Diffractive Dijets with Gap

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Jet-gap-jet event

Gaps between jets in hadronic collisions

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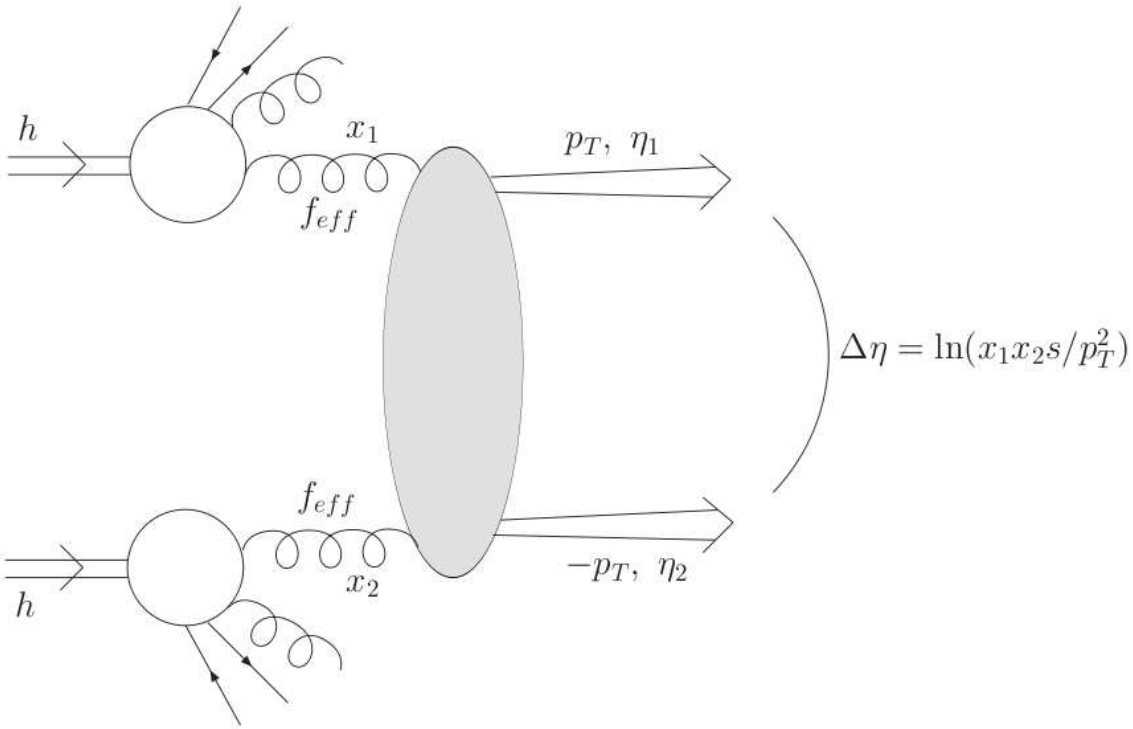


