Λs in BRAHMS

(Never give up...)

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BRAHMS Collaboration Meeting, BNL, 6th–8th December 2002

Overview

- How we find Λs in BRAHMS

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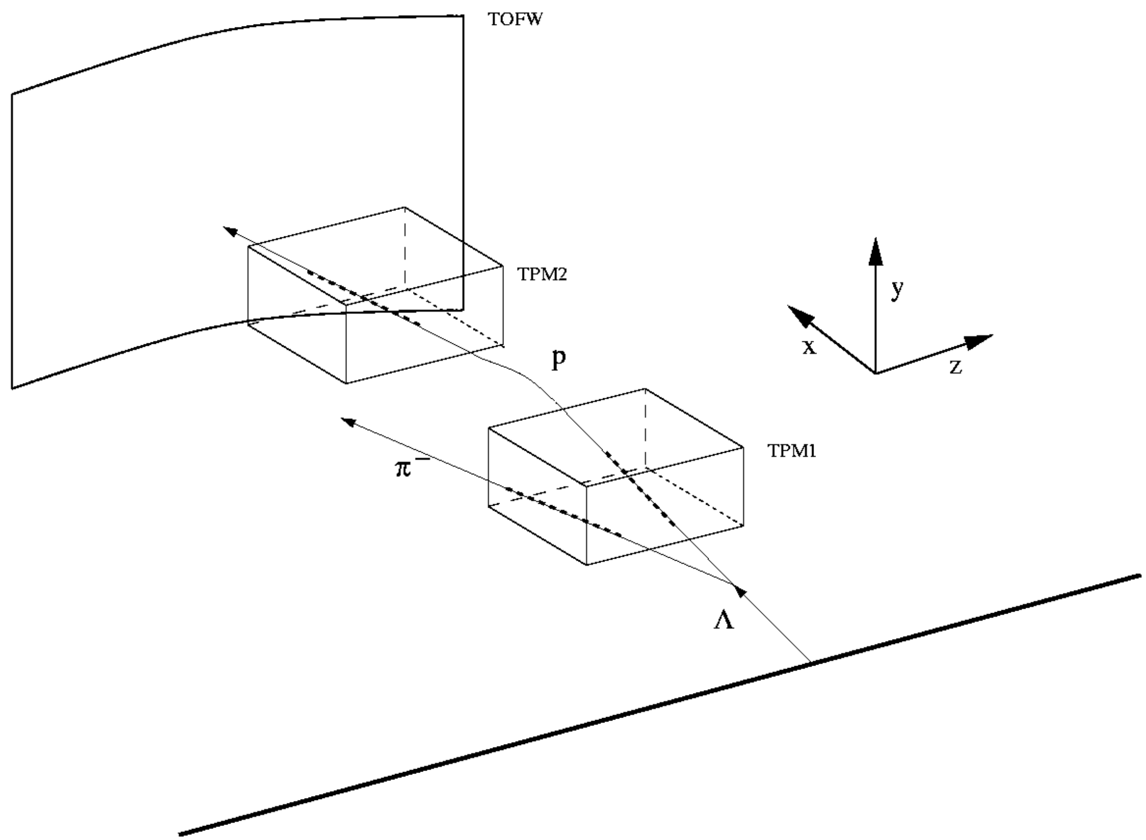
- Future prospects

The data we have analyzed

Angle	Fields	Trigger 6
90	700 A/B	–
60	500 A/B	–
40	1000 A/B	–
35	700 A/B	–

I will present data from 35^o and 40^o, the rest is currently being analyzed but is more tricky due to lower statistics.

How do we find Λs?



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- Look for a signal peak at $\sim m_\Lambda \ldots$

How do we find Λs?

