Con il contributo di:

Nanoinnovation 2016

A Cyber-Physical Future, Intellimech towards Industry 4.0

Consorzio Intellimech

Fabio Floreani

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Intellimech

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INTELLIMECH is one of the **first entirely private-held research consortium** which aims at representing a benchmark for innovative – led enterprises, science institutes, advanced research and development organizations in the Italian panorama

It **counts 22 enterprises** and promotes pre-competitive **projects in the mechatronics field**.

The Consortium converts R&D and interdisciplinary experimental activities into **pre-competitive technological platforms** and **pre-production prototypes** in innovative cross-industry applications, involving directly the Consortium's partners

Nanoinnovation 2016

Our projects: details

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Technological Update Projects

- **Projects selection through a depth analysis about prior industrial technologies; forecasting and technological benchmarking through the voice of experts and the scientific committee of the consortium.**

Specific projects

- **Engineering of the results of pre-competitive projects for Consortium Members and for Non-Members too.**

Pre-Competitive Projects

- **Selection of R&D projects for competitive technological platforms shared across the Members.**

TYPE	BUDGET	LENGTH	IPR	OUTCOME
Shared	Low	6 months	Members	State of the art, market and industrial applications..
Specific	Depending on the effort	Depending on the effort	Customer	Depending on the project
Shared	High	1 or 2 years	Members	Demonstrator, pilot or prototype

Our projects

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TECNOLOGIE

Manufacturing Big-Data | Advanced HMI | Cloud manufacturing | Advanced automation | …

PROCESSI

Operations

Qualità

Manutenzione & Service

ESIGENZE E PROBLEMATICHE SPECIFICHE DEI SOCI

From Industrial need to technological solutions

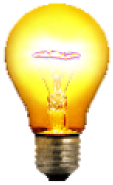
Technological Update Projects

TECNOLOGIE

IoT & Smart object | Manufacturing Big-Data | Advanced HMI | Cloud manufacturing | Advanced automation | …

TECNOLOGIE ABILITANTI

From technological so9lutions to ideas



Aziende del Consorzio

ABB, Balance Systems, BALLUFF sensors worldwide, brembo, CMS Industries, CONFINDUSTRIA BERGAMO, cosberg innovaction, ELETTROCABLAGGI, FASSI, G.O., EFae, itema, kilometro rosso, Lovato electric, N&W, SAME DEUTZ-FAHR, INDEVA, SERVIZI, SIAD MACCHINE IMPIANTI, VINSERVICE, VALTELLINA, TenarisDalmine

Problemi e necessità

Soluzioni tecnologiche

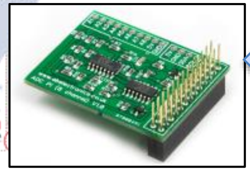
Idee progettuali

Dimostratori tecnologici

Ricercatori e CTS

Specific Projects

From technology demonstrators to specific applications



From ideas to technology demonstrators

Pre-Competitive Projects

TECNOLOGIE

IoT & Smart object | Manufacturing Big-Data | Advanced HMI | Cloud manufacturing | Advanced automation | …

PROCESSI

Operations

Qualità

Manutenzione & Service

Soluzioni = Processi ∩ Tecnologie

Project Path

Technological Update Projects

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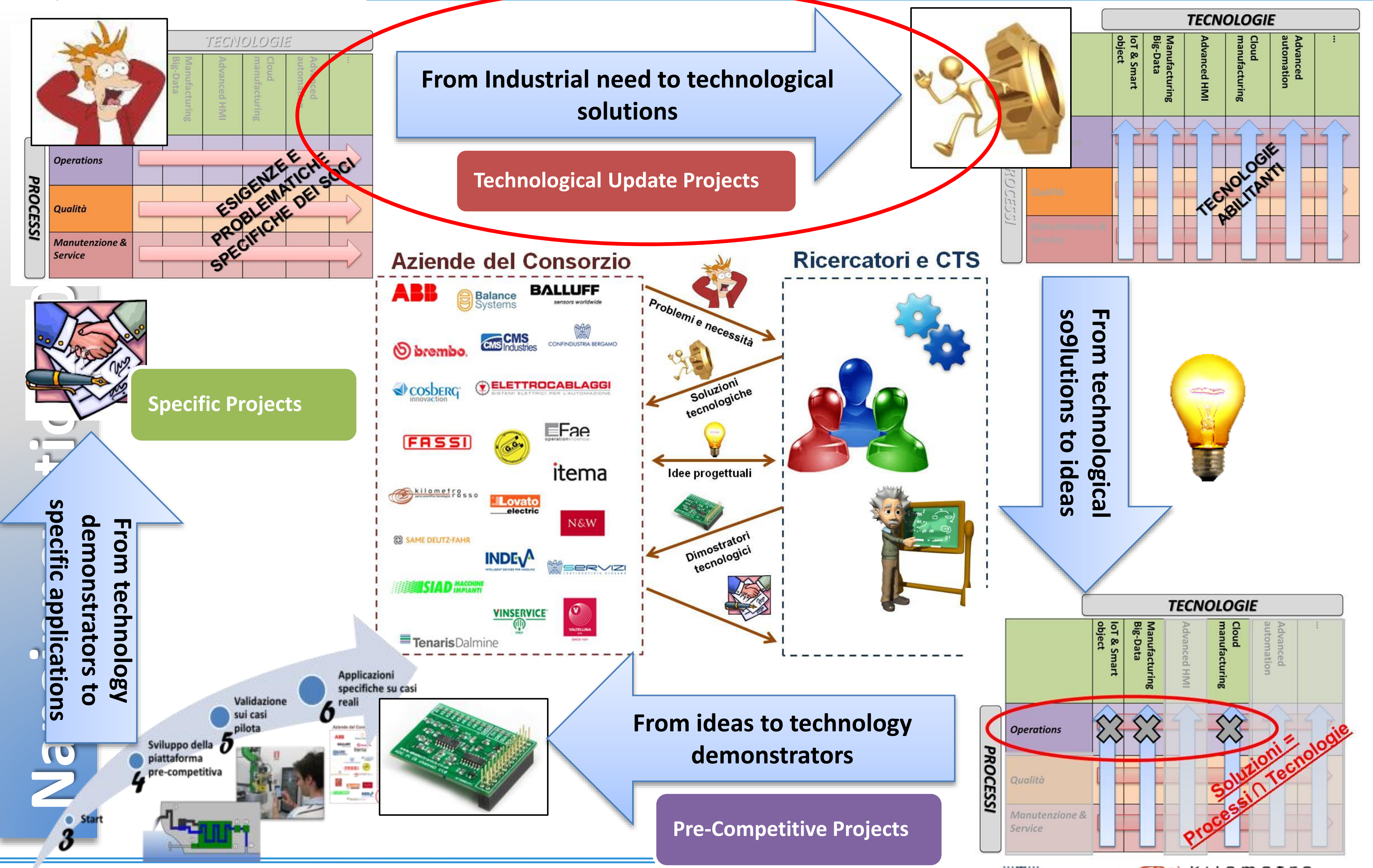


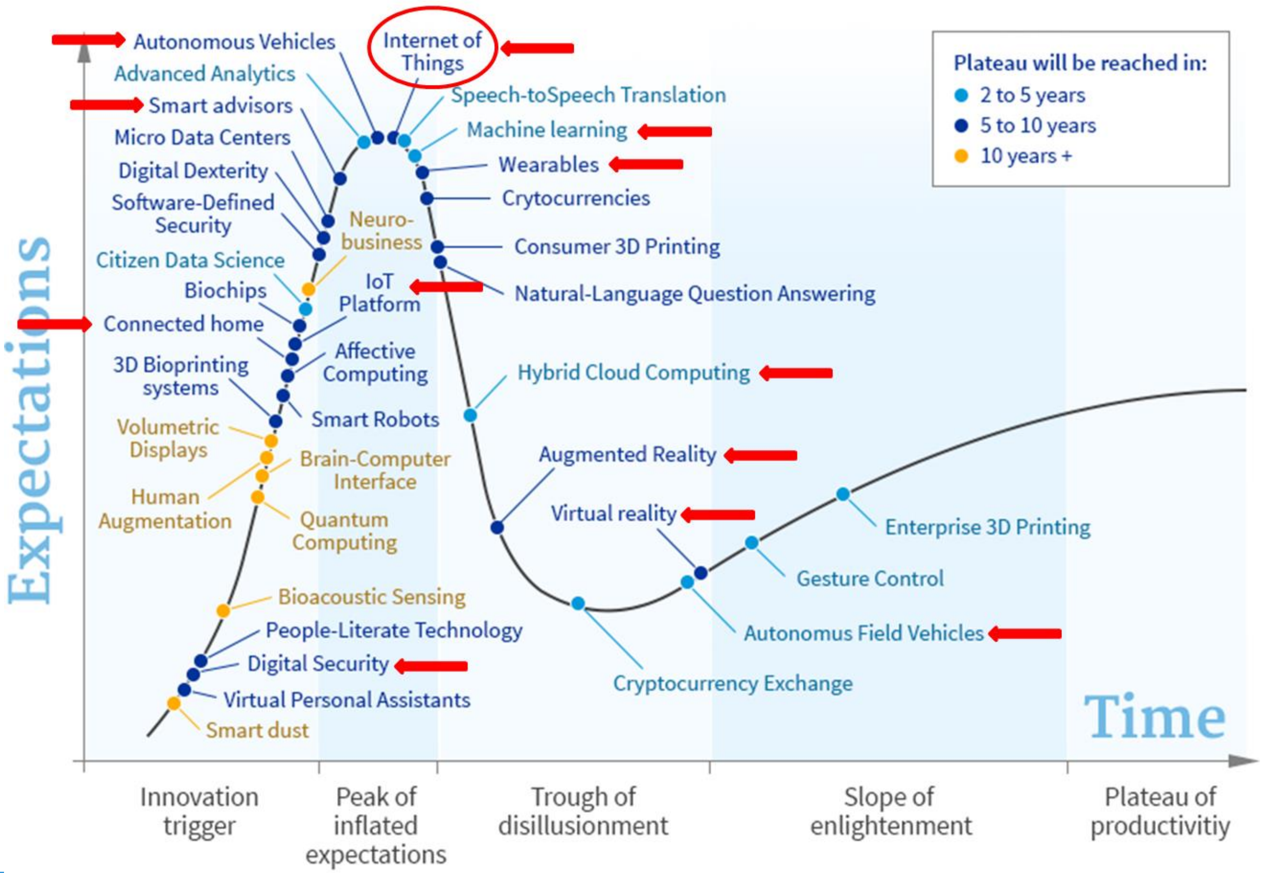
Technological Update Projects

IOT project

Nanoinnovation 2016

Technological systems and solutions for the **monitoring** and the **predictive diagnostic** in **maintenance and service.**

<u>Enterprise need:</u> monitoring production KPIs keeping them within specific limits



Technological Update Projects

IOT project

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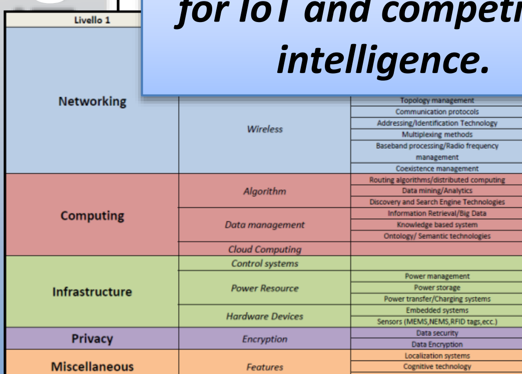
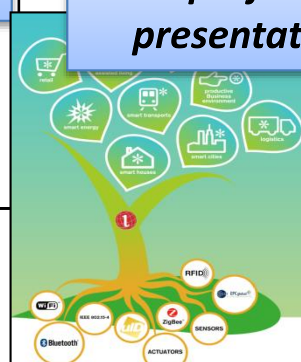
		Year									
WP	Definition	1	2	3	4	5	6	7	8	9	10
1	*Analisi della tematica e definizione degli ambiti tecnologici di interesse*										
	Dettaglio e										
	e ... nto ... ty										
4	*...ioni e valutazioni finali*										

