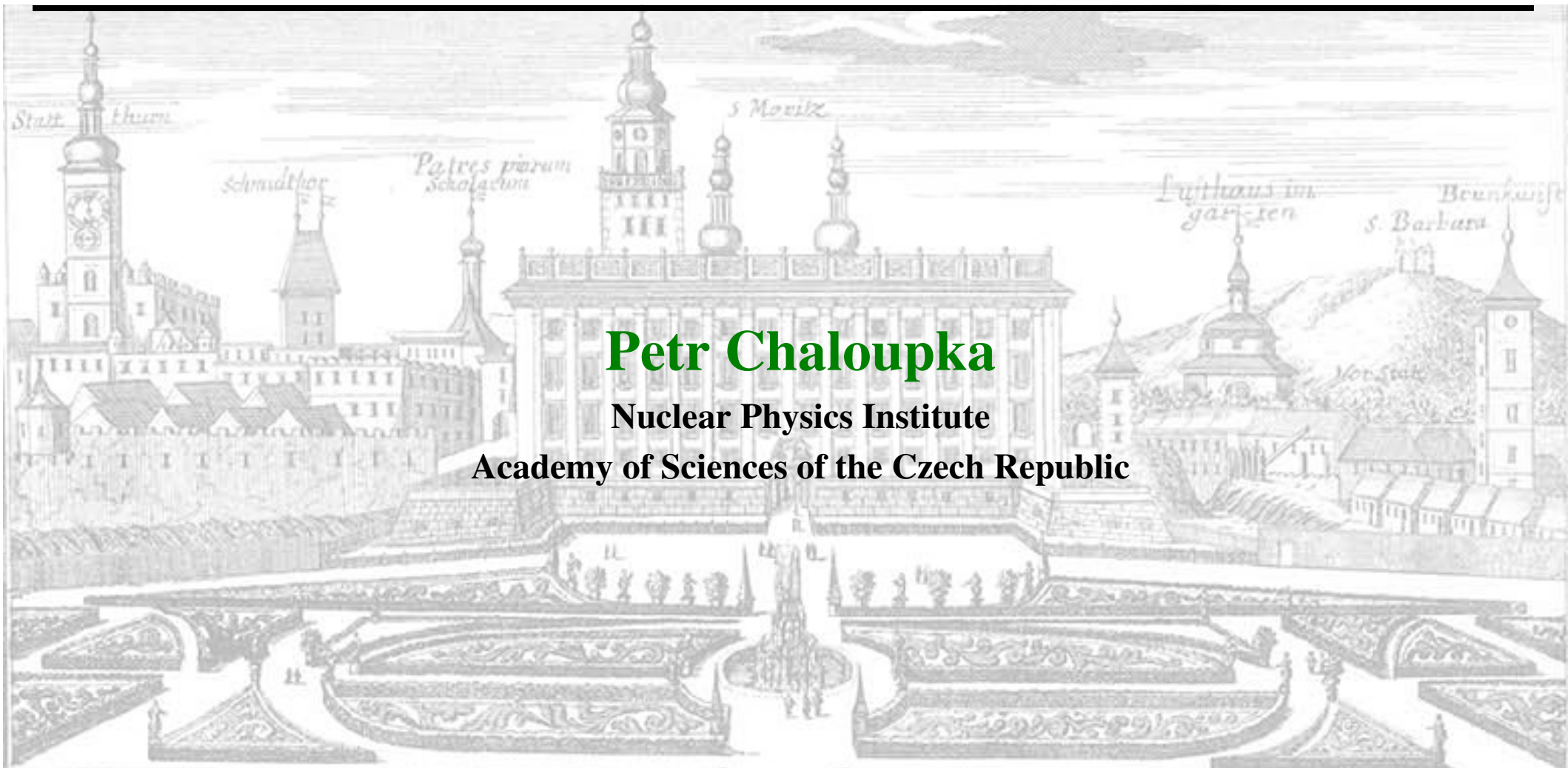


Der Lustgarten hinter dem Schloss

33

π -E correlations at RHIC



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Outline

Motivation

Current results on π - \bar{E} :

