benchmark analysis: $\bar{p}p \rightarrow \Xi^- \bar{\Xi}^+ \pi^0$

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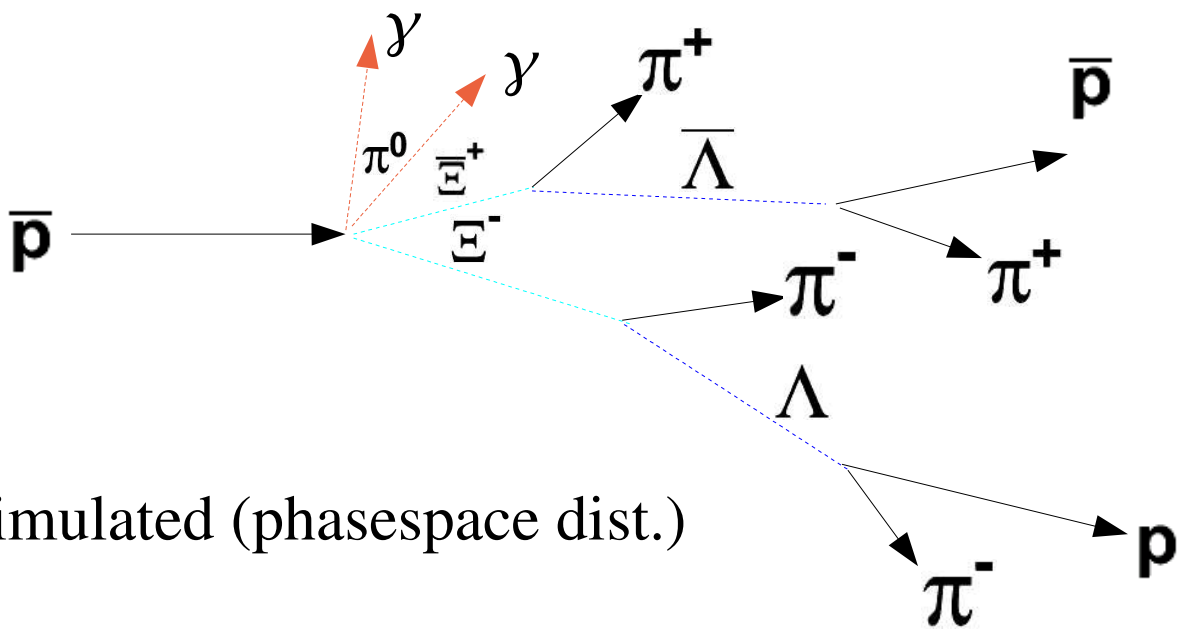
physic case: baryon spectroscopy

In PDG(2006) 12 Ξ hyperons are mentioned.
Only Ξ^0,Ξ^- and $\Xi(1530)$ have 4 stars, 4 Ξ have 3 stars.
For the other 5 states, evidence of existence is only fair or poor.

- many Ξ^* have quite narrow witdths (<30 MeV)
- cross section $\bar{p}p \rightarrow \Xi^*\bar{\Xi}$ $\sim 2\mu$b

