Phantom for Measuring Signal Sensitivity of Optical Coherence Tomography (OCT) Imaging Devices User Manual

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Phantom for Measuring Signal Sensitivity of Optical Coherence Tomography (OCT) Imaging Devices

Introduction

This document describes the materials and methods to image an OCT sensitivity phantom fabricated per the reference below. A method to analyze an OCT image to obtain a sensitivity measure from the phantom is also provided.

Reference

D. M. Fitzgerald, J. Guag, Z. Liu, D. X. Hammer, R. D. Sochol, and A. Agrawal, "Tailored Reflectivity Microstructures for Measuring Signal Sensitivity of Optical Coherence Tomography Medical Imaging Systems," Adv. Mat. Tech., under review (2024).

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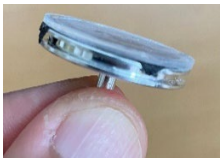
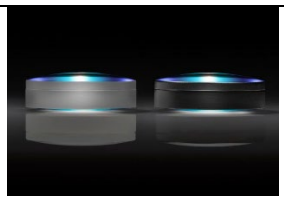
Materials

Item	Amount/ Quantity	Supplier (Product ID[s]) *recommended supplier and products; alternatives are possible	Image(s)
Phantom	1	FDA	 Note: Phantom is a thin plastic disk and is not necessarily attached to metal post.
Phantom mount for imaging	1	Thorlabs* (CP33, LMR1)	

Model eye lens for retinal OCT imagers	1	Edmund Optics* (49-952, 49-952-INK)	 "-INK" version on right

IMAGING INSTRUCTIONS

1. If a retinal imaging OCT system is being tested, then prepare and position the model eye which focuses the imaging beam onto the surface being imaged.
2. Remove the phantom from its storage case and blow the surface with clean dry air to remove any dust.
3. Install phantom into model eye or separate mount with retaining ring applied to back side of phantom. This ensures the front surface of the phantom is as flat as possible in the mount.
4. Position front surface of phantom as perpendicular as possible to the optical axis of the OCT system.
5. In the absence of a model eye, axially position the phantom to maximize signal from the microstructures. Note that each microstructure's signal level may differ from each other.
6. Acquire a raster scan across all the angled microstructures with high spatial sampling to maximize the number of pixels on each microstructure.

ANALYSIS INSTRUCTIONS

1. Locate each angled microstructure's region of interest in the OCT image volume.
2. Compute the noise level as the standard deviation of a block of signal-free pixels just above the microstructure surface.
3. Extract the signal intensity level from a particular location along the central long axis of the microstructure, ensuring the axial location corresponds to the top surface of the microstructure (maximum signal at that lateral position).
4. The sensitivity criterion (SNR=1) is the location along the central long axis where the signal level equals the noise level.
5. This location can be recorded as the relative position along the long axis, for comparison to other imaging settings or other OCT instruments.

USAGE NOTES

1. Do not touch the phantom surface. Clean the phantom surface only clean dry air.
2. Store the phantom securely in a dust-free case which prevents the phantom from moving within.