**Advanced MicroBeam**

***Electron Microprobe Analysis*** **is a nondestructive analytical method which produces a finely focused electron beam that can be moved around the analyte and measures the chemical compositions of solid samples. The electron beam can be focused from a large diameter down to one micron and smaller. The electron beam penetrates the sample from .3 to 3 microns and analyzes an area of about 1 cubic micron. Characteristic elemental x-rays are emitted from the sample and diffracted to a detector using curved crystal Wavelength Dispersive Spectrometers. In addition, the electron beam can be scanned to acquire microscopic electron images and elemental x-ray maps. Applications: Quantitative analysis of coatings, weld zones, super alloys, fuel cells, steels, rare earths and other critical analyses.**

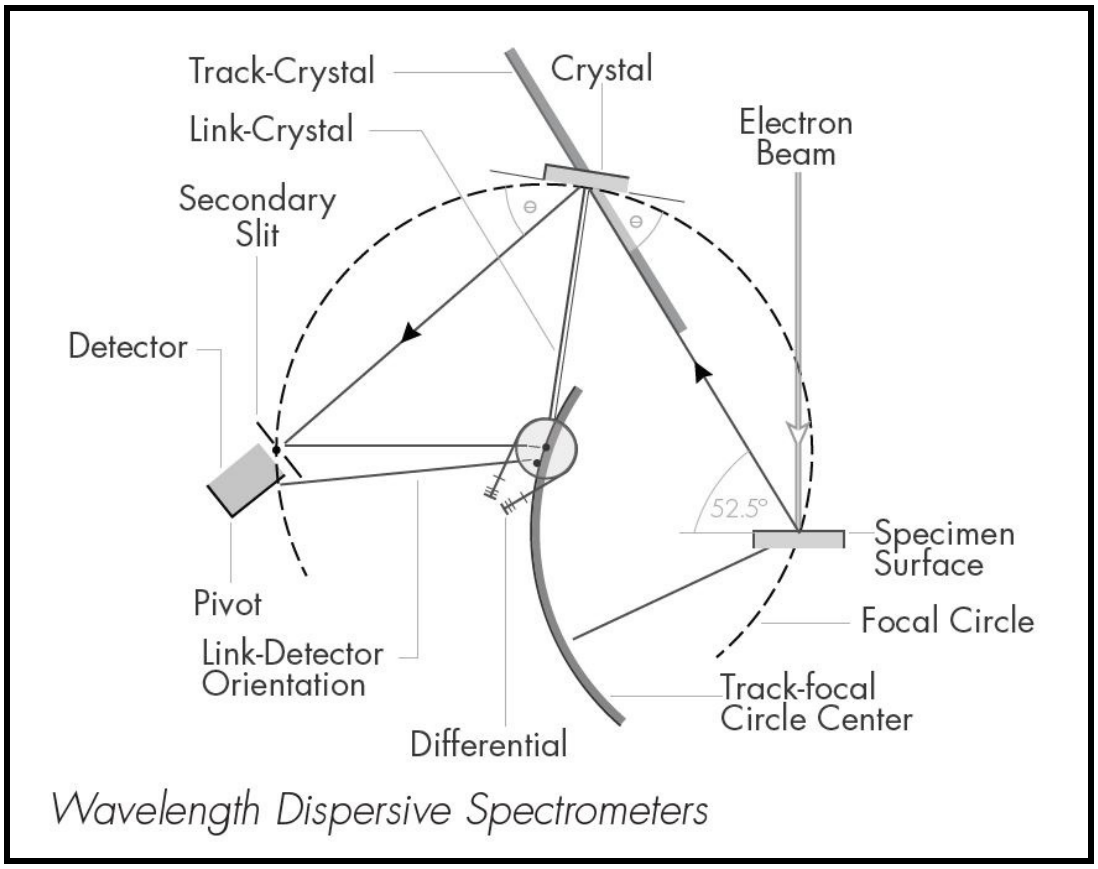



***Figure 1: Electron Beam, Sample, Crystal and Detector***

## *Advantages of Wavelength Dispersive Spectrometers*

- **Better Detection Limits than Energy Dispersive Spectrometer**
- **Better Energy Resolution than Energy Dispersive Spectrometer**
- **Better Elemental Identification than Energy Dispersive Spectrometer**
- **Improved Analytical Efficiency with patented Solid-State Detectors for WD Spectrometers**
- **Xenon Gas Detectors: Better detection efficiency for metals**
- **No primary slit window to absorb valuable characteristic x-rays. Windows are on detectors only.**

