

# Probe hardware and software updates

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## 1 Introduction

A spectral domain optical coherence tomography probe (hereafter “the probe”) was designed by Nathan Lin, and is presented in his PhD thesis. While his preliminary work validated the functionality of this probe, a significant amount of work has been done since his departure to improve the probe’s functionality.

In particular, I have worked at improving the probe’s accessibility, allowing for better interfacing with the ThorImage software, and for real-time B-Scanning at higher quality than what ThorImage produces. I have also produced acquisition software that allows us to process probe-acquired data using the exact same pipeline as standard bulk-optics-acquired data.

In this document, I will discuss these advancements at a high level, giving significant detail for new features and leaving older features to previous documentation found on [my GitHub page](#). In particular, for information on the probe, see the Probe Driver Report. For excruciating detail on the theory of OCT background subtraction and the acquisition/processing functions for the probe, see the Fixed-Background Processing Report.

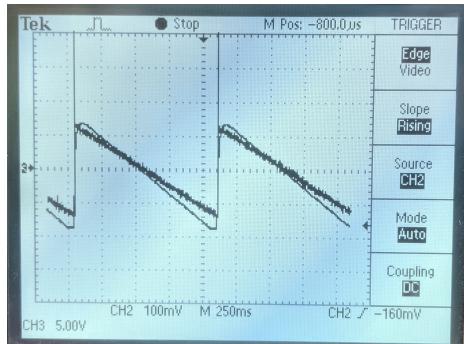


Figure 1: Response at 10 kHz.

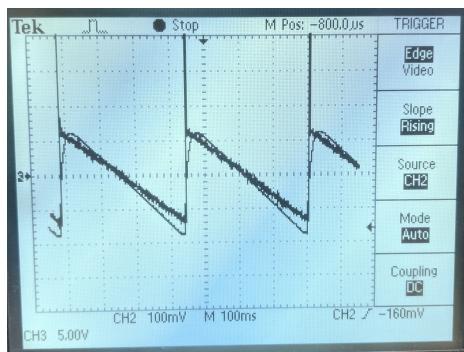


Figure 2: Response at 28 kHz.

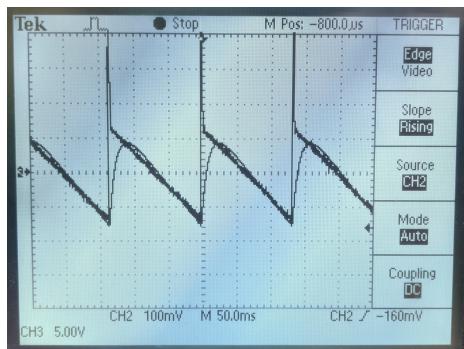


Figure 3: Response at 76 kHz.



Figure 4: Response at 76 kHz.

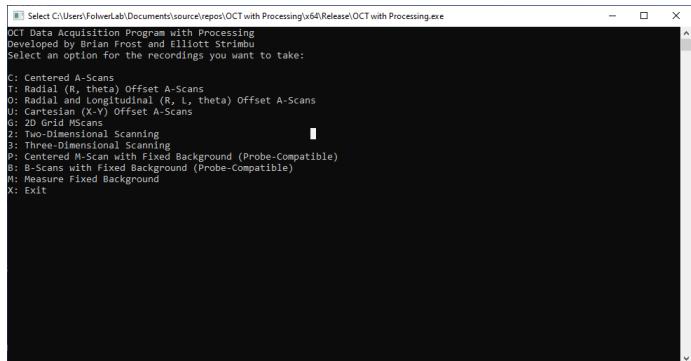


Figure 5: .

## 2 The background in OCT processing

- 2.1 Why do we need a background?
- 2.2 How does ThorImage capture the background?
- 2.3 How do our programs handle the background?

