What is OCT?

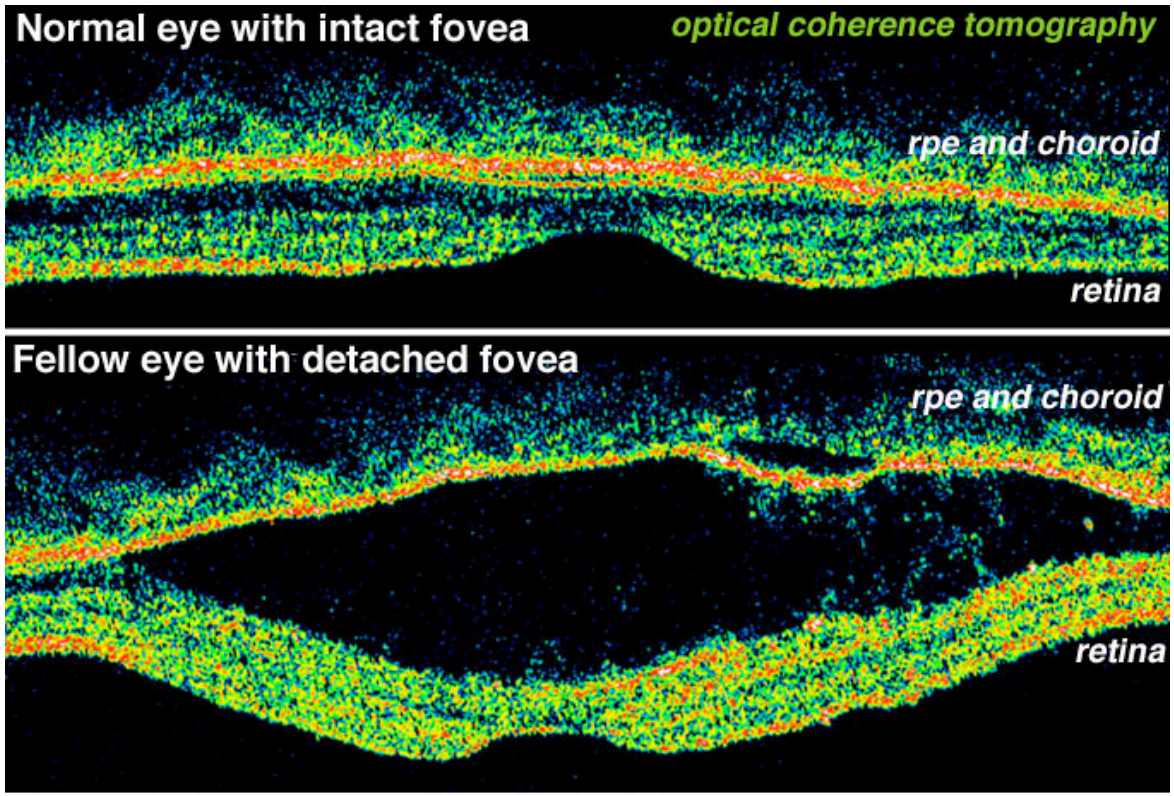
