

Study of the charged particles correlations in Xe+W interactions at an energy of 3.0 GeV/n

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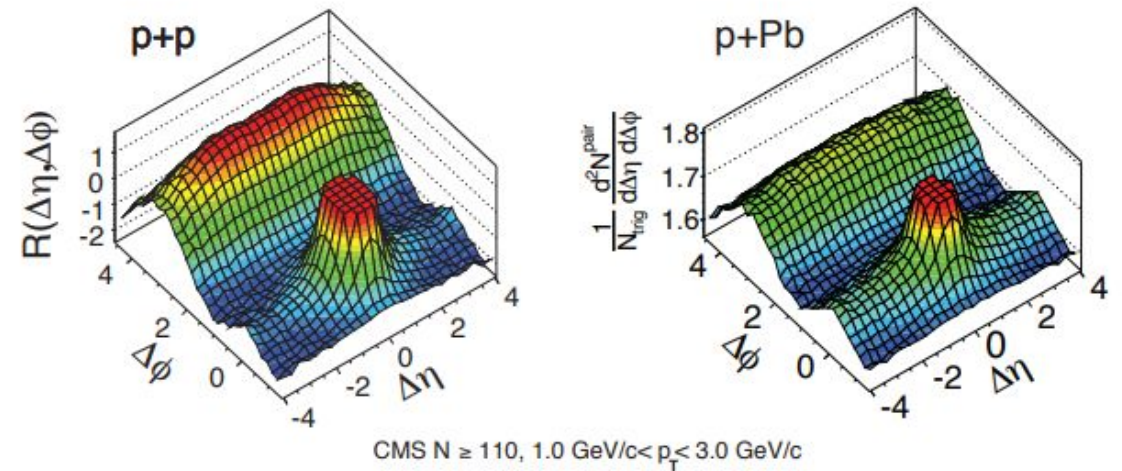
DSS collaboration
LHEP JINR

Outlook

1. Motivation
2. Experiment at Nuclotron ITS
3. PHQMD model
4. Comparison of the experiment with simulation
5. Conclusions

Motivation

- 1) Flows
- 2) HBT correlation
- 3) Ridge effect
- 4) Two-particle angular correlations
- 5) Three-particle angular correlations



Detector setup

Large detectors

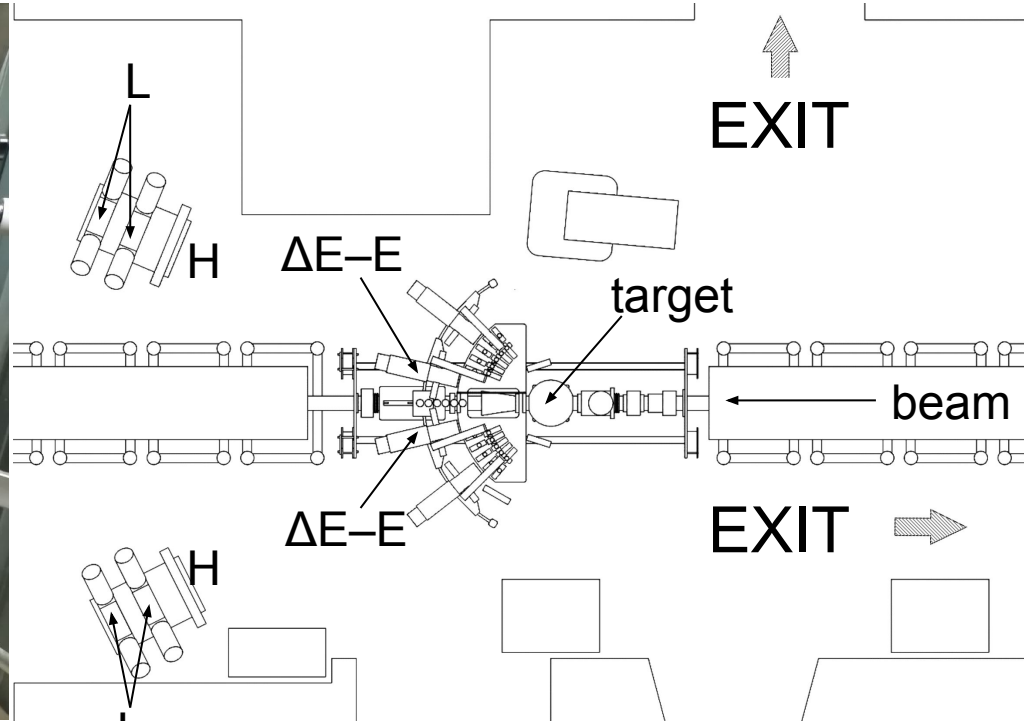
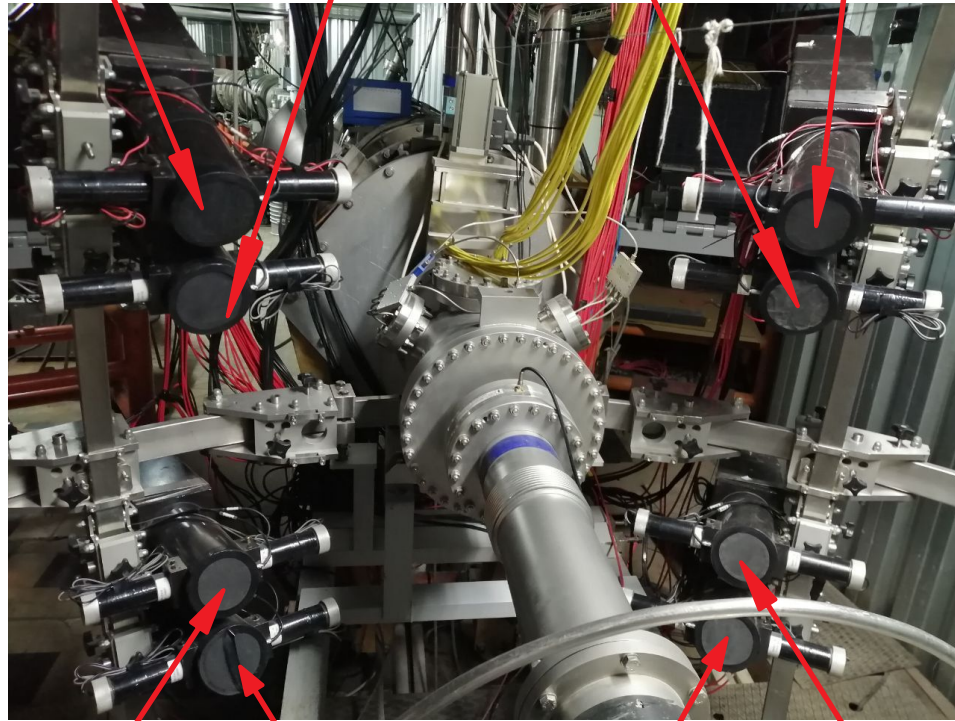
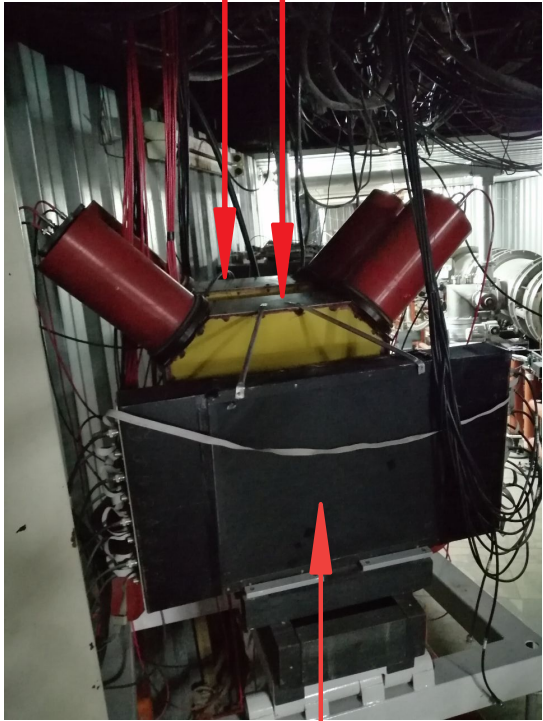
$\Delta E-E1$

