



XVII CONGRESSO SOC

Presidente del Congresso:
Prof. Giovanni Scorcìa

Organizzatori:
Dr. Pasquale Cozzupoli, Dr. Giovanni Spinelli

“CORSO AVANZATO DIAGNOSTICO-CHIRURGICO DI SEMEIOTICA STRUMENTALE”

Responsabile Scientifico: **A. Lucente**
27 ottobre 2017, Reggio Calabria

**ANGIO OCT:
CARATTERISTICHE E PERFORMANCE**



Disclosure

Consulting Free

- Carl Zeiss Meditec
- Alfa Intes
- Mesofarma srl

Foreword: 25 Years of Optical Coherence Tomography

by: James Fujimoto and David Huang

The market is just over \$1B in 2012, and it is expected to grow by 18–30% per year for the foreseeable future

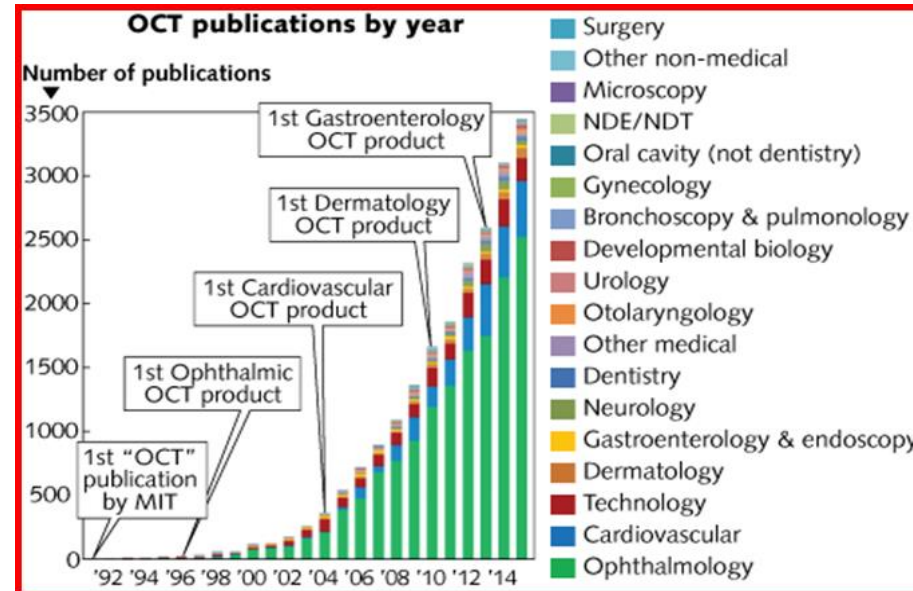
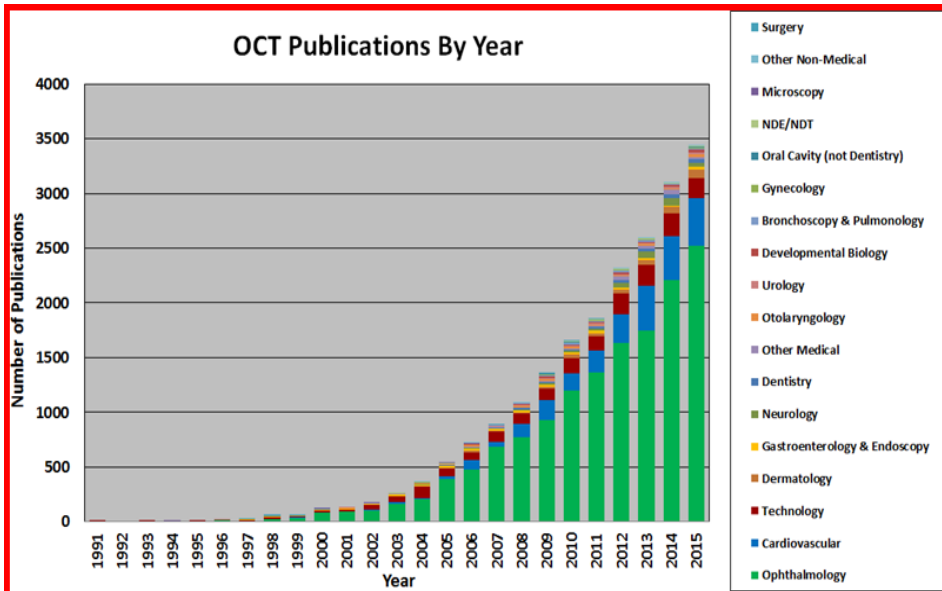
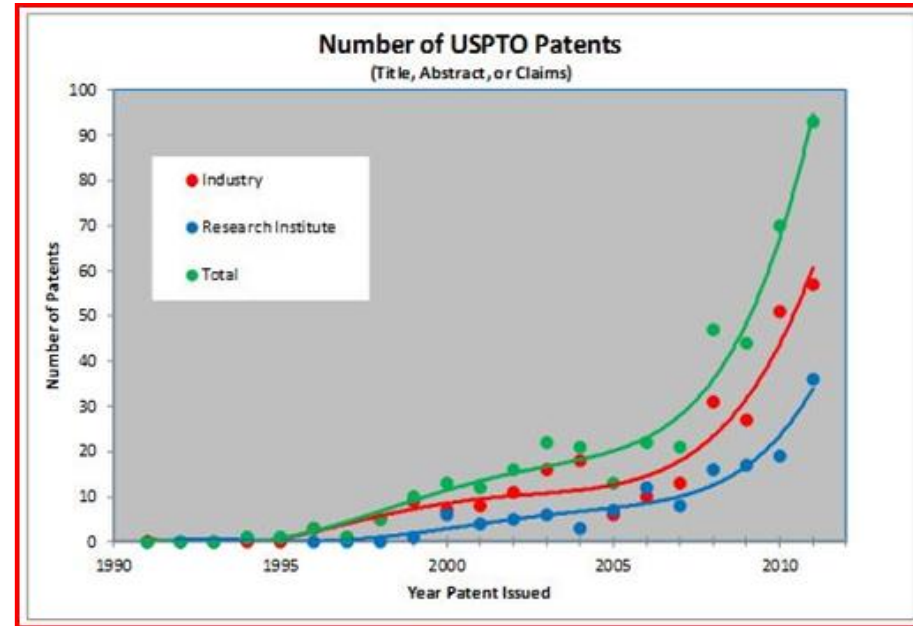


