



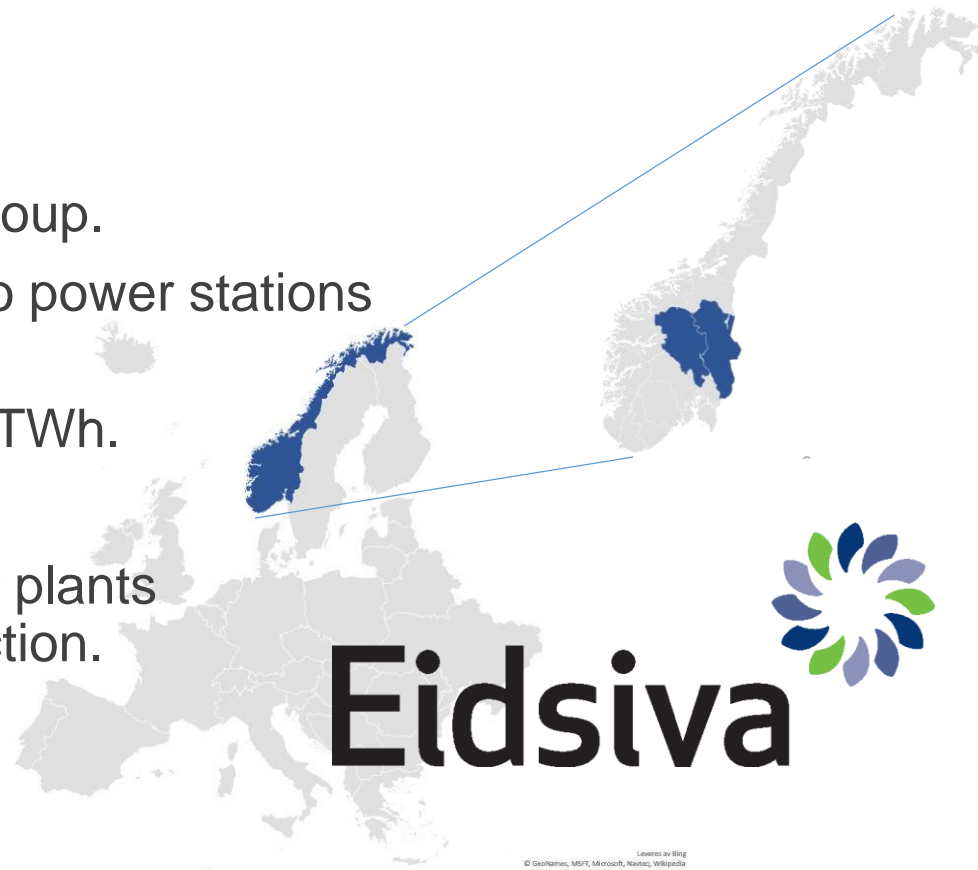
# Utilizing the Flexibility in PI System to Incorporate ML and AI in CBM

