HighRes Anterior Segment OCT
CASIA SS-1000
-
Case Reports

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Content

- Imaging modalities for the anterior eye segment and characterization of the CASIA-OCT
- Measurement samples with the Casia 1000
  - Corneal pathologies
  - Following penetrating keratoplasty + complications
  - Anterior segment analysis
  - Refractive surgery and IOL implantation + complications
- Conclusions

Oculus Pentacam HR

- LED with 475 nm UV-free
- Rotating slit projection
- 100 images in 2 s
- 500 axial points

TMS-5 Tomey

Rot. Slit | Placido

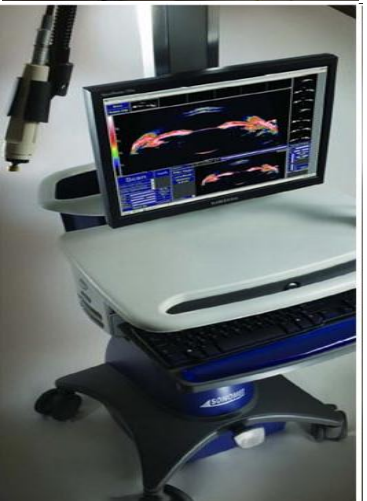
- 25 or 31 rings x 256 points
- acquisition time .5 s (n=4)
- 6400 / 7300 datapoints
- 64 frames in 1.0 s
- 40960 measurement points
- Placido and/or Scheimpflug
- Data merging & motion correction

Zeiss Visante TD-OCT

- SLD mit 1310 nm
- 2000 Scans/s
- Resolution axial/lateral 18/60 µm
- AS scan (16x6 mm) 256 A-scans (.125 s/slice)
- HR cornea scan 512 A-scans (.25 s/slice)

Ziemer Galilei (Bon Optics)

- Placido-topography+Dual Scheimpflug-Imaging (rotating slit)
- Merging of Placido & Scheimpflug data



Sonomed UBM

- 35 or 50 MHz
- Resolution (50 MHz) axial/lateral 18/40 µm
- Acquisition time HR/3D 3 s
- No topographic function or image processing

Reichert Reflex UBM

- 35 or 50 MHz
- Resolution (50 MHz) axial/lateral 16/45 µm
- Acquisition time HR/3D 2 s
- No topographic function or image processing

Tomey SS Casia 1000 (SS-OCT)

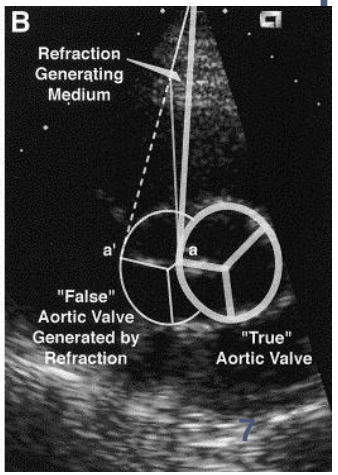
- Light source 1310 nm (NIR)
- Spatial resolution axial 10 µm, lateral 30 µm
- Anterior segment analysis (16x16x6 mm)
- Corneal scan (10x10x3 mm)
- 30.000 A scans/s
- Modalities:
  - 2D/3D measurement and data analysis
  - Corneal topography (anterior and posterior)
  - Anterior segment measurement
  - Pachymetry mapping
  - HR-cornea scan
  - Densitometry map

Optical tomography vs. Ultrasound

- Refractive index of ALL media must be known
  Tissue opacities block light
  (NIR!!!, e.g. CASIA)
- **Deeper structures MUST be corrected by inverse raytracing through superficial structures!!!!**
- Error propagation if superficial structures are not measured or analyzed appropriately

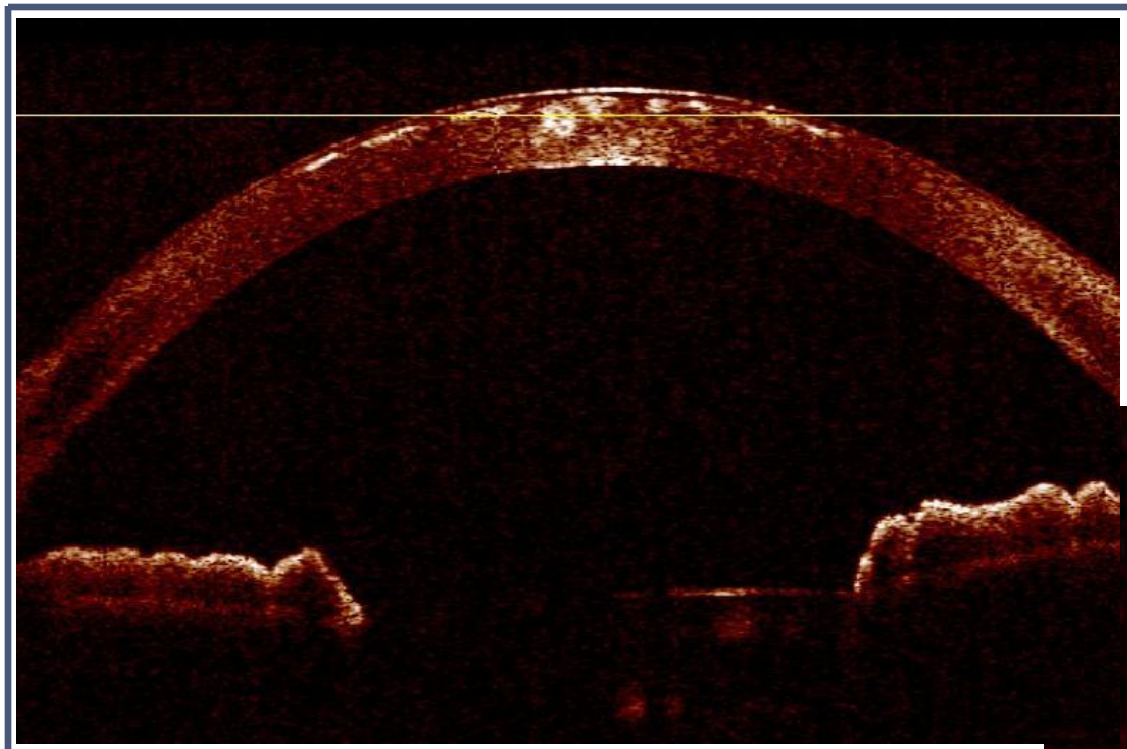
- Speed of sound of ALL media must be known
  (especially in pathologic tissue or cataractous lenses unrealistic!!!)
- Refraction at interfaces
  (e.g. at corneal front surface or vacuoles)
- Error propagation for deeper structures if superficial structures are measured or interpreted uncorrectly.

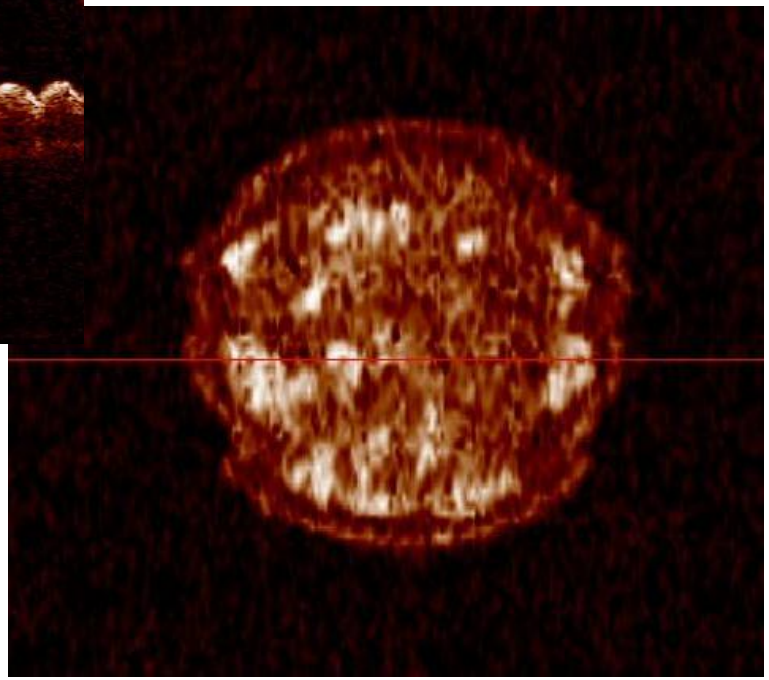
10th order polynomial fit (CASIA) instead of spherical model in Pentacam



Measurement samples: Measurement with corneal pathologies (e.g. dystrophies and keratoconus)

