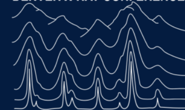
# DXC DENVER X-RAY CONFERENCE
73rd Annual Conference on Applications of X-ray Analysis



# 2024 PROGRAM

**5 - 9 August 2024**
**The Westin Westminster, Westminster, Colorado, USA**

## SPONSORED BY:

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PETRICK

PROTO X-RAY DIFFRACTION

**Welcome to the Denver X-ray Conference! From its humble beginning of 35 participants on the University of Denver campus, to a nationally and internationally recognized annual event, this year, DXC will celebrate 73 years as the leading annual forum on general X-ray analysis, including both X-ray fluorescence and X-ray diffraction.**

# 2024 DENVER X-RAY CONFERENCE ORGANIZING COMMITTEE


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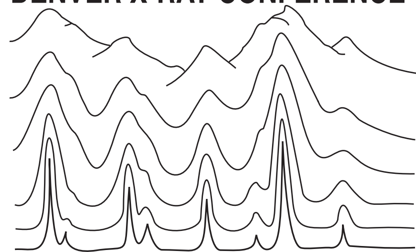
Paul Predecki, University of Denver, USA

Rene van Grieken, University of Antwerp, Belgium


## *Future Conferences:*




**4 - 8 August 2025**
The Bethesda North Marriott Hotel & Conference Center, Rockville, Maryland, USA

**3 - 7 August 2026**
The Westin Chicago Lombard, Lombard, Illinois, USA

# DXC uses Whova as our official event app!

Join our event app to access:

- Late announcements
- Personalized agenda, session details
- Speaker & attendee profiles
- Networking, meet-ups, messages
- Abstracts
- Exhibit Poster Game - Win one of *three* $100 Amazon gift cards!

How to join Whova:

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Having trouble joining? Search for our event and enter the invitation code: dxc2024attendee

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X-RAY DIFFRACTION

# D6 PHASER AUTOLOADER

Automated Benchtop Powder XRD for Process and Quality Control

## The Power of Automation

Automated X-ray diffraction provides accurate and comprehensive data collection and evaluation. From pharmaceuticals to construction materials, data-driven decisions enhance overall production quality and ensures that products meet stringent quality standards.

In today's fast-paced industrial landscape, quality and process control plays a pivotal role in ensuring product consistency, safety, and compliance. Whether you're managing a laboratory, overseeing production processes, or handling critical materials, the shift toward automated quality control offers substantial advantages.

When it comes to X-ray diffraction, the D6 PHASER AUTOLOADER provides a state-of-the-art solution for analysis ranging from positive material identification to phase and structure quantification. Access to these fast and reliable measurements is ideal for big data initiatives.

Laboratory managers face the challenge of optimizing resources while maintaining quality. Automated quality control reduces labor costs by minimizing manual tasks. Efficient resource utilization translates to cost savings and streamlined operations. Moreover, consistent handling and reduced variability enhance data quality, contributing to reliable results. Managers can rest assured that their processes meet the quality control protocols.

## Key features

The D6 PHASER AUTOLOADER is a dedicated X-ray powder diffractometer with external sample loader featuring:

- Industry-standard specimen rings
- Up to 5 magazine positions
- Manual loading position for priority samples
- Optional position for sample transit from/to conveyor belt
- Support for up to 96 mm wide conveyor belts
- Sample pre-loading
- Specimen rotation during measurement
- Optional workbench

# Technical Excellence, Efficiency and Versatility

## Powerful Performance

The D6 PHASER is engineered to meet the rigorous demands of quality control engineers and laboratory supervisors. It features an X-ray source power of up to 1.2 kW, the highest available on the market, ensuring efficient sample analysis. The system's short beam path contributes to its superior performance compared to many floor-standing systems. The tailored beam optics are designed for precision, providing optimal intensity and accuracy. Additionally, the D6 PHASER AUTOLOADER benefits from industry leading hardware such as Dynamic Beam Optimization (DBO) and advanced detectors, ensuring data quality on par with Bruker's floor-standing instruments. This integration facilitates a high level of analytical performance in quality control processes.

## Sample Handling and Automation

The D6 PHASER AUTOLOADER is designed to streamline sample handling. It accommodates up to five sample positions, providing flexibility for a variety of holders. A precision mechanical gripper ensures safe and efficient handling. Samples are preloaded on an externally accessible sample swing, while maintaining X-ray safety for the operator. This allows a continuous measurement workflow with minimal downtime by exchanging a processed sample for the next one in the queue while a measurement is running. The loading position also allows manual sample introduction, ideal for priority measurements. Sample size compatibility includes both 51.5 mm steel rings and smaller 40 mm holders made from boric acid.

Once loaded into the measurement position, the sample is rotated, a critical feature that contributes to improved particle statistics. By continuously rotating the sample, data accuracy is improved, resulting in more precise and statistically robust results.

## Seamless Integration

- **Stand-Alone Operation**: the D6 PHASER AUTOLOADER operates independently, without direct connectivity to an automated sample preparation system. Users can create predefined measurement recipes using pushbutton templates. These templates encapsulate the necessary steps for data acquisition, including parameters like exposure time, scan range, and detector settings. Once the measurement is complete, the AUTOLOADER follows the template instructions to evaluate the data.

- **Online Operation**: the analyzer is part of a larger automated system within the plant. The AUTOLOADER interfaces directly with the plant's control center, which oversees various processes, including sample preparation machines, transport conveyors, and the analyzer. The well-established AXSCOM software (already utilized for floor-standing XRD and XRF analyzers) serves as the bridge between the D6 PHASER AUTOLOADER and external control systems.

Efficiency and Accessibility Redefined. The D6 PHASER AUTOLOADER isn't just another benchtop X-ray diffractometer — it's streamlining your workflow, enhancing safety, and maximizing efficiency.

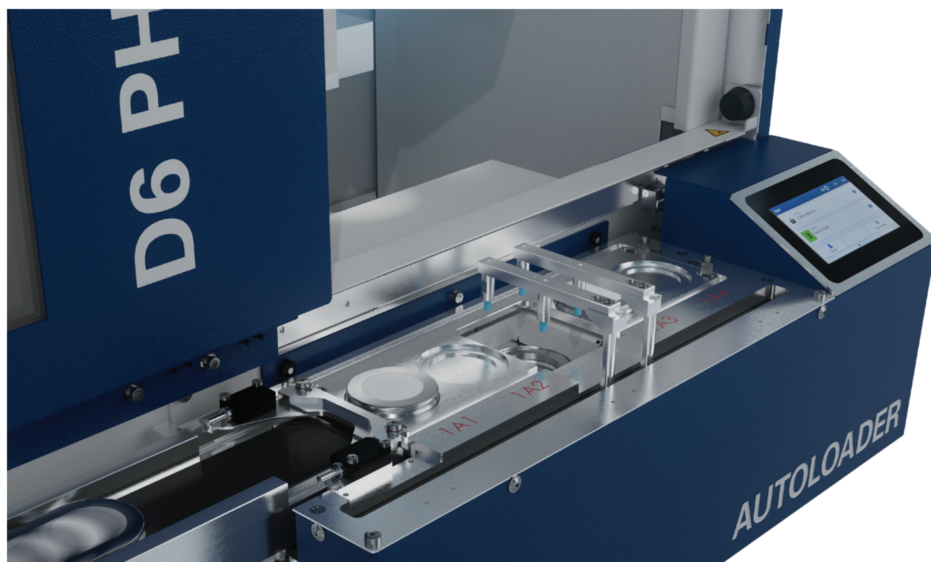


**Figure 1**
D6 PHASER X-ray powder diffractometer equipped with AUTOLOADER for online operation.

The **DIFFRAC.SUITE** provides comprehensive analytical capabilities when it comes to automated powder diffraction data analysis.

- **DIFFRAC.DQUANT** offers two distinct approaches for automated quantification of sample composition. The first method, Classic Single Peak Calibration-Based Quantification, evaluates single peaks using calibration curves and reference standards, making it ideal for rapid routine analysis and straightforward tasks with low quantification limits. On the other hand, the Full Pattern Calibration-Based Partial Least Squares (PLS) method utilizes PLS regression to analyze the entire diffraction pattern. This approach models complex relationships between the diffraction pattern and composition, enabling accurate quantification of properties, even those not directly related to concentrations. Both methods are integral to DIFFRAC.DQUANT, catering to different analytical needs.

- The Rietveld method, in **DIFFRAC.TOPAS BBQ**, is a technique for phase analysis by crystal structure-based quantification. It uses detailed crystallographic information to fit the entire diffraction pattern of a sample. This comprehensive approach allows precise determination of quantitative phase composition, ensuring that calculated phase fractions are accurate and reliable. It's a valuable tool for researchers and industrial users who require detailed phase analysis in their work. With pre-built application packages for construction materials, aluminum, pharmaceutical or battery materials markets, it's easy to implement.

- **DIFFRAC.EVA** offers two different methods of automated material analysis. Positive Materials Identification (PMI) is a correlation-based analysis that identifies the type of material by matching measured reference scans with unknown sample scans. It's a fast method of material identification without the need for detailed analysis of the components of a mixture. Conversely, SQUALL (semi-quantitative analysis of all materials) provides automatic identification of the phases present in a sample. This is achieved by matching reference scans and using Reference Intensity Ratios (RIR) to provide a more detailed understanding of the phase composition of the sample, particularly useful for phases where an accurate or well-defined crystal structure is not available or a good analytical description of the peak profiles does not exist (e.g. clays).

## Data Management:

The **DIFFRAC.SUITE** is designed for efficient data management. All measurement and evaluation results are stored in the instrument's internal database. This centralized storage not only makes data easy to access, but also helps to maintain and manage data integrity. The system can also integrate smoothly with a plant's Laboratory Information Management System (LIMS). This integration is critical because it ensures traceability, quality control, and compliance with industry standards. This increases the reliability and accountability of the analytical processes within the plant.

## cGxP Solutions:

The 21 CFR Part 11 compliant version of the DIFFRAC.SUITE has been carefully

**Figure 2**
Results manager view, showing selected results of TOPAS quantitative phase analysis results from a cement plant.

## Technical specifications

| | |
|---|---|
| **Geometry** | Theta/Theta (sample always horizontal) |
| **Max. usable angular range** | -3 to 152 ° 2θ |
| **Accuracy** | ± 0.01° through entire measuring range |
| **Achievable peak width** | < 0.03° FWHM |
| **X-ray wavelengths** | Cu, Co, Cr standard ceramic sealed tube (others on request) |
| **X-ray generator options** | 540 W (30 kV, 18 mA)<br>600 W (40 kV, 15 mA)<br>1.2 kW (40 kV, 30 mA) |
| **Detector options** | SSD 160-2<br>LYNXEYE-2<br>LYNXEYE XE-T |
| **Sample stage** | Rotating sample of 51.5 or 40 mm diameter |
| **AUTOLOADER** | Mechanical gripper for up to 5 positions and 1 manual position.<br>Optional belt connection |
| **Stage attachments** | Fixed or motorized air-scatter screen |
| **Primary optics** | Fixed or motorized, divergence slit, Soller collimators |
| **Cooling options** | Internal water-to-air cooling (540 W, 600 W, 1.2 kW)<br>Connection to laboratory supply, 3.6 l/min at 3 – 4.5 bar |
| **Exterior dimension** (h x d x w) | 70.0 cm (27.6") x 66.7 cm (26.7") x 88.5 cm (35.0"), width 110 cm (43.3") with open door |
| **Max. weight** | 160 kg (353 lbs) |
| **Power supply** | 100 V – 240 V (600 W and 540 W), 200V – 240 V (1.2 kW) |
| **Computer** | PC connected via LAN interface |

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**Bruker AXS**

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# PDF-5+ 2025

## *THE* POWDER DIFFRACTION STANDARD

**Inorganic & Organic entries are combined into one powerful database with 1,104,100+ entries.**

**www.icdd.com/pdf-5**

- 626,100+ entries with atomic coordinates
- Features 457,800+ entries for inorganic materials and 650,200+ entries for organic materials
- All entries have digital patterns for use in total pattern analysis
- 997,300+ entries have $I/I_c$ values for quantitative analysis by Reference Intensity Ratio
- All entries are stored in a standardized format for easy search and interpretation
- All entries go through a rigorous editorial process to ensure quality

# JADE® PRO

## IDENTIFY WITH CONFIDENCE

**You need data you can trust, AND you need to find the best way possible to analyze your data. Now you can extend the power of your ICDD PDF-5+ by including the highly regarded data analysis software JADE Pro. We created JADE to provide independent, unbiased results for peak search, Whole Pattern Fitting, and Rietveld. JADE gets daily improvements and has grown to include an enormous list of valuable tools for your materials research and exploration.**

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- All-inclusive - Everything in JADE Standard and so much more
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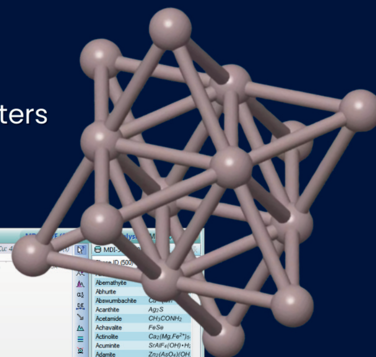
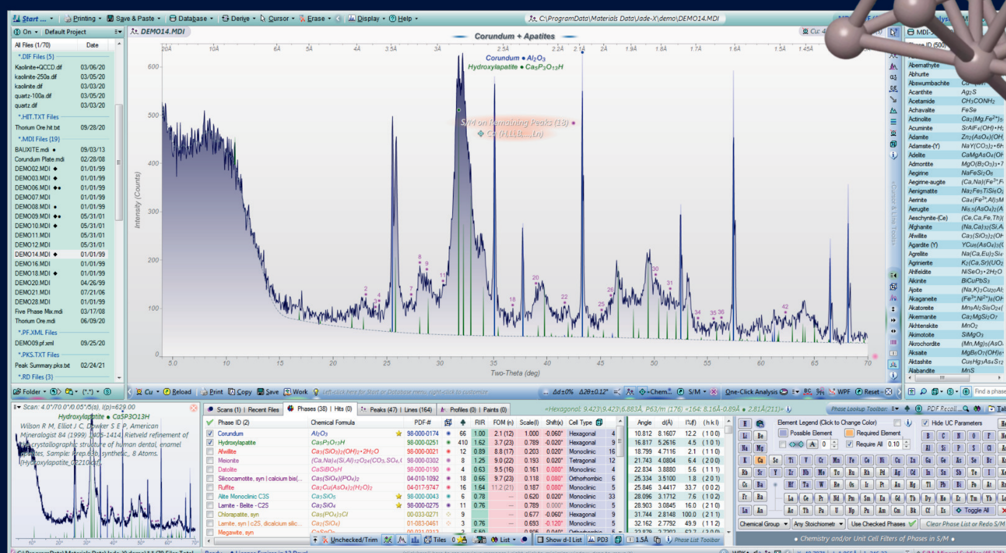
- Batch processing Whole Pattern Fitting (WPF) and Rietveld
- One-Click-Analysis™ for Whole Pattern Fitting (WPF)
- Pattern Indexing (All Crystal Systems)
- Rietveld Structure Refinement (Atomic Parameters)
- Ab Initio Tools (Charge Flipping +)
- Cluster Analysis of Powder Patterns
- Hardware Independent - supports a wide range of diffractometers





# LET OUR TEAM OF EXPERTS HELP YOU TAKE YOUR SKILLS TO THE NEXT LEVEL!

## Fundamentals of X-ray Powder Diffraction Clinic:

For the novice with some XRD knowledge or for the experienced with an interest in the theory behind XRD, this clinic offers a strong base for increased lab performance.

The clinic covers instrumentation, specimen preparation, data acquisition and qualitative phase analysis through live demonstrations. It consists of hands-on exercises, demonstrating the latest software, including data mining with the Powder Diffraction File (PDF) and use of the powder diffractometer: optical arrangement, factors affecting instrumentation profile width, choice and function of divergence slit, calibration and alignment, detectors, and X-ray optics.

www.icdd.com/xrd

## Advanced Methods in X-ray Powder Diffraction Clinic:

For the experienced XRD scientist, this session offers enhanced analysis skills through intense problem solving, as well as an introduction to the Rietveld Method. The course emphasizes computer-based methods of data interpretation, both for qualitative and quantitative phase analysis.

