UNIVERSITY OF LATVIA

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UNIVERSITY OF LATVIA
INSTITUTE OF ATOMIC PHYSICS AND SPECTROSCOPY

Optical frequency comb generated inside silica microsphere for WDM Data Transmission System

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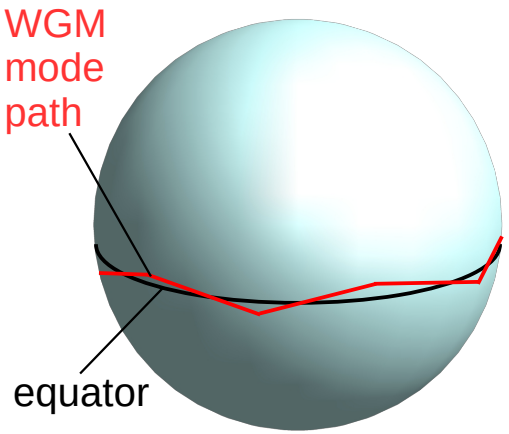
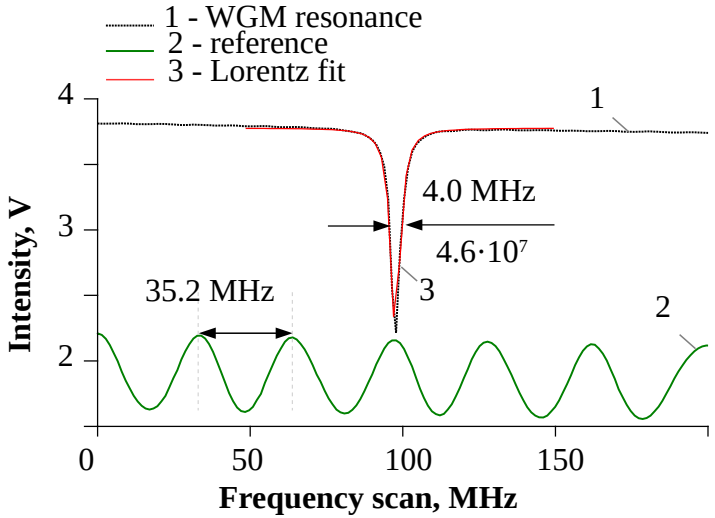
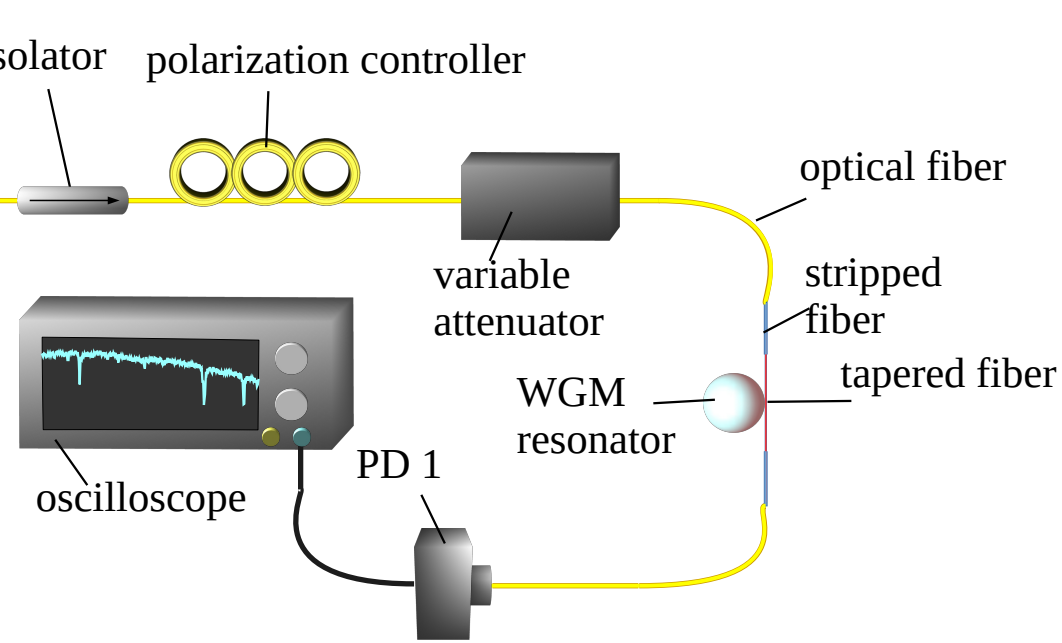
Whispering Gallery Mode Resonators



