Science and Technology Facilities Council
Daresbury Laboratory

60 years 1962–2022

ITRF:
Project Kickoff Meeting

20th September 2022

ITRF Kickoff Meeting

https://ukri.zoom.us/j/98909305505

ITRF Kick-Off Meeting Agenda

	Agenda Science	
Time	Item	**Speaker**
14:00	Welcome and Meeting Introduction (Massimo Noro)	**Massimo Noro**
14:05	Background to ITRF – the Science (10/10/10 min)	**Jason Parsons, Karen Kirkby, Amato Giaccia (by Zoom)**
14:35	What is ITRF? Facility Concept; Who is Working on ITRF? (10 min)	**Hywel Owen**
14:45	LhARA (30 min)	**Ken Long**
15:10	The NIMMS Programme and He Synchrotron (10 min)	**Elena Benedetto (by Zoom)**
15:20	Break	
	Project	
15:30	ITRF Project Management (15 min)	**Neil Bliss**
15:50	WP1 LhARA: project, technical risks and management (25 min)	**Colin Whyte**
16:15	WP2 Facilities and Costing (10 min)	**Neil Bliss**
16:25	WP3 Synchrotron/Conventional Option (10 min)	**Karen Kirkby**
16:35	Immediate Next Steps (10 min)	**Massimo Noro**
16:45	Discussion	
17:00	**Meeting Close**	

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What is ITRF?

Hywel Owen (on behalf of the ITRF project)
STFC Daresbury Laboratory
Accelerator Science and Technology Centre

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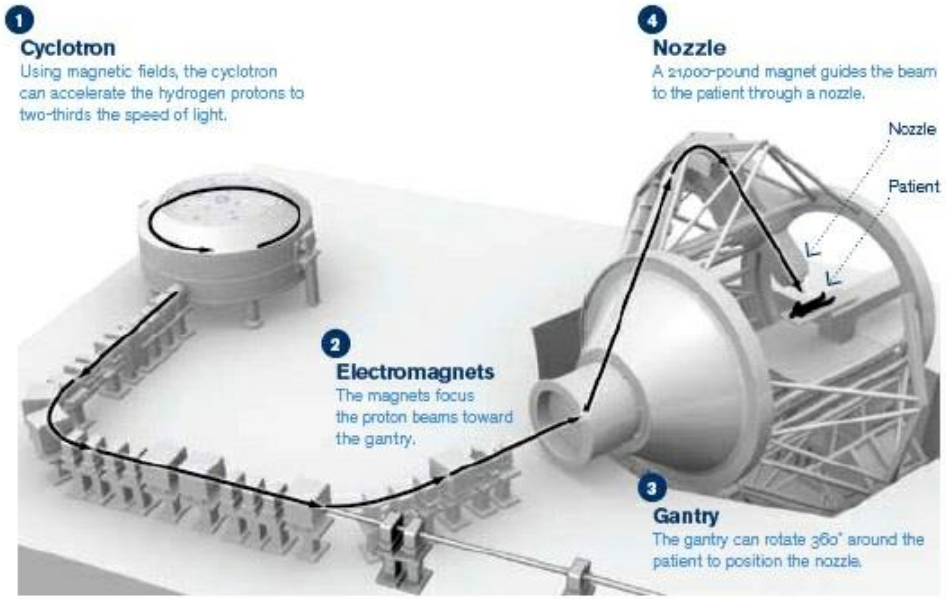
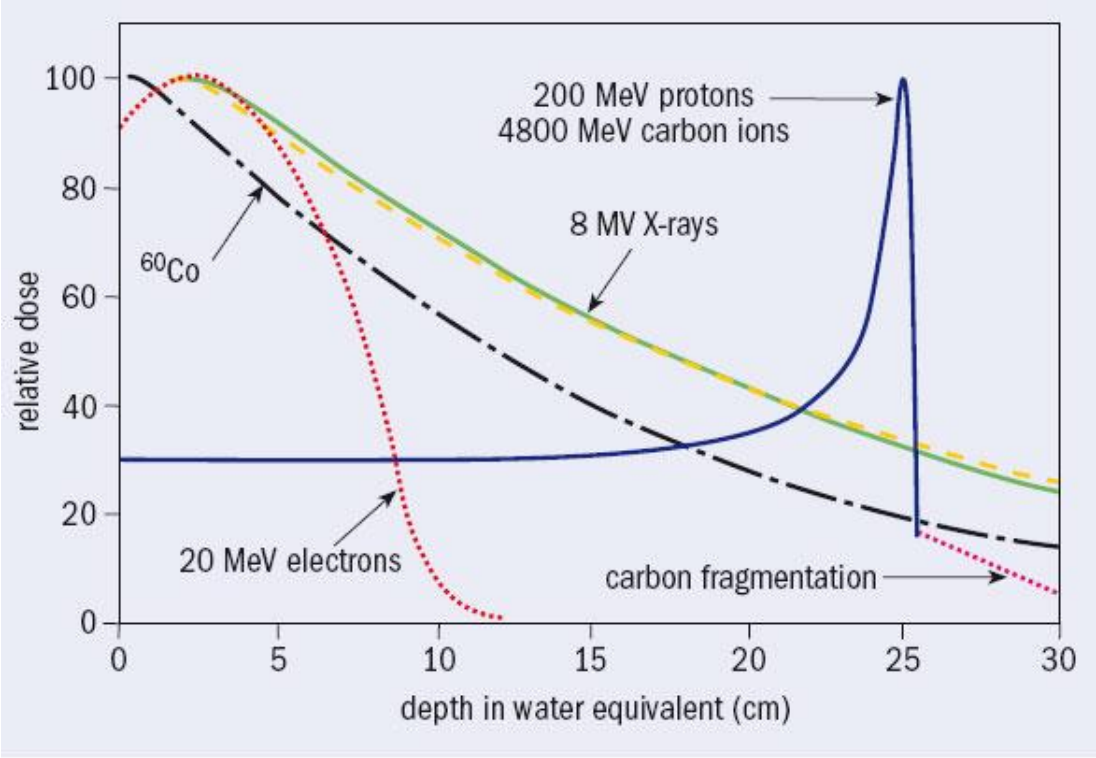
Why protons? Why ions?