## *Solid-State Detectors for Wavelength Dispersive Spectrometers*

**In the past, Electron Microprobe Analysis was slow, expensive, and did not compete well with SEM/ EDS systems when considering analytical throughput and end-user pricing. This was due to the use of gas proportional counters that can be saturated at low operating currents. To compensate for this, we have equipped our wavelength dispersive spectrometer with a solid-state detector counting system and have achieved a major improvement in analytical efficiency.**

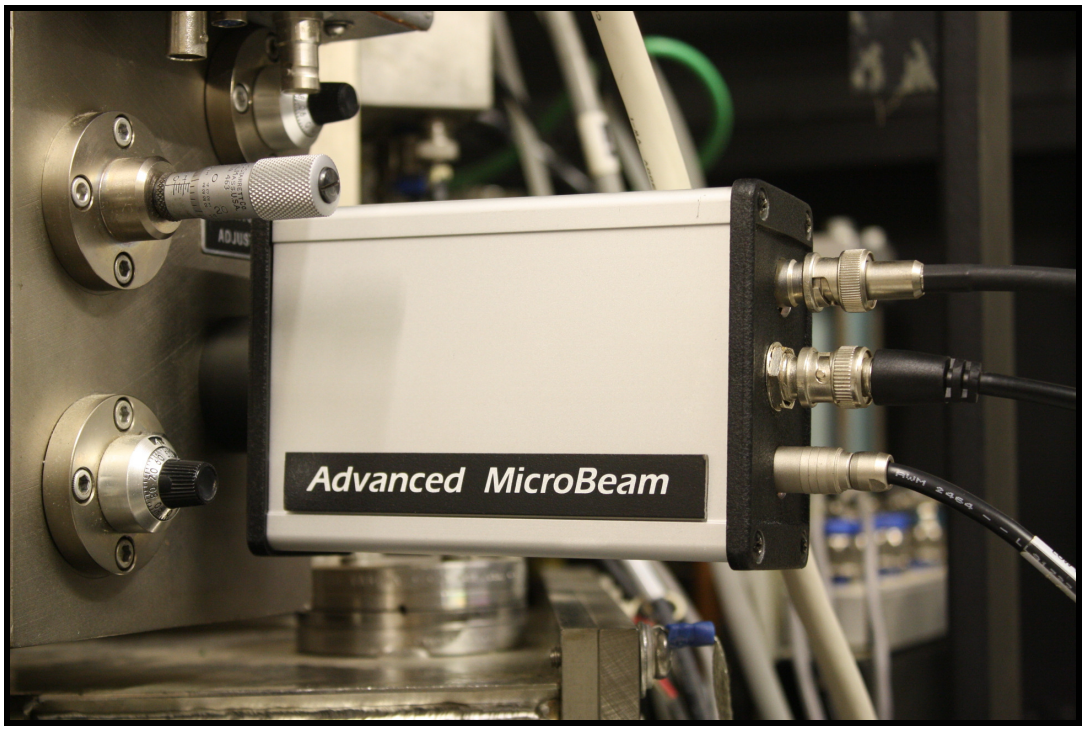



*Figure 2: Solid-State Detector Amplifier on Wavelength Dispersive Spectrometer. Capable of 10 Million Counts/ Second*

