Using a Diode Array UV-Vis in Regulated Environments

Workflow, Performance and Compliance Benefits

Presenter:
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Spectroscopy Product Manager
Agilent Technologies, Australia
Agenda

Introduction of the new Agilent Cary 8454 UV-Vis – features that work for today’s laboratories

Performance and design of the diode array UV-Vis: workflow and productivity benefits

Tools for compliance of the Cary 8454 UV-Vis spectroscopy system
Introduction to the NEW Agilent Cary 8454 UV-Vis
A history of proven technology

- The Cary name represents over 60 years of excellence in optical design
- Award winning innovations

Howard Cary - the man behind the early Cary instruments.
A history of proven technology

- History of production, reliability and support
- Agilent is leader in photo diode array technology – both LC and UV

The Agilent Cary 8454 continues the tradition of Agilent’s #1 position in UV-Vis Diode Array technology.

“Lights the way for faster, nondestructive, chemical identification”
Agilent Cary 8454 UV-Vis diode array
Designed for today’s laboratories

Instrument design considerations
- Compact footprint to preserve valuable bench space
- Optical and mechanical design must be robust and reliable for everyday use in multiuser environment - zero user alignment required

Workflow considerations
- Sampling throughput is important due to time and productivity constraints
- System must have performance that matches or exceeds the requirements
Agilent Cary 8454 UV-Vis diode array
Designed for today’s laboratories

Simple optical design
- Simple optical and mechanical design ensures durability
- Reliability – no moving parts affect the measurement

Fixed grating and non moving optical components
Easily replaceable lamp modules
All light goes through the sample
Agilent Cary 8454 UV-Vis diode array

Designed for today’s laboratories

Instrument Design

- Small footprint – less laboratory space
- Open sample compartment – easy access for improved workflow, less user error
- Hard surface buttons – suitable for chemical laboratories
Workflow and Productivity Benefits
Benefits for workflow and productivity

With diode array technology

Speed of the diode array

- Data collection
- Result presentation
Benefits for workflow and productivity

With diode array technology

Speed of the diode array

- Data collection
- Result presentation - turn data into an answer!
Benefits for workflow and productivity

With diode array technology

Application Benefits

- Simultaneous acquisition of a full spectrum in a single step – Fast!
- Monitor reactions that occur on a seconds time scale – applications for kinetics
- Identification of undesired peaks in existing and characterized products - QA/QC efficiency

http://www.chem.agilent.com/Library/applications/5991-4283EN.pdf
Benefits for workflow and productivity

With diode array technology

Application specific software modules

- Advanced Mode
  - Compare spectra
  - Define equations
  - Perform math analysis
  - Automated analysis
  - Complex reports

- Biochemical Analysis
  - Time traces
  - Single-/multi-cell kinetics
  - Thermal denaturation
  - Mathematical operations

- Dissolution Test
  - Single bath control
  - Multibath control
  - Multicomponent analysis
  - Customizable analysis
  - Customizable reports

General Purpose

- Measure
- Display
- Store
- Print
- Analysis
- Methods
- Standards

Agilent Technologies
Dissolution and the New Agilent Cary 8454 UV-Vis
Scalable solutions for every workflow

Agilent, Varian and VanKel dissolution apparatus can be directly linked to the 8454 UV-Vis spectrophotometer for unattended, online analysis.
Dissolution and the New Agilent Cary 8454 UV-Vis

Online and offline solutions

Online and offline solutions are available for dissolution sample analysis with the UV-ChemStation software – providing a single-vendor solution from an established market leader.

Combining a sipper system with an XY autosampler eliminates manual handling errors and maximizes throughput for offline UV-Vis sample analysis.
Benefits for workflow and productivity

With diode array technology

Productivity benefits

- High throughput liquid analysis
- Multi wavelength analysis
- Excellent photometric performance

Full backwards compatibility
Tools for Compliance
Tools for compliance

Cary 8454 UV-Vis System

Design for regulated environments

- built-in self-test procedure for optical performance and electronics check
- initiate at any time
- detect any changes in instrument performance
- results stored in electronic logbook and can be printed and reviewed as required

<table>
<thead>
<tr>
<th>Test</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Electronic</td>
<td>• Check microprocessor performance</td>
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<tr>
<td></td>
<td>• RAM</td>
</tr>
<tr>
<td></td>
<td>• Communications interface</td>
</tr>
<tr>
<td></td>
<td>• Shutter</td>
</tr>
<tr>
<td>Optics</td>
<td>• Intensity profile</td>
</tr>
<tr>
<td></td>
<td>• Dark current</td>
</tr>
<tr>
<td></td>
<td>• Wavelength accuracy of deuterium lamp emission lines</td>
</tr>
<tr>
<td></td>
<td>• Resolution of deuterium lamp emission lines</td>
</tr>
</tbody>
</table>
Tools for compliance

