

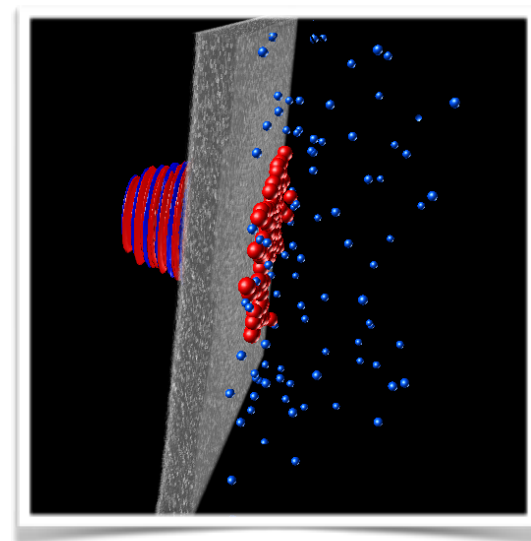
LhARA laser-driven proton and ion source: overview

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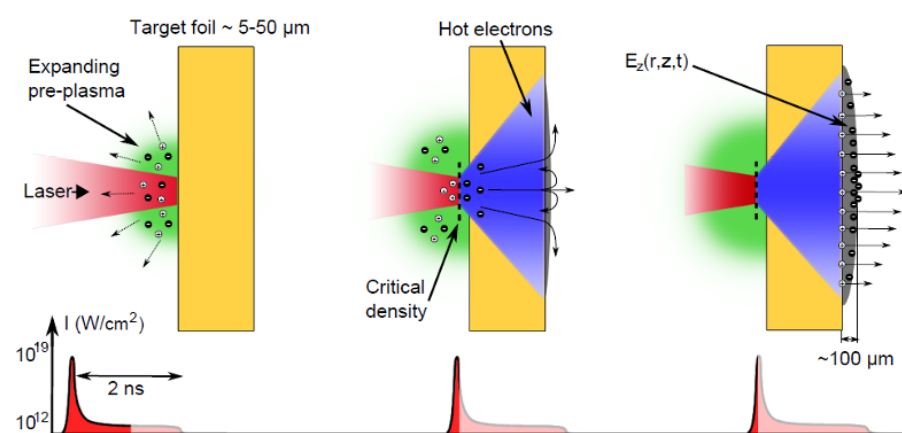
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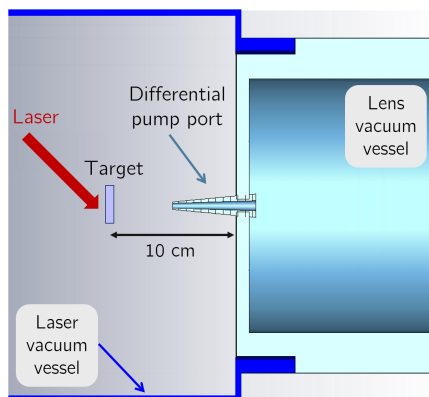


Source: Target Normal Sheath Acceleration



- ❖ Ion spectral characteristics depend on fast electron temperature, density and total number
- ❖ Ion spatial characteristics depend on transport physics defined by material, target properties and self-generated fields
- ❖ Everything is sensitive to input laser and plasma parameters

Interface between source and first Gabor lens: a conical nozzle is designed to absorb low-energy particles from the source



Initial design parameters of the nozzle*

Distance from target	[cm]	5
Length	[cm]	5
Entrance aperture radius	[mm]	2.0
Exit aperture radius	[mm]	2.87

*Parameters will be updated after detailed simulation and experiment campaigns

Laser specs will be better defined after R&D

Initial laser parameters

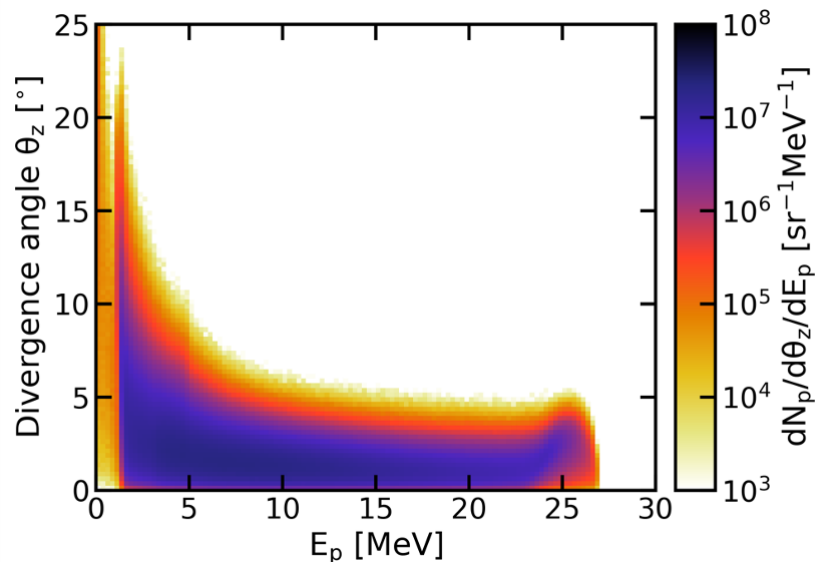
P	[TW]	100
τ	[fs]	25
rep. rate	[Hz]	10
contrast		10^{10}

For higher flexibility
“off-shelf” alternatives: 250 or 500 TW

Need high-rep. rate target

To be evaluated

Beam parameters at the exit of the source: ensuring required number of protons at 15 MeV is the challenge



Goal:
 $\sim 10^9$ protons @ 15 MeV \pm 1%
 $\sim 10^8$ carbon ions @ 4 MeV/u*
 at 10 Hz

Initial tests at 1 Hz
 Ramp up to 5 Hz in the 5-years programme

*R&D required

Milestones for our 2-year programme

- ❖ 2D/3D hydro + PIC simulations to identify key laser parameters [month 12] and optimise proton/heavier ion acceleration [month 24]
- ❖ Design adequate proton/heavy ion and laser diagnostics [month 18]
- ❖ Proof-of-concept experiments at 1 Hz on SCAPA [month 24]
- ❖ Quantification of the impact of debris at high-rep. rate [month 24]
- ❖ Preliminary advanced targeted study [month 19]