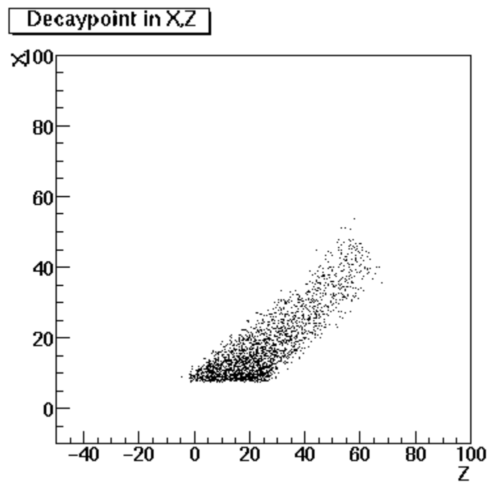
Invariant mass:

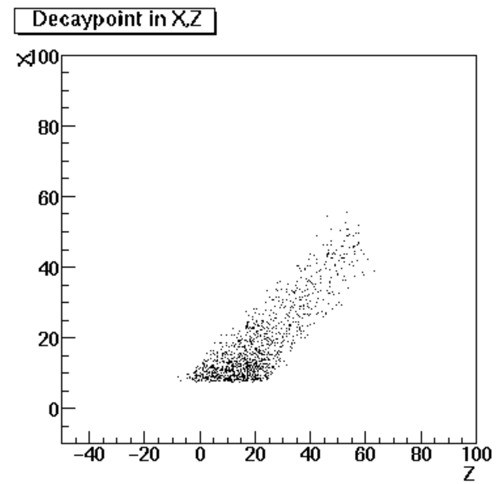
(0) $$m_\Lambda^2 = m_p^2 + m_\pi^2 - p_\Lambda^2 + \sqrt{m_p^2 + p_p^2} + \sqrt{m_\pi^2 + p_\pi^2}$$

Cuts applied:

- Track separation — do the tracks really cross?
- Decay position — is it between the coll. vertex and TPM1?
- Planarity — does it all happen in a plane?
- Proton momentum — higher p_p means lower statistics but a cleaner sample

Secondary vertex determination





35^o 40^o

"Decaypoint" = the midpoint of the shortest line between the proton and pion tracks. There are cuts applied both to

- smallest distance in x
- longest distance from the collision vertex

Data: 35^o, B field

Proton momentum $\geq 2GeV$

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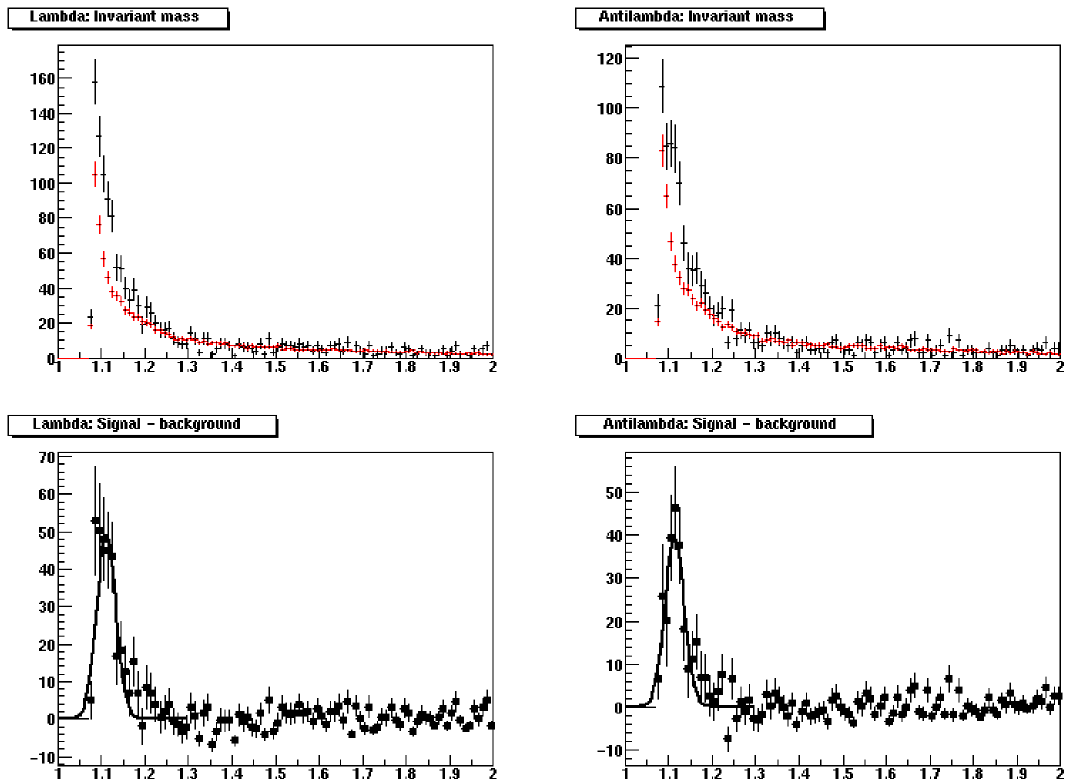

