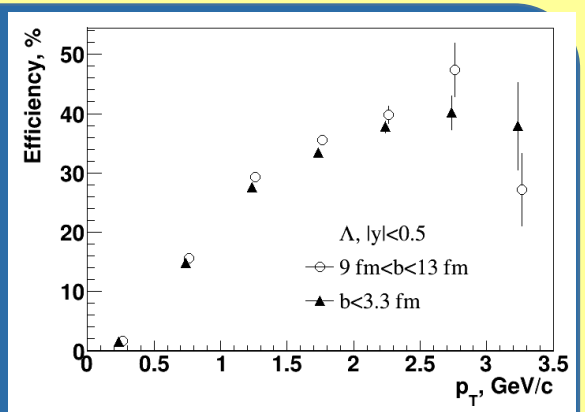


Λ reconstruction

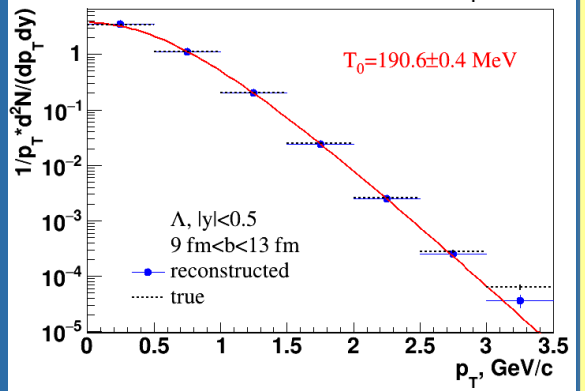


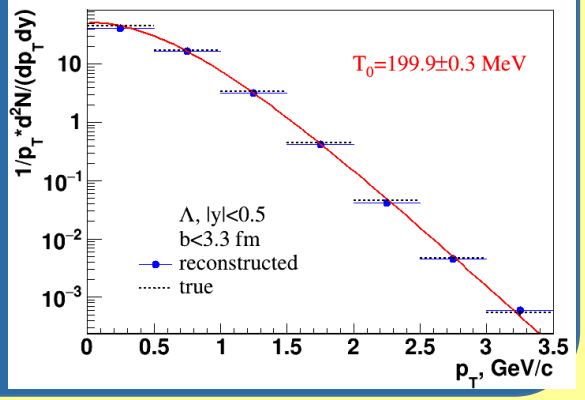
p_T dependence of Λ for all centralities

Efficiency of true Λ in p_T and b bins for |y|<0.5:
(reco & select Λ) / (all gen Λ)

