

A Field Deployable Ion Trap Mass Spectrometer with Atmospheric Pressure Interface

Arnold Lee, Alexander Misharin, Konstantin Novoselov,
Victor Laiko, Vladimir M. Doroshenko*



MassTech, Inc.
6992 Columbia Gateway Drive
Columbia, Maryland 21046
(443) 539-1758
www.apmaldi.com

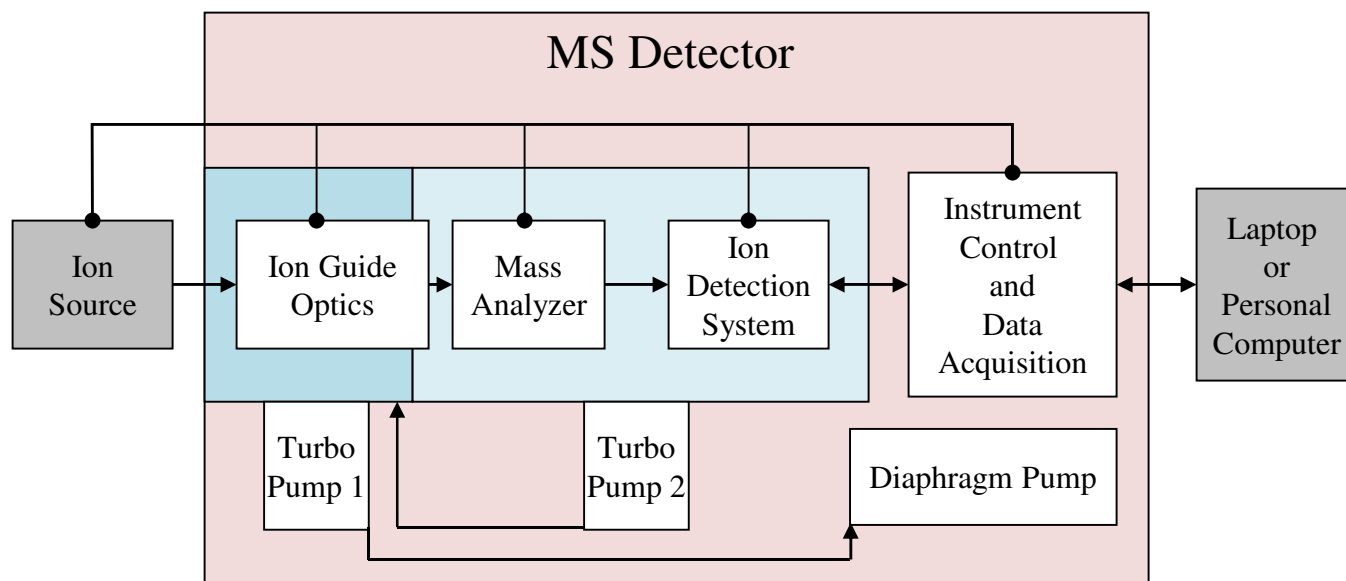
Talk Line-up

- **Goals for MT Explorer 50 development**
- **MTE50 design features**
- **MTE50 specifications**
- **MTE50 configurations**
- **MTE50 potential market**

Goals for MT Explorer 50 Development

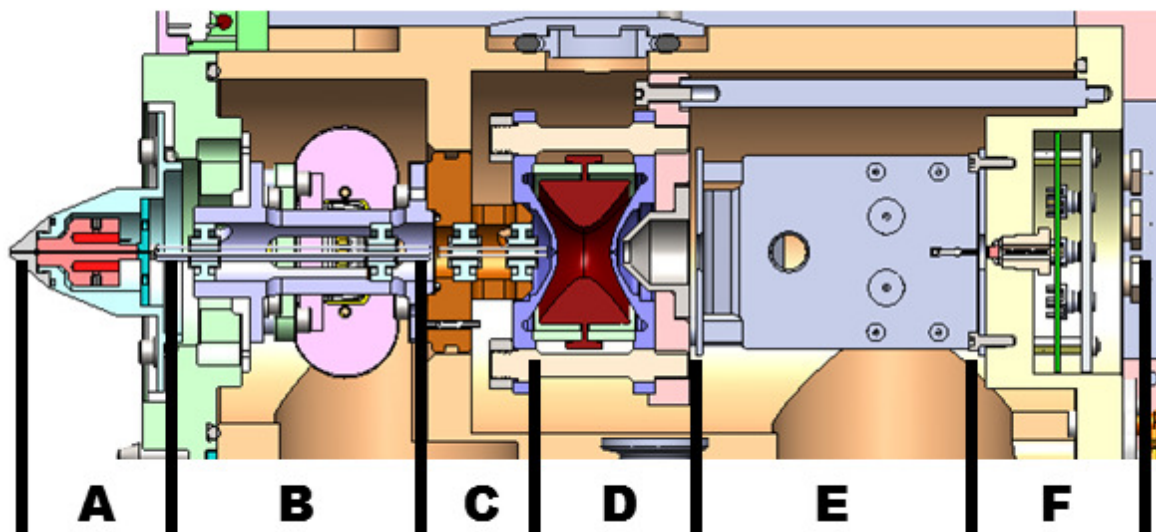
- **Field-deployable instrument for:**
 - ✓ **small molecule analysis**
 - ✓ **biomolecule analysis**
- **Sensitivity comparable with that of commercial desktops**
- **Interfacing with all atmospheric pressure (AP) ionization techniques**
- **Providing software tools for custom application software development**

MTE50 Design Features



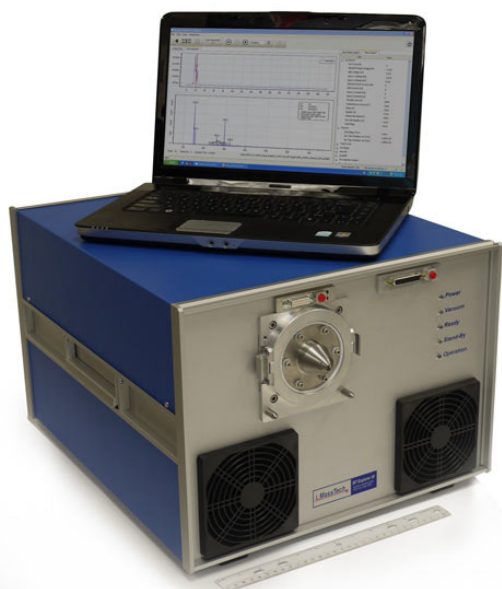
- Two vacuum chamber design (U.S. Patent 8,471,199)
- Bounded hydrogen (metal hydride) cartridge as a source for buffer gas (U.S. Patent 8,476,586)