The advanced course covers a wide range of topics including systematic errors, factors affecting intensities of diffraction peaks; data reduction algorithms; phase identification; advanced data mining with the PDF and its application in search/match; powder pattern indexing methods; structure solution methods; quantitative phase analysis using both reference intensity ratio (RIR) and Rietveld Method.

www.icdd.com/xrd

## Rietveld Refinement & Indexing Clinic:

Powder pattern indexing and Rietveld structural refinement techniques are complementary and are often combined to determine the structure of a material. Successful indexing of a powder pattern is considered strong evidence for phase purity. Indexing is considered a prelude to determining the crystal structure, and permits phase identification by lattice matching techniques. This clinic introduces the theory and formalisms of various indexing methods and structural refinement techniques along with quantitative analysis. One unique aspect of this clinic is the extensive use of computer laboratory problem solving and exercises that teach method development in a hands-on environment.

www.icdd.com/rietveld

## Practical X-ray Fluorescence Clinic:

From theory to hands-on exercises, this course offers techniques and skills to improve lab performance. Discover the latest in cutting-edge instruments such as TXRF, hand-held devices, energy dispersive and wavelength dispersive spectrometers through live demonstrations.

The XRF course covers the basics of X-ray spectra; instrumentation design; methods of qualitative and quantitative analysis; specimen preparation and applications for both wavelength and energy dispersive spectrometry. The course emphasizes quantitative methods, use of automated X-ray spectrometers, review of mathematical matrix correction procedures, and new developments in XRF.

www.icdd.com/xrf

## More information at www.icdd.com/icdd-education

**Please note:** A minimum of 10 registrants per course is required, otherwise the course will be cancelled and your registration fee will be refunded. You will be notified of a course cancellation no later than two weeks prior to the start of the course.

### For More Information Contact:

**Elizabeth Dempsey, Education Coordinator**
**Tel:** 610.325.9814 **Fax:** 610.325.9823
**Email:** clinics@icdd.com

**Location**
ICDD Headquarters
12 Campus Boulevard
Newtown Square, Pennsylvania 19073-3273 USA

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# 2025 LUDO FREVEL Crystallography SCHOLARSHIP AWARDS

## DEADLINE

Applications must be submitted online by

**10 OCTOBER 2024**

All applications must be submitted via the ICDD website at www.icdd.com/ludo-frevel-scholarship

**Over $574,750** in scholarships awarded since 1991!

**DONATIONS**: Scholarship awards are made possible by donations from both individuals and corporations. Contributions can be directed to the Ludo Frevel Crystallography Scholarship Fund at www.icdd.com/ludo-frevel-scholarship/#donate. 100% of all donations to the scholarship fund are applied to student funding, as defined by the program's charter. The Ludo Frevel Scholarship Program is a registered non-profit charity, and all donations are tax-deductible.

The science of crystallography has played a key role in the development of X-ray diffraction, electron diffraction and neutron diffraction for the elucidation of the atomic structure of matter. Crystallography is an interdisciplinary branch of science that is taught in departments of physics, chemistry, geology, molecular biology, metallurgy and materials science.

### SCHOLARSHIP COMMITTEE

A committee, consisting of the ICDD Scholarship Committee Chairman, the ICDD Chairman, the Chairman of the ICDD Education Subcommittee, the ICDD Corporate Secretary, and three individuals without conflicts of interest, administers the awarding of the scholarships. One or more accredited professors (with no conflicts of interest) may be invited to assist in the selection of successful candidates.

### APPLICANT QUALIFICATIONS

The applicant should be enrolled in a graduate degree program during the 2025 calendar year with major interest in crystallography — e.g., crystal structure analysis, crystal morphology, modulated structures, correlation of atomic structure with physical properties, systematic classification of crystal structures, phase identification and materials characterization. Students with a graduation date prior to 1 July 2025 are not eligible for the 2025 scholarship award. The term of the scholarship is one year. The recipient may submit an application for one renewal at the end of the first year. Because a limited number of scholarships are awarded, renewal applications will be considered on a competitive basis in conjunction with all applications that have been submitted up to the closing date.

### EVALUATION OF APPLICATIONS

The amount of available funding limits the number of scholarships that can be granted in any given year. A selection committee will evaluate the applications received to determine which are most deserving of a scholarship. These evaluations consider both the proposal (impact, innovativeness, originality, efficacy of approach, and relationship to crystallography) and the student (recommendation letter, educational track record, prior work and/or research, honors, awards, and professional activities) in determining which applicants will receive the award.

There is a limitation of one award per educational institution. In the event that two or more candidates from one institution are considered to be among the top applicants, only one will be given an award.

### SCHOLARSHIP FUND RESTRICTIONS

The scholarship award is to be used by the graduate student to help defray tuition and laboratory fees. A portion of the award may be applied to registration fees and travel costs to attend accredited scientific meetings related to crystallography, where the recipient is presenting results of work performed as part of his or her graduate studies.

## HOW TO APPLY

Applications must be submitted online by 10 October 2024

**1. A description of the candidate's proposed graduate degree research (two-page limit) including:**

- Purpose and rationale for the research
- Proposed methodology to be used in the study
- References and/or descriptions of the scientific background for the proposed research

**2. A curriculum vitae including (two-page limit):**

- Educational preparation (institutions, dates, degrees obtained and in progress, and particularly-pertinent course work)
- Awards, honors received
- Any research publications and/or presentations given
- Any work experience (dates, employers, positions)
- Professional activities, memberships

All applications are to be submitted online at the ICDD website: www.icdd.com/ludo-frevel-scholarship. Please follow the instructions on that web page.

The preferred method of application is via the web; however, if you require an alternate method, please contact Elizabeth Dempsey at dempsey@icdd.com or 610.325.9814.

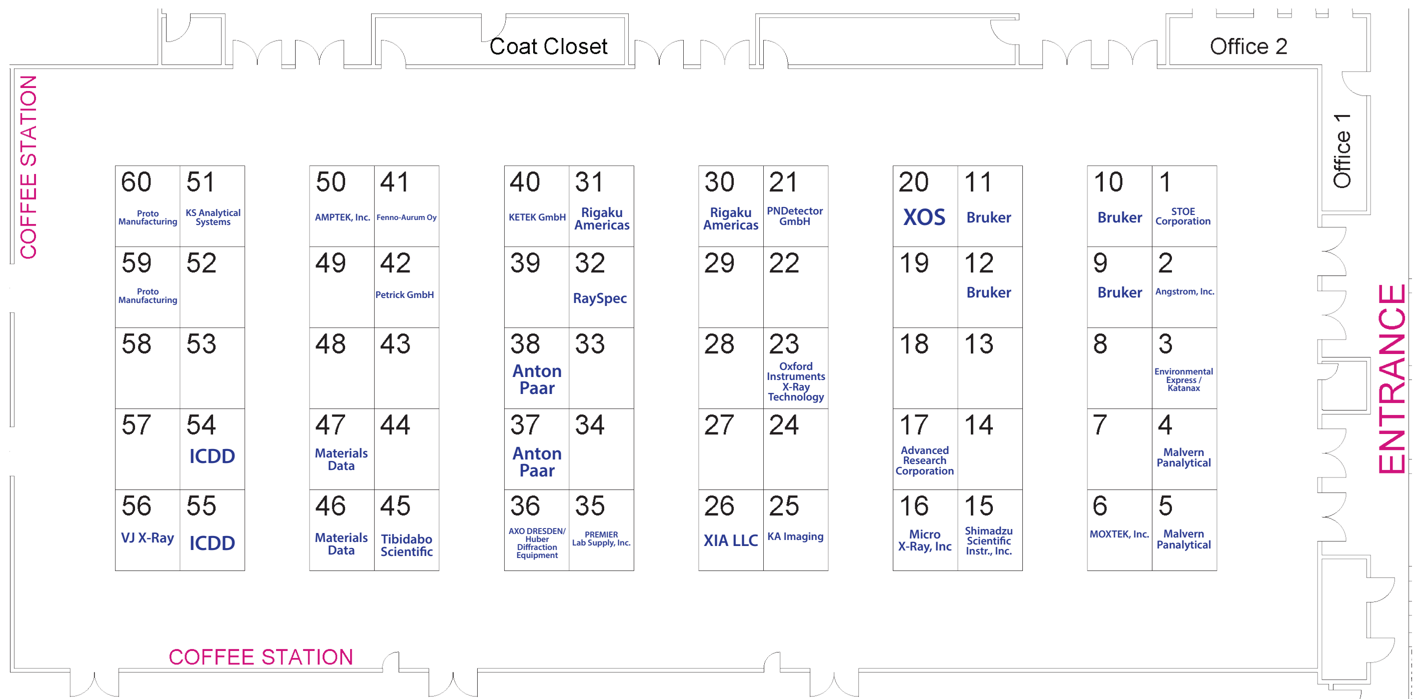
Submission of the two documents below must be in PDF format. You will also be asked for the contact information of your primary research advisor. An email will be sent to this advisor seeking a letter of recommendation on your behalf. His/her letter must be submitted on or before the deadline date.

# 2024 Denver X-ray Conference Exhibitors

**Exhibits will be held in the Westminster Ballroom.**

## Exhibit Hours

| | |
|---|---|
| Tuesday, 6 August | 10:00am - 5:00pm |
| Wednesday, 7 August | 12:00pm - 7:00pm |
| Thursday, 8 August | 10:00am - 2:00pm |




| Exhibitor | Booth Number(s) |
|---|---|
| Advanced Research Corporation | 17 |
| AMPTEK, Inc. | 50 |
| Angstrom, Inc. | 2 |
| Anton Paar | 37, 38 |
| AXO DRESDEN / Huber Diffraction Equipment | 36 |
| Bruker | 9, 10, 11, 12 |
| Environmental Express / Katanax | 3 |
| Fenno-Aurum Oy | 41 |
| ICDD | 54, 55 |

| Exhibitor | Booth Number(s) |
|---|---|
| KA Imaging | 25 |
| KETEK GmbH | 40 |
| KS Analytical Systems | 51 |
| Malvern Panalytical | 4, 5 |
| Materials Data | 46, 47 |
| Micro X-Ray, Inc | 16 |
| MOXTEK, Inc. | 6 |
| Oxford Instruments X-Ray Technology | 23 |
| Petrick GmbH | 42 |
| PNDetector GmbH | 21 |

| Exhibitor | Booth Number(s) |
|---|---|
| PREMIER Lab Supply, Inc. | 35 |
| Proto Manufacturing | 59, 60 |
| RaySpec | 32 |
| Rigaku Americas | 30, 31 |
| Shimadzu Scientific Instr., Inc. | 15 |
| STOE Corporation | 1 |
| Tibidabo Scientific | 45 |
| VJ X-Ray | 56 |
| XIA LLC | 26 |
| XOS | 20 |

# Exhibitors

| Exhibitor | Description |
|---|---|
| **Advanced Research Corporation**<br>**Booth: 17**<br>**Website: www.arcnano.com**<br>**Email: sales@arcnano.com** | Arc Nano is a merchant supplier of Beryllium X-ray Window Assemblies and 5-axis precision machined 3D Beryllium components as used in analytical tools and in structural components for Mil/Aerospace systems. Arc Nano has in-house 200 mm Wafer Fab and 500 mm Mech Fab operations. We are your One Stop High Tech Fab for difficult to obtain, complex and precision components. Arc Nano is ISO Certified and ITAR Registered. |
| **Amptek, Inc.**<br>**Booth: 50**<br>**Website: www.amptek.com**<br>**Email: amptek.sales@ametek.com** | Amptek is a high technology company and a recognized world leader in the design and manufacture of state-of-the-art nuclear instrumentation for the satellite, x-ray and gamma ray detection, laboratory, analytical, and portable instrumentation industries. |
| **Angstrom, Inc.**<br>**Booth: 2**<br>**Website: www.angstrom-inc.com**<br>**Email: sales@angstrom-inc.com** | Angstrom is a manufacturer of sample preparation equipment and supplies for XRF analysis. Our product line includes the TE250 Ring & Puck Mill, the 4451AE Pellet Press and the 4452 Programmable Pellet Press. All of our products are rugged and highly regarded in the XRF community - well suited for laboratories that require high sample throughput. A complete line of aluminum sample cups are offered in various depths and diameters. |
| **Anton Paar**<br>**Booths: 37, 38**<br>**Website: www.anton-paar.com**<br>**Email: info.us@anton-paar.com** | Driven by 60 years of experience in X-ray diffraction (XRD), small-angle X-ray scattering (SAXS) and advanced X-ray optics, Anton Paar provides X-ray analysis solutions for every challenge. Our state-of-the-art X-ray instrumentation is used by customers across a large number of fields in both academia and industry. https://www.anton-paar.com/us-en/x-ray-analysis/ |
| **AXO DRESDEN / Huber Diffraction Equipment**<br>**Booth: 36**<br>**Website: www.axo-dresden.de**<br>**Email: contact@axo-dresden.de** | AXO DRESDEN is a specialist for tailored high precision deposition and multilayer coatings for multilayer X-ray optics, XRD and XRF applications. In addition to that we offer Multilayer Laue Lenses (MLLs) as well as Primux 50 micro focus X-ray source systems.<br><br>HUBER DIFFRACTION is a manufacturer of precise positioning and diffraction equipment for laboratory, synchrotron and neutron applications. |
| **Bruker**<br>**Booths: 9, 10, 11, 12**<br>**Website: www.bruker.com**<br>**Email: info.baxs@bruker.com** | Bruker is the worldwide leading supplier of advanced X-ray solutions. Continual innovation in X-ray sources, optics, detectors, software and sample handling ensures that Bruker is able to offer a solution for virtually any X-ray analytical task. Stop by our booth to learn about the latest innovations in diffraction, fluorescence, micro-XRF, microtomography. EDS, WDS and EBSD systems. |
| **Environmental Express/ Katanax**<br>**Booth: 3**<br>**Website: www.katanax.com** | Environmental Express/Katanax specializes in electric fusion fluxers for sample prep automation used in X-ray spectroscopy and ICP analysis. Your trusted partner for innovation, development, and manufacturing of sample collection, preparation, single-use consumables and analysis equipment utilized in environmental water, air, and soil regulatory compliance testing. |
| **Fenno-Aurum Oy**<br>**Booth: 41**<br>**Website: www.fenno-aurum.com**<br>**Email: rrk@fenno-aurum.com** | Fenno-Aurum Oy designs and manufactures radiation detectors for X-ray, gamma-ray and Ultraviolet detection applications. We specialize in gas filed radiation detectors based on the proportional counter design for Industrial and scientific applications. We are an OEM vendor, also build custom designed radiation detectors, associated electronics etc.<br><br>By 2025, we will introduce world's most sensitive, ultra-fast, air-cooled, compact and low-cost desktop EDXRF/ WDXRF analyzer for various applications begin with food industry. World's most sensitive Single photon UV sensor for fire alarm and 6G applications would follow soon. |
| **International Centre for Diffraction Data (ICDD)**<br>**Booths: 54, 55**<br>**Website: www.icdd.com**<br>**Email: info@icdd.com** | ICDD, started in 1941, focuses on meeting the needs of the scientific community through the publication of the Powder Diffraction File™ (PDF®) and JADE® software. We strive to provide quality educational opportunities to exchange new ideas and information for materials characterization. ICDD's carefully curated and edited material identification databases interface with diffractometers and analysis systems of the world's leading X-ray equipment manufacturers and software developers. The Powder Diffraction File and JADE are available in a variety of licensing options. Visit us to discuss your analysis needs. |
| **KA Imaging**<br>**Booth: 25**<br>**Website: www.kaimaging.com**<br>**Email: sales@kaimaging.com** | The BrillianSe™ X-ray Detector provides a unique combination of high spatial resolution using 8 µm pixels, and high Detective Quantum Efficiency (DQE) for energies up to 120 keV. This combination enables efficient imaging at low flux and high energy, as well as propagation-based (grating-less) phase-contrast enhancement for improved sensitivity when imaging low-density materials.<br><br>The InCite™ 3D X-Ray Microscope provides phase contrast imaging and micro-CT capabilities and is the first commercial X-ray CT system that utilizes BrillianSe™. |
| **KETEK GmbH**<br>**Booth: 40**<br>**Website: www.ketek.net**<br>**Email: info@ketek.net** | KETEK, the leading manufacturer of Silicon Drift Detectors, presents its next generation 3.0 electronics series, featuring the new, proprietary Digital Pulse Processor DPP3 offering superior throughput capability up to 4Mcps based on an ultra-short peaking time of 25ns. We further introduce the new, very compact AXAS-D 3.0 system, which offers superior energy resolution better than 126eV, excellent connectivity by Ethernet & USB and a mapping mode for scanning applications as µXRF and EDS. |