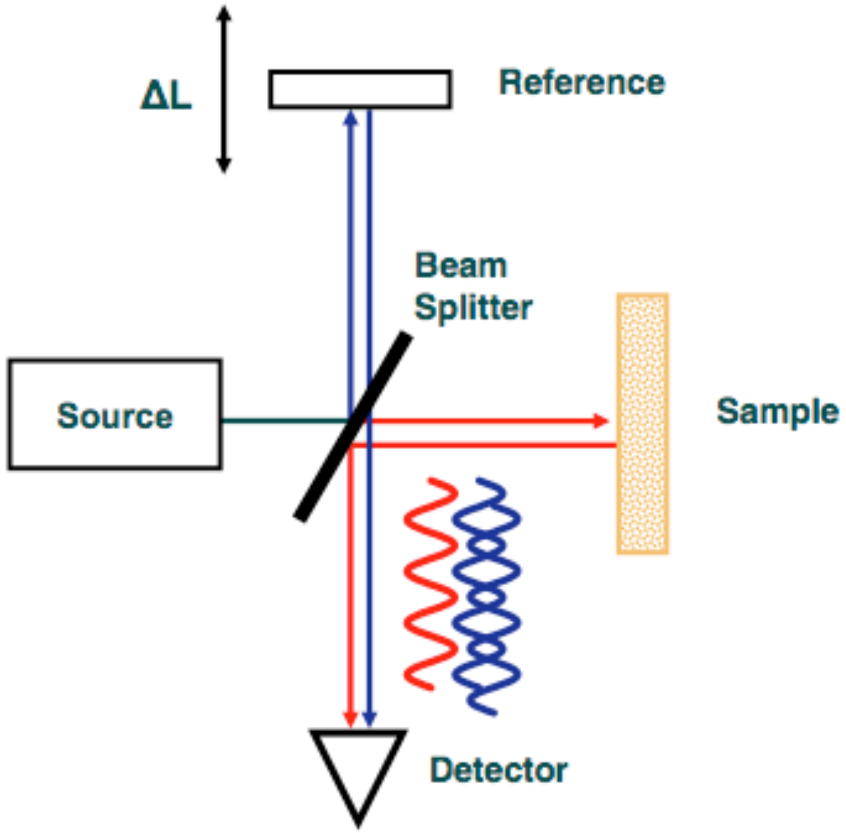
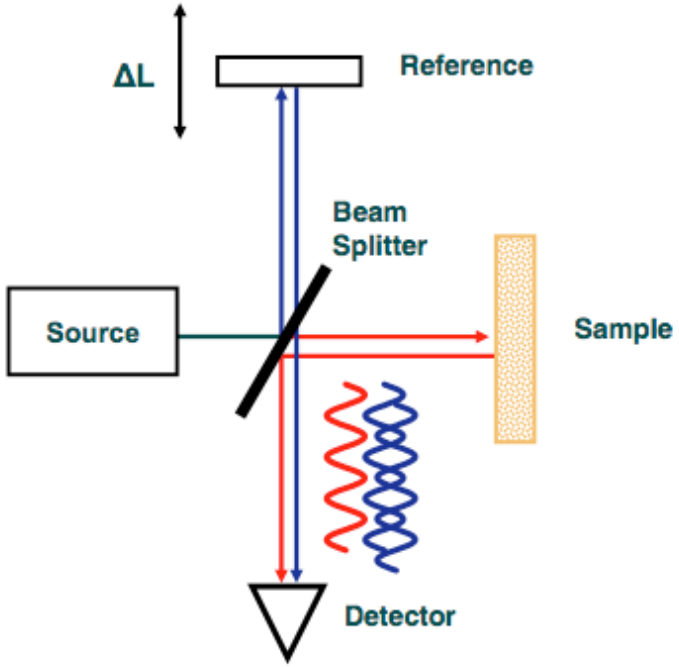


