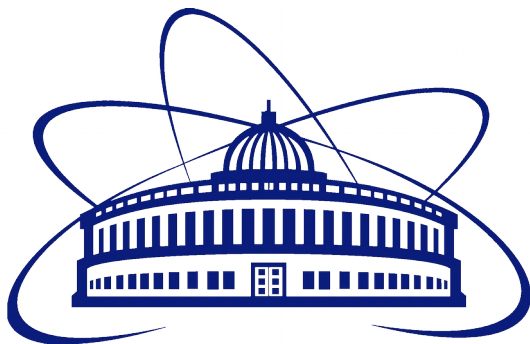


# Global hyperon polarization at MPD: status and plans

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## MPD Polarization Meeting «Vorticity and Polarization in Heavy-Ion Collisions»

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- Centrality determination
- Event plane angle & resolution
- Polarization transfer
- Outlook

- Data: MC simulation using PHSD generator<sup>1</sup>
  - Au-Au,  $\sqrt{s_{NN}} = 7.7$  GeV,  $\sim 1.5$ M MB events
  - Global  $\Lambda(\bar{\Lambda})$  polarization
    - Thermodynamical (Becattini) approach<sup>2</sup>
- Track selection criteria for reconstruction:
  - Number of TPC hits:  $N_{\text{hits}} > 10$
  - $|\eta| < 1.3$

$$\bar{P}_{\Lambda/\bar{\Lambda}} = \frac{8}{\pi\alpha} \frac{1}{R_{EP}^1} \langle \sin(\Psi_{EP}^1 - \phi_p^*) \rangle$$

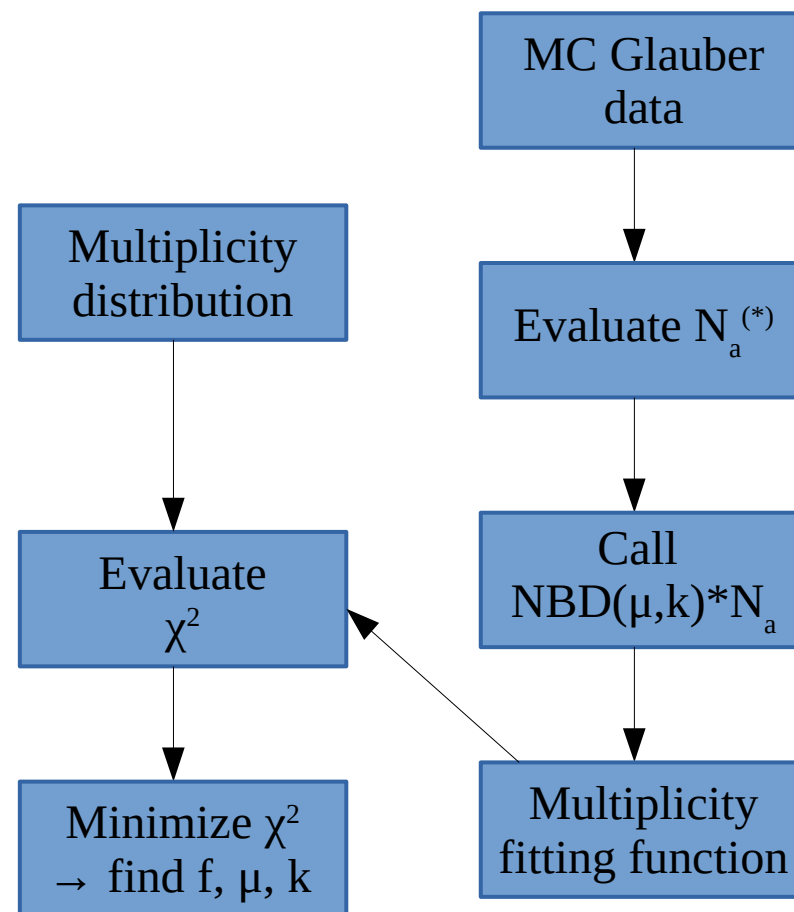
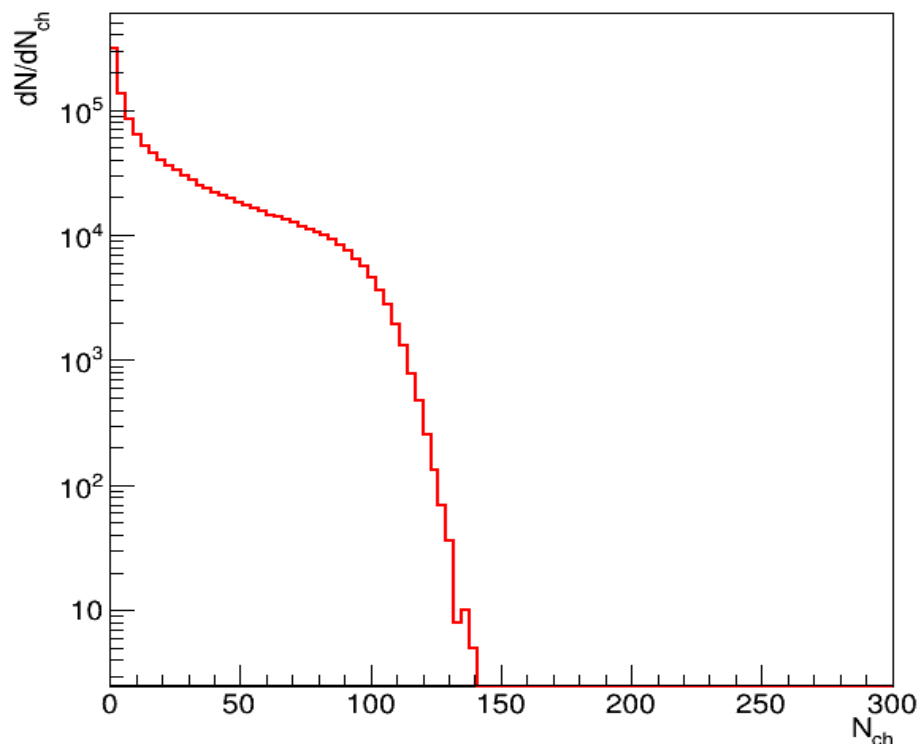
→ Need to calculate:  $\Psi_{EP}^1$  and  $R_{EP}^1$