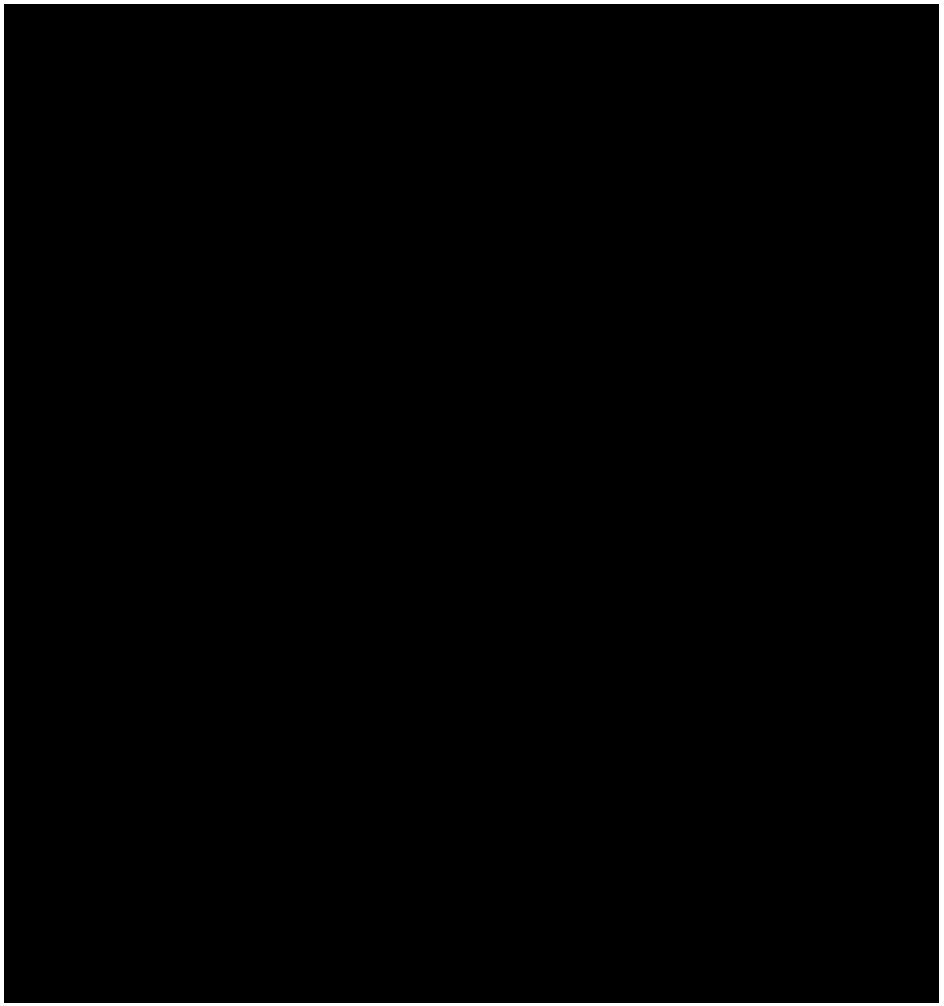
Stromal corneal dystrophy



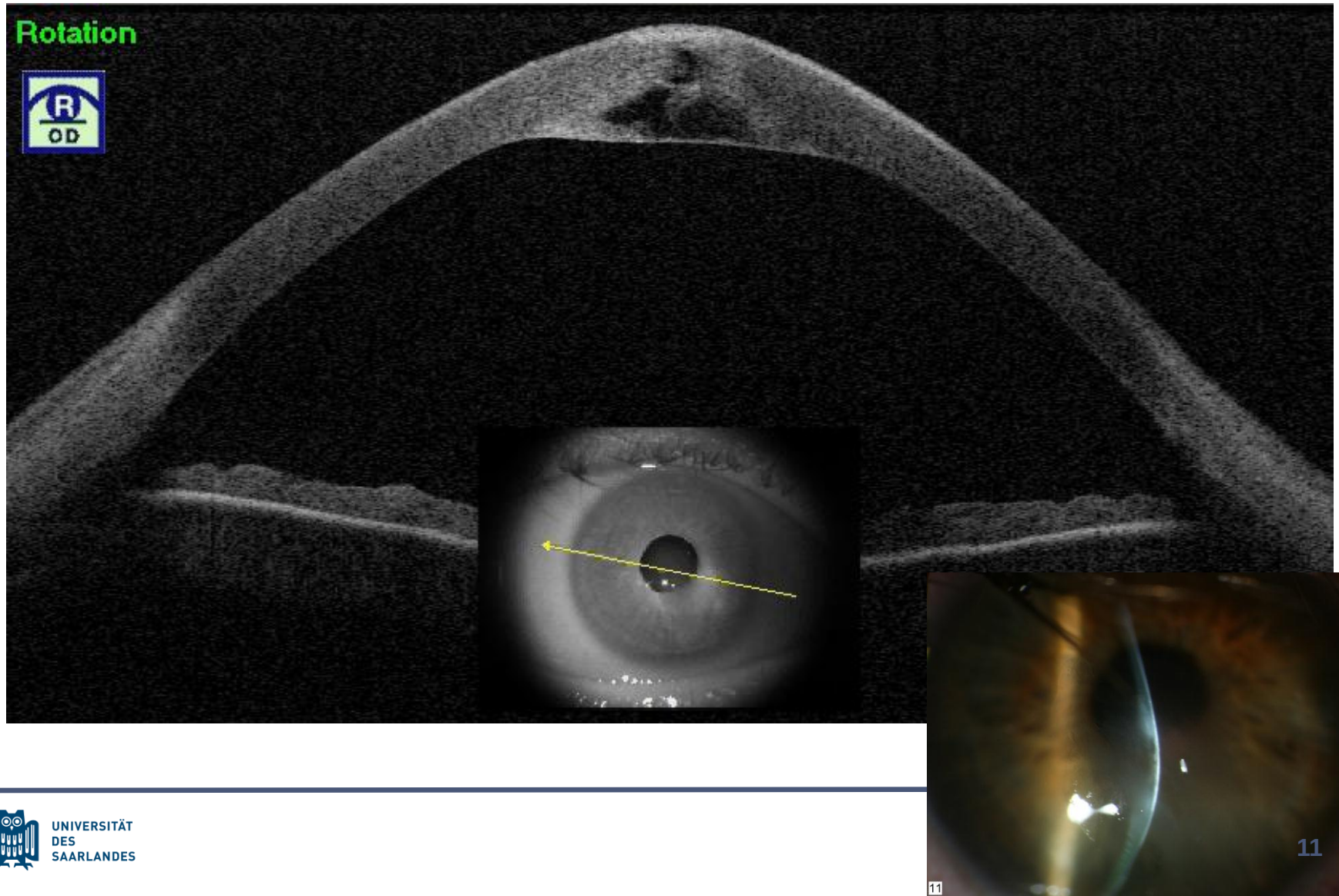


Granular stromal dystrophy

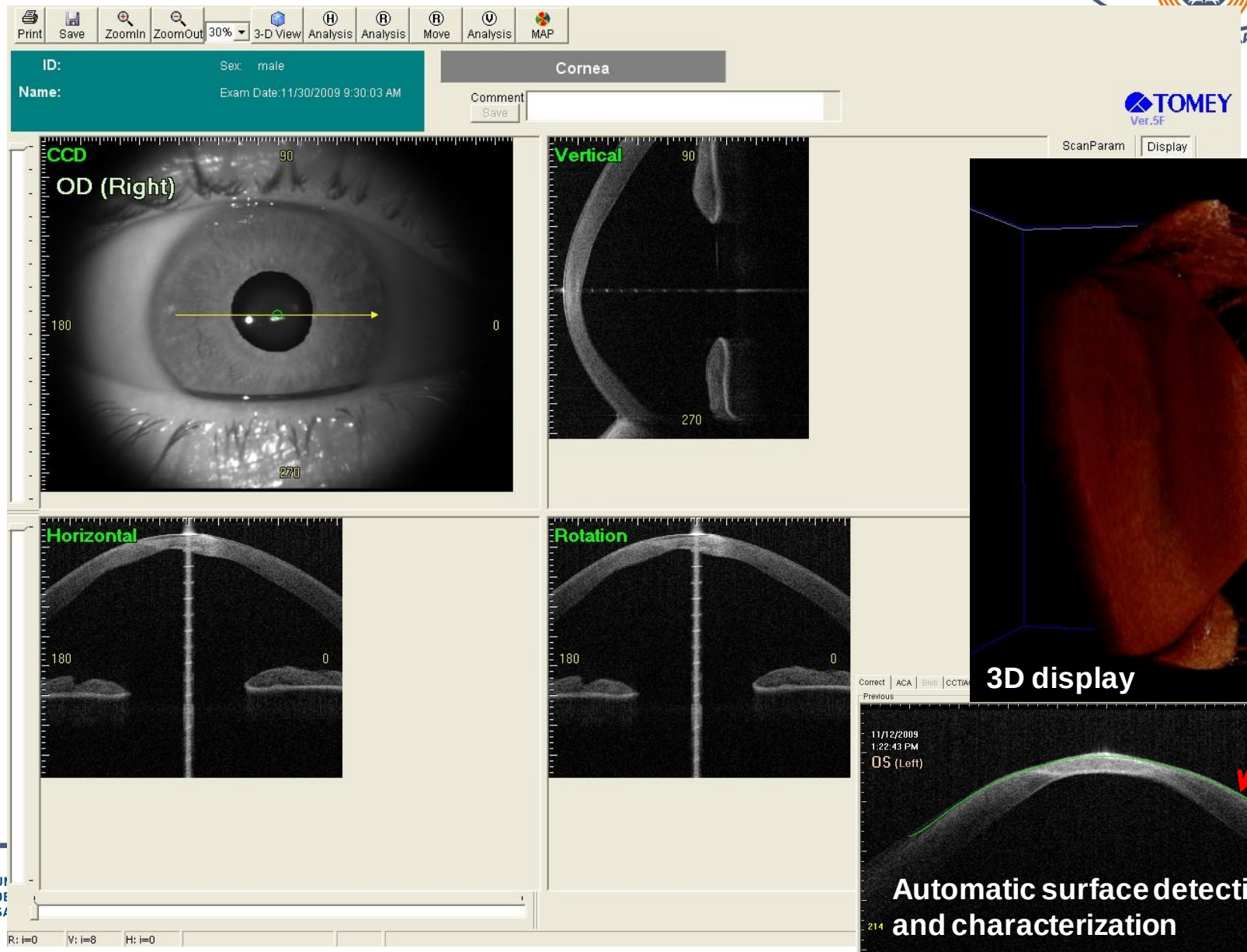
Stromal corneal dystrophy



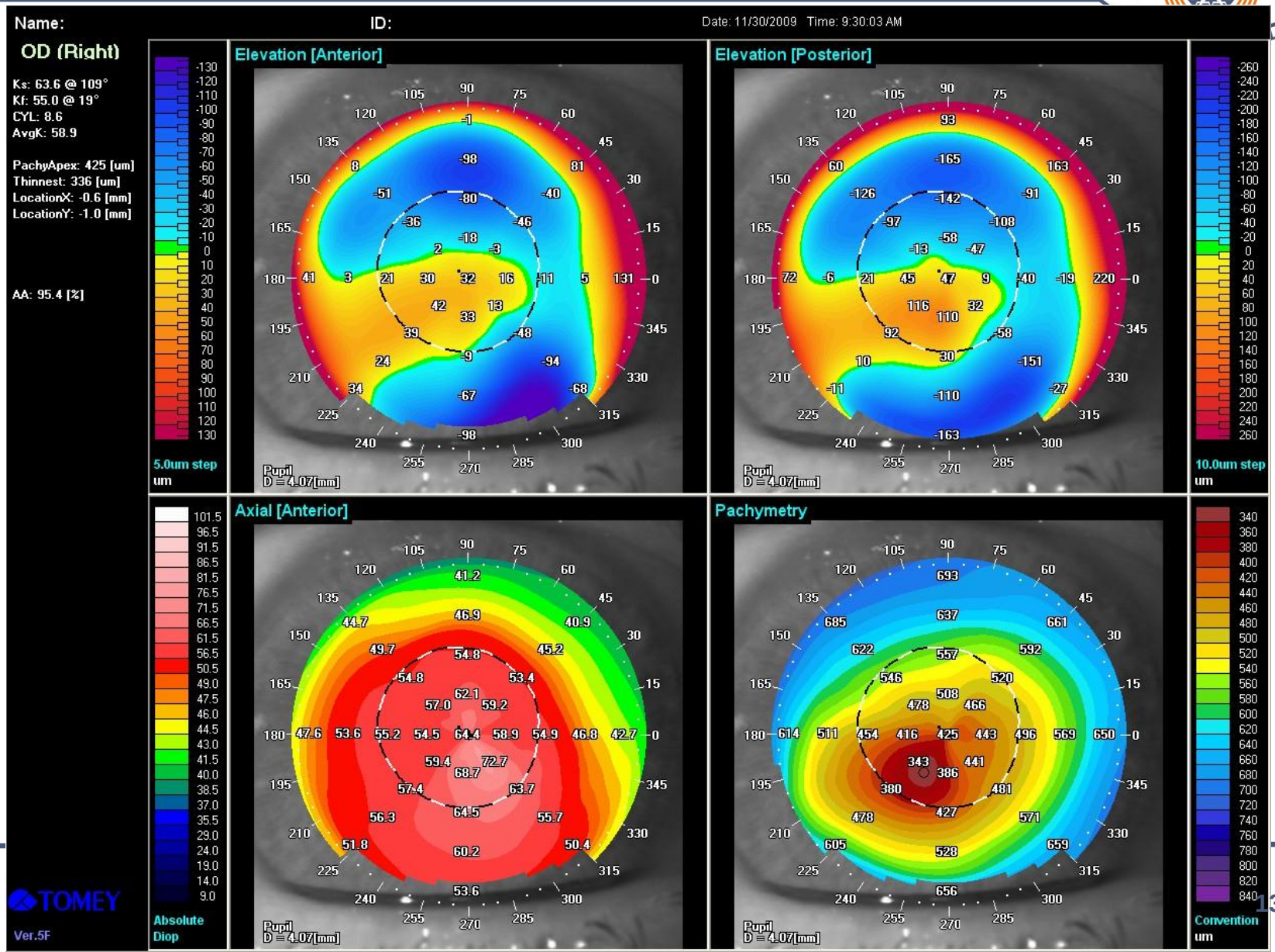
Keratoconus ante perforationem



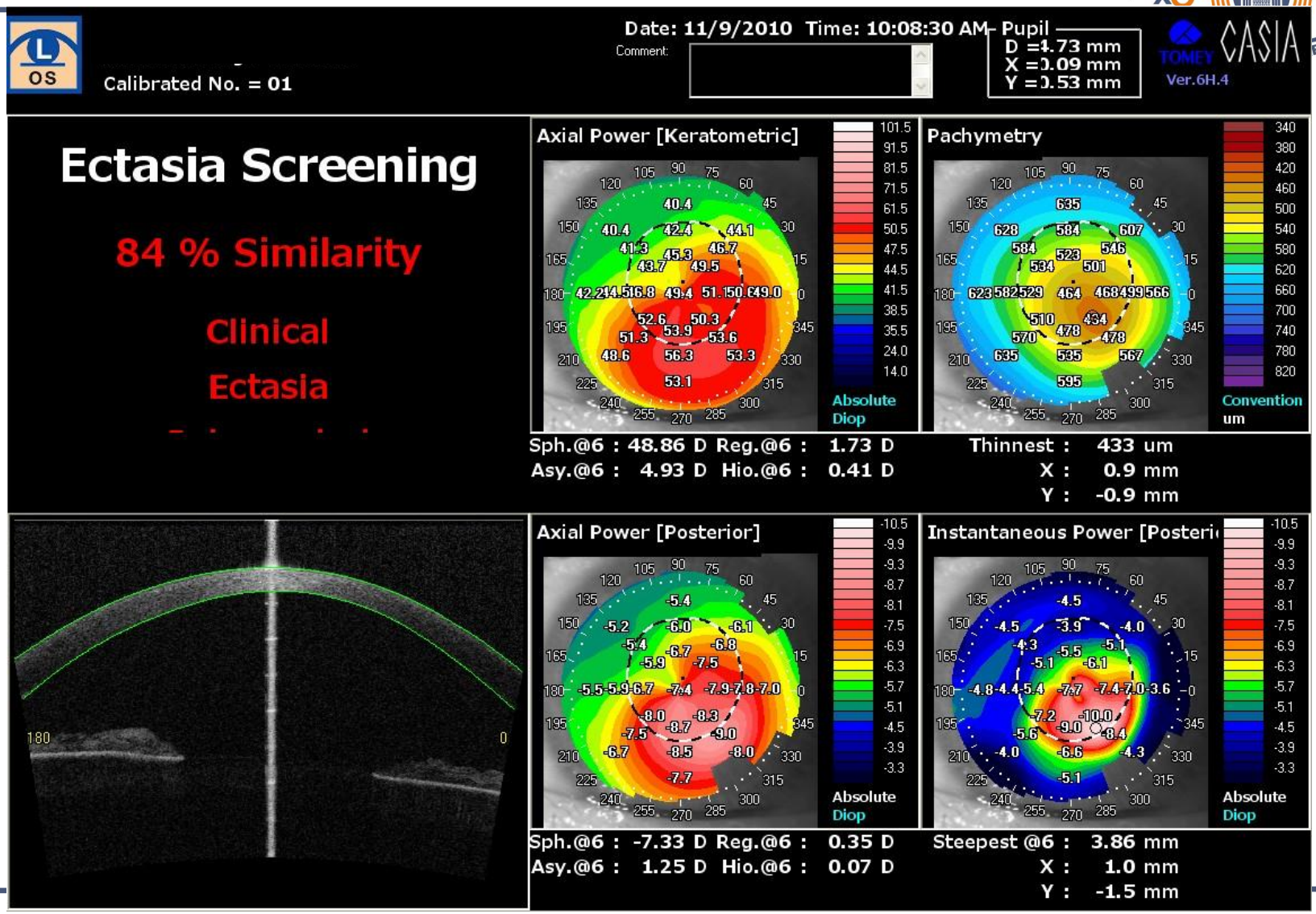
Overview image: Keratoconus



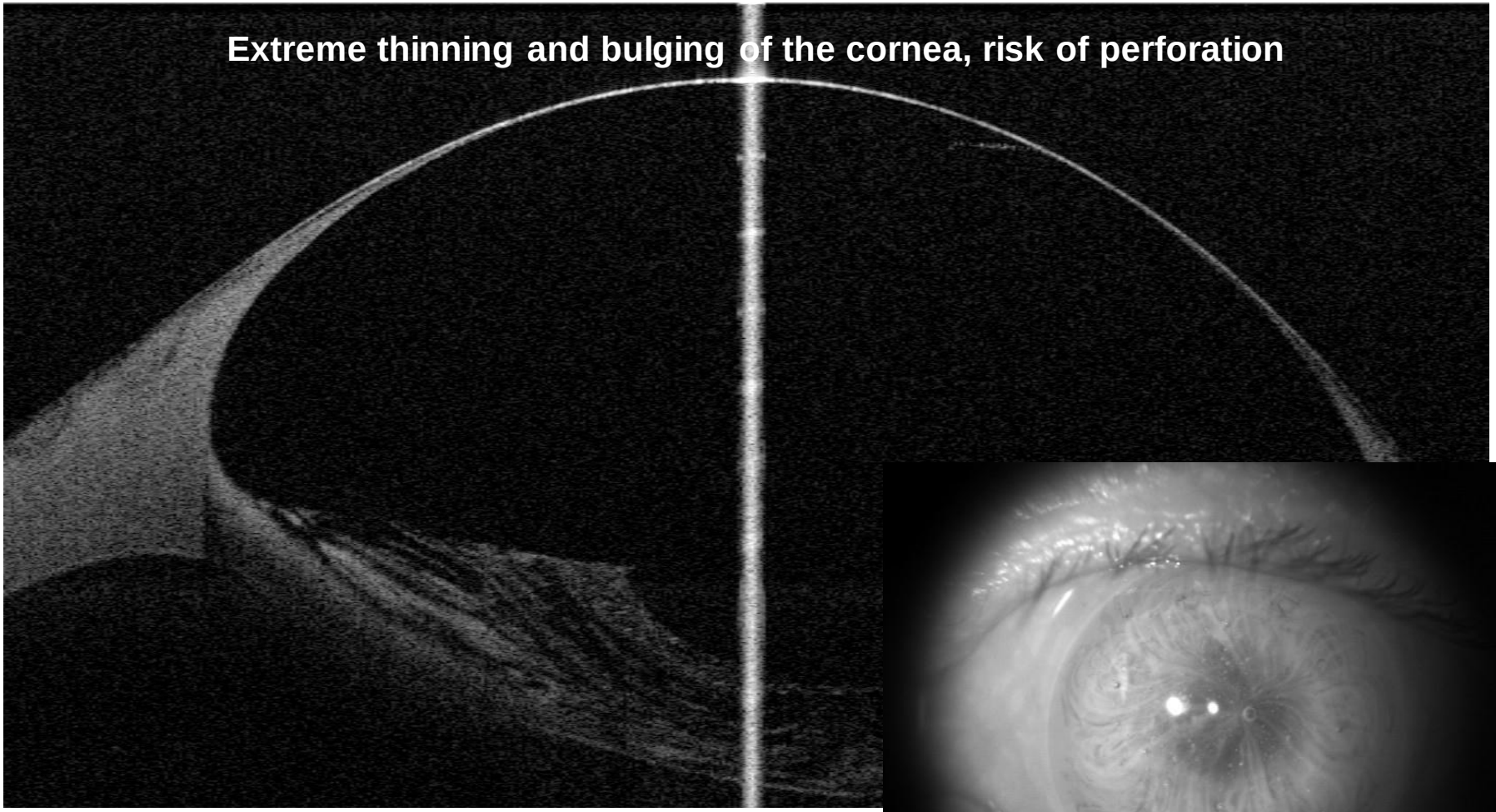
Corneal topography in keratoconus

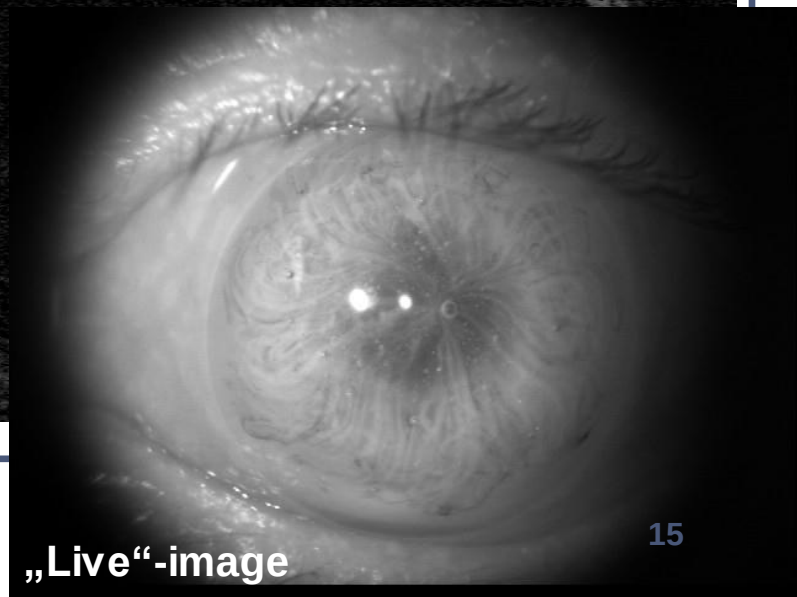


Dedicated KC screening software

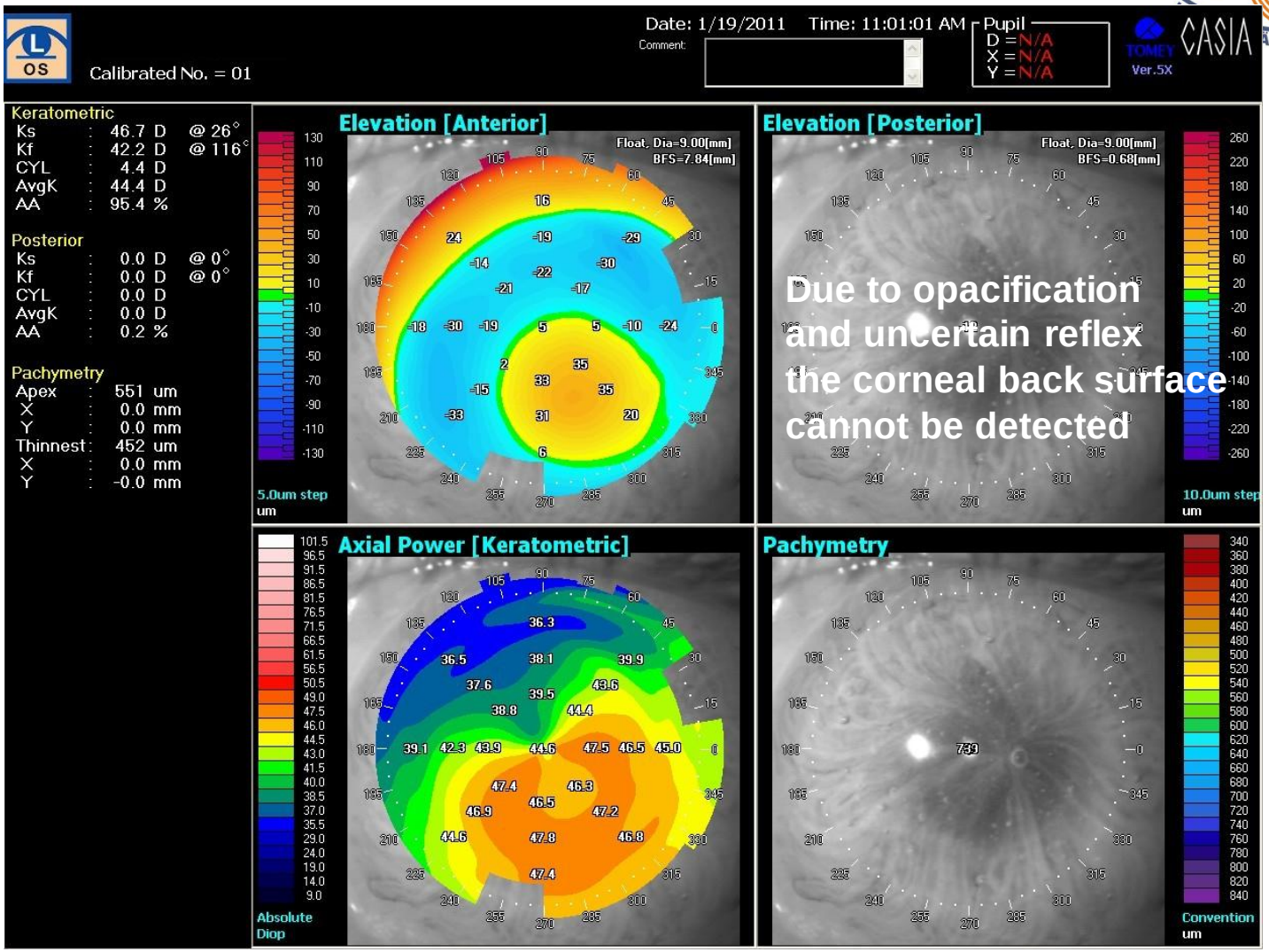


Cross sectional view in keratoglobus

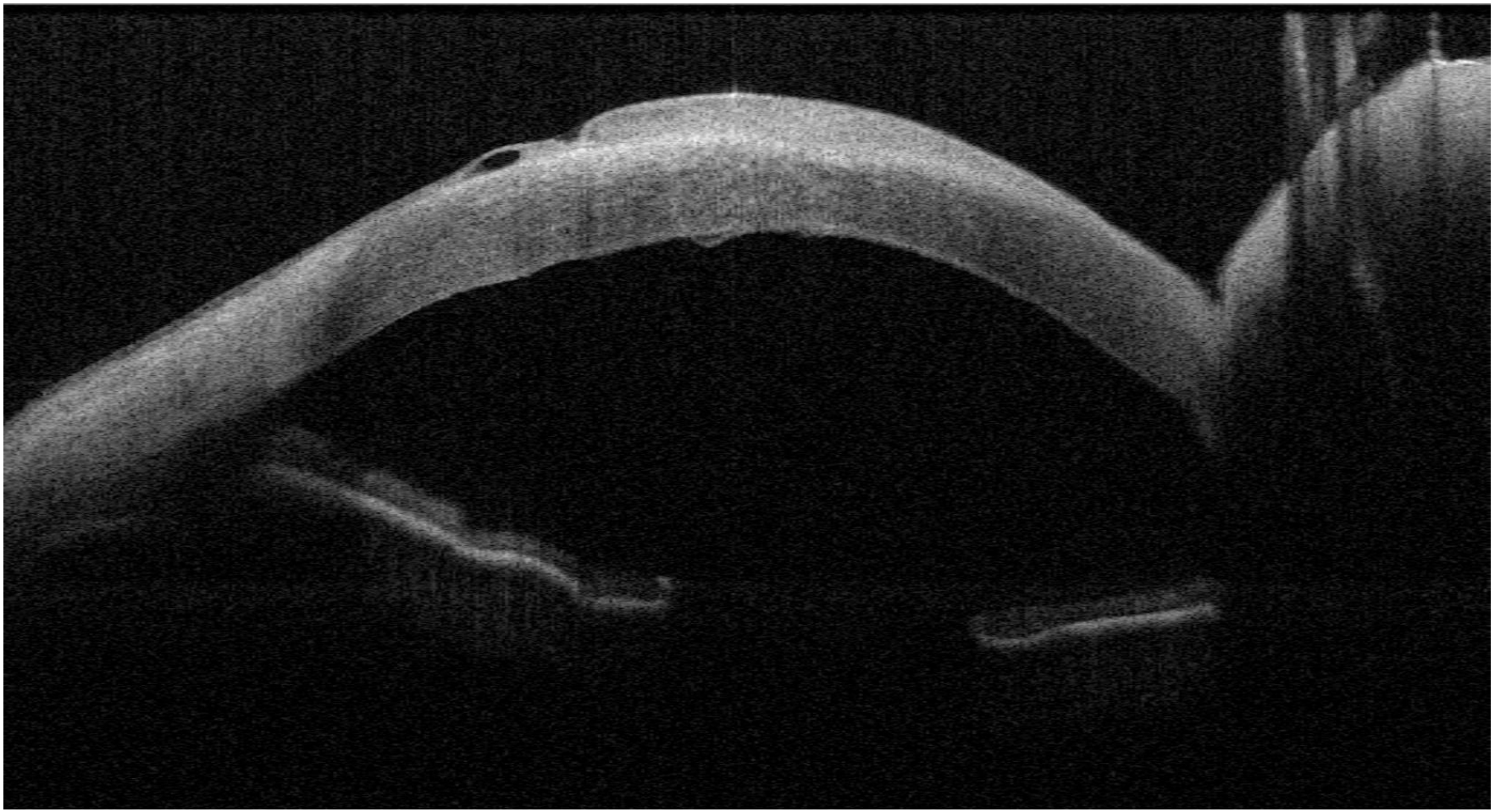




