

Metrology for Digital Transformation - SIM Conference 2022  
Buenos Aires, Argentina, 02 de septiembre de 2022

An abstract graphic consisting of a complex network of thin, light blue lines and nodes, resembling a data network or a molecular structure, set against a dark blue background. The lines are interconnected, forming various geometric shapes and patterns that extend across the width of the slide.

# Traceability of vibration measurements in the context of industry 4.0

Dr. Ing. Cristian R. Muzzio - HITEC S.R.L.

**HITEC SRL**  
sensing & control

# Agenda

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- ✓ The company
- ✓ Concepts on I4.0 and Predictive Maintenance
- ✓ teSensors and teBox – Edge computing
- ✓ Platform – Data Analysis
- ✓ DCC integration
- ✓ Q&A

# HITEC

**HITEC SRL**  
sensing & control



**+35**

Years of experience

**+40**

Experienced professionals

**+10%**

Dedicated r&d staff

**+800**

Customers who trust us

**+15**

World-class brands that accompany us

**+1.000**

Executed projects

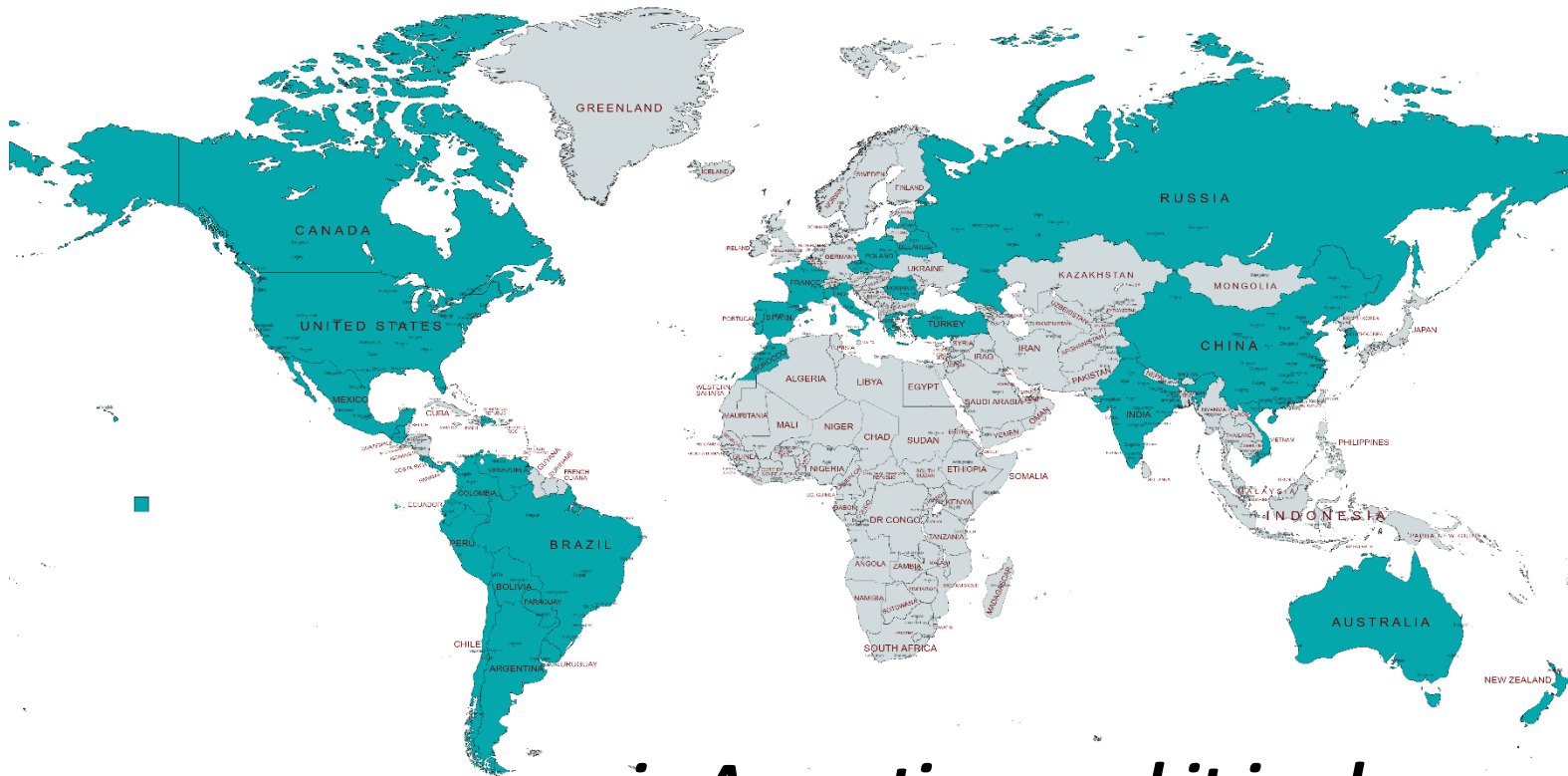


Management System  
ISO 9001:2015



www.tuv.com  
ID 9000021098

# Our technology is recognized...



***... in Argentina, and it is also spread across the globe.***



# Calibration laboratory



# Calibration laboratory

- ISO 17025 (OAA, LC 023) laboratory from 2007 to 2017
- Belongs to the INTI-SAC network since March, 2019
- Specialization on key variables
- Measurement capabilities ranked among the best in the private sector



