CASE STUDY

QT Assemble

Overcome the technological barrier of assembly and integration to secure markets in quantum technologies

Quantum technologies will transform society in markets including sensing, timing, navigation, communications and computing. However the practical, real-world implementation of quantum 2.0 systems is critically reliant on numerous, complex sub-systems and components.

The aim of the Innovate UK funded QT Assemble project (#50414) was to address key technological barriers in sub-component development, develop the UK component supply chain and hence access the developing market in quantum technologies.

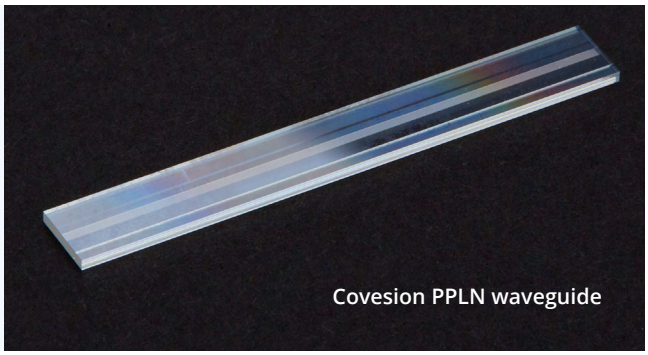
The project brought together a broad consortium of UK industrial and academic partners including Fraunhofer CAP (lead), AegiQ, Caledonian Photonics, Covesion, Alter Technology, Skylark Lasers, Infleqtion, Photon Force, Gooch & Housego, Power Photonic, RedWave Labs, University of Strathclyde, University of Southampton, and Inex.

Application

Two key quantum themes were identified together with the associated market applications and required sub-systems.

	End applications:	Required sub-systems:
ATOM BASED QUANTUM SENSING	• Inertial sensors • Gravitometers • Magnetometers • Cold atom clocks	• Lasers • Beam delivery • Atom traps • Control electronics
PHOTONICS BASED QUANTUM INFORMATION	• Quantum key distribution • Quantum communication • Quantum computing • Photon based sensing	• Photon sources • Laser and beam delivery • Photon detector arrays • Control electronics

Covesion's role within the project was to develop our periodically poled lithium niobate (PPLN) waveguide technology for integration into narrow linewidth, low SWaP laser sources for atom / ion cooling, trapping and interrogation.



