SENSOR NETWORKS AND DATA COMMUNICATIONS

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BIOGRAPHY

- **Dr. Yao-Chun Shen is a Senior Lecturer at Department of Electrical Engineering and Electronics, University of Liverpool since June 2007. Before that he has worked on terahertz-related technology for many years, first as a Research Associate at the Cavendish Laboratory, University of Cambridge, and then as a Senior Scientist at TeraView Limited, Cambridge. He has been awarded 6 patents, published 3 book chapters and over 100 peer-reviewed papers that are highly cited with an h-index of 27 (http://scholar.google.co.uk/citations?user=2oPuJqQAAAAJ). His current research interests include spectroscopy and imaging technologies in general, and particularly the development of novel terahertz (THz) spectroscopic imaging and optical coherency tomography (OCT) techniques for non-contact and non-destructive evaluation and industry applications.**

RESEARCH INTERESTS

- **Terahertz devices, systems and industrial applications, Terahertz pulsed spectroscopy and imaging, Optical Coherency Tomography, Infrared spectroscopy and imaging, Non-destructive and non-invasive evaluation and inline monitoring.**

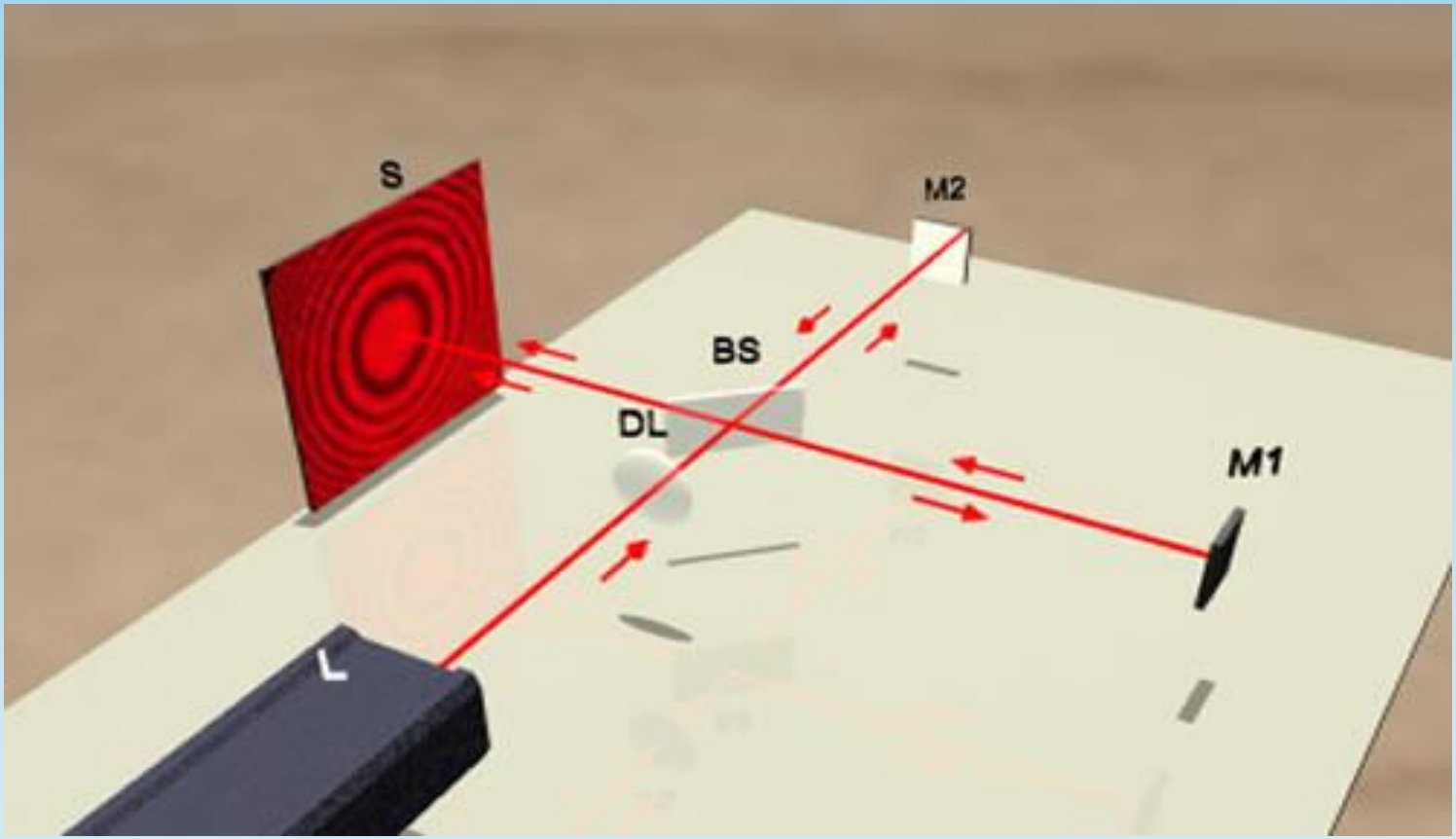
OPTICAL COHERENCE TOMOGRAPHY (OCT)

