

Corrosiedetectie in Maritieme Infra en Schepen

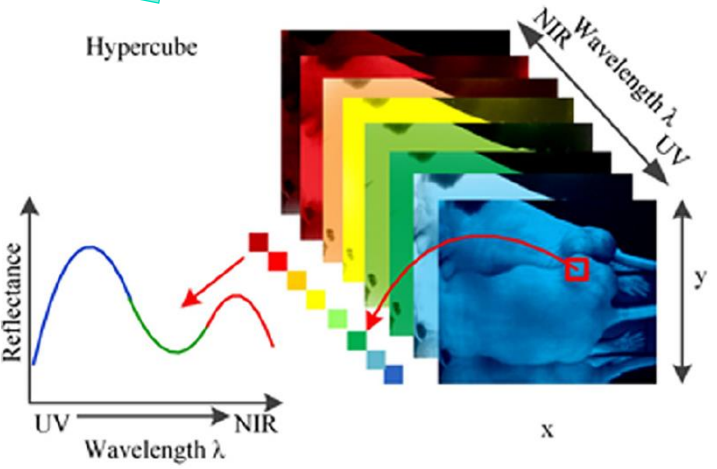
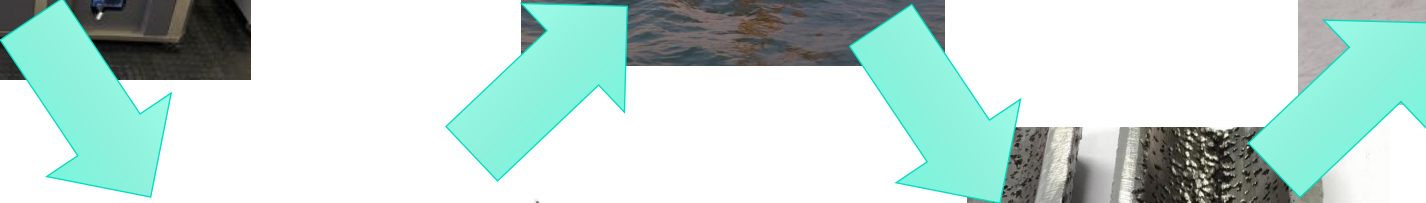
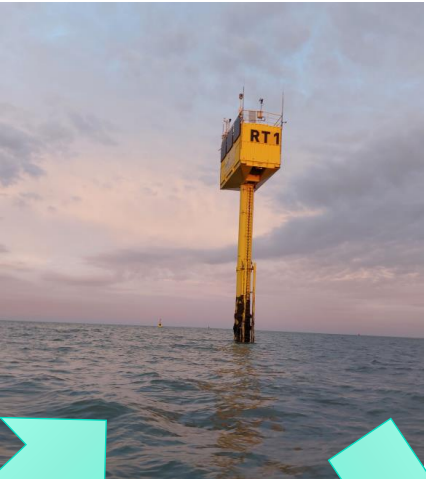
29/06/2023

Jeroen Tacq, Sirris

jeroen.tacq@sirris.be



Inhoud



Het belang van praktijkonderzoek, testen en demonstrenen van innovaties

- Grote concentratie van industrie in grensgebied Vlaanderen – Nederland
- Corrosie is een groot probleem: veiligheid, milieu, productieverlies, reputatieverlies → Hoge kosten
- Aanpak van corrosie vereist:
 - Testfaciliteiten, Verankering van kennis
 - Meer innovatie en samenwerking



Goals

- ✓ Platform for industry oriented R&D and testing
- ✓ Realistic test environments to develop and demonstrate Corrosion Management Solutions
- ✓ Improved education



Simulated industrial environment



Laboratory testing



Maritime environment

The importance of Applied Research, Testing and Demonstrating Innovations

- ✓ Stay ahead, but don't take unnecessary financial or safety risks
- ✓ Improved understanding of performance and capabilities of innovations

Innovation project

Simulated industrial environment

- More controlled testing, but still very realistic
- Limited acceleration
- Not standardised



Field Trials

- The real deal
- Slow process
- Difficult to interpret and compare solutions

Laboratory testing

- Strongly accelerated
- Compare potential solutions
- Not easy to link to 'real' performance
- Standardised



Corrosion Laboratory @ Sirris



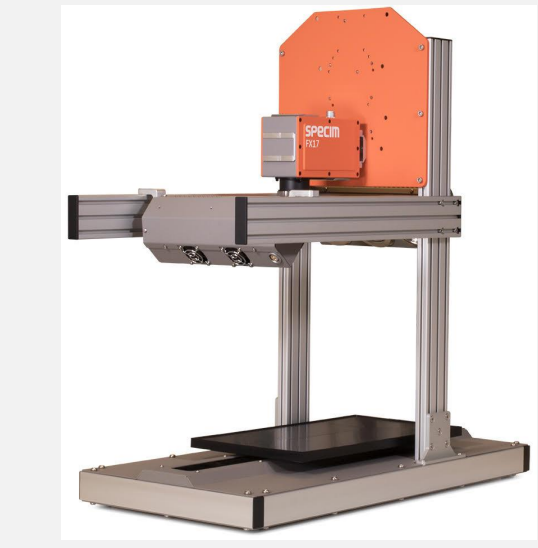
Salt spray and condensation testing



Potentiostat for Electrochemical Corrosion experiments and development of monitoring techniques



Large Climate Chamber
+/- 60°C
10.6 x 7 x 8m
>150 ton equipment
5% to 95%RH
Ice-spray testing
www.owi-lab.be



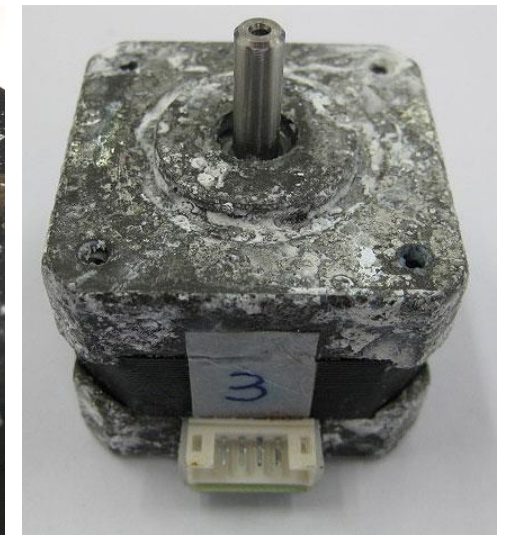
Hyperspectral line-scan camera
SWIR Range
900 nm to 1700 nm

