



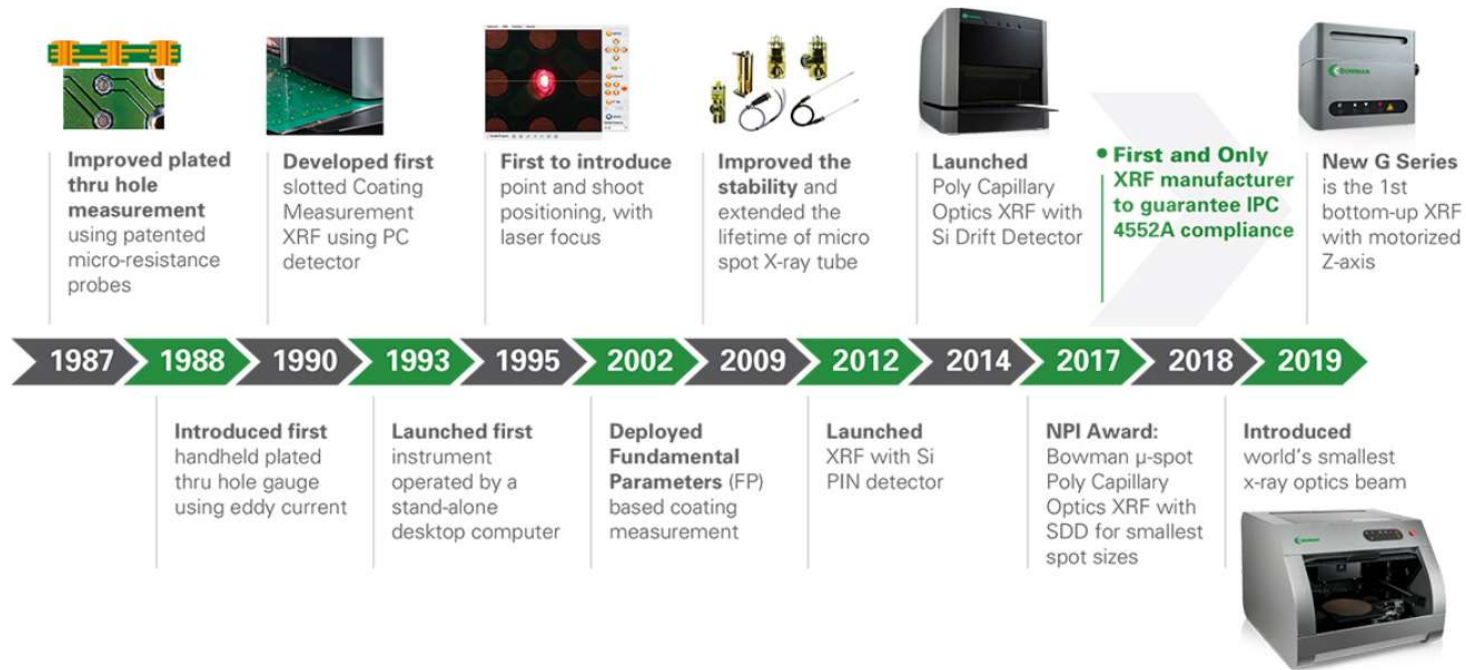
10
YEAR
ANNIVERSARY



Superior Technically.
Supported Locally.

Superior Technically.
Supported Locally.

CMI to Bowman



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BOWMAN Company Info

- Founded in 2009 by **Tom Leone** and **Jun Choi**
- Main office: Schaumburg, Illinois (**Chicago** suburb)
- *All products designed, engineered and manufactured in Schaumburg, **USA***
- *Focus on **XRF** technology*
- Sold more than **1000 units** worldwide since 2013
- Worldwide supporting team, **200+**
- *All key managers and engineers are from **CMI** International (founded in 1985)*

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Comprehensive XRF technology



What's Distinctive:
Unique measurement geometry, entry level price



What's Distinctive:
Exceptional performance in an entry-level XRF



What's Distinctive:
Measures the widest variety of shapes, sizes, quantities



What's Distinctive:
High performance for small samples



What's Distinctive:
The most advanced poly-capillary optics available



What's Distinctive:
Chamber volume 600% larger than other units

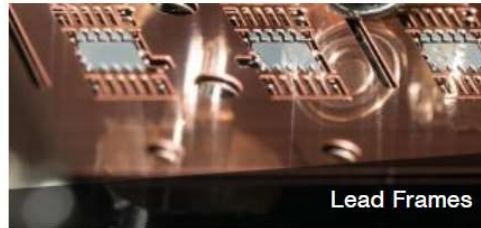
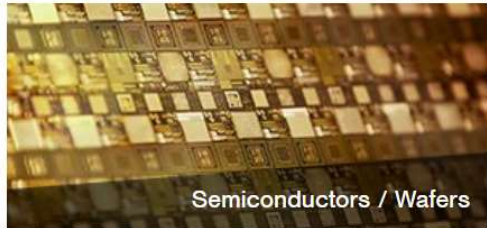
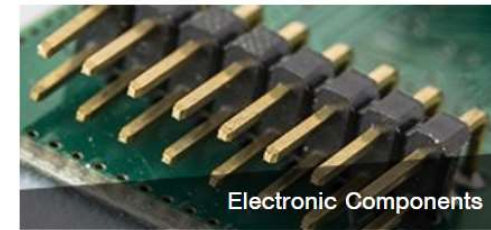
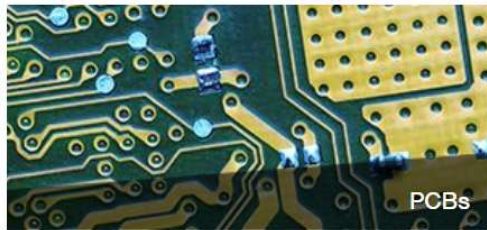


What's Distinctive:
Measures the smallest features in microelectronics

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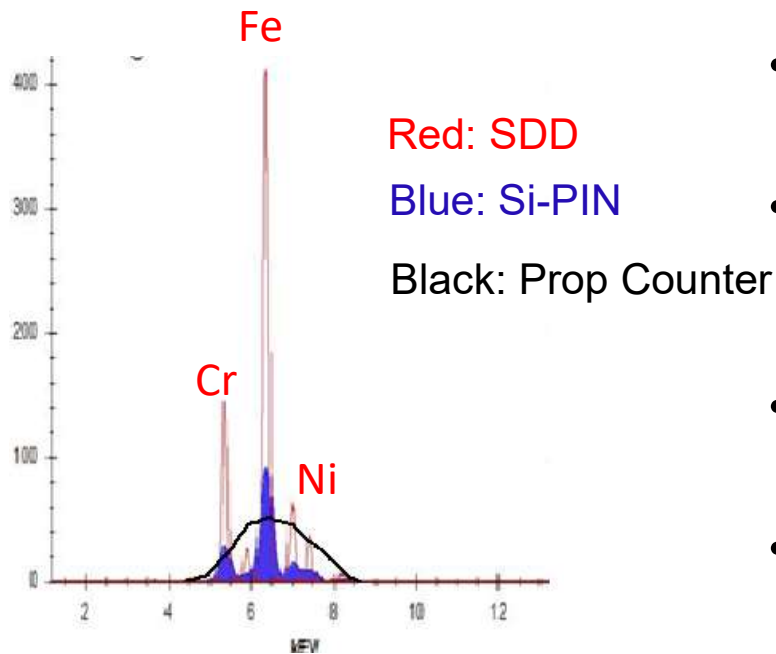


Major Applications



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Advantage of solid state detector



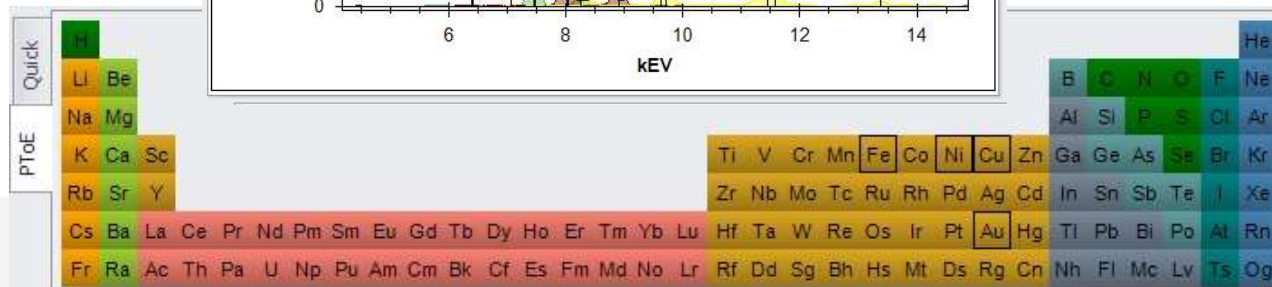
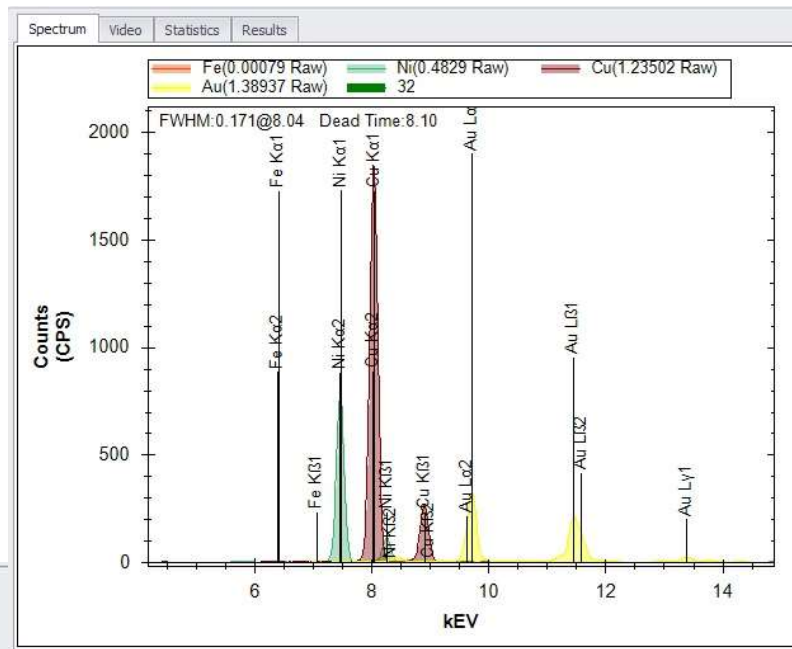
- Improved signal sensitivity for low Z elements
- Improved detection limits down to Angstrom or ppm level
- Separation of overlapping elements
- Improved stability with minimal drift

304 Stainless Steel Spectra from different detectors

Bowman only uses solid state detectors (Si-PIN or SDD)

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Spectrum analysis



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The Bowman Advantage



Intuitive User Interface

It takes advanced design ... to make testing *simple!* Bowman XRF coating measurement systems are powered by leading edge software that combines intuitive, visual controls with time-saving shortcuts, flexible searchability and the industry's only true one-click report generator.

