CEIDEN
PLATAFORMA TECNOLÓGICA DE ENERGÍA NUCLEAR DE FISIÓN

POLITÉCNICA

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ETSII | UPM

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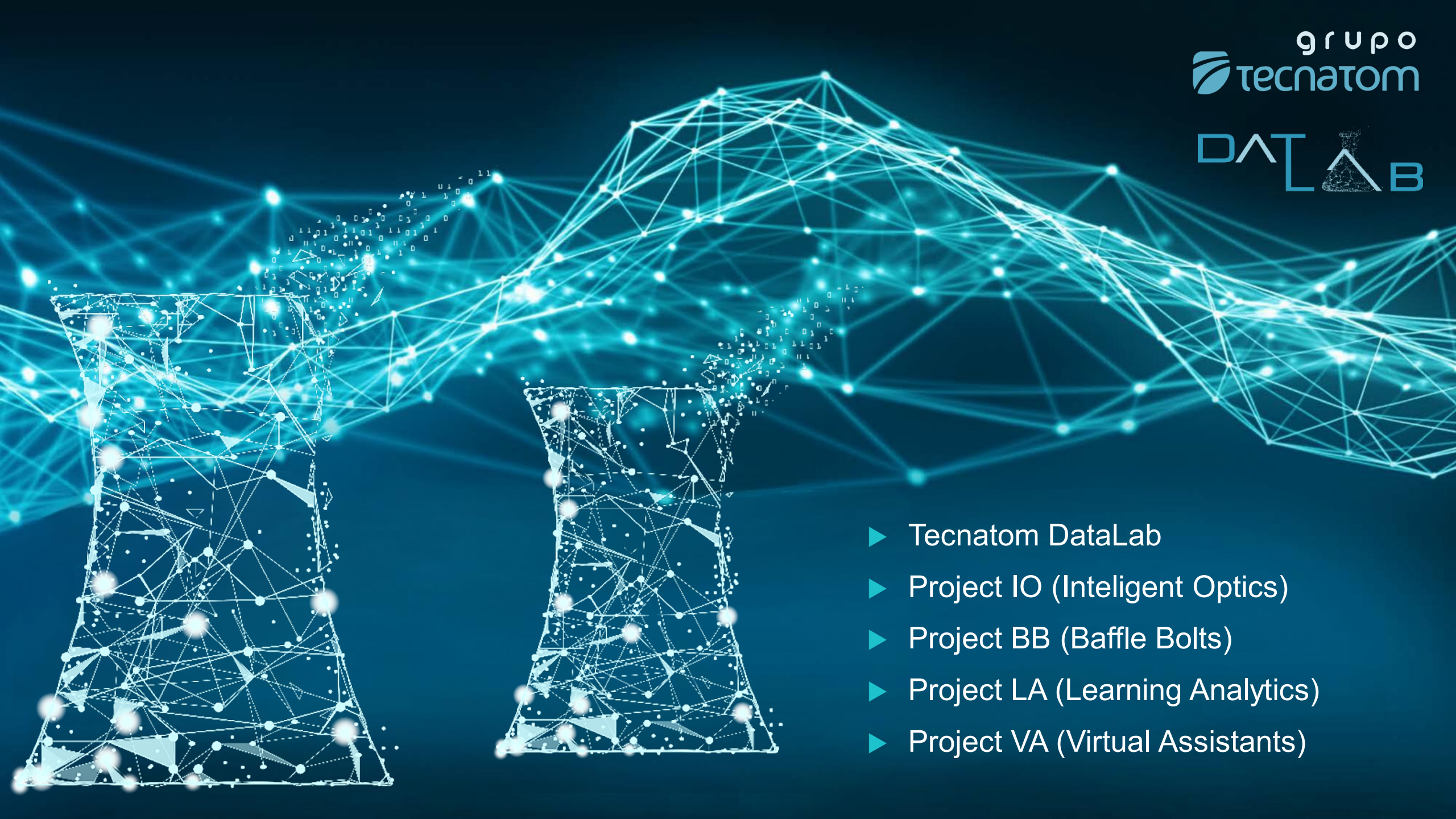
DATLAB

3rd Workshop of Spanish Users on Nuclear Data

"Machine Learning in Nuclear Science and Technology Applications"

Berenger Briquez
CDO
Tecnatom

27/05/21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Project IO (Inteligent Optics)
Project BB (Baffle Bolts)
Project LA (Learning Analytics)
Project VA (Virtual Assistants)


