

The high-energy QCD dynamics from Higgs+jet correlations at FCC

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Hors d'œuvre

- Higgs sector → SM benchmarks, BMS portals
- Gluon fusion → key ingredient for precision QCD
- Fixed-order ← improved by resummations
- FCC energies ↔ high-energy (HE) resummation
- Higgs+jet → golden channel to hunt for HE signals

NLL/NLO differential cross section

$$\frac{d\sigma}{dy_1 dy_2 d^2\vec{k}_1 d^2\vec{k}_2} = \sum_{r,s=q,g} \int_0^1 dx_1 \int_0^1 dx_2 f_r(x_1, \mu_F) f_s(x_2, \mu_F) \frac{d\hat{\sigma}_{r,s}(x_1 x_2 s, \mu_F)}{dy_1 dy_2 d^2\vec{k}_1 d^2\vec{k}_2}$$

$$\frac{d\hat{\sigma}_{r,s}(x_1 x_2 s, \mu)}{dy_H dy_J d^2\vec{p}_H d^2\vec{p}_J} = \frac{1}{(2\pi)^2}$$

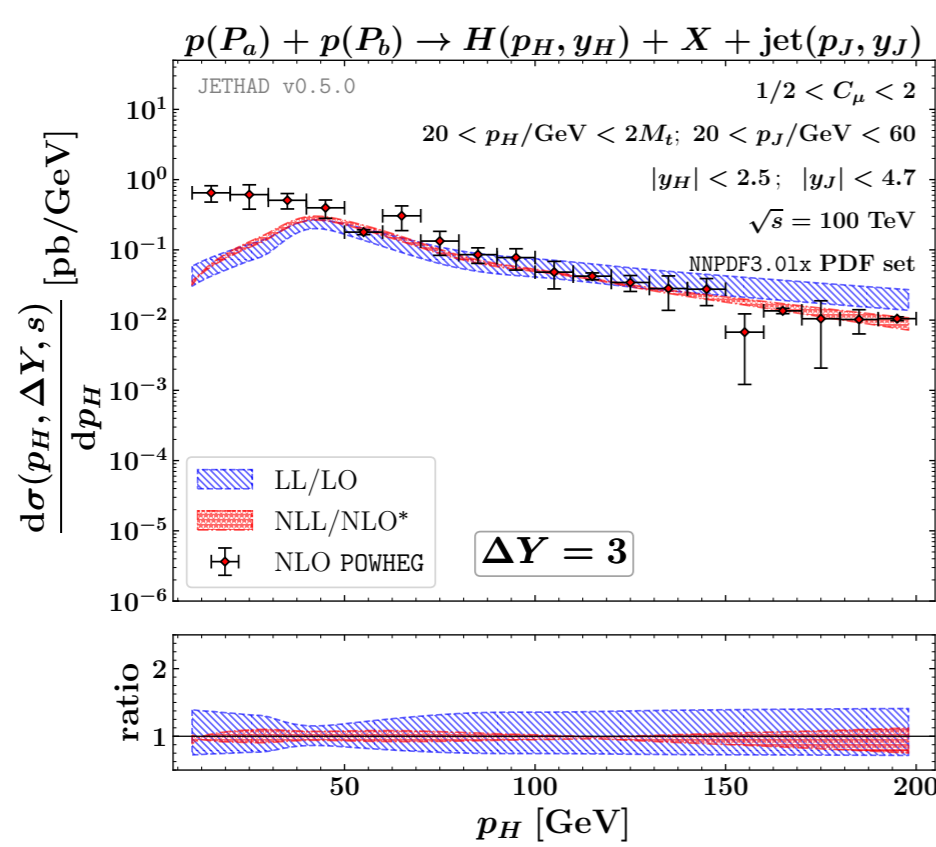
$$\times \int \frac{d^2\vec{q}_1}{\vec{q}_1^2} \mathcal{V}_H^{(r)}(\vec{q}_1, s_0, x_1, \vec{p}_H)$$

$$\times \int_{\delta-i\infty}^{\delta+i\infty} \frac{d\omega}{2\pi i} \left(\frac{x_1 x_2 s}{s_0} \right)^\omega \mathcal{G}_\omega(\vec{q}_1, \vec{q}_2)$$