MTE50 Design Features



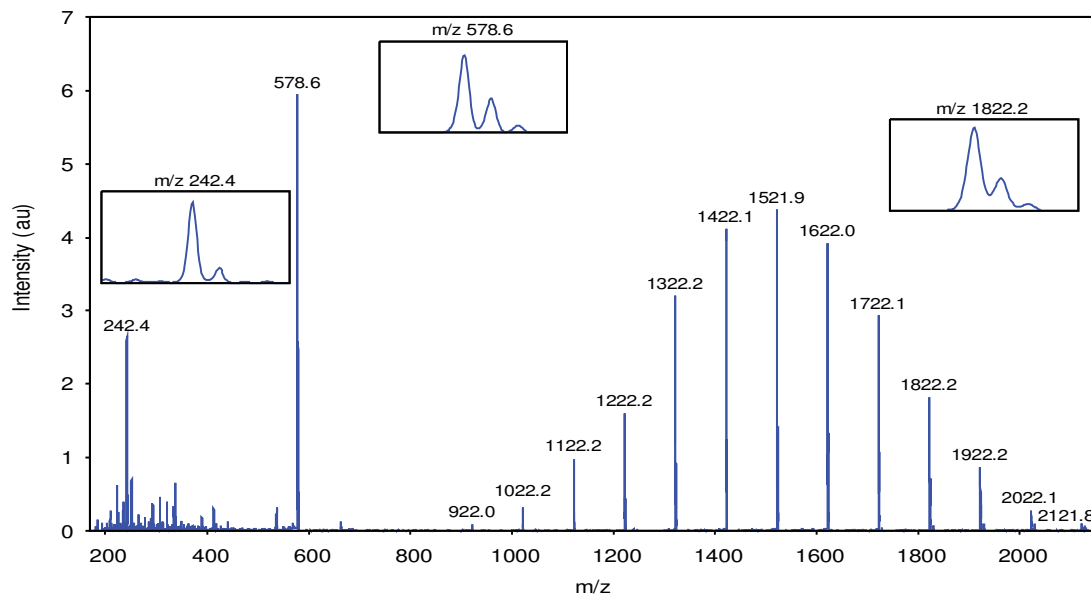
- A. Cone, heating elements and inlet capillary
- B. Ion optics: inlet hexapole ion guide and conductance limit orifice
- C. Ion Optics: MS analyzer hexapole ion guide
- D. Ion trap mass analyzer
- E. Conversion dynode and electron multiplier
- F. Pre-amplifier

MTE50: Specifications

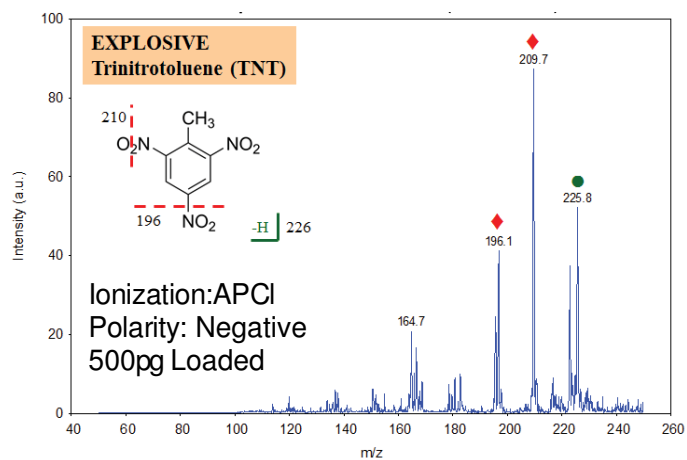


- Atmospheric pressure interface (API)
- MS and MS/MS modes of operation
- Mass range: 30-2,500 Da
- Mass accuracy 0.3 Da
- Weight 75 lb
- Dimensions 12"x17"x20"
- Power 100-300W

