

High-rejection BIPD filter

Brillouin & Raman spectroscopy



Spectral analysis of the inelastically **Brillouin** and **Raman** scattered light provides unique information about the material physical properties in a **non-contact**, **label-free** and **3D** fashion at high spatiotemporal resolution. A fundamental obstacle in conducting spectral investigations is given by the collection of strong laser background light arising from elastic scattering and specular reflections overwhelming the weak inelastic scattered light.

- **Ultra-high rejection of Rayleigh light**
- **Simultaneous Brillouin & Raman THz**
- **Tunable for all visible wavelengths**
- **High stability for long acquisitions**

Specto's proprietary Birefringent-Induced Phase Delay (BIPD) filter represents a simple and effective solution to suppress extremely high levels of laser background light arising from Rayleigh scattering and specular reflections. Being common-path and ultra-compact, the BIPD module offers easy and flexible integration in standard optical setups, providing access to the **ultra-low ($0.1-100 \text{ cm}^{-1}$) frequency region**. The superior rejection capability of the BIPD filter enables the investigation of poorly characterized **turbid materials**, providing users the opportunity to analyze **mechanical**, **structural** and **chemical properties** in one shot.

Operating wavelengths	400 nm - 900 nm
Transmission efficiency	< 2 dB*
Free Spectral Range	0.5 – 200 cm^{-1} **
Extinction ratio	> 45 dB
Spectral bandwidth	< 50 MHz (<0.01 cm^{-1})
Dimension	10 x 8 x 17 cm^3
Weight	3 Kg
Optical I/O	free space / fiber
Working temperature	15°C to 35°C

*at peak transmission in free space

** Specto Photonics supports customization and offer guidance by a team of experts to satisfy specific customers needs



User-friendly
software



Full libraries for easy
automation & control



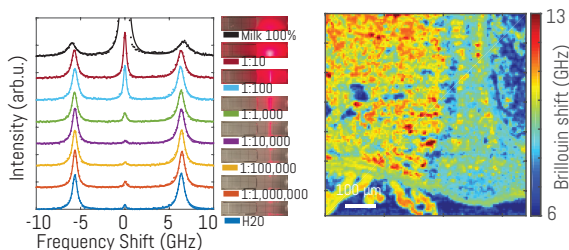
Temperature
stabilized



Direct USB-C
connection

Brillouin spectroscopy

Brillouin spectroscopy is an all-optical elastography method used to explore the mechanical properties of materials by probing their acoustic phonons [1]. It provides precise information about **elastic moduli**, **viscosity**, and **phase transitions** at microscopic scales. The non-destructive and label-free features make this method ideal to investigate viscoelastic properties in the volume of living biological systems.

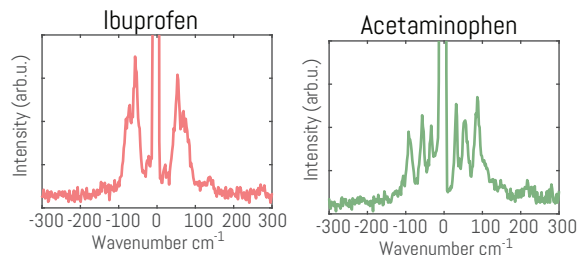


BIPD-assisted Brillouin acquisition of milk and bone tissues

Specto's BIPD filter unleashes the full potential of Brillouin spectroscopy, providing the opportunity to investigate **turbid media** that are still poorly characterized [2]. The ultra-high extinction enables 3D mechanical imaging using single-stage spectrometers.

Raman THz spectroscopy

Raman THz spectroscopy provides detailed insights into the **molecular structure** and material **dynamics**. By analyzing the vibrational modes in the terahertz range, this technique enables the investigation of low-frequency phonon modes and intermolecular interactions. It is particularly valuable in pharmaceuticals and material science, where understanding molecular interactions and polymorphism is a crucial requirement.

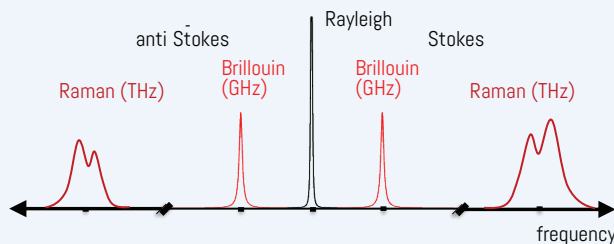


BIPD-assisted Raman THz spectroscopy

Specto's BIPD filter extends the capability of standard Raman spectrometers with minimal effort and across a broad range of wavelengths, providing the opportunity to acquire Raman THz spectra in the low frequency region.

Brillouin-Raman co-registration in one shot?

Our proprietary BIPD filter not only extends the capability of individual spectrometers, but it also enables the co-registration of Brillouin and Raman THz spectra, providing the opportunity to collect fundamental data about mechanical, structural and chemical properties of materials in a single shot!



REFERENCES

- [1] R. Prevedel et al., Brillouin microscopy: an emerging field for mechanobiology, **Nature Methods** 16, 969–977 (2019)
- [2] G. Antonacci et al., Birefringence-induced phase delay enables Brillouin mechanical imaging in turbid media, **Nature Communications** 15, 5202 (2024)

About Specto Photonics

Specto is ushering in a new era of biomedical research with groundbreaking technology. Our mission is to provide solutions to democratize ultra-low frequency spectroscopy, giving access to fundamental physical properties of materials in 3D.

Specto S.r.l.
Via Giulio e Corrado Venini 18
20127, Milano, Italy
info@spectophotonics.com
www.spectophotonics.com