## 3 Probe control signals and circuitry

- 3.1 Telesto output signal
- 3.2 Circuit function and capacitance values
- 3.3 Adjusting resistances for each probe

## 4 Control programs for fixed background

- 4.1 Option M: Measure Background
- 4.2 Taking and observing B-Scans with fixed background
- 4.3 Option P: M-Scans with fixed background

## 5 Signal quality

- 5.1 SNR in air vs. water

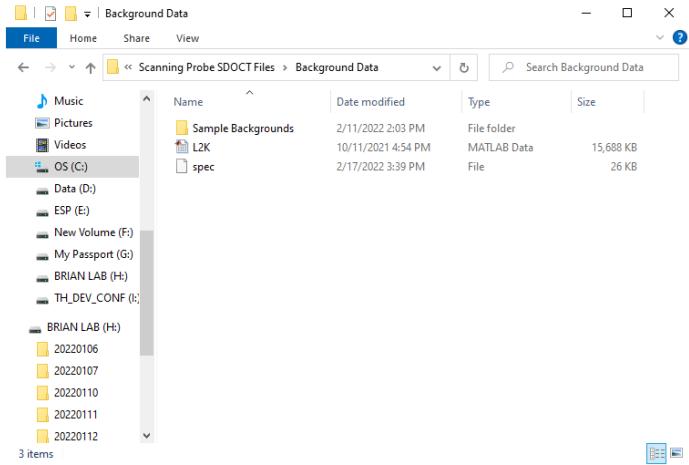


Figure 6: .

```
Using probe or bulk optics? (p/b)
>K
>K
one shot size: 100
Select FOV in millimeters: .36
0000
You are using a probe, so we will B-Scan with 0.04um pixel size at 28kHz sampling rate.
tid: 3
tid: 1
tid: 4
tid: 5
tid: 6tid: 0
tid: 2

Providing FFT...
Coloring data of size 9216000.
Press 'X' to stop, anything else to continue.
```

Figure 7: .

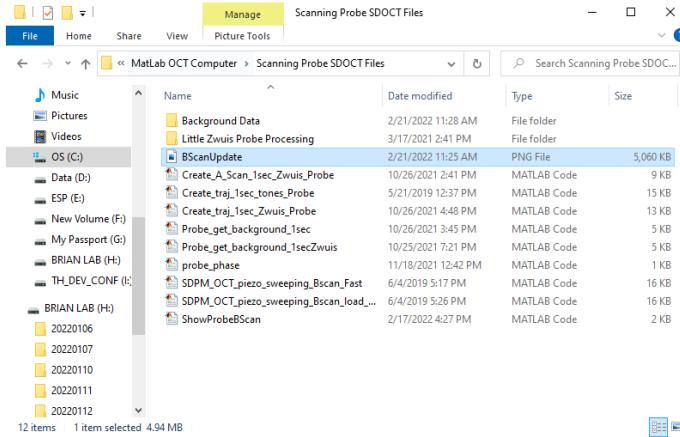


Figure 8: .

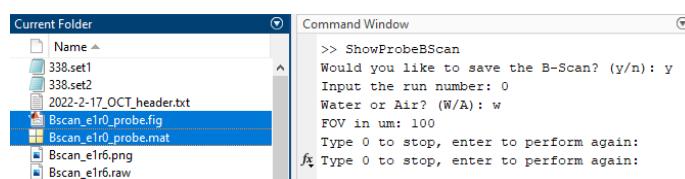


Figure 9: .

