todetector segments. Since the absorption coefficient α is strongly dependent on the wavelength near the band edge, this ratio provides a sensitive measure of the wavelength.

3.2.2 Standalone Performance

The 2-section wavelength monitor was fabricated using the process described in Chapter 2, section x as a standalone device. Light from an Agilent 81600B Tuneable Laser Source (TLS) was passed through a polarisation controller to select pure TE polarised light was injected into the device via a lensed fibre. The two sections of the device were biased at 0 Volts and the generated photocurrents were read out using a Keithley SourceMeter®. The schematic of this measurement setup is shown in figure 3.3. The wavelength of the TLS was swept keeping the optical power constant at a value of 1mW and the resulting photocurrents and the photocurrent ratio are plotted in figure 3.4. Comparing this with figure 3.2, we can see good agreement between the theoretical and experimentally obtained performance of the wavelength monitor.

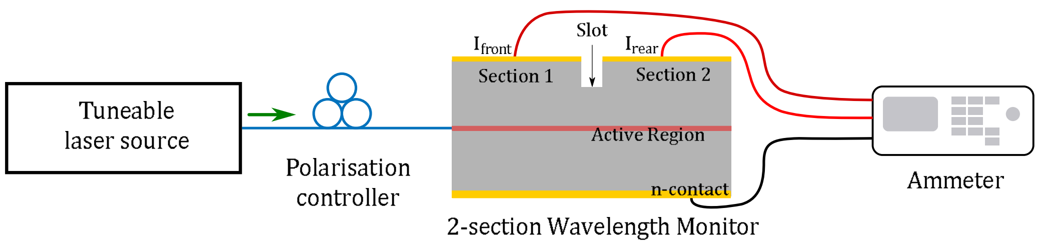
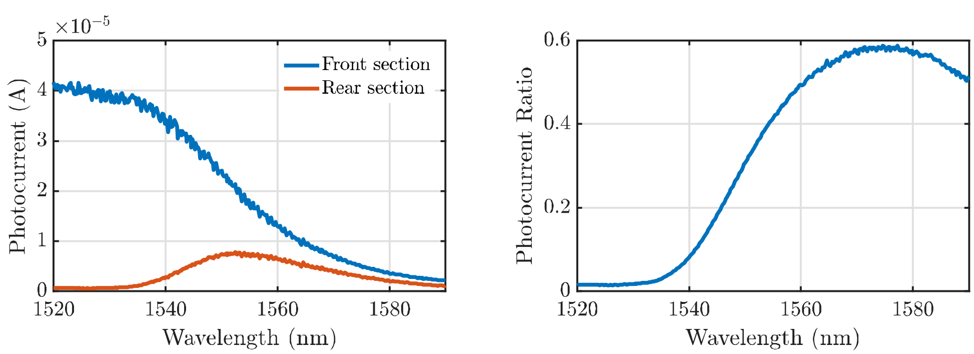


Figure 3.3: Schematic of the measurement setup



(a) (b)

Figure 3.4: (a) Photocurrents from front and rear sections and (b) Ratio of photocurrents as a function of wavelength

According to equation 3.9, the photocurrent ratio is theoretically independent of optical input power. This was tested and plotted in figure 3.5. We observe that while the photocurrents in the individual sections go down as the input power decreases, the ratio between them remains constant and thus independent of the optical power, thus making it a robust indicator for sensing the input wavelength.

