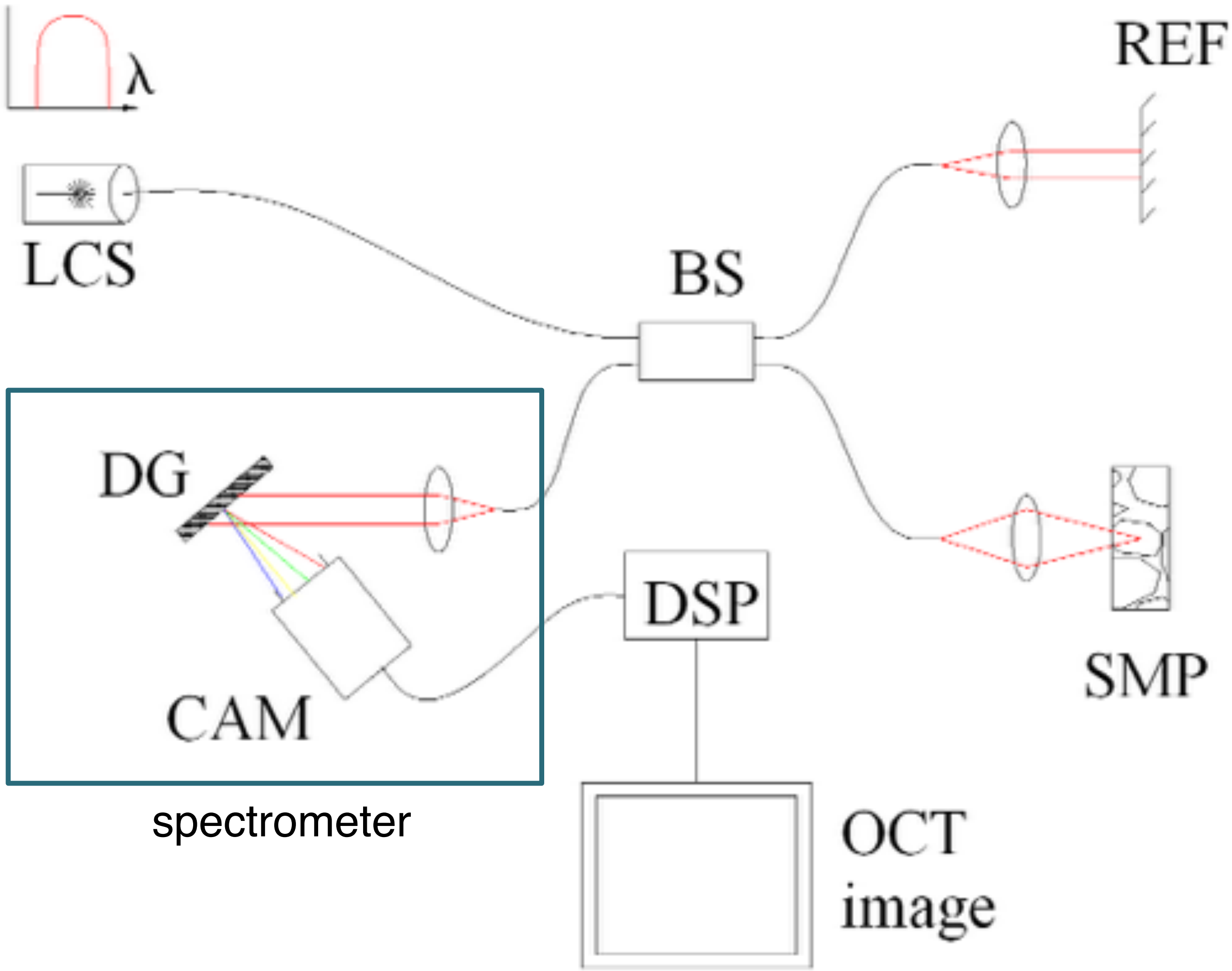
Zeus OCT

OCT Spectral Domain for Anterior Segment

Optical Coherence Tomography



Optical Coherence Tomography

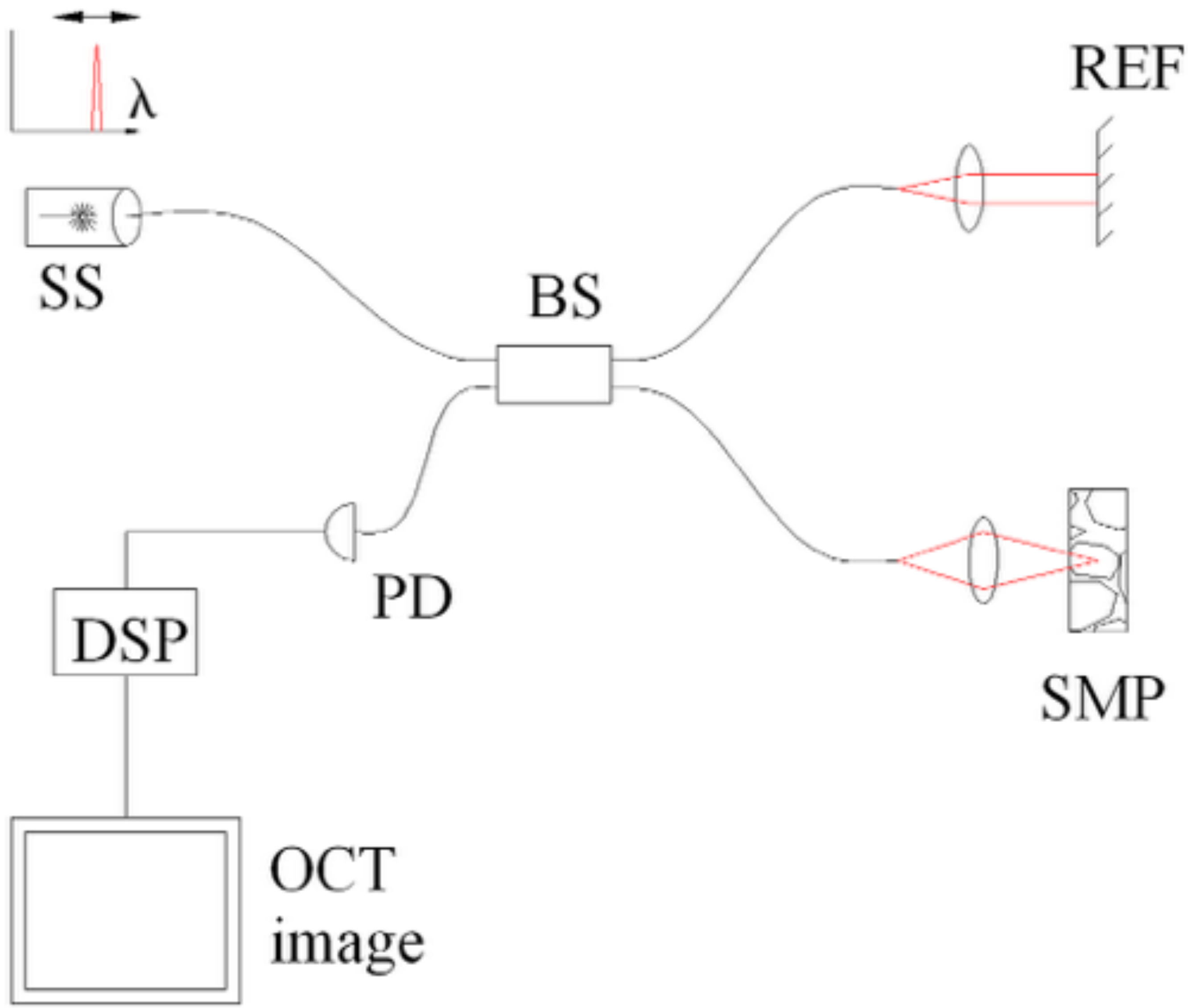
LCS : Low coherence Source
BS : Beam Splitter
REF : ReferenceArm
SMP: Sample under test
DG : Diffraction Grating
CAM: full-field detector
DSP: Digital Signal Processor

Optical Coherence Tomography – Swept Source

No more spectrometer

Source more expensive

It can go deeper.
Es. Movu,
new IOL master



Benefit of OCT technology

- Hi-res pictures
- Section pictures displaying internal structure
- Directly and instantaneously displaying the tissues morphology
- Do not need to extract tissues to be analized.

