The Lund MCnet team

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The People

- ▶ Active staff
    - ▶ Leif Lönnblad
    - ▶ Malin Sjödahl
    - ▶ Torbjörn Sjöstrand
- ▶ MCnet ESRs
    - ▶ Christian Bierlich
    - ▶ Christine Rasmussen
    - ▶ Ilkka Helenius (postdoc arriving after summer)
    - ▶ Spyridon Argyropoulos (short-term coming soon)
- ▶ Other students/postdocs
    - ▶ Jesper Christansen (currently ESR at CERN)
    - ▶ Johan Thorén (starts after summer)
    - ▶ Yi-Jian Du (erasmus postdoc)

- Other staff
    - Gösta Gustafson (retired but active)
    - Johan Rathsman (outreach issues)
- The DESY connection
    - Hannes Jung
    - Simon Plätzer
    - Stafan Prestel

The Projects

- PYTHIA8
- ThePEG/Ariadne
- Outreach

The Planetarium

The Department of Astronomy and Theoretical Physics in Lund has a Planetarium with a brand new digital projector.

The software is designed to track and display stars and planets in time and space but can, of course, also be used to track other stuff as well.

It should be possible to interface our event generators to the planetarium software to be able to go in and manuver around inside particle collisions.

It could be an excellent public outreach facility, but it could also be an excellent research tool.

We have one or two short-term ESR positions allocated for this. (Not necessarily only for HEP PhD students).

DIPSY

THEPEG/ARIADNE

DIPSY is a part of the ARIADNE program — the original dipole-based shower program.

DIPSY goes nuclear! (see talk by Christian Bierlich)

ARIADNE is implemented in THEPEG, the same platform on which HERWIG++ is built.

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*L.L., Christian Bierlich, Gösta Gustafson, Andras Ster.

N_c: **From three to infinity and back**

- ► ColorFull, a publicly available C++ library for exact color structure (writeup in progress)
- ► Decomposing color structure in multiplet bases (see talk by Johan Thorén).
- ► MHV recursion relations in multiplet bases
- ► Color structure of (soft) gluon exchange in multiplet bases

†Malin Sjödahl, Simon Plätzer, Johan Thorén, Yi-Jian Du, Yi-Jian Du.

PYTHIA

- Gradual improvement of PYTHIA 8 in many different ways.
  New releases 2 – 4 times a year.
  Latest release 8.185 on 15 March.
- Write new (brief) CPC article for PYTHIA 8.2 release
  sometime during the year
- Colour reconnection & MPI:
  currently centered at CERN (Peter & Jesper)
- Colour reconnection effects on the top mass (Spyridon):
  use existing and new CR models
  + write some ad hoc worst-case models
- Heavy quark (b/c) production at the LHC (Fabricio):
  new options for $g \to Q\overline{Q}$ in FSR (ISR set by PDFs)
- Arbitrary hard processes in diffractive events (Christine)

‡Torbjörn Sjöstrand, Jesper Roy Christiansen, Christine Rasmussen, Spyridon Argyropoulos, Fabricio Jimenez, Stefan Prestel.

Recent results – Gluon Branching Options

New scenarios for gluon branching to quark pairs in FSR, exemplified by $g \rightarrow b\bar{b}$ rates at LEP1, in %:

| no.	$\alpha_s(p_\perp^2)$	$\alpha_s(m^2)$	comment
1	0.41	0.32	current default (with $\alpha_s(p_\perp^2)$)
2	0.53	0.47	add mass term in splitting function
3	1.12	0.92	pure DGLAP, no dipole mass suppression
4	0.40	0.32	ME-based ($H \rightarrow gg \rightarrow Q\bar{Q}g$)

Compare with published LEP1 $g \rightarrow b\bar{b}$ rates, in %:

$0.21 \pm 0.11 \pm 0.09$	DELPHI 97
$0.277 \pm 0.042 \pm 0.057$	ALEPH 98
$0.307 \pm 0.071 \pm 0.066$	SLD 99
$0.33 \pm 0.10 \pm 0.08$	DELPHI 99
$0.307 \pm 0.053 \pm 0.097$	OPAL 00

Recent results – Weak Showers

"Weak Gauge Boson Radiation in Parton Showers"

Christiansen &Sjöstrand arXiv:1401.5238 [hep-ph], to appear in JHEP
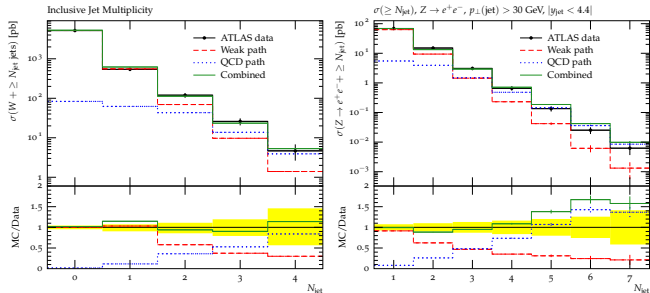
W/Z emission off quarks resolves shortcoming of QCD showers! (Good for jet rates and $p_\perp$ spectra, less so for angular correlations.)

Also applications e.g. for *W/Z* production inside high-$p_\perp$ jets.

MEPS matching at NLO: UNLOPS

Adding NLO-generated samples for several jet multitplicities and combining with parton showers (and MPI and hadronization).

Unitarity: Adding a NLO 2-jet sample must not destroy NLO 1-jet correctness, irrespectively of merging scale.

Implemented in PYTHIA8.

The new frontier: Matching at NNLO.

[§]L.L., Stefan Prestel