Baryon Stopping as a Possible Signal of Mixed-Phase Onset

Yu.B. Ivanov

GSI&Kurchatov Inst.

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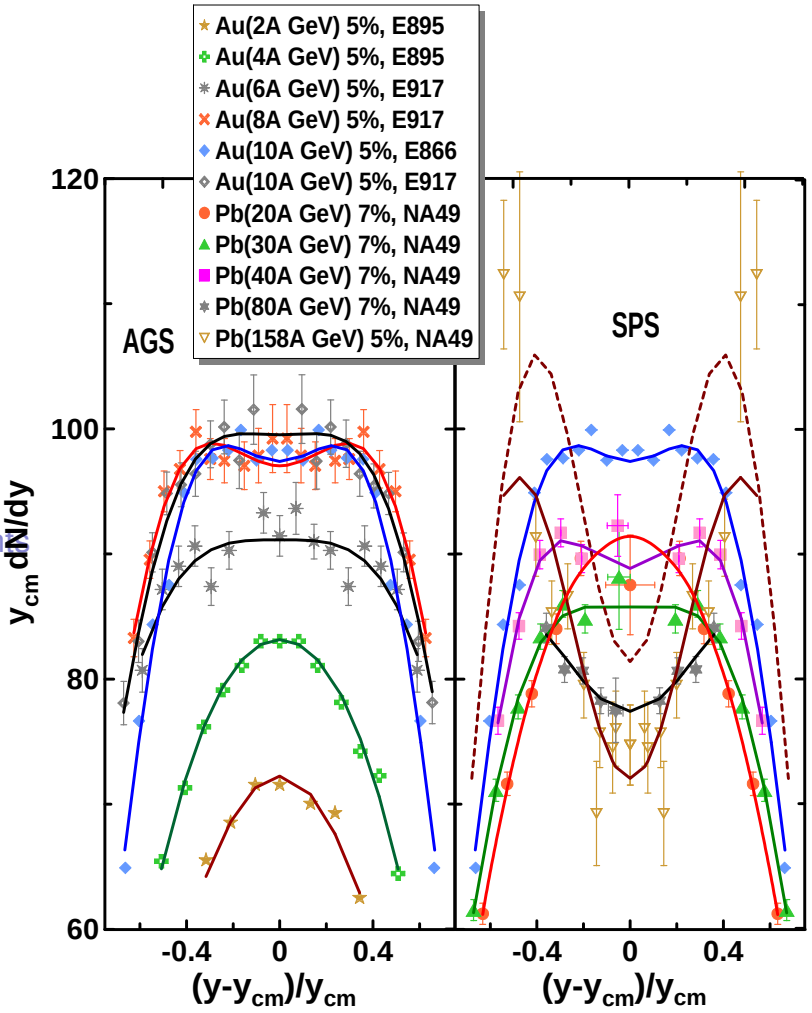
Two-Thermal-Sources Fit

$$\frac{dN}{dy} = a\left(\exp\left\{-(1/w_s)\cosh(y - y_{cm} - y_s)\right\}\right.$$
$$\left. + \exp\left\{-(1/w_s)\cosh(y - y_{cm} + y_s)\right\}\right)$$



Two thermal sources shifted by $\pm y_s$ from the midrapidity.

w_s = width of the sources

Reduced curvature in the midrapidity

$$C_y \equiv \left(y_{cm}^3 \frac{d^3N}{dy^3}\right)_{y=y_{cm}} \Big/ \left(y_{cm}\frac{dN}{dy}\right)_{y=y_{cm}}$$
$$= (y_{cm}/w_s)^2 \left(\sinh^2 y_s - w_s \cosh y_s\right)$$

with respect to the "dimensionless" rapidity $(y - y_{cm})/y_{cm}$.

