

Net Proton distributions in pp and Au+Au collisions at 62 and 200 GeV.

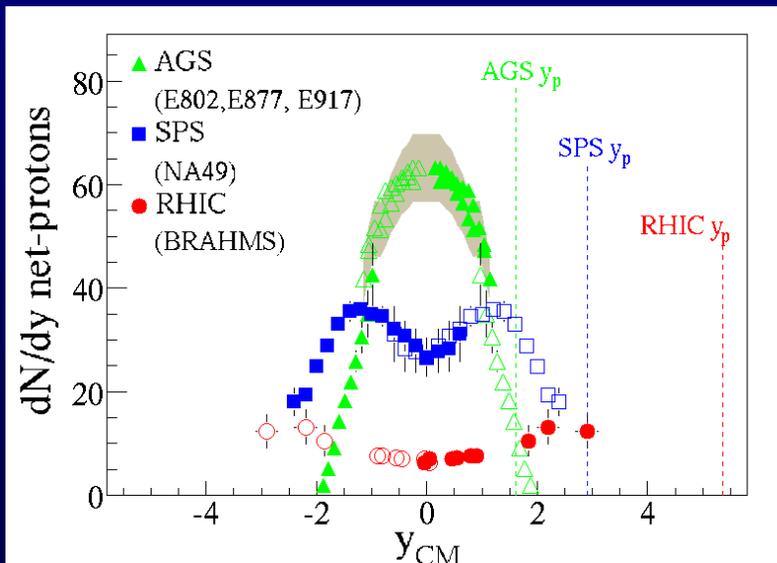
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For the BRAHMS Collaboration
DNP October, 2008

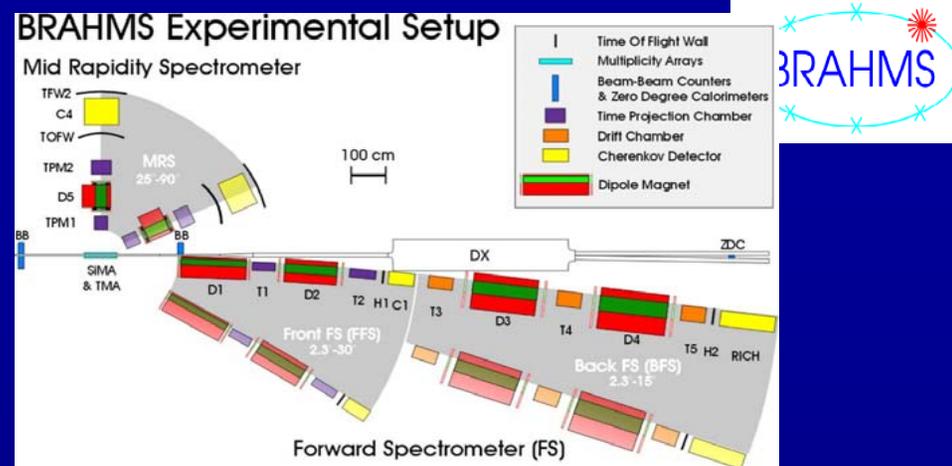


Overview

- Background
 - Net baryon/proton reflects the earliest interaction in HI reactions and set the stage for the amount of energy available to particle production
 - With the high energy at RHIC, a relative baryon free region develops, not seen in previous lower energy data from AGS,SPS..
- Nearly completed analysis of BRAHMS data from pp and AuAu systems (run-4,run-5,run-6)
- Examine p, pbar and net-proton distributions vs. centrality, collision energy