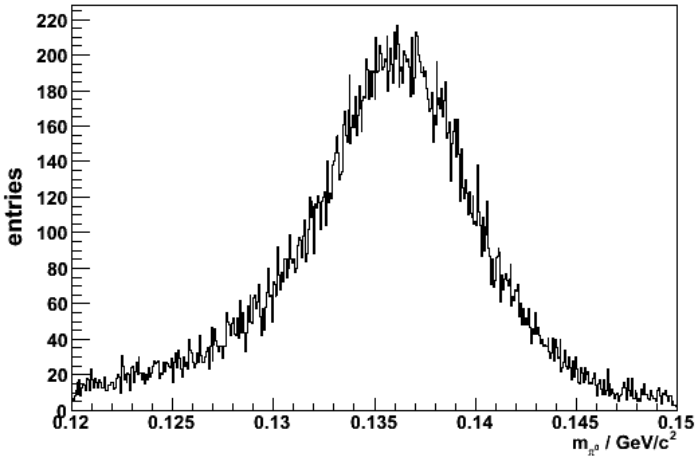


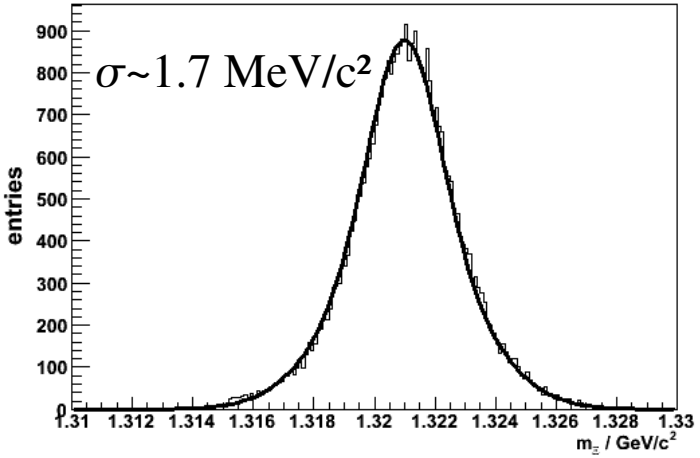
500000 $\bar{p}p \rightarrow \Xi^- \bar{\Xi}^+\pi^0$ events simulated (phasespace dist.)
beammomentum: 6 GeV/c
Ξ and Λ decay in geant4
205096 events where both Λ decay into $p^+\pi^-$ (or cc)

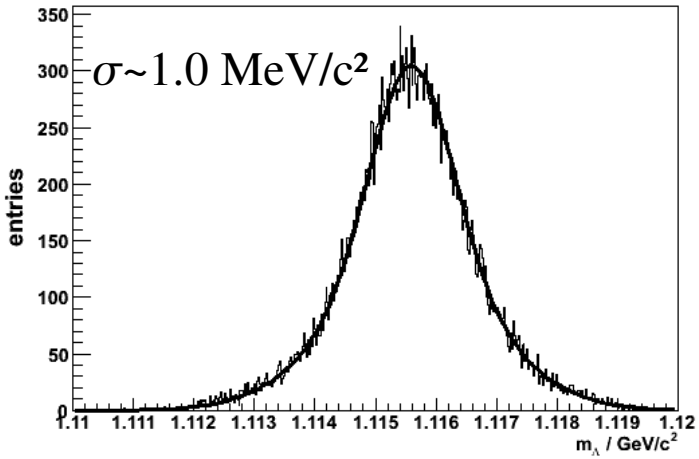
preselection

- 120 MeV < m_{π° <150MeV
- 1112 MeV < m_{Λ} <1119MeV
- 1315 MeV < m_{Ξ} <1327MeV
- 3.56 GeV < sqrt(s) $_\circ$ < 3.7 GeV
- some cuts on total momentum
- vertex prob of Λ and $\Xi > 0.001$
- exact 1 $\bar{p}p \to \Xi^- \bar{\Xi}^+ \pi^0$ candidate

