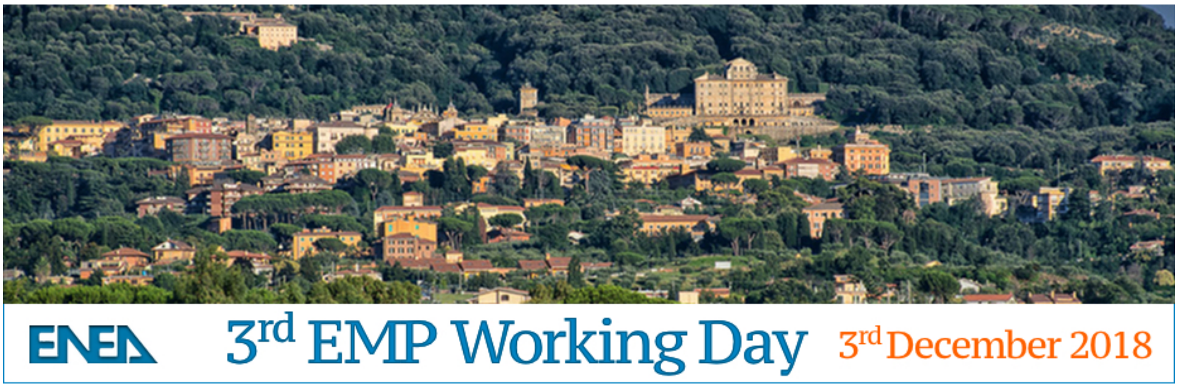

ENEA - Centro Ricerche Frascati, Italy

Book of Abstracts

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Section 1

EMP Generation and effects

EMPs generation and biological influence studies of emitted waves

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High-power laser interaction with materials and particularly with thin metallic films is starting to get more applications not only in fundamental physics studies but also in scientific and (quite soon) medical applications. Thus, particle acceleration using such interactions is becoming more and more an alternative to the classic accelerators due to costs, sizes and even performances in some particular cases. However, there are side- effects which should be taken in consideration, as the possibility of producing strong electromagnetic pulses (EMP), X-ray, and so on. Even if EMP is mostly known as sometimes dangerous for the used devices, in some cases it might become dangerous for peoples as well. If there are some data on the EMP influences on various electrical devices, influences on the leaving organisms are still scarce and it might have to be considered while the laser power will further increase in the experiments and future applications.

Using PW laser facility from CETAL (NILPRP, Magurele) several metallic materials were irradiated with 800 nm (+/- 25 nm) wavelengths, short (35 fs) pulse duration and several joules energy per pulse. Emitted spectra and corresponding intensities were monitored using wide-band antennas and high-frequency oscilloscopes. Using some generators, some influences on living cells for "long time' irradiation from such experimental 'side-effects' were investigated and are presented together with some interpretation of their generation and possible absorption mechanisms. Some discussion on the generation mechanisms together with the possible protection measures are also discussed.

Development of a low EMP proton source

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The targets that are used to produce high-energy protons with ultra-high intensity lasers generate a strong electromagnetic pulse (EMP). Several strategies are possible to mitigate that undesired side effect. In a recent publication [1], P. Bradford et al. report significant EMP mitigation by optimizing the material and the shape of the target stalk. They obtained a maximal 4.5 EMP amplitude ratio by using a spiral PTFE stalk instead of a regular stalk. We develop and test a different concept of EMP mitigation for a proton-target called the "birdhouse". It consists in confining the EMP field in a finite volume and in dissipating the trapped electromagnetic energy with an electric resistor. A prototype was tested at the IFPILM institute's 10 TW 50 fs laser facility in Warsaw. The results were recently published [2]. The recorded average EMP mitigation ratio is about 20 for frequencies from 100 MHz to 6 GHz. The EMP mitigation ratio attains the level of 50 in the frequency range of 1 - 2 GHz where microwave emission is maximal. We measured the intensity of proton emission in two directions: along the laser propagation direction and along the edge of the proton beam. We observed that the "birdhouse" induces a two-fold increase of the intensity in the center of the proton beam and a two-fold reduction of the intensity on its edge. We did not observe any modification of the proton beam normalized spectrum. These obtained performances are encouraging but they have to be confirmed on a high-energy laser facility ($>$ 100 J). For these energies, the real challenge for EMP mitigation solutions is to resist to the extremely high voltage between the target and the chamber that induces surface breakdown along the target stalk. By adjusting the "birdhouse" design, the EMP confinement strategy should be a lead to handle such a voltage.

