Jet properties in particle correlation

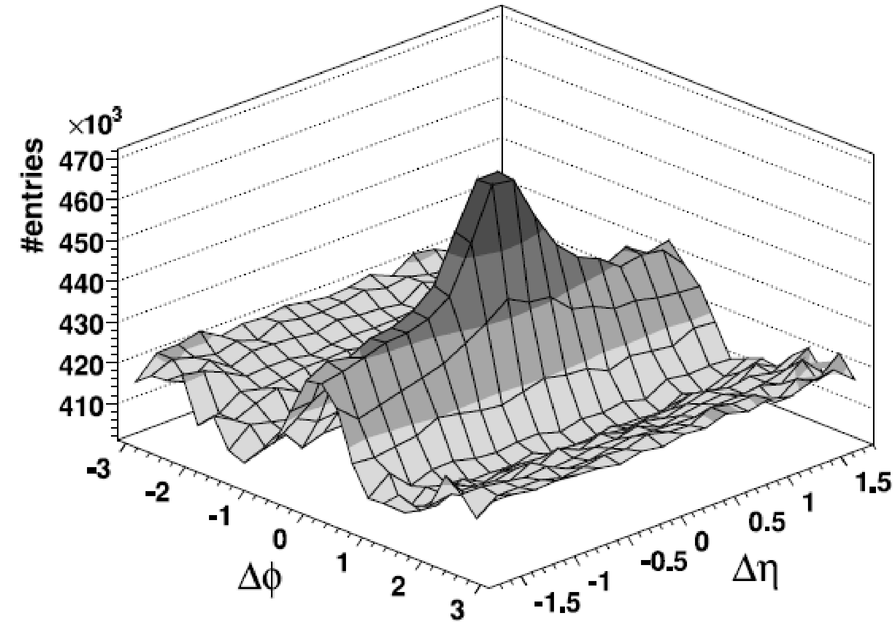
Jiri Kral
University of Jyväskylä
for the group of University of Jyväskylä et al.

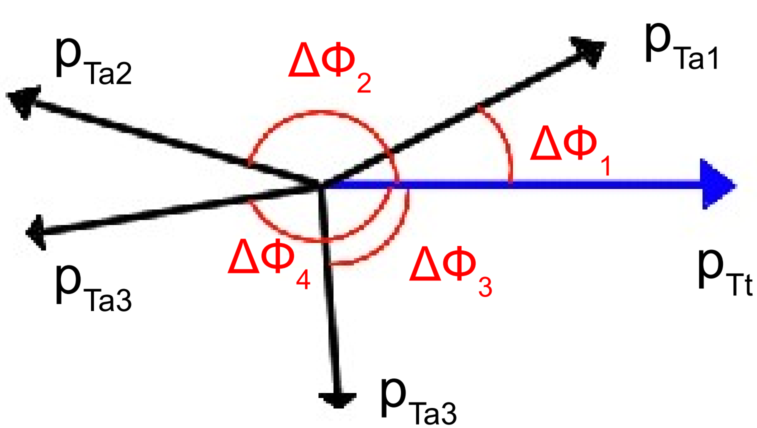
Introduction

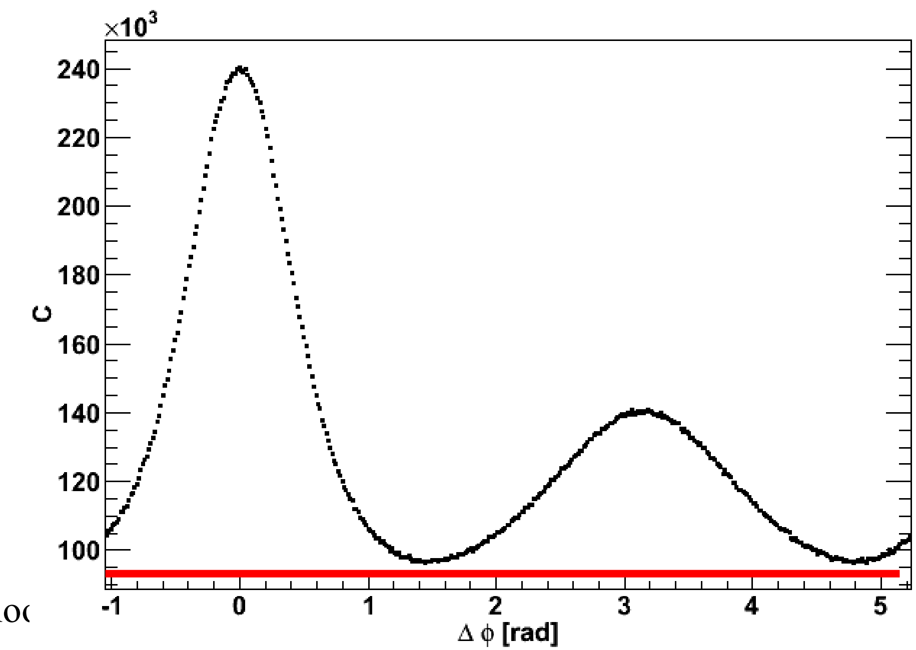
- particle correlation is a tool, that can extract information about colliding partons, jet fragmentation process or modification to these imposed by jet passing through a medium
- correlation are realtively easy to use in a “noisy” environment (A-A collisions)
- need for a baseline measurement in p-p