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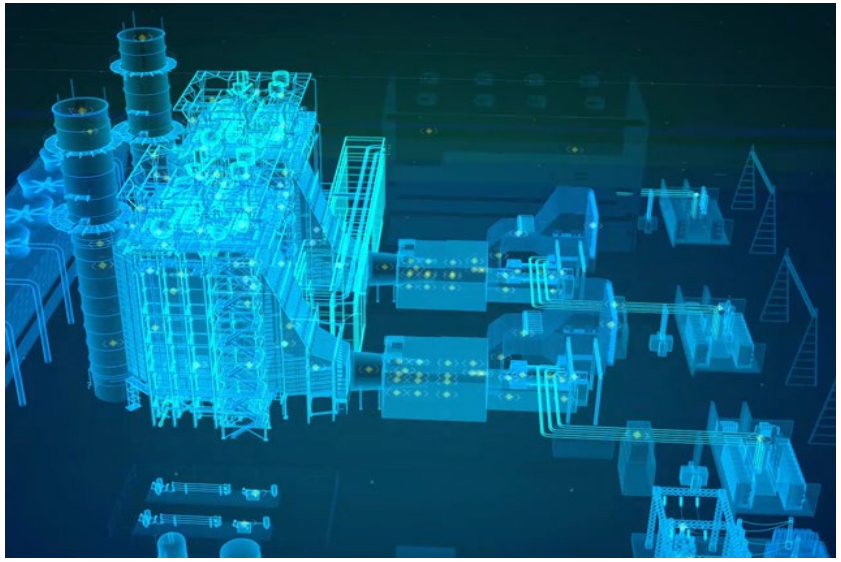
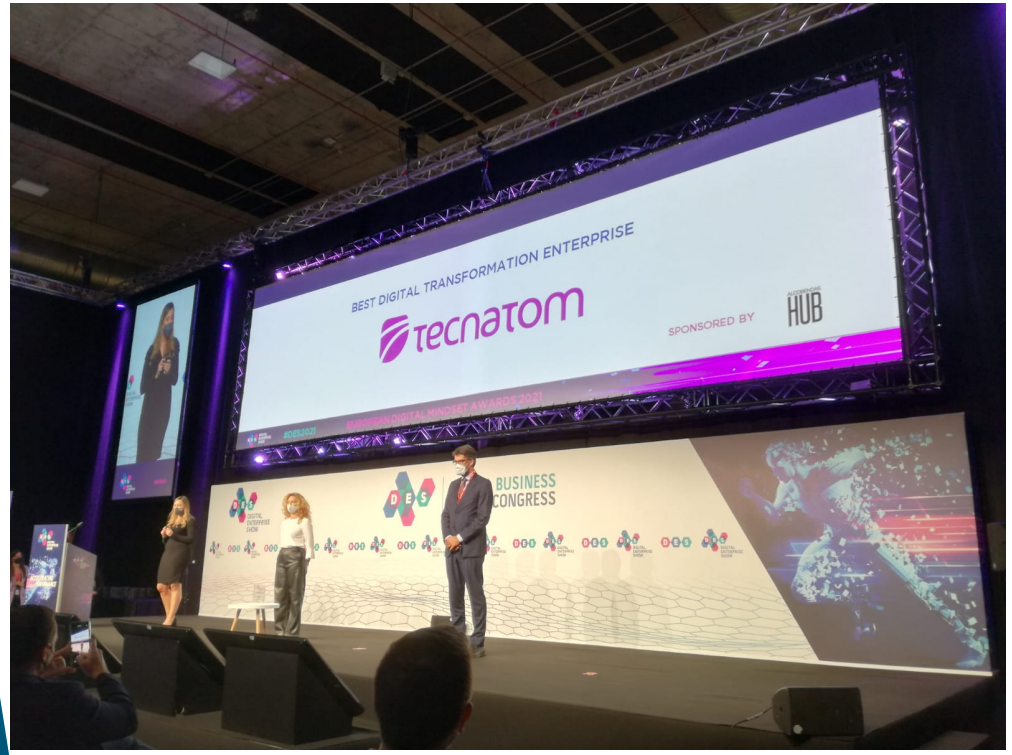
From a traditional model to a cutting-edge approach

- 60 years in a regulated sector
- Traditional approach to :
  - Operations
  - Training
  - Maintenance
  - Asset management
  - Non-destructive tests



- Agile as a startup
- New products and services based on AI, Data Science, Machine / Deep Learning
- Data Platform, Data Lake & Data Governance
- 2 new structures DataLab & Software Factory
- 1 CDO