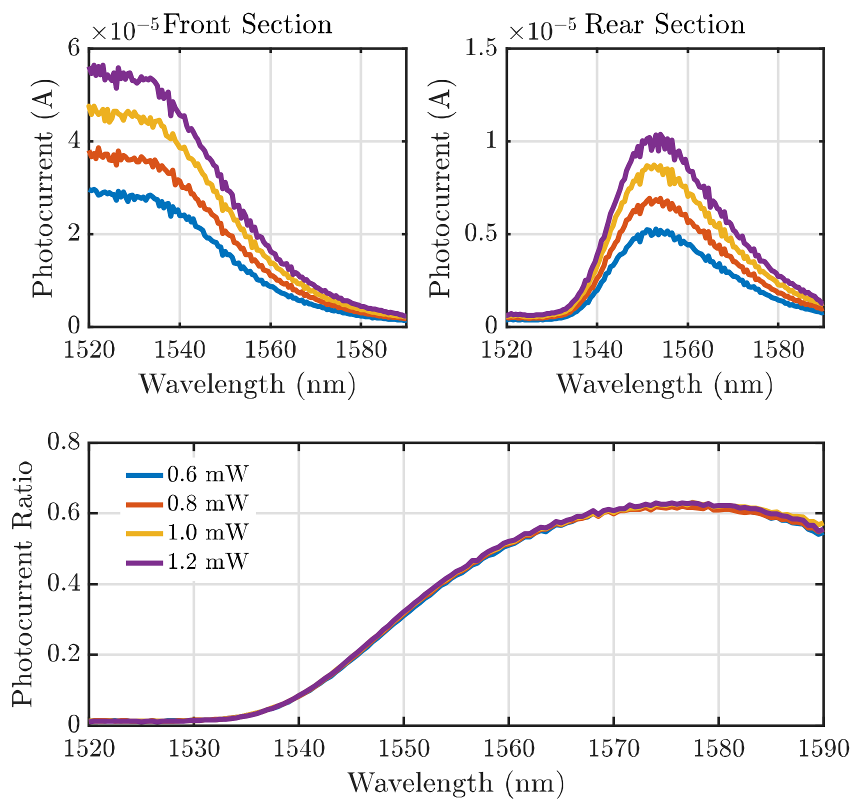


Figure 3.5: Readouts from the wavelength monitor as a function of input optical power

The wavelength-tuneable slotted Fabry-Perót laser described Chapter 2 and the wavelength monitor described in the section above were mounted on separate butterfly packages. The light was coupled between them using a single mode optical fibre. The tuneable laser was placed on a mount with a thermoelectric cooler (TEC). As the wavelength of the laser is tuned using its drive currents, the photocurrents in the wavelength monitor are read out and fed into a LabVIEW™ program. This program then sets the temperature of the TEC mount underneath the laser accordingly, which fine-tunes and stabilises the lasing wavelength. The schematic of this setup is shown in figure 3.6, and the readout from the wavelength monitor is shown in figure 3.7. The red curve is the value of the photocurrent ratio theoretically resulting from the setting of the wavelength of the tuneable laser. The laser was tuned between three diferent wavelengths λ_1, λ_2 and λ_3. The black curve shows the measured value of the photocurrent ratio resulting from the stabilisation of the laser using a PID controller in the feedback loop. From these measurements, we can obtain the sensitivity value for the wavelength monitor to be 1.3 GHz or 0.01nm (around 1550nm wavelength range).

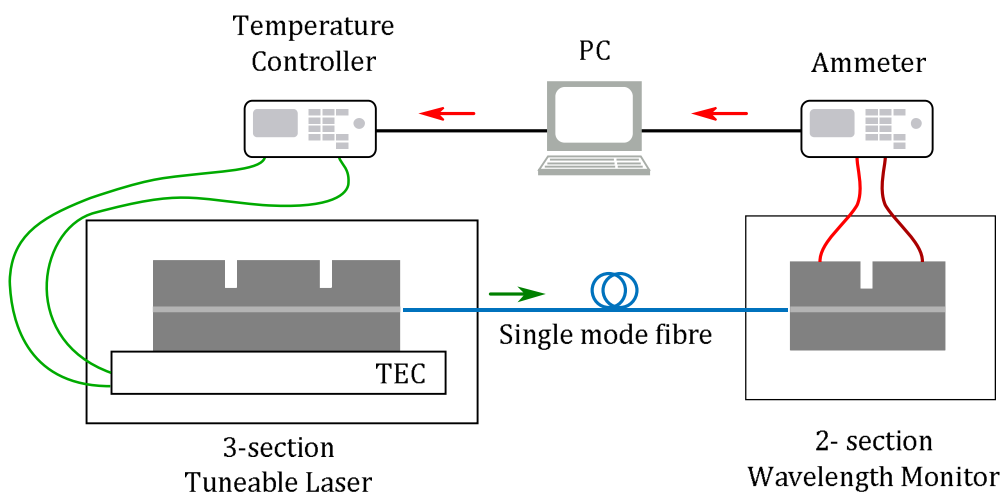


Figure 3.6: Schematic of the wavelength stabilisation setup

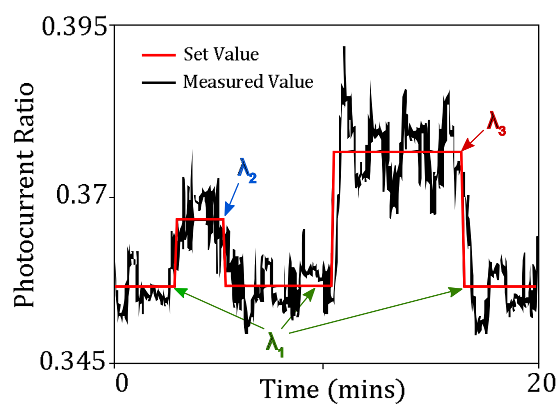


Figure 3.7: Schematic of the wavelength stabilisation setup