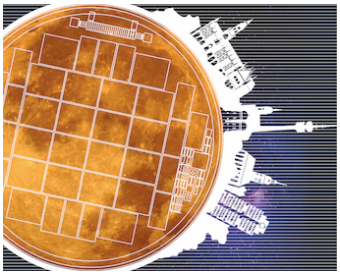

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# Silicon detectors in medical applications and for characterization of laser-driven ion sources

Silicon detectors are widely used in medical applications, ranging from imaging to dosimetry, treatment verification and quality assurance in radiation therapy. Also in a pre-clinical environment, they exhibit great potential for beam diagnostic of novel ion sources, such as laser-driven ion (LION) sources. There is major interest in pushing this unique acceleration mechanism towards biomedical applications. The special features of LION sources include an ultra-short duration ($\sim$ 1 ps at the source) of the polyenergetic ion bunches hosting a huge number of protons ($\sim 10^{12}$ per bunch).
After a general overview of silicon detectors in medical applications, two setups for characterization of LION bunches in terms of energy spectra are presented. In the first setup, a 10 $\mu$m thin prototype silicon microdosimeter is used to measure the time-of-flight signal of ns-short proton bunches. Spectra are deconvolved from the measured current, taking into account the device specific response of detector and electronics. In the second setup, the sensor chip of a Timepix detector is irradiated edge-on, hence the energy deposition of all protons along the entire penetration depth in the chip is measured.
The ability of the two setups to enable energy spectra reconstruction was tested at a Tandem accelerator, where 3D-printed passive absorbers were used to generate polyenergetic proton bunches from few-ns short monoenergetic bunches. Reconstructed spectra are compared to spectra expected from Monte Carlo simulations, showing very promising agreement encouraging future application.

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