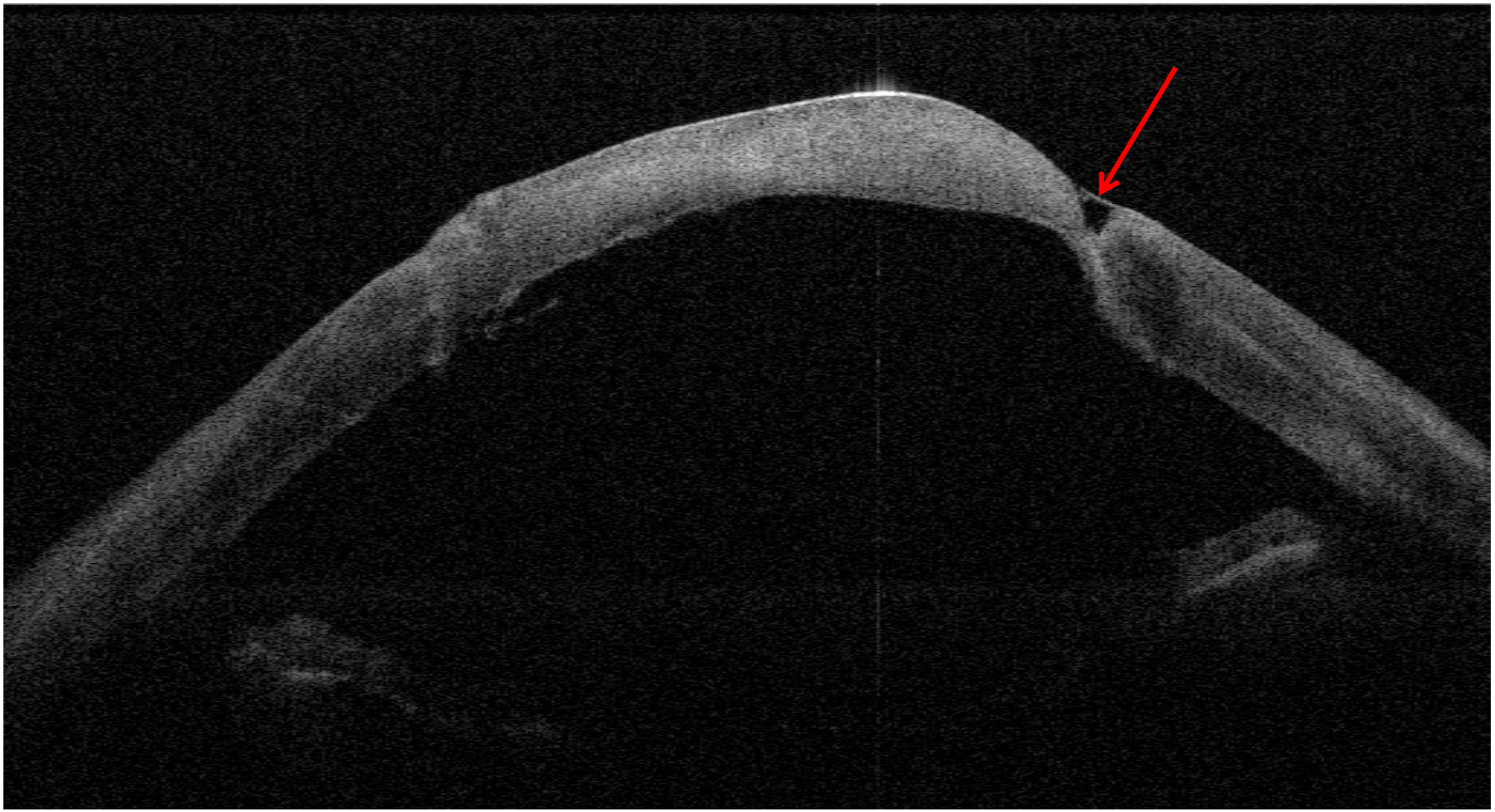
Corneal topography map in keratoglobus



Examination of amniotic membrane in situ

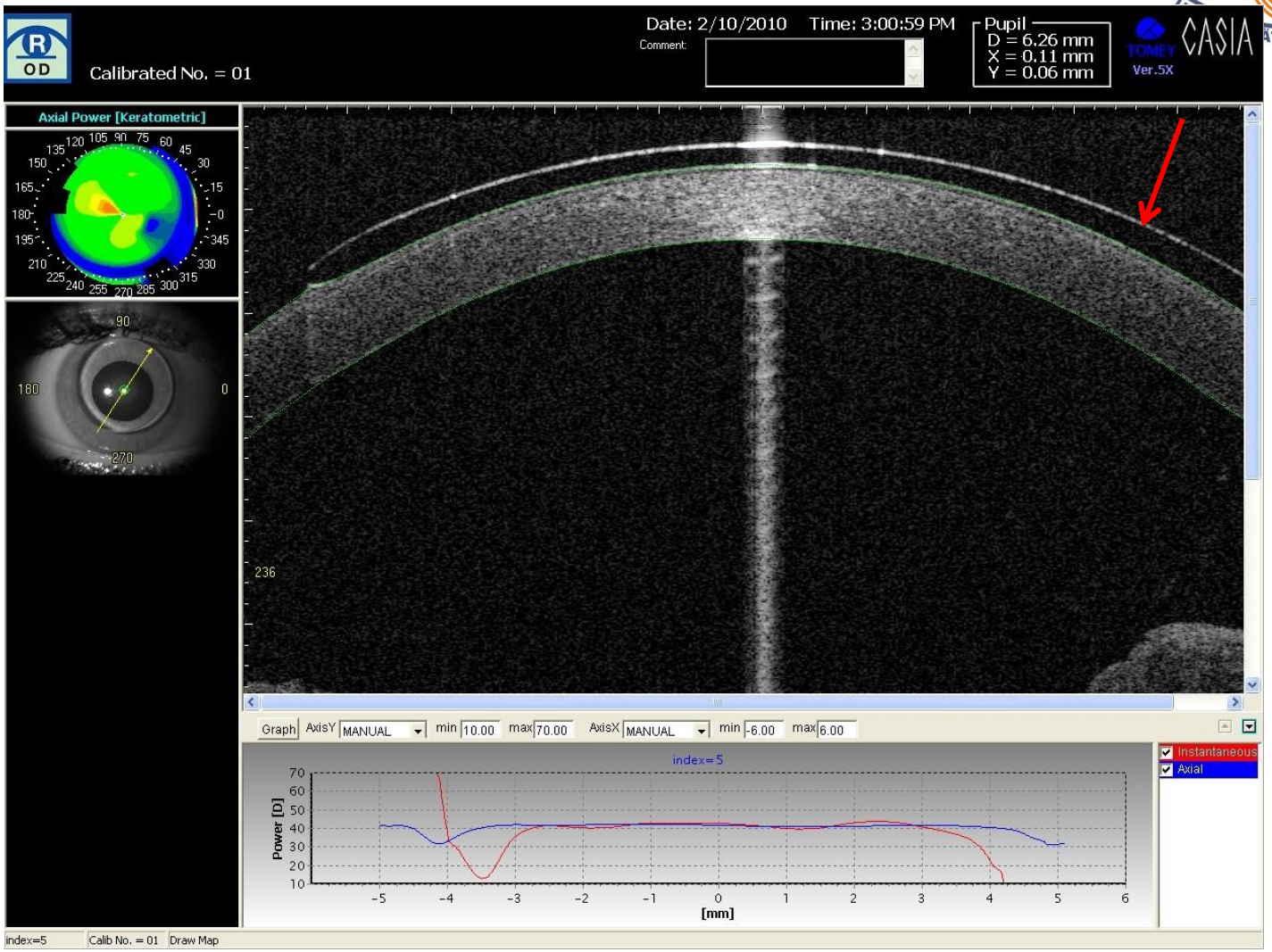


Perforating injury with a steel needle

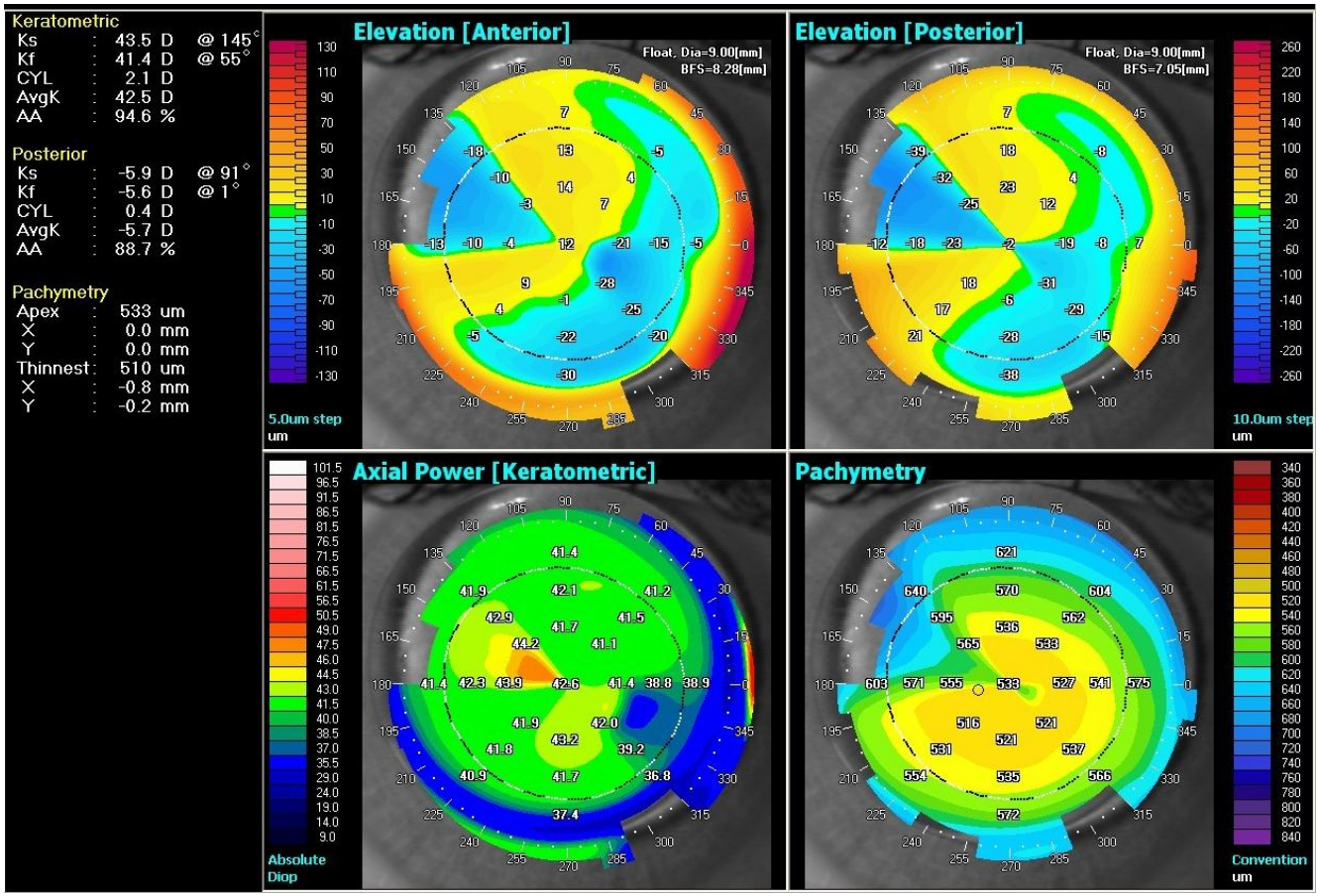


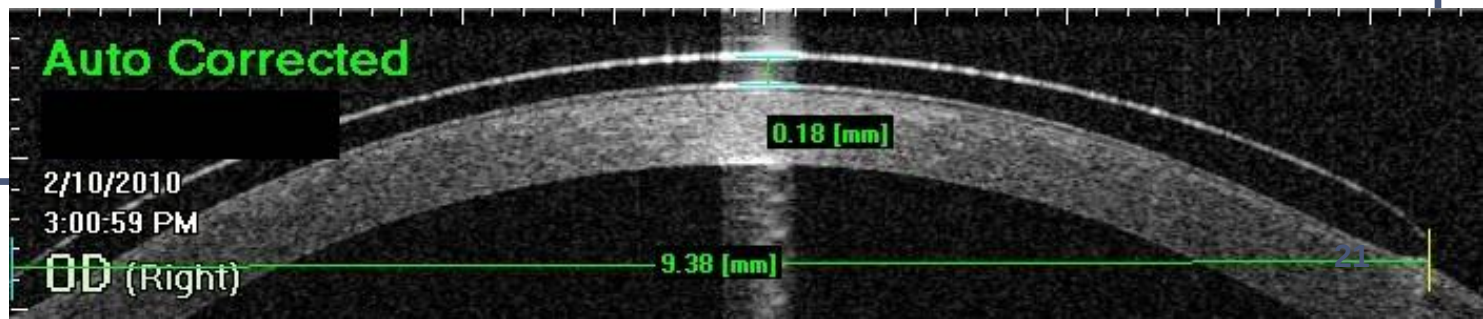
Descemet detachment and corneal edema in bullous keratopathy

Corneal measurement through a CL



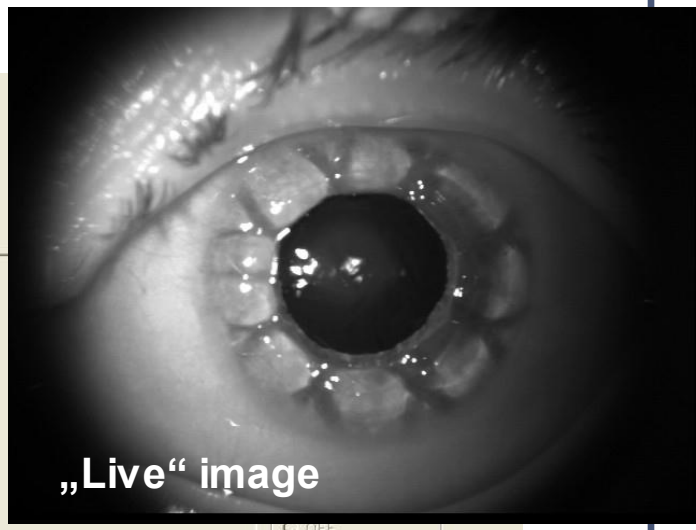
Topography and size of a CL



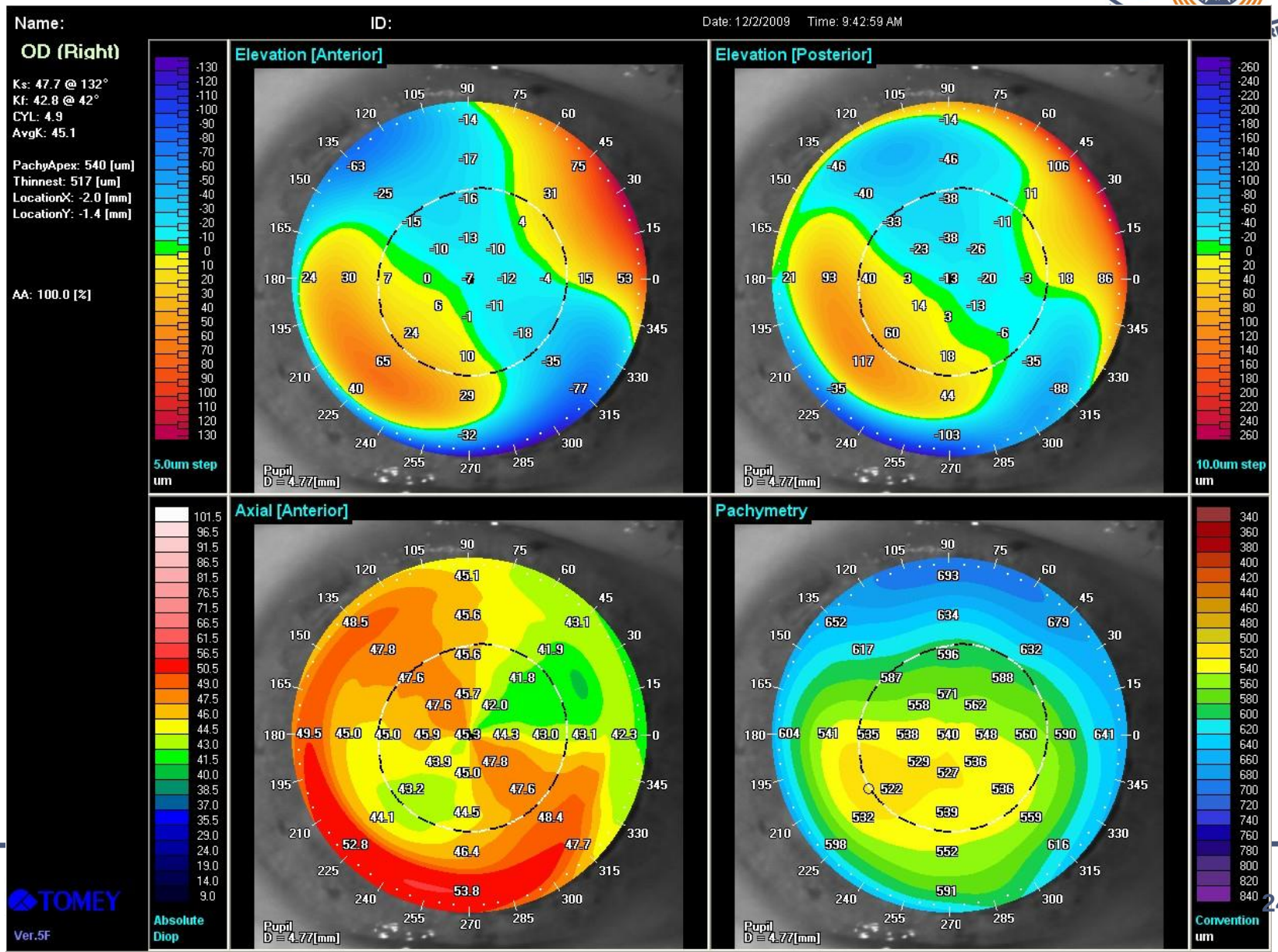


Measurement samples: Diagnostics after penetrating (PK) or lamellar (LK) keratoplasty + complications