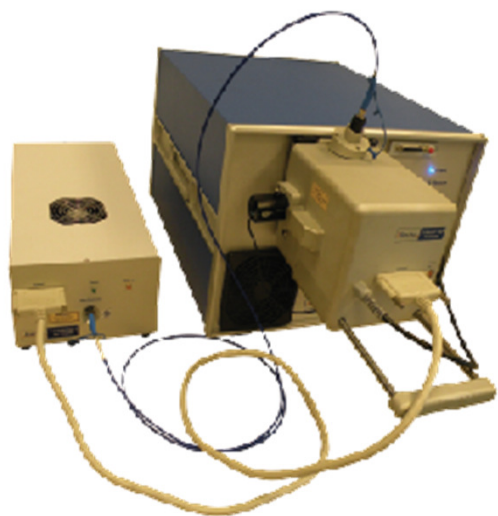
ESI-MS of the calibration mixture



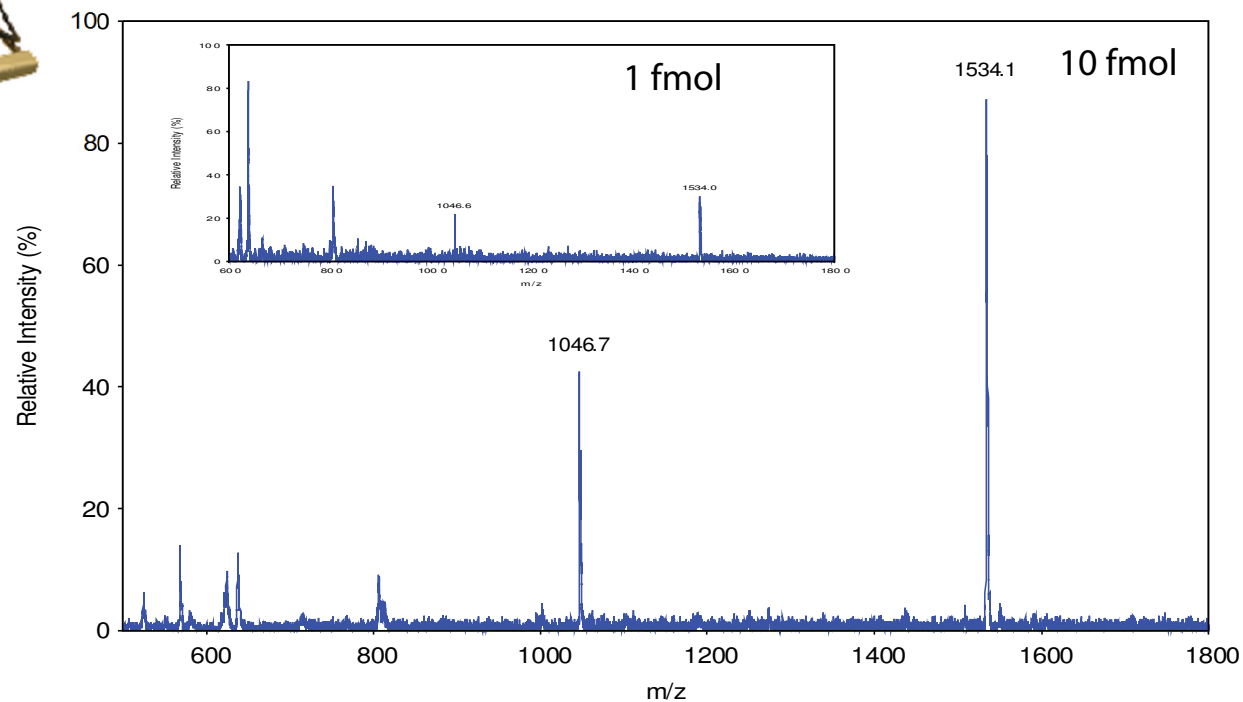
APCI-MS/MS of TNT



MTE50 Interfaced with AP-MALDI Ion Source

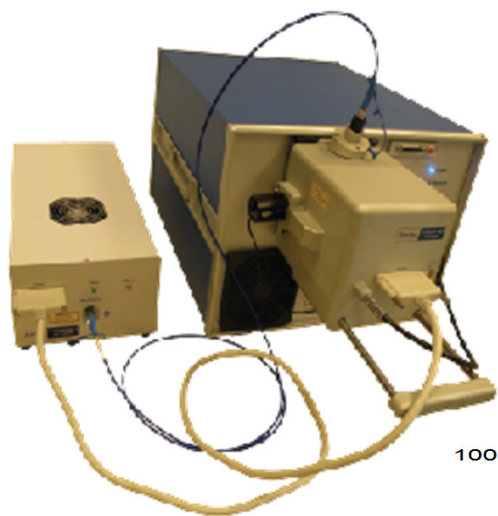


Limit of detection

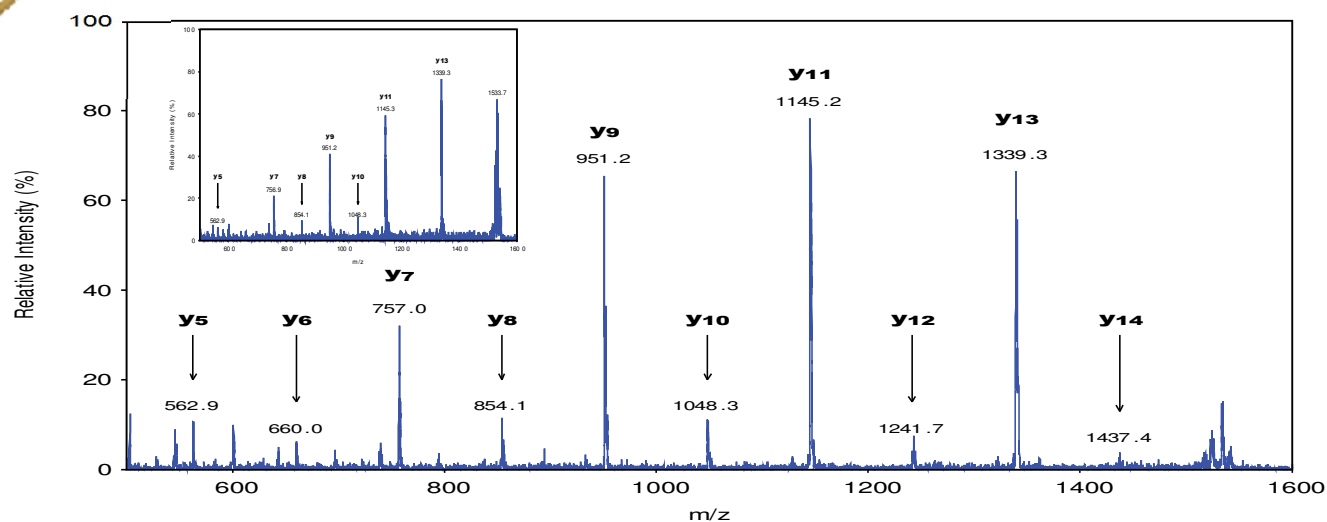


AP MALDI MS spectra of peptide mixture of Angiotensin II (MW 1046 Da) and P14R (MW 1534 Da): 10 fmol and 1 fmol (insert) loaded