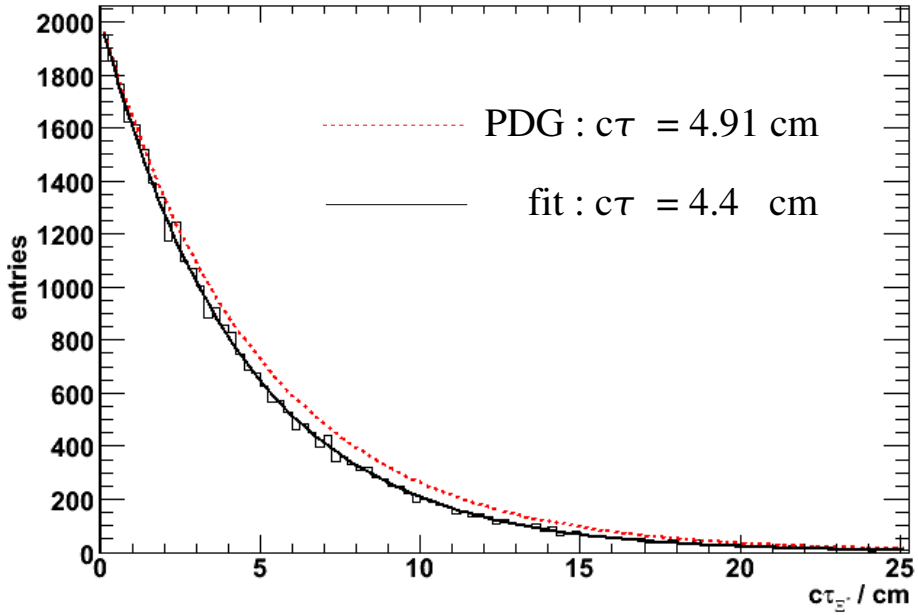
➡35667 events (17.4%) remains

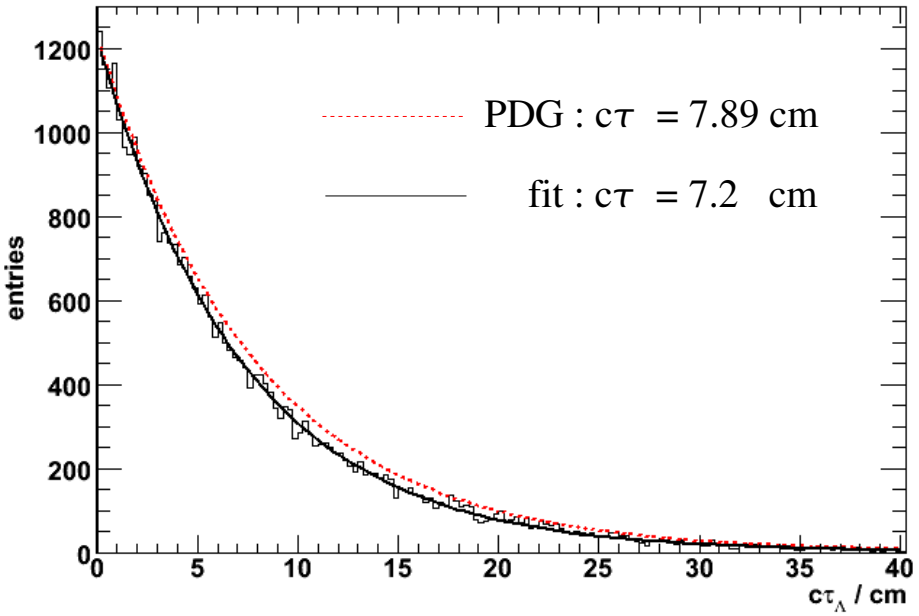






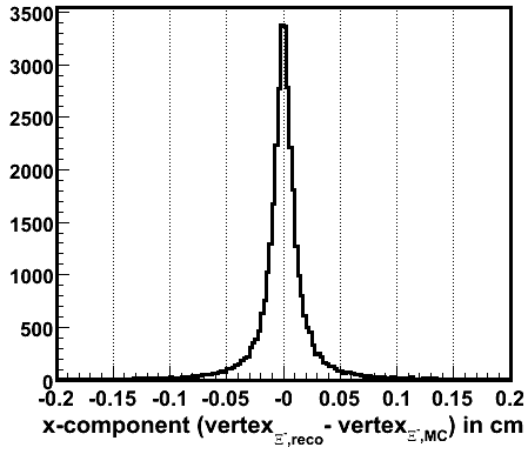
lifetimes

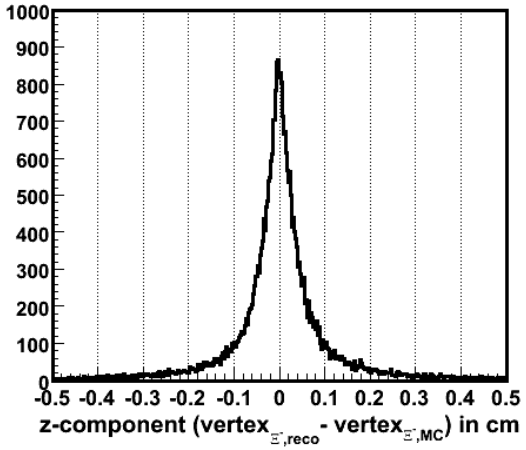


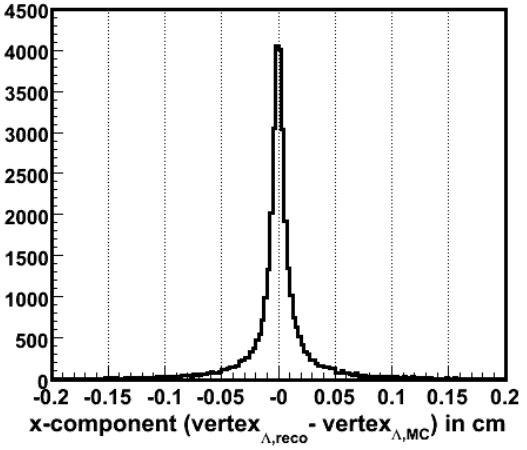


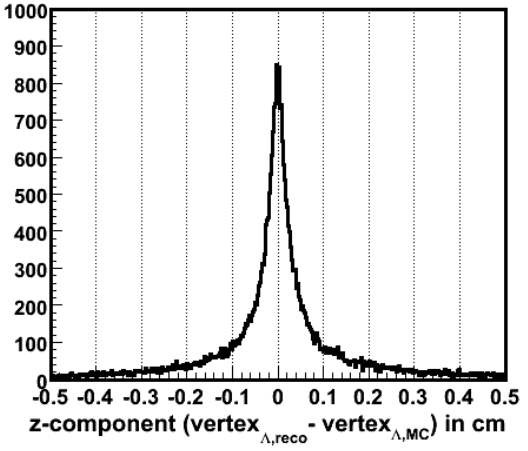
fitted lifetimes 10% too low because of lower effiency for hyperons decaying far away from IP

