QED resummation methods

Status, updates and plans

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Status and updates

- QED initial-state shower for e^+e^- in SHERPA
  - Careful treatment of the electron structure function
  - Initial-final interference currently slightly underestimated - need to evaluate impact on different processes, and find a solution
- MC@NLO matching implemented for QED/EW NLO matched to QED parton shower with SHERPA and OPENLOOPS or RECOLA
- Currently only approximate $\mathcal{KP}$ terms
- In validation against fixed-order NLO EW, found that these were insufficient
  - Two physics bugs cancelled each other out...
- Waiting on Marek Schönherr's full implementation of the e^+e^- $\mathcal{KP}$ terms

Outputs

- Test case: future e^+e^- collider at 91.2 GeV, 240 GeV and 500 GeV
- Look at test process $e^+e^- \to \nu_\mu \bar{\nu}_\mu$
- at 91.2 GeV: mostly soft radiative corrections important due to steep Z resonance
- at 500 GeV: mostly hard collinear radiation important, moves off the structure function peak
- 'Useful' test case: $e^+e^- \to ZH$ at 240 GeV (proposed)
- NLO EW corrections important, full decays needed
- We add matching to initial-state radiation from e^+e^-
- Paper almost done, hopefully arxiv 2510.xxxxx or 2511.xxxxx
- Additionally, advising on QCD+EW NLO matching study with Joanne Roper, new PhD student at IPPP Durham

Plans for the next year

- Understand the collinearly-enhanced YFS/CEEX method
- Work out if it can be implemented in Jérémy's framework and what the benefits could be: if beneficial, implement it!
- Investigate which experimental observables benefit from additional radiation beyond NLO
  - Does eikonal (YFS) or collinear (PS) approximation perform better?
  - Can we combine the benefits of both?
- Apply NLO+PS to low-energy e^+e^- collider processes, test against BabaYaga PS, Phokhara & KKMC CEEX, Sherpa EEX, ...
- Help run Sherpa and Phokhara for next RMCL2 effort
- Hope for a resolution of the $g-2$ tension, whether new physics or not...

Thanks for listening!