$\Delta E-E3$

$\Delta E-E4$

$\Delta E-E2$

Internal Target Station



Hodoscope

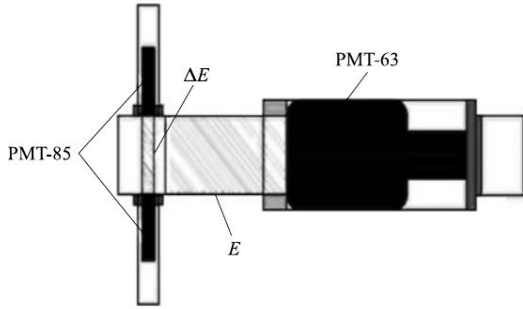
$\Delta E-E9$

$\Delta E-E5$

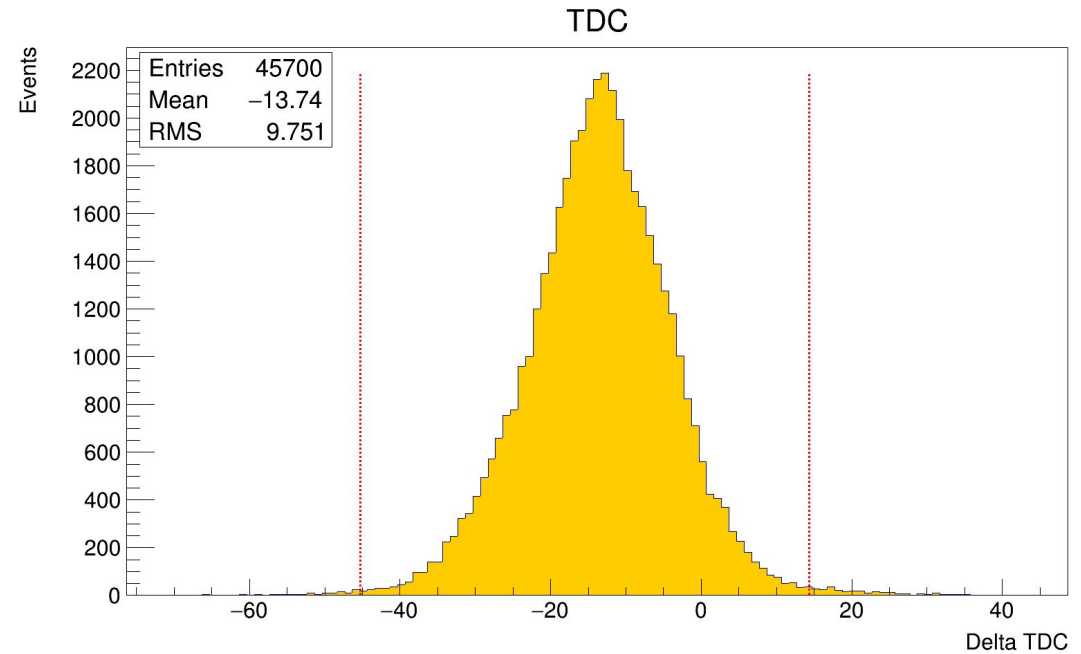
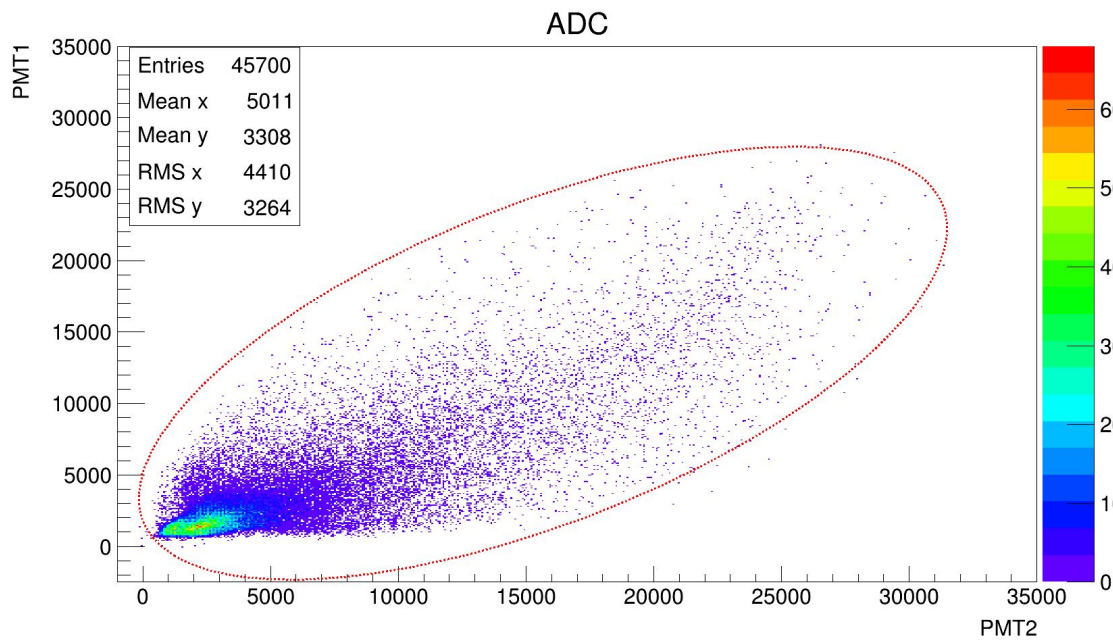
$\Delta E-E6$

