Global Gauge Corporation

Industrial Measurement Systems
Made in America - Respected Worldwide

Presented by David Kober
Vice President, Sales & Marketing

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Introduction to Coating Weight Measurement

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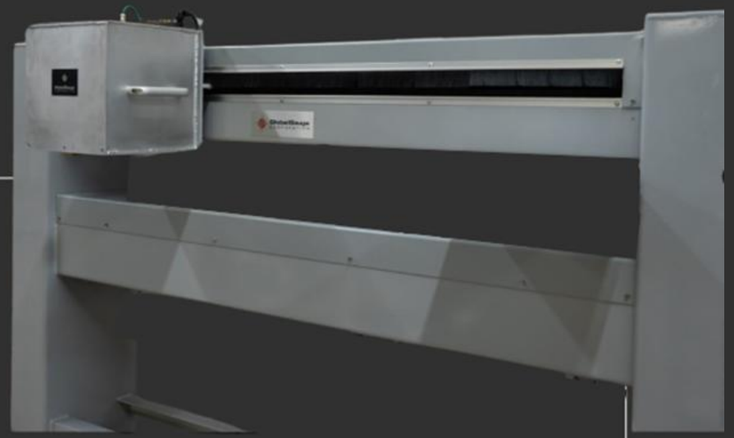
Multi-Sensor
Assembly

Integrated
Measurement Heads

Split or O-Frame
Designs



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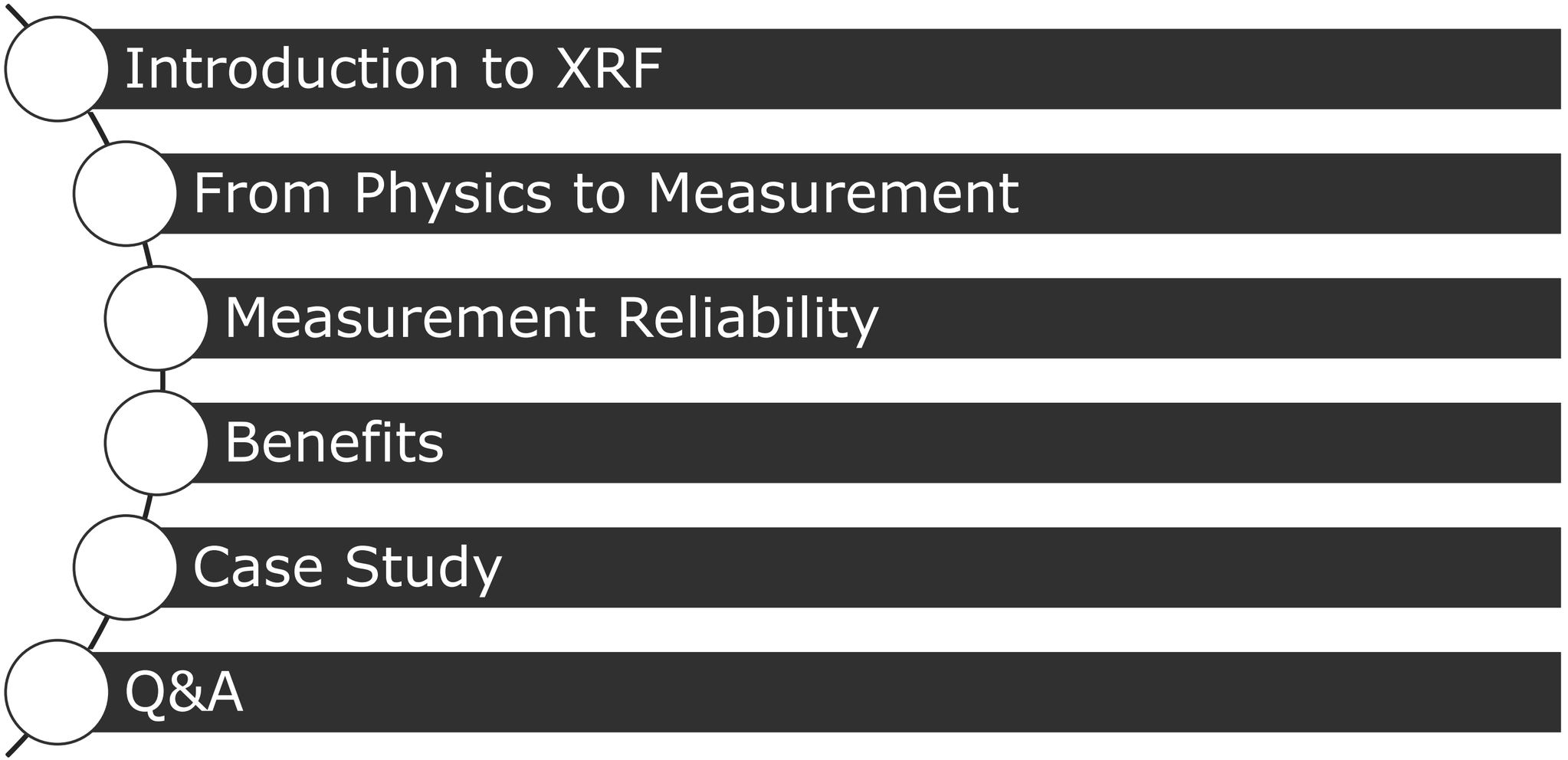
Agenda


Introduction to XRF
From Physics to Measurement
Measurement Reliability
Benefits
Case Study
Q&A

