Contribution ID: **403** Type: **talk**

PISCES: A hybrid parameter inference technique combining a Poisson likelihood treatment for statistical uncertainties with a Gaussian multivariate treatment for systematic uncertainties

Tuesday 13 July 2021 17:15 (15 minutes)

Many particle physics experiments utilise a pull term method to perform fits to data, in which systematic uncertainties are treated as nuisance parameters that reweight the predicted spectrum. However, this approach scales poorly in fit complexity as the number of systematic uncertainties increases. Conversely, one can utilise a Gaussian multivariate technique, in which systematic uncertainties are encoded into a covariance matrix. This approach is convenient for performing joint fits, and scales well to an arbitrarily large ensemble of systematic uncertainties; however, it also treats statistical uncertainties as Gaussian, which is inappropriate in any experiment which operates in a low-statistics environment, such as a neutrino physics experiment.

We present a novel method named PISCES (Parameter Inference with Systematic Covariance and Exact Statistics), a hybrid technique that combines a Gaussian multivariate treatment of systematic uncertainties with a Poisson likelihood treatment of statistical uncertainties. Under this method, only physics nuisance parameters are profiled using a fitter, while optimal systematic pulls in each analysis bin are calculated using a covariance matrix with each evaluation of the objective function. This technique is fast and memory-efficient, and convenient for performing joint fits over many samples. Following an introduction to the method, demonstrations using toy experiments and time and memory benchmarks are presented.

Are you are a member of the APS Division of Particles and Fields?

No

Primary author: HEWES, Jeremy Edmund (University of Cincinnati (US))

Presenter: HEWES, Jeremy Edmund (University of Cincinnati (US))

Session Classification: Neutrinos

Track Classification: Neutrino Physics