

R&D at University of Zagreb

Mirko Planinić, Antonija Utrobičić and Marinko Kovačić

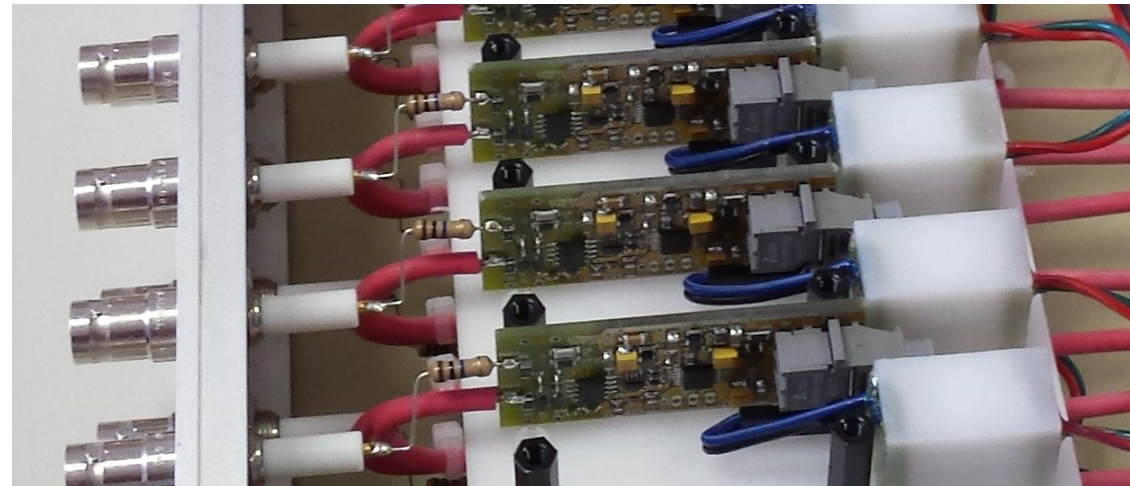
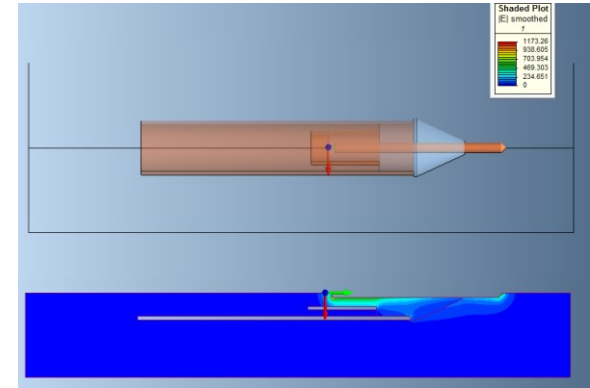
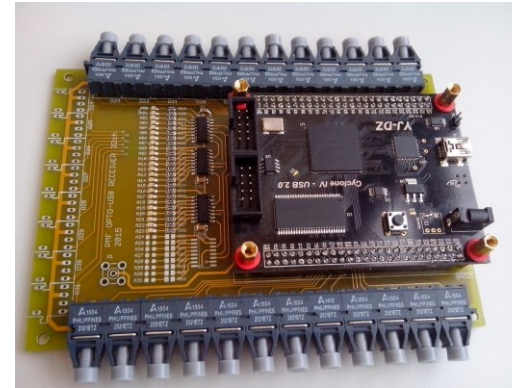
26. September 2018.

