Progress in event centrality calibration

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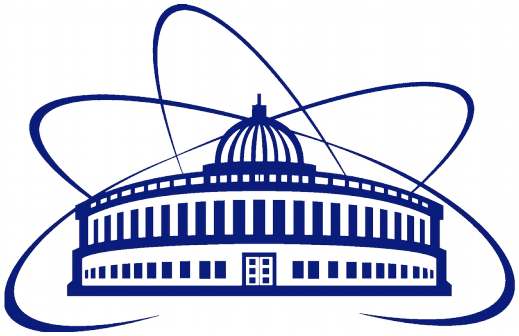
MPD PWG2 meeting



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[1] Joint Institute of Nuclear Research, Dubna, Russia

Centrality calibration

- MC-Glauber based centrality framework from MEPhI group
  - Code and documentation: https://github.com/FlowNICA/CentralityFramework
- Direct impact parameter reconstruction (Γ-fit)
  - Code and documentation: https://github.com/Dim23/GammaFit
- MC-Glauber (MC-Gl) framework → implemented (recommended)
  - Obtain charged particle multiplicity
  - Compare with MC-Glauber simulation
  - Easy-to-follow manual

For details see AN and report by P. Parfenov (https://indico.jinr.ru/event/2065/)

Centrality calibration

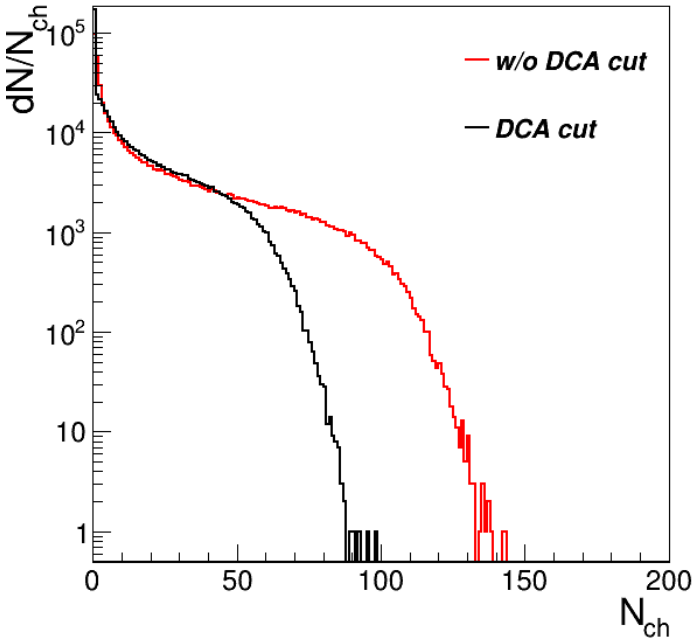
- Data: MC simulation using PHSD generator[1]
  - Au-Au, $\sqrt{s_{NN}} = 7.7$ GeV, 1.4M MB events
  - Global $\Lambda(\bar{\Lambda})$ polarization
    - Thermodynamical (Becattini) approach[2]
- Track selection criteria for reconstruction:
  - Number of TPC hits: $N_{hits} > 10$
  - $|\eta| < 1.3$

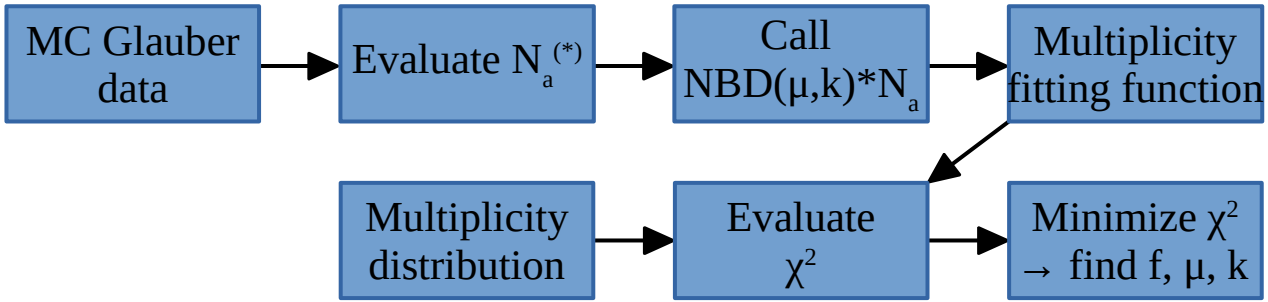
[1] W. Cassing, E. Bratkovskaya, PRC 78 (2008) 034919; NPA831 (2009) 215; W. Cassing, EPJ ST 168 (2009) 3

