



MPD Polarization
Meeting

Progress on the study of Hyperon Global Polarization AuAu collisions at $\sqrt{s_{NN}} = 7.7$ GeV

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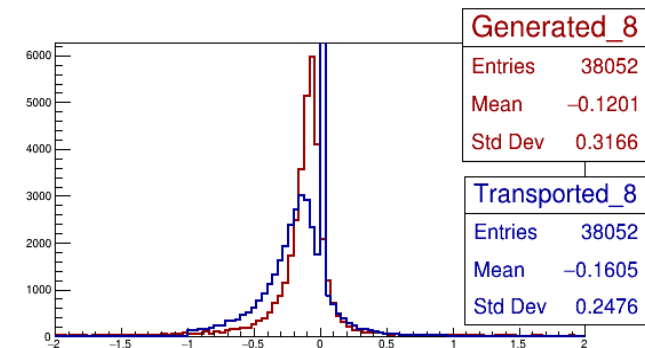
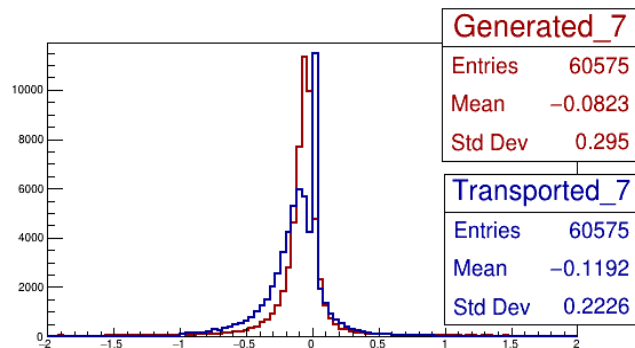
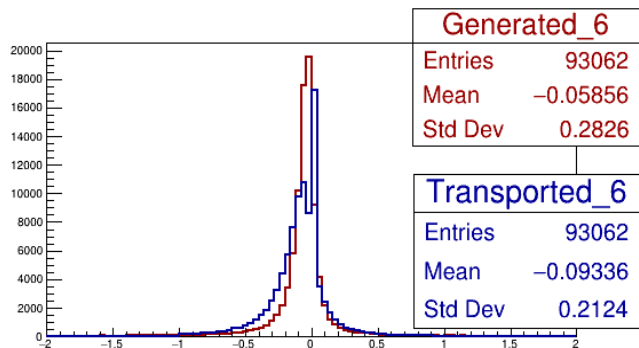
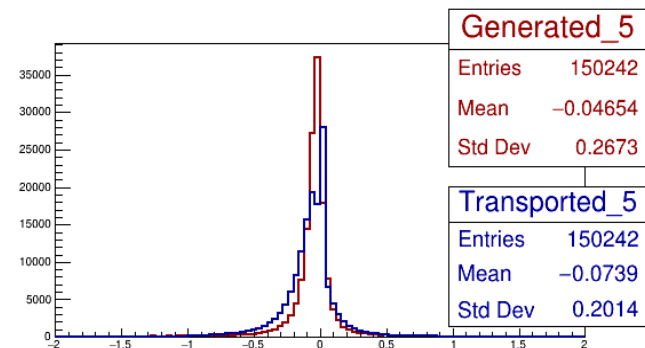
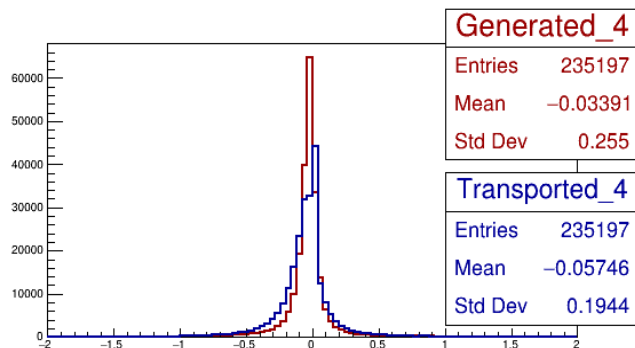
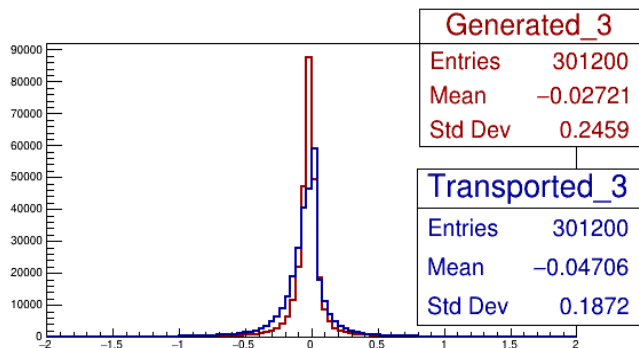
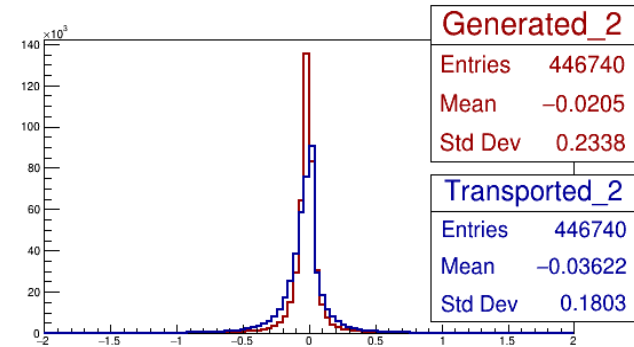
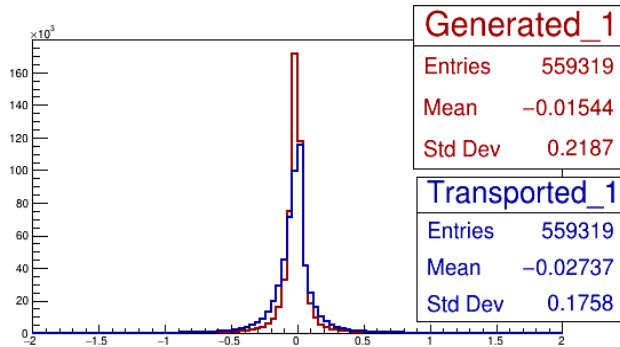
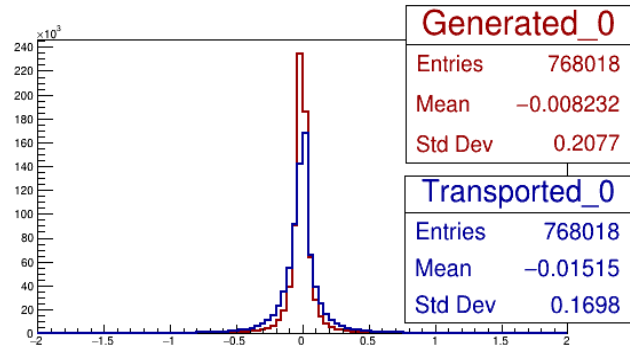