References

[1] P. Bradford, N. C. Woolsey, G. G. Scott, G. Liao, H. Liu, Y. Zhang, B. Zhu, C. Armstrong, S. Astbury, C. Brenner, P. Brummitt, F. Consoli, I. East, R. Gray, D. Haddock, P. Huggard, P. J. R. Jones, E. Montgomery, I. Musgrave, P. Oliveira, D. R. Rusby, C. Spindloe, B. Summers, E. Zemaityte, Z. Zhang, Y. Li, P. McKenna, and D. Neely, EMP control and characterization on high-power laser systems, High Power Laser Science and Engineering 6, e21 (2018)

[2] J. L. Dubois, P. Rączka, S. Hulin, M. Rosiński, L. Ryć, P. Parys, A. Zaraś-Szydłowska, D. Makaruk, P. Tchórz, J. Badziak, J. Wołowski, J. Ribolzi, and V. Tikhonchuk, Experimental demonstration of an electromagnetic pulse mitigation concept for a laser driven proton source, RSI 89, 103301 (2018)

Generation of strong magnetic fields with lasers: from nano- to picoseconds

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Recent experiments with high intensity lasers are showing possibilities to generate strong magnetic fields exceeding a kiloTesla level. They are promising new studies of laser matter interaction in unexplored domain. However, the physical processes leading to generation of strong quasi-stationary currents exceeding hundreds of kiloAmperes are not sufficiently understood. In this talk we present theoretical models and target setups that can be used for generation of strong magnetic fields on nanosecond and picosecond time scale and several examples of their application in experiments.

Magnetic fields of nanosecond duration are generated in a coil connected to a laser-driven diode, which supplies a quasi-stationary electric current. We present a self-consistent model explaining generation of a strong magnetic field in such a system, which accounts for three major effects controlling the current: space charge neutralization in the diode, plasma magnetization and heating of the coil wire. The model provides the necessary conditions for transporting strongly super-Alfvenic currents in the system. Its validity is confirmed by a comparison with experimental data.

Magnetic fields induced by sub-picosecond laser pulses may exist much longer time than the laser pulse duration. Their origin is in supra-thermal electron ejection from the target or in generation of hot electron vortices. Without confinement, these magnetic fields are emitted in a form of high amplitude electromagnetic pulses presenting danger for diagnostics operation and electronic devices in the experimental chamber. In contrast, while confined within the target structure, these magnetic fields could be used for controlling electron and ion acceleration and guiding. We present a theoretical model of target charging and electromagnetic field generation followed with several examples of its application in experiments.

Effect of EMP on ion trajectory inside of Thomson parabola analyzer

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Interaction of high energy laser pulse with a solid targets causes production of the high intensity electromagnetic pulse (EMP). The voltage of associated with EMP electric fields can reach up to MV/m and strongly influence behavior of charged particles from plasma. In this work we describe the effect of EMP on ion trajectory inside of Thomson parabola analyzer and compare it with antennas measurement.

EMP and emissions from laser plasma interactions

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EMP pulses emitted during laser plasma interactions have been studied experimentally and the scaling dependence on target parameters is becoming better understood (P Bradford et al, HPLSE, 6, E21, 2018) Using a recently developed cryogenic target system, an ultra thin layer of deuterium can be readily deposited as a pure low Z surface layer. By controlling the thickness of the deuterium layer it can act as a probe of the acceleration sheath dynamics. Studies using the Vulcan ps laser showing the dependence of the EMP and the escaping electrons using a series of B-dot and D-dot probes and ancillary diagnostics will be presented.

Sheath field and EMP correlations

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High power laser interactions with solids are associated with the generation of large amounts of intense broadband (up to several GHz) electromagnetic pulses (EMP) driven by the ejection of hot electrons from the target. The transient electromagnetic fields can reach up to several hundreds of kV m-1, which is a major concern for facilities as it causes significant equipment failures for facility systems and experimental diagnostics. We present results from an experimental study which investigated the correlation between the sheath field which drives ion acceleration and EMP, from picosecond laser-target interactions. The measurements show that EMP scales with laser energy whilst also being sensitive to other laser and target parameters. We observed a correlation between EMP energy and the maximum proton energy and the number of protons which indicates a relationship between the driver of the EMP and the electrostatic sheath field.

