

# $\Lambda_c \bar{\Lambda}_c \rightarrow \Lambda \pi^+ \bar{\Lambda} \pi^-$ Reconstruction

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- EvtGen Simulation Input
- Kinematic of the Decay Process
- Reconstruction

## EvtGen 11GeV/c

- $\Lambda_c \bar{\Lambda}_c \rightarrow \Lambda \pi^+ \bar{\Lambda} \pi^-$
- $\Lambda \bar{\Lambda} \rightarrow \pi^- \bar{p} \pi^+$
- 11GeV/c, 400000 Events on Prometheus
- reaction threshold at 10.18 GeV/c

# EvtGen 11GeV/c

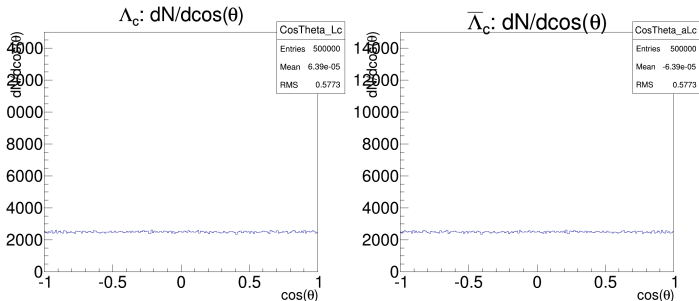


Figure : Events have been equally distributed in  $\cos(\theta)$

# EvtGen 15GeV/c

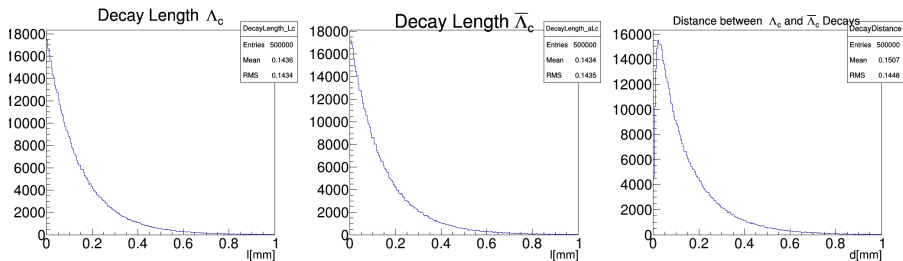


Figure : Decay lengths of  $\Lambda_c$  (144  $\mu\text{m}$ ),  $\bar{\Lambda}_c$  (143  $\mu\text{m}$ ) and their distance (151  $\mu\text{m}$ ).

# EvtGen 11 GeV/c

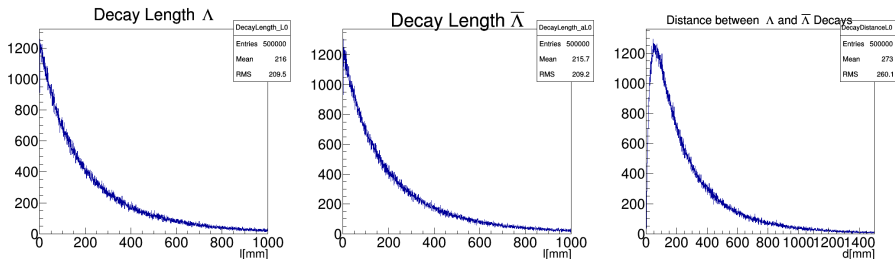


Figure : Decay lengths of  $\Lambda_0$  (21.6 cm),  $\bar{\Lambda}_0$  (21.6 cm) and their distance (27.3 cm).

# EvtGen 11 GeV/c

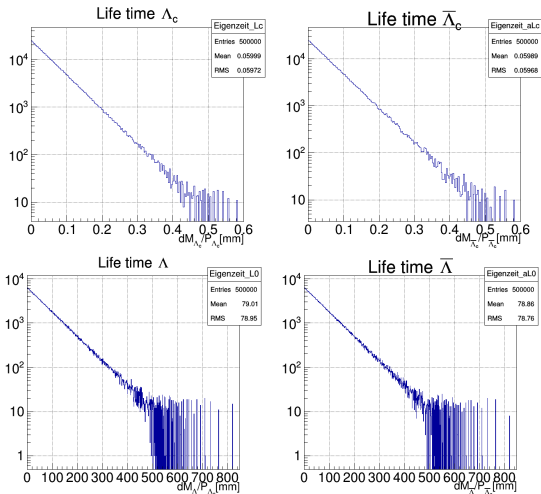


Figure : Lifetime of  $\Lambda_c$  and  $\bar{\Lambda}_c$  ( $59.9 \mu\text{m}$ ), and  $\Lambda_0$  and  $\bar{\Lambda}_0$  (78.9 mm)

