ALIGNMENT OF TOF400@TOF700 AND FEMTOSCOPY STUDY AT BM@N

Nelli E. Pukhaeva

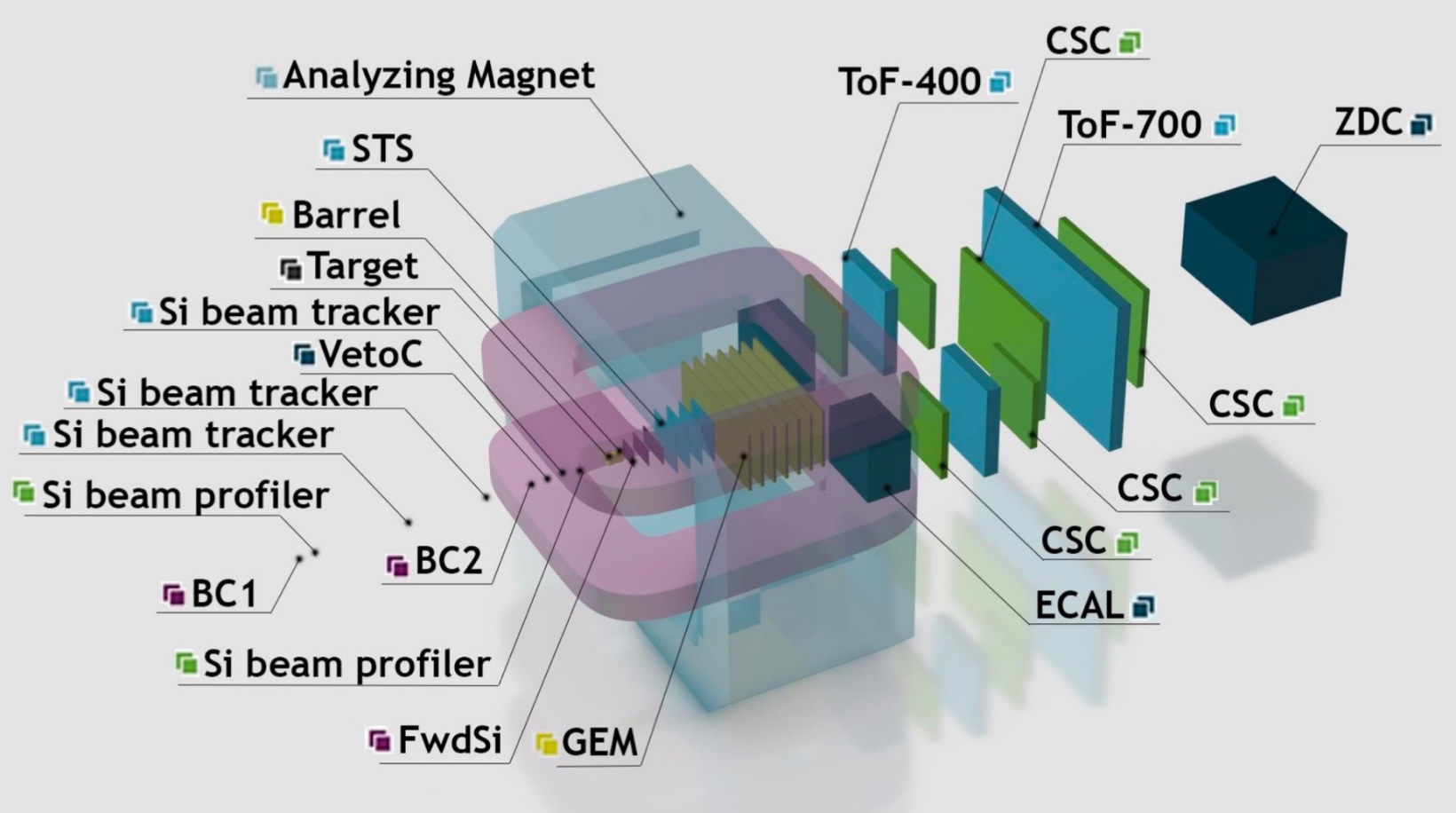
JINR

The XV-th International School-Conference “The Actual Problems of Microword Physics”
Minsk, Belarus, 27 August– 3 September, 2023


