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Characterisation of a scintillating fibre-based hodoscope exposed to the CNAO low-energy proton beam

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A 32×32 Bicron 1 mm^2 polystyrene scintillating fibre-based beam hodoscope, with an entrance window of $6 \times 6 \text{ cm}^2$, has been designed and characterised for monitoring low-energy charged particle beams. The hodoscope has been designed to fit into the 60 MeV/c negative muon beam at Port 1 of the RIKEN-RAL muon facility (UK) as a beam monitor for the FAMU experiment. Each fibre is read by a 1 mm^2 Hamamatsu SiPM biased with around -70 V , and the signal is fanned out and digitised by means of CAEN VME digitisers.

After calibrations made using cosmic muons and a $^{90}\text{Sr}/^{90}\text{Y}$ 3.7 kBq source, the detector has been exposed to the calibrated single-proton beam at CNAO (Italy), in the momentum range between 340 MeV/c and 690 MeV/c . The activation of the instrument materials has been tested by exposing a mock-up to the same particle beam in advance with respect to the measurement run.

This experimental campaign provides further calibration in dE/dx and shows the feasibility of the detector as an instrument for proton beam characterisation too. In particular, aside from its usage in FAMU, we investigated the possibility of using our hodoscope as a beam monitor in hadron therapy at CNAO.

Collaboration

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