

Physics analysis with KF Particle Finder

May 2014 Frankfurt

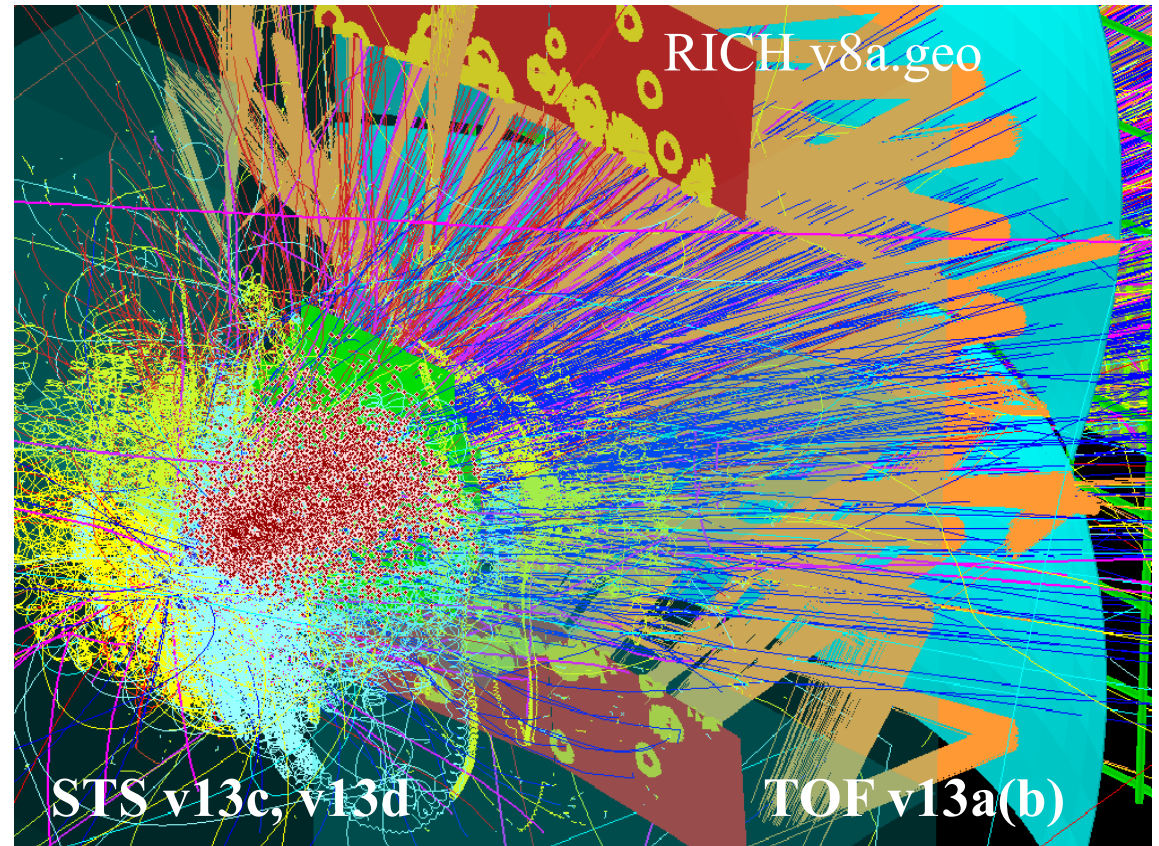


5M central Au +Au,
25, 15, 10, 6, 4 AGeV
UrQMD 3.3p2;

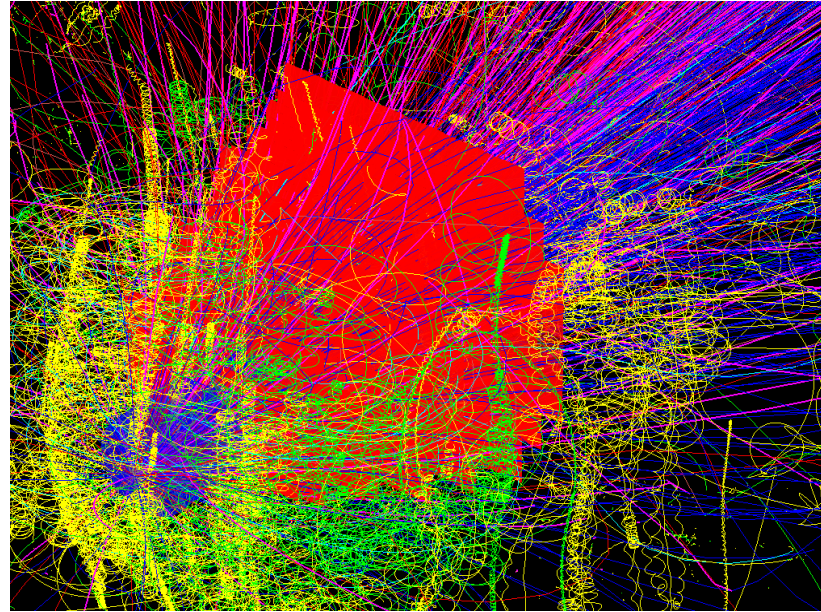
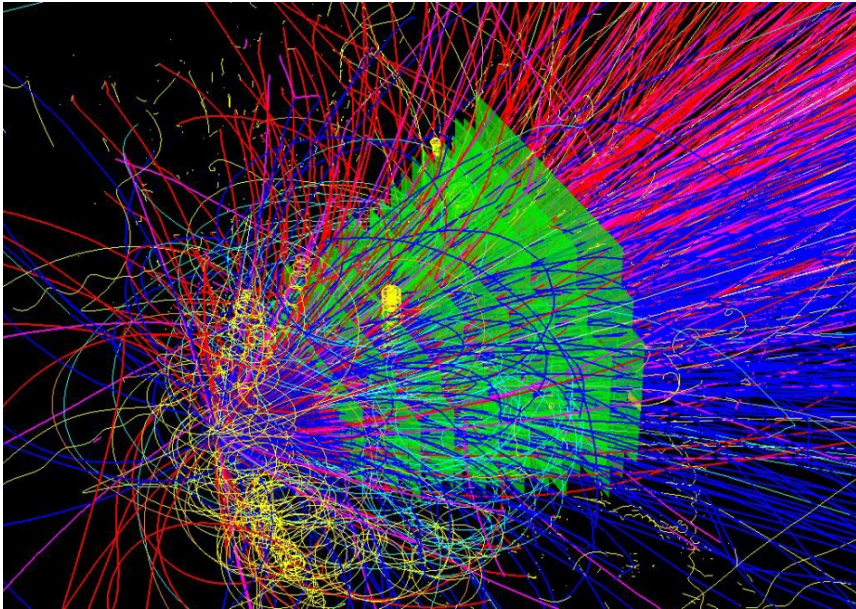
New:

- ✓ PHSD
- ✓ HSD
- ✓ 50 M b=0 p + C 25GeV
- ✓ 5M b=0 Au +Au 25AGeV

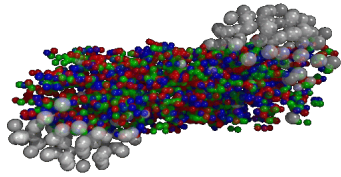
Vassiliev Iouri, I.Kisel, M.Zyzak, I. Kulakov and V.Vovchenko



central event: Au+Au @ 25A GeV



667 π
160 p
53 K
32 Λ
27 K_S^0
0.44 E^-
0.018 Ω^-

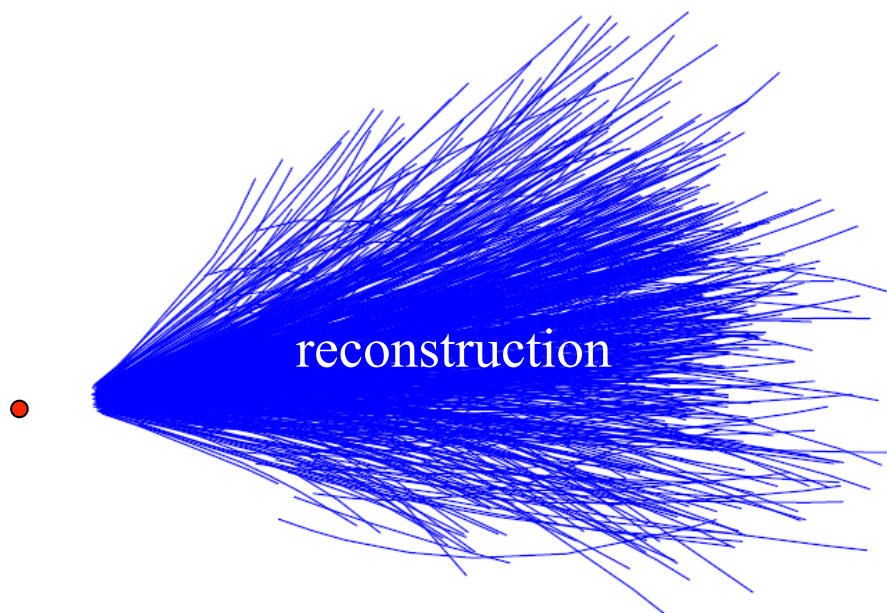


UrQMD

599 π
174 p
42 K
30 Λ
24 K_S^0
2.4 E^-
0.005 Ω^-



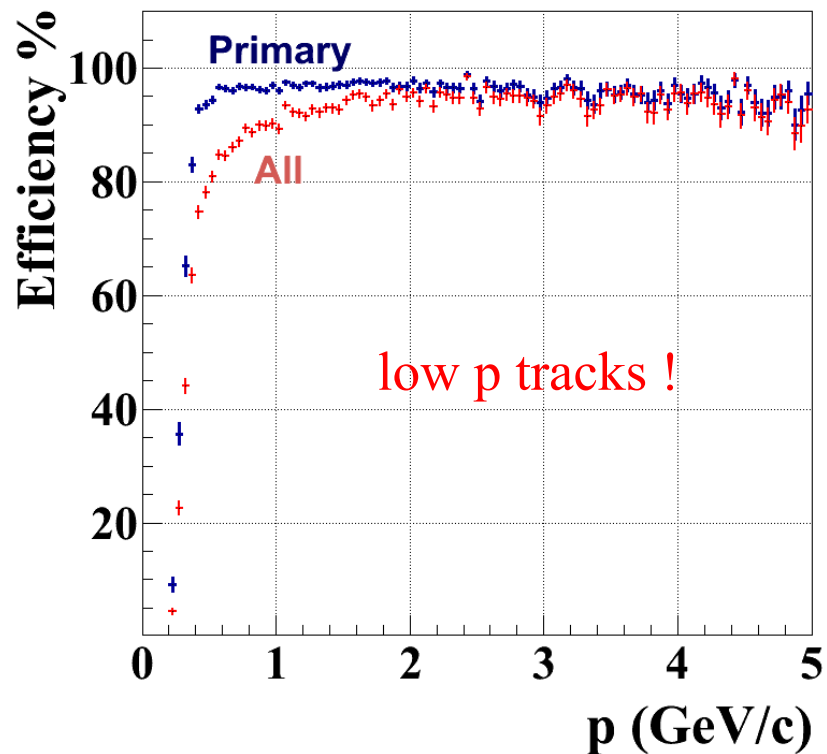
Central event: Au+Au @ 25A GeV



SIMDized tracking + KFParticle

mbias : **10** (TF) + **2** (PF) ms/core
central: **82** (TF) + **16** (PF) ms/core

