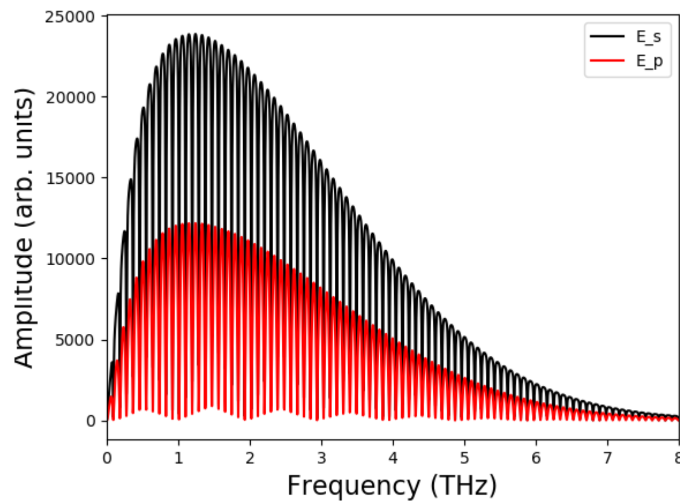

Figure 5. Frequency-domain electric fields generated by equations and for a sample with real refractive index 3.4177, absorption coefficient 0.03 cm^{-1} and thickness 500 μm.

These values are based on the characteristics of high resistivity silicon [9, 10].

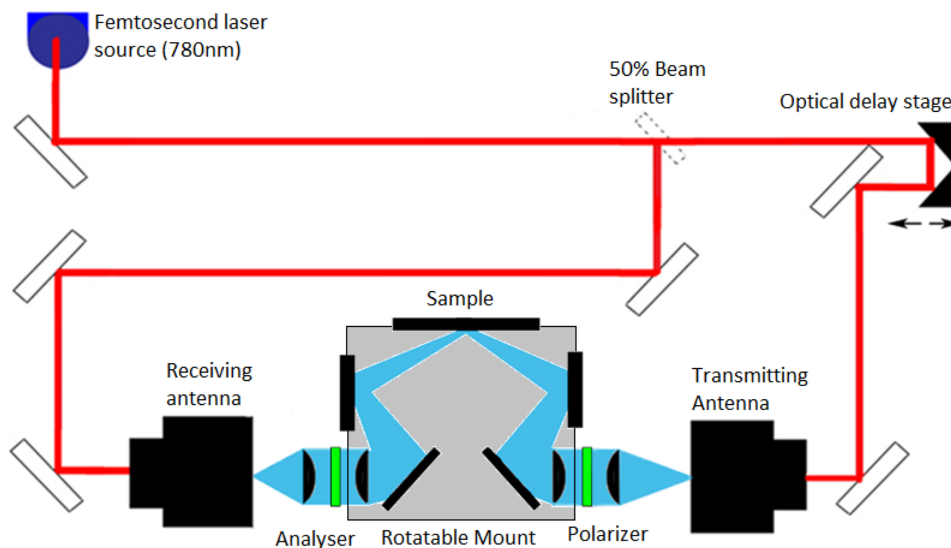

Figure 6. A diagrammatic representation of the experimental setup used by our lab.

By using an IFFT the electric fields can be transformed back to the time-domain. Experimental data for this sample was measured using a setup with a layout as depicted in figure 6. Since the experimental setup performs its measurements in the time-domain, it is convenient to compare the simulated data and experimental data in the time-domain.

By comparing figure 7 and 8, it is found that the simulated data correlates with the experimental data. The time delay between between successive pulses correspond and, the phase shifts in pulses are as expected in both the simulated and experimental data (seen in pulses

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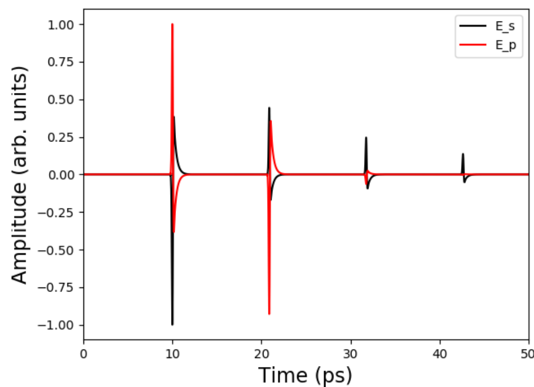

Figure 7. Normalized time-domain electric fields generated by taking an IFFT of electric fields presented in figure 5.

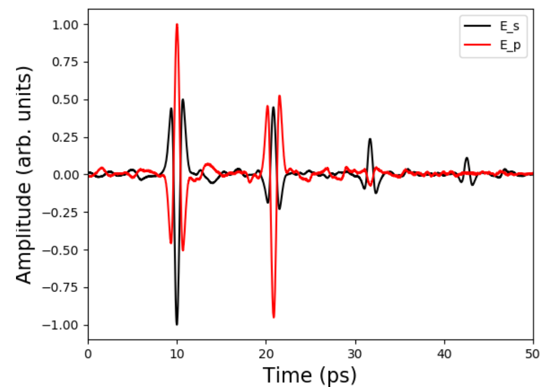

Figure 8. Normalized time-domain electric fields measured in our lab for a high resistivity silicon sample.

flipping when a π phase-shift occurs). Finally, the decrease in amplitude between successive pulses is also well matched.

5. Conclusion

The applicability of time-domain THz ellipsometry relies heavily on the quality of the material parameters that can be extracted from experimental data. In order to verify extracted material parameters, we have successfully simulated real time-domain THz ellipsometry measurements on high resistivity single crystalline Silicon, and compared these simulations to experimental measurements. The simulations and measurements agreed in shape and structure, which lends credibility to the simulated data. This simulated data will in future be used to test our material parameter extraction algorithms, in order to verify their accuracy. This verification is crucial in validating material parameters extracted from our experimental measurements of unknown or complex samples

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