

LEADING IN  
PRODUCTION  
EFFICIENCY

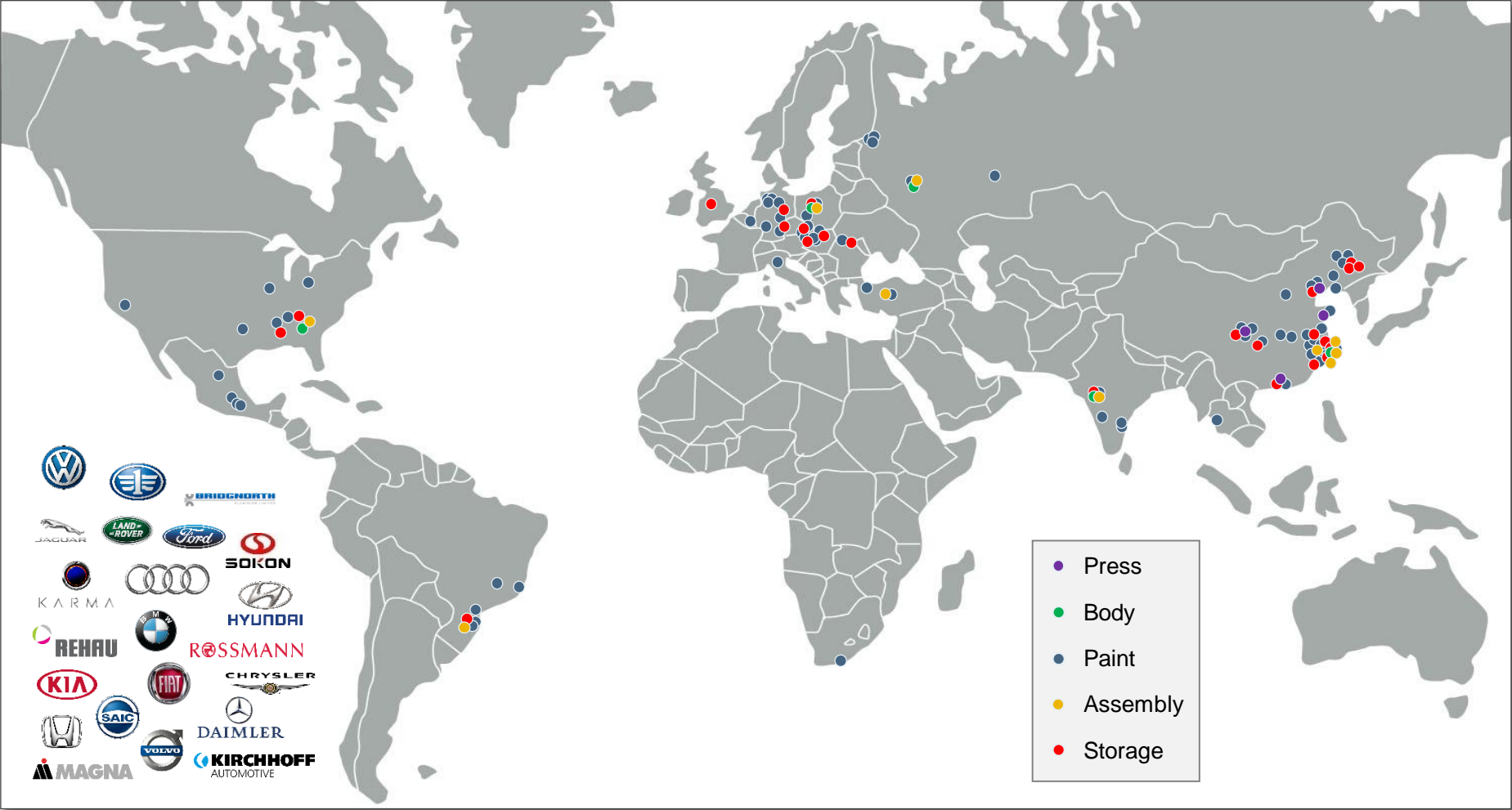
The background of the slide is a blue-tinted photograph of an industrial machine, possibly a spray coating system, with a nozzle spraying a substance onto a surface. A solid blue square is positioned on the right side of the slide, partially overlapping the text area.

## **DXQ – State of the art software products for plant operation**

October 23, 2019  
Bietigheim-Bissingen

**Bernd Kremer, Senior Manager Sales Digital Solutions, Dürr Systems AG**

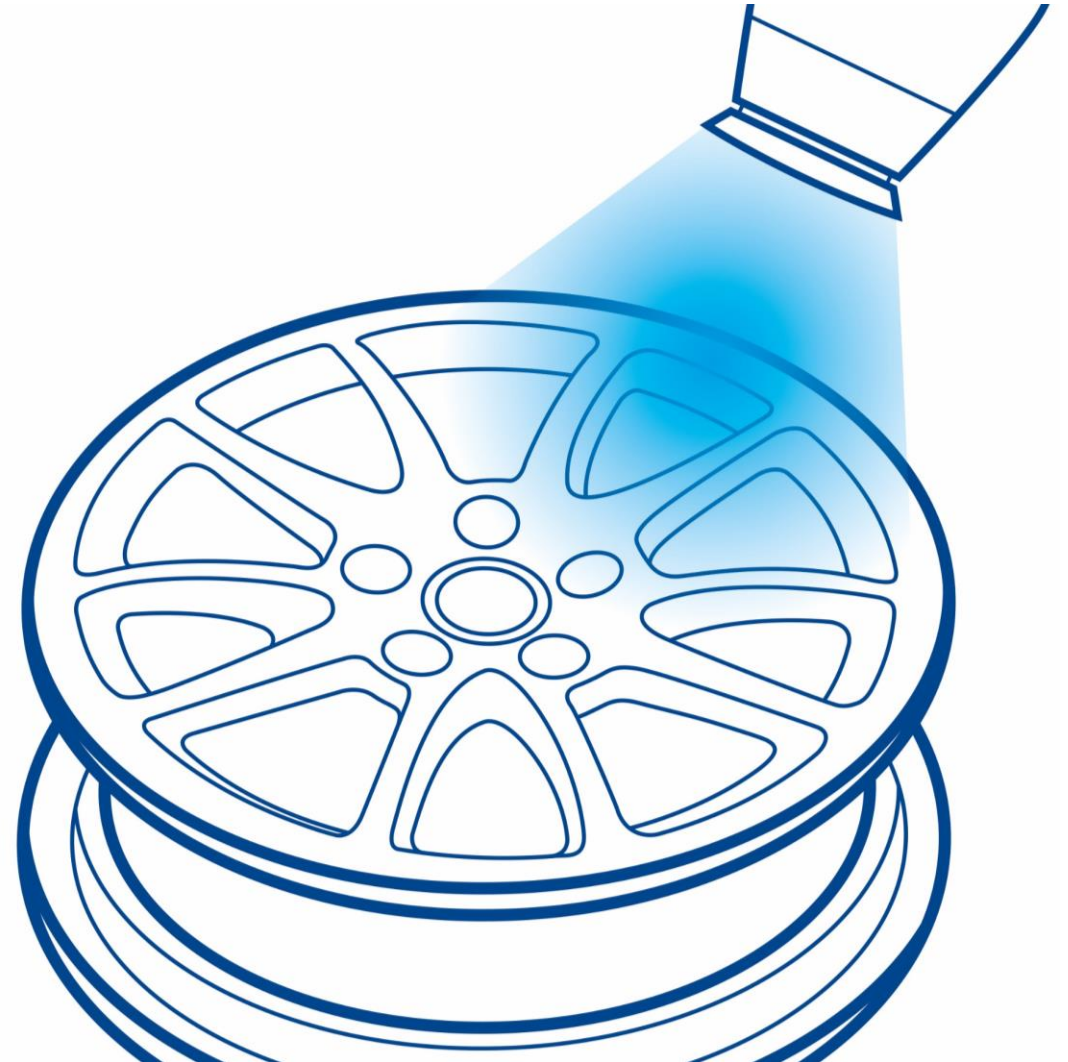
# Dürr – 21 years of digital transparency with Dürr



## Global success

- 178 shops
- 105 locations
- 20 countries
- 6 completely integrated factory systems
- 4 press shops

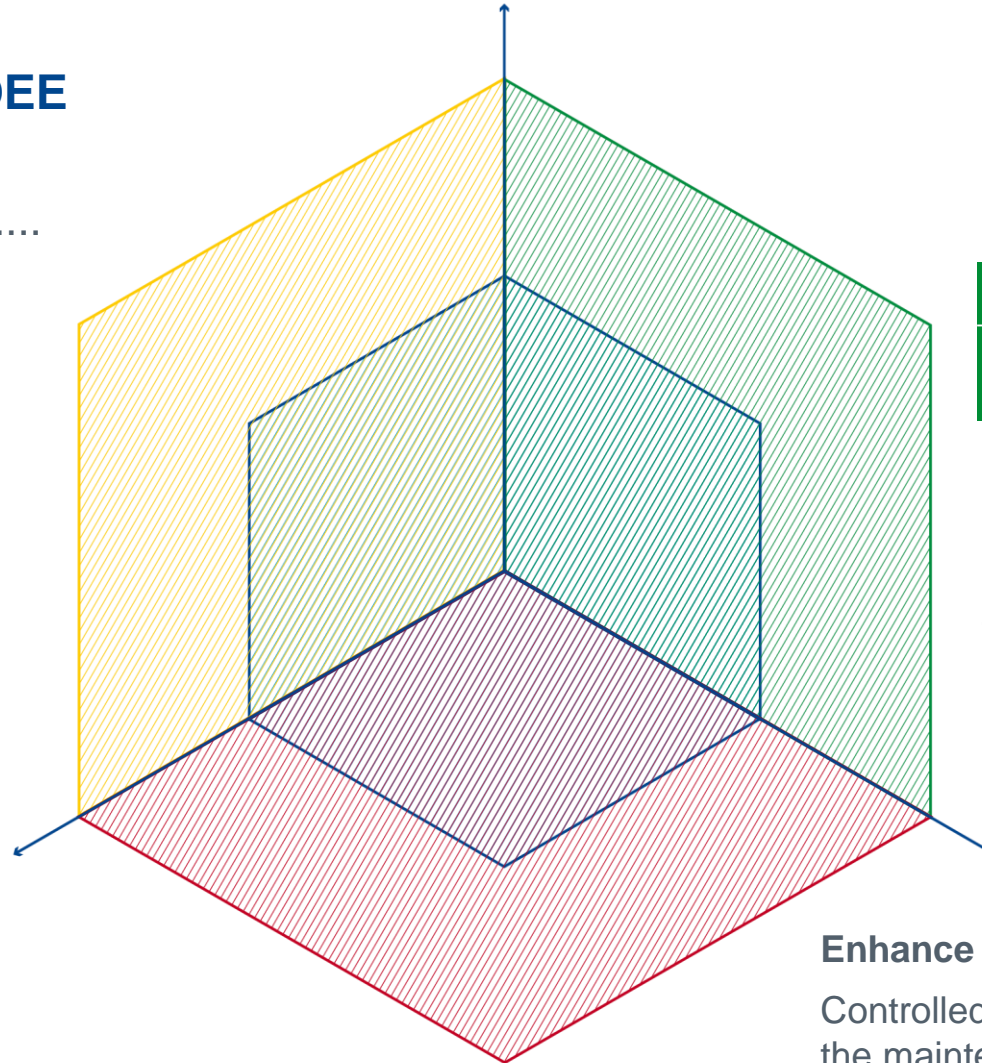
- 1 DXQ digitalization by Dürr
- 2 Wheel tracking solution by Olpidürr
- 3 Questions and answers



# Plant operation

## Approaches to improve the OEE

OEE is made up of three aspects ....