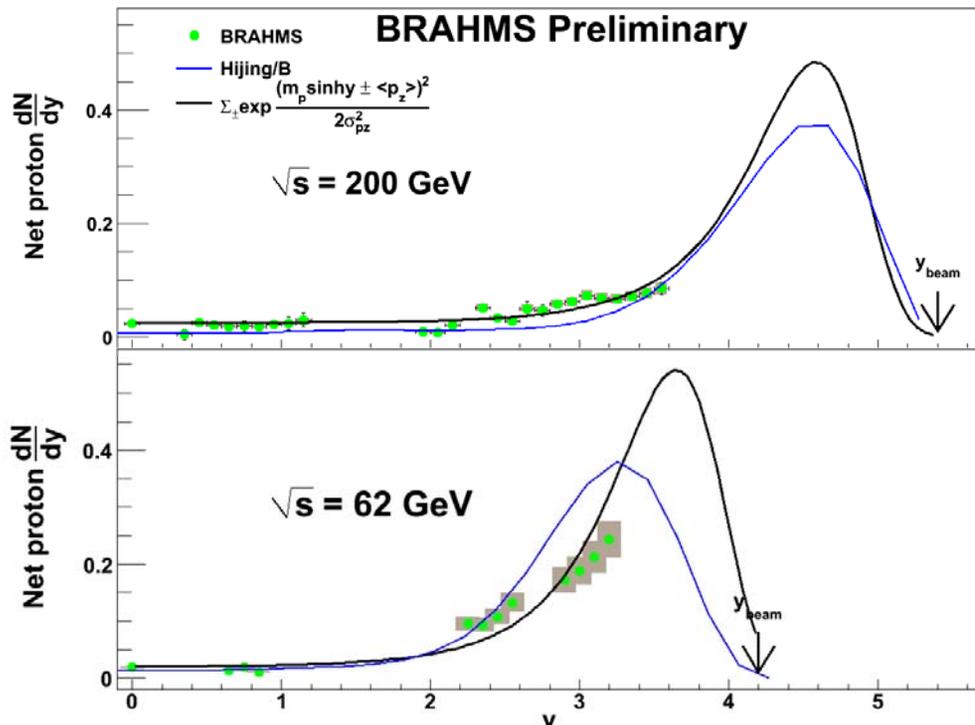
Experiment



- Measurements carried out with BRAHMS spectrometer 40-90°, and 2.3-12°.
- Au+Au at 200 and 62.4 GeV [Run-4]
- p+p at 200 [run-5] and 62.4 GeV [run-6]
- Particle identification with TOF and RICH.
- The lower energy runs were short and have limited coverage in $y-p_t$

pp 62.4, 200 GeV

Data compared to fit function that conserve integrated net-p yield. Also compared to model calculations of Hijing/B



