

**Working title of your festival activity** (max 5 words, needs to be a public-friendly and fun title. Examples from the 2024 festival included 'Paint Drip Brains', 'Clean Green Zooming Machines', and 'Coral Constructors')

Laser focussed health and science

**What type of activity are you proposing to engage the public at the Festival (N.B. there is more information on what these types of activity mean and some examples in the Festival guidance document):**

Interactive

**Please provide a brief overview of your broad research area and why it would be of interest to wider audiences** (Please limit your response to max 300 words).

Proton and ion beams are fantastic for killing cancer, but today, proton- and ion-beam therapy relies on huge, expensive accelerators. We're changing the game with "LhARA", an exciting new hybrid system that uses laser beams!

A laser beam is energy in its purest form. By focusing this energy in a tiny spot, proton and ion beams with unique properties can be created. Our research programme aims to harness these unique properties to create a new type of radiotherapy to treat cancer and to provide new capabilities for the advancement of science and innovation!

Our collaboration unites brilliant scientists and engineers from a variety of fields: theoretical and experimental laser-plasma physicists, accelerator scientists, detector and instrumentation developers, biologists, clinicians, and experts in artificial intelligence, robotics, automation and control. Together, we're harnessing lasers to deliver a range of high-energy particles, first to research, then to tackle hard-to-treat cancers. And, we are developing fully automated machines that rapidly deliver personalised radiation therapy in real time to each patient.

Our mission to transform particle-beam therapy leverages cutting-edge science and engineering. The realisation of our vision will not only advance cancer treatment but will also spark discoveries, lead to new ideas, and drive the creation of novel techniques that can be used to advance scientific exploration.

Isn't it amazing how exciting science can bring so much hope and innovation?

**Why do you want to take part in the Festival?** (Please limit your response to max 300 words)

Our wish to take part in the Festival stems from:

- Our commitment to communicate our excitement in the ambitious multidisciplinary journey on which we've embarked to the public, patients, students, fellow scientists, industrialists, influencers, decision makers ... i.e. as broad an audience as possible!
- A recognition of the need to create a buzz around our vision and to communicate the potential for clinical benefit and the opportunity to create new capabilities for accelerator-based science and innovation;

- An ambition to show how a multidisciplinary scientific collaboration can make a huge contribution to healthcare and lay the foundations of future scientific investigation; and
- Our wish to demonstrate the breadth of benefit that will be derived from our programme and to highlight the potential for the creation of scientific and clinical impact in the short term.

**What are you planning to do as your activity at the Festival?** Please describe in as much detail as you know what your activity will look like (what materials or equipment will be used, and how will you set them up), and how the attending public will experience it. There will be opportunities to develop ideas further and we are open to initial ideas/concepts. (Please limit your response to max 300 words)

We will have:

- An interactive, virtual-reality tour of the Laser-hybrid Accelerator for Radiobiological Applications (LhARA) that we are developing to serve the Ion Therapy Research Facility (the ITRF);
- A set of 3D-printed components that can be used, with “outline instructions” to “build your own” LhARA;
- A series of videos presented by members of the team describing a variety of LhARA’s subsystems , the scientific and technical challenges, and the steps we are taking to address each challenge; and
- Models of state-of-the-art particle beam therapy systems and a forward-looking concept for what a clinical system based on the LhARA technique might be like.

In addition, we plan to have games such as “Top Trumps” tailored to create discussion around our key messages and the key challenges that the realisation of our vision presents.

**What would you like visitors to gain from interacting with you and your activity on the day? What will visitors be able to do or see?** (e.g. have fun, become curious about your research area, understand your research area better, gain perspectives on your research area, etc. Please limit your response to max 300 words)

The ideal outcome will be that visitors will:

- Engage with our vision and recognise the clinical benefits that our programme aspires to deliver;
- Be encouraged to support our ambition to create a world-leading radiotherapy research laboratory;
- Understand how research in laser physics, accelerator physics, and biological sciences underpins our project, and how they are being used to develop new, cutting-edge technologies and techniques for healthcare;
- Gain insight into how the LhARA collaboration’s world-leading researchers address these complex scientific challenges;
- Learn how the LhARA collaboration's multidisciplinary and unified approach to the creation of scientific excellence is essential for us to deliver our vision to create real societal, technological, and scientific impact; and
- Participate in fun activities that will inspire young audiences to be at the heart of the curiosity-led science of the future.

**Will your proposed festival activity be contributing to ongoing or forthcoming research?** For example, will you be collecting data for research purposes, gathering public feedback on a research project etc.

We plan to collect statistics on the way in which the exhibit is received and on ways in which it can be improved. We also plan to collect statistics on the perception of LhARA and the public's enthusiasm for supporting our long-term vision and goals. In addition, we plan to collect statistics to support diversity analysis and to inform discussions of how to attract students into STEM.

**Do you think your proposed activity might require some ethical approval (i.e. are you collecting public data or involving them in an active study)?** If the answer to the below is yes, please bear in mind you will need to start conversations early with Imperial's Research Governance and Integrity team as soon as your involvement in the 2025 Festival is confirmed.

No.

**Please indicate what equipment / resources you might need to run your activity?** e.g. tables, floor space (please give an idea of ideal size), power requirements (please give an idea of items that will need power), a fenced or sterile area, a high ceiling, water supply, wall space, hired in plasma screens (each requires a £300 contribution from your team's budget)....etc?

We are likely to require a floor space of roughly 4 x 4 m<sup>2</sup>, mains power for the video displays and virtual reality system, chairs for the VR participants or a fenced area to minimise risk of collisions, and table space for the models and games.

**Can you explain what steps you are taking to reduce the environmental impact of your Festival activity?** The Great Exhibition Road Festival is making efforts to reduce its CO<sub>2</sub> emissions to be as green as possible and is encouraging teams to reduce their own carbon footprint, as well as the amount of waste / rubbish they generate

All components of our exhibit at the Great Exhibition Road Festival have been conceived as part of a "travelling exhibition" with which we seek to communicate our initiative across the country. Therefore all items will be constructed such that they can be transported and re-used. Our communication plan defines our exhibit at the Great Exhibition Road Festival as the "gala opening" of our public engagement strategy.

We are expecting the Festival to get busy at certain times over the weekend, and with two long days of 6+ hours engaging the public, it is key that each activity is delivered by sufficient numbers of people to allow everyone to take the breaks they need. **How many people do you estimate will be able to help you deliver your activities at the Festival:**

We have engaged with the "4-nation" LhARA collaboration in the development of our vision for an exhibit at the Great Exhibition Road Festival. We, and the collaboration as a whole, see our exhibit as part of our communication and outreach programme. Our communication plan includes the presentation of our programme at the 2026 Royal Society Summer Exhibition. We therefore anticipate that the 10-person strong local team from Imperial will be supplemented by other members of the LhARA collaboration.

**Does your proposed Festival activity link to any upcoming academics papers or the launch of new facilities, labs or institutes that might provide a news hook for media coverage?**

Yes; we shall have recently published the Conceptual Design Report for LhARA to serve the ITRF. In addition, the present wave of funding has allowed progress to be made in a number of aspects of the programme (ion-acoustic dose-profile measurement, laser-driven ion capture, transport and acceleration, studies of the biological impact of spatially fractionated, and perhaps, laser-driven beams). It is our intention to bring this to publication over the next 9 months or so. This together with the ongoing media interest in cancer and technology stories is likely to ensure main stream media coverage.

**Would you like to sign up to the Societal Engagement newsletter?** This monthly newsletter features the latest opportunities to get involved with engagement at Imperial as well as training and funding opportunities.

Yes.