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Caratteristiche e Performance degli OCTA

Studio Oculistico
In Oculis Salus
dott. A. Lucente

www.amedeolucente.it

Disclosure

Consulting Free

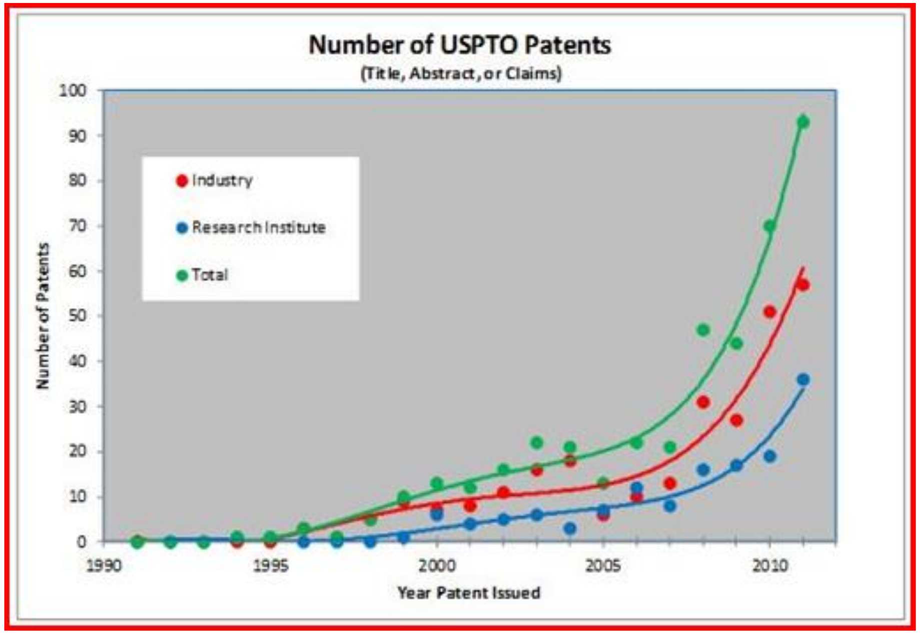
- Carl Zeiss Meditec
- Alfa Intes
- Mesofarma srl

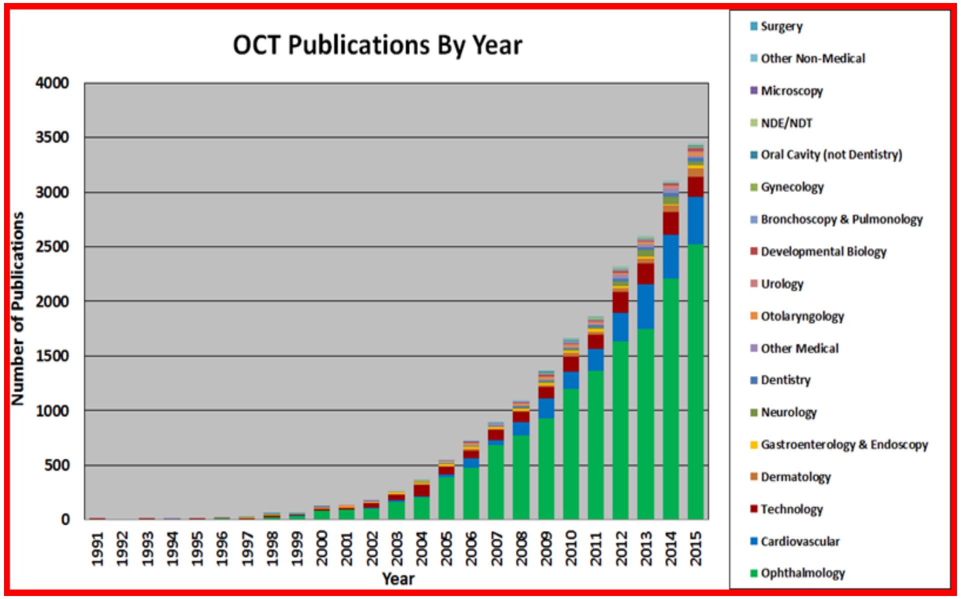
Foreword: 25 Years of Optical Coherence Tomography

