

# 光學同調斷層掃瞄 Optical Coherence Tomography (OCT)

第七組

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(演講順序)

# Outline

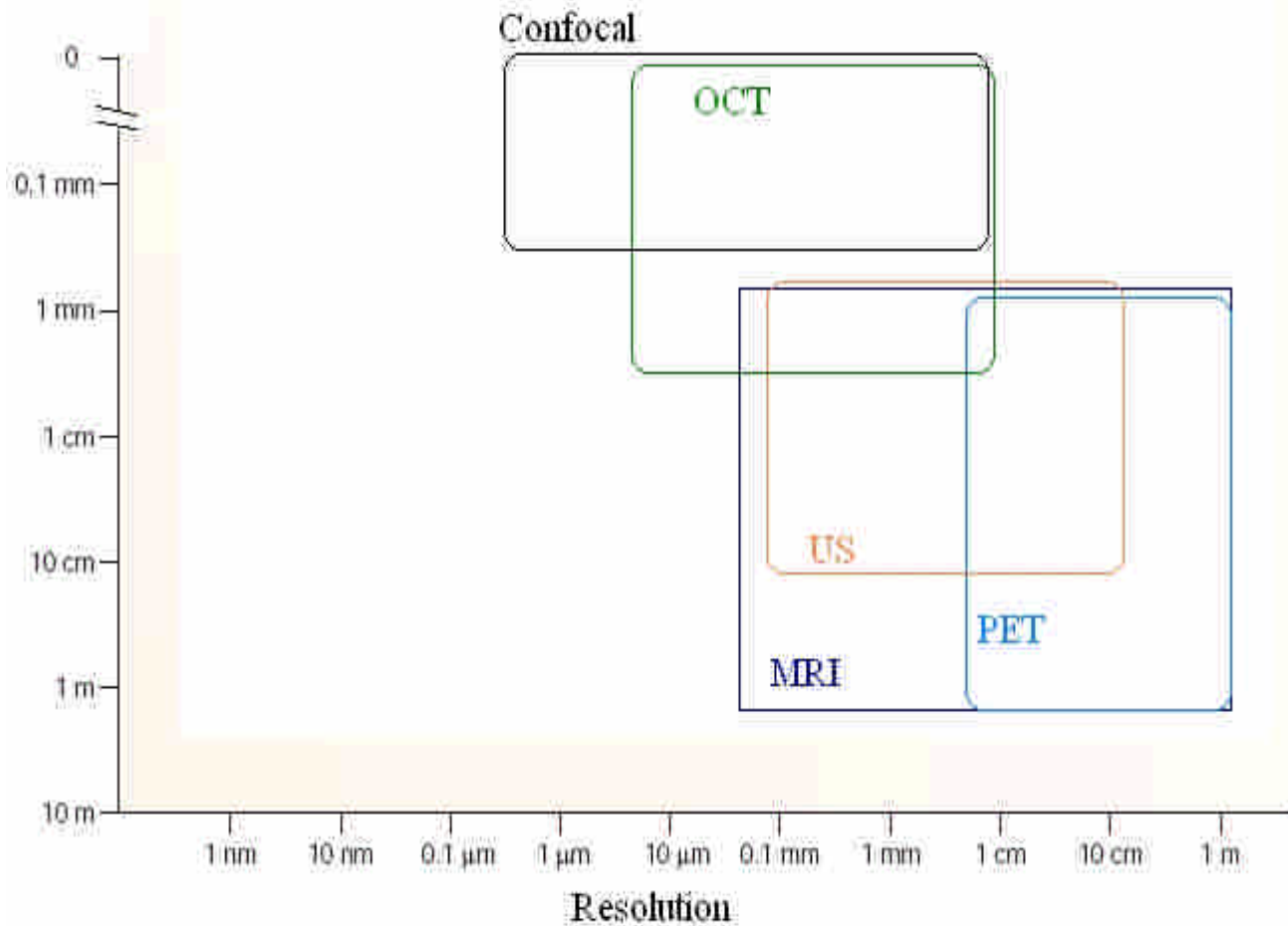
- OCT的特性
- OCT的原理---邁克森干涉儀（*Michelson Interferometer*）
- 儀器與經驗分享