1. Kick-off, technologies for IoT and competitive intelligence.



2. IoT-A European project presentation.



3. Fitman European project presentation.

4. Cybersecurity in IoT.

5. Industrial applications.

Project Path

Project ideas

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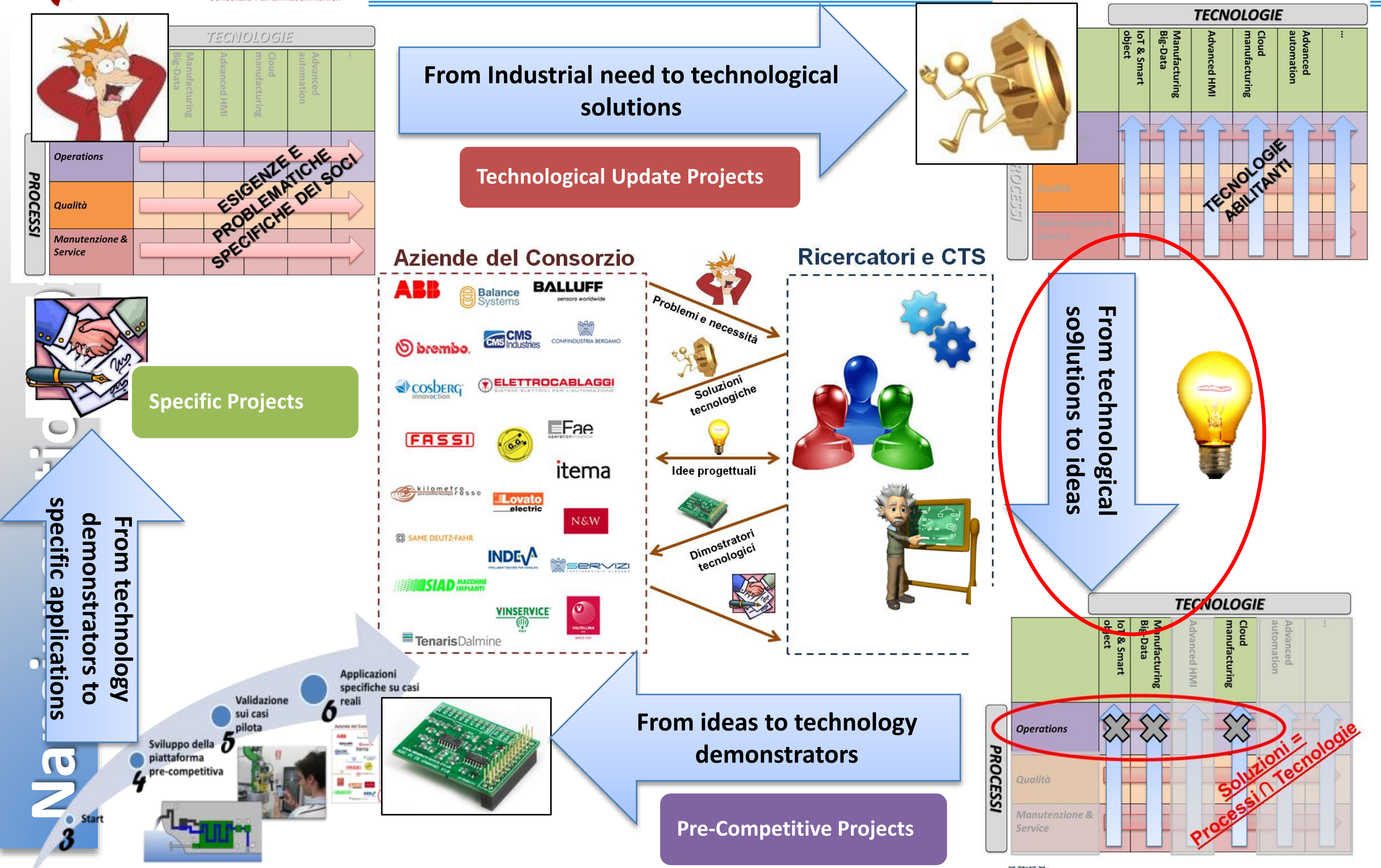

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Project idea

Smart monitoring

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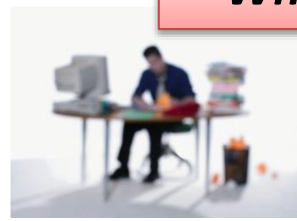
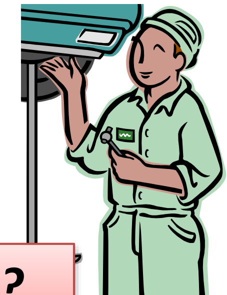
When?

Where?





How?

Who?

What?

CHALLENGE:

***User-centric Approach**: To prevent individual users from being »deluged« and overtaxed by all the information provided by the individual systems of a factory, **the information must be made available as role-specific information and must be distributed accordingly. Each user is supplied with »specially tailored« information that he needs for his tasks.** Intelligent data fusion, filtering and decision-support systems are necessary to that end.*

Courtesy of Fraunhofer institute

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Project Path

Pre-Competitive Projects

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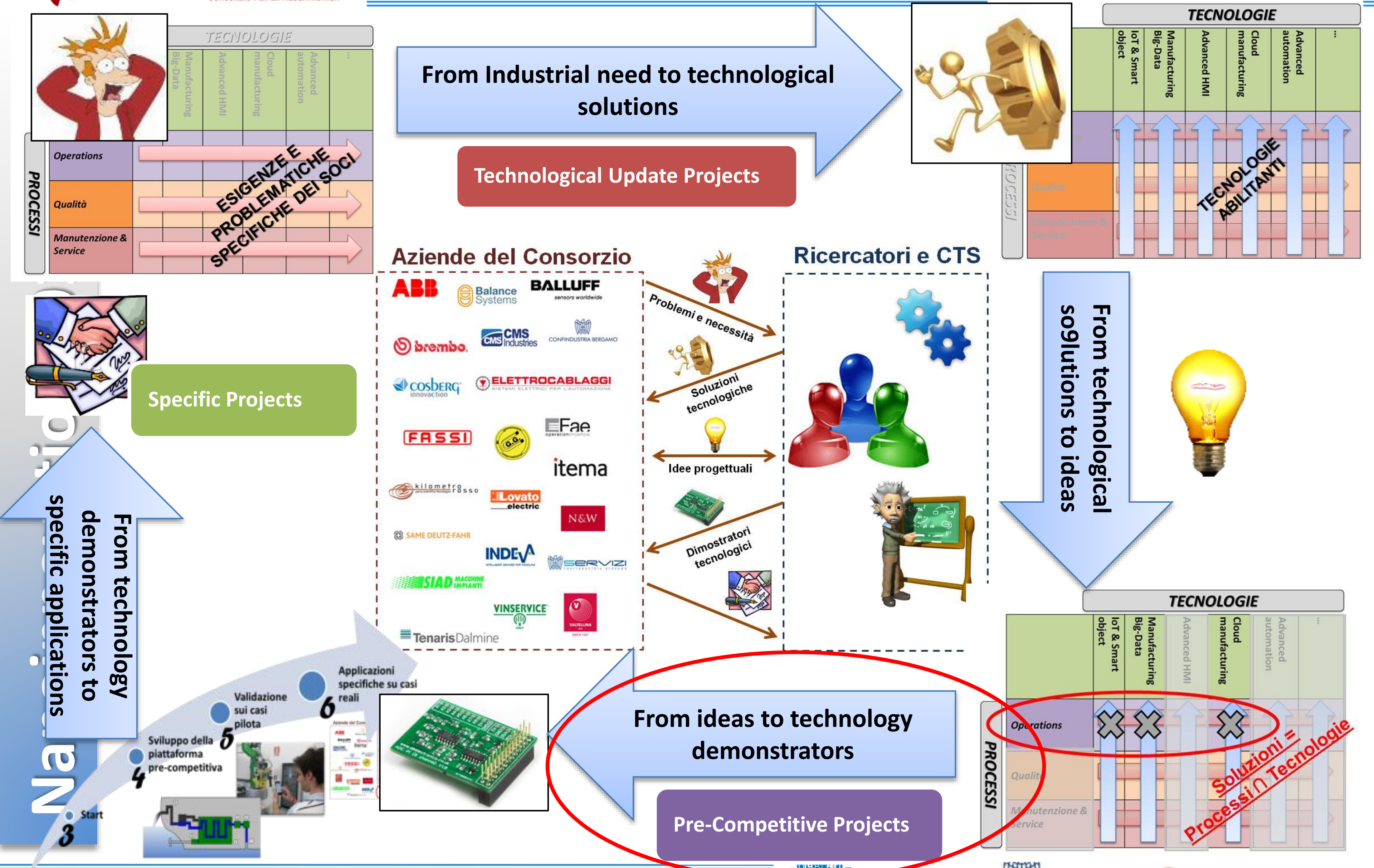

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Pre-Competitive Projects

TOUCHPLANT

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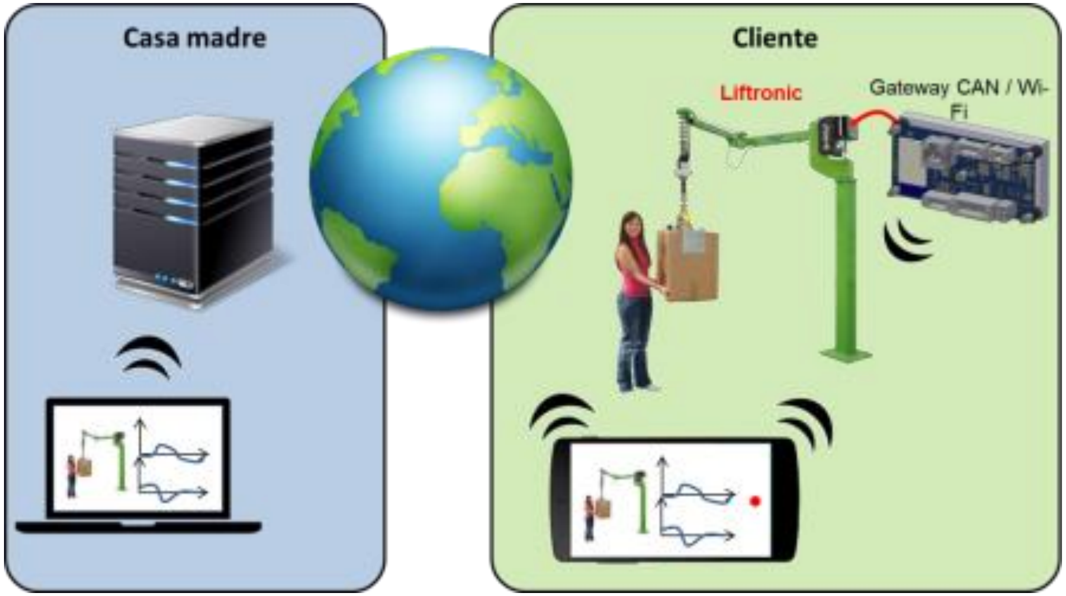
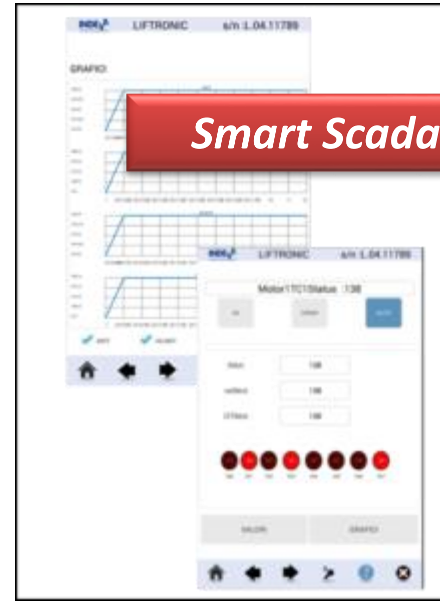
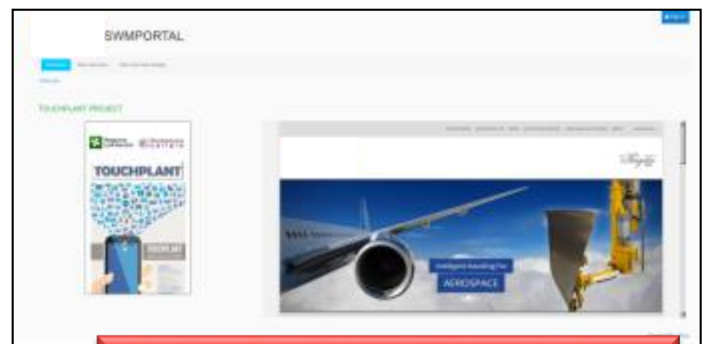




