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LHARA, THE LASER-HYBRID ACCELERATOR FOR RADIOBIOLOGICAL APPLICATIONS

Type: Abstract Submission

Topic: ASA - Radiation Modalities: / ASA05. New horizons in FLASH Laser driven ions, VHEE etc

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Background and Aims

LhARA is the highly flexible accelerator required to elucidate the mechanisms that determine the biological impact of ionising radiation on cells and tissues. A high-powered laser will generate a large flux of protons or ions which will be captured and formed into a beam using novel, strong-focussing electron plasma lenses and accelerated using a fixed field alternating gradient accelerator. The technologies demonstrated in LhARA have the potential to be developed to transform the clinical practice of particle-beam therapy by delivering proton and ion beams in completely new regimens.

Methods

Through UKRI and STFC support, the collaboration has begun to lay the foundations for LhARA to serve the Ion Therapy Research Facility (ITRF). LhARA Stage 1 will deliver proton energies up to 15 MeV to an *in vitro* end-station. In stage 2, the protons will be accelerated to 125 MeV and carbon ions to 30 MeV/nucleon and delivered to both an *in vitro* and an *in vivo* end-station. The laser-hybrid approach enables an extremely high instantaneous dose in a short pulse to be exploited in radiobiological research. LhARA will allow FLASH (dose rates >40 Gy/s) and spatial fractionation at FLASH dose rates to be studied with great translational potential and for the benefit of cancer patients. The availability of proton and ion beams in different temporal and spatial structures will enable comprehensive and systematic studies of radiation biology using appropriate cell and animal-based models.

Results

Simulation of the performance of LhARA have been used to demonstrate that dose rates of up to 156 Gy/s for protons and 730 Gy/s for carbon can be achieved.

Conclusions

The status LhARA in the context of the ITRF will be described. The characteristics of the proton and ion beams will be described and the biological potential of the unique temoporal, spacial, and spectral structure of the beams will be discussed.

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