Section 2

EMP characterization and analysis

Temporal characteristics of laser-produced EMP within region of near-field

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Time-space-frequency analysis of electromagnetic pulses (EMP) generated by a kJ-laser interaction is presented. The correlation between signals received by several loop antennas is investigated to determine spatial variations in the local electromagnetic field within and around the interaction chamber. A fast Fourier transform of antenna signals is performed to resolve the temporal and frequency components ranging from the megahertz to gigahertz.

EMP emission: variation with laser and target parameters at high intensity

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We present experimental data from the VULCAN laser facility that demonstrates how gigahertz EMP can be readily and effectively reduced. Characterization of the EMP was achieved using B-dot and D-dot probes positioned outside of the target chamber, in front and behind the target interaction point. We obtained scalings with laser energy, pulse duration, defocus and pre-pulse delay. We also show that target stalk geometry, material, geodesic path length and foil surface area can all play a significant role in the reduction of EMP. Plastic supports with spiral geometries reduced the measured EMP by over an order of magnitude compared with cylindrical supports made from Al and by a factor of ∼7 compared with plastic cylinders. Furthermore, by switching from metal foils (3×8mm, 100 μm thick Cu) to wire targets (∅=25-100 μm) it is possible to reduce the EMP energy by a factor of ∼10. A combination of electromagnetic wave and 3D particle-in-cell simulations suggest that the efficacy of the modified supports can't be attributed to a change in their induction or classical resistance. We are therefore looking to study the effect of photoionization and charge implantation on return currents in future work.

Detection of EMPs generated in interactions of intense lasers with matter by dielectric and conductive probes

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The measurement of intense electromagnetic fields in the radiofrequency-microwave regime in experiments of laser interaction with matter is a hot topic both in laser-plasma particle-acceleration context and in inertial-confinement-fusion one. Fields up to MV/m intensity are generated in powerful interactions, but their accurate characterization is a very delicate and complex issue, especially when using classical conductive probes. In this work we describe the three-dimensional measurements of these fields by means of electro-optic methods based on Pockels effect, capable to give accurate field characterization in very harsh environments for laser intensities up to the petawatt range. We describe also techniques used to achieve suitable field measurements also by means of classical conductive probes, and we compare in detail pros and cons of the two methodologies [1].

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EMP temporal analysis and propagation

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A time-frequency analysis of EMP data taken on the Vulcan Petawatt is presented. The time-frequency analysis applies a scanning time-window across the data within which the frequencies are resolved with a Fourier transform. As the frequencies of the measured EMP signal range from megahertz to gigahertz applying different scanning window lengths maximises the temporal information obtained, the considerations that need to be taken into account is discussed. Measurements of EMP signal have been taken at different locations simultaneously along the same line of sight within the Vulcan Petawatt interaction chamber. The initial analysis of this data will be presented looking at how the signal changes when it propagates across the chamber.

Characterization of strong electromagnetic pulses generated in high-intensity laser-matter interactions at various laser parameters

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The process of laser-target interaction at high laser energies and high intensities may lead to generation of strong electromagnetic pulses (EMP), with frequencies in the GHz range. There are several physical processes that may result in the generation of EMP, but at present a complete quantitative description of this phenomenon is lacking. An important contribution to this process comes from the electric polarization of the target and the resulting neutralization current [1, 2, 3], but the detailed dynamics of this process is different in the case of fs, ps and ns lasers. Recently the IPPLM team performed experiments on EMP generation at various laser facilities:
1. The IPPLM laser facility (0.4 J, 50 fs), together with the CELIA team (J.-L. Dubois, S. Hulin, V. Tikhonchuk); the aim was primarily to extend the investigations of the electric charge deposition and EMP generation of micrometer foils started in [4] to higher energies on target, in correlation with proton acceleration measurement.
2. The PALS laser facility in Prague (700 J, 300 ps), together with the PALS team (J. Cikhardt, M. Pfeifer, J. Krása, M. Krůs, J. Dostál); the aim was to perform direct measurement of the electric field in correlation with the neutralization current measurement.
3. The Vulcan laser facility at RAL (700 J, 600 fs), together with teams from RAL and Univ. of Strathclyde (D. Carroll, S. Giltrap, D. Neely, R. Wilson, P. McKenna); the aim was to study EMP generation off ultra-thin foil targets in the PW range.
4. The ILIL facility in Pisa (3 J, 35 fs), together with the ILIL team (L. Gizzi, F. Baffigi, L. Labate, P. Koester, F. Brandi, D. Giove, A. Fazzi).
Results from these experiments are summarized and confronted with the results obtained by other research groups. Then an attempt is made to provide some model explaining EMP generation in various regimes.