Cary 8454 UV-Vis System

Regulatory requirements

- Hardware performance specifications meet global (USP, EP/BP) pharmacopeia requirements

- Wavelength range: 190 – 1100 nm
- Slit width: 1 nm
- EP Resolution Test: >1.6
- Photometric accuracy: ±0.005 A (NIST 930E)
- Wavelength accuracy: <± 0.5 nm (NIST 2034)
- Wavelength reproducibility: <± 0.02 nm
- Low stray light: < 0.03% (340 nm)
Making Compliance Easy

Qualification tests for Hardware and Software

- Complete qualification services (Enterprise Edition IQ/OQ) for hardware, software and accessories
- Hardware tests for instrument performance – parameters and instrument performance specified/recommended by USP/EP

Two categories:
- OQ Tests – Global Suite (adequate to verify instrument performance)
- Extra OQ Tests available on demand
OQ Tests – Wavelength Accuracy – Source

Tests how close indicated wavelength is to actual wavelength

**How:** scans deuterium emission lines which occur at known wavelengths

**Effects:** errors both quantitative and qualitative spectroscopy
OQ Tests – Wavelength Accuracy and Reproducibility – Holmium Oxide

Tests how ability of instrument to correctly identify specific wavelengths

**How:** repeated scans of solution to produce exactly the same trace

**Effects:** quantitative errors due to wavelength shifts

Optical design of Cary 8454 has no moving parts – therefore excellent reproducibility

Holmium oxide (4%) in perchloric acid (10%)

https://www.chem.agilent.com/Library/technicaloverviews/Public/5991-3446EN.pdf
OQ Tests – Toluene/Hexane Resolution

- Spectral Bandwidth (SBW) = ability to resolve absorption lines separated by small difference in wavelength
- Toluene/Hexane used to calculate SBW
OQ Tests – Stray Light

Tests whether wavelengths of light other than desired reach detector

**How:** measures solutions that do not transmit light at indicated wavelengths, so any observed light must be stray light

**Effects:** determines maximum absorbance of instrument and can cause deviations from Beer-Lambert Law.
OQ Tests – Photometric Accuracy

Tests accuracy of the instrument

**How:** measured using NIST953a for UV region and 930e for Vis region

**Effects:** poor accuracy will produce incorrect results

[Image of Agilent 8453/8454 Instrument Performance Verification Setup]

http://intranet.chem.agilent.com/Library/technicaloverviews/Public/5991-3447EN.pdf
21 CFR 11 compliance solutions

Security Pack
Simple workstation compliance solution

Compliance Pack
Existing OpenLAB ECM users with large instrument groups

UV-Visible ChemStation B.05.02
ECM Integration – Mandatory User Logon

- Provide **ECM login** at ChemStation startup
- **Users, passwords & policies** are centrally defined in ECM
- **Protect** all ChemStation data in ECM **from unauthorized access**
- **Mandatory login** enforces login and thus provides ChemStation access to authorized individuals only
User privileges

- allow varying levels of method manipulation, data analysis, system access and validation
- privileges can be “customized” by ECM globally for site, or by project
# Single Audit Trail
Captures information that was in Security Pack Run and Method Change Logbooks

## Audit Trail

<table>
<thead>
<tr>
<th>Time</th>
<th>User Name</th>
<th>Description</th>
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<tbody>
<tr>
<td>6/20/2013 1:33:05 AM</td>
<td>analyst1</td>
<td>Changed path length of call &quot;1&quot; from &quot;1&quot; to &quot;0.5&quot;.</td>
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<td>6/20/2013 1:31:49 AM</td>
<td>analyst1</td>
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<td>analyst1</td>
<td>Changed Analyte Name from &quot;&quot; to &quot;NaCl&quot;.</td>
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<tr>
<td>6/20/2013 1:30:08 AM</td>
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<td>6/20/2013 12:32:51 AM</td>
<td>Administrator</td>
<td>Measure Sample done.</td>
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<td>labmanager1</td>
<td>Changed Wavelength 4 from &quot;nm&quot; to &quot;900nm&quot;.</td>
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<td>labmanager1</td>
<td>Measure Blank done.</td>
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<td>6/20/2013 12:30:25 AM</td>
<td>labmanager1</td>
<td>ECM User Changed from &quot;Administrador&quot; to &quot;labmanager1&quot;.</td>
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<td>6/20/2013 12:29:25 AM</td>
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<td>Changed Wavelength Range from &quot;130nm-1100nm&quot; to &quot;190nm-1000nm&quot;.</td>
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<tr>
<td>6/19/2013 2:14:32 AM</td>
<td>Administrator</td>
<td>Changed Wavelength 3 from &quot;nm&quot; to &quot;700nm&quot;.</td>
</tr>
<tr>
<td>6/19/2013 2:14:32 AM</td>
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<td>Changed Wavelength 2 from &quot;nm&quot; to &quot;660nm&quot;.</td>
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<tr>
<td>6/19/2013 2:14:16 AM</td>
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<td>Switched Enter Concentration from &quot;Concentration&quot; to &quot;Weight &amp; Volume&quot;.</td>
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<td>Changed Wavelength from &quot;480nm&quot; to &quot;600nm&quot;.</td>
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<td>6/19/2013 2:11:44 AM</td>
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<td>Loaded Method &quot;\Test\ChemStation\TO\Method\Standard Mode.m&quot; from ECM.</td>
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## Electronic Signature Logbook