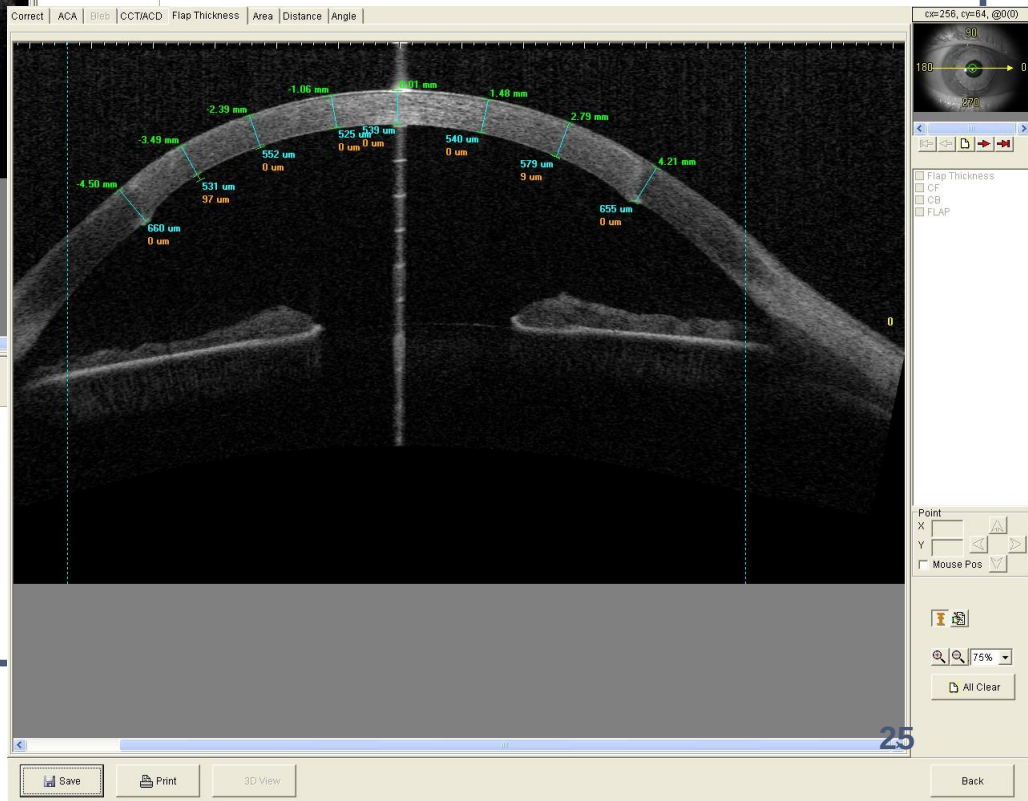
Overview image: following PK



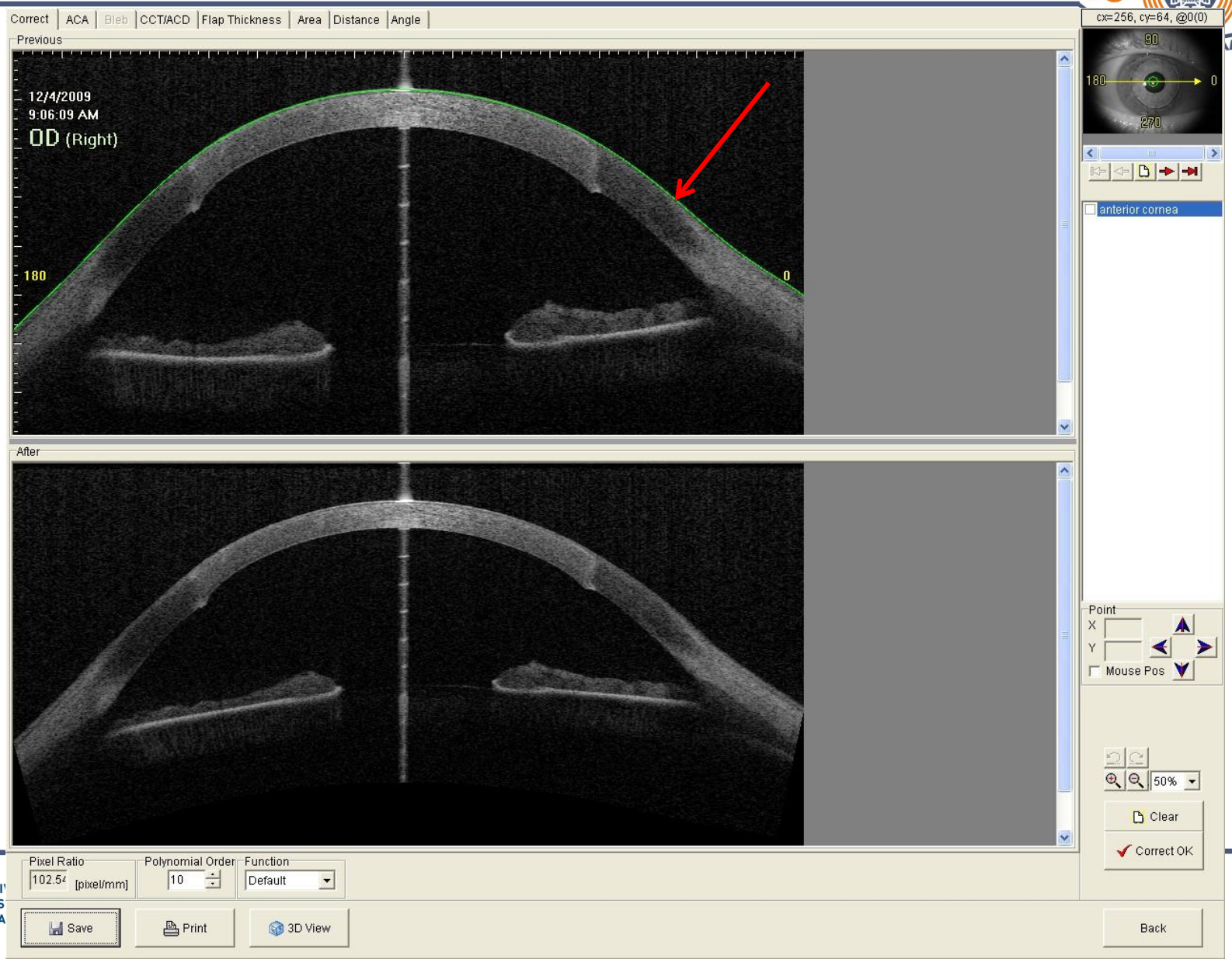
Corneal topography following PK



Graft diameter and CCT profile

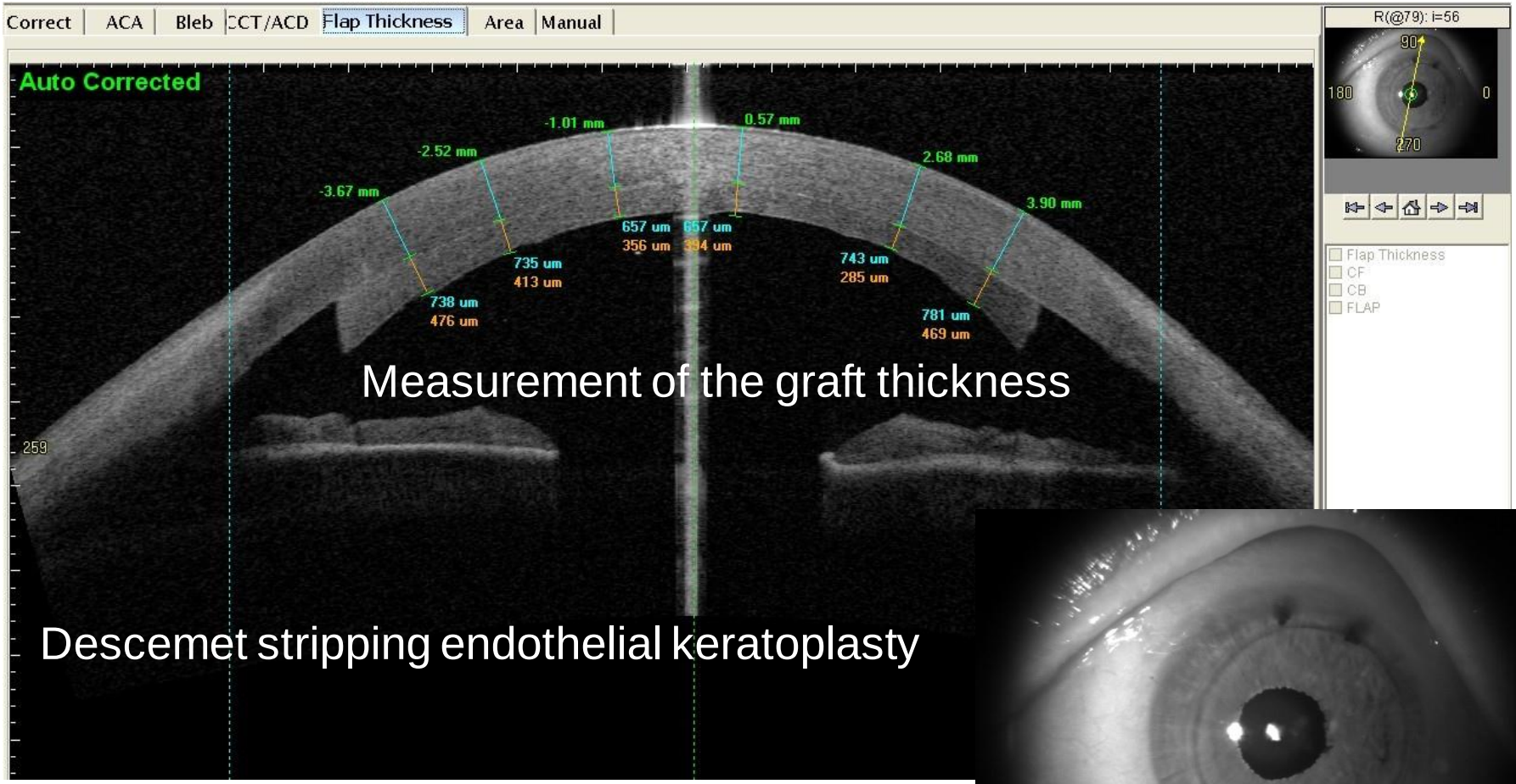


Automatic surface recognition following PK



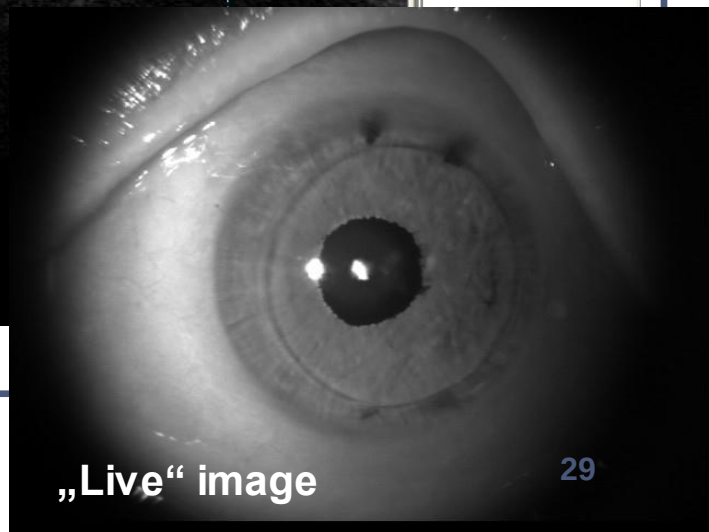
Step formation and flat ACD

Following DSEAK



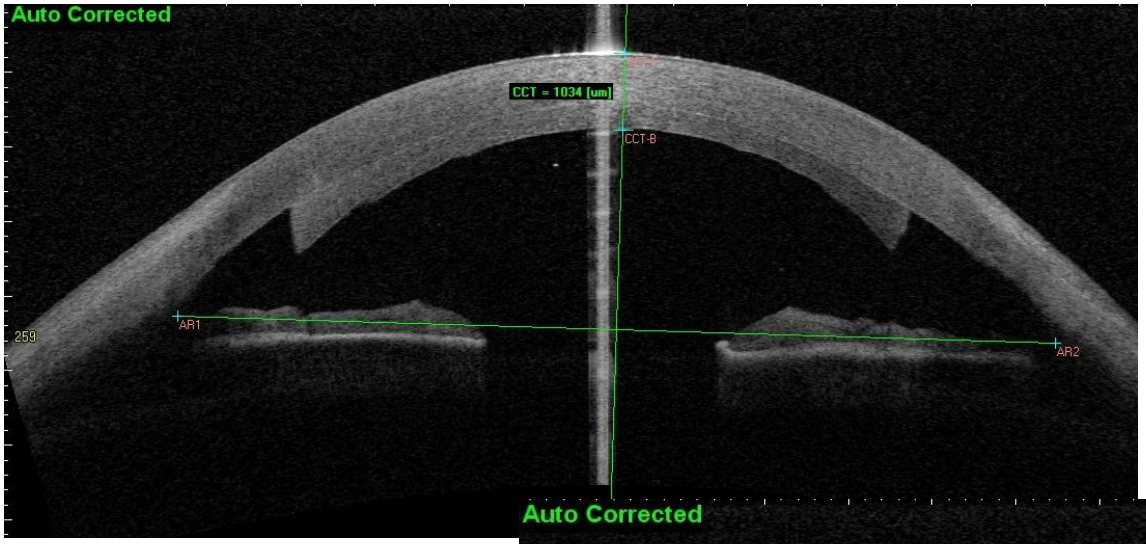
Measurement of the graft thickness

Descemet stripping endothelial keratoplasty



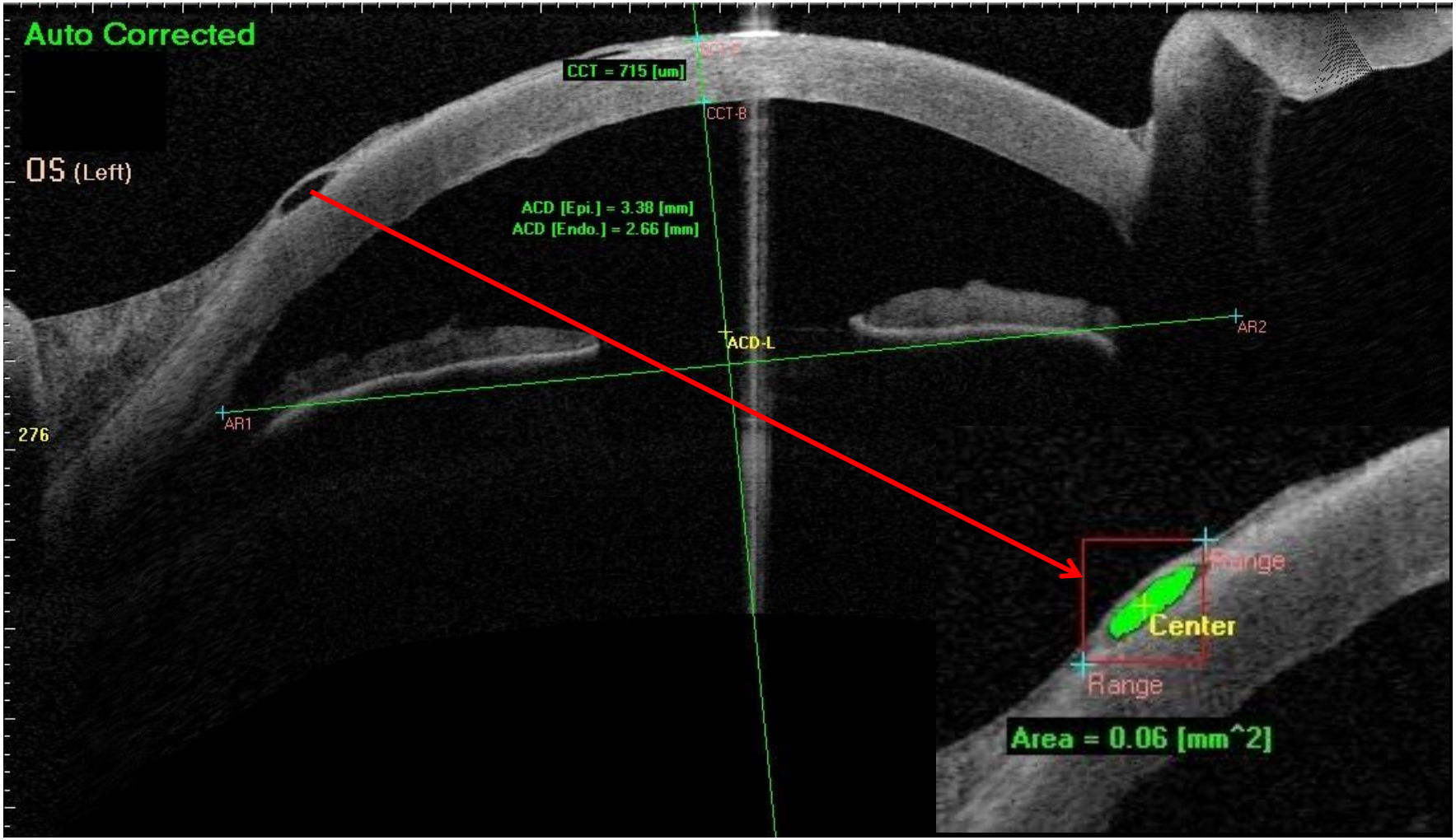
„Live“ image

Measurement w-t-w and graft diameter

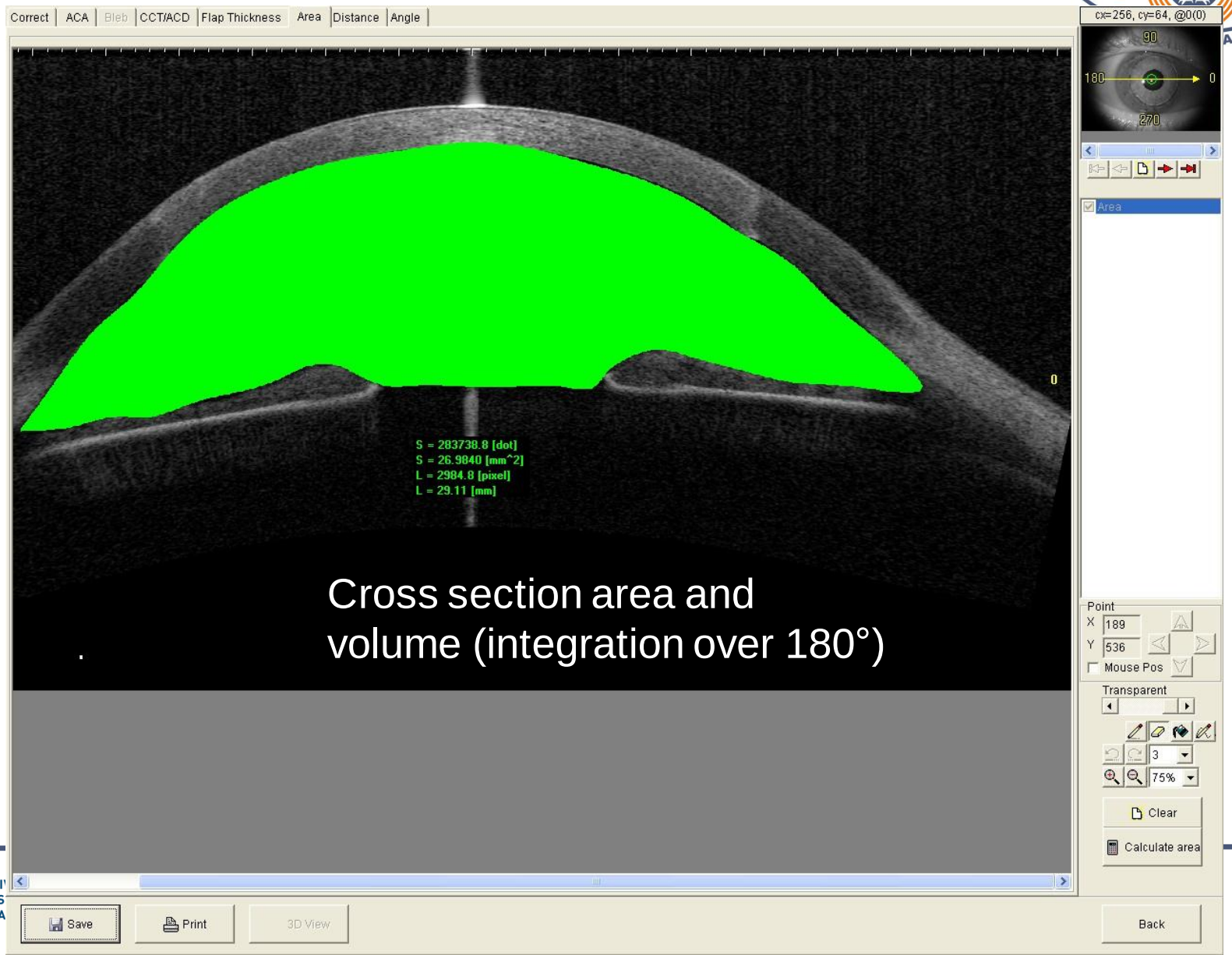


Measurement samples: Anterior segment analysis