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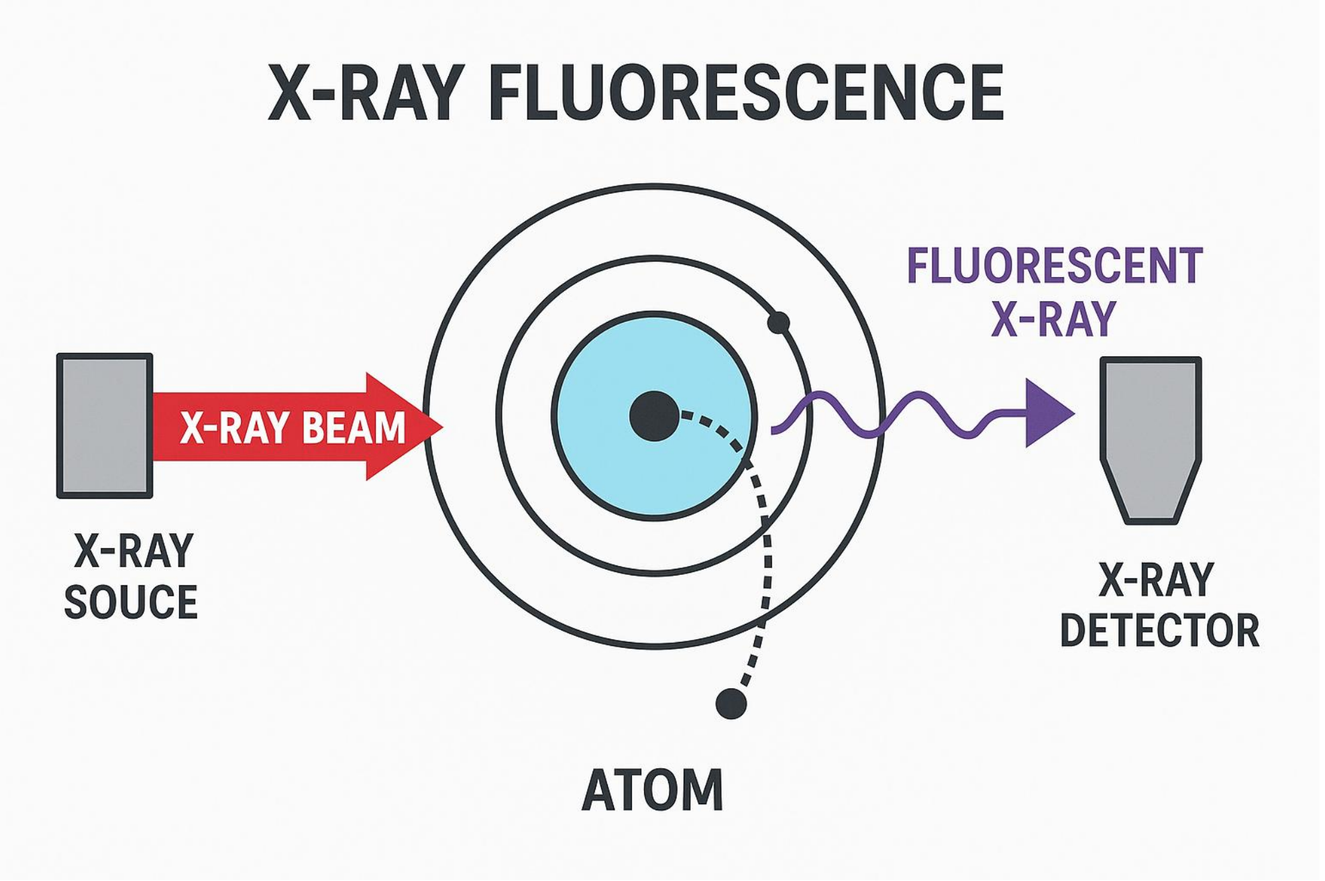
Introduction to X-Ray Fluorescence

Introduction to XRF

What is XRF (X-Ray Fluorescence)

1. **Basic Concept**
   - An **x-ray beam** is fired at a material.
   - The high-energy x-rays knock out **inner-shell electrons** from atoms.
   - When an **outer-shell electron** falls down to fill the vacancy, it emits a new x-ray photon
     → this is called **fluorescence**.

2. **Why It's Useful**
   - Every element emits x-rays at **unique energies** (like a fingerprint).
   - By measuring the energies of the fluorescent x-rays, you can identify which elements are present.
   - By measuring the **intensity** of these x-rays, you can figure out **how much** of each element is there.



Introduction to XRF

Why XRF in Tin Plating?

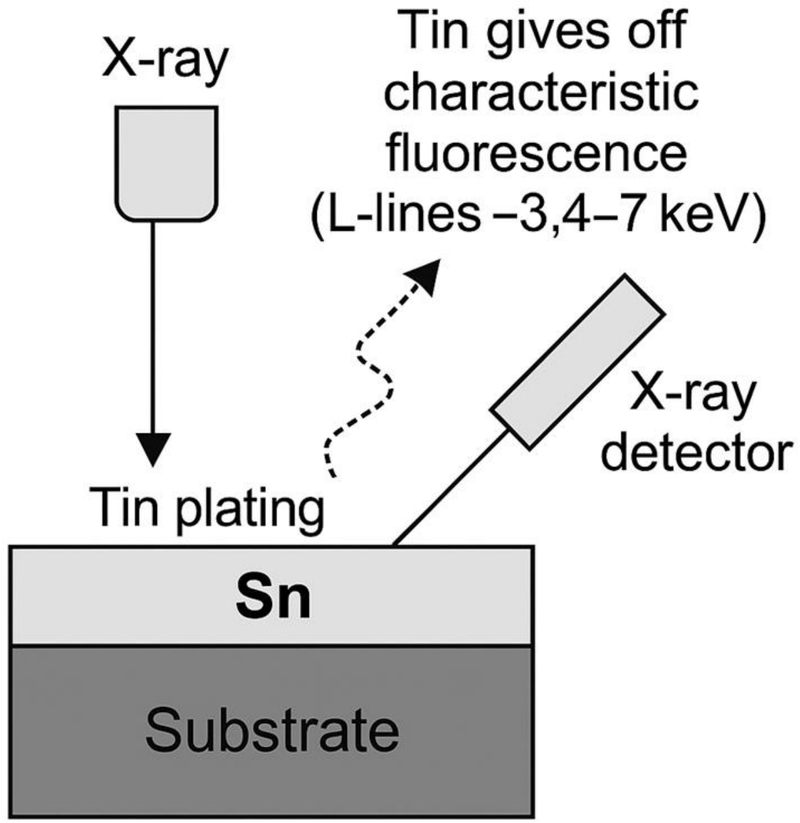
- Critical for in-line coating thickness measurement
- Non-contact method

