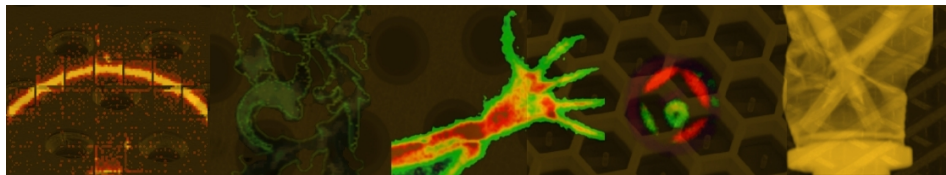


# **MPGD Applications Beyond Fundamental Science Workshop**



## **Report of Contributions**

Contribution ID: 1

Type: **not specified**

## CERN developments of optical readout for MPGDs

*Thursday 15 September 2016 09:40 (30 minutes)*

In recent years, MPGDs found applications beyond High Energy Physics mainly due to their imaging capabilities. Typically, MPGDs have the signals read out electronically, this means that each channel has its own amplification and digitisation chain. Despite being unavoidable in some occasions, an alternative to this approach exists: the so-called optical readout. Scintillation light produced during the amplification avalanche can be detected, making the gaseous detector a scintillating plate with extraordinary light yield. The first ideas of taking pictures of scintillating gases go back to the beginning of the '80. For instance, Charpak and collaborators used an image intensifier camera to photograph a parallel plate avalanche detector filled with Ar/CH<sub>4</sub>/TEA. The choice of the gas mixture was mainly driven by the scintillation spectrum. Unfortunately, not many gases scintillate in the visible window, for which most of the light sensors are optimised. CF<sub>4</sub> is one of them, and the mixture of Ar/CF<sub>4</sub> 80/20 emits orange light in a broad peak around 630 nm. Modern MPGDs coupled with modern cameras are very promising tools to deliver fast and good quality images: This robust and versatile device is ideal for imaging purposes and can find several applications, for instance x-ray radiography and fluoroscopy, energy-resolved photon counting, and x-ray crystallography. The focus of the talk will be put on the recent developments of the optical readout for MPGDs at CERN.

**Primary author:** RESNATI, Filippo (CERN)

**Presenter:** RESNATI, Filippo (CERN)

**Session Classification:** Workshop I

Contribution ID: 2

Type: **not specified**

## **Towards the application of patterned RPCs to very high resolution RPC-PET for small animals**

*Thursday 15 September 2016 15:40 (20 minutes)*

We present imaging results of needle-like and planar  $^{22}\text{Na}$  sources obtained with a prototype of a high-acceptance small-animal positron emission tomograph based on patterned resistive plate chambers (RPC-PET). The maximum-likelihood expectation-maximization (MLEM) reconstruction of the acquired data yielded an excellent and stable resolution of 0.4 mm FWHM.

**Presenter:** FONTE, Paulo

**Session Classification:** Workshop III

Contribution ID: 3

Type: **not specified**

## Applications of MPGD detectors for hadron therapy and investigation of their potential use for environmental gamma rays monitoring.

*Thursday 15 September 2016 17:20 (20 minutes)*

Remarkable scientific and technological progress during the last years has led to the construction of accelerator based facilities dedicated to hadron therapy. This kind of technology requires precise and continuous control of position, intensity and shape of the ions or protons used to irradiate cancers. Patient safety, accelerator operation and dose delivery should be optimized by a real time monitoring of beam intensity and profile before and during the treatment, by using non-destructive, high spatial resolution detectors. For this purpose, inspired by a prototype designed and developed at LNF as beam detector monitor for the DAFNE e+e- machine, the authors have studied and built a beam monitor for hadron therapy application. Based on Micro Pattern Gaseous Detectors (MPGDs), it is called TPC-GEM (TPG) detector and is characterized by high spatial resolution and rate capability. Due to the low amount of material in the active volume, it is “not invasive”, therefore the beam characteristics are preserved, so minimizing the uncertainties on beam position, intensity, energy and stability.

