Kinematic variables

Antoni Aduszkiewicz

University of Houston

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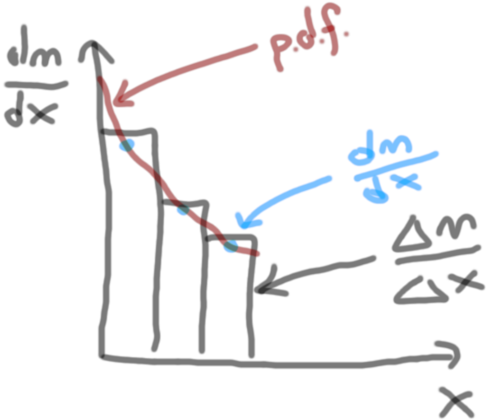
Binning correction

- Experiments wish to measure a function of probability density of producing a particle at given point of kinematic phasespace
- What they measure instead is probability to produce particles in finite size variable ranges, that is integral of the distribution of the width of the bin $(\Delta n / \Delta x)$
- If probability density function is not linear the measured value does not equal p.d.f. at the center of the bin.



Binning correction

- Obtaining sampled p.d.f. from the binned distribution requires a correction, based on assumption of the shape of the spectrum. NA49 example plot shows that if the bins are too large, the correction can be large as well.

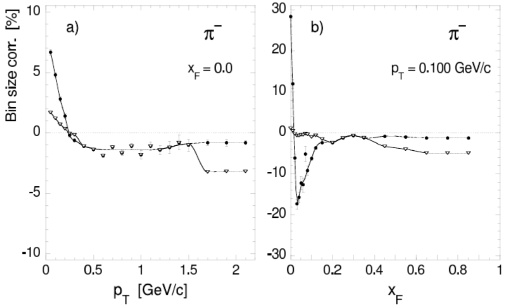
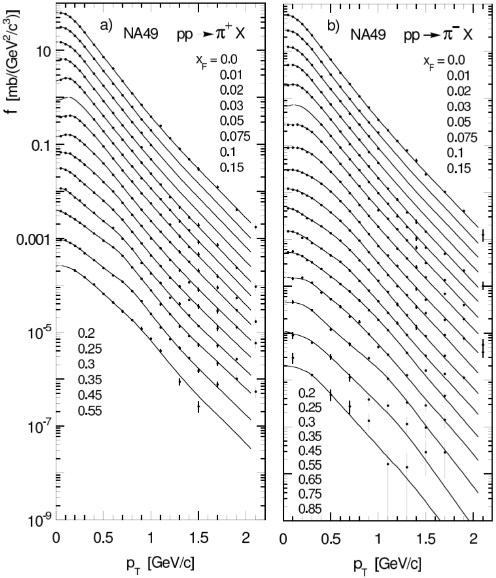


Figure 25: Correction due to the binning in a) p_T and b) x_F. Full circles represent the correction for a fixed bin of $\Delta p_T = 0.1$ GeV/c and $\Delta x_F = 0.05$, respectively; open triangles describe the correction for the bin sizes actually used.

[http://arxiv.org/abs/hep-ex/0510009, NA49 p+p→$\pi^{\pm}$@158 GeV/c]

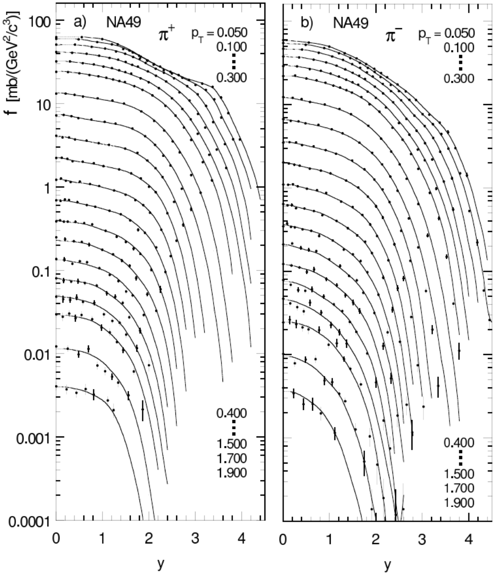
Conversion of kinematic variables

- The points in the plot shows resulting NA49 pion spectra, corrected for the bin size
- Rectangular bins in one set of variables (e.g. (x_F, p_T)) are not rectangular in another set (p, θ).
- In order to change the variables one needs to assume the shape of the spectrum (continuous lines).