Correlation

- different properties can be correlated
- pick a leading particle, correlate others with it

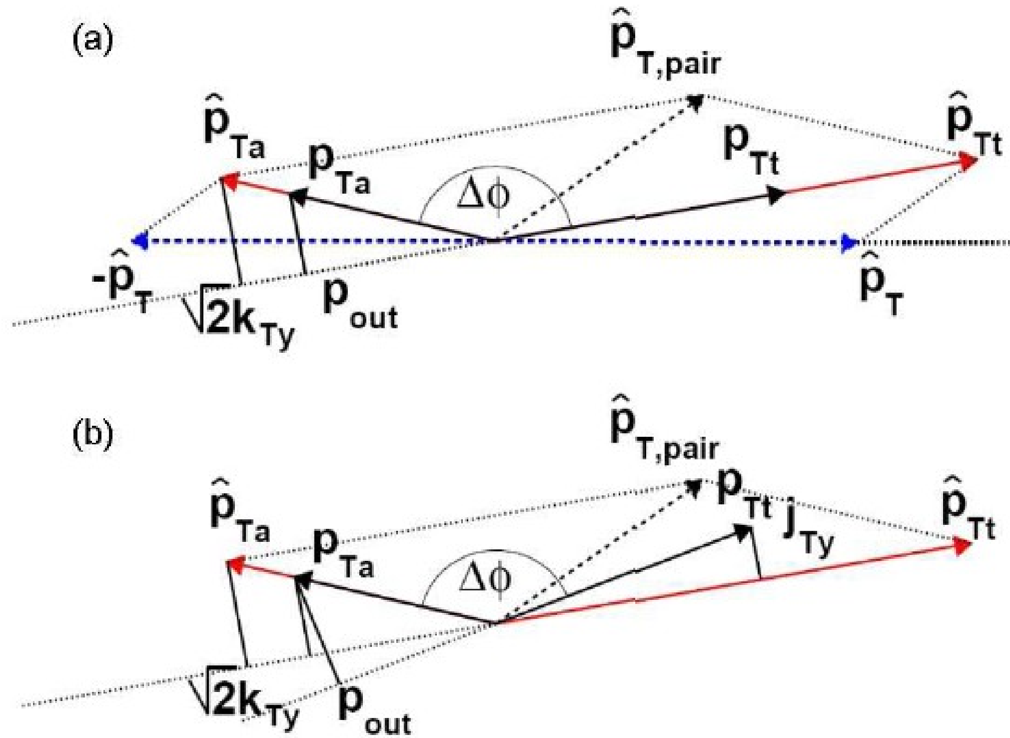






k_T

- two partons scattered by collision are back to back in their CMS frame
- the parton frame does not necessarily correspond to their mother proton frame (LAB) -> the scattered partons are boosted
- k_T describes accoplanarity and momentum imbalance

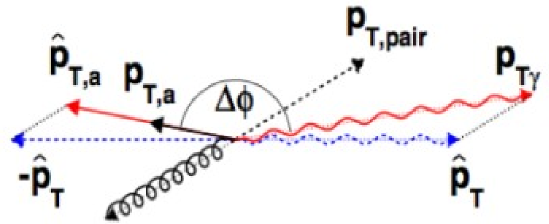


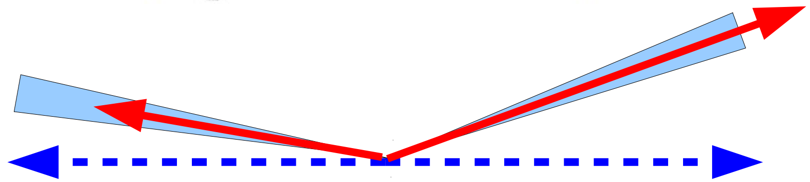
$$\langle p_{T,pair} \rangle = \sqrt{2} \times \langle k_T \rangle$$

$$\langle k_T^2 \rangle = \langle k_T^2 \rangle_{INTRINSIC} + \langle k_T^2 \rangle_{RADIATIVE} + \langle k_T^2 \rangle_{NLO}$$