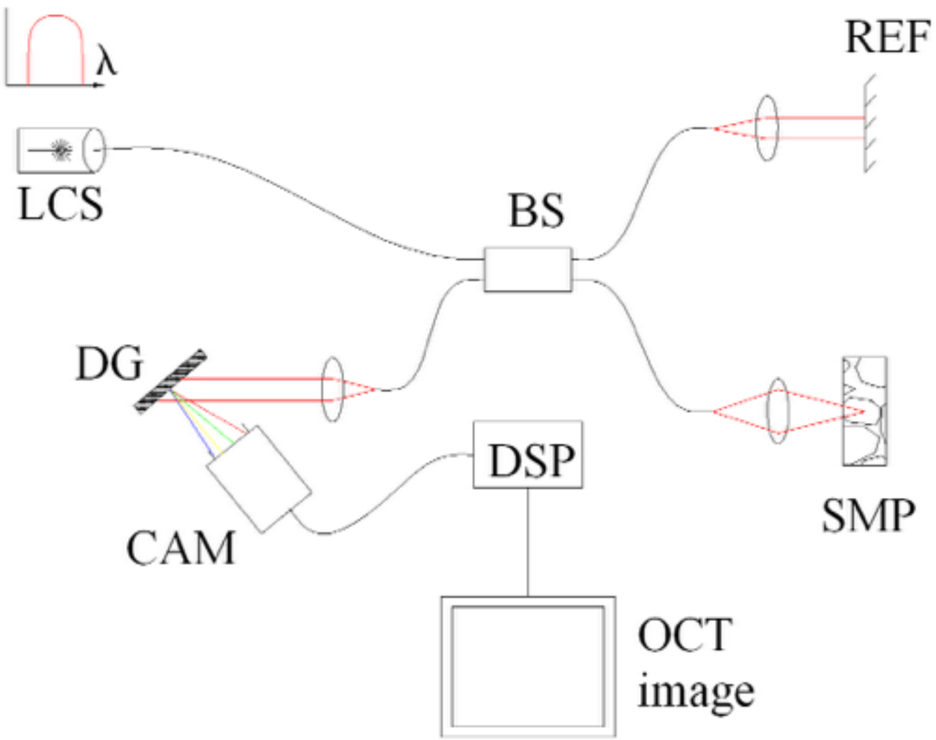
- Tissues to be analized do not need to be prepared.
- Measurements are objective, accurate and repeatable.
- No radiation, no health danger at all.

Difference with Ecography

- Ecography analyzes the reflection of a sound-wave by tissues.
- The benefit of the OCT is dued to the wave dimensions; waves are smaller respect ecography. OCT wavelengths are between 820-870 nm and sometimes 1300 nm.
- Respect ecography, with smaller wavelengths, pictures are more detailed.

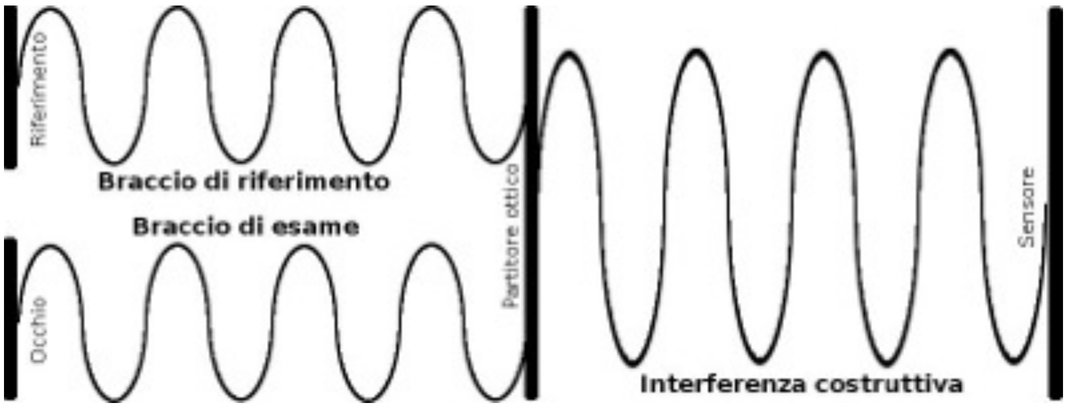
How OCT works

Light source is splitted in two partially coherent rays. One ray goes to the reference arm (REF) and the other goes to the measurement arm (on the ocular tissues to be examinated «SMP»). The reflected light from both arms is then recombined and then sent to a sensor.

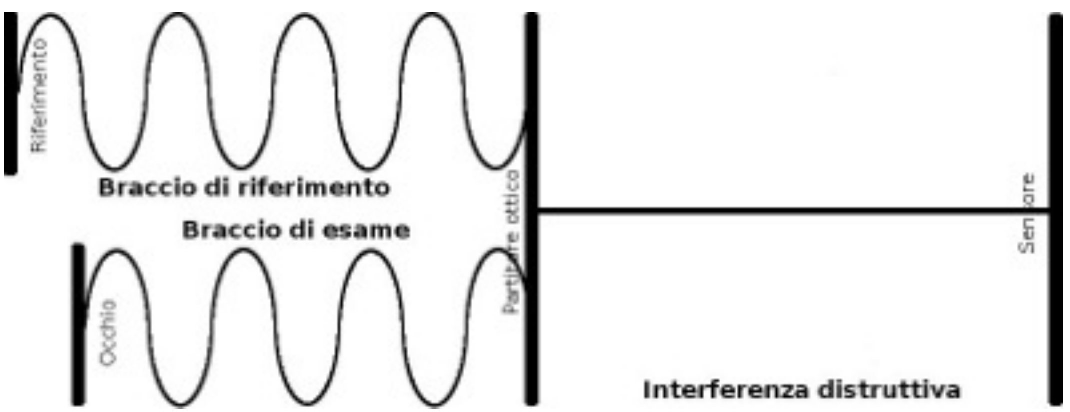


Reflected waves coming from the refernece arm and measurement arm, joining between them, they generates a new wave with different specs, depending on the “coherence” grade from the two arms.

