Single- and Multi-soliton generation in ANDi-laser with tunable spectral filtration

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***Abstract* — We investigated the influence of spectral filtration inside all-normal dispersion (ANDi) fiber mode-locked laser on dissipative soliton formation. The circular fiber cavity with semiconductor saturable absorber mirror (SESAM) and tunable spectral filter was chosen as experimental platform. It was found that central wavelength of the spectral filter significantly influences on whether single or multi-soliton regime would be generated. Depending on matching between net spectral losses of the laser cavity and filter spectral profile it is possible to generate from 1 to 3 solitons inside optical bunch.**

Keywords— mode-locked fiber laser, dissipative solitons, multi-pulse generation.

I. Introduction

ANDi mode-locked fiber lasers have already shown their significant impact at various fields including spectroscopy micromachining, nonlinear microscopy. Spectral filtration inside ANDi lasers play the key role in stabilization of mode-locked regimes: it cuts spreading temporal and spectral wings of the optical pulse each roundtrip [1]. Therefore, most of the work were focused mainly on influence of the bandwidth of a spectral filter to pulse formation.

The scope of the current work is more focused on selection of the central wavelength of a spectral filter. We have found an architecture of the laser cavity where the central wavelength of the filter affects the dynamics of pulse generation more strongly than the bandwidth.

II. Experimental Setup

The scheme of a ANDi laser with tunable filter and SESAM is presented in Fig.1.

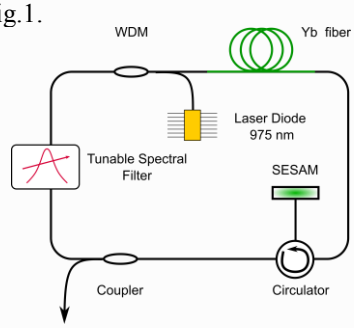

Fig.1. The scheme of ANDi mode-locked fiber laser.

Laser cavity was consisted with elements maintaining polarization state of the optical radiation (PM980 fiber).

As an amplifying fiber single-core Yb – doped fiber was used. SESAM (Batop SAM1064) provided mode-locking inside the laser cavity.

III. Results

Fig. 2. demonstrates the map of average power of the output radiation depending on central wavelength and bandwidth of the spectral filter.

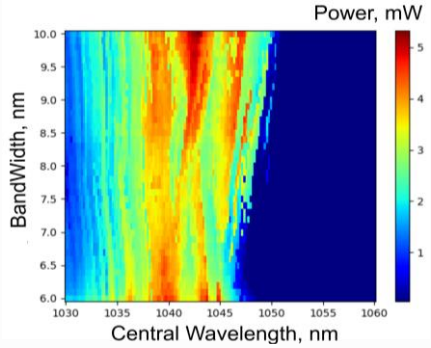

Fig.2. Average power of output radiation against central wavelength and bandwidth of spectral filter

The maxim of average power at 1043 nm and 10 nm bandwidth corresponds to single-pulse regime. Detuning from these parameters leads to decrease of average power and a transition to a two- or three-pulse generation mode.

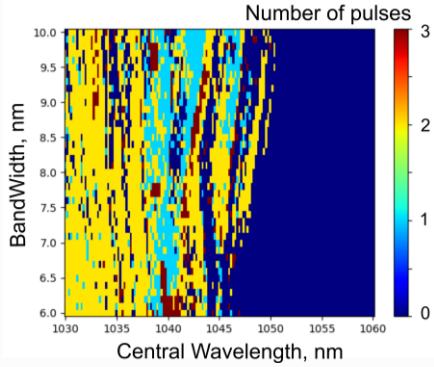

Fig.3. Number of solitons of output radiation against central wavelength and bandwidth of the spectral filter.

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This work was supported by Russian Science Foundation (17-72-30006).

2022 International Conference Laser Optics (ICLO) | 978-1-6654-6664-6/22/$31.00 ©2022 IEEE | DOI: 10.1109/ICLO54117.2022.9839943

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