Simulation of heavy ion collisions in BBC detector (phase 0)

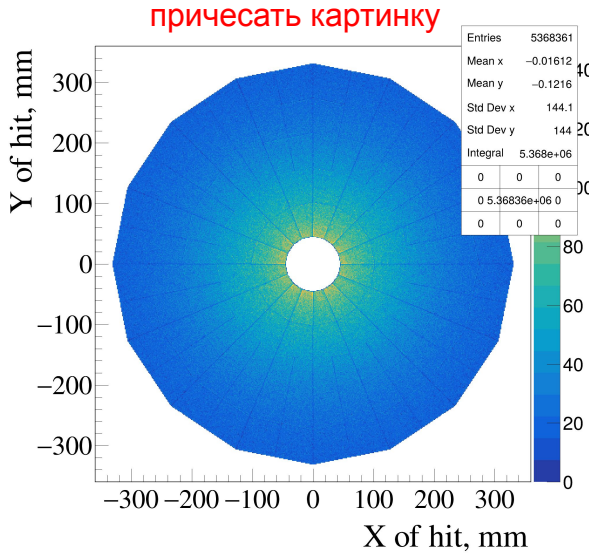
Ivan Volkov, Ksenia Volkova

LHEP JINR

Outlook

1. PHQMD generator
2. Condition of the simulation in Geant4
3. Results of the simulation
4. Conclusions

причесать картинку



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.

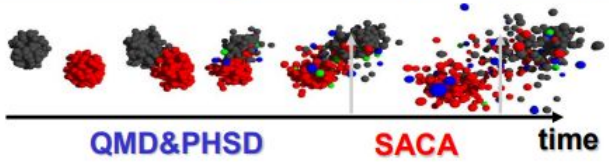
Realization: combined model PHQMD = (PHSD & QMD) & SACA

Parton-Hadron-Quantum-Molecular Dynamics

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

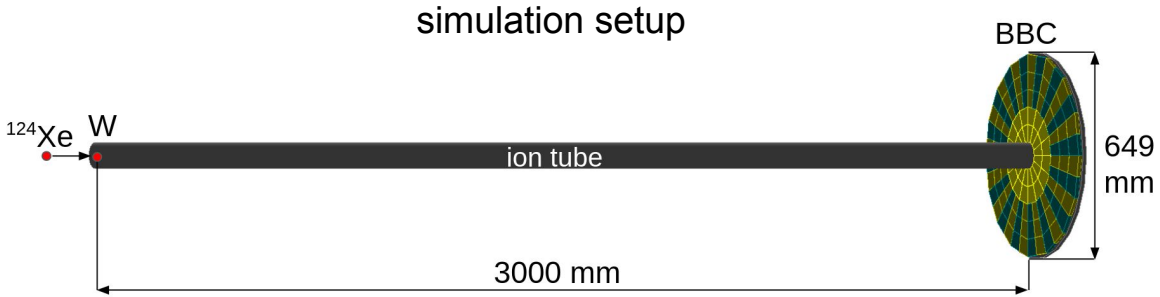
Propagation of partons (quarks, gluons) and mesons
+ collision integral = interactions of hadrons and partons (QGP)
from PHSD (Parton-Hadron-String Dynamics)

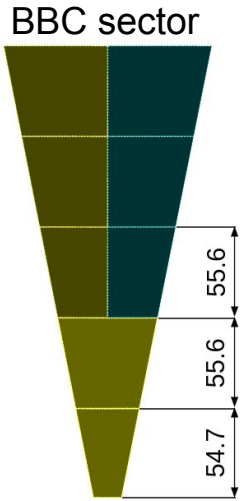
Clusters recognition:
SACA (Simulated Annealing Clusterization Algorithm)
vs. MST (Minimum Spanning Tree)