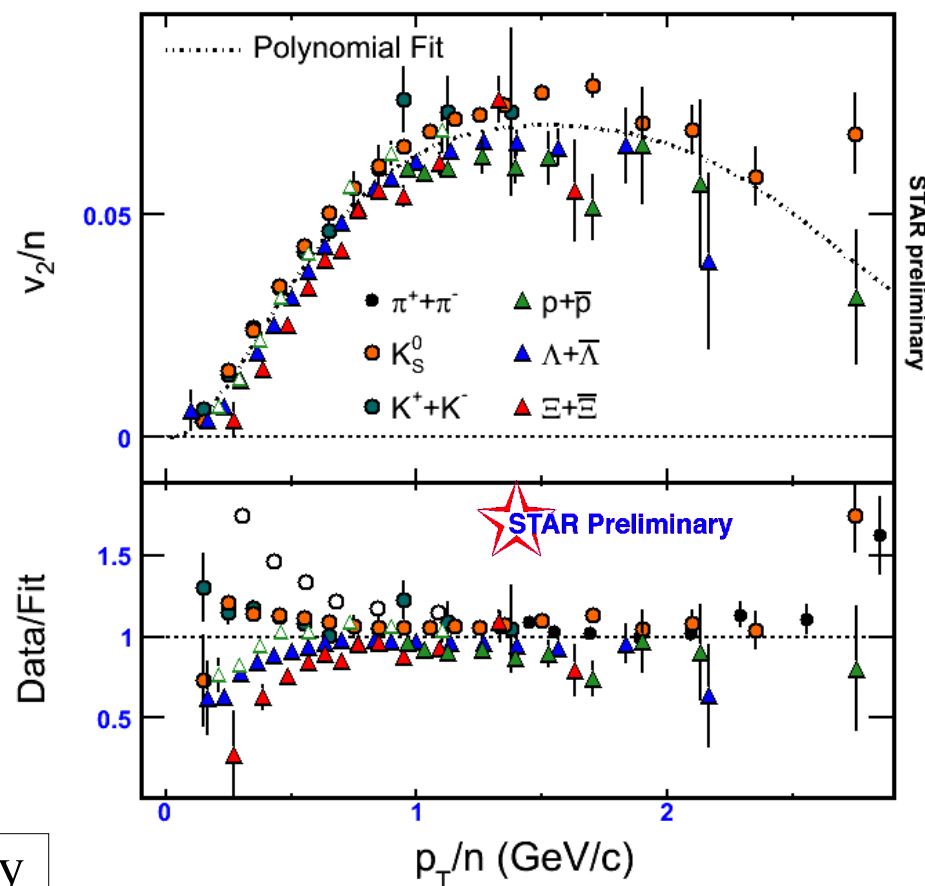
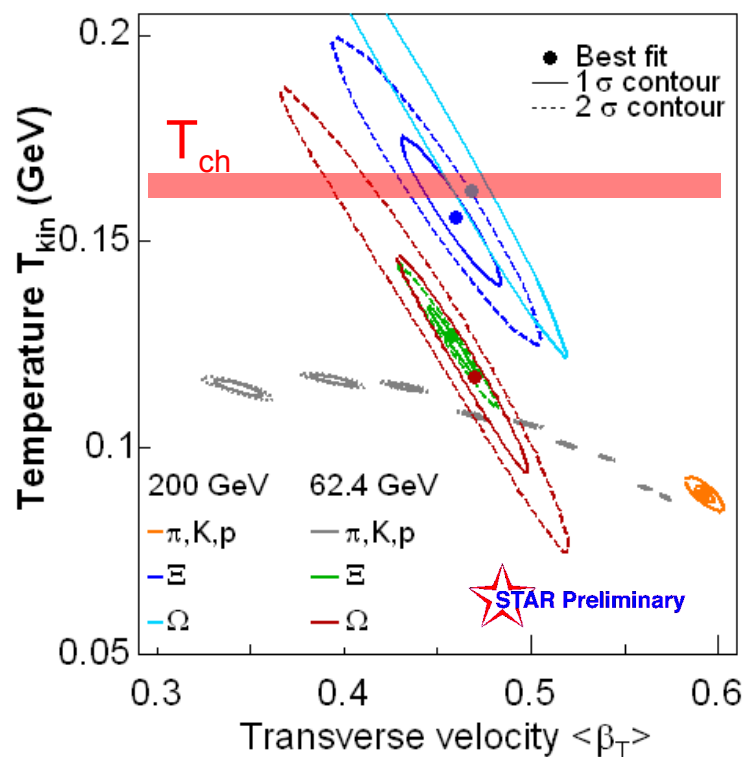
- 200 and 62 GeV AuAu
- 200 GeV dAu

Model comparisons:

- Blastwave
- RQMD

Conclusions

What we know about Ξ

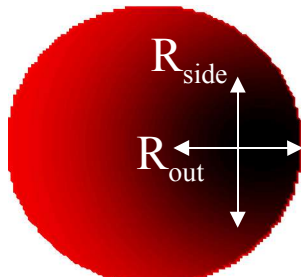


- Different thermal freeze-out behaviour: early decoupling?
- **Elliptic flow** comparable to other hadrons
- Suggesting early partonic collectivity?

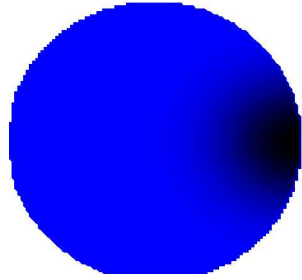
Can we test it with $\pi-\Xi$ correlations?

Effects of transverse flow

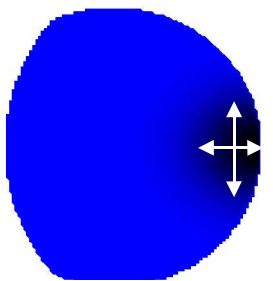
Emission points from Blastwave
 $\beta t = 0.73$ for all species



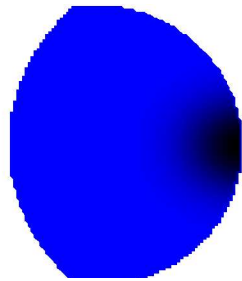
Pion
pt = 0.15 GeV/c



Proton
pt = 1. GeV/c



Ξ^-
pt = 1.4 GeV/c



Ω^-
pt = 1.8 GeV/c

- Correlation between momentum and emission point
- Effective **reduction of source size** and **shift** in average emission point
- Effect **increases with m_T**

