Λ_C^+ / D^0 Projection

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Outline

- Introduction
- $\Lambda_c^+ Reconstruction$
- $\Lambda_C^+ / D^0\ Projection$
- Conclusion

Hadronization

- partons → hadrons
  - e^+e^- collider
  - electron-ion collider
  - hadron collider
- Phenomenological models:
  - Lund String Model
  - …

Hadronization

- Hadron cross section → convolution of **the parton distribution functions (PDFs)**, **the parton hard-scattering cross sections**, and **the fragmentation functions**
- Different models → different fragmentation functions
- Baryon-to-meson ratios are sensitive to fragmentation functions used in calculations

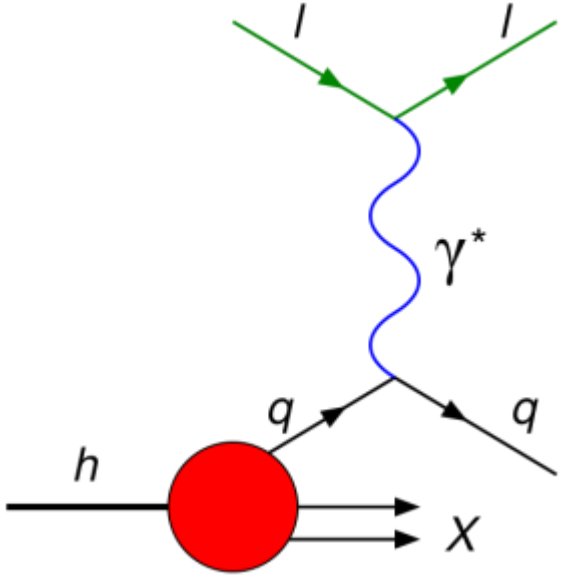
Λ_c^+ / D^0 ratio

- Polarized Electron Ion Collider in China (EicC)
- Deep Inelastic Scattering

  ep 3.5GeV × 20GeV at $100 fb^{-1}$
- PYTHIA
- Models:

  QCD Color Reconnection

  MPI Color Reconnection

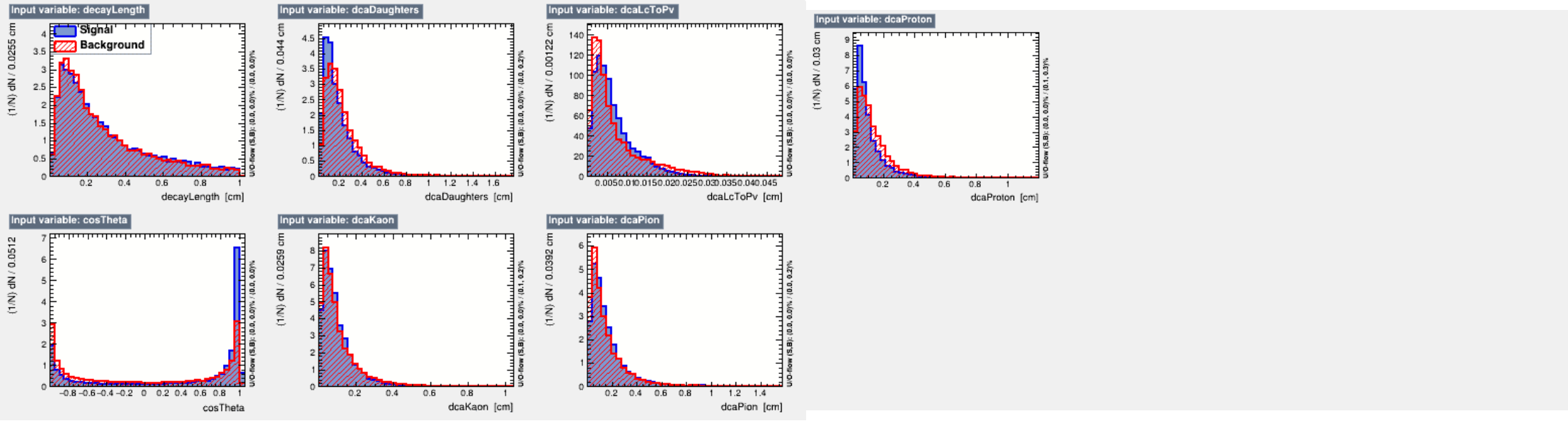


Λ_C^+ Reconstruction

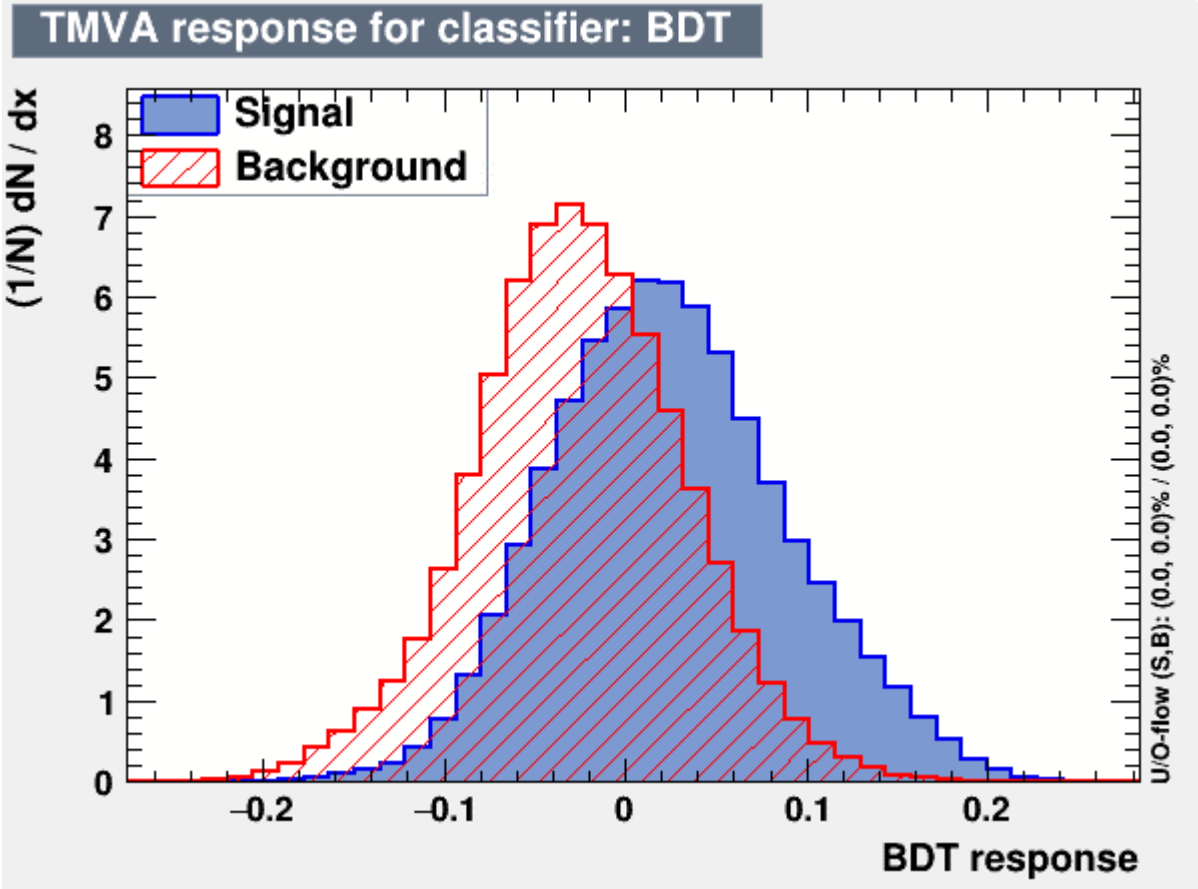
Λ_c^+ Reconstruction

- MC ep collision events (3.5GeV × 20GeV)
- Smearing events (simulating detector responses)
- Cut Calculation
- Distinguishing signals from backgrounds with Boosted Decision Tree (BDT)

BDT Training Results

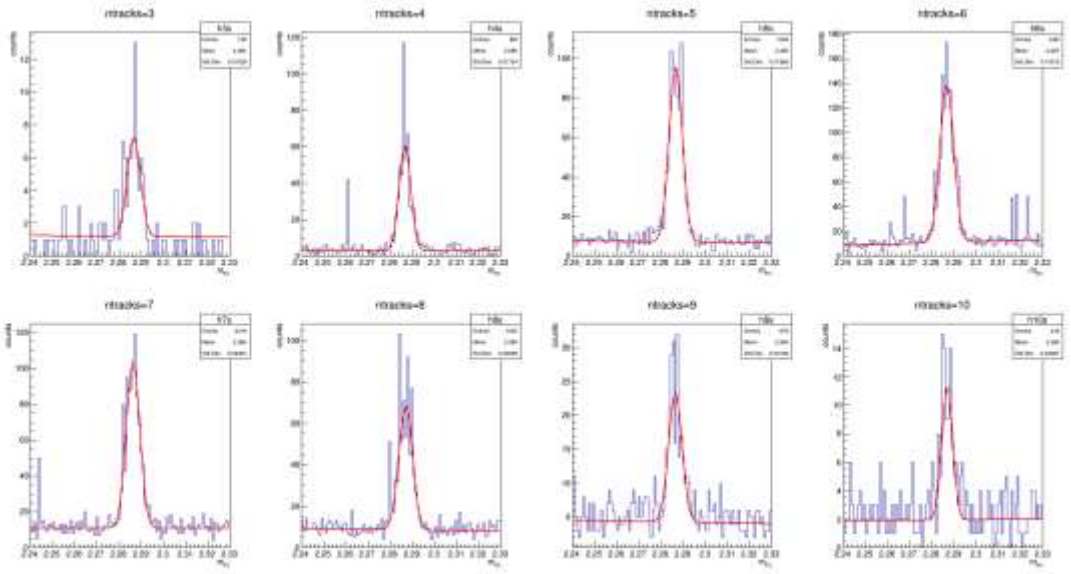


BDT Training Results

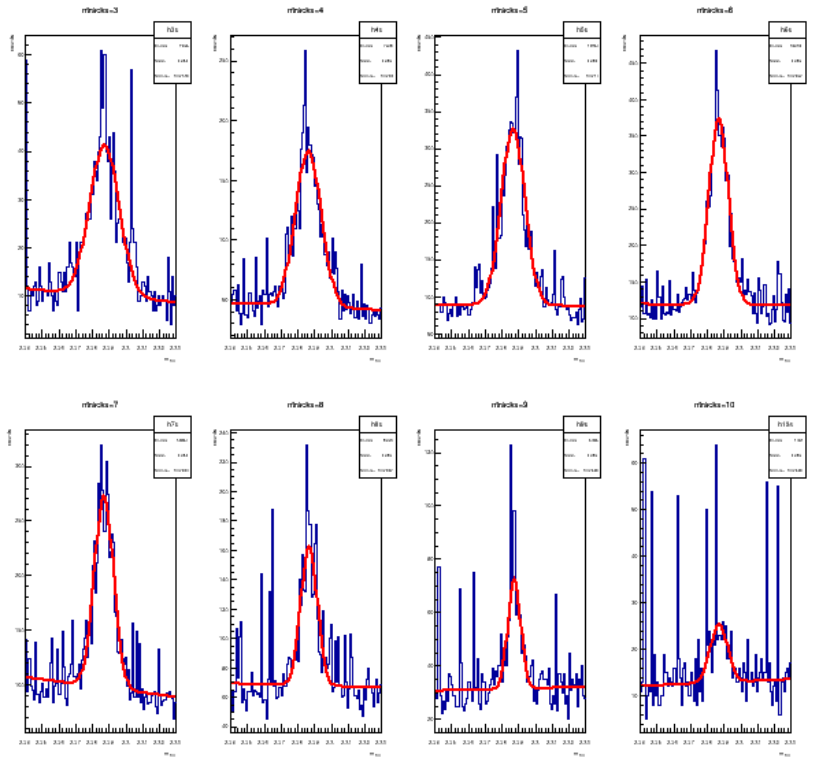


Λ_c^+ Reconstruction Results (MPI-CR Model)