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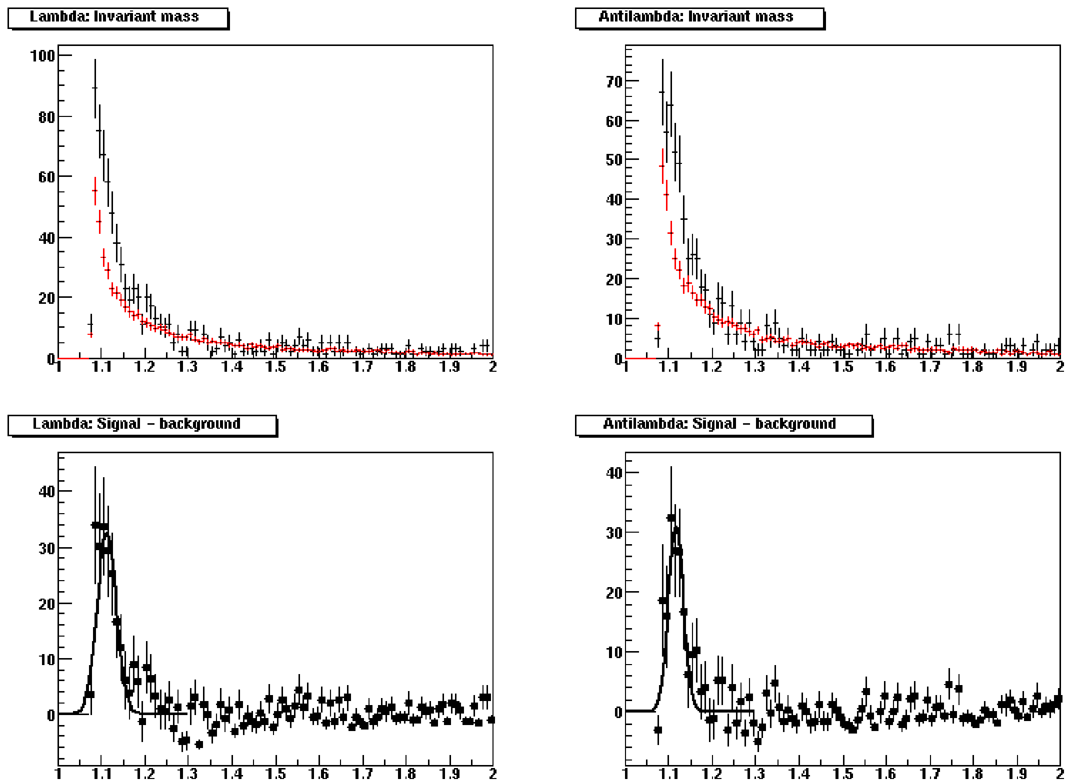
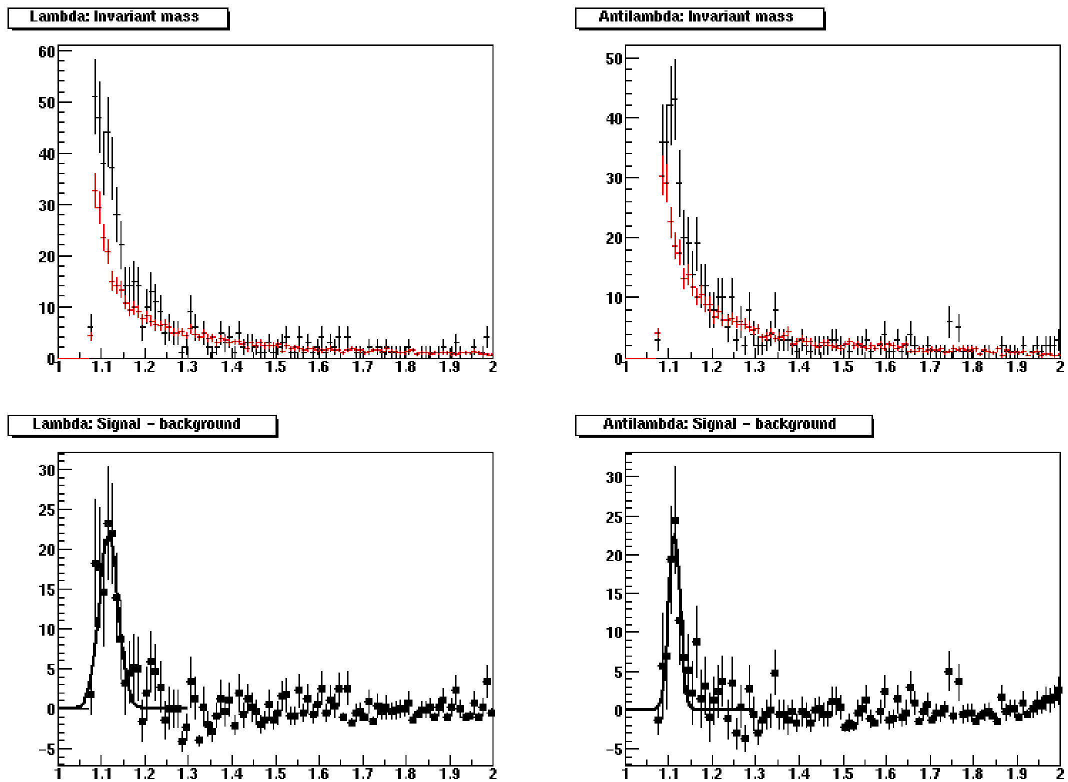


