

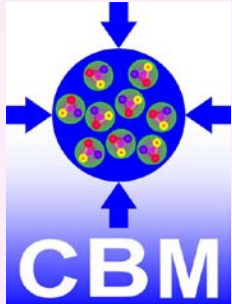
Multi-Strange Hyperons Triggering at SIS 100

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For the CBM collaboration



DPG Spring meeting
Darmstadt, 14-18 March 2016

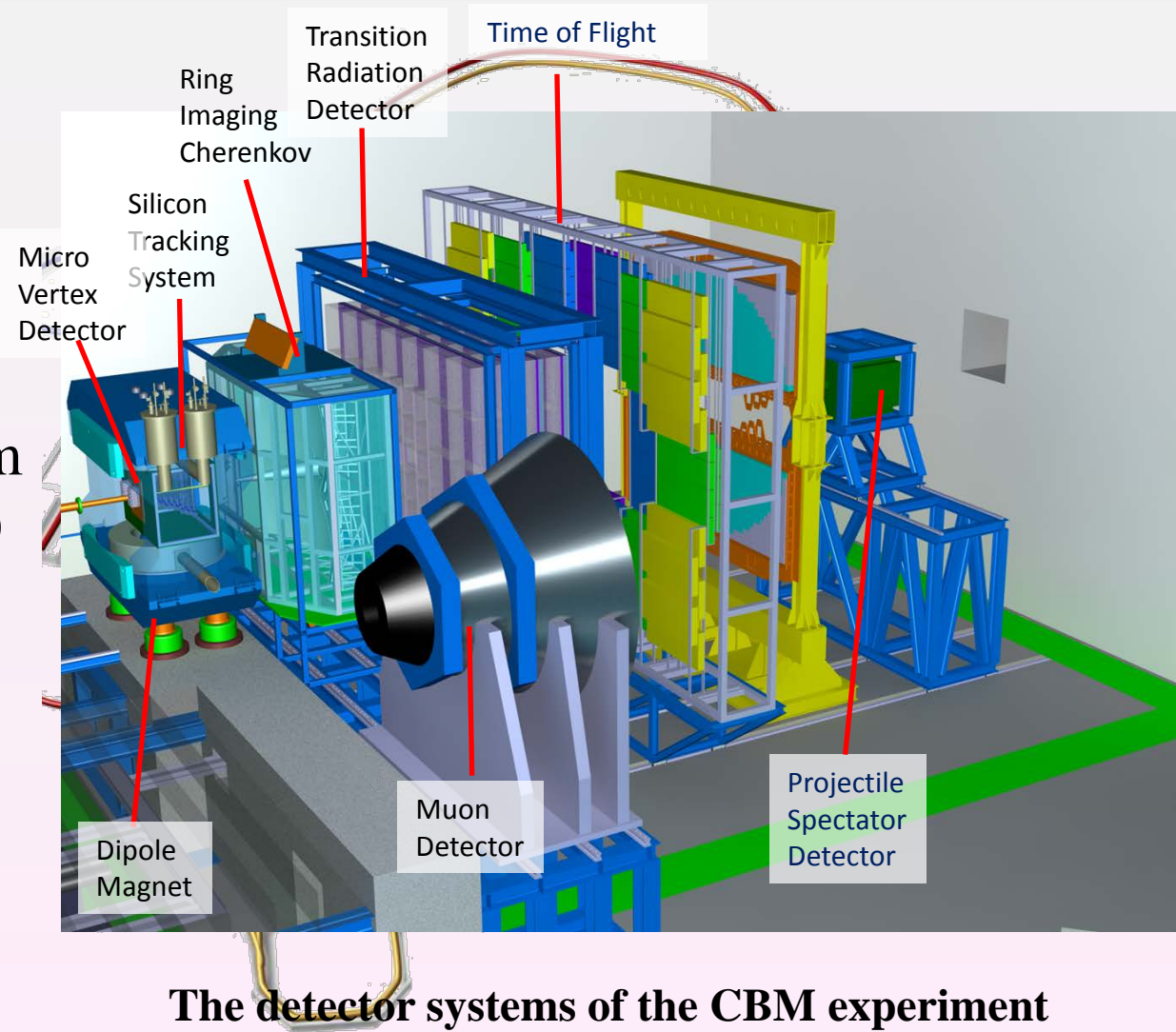


The Compressed Baryonic Matter (CBM) Experiment at FAIR

Explore QCD phase diagram in the region of high net baryon densities

Physics program is performed with ions beam delivered by SIS 100/300 accelerator at FAIR