Converted spectra

- The plot shows converted spectra in (y, p_{T})



Overview of scaling MC correction

Following the presented procedure to correct MC spectra would require:

- Assuming (modelling) shape of the measured (true) spectrum to apply binning correction
- Modelling shape of the spectrum again to convert variables
- Modelling shape of the MC (wrong) spectrum (easier if we have high statistics)
- Divide two converted spectra to calculate the correction factor

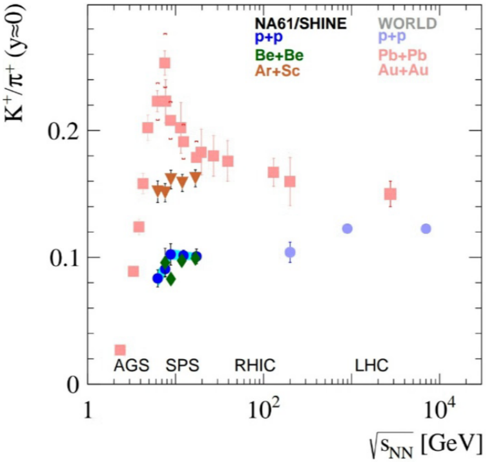
I believe we could simplify this procedure a lot, as follows:

- Generate MC spectra in the same bins as the data, without binning correction
- In each bin calculate the correction factor by dividing data by MC spectrum
- Model (parametrize) the correction factor
- Recalculate the correction factor to another variable set (if needed)

This procedure is much safer, as it allows to avoid modelling of the spectrum itself, which varies a lot with changing kinematic variables, and scale the correction factor only.

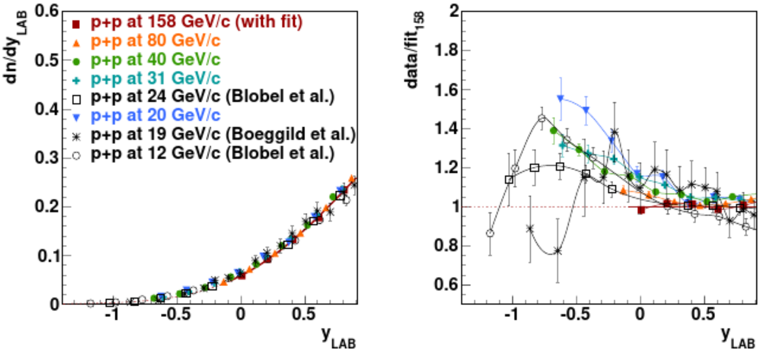
Scaling the spectra: Onset of Deconfinement region

- In the region of $\sqrt{s} \approx 10$ GeV multiplicity and shape of the hadron spectra varies rapidly with the collision energy
- While the most dramatic effects are observed in heavy ion collisions and p+A will be rather similar to p+p scaling with the energy might be non-trivial



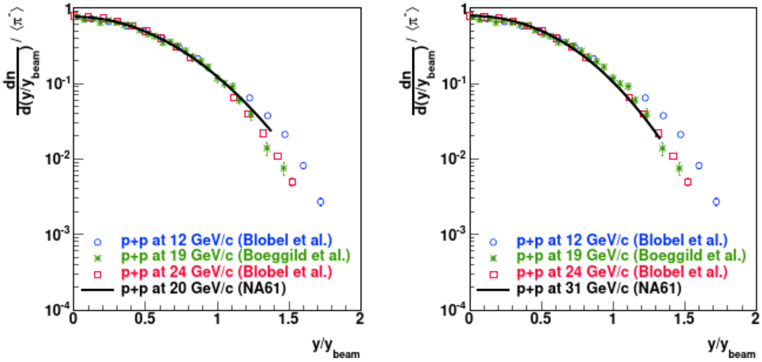
Ratio of inverse slope parameter of transverse mass spectra of K^+ and π^+

Scaling shape of the spectrum with rapidity



- Scaling rapidity spectrum tails doesn't work well

Scaling shape of the spectrum with rapidity



- Normalizing to beam rapidity doesn't work well in the tails