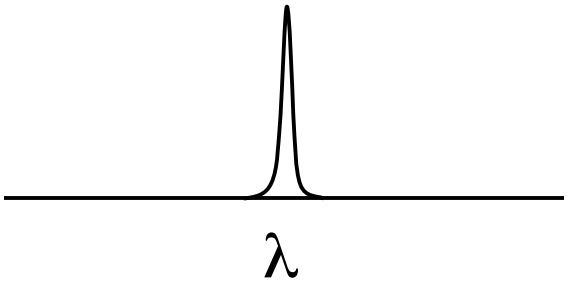
Fig. 31b. Optical coherence tomography (OCT) images of the patient's normal macula and of the retina in the other eye with the macular detachment.

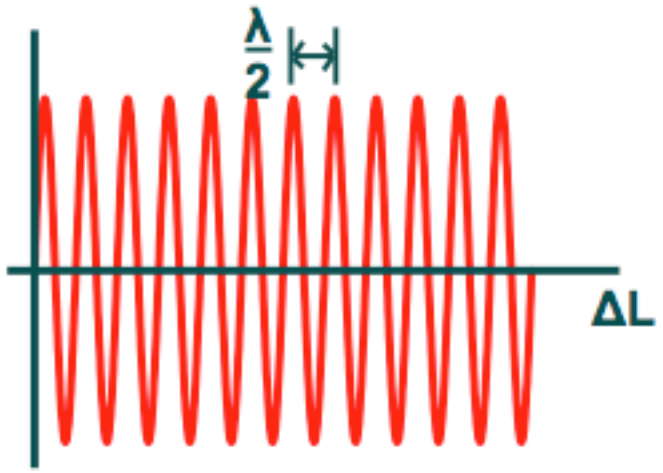
Interferometer



Sample: a mirror

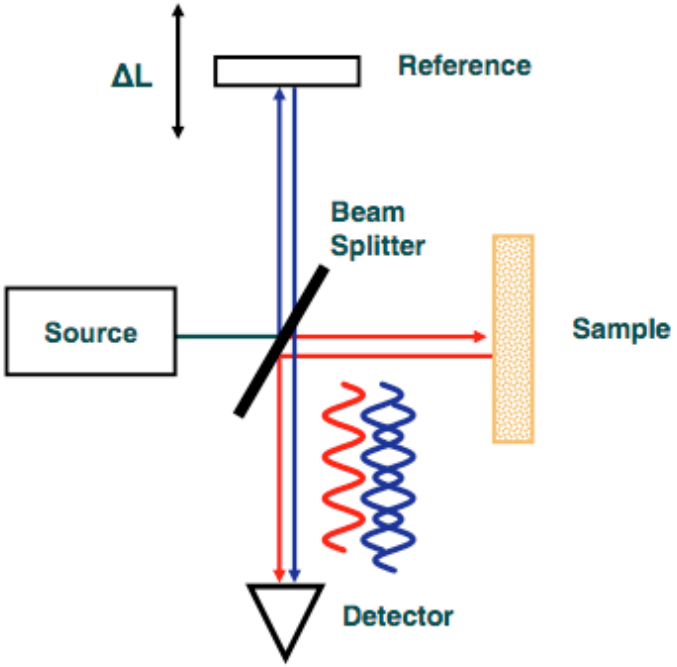


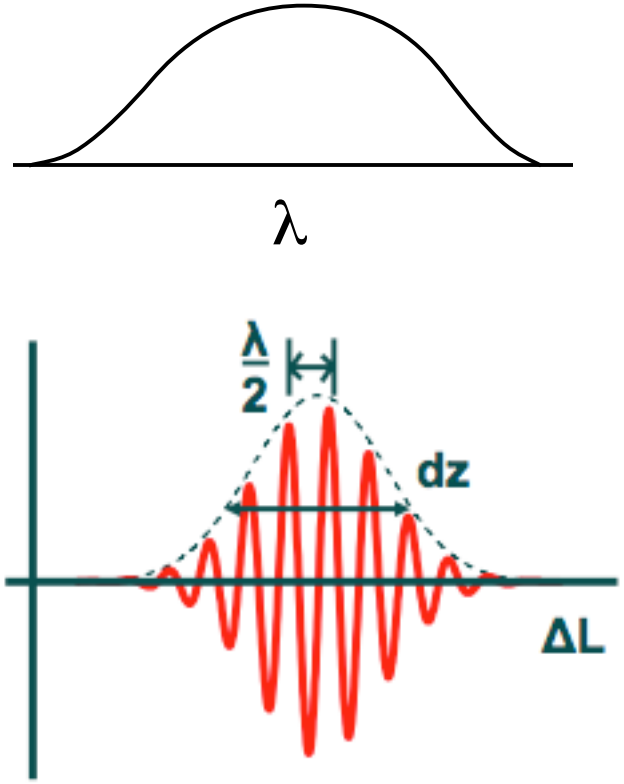




$$I = k_1 I_S + k_2 I_S + 2\sqrt{(k_1 I_S) \cdot (k_2 I_S)} \cdot Re\left[\gamma(\tau)\right] \qquad (1)$$