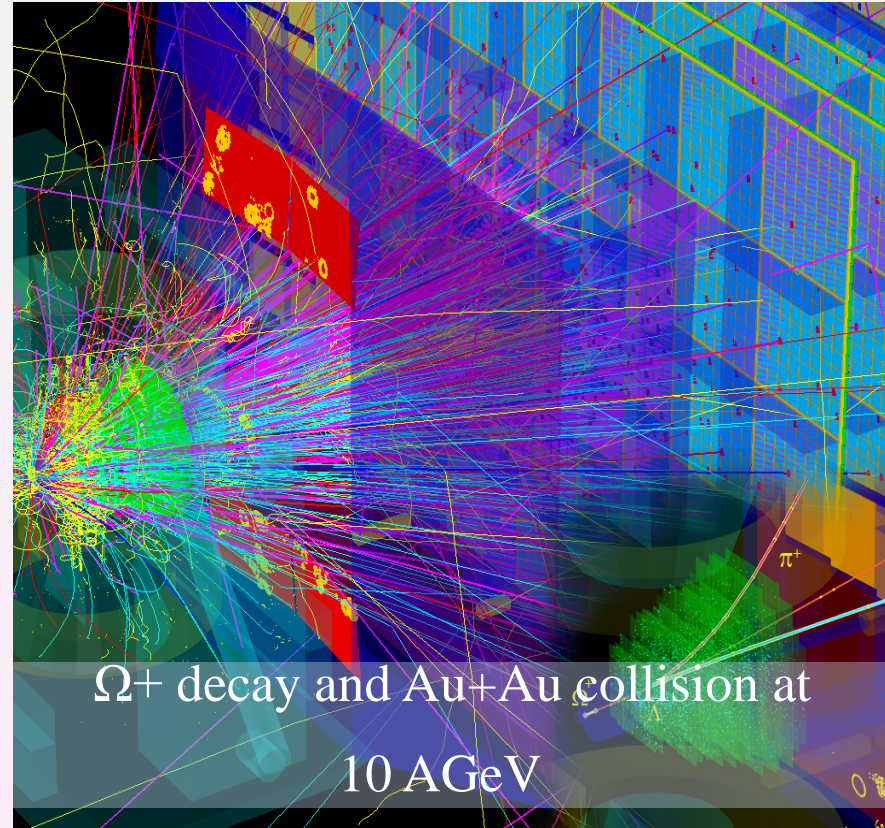
1st phase SIS100 with energies up to 11 AGeV for heavy nuclei, 29 GeV for protons



The detector systems of the CBM experiment

Experimental challenges

- Strangeness enhancement is one of the earliest proposed signatures of the formation of a deconfined QGP
- Multi-strange hyperons are very rare
- Interaction rates up to 10 MHz
- High multiplicity of charged particles produced in heavy ion collisions
- Huge data rates up to 1 TB/s



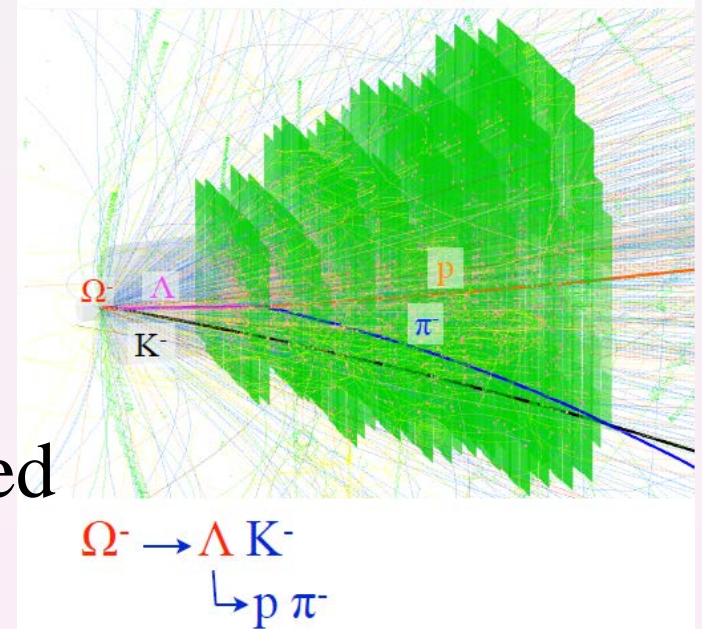
Software Trigger to decide what data to save