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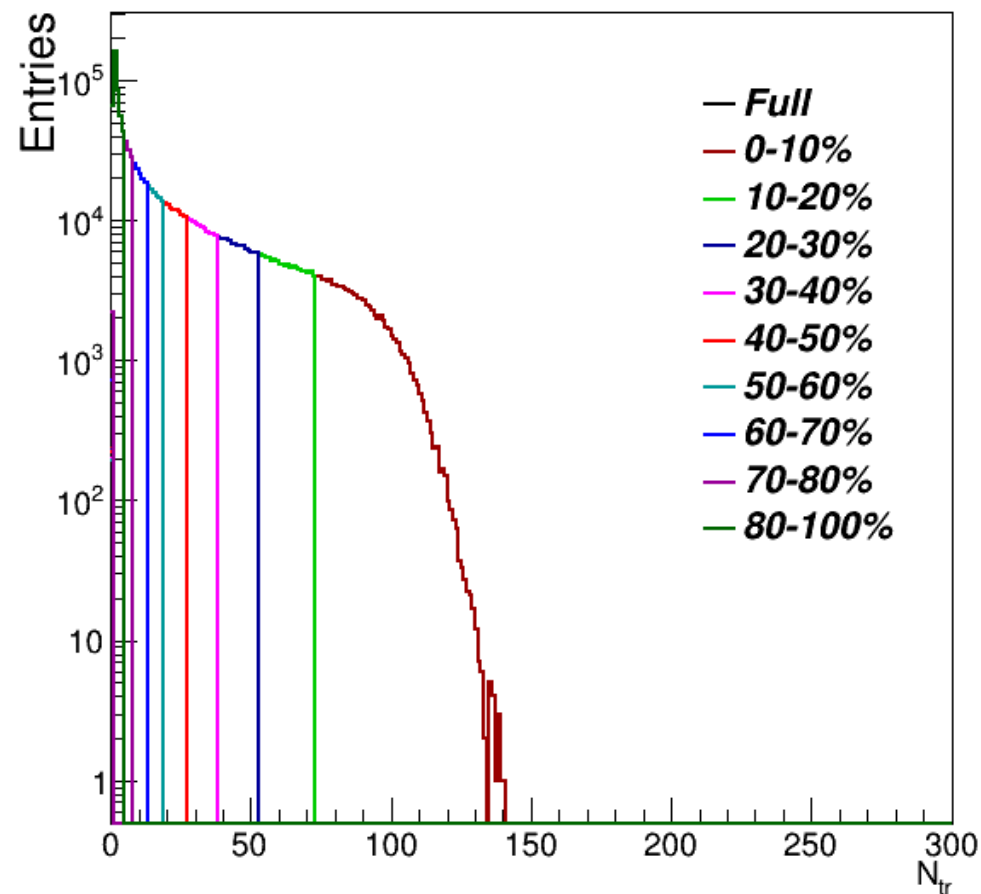
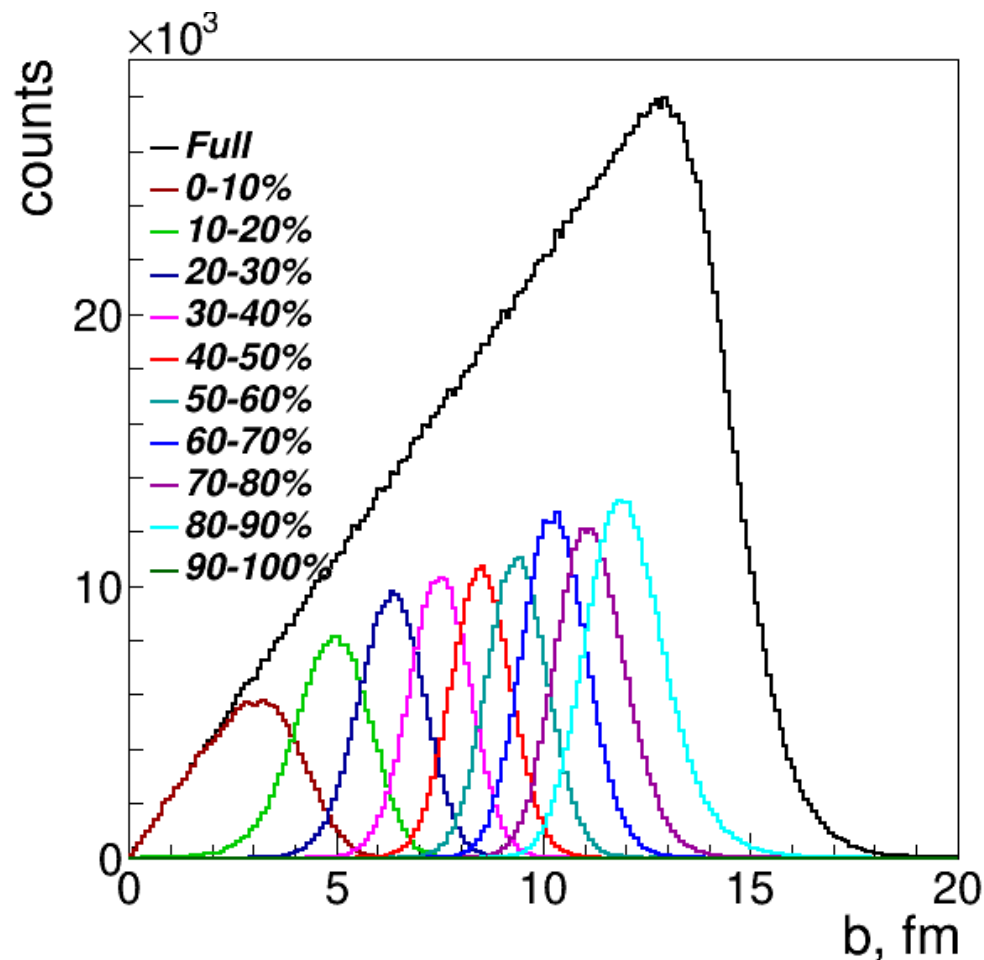
<sup>1</sup>W. Cassing, E. Bratkovskaya, PRC 78 (2008) 034919; NPA831 (2009) 215; W. Cassing, EPJ ST 168 (2009) 3

<sup>2</sup>F. Becattini, V. Chandra, L. Del Zanna, E. Grossi, Ann. Phys. 338 (2013) 32

- MC-Glauber based centrality framework from MEPHI group
  - Analysis note and official code should appear soon after CPOD
- Multiplicity in TPC:
  - $|\eta| < 1.5$
  - $0 < p_T < 3$
  - $N_{\text{hits}} > 16$

