Continuous Emissions Monitoring of Substation Assets

Spotlight on Sulfur Hexafluoride (SF_6)

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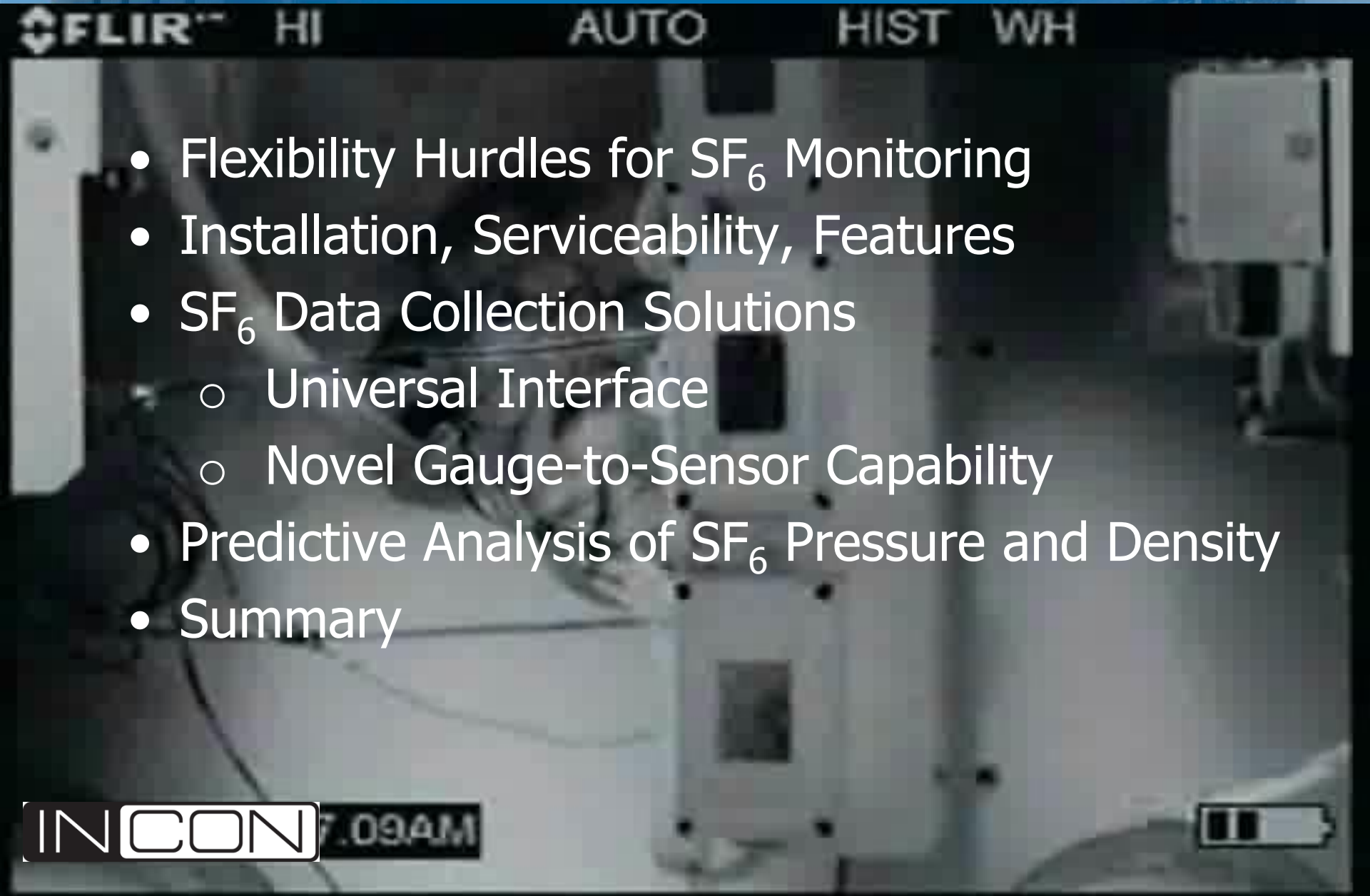
Presentation Overview