More at: <https://testlabs.sirris.be/>

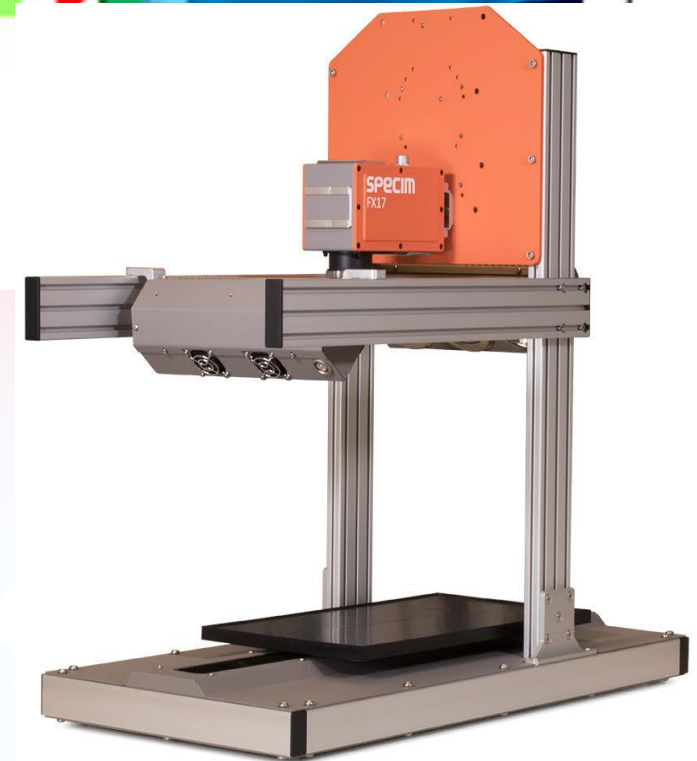
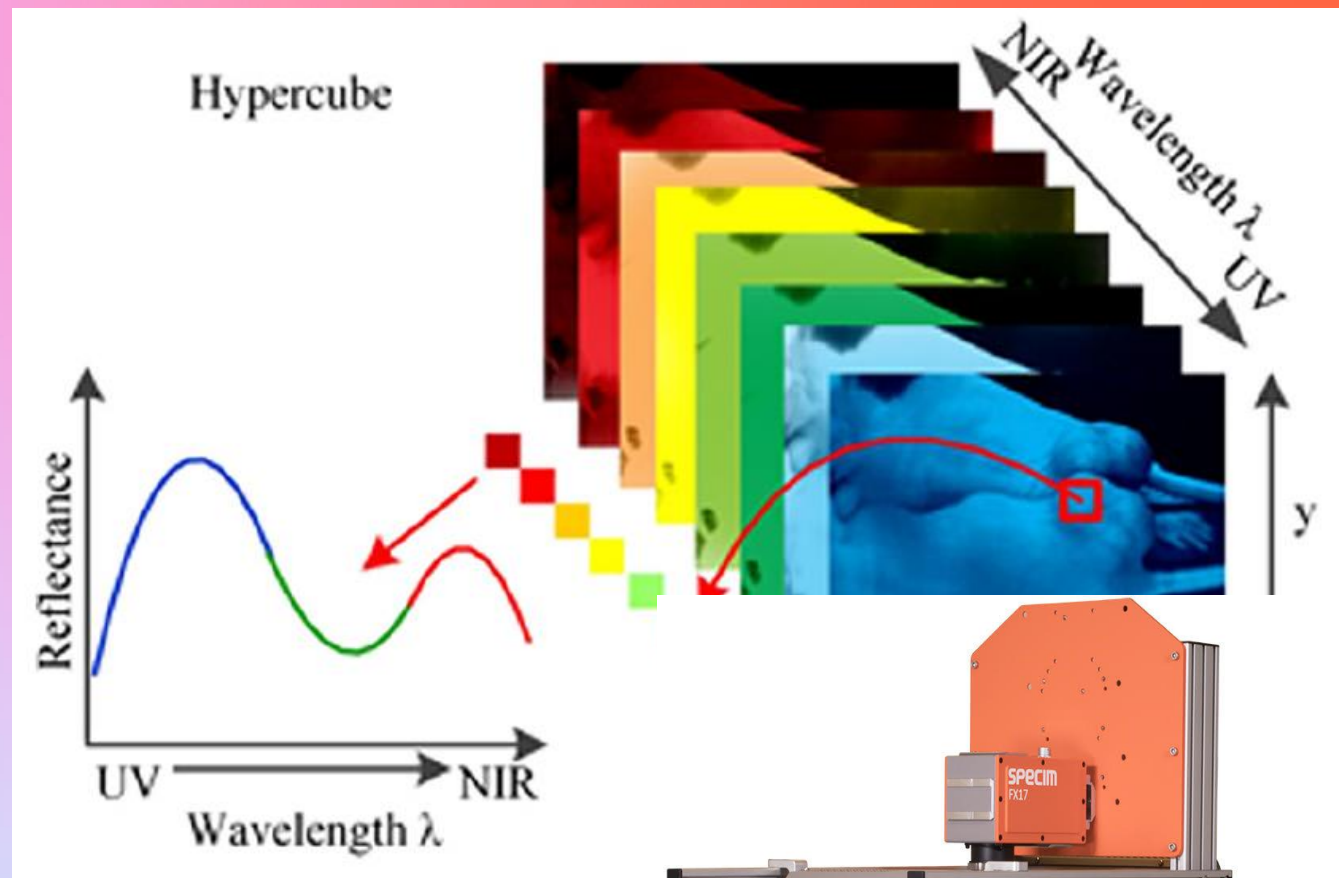
Case: Corrosion testing of offshore inspection drones

ICON RAINBOW

- No existing test standards for maritime electronics
- “Home-made” test based on existing tests
- Combination of tests for automotive (electronics) and offshore
- Full drone test: corrosion testing followed by flight and electronics testing



