

GAS DETECTORS R&D GROUP – LIP COIMBRA



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GASEOUS DETECTORS R&D

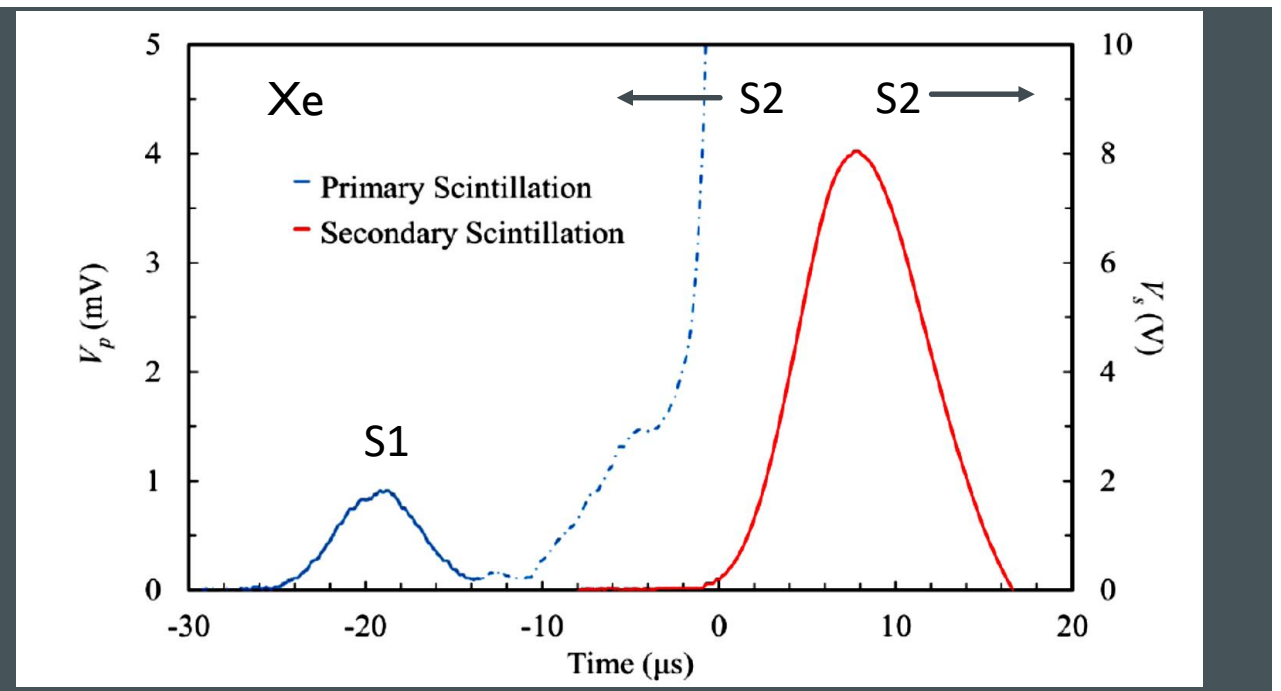
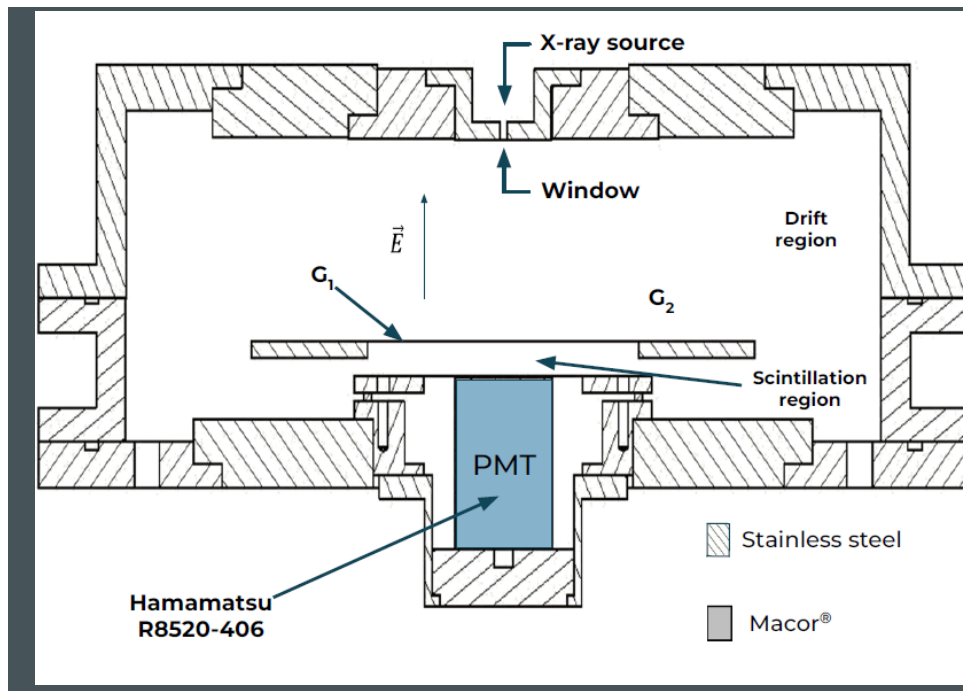
STUDY OF GAS MIXTURES

