

**Study of Λ - Λ correlations
with
STAR Detector at RHIC**

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Outline

- Introduction
- Two particle correlations
- $\Lambda\Lambda$ correlations and H dibaryon
- Overview of STAR detector
- Analysis details & results
- Summary

Introduction

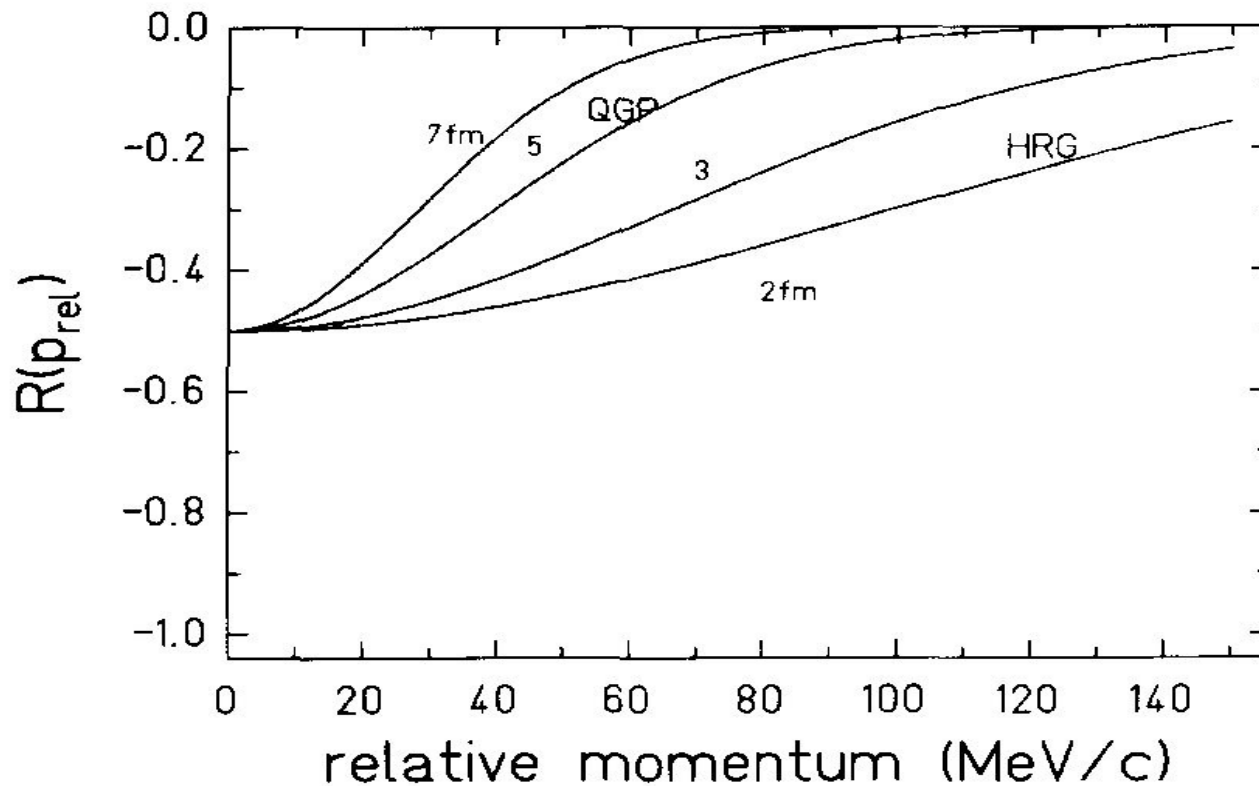
- * Two particle correlation function, $R(p_{rel})$ are sensitive to the size r_0 of the emitting region.
- * Correlation functions with Λ
 - no Coulomb interactions
 - Sensitive to hyperon-hyperon interactions
 - Shed some light on possibility of H (uuddss) formation

Two Particle Correlation Function

The two particle Correlation Function

$$R(Q) = -0.5 \cdot \exp(-Q^2 r^2)$$

Where Q is relative momentum between two Λ and λ is degree of incoherence of the source



H dibaryon

- * Six quark state (uuddss)*
- * Properties : $J^\pi = 0^+$, mass – (1.2-2.8) GeV/c²
- * Depending on the mass we have different decay modes of H:

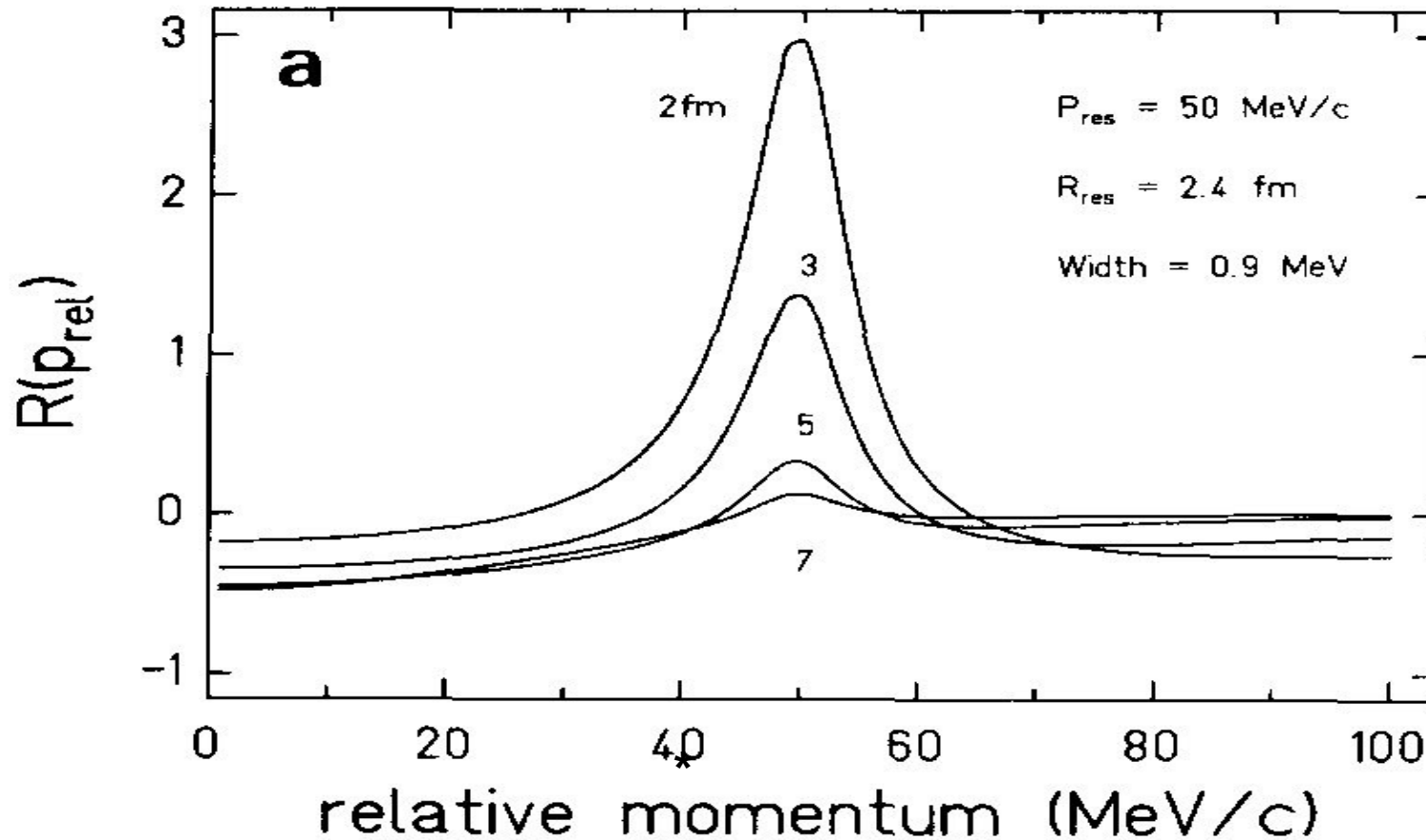
Channel	Threshold Mass (GeV/c ²)	ΔS
$\Lambda\Lambda$	2.231	0
$\Lambda N\pi$	2.192	1
$NN\pi\pi$	2.152	2
Σn	2.134	1
Λn	2.055	1
$NN\pi$	2.016	2
nn	1.879	2

} Possible to look with STAR

H^0 in Λ - Λ correlations

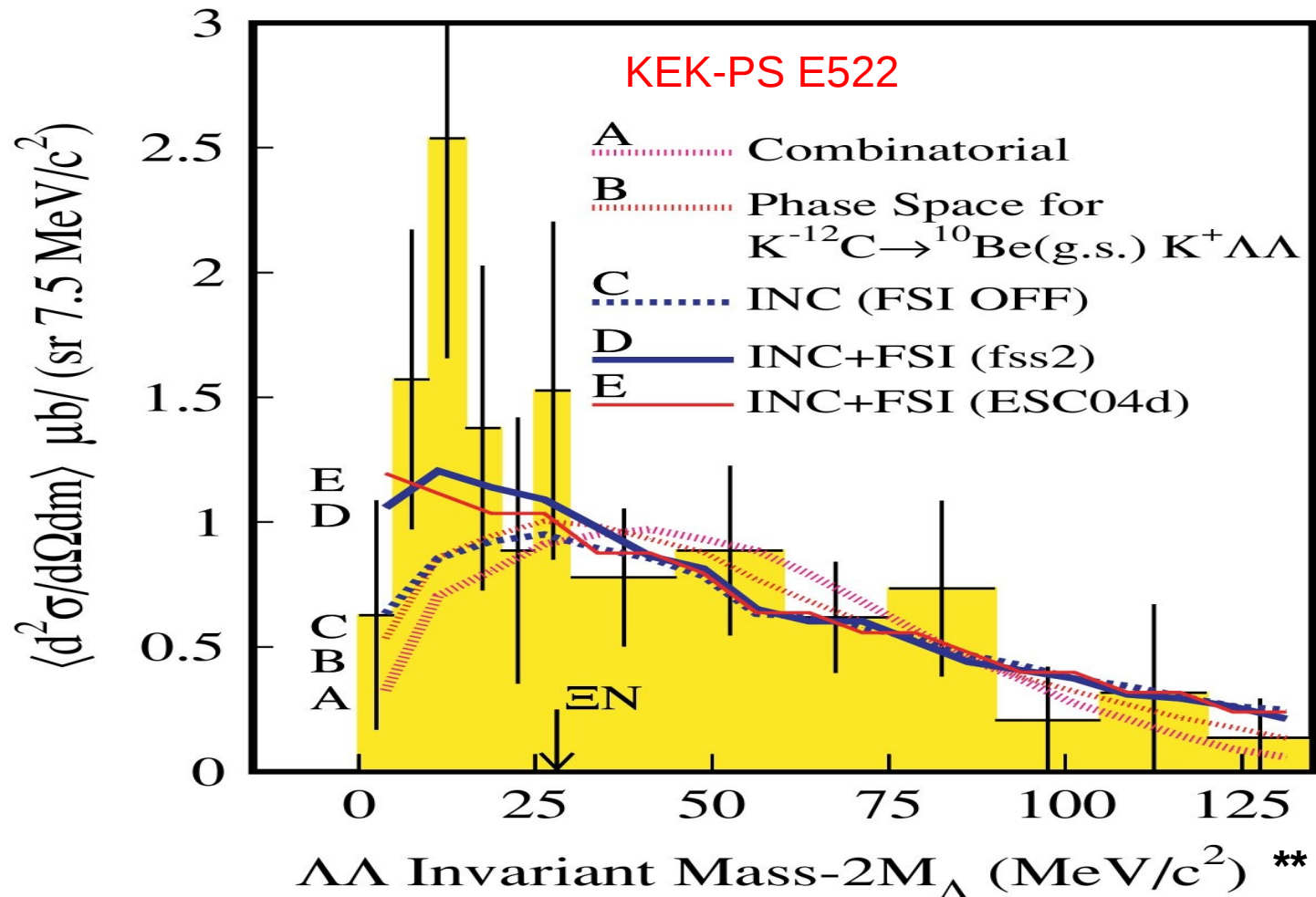
Influence of possible low energy resonance on Λ - Λ correlations.