HypIRspec



Hyperspectral imaging for monitoring of offshore wind turbines

Harsh environment → corrosion

Repair cost at sea = X 100

→ Use hyperspectral imaging for inspection and monitoring

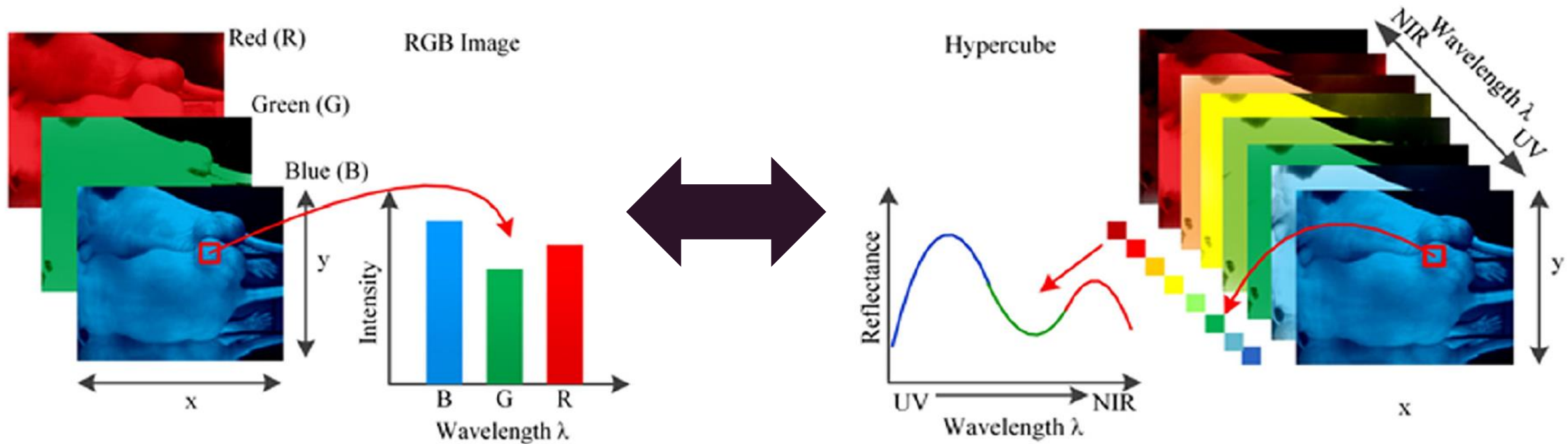


AGENTSCHAP
INNOVEREN &
ONDERNEMEN



Vlaanderen
is ondernemen

Hyperspectral imaging for monitoring of offshore wind turbines



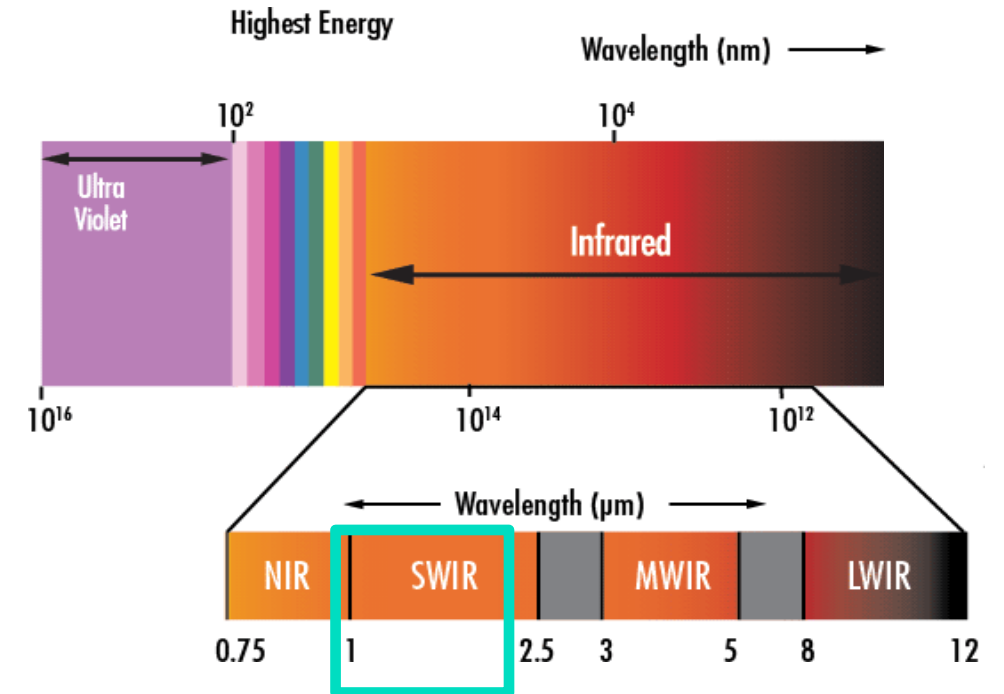
Mehta et al, Single-Cell Analysis Using Hyperspectral Imaging Modalities. J Biomech Eng. 2018 Feb 1;140(2)