DISCO meeting



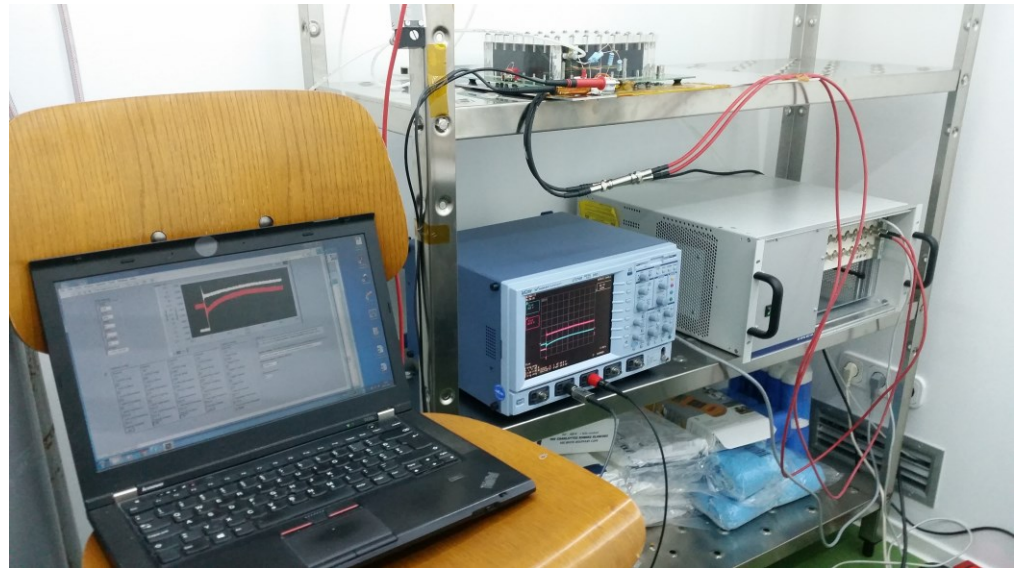
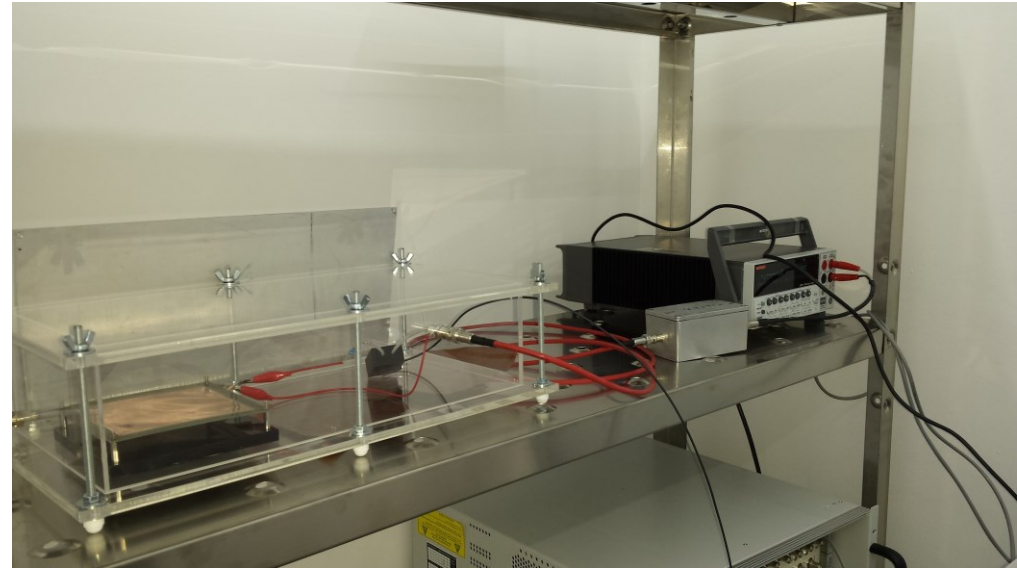
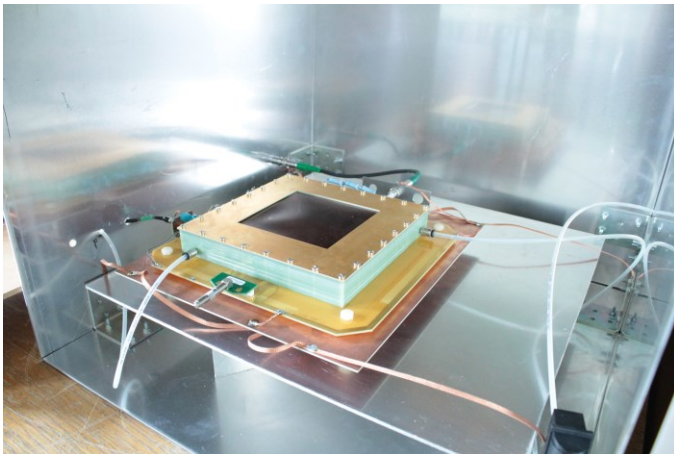
Research group members and experience

- Group members:
 - Mirko Planinić, Antonija Utrobičić, Filip Erhardt, Marko Jerčić and Nikola Poljak- *Faculty of Science, University of Zagreb, Croatia*
 - Marinko Kovačić *Faculty of Electrical Engineering and Computing, University of Zagreb, Croatia*
- Experience in:
 - Development of custom-made experimental setups (Concept design, 3D design, technical documentation for manufacture and PCB designs).
 - Development of hardware and firmware for custom made measurement equipment (Floating multichannel pico/microammeter, High bandwidth HV probes, preamplifiers, and custom power supply).
 - Electrical circuit simulation (SPICE) and software development for automatized measurements (LabVIEW).
 - FEM simulations (2D/3D electrostatic, electromagnetic and thermal)
 - Simultaneous optical and electrical recording of discharges in the GEM detector.



