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## ROBAST: Development of a Non-sequential Ray-tracing Simulation Library and its Applications in the Cherenkov Telescope Array

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We have developed a non-sequential ray-tracing simulation library, ROot-BAsed Simulator for ray Tracing (ROBAST), which is aimed to be widely used in optical simulations of cosmic-ray and gamma-ray telescopes. The library is written in C++, and fully utilizes the geometry library of the ROOT analysis framework. In spite of the importance of optics simulations in cosmic-ray experiments, there has never existed any open-source software for ray-tracing simulations that can be widely used in the community. In order to reduce the dispensable effort needed to develop multiple ray-tracing simulators by different research groups we have successfully used ROBAST for many years to perform optics simulations for the Cherenkov Telescope Array (CTA). Among the proposed telescope designs for the CTA, ROBAST is currently used for 3 telescopes: the Schwarzschild-Couder Medium-Sized Telescope (SC-MST), the Schwarzschild-Couder Small-Sized Telescope (SC-SST), and the Large-Sized Telescope (LST). ROBAST is also used for simulations and development of hexagonal light concentrators proposed for the LST focal plane. Making full use of the ROOT geometry library with additional ROBAST classes, we are able to build complex optics geometries typically used in cosmic-ray experiments and ground-based gamma-ray telescopes. In this contribution we introduce ROBAST and its features developed for cosmic-ray experiments, and show several successful applications for the CTA.

### Collaboration

CTA

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