THE LMJ POWER CONDITIONING MODULES

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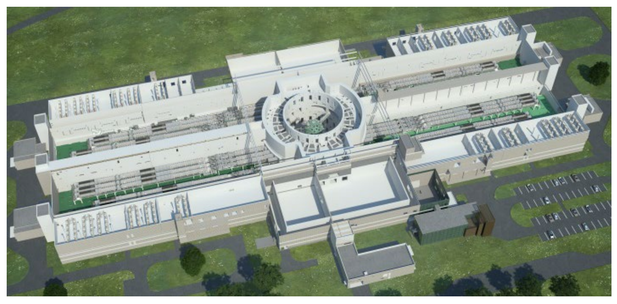
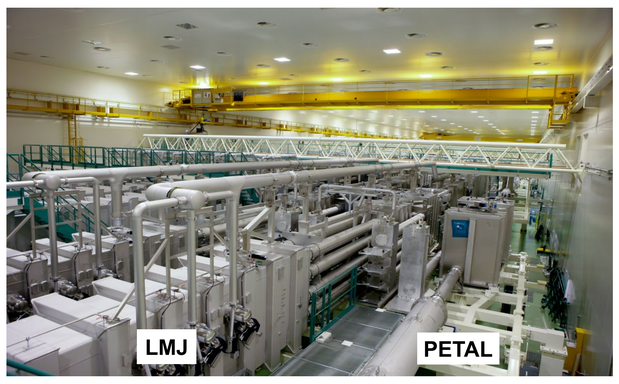
LMJ facility & PETAL laser

The Laser MegaJoule (LMJ) is a **176-beam laser facility** developed by CEA and located near Bordeaux (FRANCE).



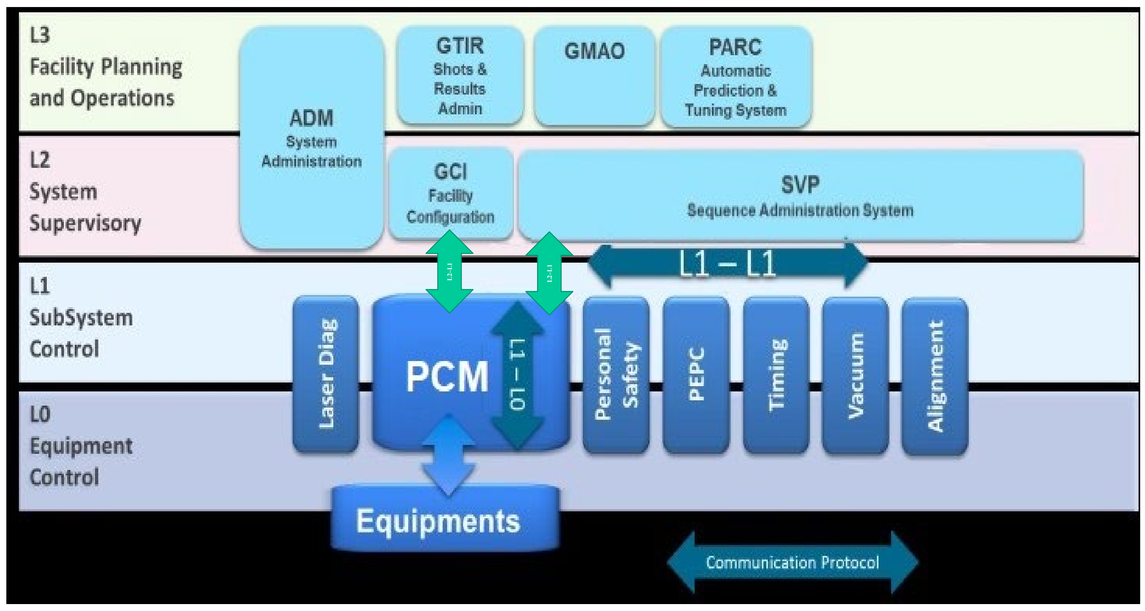


Main features of the LMJ facility:

- **22 bundles of 8 beams**
- **4 laser bays:** 3 bays with 5 bundles + 1 bay with 7 bundles
- **1 PetaWatt laser line** : a high energy multi-Petawatt laser beam with 500 fs to 10 ps short pulse and a few kJ compressed energy.

