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P1.2013 Numerical simulations of the electromagnetic field shielding in petawatt regime using Finite-Difference Time-Domain method

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The recent progresses made in the development of high intensity lasers open new perspectives of fundamental physics and also impacts applications from laboratory astrophysics and inertial confinement fusion to laser matter interaction in ultra-intense regimes. The interaction of high power laser pulses with a solid target generates intense broadband electromagnetic pulses in a wide frequency regime, from radio frequency to x-rays. In the petwatt regime, these intense laser pulses are expected to be emitted in the Giga to Tera-Hertz domain, being also called Giant Electro-Magnetic Pulses (GEMP) [1].
Starting from the cells response on particular wavelengths and respectively during petawatt irradiation experiments and considering the GEMP spectra generated during real experiments, we had performed 3D numerical simulations to investigate the behavior of different shielding materials by using a scaled configuration setup. The main objective is to compare the performances of these materials at some different frequencies, considered as relevant both for the generated frequencies and for the cell's absorbed wavelengths under the conditions imposed by high energy experiments planned to be performed at CETAL PW facility. The 3D numerical simulations of the electromagnetic field shielding have been made using FiniteDifference Time-Domain (FDTD) method using FullWave, a package of the commercial software RSoft (by Synopsys Optical Solution Group) which solves Maxwell equations. Lately, a plenty of FDTD studies had been elaborated in order to determine the optimum conditions for extreme electric field generation [2-4]. A detailed study concerning the electromagnetic field shielding under petawatt irradiation conditions has been elaborated using different structures both as metallic foil or mesh in order to measure its efficiency in a wide frequency regime (100-4000 MHz). The results obtained by this method will be presented and discussed.

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