

## **Bio-EMPulse: a research program to study the effects of nanosecond electromagnetic pulses on biological cells**

Roberto Barale<sup>1</sup>, Agostino Monorchio<sup>1</sup>, PierCiro Steardo<sup>2</sup>, Claudio Ravera<sup>3</sup>

(1) University of Pisa,  
Pisa, Italy.

(2) Oto Melara,  
La Spezia, Italy.

(3) Ansaldo Ricerche,  
Genova, Italy.

rbarale@biologia.unipi.it  
a.monorchio@iet.unipi.it

pierciro.steardo@otomelara.it

ravera@ansaldo.it

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Very recently, the concern of very short high field electromagnetic pulses on living tissue have received a considerable attention. The effects of such pulses on living tissue are profound and varied and, to date, there not has been such an exhaustive experimentation as in the monochromatic counterpart. Moreover, thermal effects are negligible in the case of pulsed fields with respect to analogous exposition to monochromatic waves.

A new field of research, bioelectrics, is emerging to study these effects, as well as the naturally occurring electric fields in biological systems. Bioelectrics relies on an interesting pairing of disciplines, apparently very distant from each other: high-voltage engineering and cell biology. In particular, the new field depends on advanced pulsed power technology.

At the beginning of 2005, the Italian Ministry of Defence, in the framework of CEPA 1.20, funded a three-year term R&D project aimed at a comprehension of the interaction between high level electromagnetic pulses and biological cells. The research activity is being jointly conducted by the Department of Biology and the Department of Information Engineering at the University of Pisa, Ansaldo Ricerche and Oto Melara. In particular Ansaldo Ricerche and Oto Melara are working for providing a pulse generator to be used for *in vitro* experiments consisting in radiating living tissues. The Dept. of Information Engineering is involved in the numerical experiments and dosimetric evaluation conducted by using specifically derived electromagnetic codes. The activity of Dept. of Biology is focused on the evaluation of genotoxic response: the induction of toxic and genotoxic effects are investigated at cellular level by means of peripheral human lymphocytes. Experiments are being conducted at facilities of CISAM of Italian MoD, located in San Piero a Grado – Pisa.

The aim of this paper is to present the methodologies and the preliminary results of the above mentioned research activity. In particular, the presentation will be focused on the technological solutions thus far adopted, the results of the numerical investigations and the preliminary results obtained from the biological experiments.