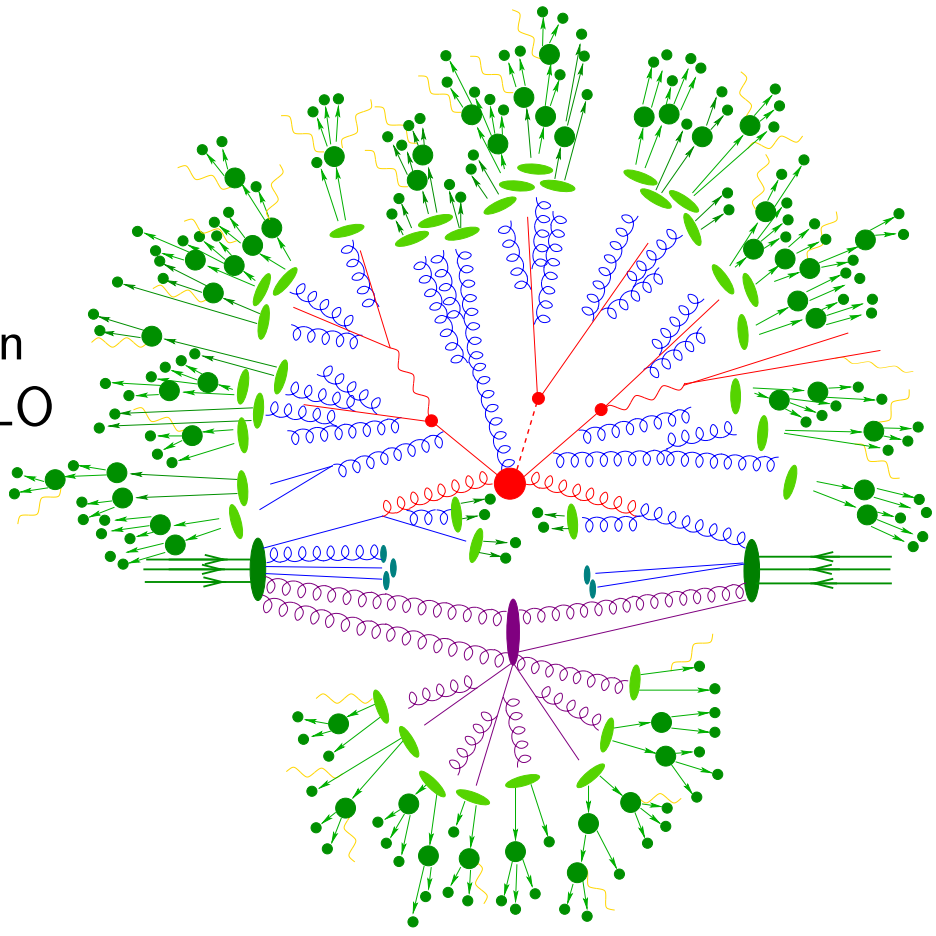
Event simulation for hadron colliders

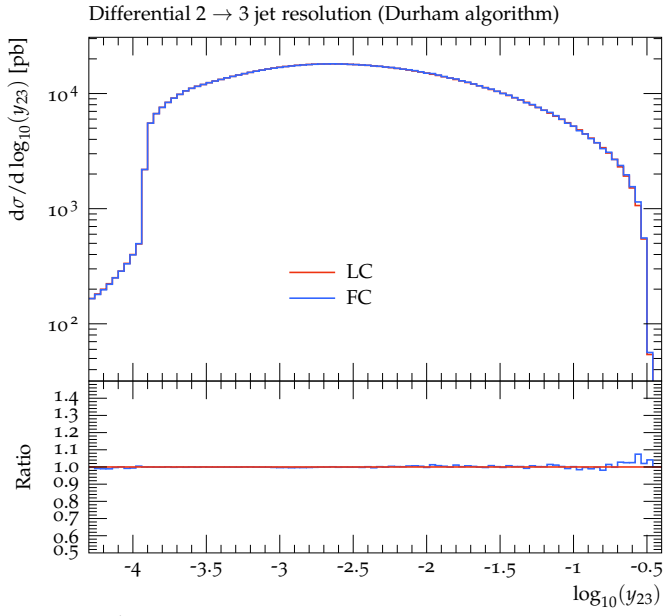
- **Hard interaction**
  Improved MC integration
  Code restructuring for MPP
  [S. Prestel,H. Schulz,SH] arXiv:1905.05120
- **Radiative corrections**
  Automated full-color resummation
  Extension of parton shower to NLO
  [F. Dulat,S. Prestel,SH] arXiv:1805.03757
  Automated FONLL matching
  [J. Krause,F. Siegert,SH] arXiv:1904.09382
- **Hadronization** & **Decays**
  Looking into color-aware
  hadronization models