- **OCT use low-coherence interferometry to produce a two or three dimensional image of optical scattering from internal tissue microstructures.**
- **Michelson interferometer is used to perform low-coherence interferometry**
- **OCT measures intensity of reflected infrared light.**

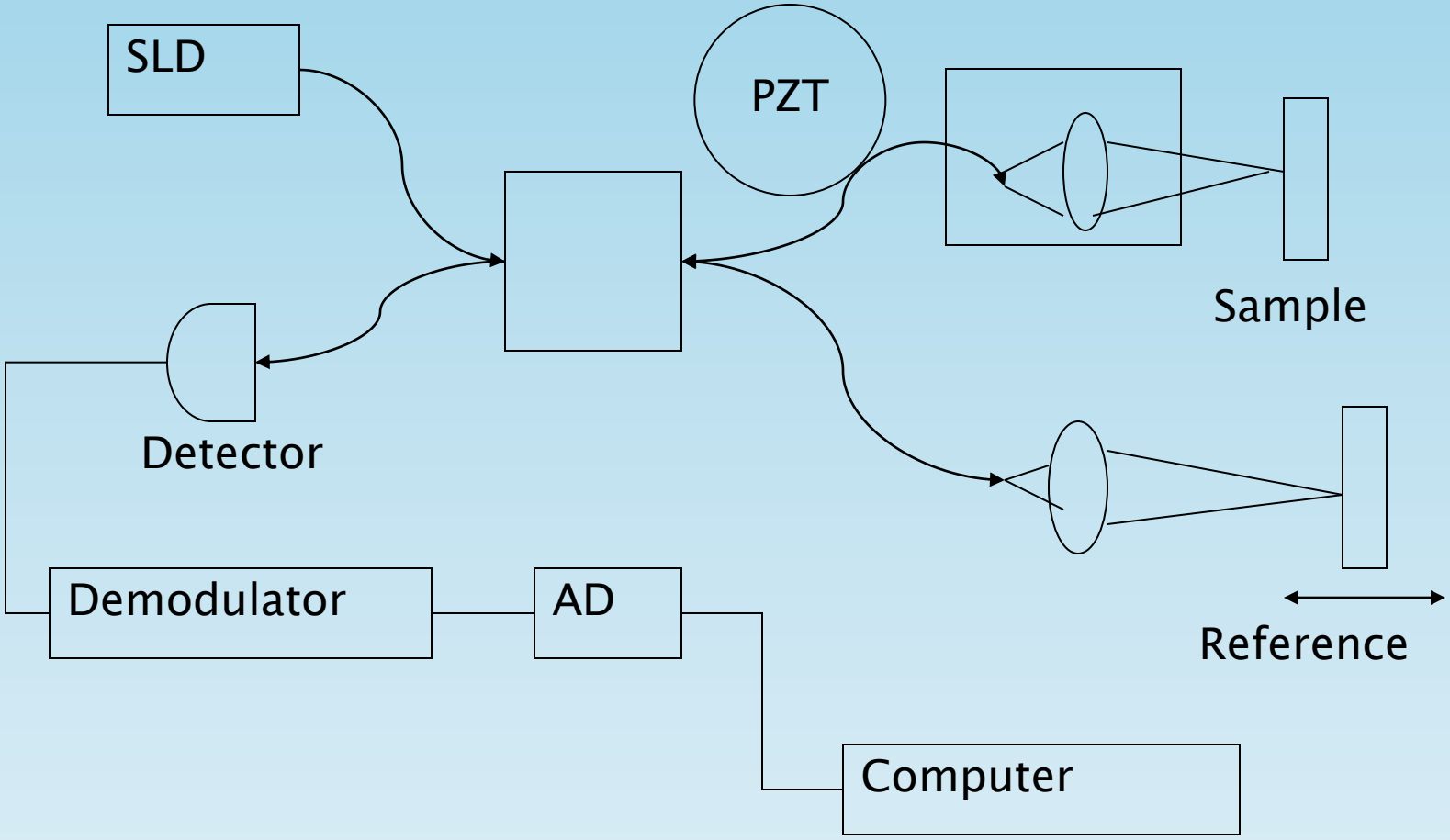
INTRODUCTION OF OCT

- James G. Fujimoto, 1991
- What is OCT:
  diagnostic medical imaging techonology
- Why OCT: better diagnose and treat disease
- Main application areas:
  heart disease and cancer