Bandwidth

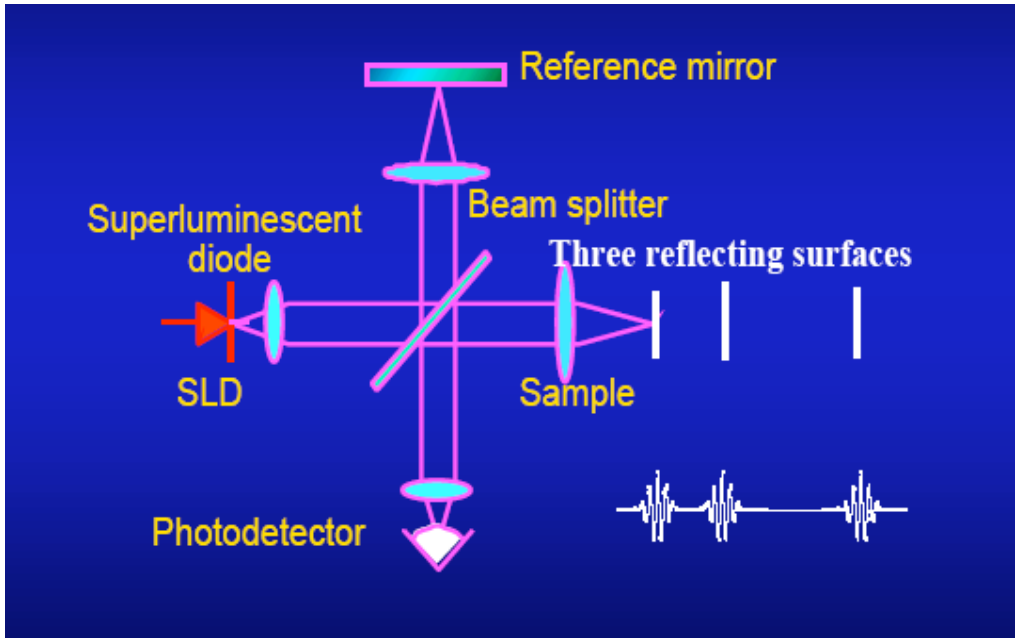


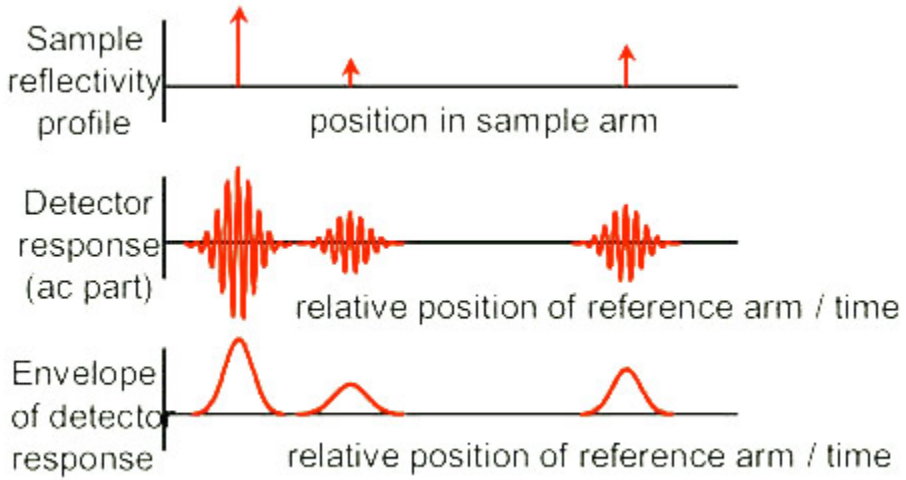


$$I = k_1 I_S + k_2 I_S + 2\sqrt{(k_1 I_S)\cdot(k_2 I_S)}\cdot Re\left[\gamma(\tau)\right] \qquad (1)$$

