

Transverse momentum distributions of baryons at LHC-energies.

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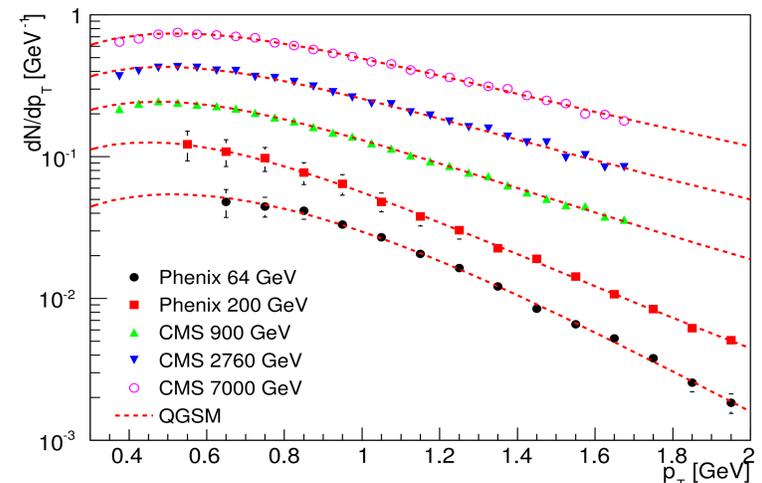
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Abstract

As it is seen from the data on proton (antiproton) transverse momentum spectra in RHIC and LHC (PHENIX, ALICE and CMS experiments), the slopes of the distributions at $0,5 \text{ GeV} < p_T < 2,0 \text{ GeV}$ are changing with the increase of energy. The description of available data in the considered region of p_T with the phenomenological dependence, which was suggested long ago in the research of multiparticle production at lower energy hadron collisions in the framework of Quark-Gluon String Model, shows the slow growing of average p_T that was not observed before. This growing, as the result of the energy variation of the distribution form, has been obtained as well at the recent study of Λ transverse momentum spectra in the same model approach. Here we have combined both results and conclude that average p_T of baryons increase with energy as well as with the mass of baryons. The last conclusion will be more obvious, if the LHC data on Λ_b become available.

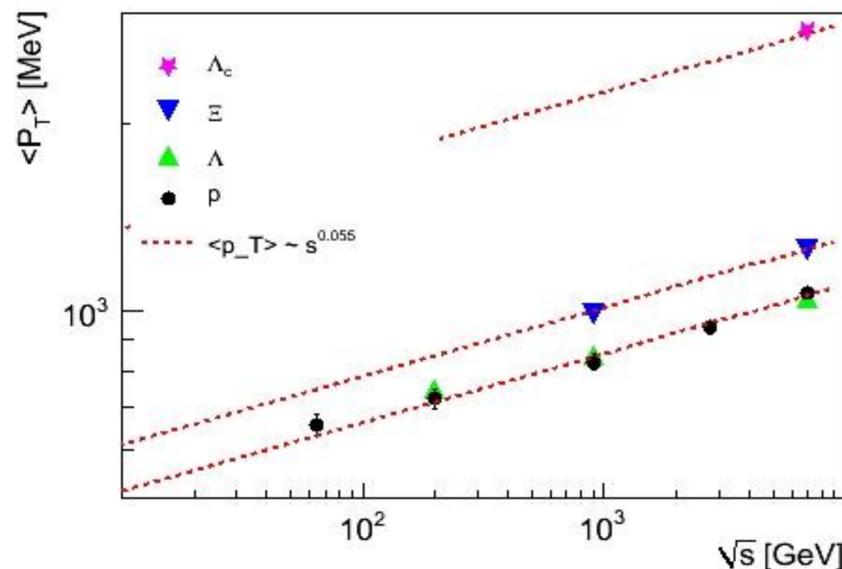
Transverse momentum spectra

The direct theoretical study of QCD for baryon production in high energy collisions seems to be difficult in the moment. Therefore, various phenomenological models are used to describe it, observe dependences in the experimental data and make predictions for further experiments. Recently Λ -baryon production has been studied in terms of the Quark-Gluon-String-Model (QGSM). Here it is suggested to study proton and anti-proton production at LHC-energies and compare the observed dependences on the mean transverse momenta, $\langle p_T \rangle$, as a function of c.m.s. energy with observations derived for Λ and Λ_c production.



Spectra of baryons tends to become harder with the increase of energy.

