Hadronic spectra in p+p collisions at RHIC and LHC energies

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Introduction

The p+p collisions are important to understand particle production mechanism in partonic collisions and are also used as baseline for heavy ion collisions. We present systematic analysis of mesons and baryons in p+p collisions at RHIC and LHC energies. The hadron spectra in p+p collisions are described by Tsallis function which is given by :

$$\frac{1}{2\pi p_T}\frac{d^2N}{dydp_T} = \frac{1}{2\pi}\frac{dN}{dy}A(n,T)\left(\frac{nT+m_T}{nT+m}\right)^{-n}; \quad A(n,T) = \frac{(n-1)(n-2)}{(nT+m(n-1))(nT+m)} \quad (1)$$

Here dN/dy is the integrated yield of the particle, n is the power which determines the shape of the spectra at high p_T and T foverns the low p_T part. m_T is the transverse mass given by $m_T = \sqrt{p_T^2 + m^2}$, m is the rest mass of the particle. Here we use all data from PHENIX ($|y| < 0.35$) [1], STAR ($|y| < 0.5$, $|y| < 0.75$) [2], ALICE ($|y| < 0.9$) [3] and CMS ($|y| < 1.0$) [4]. The errors on the data are quadratic sums of statistical and uncorrelated systematic errors wherever available.

TABLE I: Parameters for pions and protons.

$\sqrt{s}$	T (MeV)	n_{pion}	n_{proton}	n_{proton}/n_{pion}
62.4 GeV	93	10.34	12.70	1.235
200 GeV	106	9.06	11.48	1.267
900 GeV	109	7.903	10.18	1.286
2.76 TeV	109	6.08	7.21	1.117
7.0 TeV	110	5.54	6.18	1.026

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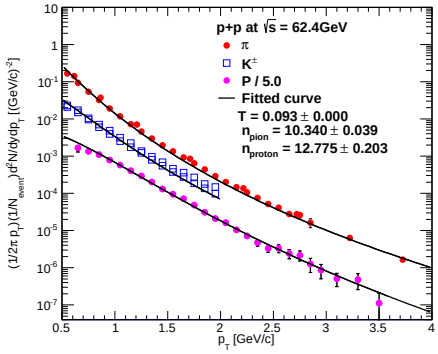

FIG. 1: Invariant yield vs p_T of hadrons in p+p collision at at $\sqrt{s} = 62.4$ GeV.

Results and Discussions

Figure 1 shows the invariant yield of $\pi^{\pm}$, $K^{\pm}$ and proton as a function of p_T for p+p collision at $\sqrt{s} = 62.4$ GeV. Figure 2 shows the invariant yield of different hadrons at two RHIC and three LHC energies. We fit all hadron spectra with Tsallis function. Here we keep parameter T as fixed obtained by thermal model fit to particle ratio. For a particular energy, we fit π and proton spectra with Tsallis function by fixing T and obtain n, dN/dy which are used to obtain the spectra of other mesons and baryons respectively. Here we observe that all meson spectra scale with pion spectra and all baryon spectra scale with proton spectra at $\sqrt{s} = 62.4$ and 200 GeV energies [5]. But at LHC energies, the kaon and ϕ spectra do not scale with pion spectra. We also see that, the value of parameter n decreases with the increasing $\sqrt{s}$. The ratio n_{proton}/n_{pion} approaches to unity at $\sqrt{s} = 7$ TeV, which means that both pion and proton behave same at 7 TeV.

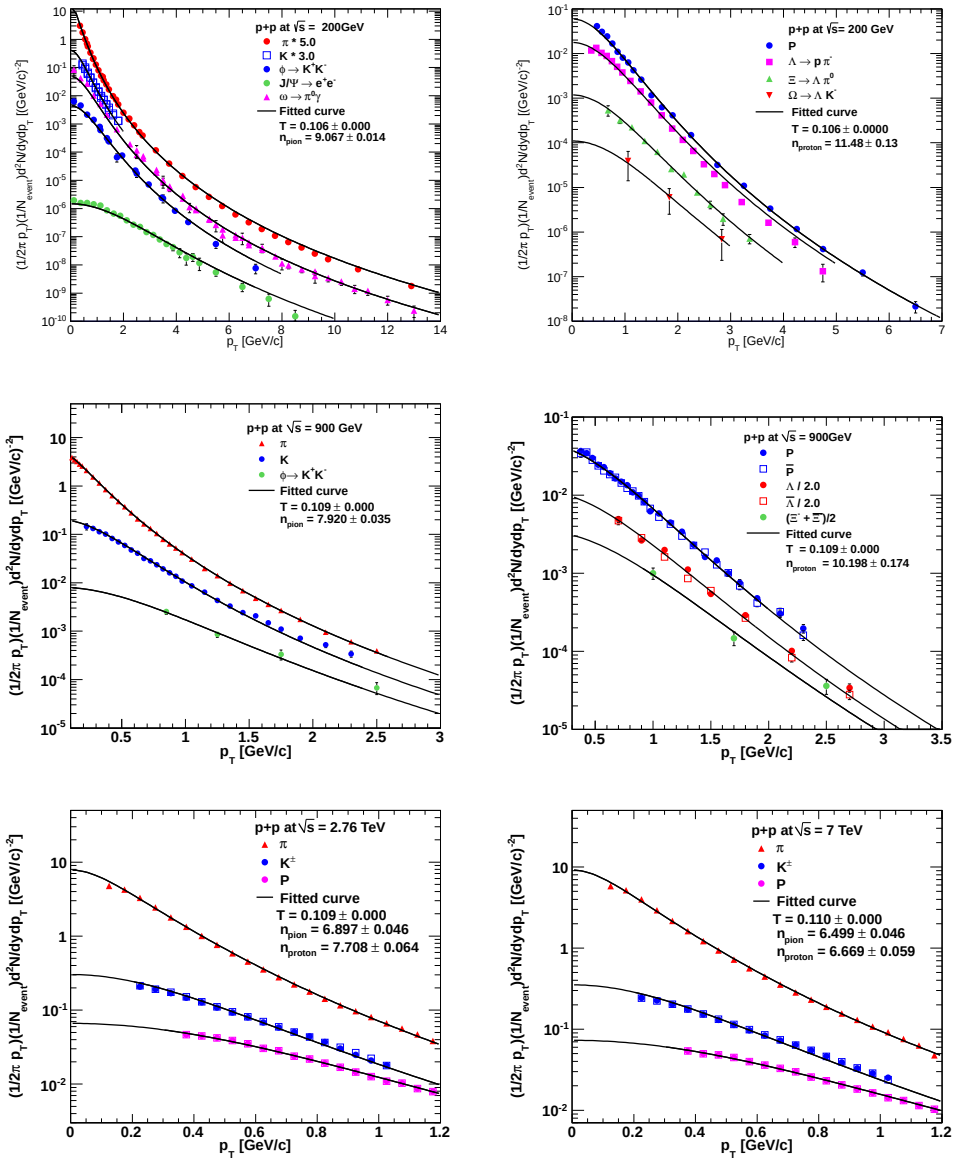

FIG. 2: The invariant yield of hadrons as a function of p_T for p+p collision at different energies.

References

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