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A new nuclear imaging detection technology for total body, flexible and fast SPECT diagnoses.

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The International Agency for Research on Cancer estimated a 25% risk of tumor incidence in the European population (2018), destined to increase in the coming years. Prevention and early diagnosis remain the fundamental tools, and nuclear imaging plays a pivotal role for noninvasive diagnosis.

One of the most used diagnostic technology is the Single Photon Emission Computed Tomography (SPECT). While the conventional SPECT detector heads are generally built using collimators coupled to monolithic inorganic crystals, in this contribution we investigate a gamma detector concept that relies on a tungsten metal frame (hive), that serves both as a collimator and as a container for the scintillator segments. The active material has been chosen to be organic scintillators enriched with high-Z elements to profit from the extremely fast scintillation process and a still remarkable photoelectric effect probability.

Thanks to the very short scintillation time of the active material and to the pixellated readout, an incredibly high count-rate capability will be achievable.

The readout system is a custom design tuned for fast scintillation events with an independent channel for each scintillator segment allowing the simultaneous measurement of the gamma arrival time and energy.

This device has the potential of opening the way to a new family of gamma imaging detectors based on organic scintillators combined with 3D printed collimators, allowing for a significant cost reduction while achieving a beyond state-of-the-art count-rate capability and field of view.

Images from conventional SPECT 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.

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