up to 80 cores/CPU

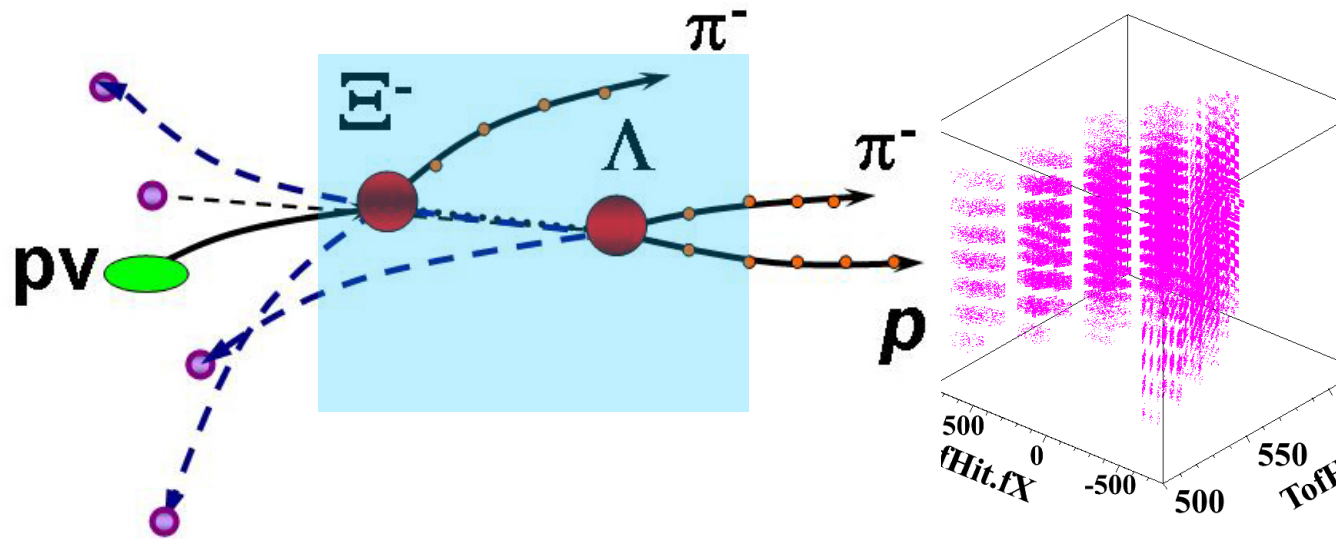
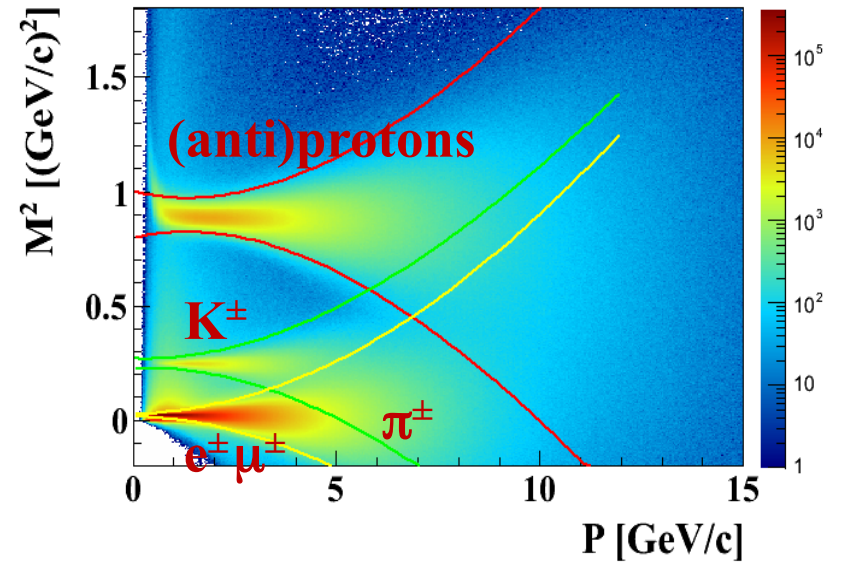
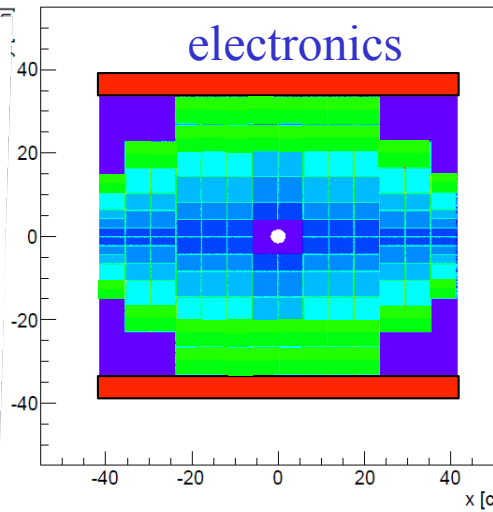
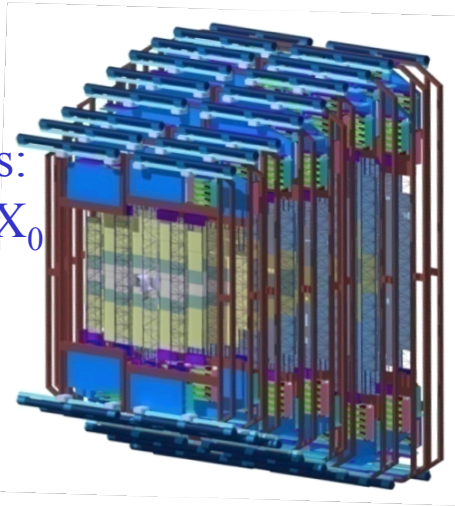


648 reconstructed tracks
Ref. prim. eff = **96%**
All set eff = **90%**
dp/p = **1.0%**

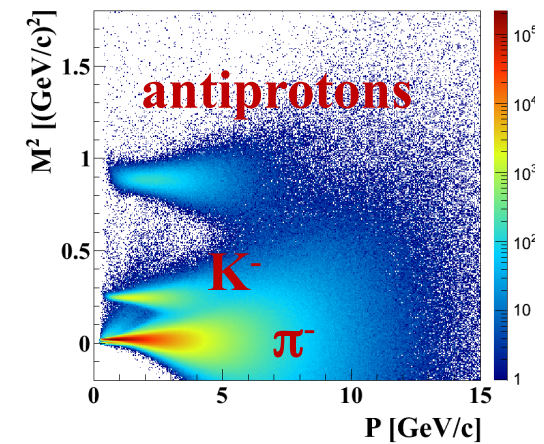
STS v13c includes **CBM simulation set-up: STS v13c+ToF v13b**
 cables, electronics and frames

r/o cables:
 $2 \times 0.2\% X_0$

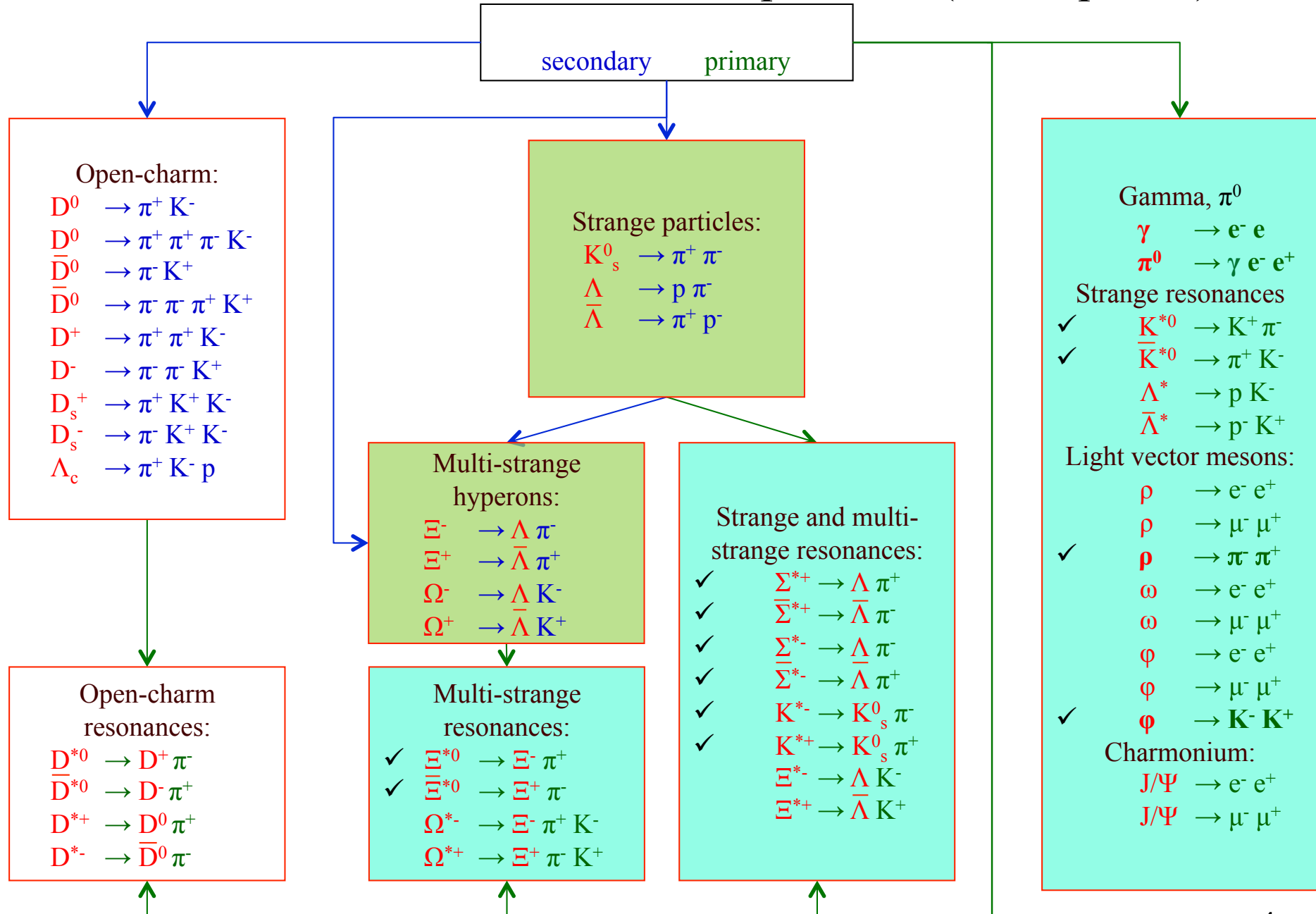
sensor:
 $0.3\% X_0$



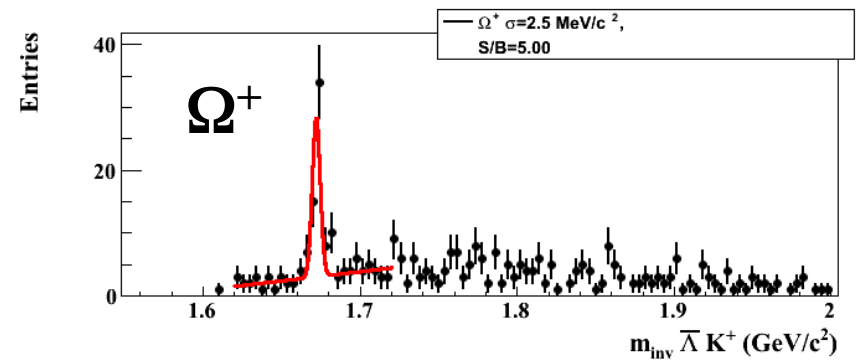
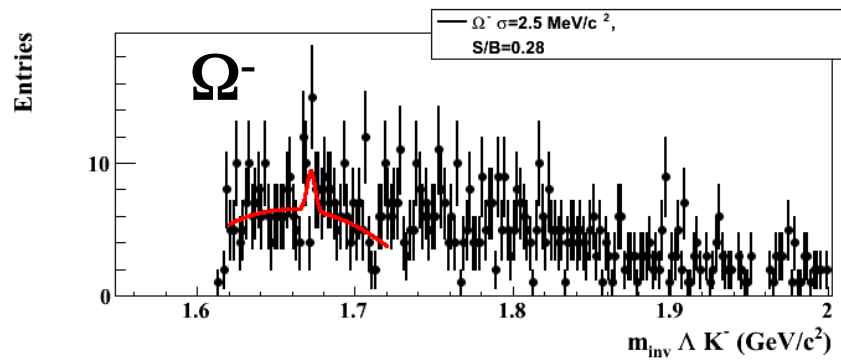
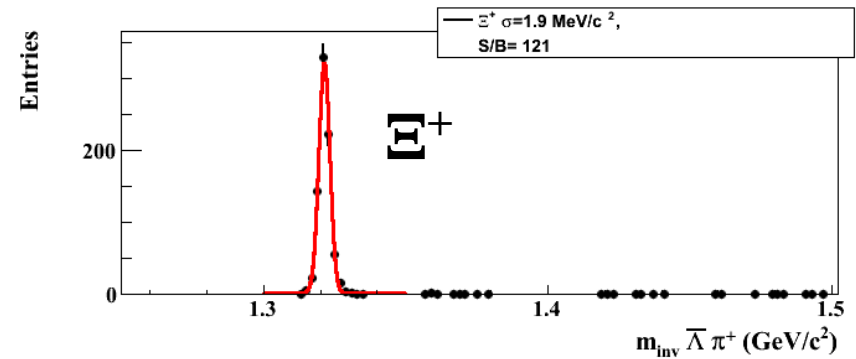
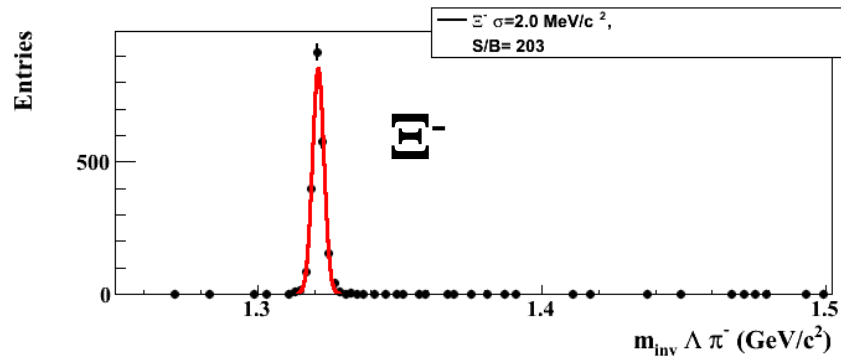
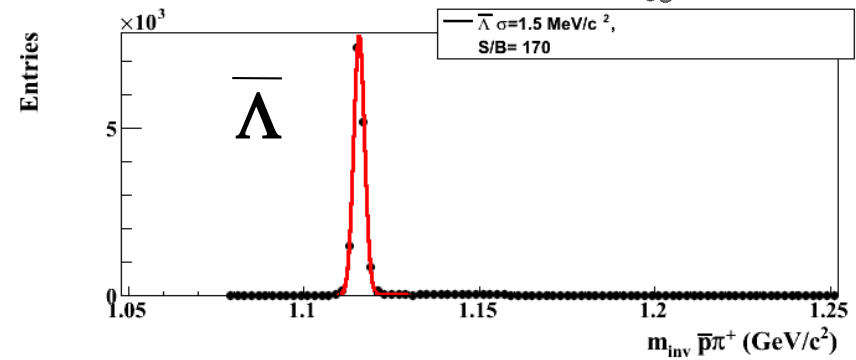
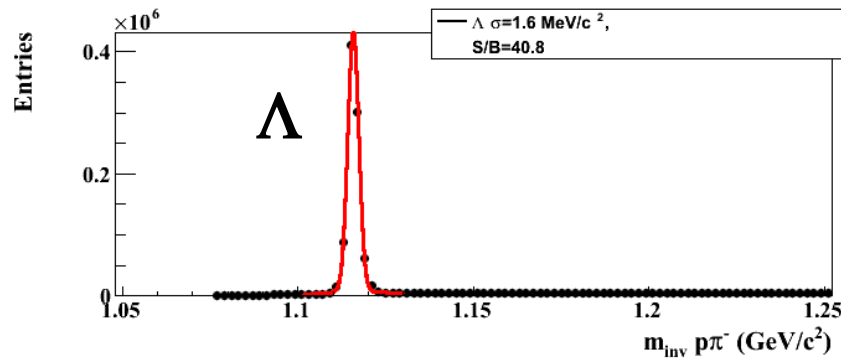
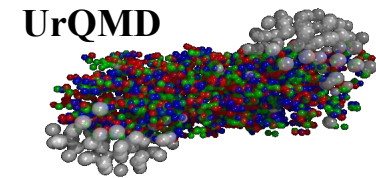
Negative tracks