# Industry 4.0

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# INDUSTRIA 4.0





# Predictive maintenance

- Types of maintenance
- Mean time between failures and availability

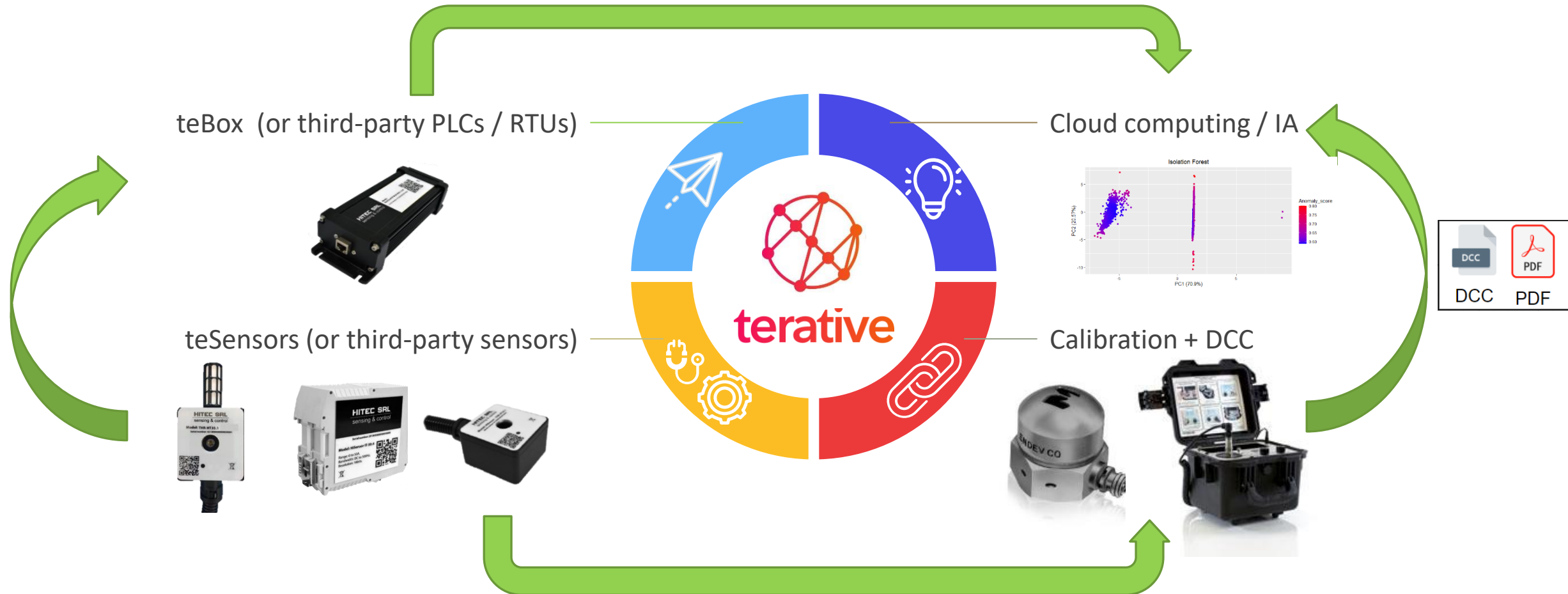
$$MTBF = \int_0^{\infty} tf(t)dt$$

- Advantages of predictive maintenance

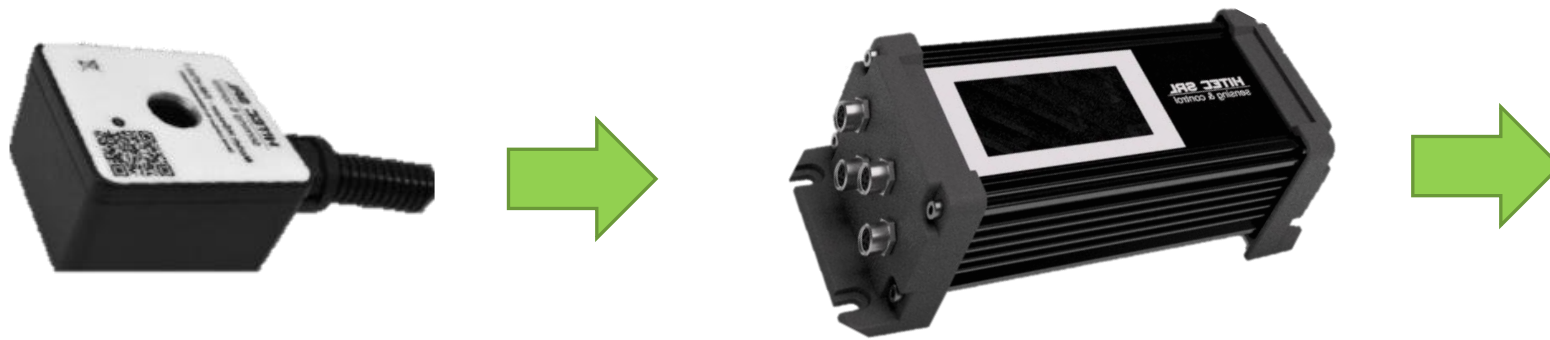




# How do we integrate the technologies?



## How do we integrate the technologies?

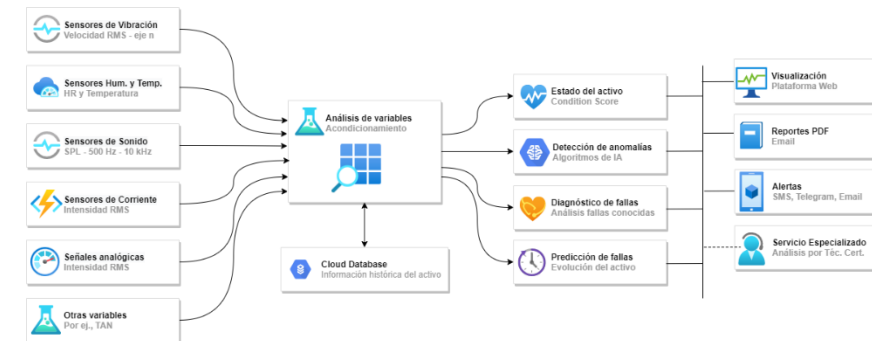
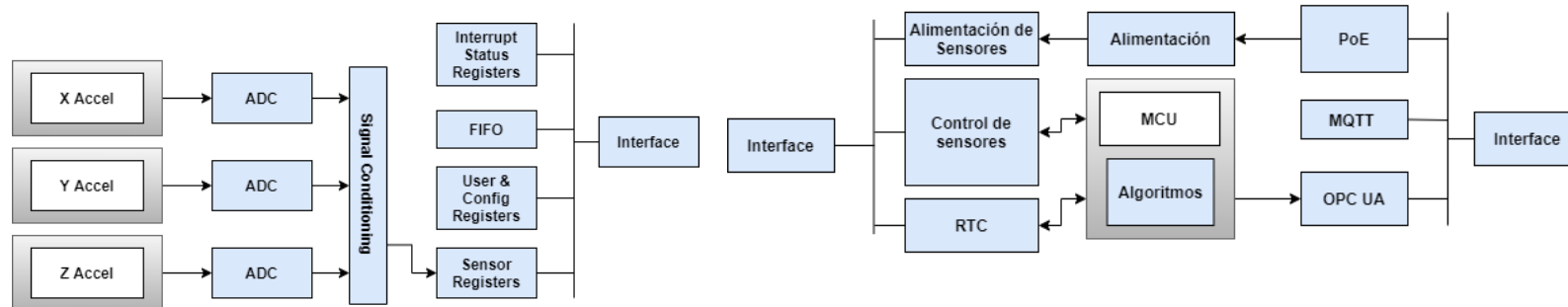


iterative Assets Status Historian Analytics Settings Security Logged user: "hitec@hitec"

Assets

Search:

System	Asset	Location	Condition	Notes
Bomba de agua	Motor	Sala de bombas	<div style="width: 325%;"></div> 325 %	
Bomba de agua	Caño	Sala de bombas	<div style="width: 295%;"></div> 295 %	
Banco de pruebas	Motor CF	Taller de I+D	No data available	
Banco de pruebas	Motor F	Taller de I+D	No data available	
Valija Demo	Motor	Taller de I+D	No data available	



# teSensor VT

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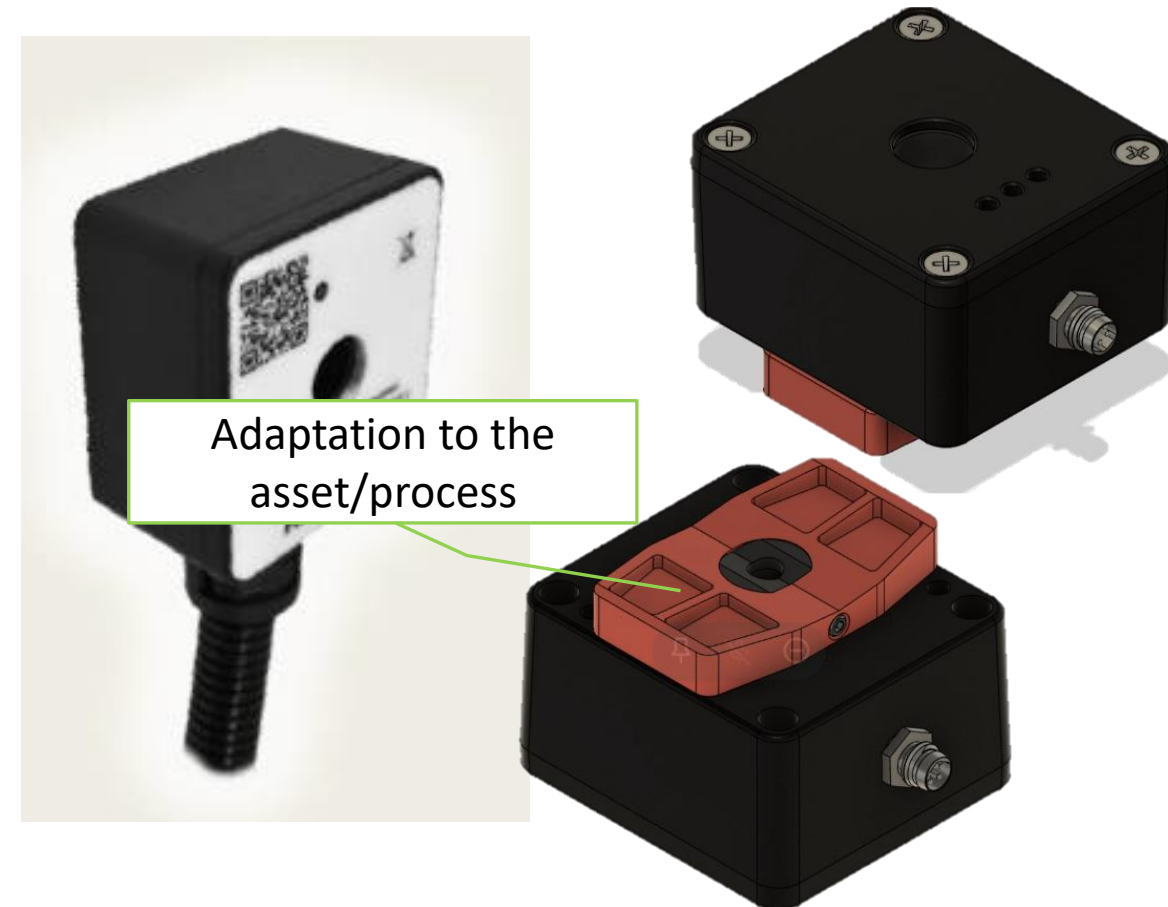
## Features:

- Velocity and acceleration in 3 axes and RMS, average acceleration, peak acceleration, crest factor, FFT analysis
- Measuring range: -16 g a 16 g
- Bandwidth: 500 Hz
- IP65 protection



# Measurement point

- The sensor anchor must allow for repeatable reinstallation relative to the measurement point
- The sensor anchor must allow for repeatable reinstallation relative to the sensor orientation





# teBox – Edge computing

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## Features:

- Edge computing capability (FFT, calculated variables, data management)
- PoE power
- Communication by MQTT, OPC UA, Red Node, etc.