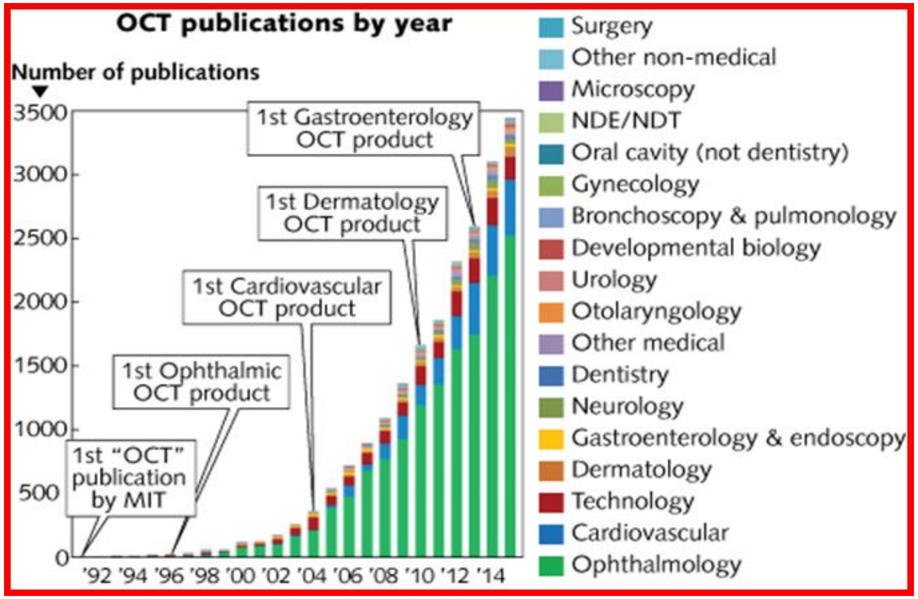
by:James Fujimoto and David Huang

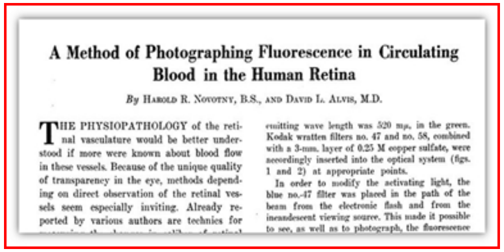
The market is just over $1B in 2012, and it is expected to grow by 18–30% per year for the foreseeable future

±50.000 OCT/AngioOCT
±250.000 Ophthalmologists









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

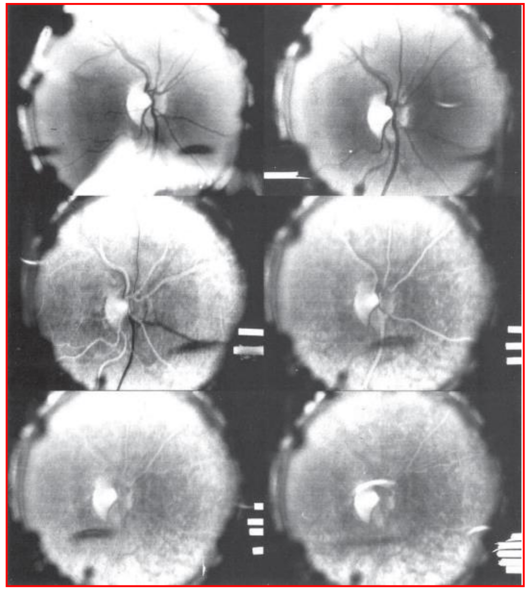
By Harold R. Novotny, B.S., and David L. Alvis, M.D.

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 technics for

emitting wave length was 520 mμ, in the green. Kodak wratten filters no. 47 and no. 58, 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.

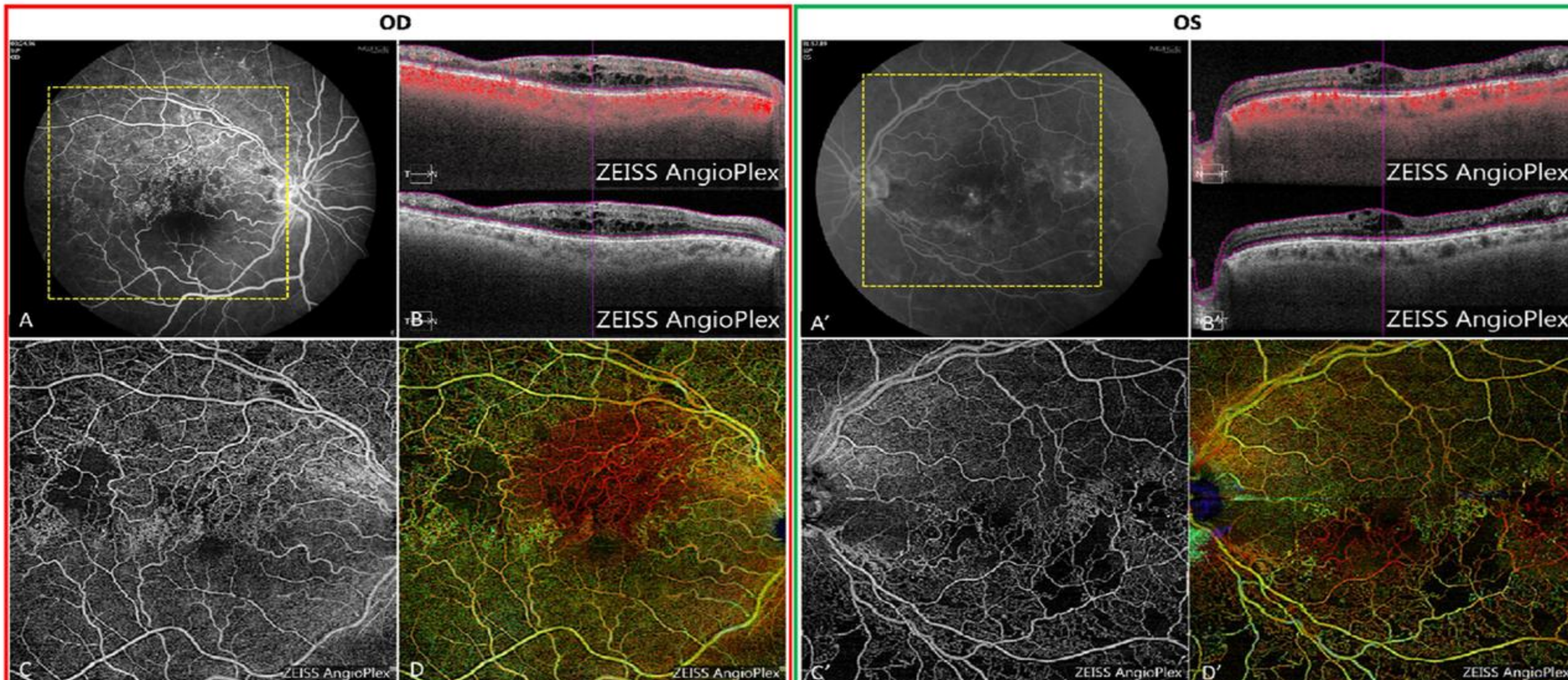
In order to modify the activating light, the blue no. 47 filter was placed in the path of the beam from the electronic flash and from the incandescent viewing source. This made it possible to see, as well as to photograph, the fluorescence