MICHELSON INTERFEROMETER



FUNDAMENTAL OCT SCHEMATIC

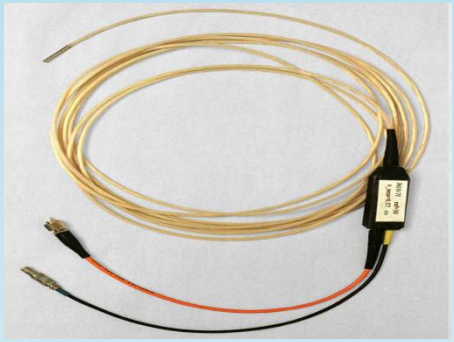


ADVANTAGE OF OCT

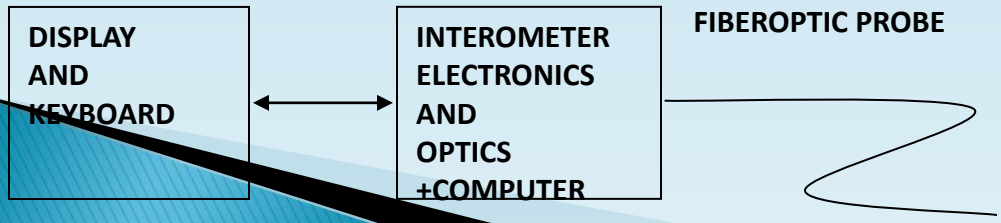
- Broad dynamic range,
- High resolution
- Rapid data acquisition rate,
- Small inexpensive catheter/endoscope design
- Compact portable structure

  (fiber optically based, making possible the development of small catheters and endoscopes)
- The frame rate for OCT systems are four to eight frames per second.(assume an image size of 256 by 512 pixels.)