<table>
<thead>
<tr>
<th>Time</th>
<th>User Name</th>
<th>Description</th>
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</thead>
<tbody>
<tr>
<td>6/20/2013 12:34:37 AM</td>
<td>Administrator</td>
<td>results viewed</td>
</tr>
<tr>
<td>6/20/2013 12:29:55 AM</td>
<td>Administrator</td>
<td>Result reviewed</td>
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<tr>
<td>6/19/2013 2:12:20 AM</td>
<td>Administrator</td>
<td>Test validation</td>
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<tr>
<td>6/19/2013 1:58:03 AM</td>
<td>Administrator</td>
<td>Completed test</td>
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Meeting the requirements of 21 CFR Part 11

<table>
<thead>
<tr>
<th>11.10</th>
<th>Control for closed systems</th>
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</thead>
<tbody>
<tr>
<td><strong>21 CFR Part 11</strong></td>
<td>Requirement</td>
</tr>
<tr>
<td><strong>11.10(a)</strong></td>
<td>Has the system been validated in order to ensure the ability to discern invalid or altered system data?</td>
</tr>
<tr>
<td><strong>11.10(b)</strong></td>
<td>Is the system capable of generating accurate and complete copies of all required records in both human readable and electronic form suitable for inspection, review and copying by the FDA?</td>
</tr>
<tr>
<td><strong>11.10(c)</strong></td>
<td>Are the records protected for accurate and convenient retrieval throughout the record retention period?</td>
</tr>
</tbody>
</table>

http://intranet.chem.agilent.com/Library/technicaloverviews/Public/5991-3449EN.pdf
New Agilent Cary 8454 UV-Vis

Reliable, Repeatable Results across the entire UV-VIS spectrum in less than one second!

What is NEW?

• Diode array detector
  • Latest technology spectrograph from Agilent’s leading HPLC
• Electronics and firmware
• Software (OpenLAB ECM)
• Modern cover design

What is the same?

• Proven optical design as the 8453
  • We listened to our customers…”Provide a seamless transition for my 8453/8452 methods so that I do not have to re-validate my SOP’s”
• Full backwards compatibility with accessories
Seamless method transition

- Transfer methods from your Agilent 8453 /8452 with ease
- Remove the need for re-validation, saving cost and time
- Maintain confidence in your results while ensuring productivity continues

**Seamless method transfer**
UV-Visible ChemStation showing triplicate salicylic acid standards, and calibration at 297 nm, collected on the Cary 8454 using a method generated on an 8453 UV-Vis

**Confidence in results**
Overlay of triplicate spectra collected on the Cary 8454 and the 8453 of 0.05 mg/mL salicylic acid.
And, don’t forget Agilent has the solution for all your routine UV-Vis needs

Cary 60 UV-Vis
- Small volumes (2 – 50 uL)
- Remote sampling using Fiber Optics
- Turbid samples

Cary 100/300 UV-Vis
- DNA or Protein thermal melts
- Higher sample throughput using 6x6 sample transport
- High turbidity samples using integrating sphere or instrument wide photometric range
The New Agilent Cary 8454 UV-Vis

- Photodiode array: full spectrum within 1 second - fast, complete data
- Small footprint and open sample area for ease of use and improved productivity
- Perfect for highly efficient routine QA/QC applications
- Controlled by UV-Vis ChemStation Software – applications for multi-component analysis, new 21CFR11 compliant link to OpenLAB ECM
- Dissolution Software driver available

Enhancing confidence in results, productivity and compliance
Where to go for more information

Agilent Life Science and Chemical Analysis Homepage:
http://www.agilent.com/chem

UV-Vis Spectroscopy homepage:

Speak to your local Agilent representative!