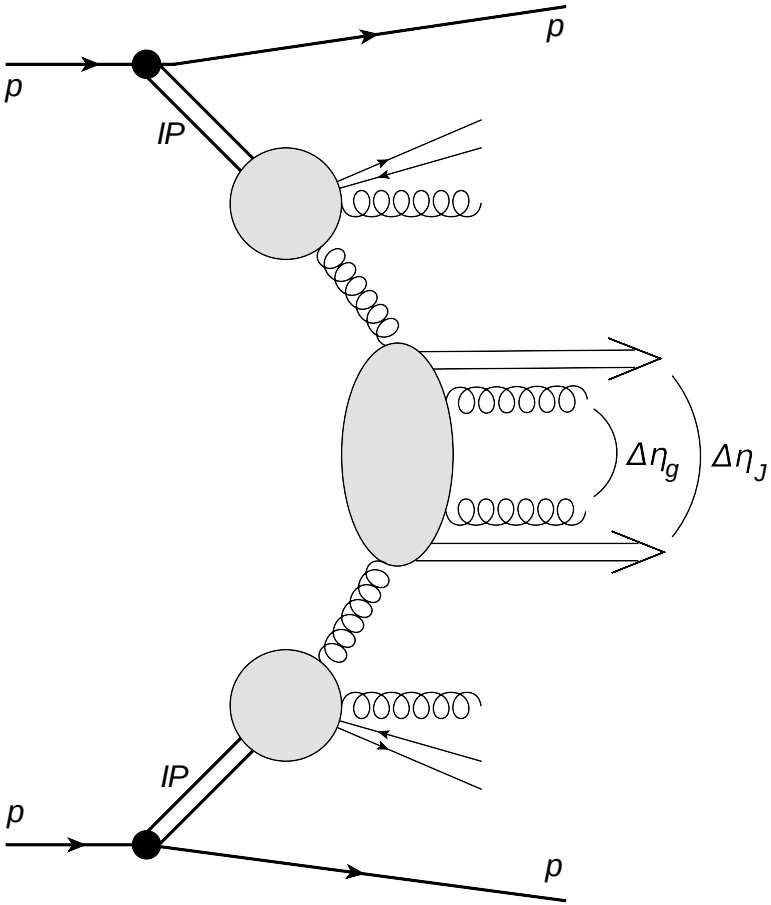
Feynman diagram of *pp* $\rightarrow$ *jet-gap-jet* process.

The parton-level NLL-BFKL calculation was embedded into the HERWIG MC.

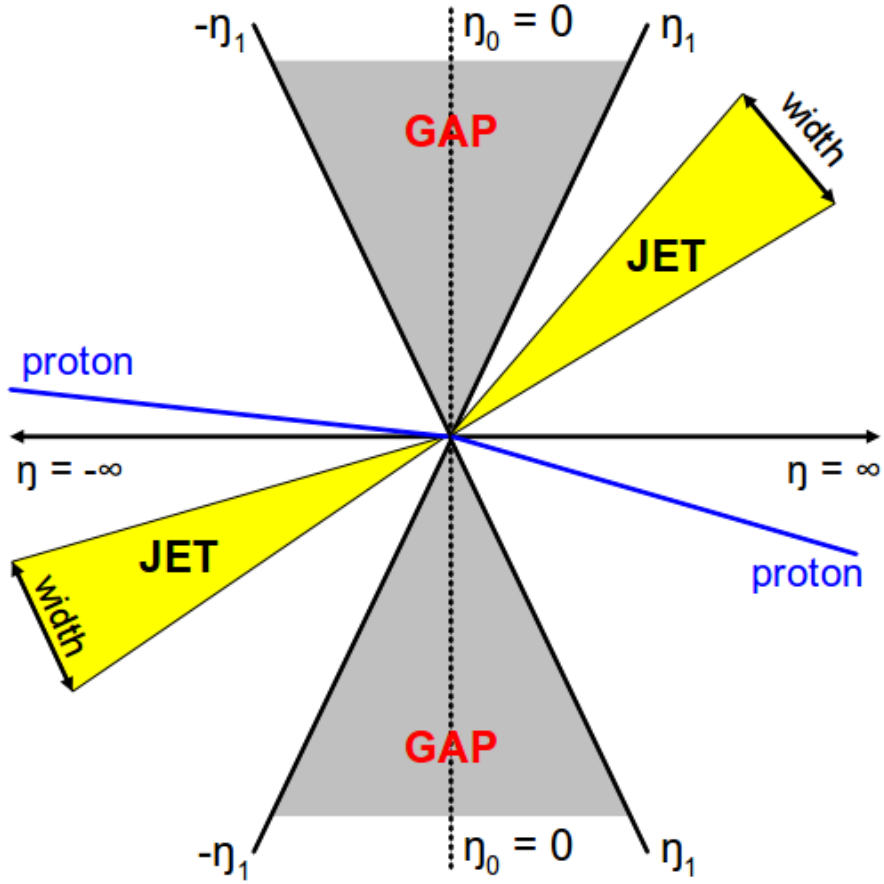
After adjusting the overall normalization the NLL-BFKL calculation was able to describe all Tevatron data, except the higher end of the $\Delta_{\eta J}$ dependence measured by CDF.