UK position and clinical justification:
https://www.birpublications.org/doi/10.1259/bjr.20200247

$$-\frac{dE}{dx} = \frac{4\pi}{m_e c^2} \cdot \frac{nz^2}{\beta^2} \cdot \left(\frac{e^2}{4\pi\varepsilon_0}\right)^2 \cdot \left[\ln\left(\frac{2m_e c^2 \beta^2}{I \cdot (1-\beta^2)}\right) - \beta^2\right]$$

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Ions such as C6+ provide superior RBE that is beneficial for certain hard-to-treat tumours
Providing those sorts of treatments is the USP for the CRTF and ITRF provides evidence for its need

ITRF: Ion Therapy Research Facility

Beyond protons, for cancer treatment

WHY

- one in two people will develop cancer in their lifetime in the UK
- conventional radiotherapy used in around 50% patients
- ion therapy may offer benefits for certain patients, but the basic radiobiology needs exploring

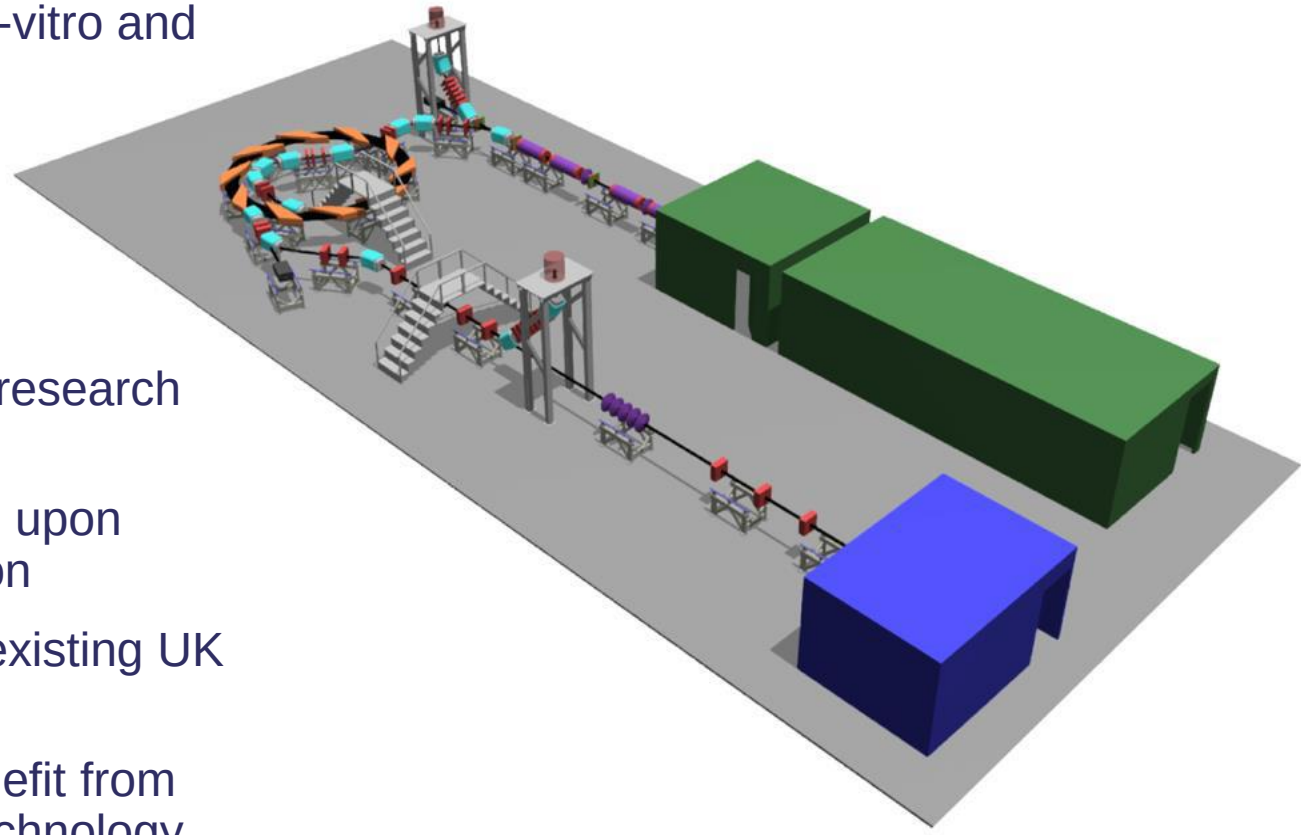
WHAT

- a world-first infrastructure for proton/ion beams towards cancer treatment
- a flagship project for the region, building on the UK's research community strengths and the science and innovation heritage of the national laboratories

Ion Therapy Research Facility – the ambition

HOW

- A compact, single-site national research infrastructure delivering very high dose rates
- Protons and beyond, at energies sufficient for both in-vitro and in-vivo studies
- Consider technical options, with different risk profiles

