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## Leverage Data To Enhance Arc Management And Anomaly Detection Capabilities On Advanced Energy™ (AE) Power Supplies To Reduce Operational Costs

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Advanced Energy Industries, Inc., Fort Collins, CO

AE's range of pulsed, DC and RF power supplies are key components on industrial coaters. Intelligent arc management is critical in such equipment to optimize process performance. Historical data logs help the user visualize process anomalies including arc patterns or triggers. As we transition into the era of advanced data science and computing, power supply data can be harnessed for predictive diagnostics and troubleshooting.

This presentation features PowerInsight which is AE's (Internet of Things) IoT solution. PowerInsight captures and records high resolution data on total power systems with the ability to integrate with other data monitoring systems. Users can gain actionable insights from PowerInsight's custom dashboards and alerts, maximizing power supply and equipment functionality. It also highlights use cases in which process engineers made data driven decisions to refine process conditions and reduce operational costs.

<https://www.svc.org>

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## Leverage Data To Enhance Arc Management And Anomaly Detection Capabilities On Advanced Energy™ (AE) Power Supplies To Reduce Operational Costs

Craig Rappe



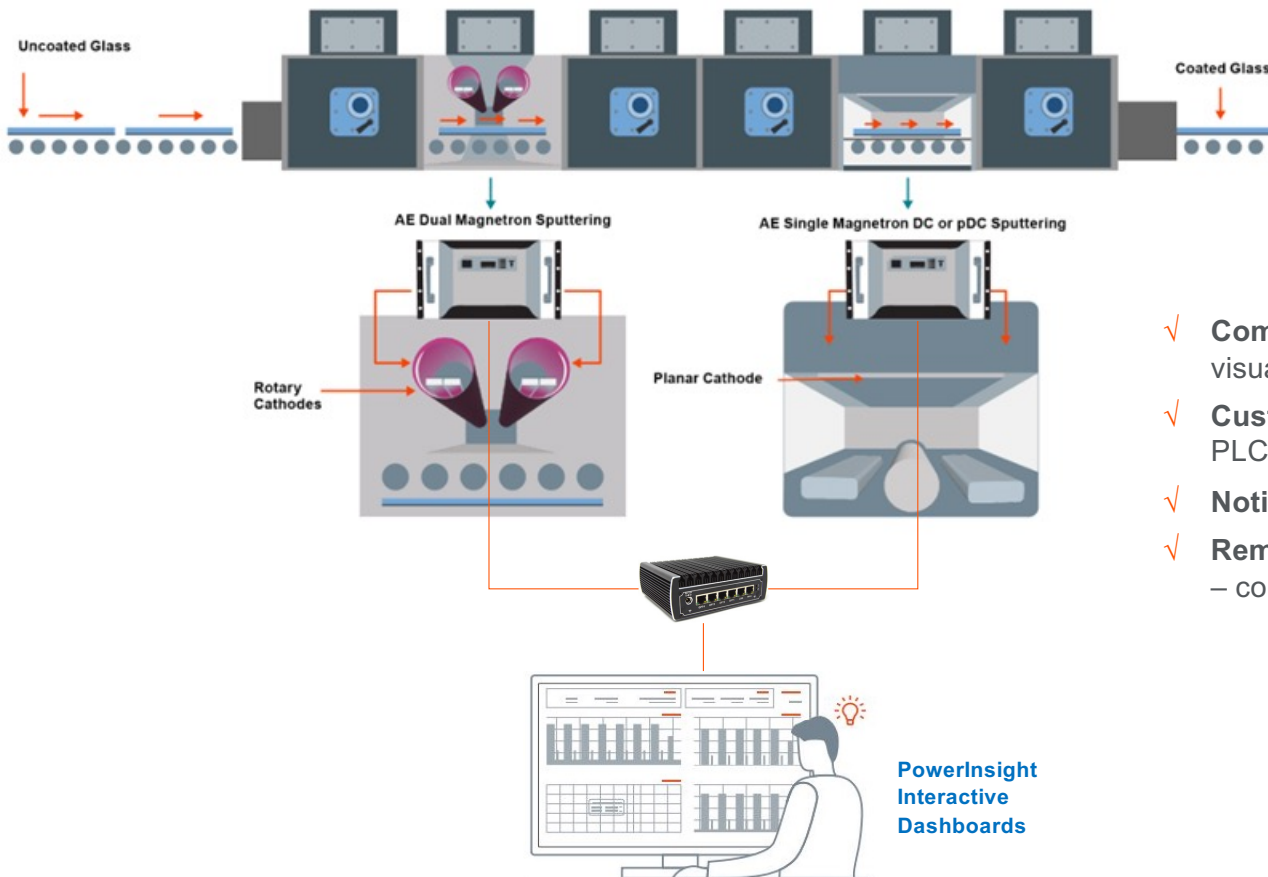
# Agenda



1. PowerInsight -- AE's IoT Solution for Total Power System Monitoring
2. Integrate with other systems
3. User Cases
4. Summary

