ROUNDTABLE SUMMARY

October 27, 2022

Scrip
Pharma Intelligence

Navigating the Regulatory Landscape – Enhancing Spectroscopy Validation and Compliance in the Pharmaceutical Lab

Suja Sukumaran, PhD, Product Manager, Thermo Fisher Scientific

KEY TAKEAWAYS

- Spectroscopy instrumentation answers key questions for pharma lab researchers and operators.
- To comply with spectroscopy requirements, companies must fulfill a series of qualifications.
- Common pitfalls that stem from outdated technology can lead to non-conformance.

in partnership with

ThermoFisher
SCIENTIFIC

OVERVIEW

Fourier-transform infrared (FTIR) spectroscopy is one of the most common forms of infrared spectroscopy and one of the most popular analytical techniques for quality assurance (QA), quality control (QC), and materials identification in the pharmaceutical industry. With pharma, food, and consumer goods manufacturers facing increasing regulatory requirements and market pressures at every step along the product life cycle, FTIR is an essential capability to ensure compliance and market staying power.

CONTEXT

Suja Sukumaran discussed types of analytical spectroscopy instruments, applications, and requirements for validation and 21 CFR Part 11 compliance. She shared tips for navigating the regulatory landscape with respect to FTIR spectroscopy instrumentation and presented the Thermo Scientific™ Nicolet™ Summit™ X FTIR solution.

KEY TAKEAWAYS

Spectroscopy instrumentation answers key questions for pharma lab researchers and operators.

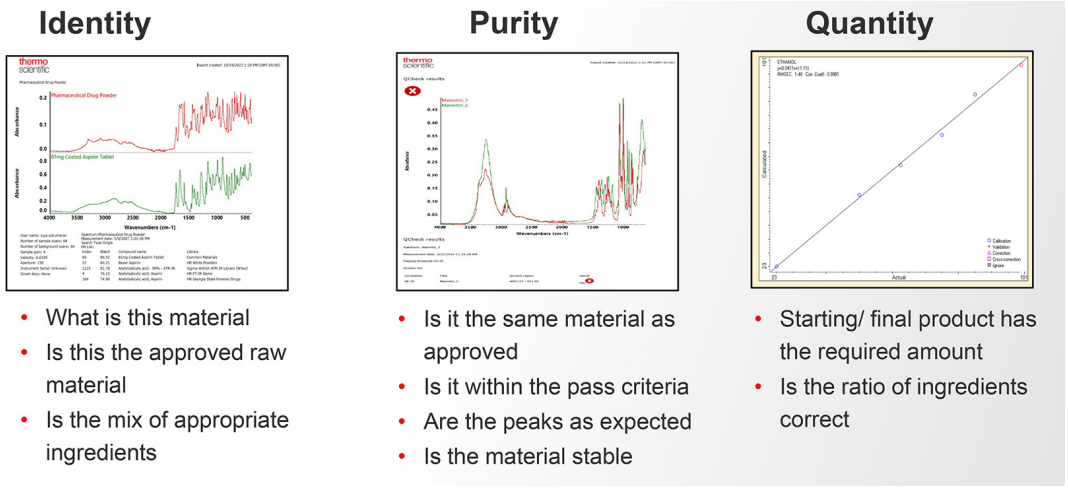
Pharma labs use spectroscopy instrumentation such as FTIR, near-infrared (NIR), Raman, and UV-Vis to ensure product quality, comply with regulations, and maintain marketability. Each of these spectroscopies has a different role to play and is commonly deployed either as part of a general analysis of a product or in targeted applications such as the testing and release of products.

The questions these instruments answer for drug developers can be grouped into three categories, which map to three key stages of the pharmaceutical product life cycle:

- Raw materials qualifications
- In-process QC
- Intermediate or finished product QC

Within each stage, spectroscopy provides clarity about the identity, purity, and quantity of the materials used, evaluating each against a USP reference standard and using a company's own pass/fail criteria.Many of the typical questions FTIR spectroscopy answers are listed in Figure 1.