Image shows at the Fovea:

2.0 x 2.0 mm (A)

3.0 x 3.0 mm (B)

6.0 x 6.0 mm (C)

8.0 x 8.0 mm (D)

12 x 12 mm 12 x 16 mm

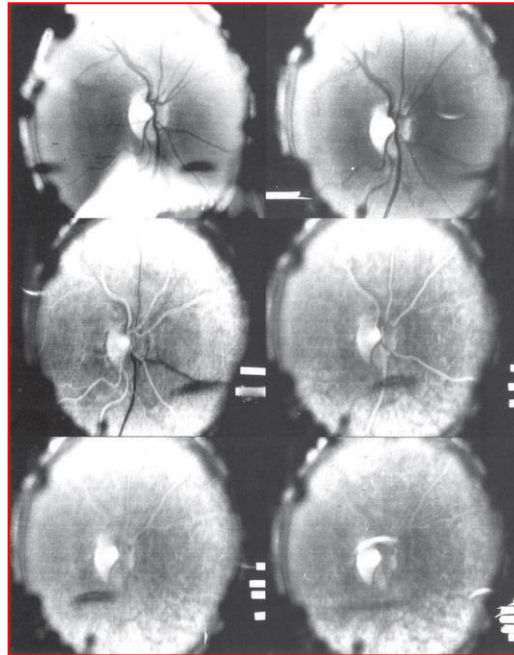
Images at the Optic Nerve:

3.0 x 3.0 mm (E)

6.0 x 6.0 mm (F)

8.0 x 8.0 mm

Capillary Network



A Method of Photographing Fluorescence in Circulating Blood in the Human Retina

By HAROLD R. NOVOTNY, B.S., AND DAVID L. ALVIS, M.D.

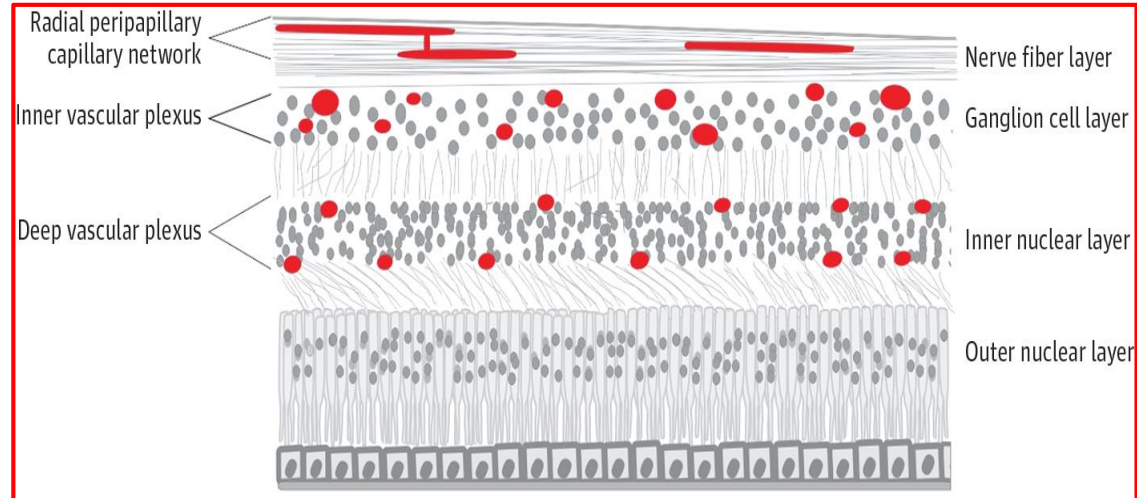
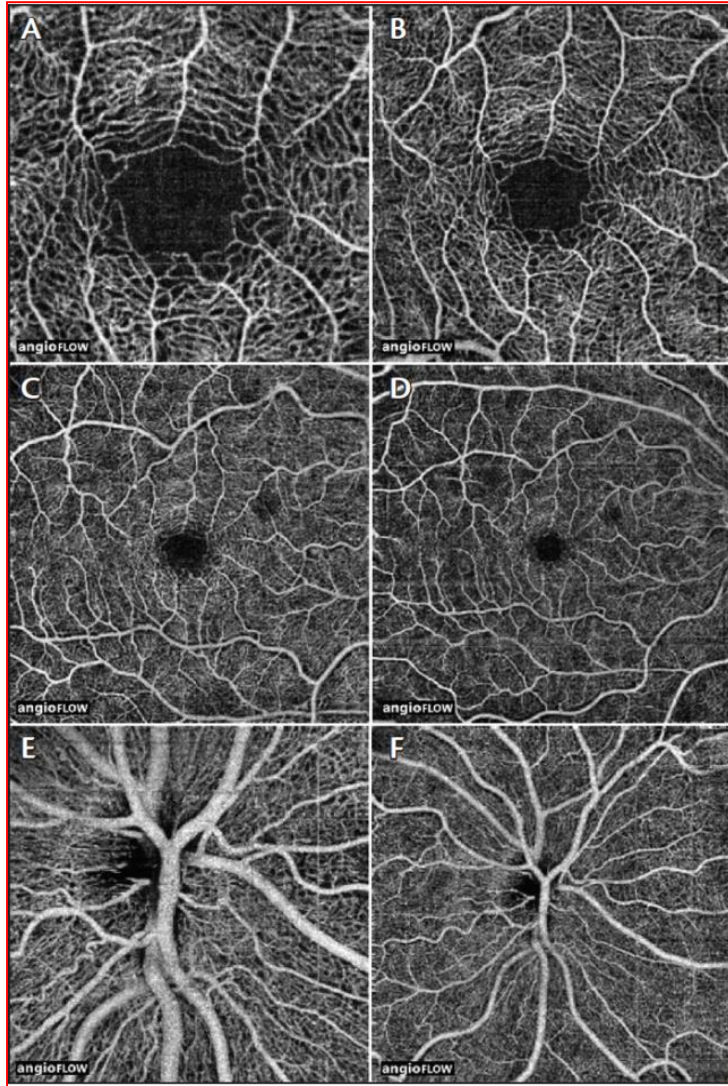
THE PHYSIOPATHOLOGY of the retinal vasculature would be better understood if more were known about blood flow in these vessels. Because of the unique quality of transparency in the eye, methods depending on direct observation of the retinal vessels seem especially inviting. Already reported by various authors are techniques for