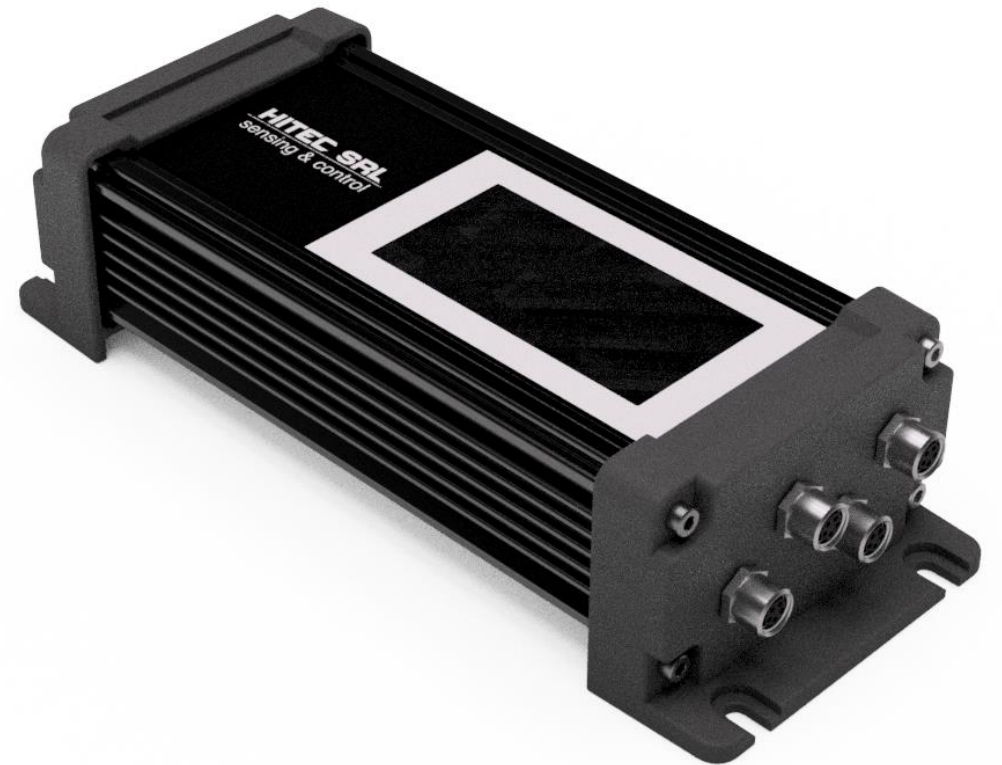


# teBox – Edge computing

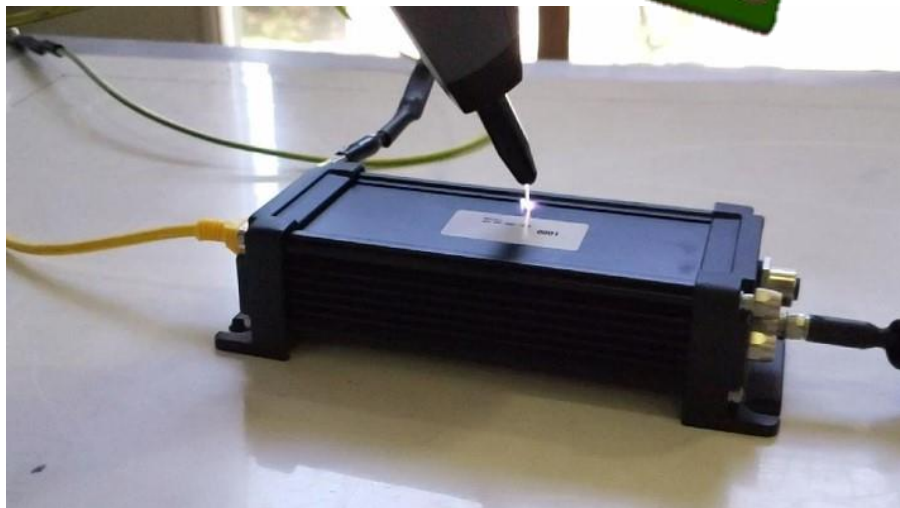
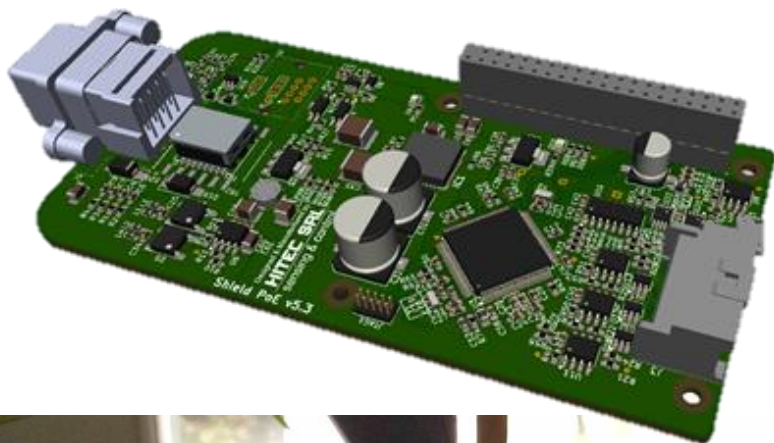
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## Features:

- Ready for different types of teSensors: vibration, acoustic emission, ambient temperature and relative humidity, electrical intensity and frequency, analog signals
- 4 ports for communication with sensors
- IP67 protection

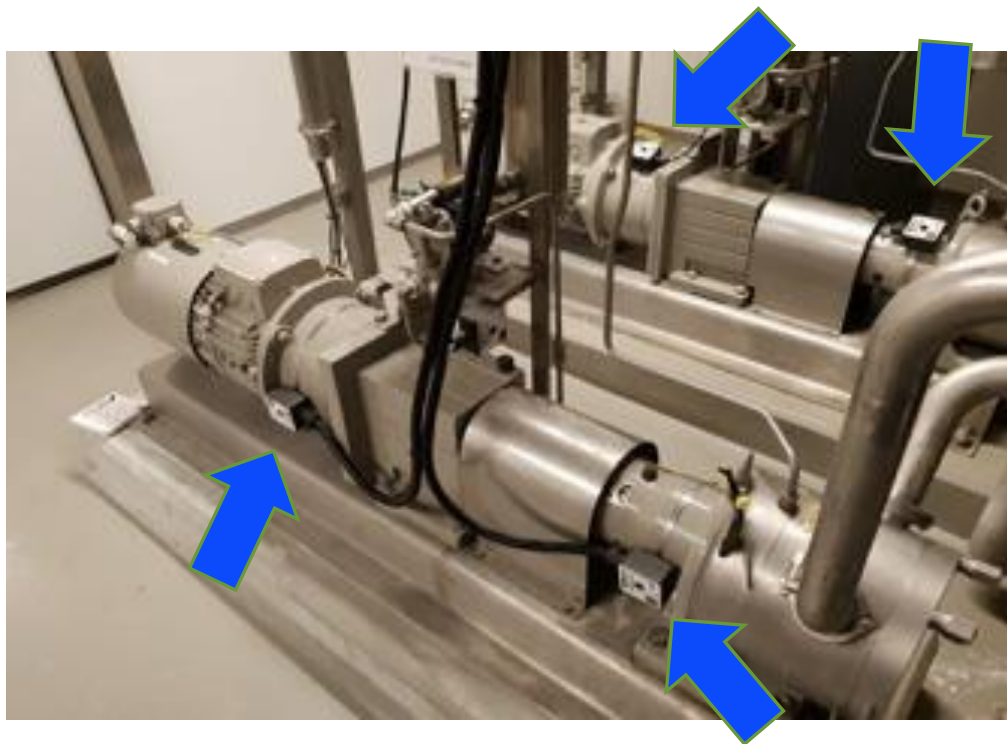


# teBox – Edge computing



# teBox + teSensor VT

## Usage example






# Cloud-based Platform




# Cloud-based Platform

 **Estado del activo**  
Condition Score

 **Detección de anomalías**  
Algoritmos de IA

 **Diagnóstico de fallas**  
Análisis fallas conocidas

 **Predicción de fallas**  
Evolución del activo

terative Demo Assets Status Historian Analytics Settings Security Logged user: "hitec@demo"


