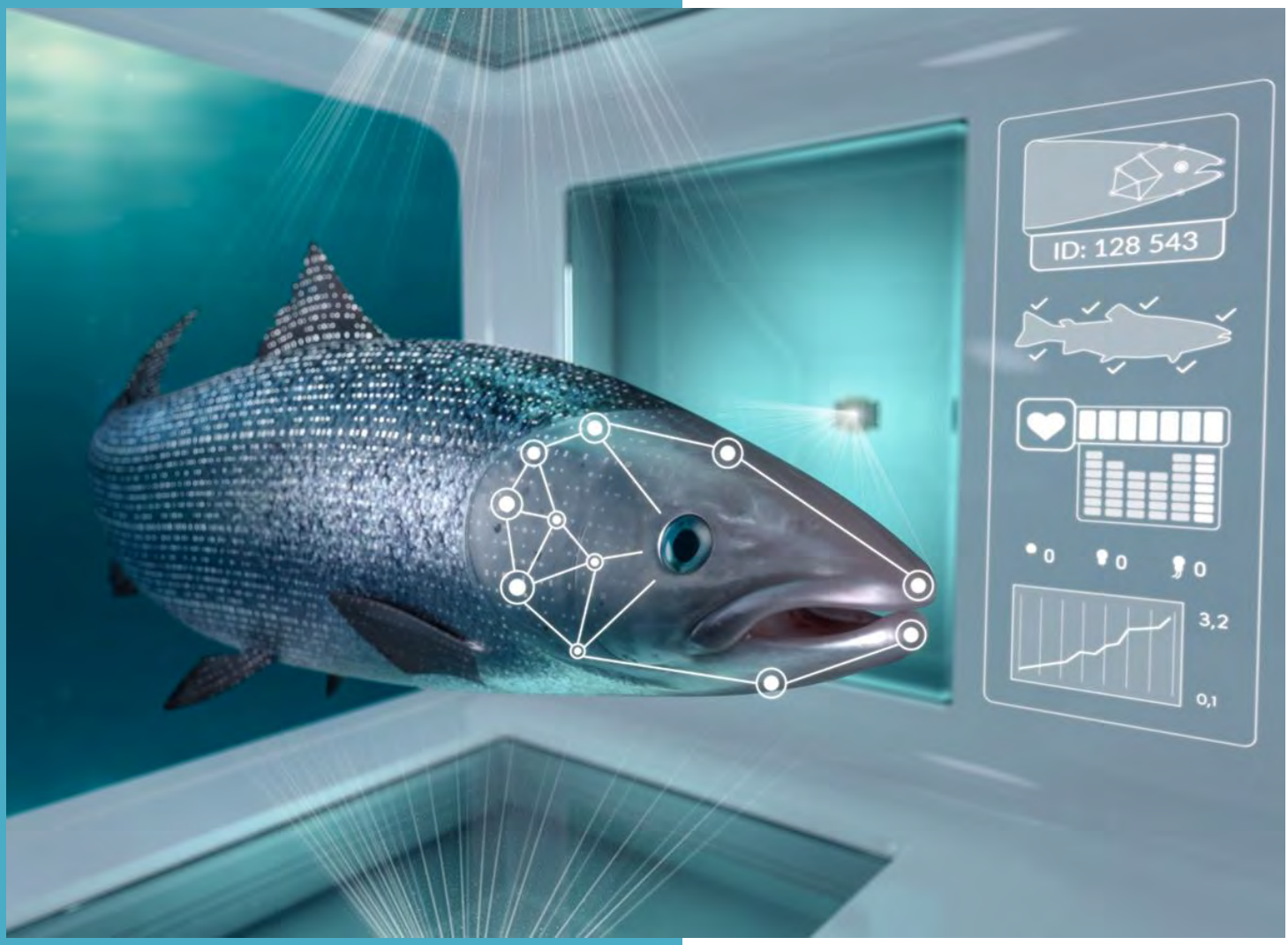
CERMAQ

iFarm: Testing of system components Phase 1 (Concept-tests sensor)



Cermaq Norway

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Background

"Målkriterium 2.2 Uttesting av systemkomponenter" describes that the project, if needed, shall conduct small scale system tests of central components as the sensor and sorting units.