Selection strategy of Multi-strange hyperons

- Selection of events containing multi-strange hyperons : $\bar{\Lambda}$, Ξ^- , $\bar{\Xi}^+$, Ω^- , and $\bar{\Omega}^+$ based on simulated data using:

- *Decay topology in STS
- *TOF particle identification

- The selection strategy is developed for Au+Au collisions at SIS 100 energies



Simulation

Simulation approach:

- Events are generated with UrQMD generator
- Particles are propagated one by one through the CBM detector systems using GEANT3 transport
- Reconstruction of simulated events
- Physics analysis

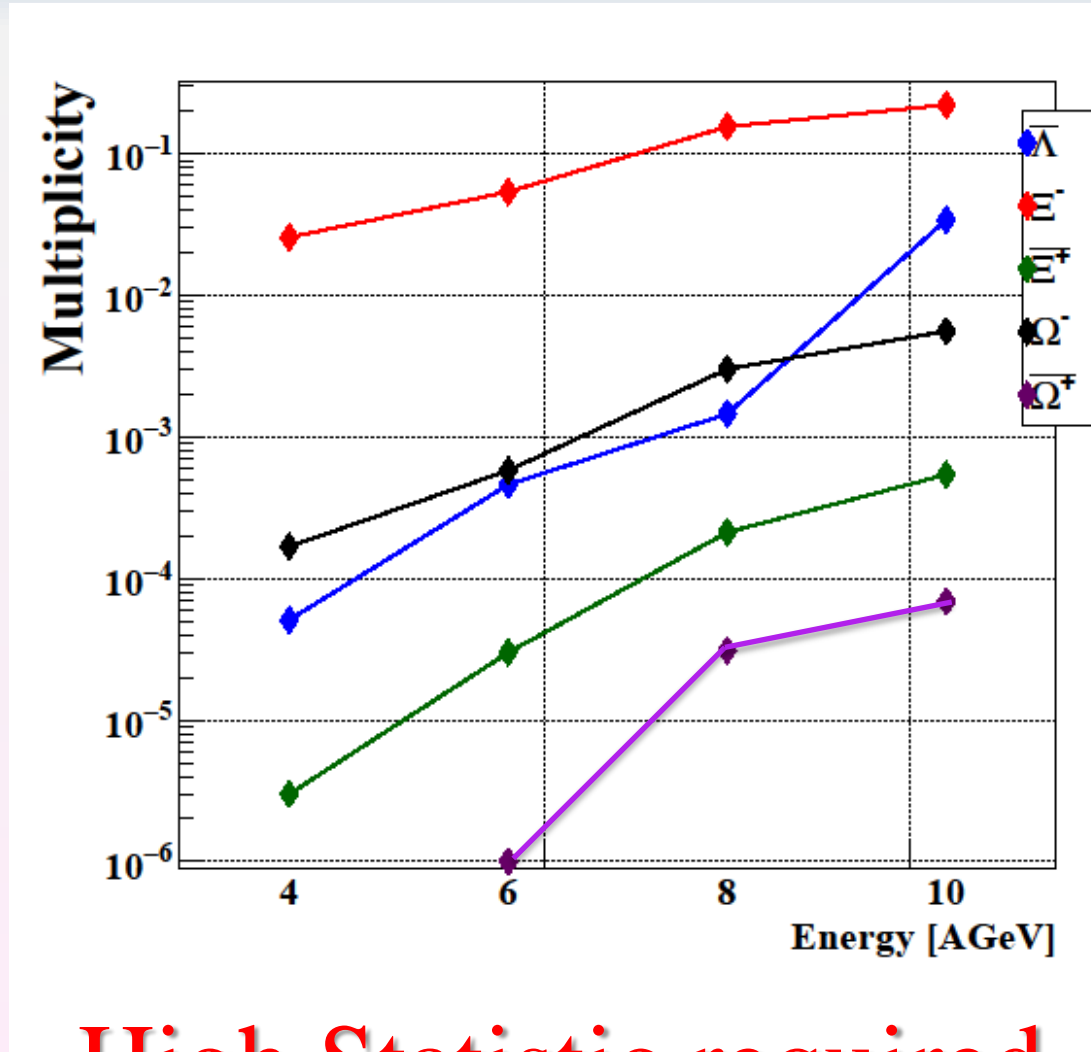
Simulation setup:

*CbmRoot

*Geometry : magnet + STS +TOF

*KF Particle Finder package [M.Zyzak HK 25.5]

Multiplicity per Au+Au central event (UrQMD)

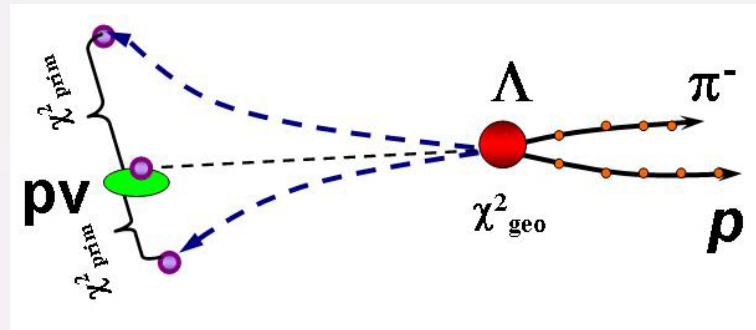


High Statistic required

Hyperons selection cuts, decay topology

Selection cuts in KF Particle Finder, to ensure:

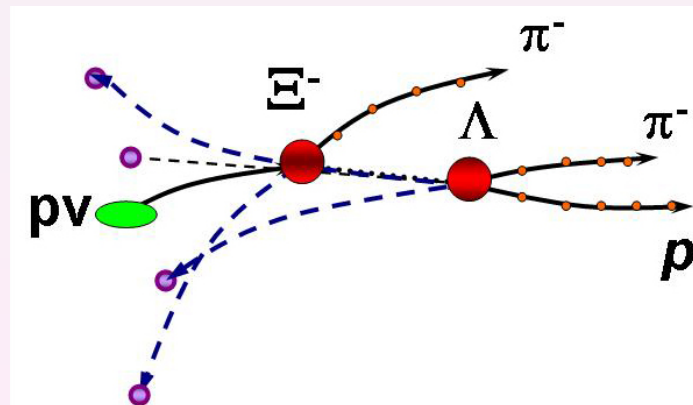
- Charged tracks are secondary
- Secondary vertex position is at a certain distance from the Primary vertex