Content

- Check transfer of polarization to MCTracks
- Hyperon reconstruction through its daughter particles (MCTracks)
 - Pt, Invariant Mass
 - Θ^* Laboratory frame
 - Θ^* Λ frame
- Comparison with UrQMD
- Alternative way to get polarization
- Summary

Hyperon polarization transport

- There is difference between generated data files *.dat and transported data with MCTracks in dst*.root files (400,560) ~ 402500 events
- From *.dat → Pol(1)
- From dst*.root → weight*Pol(1)



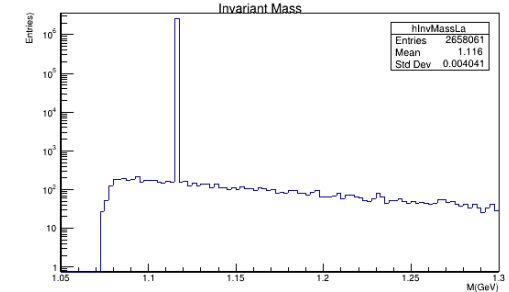
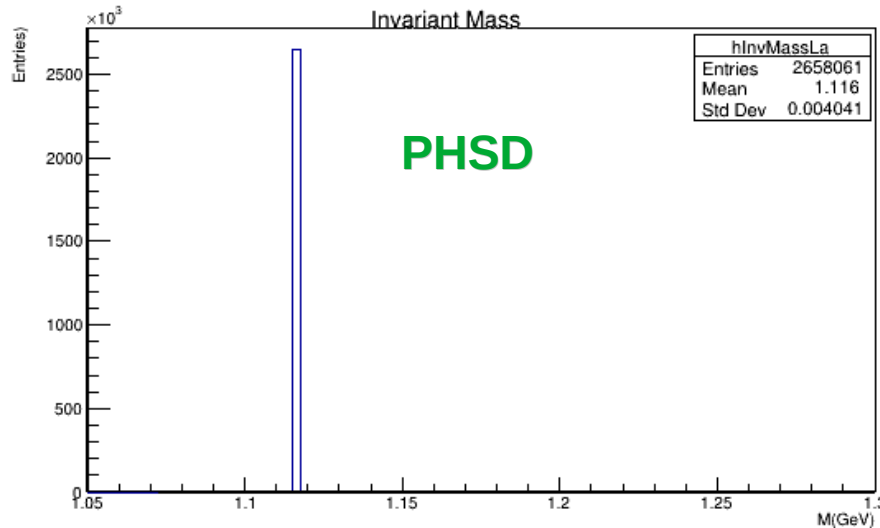
Hyperon polarization transport