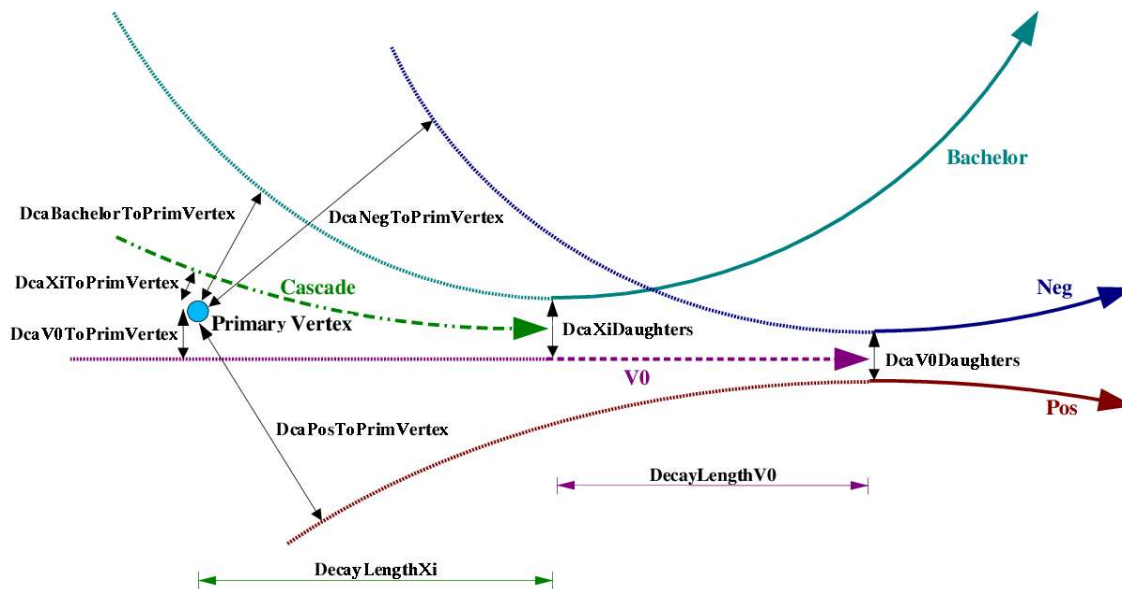
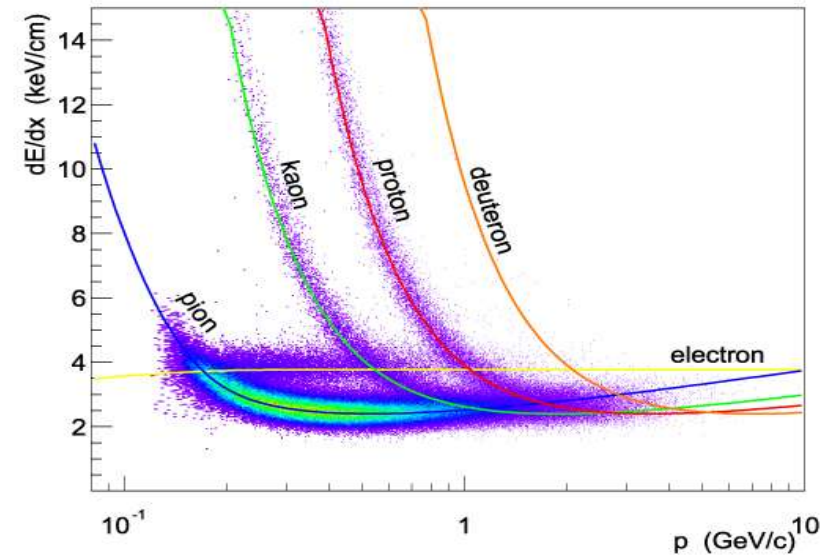
Non-identical correlations
can test flow by measuring
sizes and shifts of the sources

Particle identification

- Charged particles at mid-rapidity via dE/dx in TPC

$$\pi: y = \{-0.5, 0.5\}$$

$$p_t = \{150, 800\} \text{ MeV}/c$$



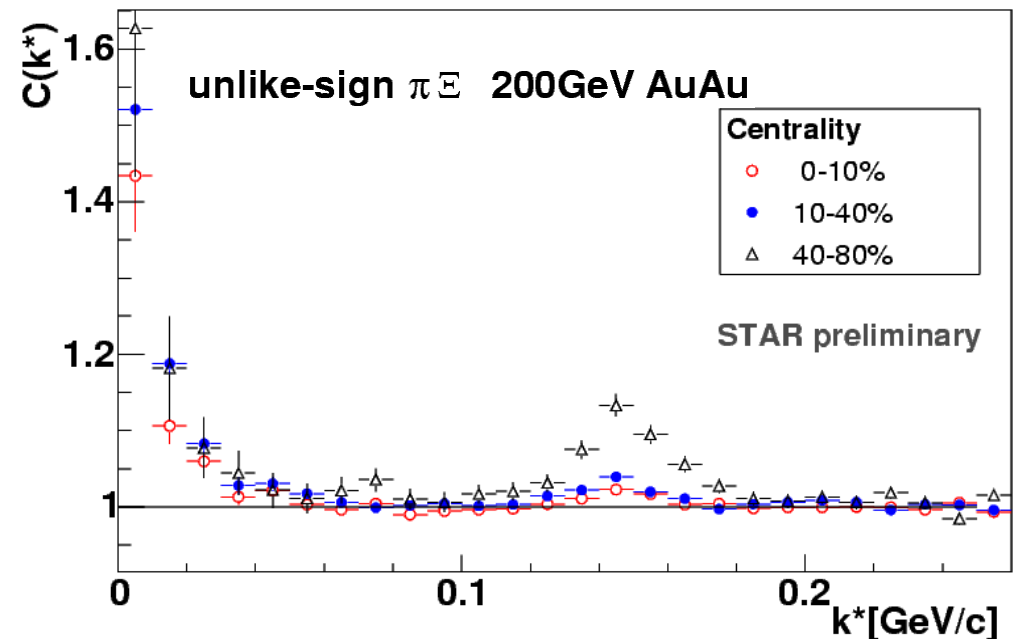
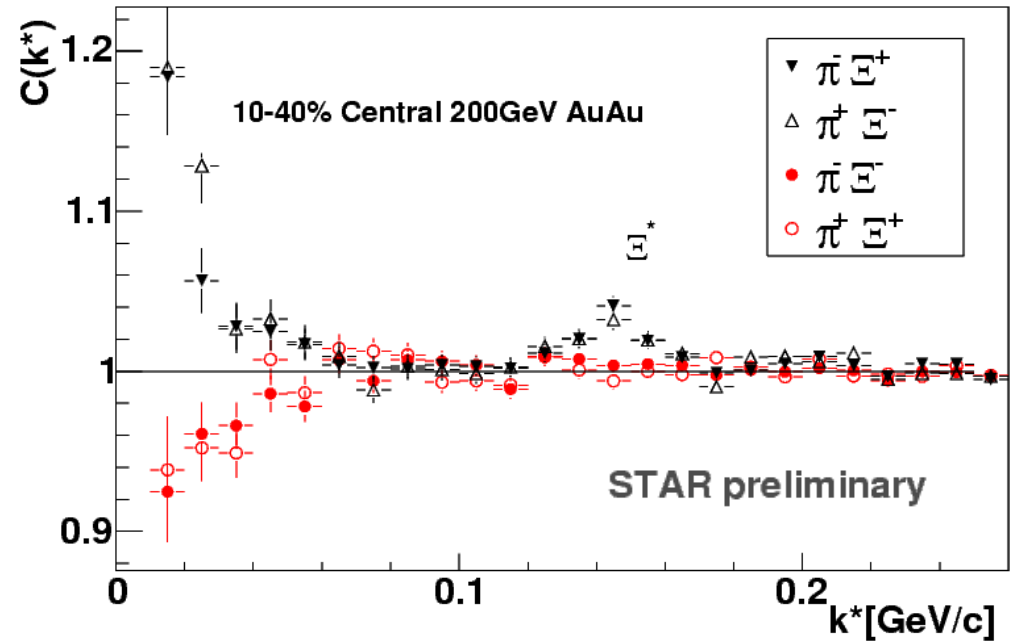
- Topological reconstruction of Ξ^\pm



