SUBSEE

Fast and accurate prototype of 3D geometry measurement device for the arctic environment

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Project idea

The project focuses on Arctic Sea Monitoring system, based on a picosecond class pulsed laser and single photon counting (SPC) detector to provide fast, high resolution 3D data capture. The technology platform will be utilised in two ways.

Firstly, a protype will be realised, based on the Laser Time of Flight distance measurement method.

Secondly, the potential of the system for the monitoring of the water environment quality will be demonstrated. The technology platform used for 3D measurement can be applied to acquire a time resolved fluorescence data from an object of interest for e.g. material identification / discrimination or biological studies of phytoplankton chlorophyll.

Compared to state of the art 3D method - the sonar, the spatial resolution of the 3D data provided by the optical system is remarkably higher and the measurement is practically immune to the gradients in temperature or salinity of the water. However, the optical methods are inherently more sensitive for backscatter in turbid water.

The main target of the project is to prove the potential of the SPC technology providing increased immunity for the turbidity and faster, massively parallel signal acquisition.

Applications are for instance, offshore engineering, offshore oil-, gas- and mineral-production, bathymetry, seafloor excavation, laying of cables and tubes, fishery and biomass studies as well as studies of underwater structures in harbours and investigations of wrecks (Fig. 1).

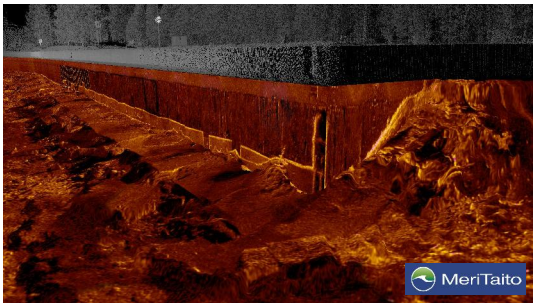

Fig 1. Hybrid 3D image of underwater structures in Saimaa canal, Meritaito Oy.

User need

- Minimize risk, cost and negative environmental impact of marine activities, simultaneously maintaining production efficiency
- Fast and high resolution 3D imaging for controlling Remotely Operated Underwater Vehicles (ROV)

Approach

- Accurate 3D geometry and water quality measurement using picosecond laser and SPC.

Benefits

- Early detection of structure breakdown, maintenance need, environmental risks & preventive actions
- Savings in working time

Users

- Instrument manufacturers
- Marine survey service and infrastructure management companies
- Ports, oil and gas companies

Technology

The collected travel times of the photons are represented as histograms (Fig. 2). The backscatter rising from water turbidity is seen as a linear trend in semilog-Y histogram, whereas the echoes from the solid objects are seen as sharp peaks.

Due to shorter response time of the SPC detector, better separation for closely located objects is achieved in depth (z) direction.

An array of SPC detectors can be integrated to a silicon chip with the data processing logic, resulting in drastically decreased cost and size.

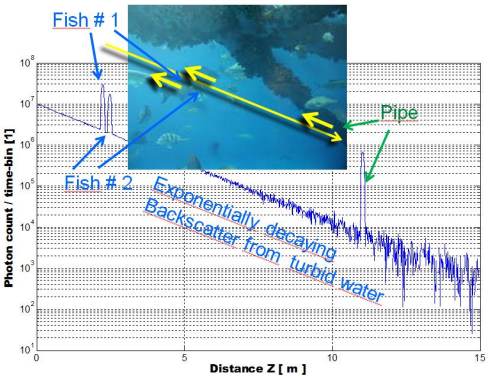

Fig 2. A histogram of detected photons in turbid water.

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