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Proton energy reconstruction with ASTRA

There has been a sharp uptake of proton beam therapy in recent years as it can potentially offer improved treatment for cancers of the head and neck and in paediatric patients. However, treatments are currently planned using conventional x-ray computerized tomography (CT) images due to the absence of devices able to perform high quality proton CT (pCT) under realistic clinical conditions. Recently, A Super Thin RAnge Telescope (ASTRA), inspired by recent developments in neutrino plastic scintillator detectors, has been proposed with the potential to overcome most of the limitations in currently available technologies. Simulations conducted using GEANT4 yield an excellent expected proton energy resolution, reconstructed with a hybrid tracking and calorimetric method, similar to 0.5%. Additionally, ASTRA is expected to be able to deal with proton rates as high as 10^8 protons/s and due to its geometry has the potential to reconstruct multiple 3D proton tracks simultaneously. Here, the novel ASTRA detector concept is presented focussing on its calorimetric capabilities and its expected energy reconstruction performance.

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