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FIRST GaN DETECTOR ARRAY FOR HIGH ENERGY PROTON BEAM IMAGING

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Energetic proton beams (60-230MeV) are used in proton therapy. Currently, x-ray imaging is used before each proton therapy treatment to accurately tune the proton beam, but the conversion to proton range introduces an error up to 3%, which could be cut by using proton imaging instead. At this moment no device for proton imaging is available on the market. We propose a GaN detector for proton imaging. GaN is a wide band-gap material, chemically and mechanically stable and technologically mature. The high displacement energy of GaN, makes it more robust to proton irradiation than most other semiconductors. We fabricated and tested GaN Schottky and pin diodes for proton detection and we demonstrated that they are sensitive (minimum detectable proton beam <1pA), linear as a function of proton current, fast (<1s) and robust. Detecting low proton currents opens the way to proton imaging with matrix of diodes and with high resolution, since diodes can be as small as tens of μm. We fabricated on a single 3 inches sapphire wafer a 1D array of 128 GaN pin diodes with a 500μm pitch. The diodes are branched to a read-out circuit placed out of the irradiation field. At Cyrcé-IPHC (25 MeV) we biased and translated the detector to scan metallic and plastic objects in proton beam contrast: the first proton radiographies with a GaN detector. Next, by creating a two-dimensional array we aim to obtain the first compact, static detector for "real time proton imaging".

Primary experiment

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