Since full scale testing in a cage is challenging, the iFarm project decided to build up a fish tank with RAS technology, next to the offices of BioSort, where the sensor and sorting technology is developed. From August 2020 to January 2021, 11 fish was kept successfully in this tank and were at the end of this period taken out of the tank as the project did not have further test needs with fish at that point.

Before starting tests, Mattilsynet was contacted and confirmed that for this number of fish:

"Å holde laks i akvarium er ikke søknadspliktig etter forsøksdyrforskriften dersom vannkvaliteten, temperaturen, fórtilgang og øvrige forhold, inkl. bruk av lys og kamerautstyr i karene, gir god helse og trivsel. Alle nye metoder som benyttes i dyrehold skal være dokumentert mht. konsekvenser for velferden (dyrevelferdsloven § 8 og akvakulturdriftforskriften § 20). Det gjelder også kamerautstyr og lys. Dersom det er fare for at utprøvingen av kamera og lys kan medføre noen belastning på laks (f. eks. skader eller stress) vil forsøkene være søknadspliktige etter forsøksdyrforskriften."

Tests has been carried out in accordance with the information from Mattilsynet such that the tests did not cause any stress for the fish. This, of cause, limits the type of tests that can be conducted, but the fish tank as proven very useful in regards to basic testing of illumination and cameras.

Photo shows iFarm fish tank with RAS technology

This is not an attempt to make a full test report since this is not the type of small scale tests the iFarm project did at Institute of Marine Research in 2017 and 2018. However, in order to show the development stages of the sensor, the project has decided to make this overview (primarily through

photos) of the different tests that has been conducted leading up to the sensor unit that is being tested out at Martnesvika (Phase 1 of the project).

There has also been carid out concept tests for the sorting system in the fish tank, but since the first sorter unit will be installed in a cage in phase 2 (Langøyhovden), the fish tank tests for sorter units will be reported together with the reporting of the cage tests for the sorter.

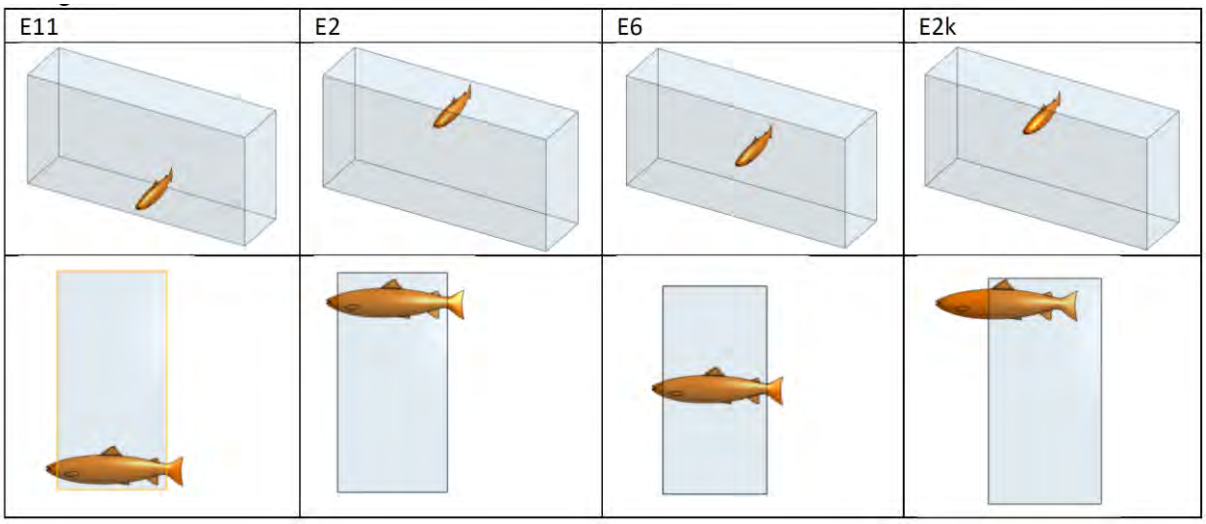
Four sensor tests have been carried out:

- Studio test – a test in air (dry test)
- AquaScope – first test in water allowing use of dry standard illumination units through windows, with plastic fish
- Tech tester – first unit with custom under water illumination units, with plastic fish
- Martnesvika sensor - in fish tank, with real salmon

The target of the tests has been to test out geometries, illumination alternatives and camera configurations. One primary focus has been on creating the best possible diffuse illumination to minimize reflections, both through placement of illumination and design of illumination units. In addition, camera placement and settings, lenses and general image quality has been tested.

