Energy dependence of transverse mass spectra of kaons produced in p+p and p+p interactions
A compilation

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- Anomaly observed in the $T$ vs $\sqrt{s_{NN}}$ dependence for central Pb+Pb collisions
- How does this dependence look like for p+p interactions?

See also in our paper: arXiv:hep-ex/0308002
- Pion multiplicity
  a compilation of p+p data existed

- Kaon multiplicity
  a compilation of p+p data existed

- Kaon inverse slope parameter
  a compilation of p+p data did not exist
The Pb+Pb results show a phase transition like behaviour (caloric curve Kochtopfmodel)

Do we see a similar dependence for p+p?
We compiled and analyzed data on $m_T$ spectra of $K^0_S$, $K^+$ and $K^-$ in $p+p$, $p+\bar{p}$ interactions at all energies ($\sqrt{s_{NN}} = 4.74\text{GeV}-1.8\text{TeV}$). The data originate from fixed target and collider experiments performed during the last 30 years.

The spectra were fitted by a simple exponential function

This parametrization is valid only in low $m_T$ region ($m_T<1.2\text{GeV}$); at higher $m_T$ the power law behaviour $m_T^{-p}$

$$\log\left(\frac{1}{m_T} \frac{dN}{dm_T}\right) = C \epsilon^B \frac{m_T^m}{T}$$

![Graph showing the power law behavior of $m_T^{-p}$](image)
$dn/(m_T dm_T)$ spectra

$K^+ + K^-$

$K^+$

$K^-$

$m_T - m_0$ (GeV/c$^2$)
Exponential function fits the data

Inverse slope parameter increases with energy
No obvious difference between $K^0_s$, $K^+$ and $K^-$

$T$ for $p+p$ and $p+p\bar{p}$ reactions is similar

Logarithmic increase of $T$ with $\sqrt{s_{NN}}$

Few points do not match the fit (possible systematic errors)
Fits in low and high $m_T$ regions

- In the low $m_T$ region ($m_T<0.75$) $T$ seems to be energy independent.

- In the high $m_T$ region ($m_T>0.75$ GeV/c$^2$) it shows logarithmic increase (beginning of the power law ?)

- Possible large systematic errors when using different $m_T$ intervals for a comparison.

- For a comparison with $A+A$ data a similar $m_T$ range was used.

Is the $T$ parameter the same when we fit different $m_T$ regions?
Comparison p+p to Pb+Pb

- No significant difference between K⁺ and K⁻ dependences for both p+p and Pb+Pb collisions
- T(p+p) < T(Pb+Pb) at all energies
- No significant transition like structure in T(p+p)
- Quality of the world p+p data is poor → new measurements are needed