# OCT的特性

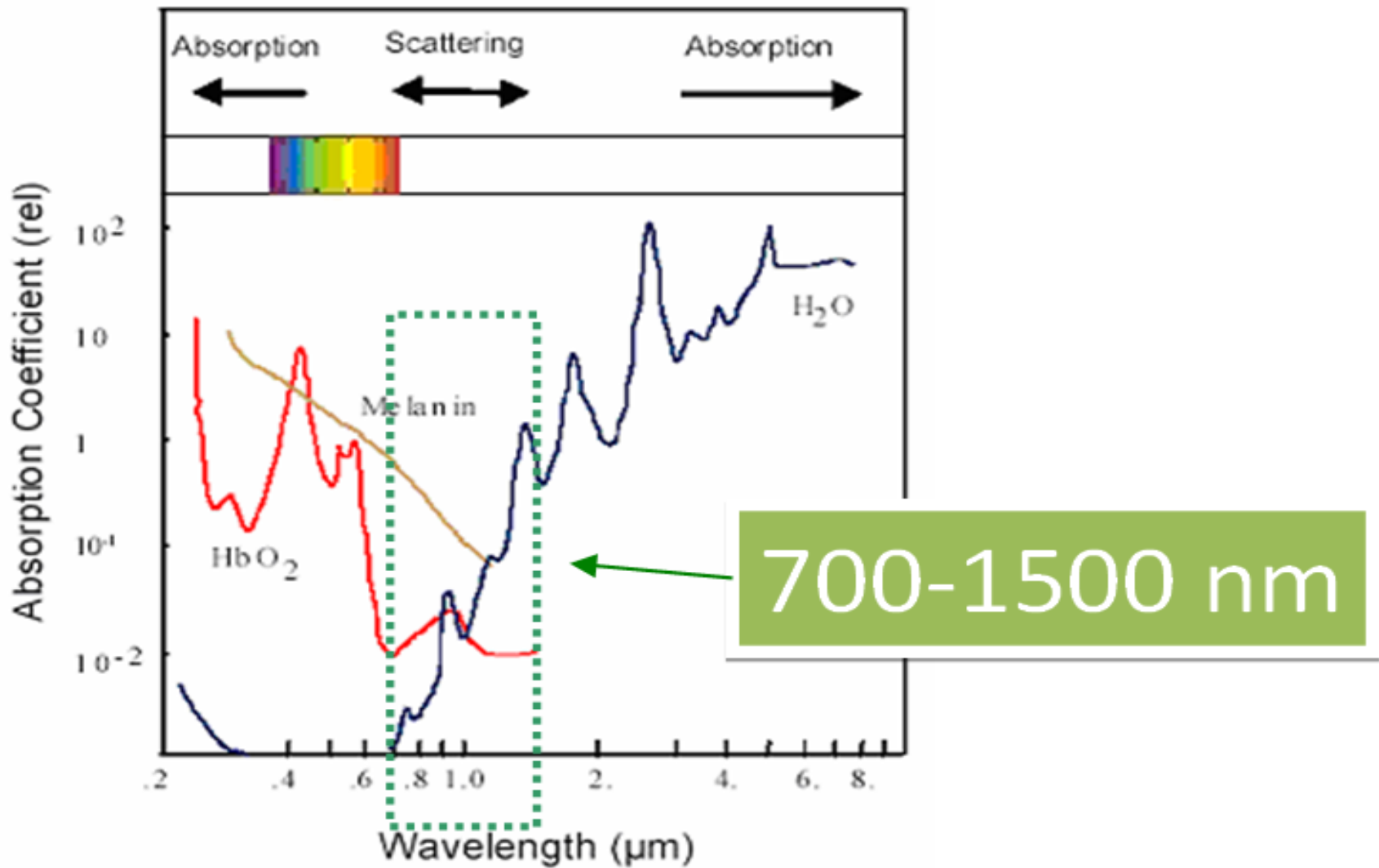
主要應用：

- 人體黏膜組織之早期癌症檢測 (直腸癌、皮膚癌以及鼻咽癌)
- 眼科，做為視網膜病變以及角膜檢測。

OCT:非侵入式、高解析、高速掃瞄及成像

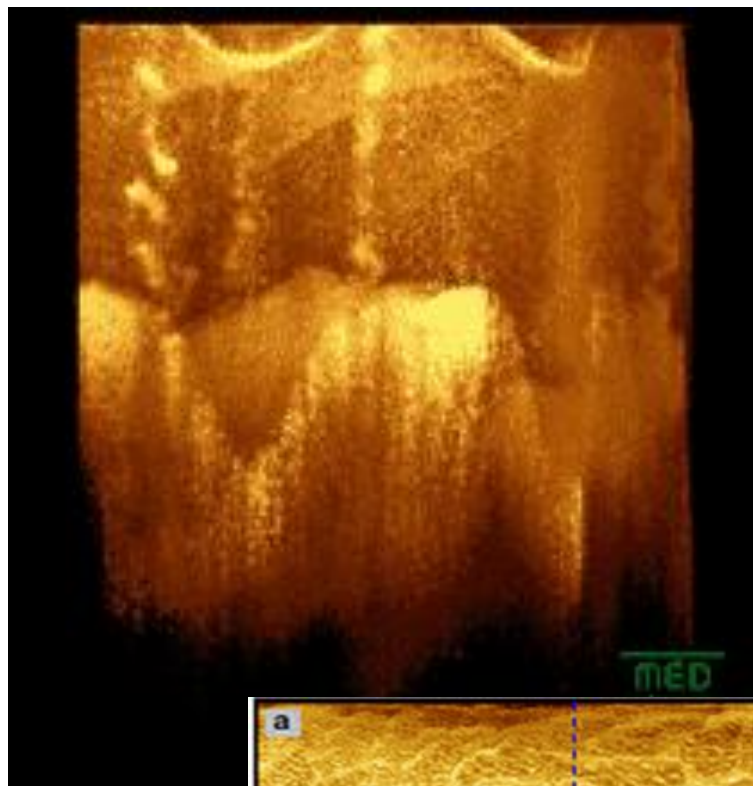


