NLO Matching and Dipole-type Showers

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Status of ongoing work.

Dipole-type showers.

Automating NLO matching.

Related projects.

Conclusions.

Status of ongoing work

Calculational frameworks for showers and matching

- $\rightarrow$ NLO understood
- $\rightarrow$ Different multiplicities?
- $\rightarrow$ Showers at NLO and matching at NNLO?

Local recoils and coherence issues in CS-type showers

- $\rightarrow$ New recoil strategies for initial state radiation
- $\rightarrow$ Anomalous dimensions and exponentiation properties

Status of ongoing work

Modified CS-type shower as add-on to Herwig++

- $\rightarrow$ Final state radiation working
- $\rightarrow$ Checking ISR

Automated NLO matching

- $\rightarrow$ General NLO interface, POWHEG set up automatically
- $\rightarrow$ e^+e^- working
- $\rightarrow$ Testing Drell-Yan and DIS　　　　　　[together with Luca]
- $\rightarrow$ Go on with VBF and related　　　　[together with VBFNLO collab & Luca]

Dipole-type showers.

Hardness-ordered showers with local recoils appealing for matching purposes.

Still need confidence in shower properties:

- $\rightarrow$ Anomalous dimensions?
- $\rightarrow$ $p_\perp$ from ISR?
- $\rightarrow$ Exponentiation properties?

Rethink dipole-type showers a la Catani-Seymour.

Dipole-type showers.

Hardness-ordered showers with local recoils appealing for matching purposes.
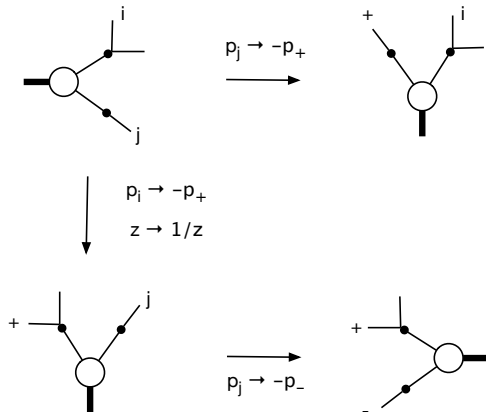
Still need confidence in shower properties:

- $\rightarrow$ Anomalous dimensions? $\rightarrow$ O.k. for final state.
- $\rightarrow$ $p_\perp$ from ISR? $\rightarrow$ Solved.
- $\rightarrow$ Exponentiation properties? $\rightarrow$ In progress.

Rethink dipole-type showers a la Catani-Seymour.

Initial state radiation.

Treat all configurations on equal footing ($\sim$ crossing).

Exact phasespace factorization still possible.

Form factor analysis.

Find the correct anomalous dimensions with arbitrary hard scale Q^2 fixed to relevant dipole scale s_{ik}.

$$\Gamma_q(p_\perp^2, \cdot) = C_F \left(\ln \frac{s_{ik}}{p_\perp^2} - \frac{3}{2} \right)$$

$$\Gamma_g(p_\perp^2, \cdot) = C_A \left(\ln \frac{s_{ik}}{p_\perp^2} - \frac{11}{6} \right)$$

Consequence of the screening of soft singularities at fixed $p_\perp$.

Form factor analysis.

Does not fix the 'right' ordering.

$p_\perp$ ordering is reasonable, but form factors e.g. suggest allowing for kinematically possible unordered emissions.

Final truth from studying exponentiation properties (in progress).

Automating NLO matching.

POWHEG-type matching $+$ dipole subtraction nicely fits into dipole-type shower.

Adaptive sampling of Sudakov-type distributions with arbitrary splitting kernels in place: allows for automatization.

Clean interface to NLO building blocks. Everything else worked out automatically.

MC@NLO variant and plain NLO also possible.
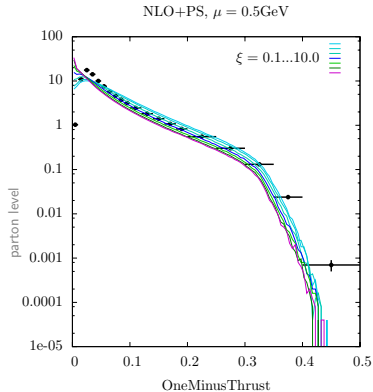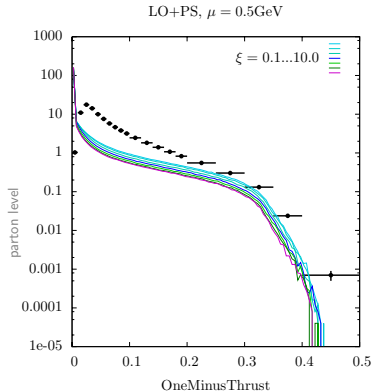
Automating NLO matching.

Require from NLO just the NLO ingredients:

- $\rightarrow$ Born phasespace generator.
- $\rightarrow$ Born, subtracted virtual and collinear remainder differential cross sections.
- $\rightarrow$ Real emission matrix element and each subtraction term individually.

Everything downstream is done automatically.

$e^+e^- \to$ jets at LO and NLO.

Preliminary. Hadron-level underway.

LO+PS, $\mu = 0.5$GeV

NLO+PS, $\mu = 0.5$GeV

Related projects.

General interface for NLO codes suggested at Les Houches.

[SP, Peter Skands,...]

Extensions of LHE files towards including matching/merging information.   [Leif]

$\rightarrow$ Planning to extend ThePEG to include respective functionality.

Thanks.