

$gg \rightarrow H$ With an Inclusive Central Jet Veto

Frank Tackmann

Massachusetts Institute of Technology

Work with Iain Stewart, Wouter Waalewijn,
Carola Berger, Claudio Marcantonini

[arXiv:0910.0467, arXiv:1002.2213, arXiv:1006:xxxx]



Beam Thrust: Definition and Factorization Theorem

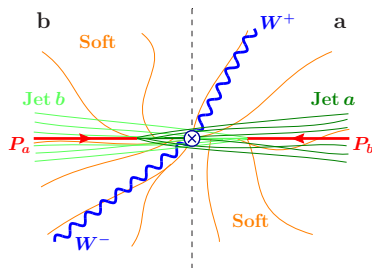
$$\mathcal{T}_B^{\text{cm}} = \sum_k |\vec{p}_{kT}| e^{-|\eta_k|} = \sum_k (E_k - |p_k^z|)$$

Factorization in 0-jet limit $\mathcal{T}_B^{\text{cm}} \ll m_H$

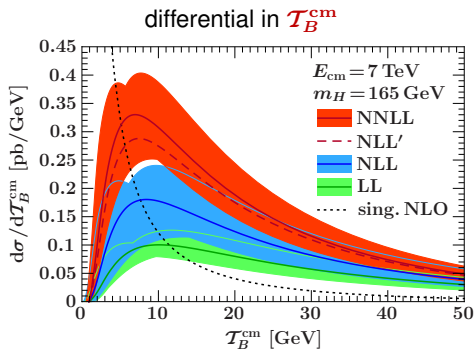
$$\frac{d\sigma}{d\mathcal{T}_B^{\text{cm}}} = \frac{\sqrt{2}G_F m_H^2}{576\pi E_{\text{cm}}^2} H_{gg}(m_t, m_H^2, \mu) \int dY$$

$$\times \int dt_a B_g(t_a, x_a, \mu) \int dt_b B_g(t_b, x_b, \mu) S_B^{gg} \left(\mathcal{T}_B^{\text{cm}} - \frac{e^{-Y} t_a + e^Y t_b}{m_H}, \mu \right)$$

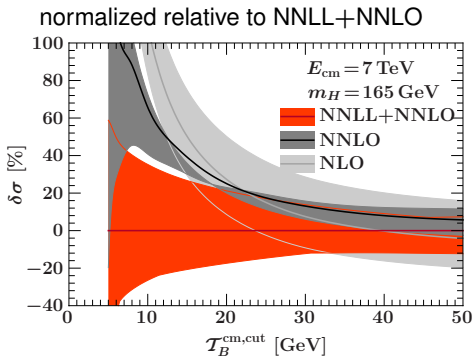
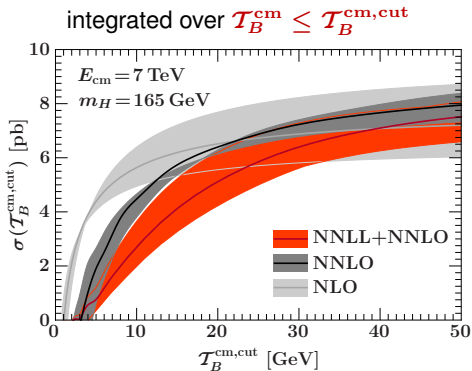
- $x_{a,b} = (m_H/E_{\text{cm}}) e^{\pm Y}$
- **Hard function**: contains $gg \rightarrow H$ vertex plus hard virtual corrections
- **Gluon beam function**: collinear ISR from incoming gluons
- **Soft function**: underlying soft radiation everywhere



Beam Thrust Cross Section for Higgs Production



Beam Thrust Cross Section for Higgs Production



- Matched to full NNLO (obtained from FEHiP)
- NNLL+NNLO central value outside NNLO uncertainty band for $\mathcal{T}_B^{\text{cm, cut}} < 40 \text{ GeV}$
- Perturbative uncertainties are larger than suggested by fixed order (can still be reduced by going to N³LL+NNLO)
- VBF: Expect similar large effects (much higher hard scale $\sim 1 \text{ TeV}$)