In Coating Weight Gauges (Tin Plating Example)

- The **primary x-ray tube** excites the tin atoms in the coating.
- Tin gives off **characteristic fluorescence** (L-lines ~3.4–3.7 keV).
- A detector measures these emissions.
- Signal intensity

  → proportional to **coating weight**

  (mg/ft², g/m², or base blocks)



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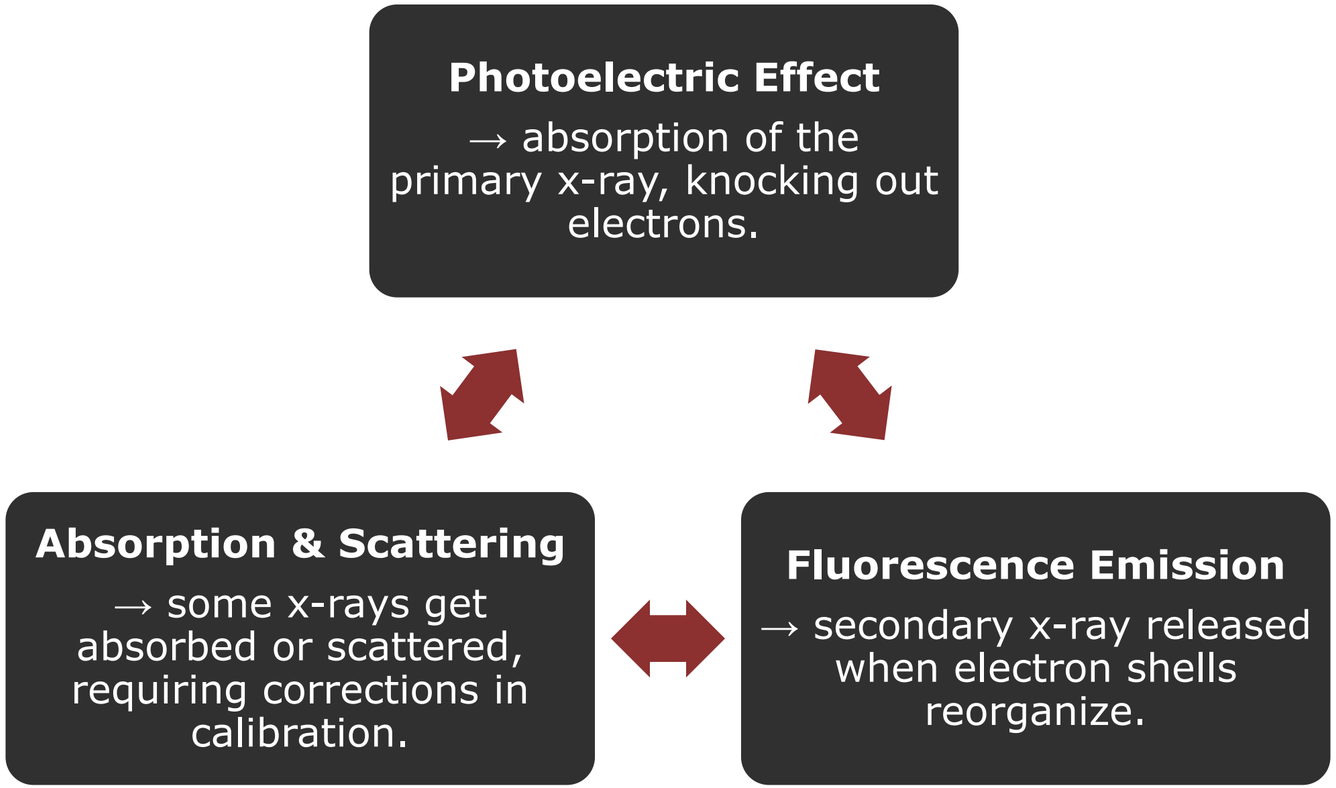
Fundamental Physics

