Konkrete eksempler på bruk av Industri4.0 i Hydro

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2018-04-18, Oslo, Styreinstituttet

A resource-rich and customer-oriented aluminium company

With robust positions across the value chain

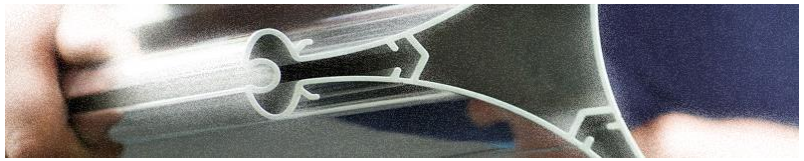
Bauxite & Alumina

Energy

Primary Metal

Rolled Products

Extruded Solutions



- Global provider of alumina, aluminium and aluminium products and solutions
- Leading businesses along the value chain; raw materials, energy, primary metal, rolled products, extruded solutions and recycling
- 35,000 employees at more than 150 locations in more than 40 countries on all continents
- Market cap ~NOK 110 billion/USD 14 billion
- Annual revenues ~NOK 137 billion (2016)*
- Included in Dow Jones Sustainability Indices, Global Compact 100, FTSE4Good

*) The sum of Hydro's and Sapa's individual turnover In 2016

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Digitalisering - er det en revolusjon eller en hype?

… eller bare en ny inntektsstrøm for konsulenter og leverandører?

What is Industry4.0 for Hydro?

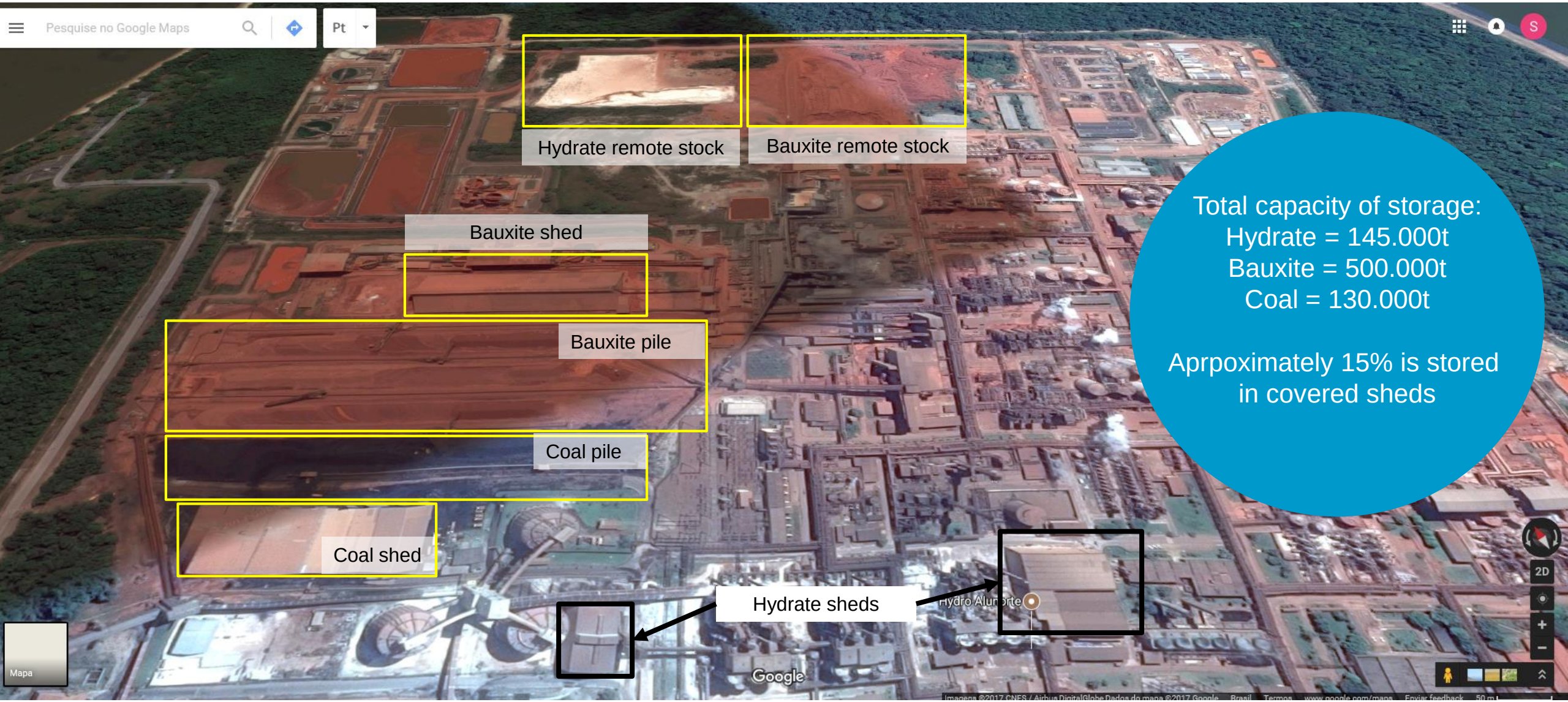
- For Hydro the business case is not to sell digital platforms and solutions but to utilize the digital opportunities to improve productivity, cost, safety and environmental footprint