- Design and planning of devices;
- Study of **drift of electrons and ions** in gases;
- Study of **amplification mechanisms**: light and charge;
- **Monte Carlo simulation** to explain experimental results;

CURRENT DEVICES AND STUDIES

GPSC – GAS PROPORTIONAL SCINTILLATION COUNTER

STUDIES OF PRIMARY AND SECONDARY SCINTILLATION IN DIFFERENT GASES



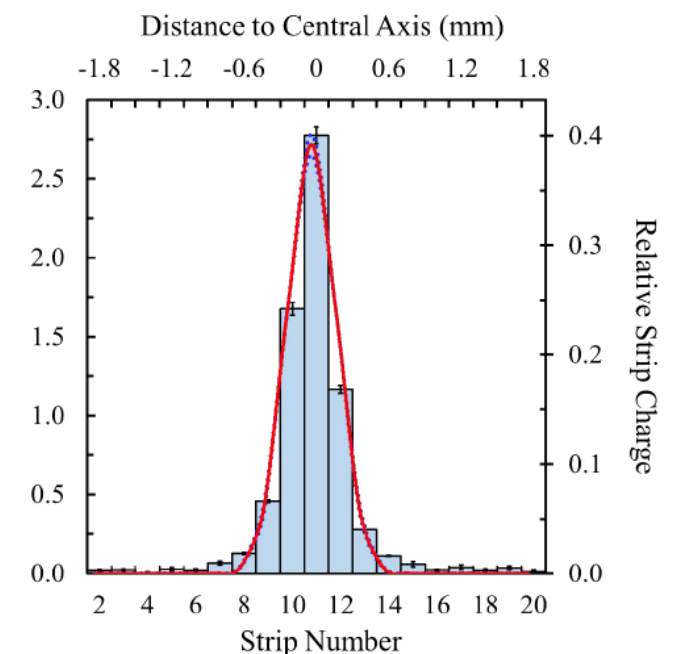
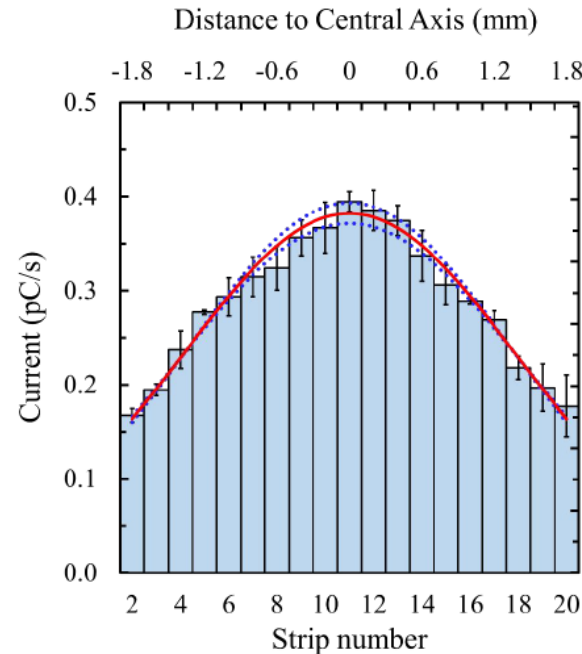
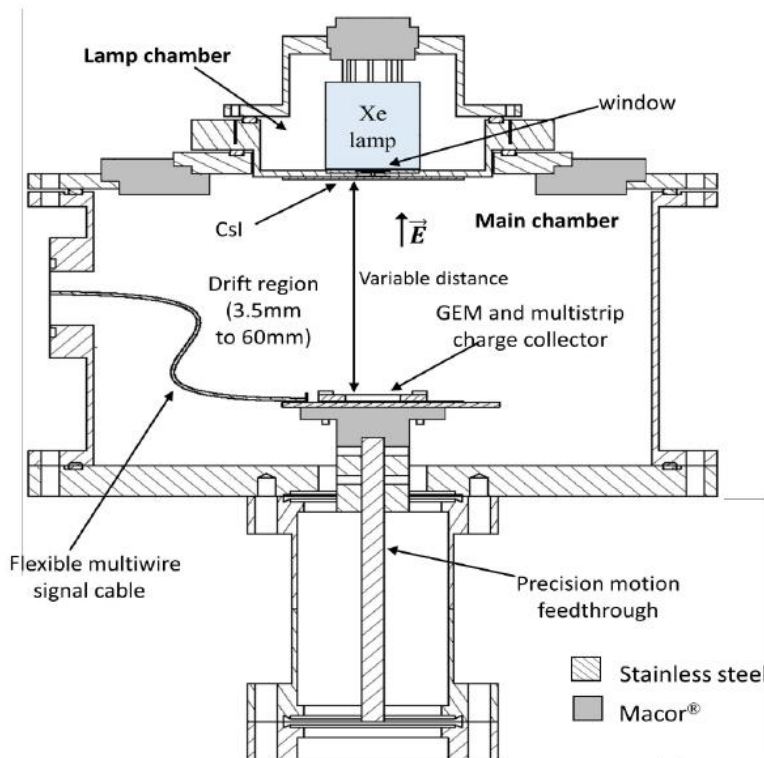
CURRENT DEVICES AND STUDIES

