Progress in BRAHMS

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The last data from the BRAHMS experiment at RHIC were taken in 2006. Most, if not all, of the data analysis of the various data sets has been completed. There are a number of papers in preparation, notably a summary of the 200 and 62 GeV p + p data, a long paper showing results on the 200 and 62 GeV Cu + Cu data, a summary paper on 200 GeV Au + Au that, among other topics, extends the analysis of the stopping[1] to include the centrality dependence.

We have completed the analysis of the 200 GeV p + p data of run V at the Cyclotron Institute and are in the process of preparing the summary of the 200 and 62 GeV data. Among the analysis that we performed in the past year builds on the net proton rapidty distributions previously shown[2]. In that work we demonstrated longitudinal scaling from 17 GeV to 200 GeV.

We have extended that work to extract net baryon distributions. This is done by correcting the net protons for other baryons that are not observed in our experiment:

$$\frac{dN_{B-\bar{B}}}{dy} = \frac{dN_{p-\bar{p},meas}}{dy} \frac{n_p + n_n + n_\Lambda}{n_p + c_1 n_\Lambda}$$

where n_i is the true net number of each particle species and c_1 is the number of protons from weak decays for each lambda which was determined from Hijing calculations[1]. This expression can be rewritten in terms of ratios of the various particles to protons and then the important parameters are the net proton to net lambda and net proton to net neutron ratios. We employed Pythia[3] calculations to estimate these ratios as a function of rapidity. We checked the results of nl/n_p at mid rapidty with measured data[4] and found the results to agree within error.

The solid points in the bottom two panels of Fig. 1 show the net baryon distribution extracted in this way for the 62 GeV and 200 GeV data, respectively. The solid points in the top panel show the net baryon distribution extracted from net proton distributions at 17 GeV[5]. This study details a complete measurement over the entire rapidity range at 17 GeV.

We wish to study stopping in 200 and 62 GeV p + p collisions. Without a measurement over the entire rapidity distribution, results must be corrected for the unobserved yield. We have, in fact, performed such corrections in several studies of Au + Au at 200 GeV[1] and 62 GeV[6]. The largest rapidity measured in the p + p data, both at 62 and 200 GeV, is well below the beam rapidity. Although we could, in principle, perform estimates of the corrections for the unobserved yield, we examine whether the longitudinal scaling observed in the net proton distributions [2] can provide information on the stopping at 200 and 62 GeV.

The study at 17 GeV also quoted the results in terms of dN/dx_F. The open squares in the top panel of Fig. 1 show the dN/dx_F transformed to dN/dy. As expected they overlap in the region of rapidity where dN/dx_F is quoted. If there is longitudinal scaling in the net baryon distributions, the dN/dx_F should be constant. We therefore transform the dN/dx_F to dN/dy for each of the systems at 200 and 62 GeV. These data transformed from 17 GeV are shown as open squares in the bottom two panels of Fig. 1. We

