A Geant4 based engineering tool for Fresnel lenses

João Costa¹, Mário Pimenta², Bernardo Tomé²

Geant4 is a simulation toolkit including optical-photon tracking in complex 3D geometries. This capability was explored to develop a simulation tool for Fresnel lenses. This tool can be used on stand-alone design and optimization studies or integrated in a full Geant4-based detector simulation.

FRESNEL LENS GEOMETRY IMPLEMENTATION

Each facet of the Fresnel lens is built from a piece of the original lens surface translated to the flat side of the lens.

The lens geometry is described in Geant4 through a parameterized replication of conical shaped facets (G4Cons volumes).

Possibility of simulating monolithic or segmented lenses.

SIMULATIONS TAKE INTO ACCOUNT:

Realistic incident light spectrum;
Effects of finite groove size;

PERFORMANCE STUDIES INCLUDE:

Study of light detection efficiency and assessment of the effect of grooved lens structure onto light throughput (bottom left);
Study of point spread function (PSF) for varying focal distance and wavelength (bottom right);