Jørgen T. Foss, Ole Kristian Grindbakken  
and Joakim Gundersen



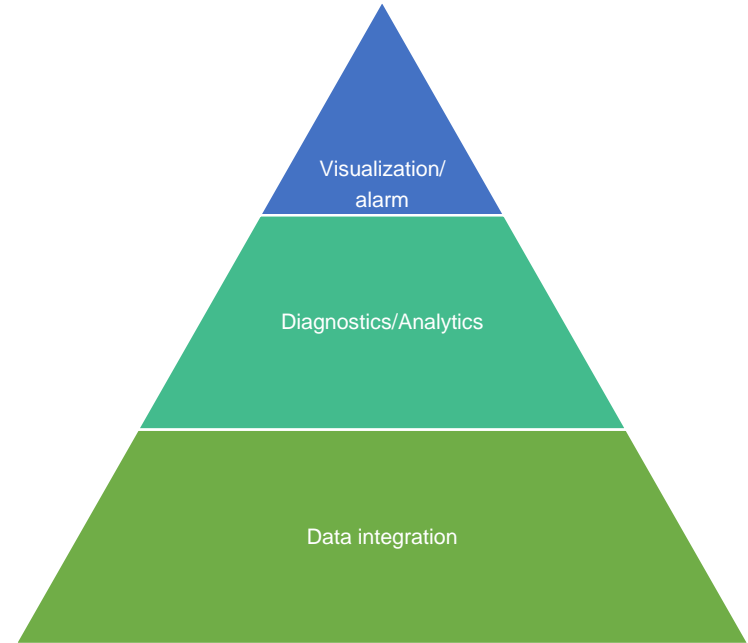
# Eidsiva Vannkraft AS

- Part of the Eidsiva Energi AS group.
- Operates and maintain 48 hydro power stations in the southeast of Norway.
- Annual production of about 7.5 TWh.
- 4<sup>th</sup> largest operator in Norway.
- Building three new hydro power plants with about 0.7 TWh new production.



# Online Condition Monitoring

- Give a better, simpler and more efficient solution for condition monitoring.
- Lead the attention to where it is most valuable.
- Detect changes in due time before critical.
- A place to store and share knowledge and experience.
- Flexible, scalable and build on generic principles.
- Result in more predictive and condition based maintenance.