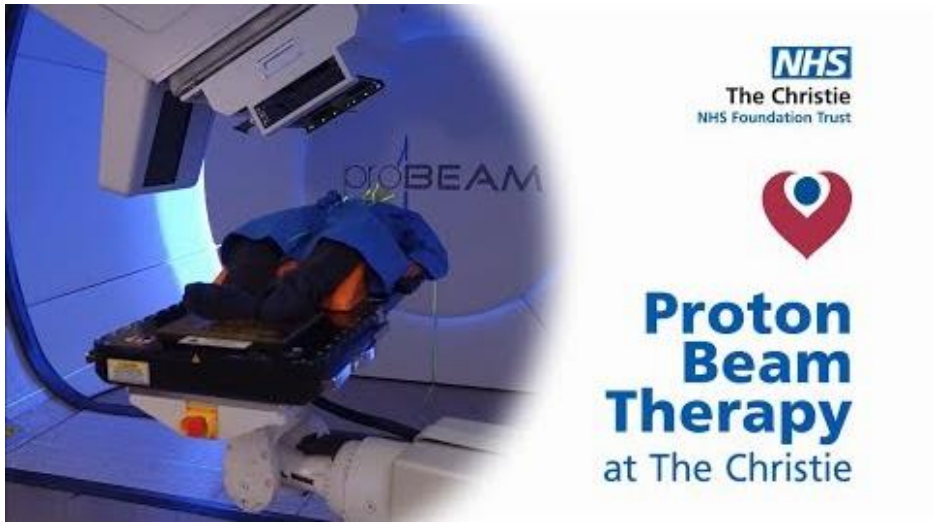


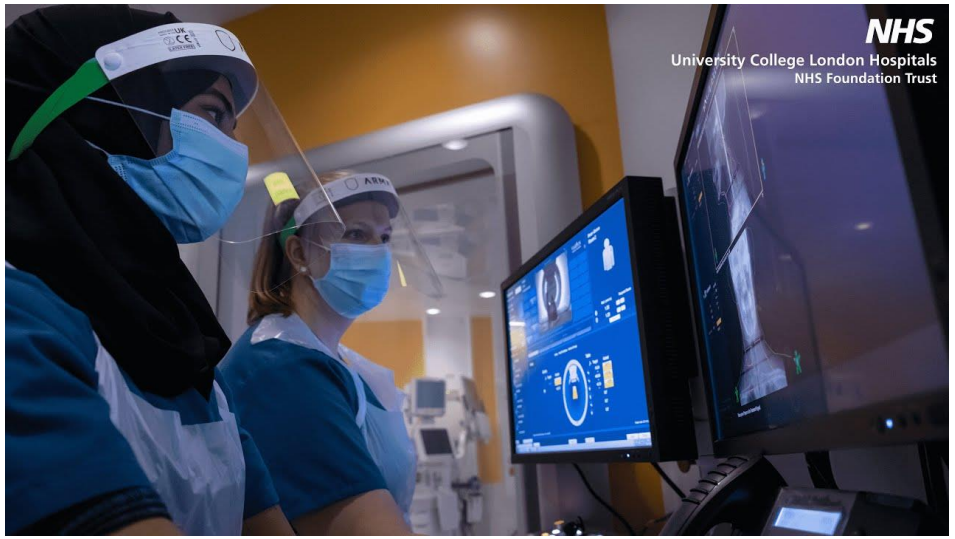
PROPOSED PLAN

- Conceptual design of layout, cost and operation of a research facility
- Develop innovative laser-plasma technology, building upon world-leading expertise within the LhARA collaboration
- Develop innovative end-station designs, building on existing UK expertise in proton radiobiology research
- Collaborative agreement with CERN allows us to benefit from enormous experience and expertise in accelerator technology and successful projects

Building on the NHS success: proton beam therapy

- The first ion in clinical use in the NHS is the **proton**
- The NHS approach with proton beam therapy is:
  - evidence-based with intention to cure
  - emphasis on children & young adults, under 25
- Intend to build on experience gained in proton therapy clinical and research activity