### 100% system performance

The main focus of operations and production planning departments

#### Factory transparency and control

Production control driven by the MES with optional modules (e.g. Advanced Planning, Material logistics, ...)

- **DXQ**operate
- **DXQ**control

### 100% production quality

The main focus of quality management departments

#### Increase OK units / Quality

Recording production and quality data with reference to the single product. Analysis and correlation of the recorded data

- **DXQ**equipment.analytics
- **DXQ**plant.analytics

### 100% system availability

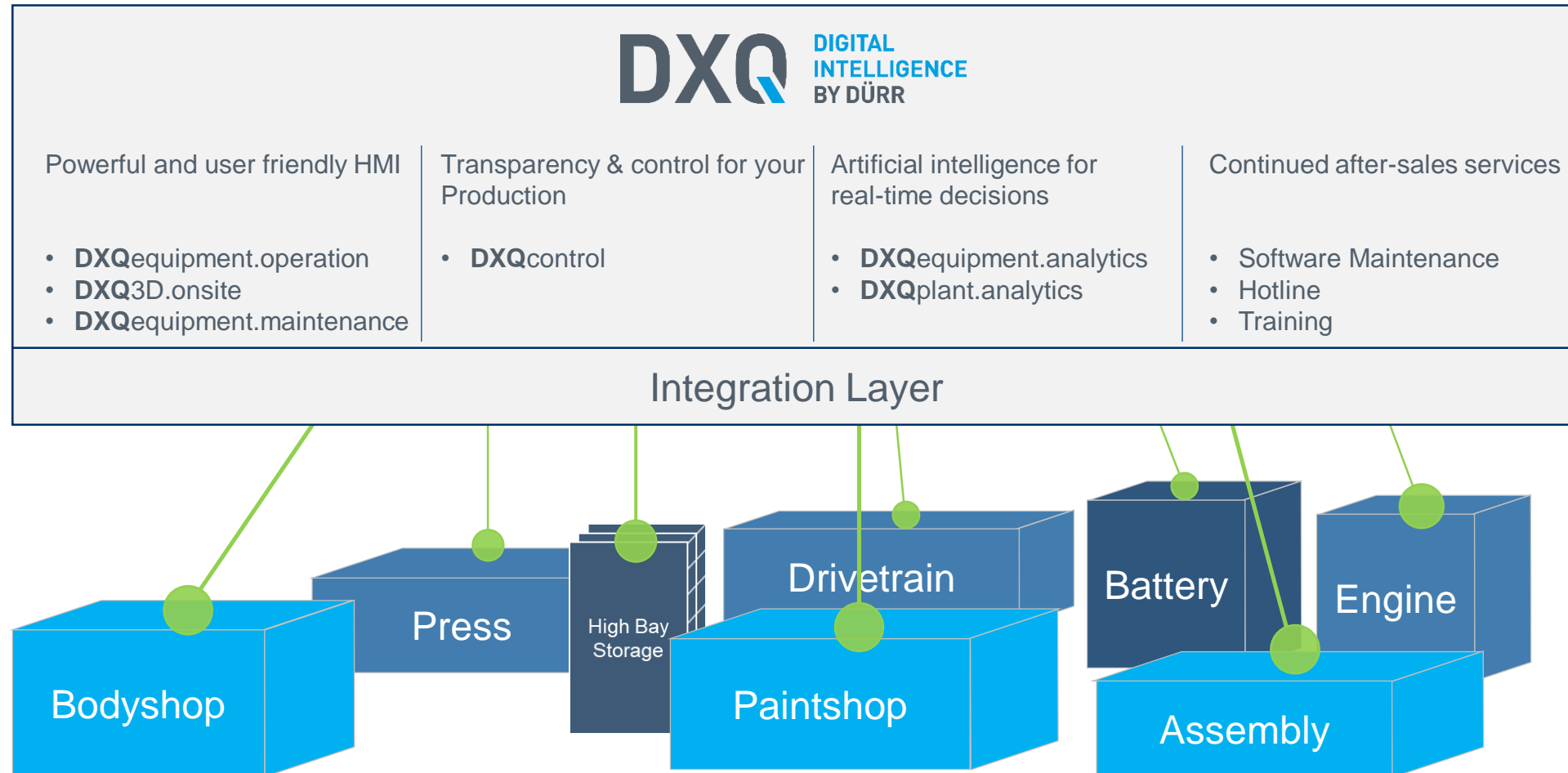
The main focus of maintenance management departments

#### Enhance Availability

Controlled maintenance in accordance with the maintenance plan including recording of the tasks and findings.

- **DXQ**maintenance.assistant
- **DXQ**equipment.analytics

# The DXQ portfolio



# DXQequipment. operation

## Features:

- Touch based user interface for process, conveyors and application usage
- Scalable from machine to plant to factory
- User interface for the visual analysis of time series and event data
- HTML5 based, supporting all standard devices
- Adresses color blind people

## Benefits:

- Any HTML5 based device can be used
- Ease of use due to concentration on user
- Optimized operation philosophy
- Fully integrated into the DXQ product family

## Added Value:

- Increased plant availability through faster troubleshooting.
- Full integration of data into IIOT world of ADAMOS



## Features:

- Automatic observation of maintenance tasks for the entire plant
- Maintenance planning according to usage, run-times and equipment condition.
- Plant visualization indicates due maintenance tasks.
- Customizable database to adjust tasks and integrate other systems.

## Benefits:

- Operation of the equipment at the defined optimum operating point according to specifications.
- Maintenance according defined activities with appropriate documentation.
- Complete history of executed maintenance tasks.

## Added Value:

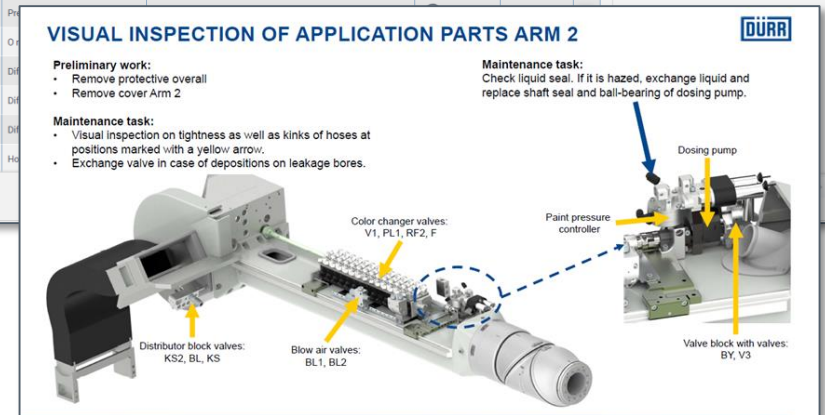
- Increased availability and reliability of the equipment / plant.
- Holistic increase of overall plant effectiveness.
- Reduction of maintenance management effort.

## VIDEO:

[https://www.durr.com/fileadmin/durr.com/01\\_Products/12\\_Software\\_Controls/DXQ/01\\_DXQoperate/duerr-dxqequipment-maintenance-video-de.mp4](https://www.durr.com/fileadmin/durr.com/01_Products/12_Software_Controls/DXQ/01_DXQoperate/duerr-dxqequipment-maintenance-video-de.mp4)

The screenshot displays the DXQoperate software interface. The main window shows a table of maintenance tasks with columns for Ident Number, Function Group, Function Element, Component, Task, Next Maintenance, and Status. The table lists various tasks such as 'Purge cycle', 'Spray pattern', 'Brakes of all axes', and 'Electrical connectors'. A detailed view on the right shows the 'Check' task for 'CC exterior R11 Arm 2', including a description, next maintenance date (04/10/2019), interval (1 Week), and premonition (1 Day before).