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| **KS Analytical Systems**<br>**Booth: 51**<br>**Website: www.ksanalytical.com**<br>**Email: ksa@ksanalytical.com** | KS Analytical Systems is a premier provider of advanced analytical solutions, specializing in X-ray diffraction (XRD), X-ray fluorescence (XRF), and X-ray microscopy (XRM) technologies. We offer both refurbished and new instrumentation focusing on accuracy, efficiency, and outstanding customer support. |
| **Malvern Panalytical**<br>**Booths: 4, 5**<br>**Website: www.malvernpanalytical.com** | At Malvern Panalytical, we are big on small – helping our customers unleash the power of very small things, to make big things happen. Our materials analysis solutions provide highly reliable and robust elemental, morphological and structural information that can help scientists and engineers solve challenges with maximizing productivity, developing better products and getting them to market faster. We will feature XRD and XRF systems, and will have application scientists available to answer your questions. Visit us in booths 4 & 5 and come see our newest XRF system - Revontium! |
| **Materials Data**<br>**Booths: 46, 47**<br>**Website: www.materialsdata.com**<br>**Email: mdi@materialsdata.com** | Materials Data (MDI™), based in California and part of the International Centre for Diffraction Data, creates JADE™, hardware-independent analysis software for X-ray Powder Diffraction. Our software tools are engineered by a group of PhD Materials Scientists with a vision for better methods to analyze, characterize, quantify and simulate both the complex and routine. Together with the ICDD, we are building scalable products with break-through ideas and methods for our XRD community. Visit us in booths 46 and 47 at DXC for a demonstration of JADE. |
| **Micro X-Ray, Inc.**<br>**Booth: 16**<br>**Website: www.microxray.com**<br>**Email: sales@microxray.com** | Micro X-Ray designs and manufactures X-ray tubes and X-ray sources entirely in our California facility. Our X-ray sources provide best-in-class performance for a wide variety of XRF modalities. We offer packaged tubes in various configurations and geometries, with customizable power levels, target materials, spot geometries, integrated shielding, and integrated cooling options tailored to your application and environment. Whether you are a large OEM, system integrator, repair facility, or university, we welcome the opportunity to discuss your specific X-ray tube requirements. |
| **MOXTEK, Inc.**<br>**Booth: 6**<br>**Website: www.moxtek.com**<br>**Email: info@moxtek.com** | MOXTEK is a leading supplier of advanced nano-optical and X-ray components used in display electronics, imaging, and analytical instrumentation. MOXTEK provides innovative, solution-based products and services focused on performance, quality, and value. MOXTEK products enable many new scientific discoveries and improve the quality of everyday life. MOXTEK X-ray products empower compact handheld and benchtop elemental analysis for positive material identification. MOXTEK products are used in various EDXRF, WDXRF, and XRD systems for environmental screening, hazardous substance analysis, and sorting and recycling. |
| **Oxford Instruments X-Ray Technology**<br>**Booth: 23**<br>**Website: www.xray.oxinst.com**<br>**Email: info.oiplc-web@oxinst.com** | X-Ray Technology is a leading manufacturer of X-ray tubes, power supplies, and integrated x-ray sources. Our solutions enable breakthrough R&D and high-volume OEMs in the global analytical, medical imaging, food quality & packaging inspection, and industrial NDT markets. |
| **Petrick GmbH**<br>**Booth: 42**<br>**Website: www.petrickgmbh.de**<br>**Email: antje.petrick@petrickgmbh.com** | PETRICK GMBH is specialized in the production and development of X-ray tubes and X-ray tube assemblies for medicine and technique since 1991. Apart from our diverse product portfolio, we develop solutions for your specific case of application and also produce small batches and single pieces. We are open, working together with institutes and universities. |
| **PNDetector GmbH**<br>**Booth: 21**<br>**Website: www.pndetector.de**<br>**Email: sales@pndetector.de** | PNDetector is developing and manufacturing advanced radiation detectors for material analysis in a wide range of applications such as microanalysis, quality assurance and materials science.<br><br>The silicon sensors are fabricated in PNDetector's own cleanroom facilities in Munich. The cleanroom is dedicated to an ultra-pure fabrication with a high level of contamination control, insuring very low dark-current levels. The emphasis in production and development is on Silicon Drift Detectors (SDDs) Backscattered Electron Detectors (BSE) and Charged Coupled Devices (pnCCDs). |
| **Premier Lab Supply, Inc.**<br>**Booth: 35**<br>**Website: www.premierlabsupply.com**<br>**Email: info@premierlabsupply.com** | PREMIER Lab Supply is a GLOBAL manufacturer and distributor of XRF sample preparation products and services for over 25 years. PREMIER offers a robust line of XRF sample cups and thin film products, including innovative and patented CEMBLES®, CapX® and FilmVelopes® for liquid and powder testing as well as aluminum cups and binders for press pellet applications. A full line of both new and refabricated platinum and fusion labware is available for XRF and ICP sample preparation. PREMIER's platinum refabrication service can refine your existing labware back to brand new condition. PREMIER provides Gas & Electric Fusion Machines for XRF and ICP dissolutions and Manual and Automated Presses for XRF Press Pellet Applications. PREMIER Lab Supply is committed to ensuring you achieve accurate and reproducible results, all at value-based pricing. We are XRF Sample Preparation Specialists®. |
| **Proto Manufacturing**<br>**Booths: 59, 60**<br>**Website: www.protoxrd.com**<br>**Email: info@protoxrd.com** | Proto is one of the fastest growing x-ray diffraction companies in the world. With our versatile team of scientists, you are sure to get the correct system for your experimental needs. Our product line includes systems for high-resolution diffraction, powder diffraction, crystallography, Laue orientation, and residual stress measurement. We also offer x-ray tubes, high-end MetalJet systems, and other custom creations.<br><br>Proto is committed to delivering quality products with world-class support that you can count on long after the initial sale. |

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| **RaySpec, Ltd.**<br>**Booth: 32**<br>**Website: www.rayspec.co.uk**<br>**Email: sales@rayspec.co.uk** | RaySpec Ltd is a specialist manufacturer of customised Silicon Drift Detectors (SDD) and signal processing electronics for X-Ray Fluorescence applications. RaySpec have been supplying X-ray detectors for over 25 years, but we were previously known as Gresham Scientific, E2V and SGX Sensortech. RaySpec supplies original equipment manufacturers and specialist end-users in synchrotrons and research facilities around the world. The unique capabilities of RaySpec allow us to satisfy the most demanding of specialised requirements. Detectors are available with a wide range of active areas in single and multi-sensor designs. With optimisations available for high count rate, high solid angle and 3rd party pulse processing electronics. RaySpec prides itself on building bespoke solutions to meet the needs of our customers. If you have a project requiring an SDD we will work with you to find the optimal solution. |
| **Rigaku Americas Corporation**<br>**Booths: 30, 31**<br>**Website: www.rigaku.com**<br>**Email: info@rigaku.com** | Rigaku Corporation is a leading manufacturer and supplier of analytical equipment with diverse groups specializing in X-ray, Electron, Infra-red and Thermal technologies.<br><br>The X-ray technologies embrace the primary X-ray applications of: X-ray Diffraction (XRD), Single Crystal Analysis (SCX), Small Angle X-ray Scattering (SAXS), X-ray Fluorescence (XRF) (Wavelength and Energy Dispersive) and X-ray imaging (XCT) including 3D X-ray microscopy. The recent introduction of Electron Diffraction for single crystal analysis completes Rigaku's unprecedented range of diffraction solutions for materials analysis.<br><br>For more than seven decades, Rigaku has been providing industry ready and customized solutions for materials characterization, and welcomes an opportunity to consult with you on your materials analysis requirements. |
| **Shimadzu Scientific Instruments, Inc.**<br>**Booth: 15**<br>**Website: www.ssi.shimadzu.com**<br>**Email: maquaranta@shimadzu.com** | Shimadzu offers a full range of EDXRF spectrometers for various materials science applications. Advanced EDX-7200/8100 spectrometers incorporate a high-performance, electronically cooled semiconductor detector, a high fluorescent X-ray count per unit time, five primary filters, four different sizes of collimator and a sample observation camera. Software features an intuitive user interface, simplifying operation for all operators. |
| **STOE & Cie GmbH**<br>**Booth: 1**<br>**Website: www.stoe.com**<br>**Email: info@stoe.com** | Originally founded in 1887 with the primary objective of manufacturing equipment for the optical examination of crystals, STOE has been at the forefront of powder and single crystal X-ray diffraction since the 1960s. Inventing and patenting the STOE transmission geometry technique for Powder XRD, they additionally developed the first pixel detector XRD system with an open Eulerian cradle for single crystals. Based in Darmstadt, Germany, STOE keeps the R&D, software programming, electrical and mechanical engineering, and production all in house, allowing to provide customers with standard as well as individual solutions. STOE is committed to delivering uncompromising quality, distinguishing themselves through their meticulous attention to detail. As a result, they have become THE go-to partner in X-ray Diffraction for crystallographers, chemists, material scientists, and pharmacists worldwide. |
| **Tibidabo Scientific**<br>**Booth: 45**<br>**Website: www.tibidaboscientific.com**<br>**Email: info@tibidaboscientific.com** | Tibidabo Scientific Industries is a global leader in advanced technologies across scientific and medical research, life sciences, agriculture, recycling, aerospace, defense and security, and industrial markets. Our collaborative approach empowers customers to make informed decisions and implement effective solutions using cutting-edge and groundbreaking technologies that drive innovation in both new and existing applications. |
| **VJ X-Ray**<br>**Booth: 56**<br>**Website: www.vjxray.com**<br>**Email: info@vjxray.com** | Since 2008, VJ X-Ray has designed and manufactured integrated x-ray sources and high voltage generators for OEMs of X-Ray Inspection Systems in markets including Security, Food & Pharmaceutical, Industrial NDT, Medical, Electronics, and Analytical Instrumentation. The IXS series of integrated X-ray sources incorporates the high voltage power supply, X-ray tube, and control electronics into single compact products. These units have high stability and performance over an extensive range of output power.<br>The small form factor, integrated cooling, and proprietary radiation shielding of IXS products set them apart from their competition. The HVL/HVG series of high voltage x-ray generators are optimized for performance and reliability over a variety of voltage and current outputs. VJ X-Ray serves their global customer base from their two facilities in New York, United States and Suzhou, China. Their technical team has over 20 years of experience in high voltage design and X-ray integration, allowing them to build a solid foundation to support OEM's customized solutions. |
| **XIA LLC**<br>**Booth: 26**<br>**Website: www.xia.com**<br>**Email: sales@xia.com** | XIA LLC is an ISO 9001:2015 certified company that invents, develops and markets advanced digital pulse processing and data acquisition electronics for use with x-ray and gamma-ray detectors in industry, university research and National Labs. We are technology leaders in high-rate spectroscopy electronics at synchrotron facilities around the world, as well as a major OEM supplier for compact low power handheld and benchtop spectroscopy instruments. Please visit the XIA Booth (#26) for more information. |
| **XOS**<br>**Booth: 20**<br>**Website: www.xos.com**<br>**Email: info@xos.com** | XOS is a global leader in elemental analysis, offering solutions that help drive innovation, ensure compliance, and improve customer efficiency in scientific research, semiconductor and battery manufacturing, pharma, and other industries. XOS advanced optics and OEM subsystems can increase precision, speed, and spatial resolution while helping decrease the instrument's size, complexity, and cost. Experts choose XOS for a broad range of applications, including microanalysis, plating thickness gauge, forensics, and high-resolution elemental mapping. |

# COMPREHENSIVE SOLUTIONS FOR XRF DETECTION

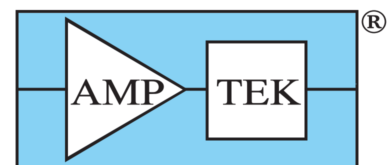
# Introducing the PLEIADES™ X-Ray System

The XRA-700 is a multichannel X-ray spectroscopy system, with 7 high performance X-ray detectors and low noise preamplifiers and a control unit with power supplies and cooling. Building on Amptek's history of producing the widest range of X-ray detectors, the XRA-700 can house any combination of Amptek detectors, for unprecedented flexibility in configuring your experiment. The XRA-700 is compatible with standard third party digital pulse processors.

## INCLUDES SEVEN INDEPENDENT DETECTORS

Contains seven high performance X-ray spectroscopy detectors with unequalled flexibility. Each XRA-700 can be configured to mix-and-match Amptek's X-ray spectroscopy detectors:

- 70 mm$^2$, 0.5 mm thick FASTSDD®s.
- 70 mm$^2$ FASTSDD with C2 entrance window (40 nm of $Si_3N_4$) for light element detection.
- 1 mm thick, 70 mm$^2$ FASTSDD for up to 2x intrinsic efficiency >15 keV
- CdTe detectors for high efficiency up to 100 keV
- The XRA-700 can be reconfigured for different detector options in the field.
- Quick and cost effective repair of standard modules.

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# Monday AM Workshops, 5 August
9:00am – 12:00pm

## Introduction to Machine Learning for X-ray Analysis – Part 1 — Standley I

**Organizers & Instructors:**
**Howie Joress,** NIST, USA, howie.joress@nist.gov
**Brian DeCost,** NIST, USA, brian.decost@nist.gov
**Austin McDannald,** NIST, USA, austin.mcdannald@nist.gov
**Ming-Chiang Chang,** Cornell University, USA, mc2663@cornell.edu
**David Hoogerheide,** NIST, USA, david.hoogerheide@nist.gov

This tutorial aims to provide an overview of machine learning methods for X-ray analysis practitioners. This tutorial will summarize the types of X-ray analysis tasks that can be aided by machine learning and will introduce some common algorithms and their conceptual basis and practical limitations. We will focus on three areas: phase mapping, phase ID, and quantitative phase analysis. We hope you will leave the tutorial with the ability to formulate your X-ray analysis problems into well-phrased questions for your machine learning expert colleagues and collaborators.

## Sample Preparation of XRD — Standley II

**Organizer & Instructors:**
**Tim Fawcett,** ICDD, Emeritus, USA, dxcfawcett@outlook.com
**Sue Quick,** The Pennsylvania State University, USA, quick@cse.psu.edu
**Mark Rodriguez,** Sandia National Laboratories, USA, marodri@sandia.gov

Specimen preparation is often the limiting step for obtaining good results in a diffraction experiment. Preparation methods can influence the accuracy and precision of peak positions, intensities and profiles. These are the basic measurements required for qualitative and quantitative analysis. The presentation will focus on crystallite and particle effects, orientation and texture, particle statistics and how various preparation methods can reduce or eliminate these influences.

We will also discuss “tricks of the trade” and various techniques that experts use to analyze odd shaped parts, limited samples, and air and moisture sensitive specimens.

## Non-ambient XRD — Cotton Creek

**Organizer & Instructor:**
**Scott Misture,** Alfred University, USA, misture@alfred.edu

This half-day workshop will focus on high temperature XRD in laboratory instruments and will include an overview of the capabilities of the various commercially-available non-ambient stages. Pitfalls, tips and tricks for using non-ambient stages for controlled temperature, gaseous atmosphere, and applied electric fields will be covered with brief examples. Topics will include temperature calibration, accuracy of the XRD patterns (instrument optics, calibration and/or corrections for specimen displacement) and handling the resulting large datasets to obtain phase ID, cluster analysis, and (automated) Rietveld full-pattern fitting.

