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

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**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

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**MTE50 Interfaced with AP-MALDI Ion Source**

- **Limit of detection**
- 1 fmol
- 10 fmol

**MS/MS capability**

- AP MALDI MS/MS spectra of peptide ions: 10 fmol and 1 fmol (insert) loaded
MTE50 Interfaced with AP-MALDI Ion Source

Identification of Bacillus Globigi spores

AP MALDI MS spectrum of Bacillus Globigi 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

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

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

Relative Intensity (%)/
m/z

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.

Detection of explosives

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

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.

Detection of explosives

DS-APCI MS and MS/MS spectra of TNT. Direct injection. Solid probe of 100 pg of TNT; MS mode; 0.1% formic acid.

Relative Intensity (%)/
m/z
MTE50 Interfaced with DS-sESI Ion Source

Detection of explosives

DS-sESI MS spectra 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 by direct injection. 0.1% formic acid.

MODAS: Control Software

Software tools for custom application software development

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)