Ident Number	Function Group	Function Element	Component	Task	Next Maintenance	Status
CC exterior	R11	EcoBell3	Purge cycle	Check	04/04/2019	Red
CC exterior	R11	EcoBell3	Spray pattern	Check	04/04/2019	Red
CC exterior	R11	Arm 2	Arm 2	Check	04/10/2019	Red
CC exterior	R11	EcoBell3	EcoBell3	Check	04/10/2019	Red
CC exterior	R11	Robot	Brakes of all axes	Check	05/03/2019	Orange
300261	TA101	F100	Electrical connectors	Check	05/03/2019	Yellow
300261	TA101	F200	Electrical connectors	Check	05/03/2019	Yellow
300261	TA101	M06	Actuator	Check	05/03/2019	Yellow
300261	TA101	M26	Actuator	Check	05/03/2019	Yellow
300261	TA101	M36	Actuator	Check	05/03/2019	Yellow
300261	TA101	P115	Bimetal thermometer	Check	05/03/2019	Yellow
300261	TA101	Q16	Actuator	Check	05/03/2019	Yellow
300261	TA101	R241	Stainless steel compensator DN200	Check	05/03/2019	Yellow
P1C1T1	TA111	P112	Pressure transducer	Check	05/03/2019	Yellow
CC exterior	R11	Hand axis	Hand axis	Check	05/03/2019	Yellow
300261	TA101	B12	Distributor block valves	Check	05/03/2019	Yellow
300261	TA101	B32	Blow air valves	Check	05/03/2019	Yellow
300261	TA101	B42	Color changer valves	Check	05/03/2019	Yellow
300261	TA101	E19	Valve block with valves	Check	05/03/2019	Yellow



## Features:

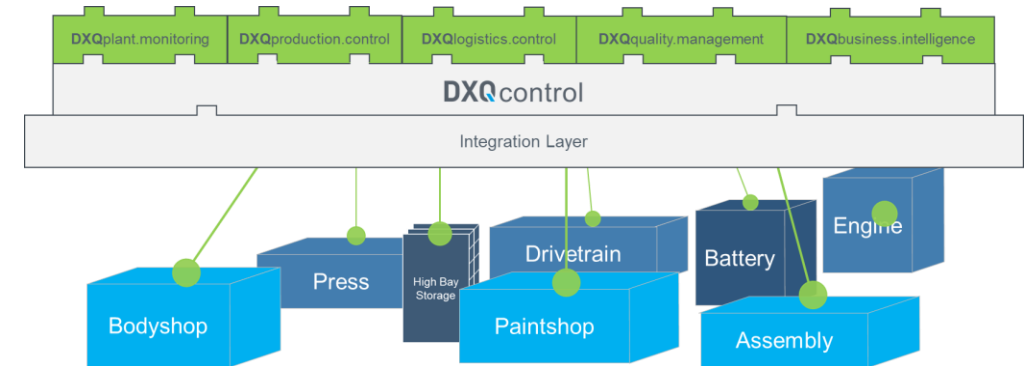
- Complete MES / SCADA functionality for Production, Maintenance, Logistics and Quality in automotive factories
  - DXQplant.monitoring
  - DXQproduction.control
  - DXQlogistics.control
  - DXQquality.management
  - DXQbusiness.intelligence

## Benefits:

- Standards-based portfolio - Modular and Scalable
- Digital solutions for planning, operation, and control in sync with production
- Open interfaces for rapid integration

## Added Value:

- Transparency and control for your production
- Turnkey solutions for automotive production





## Features:

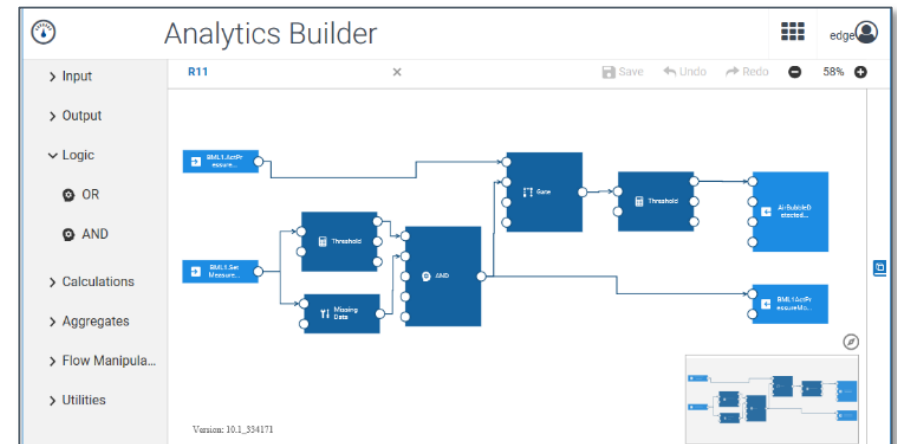
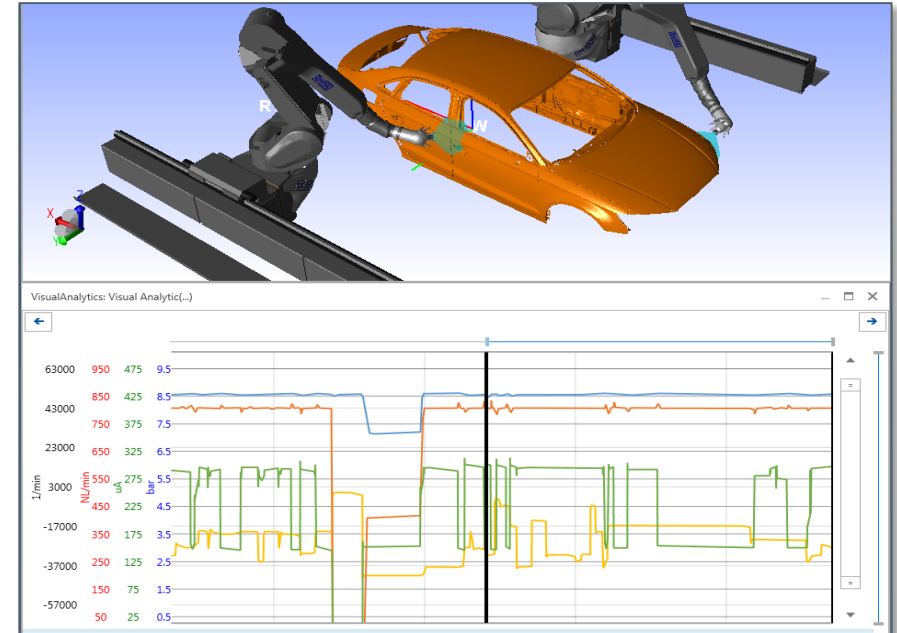
- Acquisition and analysis of sensor, actor and production data with one tool
- Synchronous 3D visualization with the cursor position (time) in the signal representation.
- Identify quality problems. Optimizing process parameters and path programs. Carry out cause analyses.
- Graphical creation of analysis models instead of programming.

## Benefits:

- Near real-time analysis of sensor data for the detection of patterns, errors.
- Digital fingerprint of the workpieces for the customers.

## Added Value:

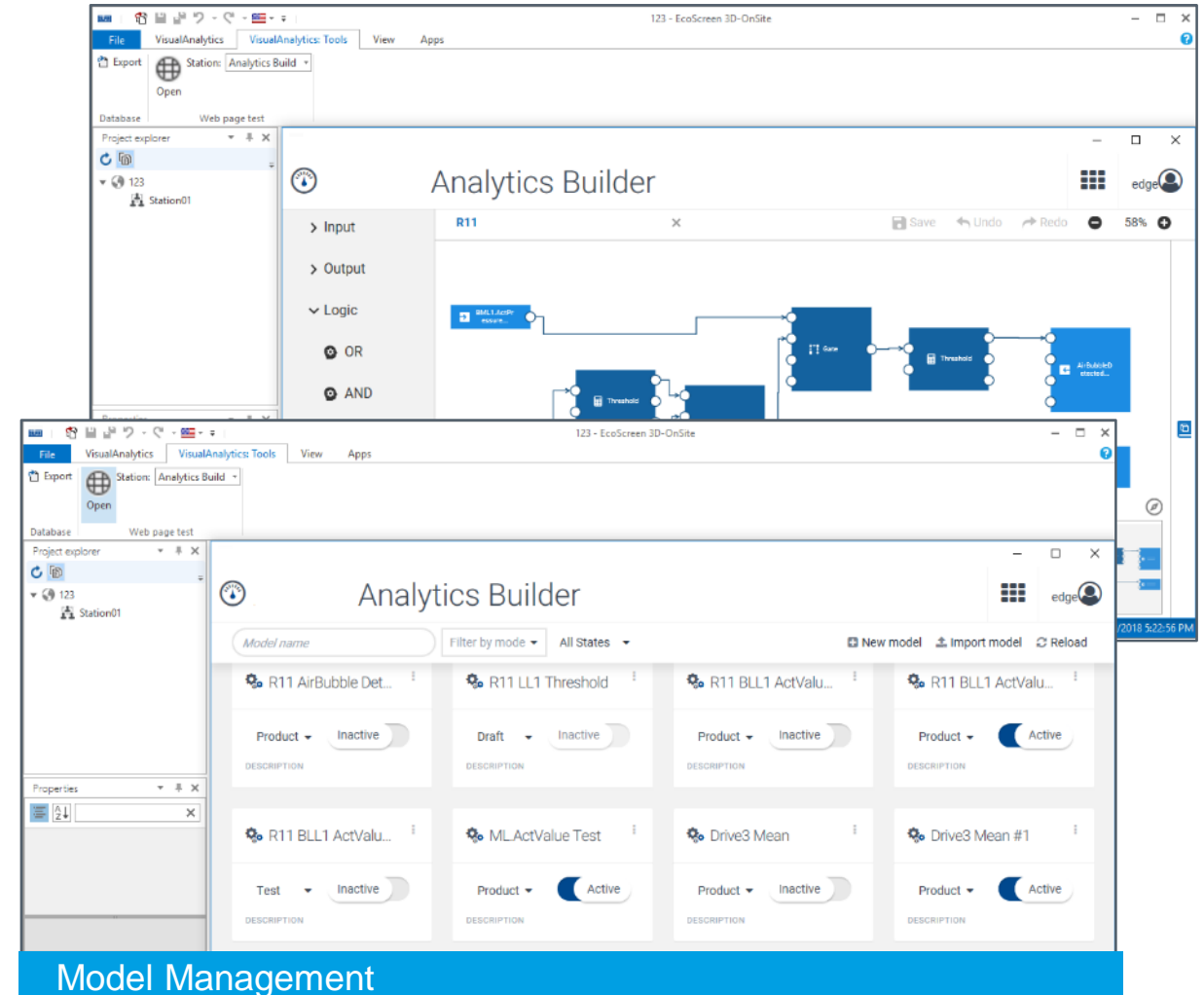
- Increased plant availability by faster troubleshooting and predictive maintenance
- Increased quality of the produced workpieces (increased First-Run-Rate).
- Lower cost of workpiece quality due to elimination of inspection stations.



