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Field Deployable Mass Spectrometer for Rapid Analysis of CBRNE Threats

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Current mass spectrometry methods are typically not well suited to provide timely characterization of samples of interest in a threat investigation scenario. This limits their use by professional personnel to inform the best course of action in response to an event. A field-deployable, rapid, and accurate identification method for chemical, biological, radiological, nuclear and explosive (CBRNE) threats could enhance performances in response to these potentially life terrorizing situations. Such a system is under development at Canadian Nuclear Laboratories (CNL).

There are two main technical requirements for a practical field-deployable mass spectrometer. The first requirement is that the spectrometer must possess sufficient resolution for isotopic identification. This is accomplished through the use of a commercial compact mass spectrometer which employs a multi-turn time of flight method capable of high mass resolution. The second requirement is that the mass spectrometer must have a simple sample introduction and ionization technique. This requirement will be met through the use of the original electron ionization (EI) source for gas analysis plus two additional ion sources. One is a CNL-developed compact laser ionization source which utilizes a focused, pulsed, high power laser beam for ablation and ionization of solid samples. The other is a matrix-assisted laser desorption ionization (MALDI) source which allows for the ionization of organic/biological samples. The ability to couple the EI source for gas analysis, the laser ionization source for solid analysis and the MALDI source for organic/biological analysis interchangeably with a mass spectrometer allows for analysis of the full spectrum of CBRNE threats.

The current progress towards development of this field-deployable mass spectrometer will be presented including proof of concepts through experiments and an in-depth description of the physics behind the methods used. Future development plans will also be summarized.

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