Key Physics Effects



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From Physics to Measurement

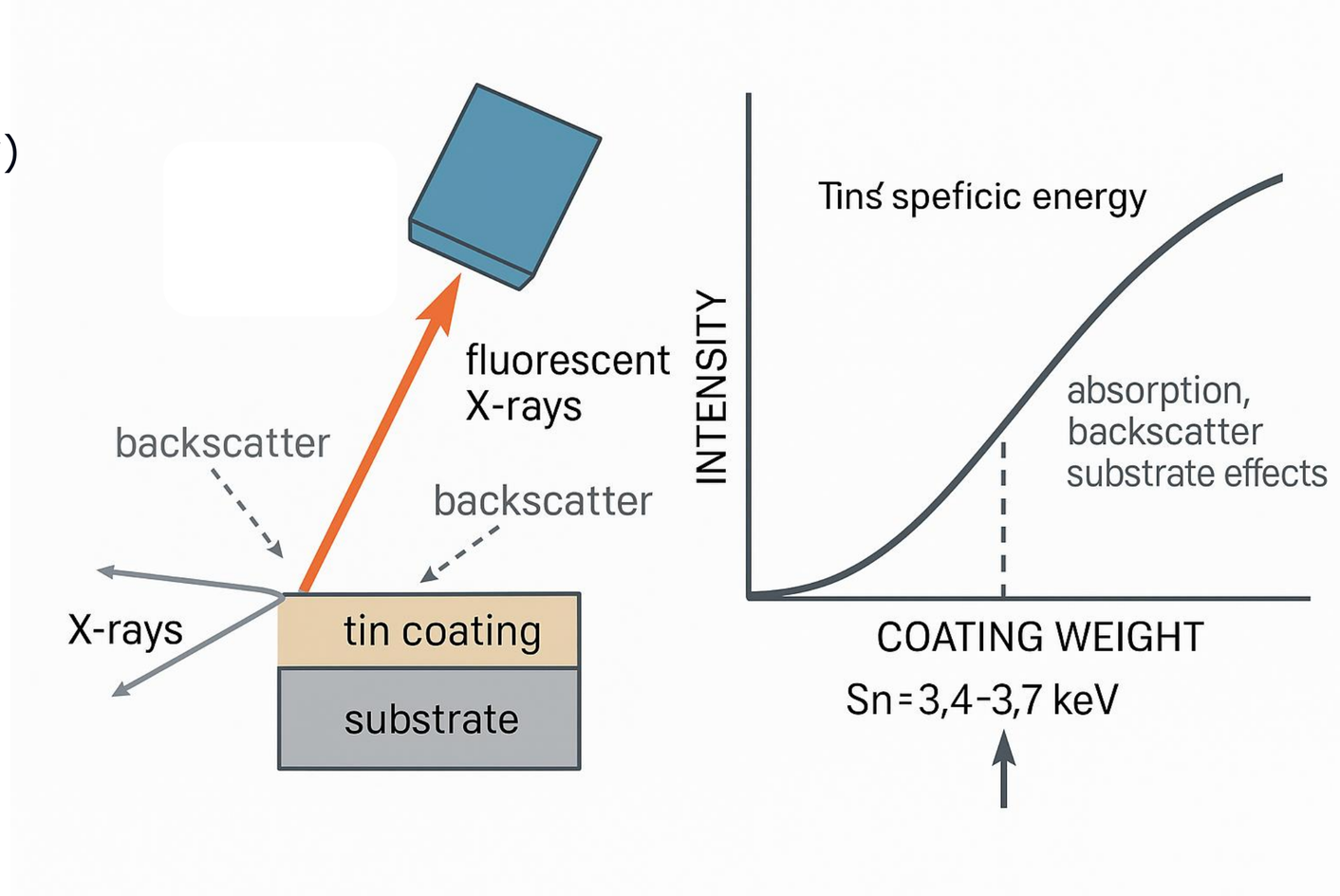
From Physics to Measurement

How do we leverage these principles?

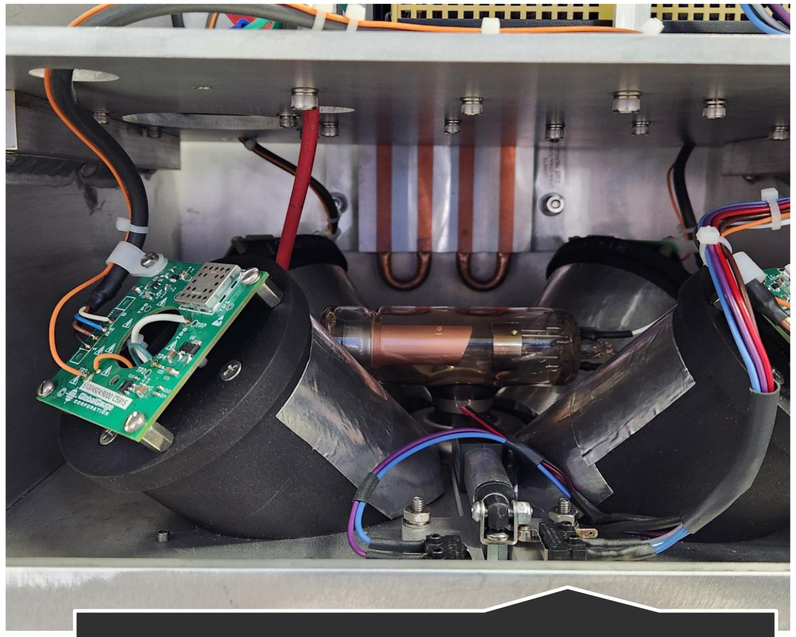
- Detector collects fluorescent X-rays at tin's specific energy
- Intensity ∝ coating thickness (areal density)

What else needs to be considered?

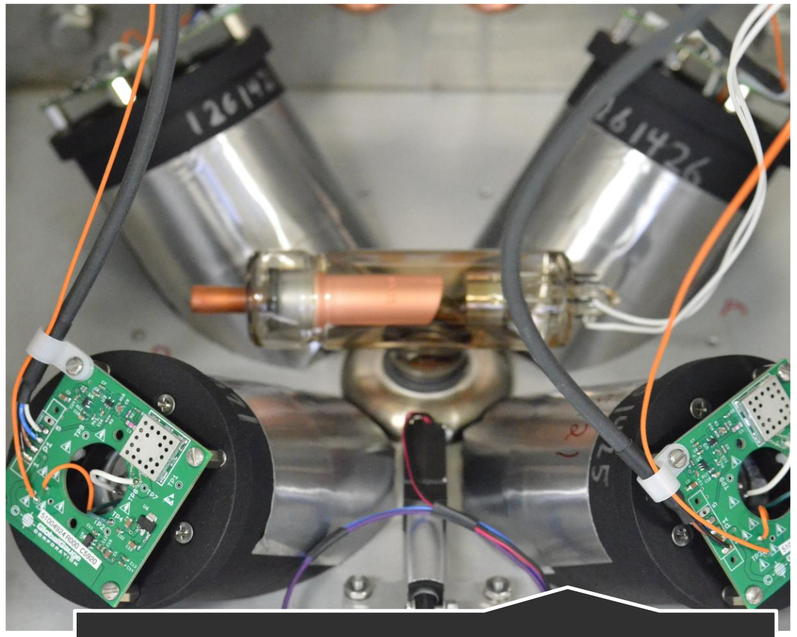
- Corrections:
  - Absorption
  - Backscatter
  - Substrate effects



Multi-Detector Layout



4x ion chamber detectors at 45° angles



Central X-ray tube for uniform excitation

Integrated Measurement Head

Physics Advantages of Multi-Detector Layout

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Central X-ray tube for uniform excitation.

Four ion chamber detectors at 45° angles.

System averages detector signals → stable, reliable measurement.

Increased solid-angle coverage → more efficient fluorescence capture.