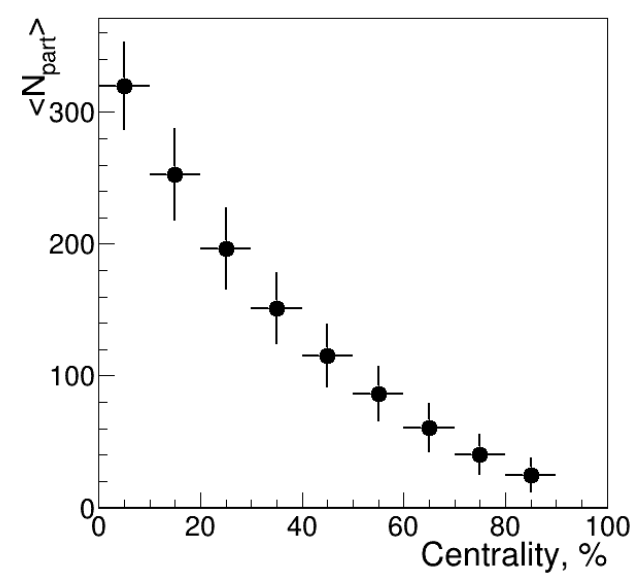
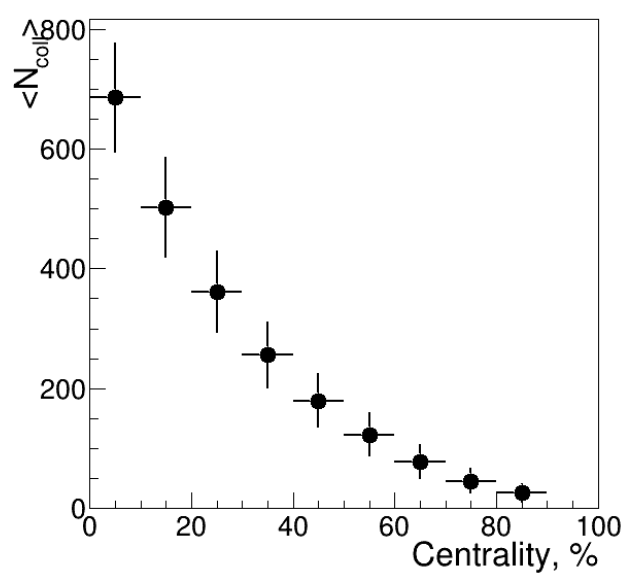
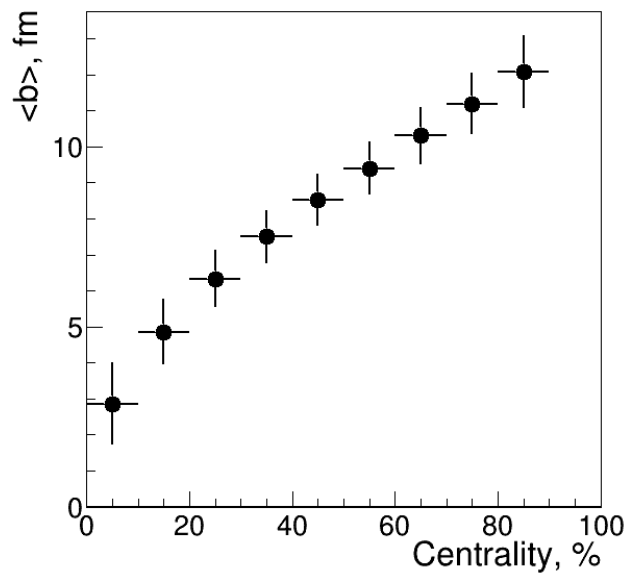
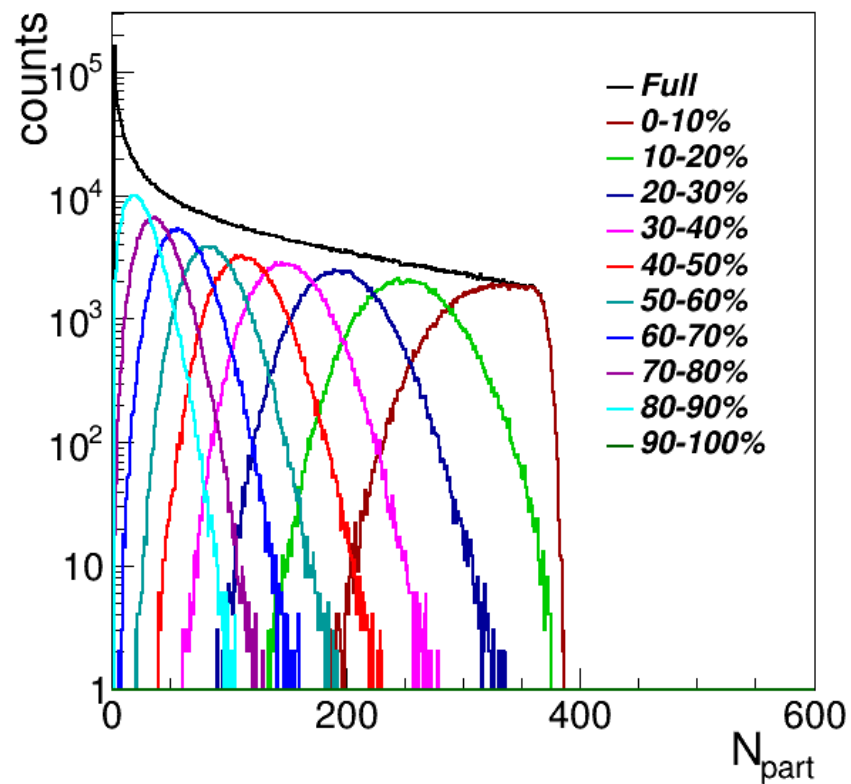
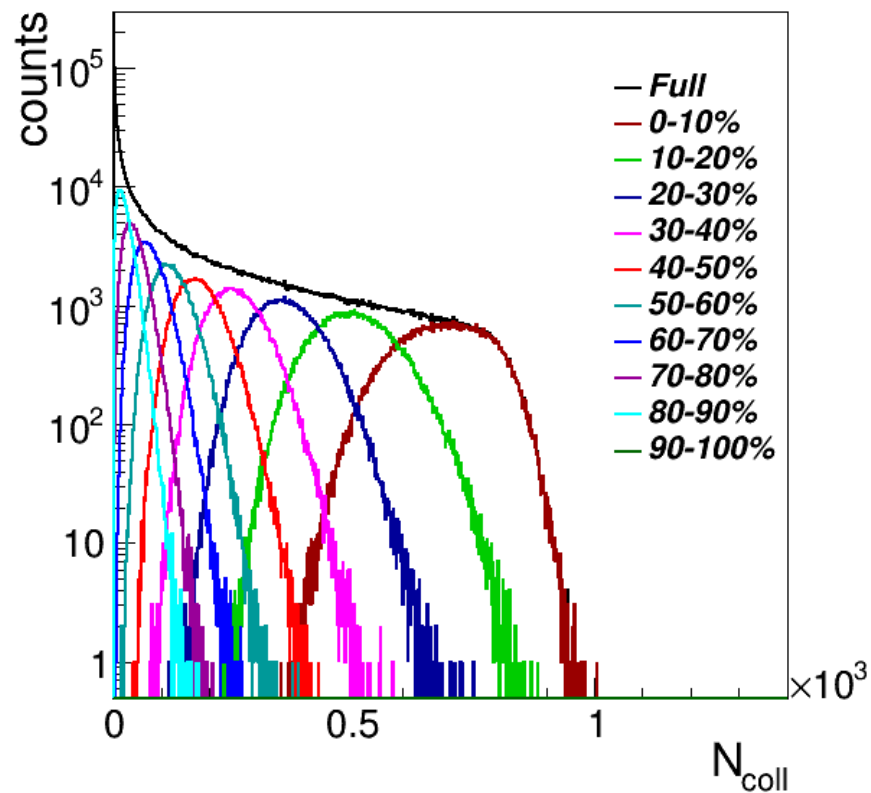


$$^{(*)} N_a = f N_{\text{part}} + (1 - f) N_{\text{coll}}$$



- › Centrality is calculated via TPC multiplicity
- › Last interval (90-100%) is not determined correctly

# Centrality determination (TPC)



- Event plane angle can be measured as:

- $\Psi_{EP}^n = \frac{1}{n} \arctan \frac{Q_y}{Q_x}$

- $Q_y = \sum_i w_i \sin(n\phi_i)$

- $Q_x = \sum_i w_i \cos(n\phi_i)$

$$w_i = \begin{cases} -E_i, -p_{Ti} & \text{if } \eta < 0 \\ E_i, p_{Ti} & \text{if } \eta > 0 \end{cases}$$

«-» appears only for 1st-order EP!