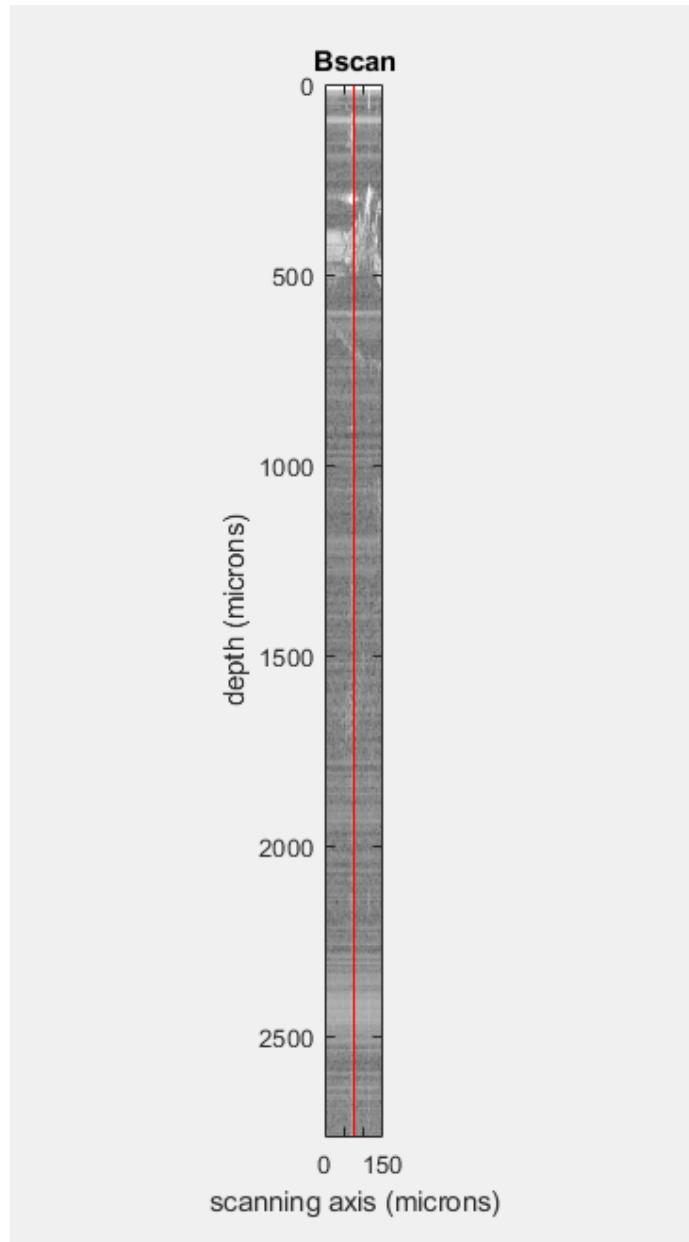


Figure 10: .

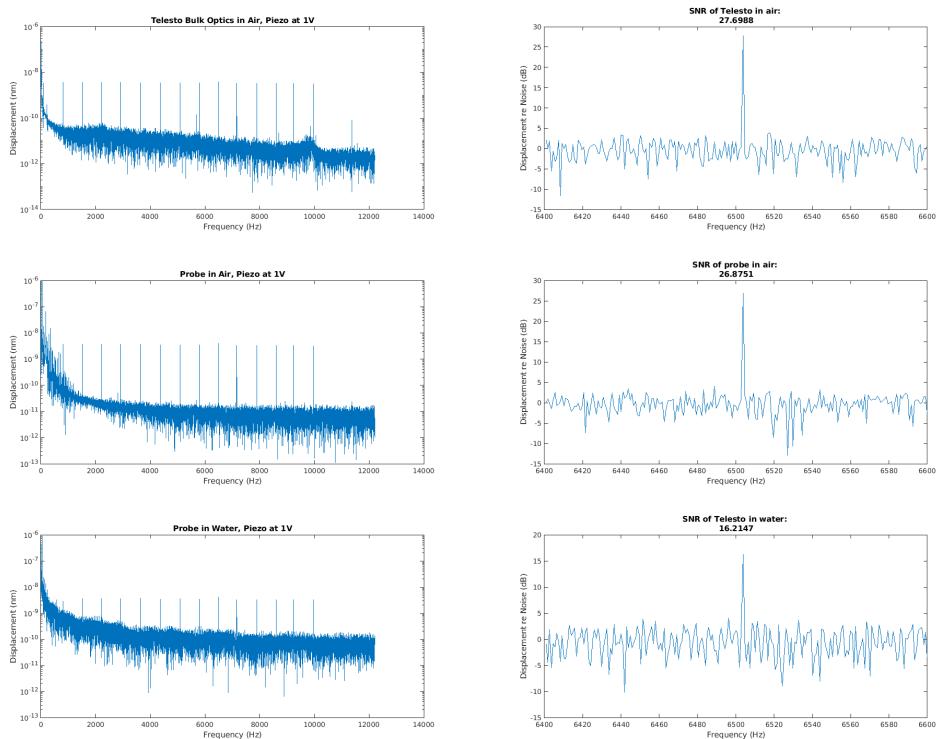


Figure 11: .