### Assets


Search:


System	Asset	Location	Condition	Notes
System 1	ASSET 4 (VPF)	Area 1	54.61 %	High value on Vibration
System 1	ASSET 3 (ELECT)	Area 1	54.27 %	High value on Vibration
System 1	ASSET 2 (BPFO)	Area 1	53.43 %	High value on Vibration
System 1	ASSET 1 (HEALTHY)	Area 1	15.28 %	

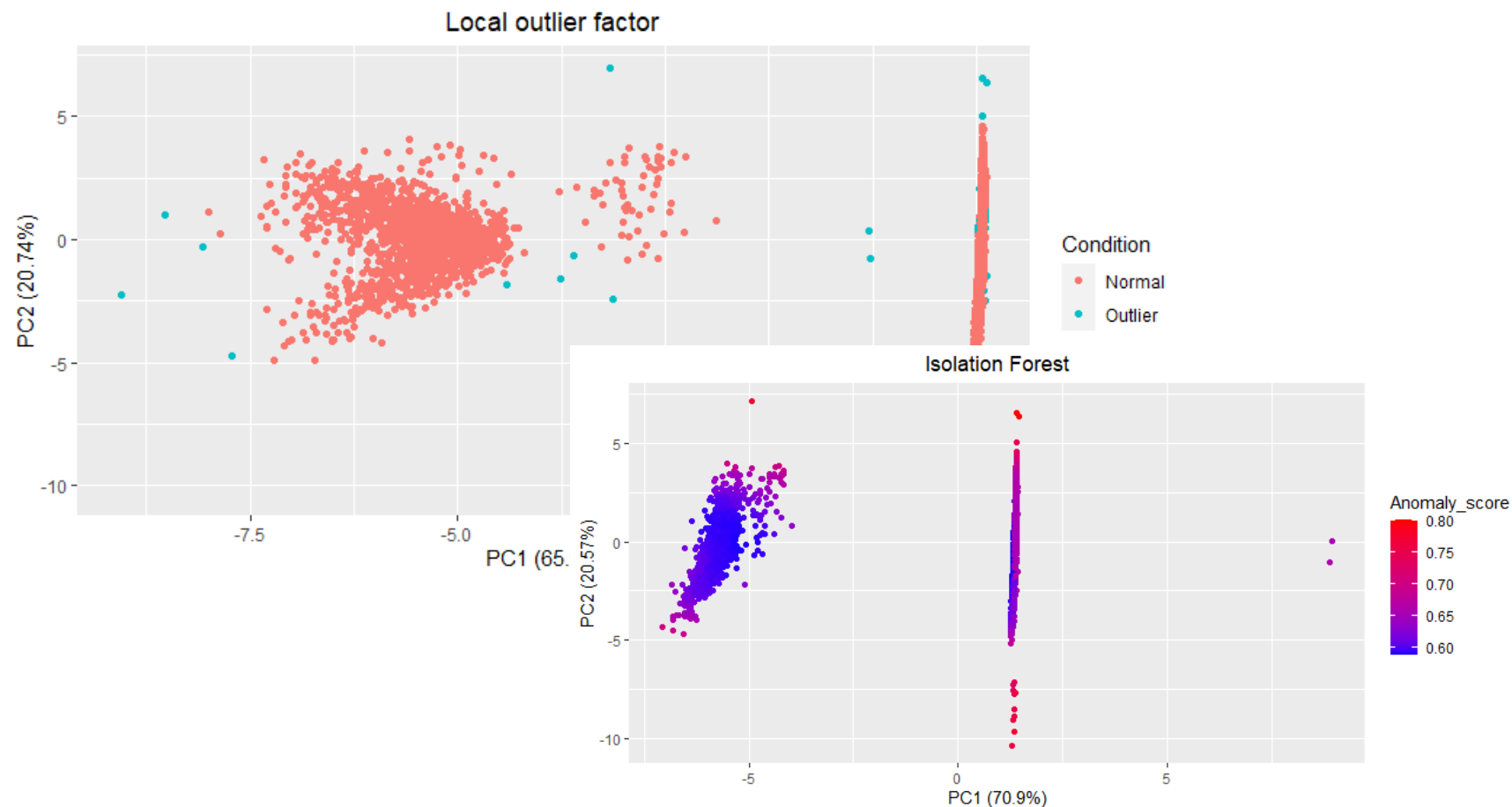
# Cloud-based Platform

 **Estado del activo**  
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Evolución del activo




## Cloud-based


 **Visualización**  
Plataforma Web


 **Reportes PDF**  
Email

 **Alertas**  
SMS, Telegram, Email

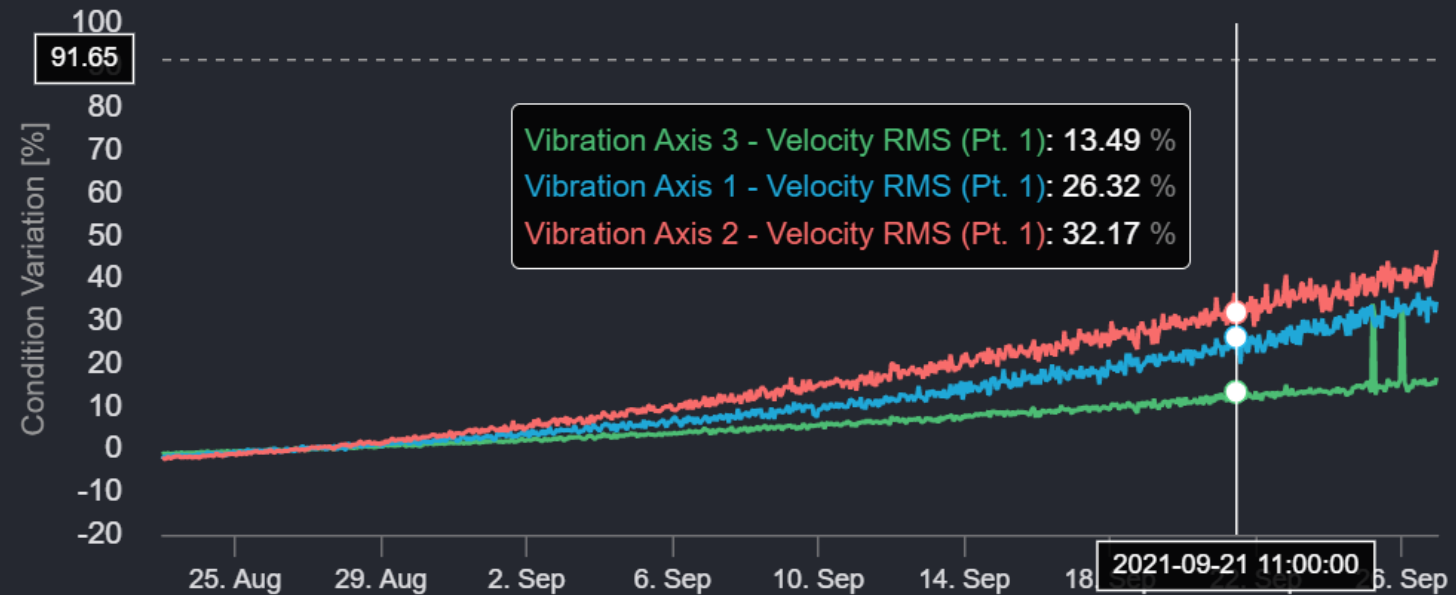
 **Servicio Especializado**  
Análisis por Téc. Cert.