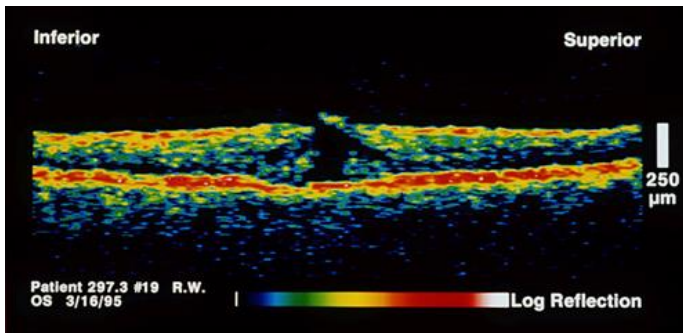

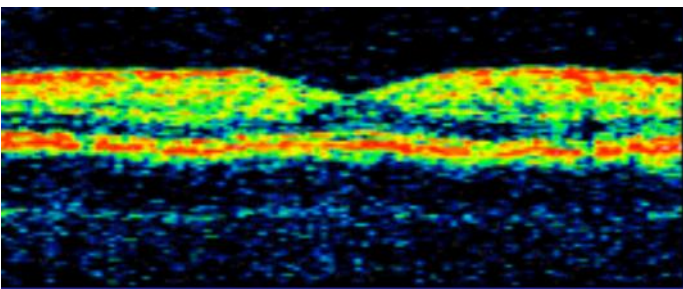

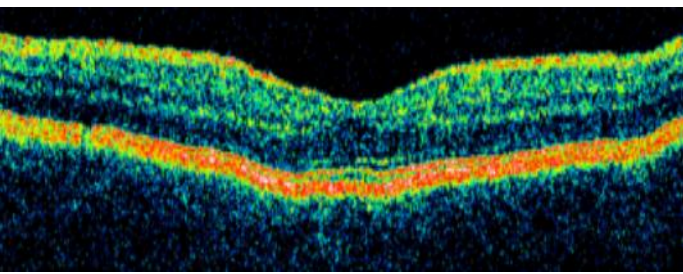

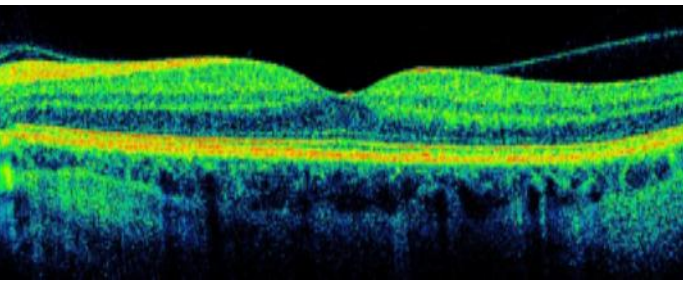
emitting wave length was 520 mμ. in the green. Kodak Wratten filters no. 47 and no. 38, combined with a 3-mm. layer of 0.25 M copper sulfate, were accordingly inserted into the optical system (figs. 1 and 2) at appropriate points.

In order to modify the activating light, the blue no.-47 filter was placed in the path of the beam from the electronic flash and from the incandescent viewing source. This made it possible to see, as well as to photograph, the fluorescence

