

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 ($0.1\text{-}100\text{ cm}^{-1}$) 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	> 50 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



Temperature stabilized

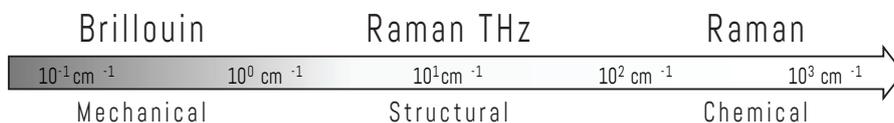


Full libraries for easy automation & control



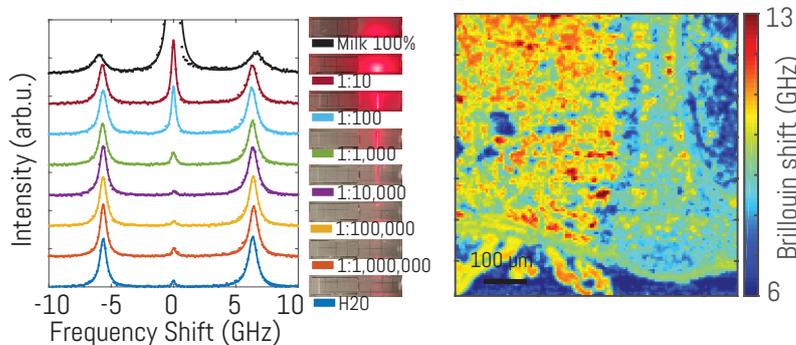
Direct USB-C connection

Applications



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.

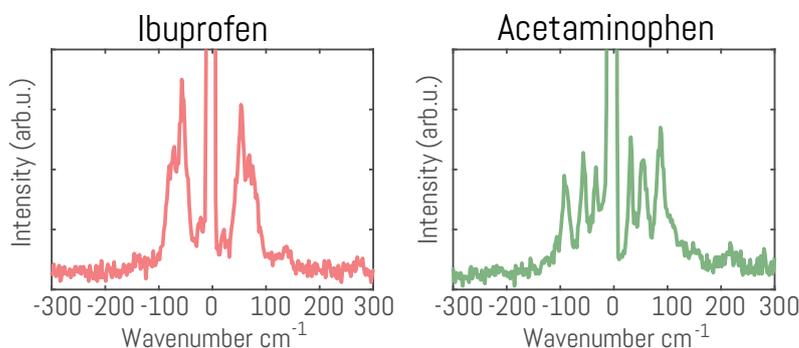


BIPD-assisted Brillouin acquisition of milk and bone tissues

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.

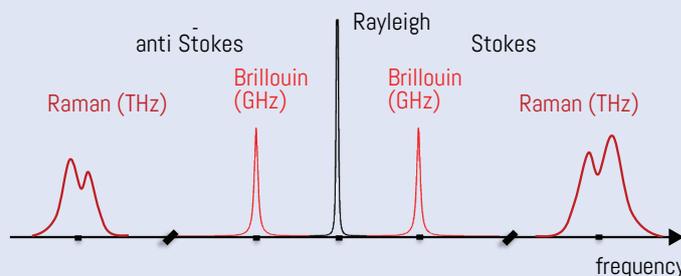


BIPD-assisted Raman THz spectroscopy

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)

