Contribution ID: **70** Type: **Flashtalk with Poster**

Robust Uncertainty Quantification in Parton Distribution Function Inference

Tuesday, 30 April 2024 17:13 (3 minutes)

Uncertainty quantification (UQ) is crucial for reliable predictions in inverse problems, where the model parameters are inferred from limited and noisy data. Monte Carlo methods offer a powerful approach to quantifying uncertainty in inverse problems, but their effectiveness hinges on the accuracy of the input data. This talk explores the robustness of an inverse problem methodology that utilises Monte Carlo methods for uncertainty estimate in conjunction with a dense neural network to model the Parton Distribution Functions (PDFs) , i.e. the functions that parametrise the momentum distribution of the elementary components of protons.
We employ a closure testing methodology to assess the faithfulness of the estimated uncertainties and evaluate the robustness of our fitting procedure under erroneous uncertainty estimates in the input data. Our results demonstrate the effectiveness of our methodology in handling inaccurate input uncertainty and highlight its potential for robust UQ in inverse problems.

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Session Classification: 3.3 Hardware acceleration, FPGAs & Uncertainty quantification

Track Classification: Session B