References

[1] J.-L. Dubois et al., Phys. Rev. E 89, 13102 (2014).

[2] A. Poyé et al., Phys. Rev. E 91, 43106 (2015).

[3] J. Krása et al., Plasma Phys. Control. Fusion 59, 065007 (2017).

[4] P. Rączka et al., Laser Part. Beams 35, 677 (2017).

Section 3

EMP mitigation

EMP mitigation on the LMJ-PETAL facility

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The interaction of a Petawatt laser with a flat target can produce intense electric field [1] which may exceed 1 MV/m. Such a field leads to equipment failures, may damage diagnostics and produce spurious signals in detectors. As part of the PETAL project, we have studied the EMP generation mechanisms. A 3D, multi-physics, simulation chain has been developed. An EMP diagnostic has also been developed and set up inside the LMJ experimental chamber. Mitigation devices have been developed and tested on different campaigns, in several facilities, at low and high laser energy, in order to prepare the first PETAL experiments.

A mechanism of the EMP generation has been identified [2, 3]. The proof of concept of this scheme is a major scientific breakthrough which has allowed us to develop a multi-physics simulation chain. The simulation is performed in four subsequent steps with a suite of numerical codes. First, the effect of the laser pre-pulse on the solid target is simulated with a hydrodynamic code developed at CEA/DIF. Second, the main laser-plasma interaction is simulated with a particle-in-cell (PIC) code developed at CEA/DIF. The electrons are propagated inside the target by a Monte-Carlo code. Finally the escape of electrons from the target and their propagation to the laser chamber is simulated by another PIC code developed at CEA/CESTA. This simulation chain has been validated on different experimental campaigns. Magnetic field measurements have been compared to numerical results.

New target holders have been designed by numerical simulations. They are composed of a glass capillary with inside resistive gel. One end of this capillary is fixed to the target and the other end is fixed on a conducting cylinder surrounded by a magnetic material which operates as an inductance. The goal of this new holder is to mitigate the discharge current produced and to limit the generation of the electromagnetic radiation. These devices have been tested, first, at low laser energy (0.1 J), than, at higher energy (80 J) on the POPCORN campaign at the LULI2000 facility and finally on the first PETAL experiments up to 400 J. For these last campaigns, the results show a very good agreement on the radiated magnetic field between the simulations and the measurements. As expected, the new target holder with integrated mitigation device, reduce the radiated electromagnetic field by a factor greater than 3 on the frequency bandwidth of interest. The next step will be to validate the performances of this new target holder at higher laser energy closed to 1 kJ.

References

[1] "Analysis of EMP measurements in the NIF's chamber", Brown et al., EPJ 59 (2013).

[2] "Target charging in short-pulse-laser experiments", Dubois et al., Phys. Rev. E 89 (2014).

[3] "Physics of giant EMP generation in short-pulse laser experiments", Poyé et al., Phys. Rev. E 91, (2015).

Overview of EMP Shielding and Damage Mitigation at ELI-NP

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Soon, ELI-NP will become available for experiments of unprecedented performance with two very high intensity laser beams of 10 PW and pulse duration of about 25 fs, which are focused on to targets giving intensities up to 10^{23} W/cm^2 [1, 2].

Within this facility the problems with EMP [3] are particularly acute, where measurements of the unique physical phenomena [4, 5] are often hampered by EMP peak-up. The EMP produced in laser target interactions can induce temporally failure, or irreversible damage of electronic devices in the target positioners, controls and diagnostic systems [6].