Smart Scada

Video & Data Sync



Data Center & Remote server

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Pre-Competitive Projects

TOUCHPLANT, vendor case

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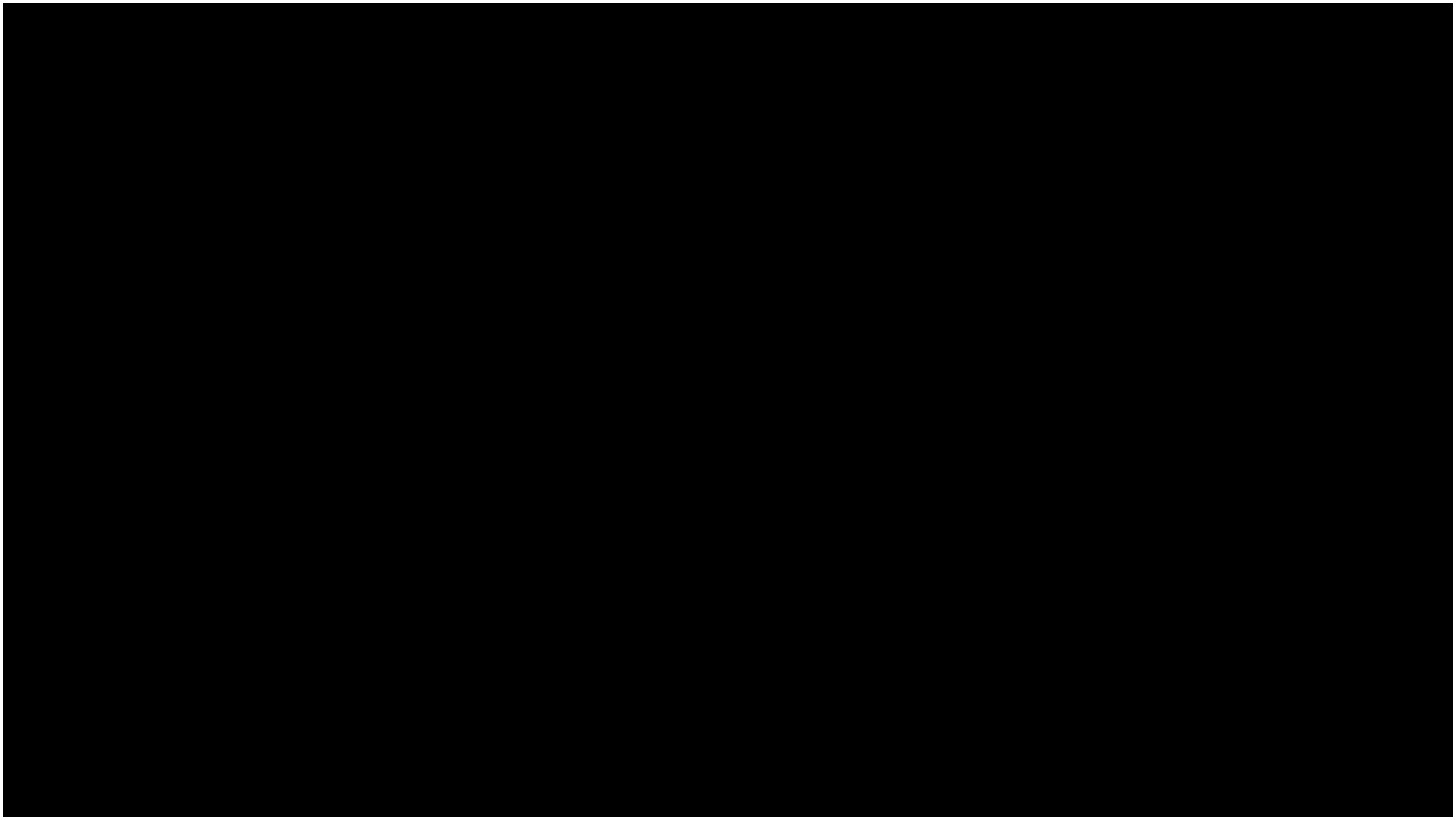

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Project Path
Specific Projects

INTELLIMECH® CONSORZIO PER LA MECCATRONICA

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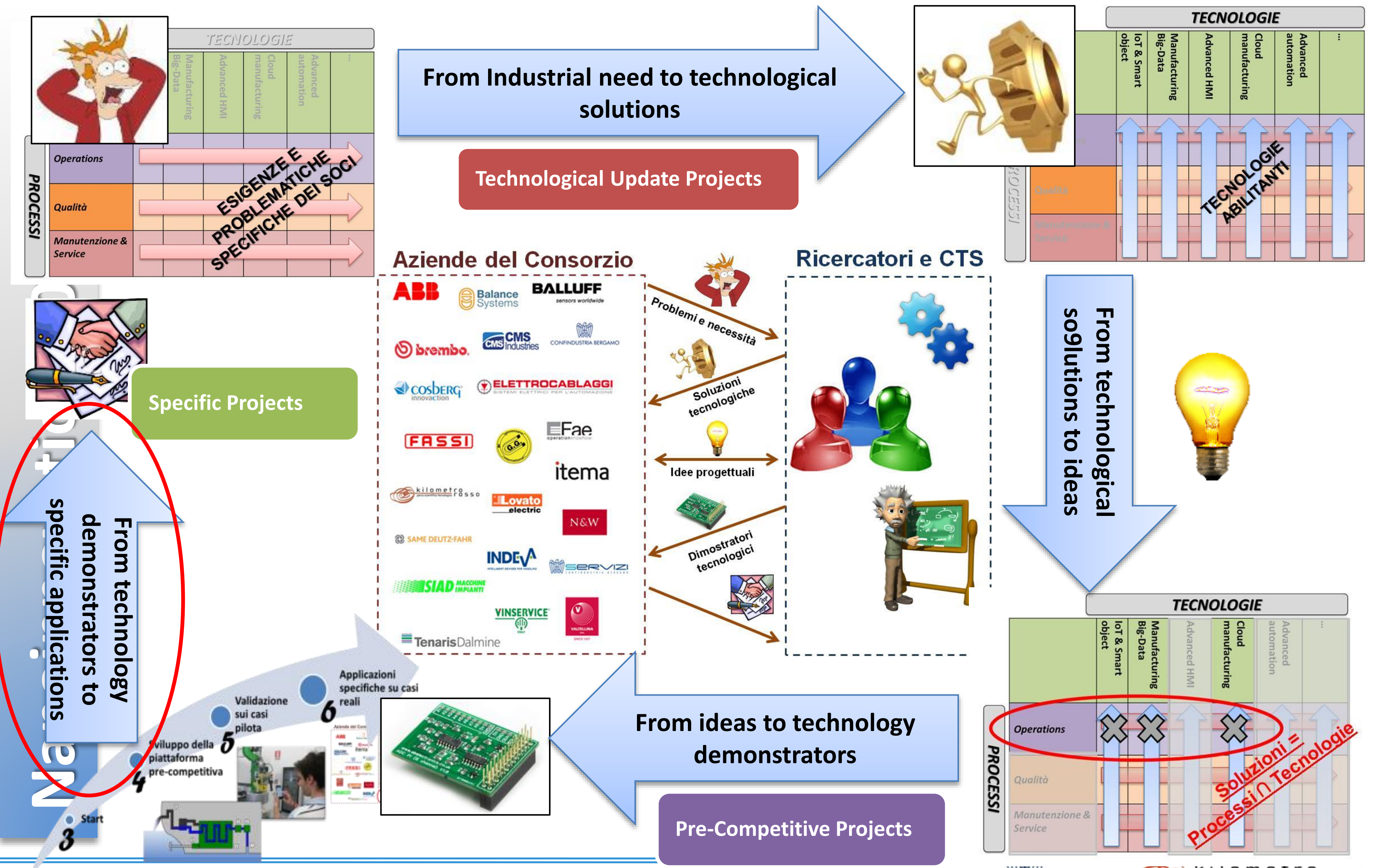

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Specific Projects

MAINTE – Loom monitoring System

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- Develop a web-based machines monitoring system accessible from all modern devices (computers, smartphones, tablets..).
- Give operators the ability to customize the information displayed.
- Provide a data analysis tool for the data collected from the machines usable even by untrained personnel.
- Use the data collected from the machines to provide additional information on the quality of the finished pieces of cloth.

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Specific Projects

MAINTE – Loom monitoring System

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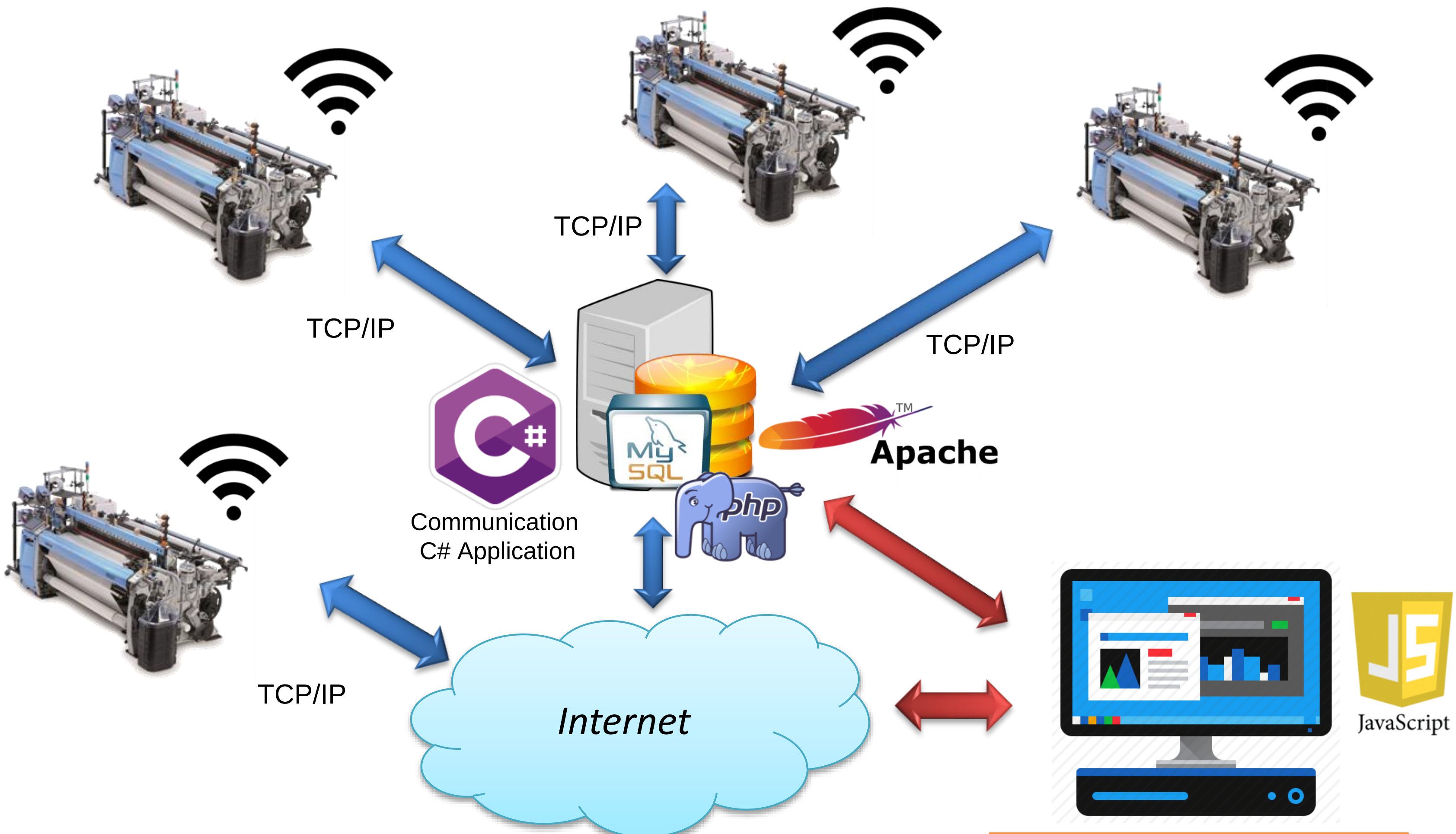