MTE50 Interfaced with AP-MALDI Ion Source

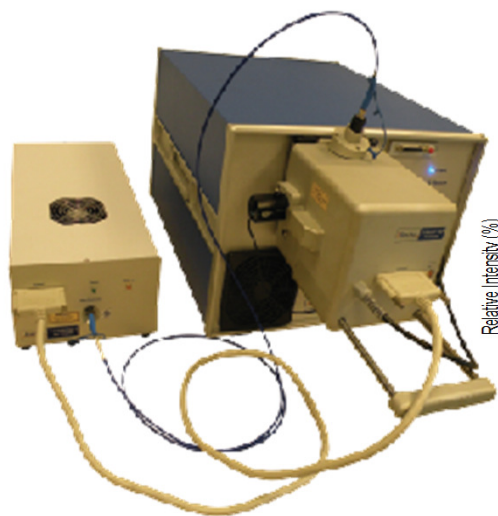


MS/MS capability

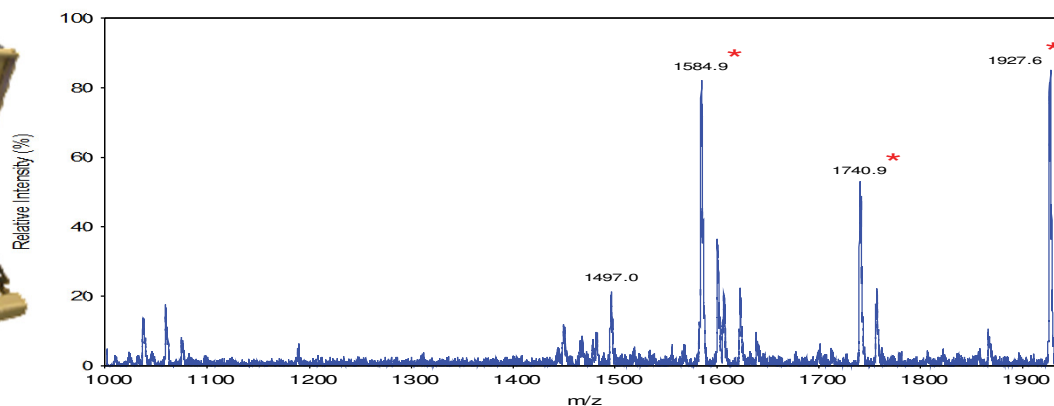


AP MALDI MS/MS spectra of P14R peptide ions: 10 fmol and 1 fmol (insert) loaded

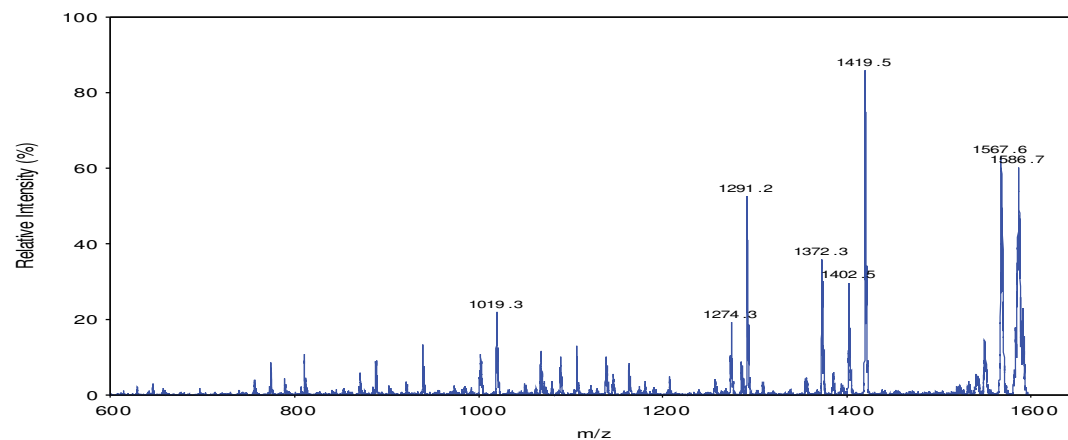
MTE50 Interfaced with AP-MALDI Ion Source



Identification of *Bacillus Globigii* spores



AP MALDI MS spectrum of *Bacillus Globigii* spores after chemical processing and digestion by trypsin (BG spores biomarker peptide are indicated)

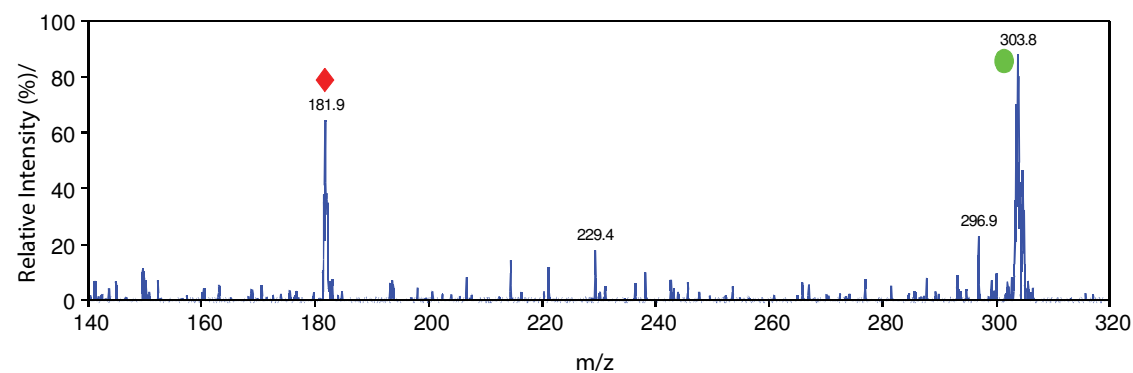
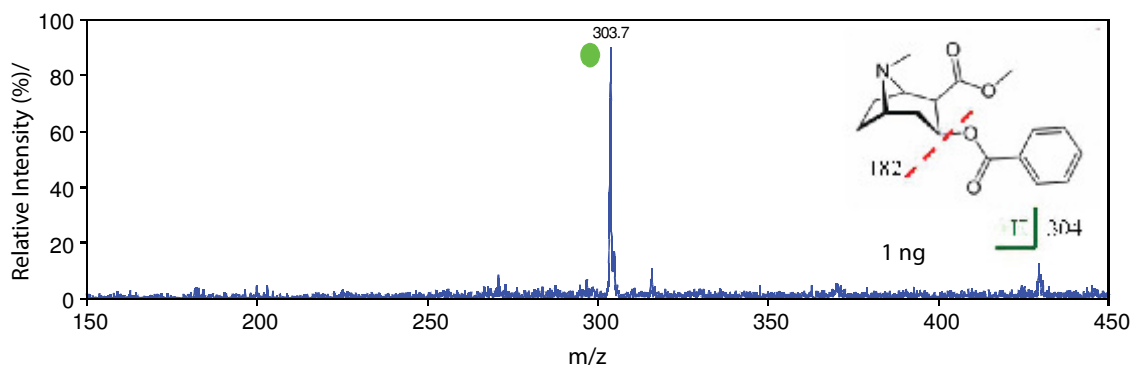


