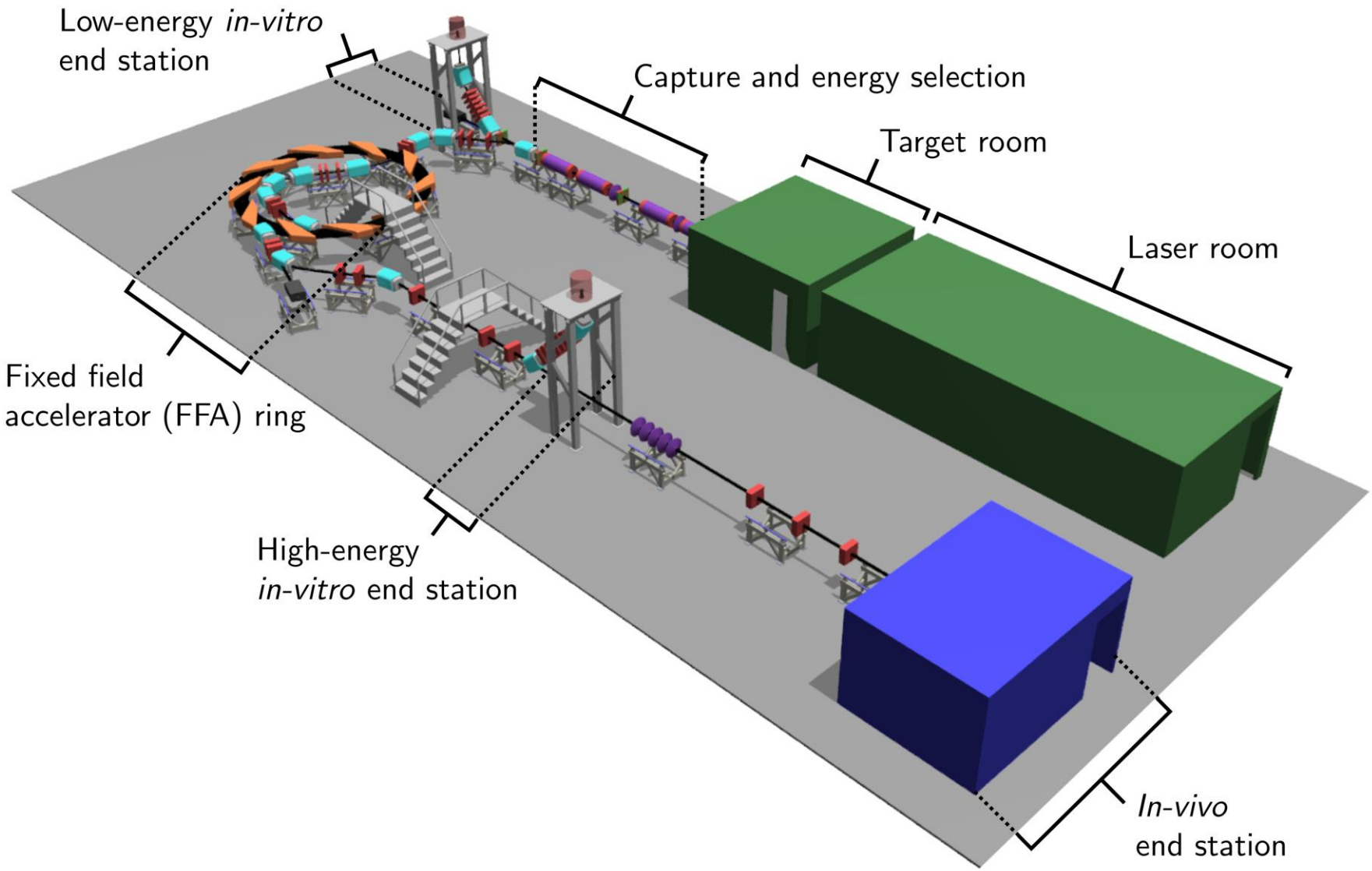
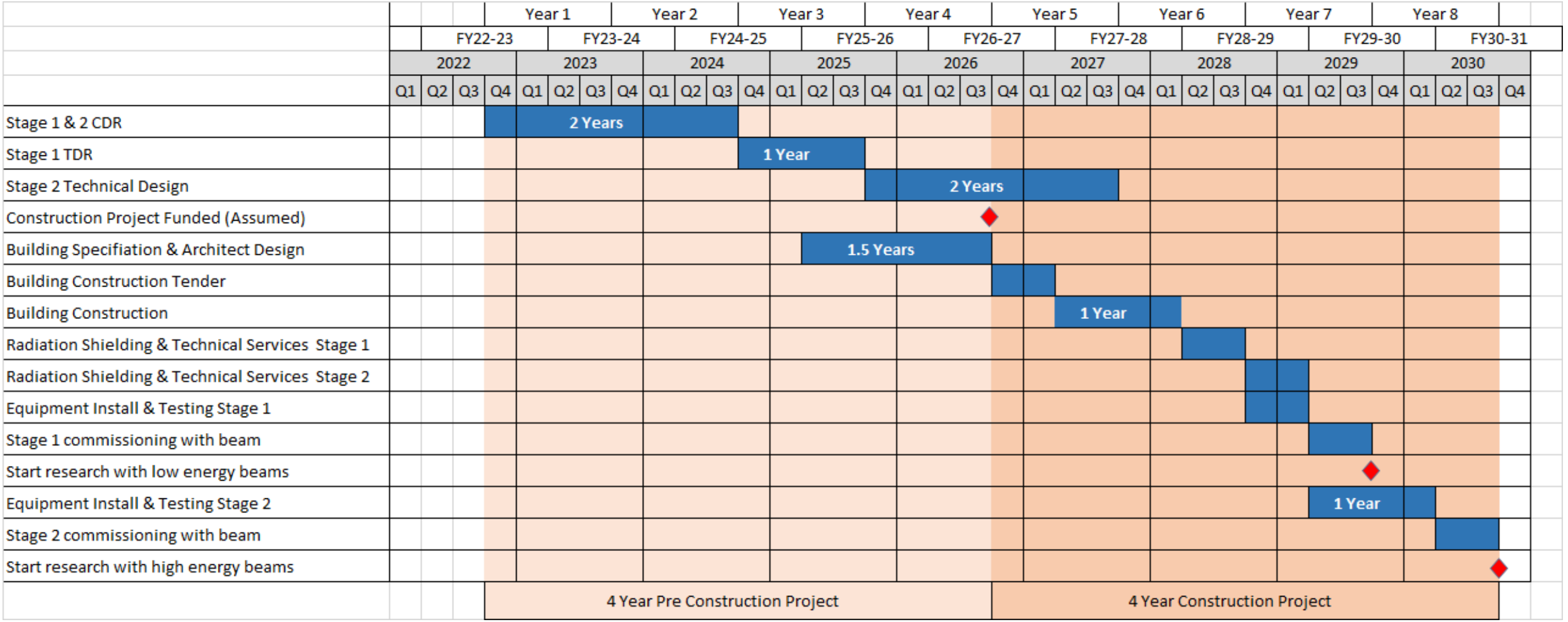
- Resources and Project Plan
  - Why Gabor lenses?