$\Delta E-E8$

Selection by ΔE -E detectors

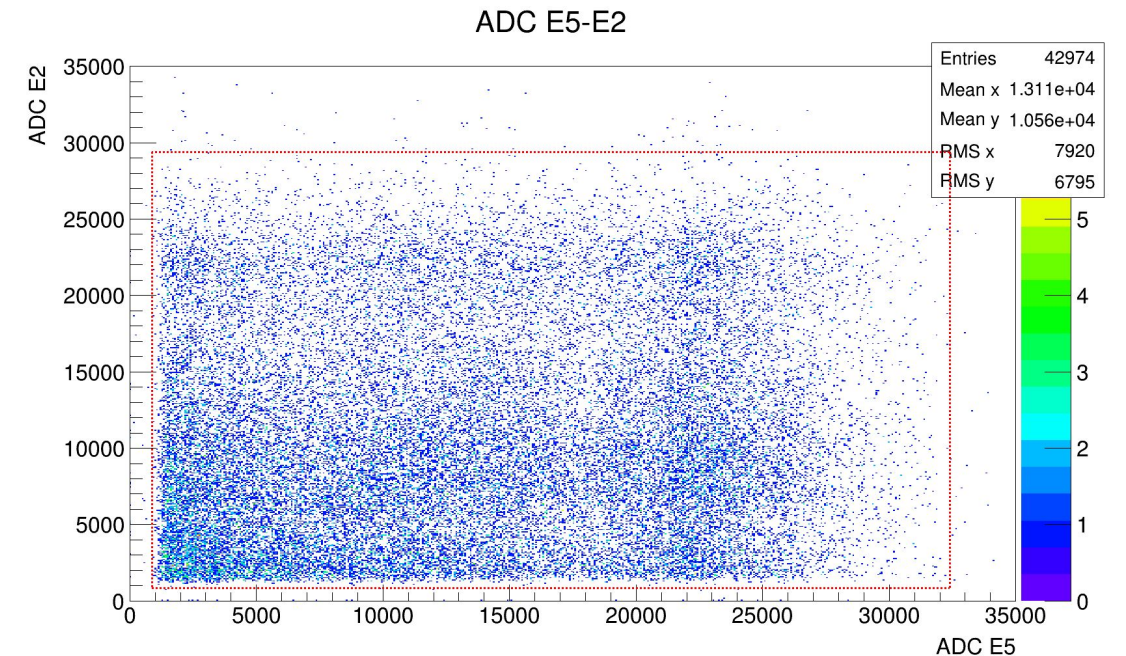
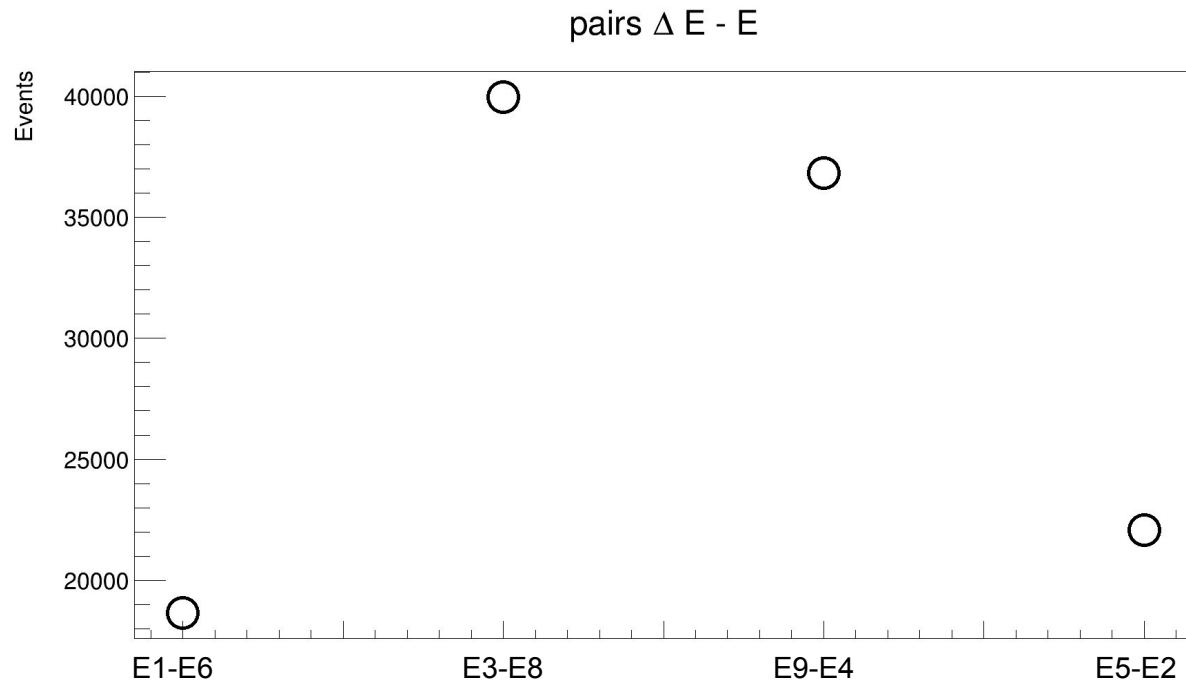
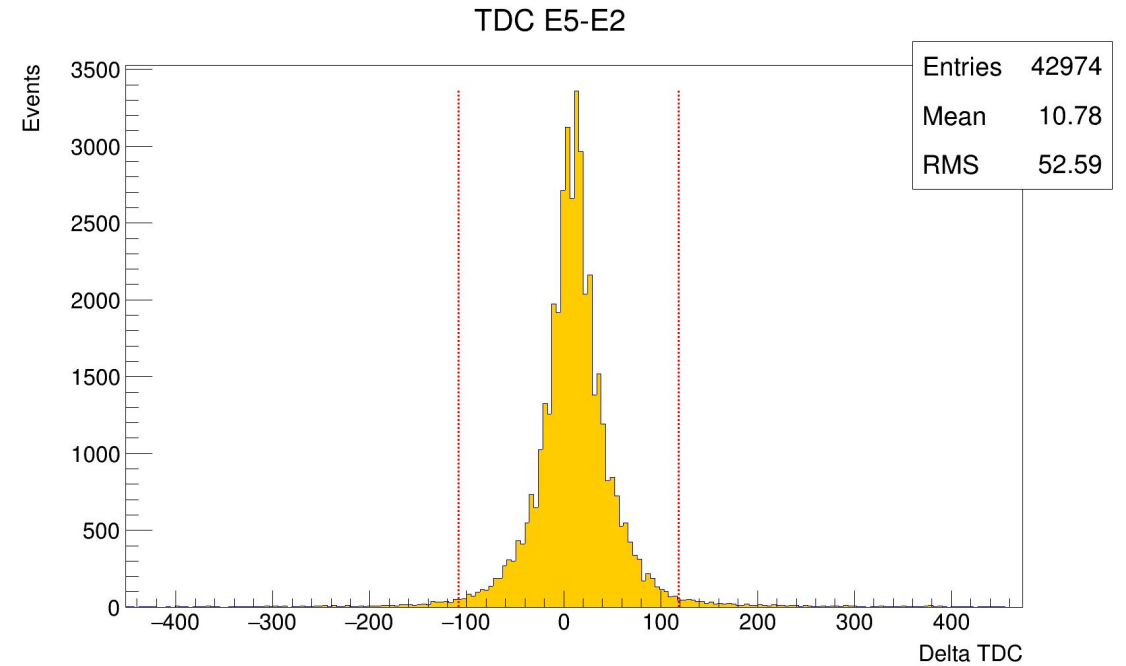
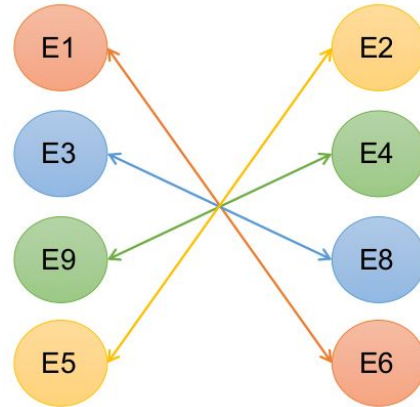


Coincidences of the signals from **3 PMTs of each ΔE -E** detector were used as a software **trigger**. Time of flight difference and correlation of ionization losses were used to select useful events.

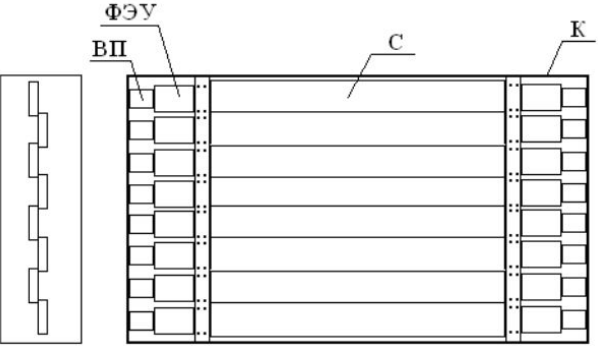


Selection scattering plane

We select four ΔE -E detectors pairs placed in one scattering plane.
TDC and ADC information was also used.

