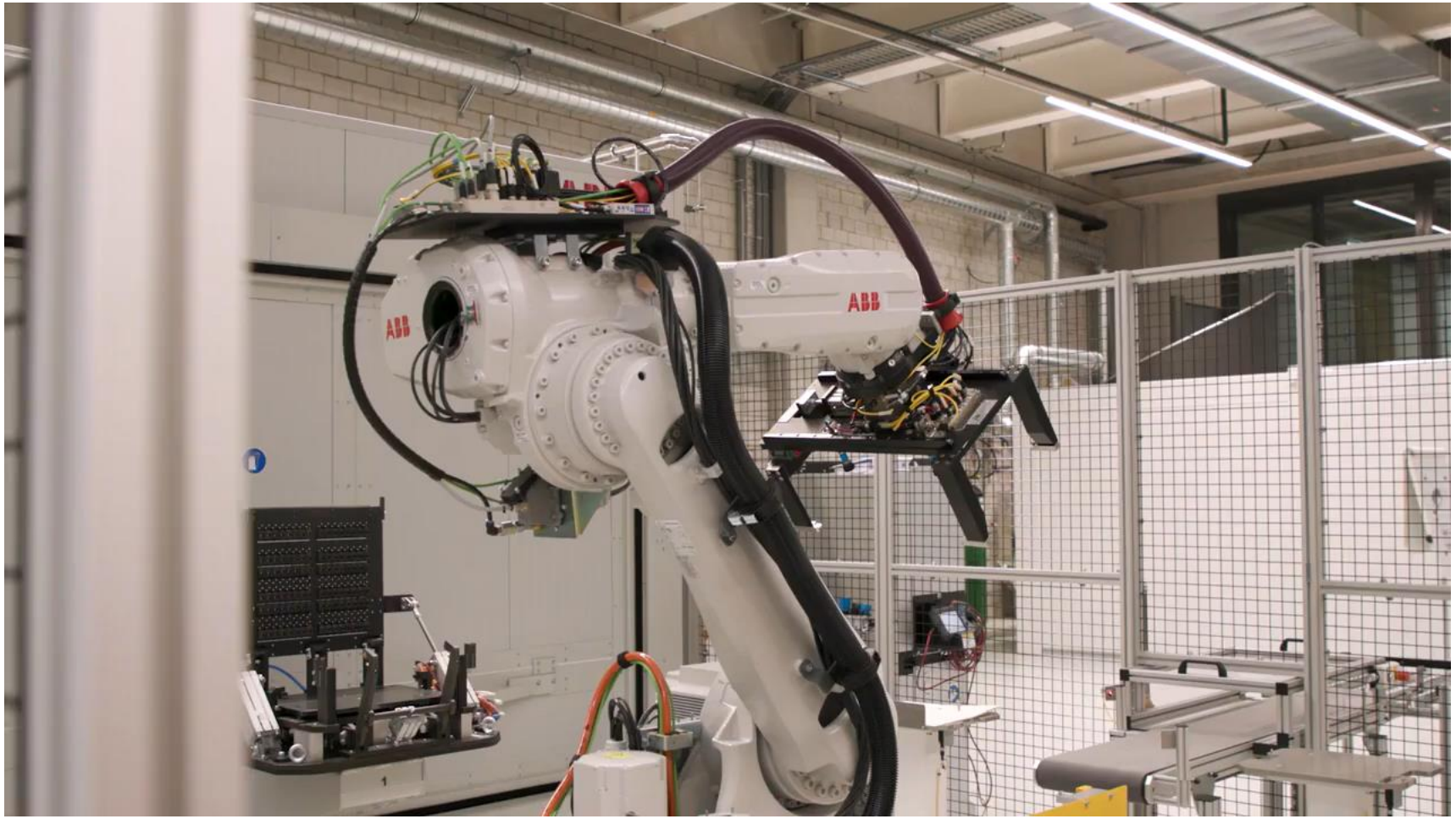
JUNE 2025

ABB Traction Battery

Michael Zanetti, MSc ME ETH
Project Manager Automation

Semiautomated Battery Production

Baden (CH)



ESS Baden | Movie source

Traction Batteries

Flexible engineering based on standardized modules and packs

Battery cell

Battery module
With standard capacity

Max Battery pack
With standard capacity

Battery System
- Variable capacity by parallel connection
- Auxiliary components such as battery thermal management

Battery kit for integrators
With standard capacity

Pro Battery pack
With standard capacity

Battery System
- Variable capacity by parallel connection
- Auxiliary components such as battery thermal management

ABB Traction Battery
Selected Success Stories

Railway

Newbuild – Battery only regional train

Most economical solution in partially electrified networks

Railway

Retrofit – Hybrid diesel electric drive train retrofitted with a battery

Up to 35% efficiency improvement, reduced local emissions and reduced maintenance