European Digital Mindset Awards DES21

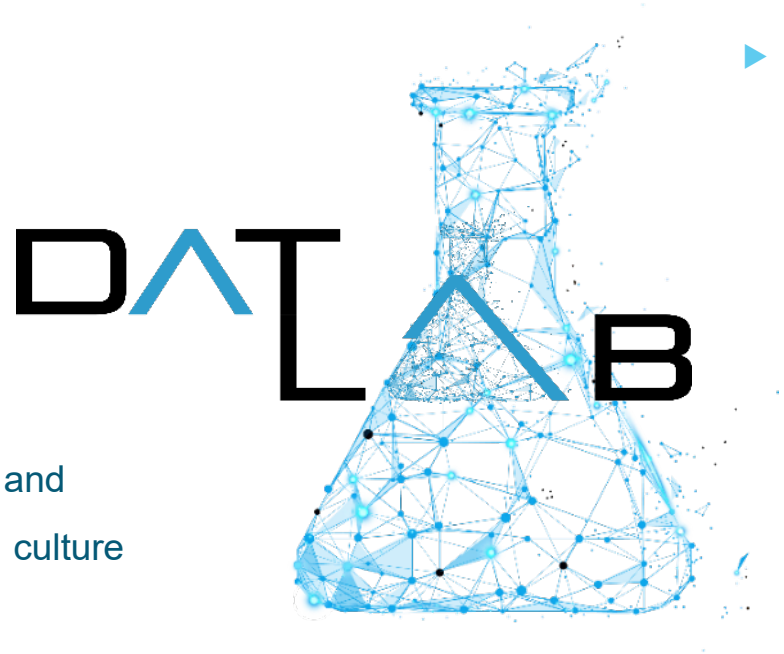


BEST DIGITAL TRANSFORMATION ENTERPRISE

"Tecnatom transforms a traditional group with 60 years of expertise into an agile start-up applying cutting-edge technologies and lean management."

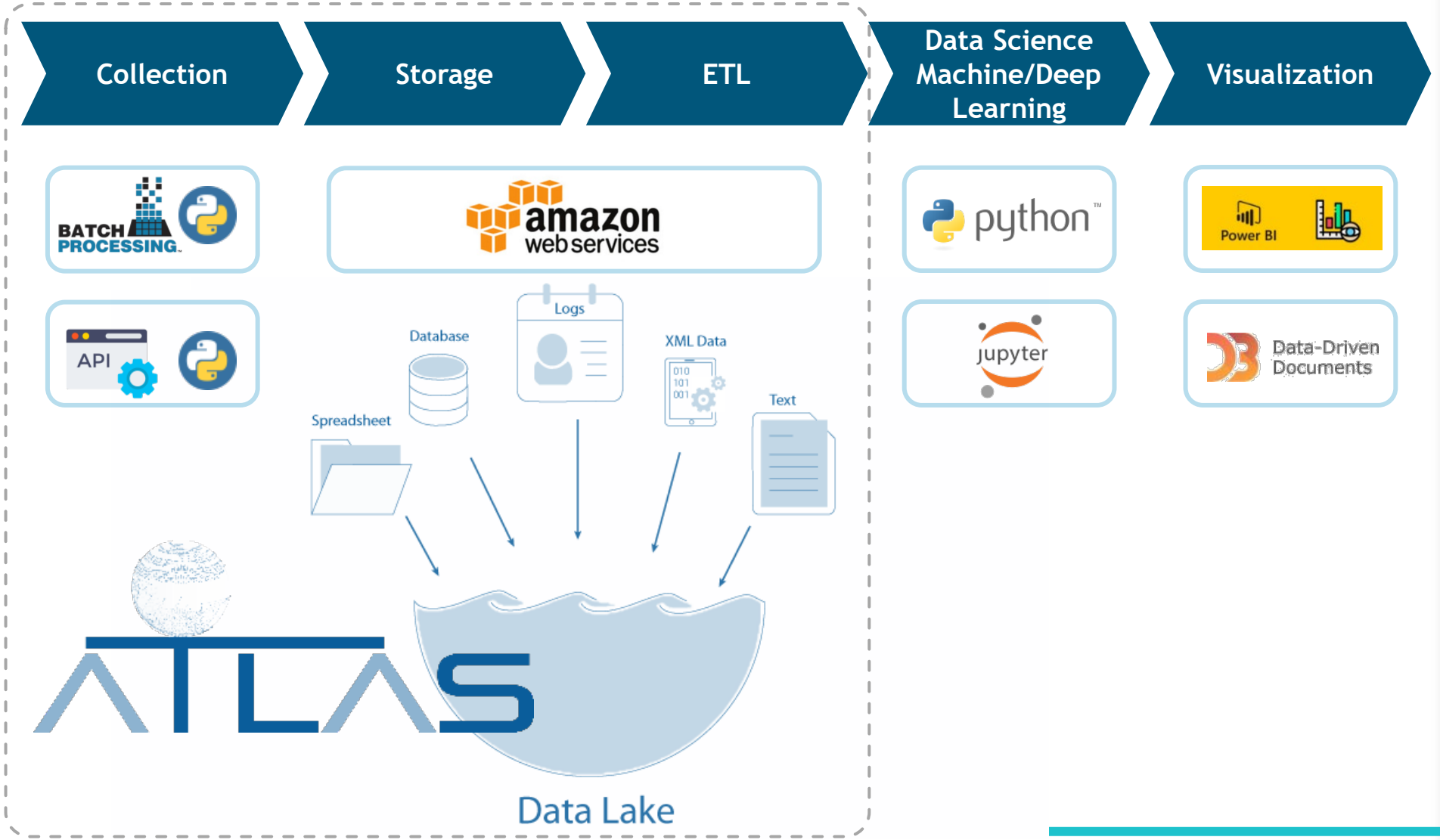
DataLab Overview

- A multidisciplinar team dedicated to Artificial Intelligence & Data Science
- State-of-the-art technological stack and best practices implementation
- A full range of data experts to manage and improve the entire data pipeline
- Ensure collective intelligence between humans and technologies using data