Monitoring

Data analysis

Customization

System architecture

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Specific Projects

MAINTE – Loom monitoring System

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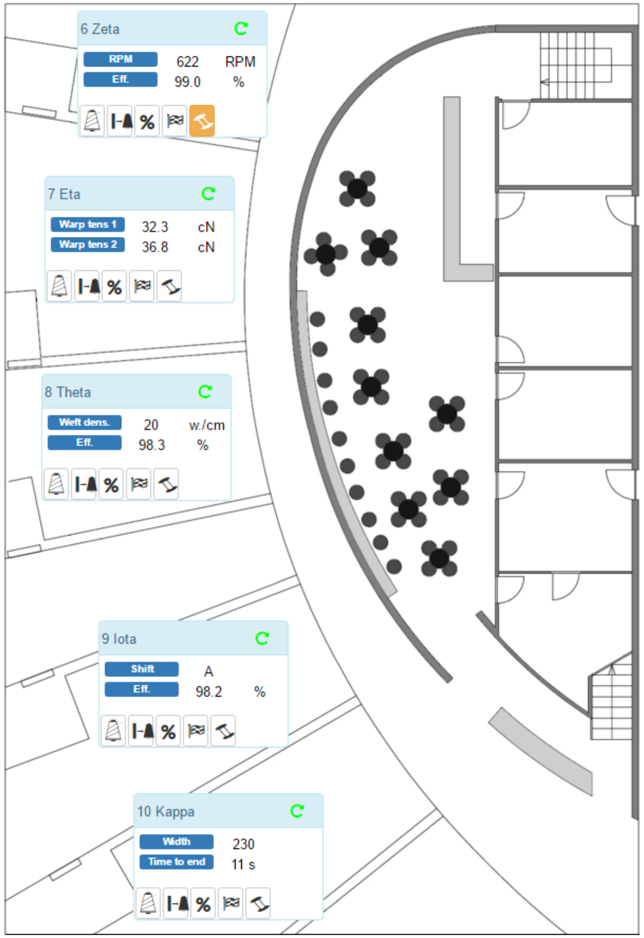
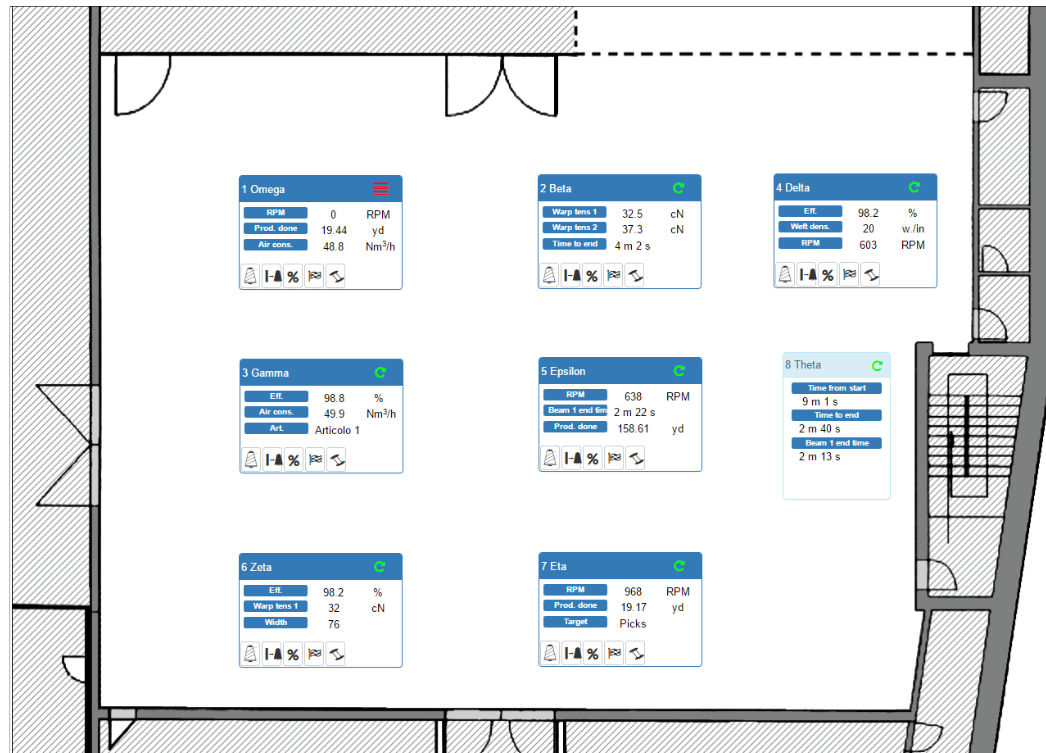


Monitoring views and Real-Time Data



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Specific Projects

MAINTE – Loom monitoring System

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Current data loom 4 Delta

Loom's data

Loom model:	R9000p
Production state:	Loom weaving
Room:	Room 1
Group:	Group 2
Warnings:	Cone change

Shift:	A
Far:	Not active at this event
Article name:	Article 1
Weft pattern:	Draw 32
Dobby pattern 1:	Canvas 1
Dobby pattern 2:	Canvas 2
Lot warp A:	Cotton 1
Lot warp B:	Cotton 2
Lot weft:	Cotton 3
Stop declaration:	0
Piece number:	313

Real-Time Data: Machine overview

Last update:	06/05/2016 14:13:28	
Loom RPM:	603	RPM
Efficiency:	98.2	%
Production target:	External drawings	
Done production:	158.00	yd
Desired production:	166.00	yd
Time from start production:	1 m 44 s	
Time to end production:	9 m 57 s	
RFID Transponder:	RFID_TRANSPONDER	
Air consumption:	50	Nm^3/h

Weft Density:	20	w./in
Number of beams:	3	
Warp tension 1:	31.2	cN
Warp tension 2:	36.3	cN
Warp tension 3:	38.1	cN
Warp tension 4:	37.5	cN
Time to end beam 1:	57 s	
Time to end beam 2:	2 m 52 s	
Time to end beam 3:	1 m 52 s	
Time to end beam 4:	1 m 42 s	

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Specific Projects

MAINTE – Loom monitoring System

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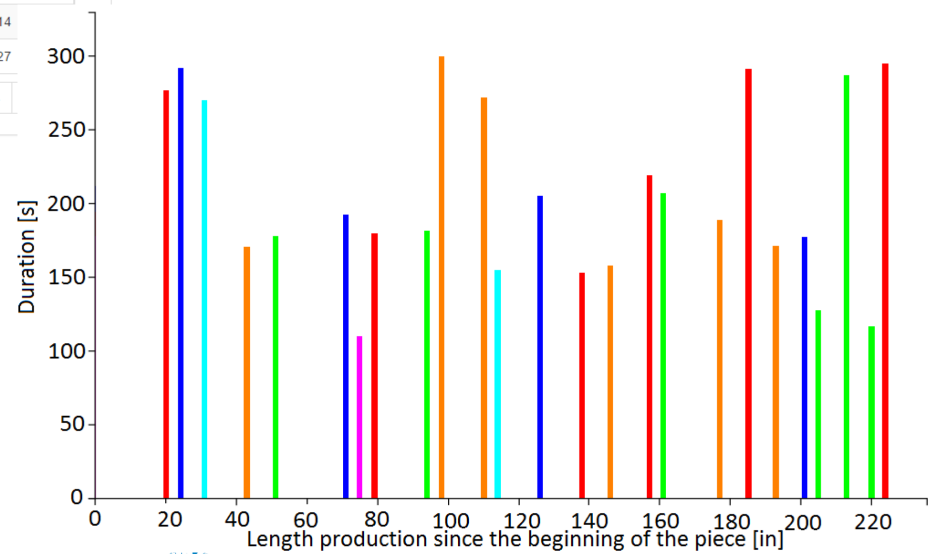
When a loom stops weaving due to a fault, in the piece a defect is inserted that is much more remarked much more lasts the stop. Tracking the stops it is possible to find defects more easily and with more precision.

Show 10 entries Search:

Description	Length production since the beginning of the piece [m]	Duration [s]
Stop due to weft short insertion	0	27
Stop due to weft gripper exchange failure	7.96	21
Stop due to weft advanced insertion	15.71	24
Stop due to weft pinching failure	25.09	23
Stop due to weft advanced insertion	36.92	16
Stop due to weft lost by left-hand gripper	44.27	22
Stop due to warp broken	49.88	28
Stop due to weft lost by right-hand gripper	58.14	12
Stop due to weft lost by right-hand gripper	58.24	14
Stop due to weft lost by right-hand gripper	65.89	27

Showing 1 to 10 of 34 entries Excel CSV PDF Print Previous 1 2 3 4

Historical Data: Piece Analysis



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General statistics

Production efficiency	77.4%
Total picks:	200254
Length of the fabric:	49.55 m
Total time:	23 h 59 m 59 s
Total downtime:	5 h 26 m 9 s
Date and time of opening:	2016-01-01 00:00:00
Date and time of closing:	2016-04-25 00:00:00

Various stops

Various stops: 24

over 100.000 beats: 11.98

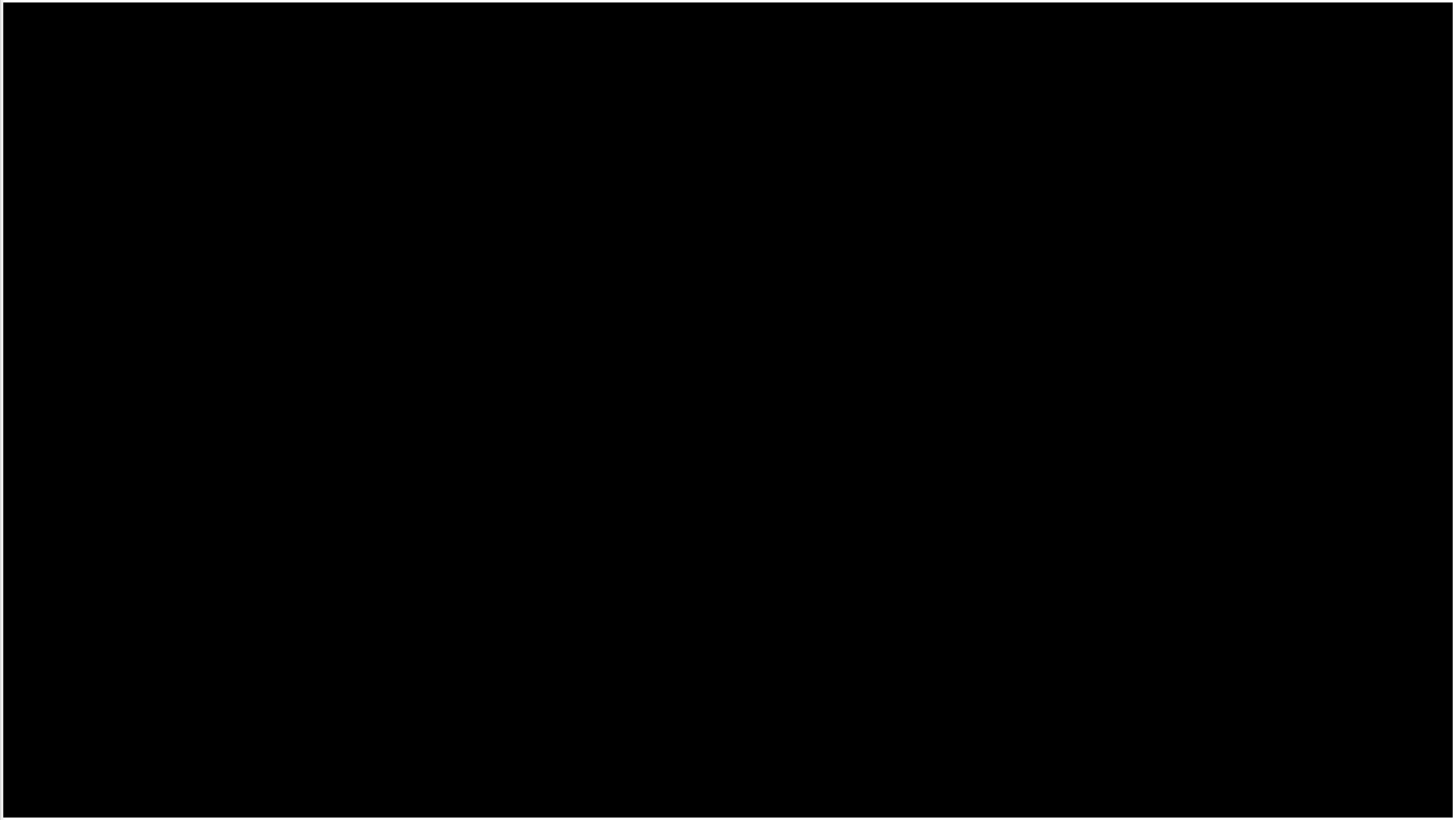
Total time: 8 m 11 s

Various stops	Stops	/100000	Time
Stop due to a cone change	9	4.49	3 m 7 s
Stop due production end	4	2.00	1 m 35 s
Manual stop	8	3.99	2 m 45 s
Stop due to a generic failure	3	1.50	44 s