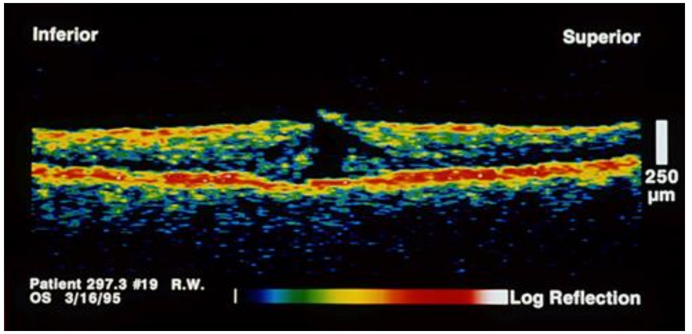
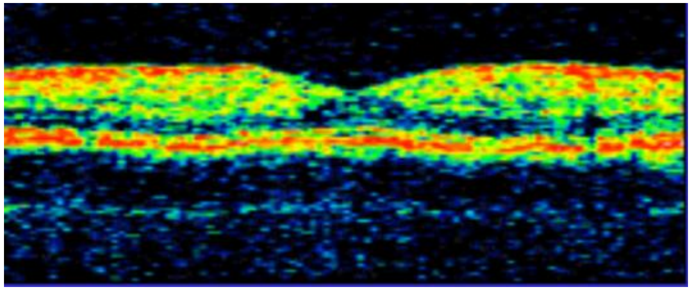
Image shows at the Fovea:
2.0 x 2.0 mm (A)
3.0 x 3.0 mm (B)
6.0 x 6.0 mm (C)
8.0 x 8.0 mm (D)
12 x 12 mm 12 x 16 mm
Images at the Optic Nerve:
3.0 x 3.0 mm (E)
6.0 x 6.0 mm (F)
8.0 x 8.0 mm