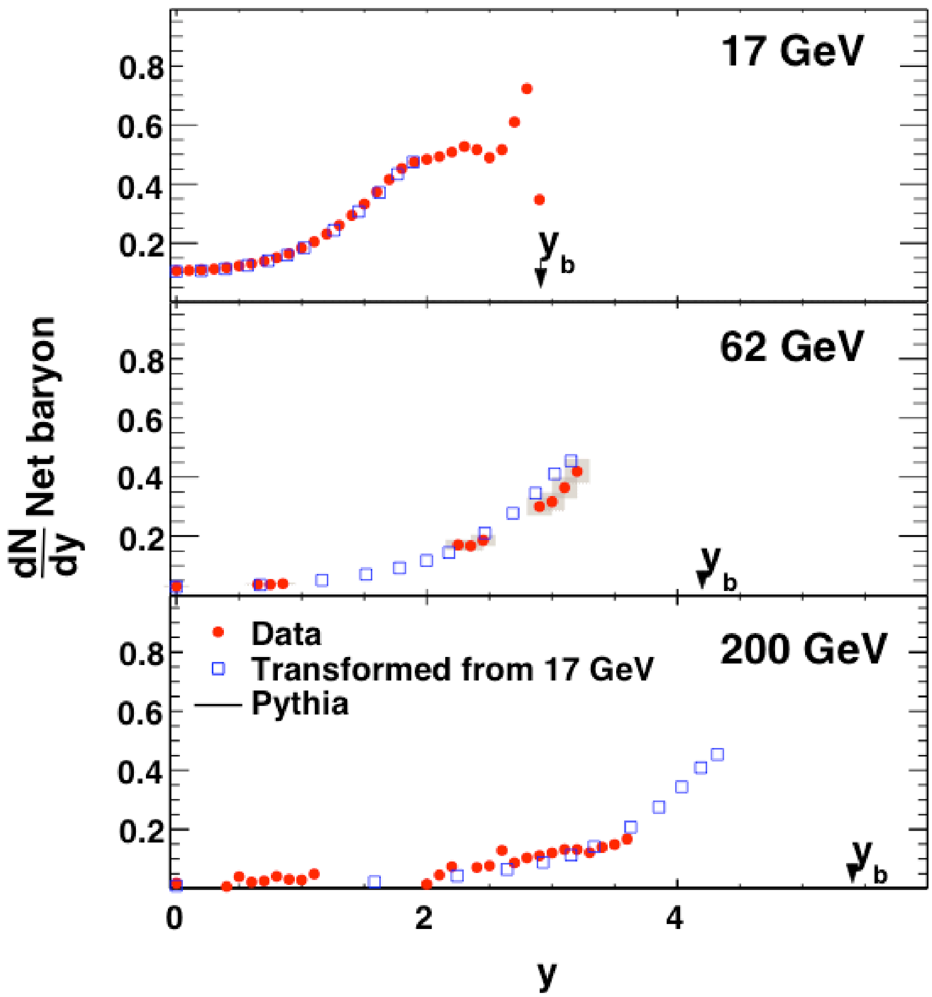

FIG. 1. Net baryon distributions for 17 GeV (top panel), 62 GeV (middle panel) and 200 GeV (bottom panel).

note nearly complete overlap in the regions of common rapidity. We interpret this to mean that we do, indeed, observe longitudinal scaling in the net baryon rapidity density from 17 GeV to 200 GeV implying that the mechanism of baryon transport does not change over this large range of $\sqrt{s_{nn}}$.

We have also extracted 4π multiplicities for the products measured in our experiments. This was done by integrating the rapidity densities that we measured [7] from mid-rapidity to the beam rapidity. To accomplish the integration, we fit the data to a Gaussian and then integrated the Gaussian from y=0 to $y=y_p$. Fig. 2 shows the 4π multiplicities that we extracted along with data from earlier measurements. Also shown in the figure are data from earlier measurements at lower energies [8,9]. We note that the BRAHMS data at 62.4 and 200 GeV extends the earlier systematics. The dashed curves show fits to our data as well as the earlier data. These fits are extrapolated to LHC energies and provide a prediction of particle multiplicities that can be expected at those energies.

The results of the 200 and 62.4 GeV p + p data are summarized in a detailed paper that is in final preparation by the BRAHMS collaboration.

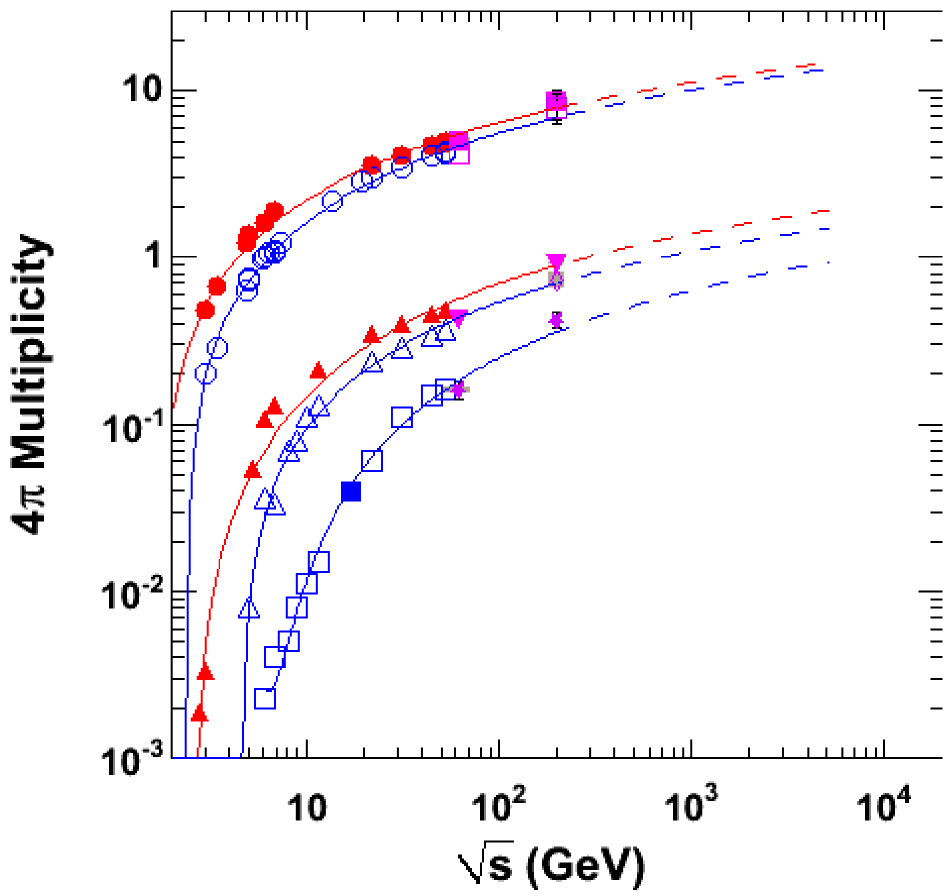

FIG. 2. 4π multiplicities as a function of $\sqrt{s_{nn}}$. The points at 62.4 and 200 GeV represent our data while the points at lower energies are from [8] and [9]. Solid symbols represent positive particles and open symbols represent negative particles. Circles represent pions, triangles represent kaons and squares represent anti-protons.

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