ITRF

Ion Therapy Research Facility



Timeline & Milestones for the Design



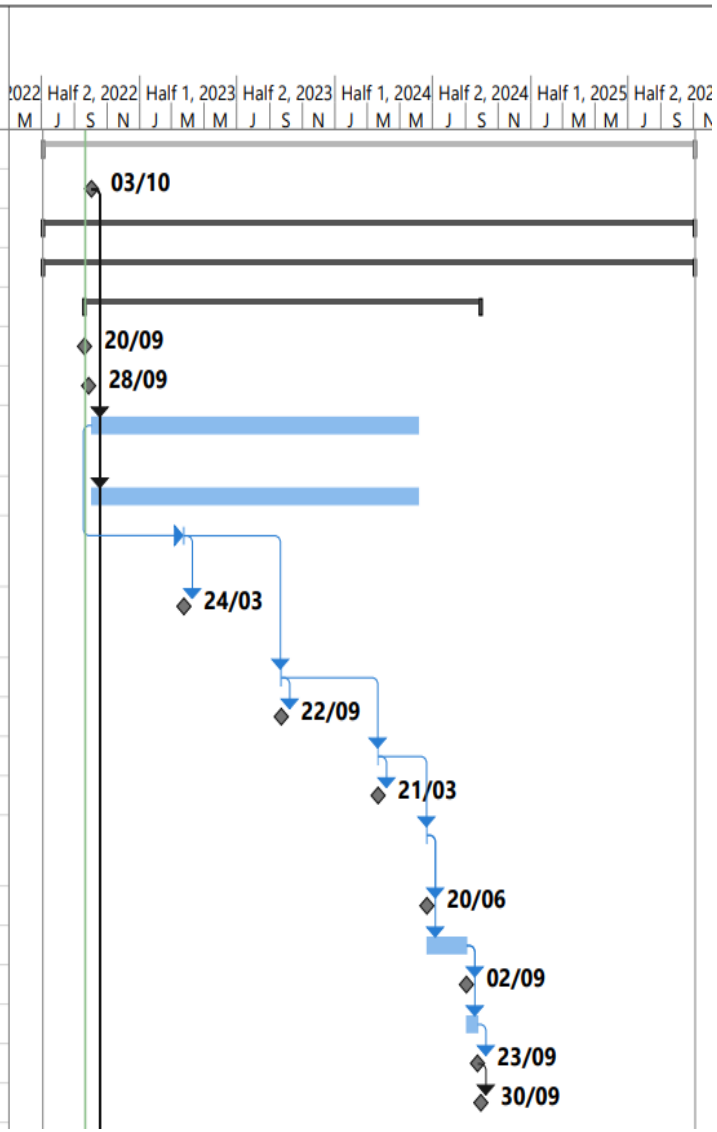
LhARA Project Schedules & Milestones

3 documents:

1. 1272-pa1-pm-ppl-0005-v1.0 - ITRF CDR milestones and deliverables 2022-10-18
2. 1272-pa1-pm-ppl-0004-v0.7 - ITRF CDR schedule 2022-09-20
3. 1272-pa1-pm-ppl-0001-v2.0 - ITRF schedule 2022-07-20 (Covered later in WP6 talk)

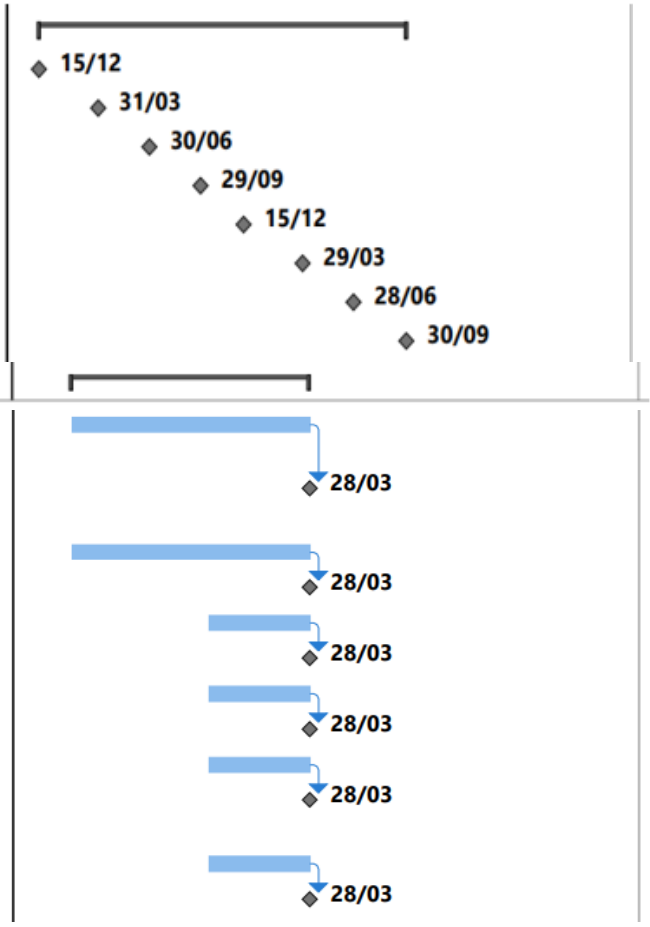
CDR Schedule 1272-pa1-pm-ppl-0004-v0.7 - ITRF CDR schedule 2022-09-20

