NEXIONA
IOT CONNECTOCRATS

Predictive Maintenance -
Alten Maschinen neue Tricks beibringen ???

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Disruptive Entwicklungswellen

NEXIONA CONNECTOCRATS

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Predictive Maintenance

Vorhersagemodelle krempeln die Wartung um

ANY ASSET DESERVES TO BE CONNECTED

Predictive Maintenance

- ✓ Vorausschauende Instandhaltung
- ✓ Automatisierte Zustandserfassung
- ✓ Präzise Vorhersage von Maschinenausfällen
- ✓ Ausnutzung von Nutzungsvorräten
- ✓ Erhöhung der Planungssicherheit
- ✓ Steigerung der Produktionsqualität
- ✓ Senkung der Kosten

Predictive Maintenance

NEXIONA CONNECTOCRATS

IIoT – A GAME-CHANGER for PREDICTIVE MAINTENANCE

ANY ASSET DESERVES TO BE CONNECTED

Predictive Maintenance

Project: SAFEPRES

Die Ziele des SAFEPRES-Projekts lauten:

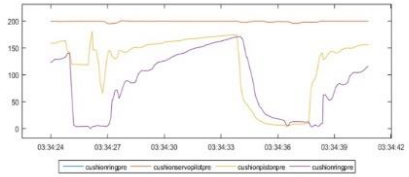
- Erkennung von Betriebsanomalien der Hydraulikpumpen & Pressen
- Identifikation des wahrscheinlichen Ursprungs der Anomalie
- Implementierung einer Applikation zur automatischen Zyklus-zu-Zyklus-Analyse des Pressenbetriebs mittels einer IIoT-Plattform (Industrial Internet of Things)

Roadmap of the SAFEPRES project

Starting Point

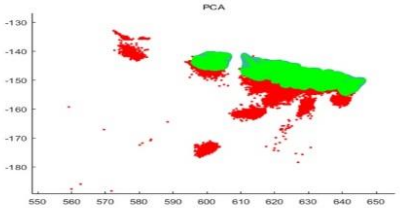
Available data?

- 30 press signals.
- Expert's knowledge.



How is the ideal press cycle?

- Operating behaviour of the press.
- Data filtering rules.
- Cycle segmentation rules.

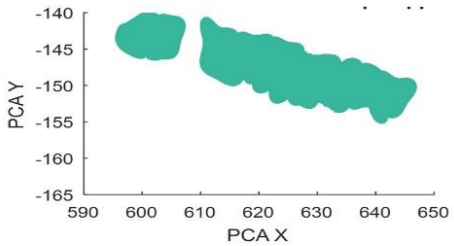


How to characterize the behaviour of the auxiliary pump?

- Statistical characterization of auxpumppre.
- Labelling of "ideal" cycles.
- PCA projection to common base.

Normality Model

- Input data space clustering
- Normality boundaries detection
- Characterization of normal operation area.
- Cycle by cycle normality detection



Do other press elements affect the auxiliary pump pressure?

- Press elements characterization.
- Correlation study.
- Selection of slide and cushion as influent elements.

How to characterize the affectation of slide and cushion operation?

- Fisher based feature selection.
- PCA projection to common base.
- Feature space segmentation in operating areas.

Affectation Maps

- Correlation of operating area vs. normality of auxpumppre.
- Characterization of the negative affectation of the press operation.
- Affectation modelling based on press data historic.

Reliability Maps

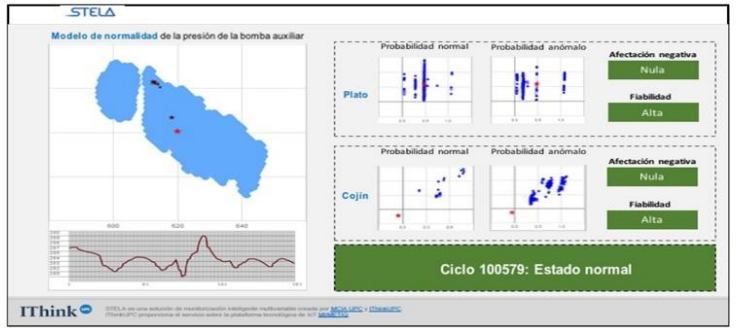
Can we give information regarding the significance of each operating area?

- Significance modelling of each operating area in regard with the press data historic.
- Readjustment of the reliability map in regard with the stable operating points of the press.

STELA

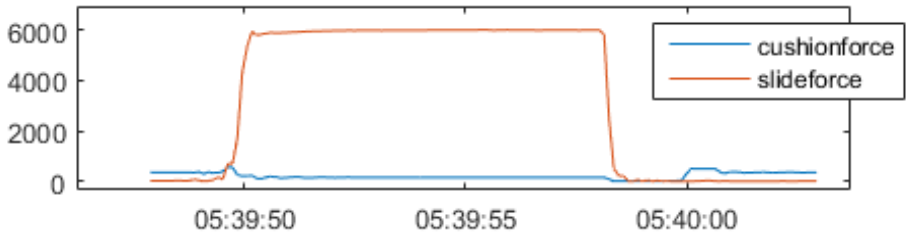
Monitorization agent

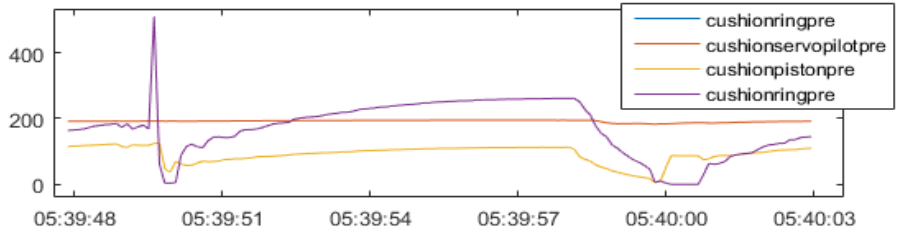
- Intelligent monitoring solution based on a multivariable approach.
- Application developed under IoT framework – MIMETIQ
- Allows real time analysis of press cycles.
- Shows normality model, affectations and reliability of slide and cushion.

