Development of Micro-Time-Of-Flight Mass Spectrometer with Orthogonal Injection for I*n situ* Gas Analysis

Frédéric Progent[1], Alexandre Sonnette[1], Jérôme Tupinier [1], Pierre-Etienne Buthier [1], Frédéric Chaumont[1], Sébastien Vigne [1], Thomas Alava [2]

[1] CEA, DAM, DIF, F-91297 Arpajon, France ; [2] CEA, LETI, MINATEC Campus, F-38054 Grenoble, France

CEA works on *in situ* gas field analyzers, especially on miniaturization of time of flight mass spectrometer. Such device has numerous applications covering a wide range of analyze fields such as environment, industry, space, homeland security, etc. In this regard, the device must have a small footprint, be lightweight, low power consuming and easily usable. CEA works therefore on Micro-Electromechanical System (MEMS).

CEA has developed a linear micro time-of-flight (µ-ToF) mass spectrometer on chip. Results on linear µ-TOF have been previously shown. Briefly, linear µ-TOF is composed of an ionization stage and a zone of extraction and focalization of the ions. Each part has been optimized. Electronic impact is used for ionization and ions are detected on a Micro Channel Plate (MCP), mass spectra are recorded with an oscilloscope.

This linear µ-TOF is used to investigate orthogonal injection. Currently, two devices of orthogonal injection are evaluated: the first one is composed of metallic electrodes, the second one is a MEMS to test orthogonal injection on a chip assemblage (Fig 1 A).

Metallic structures are used to explore geometric layout of electrodes and associated voltage setting. Using gas mixtures of rare gas in helium we were able to obtain limit of detection at 10 ppm. Results help on chip studies and provide guideline for voltage setting.

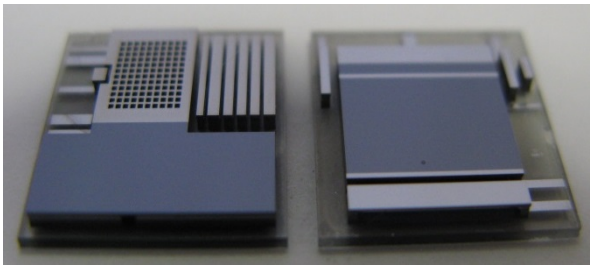
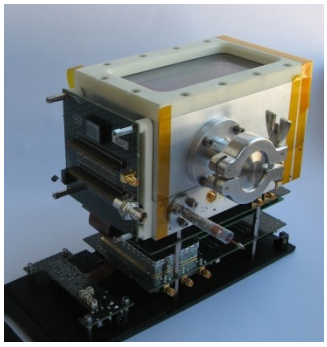
A)  **B)** 

Fig. 1: A) Ion source and orthogonal injection chips; B) Electronic device

Furthermore, very significant efforts have been made to reduce size of electronics. A complete power supplies system has been designed and validated (Fig 1 B).

This work shows encouraging results and pulls the µ-TOF one step closer towards a fully integrated portable analytical system.