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Simulation with GEANT4 of a new imaging Gamma-ray Compton Backscattering device

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A novel imaging device is proposed based on the gamma-backscattering technique described in Refs. [1,2], developed at GSI (Darmstadt, Germany) and modified by the Nuclear Physics Group at National University in Bogotá, which has been successfully tested by observation of concealed objects behind metallic walls, inspection of metallic structures and localization of buried objects [3,4]. The camera comprises essentially a positron source, a backscattering detector and a position detector that determines the direction of correlated 511 keV gamma-rays used to inspect the object. The backscattered gamma-rays are detected with a Compton Camera, following a design presented in Ref. [5], which provides additional information on the position where the scattering process occurs. In order to evaluate the imaging capabilities of the new camera a simulation was developed using the GEANT4 [6] simulation toolkit. In this work, a description and characterization of the new device is presented. Simulated results suggest already methods to improve the position resolution of the camera, which has been applied to study defects presented in corroded metallic structures.

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Primary authors: Mr CAMILO FLECHAS GARCIA, David (Universidad Nacional de Colombia); Prof. CRISTANCHO MEJÍA, Fernando (Universidad Nacional de Colombia)

Presenter: Mr CAMILO FLECHAS GARCIA, David (Universidad Nacional de Colombia)

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