Figure 1. Questions FTIR spectroscopy can answer

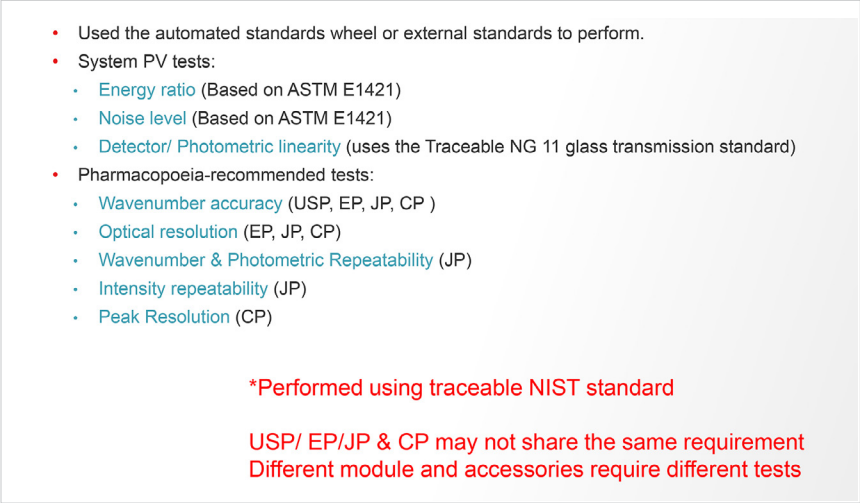


To comply with spectroscopy requirements, companies must fulfill a series of qualifications.

As organizations evaluate the optimal spectroscopy instrumentation for their needs, they must consider four distinct components that regulators require for spectroscopy compliance. Those components are:

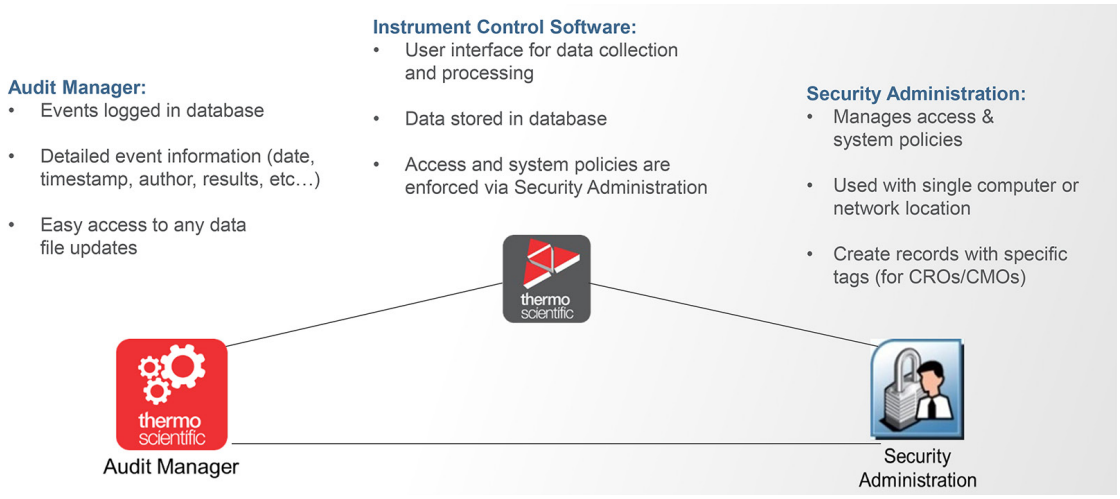
- System qualification: This includes design qualification (DQ), installation qualification (IQ), operational qualification (OQ), and performance qualification (PQ). It is important to note that both IQ and OQ must be performed at the user's site by a certified service representative or service engineer, and the full IQ protocol includes a subset of requirements known as re-qualification (RQ). Common OQ tests are listed in Figure 2.