# Design and functional principle

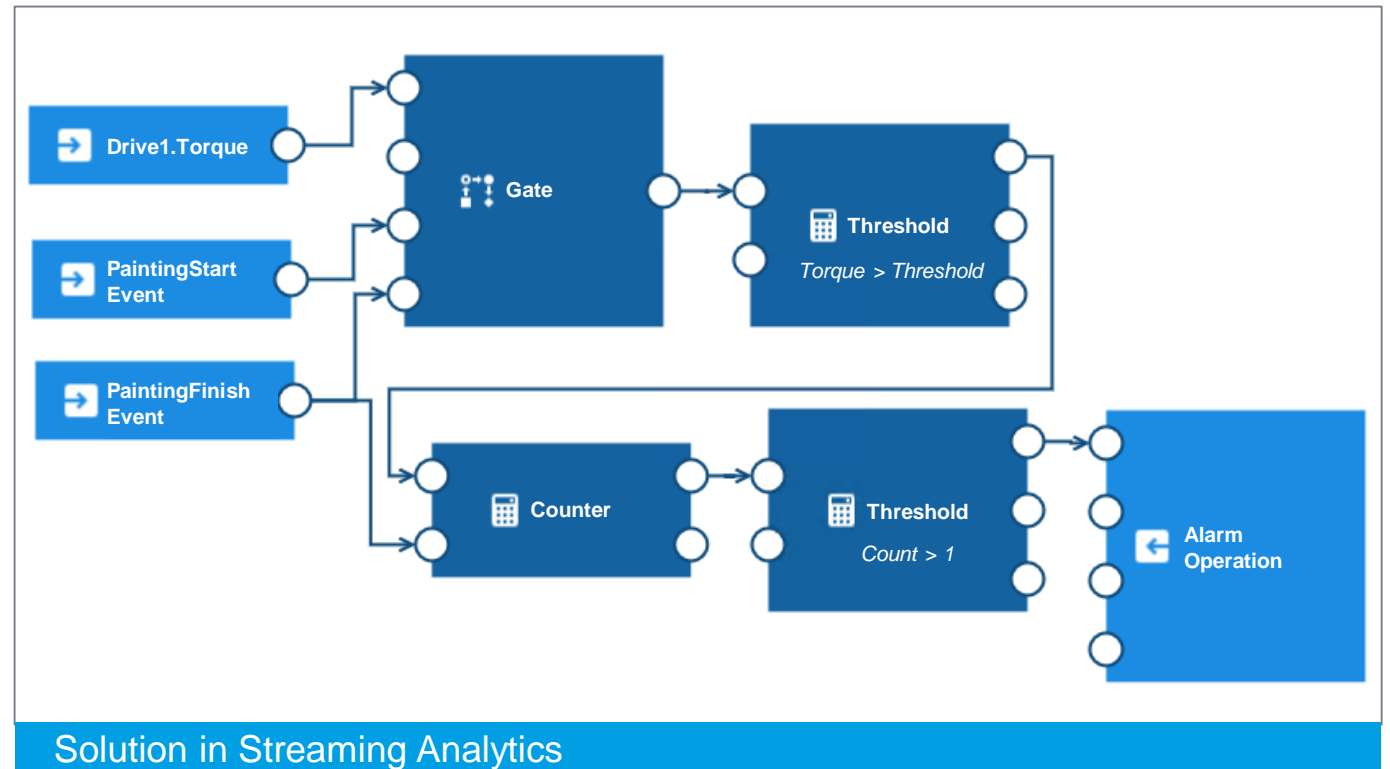
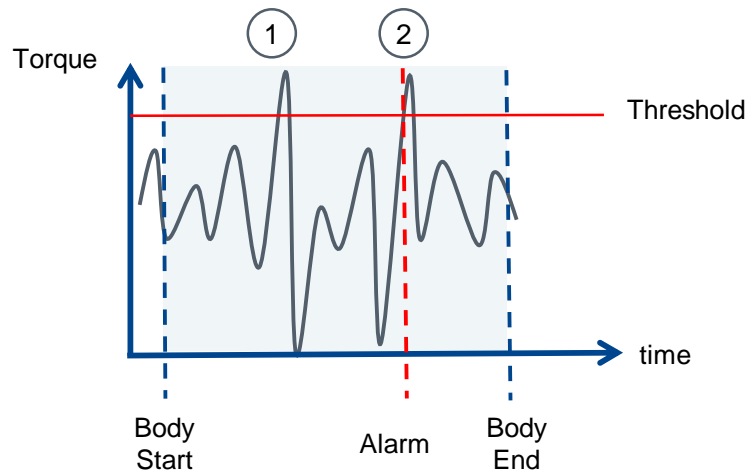
## Streaming Analytics – Model management and editor

- Analyze Data Streams to recognize Patterns, Relationships and Errors
- Near real-time Processing of Sensor Data and Events
- Extensive Block Library
- Graphical Editor to build Models by connecting Blocks
- No Programming Skills required
- Configurable Reaction Types to Model Output (i.e. stop station)
- Store Model Output in Database
- Simple Model Management
- Simulate Models on historical Data before Deployment



## Streaming Analytics – Example of application

- Torque peak counter Axis 1
  - Stop conveyor if threshold is breached the second time



Task

Solution in Streaming Analytics

## Features:

- Near real-time monitoring of the quality of the heat-up and baking process
- Near real-time simulation of car body specific heat-up curves
- Permanent and car body specific recording of process data and simulated heat-up curves
- Simplified recording and evaluation of test- and calibration runs
- Car body specific display of heat-up curves and process values
- Transparency of baking process due to near real-time display of key figures
- Integrated in DXQequipment.operation

## Benefits:

- Simplified evaluation of heat-up curves
- Digital fingerprint of the workpieces for the customer
- Central and permanent storage of sensor values of measurement runs

## Added Value:

- Support with tests and calibration as well as with process and quality surveillance

## VIDEO:

[https://www.durr.com/fileadmin/durr.com/01\\_Products/12\\_Software\\_Controls/DXQ/02\\_DXQanalyze/duerr-dxqequipment-analytics-video-de.mp4](https://www.durr.com/fileadmin/durr.com/01_Products/12_Software_Controls/DXQ/02_DXQanalyze/duerr-dxqequipment-analytics-video-de.mp4)



### AI-based analytics models

#### Anomaly detection – Quality indicator

- Self-learning system
- Detection of parameters responsible for quality deviations in the Turbine, Shaping Air, High Voltage, Dosage Pump due to e.g.
  - Disruption of paint supply (Air bubbles)
  - Dirt (Shaping Air, External Charging)
  - Loss of bell-cup
  - Viscosity deviations
- Prediction about car body quality → Visualization of quality indicator per vehicle (ok, nok)

#### Predictive maintenance

- Self-learning, predictive detection of:
  - Dirt, residual humidity on the atomizer
  - Residual Life Time of
    - Mixer (2K)
    - Pumps
    - Main needle valve
  - Problems with valve action (according to long rinsing)
  - Change of motor behaviour (temp, torque)
  - Leakage on paint pressure regulator
  - Wear of Turbine, shaping air and LCC-drive



Logbook quality problems

Feedback Customer

Logbook equipment problems

### AI-based analytics models

#### Process monitoring and fault analysis

- Detection of signal patterns in historic data for fault analysis
- Fault prediction for monitoring the bath temperature of the e-coat and pre-treatment
- Simulation for monitoring the heat-up curves of the EcoIncure
- Root-Cause-Analysis for Air (re-)circulation as well as e-coat and pre-treatment

#### Detection of quality problems and anomalies

- Detection of systematic patterns in quality defects in terms of body color, type, fault type and position throughout the complete plant
- Detection of process anomalies for air (re-)circulation as well as e-coat and pre-treatment

Maintenance plans

Feedback Customer

Quality defects from inspection



## Features:

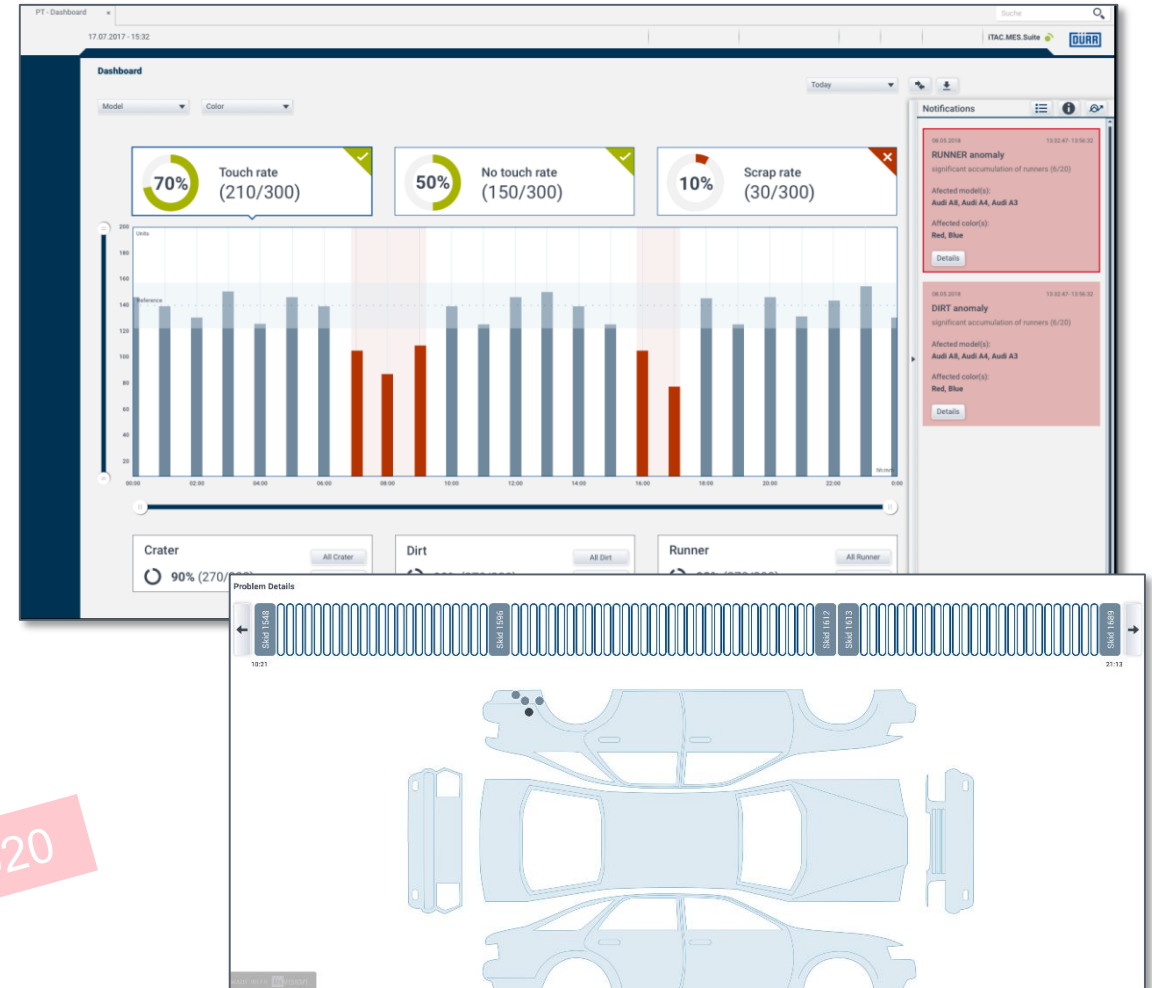
- Correlation of process data and work piece quality data alongside the whole value chain
- Dashboarding for quality relevant plant KPIs
- Smart pattern recognition for systematic quality defects
- Structured visualization of workpiece-related life cycle data

