Experimental setup for irradiation of cell cultures at L2A2

A. Torralba[1], L. Palenciano[1], J. Peñas[2], R. Contreras[2], A. Bembibre[2], A. Coathup[2], J. Benlliure[2], A. Vega[3,4], M.E. Aguado-Barrera[3,4], C. Ruiz[5], and M. Seimetz[1]

1) *Instituto de Instrumentación para Imagen Molecular (I3M), CSIC-Universitat Politècnica de València, Valencia*
2) *Instituto Galego de Física de Altas Enerxías (IGFAE), Universidade de Santiago de Compostela, Santiago de Compostela*
3) *Fundación Pública Galega Medicina Xenómica, Hospital Clínico Santiago de Compostela, Santiago de Compostela*
4) *Instituto de Investigación Sanitaria de Santiago de Compostela (IDIS), Santiago de Compostela*
5) *Instituto de Física Fundamental y Matemáticas, Universidad de Salamanca, Salamanca*

E-mail: mseimetz@i3m.upv.es

Laser-plasma proton sources and their applications to preclinical research has become a very active field of research during recent years [1]. In addition to their small dimensions as compared to classical ion accelerators they offer the possibility to study biological effects of ultra-short particle bunches and the correspondingly high dose rates. We report on the design of an experimental setup for the irradiation of human cancer cell cultures at the L2A2 laboratory, at the University of Santiago de Compostela, making use of a 1.2 J Ti:Sapphire laser with 10 Hz repetition rate.

Our setup comprises a proton energy separator consisting in two antiparallel magnetic fields realized by a set of permanent magnets. It allows for selecting a narrow energy window around an adaptable design value of 5 MeV out of the initially broad spectrum typical for Target Normal Sheath Acceleration (TNSA). At the same time, unwanted electrons and x-rays are segregated from the protons. This part of the setup is located inside the target vessel of the L2A2 laser. A subsequent vacuum flange sealed with a thin kapton window allows for particle passage to external sample irradiation. A combination of passive detector materials and real-time monitors is applied for measurement of the deposited radiation dose.

A critical point of this interdisciplinary project is the manipulation of biological samples under well-controlled, sterile conditions. Cell cultures are prepared in sealed flasks with an ultra-thin entrance window and analysed at the near-by Fundación Pública Galega Medicina Xenómica and IDIS. The first trials will be centred at the quantification of DNA double-strand breaks as a function of radiation dose. Data taking at L2A2 is scheduled for September 2021.

References

[1] P. Chaudhary *et al.*, Frontiers in Physics **9**, 624963 (2021)