

What can we study at the NUCLOTRON accelerator using the 2-meter streamer chamber

**Search for identical pion correlations and production of kaons
and lambdas on the streamer chamber**

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RESULTS OF THE FIRST ESTIMATES

The 2-meter streamer chamber **can be easy upgraded** to investigate the Bose-Einstein interference correlations of the negative pions in Pb+Pb central collisions in the Nuclotron 5-A energy beam:

- beamline can operate at the maximal Nuclotron energy
- the trigger of the central collisions was successfully used in the Mg+Mg experiments
- modern digital cameras offers high enough resolution to measure 60-80% negative pions (preliminary estimates)

INSTRUMENT

Streamer chamber

200cm×100cm×60cm

size of a streamer 1-2mm

digital cameras of 10 Mpixels available (3 cameras – \$ 1200)

trigger – scintillating counters rejecting interactions with stripping protons or nuclear fragments inside a specified forward cone

PREVIOUS EXPERIMENT

4.4·A GeV/c ^{24}Mg beam

target – 1.2 g/cm² Mg inside the streamer chamber

trigger – fragments do not hit forward cone of $\sim 2.4^\circ$ what corresponds to a stripping nucleon transverse momentum of ~ 180 MeV/c

central interactions accounted $\sim 4 \cdot 10^{-4}$ of all inelastic MgMg interactions

π^- multiplicity ~ 10

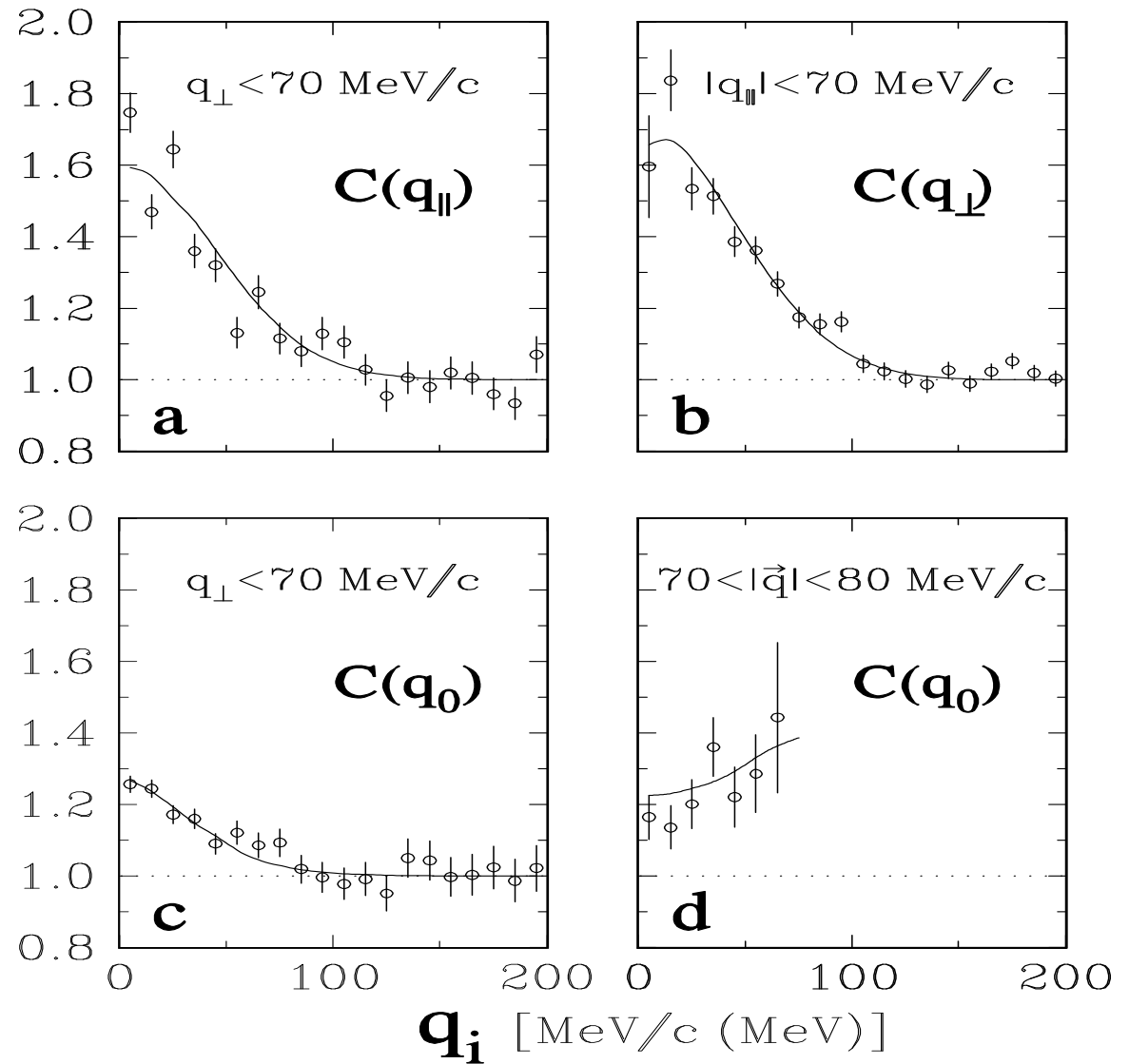
120 000 pions measured (14 000 events)

