



QUANTIC

The UK Quantum Technology Hub
in Quantum Enhanced Imaging

Single-photon underwater 3D imager

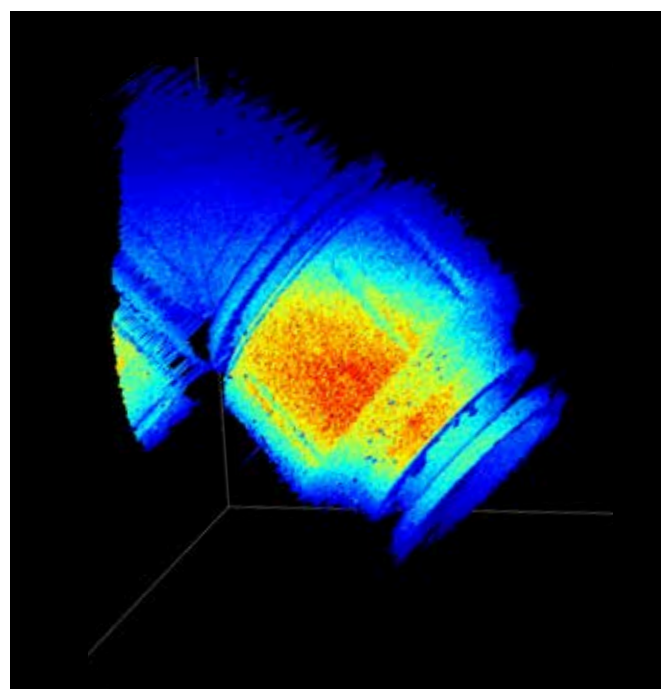
Obtaining high resolution images of objects underwater using a conventional camera can be difficult due to the high levels of absorption and scatter in naturally occurring water. Our single-photon camera captures three-dimensional images of objects that are up to 9 attenuation lengths from our transceiver system.

Whilst underwater acoustic approaches can detect objects at very long distances, it can be difficult to obtain detail from a sonar image. Underwater optical imaging can give comparatively high spatial resolution but will be very restricted in maximum target distance due to the attenuating properties of water, which depend on a number of factors such as temperature, salinity and the nature of the dissolved organic matter and particulates in the water.

Researchers at Heriot-Watt have pioneered an active 3D imaging system specifically for use in highly scattering underwater environments based on the time-of-flight approach and the time-correlated single-photon counting (TCSPC) technique used in, for example, fluorescence spectroscopy. This approach relies on the measurement of the time difference between a repetitive pulsed laser signal and a photon event recorded by a sensitive single-photon detector. The high sensitivity and excellent time resolution means that it is possible to obtain three-dimensional data using a scanning transceiver. This data can form much higher resolution images at longer distances than currently achievable by existing optical systems.

Underwater optical imaging is a field of increasing interest. QuantIC is interested in further technical developments, leading to new applications of this technology which address market needs and deliver competitive advantage in a number of application areas, including:

- Security and Defence
- Marine Science
- Offshore Engineering
- Environmental monitoring



“Depth image of a 15 mm diameter pipe fitting (in cloudy water) located at 8 attenuation lengths from the time-of-flight transceiver”

QuantIC has a £4M Partnership Resource Fund to support industry led projects. Work with us to develop new technology and facilitate its translation into commercial products.

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