Cross section measurement of inclusive forward jet and simultaneous central and forward jet production.

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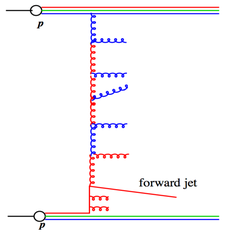
Motivation

Jets in hadron-hadron collisions

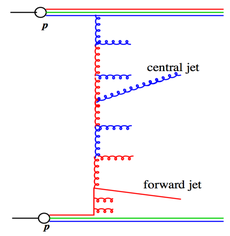
- Sensitivity to parton radiation
- Sensitive to the underlying partonic processes, namely multi-parton interaction
- Better understanding of the parton density functions (PDFs)
- Measurement made at large rapidity range $|\Delta\eta| \leq 7.5$
- Important for the measurement of the vector-boson scattering cross section
- Essential for the Higgs searches background control



Feynman diagram for inclusive forward jet production

Jets at large rapidities

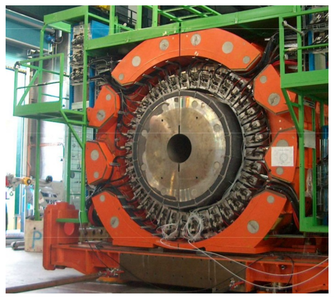
- Two-scale process $x_2 << x_1$
- Possibility to study QCD parton dynamics in the low-x regime
- Large eta help distinguish from different evolution equations



Feynman diagram for simultaneous central and forward jet production

HF Calorimeter

- Iron absorbers with embedded hard quartz fibers
- Located 11.2 m from interaction point on both sides of the detector
- Allows to measure jets in 2,7<|η|<5.2



One of the HF Calorimeter modules in the CMS detector

Data Sample and Event Selection

Dataset

- 2010 data
- $\sqrt{s}$ = 7 TeV
- Integrated Luminosity: 3.14 pb^{-1}

Jets

- Reconstructed with anti-k_T, R = 0.5
- Central jet: |η|< 2.8
- Forward jet: 3.2<|η|<4.7

Inclusive forward jet selection

- A forward jet with p_T > 35 GeV

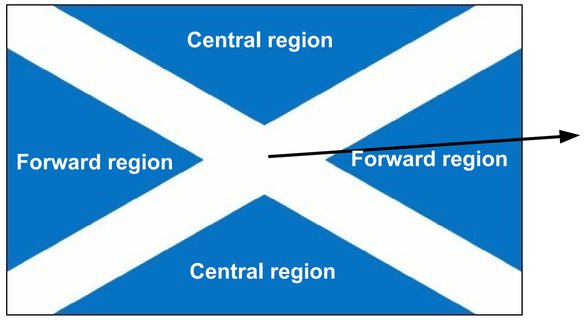
Inclusive forward jet selection

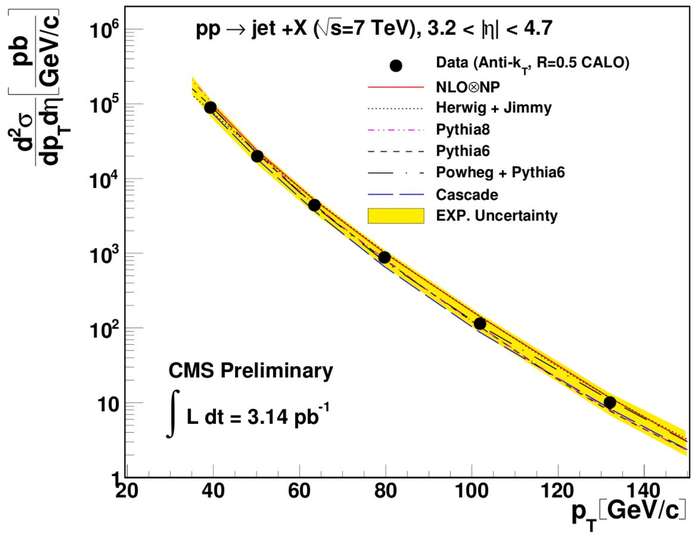
- A forward jet with p_T > 35 GeV
- A central jet with p_T > 35 GeV

