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Differentiable Physics Emulator for Water Cherenkov Detectors

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The water Cherenkov detector stands as a cornerstone in numerous physics programs such as precise neutrino measurements. In a conventional physics analysis pipeline, the understanding of detector responses often relies on empirically derived assumptions, leading to separate calibrations targeting various effects. The time-consuming nature of this approach can limit the timely analysis upgrades. Moreover, it lacks the adaptability to accommodate discrepancies arising from asymptotic inputs and factorized physics processes.

Our work on the differentiable physics emulator enhances the estimations of systematic uncertainties and advances physics inference across all the aforementioned aspects. We construct a physics-based AI/ML model that is optimizable with data. We can infer convoluted detector effects using a single differentiable model, informed by robust physics knowledge inputs. Furthermore, our model is a robust solution for experiments employing similar detection principles.

Alternate track

1. Detectors for Future Facilities, R&D, Novel Techniques

I read the instructions above

Yes

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