 CS during current period


 Variables with high CS value


 Variables with high CS variation

from 2021-08-23 to 2021-09-26



 Vibration Axis 3 - Velocity RMS (Pt. 1)  
Max: 34.14 %  
Min: -1.19 %  
Avg: 6.18 %


 Vibration Axis 1 - Velocity RMS (Pt. 1)  
Max: 36.80 %  
Min: -2.32 %  
Avg: 11.74 %


 Vibration Axis 2 - Velocity RMS (Pt. 1)  
Max: 46.72 %  
Min: -2.33 %  
Avg: 16.15 %



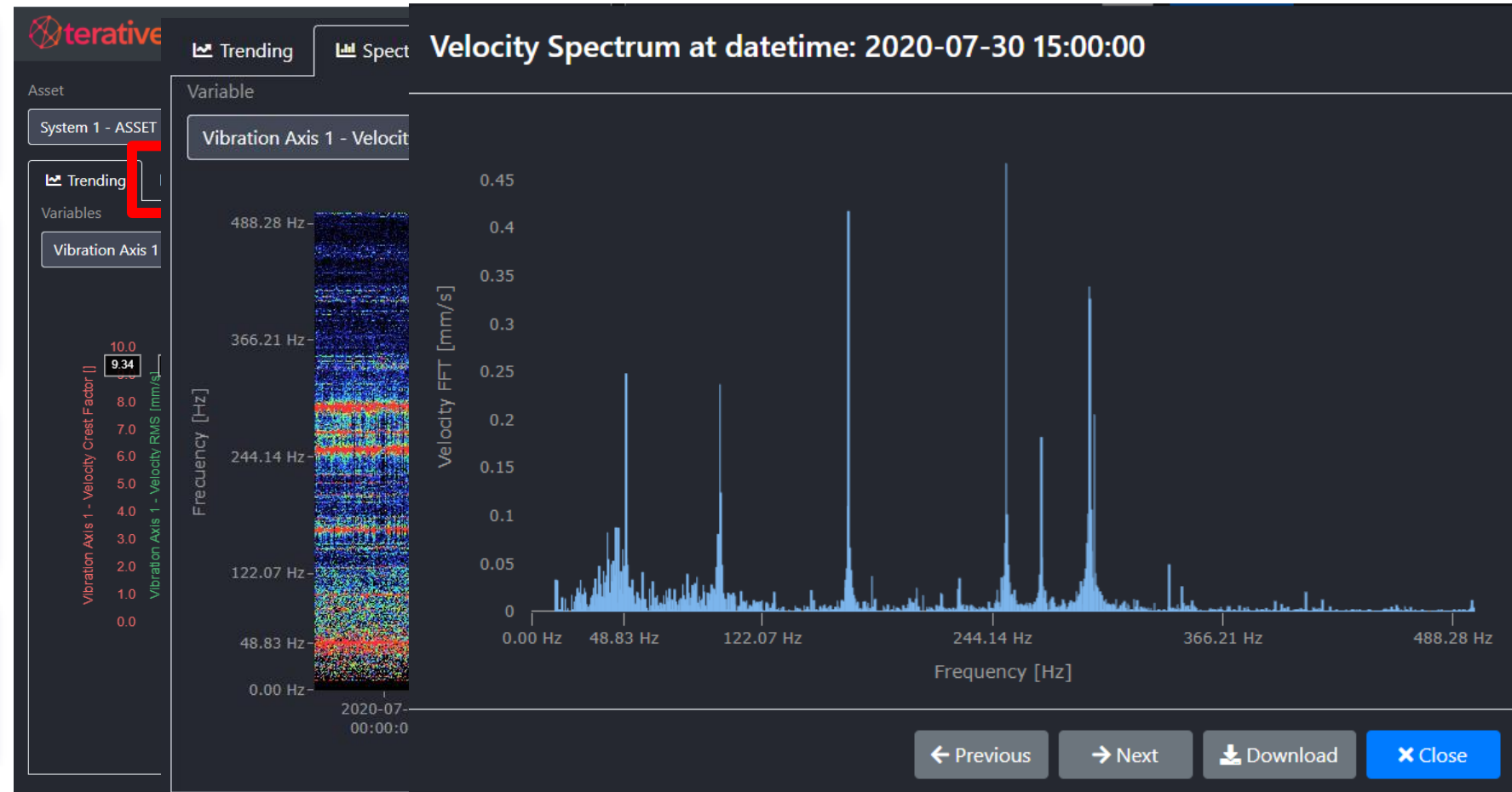
# Cloud-based Platform

 **Visualización**  
Plataforma Web

 **Reportes PDF**  
Email


 **Alertas**  
SMS, Telegram, Email


 **Servicio Especializado**  
Análisis por Téc. Cert.



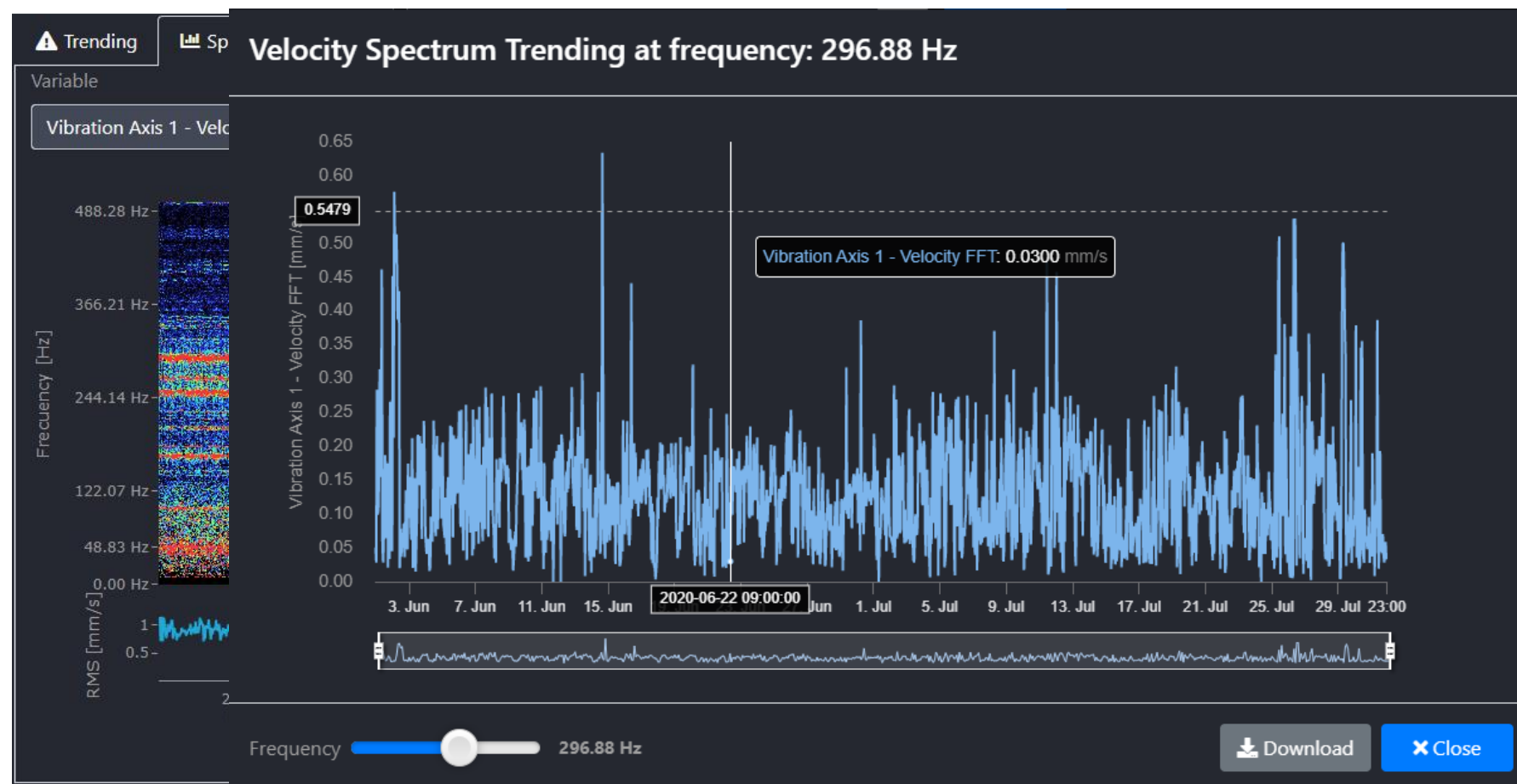
# Cloud-based Platform

 **Visualización**  
Plataforma Web


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## Cloud-based Platform




**Visualización**  
Plataforma Web



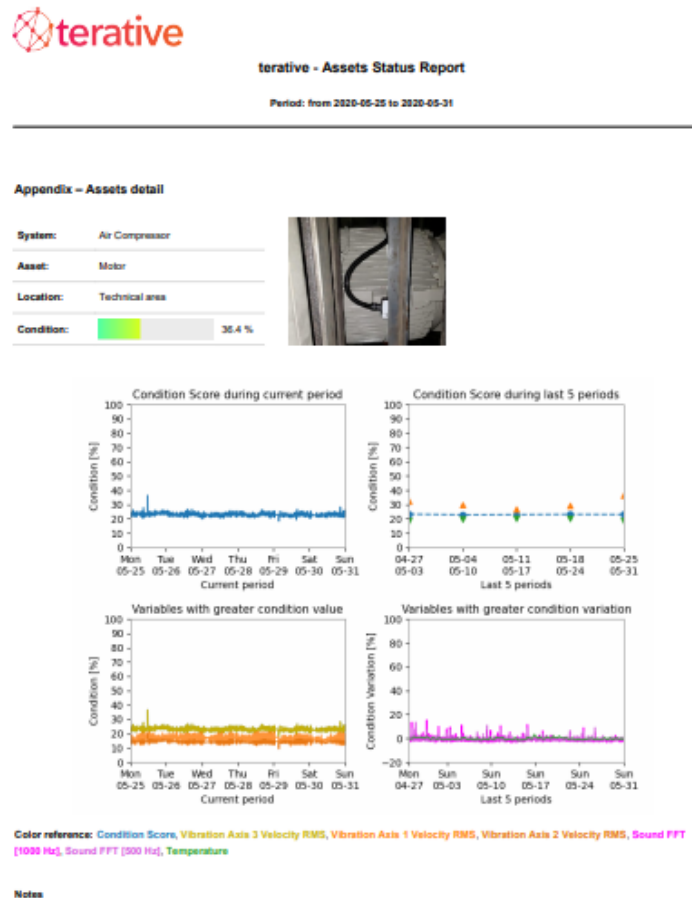
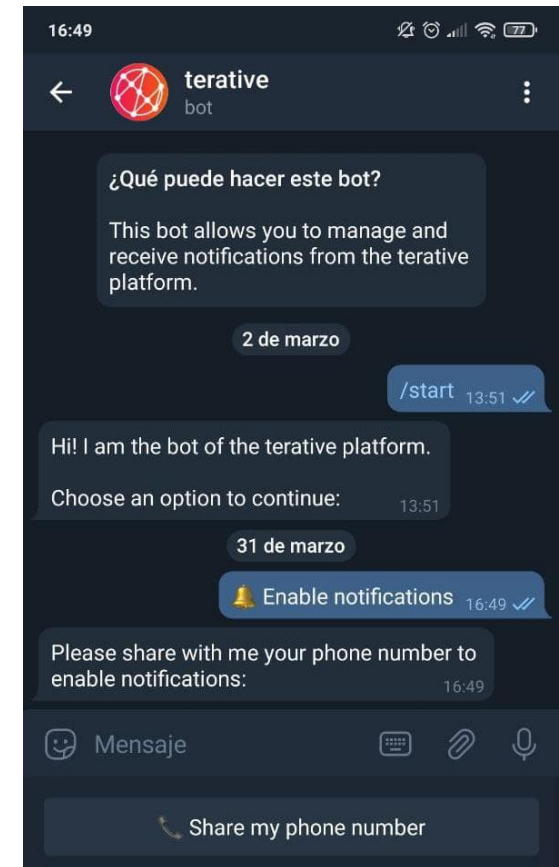