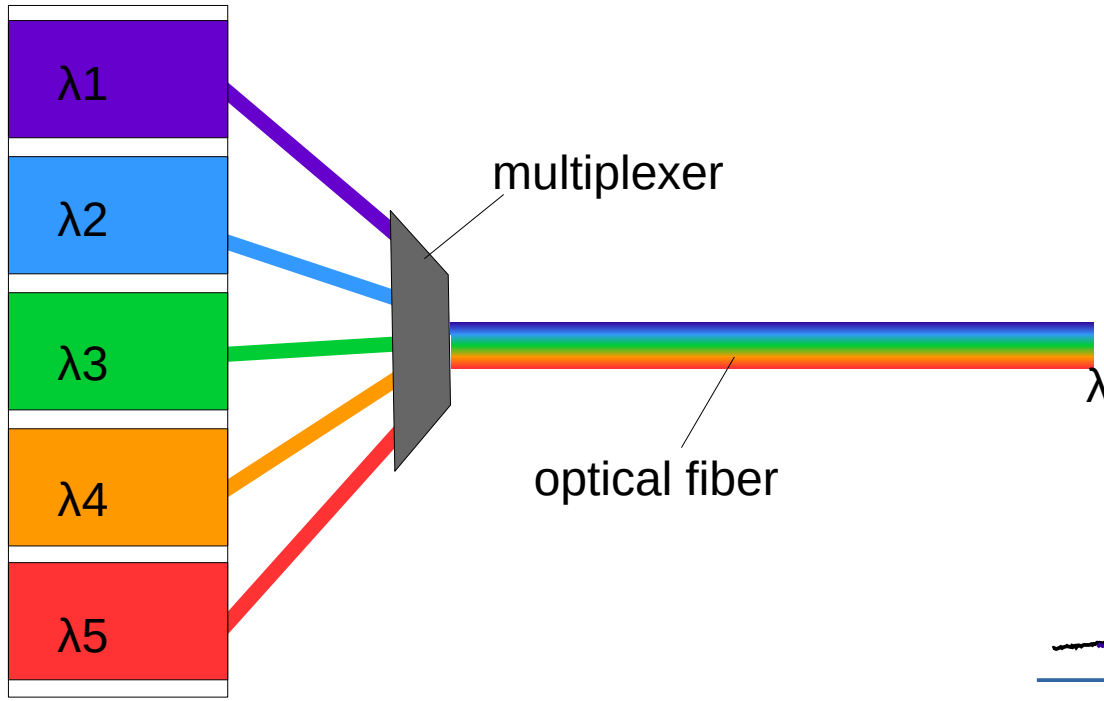




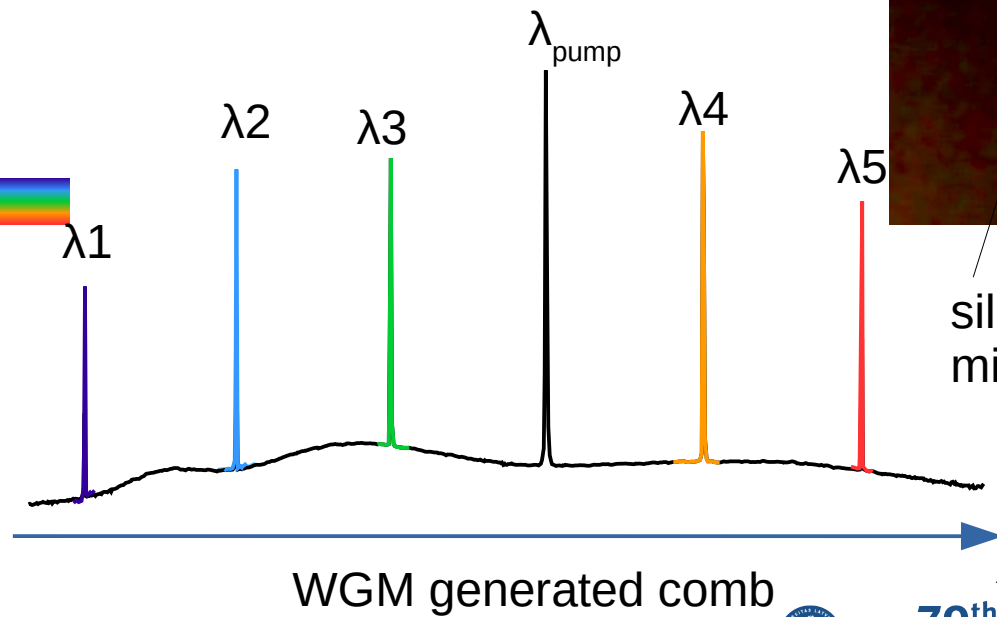
The resonators were characterized by measurement of the Q factor.

Wavelength Division Multiplexing

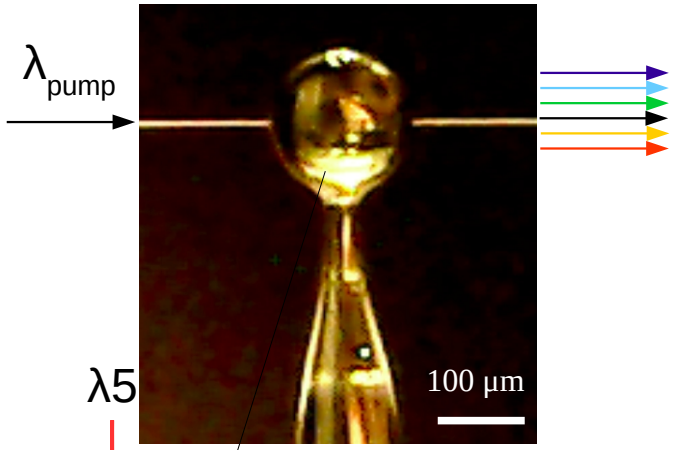
Replace laser array with frequency comb generated inside WGM resonator.