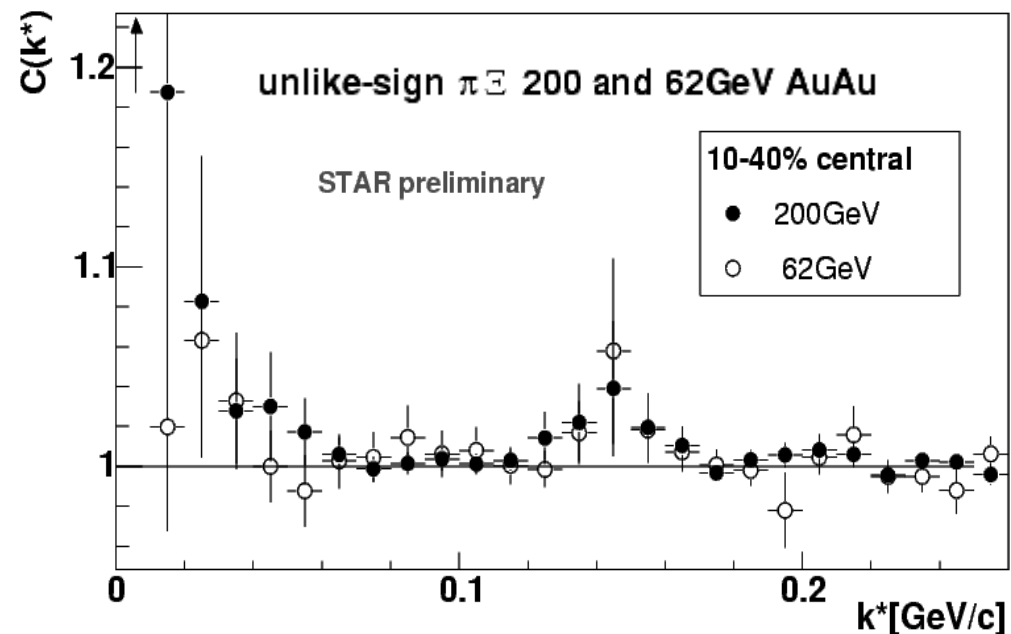
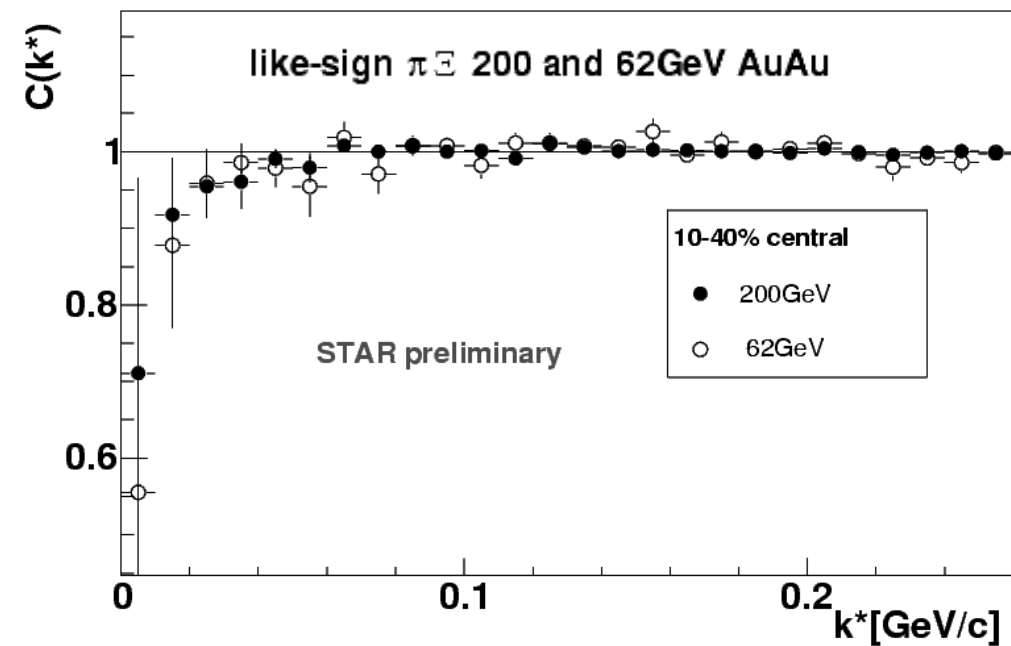
$$\Xi: p_t = \{1, 3\} \text{ GeV}/c$$

π - Ξ in 200GeV AuAu

- Data from RHIC's year 2004 high statistics AuAu run
- Data corrected for π and Ξ sample purities
- **Coulomb and strong (Ξ^*1530)** final state interaction effects present.
- **Centrality dependence** observed, particularly strong in the Ξ^* region



