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Overview of some key achievements on the route to IFE

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The EUROfusion ToIFE project, launched in 2014 and gathering 14 European laboratories from 9 different countries, aims at achieving the fundamental understanding required to demonstrate the viability of laser-driven fusion as an alternative road towards sustainable, clean and secure energy source. It hinges on (i) a program of experiments and numerical simulations to understand underlying obstacles to central hot-spot ignition on MJ-scale laser facilities and to reduce uncertainties that input into all inertial fusion ignition schemes [focusing on studies related to the radiative properties of the ablator dopants, to multi-speckle –plasma interaction, to foam-induced imprint smoothing and hydrodynamic instabilities or to ion stopping in plasmas], (ii) a program of experiments and numerical simulations towards demonstration of shock ignition, currently the most promising scheme for fusion energy [including the building of an integrated simulation platform], (iii) a program of numerical simulations and experiments to test the viability of other alternative ignition schemes (electron- and ion-driven fast ignition or impact ignition) [with emphasis on magnetic collimation of electron beams, improvement of the laser-to-ion conversion efficiency thanks to advanced acceleration schemes and demonstration of laser-induced p-B fusion reactions] and (iv) the conceptual design of an Inertial Fusion Energy (IFE) reactor based on the development of key technologies, such as high-repetition-rate laser drivers or innovative materials, for fusion targets or first walls.
Significant results have been achieved so far and part of them, obtained by the French partners, will be discussed here.

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Primary author: Mrs JACQUEMOT, Sylvie (LULI)

Presenter: Mrs JACQUEMOT, Sylvie (LULI)

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