ARIADNA
BM@N
SPD
MPD
NICA
ACCELERATOR COMPLEX

BM@N setup at RUN8

^{124}Xe+CsI (2%)



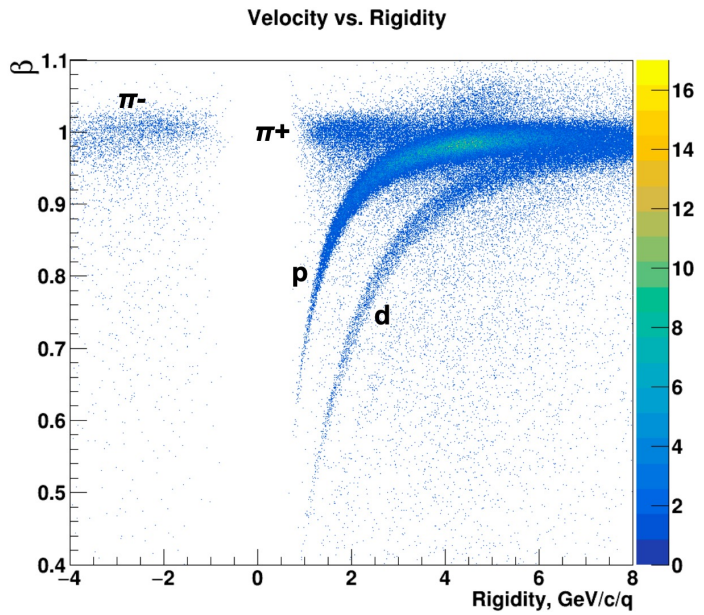
Data taking from 12 of December 2022 to 2 of February 2023, 3.8 AGeV, more 550 mill events

BM@N at RUN8 3.8 GeV

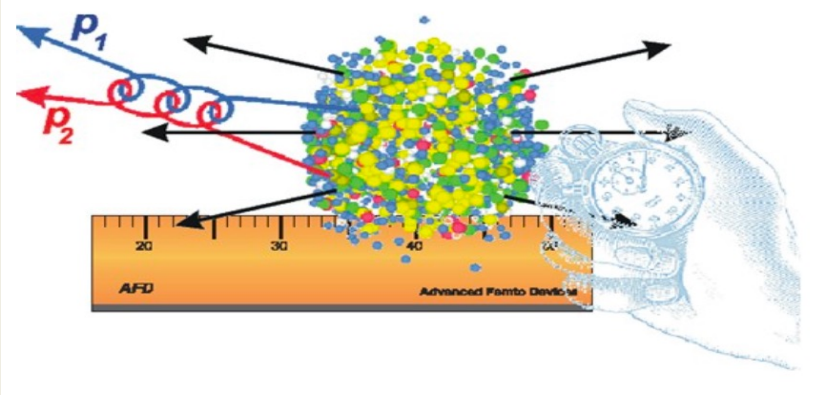
^{124}Xe+CsI (2%)

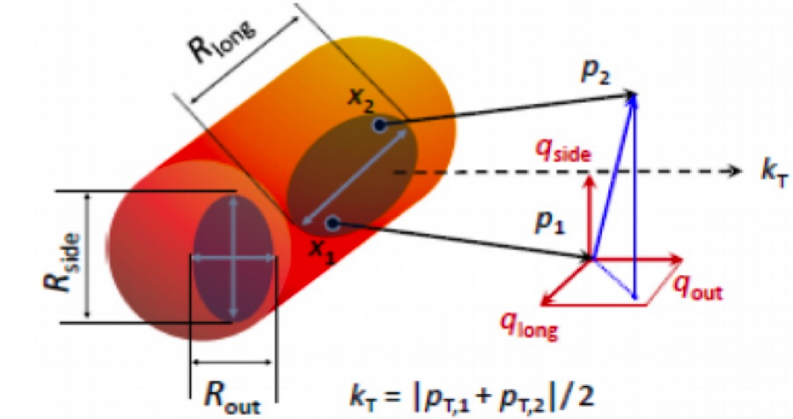
Raw online data: ToF-700 π+, p, d identification

