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Methods to quantify the performance of the primary vertex reconstruction in the ATLAS experiment under high luminosity conditions

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Presented in this contribution are methods currently developed and used by the ATLAS collaboration to measure the performance of the primary vertex reconstruction algorithms. These methods quantify the amount of additional pile up interactions and help to identify the hard scattering process (the so called primary vertex) in the proton-proton collisions with high accuracy. The correct identification of the primary vertex and knowledge of the amount of pile up per bunch crossing is crucial for many physics analyses. With the increasing instantaneous luminosity at the LHC additional effects like splitting one vertex into many or reconstructing several pile up interactions as one become sizable effects. Statistical methods based on data and Monte Carlo simulation are applied to disentangle the different contributions. The mathematical methods, their software implementation and comparisons with independent
luminosity measurements are presented.

Summary

Because of the increasing amount of the pile up interactions, current and future LHC conditions represent a high challenge for data reconstruction and analysis. Presented in this contribution is the discussion of mathematical and computing methods to quantify the performance of primary vertex reconstruction in ATLAS. Methods to disentangle various pile up effects are presented, the influence of the these effects on data analysis is evaluated. The approaches to the vertex reconstruction in the high luminosity environment are shown.

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