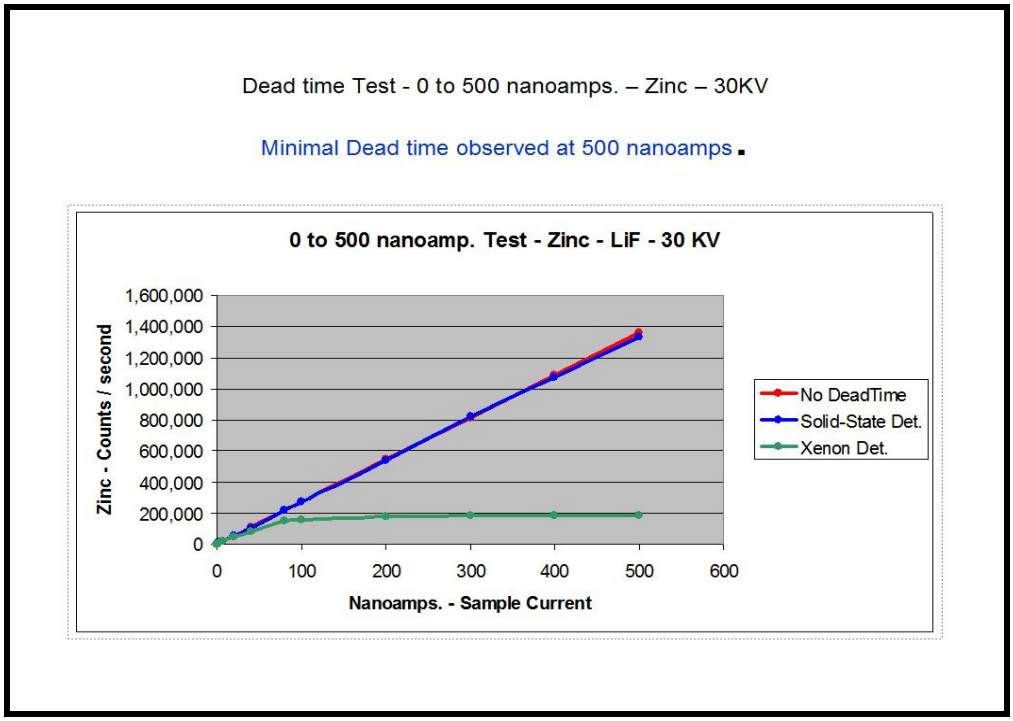



*Figure 3: Minimal Dead Time from 0 to 500 Microamps. of Sample Current*

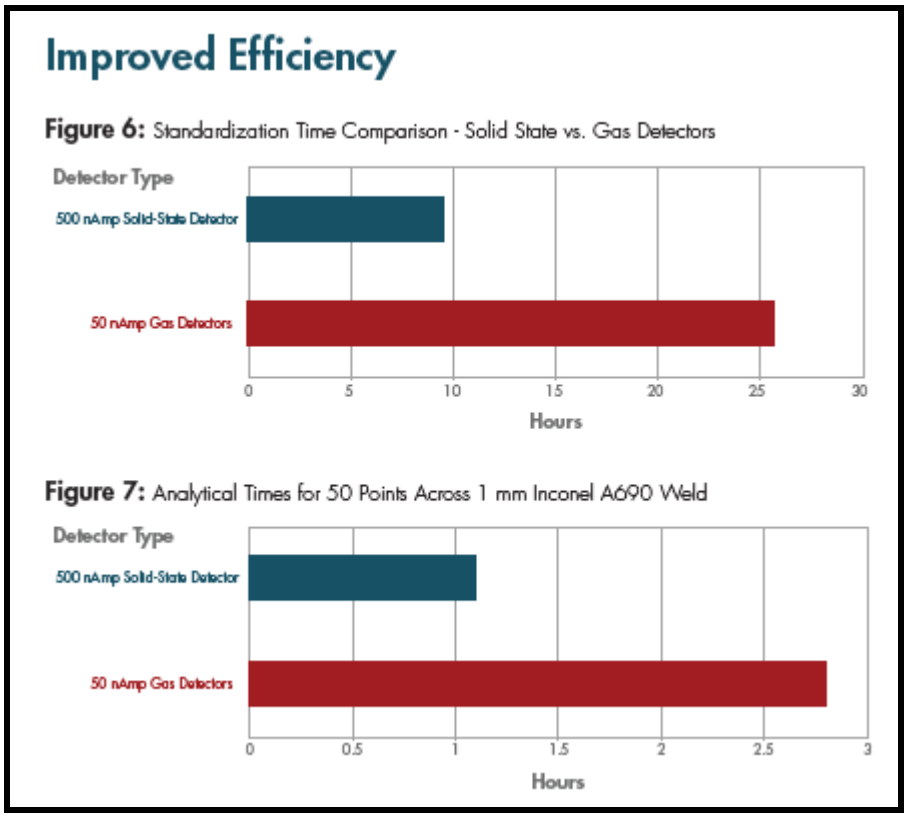



***Figure 4: Efficiency Test with One Solid State WD Detector***

## *Instrument Specifications:*

**Gun Voltage: 1 to 50 KV**
**Elements Detected: Be to U**
**Wavelength Dispersive Spectrometers: 5**
**Roland Circle Radius: 127 mm**
**Energy Dispersive Spectrometer: 1**
**WD Detection Limit Range: WDS: 10 PPM to 300 PPM**
**Digital Electron Imaging and X-Ray Mapping**
**X-Ray Takeoff Angle: $52.5^0$**
**Working Distance for Quantitative Analysis and Mapping: 6.35 mm**
**Working Distance for Imaging: 6.35 mm to 185 mm**
**Beam Current Stability (24 Hours): +- .5%**
**Cryogenic Anti-contamination Device: LN Cooled Sample Cold Plate**
**Spectrometer Speed ( Lower Limit to Upper Limit ): 22 Seconds**
**Light Microscope Type: Cassegrain – Coaxial to Electron Beam**
**Light Microscope Magnification: 12X ; 300X ; Coaxial ; 0 Degrees**
**Sample Viewing Choices: Video Camera or Direct Eye Pieces**
**Depth of Focus: 3 Microns**
**Field of View @ 300X: 700 Microns**
**Resolution: 