If the two waves are “coherent”, thus maximum and minimum peaks are in the same points, we have a “constructive-interference” and resulting wave has a bigger apmplitude.



If the two waves are in phase opposition (maximum and minimum peaks are in opposite points) we have distructive-interference and the resulting wave has zero amplitude.



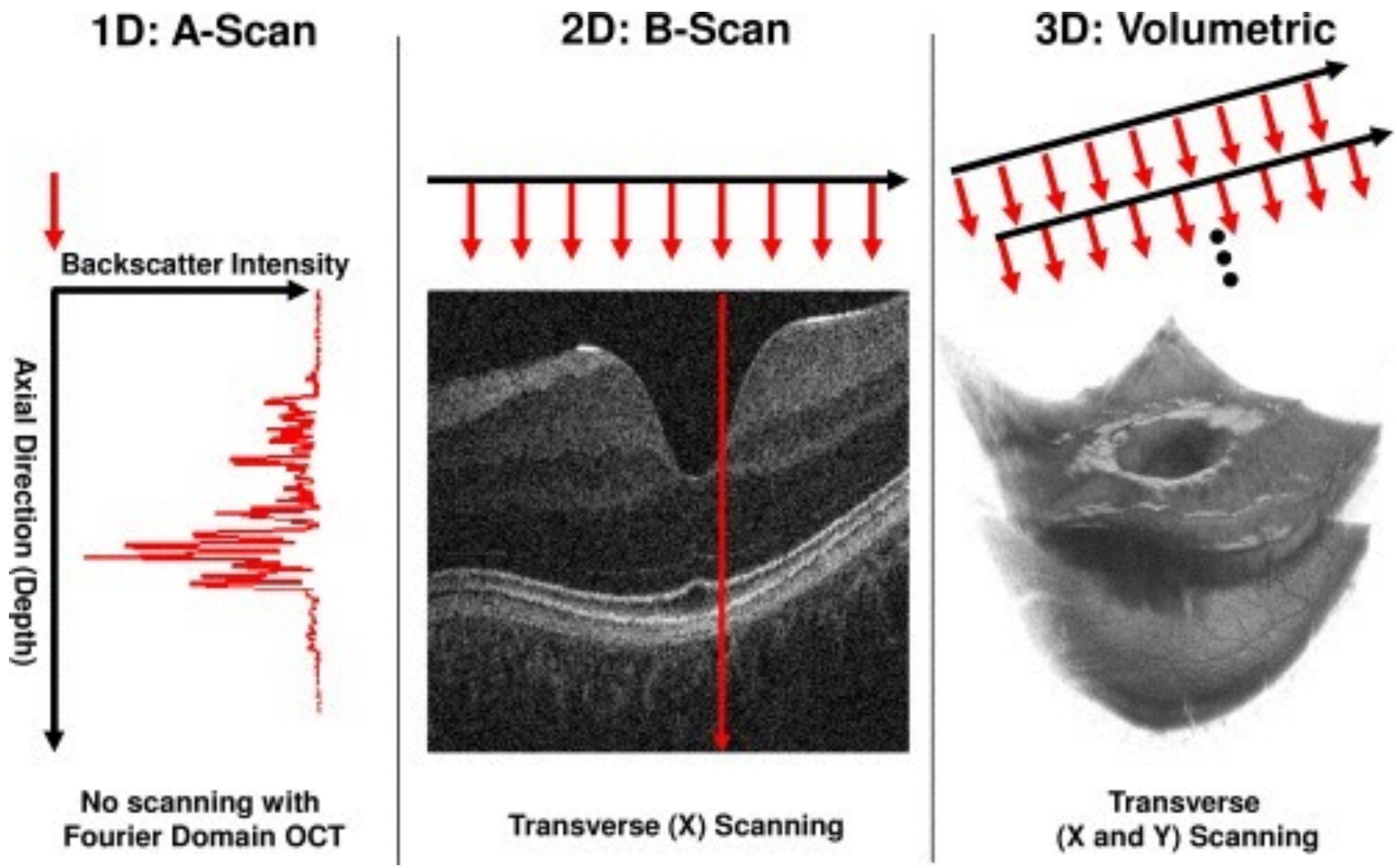
A-scan

- A-scan trace, monodimensional, analyze reflectivity of structures and their depths along a single ray.

- In OCT they are rarely used.
- They are used to measure axial length.