$|y| < 1$



$1 < y < 3$



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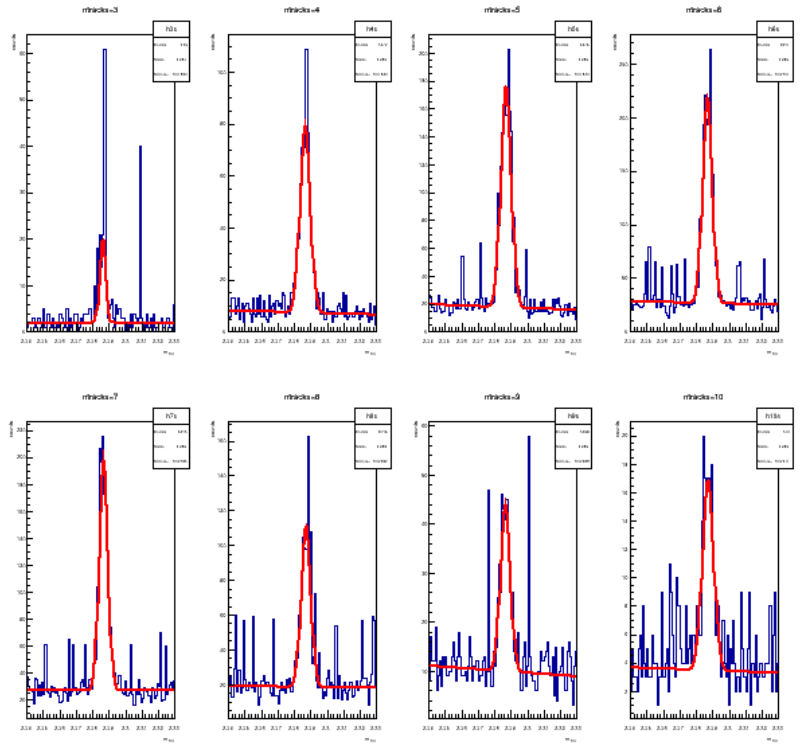
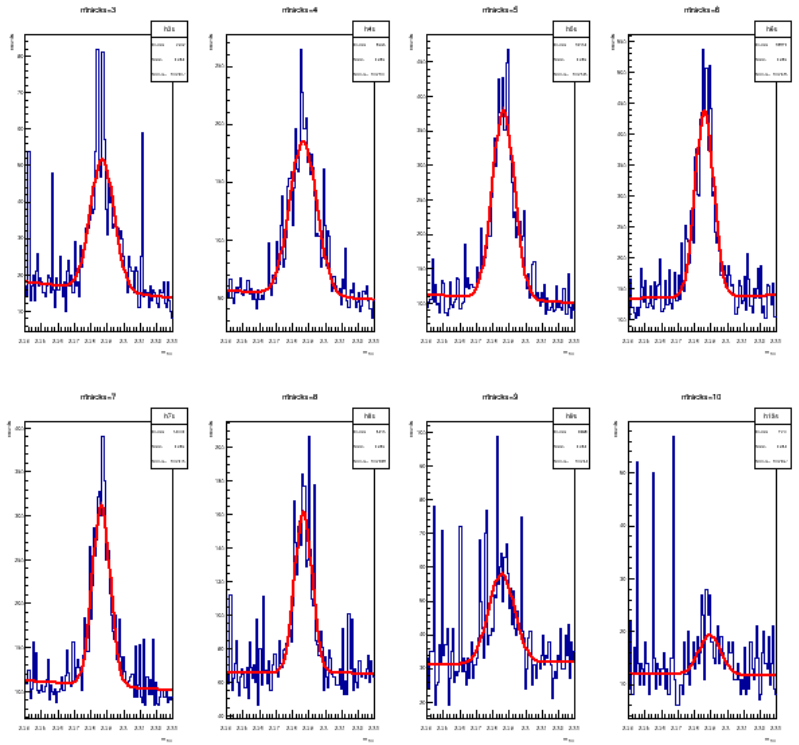