Historical Data:
Statistics and Data-Analysis

Specific Projects

MAINTE – Loom monitoring System

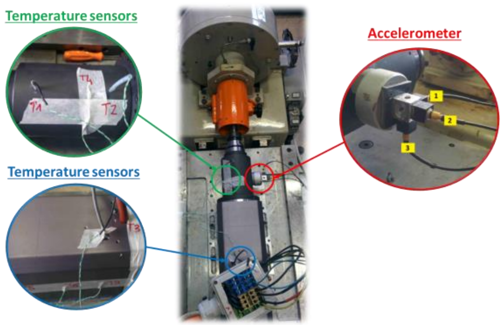


Specific Projects

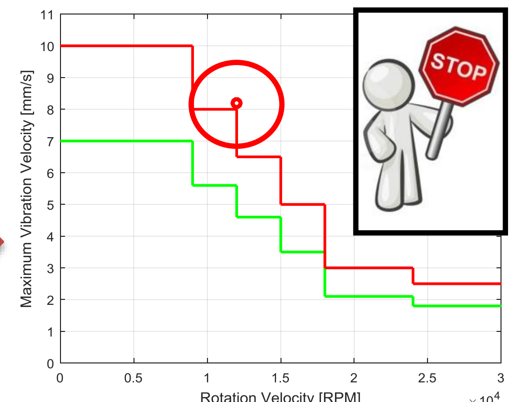
MANABB

Technological systems and solutions for the **monitoring** and the **predictive diagnostic** in **maintenance and service.**

Enterprise need: monitoring the health state of machines and early detect their failure…

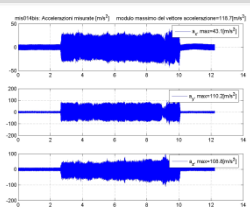


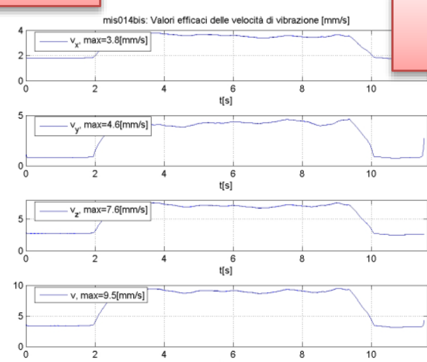
1) Data acquisition



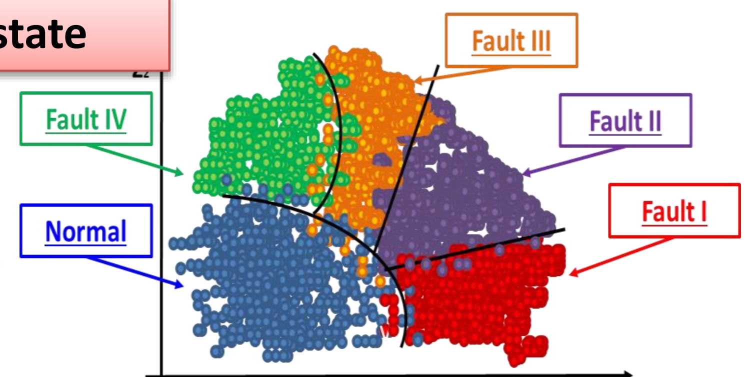
3) Health state

5) Maintenance management





2) Features extraction



4) Failure causes

Context

Critical Devices

- Low Voltage Circuit Breaker (LVCB) are often used for critical application (safety)

Standard maintenance approach

- Unlike High Voltage Application in LVCB only Corrective or Preventive approach are commonly used

First research in this field

- No works are available in literature about this class of devices

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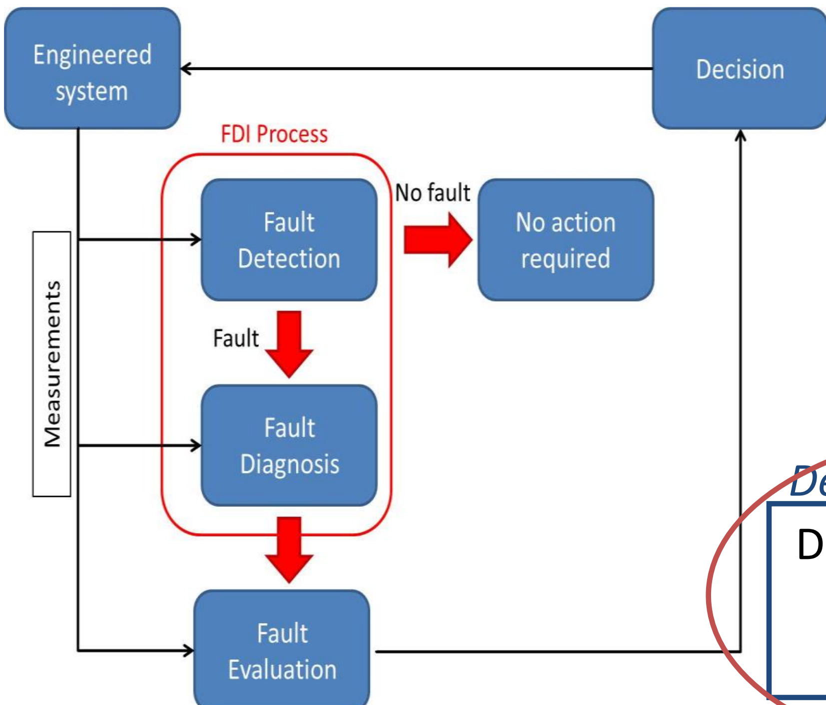
Methodology

The project deals with ***Pattern Recognition*** techniques to develop a methodology for ***Fault Detection***, the first phase of a ***FDI system***.



FDI system

Continuous monitoring of weak signals to automate process of *fault detection* and *identification* of the causes

Detection

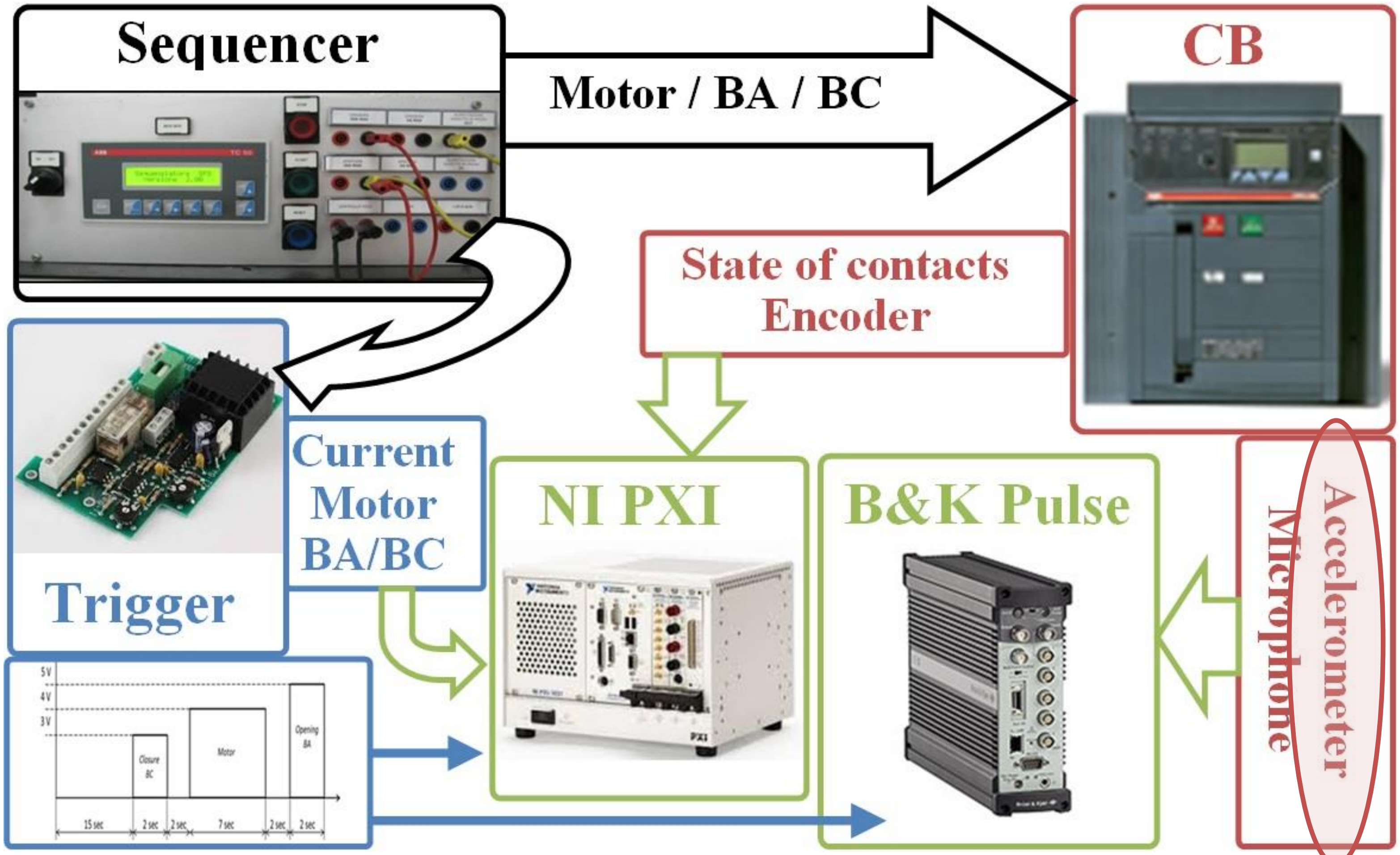
Detects the presence of the fault in the system

Identification

Identifies the type of the fault, the position and related causes

Con il contributo di:

The bench setup



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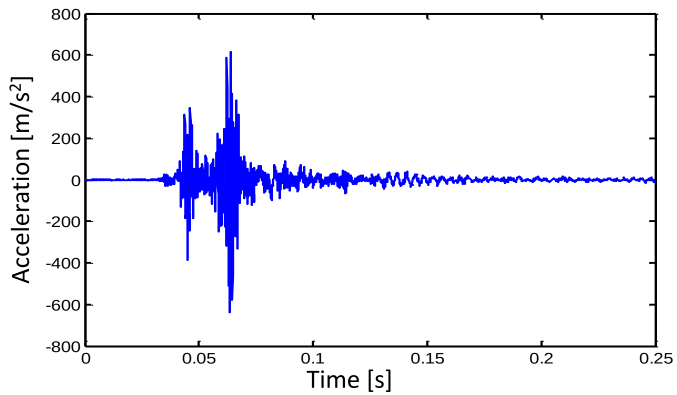
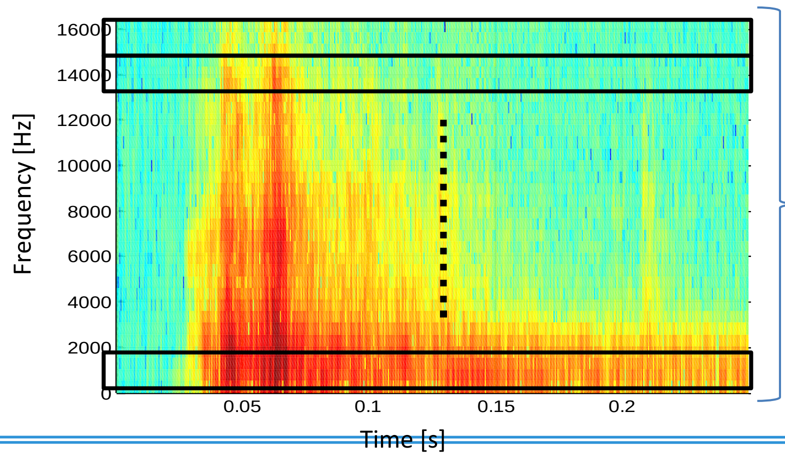
Algorithms

Original acceleration signal:



Spectrogram 1



The process to extract information could be summarized in 3 steps:

1. Extract the spectrogram from the original signal (single axis acceleration or acceleration module);
2. For every frequency band defined by the Spectrogram compute the DTW distance between the test and the reference signal
3. Extract information from the distances simply calculating the **mean** and the **standard deviation**.