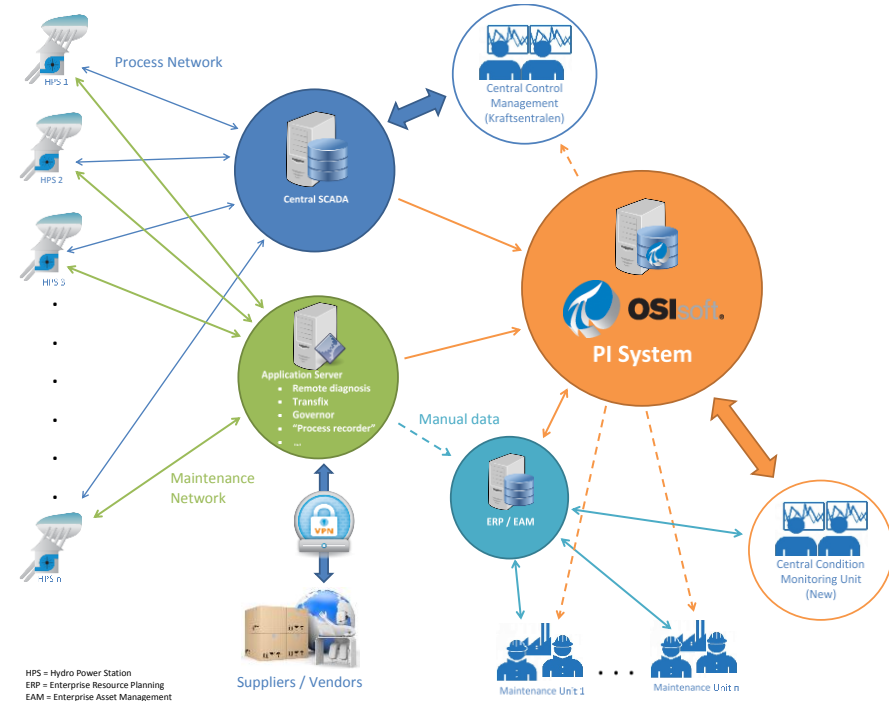


# No room for expensive, highly specialized solution

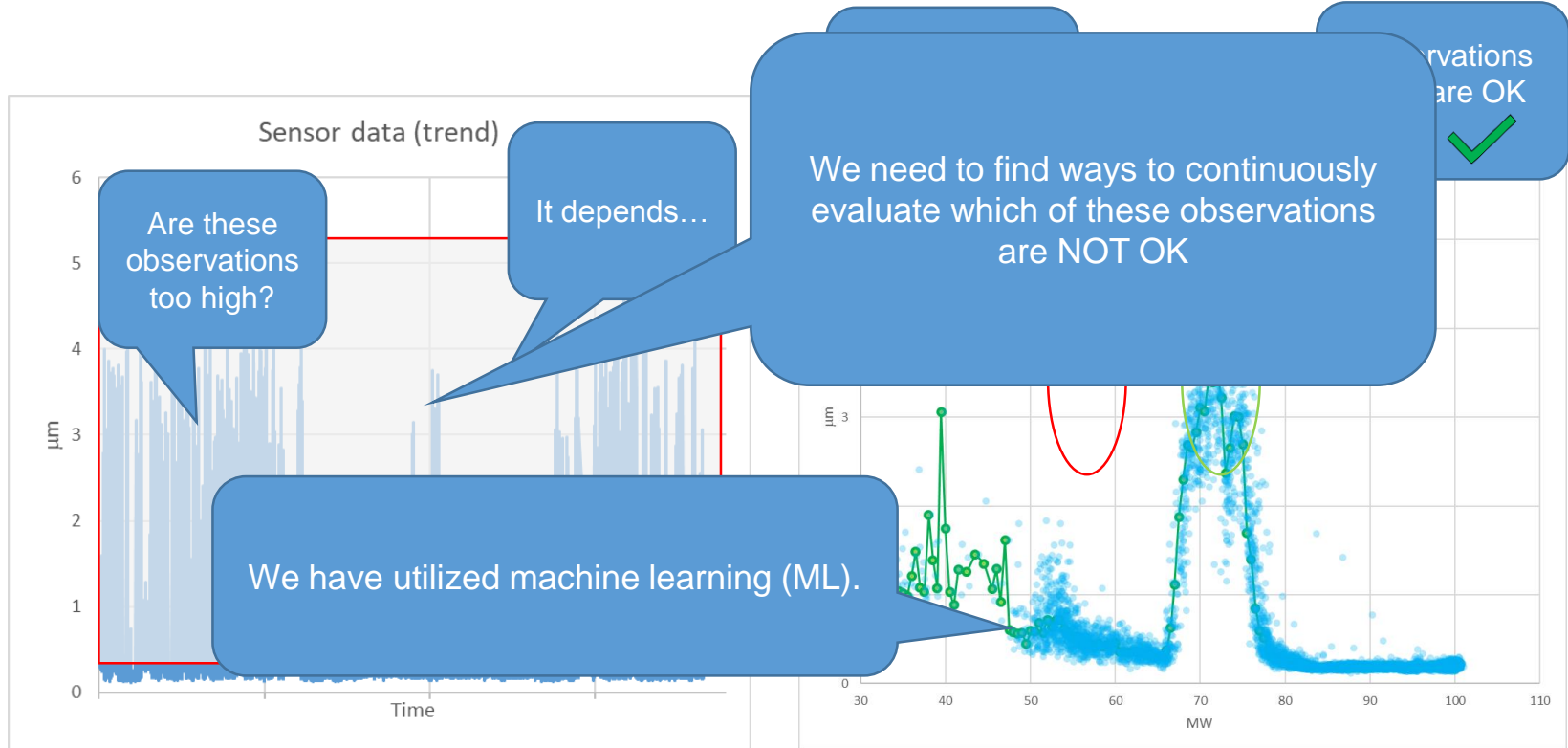
- 98,9% availability of the generating units.
- Long term perspective for low/variable energy prices.
- Power plants with huge variations in age, technology and size.
- Big investments already made in solutions and infrastructure for remote operation and data collection.