Hyperspectral imaging for monitoring of offshore wind turbines



Specim FX17

- Line scan (670FPS)
- 224 wavelength bands
- 10-20 seconds/cube



This study

Hyperspectral imaging for monitoring of offshore wind turbines

Case:
Corrosion
detection

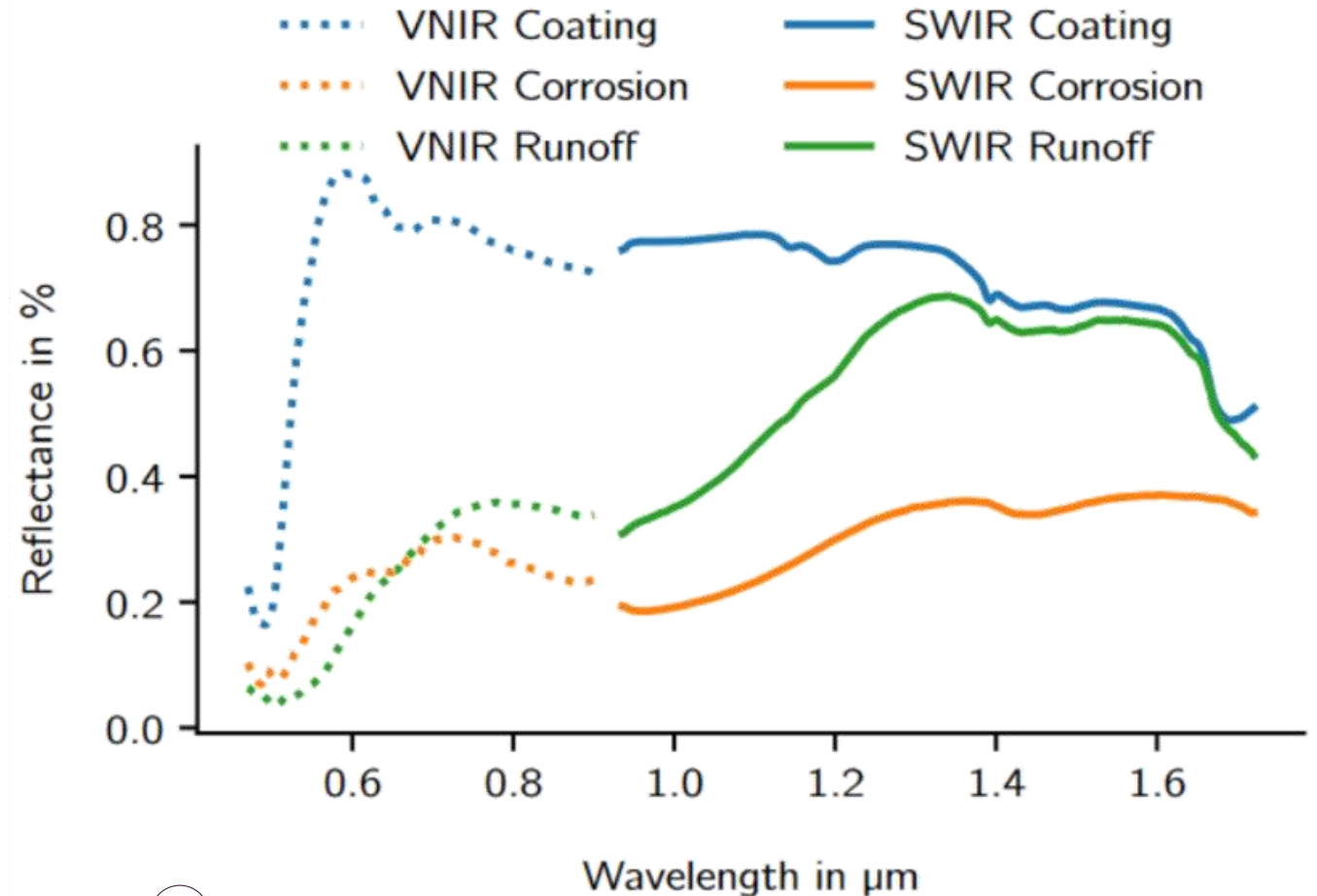


Hyperspectral imaging for monitoring of offshore wind turbines

Case:
Corrosion
detection



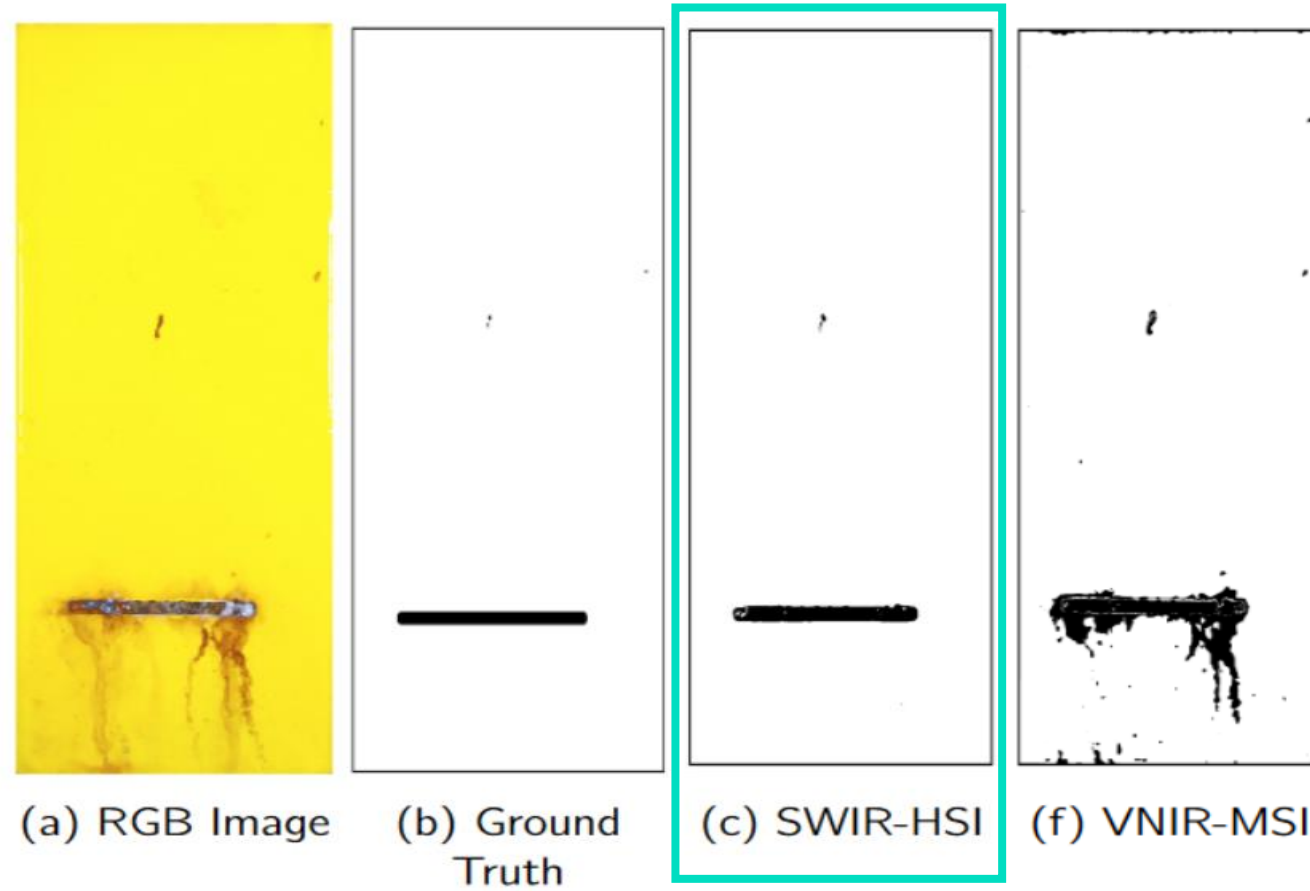
ISO 12944-9
accelerated
corrosion
testing



Hyperspectral imaging for monitoring of offshore wind turbines

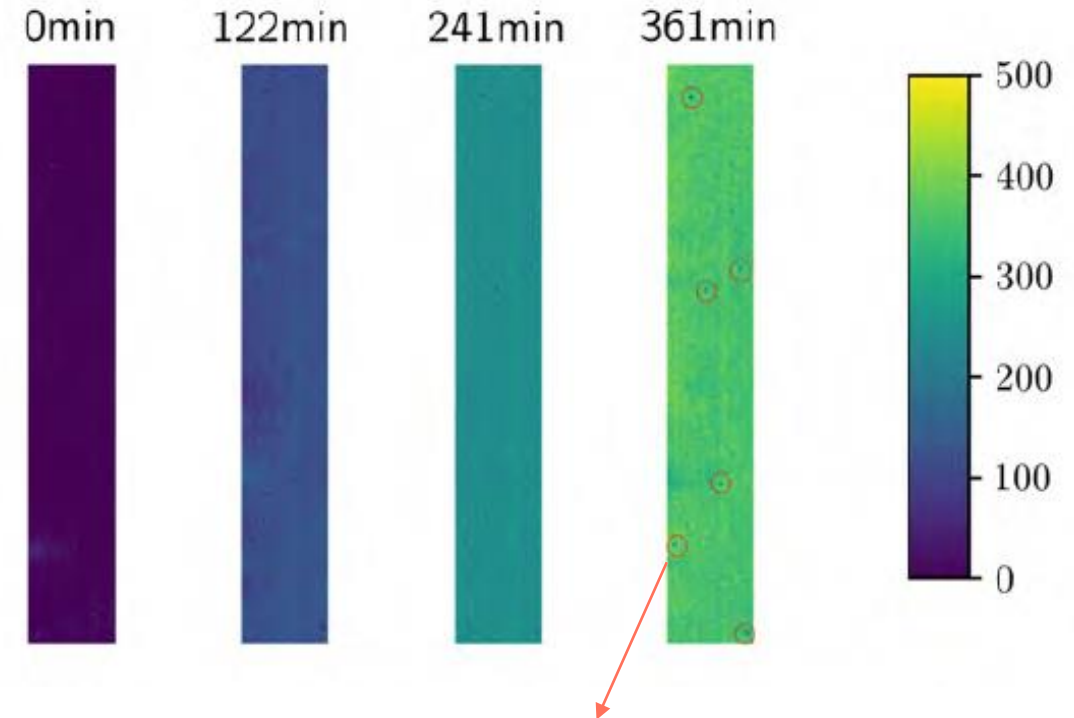
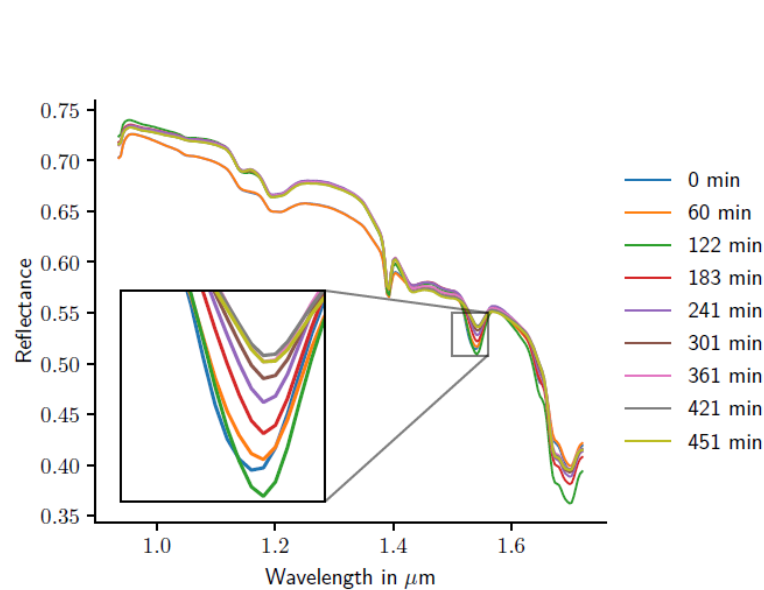
Case:
Corrosion
detection

Black pixels =
identified as
corrosion



Hyperspectral imaging for monitoring of offshore wind turbines

Case:
Coating
curing



Work from Ph.D. Thesis Thomas De Kerf

anomalies are caused by air bubbles created during the curing process

Hyperspectral imaging for monitoring of offshore wind turbines

Open questions

- Accuracy of corrosion detection and coating during in field applications (reflectance from sun, etc.)
- Other potential applications
- Use on drones?
- Business case?



Work from Ph.D. Thesis Thomas De Kerf

Data Gedreven beheersing van Corrosie



Corrosie Monitoring



Data and AI drive a mindset change in Corrosion Management

- Evaluate sensing and inspection techniques.
- Risk monitoring based on data and Artificial intelligence (AI).
- Modelling combining lab data and results from field testing.



