WS101-2:

Ion acceleration at the Intense Laser Irradiation Laboratory:

from exploration to exploitation

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The development of ion acceleration techniques based on ultra-intense lasers has been advancing rapidly due to the dramatic progress of laser systems capable of delivering increasingly higher power laser pulses. Based on these developments, laser-driven acceleration is now moving from pure scientific exploration to applications. In this context, the primary accelerating process known as Target Normal Sheath Acceleration (TNSA) represents a robust mechanism to accelerate light ions from laser interaction with thin foil targets [1].

Here, an overview is given about the ion acceleration activities ongoing at the Intense Laser Irradiation Laboratory within the TNSA regime [2].

Specifically, the activity with a 200 TW laser aims at establishing a beam-line of > 10 MeV protons coupled with a beam transport line that will provide an advanced test facility for the development and exploitation of laser-driven ion sources [3].

In parallel, a 10 TW laser beam-line is designed to serve as a practical platform for the assessment and development of a compact few MeV proton beam-line to perform Particle Induces X-ray Emission (PIXE) in *ambient air*, and to produce single-dose specific amounts of radioactive isotopes for biomedical imaging within suitably devised integrated high-yield microfluidic-based setups.

A description of the main components is given, including the laser, the beam transport lines, the interaction chamber, and the diagnostics. A review of the main results obtained so far is reported, including details of the laser-plasma interaction and ion beam characterization.

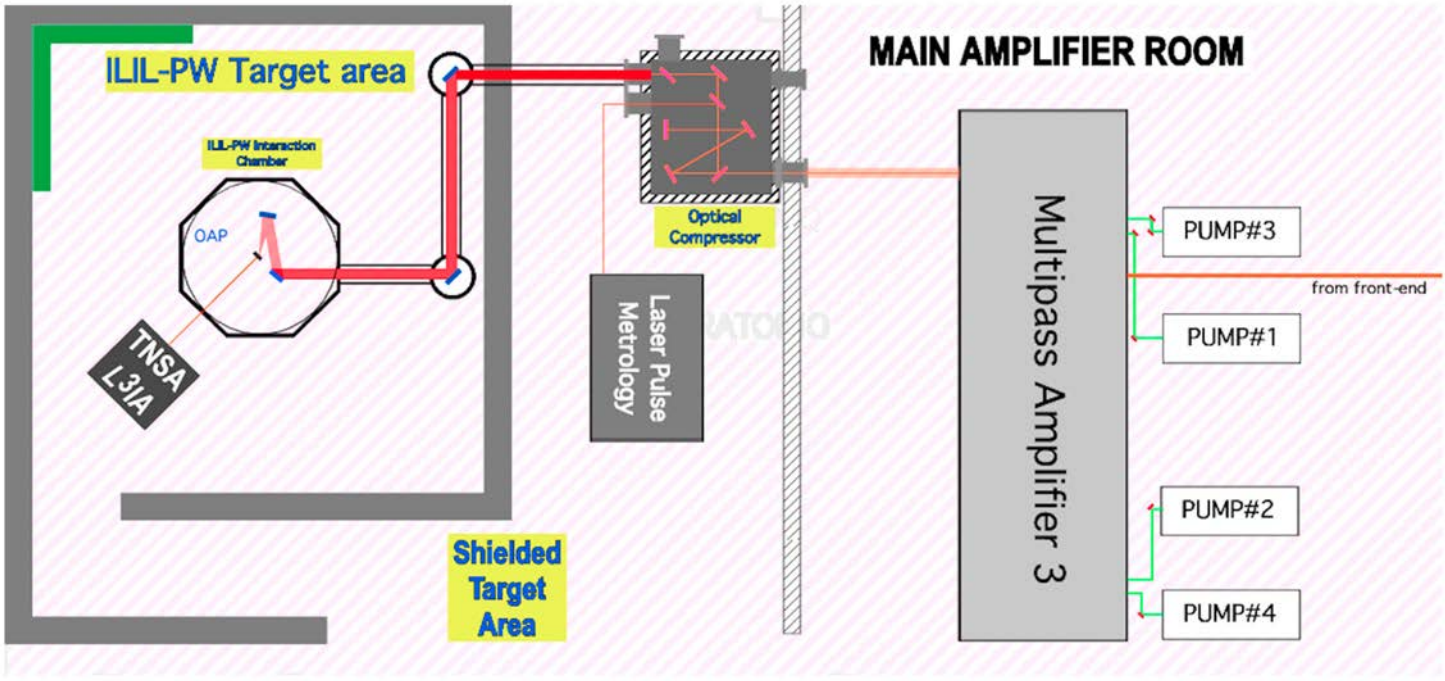

Figure 1: Lay-out of ILIL-PW system comprising the main multi-pass amplifier, compressor, and target area [2].

[1] R.A. Snavely, Intense high-energy proton beams from petawatt-laser irradiation of solids, Phys. Rev. Lett. **85**, (2000) 2945.

[2] L.A. Gizzi *et al.*, A New Line for Laser-Driven Light Ions Acceleration and Related TNSA Studies, Appl. Sci. **2017** (2017) 984.

[3] L.A. Gizzi *et al.*, Light Ion Accelerating Line (L3IA): Test experiment at ILIL-PW, Nuclear Inst. and Methods in Physics Research **909** (2018) 160.