皮下幾mm & 高解析度

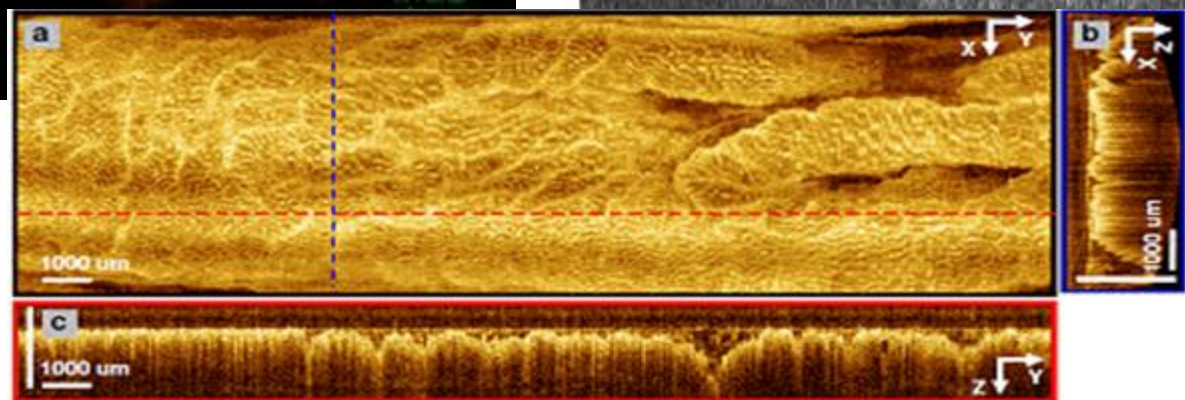
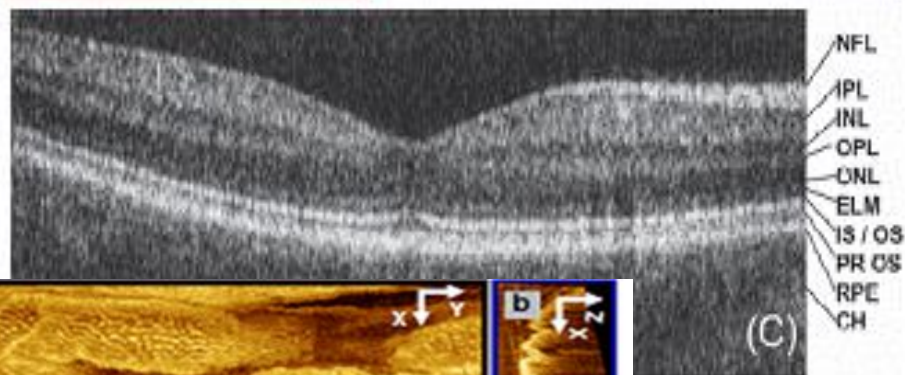
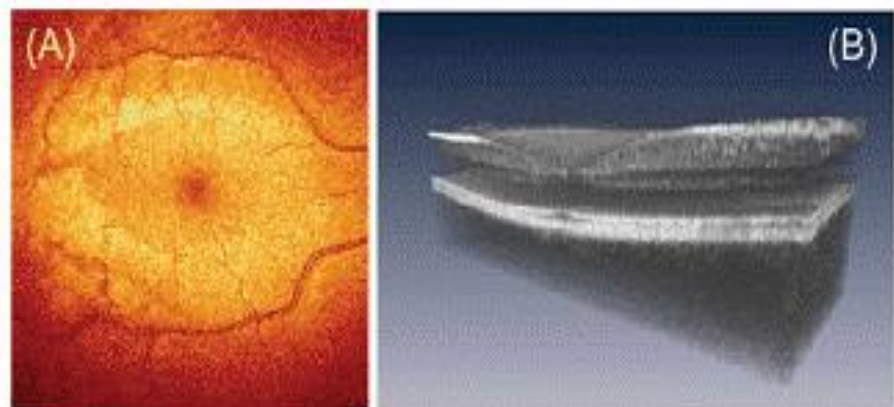