B-scan

- B-scan traces, bidimensional, are made by joining about 1600 A-scan traces, performed along a line of about 6 mm length.
- These are the most common representations used for ophthalmic purposes.
- Images are very similar to the istological section of tissue.
- They are used to evaluate the internal structure of tissues in order to measure thickness.



1D: A-Scan
2D: B-Scan
3D: Volumetric
Backscatter Intensity
Axial Direction (Depth)
No scanning with
Fourier Domain OCT
Transverse (X) Scanning
Transverse
(X and Y) Scanning

C-scan

- C-scan traces, three-dimensionals, are obtained by joining 265 horizontal B-scan traces.
  They allow to recognize bubble surfaces on retina, their ratios with retinal topography and possible deformations.
- Zeus does not have them.

Application: B-scan

- Corneal B-scan traces allow to measure in accurate way the corneal thickness in a wide range of points.
- We can compare the localization of the thickness variations with the localization of the corneal deformation (obtained by corneal topography) in order to distinguish pathology that generates similar surface corneal deformations but with different causes (for example keratoconus and corneal warpage).
- Corneal thickness are useful to plan refractive tratments and/or therapeutic treatments.

Who can use Zeus

- Hospitals
- Useful to observe pathologies difficult to be acquired with sirius
- Refractive, cataract

Zeus vs Sirius

- Image resolution
- Irregular cornea (transplantations, ISCR)
- Strong keratoconus (iper-reflectivity of Scheimpflug can fail on picture)
- Epithelial flap
- Imaging and epithelial measurement
- Schlemm’s channel

ZEUS tech specs

Light source: SLED@840 nm

Resolution:
Axial depth 3.8 um (in air)
Transverse 35 um

Scan range: 16x16x10 mm (in air)

Output power: less than 5 mW

ACQUISITION FOR TOPOGRAPHY/TOMOGRAPHY

Keratoscopy 640x480 pixels
Star scanning for 25 OCT sections on a trasversal field of 16 mm (1024 A-scan for picture)
Axial: 10 mm (in air)
Acquisition time: about1s

Maps:
Tangential and sagittal curvature
Elevation
Refractive power
Corneal thickness
Epithelial thickness @8mm (competitors make it on 6 mm)
Anterior chamber depth

ACQUISITION FOR TOPOGRAPHY/TOMOGRAPHY

Indices:
Summary indices
K-readings
Epithelial thickness indices
Shape indices
Refractive analysis indices
Keratoconus screening

Advanced analysis:
Customizable summaries
Keratoconus summary
ICRS summary
Optical corneal analysis
Follow-up summaries

Pupillography:
Four light conditions.

ACQUISITION WIDE SINGLE SECTION

Scan method: 2D single
1 OCT section on a field of 16 mm @selected angle
(1600 A-scan for picture)
Axial: 10 mm (in air)
Acquisition time: 80 ms
Image mode: raw/averaged

ACQUISITION FOR EPITHELIUM SINGLE SECTION

Scan method: 2D single
Map on 8 mm with 800 AScans
Axial: 3 mm (in air)
Acquisition time: 40ms
Image mode: raw/average