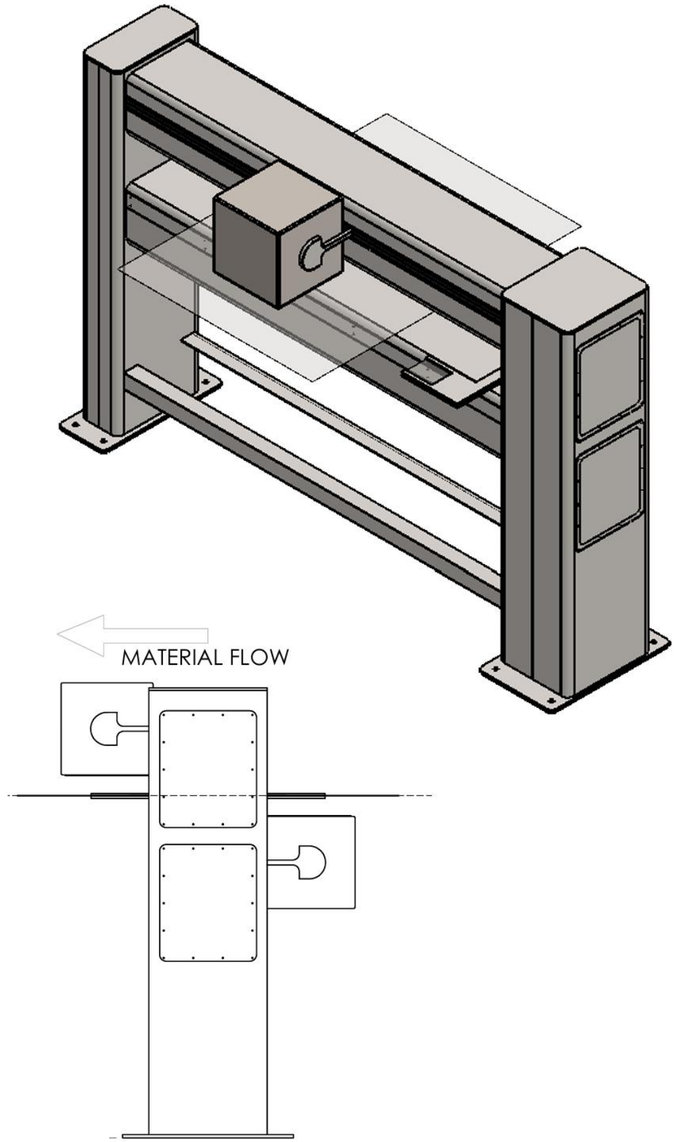
Averaging reduces statistical noise (Poisson noise).

Multiple viewing angles mitigate local geometry or surface effects.

Measurement Reliability & Error Handling

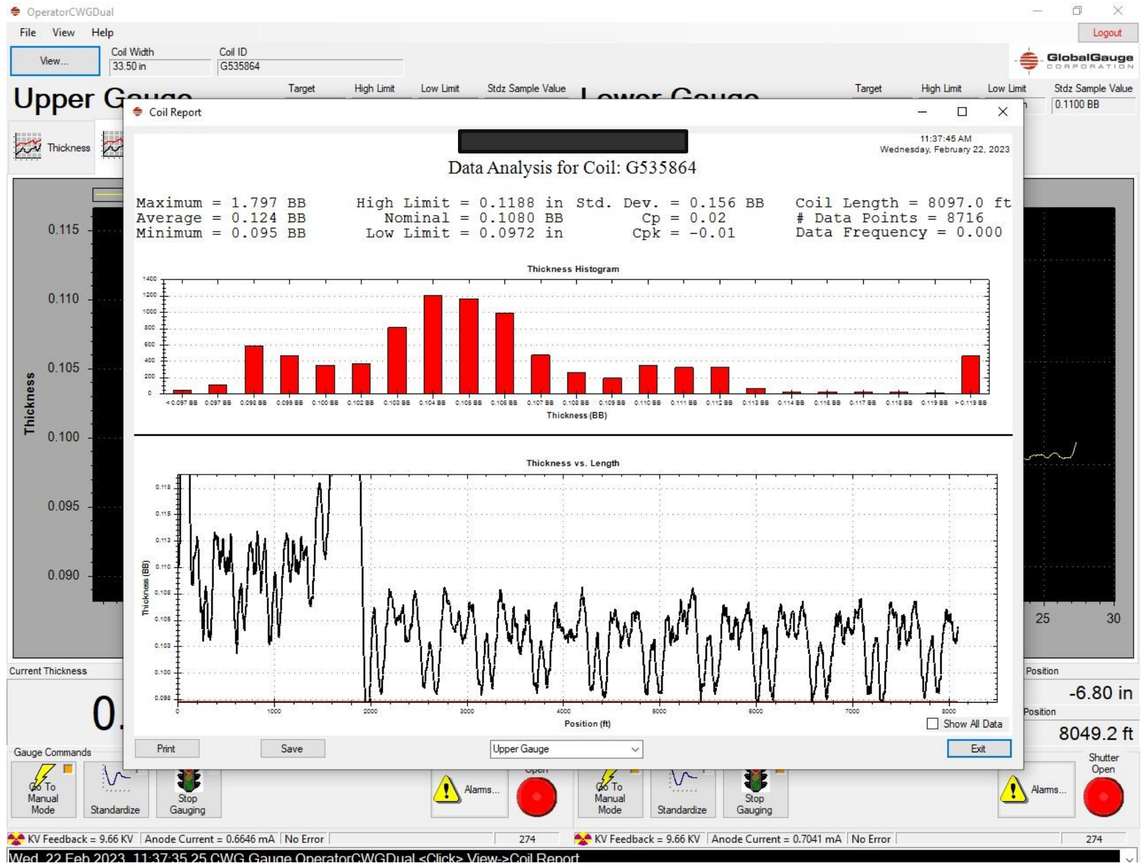
Why multiple detectors?

- Built-in redundancy: 4 detectors → system runs even if one fails.
- Outlier rejection: detects and excludes faulty signals.
- Continuous averaging → smoother real-time readings.



Benefits for Tin Plating Operations

- Higher confidence in coating weight measurements.
- Reduced downtime – system continues even with partial detector faults.
- Non-contact, real-time, inline measurement.
- Improved process control → quality + material savings.



