# A Single Mode Laser Output of a Superluminescent-diode System with Feedback Mechanism Using a Volume Bragg Grating

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(NSC-95-2112-M-415-004)

**Abstract** --- *We construct a superluminescent-diode system subjected to an optical feedback mechanism using a volume Bragg grating as the spectral line narrowing element. A single mode laser output with a spectral width of 0.25 pm has been achieved.*

**Keywords**: *Superluminescent diode (SLD), Optical feedback, Volume Bragg grating, Laser*

## INTRODUCTION

Several external cavity techniques by means of volume Bragg gratings (VBG) are presented [1, 2]. VBG recorded in a photo-thermo-refractive (PTR) glass has often been applied to high efficient selective feedback elements for spectral line narrowing and stabilization of the semiconductor lasers [3, 4].

In this study, we construct a superluminescent-diode (SLD) system subjected to an optical feedback mechanism using a volume Bragg grating. High output power and large optical bandwidth are key features of SLD, and the extremely high optical gain in SLD active region may result in very high optical power sensitivity to external optical feedback [5]. Thus, the single mode laser output of the external resonator by a SLD system with reflecting PTR Bragg grating can be achieved.

## EXPERIMENTAL SETUP

A schematic diagram of the experimental system is shown in Figure 1 and Figure 2. The 2-mW collimated light from a SLD source at 836 nm with a spectral width (FWHM) of 22 nm is split into the reflection and the transmission arms by a non-polarizing cube beam splitter (BS). The optical power delivered to the reflection arm is about 70% of the total optical power of the source. And then we insert a volume Bragg grating (VBG) between the beam splitter and the reflection mirror to form a V-cavity. The VBG has a nominal resonant wavelength of 850 nm, and the resonant wavelength could be shifted towards shorter wavelengths by turning an angle of incidence onto the VBG. We turn the VBG's angle to obtain the maximum diffraction efficiency for the experimental system source. Afterward we feed back the diffracted beam and observe the spectrum characteristics of the laser output by a Fabry-Perot interferometer (TecOptics). The lasing wavelength is measured by a wavelength meter (Burleigh).

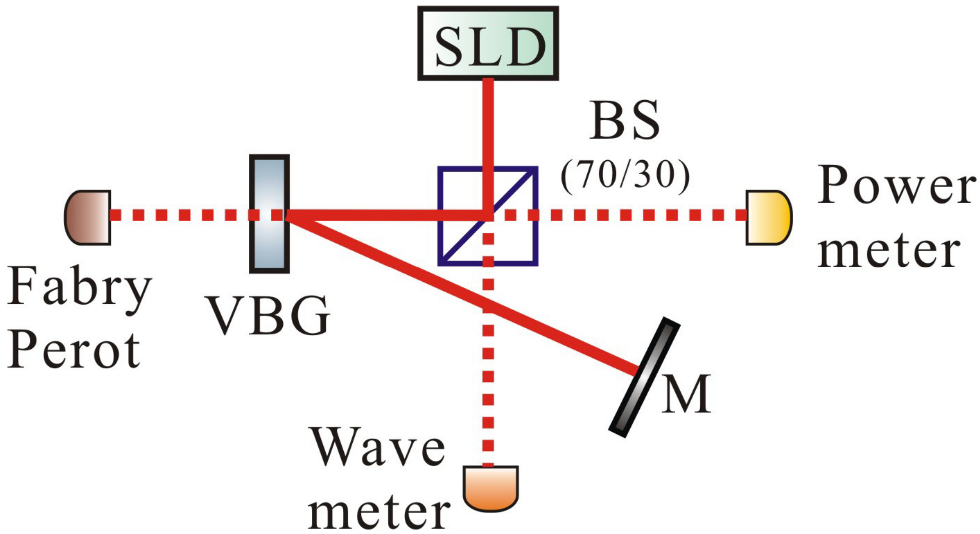


Figure 1. Experimental setup of a single mode laser output. BS (70/30), beam splitter with the ratio of separating light of reflection and transmission at 70:30. VBG, volume Bragg grating. M, mirror.