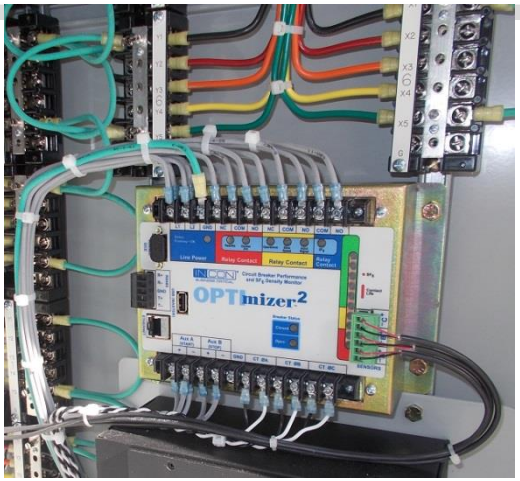
- Flexibility Hurdles for SF_6 Monitoring
- Installation, Serviceability, Features
- SF_6 Data Collection Solutions
  - Universal Interface
  - Novel Gauge-to-Sensor Capability
- Predictive Analysis of SF_6 Pressure and Density
- Summary

Flexibility Hurdles for SF_6 Monitoring

Pumped-Storage Generator Breaker

SF_6 Insulated Bus

GIS Circuit Breakers & Sections



Any SF_6 Circuit Breaker

For SF_6 monitoring, one size can fit all if:

- Setup is intuitive
- In-situ and continuous
- Interface to asset is kept simple
- High resolution sensing can detect small leaks
- Sensors make use of legacy/existing accessories

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Installation, Serviceability, Features

Requirements

- Involvement of human assets
- Solutions must be easy to perform in the field and expedient
  - ✓ Necessitates pre-engineering & innovation
- First line of environmental defense - Field Technicians

Comprehensive Features

- Contact wear
- Restrike detection
- Timing
  - ✓ Trip (interruption)
  - ✓ Contact travel
- Control circuit failure
- Mechanism problems

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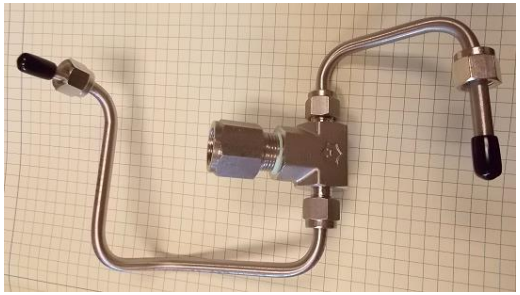
SF_6 Data Collection Solutions

Universal Interface: INCON OPTImizer²

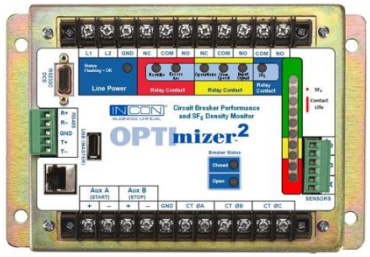
- Proven in all SF_6 equipment types- Breakers, Bus, GIS, Bushings
- Sensor Plumbing Adaptors for any legacy SF_6 circuit breaker:

ABB PA/PM Breaker



HICO 144kV Breaker

Crompton-Greaves 245kV Live Tank



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SF_6 Data Collection Solutions

Regardless of SF_6 monitor brand …

… the most critical part is the sensor installation

- Moisture ingress
- You might create a leak
- Do you have the right parts?
- You might break a 40+ year-old fitting
- Where is the best place for the sensor?

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SF_6 Data Collection Solutions

Novel Gauge-to-Sensor: INCON LenSense

- Sensor function without plumbing
- Innovation and finesse rather than brute force
- Simple lens replacement for most SIEMENS breakers

Patented!

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SF_6 Data Collection Solutions