- Respectively, within the flow group implementation:

- $w_i = E_i/E_{\text{total}}$  (for the TPC Event plane)

- $w_i = p_{Ti}/p_{T\text{total}}$  (for the FHCAL Event plane)

- 
- Event plane resolution can be calculated as:

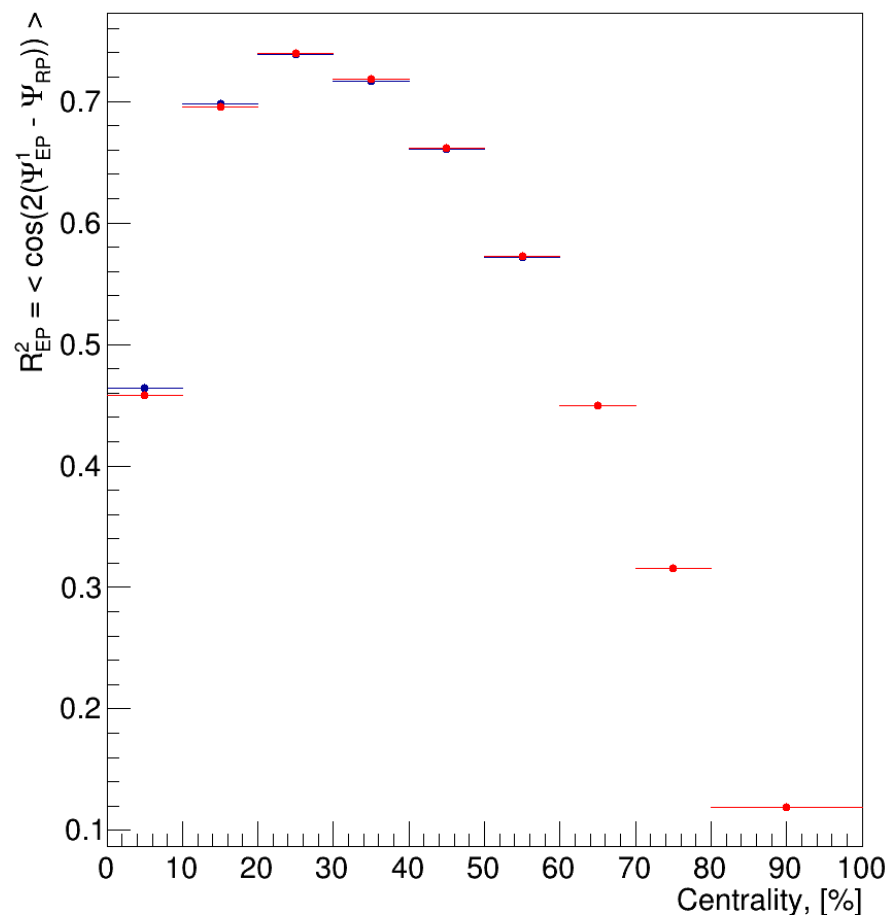
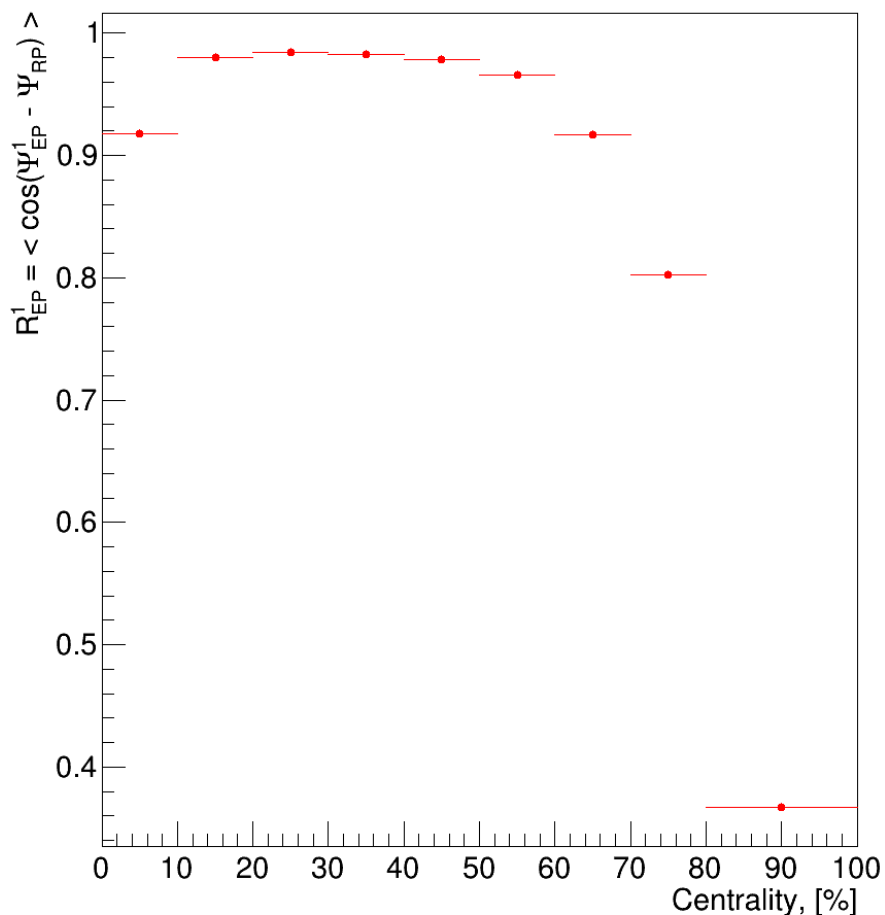
- $R_{EP}^1 = \langle \cos(n(\Psi_{EP}^1 - \Psi_{RP})) \rangle$  (w.r.t. reaction plane angle from the model)

- $R_{EP}^1 = \langle \cos(n(\Psi_{EP,R}^1 - \Psi_{EP,L}^1)) \rangle$  (sub-event resolution) →

