Electromagnetic pulses measurement in the fs TW system VEGA II @ CLPU

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When high intense laser beam interacts with solid target a giant electromagnetic pulse (EMP) is generated and it propagates inside and outside the interaction chamber with high level of risk for all the electronic devices and detectors involved in the experiment. In fact, the EMP can reach a maximum electric fields of MV/m and its frequencies can vary from tens of MHz to hundreds of GHz, this wavelength allows a strong resonance effect inside electronics components compromising their performance and in same case producing even the destruction of the device itself.

At the origin of the emission of EMP there is electrons generation and their ejection from target with subsequent charging of the target [1]. This strong polarization of the system target-target holder triggers a big oscillating current between the interaction point and the ground with frequencies of 10's of MHz. In the same time the return current in the proximity of the interaction point onto the target, gives rise to electromagnetic waves with frequencies up to 100's GHz [2-5].

In the present work we describe EMP measurements in the target area at Centro de Laseres Pulsados (CLPU) when the 30 fs, 6 Joules VEGA II laser pulse interact with Al solid target in a 100 um^2 area. We estimated the EMP electric field amplitude and frequency distribution both close to the target (with Moebius loop antenna) and outside the interaction chamber (Semi-log antenna). These results will be taken into account in the upcoming experiments when sensitive electronics and controllers could be placed in the target area, in this way we can reduce as much as possible the risks due to electromagnetic interference (EMI) and we can give new inputs in the implementation of shielding and grounding.
Results from finite element method (FEM) simulation, are finally discussed and compared with experimental outputs.

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