



Sense | Analyze | Optimize

Feelit introduction deck – 2021

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IMAGINE
A WORLD
WHERE
THINGS
FEEL



Wear



Pressure



Wall thinning



Temperature



Micro fracture



Loosening

Optimizing manufacturing costs

Drawbacks of Corrective and Preventive Maintenance

- 1. Unexpected downtime**

Unplanned downtime = significant \$\$\$

- 2. Loss of products**

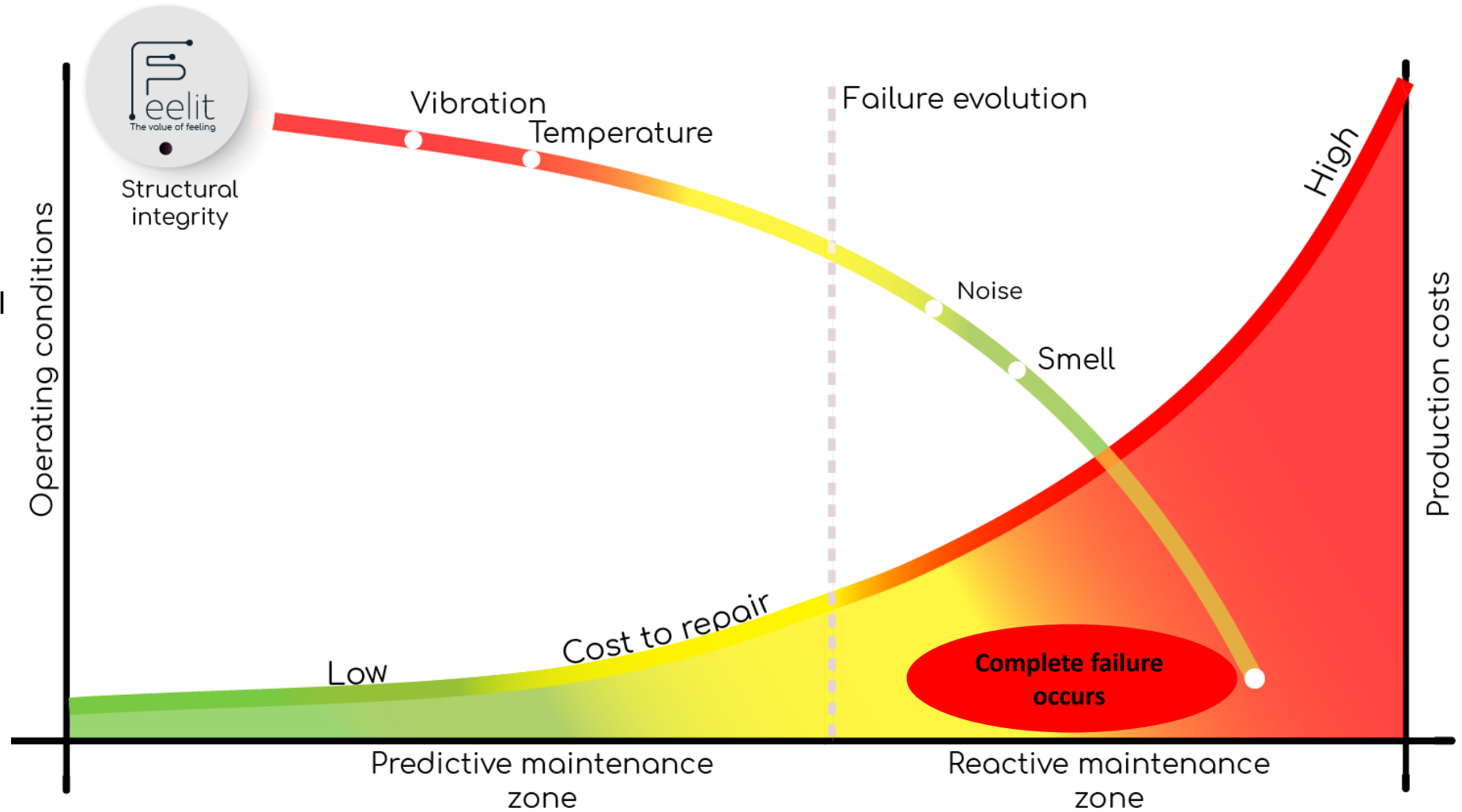
- 3. Loss of resources**

- 4. Safety issues**

- 5. Environmental damage**

Why Condition-Based and Predictive Maintenance?