**Reportes PDF**  
Email



**Alertas**  
SMS, Telegram, Email



**Servicio Especializado**  
Análisis por Téc. Cert.

16:49

terative bot

¿Qué puede hacer este bot?

This bot allows you to manage and receive notifications from the terative platform.

2 de marzo

/start 13:51 ✓

Hi! I am the bot of the terative platform.  
Choose an option to continue: 13:51

31 de marzo

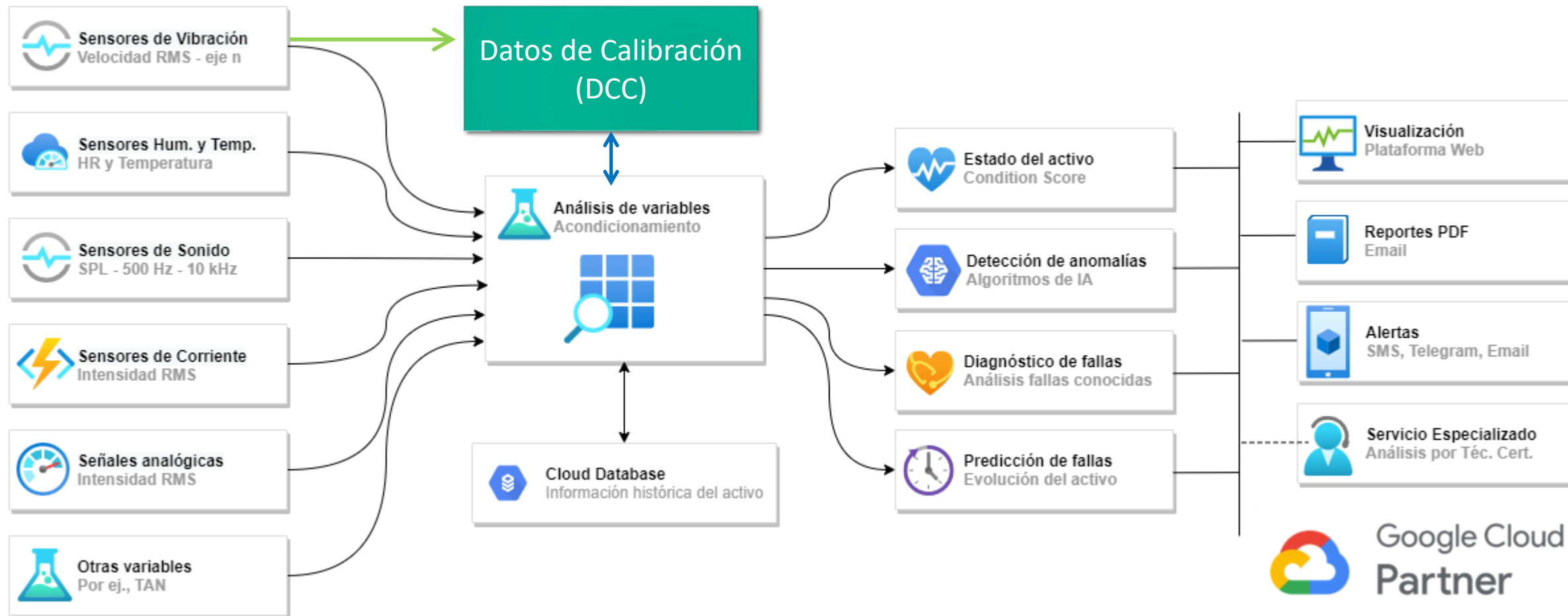
Enable notifications 16:49 ✓

Please share with me your phone number to enable notifications: 16:49

Mensaje

Share my phone number

# Big data – Data quality



# ANR Asociativo INTI- Hitec

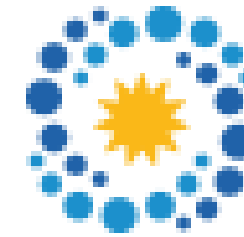
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**HITEC SRL**  
sensing & control

## General objective:

Implement and spread the use of digital calibration certificates in calibration services within the industry 4.0 framework.