H. Novotny and D. Alvis; Circulation 1961

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



<table>
<tr><th>Model Image</th><th>Year</th><th>Single line Scan</th><th>Scans Sec</th><th>Resolution (microns)</th><th>B Scan</th></tr>
<tr><td></td><td>OCT
1995
N° 200
al 1999</td><td>100 A-scans
x 500 points</td><td>100</td><td>20</td><td>
</td></tr>
<tr><td></td><td>OCT2
2000
N°400
al 2002</td><td>100 A-scans
x 500 points</td><td>100</td><td>20</td><td></td></tr>
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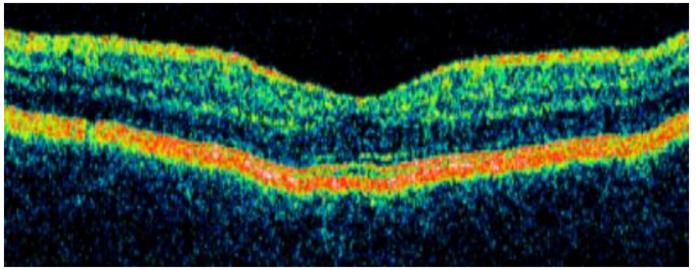
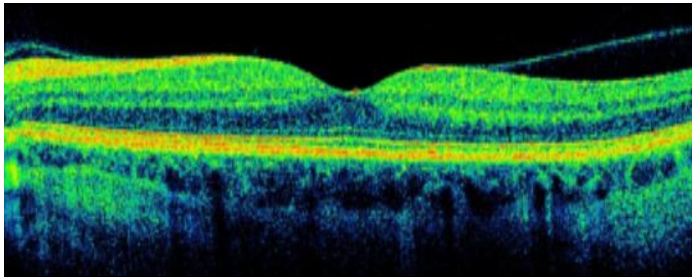
Stratus
2002
N° 6000
al 2006</td><td>512 A-scans
x1024 points</td><td>500</td><td>10</td><td></td></tr>
<tr><td></td><td>HD-OCT
2007
N°10000
al 2012</td><td>4096 A-scans
x 1024 points</td><td>27,000</td><td>5</td><td></td></tr>
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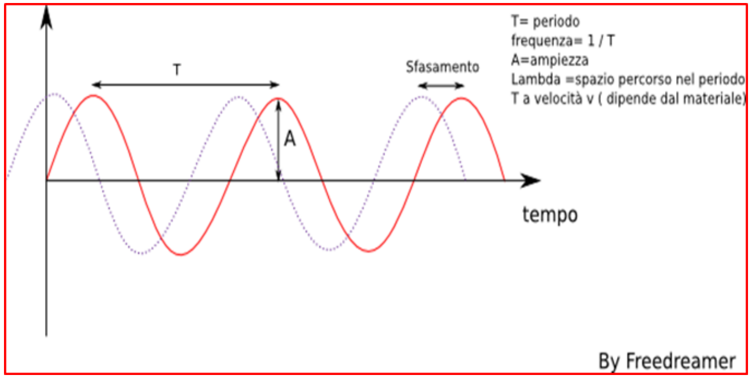
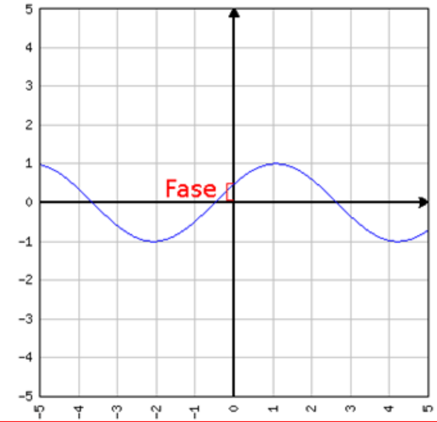
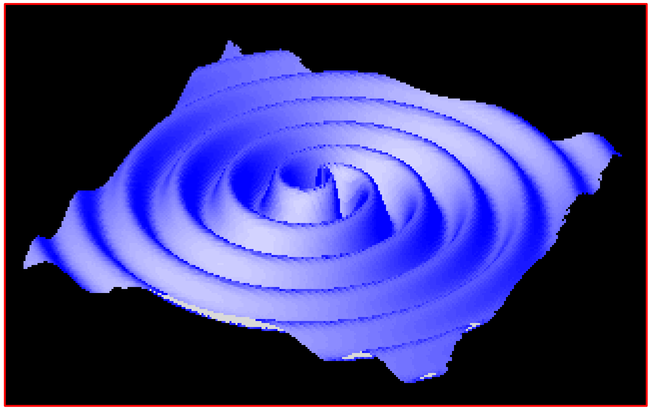
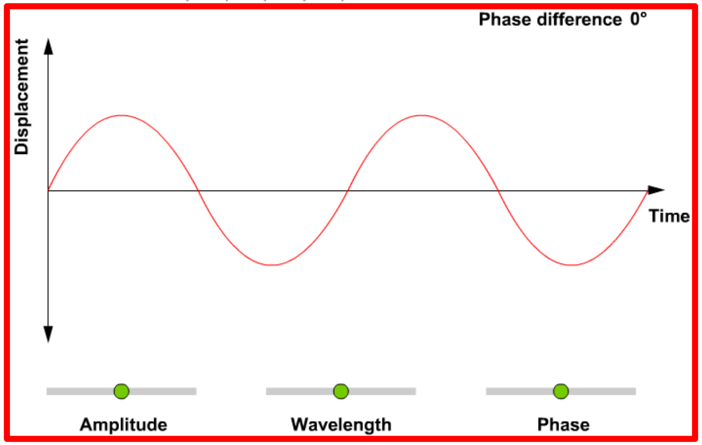
What is a wave? «energy propagated through matter» A. Einstein









a)Angiografia dyeless basata sull’ampiezza del segnale OCT

b) Angiografia dyeless basata sulla fase del segnale OCT

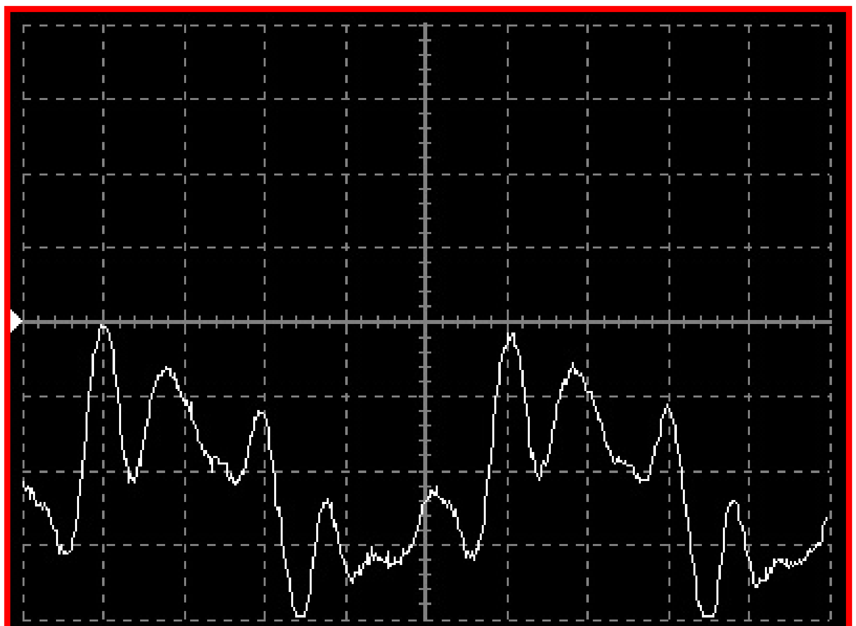
c) Angiografia dyeless basata sull’ampiezza e sulla fase del segnale OCT (complex signal)