Diffractive jet-gap-jet event

Extension of the BFKL tests: the measurement of the diffractive jet-gap-jet events.



Feynman diagram of $pp \to p\text{-}jet\text{-}gap\text{-}jet\text{-}p$ process.



Event signature:

- two outgoing protons,
- two jets in opposite hemispheres,
- gap (symmetric in η) between jets.

HERWIG 6.510 Monte Carlo with function (HWHSNM) modified by Ch. Royon is used. Matrix element for colour-singlet parton-parton scattering includes spin and colour averages and sums.
C.R. modification allows to use BFKL LL and NLL with all conformal spin resummed.

Modified HERWIG included in **Forward Physics Monte Carlo** (FPMC) – tool designed to simulated central particle production with one or two leading intact protons and some hard scale in the event. In FPMC the following production mechanisms are implemented: single diffractive dissociation, double pomeron exchange, and exclusive production due to two-gluon or two-photon exchanges.

FPMC : a generator for forward physics

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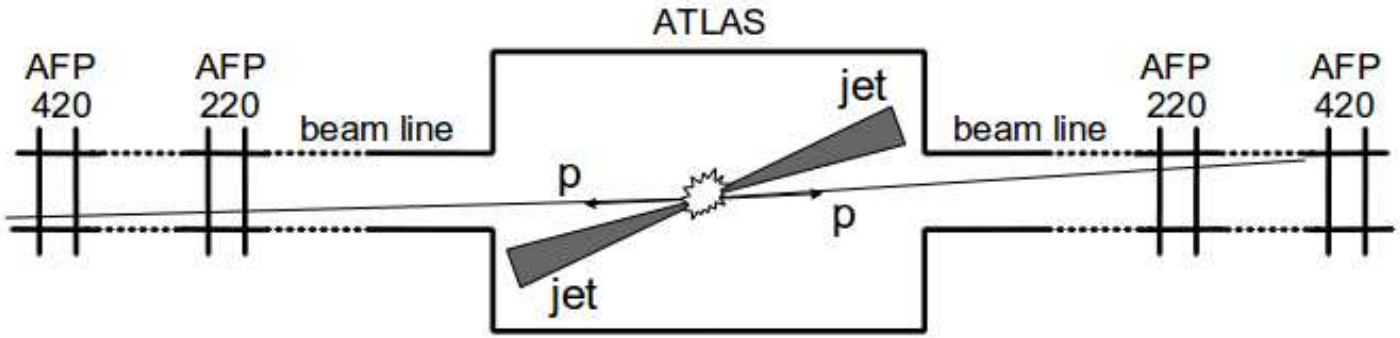
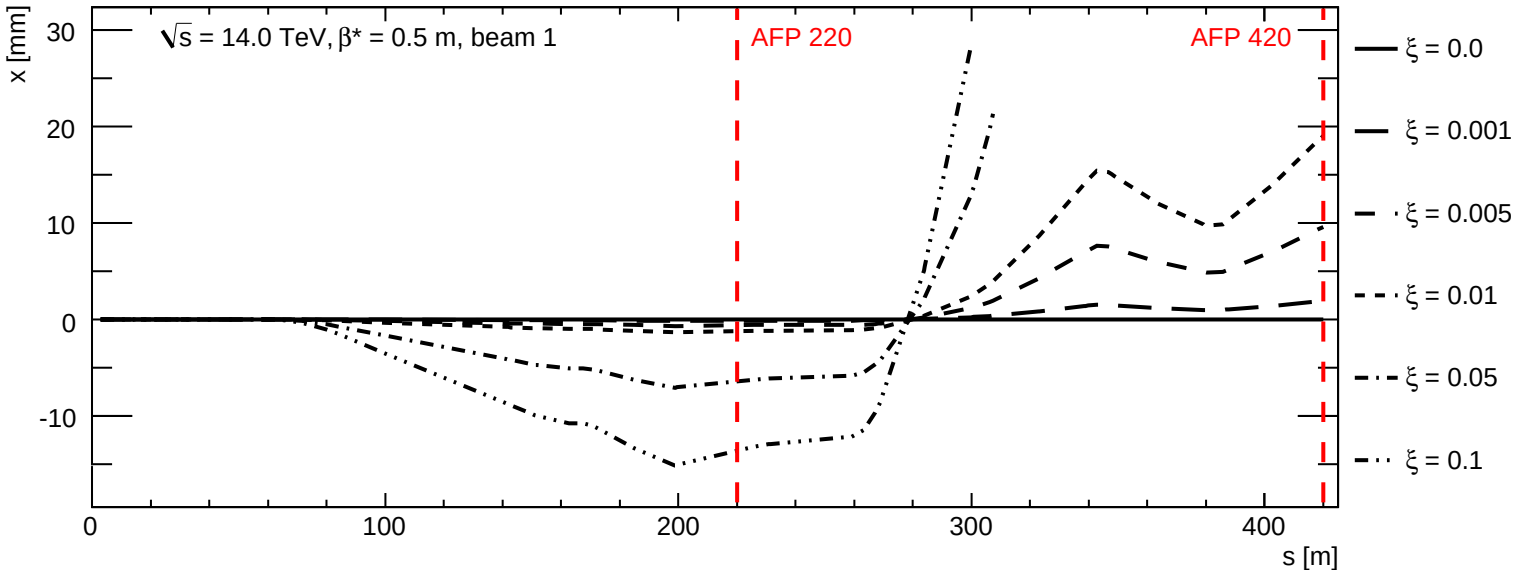
Idea of the measurement: outcoming protons are tagged in the AFP/HPS stations, jets are measured in the ATLAS/CMS detector.