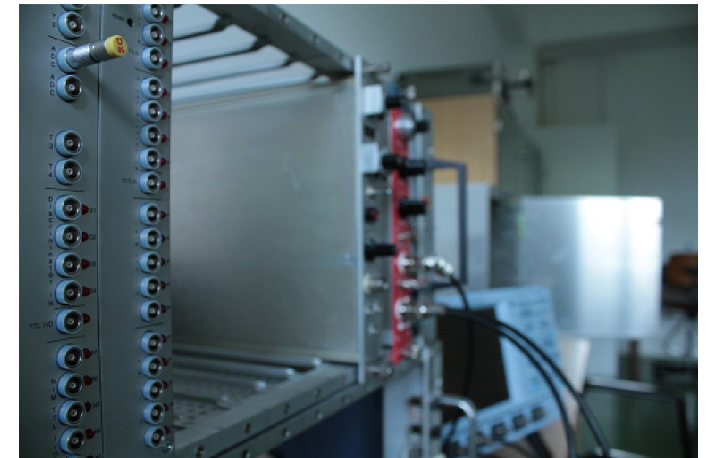
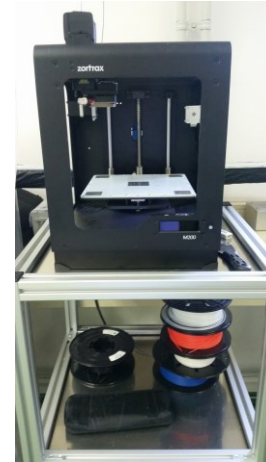
Zagreb Lab

- Lab 75 m² working area with the clean room (6 m²) - ISO5 class at rest, according to HR EN ISO14644-1:1999 standard
- Existing experimental setups in the lab:
 - Setup for electrical QA test of GEM foils with Zagreb picoammeters.
 - Standard GEM kit setup.
 - Customized setup for discharge studies in GEM detector.