Lambda-correlation with resonance



UFM TP 88-309

H^0 in Λ - Λ correlations

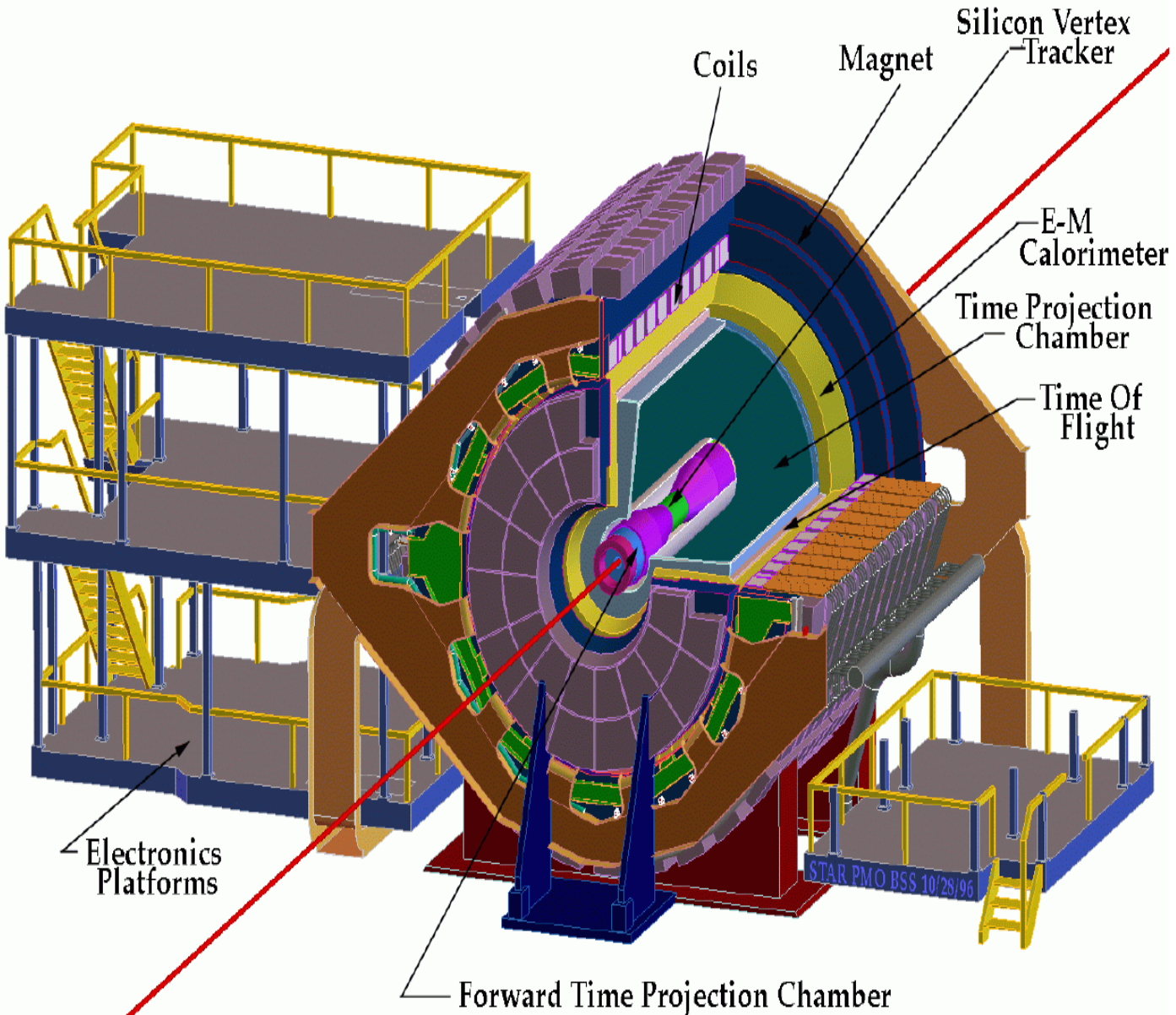


scattering length ($a_{\Lambda\Lambda}$) = $-0.10^{+0.45}_{-2.37} \pm 0.04$ fm***