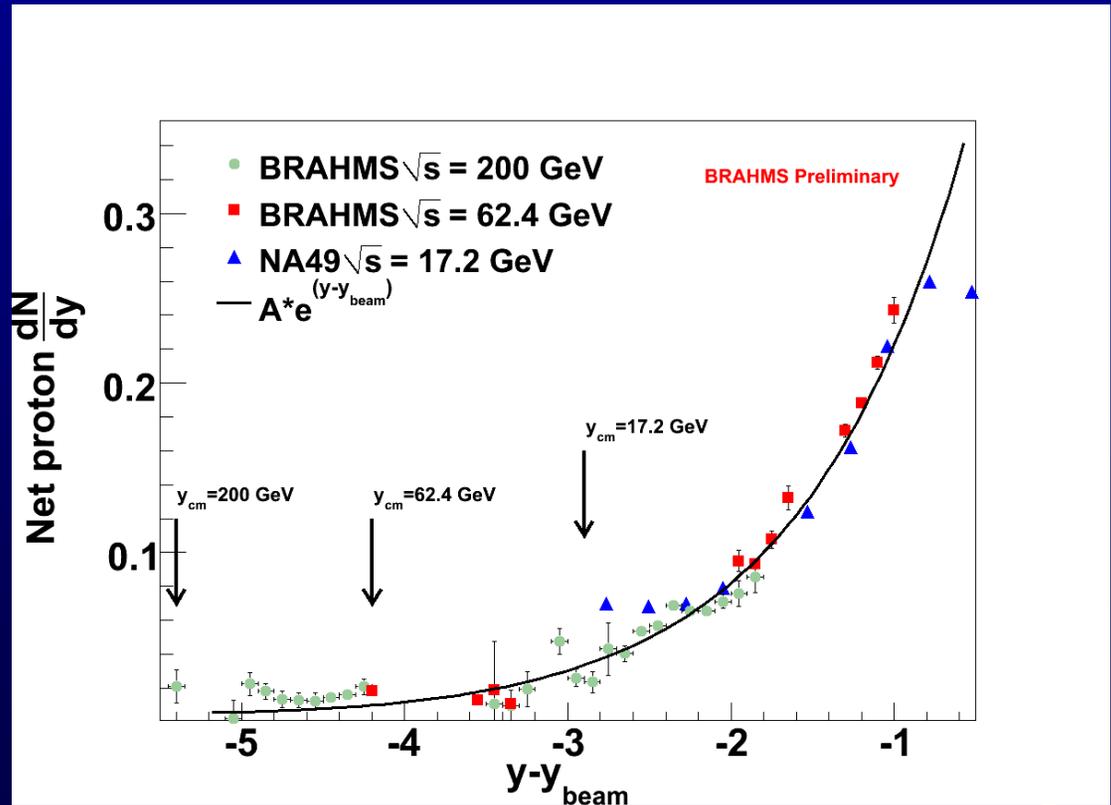
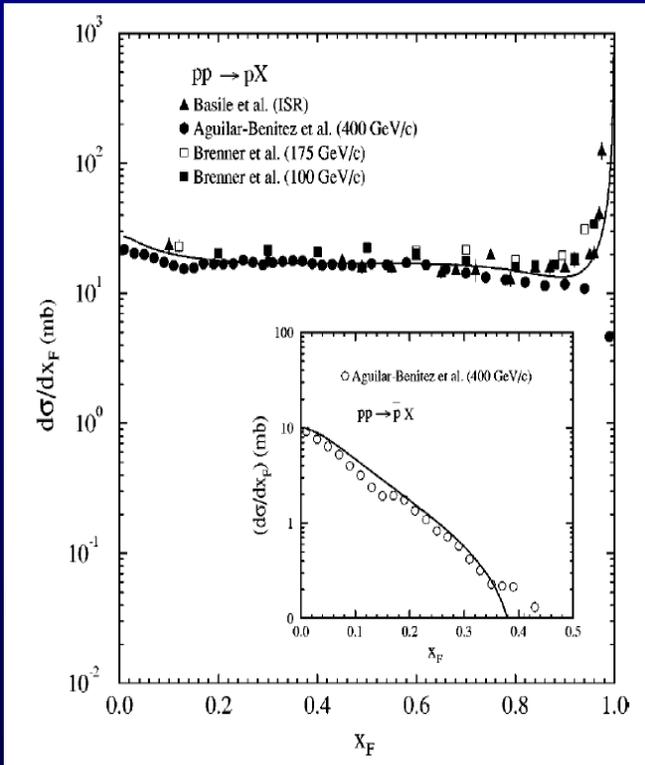
$$\delta y = y_{beam} - \frac{2}{N_{part}} \int_0^{y_{beam}} y \frac{dN_{B-\bar{B}}(y)}{dy} dy$$