- There is difference between generated data files .dat and transported data with MCTracks in dst.root files
- The following analysis is over MCTracks (~ 90kE for UrQMD and 402kE for PHSD)
 - From dst*.root → weight*Pol(1) for PHSD data
 - From dst*.root → Pol(1) for UrQMD data

MCTracks

- Invariant Mass: $M^2 = m_p^2 + m_\pi^2 + 2(E_p E_\pi - p_p \cdot p_\pi)$

Invariant Mass is 1.116 GeV as we expect



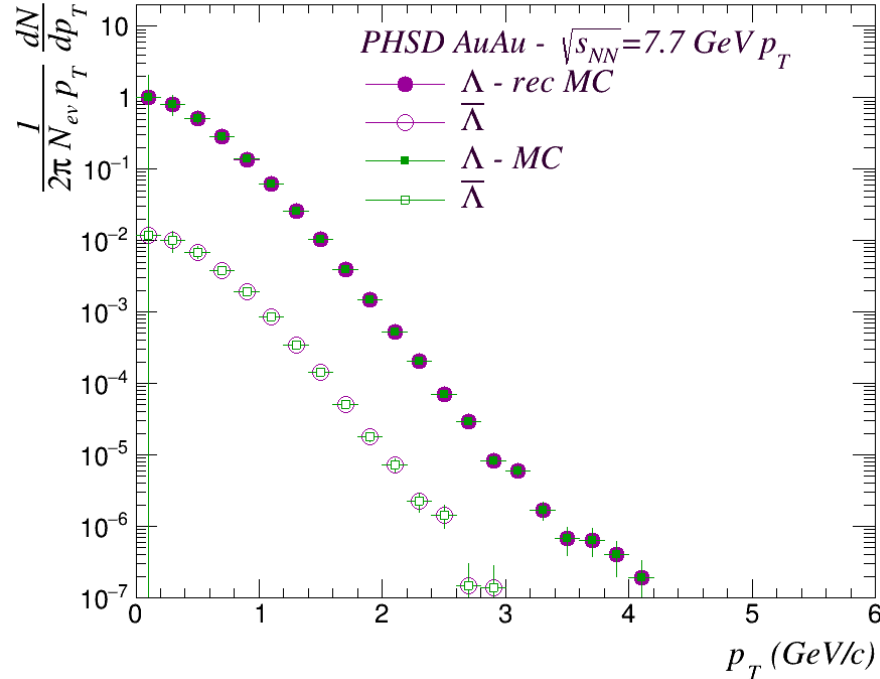
Only few Λ decay in more than two particles, not in the case of lambda bar

Similar behaviour in case of UrQMD

Hyperon reconstruction

MCTracks

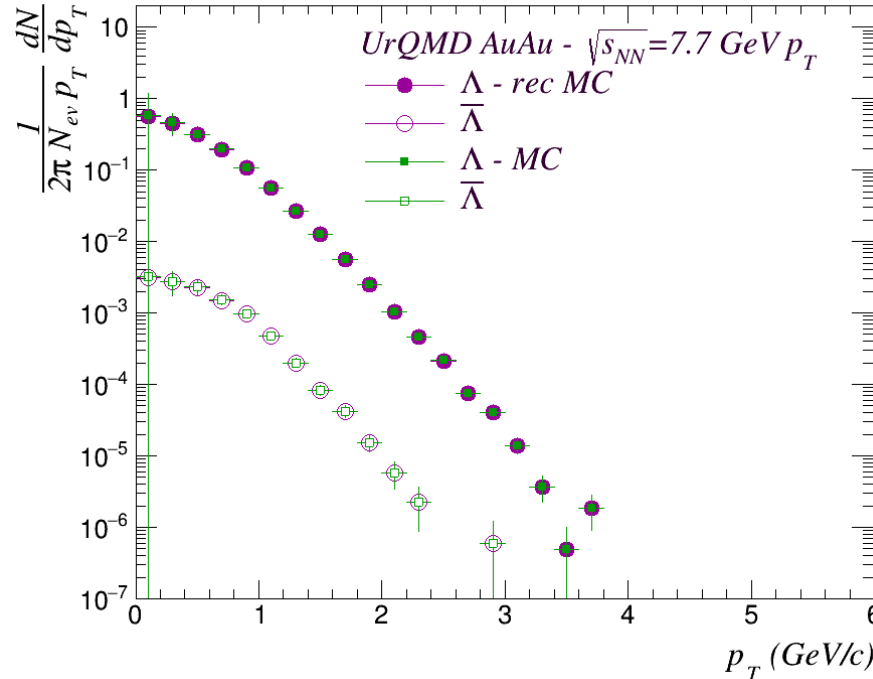
- Transverse Momentum: $P = p_\rho + p_\pi$