# The PI System as Platform for Online Condition Monitoring

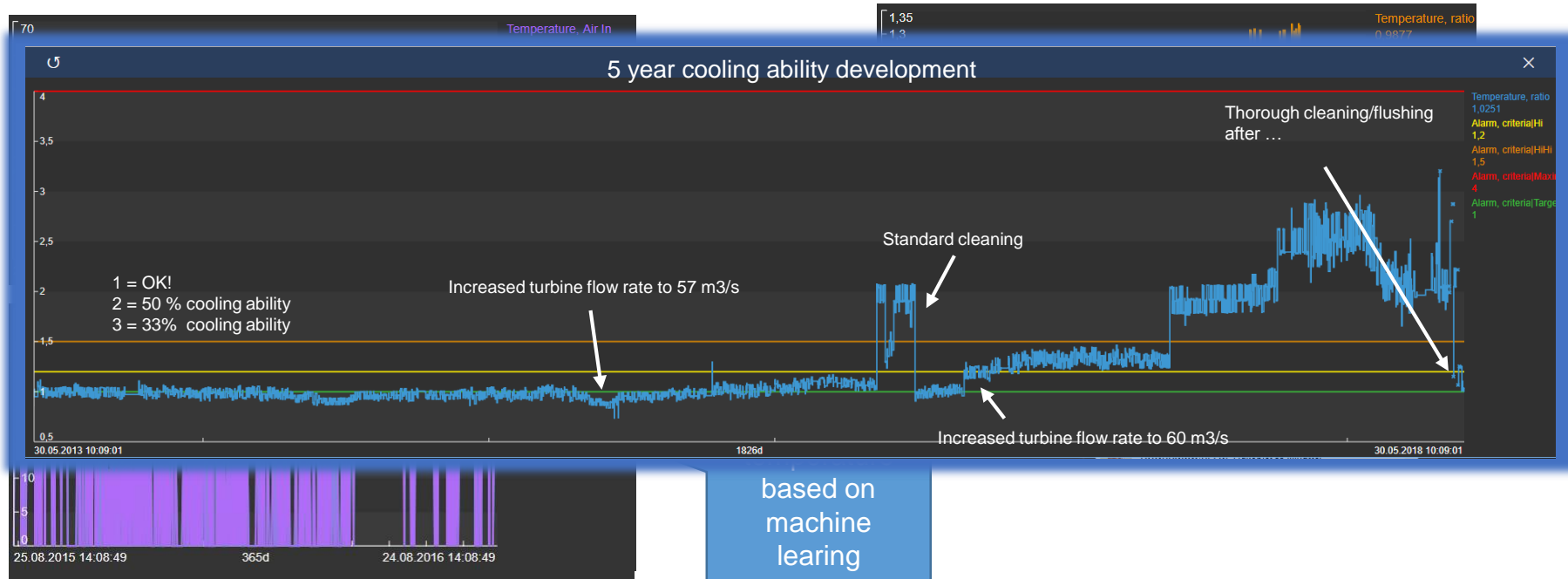
- Highly flexible, scalable and cost effective.
- Give the user the ability to transform the collected data, together with inhouse expertise and knowledge, to valuable information and better insight of the plants operation and condition.
- A platform for incorporate inhouse Machine Learning (ML) and Artificial Intelligence (AI) models in the condition monitoring.



