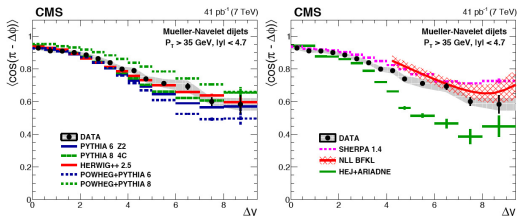


Snowmass
BFKL Observables

C.Baldenegro, S. Cerci, G. Chachamis, M. Kampshoff, M. Klasen, C.
Royon, A. Sabio Vera, D. Sunar Cerci

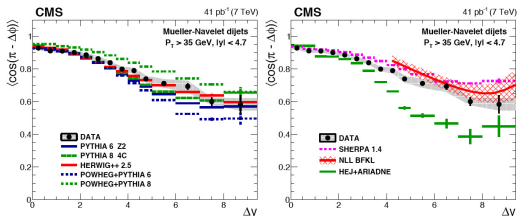
9.02.2022

Motivation



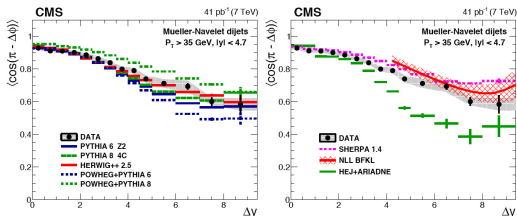
- Previous study: No clear sign of BFKL) look for less inclusive variables
- Goal: Can we corner BFKL effects at current energies in multijet production at the LHC?

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Motivation



- Previous study: No clear sign of BFKL) look for less inclusive variables
- Goal: Can we corner BFKL effects at current energies in multijet production at the LHC?
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- > Compare NLO calculation (POWHEG + Pythia) with BFKL (BFKLex)

Mueller-Navelet Jets

- Cuts (under investigation):

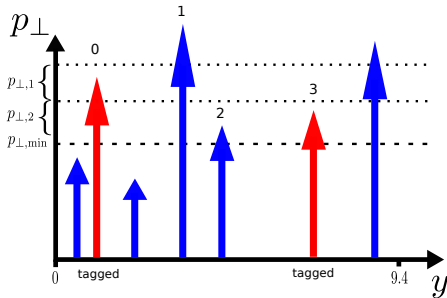
$$p_{T0} \in [30; 40] \text{ GeV}$$

$$p_{Tn_i} \in [20; 30] \text{ GeV}$$

$$p_{T\min} \geq 20 \text{ GeV}$$

$$y \in [4.7; 4.7]$$

- Maximize $\sum_j p_{Tj}$ in tagging



- ! Only take into account minijets $\rightarrow N_{\text{Jets}} \geq 4$
tagged jets are not part of the observables

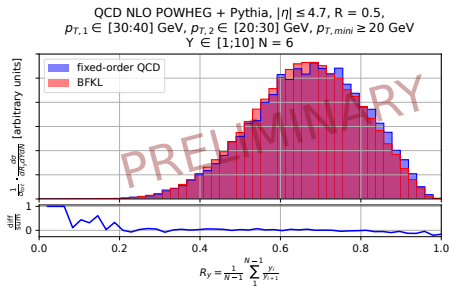
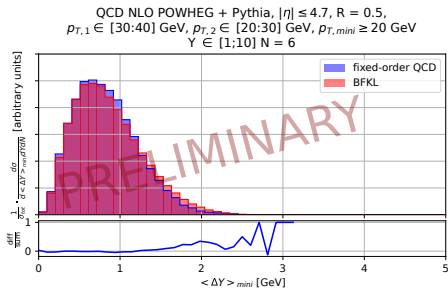
$$\zeta p_T \tilde{E}_{\text{mini}} \propto \frac{1}{N_{\text{Jets}}} \prod_i p_{Ti}$$

$$\zeta \Phi y \tilde{E}_{\text{mini}} \propto \frac{1}{N_{\text{Jets}}} \prod_i y_i$$

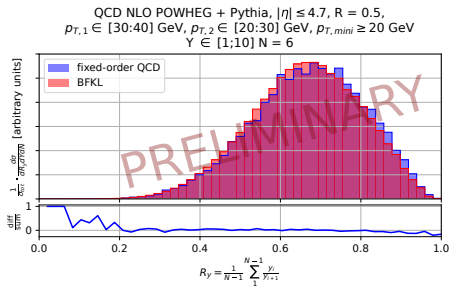
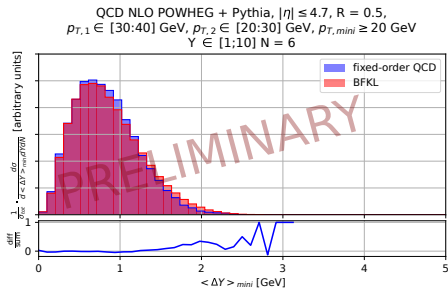
$$R_y \propto \frac{1}{N_{\text{Jets}} - 1} \prod_i \frac{y_i}{y_{i\hat{A}1}}$$