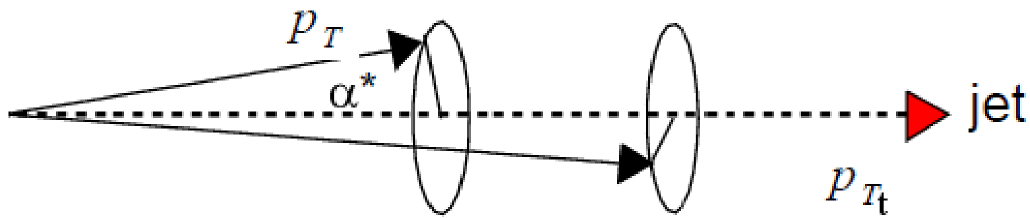
j_T

- products of parton fragmentation are born with momentum component perpendicular to jet axis





$$j_T = p_T \sin(\alpha^*)$$



$$\sqrt{\langle j_T^2\rangle} = \sqrt{2\langle j_{Ty}^2\rangle}\ ;\quad \sigma_N \frac{\sqrt{2}\langle p_{Tt}\rangle\langle p_{Ta}\rangle}{\sqrt{\langle p_{Tt}\rangle^2+\langle p_{Ta}\rangle^2}}$$

the most crucial assumption j_T = p_{Tt} and p_{Ta}

j_T, k_T in correlation

- when correlating particles, nearside contains contribution of j_T only
- away-side peak contains convolution of j_T and k_T

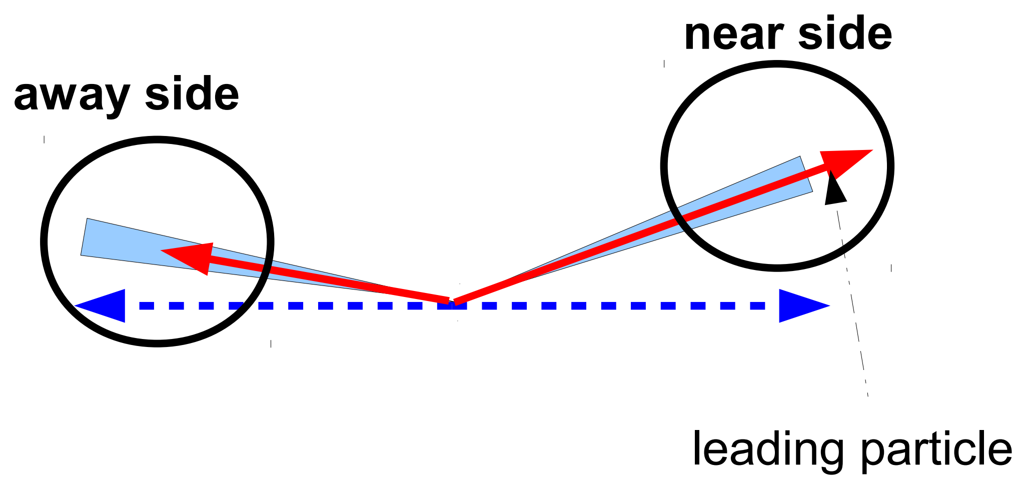
  $j_T << k_T$

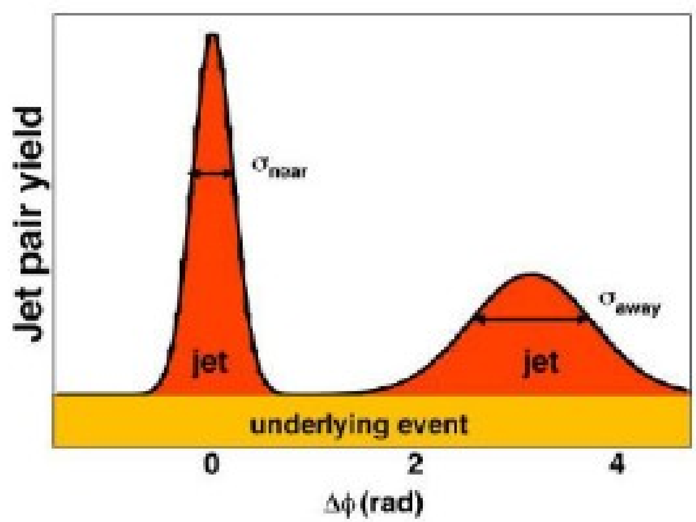
  $j_T \sim 700$ MeV

  $k_T \sim 5$ GeV

  therefore:

  $<k_T> \sim \sigma_A$





$\langle j_T \rangle \propto \sigma_N$

jet fragmentation transverse momentum, j_T-scaling.

