Performance of invariant mass fit method for global polarization measurements of Λ hyperons in the MPD experiment

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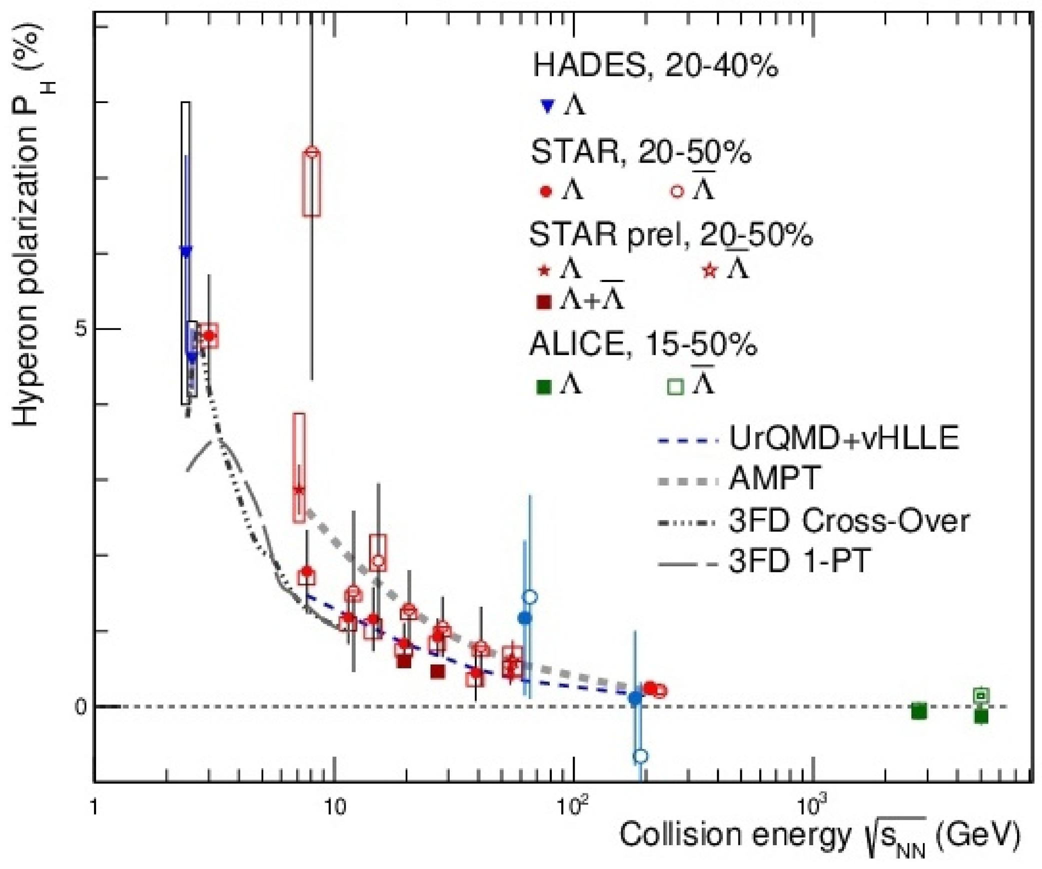
P_H at Nuclotron-NICA energies



$$\frac{dN}{d\cos\theta^*} = \frac{1}{2}(1 + \alpha_H |\vec{P_H}| \cos\theta^*)$$