Covesion PPLN waveguide

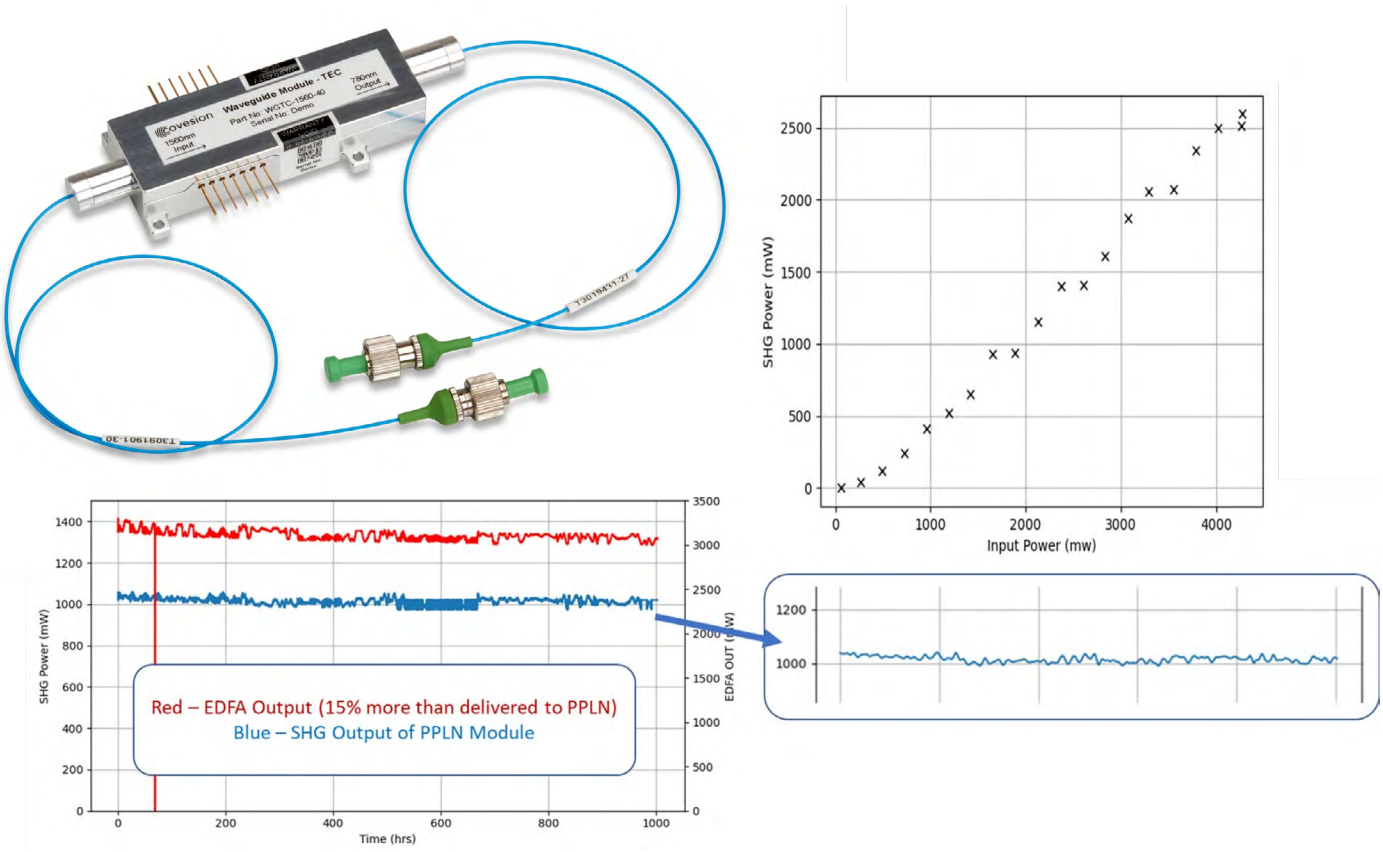
Key objectives & project success

Covesion's primary objectives were to;

- demonstrate >2W of 780nm output in Covesion PPLN waveguides using telecoms pump lasers
- develop a1560-780nm fiber-coupled PPLN waveguide package, targeting up to 2W 780nm output
- test package reliability and lifetime (>1000 hours)

We successfully achieved all of these targets with the development of a new PPLN waveguide package delivering;

- **improved chassis design**
- **improved launch stability**
- **improved thermal control and stability**



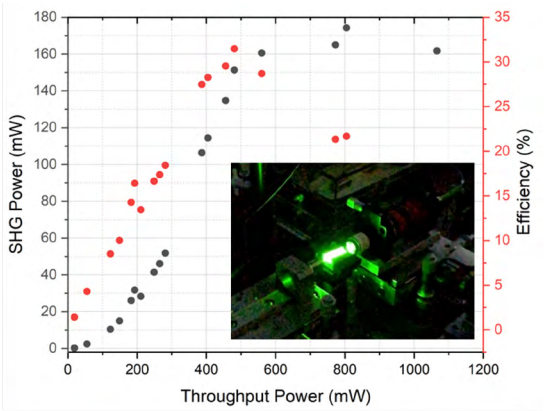
780nm fiber-coupled waveguide package and test data

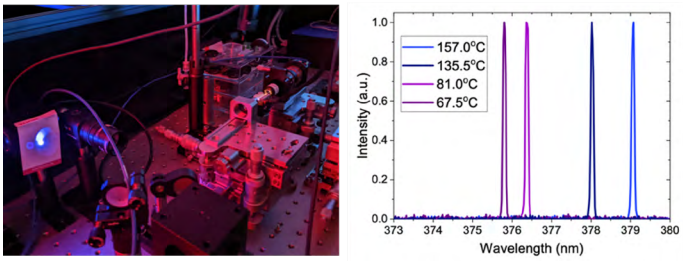
CASE STUDY

In addition to achieving our primary objectives we have also extended our design and manufacturing capabilities for PPLN waveguides towards atom- and ion-specific blue-green wavelengths. Working with the University of Southampton we have successfully demonstrated PPLN waveguides for UV, blue and green generation in the 376-532nm range with waveguide chip level performance demonstrated of;

- 150mW output in the green
- 100µW output in the blue (targeting Ca ion trap wavelengths)

University of Southampton





Visible waveguide development

A key project objective was to foster collaboration between the project partners in order to develop more complex technology demonstrators. Collaboration between Infleqtion and Covesion resulted in the µMOT demonstrator system. This atomic physics experiment in a single 3U 19" rack chassis demonstrates that a source of cold atoms can be generated in a small form factor, in a highly stable system, that can operate continuously for many weeks. A key component within the system is the Covesion fiber-coupled waveguide package which provides a robust, reliable, and easily integrated component for generating the 780nm light needed for Rb atom cooling,

The system was exhibited at the Quantum Technologies Showcase in November 2023.

