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Optimally sensitive observables for global EFT fits

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Global interpretations of particle physics data in the context of the Standard Model Effective Field Theory (SMEFT) rely on the combination of a wide range of physical observables from many different processes. A key open question to inform such global SMEFT fits is how one can construct new classes of measurements that bring in, in a well-defined statistical sense, a maximal amount of information into the EFT parameter space. We present ongoing work towards assembling optimally-sensitive LHC observables for EFT fits based on unbinned deep-learning parametrisations of the extended log-likelihood ratio, with the ultimate goal of integrating such observables as building blocks of future global EFT fits. We validate them with explicit analytic calculations, and devote particular attention to the role played by systematic and theory errors. As a proof of concept, we study the constraints on the SMEFT parameter space provided by top quark pair production and by Higgs boson production in association with vector bosons at the HL-LHC. Furthermore, we study to what degree binned analyses can achieve sensitivity approaching the optimal limit.

Authors: TER HOEVE, Jaco (VU Amsterdam / Nikhef); ROJO, Juan (VU Amsterdam and Nikhef); MADIGAN, Maeve (University of Cambridge); GOMEZ AMBROSIO, Raquel (Milano Bicocca); SANZ GONZALEZ, Veronica (Universities of Valencia and Sussex)

Presenter: TER HOEVE, Jaco (VU Amsterdam / Nikhef)

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