CKKW-L merging of $e^+e^- \to$ jets and PhD plans

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Introduction

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Diploma Thesis: -10/08
NLO corrections to triple W production + leptonic decays

PhD project: 02/09+
CKKW-L merging at NLO for W+jets

Plans

We want to provide a (static) interface between existing fixed order calculations and the parton shower in a standardised way, since

- Fixed order calculations can be tricky, so we'd like to leave these to the experts - we don't want to fool around.
- Parton showers can be tricky, so we'd like to make showering as easy as possible for the fixed order community.

Plan for my PhD:

- A `Hello World` program: $e^+e^- \rightarrow$ jets merging.
- Next Step: Move on to $pp \rightarrow W+$jets merging at LO.
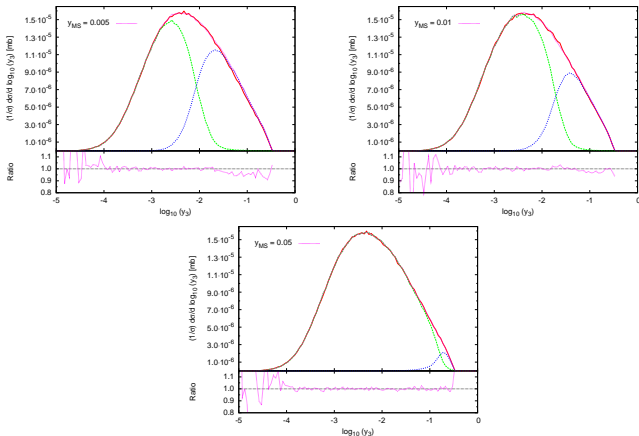- Then do $pp \rightarrow W+$jets merging at NLO.

$e^+e^- \rightarrow$ jets merging

Steps for N-jet-merging:

- Calculate kinematics for final states $e^+e^- \rightarrow 2, 3, \ldots N$ jets with exact matrix elements and store events in a LHE file
- Process the events in Pythia:
  1. Find all histories that could have led Pythia to such a final state by reclustering the final jets in all possible ways
  2. Choose one history by the product of splitting functions, do a trial shower and veto when an emission has occured between any of the reconstructed splitting scales ($=$ Sudakov reweighting)
  3. Reweight with the α_s value the shower would have used
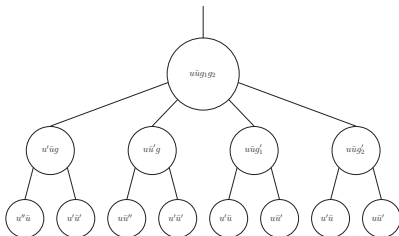
$e^+e^- \to$ jets merging

Steps for N-jet-merging:

- Calculate kinematics for final states $e^+e^- \to$ 2, 3, ... N jets with exact matrix elements and store events in a LHE file
- Process the events in Pythia
- Do this for all multiplicities.
- Add the output to get distributions.

$e^+e^- \rightarrow$ jets merging: First results

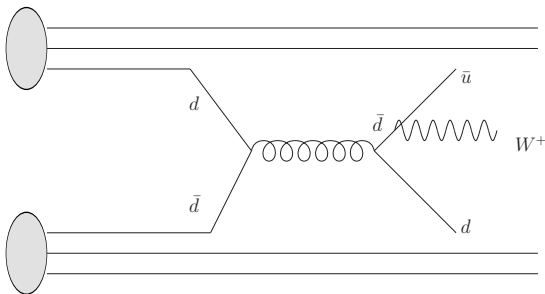Three jet distributions can be checked against Pythia, since the first emission is correct there:

Further testing will be done in the next weeks (e.g four jet observables like the Bengtsson-Zerwas angle etc.)

New difficulties compared to $e^+e^- \rightarrow$ jets:

- "ISR is always more complicated."
- For some events, no ordered (shower-like) histories may exist.

Outlook: $pp \rightarrow W$+jets merging at NLO

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- "ISR is always more complicated."
- For some events, no ordered (shower-like) histories may exist.

Difficulties at NLO:

- Which regularisation to use?
- Subtract NLO pieces from LO+PS piece.
- Initial state splittings are regarded differently in a PS and in a NLO calculation.