$$\delta y(200) \sim 1.2$$

$$\delta y(62) \sim 1.00$$

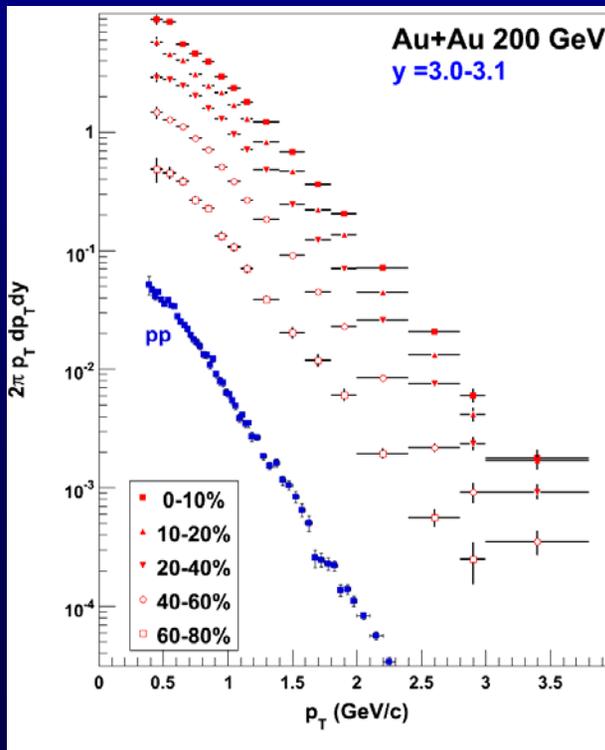
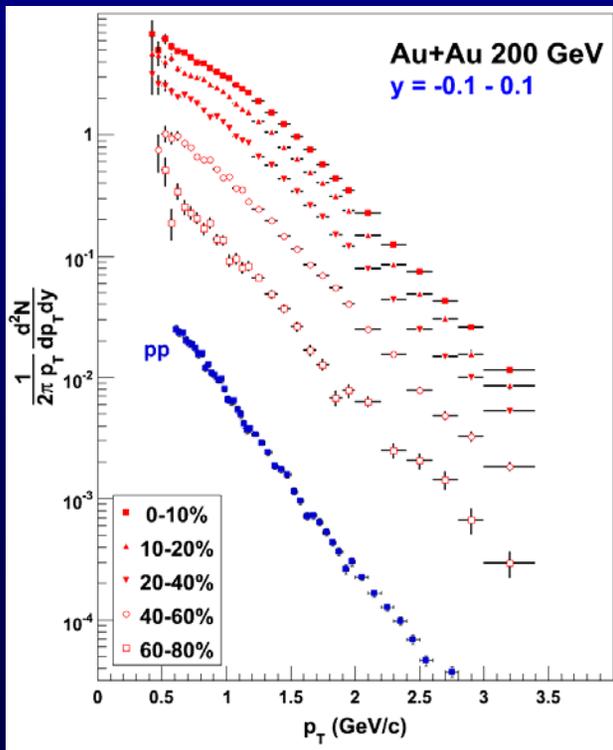
Scaling in pp

- pp collision at lower energies exhibits a feature where $dN/dx \sim c$ with an integral of $\sim 0.6-0.7$
- This implies for constant $\langle m_T \rangle$ vs. rapidity that $dN/dy \sim \exp(-y)$
- The present data confirms this behavior at 200 GeV

