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Utilizing Machine Learning for Analysis of Tiara for Texas[1]
JACQUELINE VAN SLYCKE, Siena Coll, DR. GREG CHRISTIAN, Cyclotron Institute, Texas AM University — The Tiara for Texas detector at Texas A&M University consists of a target chamber housing an array of silicon detectors and surrounded by four high purity germanium clovers that generate voltage pulses proportional to detected gamma ray energies. While some radiation is fully absorbed in one photopeak, others undergo Compton scattering between detectors. This process is thoroughly simulated in GEANT4. Machine learning with scikit-learn allows for the reconstruction of scattered photons to the original energy of the incident gamma ray. In a given simulation, a defined number of rays are emitted from the source. Each ray is marked as an event and its path is tracked. Scikit-learn uses the events' paths to train an algorithm, which recognizes which events should be summed to reconstruct the full gamma ray energy and additional events to test the algorithm. These predictions are not exact, but were analyzed to further understand any discrepancies and increase the effectiveness of the simulation. The results from this research project compare various machine learning techniques to determine which methods should be expanded on in the future.

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