- AI & DS knowledge transfer and promotion of our data-driven culture internally
- Alignement with Software Factory to cover applicative needs for your data
- Internal and external ecosystem of partners & stakeholders
- Ensure transversal technologies, tools, processes & competencies

Data management



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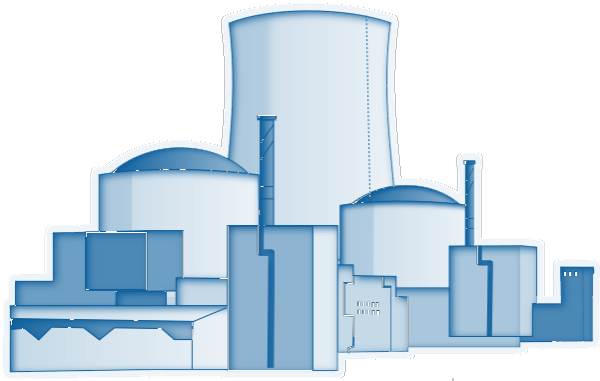
Baffle Bolts

Nuclear Power Plant Inspection

SAFETY CULTURE

PERIODIC INSPECTIONS AND MAINTENANCE



NDT

INTEGRITY STUDIES

- Management of large amounts of data (thousands of areas and components to be inspected)
- Need to perform rapid component integrity analysis
- Extremely demanding and labor-intensive procedures.