## Basic XRF — Meadowbrook

**Organizers & Instructors:**
**Andy Drews,** Ford Motor Company, USA, adrews@ford.com
**Peter Wobrauschek,** Atominstitut – TU Wien, Austria, wobi@ati.ac.at

This workshop provides a basic introduction to the principles of XRF specifically aimed at those new to the field. In the first half, there will be a general overview of the XRF technique, including a discussion of the basic principles of X-ray interactions with matter. The emphasis in the first half will be on understanding the underlying physical phenomena, how the technique is applied, optimization of the signal, and approaches to quantitative analysis. In the second half of the workshop, examples of real-world applications will be presented to illustrate some of the challenges and opportunities that the analyst may face. This half will include a description of a variety of specimen formats and the flexibility of the XRF technique, including a discussion of the capabilities of bench-top EDX instruments, micro analyzers, Total Reflection XRF (TXRF) instruments, and handheld analyzers.

# Monday PM Workshops, 5 August
1:30pm – 4:30pm

## Introduction to Machine Learning for X-ray Analysis – Part 2 — Standley I

**Organizers & Instructors:**
**Howie Joress,** NIST, USA, howie.joress@nist.gov
**Brian DeCost,** NIST, USA, brian.decost@nist.gov
**Austin McDannald,** NIST, USA, austin.mcdannald@nist.gov
**Ming-Chiang Chang,** Cornell University, USA, mc2663@cornell.edu
**David Hoogerheide,** NIST, USA, david.hoogerheide@nist.gov

This workshop aims to provide an overview of machine learning methods for X-ray analysis practitioners. The workshop will summarize the types of X-ray analysis tasks that can be aided by machine learning and will introduce some common algorithms and their conceptual basis and practical limitations. We will focus on three areas: phase mapping, phase ID, and quantitative phase analysis. We hope you will leave the tutorial with the ability to formulate your X-ray analysis problems into well-phrased questions for your machine learning expert colleagues and collaborators.

## Practical Microcomputed Tomography — Standley II

**Organizer & Instructors:**
**Stuart Stock,** Northwestern University, USA, stuart.r.stock@gmail.com
**Victoria Cooley,** Argonne National Laboratory, USA, vcooley@anl.gov
**Alberto Mittone,** Argonne National Laboratory, USA, amittone@anl.gov

X-ray microCT uses a set of projections (radiographs) of the object, obtained at different viewing angles, to reconstruct the cross-section of the specimen. There currently are 4,000-5,000 microComputed Tomography (microCT) systems operating worldwide, and it is increasingly likely that X-ray diffraction and spectroscopy specialists will be called upon to do microCT scans as part of their regular duties. The choice of data collection parameters can have an enormous effect on the quality of measurements made from microCT reconstructions, and inexperienced users may inadvertently select conditions far from optimum. After a 30 minute introduction to the modality, one instructor will work with each small group of attendees on a separate specimen type. Within each group, each attendee will work separately and will examine the effect of non-optimum vs more ideal scanning parameters on different types of measurements common in microCT.

Attendees will need to bring their own laptop. Prior to the workshop they need to install ImageJ and the BoneJ plugin for ImageJ. Both are free. The attendees will also need to download the sample data sets and store them on local media (i.e., on their computer's hard drive or a portable hard drive). Please visit the DXC Workshop Handout website for downloadable files.

## XRF of Layered Structures — Cotton Creek

**Organizer & Instructors:**
**Peter Wobrauschek,** Atominstitut – TU Wien, Austria, wobi@ati.ac.at
**Klaudia Hradil,** TU Wien X-ray Center, Austria, klaudia.hradil@tuwien.ac.at
**Dieter Ingerle,** Atominstitut – TU Wien, Austria, dieter.ingerle@tuwien.ac.at
**Christina Streli,** Atominstitut – TU Wien, Austria, streli@ati.ac.at

The characterization of layered structures from the nanometer range to the 10 µm range is of increasing importance, especially if the analytical methods are non-destructive.

In the first part, Confocal micro-XRF (X-ray fluorescence analysis) is introduced by Christina Streli. This technique allows the characterization of layers in the range of some 10 µm. The principle and some experimental setups (synchrotron radiation as well as lab instruments) will be described and some showcases presented.

In the second part, GIXA, Dieter Ingerle will present the combination of Grazing incidence XRF (GIXRF) and X-ray reflectivity (XRR). GIXA allows the characterization of nanometer layers, the determination of the elemental composition and density and thickness. Setups, data evaluation software and showcases are presented.

The third part of the workshop, presented by Klaudia Hradil, will include the theoretical background and experimental techniques of thin film analysis by X-ray diffraction methods. This will include the experimental techniques and the analysis of data for grazing incidence diffraction. The possibilities for the microstructure properties analysis of thin films like stress/strain and texture analysis, classical phase analysis, and thin film crystallinity properties with lab methods will be introduced for selected examples.

# Quantitative XRF



**Organizers & Instructors:**
**Kosuke Kawakyu,** Rigaku Corporation, Japan, kawakyu@rigaku.co.jp
**Alexander Seyfarth,** SGS North America Natural Resources Division, USA, alexander.seyfarth@sgs.com

This workshop will cover an introduction to fundamental parameters for quantitative XRF analysis by Alexander Seyfarth and examples using fundamental parameters for semi-quantitative analysis by Kosuke Kawakyu.

## Machine Learning and Autonomous for X-ray Diffraction: An "Unconference" – Part 1 — Standley I

**Organizers & Instructor:**
**Howie Joress,** NIST, USA, howie.joress@nist.gov
**Brian DeCost,** NIST, USA, brian.decost@nist.gov
**Austin McDannald,** NIST, USA, austin.mcdannald@nist.gov
**Zachary Trautt,** NIST, USA, zachary.trautt@nist.gov

New! A one-day "Unconference" on autonomous and ML methods for x-ray diffraction! Suggest and vote on topics of interest through the Whova app. Voting will remain open until Monday evening, 5 August. Suggestions can be areas of needed research, hard problems to solve, or things that you don't understand. Take a deeper dive into the most popular topics and hope that these "Unconference" discussions will be informative for attendees, as well as, provide the DXC community with guidance for future research directions.

## X-ray Sources and Optics — Standley II

**Organizer & Instructors:**
**Andy Drews,** Ford Motor Company, USA, adrews@ford.com
**Sterling Cornaby,** MOXTEK, Inc., USA, scornaby@moxtek.com
**Brendan Waffle,** XOS, USA, Brendan.waffle@xos.com
**Michael Wojcik,** Argonne National Laboratory, USA, mwojcik@anl.gov

Continued advancements in X-ray optics and sources are enabling higher performance for X-ray analyses in all settings. Miniaturization of sources for laboratory settings and incorporation of factory-coupled optics has brought new capabilities to everyday users, while continued development of next generation synchrotron sources continues to push development of new high performance optics operating at ever higher fluxes. These advances impact all modalities of X-ray measurements, from scattering experiments at the cutting edge, to new levels of spectroscopic and imaging measurements. This workshop will provide a wide-ranging introduction to some of the common and emerging options available to users with the goal and increasing the awareness of the community and enhancing the toolkits for those planning experiments and equipment purchases.

## Sample Preparation for XRF — Cotton Creek

**Organizer & Instructor:**
**Yusniel Cruz Hernandez,** Malvern Panalytical, USA, yusnielchdez@gmail.com
**Debbie Siples,** Malvern Panalytical, USA, debbie.siples@malvernpanalytical.com

This workshop will focus on sample preparation of a variety of materials for XRF analysis. Fusion and powder preparation will be encompassed in deep details. It will address the concept of fusion and the theory behind the development of fusion methods, as well as their applications. Further to this, we will be covering some fundamental and advanced concepts of XRF physics. The interconnection among sample preparation methods, calibration range, standard selection, and accuracy will be discussed as well as an overview of WROXI XRF solutions.

## Micro XRF — Meadowbrook

**Organizer & Instructors:**
**Kouichi Tsuji,** Osaka Metropolitan University, Japan, k-tsuji@omu.ac.jp
**Daisuke Matsunaga,** Horiba Co., Ltd., Japan, daisuke.matsunaga@horiba.com
**Brian Patterson,** Los Alamos National Laboratory, USA, bpatterson@lanl.gov

The workshop will cover the basic principles of Energy Dispersive X-ray Fluorescence (EDXRF) analysis including theory, instrumentation, spectral processing, and qualitative & quantitative analysis. EDXRF instruments have been applied for manufacturing process control, environmental field analysis, planetary exploration, and so on. Micro-XRF utilizes any one of a subset of optics to reduce the analysis area and is used to provide spatial information on samples that are difficult to analyze by more traditional EDXRF spectrometers such as small particles or small features, odd size samples or localized contaminated areas. This technique is used to investigate contaminated particles in the laboratory and elemental mapping of various samples. We will introduce the state-of-the-art instruments (X-ray source, X-ray optics for micro beam, and detectors), and confocal micro-XRF for 3 dimensional analysis. Recent applications of micro XRF analyzers in various fields such as industry, environmental science, and artwork will also be discussed.

## Tuesday PM Workshops, 6 August
1:30pm – 4:30pm

### Machine Learning and Autonomous for X-ray Diffraction: An "Unconference" – Part 2 — Standley I

**Organizers & Instructor:**
**Howie Joress,** NIST, USA, howie.joress@nist.gov
**Brian DeCost,** NIST, USA, brian.decost@nist.gov
**Austin McDannald,** NIST, USA, austin.mcdannald@nist.gov
**Zachary Trautt,** NIST, USA, zachary.trautt@nist.gov

New! A one-day "Unconference" on autonomous and ML methods for x-ray diffraction! Suggest and vote on topics of interest through the Whova app. Voting will remain open until Monday evening, 5 August. Suggestions can be areas of needed research, hard problems to solve, or things that you don't understand. Take a deeper dive into the most popular topics and hope that these "Unconference" discussions will be informative for attendees, as well as, provide the DXC community with guidance for future research directions.

### Stress Analysis — Standley II

**Organizer & Instructors:**
**Thomas Watkins,** Oak Ridge National Laboratory, USA, watkinstr@ornl.gov
**Jeffrey Bunn,** Oak Ridge National Laboratory, USA, bunnjr@ornl.gov
**Jun-Sang Park,** Argonne National Laboratory, USA, parkjs@anl.gov

This workshop is intended to introduce novice users to the basic techniques used in laboratory X-ray, synchrotron X-ray and neutron diffraction-based residual stress/strain determinations. After a brief introduction reviewing basics of stress/strain and residual stress determinations, the following will be discussed for the three sources: safety, instrument alignment/calibration, experimental considerations, data collection and analysis, limitations, and examples.

### 2D Detectors — Cotton Creek

**Organizers & Instructors:**
**Tom Blanton,** ICDD, USA, tblanton@icdd.com
**Bob He,** Bruker AXS Inc., USA, bob.he2020XRD@gmail.com
**Joe Ferrara,** Rigaku, USA, joseph.ferrara@rigaku.com
**Marcus Mueller,** DECTRIS Ltd., Switzerland, marcus.mueller@dectris.com
**Scott Speakman,** Malvern Panalytical, USA, scott.speakman@panalytical.com

Two-dimensional diffraction data contain abundant information about the atomic arrangement, microstructure, and defects of a solid or liquid material. In recent years, the use of two-dimensional detectors has dramatically increased in academic, government and industrial laboratories. This workshop covers recent progress in two-dimensional X-ray diffraction in terms of detector technology, geometry and configuration of the two-dimensional diffractometer. Various applications such as phase ID, texture, stress, crystallinity, combinational screening and thin film analysis will be discussed.

### XRF Trace Analysis — Meadowbrook

**Organizer & Instructors:**
**Peter Wobrauschek,** Atominstitut – TU Wien, Austria, wobi@ati.ac.at
**Wataru Matsuda,** Rigaku, Japan, w-matuda@rigaku.co.jp
**Christina Streli,** Atominstitut – TU Wien, Austria, streli@ati.ac.at
**Kouichi Tsuji,** Osaka Metropolitan University, Japan, k-tsuji@omu.ac.jp

Both beginners and experienced X-ray scientists and applicants, physicists, and chemists, should gain information by attending the trace analysis workshop. Presentations of most modern techniques and instrumentation for trace element analysis using EDXRS will be given. Physical methods to improve minimum detection limits in XRF by background reduction will be discussed; special emphasis will be on Synchrotron radiation as excitation source. Introduction to total reflection XRF (TXRF) and actual instrumentation will show achievable advantages and results in terms of detection limits, sensitivities, and detectable elemental range down to light elements (e.g. Carbon). Micro-XRF and Confocal µ-XRF will be presented as methods for 2D and 3D spatial resolved elemental imaging. Applications from fields as environment, microelectronics, forensic, and life science will show the successful use of the various XRF spectrometric techniques. The possibilities of trace analysis using Wavelength dispersive XRF will also be covered, showing the benefits and limitations of the technique. A comparison of achievable detection limits with the various techniques on some specific samples will be discussed.

# FENNO-AURUM

## Fenno-Aurum Oy : Company Profile.

Fenno-aurum Oy was founded in Espoo, Finland during 2012 by a serial entrepreneur and a globally recognized scientist Dr.Heikki Sipilä. He has done extensive work in X-ray analysis filed covering industrial,scientific and space applications. Heikki designed several unique patent protected detectors and successfully developed products for worlds most popular OEM brands. Made a couple of successful exits to USA and UK companies. He executed several space missions and applications both directly and indirectly through our collaborators/ partners.

Fenno-aurum Oy designs and manufactures radiation detectors for X-ray, gamma-ray and Ultraviolet detection applications. We specialize in gas filed radiation detectors based on the proportional counter design for Industrial and scientific applications. We are an OEM vendor, also build custom designed radiation detectors, associated electronics etc.

By 2025 We will introduce world's most sensitive, ultra-fast, air-cooled, compact and low-cost desktop EDXRF/WDXRF analyzer for various applications begin with food industry. World's most sensitive Single photon UV sensor for fire alarm and 6G applications would follow soon.

## Current Products.

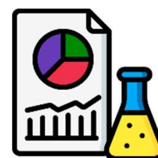
- An OEM manufacturers for Gas filled detectors.
- Ultra sensitive Gas filled proportional counters for various XRF applications
- Custom designed Gas filled detectors on request. Temperature range from -150 C to 300 C. Large area position sensitive detectors. Special applications high temperature range GM detectors.
- Neutron detectors based B4C neutron convertors.
- Sealed thin window gas filled for space applications.

