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A hybrid accelerator to deliver therapeutic electron beams at high energies

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Very High Energy Electrons (VHEE) are emerging as a cancer treatment commodity. Compared to protons, VHEE is less sensitive to inhomogeneities within the human body. This means they are less damaging to healthy tissue when treating dynamic organs such as the lungs, liver, and kidneys. VHEE have a range of penetration depths depending upon the energy, often ranging from 50 MeV to 250 MeV. Such beams can be generated using radiofrequency photoinjectors followed by tens of meters long copper-based booster linacs. We are envisaging a hybrid approach where high-brightness electron beams are generated using mature copper photoinjector technology and injected into a plasma module for further acceleration. The goal is proof of a compact VHEE radiotherapy machine within a meter. In this contribution, we will review therapeutic electron beams and discuss the layout of the hybrid VHEE machine and a technique developed to match the conventional electron source and the plasma accelerator.

Primary author: Mr BYRNE, Jordan (The University of Manchester and the Cockcroft Institute)

Co-authors: Dr XIA, Guoxing (The University of Manchester); Dr SABERI, Hossein (The University of Manchester and the Cockcroft Institute); Dr OWEN, Hywel (STFC, UKRI); Mr ZHANG, Jiaqi (The University of Manchester and the Cockcroft Institute); Dr TAYLOR, Mike (The University of Manchester and the Cockcroft Institute); APSIMON, Oznur (The University of Manchester); Prof. BOOGERT, Stewart (The University of Manchester and the Cockcroft Institute); Dr PACEY, Tom (STFC, UKRI)

Presenter: APSIMON, Oznur (The University of Manchester)

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