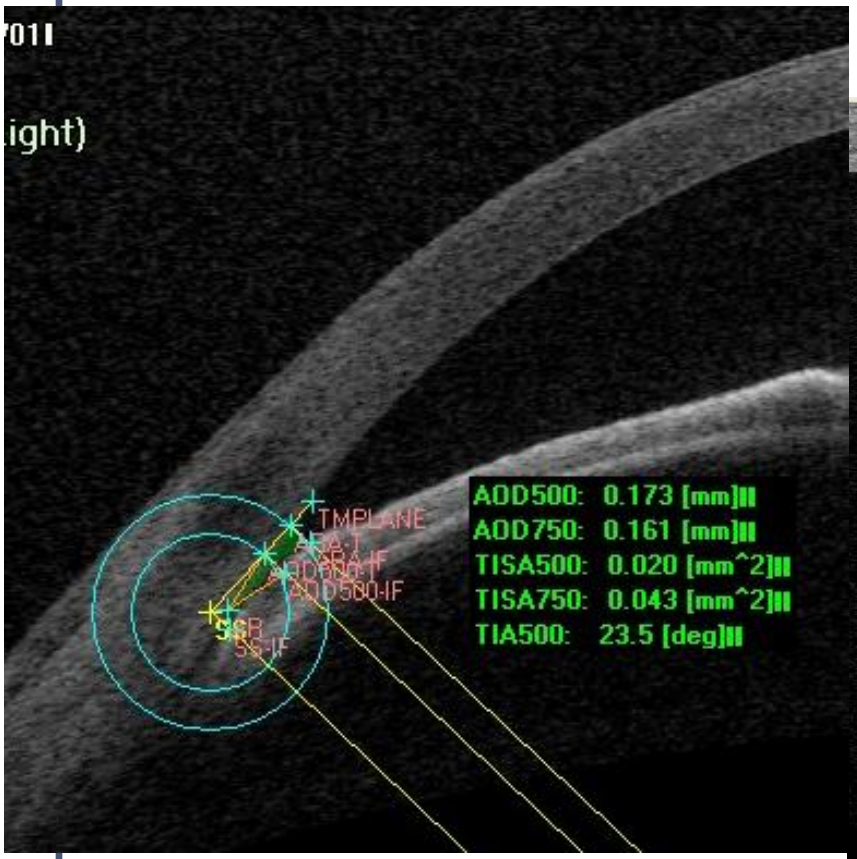
Anterior chamber depth measurement

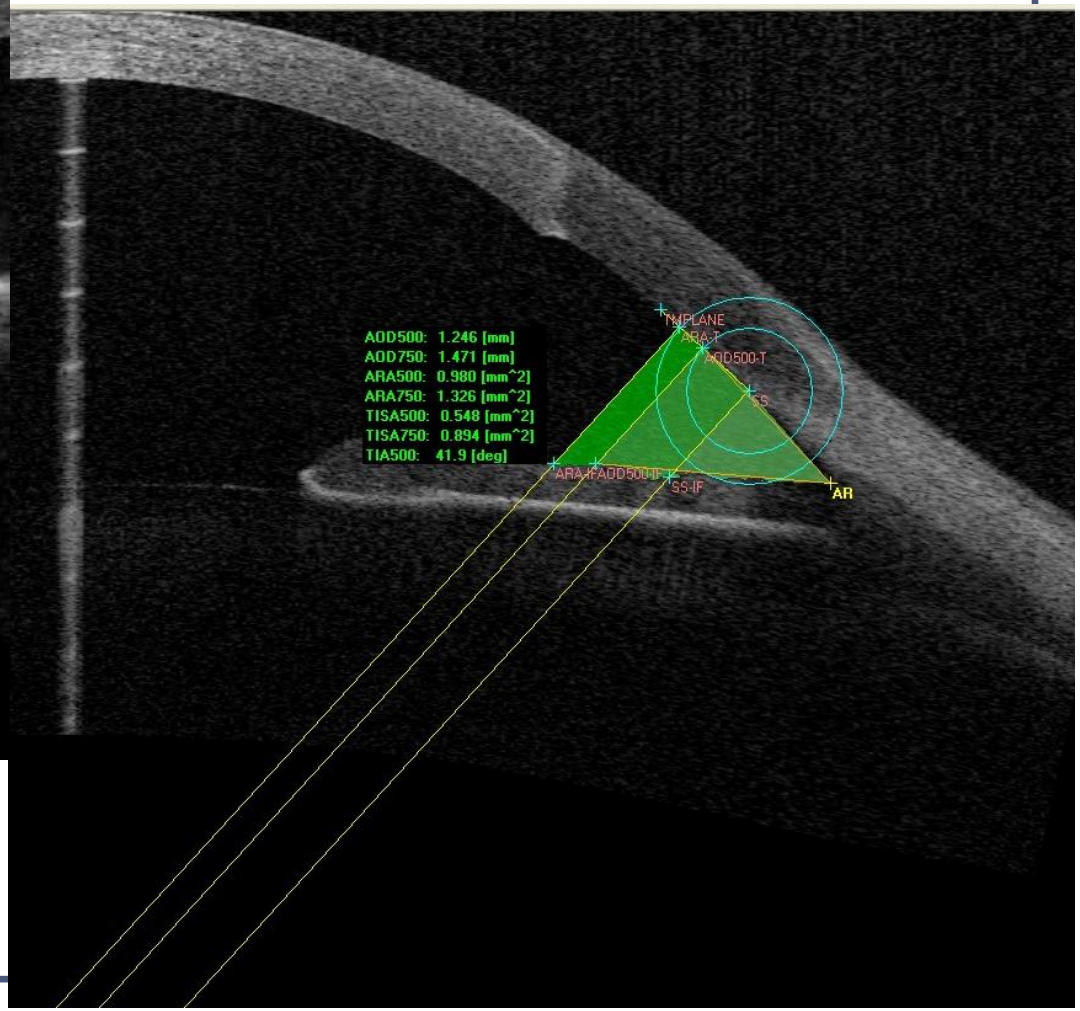


Anterior chamber analysis

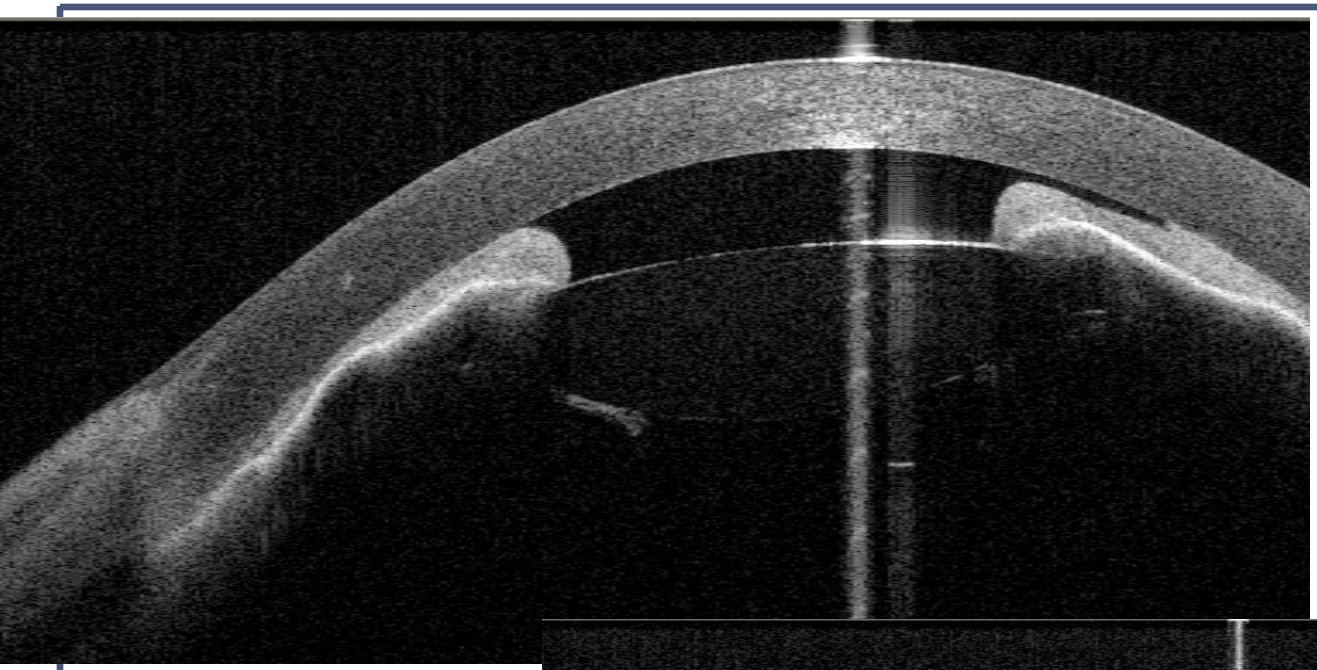


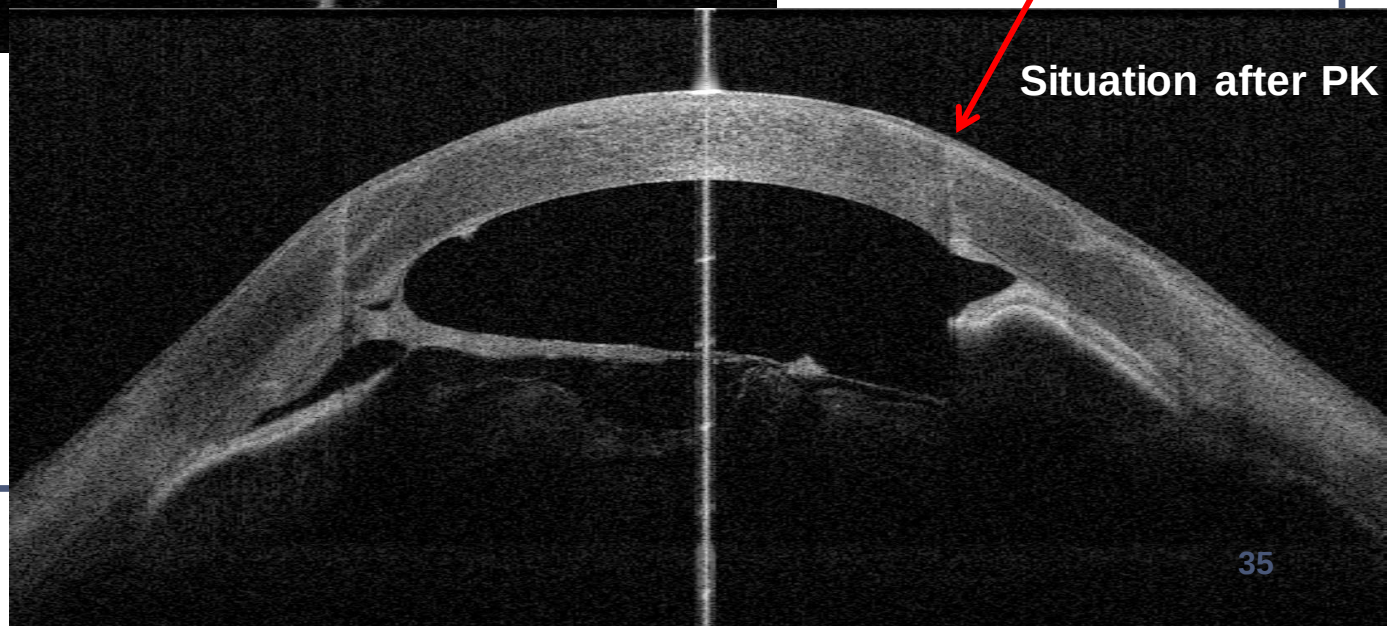
Angle measurement



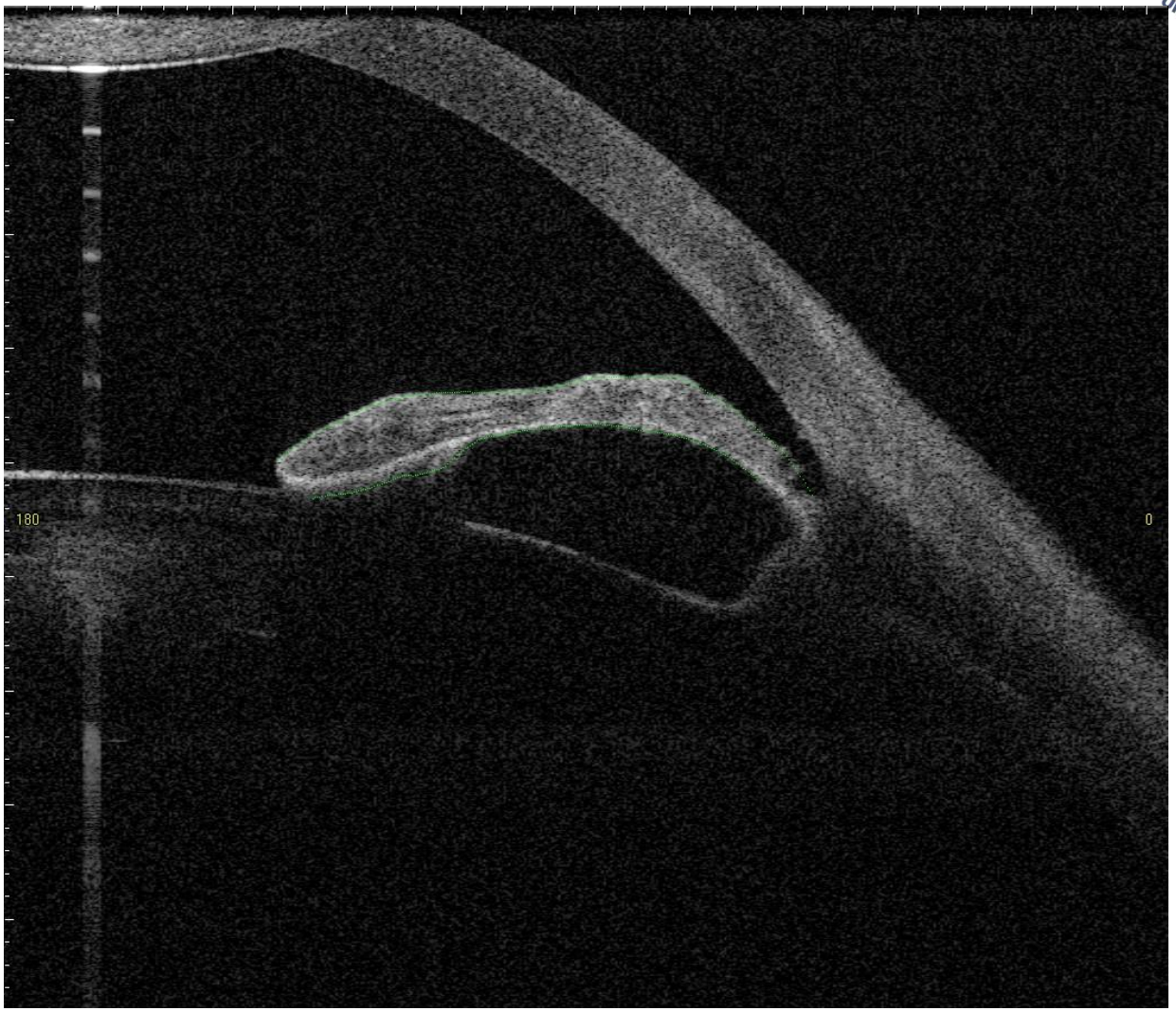


Complete and partial anterior synechiae

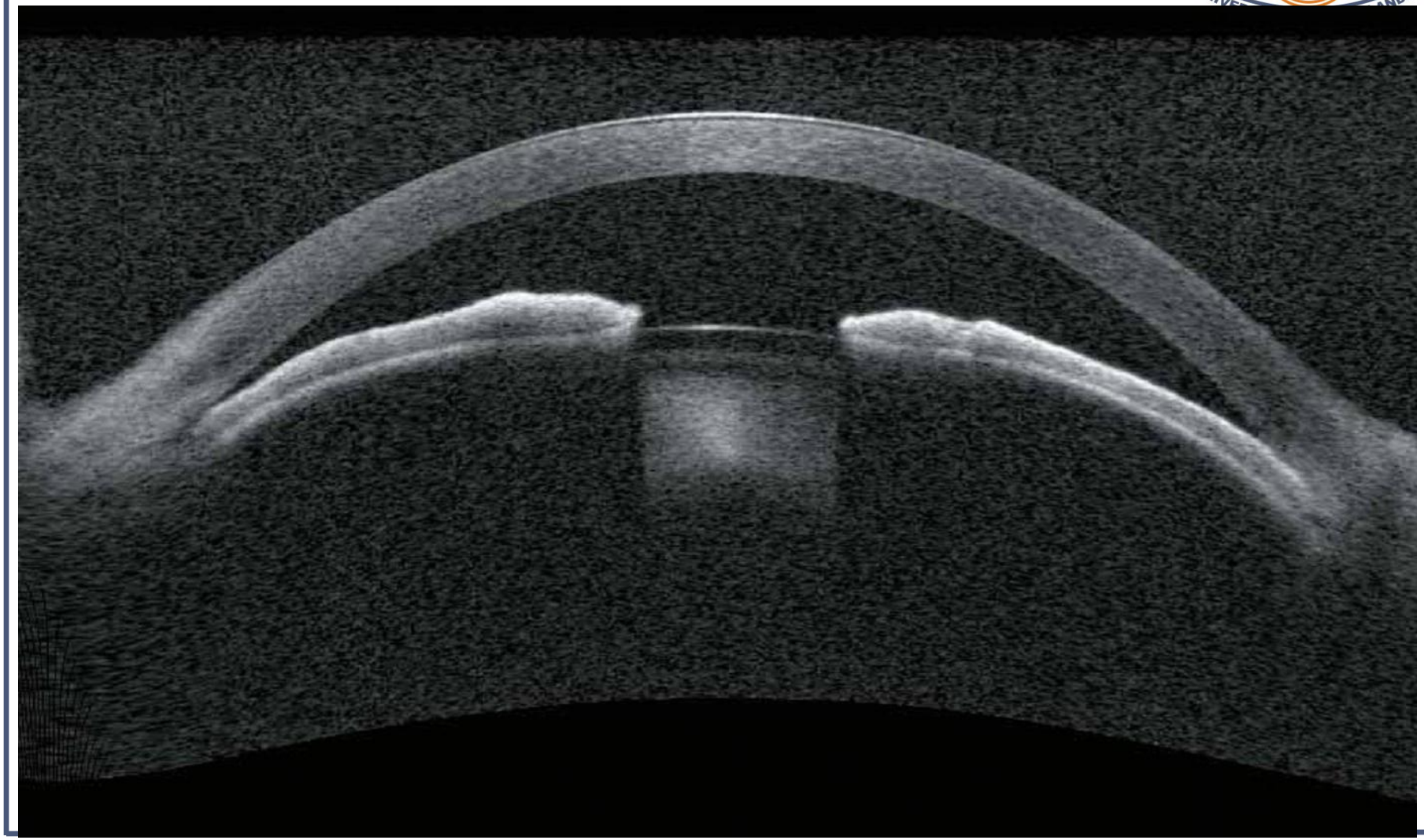




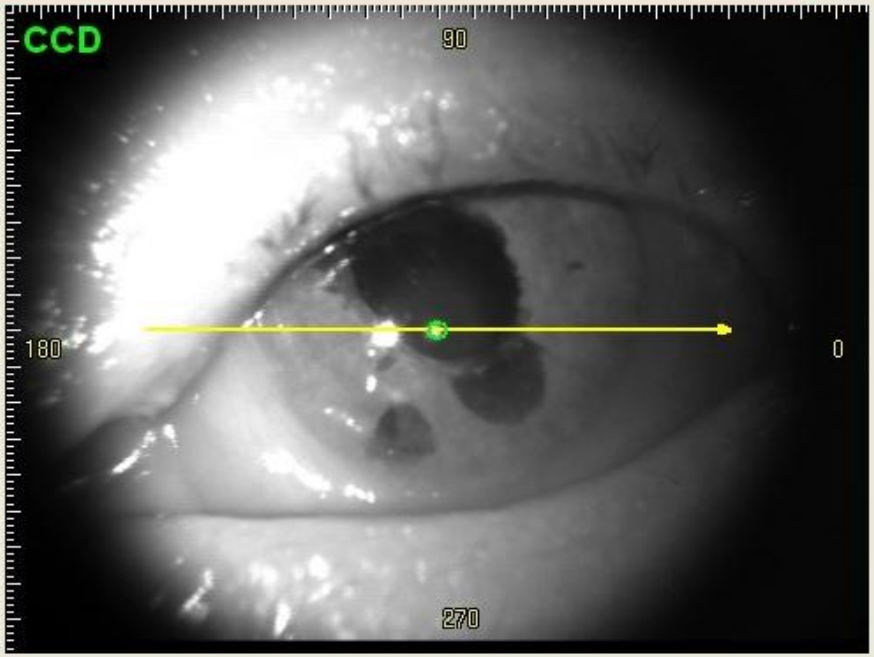
Posterior synechia with cyst

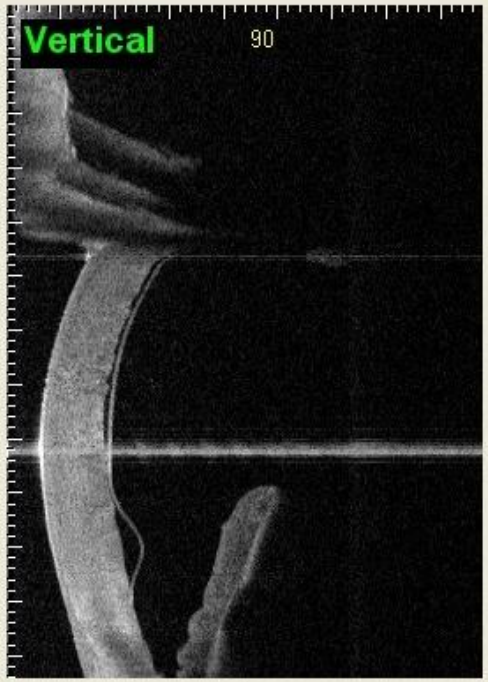


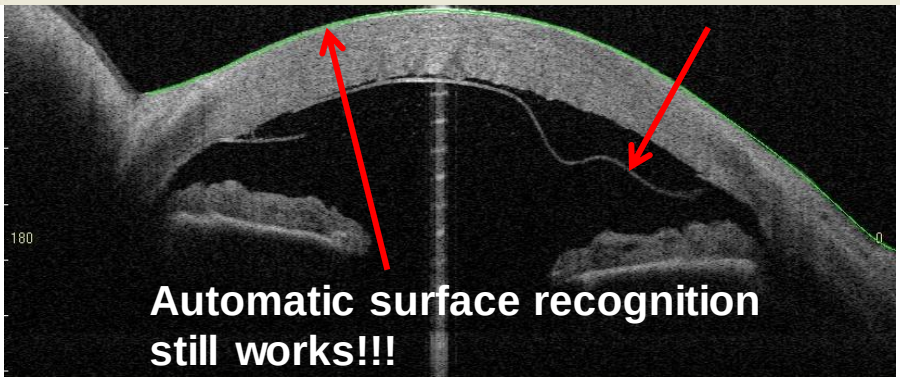
Angle closure glaucoma



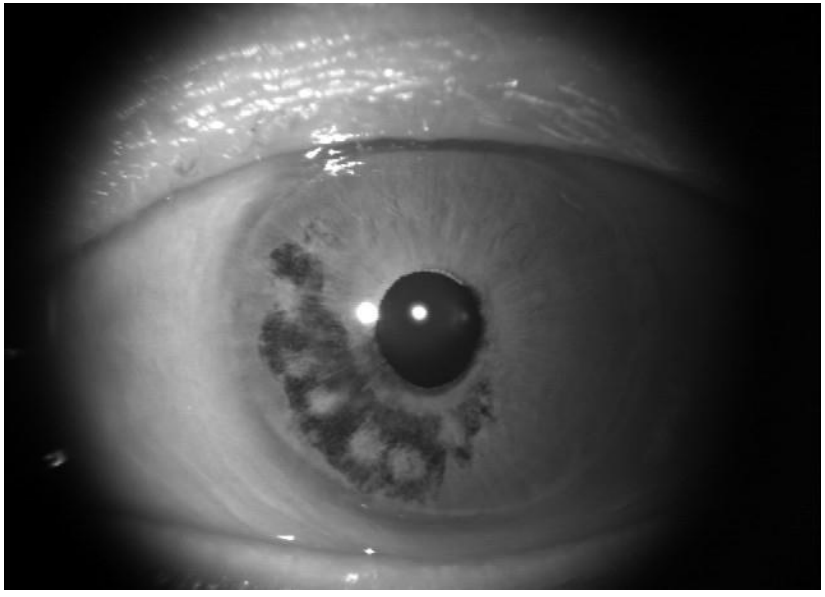
Severe iris defect and Descemet detachment after ocular trauma