Stationary

Peak shaving and recuperation for a cable car

Integration of PV generation and reduction of grid charges

Mining

Newbuild – full electric / hydrogen / hybrid dump trucks

Long cycle stability under harshest conditions

Mining

Retrofit – zero emission dump truck

Proof of concept for the conversion of a diesel mechanic truck, and proof of concept of 100% regenerative operation

Bus

Newbuild – full electric bus and trolleys

Range extension, catenary-based trickle charging, opportunity and flash charging

High Density Traction Battery

Pro Series

Safe

Highest safety
By design and cell selection

Flexible

Multi-pack paralleling
To adapt capacity

80%

Rapid charging
Charging in less than 10 min

>20.000

Long life
Over 20.000 cycles

Plug & play

Easy connectivity
Simple installation

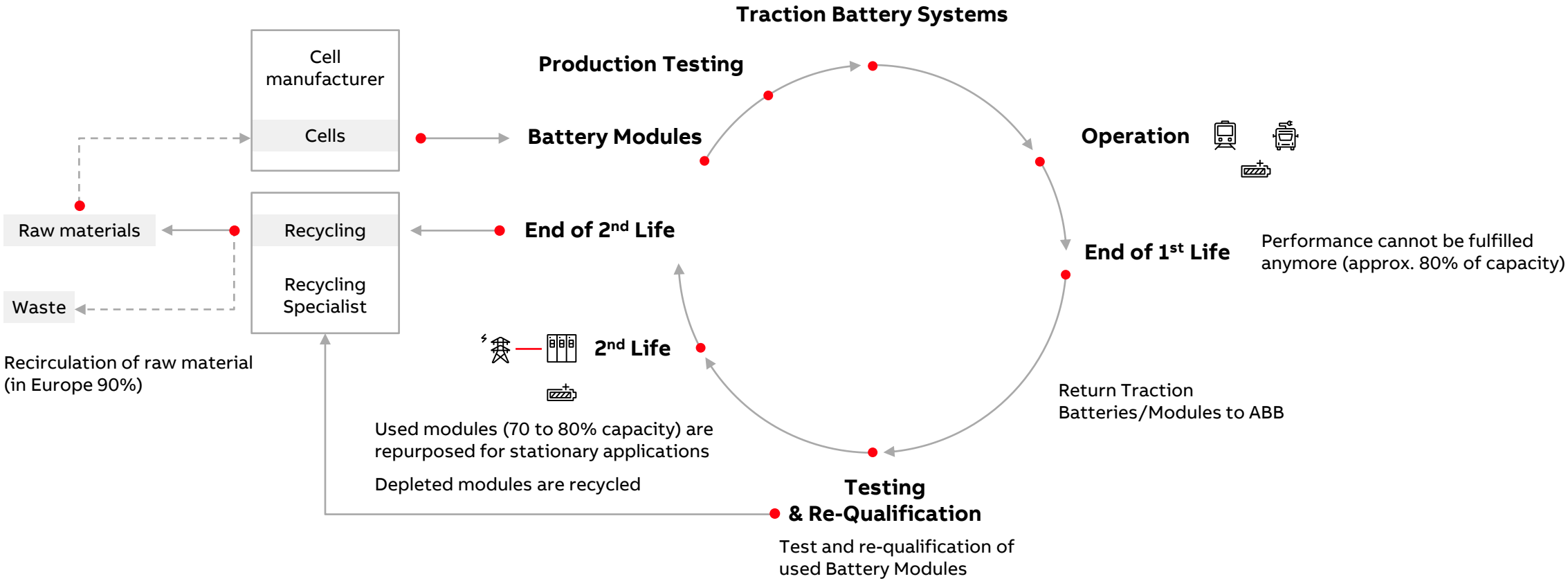
Wide temperature operation
Excellent performance

Battery management system
Integrated supervision

Configurable interfaces
For all installation needs

Battery Life Cycle

From production till end of life, Service Concept, recycling concept & potential 2nd Life Concept



Fully Automated Laser Welding

Pro Series Battery Packs

Pro Series

- Each Pro Pack includes 24 modules
- Each module requires 64 weld seams — totaling up to 1,536 seams per Pro Pack
- Cycle time under 2 minutes per module, including integrated automated Weld Seam Inspection (WSI)

Why Technology for Weld Seam Inspection (WSI) is Needed

	Current Challenges	Possible Solution with Automated WSI
Real-Time Monitoring	Existing measuring equipment does not provide reliable and continuous measurement during the welding process.	Pre-, in-, and post-process monitoring with high accuracy and independent measurement systems.
Quality Control	Visual inspection after welding is subjective and highly dependent on the auditor.	Independent measurements allow objective evaluation, enabling earlier detection of defects.
Testing Time	Each weld must be visually inspected after the welding process, consuming significant time.	In-situ measurement and real-time evaluation streamline the process.
Sustainability	Faulty welds are often identified late in the process, resulting in unnecessary material waste and production time.	Early detection allows for adjustments before or during welding, significantly reducing material waste and costs.

