

ENVIRONMENTALLY-FRIENDLY GAS MIXTURES FOR GASEOUS TRACKING AND TIMING DETECTORS

Minutes of the first quarter meeting

Date	31.03.2023
Location	Virtually via Zoom
Participants	Christian Franck, Dario Stocco, Marnik Metting van Rijn, Gianluca Rigoletti, Beatrice Mandelli, Piet Verwilligen, Rob Veenhof, Roberto Guida and Stephen Biagi
Apologies	Archana Sharma

The first quarter meeting aimed to define the framework for the collaboration between the ETH Zurich and CERN with regard to the second phd student Dario Stocco. The progress achieved since the kick-off meeting in cross section fitting was communicated and discussed. The foundation of an intensive training scheduled at CERN was established.

Content

Subsequent measures

Christian opens the meeting

Round of introduction

- **Dario:** Communicates his experience with methane-emission monitoring. **Gianluca:** Relevant topic also at CERN.

Marnik's current state of research

- **Marnik:** Summarizes the fitting routine. Presents attained diluted HFO1234ze swarm measurements in argon and provides a preliminary set of cross section. Bolsig simulations are shown to be coinciding fairly well with the acquired data.
 - **Beatrice:** Proposes to investigate R-134a first, as a cross section set is already available and to ensure its completeness. Enables a verification of available data. **Stephen:** C_2F_6 is related to R134a, whilst C_3F_8 is with HFO1234ze. Reveal similar resonance structure respectively. **Christian:** Potential of improvements in the R134a cross section set? **Piet:** R134a currently has a three star rating out of five. Data acquired from the Pulsed Townsend experiment situated at HVL is used to derive the cross sections.
 - **Stephen:** No Fano-Factor measurements available for R134a. Explains how this quantity can be obtained in an experimental set up, where the number of electrons generated are measured upon application of an x-ray or an α -particles source. The scattering is performed in a chamber with a low applied electric field to induce a measurable current without generation of additional ions. The first factor yields a quantity related to the energy per ion pair. **Christian:** Requires further investigation including a cost-benefit analysis for this experimental technique. **Piet:** Similar measurements performed in GEM. **Roberto:** Does not work in RPCs. **Piet:** Measurements must be done in pure HFO. Must need to conduct a literature research to evaluate the feasibility.
- The primary gas of focus will be changed from HFO1234ze to R134a and an in-depth measurement campaign will be conducted in argon. From the acquired swarm data, the available cross-section set will be improved and a five star rating is targeted.
 - Setting up of an experiment allowing for attaining the Fano factor is considered and will be evaluated in a cost-benefit analysis.

Darios training structure

- **Roberto:** Simulating RPC detectors provides an easy start following the parallel geometry. **Beatrice:** Streamers are difficult to model while RPCs in avalanche mode are easier. An experimental setup to validate the simulations can be provided at CERN. **Rob:** Working on an actual example problem is a preferred start to get into Garfield. **Piet:** Take a very simple gas as a starting point, maybe a noble gas or R134a. May reveal itself useful as reference later. The derived cross sections resulting from this project shall be implemented into Magboltz. **Gianluca:** An instructive manual for Garfield is provided online.
- **Roberto:** Proposes a school format for the intensive training, where an introduction to Garfield and cross-section evaluation can be addressed. A visit of Stephen at CERN is possible. **Christian:** The training would optimally be taking place around May. **Roberto:** A general visit to CERN can be done at any time. Consider informing Roberto or Gianluca 7 – 10 days prior.
- Dario will help finding an optimal date for the school. Further planning will be initiated after scheduling. Expected time frame is between May and June.

F-gas regulation

- **Christian:** Addresses the F-gas regulation, which was accepted on the preceding day. The choice of gases for this project will remain the same, but closely observing the situation is required. **Beatrice:** Chinese company provides some alternatives to 3M products.

Sharing platform

- **Gianluca:** Where will the information be provided and shared? **Marnik:** Slides, Minutes and schedules on indico. **Christian:** Gitlab for code. Simulation data and further information can be stored on polybox.

The next official meetings date will be announced when due (expected fall 2023).