- Explorational initiatives in 5 main categories:

    - Automation/robotization
    - Real-time connectivity
    - Smart sensors
    - Advanced analytics/machine learning
    - Digital twins

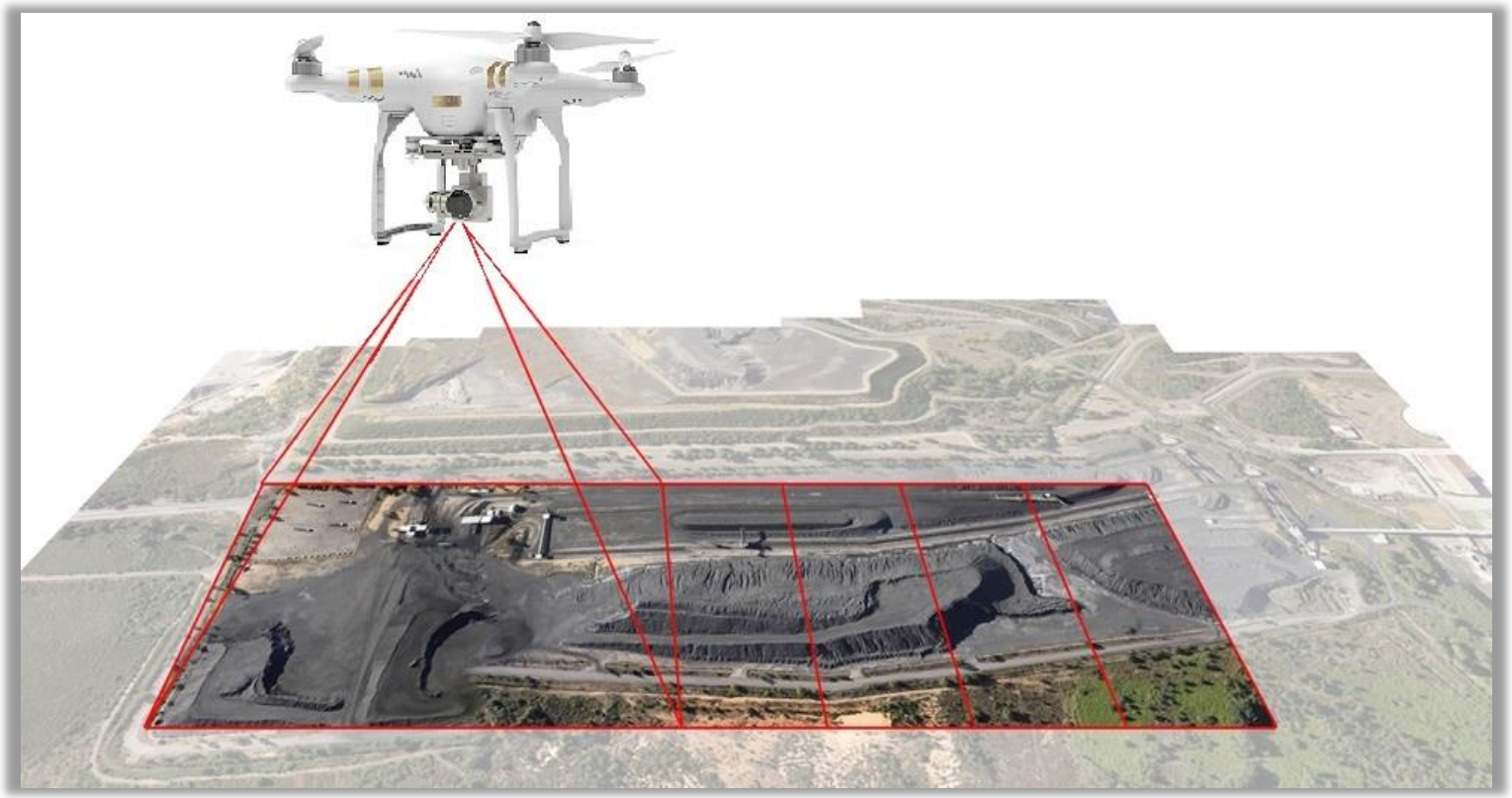
Automation – drones for inspection

Alunorte stocks: Bauxite, hydrate and coal are stored in different ways: covered sheds or open patios



Stock pile management

Project aims to use drone (photogrammetry) and laser scanner (LIDAR)



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Automatisering kommer

… og fjerner uønskede arbeidssituasjoner (ergonomi, eksponering og skaderisiko)