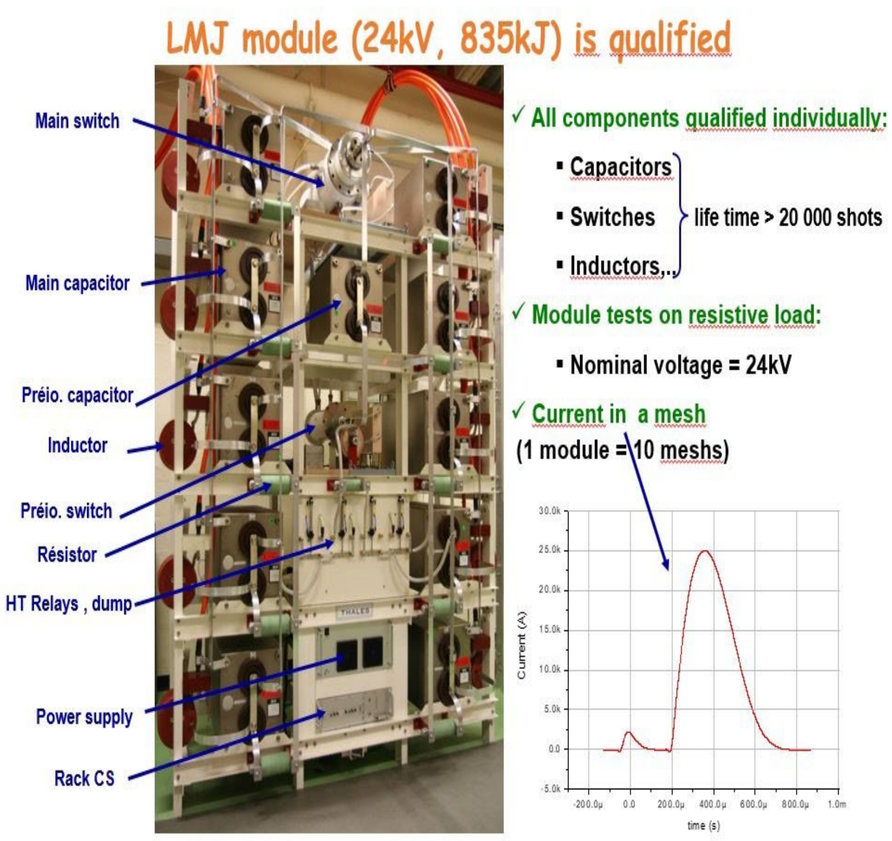
PCM CONTROL SYSTEM

The LMJ facility has a control system which is divided into **4 layers**.



The **L1 and L0 layer** are divided into **12 major subsystems**, corresponding to the main functions of the LMJ beam's control system. The **PCM CS** receive shot parameters from facility Configuration software, called GCI and from sequence administration system, called SVP.