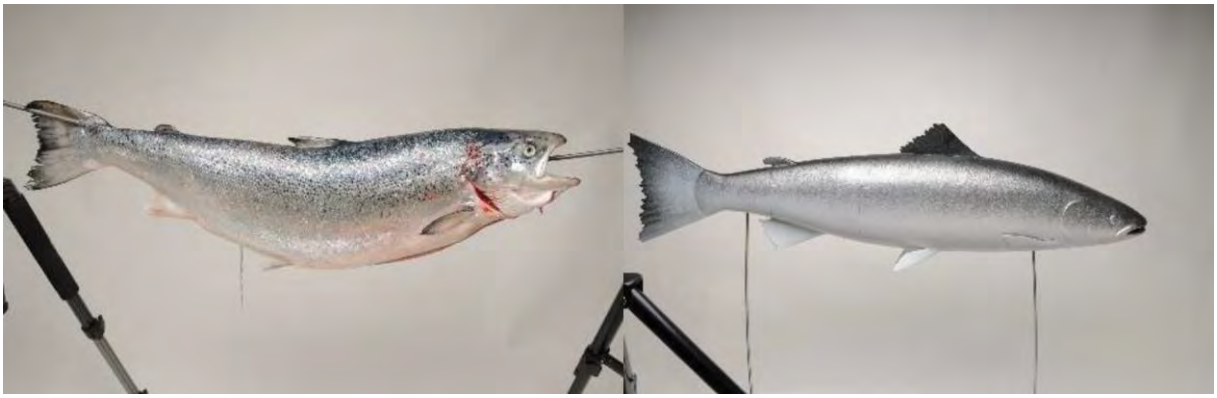
One primary direction the development work took us, was to place most of the illumination above the fish, as the back of the fish is dark and has less reflective features. This has proven to be a good approach.

In all tests, a primary challenge is to get sufficient image quality for different positions of the fish in the sensor opening. That means testing how to best compensate for the varying illumination of the different positions of the fish in the sensor opening. The below shows typical test positions of the fish in the sensor.