Deriving from nuclear weapons tests and the nuclear power plant accidents,  $^{137}\text{Cs}$  is present in almost all soils in Europe, due to its relatively long half-life of 30.2 years, and it is the main source of artificial  $\gamma$ -radiation. As a consequence of Chernobyl accident in 1986, most European countries extended their  $\gamma$ -dose rate monitoring networks for early warning, moreover the Fukushima disaster in 2011 triggered the need for a series of further improvements for radiation protection. The types of detector in use for these monitoring networks are Geiger-Müller counters, proportional counters, scintillation detectors and ionization chambers. With the aim to design a new gamma detector characterized by higher sensitivity and efficiency, larger active volume and low costs, the authors are studying a potential use of MPGDs for environmental gamma measurements.

The aim of this talk is to present two applications of MPGDs beyond HEP under study: quality assurance in cancer treatments and radiological monitoring. The Monte Carlo simulations of the beam monitor prototype carried out to optimize the geometrical set up and to predict the detector behavior will be shown. The experimental results of the TPC-GEM characterization using an X-ray tube will be presented, as well as the future developments. Moreover the preliminary feasibility study for environmental gamma rays detection based on Monte Carlo simulations will also be shown.

**Primary author:** ALTIERI, Palma Rita (Universita e INFN, Bari (IT))

**Presenter:** ALTIERI, Palma Rita (Universita e INFN, Bari (IT))

**Session Classification:** Workshop IV

Contribution ID: 4

Type: **not specified**

## First results of a combined fast-neutron & gamma-ray LXe imaging detector with gaseous photomultiplier readout

*Thursday 15 September 2016 09:20 (20 minutes)*

We are developing a new detector concept for simultaneous imaging and spectroscopy of fast neutrons and gammas; it combines a liquid-Xe (LXe) scintillator coupled to a UV-sensitive gaseous imaging photomultiplier (GPM).

The research focuses on validating this new idea for simultaneously detecting concealed explosives, comprising low-Z materials, and high-Z fissile materials, utilizing respectively fast-neutron resonant transmission radiography and dual discrete gamma-ray radiography. Neutron spectroscopy is performed by Time-Of-Flight; gamma-ray analysis requires pulse-height analysis. Imaging of both relies on scintillation-light localization from a liquid xenon (LXe) converter, with a UV-sensitive, cascaded-THGEM/CsI gaseous photomultiplier (GPM).

The properties of an imaging-GPM, in Ne/CH<sub>4</sub> mixtures at cryogenic temperatures, will be presented. Localization properties will be given for low-energy gammas and fast neutrons, using pad readout electronics, in combination with LXe-filled capillary neutron and gamma-ray converter. The experimental results, obtained with gamma-ray and fast-neutron sources will be compared with that of extended GEANT-4 simulations.

**Presenter:** COIMBRA, Artur Cardoso (Weizmann Institute of Science (IL))

**Session Classification:** Workshop I

Contribution ID: 5

Type: **not specified**

## A robust large area x-ray imaging system based on 100 $\mu\text{m}$ thick Gas Electron Multiplier (GEM)

*Thursday 15 September 2016 12:00 (20 minutes)*

Imaging applications with Gas Electron Multipliers as amplification devices provide excellent spatial resolution (of the order of hundreds of  $\mu\text{m}$ ) for areas as large as  $10 \times 10 \text{ cm}^2$ , making use of discrete channel readout. A drawback is the need for complex and expensive electronic systems. In applications where resolutions of the order of the mm are required, a simpler and cheaper solution is to determine the position of the interaction using the resistive charge division method. This solution requires a minimum of 4 readout channels to achieve 2D imaging over large areas, greatly simplifying the electronic system. A large signal-to-noise ratio is however required with the GEM's operating at high gain, in some cases, near the discharge limit.

We have developed a non-standard GEM, made from a 100 micron thick kapton foil (2-fold thicker than standard GEM's). The 100 micron thick GEM is produced using the same wet etching technique as the standard GEM and is virtually immune to discharges. A robust detector that can safely operate at the high gains necessary to achieve an adequate signal-to-noise ratio for imaging applications was developed.

