Frequency tuning and alignment of the ECDL-6407R.

The following experimental data specify the operation of the ECDL-6407R and might serve as references for its alignment.

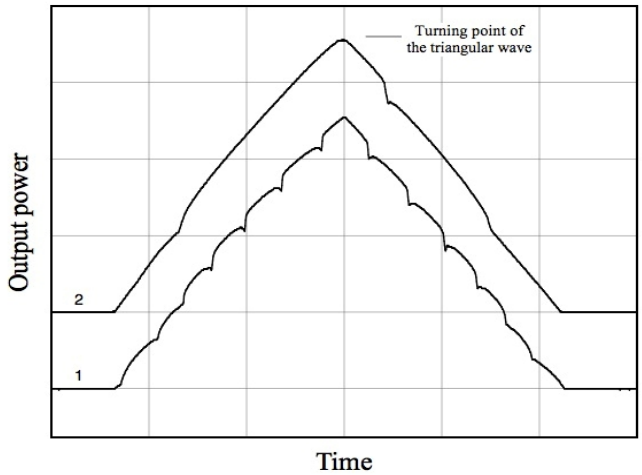

Fig.1. The dependencies of the output power on the LD current. The LD current is changed by the symmetrical triangular wave. **1)** The PZT scan is off. **2)** The PZT scan is on. The curves are shifted vertically in respect to each other to make the picture more readable.

Fig.1 shows a pair of oscillograms which correspond to dependencies of the ECDL output power on the LD current at different positions of the SCAN knob. The signal of the built-in triangular wave generator is used to synchronize oscilloscope and to control the laser current. The LD current linearly changes in time and a photodetector registers the corresponding change of ECDL power.

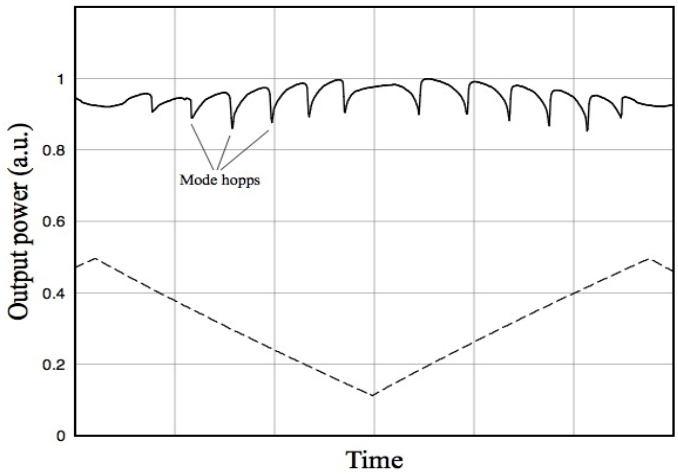

Fig.2. The output power (upper solid curve) **and the** signal of the built-in triangular wave generator (lower dashed curve) **on the PZT voltage sweeping.** The LD current is constant.

The practically flat regions at the bottom of the oscillograms correspond to subthreshold regime of the ECDL. The LD current change causes variations of the temperature and the index

of refraction of the LD gain medium and hence the change of the optical length of the LD and of the whole ECDL cavity. The clearly observed steps on the power-on-current dependencies are resulted from the extended cavity mode hops.

The next oscillograms (Fig.2) are recorded at the constant LD current and the linear sweep of the PZT voltage. The upper solid curve demonstrates how six sequential mode hops are reflected in the output power. The zero power level is at the bottom of the screen. Every mode hop is accompanied by the change in power of approximately 10%.