**Agencia I+D+i**

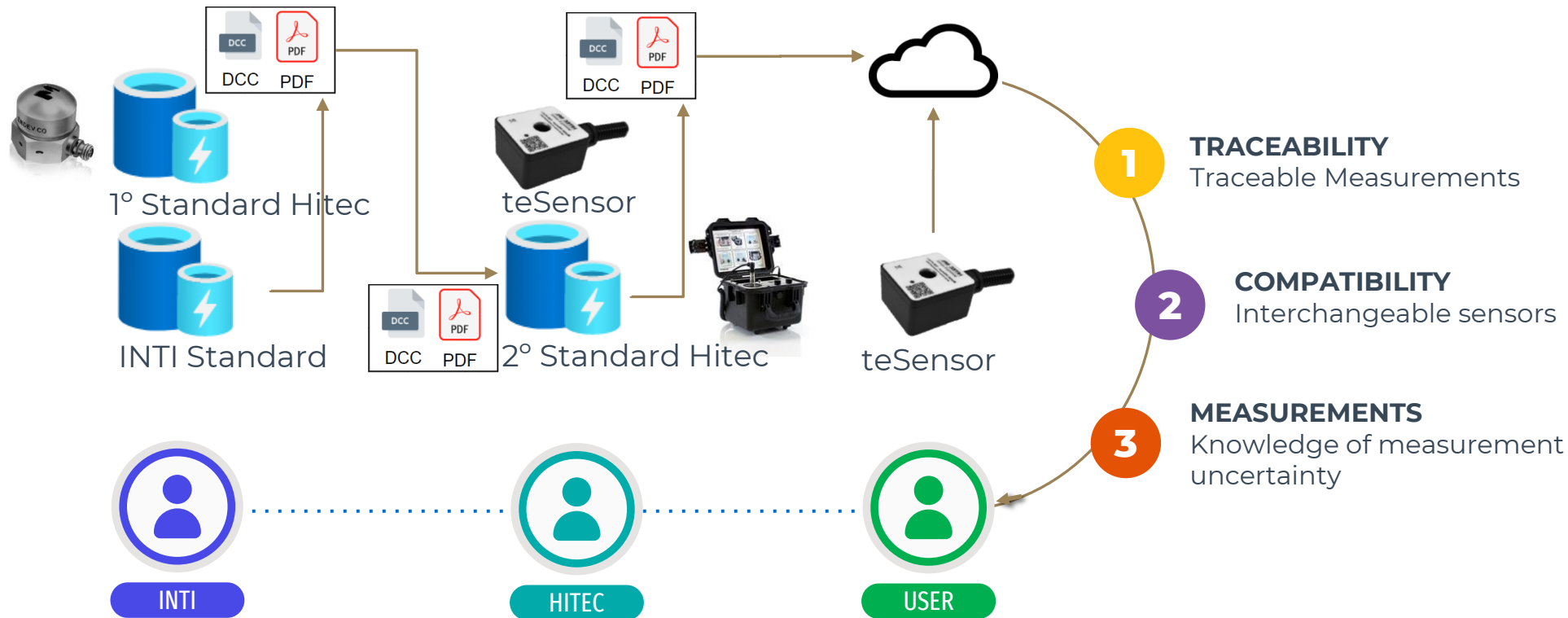
## Particular objective:

The particular objective of this project is the adaptation of the vibration sensors manufactured by the company (teSensors) so that they can automatically receive and adjust to the DCCs emitted from a calibration system adapted for this purpose.





# Traceability Chain



# Acquired equipment

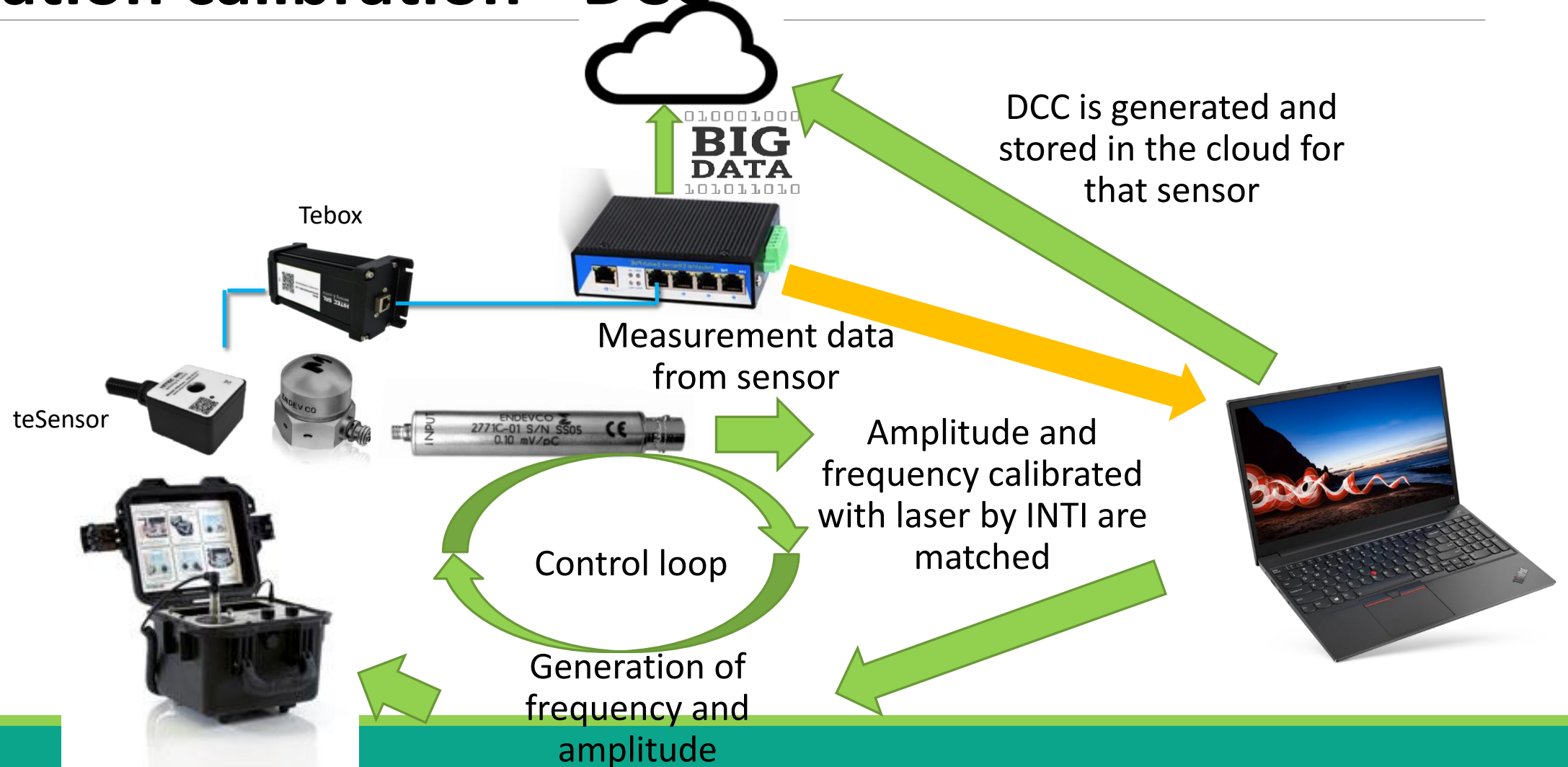
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- Portable Shaker Vibration Calibrator with known vibration reference source
- Cell Vibration pattern, signal amplifier and signal conditioner