CHARGE DIFFUSION MEASURING DEVICE

ALLOWS TO STUDY DIFFUSION OF ELECTRONS (OR IONS) IN DIFFERENT GASES

Xe

CH₄



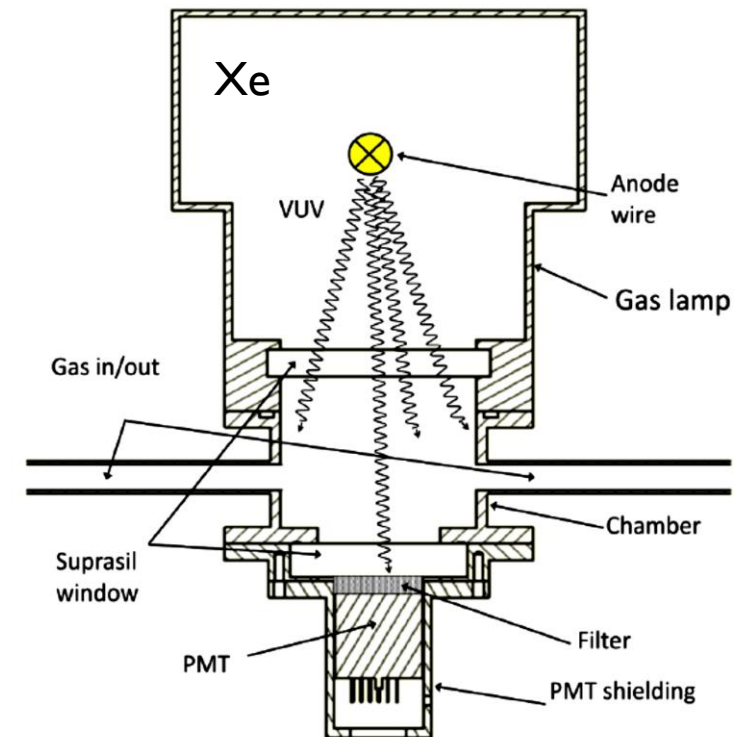
Results were obtained, and a good agreement was found with values from the literature