Calibration of thermocouples


Level measurements


Superheat measurements

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Avansert kran med økt automatisering og funksjonalitet

Pot Tending Machine (PTM) for håndtering av celledeksler ved anodeskift

PTM (Pot tending machine) for håndtering og drift av elektrolyseceller

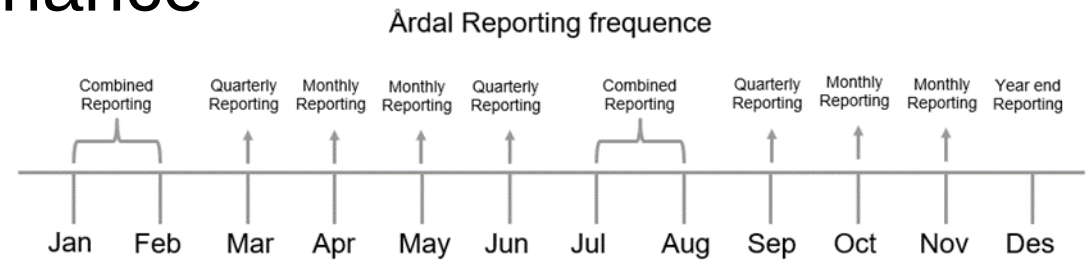
Automatisert håndtering av celledeksler,
her i drift ved Qatalum

Automatisert anodeskift vil delvis baseres på globalt posisjoneringssystem og utføres med delvis eller full automatisering