Studio test - dry

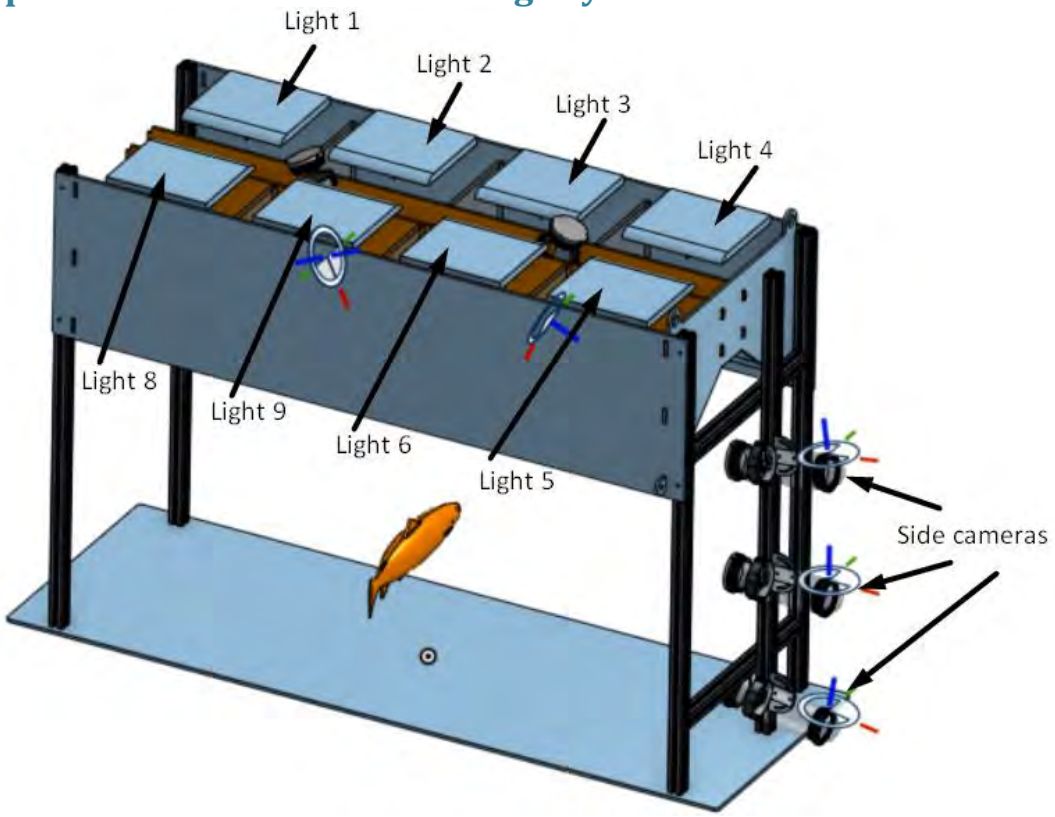
Studio illumination



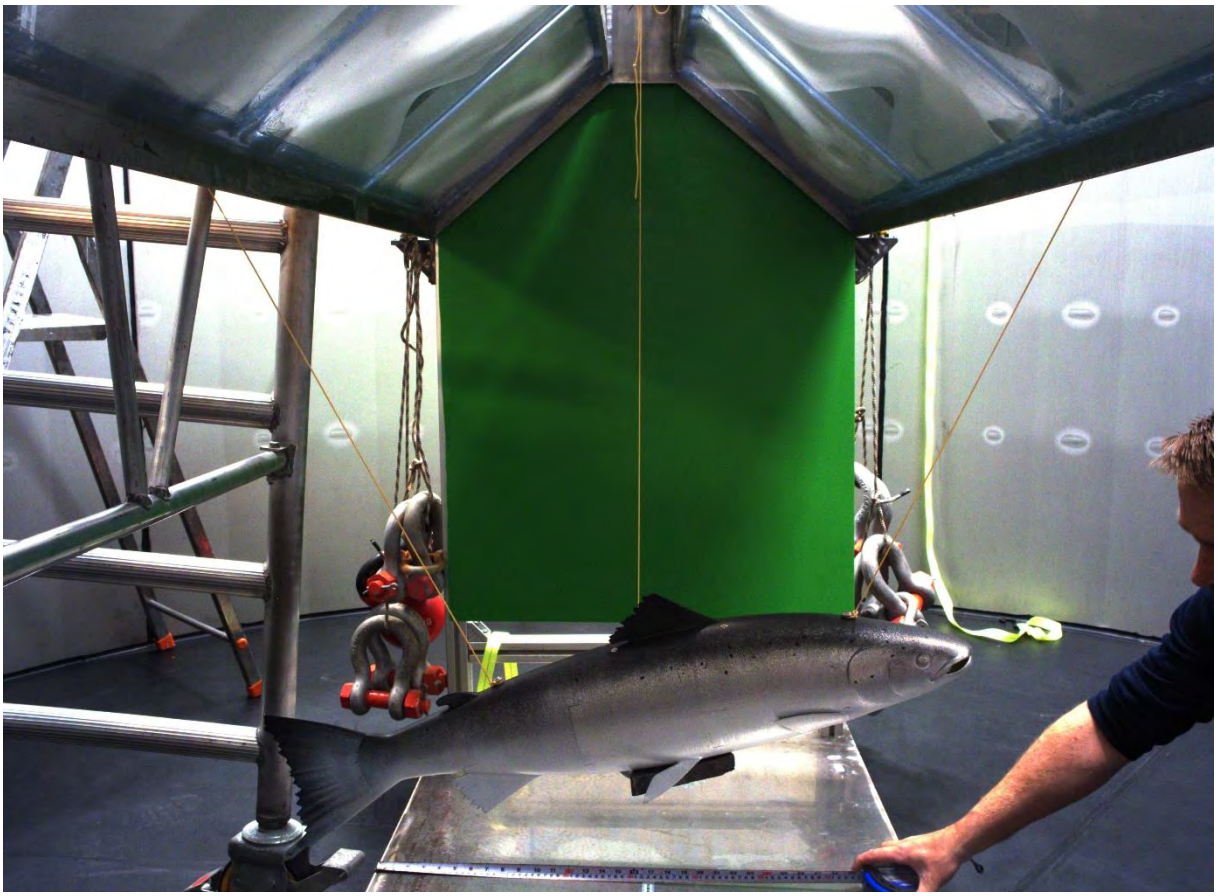
Comparing reflection of real fish with specially designed reflective plastic fish