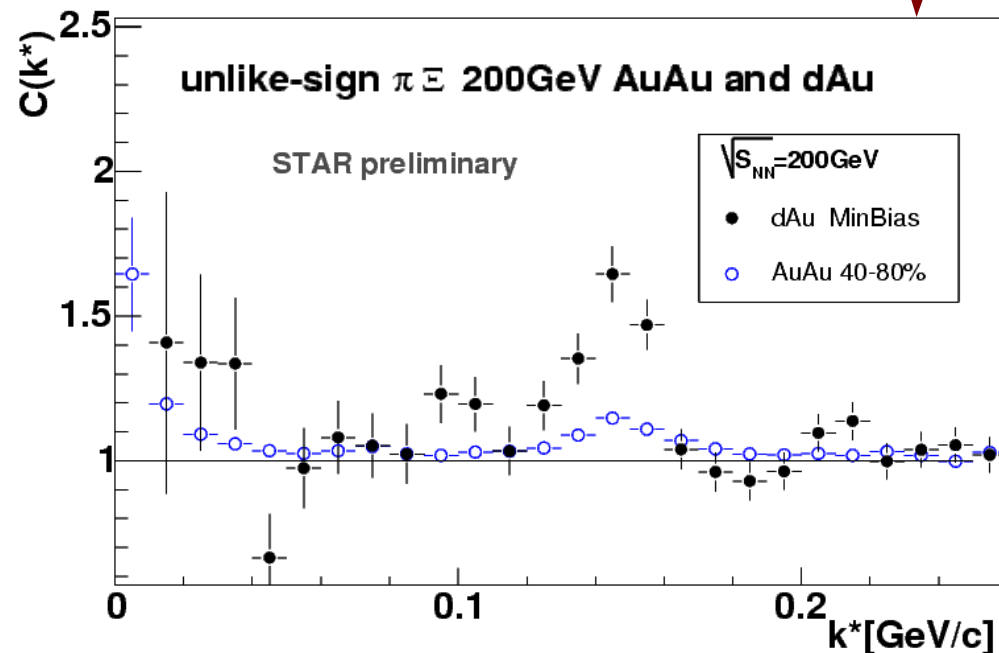
π - Ξ systematics



- π - Ξ CF measured for the first time in **62GeV AuAu** and **200GeV dAu** collisions