5 laser array

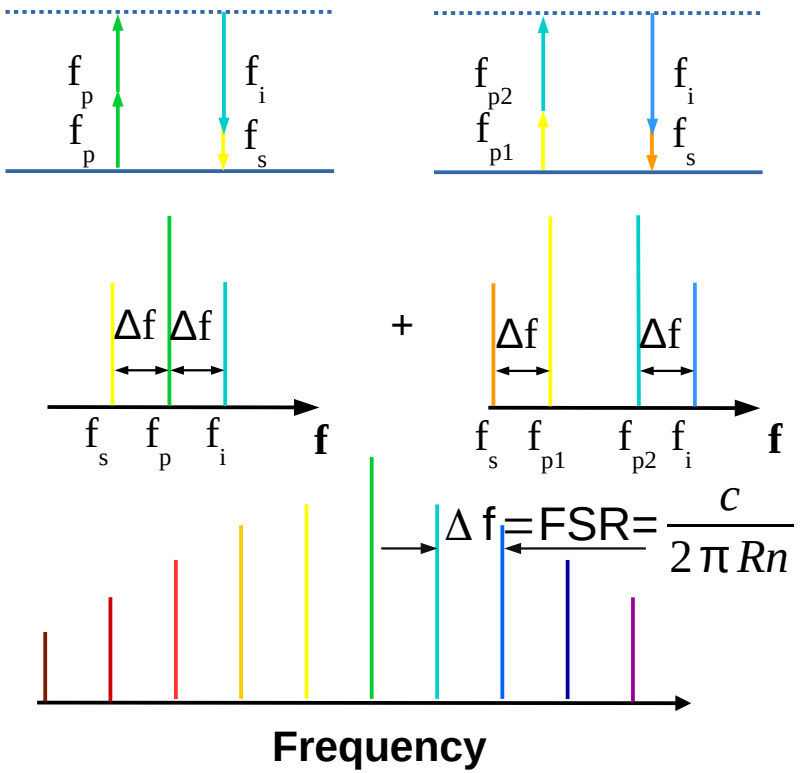


WGM generated comb

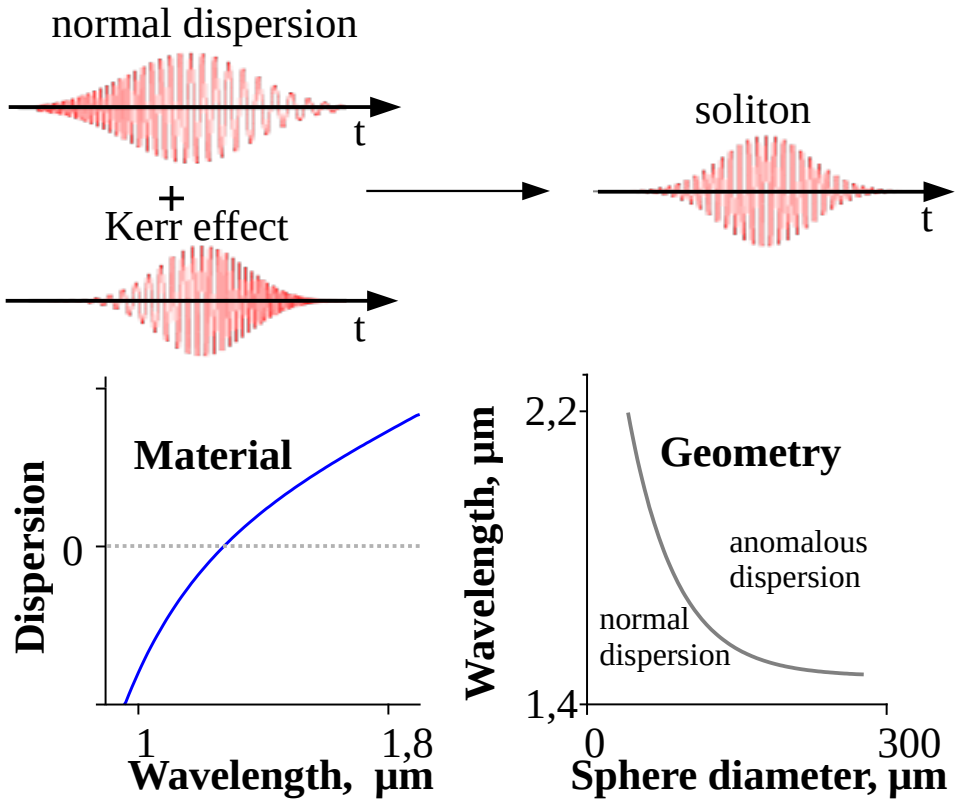


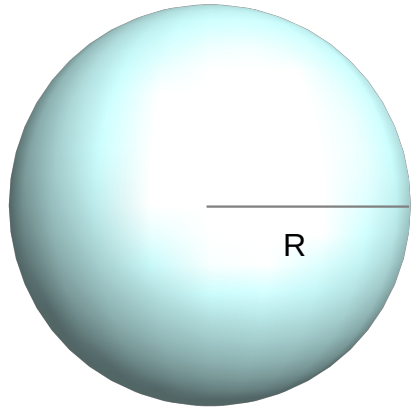
Generating the Comb

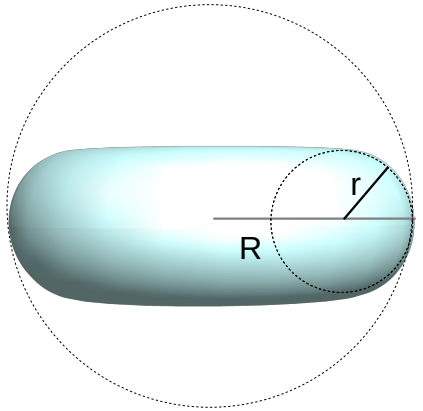
FWM VS losses.



Dispersion VS Kerr effect.