取被吸收比率最少的那個頻段

# 手指

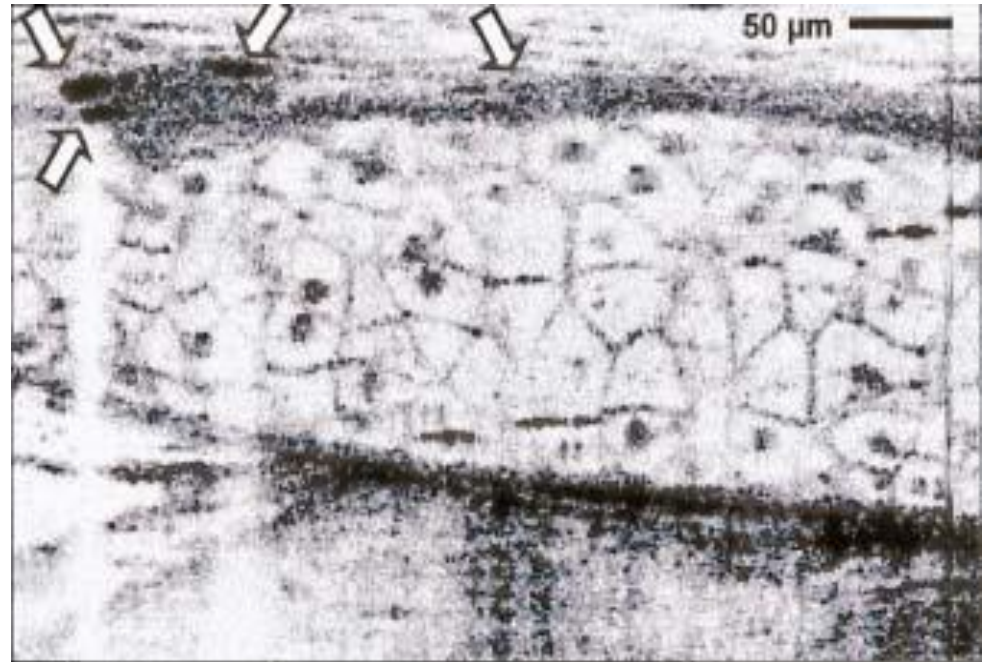
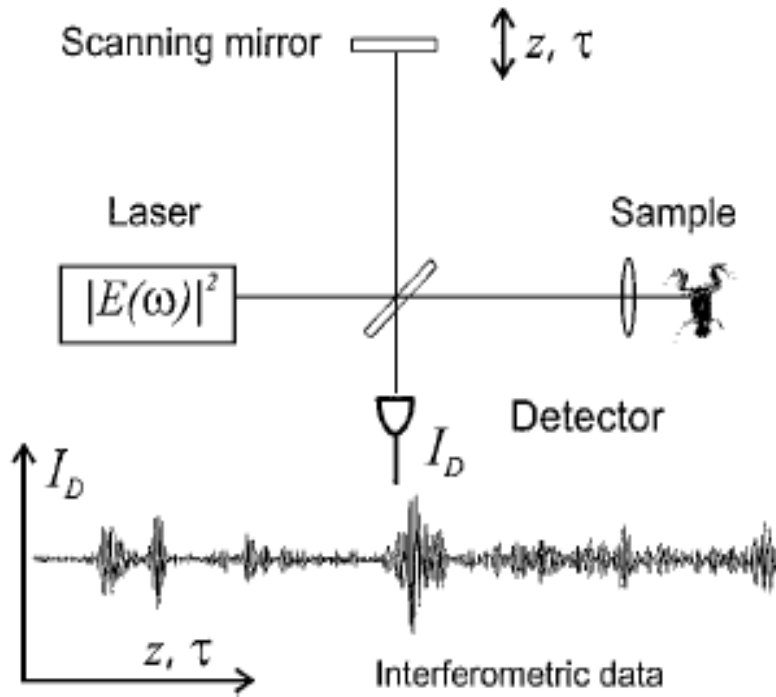