vetrex resolutions

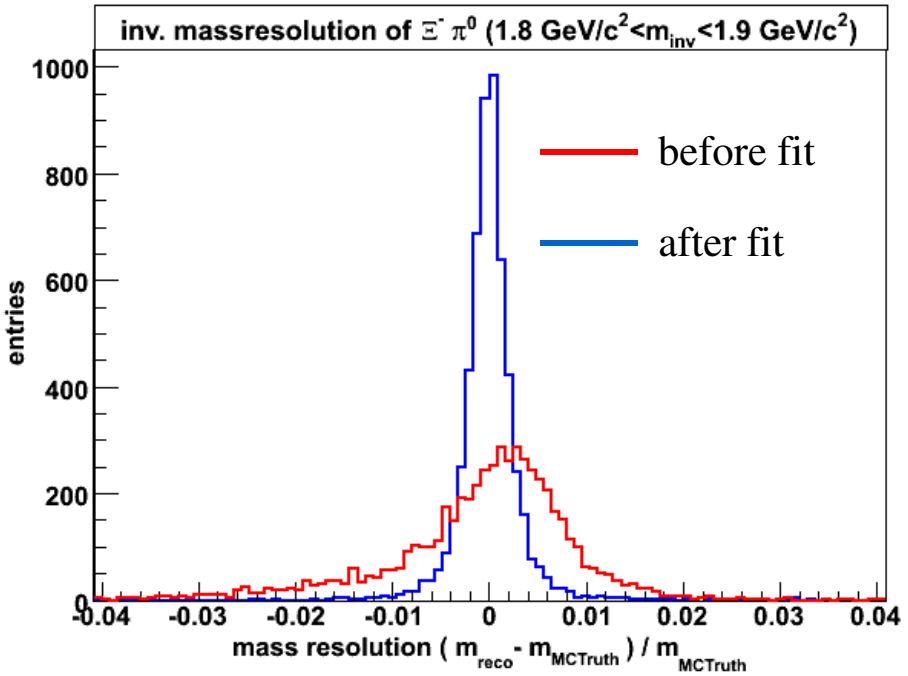


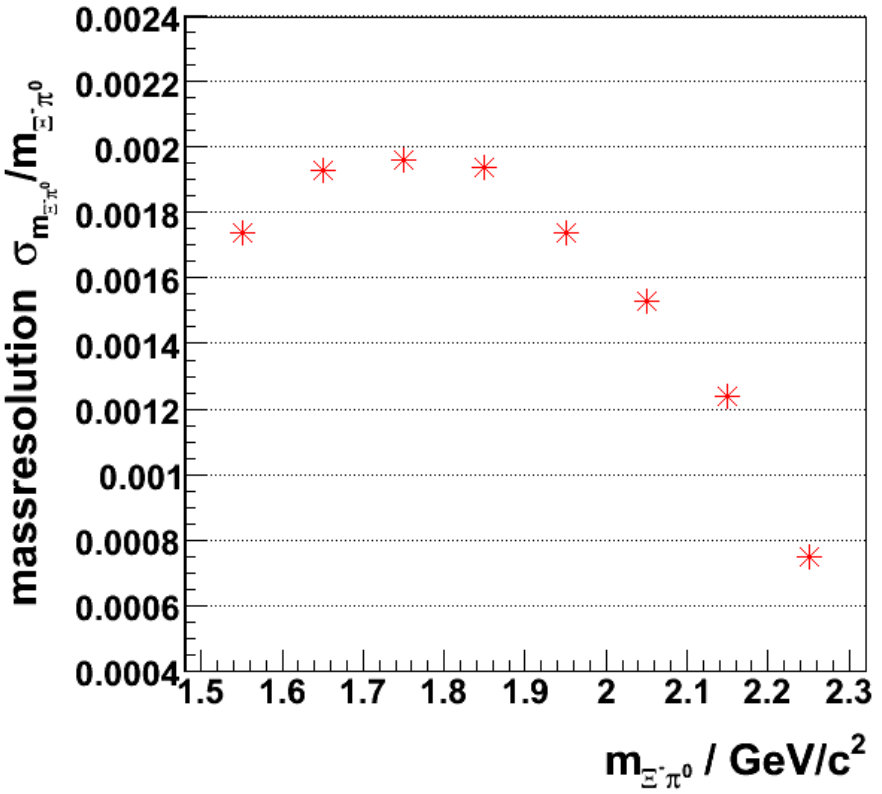




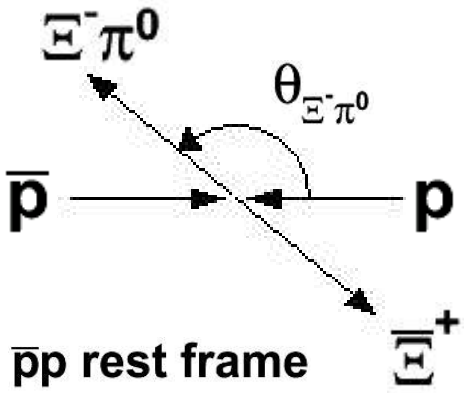