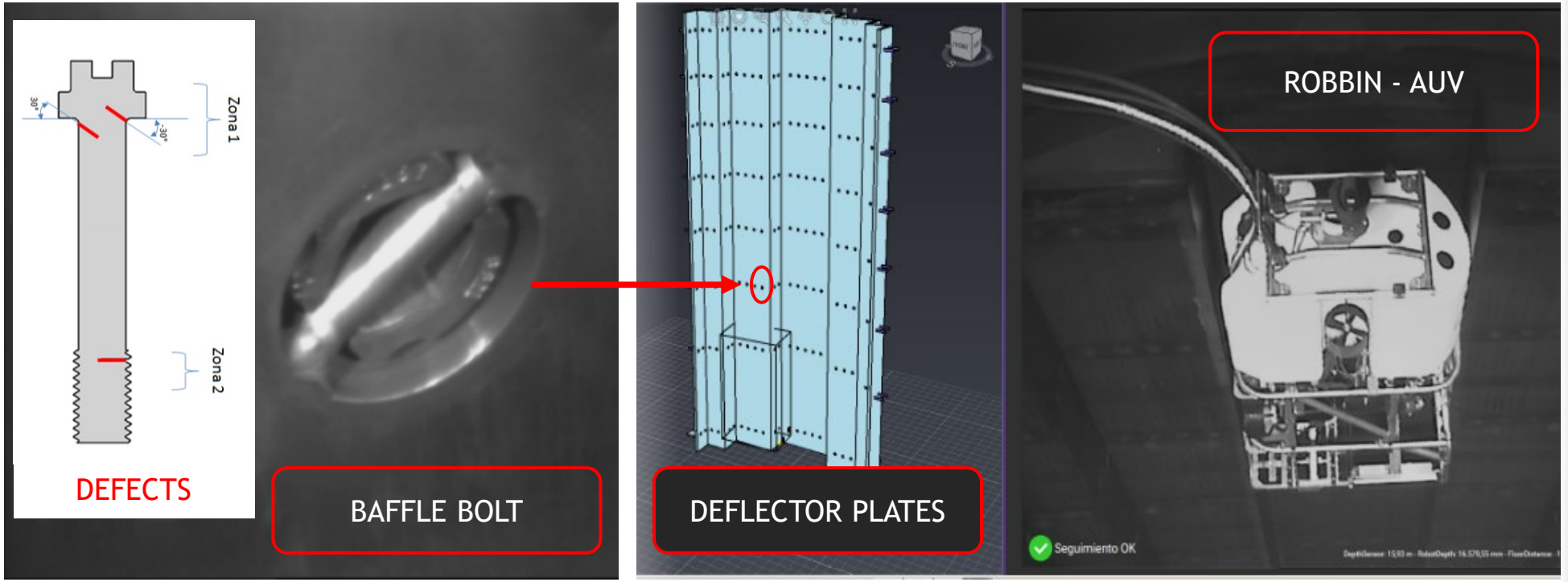
JOBS WITHIN SPECIAL ENVIRONMENTS

- ROBOTICS AND TELEOPERATION
- SENSORIZATION
- OPTIMIZATION OF PROCESSES

AI & ML SOLUTIONS

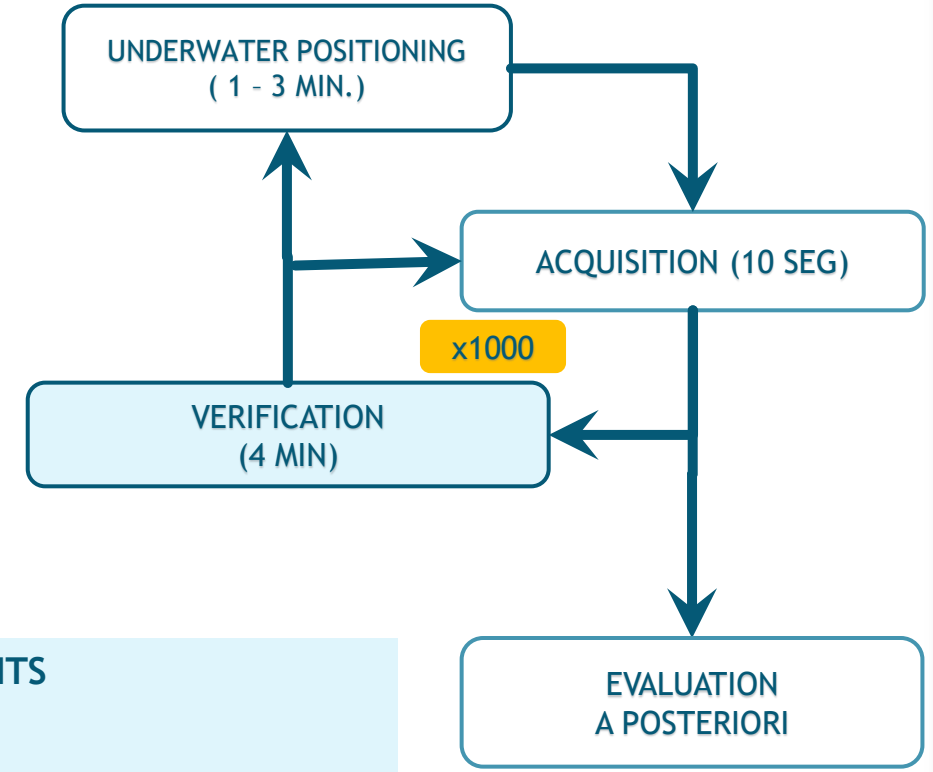
- Operating efficiency
- Cost reduction
- Time savings
- Human safety
- Quality guarantees

Automatic Baffle Bolts acquisition verification



- Inspection of the screws (Baffle Bolts) that secure the deflector plates to the core. This is done in immersion, accessing the screw heads with the positioning of the Robbin AUV.