- Identify when an asset's performance or condition reaches an unsatisfactory level
- Alerts the moment monitored parameters are out of bounds





Feelit is providing condition monitoring and predictive maintenance for the process and automotive industries



Leading investors and customers



Technion
Israel Institute of Technology



MERCK



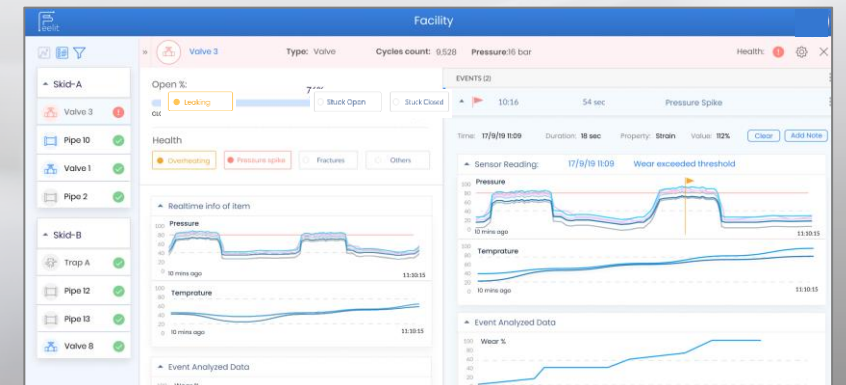
ICL

MIGROS

Why Feelit?

- Non-intrusive
- Zero downtime installation
- Flexible sticker configuration
- 50x higher sensitivity vs. strain gauge
- Quick time to value – days to a week
- Actionable insights
- Plug and play installation – DIY

Dedicated UI or API interfacing



Simple 3 step installation

01

Identify high risk process points
(e.g., safety valve)

02

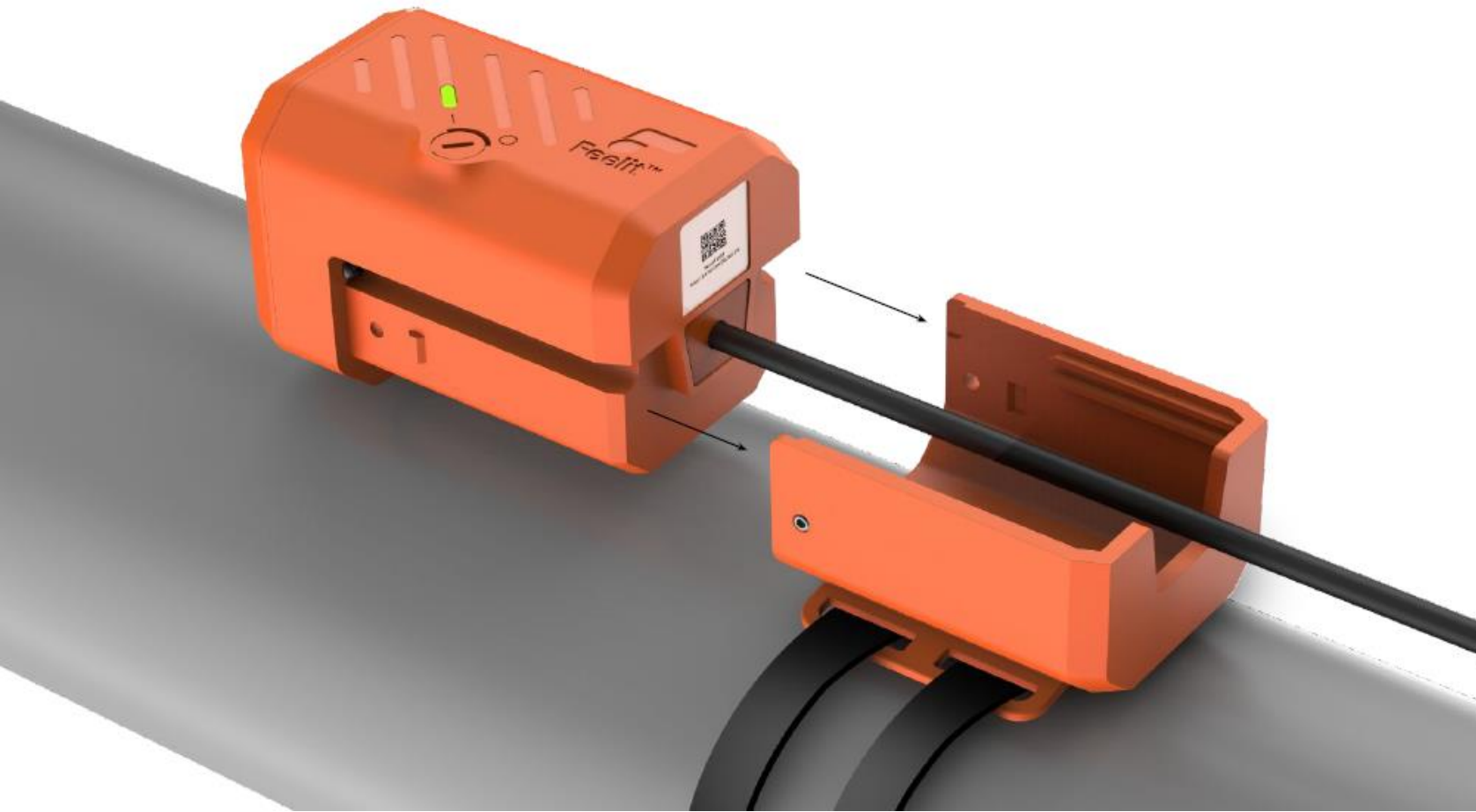
Attach nanotechnology sensors
& edge devices

