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The way we succeed in our research within LGAD R&D enabling real time and 4D tracking for LHC-HL, by designing the scientific tools and performing the experiments at the European Research Infrastructures: The case of Montenegro RD50 group

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In this paper we present our three different research activities set at the different EU labs. Due to lack of scientific tools at the premises of the University of Montenegro this was the way that allows us to be successful in taking role and responsibility towards addressing the questions of high priority within LGAD Research and Design activities as a member of RD50 CERN Collaboration.
Firstly, we will overview our research at the EU laser facility ELI Beamlines in Prague, where we built an unique femtosecond laser based experimental station and state-of-the-art scientific tool, based on technique of transient currents with two modalities: Single Photon and Two Photon Absorption (TCT-SPA/TPA), for characterization of the state-of-the-art timing detector LGAD that is needed for ATLAS and CMS upgrade (LHC-HL). Single Event Burnout was systematically studied during a few comprehensive campaigns (LGAD's fatalities has been firstly observed in Fermilab's beam tests with protons). A new research target, utilization of TPA for the interpad distance study in TI-LGAD (more advanced version of segmented LGAD) will be briefly overviewed as well.

The second case we will be overviewing in this article is our ion microbeam studies of charge transport in semiconductor radiation detectors with three-dimensional structures. In this study a few LGADs have been tested using the Tandem accelerator and low-energy ions (carbons and H+) at the Rudjer Boskovic Institute in Zagreb. The method of Ion Beam Induced Charge (IBIC) and ions with different energies (and thus with the different position of Brag peaks) were used to probe the different detector depths in order to study LGAD's response. The gain suppression has been observed and systematically studied.

The third case we will be discussing is devoted to our future goal that is now in the preparation phase. Our aim is to utilize 30 MeV proton from Cyclotron in Prague in order to study the LGAD's response; the 30 MeV protons are not minimum ionizing particles (MIP) and extended knowledge on effects of charge screening (covering large energy region for non-MIP particles) in LGADs is of significant importance From the application point such studies are needed as the energy of 30 MeV are close to protons energies encountered in proton-CT therapy.

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