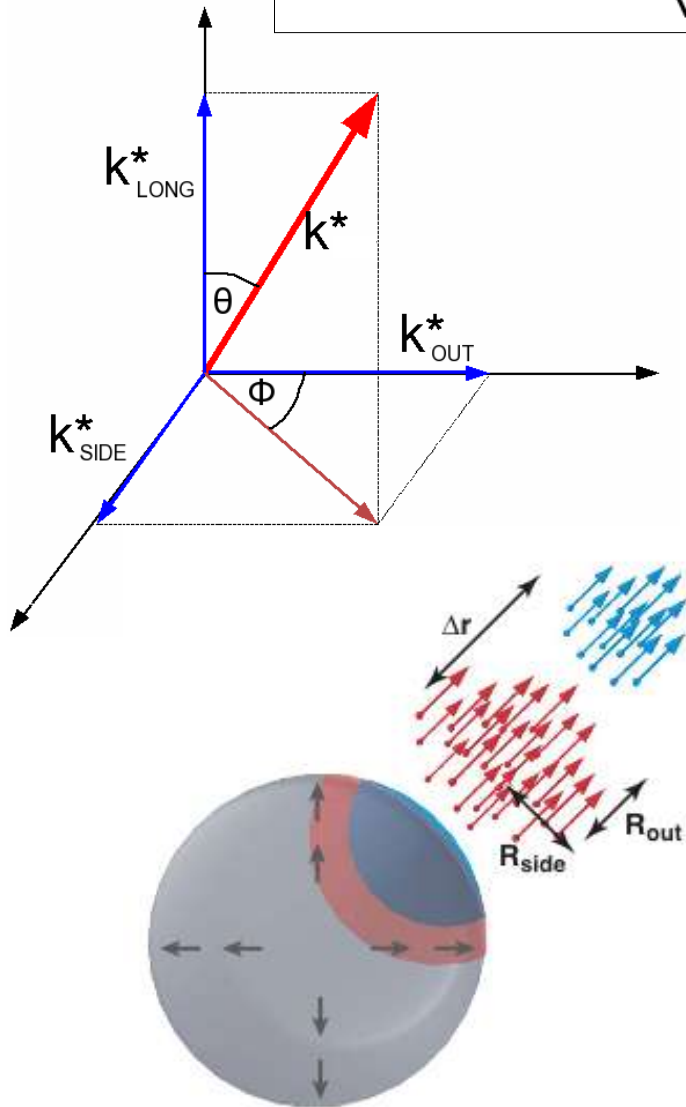
- No significant energy dependence

- Strong **system dependence**



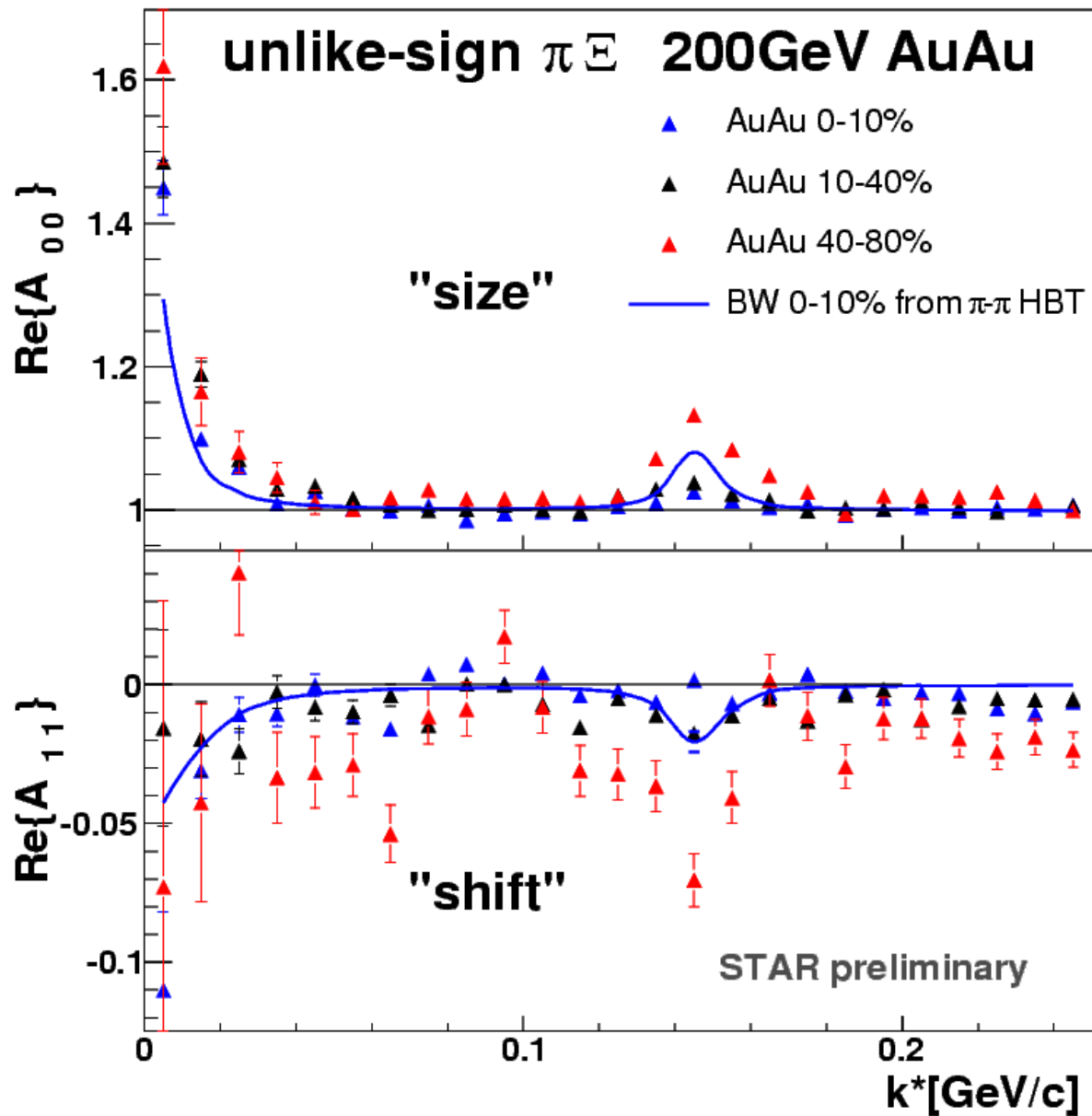
Spherical harmonics decomposition

$$A_{l,m}(|\vec{k}^*|) = \frac{\Delta_{\cos\theta}\Delta\varphi}{\sqrt{4\pi}} \sum_i^{\text{all bins}} Y_{l,m}(\theta_i, \varphi_i) C(|\vec{k}^*|, \cos\theta_i, \varphi_i)$$



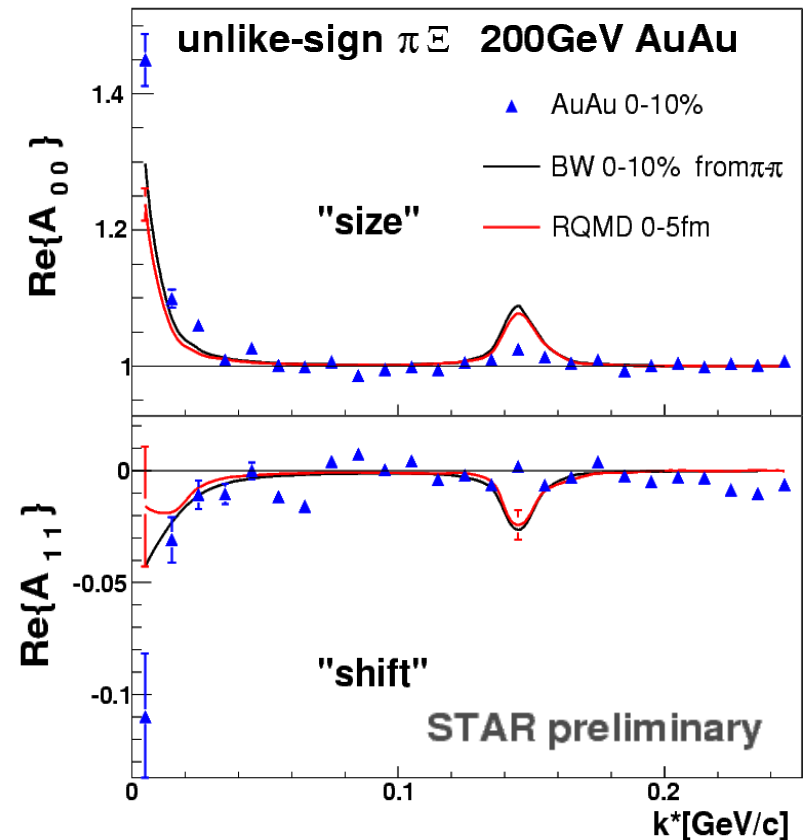
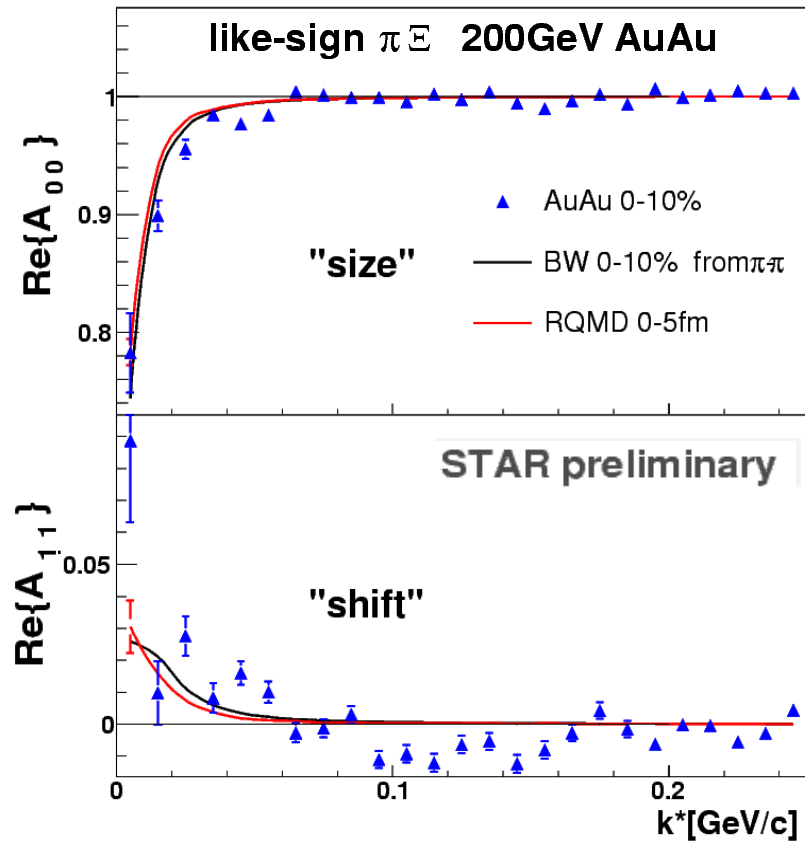
- Testing symmetry in k^* space by decomposition of CF into spherical harmonics
- Different A_{lm} coefficients correspond to different symmetries of the source
- A_{00} - angularly averaged CF
- **A_{11} to study shift in R_{out} direction**