03

Connect to RetroFeel™ real-time software



RetroFeel™ “Click & Stick” installation



RetroFeel™ offerings

PIPE

- Pressure
- Temperature
- Wall thinning
- Scaling
- Leakage & burst



RetroFeel™ offerings

FLANGE

- Displacement
- Deformation
- Bolt & clamp load loosening
- Gasket wear



RetroFeel™ offerings

VALVE

- State (Open | close)
- Actuator integrity
- Internal leakage
- Hammering

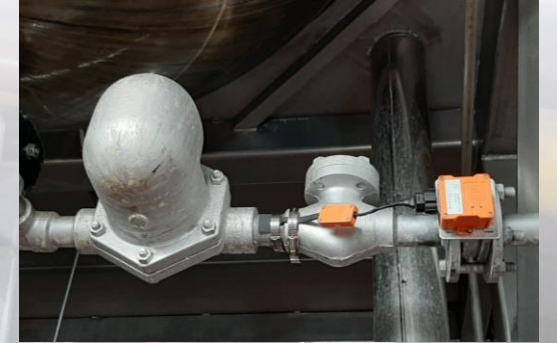
*In development
(Beta phase)*



RetroFeel™ offerings

STEAM TRAP

- Steam trap malfunction
- Heating system abnormal activity
- Hammering



RetroFeel™ offerings

ROTATING ASSETS

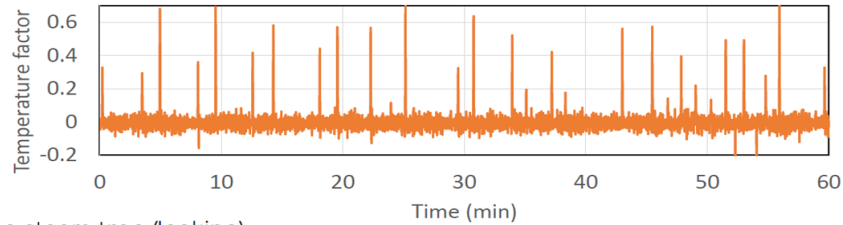
- <1,200 RPM
- Separator, Mixer, Pump etc.

*In development
(Beta phase)*

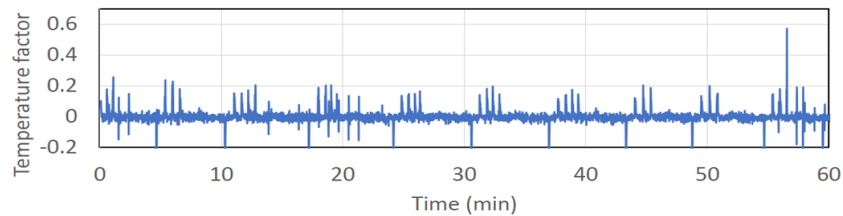


RetroFeel™ - Steam system monitoring example

Functioning steam trap



Malfunctioning steam trap (leaking)



Customer:

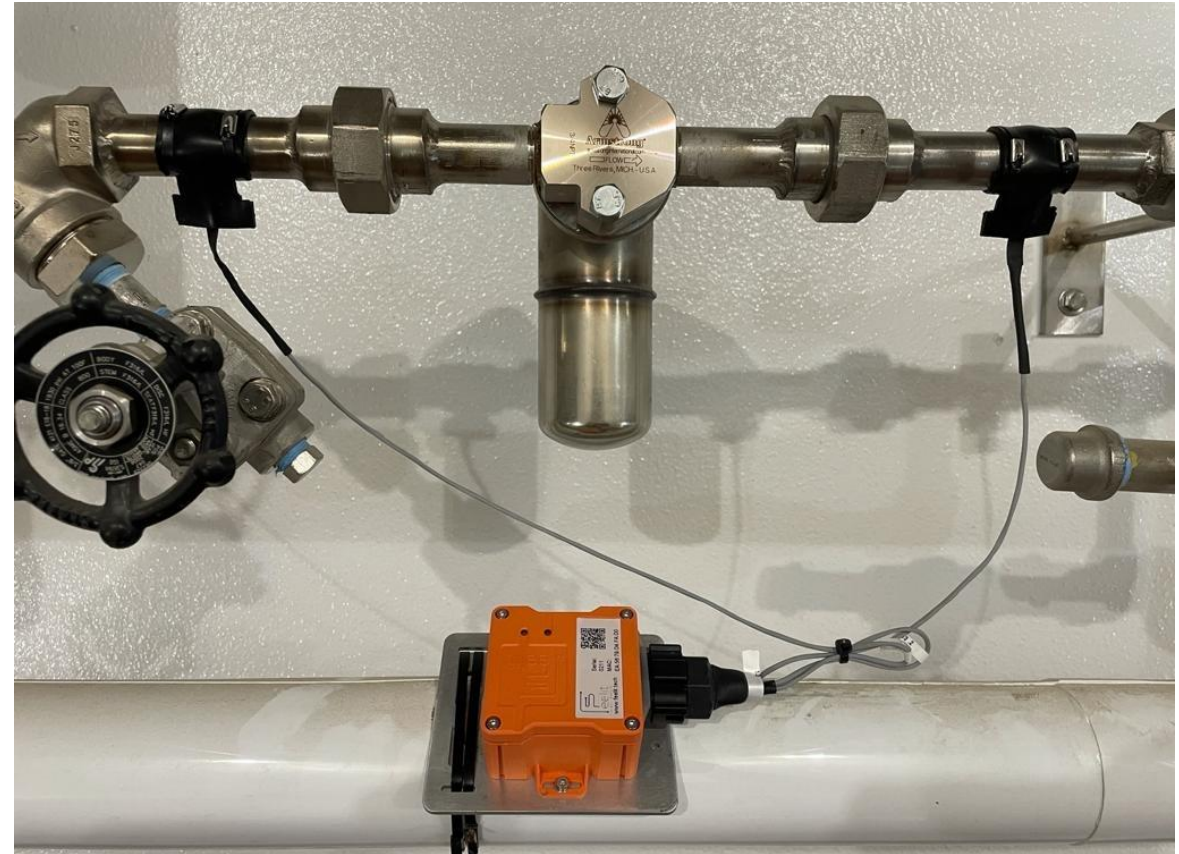
Sigma
(Merck biopharma facility)

Read more: <https://bit.ly/31qNlxh>

Purpose:

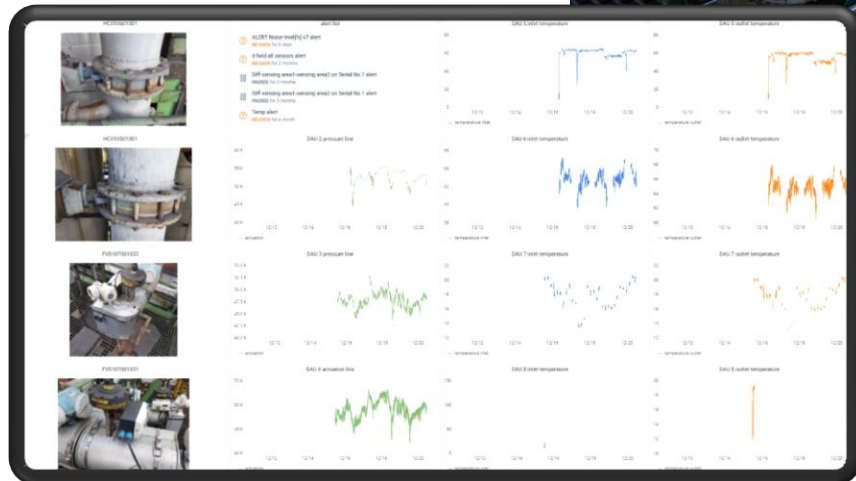
Steam-trap monitoring

(malfunction alerts helping reduce energy losses and risk of process heat exchange stalling)