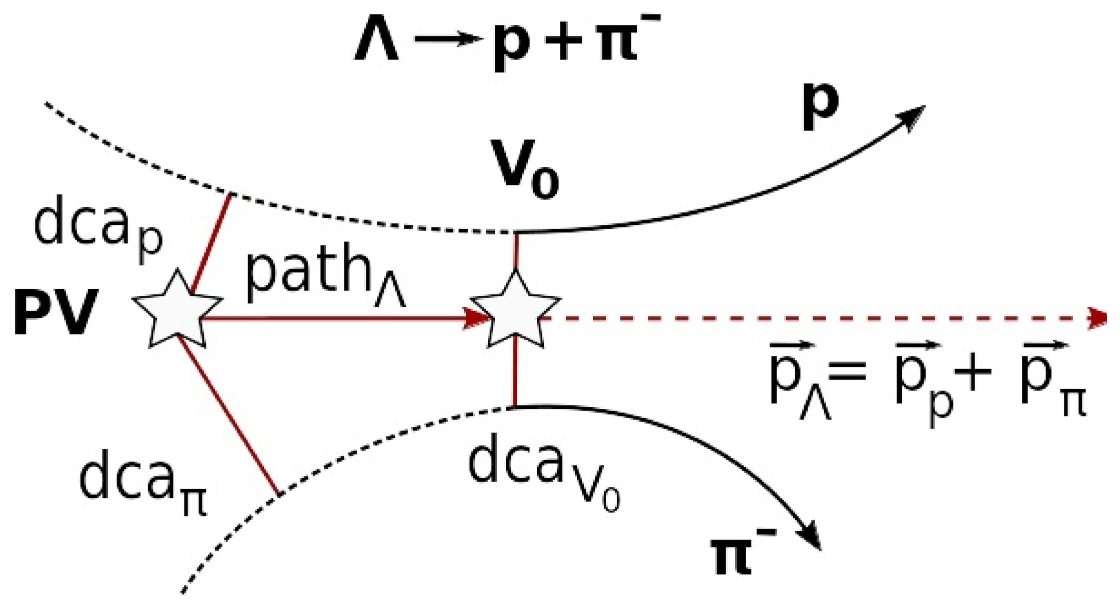
NICA energy range will provide new insight of:

- Evolution of polarization at lower energies(model-dependent peak location)
- Origin of the global polarization signal(thermal approach, axial vortical effect, chiral vortical effect)

Studying the global polarization of Λ with the MPD experiment will provide information about:

- **$\Lambda(\bar{\Lambda})$ - splitting of global polarization**
- **Energy and kinematical dependences, improving precision**
- **Probing the vortical structure using various observables**

Λ reconstruction



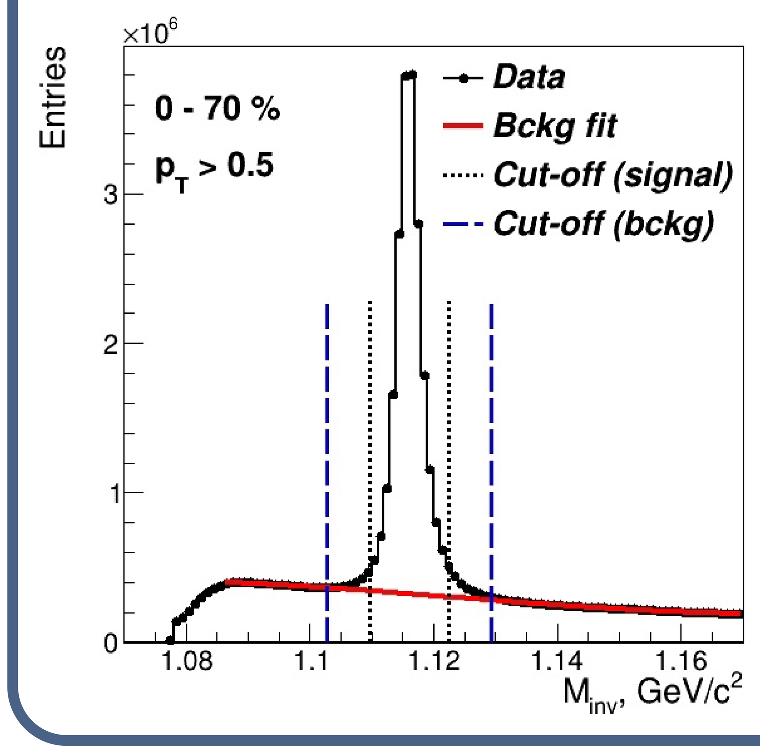
P_Λ using the azimuthal angle of proton: $\bar{P}_\Lambda = \frac{8}{\pi\alpha}\frac{1}{R^1_{EP}}\langle \sin(\Psi^1_{EP} - \phi^*)\rangle$, * - in Λ rest frame