CURRENT DEVICES AND STUDIES

LIGHT MEASURING DEVICE

STUDIES LIGHT TRANSMISSION/ABSORPTION IN DIFFERENT GASES

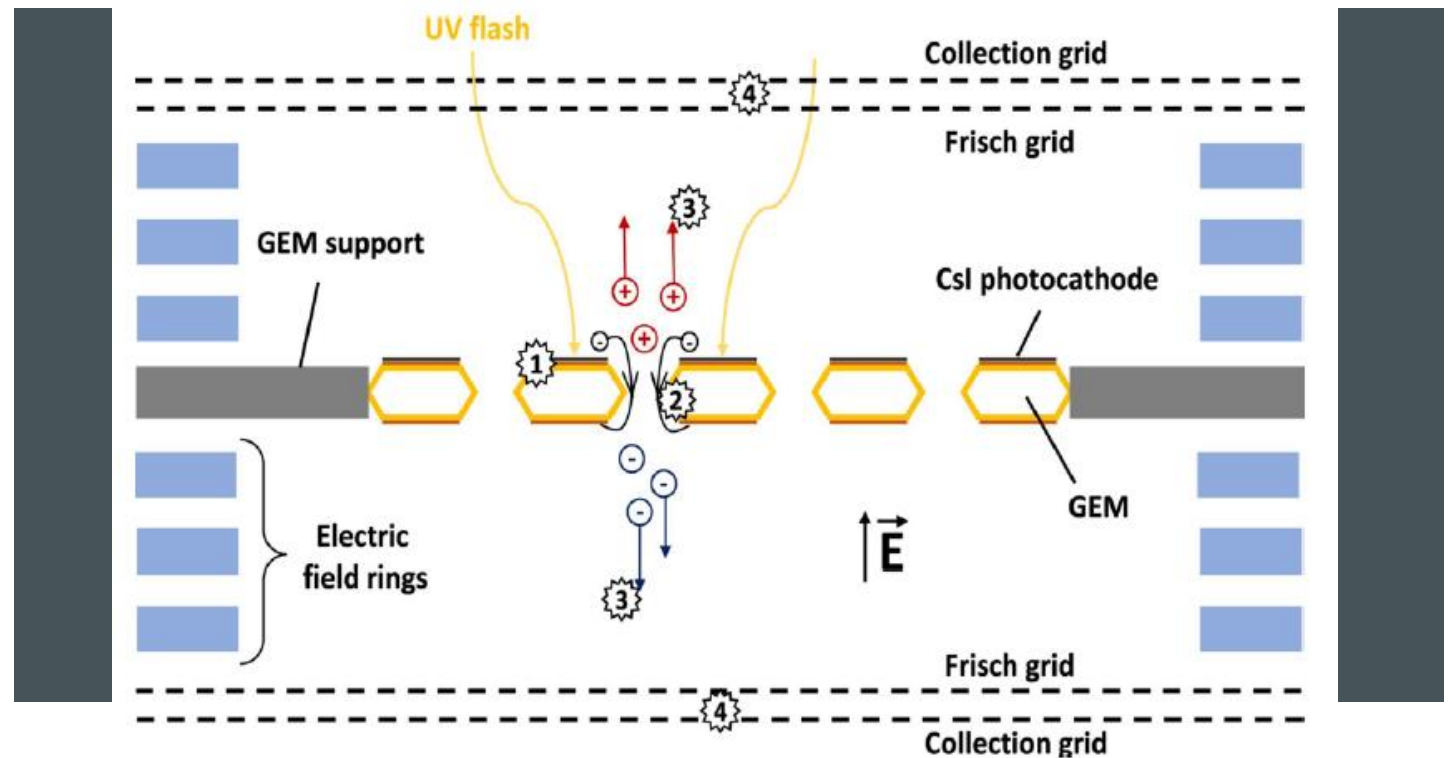
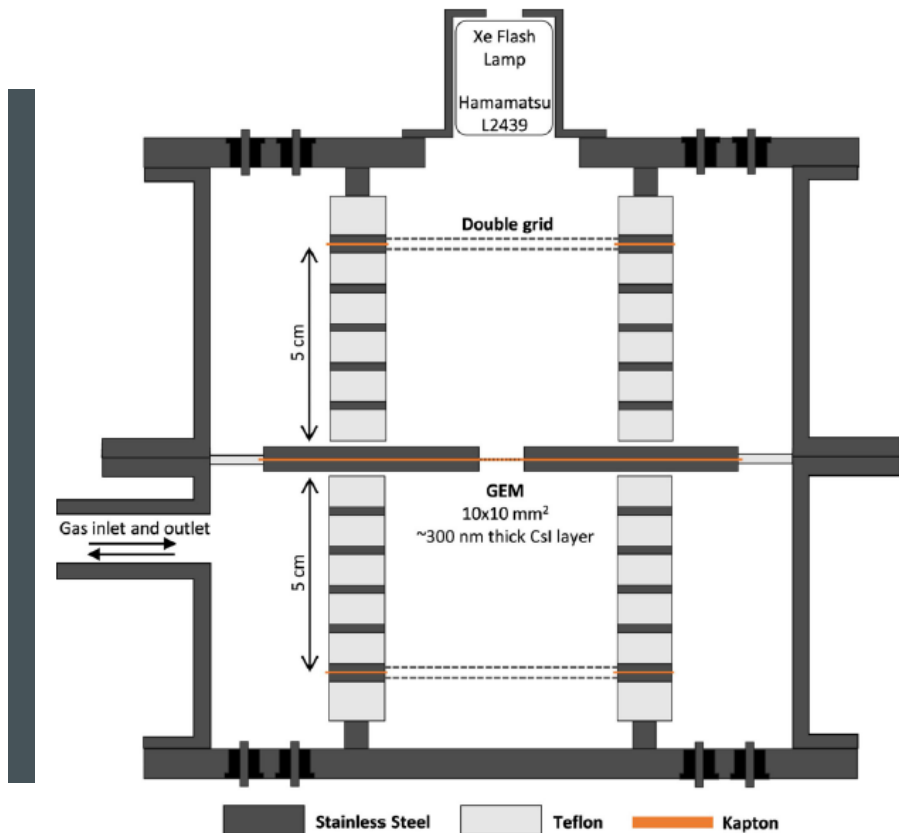
- The signals obtained in the PMT in vacuum and through gas mixtures is compared
- After several corrections (reflectivity, solid angle, etc) the fraction of light absorbed is assessed.
- Using adequate bandpass filters, the possibility of reemission in another wavelength is also assessed. This allows the study of gases that act as wavelength shifters.