ID	Task Mode	WBS	Task Name	Duration	Start	Finish
0		**0**	**ITRF CDR schedule**	**870 days**	**Mon 04/07/22**	**Mon 03/11/25**
1		1	Project start	0 days	Mon 03/10/22	Mon 03/10/22
2		**2**	**WP0 ITRF Management & Conceptual Design Review**	**870 days**	**Mon 04/07/22**	**Mon 03/11/25**
3		**2.1**	**UKRI Infrastructure Funding Waves**	**870 days**	**Mon 04/07/22**	**Mon 03/11/25**
15		**2.2**	**ITRF Conceptual Design Report (CDR) - 2 years**	**529 days**	**Tue 20/09/22**	**Mon 30/09/24**
16		2.2.1	ITRF Team Kick-Off meeting at STFC Daresbury Laboratory	0 days	Tue 20/09/22	Tue 20/09/22
17		2.2.2	ITRF IF monitoring kick off meeting	0 days	Wed 28/09/22	Wed 28/09/22
18		2.2.3	Project Management Plan; scope, specifications, risk, finance, stakeholders, deliverables	437 days	Mon 03/10/22	Tue 04/06/24
19		2.2.4	Technical studies	437 days	Mon 03/10/22	Tue 04/06/24
20		**2.2.5**	**Preliminary Conceptual Design Review (6 months) - refine scope, specifications, define parameters and schematic diagram of facility equipment.**	**2 days**	**Thu 23/03/23**	**Fri 24/03/23**
21		2.2.6	M2: ITRF Refined scope, specifications, defined parameters and schematic diagram of facility equipment complete.	0 days	Fri 24/03/23	Fri 24/03/23
22		**2.2.7**	**Interim Conceptual Design Review 1 (12 months) - specify baseline design**	**2 days**	**Thu 21/09/23**	**Fri 22/09/23**
23		2.2.8	M4: ITRF Baseline designs complete	0 days	Fri 22/09/23	Fri 22/09/23
24		**2.2.9**	**Interim Conceptual Design Review 2 (18 months) - refine specificatiosn & designs**	**1 day**	**Thu 21/03/24**	**Thu 21/03/24**
25		2.2.10	M15: Refined ITRF specifications & designs	0 days	Thu 21/03/24	Thu 21/03/24
26		**2.2.11**	**Final Conceptual Design Meeting (21 months) - final specification & design ready for CDR write up**	**1 day**	**Thu 20/06/24**	**Thu 20/06/24**
27		2.2.12	M16: Start ITRF CDR write up	0 days	Thu 20/06/24	Thu 20/06/24
28		2.2.13	CDR writing	52 days	Fri 21/06/24	Mon 02/09/24
29		2.2.14	Chapter authors complete CDR writing	0 days	Mon 02/09/24	Mon 02/09/24
30		2.2.15	Proof reading and final adjustments to CDR	15 days	Tue 03/09/24	Mon 23/09/24
31		2.2.16	M18: ITRF CDR Publication	0 days	Mon 23/09/24	Mon 23/09/24
32		2.2.17	M19: ITRF CDR phase complete	0 days	Mon 30/09/24	Mon 30/09/24



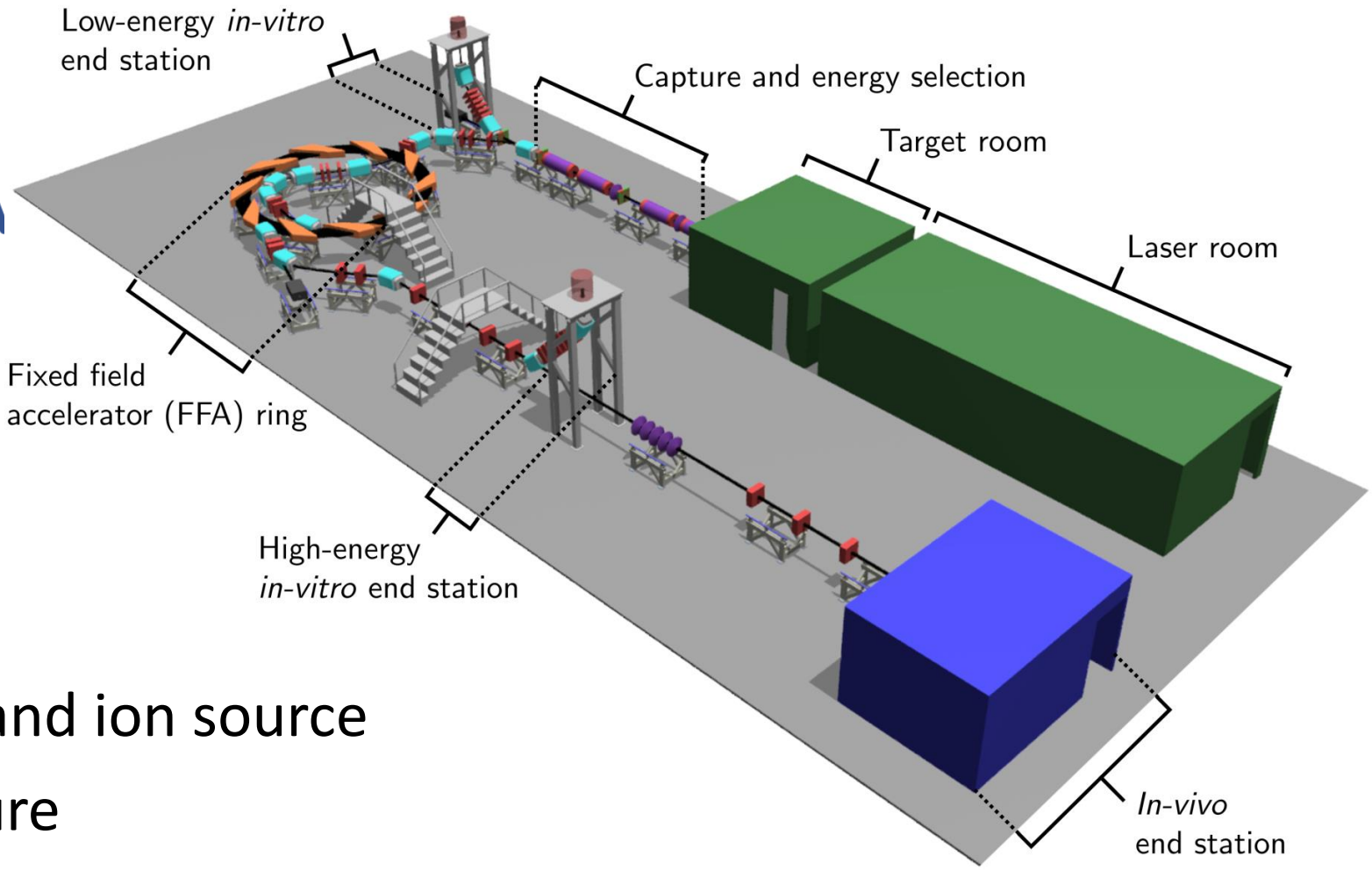
CDR Schedule 1272-pa1-pm-ppl-0004-v0.7 - ITRF CDR schedule 2022-09-20