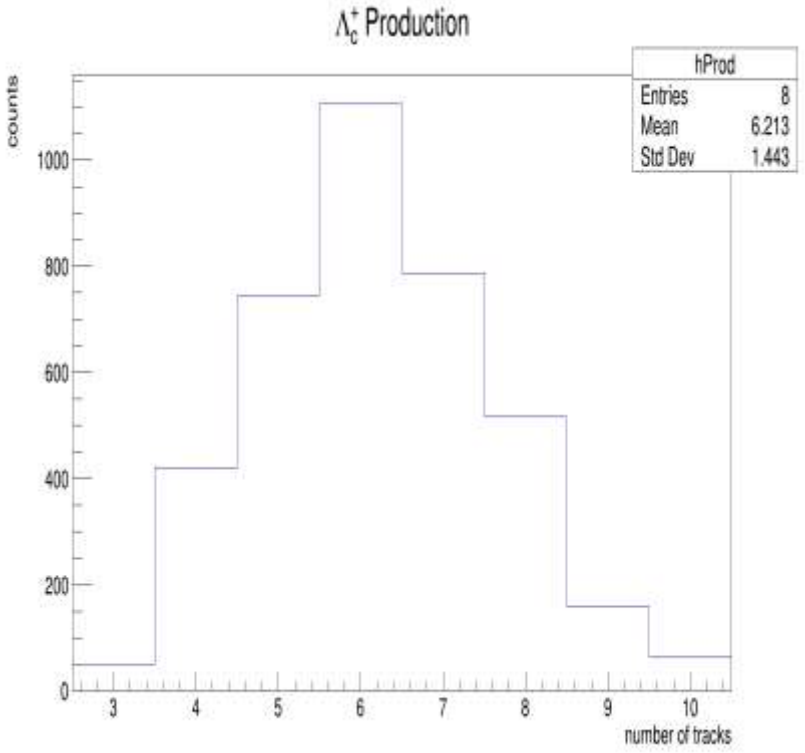
$1 < y < 3$

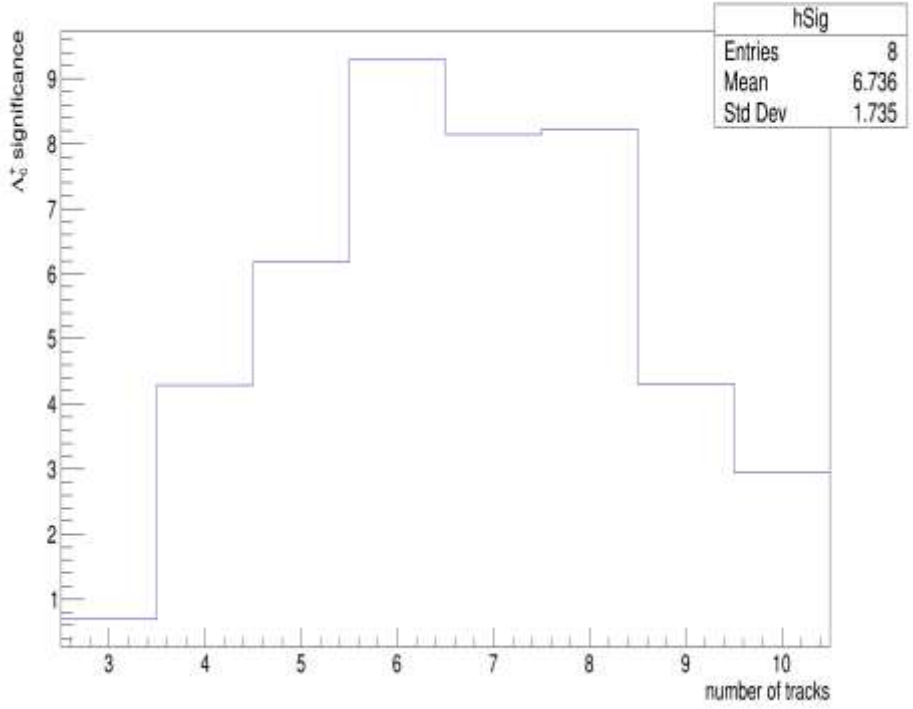


Λ_c^+ Reconstruction Results (MPI-CR Model)

- $|y| < 1$

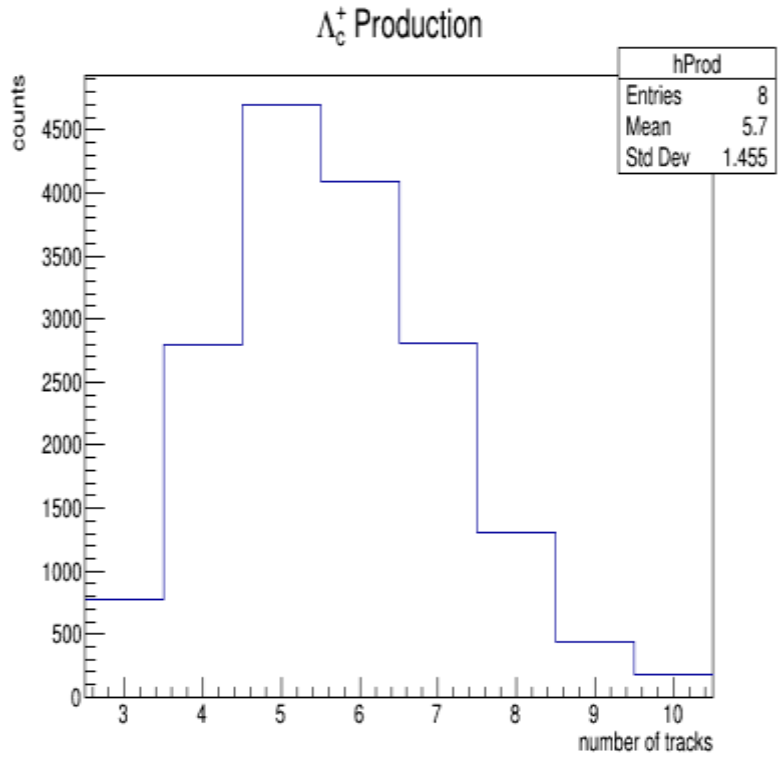
$$significance = \frac{S}{\sqrt{S+B}}$$

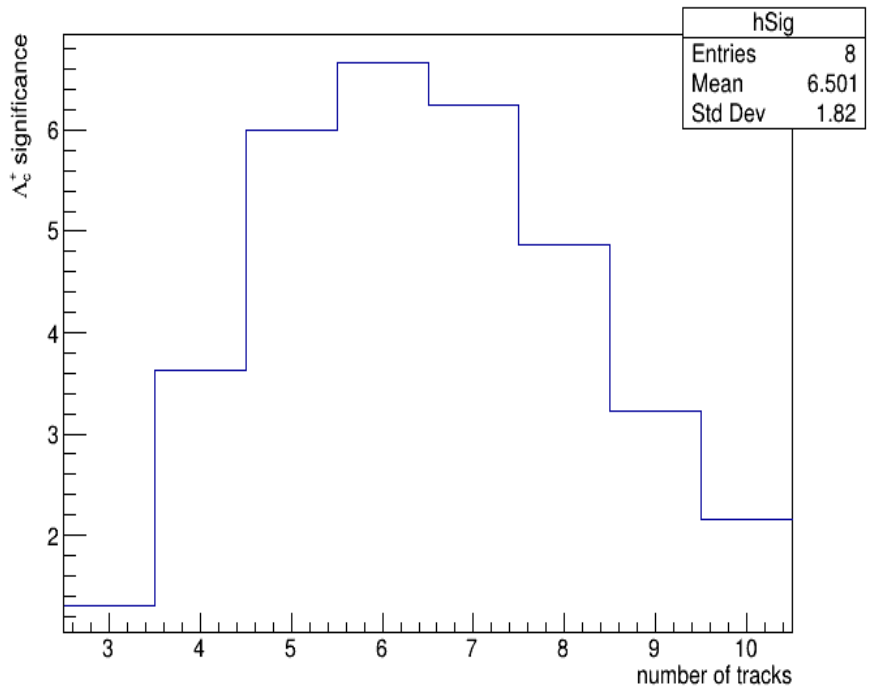




Λ_c^+ Reconstruction Results (MPI-CR Model)