## On ongoing Project

- Ultra-sensitive single phonon UV Sensors
- Ultra-sensitive, rapid, compact and low cost XRF analzyers

## Industries covered

- Food analysis
- Pharmaceutical
- Coating thickness
- Industrial
- Scientific



NEW

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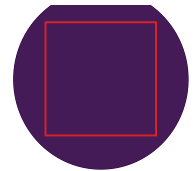
AT BOOTH #40

*POSTER SESSION:*
**KETEK's NEXT GENERATION AXAS 3.0 SYSTEM**
*August 6th, 05:00 - 07:00 pm*

*ORAL SESSION:*
**LATEST GENERATION OF SILICON DRIFT DETECTORS AND READOUT ELECTRONICS**
*August 7th, 02:30 pm*



KETEK

# AXAS 3.0

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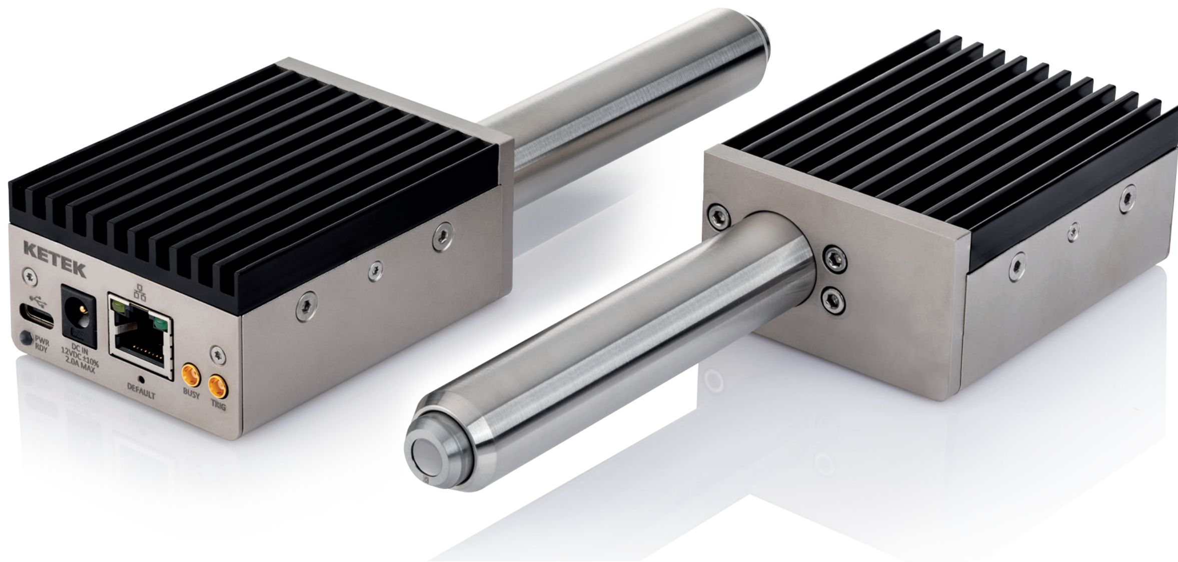


- New high-performance Digital Pulse Processor DPP3 with peaking times down to 25 ns
- New generation 3.0 preamp technology
- Mapping Mode optimized for time critical scanning applications
- Ethernet and USB 2.0 Type C interface
- Designed for SDDs ≤ 50 mm² active area
- Extremely small form factor: 81 x 61 x 36 mm³ (AXAS body only)
- Windows and Linux software including programming libraries for easy getting started

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# XRD Poster Session – Monday Evening, 5 August

## 5:00pm – 7:00pm • Westminster Foyer

***Signifies presenting author***

The Monday evening XRD poster session will be held 5:00pm – 7:00pm in the Westminster Foyer, in conjunction with a wine and cheese reception. Three "Best Poster" awards will be given at the end of the session, including "Best Student Poster".

**Chairs:**
**Ercan Cakmak,** Oak Ridge National Laboratory, USA, cakmake@ornl.gov
**Tom Watkins,** Oak Ridge National Laboratory, USA, watkinstr@ornl.gov

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D-15 Crystal Structures of Large-Volume Commercial Pharmaceuticals
**James Kaduk*,** North Central College, USA
**T. Ens,** North Central College, USA
**A. Dosen, T. Blanton,** ICDD, USA

D-27 Deposition and Structural Characterization of Pt Films
**Qiyin Lin*,** University of California Irvine, USA

D-37 Structural Analysis of Aluminosilicate Minerals in Traditional Chinese Medicine
**Go-Woon Lee*,** KIER, Korea

D-53 Synthetic and Biogenic Ammonium Urates
**Shae London*, A. Thornton, J. Swift,** Georgetown University, USA
**T. Fawcett,** ICDD, USA
**G. Schuett,** Chiricahua Desert Museum, USA

D-54 Solid State Desolvation of 5-Fluorocytosine Forms
**Lindsey K. Foote*, J.E. Mann, S.A. Kelly, J.A. Swift,** Georgetown University, USA

D-55 The Role of Stacking Faults of Crystalline Substances for the Stability of Micro- and Macro-Structure and Phase Formation
**Boris N. Kodess*, P. Kodess,** ICS&E, USA and VNIIMS, Russia

D-57 Collagen Degradation Investigation in Archaeological Second Metacarpal Bones Using Synchrotron Wide-Angle X-ray Scattering
**Misha Romanov*, W. Abramovich, G. Gonzalez Aviles,** DePaul University, USA
**J.-S. Park,** Argonne National Laboratory, USA
**S.R. Stock,** Northwestern University, USA

D-69 Evaluation of the Optimal Sample Preparation Procedure for XRD-Based Morphological Quantification of Talc
**Daniel Dodoo*,** The University of Melbourne, Australia
**N.A.S. Webster,** CSIRO Mineral Resources, Australia

D-76 Evolution of Au@Pt Core–Shell Nanoparticles at High-Temperature
**Jianhua Li*,** Rice University, USA

D-81 Structural Characterization by Using SAXS and XRD on pre- and post- Lyo LNP Drug Products
**Kuo-Chih Shih*, M. Brown,** Malvern Panalytical, USA

D-87 Structural Analysis of Li-ion Cathodes via X-ray Diffraction (XRD)
**Nick Rodesney*, N. Henderson, B. Jones,** Bruker, USA

D-90 Combining Non-Ambient X-ray Diffraction and Raman Spectroscopy – A Customized Solution from Anton Paar
**Barbara Puhr*, M. Kremer, A.O.F. Jones**, Anton Paar GmbH, Austria

D-93 Isotropic Negative Thermal Expansion in $ZrW_2O_8$ and $HfW_2O_8$ from 1100 to 1275 °C
**Benjamin S. Hulbert*,** University of Illinois at Urbana-Champaign, USA; NASA Glenn Research Center, USA
**D.W. Blake, W.M. Kriven,** University of Illinois at Urbana-Champaign, USA
**G.S. Mattei,** Stony Brook University, USA

D-102 Crystalline Phase Analysis of Cosmetic Foundation Using Powder X-ray Diffractometry
**Hibiki Shirata*, Y. Koike,** Meiji University, Japan
**A. Ohbuchi,** Rigaku Corporation, Japan

D-106 Leaching Characterization of Heavy Metals from Municipal Solid Waste Incineration Fly Ash by Acid-Alkali Leaching Test with Powder X-ray Diffractometry
**Rina Sekino*, H. Shirata, Y. Koike,** Meiji University, Japan
**A. Ohbuchi,** Rigaku Corporation, Japan

D-123 Effect of Ti Doping on Structural Stability and Cycling Performance of $LiMnO_2$
**Yong-Il Kim*, K.-B. Kim,** Korea Research Institute of Standards and Science, South Korea
**D. Han,** Seoul National University of Standard and Science, South Korea

D-134 A Novel Cancer Biomarker - Unveiling the Role of Microcalcifications in the Prostate
**Sarah Gosling*, M. Kitchen, C. Greenwood,** Keele University, United Kingdom
**E. Arnold, T. Geraki, T. Snow,** Diamond Light Source, United Kingdom
**P. Cool,** The Robert Jones and Agnes Hunt Orthopaedic School, United Kingdom
**K. Rogers,** Cranfield University, United Kingdom
**I. Lyburn,** Thirlestaine Breast Centre, Gloucestershire Hospitals NHS Foundation Trust, United Kingdom
**N. Stone,** University of Exeter, United Kingdom

D-138 In Situ Investigation of MOF Materials under Varying Temperature and Humidity
**Alice Thwin*, S. Gulec,** Anton Paar, USA

D-141 Use of X-ray Optics to Manufacture a Synthetic Retina
**Joanna Maj*,** University of Chicago, USA

D-154 Small Molecule X-ray Powder Diffraction (XRPD) with D6 PHASER
**Nathan Henderson*, N. Rodesney, B. Jones,** Bruker, USA

D-156 ICDD® Polymer Diffraction Raw Data Project – Polymers, Glasses and “Minerals”
**Tom Blanton*, M. Rost, D. Bohnenberger,** ICDD, USA

D-159 Standardless Quantification of Crystalline Polymorphic Mixtures Using the Component Decomposition Method
**Takumi Ohta*, K. Kihara, A. Sasaki,** Rigaku Corporation, Japan

D-160 Qualitative Phase Analysis of Brand Name Vs Generic Drugs (Antacids and Acid Reducers) Using Powder X-ray Diffraction
**Adarsh Kabekkodu*,** Downingtown East High School, USA
**M. Rost,** ICDD, USA

D-163 Plug-In SAXS: A New Approach to an Economic and Resource-Saving Small & Wide--Angle X-ray Scattering Instrument
**Hannes Mio*,** Photron-X, Austria
**A. Bóta,** Research Centre for Natural Sciences – HUNREN, Hungary

D-164 Integration of Mythen 2R Detectors into Legacy Diffractometers
**Hannes Mio*,** Photron-X, Austria

D-166 Synchrotron-Based Multi-Modal Imaging Unveils Structure – Composition – Performance Correlations in CIGS Solar Cells
**Niklas Pyrlik*, C. Ossig, J. Hense, C. Ziska,** German Electron Synchrotron (DESY) and Universität Hamburg, Germany
**S. Patjens, G. Fevola, M. Seyrich, F. Seiboth, A. Schropp, J. Garrevoet, G. Falkenberg, C.G. Schroer, M.E. Stuckelberger**, German Electron Synchrotron (DESY), Germany
**R. Carron,** Swiss Federal Laboratories for Materials Science and Technology Empa, Switzerland

D-167 To Fix or Not to Fix: Deciphering Tissue Chemistry Though Multi-Model Analysis
**Beau Herrington*, L. Adams, A. Ajeer, S. Gosling, C. Greenwood,** Keele University, United Kingdom

D-169 Comprehensive Analysis of Glauconite Sand: DCB Treatment Effects on Mineral Composition
**Md Ashikuzzaman*, W. Sun, Z. Westgate, D. DeGroot, G. Zhang,** University of Massachusetts Amherst, USA

D-170 Solid Decolorization: Dismantling of an Orange-Red Zwitterionic Cocrystal by Multicomponent Milling
**Charles I. Ezekiel*, C. Ortiz-de León,** University of Iowa, USA
**E. Reinheimer, L.R. MacGillivray,** Université de Sherbrooke, Canada

D-171 Crystal Structure of Methoxmetamine and Methoxetamine Hydrochlorides Determined From Laboratory X-ray Powder Diffraction Data
**Graciela Diaz de Delgado*, A. Dugarte-Dugarte, J.M. Delgado,** Universidad de Los Andes, Venezuela
**J. van de Streek,** Avant-garde Materials Simulation, Germany

# XRF Poster Session – Tuesday Evening, 6 August

## 5:00pm – 7:00pm • Westminster Foyer

**Signifies presenting author*

The Tuesday evening XRF poster session will be held 5:00pm – 7:00pm in the Westminster Foyer, in conjunction with a wine and cheese reception. Three DXC "Best Poster" awards will be given at the end of the session, including "Best Student Poster".

**Sponsored Awards:**

**Amptek Award for Best Student XRF Poster -** Best Student Poster during the XRF Poster Session and awarding the winner with an Apple iPad. This award is separate from the DXC Best Student Poster Award.

**Moxtek Scientific Merit Award –** recognizes the Best Poster Presentation for the DXC XRF Poster Session presented by a non-profit organization/university that explores the application of XRF to serve improving knowledge of our world. Awardee will receive a $1,500 prize from Moxtek, Inc.

**XOS Innovation Award™** - recognizes the Best Poster Presentation at the Denver X-ray Conference characterized by the spirit of innovation, excellence in research, and scientific and/ or community impact. Selection Criteria can be found within the Whova event app, under the XRF Poster Session. The Grand prize awardee will receive an iPad Air, the runner-up will receive Bose QuietComfortII Wireless/Bluetooth Ear Buds.

**Chairs: Martina Schmeling,** Loyola University Chicago, USA, mschmel@luc.edu
**Diane Eichert,** Elettra-Sincrotrone Trieste, Italy, diane.eichert@elettra.eu

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F-22 KETEK's Next Generation Analytical X-Ray Acquisition System AXAS 3.0
**Thomas Ganka*, C. Langer, C. Berger, C. Luckey, J. Knobloch,** KETEK GmbH, Germany

F-26 Impacts of Anthropogenic Climate Change on Transport of Heavy Metals in Historical Mining Tails in the Pike-San Isabel National Forest, Little Sacramento Creek Drainage Area
**Debbie Siples*,** Malvern Panalytical, USA

F-33 Method Development of Quantitative Chemical State Analysis by X-ray Emission Spectroscopy for Lithium-Ion Battery Materials
**Takumi Ohta*, H. Takahara,** Rigaku Corporation, Japan
**H. Kobayashi,** National Institute of Advanced Industrial Science and Technology, Japan

F-36 Comparative Elemental Analysis Study of Polyurethane Adhesive Products Using X-ray Fluorescence Spectrometers with Different Configurations
**Anik Chowdhury*,** DuPont, USA
**L. Brehm,** Retired, Dow, USA

F-38 Evaluation of Different Sample Preparation for Trace Elements in Biological Samples – Performance and Greenness
**Sebastian Hauser*, J. Karletshofer, K. Leopold,** Ulm University, Germany

F-50 Detection of Fluorescent X-rays from Noble Gas for Visualization of Microscopic Space
**Hiromi Ozawa*, R. Fujii, K. Tsuji,** Osaka Metropolitan University, Japan

F-72 Optimizing X-ray Detectors for Elements with Z>45
**Robert Redus*, P. Bennett, R. Dubay,** Amptek, USA

F-98 Light Element Analysis with XRF
**Julia Sedlmair*,** Bruker AXS, USA

F-121 Statistical Scaling for the Standardization of Elemental Image by X-ray Fluorescence Spectrometry
**Wataru Matsuda*, A. Morikawa, A. Ohbuchi, T. Moriyama, T. Nakamura,** Rigaku Corporation, Japan

F-128 Development of High-Resolution Zone Plates for X-ray Fluorescence Experiments at the Advanced Photon Source
**Michael Wojcik*, R. Conley, L. Assoufid,** Argonne National Laboratory, USA

F-146 Strategies For In Vivo Diagnosis of Fertilizer Absorption and Transport in Plants by X-ray Fluorescence
**Vinicius Rezende*, H. de Carvalho, G. Montanha,** University of São Paulo, Brazil

F-150 ReMade@ARI: Free Access to Research Infrastructures for Circular Economy
**Michael Stuckelberger*,** Deutsches Elektronen-Synchrotron DESY, Germany
**L. Bhaskaran, B. Schramm, S. Facsko,** Helmholtz-Zentrum Dresden-Rossendorf e.V., Germany

F-161 A Wonderful Combination—Vibrational Spectroscopy and Energy Dispersive X-ray Fluorescence for Raw Materials Identification and Contaminant Analysis
**Joel Langford*, H. Chen, G. Vial,** Shimadzu Scientific Instruments, USA

F-165 Advanced Spectroscopy Measurements at the New APS Spectroscopy Beamline
**Mark Wolfman*, M. Wyman, J. Huang, M. Pape, M. Solovyev, C. Sun, G.E. Sterbinsky, S. Kelly,** Argonne National Laboratory, USA
**Y. Chen, D. Motta Meira,** Canadian Light Source, Canada

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We are open to working together with institutes and universities.