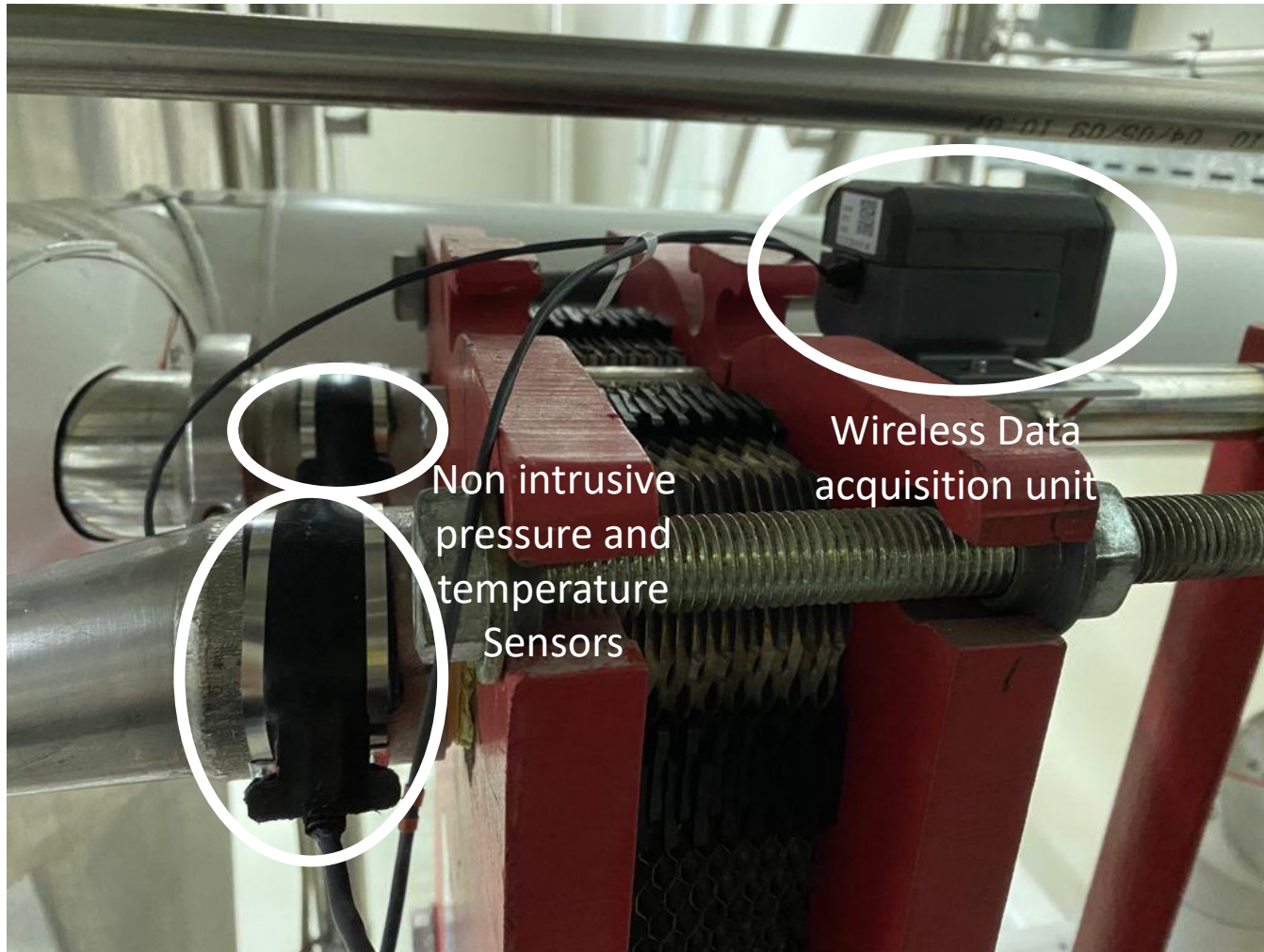
RetroFeel™ sensor under insulation example

Feelit sensor applied under insulation of control valve to monitor valve integrity via pressure and thermal patterns:

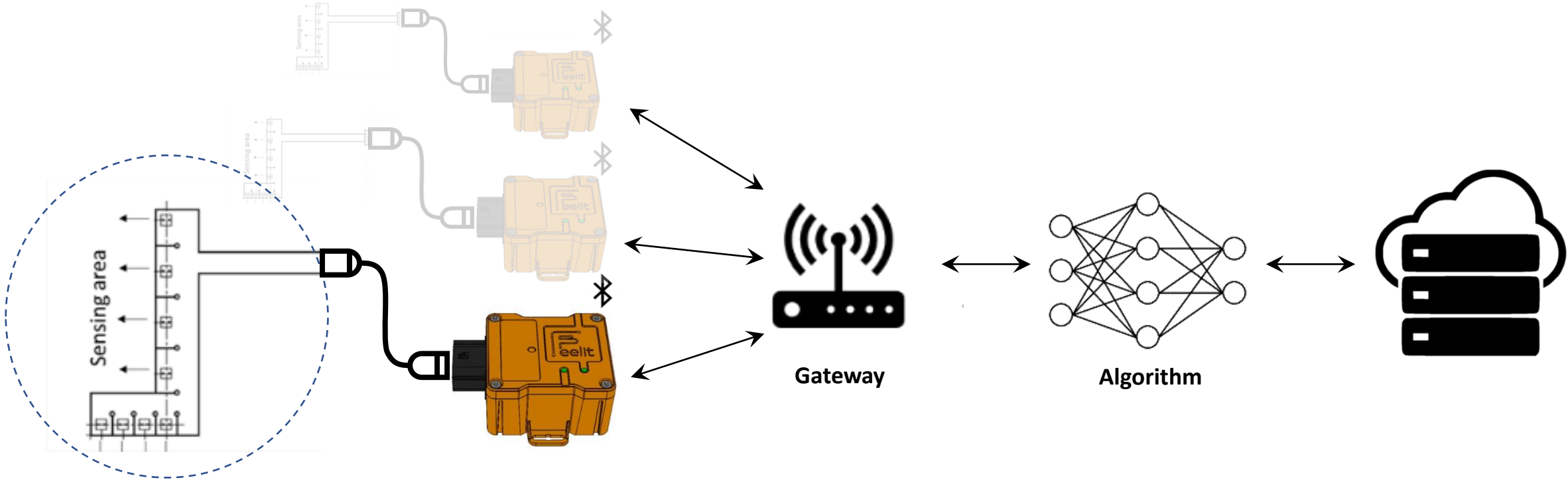


Customer site: Dortmund, Germany

Heat exchanger installation



RetroFeel™ system



Nanomaterial sensor

DAU – Data Acquisition Unit (Bluetooth)

Gateway (LTE/ WiFi)

Feelit algorithm layer

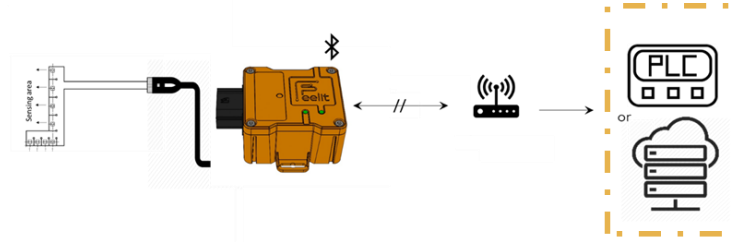
Cloud application (Azure/IBM)

Edge device

RetroFeel™ spec

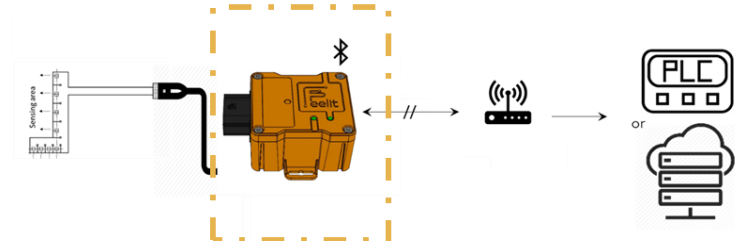


Application	Azure/IBM/AWS SCADA/PLC	Web browser UI Dedicated integration
	Router (Linux/Android)	NUC (Intel)/ Windows 10 edges per router 220V or 110V power source LTE (SIM) or Wi-Fi*

