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Office of Technology Development

Cryogenic Fourier Transform Mass Spectrometer

Invention:

Researchers from the Department of Biochemistry at Boston University are developing a Fourier transform mass spectrometer (FTMS) instrument with a magnetic field greater than 10T and both a cryo-pumped vacuum system and amplifier cooled to the same temperature as the superconducting magnet.

Features and Benefits / Advantages:

- **Improved sensitivity and detection limits**
- **Improved mass detection accuracy**
- **Improved signal / noise ratio**
- **Decreased base pressure of the FTMS**
- **Elimination of the insulation required to generate a room-temperature bore**
- **Ability to use larger bore diameters**
- **Ability to use higher magnetic field, smaller bore diameters**
- **Ability to use lower cost, higher field magnets**
- **Decreased amplifier thermal and shot noise**

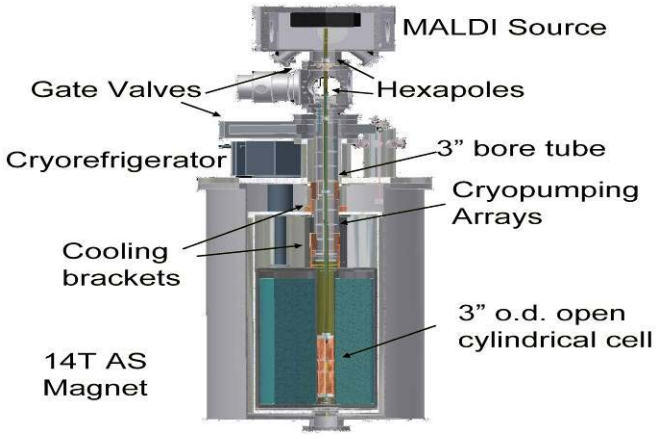
Applications:

- Fourier transform mass spectrometers with the following ion sources:
  - MALDI Matrix-Assisted Laser Desorption/Ionization
  - ESI Electrospray Ionization
  - EI Electron-Impact Ionization
- Fourier transform mass spectrometers using the following fragmentation methods:
  - CAD Collisionally Activated Dissociation
  - SID Surface-Induced Dissociation
  - ECD Electron Capture Dissociation
  - EDD Electron Detachment Dissociation
  - ETD Electron Transfer Dissociation
  - IRMPD Infrared Multi-Photon Dissociation
  - UVPD UV Photon Dissociation

Stage of Development:

A prototype has been constructed and successfully tested for 14T performance and 350k resolving power. Testing is currently being conducted to improve performance to 500k resolving power and 0.1-0.2 ppm mass accuracy.

Background:



An apparatus and method for performing ion mass spectrometry via Fourier transform ion cyclotron resonance utilizes a superconducting magnet with a bore and a vacuum chamber received in the magnet bore. The superconducting magnet and the vacuum chamber are enclosed in a cooling chamber and cooled together until the operating temperature of the magnet is reached. Because of the temperature of the vacuum chamber is similar to the operating temperature of the superconducting magnet during operation, the wall of the vacuum chamber is sufficiently cold to function as a cryogenic vacuum pump to provide enhanced pumping of the volume in the vacuum chamber. The approach of cooling the vacuum chamber wall to provide cryogenic pumping can also be used when the magnet is of a non-superconducting type.

Intellectual Property:

US Utility Patent 6,720,555 B2

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