NOWADAYS AND FUTURE EQUIPMENT

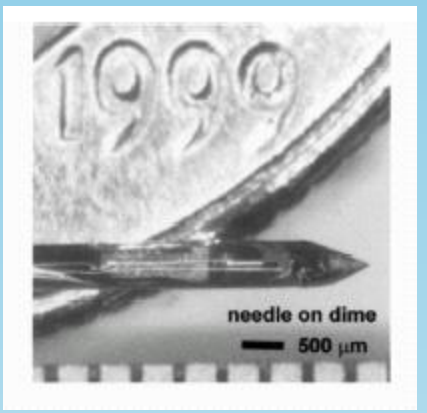


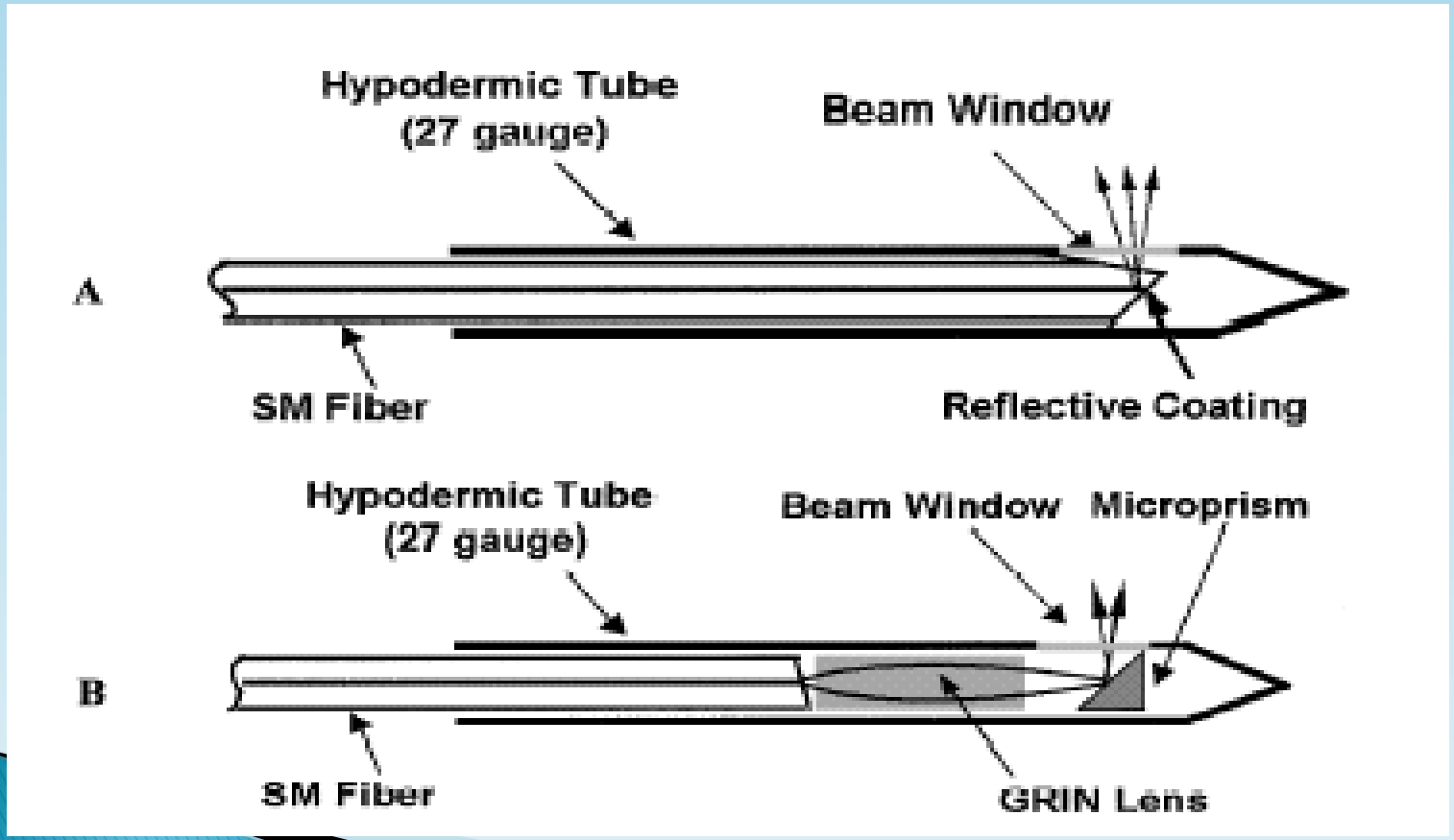
- Low-coherence Superluminescent diode:800 –1300 nm center waveength and severl milliwatts power.