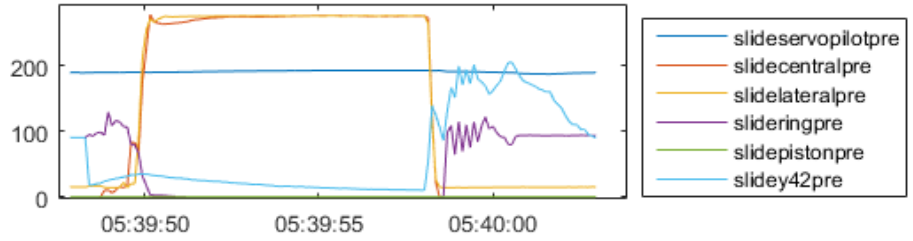


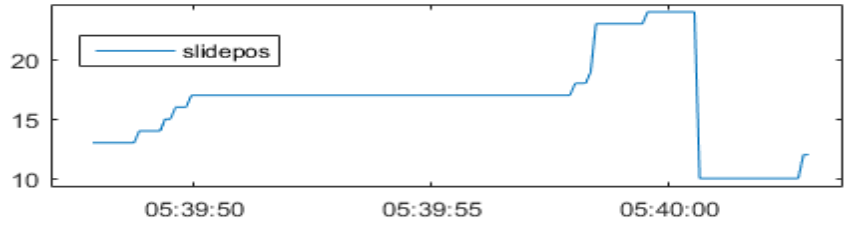
Initial data of the SAFEPRES project

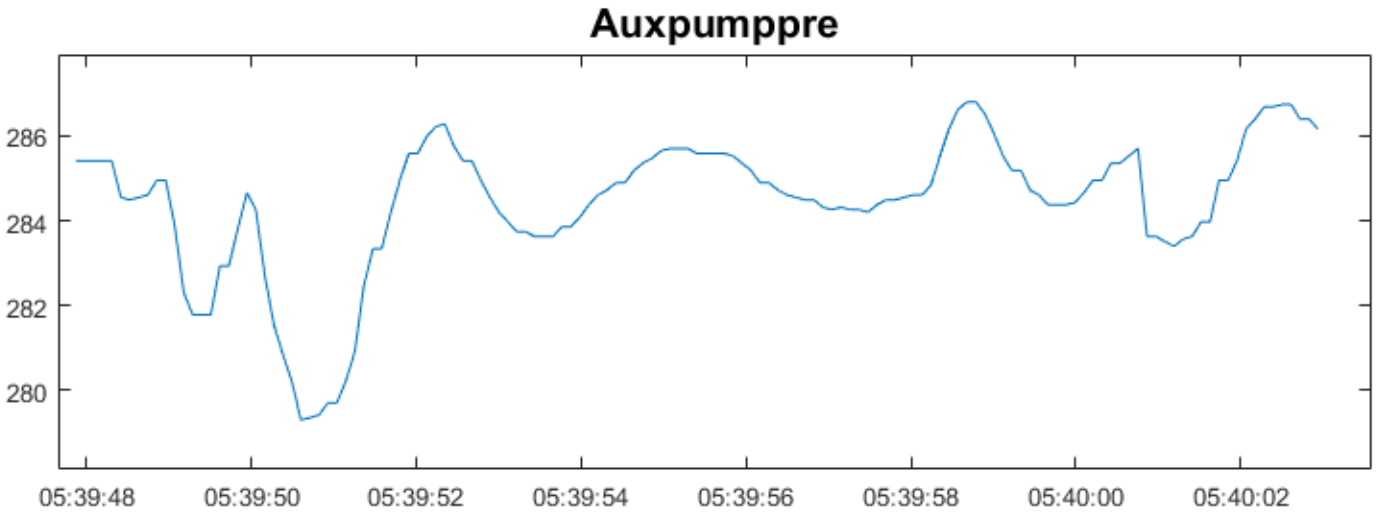
- INITIAL DATA
  - Signals recorded during the press cycle.
  - 30 signals considered in the analysis.



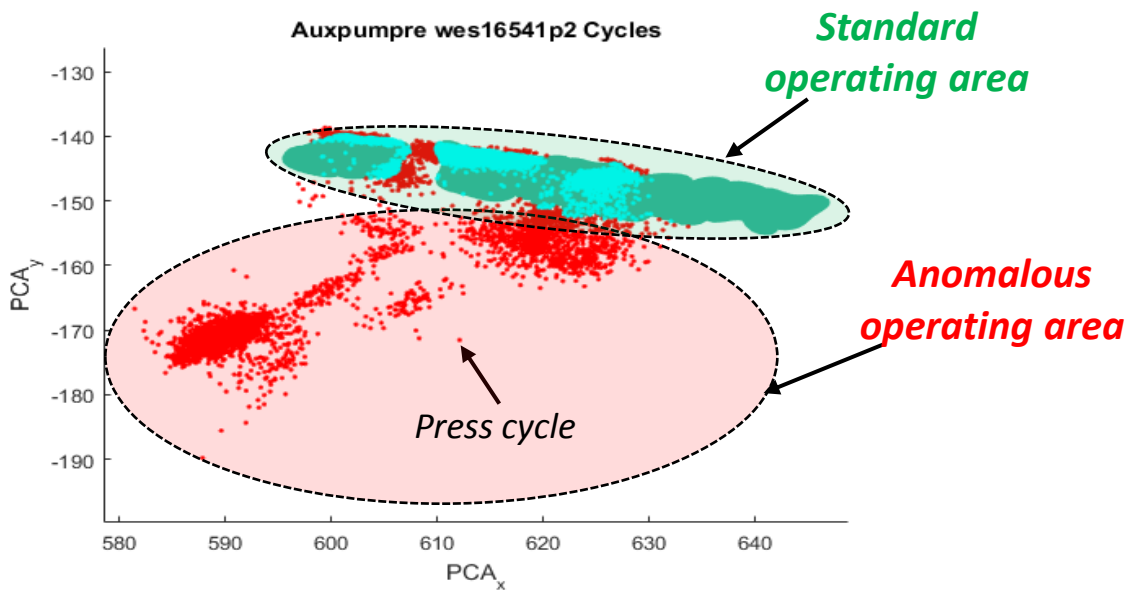








Normality model of auxpumppre



PCA Projection of Auxpumppre indicators

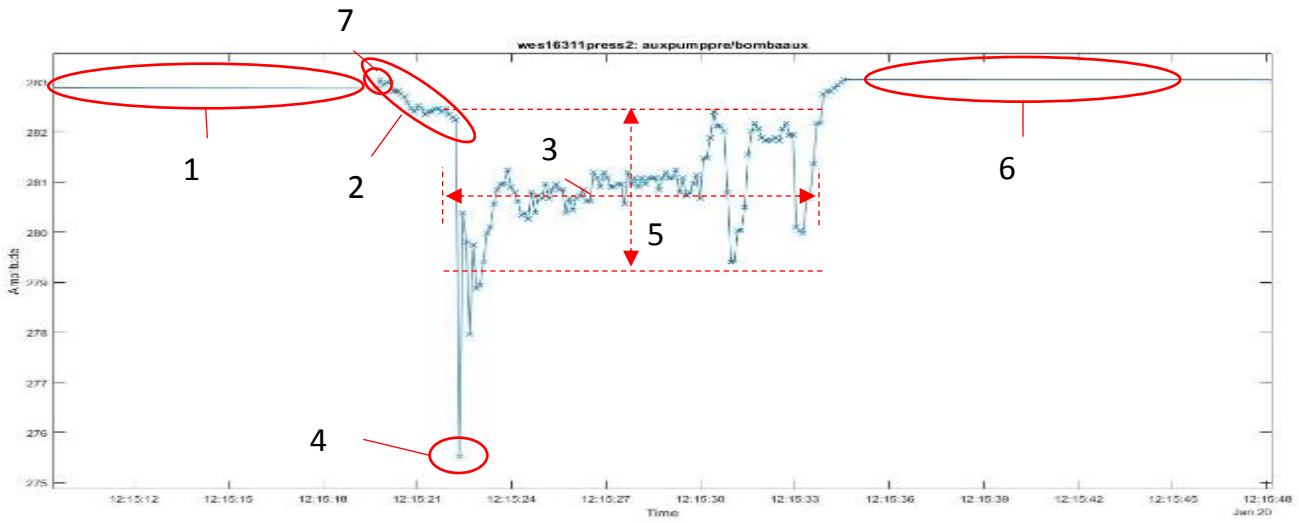
- Based on the modelling of expert knowledge in segmentation rules.
- It labels each new press cycle based on a statistical definition of the auxpumppre signal.
- It indicates whether the cycle analysed is standard or anomalous operation of the auxiliary pump.