Without dedicated ToF calibration

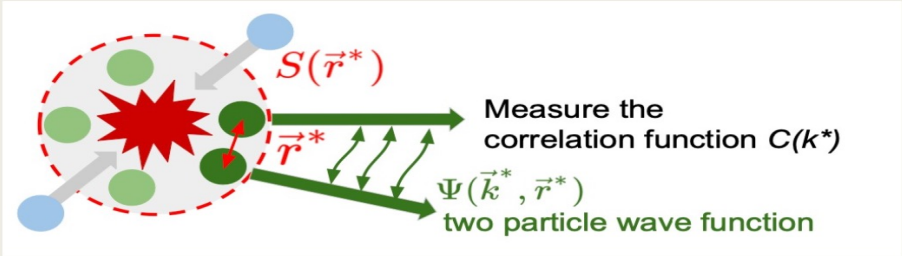


BM@N data of Ar-nucleus 3.2 GeV





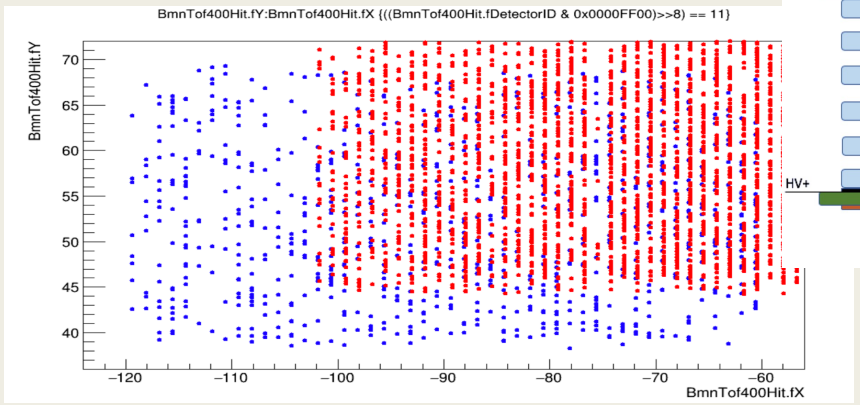
Femtoscopic principle:

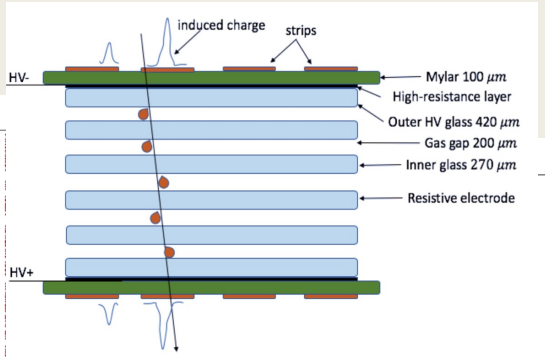


- Two colliding beam
- Production of multiple particles
- Emission source S(r*)
- Particle close in momentum space (k*)
- Final state interaction
- Modifying measured k* distribution

- *Quantum statistics (QS):*
  - bosons (pions, Kaons, …) – Bose-Einstein QS
  - fermions (protons, …) – Fermi-Dirac QS
- *Final-state interaction (FSI):*
  - strong interaction
  - Coulomb repulsion or attraction