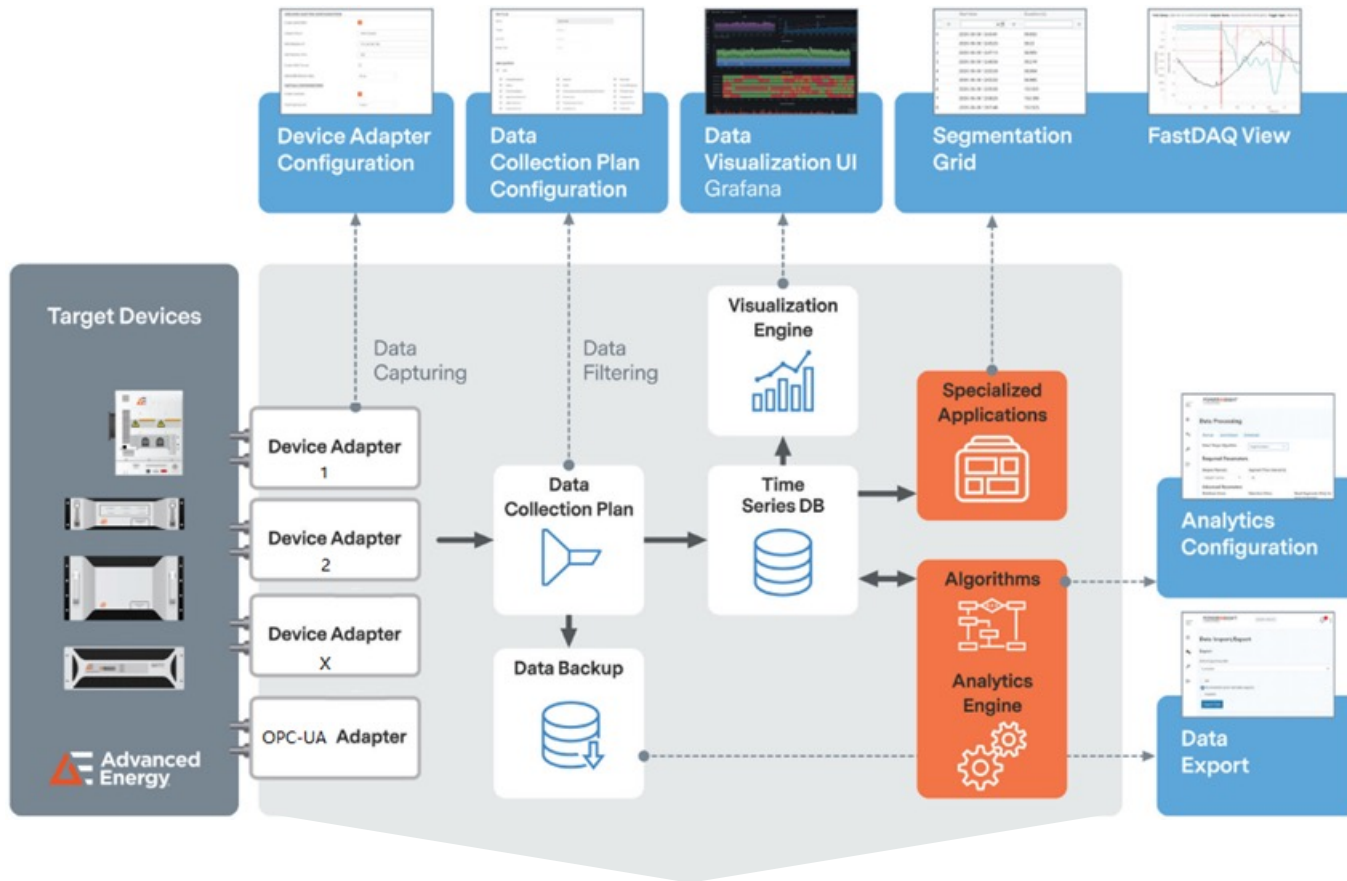
# PowerInsight -- AE's IoT Solution for Total Power System Monitoring