The full report from the studio test can be found as an attachment. It reflects the type of test also done in the fish tank, but in a less structured and more iterative matter.

AquaScope – first test in water allowing dry standard illumination



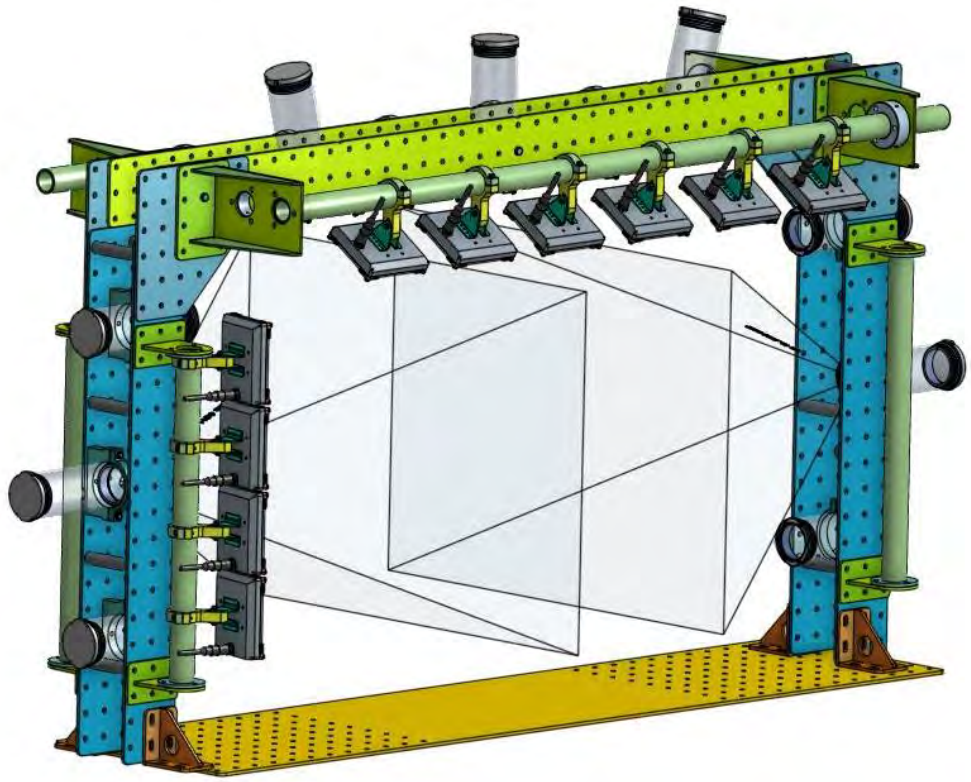
Drawing of AquaScope test, showing placement of cameras and illumination



