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## Accurate Surrogate Amplitudes with Calibrated Uncertainties

Neural networks for LHC physics have to be accurate, reliable, and controlled. Using surrogate loop amplitudes as a use case, we first show how activation functions can be systematically tested with KANs. For reliability and control, we learn uncertainties together with the target amplitude over phase space. Systematic uncertainties can be learned by a heteroscedastic loss, but a comprehensive learned uncertainty requires Bayesian networks or repulsive ensembles. We compute pull distributions to show to what level learned uncertainties are calibrated correctly for cutting-edge precision surrogates.

Secondary track

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