No/weakly bound state

STAR Detector



Time projection Chamber (TPC), Time of Flight helps in particle identification

E-M calorimeter helps in measuring energy

Silicon Vertex Tracker and upVPD helps in tagging the vertex and event trigger

Λ reconstruction

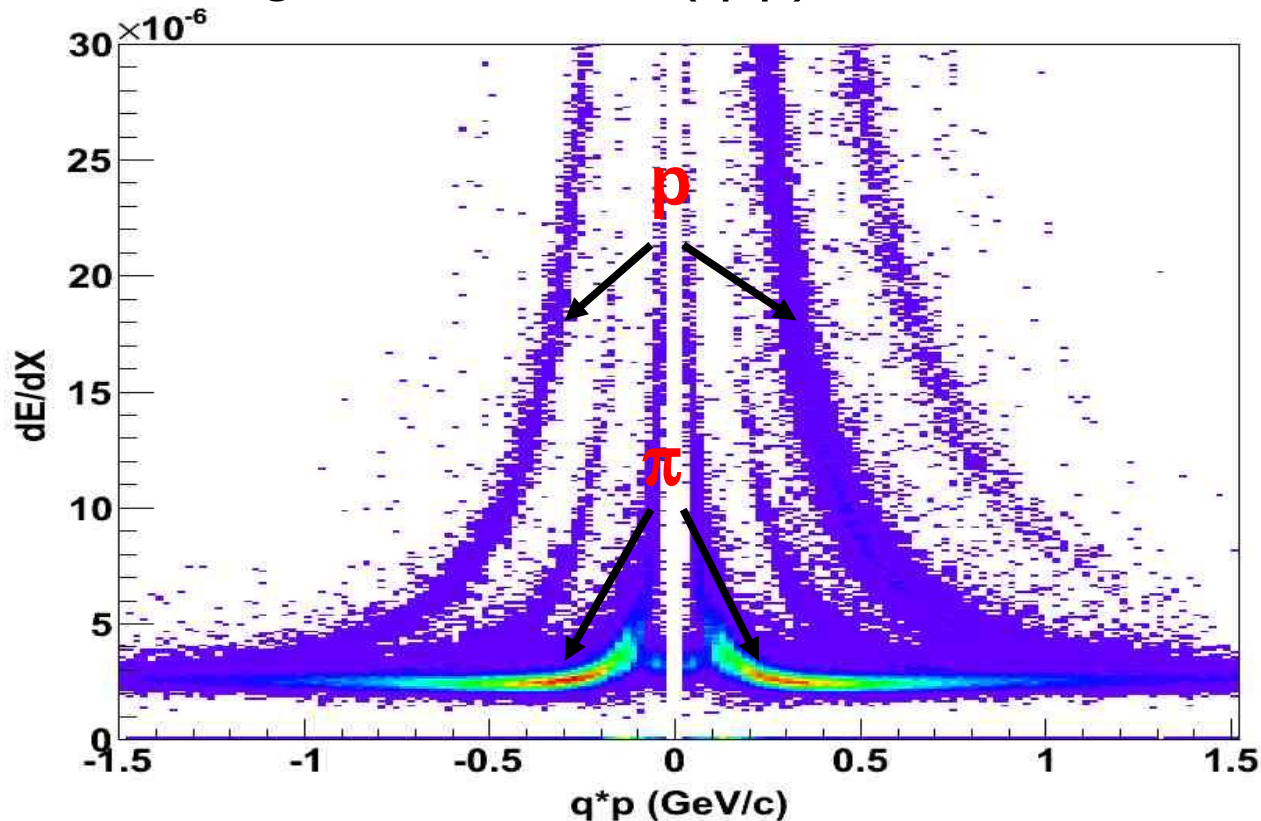
$\Lambda \rightarrow p\pi$

Mass = 1.1156 GeV

Branching ratio = 63%

Mean Life time $\tau = 2.63 \times 10^{-10}$ s, $c\tau = 7.89$ cm

To reconstruct Λ select pair of proton and pion from the particle identification (PID) plot generated using dE/dx and charge*momentum ($q \cdot p$) information from the TPC.