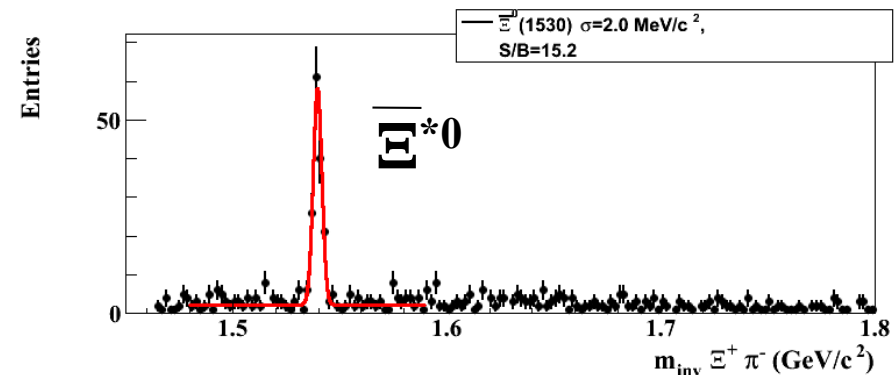
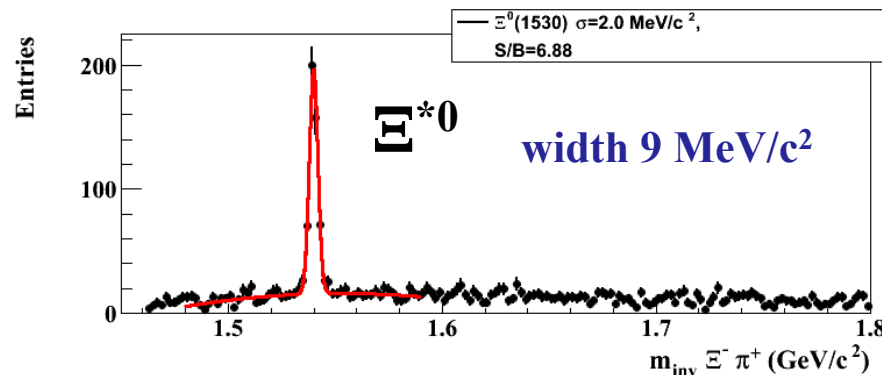
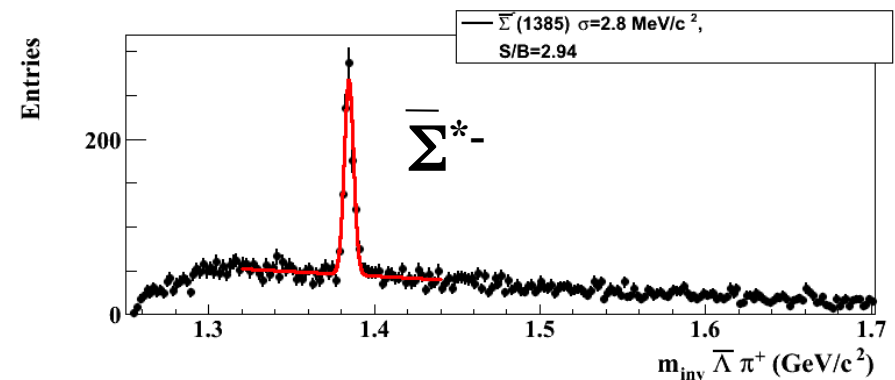
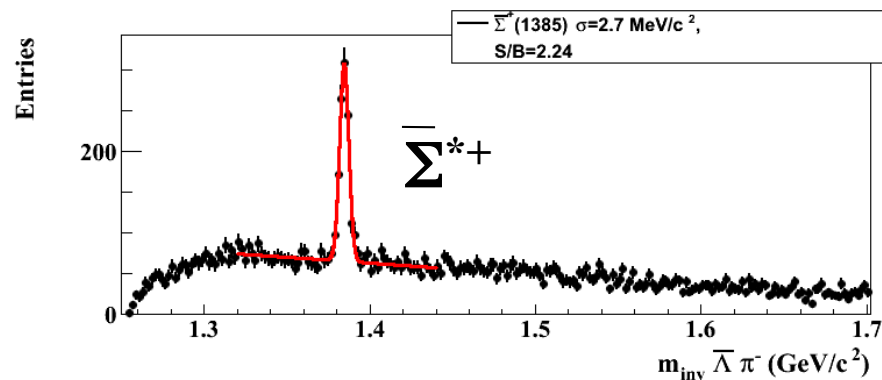
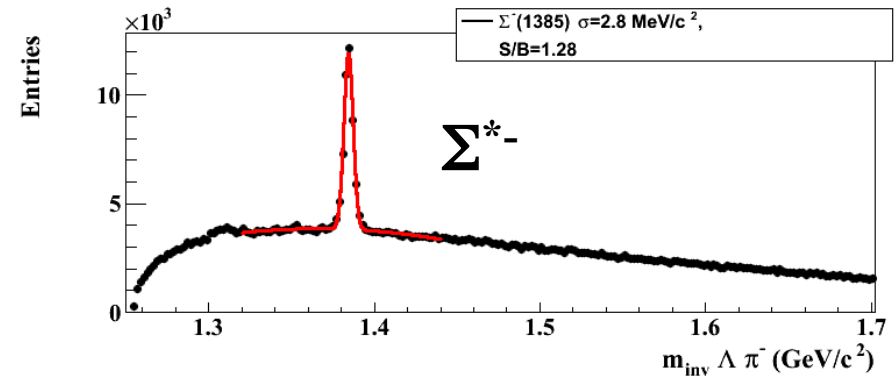
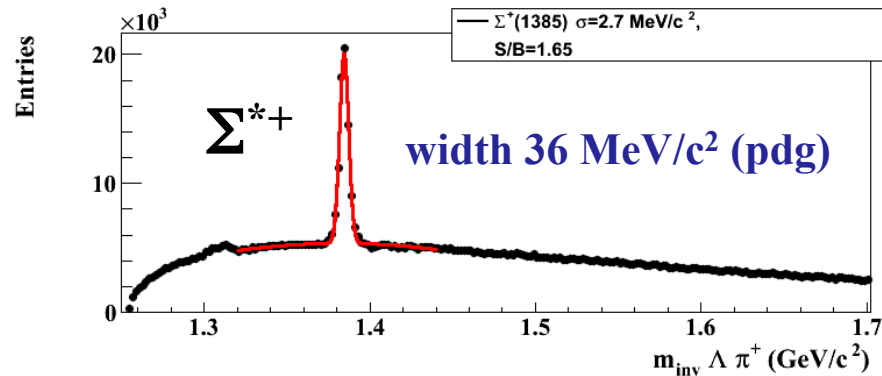
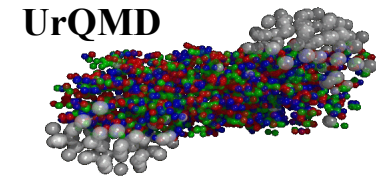
KF Particle Finder for the CBM Experiment (development)



p+C 25 GeV 50M central events

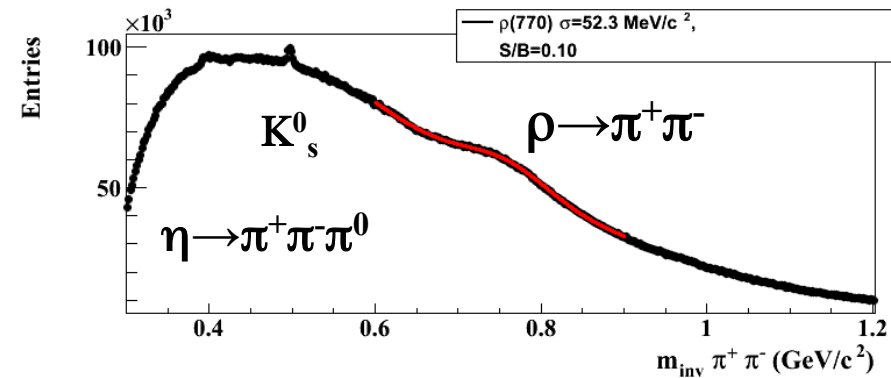
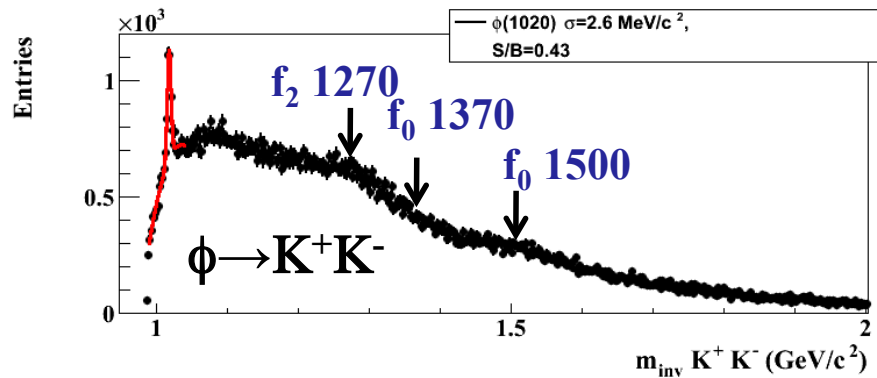
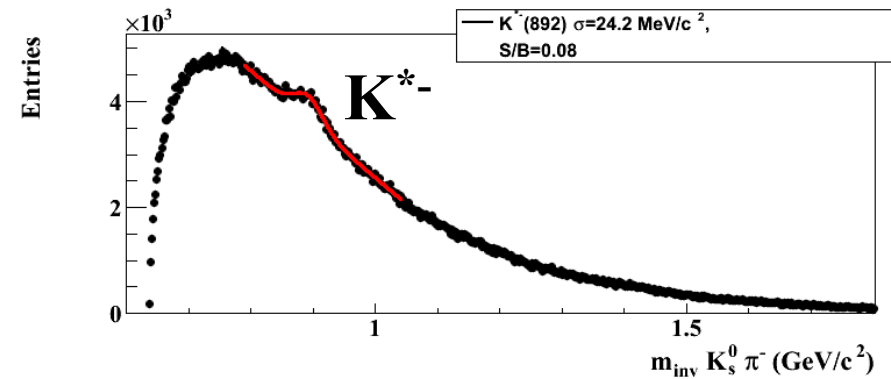
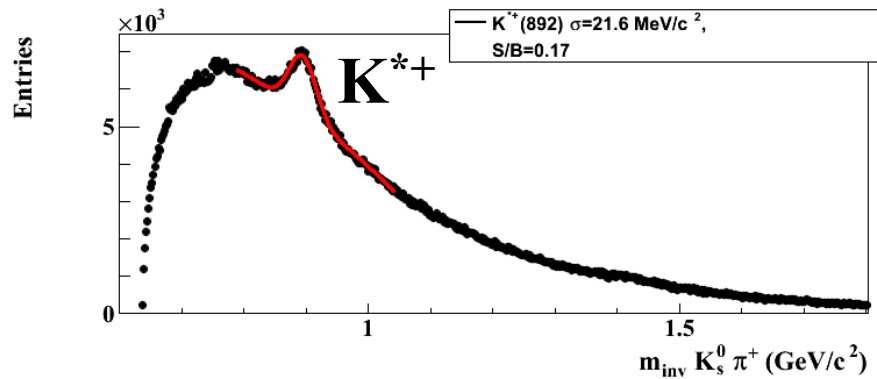
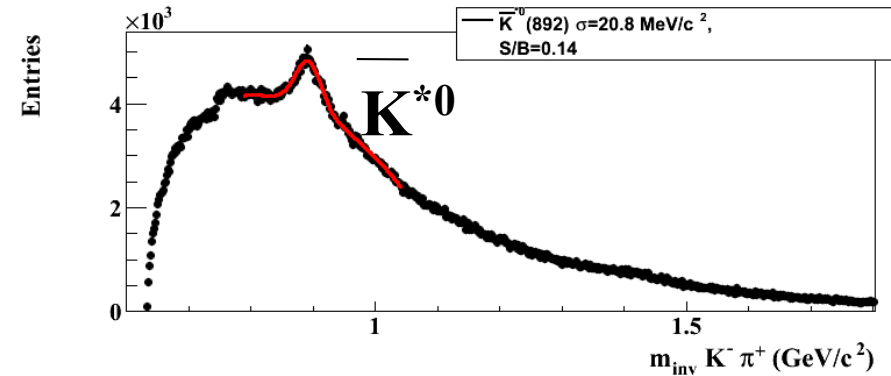
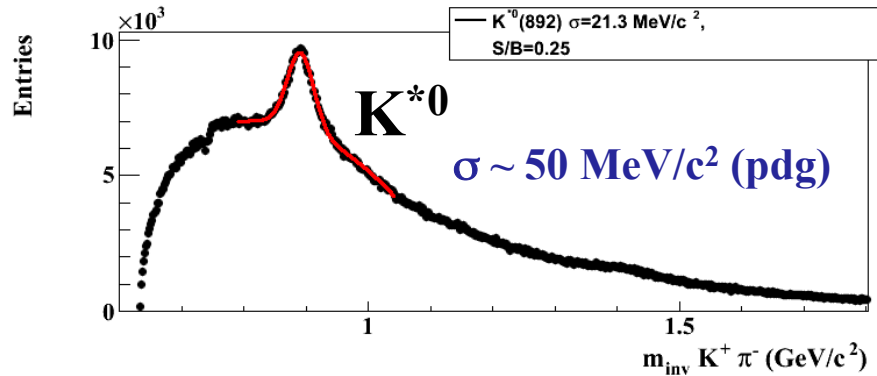
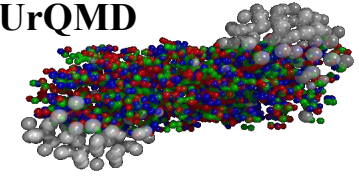