The information on EMP produced by fs laser - matter interaction, even for relatively low laser energy of tens of mJ, started to become available in literature [7]. These experimental results and theoretical calculations are consistent with our current understanding on EMP generation mechanism [8]. Consequently, we now have a more accurate estimation of the EMP to be generated at ELI-NP, in correlation with the limits of exposure for electronic equipment and personnel. In this challenging context, the shielding strategy applied at ELI-NP is presented with the current status of the implementation of the EMP shielding within the building. The important aspects, which shall be considered in the design of experimental instruments, in order to obtain and maintain the overall integrity of electromagnetic shield, are pointed out. Most significant approaches for the shielding the equipment susceptible by EMP damage and malfunction, to be applied soon at ELI-NP, are presented for review to the scientific community.

References

[1] N.V. Zamfir, Romanian Reports in Physics, Vol. 68, Supplement, P. S3–S4, 2016

[2] S. Gales, Romanian Reports in Physics, Vol. 68, Supplement, P. S5–S10, 2016

[3] M. Mead et.al., Rev. Sci. Instrum.,75, 4225, 2004

[4] F. Negoita et al., Romanian Reports in Physics, Vol. 68, Supplement, P. S37–S144, 2016

[5] I. C. E. Turcu et al., Romanian Reports in Physics, Vol. 68, Supplement, P. S145–S231, 2016

[6] D. C. Eder et al., Lawrence Livermore National Laboratory Report, LLNL-TR-411183, 2009

[7] A. Poye et al., Physical Review E 98, 033201, 2018

[8] M. Mead, "Extreme Light Infrastructure – ELI Nuclear Physics, EMP Shielding and Damage Mitigation", IFIN-HH Document No. 1999/03.05.2012, Issue: 1

EMP mitigation on the Vulcan Petawatt Laser System

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EMP mitigation from High-Intensity laser interactions is of great importance to facilities in order to decrease equipment failures and noise levels on critical diagnostics. In this paper we present the experimental results from a specific campaign on different target mounting systems in order to dramatically reduce the resultant EMP in a way that is easily deployable on almost any facility.

Characterization and modelling of ultrashort laser pulse driven electromagnetic pulses

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An Electromagnetic Pulse (EMP) is an intense burst of electromagnetic energy caused by a sudden, rapid acceleration of electrons. EMPs are a known issue for facilities delivering picosecond (ps) long laser pulses and can last for orders of magnitude longer than the original laser pulse length. Issues include interference with diagnostic devices, actuators and even damage on electrical components. Recent advances of Petawatt (PW) lasers enable ultra-short femtosecond (fs) time regime pulses and the establishment of large scale laser facilities imposes the demand for reliable operation of its beamlines. However up to now, no systematic study is available investigating EMPs at multi-Joule femtosecond class lasers. In this paper, scaling laws are presented connecting the energy of the EMPs with various laser parameters. Furthermore, we simulated the generated EMP emitted by the target holder. This study will enable more efficient target design, with respect to EMP handling, in laser facilities performing ultra-high intensity experiments.

LP EMP Propagation and Mitigation in ELI-Beamline Large Size Structures

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An extensive 3D numerical simulation of a transient electromagnetic field evolution inside large ELI-Beamlines structures will be presented. Laser-plasma generated Electro-Magnetic-Pulse (LP EPM) propagation in an experimental area of ELI L4 beamline, namely inside vacuum vessels of compressor, large-size beam-transport manifold and P3 interaction chamber was successfully simulated. High frequency RF pulse propagation, confinement and attenuation was investigated in order to reduce hazardous EMP effects to laboratory infrastructure. Entire size and complexity of L4 beamline chain requires a full-3D time-dependent calculation with large demands on computing hardware performance and memory. Dedicated multi-processor, multi-core server was used for large data import, calculation, output processing and field visualization with ANSYS AEDT HFSS module using Transient Solver. Simulations confirm that use of common construction materials for beamline-vacuum-vessels does not attenuate EMP sufficiently, and the structure behaves as a large-size EMP reverberation chamber with a long decay time. To mitigate detrimental EMP effects, an efficient RF/microwave blocking and absorption strategies are discussed. Electronic industry ferrimagnetic ceramics were examined for a stable, vacuum compatible, clean-room compatible, nuclear activation compatible RF/microwave absorbing material in MHz/GHz region. Materials economically viable in large quantities required for large structures were identified. Initial tests of selected materials were performed and an absorbing structure optimization is in progress.