2

DTW with Reference signal

D_1
D_2
D_n

3

Indexes for every test:

mean(D_1÷D_n)
stdDev(D_1÷D_n)

DTW on freq-band

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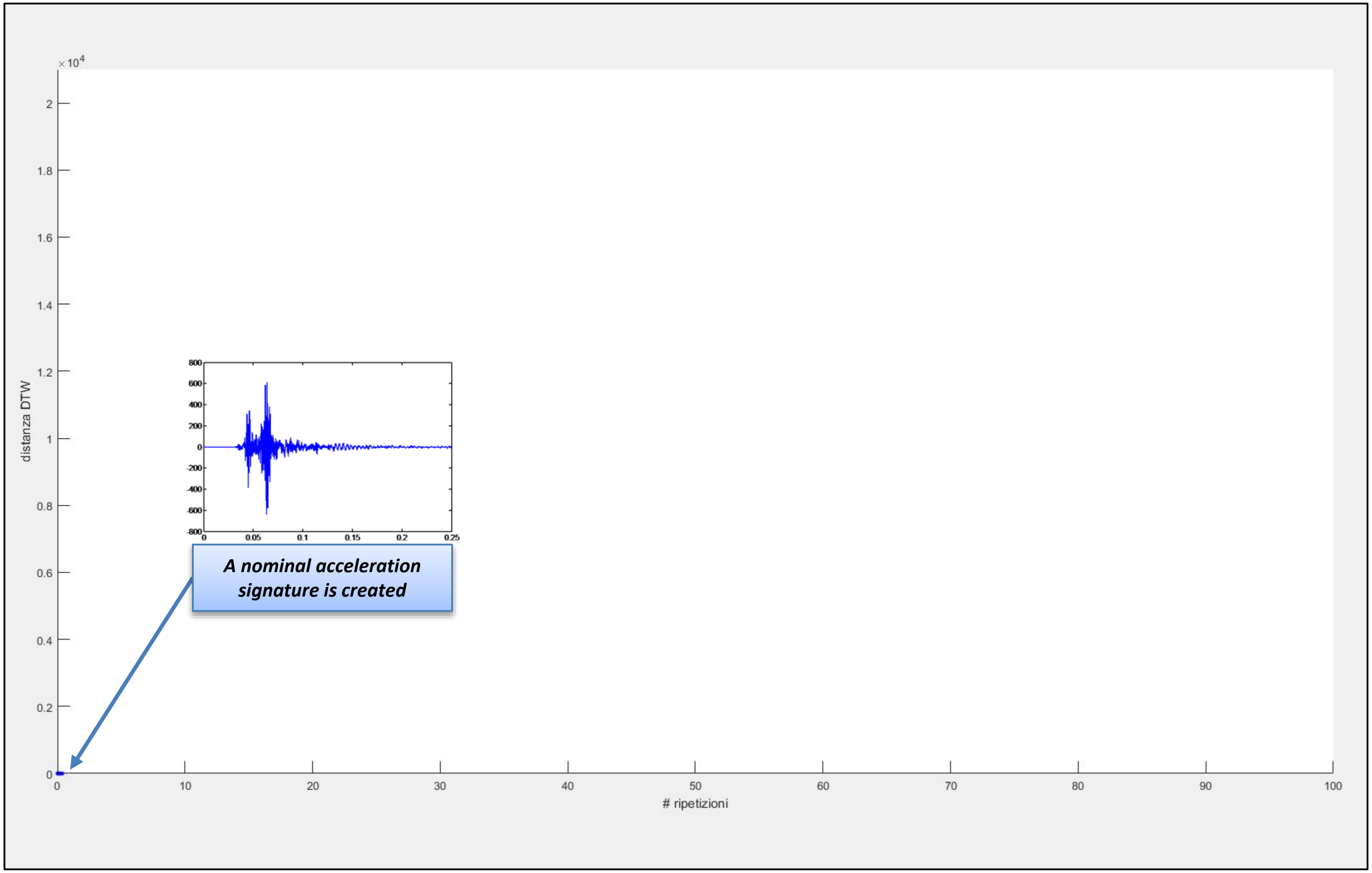

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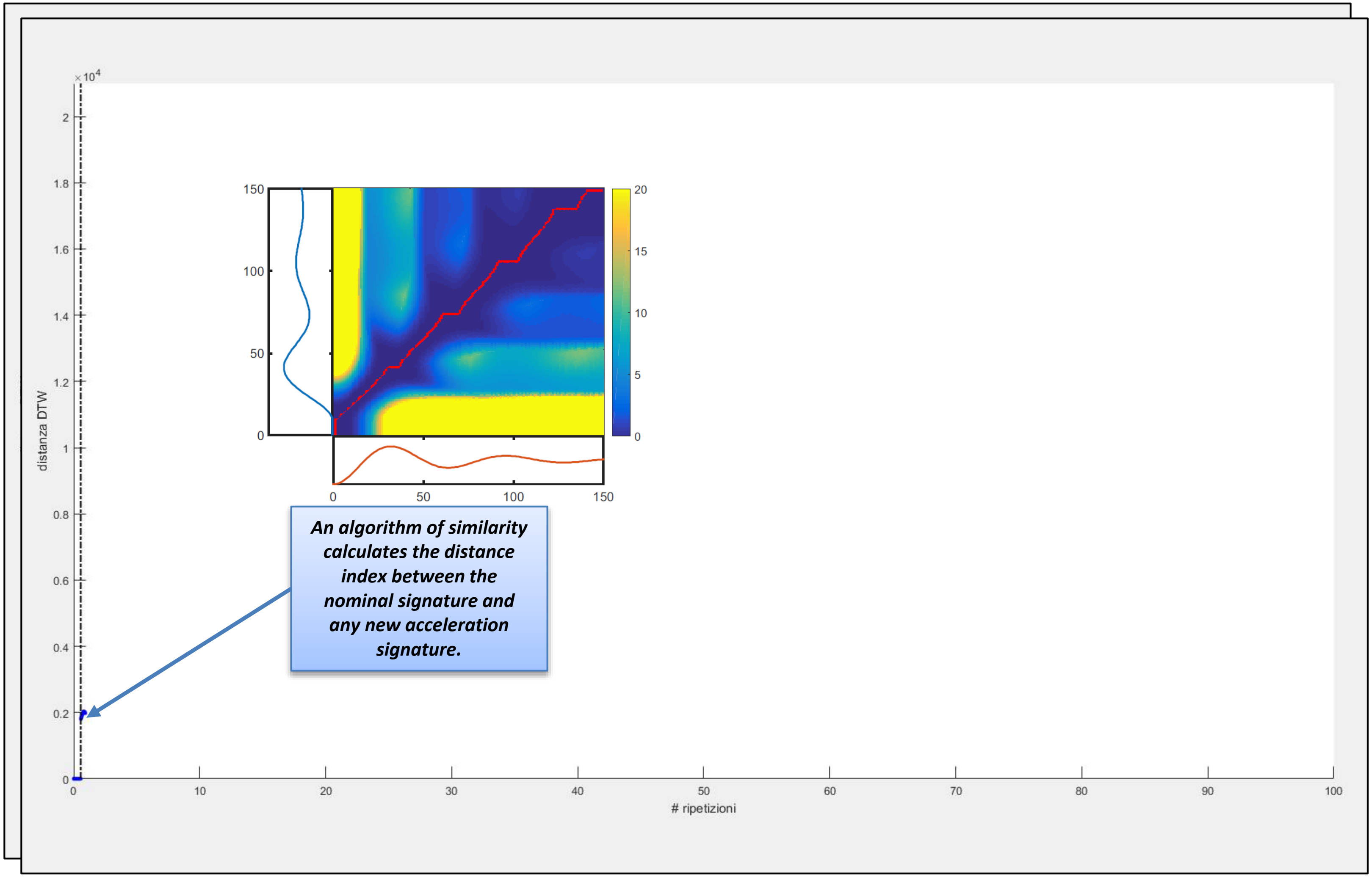

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Specific Projects

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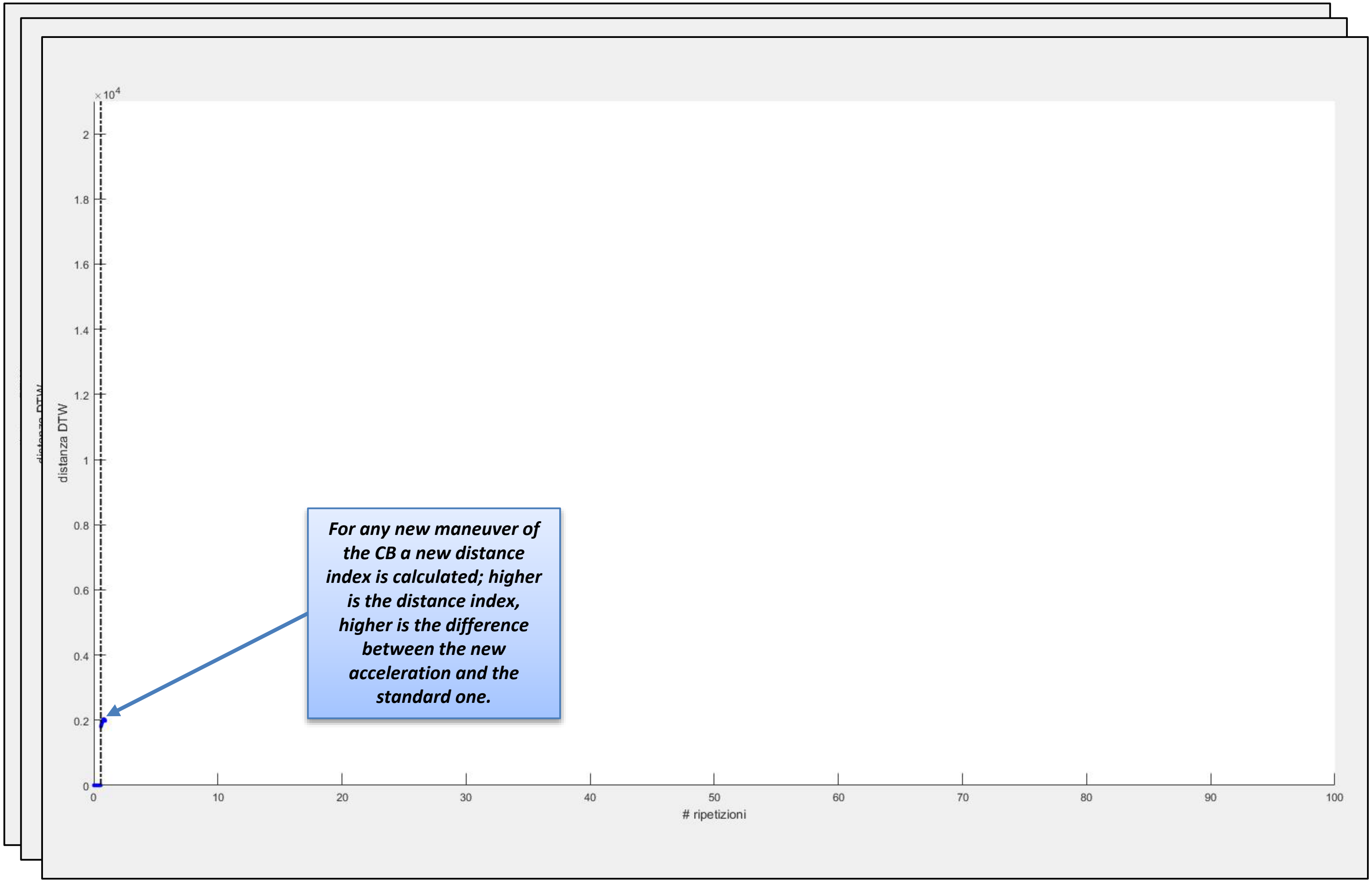

For any new maneuver of the CB a new distance index is calculated; higher is the distance index, higher is the difference between the new acceleration and the standard one.

Specific Projects

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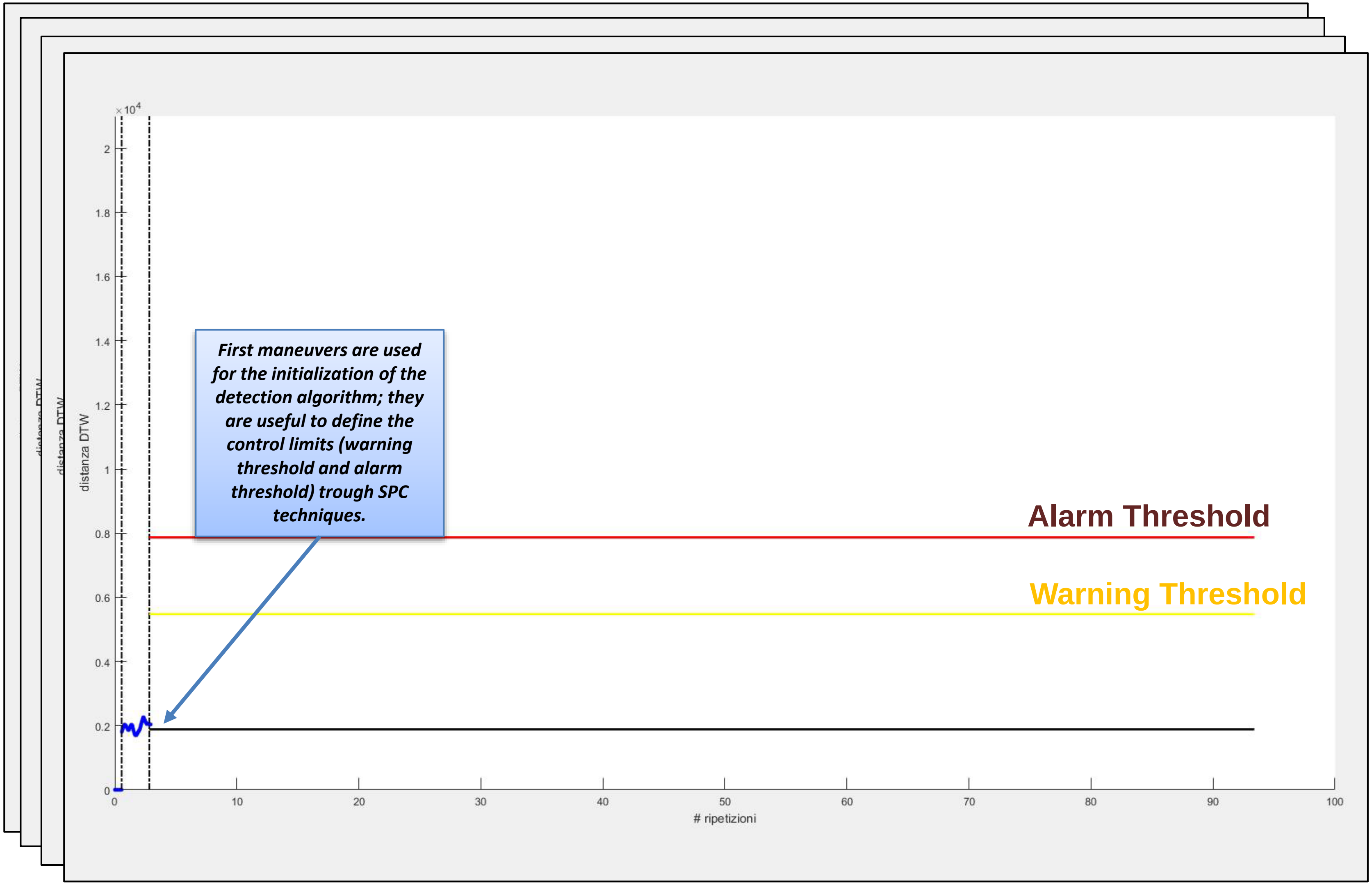