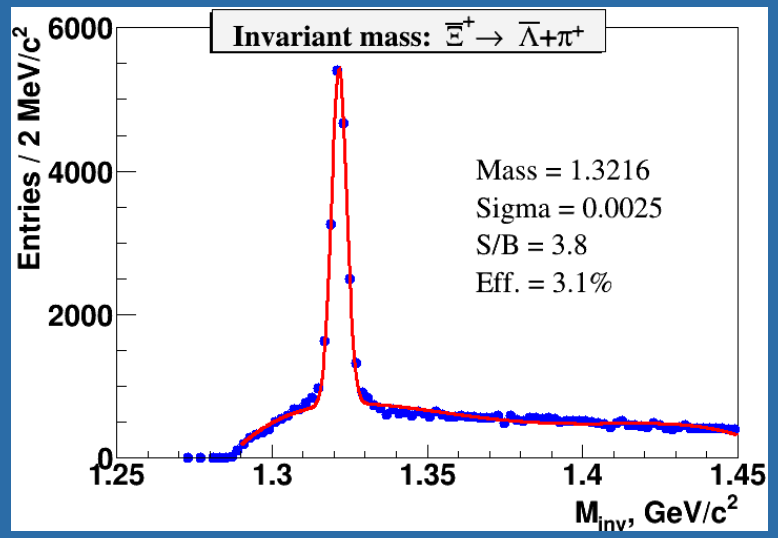


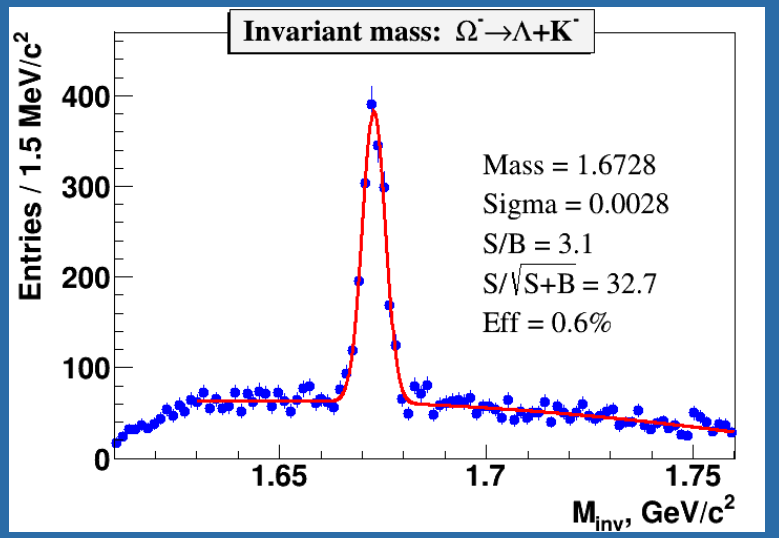
Reconstructed spectrum:
fit of selected Λ in each bin
(Gauss ± 3σ) / Eff.

