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Development of a novel neutron tracker for the characterisation of secondary neutrons emitted in Particle Therapy.

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The MONDO (MOnitor for Neutron Dose in hadrOntherapy) project addresses the technical challenges posed by a neutron tracker detector: high detection efficiency and good backtracking precision. The project main goal is to develop a tracking device capable of fully reconstruct the four-momentum of the ultra-fast secondary neutrons produced in Particle Therapy treatments via double elastic scattering interactions.
The tracker - $10 \times 10 \times 20\ cm^3$ - is made by a matrix of thin squared scintillating fibres ($250\ \mu m$) arranged in layers orthogonally oriented. A tailored readout silicon sensor based - SBAM (SPAD-Based Acquisition readout for MONDO experiment) - matched to the MONDO needs of single photon detection capability, high spatial resolution and compactness - has been developed in collaboration with Fondazione Bruno Kessler (FBK).
A small detector prototype ($4 \times 4 \times 4.8\ cm^3$) has been built and tested with a sensor prototype, *SPADnet-I*, in order to experimentally evaluate the light output expected and consequently optimise the final readout.
The simulation characterisation of the detector response with monochromatic neutrons in the [20-300] MeV will be presented together with the expected performances of MONDO as neutron beam monitor.
The preliminary measurements at electron and proton beams of the prototype with the SPAD array readout and the first SBAM chip test results will be reported.

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