NHS
The Clatterbridge
Cancer Centre
NHS Foundation Trust

The Clinical Context

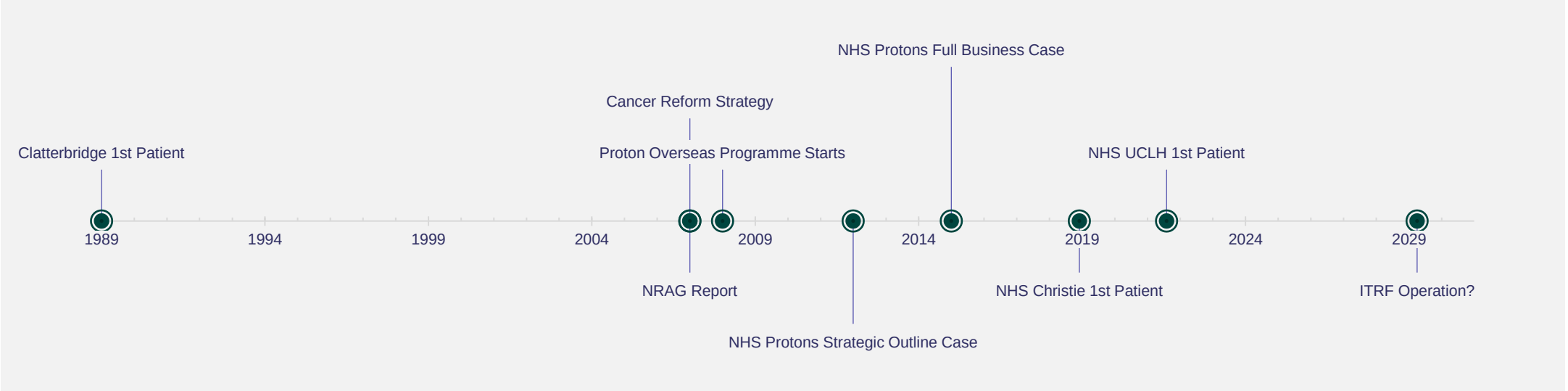
- 1989: Clatterbridge UK world's 1st hospital proton therapy centre (62 MeV, ocular); 100 patients/year
- 2007: NRAG report 'Radiotherapy: developing a world class service for England' recommends proton facilities
- 2007: Cancer Reform Strategy
- 2008: Proton Overseas Programme; 1102 patients (2008 – 2018)
  https://doi.org/10.1016/j.ijrobp.2020.07.2456
  https://doi.org/10.1016/j.clon.2018.02.032
- 2012 NHS Strategic Outline Case
- 2015: Full Business Case approved for 2 NHS centres
- 2018: NHS Christie 1st patients – seen as a big success story
- 2021: NHS UCLH 1st patients

Clatterbridge – 62 MeV Scanditronix cyclotron
Basis for much UK technology and clinical-related research

Christie – 250 MeV Varian cyclotron
+ unique research beamline

Protons in UK:
- Evidence-based
- Intention to cure
- Emphasis on children, young adults (<25), adults with rare tumours

ITRF Timeline – Where Do We Want to Get To?



	YR	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41
ITRF	PA1 ITRF Conceptual Design																				
	PA2 ITRF Technical Design																				
	Construction																				
	ITRF research - physics + pre-clinical biology																				
Ion	Appraisal of clinical evidence																				
Overseas	Partner Research Programmes																				
Programme	Referral Programme																				
	Cost Analysis																				
CRTF	CRTF Technology Collaborations																				
	CRTF Conceptual Design																				
Clinical	CRTF Technical Design																				
Research &	CRTF Tendering																				
Treatment	CRTF Construction																				
Facility	Commence clinical research & treatment																				

ITRF Status & Plan

- ITRF funded through UKRI Infrastructure Fund
- 2-year Preliminary Activity would deliver a CDR to address:
  - What research programme ?
  - What design ?
  - What cost basis ?
  - What operating model ?
- During the Preliminary Activity:
  - Working groups to produce Conceptual Design Report, outline design and costing
  - Review designs with community
  - Establish funding roadmap
  - Develop key technologies
  - Examine alternative ways to achieve research goals
- STFC – CERN have agreed an Umbrella Collaboration Agreement to provide a framework to enable free exchange of ideas and technologies that is very relevant to ITRF (NIMMS project)

Partner/Collaborating Organisations

- STFC (BID, ASTeC*, TD*, ISIS, CLF, PPD*)
- John Adams Institute/Cockcroft Institute
- University of Birmingham*
- Imperial College (Physics*, Computing, Aeronautics, Surgery and Cancer)
- Imperial College Healthcare Trust*
- Lancaster University*
- University of Liverpool (Physics*, Sys Mol Biol)
- University of Manchester (Physics*, Cancer Sciences*)
- University of Oxford (Physics, Materials, Oncology)
- QU Belfast*
- RHUL*
- University of Surrey
- Swansea University
- UCL *
- University of Strathclyde*
- Christie Hospital
- Clatterbridge Cancer Centre

- Institute of Cancer Research*
- Rosalind Franklin Institute
- National Physical Laboratory

- CERN
- INFN Catania
- Leo Cancer Care
- Maxeler Technologies Limited
- Corerain Technologies (China)
- Institut Curie
- Netherlands Cancer Institute
- Hampton University
- Stanford University
- Cyril & Methodius University (N Macedonia)

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