# Brief description for a hadron and string cascade model JPCIAE

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The JPCIAE model [1,2] is based on the LUND string model [3]. In JPCIAE, a nucleus-nucleus collision is depicted as a superposition of hadron-hadron (hh) collisions. If the cms energy of a hh collision is large enough for running PYTHIA ($\geq$4 GeV, for instance) the hh collision is then executed by calling PYTHIA, otherwise, it is treated as the conventional two-body collision [4–6]. If the cms energy of a hh collision is larger than 10 GeV, PYTHIA with special selection of QCD hard processes, the J/$\psi$ production process

$$g + g \rightarrow J/\psi + g(1.3 \times 10^{-5} mb) \tag{1}$$

for instance, is possible to be executed. The re-interactions among the produced particles and the participant and spectator nucleons are taken into account consequently.

In JPCIAE, the nucleus-nucleus collision is simulated in the Lab. or CMS frame. The center of target nucleus refers to as the spatial origin and the moment when the first hh collision happens stands for origin of time. We initialize the nucleons of colliding nuclei in spatial space according to Woods - Saxon distribution. Projectile nucleons are given an incident momentum and target nucleons are at rest (simulation in the Lab. frame, for instance). The Lorentz contraction is taken into account then.

The initial particle list is composed of projectile nucleons and target nucleons and the initial collision (time) list is constructed by colliding pairs, each pair of which is composed of a projectile nucleon and a target nucleon. We calculate the collision time when colliding partners approach minimum distance by assuming the straight line trajectory.

After the first hh collision with smallest collision time from initial collision (time) list is proceeded, the particle list and collision list are then updated with the produced particles included in both lists. Repeat this process till the collision list is empty. We have then the statistics for final states.

The following results are the $\eta$ distributions of charge particles (both charged $\pi$ and kaon and proton) and the rapidity distributions of net baryon (proton, $\Lambda^0$ and $\Sigma^0$) in full phase space and the transverse momentum distributions (-0.5<y<0.5) predicted by JPCIAE for Au(100 GeV/nucleon)+Au(100 GeV/nucleon) and p(100 GeV/nucleon)+ Au(100 GeV/nucleon) (b<3 fm) and p(100 GeV/nucleon)+p(100 GeV/nucleon) (b=0 fm) collisions. The total event numbers are 130, 1000, and 5000 for Au+Au, p+Au, and p+p reactions, respectively. Since in JPCIAE there is no introduction of the QGP phase JPCIAE predictions here are the benchmark for the QGP formation in RHIC.

