

Flexible trigger menu implementation on the Global Trigger for the CMS Level-1 trigger upgrade

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In 2016 the Large Hadron Collider (LHC) will continue to explore the physics at the high-energy frontier. The integrated luminosity is expected to be about 25 fb^{-1} in 2016 with the estimated peak luminosity of around $1.1 \times 10^{34} \text{ cm}^{-2} \text{ s}^{-1}$ and the peak mean pile-up of about 30. The CMS experiment will upgrade its hardware-based Level-1 trigger system to keep its performance for new physics searches and precision measurements with the data collected in the higher luminosities.

The Global Trigger is the final step of the CMS Level-1 Trigger and implements a trigger menu, a set of selection requirements applied to the final list of objects from calorimeter and muon triggers, for reducing the 40 MHz collision rate to 100 kHz. The Global Trigger is being upgraded with the state-of-the-art FPGA processors on Advanced Mezzanine Cards with optical links running at 10 GHz in a MicroTCA crate. The upgraded system will benefit from increased processing resources, enabling more algorithms at a time than previously possible as well as allowing CMS to be more flexible in how it handles the available trigger bandwidth. Algorithms for a trigger menu, including topological requirements on multi-objects, can be realised on the Global Trigger using the newly developed trigger menu specification grammar. Analysis-like trigger algorithms can be represented in an intuitive manner then the algorithms are translated to corresponding VHDL code blocks to build a firmware. The grammar can be extended in future as the needs arise. The experience of implementing trigger menus on the upgraded Global Trigger system will be presented.

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Trigger

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