1 Micron**
**Total Number of Final Apertures: 6**

***Sample Holders:***

**5X 1" (25.4 mm) Round**
**4X 1.25" ( 31.7 mm) Round**
**1X 1.5"; 1X 1.25"; 1X 1" Round (1X 38.1mm; 1X 37.1mm; 1X 25.4mm)**
**Telescoping Sample Holder: Variable sample sizes**
**X: Up to 4" (101.6 mm)**
**Y: Up to 2.5" (63.5 mm)**
**Z: Up to .87" (22 mm)**
**Dual Thin Section Slide Holder with Transmitted Light Illuminator**
**Other Bulky Samples can be analyzed; Contact us to discuss**
**Integrated Circuit with Electronic Feed-through available**
**Custom Sample Holder Design Service**

***Crystals***

| | | |
|---|---|---|
| **LiF :** | **Wavelength Range: 1.0 – 3.83 Å** | **Johannson** |
| **PET:** | **Wavelength Range: 2.18 – 8.30 Å** | **Johannson** |
| **ADP:** | **Wavelength Range: 2.66 – 10.1 Å** | **Johannson** |
| **RAP:** | **Wavelength Range: 6.55 – 24.8 Å** | **Johannson** |
| **TAP:** | **Wavelength Range: 6.44 – 25.6 Å** | **Johann** |

***Multi Layer Crystals***

| | ***Elements*** |
|---|---|
| **No. 1:** | **N, F, O** |
| **No. 2:** | **N** |
| **No. 3:** | **B, C, N, O** |
| **No. 4:** | **B, Be** |
| **No. 6:** | **Be, B** |