- **It provides no information on which components of the press affect the anomalous operation of the auxiliary pump.**

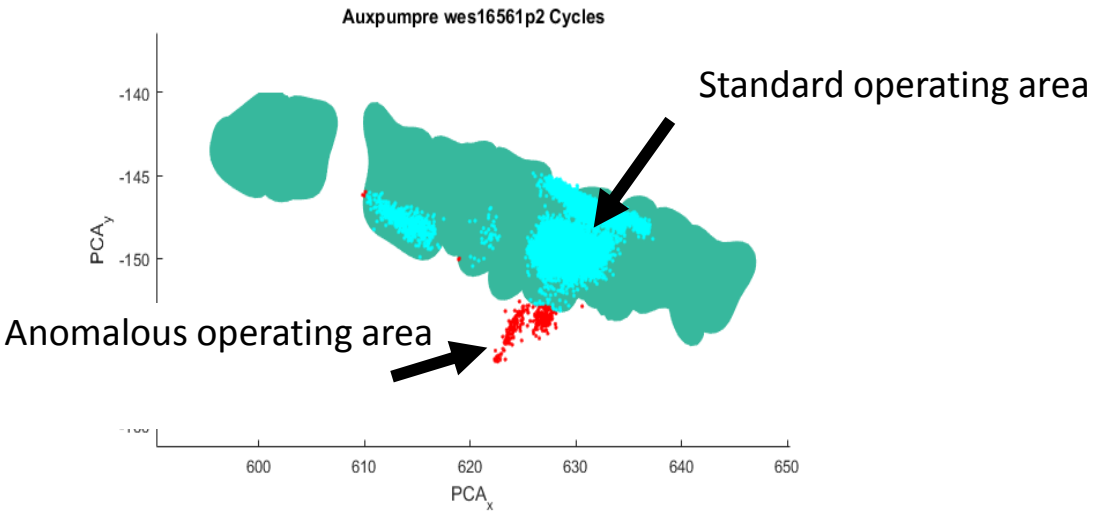
1. Detection of anomalies. Classifier in accordance with AUXPUMPPRE.

A. Auxpumppre Indicators

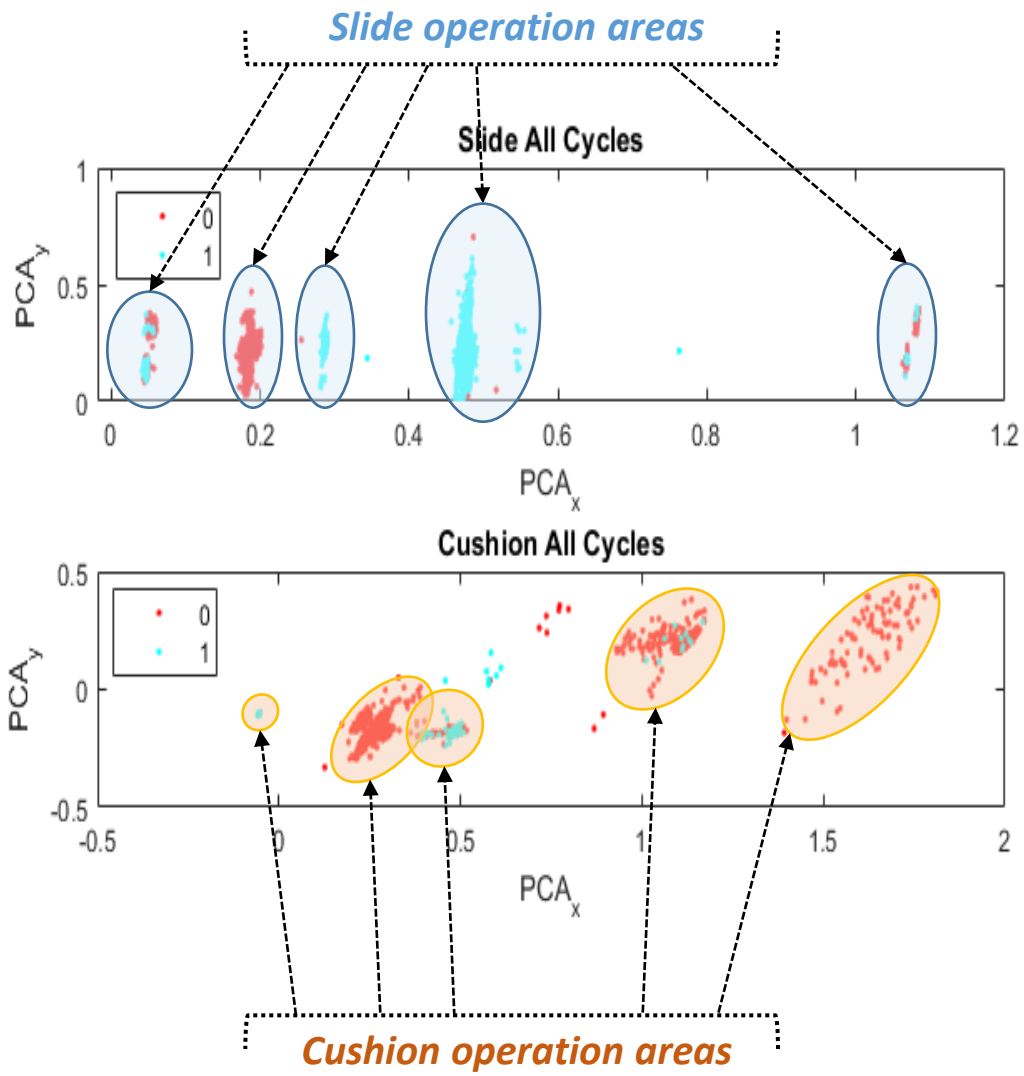
1. Value at rest
2. Variance of initial interval
3. Maintenance value
4. Minimum maintenance value
5. Variance during maintenance
6. Post-maintenance value
7. Maximum cycle value