$\langle k_T \rangle \propto \sigma_A$

parton transverse momentum, intrinsic + NLO radiative correct. Energy loss-k_T broadening.

k_T extraction

partonic

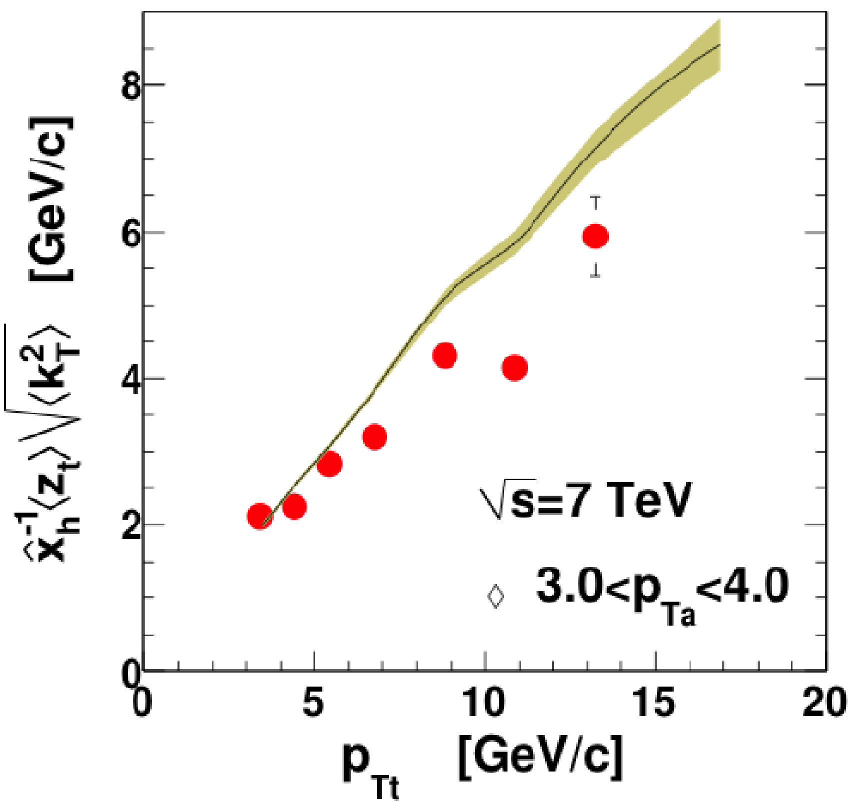
$$\frac{\langle z_t \rangle}{\langle \hat{x}_h \rangle} \sqrt{\langle k_T^2 \rangle} = \frac{1}{x_h} \sqrt{\langle p_{out}^2 \rangle - \langle j_{Ty}^2 \rangle (1 + x_h^2)}$$

hadronic

Decomposed analytically.

The only assumption , for the moment, we need to take from "outside" is a shape of an effective fragmentation function.

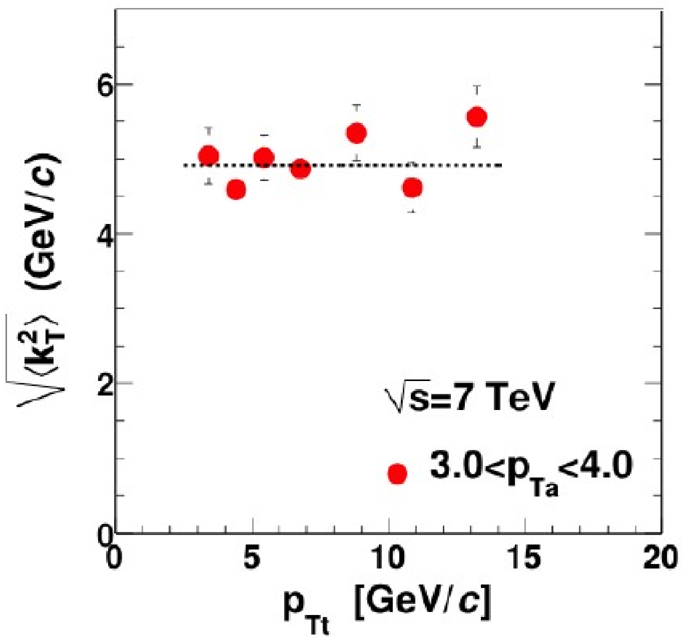
Default PYTHIA slightly overshoots – did not looked yet.



