A Geant4 based engineering tool for Fresnel lenses

João Costa[1], Mário Pimenta[2], Bernardo Tomé[2]

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

VRML visualization of a simulated Fresnel lens consisting of a central monolithic lens and two layers of petals
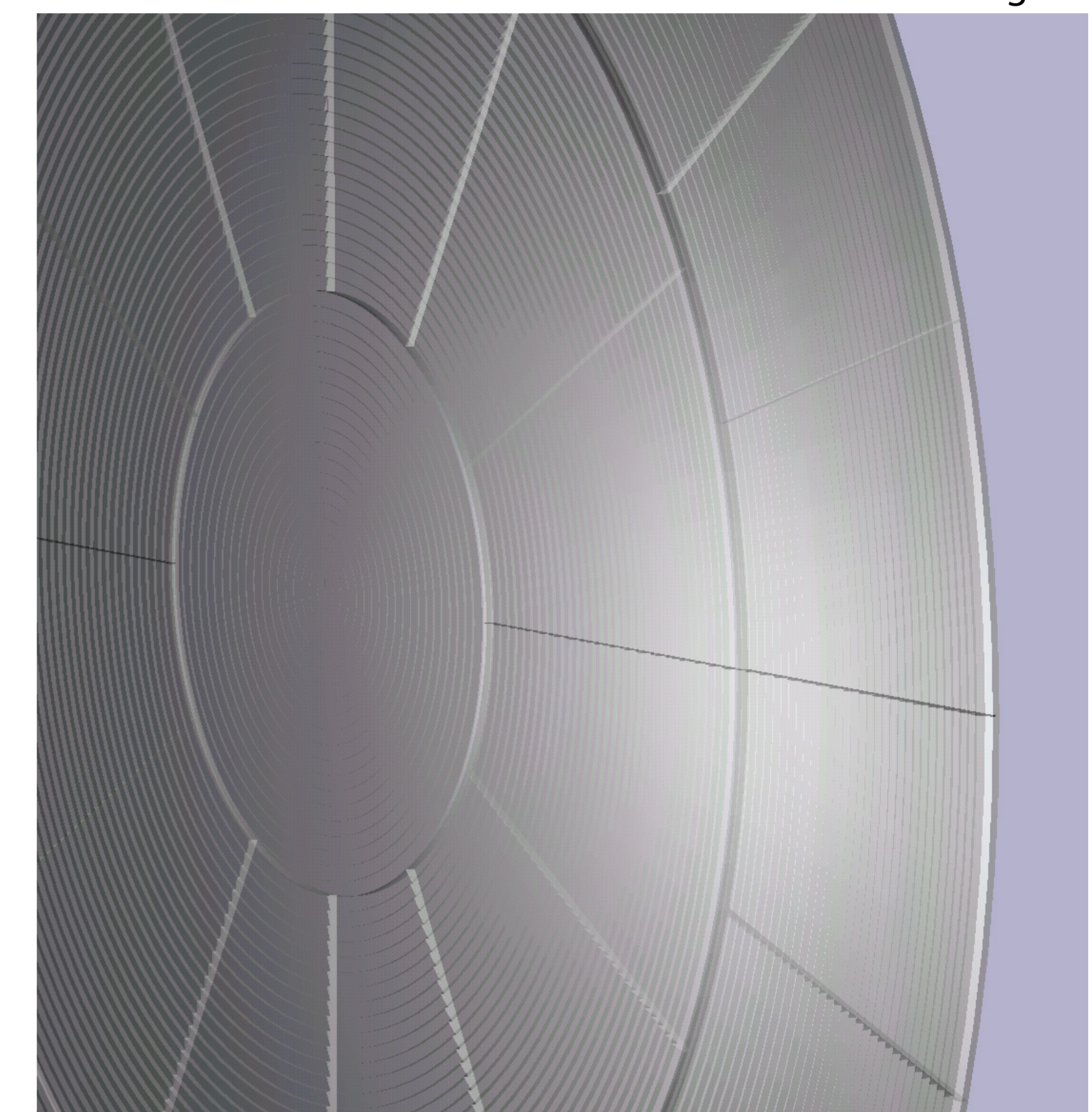
VRML visualization of a simulated Fresnel lens illustrating the focusing of on-axis light
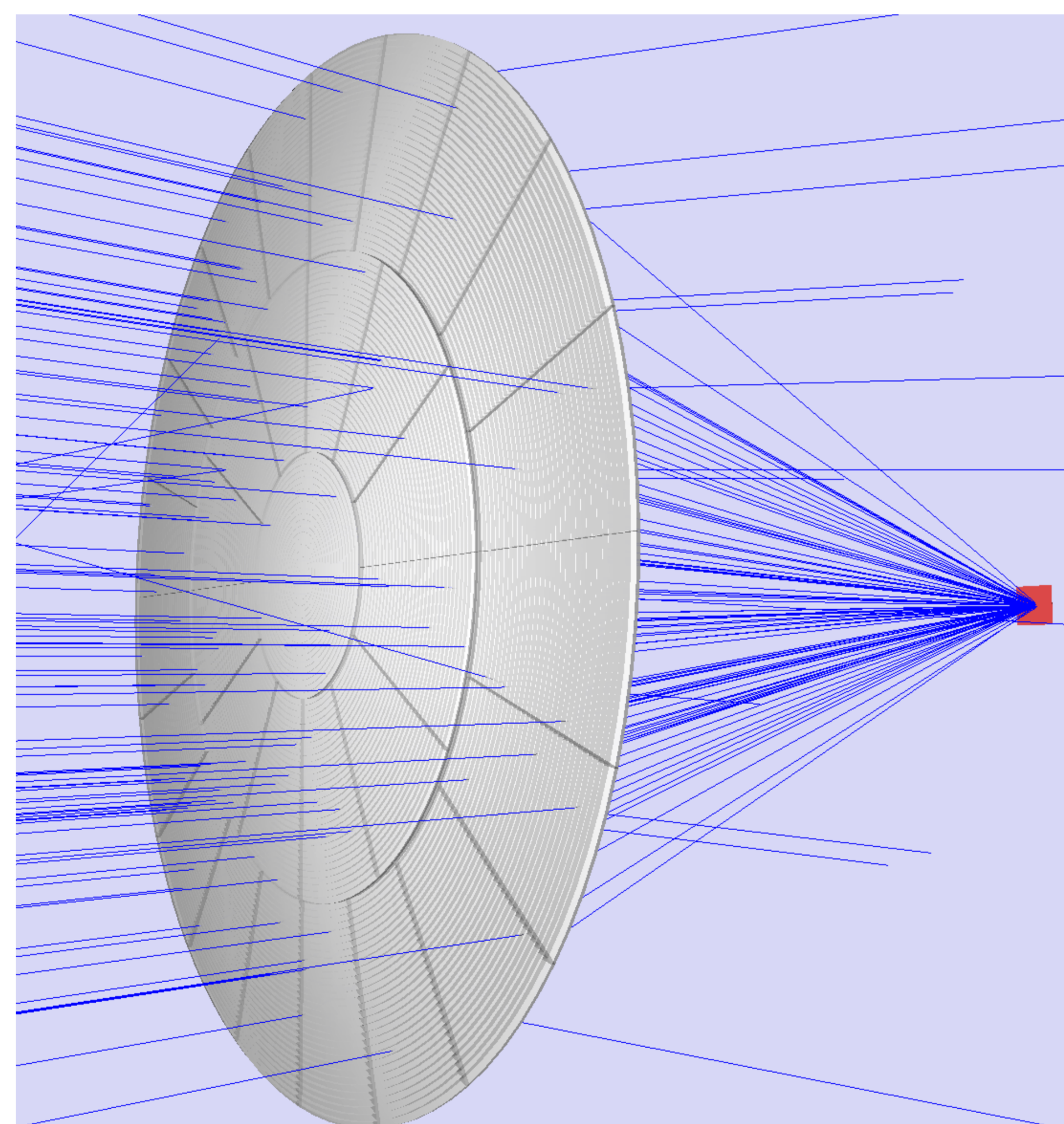
SIMULATIONS TAKE INTO ACCOUNT:

