SHERPA for p_{T}^{Z} and p_{T}^{W}

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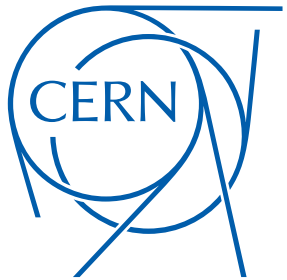
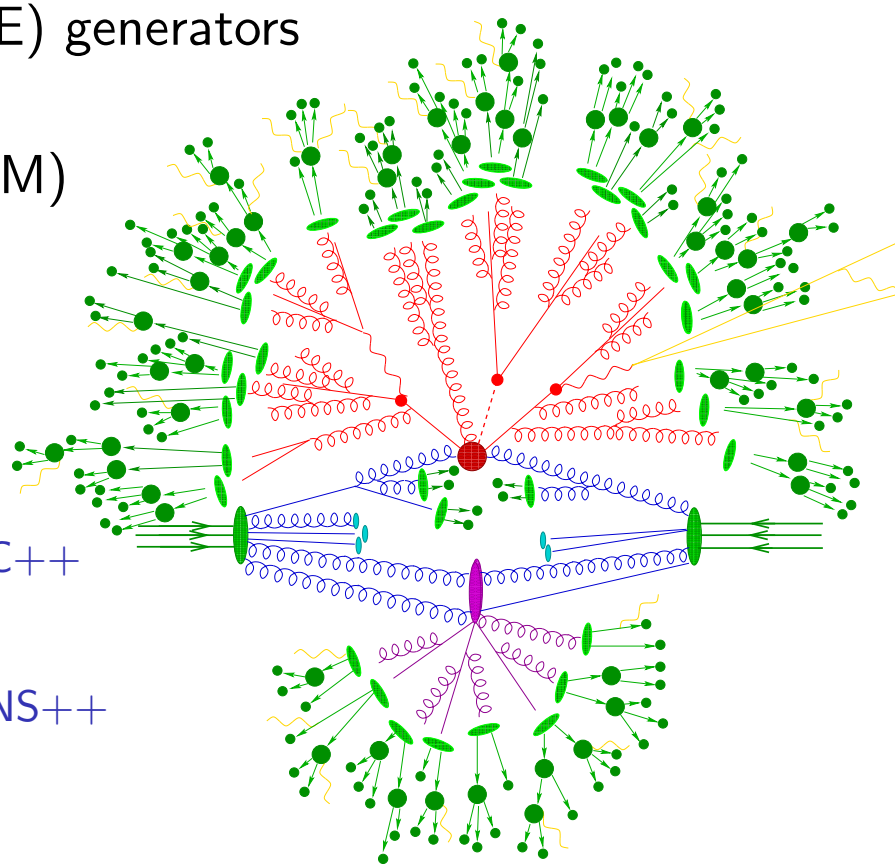
LHC EW Working Group Meeting



The SHERPA event generator framework

- Two multi-purpose Matrix Element (ME) generators AMEGIC++, COMIX
- A hard decays module (W, Z, h, t, BSM)
- Two Parton Shower (PS) generators CSSHOWER, DIRE
- A multiple interaction simulation AMISIC++
- A cluster fragmentation module AHADIC++ also interface to PYTHIA string model
- A hadron and τ decay package HADRONS++
- A higher order QED generator using YFS-resummation PHOTONS++



Sherpa's traditional strength is the perturbative part of the event

LO, NLO, NNLO, LOPS, **NLOPS**, **NNLOPS**, MEPS, MENLOPS, **MEPS@NLO**

Acronyms and nomenclature

Fixed order calculations

- matrix elements only, implies fixed multiplicities
- no parton shower, no non-perturbative physics, no particle level

$\Rightarrow$ LO, NLO, NNLO

Parton shower matched calculations

- combination of fixed order calculation and parton shower for one multiplicity
- particle level predictions, no multijet observables

$\Rightarrow$ LoPs, **NLoPs**, **NNLoPs**

Multijet merged calculations

- combination of parton shower matched calculations for increasing final state multiplicities (mostly jets)
- particle level predictions, multijet observables

$\Rightarrow$ MePs(@LO), **MePs@Nlo** (special case MeNLoPs)

SHERPA for p_{T}^{Z} and p_{T}^{W}

Fixed order:

- NNLO QCD and NLO EW for inclusive W and Z production
- NLO QCD and NLO EW for $p_{\mathrm{T}}^{W/Z}$

