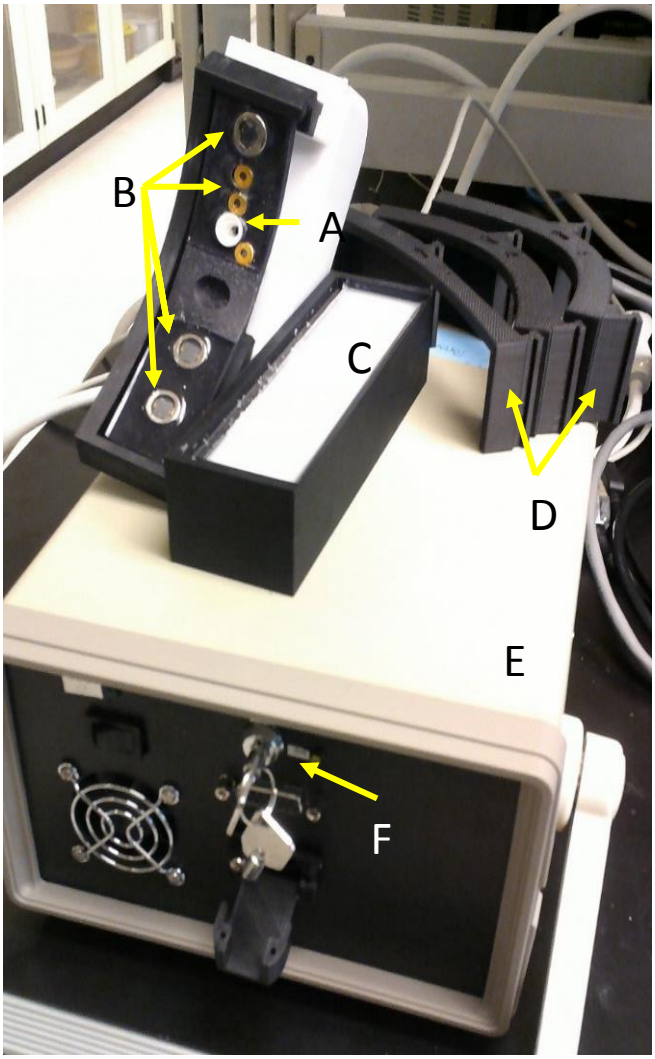
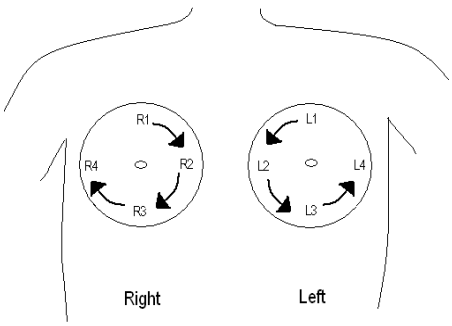


eFigure 1. The LEGACY optical spectroscopy device comprises a light emitting source cone (A) emitting sequentially the light from 13 laser diodes (wavelength from 635 to 1050nm); and six photodetectors (B) which quantify the diffuse reflectance at known distances (from 10 to 75 mm) from the light emitting cone. The light responsivity of the device is calibrated daily using light scattering standards (C).

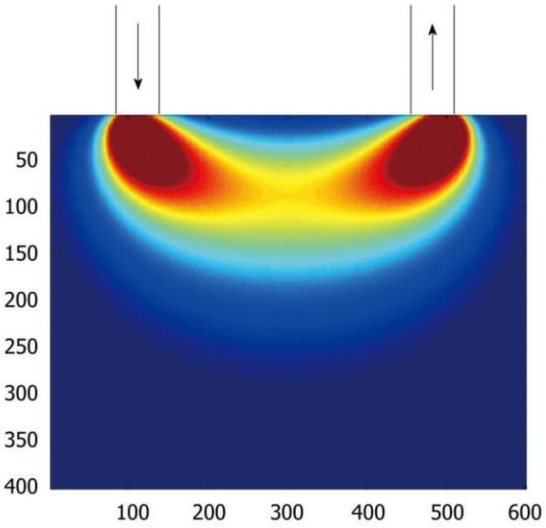
The changing curvature of the device is matched by 5 different preformed shapes (D) holding the light source and detectors at known distances on the curved surface. Light emission and detection quantification are maintained by the controller (E). To preclude unauthorized access to the light source the system is secured by a key switch (F).

For optical spectroscopy measurements, the source and reflectance detectors are held by the participant or a parent onto the breast, whereby the nipple is placed into the central depression below the light source.

Four different alignments are used for each breast, obtaining a total of 24 diffuse reflectance measurements of the breast as shown in eFigure 2. Sample calculations of the optically interrogated tissues are shown in eFigure 3.



eFigure 2. The left shows the LEGACY optical spectroscopy device as it would be applied to breast in direct contact with the skin. The right shows the sequence of the diffuse reflectance measurements collected from each breast, covering 4 quadrants of each breast.



eFigure 3 shows the photon path density between a source (left) and detector (right) separated by 40 mm. Red indicates high photon density and dark blue indicates very low photon density. As shown, the majority of the detected photons did not penetrate more than 10-15 mm into the tissue (size of simulation is 40mm by 60 mm). While a high photon density is noted in the 5 mm proximal to the source and the detector, the majority of the photon path density is beyond 5 mm depth and beyond the pigmented layers of the skin. Hence, the technology is independent of the skin type. One should note also that melanin mediated light absorption and scattering is greatly diminished beyond 700 nm.