

Combining the Thermo Scientific LTQ Velos with industry leading Orbitrap™ technology the Thermo Scientific LTQ Orbitrap Velos provides the next level of performance for your research.

Thermo Scientific LTQ Orbitrap Velos

Hybrid FT Mass Spectrometer
Ultimate Confidence



- New API source with new S-lens ion optics technology
- Dual-Pressure Linear Ion Trap
- Collision cell with axial field gradient
- Resolving power of >100,000
- Mass accuracy better than 1 ppm
- Multiple fragmentation techniques: CID, HCD, and available ETD
- Parallel MS and MSⁿ analysis

The Thermo Scientific LTQ Orbitrap Velos combines the proven mass accuracy and ultra-high resolution of the Orbitrap mass analyzer, with the increased sensitivity and improved cycle time of the LTQ Velos™. The high mass accuracy of the LTQ Orbitrap Velos increases the speed and confidence of identification in complex samples by minimizing false positive identification. The ultra-high resolution provides certainty in analytical results by enabling molecular weight determination for intact proteins and in-depth analysis of isobaric species. The new HCD cell in the LTQ Orbitrap Velos is more efficient, resulting in improved quantitation of isobarically-labeled peptides, such as applications requiring Tandem Mass Tags (TMT). Electron Transfer Dissociation (ETD) generates complementary information for highly sensitive PTM analyses and *de novo* sequencing.



Hardware Specifications

LTQ Velos Dual-Pressure Linear Trap

Ion Max™ API Source

- Enhanced sensitivity and ruggedness
- Sweep Gas™ reduces chemical noise
- 60° interchangeable ion probe orientation
- Removable metal ion transfer tube provides vent-free maintenance

S-Lens

- A progressively spaced stacked ring ion guide ("S-lens")
- The S-lens is a radio frequency (RF) device that captures and efficiently focuses the ions in a tight beam
- Large variable spacing between electrodes allows for better pumping efficiency and improves ruggedness
- Automatic tuning program for optimizing transmission

Transfer Ion Optics

- Advanced ion guides
- High stability and ion transmission efficiency

Dual-Pressure Linear Trap

- High-pressure cell for improved isolation and fragmentation efficiency
- Low-pressure cell for improved scan speed, resolving power and mass accuracy

Vacuum System

- Differential pumped vacuum system to 10⁻⁵ Torr
- Split-flow turbomolecular pump controlling vacuum in three regions
- Dual rotary vacuum pump configuration
- Aluminum high-vacuum analyzer chambers

Detection System

- Patented dual conversion dynode detector
- Two off-axis continuous dynode electron multipliers with extended dynamic range
- Digital electronic noise discrimination

Orbitrap Mass Analyzer

- Gas-free multipole ion transfer optics
- Improved gas (nitrogen) filled C-Trap
- High-transmission ion transfer optics
- Straight multipole collision cell with axial field for HCD
- Orbital trap
- Active temperature control using a Peltier element
- Differentially pumped vacuum system with:
 - Rotary vane pumps as fore vacuum pumps, one water-cooled 60 L turbomolecular pump, and two water-cooled 210 L turbomolecular pumps
 - Final vacuum under operating conditions < 4 x 10⁻¹⁰ Torr
 - Vacuum control by active Pirani gauge and cold ion gauge
- Low noise detect amplifiers
- 14-bit signal digitization
- Ultra-fast real-time data acquisition and instrument control system
- Automatic calibration of all transfer and Orbitrap parameters via instrument control software

Options

- H-ESI II – Heated Electrospray Ionization Source for enhanced ionization efficiency with flow rates of 1 µL/min or to < 2000 µL/min.
- ESI probe compatible with liquid flow rates of < 1 µL/min to 1 mL/min without splitting (required)
- Nanospray source supports static packed tip and dynamic nanospray experiments, compatible with liquid flow rates of 50 nL/min to 2 µL/min*
- APCI source compatible with liquid flow rates of 50 µL/min to 2 mL/min without splitting
- APCI/APPI source compatible with liquid flow rates of 50 µL/min to 2 mL/min without splitting
- Metal needle option for high- and low-flow analyses