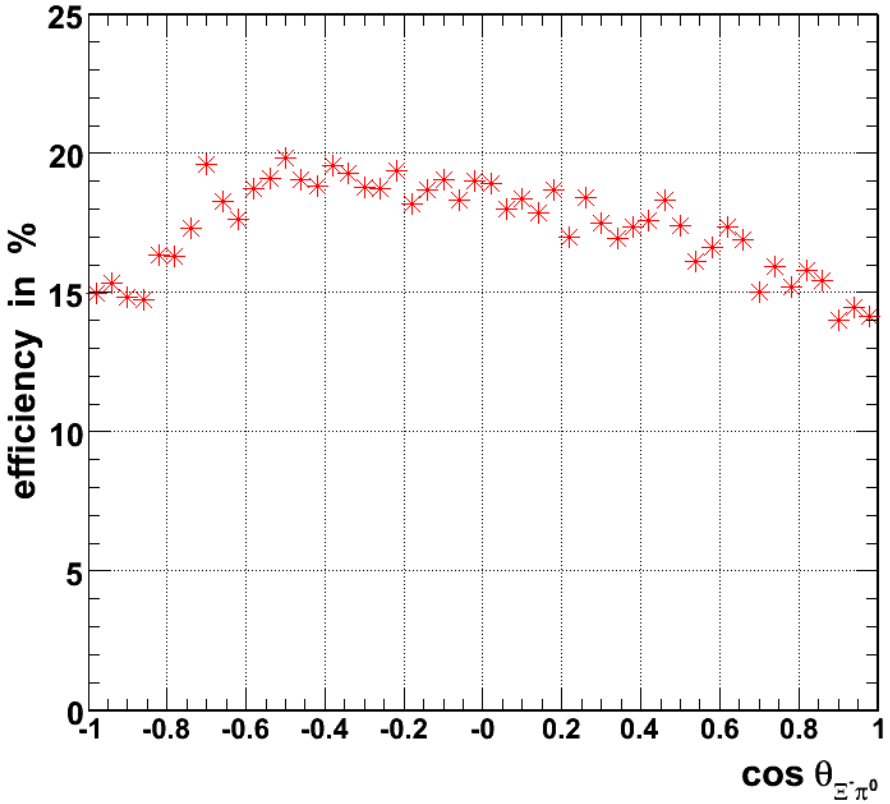
fit with constrain on total momentum and total energy (4C)
in addition mass constrain on Λ,Ξ and π^0