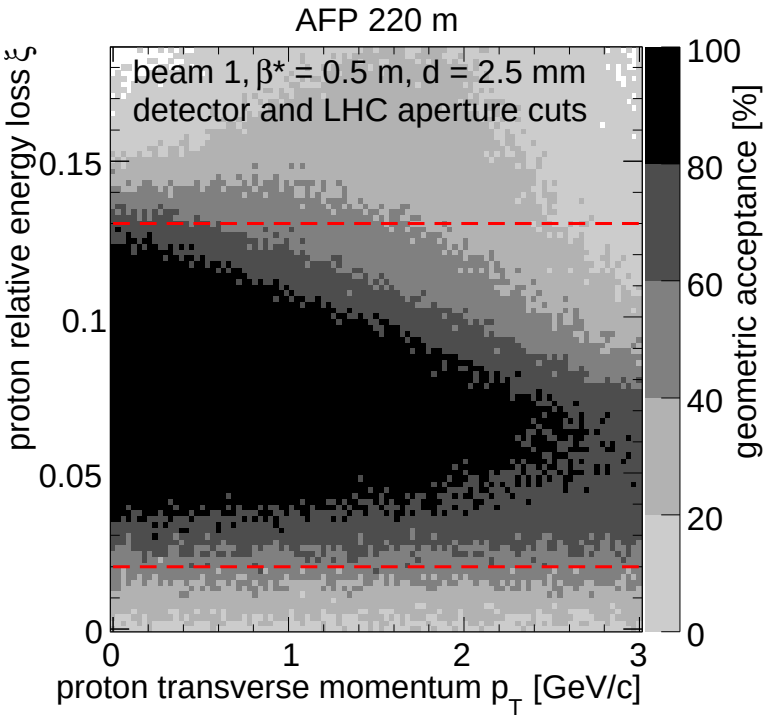
Path of protons with different energy loss through the LHC magnetic structure near the ATLAS Interaction Point.