→ Can be used to estimate experimental resolution<sup>1</sup>

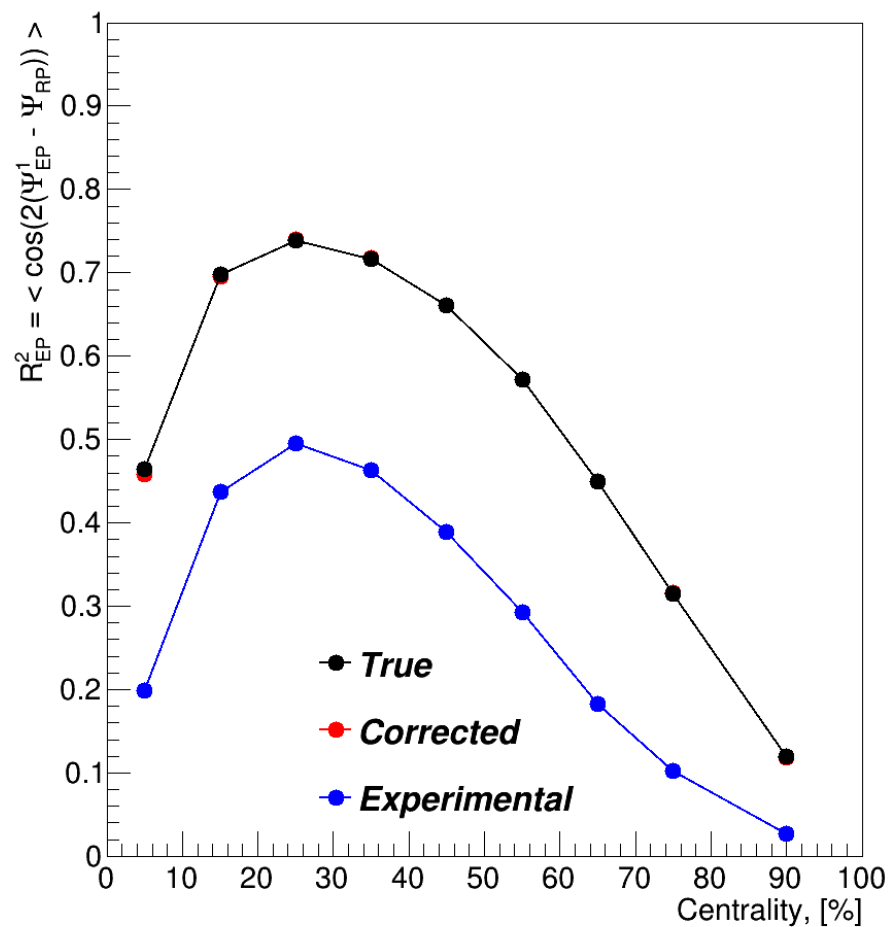
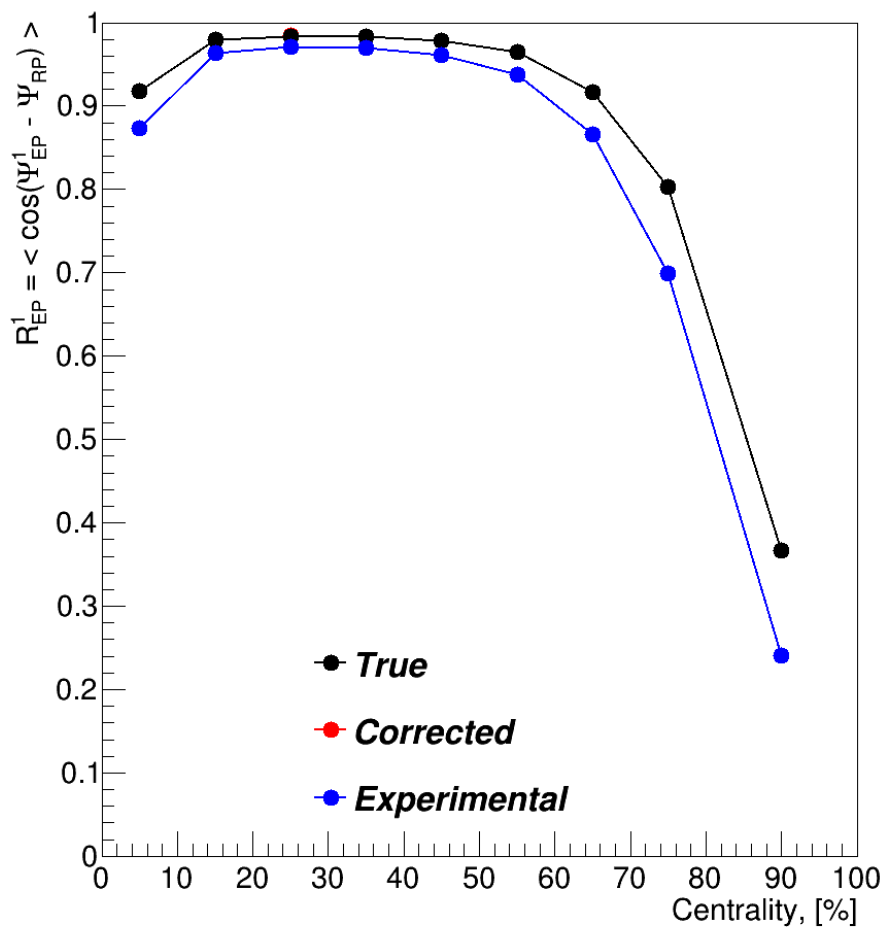
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<sup>1</sup> A. M. Poskanzer, S. Voloshin Phys.Rev. C (1998) 58. pp. 1671–1678



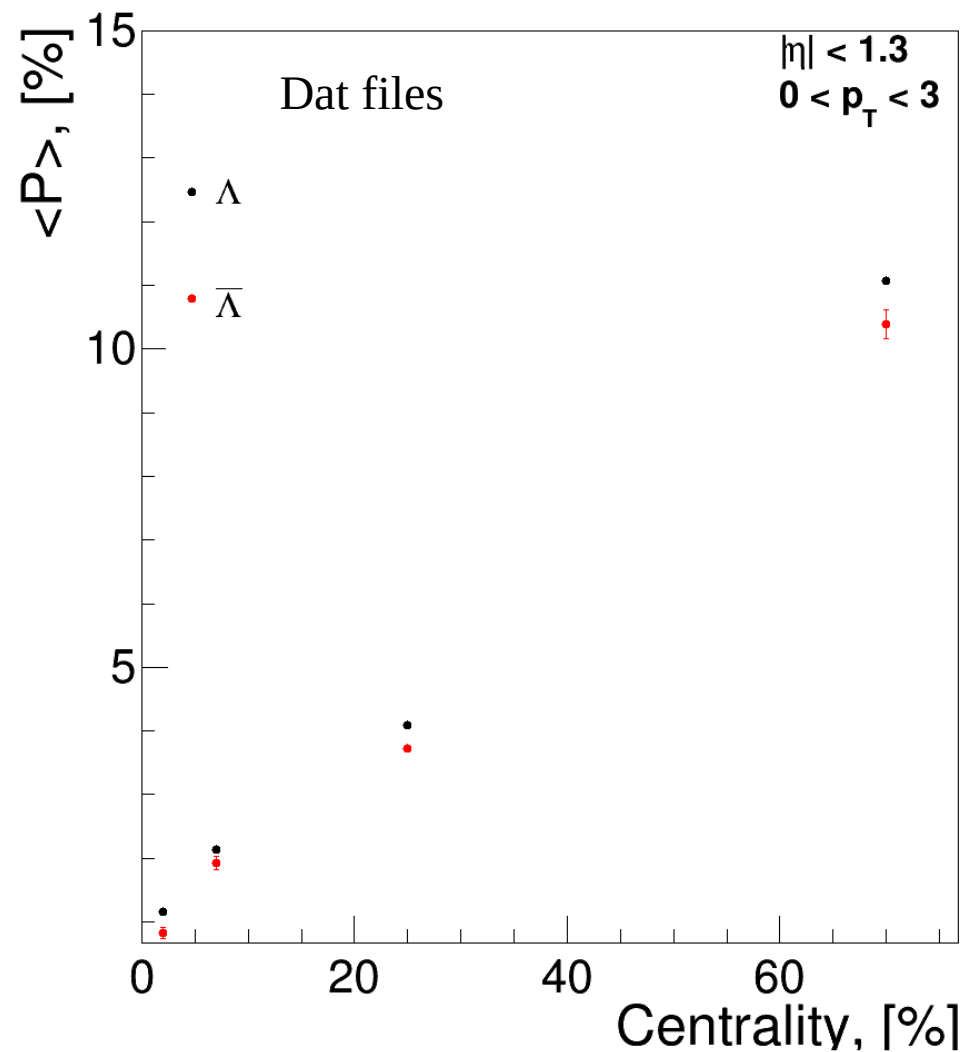
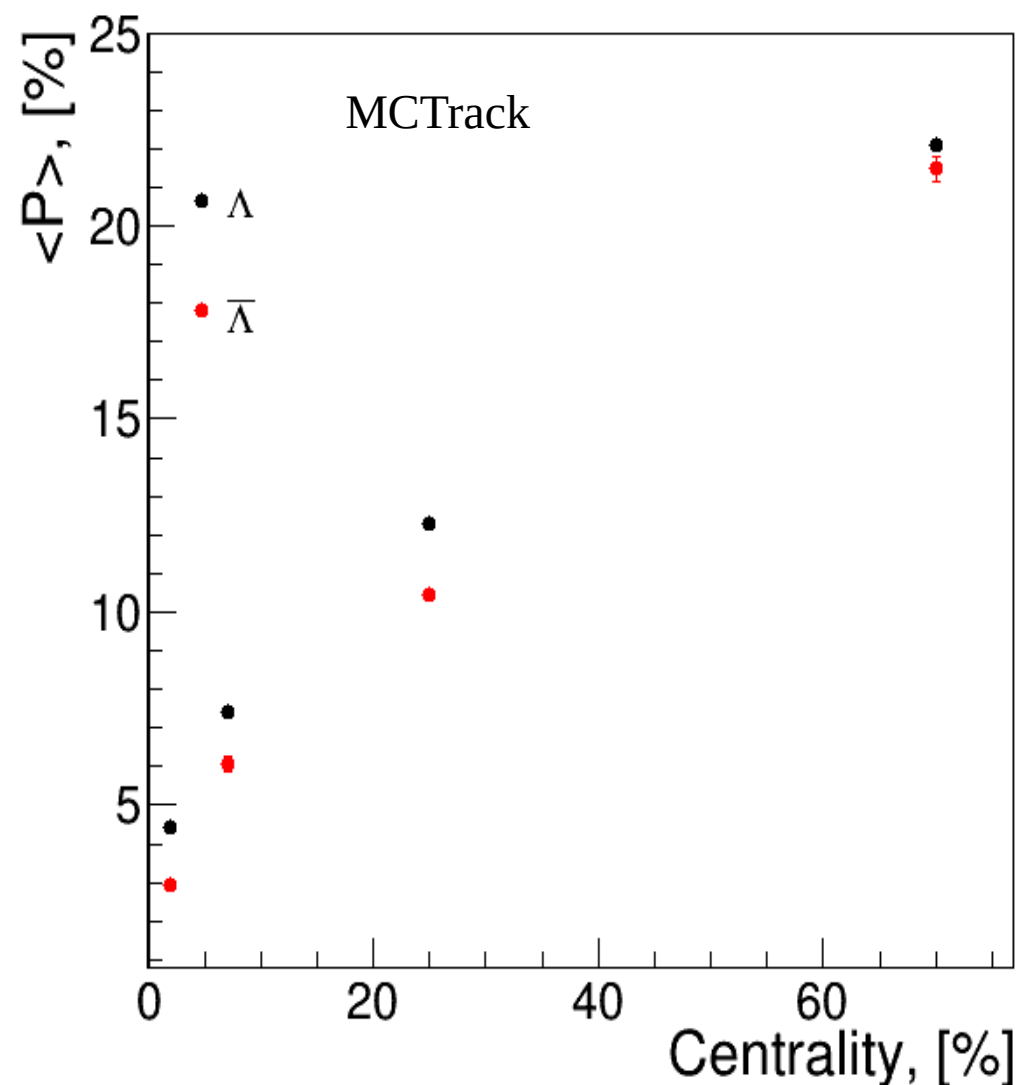
- Centrality is calculated via TPC multiplicity
- Event Plane angle through FHCAL (raw and corrected)
- ➔ Need to estimate experimental resolution (using sub-event resolution)





