

# Virtual Lab

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## 1 INTRODUCTION

This virtual lab is designed to study the new method to measure blood vessel oxygen saturation using spectral relations and ratio data for the case of homogeneous medium. It contains basically four panels, one parameter panel and three display panel.

## 2 HOW TO START GUI

Run GUI\_export.m in MATLAB environment.

## 3 CROSS-PLATFORM COMPATIBILITY

This program has been so far tested successfully in different Operating Systems including windows 7 and OS X. In order to show the UI properly, the font size should be set '100%' or 'Default' for the OS. The earliest MATLAB version tested so far is MATLAB 2013b.

## 4 MAIN FUNCTIONS

Three modes are allowed,

- Single Forward: forward simulation runs using the parameters from the column of *Reference*. Result is shown on the button right axes on the Forward result panel.
- Continuous Forward: forward simulation runs using the parameters from the column of *Manual Fitting*. Result is shown on the button right axes on the *Forward result* panel.

- Reconstruction: inverse problem is solved using the parameters from the column of *Initial guess* and the result of *Single Forward*. Result is shown on the *Reconstruction result* panel.

## 5 OTHER FUNCTIONS

### 5.1 NOISE LEVEL

Users are allowed to change the noise level  $n\%$  which is implemented in a simple way noisy result  $\tilde{s} = s \cdot 2 \cdot n\% \cdot (0.5 - \xi)$ , where  $s$  is the resultant ratio data and  $\xi = rand$ .

### 5.2 NUMBER OF PROBES AND DISTANCES BETWEEN PROBES AND THE VESSEL

The minimal number of probes is 1. By default, the Probe 1 is located in the center of the surface of the bulk and blood vessel is located at (0, dis1); if number of probes is 2, probe 2 is placed at (dis2, 0); if three or more probes are used, the other probes are placed between probe 1 and Probe 2 with the same distance between two neighbor probes. In the button right part of the parameter panel, users are allowed to change change number of probes, the distance between probe 1 and the vessel (dis1) and the distance between probe 1 and 2 (dis2).

### 5.3 PLOT SPECTRA OF COEFFICIENTS

In the *Single Forward* mode, by clicking the radio button *plot spectra of coefficients*, the result will be shown in the third display panel *Spectra of coefficients*.

### 5.4 PLOT FLUENCE

In the *Single Forward* mode, by clicking the radio button *plot fluence*, the result will be displayed in the button left of the panel *Forward result*. The signal of ultrasound for probe 1 is shown in the terms of the product of absorption of the blood vessel and the fluence calculated by Green function.

### 5.5 PLOT ULTRASOUND SIGNAL

In the *Single Forward* mode, by clicking the radio button *plot ultrasound signal*, spectra of intensities of signals gathered from all probes will be shown on the top right axes of the display panel *Forward result*.

## 6 EXAMPLES

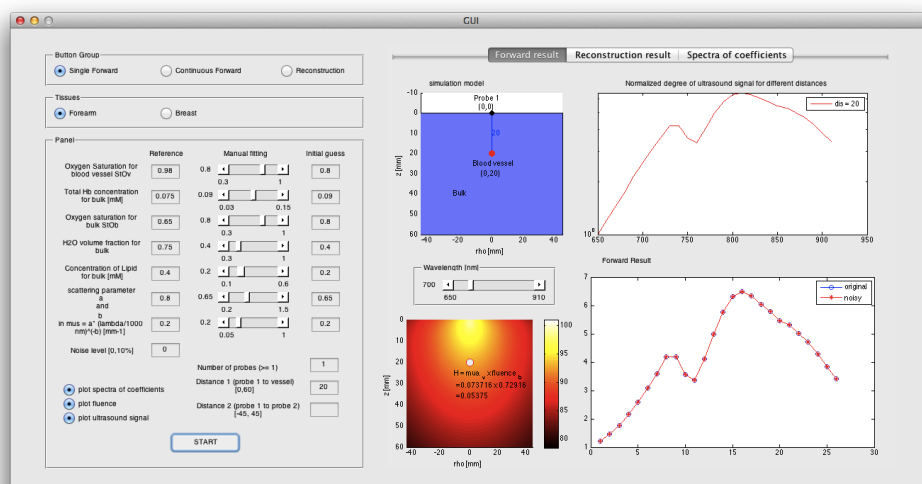


Figure 6.1: example of Simple Forward