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Perfecta Coating Weight Gauge

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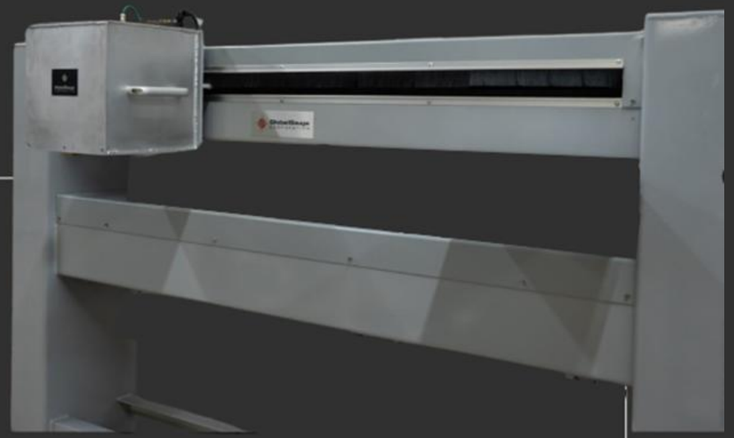

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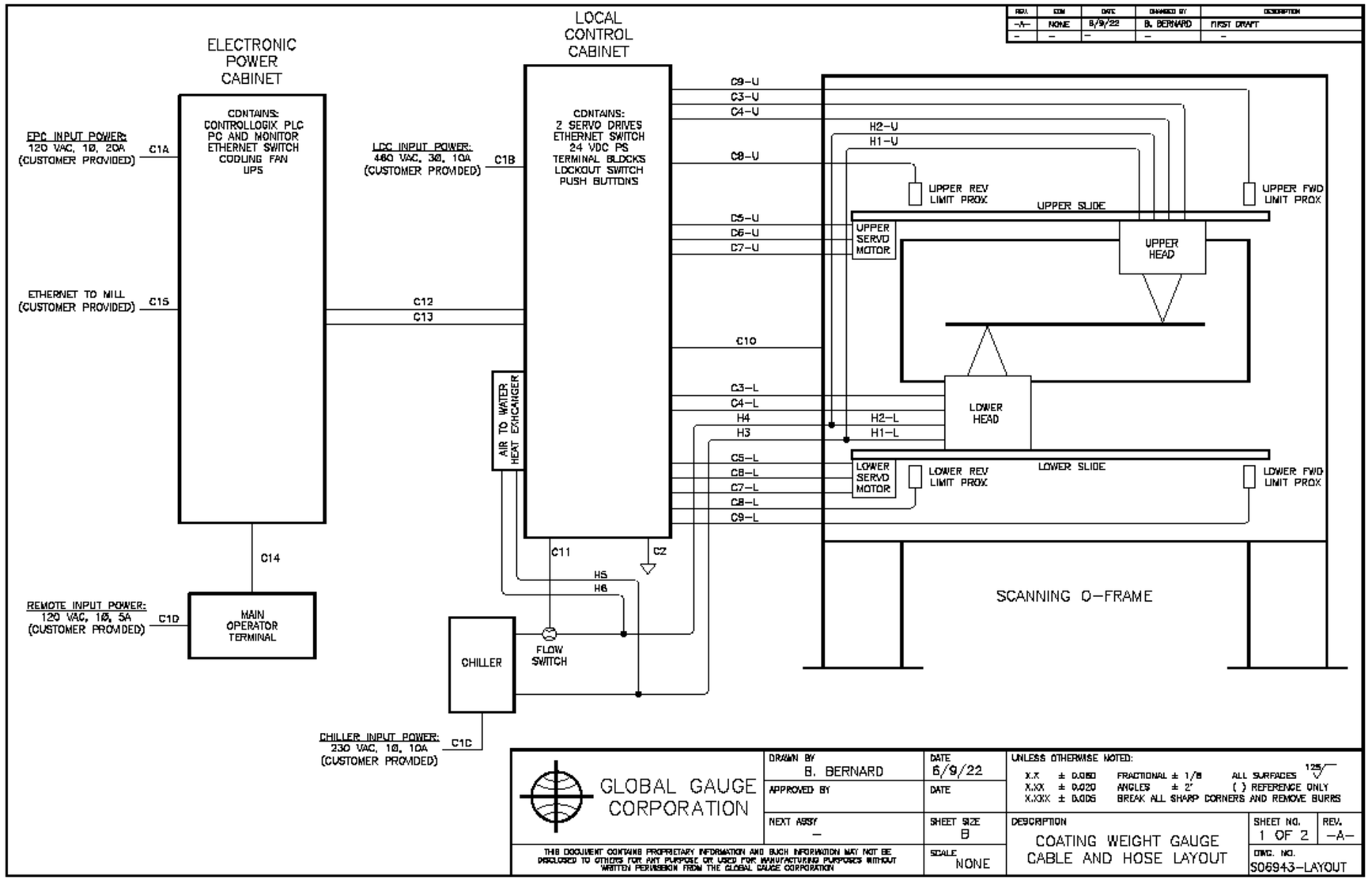
Case Study

System Topology

- EPC
- LCC
- O-Frame
- Integrated Measurement Heads
- Chiller
- Remote Operator's Console (HMI)



