ERC workshop

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in the group of

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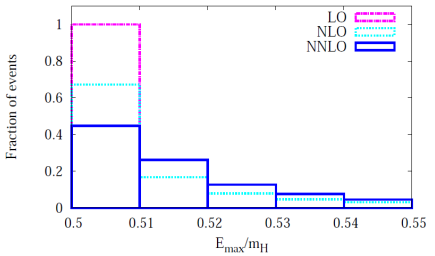
Non-linear mappings for NNLO

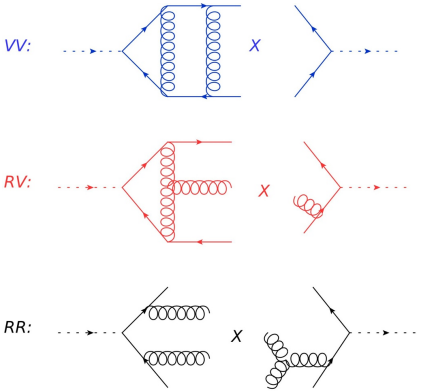
- Non-linear mappings:
  - *On the factorisation of overlapping singularities* [arxiv:1011.4867]
    - Developed a systematic approach towards factorising overlapping singularities with nonlinear mappings:

      e.g.

$$I = \int_0^1 dxdy \frac{x^\epsilon}{x(ax+y)} \qquad x \mapsto \frac{x(y/a)}{1-x+(y/a)} \qquad \mapsto \int_0^1 dxdy \frac{(xy)^\epsilon}{xy} \left(a(1-x)+y\right)^{-\epsilon}$$

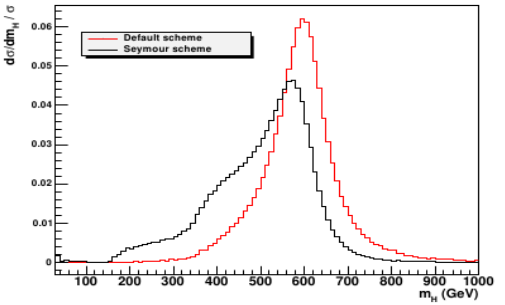
    - Applying such mappings recursively we showed how one can factorise singularities typically occurring in NNLO QCD corrections:
      - Found mappings for double real corrections to the hadronic production of a massive system.
      - Factorised singularities of most complicated massless two-loop integrals..
  - *The fully differential H to b bbar width at NNLO* [arXiv:1110.2368]
    - Bottom quark is dominant decay mode for light higgs and can lead to a discovery in the associated higgs production..
    - Used nonlinear mappings for both double-real and real-virtual corrections
    - Wrote a fully differential Monte-Carlo event generator.



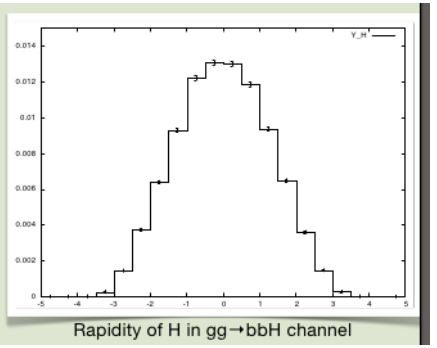


IHixs & EHixs

- **IHixs:** Code for Inclusive Higgs production (gg,b bbar → H)
  - *Total cross-section for Higgs boson hadroproduction with anomalous Standard Model interactions* [arXiv:1107.0683]
    - Includes NNLO QCD in HQET, NLO mass effects, electroweak corrections
    - Off-shell effects
    - BSM effects, enhanced yukawa caouplings
      - *Higgs production cross-section in a Standard Model with four generations at the LHC* [arXiv:1103.3645]



- **EHixs:** Code for Exclusive Higgs Production (gg,b bbar → H) ... ***in progress***
  - Successor of FeHip written in C
  - Uses non-linear mappings for double-real corrections
  - Currently have b bbar → H "nearly" implemented



near future plans

$$|M_{RR}|^2 = \sum_{D_i \in D} \frac{N_i(\epsilon, \{s_{kl}\}))}{D_i}$$

Process dependent
Numerator functions

Universal singularity
structures

$$D := \{s_{13}s_{23}s_{134}s_{234}, s_{13}s_{23}s_{14}s_{24}, s_{13}s_{24}s_{134}s_{234}, ..., \left(s_{34}s_{134}s_{234}\right)^2, ...\}$$

- Know how to factorise denomenators
- Tedious to find numerators in CDR, currently use classic Feynman Diagram methods

- Idea:
  - Use Recursion relations (Berends-Giele or BCFW) to compute the numerators numerically,
  - Potential Difficulties:
    - Epsilon pieces
    - Quadratic divergences