Contribution ID: **461** Type: **Poster Presentation**

New results on energy and momentum conservation for particle emission in A+A collisions at not too high energies

Our presentation will be based on our recent paper [1].
We construct a new, simple model of the heavy ion collision.
This model is local in the impact parameter plane and appropriate for the SPS
energy range. It can be regarded as a new realization of the "fire-streak" approach, originally applied to studies of lower energy nucleus-nucleus reactions.

Starting from local energy and momentum conservation, we
nicely describe the whole centrality dependence of the pion rapidity distribution in Pb+Pb collisions at $\sqrt{s_{NN}} = 17.3$˜GeV.
In particular we explain the broadening of the pion rapidity distribution
when going from central to peripheral collisions.

The results of our calculations are compared with SPS experimental data.
We discuss the resulting implications on the role of energy and momentum conservation for the dynamics of particle production in heavy ion collisions.
We conclude that it plays a dominant role in the centrality dependence of the
shape of pion rapidity spectra.

A specific space-time picture emerges, where the longitudinal evolution of
the system strongly depends on the position in the impact parameter (b_x, b_y) plane.

In non-central collisions we predict the existance of "streams" of excited matter moving very close to the spectator system in configuration (x, y, z) space.

This picture is consistent with our earlier findings on the longitudinal
evolution of the system as deduced from electromagnetic effects on
charged pion directed flow, and can provide an explanation for specific
low-p_T phenomena seen in the fragmentation region of Pb+Pb collisions
which we also address in this paper.

[1] A. Szczurek, M. Kie{\l}bowicz and A. Rybicki,
"Implications of energy and momentum conservation for particle emission
in $A + A$ collisions at energies available at
the CERN Super Proton Synchrotron",
Phys. Rev. C95 (2017) 024908.

Experimental Collaboration

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Session Classification: Poster session

Track Classification: Heavy Ion Physics