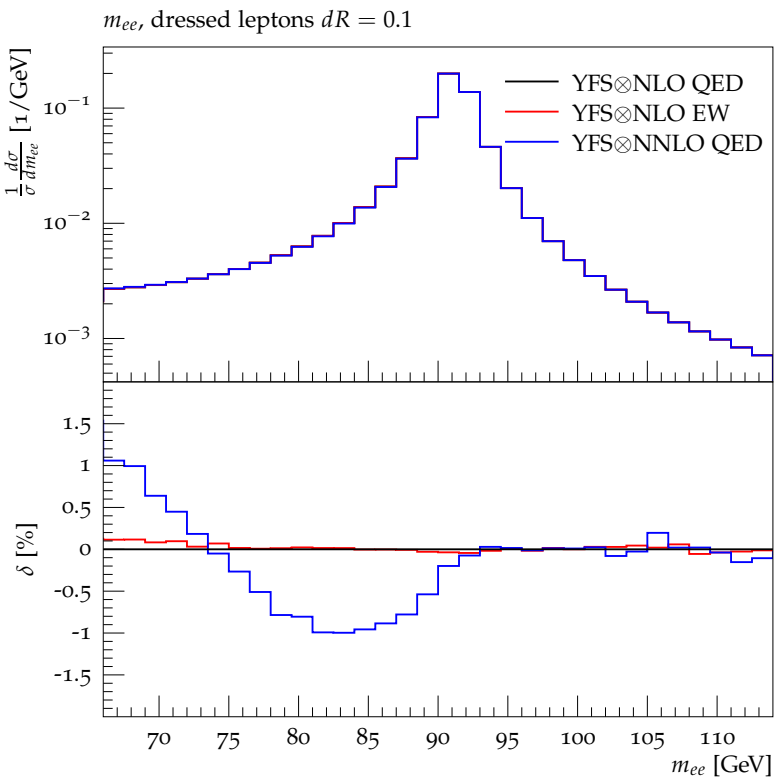
Matched to parton shower:

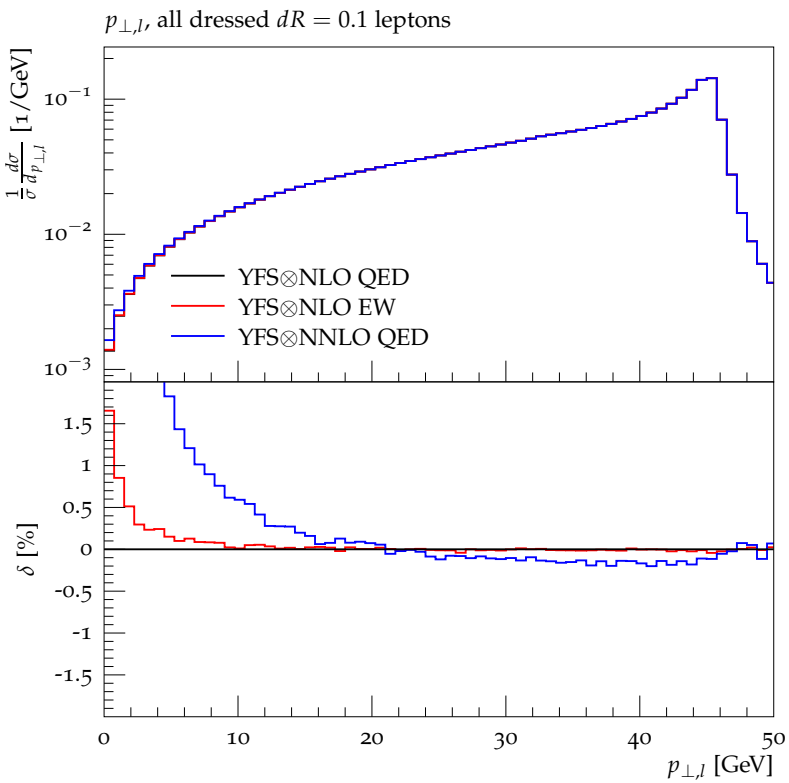
- NNLOPS for inclusive W and Z production
- NLOPS (S-MC@NLO) for $p_{\mathrm{T}}^{W/Z}$

Multijet merged:

- MEPS@NLO
  $\rightarrow$ inclusive and for low $p_{\mathrm{T}}(< Q_{\mathrm{cut}})$ same as incl. NLOPS
  $\rightarrow$ for high-p_{T}benefit from NLO accuracy for multijet processes

