

QED real corrections in the Sherpa event generator

Lois Flower

Institute for Particle Physics Phenomenology
Durham University

lois.flower@durham.ac.uk

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Parton shower

- ▶ Need to model radiation from high-energy particles from hard scattering
- ▶ Can use subtraction schemes from NLO calculations to approximate dominant soft and collinear radiation
- ▶ Catani-Seymour dipole formalism [Catani & Seymour, 1997] used in event generators for QCD shower [Schumann & Krauss, 2007]

QED parton shower

- ▶ Splitting functions have the same form as for a QCD shower

$$\langle V \rangle_{f\gamma}(z, y) \propto \frac{2}{1 - z(1 - y)} - (1 + z)$$

$$\langle V \rangle_{\gamma f}(z, y) \propto z^2 + (1 - z)^2$$

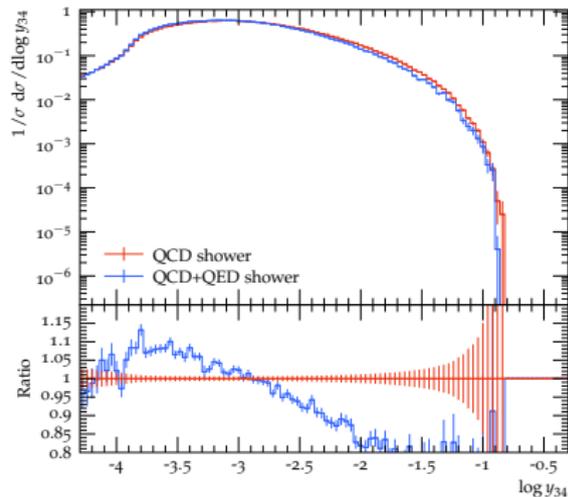
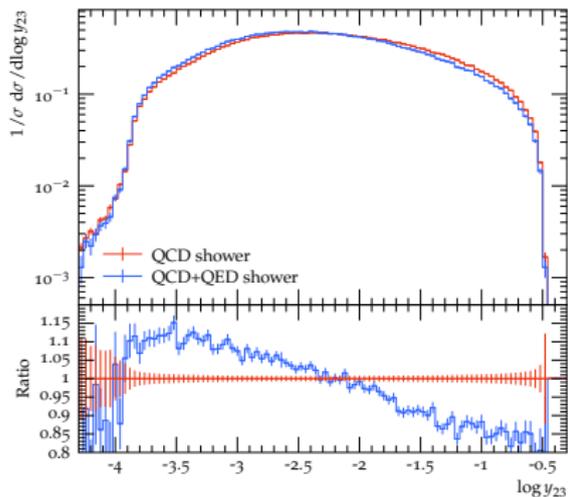
- ▶ Colour correlator $\mathbf{T}_{\tilde{ij}} \mathbf{T}_{\tilde{k}}$ replaced by charge correlator [Dittmaier, 2000]

$$Q_{\tilde{ij}\tilde{k}}^2 = \begin{cases} -\frac{Q_{\tilde{ij}} Q_{\tilde{k}} \theta_{\tilde{ij}} \theta_{\tilde{k}}}{Q_{\tilde{ij}}^2}, & \text{for } \tilde{ij} \neq \gamma \\ -\kappa_{\tilde{ij}\tilde{k}}, & \text{for } \tilde{ij} = \gamma \end{cases}$$

QED parton shower

- ▶ Requires treatment of negative weights for same-sign dipoles
- ▶ Use modified analytic weights method [Höche, Schumann & Siegert (2009)]
- ▶ Allow fermions to radiate photons with $\alpha(0)$, since most photons will be long-distance
- ▶ Photons split into fermion pairs with $\alpha(t)$
- ▶ Interleaved QCD+QED shower is then easy

Differential Durham jet rates in $e^+e^- \rightarrow q\bar{q}$



Problems to resolve

- ▶ Catani-Seymour shower in SHERPA was built for 1 or 2 spectators
- ▶ QED: any number of spectators!
- ▶ Not all spectators contribute equally yet so some cancellations are incomplete

Thank you for listening