# IoT Solution Monitor Total Power System



- ✓ **Complimentary** high-resolution data recording and visualizing.
- ✓ **Custom** dashboards for multiple power supplies and PLC, for unit and process monitoring.
- ✓ **Notify** users when defined anomalies happen.
- ✓ **Remote** access on customer internal secured network – convenient & safe troubleshooting/monitoring

# PowerInsight Software Package - Edge System

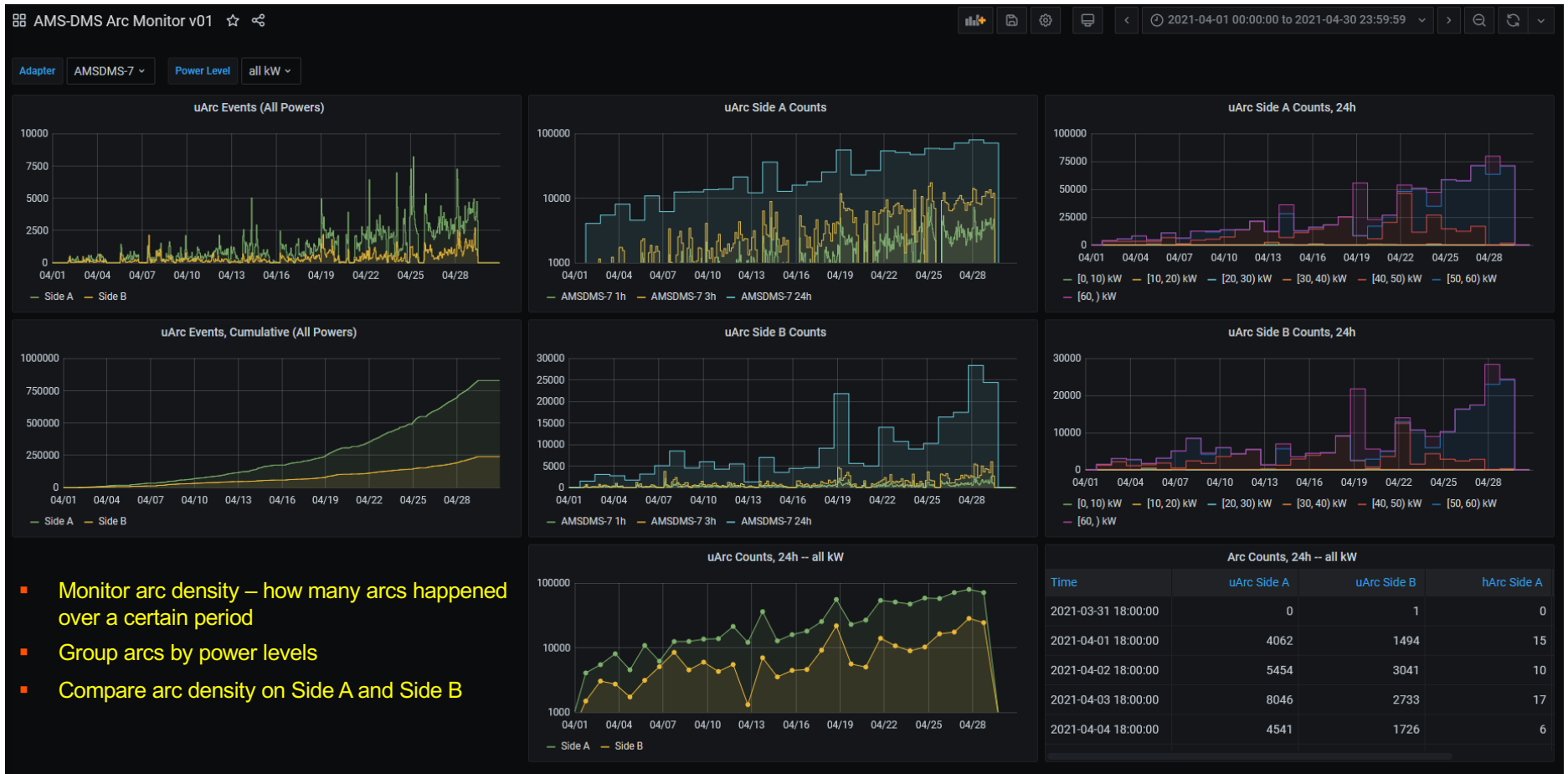


- ✓ Runs independently – doesn't slow down main PLC control speed.
- ✓ Plug & Play – users don't need to install any software.

