Welcome!

Denver, CO
Houston, TX
February 2009
• Schedule & Introductions

• Announcements

- Safety
- Evaluation forms
- Upcoming events
  > CBMSS, Feb 10\textsuperscript{th}, Nat’l Jewish Center, www.cbmss.org (also Apr 22\textsuperscript{nd})
  > AAFS, Feb 16\textsuperscript{th} – 21\textsuperscript{st}, Denver Conv. Ctr., www.aafs.org
  > AACR, Apr 18\textsuperscript{th} – 22\textsuperscript{nd}, Denver Conv. Ctr. www.aacr.org
Agilent LC/MS Overview
Leading the Industry in Performance and Reliability

LC/MS Innovations Tour: Denver 2009
Agilent’s 37 Year Heritage in Mass Spectrometry

GC/MS 1971 - 2007

1971: 5930A
1976: 5992A
1986: 5970B MSD
2007: 5975C

ICP-MS 1994 - 2006

1994: 4500
2006: 7500cx

LC/MS 1994 - 2004

1996, 2000: LC/MSD, LC/MSD Ion Trap
2003, 2006: LC/MSD TOF

- Over 27,000 GC/MS, 2,500 ICP-MS and 4,500 LC/MS systems
- Agilent (and previously, as HP) has sold more quadrupole MS systems than any other mfr.
Agilent’s newer LC/MS systems – A look inside

Over 10 years in LC/MS atmospheric sampling and patented orthogonal geometry - result in industry leading sensitivity and robustness

Collision cell incorporates axial acceleration for high speed MS/MS analysis
Major milestone !!

> 900 Agilent Triple Quads Sold!

408 in FY08!
Agilent LCMS at Beijing 2008 Olympics

- CADA Lab (China Anti-Doping Lab)
- 18 Agilent LCMS Systems
- 19 Agilent GC/MS Systems
- 10 Agilent Application Engineers

- >4,500 samples
- 24 hr turnaround time
- 100 CADA scientists

"Agilent’s liquid chromatography and mass spectrometry instrumentation will help make China’s Anti-Doping Agency testing in the 2008 Olympic Games the most technologically advanced yet."

Dr. Du Lijun, Director of China’s Anti-Doping Agency
The 6000 Series LC/MS portfolio

6500 Series QTOFs
Ultimate MS/MS system value with high analytical performance for accurate mass based structural studies and identification of proteins and small molecules

6400 Series Triple Quadrupoles
High sensitivity MS/MS system for targeted quantitative, confirmatory analysis

6100 Series Single Quads
Easy to use, inexpensive, high selectivity MS system for screening and routine quantitation

6300 Series Ion Traps
Sensitivity MS\textsuperscript{n} system for the screening and identification of unknowns

6200 Series TOFs
High throughput walk-up accurate mass system for screening and compound confirmation

Powered by: 1200 Series LC and Rapid Resolution System

Qualitative
Quantitative

Agilent Technologies
LC/MS – Ion sources

Wide range of sampling conditions

Sources are interchangeable between mass spectrometer platforms

Multimode source

- Flow rates up to 2 mL/min
- Simultaneous operation

HPLC-Chip/MS

- Nanoelectrospray without the fuss
- Reproducible response and retention times
- On-chip enrichment for speed and sensitivity
HPLC-Chip technology

- Stator
- Rotor
- Six-port valve
- Sample Ports
- Enrichment Column
  - 40 nL, 160 nL
  - 500 nL - NEW
- Analytical Column
  - 75 x 50 µm cross section
  - 43 mm, 150 mm
- New Laser Ablated ESI Tip
Agilent High Performance 1200 Series LC: Best in Class “Front End” Systems for MS

Preparative LC  Standard LC  Rapid Resolution LC  Capillary & Nano LC  High Sensitivity HPLC-Chip/MS

Chose from the industry’s most comprehensive LC portfolio to configure an integrated LC/MS system
Agilent LC-MS column configurations:

<table>
<thead>
<tr>
<th>Column Type</th>
<th>Column I.D.</th>
<th>Column Lengths</th>
<th>Particle Sizes</th>
<th>Flow Rate Range</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nano</td>
<td>0.075, 0.10 mm</td>
<td>50, 150 mm</td>
<td>3.5 µm</td>
<td>100 – 600 nL/min</td>
</tr>
<tr>
<td>Capillary</td>
<td>0.3, 0.5 mm</td>
<td>35-150, 250</td>
<td>3.5, 5 µm</td>
<td>1 – 10 µL/min</td>
</tr>
<tr>
<td>MicroBore</td>
<td>1.0 mm</td>
<td>30, 50, 150</td>
<td>3.5, 5 µm</td>
<td>30 – 60 µL/min</td>
</tr>
<tr>
<td>NarrowBore</td>
<td>2.1 mm</td>
<td>15 – 250</td>
<td>3.5, 5, 8 µm</td>
<td>0.1 – 0.3 mL/min</td>
</tr>
<tr>
<td>Solvent Saver</td>
<td>3.0 mm</td>
<td>50 – 250</td>
<td>3.5, 5 µm</td>
<td>0.3 – 1 mL/min</td>
</tr>
<tr>
<td>Analytical</td>
<td>4.6 mm</td>
<td>15 – 250</td>
<td>1.8, 3.5, 5 µm</td>
<td>1 – 1.5 mL/min</td>
</tr>
</tbody>
</table>

... plus Prep columns – 9.4, 21.2, 30, and 50 mm id
Agilent Jet Stream ion generation

No ion left behind…

The collimated thermal containment zone creates a dramatically “brighter source”

- LC sample inlet
- Nebulizing gas
- Super-heated sheath gas
- MS inlet
- Nozzle voltage
- Heated drying gas
- Resistive sampling capillary
Agilent Jet Stream: Thermal Gradient Focusing technology
Innovations with new “Agilent Jet Stream” Technology:
*5-10x increase in sensitivity*

6460 LC/QQQ

6530 LC/Q-TOF
New 6460 Triple Quad: World’s Most Sensitive QQQ with Agilent Jet Stream Technology

NEW Agilent 6460 Triple Quad LC/MS
The World’s Most Sensitive Triple Quad!