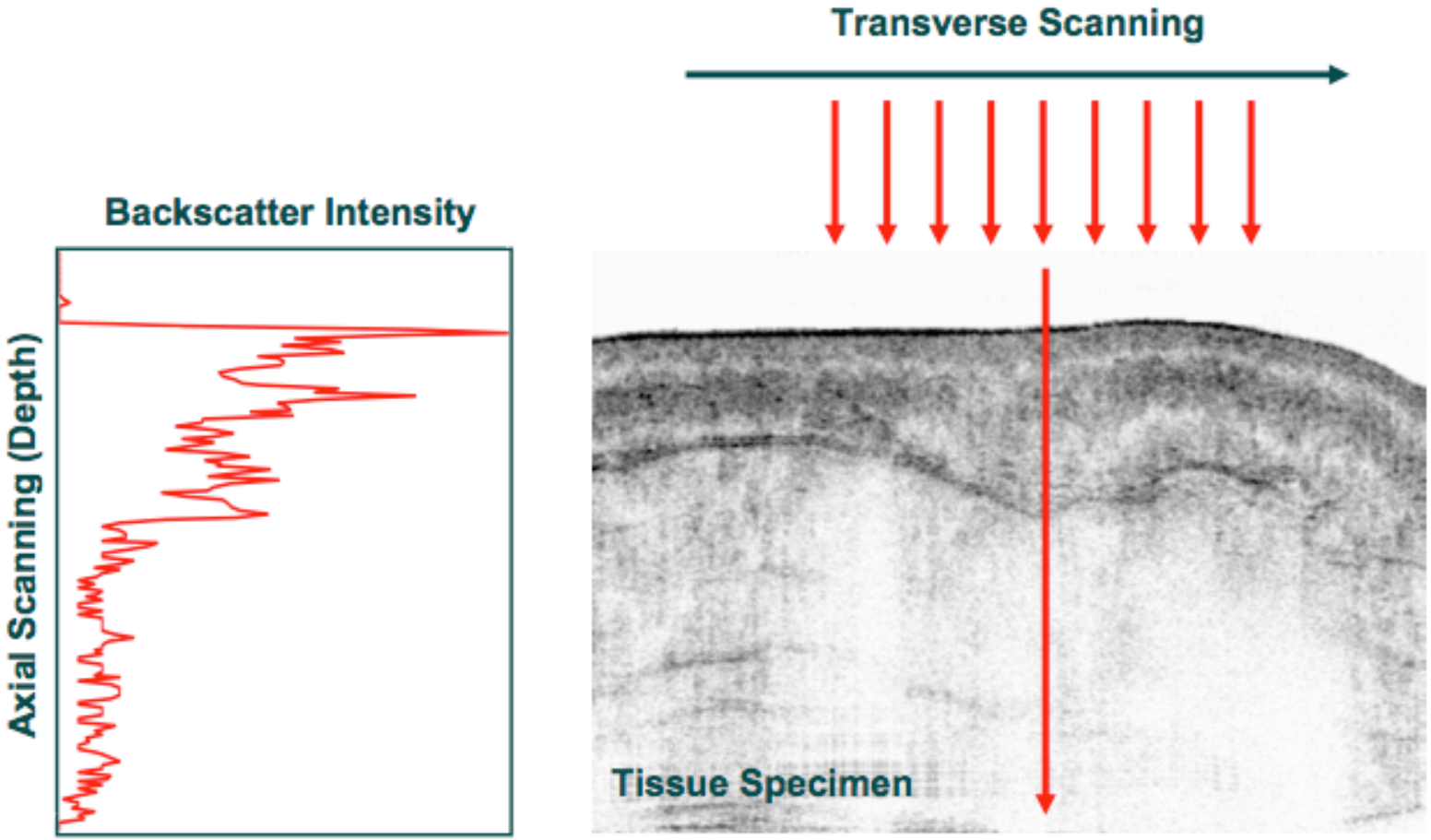
$$\gamma(\tau) = \exp\left[-\left(\frac{\pi\Delta\nu\tau}{2\sqrt{\ln 2}}\right)^2\right]\cdot\exp\left(-j2\pi\nu_0\tau\right) \qquad (2)$$

