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# Statistical tools for the Higgs discovery - the status and future of collaborative statistical model building

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The discovery of the Higgs boson by the ATLAS and CMS is the result of an elaborate statistical analysis of many signal and control samples for which a set of common tools has been used that were specially developed for the LHC. The key feature of this tool design has been a logical and practical separation between model building, the formulation of the likelihood function, and the statistical inference procedures, which invariable take the likelihood function as experimental input. By allowing the likelihood functions to be expressed in a uniform language (RooFit), components of full analysis model of the Higgs could be formulated by independent teams of physicists, each focusing on a particular Higgs decay mode, and be assembled in a full model in a relatively short time frame. The ability to persist physics likelihood models of arbitrary complexity in ROOT files has further contributed to the exchange of ideas and analysis components, with physicists being able to perform each others full statistical analysis with literally a few lines of code. The RooStats suite of analysis tools that perform the statistical tests
on these models, (construction of confidence intervals, upper limits etc), also benefits from this model uniformity: the statistical problem to be solved can be fully specified by a (persisted) RooFit model and a declaration of the parameters of interest, providing
a compact uniform interface to a variety of calculation methods: Bayesian, Frequentist or Likelihood-based. I will present an overview of the design and practical successes of RooFit/RooStats tool suite, and their prospects for future use in particle physics.

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