

Laser-hybrid Accelerator for Radiobiological Applications (LhARA)

The LhARA collaboration

H. Ahmed¹, M. Alderton², R.A. Amos³, D.O. Ariyanto⁴, C.J. Baker⁵, J. Bamber⁶, J. Bebbington⁷,
W. Bertsche^{8,9}, R. Bingham^{2,10}, N. Bliss¹¹, E. Boella^{12,9}, S. Boogert^{8,9}, M. Borghesi¹³, R. Buckley⁷,
P.N. Burrows^{14,15}, G. Casati^{16,17}, M. Charlton⁵, X. Chen¹⁸, J. Clarke⁷, B.T. Cox³, G. Cox¹¹, T.S. Dascalu^{12,9},
5 E. Dolier², M. Dosanjh^{14,15}, N.P. Dover^{16,17}, C. Dyson^{16,17}, S. Eriksson⁵, A. Fernandez-Rodriguez^{19,20},
S. Gerlach²¹, A. Giaccia^{22,23}, S. Gibson^{24,25}, A. Goulden⁷, R. Gray^{2,9}, S. Green²⁶, T. Greenshaw²⁷,
S. Griffiths¹¹, D. Gujral²⁸, H.C. Hall²⁹, C. Hardiman³⁰, E.J. Harris⁶, C. Hill¹¹, P.R. Hobson³¹,
R.P. Hugtenburg³², A. Isaac⁵, M. Johnson⁷, W.G. Jones^{16,29}, P.J. Jurj^{16,17}, M. King², A. Knoll³³,
N. Kumar^{27,9}, T.J. Kuo^{16,17,34}, A. Kurup^{16,17}, J.B. Lagrange³⁴, J. Lascaud²¹, A.M. Lombardi³⁵,
10 K.R. Long^{16,17,36}, W.G. Luk³⁷, S. Lyu¹⁸, T.A.M. Masilela³⁸, P. Matthews^{39,40}, M. Maxouti^{16,17,36},
J.M. McGarrigle^{16,41}, P. McKenna^{2,9}, R. McLauchlan^{30,42}, I. McNeish⁴, E. Melia⁴³, K. Middleman⁷,
Z. Najmudin^{16,17}, M. Noro⁴⁴, S.R. O'Neill^{12,9}, L. Obst-Huebl⁴⁵, U. Oelfke⁶, H. Owen⁷, C. Palmer¹³,
F. Parambil²⁷, K. Parodi²¹, J.L. Parsons⁴³, J. Pasternak^{16,17,34}, M. Patel^{27,9}, R. Pattathil¹, M. Pereira^{24,25},
H. Poptani²⁷, Y. Prezado^{46,20}, P. Price⁴, T. Price⁴⁷, K.M. Prise⁴⁸, C. Pugh⁷, P. Ratoff^{12,9}, R. Razak^{16,17},
15 F. Romano⁴⁹, P. Ruksasakchai⁵, M. Sabate-Gilarte⁵⁰, Z. Sadur¹⁶, A. Sandhu⁵¹, G. Schettino⁵², J. Schreiber²¹,
W. Shields^{24,25}, B. Smart⁵⁰, R.A. Smith¹⁶, A.M. Snijders⁴⁵, D. Spiers^{2,9}, S. Tantawi⁵¹, J.W.G. Thomason³⁴,
B. Torrance², S. Towe⁵³, T. Underwood^{53,3}, A. Vick⁷, A. Vikhoreva¹¹, P. Weightman²⁷, C.P. Welsch^{27,9},
C. Whyte^{2,9}, R. Wilson², N. Zakhir¹⁶, D.P. van der Werf⁵

1 Central Laser Facility, STFC Rutherford Appleton Laboratory, Harwell Oxford, Didcot OX11 0QX, UK

2 Department of Physics, SUPA, University of Strathclyde, Glasgow G4 0NG, UK

3 Dept of Medical Physics and Biomedical Engineering, University College London, WC1E 6BT

4 Department of Surgery and Cancer, Imperial College, Hammersmith Hospital London, W12 0NN, UK

5 Department of Physics, Faculty of Science and Engineering, Swansea University, Singleton Park, Swansea, SA2 8PP, UK

6 Joint Department of Physics, Institute of Cancer Research and Royal Marsden NHS Foundation Trust, Sir Richard Doll Building 28 Oakleaf Avenue, Sutton, London, SM2 5GP

7 Accelerator Science and Technology Centre, STFC Daresbury Laboratory, Daresbury, Cheshire, WA4 4AD, UK

8 Department of Physics and Astronomy, The University of Manchester, Oxford Rd, Manchester, M13 9PL, UK

9 Cockcroft Institute for Accelerator Science, Keckwick Ln, Daresbury, Warrington WA4 4AD

10 Central Laser Facility, STFC Rutherford Appleton Laboratory, Harwell Oxford, Didcot OX11 0QX, UK

11 Technology Department, STFC Daresbury Laboratory, Daresbury, Cheshire, WA4 4AD, UK

12 Department of Physics, Lancaster University, Bailrigg, Lancaster, LA1 4YW, UK

13 School of Mathematics and Physics, Queen's University Belfast, University Road, Belfast, BT7 1NN, Northern Ireland, UK