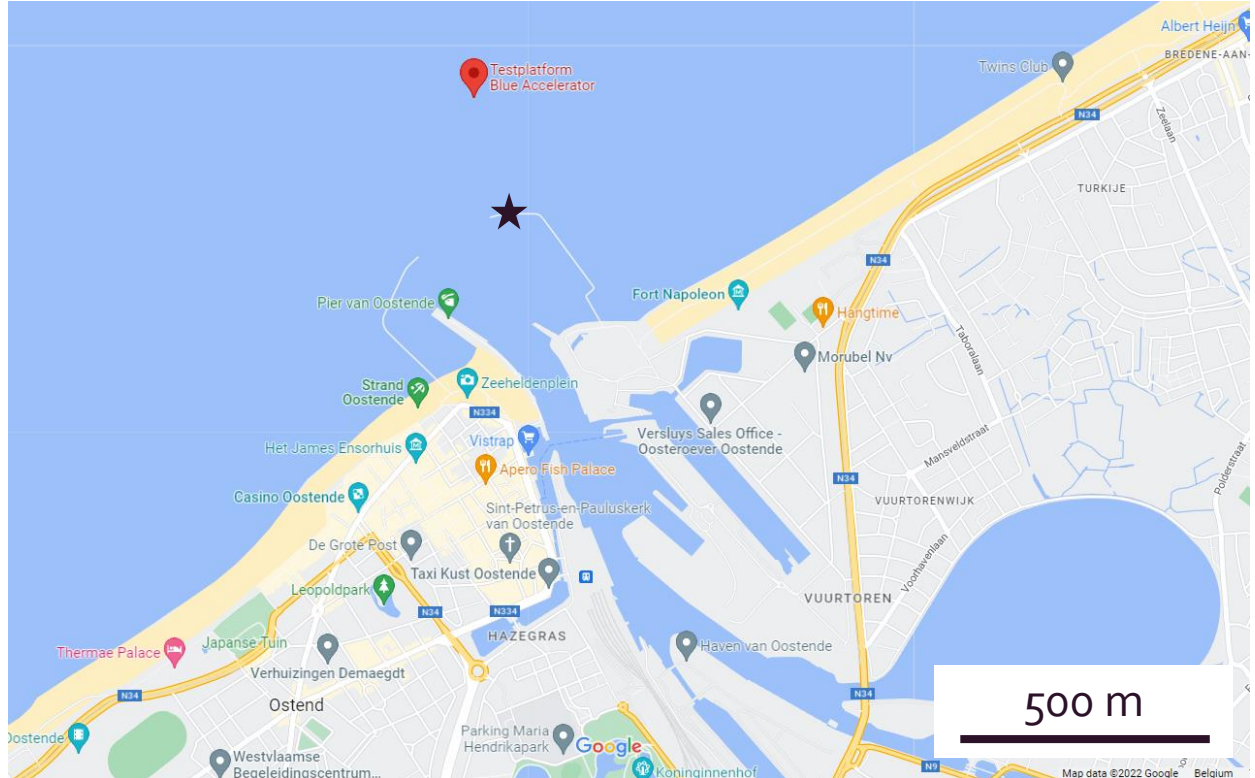
Case Study – Blue Accelerator

BELGIAN OFFSHORE TEST SITE – MEASUREMENTS STARTED ON 18-05-2022



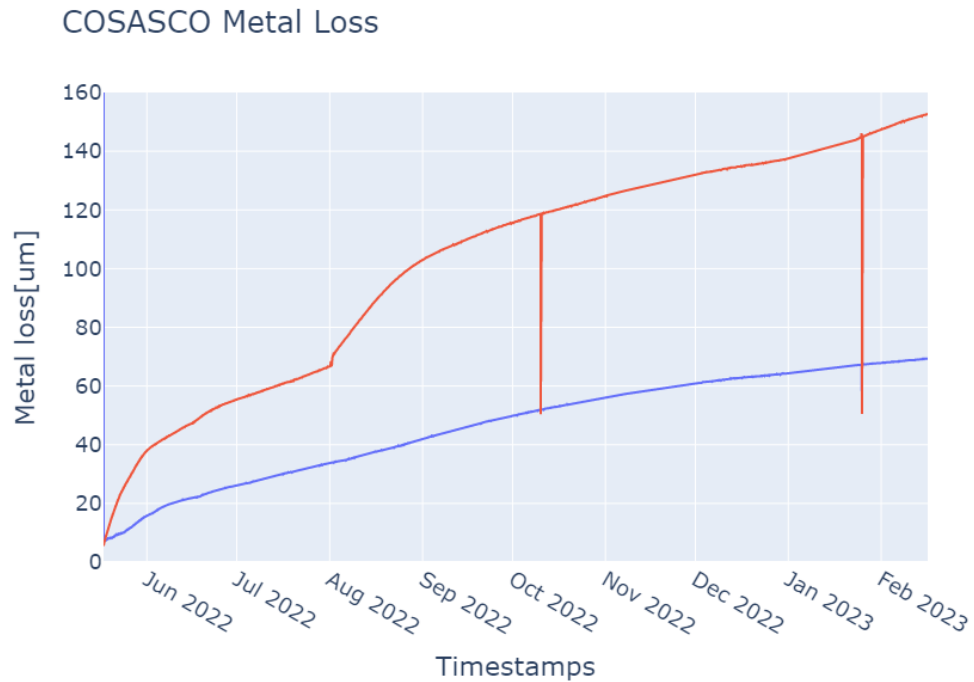
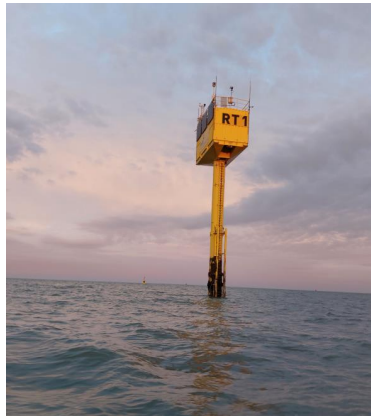
Case Study – Blue Accelerator

