ATGEN interface to event generation and analysis: structuring and reusing common procedures.

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The ATGEN package interfaces several event generators, performs generic analysis and provides input for the detector simulation. A WWW tool was implemented to assist the tuning of each generator. The implications on the possibilities and requirements for a future design have been analyzed.

Key words: Simulation; Simulation tools; GUI's; world-wide collaboration; WWW applications.

1 Introduction

Event generators are an essential part of the simulation software used in the design of the ATLAS - LHC detector. While it is now hard to question the details of the structure of the simulated events, the situation will clearly be different when models and generators will be scrutinized in order to extract the physical meaning of LHC data.

The ATGEN package interfaces to generators of both the parton shower type (PYTHIA, ISAJET, HERWIG)[1] and matrix elements type (NJETS, VECBOS)[1], unifying the user behavior for the different generators while strictly respecting their physics contents. It allows data to be stored and feed into the GEANT detector simulation. Generic analysis routines that compute automatically the kinematic quantities for the selected particles and decays are included.

2 Selecting The Generator Options

A functional model for event generation is presented in Fig. 1. The typical process flow is associated with the central column while additional correlations are described on the left part. Available generators contain only one choice of the actions depicted on the right column for each process. An important user requirement for the future interface is to allow to combine different options for each process. The system should include some degree of expertise in order to warn the user and help him avoid physically inconsistent selection of options.

3 Reusing Analysis Methods

To avoid large, problem specific, user procedures, generic analysis routines are included in the package. The associated input control statements select particles in the event record and compute the required kinematic variables and reconstructed decays.

The event is scanned for particles meeting one of the sets of the conditions defined by having a particle ID (`IDPA`), decayed from (`IDMO`), status (`IDST`) and having kinematic variables obeying the conditions

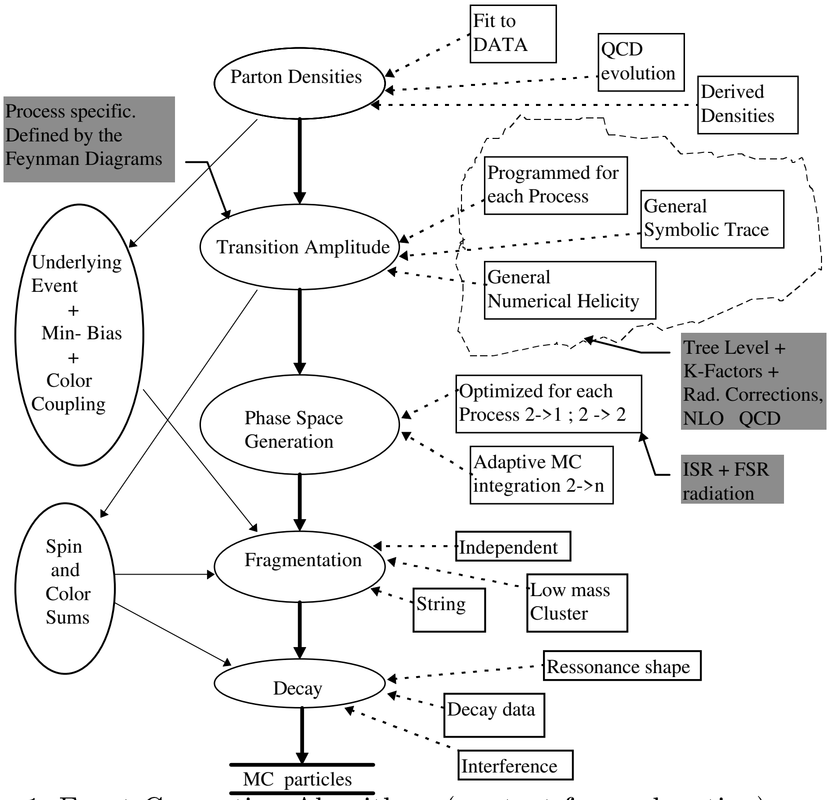

Fig. 1. Event Generation Algorithms (see text for explanation).

in IDKI. Once they have been found, the kinematic variables associated with individual particles or selected clusters are automatically computed.

Event selection at generation level is implemented by requiring that particles meeting specified conditions must be present. Although some very specific problems still have to be coded in the user routines, one finds that simple input statements can do large chunks of the analysis automatically, structuring the procedures in reusable form.

4 Reproducibility

The large time scale involved in LHC stresses the importance of being able to reproduce previously simulated data. A code managing mechanism for the different generators is being maintained. A strict requirement on reproducibility for the future system implies not only version control of all used algorithms but also an open user input selection database, a reusable set of analysis methods as well as random number control.

5 The WWW interface

The ATGEN input syntax has to cope with both a large number of options to tune each event generator and the specificity of driving the user analysis for different channels. Using WWW, a simple CGI tool was developed to assist in building the input statements while providing links to the generator documentation. It is also managing a database of user procedures, further simplifying the detailed discussion on relevant options and methods. The interface is implemented in PERL5 and is available at:
`<http://atlasinfo.cern.ch/atlas-bin/atgen.cgi>`.

This implementation has the advantage of being supported by a widely available client architecture while concentrating all software maintenance in one central repository. Also, when a user assembled input is stored on the server, it becomes immediately available for discussion to the whole community.

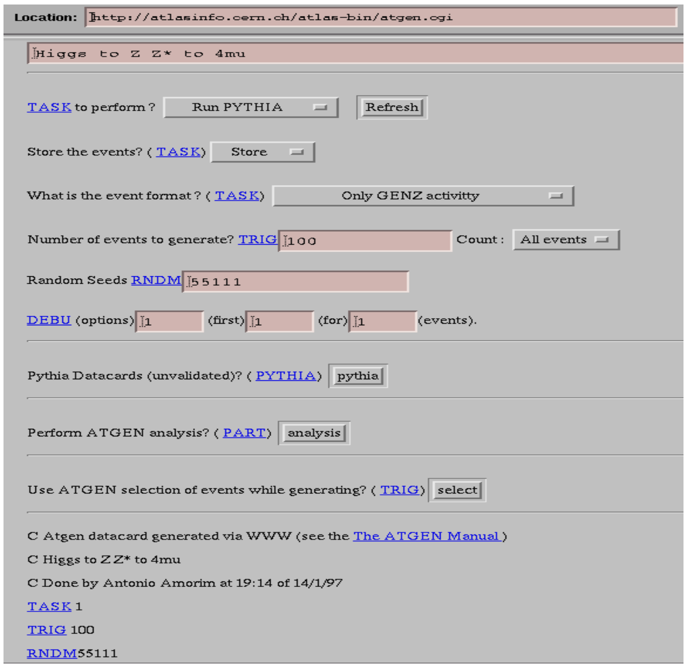

Fig. 2. Browser window with direct links to the documentation.

6 Outlook

The necessity to spread the analysis over an unprecedented large community of users, makes it necessary to have the tools to avoid lengthy user specific code whose options may not be structured and documented. The ATGEN package, together with its WWW interface, constitute a first attempt to evaluate the requirements of a future system were abstraction and re-usability together with directly documented tuning, with an optimum degree of expertise, should be envisaged.

The future development will fit in the redesign of the ATLAS software in the object oriented framework and will be open to incorporate the wide progress on event generators [2]. The goals include assembling a database of data, methods, tuning options and documentation. Reusable analysis methods have also to be implemented. To cope with data coming from time consuming simulations a cache system has to be developed together with a centralized bookkeeping of the performed simulations.

References

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