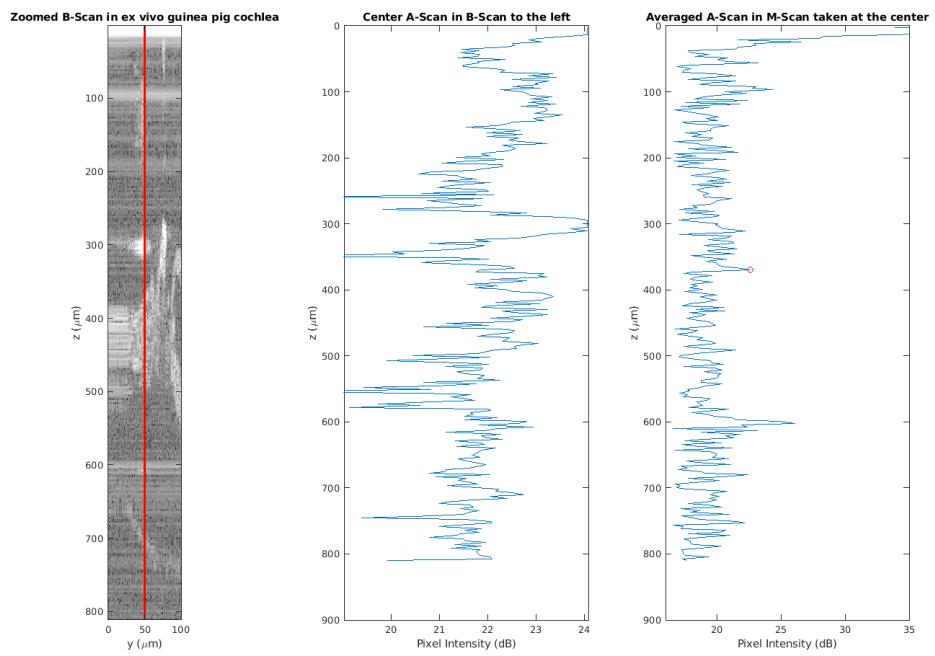


Figure 12: .

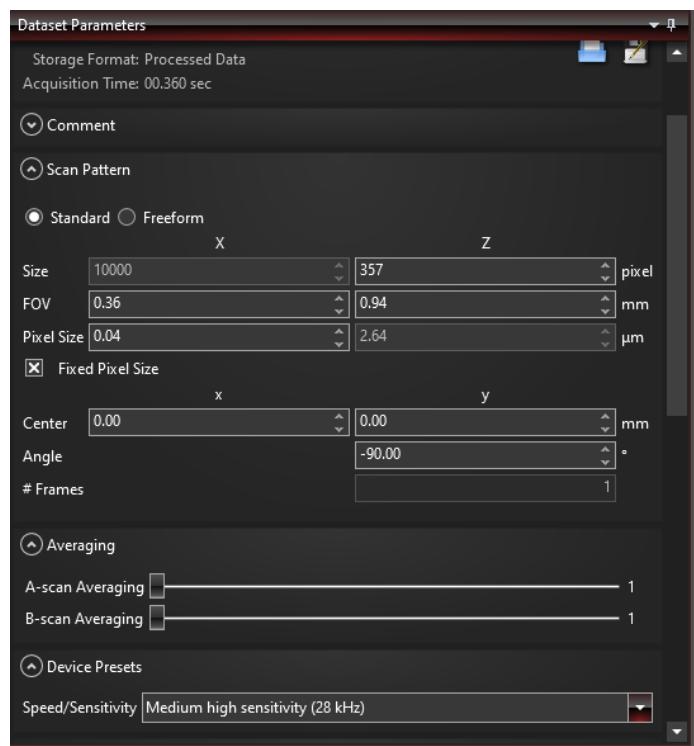


Figure 13: .