Light echoes





Scanning


Backscatter Intensity
Axial Scanning (Depth)
Transverse Scanning
Tissue Specimen

Spatial resolution

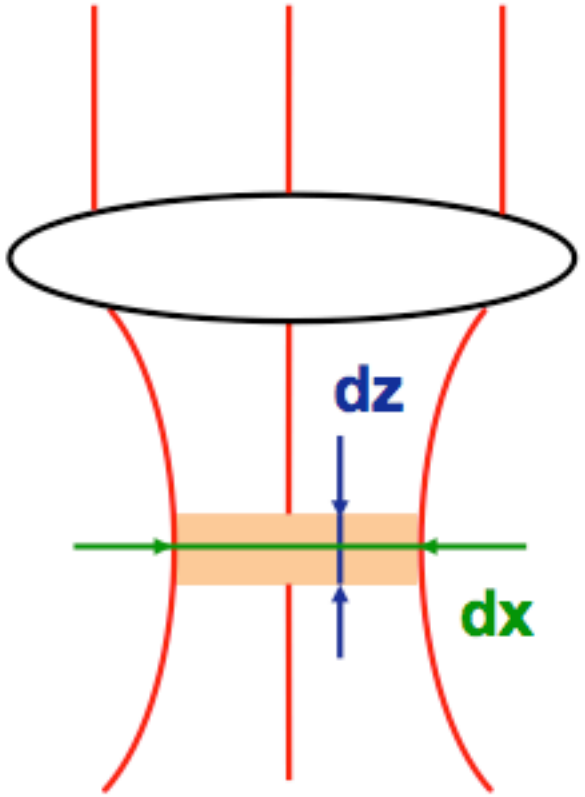
Resolution:

•Axial:

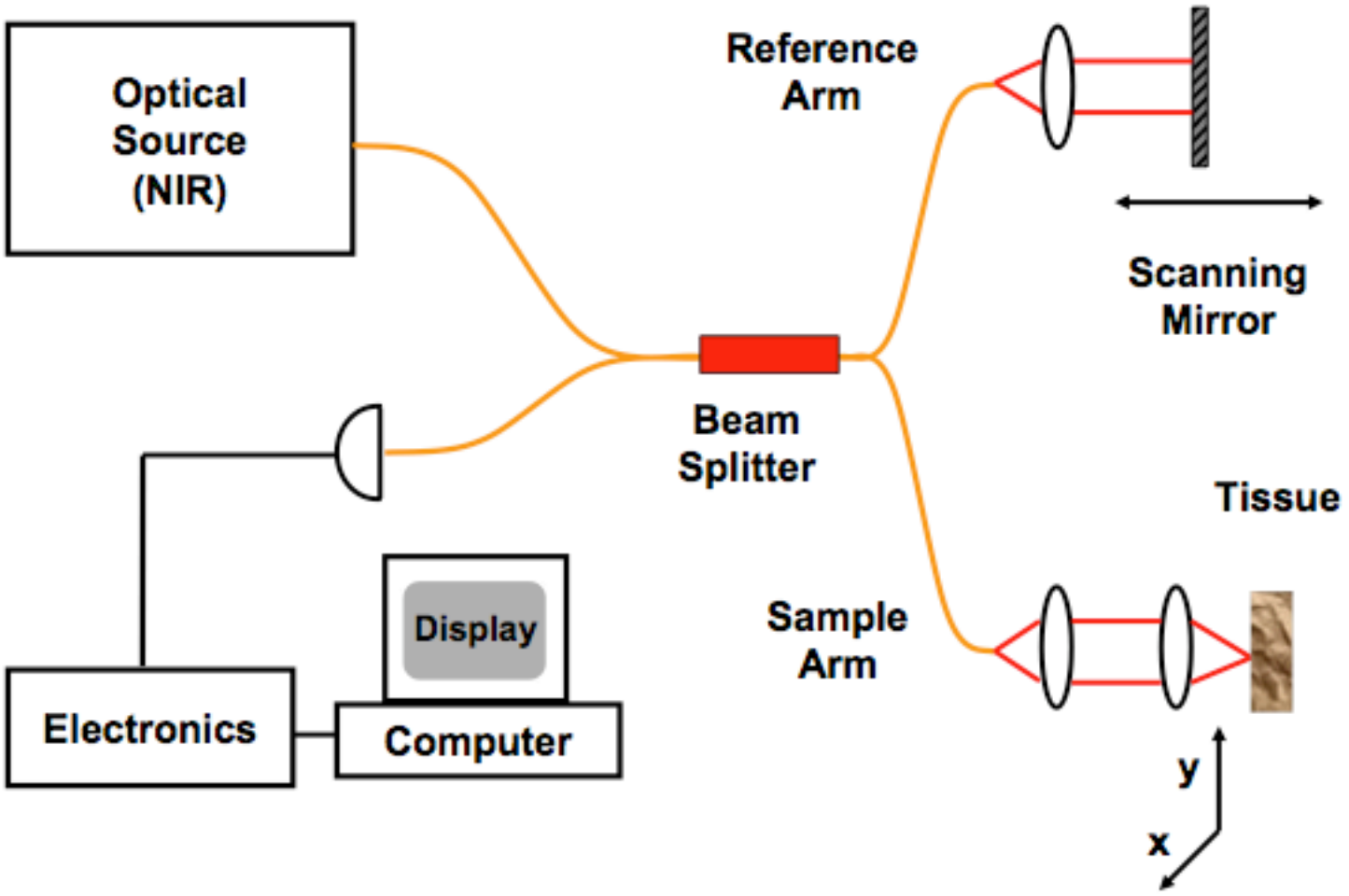
$$dz = \frac{2\ln(2)}{\pi}\frac{\lambda_o^2}{\Delta\lambda} = 10\mu m$$