PCM Description

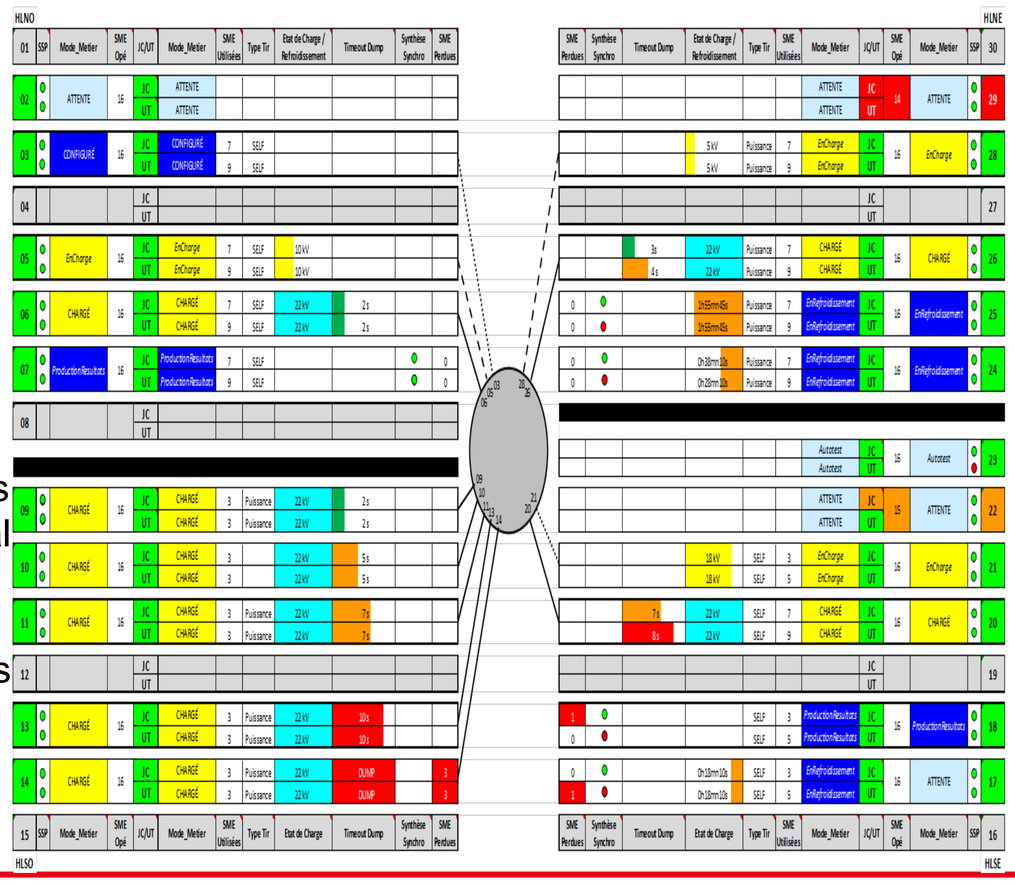


Hardware details :

- 44 L0 bays
- 352 modules
- 3520 capacitors 290µF / 24kV
- 200kms of coaxial cables

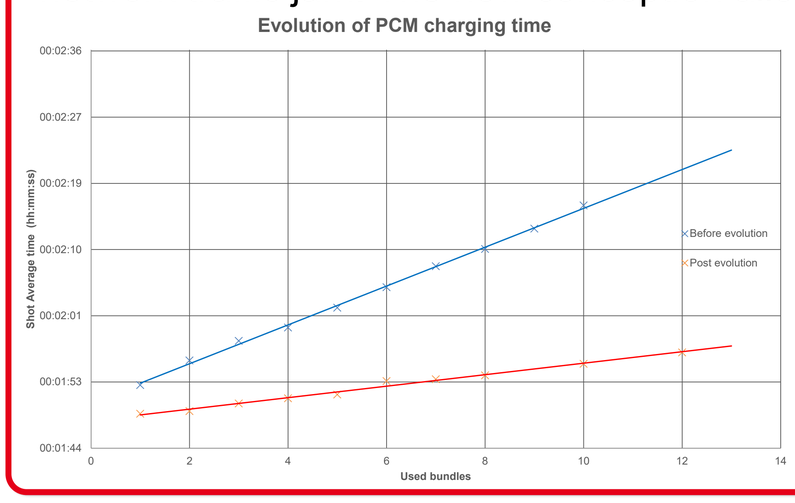
Synthesis PCM CS HMI :

- Geographic positions
- Bundle numbers
- Bundles available or not
- Number of working modules
- Authorization from Personal Safety System
- Kind of shot choice
- Bundle working states during the shot
- Successful shot or DUMP



PCM CS evolution in 2023

Before the 2023 PCM CS upgrade, there was around 2 seconds by bundles of delay between shot Go order and the effective beginning of capacitors charging. This delay comes from the bundle request for configuration parameters (equals for all bundles) on the LMJ server. Because of those requests in the same time for 10 bundles, a network traffic jam had made the shot failed. We had to change the architecture of PCM CS to remove this network traffic jam. The new conception allow us to load in local the configuration parameters and to follow with logs each step of shot sequence. Since this evolution, there is no more traffic jam and we are confident in the shot sequence timing for PCM.



PCM CS next evolution

New "validation sequence" for 2024: to be able to test all the equipments before a LMJ power shot.

Actually for a LMJ shot, to try if the equipments work we do a "Self sequence" however it's done outside the main LMJ shot sequence. That means all the equipments are tuned off at the end of the Self sequence and turned on at the last time before the shot. Sometimes at the upon power-up, the HV power supply or the low level communication are KO.

To be more confident about PCM equipments during the LMJ shot, we will add the "validation sequence" that will realize PCM charge at 3kV to the ground without turn-off the HV power supply for LMJ power shot which follows. It will let the time to the LMJ shot director to decide to stop, to make maintenance operations or to continue the shot.

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