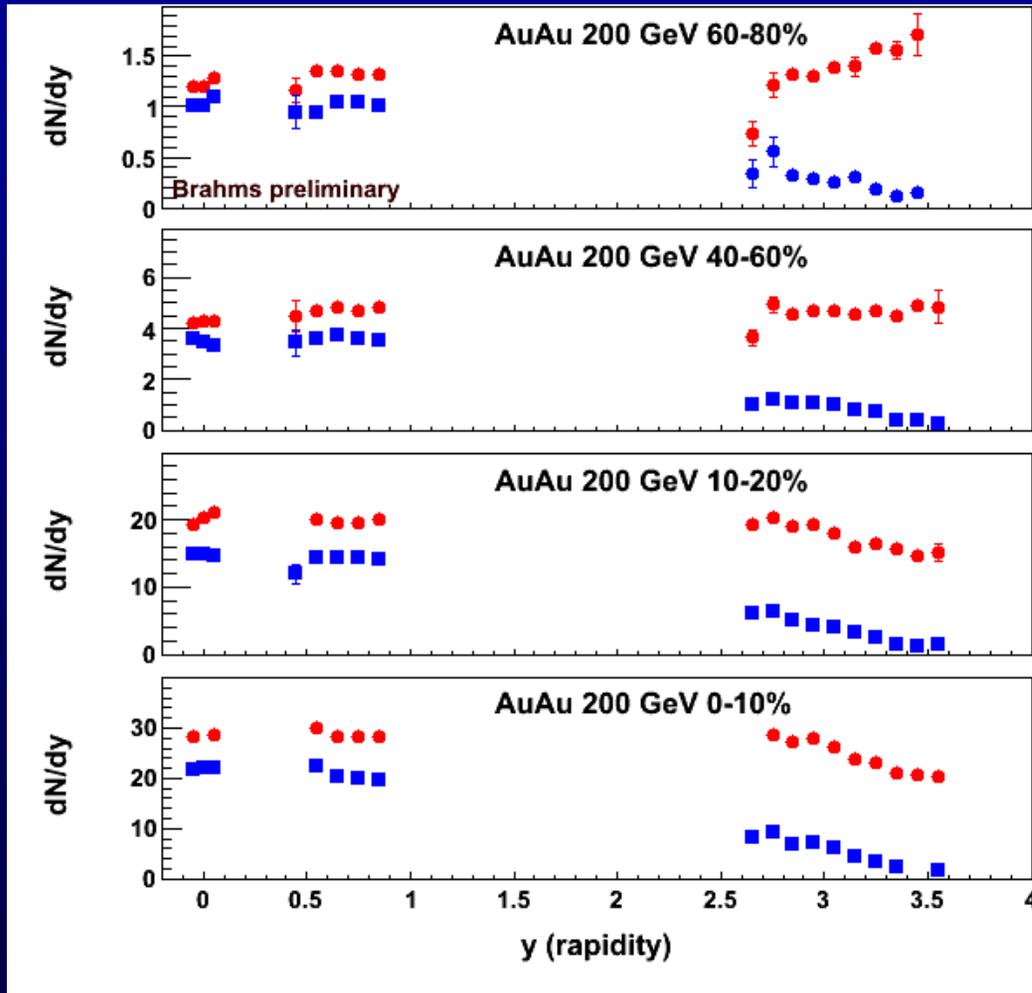


Au+Au – rapidity and centrality

- The spectra softens with decreasing centrality
- $\langle p_T \rangle$ change from $y \sim 0$ to $y \sim 3$
- The peripheral Au+Au evolves towards pp shape; still $\langle v \rangle \sim 1.7$ (mean # collisions)



