# PROJECT FACTSHEET

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# FieldSpec PoC

Exploring the potential of a new generation of small-sized mass spectrometers for field-based isotope detection at high frequencies


## Inspiration

Nitrate pollution of surface waters is a major international problem, but poorly understood in the context of key hydrological processes and drivers. Much of this is because of sampling limitations for defining the origin and pathway of water mediated biogeochemical interactions and transformations.
The potential for high frequency hydro-chemical and isotopic measurements to improve our understanding of the rainfall-runoff transformation processes will eventually also lead to a better understanding of the origin and fate of pollutants (e.g. nitrates). This will in turn lead to significant improvements in the elaboration and implementation of surface and groundwater quality protection policies, as advocated in the European Water Framework Directive.

To date, the N-isotope field is still forced to rely on protocols consisting of cumbersome sampling and the low frequency analysis potential of expensive and complex laboratory mass spectrometers. The development of portable field mass spectrometers for the analysis of both O and H isotopes up to par with laser spectrometers on the one hand and for the analysis of 15N and 18O of nitrate on the other hand would form a significant contribution to experimental hydrology and related fields of interest.

## Innovation

The FieldSpec PoC project aims to design, craft and test a portable mass spectrometer device entirely dedicated to hydrological research questions (water and pollutant flowpaths and residence times). The instrument is envisaged to help tackle issues related to rapid changes in isotope ratios, e.g. during storm events. The device will have to be suited for field measurements of pure water (rainfall and streamflow) at high frequencies., needs to be robust, with few calibration requirements, and its mass resolution must be high enough to eliminate mass interferences for optimised precision on the isotopic measurements.

Special emphasis will be placed on eliminating or substantially reducing the memory effect of the inlet system. To reduce the size, mass and power consumption of the system and to guarantee the required high mass resolving power, a double focusing design with an adjustable electrostatic analyser and a permanent magnet will be used. The instrument will be equipped with robust, thermally stable, low power control electronics, along with a simple user interface to allow easy operation in the field.

## Impact

The development of this portable mass spectrometer will allow hydrologists access to information well beyond the scope of what is currently available from either conventional isotope ratio mass spectrometry or laser spectrometry. Offering the potential for simultaneous isotopic ratio measurements over a large mass range – in contrast to laser spectrometers which are element-specific – use of the device may well be extended to numerous other applications in environmental sciences (e.g. related to carbon cycle, phosphorus cycle, etc) and beyond (e.g. oil industry).

## Partners

GNS Science (NZ) , University of Saskatchewan (CA)

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