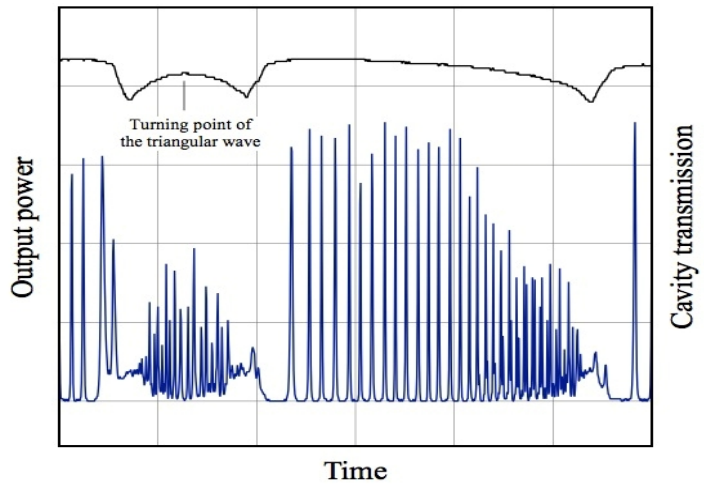

Fig.3. The output power (black curve) **and the transmission of a confocal Fabry-Perot cavity** (blue curve) **on the laser tuning between two consecutive ECDL mode hops.**

Fig.3 demonstrates the spectral behavior of the ECDL between two consecutive mode hops. The black oscillogram is a stretched segment of the solid curve of Fig.2. The lower blue oscillogram displays the transmission of a confocal Fabry-Perot cavity. The free spectrum range of the cavity is 250 MHz. The number of the cavity transmission peaks demonstrates the continuous tuning range of 7 GHz, though the contrast of the peaks reveals that the extended cavity laser operates in a high-coherent regime only part of this range (about 5 GHz). The switch-over from the high-coherent regime to the low-coherent one can be diagnosed using just a power dependence on the tuning parameter (PZT voltage, current, etc.): the smooth power change indicates high-coherent regime, while the kinks and fractures inform about some instabilities (mode competition, parasitic optical feedback and so on) degrading the laser linewidth.

It is possible to expand continuous tuning range of the ECDL using united tuning of the LD mode, the extended-cavity mode, and the peak of the grating reflection. This is achieved by the synchronous sweeping of the piezo voltage and the LD current. The Fig.4 demonstrates such full-scale tuning of the ECDL-6407R. The PZT scan is set close to the maximum, while the current scan and the DC levels of the LD current and the PZT voltage are found

experimentally to avoid mode-hops inside the full tuning range. Their exact values might be different for the cases of increasing or decreasing current (one mode-hop is still observable on the right side of the curve).

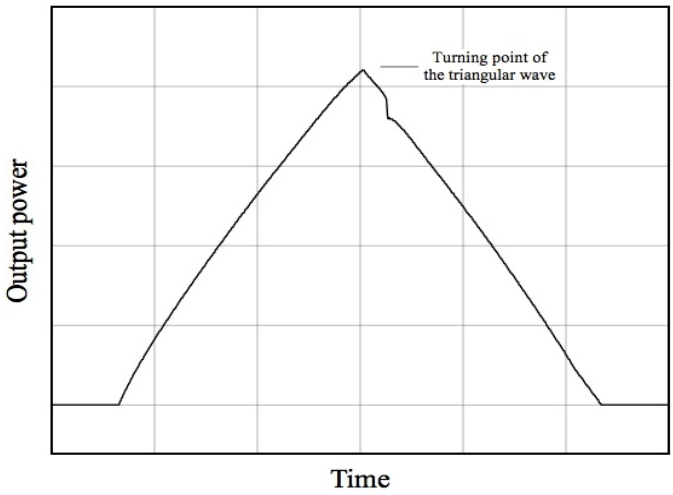

Fig.4. The laser output power at the synchronous scan of the piezo and the LD current.

Specifications.

1. Wavelength	**637 nm**
2. Output power	
@ 51 mA	2.0 mW
@ 55 mA	5.4 mW
@ 60 mA	**9.1 mW**
@ 65 mA	12.5 mW
@ 69 mA	15 mW
3. Continuos tuning range	
by PZT only	5 GHz
by PZT+LD current	25 GHz
4. Coarse tuning range	± 2 nm
5. Polarization	linear vertical
6. Beam shape	elliptical 5×1.5 mm^2
7. Threshold current	49 mA
8. Operating current	**60 mA**
9. Thermistor	**11.0 kOhm**
10. Optical head dimensions	56×50×33 mm^3
11. Optical head weight	150 g
12. Electronic unit dimensions	260×210×70 mm^3
13. Electronic unit weight	2.5 kg