•Transverse:

$$dx = 2w_o = \sqrt{\frac{2b\lambda}{\pi}} = 20\mu m$$

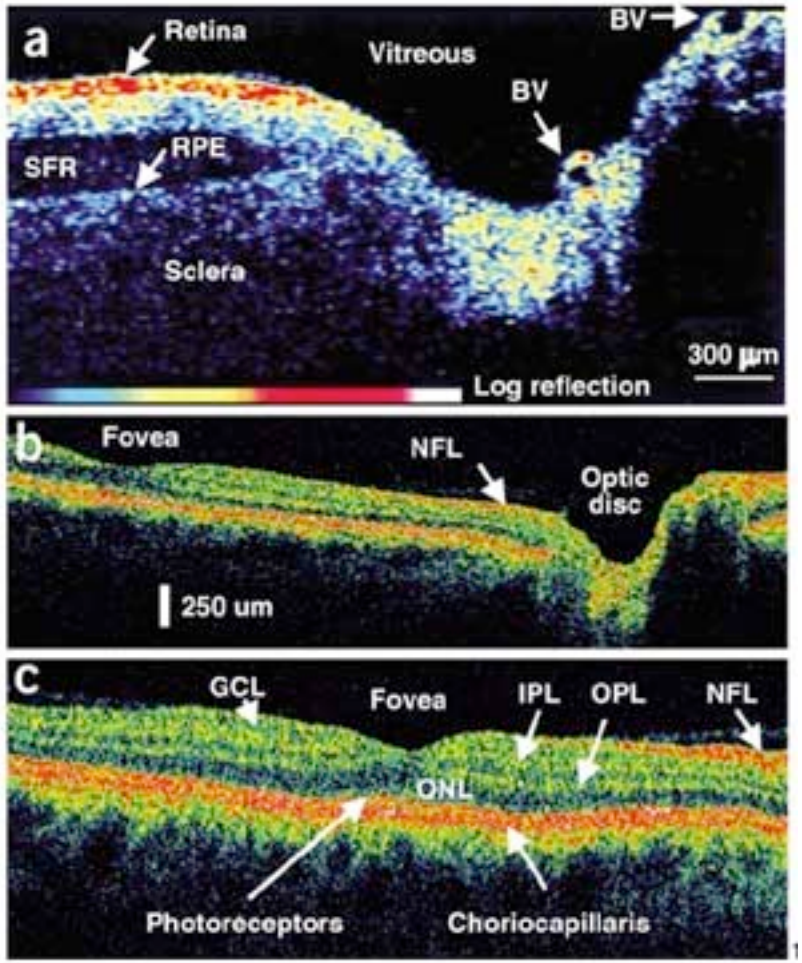


Typical setup