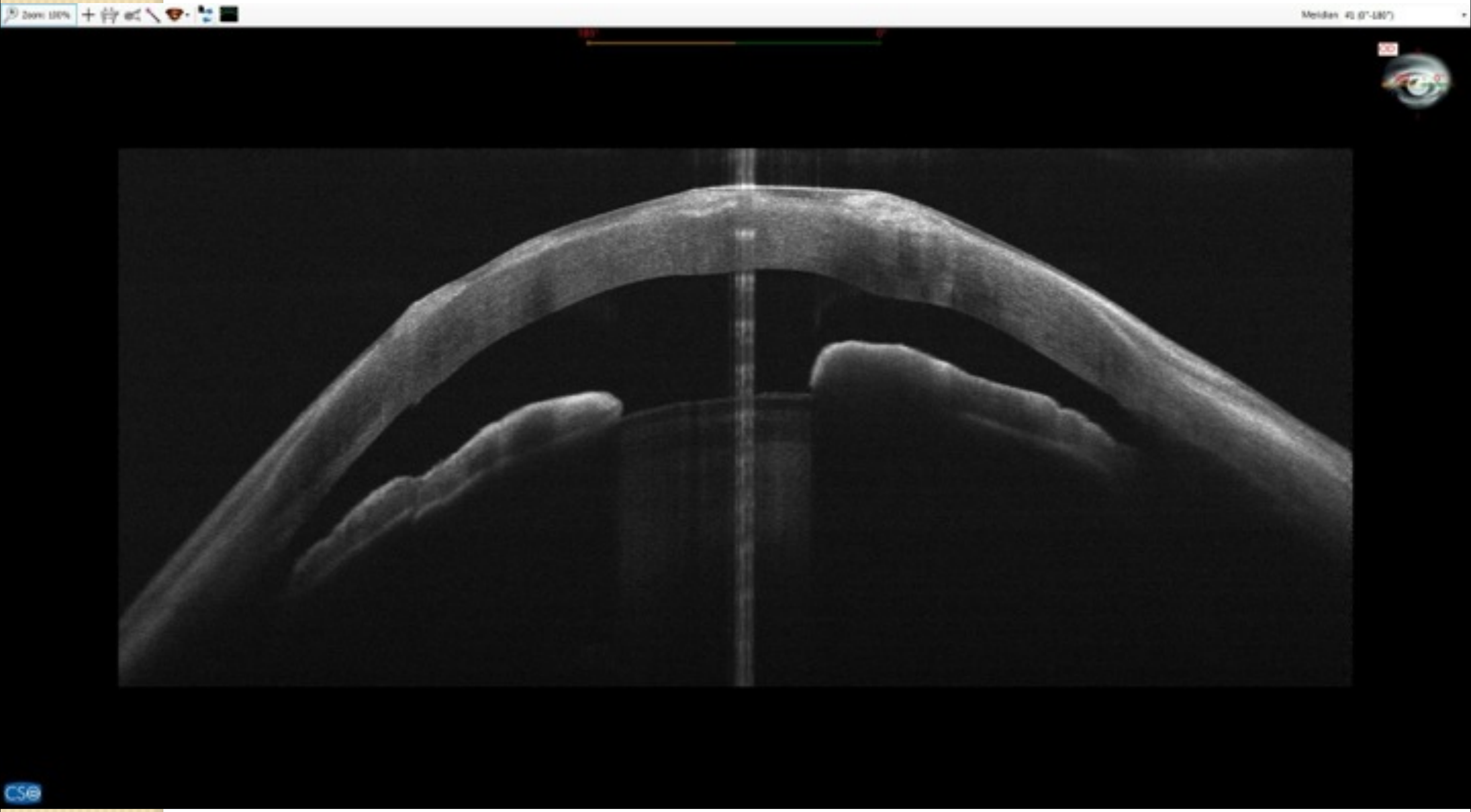
BENEFITS RESPECT COMPETITOR

Better quality pictures

Better axial resolution, Placido → better accuracy and better reliability on pachimetry

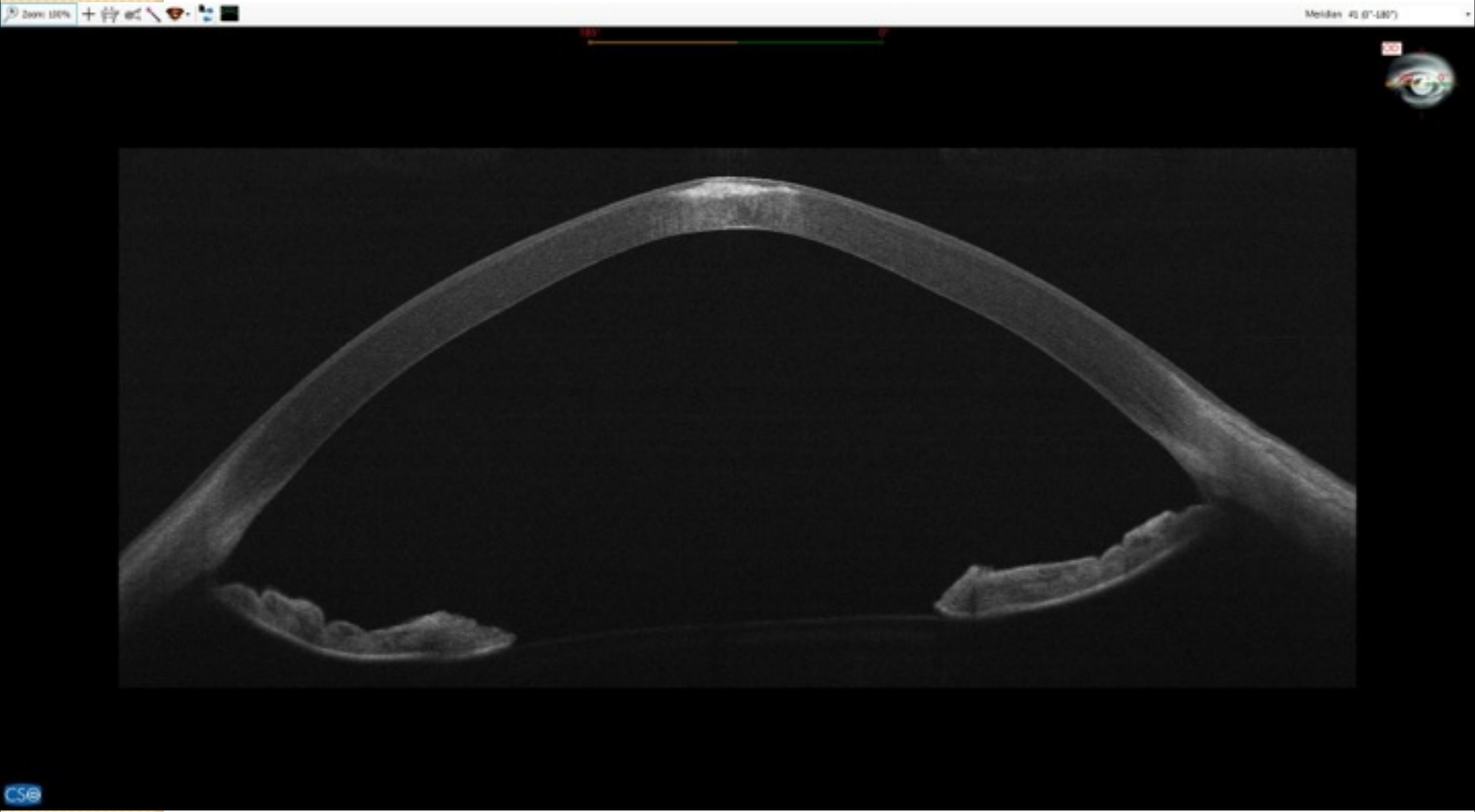
Imaging of cornea tissue (epitelium, stromal flap, cross-linking stripes, Schlemm channel…)

