

# Patron Shower and Resummation

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# Purpose of the meeting

- Agree on a general formalism to describe and represent the parton shower as an integral equation. Find an efficient formalism to represent every part of the shower evolution
- Deriving the summation of some important physical observables in a given shower model from the shower evolution equation and compare to known analytical results.
  - DGLAP evolution (energy distribution), Drell-Yan  $p_T$  distribution,...
- We should also investigate here if there is a general strategy to get the summation of large logs for any quantities from the shower equation or it is a case by case procedure.
- We would like to study and compare as many shower models and implementations as possible, such as angular ordered shower (Herwig, Sherpa), color dipole shower model (Ariadne, Pythia, CS-dipole shower), CCFM based (Cascade).
- Numerical comparison focusing on large logarithms and strictly at parton level (no hadronization, no tuning involved).



# Parton Shower Development

- Recent developments on parton shower algorithm
- Difference between the strategies, angular ordered shower, dipole shower,...
- There is no big difference between virtuality ordered and  $p_T$  ordered shower but the angular ordered showers are organized along a different strategy. Now, the questions:
  - Are the angular ordered and hardness ordered showers equivalent?
  - How different are they? Where is the difference?
  - Is it possible to derive angular ordered shower equation from the hardness ordered one?
- Is the parton shower algorithm well defined? How flexible are they? What are the main guide lines?
- What can we learn from the analytic resummation techniques?
- Does it make sense to talk about “**conventional shower scheme**”?



# DGLAP vs. Dipole Shower

Recent paper of Dokshitzer and Marchesini raised troubling issues about whether a dipole based shower could give the DGLAP equation for the quark energy distribution.

- Do we understand the paper of Dokshitzer and Marchesini?
- An overview on the recent theoretical progress on this issue.
- Recent numerical studies.
- What about the initial state radiations? Is the initial state dipole based parton shower safe?



# Drell-Yan $p_T$ distribution

- ✦ We would like have an overview what has been done and what is the current accuracy, what kind of analytic techniques are available.
- ✦ From the point of the parton shower we would like to investigate whether the parton shower algorithms are able to sum up the large logarithms at least at NLL level.
- ✦ What is the difference between shower models and implementations.
- ✦ How and to what extent one could transfer the information between the analytical resummation and showers, looking for places where improvement is possible.



# Matching Procedures

The matching of the parton shower and exact matrix element is one of the hottest topic of the Monte Carlo event generator developments.

- An overview on the recent theoretical progress.
- Quality and precision of the matching algorithm.
- How predictive are they?
- Is there a strategy to validate the matching procedure?
- Are the available matching procedures safe at LL and NLL level?



# Proceedings

We would like a proceedings as a single publication on:

- ✦ Theoretical “principles”: ordering, PDF4MC, validation strategy,...
- ✦ A list of observable what one can use for validating of patron showers
- ✦ Proposing a common mathematical formalism
- ✦ Some constraints for matching procedures
- ✦ .....