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Off-shell Higgs into 4 leptons & electron tracking in ATLAS

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The Higgs decay into two Z bosons, each Z decaying into two charged leptons (hence Higgs-to-4-lepton decay) is called the golden channel as it is one of the Higgs decay channels with the cleanest signal. The study of the off-shell Higgs offers new possibilities of analysis beyond the on-shell data. The off-shell region is defined as a centre-of-mass energy of more than 220 GeV.
We thus have the aim of analysing ATLAS'Run 2 data in this channel and in the off-shell region using the framework of EFTs (Effective Field Theory), and in particular the SMEFT (Standard Model EFT), which aims to better understand the deviations of the data relative to the SM. The big picture goal is to generate trustworthy Monte-Carlo samples for the relevant EFT operators in order to fit data to the SMEFT and measure the Wilson coefficients for those operators. In my work so far, I have focussed on the Monte-Carlo generation process in order to compare and validate several software versions.
As part of my ATLAS Qualification Task (QT), I am also working on the software aspect of ITk: for HL-LHC, ATLAS will replace its Inner Detector with an all-silicon Inner Tracker (ITk). Along the instrumental upgrade, ATLAS will also (re)introduce the ACTS software, designed for better efficiency at tracking charged particles. ACTS (Acts Common Tracking Software) is an experiment-independent software currently under development and its integration to ATLAS-ITk is ongoing.
Electron tracking is particularly challenging because of bremsstrahlung, as the particle loses energy as it progresses in the tracker. A new tracking algorithm is currently developed in the team in order to better address this issue. Before working to implement and integrate this algorithm in a release build of ACTS, the performances (correctness on the one hand and performance on the other hand) of this new tracking algorithm must be compared with the reference one. In order to do this, pull plots are a useful tool to gauge the physical correctness of the algorithm.

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