AP MALDI MS/MS spectrum of BG peptide ion with m/z value of 1584 in the spectrum above

MTE50 Interfaced with DART Ion Source



Detection of narcotics



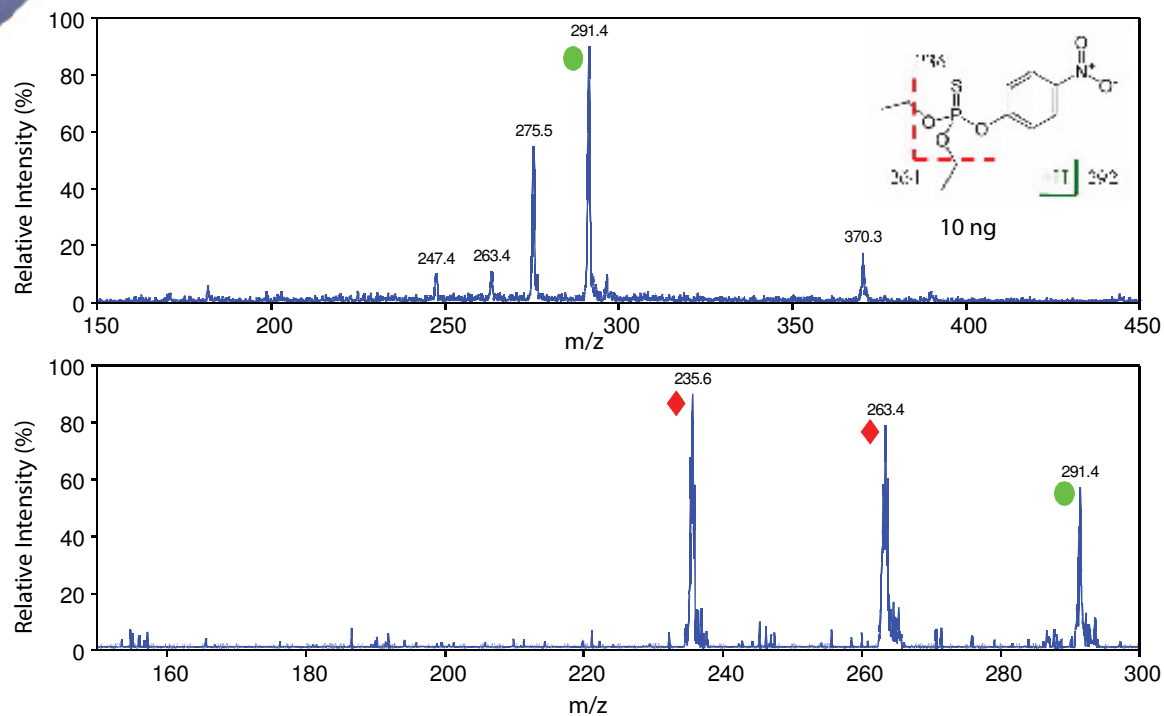
DART MS and DART MS/MS spectra of Cocaine. The molecular ion is indicated with green circle; fragment ions are indicated with red diamonds.

MTE50 Interfaced with DART Ion Source



Detection of pesticides

Parathion



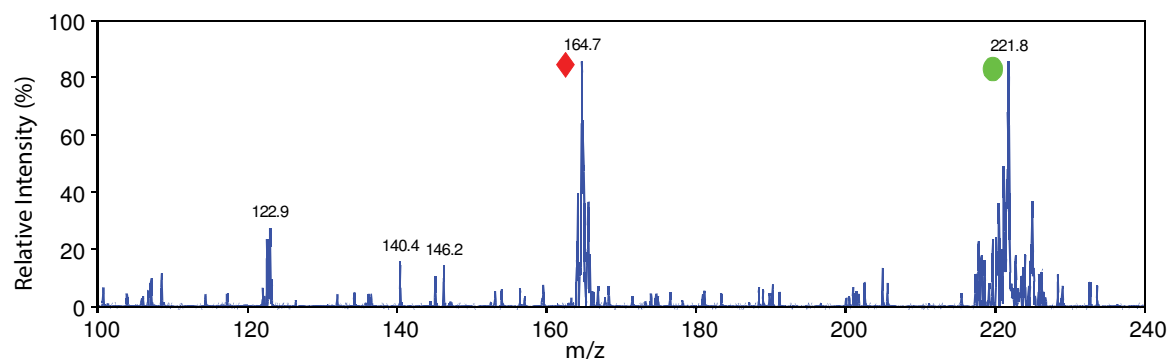
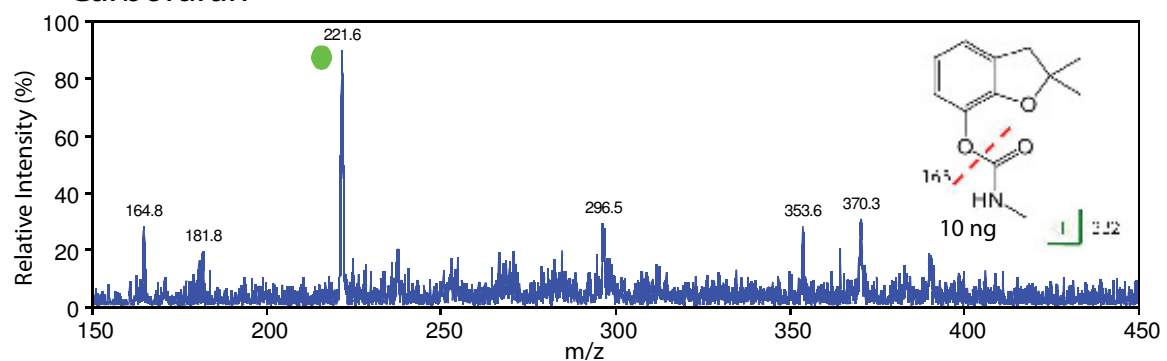
DART MS and DART MS/MS spectra of Parathion. The molecular ion is indicated with green circle; fragment ions are indicated with red diamonds.