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- brilliant focal spots and long life time
- customer-specific new development

## X-RAY TUBE **ASSEMBLIES**

- up to 80 kV
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## DENTAL **X-RAY TUBES**

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- high voltage power supplies from various manufacturers
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- point-shaped focal spots from 30 µm till 1 mm
- line focus focal spots 100 µm x 2000 µm
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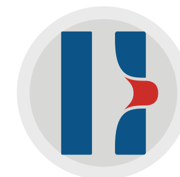

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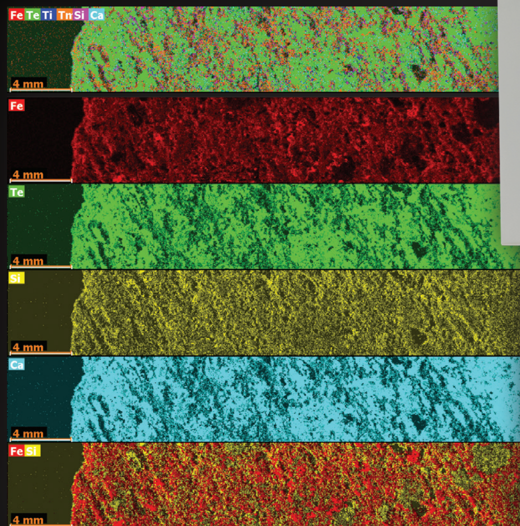

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## Plenary Session – Wednesday AM, 7 August
## 8:30am – 11:45am

***Signifies presenting author***

### Bio-Medical Imaging — Standley I & II

**Chair: Scott Misture,** Alfred University, USA, misture@alfred.edu

| | | |
|---|---|---|
| 8:30 | | Welcoming Remarks and Awards<br>**Scott Misture,** Chair of the Denver X-ray Conference, Alfred University, USA<br><br>2024 Birks Award presented to **Piero A. Pianetta**, Stanford University, USA. Presented by **Scott Misture**, Alfred University, USA, Chair of the Denver X-ray Conference.<br><br>2024 Robert L. Snyder Student Awards to be announced by **Tom Blanton**, Executive Director, ICDD, USA.<br><br>Remarks by the Plenary Session Chair, **Scott Misture.** |
| 9:00 | P-12 | Beyond Jaws: The Mineralized Cartilage of Shark Vertebral Centra<br>**Stuart R. Stock*,** Northwestern University, USA |
| 9:45 | P-104 | X-ray Fluorescence Microscopy Brightens up Biological and Medical Research<br>**Olga Antipova*, S. Chen, B. Lai, Q. Jin, E. Rozhkova,** Argonne National Laboratory, USA<br>**B. Twining,** Bigelow Laboratory, USA<br>**O. Ponomarenko,** University of Saskatchewan, Canada<br>**Y. Pushkar, L. Nie,** Purdue University, USA<br>**G. Woloschak, T. Paunesku,** Northwestern University, USA<br>**M. Ralle,** Oregon Health and Science University, USA<br>**R. Pourzal,** Rush University, USA |
| 10:30 | | Break |
| 11:00 | P-115 | Paleobiomedical Imaging: The Use of X-ray and CT to Study Egyptian and Peruvian Mummies<br>**Andrew Nelson*,** The University of Western Ontario, Canada |

## Oral Sessions – Wednesday PM, 7 August

***Signifies presenting author***

### New Developments in XRD & XRF Instrumentation — Standley I

**Chairs: Andy Drews,** Ford Motor Company, USA, adrews@ford.com
**Tim Fawcett,** Emeritus, ICDD, USA, dxcfawcett@outlook.com

| | | |
|---|---|---|
| 1:30 | S-19 | Basic Physical Limitations for Simultaneous Imaging and Spectroscopy of Photons from 30 eV to 10 keV with Pixelated Silicon Detectors – and: How Close We Are<br>**Lothar Strueder*,** University of Siegen and PNSensor, Germany<br>**B. Eckert, M. Huth, H. Soltau, P. Majewski,** PNDetector, Germany<br>**R. Hartmann, P. Holl,** PNSensor, Germany |
| 1:45 | S-60 | SmartLab SE Automated Multipurpose XRD Diffractometer: Unveiling the Superiority of Floor Standing Instruments over Benchtop Alternatives<br>**Ekaterina Vinogradova*, K. Saito,** Rigaku Americas, USA |
| 2:00 | S-20 | Monolithic Pixelated X-ray Detectors with a Center Hole for Simultaneous Measurements of Diffraction and Fluorescence in Laboratory Set-Ups<br>**Heike Soltau*, M. Huth, P. Majewski, B. Eckert,** PNDetector, Germany<br>**R. Hartmann, P. Holl,** PNSensor, Germany<br>**L. Strueder,** University of Siegen and PNSensor, Germany |
| 2:15 | S-10 | What's next with Highscore(Plus) – One Stop Shop Automation and More<br>**Thomas Degen*, M. Sadki, M. Gateshki, E. Bron,** Malvern Panalytical B.V., Netherlands |

| | | |
|---|---|---|
| 2:30 | S-25 | Latest Generation of Silicon Drift Detectors and Readout Electronics<br>**Andreas Pahlke*, L. Bienkowski, M. Fraczek, M. Hofmann, J. Knobloch,** KETEK GmbH, Germany |
| 2:45 | S-70 | Going beyond – News in Non-Ambient and Operando X-ray Diffraction<br>**Barbara Puhr*, M. Kremer, A.O.F. Jones,** Anton Paar GmbH, Austria |
| 3:00 | | Break |
| 3:30 | S-85 | Enabling Routine Laboratory Fluorescence Mode X-ray Absorption Spectroscopy<br>**Zachary Lebens-Higgins*, W. Holden, D. Mortensen, P. Aronstein,** easyXAFS LLC, USA |
| 3:45 | S-91 | X-ray Spectrometer Technology at Amptek<br>**Robert Redus*, P. Bennett, A. Huber,** Amptek, USA |
| 4:00 | S-131 | STOE Beam Optimization 2.0<br>**Michael Teck*, T. Hartmann,** Stoe & Cie GmbH, Germany |
| 4:15 | S-136 | Advancing Silicon Drift Detectors<br>**Andrew Jarrett*, J. Wang, M. Zhang, E. Tikhomirov, Y. Tomimatsu, G. Rigby, D. Redfern,** Hitachi High-Tech America, USA |
| 4:30 | S-144 | Enhancing Mineral Classification in the Powder Diffraction File™<br>**Soorya Kabekkodu*, D. Sagnella, V. Bosnic, J. Blanton, T. Blanton,** ICDD, USA |

## Stress and Texture Analysis — Standley II

Chair: **Tom Watkins,** Oak Ridge National Laboratory, USA, watkinstr@ornl.gov

| | | |
|---|---|---|
| 2:00 | D-112 | Invited - Multi-Scale, Multi-Modal Stress and Structure Characterization Using High-Energy Synchrotron Radiation at the Upgraded Advanced Photon Source<br>**Jun-Sang Park*, C.A. Chuang, V. Cooley, L.C. Gallington, P. Kenesei, J. Okasinski, S. Shastri, J. Almer,** Argonne National Laboratory, USA |
| 2:30 | D-155 | Invited - Mapping Full Stress Tensors in Advanced Manufactured Mock-Up of the Spallation Neutron Source Second Target Station's Target Using Neutron Diffraction<br>**Jeff Bunn*, J. Mach, T. Muth, J. Montross, D. Kyle,** Oak Ridge National Laboratory, USA |
| 3:00 | | Break |
| 3:30 | D-88 | X-ray Diffraction Measurements of Residual Stress in a Cold Sprayed Ni Coating<br>**Laura G. Wilson*, E.J. Young-Dohe, R.B. Rogers, D.L. Ellis,** NASA Glenn Research Center, USA |
| 3:50 | D-58 | Characterizing Nanoscale Thin-Film Residual Stresses for Stress Mitigation and Engineering in Next Generation X-ray Optics<br>**Taylor Wood*, D. Pagan, F. Grise, R.L. McEnttaffer,** The Pennsylvania State University, USA<br>**A. Woll, L. Smieska,** Cornell High Energy Synchrotron Source, USA |

## Rietveld and PDF Applications — Cotton Creek

Chair: **Kevin Stone,** SLAC National Accelerator Laboratory, USA, khstone@slac.stanford.edu

| | | |
|---|---|---|
| 2:00 | D-63 | Uncovering Disorder in Scheelite Structured Oxides through Local-Scale Analysis<br>**Frederick Marlton*,** University of Technology Sydney, Australia<br>**B. Mullens,** Stony Brook University, USA<br>**M. Saura-Múzquiz,** Universidad Complutense de Madrid, Spain<br>**P. Chater,** Diamond Light Source, United Kingdom<br>**B. Kennedy,** University of Sydney, Australia |
| 2:20 | D-41 | Quantification of Carbonate Mineral Phases in Complex Oil-Well Cement Slurry Blends Containing High Amorphous Content Using Rietveld Refinement<br>**Sandeep Kumar Borra*, D.A. Castillo, P.K. Goswami, W. Abdulrazzaq,** Halliburton, USA |

| | | |
|---|---|---|
| 2:40 | D-64 | There Is Order in the Chaos: Revealing the Local Structure of the Inorganic Framework in $CsPbI_3$ Based Thin Films<br>**Sikhumbuzo M. Masina*, S. Hesse, M.R. Cosby, V. Thampy, K.H. Stone,** SLAC National Accelerator Laboratory, USA |
| 3:00 | | Break |
| 3:30 | D-62 | Crystallographic Analysis of a Squalus Acanthias Dogfish Dorsal Spine<br>**Gabriela B. Gonzalez Aviles*, J. Karavitis,** DePaul University, USA<br>**J.D. Almer, J.-S. Park,** Argonne National Laboratory, USA<br>**C. Tribuzio,** Auke Bay Laboratories, USA<br>**S.R. Stock,** Northwestern University, USA |
| 3:50 | D-162 | Phase Transitions In Magnetocalorics by Variable Temperature and Magnetic Field by Total X-ray Scattering<br>**Valeri Petkov*,** Central Michigan University, USA |

## Quantitative Analysis of XRF — Meadowbrook

Chair: **Christopher Heirwegh,** Jet Propulsion Laboratory, California Institute of Technology, christopher.m.heirwegh@jpl.nasa.gov

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|---|---|---|
| 1:30 | F-103 | Invited – Quantifying Gold Nanoparticle Bio-Distribution Using Total Reflection X-ray Fluorescence<br>**Gabriella Mankovskii*,** Toronto Metropolitan University, Canada |
| 2:00 | F-132 | Invited – Cryogenic Microcalorimeters for Quantitative X-ray Fluorescence Analysis<br>**Joseph Fowler*,** NIST Boulder Laboratories, USA |
| 2:30 | F-126 | Quantification of Particulate Matter Calibration Samples Using Synchrotron Radiation<br>**Thomas Hase*,** University of Warwick, United Kingdom<br>**L. Borgese, P. Cirelli,** University of Brescia, Italy<br>**D. Wermeille,** University of Liverpool, United Kingdom & XMaS Beamline, France<br>**D. Eichert,** Elettra-Sincrotrone Trieste, Italy |
| 2:50 | F-119 | Angular Calibration for Synchrotron 2D/3D Quantitative X-ray Fluorescence Analysis of Biological Applications<br>**Xiaoyang Liu*, T. Isik, S. Chen,** Argonne National Laboratory, USA<br>**Q. Jin,** Northwestern University, USA<br>**S. Soini, V. Merk,** Florida Atlantic University, USA |
| 3:10 | | Break |
| 3:40 | F-45 | Invited – Ultimate Portability: Design and Operation of X-ray Analysis Instruments on Mars<br>**Benton C. Clark*,** Space Science Institute, USA |
| 4:10 | F-77 | Studying Aqueous Alteration on Mars through Quantitative XRF from the Planetary Instrument for X-ray Lithochemistry<br>**Kimberly P. Sinclair*, D.C. Catling, W.T. Elam,** University of Washington, USA<br>**B.C. Clark*,** Space Science Institute, USA<br>**Y. Liu,** Jet Propulsion Laboratory, Caltech Institute of Technology, USA |
| 4:30 | F-80 | Invited - A Compressed Approach to Re-Calibrate PIXL's XRF Elemental Quantification Capabilities In-Flight<br>**Christopher M. Heirwegh*, A.C. Allwood,** Jet Propulsion Laboratory, California Institute of Technology, USA<br>**B.P. Ganly,** CSIRO, Australia<br>**P. Colosimo,** University of Washington, USA |

# Oral Sessions – Thursday AM, 10 August

**Signifies presenting author*

## Mining, Recycling, and Sustainable Materials — Standley I

**Chair: Kouichi Tsuji,** Osaka Metropolitan University, Japan, k-tsuji@omu.ac.jp

| Time | Code | Presentation |
|---|---|---|
| 8:30 | S-24 | Invited - XRF Analysis in Recycling Fields<br>**Daisuke Matsunaga*, H. Nakano, T. Ampo, T. Aoyama,** HORIBA Ltd., Japan<br>**J. Kondo,** EGS CO. Ltd., Japan |
| 9:00 | S-113 | Invited - Determination of Abundances, Distribution, and Species of Rare Earth Elements in Natural Samples Using Advanced X-ray Spectroscopy<br>**Yoshio Takahashi*,** The University of Tokyo, Japan |
| 9:30 | S-51 | Revealing Calcium Carbonate Transformation Under In Situ Heating Using 4D Sparse Ptychographic X-ray Nanotomography<br>**Zhao Jiang*, M. Durelle, T. Turner, Y.-Y. Kim, F. Meldrum,** University of Leeds, United Kingdom<br>**J. Ihli,** University of Oxford, United Kingdom<br>**Z. Gao,** Brookhaven National Laboratory, USA<br>**C. Appel, A. Diaz, M. Guizar-Sicairos, M. Holler,** Paul Scherrer Insitute, Switzerland |
| 9:50 | | Break |
| 10:20 | S-52 | Invited - Exploring the Benefits of Using Handheld XRF to Support Lithium-Ion Battery Recycling Process<br>**Jordan Rose*,** Hitachi High-Tech Analytical Science, USA |
| 10:50 | S-151 | Studying Slag Melt Characteristics and Elemental Species With Respect to the Recovery of Critical Elements<br>**Ursula E.A. Fittschen*, I.A. Alhafez, A. Schnickmann, T. Schirmer, N. Merkert,** Clausthal University of Technology, Germany<br>**S. Hampel,** Deutsches Elektronen Synchrotron, Germany |
| 11:10 | S-48 | An Investigation into the Floatability of Talc by Quantifying Its Platy Morphology Using XRD<br>**Daniel Dodoo*, S.P. Usher, P.J. Scales, A.D. Stickland,** The University of Melbourne, Australia<br>**N.A.S. Webster,** CSIRO Mineral Resources, Australia<br>**L. Forbes,** The University of Queensland, Australia |
| 11:30 | S-49 | Energy-Dispersive X-ray Diffraction Analysis for Localized Region<br>**Kouichi Tsuji*, N. Taniguchi, M. Okuda, S. Fukumoto,** Osaka Metropolitan University, Japan |

## General XRD – Part 1 — Standley II

Chair: **John Okasinski,** Argonne National Laboratory, USA, okasinski@anl.gov

| Time | Code | Presentation |
|---|---|---|
| 9:00 | D-17 | Preparation of Cobalt Aluminate Thin Films and Study of Some of Their Physical Properties<br>**Nasser Saad Al-Din*, A. Aton, A. Al-Zoubi,** University of Al-Baath, Syria |
| 9:20 | D-30 | XRD Hydration Monitoring of Amorphous and Crystalline Portland Cement Phases Depending on High Energy Mixing<br>**Steffen Witzleben*,** Bonn-Rhein-Sieg University of Applied Sciences, Germany |
| 9:40 | D-42 | X-ray Powder Diffraction in Education<br>**Robert Dinnebier*,** Max Planck Institute for Solid State Research, Germany |
| 10:00 | D-44 | Reciprocal Space X-ray Computed Tomography<br>**Arturas Vailionis*,** Stanford University, USA |
| 10:20 | | Break |
| 10:50 | D-46 | Utilizing New Compact X-ray Diffractometer, Miniflex XpC In Conjunction with EasyX Software to Perform Automated Analysis of XRD Samples<br>**Akhilesh Tripathi*,** Rigaku Americas, USA |