Users have unlimited ability to create new applications and format reports. All readings save to the database, and all user levels are password protected.

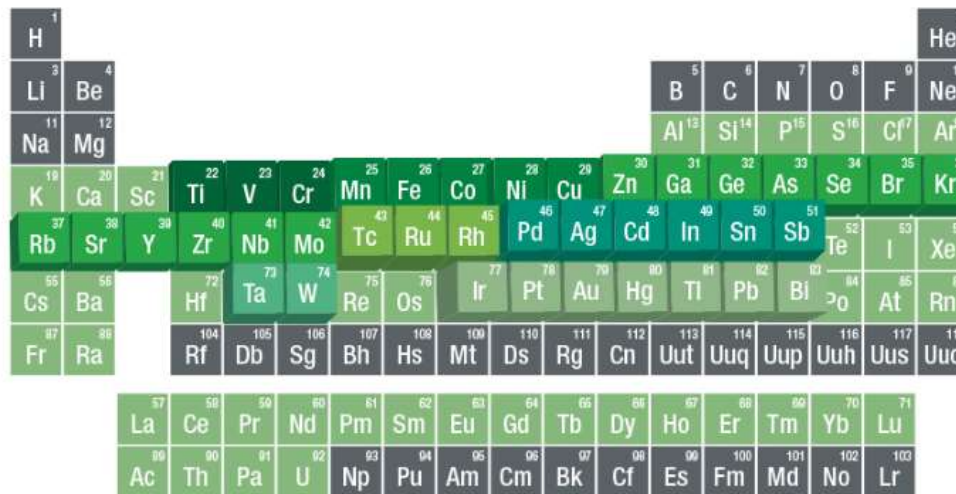
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The Bowman Advantage

Unmatched Coating Thickness Range

Bowman XRF measurement systems have a precision analysis range from Al 13 to U 92.



0.02 to 20 microns	0.01 to 30 microns	0.01 to 40-60 microns	0.01 to 70 microns
0.005 to 110 microns	0.02 to 10 microns	0.005 to 10 microns	ask for details

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B series



- **The B Series** represents the most basic top-down measurement configuration.
- Fixed base plate with slot for ease of manual sample positioning
- High resolution Silicon Drift Detector
- 20x micro viewing camera with 6x digital zoom
- Optional multi-collimators and variable focal depth
- Guaranteed to meet IPC-4552A, 4553A, 4554 and 4556
- ASTM B568, DIN 50987 and ISO 3497

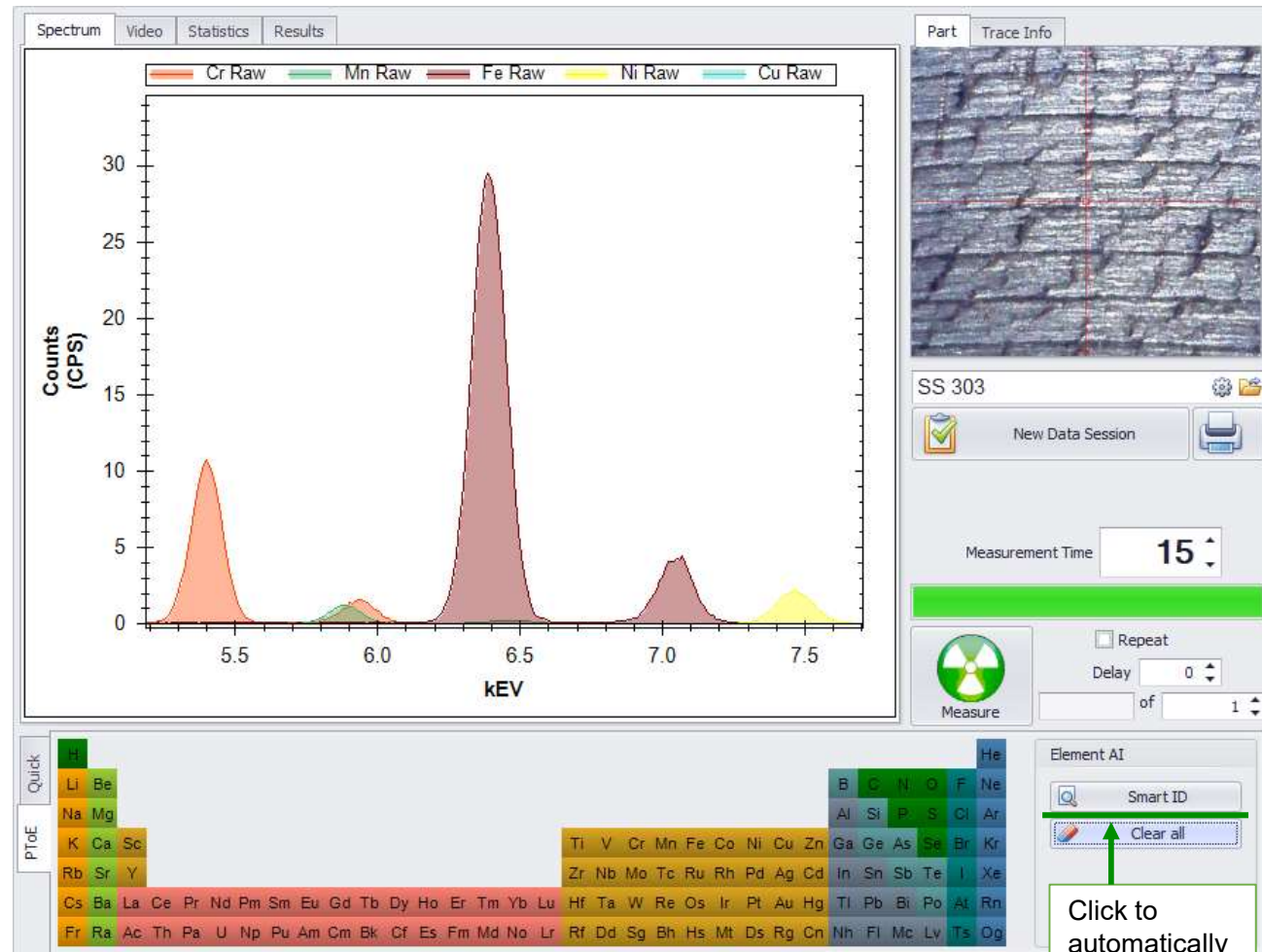


Smart ID

- Automatically identify unknown elements
- Selectively identify individual elements

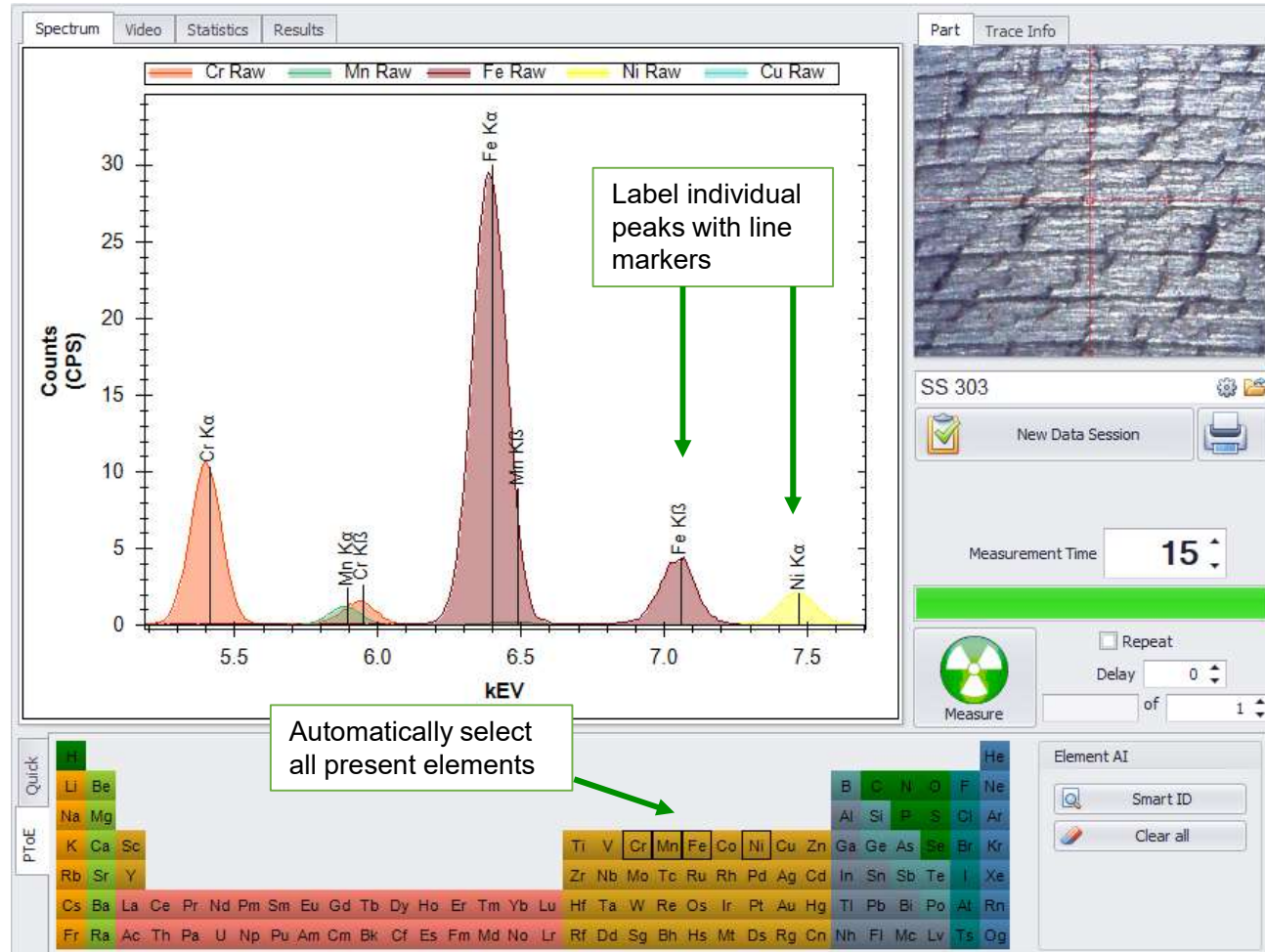
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Automatically identify unknown elements based on peak position