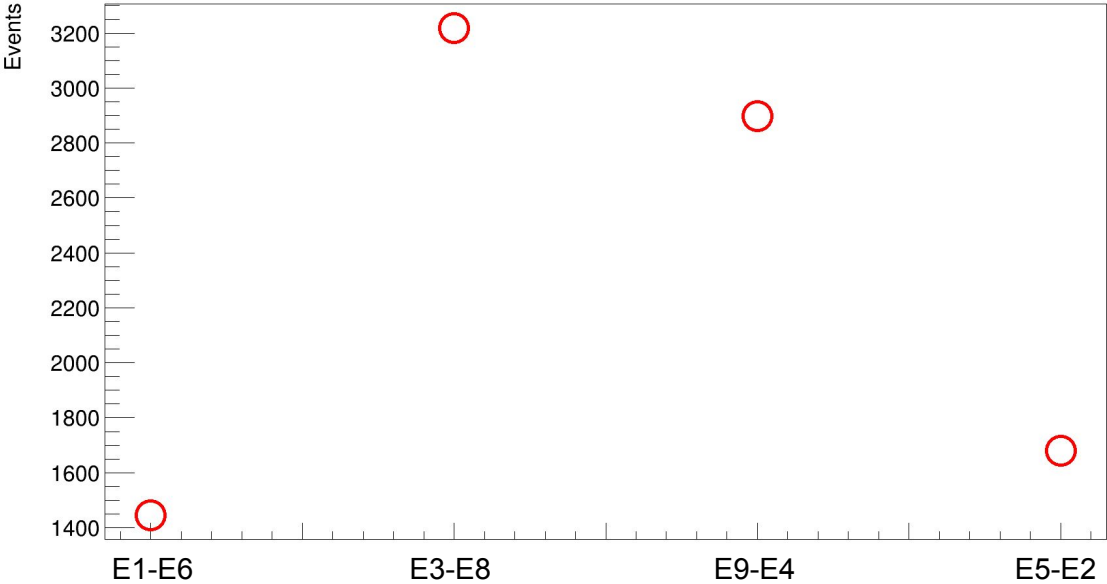


Selection of 3-particles correlation

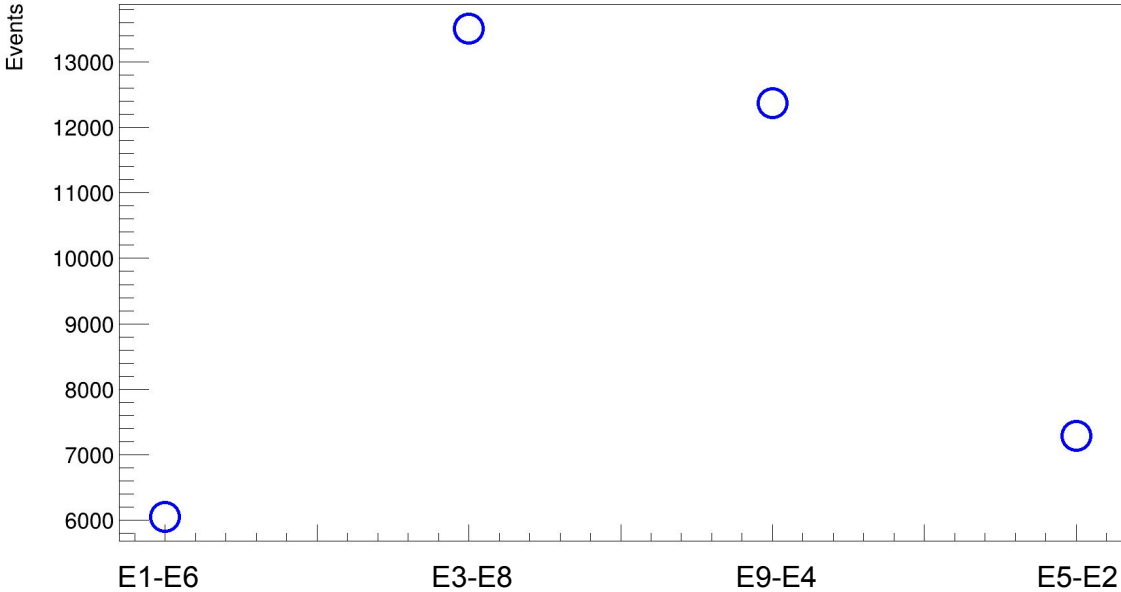


The **full selection events** is the next: coincidences of the signal six PMTs in **pair $\Delta E-E$** and **not any other pairs $\Delta E-E$** , coincidences of the signal one or two nearby scintillators in **hodoscope** and not any other strips, also coincidences of the signal two **large** scintillators behind hodoscope.

pairs $\Delta E - E$ and left Hodoscope



pairs $\Delta E - E$ and right Hodoscope



PHQMD generator

Transport approach is designed to provide a microscopic description of nuclear cluster and hypernucleus formation as well as of general particle production in heavy-ion reactions at relativistic energies. The clusters are identified by the MST or the SACA algorithm which finds the most bound configuration of nucleons and clusters. Collisions among hadrons as well as Quark-Gluon-Plasma formation and parton dynamics in PHQMD are treated in the same way as in the established PHSD transport approach.

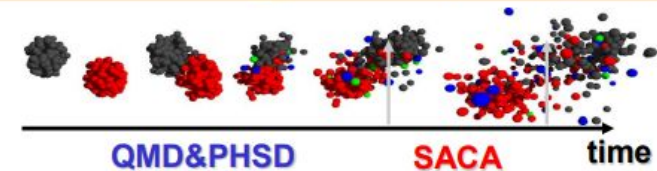
Realization: combined model **PHQMD** = (PHSD & QMD) & SACA

Parton-Hadron-Quantum-Molecular Dynamics

Initialization → propagation of baryons:
QMD (Quantum-Molecular Dynamics)