B. Graphic display of the auxiliary pump operating point in a press within a set of presses in the study



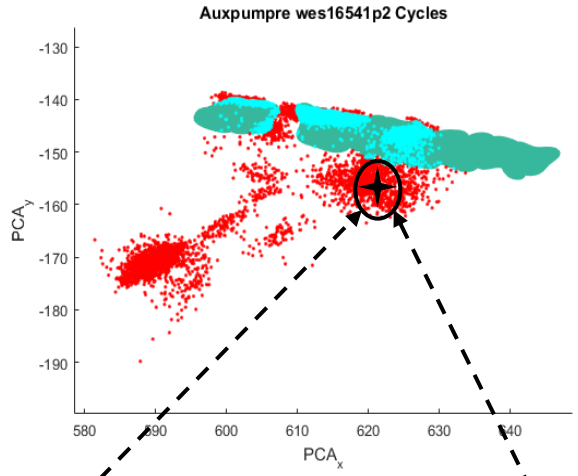
Effect of the Cushion and Slide on Auxpumppre normality



- We wish to characterise the negative effect of the different operating modes of the cushion and slide to quantify their influence on anomalous auxpumppre behaviour.
- To this end, these elements are characterised separately in the areas where the value and variability of auxpumppre is critical (at rest, maintenance, post-maintenance).
- The best indicators are selected based on the average Fisher per press and a common PCA projection is carried out for all the presses.
- In the resulting projections (for cushion and slide) areas can be seen that correspond to the operating areas (different configurations) of the elements.
- **We wish to analyse the correlation between the cycles of these areas and the normal operation of the auxiliary pump. This will give us the negative effect of said operating area on the normality of the auxpumppre cycles.**

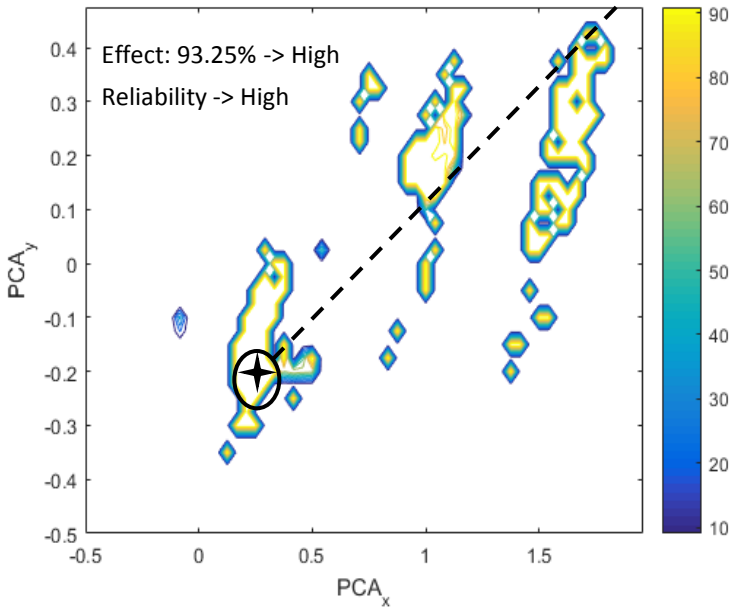
2. Determining the origin of the anomaly. Display for the Expert.

Example of analysis: Anomalous cycle in accordance with the operation of auxpumppre with effect due to cushion operation.