BELGIAN OFFSHORE TEST SITE



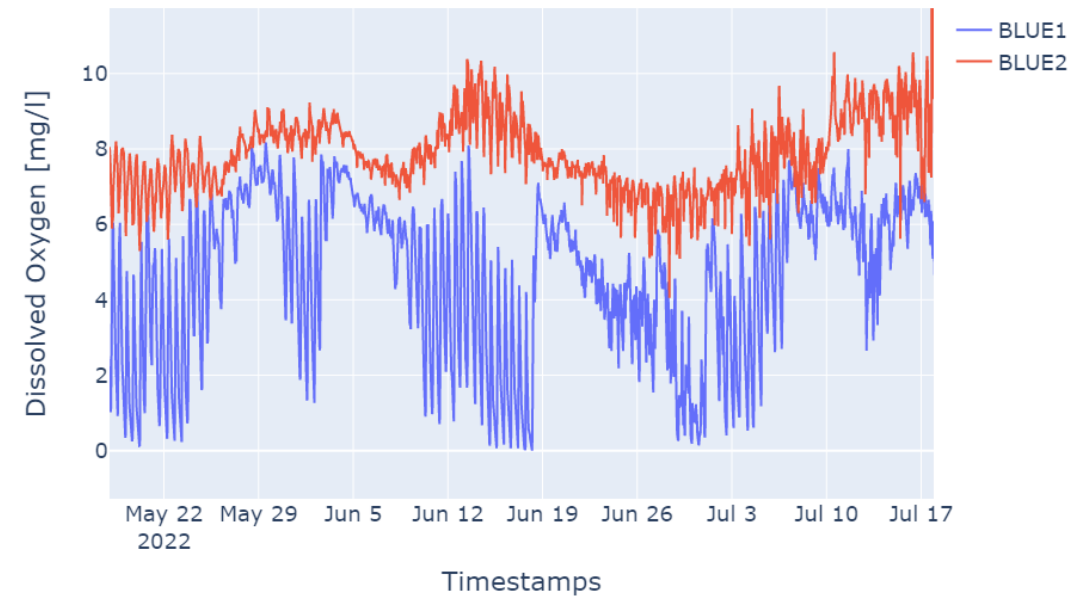
Case Study – Blue Accelerator

BELGIAN OFFSHORE TEST SITE



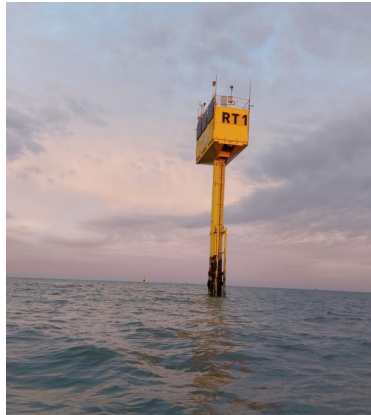
RED = External

BLUE = Internal

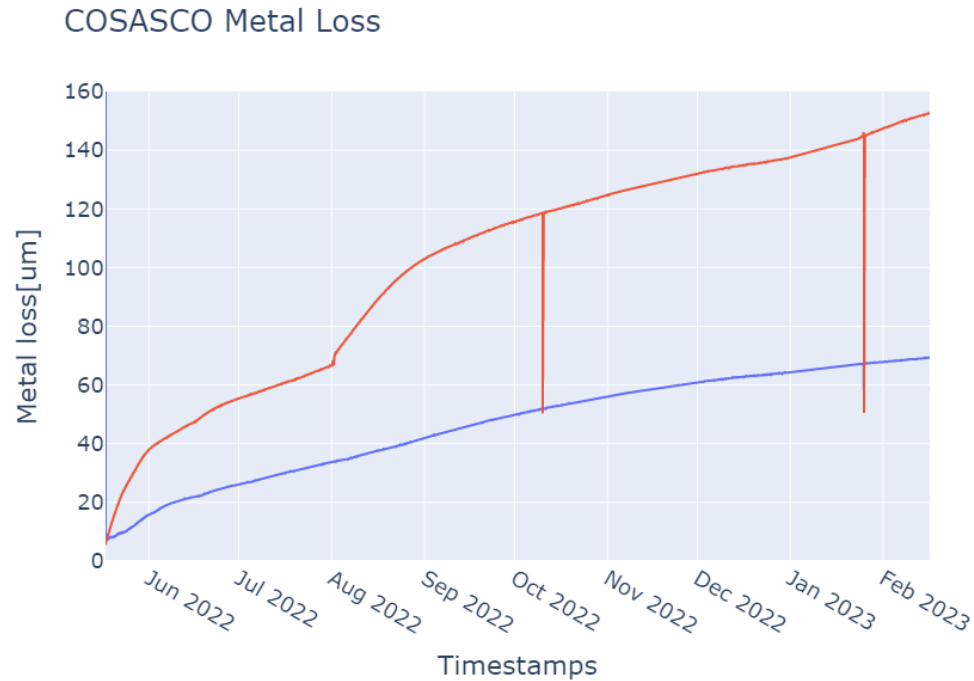


Case Study – Blue Accelerator

BELGIAN OFFSHORE TEST SITE



RED = External
BLUE = Internal



External

Internal



In case of different turbines, can be used for inspection planning.
Data can be used for life calculations (> see also part on pitting corrosion.)

Case Study – Blue Accelerator

BELGIAN OFFSHORE TEST SITE

SOCORRO App at: <https://app-c14q.onrender.com/>

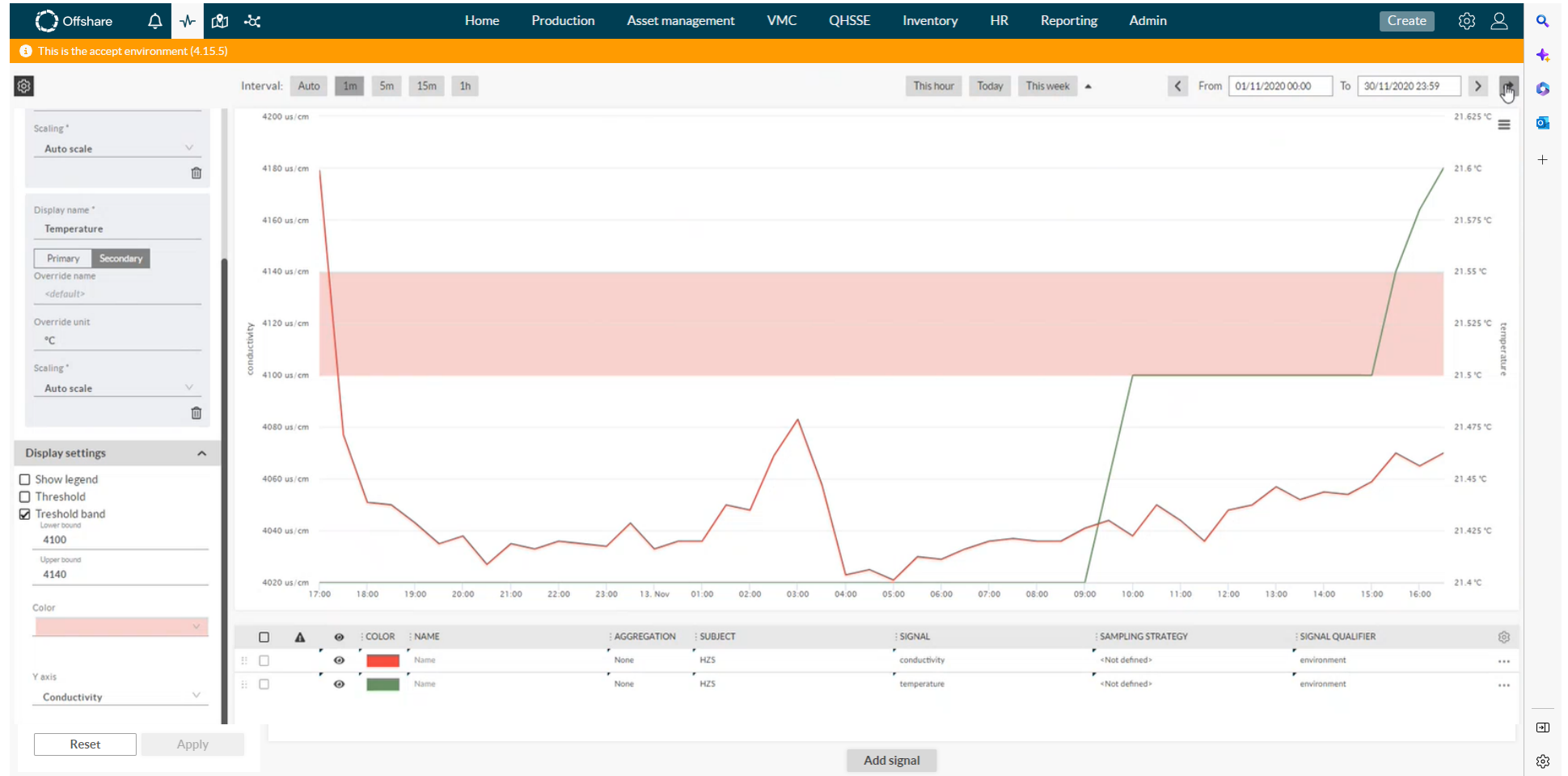


Variation in calculated Corrosion Risk caused by:

- Increase in T and pH
- Followed by decline in DO
- Again increase in T, pH and DO

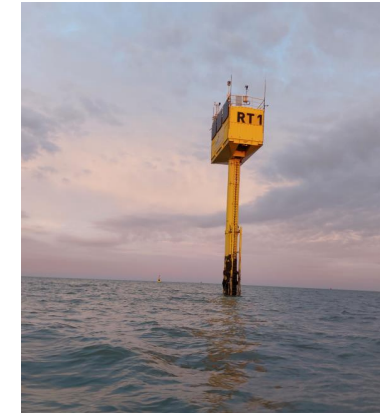
Case Study – Blue Accelerator

BELGIAN OFFSHORE TEST SITE

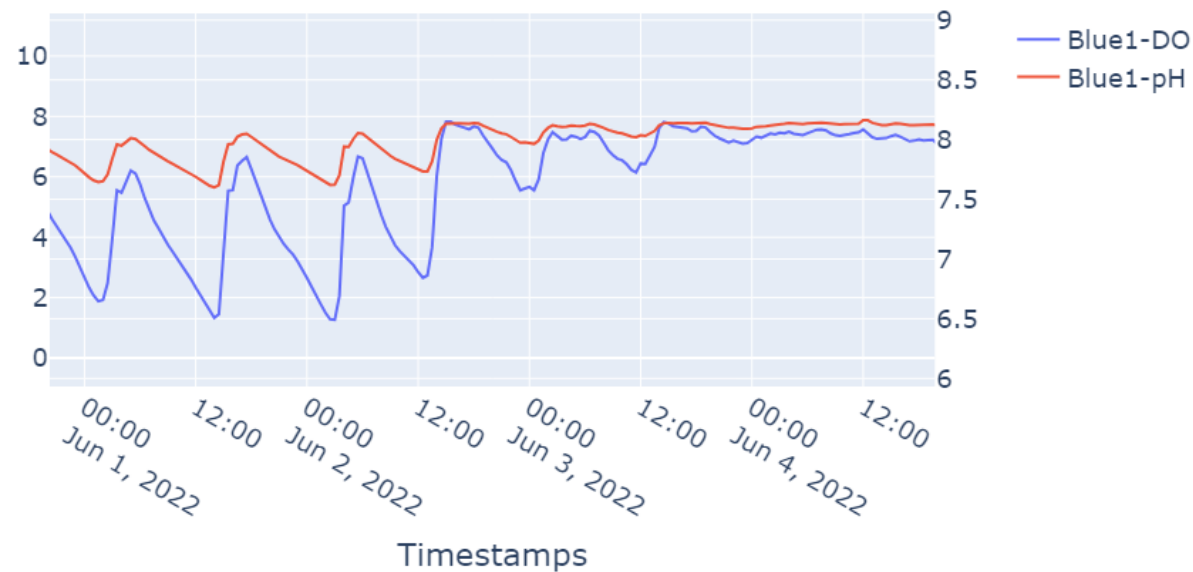


Case Study – Blue Accelerator

BELGIAN OFFSHORE TEST SITE



Internal

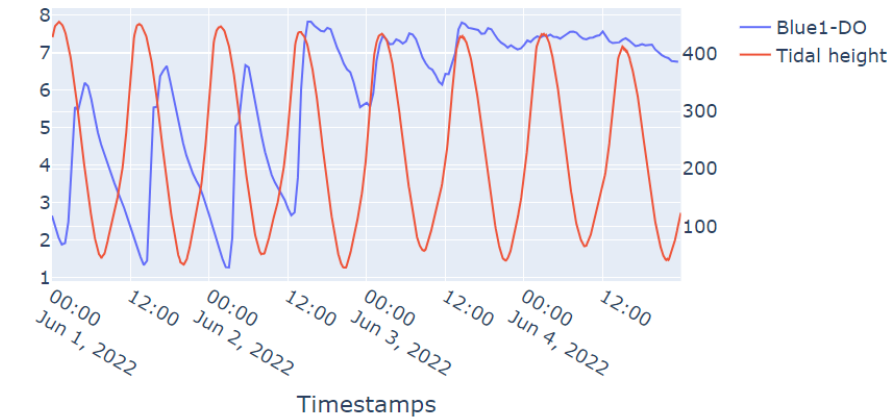


- Perfect correlation between DO and pH
- Follows tidal variations
- MP has a small opening at the bottom for J-tube

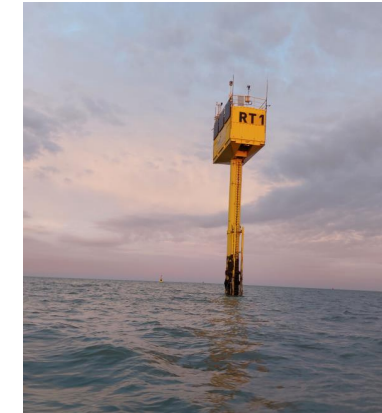
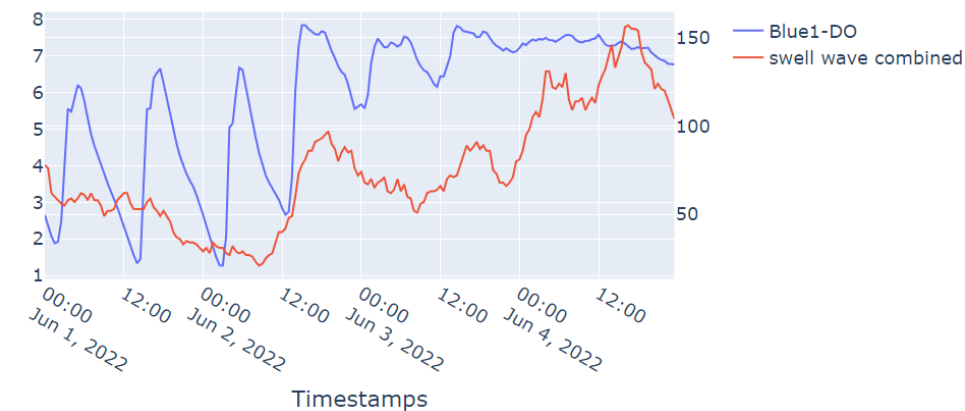
Case Study – Blue Accelerator

BELGIAN OFFSHORE TEST SITE

BLUE1



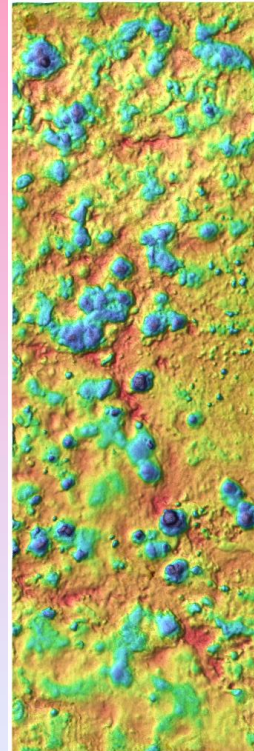
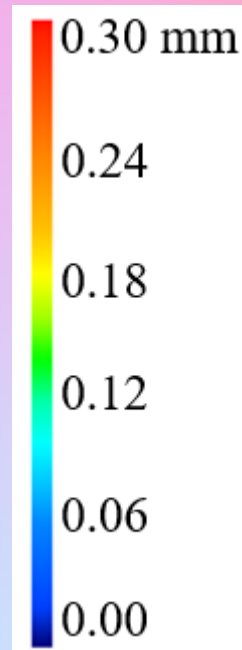
BLUE1