p+C 25 GeV 50M central events

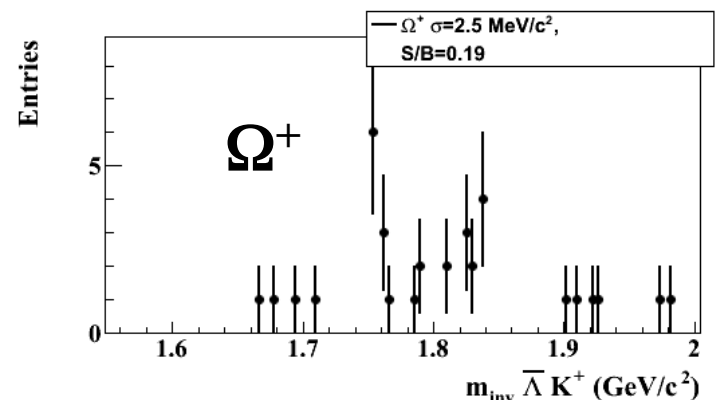
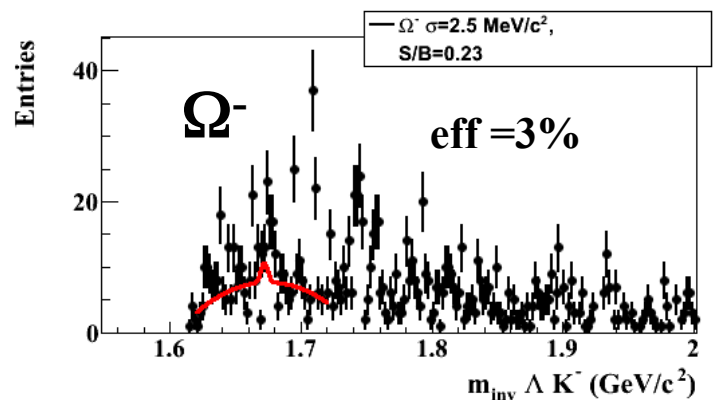
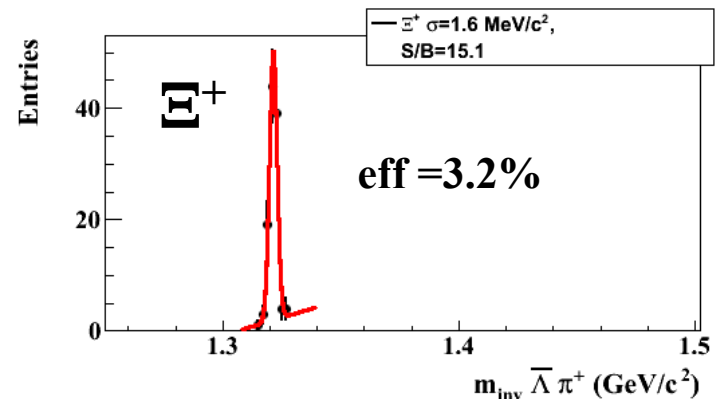
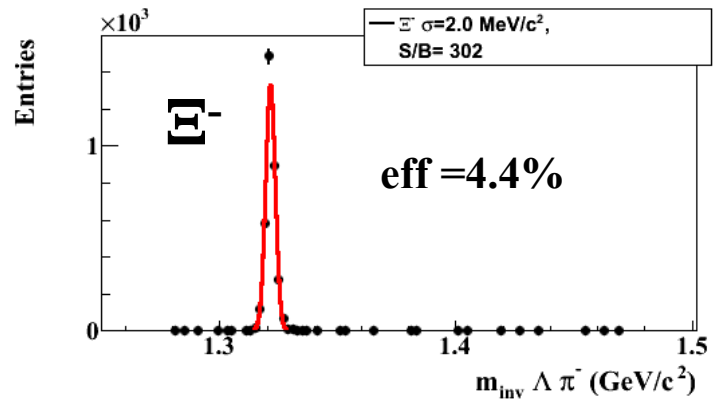
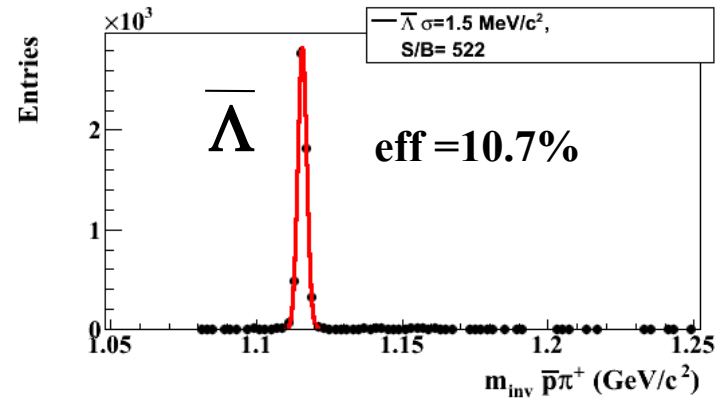
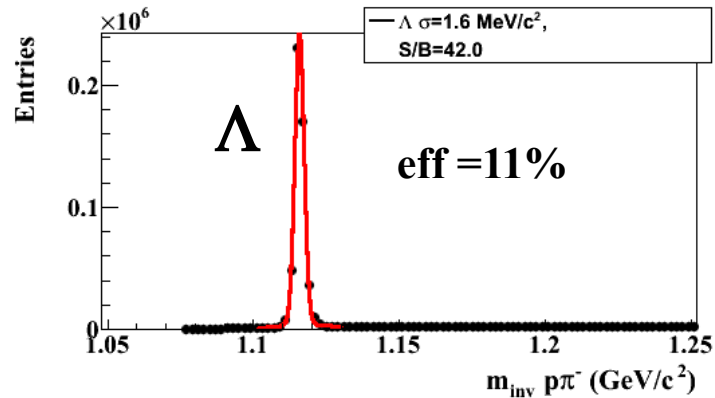


p+C 25 GeV 50M central events

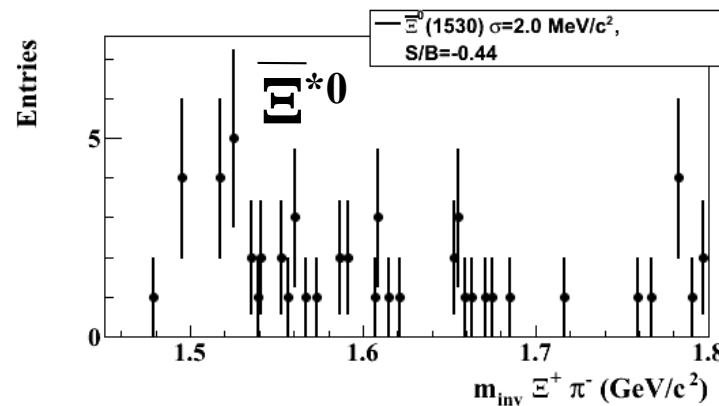
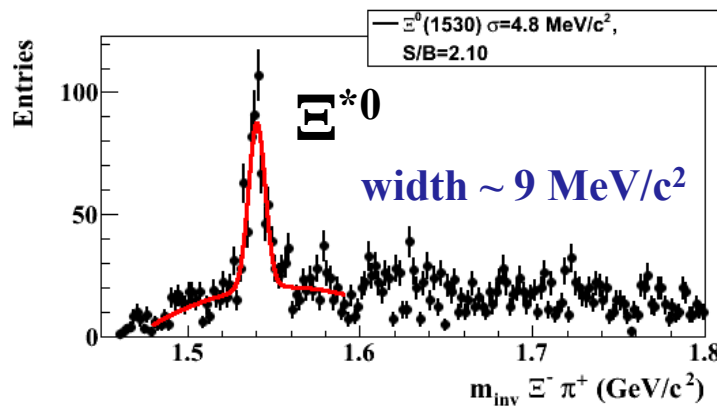
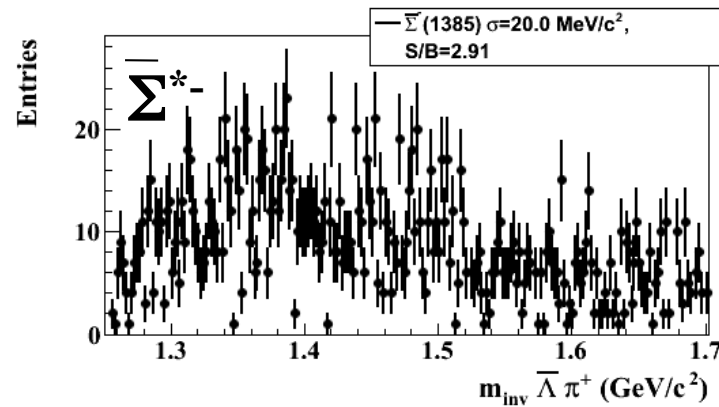
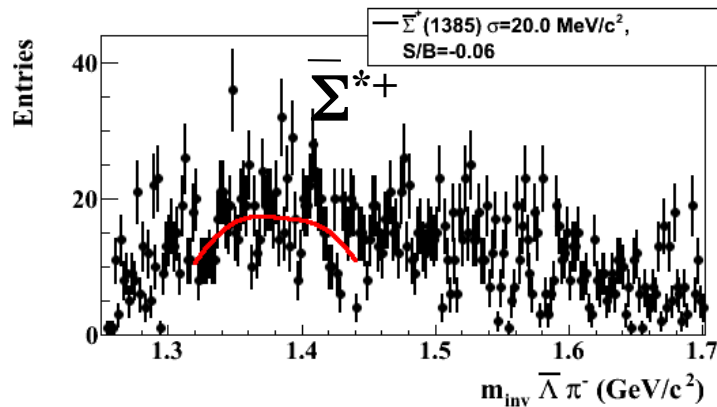
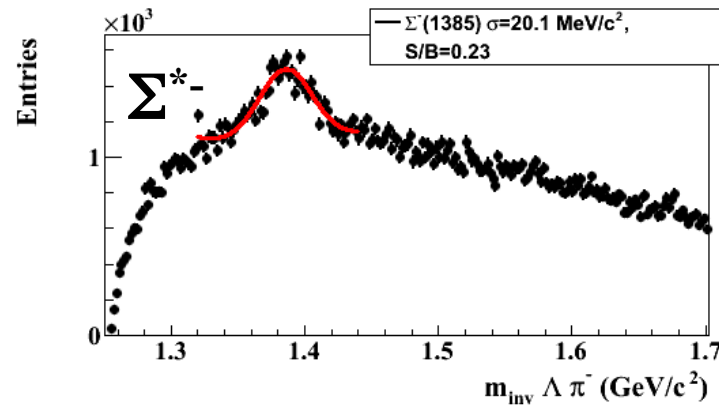
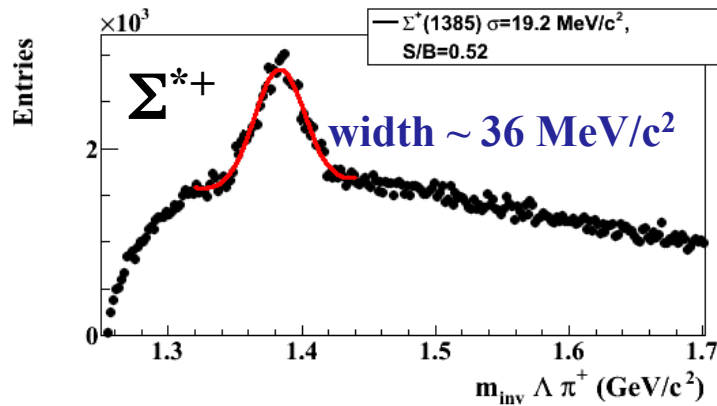
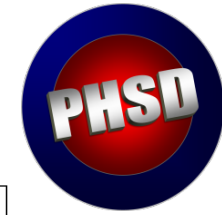
UrQMD