CURRENT DEVICES AND STUDIES

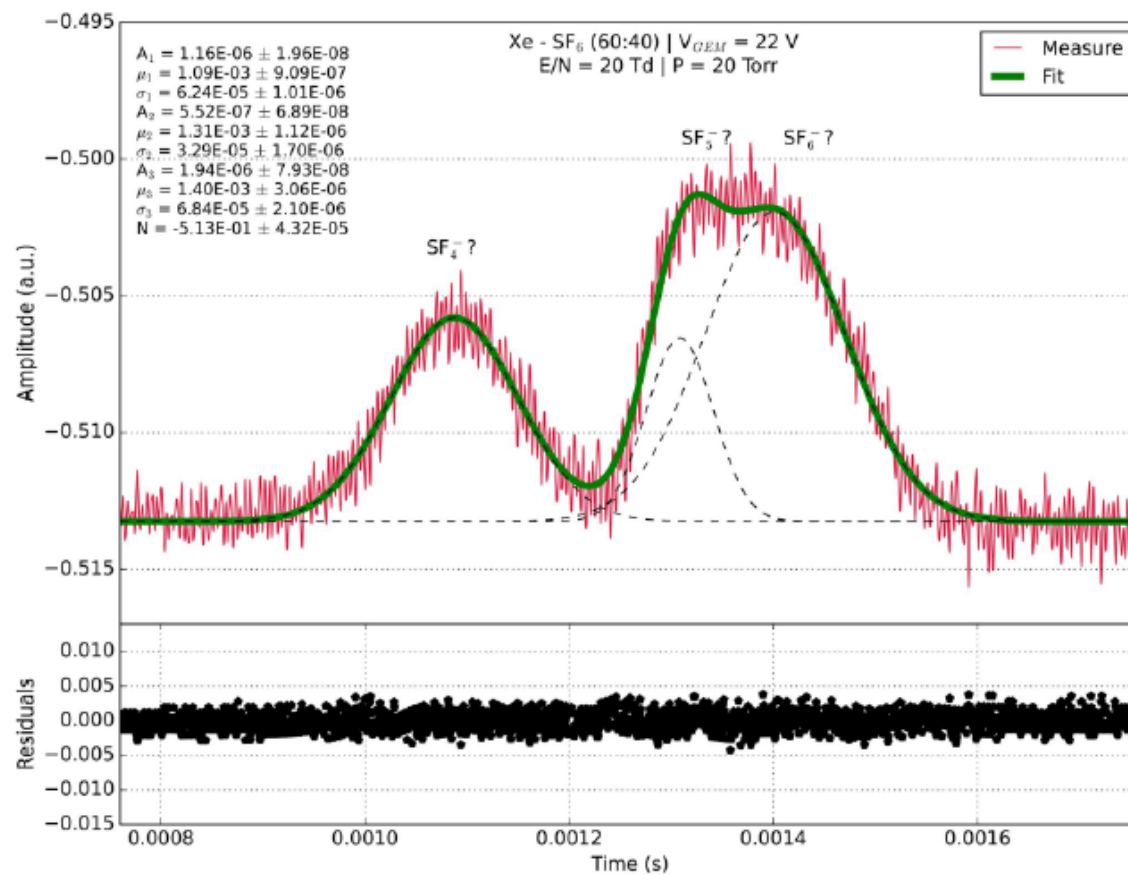
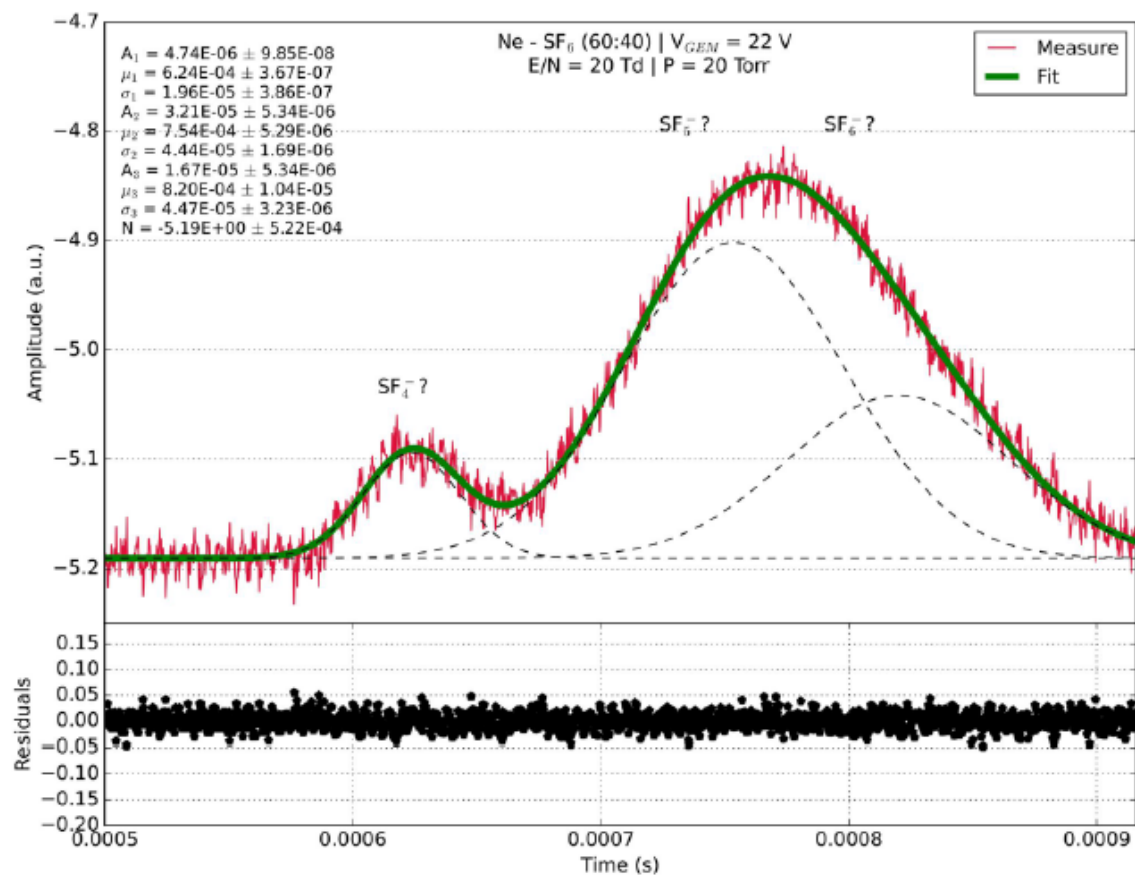
DUAL POLARITY ION DRIFT CHAMBER

STUDIES OF ION MOBILITY (POSITIVE AND NEGATIVE IONS)



RESULTS OF THE ION MOBILITY SYSTEM

With tentative identification of the ions present for Ne-SF₆ (60:40) (left) and Xe-SF₆ (60:40)