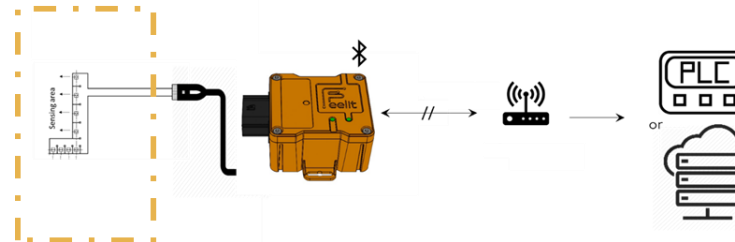


* Needs to be supplied by customer IT

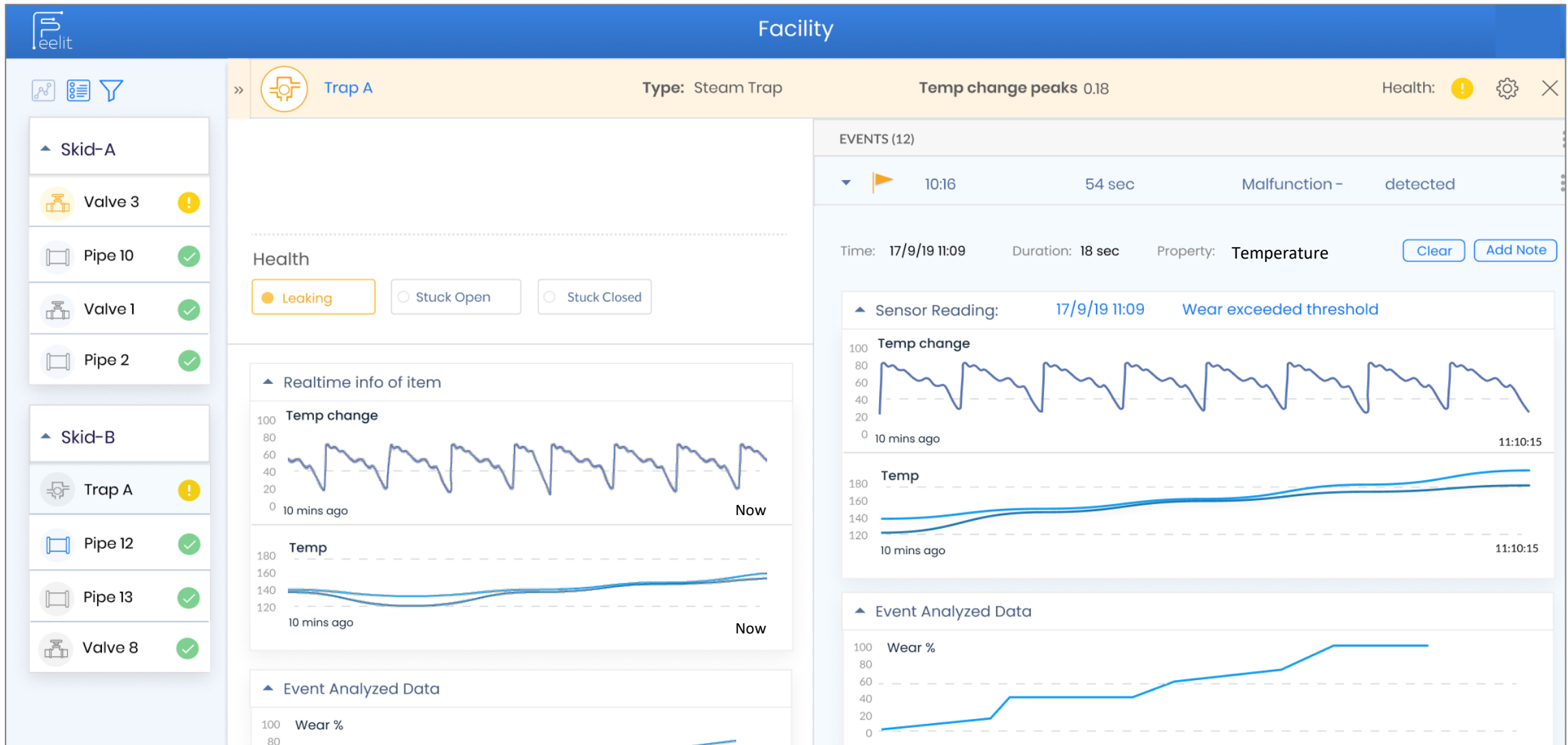
Edge device:	Operating temperature	-10°C to 80°C (14°F to 176 °F)
	Sampling rate per channel BLE communication	up to 100Hz (8 channels) 2.4GHz
	Power source	Lithium battery 3.6V



Sensor:	Operating temperature (strain/temperature)	-70°C to 100°C/250°C -94°F to 212°F/482°F
	Chemical protection Water protection	Acids, bases & solvents IP67
	# sensing points	up to 8 (strain, pressure, vibration, temp.)