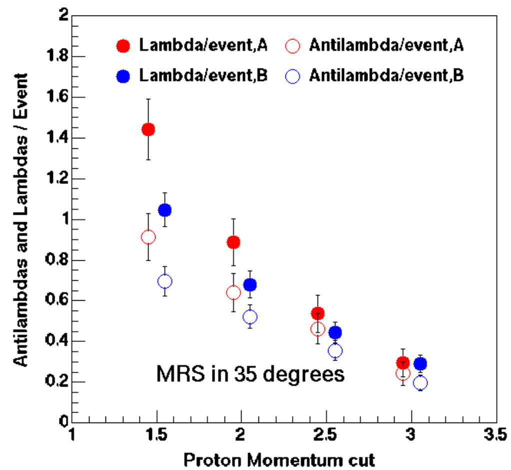
Proton momentum $\geq 2.5GeV$

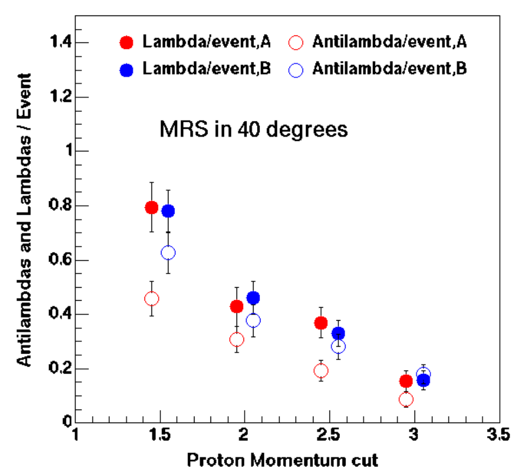
Data: 35^o, B field



Proton momentum $\geq 3GeV$

Rates per event





35^o 40^o

For a reasonable cut in p_p we see $\sim 0.5\frac{\Lambda}{event}$ at 35 ^{o} and $\sim 0.3\frac{\Lambda}{event}$ at 40 ^{o}

How to calculate a ratio

$n_{\Lambda,\mathbf{A}}$: density of Λs in phase space covered by A setting.
Observed number of Λs in setting A can be expressed:

$$N^{obs}_{\Lambda\mathbf{A}} = n_{\Lambda,\mathbf{A}} \cdot \mathrm{Acc}_{\Lambda,\mathbf{A}} \cdot N_{evts,\mathbf{A}}$$

where $\mathrm{Acc}_{\Lambda,\mathbf{A}}$ is the acceptance for Λs in the A setting.
Calculate the ratio:

$$\frac{N^{obs}_{\bar{\Lambda}\mathbf{A}} \cdot N^{obs}_{\bar{\Lambda}\mathbf{B}}}{N^{obs}_{\Lambda\mathbf{A}} \cdot N^{obs}_{\Lambda\mathbf{B}}} = \frac{n_{\bar{\Lambda},\mathbf{A}} \cdot \mathrm{Acc}_{\bar{\Lambda},\mathbf{A}} \cdot N_{evts,\mathbf{A}} \cdot n_{\bar{\Lambda},\mathbf{B}} \cdot \mathrm{Acc}_{\bar{\Lambda},\mathbf{B}} \cdot N_{evts,\mathbf{B}}}{n_{\Lambda,\mathbf{A}} \cdot \mathrm{Acc}_{\Lambda,\mathbf{A}} \cdot N_{evts,\mathbf{A}} \cdot n_{\Lambda,\mathbf{B}} \cdot \mathrm{Acc}_{\Lambda,\mathbf{B}} \cdot N_{evts,\mathbf{B}}}$$

The numbers of events cancel directly.
Acceptance of particle in setting A = Acceptance of antiparticle in setting B:

$$\mathrm{Acc}_{\bar{\Lambda},\mathbf{B}} = \mathrm{Acc}_{\Lambda,\mathbf{A}}; \quad \mathrm{Acc}_{\bar{\Lambda},\mathbf{A}} = \mathrm{Acc}_{\Lambda,\mathbf{B}}$$

How to calculate a ratio

The regions of phase space covered by settings A and B are approximately equal so that the particle densities do not change significantly:

$$n_{\Lambda,\mathbf{A}} \approx n_{\Lambda,\mathbf{B}} \; (= n_\Lambda); \quad n_{\bar{\Lambda},\mathbf{A}} \approx n_{\bar{\Lambda},\mathbf{B}} \; (= n_{\bar{\Lambda}})$$

The ratio of observed antiparticles/particles gives:

$$\frac{N^{obs}_{\bar{\Lambda}\mathbf{A}} \cdot N^{obs}_{\bar{\Lambda}\mathbf{B}}}{N^{obs}_{\Lambda\mathbf{A}} \cdot N^{obs}_{\Lambda\mathbf{B}}} \approx \left(\frac{n_{\bar{\Lambda}}}{n_\Lambda}\right)^2$$

and an approximate $\bar{\Lambda}/\Lambda$ ratio can be found very simply:

$$\frac{n_{\bar{\Lambda}}}{n_\Lambda} \approx \left(\frac{N^{obs}_{\bar{\Lambda}\mathbf{A}} \cdot N^{obs}_{\bar{\Lambda}\mathbf{B}}}{N^{obs}_{\Lambda\mathbf{A}} \cdot N^{obs}_{\Lambda\mathbf{B}}}\right)^{1/2}$$

Ratios — what do we expect?