Accessing shift between sources



- $A_{11} \neq 0$ in Coulomb and strong region
- **Shift** in the average emission point between $\pi^- \bar{\pi}^+$

Model comparison

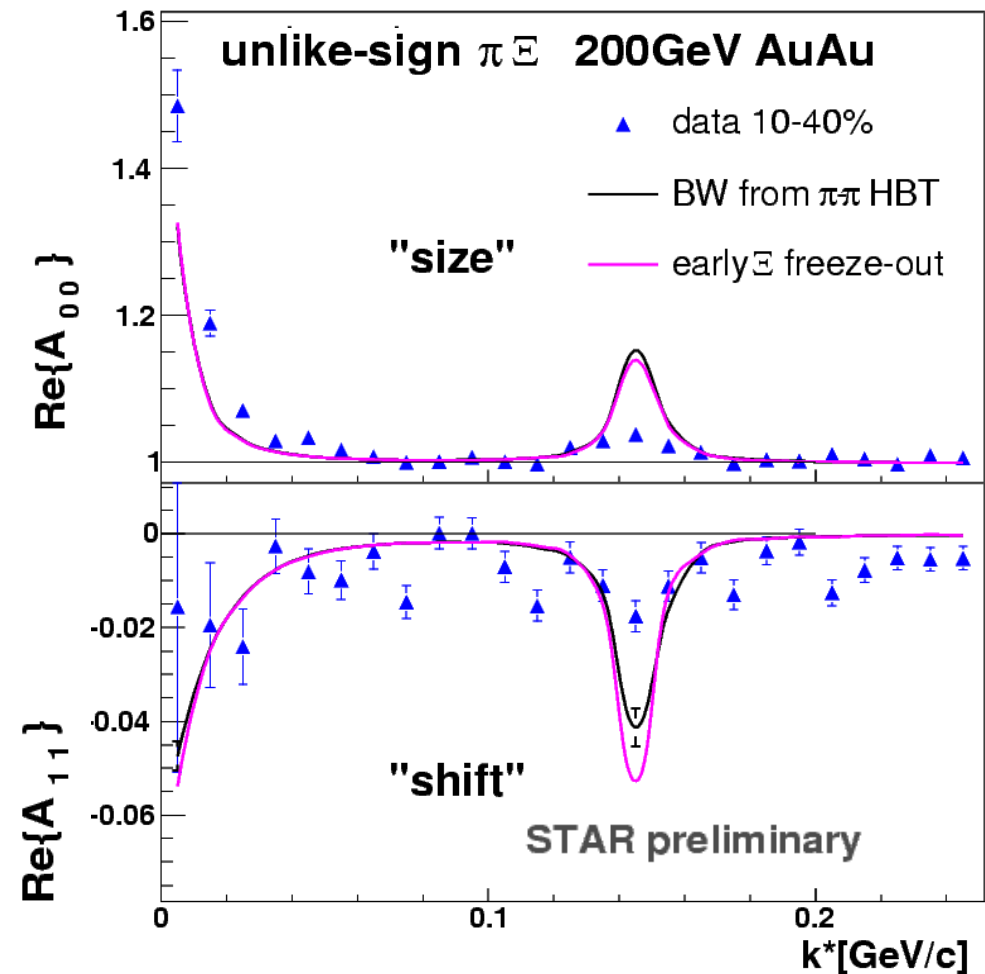


Model:

- S. Pratt's FSI (Phys.Rev. C68, 054901(2003))
+
- Emission points from:
 - Blastwave: constrained by π - π HBT
 - RQMD
- Difference between measured and calculated CF under investigation
- Observed **shift agrees** qualitatively **with flow scenario.**

Early freeze-out ?

