Simulation of Photons with Accelerated Ray-tracing for Cherenkov detectors

Roberta Cardinale on behalf of the SPARCh team

University of Genova

2024-10-04

Objectives and Team Members

Objectives

Propagation of photons produced in HEP simulations is computationally expensive. Optimization of simulations and data reconstruction in Ring Imaging CHerenkov detectors, addressing the growing challenges related to data volume, computational complexity, and the precision required for the next generation of high-energy collider physics experiments.

1. Development of a framework for **fast optical photon ray tracing**, utilizing optical CAD and ray tracing libraries with built-in hardware accelerators to speed up the tracing of optical photons produced in **Cherenkov detectors simulations** with validation using detector benchmarks

2. Study of **new algorithms based on ML and DL for the reconstruction of photons in RICH detectors** in high-multiplicity environments, aimed at improving particle identification performance compared to standard particle identification algorithms, with the development of test benches

Team Members

Roberta Cardinale (35%), Elisabetta Spadaro Norella (35%), Alessandro Petrolini (25%), Antonino Sergi (20%)

Outcomes

1 Code development + Paper presenting the framework, the validation process using a detector benchmark, and performance comparisons with traditional ray tracing methods

2 Development of ML/DL models + Paper on development, testing, and performance improvements over standard particle identification algorithms.

1-2 Note tecniche e presentazioni intermedie

Resources

- Multi-core CPUs used for standard photon ray tracing and machine learning studies
- GPUs dedicated for accelerated photon ray tracing
- Need of installing
- The project budget includes the purchase of a dedicated GPU (1x NVIDIA L40S 48GB EDU) to be installed at the Genova local computing farm
- Need also of memory and storage space