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The iMPACT project tracker and calorimeter

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In recent years the use of energetic protons and carbon ions (hadrons) for cancer radiation treatment has exponentially grown in importance. Its effectiveness is anyway still limited by the necessity to rely on X-rays CT data to plan the dose delivery, which leads to aiming errors. Many groups are therefore trying to realize a proton CT (pCT) to overcome this limitation.

The iMPACT project (innovative Medical Protons Achromatic Calorimeter & Tracker) aims building a pCT scanner which overcomes present state-of-the-art limitations, mostly the low tracking speed, which requires long times (many minutes) to acquire a target 3D image. The iMPACT goal tracking speed is in fact 1 GHz, which would reduce the acquisition time from minutes to seconds. The tracker will use CMOS monolithic active pixel sensors (MAPS) for tracking high rate particles over a large area. MAPS allow to practically cover large areas respect to hybrid-pixel or micro-strip sensors, but specific improvements are necessary to effectively use them in a pCT scanner at such speed. Present state-of-the-art also does not offer a calorimeter capable of 1 GHz particle tracking. An achromatic calorimeter will hence be employed, i.e. a calorimeter where the position of the proton maximum stopping power (dE/dx) is used to derive its entrance energy.

This contribution will illustrate which solutions have been devised for both the tracker and the calorimeter and how that will boost the actual tracking performances.

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