C_y is independent of the overall normalization

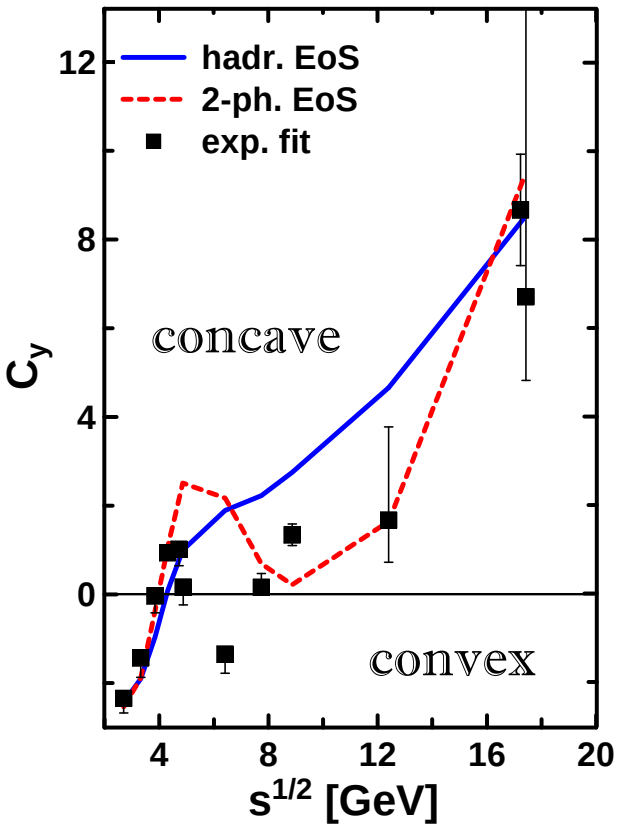
C_y = **shape (concave or convex) at midrapidity**

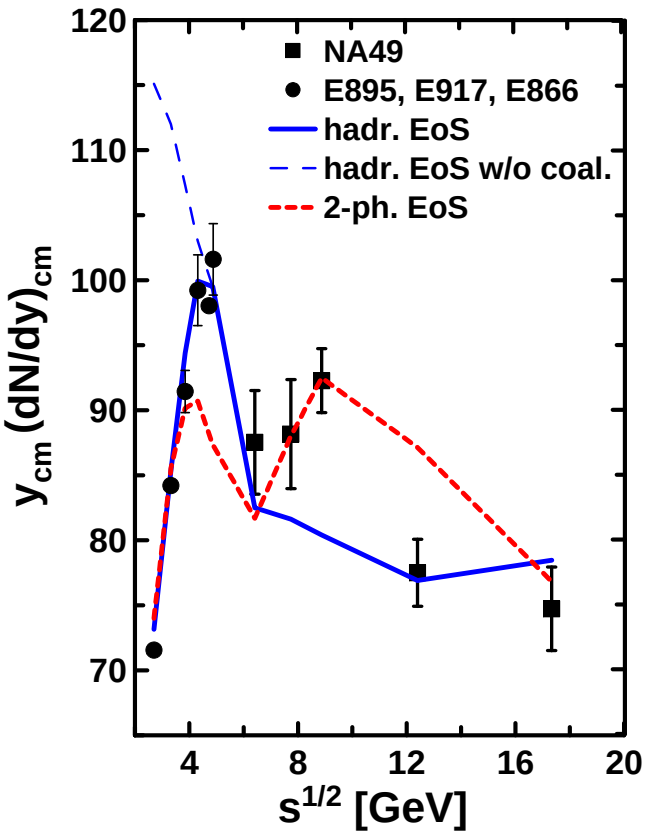
and

$(y_{cm} dN/dy)_{y=y_{cm}}$ = **magnitude at midrapidity**

two independent characteristics of a spectrum

“zig-zag” irregularity





C_y in 2P-EoS scenario $\Rightarrow$ zig-zag irregularity

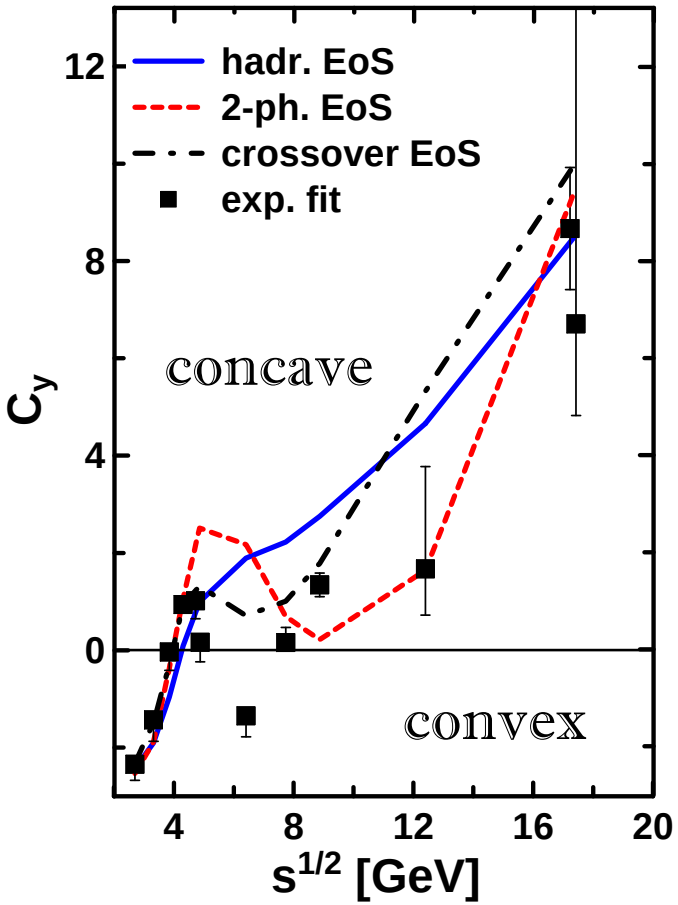
[qualitatively similar to that in the data]