Data Set – AuAu

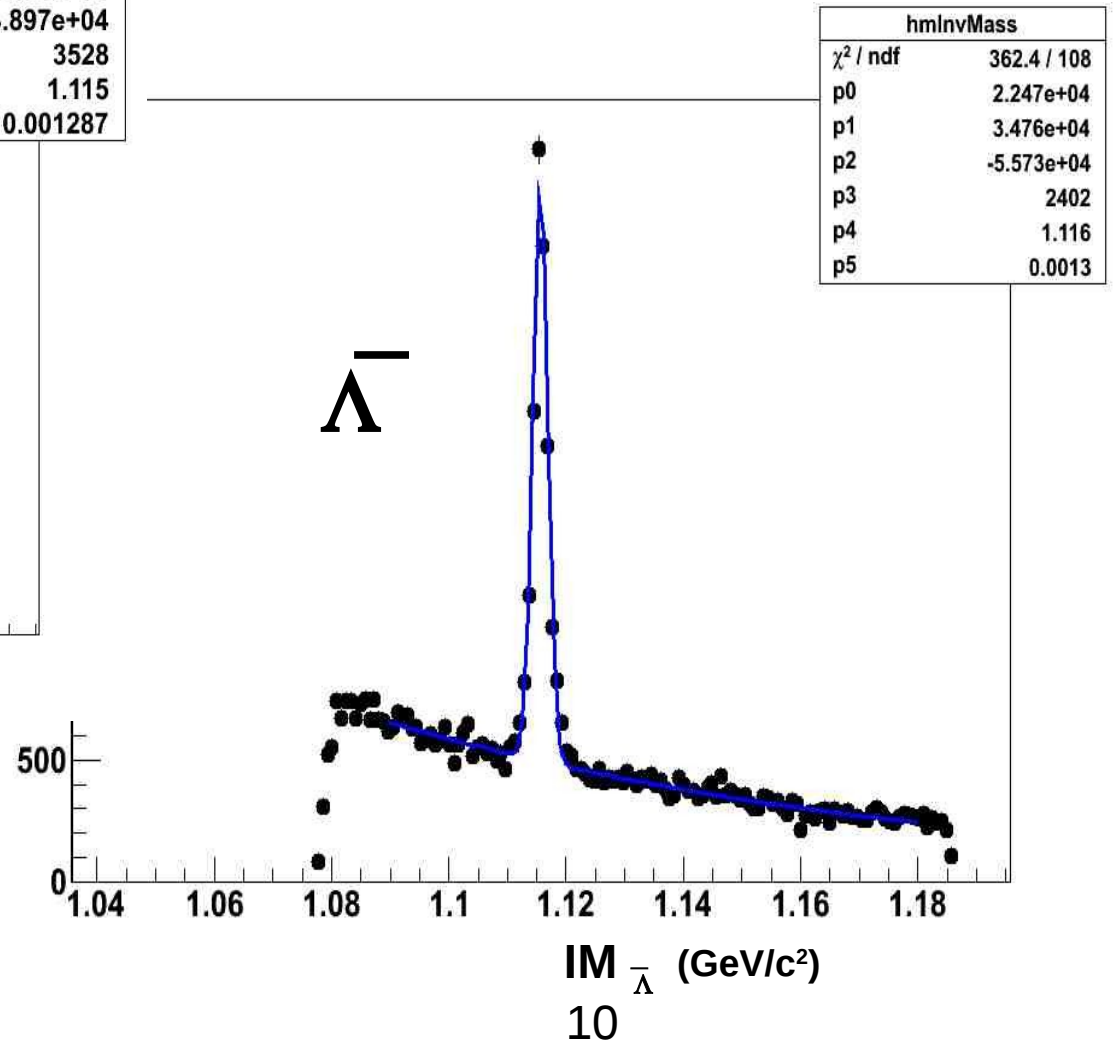
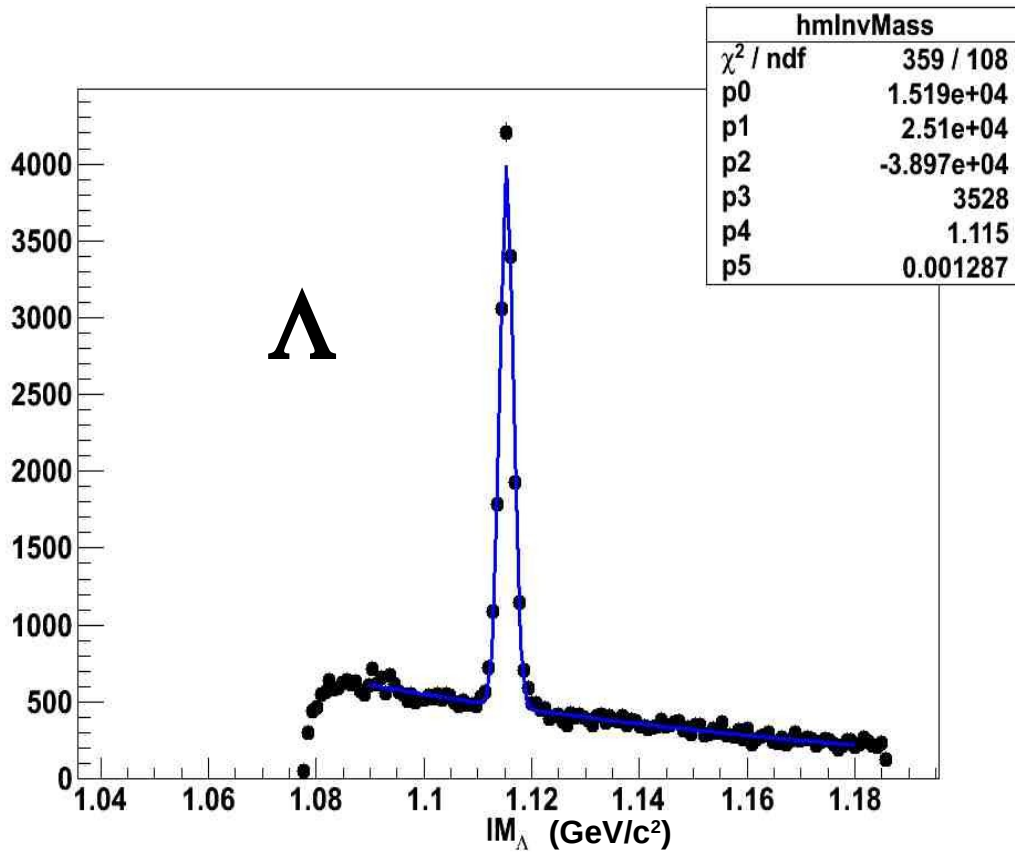
$\sqrt{s_{NN}} = 39$ GeV (year - 2010)