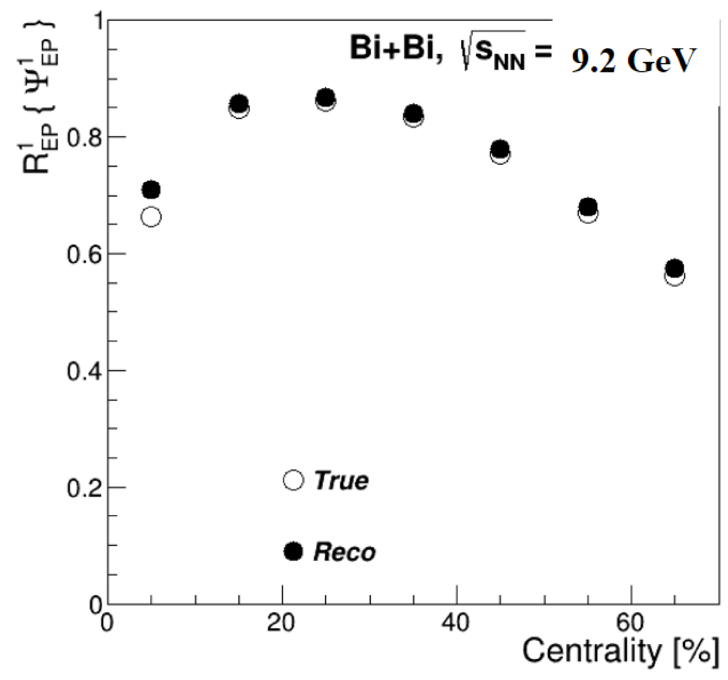
Event plane resolution is obtained from FHCal

Selection of Λ with ω_2: $\omega_2 = \ln\frac{\sqrt{\chi^2_\pi \chi^2_p}}{\chi^2_\Lambda + \chi^2_{V_0}}$

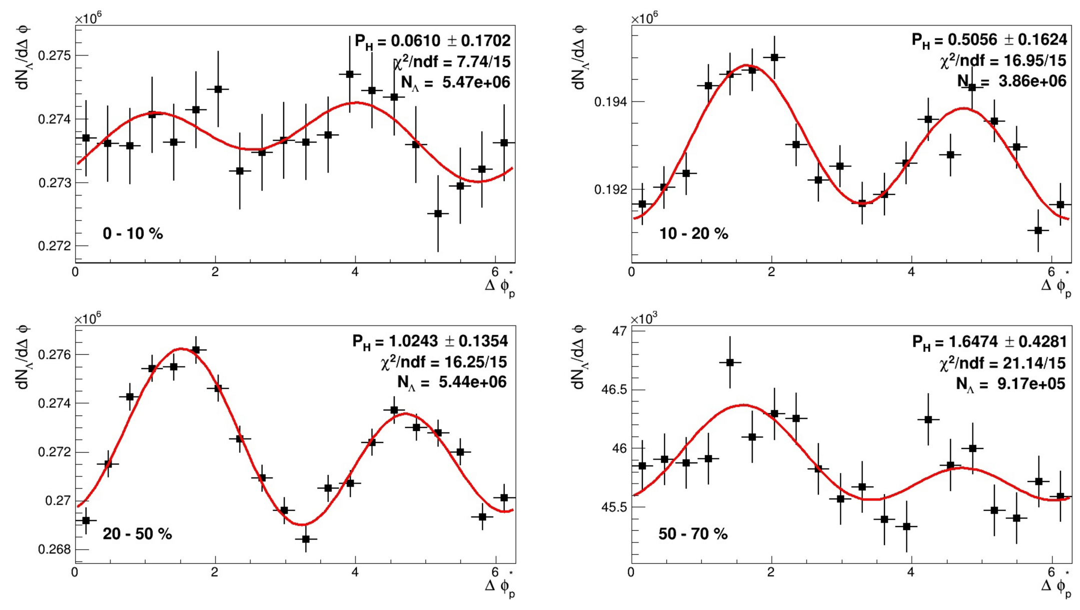
or χ^2(5 parameters): $\chi^2_\pi, \chi^2_p, \chi^2_{V_0}, path_\Lambda, angle_\Lambda$