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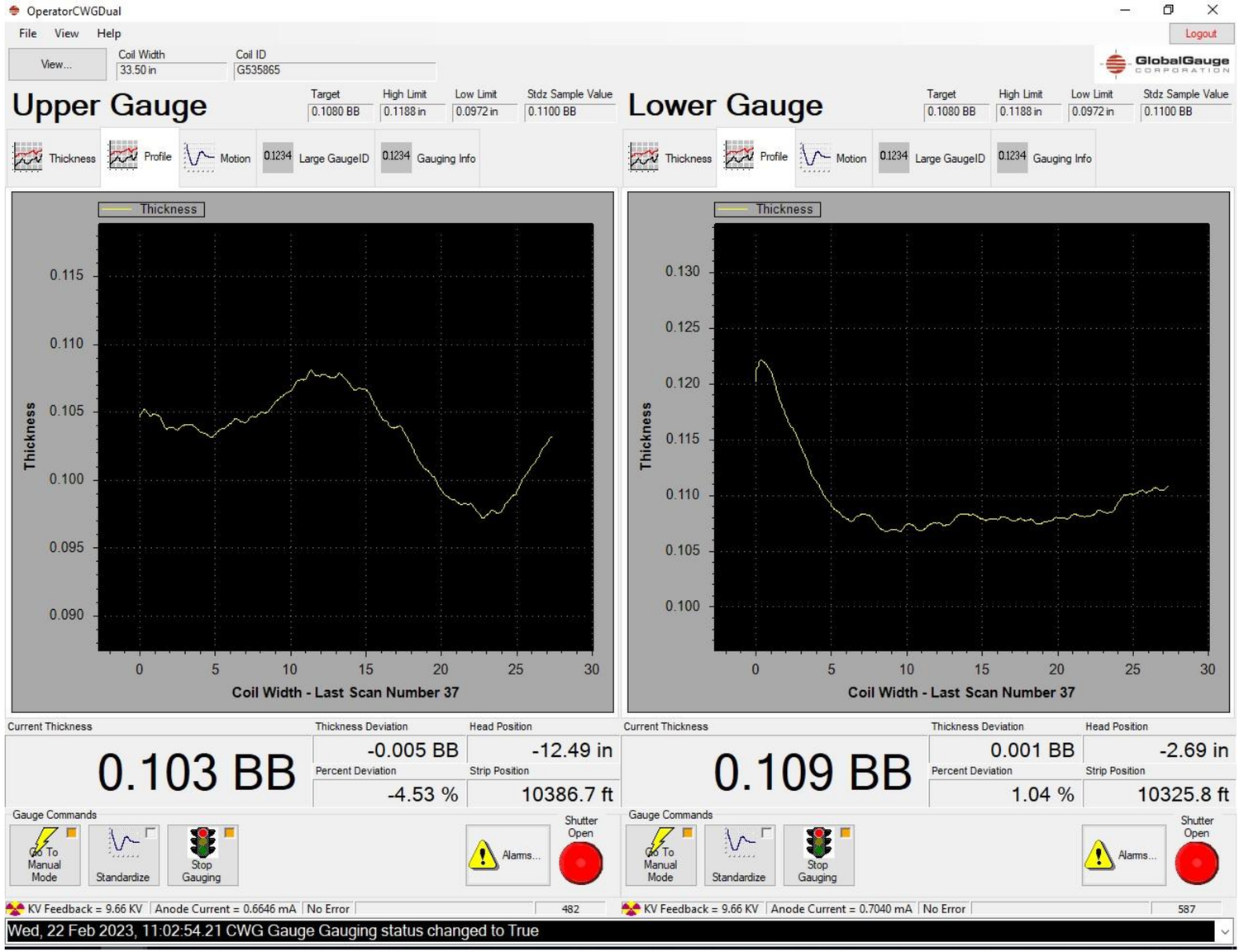

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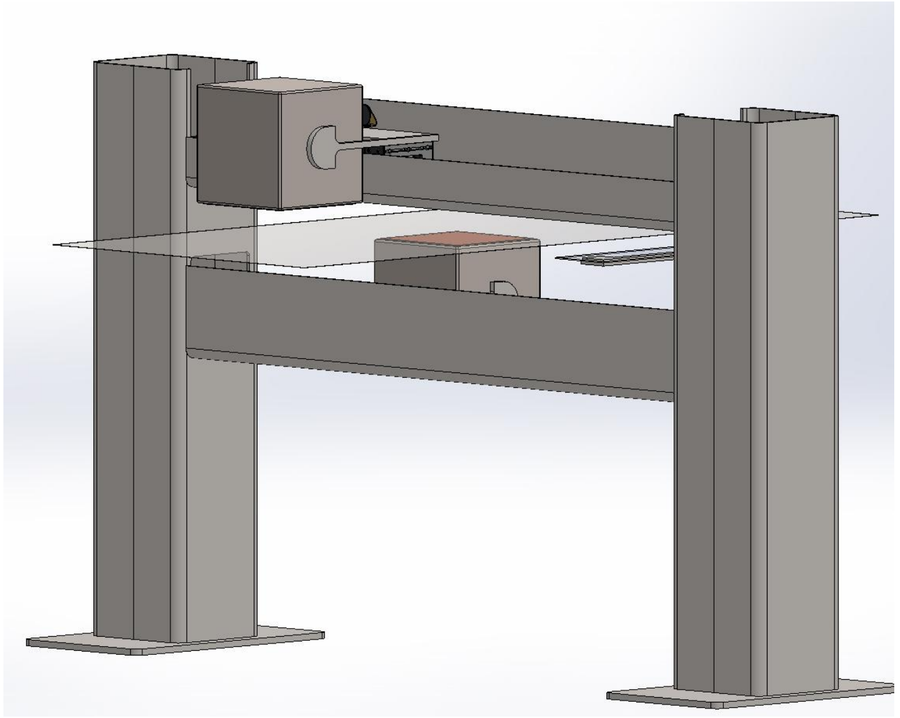
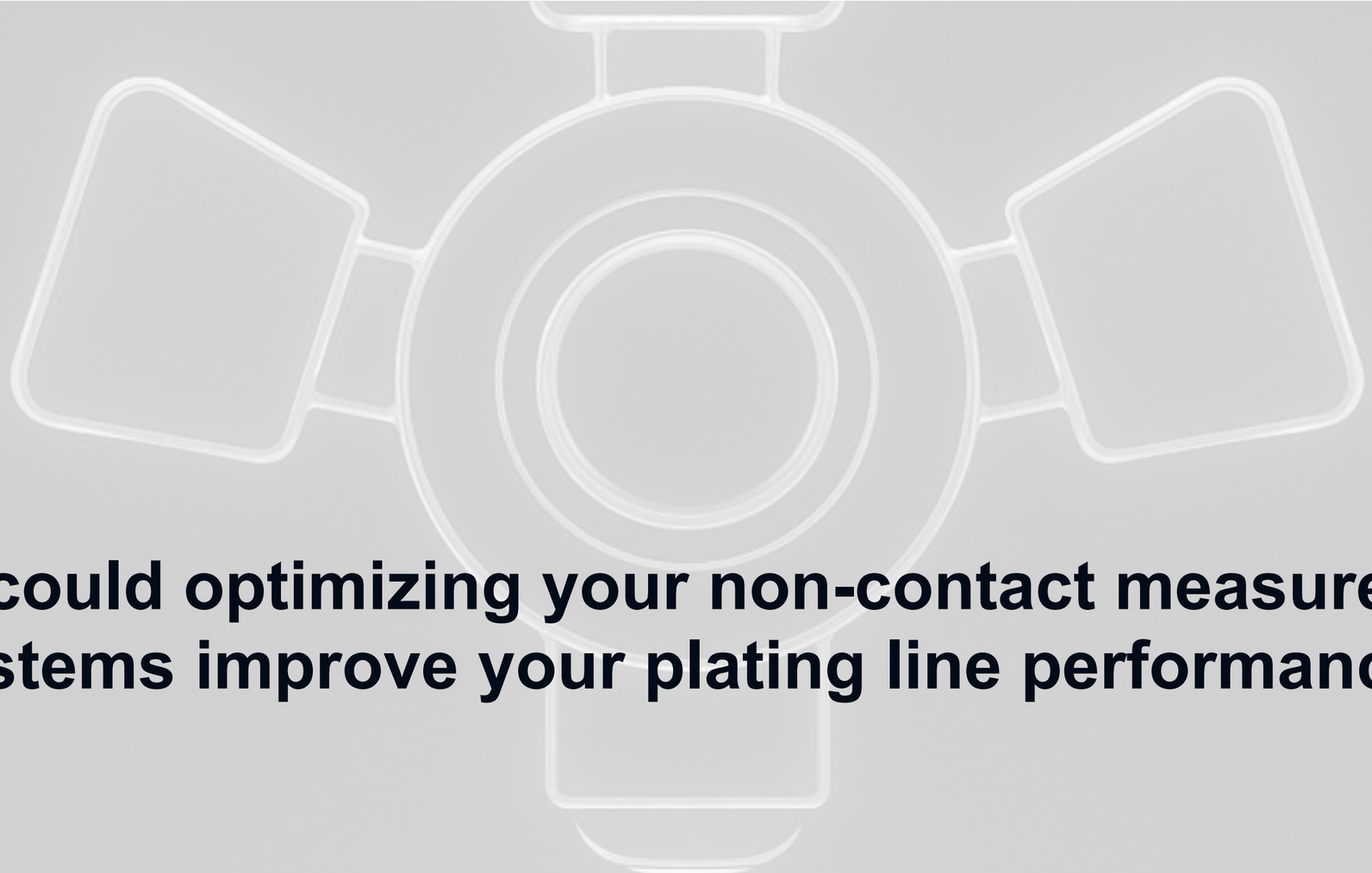