# 視網膜

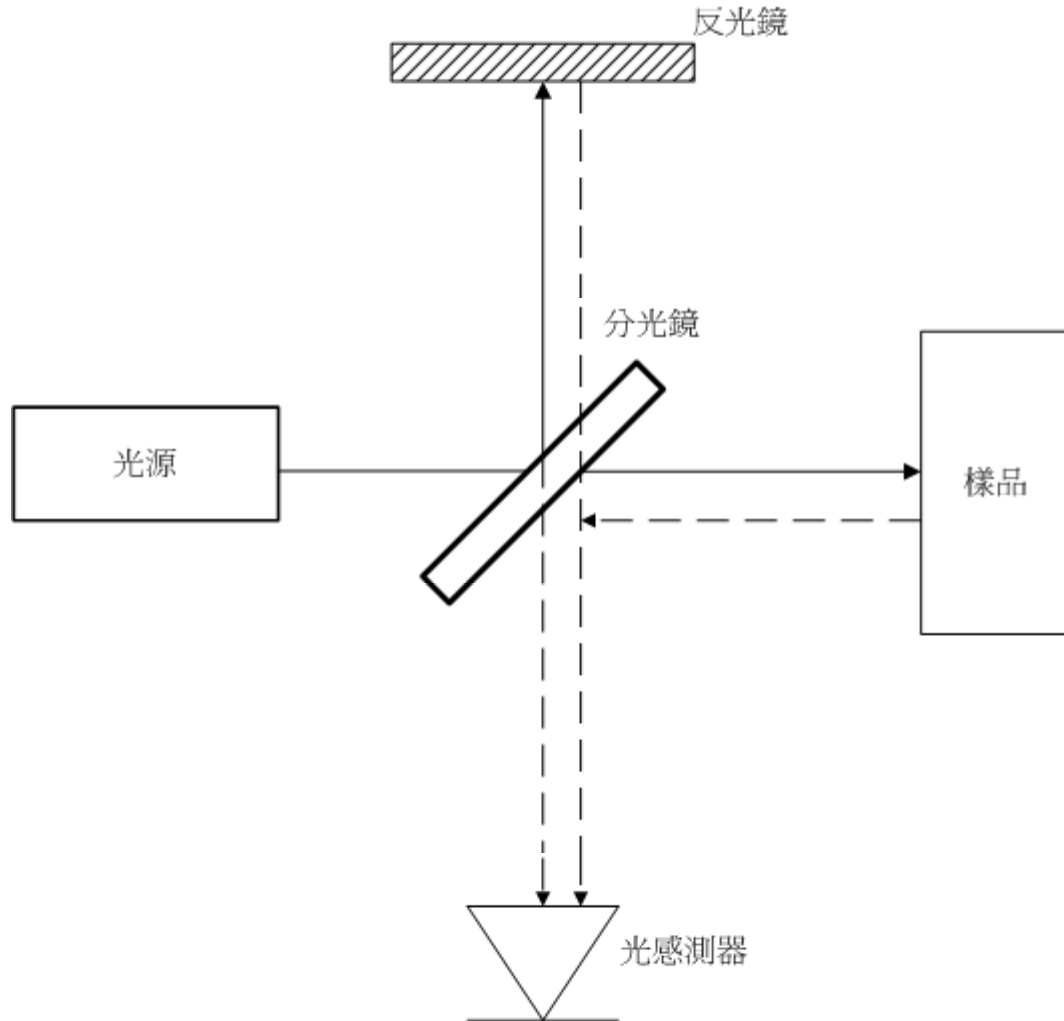




# 非洲牛蛙蝌蚪的組織的二維斷層影像



# OCT原理:邁克生干涉儀



# 使用光源

- 寬頻光源
- 半導體光源

# 爲何選用寬頻寬光源?

同調長度 (Coherence length)  $l_c$

$$l_c = \frac{2c \cdot \ln 2}{\pi} \cdot \frac{1}{\Delta\nu} \approx 0.44 \frac{\lambda_0^2}{\Delta\lambda}$$

$\Delta\lambda$  is the spectral width of the source.

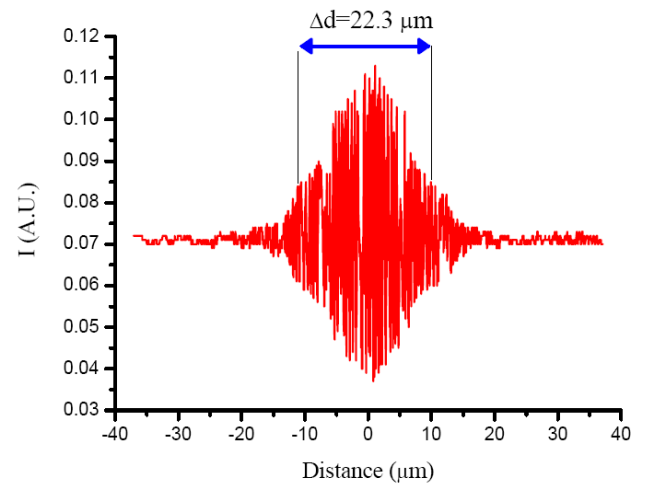
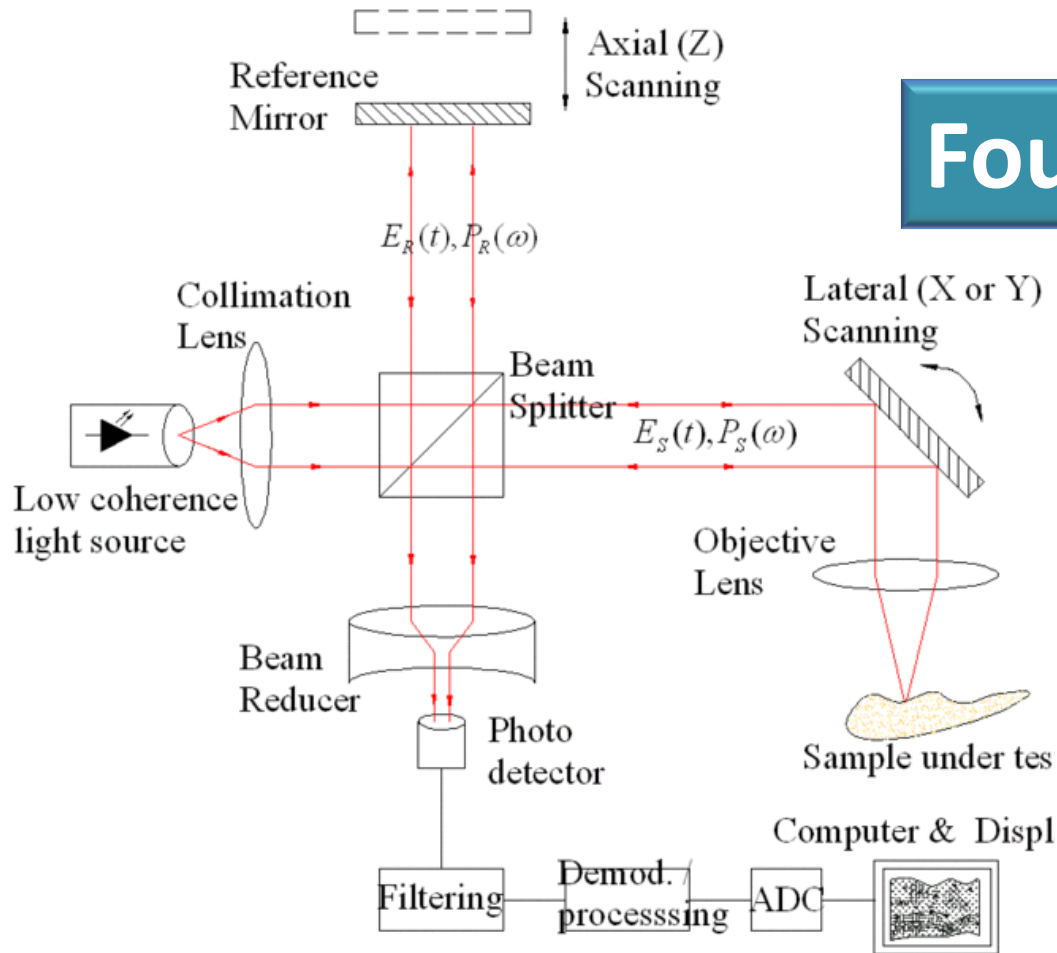
而光源的同調長度和光源的頻寬成反比，  
所以頻寬越寬的光源其同調長度越短。