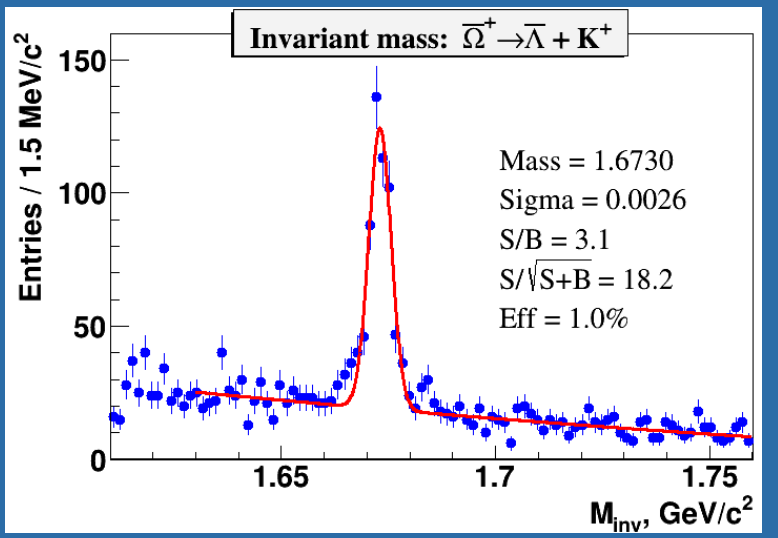


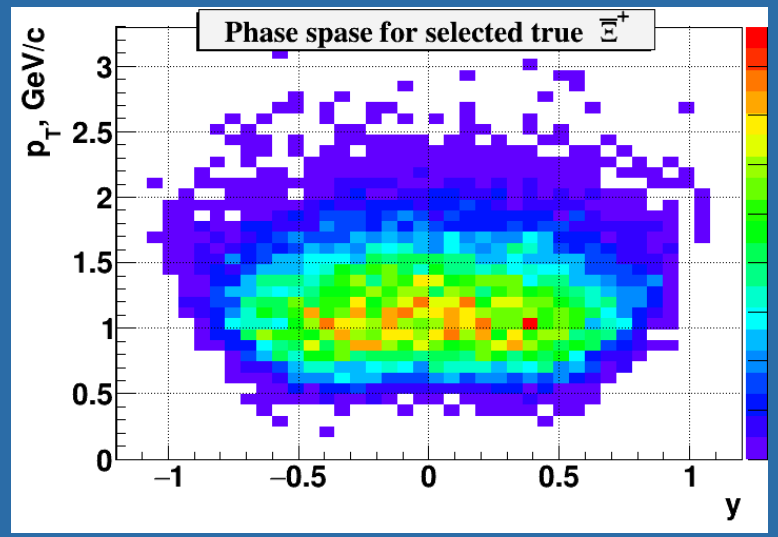


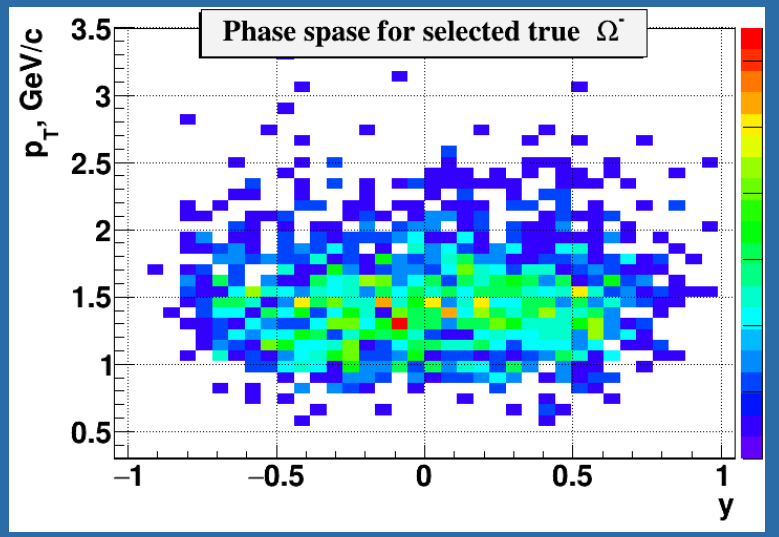
Ξ^+, Ω^-, Ω^+ reconstruction and Phase space