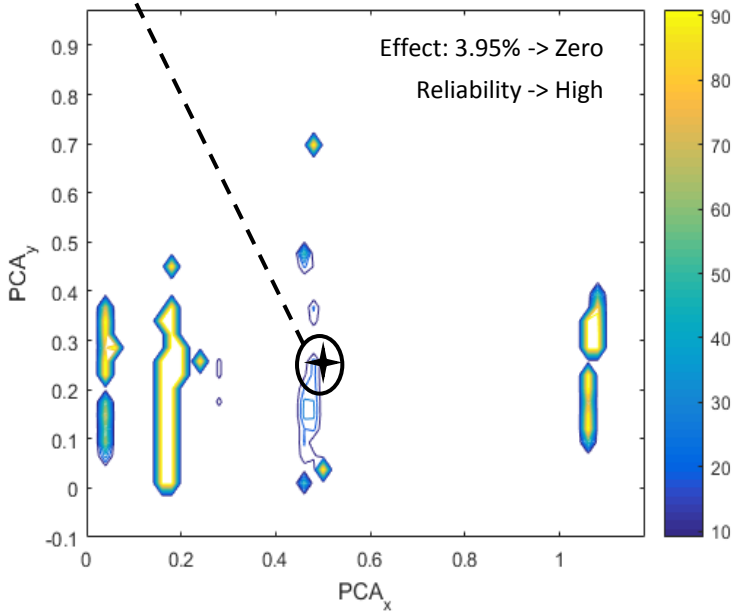


Normality model of auxiliary pump pressure

Cushion Effect Map

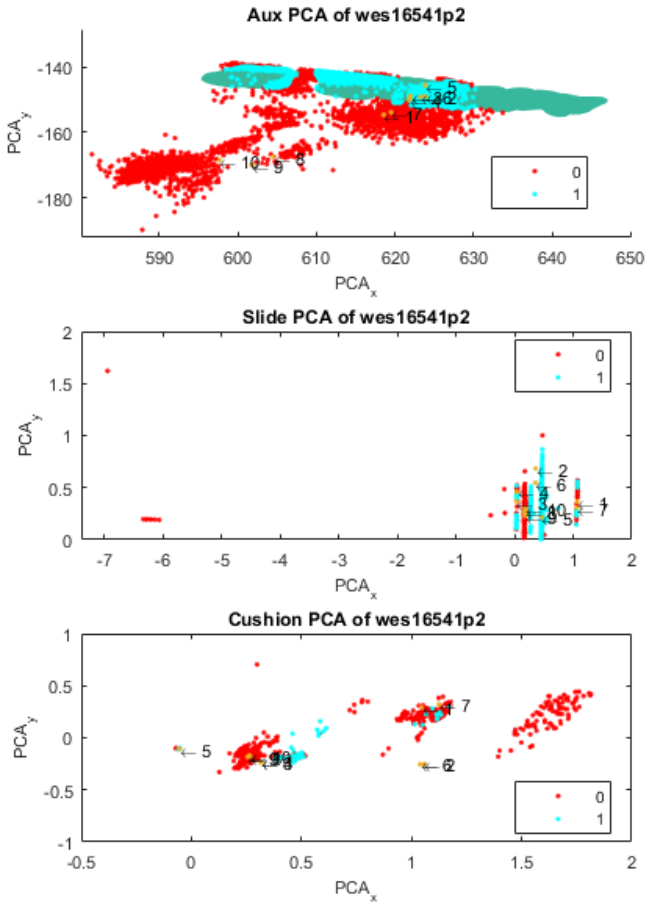


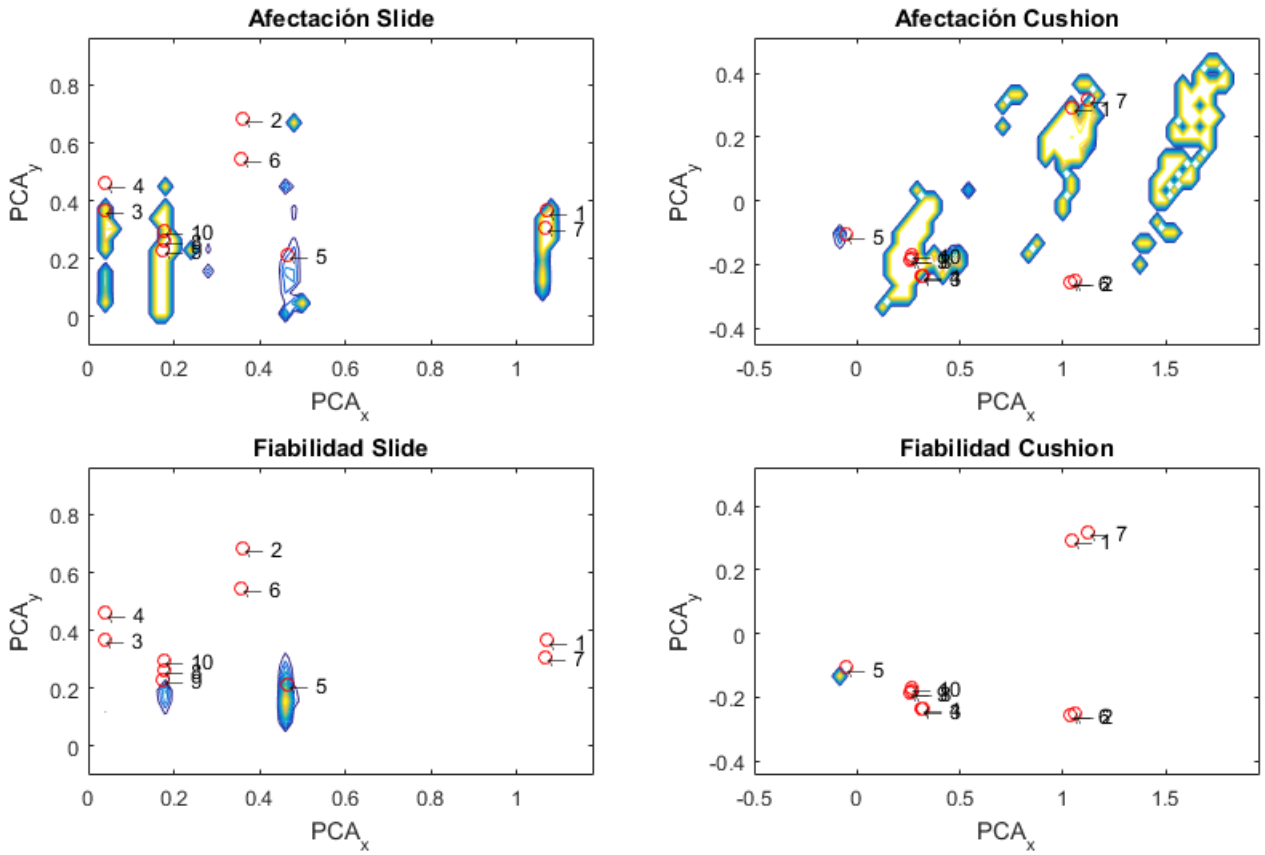
Slide Effect Map



Maps of effects on auxiliary pump operation, based on the indicators calculated using the recorded cushion and slide signals.

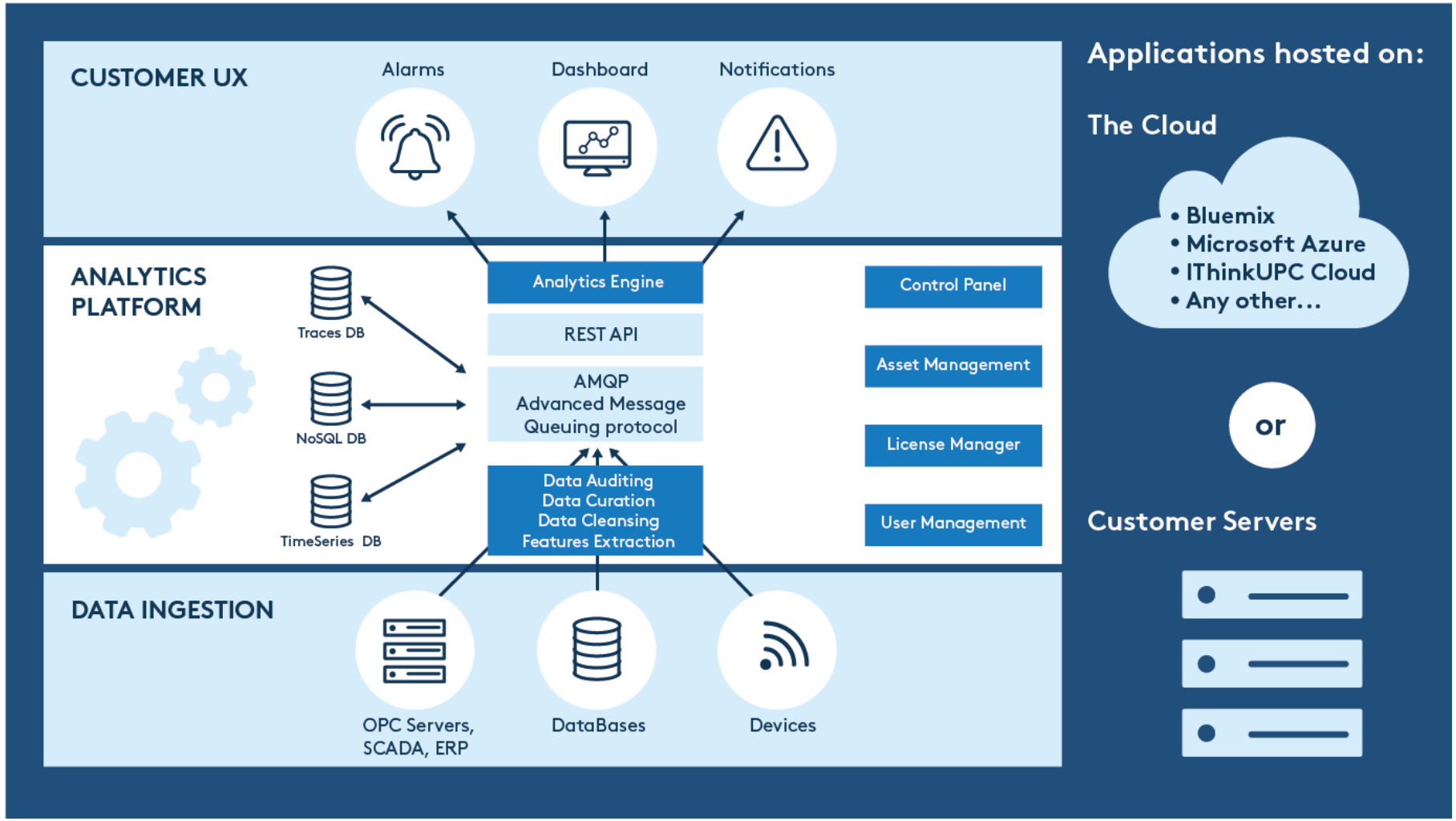
Generic example of the normality model analysis, effect on cushion and slide with their corresponding reliability of stamping press cycles, synthesising the information of 30 signals and characteristics and comparing them with the root cause diagnosis model.





