EW Higgs Boson plus Three Jet Production at HL/HE LHC

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H+3 Jets at 13 TeV

• (Inclusive cuts) Collider Energy and Cuts used: At least three anti-kt jets with R=0.4
  \[ \sqrt{S} = 13 \text{ TeV} \]
  \[ p_{Tj} > 30 \text{ GeV} \quad |y_j| < 4.4 \]

• PDF set: MMHT2014
• Scales: HT(jets)

In collaboration with Simon Platzer, Peter Schichtel, Michael Rauch, Malin Sjodahl, and Francisco Campanario.
https://arxiv.org/abs/1308.2932
https://arxiv.org/abs/0710.5621
https://arxiv.org/abs/1610.07922
H+ 3 Jets: Inclusive Cuts

\begin{align*}
\frac{d\sigma}{dp_T,3} \text{ (pb/GeV)} &\quad \text{LO} \\
\frac{d\sigma}{dp_T,3} \text{ (pb/GeV)} &\quad \text{NLO}
\end{align*}

\begin{align*}
K &\quad \text{LO} \\
K &\quad \text{NLO}
\end{align*}
NLO H+3 Jets: VBF Cuts

\[ \frac{d\sigma}{d\Delta y_{12}} \text{ (pb)} \]

\[ \frac{d\sigma}{dm_{12}} \text{ (pb/GeV)} \]

\[ R \]

\[ \Delta y_{12} \]
H+ 3 Jets: VBF cuts

(VBF Cuts) $m_{12} > 600$ GeV $\Delta y_{12} = |y_1 - y_2| > 3$
NLO H+3 Jets

Inclusive Cuts

VBF Cuts
NLO H+3 Jets

Inclusive Cuts

VBF Cuts
Proposed Studies for HL/HE LHC

• Simulate EW H+3 jets at NLO with and without PS using HJETS++ and VBFNLO matrix elements interfaced to the Herwig 7 event generator at collider energies of 14 TeV and 27 TeV.

• Human Resources: TF, M. Rauch, Simon Platzer, Michael Rauch, Malin Sjodahl, Francisco Campanario, and Tinghua Chen (Masters student, WSU)

• Timeline: a few months (?)
Simulation Tools and Matrix Elements

- Herwig 7 Event Generator (https://herwig.hepforge.org)
- HJETS++ (https://hjets.hepforge.org)
- VBFNLO (https://www.itp.kit.edu/vbfnlo)
Thanks to Juan for the notification and to Michael Rauch for helping me isolate the bug!  
https://arxiv.org/abs/1802.02445