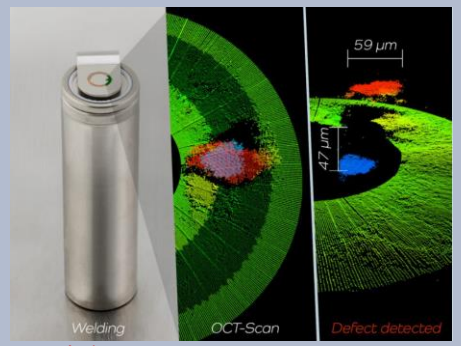
Laser Welding Monitoring (LWM)

Analysed Technologies for Automated Production

	Advantages	Challenges	Potential
Optical Coherence Tomography (OCT)	• Detection of external and internal defects • Pre-/In-/Post-Monitoring *Evenness Cell Connector, Weld Depth, Weld Geometry*	• Data processing requires significant computational power • Cycle time	
Photo Diode Measuring System (PDMS)	• Fast, real-time data collection • Surface defects can be detected quickly during the welding process. • Investment costs *Key Holes, (Gap between layer)*	• Influenced by process light and "Schmauch“ • Requires calibration for a stable analysis	
Machine Vision	• Effective surface defect detection • Flexible, suitable for multiple processes. *Key Holes at the Surface, Weld Geometry*	• Limited to surface inspection • Requires large data sets for training	

Key insights

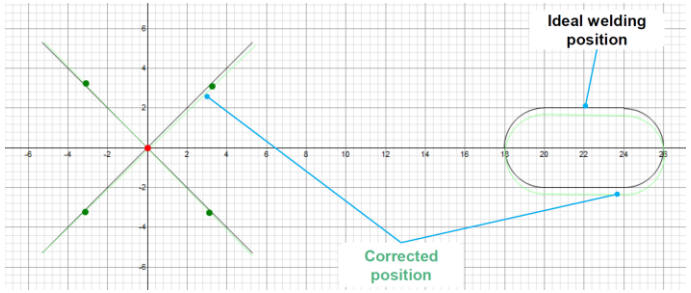
- **OCT** offers the best defect detection: It identifies both **external and internal** flaws
- Automation-ready: All systems can support automated production, but **OCT** offers the **most comprehensive data** for process optimization.
- **PDMS** is **fast** but affected by light and limited to real-time depth info. **Machine Vision** is **flexible** but only detects surface defects.



OCT | Picture source

Optical Coherence Tomography (OCT)

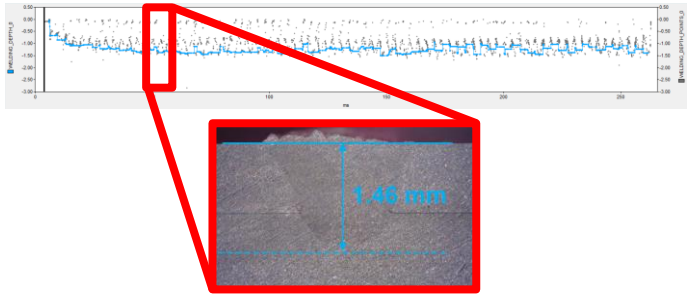
Pre-Process



- Measures various distances to ensure correct positioning
- Centers the laser at the optimal welding point

Early defect detection: Finds surface and internal defects immediately, reducing rework and scrap

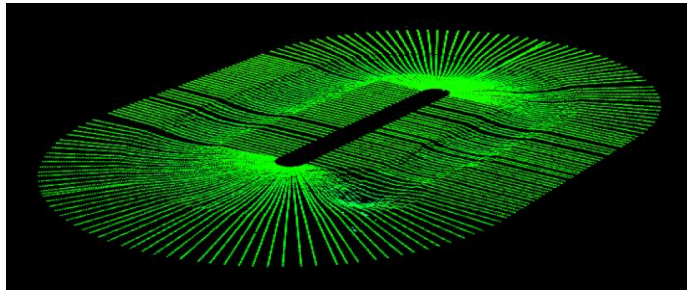
In-Process



- Measures keyhole depth to ensure proper weld penetration
- Enables immediate corrective actions to reduce rework

High precision: Accurately measures keyhole depth and welding position with micrometer resolution.

Post-Process



- Scans the weld surface to detect errors between the cell terminal and cell connector
- Inspects the surface for defects such as gaps, cracks, or uneven welds

Non-contact & safe: Uses light-based scanning, so it doesn't damage components during inspection.


ABB