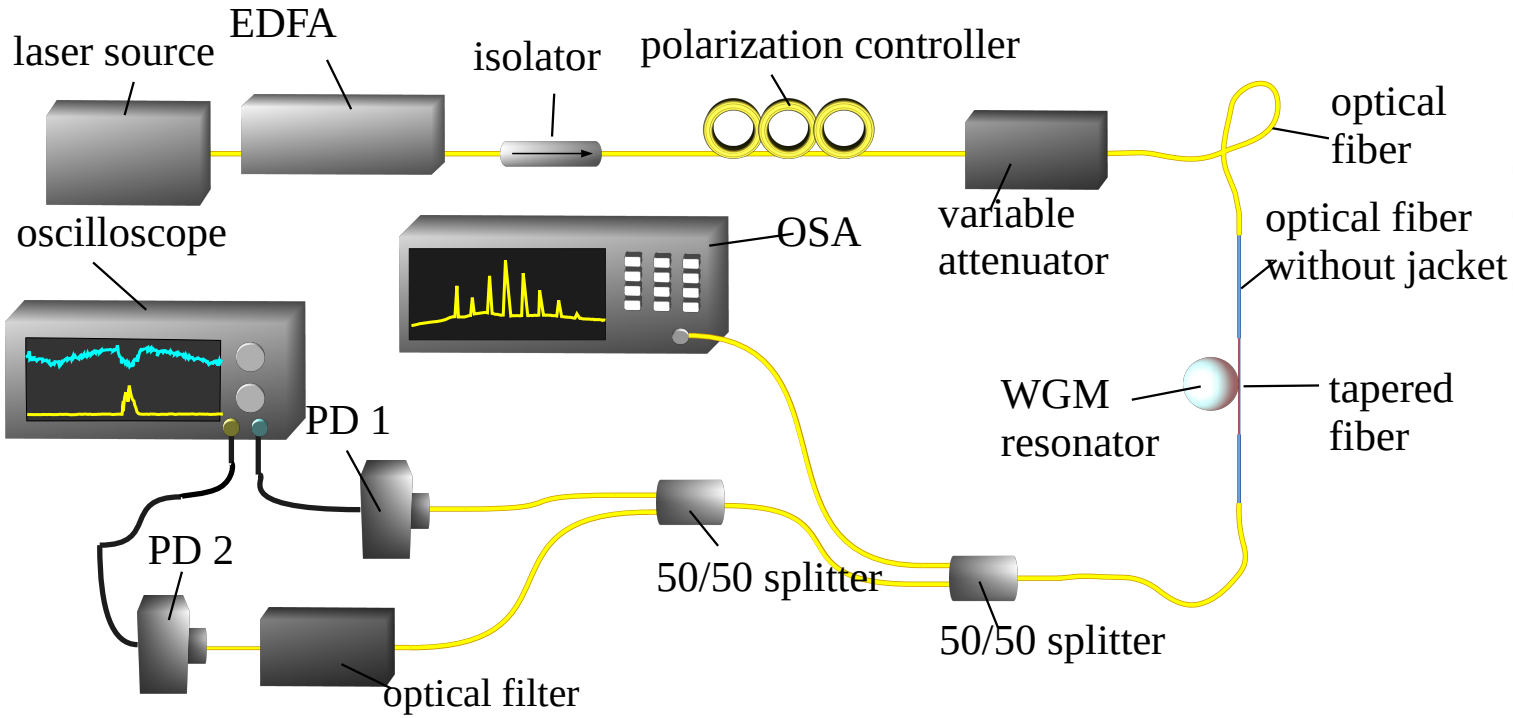


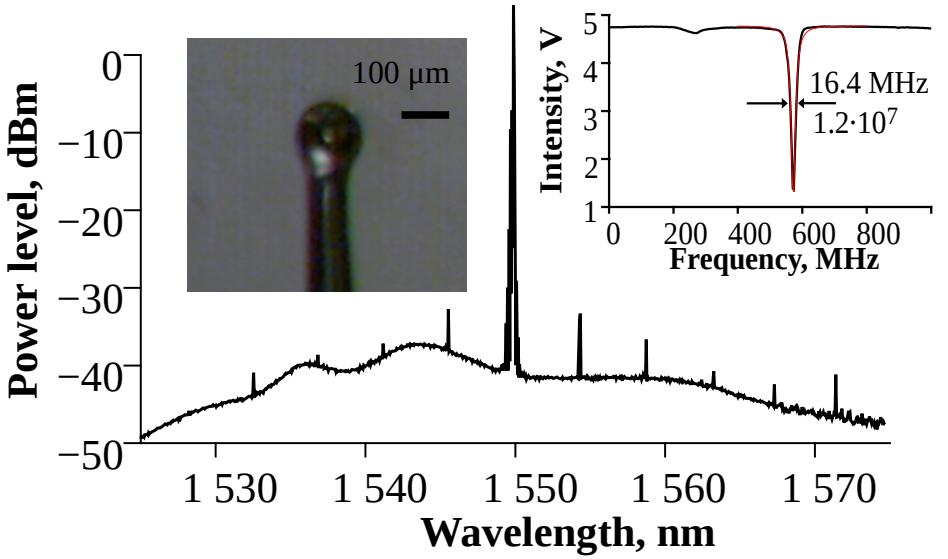


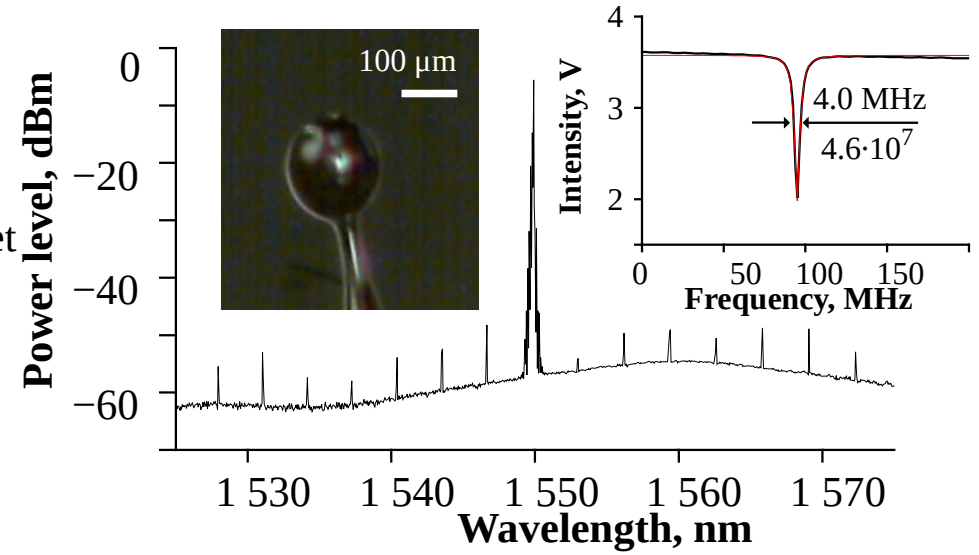


Generating the Comb

A tunable 1550 nm laser was amplified and coupled inside the silica microsphere resonator.