Hyperon reconstruction

MCTracks

- Transverse Momentum: $P = p_\rho + p_\pi$

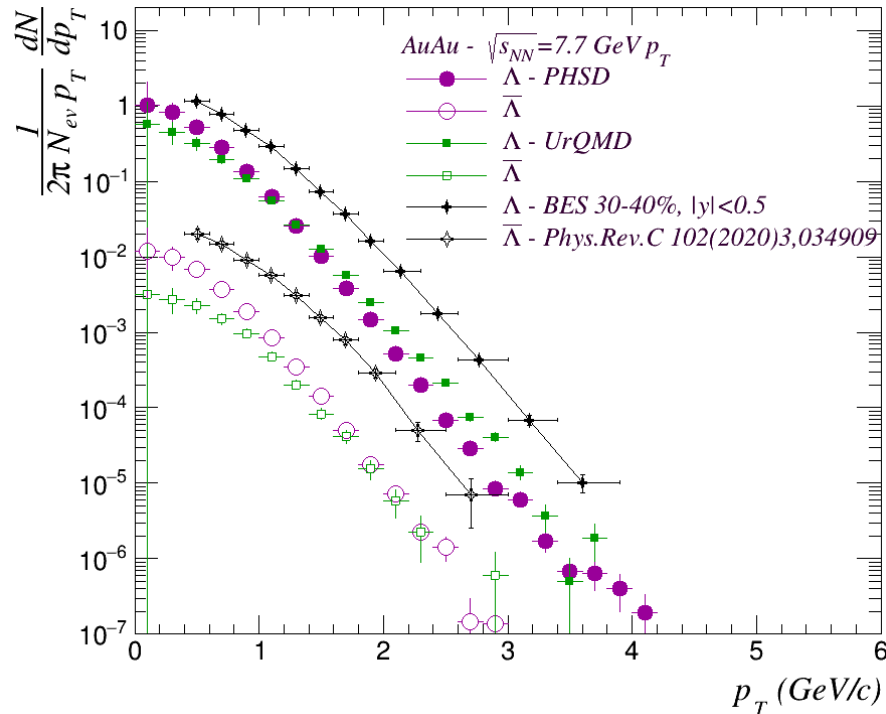


Hyperon reconstruction

MCTracks



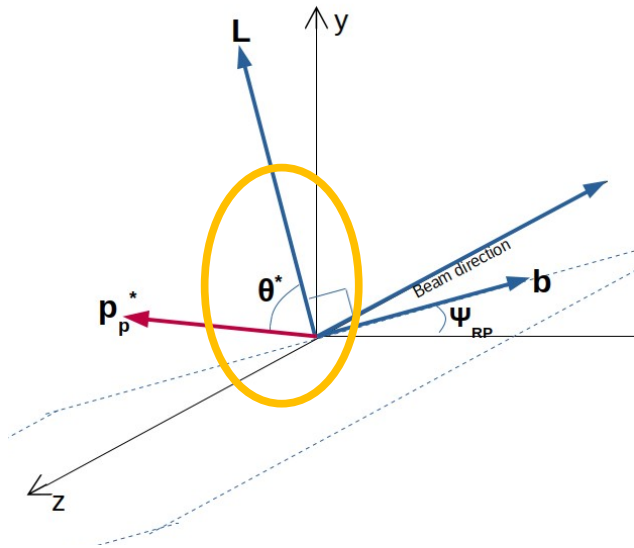
- Transverse Momentum: $P = p_\rho + p_\pi$