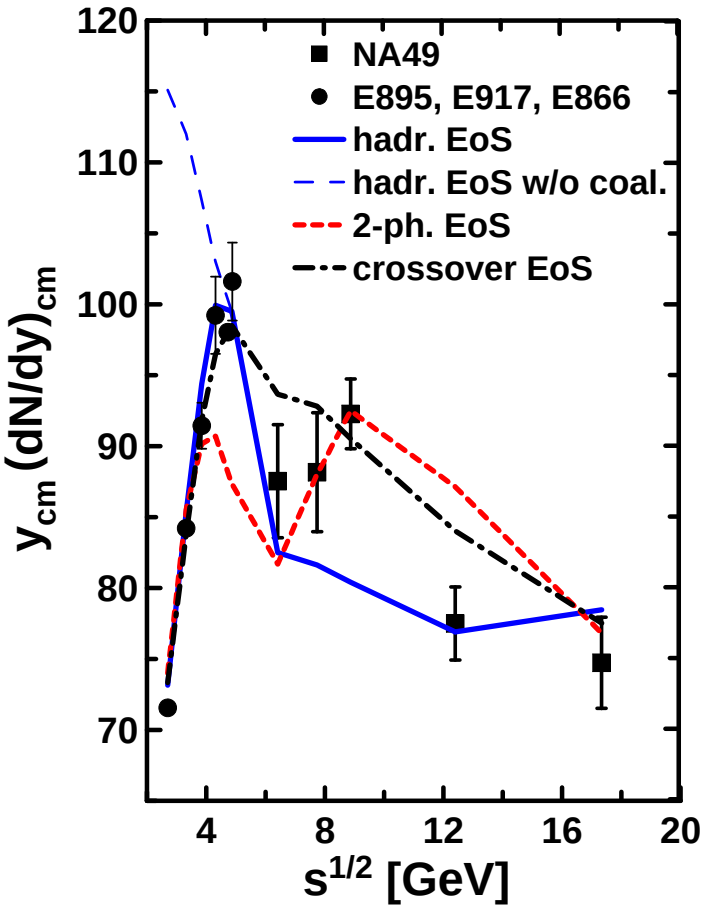
Hadronic scenario $\Rightarrow$ monotonous behaviour

Crossover EoS (preliminary)

Crossover transition to QGP

[Khvorostukhin, Skokov, Redlich, Toneev, Eur. Phys. J. **C48**, 531 (2006)]





Phase transition is smoother $\Rightarrow$ wiggle instead of zig-zag

Summary

- **Baryon stopping is sensitive to phase transition into QGP**
- **Data qualitatively favor onset of a phase transition between 10 and 20 GeV/nucl.**

  This is the range, where other irregularities (horn, step) occur.
- **Still the question: Why there is no quantitative agreement?**

Problems

- **It is suspicious that zig-zag occurs at the border between AGS and SPS energies.**
- **Too narrow range of $y - y_{cm}$ in data at 80A and 158A GeV.**
- **Neutrons are unavailable.**

Experimental Requirements

- **Net-proton dN/dy within the same exp. setup at energies $6A \leq E_{lab} \leq 40A$ in the range at least $|y - y_{cm}| \leq 0.7$ (better if 0.9)**

- **What we expect in the nearest future:**
  - **Au@RHIC $E_{lab} \geq 18A$ GeV**
  - **Pb@SPS $E_{lab} \geq 20A$ GeV**
    In@SPS $E_{lab} \geq 10A$ GeV
  - **Au@FAIR/GSI (1st stage) $E_{lab} \leq 10A$**
  - **Au@NICA $6A \leq E_{lab} \leq 60A$**

- **Neutrons are highly appreciated (but not critical)**