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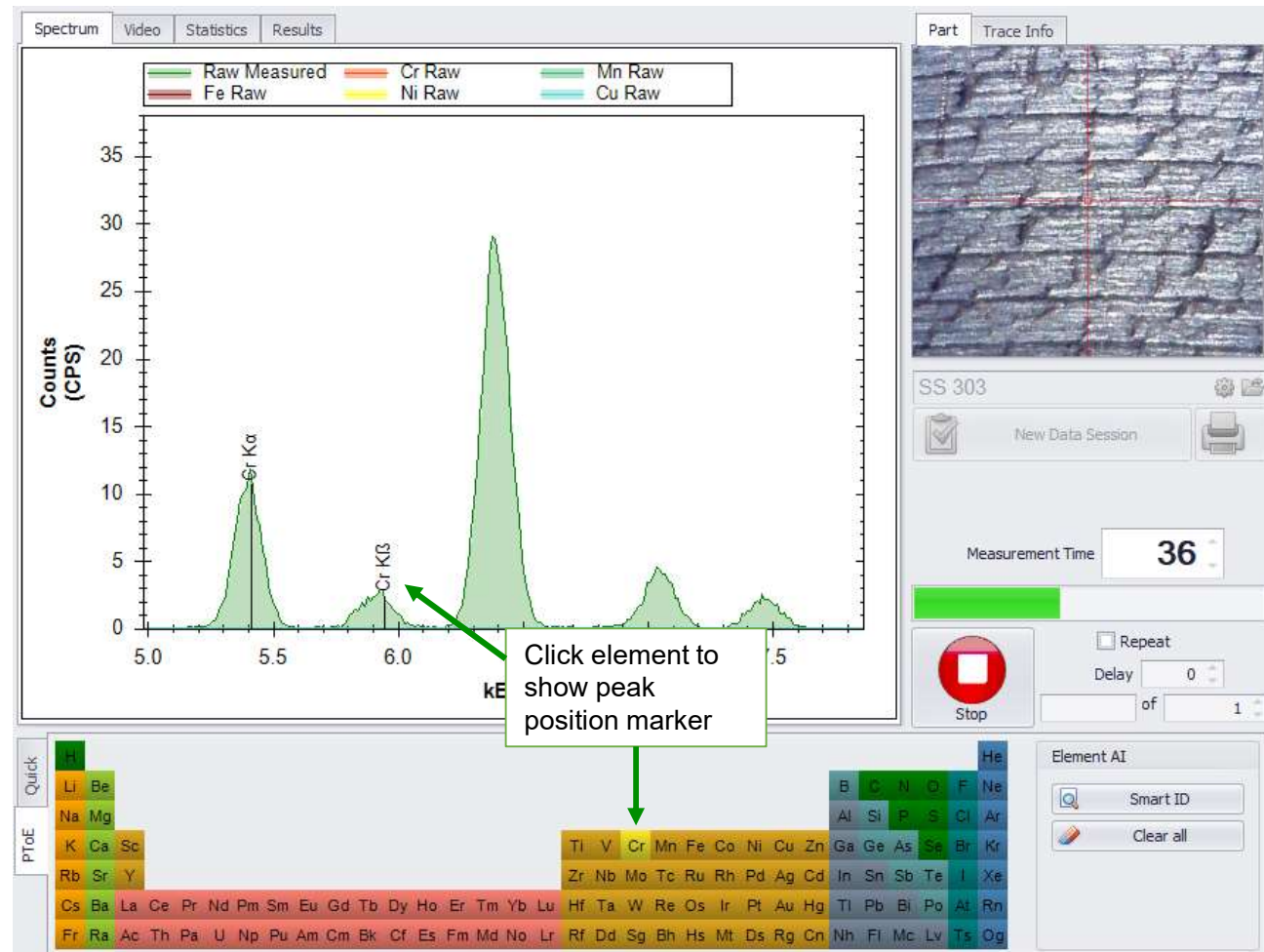
Automatically identify unknown elements based on peak position



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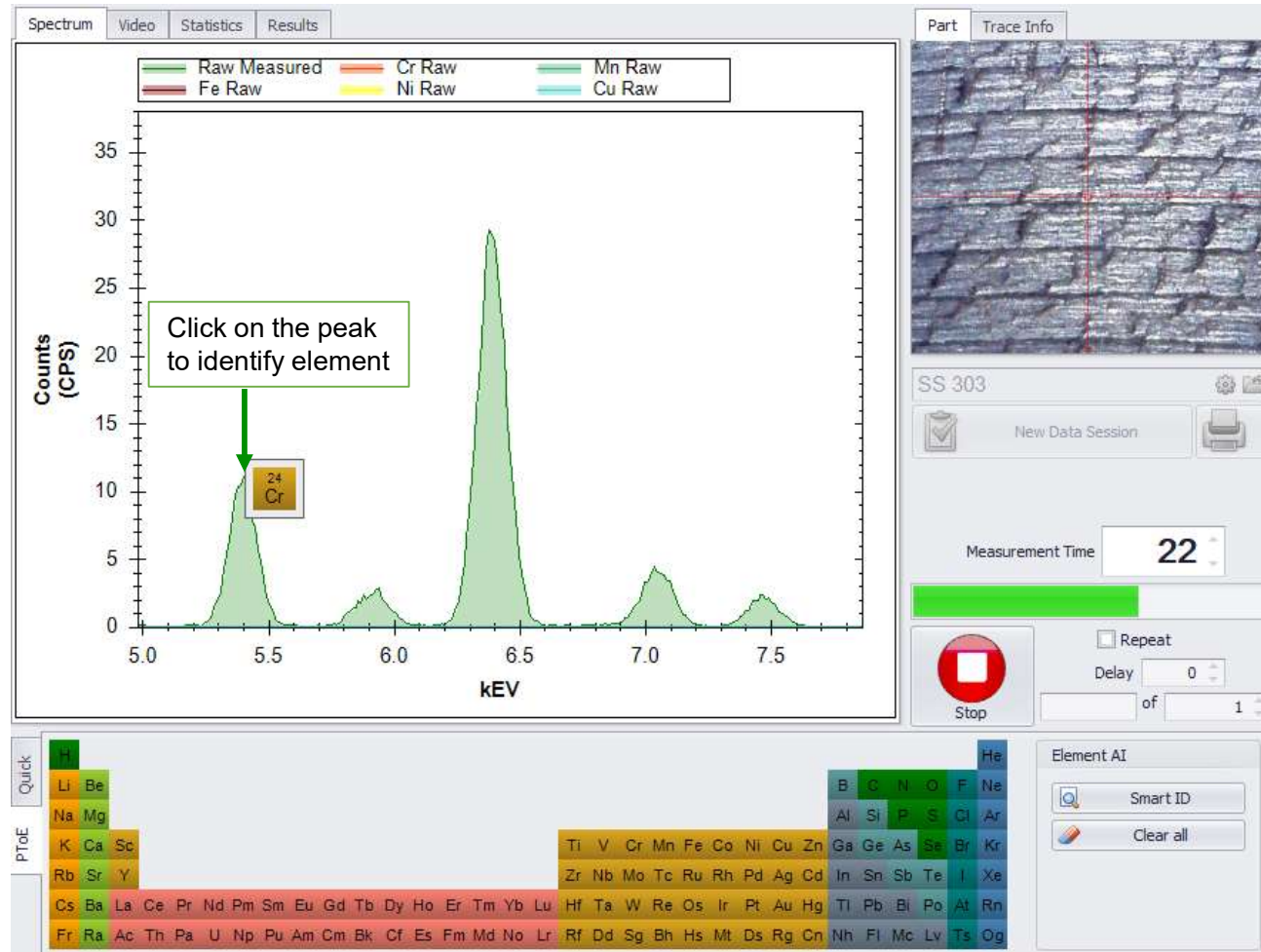
Manually identify individual elements by

- Clicking on the element from the periodic table
- Hovering over elements will pull up temporary peak markers



Manually identify individual elements by

- Clicking the peak on graph





Materials Analysis(Spectrum Matching)

