high-transverse-momentum charged-hadron production at the Tevatron

[0904.1098], 29 Apr 2009
CDF Run II, $\sqrt{s} = 1.96 TeV$

- Observables:
  - incl. charged particle p_T
  - trans. energy sum $\sum E_T$
  - $C_{<p_T>}$ vs N_{ch}
- What is new?
- Tracking system:
  - inner silicon
  - outer drift chamber(COT)
  - trans. mom resolution: $\sigma(p_T)/p_T \simeq 0.1\% p_T/\mathrm{GeV}$
- Minimum bias trigg. - BBC
- Systematic uncertainties.
- Cuts: $p_T \geq 0.4$ GeV, $\eta \leq 1$
- Comparison with CDF data from 1988.

power-law modeling:

$$f = A\left(\frac{p_0}{p_T+p_0}\right)^n$$
$$\Downarrow$$
$$A\left(\frac{p_0}{p_T+p_0}\right)^n + B\left(\frac{1}{p_T}\right)^s$$

[1003.1854] 9 Mar 2010
Albinio, Kniehl, Kramer

[1003.2963] 15 Mar 2010
Arleo, d'Enterria, Yoos

[1003.3433], 17 Mar 2010
M.Cacciari, G.Salam, Strassler

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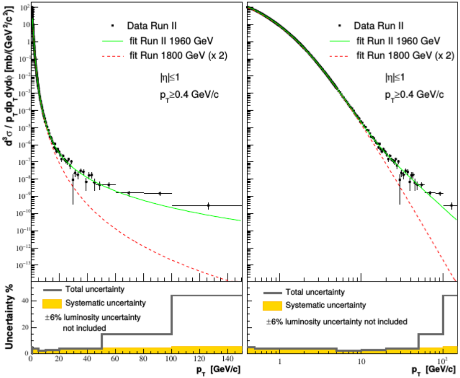

FIG. 5: Left upper plot: the track p_T differential cross section is shown. The error bars describe the uncertainty on the data points. This uncertainty includes the statistical uncertainty on the data and the statistical uncertainty on the total correction. A fit to the functional form in Eq. 8 in the region of $0.4 < p_T < 10$ GeV/c is also shown for the data used in the 1988 analysis [5] at the center of mass energy of 1800 GeV (dashed line). A fit with a more complicated function (Eq 9) is shown as a continuous line. The fit to the 1800 GeV data is scaled by a factor 2 to account for the different normalization. In the plot at the bottom the systematic and the total uncertainties are shown. The total uncertainty is the quadratic sum of the uncertainty reported on the data points and the systematic uncertainty. The right-hand-side plots show the same distributions but with a logarithmic horizontal scale.

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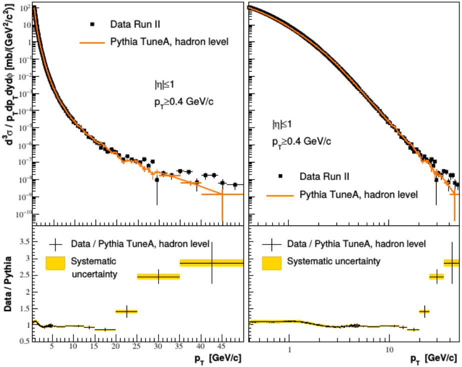

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[1003.1854] 9 Mar 2010
Albinio, Kniehl, Kramer

- NLO QCD, using PDF and FF (fragm. functions)
- FF: AKK08, DSS, HKNS
- ren. and fact. scale:

  $\mu = kp_T$, $\mu_f = k_f p_T$, $k, k_f = 0.5, 1, 2$
- PDF: CTEQ6.6M, MSTW2008, HERAPDF0,1
- Final state hadron's mass effects.
- gluon FF - less constrained then quark
- "have no left-over adjustable parameters"
- Factorization breaking in high-transverse-momentum charged-hadron production at the Tevatron?
- CMS ($p_T < 4$) GeV?