33	**3**	**UKRI Infrastructure Fund (IF) Deliverables**	**467 days**	**Thu 15/12/22**	**Mon 30/09/24**
34	3.1	D1: Y1Q1 IF progress report	0 days	Thu 15/12/22	Thu 15/12/22
35	3.2	D2: Y1Q2 IF progress report	0 days	Fri 31/03/23	Fri 31/03/23
36	3.3	D3: Y1Q3 IF progress report	0 days	Fri 30/06/23	Fri 30/06/23
37	3.4	D4: Y1Q4 IF progress report	0 days	Fri 29/09/23	Fri 29/09/23
38	3.5	D5: Y2Q1 IF progress report	0 days	Fri 15/12/23	Fri 15/12/23
39	3.6	D6: Y2Q2 IF progress report	0 days	Fri 29/03/24	Fri 29/03/24
40	3.7	D7: Y2Q3 IF progress report	0 days	Fri 28/06/24	Fri 28/06/24
41	3.8	D8: Y2Q4 IF progress report	0 days	Mon 30/09/24	Mon 30/09/24
81	**5**	**WP2 ITRF Facilities & Costing**	**302 days**	**Wed 01/02/23**	**Thu 28/03/24**
82	5.1	Preliminary design study of bulk shielding, beam dump and radioprotection requirements	302 days	Wed 01/02/23	Thu 28/03/24
83	5.2	M7: Preliminary design study of LhARA bulk shielding, beam dump and radioprotection requirements complete	0 days	Thu 28/03/24	Thu 28/03/24
84	5.3	Mechanical design of accelerator systems & integration	302 days	Wed 01/02/23	Thu 28/03/24
85	5.4	M7: Mechanical design of LhARA accelerator systems & integration complete	0 days	Thu 28/03/24	Thu 28/03/24
86	5.5	Preliminary design of the building and infrastructure requirements	129 days	Mon 02/10/23	Thu 28/03/24
87	5.6	M7: Preliminary design of LhARA building and infrastructure requirements complete	0 days	Thu 28/03/24	Thu 28/03/24
88	5.7	LhARA vacuum systems specifcation	129 days	Mon 02/10/23	Thu 28/03/24
89	5.8	M7: Finalise LhARA vacuum systems specifcation	0 days	Thu 28/03/24	Thu 28/03/24
90	5.9	Preliminary design of the mechanical supports including the vertical arc	129 days	Mon 02/10/23	Thu 28/03/24
91	5.10	M7: Preliminary design of LhARA mechanical supports including the vertical arc complete	0 days	Thu 28/03/24	Thu 28/03/24
92	5.11	Estimation of LhARA power consumption and cooling requirements	129 days	Mon 02/10/23	Thu 28/03/24
93	5.12	M7: Estimation of LhARA power consumption and cooling requirements complete	0 days	Thu 28/03/24	Thu 28/03/24



LhARA
Laser-hybrid Accelerator for Radiobiological Applications

LhARA - Project organisation



- WP1 – Project management
- WP2 – Laser Driven proton and ion source
- WP3 – Proton and Ion Capture
- WP4 – Real-time dose-deposition profiling
- WP5 – End station development & Instrumentation
- WP6 – Facility design and integration

Project management

All the essential planning and organisation, but also..

Engagement and outreach:

Stakeholder

Peer group

User community

Public

Patient

Diversification of LhARA funding – alternate funding sources

CDR Milestones 1272-pa1-pm-ppl-0005-v1.0 - ITRF milestones and deliverables 2022-10-18