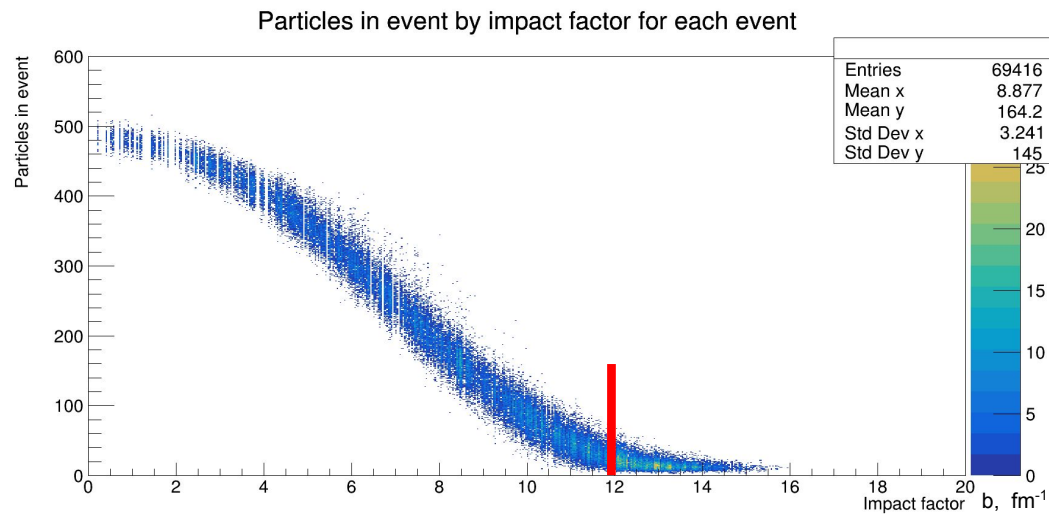
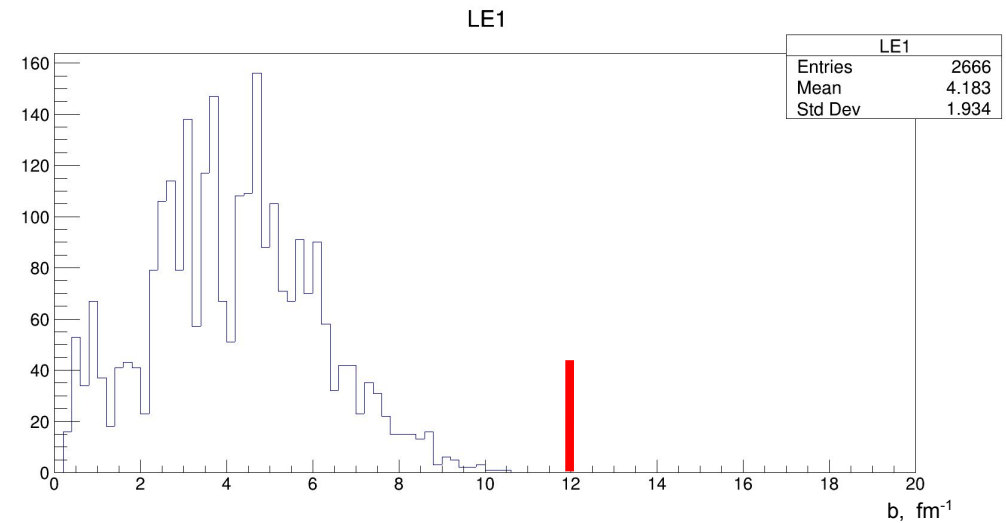
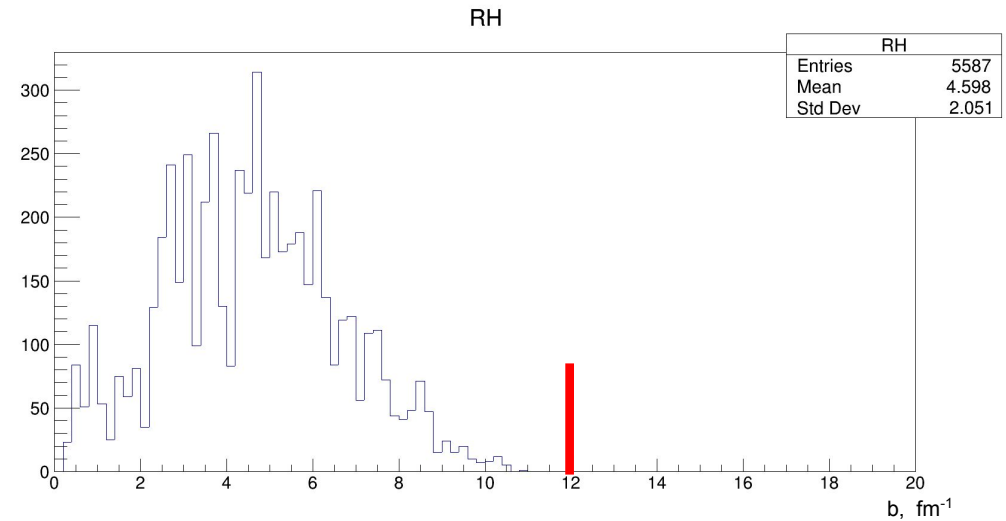
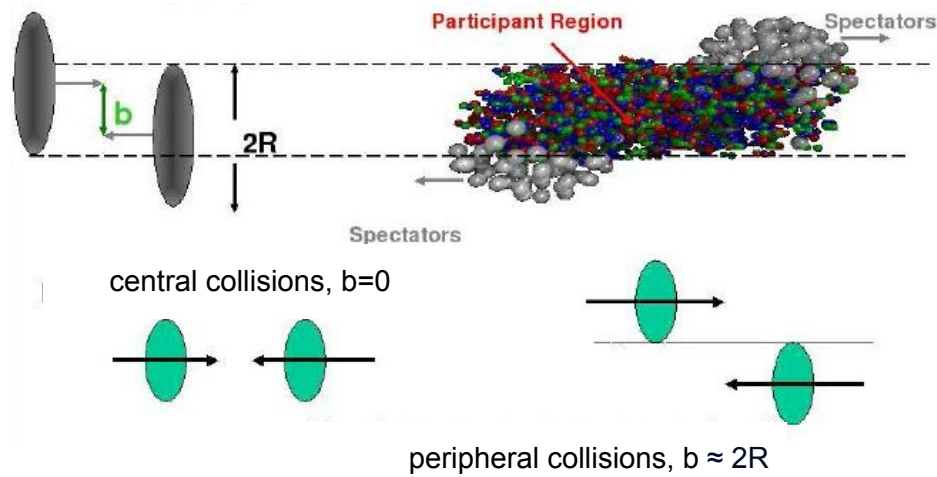
Propagation of partons (quarks, gluons) and mesons
+ **collision integral** = interactions of hadrons and partons (QGP)
from **PHSD** (Parton-Hadron-String Dynamics)