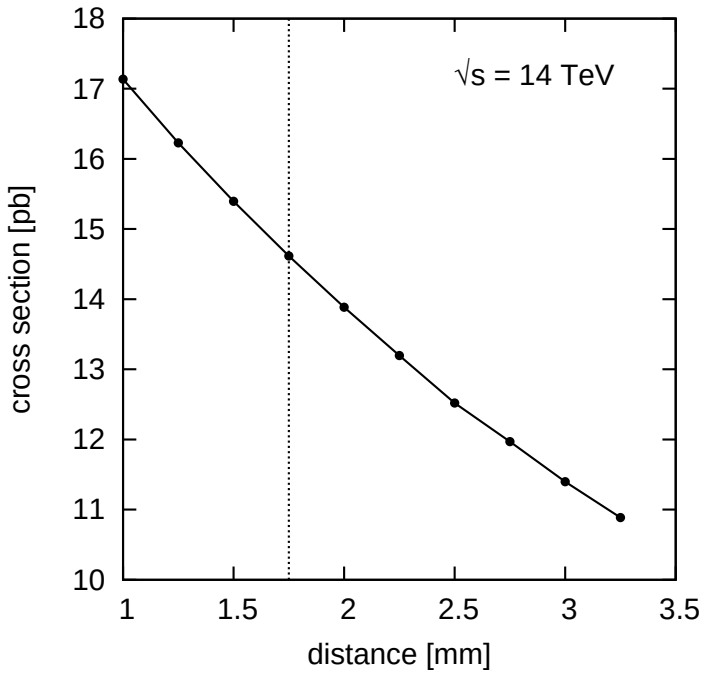
Protons were generated in IP $= (0, 0, 0)$ with transverse momentum $p_T = 0$.

AFP geometric acceptance

Geometric acceptance (left): ratio of the number of protons of a given relative energy loss (ξ) and transverse momentum (p_T) that crossed the active detector area to the total number of the scattered protons having ξ and p_T.

