

Call for proposals for experiments on the LMJ-PETAL laser facility from the Academic Community

ILP (Institut Lasers et Plasmas), CEA (Commissariat à l’Energie Atomique et aux Energies Alternatives) and Région Aquitaine Limousin Poitou Charentes invite research groups from the Academic Community to submit proposal for experiments to be performed on the LMJ/PETAL laser facility in 2019.

Context:

The LMJ-PETAL laser facility operated by CEA on the site of CESTA at Le Barp near Bordeaux is open for 20% of the facility time to Academic Access from European research groups.

Topics:

Researchers may apply for time on LMJ-PETAL to perform experiments in any area of science accessible on such facility and in particular in the 4 following topics:

- 1) Study of physics of direct drive approach to Inertial Confinement Fusion for the production of energy, including shock ignition and fast ignition.
- 2) High Energy Density Physics, including studies on matter in extreme pressure conditions.
- 3) Laboratory astrophysics, including nuclear physics in plasma environment.
- 4) High Energy Physics.

The ILP (Institut Lasers et Plasmas), which federates the French research groups working on the physics of laser produced plasmas, has taken the initiative of organizing several working groups in order to define the “Scientific Case” for Academic research on LMJ-PETAL. This has been finalized in 2014 and is available at the address:

<http://www-lmj.cea.fr/docs/2015/Scientific-Case-LMJ-PETAL-v4.pdf>

Submitted proposals will be judged on the basis of excellence in science, taking into account their and feasibility and their coherence with the priorities fixed by the scientific case.

Academic Access:

Experiments will be approved on a two-year basis. Selected experiments will be given a few laser shots in the first year, intended to demonstrate the feasibility of the experiment and debug any possible problems related to target design and diagnostics. On the basis of the results of the campaign of the first year, and subject to peer-review, more laser shots will be assigned on the second year.

We expect to select 2 or 3 successful proposals for 2019 each with a number of shots typically limited to 3-4.

Successful applicants will be partnered with a facility liaison scientist who will help match the experimental goals with the facility's capabilities, and facilitate the fielding of experiments on LMJ-PETAL.

Direct financial support for experiments is not available. Successful applicants will need to use the standard diagnostics provided by the facility and to be able to independently support target fabrication. They will also need to pay for their stay and travels.

Proposals will be judged on their scientific merit, technical achievability, and coherence with the "Scientific Case". The expected results of the experiment must be of significant interest.

The solicitation is open to international consortia of scientists from academic community. In all case, the Principal Investigator (PI) must be a scientist from an Academic Institution within the European Union. No proposals having a direct relevance for defense issues can be submitted.

All researchers involved in LMJ-PETAL experiments will be required to follow the policies and procedures jointly established by CEA and ILP regarding site access, computer use, and related topics.

Applicants are free to submit as many applications as they wish. A separate proposal must be submitted for each proposed campaign.

The Facility:

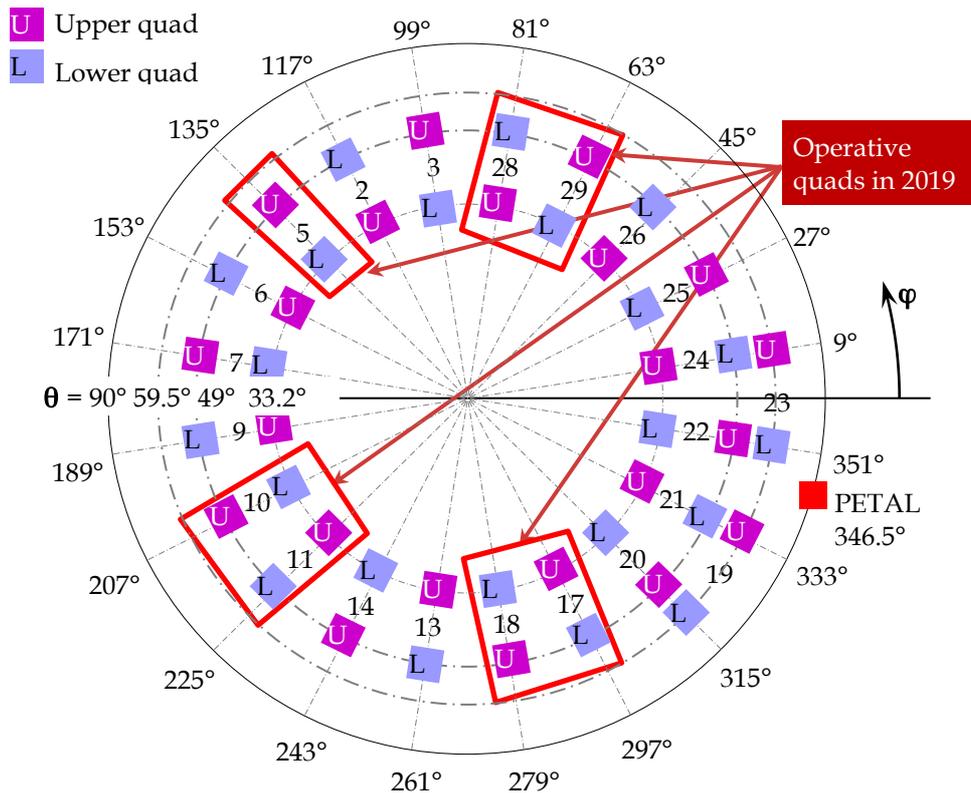
LMJ (Laser Megajoule), developed by the CEA, is under construction at the CEA/CESTA site ([Centre d'Etudes Scientifiques et Techniques d'Aquitaine](#)). It will include 176 beams and deliver 1.3 MJ of 0.35 μm light on targets. LMJ is designed to provide the experimental capabilities to study High Energy Density Physics (HEDP), and will be a keystone of the French Simulation Program.

PETAL (PETawatt Aquitaine Laser) is the short-pulse high-intensity companion of LMJ. PETAL has been funded by the Region Aquitaine, the French Ministry of Research and the European Union. The Region is the contracting owner of the PETAL facility, the CEA is the project manager and the prime contractor of PETAL, and the technical and scientific assistance is provided by the ILP. PETAL is also part of the "Pole de compétitivité" «Route des lasers» (one of the French "excellence clusters").

PETAL is a short-pulse PETAL (500 fs to 10 ps) ultra-high-power, high-energy beam (3.5 kJ compressed energy, limited to 1 kJ on target in the first years of operation).

THE CONFIGURATION of the LMJ/PETAL facility available for Academic experiments in 2019 will include 14 Quad, each composed of 4 laser beams each delivering a typical energy of **3 kJ**.

The Irradiation geometry of LMJ quads and PETAL beam is shown in the figure. The operative quads at the beginning of 2019 are indicated in red (Bundles # 5, 10, 11, 17, 18, 28 and 29). Typical focal spots will be a few hundreds μm in diameter.



PETAL will come in the equatorial plane with respect to LMJ beams and its initial energy on target will be limited to 1 kJ in 0.5 ps (due to damage threshold of the mirrors used for the final beam delivering). For more details, see the “User guide” (see link below).

DIAGNOSTICS: Several diagnostics will be available for first Academic experiments in 2019. These will include:

DIAGNOSTICS developed within the PETAL+ project. The PETAL+ project is an “Equipex” funded by ANR (the French national Agency for support to Research) and managed by the University of Bordeaux. Under this project, research groups from the French Academic Community (Universities, CNRS) and from CEA have collaborated to develop several diagnostics tools:

- **A radiography tool:** A box installed close to the LMJ chamber centre, which will contain a stack of RCF films (or IPs) separated by different filters to provide the plasma radiography at different proton energies;
- **SEPAGE:** A two-channel electron, ion and proton spectrometer, corresponding to low- and high- energy ranges (response [0.1-20] MeV and [10-150] MeV), based on Thomson parabolas for ions/protons discrimination and energy spectra measurements;
- **SESAME:** A set of two identical magnetic spectrometers attached to the LMJ chamber wall to detect both protons and electrons (above 4-5 MeV) to determine the angular distribution of the charged particles from the PETAL target, one at 0° and one at 40° with respect to the PETAL axis.
- **SPECTIX:** A two-channel hard photon spectrometer based on a Cauchois-type transmission optics with: Energy range: 6 to ~ 100 keV, Resolving power: ≥ 300

(except for the lowest energies in the range), Signal dynamics: 10^{10} to 10^{13} photons/sr

DIAGNOSTICS developed by CEA: Available diagnostics in 2019 will consist of:

- seven hard and soft X-ray imaging systems (30 eV to 15 keV range) with a 15 to 150 μ m spatial resolution and a 30 to 120 ps time resolution,
- a diagnostic set for hohlraum temperature measurements including an absolutely calibrated broadband X-ray spectrometer (30 eV - 20 keV), a grating spectrometer, a time resolved imaging system of the emitting area,
- an absolutely calibrated broadband X-ray spectrometer (30 eV - 7 keV),
- a time resolved high resolution X-ray spectrometer (1 - 15 keV) coupled to a framing camera,
- an optical diagnostic set dedicated to EOS measurements including 2 VISAR (Velocity Interferometer System for Any Reflector), 2 SBO (Shock Break Out), a pyrometer and a reflectivity measurement,
- a Full Aperture Backscatter System, and a Near Backscatter Imager to measure the power, spectrum, and angular distribution of backscattered light to determine the laser energy balance,
- a neutron pack, to measure neutron yield, ion temperature and neutron bang time.

More details in LMJ-PETAL User Guide available at

<http://www-lmj.cea.fr/en/ForUsers>

and even more directly at

http://www-lmj.cea.fr/docs/2016/LMJ_PETAL_Users_guide_v1.2.pdf

How it works:

This is a two-stage call. **Preliminary Proposals are due by June 30th, 2016.**

The first selection by experts of the SAC-P (International Scientific Advisory Committee of PETAL) will be organized by the Institute Lasers et Plasmas (ILP) in September 2016.

After this pre-selection, the deposit of the full proposals will be asked for December 2016.

The Preliminary Proposal should be no more than four pages long, following the attached template, and will need to include the following information:

1. **Title** (name of proposed experiment)
2. **Scientific discussion:** Describe the purpose for the proposed experiment, the key scientific questions that are addressed, the proposed experimental method (including laser energy and beam configuration), and expected results.
3. **Experimental feasibility:** Describe the degree to which the experiment is uniquely suited to LMJ-PETAL and the feasibility of LMJ-PETAL for conducting the proposed work. Please indicate where related experiments have been and/or will be done on other facilities.
4. **Required capabilities and resources:** Provide a short (approximately one paragraph) estimate of the capabilities and resources required within and external to LMJ-PETAL to execute the experiment, including required diagnostics. Include any additional information on target alignment requirements. More detailed resource information will be requested for those asked to submit full proposals.

In addition to the 4 pages, the proposal should contain all information on the experimental team: Identify the Principal Investigator (PI) and collaborators. Note that the PI has specific responsibilities for governance of data and publications on behalf of the team.

For each individual, list: Full name; Affiliation; E-mail address.

Proposal Review: Proposals will be reviewed by the International Scientific Advisory Committee of PETAL (SAC-P) charged by ILP with the task of review and selection.

For this goal, the SAC-P will be joined by scientists from CEA/DAM in order to judge for the feasibility of the experiments and the compatibility with LMJ-PETAL set-up and the available diagnostics tools.

PI of selected proposals will be invited to submit a full proposal, which will need to include:

- 1) a detailed plan of use of the diagnostics available on LMJ-PETAL,
- 2) a detailed target design, including specification on how the targets will be produced and funded,
- 3) detailed results from numerical simulations showing that the proposed experiment will likely work,
- 4) a clear indication of preliminary experimental steps to be conducted on intermediate laser facilities in order to assure the success of the experimental campaign on LMJ-PETAL.

Due to the limited number of shots available for Academic Research, and to their high cost, experiments on LMJ-PETAL must be considered as the arrival point of experimental campaigns starting on smaller scale laser facilities. It is expected that the basic ideas of the experiments, and their feasibility, be tested on smaller laser facilities before proceeding to experiments on LMJ-PETAL.

Full proposals are expected to be submitted by December 2016 and final selection will take place shortly afterwards.

Between the final approval of the experiment and its realization in 2019, 3 readiness reviews will be conducted in front of a small highly qualified panel jointly appointed by ILP and CEA for each of the selected proposal. Such panel will verify the progress of the proposing consortium towards the realization of the experiment. Whenever no progress is made in terms of providing target design, computer simulations, diagnostics use plan, the panel will give indication to SAC-P and ILP to postpone or cancel the experiment. The number of shots assigned to such experiment will be re-assigned to proposals in a waiting list (after the first readiness review) or to the other successful proposals (after the second and third reviews).

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