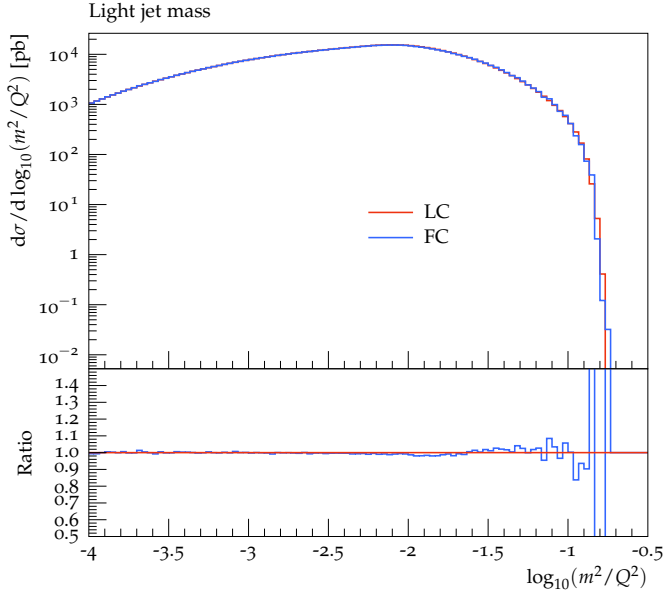


Precision resummation

D. Reichelt (Fulbright Scholar 2019), SH

- First ever practically usable full color resummation in soft gluon limit
- Extends existing approaches and improves efficiency by separating collinear/soft terms at integrand level
- Applicable to both global & non-global observables, recovers known NLL formalism for global observables
- Crucial ingredient for parton shower at NLO ($\leftrightarrow$ automated NNLL)





Event Generation with Normalizing Flows

C. Gao, J. Isaacson, C. Krause, H. Schulz, SH

- Novel MC integration technique developed by ETH & Disney Research relies on triangular form of Jacobian matrix to eliminate dependence on Neural Network gradient in inference ($\leftrightarrow$ fast event generation)
- Combined with recursive multi channel & applied to most problematic processes in (HL-)LHC simulations

unweighting efficiency $\langle w \rangle / w_{\max}$		LO QCD $n=1$	LO QCD $n=2$	LO QCD $n=3$	NLO QCD (RS) $n=1$
$W^+ + n$ jets	Sherpa	$1.1 \cdot 10^{-2}$	$5.1 \cdot 10^{-3}$	$8.0 \cdot 10^{-4}$	$9.0 \cdot 10^{-3}$
	NN+NF	$1.2 \cdot 10^{-1}$	$1.2 \cdot 10^{-2}$	$2.0 \cdot 10^{-3}$	$1.4 \cdot 10^{-2}$
	Gain	12	2.3	2.5	1.6
$W^- + n$ jets	Sherpa	$9.4 \cdot 10^{-3}$	$6.9 \cdot 10^{-3}$	$1.0 \cdot 10^{-3}$	$8.4 \cdot 10^{-4}$
	NN+NF	$1.5 \cdot 10^{-1}$	$1.5 \cdot 10^{-2}$	$2.2 \cdot 10^{-3}$	$1.5 \cdot 10^{-3}$
	Gain	16	2.2	2.2	1.8