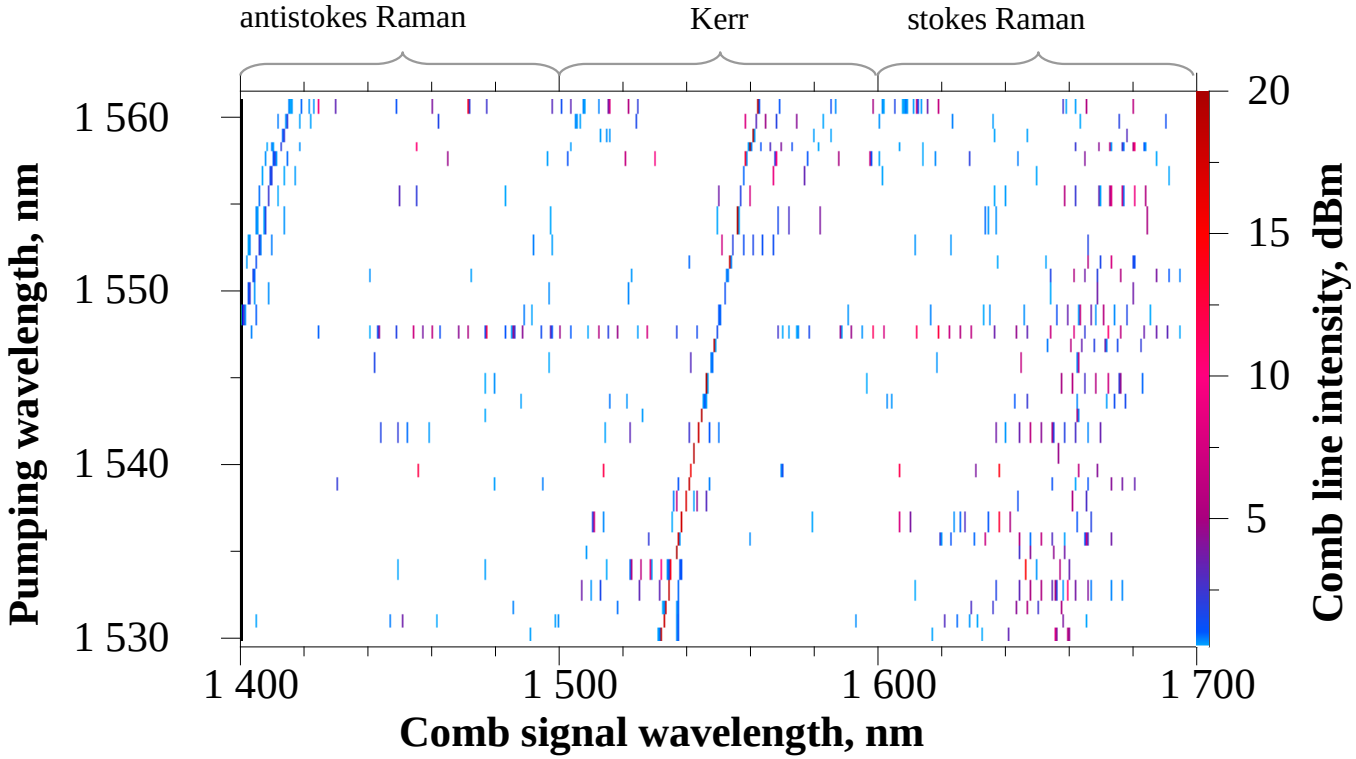


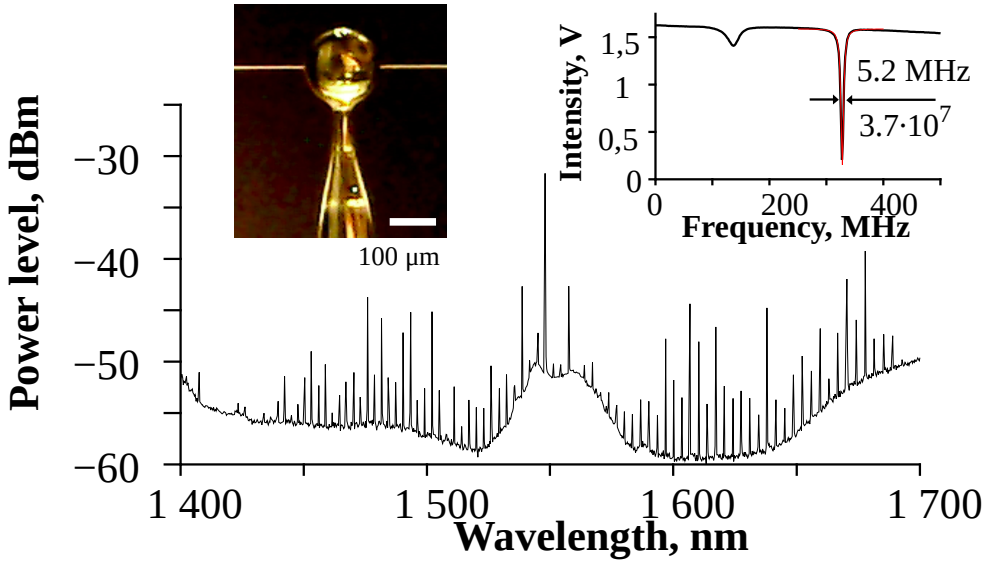


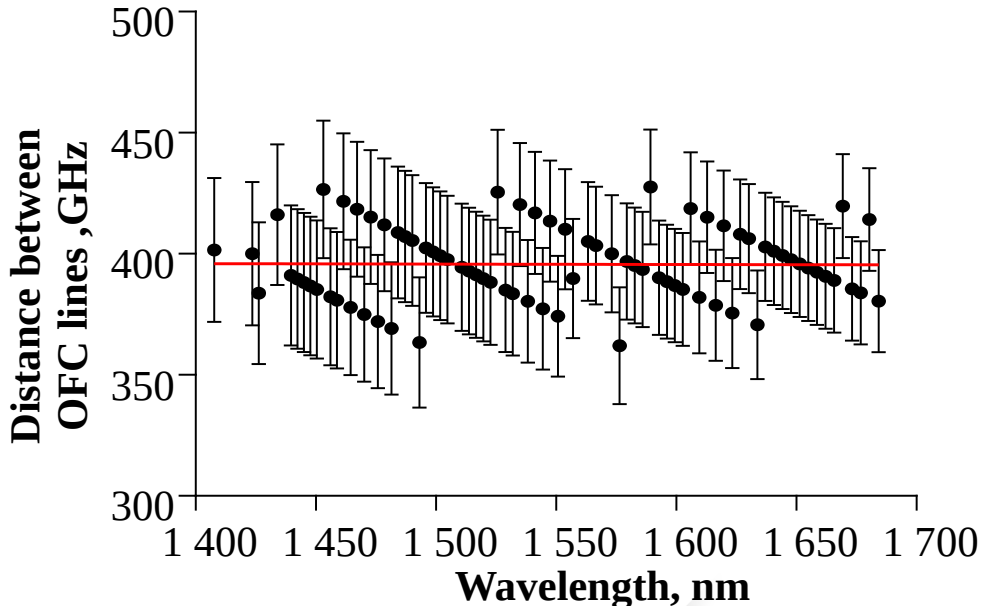


Tuneing Pumping Laser

32 different C-Band channels were pumped inside the WGM microsphere.





