Inclusive distributions at the LHC as predicted from the DPMJET-III model with chain fusion

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Abstract. DPMJET-III with chain fusion is used to calculate inclusive distributions of Pb-Pb collisions at LHC energies. We present rapidity distributions as well as scaled multiplicities at mid-rapidity as function of the collision energy and the number of participants.

1. Bibliography

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Monte Carlo codes based on the two-component Dual Parton Model (soft hadronic chains and hard hadronic collisions) are available since 10-20 years. The present codes are PHOJET for h-h and -h collisions [1] and DPMJET-III based on PHOJET for h-A and A-A collisions [2]. To apply DPMJET-III to central collisions of heavy nuclei the percolation and fusion of the hadronic chains had to be implemented [3].

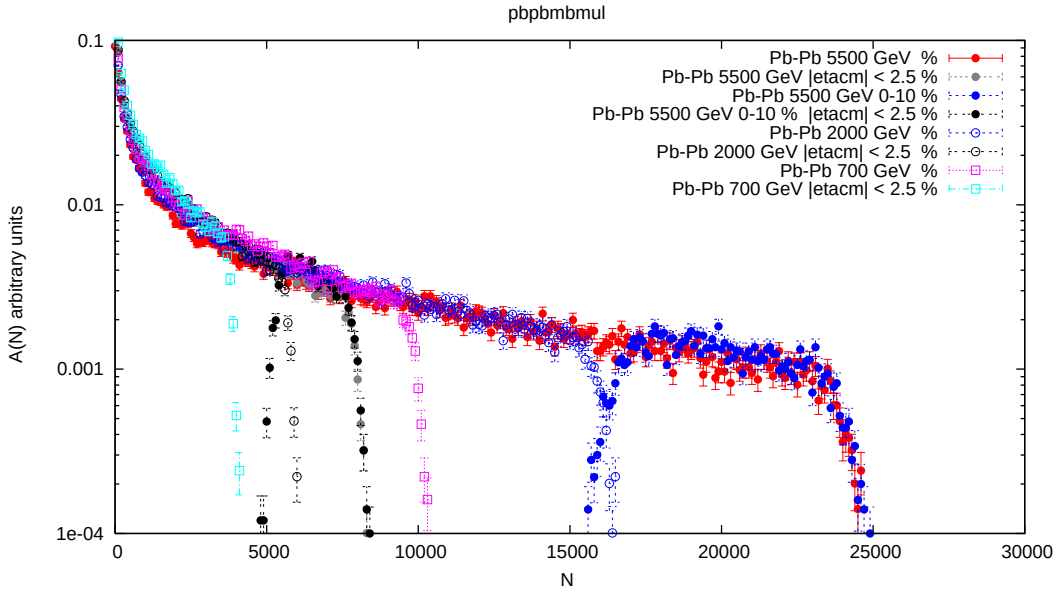

Fig.1 Multiplicity distributions in minimum bias and 0-10 % central collisions in Pb-Pb collisions in the full $_{cm}$ range and for $j_{cm}j$ 2.5. (from DPMJET-III).

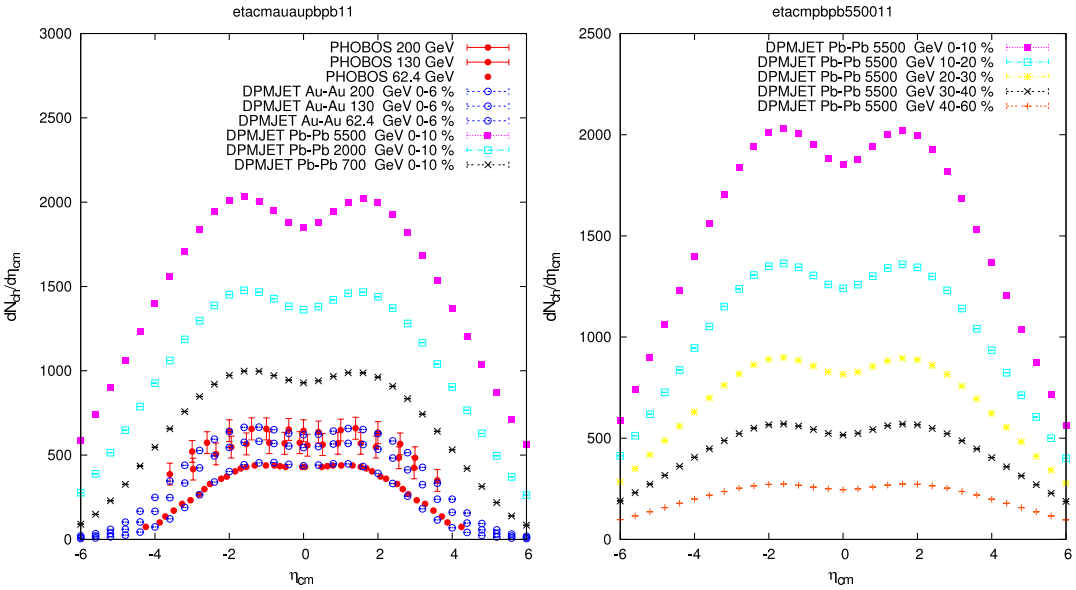

Fig.2 (left) Central RHIC and LHC collisions (right) LHC Pb-Pb collisions from DPMJET-III.