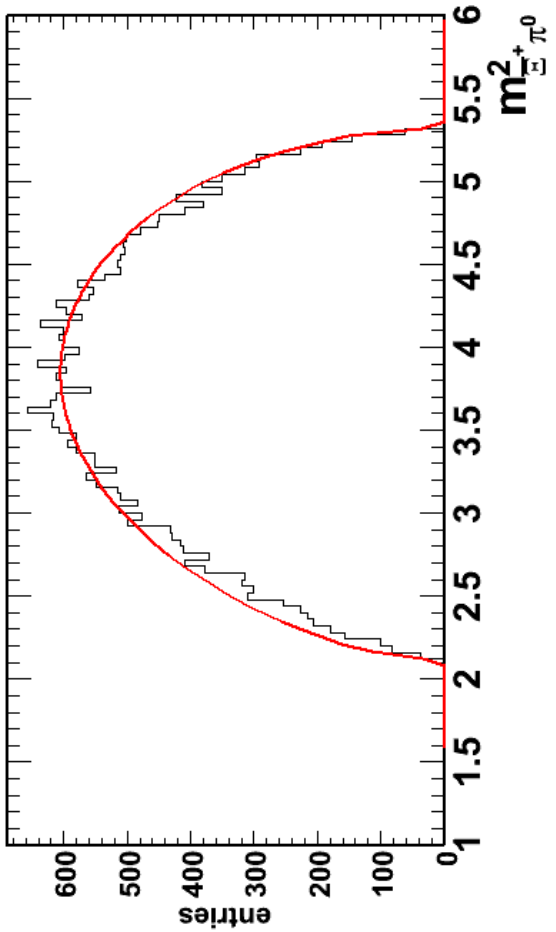




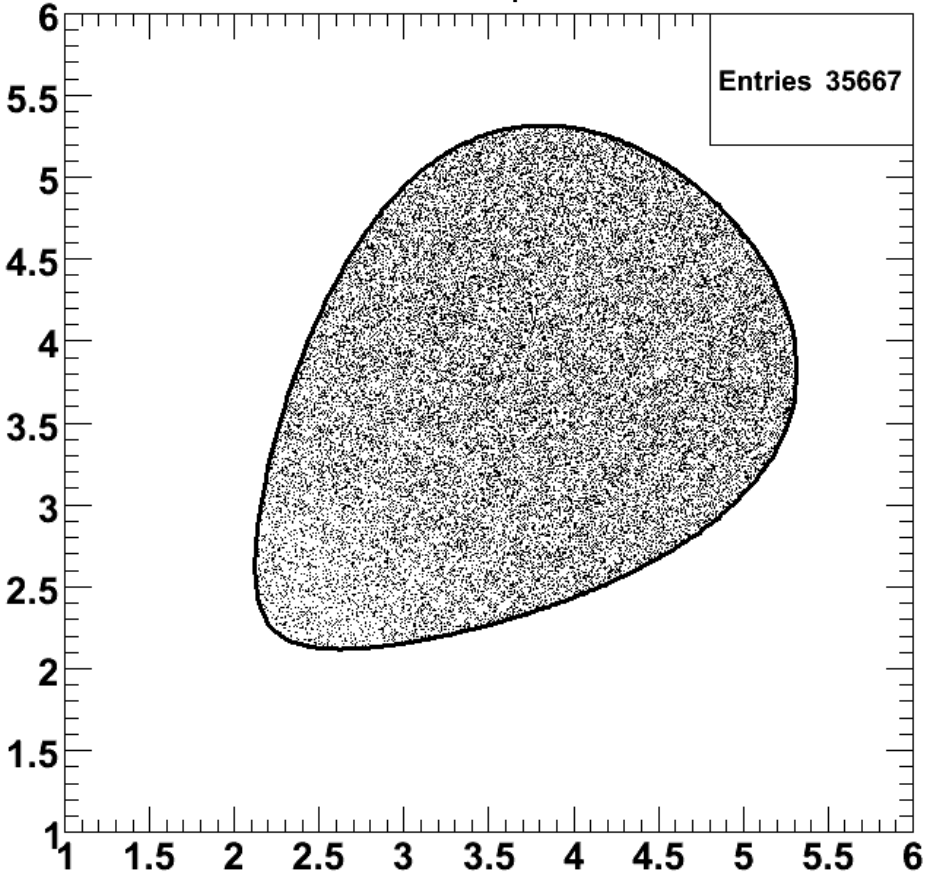
efficiency dependancy on production angle of $\bar{\Xi}^+\pi^0$

