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Advanced online system for data analysis and Monte-Carlo simulations in High Energy Physics

In this paper we present an integrated system for online Monte Carlo simulations in High Energy Physics. Several Monte Carlo simulations codes will be implemented: GEANT, PYTHIA, FLUKA, HIJING. This system will be structured in several basic modules. First module will ensure the system's web interface, the access to the other modules and will allow the logging of many users at the same time. Another module will be made of several Monte Carlo simulation codes for studying phenomena in High Energy Physics, these phenomena being treated differently according to their specific simulation codes. This module will be a scalable one, that will allow the further addition of other codes. A third module will contain analysis programs in order to obtain scientific results from simulated data or from experimental data. The last module will have the necessary Application Program Interface (API) for the management of the connections and of data in databases: experimental data and simulated data for comparative studies. One of the this system's applications (as a consequence of its accessibility and functionality) will be the development and implementation of educational modules: laboratories, classes and seminars.

Summary

During the last years, the increasing in scientific experiments' complexity brought up the need for more precise theoretical predictions and experiments using Monte Carlo simulation codes. This fact opens new perspectives for creating new instruments to facilitate their use both in scientific research, to obtain descriptions as close of reality as possible of the natural phenomena, and in education, for making the students acquainted with advanced instruments for scientific research.

The purpose of this project is to create an advanced integrated system, easy to use, with applications in science and education, system that will offer quick access to experimental data and their analysis.

This system will be structured in several basic modules. First module will ensure the system's web interface, the access to the other modules and will allow the logging of many users at the same time.

Another module will be made of several Monte Carlo simulation codes for studying phenomena in physics, chemistry and so on, these phenomena being treated differently according to their specific simulation codes. This module will be a scalable one, that will allow the further addition of other codes.

A third module will contain analysis programs in order to obtain scientific results from simulated data or from experimental data.

The last module will have the necessary API for the management of the connections and of data in databases: experimental data and simulated data for comparative studies.

Due to the large hardware resources requirements that are specific to Monte Carlo simulation codes and to the fact that there will be many students running simultaneously the simulation codes and the data analysis, the system will be implemented in a distributed computing network (GRID).

One of the this system's applications (as a consequence of its accessibility and functionality) will be the development and implementation of some educational modules: laboratories, classes and seminars. The reasons for using this system in e-learning are:

doesn't need installing software locally by the user;

the user focuses on scientific phenomenology and not on developing the code for simulations/analysis

simultaneous use of the system by many users (Multi-user and Multi-tasking)

the possibility to obtain and to use scientific results with the help of advanced instruments frequently used in research (simulation and analysis codes)
fast obtained results due to the distributed computing network (GRID)

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