of lambdas = 2

$|\text{vertex } z| < 30$ cm

$|\eta| < 0.8$

Λ reconstruction



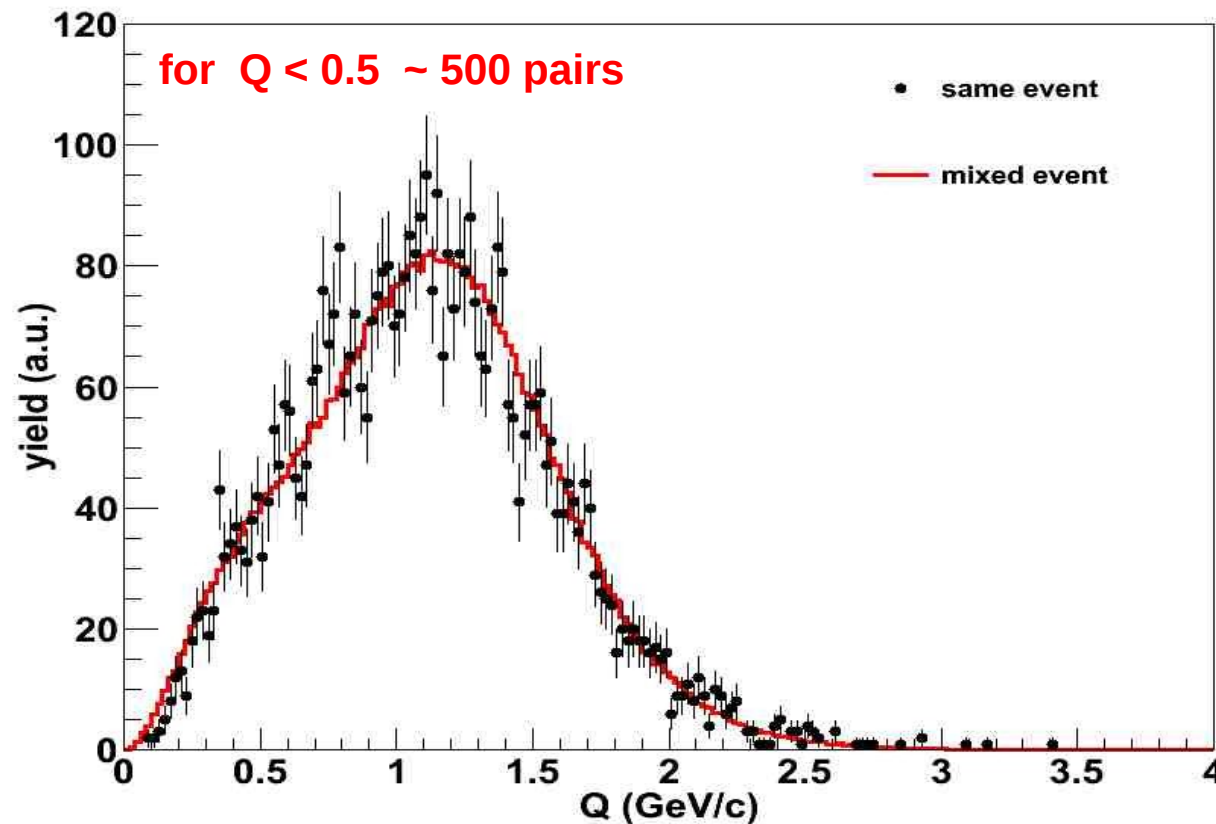
Correlation Function

The two particle Correlation Function (CF)

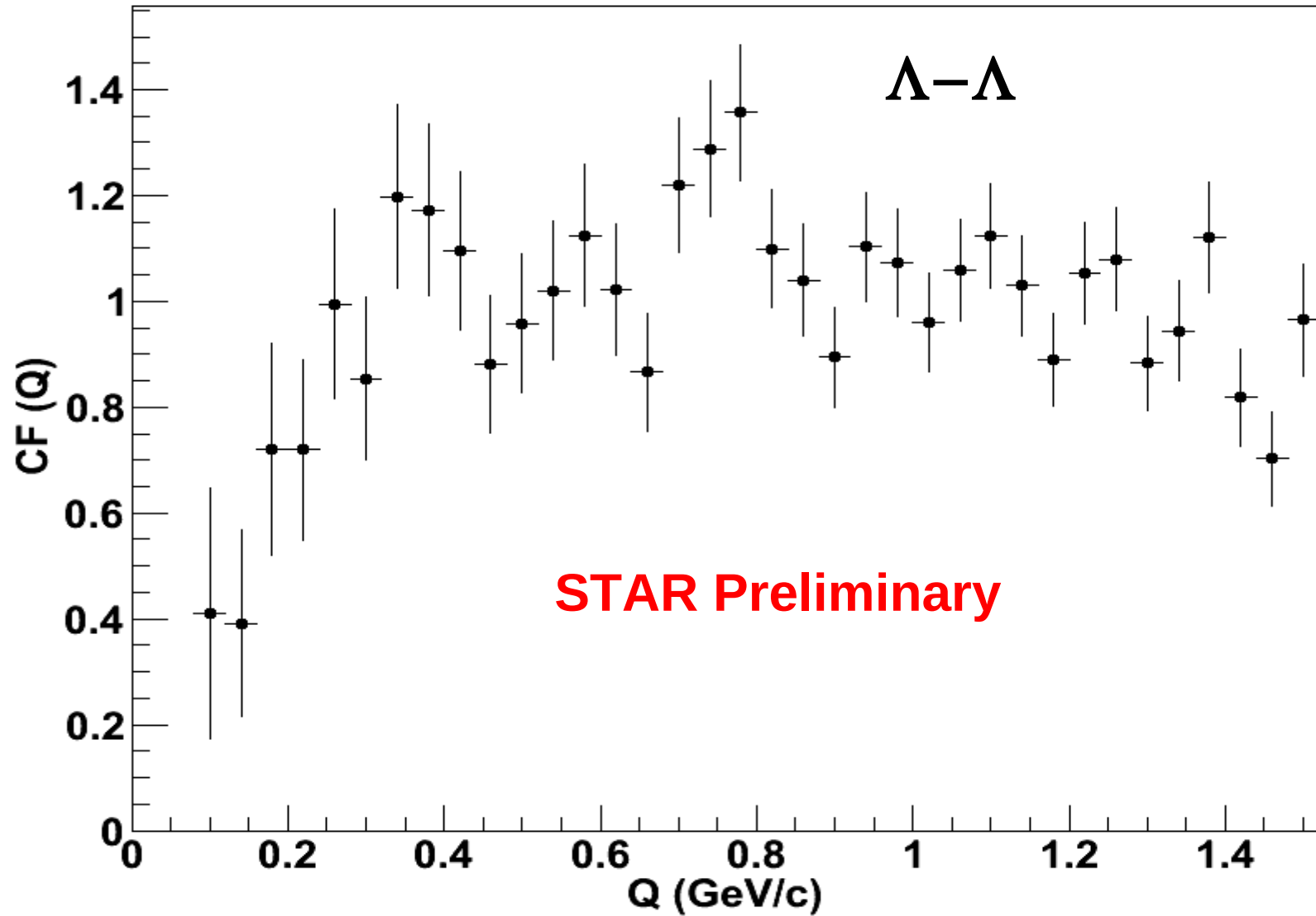
$$CF(Q) = A(Q)/B(Q)$$

Where Q is relative momentum between two Λ

$A(Q)$ the relative momentum distribution generated by taking pair from same event and $B(Q)$ is the reference distribution generated by mixing two particles from different events