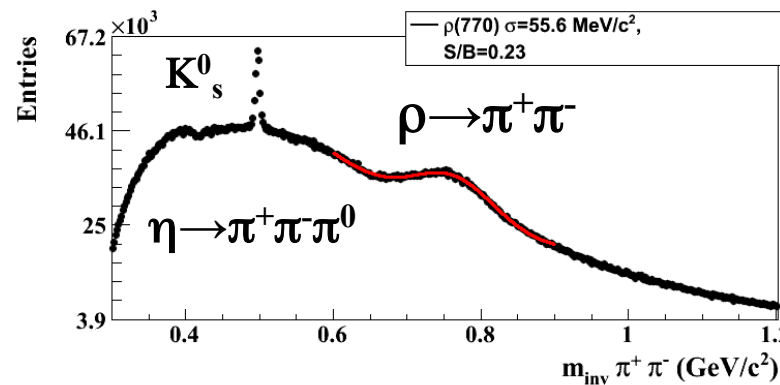
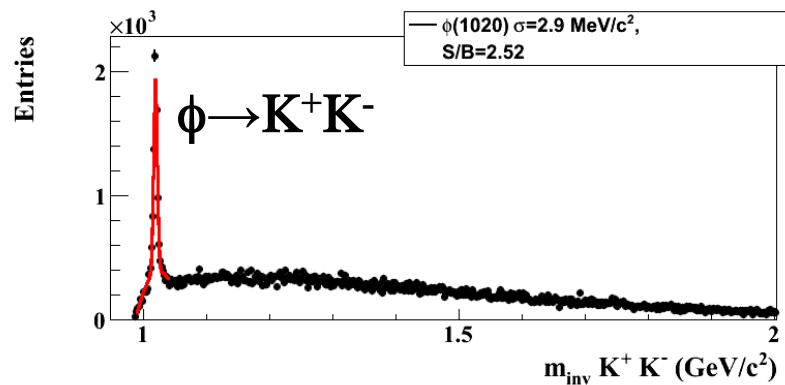
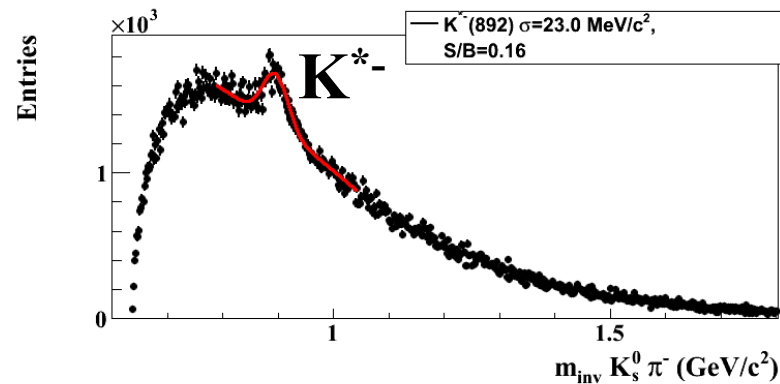
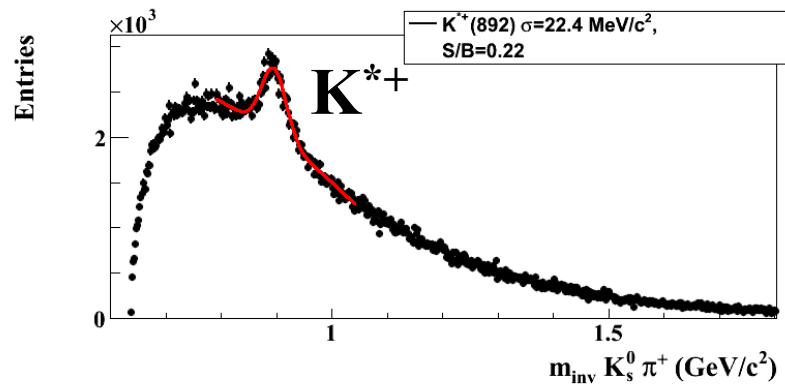
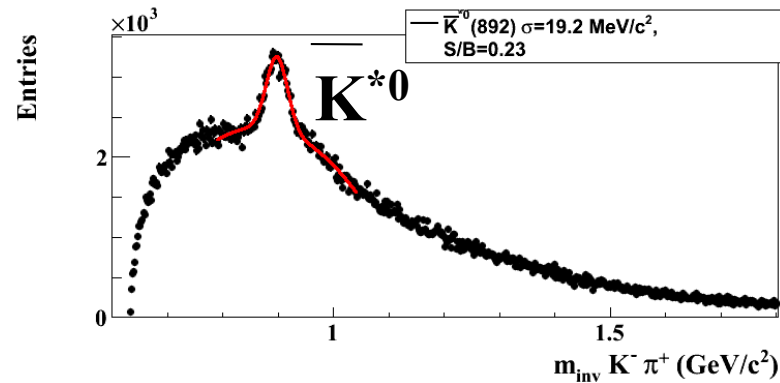
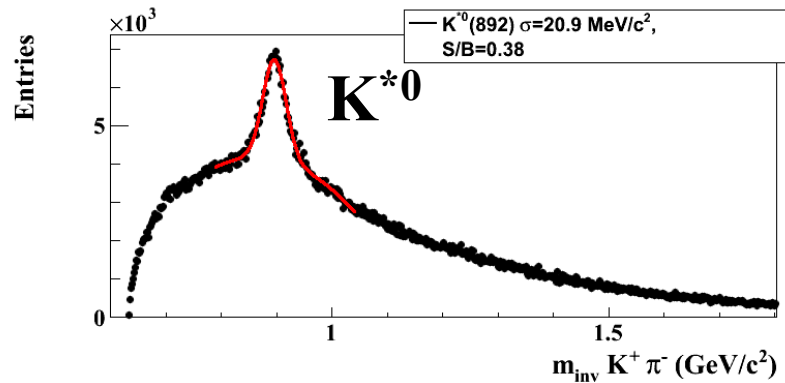
p+C 25 GeV 50M central events



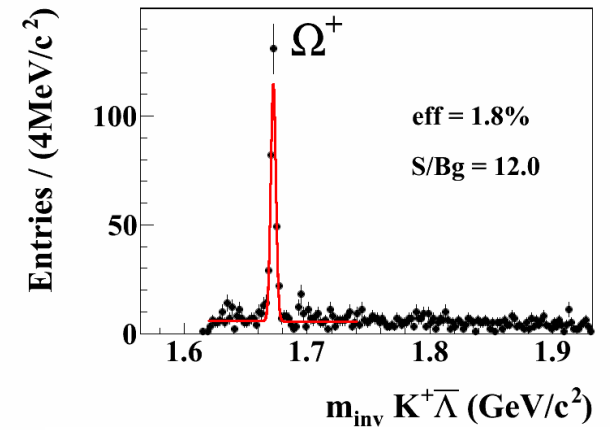
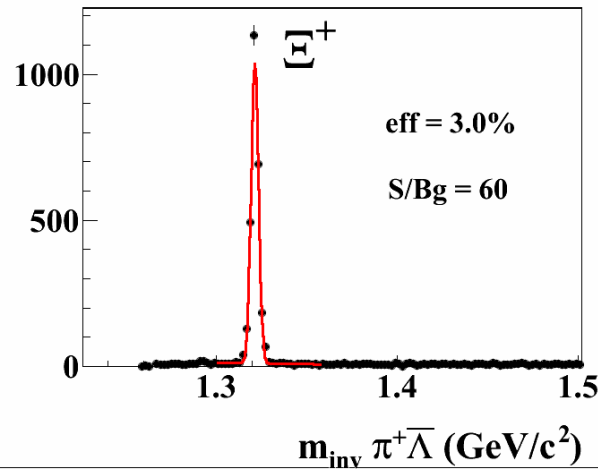
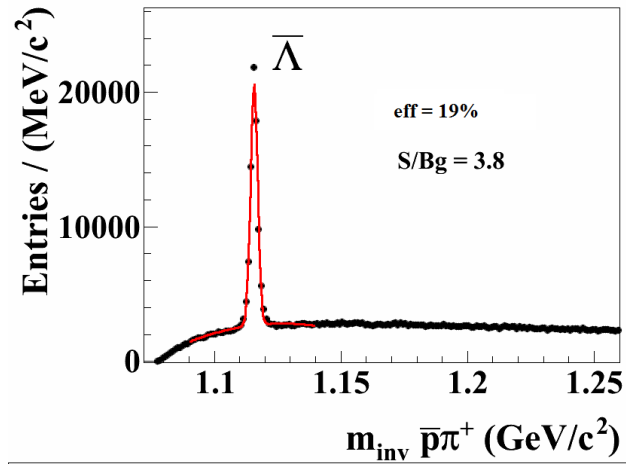
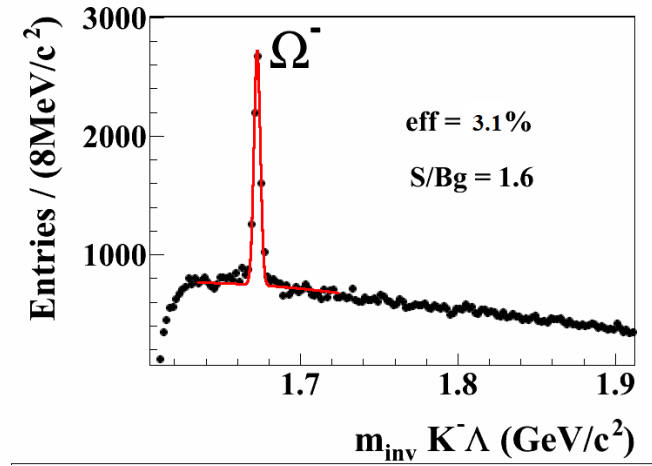
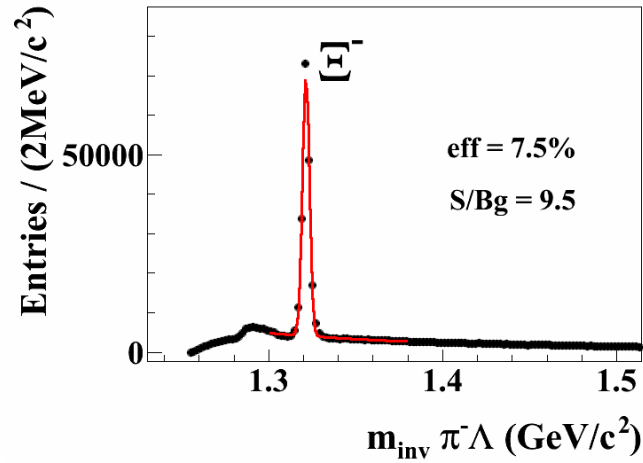
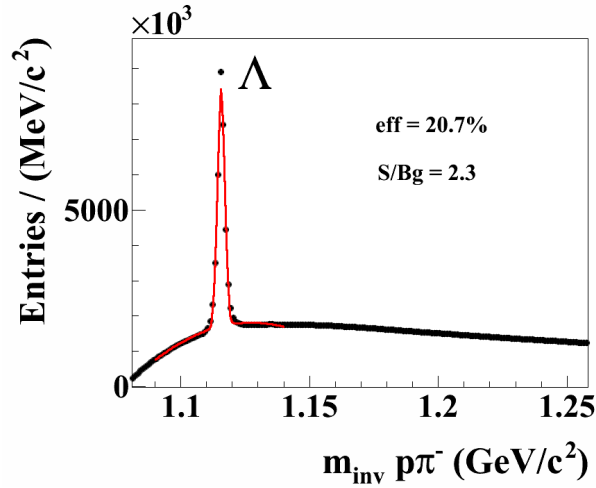
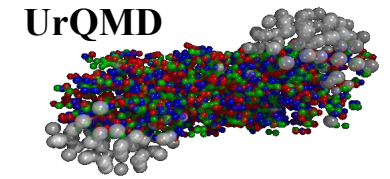
p+C 25 GeV 50M central events