MTE50 Interfaced with DART Ion Source



Detection of pesticides

Carbofuran

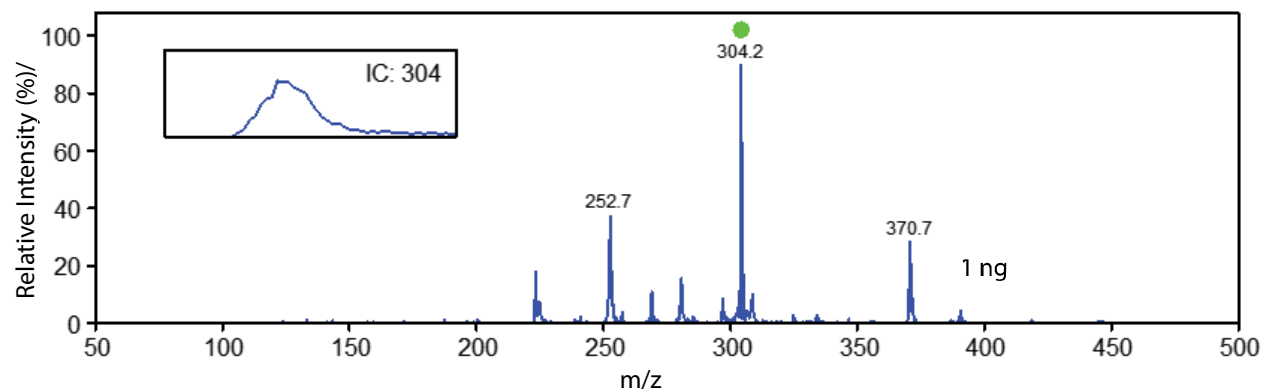


DART MS and DART MS/MS spectra of Carbofuran. The molecular ion is indicated with green circle; fragment ions are indicated with red diamonds.

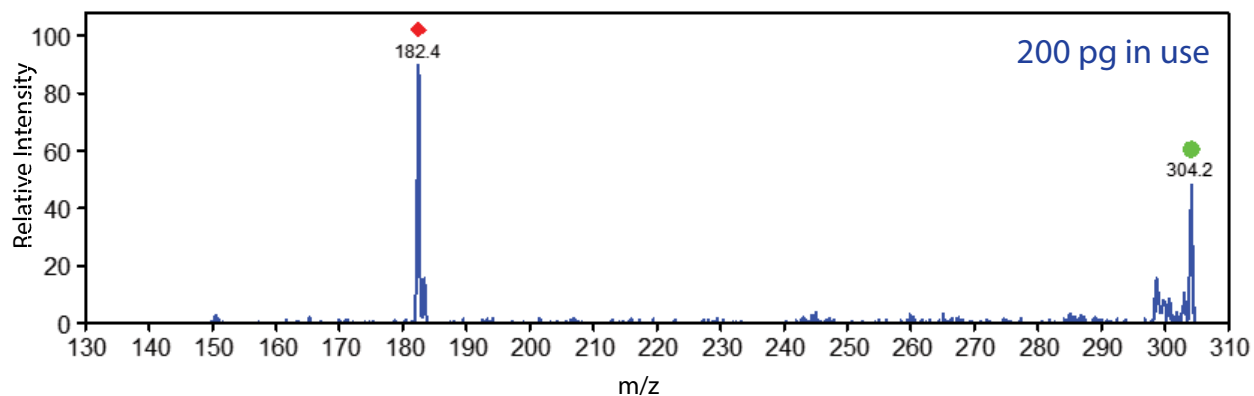
MTE50 Interfaced with DS-APCI Ion Source



Detection of narcotics

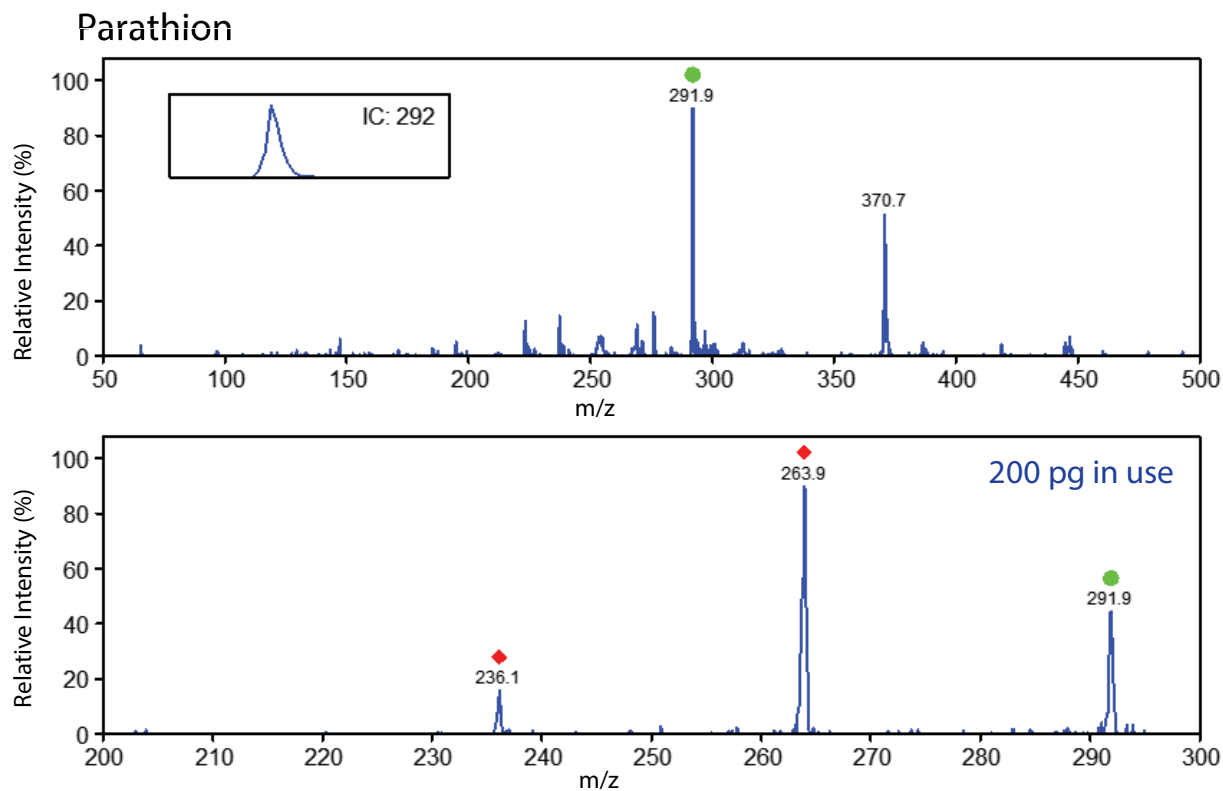


DS-APCI MS (above) and MS/MS (below) spectra of Cocaine. The molecular ion is indicated with green circle; fragment ions are indicated with red diamonds.