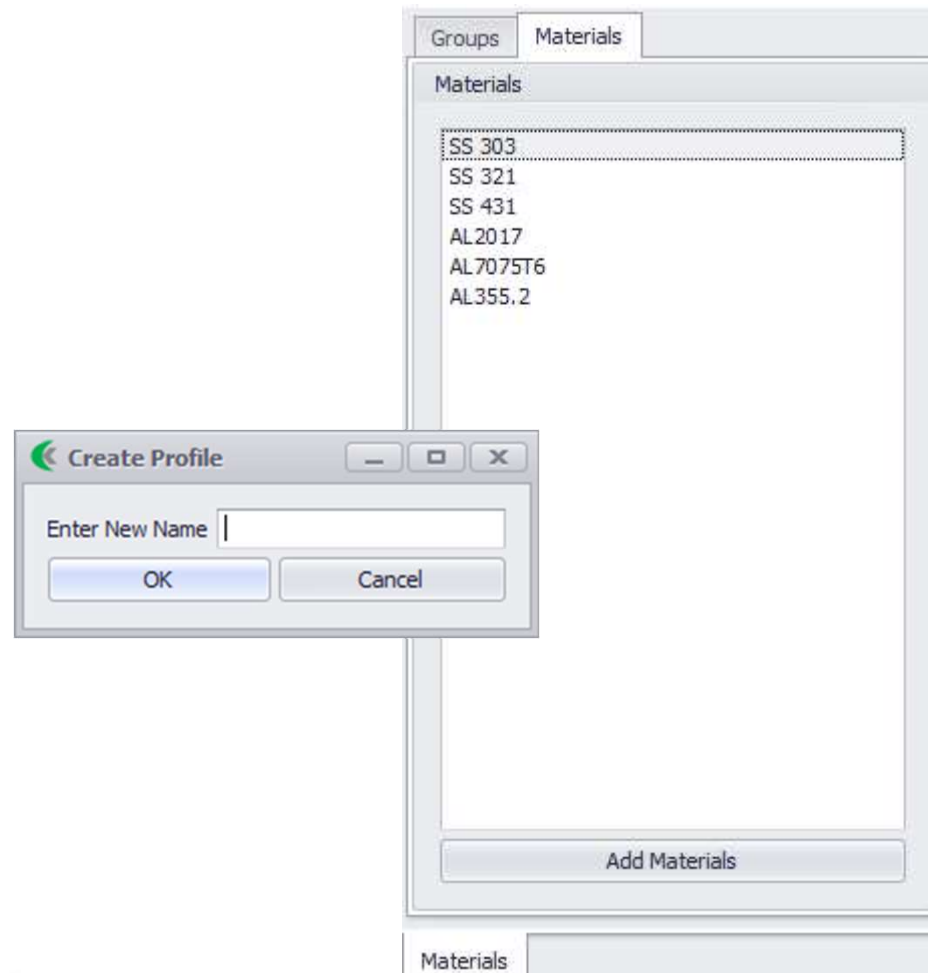
- Identify unknown material using spectrum library
 - Collect spectrum of known alloys
 - Fit unknown spectrum to library
 - Automatically call and analyze material in linked application



Materials Analysis

Materials Tab

- Add alloys

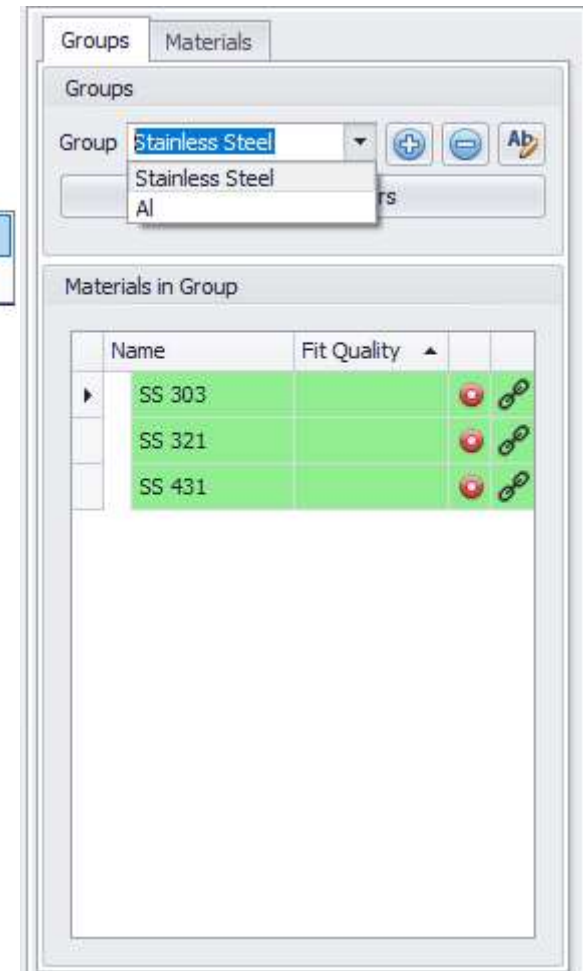
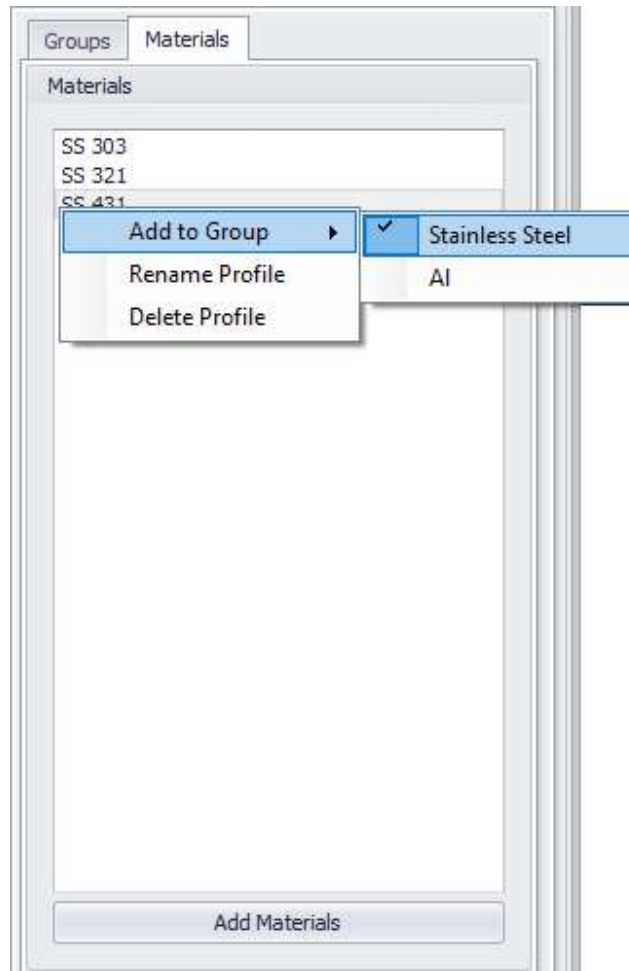


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Materials Analysis

Materials Tab

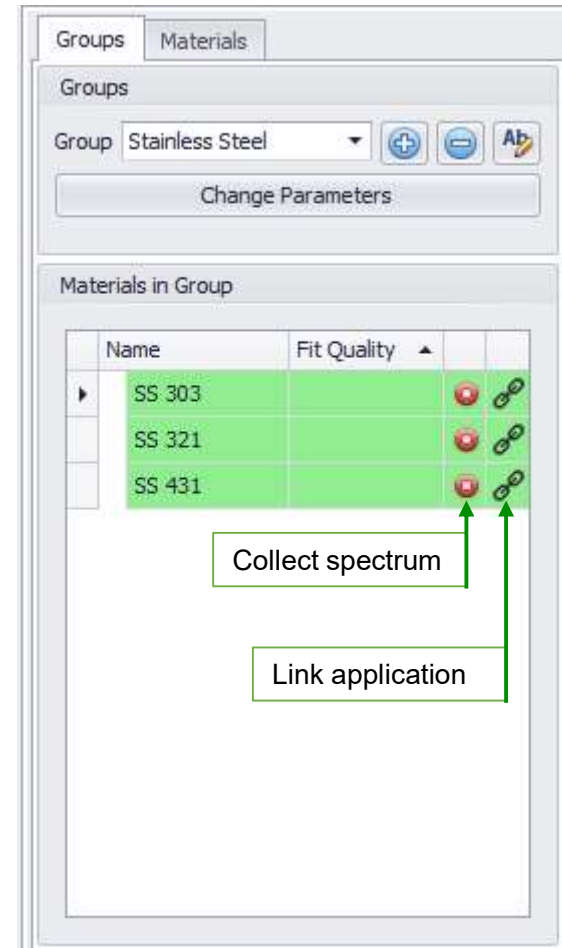
- Create and sort into groups



Materials Analysis

Materials Tab

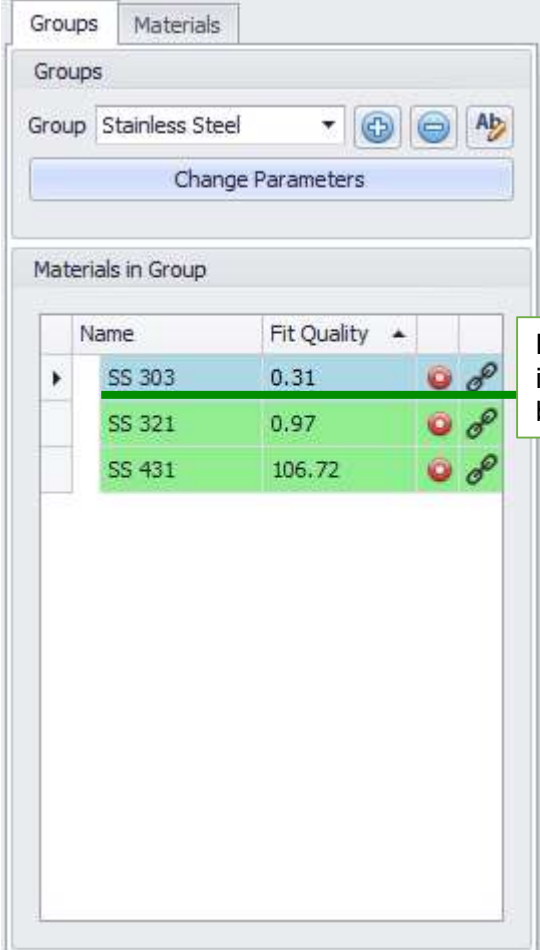
- Collect spectrum
- Link materials to application