Angular distribution MCTracks

- Angle between p_p and L

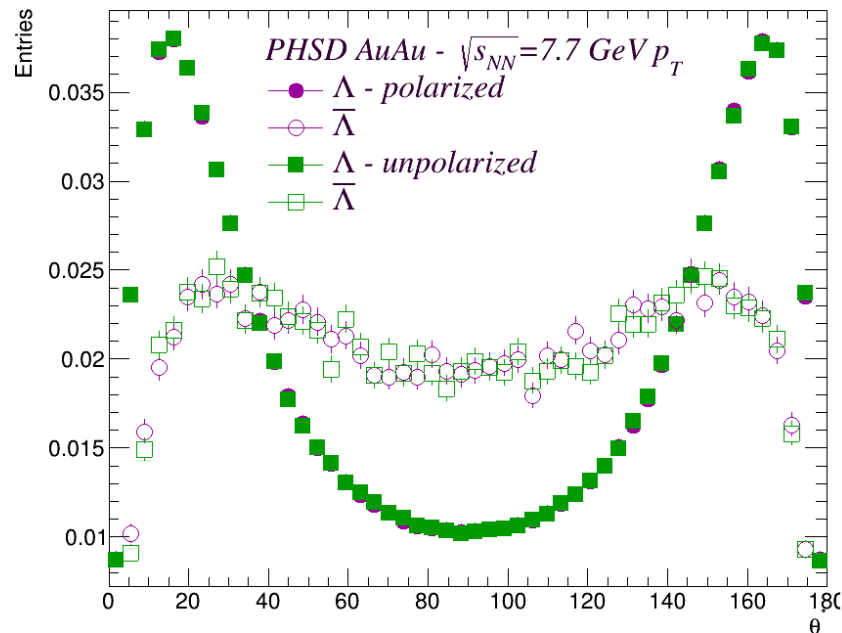
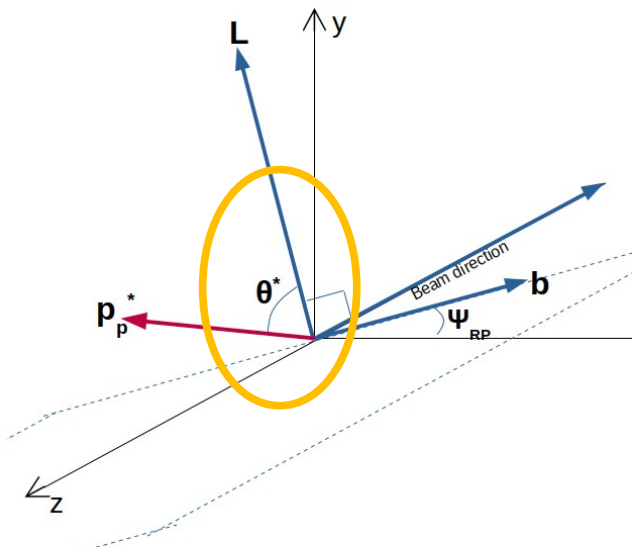
$$P_H = \frac{3}{\alpha_H} \langle \cos(\theta^*) \rangle$$



- Angular distribution is affected by polarization we expect this value differs between polarized and unpolarized distributions

Angular distribution MCTracks

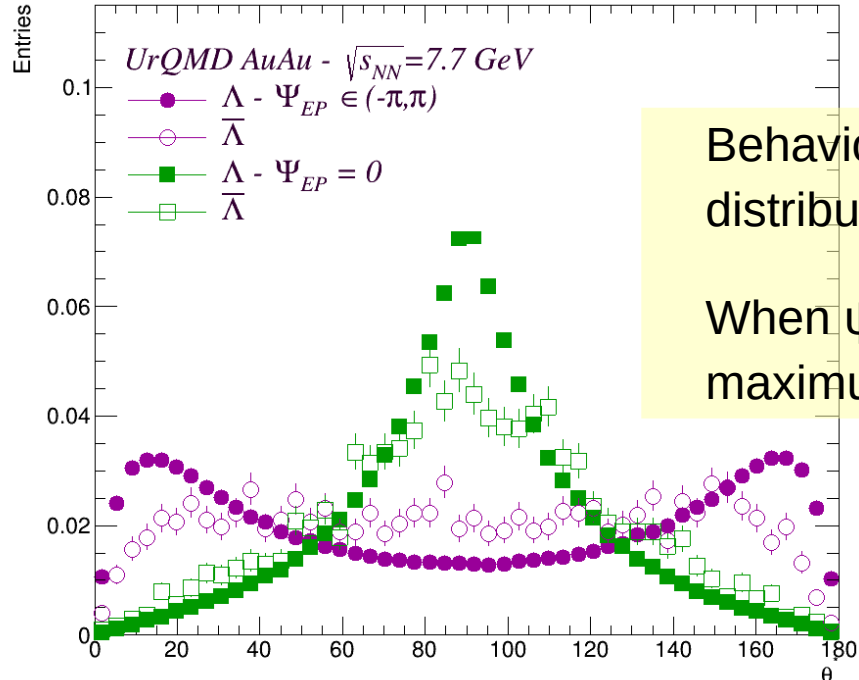
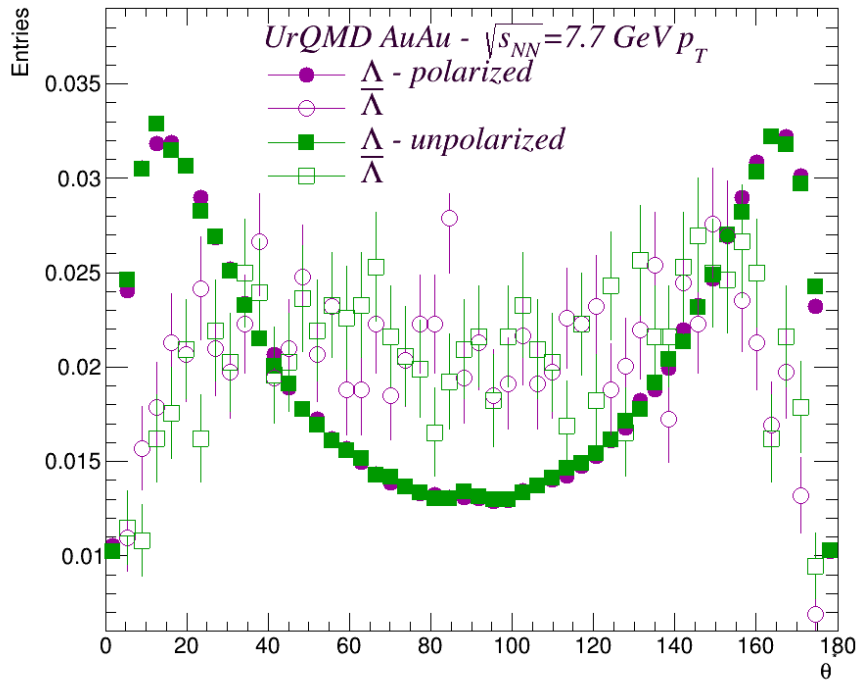
- Angle between p_p and L in the lab frame