## Benefits:

- Early detection of defects to reduce production costs
- Prevention of production stops due to quality defects
- Indication of root-causes based on Big-Data-Analytics and expert rules

## Added Value:

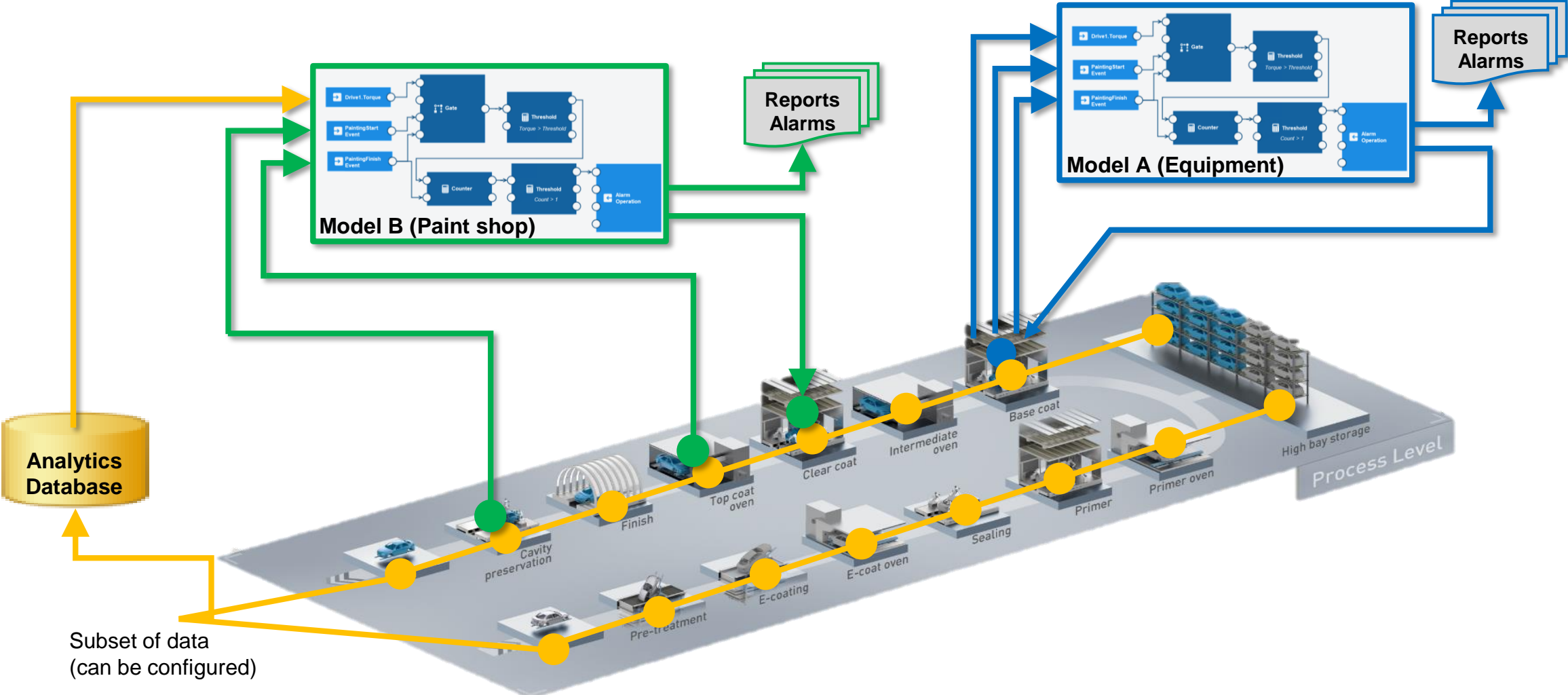
- Increase of First-Run-Rate and reduction of rework
- Reduced maintenance and repair effort
- Holistic increase of paint shop efficiency



Available in 2020

# Plant operation / OEE Improvement

Correlation of data, signals, events as sources of action





# DXQsupport

## Excellence through cooperation and service



### Features:

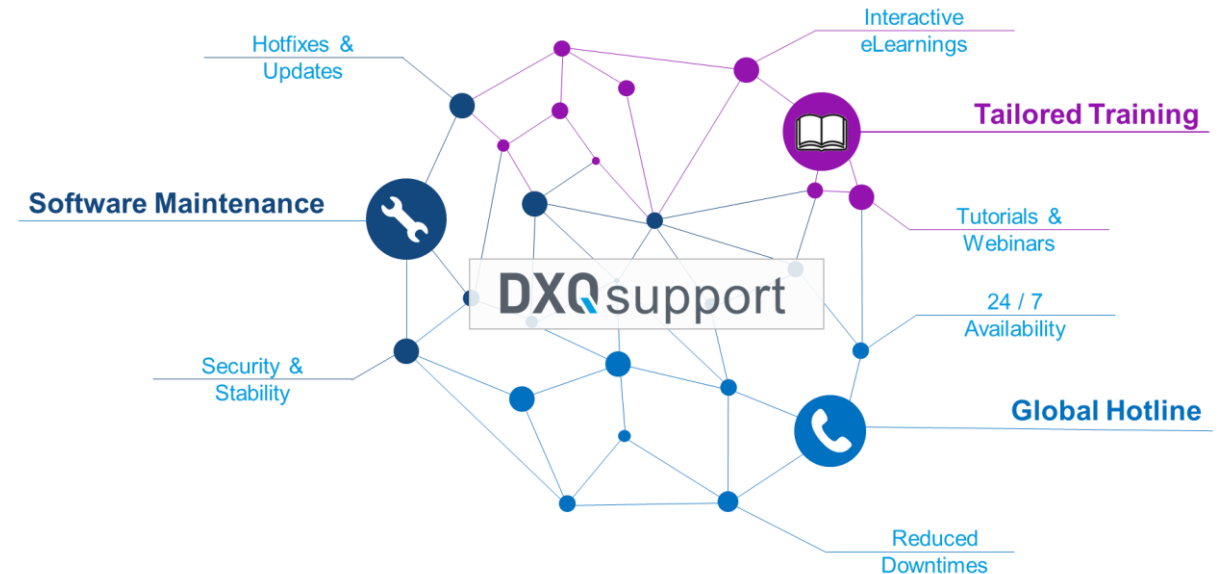
- Central hotline for DXQ products
- Extended Services (System Audits, Database Administration, Ramp-Up Assistance)
- Tailored and modular training catalogue
- Continuous updates through software maintenance

### Benefits:

- Increased Performance, Quality, Availability and Security
- Direct and quick access to system experts
- Regular updates ensure security and stability
- Increased know-how through tailored trainings

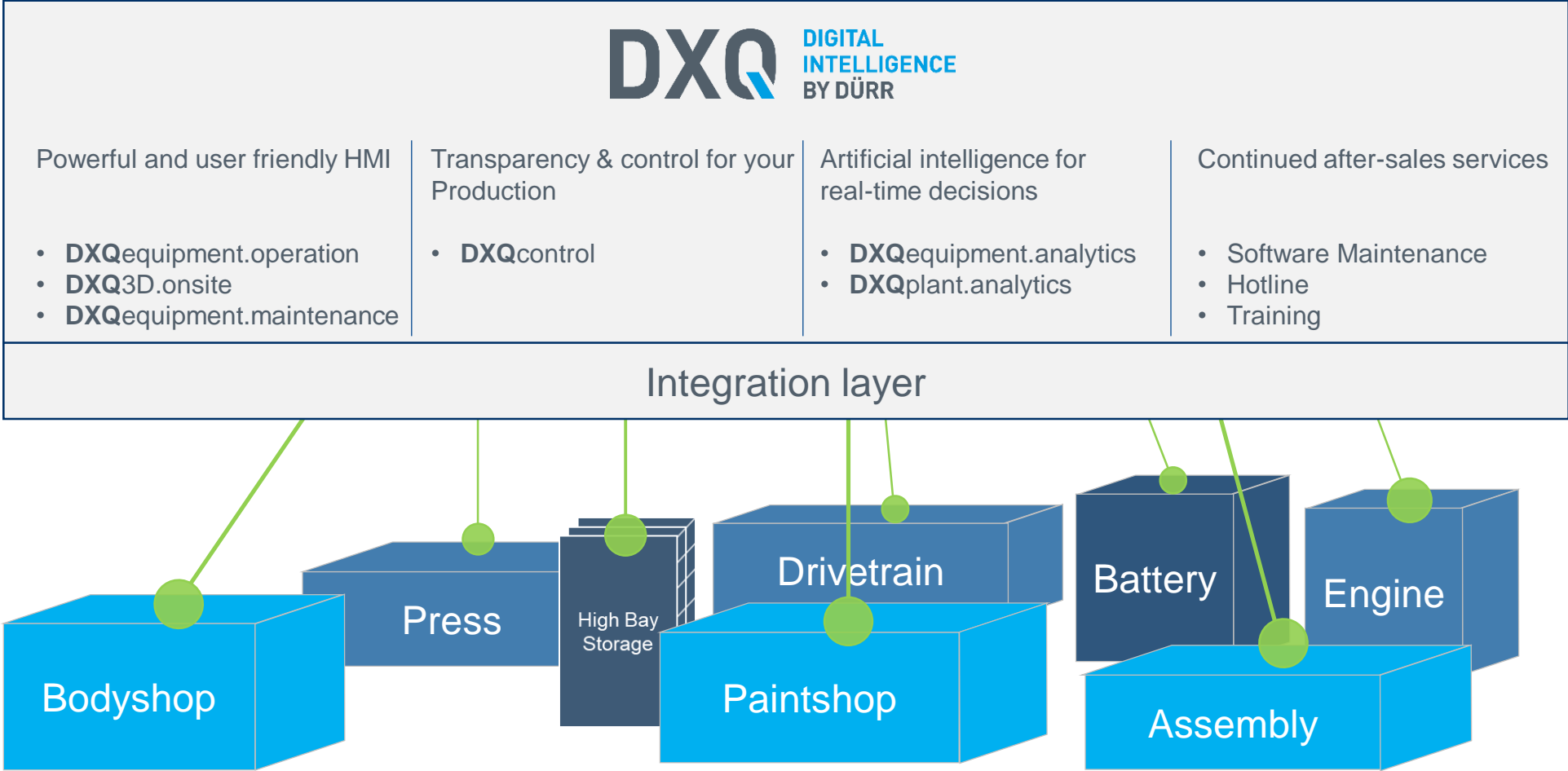
### References:

- Hotline, Training, Maintenance
  - All Dürr software installations

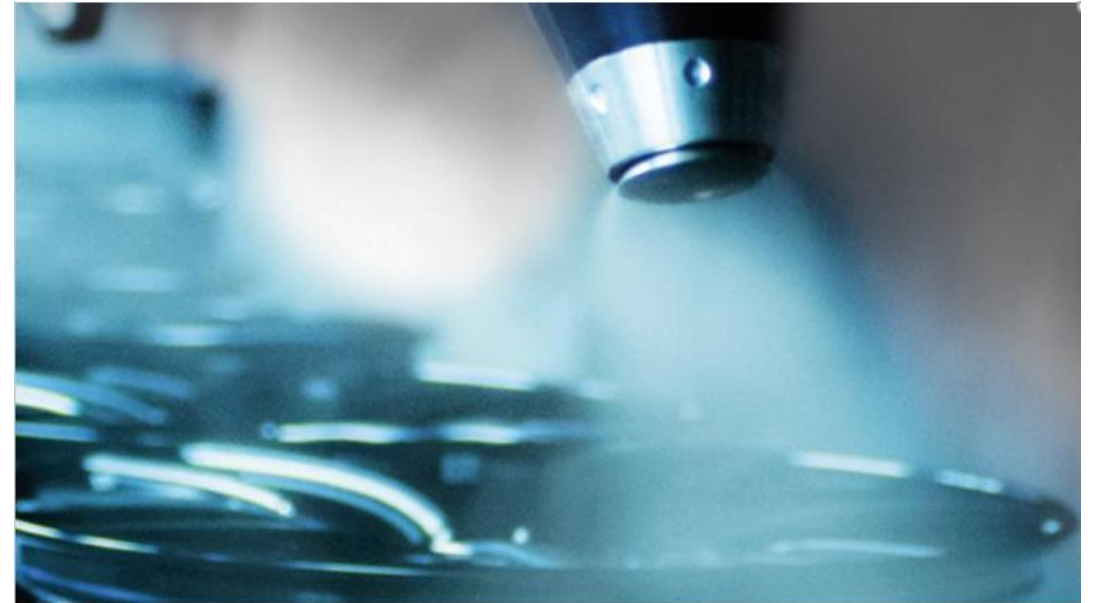


# Digitalization

## The DXQ portfolio



- 1 DXQ digitalization by Dürr
- 2 Wheel tracking solution by Olpidürr
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## ERP system

- Customer orders, purchasing, invoicing
- ...

Standardized ERP integration layer



## MES System

- Production management, machine data collection, traceability, process control
- ...

Standardized shop floor integration layer

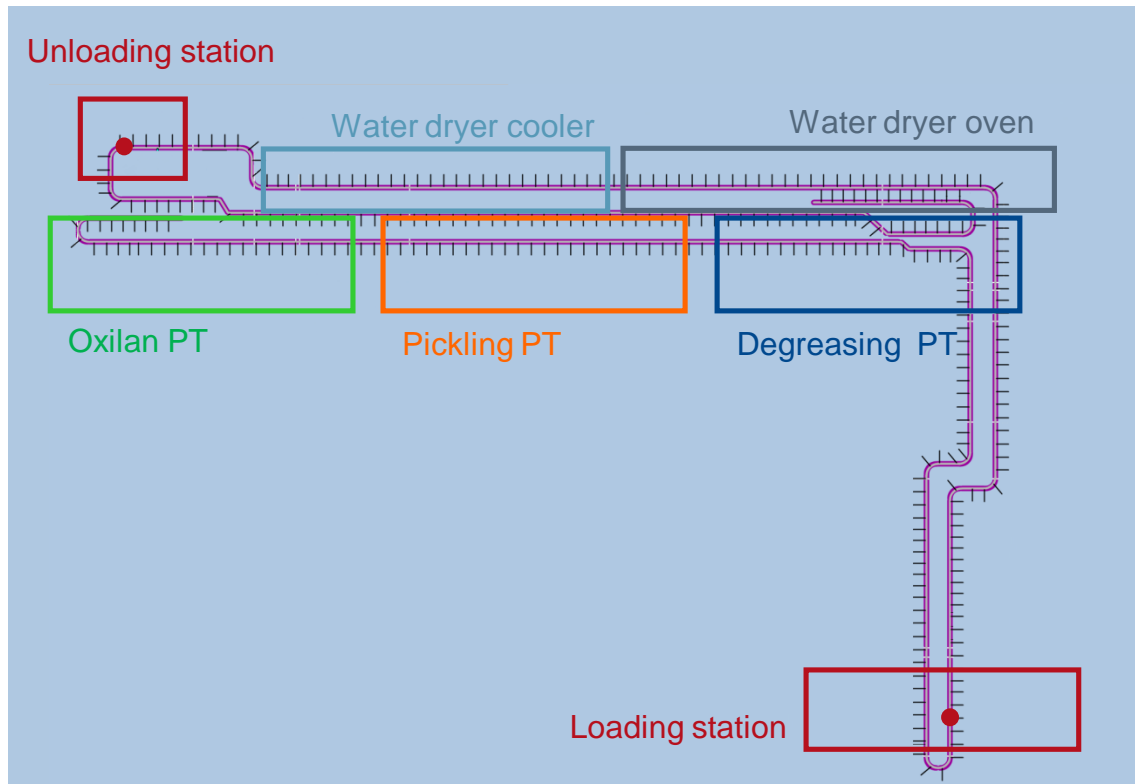


## Shop floor

- Execution of production orders incl. confirmation to MES
- ...

# Wheels traceability

## Tracking points



## How many tracking points?

- Loading station
- Degreasing section
- Pickling section
- Oxilan section
- Waterdryer oven
- Waterdryer cooler
- Transfer station (from the Pretreatment loop to the following ones)
- ...

For each tracking point the system records and archive all the information

# Masterdata (Wheel editor)



- Management of all production parameters -

The screenshot displays the 'Masterdata (Wheel editor)' interface. At the top, there is a header bar with the DÜRR logo, user information (Administrator, # 1200), and system status (09:20:42). Below the header, a red bar shows recent logins. The main interface is divided into several sections:

- Left Sidebar:** Contains navigation options for 'Wheel / Stage Association', 'Wheel Types', 'Gripping Offsets', 'Stages', 'Pretreatment', 'IR Oven', 'Base Coat Application', 'Base Coat Color', 'Clear Coat Application', 'Clear Coat Color', 'Powder Application', and 'Powder Color'.
- Central Table:** A table with columns for 'Wheel Name', 'A - External Wheel Diameter [mm]', 'A0 - Wheel Size [inch]', and 'B - Wheel Height'. The table contains several rows of data, with row 0204 highlighted.
- Right Sidebar:** A 'Recipe' management section with a 'Batch' dropdown and a list of recipes. The 'Pretreatment' recipe is highlighted. The list includes various spray and application steps, each with a 'Yes' status.
- Bottom Toolbar:** A horizontal bar with various icons for navigation and system control.

Wheel Name	A - External Wheel Diameter [mm]	A0 - Wheel Size [inch]	B - Wheel Height
0203	496.2	18	206.75
0204	496.2	18	206.75
0205	496.2	18	206.75
0206	440.2	16	190.91
0207	471.2	17	207.25
0208	471.2	17	205.6
0209	471.2	17	205.6

Recipe Name	PT
PE011 Spray Enabled	Yes
PE012 G11 Spray Enabled	Yes
PE012 G21 Spray Enabled	Yes
PE013 Spray Enabled	Yes
PS021 Spray Enabled	Yes
PS021 Q97 Spray Enabled	Yes
PS022 Spray Enabled	Yes
PS022 Q97 Spray Enabled	Yes
PA031 Spray Enabled	Yes
PA031 Q97 Spray Enabled	Yes
PS051 Spray Enabled	Yes
PS051 Q97 Spray Enabled	Yes
PS052 Spray Enabled	Yes
PS052 Q97 Spray Enabled	Yes
PS053 Spray Enabled	Yes
PS053 Q97 Spray Enabled	Yes
PP061 Spray Enabled	Yes
PP061 Q87 Spray Enabled	Yes
PS071 Spray Enabled	Yes
PS071 Q97 Spray Enabled	Yes
PS072 Spray Enabled	Yes
PS072 Q97 Spray Enabled	Yes

The screenshot displays the 'Conveyor Layout' interface. The main area shows a complex network of conveyor belts represented by green lines and dots, with various stations and components labeled (e.g., SF101, UD101, RB002, UR111, WA111, GT112, BA111, GT113, WA111, GT114, WA111, GT112, BA121, GT122, WA121, RB003, UD121, UD122, UD123, UD124, UD125, UD126, UD127, UD128, UD129, UD130, UD131, UD132, UD133, UD134, UD135, UD136, UD137, UD138, UD139, UD140, UD141, UD142, UD143, UD144, UD145, UD146, UD147, UD148, UD149, UD150). The interface includes a top navigation bar with the DÜRR logo, user information (# 500 Administrator), and a date/time display (09:18:23 2019/10/17). A red status bar at the top contains system messages. On the right, a 'Wheel 1452' specification window is open, showing a table of parameters and a technical drawing of a wheel.