Condition of the simulation in Geant4

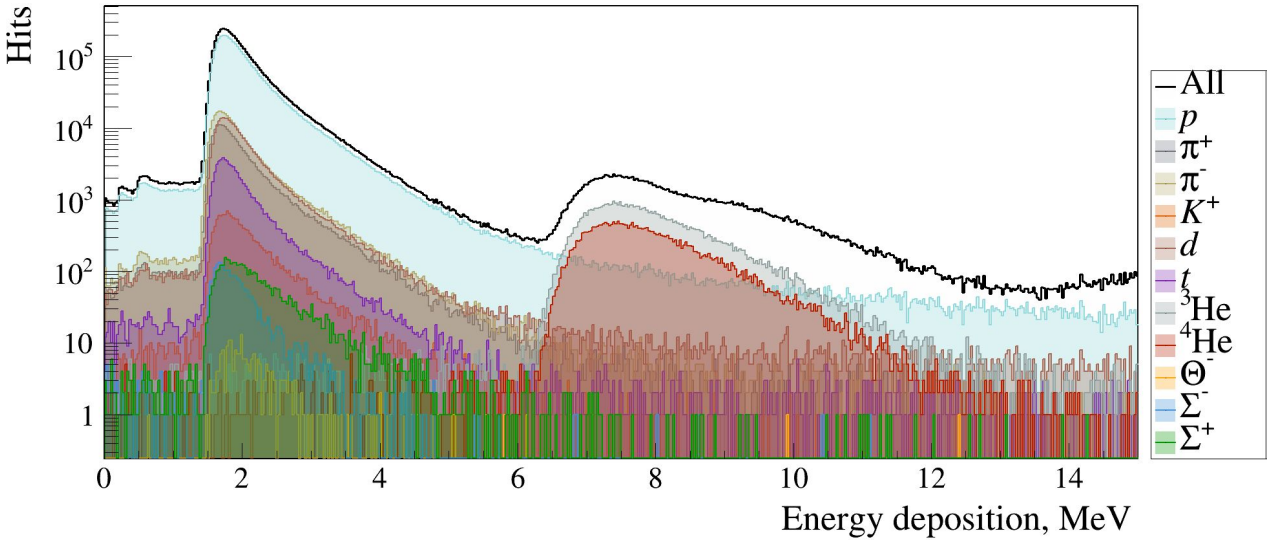
^{124}Xe beam with energy **3 GeV/n** collides with the **W** target.
The detector is a disk with an inner radius of **45 mm** and an outer radius of **324.5 mm**, which is divided into **16 sectors** and **5 rows**. A total of **128 scintillators**, the **gap** between scintillators is **0.6 mm**, **thickness - 10 mm**. Distance from target to detector **3m**.





environment - vacuum
detector material - polystyrene
neglect of particle dispersion on the ion tube

Energy deposition

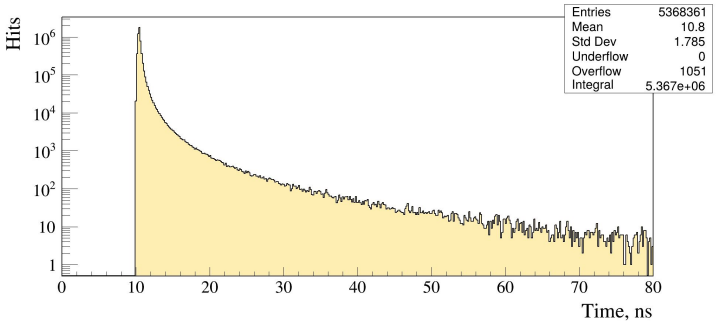


particles	%
p	76.38
π+	4.13
π−	6.34
d	5.35
t	1.31
^{3}He	1.03
^{4}He	0.55
K+	0.30
Sigma+	0.08
Sigma-	0.05
other	4.48

