Contribution ID: **332** Type: **Oral contribution**

Emerging trends in cellular response to proton irradiations at ultra-high dose rates

Wednesday, 20 September 2023 16:45 (20 minutes)

The ultrashort nature of laser-driven proton bursts allows, with appropriate arrangements, to perform single pulse irradiation of cellular samples at dose rates reaching 1010 Gy/s. Motivated by the FLASH radiotherapy context, there is significant interest in assessing any divergence in biological response at these ultra-high dose rates (UHDR) from the behaviour observed in irradiations under conventional conditions.
We will report on results of recent campaigns using laser-accelerated proton beams at the VULCAN laser at the Rutherford Appleton Laboratory, UK. A magnetic transport system, coupled in selected shots to a target-based collimation technique, allowed the delivery of doses up to 10s of Gy at ~30 MeV energies, in single pulses of ~400 picoseconds. The irradiations employed different cell models, including cancerous glioblastoma stem-like cells (GSCs, irradiated as 2D monolayers and 3D spheroids), and normal fibroblast cells AG01522. Cell survival and DNA damage were investigated and compared to X-Ray and conventional proton irradiations.
The comparison highlights clear differences in biological response, pointing to the ability of the UHDR pulses to remove differences related to the microenvironment in cancerous cells (e.g. hypoxic effects in the spheroid' s core) and to a significant sparing of the normal AG01522 cells.

Primary authors: BORGHESI, Marco (Queen's University Belfast); CHAUDHARY, Pankaj (Queen's University Belfast); Dr ODLOZILIK, Boris (Queen's University Belfast); Dr MCMURRAY, Aaron (Queen's University Belfast); AHMED, Hamad (STFC Rutherford Appleton Laboratory); DORIA, Domenico (ELI-NP, HH-IFIN, QUB); Dr MCILVENNY, Aodhan (Lawrence Berkeley National Laboratory); MILLUZZO, Giuliana Giuseppina (Istituto Nazionale di Fisica Nucleare); Dr MARTIN, Philip (Queen's University Belfast); Dr BOTCHWAY, Stan (STFC Rutherford Appleton Laboratory); CATALANO, ROBERTO (LNS); Mr CAVANAGH, Owen (Queen's University Belfast); Mr FEGAN, Conor (Queen's University Belfast); GREEN, James (STFC Rutherford Appleton Laboratory); Dr GREENWOOD, Benjamin (Lawrence Berkeley National Laboratory); Mr MCCAY, Adrian (Queen's University Belfast); Dr MCCALLUM, Sean (Queen's University Belfast); Mr MORROW, Jonathan (Queen's University Belfast); PETRINGA, Giada (Istituto Nazionale di Fisica Nucleare); CIRRONE, Giuseppe (Istituto Nazionale di Fisica Nucleare); KAR, Satyabrata (Queen's University Belfast); PRISE, Kevin (Queen's University Belfast)

Presenter: BORGHESI, Marco (Queen's University Belfast)

Session Classification: WG5: Applications

Track Classification: WG5: Applications