Lund MCnet Studentship

Seyi Latunde-Dada

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Projects

1. CKKW and/or CKKW-L-merging with one-loop matrix elements
2. MC@NLO for Higgs boson hadronic decay

CKKW and/or CKKW-L merging with one-loop MEs

- This has already been done with success by Leif and Nils for the generation of hadronic events at LEP. (hep-ph/arXiv:0811.2912)
- The next step is to extend this treatment to initial state showers in order to generate LHC events.
- The generic CKKW/CKKW-L method involves separating the domains of applicability of *tree-level* MEs and parton showers at a given value of some jet resoluton variable y_{MS}. Above y_{MS}, the ME is used and below y_{MS}, the parton showers are implemented.

CKKW and/or CKKW-L merging with one-loop MEs

- The matrix elements are modified by Sudakov form factors and coupling constants in the form of weights to ensure the exclusivity of the events and to avoid double counting, the parton showers are subjected to a veto so that no branchings with $y > y_{\mathrm{MS}}$ occur in the shower.
- NB: One difference between CKKW and CKKW-L is in the way the veto is performed. CKKW uses the veto described above starting from the hard scale whilst CKKW-L starts from the scale of the last ME emission and vetoes the first emission only. Another difference between the two approaches is the use of the actual shower to calculate the Sudakov weights in CKKW-L rather than computing them analytically as is done in CKKW.

CKKW and/or CKKW-L merging with one-loop MEs

- The aim of the project is to develop an analytical framework for the replacement of the *tree-level* MEs in the generic process with one-loop MEs which include virtual corrections (regulated with the addition of unresolvable real emissions) in initial state showers.
- To avoid double counting, this would involve expanding the parton shower to one-loop order and subtracting off the terms correspondng to the one-loop ME.
- There will also be terms generated from the difference in coupling constant scales of the one-loop ME (renormalization scale) and the scale used in the parton shower (typically the p_{T} of the emission).
- One other consideration relating to initial-state showers are the pdf ratios accompanying the Sudakov form factors.

CKKW and/or CKKW-L merging with one-loop MEs

- The end result will be the generation of two different samples of weighted events at ME level: one set with tree-level MEs and the other with one-loop MEs.
- The weights for tree-level events include products of Sudakov form factors and coupling constant ratios (as in the generic process and as do the one-loop ME events) from which are subtracted the double counted one-loop terms mentioned above.
- The samples are then showered according to the veto procedure specific to the method.

MC@NLO Higgs boson hadronic decay

- This will follow the same lines as was done for Z boson production at LEP.
- Subtle differences will include variable invariant boson masses and different couplings but should be straightforward to implement.
- The POWHEG method could also be implemented to make it generator-independent.