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Type: **Short talk (15min. + 5 min. Q/A)**

Improving KM3NeT Event Reconstructions and Simulations using Generative Neural Networks

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The KM3NeT collaboration is building two neutrino telescopes in the Mediterranean Sea: ORCA for low-energy oscillation studies and ARCA for the detection of high-energy astrophysical neutrinos. Both detectors are three-dimensional arrays of photomultiplier tubes that record Cherenkov light from secondary particles produced in neutrino interactions. High-level variables - such as the particle's energy, direction, and interaction point - are reconstructed using maximum-likelihood fits, which require a mapping from a set of event hypotheses, including nuisance parameters, to the expected photon-arrival-time distributions at each photomultiplier tube.

At present, this mapping uses lookup tables computed numerically from semi-analytic parameterizations. Extending the event hypothesis with additional nuisance parameters is challenging because the table's size grows exponentially. We propose replacing the tables with a generative neural network trained on simulations that include detailed photon propagation while spanning the nuisance parameter space. The resulting model is intended to support maximum-likelihood reconstruction, fast generation of simulated events, and detector calibration. This contribution reports the project's current status and outlines the next steps.

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Session Classification: Experiments - Cherenkov-based Neutrino Telescopes