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Concepts, Developments and Advanced Applications of the PAX Toolkit

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Physics analyses at modern collider experiments enter a new dimension of event complexity. At the LHC, for instance, physics events will consist of the final state products of the order of 20 simultaneous collisions. In addition, a number of today's physics questions is studied in channels with complex event topologies and configuration ambiguities occurring during event analysis.

The Physics Analysis eXpert toolkit (PAX) is a continuously maintained and advanced C++ class collection, specially designed to assist physicists in the analysis of complex scattering processes. PAX allows definition of an abstraction layer beyond detector reconstruction by providing a generalized, persistent HEP event container with three types of physics objects (particles, vertices and collisions), relation management and file I/O scheme. The PAX event container is capable of storing the complete information of multi-collision events (including decay trees with spatial vertex information, four-momenta as well as additional reconstruction data). An automated copy functionality for the event container allows the analyst to consistently duplicate event containers for hypothesis evolution, including its physics objects and relations. PAX physics objects can hold pointers to an arbitrary number of instances of arbitrary C++ classes, allowing the analyst to keep track of the data origin within the detector reconstruction software. Further advantages arising from the usage of the PAX toolkit are a unified data model and nomenclature, and therefore increased code lucidity and more efficient team work. The application of the generalized event container provides desirable side-effects, such as protection of the physics analysis code from changes in the underlying software packages and avoidance of code duplication by the possibility of applying the same analysis code to various levels of input data.

We summarize basic concepts and class structure of the PAX toolkit, and report about the developments made for the recent release version (2.00.10). Finally, we present advanced applications of the PAX toolkit, as in use at searches and physics analyses at Tevatron and LHC.

Summary

References:

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[2] Martin Erdmann et al., New Applications of PAX in Physics Analyses at Hadron Colliders, Proceedings of the 2004 Computing in High Energy and Nuclear Physics conference (CHEP04), Interlaken, Switzerland, September 2004.

[3] Steffen Kappler et al., The PAX Toolkit and its Applications at Tevatron and LHC, accepted by IEEE Trans. Nucl. Sci., 2005.

[4] Project webpage: http://www.cern.ch/pax

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