**POWERINSIGHT**  
by Advanced Energy™



# PowerInsight Arc Trend Data Dashboard



- Monitor arc density – how many arcs happened over a certain period
- Group arcs by power levels
- Compare arc density on Side A and Side B

AMS Current Status								
Time	Regulation Mode	AMS Setpoint	AMS Power Output	AMS Voltage Output	AMS Current Output	Power Limit	Voltage Limit	Current Limit
2022-05-08 18:10:20	Power	21300	21.3 kW	341 V	63 A	60.0 kW	1,000 kV	120 A

AMS Serial Number

# 1227130

DMS Current Status							
Time	Power Out A (%)	Power Out B (%)	DutyCycle	Hard Arc Side A (Arcs/run)	Hard Arc Side B (Arcs/run)	Micro Arc Side A (Arcs/run)	Micro Arc Side B (Arcs/run)
2022-05-08 18:10:20	50	50	50	0	0	18566	1787851

No data

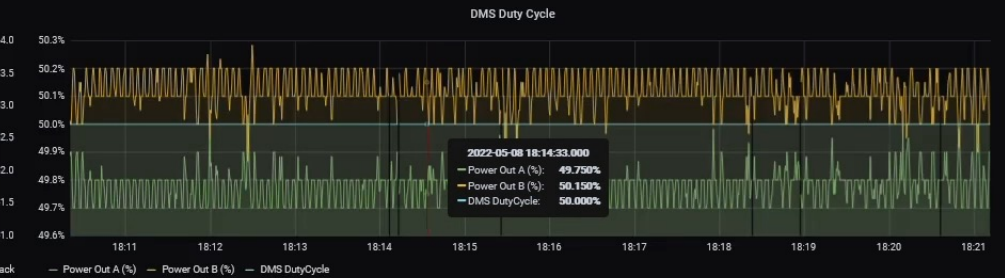
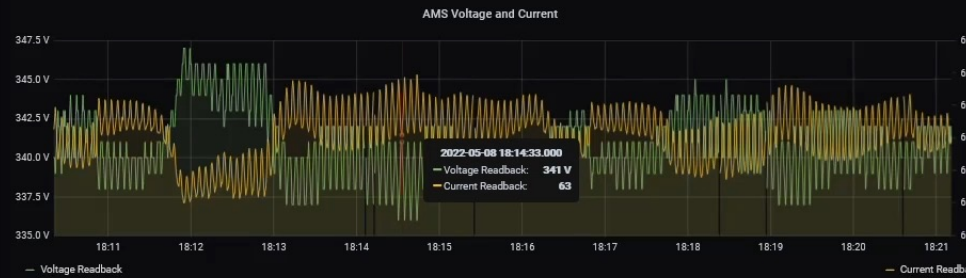
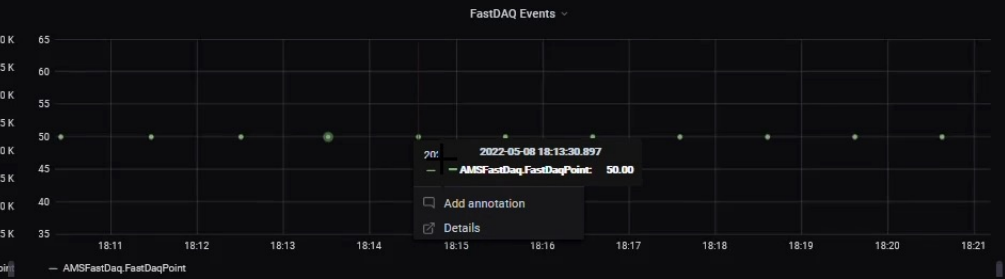
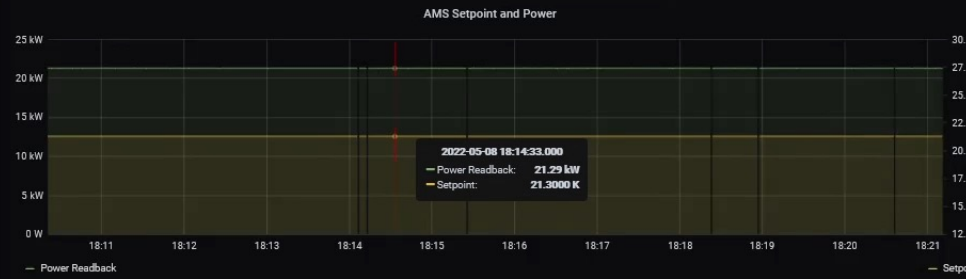
DMS Faults