Dawn of a New Era in Imaging

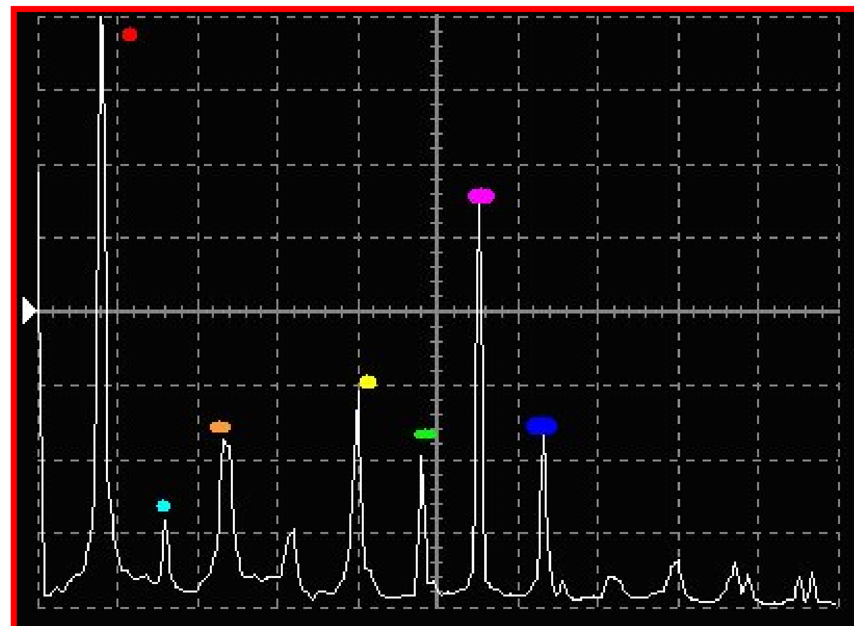
$$X(f) = \int_{-\infty}^{+\infty} x(t) \cdot e^{-j\,2\pi\, f\, t}\, dt$$

$$x(t) = \int_{-\infty}^{+\infty} X(f) \cdot e^{+j\,2\pi\, f\, t}\, df$$

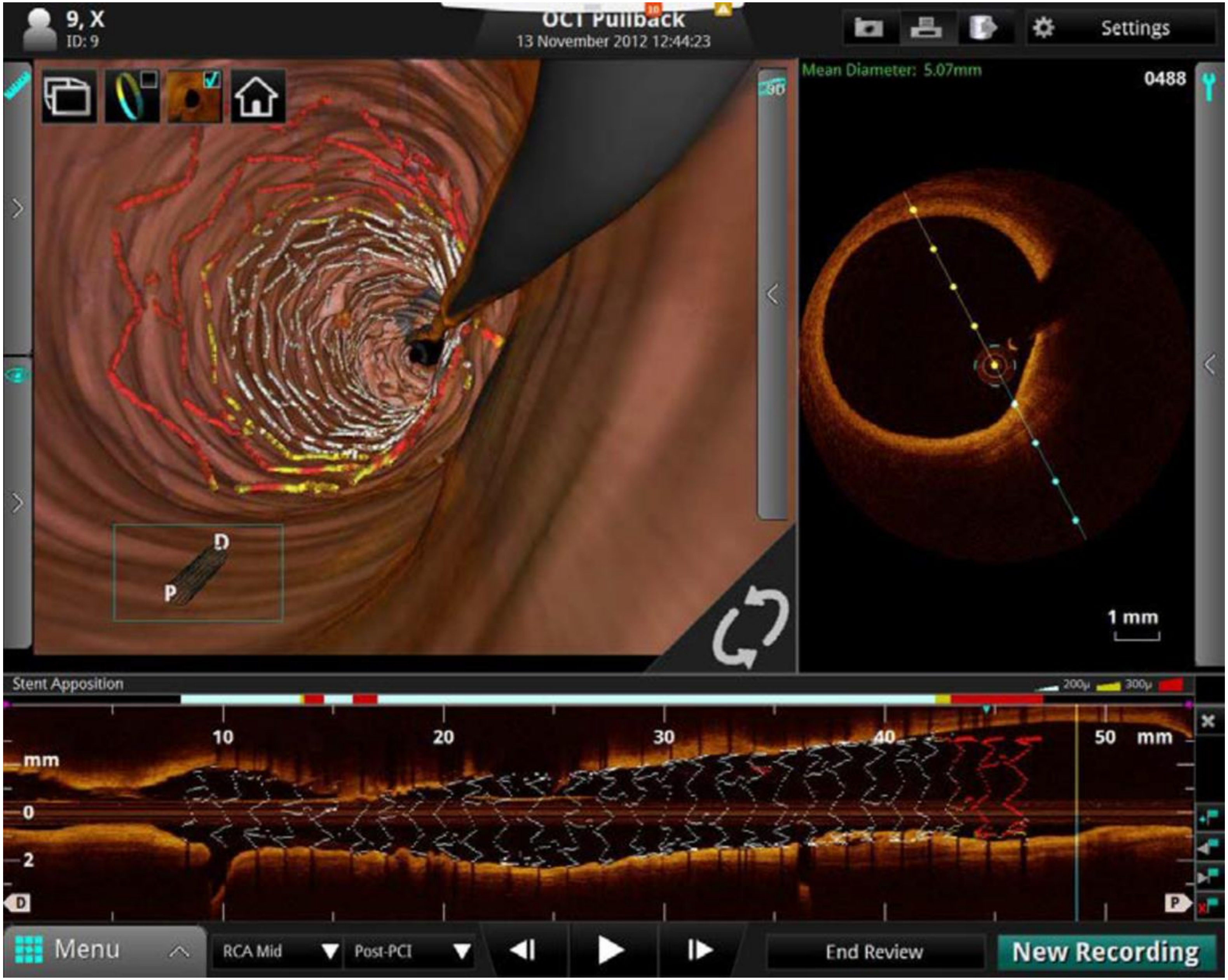
Trasformata e Antitrasformata di Fourier