- Breaking Sensitivity Barriers with Agilent Jet Stream Technology
- Ultra-sensitive food safety and water analysis
- New MassHunter MS Optimizer Software for automated method development
QQQ MRM optimization:

2 key parameters:

Fragmentor Voltage  Collision Energy
MassHunter “Dynamic MRM”

A simple comparison of MRM and “Dynamic MRM”

<table>
<thead>
<tr>
<th>Time Segment 1</th>
<th>Time Segment 2</th>
<th>Time Segment 3</th>
<th>Time Segment 4</th>
</tr>
</thead>
<tbody>
<tr>
<td>Time (min)</td>
<td>1  2  3  4  5</td>
<td>6  7  8  9  10</td>
<td>13  14  15  16</td>
</tr>
<tr>
<td></td>
<td>12  11  10  9</td>
<td>8  7  6  5  4</td>
<td>17  18  19  20</td>
</tr>
<tr>
<td></td>
<td>21  22  23  24</td>
<td>25</td>
<td></td>
</tr>
</tbody>
</table>

**MRM**

- Compounds (10/block):
  - Time Segment 1: 50
  - Time Segment 2: 80
  - Time Segment 3: 100
  - Time Segment 4: 70

- Cycle Time (sec):
  - Time Segment 1: 0.5
  - Time Segment 2: 0.8
  - Time Segment 3: 1
  - Time Segment 4: 0.7

**Scheduled MRM**

- Max Coincident Cycle Time (sec):
  - Time Segment 1: 20
  - Time Segment 2: 40
  - Time Segment 3: 40
  - Time Segment 4: 30

- Time Segment 1: 0.2
  - Time Segment 2: 0.4
  - Time Segment 3: 0.4
  - Time Segment 4: 0.3

=> **2 x shorter cycle times supports narrow chromatographic peaks, more analytes or longer dwell per analyte.**
Introducing the Agilent 7000 Series GC Triple QQQ: Shipping Feb’09
Why a Triple Quadrupole?

A picture is worth a thousand words.

- GC/MS Single Quad SIM
  - MS SIM
  - S/N: 116:1 RMS

- GC/MS/MS QQQ MRM
  - MS/MS MRM
  - EI 100 fg HCB in “DIRTY” Matrix

100 fg HCB
Cutting Edge 6530 Q-TOF Performance

With…

Agilent Jet Stream Technology
True Hi-Def TOF Technology

Unmatched sensitivity, speed and mass accuracy
Unique data mining tools for faster compound ID

✓ Mass accuracy – approaching FTMS mass accuracy
✓ Sensitivity- high femtogram level detection
✓ Increased resolving power: >20,000
✓ Extended dynamic range: 5 Decades in-Scan
✓ Acquisition speed: 10 MS/MS per second

Leads the industry in all dimensions*

* For systems less than 0.5 Ton and 9 feet in height
New Ultra High Speed Acquisition
Matching TOF/QTOF Analyzers and Electronics Performance

Two New Modes: 4 GHz for Enhanced Resolving Power
2-Channel x 2 GHz Dual Gain for Extended Dynamic Range

• 4 GHz (8 bit) Analog-Digital-Converter ADC
  – Adapted from Agilent’s High Speed Oscilloscope Systems

• Ultra High Speed FPGA process and store transients in real time
  – Up to 20,000 m/z depth
**4 GHz ADC resolution example: two compounds**

- nominally 195 \( m/z \) separated by 0.036 Da

![Methyl 5-acetylsalicylate](image)

\([M+H]^+ 195.065185 \ m/z\)

Butyl paraben

\([M+H]^+ 195.101571 \ m/z\)

![FIA, 2 scans/sec (6713 transients/scann)](image)

*2 IRM averaged over five scans*

---

4 GHz board, 1 GHz rate

6,100 FWHM resolution

Error = + 0.8 ppm

4 GHz, high resolution mode

0.036 Da

14,000 FWHM resolution

Error = - 0.9 ppm
New 4 GHz acquisition system — up to 5 decades of in-spectrum dynamic range

In-Scan Dynamic Range

This Example

\[ \frac{9 \times 10^6}{250} = 3.6 \times 10^4 \]

Maximum

\[ \frac{3 \times 10^7}{250} = 1.2 \times 10^5 \]
New Agilent MassHunter Workstation Software

**Instrument Control**
- Real-time monitoring
- Method set-up
- Autotune

**Qualitative Analysis**
- Chromatographic results
- Spectral results
- Find compounds

**Quantitative Analysis**
- User filters
- Compound results
- Calibration curve
Full integration: the lab, business applications, OpenLAB, the company network