Generating multi-gluon events with the color-flow decomposition and optimized phase space integration



In collaboration with J. Alwal, K. Hagiwara (KEK), F. Maltoni (UCL) and T. Stelzer (UIU)

Introduction

- Accurate simulation of multi-jet events based on Matrix-Element calculations would become more important at the upgraded LHC.
 - Production & Decay of more massive particles
 - Harder & more ISRs
 - Spin-correlations of pair-produced particles
 - Sub structure of broad jets



Flexible multi-jet event generator is desired which can deal with SM and many possibilities of New Physics in the same footing.

Problems in multi-jet generation



2. Heavy Color Summation F. Maltoni et.al., PRD67 (2003) Color-Flow decomposition (1/Nc expansion)

$$\sum_{\text{color}} |\mathcal{M}|^2 = \sum_i |A_i|^2 + \frac{1}{N_c^2} \sum_{i,j} A_{ij}^1 + \frac{1}{N_c^4} \sum_{i,j} A_{ij}^2 + \cdots$$

3. Huge # of integration channels Channel Optimization

2. Heavy Color Summation



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$$\mathcal{M} = \sum_{i=1}^{N_{cf}} C_i A_i$$
Polynomial of Nc:
$$\sum_{color} |\mathcal{M}|^2 = \sum_{i,j}^{N_{cf}} \sum_{color} C_i^* C_j A_i^* A_j$$
1/Nc expansion
$$= N_c^m \sum_i \left\{ |A_i|^2 + \frac{1}{N_c^2} A_i^* (A_{j1,1} + A_{j1,2} + \cdots) \right.$$

$$(m = n_g + n_q/2) + \frac{1}{N_c^4} A_i^* (A_{j2,1} + A_{j2,2} + \cdots) + \cdots$$





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Results

Leading Color gluon scattering process as the first step

Cross section



Distributions: gg -> 4g

Good agreement with MG LC results



Distributions: gg -> 5g

Passes self-consistency checks





Time measurement (preliminary)

Our reduced channeling seems not to sacrifice the computational time significantly. (need more study on gg>6g?)



Summary & Outlook

• It is shown that gg > 6g events can be generated at Leading Color Order, using recursive amps and peripheral channeling.

• Inclusion of NLC and quark subprocesses are next step.



Backup Slides

of vertex evaluations