RetroFeel™ customizable web-browser UI



The screenshot displays a web browser interface for a facility monitoring system. The top navigation bar is blue and contains the 'eelit' logo on the left and the word 'Facility' in the center. Below the navigation bar, there is a sidebar on the left with a list of components: Skid-A (Valve 3, Pipe 10, Valve 1, Pipe 2) and Skid-B (Trap A, Pipe 12, Pipe 13, Valve 8). The main content area is divided into several sections:

- Trap A Header:** Shows 'Type: Steam Trap', 'Temp change peaks 0.18', and 'Health: !' with a settings gear icon.
- Health Section:** Features three radio buttons: 'Leaking' (selected), 'Stuck Open', and 'Stuck Closed'.
- Realtime info of item:** Contains two line graphs: 'Temp change' (y-axis 0-100) and 'Temp' (y-axis 120-180), both showing data from '10 mins ago' to 'Now'.
- Event Analyzed Data:** Shows a 'Wear %' graph (y-axis 0-100) with data from '10 mins ago' to 'Now'.
- EVENTS (12):** A table of events with columns for time, duration, and property. One event is highlighted: '10:16', '54 sec', 'Malfunction - detected'. Below the table, it shows 'Time: 17/9/19 11:09', 'Duration: 18 sec', and 'Property: Temperature' with 'Clear' and 'Add Note' buttons.
- Sensor Reading:** A section titled 'Sensor Reading: 17/9/19 11:09' with the note 'Wear exceeded threshold'.
- Temp change graph:** A detailed line graph showing temperature fluctuations over time, with a y-axis from 0 to 100 and x-axis from '10 mins ago' to '11:10:15'.
- Temp graph:** A detailed line graph showing temperature over time, with a y-axis from 120 to 180 and x-axis from '10 mins ago' to '11:10:15'.
- Event Analyzed Data:** A detailed line graph showing wear percentage over time, with a y-axis from 0 to 100 and x-axis from '10 mins ago' to '11:10:15'.

RetroFeel™ – Steam Trap condition status report

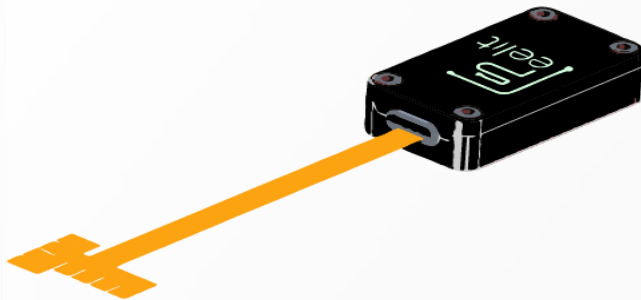
Steam Trap Details Summary **5**



Tag Name	PU area ST 147
Manufacturer	Spirax Sarco
Model	FT47-4.5
Type	Float
Steam Pressure in	5barg
Connection Size	25mm
Application	Process
Monitoring Report cycle	18-December-2020 – 18-February-2021
Monitoring Duration	59 Days
Condition	Abnormal Behavior
Steam Loss(USD)	0
Suggested Action Item	<ol style="list-style-type: none">1. Stuck close inspection2. Steam line inspection

Competitive advantage – Sensing solution

Sensing hardware



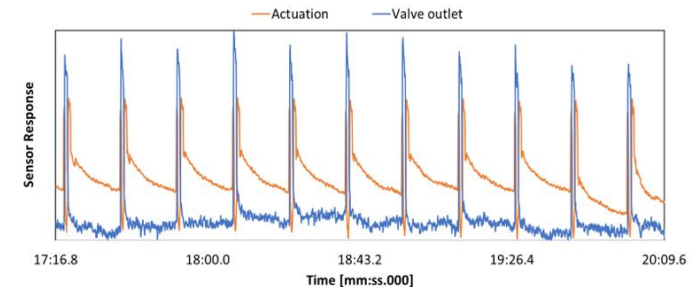
- Ultra high sensitivity nanomaterials sensor
- Flexible & conformable
- Unique form factor:
 1. Ultra-thin (50µm)
 2. Ultra-long (2m)
 3. Embeddable

0 ZERO

- Downtime
- Installation risk



Analytics



- **Physical properties** – e.g. strain, pressure, vibration & temperature
- **Operational indicators** – e.g. valve state, misalignment & leakage/pressure discharge
- **Predictive models** – e.g. leakage risk & time to failure

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Thank you.