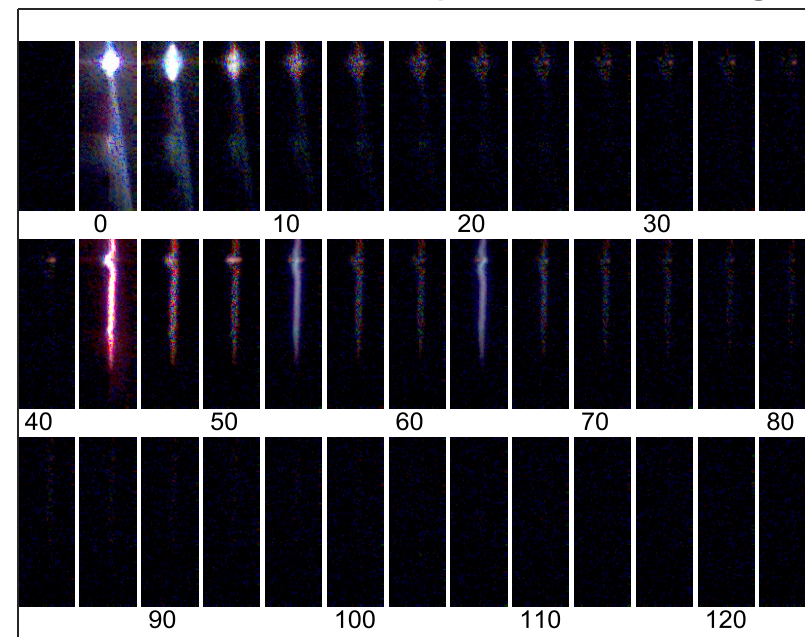
Equipment

- HV power supply:
 - Negative: Mpod Mini HV crate+ 2 Mpod HV Module (EHS 8060n and EHS 8080n)
 - Positive: CAEN SY2527 universal multichannel power supply with A1733P 12ch, 3/4 kV, 3/2 mA board)
- charge sensitive preamplifier - Ortec 142 IH
- Spectroscopy Amplifier - CaenN968
- Keithley 6485 picoammeter
- Zagreb floating multichannel picoammeter.
- Zagreb floating microammeter.
- FADC + MCA - NIMBox/NEMBox AADN
- LeCroy waverunner 500 MHz, 4GS/s, 4 channel oscilloscope
- LeCroy HV 4kV, 100:1, 400 MHz probe
- $Ne - CO_2 - N_2$ (90:10:5), $Ar - CO_2$ (70-30), N_2 gas bottles.
- GEM kit detector + couple spare foils (SP and LP)
- Various radioactive sources (Fe-55, Sr-90, Am-241)
- Mini-X X-Ray Tube
- 3D printer zortrax M200
- Various FPGA and MCU development systems

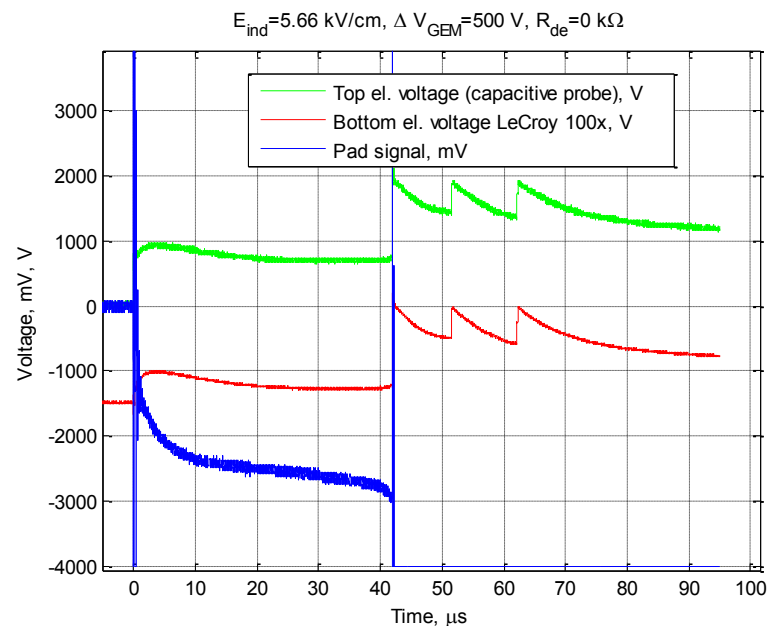


Group activities

- Research in physics of discharge propagation in GEM detector (delayed and GEM to GEM).
 - Development of custom-made laboratory setup for the measurement of GEM discharge propagation characteristics. Chamber, readout plane, HV probes, custom-made THGEM foil...
 - Simultaneous optical and electrical measurements of delayed DP.
 - Measurements mechanism with various GEM electrode geometries, supply topologies, and gas types
 - Analysis of the recorded data from discharge measurements.
 - Research on the correlation between the optical and electrical measurements.
 - Electrical and thermal simulation of conditions in detector during the discharge.



Time, μ s



Hardware development activities

- Development of active discharge propagation mitigation device for GEM detector.
 - Currently in the conceptual design phase.
 - The first prototype tested.
- **GEMi:** Intelligent power supply for GEM detector (European Structural and Investment Funds project? Still under evaluation.)
 - **Start of the research project:** 2019?
 - **Duration:** 36 months
 - **Leadership and Institutions:** prof. Dr. Sc. M. Planinić, University of Zagreb in collaboration with Dr.Sc. Marinko Kovačić (*Faculty of Electrical Engineering and Computing, University of Zagreb, Croatia*) and prof. Dr. Sc. Robert Pezer (*Faculty of Metallurgy, University of Zagreb, Croatia*).
 - **Project goal:** Development and manufacture of intelligent power supply for GEM detector.
 - The focus of this project is on **the development of intelligent power supply system for GEM detector with integrated precise current measurements and ultra high-speed discharge propagation protection device** to achieve better detector stability and diagnostic in case of malfunction.

Summary

- Our research is mostly related to discharge propagation in GEM detector in order to gain a better understanding of the physical mechanism and to be able to develop propagation protection device.
- We are interested in:
 - Development of custom experimental setups for discharge measurements.
 - Collaboration and research with plasma physics and simulation experts to gain a better understanding in physics involved in complex discharge process.
 - Development of an intelligent power supply system for GEM detector in order to increase detector stability.