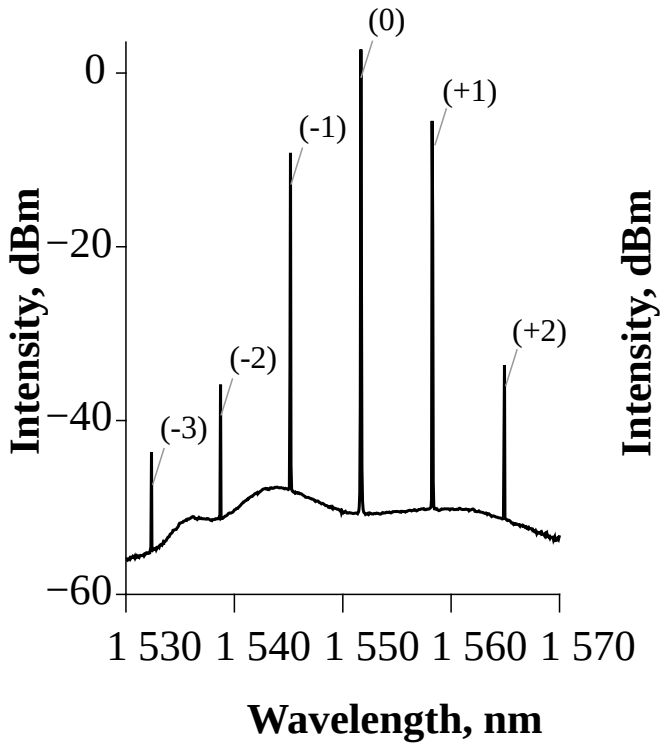


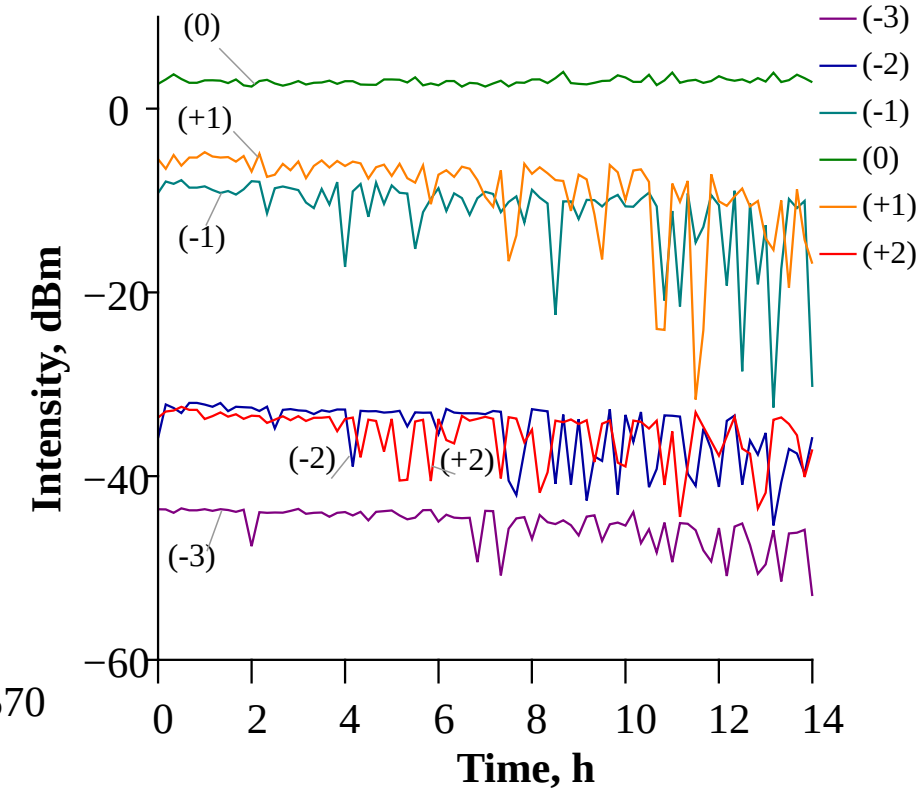
Temperature control important for long term stability.

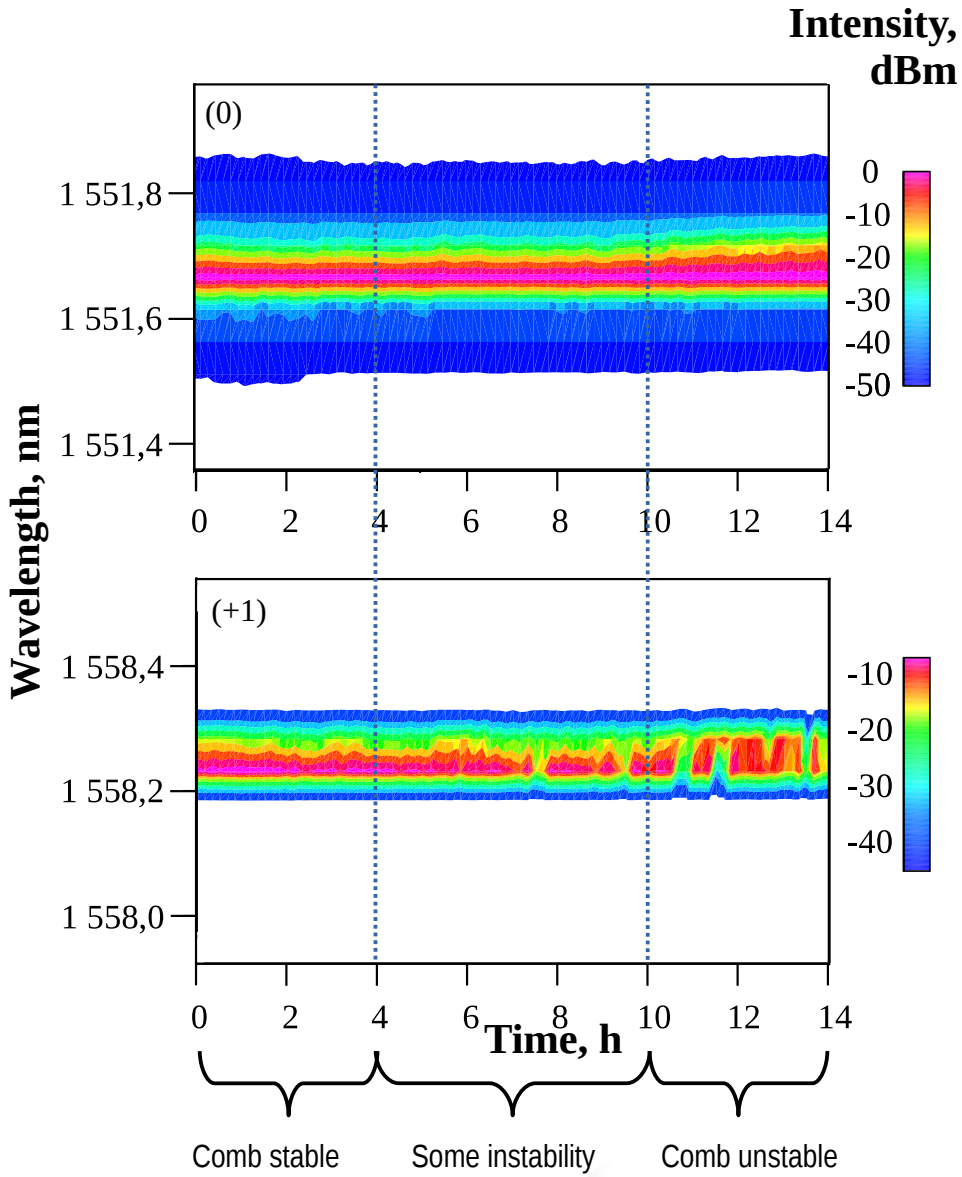
- Resonance excitation wavelength – temperature may shift resonance position.
- Coupling conditions – temperature may change the resonance and taper positioning.
- Excitation light polarization – temperature may change optical fiber length.
- Eliminating the causes of instability will improve both the stability and the suitability of the system for WGM data transmission.