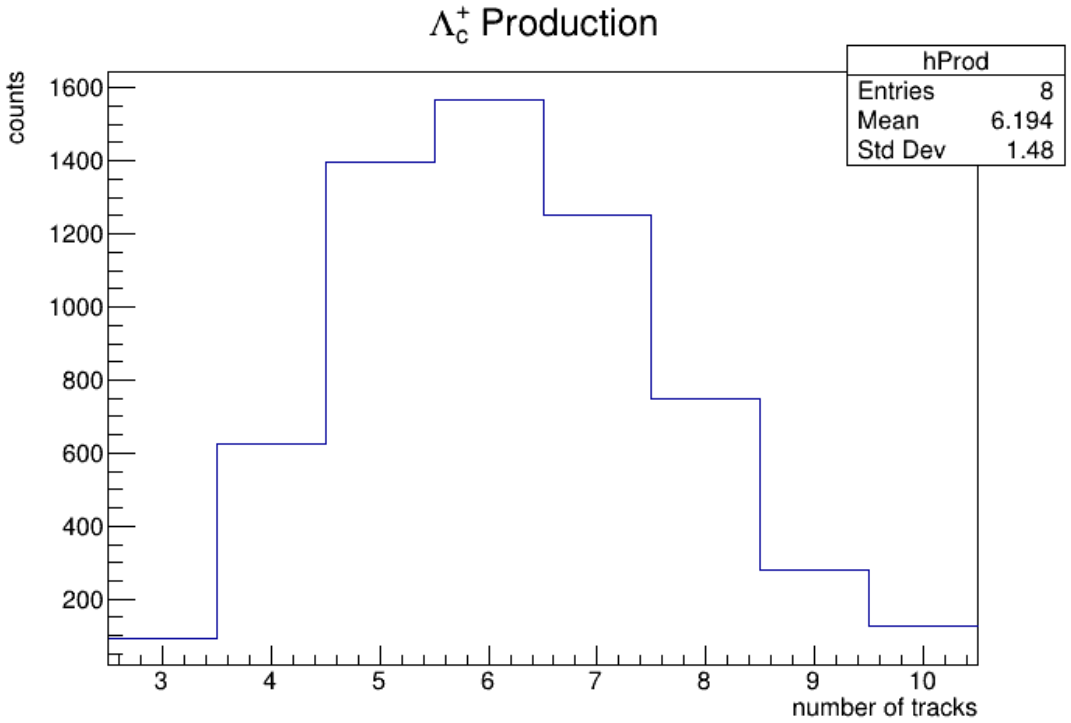
- $1 < y < 3$

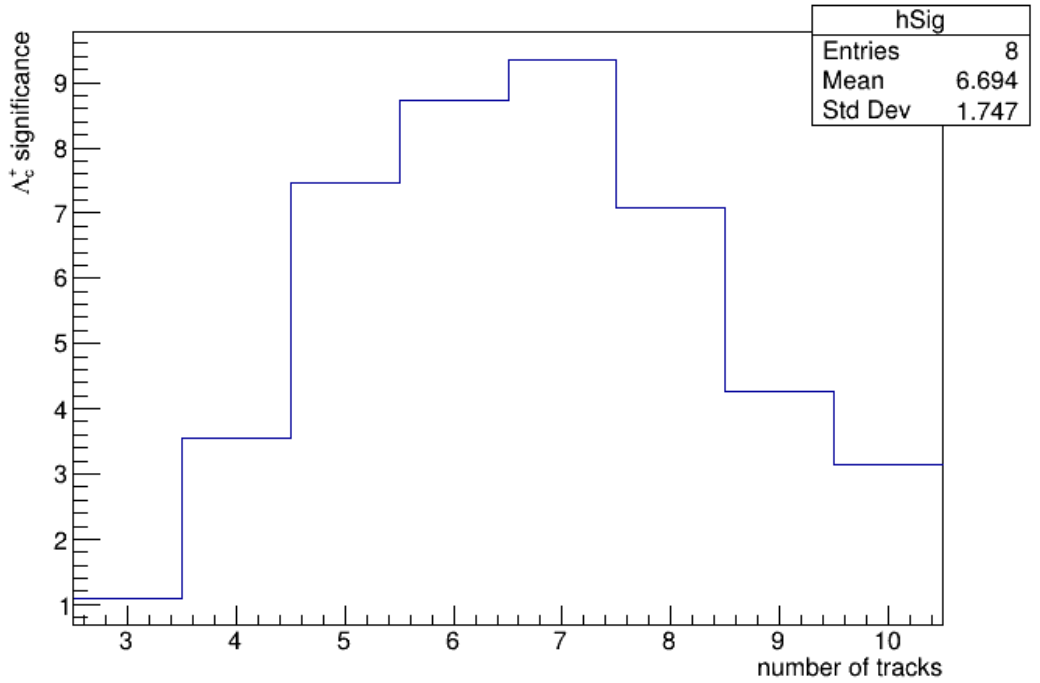




Λ_c^+ Reconstruction Results (QCD-CR Model)