Materials Analysis

Groups Tab

- Measure unknown material
- Software fits unknown to materials library
- Smaller the value, the better the fit



The screenshot shows the 'Materials' tab in the software. The 'Group' is set to 'Stainless Steel'. Below the group name is a 'Change Parameters' button. The 'Materials in Group' section contains a table with the following data:

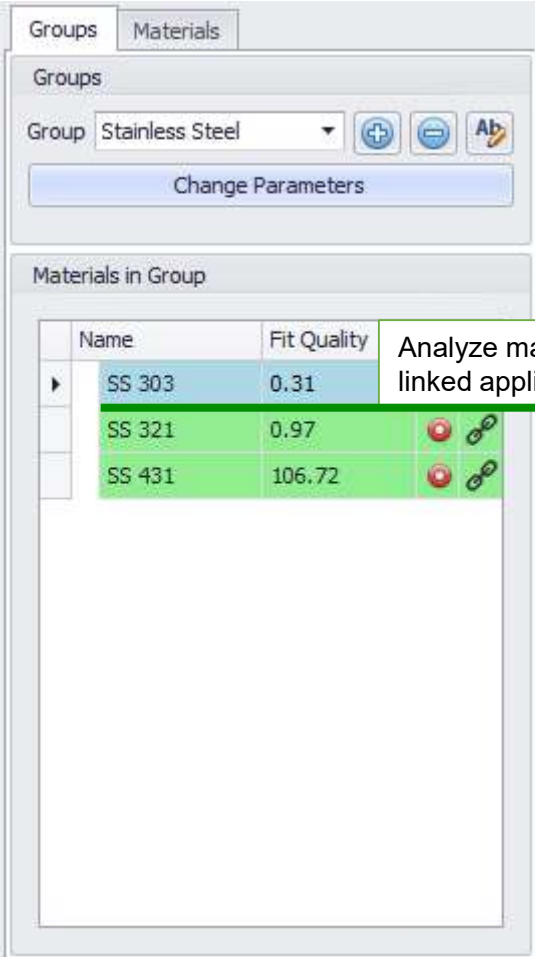
Name	Fit Quality		
SS 303	0.31		
SS 321	0.97		
SS 431	106.72		

A callout box points to the first row (SS 303) with the text: "Best fit material is highlighted in blue".

Materials Analysis

Groups Tab

- Double click on the best fit to analyze material





Groups Materials

Groups

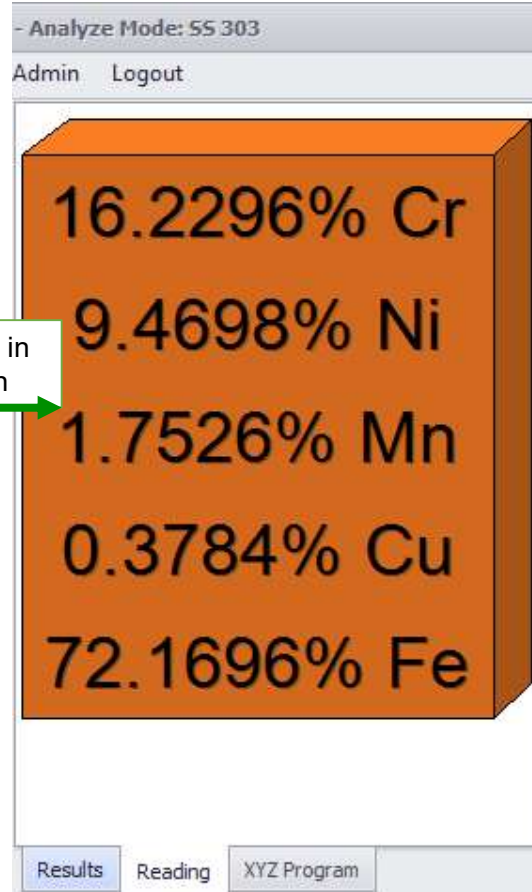
Group Stainless Steel

Change Parameters

Materials in Group

Name	Fit Quality	
SS 303	0.31	
SS 321	0.97	
SS 431	106.72	

Analyze material in linked application



Analyze Mode: 55 303

Admin Logout

16.2296% Cr

9.4698% Ni

1.7526% Mn

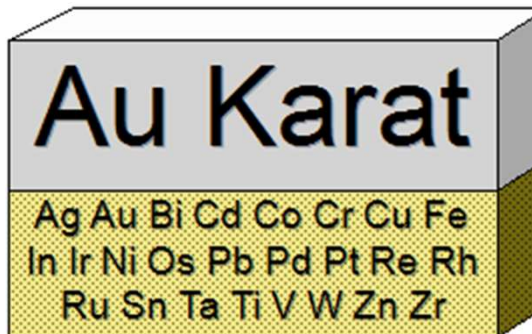
0.3784% Cu

72.1696% Fe

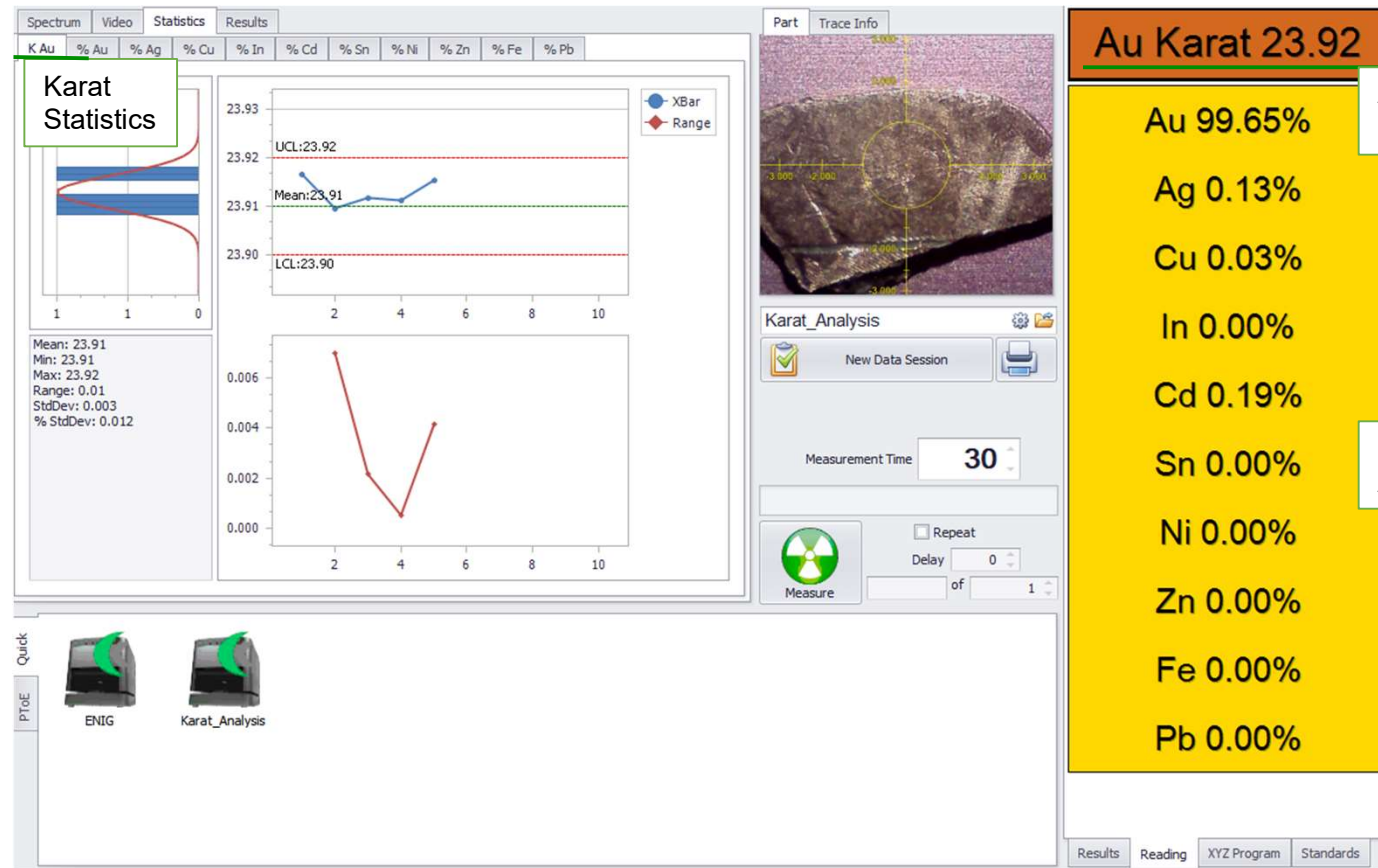
Results Reading XYZ Program

Karat Analysis

- Automatic Karat computation
- Up to 25 element analysis
- Optional displays



Karat Analysis



Karat Analysis

Display options

Karat Analysis Options

Display gold karat

Display full element names

Hide undetected elements

Au Karat 23.92

Au 99.65%

Ag 0.13%

Cu 0.03%

In 0.00%

Cd 0.19%

Sn 0.00%

Ni 0.00%

Zn 0.00%

Fe 0.00%

Pb 0.00%

Karat Analysis Options

Display gold karat

Display full element names

Hide undetected elements

Gold Karat 23.92

Gold 99.65%

Silver 0.13%

Copper 0.03%

Indium 0.00%

Cadmium 0.19%

Tin 0.00%

Nickel 0.00%

Zinc 0.00%

Iron 0.00%

Lead 0.00%

Karat Analysis Options

Display gold karat

Display full element names

Hide undetected elements

Gold Karat 23.92

Gold 99.65%

Silver 0.13%

Copper 0.03%

Cadmium 0.19%

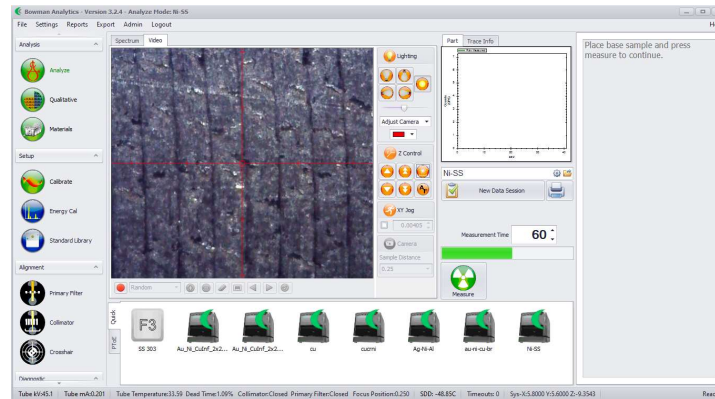
Post Analytical Script

- Apply corrections to software calculated results:
 - Normalization the composition of selective elements
 - Slope correction
 - Offsets
 - Inhibit elements, etc
- Software will display post-script corrected values