## Cultural Heritage — Cotton Creek

Chair: **Martina Schmeling,** Loyola University Chicago, USA, mschmel@luc.edu

| | | |
|---|---|---|
| 8:30 | S-99 | Invited – Use of XRF at the Canadian Conservation Institute to support Cultural Heritage Science Research<br>**Maeve Moriarty*,** Canadian Conservation Institute, Canada |
| 9:00 | S-117 | Invited – Synchrotron Radiation Techniques in the Cultural Heritage Analyst's Toolkit<br>**Diane Eichert*,** ELETTRA - Sincrotrone Trieste, Italy |
| 9:30 | S-111 | Traditional Ceramic Artifacts from Yucatan Peninsula, México: Implications for Manufacturing Process Based on Elemental Analyses<br>**Oscar G. de Lucio*, M. Pérez, J. Miranda,** IF-UNAM, México<br>**H.M. Sobral,** ICAT-UNAM, México<br>**C. Márquez-Herrera,** FQ-UNAM, Mexico<br>**A. Goguitchaichvili,** SAN-IGUM-UNAM, México<br>**S. Ortiz,** IIA-UNAM, México |
| 9:50 | S-14 | Multiple Modality Assessment of Diagenesis in Ancient Human Second Metacarpal Bones<br>**Stuart R. Stock*, L.L. Gardner, S. Jacobsen,** Northwestern University, USA<br>**W. Abramovich, M. Romanov, G. Gonzalez Aviles,** DePaul University, USA<br>**S. Flohr, U. Kierdorf, H. Kierdorf,** University of Hildesheim, Germany<br>**J.D. Almer, J.-S. Park,** Argonne National Laboratory, USA |
| 10:10 | | Break – Trace Analysis will begin after the break. |

## Trace Analysis — Cotton Creek

Chair: **Martina Schmeling,** Loyola University Chicago, USA, mschmel@luc.edu

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|---|---|---|
| 10:40 | F-47 | Invited - Next Generation Elemental Analyses in the Chemical Speciation Network: Investigation of Current X-ray Fluorescence Technology<br>**Jason Giacomo*, N. Spada, J. Wang, N. Hyslop,** University of California, USA |
| 11:10 | F-105 | Invited - Evaluation of Toxic Elements Uptake by Plants Using X-ray Fluorescence Microscopy<br>**Olga Antipova*,** Argonne National Laboratory, USA<br>**O. Ponomarenko,** University of Saskatchewan, Canada<br>**T. Varga,** Pacific Northwest National Laboratory, USA<br>**A. Nisperos, A. Oberai, E. Horan,** Lemont High School, USA<br>**T. Banas, S. Barger, E. Ma, A. Pradhan, A. Lazowski,** Naperville Central High School, USA |
| 11:40 | F-67 | Biomonitoring of Chicago's Pilsen and Little Village Industrial Corridors Using Daucus Carota<br>**Alyssa Tovar*, M. Schmeling,** Loyola University Chicago, USA |
| 12:00 | F-79 | Analysis of Heavy Metals in White Grape Vinegar<br>**Monika Rasic*, M. Schmeling,** Loyola University Chicago, USA |

## Micro XRF and Synchrotron Applications — Meadowbrook

Chair: **Peter Wobrauschek,** Atominstitut – TU Wien, Austria, wobi@ati.ac.at

| | | |
|---|---|---|
| 9:00 | F-125 | Invited – Decoding the Elemental Fingerprints of Ancient Gold: A Synchrotron-based Approach<br>**Martin Radtke*,** BAM, Germany |
| 9:30 | F-35 | MAXI- macro XRF Scanning Device with mm Spot Size for A4 Area Scans<br>**Patrick Kraus*, P. Wobrauschek, P. Kregsamer, C. Streli,** Atominstitut – TU Wien, Austria<br>**D. Ingerle,** TU Wien X-Ray Center, Austria |
| 9:50 | F-74 | Assessing Coating Deposition Performance of a Board Argon Ion Beam Precision Etching and Coating System Using Micro-XRF<br>**Shangshang Mu*, G. Weppelman, G. Xu, S. Coyle,** Gatan/EDAX, USA |

10:10 Break

10:40 F-118 Invited – Monochromatic Tube Excited microXRF of Daguerreotypes
**Dieter Ingerle*, V. Ljubić Tobisch, K. Hradil,** TU Wien X-Ray Center, Austria
**P. Wobrauschek, C. Streli, K. Whitmore,** TU Wien, Austria

11:10 F-23 Highly Flexible Coated Hollow Capillaries for Synchrotron Radiation
**Jörn Volkher Wochnowski*,** Technische Hochschule Lübeck, Germany
**Y. Tanaka,** RIKEN SPring-8 Center, Japan

11:30 F-96 Plutonium X-ray Emission Lines
**Rachel Lim*, A. Baker,** Lawrence Livermore National Laboratory, USA
**A. Ditter, D. Shuh, S. Donald, B. Chung,** Lawrence Berkeley National Laboratory, USA

11:50 F-153 In Situ Studies of High Entropy Oxides for Li-Ion Anodes
**Carlo U. Segre*,** Illinois Institute of Technology, USA
**O.J. Marques,** SLAC National Accelerator Laboratory, USA

# Oral Sessions – Thursday PM, 8 August

****Signifies presenting author***

## Bio-Medical — Standley I

**Chair: Charlene Greenwood,** Keele University, United Kingdom, c.e.greenwood@keele.ac.uk

1:30 S-39 Invited – Tabletop X-ray Transmission + Diffraction Imaging Systems for Task-Specific Sample Analysis
**Joel Greenberg*, C. Dudley, T. Richmond, D. Pike, C. Peters, S. Kida, E. Espenhahn, R. Moody, A. Kapadia, D. Coccarelli,** Quadridox, USA
**S. McCall,** Duke University Health Systems, USA

2:00 S-75 X-ray Diffraction in Histological Sections Using a Laboratory Source
**Charlene Greenwood*, S. Gosling,** Keele University, United Kingdom
**R. Scott, K.D. Rogers,** Cranfield University, United Kingdom
**I. Lyburn, E. Cornford,** Gloucestershire Hospitals NHS Foundation Trust, United Kingdom
**P. Bouzy, N. Stone,** University of Exeter, United Kingdom
**S. Pinder,** King's College London, United Kingdom
**E. Arnold,** Diamond Light Source, United Kingdom

2:20 S-145 Invited – Innovations in Soft Tissue Characterisation: Harnessing X-ray Diffraction and Machine Learning for Early Cancer Detection
**Ash Ajeer*, L. Adams, S. Gosling, C. Greenwood,** Keele University, United Kingdom

2:50 Break

3:20 S-129 Invited - Accurate Analysis of Nanocrystalline Hydroxyapatite: Local Order from Total Scattering
**Emily L. Arnold*,** Diamond Light Source Ltd., United Kingdom
**C. Greenwood,** Keele University, United Kingdom
**K.D. Rogers,** Cranfield University, United Kingdom

3:50 S-13 Mineralized Tissue of Shark Vertebral Centra Studied with microCT under in situ Load
**Stuart R. Stock*,** Northwestern University, USA
**J.T. Parker,** Lawrence Berkeley National Laboratory, USA
**M.S. Passerotti, L.J. Natanson,** Northeast Fisheries Science Center, USA
**D.Y. Parkinson,** Lawrence Berkeley National Laboratory, USA

4:10 S-130 Exploring Prostate Cancer Biomarkers: Insights from Tissue Microenvironments and X-ray Scattering Analysis
**Beau Herrington*, S. Gosling, L. Adams, A. Ajeer, M. Kitchen, C. Greenwood,** Keele University, United Kingdom
**E. Arnold, A. Smith, T. Snow,** Diamond Light Source Ltd., United Kingdom
**P. Cool,** The Robert Jones and Agnes Hunt Orthopaedic School, United Kingdom
**I. Lyburn,** Thirlestaine Breast Centre, Gloucestershire Hospitals NHS Foundation Trust, United Kingdom
**K. Rogers,** Cranfield University, United Kingdom
**N. Stone,** University of Exeter, United Kingdom

4:30 S-109 Prostate Microcalcification Crystallography as a Marker of Pathology
**Sarah Gosling*, M. Kitchen, C. Greenwood,** Keele University, United Kingdom
**E. Arnold, K. Geraki, T. Snow,** Diamond Light Source Ltd., United Kingdom
**P. Cool,** The Robert Jones and Agnes Hunt Orthopaedic School, United Kingdom
**I. Lyburn,** Thirlestaine Breast Centre, Gloucestershire Hospitals NHS Foundation Trust, United Kingdom
**K. Rogers,** Cranfield University, United Kingdom
**N. Stone,** University of Exeter, United Kingdom

## General XRD – Part 2 — Standley II

Chair: **John Okasinski,** Argonne National Laboratory, USA, okasinski@anl.gov

1:30 D-78 An Application of XRD for Explosives Detection in Aviation Security: Combining Strengths of X-ray Transmission and Scatter for Better Performance
**David Coccarelli*, J. Greenberg, C. Dudley, T. Richmond, D. Pike, C. Peters, R. Moody, E. Franco,** Quadridox, USA

1:50 D-89 X-ray Diffraction Based Phase Identification in NiTiHf Shape Memory Alloys with Variable Hf Content
**Laura G. Wilson*, E.J. Young-Dohe, O. Benafan, R.B. Rogers,** NASA Glenn Research Center, USA
**A. Garg,** NASA Glenn Research Center and University of Toledo, USA

2:10 D-94 The Brockhouse sector beamlines at the Canadian Light Source
**Beatriz Moreno*, A. Leontowich, N. Appathurai, A. Rahemtulla, G. King,** Canadian Light Source, Canada
**S. Kycia,** University of Guelph, Canada

2:30 D-95 Comparison of Phase Distributions and Microstructure in Electron Beam Welded Reactor Pressure Vessel Steel Fabricated via Forging and PM-HIP
**Jasmyne N. Emerson*, E.H. Marrero, G.A. Nemets, J.P. Wharry, M.A. Okuniewski,** Purdue University, USA
**M. Topsakal, S. Gill, X. Xiao,** Brookhaven National Laboratory, USA

2:50 Break

3:20 D-124 Deconvolutional Treatment on Sample Transparency Aberration at Low Angles
**Takashi Ida*,** Nagoya Institute of Technology, Japan

3:40 D-137 High Resolution X-ray Diffraction Analysis of Proton Irradiated GaN
**Shwetha Sunil Kumar*, R. Hyderkhan, B. Reeja-Jayan,** Carnegie Mellon University, USA
**B. Rout,** University of North Texas, USA
**S. Ghose,** Brookhaven National Laboratory, USA

## Non-ambient Measurements — Cotton Creek

Chair: **Andy Drews,** Ford Motor Company, USA, adrews@ford.com

2:00 D-56 Invited - Thinking Outside the Crucible: Containerless Processing for Science at Extremes
**Dante Quirinale*,** Oak Ridge National Laboratory, USA

2:30 D-68 Invited - Structure and Intrinsic Properties of Single-Wall and Double-Wall $TiO_2$ Nanotube Layers under the Different Thermal Treatment
**Ludek Hromadko*, H. Sopha, J.M. Macak,** University of Pardubice, Czech Republic
**Z. Spotz,** Brno University of Technology, Czech Republic

3:00 Break

3:30 D-127 High Pressure Neutron Diffraction on Defect Helium Perovkites: Formation and Stability
**Antonio M. dos Santos*, J.J. Molaison,** Oak Ridge National Laboratory, USA
**S. Ma, A.P. Wilkinson,** Georgia Institute of Technology, USA

3:50 D-152 In-Situ Monitoring Of Cristobalite within a Glass Matrix via High-Temperature XRD
**Mark A. Rodriguez*, S. Dai, J.J.M. Griego, N. Valdez,** Sandia National Laboratories, USA

4:10 D-158 Crystal Structure Solution and High Temperature Thermal Expansion in $CaZr_4(PO_4)_6$ and $SrZr_4(PO_4)_6$
**Benjamin S. Hulbert*, W.M. Kriven,** University of Illinois at Urbana-Champaign, USA

## General XRF

## Meadowbrook

Chair: **Ursula Fittschen,** TU Clausthal, Germany, ursula.fittschen@tu-clausthal.de

| Time | Paper | Session |
|---|---|---|
| 1:30 | F-84 | Invited - The Fate of Macro, Micro and Trace Elements in Soil Ecosystems: A TXRF Story<br>**Ignazio Allegretta*,** Università del Salento, Italy |
| 2:00 | F-139 | Invited – Continuous X-ray Fluorescence Core Scanning in the Mining Industry: Application Examples and Method Developments<br>**Miranda Lehman*, T. Monecke,** Colorado School of Mines, USA<br>**A. Lundström,** Veracio, Sweden<br>**A. Seyfarth,** SGS North America Natural Resources Division, USA |
| 2:30 | F-133 | AIR-CAL: AIR Particulate Reference Material for Elemental Quantification and CALibration Procedures<br>**Diane Eichert*,** ELETTRA - Sincrotrone Trieste, Italy<br>**L. Borgese,** University of Brescia, Italy |
| 2:50 | | Break |
| 3:10 | F-149 | Invited – Multi-Modal Scanning X-ray Microscopy: From Material Properties to Nanoscopic Solar-Cell Performance<br>**Michael Stuckelberger*,** Deutsches Elektronen-Synchrotron DESY, Germany |
| 3:40 | F-107 | Mineral and Rock Texture Characterization from X-ray Spectroscopy with the PIXL Instrument on Mars<br>**Michael Tice*, L. O'Neil,** Texas A&M University, USA<br>**B. Ganly,** CSIRO, Australia<br>**M. Jones, B. Orenstein, D. Flannery,** Queensland University Technology, Australia<br>**S. VanBommel,** Washington University in St. Louis, USA<br>**B. Clark,** Space Science Institute, USA<br>**A. Allwood,** Jet Propulsion Laboratory, California Institute of Technology, USA<br>**J. Hurowitz,** Stony Brook University, USA |
| 4:00 | F-108 | Comparing Analysis Capability of Different X-ray Fluorescence Technologies (WD, ED, Micro and Portable XRF) for Quantifying Metals in Polymers<br>**Poulami Dutta*, T. Stewart,** Dow Inc., USA |
| 4:20 | F-29 | Analysis of the Pixel Structure in pnCCDs and Its Effects on Subpixel Resolution<br>**Lothar Strüder*,** PNSensor and University of Siegen, Germany<br>**B. Eckert, S. Aschauer, M. Huth, P. Majewski, H. Soltau,** PNDetector, Germany |

# Oral Sessions – Friday AM, 9 August

**Signifies presenting author*

## Machine Learning Techniques in X-ray Analysis — Standley I

Chairs: **Mathew Cherukara,** Argonne National Laboratory, USA, mcherukara@anl.gov
**Apurva Mehta,** SLAC, SSRL, USA, mehta@slac.stanford.edu

| | | |
|---|---|---|
| 8:30 | S-61 | Invited - Virtual Scientific Companion for Synchrotron X-ray Experimentation<br>**Esther Tsai*,** Brookhaven National Laboratory, USA |
| 9:00 | S-73 | Exploring LLM Applications for X-ray User Facility Operations<br>**Michael Prince*, T. Zhou, H. Chan, A. Vriza, V. Sastry, M. Cherukara,** Argonne National Laboratory, USA |
| 9:20 | S-28 | Rapid Detection of Rare Events during Material Deformation Using Machine Learning and X-ray Diffraction<br>**Hemant Sharma*, W. Zheng, J.-S. Park, P. Kenesei, R. Kettimuthu, A. Miceli,** Argonne National Laboratory, USA |
| 9:40 | S-65 | Invited - Advancing Materials Characterization through Physics-Guided Machine Learning<br>**Nina Andrejevic*,** Argonne National Laboratory, USA |
| 10:10 | S-97 | Physics-Informed AI Models for High-Resolution 3D X-ray Imaging of Nanocrystals<br>**Henry Chan*, M. Cherukara, R. Harder, V. Sastry, A. Chandrasekhar,** Argonne National Laboratory, USA |
| 10:30 | | Break |
| 10:50 | S-148 | Invited - PtychoPINN: Physics-Informed Machine Learning for High-Resolution Lensless Imaging<br>**Oliver Hoidn*, A. Mishra, M. Seaberg, A. Mehta,** SLAC National Accelerator Laboratory, USA |
| 11:20 | S-40 | Ptychographic Scan Position Prediction Using Single-Shot Phase Retrieval Neu-ral Networks<br>**Ming Du*, T. Zhou, J. Deng, D.J. Ching, S. Henke, M.J. Cherukara,** Argonne National Laboratory, USA |
| 11:40 | S-122 | Deep Learning of Structural Morphology Imaged by Scanning X-ray Diffraction Microscopy<br>**Aileen Luo*, A. Singer,** Cornell University, USA<br>**T. Zhou, M.V. Holt, M.J. Cherukara,** Argonne National Laboratory, USA |