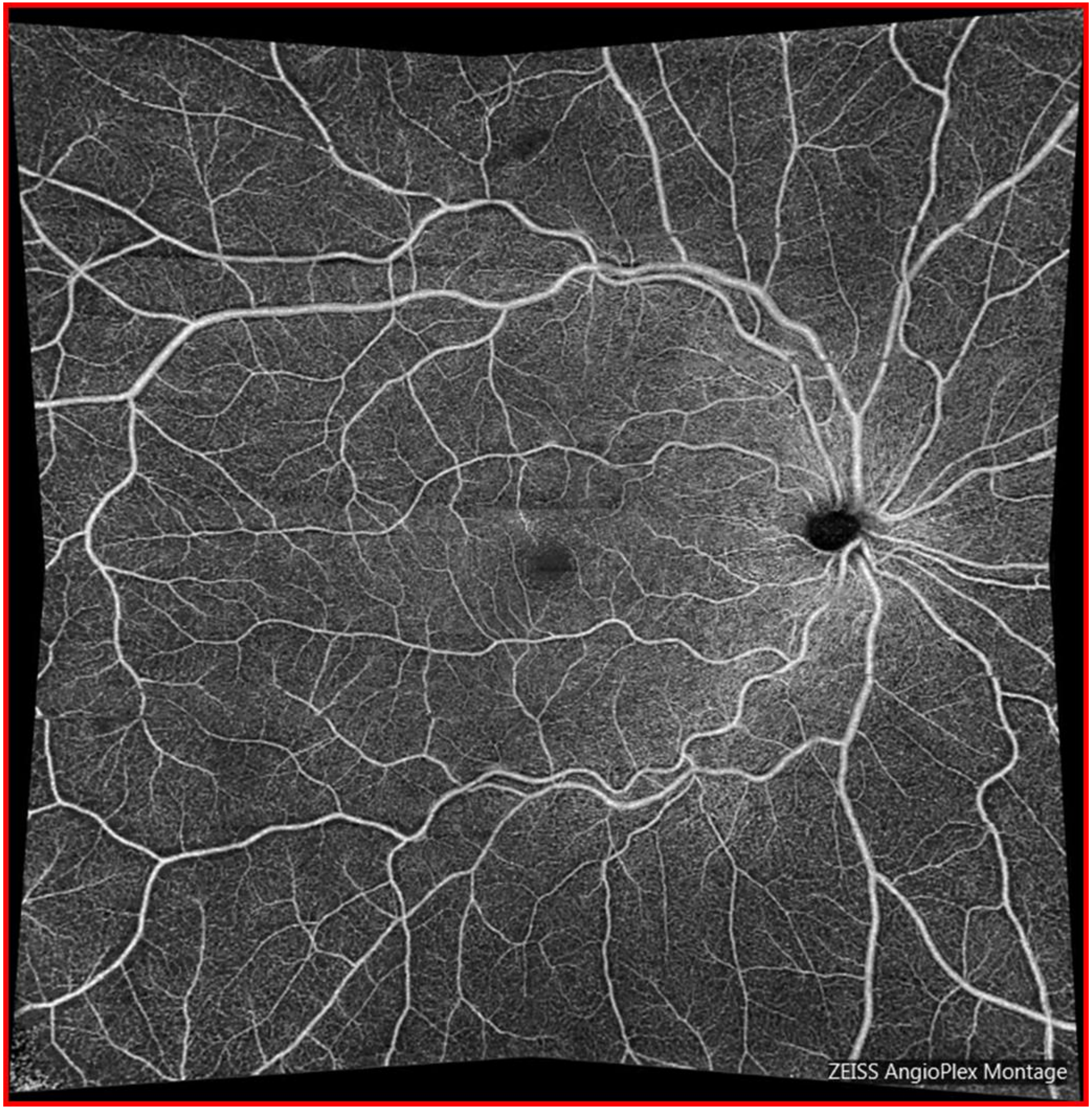
L'onda della nota 'La' del clarinetto che varia nel tempo viene registrata tramite oscilloscopio *x(t) dominio del tempo*