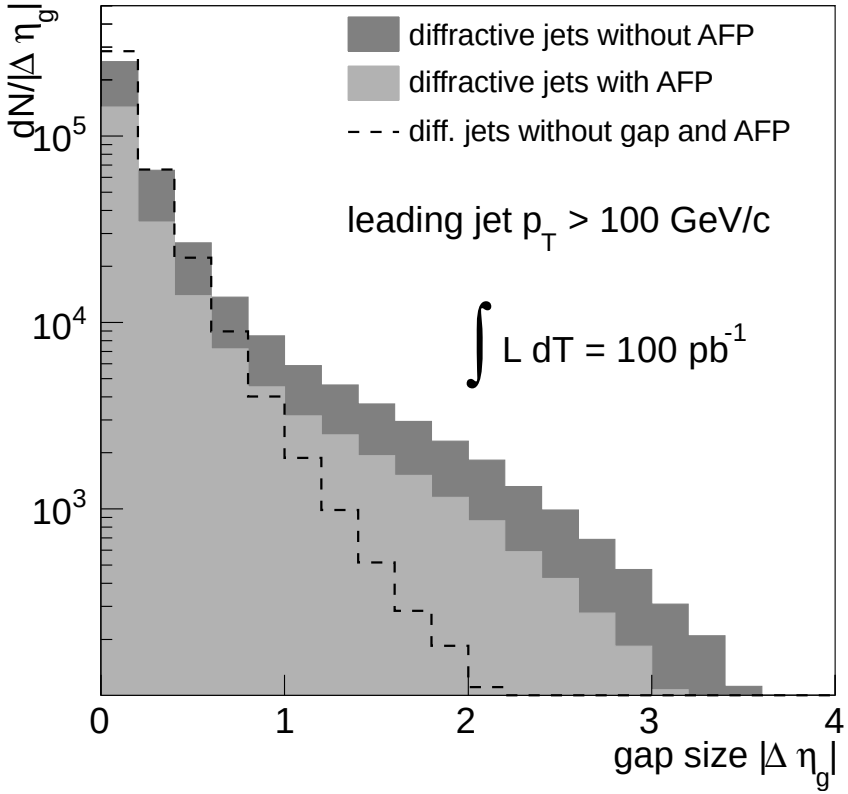


$0.02 < \xi < 0.13$

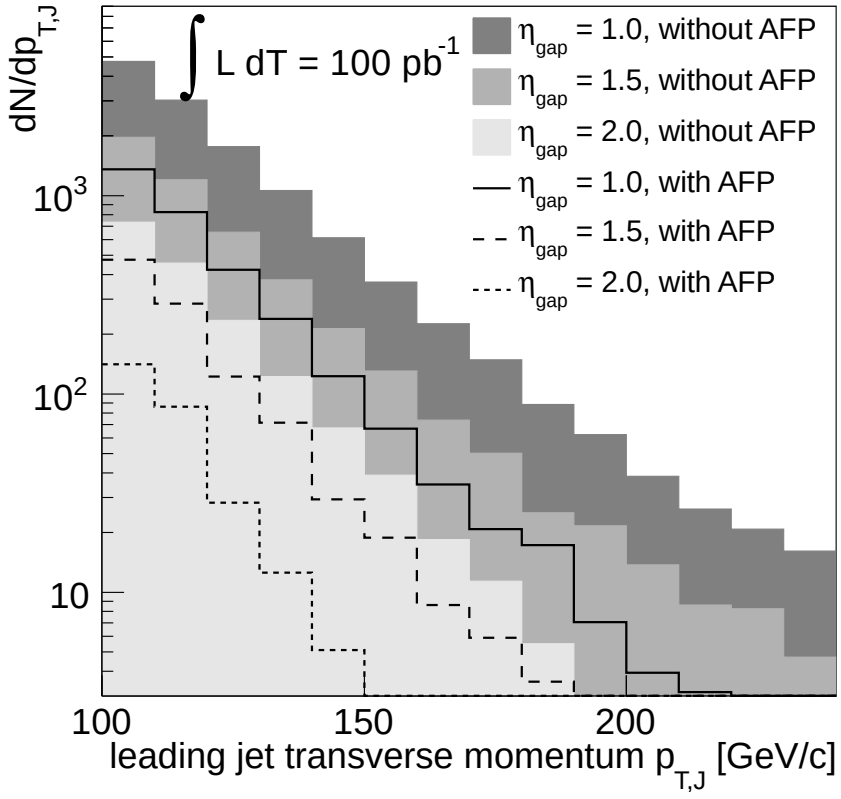


Right: **visable cross-section** as a function of the distance between the detector and the beam centre (for leading jet with $p_T > 100$ GeV/c).

Central jets



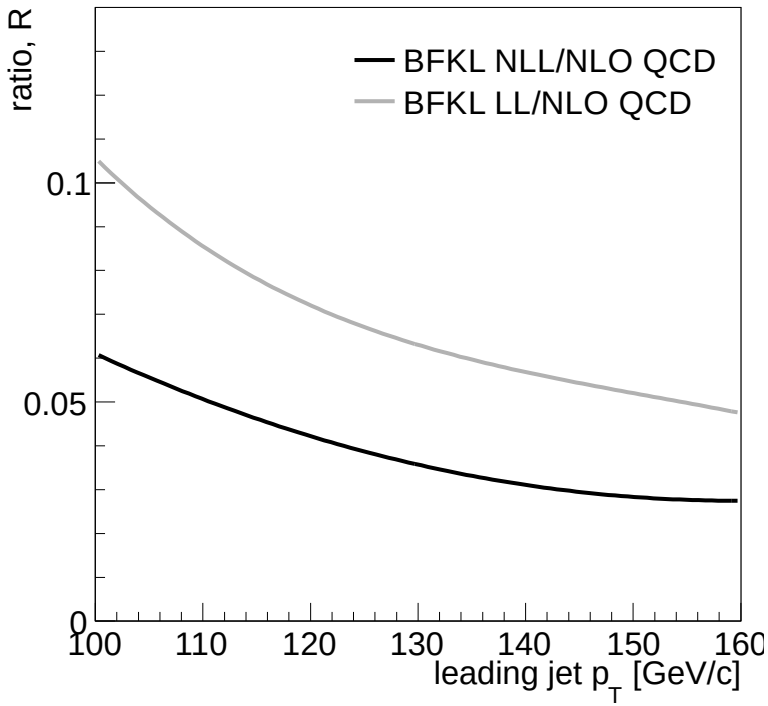
The gap size distribution for non-diffractive jets and diffractive jet-gap-jet events.