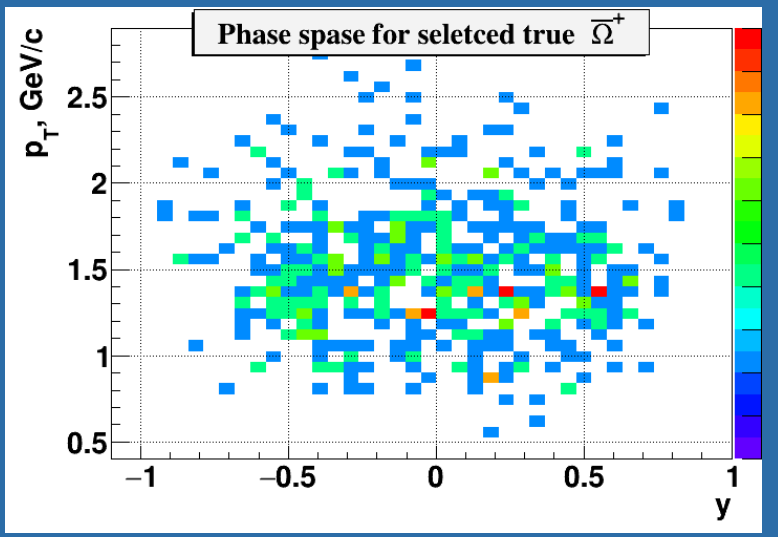










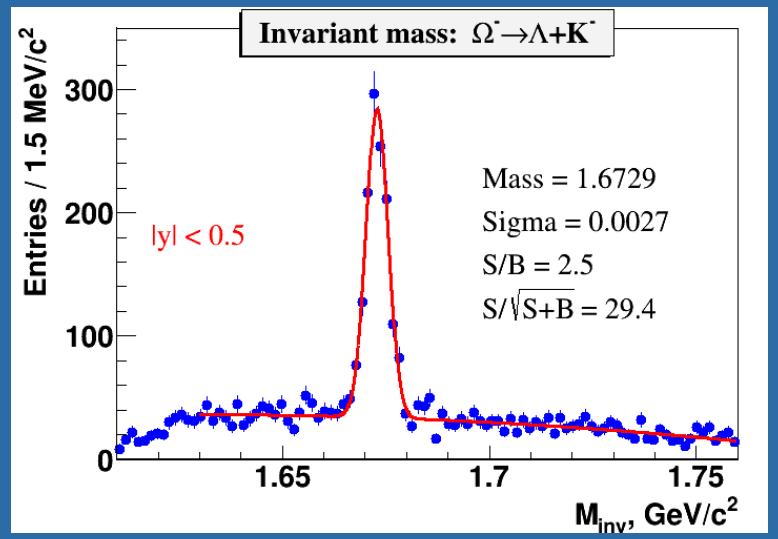


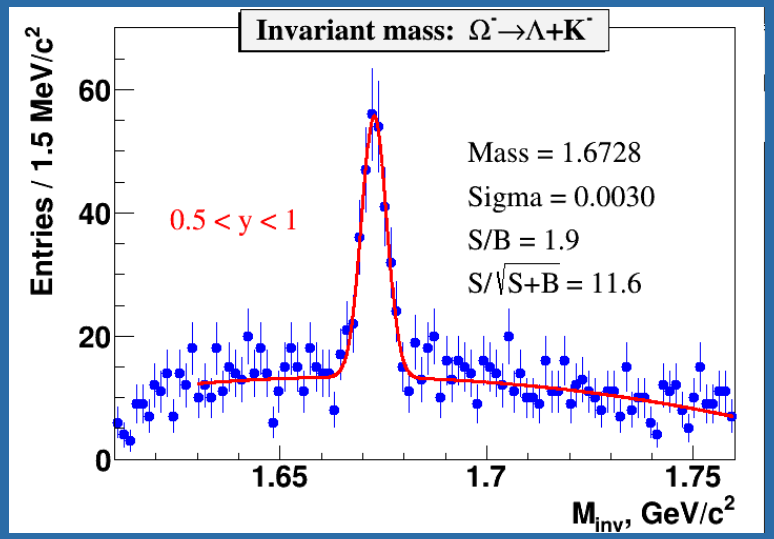
Statistics **15089**

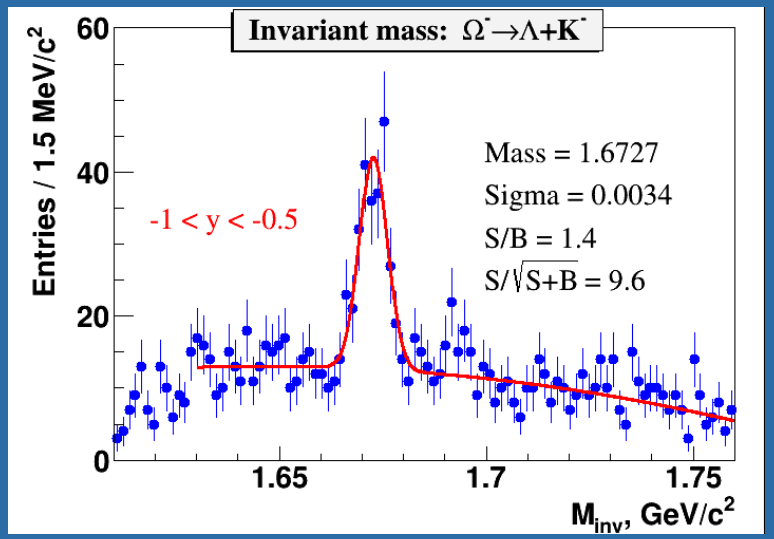
Statistics **1531**

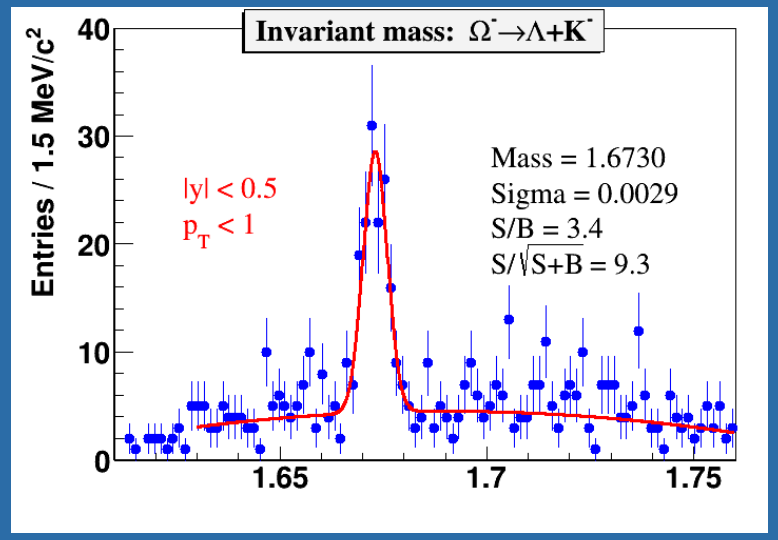
Statistics **502**

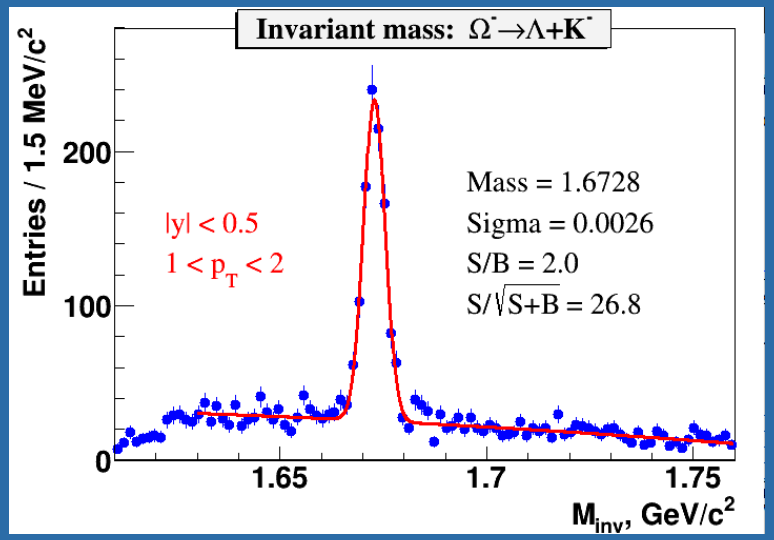
Ω^- hyperon: y & p_T dependence

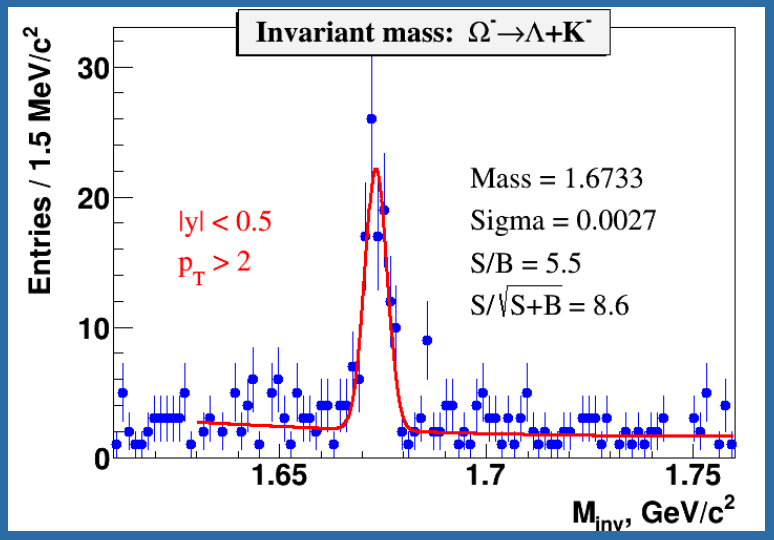