Behaviour due to ψ_{EP} distribution in $(0, 2\pi)$
For UrQMD when ψ_{EP} is zero maximum is around $\pi/2$

Angular distribution MCTracks

- Angle between p_0 and L in the lab frame



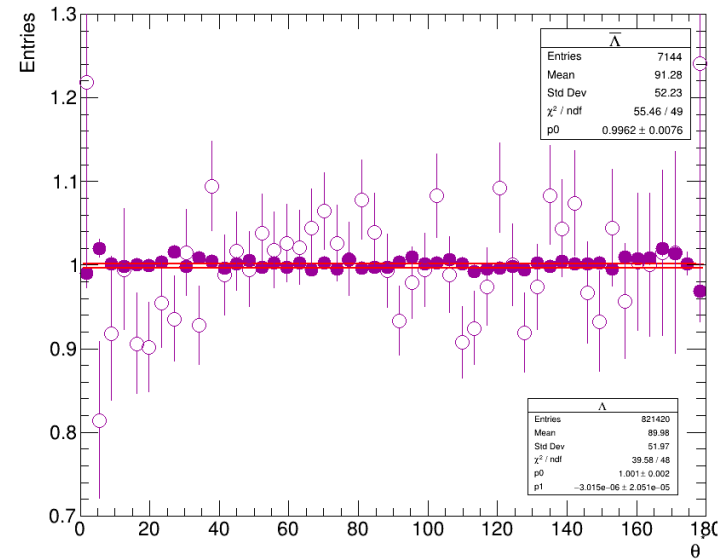
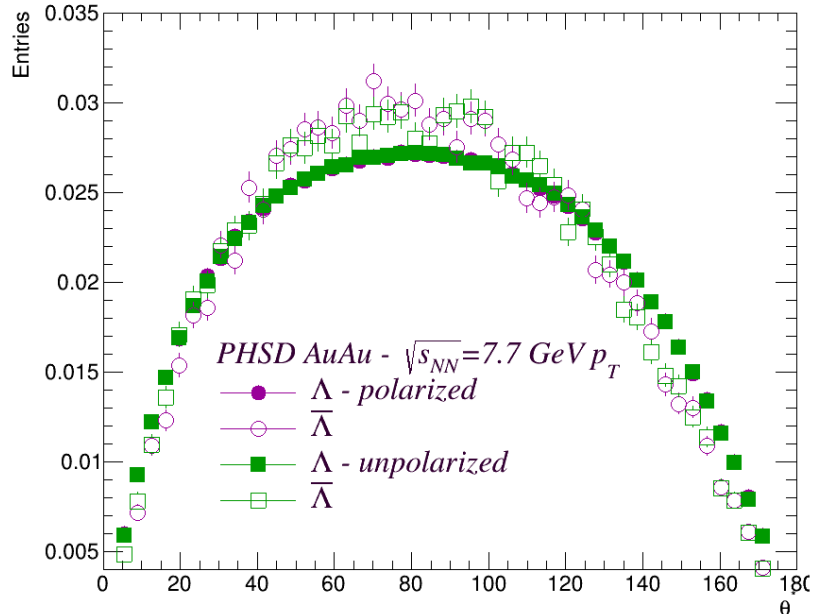
Behaviour due to Ψ_{EP} distribution in $(-\pi, \pi)$

When Ψ_{EP} is zero maximum is around $\pi/2$

Polarization in UrQMD → value expected from reconstruction assigned to MCTracks trough MpdStack class, it shouldn't be polarized!!!

