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TIMBER and 2DAlphabet: modular event selection and background estimate frameworks for boosted object searches and beyond

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Event selection and background estimation are the backbone of every search for new physics at the Large Hadron Collider. The TIMBER and 2DAlphabet software frameworks are designed to simplify both procedures and facilitate the development of modular, general-purpose code for physics analyses using Ntuple-like data formats. TIMBER is a Python library designed for streamlining event selection by providing tools for the slimming/skimming of large datasets, automatic application of corrections to Monte Carlo, visualization of analysis cutflows, simple plotting, and the production of histograms for use in shape-based background estimates. By making use of ROOT's high-level columnar analysis framework, RDataFrame, TIMBER achieves greatly reduced computation times while retaining the readability and simplicity of Python scripting. The 2DAlphabet framework is also presented as a tool for performing data-driven background estimates using a two-dimensional extension to the ABCD (alphabet) method. This Python package automatically constructs the workspace and input to the two-dimensional binned likelihood, and provides the user with tools to plot the resulting distributions and perform a battery of statistical tests to validate the results.

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