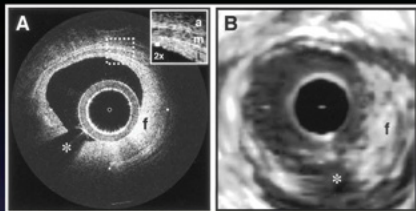


# 2G-OCT: Recent Advances and Future Direction

*Wang-Yuhl (William) Oh, Ph.D.*

Associate Professor, Dept. of Mechanical Engineering, KAIST  
Harvard Medical School, Massachusetts General Hospital

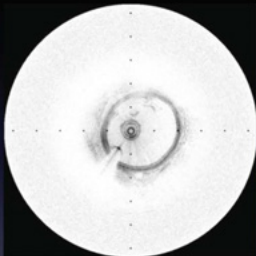
# 1G-OCT: First Intracoronary OCT in Living Patients



*I.K. Jang, B.E. Bouma, S.J. Park, S.W. Park, K.B. Seung, G.J. Tearney, et al., JACC 39, 604 (2002).*

- 42 ex-vivo imaging: Plaque classification
- 10 living patients
- ~10  $\mu m$  resolution

## 2G-OCT: First *In-Vivo* Comprehensive Coronary Microscopy



- 2G-OCT: New light source & New detection scheme
- > 10 X faster imaging
- 4~5 s for > 5 cm swine coronary artery imaging *in vivo*

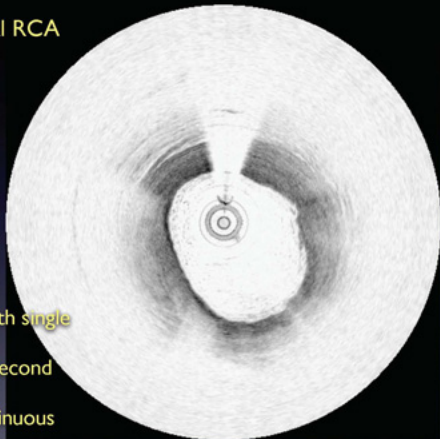
W.Y. Oh, et al., *Appl. Phys. Lett.* **88**, 103902 (2006).



S.H. Yun, W.Y. Oh, et al., *Nature Medicine* **12**, 1429 (2006).

# First In-Man Comprehensive Cardiovascular Imaging

Distal RCA

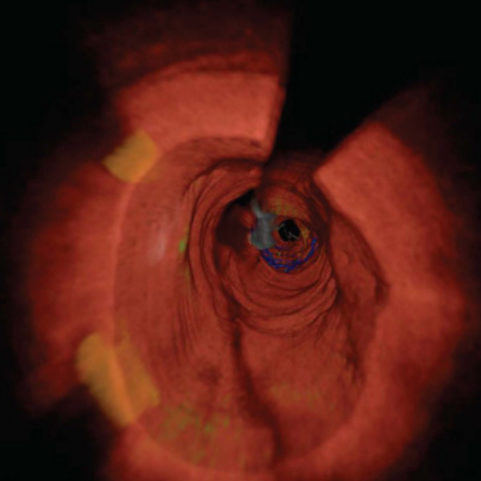


- 7 cm pullback with single saline flush
- 110 frames per second for 4 sec
- > 700 MB/s continuous acquisition
- 2 - 3 GB/vessel

G.J. Tearney, W.Y. Oh, et al., *JACC Imaging*, 1, 752 (2008).



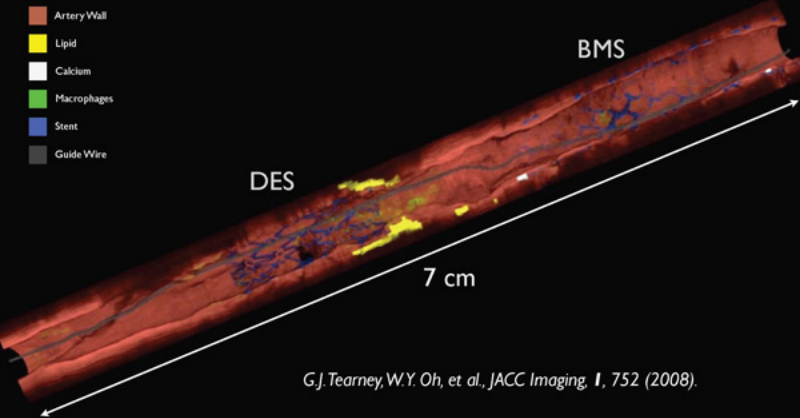
- Artery Wall
- Lipid
- Calcium
- Macrophages
- Stent
- Guide Wire