Realistic incident ligth spectrum;

Effects of finite groove size ;

Example of simulated point spread function

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);
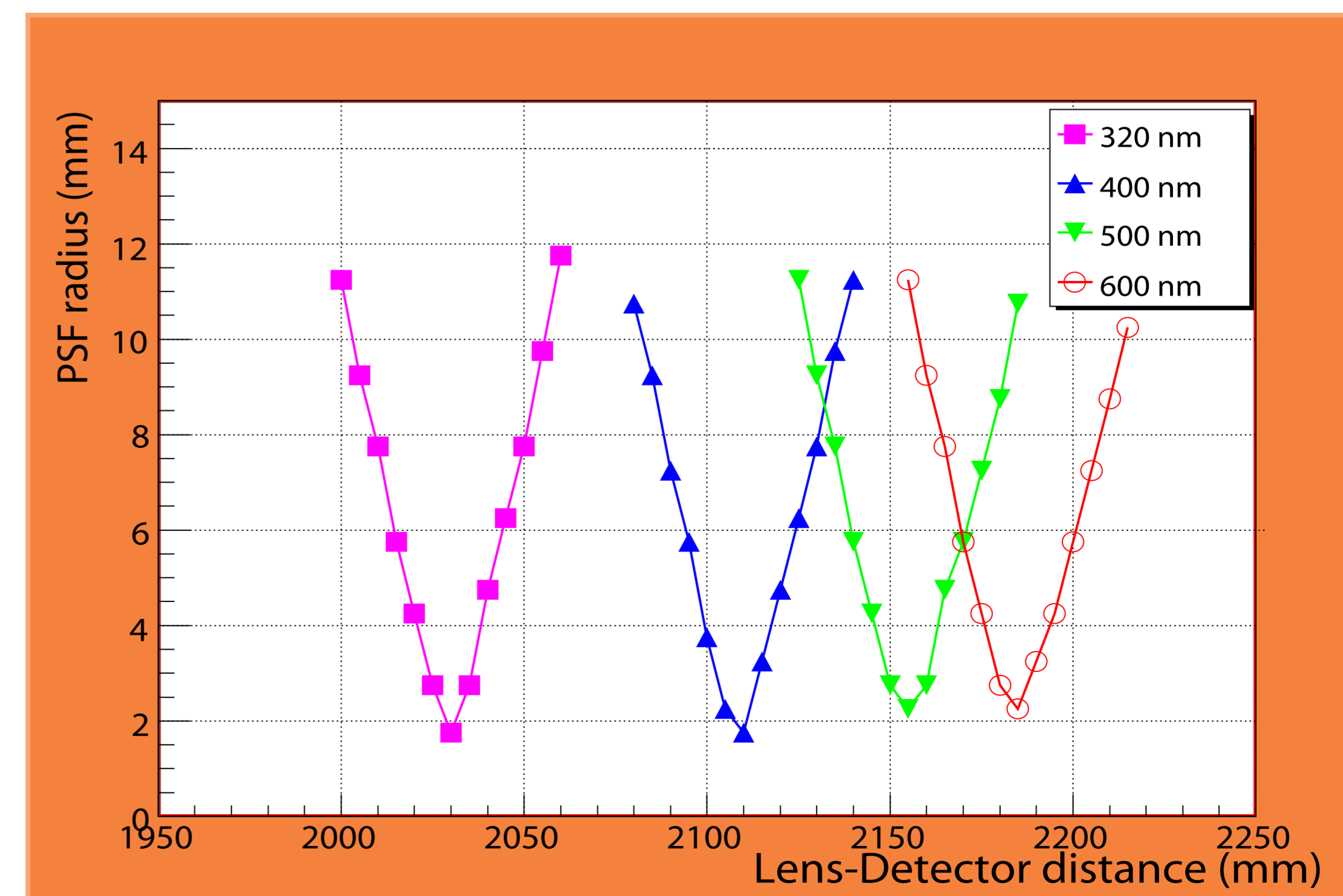