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The reSPECT project for a flexible and fast total body nuclear imaging diagnoses with high-Z organic scintillators

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In this contribution we present a new total body SPECT gamma detector concept that relies on a tungsten metal frame, that serves both as a collimator and as a container for the scintillator segments, organized in a grid geometry with holes of few millimeter (diameter). The active material is organic scintillators enriched with high-Z elements allowing to profit of the extremely fast scintillation process and a reduction in costs. The enriched scintillator produced for this reSPECT project have been loaded with Bismuth in concentration from 2 up to 10%. The results are promising in terms of light output and photon-interaction probability via photoelectric effect. A readout system that can properly integrate the short signals and handle high event rates is needed; we therefore considered a custom design tuned for fast scintillation events with an independent channel for each scintillator segment allowing for possible applications of SPECT in advanced theragnostic. Multiple FPGA-based modules will combine the readout channels and pre-process the data in real-time.
Images from patients of Policlinico Umberto I Hospital have been exploited as starting point for a Montecarlo based reconstruction study with the aim of optimizing the detector geometry and of evaluate the achievable performances. In this contribution, the expected performances of a total body system will be presented together with the results obtained with the first prototypes.

Field

Systems and applications

Primary authors: BURATTINI, Alberto (Istituto Nazionale di Fisica Nucleare); SARTI, Alessio (La Sapienza - INFN Roma 1); DE GREGORIO, Angelica (Istituto Nazionale di Fisica Nucleare); SCHIAVI, Angelo (SBAI Department, Sapienza University of Rome); MUSCATO, Annalisa (Sapienza University of Rome, Post-graduate School in Medical Physics, Rome, Italy); ROCCO, Daniele; MANUZZATO, Enrico (FBK); QUATTRINI, Flaminia (Istituto Nazionale di Fisica Nucleare); FRANCIOSINI, Gaia (Istituto Nazionale di Fisica Nucleare); TRAINI, Giacomo (Istituto Nazionale di Fisica Nucleare); DE VINCENTIS, Giuseppe (Department of Radiological Sciences, Oncology and Anatomo-Pathology, University of Rome, Rome, Italy); GASPARINI, Leonardo (FBK); MATTIELLO, Leonardo (Sapienza University of Rome, Department SBAI, Rome, Italy); GARBINI, Marco; MAGI, Marco (Istituto Nazionale di Fisica Nucleare); TOPPI, Marco (Istituto Nazionale di Fisica Nucleare); MARAFINI, Michela (CREF Centro Ricerche Enrico Fermi, Rome, Italy); KRAH, Nils (University Lyon, CNRS, CREATIS, Lyon, France); PASSERONE, Roberto (University of Trento, Department of Information Engineering and Computer Science, Trento, Italy); FRANTELLIZZI, Viviana (Department of Radiological Sciences, Oncology and Anatomo-Pathology, University of Rome, Rome, Italy); DAVID, marta (Sapienza University of Rome, Department SBAI, Rome, Italy); PATERA, vincenzo (Universita' di Roma "La Sapienza" & INFN)

Presenter: MARAFINI, Michela (CREF Centro Ricerche Enrico Fermi, Rome, Italy)

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