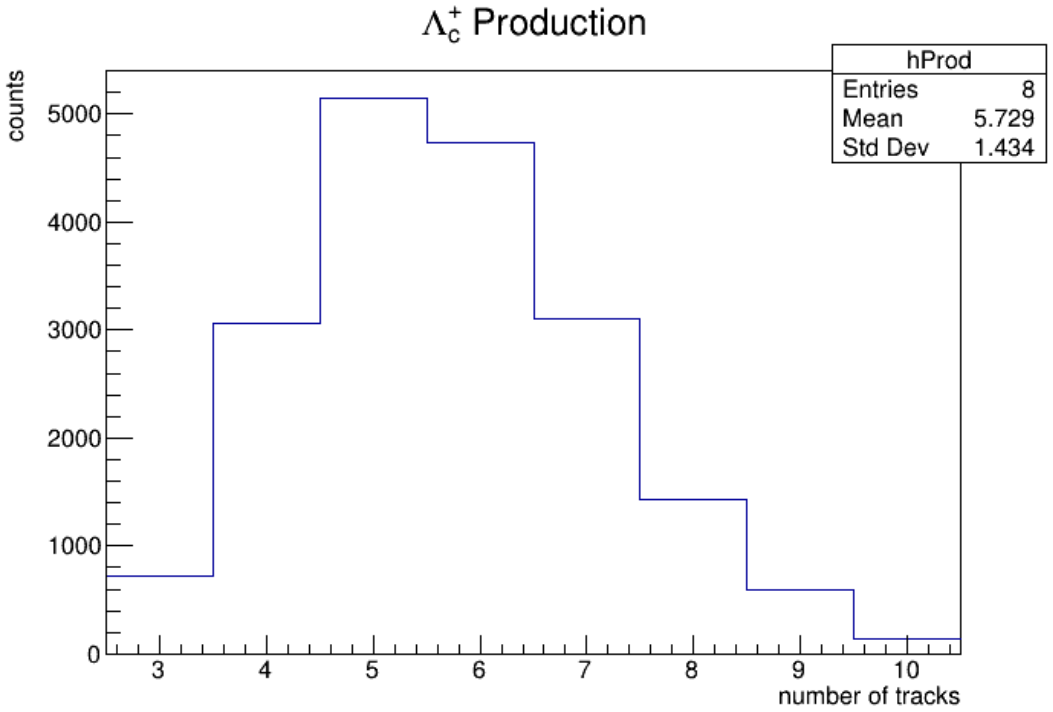
- $|y| < 1$

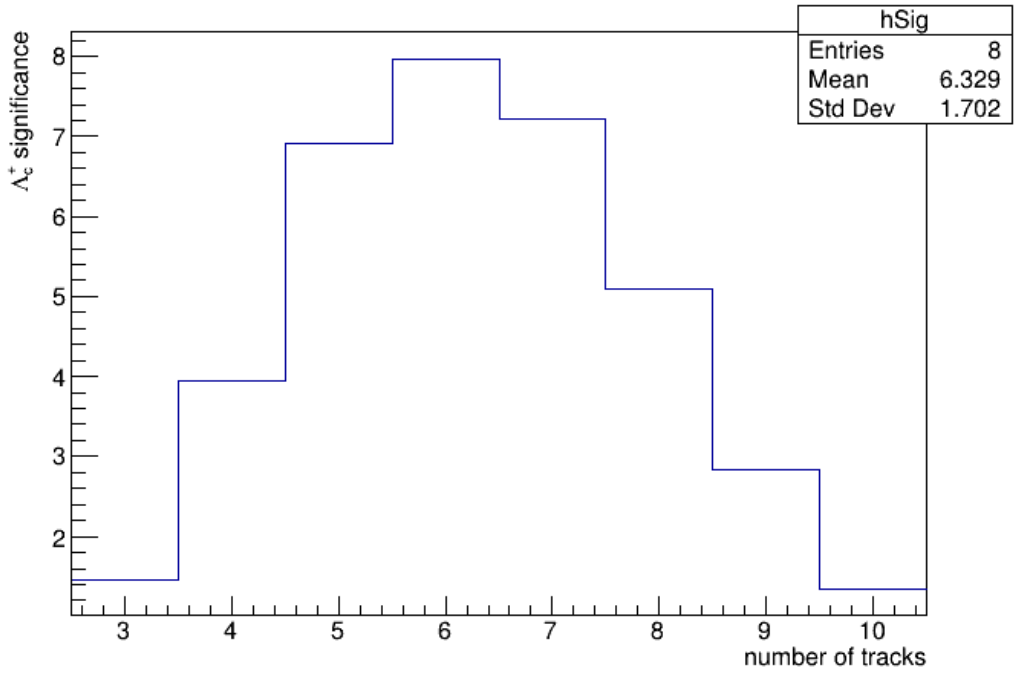




Λ_c^+ Reconstruction Results (QCD-CR Model)

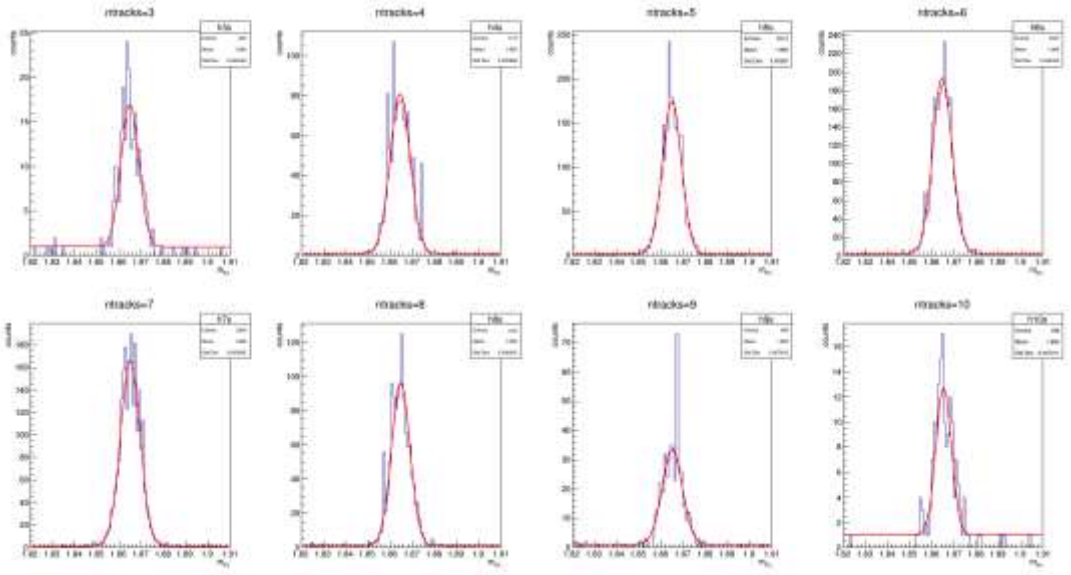
- $1 < y < 3$



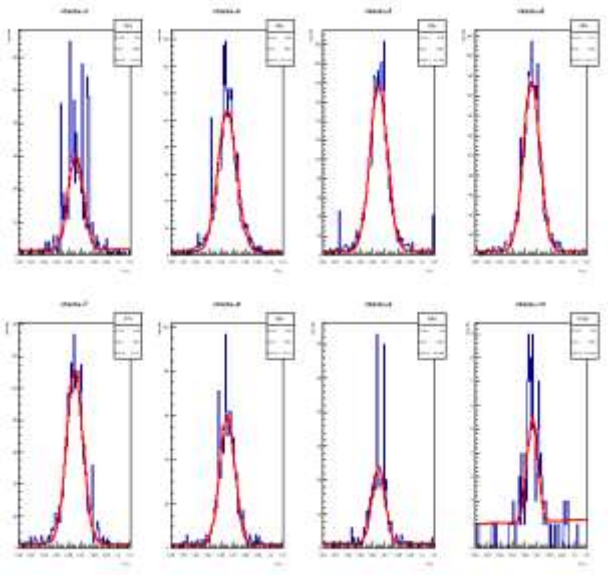


D^0 Reconstruction Result (MPI-CR Model)