If the Λs are produced by a thermal source we may expect that

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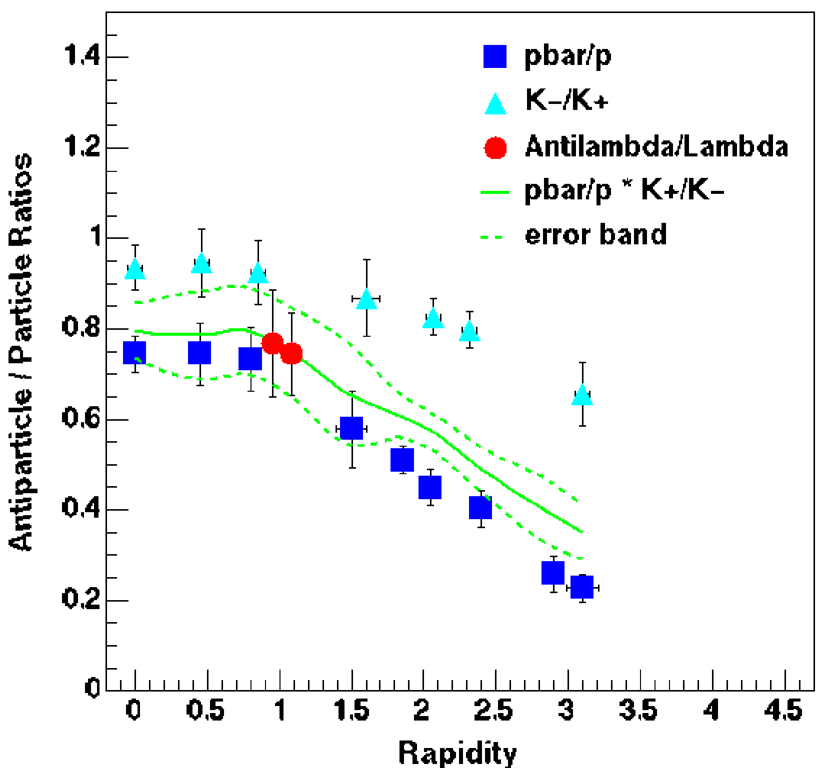
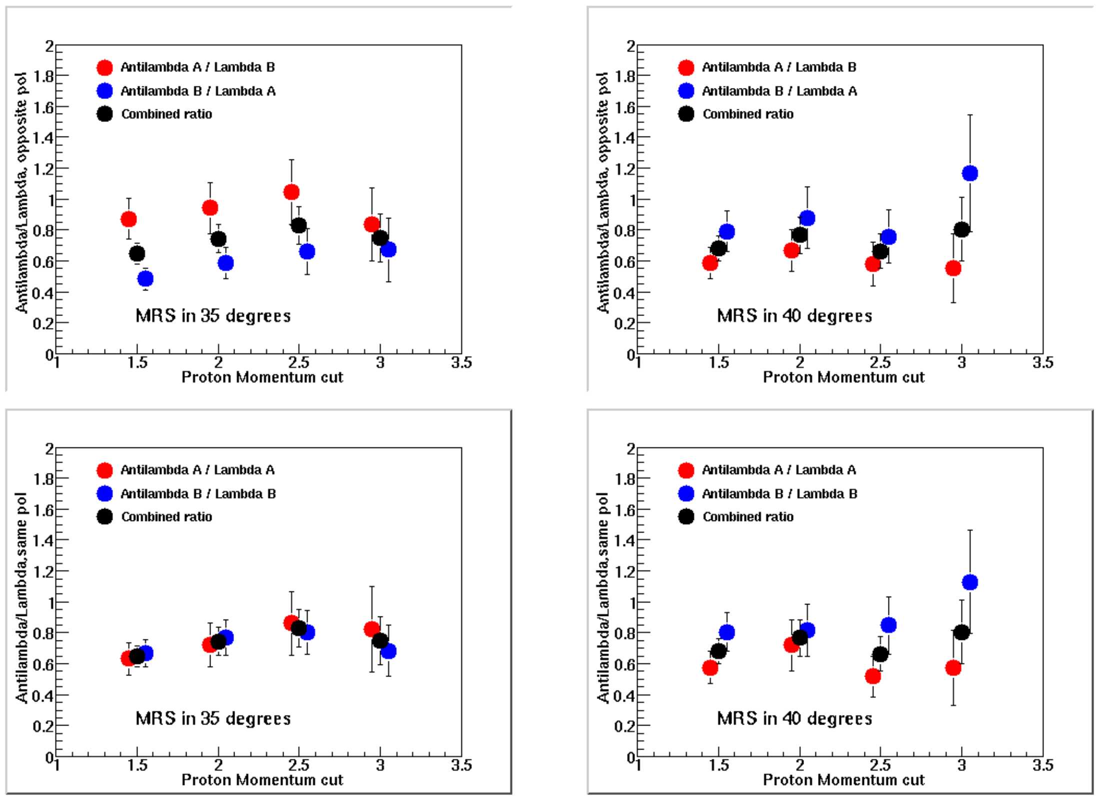
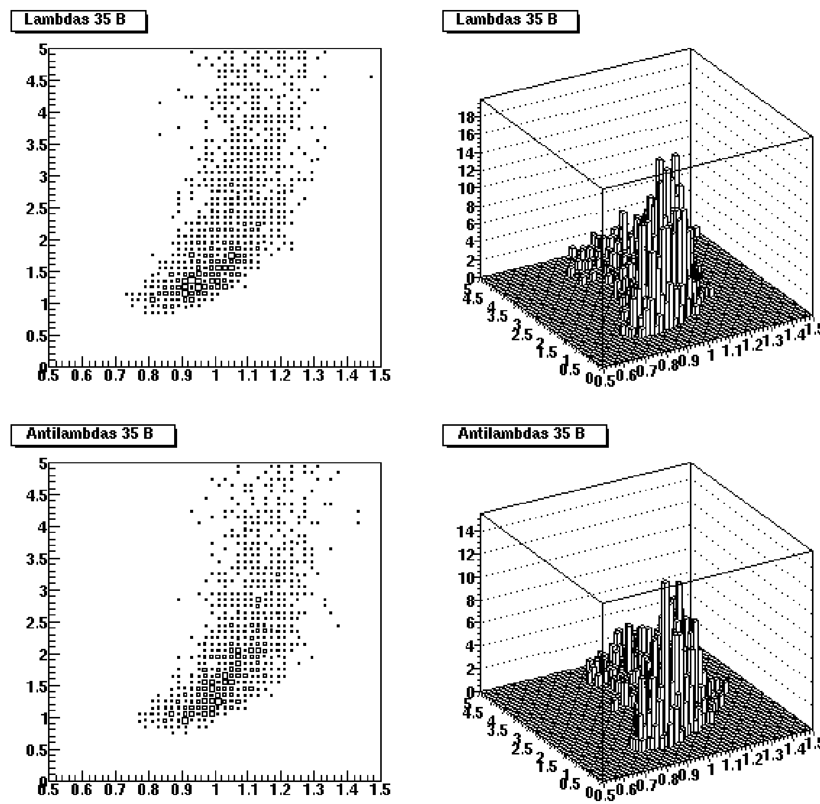