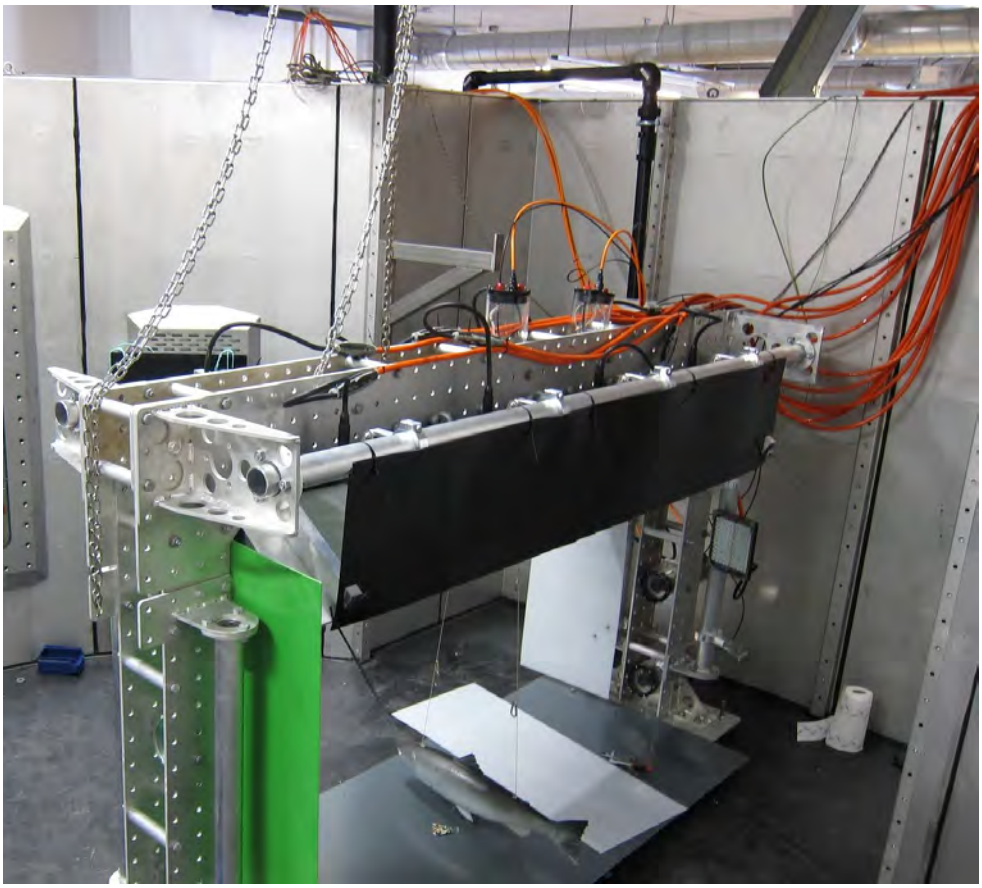
Arranging AquaScope test in fish tank

Example of image taken by one of the sensor cameras in the AquaScope test

Tech tester – first unit with custom designed under water illumination

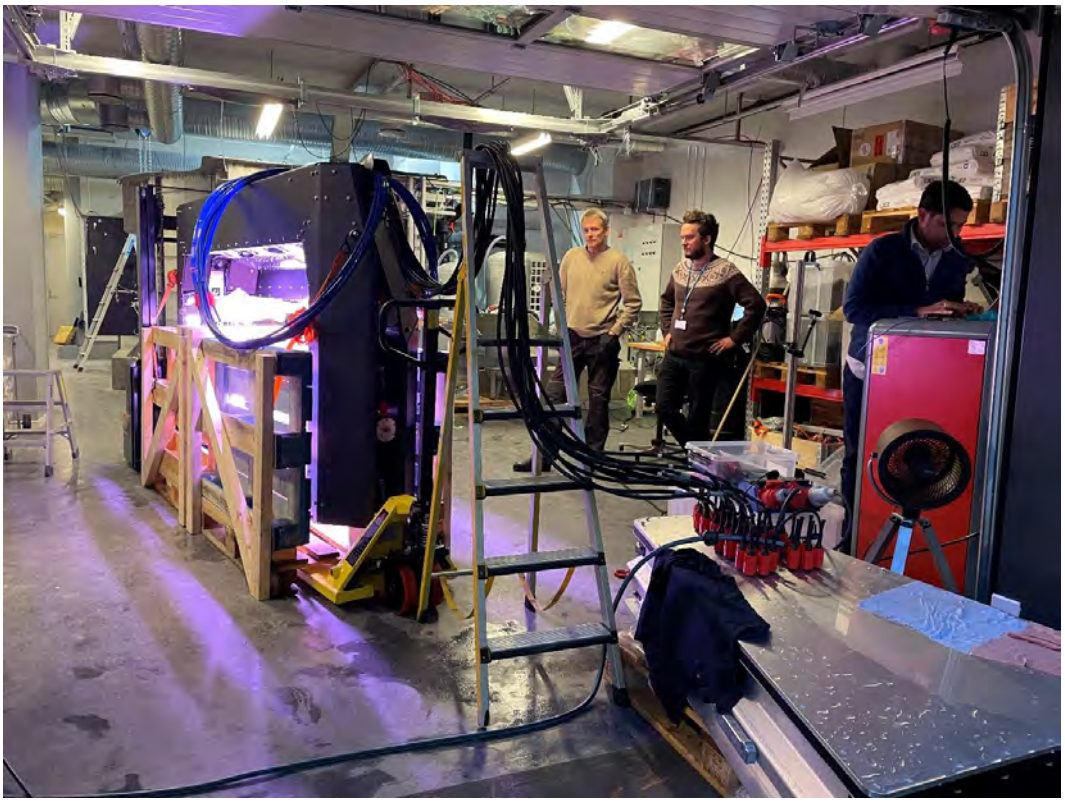


Drawing of tech tester with custom designed under water illumination units



Tech tester placed in fish tank

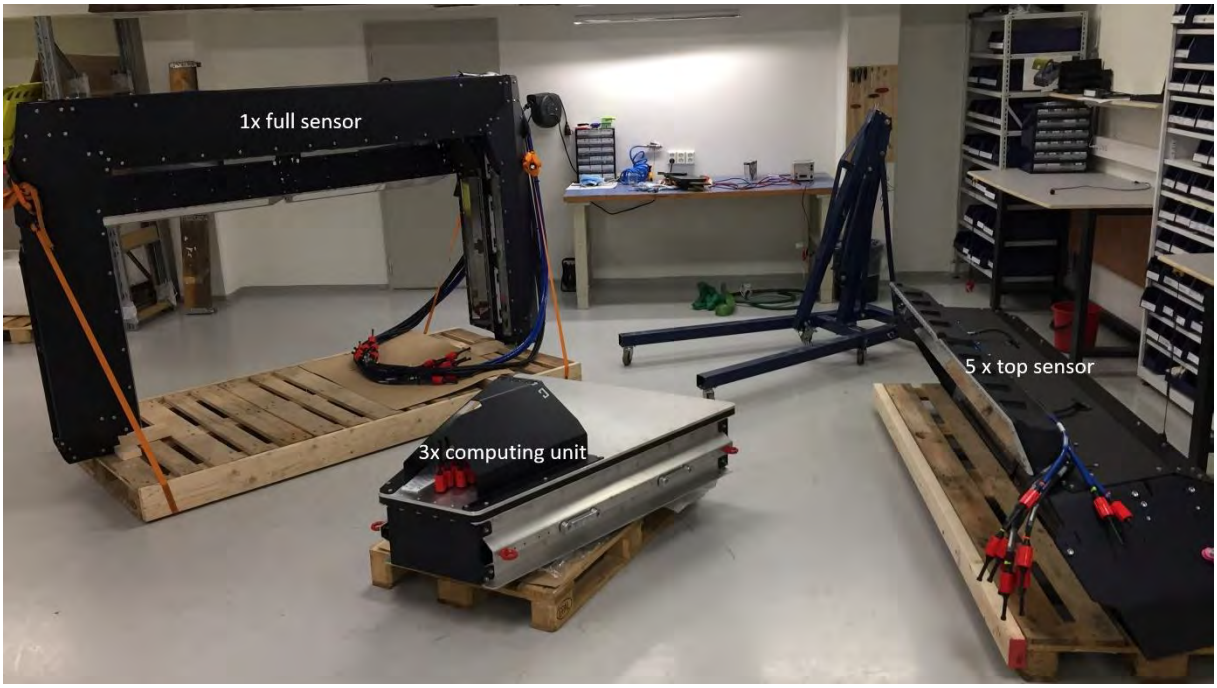
Martnesvika sensor - in fish tank, with real salmon



Sensor being tested dry in BioSort lab. The box in the right bottom corner of the photo is the computing unit which needs to be water cooled.

Sensor being lifted into the fish tank

Image taken by one of the sensor unit cameras in the fish tank



The sensor arrangements shipment to be assembled with the Dome and the Saddle housing consisted of 1 full sensor, 5 top sensors, and 3 computing units