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Development of silicon monolithic arrays for dosimetry in external beam radiotherapy

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This presentation is a review of the activity of our collaboration, aimed to develop new tools with high spatial resolution and high performances for dosimetry in external beam radiotherapy.
The first step (in2007) was the introduction in dosimetry of detector solutions mutated from high energy physics, namely epitaxial silicon as base material, and a guard ring in the diode design. This allowed obtaining state of the art radiation hardness, in term of sensitivity dependence on accumulated dose, with a robust geometry particularly suitable to monolithic arrays and modular design.
Following this study a 2D monolithic array has been developed, featuring a detector based on 6.3x6.3cm2 modules with 3mm pixel pitch. This prototype has been widely investigated and turned out to provide good performances in the measure of dose distributions of small and IMRT fields.
A further linear array prototype has been recently design to investigate increased spatial resolution (1mm pitch) and technical solutions to further improve radiation hardness. This 24cm long device is based on a modular assembly of 64cm long modules. It features low sensitivity changes versus dose (0.2%/kGy) and dose per pulse (⊠1% in the range 0.1-2.3mGy/pulse, covering applications with flattened and unflattened fields). It has been tested with very satisfactory results in quality assurance of linear accelerators, with special regards to small fields, as well as profiling of proton pencil beams.

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