BM@N data Run Ar-nucleus 3.2 GeV





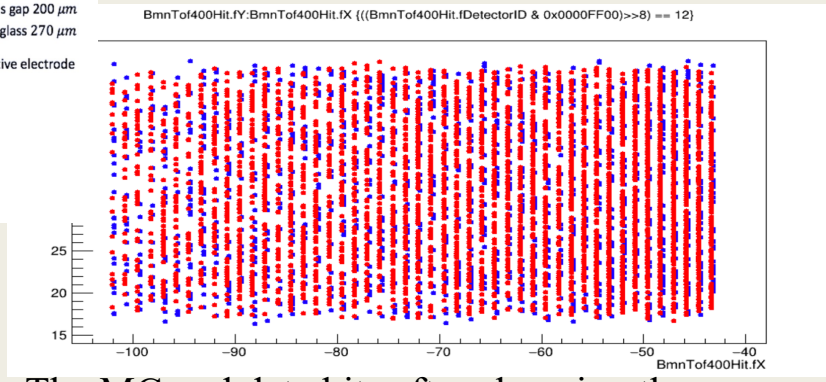
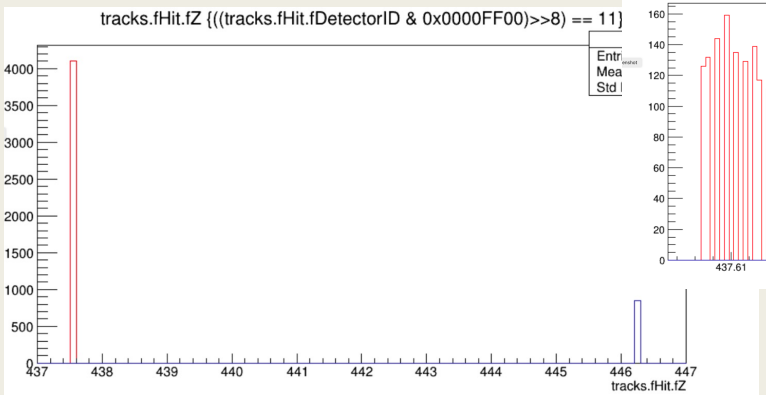
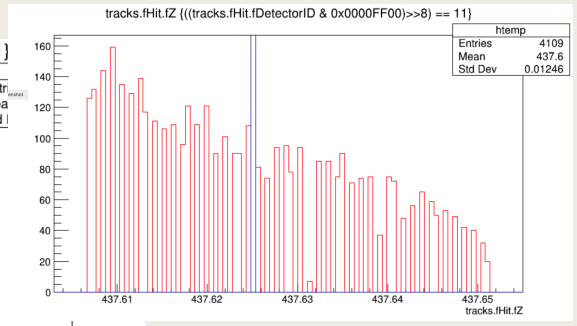
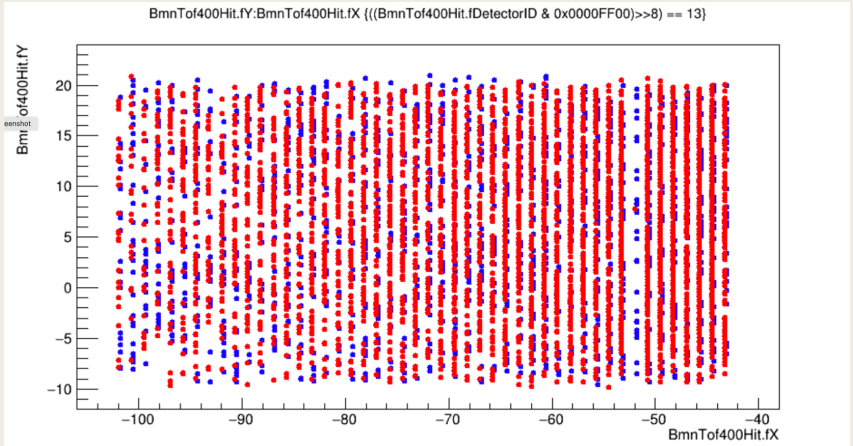


Figure illustrates the TOF400 hits position of overlayed xy axis for the 11th plane, the reconstucted TOF400 MC hits in blue and the TOF400 data hits in red.