Pre-script Values		Post-script Values
Au Karat 23.92		Au Karat 23.91
Au 99.65%		Au 99.61%
Ag 0.13%	0.5*slope	Ag 0.06%
Cu 0.03%		Cu 0.33%
In 0.00%		In 0.00%
Cd 0.19%	Offset: -0.19	Cd 0.00%
Sn 0.00%		Sn 0.00%
Ni 0.00%		Ni 0.00%
Zn 0.00%		Zn 0.00%
Fe 0.00%		Fe 0.00%
Pb 0.00%		Pb 0.00%

Base Correction

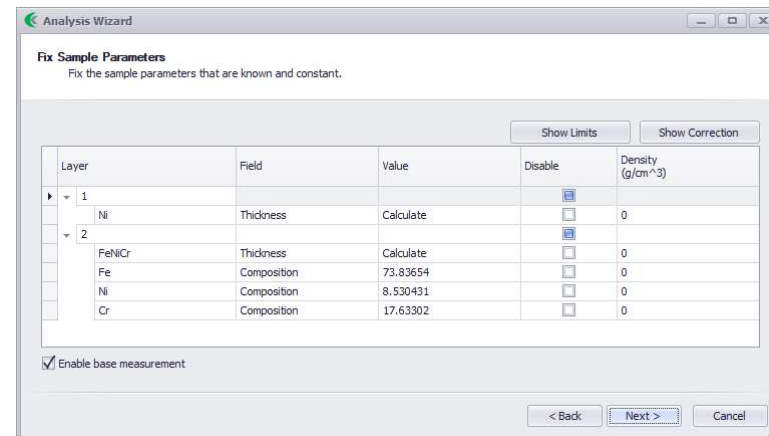
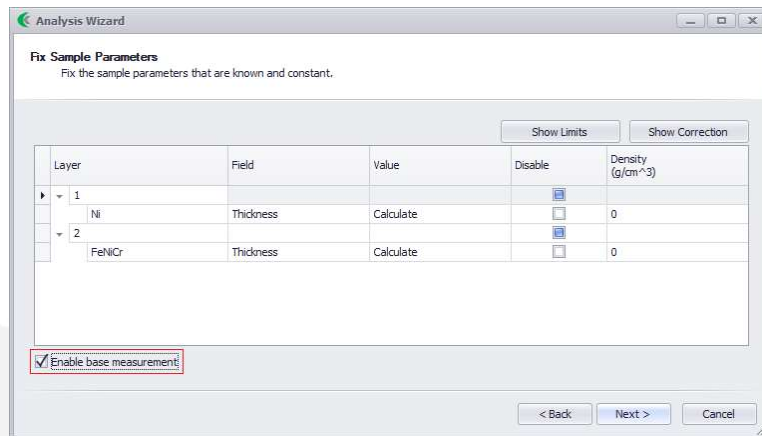
Enable Base correction



Measure Sample Base Material



Composition Values calculate automatically





Reference standards

Bowman's *"the standard"*
in **XRF Standards!**



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ISO 17025:2017 Accreditation & Scope



CERTIFICATE OF ACCREDITATION

ANSI National Accreditation Board
11617 Coldwater Road, Fort Wayne, IN 46845 USA

This is to certify that

Bowman Analytics, Inc.
1125 Remington Road
Schaumburg, IL 60173

has been assessed by ANAB and meets the requirements of international standard

ISO/IEC 17025:2017


and national standard

ANSI/NCSL Z540-1-1994 (R2002)

while demonstrating technical competence in the field of

CALIBRATION

Refer to the accompanying Scope of Accreditation for information regarding the types of activities to which this accreditation applies

L2213
Certificate Number

ANAB Approval
Certificate Valid Through: 11/21/2020
Version No. 003 Issued: 12/12/2019



This laboratory is accredited in accordance with the recognized International Standard ISO/IEC 17025:2017. This accreditation demonstrates technical competence for a defined scope and the operation of a laboratory quality management system (refer to joint ISO-ILAC-IAF Communiqué dated April 2017).



ANSI National Accreditation Board

**SCOPE OF ACCREDITATION TO ISO/IEC 17025:2017 AND
ANSI/NCSL Z540-1-1994 (R2002)**

Bowman Analytics, Inc.
1125 Remington Road
Schaumburg, IL 60173
Ron Wochinski
847-781-3523

CALIBRATION

Valid to: November 21, 2020

Certificate Number: L2213

Length – Dimensional Metrology

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Coating Thickness Measuring Equipment and Coating Thickness Standards	(0.1 to 3 000) µin	3.5% of reading	ASTM B568 (X-Ray)
	(100 to 2 000) µin	4.9% for Eddy Current	ASTM E376 (Eddy Current)
	(100 to 60 000) µin	6.2% for Magnetic Induction	ASTM B499 (Magnetic Induction)

Mass and Mass Related

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-) ²	Reference Standard, Method, and/or Equipment
Composition – NiP	(1 to 99) wt%	0.62 %	ASTM B568 (X-Ray)
Composition – Alloy	(1 to 99) wt%	1.68 %	

Calibration and Measurement Capability (CMC) is expressed in terms of the measurement parameter, measurement range, expanded uncertainty of measurement and reference standard, method, and/or equipment. The expanded uncertainty of measurement is expressed as the standard uncertainty of the measurement multiplied by a coverage factor of 2 (k=2), corresponding to a confidence level of approximately 95%.

Notes:

1. On-site calibration service is available for this parameter, since on-site conditions are typically more variable than those in the laboratory, larger measurement uncertainties are expected on-site than what is reported on the accredited scope.
2. Weight per centage applied unless otherwise indicated.
3. This scope is formatted as part of a single document including Certificate of Accreditation No. L2213.


Vice President

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New Bowman Standards

- New standard model allows stacking multiple standards flat and evenly for custom applications.
- Total thickness: 8mil
- Shorter lead time: 2-3 weeks for most standards.



Bowman Infinite Card

- Will include 15 elements in a compact design for quick spectrum reference.
- 2mm total thickness, 2" x 3" (H x L)
- Low profile design to be used in both collimated and optics systems.
- Al, Ti, Cr, Fe, Ni, Cu, Zn, W, Mo, Pd, Ag, Cd, Sn, An, Pb
- Upcoming software version will allow the user to collect reference element checkpoints and extrapolate the INFs in between.





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What are X-rays

- X-rays are a type of radiation called electromagnetic waves.
- Invisible lights have a wavelength ranging from 0.03 to 3 nanometers.

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The Electromagnetic Spectrum