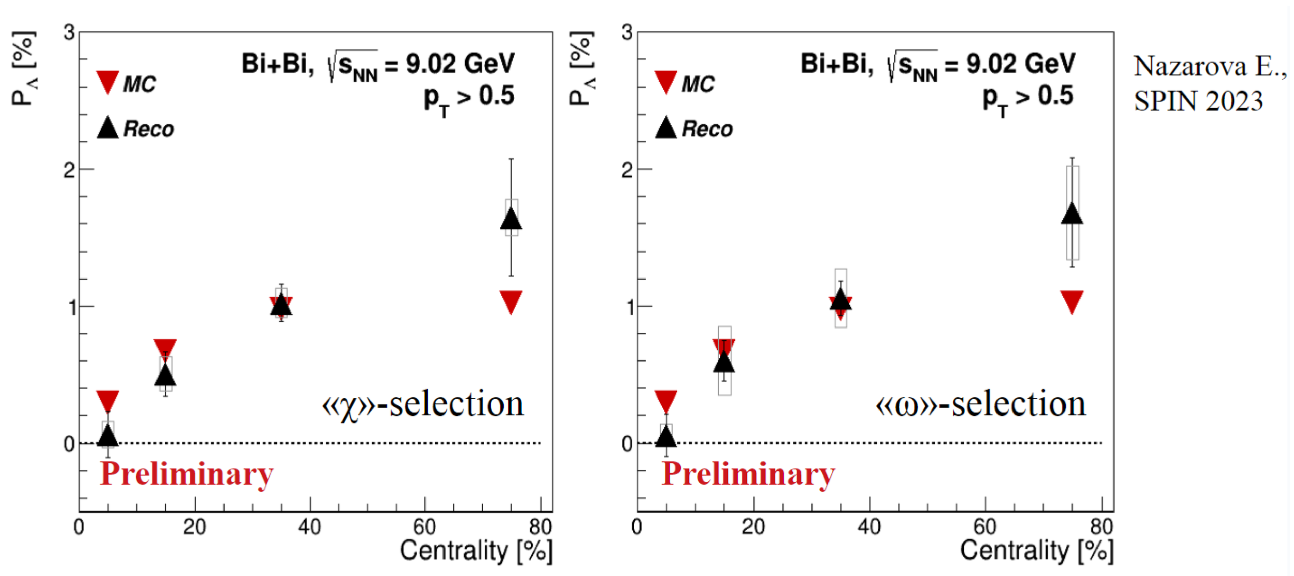
Fit inv mass in bins of selection parameters and take with maximum significance.