µMOT demonstrator system

Infleqtion + Covesion

Engineering on your wavelength

www.covesion.com

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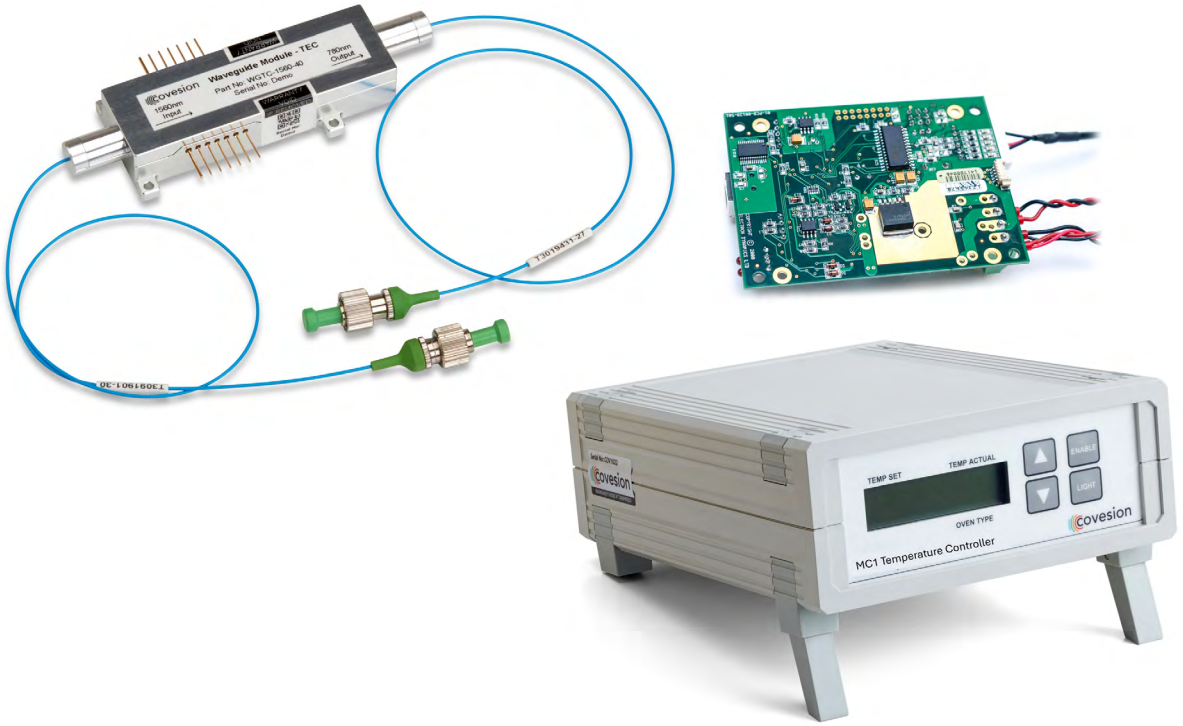
Exploitation

The 1560-780nm fiber coupled waveguide component package developed under QT Assemble has been released as a commercial product and is available for purchase. This waveguide component is capable of delivering an SHG output of up to 2W at 780nm. Together with the waveguide component Covesion offers compatible temperature controllers in benchtop and OEM PCB form in order to provide a full customer specific solution.

PPLN waveguides for green/blue generation at 532nm and 422/423nm (for Sr/Ca ion applications) are planned for release by Covesion later this year. These waveguides will be available as fiber-coupled packages with customisation options available on request.

Overall the QT Assemble project has enabled Covesion to develop our range of PPLN waveguide solutions, develop relationships with industrial and academic partners, and demonstrate the integration of our wavelength conversion technology into complex quantum system demonstrators.



2W 780nm fiber coupled waveguide and compatible temperature controllers

www.covesion.com

EMAIL: sales@covesion.com

TEL: +44 (0)1794 521638

About us

Covesion are world leaders in the research, development and manufacture of MgO:PPLN crystals and waveguides for highly efficient, non-linear frequency conversion. With over 20 years' experience in the manufacture of PPLN technologies for the photonics industry, experts at Covesion are well equipped to provide insight and guidance on the design of systems for generating visible and IR light.

Covesion Ltd, Unit F3, Adanac North,
Adanac Drive, Southampton SO16 0BT, UK

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