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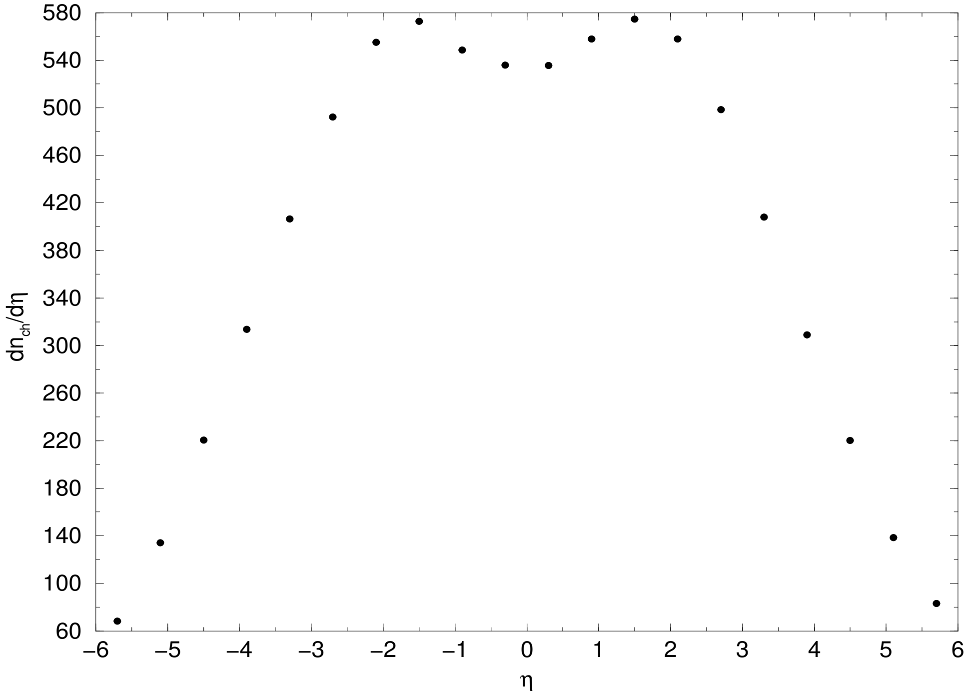
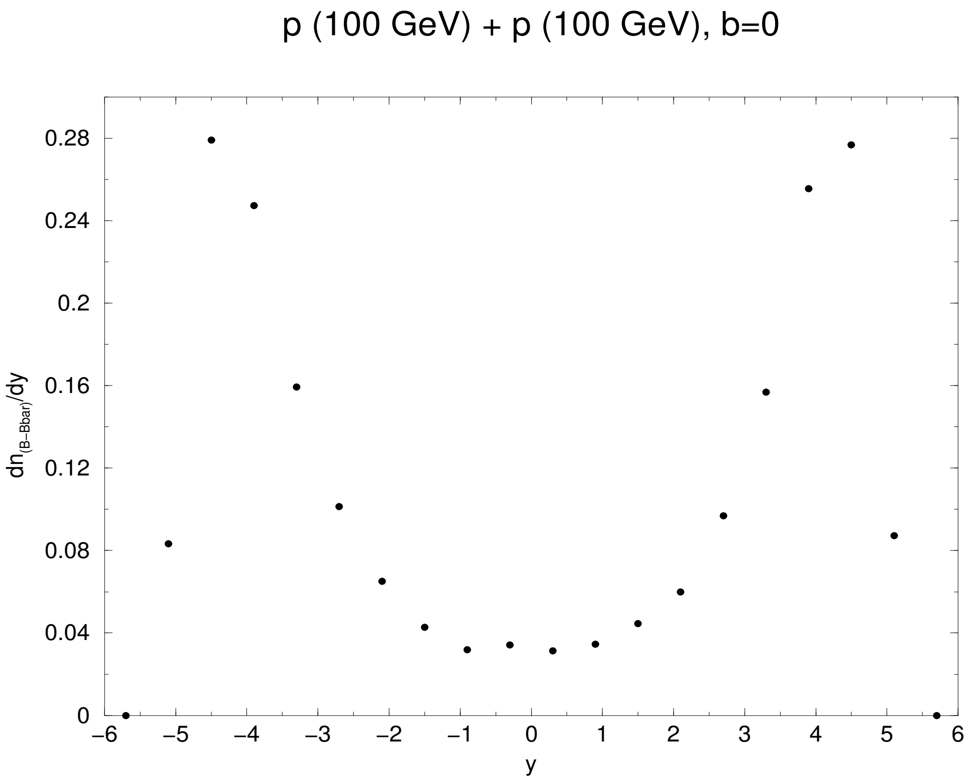