Comb Stability - 800 GHz Comb

Comb line spacing 2 FSR

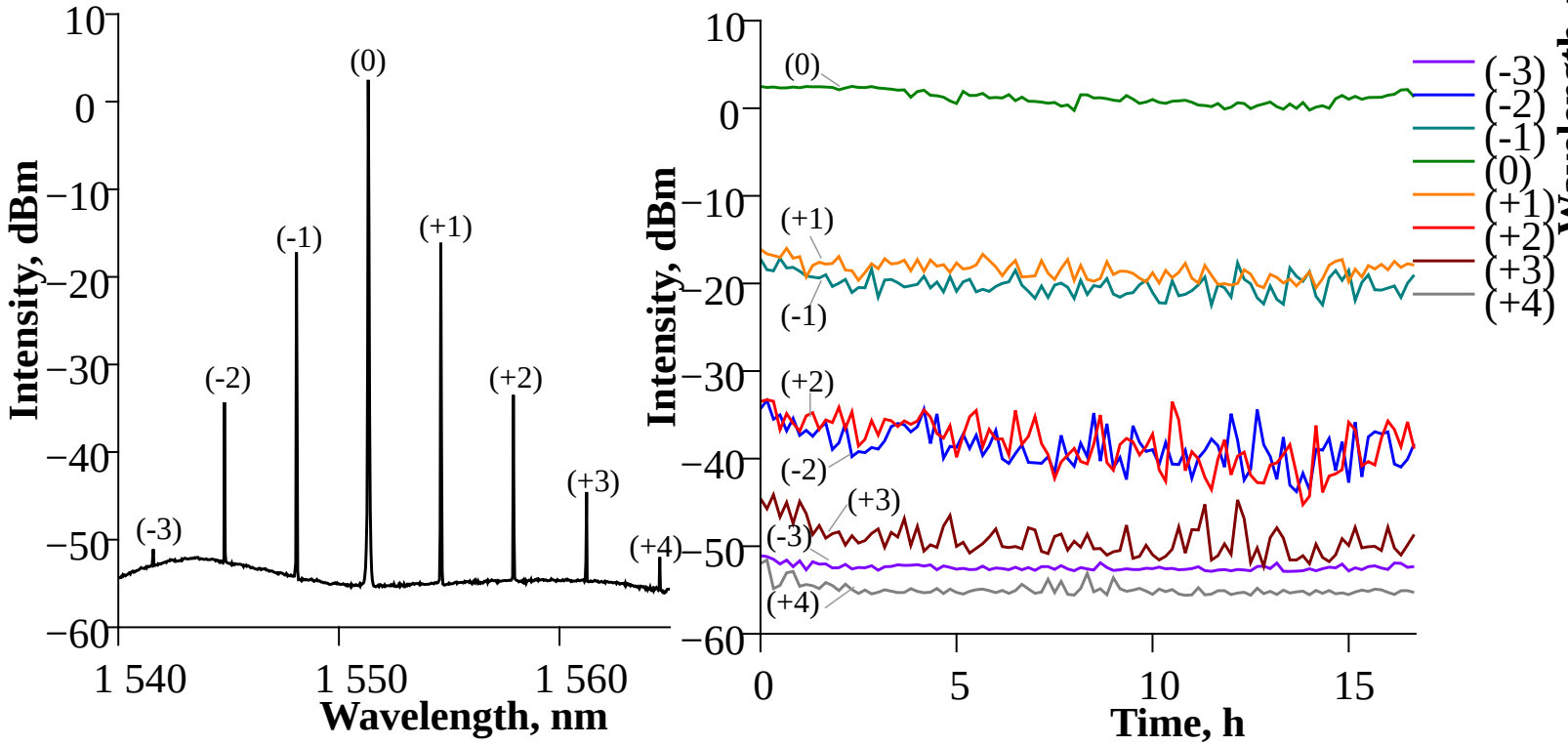


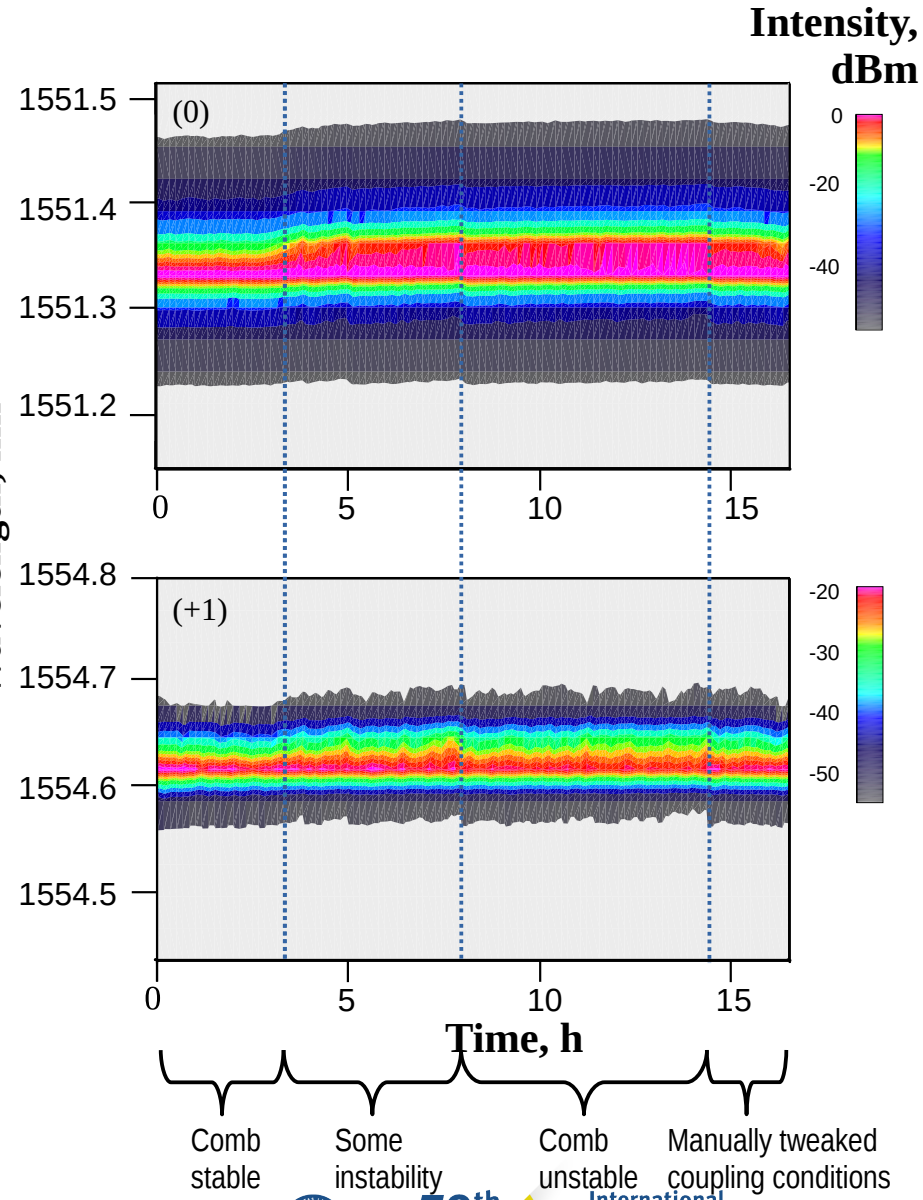




Comb Stability - 400 GHz Comb

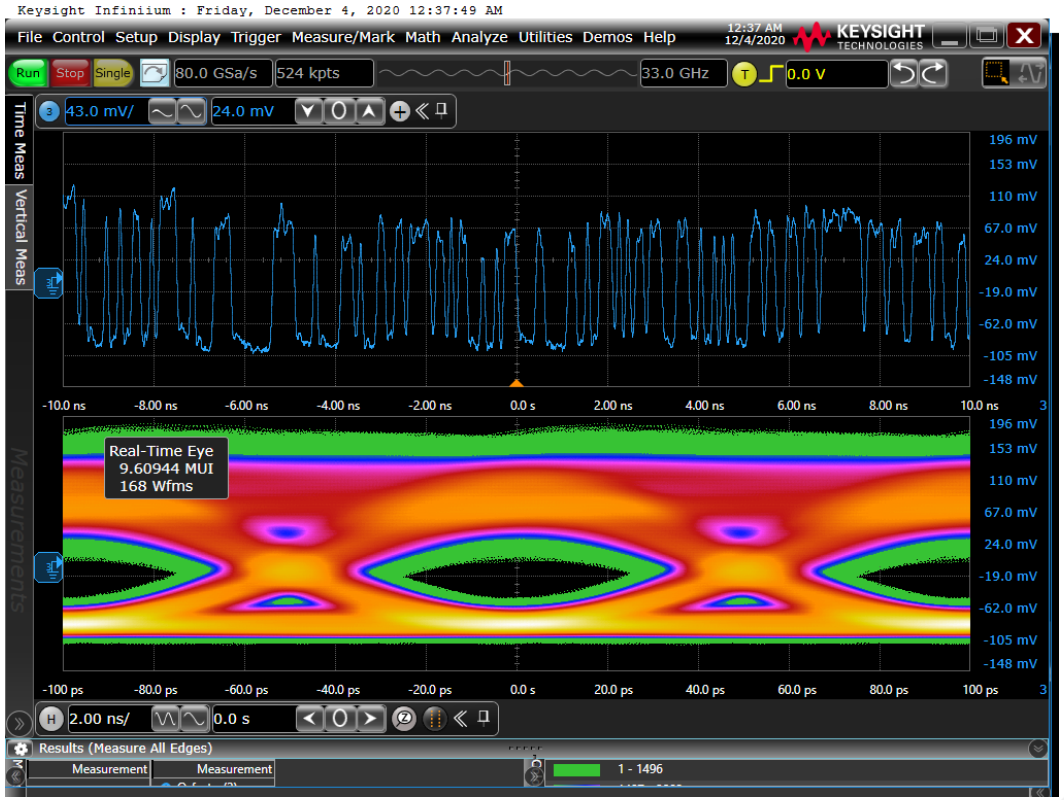
Comb line spacing 1 FSR





WDM data transmission

10 Gbit/s data and eye diagram on WDM selected OFC line (+1) before and after 20 km



Publications

Published:

- J. Braunfelds, R. Murnieks, T. Salgals, I. Brice, T. Sharashidze, I. Lyashuk, A. Ostrovskis, S. Spolitis, J. Alnis, J. Porins, V. Bobrovs, Frequency comb generation in WGM microsphere based generators for telecommunication applications, Quantum Electronics. 50 (2020) 1043–1049. https://doi.org/10.1070/QEL17409
- E.A. Anashkina, M.P. Marisova, A. V. Andrianov, R.A. Akhmedzhanov, R. Murnieks, M.D. Tokman, L. Skladova, I. V. Oladyshkin, T. Salgals, I. Lyashuk, A. Sorokin, S. Spolitis, G. Leuchs, V. Bobrovs, Microsphere-based optical frequency comb generator for 200 GHz spaced WDM data transmission system, Photonics. 7 (2020). https://doi.org/10.3390/PHOTONICS7030072

Submitted:

- T. Salgals, J. Alnis, R. Murnieks, I. Brice, J. Porins, A. V Andrianov, E.A. Anashkina, S. Sandis, V. Bobrovs, Demonstration of fiber optical communication system employing silica microsphere-based OFC source, Optics Express. (2021)
- I. Brice, K. Grundsteins, A. Sedulis, T. Salgals, S. Spolitis, V. Bobrovs, J. Alnis, Frequency comb generation in whispering gallery mode silica microsphere resonators, SPIE Proceedings. (2021).

Paldies par uzmanību!