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The Offline Framework of the Pierre Auger Observatory

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The Pierre Auger Observatory is designed to unveil the nature and the origin of the highest energy cosmic rays. Two sites, one currently under construction in Argentina, and another pending in the Northern hemisphere, will observe extensive air showers using a hybrid detector comprising a ground array of 1600 water Cerenkov tanks overlooked by four atmospheric fluorescence detectors. Though the computing demands of the experiment are less severe than those of traditional high energy physics experiments in terms of data volume and detector complexity, the large geographically dispersed collaboration and the heterogeneous set of simulation and reconstruction requirements confronts the offline software with some special challenges.

We have designed and implemented a framework to allow collaborators to contribute algorithms and sequencing instructions to build up the variety of applications they require. The framework includes machinery to manage these user codes, to organize the abundance of user-contributed configuration files, to facilitate multi-format file handling, and to provide access to event and time-dependent detector information which can reside in various data sources. A number of utilities are also provided, including a novel geometry package which allows manipulation of abstract geometrical objects independent of coordinate system choice. The framework is implemented in C++, follows an object oriented paradigm, and takes advantage of some of the more widespread tools that the open source community offers, while keeping the user-side simple enough for C++ non-experts to learn in a reasonable time. The distribution system includes unit and acceptance testing in order to support rapid development of both the core framework and contributed user code. Great attention has been paid to the ease of installation.

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