DESCRIPTION OF THE ELECTROMAGNETIC PULSES PRODUCED BY NANOSECOND LASER-PLASMA INTERACTION IN THE ABC LASER BY CONDUCTIVE AND DIELECTRIC PROBES

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Lasers focused on targets at very high power densities produce plasmas accompanied by a broad spectrum of electromagnetic and particle radiation. In particular, transient RF-microwave electromagnetic pulses (EMPs) of high intensity and with large frequency bands. The effects of EMPs are relevant on the behaviour of most of the detectors used for plasma characterization and they can be even damaging for hundreds of nanoseconds from the laser pulse. It is known that target nature, laser regime and intensity affect the EMP features. It is an important issue for the safe operation of all the electronic equipment within the experimental vacuum chamber and nearby, for this reason this is now object of research by many groups around the world. Anyway, to the authors' knowledge there are still very few reported works on measurements of EMPs due to long-pulse lasers. The detection of the single component of the electromagnetic field, is commonly performed by electric or magnetic conductive probes [1-5], and by broadband antennas [6-9]. Target return currents have been measured also by inductive probes [4]. Estimation of one component of the transient magnetic fields in specific time instants have been also performed by detection of Faraday rotation in birefringent crystals, or by proton deflectometry [5].
In this work[i], we report about the measurement of EMPs in experiments performed with the ABC laser in the nanosecond regime, at focused laser intensities of 10^{13}-10^{15} W/cm^2, typical of inertial confinement fusion. We describe experiments and data analysis in time and frequency domain. Detection of the electromagnetic fields has been carried out by dielectric probes, where electric fields induce birefringence because of the Pockels electro-optic effect. This allowed us to measure the different components of the generated electric fields along time in given positions [10]. Results are compared with those from classical broadband antennas. Considerations obtained by analytical and numerical modeling of the electromagnetic fields within the experimental chamber will be also presented.

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