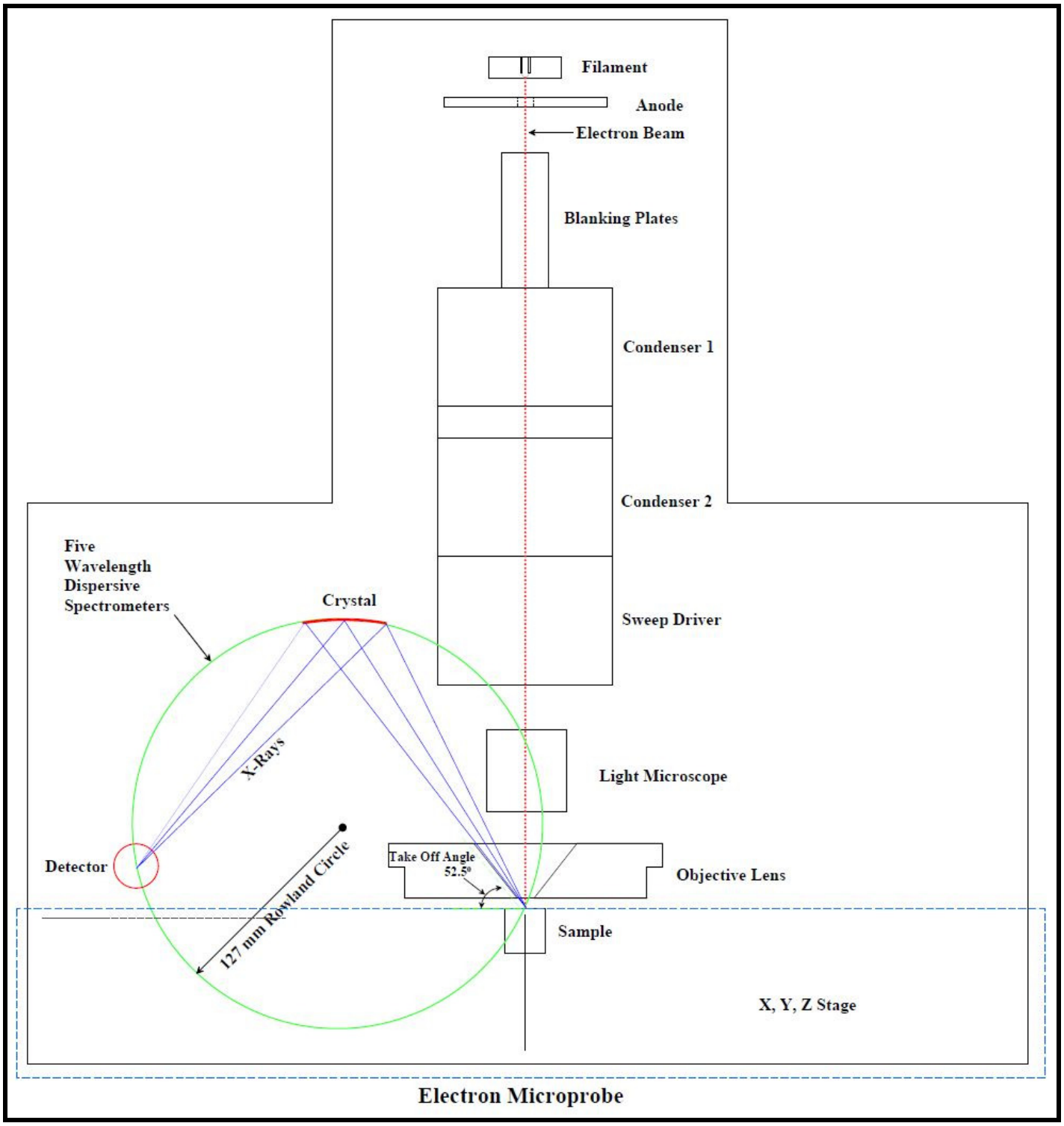
***WDS Detectors***

| | |
|---|---|
| ***<u>Solid-State</u>*:** | **Maximum Count Rate: 10 X 10 $^{6}$ CPS – 1.5 to 12 KeV** |
| **Xenon:** | **Maximum Count Rate: 100K CPS – 1.5 to 12 KeV** |
| **P-10 Flow:** | **Maximum Count Rate: 100K CPS – .1 to 2 Kev** |

***System Vacuum:*** **2 X $10^{-6}$ Torr**

***Standards:***

**15 Rare Earths**
**13 Carbon Steels**
**38 Pure Metals**
**35 Pure Metals, Minerals, and Borosilicate Glasses**
**56 Pure Metals, Heavy Metals and Minerals**
**13 Standards for Fuel Cells**
**59 Pure Metals and Minerals**
**Various NIST Standard Reference Materials**
**Custom Made Standards are also available – Call for Lead Times**