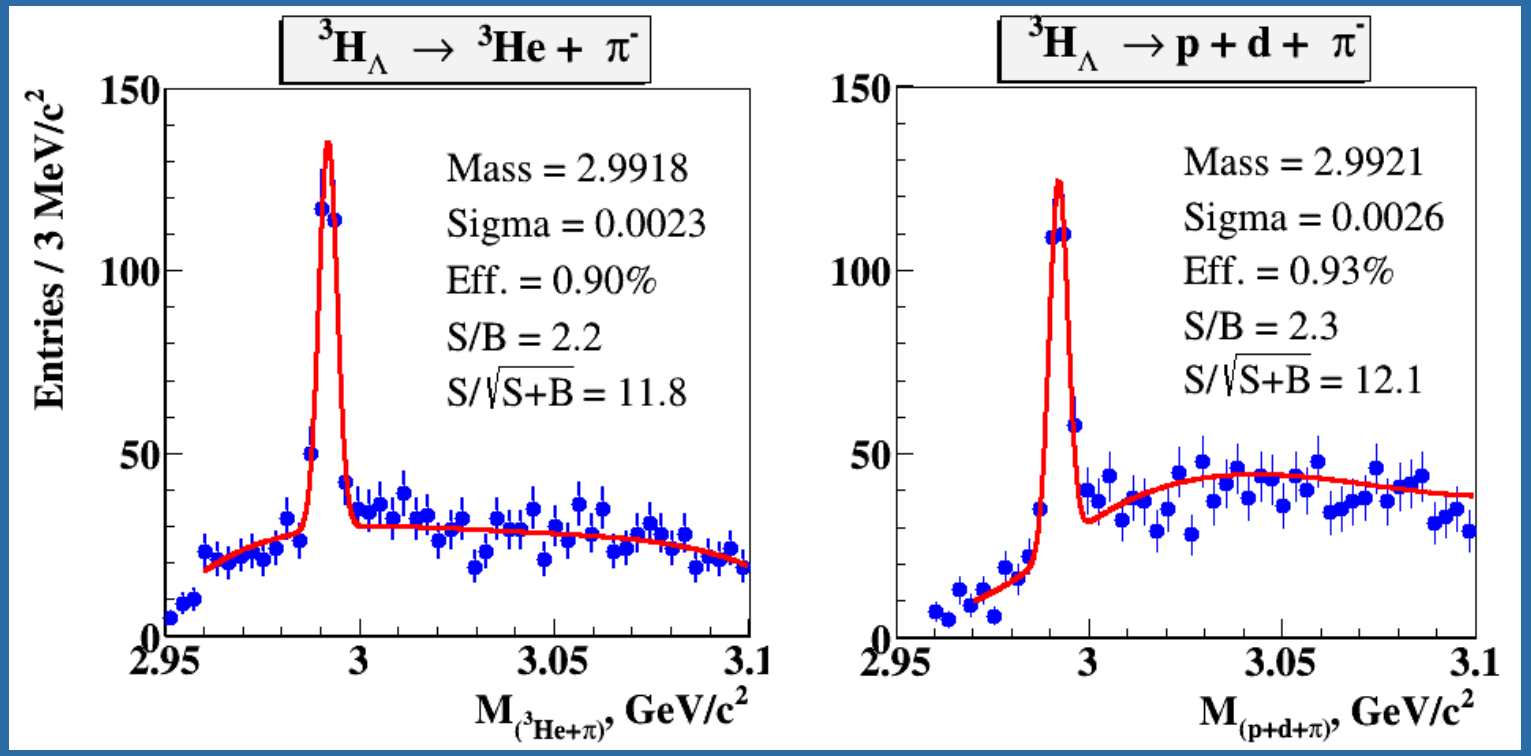
H^3_Λ reconstruction

Data set

Generator: DCM-QGSM ,
Au+Au @ 5GeV,
0.9M events, central

Detectors: TPC & TOF

PID: dE/dx in TPC & β in TOF



- First preliminary results for hypertritos are based on a small data set
- Request for 2020: >10M central collisions at several energies (DCM-QGSM generator requires some tuning to describe fragment yields)

Summary

- Multistrange hyperons are reconstructed in min. bias Au+Au at 11 GeV
- MPD efficiency is estimated in p_T bins for several centrality intervals
- Invariant yields of (anti)Λ are obtained for central and peripheral collisions
- Analysis for Ξ and Ω is ongoing, the latter requires a larger data volume
- First preliminary results for hypertritons are obtained. For more detailed study larger data sets needed (10M central collisions at several energies)