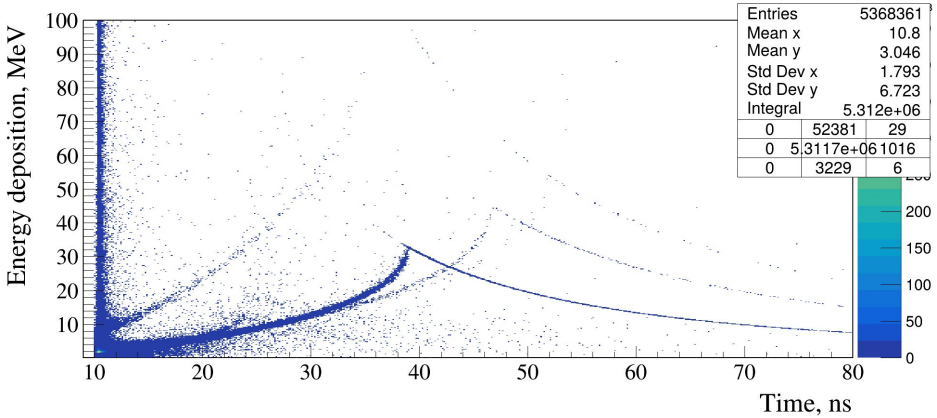
Частицы, которые оставили энергию в детекторах.
Мезоны 10.77%, Ионы 12.72%.