Experimental resolution (estimated from sub-event resolution)

<sup>1</sup> A. M. Poskanzer, S. Voloshin Phys.Rev. C (1998) 58. pp. 1671–1678



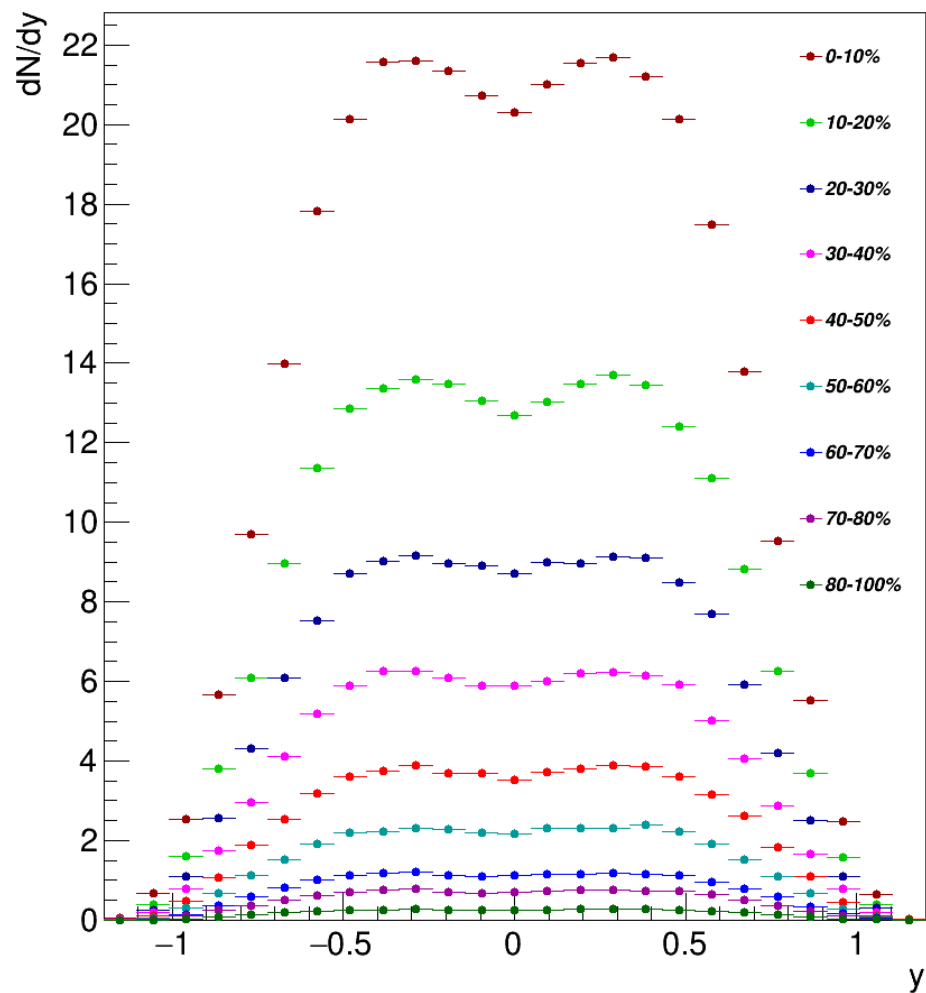
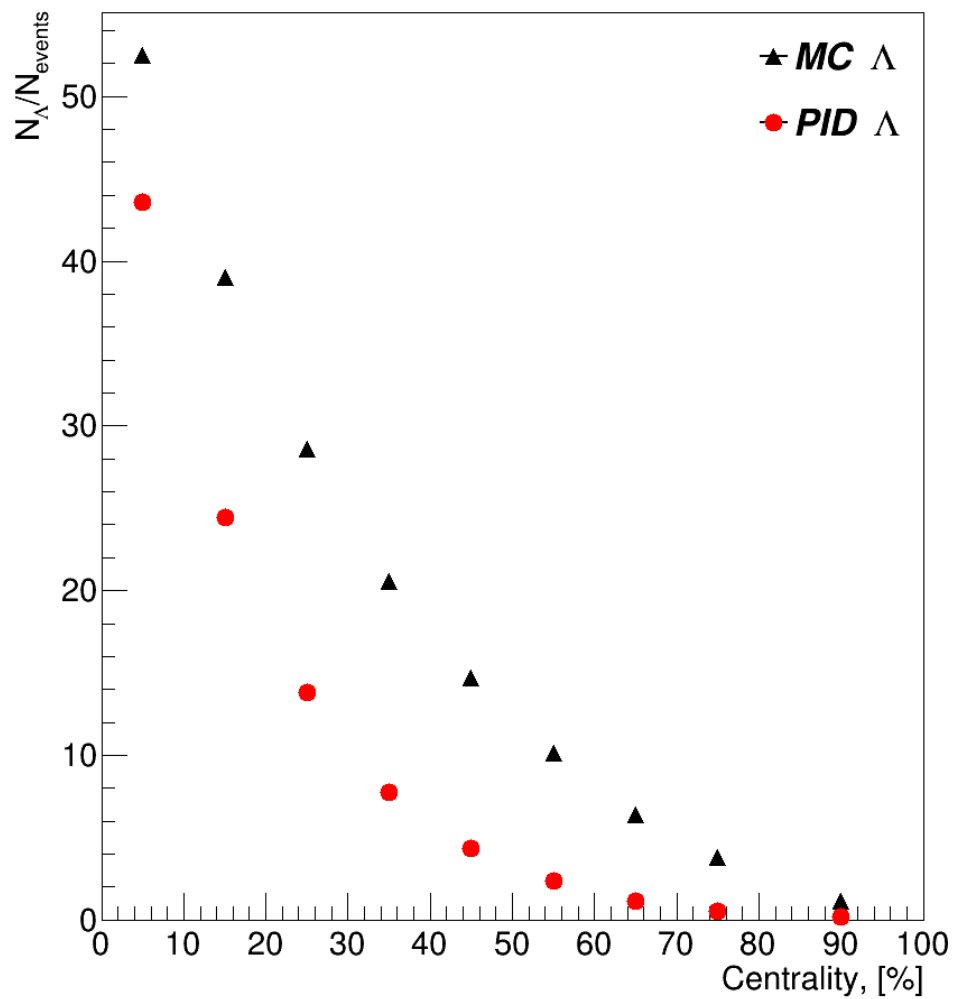
- Mean values ( $\langle P_y \rangle$ ) from MCTracks (left), from .dat files (right)
- Solved the problem with incorrect values in MCTracks → currently testing