$$\chi^2_{\text{prim}} > 3 \text{ for } \pi, p$$

$$\chi^2_{\text{geo}} < 3 \text{ for } \Lambda$$

$$l/\Delta l > 10 \text{ cm for } \Lambda$$



$$\chi^2_{\text{prim}} > 3 \text{ for } \pi, K$$

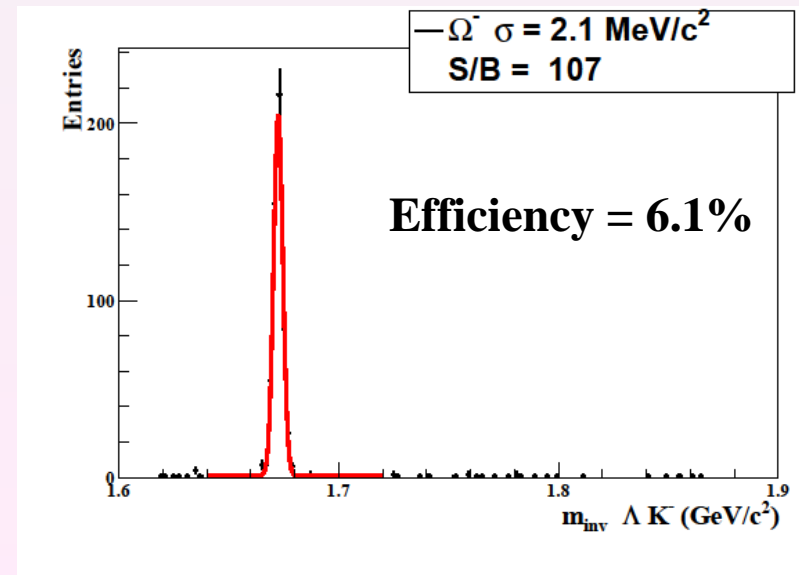
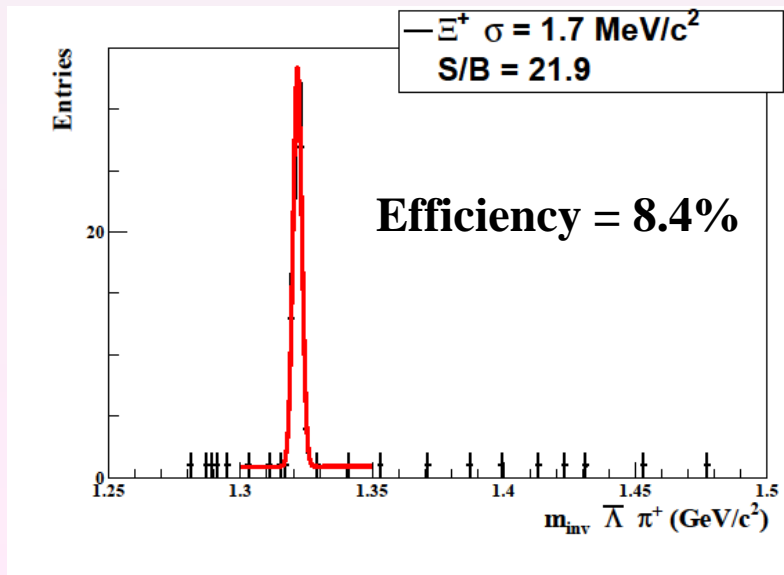
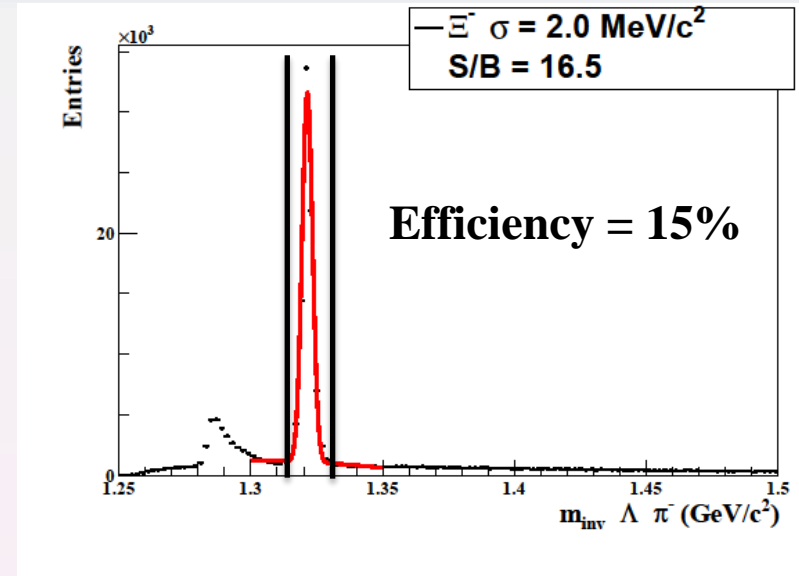
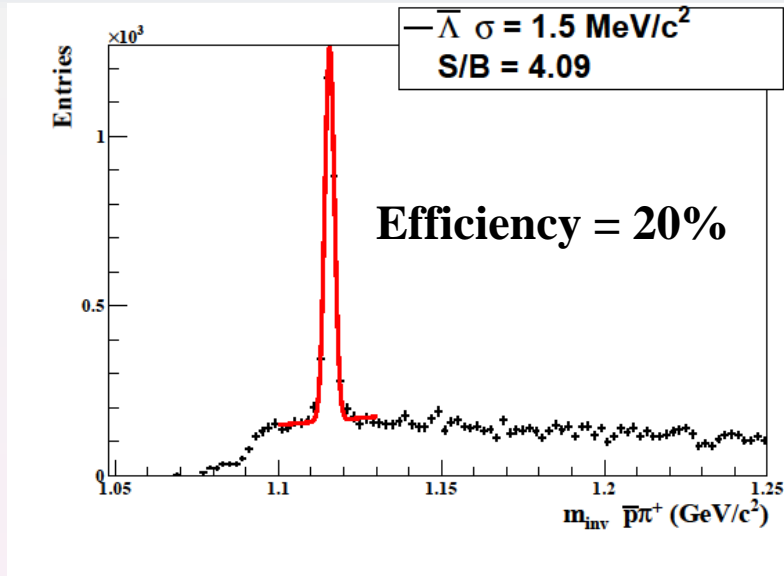
$$\chi^2_{\text{prim}} > 5 \text{ for } \Lambda$$