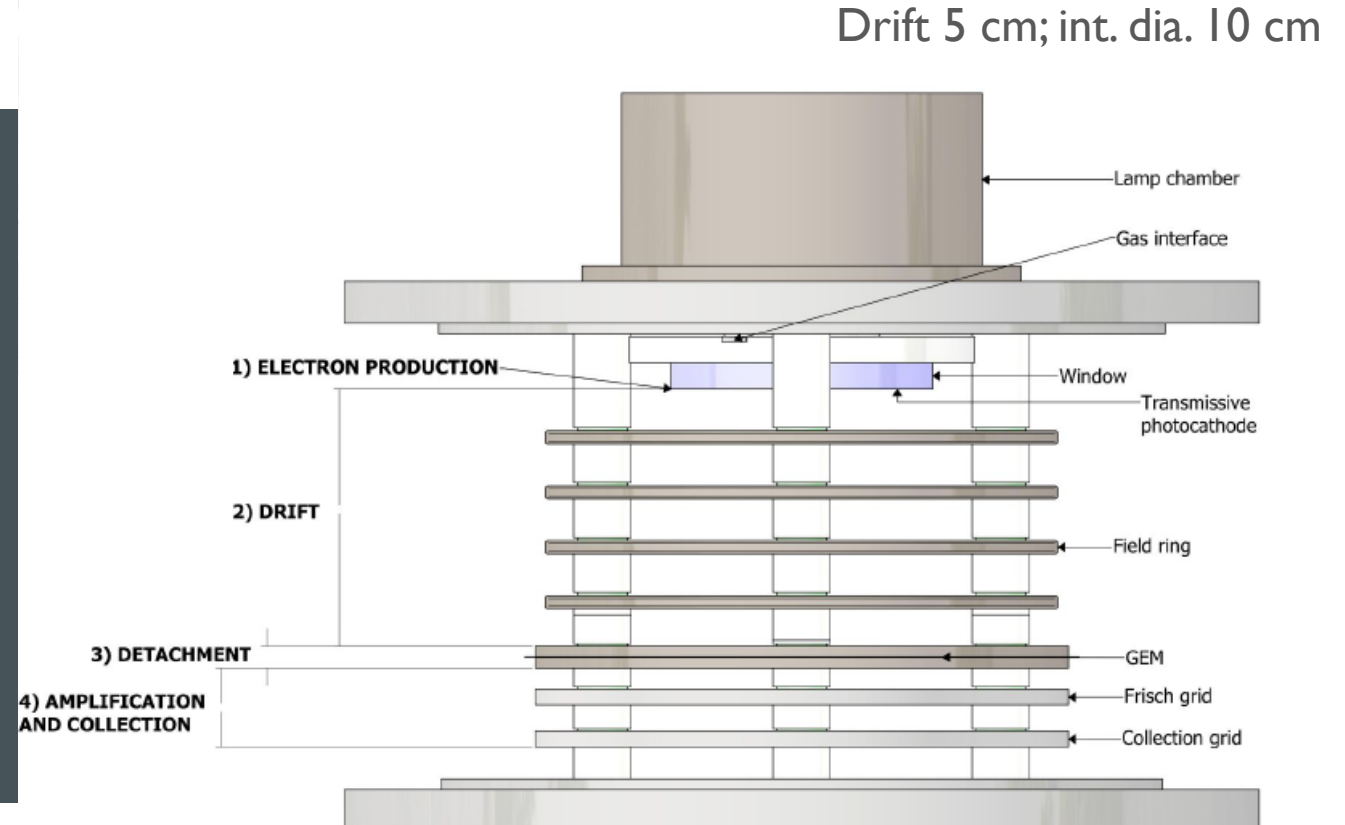


CURRENT DEVICES AND STUDIES

STUDY OF NEGATIVE IONS AS CHARGE CARRIERS

This device intends to study:

- Attachment efficiency of electrons to the electronegative gas molecules;
- Drift of negative ions through the gas;
- Dependence of efficiency of de-attachment of electrons from electronegative ions, with applied electric field;
- Efficiency of gas amplification, through light production or charge multiplication;