Angular distribution MCTracks

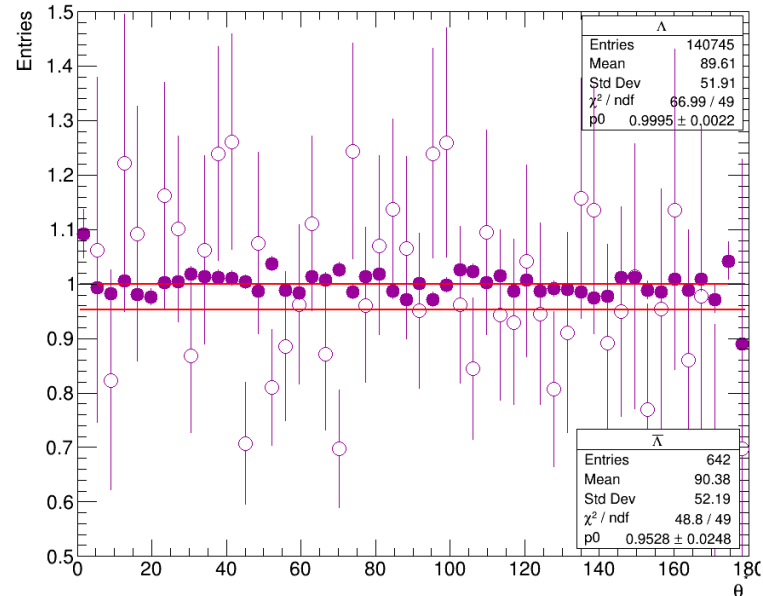
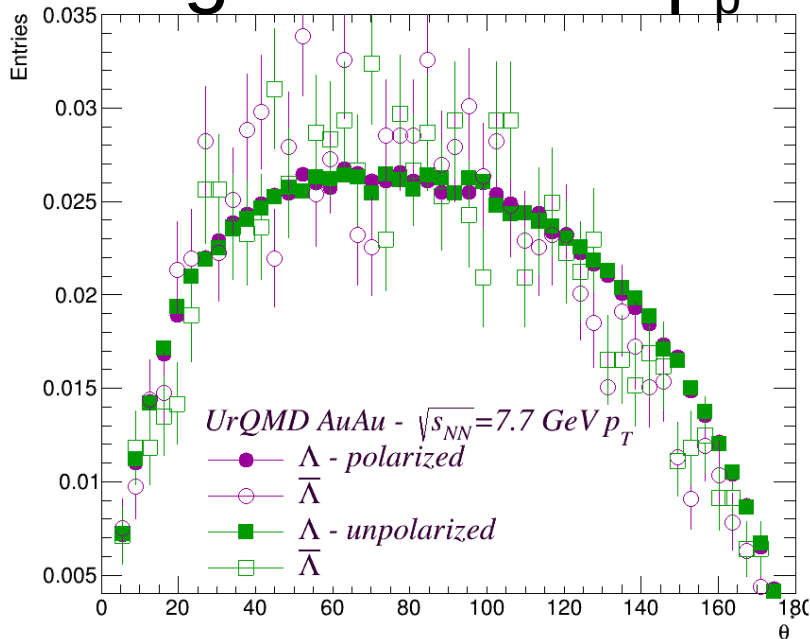
- Angle between p_p and L in the Λ frame



Distributions differ by less than 1%, we can think that polarization is not related with the proton angular distribution

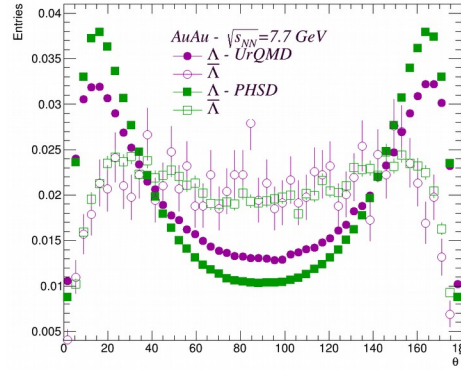
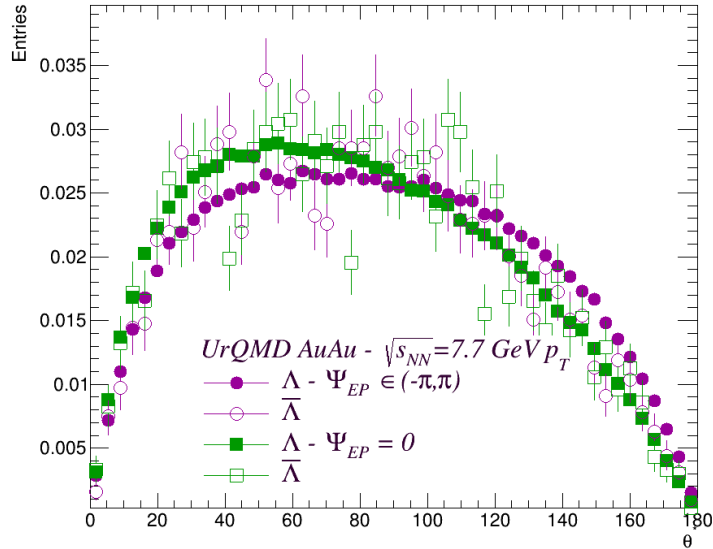
Angular distribution MCTracks