*Lower limit is dependent on gauge of needle used

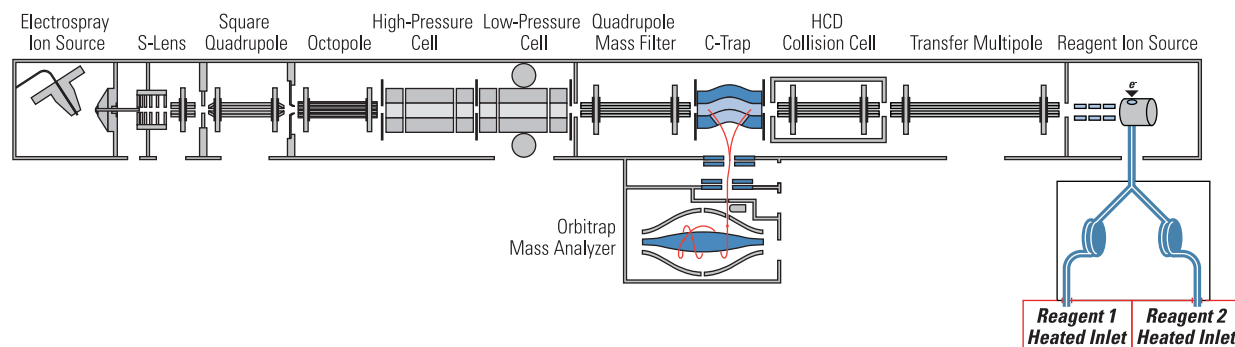
Performance Characteristics

PERFORMANCE CHARACTERISTICS

Mass Range	<i>m/z</i> 50-2000, <i>m/z</i> 200-4000
Resolution	60,000 at <i>m/z</i> 400 at a scan rate of 1 Hz, minimum resolution 7,500 maximum resolution >100,000 at <i>m/z</i> 400
Mass Accuracy	< 3 ppm with external calibration, < 1 ppm using internal calibration
MS/MS Sensitivity (Ion Trap)	Electrospray Ionization (ESI) -2 µL of a 50 fg/µL solution of reserpine (100 femtograms total) injected at a flow of 500 µL/min will produce a minimum signal-to-noise ratio of 100:1, for the transition of the isolated protonated molecular ion at <i>m/z</i> 609 to the largest two product ions, <i>m/z</i> 397 and <i>m/z</i> 448, when the mass spectrometer is operated at unit resolution in the full-scan MS/MS mode, scanning the product ion spectrum from <i>m/z</i> 165 - 615.**
Dynamic Range	>5,000 within a single scan guaranteeing specified mass accuracy
MS Scan Power	MS ⁿ , for n = 1 through 10
ETD option	3 µL/min infusion of a 1 pmol/µL solution of Angiotensin I will produce an electron transfer dissociation fragmentation efficiency of >15%
Analog Inputs	One (1) analog input (0-1 V), One (1) analog (0-10 V)

** Requires H-ESI II.

Schematic of the LTQ Orbitrap Velos



Software Features

Data System

- High performance PC with Intel® microprocessor
- High resolution LCD color monitor
- Microsoft Windows® XP operating system
- Microsoft Office XP software package
- Thermo Scientific Xcalibur processing and instrument control software
- FT-Programs software tools: ProteinCalculator and Recalibrate Offline

Operation Modes

- Data Dependent Decision Tree – Automatic selection of the optimal fragmentation technique based on peptide properties (charge state, m/z) for highest fragmentation efficiency.
- High-resolution accurate-mass scans at high repetition rates
- Precursor ion isolation and fragmentation in the linear ion trap (CID) with high resolution accurate mass MS/MS and MSⁿ data acquisition in the Orbitrap mass analyzer
- Data Dependent™ scans using both the linear ion trap and the Orbitrap mass analyzer
- Data Dependent MS/MS with parallel acquisition of multiple MSⁿ scan in the linear ion trap while acquiring a high resolution full scan MS spectrum in the Orbitrap analyzer
- Ion Mapping, Neutral Loss Ion Mapping, Parent Ion Mapping, user selectable Dynamic Exclusion™, Nth order Triple Play experiment, Data Dependent Ion Tree experiment, Total Ion Map experiment