$|y| < 1$

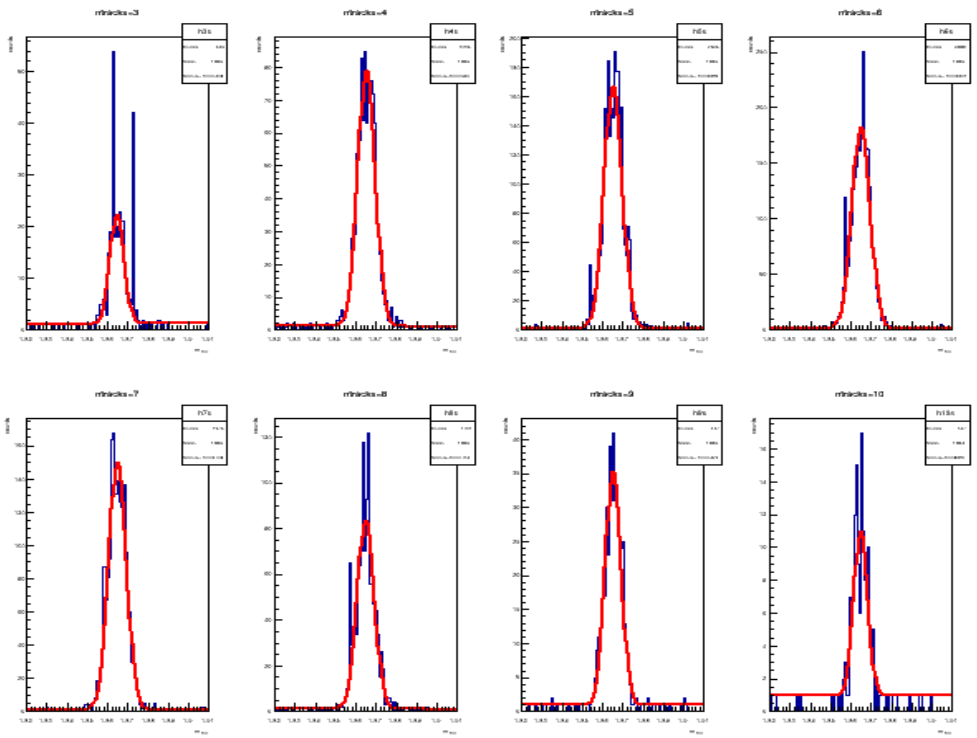


$1 < y < 3$

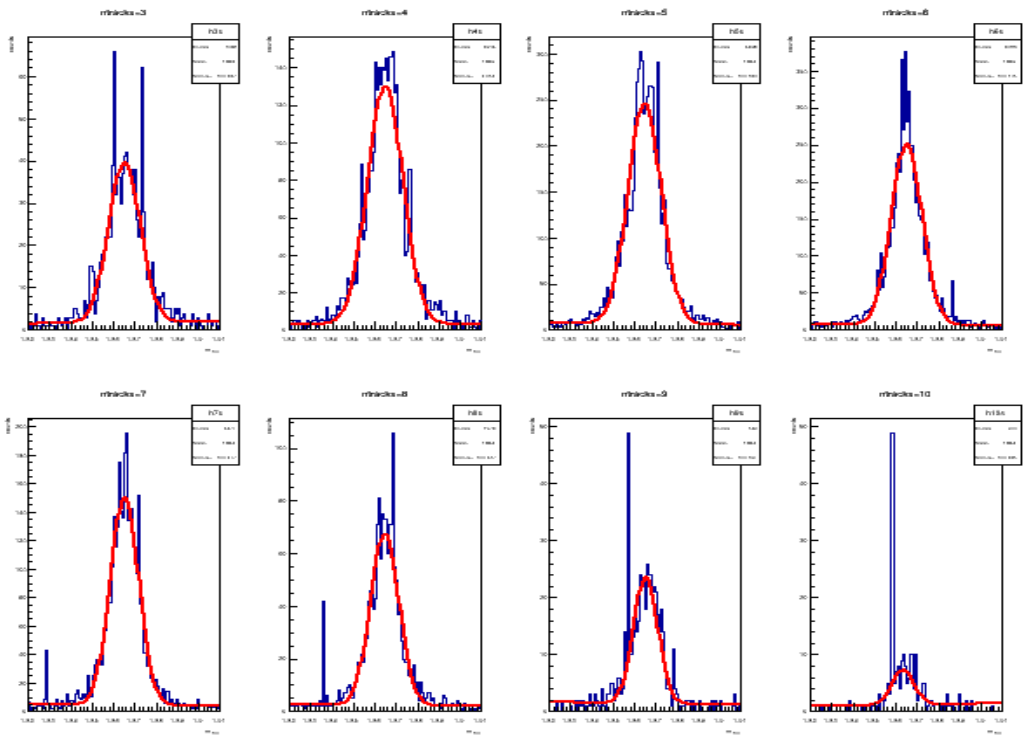


D^0 Reconstruction Result (QCD-CR Model)