# 爲何同調長度要低(低同調)

- 如果光源的同調長度愈長，代表干涉時兩道光束的光程差可以相差很大也會有干涉現象，反之如果光源的同調長度很短的話，那只有在兩道光束幾乎沒光程差的情況下才會形成干涉。
- 低同調→空間上的解析能力好

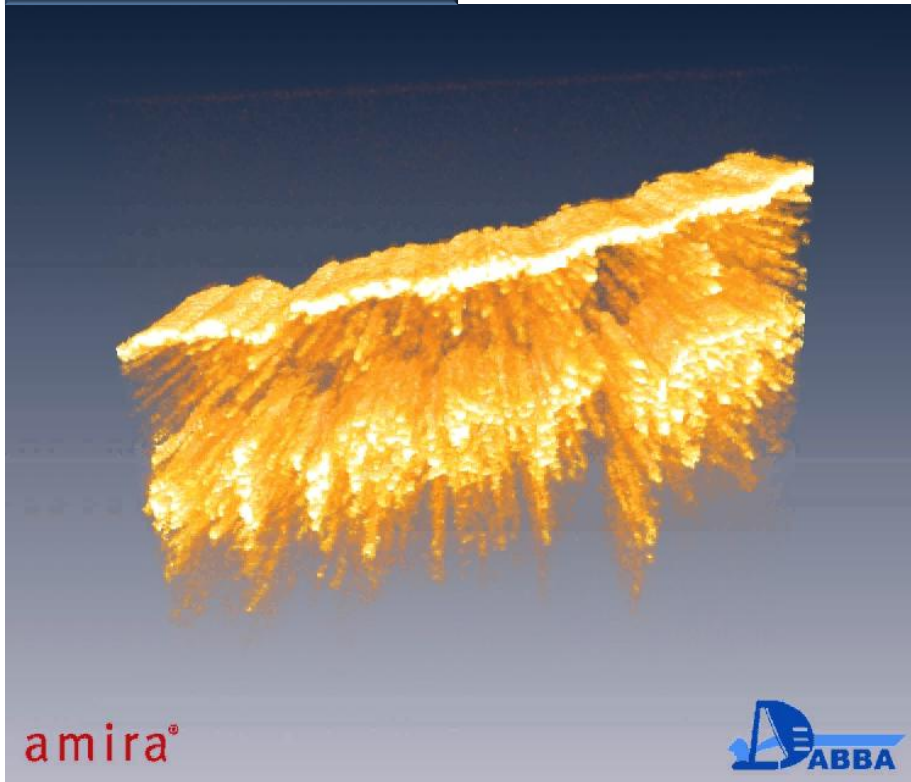
- 測量光進入物質或生物組織後所產生的背向散射光而得到的組織影像。
- 當反射鏡做連續掃描時，可以量測到一連串的干涉波包，這些波包代表樣本在不同深度的介面之背向散射光的干涉結果，因此可以得到待測**樣本斷層結構**的厚度資訊。