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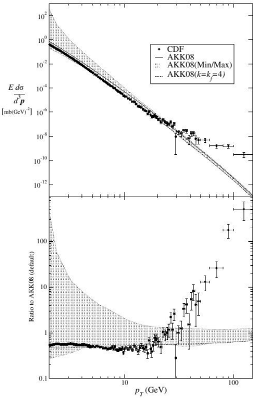

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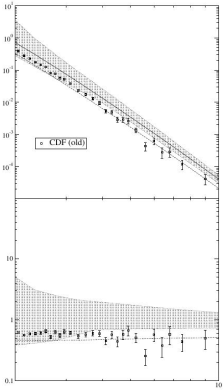

high-transverse-momentum charged-hadron production at the Tevatron

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  vs
  CDF incl. charge particle
  ⇓
  jet = single hadron
- CDF charged particle spectra within jets for a dijet mass of

  200 − 260 GeV
  ⇓
  $p_{t,jet} \sim 100$ GeV
  ⇓
  0.1% jets contain hadron carrying of jet 90% mom.

- BSM physics?

Large x-section, ionising (electic or magnetic charge or large dipole mom.), not affect the dijet fragm.

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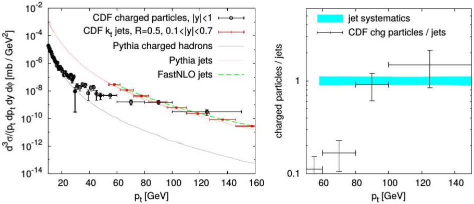

Figure 2: Left: comparison of the charged-particle data [1] with CDF data on the inclusive jet spectrum [6], showing also predictions from Pythia and the NLO calculation for the jets from FastNLO and NLOJet++ [9, 10] with CTEQ66 PDFs [11]. Right: ratio of the charged-particle spectrum to the (rebinned) CDF inclusive jet spectrum. Note that the charged-particle and jets data correspond to slightly different rapidity ranges. For the p_t range of relevance, the mismatch in rapidity ranges implies only modest additional corrections, $\mathcal{O}(10\%)$ (which have not been applied).

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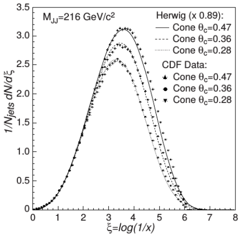

Figure 3: Figure 20 of ref. [12], by the CDF Collaboration, showing the inclusive distribution of momentum fraction x of charged particles in cones around each of the two jets axes in dijet events at the Tevatron (Run I).

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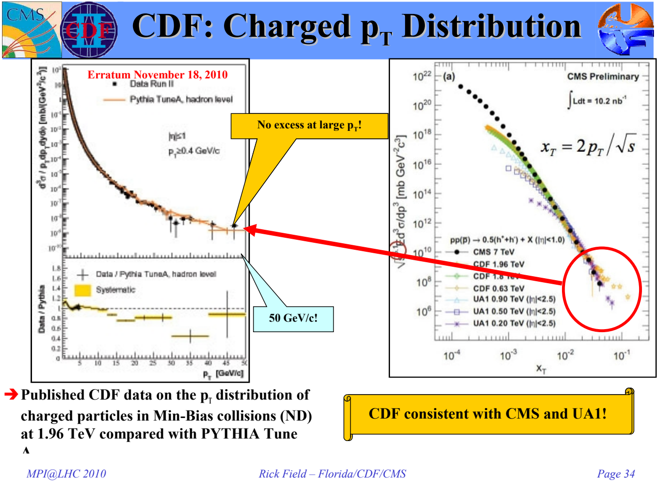
Questions:

- What kind of problems we might encounter measuring hight-pt charged particle in CDF?
- Can we check how these hight-pt charged particle events look like?
- [1005.1078] May 2010, contribution of weak interaction? (I am checking it.)

Solution to the mistery



This is ok

everyone makes mistakes - important is to understand what is going on!

Solution to the mistery

This is ok everyone makes mistakes - even MC authors ;).
Important to check your analysis using more then one MC generator.
And answer questions like:
Is the effect I'm seeing due to different models, or approximations, or is it a bug?