Not available for sale
Pending 510(k)

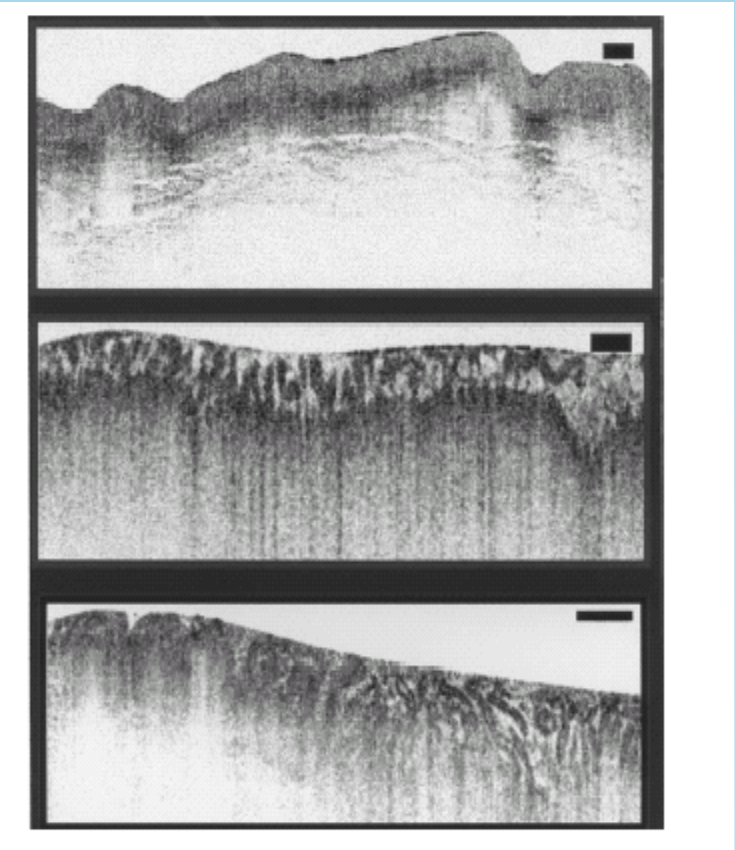
NEEDLE FOR OCT





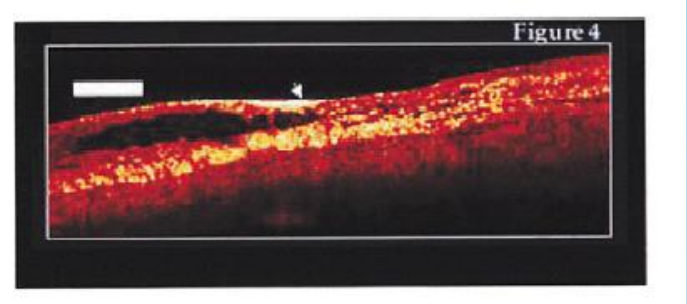
OCT APPLICATION

Esophagus & epithelium & early cancer

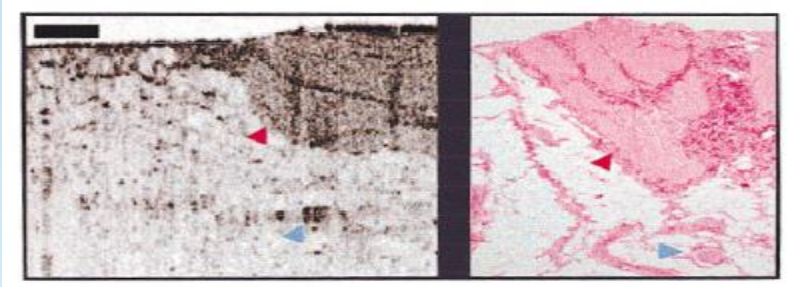


A Reduce High False-Negative Rates

Vulnerable plaque



B Reduce Biopsy Hazardous Prostate



Applied in guiding microsurgical procedure

LIMITATION

- **Penetration: 2-3mm Ideal: 4mm**
- **Resolution :**

  catheter/endoscope based image: 10µm, noncatheter: 4 µm,

  1. femtosecond laser is expensive (1 µm)