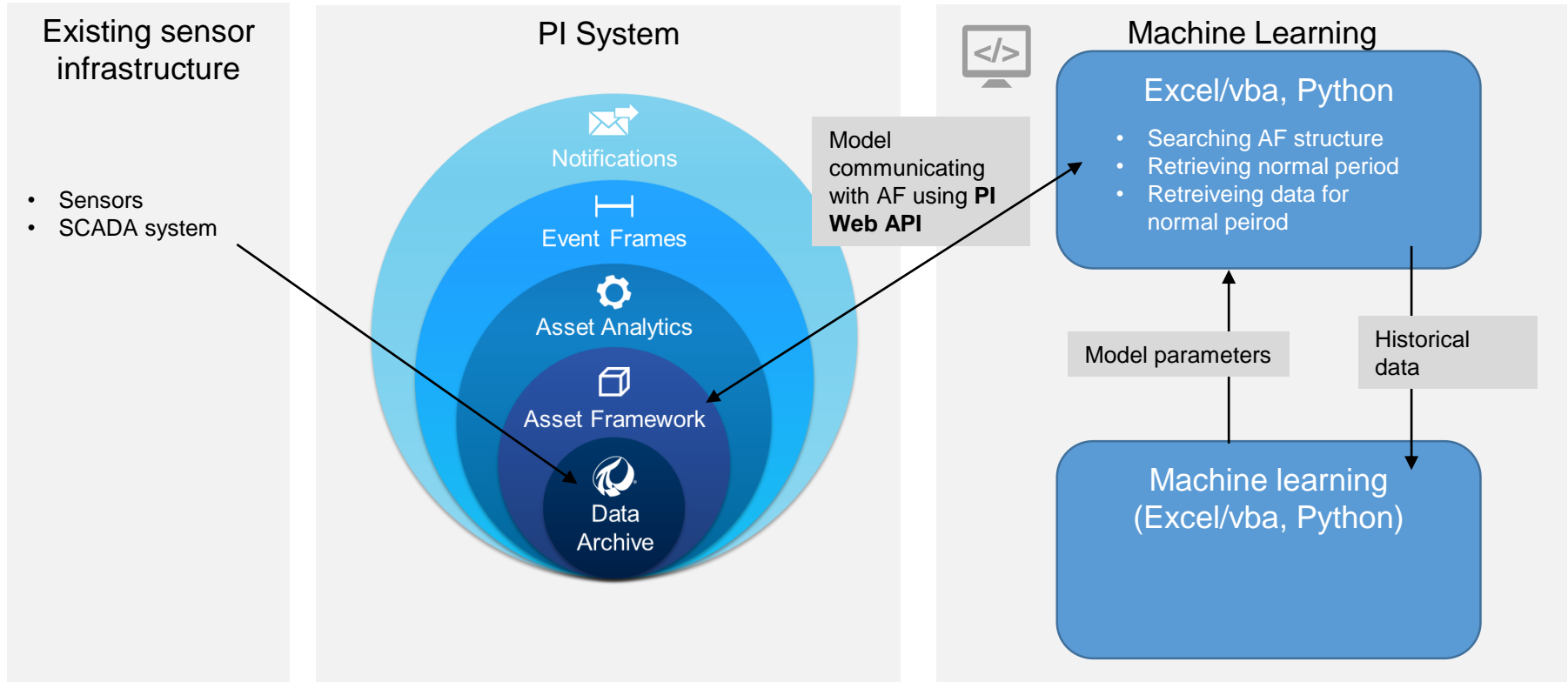
# How to evaluate observations



# Example of ML – Stator Cooler

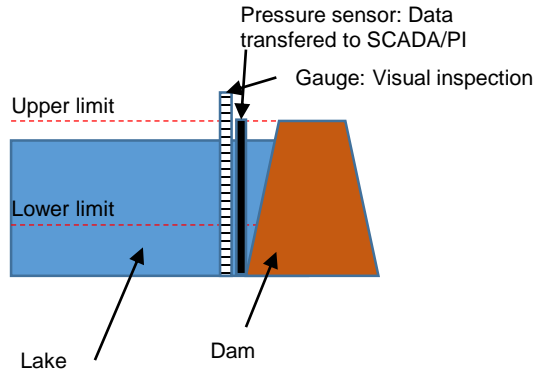


# Implementation – Machine learning





# Pressure sensor control on hydro reservoir



- Damages due to flood water
- Fines apply if upper or lower limit is passed
- Correct level important for correct planning
- Different technologies - Different issues.
- About 100 manual readings pr. month obligated by the governmental authority
- **Can we do this with image analysis and using the PI system as supporting framework?**

