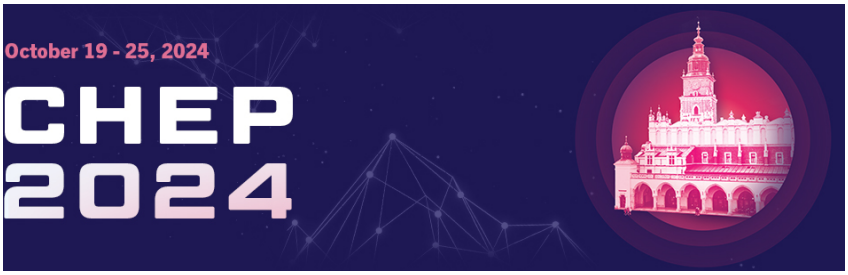

Contribution ID: **281** Type: **Talk**

Optimizing cut-based algorithms to specific physics acceptance regions

Tuesday 22 October 2024 16:15 (18 minutes)

Developments of the new Level-1 Trigger at CMS for the High-Luminosity Operation of the LHC are in full swing. The Global Trigger, the final stage of this new Level-1 Trigger pipeline, is foreseen to evaluate a menu of over 1000 cut-based algorithms, each of which targeting a specific physics signature or acceptance region. Automating the task of tailoring individual algorithms to specific physics regions would be a significant time saver while ensuring flexibility to adapt swiftly to evolving run conditions. This task essentially resembles a multi-objective optimization problem, where the goal is to strike a balance between the trigger rate and the trigger efficiency of the desired physics region.

We present the idea of leveraging achievement scalarization, a technique to turn the two objective functions into a scalar function with a minimum closest to a reference point chosen by a decision maker. An iterative gradient descent approach can then be employed to minimize this function, each iteration slightly modifying the cut parameters in the direction of descent. The decision maker in this context can be a single person designing parts of the menu or a collective group like CERN's data performance group agreeing on specific goals for upcoming data-taking sessions.

Preliminary results of using this procedure in targeting B meson decays have demonstrated promising outcomes. Ongoing efforts involve exploring alternative minimization techniques like evolutionary algorithms and extending the method to other physics signatures.

Primary author: HUBER, Benjamin (Technische Universitaet Wien (AT))

Co-authors: RABADY, Dinyar (CERN); LEUTGEB, Elias (Technische Universitaet Wien (AT)); BORTOLATO, Gabriele (Universita e INFN, Padova (IT)); SAKULIN, Hannes (CERN); HEIKKILAE, Jaana (CERN); CEPEDA, Maria (CIEMAT)

Presenter: HUBER, Benjamin (Technische Universitaet Wien (AT))

Session Classification: Parallel (Track 3)

Track Classification: Track 3 - Offline Computing