[2] F. Becattini, V. Chandra, L. Del Zanna, E. Grossi, Ann. Phys. 338 (2013) 32

Centrality calibration

- MC-Glauber based centrality framework
  - Comparison of multiplicity distribution with MC Glauber simulation
- Selection for Multiplicity (500k events recommended):
  - $|\eta| < 0.5$
  - $p_T > 0.15$
  - $N_{hits} > 16$
  - $|DCA| < 0.5$ cm (optional)

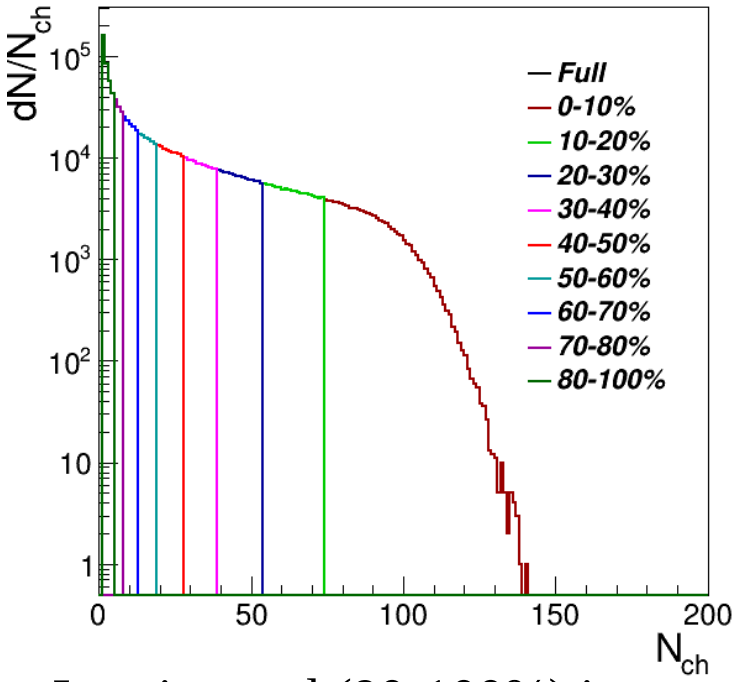




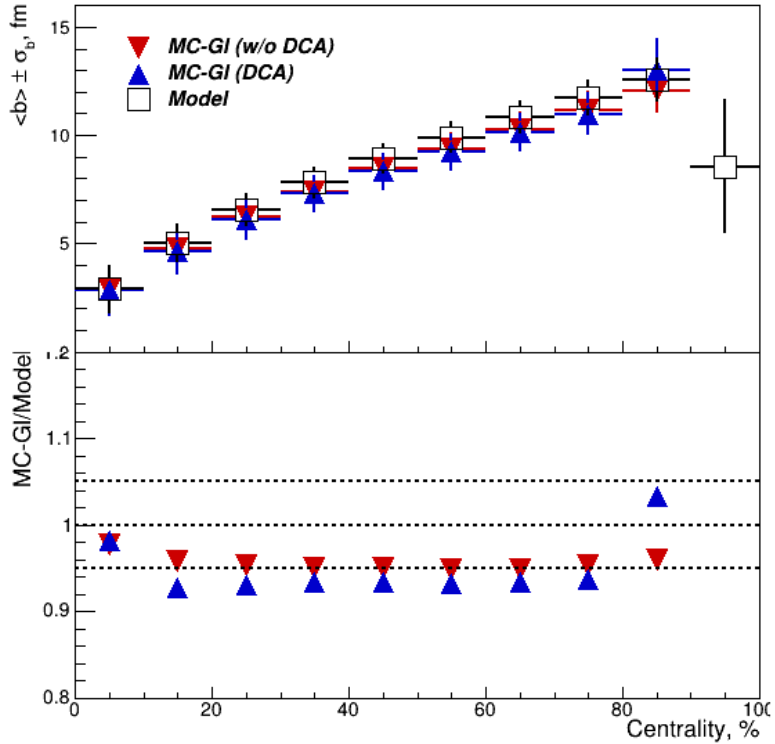
- NBD — negative binomial distribution