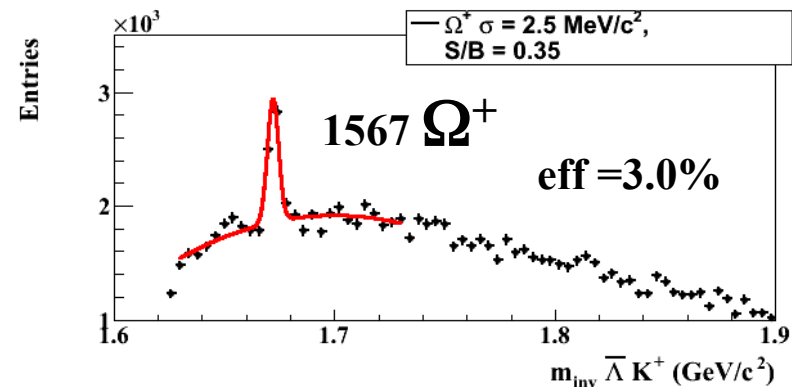
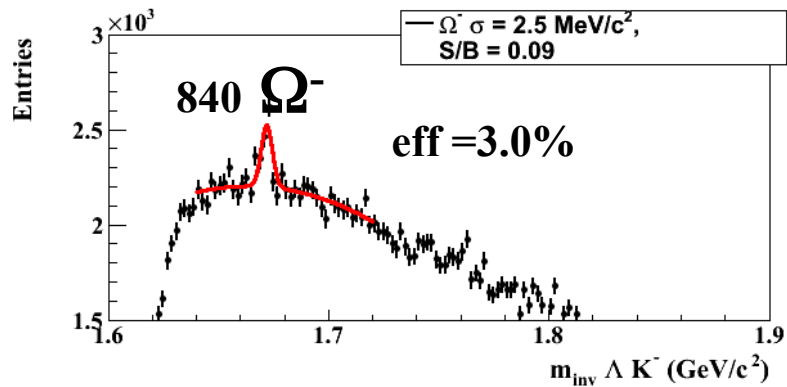
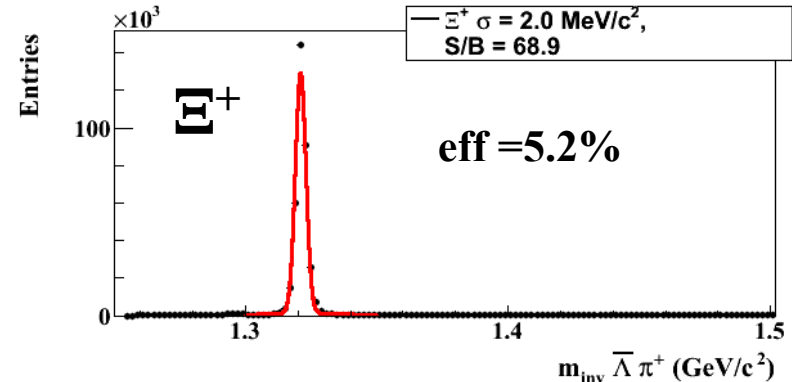
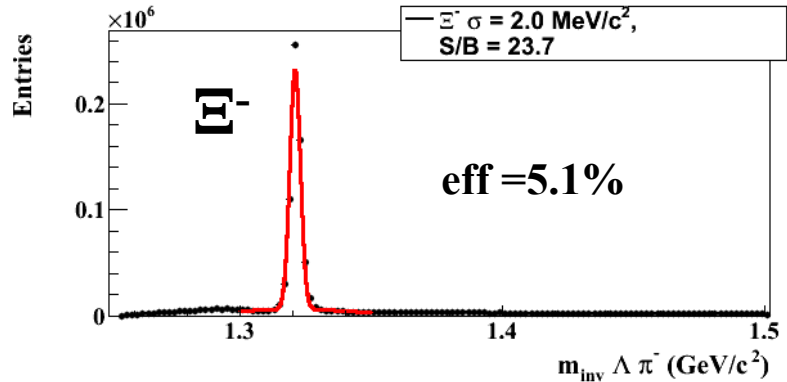
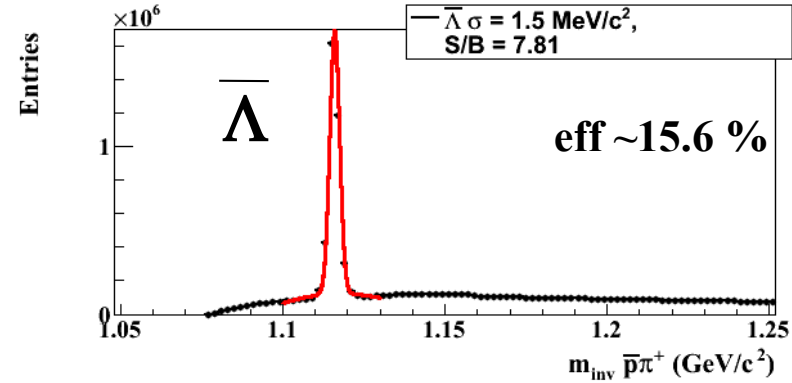
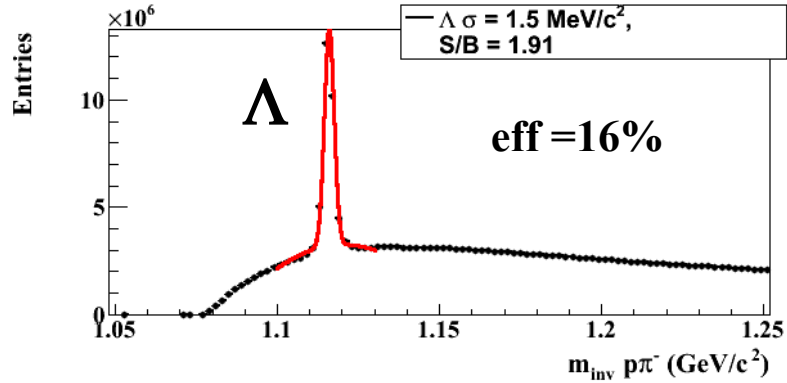
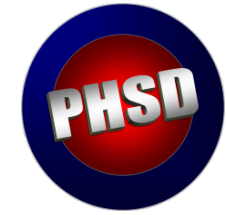
p+C 25 GeV 50M central events



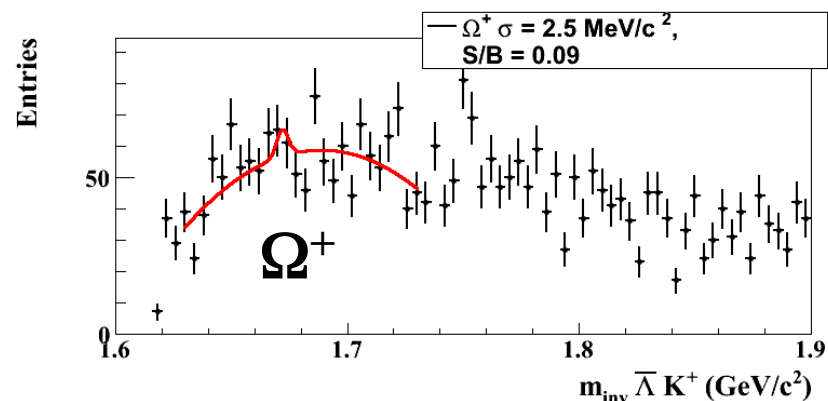
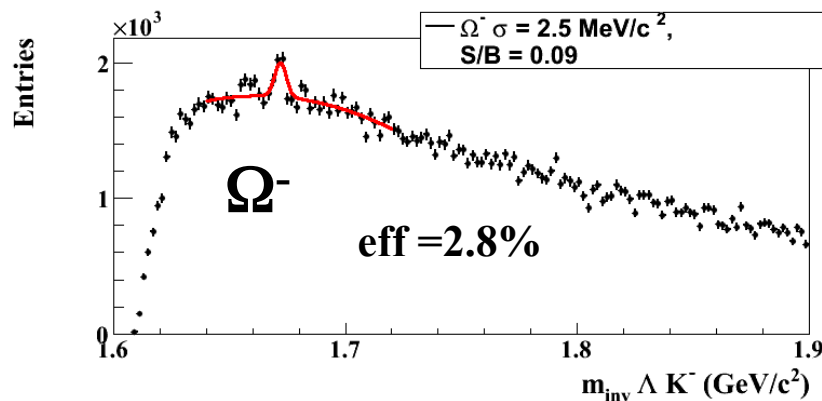
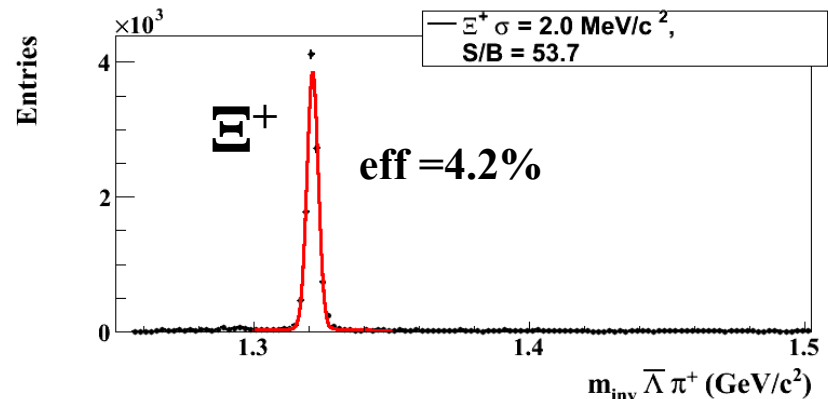
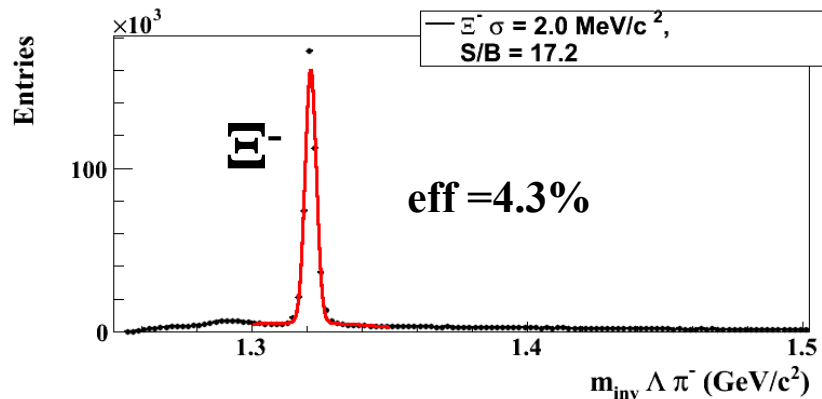
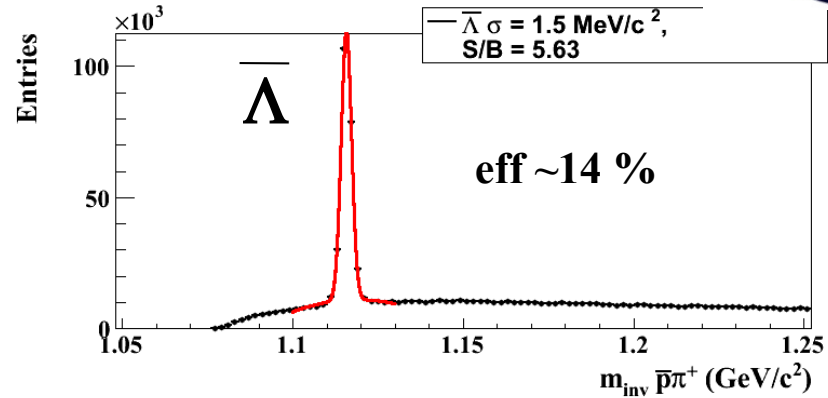
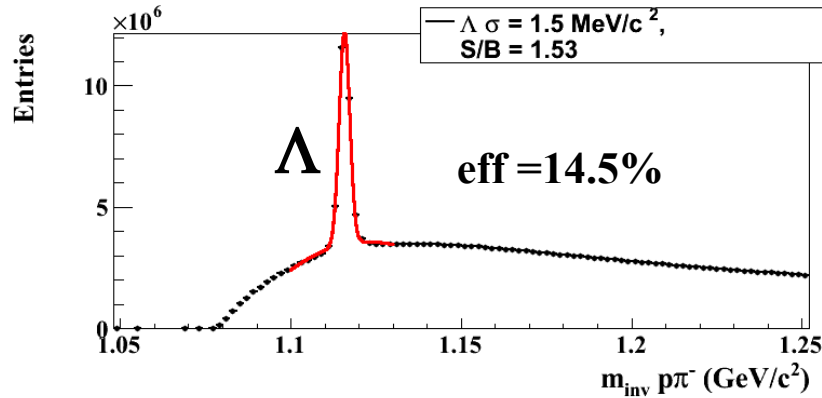
Au+Au 25 AGeV 5M central events