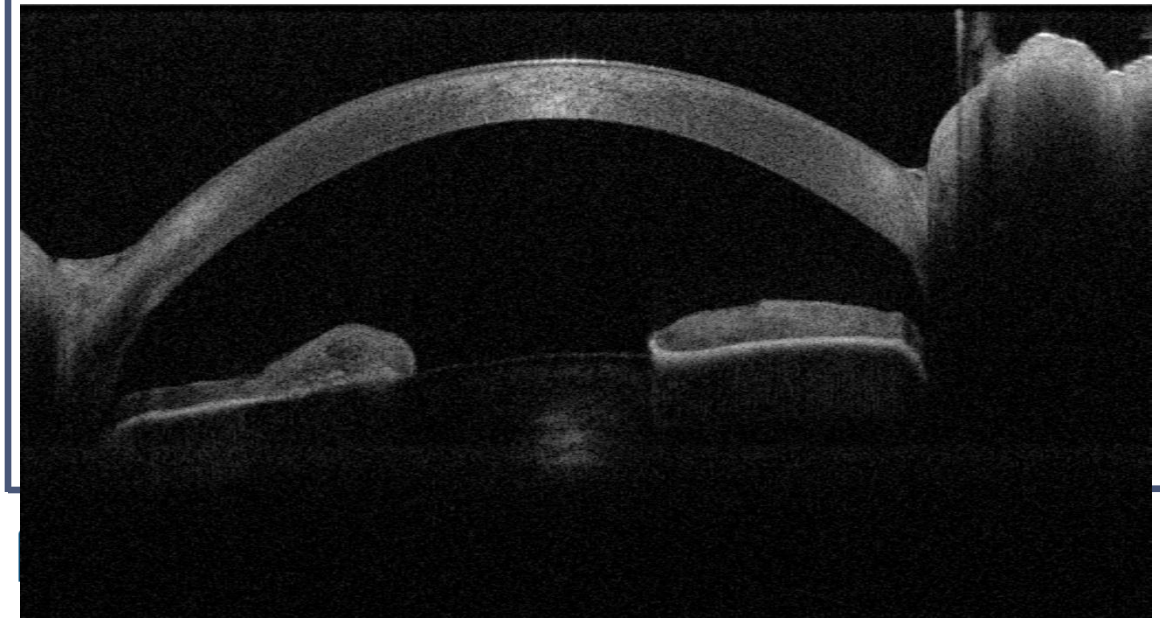


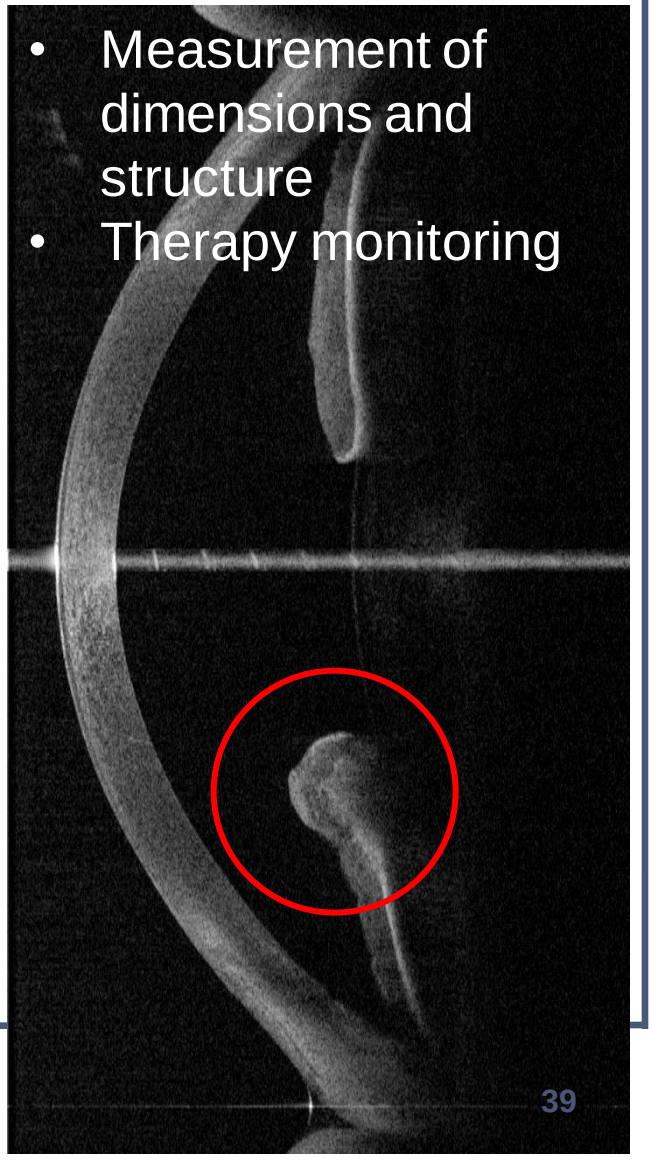




Malignant iris tumor

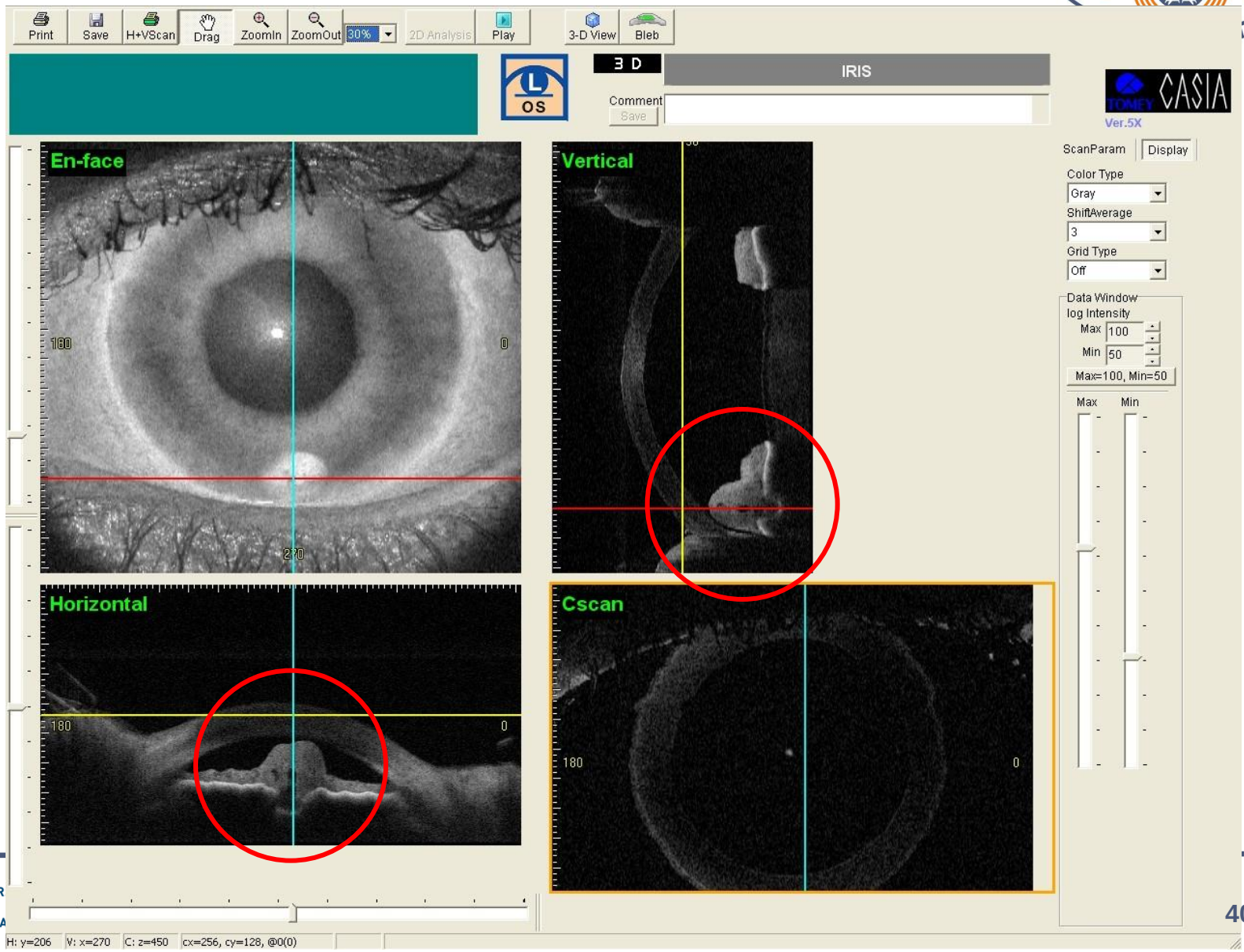






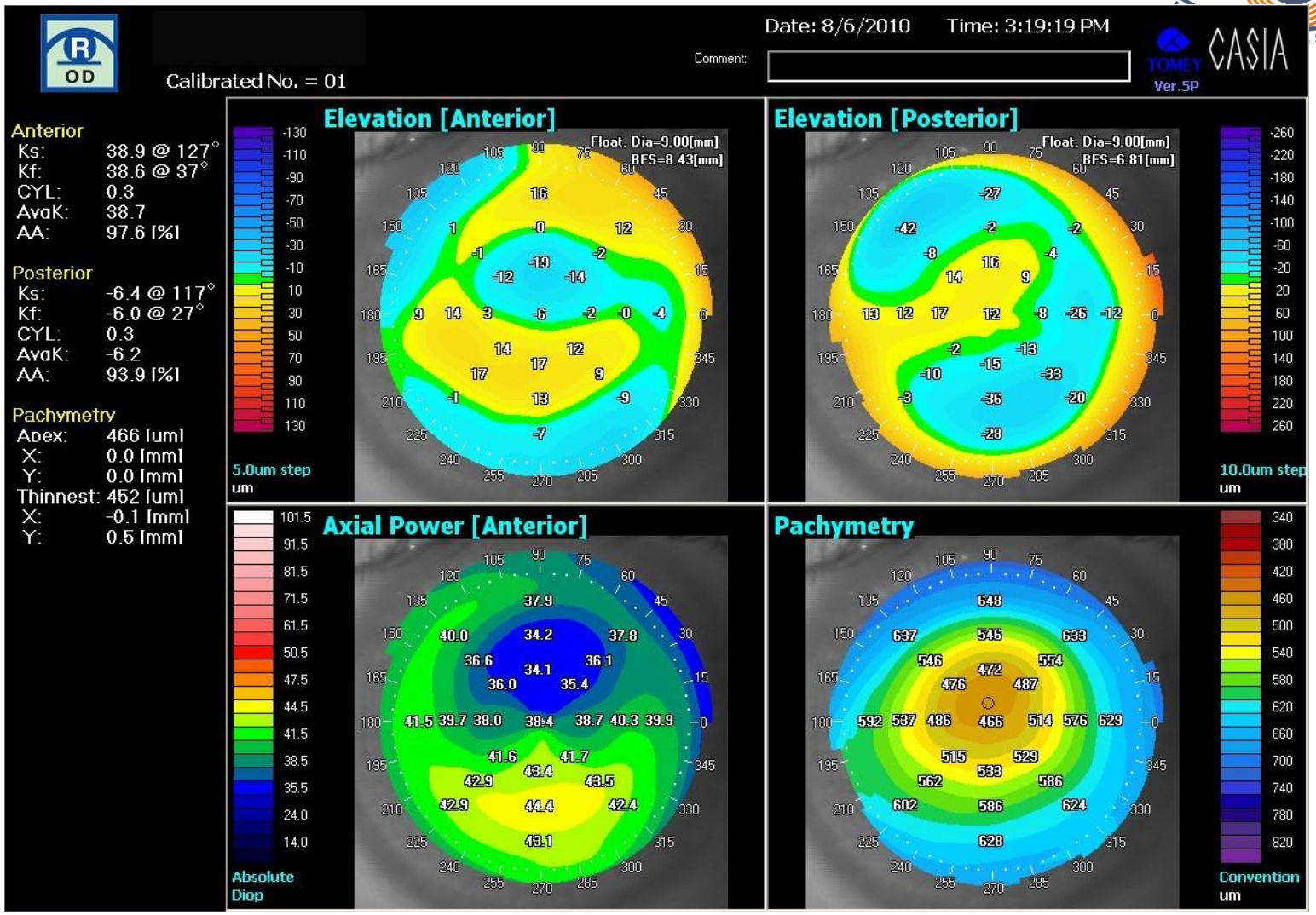
- Measurement of dimensions and structure
- Therapy monitoring

Peripheral iris cyst

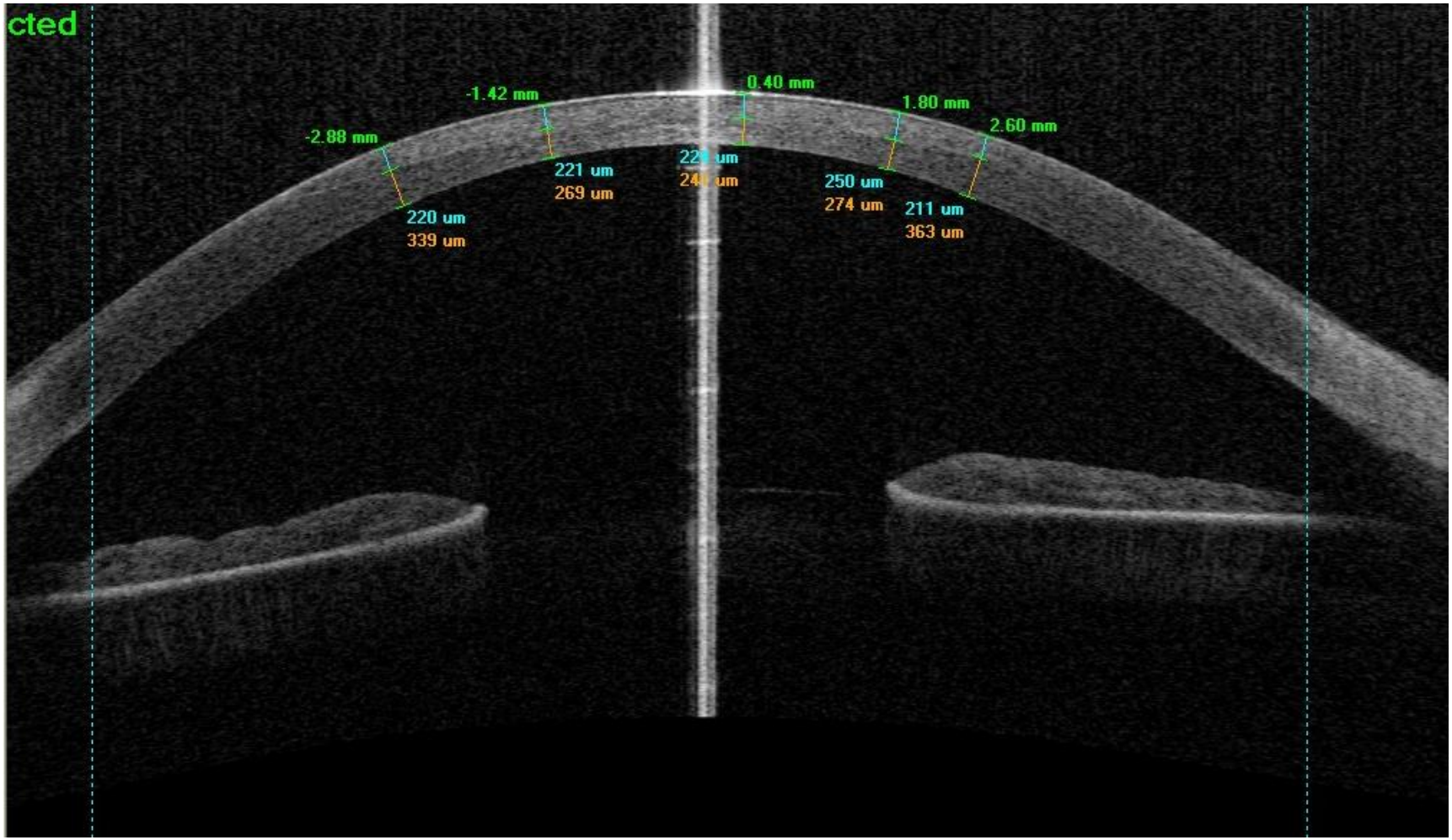


Measurement samples: Refractive surgery and IOL implantation

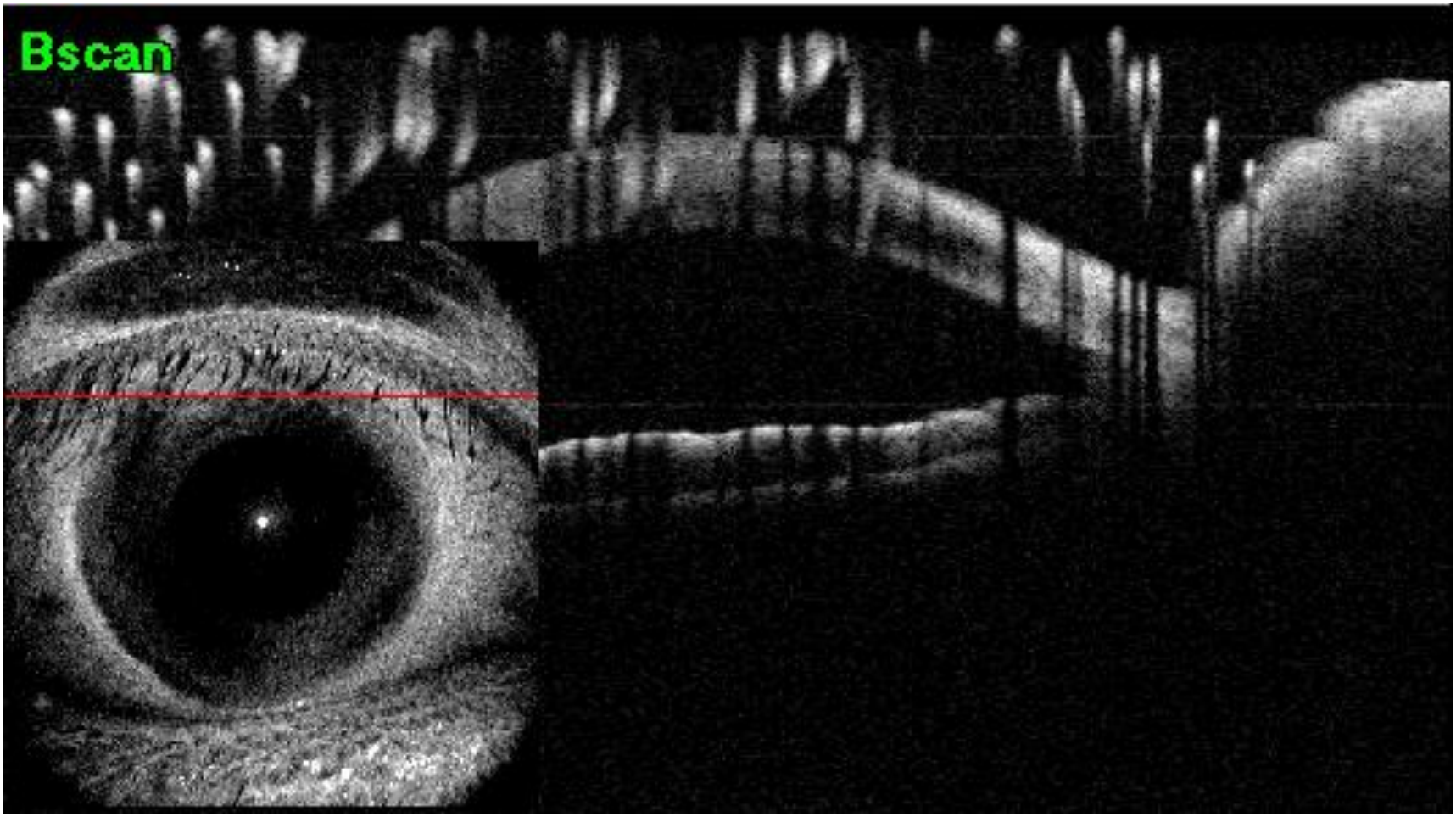
Corneal topography following LASIK



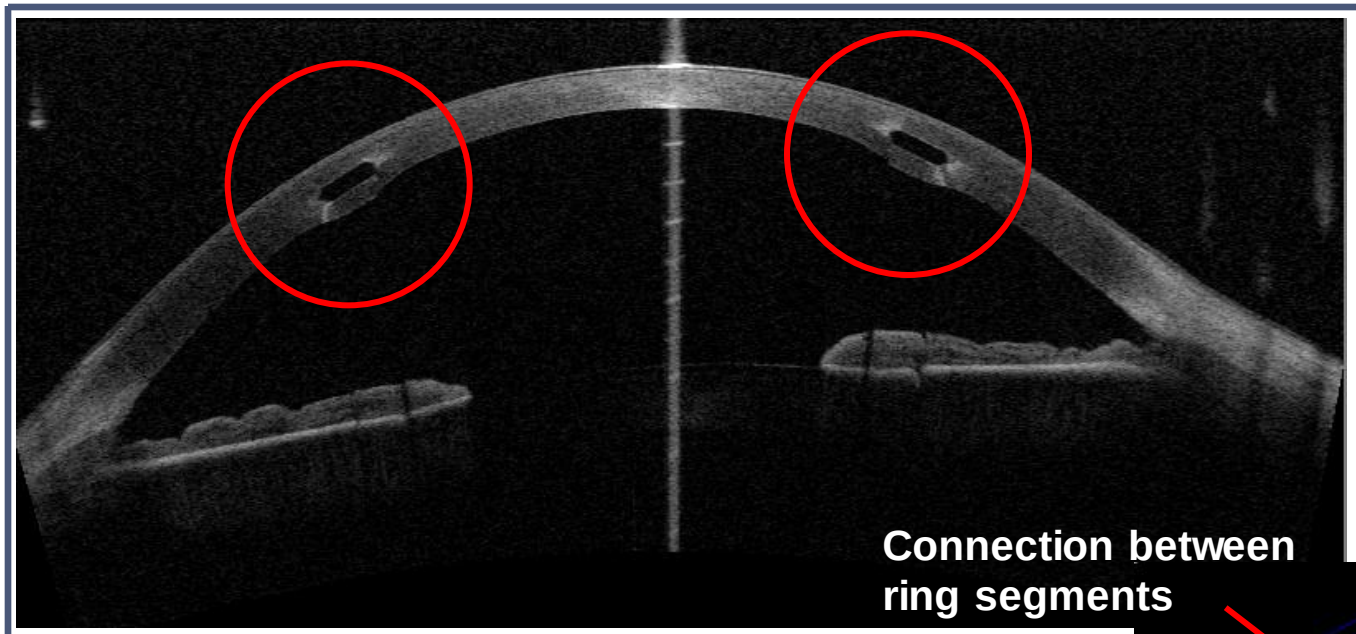
Evaluation of flap thickness after LASIK