No data

DMS Warnings

No data

AMS Faults



DMS Sputter Current

DMS Arc Per Run

# Custom Notification



**Customer's Status Quo:** Current escalation plan is counting on Technicians to notice certain arc events and respond accordingly



**PowerInsight Solution:**  
Custom alarm if a power supply has x or more microarc events greater than a certain number in a certain period of time.

# Integrate with other systems

# Pulling Data From PLC Via OPC-UA



Combined visualization of power supply and tool parameters from PowerInsight



# Pulling Data From RGA (Residual Gas Analyzer)



- System under development in AE's Customer Solutions Lab (CSL)
- Case-by-case compatibility enabled to read and visualize data from non-AE equipment



Visualize RGA data on dashboard

The screenshot shows a web interface for exporting data. The title is "Export Data - Default Data Collection Plan" with a close button (X) in the top right. Below the title are two rows of date and time selection: "Start date" set to 04/24/2024 at 00:00, and "End date" set to 04/24/2024 at 15:30. Under "Select Export type:", there are two radio button options: "Processed Csv Files (Zipped)" (unselected) and "Raw Csv Files (Zipped)" (selected). An orange "EXPORT DATA" button is located at the bottom right of the form.

Easy to Download CSV File raw data



AE's Customer Solutions Lab in Karlstein

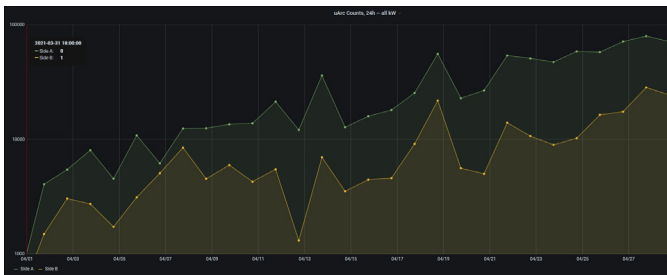
# User Cases

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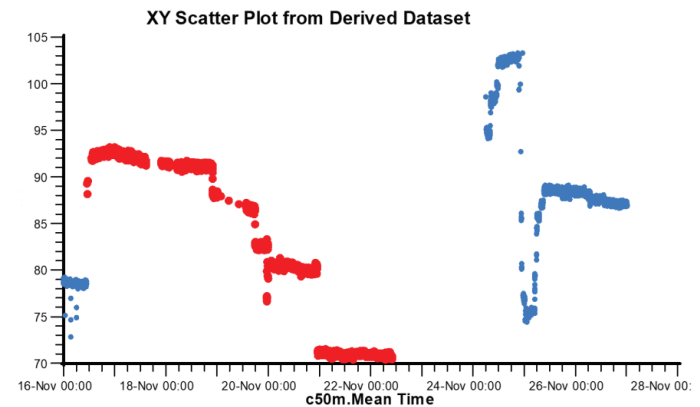
- Case 1: Arc rates and chamber pressure data helped save burn-in time by monitoring system condition before production.
- Case 2: PowerInsight replaced existing method to estimate remaining target life and accurately calculate the best timing for target replacement.
- Case 3: PowerInsight monitor the trend of nodule growth based on the hypothesis that it has correlation with arc density.



Case 1 Arc rate is substantially higher on one cathode versus other during operation – indicates potential issue



Case 3 Automatically plotting arc density for Side A and Side B



Case 2 Monitor impedance that typically decreases gradually as the target is consumed, more precisely characterize the process and predict target-material consumption

# Summary

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As we transition into the era of advanced data science and computing, power supply data can be harnessed for predictive diagnostics, monitoring, and troubleshooting.

- PowerInsight captures and records high resolution data on total power systems with the ability to integrate with other data monitoring systems.
- Users can gain actionable insights from PowerInsight's custom dashboards and alerts, maximizing power supply and equipment functionality.
- Enable users to make data driven decisions to refine process conditions and reduce operational costs.