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Tensorflow-based Maximum Likelihood fits for High Precision Standard Model Measurements at CMS

With increasing integrated luminosity at the LHC, highly differential and extremely precise measurements of Standard Model processes become possible. This imposes stringent requirements for accurate modelling of systematic uncertainties of both experimental and theoretical origin. One possible method for the unfolding of detector response is the use of maximum likelihood fits, with systematic uncertainties represented by nuisance parameters. Precise Standard Model measurements in Run 2 already pose a challenge with respect to the speed and stability of Standard Tools. A Tensorflow-based implementation for binned maximum likelihood fits has been used for the unfolding and statistical interpretation of high precision differential cross section measurements of W boson production recently released by CMS, involving maximum likelihood fits including hundreds of millions of events, with hundreds of measured cross sections and over a thousand nuisance parameters. This has led to huge benefits in terms of speed, stability, and flexibility for the sophistication of the measurement and systematic uncertainties, as well as statistical interpretation.

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