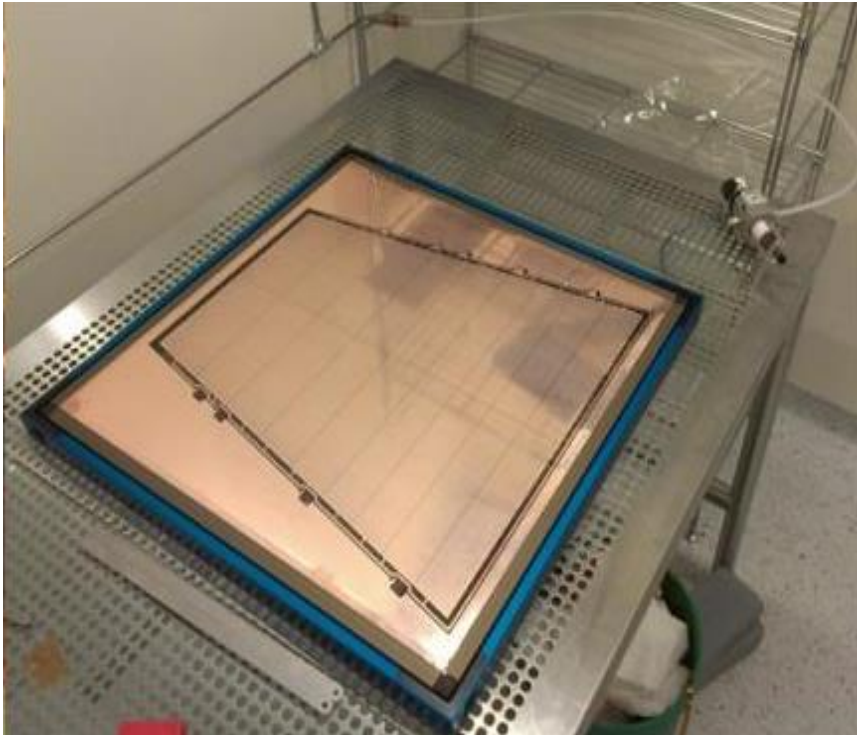


MONTE CARLO SIMULATION

- **Custom Monte Carlo simulation** has been a standalone investigation tool for a diversity of fields in our group, acting as an alternative to experimental work;
- **MC simulation** has also been used as a complement to experimental work to **estimate errors**, the **detection efficiency** of a system or the **sensitivity** of an experimental setup;
- Detailed modeling of the events within the detector is sometimes required to understand and predict some results of the experimental systems that are being developed.

COLLABORATIONS

DRDI Collaboration

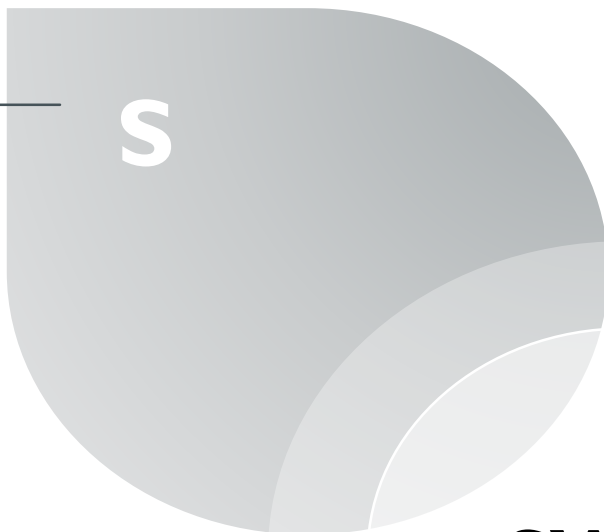


NEXT – Neutrinoless double beta decay Experiment with a **Xe Time** projection chamber



STRENGTHS

- Several students doing thesis, curricular internships and summer internships in the last years.
- Theoretical, simulation and experimental experience/know-how
- Presence in the NEXT and in DRDI Collaborations
- Good involvement with young researchers



WEAKNESSES

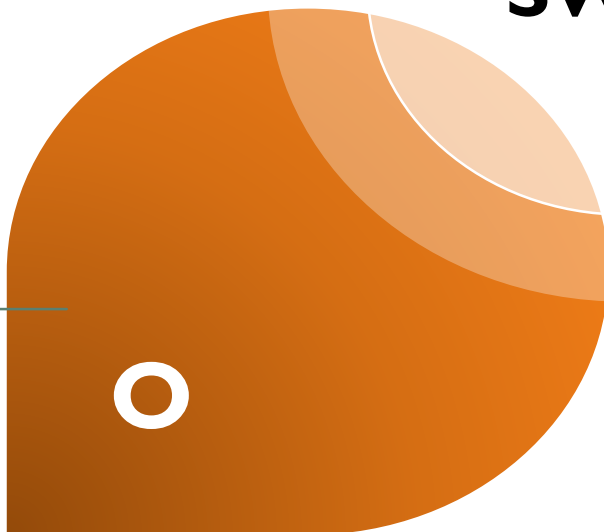
- Lack of/very limited and non-stable internal and external funding leading to less projects, grant holders, laboratory material and, ultimately, results
- Reduced number of early career researchers



SWOT

OPPORTUNITIES

- Possible new partnership with Astrocent Laboratory, Warsaw, Poland.
- Successful student internships leading to MSc and PhD projects
- Negative ions as charge transport in noble gases may provide necessary knowledge on rare-event experiments



THREATS

- Possible loss of **key PhD members** of the team (José Escada and Alexandre Trindade)
- Irregularity in funding projects (FCT, mainly)