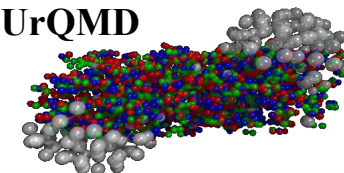


Au+Au 25 AGeV 5M central events

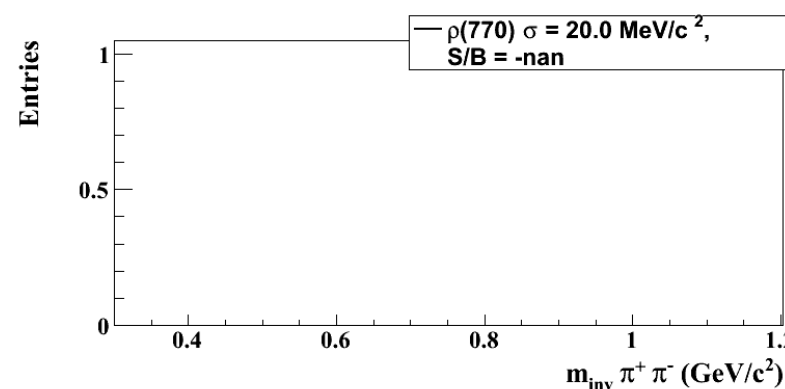
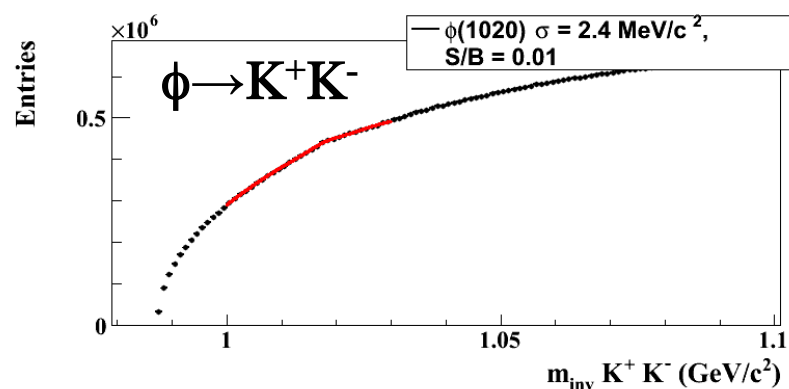
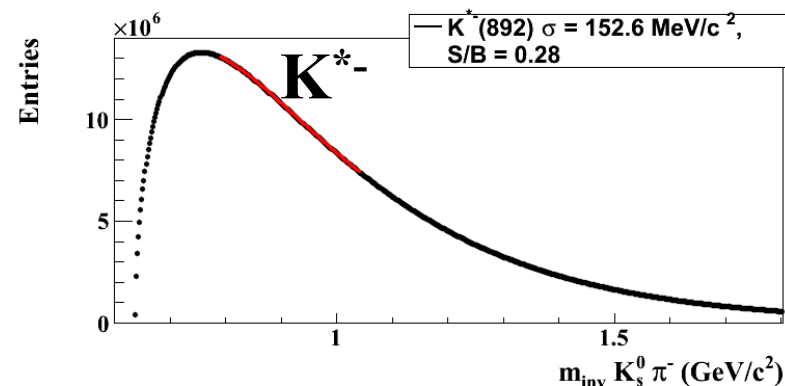
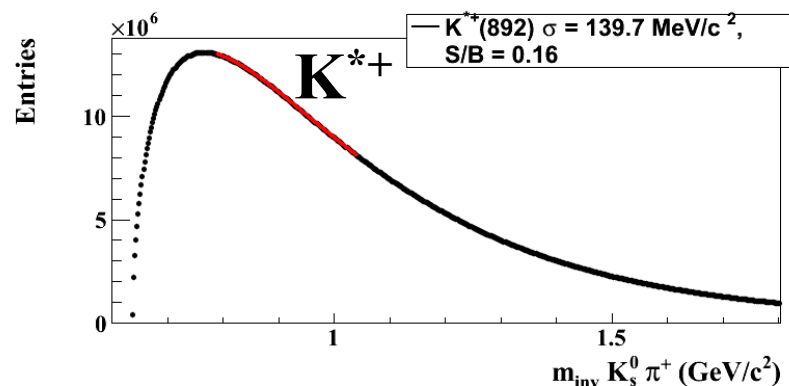
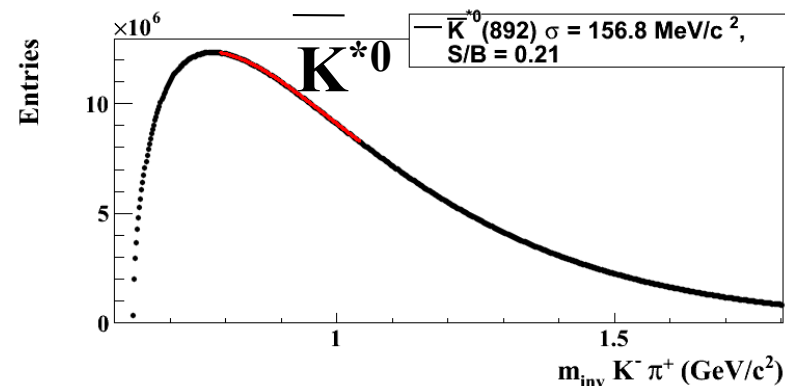
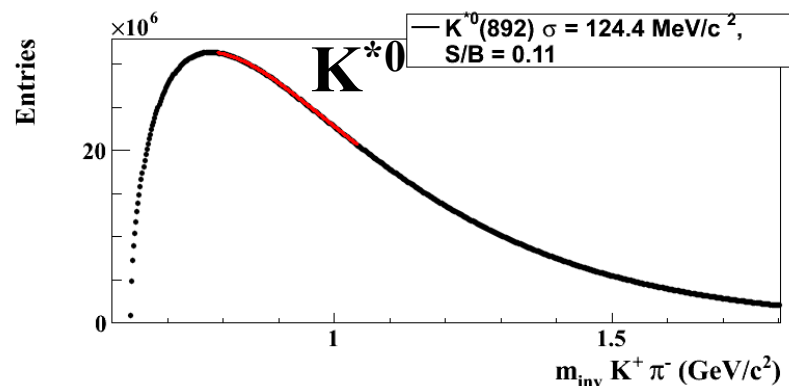


Au+Au 25 AGeV 5M central events

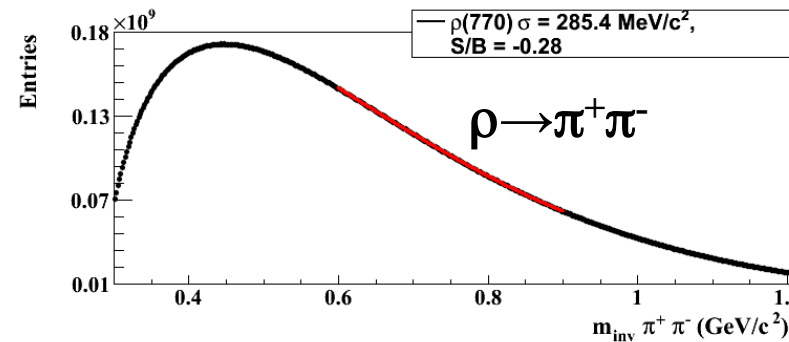
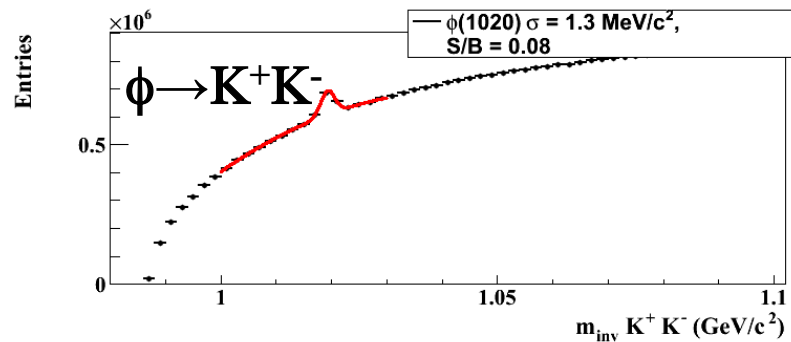
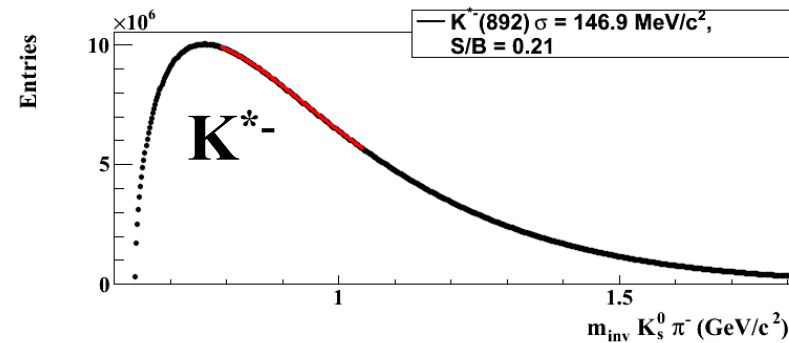
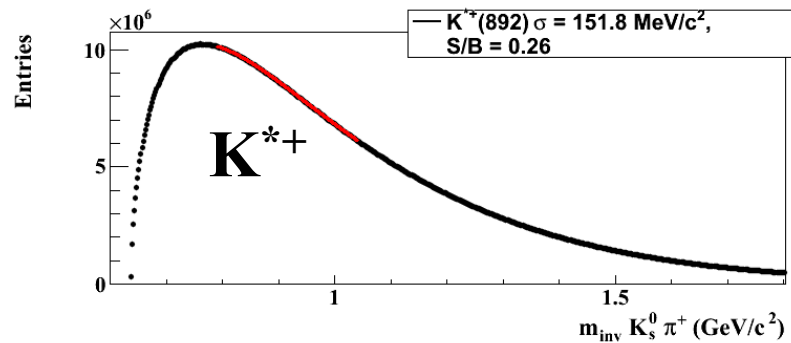
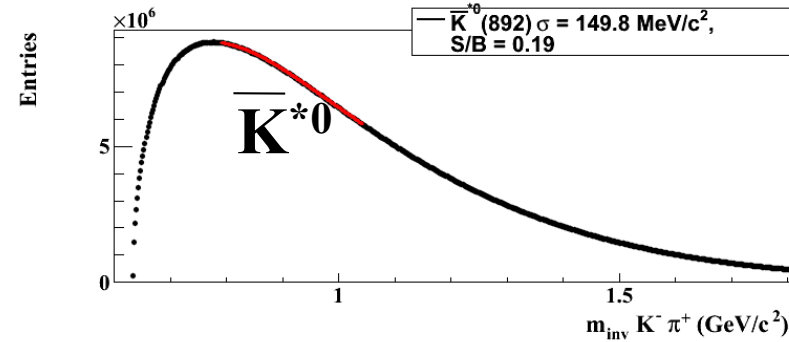
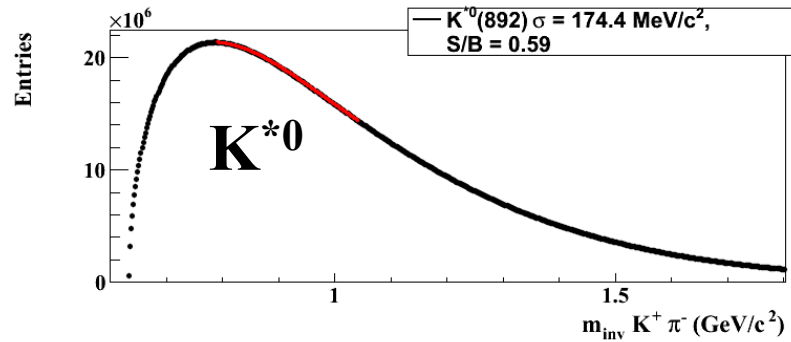
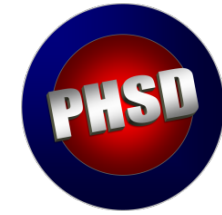