## Energy Materials Characterization — Standley II

Chair: **Mark Rodriguez,** Sandia National Laboratories, USA, marodri@sandia.gov

| | | |
|---|---|---|
| 8:30 | S-16 | Invited – Examples of X-ray Characterization Techniques in Energy Storage Research<br>**Katharine Harrison*,** National Renewable Energy Laboratory, USA |
| 9:00 | S-147 | Invited – Multi-scale X-ray CT for Characterization of Energy Materials<br>**Donal Finegan*,** NREL, USA |
| 9:30 | S-59 | Advancing Lithium-Ion Battery Research: XSPA-400 ER Detector Technology for Enhanced XRD Structural Characterization<br>**Ekaterina Vinogradova*, K. Saito,** Rigaku Americas, USA |
| 9:50 | S-114 | Investigating Safety in High Nickel NMC\|\|LTO Batteries<br>**Noah B. Schorr*, B.R. Perdue, J.L. Langendorf, M. Salazar, M. Diaz, M.A. Rodriguez, N.R. Valdez,** Sandia National Laboratories, USA |
| 10:10 | | Break |
| 10:30 | S-157 | Invited – Spatially and Temporally Resolved Investigation of Electrochemical Energy Storage Systems via X-ray Diffraction<br>**Amy Marschilok*, K. Takeuchi, E. Takeuchi,** Stony Brook University, USA |
| 11:00 | S-135 | Non-destructive Inspection of Batteries Using X-ray Computed Tomography<br>**Angela Criswell*,** Rigaku Americas Corp, USA |

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|---|---|---|
| 11:20 | S-71 | X-ray Diffraction for Battery Analysis: Modern Challenges and Modern Solutions<br>**Andrew Jones*, M. Kremer, B. Schrode, P. Vir,** Anton Paar GmbH, Austria |
| 11:40 | S-21 | 3D Visualization of Nanoscale Structural Evolution by Bragg Coherent X-ray Diffraction Imaging<br>**Wonsuk Cha*,** Argonne National Laboratory, USA |

## Industrial Applications of XRD — Cotton Creek

Chair: **Tim Fawcett,** Emeritus, ICDD, USA, dxcfawcett@outlook.com

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|---|---|---|
| 8:30 | D-142 | Invited – Industrial Application of XRD<br>**Bryan Wheaton*,** Corning Incorporated, USA |
| 9:00 | D-9 | Applications of X-ray Powder Diffraction and Rietveld Methods for Identifying the Root Causes of the Accumulated Sludge Deposits in Refineries and Gas Plants<br>**Fatimah Edhaim*, H. Sitepu,** Saudi Aramco, Saudi Arabia |
| 9:20 | D-120 | How the Integration of Modern AI Tools Improve Quality Control within the Industrial Setting: A Case Study with Cluster Analysis Performed On Iron Slags, Steel Slags, and Cement<br>**Jessica Lyza*, S. Page,** Edward C. Levy, Co., USA<br>**T. Fawcett,** ICDD, USA |
| 9:40 | D-116 | Application of the I/Sm Geothermometer at the Borinquen Geothermal Field, Costa Rica<br>**Edward Hakanson*,** Instituto Costarricense de Electricidad, Costa Rica |
| 10:00 | | Break |
| 10:20 | D-66 | The Degree of Crystallinity of Polyphenylene Sulfide Composites Determined by Using Newly Developed Method<br>**Hideo Toraya*,** Rigaku Holdings Corporation, Japan |
| 10:40 | D-32 | Applications of Powder X-ray Diffraction in Advancing the Small Molecule Development Pipeline<br>**Paroma Chakravarty*, M. Bui, A. DiPasquale, J. Lubach,** Synthetic Molecule Pharmaceutics, Genentech Inc., USA |
| 11:00 | D-31 | Investigation of the Stability of Membranes for Drinking Water Desalination by XRD and XRF<br>**Steffen Witzleben*,** Bonn-Rhein-Sieg University of Applied Sciences, Germany |
| 11:20 | D-101 | Fast and Stable Analysis for Quality Control by XRD<br>**Yuki Ichikawa*, T. Kuzumaki, A. Ohbuchi,** Rigaku Corporation, Japan |
| 11:40 | D-100 | Geographical Profiling of Sand by Micro-XRF<br>**Sergey Mamedov*,** HORIBA Instruments Incorporated, USA |

## Industrial Applications of XRF — Meadowbrook

Chair: **Poulami Dutta,** Dow Chemical Company, USA, pdutta1@dow.com

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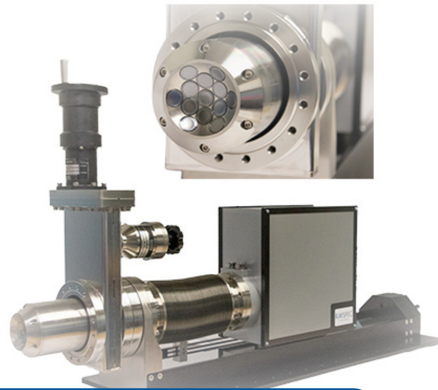
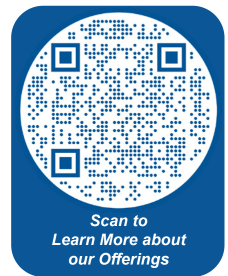
|---|---|---|
| 8:30 | F-92 | Invited – The Adaptive Role of XRF from Material Discovery to Production<br>**Britt Vanchura*,** Dow, USA |
| 9:00 | F-18 | Invited – Examination of Material Failure Using in situ X-ray Tomography<br>**Brian M. Patterson*, T.E. Quintana, D. Zhang, P. Welch Jr., C. Welch, L.G. Hill, G.T. Gray III, G. Kidman, D. Hooks,** Los Alamos National Laboratory, USA |
| 9:30 | F-43 | XRF Assays for Critical Minerals in Mining and Processing: Cobalt Sulfide Ore and Concentrate Using Fusion with WD XRF<br>**Alexander Seyfarth*,** SGS North America Natural Resources Division, USA |
| 9:50 | F-82 | Universal Oxidation Method for Metallic Samples in Preparation for Borate Fusion<br>**Jean-Christophe Tremblay-Cantin*, M. Boivin,** Katanax, Canada |
| 10:10 | | Break |

10:30 F-140 WDXRF Measurement of Liquids without Helium
**Kosuke Kawakyu*, N. Okazaki, Y. Yamada,** Rigaku Corporation, Japan
**A. Quevy, S. Yamakawa,** Rigaku Americas Corporation, USA

10:50 F-11 A Step Forward for Optimized Battery Cathode Manufacturing with XRF Analysis
**Yusniel Cruz Hernandez*,** Malvern Panalytical, USA
**A. Komelkov,** Malvern Panalytical B.V., The Netherlands
**I. Rodriguez Duran,** Malvern Panalytical, Canada

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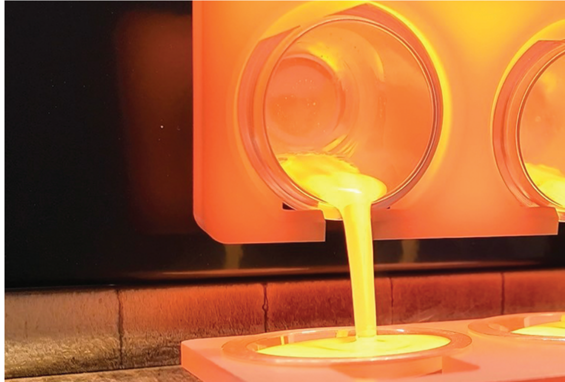

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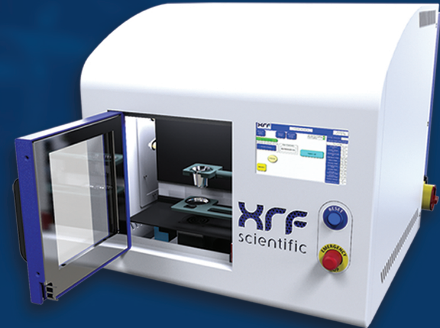

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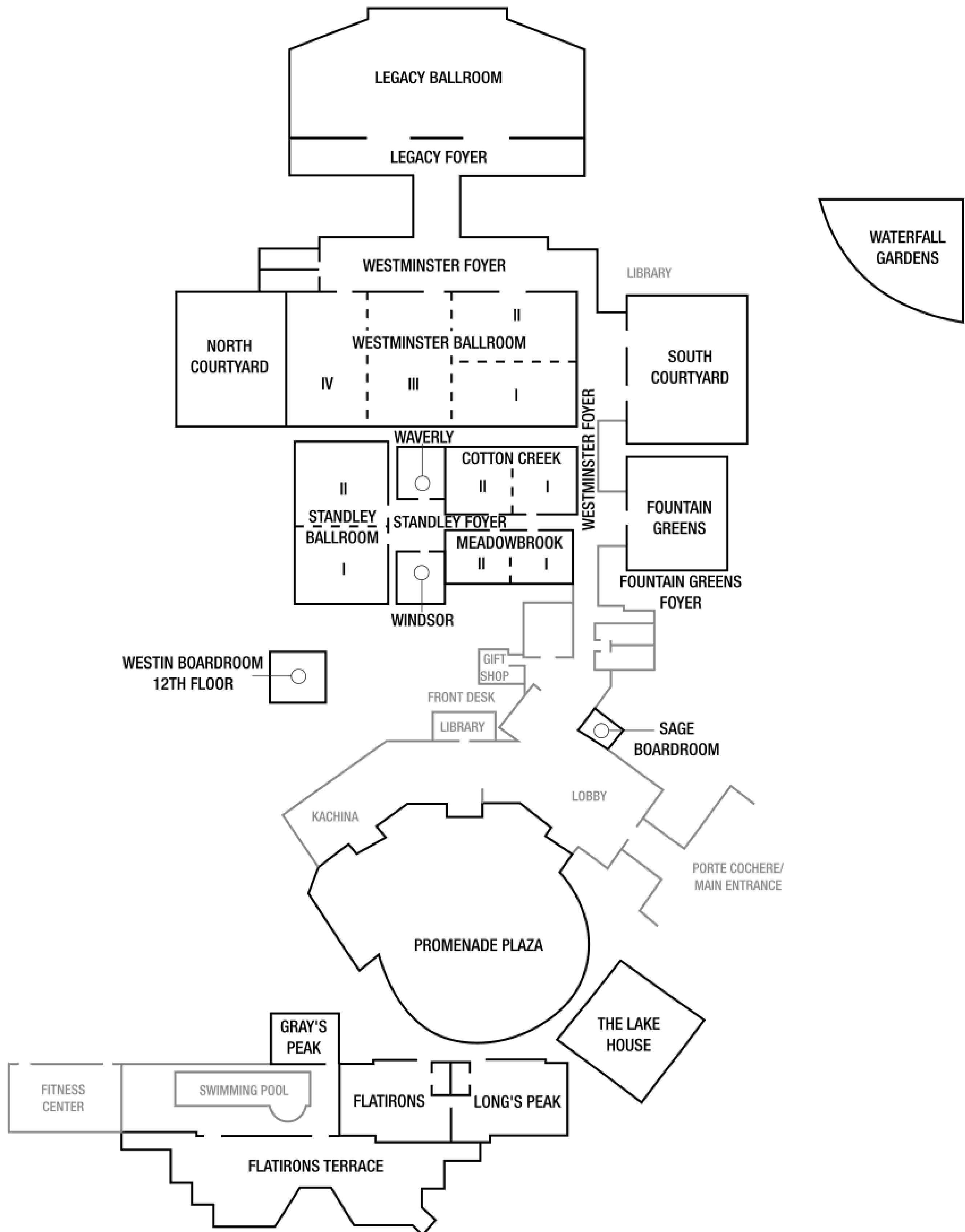
# The Westin Westminster Hotel Layout



# 2024 Denver X-ray Conference • Program-at-a-Glance • Monday – Friday • 5 – 9 August

| | Meeting Rooms | | | |
|---|---|---|---|---|
| | **Standley I** | **Standley II** | **Cotton Creek** | **Meadowbrook** |
| **Monday Morning Workshops 9:00am – 12:00Noon** | | | | |
| Special Topic | Introduction to Machine Learning for X-ray Analysis – Part 1 (**Joress/DeCost/McDannald**) | | | |
| XRD | | Sample Preparation for XRD (**Fawcett**) | Non-ambient XRD (**Misture**) | |
| XRF | | | | Basic XRF (**Drews/Wobrauschek**) |
| **Monday Afternoon Workshops 1:30pm – 4:30pm** | | | | |
| Special Topic | Introduction to Machine Learning for X-ray Analysis – Part 2 (**Joress/DeCost/McDannald**) | Practical Microcomputed Tomography (**Stock**) | | |
| XRD | | | | |
| XRF | | | XRF of Layered Structures (**Wobrauschek**) | Quantitative XRF (**Kawakyu/Seyfarth**) |
| **Monday Evening XRD Poster Session & Reception \| 5:00pm – 7:00pm (Watkins/Cakmak) \| Westminster Foyer** | | | | |
| **Tuesday Morning Workshops 9:00am – 12:00Noon** | | | | |
| Special Topic | Machine Learning and Autonomous for X-ray diffraction: An "Unconference" – Part 1 (**Joress/DeCost/McDannald**) | X-ray Sources and Optics (**Drews**) | | |
| XRD | | | | |
| XRF | | | Sample Preparation for XRF (**Cruz Hernandez**) | Micro XRF (**Tsuji**) |
| **Tuesday Afternoon Workshops 1:30pm – 4:30pm** | | | | |
| Special Topic | Machine Learning and Autonomous for X-ray diffraction: An "Unconference" – Part 2 (**Joress/DeCost/McDannald**) | | | |
| XRD | | Stress Analysis (**Watkins**) | 2D Detectors (**Blanton/He**) | |
| XRF | | | | XRF Trace Analysis (**Wobrauschek**) |
| **Tuesday Evening XRF Poster Session & Reception \| 5:00pm – 7:00pm (Schmeling/Eichert) \| Westminster Foyer** | | | | |
| **Wednesday Morning Plenary Session – Bio-Medical Imaging** Standley I & II, 8:30am – 11:45am (**Misture**) | | | | |
| **Wednesday Afternoon Sessions** | | | | |
| Special Topic | New Developments in XRD & XRF Instrumentation (**Fawcett/Drews**) | | | |
| XRD | | Stress and Texture Analysis (**Watkins**) | Rietveld and PDF Applications (**Stone**) | |
| XRF | | | | Quantitative Analysis of XRF (**Heirwegh**) |
| **Wednesday Evening Vendor Sponsored Reception \| 5:00pm – 7:00pm \| Westminster Ballroom** | | | | |
| **Thursday Morning Sessions** | | | | |
| Special Topic | Mining, Recycling, and Sustainable Materials (**Tsuji**) | | Cultural Heritage (**Schmeling**) | |
| XRD | | General XRD – Part 1 (**Okasinski**) | | |
| XRF | | | Trace Analysis (**Schmeling**) *beginning 10:40am* | Micro XRF and Synchrotron Applications (**Wobrauschek**) |
| **Thursday Afternoon Sessions** | | | | |
| Special Topic | Bio-Medical (**Greenwood**) | | | |
| XRD | | General XRD – Part 2 (**Okasinski**) | Non-ambient Measurements (**Drews**) | |
| XRF | | | | General XRF (**Fittschen**) |
| **Friday Morning Sessions** | | | | |
| Special Topic | Machine Learning Techniques in X-ray Analysis (**Mehta/Cherukara**) | Energy Materials Characterization (**Rodriguez**) | | |
| XRD | | | Industrial Applications of XRD (**Fawcett**) | |
| XRF | | | | Industrial Applications of XRF (**Dutta**) |

**Session times vary. Please consult Program Book.**

**www.DXCICDD.com**