AuAu 200 GeV



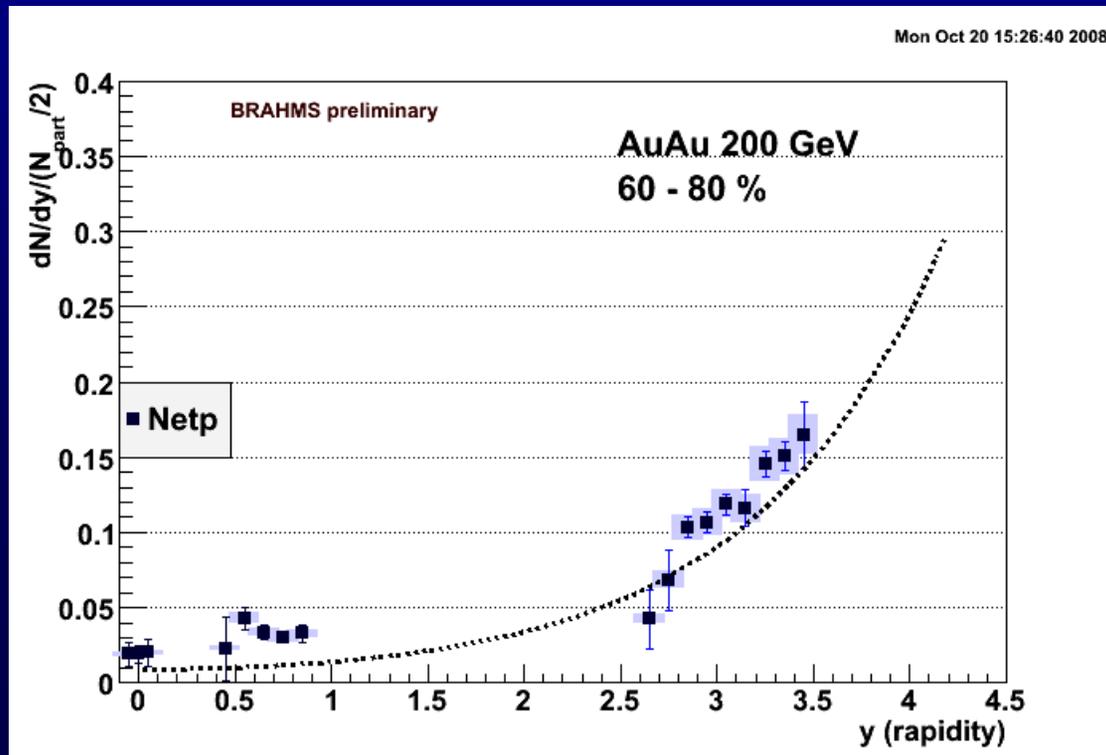
Peripheral



Central

● proton
■ p-bar

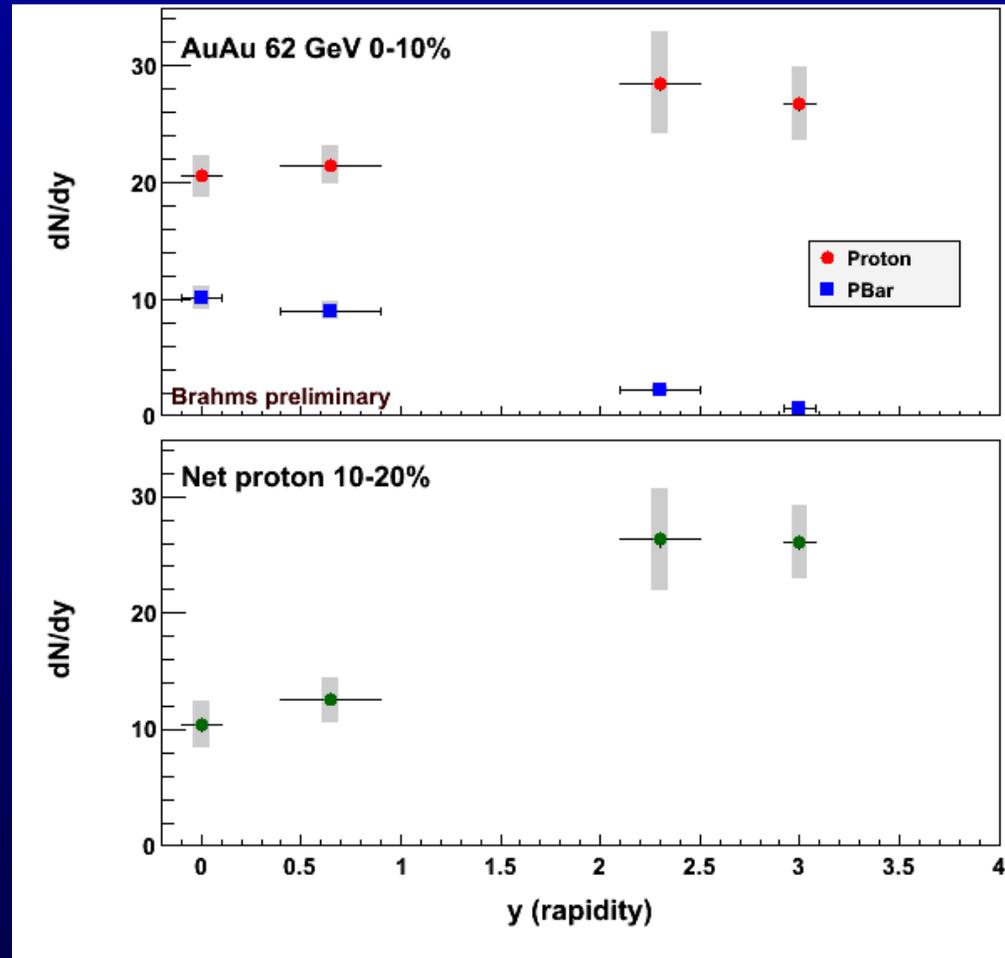
- Compare pp and AuAu in yield normalized to $N_{part}/2$
- Central collision large transport of baryon number and energy toward $y \sim 0$
- Peripheral collisions very similar to pp already from ~ 60