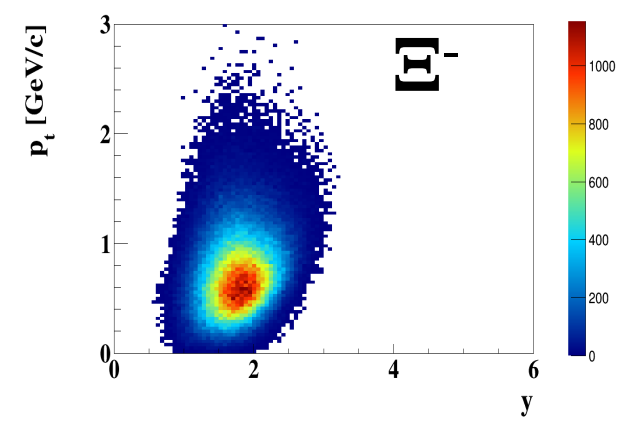
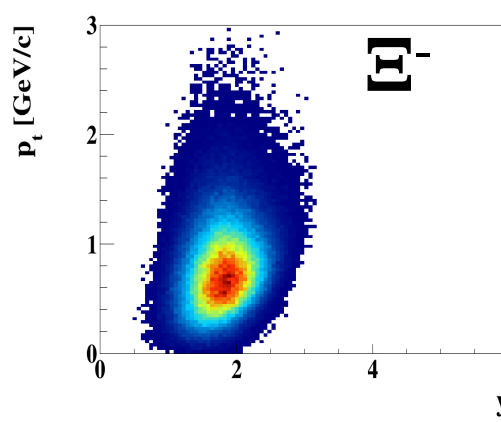
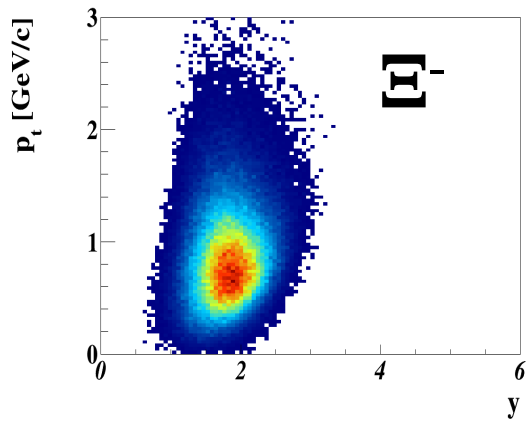
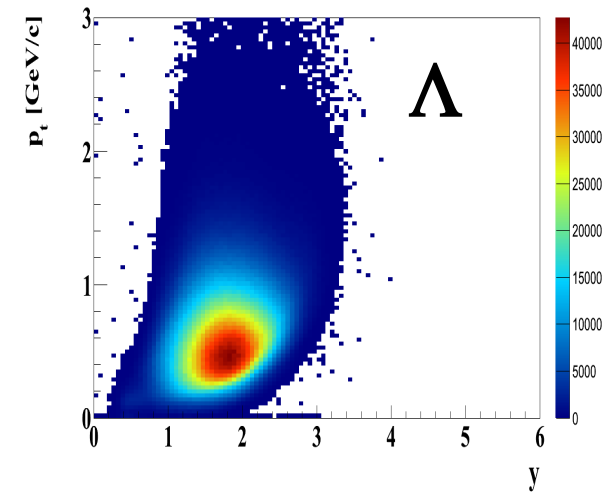
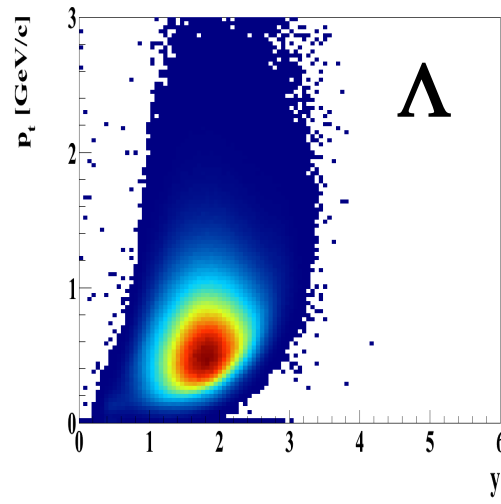
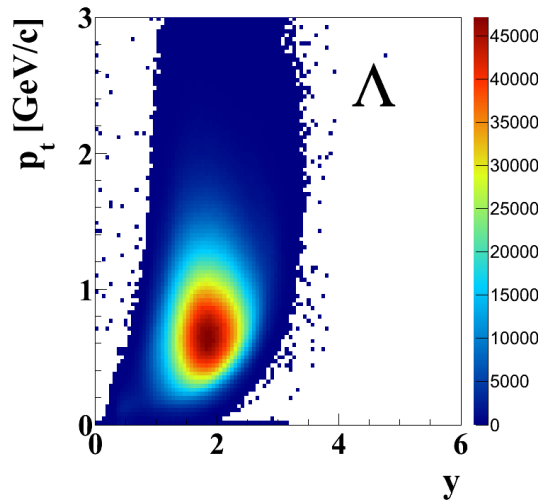
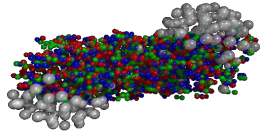
Au+Au 25 AGeV 5M central events



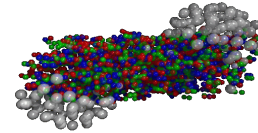
Au+Au 25 AGeV 5M central events



p_t vs Y : Λ , Ξ @ 25 AGeV



Au+Au @ 25 AGeV



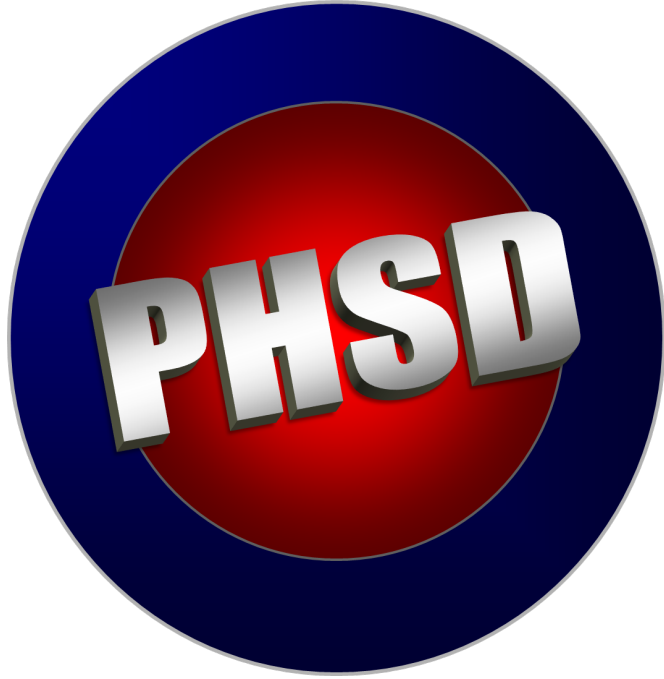
Particle	Multiplicity	Multiplicity	Multiplicity
π^-	317.7	344.6	351.9
π^+	280.9	308.3	314.8
K^-	10.2	9.95	12.6
K^+	32.1	32.9	38.6
p	173.9	171.5	160.0
pbap	2.0	0.67	0.36
Λ	27.4	26.1	25.2
Λ bar	1.5	0.23	0.115
Σ^+	6.2	5.64	8.37
Σ^-	3.9	3.27	9.56
Σ^+ bar	0.89	0.065	0.34
Σ^- bar	0.57	0.033	0.034
E^-	2.41	1.92	0.44
E^+	1.33	0.047	0.018
Ω^-	0.0055	0.004	0.018
Ω^+	0.01	0.00012	0.0032

Conclusions and outlook

- Fast reconstruction of multi-strange hyperons with KF Particle Finder (Au+Au 5M event by event @ 25A GeV) was successfully tested with PHSD model.
- Strange and multi-strange resonances sectors was tested with KF Particle Finder p+A collisions at FAIR energies.

To do:

- Event based to time based transition. Event building
- Signal extraction without MC input
- Few vertices per event handling
- New physics?
- Include particle ID from MUCH, RICH and TRD to KFParticle Finder
- Open charm reconstruction with KF Particle Finder (update)
- Direct and elliptic flow calculation for MS Hyperons

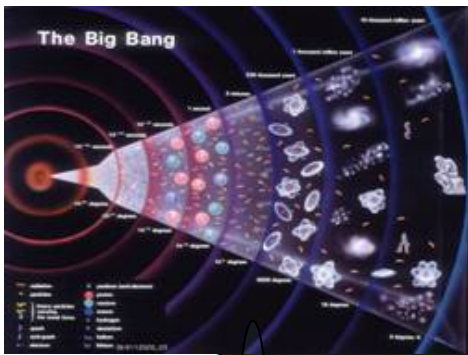


The Parton-Hadron-String Dynamics (PHSD)

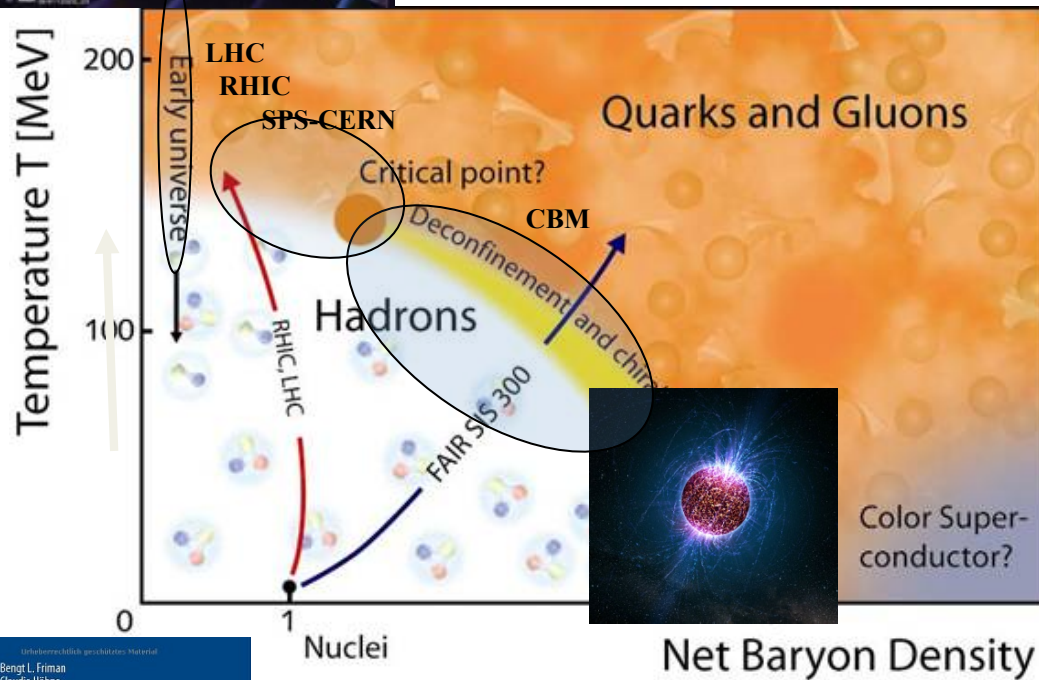
is a microscopic off-shell transport approach that consistently describes the full evolution of a relativistic heavy-ion collision from the initial hard scatterings and string formation through the dynamical deconfinement phase transition to the quark-gluon plasma as well as hadronization and to the subsequent interactions in the hadronic phase.

It has been developed by the Giessen/Frankfurt groups on the basis of the HSD transport approach and in the hadronic sector, PHSD is equivalent to HSD.

<http://fias.uni-frankfurt.de/~brat/PHSD/index1.html>



Physics case: Exploring the QCD phase diagram



Deconfinement phase transition at high ρ_B

- excitation function and flow of strangeness ($K, \Lambda, \Sigma, \Xi, \Omega \dots H^0, {}^3_\Lambda H \dots$)
- excitation function and flow of charm ($J/\psi, \psi', D^0, D_s, D^\pm, \Lambda_c$)
- charmonium suppression, for J/ψ and ψ'

Onset of chiral symmetry restoration at high ρ_B

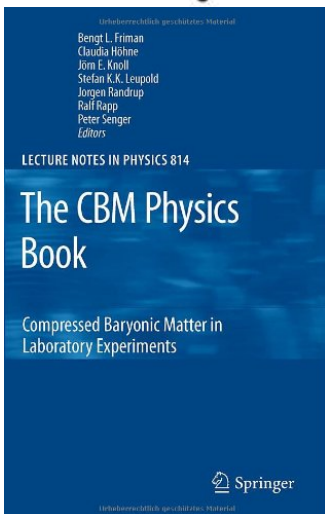
- in-medium modifications of hadrons ($\rho, \omega, \phi \rightarrow e^+e^-(\mu^+\mu^-), D^?, \Sigma^*?$)

QCD critical endpoint

- excitation function of event-by-event fluctuations ($K/\pi, \dots$)

The equation-of-state at high ρ_B

- collective flow of hadrons
- particle production at threshold energies (**open charm**)



Projects to explore the QCD phase diagram at large μ_B :

RHIC energy-scan, NA61@SPS, MPD@NICA **bulk observables**

CBM@FAIR/SIS-300

bulk and rare observables, high statistic!