Optional Thermo Scientific Application-Specific Software

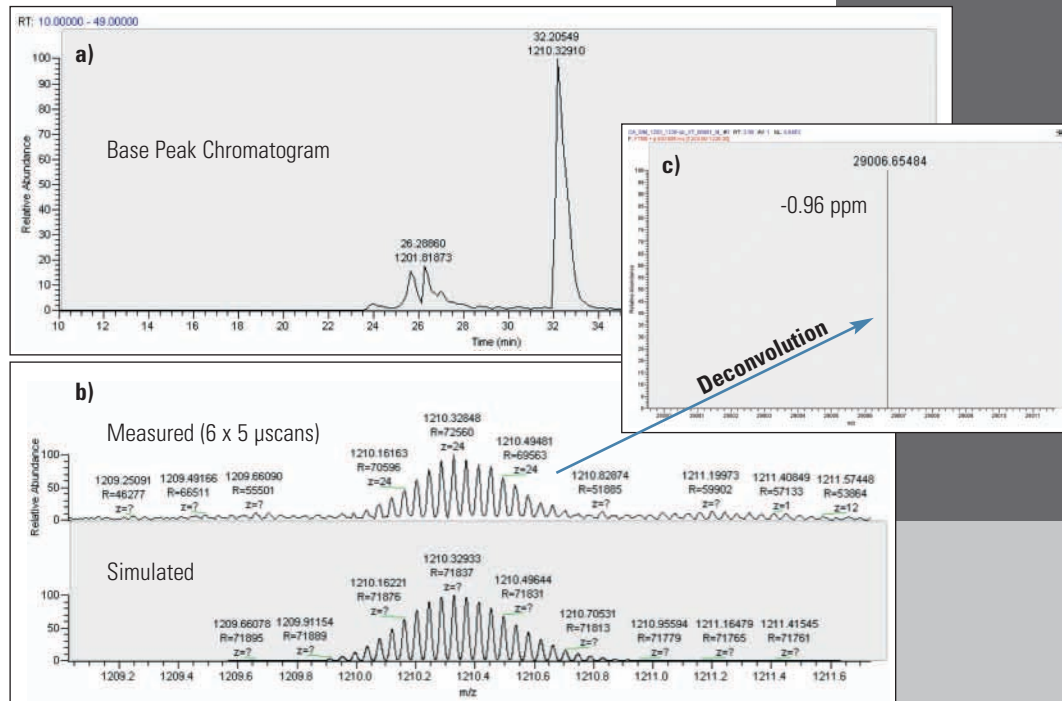
- Proteome Discoverer – Mass informatics platform for protein scientists
- ProSight PC - Top down identification and characterization of proteins incl. PTMs
- MetWorks™ – automated metabolite identification using spectral trees and accurate mass data
- Mass Frontier™ – predictive fragmentation software for spectral interpretation and classification software to identify unknowns
- PEAKS™ – powerful, easy *de novo* sequencing
- SIEVE™ – automated differential expression analysis in proteomics or metabolomics applications
- ProMass™ Deconvolution – intact protein analysis

Exclusive Technologies

- Precursor ion selection in the linear ion trap and fragmentation in the new collision cell (HCD) with high resolution accurate mass detection in the Orbitrap mass analyzer
- Pulsed-Q Collision Induced Dissociation (PQD) enables trapping of low mass fragment ions
- Unique, patented Automatic Gain Control (AGC™) ensures that the ion trap is always filled with the optimum number of ions for any scan type
- Dynamic Exclusion allows acquisition of MS/MS and MSⁿ spectra from lower intensity ion species
- WideBand Activation™ generates more structurally informative spectra
- Normalized Collision Energy™ for multiple fragmentation techniques (CID and HCD) providing reproducible data from instrument to instrument
- Stepped Normalized Collision Energy (CID and HCD) allows for the variation of the collision energies in MS/MS experiments
- Multistage Activation (MSA) generates combination of MS/MS spectra and MS³ spectra based on a user defined neutral loss