Clusters recognition:
SACA (Simulated Annealing Clusterization Algorithm)
vs. **MST** (Minimum Spanning Tree)



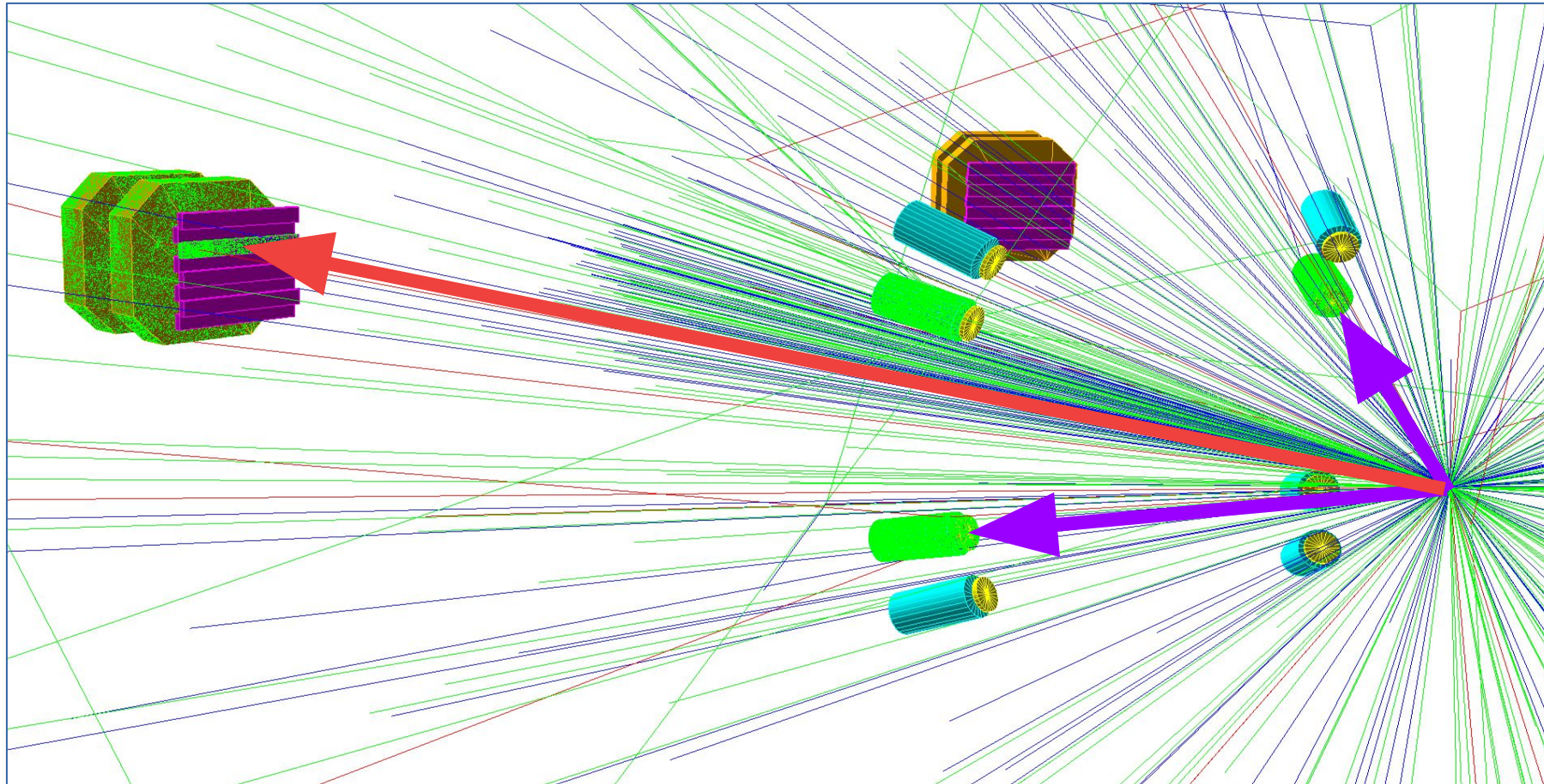
Simulation at PHQMD generator level

The angles of the detectors setup were compared with the angles of the particles in the generator.