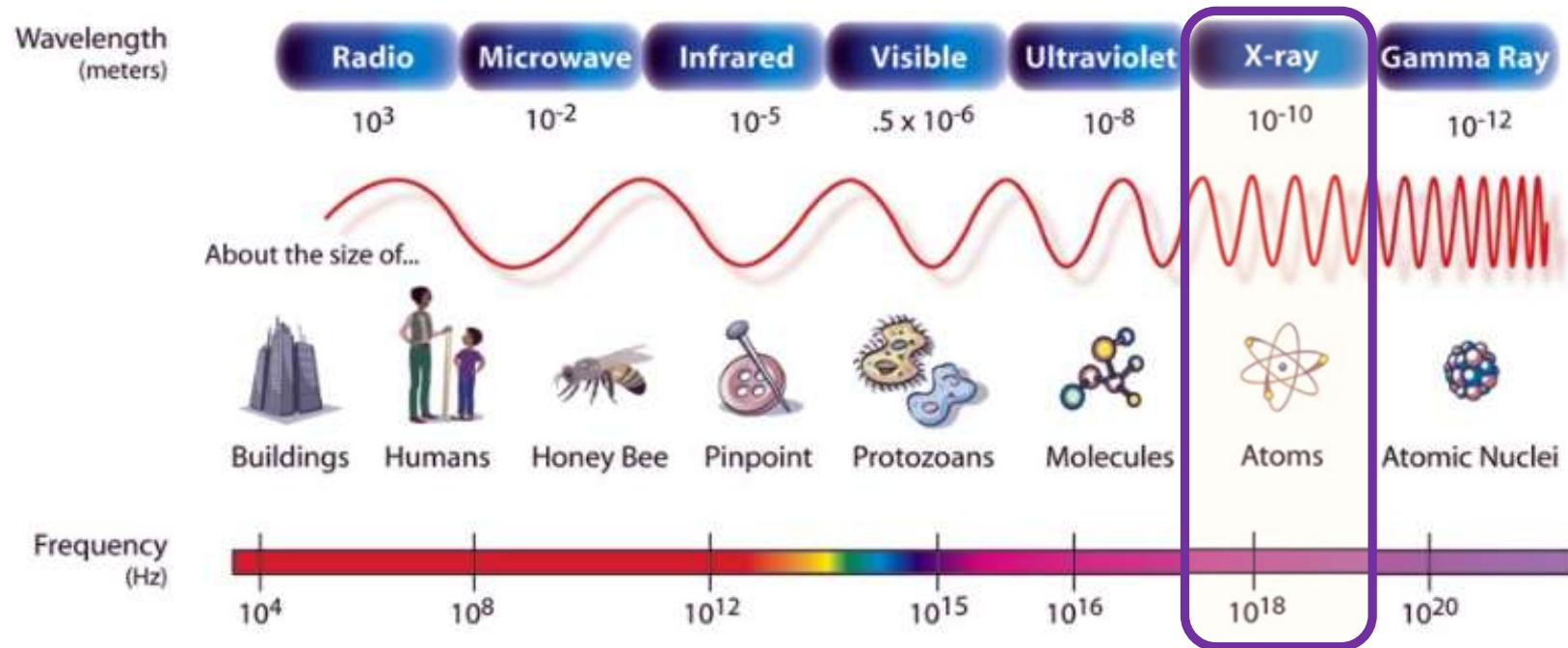
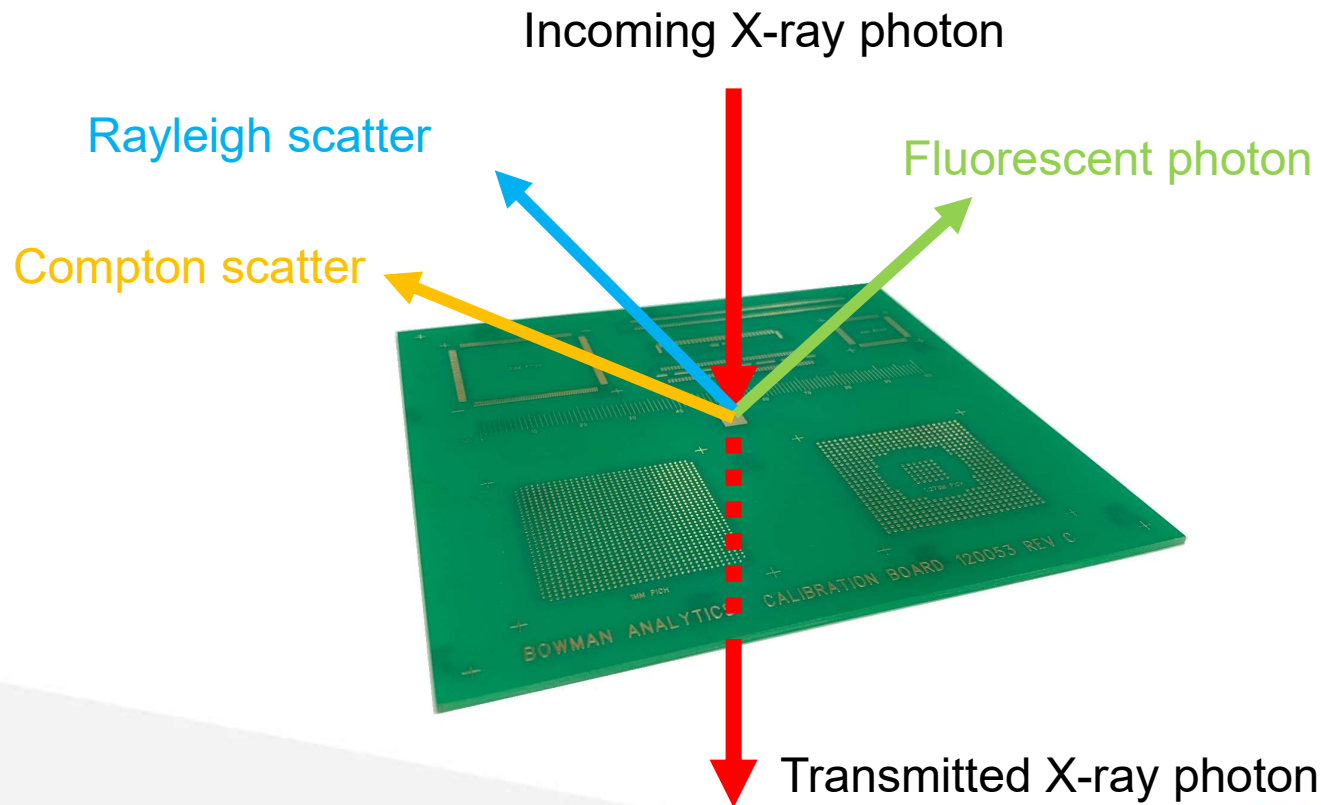
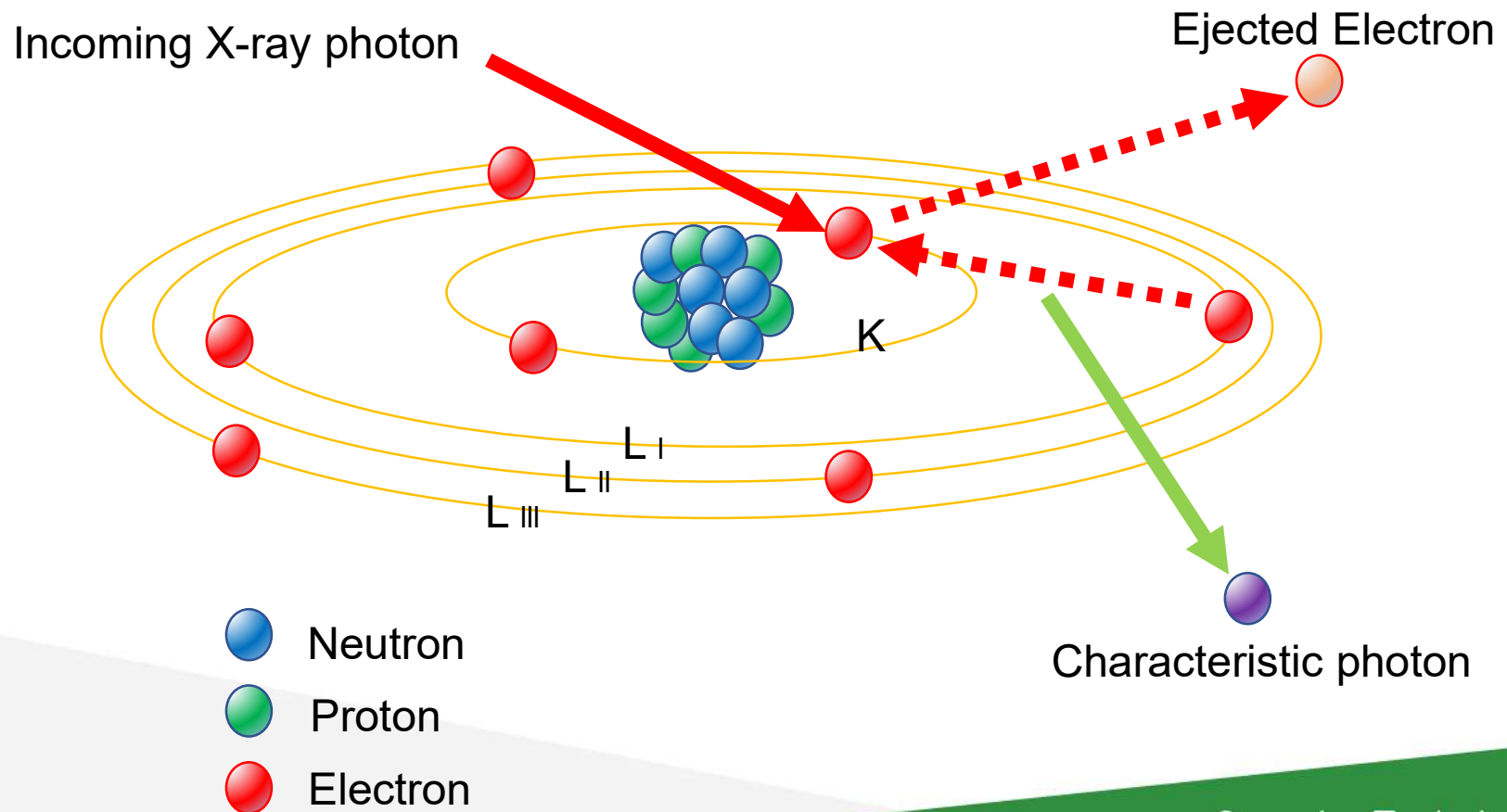


Image is from Pinterest.com

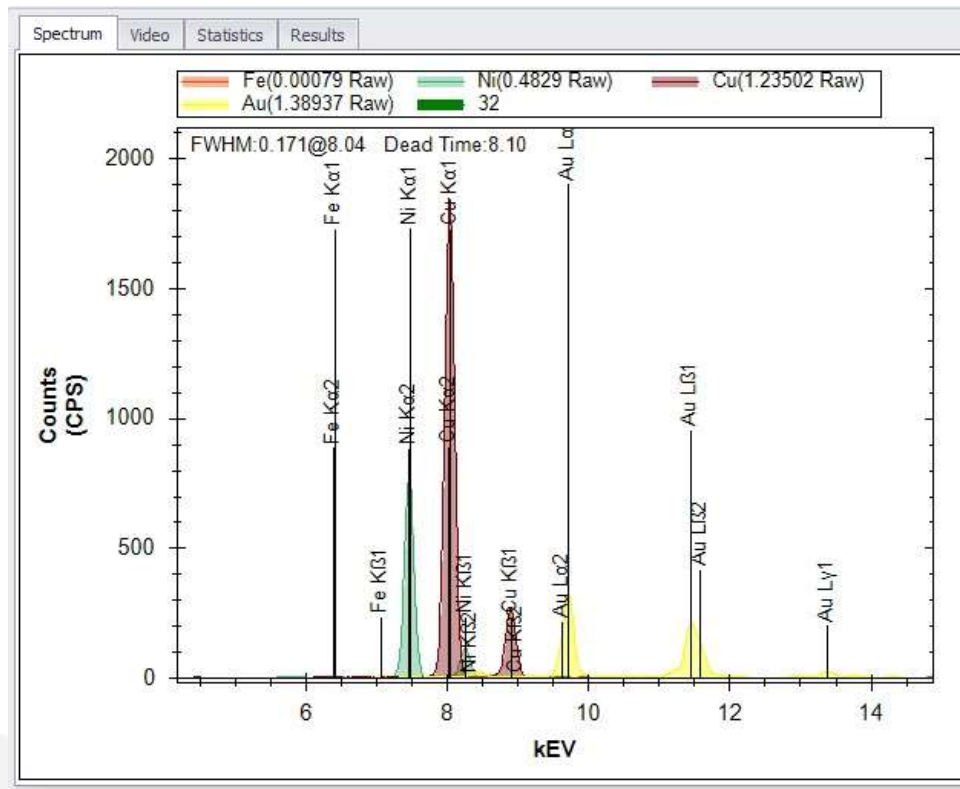
Three main interactions of X-rays with matter



