4th Asia-Pacific Conference on Plasma Physics, 26-31Oct, 2020, Remote e-conference

LMJ & PETAL Status and Recent Experiments

Patrick RENAUDIN[1]
[1]CEA, DAM-Ile-de-France, Bruyères-le-Châtel, France
e-mail (speaker): patrick.renaudin@cea.fr

The Laser Megajoule (LMJ) facility, developed by the CEA is based on 176 Nd:glass laser beams focused on a micro-target positioned inside a 10-meter diameter spherical chamber. Since the operational commissioning of the LMJ in October 2014, seven bundles of 56 beams have been commissioned, alowing to achieve several plasma experiments for the Simulation Program. The installation of new bundles is continuing, simultaneously to plasma experiments. Six experimental configurations have been defined during the ramp-up of LMJ till the completion of the facility with 176 beams and more than 30 diagnostics. This gradual phase permit to explore some of the experimental topics of the Simulation program: hohlraum energetics, radiation transport, basic science, implosion hydrodynamics, hydrodynamic instabilities, and fusion studies. To complete the experimental capabilities of LMJ, a PW beam, PETAL, has been added to the LMJ's beams, offering a combination of a very high intensity multi-petawatt beam, synchronized with the nanosecond beams of the LMJ.

The PETAL project consists of one short-pulse (0.5–10 ps) ultra-high-power (1–7 PW), high-energy beam (1–3.5 kJ) to the LMJ facility. PETAL is based on the chirped pulse amplification technique combined with optical parametric amplification. Further, it takes the benefits of the laser developments made for the high-energy LMJ facility allowing it to reach the kilojoules level. The PETAL amplifier section has the same architecture as the LIL/LMJ amplifier section using a single 37×37 cm^2 beam. The compressor stage used a segmented mirror in order to divide the initial beam into 4 subapertures which are independently compressed. These sub-apertures are coherently added using the segmented mirror with three interferometric displacements. The PETAL performances until compressor were improved in 2016 (compression till 570 fs) with an upgraded spatial uniformity and a better filling of sub-aperture of the beam. With these improvements a 1.8 PW beam is easily reachable. This combination expands the LMJ experimental field for HEDP.

A better characterization was obtained with the activation of new diagnostics: the energy contrast is 10^{-3} and power contrast is 10^{-6} 200 ps before the pulse. Improvements are going on. LMJ-PETAL is open to the academic communities for 20%–30% of the operating time; the first experiments have been performed in 2017.

References
J.-L. Miquel and E. Prene, Nucl. Fusion **59**, 032005 (2019).
M. Nicolaizeau et al., Proc. SPIE 10898, High Power Lasers for Fusion Research V, 1089802 (4 March 2019); doi: 10.1117/12.2507193