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## A Triplet Track Trigger Case Study for FCC-hh: Enhancing the Measurement of Di-Higgs Production and Higgs Self-Coupling

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The Triple Track Trigger (TTT) concept is proposed for the FCC-hh detector to exploit the full potential of the unprecedented energy ( $\sqrt{s} = 100$  TeV) and high luminosity ( $30 \times 10^{-34} \text{ cm}^{-2} \text{ s}^{-1}$ ) proton-proton ( $pp$ ) collisions at FCC-hh. The primary objective of the TTT is to trigger physics at the electroweak scale in real time by significantly suppressing signals from the low energetic  $pp$  collisions at a *pileup* rate of  $\sim \mathcal{O}(1000)$ , assuming 25 ns bunch crossing.

The TTT concept is based on a highly scalable state-of-the-art monolithic pixel sensor technology comprising three closely stacked and highly granular pixel barrel layers at large radii ( $\sim 1$  m). An extension of the TTT to the endcap region increases the geometrical acceptance to a pseudorapidity of 2.5. A simple and fast algorithm, which can be implemented in hardware processors at the first trigger level, enables online reconstruction of all TTT tracks at 40 MHz. Additionally, TTT enables the reconstruction of pileup-suppressed track-jets to trigger physics signals of interest by reconstructing the primary collision vertex with high efficiency.

This presentation focuses on a case study demonstrating the ability of the TTT to trigger the rare physics process of  $HH \rightarrow 4b$  [arXiv:2401.16046]. Based on a Geant4 simulation of the FCC-hh detector including the TTT, both the tracking and the trigger performances have been studied. A comparison of the TTT with a calorimeter trigger, illustrates TTT's superiority to select  $HH \rightarrow 4b$  events with an order of magnitude lower trigger threshold. Due to the lower trigger threshold, a substantial gain in sensitivity for measuring the Higgs self-coupling is expected. Last but not the least, a potential hardware implementation of the concept is outlined.

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