Anomaly detection in battery manufacturing

Pressure decay anomalies in vacuum chambers

Abnormal cell thickness trends (precursors to swelling)

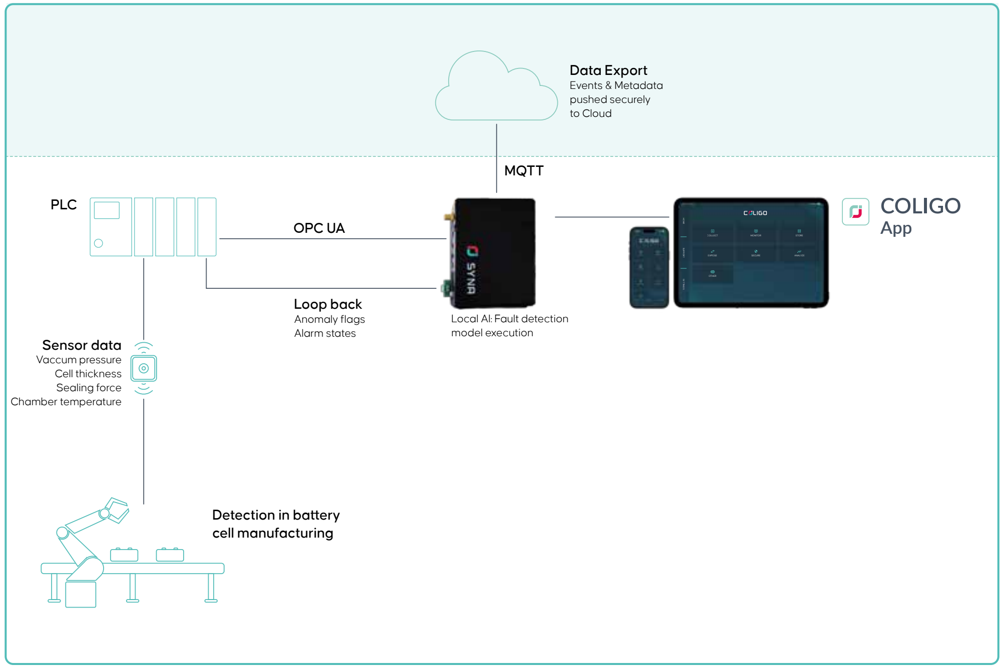
Temperature rise indicating oxygen evolution & early cell failure

Executive Summary

In lithium-ion battery cell manufacturing, even micro-leaks during vacuum sealing or early cell swelling during the formation stage can lead to catastrophic quality failures—including electrolyte leakage, safety risks, and batch-scale scrap events.

Traditional quality checks often detect defects too late in the process (e.g., final EoL testing), leading to high rework and scrap costs. The goal of deploying COLIGO is to monitor cell behaviour in real time, detect abnormal swelling or leaks at the earliest moment, and enable instant corrective action to protect yield and product safety.

The Solution



COLIGO combines the SYNA EdgeBox and the COLIGO App to enable edge anomaly detection directly at sealing stations and early formation racks:

- OPC UA connectivity to sealing equipment, sensors, and PLCs
- Local AI running on EdgeBox for continuous anomaly scoring
- No-code configuration to easily set up:
  - Data collection
  - Thresholding rules
  - Dashboards & alerts
  - Operator guidance

When a deviation is detected:

- COLIGO automatically sends visual + audible alerts
- Operators stop/adjust the sealing process
- The defective cell is removed before contaminating a batch

The Challenge

Vacuum leak issues arise due to sealing misalignment, micro-cracks, or insufficient electrolyte wetting

Defects often only become visible much later → delayed detection = high scrap cost

Process signals such as vacuum pressure, chamber temperature, force, cell thickness sensors require high-frequency monitoring

Legacy SCADA systems lack:

- Real-time analytics at millisecond resolution
- Predictive models for early abnormal behaviour
- Standardized OT-IT data flow
- Local operation during network outages

Manufacturers need a solution that:

Detects weak signals that precede swelling or leakage

Operates in real time, at the edge for uninterrupted safety

Requires no data science expertise for setup or maintenance

Data & Model Information

Attribute	Configuration
Data Types	Vacuum pressure, chamber temperature, sealing force, inline thickness gauge
Sampling Frequency	5–20 Hz (pressure / time decay curve), optional high-res thickness
Model Type	Unsupervised anomaly detection (statistical baseline + autoencoder)
Edge Deployment	SYNA EdgeBox with local runtime
Communication	OPC UA for machines, MQTT optional for enterprise / cloud
Alerts	Real-time local alarms, email / SMS available

Results & Customer Benefits

KPI	Improvement
Leak-related batch scrap	↓ 40–70%
Safety incident risk	↓ significantly
Response time to failure	↓ 50%
Manual inspection workload	↓ 20–30%
Time-to-containment of defect	Immediate vs. hours/days