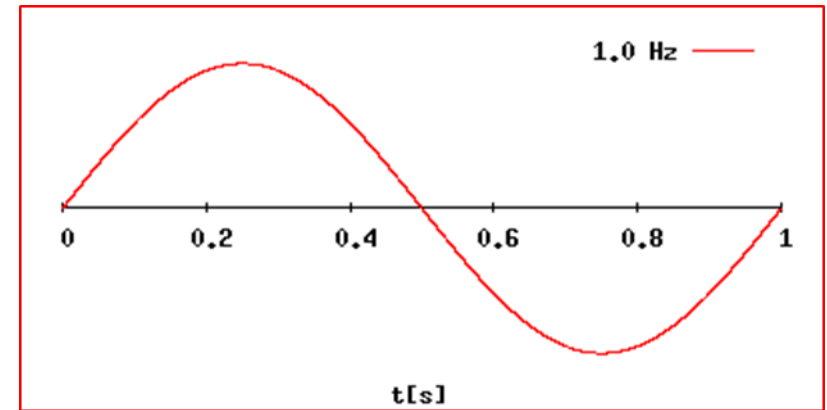
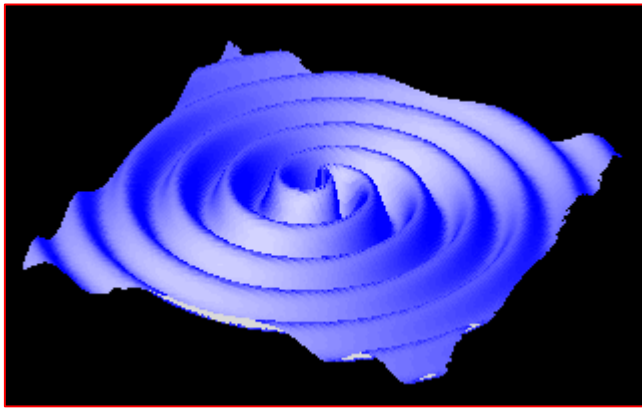
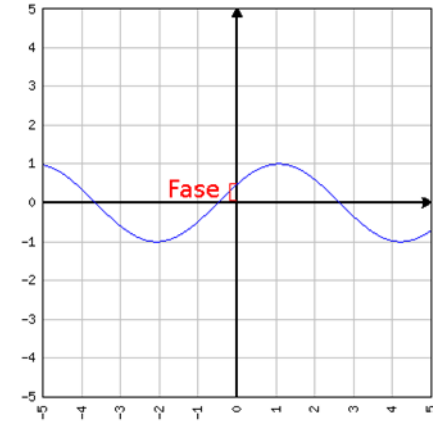
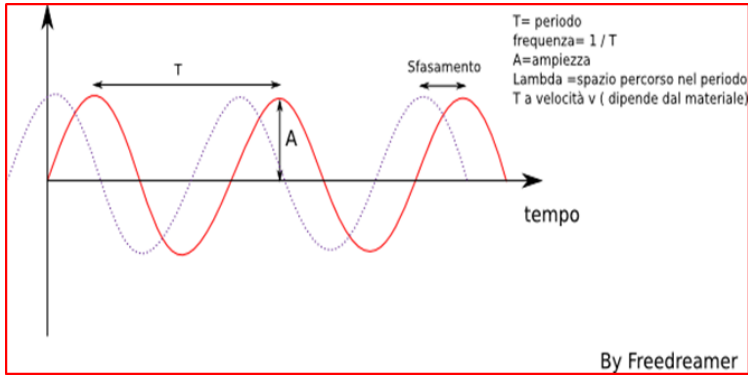


- The first fluorescein angiogram taken in November 1959, of the right eye of David Alvis with Harold R. Novotny



Model Image	Year	Single line Scan	Scans Sec	Resolution (microns)	B Scan
	OCT 1995 N: 200 al 1999	100 A-scans x 500 points	100	20	
	OCT2 2000 N:400 al 2002	100 A-scans x 500 points	100	20	
	OCT3 Stratus 2002 N: 6000 al 2006	512 A-scans x1024 points	500	10	
	HD-OCT 2007 N: 10000 al 2012	4096 A-scans x 1024 points	27,000	5	

What is a wave? «energy propagated through matter» A. Einstein

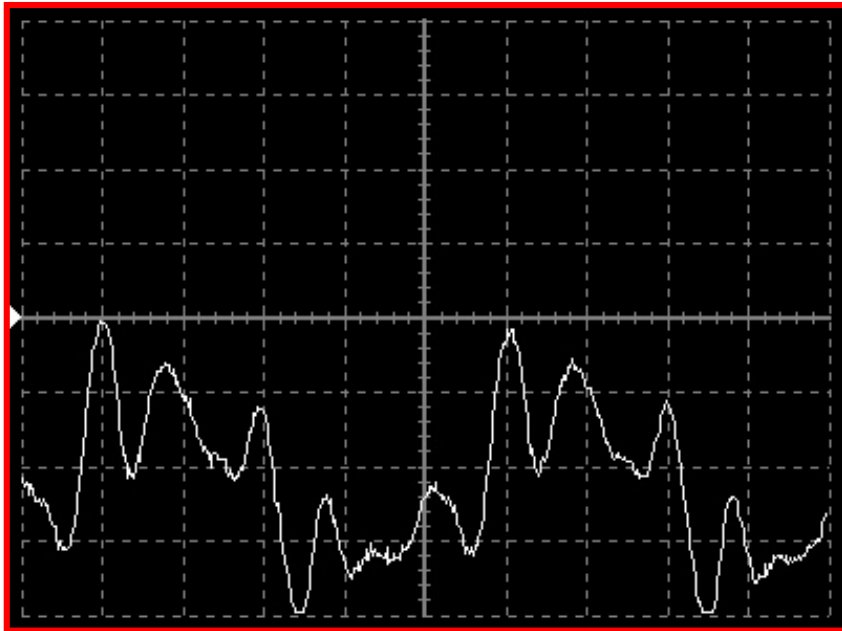


- a) Angiografia dyeless basata sull'ampiezza del segnale OCT
- b) Angiografia dyeless basata sulla fase del segnale OCT
- c) Angiografia dyeless basata sull'ampiezza e sulla fase del segnale OCT (complex signal)

