Status of the multi-PW Apollon laser infrastructure and of the first experimental campaigns

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The Apollon laser, currently under construction at Orme des Merisiers, Saclay, France, aims to be among the first multi-PW facility in the world devoted to the study of high intensity laser matter interaction at unprecedented regimes and peak intensities above 2x1022 W/cm2. The final goal of the Apollon laser is the generation of 10 PW pulses corresponding to an energy of 150 J and 15 fs duration at a repetition rate of 1 shot/minute [1,2]. The architecture of the Apollon laser is hybrid, combining a high contrast OPCPA based Front End [3] followed by 5 Ti:Sapphire multipass amplifiers allowing to reach up to 300 J before compression. Apollon provides up to four beam lines (10 PW, 1 PW, 10 TW, uncompressed beam), all generated by the same beam after the last amplifier with the possibility to be combined on the target under different geometries and synchronization configurations. The Apollon facility offers two radio-protected experimental areas: 1) The Long Focus Area (LFA) where mostly gas targets and electron acceleration experiments are realized and 2) the Short Focus Area (SFA) where tight focusing (F#2.5) on solid targets and ion acceleration is the principal objective.

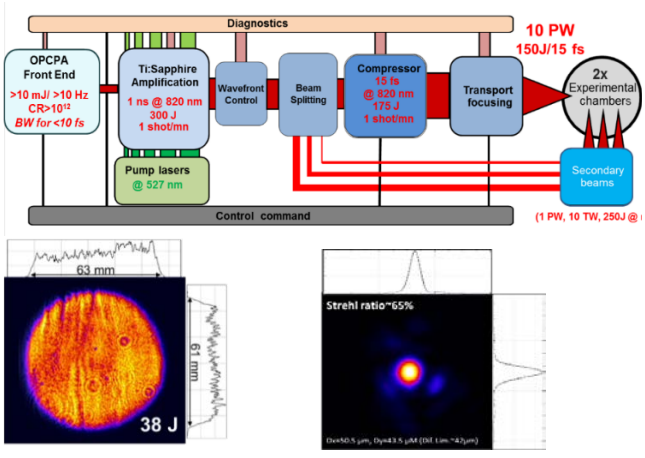

Figure 1: Simplified schematic of the Apollon-10 PW laser (left). Near field energy distribution of the 1 PW beam line (center). Focal spot in the LFA area at full energy shots.

In this work we will provide an overview of the construction progress of the facility emphasizing on the recent commissioning of the 1 PW beam-line of the system [4]. Details will be provided on the obtained performances regarding the pulse contrast, the focal spot quality as well as the overall operational stability of the laser. In a second part we will present a summary of the results of the different experimental campaigns carried out in both experimental areas on the PW level [5]. The objectives of these experiments, realized over the last 2 years, has been various including high energy electron acceleration, electron-positron pair generation, proton acceleration as well as high harmonics generation. In the last part, we present an overview of the mission profile used for the users community experiments and of the planned commissioning of the 10 PW beamline and the first experiments at the multi-PW level in 2023.

References

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