



# QUANTIC

The UK Quantum Technology Hub  
in Quantum Enhanced Imaging

## Ultra-Thin Endoscopes For 3D Imaging

**Using structured-light, even a single optical fibre can act as an endoscope. The addition of single-photon detection and timing allows 3D imaging in confined or delicate spaces. How can entire images be passed through a single optical fibre? How can photon detection and timing make best use of the backscattered light? Can we make new types of ultra-thin optical endoscopes for 3D imaging in difficult situations?**

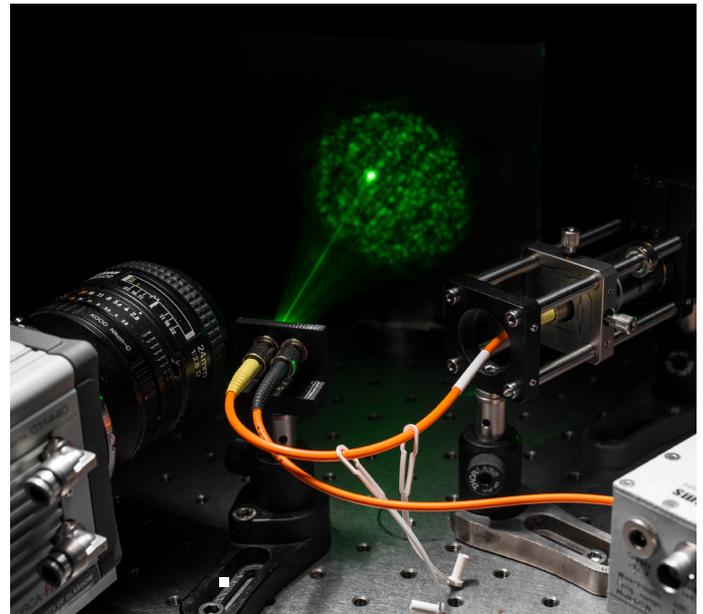
Endoscopes are used in both medical and industrial applications. Conventional endoscopes use bundles of many thousands of optical fibres to allow imaging in confined spaces. At QuantIC we are advancing this technology using structured light and only a single fibre to enable minimally invasive /covert 3D imaging.

Our approach uses precise measurement of the transmitted light to learn the optical distortion that the single fibre introduces to a transmitted image. The opposite distortion can then be introduced using an optical modulator, resulting in a scanning laser spot at the fibre output. Detecting the single-photons in this backscattered light gives both the brightness and range of every point of the object and hence every pixel in the 3D image.

We have shown laboratory-based systems using single optical fibres 50 microns in diameter and between 50mm and 5m in length, giving 50x50 pixelated images with depth resolutions of a few mm. Measuring the distortion introduced by the fibre can take several minutes, but once learnt can be applied for many hours. We apply these corrections using the same hardware as found in a digital video projector. One thrust of our work is to reduce the measurement time for learning these corrections so that we can simultaneously correct and image.

We are looking for new industry partners interested in developing systems and possible modifications based on this technology to address market needs in the following areas:

- Covert imaging
- Industrial inspection
- Medical technologies



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.

For more information, please contact:

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