# EvtGen 11 GeV/c

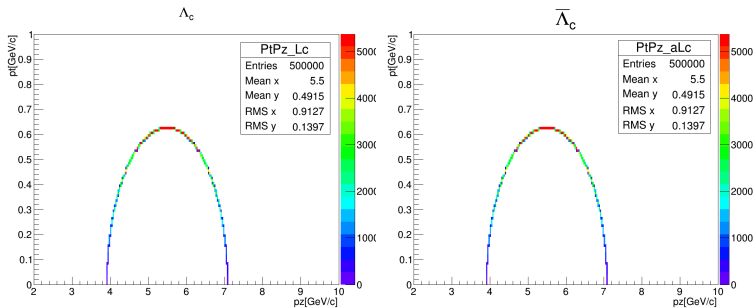


Figure : Transversal to longitudinal momenta of  $\Lambda_c$  and  $\bar{\Lambda}_c$ .



# EvtGen 11 GeV/c

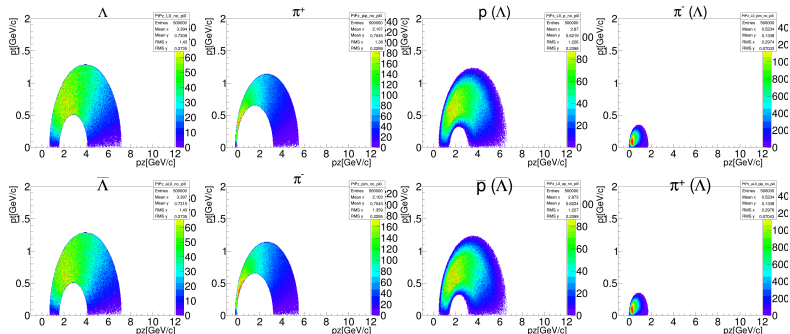


Figure : Transversal to Longitudinal momenta of the decay products.

## Reconstruction and Fit Settings

- 400000 Events of 11 GeV/c  $\bar{p}$  momentum
- Ideal pattern reconstruction
- *PidAlgoIdealCharged*
- *PndKinVtxFitter* for  $\Lambda$  and  $\bar{\Lambda}$
- *PndVtxPoca*<sup>1</sup> for  $\Lambda_c$  and  $\bar{\Lambda}_c$

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<sup>1</sup>extended by a line to helix POCA

## Cut Parameters

For  $\Lambda_c$  and  $\bar{\Lambda}_c$  Candidates:

- Cut on centre of mass momentum of  $\Lambda_c$  and  $\bar{\Lambda}_c$ .
- Cut on the fit quality of the POCA.
- Cut on the  $\Lambda$  and  $\bar{\Lambda}$  mass.

In case we have both Candidates:

- Cuts on the same as above.
- Cut on the combined momentum and mass.

# Reconstructed Events 11 GeV/c

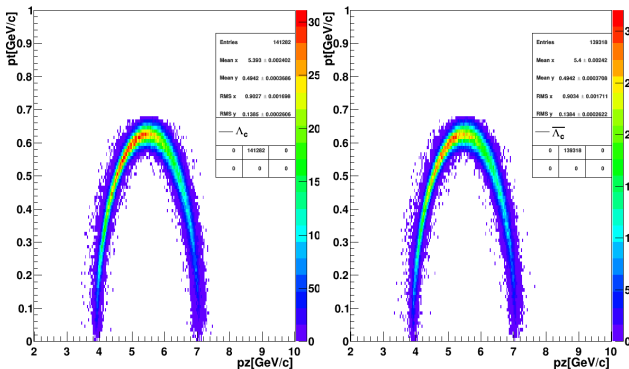


Figure : Reconstructed transverse and longitudinal momenta of  $\Lambda_c$  and  $\bar{\Lambda}_c$ .