Case 2 Fly-through of human RCA in vivo

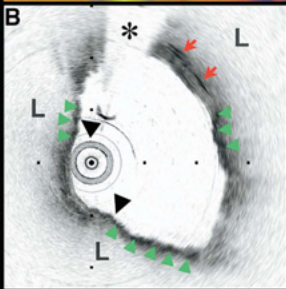
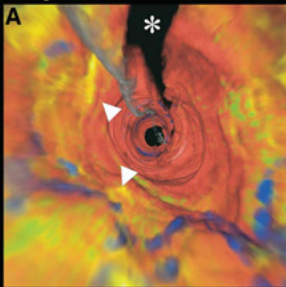
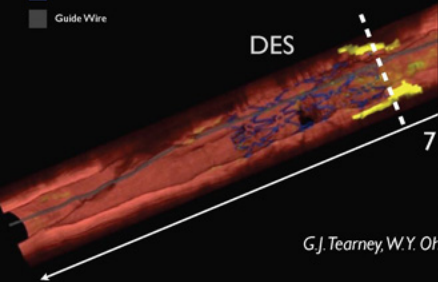


# Cutaway view

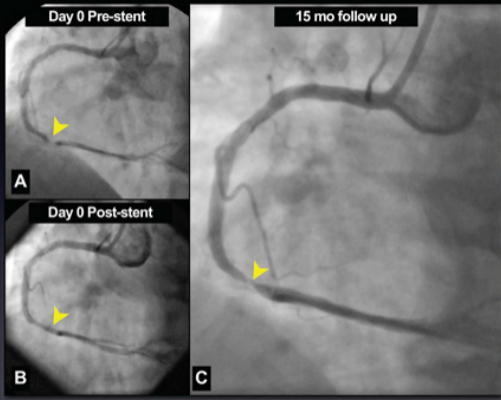


# Cutaway

- Artery Wall
- Lipid
- Calcium
- Macrophages
- Stent
- Guide Wire

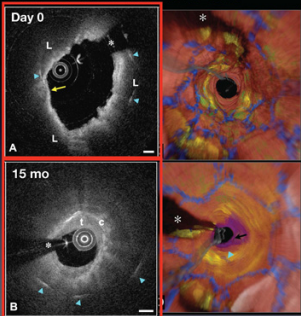


# Late Stent Thrombosis





# Late Stent Thrombosis

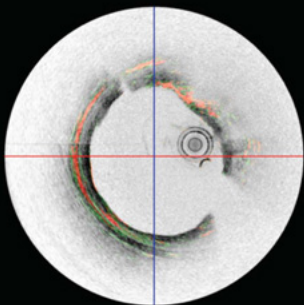


# Performance Enhancement

	1G-OCT (LightLab M2/M3)	2G-OCT (LightLab C7)	2G-OCT (KAIST)
Resolution ( $\mu\text{m}$ )	15-20 (axial) 20-40 (lateral)	15-20 (axial) 20-40 (lateral)	15-20 (axial) 20-40 (lateral)
A-scan rate (kHz)	5	50	240
Frame rate (fps)	15-20	100	100 ~ 200
Lines/frame (n)	250	500	1000 ~ 2000
Scan diameter (mm)	7	10	16
Functional imaging	No	No	Birefringence
Pullback speed (mm/s)	1-3	5-20	5-20

# On-Going Development

	Approach at KAIST Lab.
Resolution	En face: 20~30 $\mu m$ Depth: 3~5 $\mu m$
Speed	1000 kHz
Penetration	OCT+IVUS in single catheter
Functional Imaging	Birefringence, Spectroscopic, Molecular
LMA, Carotid Artery	Scan diameter: 20mm
CTO	Forward looking OCT catheter
User Interface	Improve user interface



- Plaque mechanical integrity
- Macrophage detection