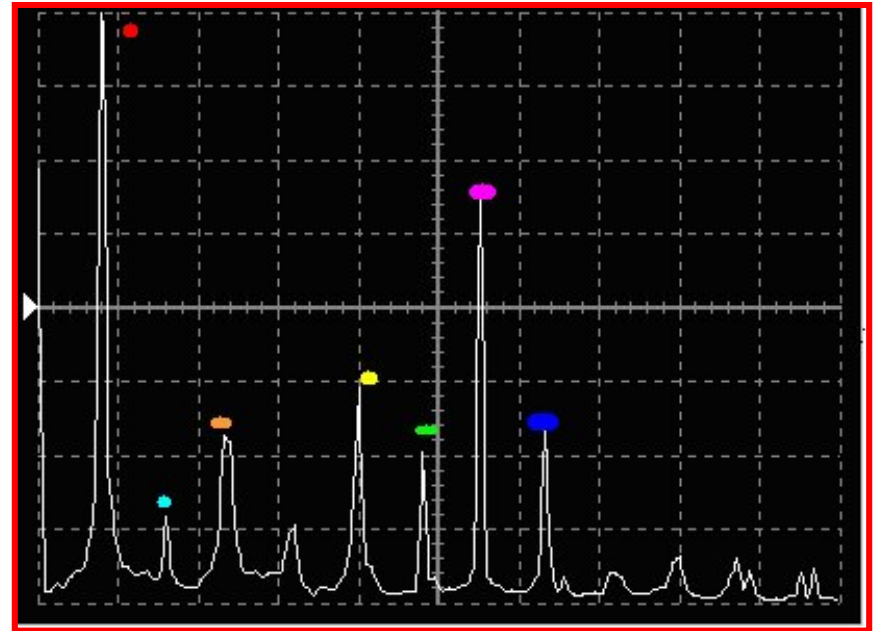
Dawn of a New Era in Imaging

$$X(f) = \int_{-\infty}^{+\infty} x(t) \cdot e^{-j2\pi f t} dt$$
$$x(t) = \int_{-\infty}^{+\infty} X(f) \cdot e^{+j2\pi f t} df$$

Trasformata e Antitrasformata di Fourier

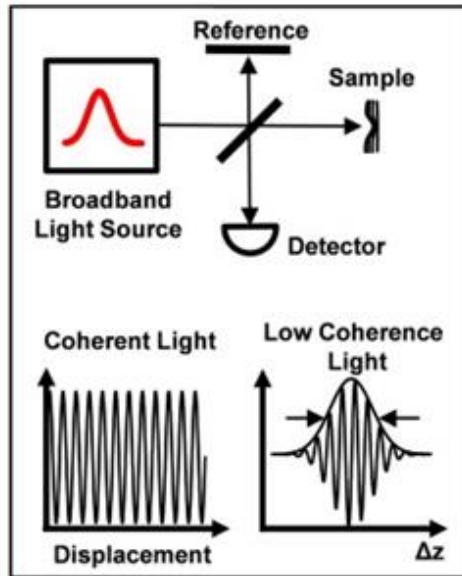


L'onda della nota 'La' del clarinetto che varia nel tempo viene registrata tramite oscilloscopio $x(t)$ *dominio del tempo*



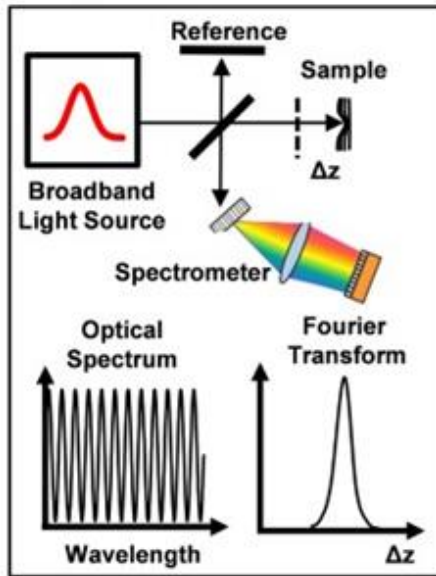
La nota 'La' del clarinetto scomposta in sottoonde nel dominio delle frequenze $X(f)$ *dominio delle frequenze*