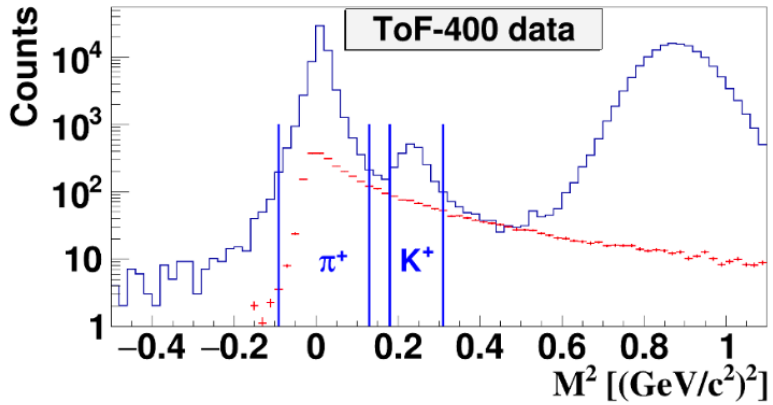
The MC and data hits after changing the geometry of the xy&z axes for the planes from 11 to 20.

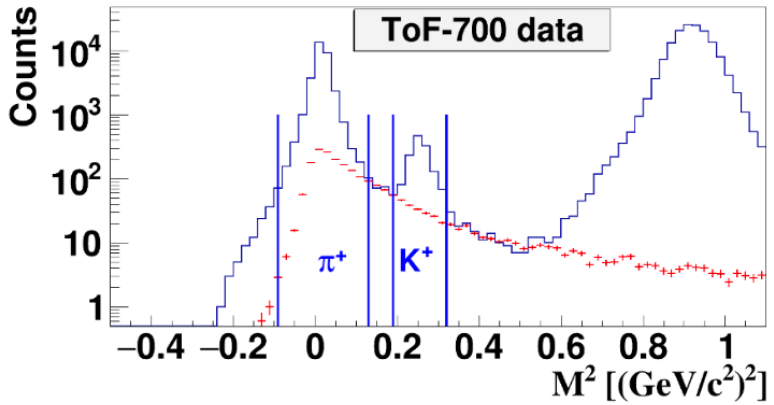


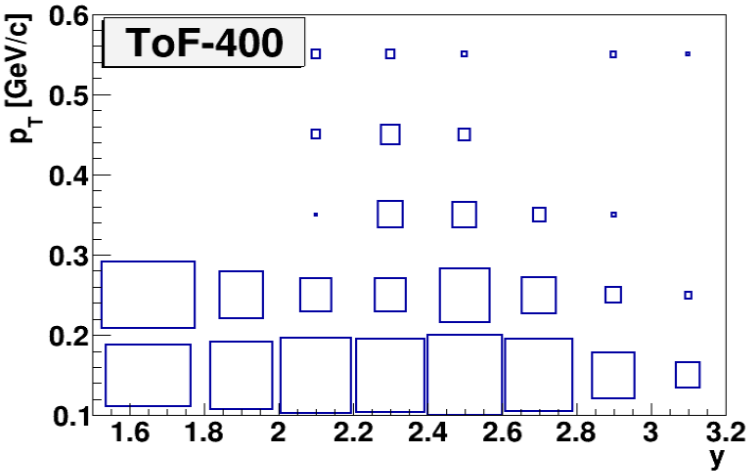


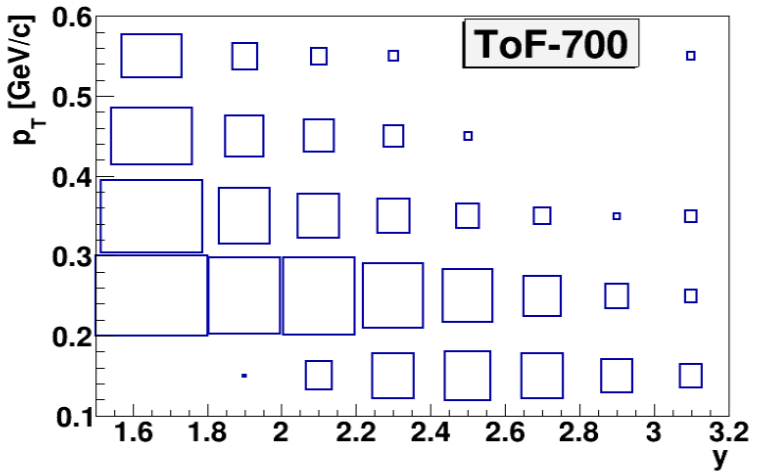


BM@N data of Ar-nucleus 3.2 GeV









BM@N data of Ar-nucleus 3.2 GeV

Multiplicity of pions

For each target