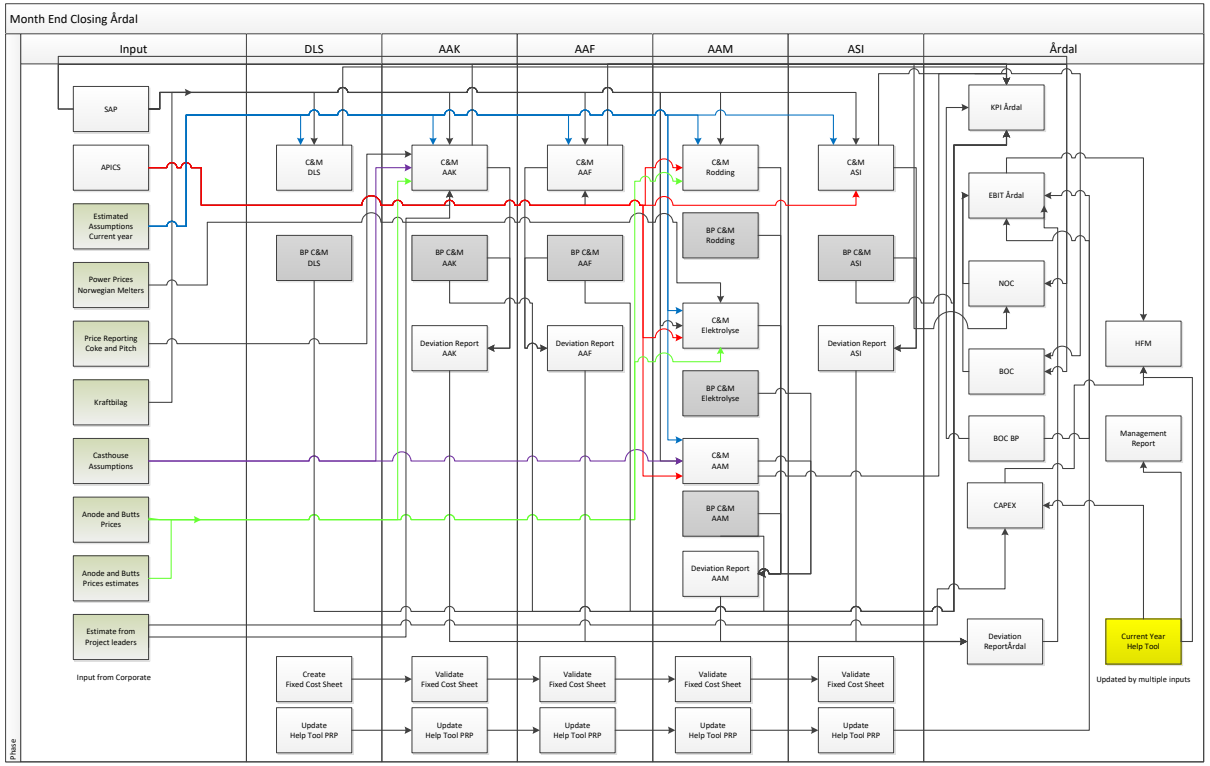
RFID reader (innhenter informasjon fra sensorer på bestemte objekter ved hjelp av radiobølger)

Process Automation Pilot – Årdal Finance

Software robots for controlling



- Implementing Robotic Process Automation (RPA) of financial reporting in Årdal Finance
- High number of very fragmented processes to be automated
  - More than 130 Spreadsheets involved in period closing process
  - Input from e-mail, meetings, xls sheets from Corporate
- Goal of the project is to free up time to be used for more value adding tasks