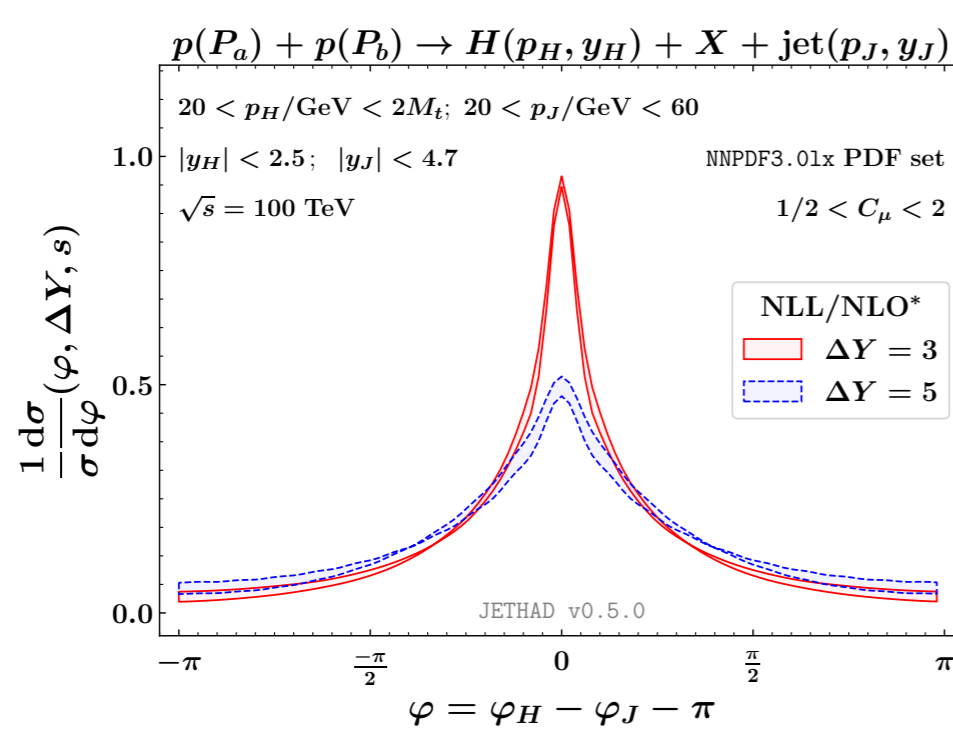
$$\times \int \frac{d^2\vec{q}_2}{\vec{q}_2^2} \mathcal{V}_J^{(s)}(\vec{q}_2, s_0, x_2, \vec{p}_J)$$