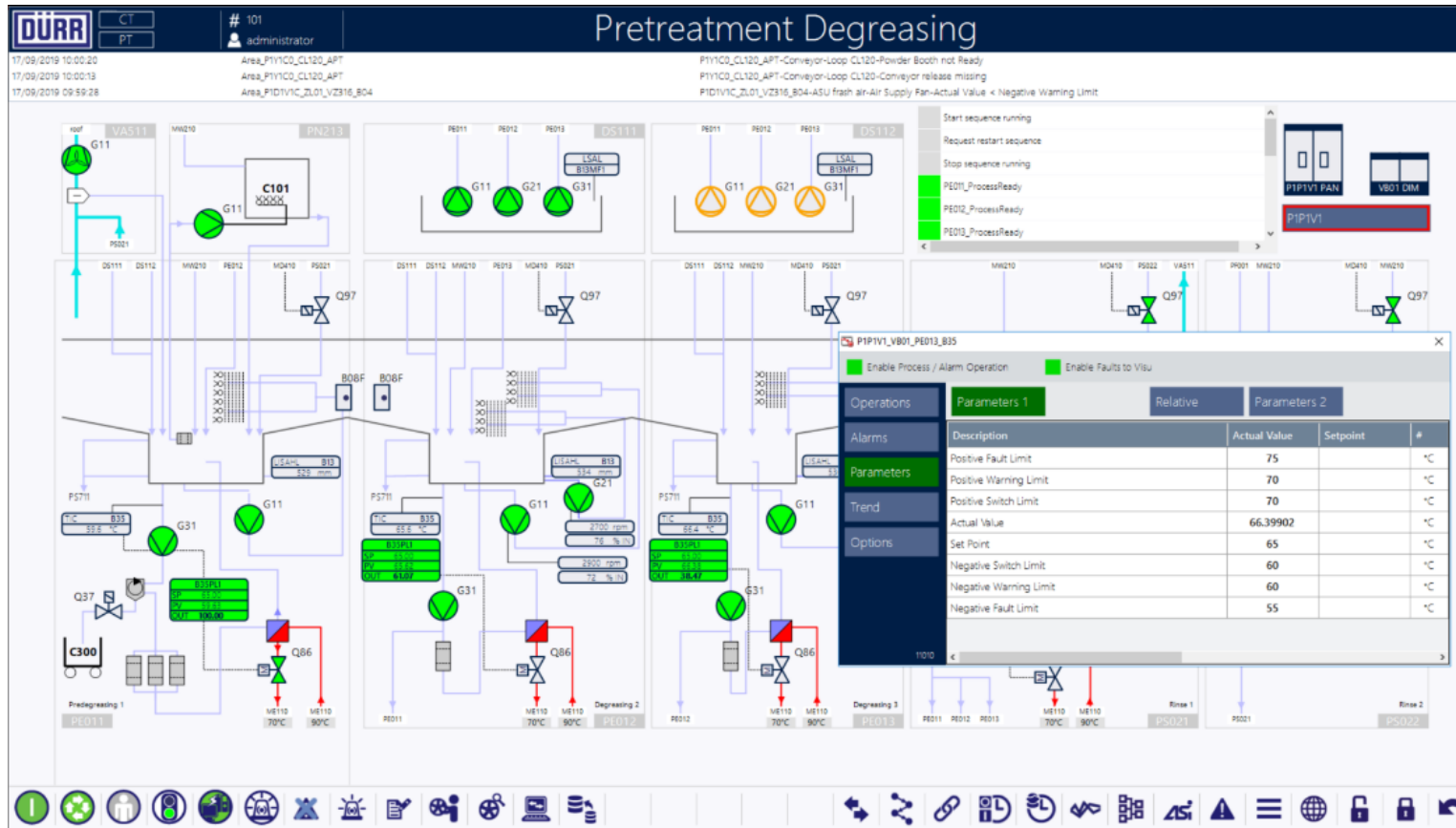
Wheel Name	7585	
A - External Wheel Diameter	471.20	mm
A0 - Wheel Size	17	inch
B - Wheel Height	203.76	mm
B1 - Overlap of the front face	2.91	mm
H - Front Wheel Shoulder to support Surface	62.26	mm
K1 - Rim Height	12.55	mm
M - Gripping Position	42.32	mm
X - Min Diameter of Rim Bed	400.10	mm
Hanger Gripping Offset	0	mm
Wheel Weight	0.00	kg
Hub Cleaning Time	1.7	s
Hub Cleaning Pressure	4.000	Bar
Mounting Face Cleaning Time	1.7	s
Degreasing Spray Override Front Setpoint (1 to 4)	0	
Degreasing Spray Override Rear Setpoint (1 to 4)	0	

## Conveyor overview

- Shows the complete production plant and presents animated with its process lines

## Conveyor monitoring

- Shows all conveyor sections and the status of every motor and all other devices



## Process overview

- Shows all the plant areas as blocks and their status with Drill down capability

## Process monitoring

- A series of overview pages (one for each area).
- Shows all the devices to monitor the analogical/digital values



# 1. Batch TRACKING

## Data record



Each record is composed by following fields:

- Tracking point ID
- Batch ID
- Recipe information (TBD)
- Wheel type
- Time of the first batch position that gets inside
- Time of the first batch position that gets outside
- Empty hanger / spindles ahead of the batch
- Number of hangers/spindles assigned to the batch
- Number of wheels assigned to the batch

The screenshot displays the 'ProductionData' software interface. It features a top navigation bar with 'Active Batches', 'History', and 'Counters' tabs. Below this is a 'Refresh' button and a date selector set to '2019/10/17'. The main area contains two tables. The top table lists active batches with columns for ID, Batch Name, Powder Application, Program Code, Powder Color, Color Code, Base Coat Application, Program Code, Base Coat Color, Color Code, and a 'Cl' column. The bottom table shows the location history for a selected batch (ID 1441), with columns for Location, Entry Date Time, Exit Date Time, Wheels Counter, Hangers/Spindles Counter, and Empty In Front.

ID	Batch Name	Powder Application	Program Code	Powder Color	Color Code	Base Coat Application	Program Code	Base Coat Color	Color Code	Cl
1447	0216_B	0216	116	Gris	3	0216	0216	BrightSilver	B999	02
1446	4506_R	NoPintar	10	Gris	3	4506R	306R	L8Z8	B333	45
1445	4506_B	4506	306	Gris	3	4506	4506	L8Z8	B333	45
1444	4325_B	4325	225	Gris	3	4325	4325	L8Z8	B333	43
1443	7582_B	7582	604	Gris	3	7582	7582	Clicker	B555	75
1442	0210_B	0210	110	Gris	3	0210	0210	BrightSilver	B999	02
1441	0210_R	NoPintar	10	Gris	3	0210R	110R	BrightSilver	B999	02
1440	0211_R	NoPintar	10	Gris	3	0211R	111R	Clicker	B555	02
1439	0211_B	0211	111	Gris	3	0211	0211	Clicker	B555	02
1438	0218_B	0218	118	Gris	3	0218	0218	Clicker	B555	02

Location	Entry Date Time	Exit Date Time	Wheels Counter	Hangers/Spindles Counter	Empty In Front
1 - AQ100	2019/10/17 01:52:03	2019/10/17 02:02:28	88	88	0
3 - GT102 automatic loading	2019/10/17 01:56:04	2019/10/17 02:06:08	84	31	4
4 - Inlet Pt degreasing	2019/10/17 01:59:59	2019/10/17 02:09:06	84	31	4
5 - Outlet Pt degreasing	2019/10/17 02:10:40	2019/10/17 02:18:49	84	31	4
6 - Inlet Pt pickling	2019/10/17 02:10:56	2019/10/17 02:19:05	84	31	4
7 - Outlet Pt pickling	2019/10/17 02:18:02	2019/10/17 02:26:11	84	31	4
8 - Inlet Pt SAM	2019/10/17 02:18:02	2019/10/17 02:26:11	84	31	4
9 - Outlet Pt SAM	2019/10/17 02:24:04	2019/10/17 02:32:13	84	31	4
10 - Inlet Waterdryer oven	2019/10/17 02:33:00	2019/10/17 02:41:09	84	31	4
11 - Outlet Waterdryer oven	2019/10/17 02:59:01	2019/10/17 03:07:10	84	31	4
12 - Inlet Waterdryer cooler	2019/10/17 02:59:17	2019/10/17 03:07:26	84	31	4

The batch record is available when the last batch wheel gets out from the plant (Olpidürr scope of supply)

## 2. Single wheel TRACKING

### Data record

**Each record is composed by following fields:**

- Tracking point ID
- Batch ID
- Wheel ID (QR code?)
- Recipe information (TBD)
- Wheel type
- Time the will remains inside a process area
- Main process data (minimum, maximum value and average)
- Applications sets / process values → have to be discussed with APT suppliers

**The wheel record is available when the last batch wheel gets out from the plant (Olpidürr scope of supply)**

# Historical data

## Results per batch / serial number



ProductionData											
Active Batches			History			Counters					
Refresh		2019/10/17									
ID	Batch Name	Powder Application	Program Code	Powder Color	Color Code	Base Coat Application	Program Code	Base Coat Color	Color Code	Color Code	Color Code
1447	0216_B	0216	116	Gris	3	0216	0216	BrightSilver	B999	B999	0216
1446	4506_R	NoPintar	10	Gris	3	4506R	306R	L8Z8	B333	B333	4506
1445	4506_B	4506	306	Gris	3	4506	4506	L8Z8	B333	B333	4506
1444	4325_B	4325	225	Gris	3	4325	4325	L8Z8	B333	B333	4325
1443	7582_B	7582	604	Gris	3	7582	7582	Clicker	B555	B555	7582
1442	0210_B	0210	110	Gris	3	0210	0210	BrightSilver	B999	B999	0210
1441	0210_R	NoPintar	10	Gris	3	0210R	110R	BrightSilver	B999	B999	0210
1440	0211_R	NoPintar	10	Gris	3	0211R	111R	Clicker	B555	B555	0211
1439	0211_B	0211	111	Gris	3	0211	0211	Clicker	B555	B555	0211
1438	0218_B	0218	118	Gris	3	0218	0218	Clicker	B555	B555	0218

