Contribution ID: **18** Type: **not specified**

Laser-Plasma Energetic Particle Production for Aneutronic Nuclear Fusion Experiments

Thursday, 29 September 2016 15:45 (15 minutes)

The main interest in the aneutronic nuclear fusion reactions for energy production concerns the possibility of greatly reducing the problems associated with neutron activation and related requirements for biological shielding, remote handling, and safety. Among the so called "advanced fusion fuels"the proton-Boron fusion reaction seems to be the most attainable from an experimental point of view, due to the relatively high cross section of the process exhibited at the centre of mass kinetic energy of 148 KeV and 580 KeV respectively. An experiment has been performed at CELIA in which a multi-TeraWatt Ti:Sapphire laser interacted at fairly relativistic intensities with different solid targets. The experiment aim was to investigate two fusion processes, p-B and D-D, the first of which aneutronic. Al thin foils were used to produce energetic protons to be addressed to a Boron target, while deuterated-plastic targets were used to induce the D-D fusion reaction. Several diagnostics were activated to monitor the effectiveness of the laser-target interaction, the energy spectrum of the accelerated particles and the release of charged particles related to the activated fusion processes.

Summary

The aim of this laser-plasma acceleration experiment was to investigate on two nuclear fusion processes, p-B and D-D, the first of which aneutronic.

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Session Classification: S5.1: Novel sources: FEL/Laser/Plasma channels