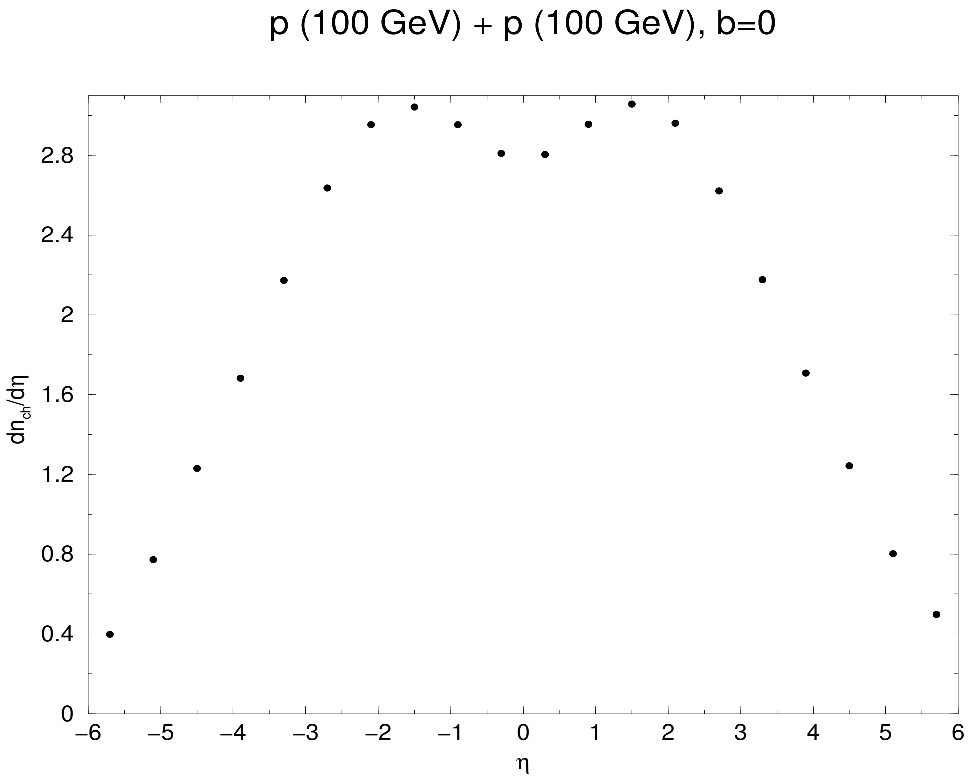
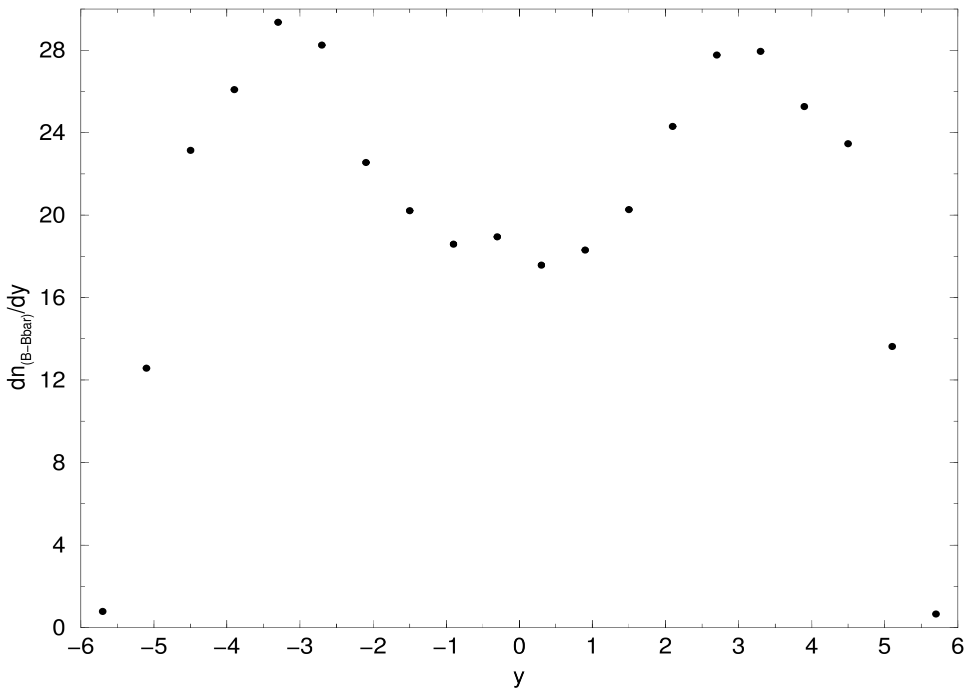
Au (100 GeV/nucleon) + Au (100 GeV/nucleon), b=0–3