$$R_{ky} \propto \frac{1}{N_{\text{Jets}} - 1} \prod_i \frac{p_{Ti}}{p_{Ti\hat{A}1}} \exp(y_i - y_{i\hat{A}1})$$

with $y_0 \neq 0$, $y_i \leq y_{i\hat{A}1}$

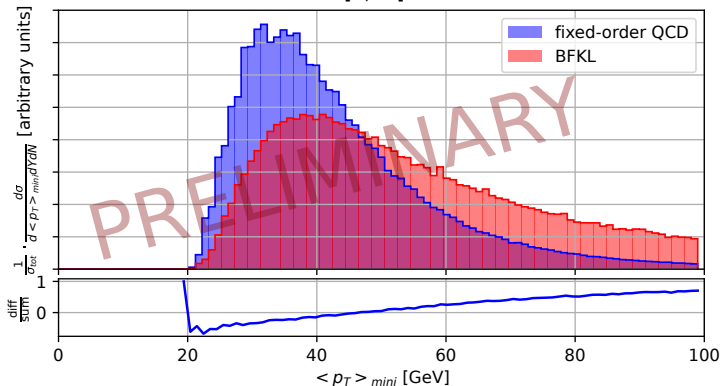


- No difference, despite strong rapidity ordering in BFKL, collinear scaling in shower

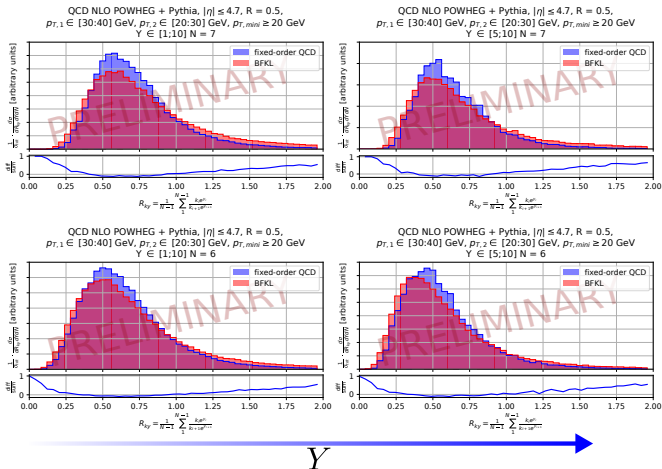


- No difference, despite strong rapidity ordering in BFKL, collinear scaling in shower
- Dominated by low- Y events, not BFKL-region) cross-check, no differences expected

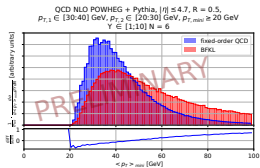
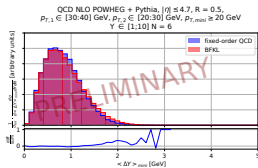
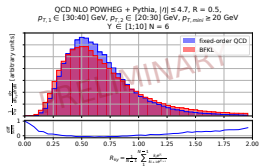
QCD NLO POWHEG + Pythia, $|\eta| \leq 4.7$, $R = 0.5$,
 $p_{T,1} \in [30:40]$ GeV, $p_{T,2} \in [20:30]$ GeV, $p_{T,\text{mini}} \geq 20$ GeV
 $Y \in [1;10]$ $N = 6$



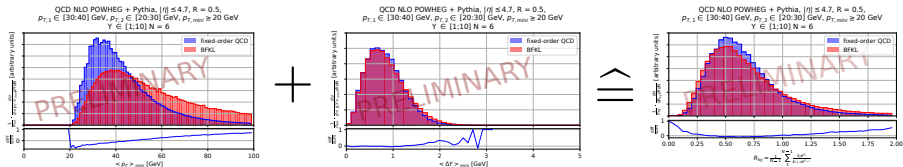
- ! Stark differences (still work in progress), results of different calculations?

N_{Jet}


- Differences should scale with Y , indecisive: Bad statistics at high Y

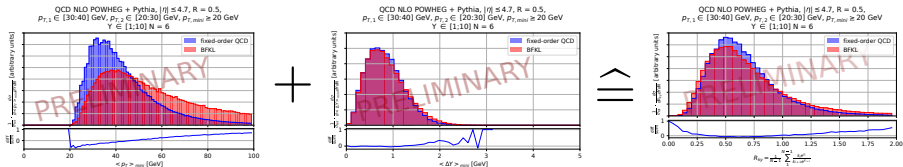

 $+$

 $\hat{=}$


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- Need to work with non-normalized quantities

Conclusion & Outlook

- very different computations, yet very similar results,
what is happening in detail?

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 - $p? \Delta R_{y\cancel{E}R_{ky}}$, where do the differences go?
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 - Where is the elephant in the room?
- ✓ We are gaining a deeper understanding of gluon emission!