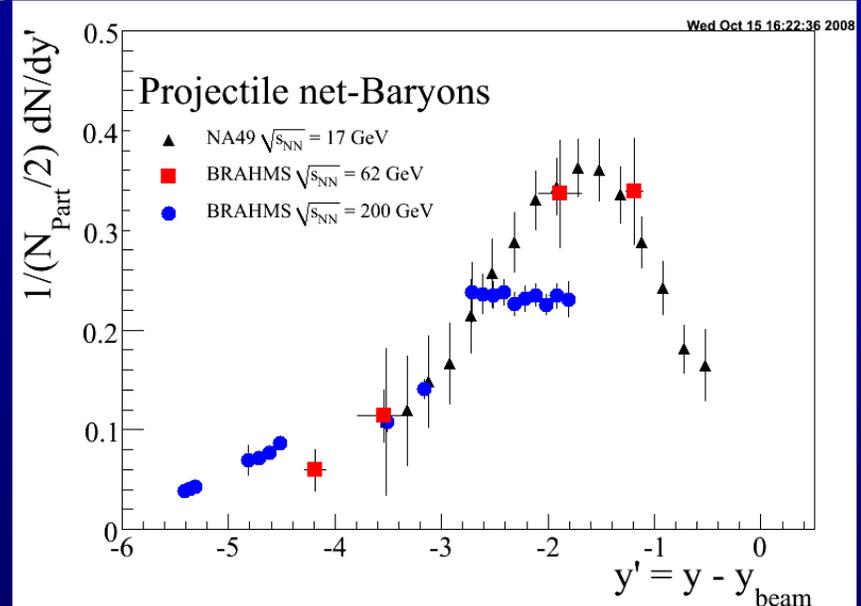
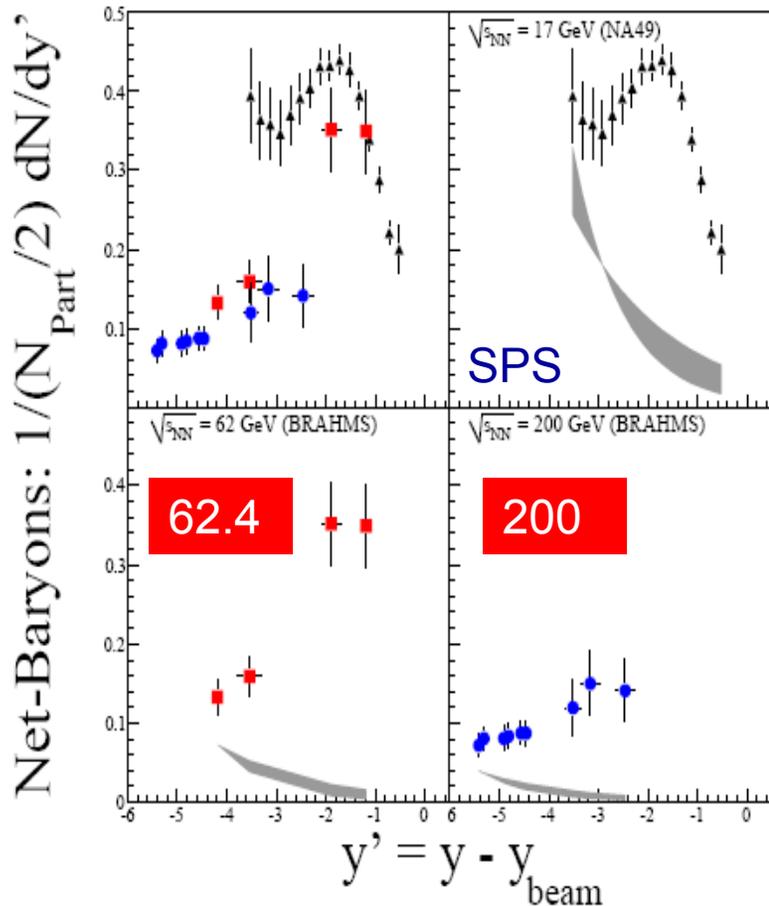
AuAu at 62.4 GeV

