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The Belle II Experiment: ROOT 6 at the High-intensity Frontier

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The Belle II detector will be operated at the SuperKEKB electron-positron collider at the KEK Research Laboratory in Tsukuba, Japan. Currently, the detector components are being integrated and the data taking is expected to commence in the year 2018. The Belle II experiment has a diverse physics program, which is taking advantage of the production of B-mesons at the Y4S resonance, to study flavor physics and possible new physics processes at an unprecedented precision.

To gather sufficient data for precision analyses, huge amounts of collision events need to be stored and processed. Furthermore, large Monte Carlo data sets need to be produced and managed. With the current projections, a disk space of 140 PB of data and Monte Carlo will be occupied after 7 years of data taking.

The ROOT framework is involved at every stage of the data processing of the experiment. The ROOT I/O functionalities are used to serialize complex C++ objects, transfer data from the detector and to save it in files on mass storage systems. Furthermore, ROOT’s libraries are extensively used in the reconstruction code to provide a convenient way to implement, among others, linear algebra, function minimization and random number generator functionalities. The TMVA package is heavily used in the analysis stage of the Belle II experiment, which employs machine learning techniques to discriminate between background and signal events.

This talk will focus on the transition from the well-established ROOT version 5 to version 6 in the context of the Belle II experiment. While ROOT version 6 includes significant improvements, foremost the LLVM-based Cling C++ interpreter, the transition on a large, existing code base proved challenging. Some of the specific solutions to properly integrate ROOT version 6 chosen by the Belle II software group will be discussed in detail. The talk will conclude with remarks on areas of improvements concerning the ROOT integration into the Belle II framework and suggestions for further improvement of the ROOT framework itself.

Author: HAUTH, Thomas (KIT)

Presenter: HAUTH, Thomas (KIT)

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