

WG1+WG2: Progress Report

ME Calculation Validation
&
ME-MC Interfaces

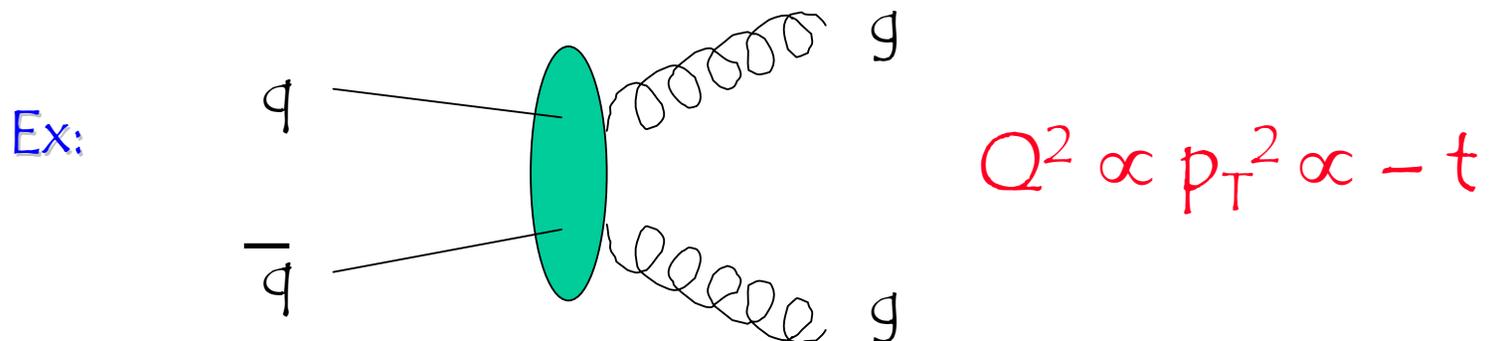
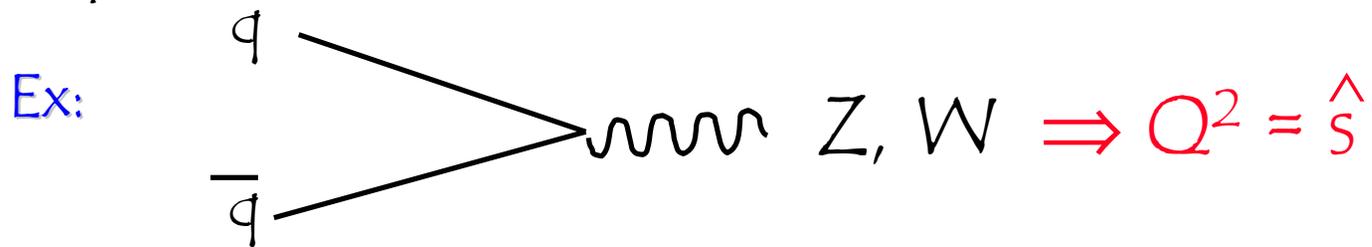
Stephen Mrenna

Concentration on interfacing ME predictions to parton showers

- LHA establishes a “universal” framework for passing ME events to PS generators
 - Implemented in:
 - ACERMC
 - AlpGen
 - CompHEP
 - Grappa
 - Herwig
 - Madgraph
 - Pythia
- ◇ Accord does NOT specify how to pick the scales in the PS
 - ◇ Possible that PS generates emissions that are harder than the “hard” process
 - ◇ Also possible to underestimate additional radiation below hard scale

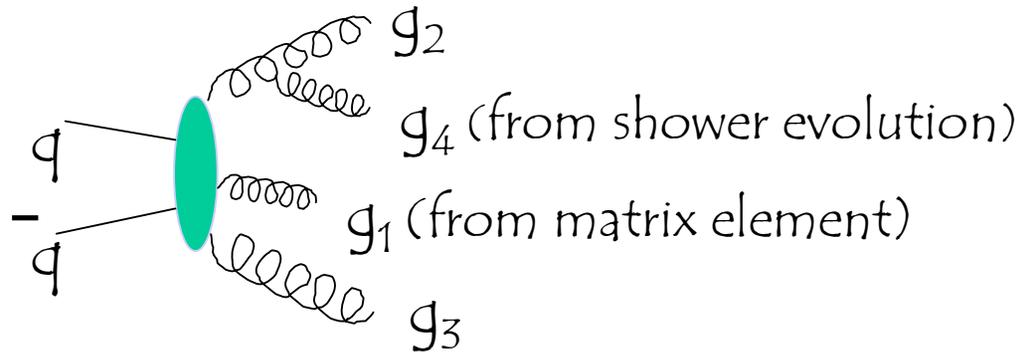
Q^2 choice for shower evolution

The choice is almost unambiguous for final states with 1 or 2 partons:



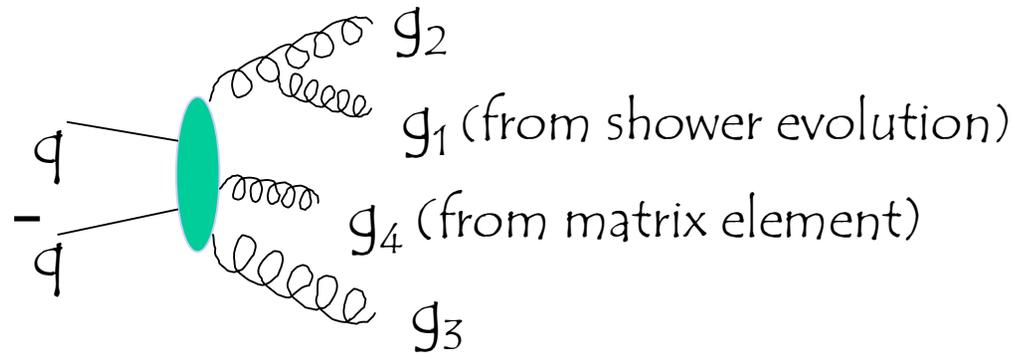
\Rightarrow the factorization theorem is easily implemented, due to the existence of a single scale

The choice is more difficult in more complex cases



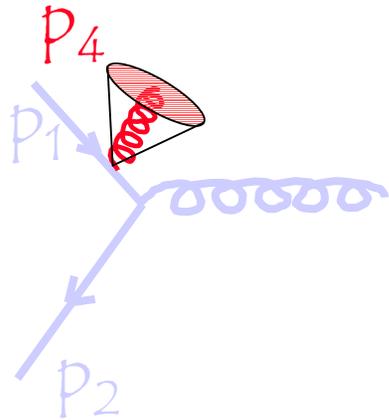
with $p_{T1} \ll p_{T4} \ll p_{T2}, p_{T3}$

versus

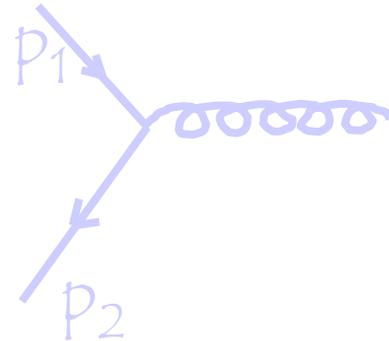


◊ For Winter Conferences, CDF/DO are relying on QCD predictions of W +Jets backgrounds to top production

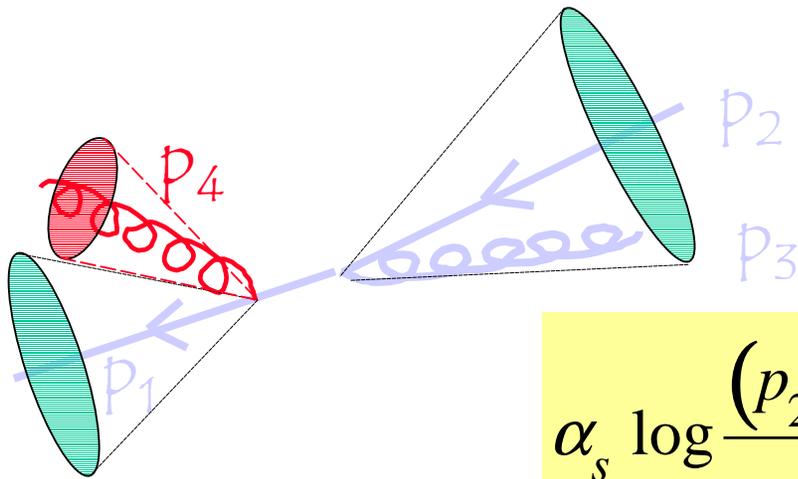
Leading vs subleading double counting
 Example: corrections to 3-parton final states



is of $O(\alpha_s)$
 relative to the
 LO process

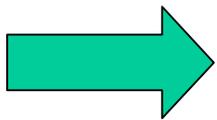


unless:



which gives a contribution to
 $\sigma_{3\text{-jet}}$ of order

$$\alpha_s \log \frac{(p_2 + p_3)^2}{E_{T \text{ jet}}^2} \approx \alpha_s \left(\log \frac{p_T^{\max}}{p_T^{\min}} + \log \frac{1}{\Delta R} \right)$$