La nota 'La' del clarinetto scomposta in sotto-onde nel dominio delle frequenze
X(f) dominio delle frequenze



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



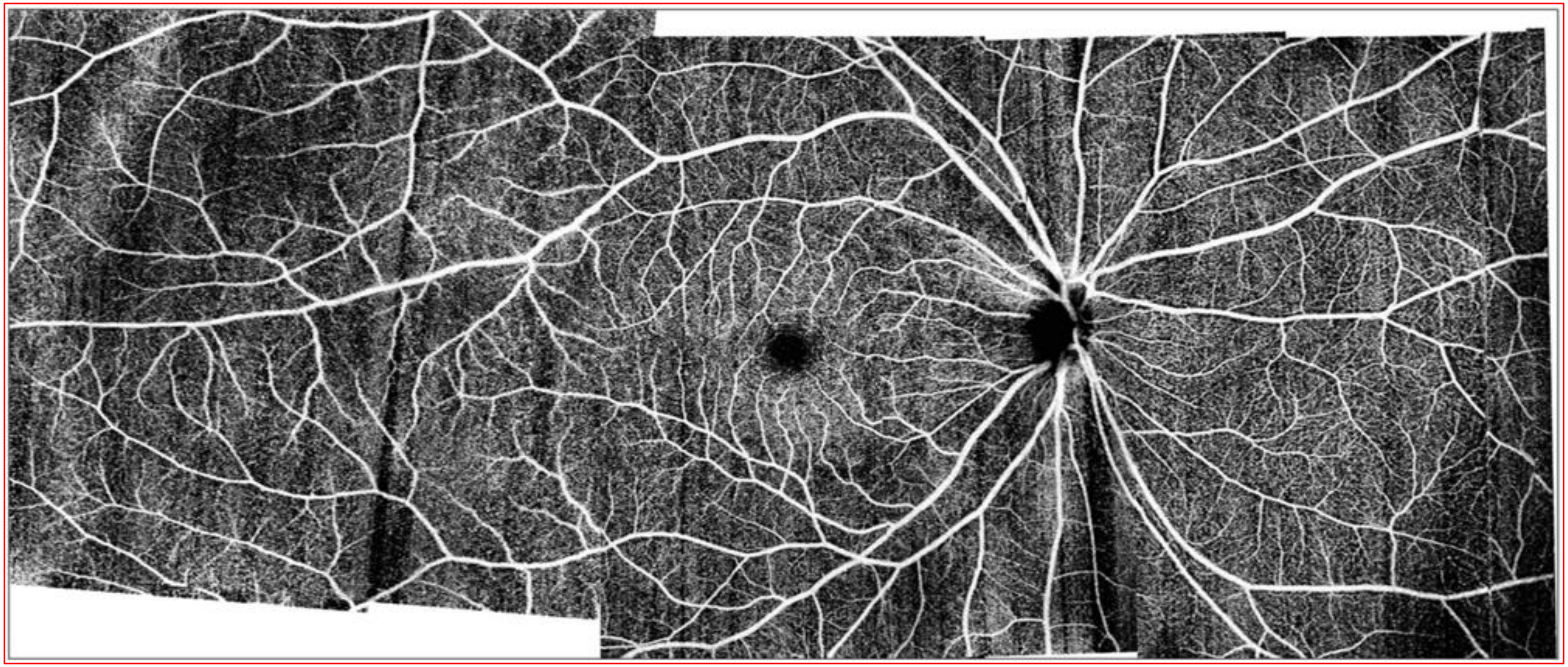
Montage 5 images 8x8mmm with AngioPlex Cirrus Zeiss 5000

Montage 6 images 6x6mm with AngioPlex Cirrus Zeiss 5000

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.



Ultra-widefield OCTA (~20-mm width, 10-mm height,7-mm depth) 200-kHz Swept-Source OCT System. (by Simon S. Gao et al.)

Ultra-Widefield 200° with Clarus Zeiss 500

- Direct ophthalmoscopy ≈ 5°– 10°
- PanOptic™ ophthalmoscope ≈ 25°
- Indirect ophthalmoscopy ≈ 37°
- Traditional fundus photography 30°– 45°
- Optos 200°
- Zeiss Clarus True color 200° wide by 200° tall, with montage 267°

Technical Specifications CLARUS 500 from ZEISS

Parameters Imaging Modes:

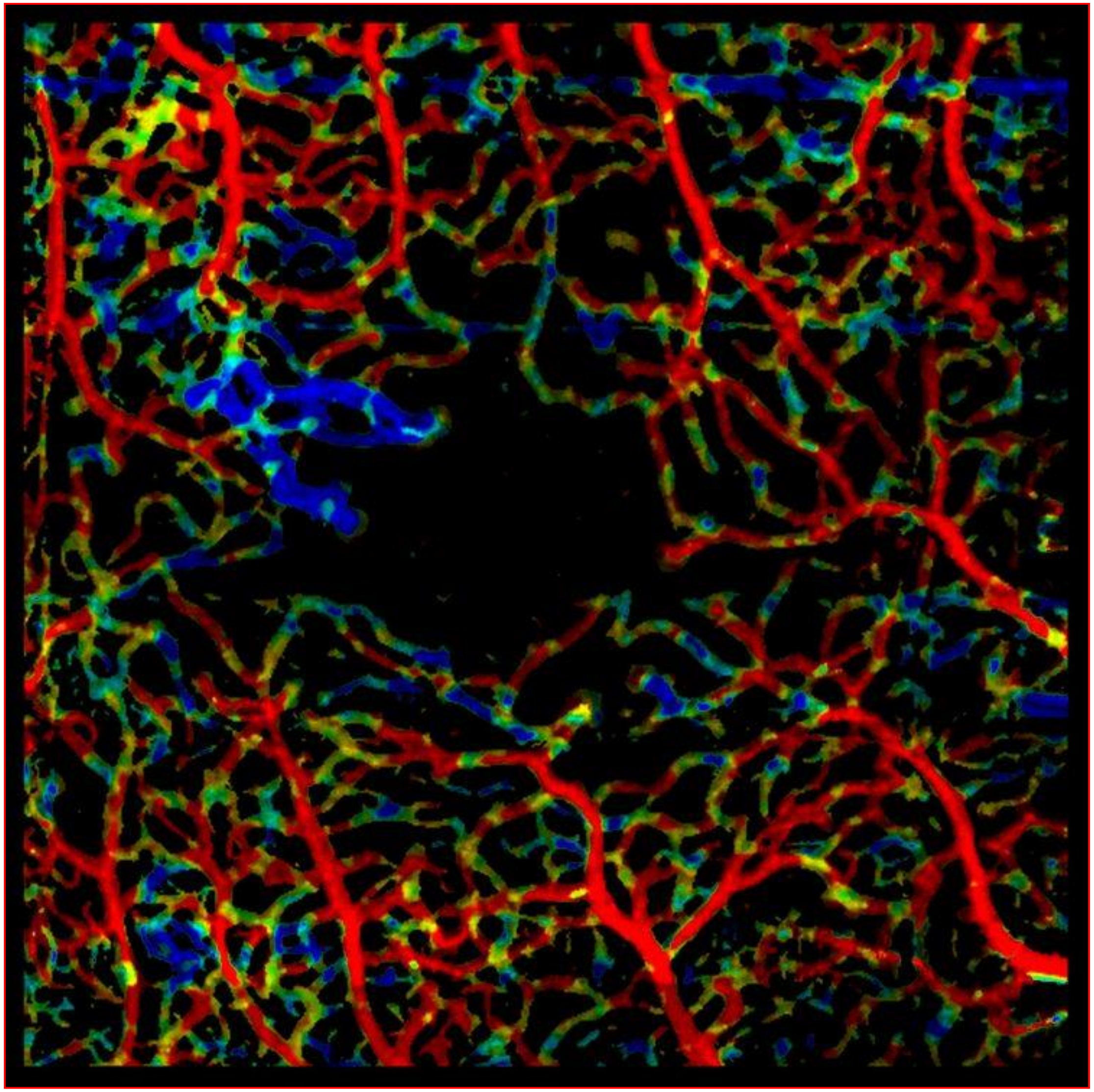
- True Color (with Red, Green and Blue channel split)
- Autofluorescence Green
- Autofluorescence Blue
- Infrared reflectance
- External eye image (ocular surface)
- Stereo

Field of View (measured from the center of the eye):

- Widefield (one image) 133°
- Ultra-widefield (two images) 200°
- Montage (up to six images) 267°

Resolution:

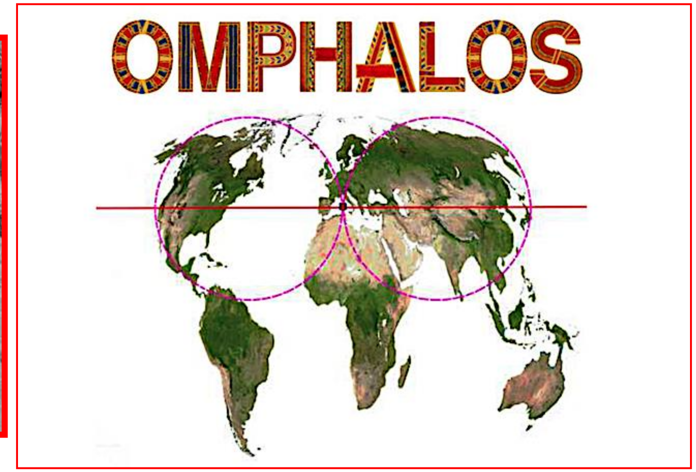
- Optical 7 microns
- Sensor 27-megapixels (9 megapixels per channel)



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**



Sardegna, Omphalos, Ombelico del Mondo (Sergio Frau)

Perfettamente equidistante dalle coste pacifiche di Giappone (11.350 Km) ed America (11.359 Km)

Thank you for your kind attention!

Studio Oculistico

In Oculis Salus

dott. A. Lucente