Dashboards with relevant information to relevant employees real-time

Real-time connectivity

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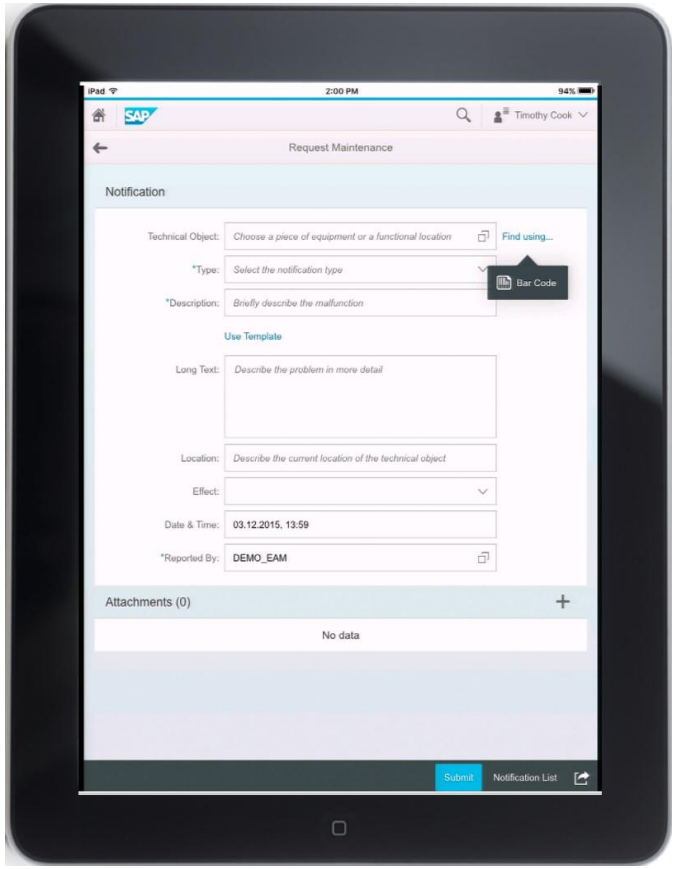
Mobile Solutions SAP preventive maintenance

Real-time connectivity



Maintenance worker shall have access to all relevant information and do all necessary requests at the workplace to enable high efficiency and effectiveness

- Online through WiFi
- Notification handling
- Work order handling
- Measurement readings
- Access to engineering documentation

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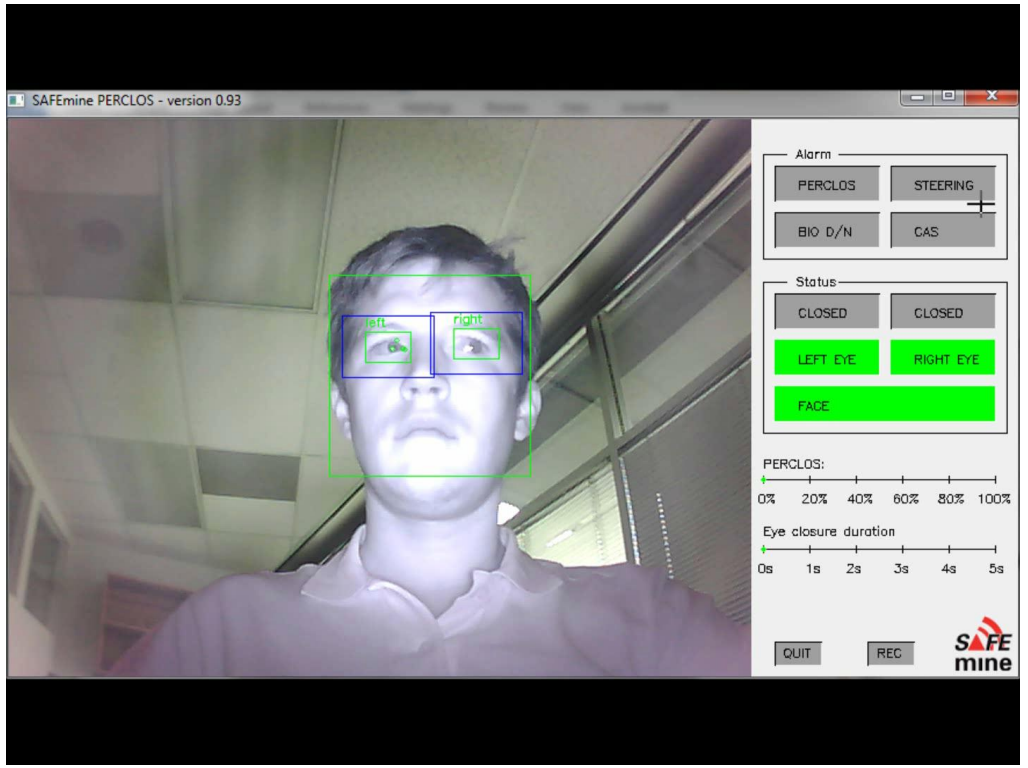
Collision avoidance and fatigue of truck drivers