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Specific Projects
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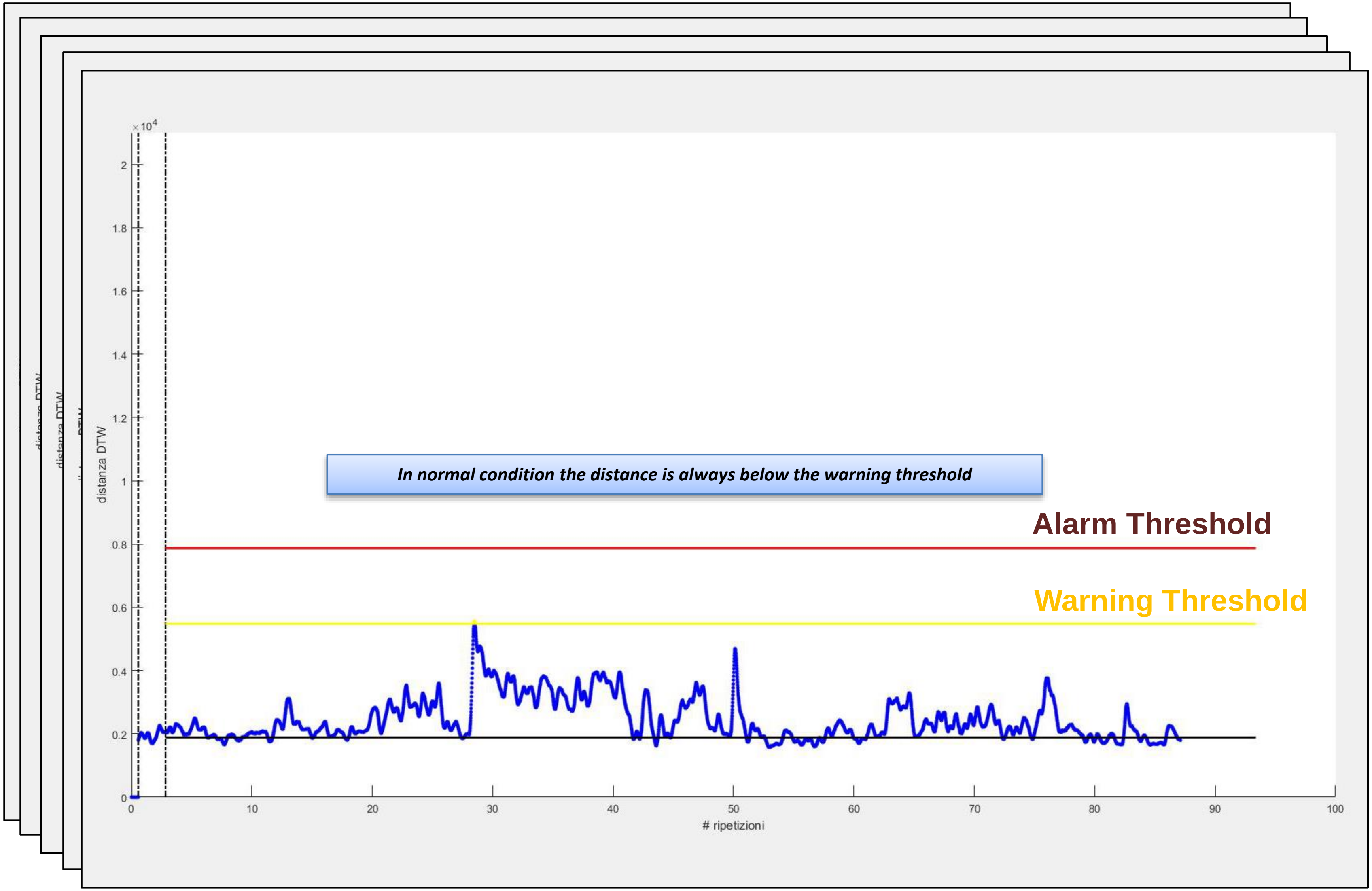

Specific Projects
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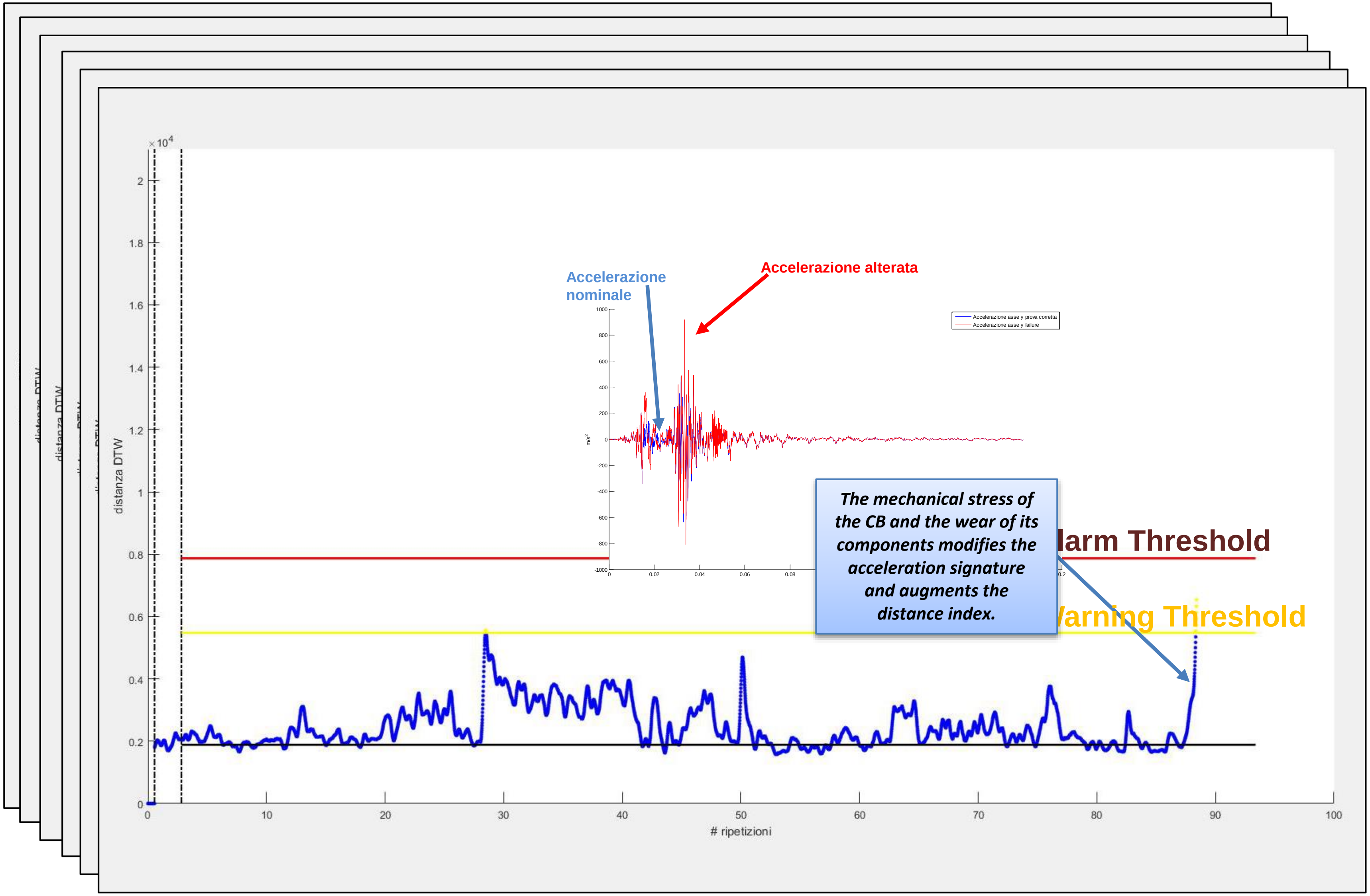

The mechanical stress of the CB and the wear of its components modifies the acceleration signature and augments the distance index.

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Specific Projects

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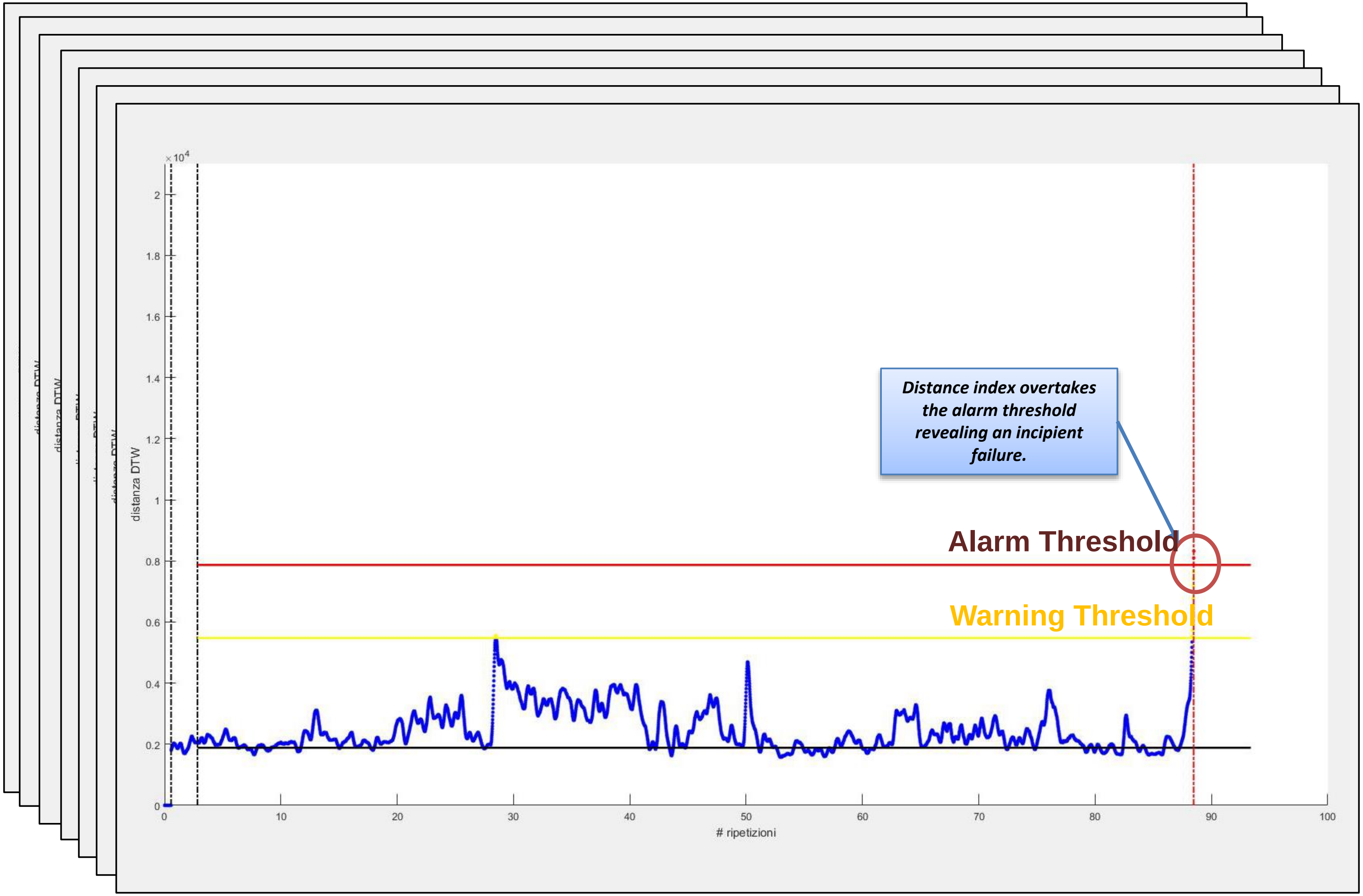

