A Simple Geometrical Model for $p+p$ and Nucleus-Nucleus Collisions, and its Comparison to Experimental Data on Small and Large Systems

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We divide the colliding nuclei in transverse plane into $1 \times 1 \text{fm}^2$ "bricks".

Bricks collide and form fire streaks. From local energy-momentum conservation we calculate the energy and rapidity of each fire streak.
The fire-streak model

Each fire streak fragments independently into pions according to the single fire-streak fragmentation function.

\[
\frac{dn}{dy} = A \cdot \left( E_s^* - m_s \right) \cdot \exp \left( \frac{-\left( y - y_s \right)^2 + \epsilon^2}{\sigma_y^2} \right)
\]

available energy  fire streak rapidity

\( E_s^*, y_s \)

total fire streak energy

mass of bricks

A. Szczurek et al., PRC 95, 024908 (2017)

Pb+Pb data points: T. Anticic et al., PRC 86, 054903 (2012)
The electromagnetic effects

V. Ozvenchuk et al., PRC 102, 014901 (2020)

The fire-streak model describes the electromagnetic effects induced by spectator charge on $x_F$-distribution of charged pions.

After freeze out the created pions find themselves in the EM field of the spectators.
**p+p collision**

Pion rapidity distribution from one fire streak reproduces the pion rapidity spectrum in p+p collision, which suggest that only single fire streak is created in pp collision.

\[
\frac{dn}{dy} = A \cdot \left( E_s^* - m_s \right) \cdot \exp \left( \frac{[(y-y_s)^2+\epsilon^2]r/2}{r\sigma_y^y} \right)
\]

- available energy
- fire streak rapidity
- total fire streak energy
- mass of bricks

Data points:
Conclusions

• We introduced a simple model of the longitudinal evolution of the system, which explains the centrality dependence of pion yields and rapidity spectra in Pb+Pb collisions.

• In this model we include initial conditions for pion production to study the electromagnetic effects in peripheral Pb+Pb collisions.

• We linked pion rapidity spectra in p+p and Pb+Pb collisions in the frame of our model.

Thank you