



The PYTHIA Event Generator

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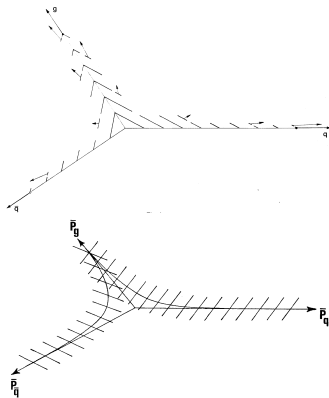
It is a great honour to receive this award!

With my deepest gratitude to
Bo Andersson[†] and **Gösta Gustafson**, my thesis advisors,
and **Hans-Uno Bengtsson[†]**, my first PYTHIA collaborator.

Also many thanks to all collaborators and colleagues
over the years, who have contributed so much.

1980: The string effect

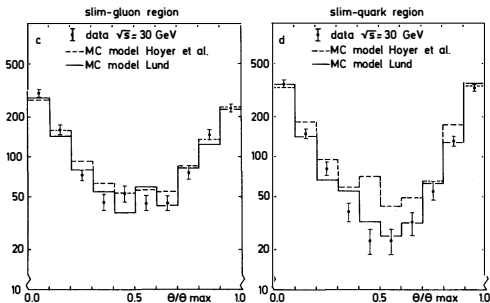
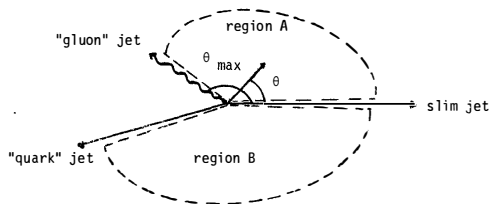
BA,GG,TS, Dec. 1979



first dynamical use of
colour topology?

1986, G. Gustafson:
dipole parton showers!

⇒ JADE, Moriond, March 1980



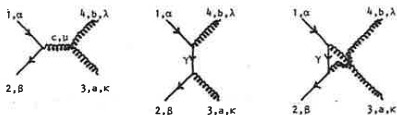
1982: The beginning of PYTHIA

LEPTO: colour flow in ep DIS
(G. Ingelman, TS)

PYTHIA: colour flow in pp/p \bar{p}
(H.-U. Bengtsson)

Process: $q_i \bar{q}_i \rightarrow e\bar{e}$

Diagrams:



Colour flows:



String configurations:



$N_C \rightarrow \infty$ classifies colour topologies



(HUB, BA, GG)

Many other active:
X. Artru, G. Mennessier
R.D. Field, R.P. Feynman
Hoyer et al., Ali et al.
F. Paige (ISAJET)
R. Odorico
T. Gottschalk

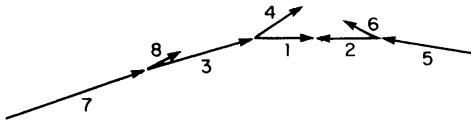
...

1984: Backwards evolution of ISR

Final-state radiation intensely studied, notably by Marchesini–Webber

Initial-state radiation big hurdle

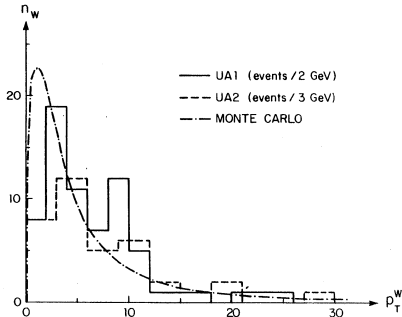
- forward evolution in time and Q^2 may not “hit right”
- backwards evolution reverses order



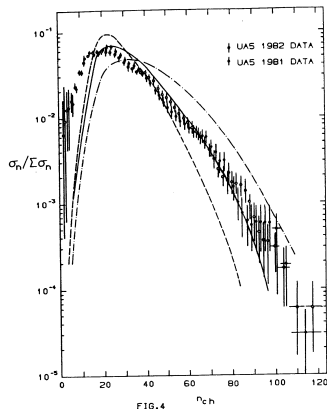
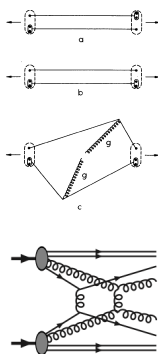
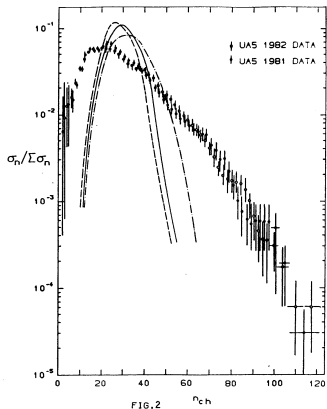
$$dP_b = \frac{df_b(x,t)}{f_b(x,t)} = |dt| \frac{\alpha_s(t)}{2\pi} \int_a \frac{dx'}{x'} \frac{f_a(x',t)}{f_b(x,t)} P_{a \rightarrow bc}(\frac{x}{x'}) \quad (2)$$

This probability exponentiates, so that one may define a form factor

$$S_b(x, t_1; t) = \exp \left\{ - \int_t^{t_1} dt' \frac{\alpha_s(t')}{2\pi} \int_a \frac{dx'}{x'} \frac{f_a(x', t')}{f_b(x, t')} P_{a \rightarrow bc}(\frac{x}{x'}) \right\} \quad (3)$$



1985: Multiparton interactions



without MPI: low- p_{\perp}
 + QCD $p_{\perp \min} = 1.6$ GeV
 + ISR+FSR

with MPI
 (but not diffraction),
 $p_{\perp \min} = 2.0, 1.6, 1.2$ GeV

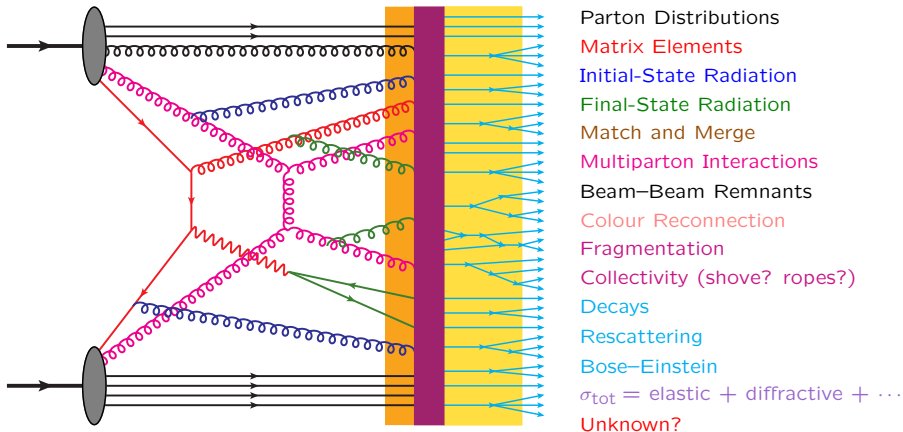
Increasing scope and complexity

1990: Aachen LHC workshop breakthrough for pp physics

2007: Transition Fortran \Rightarrow C++ gives PYTHIA 8

2021: New big physics overview almost finished;

\sim 300,000 code lines, plus manual and data files



Into the future



New organization as of May this year:

New home page: <https://pythia.org>

New mail address: authors@pythia.org

- Spokesperson: Peter Skands
- Code master: Philip Ilten
- Web master: Christian Bierlich

Current authors:

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