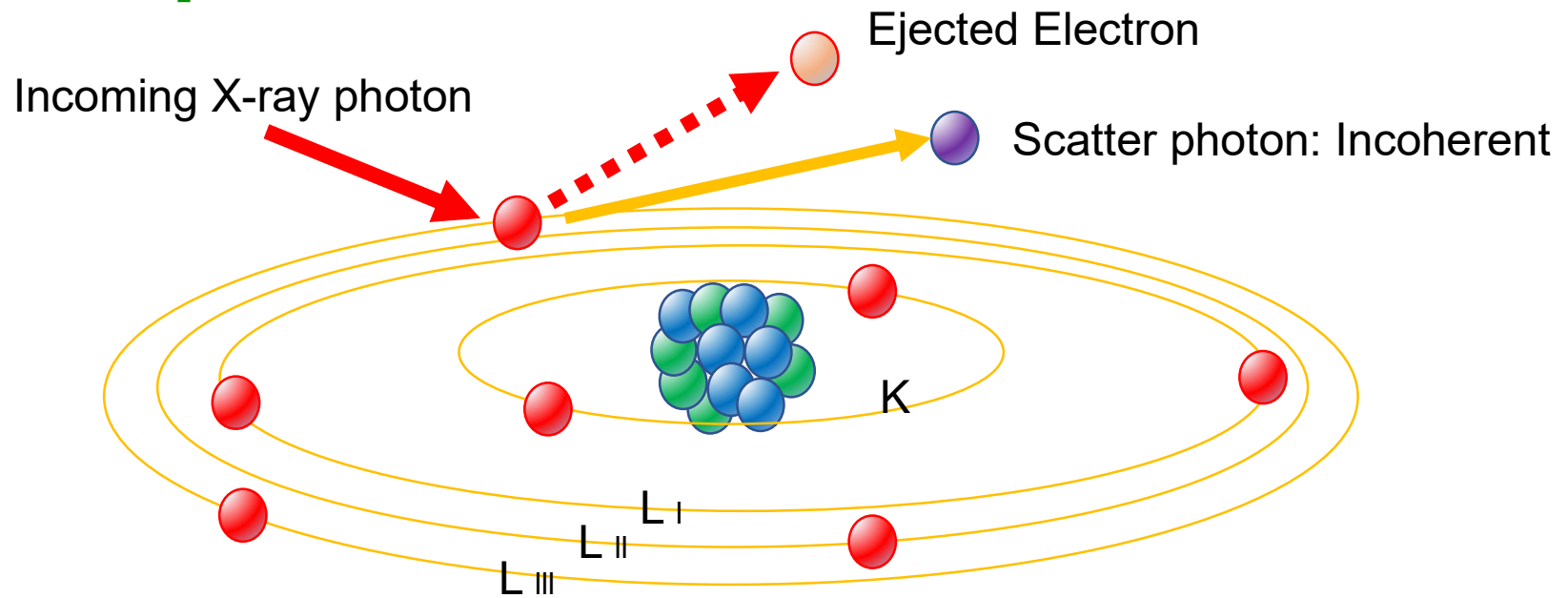
Characteristic fluorescent radiation






Sample spectrum

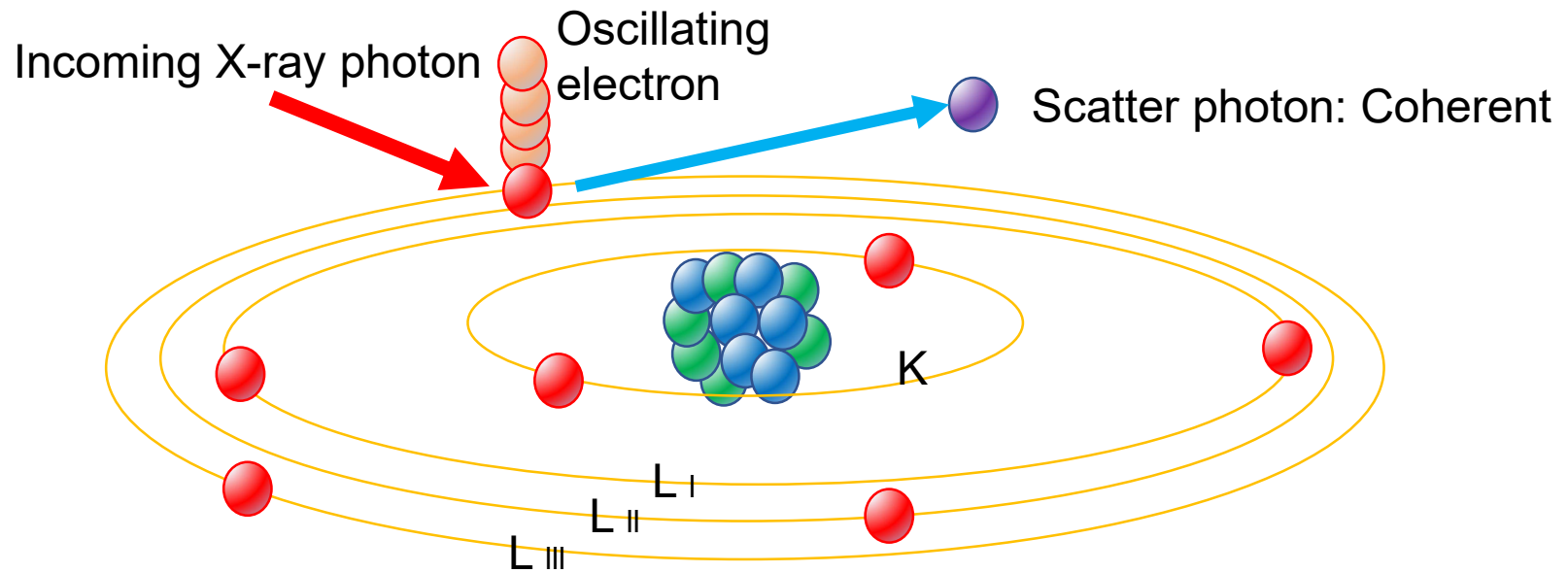





Compton scatter



-  Neutron
-  Proton
-  Electron

Rayleigh scatter



-  Neutron
-  Proton
-  Electron

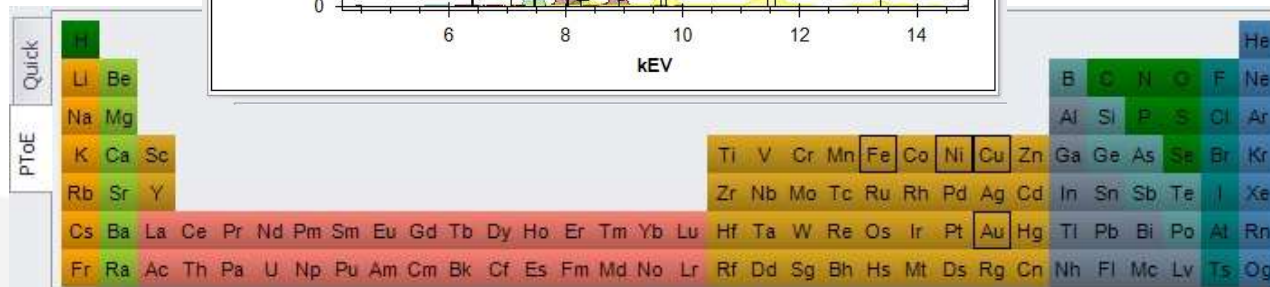
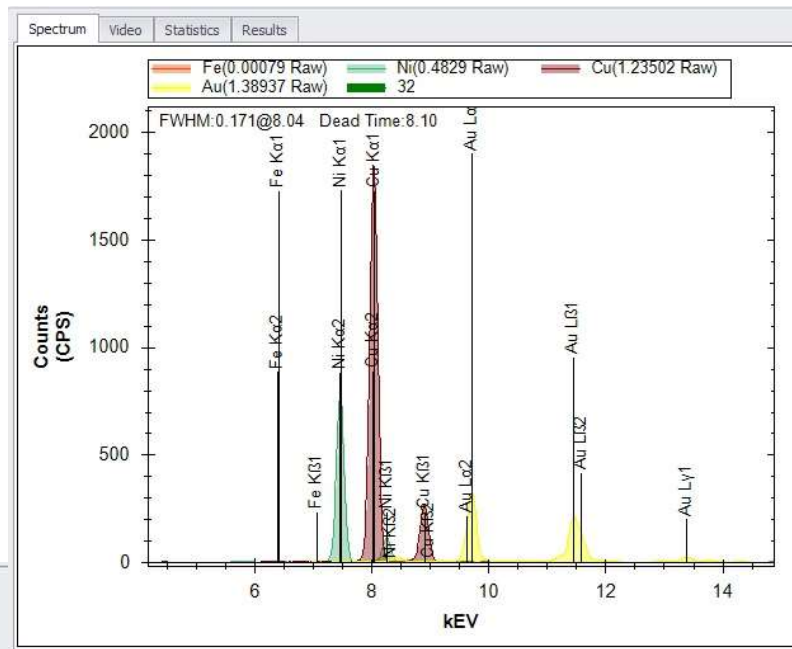


Key components

- X-ray Tube
- Primary Filters and Shutter
- Collimators
- Camera
- Detector and Digital Pulse Processor
- PC

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Spectrum analysis



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