MTE50 Interfaced with DS-APCI Ion Source

Detection of pesticides

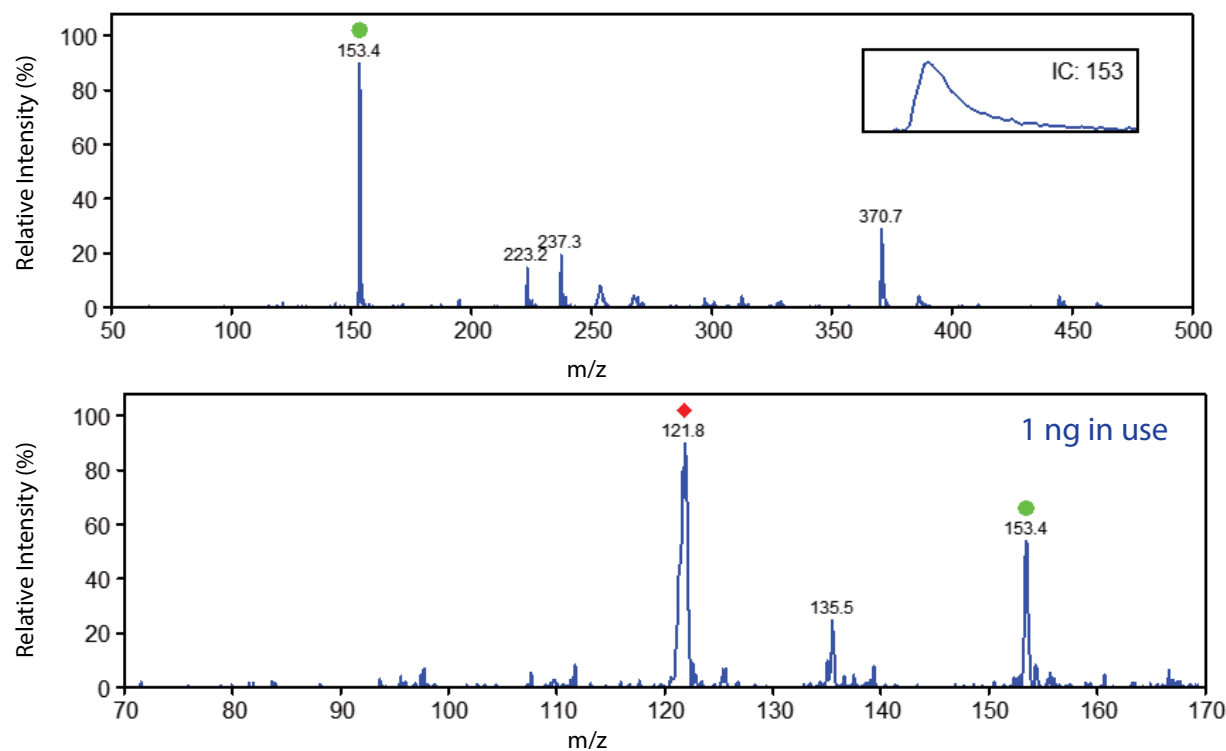


DS-APCI MS and MS/MS spectra of Parathion. The molecular ion is indicated with green circle; fragment ions are indicated with red diamonds.

MTE50 Interfaced with DS-APCI Ion Source



Methyl Salicylate

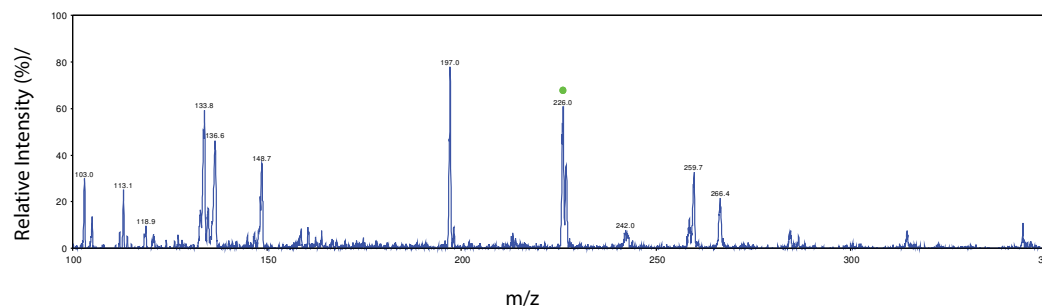


DS-APCI MS and MS/MS spectra of Methyl Salicylate. The molecular ion is indicated with green circle; fragment ions are indicated with red diamonds.

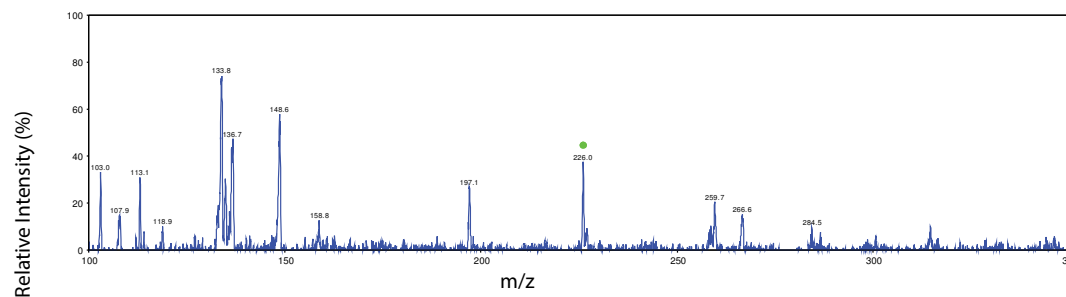
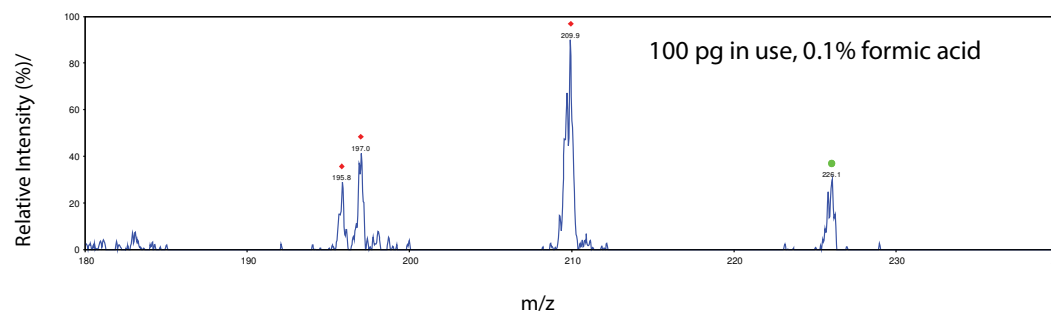
MTE50 Interfaced with DS-sESI Ion Source