Figure 2. Operational qualification common FTIR tests



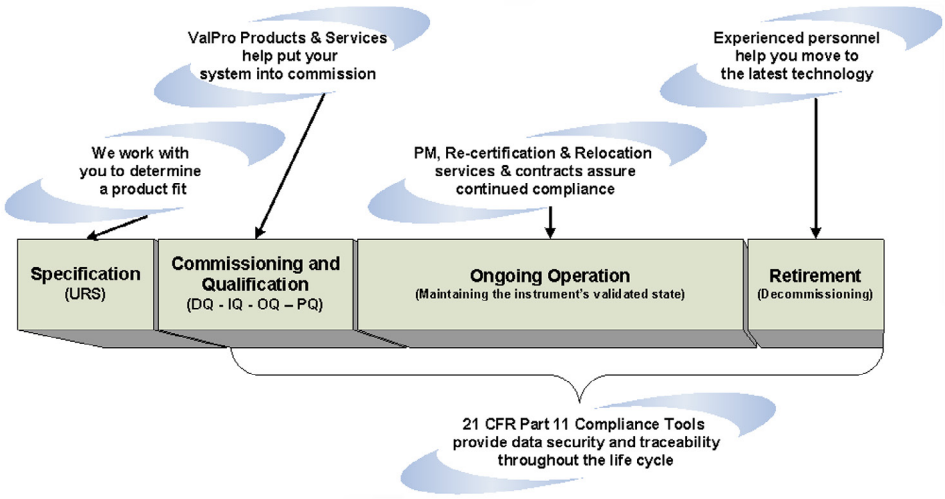
- 21 CFR Part 11 tools: Part 11 is one of the 1,400 sections written into the Code of Federal Regulations Title 21 and concerns storage of and access to electronic records. Essentially, 21 CFR Part 11 requirements aim to ensure data security and traceability throughout the product life cycle—in short, data integrity—including via electronic signatures. The way that Thermo Scientific software solutions ensure compliance with 21 CFR Part 11 is shown in Figure 3. These software solutions can be installed in either a local or a distributed fashion, a decision that may be conditioned by a lab's size or the specific spectroscopy instrument they have purchased.

Figure 3. Thermo Scientific security suite and instrument control for 21 CFR Part 11 compliance (to be read clockwise starting from Instrument Control Software)



- **Validation:** This refers to ensuring whole system functionality, including software, instrument PQ, methods, and standard operating procedures (SOPs). A summary of what a fully validated system looks like is depicted in Figure 4.

Figure 4. Representation of a fully validated spectroscopy instrumentation system



> This whole setup is part of your 21 CFR Part 11 compliance tool, and everything together provides you data security and traceability for the life cycle of your data.
>
> *Suja Sukumaran, Thermo Fisher Scientific*

Common pitfalls that stem from outdated technology can lead to non-conformance.

Some of the most frequent non-conformance issues when it comes to 21 CFR Part 11 compliance and spectroscopy instrumentation at large involve upgrade failures. Because spectroscopy instruments can often outlast the lifetime of the computers on which they are used and can be reinstalled relatively easily to other computers, users may overlook the need to update instrument configuration. "There may be an instrument that is 15-20 years old, it may not have the correct resolution, it may not have the correct specification that today's pharmacopoeia is asking for. At that time, there can be some nonconformance going on," Sukumaran said.

Other non-conformance trends may result from usage of outdated software with questionable data storage capacity or usage of a non-secure network that may have been set up before instrument validation processes were in place (resulting in staff having unrestricted access to data storage). "One thing that 21 CFR compliance really asks users to do is to restrict the access to the data only to the required personnel," Sukumaran emphasized.

Lastly, non-conformance may also occur due to not carrying out regular preventive maintenance of an instrument or not setting up SOPs and PQs correctly. "This sometimes happens because of [high] lab turnover," Sukumaran observed. "Sometimes the preventive maintenance on these systems gets overlooked and sometimes the certifications of new users get overlooked. And sometimes the changes in SOPs that are made over time may not get documented."

CONCLUSION

With spectroscopy analysis comprising an integral part of quality control in the life sciences industry, leveraging spectroscopy's full set of capabilities while ensuring data integrity and avoiding errors of negligence that may lead to non-conformance is paramount. Essential tools that capture those priorities and deliver on data integrity include:

- 21 CFR Part 11 (e.g., electronic signatures)
- Audit trails
- Qualification packages
- Certification services
- Operator training

Thermo Fisher's ISO 9001-certified spectroscopy solution Nicolet Summit X FTIR Spectrometer combines all these tools into one, uniting factory-traceable instrumentation, certified installation, and software that facilitates data integrity and regulatory compliance. This is how Sukumaran described it in a nutshell: "It is one of the most flexible, compact FTIR systems that can do a wide array of applications due to its compatibility with different types of sampling accessories.

BIOGRAPHY

Suja Sukumaran
Product Manager, Thermo Fisher Scientific

Dr. Suja Sukumaran is a Product Manager at Thermo Fisher Scientific. She received her PhD in Biophysics from Johann Wolfgang Goethe University, Germany, as part of the international Max Planck Research School. She has expertise and extensive experience in molecular spectroscopy, visible and fluorescence imaging, protein and lipid biochemistry. Lastly, her current research interests are AI for protein folding, microplastics, and recycling.