$\overline{\Lambda}/\Lambda$ ratios at $y_\Lambda \approx 1.1$



35^o 40^o

y–p_t distributions



The y–p_t of V0s at 35^o. Again, signal – m. e. BG is used.

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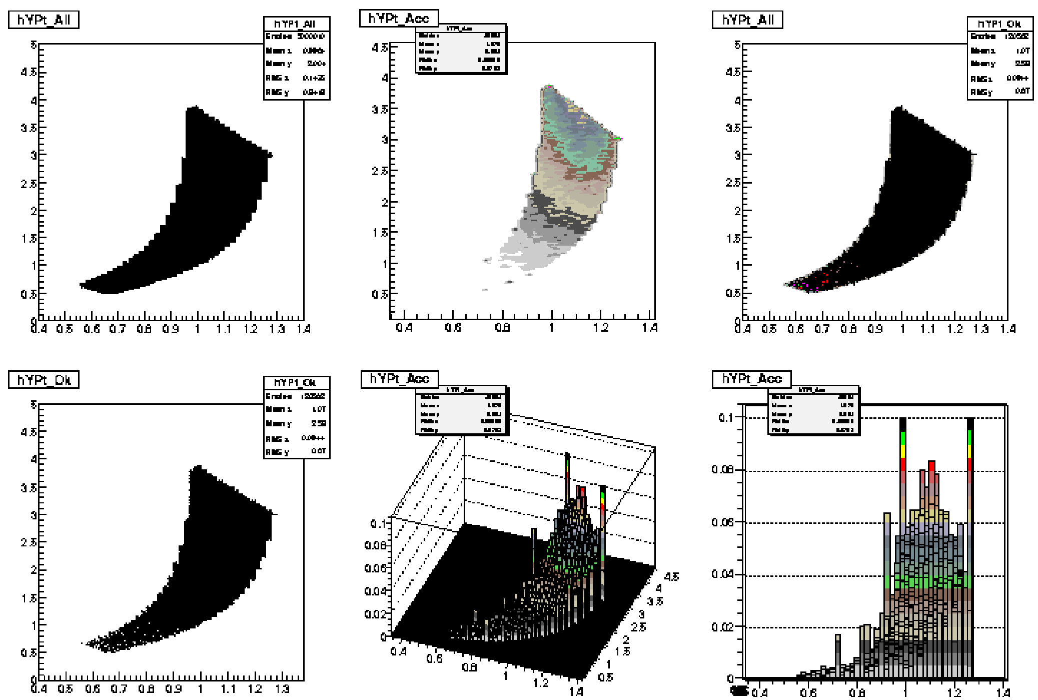
- Production under ways. . .

Acceptance maps



Acceptance from GEANT, 35^o

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- ...stay tuned!