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Specific Projects

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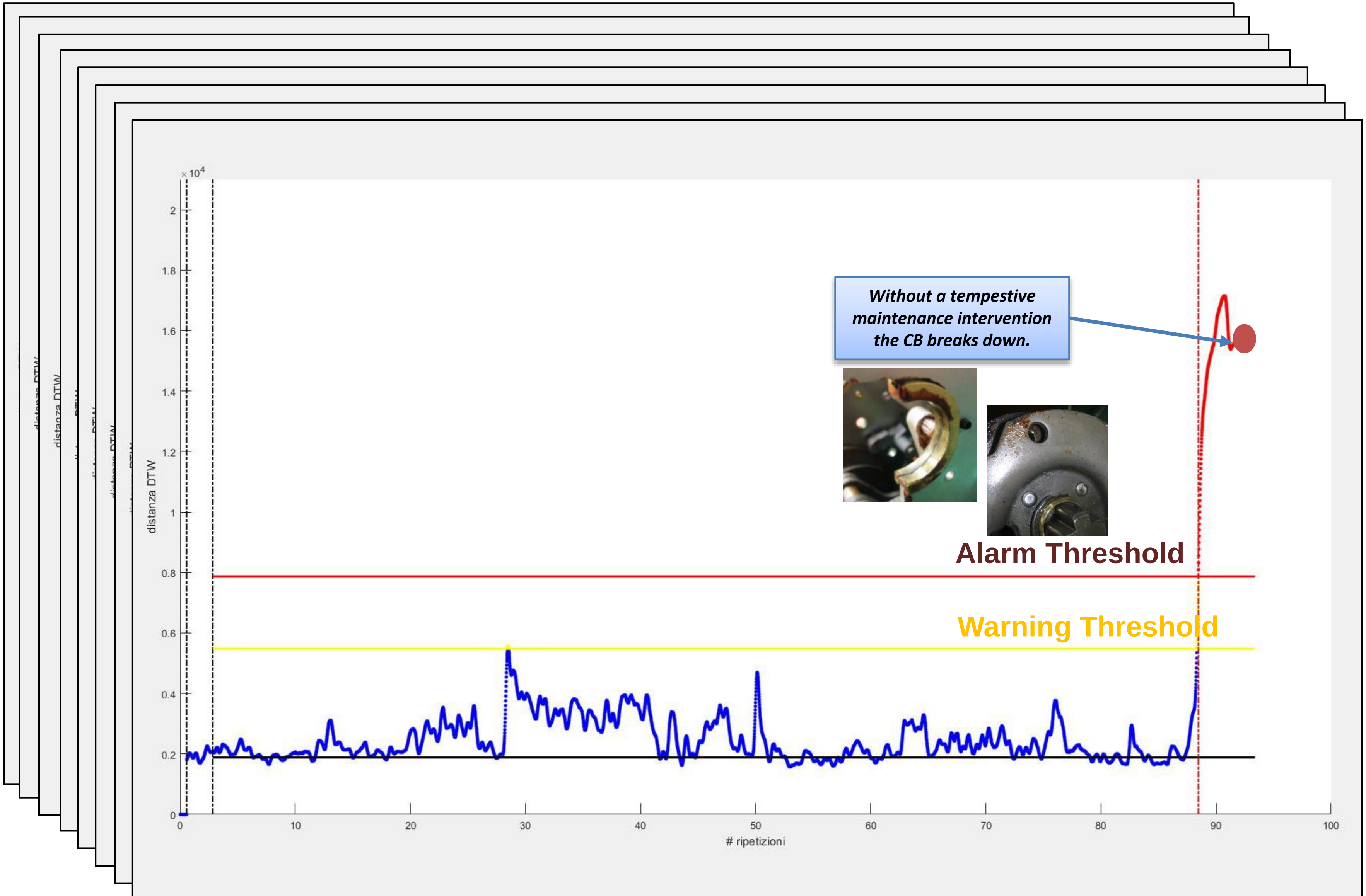
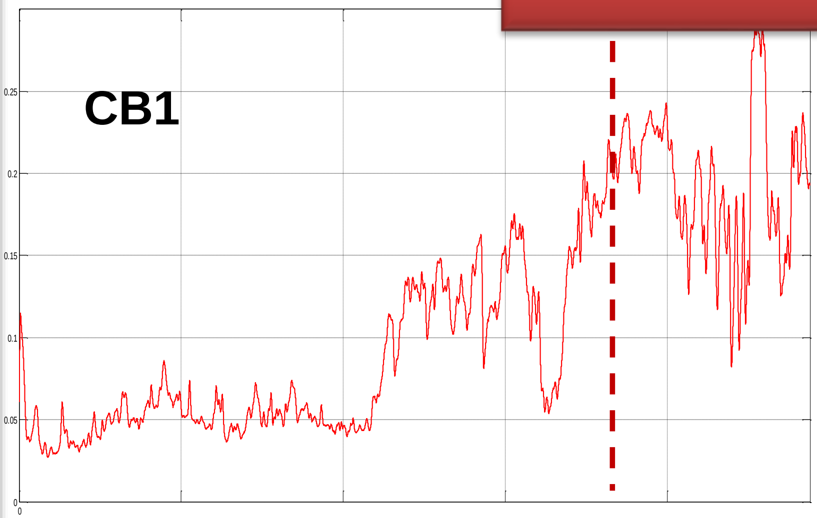
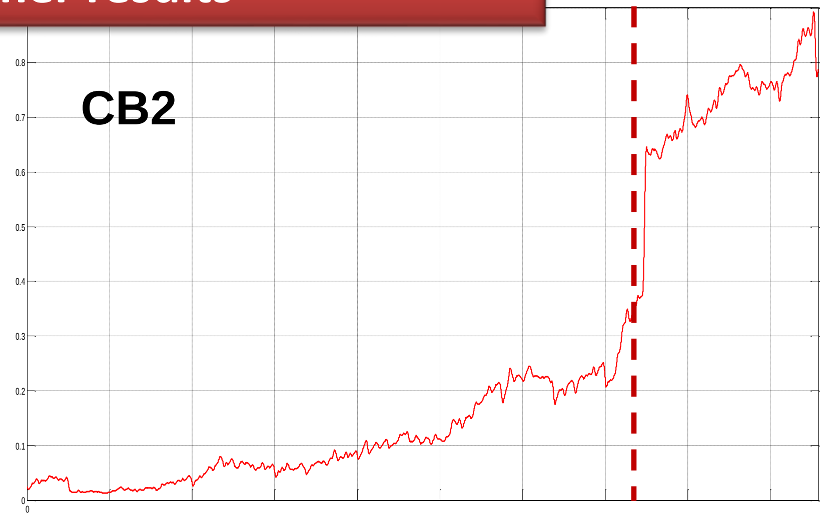


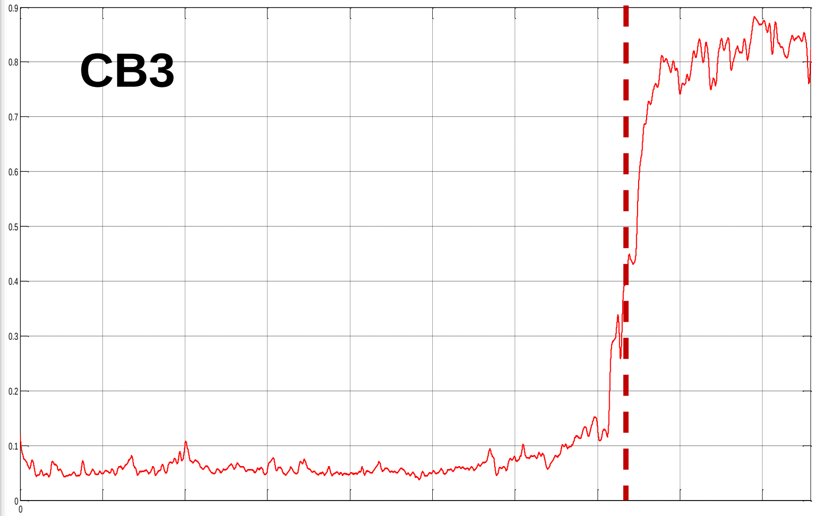
Specific Projects

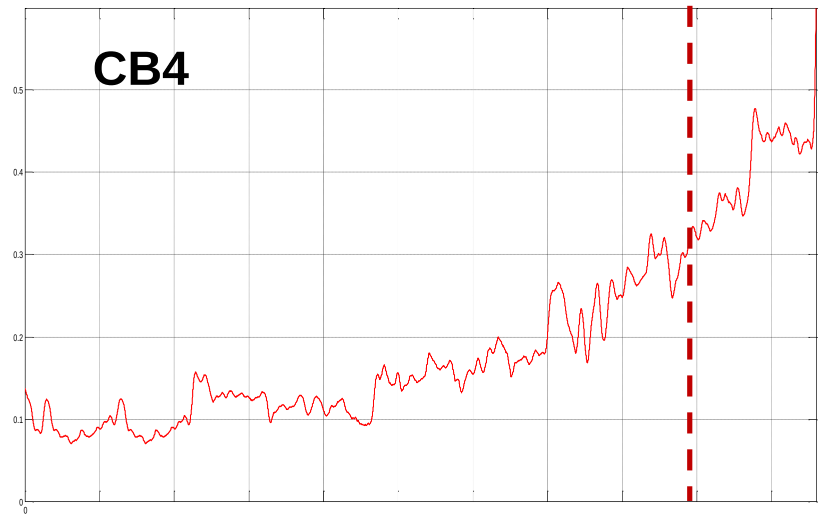
MANABB

Other results





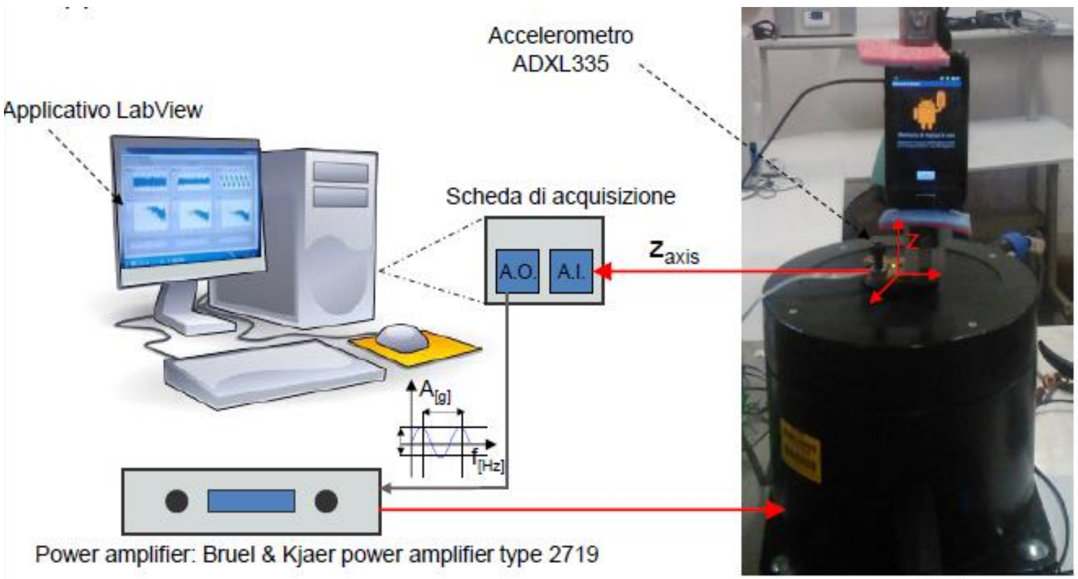




Specific Projects

MANABB

Next step



Shaker

Brüel & Kjaer vibration exciter type 4808

f=06Hz; A_{RMS}=3,0m/s^2 ; 4,5m/s^2

f=20Hz; A_{RMS}=3,0m/s^2 ; 4,5m/s^2

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Thank you!

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