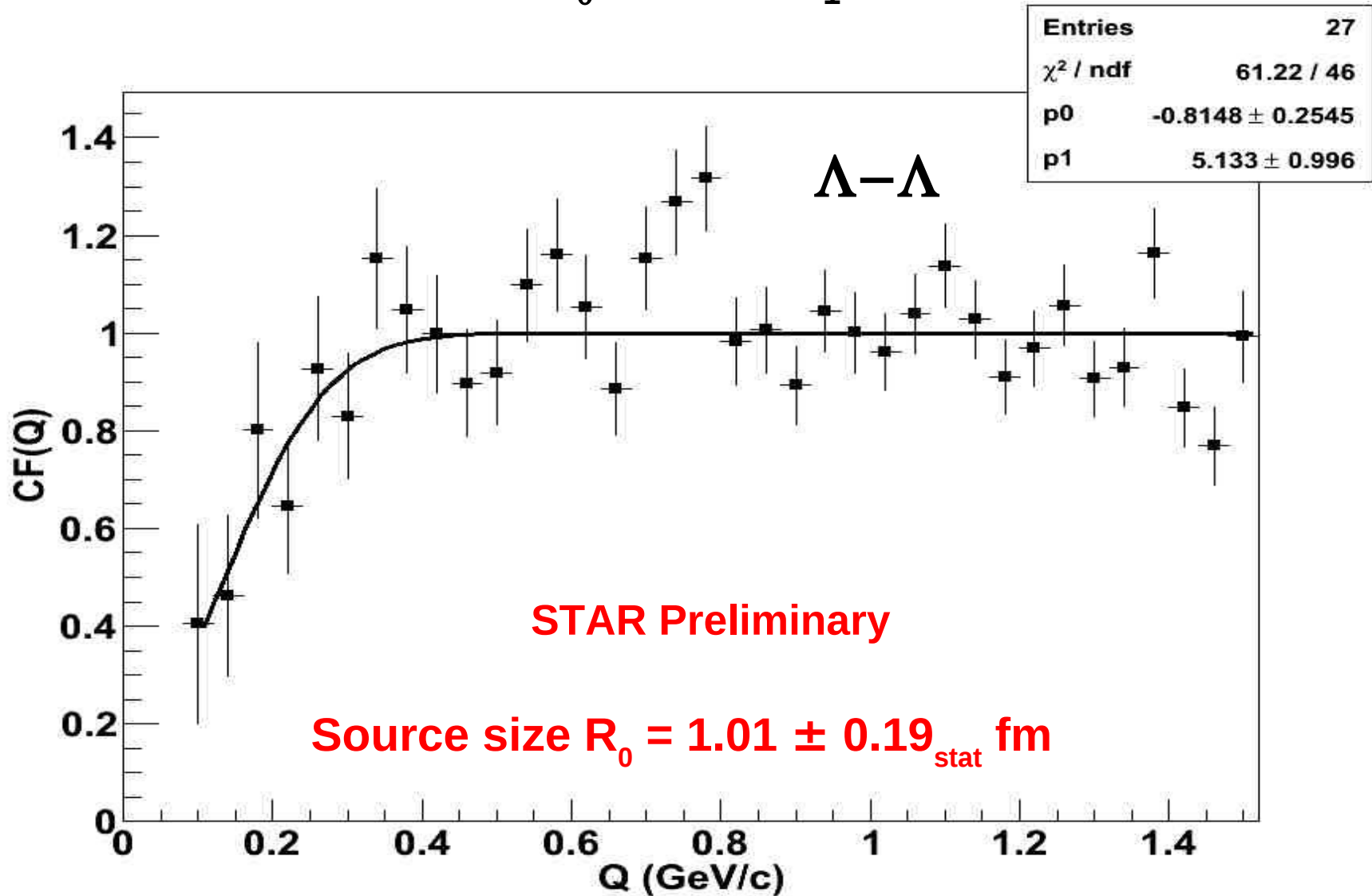
Correlation Function



Results

Fit function:

$$CF(Q) = 1 + p_0 \exp(-Q^2 p_1^2)$$



Summary

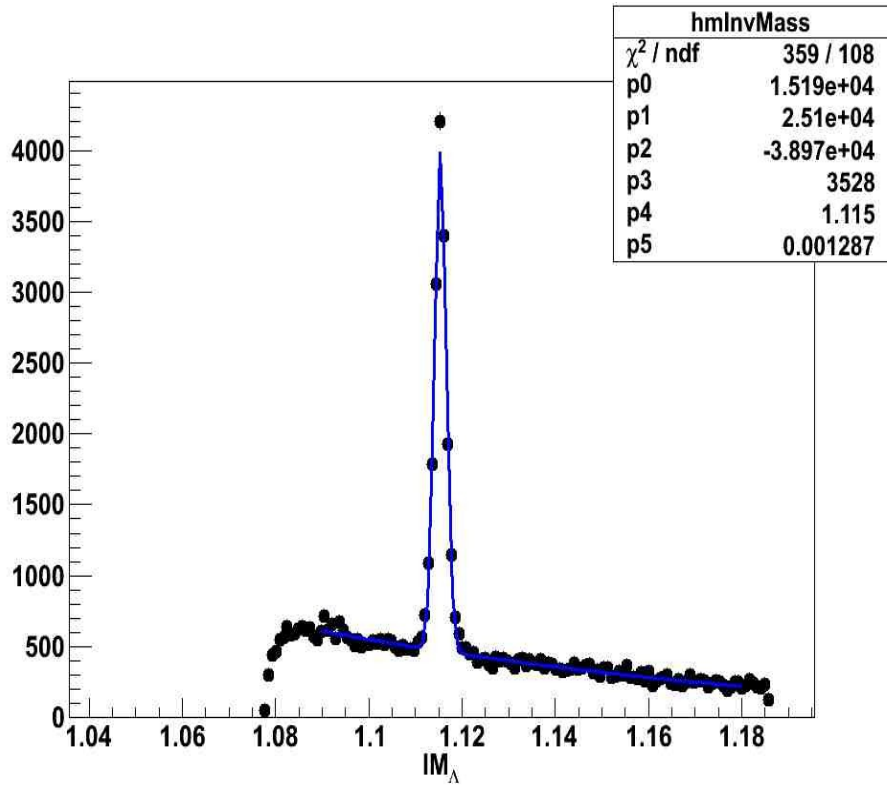
- * The first measurement of correlations for $\Lambda\Lambda$ at $\sqrt{s_{NN}} = 39$ GeV are presented.
- * The source size is estimated to be $1.01 \pm 0.19_{\text{stat}}$ fm
- * The possibilities to look for H^0 with STAR at RHIC are discussed

Outlook

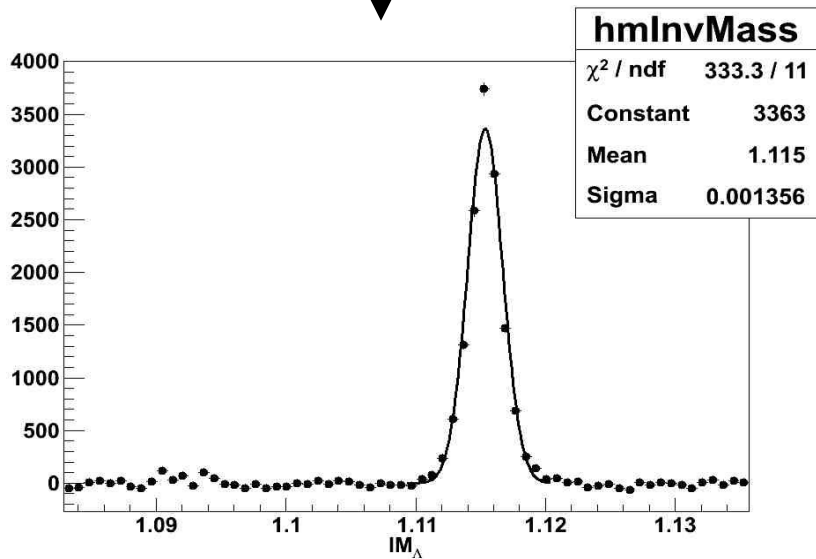
- * Analysis from $\sqrt{s_{NN}} = 200$ GeV is in progress
- * Look for the $\Lambda p\pi$ channel for H^0 signal

Thank you

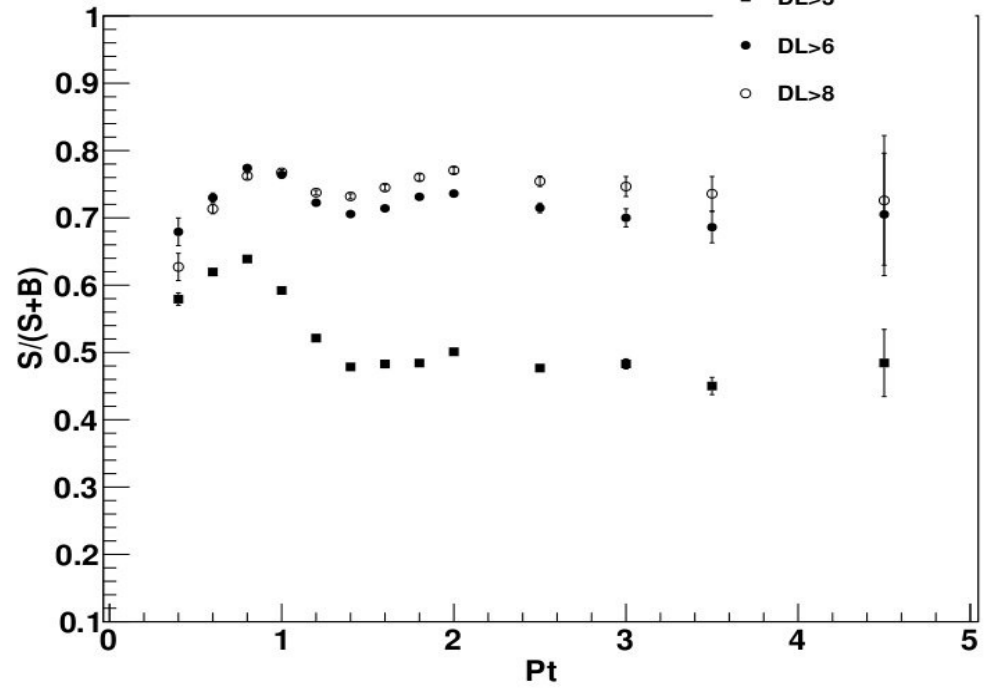
Backup



Background subtracted



Single particle purity



Pair purity