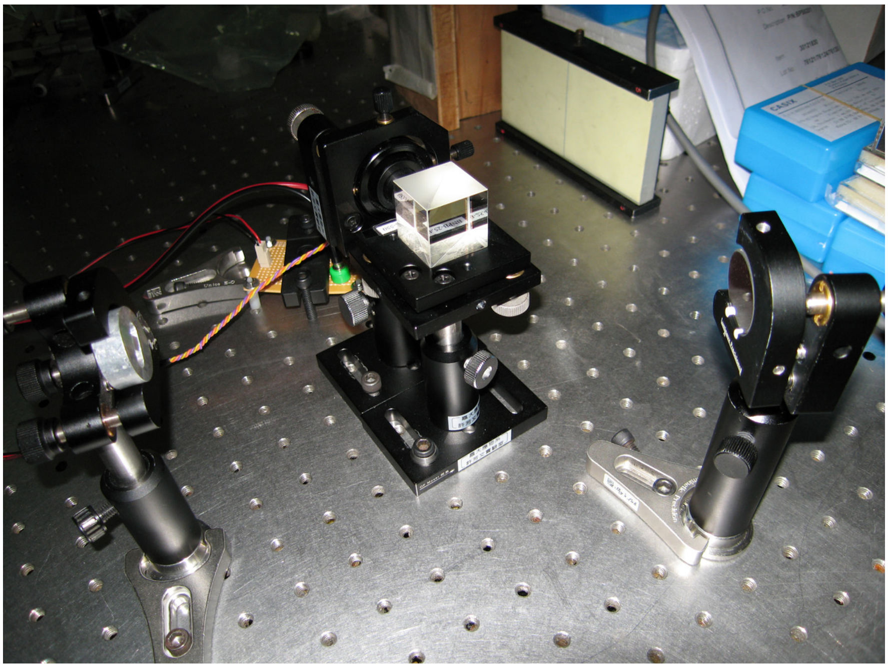

Figure 2. Photograph of the experimental setup of a single mode laser output.

## EXPERIMENTAL RESULT

Figure 3 shows the signals of the Fabry-Perot interferometer, red is the reference signal and blue is the signal of laser output. The free spectral range (FSR) of the Fabry-Perot interferometer is 7.5 GHz, and the single mode laser output at 840 nm with a spectral width of 107 MHz (0.25 pm) can be calculated.

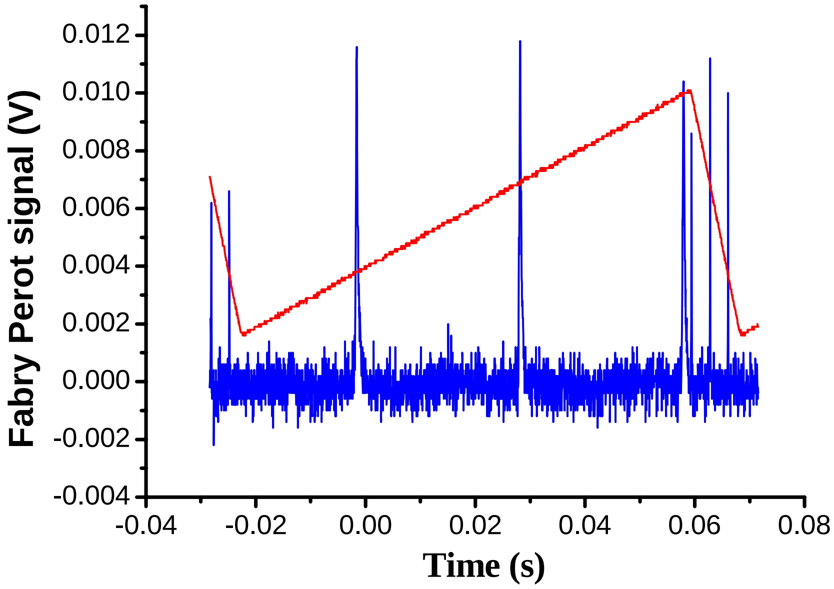


Figure 3. The experimental signals of the Fabry-Perot interferometer.

## CONCLUSION

In summary, we have achieved a single mode laser output by a SLD system with the feedback mechanism incorporating a VBG element. The laser output is of wavelength at 840 nm and has a narrow spectral width of 0.25 pm.

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