CAUTION
X-RAYS
THIS EQUIPMENT PRODUCES
X-RAYS WHEN ENERGIZED

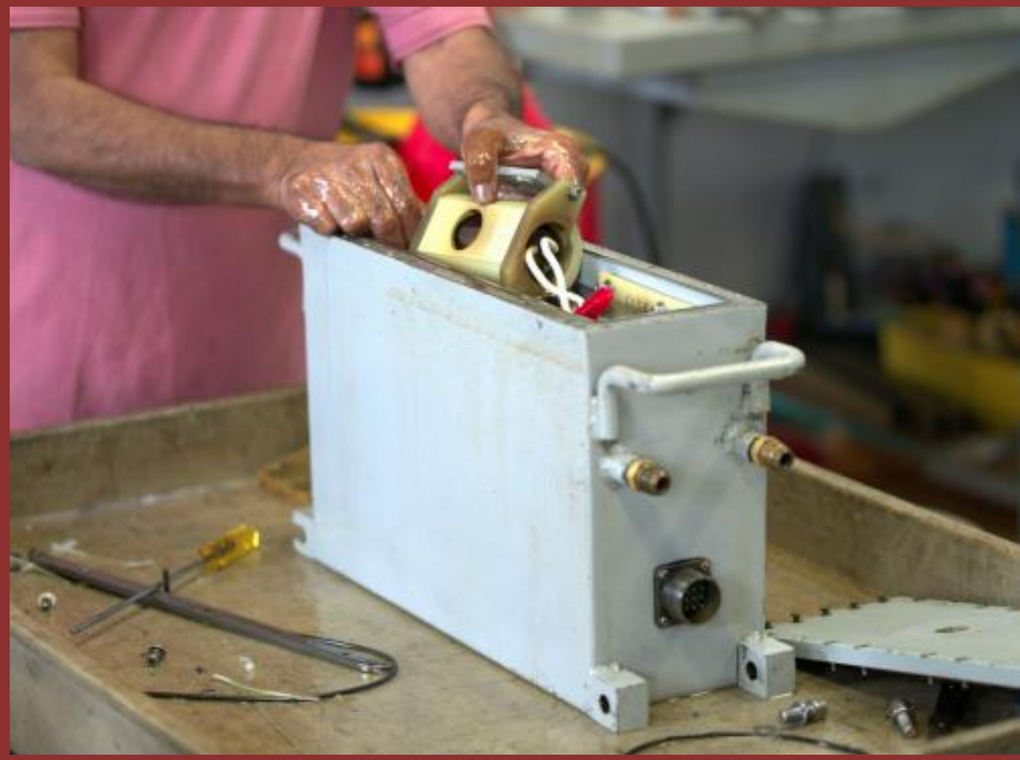
Case Study



How could optimizing your non-contact measurement systems improve your plating line performance?

LET'S TALK

- Is your current x-ray gauging supplier reliable and available 24/7/365?
- Do you struggle with supply chain of critical x-ray parts?
  - i.e. domestic, in-house generator supply?
- Do you have any current needs in our areas of expertise?
  - Thickness Gauge (new or upgrading obsolete system)
  - Coating Weight Gauges
  - Width Gauges
  - Crop Optimization / Shear Control
  - Defect Detection and Analysis (edge crack, pinhole, etc.)
  - Plant State Monitoring via IOT Infrastructure



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Thank you!

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