Electron Microprobe

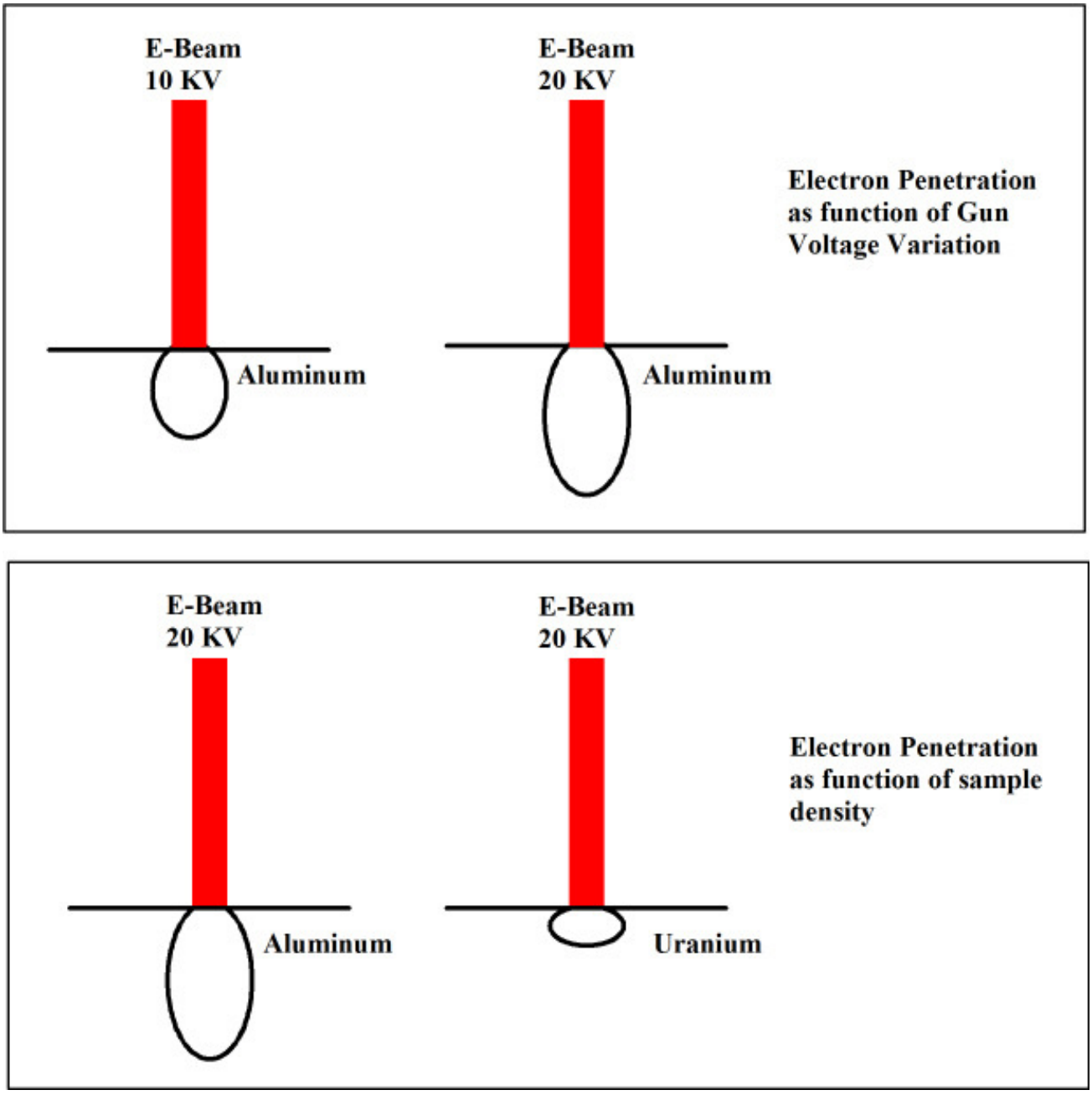



*Figure 5: Cross-Section of sample showing beam penetration - .3 to 1.7 microns*

*Figure 6: Elemental X-Ray Map*