Time of flight

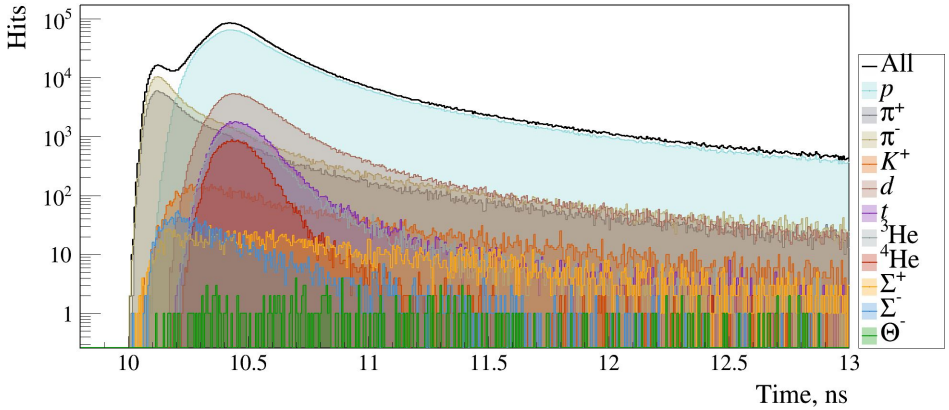
Time of all particles in all detectors



correlation of time and energy deposition



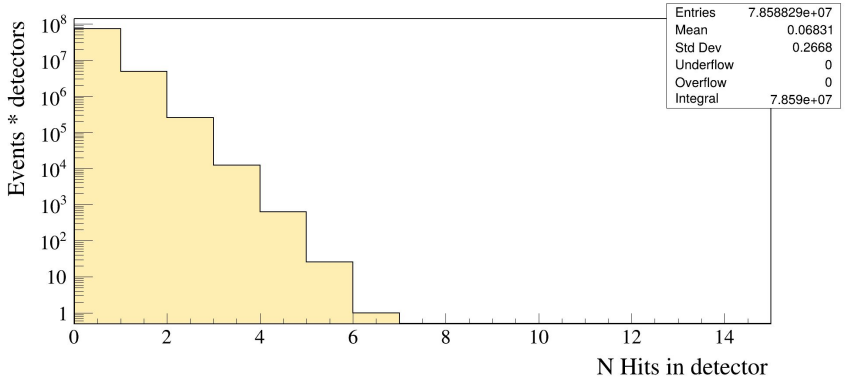
time for each particle type



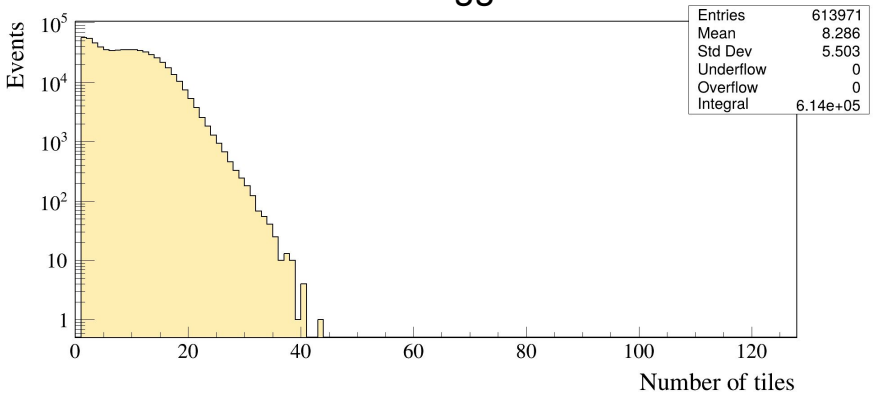
Время пролета мезонов и гиперонов от 10 нс, у протонов 10.1 нс, а ионы приходят в основном 10.2 нс. Наши детекторы не могут зафиксировать эту разницу без тоф системы. на корреляции time and energy deposition наблюдаются различные частицы. (сделать разделение и подписи)

Multiplicity in detector

The number of particles that hit the tile in one event

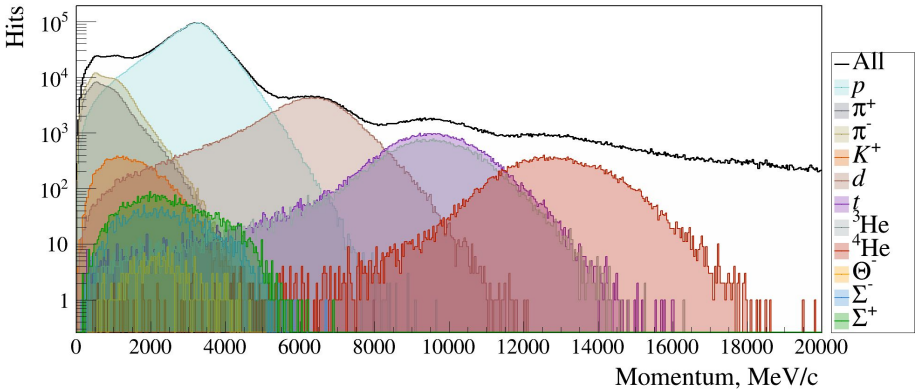


Number of detectors triggered in one event

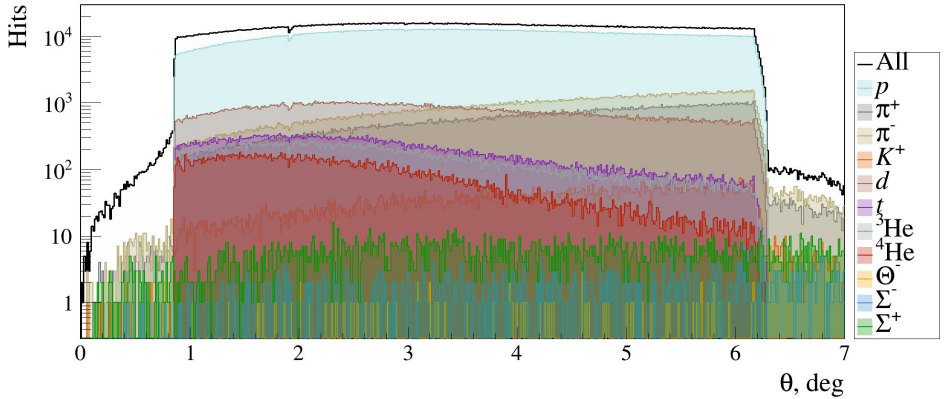


Указать множественности протонов, пионов, ... (количество на 1 событие)

Momentum and angular distributions



Хиты от частиц за границами углового диапазона детектора обусловлены распадами частиц. Так как используется алгоритм для группировки хитов от первичной частицы, сама первичная частица могла изначально лететь в другую сторону, а в детектор попал продукт распада. Представленная гистограмма отражает угол первичной частицы.



Conclusions

1. Simulated interaction of ^{124}**Xe+W** at **3 GeV/n** in the **PHQMD** generator;
2. Particle distributions in the angular range of the detector are shown;
3. A large number of nuclear fragments are observed.

Future plans

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Thank you for your attention!