

## LhARA in-vitro facility parameter list

This document defines the parameters of the LARA facility being studied within the CCAP. The document will be re-issued as required.

Parameter	Value or range	Unit	Comment
<b>Laser driven proton and ion source</b>		Contact: O. Ettlinger and Z. Najmudin	
Laser power	~ 30	TW	
Laser Energy	1	J	
Laser pulse length	30	fs	
Laser rep. rate	10	Hz	
Proton energy	15	MeV	
Proton energy spread	100	%	Due to sheath acceleration mechanism chosen for reliability
Proton beam divergence	~ 30	Degrees	
Contaminant radiation	-	-	Electrons, Carbon, Oxygen, Neutrons, X-rays
<b>Proton and ion capture</b>		Contact: J. Pozimski and C. Whyte	
Gabor lens effective length	0.857	m	
Gabor lens length (end-flange to end-flange)	1.157	m	
Gabor lens cathode radius	0.0365	m	
Gabor lens voltage	65	kV	
Gabor lens electron charge density	$10^{16}$	???	
Number of lenses	3		
Number of rebunching cavities	1		
Number of collimators	1		
Alternative technology: solenoid length	1.157	m	
Alternative technology: solenoid max field strength	0.92	T	
<b>Stage 1 beam transport</b>		Contact: J. Pasternak and W. Shields	
Number of Gabor lenses	2		same parameters as in the capture section
Number of quadrupoles	6		
Number of bending magnets	2		
Arc bending angle	90	Degrees	

Bending field	TBC	T	
Number of collimators	1		momentum collimation
Number of bunching cavities	1		
Vertical elevation of the arc	2.5	m	TBC
Alternative technology: solenoid length	1.157	m	
Alternative technology: solenoid max field strength	1.4	T	
Vacuum window	0.075	mm	
<b>Stage 2 beam transport</b>		Contact: J. Pasternak and W. Shields	
Transport line from Stage 1			6 quads and 4 dipoles (TBD)
FFA: Machine type			single spiral scaling FFA
FFA: Extraction energy	20-127	MeV	
FFA: Number of cells	10		
FFA: Orbit $R_{min}$	2.92	m	
FFA: Orbit $R_{max}$	3.49	m	
FFA: External R	4	m	TBC
FFA: Number of RF cavities	2		
FFA: RF frequency	1.46-6.48	MHz	TBC
FFA: RF voltage		kV	TBD
FFA: spiral angle	47.64	Degrees	
FFA: Max B field	1.4	T	
FFA: k	5.19		
FFA: Magnet packing factor	0.34		
FFA: Magnet gap	0.04	m	TBC
FFA: Number of kickers	2		parameters TBD
FFA: Number of septa	2		parameters TBD
FFA: Total power consumption	TBD		
Transport line to the in-vitro and in-vivo end stations			TBD
Vacuum window	0.075	mm	
<b>In vitro Biological end stations</b>		Contact: Johnathan Hughes and J. Parsons	
Maximum input beam diameter	1-3	cm	
Input beam energy spread	< 2	%	
Input beam uniformity	< 5	%	
Scintillating fibre layer	0.25	mm	
Air gap	5	mm	

Sample container base	1.15	mm	
Cell layer	0.03	mm	
Cell nutrient solution	15	mm	
Number of end stations	2		
<b>In vivo Biological end station</b>		Contact: Johnathan Hughes and J. Parsons	
Maximum input beam diameter	1-3	cm	
Input beam energy spread	< 2	%	
Input beam uniformity	< 5	%	
Spot-scanning parameters			

Table 1: Table of parameters of the LARA in-vitro facility.

### Version history

28Nov19 A. Kurup Version 1 First version, defines the LhARA baseline design.  
30Oct18 K. Long Draft 0 Zeroth draft for discussion.