- Perfect correlation between DO and pH
- Follows tidal variations
- MP has a small opening at the bottom for J-tube

Data Gedreven beheersing van Lokale en Uniforme corrosie

COOCK+ Projectaanvraag

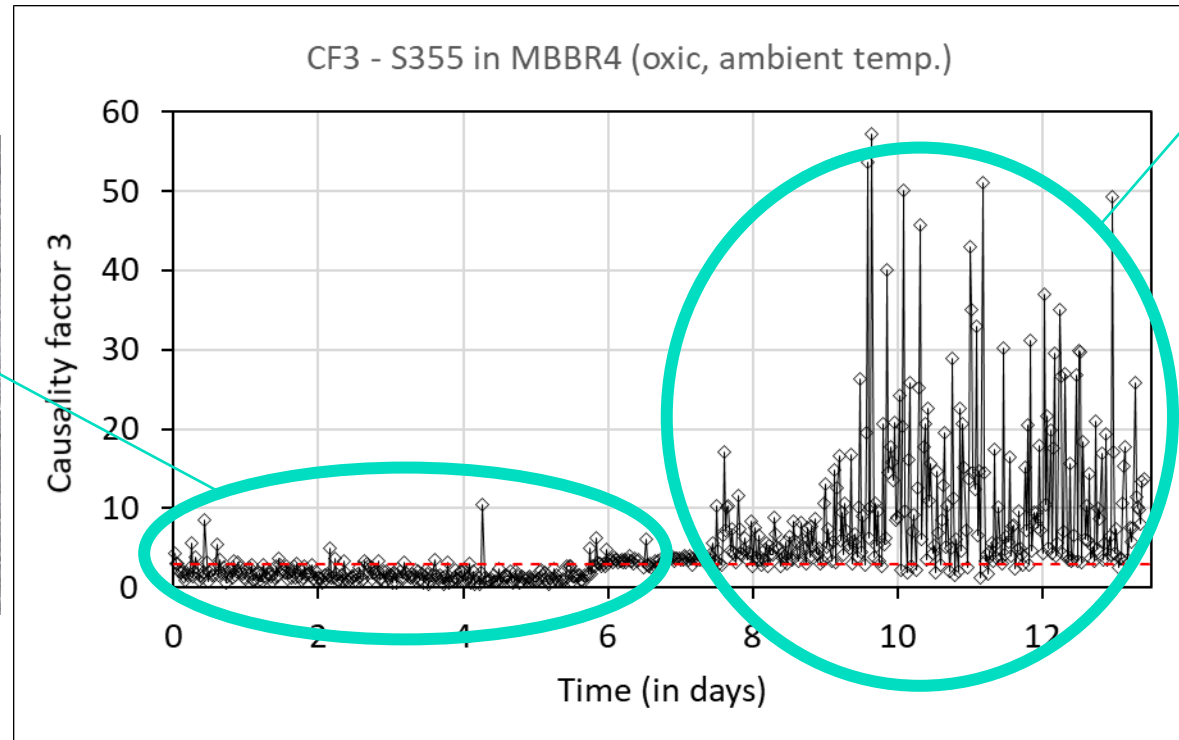
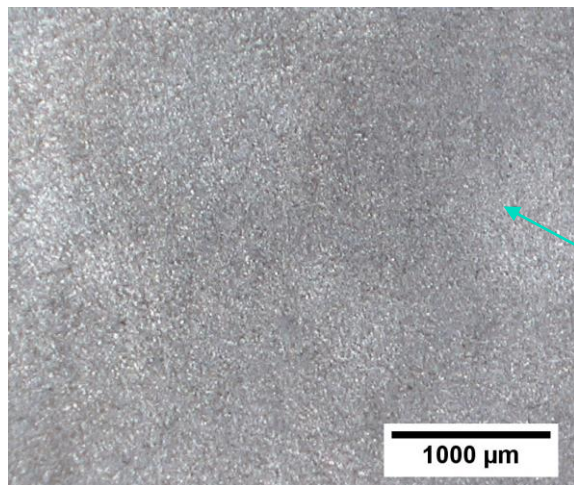


Startpunt & Technologie

FAST AND RELIABLE MEASUREMENT OF PITTING FOR MATERIAL CLASSIFICATION AND MONITORING

EFM: Elektrochemische Frequentie Modulatie

No Pitting



Pitting initiates



Focus van het project

Het ontwikkelen en aanreiken van technologie voor data gedreven beheersing van corrosie en corrosiebescherming met behulp van sensoren.

De finale doelstellingen zijn:

- ✓ *In de praktijk brengen van een methode voor het monitoren van lokale corrosie.*
- ✓ *Vereenvoudigen van de selectie en evaluatie van preventieve maatregelen* zoals corrosiebestendige materialen, coatings, kathodische bescherming, inhibitoren of via het bijsturen van procesparameters.
- ✓ *Het verlengen of beter inschatten van de levensduur van installaties mogelijk maken.*
- ✓ *Technologie aanreiken voor het reduceren van onderhoudskosten.*

Online Platform als 'Enabler' voor opname door bedrijven

Ontwikkeling van een online platform



Vertrekkende van bestaande website.

<https://corrosielabs.com/>



Toolbox met methoden voor meten en monitoren van corrosie.

Data Repository waar data publiek beschikbaar gemaakt wordt.

Gebruikers Tools voor bijv. materiaalselectie, levensduurbepaling, inspectieplanning.

InnovateCUI

A Joint Industry Project investigating Sensors and Coatings for improved management of Corrosion Under Insulation (CUI)



sirris

A new initiative for
the Chemical and
Refinery industry



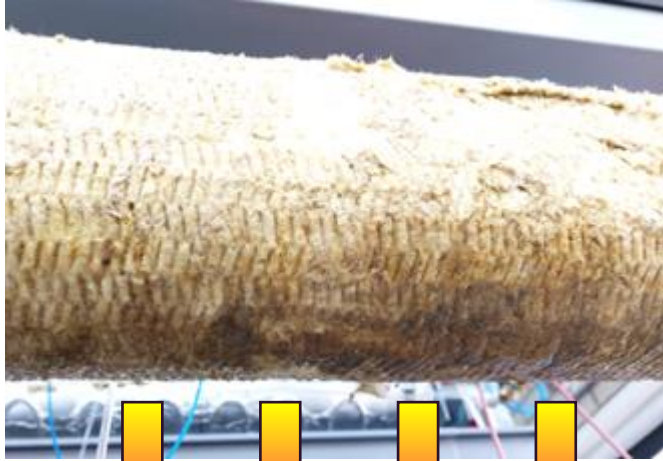
If water gets in



Insulated Piping, Tanks, Columns



Wet insulation leads to Corrosion and Energy Losses.



Sensors that detect moisture in insulation will revolutionise management of insulated piping and tanks.

We need to evaluate and understand the capabilities of these sensors!

More than 60m of test-piping @ harbour of Antwerp.





InnovateCUI

A **Joint Industry Project** investigating Sensors and Coatings for improved management of Corrosion Under Insulation (CUI) and Energy Losses.

- ✓ Reduce losses by building smarter processes
- ✓ Help companies innovate the way in which insulated piping and tanks are managed

Start: May 2023; Duration: 2 years

Are you triggered?



Jeroen Tacq, Sirris
jeroen.tacq@sirris.be
+32 493 31 06 44



© Sirris

sirris innovation
forward

 **Corrosion LABS**

Jeroen Tacq, Sirris
jeroen.tacq@sirris.be
+32 493 31 06 44