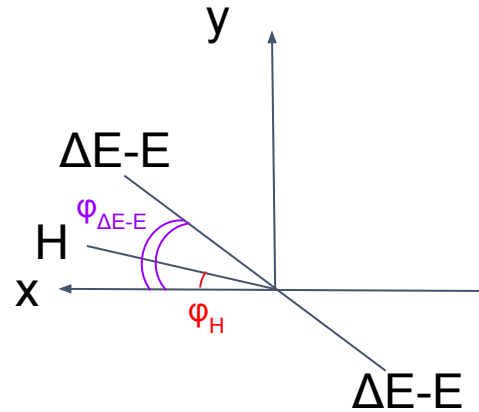
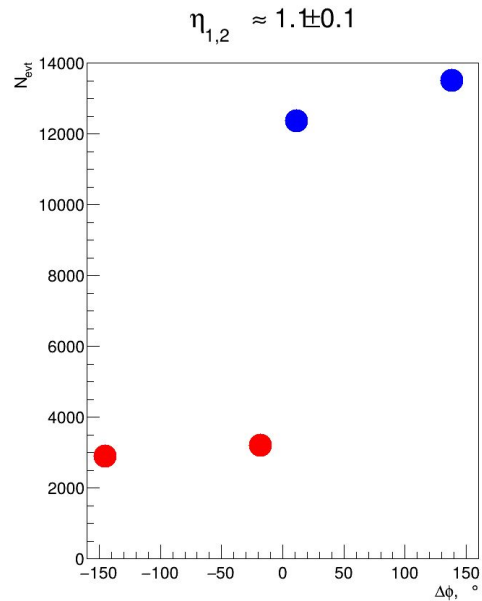
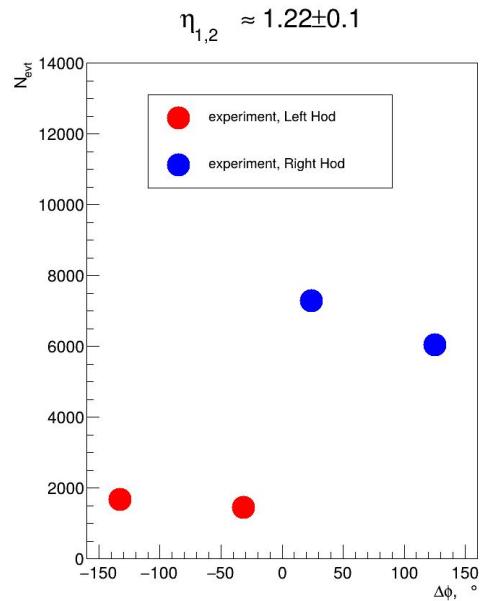
Geant4 model

Useful event with impact factor ≈ 6



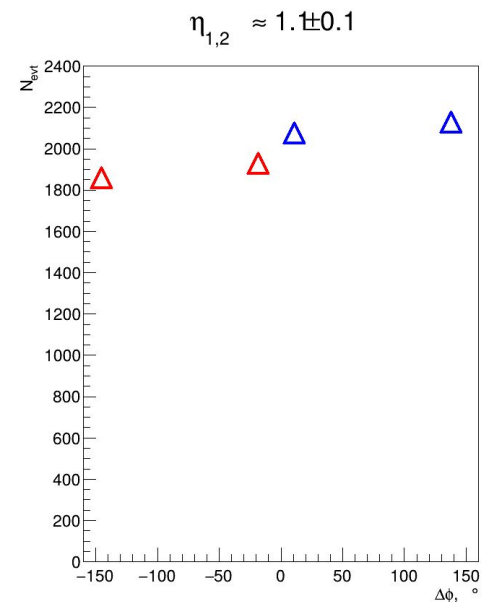
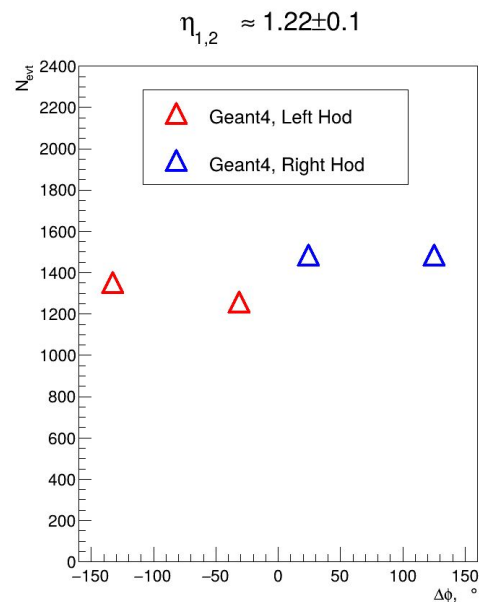
- Green dots - scintillations.
- Violet lines - $\Delta E-E$ scattering plane.
- Red line - third particle.

Comparison of the experiment with simulation

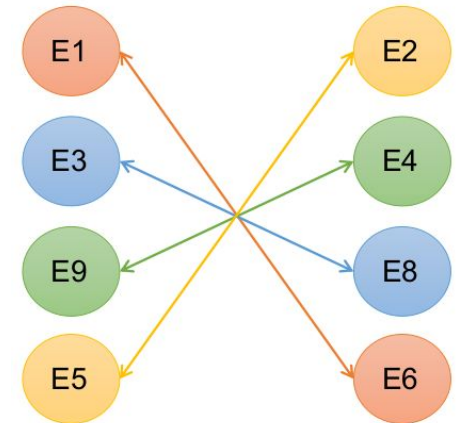


$$\Delta\phi = \phi_H - \phi_{\Delta E-E}$$

Name detectors	$\phi, ^\circ$	η
left Hodoscope	8.0	1.3 ± 0.2
right Hodoscope	164.6	1.7 ± 0.2
pair E1-E6	39.5	1.22 ± 0.1
pair E3-E8	26.5	1.1 ± 0.1
pair E9-E4	153.5	1.1 ± 0.1
pair E5-E2	140.5	1.22 ± 0.1



$$\eta_3 \approx 1.3 \pm 0.2 \quad \eta_3 \approx 1.7 \pm 0.2$$



Conclusions

1. The experimental data on the **Xe+W** interaction at a beam energy of **3 GeV/n** were obtained at the ITS of the **Nuclotron**;
2. Simulations were carried out using a **PHQMD** generator and a **Geant4** model of the setup to understand the **experimental data**;
3. The **data** on three-particle **angular correlation** obtained in the **experiment** were compared with the **PHQMD model**.

Future plans

- Perform the simulation using **other event generators**;
- Analyze the data on the **Xe+W** interaction at **3.8 GeV/n**.

Thank you for your attention!