Advanced Data Dependent Experiments

- Data Dependent features trigger acquisition of MSⁿ spectra only when a compound of interest is detected
- Isotopic Data Dependent scanning software triggers MS/MS scanning only when a specified isotopic pattern is detected
- Ion Mapping automatically generates a 3-dimensional MS/MS map, yielding product ion, precursor ion, and neutral loss information
- Ion Mapping Browser software displays data generated by Ion Mapping experiments
- Data Dependent Ion Tree performs MSⁿ experiments on up to 25 species
- MSⁿ Browser software displays data generated by Data Dependent Ion Tree and Ion Mapping experiments
- Monoisotopic precursor selection for Data Dependent MS/MS experiments
- Data Dependent (accurate) Neutral Loss - Trigger MS³ scans on only the MS/MS product ions with a pre-defined neutral loss



Intact proteins: LC-MS analysis of intact carbonic anhydrase (a). Zoom-in on charge state 24+ demonstrating the resolving power capabilities of the LTQ Orbitrap Velos system (b). Deconvoluted spectrum to display monoisotopic mass of the intact protein with an accuracy of better than 1 ppm (c).

Installation Requirements

LTQ Orbitrap Velos

Power

- 230 Vac \pm 10% 3 phase, 15 Amps, 50/60 Hz, with earth ground for the instrument
- 120 or 230 Vac single phase with earth ground for the data system
- 120 or 230 Vac single phase, 15 Amps, with earth ground for the water chiller

Gas

Helium

Ultra-high purity (99.999%) with less than 1 ppm each of water, oxygen and total hydrocarbons

Nitrogen

High purity (99.5% pure, flow rate 15 L/min) nitrogen gas supply for the API source and the C-Trap

Environment

- System averages 2800 W (10,000 Btu/hr) output when considering air conditioning needs
- Operating environment must be 16 - 26°C (59 - 78°F) and relative humidity must be 50 - 80% with no condensation
- Optimum operating temperature is 18 - 21°C (65 - 70°F)

Weight

MS: ~620 kg

Dimensions

MS: (h x w x d)

141.4 cm x 87 cm x 146.3 cm

Water Cooler

Provided with the instrument

ETD Option

Gas

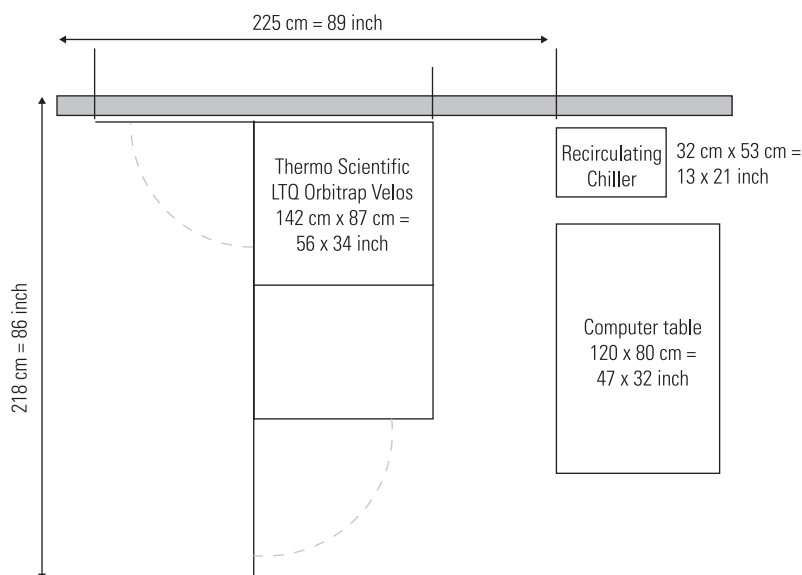
Nitrogen supply for ETD option: Ultra-high purity nitrogen (UHP, 99.999%) with less than one ppm each water and oxygen.

Access

At 79 cm access required at the rear of the instrument.

Environment

- System averages with ETD 3500 W (12,000 Btu/hr) output when considering air conditioning needs



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