	ArC (L = 2.1 μb^{-1})	ArAl (L = 2.3 μb^{-1})	ArCu (L = 1.8 μb^{-1})	ArSn (L = 1.1 μb^{-1})	ArPb (L = 0.5 μb^{-1})
Total Events	86047	331771	390691	429425	299021
Events with one pion	8139	35183	44632	50180	34472
Events with two pions	177	1052	1378	1626	1089
Events with 3 or more pions	4	14	38	32	18
Pairs of pions from the same event	192	1094	1492	1722	1146

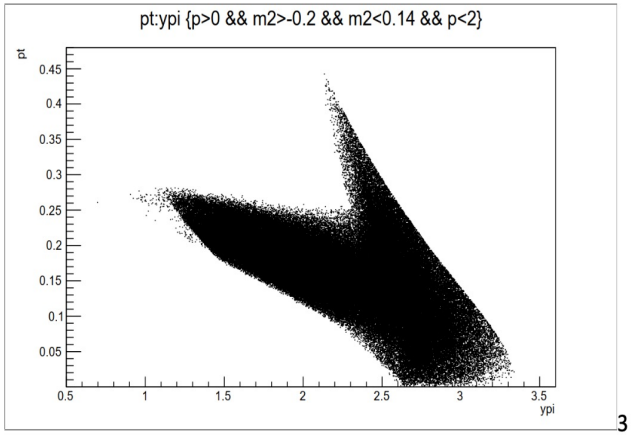
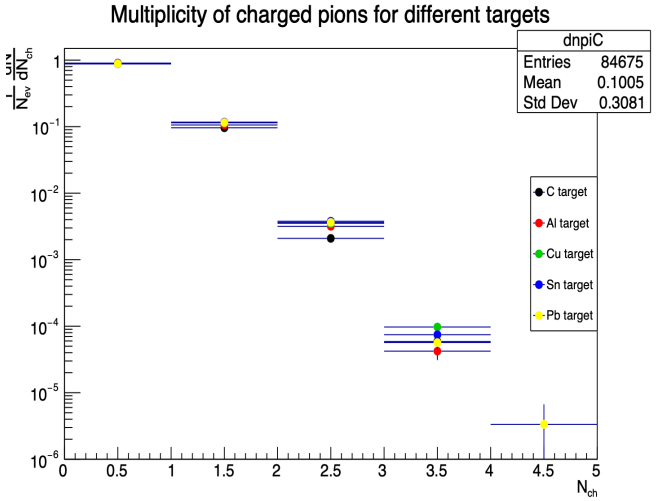
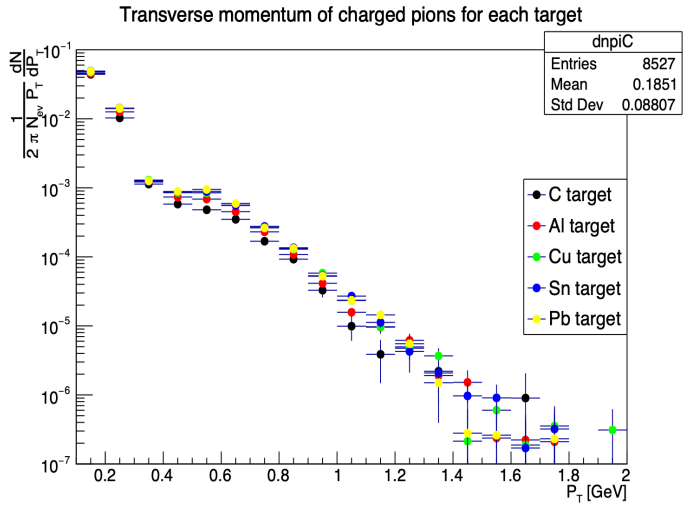