- NDT Technique: **ultrasounds** (Phased Array) looking for radiation assisted corrosion cracks in the screws.
- Need to manage around **1000** acquisitions (bolts)

Automatic Baffle Bolts acquisition verification



CURRENT CHALLENGES

-Qualitative
- Acquisition quality
- Subjective review

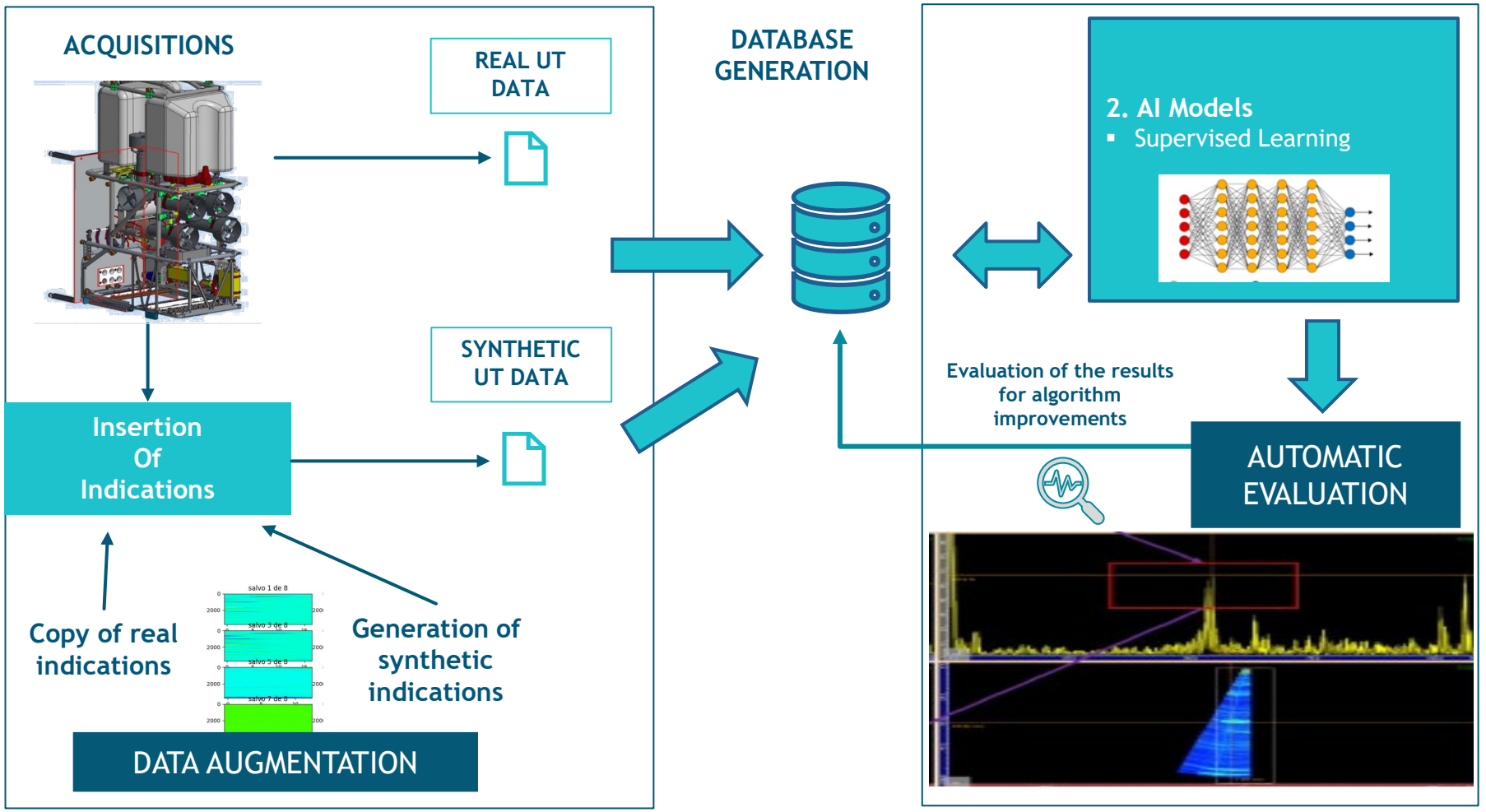
-Quantitative
- In 4 minutes by BB. (Estimated 60 hours for entire inspection)

