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EW corrections
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Discussion

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Theoretical uncertainty

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  - QCD: TH uncertainty from PDF, log-dependence of virtuals on ren. scale, α_s (value + running)
  - EW: α fixed by renormalization arguments

$$\alpha(M_{\mathrm{Z}}) = \alpha(0)/[1 - \Delta\alpha(M_{\mathrm{Z}})]$$

$$\Delta\alpha(M_{\mathrm{Z}}) = \Pi^{\gamma\gamma}_{f\neq \mathrm{t}}(0) - \mathrm{Re}\{\Pi^{\gamma\gamma}_{f\neq \mathrm{t}}(M^2_{\mathrm{Z}})\} \approx \frac{\alpha(0)}{3\pi} \sum_{f\neq \mathrm{t}} N^{\mathrm{c}}_f Q^2_f \left[\ln\left(\frac{M^2_{\mathrm{Z}}}{m^2_f}\right) - \frac{5}{3}\right]$$

-> cancels fermion mass logs from charge renormalization
external photons: δZ_{AA} cancels logs from charge ren.
-> external photons couple with $\alpha(0)$

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$$\alpha_{G_F} \equiv \frac{\sqrt{2} G_F M_{\mathrm{W}}^2 \left(M_{\mathrm{Z}}^2 - M_{\mathrm{W}}^2\right)}{\pi M_{\mathrm{Z}}^2} = \alpha(0) \left(1 + \Delta r^{(1)}\right) + \mathcal{O}(\alpha^3)$$

-> absorbs universal corrections to ren. of weak mixing angle

➡ choice of α determined by process

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  - EW:
    - **QCD + EW vs QCDxEW:**

$$\sigma^{NLO}_{QCD+EW} = \sigma^{LO} + \delta\sigma^{NLO}_{QCD} + \delta\sigma^{NLO}_{EW}$$

$$\sigma^{NLO}_{QCD\ \mathrm{x}\ EW} = \sigma^{LO} + \delta\sigma^{NLO}_{QCD} + \delta\sigma^{NLO}_{EW} + \frac{\delta\sigma^{NLO}_{QCD} \cdot \delta\sigma^{NLO}_{EW}}{\sigma^{LO}}$$

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Treat photons and partons on the same footing

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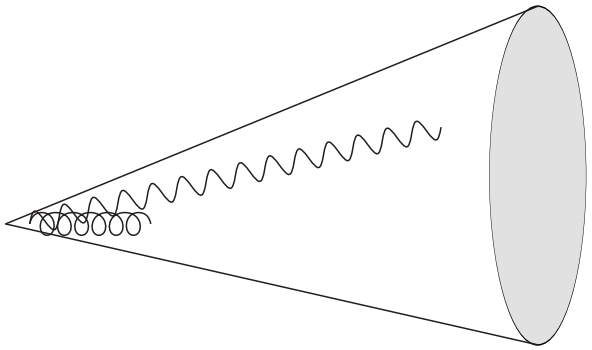
3. Both QED and QCD singularities occurring



Leads to QCD singularities

-> Needs to regularized by QCD corrections

-> Mixing of order at LO

Democratic clustering

- Clean and unambigious strategy
  (otherwise: first photon isolation then jet clustering or vice versa ?
  possible double counting of parton, might even be infrared unsafe

- No need to apply any photon isolation criterion / fragmentation function on parton level. Can be done after parton shower

BLHA interface

- Version 2 contains all necessary building blocks to incorporate EW corrections
- Might need some refinements for color- and spin correlated terms.
- **GoSam + Sherpa:**
  EW interface essentially identical to QCD interface

  `OLP_GetProcessnumber(process, nr)`
  makes contract file obsolete

  `OLP_EvalSubProcess_EW((label, momenta, mu, restot, acc))`
  identical syntax as for QCD, accuracy not supported at the moment as not used.