- Angle between p_p and L in the Λ frame

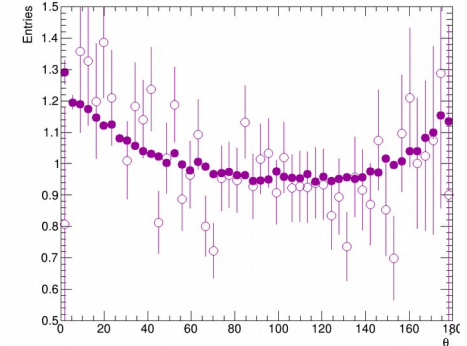
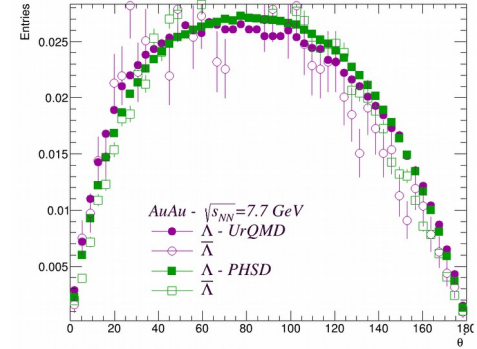


Distributions differ by less than 1%, we can think that polarization is not related with the proton angular distribution

- Differences between PHSD and UrQMD could be for p_T , or ψ_{EP} angle.

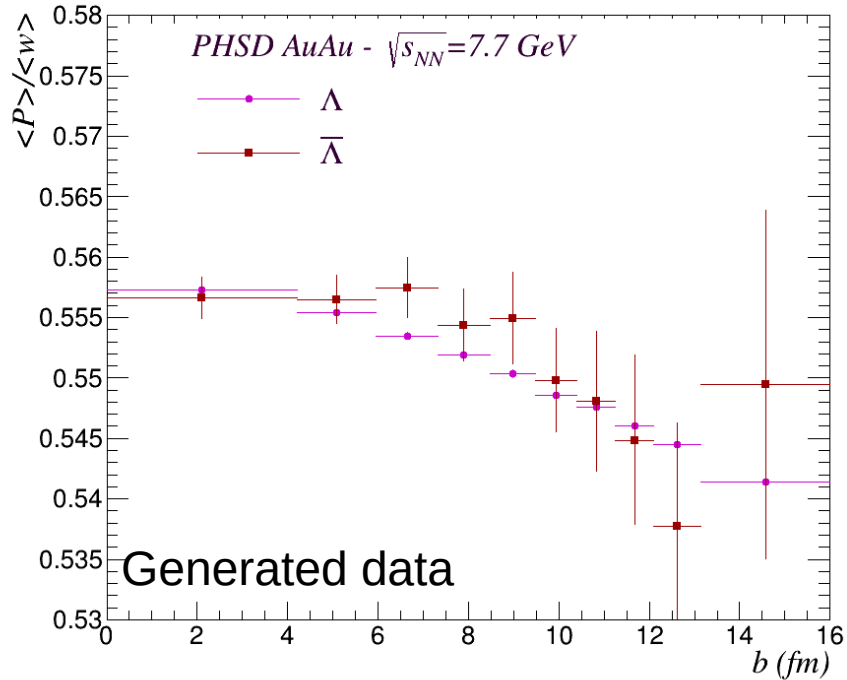


$\Psi_{EP} \rightarrow (0, 2\pi)$ for PHSD
 $\Psi_{EP} \rightarrow (-\pi, \pi)$ for UrQMD



The ψ_{EP} affects the value of the angle

Polarization in terms of mt



The distribution is polarized? We require to do the analysis with UrQMD and compare

$$\langle P_{\Lambda} \rangle_{midrap} \simeq \frac{\langle \overline{w_{zx}} \rangle_{cent. slab}}{2} \left(1 + \frac{2}{3} \frac{\langle m_T^{\Lambda} \rangle_{midrap} - m_{\Lambda}}{m_{\Lambda}} \right)$$

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Summary

- Reconstructed data – there is discrepancies between generated and transported data
- Hyperons are reconstructed through its charged decay, Invariant Mass and p_T agrees with generated data
- Angular distributions polarized and unpolarized differs in less that 1%. We need to consider if Polarization is transported to the decay products, or the difference with UrQMD is related to the angle of the Event Plane during transport
- We show m_T as alternative way to get polarization, the distribution with UrQMD is in progress.

Backup

- Polarization assigned to UrQMD Hyperons value expected from reconstruction assigned to MCTracks through MpdStack class, it shouldn't change distribution of kinematic variables

