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Pixel Detector System for Pencil Beam Scanning Proton Therapy

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At the Paul Scherrer Institute (PSI) the Center for Proton Therapy operates 3 different Gantry for patient treatment using Pencil Beam Scanning (PBS) technology. To verify the quality of our PBS beam a new Pixel Detector based on simple and inexpensive printed circuit board (PCB) technology was developed.

The physical detector principle is an ionization chamber and has an active sensor area of 12x12 cm² covered with 3600 pixels with a size of 2x2 mm² each. On the readout side we are limited to 256 channels. To fill the gap between 3600 pixel and 256 signal channels we make use of the fact that with PBS only a small part of the detector area is irradiated at a time. With a PCB layout based on channel multiplexing, it was possible to keep the number of required readout channels below the given limit, while still reaching a reasonable measurement resolution.

The readout board itself is a PSI development as well. The core component is the ADAS1128 chip from ANALOG Devices featuring 128 input channels and a digital control interface for gain calibration, offset correction and current range adaptation. The Pixel Detector is highly integrated into the therapy control system through an FPGA based interface and allows detector readout highly synchronized with the beam delivery.

With the first prototype we performed measurements with proton beam and spot scanning technology. The PBS 2D-beamprofile could be reconstructed for all energies from 70 to 230 MeV at each position of the 12x12 cm² detector area.

Minioral

Yes

Description

Pixel Detector

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