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

Centrality calibration

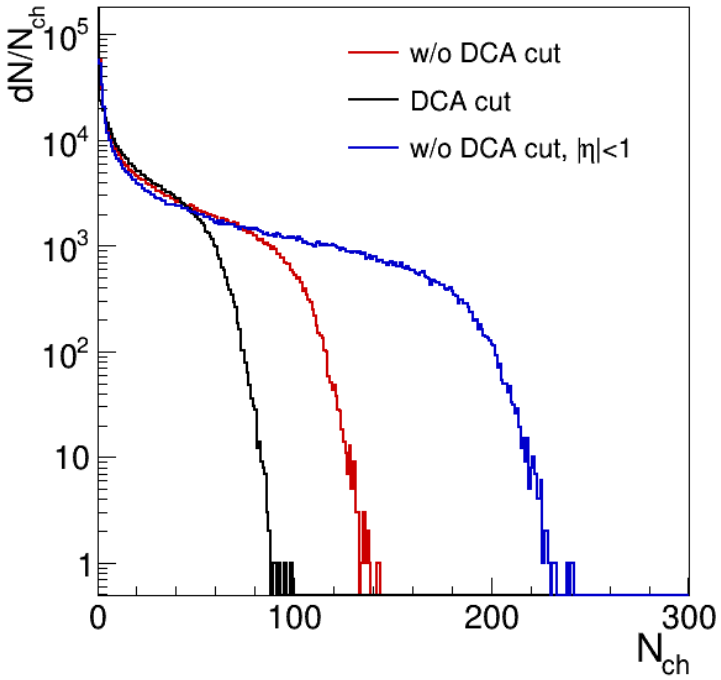


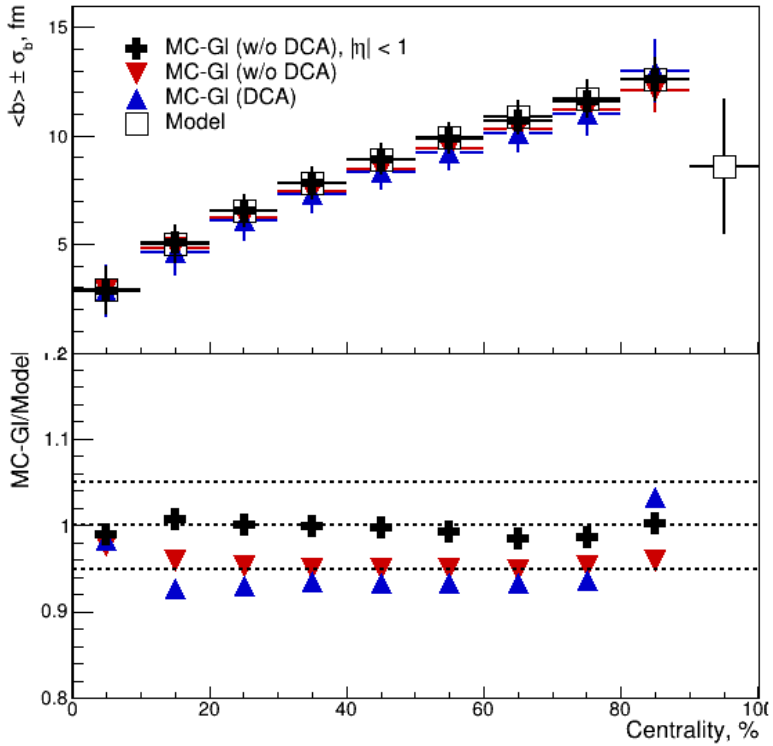
- Last interval (90-100%) is not determined correctly
  - Combined into 80-100%
- ~ 300k (20%) events discarded (zero multiplicity)



- MC-Gl method evaluation of impact parameter
  - Agreement within ~ 5%
  - Better agreement w/o DCA cut

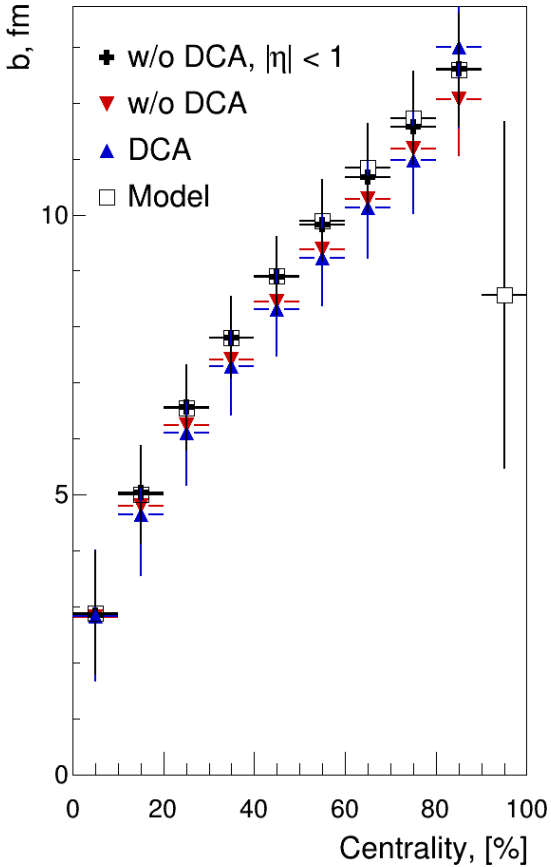
Centrality calibration (testing)

