Pseudorapidity distributions of charged particles at RHIC

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We have measured pseudorapidity distributions of charged particles from Au+Au collisions at $\sqrt{s_{NN}} = 130$ GeV [1] and 200 GeV [2] as a function of reaction centrality. Charged-particle production in the pseudorapidity range $|\eta| < 4.7$ was determined using several subcomponents of the BRAHMS experiment at RHIC. A coaxial arrangement of silicon strip and scintillator tile detectors determined particle production near mid-rapidity ($|\eta| < 3$). Two arrays of Cherenkov radiators mounted to photomultiplier tubes established the charged-particle yields at larger pseudorapidities. Also, time-projection chambers in two separate, movable spectrometer arms were used to provide independent confirmation of the results. We find $dN_{ch}/d\eta|_{\eta=0}$ and $N_{ch}|_{|\eta|<4.7}$ increase by 14% and 21%, respectively, in going from 130 GeV to 200 GeV. Scaling the observed charged-particle densities by the number of participants, we find $\frac{dN_{ch}}{d\eta}\frac{2}{<N_{part}>}$ increases for central events at mid-rapidity by 13% from the lower to higher energy. These results constrain the current theoretical understanding of particle production at RHIC energies. In particular, theoretical calculations that include parton saturation effects [3] and alternative calculations based on a multi-phase transport picture [4] will be compared to the data. Finally, pp collision data at $\sqrt{s_{NN}} = 200$ GeV which were obtained with the same detector system as used for the Au+Au results will be presented. Together with the Au+Au results and other experimental results from different energies, these data help to establish the systematics of charged-particle production as we start to achieve central energy densities in excess of that predicted to lead to the formation of a quark-gluon plasma.

References

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