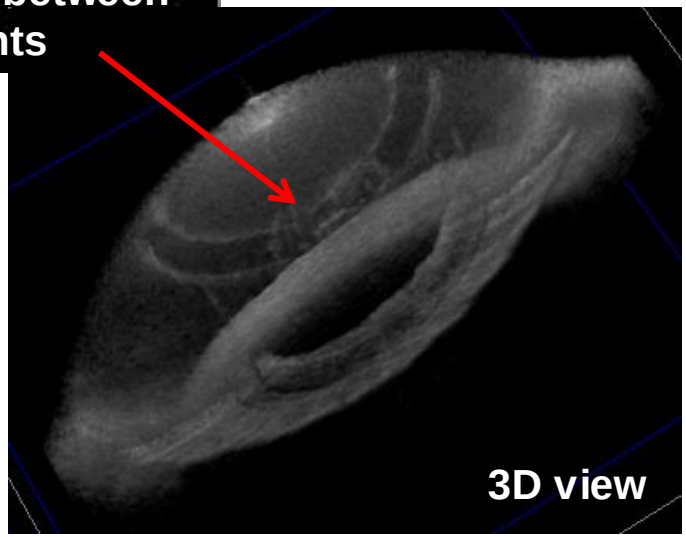
LASIK flap 3D video



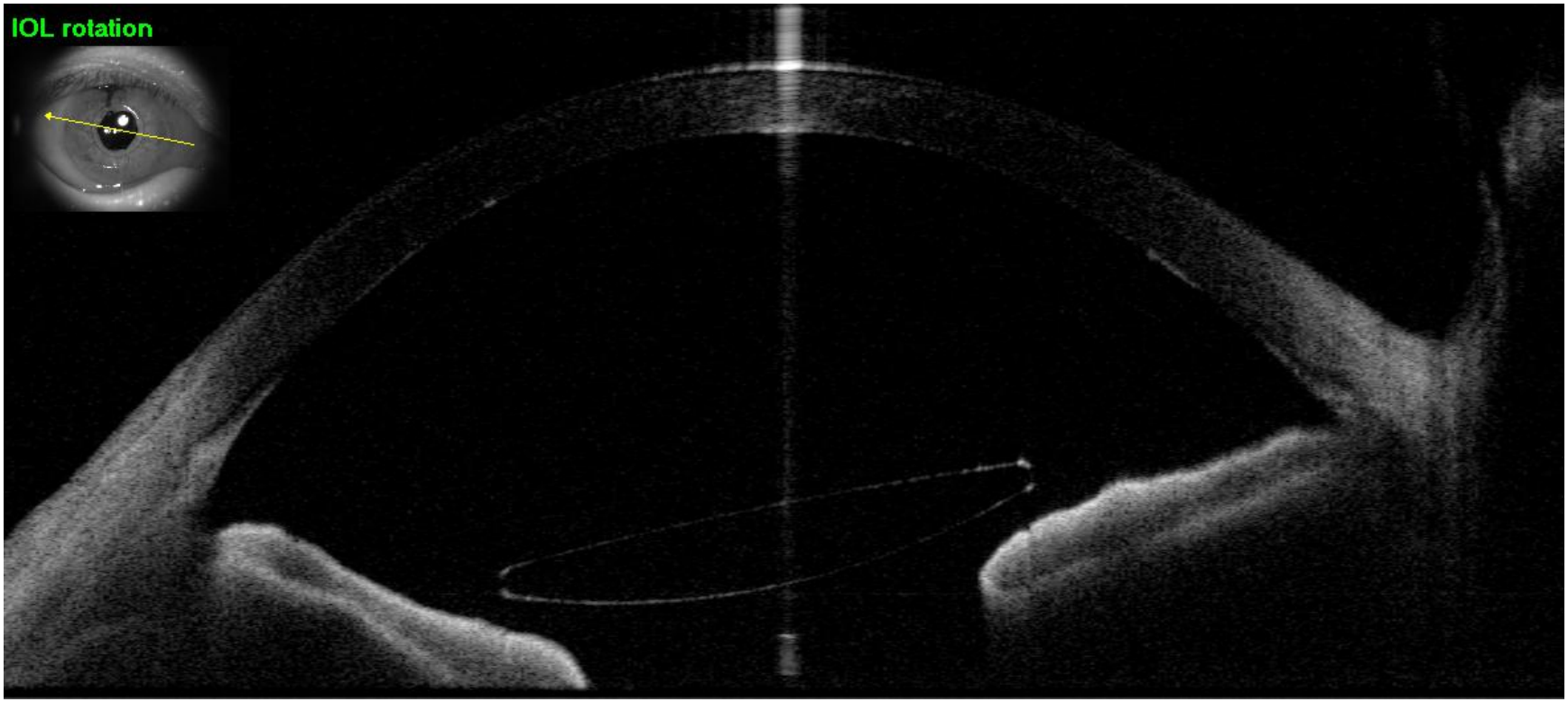
Corneal Intacs



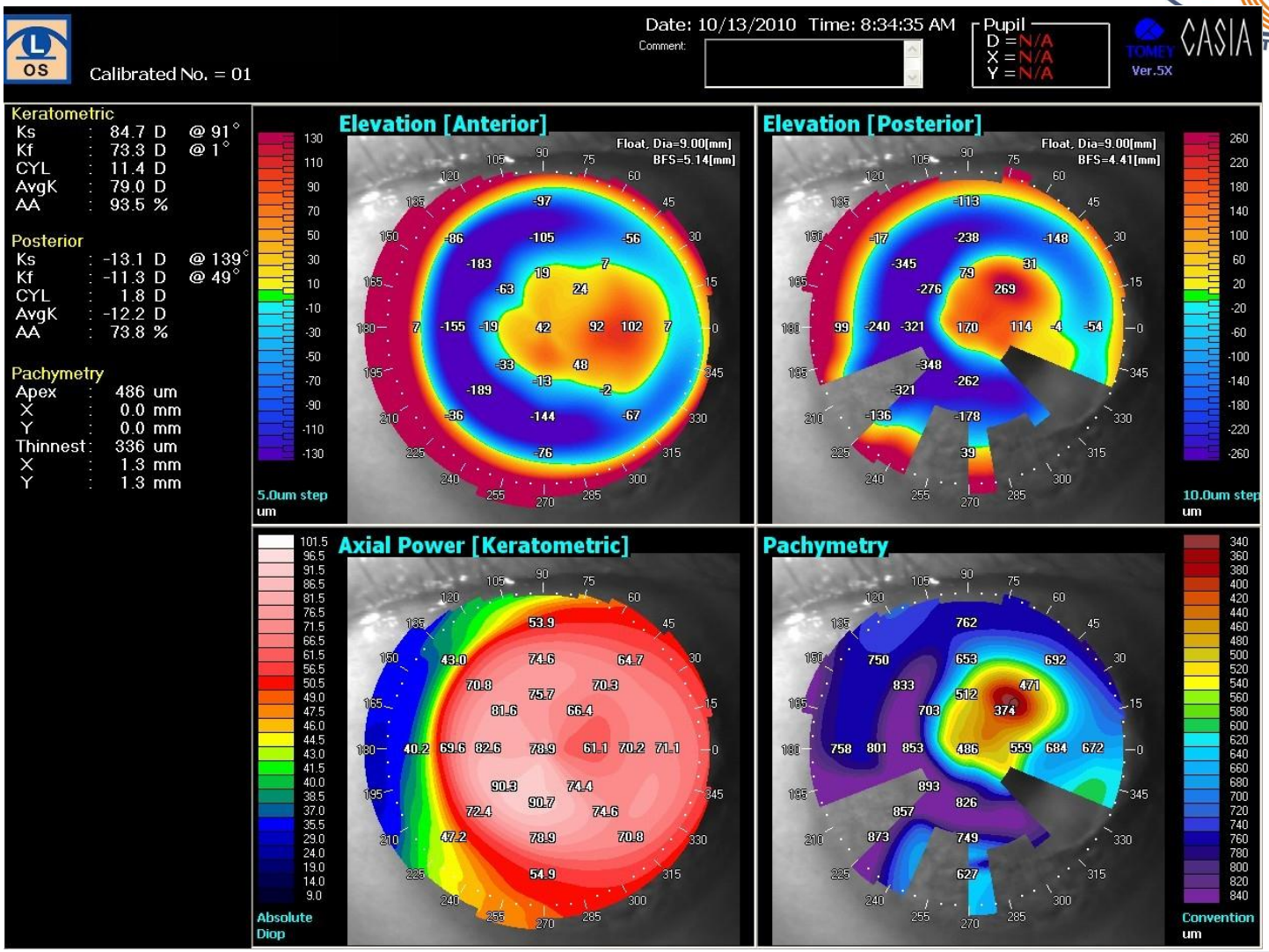
Connection between ring segments



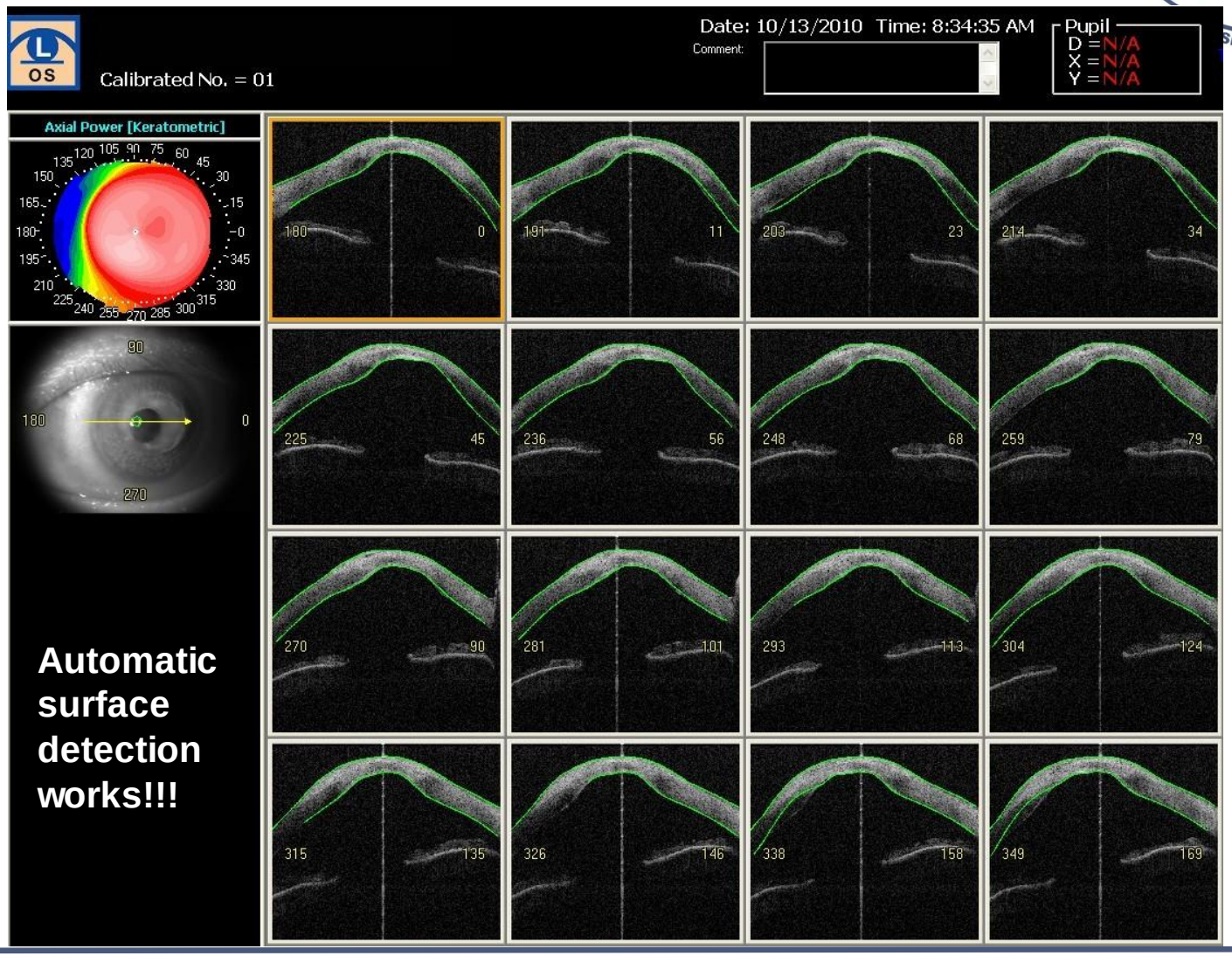
Tilted refractive anterior chamber IOL



Extreme keratectasia after LASIK – Corneal topography



Extreme keratectasia after LASIK – Meridional cross section



Conclusions

- The Casia 1000 is a powerful diagnostic tool which allows for high resolution 2D and 3D-measurements of
  - Cornea (.2-2.4 s image acquisition time)
  - Anterior eye segment (distances, chamber angles, areas,…; 1.2 s acquisition time)
  - Crystalline and artificial lens (mainly anterior segment, .5-1.2 s image acquisition time)
- Topography of the anterior and posterior corneal surface including precise full surface pachymetry (0.3 s acquisition time)
- True angles and distances ONLY if superficial surfaces are recognized and corrected properly
  - optical pathway correction with polynomials (n=10)
  - optional manual surface correction

Conclusions

- In measurement precision the Swept-Source-Technology is equivalent with SE-FD-OCT, but allows significantly shorter acquisition times
  - lower risk of movement artifacts (SS vs. TD-OCT: 30000 vs. 2000 scans/s)
- Raw data and processed data can be easily exported and postprocessed externally
- Dedicated keratoconus screening module is available with the new software version
- RGP CL fitting software in preparation
  (spherical, aspherical, multi-curved or toric CLs)

Experimental Ophthalmology

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Thanks for your kind attention

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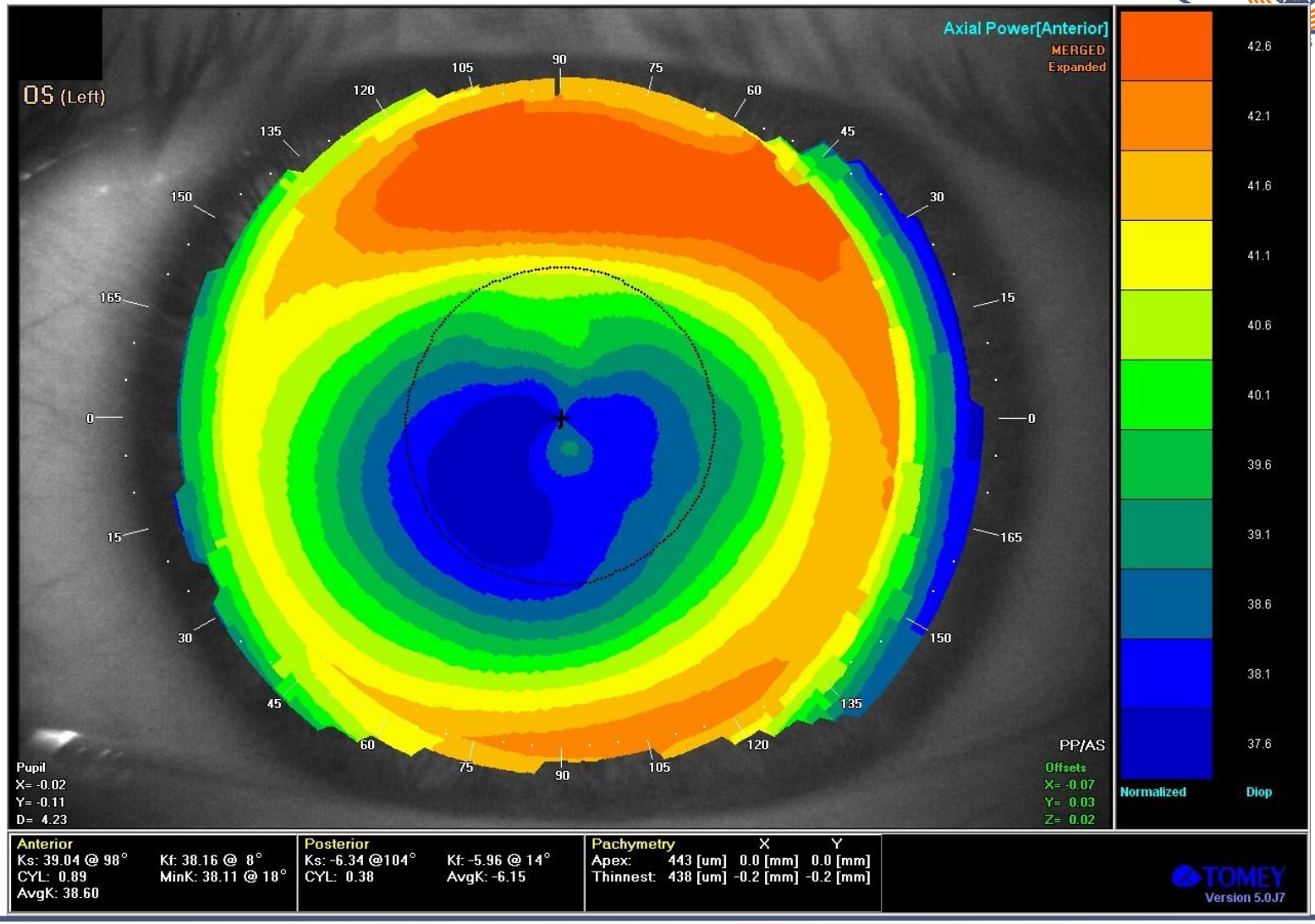
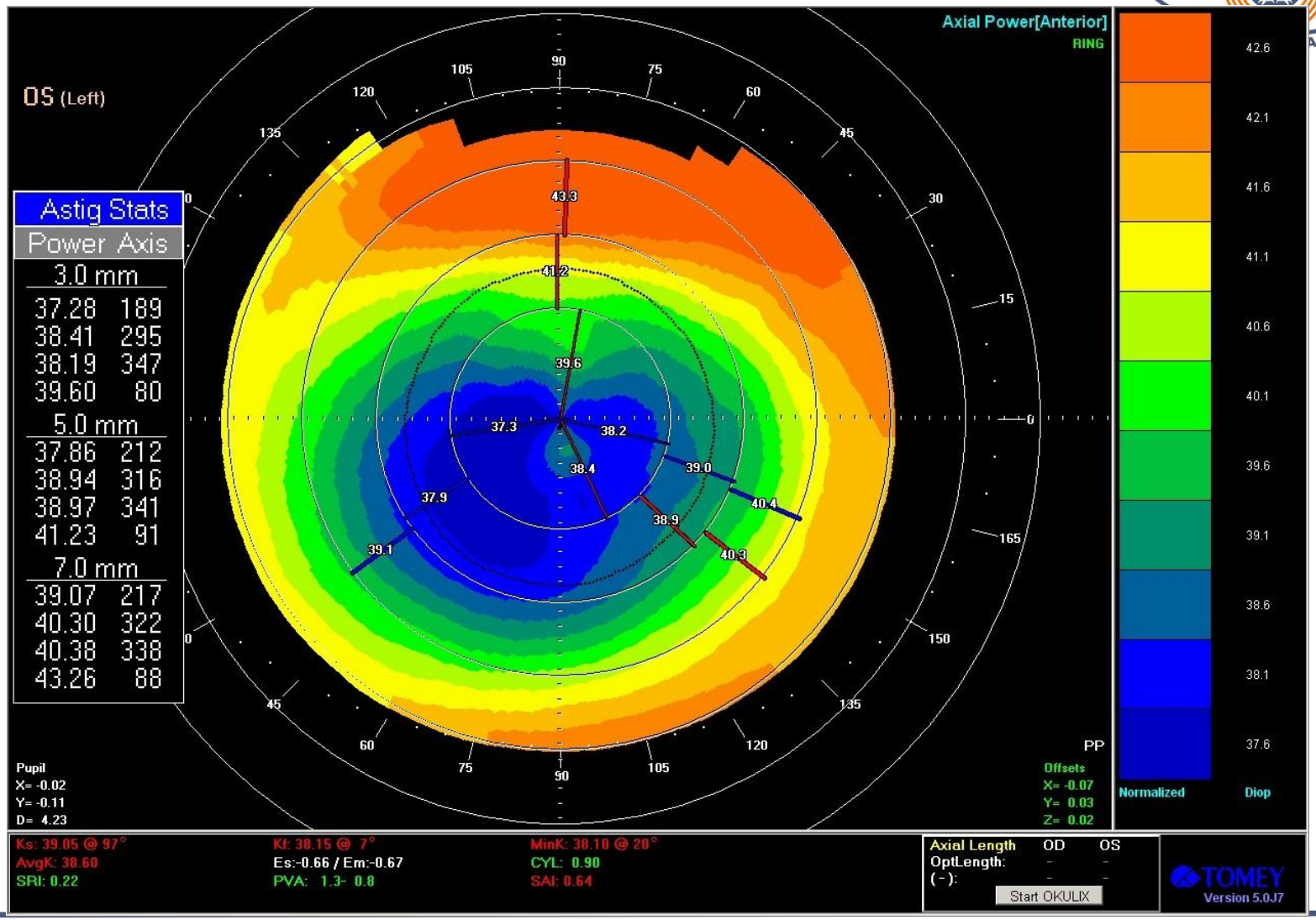
TMS-5 Anterior segment analyzer

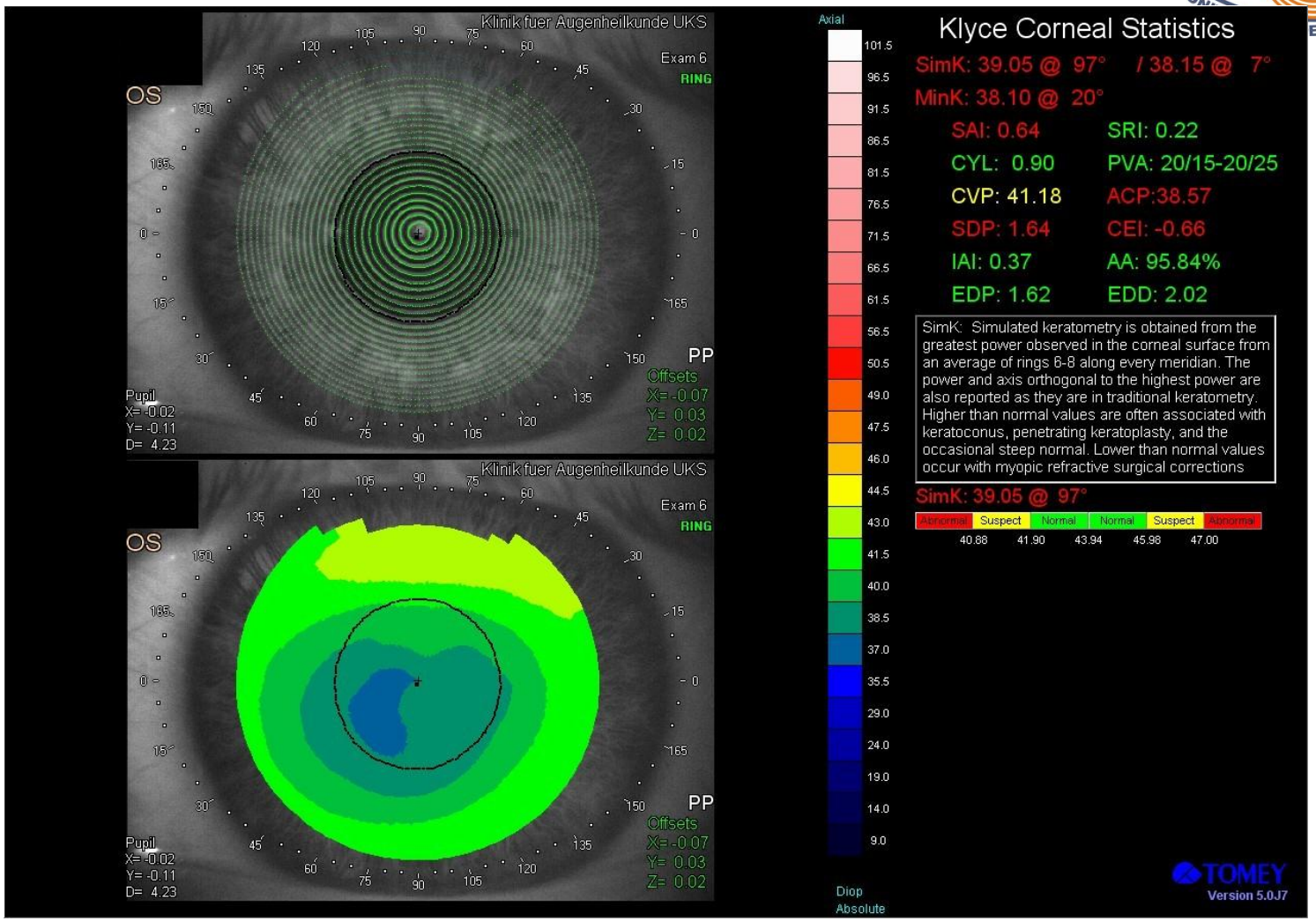
Classical topography map of the anterior corneal surface



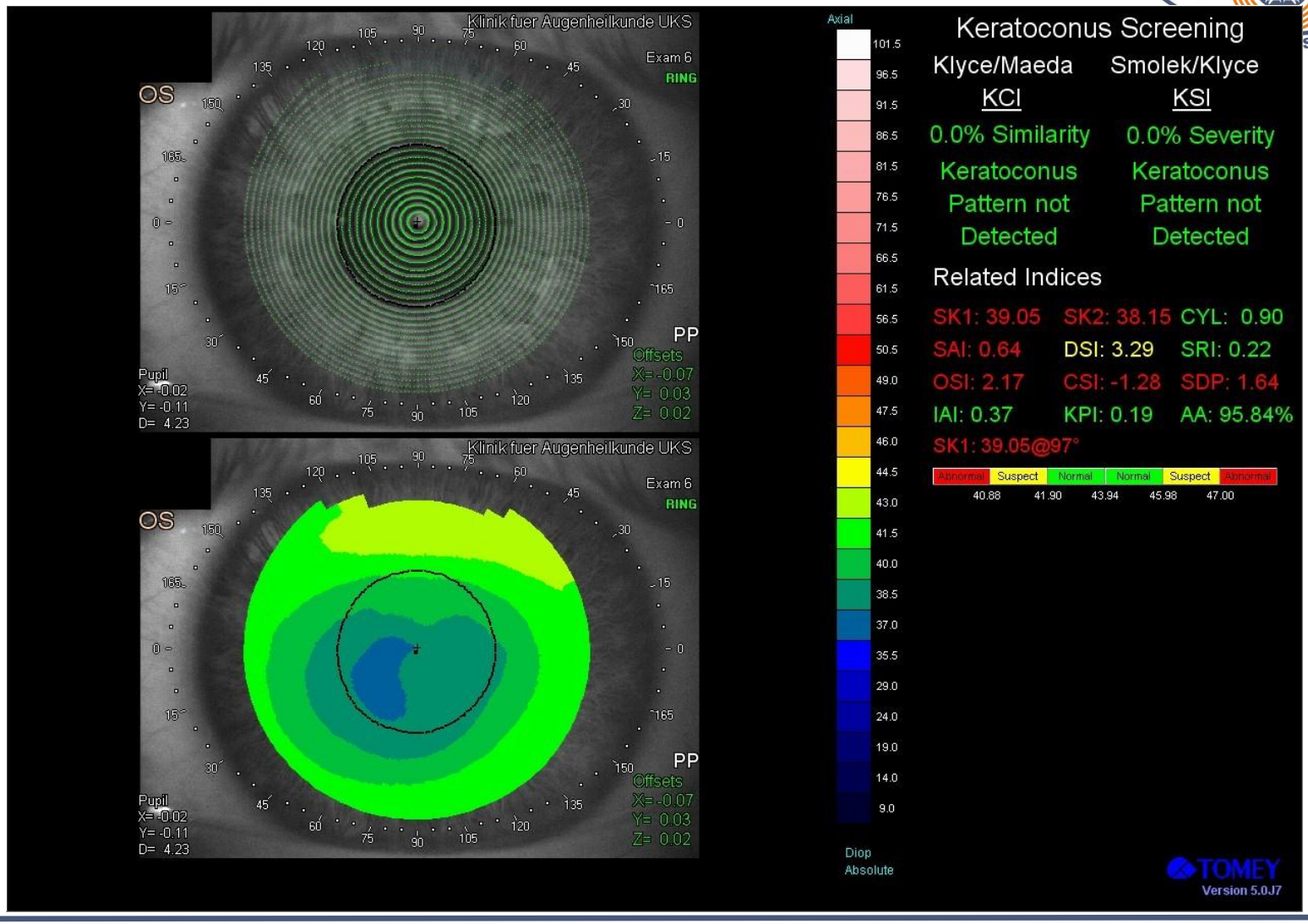
Corneal power evaluation of the anterior corneal surface (e.g. CL fitting)