# Reconstructed Events 11 GeV/c

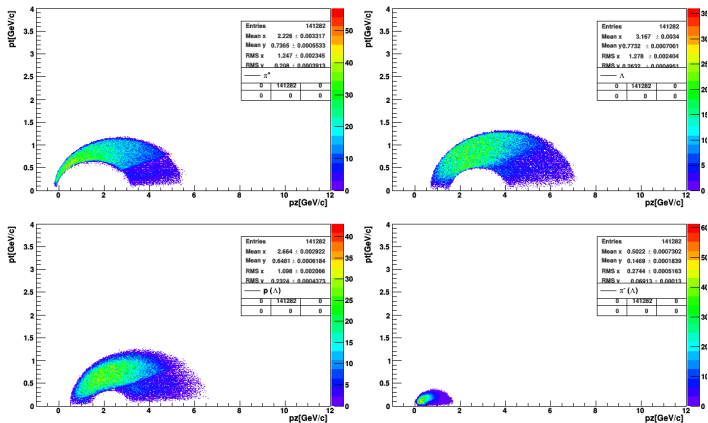


Figure : Reconstructed transverse and longitudinal momenta of the decay products of  $\Lambda_c$ .

# Reconstructed Events 11 GeV/c

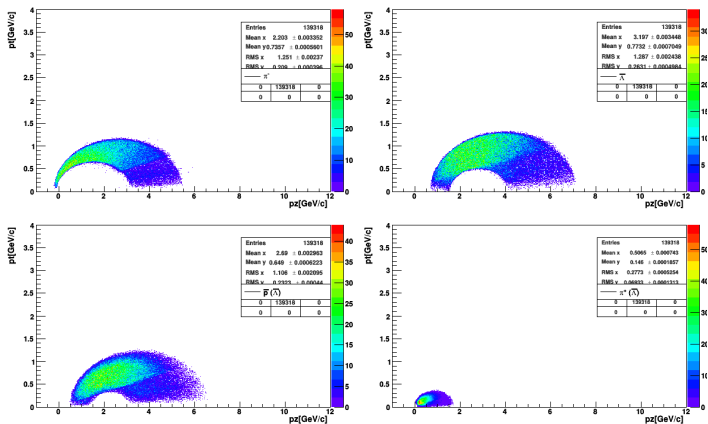


Figure : Reconstructed transverse and longitudinal momenta of the decay products of  $\bar{\Lambda}_c$ .

# Reconstructed Events 11 GeV/c

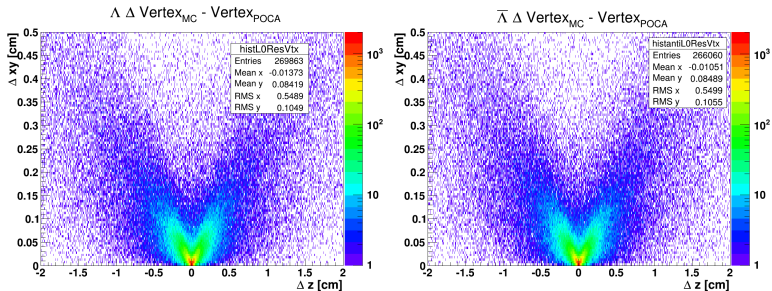


Figure : Resolution of reconstructed  $\Lambda$  and  $\bar{\Lambda}$  vertices.

## Background Considerations

- Simulated 1.2 million DPM events (15 GeV/c).
- Applied same analysis on them to find  $\Lambda_c$  and  $\bar{\Lambda}_c$  candidates.
- 1401 Candidate combinations found.
- 254(121)  $\Lambda_c$  ( $\bar{\Lambda}_c$ ) candidates survived cuts.
- 7 events showed both  $\Lambda_c$  and  $\bar{\Lambda}_c$ , but 0 of them survived the cuts on combined momentum and mass.



# Reconstruction from DPM at 15 GeV/c

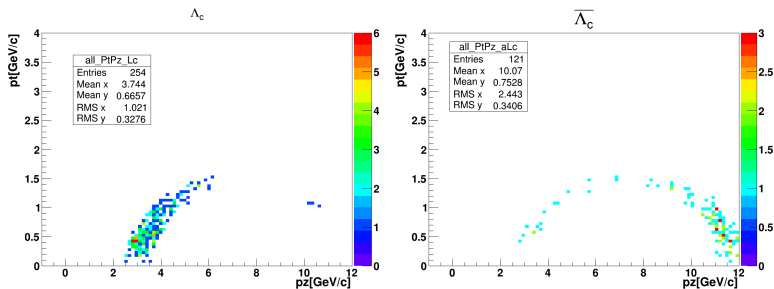


Figure : Reconstructed transverse and longitudinal momenta of  $\Lambda_c$  and  $\bar{\Lambda}_c$ .