470 000 pairs for the correlation analysis

ALL EVENTS

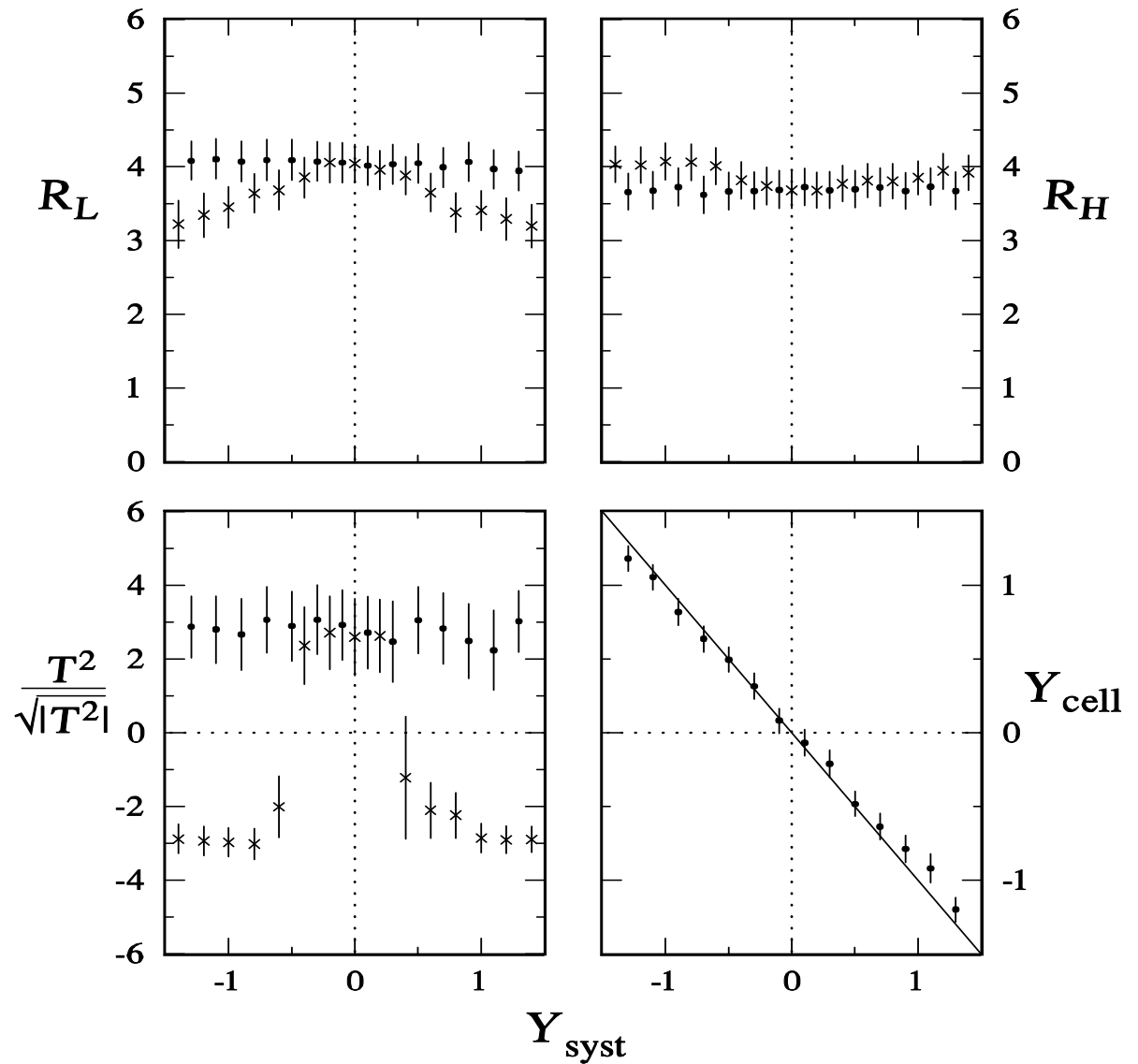
Projections on different axes q_i of different layers of correlation function for the complete π^- sample (470 000). $C(q_0)$ increases with increasing q_0 on condition $|\vec{q}| \simeq const$ (see Fig.d), what shows that the sign of T^2 is negative. Sample should be analyzed taking into account a set of generation volumes.

