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Title:

Search for long-lived particles with the ATLAS detector at CERN Large Hadron Collider

Description:

Long-lived particles are hypothesized resonances with lifetimes longer than most of the already known particles. The Standard Model, the theoretical framework in particle physics, brilliantly describes numerous subatomic processes, yet fails to explain mysteries such as matter-antimatter asymmetry and dark matter. Long-lived particles would help address these mysteries. Discovering them would constitute a clear sign of physics beyond the Standard Model. The project is focused on a search for long-lived particles, labelled "a," that would be produced in pair by the decay of a Higgs boson and would each decay, in turn, to a pair of bottom and anti-bottom quarks: $H \rightarrow aa \rightarrow bb \bar{b}\bar{b}$.

Student's role:

The student will be provided with prepared samples containing kinematic properties of simulated and possibly real proton-proton collision data. The decay of interest ($H \rightarrow aa \rightarrow bb \bar{b}\bar{b}$) will be part of simulated samples (signal), along with other decays leaving similar signatures in the detector but that are part of known processes (background). The student will use the C++-based analysis tool ROOT to make histograms from data samples. The student will thus develop and optimize algorithms for preferentially selecting the signal over the background.