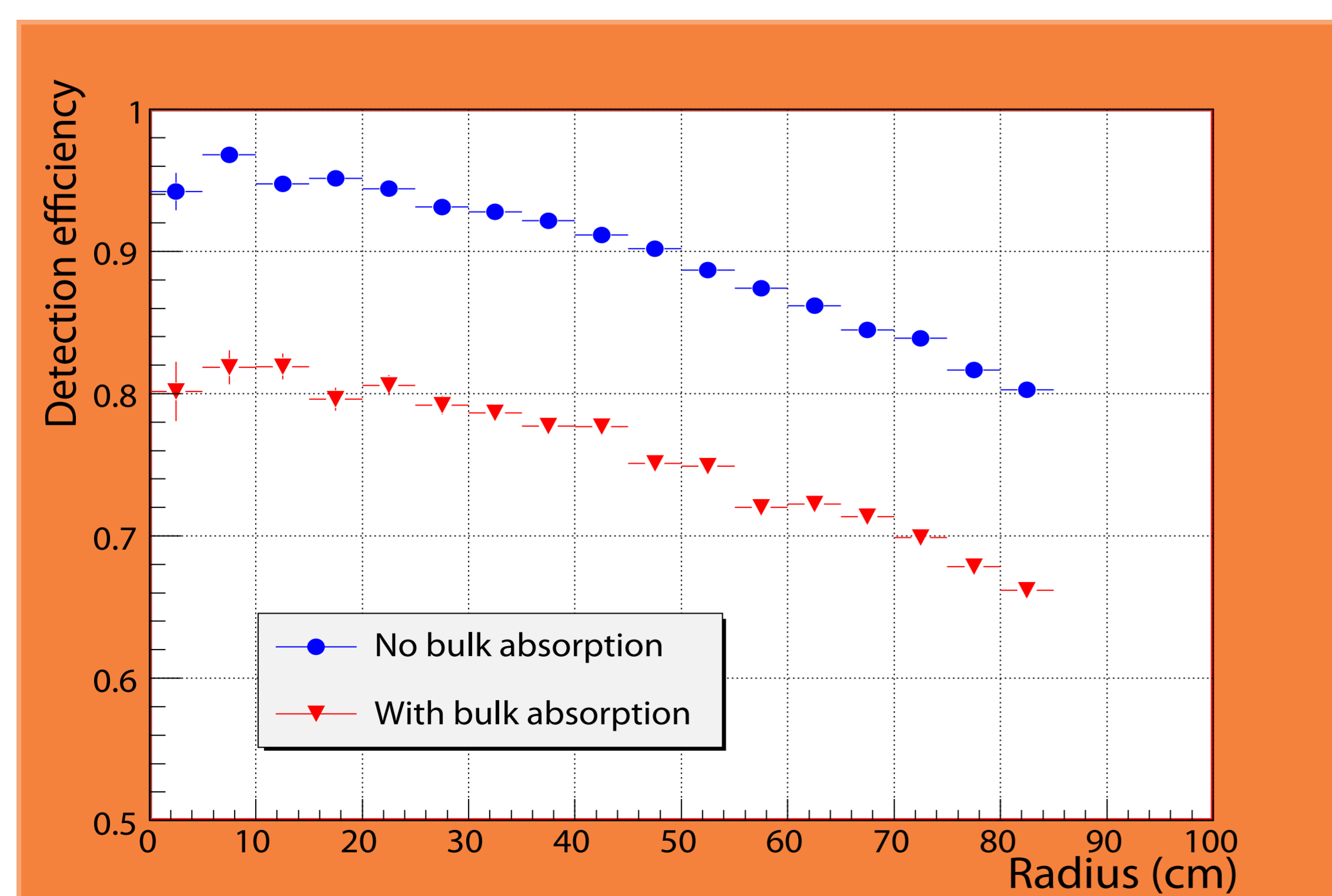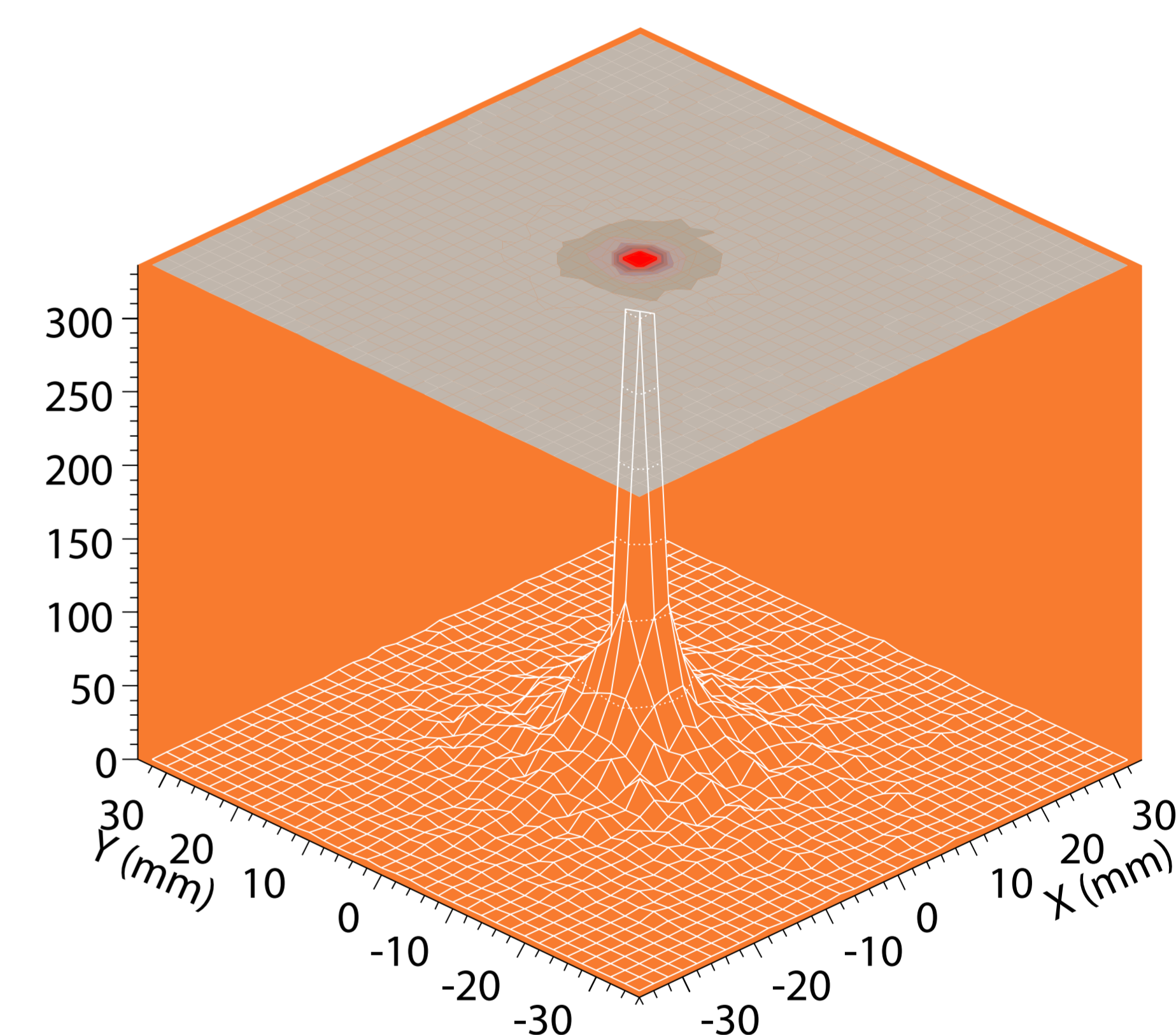
1-Laboratoire de l'Accélérateur Linéaire, IN2P3-CNRS et Université Paris-Sud 11,
Centre Scientifique d'Orsay, B. P. 34, 91898 Orsay, Cedex, France.
2-Laboratório de Instrumentação e Física Experimental de Partículas,
Av. Elias Garcia, 14–1, 1000-149 Lisboa, Portugal.

bernardo@lip.pt

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