EXPECTED BENEFITS

-Qualitative:
- Operating efficiency
- Automatic verification
- Objective parameterization

-Quantitative:
- Cost reduction
- Instant verification

Automatic Baffle Bolts acquisition verification

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Intelligent Optics

IO - Intelligent Optics

Source

Control Panel

Varied intake

Cameras
Drones
Devices

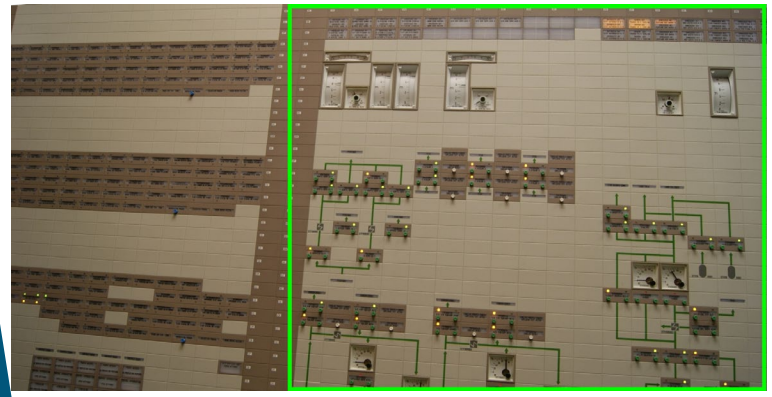
Centralization

Datalake
& Data Science

Varied visualisations

MobileApp
WebApp

Panel Identification

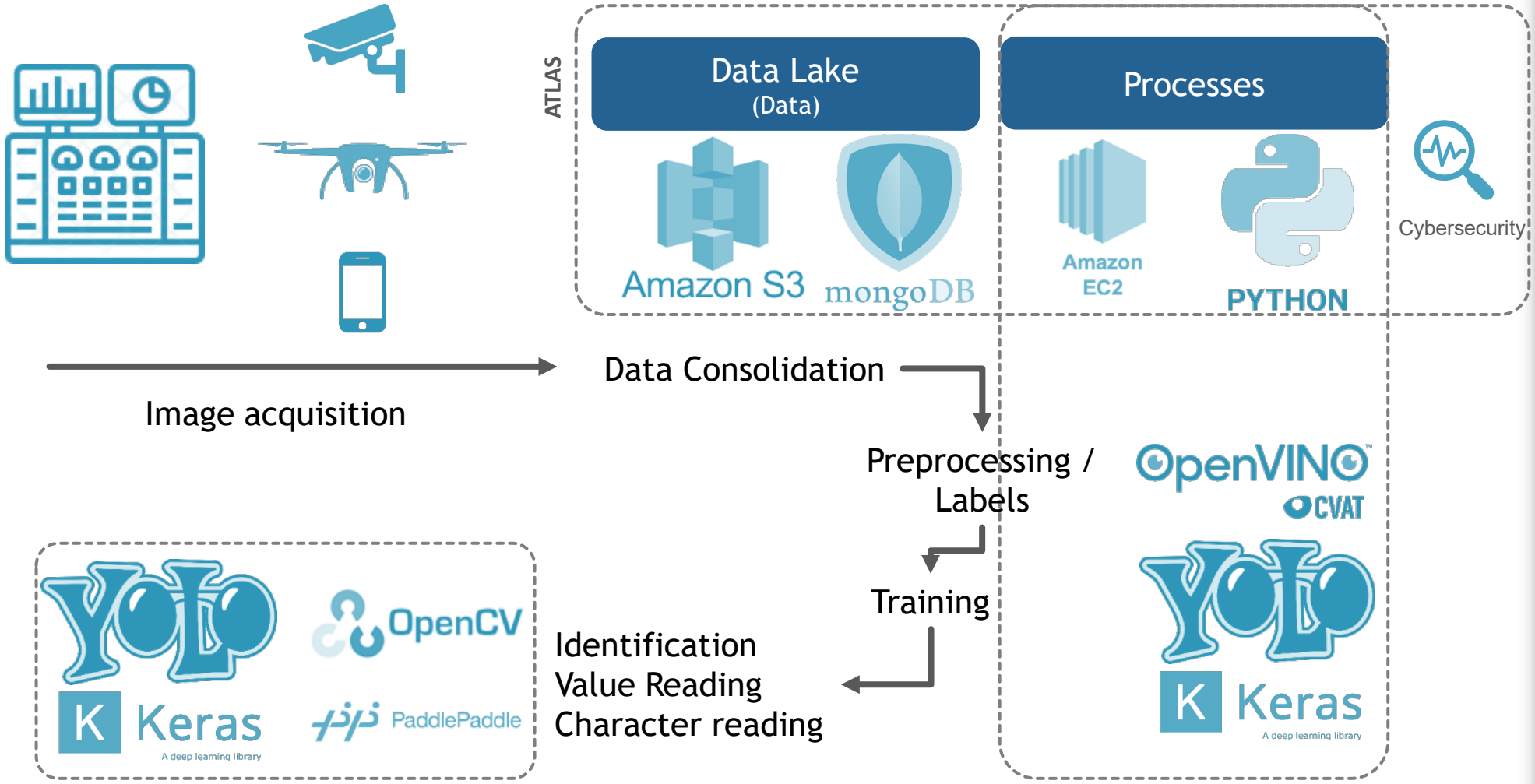


Alarm Status

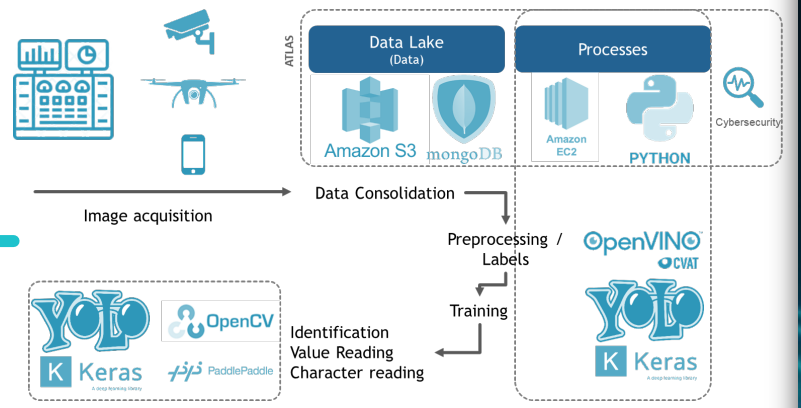
Recognition & Analysis of colours, shapes, characters

Reading Indicator

IO - Stack / Workflow

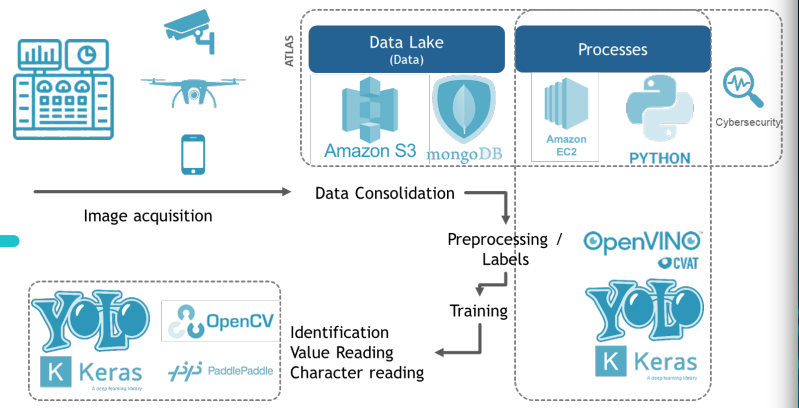


IO - Workflow



- Image acquisition
  - On-Site Images (Still cameras / Photographic reports)
  - Images in Simulators
  - Archive Images
- Data consolidation in ATLAS
  - Centralized Image uptake to Datalake
  - Non-relational database creation
- Preprocessing
  - Image enhancement (filters)
  - Image tagging: CVAT
- Training
  - Train classification layers: KERAS - YOLO
  - Training of ML models in cloud (high-capacity processing)