  2. transverse resolution needs to be similar to axial resolution, below 10 µm need short confocal parameter which results in the focus falling off rapidly.
- **Acquisition rate: <10franes/second**
- **Lack of large-scale clinical trials**

FUTURE WORKS

- **Peneration and Resolution:**

  1. Need to develop with similar median wavelength, power, and bandwidth to those of the mode locked laser.

  2. Need more complex catheter/ endoscope designs to alleviate the focus falling off rapidly.

- **Acquisition rates: video rate is anticipated with future embodiments.**

UNDERWAY WORK

- **Combine OCT with Doppler velocimetry and measurement of birefringence properties.**
- **The potential of giving OCT the ability to make both structural and dynamic assessments.**

RECENT PUBLICATIONS

- Ke Su, Y.C. Shen, and J. Axel Zeitler, Terahertz sensor for non-contact thickness and quality measurement of automobiles paints of varying complexity, IEEE Trans. Terahertz Science and Technology, 4 (2014) 432-439 (10.1109/TTHZ.2014.2325393)
- W. Tu, S. Zhong, Y.C. Shen, Q. Zhou, and L. Yao (2014) FDTD-based quantitative analysis of terahertz wave detection for multilayered structures. J. Optical Society of America A, 31 (2014) 2285–2293
- N. Khiabani, Y. Huang, L. E. Garcia-Muñoz, Y.C. Shen, A. Rivera-Lavado, A Novel Sub-THz Photomixer with Nano-Trapezoidal Electrodes, IEEE Trans. Terahertz Science and Technology (IF>4.0), 4 (2014) 501 – 508 (10.1109/TTHZ.2014.2320824)
- C. Li, J.A. Zeitler, Y. Dong, Y.C. Shen, Nondestructive evaluation of Polymer Coating Structures on Pharmaceutical Pellets using Full Field Optical Coherence Tomography, J. Pharmaceutical Sciences (IF>3.0), 103 (2014) 161-166 (10.1002/jps.23764)
- Y.C. Shen, Terahertz Time-Domain Spectroscopy and Imaging, J. Electrical & Electronic Systems 3 (2013) e113 (Editorial, doi:10.4172/2332-0796.1000e113)
- R.K. May, K. Su, L. Han, S. Zhong, J.A. Elliott, L.F. Gladden, M. Evans, Y.C. Shen, J.A. Zeitler, Hardness and density distributions of pharmaceutical tablets measured by terahertz pulsed imaging. J. Pharmaceutical Sciences (IF>3.0), 102 (2013) 2179-86
- N. Khiabani, Y. Huang, and Y.C. Shen, (2013) Theoretical modelling of THz Photoconductive Antennas in a Pulsed System. IEEE Trans on Antennas and Propagation, 61 (2013) 1538-1546
- H. Shen, L. Gao, N. Newman, Y. Dong, C. Li, Y. Huang and Y.C. Shen, Spinning disk for compressed imaging, Optics Letters (IF>3.0), 37 (2012) 46-48

SENSOR NETWORKS AND DATA COMMUNICATIONS RELATED JOURNALS

- **Biosensors & Bioelectronics**
- **Biosensors Journal**

SENSOR NETWORKS AND DATA COMMUNICATIONS RELATED CONFERENCES

- Global Summit on Electronics and Electrical Engineering, November 03-05, 2015 Valencia, Spain
- 4th International Conference and Exhibition on Biometrics & Biostatistics, November 16-18, 2015 San Antonio, USA
- 2ndInternational Conference on Big Data Analysis and Data Mining, November 30-December 02, 2015 San Antonio, USA
- 2nd International Conference and Business Expo on Wireless & Telecommunication April 21-22, 2016 Dubai, UAE

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