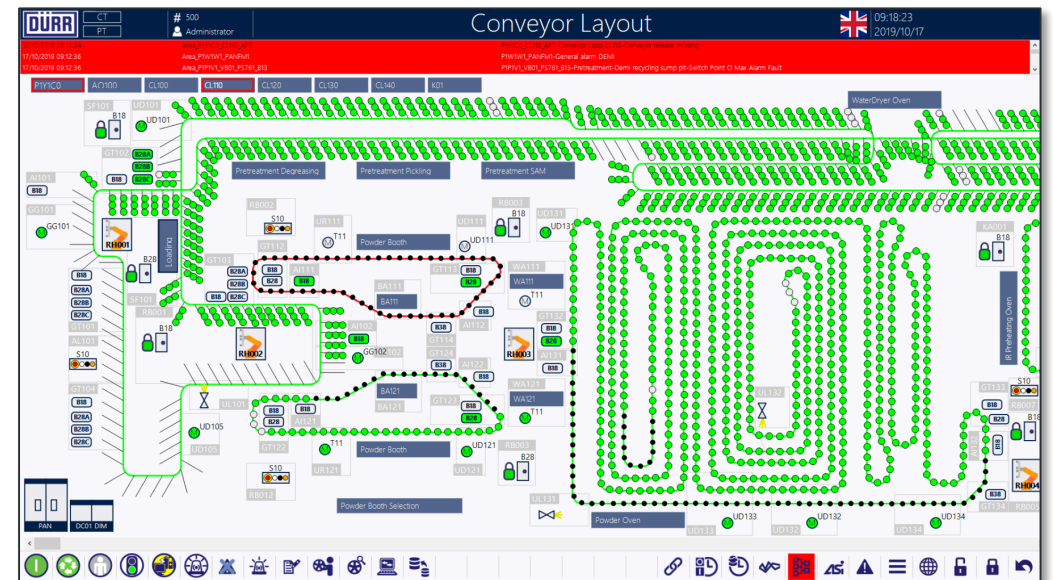
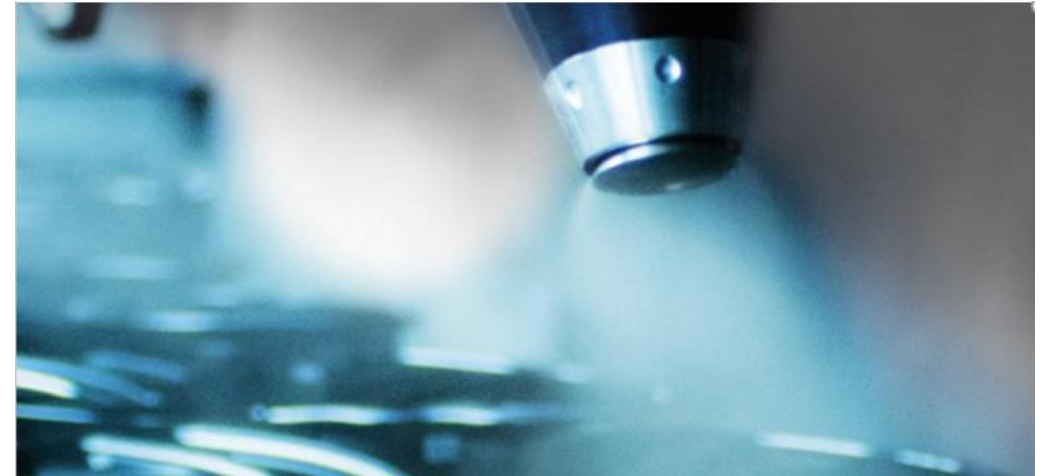
  

Location	Entry Date Time	Exit Date Time	Wheels Counter	Hangers/Spindles Counter	Empty In Front
1 - AQ100	2019/10/17 01:52:03	2019/10/17 02:02:28	88	88	0
3 - GT102 automatic loading	2019/10/17 01:56:04	2019/10/17 02:06:08	84	31	4
4 - Inlet Pt degreasing	2019/10/17 01:59:59	2019/10/17 02:09:06	84	31	4
5 - Outlet Pt degreasing	2019/10/17 02:10:40	2019/10/17 02:18:49	84	31	4
6 - Inlet Pt pickling	2019/10/17 02:10:56	2019/10/17 02:19:05	84	31	4
7 - Outlet Pt pickling	2019/10/17 02:18:02	2019/10/17 02:26:11	84	31	4
8 - Inlet Pt SAM	2019/10/17 02:18:02	2019/10/17 02:26:11	84	31	4
9 - Outlet Pt SAM	2019/10/17 02:24:04	2019/10/17 02:32:13	84	31	4
10 - Inlet Waterdryer oven	2019/10/17 02:33:00	2019/10/17 02:41:09	84	31	4
11 - Outlet Waterdryer oven	2019/10/17 02:59:01	2019/10/17 03:07:10	84	31	4
12 - Inlet Waterdryer cooler	2019/10/17 02:59:17	2019/10/17 03:07:26	84	31	4
13 - Outlet Waterdryer cooler	2019/10/17 03:16:54	2019/10/17 03:25:02	84	31	4
14 - GT103 Upstream RH002	2019/10/17 03:32:46	2019/10/17 03:40:54	84	31	4
15 - GT112 Downstream RH002	2019/10/17 03:35:18	2019/10/17 03:43:11	84	90	18
16 - Inlet Powder booth	2019/10/17 03:35:54	2019/10/17 03:43:47	84	90	18

# Agenda



- 1 DXQ digitalization by Dürr
- 2 Wheel tracking solution by Oplidürr
- 3 Questions and answers



# www.sli.do Your questions are welcome!



\*Event code: wheels

Ask your questions after the presentations

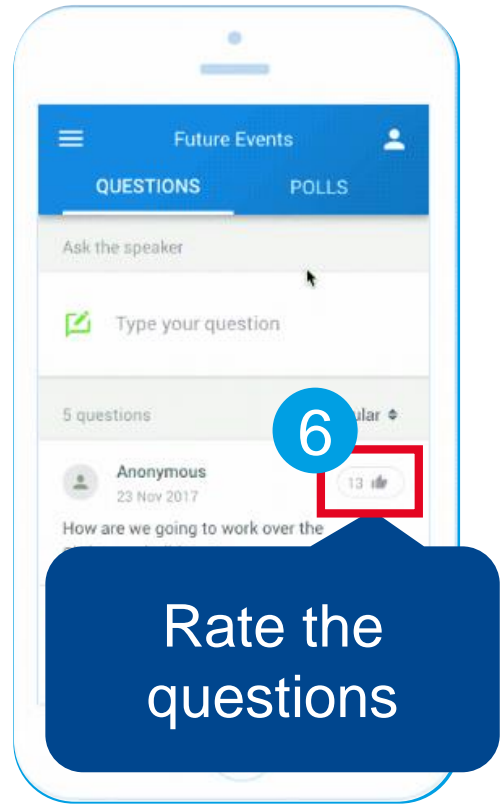
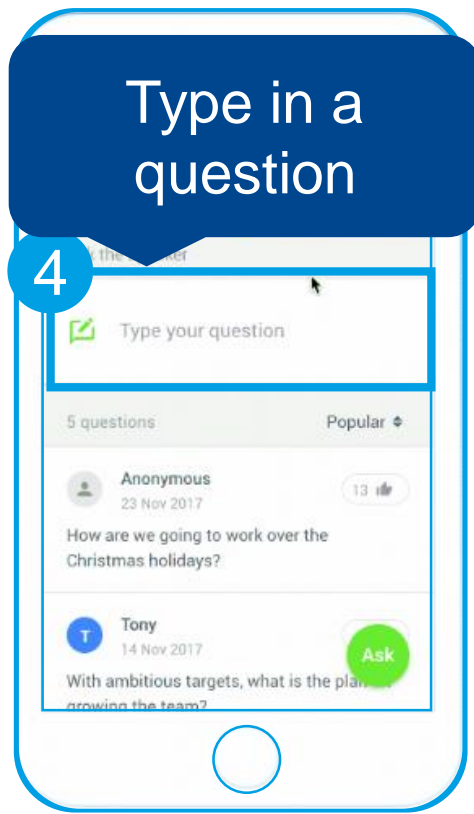
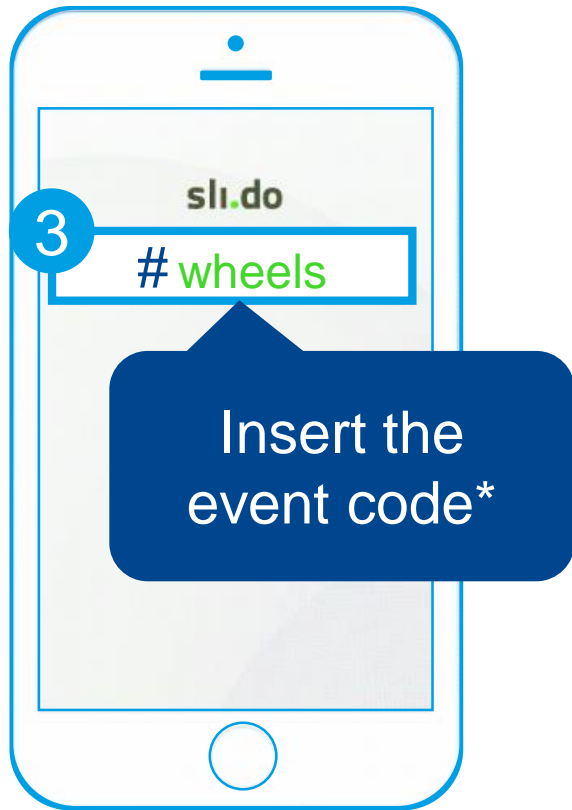
Ask your guides

Use slido for the final panel discussion

WIFI: DUERR\_EVENT

1 Open your Browser

2 Open [www.slido.com](http://www.slido.com)



October 23, 2019  
Bietigheim-Bissingen  
[www.durr.com](http://www.durr.com)

**Bernd Kremer, Senior Manager Sales Digital Solutions, Dürr Systems AG**

# **DXQ – State of the art software products for plant operation**

“Subject to change. The information in this presentation contains only general descriptions or performance characteristics, which may vary in different cases. The requested performance characteristics are only binding if they are expressly agreed in the contract.”