IO - Workflow



- Model Inference
  - Real-time classification of panels and components: KERAS - YOLO
  - Identification by Type / Position or proximate text label reading
  - Value reading: OpenCV + PaddlePaddle
  - Gauge dial position identification (tilt, height)
  - Unit identification and depth of scale
  - Multi platform (API in Cloud, Local, Edge (Jetson Nano))
- Display interface
  - JSON with panel identification, sensors and values
  - Output for any application

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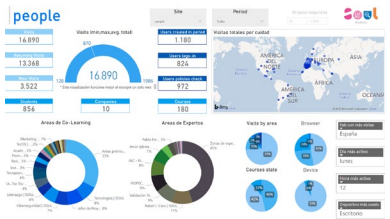
Learning Analytics

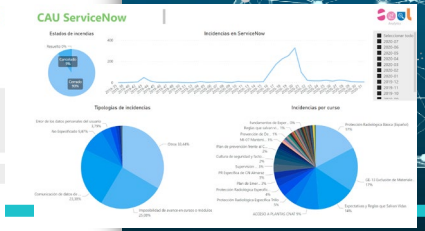
Learning Analytics - Awards 2020

SOUL Analytics provides intuitive and interactive dashboards directly connected with our Datalake merging data coming from several inputs (LMS, CMS, Web Analytics, Ticketing, Cloud infrastructure, QTB, ….)

SOUL Analytics focuses on 4 main categories:

- **Activity** : Users connection details and interactions within the platform (visit duration, day/hour, devices, operating system, browser, actions,….)
- **Attitude** : Users proactivity, collaboration and influence within the community (followers, follows, likes, comments, feedback, rating, …)
- **Assimilation** : Users learning capacity and results (course duration, tests/exams scores, attempts, ….)
- **Architecture** : Platform infrastructure monitorization to ensure service level (CPU/Memory usage, microservices activity, autoscaling/load balancer, ….)



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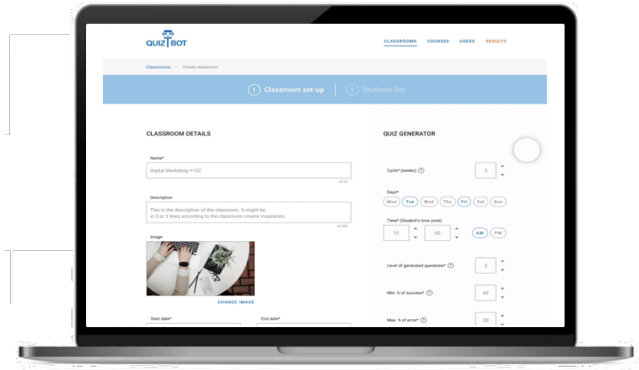
Virtual Assistants

Virtual Assistants

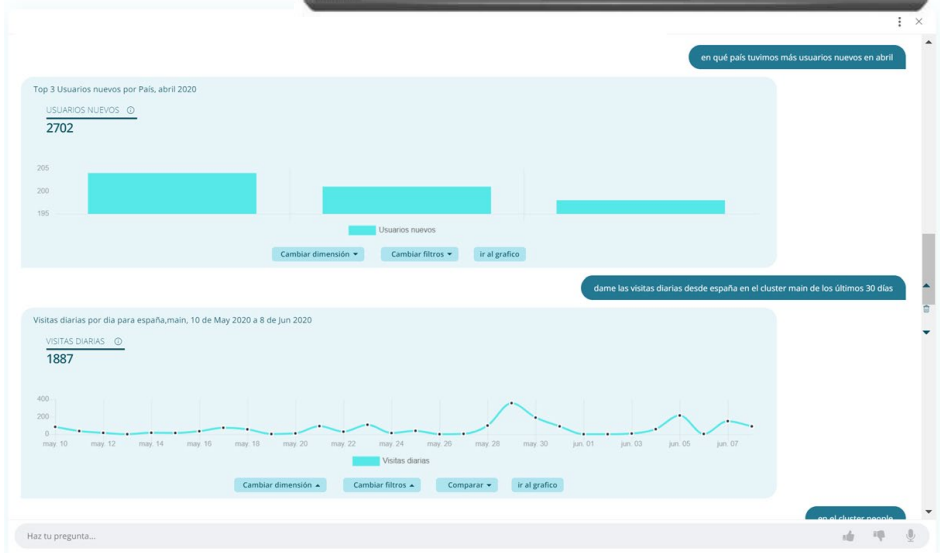
- Learning Assistant
- Ensure long-term memory



Based on Neuroscience

Machine Learning

- Analytics Assistant (speak with your data)
- Real-time & hand-free analytics

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AI + Humans = Future