Time-Domain OCT

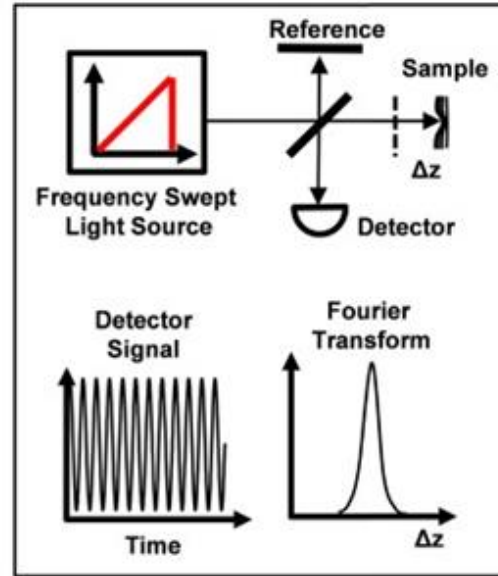


Fourier-Domain OCT

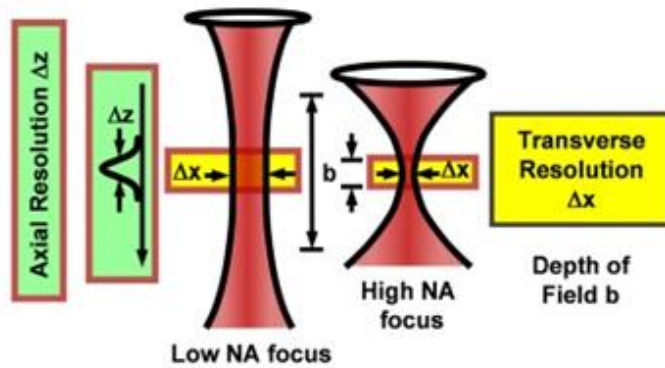
Spectral-Domain OCT



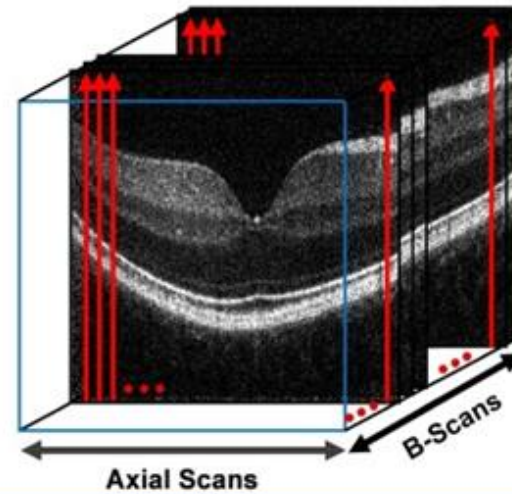
Swept-Source OCT



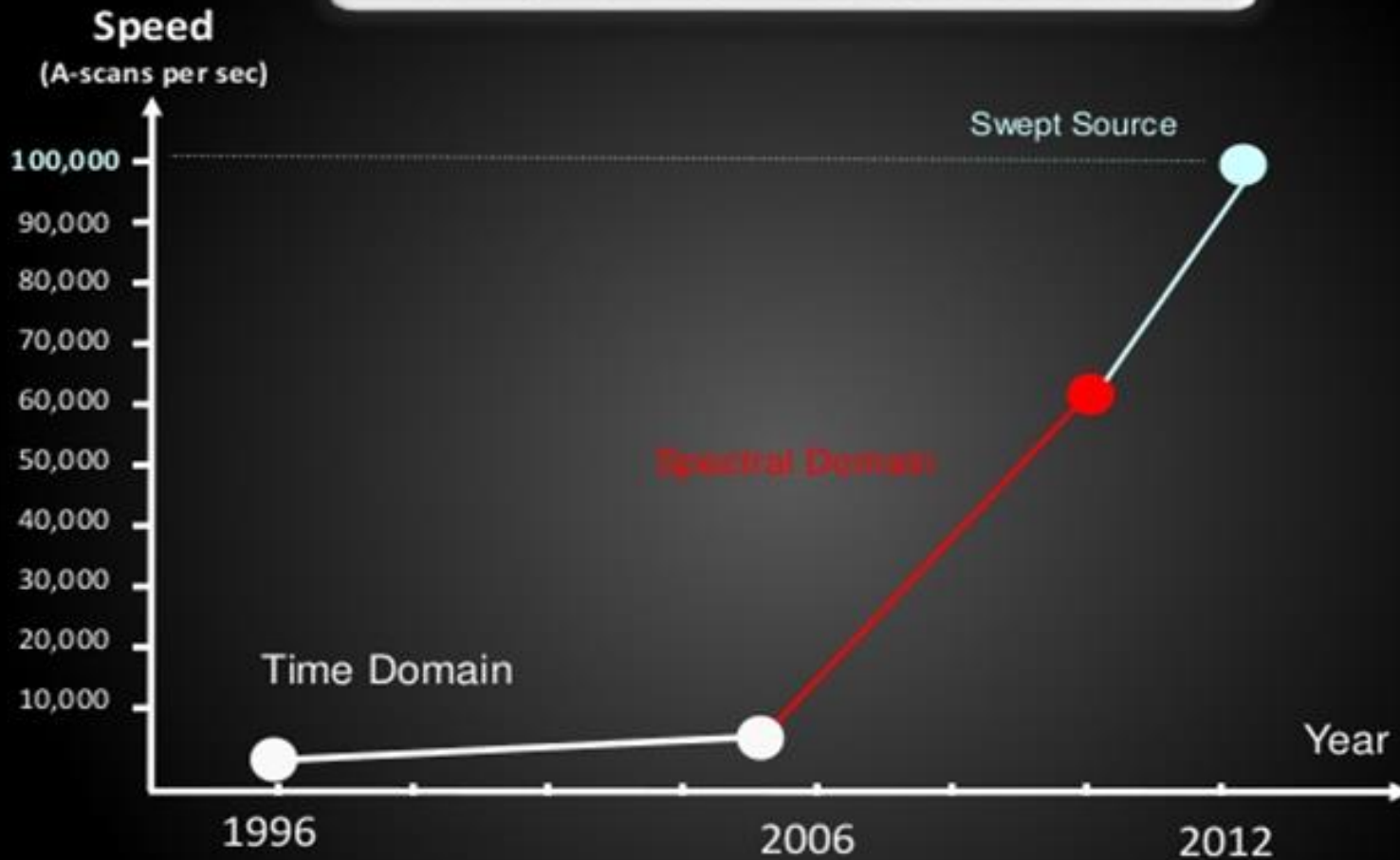
Spatial Resolution

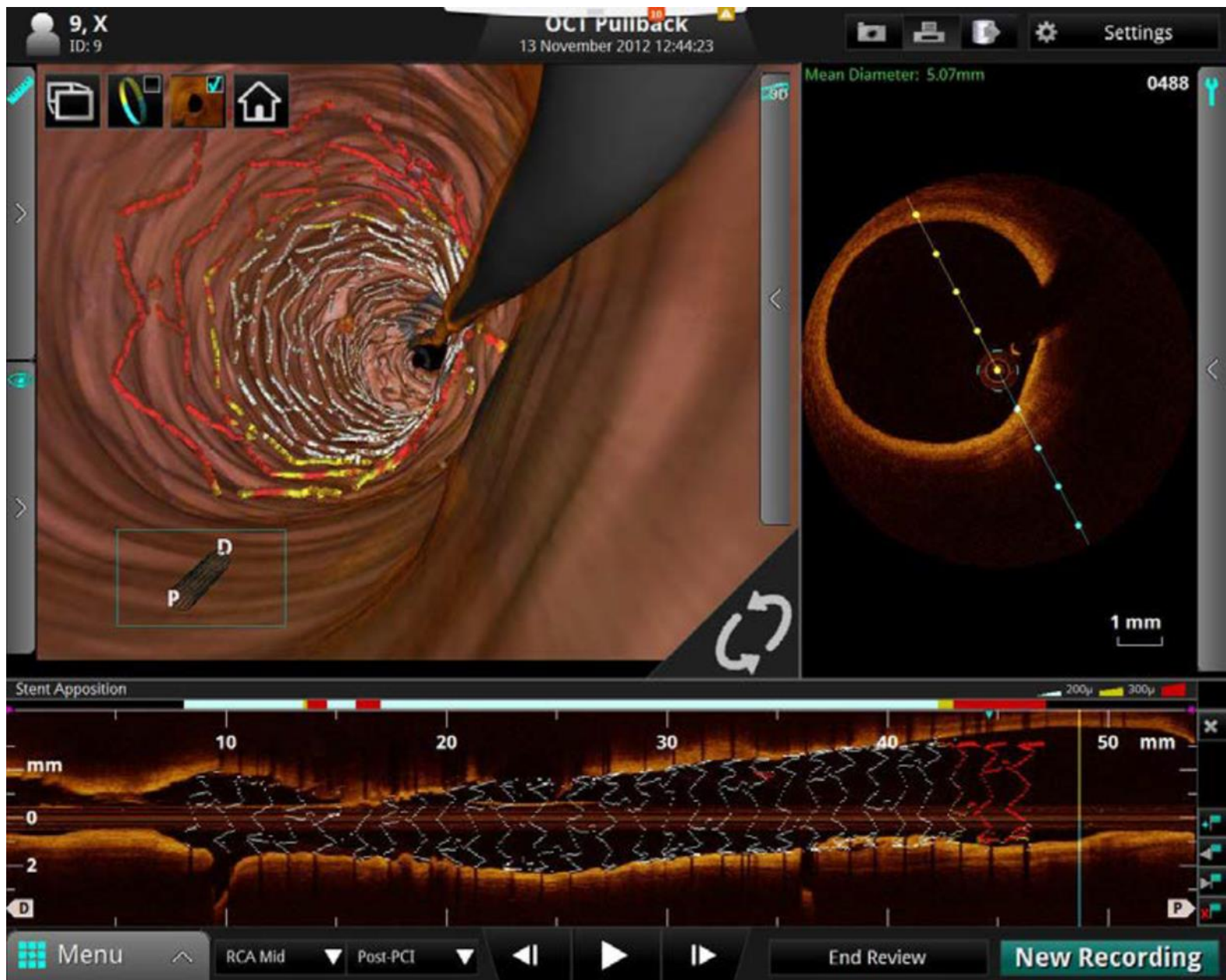


Building Up Images



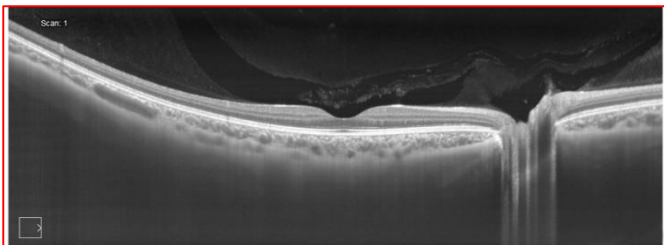
OCT evolution