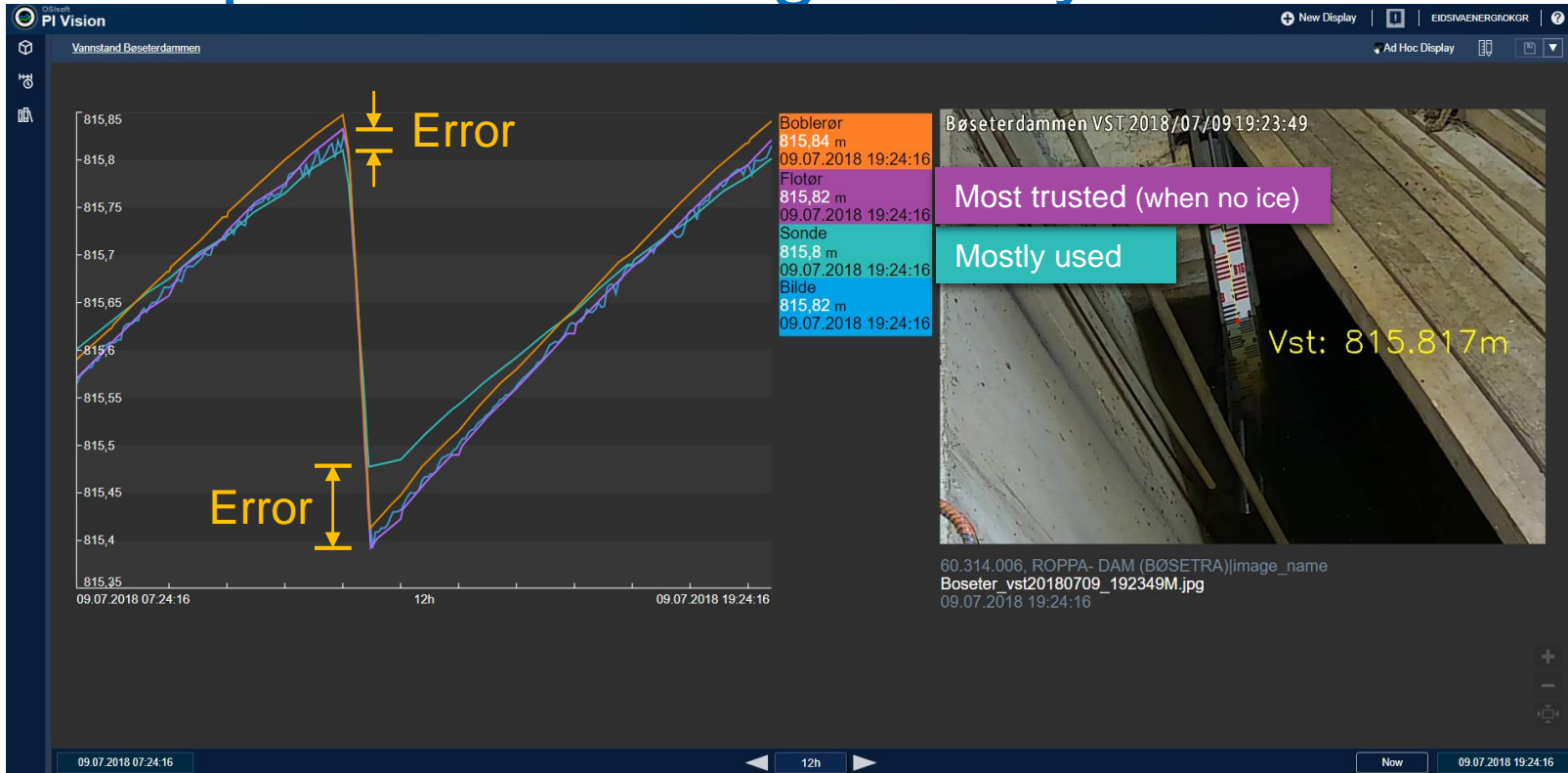
Pressure probe  
• Pressure

Bubble tube  
• Pressure

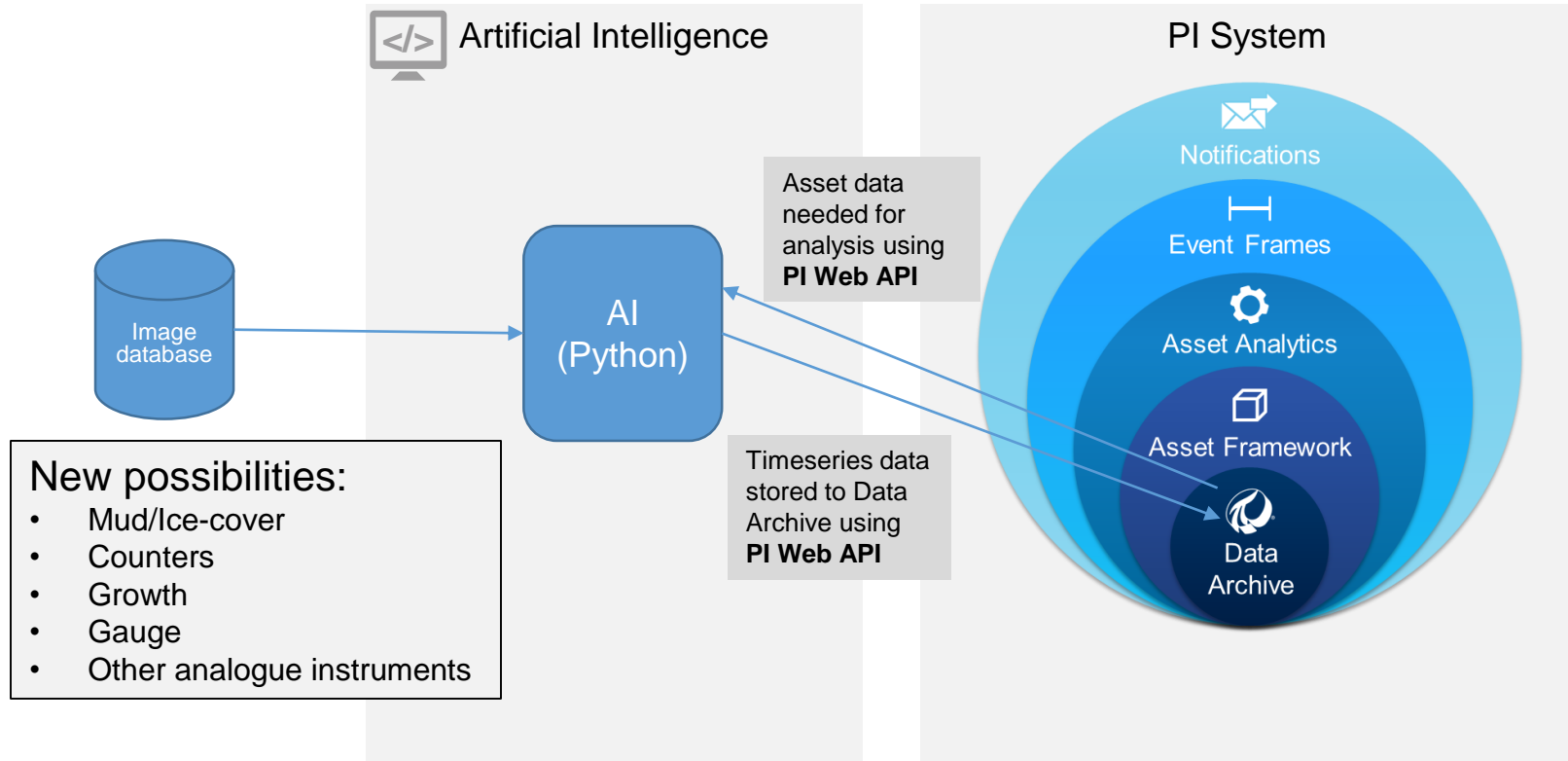
Floater  
• Distance

Image analysis  
• Relation  
between pixels

# Example of AI – Image analysis



# Implementation of Image Analysis



# EIDSIVA VANNKRAFT

## Online Condition Monitoring Solution



### CHALLENGE

Development of a online condition monitoring solution meeting the requirements for Eidsiva Vannkraft.

- Highly flexible, scalable and cost effective.
- A place to store and share inhouse expertise and knowledge.
- Turning data into valuable information.

### SOLUTION

The PI System is used as the platform

- Build on existing infrastructure for remote operations.
- Allow use of inhouse ML and AI models for advanced condition analysis.
- Integration toward other vital business systems.

### RESULTS

A cost effective solution for online condition monitoring.

- Additional value to investment already made.
- Increase the insight of the plants operation and condition.
- More predictive and condition based maintenance.



- Jørgen Taule Foss, MSc
- Digitalization Engineer
- Eidsiva Vannkraft AS
- JorgenTaule.Foss@eidsiva.no



- Ole Kristian Grindbakken, MSc
- Digitalization Engineer
- Eidsiva Vannkraft AS
- OleKristian.Grindbakken@eidsiva.no



- Joakim Gundersen, PhD
- Head of department System Operation and Digitalization
- Eidsiva Vannkraft AS
- Joakim.Gundersen@eidsiva.no

# Questions?

Please wait for  
the **microphone**

State your  
**name & company**



# Please rate this session in the mobile app!





