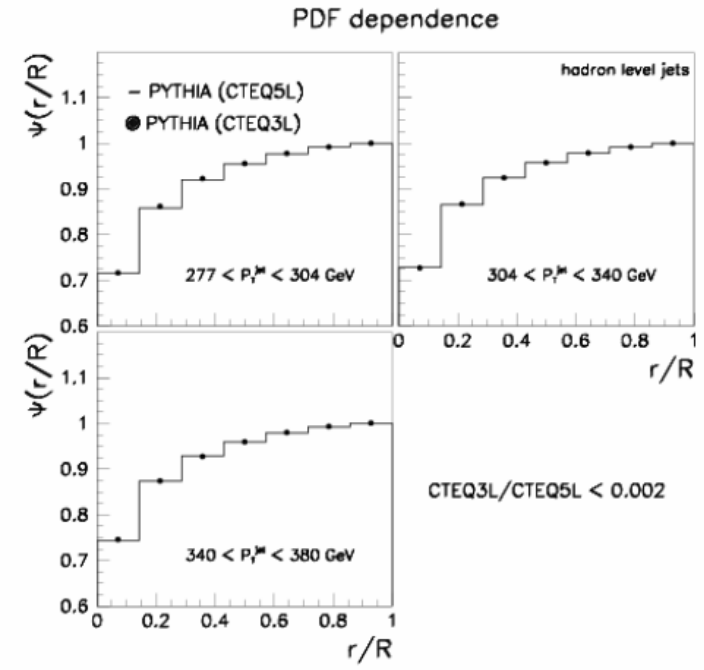
Answers to PRD Referee's Comments on the paper
"Study of Jet Shapes in Inclusive Jet Production in pp-bar collisions at sqrt(s) = 1.96 TeV

Question:

Section III:
The simulations were limited to the CTEQ5L pdf and apparently a single renormalization scale choice. How much does jet shape depend on these choices? Given the later assertions that the jet shape at high momentum transfer reflects the changing gluon/quark content and the known pdf uncertainties at high x some investigation of the jet shape with alternate pdf's is appropriate. The predictions for shape in the highest Pt bin should be repeated with a competing pdf. The predictions with alternate renormalization scales should also be repeated at a lower Pt bin where the highest sensitivity is expected. These studies would establish how much shape variation could be attributed to these choices. At the very least the authors should explain why these studies are not necessary.

Answer:

We studied the dependence of the predicted jet shapes with the PDFs by using CTEQ3 set (which does not take into account the Run I measurements of the inclusive cross section and thus underestimates the gluon distribution in the proton at very high-x). We decided to make this very extreme test since we suspected the sensitivity of the jet shapes to the change of the gluon distribution would be marginal since it is shielded by the amount of initial state-radiation allowed in the MC. You find an example of the test below. The effect was found to be less than 0.2%, well inside our uncertainties.



The sensitivity to the scale variation in the MC can be seem from the difference between PYTHIA-TUNE A and PYTHIA-default curves. The difference between those predictions is dominated by the difference in the PARP(67) parameter (from 1.0 in the default setting to 4.0 in Tune A) that governs the amount of initial state radiation. We also included the predictions from PYTHIA-default-no MPI to show the reader that the effect of MPI is sub leading , compared to the effect coming from enhancement of the gluon radiation.

Question

Section IV.
How much does jet shape vary with the 75% threshold for merging and splitting jets? Does this affect the ability of the various simulations to describe the data?

Answer

Reducing the splitting/merging factor from 75% to, for example, 50% would systematically produce fatter jets since the probability of merging increases. During the course of the analysis we observed that a 50% merging-splitting would sometimes produce unphysical, very fat, jets. This is due to the fact that, in the midpoint algorithm, the splitting/merging is an iterative procedure. The value 75% is now the default in midpoint and also allows a more direct comparison with other results in the literature. However, the conclusions concerning the agreement between MC and data are not affected by this.

Question

Section V.

Each event is required to have only one vertex. What is the efficiency of vertex reconstruction? How often is one vertex found but a second missed? How often is the vertex actually outside the tracking fiducial volume and so not actually considered? This can be important at the highest transverse energies. Is there any effect on the shape?

Answer

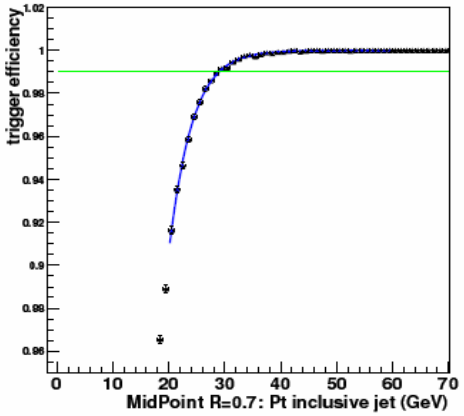
The efficiency for vertex reconstruction in events with at least one central jet (0.1 < Yjet < 0.7) is 99.8 %. The cut on 60 cm reduces this number to 96%, and it is independent of Pt of the jet. This is well described by the MC. The effect on the missing 4% is negligible, but still is taken in to account in the unfolding procedure back to the hadron level. As mentioned in the paper, a possible remaining effect due to pileup events, where a possible second vertex is not reconstructed, was investigated by comparing low and high luminosity measurements. The effect was found to be negligible.

Question

The minimum transverse energy of 37 GeV eliminates trigger bias. At what minimum threshold does bias occur and at what rapidities? Ideally a plot of efficiency as a function of pt and rapidity would be nice to see.

Answer,

You find below the figure of the trigger efficiency for central jets (0.1 < Y < 0.7). The cut on 37 GeV allows us to stay in the plateau after considering the energy scale uncertainty present in the measurement. We do not consider, however, that this figure is necessary in the paper.



Question:

Section
VIII and IX.

Twice the statement that the narrowing of the jets with increasing pt is due to the PDFs and the running of alpha_s appears. This is qualitatively true and certainly suggested by the results, but it needs strengthening. Perhaps including a plot showing the relative fractions of gluons and quarks as a function of pt would strengthen the first half of the statement. This would make a nice companion or inset to Figure 9. Perhaps referencing a LEP result
showing the narrowing of tagged gluon or quark jets with increasing pt (the running of alpha_s) would bolster the second half of the claim.

Answer:

The plot the referee suggested would be purely MC based . The authors however agree on the statement that giving a bit more information about the evolution of the mixture with Pt is useful. The authors are thus including an additional sentence in the paper to accommodate referee's suggestions.

Minor Editorial Comments

The authors will follow all the suggestions by the referee convening editorial comments.