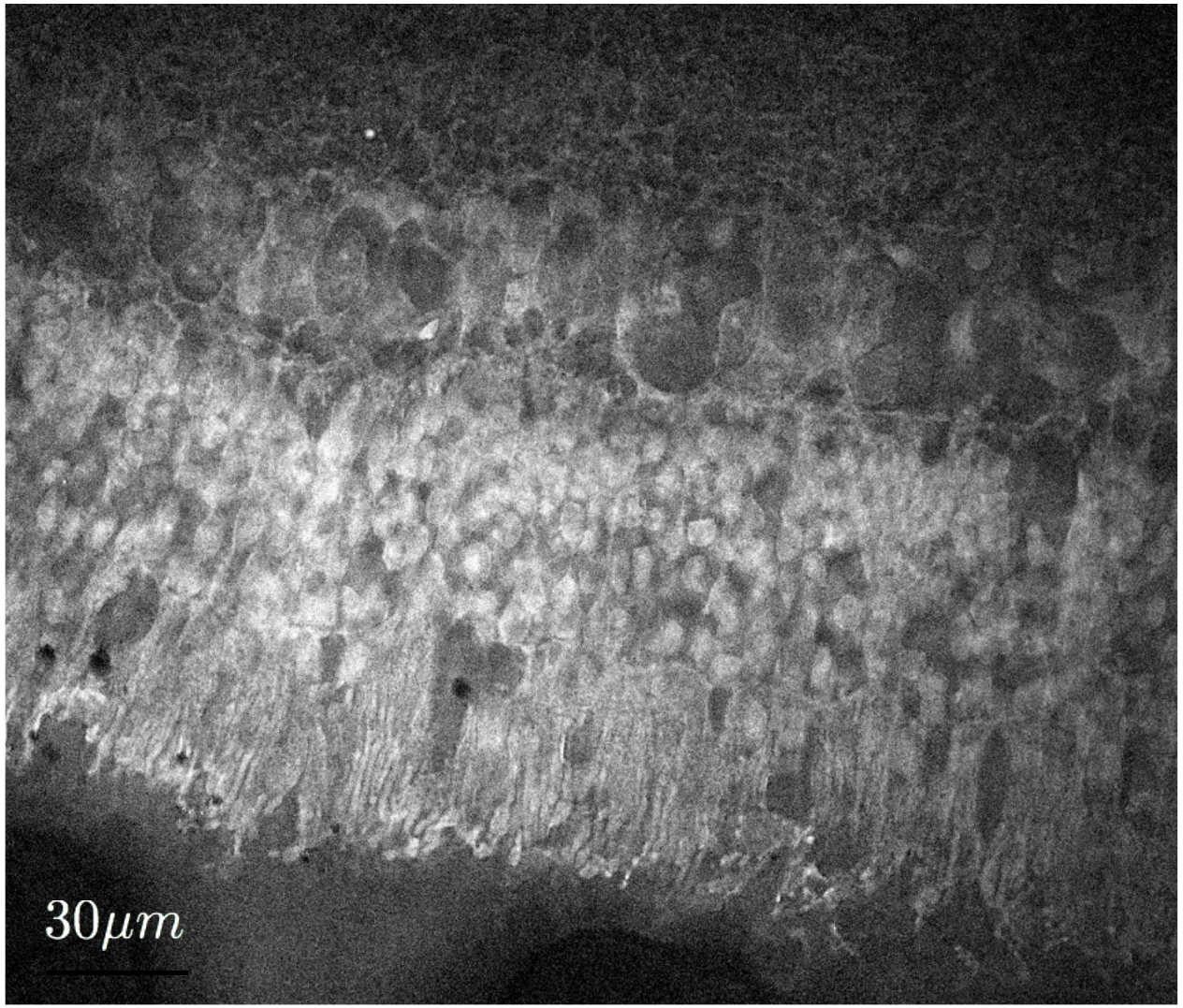


OCT Applications

Retina imaging



Quick CARS example



OCT Applications

Cardiovascular OCT