$MgMg \Rightarrow \pi^- \pi^-$ 4.4A GeV/c



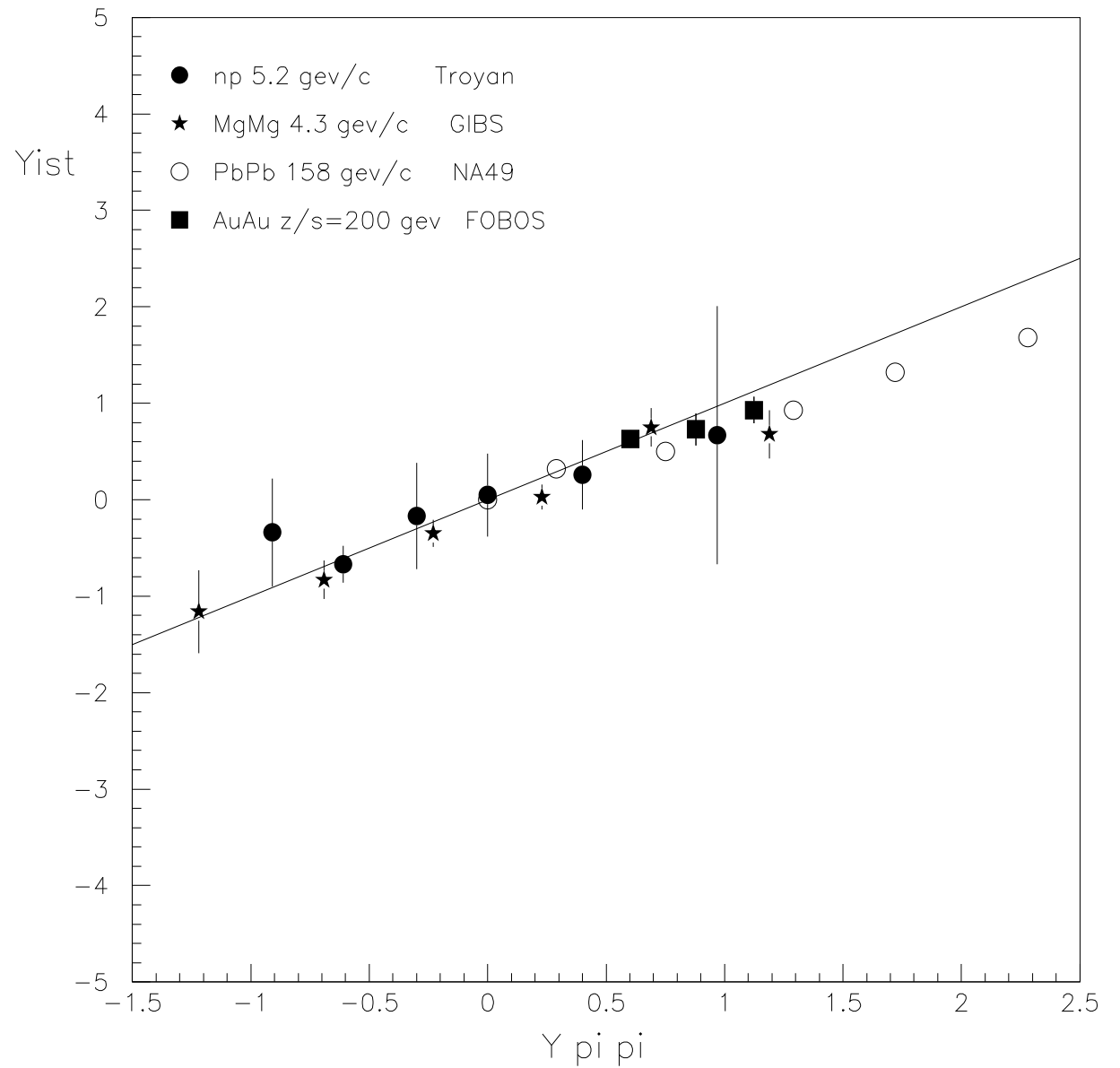
SUBSETS

Sizes and rapidities of the same central pion generation-volume element that were obtained from a fit to the central subensemble (pions with $p < 200$ MeV/c in the MgMg c.m. frame) in various reference frames moving along the reaction axis at the rapidities Y_{Syst} .