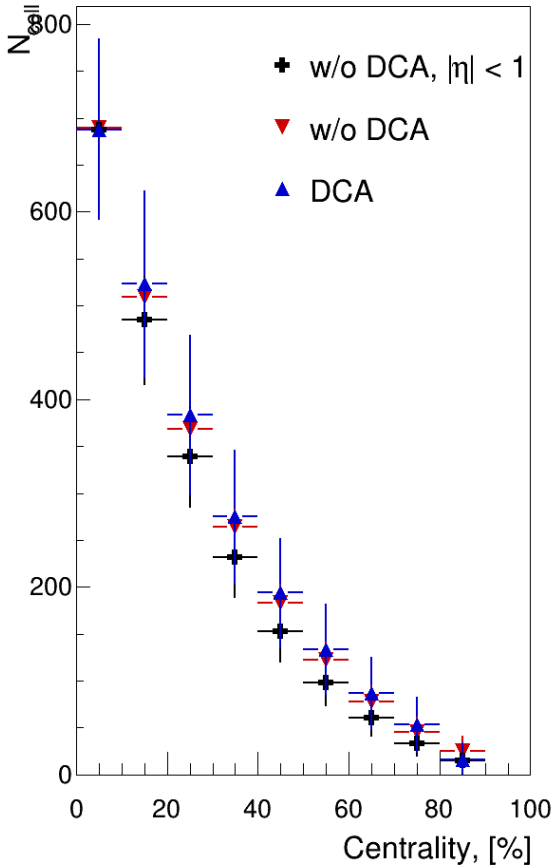


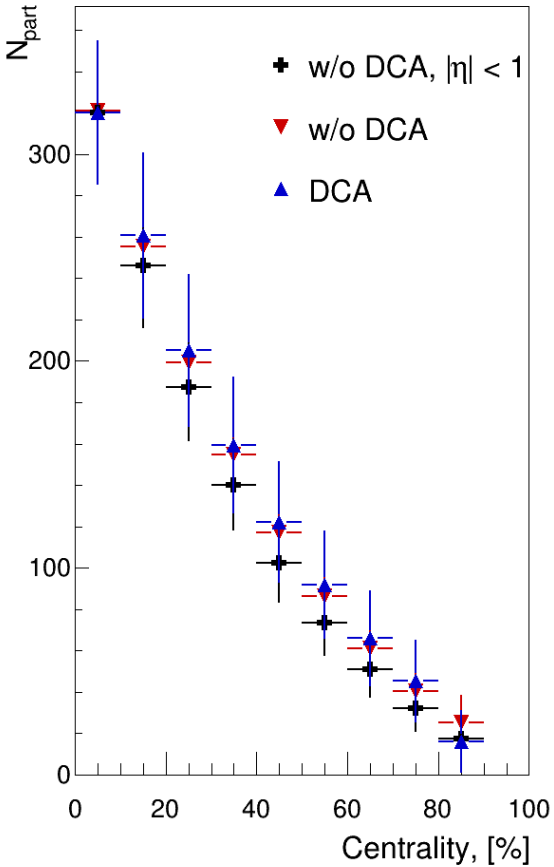


- Testing with $|\eta|<1.0$ (default is $|\eta|<0.5$)
  - Higher values of multiplicity
  - Still problem with 90-100% centrality
- Better agreement with model for b

Centrality calibration (testing)







- MC-Gl method provides information about b, N_{part}, N_{coll}

Conclusions

- Summary
  - Implemented MC-Glauber framework for centrality calibration for the PHSD dataset (AuAu @7.7 GeV)
  - Recommended cuts provide reasonable extraction of impact parameter (agreement within ~ 5%)
  - Problem with determination of the last centrality interval (90-100%)
- Outlook
  - Framework is ready-to-use
  - Varying parameters could provide a better result → need to investigate further
  - Should the choice be dependent on the dataset or universal for all?
  - Do we need to implement Γ-fit method?

Conclusions

Thank you for your attention!