Smart sensors

Anti-fatigue system

Anti-fatigue (Calibration)



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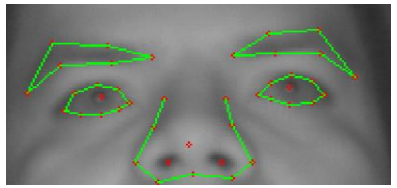
Anti-fatigue system



CAS

Algorithm development

Fatigue Assess.

Network

Remote monitoring and control

Control room

Reporting

Supervisor

Fast supervisor intervention

On board Technology (CAS, AF & Dispatch system)

Intervention

Dispatcher

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Machine learning - Automatic Intraday trading Havøygavlen wind farm

16 mills with an installed capacity of 40 MW and yearly production of 90 GWh

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Machine learning/AI-engine/advanced analytics

- Nice example of Havøygavlen by Hydro Energi
- Will these techniques replace the need for domain competence?


Original image

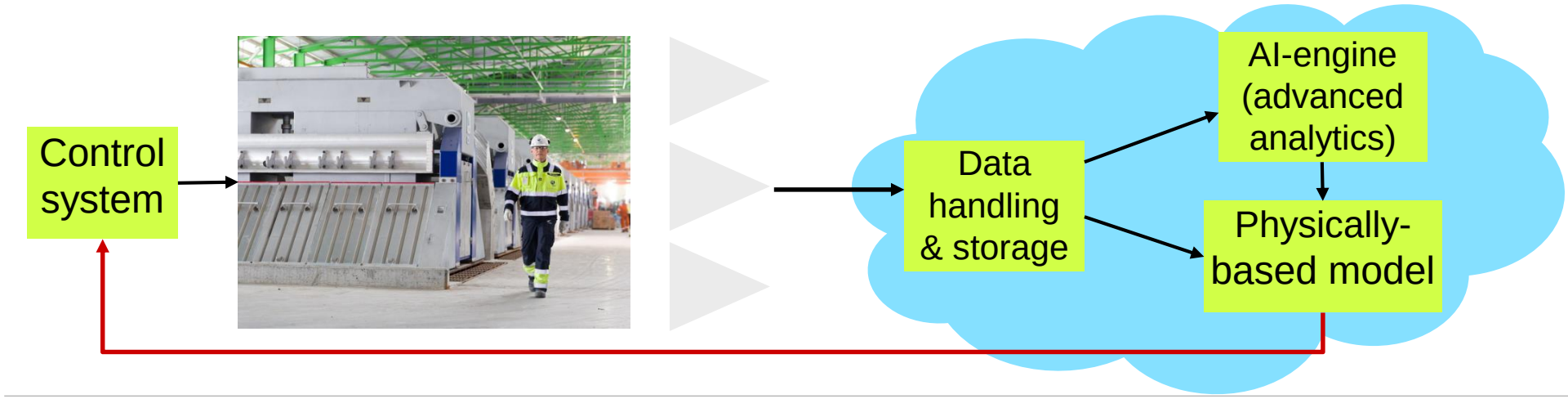

Convolutional NN interpretation

Digital twins

The concept of digital twins:

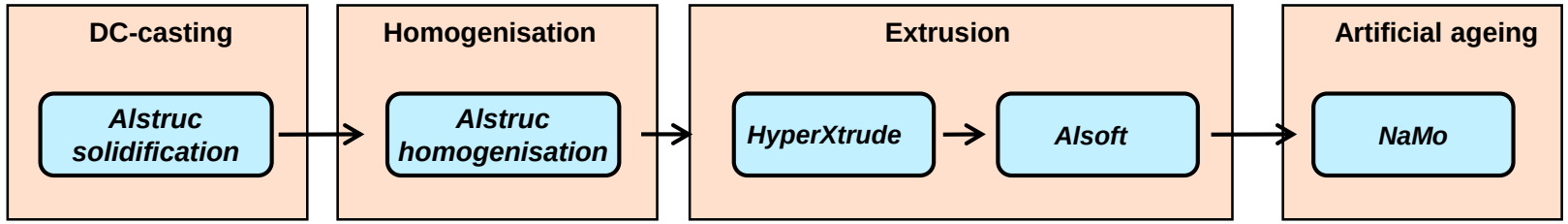
A complete digital/numerical simulation model of a physical process, like a machine, electrolysis cell or a complete plant, based on a combination of:

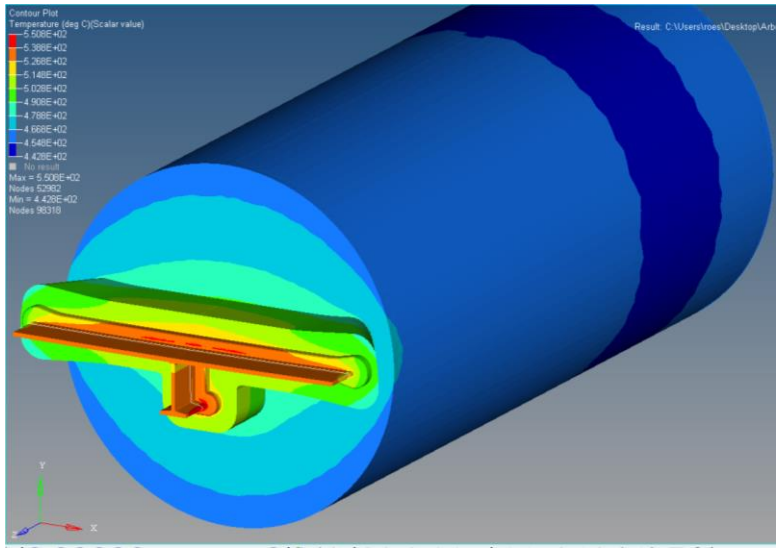
1. Physically-based models
2. Advanced sensors/measurement systems (to continuously calibrate the model)
3. Advanced analytics algorithms (statistics, machine learning, artificial intelligence)

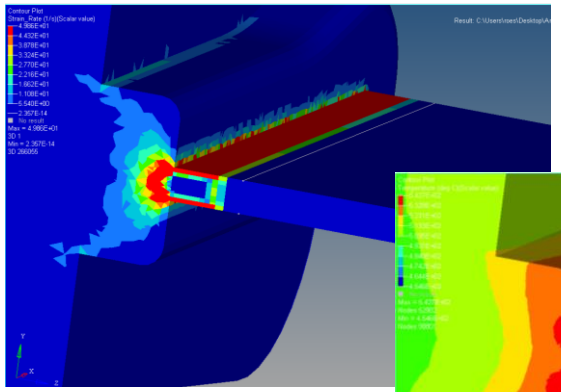


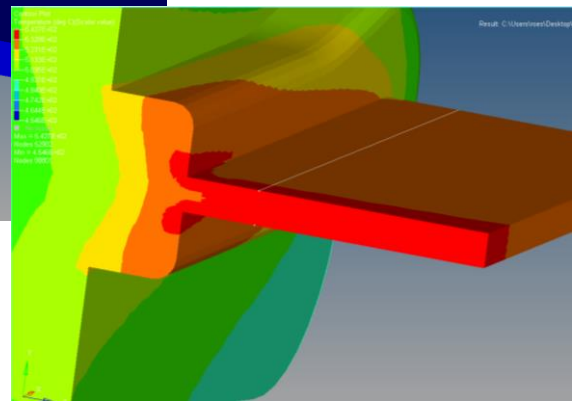
Complete extrusion value-chain simulation model

Digital twin: Complete Through Process Simulation, including neural optimisation tool