# Fourier transform



# 3D images

Normal mucosa

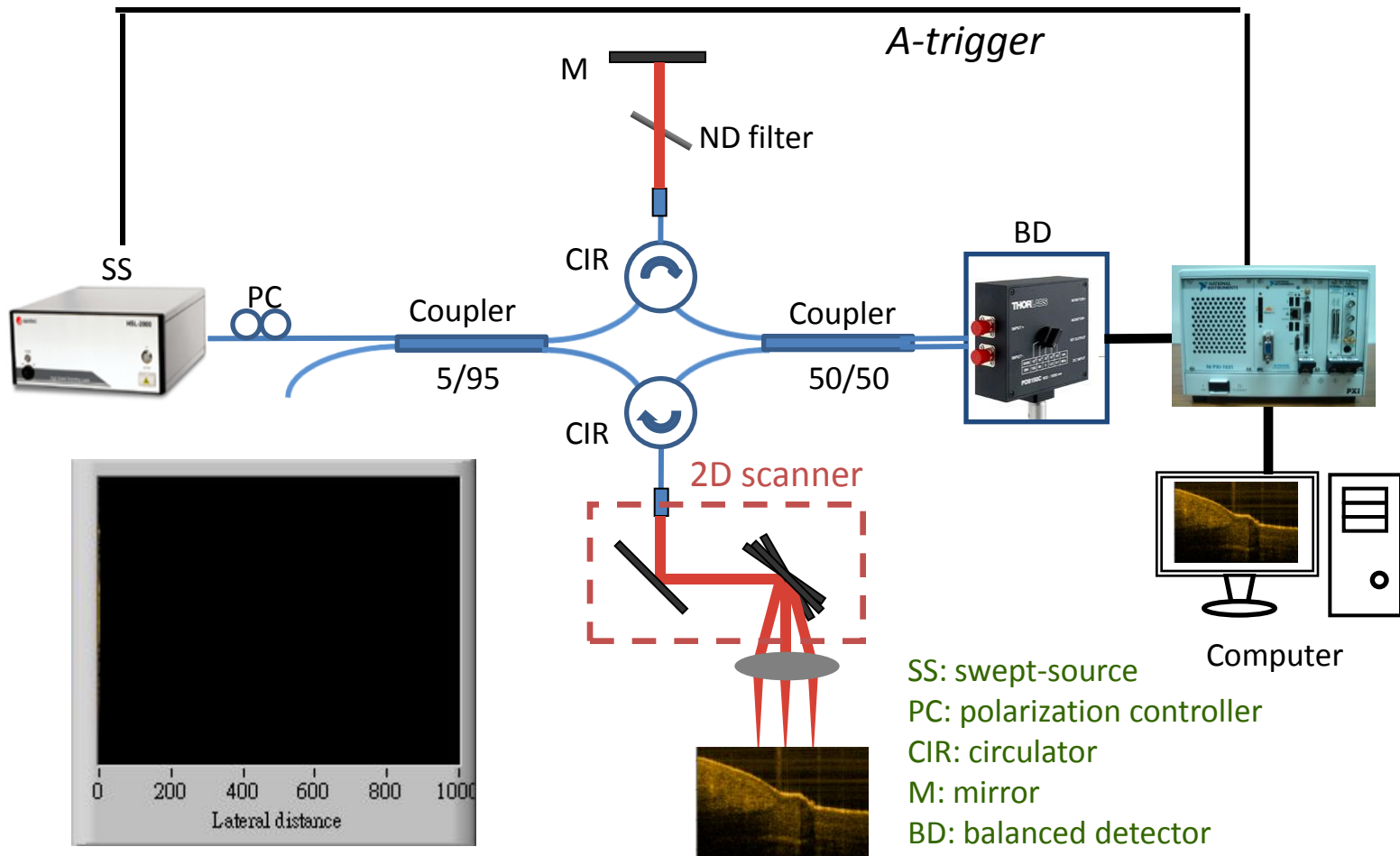


Cancerous mucosa





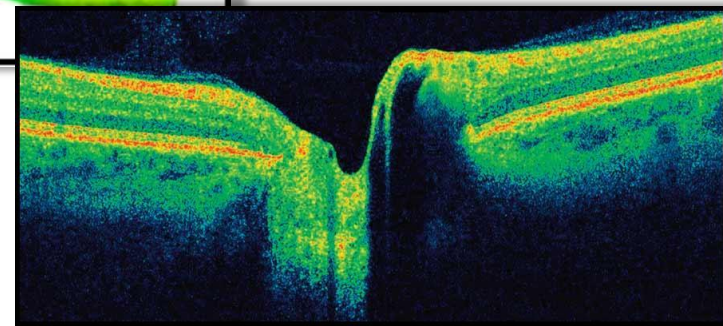
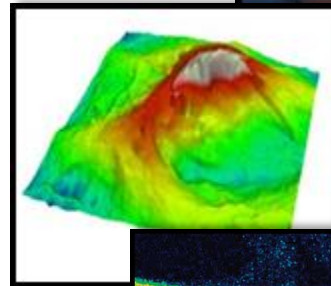
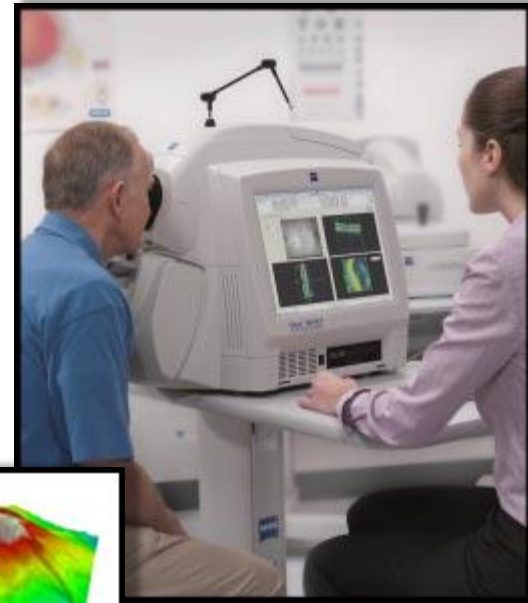
# OCT system



