

Motivation

- Drell-Yan transverse momentum spectrum

Study contributions from npQCD and perturbative multi-gluon resummation

- Rapidity interval between DY and leading jet

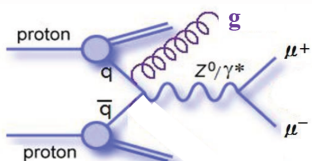
Multi-jet emissions are sensitive probe of multi-gluon emissions

- Study quark induced process especially in mass range above the Z mass

Compare to Higgs production, determine differences in soft-gluon and multi-jet resummation [1]

Dimuon p_T in different invariant mass bins

Three different event topologies

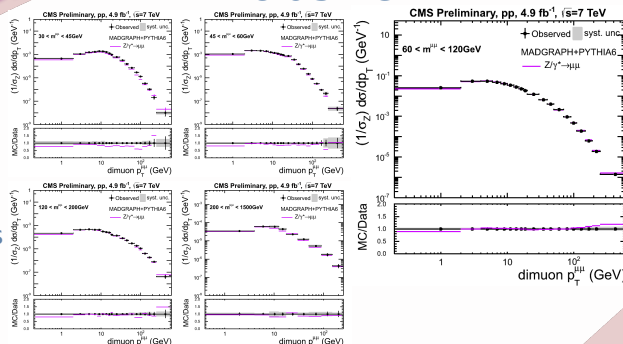


Inclusive DY, DY + 1 jet, DY + 2 jets

Event Selection

- Drell-Yan decaying into two muons with $|\eta^\mu| < 2.1$
- Transverse momentum $p_{T, \text{leading}}^\mu > 20 \text{ GeV}$ and $p_{T, \text{subl}}^\mu > 10 \text{ GeV}$
- Anti- k_T particle-flow jets with $R = 0.5$
- Kinematic cuts on the jets $p_T^{\text{jet}} > 30 \text{ GeV}$ and $|\eta^{\text{jet}}| < 4.5$
- To reduce background from top pair events $E_T^{\text{miss}} < 80 \text{ GeV}$
- Differentially in the Drell-Yan mass within $30 < m^{\text{DY}} < 1500 \text{ GeV}$

Inclusive DY



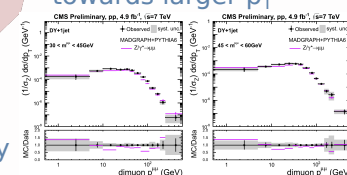
Resummation effects at small p_T

Cross Section Measurement

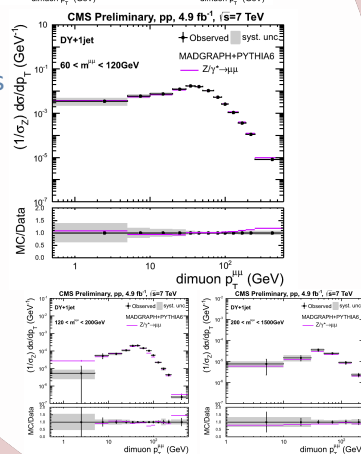
- Drell-Yan and associated jets as a function of m^{DY}
- Cross Section as a function of $p_{T, \text{DY}}$
- Cross Section as a function of $|\Delta y(\text{DY}, j^{\text{lead}})|$
- Detector and Efficiency Correction
- Normalized to the Z Peak region (60 - 120 GeV)

DY + 1 jet

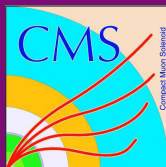
p_T is shifted towards larger p_T



Study multiple gluon emissions

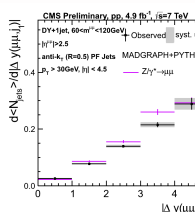


Measurement of double differential Drell-Yan and associated jet cross sections at low and high invariant masses in pp collisions at $\sqrt{s} = 7 \text{ TeV}$



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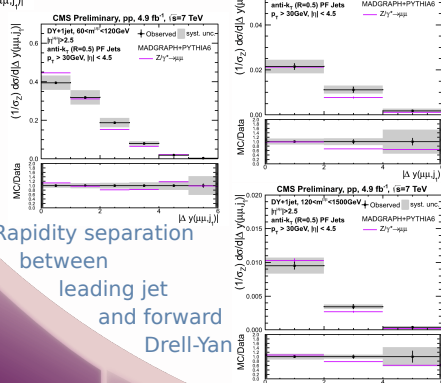
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26 August 2014
PANIC Poster Session
Hamburg



Average Number of jets between Drell-Yan and leading jet

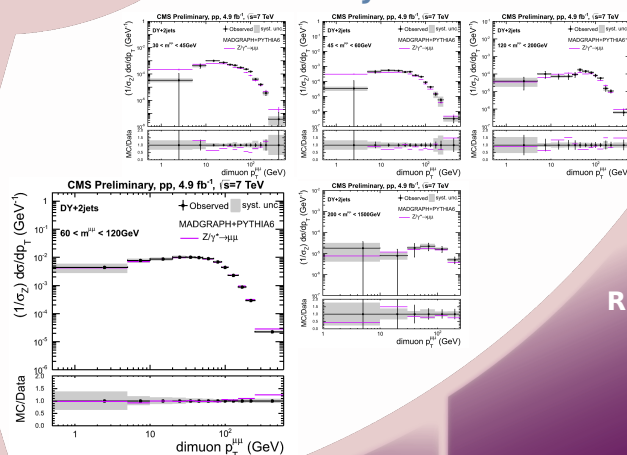
DY + 1 jet $|\Delta y(\text{DY}, j^{\text{lead}})|$

$|\eta^{\text{DY}}| > 2.5$



Rapidity separation between leading jet and forward Drell-Yan

DY + 2 jets



References

[1]
P. Ciproano et al.,
"Higgs boson as a gluon trigger",
Phys. Rev. D 88
(Nov,2013) 097501

[2]
CMS-PAS-FSQ-13-003

Conclusion

- First measurement of DY and associated jets cross section as a function of m^{DY}
- Measured p_T spectrum of DY lepton pair is well produced by MadGraph simulation
Rise at small p_T in inclusive DY is a measure for soft gluon resummation
For DY+jets the behavior at $p_T < 30 \text{ GeV}$ is a signal for perturbative jet resummation, which is well reproduced by parton showers
- Rapidity difference between DY lepton pair and leading jet
Not reproduced by MadGraph simulation
MadGraph predicts the jets to be closer to the DY lepton pair
- MadGraph shows reasonable description of number of jets as a function of $|\Delta y|$

Background Estimation

- Top Pair: scaled to describe the side region $E_T^{\text{miss}} > 80 \text{ GeV}$
- Data driven QCD background: Same sign dimuon events with inverse isolation cut
- Diboson production scaled to NLO cross section;
Single W normalized to inclusive cross section measured by CMS
- Z to $\tau\tau$ shape estimated from simulation normalized to Z+jets cross section