Mean transverse momenta



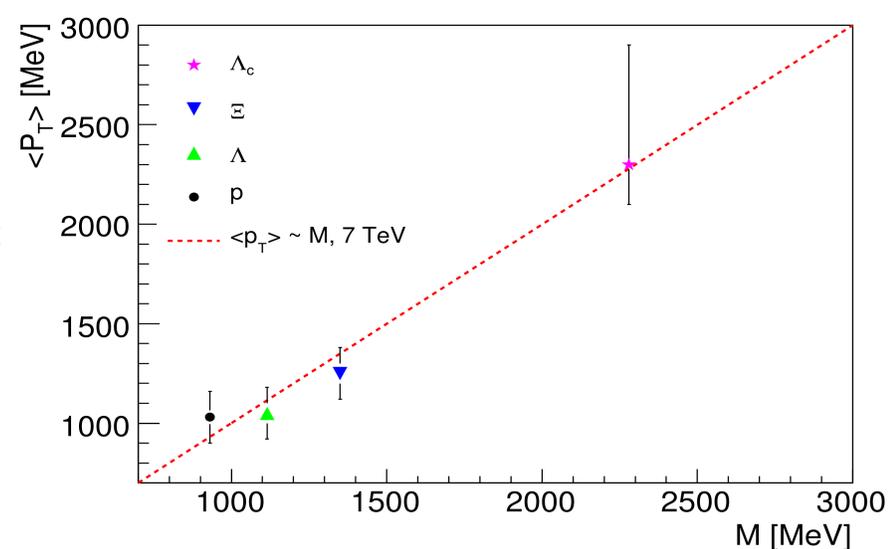
The steep rise of the mean transverse momenta $\langle p_T \rangle$ as a function of energy:

Can be parametrized by the same power-like $s^{0.055}$ behavior for all the species of produced baryons.

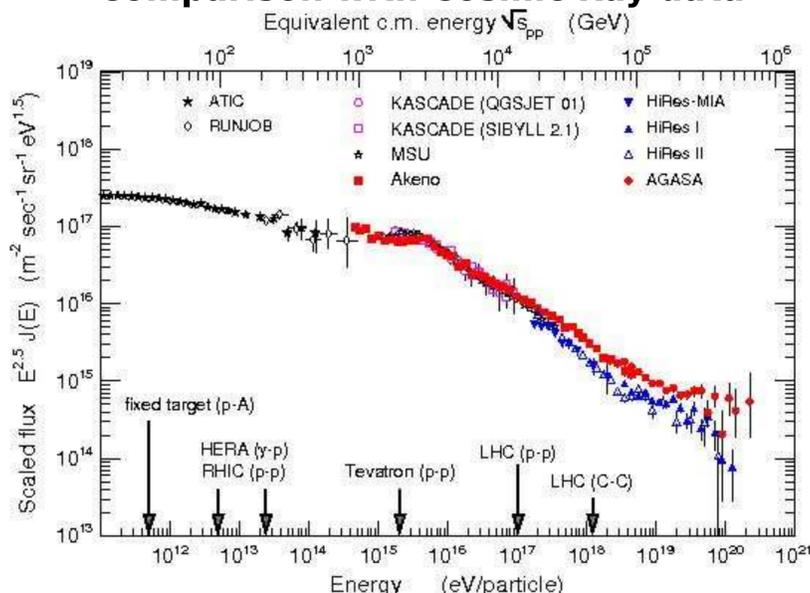
The p_T -behaviour of the baryon production might be the same independently of the quark-composition of the baryon.

A linear dependence between the mean transverse momenta $\langle p_T \rangle$ and the baryon mass M .

More measurements for heavier baryon production could shed light on the observed mass dependence of the $\langle p_T \rangle$.



Comparison with Cosmic Ray data



The changes of proton spectrum in cosmic rays at the energies between Tevatron and LHC (7 TeV) can not be caused by hadronic interactions of these energies. There are no dramatic changes in baryon spectra in collider experiments up to 7 TeV.

Conclusions

1. The data on baryon production for the energy region from RHIC to up-to-date LHC have been described in QGSM approach
2. The difference from the later QGSM study of transverse momentum distributions at lower energies is in the slight variation of slopes of spectra at low p_T .
3. The linear mass dependence of mean transverse momenta ($\langle p_T \rangle \sim M$) has been observed. More data are necessary on Λ_c and Λ_b from LHC experiments.
4. The slow growing of $\langle p_T \rangle$ in high energy hadron interaction can not be the reason of long discussed "knee" in the spectrum of cosmic ray protons at the energies between Tevatron and LHC