Screen shot of one view from the St. Jude medical cardiovascular SS-OCT imaging system user interface

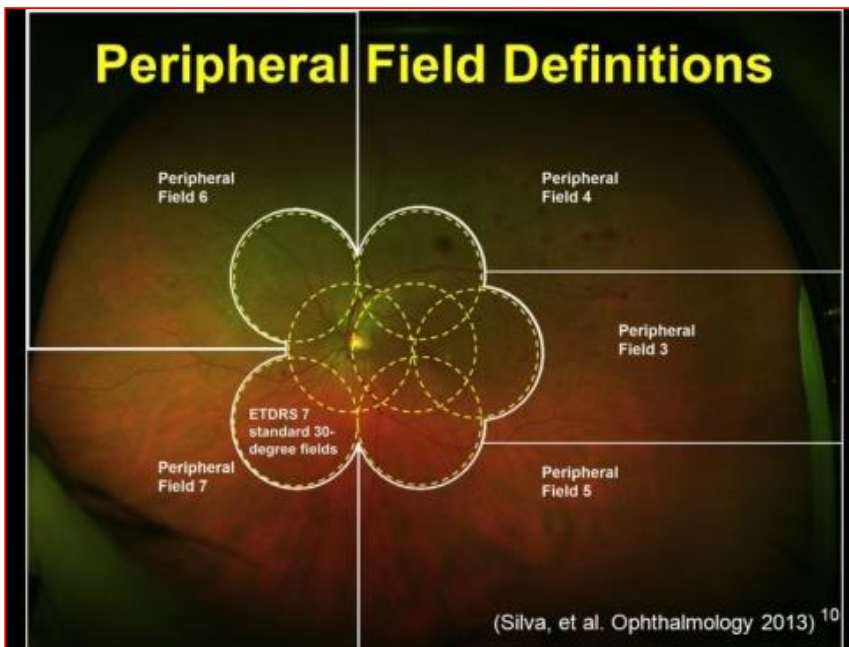
The high resolution of OCTA provides information about areas v/s WideField



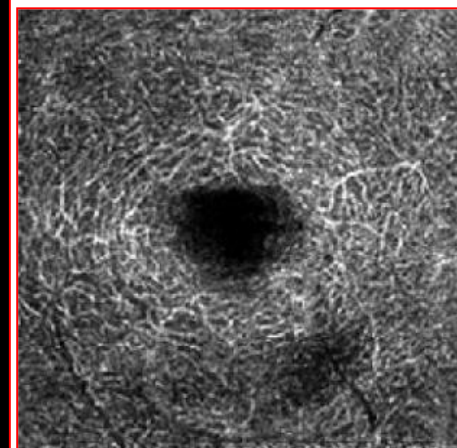
HD Spotlight 16mm B-scan of normal eye

- capillary nonperfusion
- vessel dilation and attenuation
- telangiectasias
- microaneurysms
- vascular proliferation