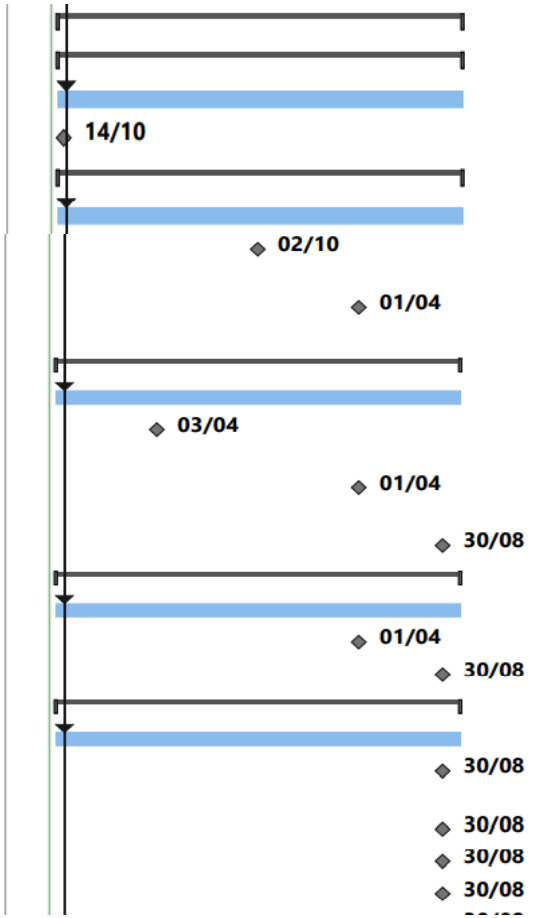
WBS	ITRF No.	High Level Milestones	Date
1		Project start	Mon 03/10/22
2.2.1		ITRF Team Kick-Off meeting at STFC Daresbury Laboratory	Tue 20/09/22
2.2.2		ITRF IF monitoring kick off meeting	Wed 28/09/22
3.1		**D1: Y1Q1 IF progress report**	Thu 15/12/22
4.6.2	M1	LhARA lattice optimisation, aperture estimation, parameter list and schematic diagram update	Tue 31/01/23
2.2.5	M2	Refined scope, specifications, defined parameters and schematic diagram of facility equipment complete **(6 month design review).**	Thu 23/03/23
3.2		**D2: Y1Q2 IF progress report**	Fri 31/03/23
4.3.2	M3	Validate LhARA plasma simulations with existing Swansea experimental set-up (LhARA M3.1)	Mon 03/04/23
3.3		**D3: Y1Q3 IF progress report**	Fri 30/06/23
2.2.7	M4	M4: ITRF Baseline designs complete **(12 month design review).**	Thu 21/09/23
3.4		**D4: Y1Q4 IF progress report**	Fri 29/09/23
4.2.2	M5	Prediction of optimised LhARA proton source parameters for 100+ TW laser systems based on hydrodynamic and kinetic simulations complete (LhARA M2.1)	Mon 02/10/23
3.5		**D5: Y2Q1 IF progress report**	Fri 15/12/23
4.6.4	M6	Preliminary design of LhARA MA RF cavity, FFA magnet, diagnostic system, control & feedback systems complete.	Thu 28/03/24
5.2	M7	Preliminary design study of LhARA Building concept design, bulk shielding assessment, mechanical systems integration support concepts, vacuum concepts, power consumption & cooling rquirements complete.	Thu 28/03/24

CDR Milestones 1272-pa1-pm-ppl-0005-v1.0 - ITRF milestones and deliverables 2022-10-18

WBS	ITRF No.	High Level Milestones	Date
4.2.3	M8	First LhARA ion source simulations and experiment on SCAPA completed (LhARA M2.2)	Mon 01/04/24
4.3.3	M9	Progress report of LhARA large diameter plasma experiments and simulations (LhARA M3.2)	Mon 01/04/24
4.3.3	M10	Geant4 simulations of beam energy deposition profile (LhARA M4.1)	Mon 01/04/24
2.2.9	M11	Refined ITRF specifications & designs **(18 month design review).**	Thu 21/03/24
3.6		**D6: Y2Q2 IF progress report**	Fri 29/03/24
2.2.12	M12	Start ITRF CDR write up **(21 month design meeting).**	Thu 20/06/24
3.7		**D7: Y2Q3 IF progress report**	Fri 28/06/30
4.6.14	M13	Finalise Conceptual Design iterations (All LhARA WP6 systems) complete	Wed 24/07/24
4.3.4	M14	Next generation plasma lens test bench design (LhARA M3.3)	Fri 30/08/24
4.4.3	M15	Acoustic sensor array design complete (LhARA M4.2)	Fri 30/08/24
4.5.3	M16	Automated cell dish handling and environmental system design complete (LhARA M5.1), End-station user-community consultation complete (LhARA M5.2), End-station component testing at Birmingham complete (LhARA M5.3), kG,y/s tests at Birmingham complete (LhARA M5.7).	Fri 30/08/24
4.5.6	M17	Specification of LhARA beam monitoring technology complete (LhARA M5.5)	Fri 30/08/24
2.2.16	M18	ITRF CDR Publication	Mon 23/09/24
2.2.17	M19	ITRF CDR phase complete	Mon 30/09/24
3.8		**D8: Y2Q4 IF progress report**	Mon 30/09/24

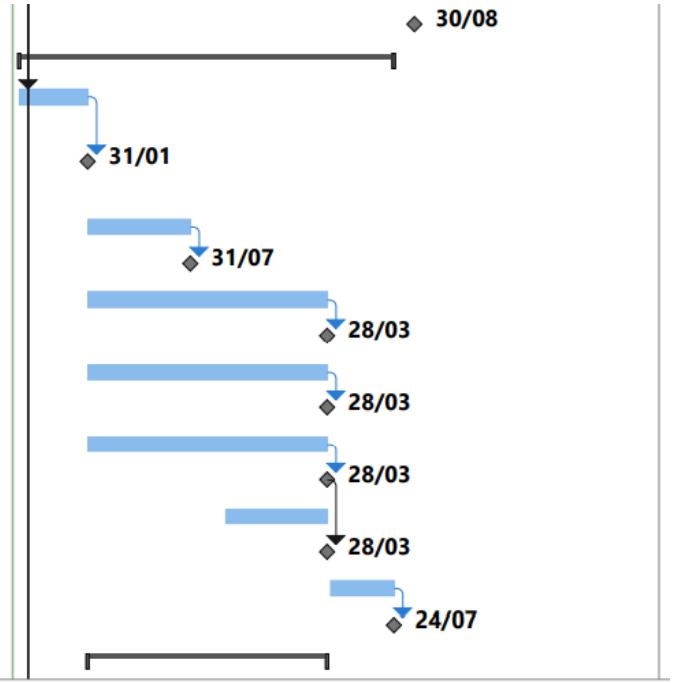
CDR Schedule 1272-pa1-pm-ppl-0004-v0.7 - ITRF CDR schedule 2022-09-20