$\Delta\phi$ fit method



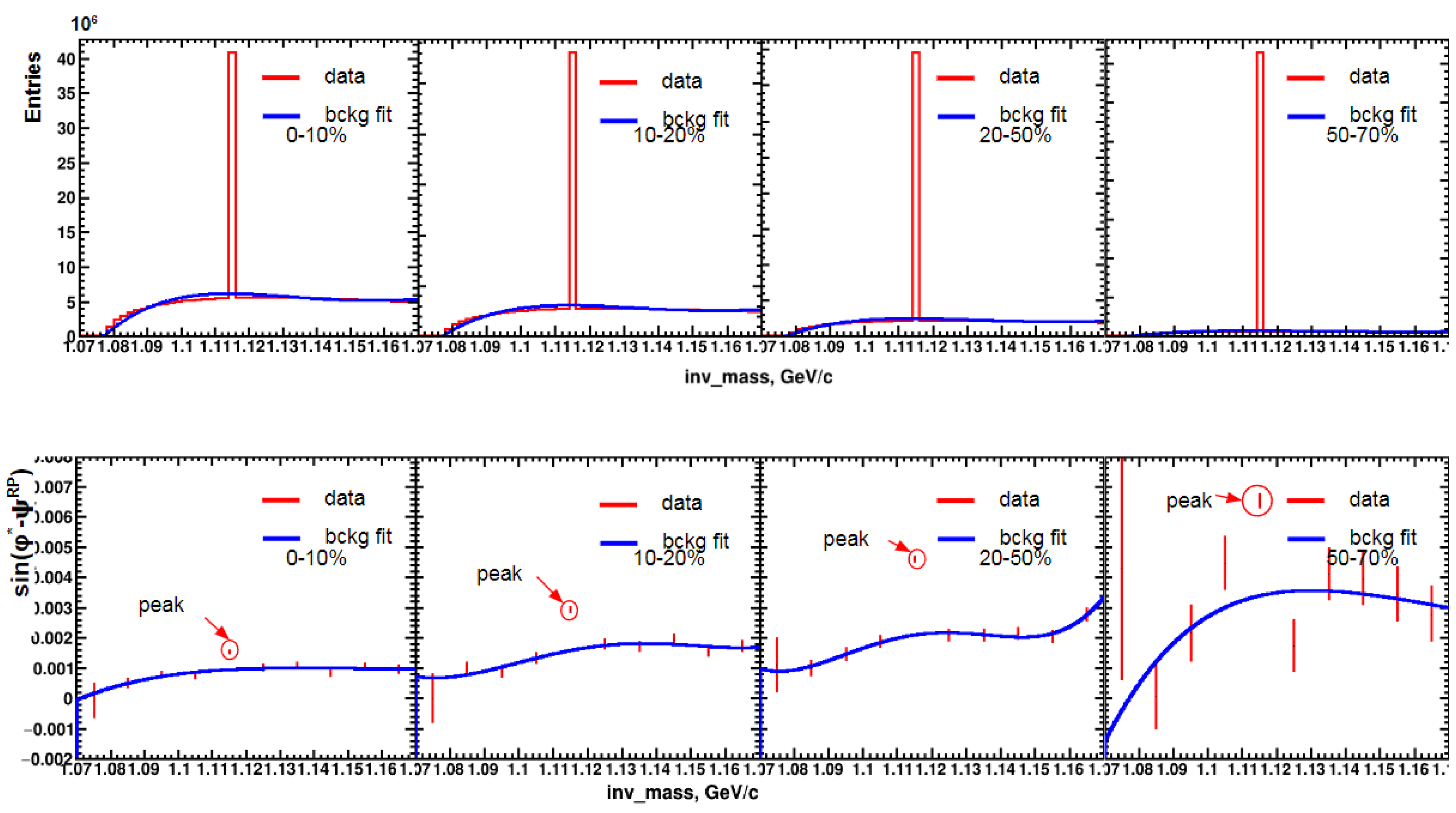


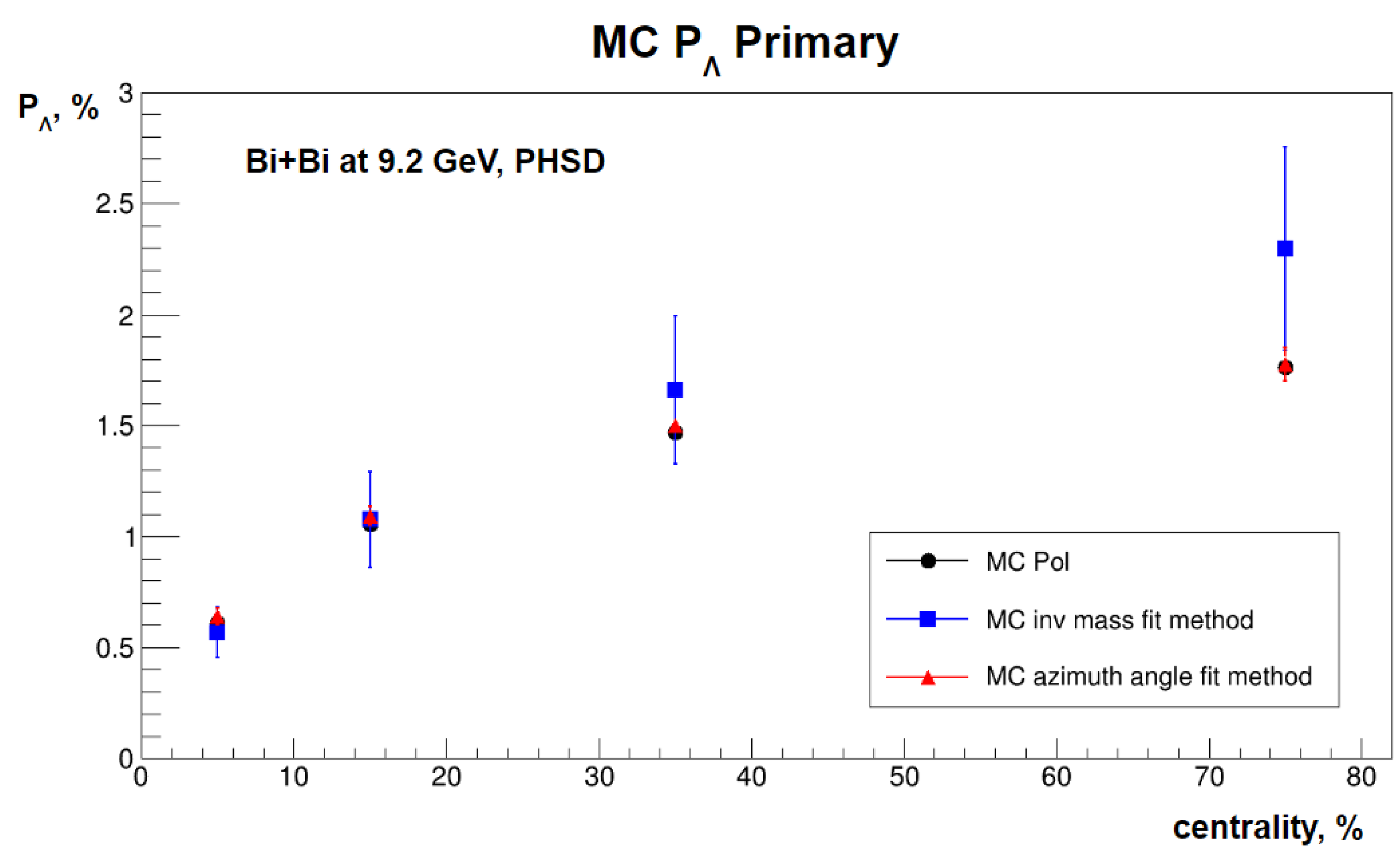
Fitting inv mass in $\Delta\phi$ bins to obtain signal-to-background ratio, then fitting $\Delta\phi$ with func:

$$\frac{dN}{d\Delta\phi^*_p} = p_0(1 + 2p_1\sin(\Delta\phi^*_p) + 2p_2\cos(\Delta\phi^*_p) + 2p_3\sin(2\Delta\phi^*_p) + 2p_4\cos(2\Delta\phi^*_p))$$

Rather good agreement between Monte-Carlo and Reco P_Λ for $\Delta\phi$ fit method.

Invariant mass fit method





Fitting inv mass to obtain signal-to-background ratio, then fitting $\sin(\Psi^1_{EP} - \phi^*)$ as a function of inv mass with func:

$P^{SB}_\Lambda(m_{inv}) = P^S_\Lambda(m_{inv})\frac{N^S(m_{inv})}{N^{SB}(m_{inv})} + P^B_\Lambda(m_{inv})\frac{N^B(m_{inv})}{N^{SB}(m_{inv})}$, then obtain $P^S(m_{inv})$. In result we have an agreement with Monte-Carlo within the errors.

Conclusions

- We already have rather good Λ selection and reconstruction for the MPD experiment.
- First results of invariant mass fit method was obtained for Monte-Carlo simulation for Bi+Bi at 9.2 GeV and it has an agreement with Monte-Carlo signal.
- Invariant mass fit method is more faster than $\Delta\phi$ fit method due to less fitting procedure and may have higher precision for bigger data sample.

It is important to provide further implementation of Invariant mass fit method for global polarization measurements.