$|y| < 1$



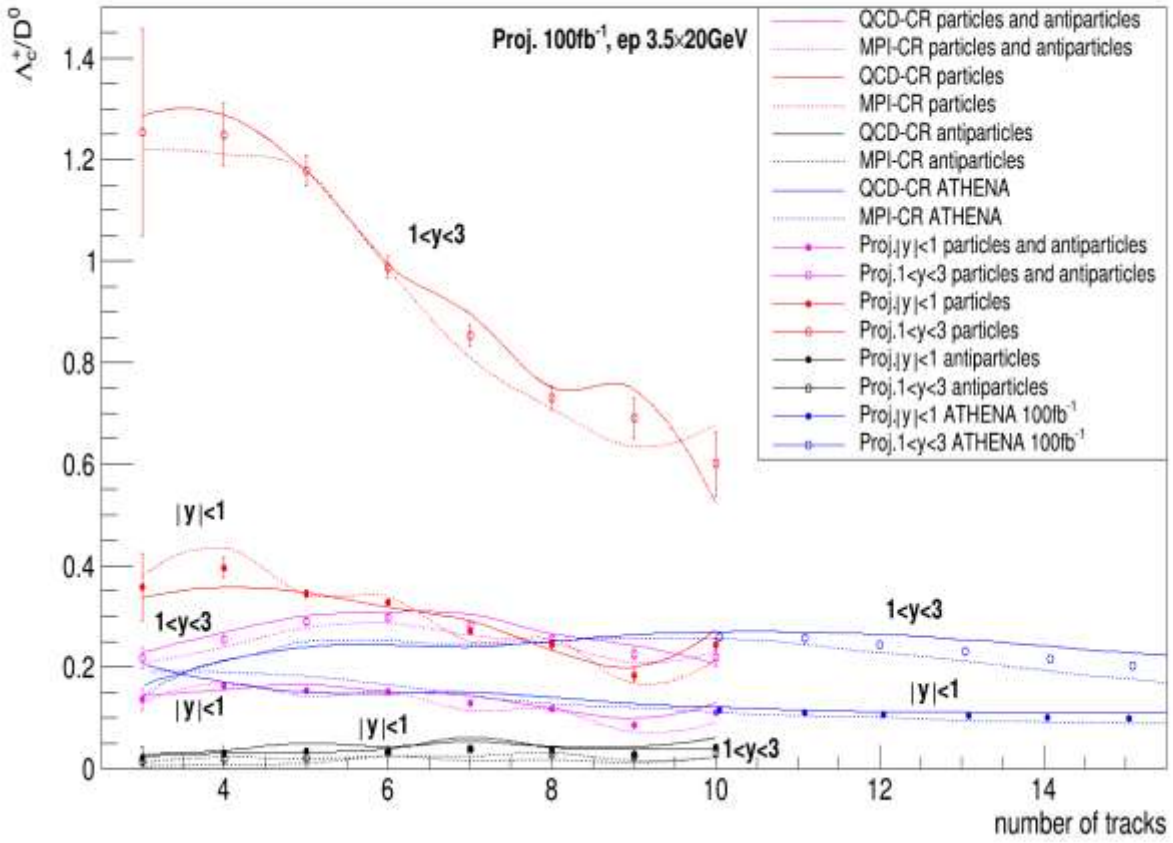
$1 < y < 3$



Λ_C^+ / D^0 Projection

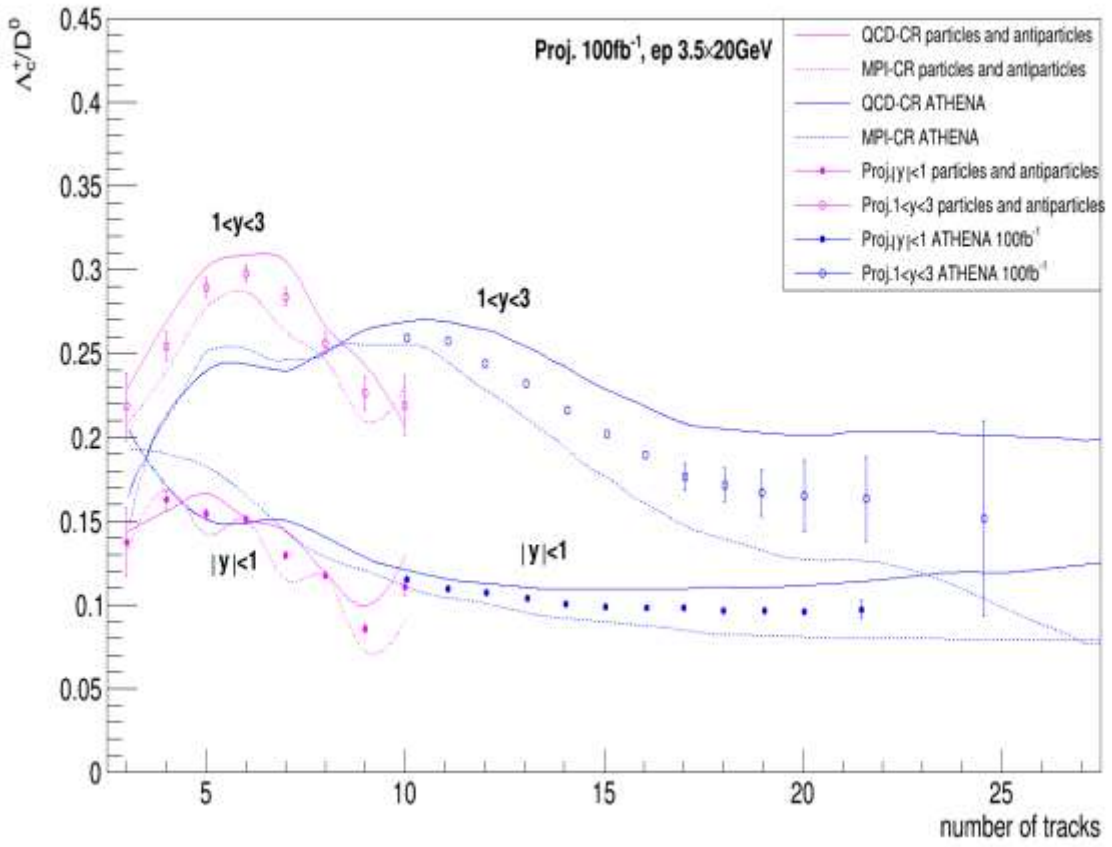
Λ_C^+ / D^0 Projection

- $error = \frac{n}{significance}$
- $\sigma_{\frac{u}{v}} = \left|\frac{\overline{u}}{\overline{v}}\right| \sqrt{\left(\frac{\sigma_u}{\overline{u}}\right)^2 + \left(\frac{\sigma_v}{\overline{v}}\right)^2}$



Λ_c^+ / D^0 Projection

- The results of EicC and EiC cover different multiplicity regions.
- With a luminosity of $100 fb^{-1}$, the results are conducive to our comprehension of hadronization models.



Conclusion

- There is a significant asymmetry in the production of particles and antiparticles.
- As the energy of EicC is lower, we can attain Λ_c^+ / D^0 ratio at smaller multiplicities.
- The statistics that can be measured is estimated.

Reference

[1] S. Acharya et al, Λ_c^+ Production and Baryon-to-Meson Ratios in pp and p-Pb Collisions at $\sqrt{s_{NN}}$= 5.02 TeV at the LHC, PHYSICAL REVIEW LETTERS 127, 202301 (2021).

[2] ATHENA Collaboration, ATHENA Detector Proposal: A Totally Hermetic Electron Nucleus Apparatus proposed for IP6 at the Electron-Ion Collider.

Thanks for your attention!