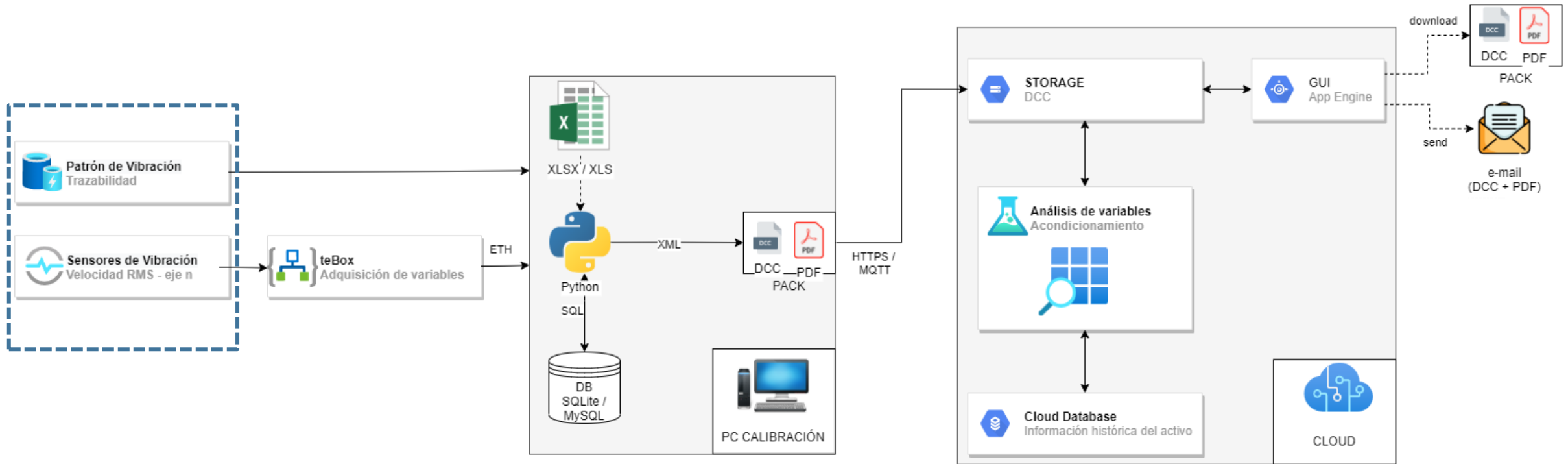


# Vibration calibration - DCC



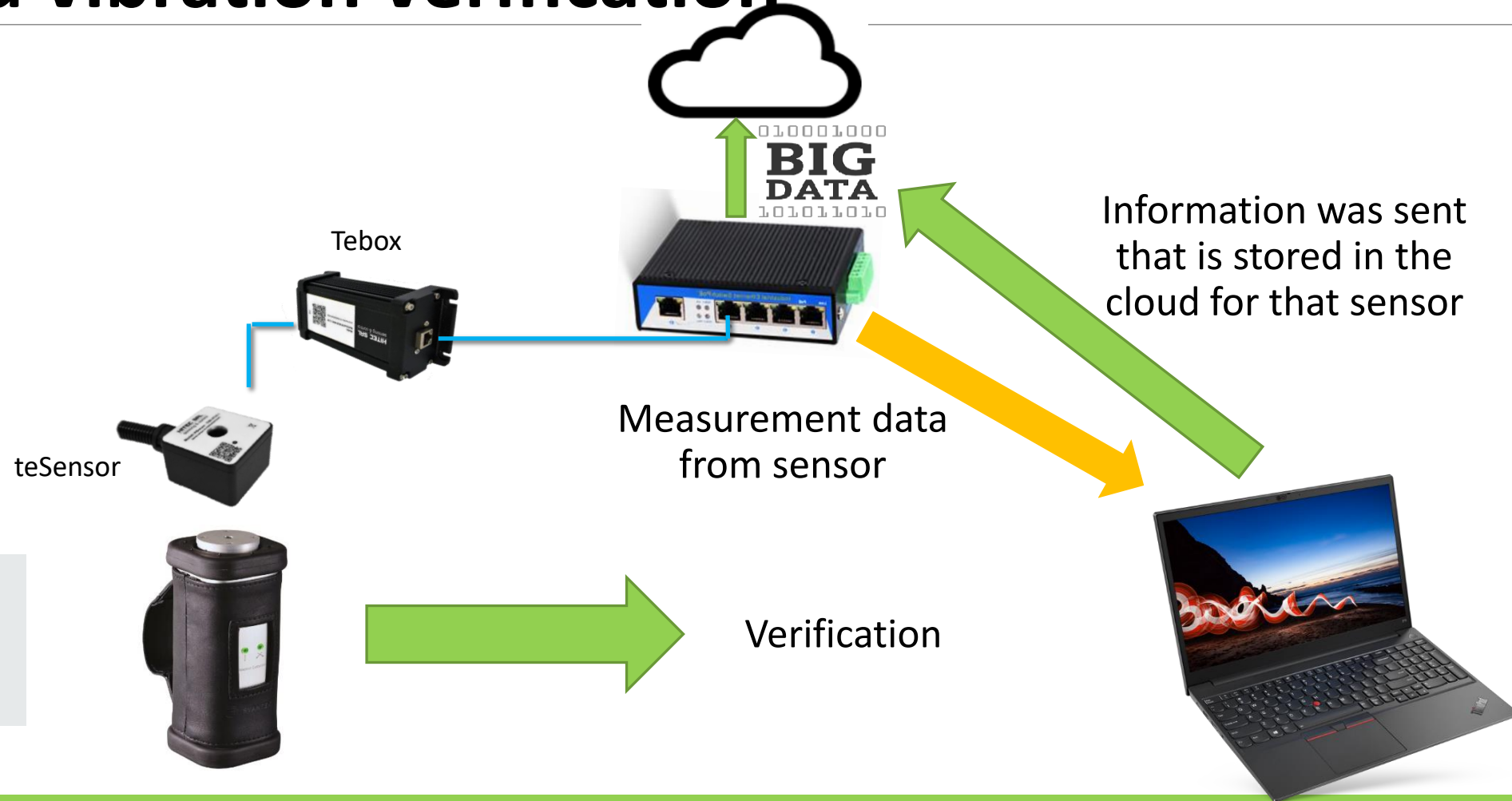


# Vibration calibration - DCC





# Field vibration verification





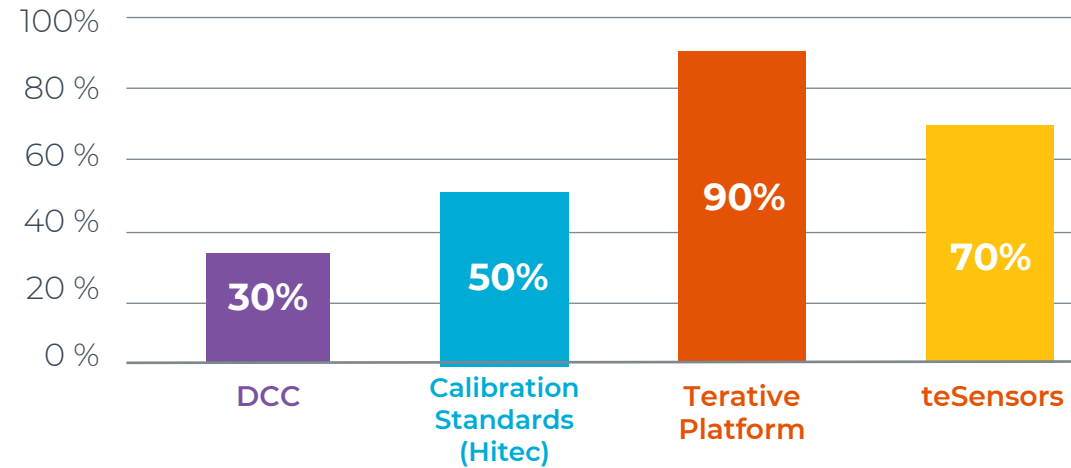
# Project current status

```

23 </xs:documentation>
24 </xs:annotation>
25 <xs:element name="digitalCalibrationCertificate" type="digitalCalibrationCertificateType"/>
26 <xs:complexType name="digitalCalibrationCertificateType">
27 <xs:annotation>
28 <xs:documentation>
29 The root element that contains the four rings of the DC.
30 </xs:documentation>
31 </xs:annotation>
32 <xs:sequence>
33 <xs:element name="administrativeData" type="dc:administrativeData"/>
34 <xs:element name="measurementResults" type="dc:measurementResults"/>
35 <xs:element name="comment" minOccurs="0"/>
36 <xs:complexType>
37 <xs:sequence>
38 <xs:any namespace="##any" minOccurs="1" maxOccurs="unbounded" type="base64Binary"/>

```

Project current status



DCC: Includes the development of the code and its configuration for inclusion in the platform  
 Primary Standard: Includes the acquisition and development of procedures.  
 Platform: Includes the development and adaptation of the platform for the use of DCC  
 teSensors: Includes the development and adaptation of teSensors for the use of DCC

# Questions?



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# Thank you!