

# New RIS-TOF facility for measuring very small Kr and Xe gas samples

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CNAB is developing a new facility based on resonance ionization spectroscopy – time of flight mass spectrometry (RIS-TOF) capable to perform isotopic abundance measurements from samples containing only a few thousands atoms of Kr or Xe. This very high sensitivity allows measurements of, fissionogenic, radiogenic and cosmogenic Kr and Xe concentrations to decipher thermal history and geochronology of minerals or to determine cosmic ray exposure of small meteorite samples. However one of the main issues is to measure  $^{81}\text{Kr}$  concentrations for dating ice core for paleoclimatic reconstruction and ancient groundwater for modeling hydrogeologic systems.

Krypton-81 is produced by nuclear reactions induced by cosmic rays in atmosphere. With a half-life of 229 ky, this isotope is considered as an ideal tracer for dating ancient groundwater or ice core. The measurement of  $^{81}\text{Kr}$  from a groundwater sample was first demonstrated using several isotopic enrichment steps followed by RIS-TOF technique [1,2]. Due to the very low abundance of  $^{81}\text{Kr}$  in groundwater – 1200 atoms/l in modern water – the dating generally requires sample volumes of at least several thousands liters [3,4]. Since 2003, in a collaborative work with IRIM, CNAB is developing a set of instruments in order to measure  $^{81}\text{Kr}$  in groundwater using reasonable volume of water (20 l). It includes: a vacuum line designed for gas extraction from water and Kr separation and purification; two mass spectrometers for isotopic enrichment of  $^{81}\text{Kr}$ ; and a RIS-TOF spectrometer for isotopic analysis of very small Kr or Xe samples.

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