EKSPLA tunable high repetition rate OPO systems and their application examples for photoacoustic microscopy

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Ekspla is recognized worldwide manufacturer of high performance solid-state Nd:YAG lasers, especially of picosecond and nanosecond time domains, as well as widely tunable parametric generators and oscillators (OPOs), sum frequency generation (SFG), and other nonlinear spectroscopy set-ups. EKSPA had been continuously growing its product portfolio and now is offering standard and specially designed lasers for the science and industry applications. As confirmed by the "Prism Awards for Photonics Innovation" grant in the 2011 year, one of the most recognized systems are high repetition rate OPOs with tuning covering almost any wavelength in ultraviolet UV, visible VIS, near infrared NIR and middle infrared MIR ranges:

- NT240 series OPO pumped by the third harmonic of the 1 kHz pump laser that ensures the highest energy in 410-710 nm (VIS) and 210-410 nm (UV) ranges;
- NT250 series pumped by the second harmonic of the pump laser that gives the highest energy in 669-2600 nm (NIR) range;
- NT270 series pumped by the fundamental wavelength of the pump laser that optimises the system's performance in 2500-4475 nm (MIR) range. This system can be extended up to 12 μm infrared IR range.

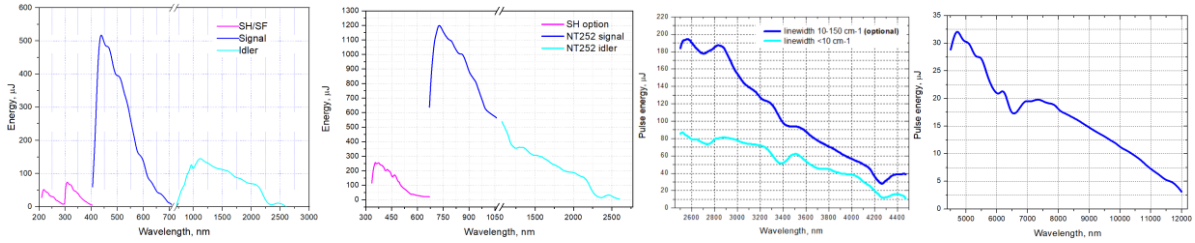

Fig. 1 The typical tuning curves of NT240, NT250, NT270 and NT270 with –XIR extension.

NT240 and NT270 series lasers were successfully deployed in photoacoustic, fluorescence and ultraviolet-localized MIR photoacoustic microscopy set-ups:

- NT240 series laser (model NT242) for the multimodal molecular ocular system with combined photoacoustic microscopy (PAM) and optical coherence tomography (OCT) [1]; for the multimodality retinal and choroidal imaging system with integrated spectral-domain OCT (SD-OCT), PAM, and fluorescence microscopy (FM) [2];
- The combination of NT242 and NT270 lasers for the ultraviolet-localized MIR photoacoustic microscopy (ULM-PAM) [3].

The set of output parameters (1 kHz repetition rate, short laser pulse 3-5 ns, >80 nJ at 580 nm [1], >2 nJ 480 nm, > 80 nJ 532 nm [2] energy; 224-250 nm, 3420 nm, 6050, 6600 nm, with the energy 10-100 μJ [3]) showed itself as highly suitable for the mentioned above photoacoustic applications.

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3. J. Shi, T. T. W. Wong, Y. He, L. Li, R. Zhang, C. S. Yung, J. Hwang, K. Maslov, L. V. Wang, "High-resolution, high-contrast mid-infrared imaging of fresh biological samples with ultraviolet-localized photoacoustic microscopy", Nature Photonics **13**, pp. 609–615 (2019).