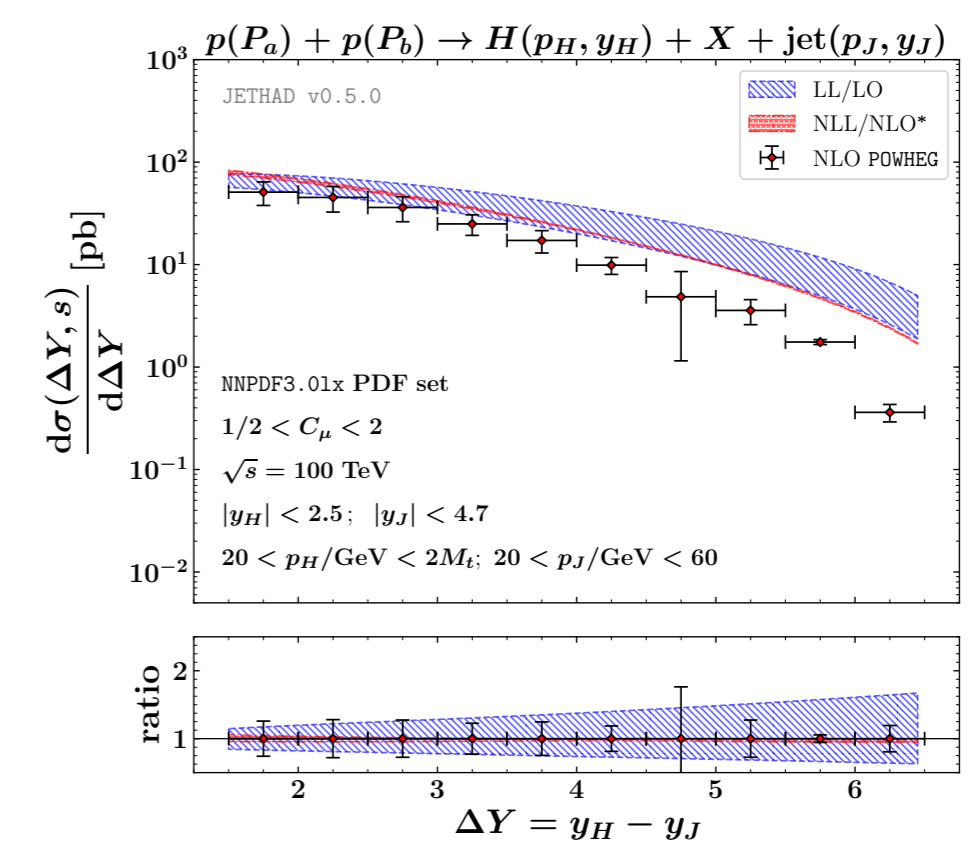
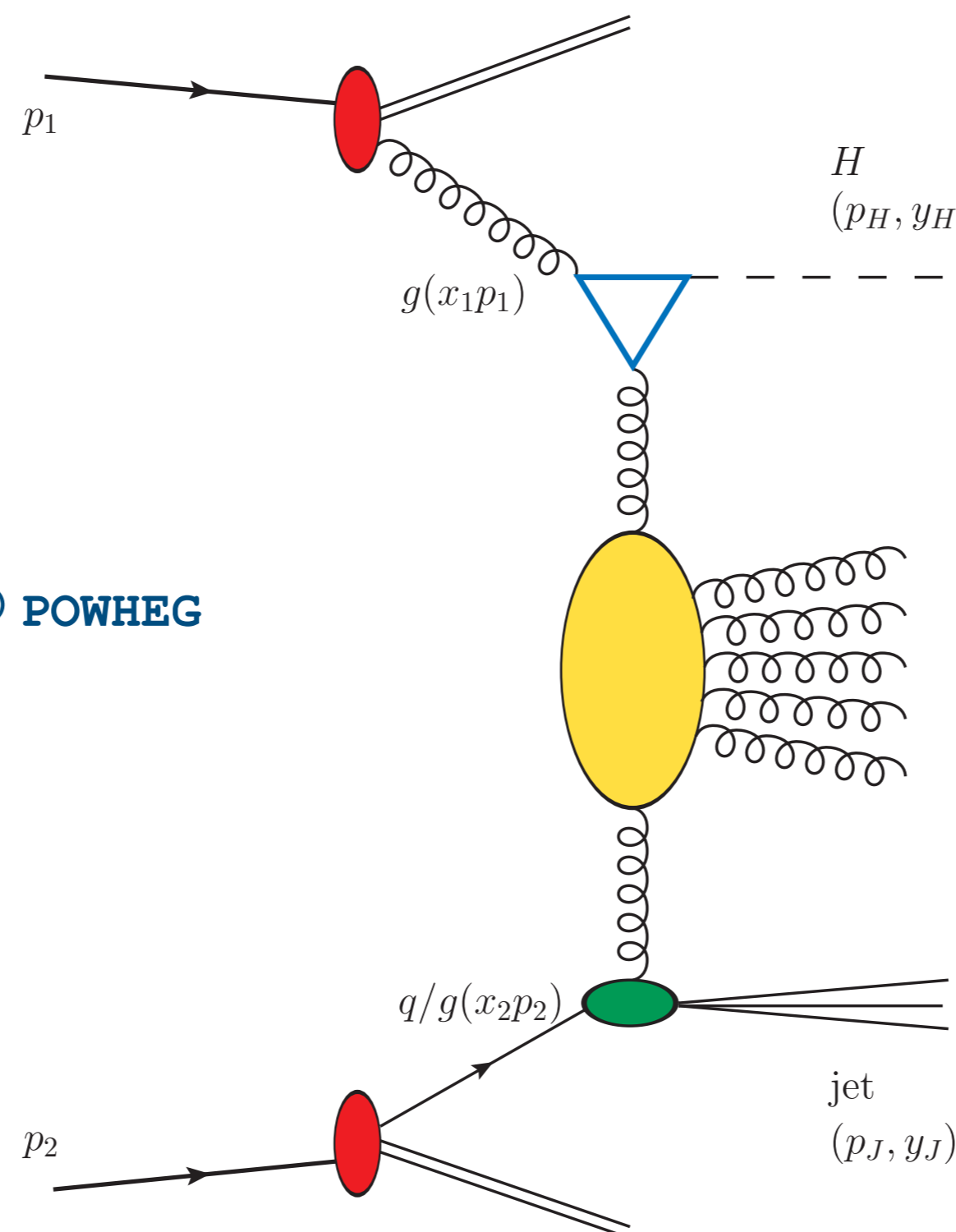
Hybrid high-energy and collinear factorization at work



Higgs p_T distribution: NLL/NLO **JETHAD** vs NLO **POWHEG**



Azimuthal distribution at NLL/NLO



Rapidity distribution: NLL/NLO **JETHAD** vs NLO **POWHEG**

HE resummation from **JETHAD**

Large-x **NNPDF3.01x** PDFs with threshold

Comparison with fixed-order from **POWHEG**

Distributions stable under NLL corrections

A path towards precision

- ✓ NLL bands nested inside LL ones → solid stability
- ✓ HE signal clearly disengaged from NLO background
- ✓ Way toward precision studies of HE QCD (j!)
- Multilateral formalism → encode other resummations
- A window on proton structure at small-x (j?)

Further information

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Take a picture to the QR code to download the paper on Higgs+jet resummed distributions at 14TeV LHC: [FGC et al., EPJ C 81 (2021) 4, 293]

