Contribution ID: **86** Type: **not specified**

Accelerating Coupled Channel Analyses Using the PAWIAN Framework

Thursday, September 26, 2024 11:30 AM (40 minutes)

Over recent decades, the continuous increase of experimental data in high-energy physics applications has led to significant demand in computational resources. In particular, the time-consuming coupled channel analyses, which sometimes require fits with several hundred free parameters extending over several weeks, are an area where such optimization is of great value. To address this issue, we are currently integrating various AI tools into PAWIAN (PArtial Wave Interactive ANalysis), a software package developed at Ruhr-University Bochum for conducting partial wave analysis more efficiently. PAWIAN's architecture enables the simultaneous analysis of data from various hadron physics experiments and supports sophisticated dynamical models such as K-matrix formalism and tensor formalism. These efforts include improvements within the minimization procedure by changing from numerical methods towards automatic differentiation within the intermediate derivative computations. With this we intend to not only speed up each minimization step but also avoid instabilities due to the higher precision of the derivatives compared to numerical results. By utilizing ADAM (Adaptive Movement Estimation Algorithm), problems such as slow convergence and local minima are intended to be resolved. Furthermore, we are working on pseudo-event binning, where events are grouped to optimize the number of function evaluations without losing precision. Preliminary results of these efforts and specific benchmark cases regarding the implementation of these AI techniques will be presented.

Author: HANISCH, Frederike (Ruhr-Universität Bochum)

Co-authors: KOPF, Bertram (Ruhr-Universität Bochum); HEINSIUS, Fritz-Herbert (Ruhr-Universität Bochum); Dr KÜSSNER, Meike (Universität Bonn); WIEDNER, Ulrich (Ruhr-Universität Bochum)

Presenter: HANISCH, Frederike (Ruhr-Universität Bochum)