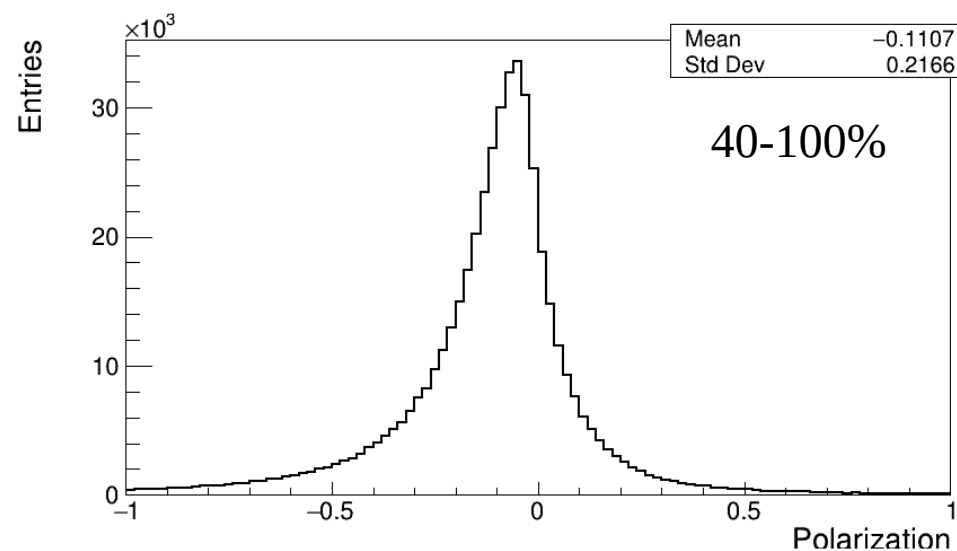
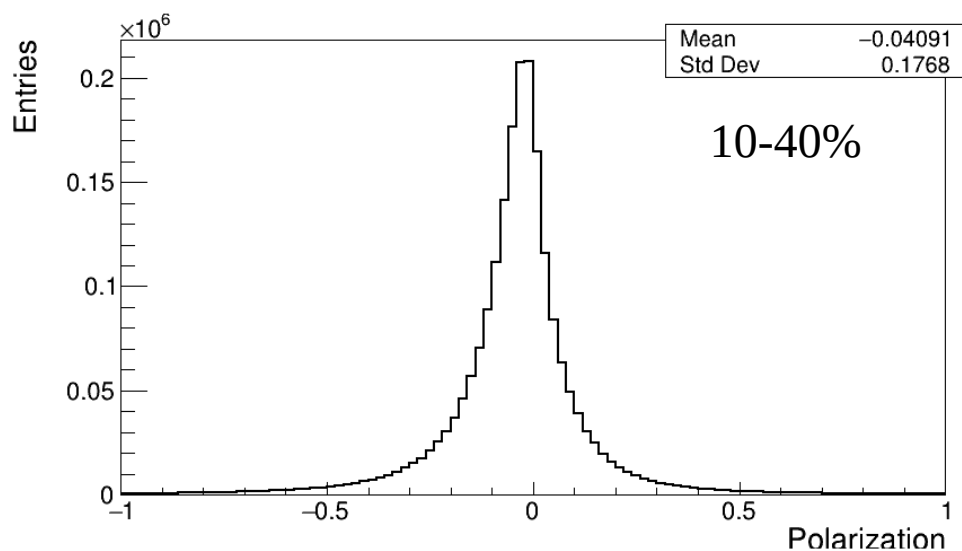
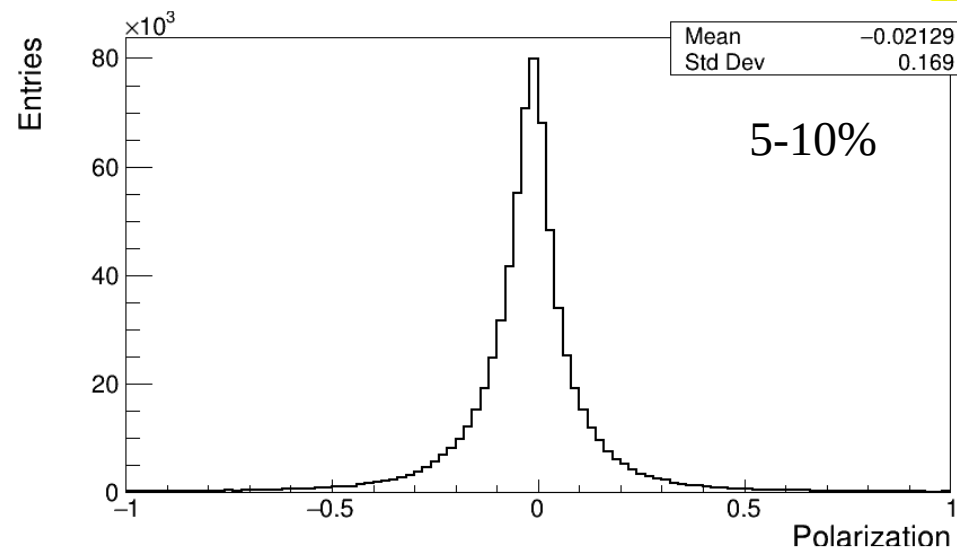
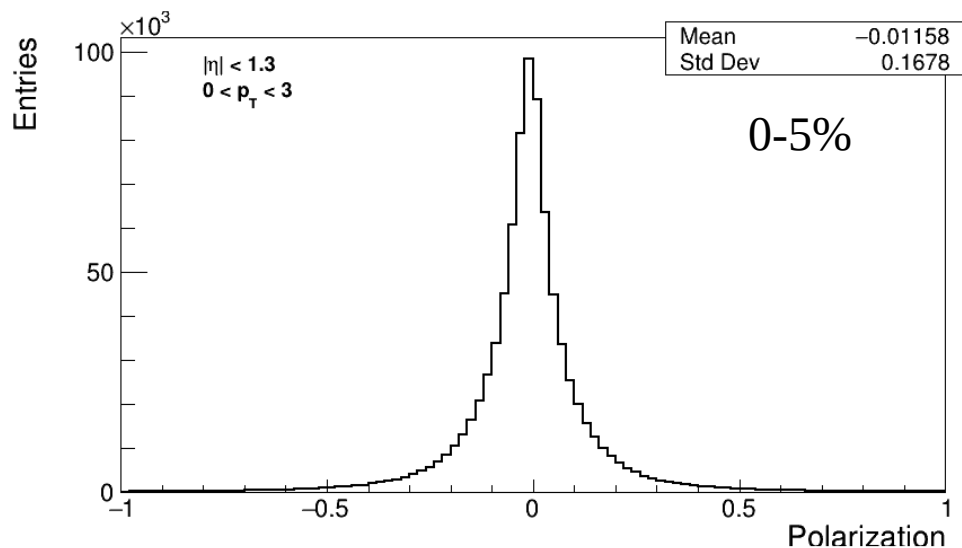
- Progress update
  - Checked new centrality calibration
  - Event plane via FHCAL w.r.t. new centrality from TPC
  - Experimental event plane resolution
  - Fixed the issue with polarization transfer to MCTracks
- Outlook
  - Waiting on the official code for centrality determination
  - Testing updated polarization transfer
  - Polarization transfer to secondary lambda
  - Global polarization reconstruction