Soft-photon resummation

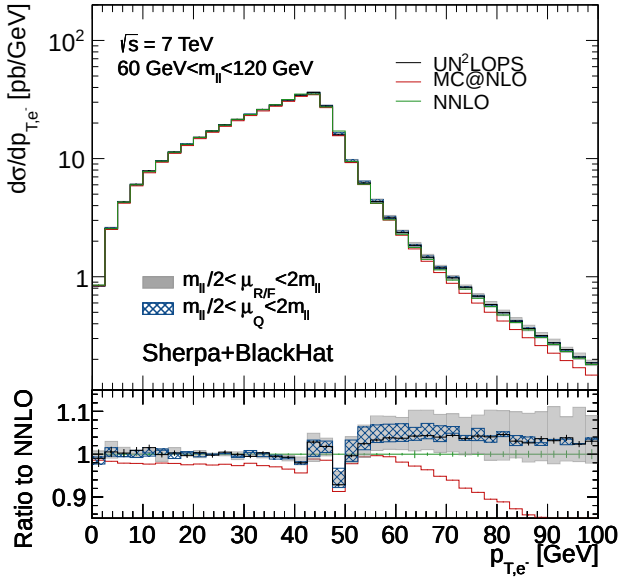


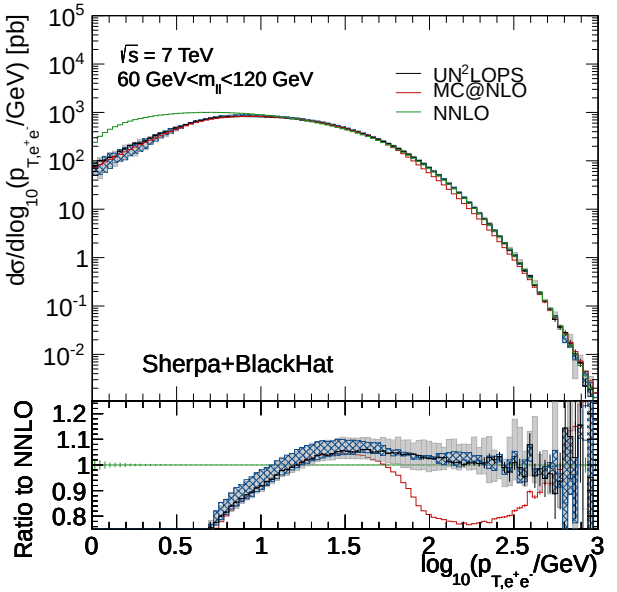


- YFS formalism, matched to NLO QED for $W \to \ell\nu$ and $Z \to \ell\ell$
- in the process of being extended to NNLO QED + NLO EW

NNLOPS for p_{T}^{W} and p_{T}^{Z}

- NNLOPS matching in UN^{2}LOPS scheme
- scheme constructed to minimise uncontroled higher order terms
- no reweighting, generated directly
- NLOPS accuracy as $p_{\mathrm{T}}^{W/Z} \to 0$
- QED corrections through YFS soft-photon res.

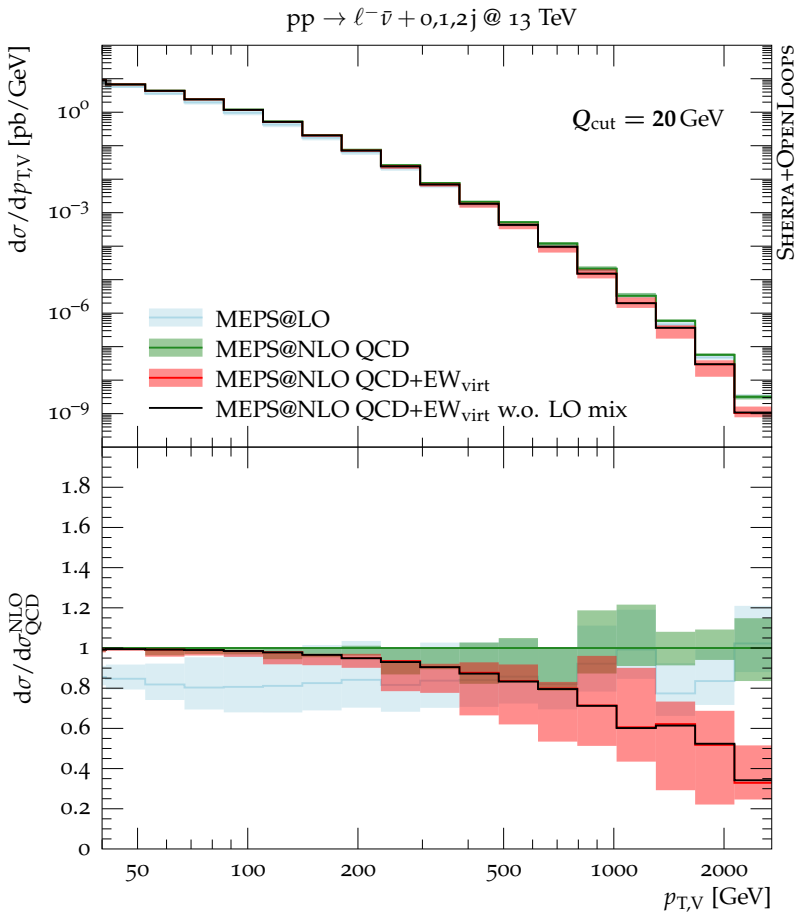




Large p_{T}^{W} and p_{T}^{Z}

MEPS@NLO QCD+EW$_{\mathrm{virt}}$

- incorporate approximate NLO EW corrections
  $\approx$ EW Sudakov approx.
  $\rightarrow$ but also includes many non-logarithmic terms that render the result closer to NLO EW
  $\rightarrow$ **recover large EW corr. at large p_{T}**
- also include large subleading orders
- QED FSR through YFS soft-photon resummation



Thank you for your attention!