- Time-domain OCT
- **Fourier-domain OCT**
- Doppler OCT

# Ophthalmology

## Retina Examining

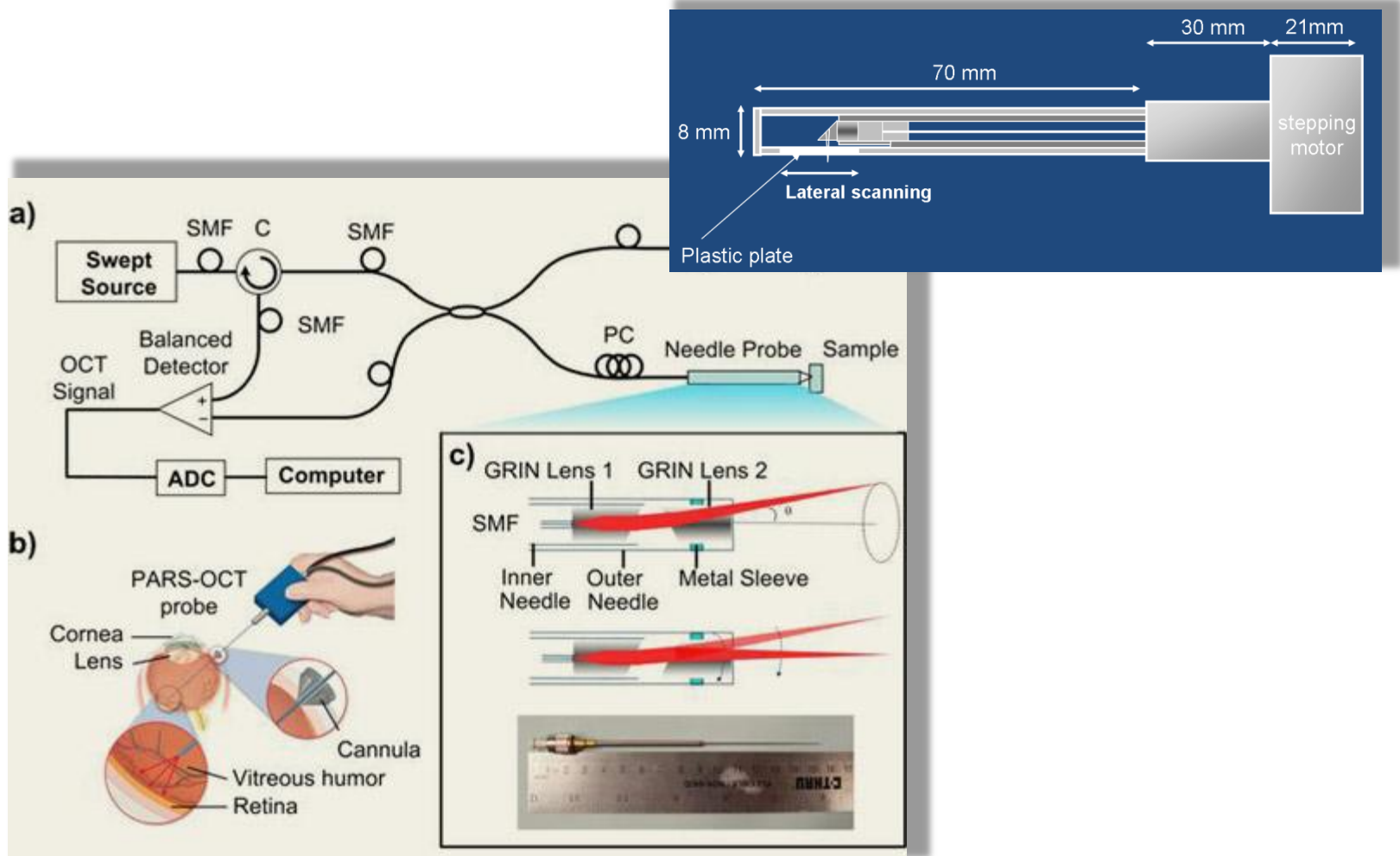


# Stomatology

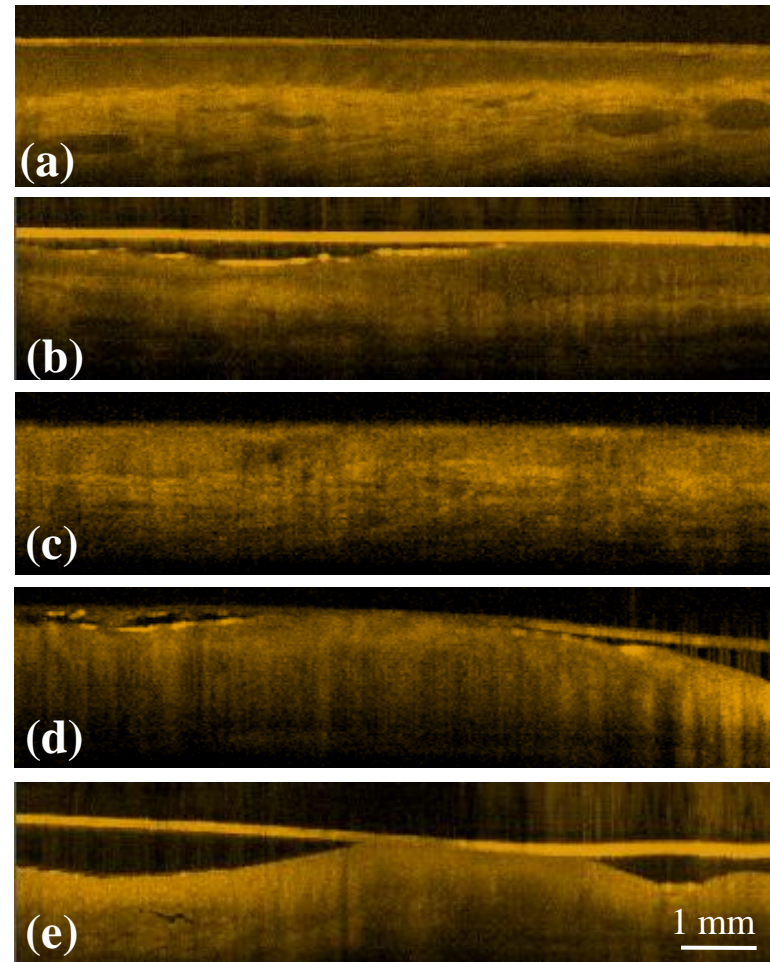
## Oral Cancer Diagnosis



# The Handpiece



<b>Normal</b>
<b>Epithelial hyperplasia</b> ✓Verrucous hyperplasia ✓Hyperkeratosis
Mild dysplasia (輕度上皮變異)
Moderate dysplasia (中度上皮變異)
Severe dysplasia (重度上皮變異)
<b>Carcinoma in situ</b> (原位癌)
<b>Squamous cell carcinoma</b> (鱗狀細胞癌)



# Oral Precancerous & Cancerous Images