Thank you for your attention!

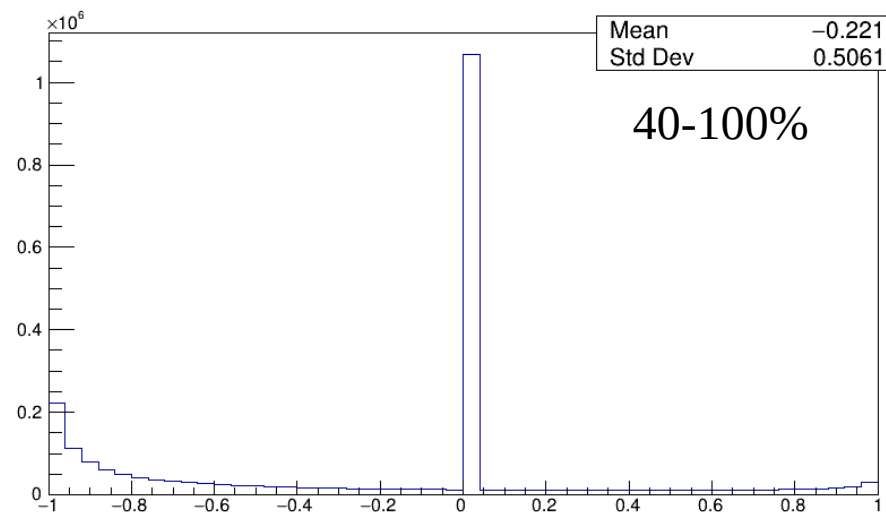
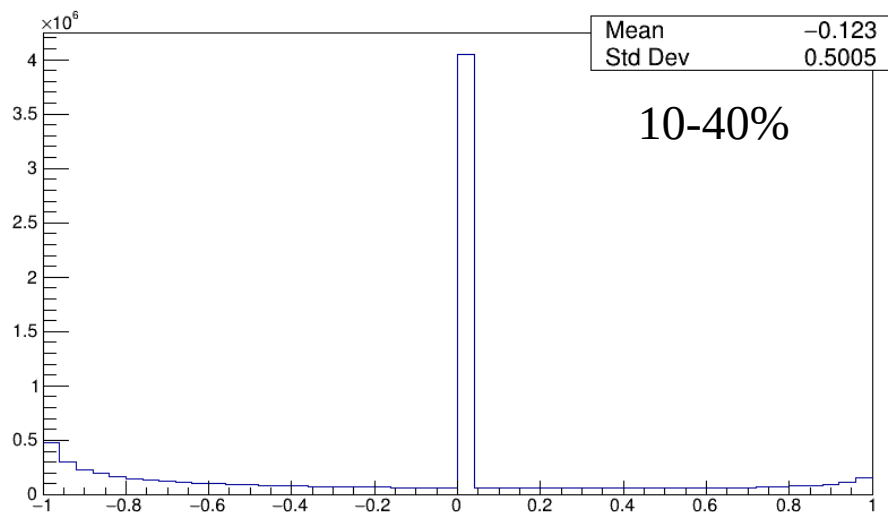
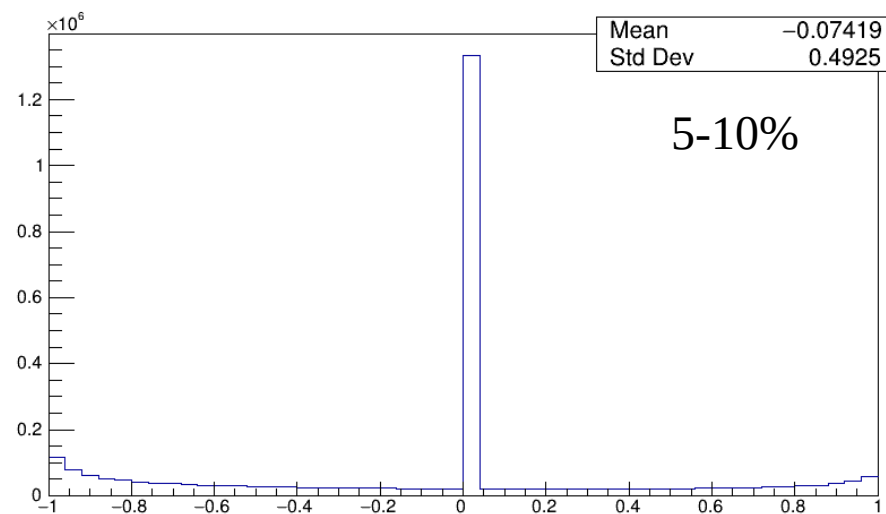
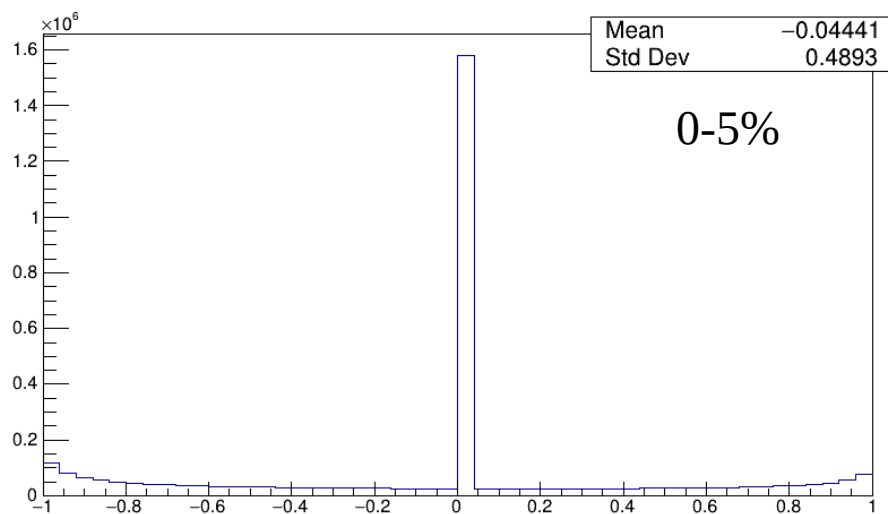


# Results (.dat files)



Values from the PHSD .dat files

This shows how the distributions  $P_y$  for Lambda,  $-\langle P_y \rangle$  corresponds to mean global polarization value



## 1. Polarization from MCTrack ( $P_y$ for Lambda)