Z boson pair production in the Geneva NNLO event generator

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HELMHOLTZ

DESY.

About Myself...

- Grown up in Castelgerundo, a small town in Northern Italy
- Bachelor, Master and Ph.D. at the Milan Bicocca University
- First PostDoc at DESY Hamburg in the Theory group

The Geneva Framework

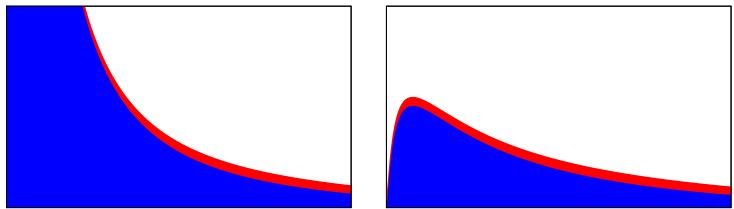
Geneva is an automated event generator that provides

- Fully differential **events** up to **NNLO QCD**
- **NNLL′ resummation** of the 0/1 jet resolution variable (the zero-jettiness $\mathcal{T}_0$ or the transverse momentum q_T for the case of color singlet production)
- **NLL resummation** of the 1/2 jet resolution variable (the one-jettiness $\mathcal{T}_1$ for the case of color singlet production)
- Matching to a **parton shower**

The Geneva Framework

We write the **NNLO differential cross section** as the sum of the resummed and fixed-order contributions and subtract the common terms

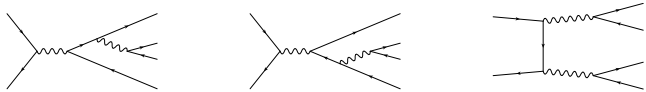
$$\frac{d\sigma^{\text{NNLO}}_{\text{CS}}}{d\Phi_0} = \int_0^{\mathcal{T}_0^{\text{max}}} d\mathcal{T}_0 \left(\frac{d\sigma^{\text{NNLL}'}}{d\Phi_0\, d\mathcal{T}_0} + \int \frac{d\sigma^{\text{NLO}_1}_{\text{CS+jet}}}{d\Phi_0\, d\mathcal{T}_0} - \frac{d\sigma^{\text{NNLL}'}}{d\Phi_0\, d\mathcal{T}_0}\bigg|_{\text{NLO}_1} \right)$$



ZZ Production

We consider proton-proton scattering processes at the LHC with four charged massless leptons in the final state

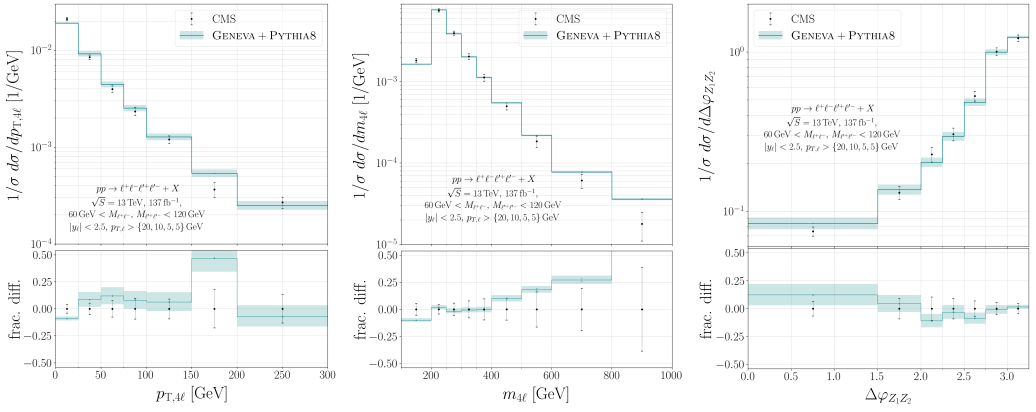
$$p\,p \to \ell^+\,\ell^-\,\ell'^+\,\ell'^- + X$$



- Diagrams up to $\mathcal{O}(\alpha_s^2)$: NNLO for quark-initiated diagrams, LO for gluon-initiated diagrams
- 0- and 1-loop matrix elements taken from OpenLoops2 (`pplll1`, `pplll1j` and `pplll12` packages) (Buccioni, Lang, Lindert, Maierhöfer, Pozzorini, Zhang, Zoller Eur.Phys.J.C 79 (2019) 10, 866)
- Two-loop virtual implemented starting from the `qqvvamp` code

(Gehrmann, von Manteuffel, Tancredi JHEP09(2015)128)

Some Nice Plots...



CMS measurements at 13 TeV from Eur. Phys. J. C 81 (2021) 200

Thank you!

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