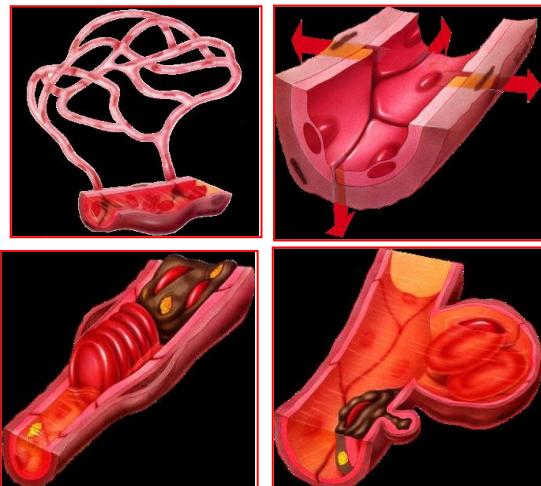
Peripheral Field Definitions



Superficial capillary



Deep capillary

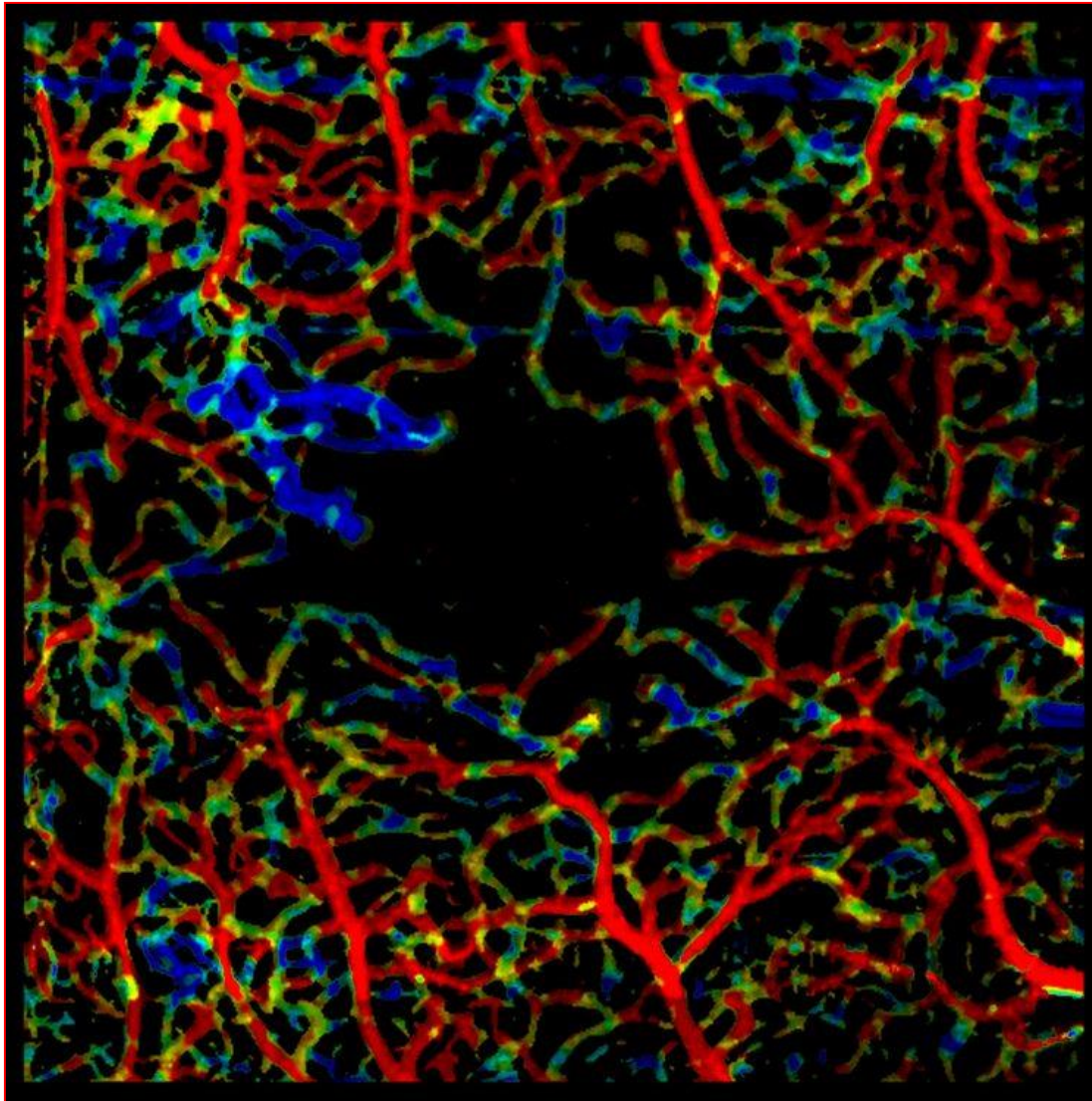


Ultra WideField: Future Direction



ZEISS receives the **first US FDA Clearance for Swept-Source OCT** posterior ocular imaging with **PLEX Elite 9000**. It is a SS-OCT instrument with a **tunable laser centered at 1050 nm**, a scan speed of **100,000 A-scans/sec** at a tissue **depth of 3.0 mm**, and an **axial resolution of 6.3 μm** , with a **56° field of view**.

Advanced Retina Imaging (A R I) a global consortium (**network**) of the highest caliber of clinicians and scientists.



Variable Interscan Time Analysis (VISTA) is a step towards quantitative optical coherence tomography angiography (OCTA) that allows determination of relative blood flow speeds. As a next innovation, the VISTA developers have created 'VISTA visualisation', a method for mapping the VISTA data into a colour-coded format to make image interpretation intuitive and easy for clinicians

The development of VISTA and VISTA visualisation represents a collaboration between teams of clinicians, optical engineers and computer scientists at **MIT and the NEEC New England Eye Centre Boston, USA; Bascom Palmer Eye Institute Miami, USA; and the Friedrich-Alexander-University Erlangen-Nürnberg, Germany**

VISTA visualisation in a 30-year-old proliferative diabetic retinopathy patient taken over a 3mm × 3mm field of view (**red indicates faster blood flow speeds; blue indicates slower speeds**). Courtesy **OCT Research Group, MIT-NEEC**



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Thank you for your kind attention!