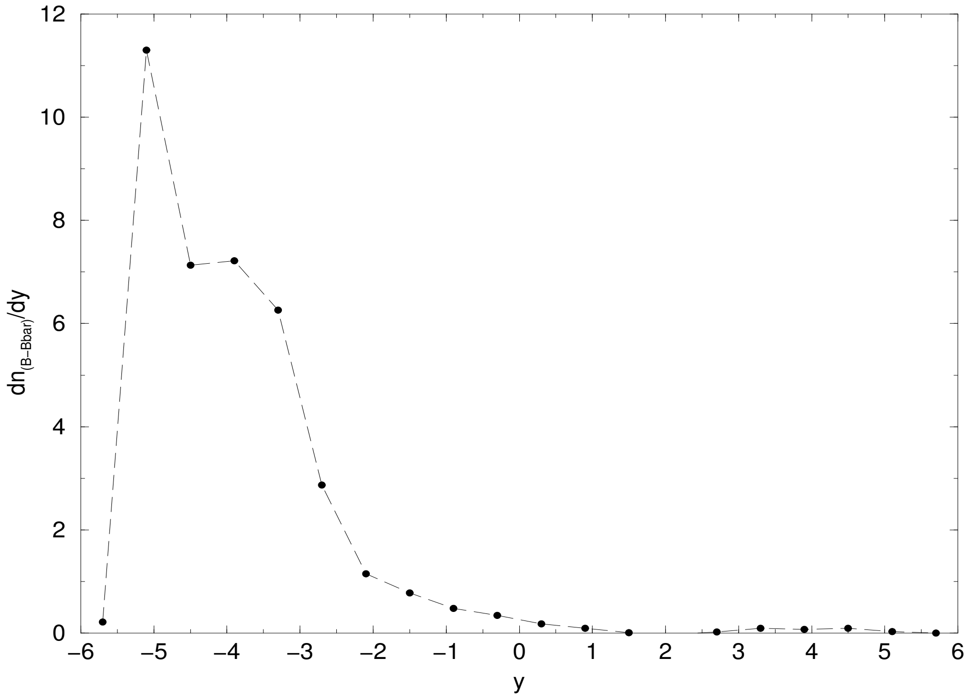

p (100 GeV) + p (100 GeV), b=0
dn(B−Bbar)/dy
y
0.28
0.24
0.2
0.16
0.12
0.08
0.04
0
−6
−5
−4
−3
−2
−1
0
1
2
3
4
5
6


p (100 GeV) + p (100 GeV), b=0
dn_ch/dη
η
0
0.4
0.8
1.2
1.6
2
2.4
2.8
−6
−5
−4
−3
−2
−1
0
1
2
3
4
5
6

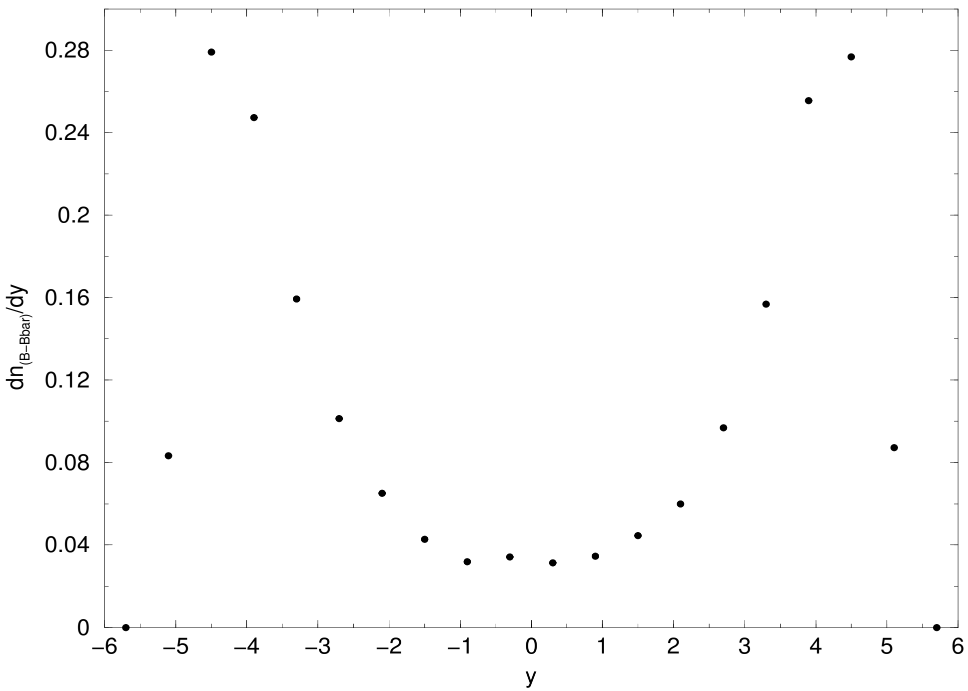
Au (100 GeV/nucleon) + Au (100 GeV/nucleon), b=0–3