3. IIoT platform on which STELA was developed

MIIMETIQ
IoT COMPOSER



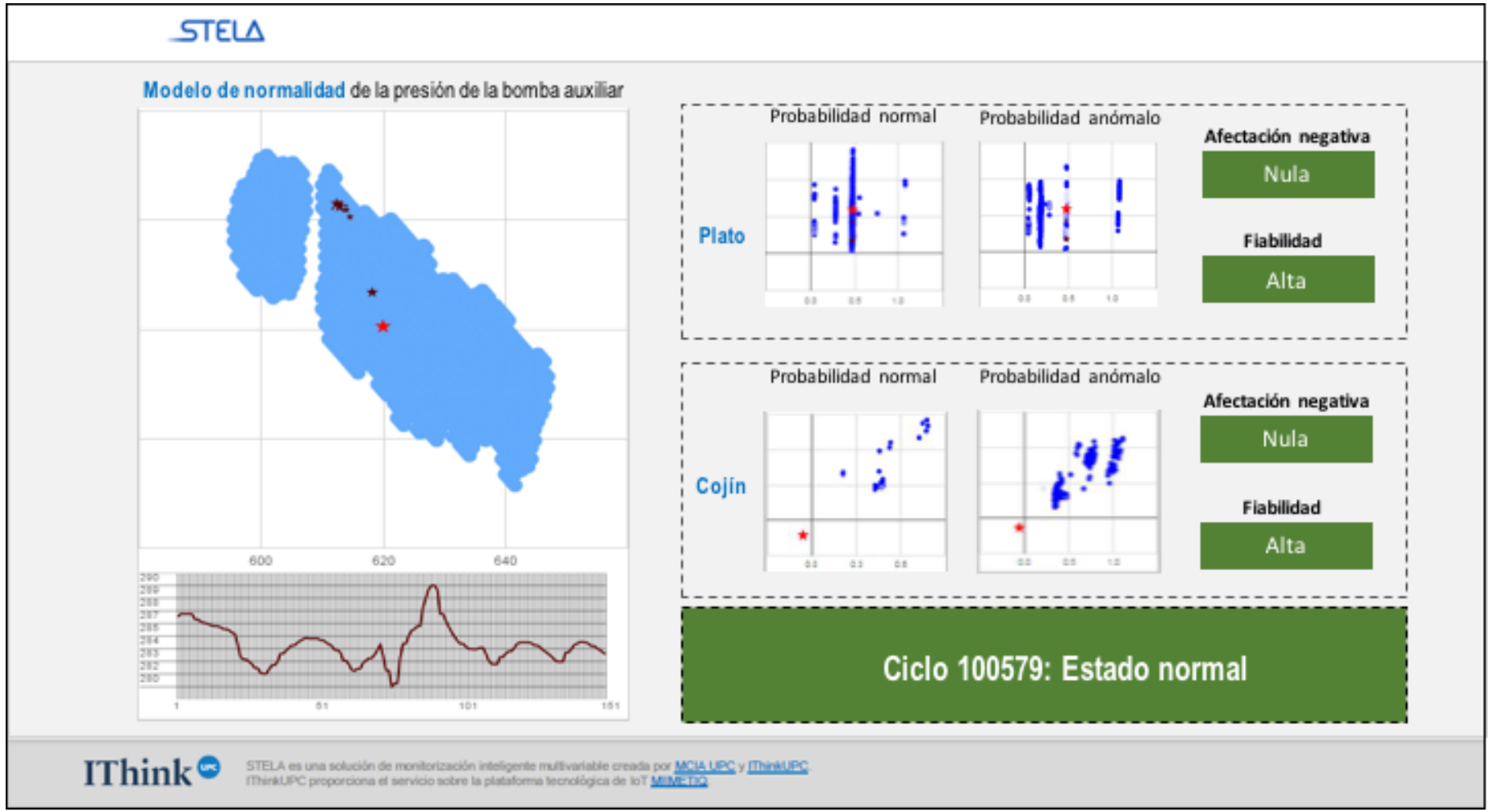
For the implementation of the final solution, both for the data input of the press signals and the rollout of advanced analytic techniques, we have used Nexiona's MIIMETIQ® IoT COMPOSER platform.

On Nexiona's MIIMETIQ® IoT COMPOSER, we have developed:

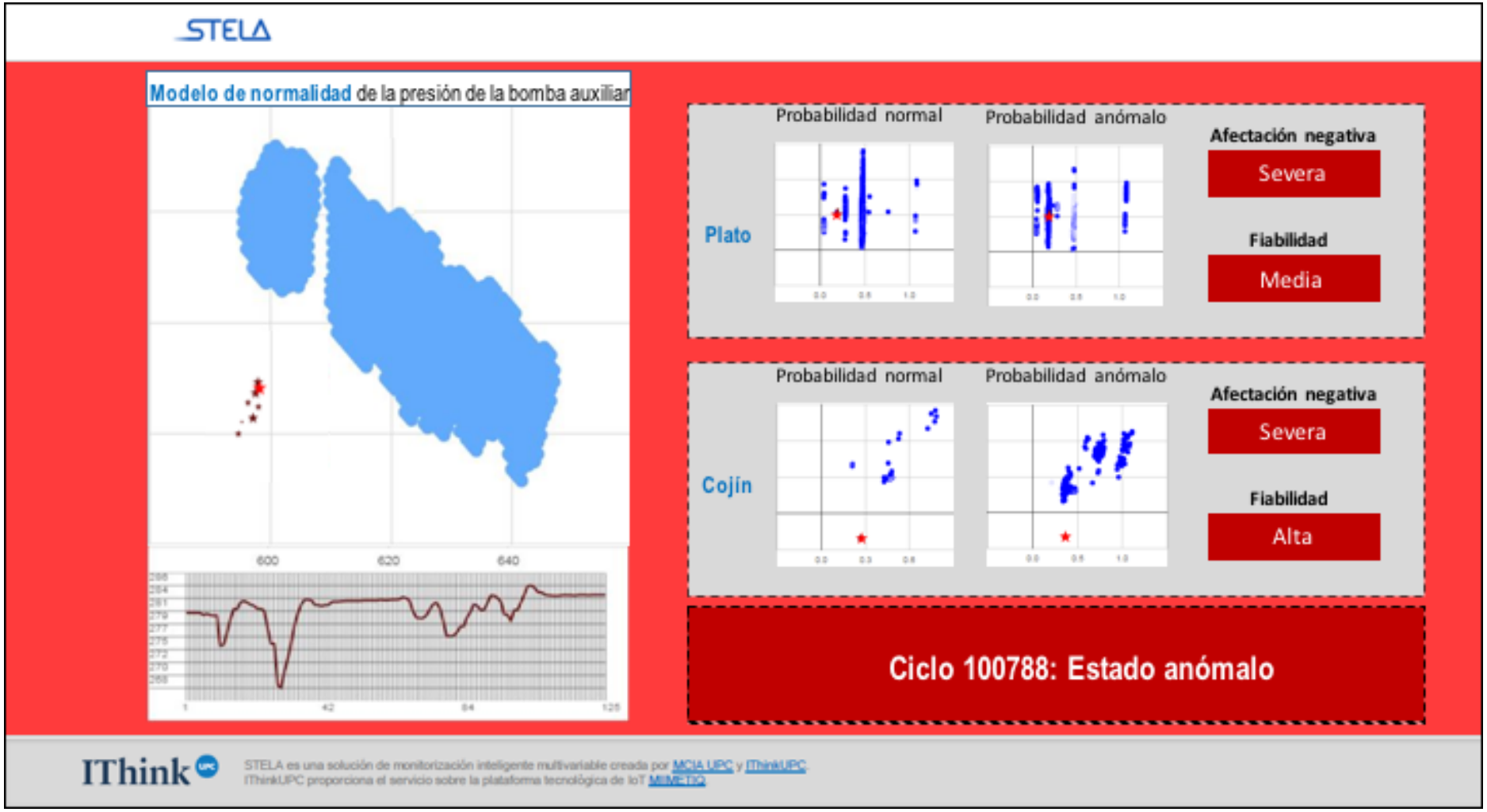
- The input of data from the signals of the presses being studied.
- All the data quality audit operations, segmentation and filtering to generate the datasets that feed the diagnosis algorithms.
- The implementation of the advanced analytics algorithms and artificial intelligence used in the project.
- The application of the final display of results, named **STELA**, that synthesises the information of 30 press signals with sampling frequencies of 100 ms in highly simple interpretation charts for plant operators and rather more complete for plant engineers and data analysts.
- MIIMETIQ® IoT COMPOSER has huge scalability and will allow Gestamp to expand the system easily in the future.

5. Examples of the STELA application for automatic, cycle-to-cycle analysis

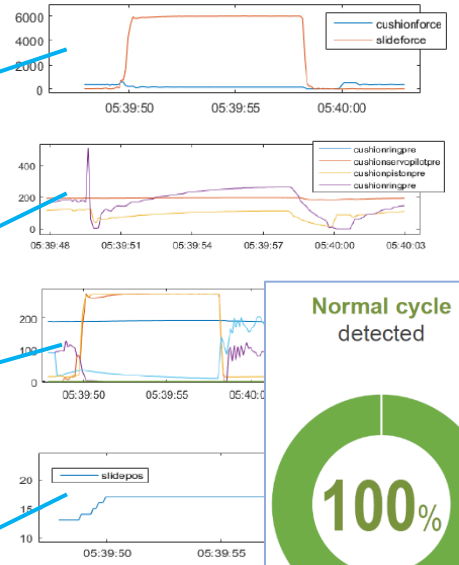
Example 1: Zero effect on the slide and zero effect on the cushion in cycle 100579 in normal operation of the auxiliary pump by our STELA application (possible indicator of correct operation of the auxiliary pump or correct press configuration):

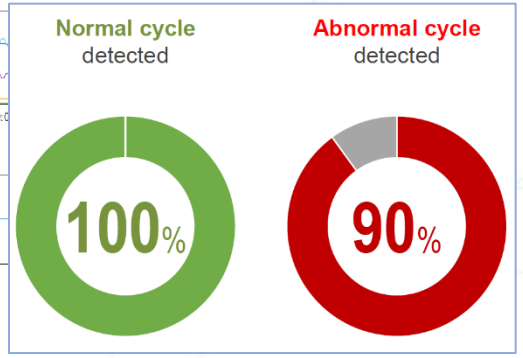


Example 2: Severe effect on the slide and severe effect on the cushion in cycle 100788 causing anomalous operation of the auxiliary pump shown by our STELA application (possible indicator of incorrect press configuration):



Predictive Maintenance





100 Produktionsstätten weltweit

Herstellung von Metall-Automobilbauteilen

Gestamp Business Goals

- Improve uptime of Hot Stamping Presses worldwide
- Reduce production costs

Predictive Maintenance

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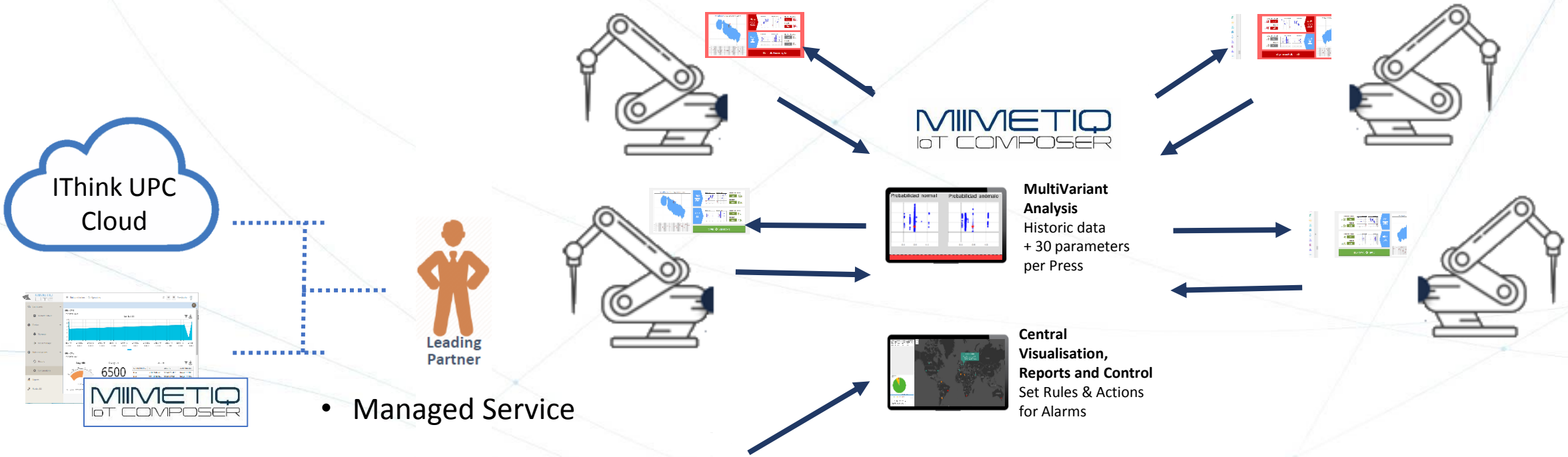
Anforderungen erfüllt - und was hat der Kunde zusätzlich bekommen:

- **Technische Anforderungen**
  - Pressen-Steuerung als zentrales Monitoring-System
  - Datenübergabe an die übergeordnete Gebäudeleittechnik
- **Visualisierung und Überwachung der Pressen**
  - ✓ *Überwachung der Anomalien*
- **Energie-Management – *Lösung:***
  - ✓ ***zentrale Steuerung***
  - Verbrauchs- und Kostenkontrolle – *Lösung:*
    - ✓ *Strom- & Leistungsmessung*
    - ✓ *Volumenstrommessung*
    - ✓ *Wärmemengenzähler*
- **Condition Monitoring mit automatisierten, vordefinierten Störmeldungen**
  - Überwachung zur vorbeugenden Instandhaltung – *Lösung:*
    - ✓ *Überwachung der Pressen-Lager über Schwingungsmessung*
    - ✓ *Betriebsstunden Kompressoren*
    - ✓ *Überwachung Öltemperatur*
    - ✓ *Überwachung Raumtemperatur*
    - ✓ *Überwachung Druckpunkte*
    - ✓ *Überwachung Leistungsaufnahme*
  - Dokumentation für Energie- und Umweltaudit
- **Predictive Maintenance**

Predictive Maintenance



- Managed Service

Historic Data

ANY ASSET DESERVES TO BE CONNECTED

Predictive Maintenance

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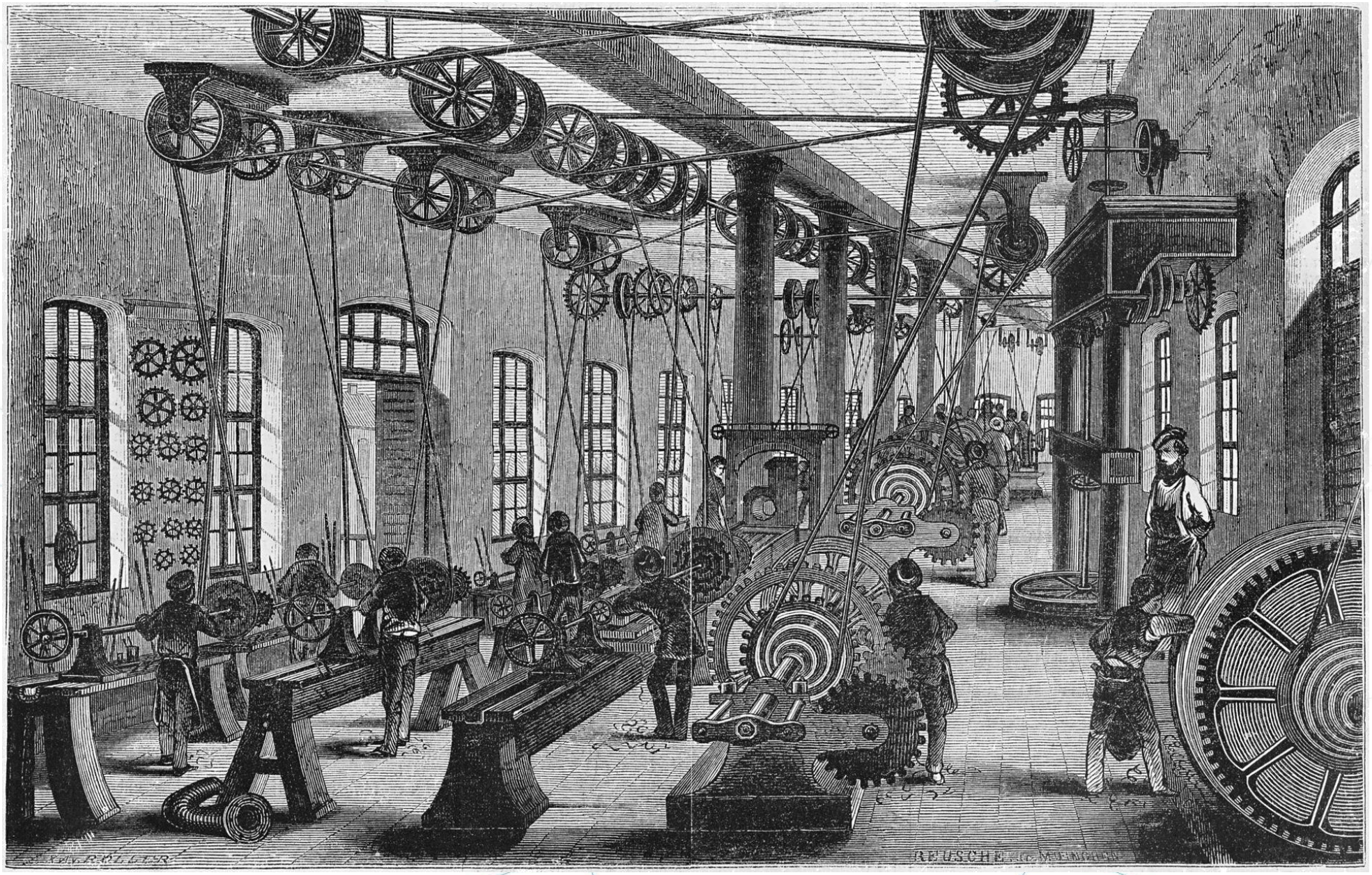

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MIIMETIQ – **Eco-System**

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accenture
HIPRA
seidor
ubuntu Software partner
CANIGÓ
DELPHI
vadecity Smart cities. Smart solutions
WATTABIT Smart Energy Management
IBM
RICOH
MEDIAPRO
arqiva
main memory
IBM PartnerWorld
ISS
webthings
WATTABIT Smart Energy Management
Gestamp
DELL
VT NETWORKS
thinxtra Empowering Internet of Things
E·G·O
enel
intel IoT Solutions Alliance
IThink UPC
grupo SIRT Tu partner tecnológico
CELSA GROUP
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