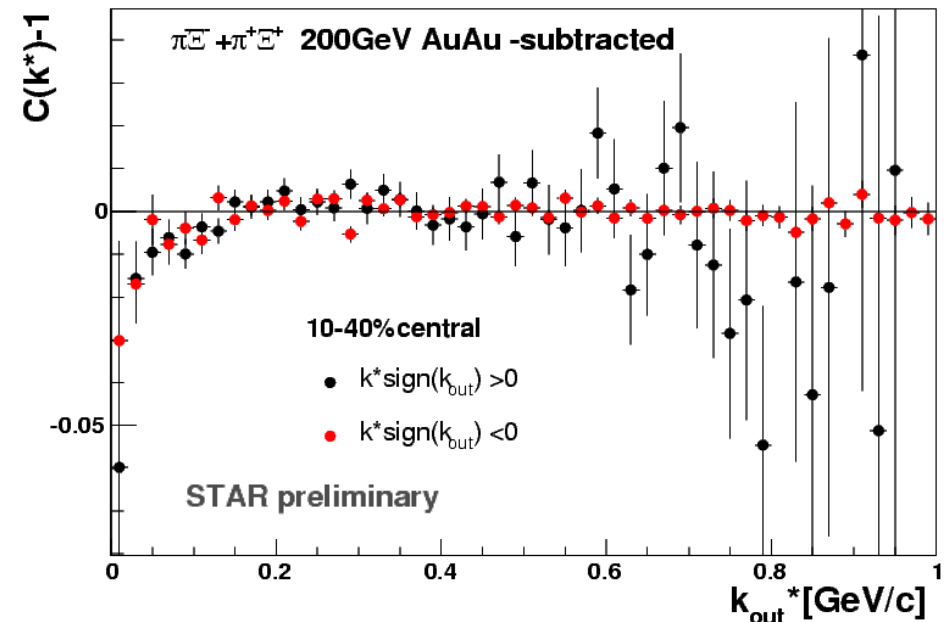
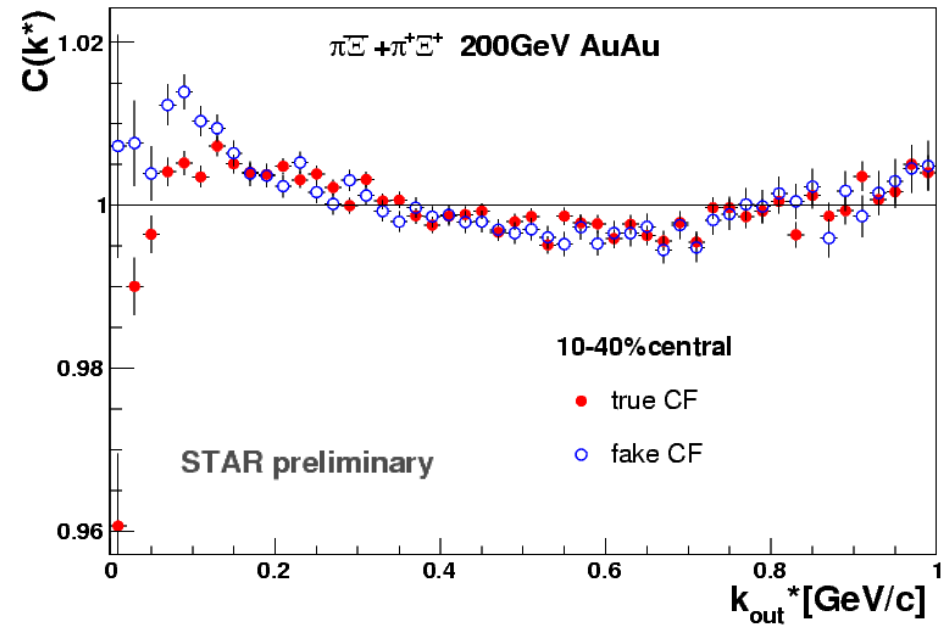
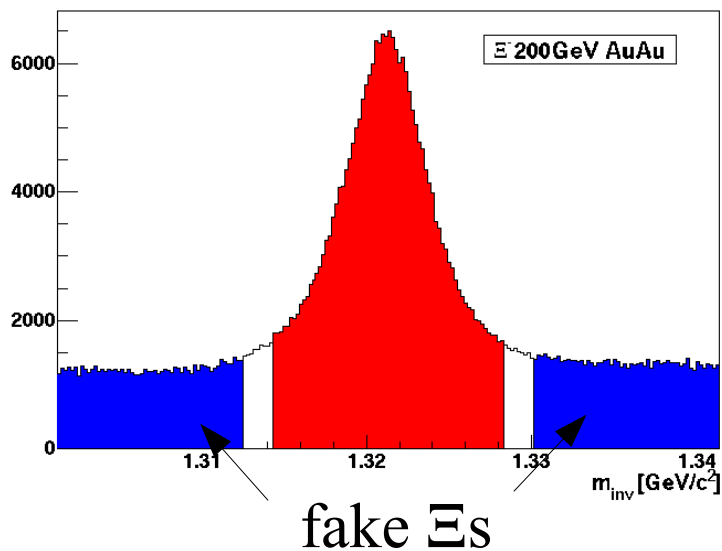
- Is this due to early freeze-out?
(Could we tell?)
- Competing changes – small overall effect
- Assumed early freeze-out scenario – **small effect on CF**



BW parameters	π	Ξ	Ξ early freeze-out
T[MeV]	103	103	150
ρ	0.93	0.93	0.75
R[fm]	10.3	10.3	9
τ [fm]	6.9	6.9	5
$\Delta\tau$ [fm]	2	2	2

Remaining technical challenges

- **Non-flat baseline issue**
- Wide k^* structure in CF
possible source: flow, detector effects-currently being investigated
- **Using fake Ξ s** to construct correlation function with similar baseline behaviour for corrections



Conclusions

- First **high statistics measurements of $\pi-\Xi$** correlations in 200 and 62 GeV AuAu and 200 GeV dAu collisions were presented.
- Coulomb and strong FSI were observed.
- Very good **sensitivity to source size** in Ξ^* peak was found. Theoretical input needed.
- Using new spherical harmonics representation of data we observe clear **shift between average emission points of π and Ξ** sources in qualitative agreement with transversally **expanding source**.