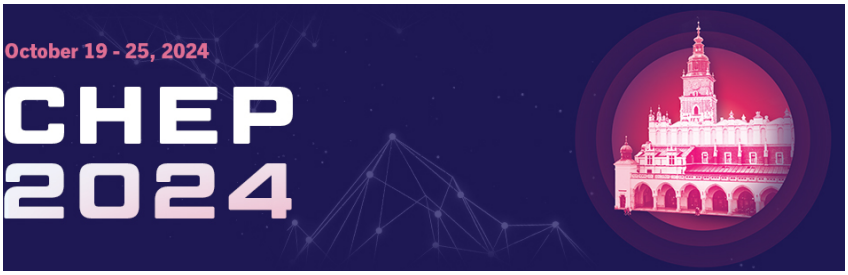

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Use of topological correlations in ML-based conditions for the CMS Level-1 Global Trigger upgrade for the HL-LHC

Thursday 24 October 2024 17:27 (18 minutes)

The High-Luminosity LHC upgrade will have a new trigger system that utilizes detailed information from the calorimeter, muon and track finder subsystems at the bunch crossing rate, which enables the final stage of the Level-1 Trigger, the Global Trigger (GT), to use high-precision trigger objects. In addition to cut-based algorithms, novel machine-learning-based algorithms will be employed in the trigger system to achieve higher selection efficiency and detect unexpected signals. The focus of this study is the comparison of different machine learning architecture models, including Boosted Decision Trees, Deep Neural Networks and Auto-Encoders. The trigger system will be implemented in FPGAs, benefiting from the performance of the employed AMD Ultrascale+ parts and an increased latency budget available in the new trigger system the utilization of topological correlations as inputs to these novel algorithms will be explored. Notable topological correlations employed are two-objects ΔR and invariant masses (e.g. di-jets, di-muons, di-electrons). The effective FPGA hardware implementation and its optimization will play a key role in this study.

Author: BORTOLATO, Gabriele (Universita e INFN, Padova (IT))

Co-authors: HUBER, Benjamin (Technische Universitaet Wien (AT)); RABADY, Dinyar (CERN); LEUTGEB, Elias (Technische Universitaet Wien (AT)); SAKULIN, Hannes (CERN); HEIKKILAE, Jaana (CERN)

Presenter: BORTOLATO, Gabriele (Universita e INFN, Padova (IT))

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