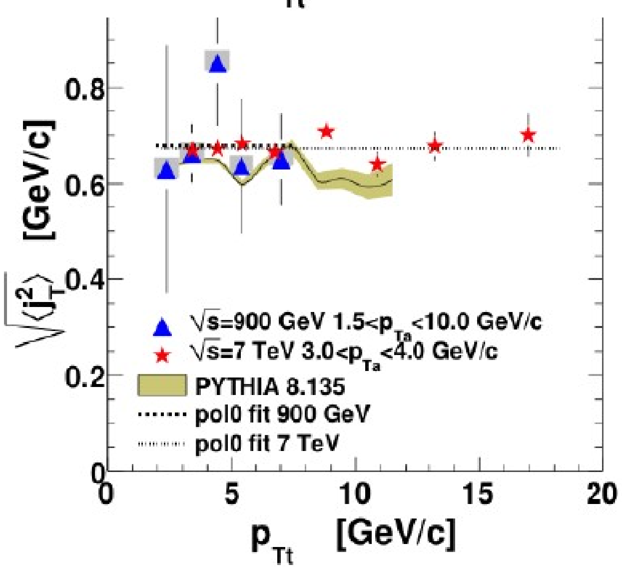
5/19/2010

27

j_T, k_T as a f of p_{Tt}



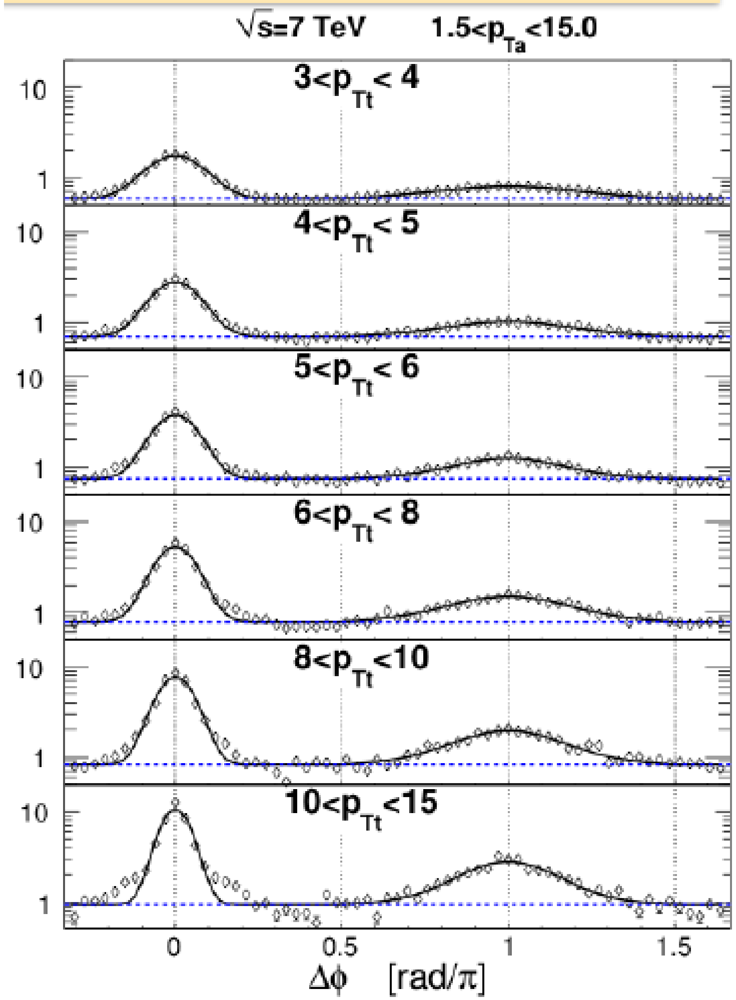
$$\sqrt{\left\langle k_T^2 \right\rangle} = 4.9 \pm 0.1 \text{ GeV/c}$$



$$\sqrt{\left\langle j_T^2 \right\rangle}_{900\text{ GeV}} = 679 \pm 44 \text{ MeV/c}$$

$$\sqrt{\left\langle j_T^2 \right\rangle}_{7\text{ TeV}} = 672 \pm 4 \text{ MeV/c}$$

$\sqrt{s} = 7$ TeV



note: the plots are early group results, nothing preliminary or official yet ;)

Thank you for attention

- 2 particle trigger correlation in phi is a nice tool, which can look into processes creating jets

Jet Properties from Dihadron Correlations in p+p Collisions at √s = 200 GeV
PHENIX collaboration, PRD 2006