Trigger

- $|\eta_{jet}| < 5$
- Trigger efficiency ≈ 100% for the measurement

Inclusive Forward Jet Production





Inclusive jet cross section (anti-k_T, R=0.5) measured at forward pseudo-rapidities (3.2<|η|<4.7), fully corrected, compared to various Monte Carlo predictions. Point-to-point (statistical) errors are smaller than the marker size, the yellow band shows the total systematic uncertainty.

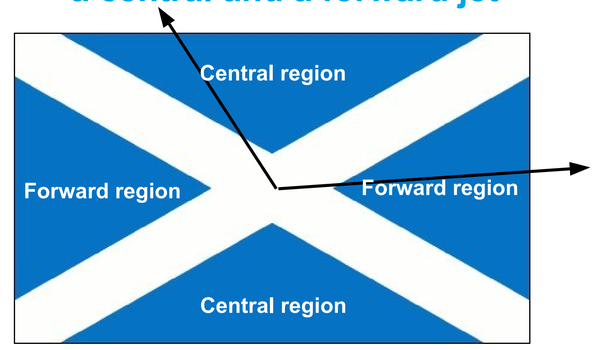
Conclusion

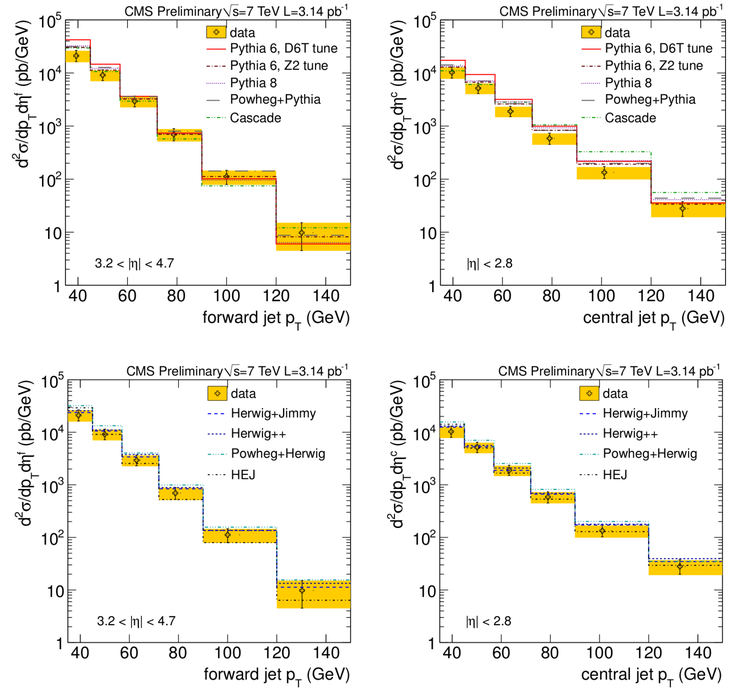
- PYTHIA, HERWIG, NLOJET++ and POWHEG and CASCADE predictions describe the data within the experimental uncertainties. The current data is not enough to differentiate between different evolution equations.

References

"Measurement of the inclusive production cross sections for forward jets and for dijet events with one forward and one central jet in pp collisions at $\sqrt{s}$ *= 7 TeV",* CMS Collaboration, FWD-11-002, arXiv:1202.0704

Simultaneous production of a central and a forward jet





The cross sections for the hadronic final state, as a function of p_T, for the forward jets on the left plots, and the central jets on the right plots compared to prediction of different Monte Carlo generators.

Conclusions

- PYTHIA tunes tend to overestimate the central jet cross section
- The shape of the p_T spectrum of forward jets is not described by most of the MC predictions, which overestimate the data at low p_T
- HEJ which accounts for multi-jet topologies reachs a good agreement with the data.