SUBSETS

The same picture
(Y_{cell} vs Y_{syst}) in
comparison with
other experiments.
(Y_{ist} used instead of
the Y_{cell})

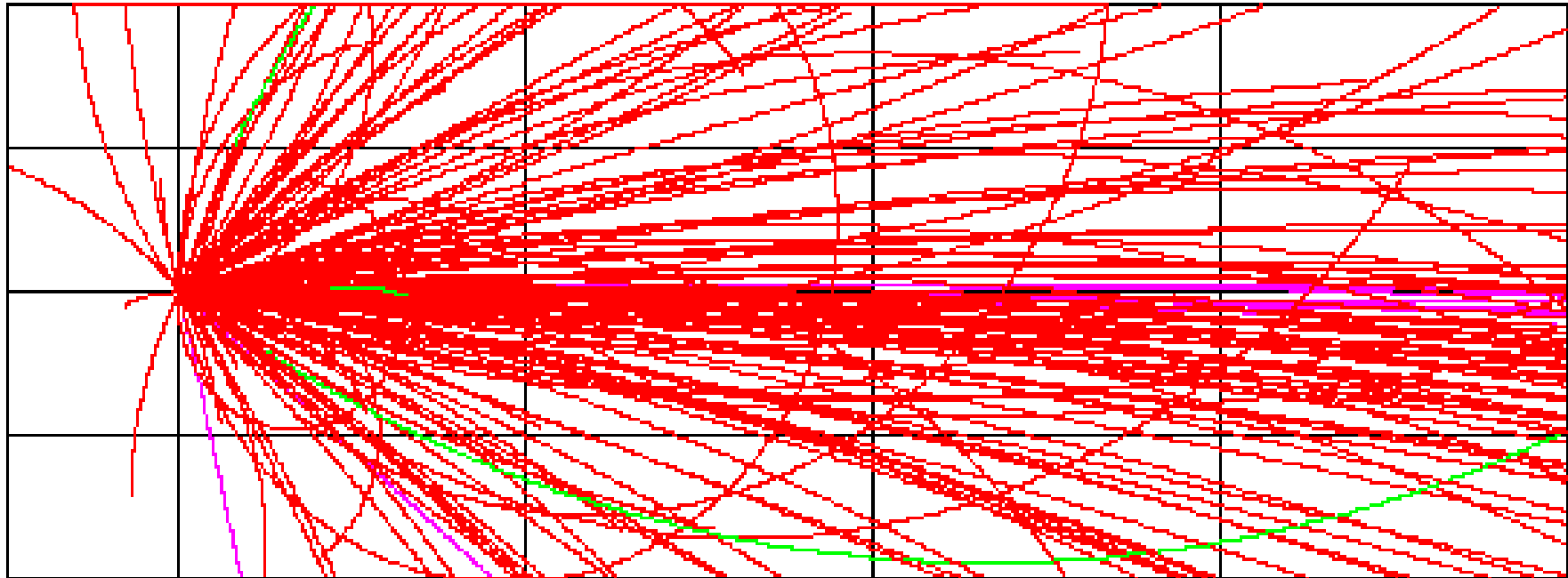


REFERENCES

1. HBT measurement of the expansion velocity of pion production volume, GIBS collaboration, Phys. Lett. B, 397 (1997) 30.
2. Interference Correlations of Pions and Elementary Cell of Phase Space, A.I.Golokhvastov, Phys. Atomic Nuclei, 65 (2002) 190.
3. Dependence of the Interferometric Sizes of the Pion Generation Volume on the Sizes of the Pion Wave Packet, M.Anikina et al., Phys. Atomic Nuclei, 65 (2002) 573.
4. Direction of the Expansion of the Volume of Pion generation in MgMg Collisions at 4.3 GeV/c per Nucleon, M.Anikina et al., Phys. Atomic Nuclei, 67 (2004) 406.

Monte Carlo

One of calculated "pictures". The streamers are drawn wider (1.5-2.0 times) than expected in the experiment due to limited computer pixel size.



LAMBDA PRODUCTION

Λ production (decays) were investigated in the previous streamer chamber experiments (in MgMg and CC interactions). 20900 central MgMg interactions. Observed 933 Λ , momenta and angular distributions as well as ratio to negative pions measured.

However, it seems too hard task to find out Λ decay vertex among hundreds of tracks near the target. So, one can hope to see only a small fraction of the lambdas emitted at the large angles...

Careful Monte Carlo for final sentence required.

Mg+Mg Central Collisions Accompanied by Λ Production at 4.3 GeV/c per Nucleon Momentum, S.A.Avramenko et al., Journal of Nuclear Physics, 55 (1992) 721

- I believe that HBT correlations can be investigated for the central PbPb interactions.
- The GIBS central collision trigger can fire the streamer chamber every 8 seconds. Statistics of 100 000 "pictures" can be recorded in 10-12 days. It seems such a sample is large enough to have high precision fits.
- Few additional runs should be carried out (Si+Si, Cu+Cu) to estimate losses and corrections.
- Preliminary estimate (using my eye instead of computer)- Λ decays can not be detected in the PbPb central collisions.
- Possibility to detect low energy pions should be carefully analyzed using adequate software (Kalman filter?). Maybe a part of Λ decays can be detected???