Figure 7. Distribution of the p_t / y for reconstructed pions





BM@N data of Ar-nucleus 3.2 GeV

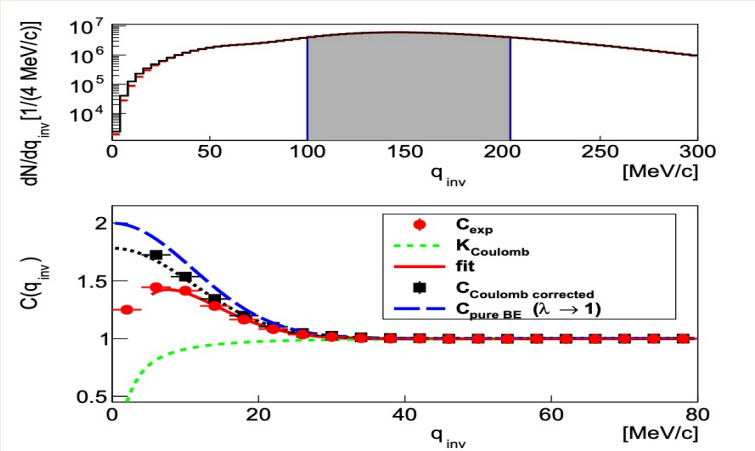
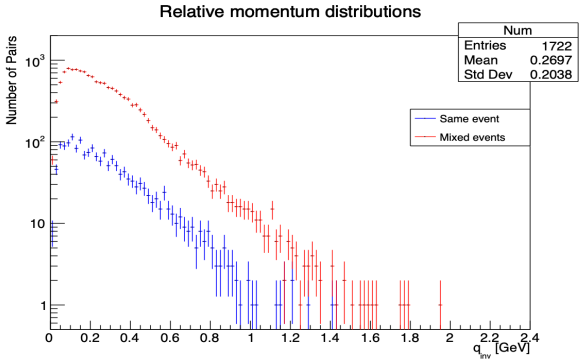
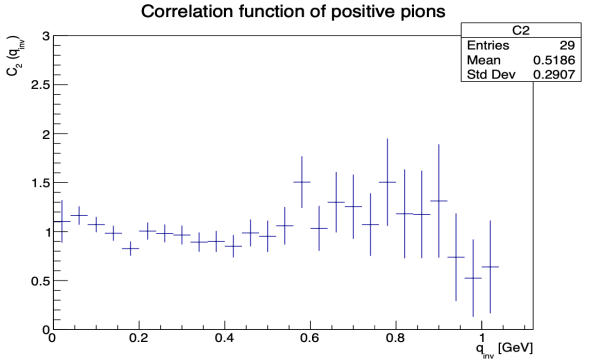


Fig. 1 Upper panel: The distribution of the invariant relative momentum q_{inv} for $\pi^-\pi^-$ pairs with transverse momentum of $p_{\mathrm{t},12} = 100-200\ \mathrm{MeV}/c$ for central (0–10%) Au + Au collisions at $1.23A$ GeV. The black (red) histogram displays the true (mixed) yield. The grey-shaded area represents the yield used for normalization. Lower panel: The one-dimensional $\pi^-\pi^-$ correlation function as function of q_{inv}. Red circles display the ratio of the true and mixed distributions, respectively. The green dashed curve represents the Coulomb correction function K_C as described in Sect. 3.2. The black squares correspond to the Coulomb-corrected correlation function. The red full (black dotted) curve shows the fit function (Eq. (5)) before (after) the Coulomb correction. The blue long-dashed curve gives the pure Bose–Einstein part (Eq. (6)) of the correlation function