$$\chi^2_{\text{geo}} < 3 \text{ for } \Xi, \Omega$$

$$l/\Delta l > 5 \text{ cm for } \Xi, \Omega$$

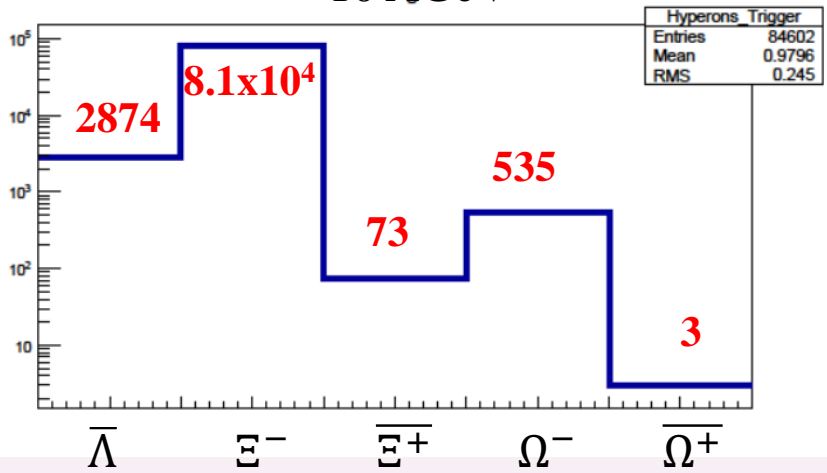
Reconstruction: Invariant Mass

5 Million Au+Au central collisions @ 10 AGeV

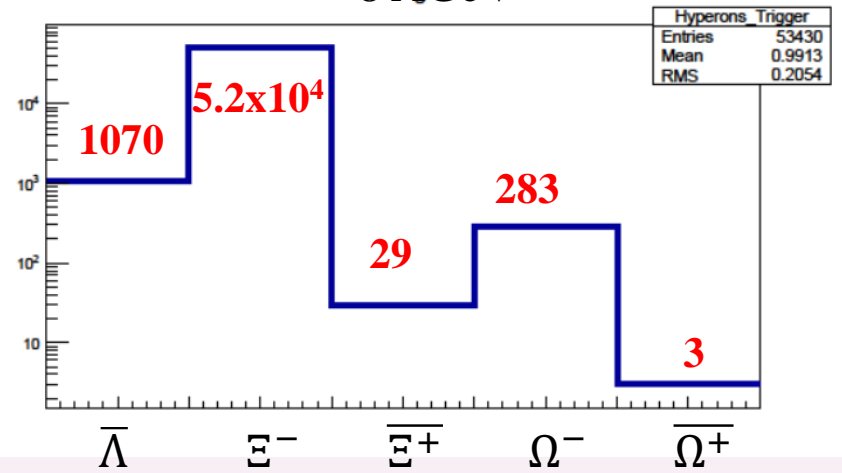


Selected Events at SIS 100 energies with 5M Au+Au central collisions

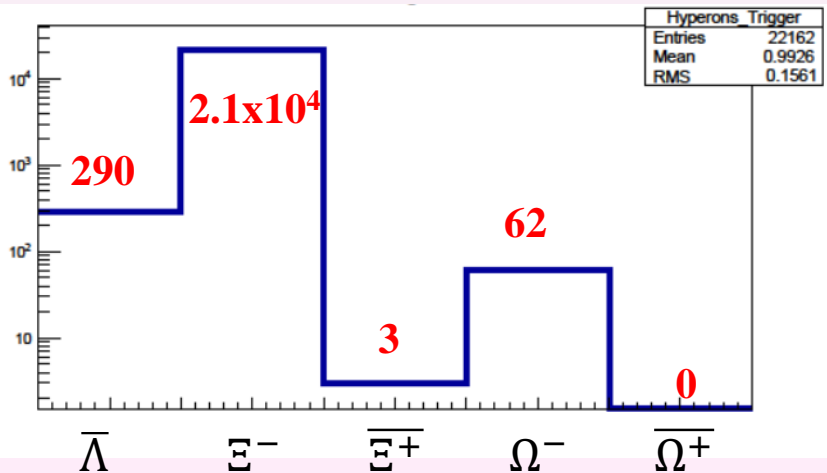
10 AGeV



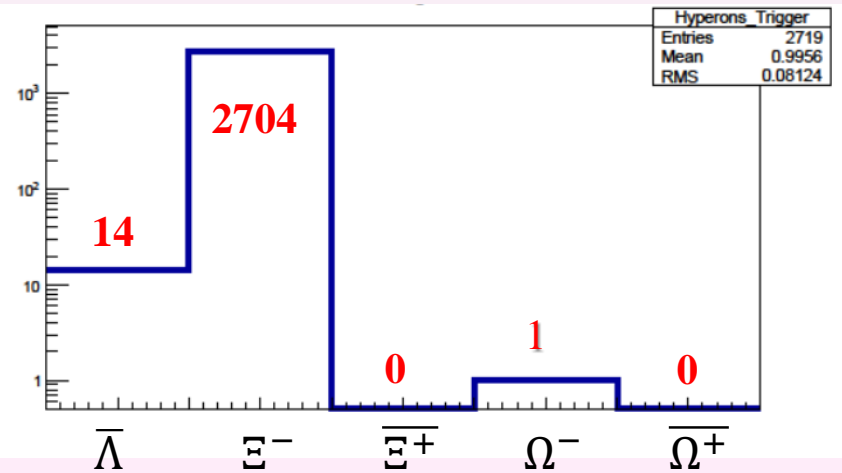
8 AGeV



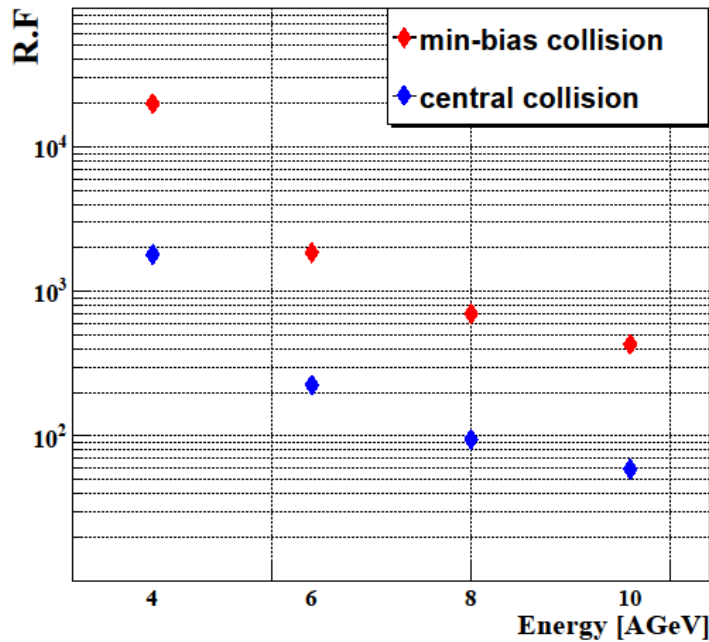
6 AGeV



4 AGeV



Rejection Factor at SIS 100 energies



$$R.F = \frac{\text{Generated events}}{\text{Selected events}}$$

R.F	4 AGeV	6AGeV	8AGeV	10AGeV
Minimum Bias	19800	1850	700	430
Central	1800	225	95	59

Summary

- ✓ CBM at FAIR is an experiment to explore QCD phase diagram in the region of high net baryon densities
- ✓ The CBM detector is an excellent device to measure multi-strange hyperons with high statistic at SIS 100 energies in the first phase of FAIR project
- ✓ The rejection factor is calculated and reaches the CBM requirement

Thank you for your attention