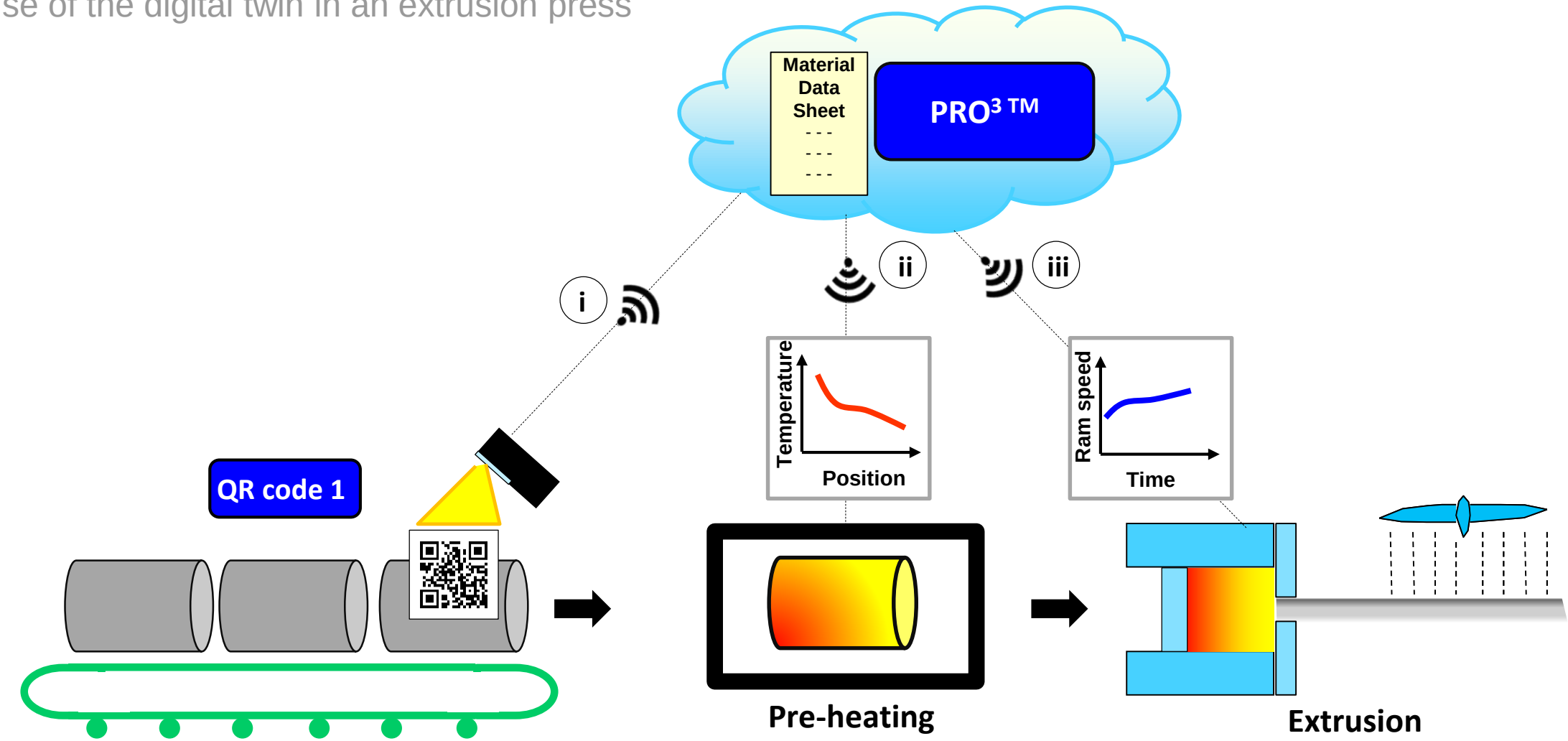






Adaptive control in production of aluminium extrusions

Use of the digital twin in an extrusion press



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