For ArSn collisions

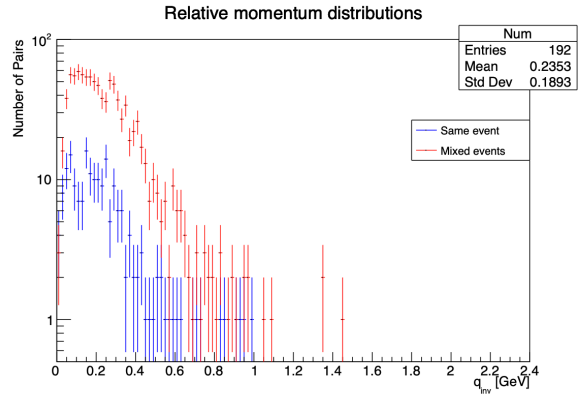


$$q_{inv} = \sqrt{q_0^2 - \vec{q}^2}$$

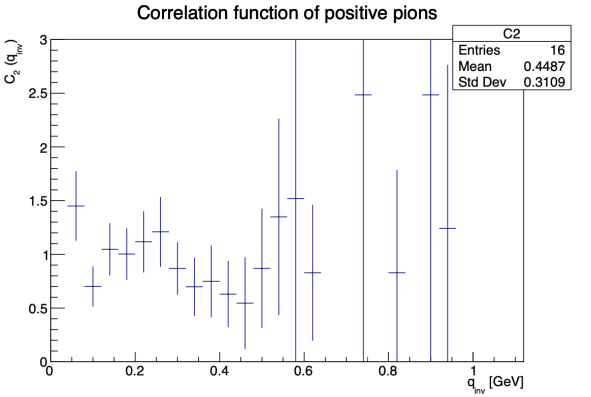


$$C_2(q) = \frac{N(q)}{D(q)}$$

For ArC collisions



$$q_{inv} = \sqrt{q_0^2 - \vec{q}^2}$$



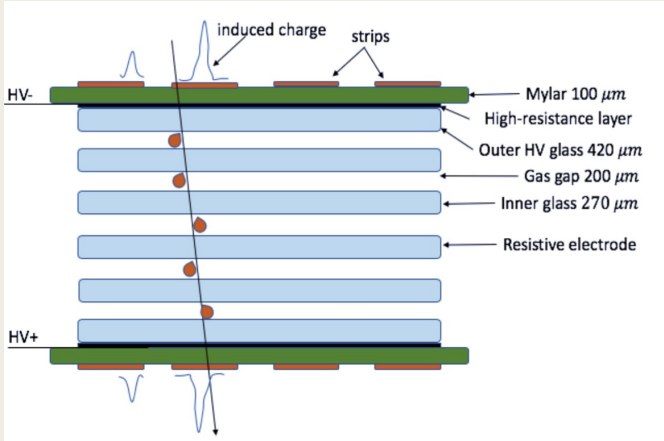
$$C_2(q) = \frac{N(q)}{D(q)}$$

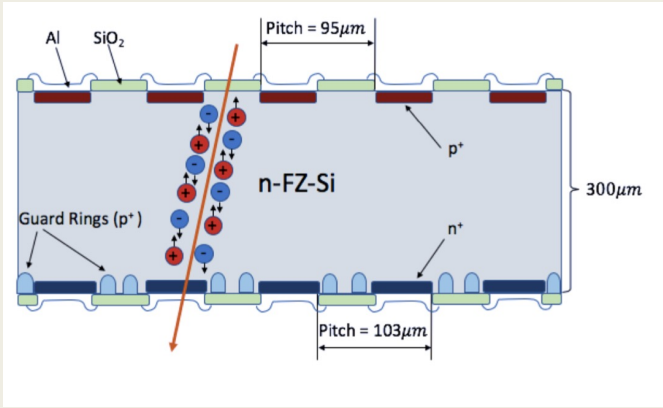
BM@N data of Ar-nucleus 3.2 GeV

Add: * data from left TOF400
* data from TOF700

Study of resolution of tracks at TOF
Si

Run8 data analysis: * without alignment
* with alignment Tof400
Tof700





Thanks for your attentions !