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Extending Prometheus: an Open Source Neutrino Detector Simulation Framework

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Open source simulation frameworks are highly valuable in experimental particle physics, enabling collaborative data simulations shared among different research groups. This thesis extends Prometheus, an open source framework created to provide unified simulation capabilities for all active and proposed gigaton neutrino telescopes: IceCube at the South Pole, KM3NeT in the Mediterranean Sea, Baikal-GVD in Lake Baikal, TRIDENT in the South China Sea, and P-ONE in the Pacific Ocean. The work of this thesis improves upon the initial implementation of Prometheus and adds simulation capability to lower-energy neutrino events.

Specific contributions of this thesis include: implementation of low-energy neutrino event generation, implementation of multi-PMT (photomultiplier tube) optical modules, improvements on photon light yield from muons, and more. This modified Prometheus framework can generate simulated datasets to support machine learning algorithms for tasks such as neutrino energy and angle reconstruction, aiding in physics analysis of active and proposed gigaton neutrino telescopes.

Field of study

Computational Physics

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Session Classification: Poster session: Enjoy the posters!