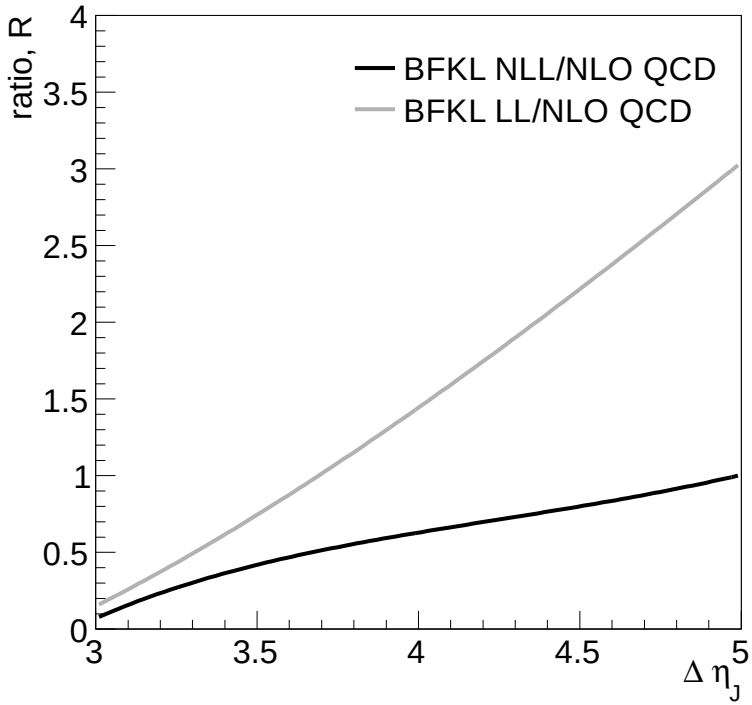


The jet transverse momentum distribution for different gap sizes with and without AFP tag requirement.

Ratio BFKL NLL/QCD NLO

$$R = \frac{\sigma(NLL\ BFKL\ FPMC)}{\sigma(Jet\ FPMC)}$$





Predictions for the ratio of the cross section for the diffractive jet-gap-jet to the inclusive jet cross section at the LHC as a function of the leading jet transverse momentum p_T (left) and the rapidity difference between the two leading jets $|\Delta\eta_J|$ (right).

Summary

- Diffractive jet-gap-jet measurement allows to test the BFKL model in very clean experimental environment.
- The HERWIG parton-level NLL-BFKL calculation was implemented into the FPMC Monte Carlo program, in order to obtain hadron-level results for the diffractive jet-gap-jet cross-section in hadron-hadron collisions, corresponding to the production of two high-pT jets around a large rapidity gap.
- Predictions for the ratio of the diffractive jet-gap-jet to the inclusive-jet cross section at the LHC, as a function of the second-leading-jet transverse momentum, and the rapidity difference between the two leading jets $\Delta\eta_J$ were presented.
- Diffractive jet-gap-jet measurement will be possible with help of the AFP detectors in special LHC runs.