## Reconstruction from DPM at 15 GeV/c

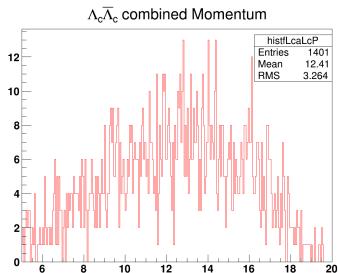


Figure : Reconstructed combined momenta of  $\Lambda_c$  and  $\bar{\Lambda}_c$  candidates.

## Summary

- With ideal reconstruction 141282  $\Lambda_c$  and 139318  $\bar{\Lambda}_c$  Candidates out of 400000 have been reconstructed.
- 47077 times  $\Lambda_c$  and  $\bar{\Lambda}_c$  have been found with 46523 of those were MC true and 43545 survived the cuts on combined momentum and mass.
- Background studies showed 7 wrong  $\Lambda_c \bar{\Lambda}_c$  combinations, which could be terminated by a cut on combined momentum and mass.

## Outlook

- Observe detector points per track and track resolutions to define parameters for a realistic reduction of the ideal reconstructed events.
- Background studies could be made with DPM reduced to the same final state particles as this decay.

Thank you for your attention!

# backup slides - EvtGen 11 GeV/c

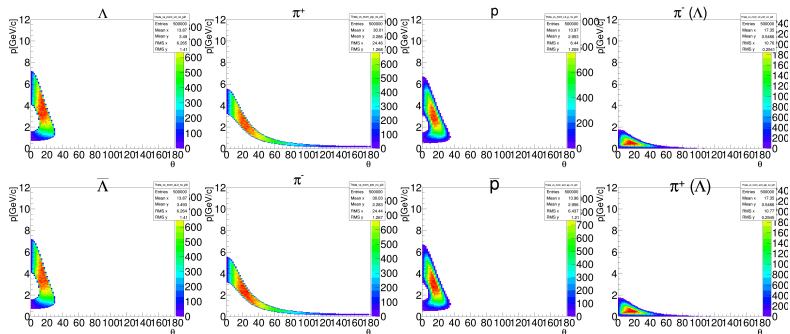


Figure :  $\theta$  to momenta of the decay products.

# backup slides - Reconstructed Events 11 GeV/c

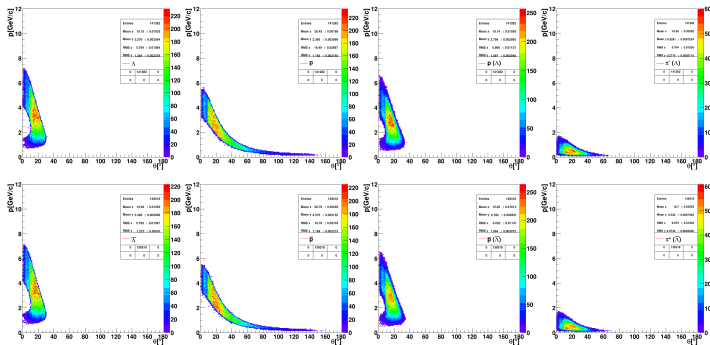


Figure : Reconstructed  $\theta$  to momenta of the decay products.

# backup slides - Reconstruction Events 11 GeV/c

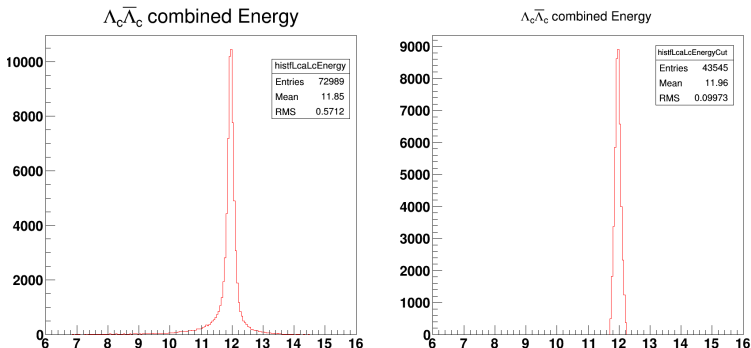


Figure : Reconstructed combined energy of  $\Lambda_c$  and  $\bar{\Lambda}_c$ , before and after cuts.