Status update

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Ingredients for NLO calculations

Matrix element handler extended to keep track of different contributions to NLO matrix elements:

- Automated real emission matrix elements: AMEGIC/COMIX ✔
- Automated dipole subtraction terms: Eur.Phys.J.C53:501-523,2008 ✔
- Virtual contributions:
  - Process classes adapted to handle all divergence structures (~ 1, $\sim \frac{1}{\varepsilon}$, ...)
  - Squared, spin-summed available in literature for many processes
  - But ultimately: Want the full ME to allow for spin correlations with decays

Loop matrix elements

- Feynman rules $\Rightarrow$ tensor integrals like

$$B^{\mu\nu}(p_1^2; m_0, m_1) = \int \mathrm{d}^4\ell \frac{\ell^\mu \ell^\nu}{[\ell^2 - m_0^2][(\ell + p_1)^2 - m_1^2]}$$

- Reduction to scalar integrals (master integrals) which are known analytically, a la Passarino-Veltman

Tensor integral reduction

- Option 1: Doing the reduction by hand
  - Not feasible for anything $\geq$ rank 3 triangles
- Option 2: Analytical GOLEM (Thomas Binoth, unpublished)
  - Helicity projection $\Rightarrow$ tensor reduction for each helicity combination
  - Maple/Mathematica/Form/... to half-automatedly simplify remaining terms
  - Feasible for all $2 \to 2$ and $2 \to 3$ processes
- Option 3: Numerical GOLEM (JHEP 0510:015,2005, arXiv:0810.0992)
  - Programmatic calculation of form factors for tensor integrals (Golem95 library)
  - Helicity projection not necessary, no worries about consistent polarisation states
  - More complex expressions, certainly slower than analytically simplified method

Status

- Some squared-summed MEs available for (internal) testing
- Some simple processes reduced by hand
- Interface to Golem95 library for more complicated processes, e.g. as a test case 4 photons
- Building up library of processes, on track for usage in CKKW@NLO
- Strategy not decided yet for $2 \to 3, 4, \ldots$

- Released version: Only fixed decay chains in hard process
- Request from experiments: Inclusive decays.

Building blocks

- Decay cascade handling unified with existing one from HADRONS
- Spin correlation implementation more elegant and also unified
- Building blocks for vertex calculators from COMIX $\Rightarrow$ automated matrix elements

Status

- Automatic creation of decay-tables from particles/vertices given by the selected model
- Automatic decay-width calculation
- Calculators for all kinds of vertices in the standard model available
- Next steps: SUSY calculators
- Will be made available in the 1.2.x series

LO Perturbative improvements (Version 1.2)

→ See Stefan's talk.

SHERPA ↔ LHCb interface

- Implemented in cooperation with Tobias Brambach & Julian Wishahi (LHCb, TU Dortmund)
- Tricky because event generation factorised into production of hadrons and their decay:
  - where to include finite width effects?
  - spin correlations are lost
- Common interface structures very much designed for EvtGen?

Released version

- Minor version update SHERPA 1.1.3
- Proper physics manual (arXiv:0811.4622 [hep-ph], soon in JHEP)

Initial Goal

Easy and automated way to validate a new version of Rivet

Features

- Event generator setups and framework, such that comparisons in the following use cases are possible:
  - Two versions of Rivet (Rivet validation)
  - Two versions of the same generator (validation)
  - Two different generators (physics)

Status

- Basics are ready
- Simple webpages with comparisons in the three use cases above can be produced
- Not very many generators/analyses setups provided yet, extending them
- Probably also useful as basis for Professor tuning runs, work in progress