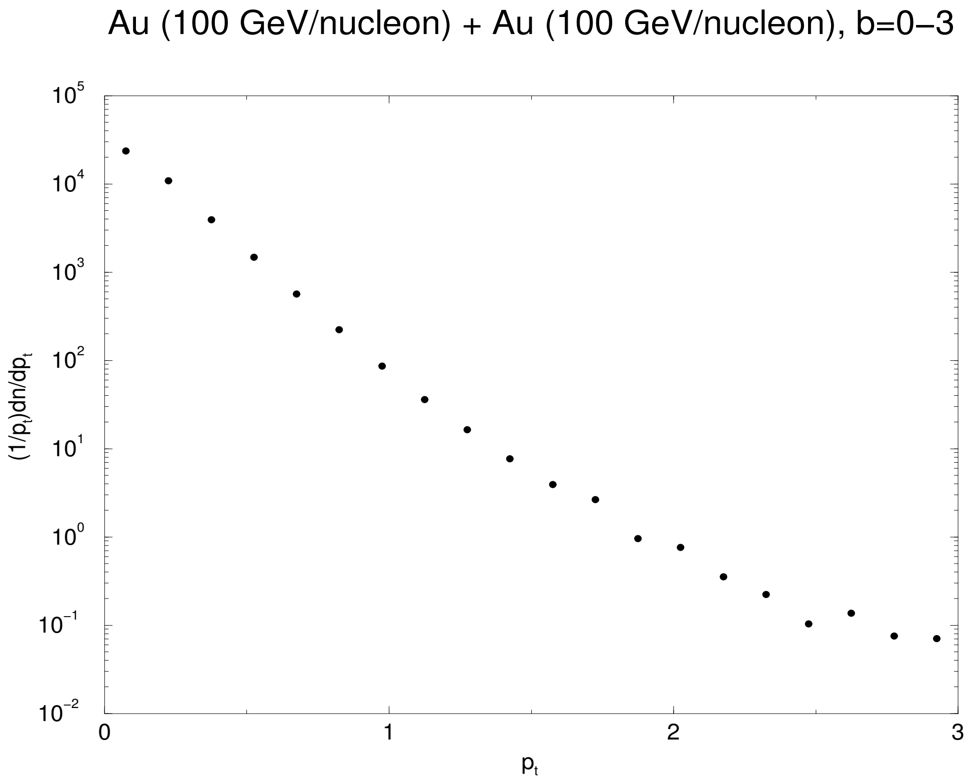


p (100 Gev) + Au (100 GeV/nucleon), b=0–3

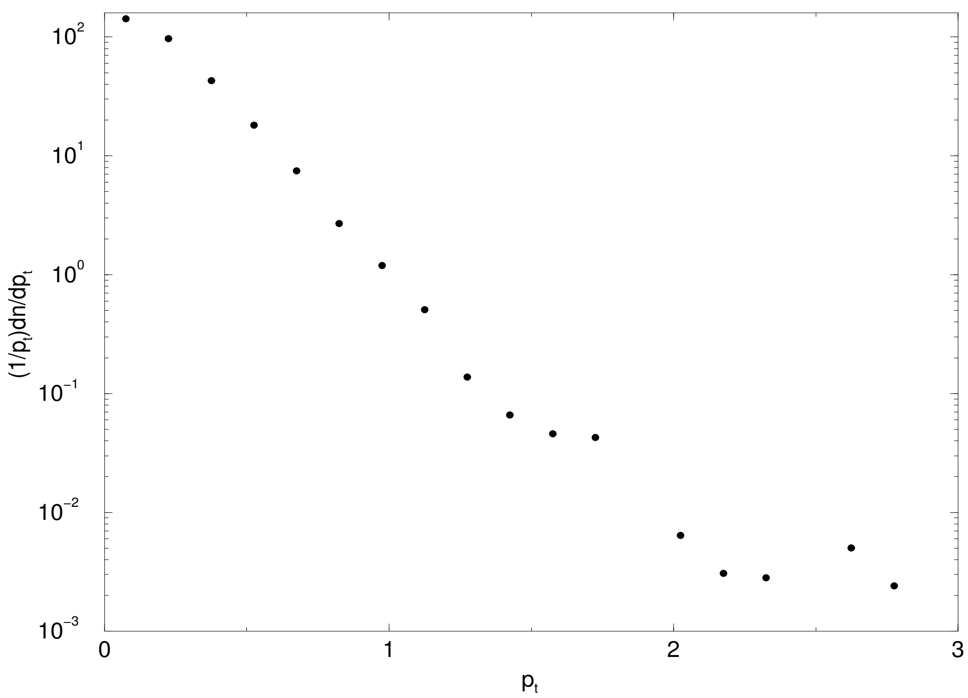


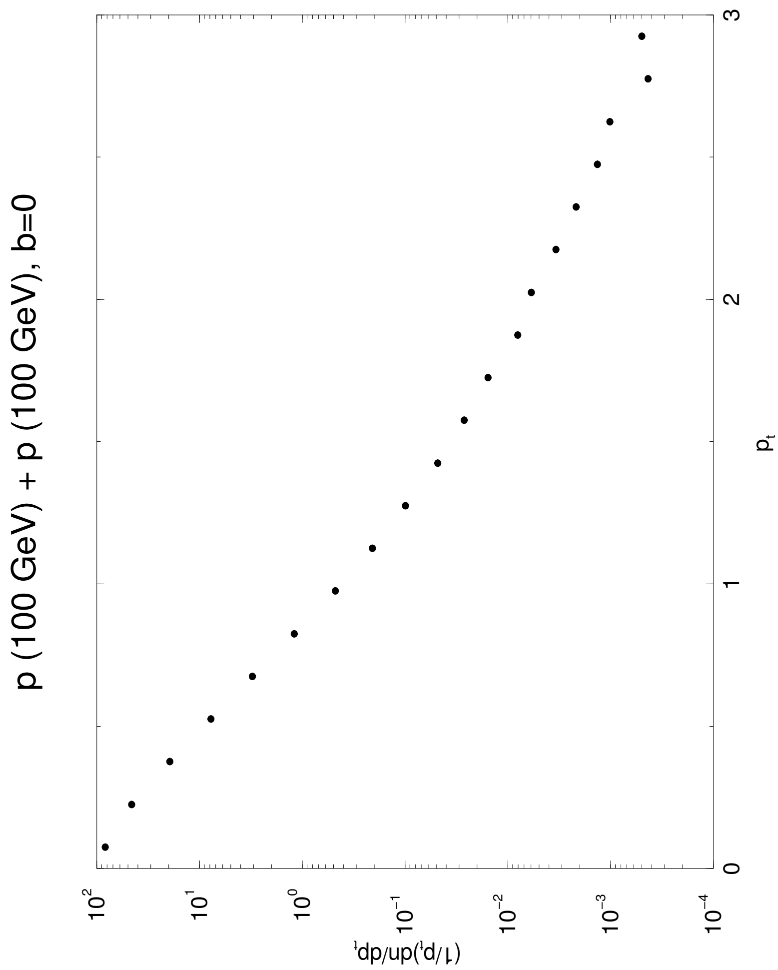
p (100 GeV) + p (100 GeV), b=0




Au (100 GeV/nucleon) + Au (100 GeV/nucleon), b=0–3
$(1/p_t)dn/dp_t$
$10^5$
$10^4$
$10^3$
$10^2$
$10^1$
$10^0$
$10^{-1}$
$10^{-2}$
0
1
2
3
$p_t$

p (100 GeV) + Au (100 GeV/nucleon), b=0–3







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