42	**4**	**WP1 LhARA**	**521 days**	**Mon 03/10/22**	**Mon 30/09/24**
43	**4.1**	**WP1.1 Project Management**	**521 days**	**Mon 03/10/22**	**Mon 30/09/24**
44	4.1.1	Project management of the LhARA project	521 days	Mon 03/10/22	Mon 30/09/24
45	4.1.2	LhARA Collaboration Meeting	0 days	Fri 14/10/22	Fri 14/10/22
46	**4.2**	**WP1.2 Laser-Driven Proton & Ion Source**	**521 days**	**Mon 03/10/22**	**Mon 30/09/24**
47	4.2.1	Sub project management of the WP1.2	521 days	Mon 03/10/22	Mon 30/09/24
48	4.2.2	M5: Prediction of optimised LhARA proton source parameters for 100+ TW laser systems based on hydrodynamic and kinetic simulations complete (LhARA M2.1)	0 days	Mon 02/10/23	Mon 02/10/23
49	4.2.3	M8: First LhARA ion source simulations and experiment on SCAPA completed (LhARA M2.2)	0 days	Mon 01/04/24	Mon 01/04/24
50	**4.3**	**WP1.3 Proton & Ion Capture**	**521 days**	**Mon 03/10/22**	**Mon 30/09/24**
51	4.3.1	Sub project management of the WP1.3	521 days	Mon 03/10/22	Mon 30/09/24
52	4.3.2	M3: Validate LhARA plasma simulations with existing Swansea experimental set-up (LhARA M3.1)	0 days	Mon 03/04/23	Mon 03/04/23
53	4.3.3	M9: Progress report of LhARA large diameter plasma experiments and simulations (LhARA M3.2)	0 days	Mon 01/04/24	Mon 01/04/24
54	4.3.4	M14: Next generation plasma lens test bench design (LhARA M3.3)	0 days	Fri 30/08/24	Fri 30/08/24
55	**4.4**	**WP1.4 Ion-acoustic dose - depositation profiling**	**521 days**	**Mon 03/10/22**	**Mon 30/09/24**
56	4.4.1	Sub project management of the WP1.4	521 days	Mon 03/10/22	Mon 30/09/24
57	4.4.2	M10: Geant4 simulations of beam energy deposition profile (LhARA M4.1)	0 days	Mon 01/04/24	Mon 01/04/24
58	4.4.3	M15: Acoustic sensor array design complete (LhARA M4.2)	0 days	Fri 30/08/24	Fri 30/08/24
59	**4.5**	**WP1.5 Novel, automated end-station development**	**521 days**	**Mon 03/10/22**	**Mon 30/09/24**
60	4.5.1	Sub project management of the WP1.5	521 days	Mon 03/10/22	Mon 30/09/24
61	4.5.2	M16: Automated cell dish handling and environmental system design complete (LhARA M5.1)	0 days	Fri 30/08/24	Fri 30/08/24
62	4.5.3	M16: End-station user-community consultation complete (LhARA M5.2)	0 days	Fri 30/08/24	Fri 30/08/24
63	4.5.4	M16: End-station component testing at Birmingham complete (LhARA M5.3)	0 days	Fri 30/08/24	Fri 30/08/24
64	4.5.5	M16: kG,y/s tests at Birmingham complete (LhARA M5.7)	0 days	Fri 30/08/24	Fri 30/08/24



CDR Schedule 1272-pa1-pm-ppl-0004-v0.7 - ITRF CDR schedule 2022-09-20

65	4.5.6	M17: Specification of LhARA beam monitoring technology complete (LhARA M5.5)	0 days	Fri 30/08/24	Fri 30/08/24
66	**4.6**	**WP1.6 LhARA Facility design & Integration**	**473 days**	**Mon 03/10/22**	**Wed 24/07/24**
67	4.6.1	LhARA lattice optimisation, aperture estimation, parameter list and schematic diagram update	87 days	Mon 03/10/22	Tue 31/01/23
68	4.6.2	M1: LhARA lattice optimisation, aperture estimation, parameter list and schematic diagram update	0 days	Tue 31/01/23	Tue 31/01/23
69	4.6.3	Preliminary design of LhARA mitigating solenoid	129 days	Wed 01/02/23	Mon 31/07/23
70	4.6.4	M6: Preliminary design of LhARA mitigating solenoid complete	0 days	Mon 31/07/23	Mon 31/07/23
71	4.6.5	Preliminary design of LhARA MA RF cavity	302 days	Wed 01/02/23	Thu 28/03/24
72	4.6.6	M6: Preliminary design of LhARA MA RF cavity complete	0 days	Thu 28/03/24	Thu 28/03/24
73	4.6.7	Preliminary design of LhARA FFA magnet	302 days	Wed 01/02/23	Thu 28/03/24
74	4.6.8	M6: Preliminary design of LhARA FFA magnet complete	0 days	Thu 28/03/24	Thu 28/03/24
75	4.6.9	Preliminary design of LhARA diagnostic system	302 days	Wed 01/02/23	Thu 28/03/24
76	4.6.10	M6: Preliminary design of LhARA diagnostic system complete	0 days	Thu 28/03/24	Thu 28/03/24
77	4.6.11	Preliminary design of LhARA control and feedback systems	129 days	Mon 02/10/23	Thu 28/03/24
78	4.6.12	M6: Preliminary design of LhARA control and feedback systems complete	0 days	Thu 28/03/24	Thu 28/03/24
79	4.6.13	Finalise Conceptual Design iterations (All LhARA systems)	80 days	Thu 04/04/24	Wed 24/07/24
80	4.6.14	M6: Finalise Conceptual Design iterations (All LhARA systems) complete	0 days	Wed 24/07/24	Wed 24/07/24
81	**5**	**WP2 ITRF Facilities & Costing**	**302 days**	**Wed 01/02/23**	**Thu 28/03/24**



