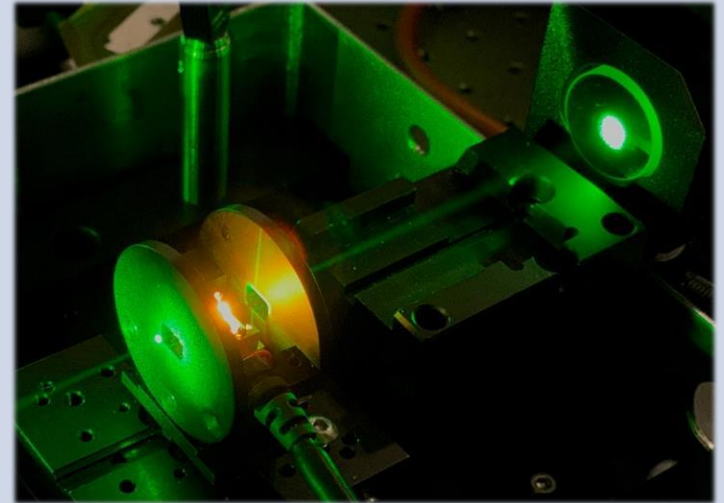


**Singular Light** is a diamond-based, universal multi-mode to single-mode laser converter, i.e., it is an efficient, simple device that relies on Raman laser conversion for generating a single longitudinal mode (SLM) laser output.

#### Characteristics:

- Quasi-chromatic output with small linewidth;
- Low phase noise;
- Simple, monolithic integration (diamond);
- Ultra-stable SLM generation;
- High-efficiency (> 40% average power conversion efficiency);
- Long coherence length;
- Tunable output (via change in angle or temperature);
- Resilient to mode competition.



Conventional techniques for producing SLM lasers are subject to several issues, requiring complex active controls and convoluted optical arrangements.

The development of the ***Singular Light*** technology stemmed out of the necessity of achieving a simple, efficient and agile multi-mode to single mode converter.

This technology could serve any field where a single longitudinal mode or single-frequency laser is necessary:

- Optical metrology and interferometry
- Light detection and ranging (LIDAR)
- High-resolution spectroscopy
- Optical data storage
- Optical communications
- On-chip diamond light sources
- Quantum computing and memory
- Holography

## Strengths

- Efficient and reliable operation
- Easily adjustable output frequency
- Simple optical configuration
- Access to new wavelengths (frequency-shifted output)
- Robust to external disturbances

## Opportunities

- Certain fields require SLM or single-frequency lasers, but have been held back due to constraints of conventional techniques.  
The monolithic approach presented herein could allow for a more seamless integration, including in photonic integrated circuits (PICs).

## Weaknesses

- Being an emerging technology, it is still in a research phase and thus requires further development in order to be integrated into a product.

## Threats

- The technology acts as a converter for a pump laser, which makes it quite versatile. However, in certain cases, it may be possible to use available laser sources that already provide SLM for specific frequencies (e.g. fiber lasers).

The *Singular Light* technology was co-developed by CERN and Macquarie University, Australia. It was further developed through a CERN KT Fund project.

The IP is owned by CERN, and a European patent application has been filed on the technology in 2020. An international PCT patent application was filed in 2021.

For further information, the contact point is:

Filipe Ramos

[cf.ramos@cern.ch](mailto:cf.ramos@cern.ch)

European Organization for Nuclear Research  
CERN

Esplanade des Particules 1,  
Geneva, Switzerland

<https://kt.cern/technologies/singular-light-integrated-single-mode-laser-converter>