Alessandro BALLESTRERO
Torino

Interfacing 4 parton LO massive ME with `PYTHIA` ...

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Brief description of FOURJPHACT

Program for

- interfacing LO Massive ME with PYTHIA (6.137) and its routine PY4JET
- studying differences between ME and PS approach to multijet events
- studying differences between parton level and fully hadronized distributions and event shape variables
- compare different approaches to the use of ME for realistic simulations (APACIC++ . . .)

Hopefully it will be possible to interface FOURJPHACT also to other PS + hadronization schemes (HERWIG . . .)

FEATURES

- **Complete LO ME calculation of all processes**
  $e^+e^- \to q\bar{q}q'\bar{q}'$ **and** $e^+e^- \to q\bar{q}gg$
  New `PHACT` **routine for** $ee \to 4q$,
  old `AB Maina Moretti` **for** $ee \to 2q2g$
- **Cross sections computations. Integration by Vegas**
- **ISR implemented (if requested) via SF method**
- **One may choose unweighted event generation.**
  Essential for interfacing PS + hadronization
- **Interface to** `PYTHIA` **: call to** `PY4JET`**.**
  For $4q$ **the lower** $q\bar{q}$ **invariant invariant mass is considered as "second emission".**
  Also for identical particles.

- **Fixed or running $\alpha_s(M)$ can be chosen.**

  - $\star$ **for $4q$ diagrams M is the invariant mass of the gluon propagator**

  - $\star$ **for $2q2g$ M is the invariant mass of the two gluons**

  No problems with gauge invariance

- **Normal cuts at parton level predefined:**
  one has only to specify the numerical value for max/min E, p$_t$, angles among partons, invariant masses

- **Jade or Durham ycut at parton level can be chosen**

- **Any other cut or ycut can be easily defined in include file**

  $2q2g$ cannot be computed without any cut.
  $4q$ is probably not reliable and inefficient without cuts.
  `FOURJPHACT` **can thus be also used to study the (in)dependence of complete final state generation from partonic cuts**

- **Partonic distributions can be easily defined in the include file (as many as one likes). Corresponding values for each bin will be given in output .dat file.**

  Possibility to compare partonic vs fully hadronized distributions

In the near future:

- **All processes generated in one shot**
- **Possibility to use** `PYTHIA` **ISR**
  (explicit photons produced)
- **New** $qqgg$ **routine with** `PHACT`
- **Colour contributions separation for each event** (`Herwig?`)

If studies will indicate the usefulness of this approach, one may consider to extend it to 5 and 6 jets and hadron hadron collisions

People willing to use `FOURJPHACT` **for studies and comparisons can find the first (test) version in**

http://www.to.infn.it/~ballestr/qcd/

and/or contact the author.

SUGGESTIONS AND REQUESTS ARE WELCOME