- 14 Particle Physics, Denys Wilkinson Building, Keble Rd, Oxford, OX1 3RH
- 15 The John Adams Institute for Accelerator Science, University of Oxford, Keble Rd, Oxford, OX1 3RH
- 16 Department of Physics, Imperial College London, Exhibition Road, London, SW7 2AZ, UK
- 17 The John Adams Institute for Accelerator Science, Department of Physics, Imperial College London, Exhibition Road, London SW7 2AZ, UK
- 18 Department of Bioengineering, Imperial College London, Exhibition Road, London, SW7 2AZ, UK
- 19 Institut des Sciences Moléculaires d'Orsay, Rue André Rivière, Bâtiment 520, 91400 Orsay, France
- 20 Institut Curie, Universit PSL, CNRS UMR3347, Inserm U1021, Signalisation Radiobiologie et Cancer, 91400 Orsay, France
- 21 Fakultät für Physik, Lehrstuhl für Medizinische Physik, Ludwig-Maximilians-Universität München, Am Coulombwall 1, D-85748 Garching, Germany
- 22 Department of Oncology, University of Oxford, Old Road Campus Research Building, Roosevelt Drive, Oxford, OX3 7DQ, UK
- 23 Department of Radiation Oncology, Stanford University, Stanford, CA 94305, USA
- 24 Department of Physics, Royal Holloway University of London, Egham, Surrey, TW20 0EX, UK
- 25 The John Adams Institute for Accelerator Science, Royal Holloway University of London
- 26 Department of Medical Physics, University Hospital Birmingham Foundation NHS Trust, Edgbaston, Birmingham, B15 2TH, UK
- 27 Department of Physics, University of Liverpool, Liverpool, L69 7ZE, UK
- 28 Imperial College NHS Healthcare Trust, Department of Clinical Oncology, Charing Cross Hospital, London W6 8RF, UK
- 29 CRUK PPI group, Charing Cross Hospital, London, W6 8RF, UK
- 30 Dept. Radiation Physics and Radiobiology, Imperial College Healthcare NHS Trust, London, W2 1NY, UK
- 31 School of Physical and Chemical Sciences, Queen Mary University of London, Mile End Road, London, E1 4NS, UK
- 32 Department of Biomedical Sciences, Faculty of Science and Engineering, Swansea University, Singleton Park, Swansea, SA2 8PP, UK
- 33 Department of Aeronautics, Imperial College London, Exhibition Road, London, SW7 2AZ, UK
- 34 ISIS Neutron and Muon Source, STFC Rutherford Appleton Laboratory, Harwell Oxford, Didcot OX11 0QX, UK
- 35 CERN, CH-1211 Genève 23, Switzerland
- 36 Particle Physics Department, STFC Rutherford Appleton Laboratory, Harwell Oxford, Didcot OX11 0QX, UK
- 37 Department of Computing, Imperial College London, Exhibition Road, London, SW7 2AZ, UK
- 38 Department of Radiation Oncology, University of California San Francisco, San Francisco, CA, 94115, USA
- 39 Rosalind Franklin Institute, Harwell Campus, Didcot, OX11 0QX, UK
- 40 Department of Brain Sciences, Faculty of Medicine, Imperial College London, Exhibition Road, London SW7 2AZ, UK
- 41 Institut Curie, 73 Rue Claude Bernard, 75005, Paris, France
- 42 Department of Physics, Imperial College London, Exhibition Road, London SW7 2AZ, UK
- 43 Department of Cancer and Genomic Sciences, College of Medicine and Health, University of Birmingham, Edgbaston, Birmingham, B15 2TT, UK
- 44 Business Innovation Department, STFC Daresbury Laboratory, Daresbury, Cheshire, WA4 4AD, UK
- 45 Lawrence Berkeley National Laboratory, 1 Cyclotron Road, Berkeley, CA 94720, USA
- 46 University of Santiago de Compostela, Center for Research in Molecular Medicine and Chronic Diseases, 15782, Santiago de Compostela, Spain
- 47 School of Physics and Astronomy, University of Birmingham, Edgbaston, Birmingham, B15 2TT, UK
- 48 Patrick G Johnston Centre for Cancer Research, Queens University Belfast, 97 Lisburn Road, Belfast, BT9 7AE, UK
- 49 INFN Catania, Via Santa Sofia, 64 - 95123 Catania - Italy
- 50 Particle Physics Department, STFC Rutherford Appleton Laboratory, Harwell Oxford, Didcot, OX11 0QX, UK
- 51 Arizona State University: Tempe, Arizona, US
- 52 National Physical Laboratory, Hampton Road, Teddington, TW11 0LW, UK
- 53 Leo Cancer Care, Broadview, Windmill Hill, Hailsham, East Sussex, BN27 4RY, UK