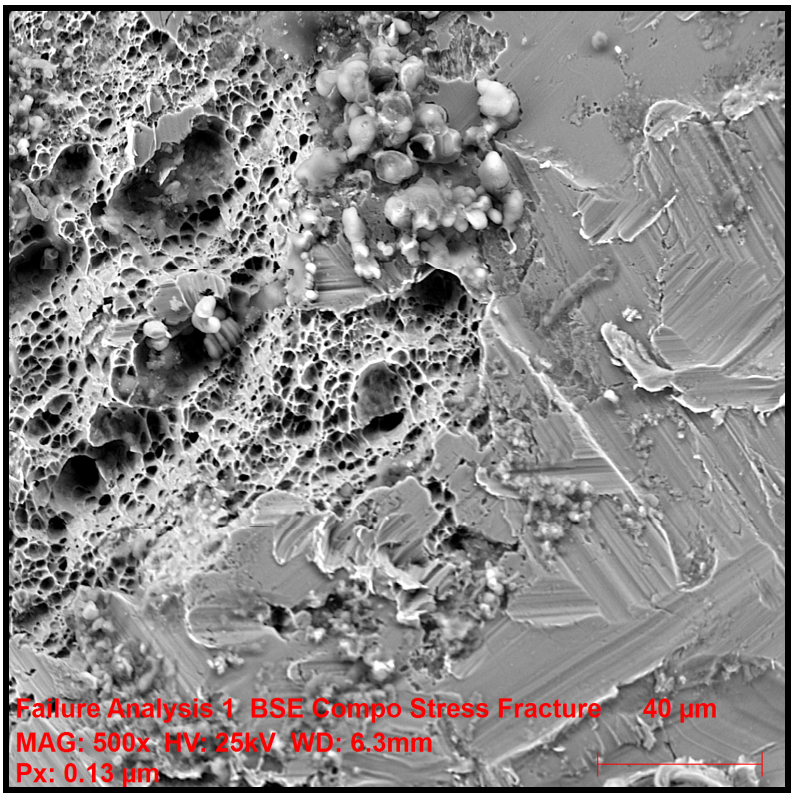



*Figure 7: Back Scattered Electron Image*

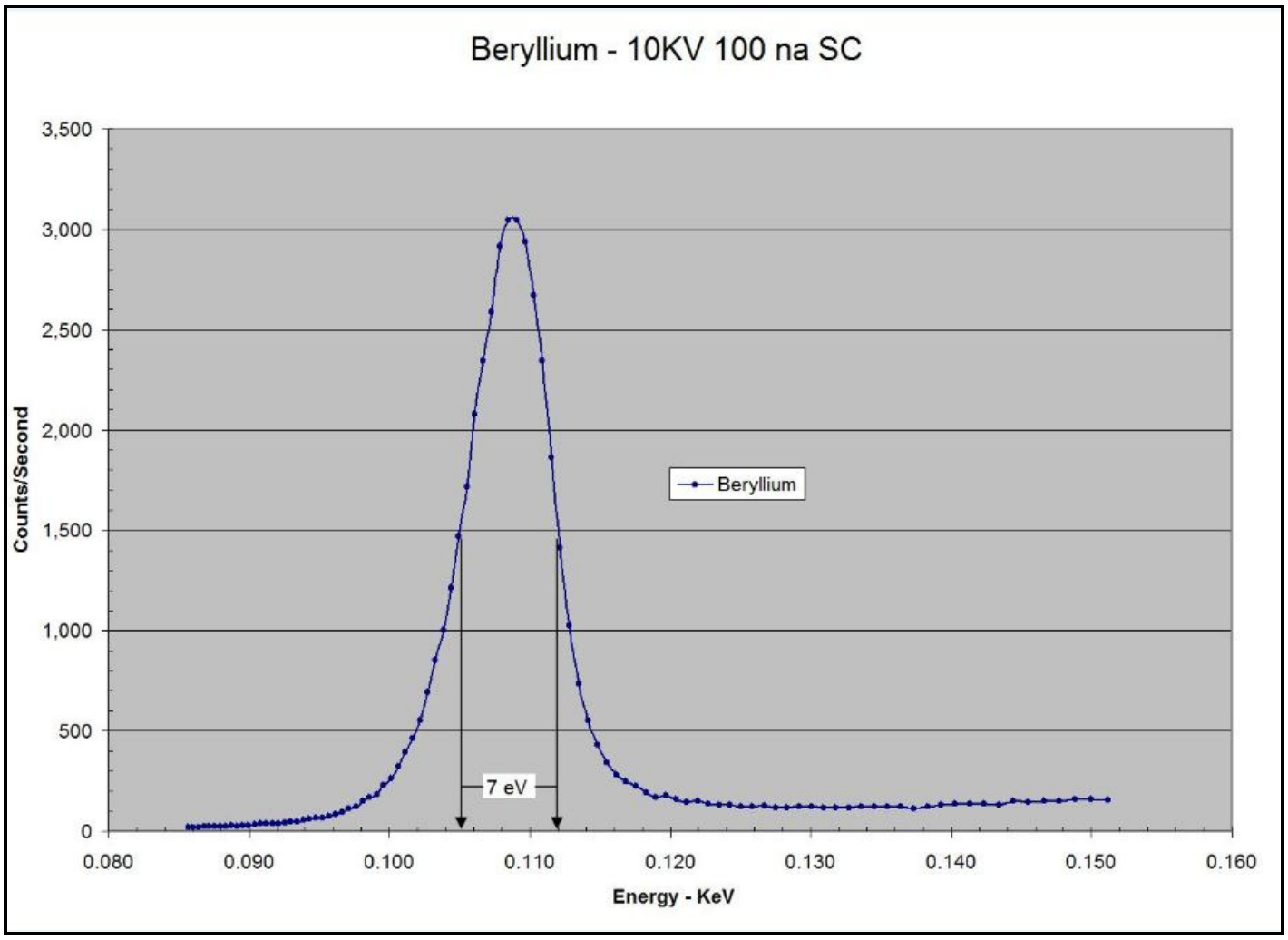



***Figure 8: Be Wave Scan***