The 62.4 GeV run allowed to observed the fragmentation protons near beam rapidity ($y_b \sim 4.2$).

An analysis extracted $dy=2.01 \pm 0.16$



Net-p p in forward hemisphere, subtracting 'target' contribution

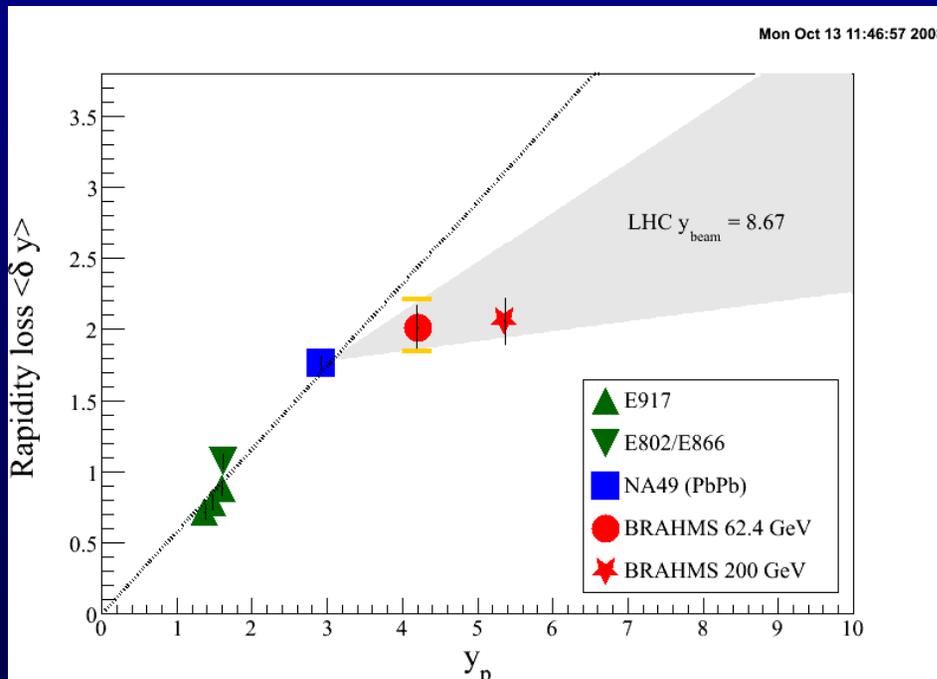


Resulting combined data show similarity between 17 and 62 GeV ; less with 200.

Net-proton do not exhibit scaling in rapidity.

Average Energy loss

- The average energy loss from the 62 GeV data are shown together with previous measurements from AGS, SPS and BRAHMS at 200 GeV
- Approximately constant above SPS energies.



Take away messages

- Presented centrality dependence dN/dy from Au+Au at 200 GeV for protons and p-bar`
- The net-proton distributions in peripheral collisions are similar to pp.
- A clear change in shape takes place at $\sim 40-60\%$ centrality ($v \sim 2$)
- The energy loss is about $\delta y \sim 2$ at $\sqrt{s} > 20$ GeV, a trend that likely will continue to LHC energies. The high rapidity region cannot be probe there, but the yield at $y \sim 0$ vs. centrality is a strong indicator of baryon stopping.
- Net-proton with 'target' contribution subtracted shows common features with energy, but shape seems to change at highest energy indicating larger baryon transport.