Resources

Staff	Year 1 Fraction	Year 1 £k	Year 2 Fraction	Year 2 £k	Total Fraction	Total £k
BHM Physics						
BHM-Phys-NoOH						
LhARA: Novel end station development	0.20	8.90	0.20	8.90	0.40	17.80
Total	**0.20**	**8.90**	**0.20**	**8.90**	**0.40**	**17.80**
IC NHS HC Trust						
IC-NHS-HC-Trst						
LhARA: Novel end station development	0.20	22.00	0.20	22.00	0.40	44.00
Total	**0.20**	**22.00**	**0.20**	**22.00**	**0.40**	**44.00**
ICR, Radiotherapy and Imaging						
ICR-Stf-1						
LhARA: ionacoustic Imaging	0.05	11.00	0.05	11.00	0.10	22.00
ICR-Stf-2						
LhARA: ionacoustic Imaging	0.05	9.95	0.05	9.95	0.10	19.90
Total	**0.10**	**20.95**	**0.10**	**20.95**	**0.20**	**41.90**
Imperial Physics						
IC-Phys-PDRA-1						
LhARA: Design and integration	0.50	86.81	0.50	86.81	1.00	173.62
IC-Phys-Stf-1						
LhARA: Laser-driven proton and ion source	0.43	73.17	0.50	85.48	0.93	158.66
Total	**0.93**	**159.98**	**1.00**	**172.29**	**1.93**	**332.28**
Lancaster Physics						
Lanc-Phys-PDRA-1						
LhARA: Laser-driven proton and ion source	0.50	60.00	0.50	60.00	1.00	120.00
Lanc-Phys-Stf-1						
LhARA: Laser-driven proton and ion source	0.05	7.50	0.05	7.50	0.10	15.00
Total	**0.55**	**67.50**	**0.55**	**67.50**	**1.10**	**135.00**
Liverpool Physics						
Liv-Phys-PDRA						
LhARA: Novel end station development	0.50	61.50	0.50	61.50	1.00	123.00
Total	**0.50**	**61.50**	**0.50**	**61.50**	**1.00**	**123.00**
Manchester Physics						
Man-Phys-Stf-1						
LhARA: Proton and ion capture	0.10	20.75	0.10	20.75	0.20	41.50
Total	**0.10**	**20.75**	**0.10**	**20.75**	**0.20**	**41.50**
Queen's Physics						
Qns-Phys-Stf-1						
LhARA: Laser-driven proton and ion source	0.05	6.50	0.05	6.50	0.10	13.00
Total	**0.05**	**6.50**	**0.05**	**6.50**	**0.10**	**13.00**

Resources

STFC Technical							
	Controls specification						
		LhARA: Design and integration	0.05	5.00	0.25	25.00	0.30	30.00
	Electrical engineering design specification						
		LhARA: Design and integration	0.05	5.00	0.55	55.00	0.60	60.00
	Mechanical engineering design specification						
		LhARA: Design and integration	0.50	50.00	0.80	80.00	1.30	130.00
	Radiation Protection Advisor						
		LhARA: Design and integration	0.03	2.50	0.08	7.50	0.10	10.00
	STFC WP management						
		LhARA: Design and integration	0.20	20.00	0.25	25.00	0.45	45.00
	Technical services specification						
		LhARA: Design and integration	0.00	0.00	0.40	40.00	0.40	40.00
	Vacuum specification						
		LhARA: Design and integration	0.00	0.00	0.20	20.00	0.20	20.00
Total			**0.83**	**82.50**	**2.53**	**252.50**	**3.35**	**335.00**
STFC-PPD							
	STFC-PPD-Stf-1						
		LhARA: ionacoustic Imaging	0.04	6.00	0.04	6.00	0.08	12.00
Total			**0.04**	**6.00**	**0.04**	**6.00**	**0.08**	**12.00**
Strathclyde Physics							
	Strathclyde-Phys-PDRA-1						
		LhARA: Laser-driven proton and ion source	0.50	61.50	0.50	61.50	1.00	123.00
	Strathclyde-Phys-Stf-1						
		LhARA: LhARA Project Management	0.50	80.00	0.50	80.00	1.00	160.00
	Strathclyde-Phys-Stf-2						
		LhARA: Laser-driven proton and ion source	0.10	13.50	0.10	13.50	0.20	27.00
Total			**1.10**	**155.00**	**1.10**	**155.00**	**2.20**	**310.00**
Swansea Physics							
	Swns-Phys-PDRA-1						
		LhARA: Proton and ion capture	1.00	107.70	1.00	107.70	2.00	215.40
	Swns-Phys-Stf-1						
		LhARA: Proton and ion capture	0.10	18.89	0.10	18.89	0.20	37.78
Total			**1.10**	**126.59**	**1.10**	**126.59**	**2.20**	**253.18**
UCL, Biomedical Engineering							
	UCL-Stf-1						
		LhARA: ionacoustic Imaging	0.05	8.75	0.05	8.75	0.10	17.50
Total			**0.05**	**8.75**	**0.05**	**8.75**	**0.10**	**17.50**
Grand total			***6.24***	***834.42***	***8.02***	***1016.73***	***14.26***	***1851.15***