Novel Gauge-to-Sensor: INCON LenSense

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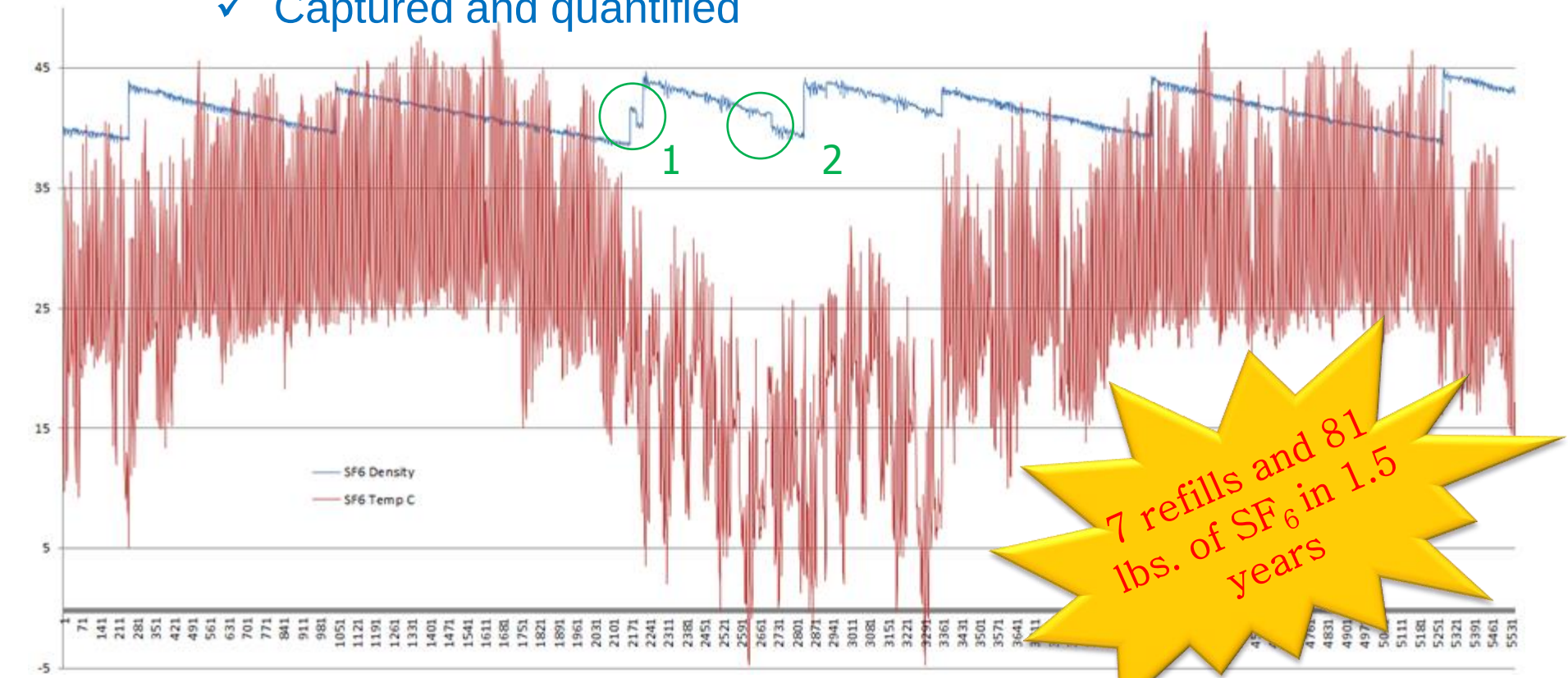
Predictive Analysis of SF_6 Pressure and Density

- 12 bit resolution assures the smallest leak is detected
- Leak Rates are trended
  - ✓ Forecast days until “Block Trip” condition exists
- “Drill-down” pressure/density/temperature data capability
  - ✓ Captured and quantified



Circuit Breaker Located in South Texas

Summary

OPTImizer^2

- Simple to install
- Compatible with all SF_6 equipment
- Automates EPA emissions reporting
- Gives timing and wear analysis on circuit breakers
- Approved by ABB, Alstom, HICO, HVB, Mitsubishi, & SIEMENS

LenSense

- Adds value to existing high-quality gauges
- Ensures monitoring and control data agree
- No plumbing connections- no risk of creating leaks
- Minutes to install and configure resulting in minimal labor costs

Reactive X Scheduled X

Condition-Based Maintenance for Continuous Emissions Monitoring

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From EUEC 2014 Keynote Speakers …

"… Reliability, Stewardship, Affordability …"

Mr. Alan Hodnik
Chairman, President, & CEO
Allete
3 February 2014
EUEC, Phoenix, Arizona
Keynote Speaker

"Flexibility is absolutely key in the power sector."

Ms. Janet McCabe
Acting Assistant Administrator
US Environmental Protection Agency
3 February 2014
EUEC, Phoenix, Arizona
Keynote Speaker

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