In Figs.1 and 2 we apply this model to minimum bias and central collisions of heavy nuclei at the LHC and at RHIC. We find an excellent agreement to RHIC data on inclusive distributions.

The behaviour of the inclusive hadron production becomes particular simple if we plot it in the form $\frac{dN}{d\ _{cm}}=\frac{N_{part}}{2}$. N_{part} is the number of participants in the A–A collisions. In Fig.3 we plot this quantity as function of N_{part} and as function of E_{CM}, in both plots we find a rather simple behaviour.

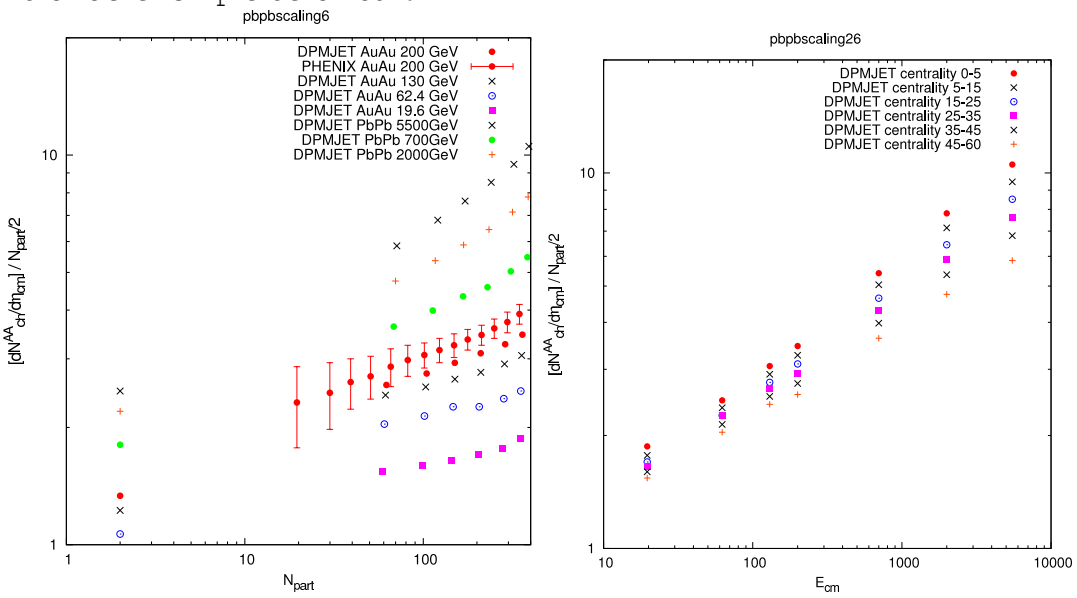

Fig.3 $\frac{dN}{d\ _{cm}}=\frac{N_{part}}{2}$ (left) over N_{part} (right) over E_{CM}, Pb–Pb and Au–Au collisions.

The limiting fragmentation hypothesis was proposed in 1969 by Benecke et al. [4]. If we apply it to nuclear collisions we have to plot $\frac{dN}{d\ _{cm}}=\frac{N_{part}}{2}$ as function of $_{cm}$ y_{beam}. In Fig.4 we plot central and less central Au–Au collisions at RHIC and LHC energies in this form. We find that DPMJET–III shows in the fragmentation region only small deviations from limiting fragmentation.

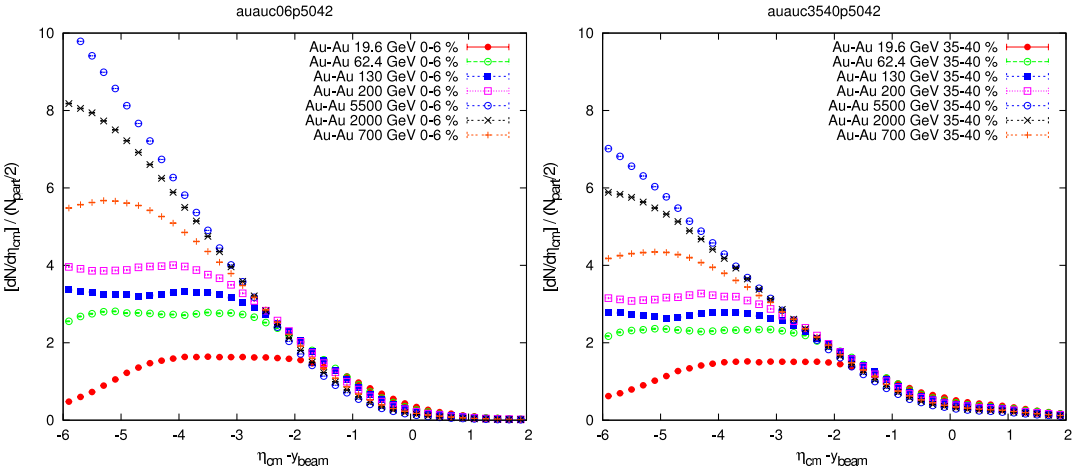

Fig.4 $\frac{dN}{d\ _{cm}}=\frac{N_{part}}{2}$ Au–Au collisions over $_{cm}$ y_{beam} (left) central, (right) less central.