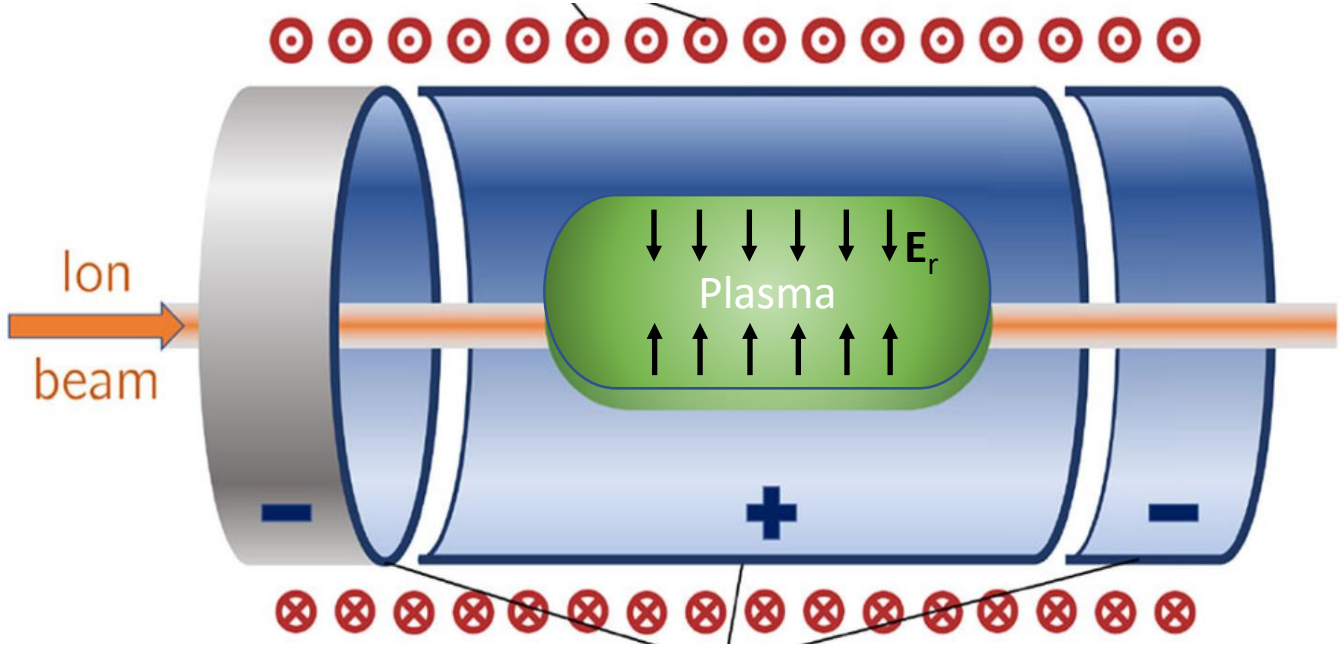
Resources

• ICL	K Long, J Pasternak, Z Najmudin,
• U.Strath	P McKenna
• STFC	B Bingham
• U.Swansea	M Charlton, S Erikson + Med Phys
• U.Man	T Price
• ICR	J Bamber, E Harris
• UCL	B Cox

Risk Register

	Number	WP Number	Name	Description	Likelihood	Impact	Score	Mitigation	Mitigated Likelihood	Mitigated Impact	Mitigated score
WP1	**1**	1.5	Resources	Insufficient resources secured to deliver the project.	**5**	**4**	**20**	Pursue additional sources of funds.	**4**	**4**	**16**
WP1	**2**	1.3	Performance specification parameters	Inadequate ion beam parameters to meet the Physics and Biolology requirements.	**3**	**5**	**15**	The project consortium includes the required experts to improve performance and adapt requirements to maximise convergence of capability and need.	**2**	**5**	**10**
All	**3**	9	Key specialist staff	Availability of key specialist staff critical to project.	**4**	**5**	**20**	Identify potential single point failure risks, apply cover and succession planning where appropriate.	**2**	**5**	**10**
WP2	**4**	2.7	Source output	Unable to deliver desired beam.	**3**	**4**	**12**	Investigate experimental techniques to increase yield	**2**	**2**	**4**
WP2	**5**	2.1	Laser Access	Laser schedule does not allow sufficient access.	**3**	**4**	**12**	Apply for access to other,similar, laser systems e.g Gemini	**2**	**3**	**6**
WP3	**6**		Plasma Density	A low density will result in too long a focal length (& beamline)	**4**	**4**	**16**	Expert experimental design coupled with established and novel mitigation measures	**4**	**3**	**12**
WP4	**7**	4.1	Low acoustic signal	Insufficient acoustic signal to noise ratio.	**3**	**5**	**15**	Employ range of established techniques. Adaptively trade dose-map resolution for enhanced signal	**3**	**3**	**9**
WP6	**8**	6.6	Facility Integration	Delayed start/insufficient early resource.	**3**	**5**	**15**	Prioritise integration work package	**1**	**4**	**4**
WP5	**9**	5.1	End Station Specification	End station specification does not clearly specify requirements.	**5**	**5**	**25**	Early progress review, input from system designers to user consultation exercise	**1**	**5**	**5**

Why Gabor Lenses



- Power consumption
  - B reduced by factor of 5-10.
  - Equivalent first solenoid as focussing element ~ 5T weight, 150-200kW.
- Electrostatic focussing compared to magnetic
  - Force proportional to q compared to qv x B
    - Heavier particles will have lower velocity, require higher solenoid field
  - Gabor lens has orthogonal E and B fields and so acts as a Wien filter
    - select for particle velocity
    - used as part of the transmission line particle selection.
- Achievable – Swansea/Manchester demonstrated capability in AWAKE.


Imperial College London
ICR The Institute of Cancer Research
Medical Research Council
Oxford Institute for Radiation Oncology
University of Oxford
John Adams Institute for Accelerator Science
LhARA
Laser-hybrid Accelerator for Radiobiological Applications
CCAP
Centre for the Clinical Application of Particles
Imperial College Academic Health Science Centre
Cancer Research UK
Imperial Centre
NHS
Imperial College Healthcare NHS Trust
The University of Manchester
University of Birmingham
University of Liverpool
NHS University Hospitals Birmingham NHS Foundation Trust
NHS The Clatterbridge Cancer Centre NHS Foundation Trust
NHS The Christie NHS Foundation Trust
institut Curie
Queen's University Belfast
Swansea University Prifysgol Abertawe
UCL Medical Physics & Biomedical Engineering
University
Clinical
Accelerator
Industry
Laboratory
Partners
Netherlands Cancer Institute
Antoni van Leeuwenhoek
Hampton University Proton Therapy Institute
Fighting Cancer, Saving Lives
University of Strathclyde Glasgow
Department of Physics
Royal Holloway University of London
Lancaster University
UKRI Science and Technology Facilities Council
ASTeC
Daresbury Laboratory
Particle Physics Department
ISIS Neutron and Muon Source
CLF central laser facility
University of Birmingham
Cyclotron Facility
Positron Imaging Centre
INFN Catania
The Cockcroft Institute of Accelerator Science and Technology
CERN
Corerain 鲲云科技
LEO Cancer Care
Maxeler Technologies Maximum Performance Computing
The Rosalind Franklin Institute
NPL National Physical Laboratory