Sample pictures



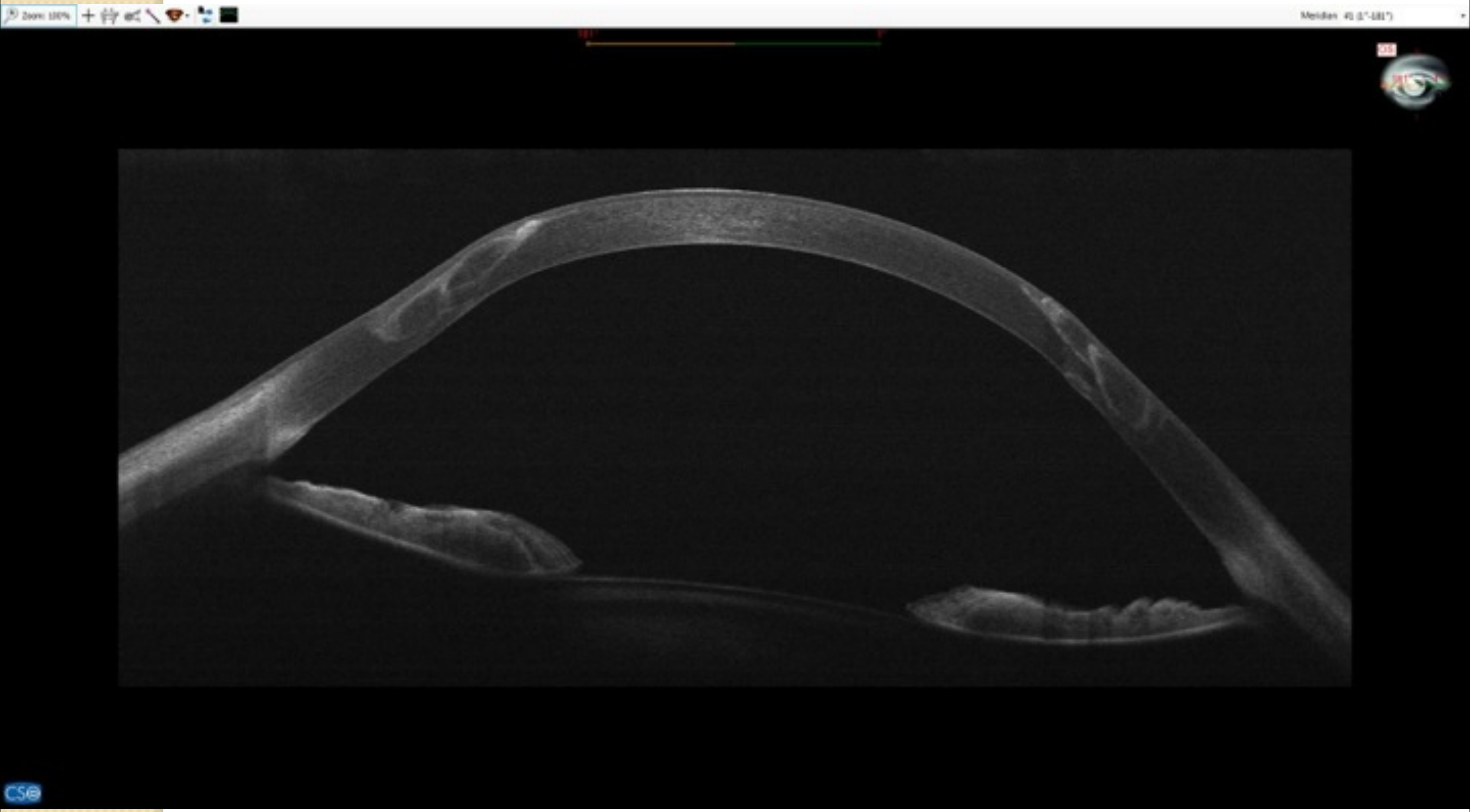
keratitis

Sample pictures



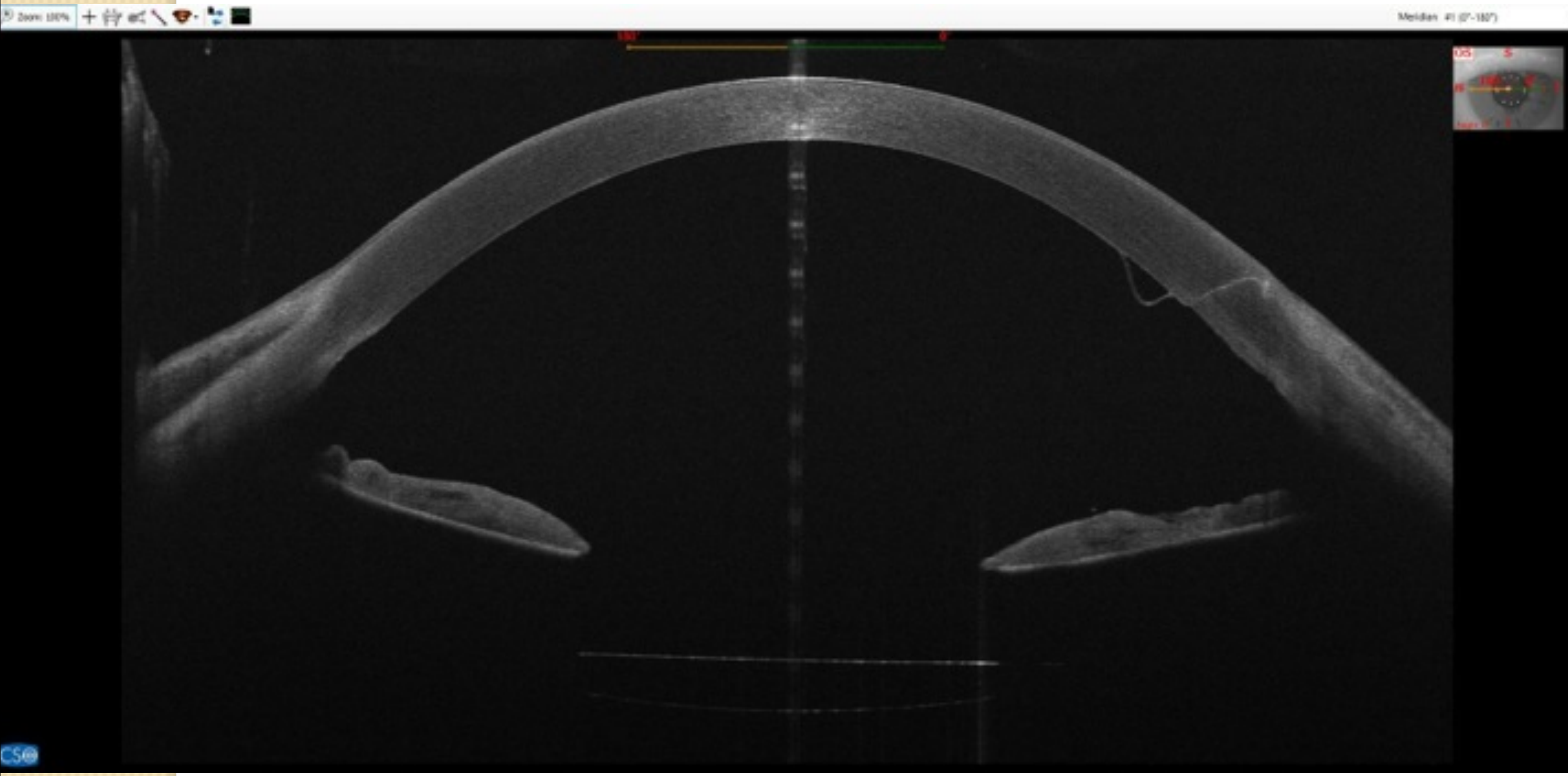
Keratoconus with transplant needed

Sample pictures



DALK (Deep Anterior Lamellar Keratoplasty) corneal transplant

Sample pictures



Endothelium detach