

# Latest advances in a Compton camera for medical applications

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## Abstract

The IRIS group of IFIC has completed the development, characterization and first tests of MACACO III Compton camera. The system performance has been enhanced through the use of new photodetectors and readout electronics (the AliVATA board) and of neural networks in the data analysis. In addition, tests are being carried out with alternative electronics (the ASIC TOFPET2 from PETSys) in order to improve the timing resolution and readout speed. The system is being evaluated both for hadron therapy treatment monitoring and for radiotracer imaging.

In-beam tests have been carried out in different locations. At the National Accelerator Center (CNA) in Sevilla, tests were carried out with 18 MeV protons impinging a graphite target to produce 4.4 MeV photons. The target was moved in 1 mm steps which were detected by the system. In the clinical gantry of Krakow's protontherapy centre, with a proton beam impinging a RW3 phantom at different energies around 90 MeV, range variations of 2 mm have been detected in a preliminary analysis. Furthermore, background reduction strategies are being implemented to improve the signal-to-noise ratio of the reconstructed images. The use of silicon sensors to reject secondary particles interacting in the Compton camera results in a reduction of the image background, according to simulations. This method has been patented and experimental verification is also ongoing.

Moreover, tests have been initiated with the system to image radiopharmaceuticals for diagnostic or treatment assessment purposes. Initial tests have served to image successfully a home-made Derenzo-like phantom filled with <sup>18</sup>F-FDG. The phantom has four sectors with rods ranging from 6 to 3 mm and is placed at a distance of 30 mm from the first detector. The 4 mm rods are clearly visible and improvements are ongoing.

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