In this work we present the results obtained with a detector composed by two 100 micron thick GEM and a  $10 \times 10 \text{ cm}^2$  2D readout electrode with resistive lines. Energy resolution of 21% and charge gains above  $10^4$  have been measured, with a  $^{55}\text{Fe}$  radioactive source. Results of the detector characterization for imaging applications are also presented.

**Primary author:** CARVALHO, Xavier (LIBPhys-Coimbra, University of Coimbra, Portugal)

**Presenter:** CARVALHO, Xavier (LIBPhys-Coimbra, University of Coimbra, Portugal)

**Session Classification:** Workshop II

Contribution ID: 6

Type: **not specified**

## MPGD-based muon telescopes for archeology: the ScanPyramids project

*Thursday 15 September 2016 10:30 (20 minutes)*

Three muon telescopes based on multiplexed Micromegas have recently been built for the ScanPyramids mission whose aim is to image four Egyptian pyramids in Giza and Daschour sites. These telescopes were installed early June on the North and East faces of Khufu and took data during 2-3 months. We will report in this talk on their operation in extreme conditions (temperature, dust in particular) and their general performance.

**Primary author:** PROCUREUR, Sebastien (CEA/IRFU,Centre d'etude de Saclay Gif-sur-Yvette (FR))

**Presenter:** PROCUREUR, Sebastien (CEA/IRFU,Centre d'etude de Saclay Gif-sur-Yvette (FR))

**Session Classification:** Workshop I

Contribution ID: 7

Type: **not specified**

## **Optically Read Out Planispherical GEM Detector for Minimizing Parallax Error**

*Thursday 15 September 2016 10:10 (20 minutes)*

**Presenter:** SAULI, Fabio (TERA Foundation (IT))

**Session Classification:** Workshop I



Contribution ID: 8

Type: **not specified**

## **MPGDs face2face with art and industry: EDXRF imaging systems**

*Thursday 15 September 2016 11:20 (20 minutes)*

**Presenter:** SILVA, Ana Luisa (University of Aveiro)

**Session Classification:** Workshop II

Contribution ID: 9

Type: **not specified**

## **(WITHDRAW) Tomographic 2-D X-ray imaging of toroidal fusion plasma using a tangential pinhole camera with gas electron multiplier detector**

*Thursday 15 September 2016 12:20 (20 minutes)*

**Presenter:** PACELLA, Danilo

**Session Classification:** Workshop II

Contribution ID: **10**

Type: **not specified**

## **GEMPix-based system for the determination of Fe-55 in radioactive waste**

*Thursday 15 September 2016 11:40 (20 minutes)*

**Presenter:** MURTAS, Fabrizio (Istituto Nazionale Fisica Nucleare (IT))

**Session Classification:** Workshop II

Contribution ID: 11

Type: **not specified**

## **X-ray detection in medical imaging**

*Thursday 15 September 2016 14:30 (50 minutes)*

**Presenter:** KAPLER, Keynote - Steffen (Siemens)

**Session Classification:** Workshop III

Contribution ID: 12

Type: **not specified**

## **Energy Resolving X-ray Imaging Systems using MPGDs**

*Thursday 15 September 2016 15:20 (20 minutes)*

**Presenter:** DAS NEVES DIAS CARRAMATE, Lara Filipa (University of Aveiro (PT))

**Session Classification:** Workshop III

Contribution ID: 13

Type: **not specified**

## **The Innovation Path: From Science to Market**

*Thursday 15 September 2016 16:30 (50 minutes)*

**Presenter:** AMORIM, Keynote - Gonçalo (ISCTE)

**Session Classification:** Workshop IV

Contribution ID: 14

Type: **not specified**

## **The GEMPix detector for energy deposition measurements in Hadrontherapy**

*Thursday 15 September 2016 17:40 (20 minutes)*

**Presenter:** MURTAS, Fabrizio (Istituto Nazionale Fisica Nucleare (IT))

**Session Classification:** Workshop IV