Detection of explosives



DS-sESI MS (above) and MS/MS (below) spectra of TNT. Direct injection. The molecular ion is indicated with green circle; fragment ions are indicated with red diamonds.

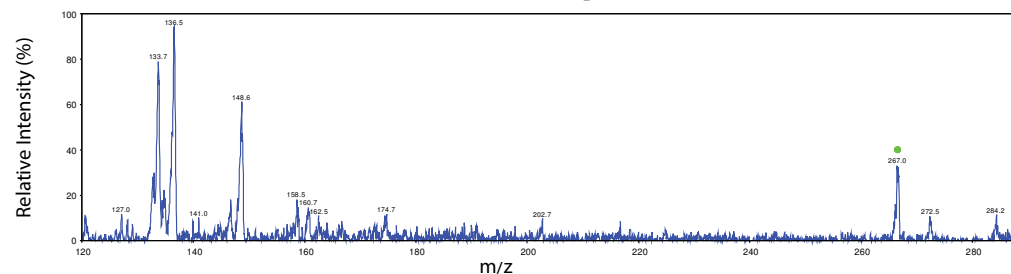


Solid probe of 100 pg of TNT; MS mode; 0.1% formic acid.

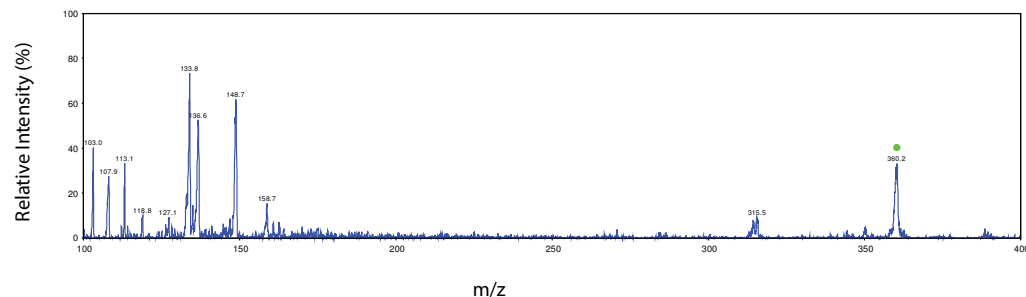
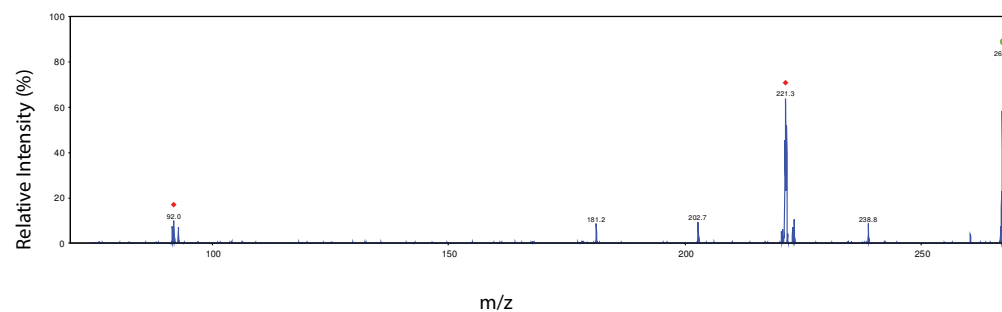
MTE50 Interfaced with DS-sESI Ion Source



Detection of explosives

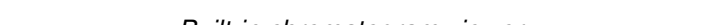


DS-sESI MS (above) and MS/MS spectra (below) of 10 ng RDX by direct injection. The molecular ion is indicated with green circle; fragment ions are indicated with red diamonds. 0.1% formic acid.

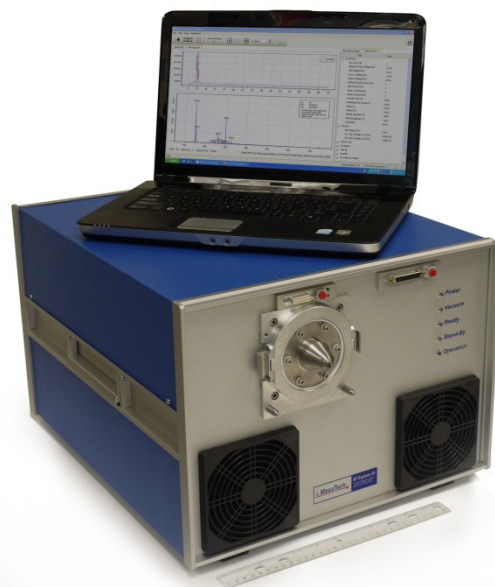


DS-sESI MS spectra of 10 ng PETN (above). 0.1% formic acid.

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Portable MS: What is the potential market?



- Field-deployable mass spectrometry (MS) applications
- Portable MS applications
- Environmental MS applications
- Ambient MS applications
- Fieldable biological MS applications (like DoD, DHS, DARPA)

Questions?



- Call: (443) 539-1758
- Email: msms@apmaldi.com
- Visit our website: www.apmaldi.com
- Address: MassTech, Inc.

6992 Columbia Gateway Drive, #160
Columbia, MD 21046