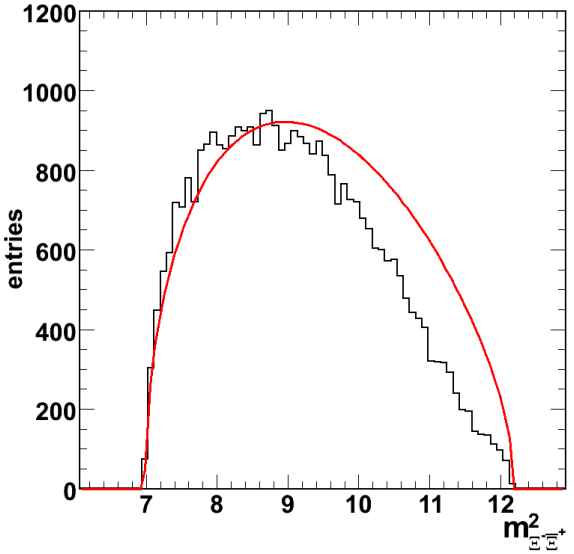


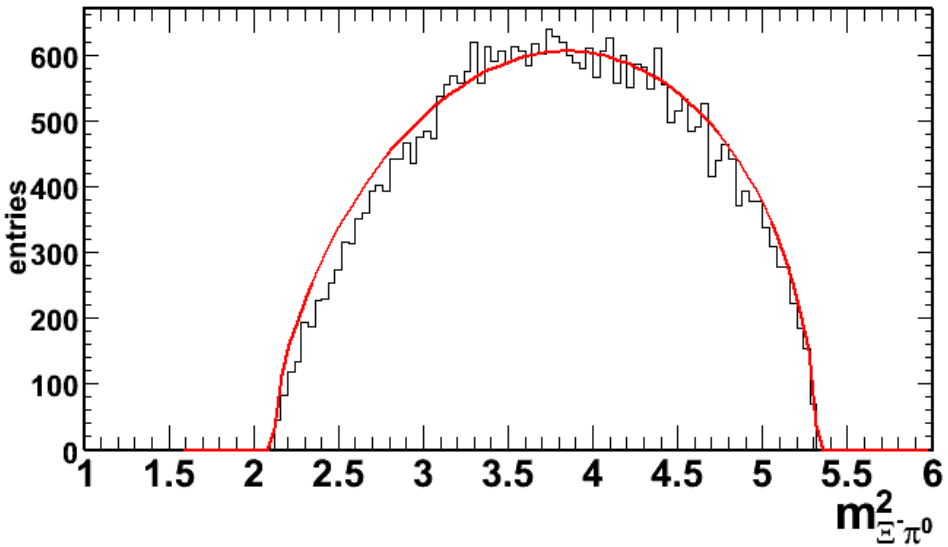


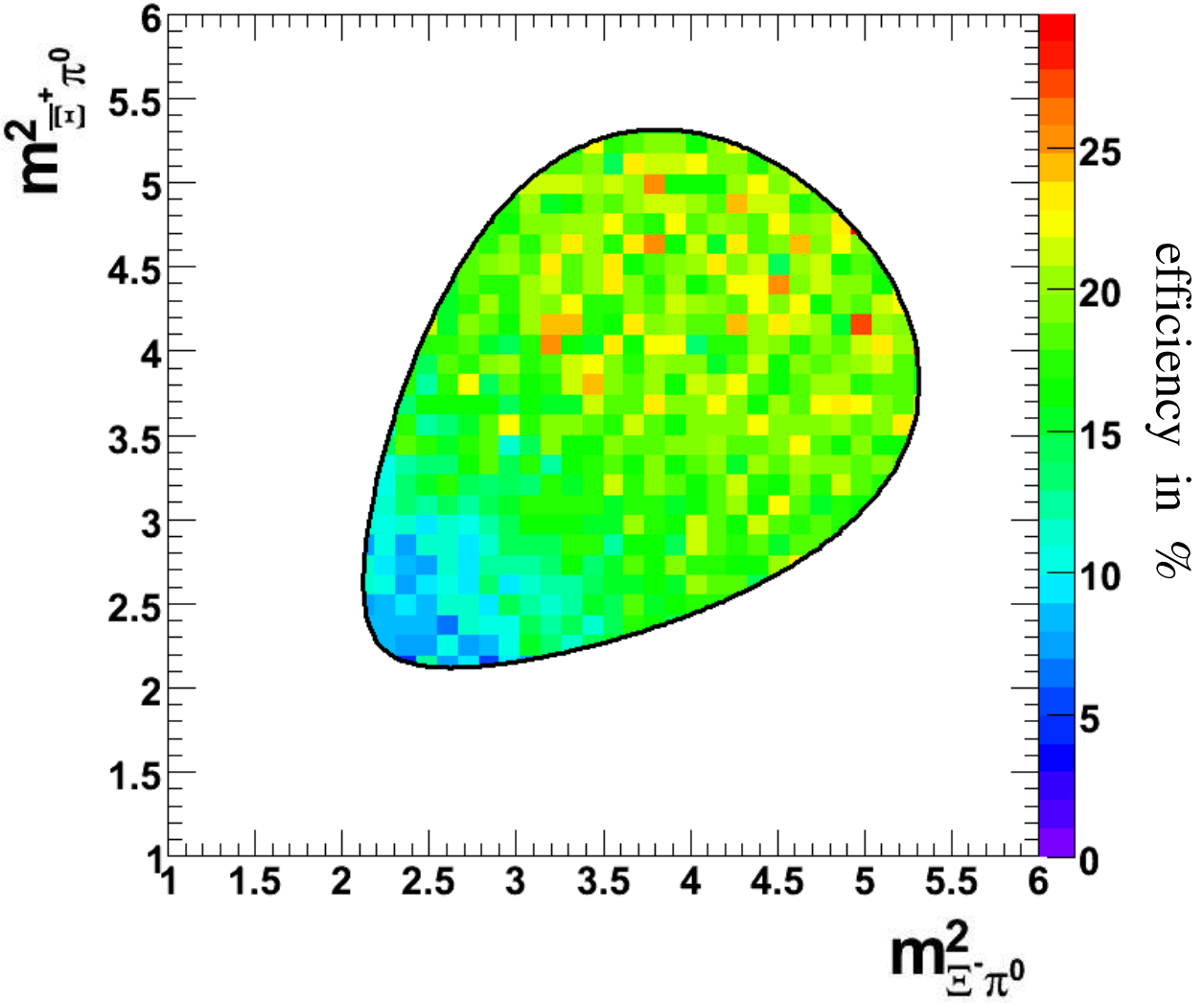

entries
$m^2_{\Xi^-\pi^0}$

dalitz plot


Entries 35667


entries
$m^2_{\Xi^-\bar{\Xi}^+}$


entries
$m^2_{\Xi^-\pi^0}$


$m^2_{\bar{\Xi}^+\pi^0}$
$m^2_{\Xi^-\pi^0}$
efficiency in %
6
5.5
5
4.5
4
3.5
3
2.5
2
1.5
1
25
20
15
10
5
0

background studies

- up to now 300000 $\bar{p}p \rightarrow \bar{\Lambda}\Lambda\, \pi^+\, \pi^-\pi^0 \rightarrow \bar{p}\pi^+p\pi^-\pi^+\pi^-\pi^0$ simulated
- 33 events pass preselection
- if cut on Ξ vertex : distance Ξ^- to IP +distance $\bar{\Xi}^+$ to IP > 1cm
  1 background event remain
  247 (from 35667) signal events get lost