Double counting is sub-leading provided ΔR and $\frac{p_T^{\max}}{p_T^{\min}}$ are not too large

$$\frac{p_T^{\max}}{p_T^{\min}}$$

MLMs prescription for estimating PS uncertainties in W+Jet events

- Generate W+N parton events with loose cuts
- Feed events to PS
- Match each hard parton to a unique reconstructed jet (dR matching)
 - N partons \rightarrow N Jets
- Throw events away with fewer matchings
- Also, throw away events with additional hard jet solely from PS
 - **Do as little harm as possible**

The prescription $N_{\text{match}}=3$ gives a much smaller uncertainty and, even more important, leads to a saturation of the rate at small ΔR_{part} :

ΔR_{part}	0.7	0.5	0.3	0.1	0.7	0.7	0.4
$p_{T \text{ min}}$	20	20	20	20	15	10	15
$\sigma(\text{partons})$	0.58	0.79	1.17	2.10	1.34	3.78	2.21
$\sigma(\text{all } N_{\text{match}})$	0.35	0.40	0.46	0.58	0.42	0.48	0.51
$\sigma(N_{\text{match}}=3)$	0.29	0.31	0.33	0.36	0.31	0.32	0.36

Presentations

- Comparisons of ME predictions (G. G.)
 - General agreement in TOTAL RATES for standard tools
 - Parton level kinematics in good agreement, but less rigorous (eyeball)
 - Need tests of unweighting (color combinations....)
- AMEGIC++ and APACIC++ (F. K.)
 - Another ME generator written in C++
 - Will interface smoothly to HERWIG++
 - Parton shower generator (Pythia-like) well-suited for adding showers to AMEGIC++ events
 - Promises update on April 1!!!

(cont)

- **W+3Jet Events and MLM Prescription (A.M.)**
 - Stable results "matched-exclusive" jet events
 - Must understand factor of 2-3 loss of events relative to parton level that would pass same cuts
- **Heavy Flavor Fraction in W+nJet Events (J.H.)**
 - Prescription of "matched-exclusive" jet events yields a HFF that is stable and agrees with Run I measurement
 - Maybe it doesn't matter too much what you do as long as you look at ratios (?)

Lively Discussions

- MLM method not a prescription in general
 - Even within its scope, one could do better
- Catani/Krauss/etc Veto-ed Showers
 - Clustering ME events and interpreting as a parton shower with appropriate Sudakov reweighting
 - Generate regular shower (cleverly) below clustering scale
- Kludging Vetoed-Showers with present generators
 - HERWIG (ala P.R.) and PYTHIA (ala S.M.) are being modified to carry out a vetoed shower on ME events
 - Beta versions in < 1 month (?)
 - HERWIG already vetos showering scales that are larger than the Factorization Scale

Website/writeup

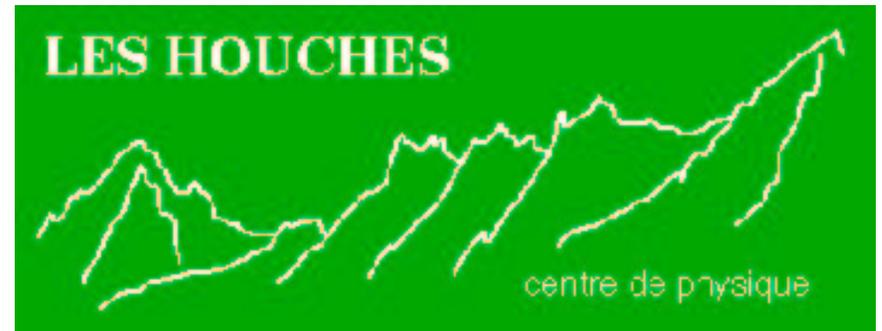
- The talks given in Working Groups 1+2 will be collected at www.pa.msu.edu/~huston/durham/
- A short writeup will summarize the prescription adopted by the WG's for dealing with the ME/MC interfacing once a proof of principle is available.

Followups

- At the Tevatron, we have had a series of one-day ME/MC workshops to deal with these types of issues
 - see <http://www-cpd.fnal.gov/MCTuning/> for copies of the talks
- The next workshop in the series will be sometime in April at Fermilab
 - details will be sent to this workshop mailing list
 - it will also be carried by live streaming
 - this would be a good place to follow up on how well the interfacing works

Les Houches 2003

- May 26 – June 5
- The wine is not as good as here but the view is better



Monte Carlo Workshop at CERN 2003

- A few words from the sponsor ...

Next Year 2004

- There will be a Santa Barbara workshop on collider physics from January thru March concentrating on the data from the Tevatron, prospects for the LHC and the tools needed to exploit them both
 - Organizers: Zvi Bern, Joey Huston, Zoltan Kunzst, Kirill Melnikov
 - Contact Joey if interested