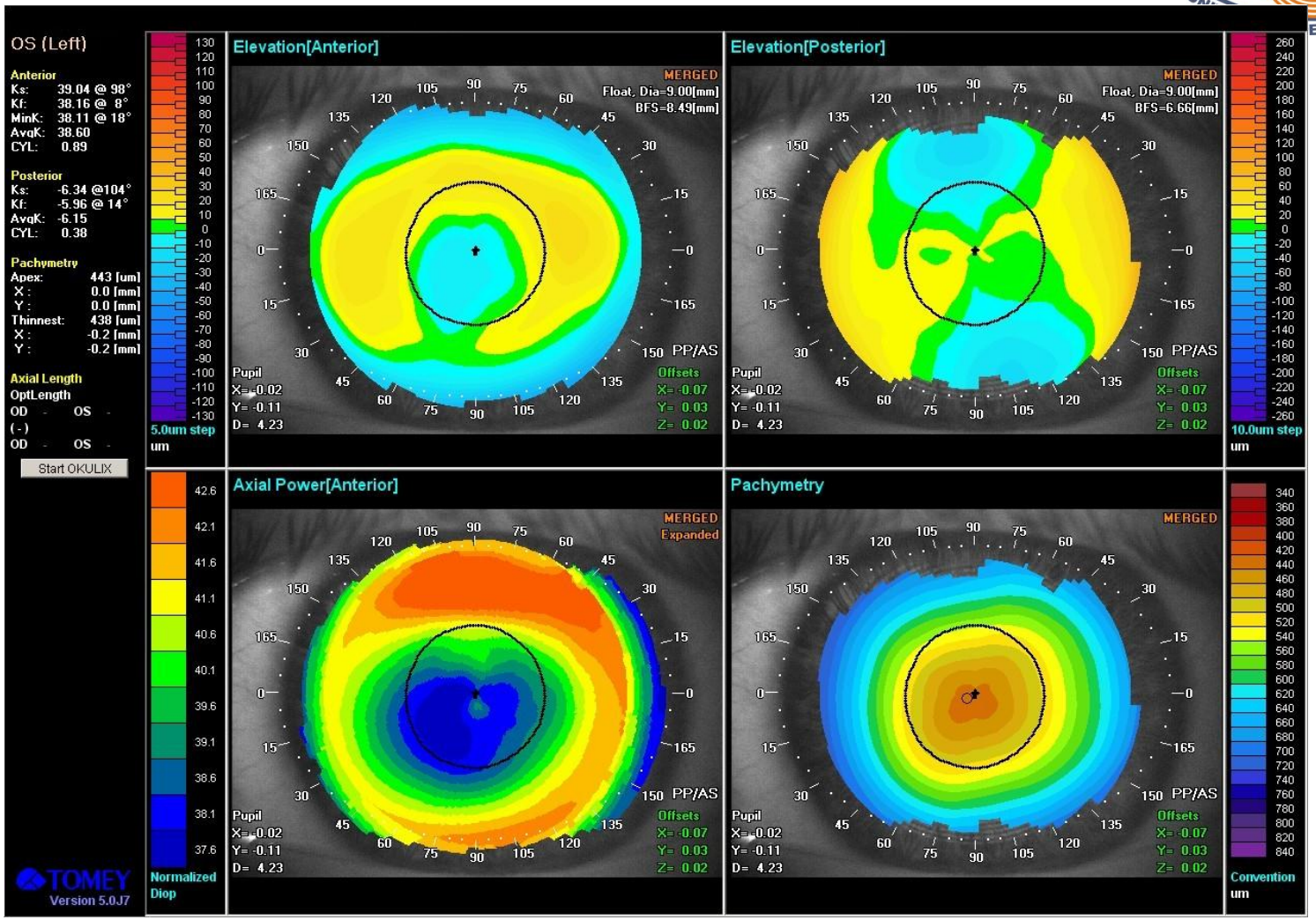
Corneal statistics (qualitative and quantitative)



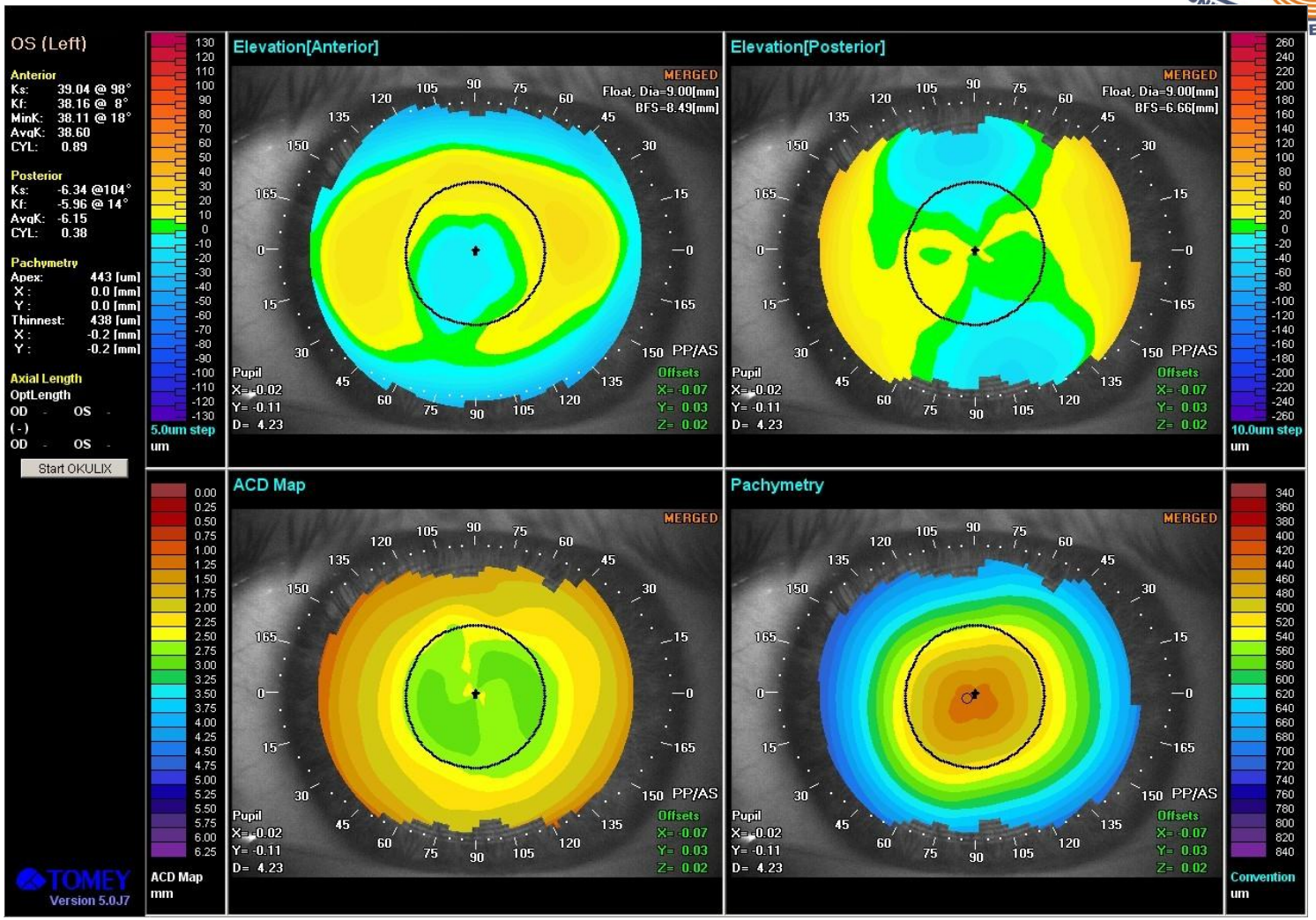
Keratoconus screening based on anterior corneal topography



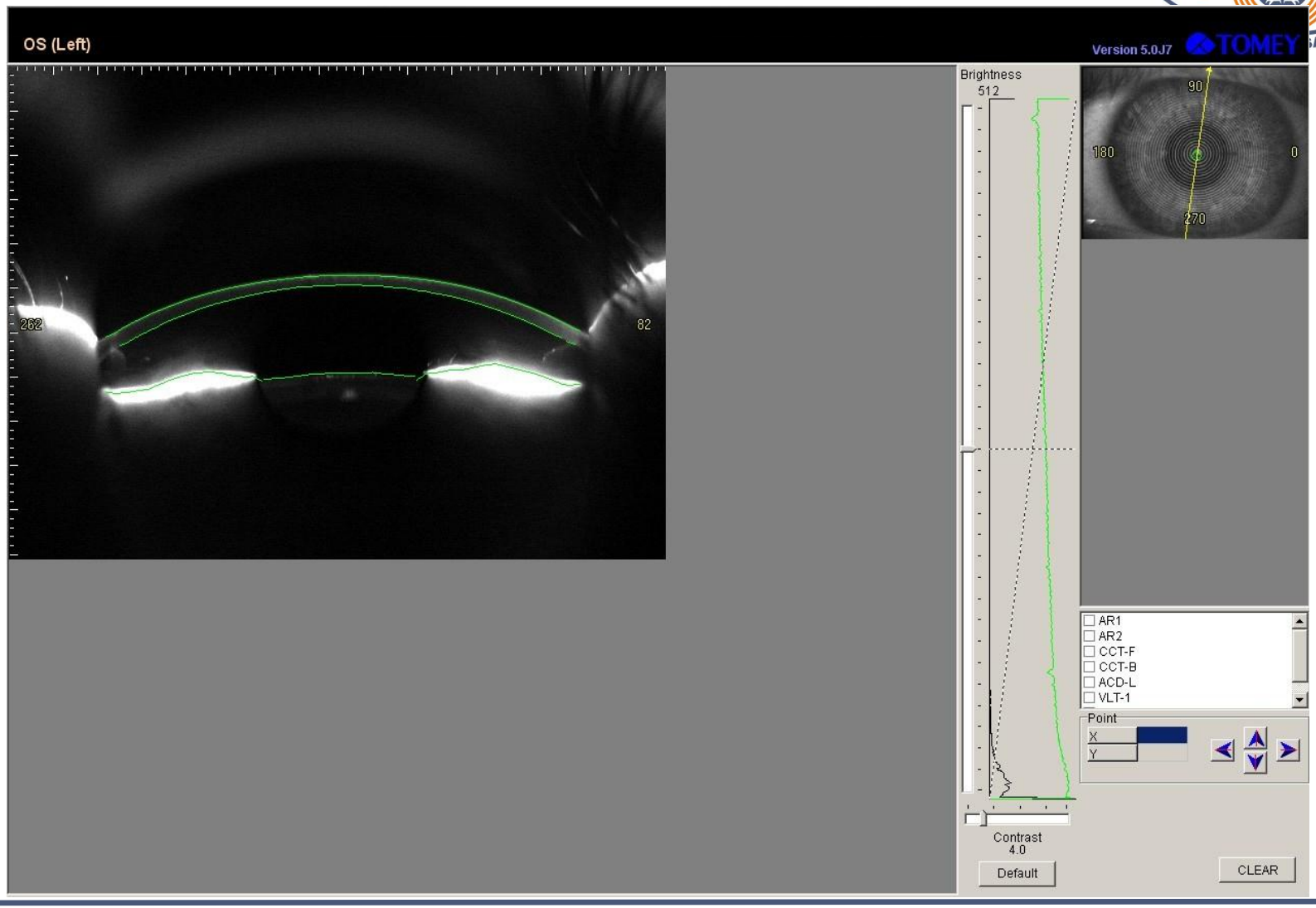
Corneal quad map



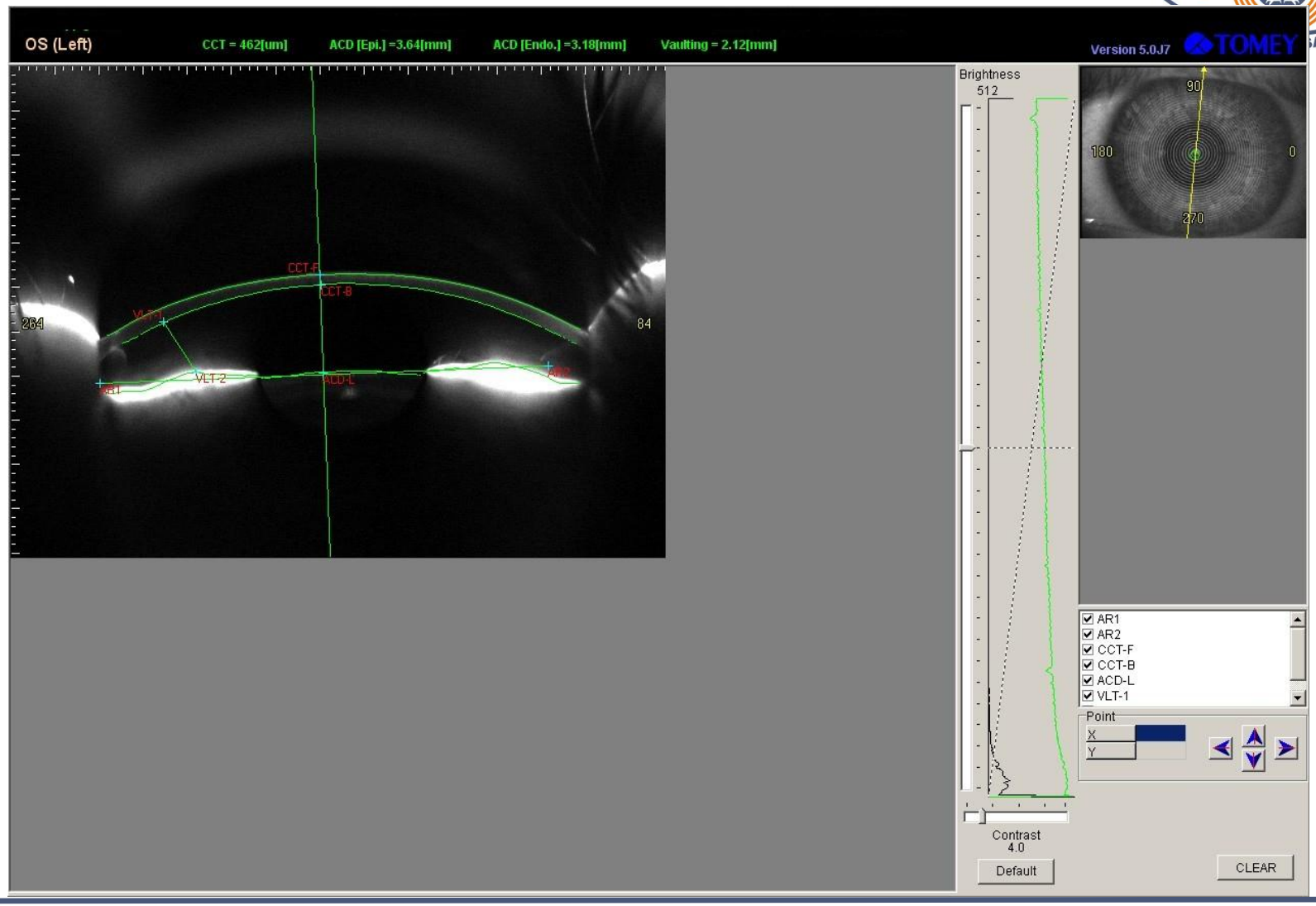
Alternatively with ACD instead of axial power (e.g. in glaucoma screening)



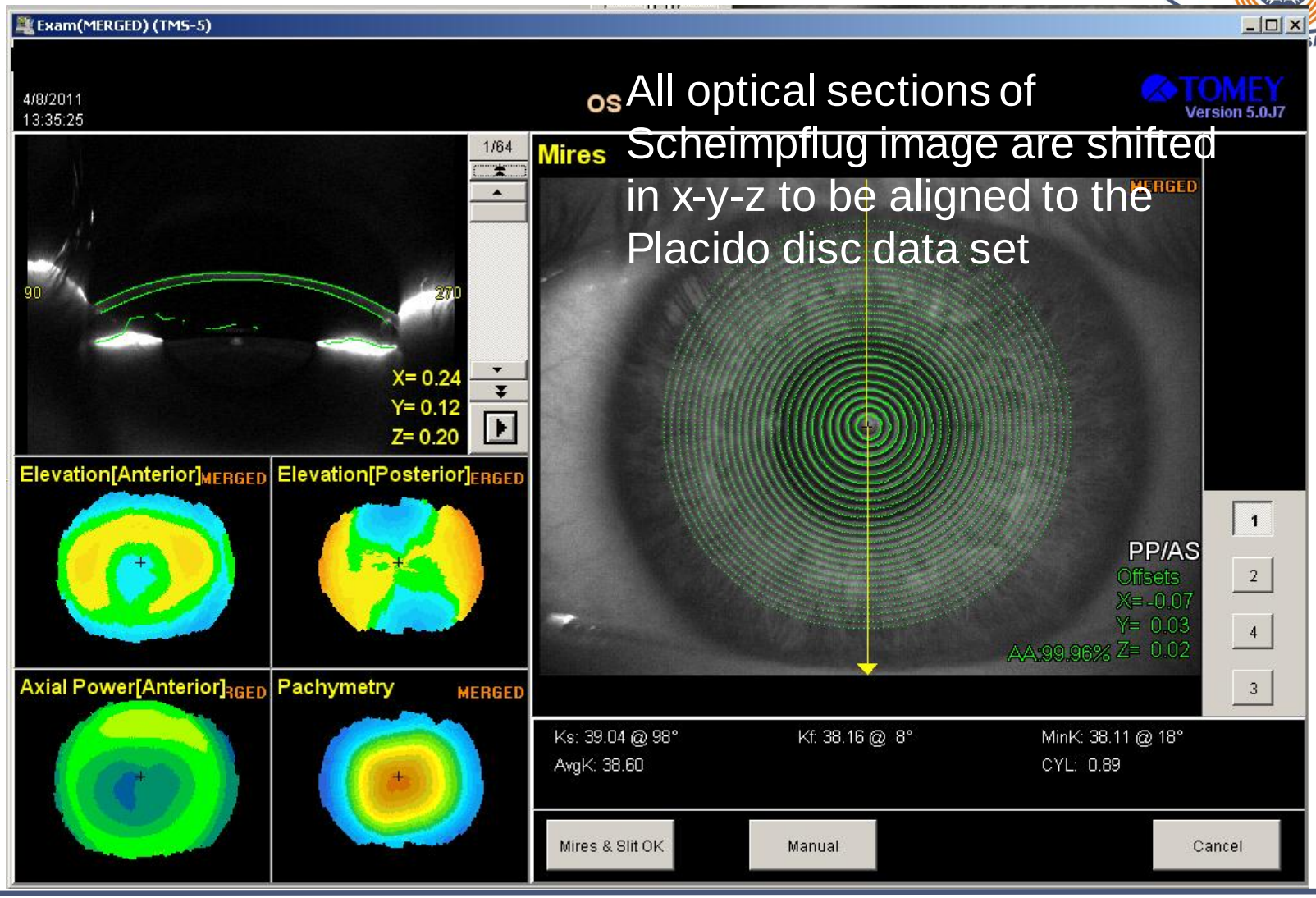
Surface detection with the Scheimpflug AC mode



Measurement of CCT, ACD and w-t-w

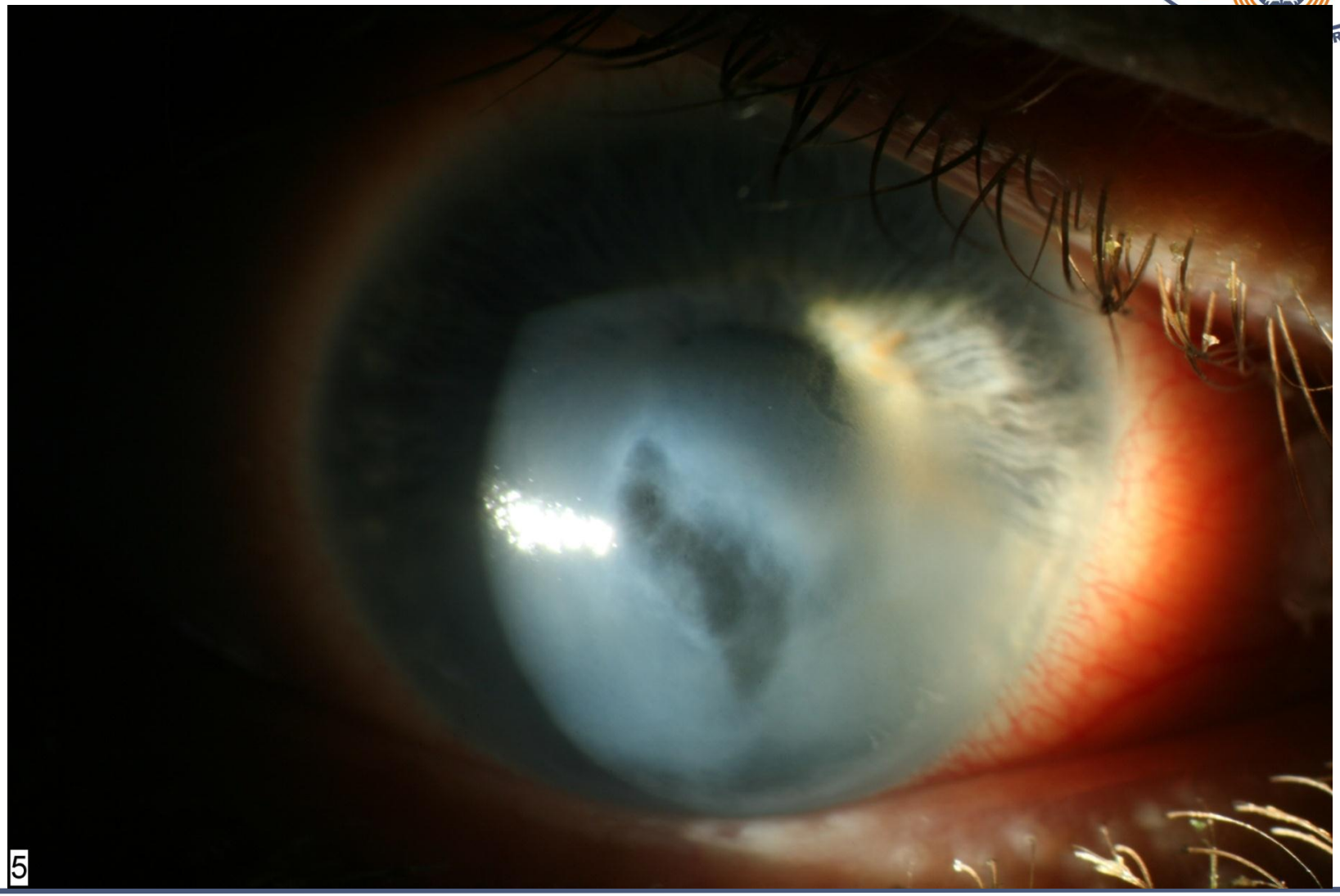


Matching of data sets originated from Placido disc and Scheimpflug modes

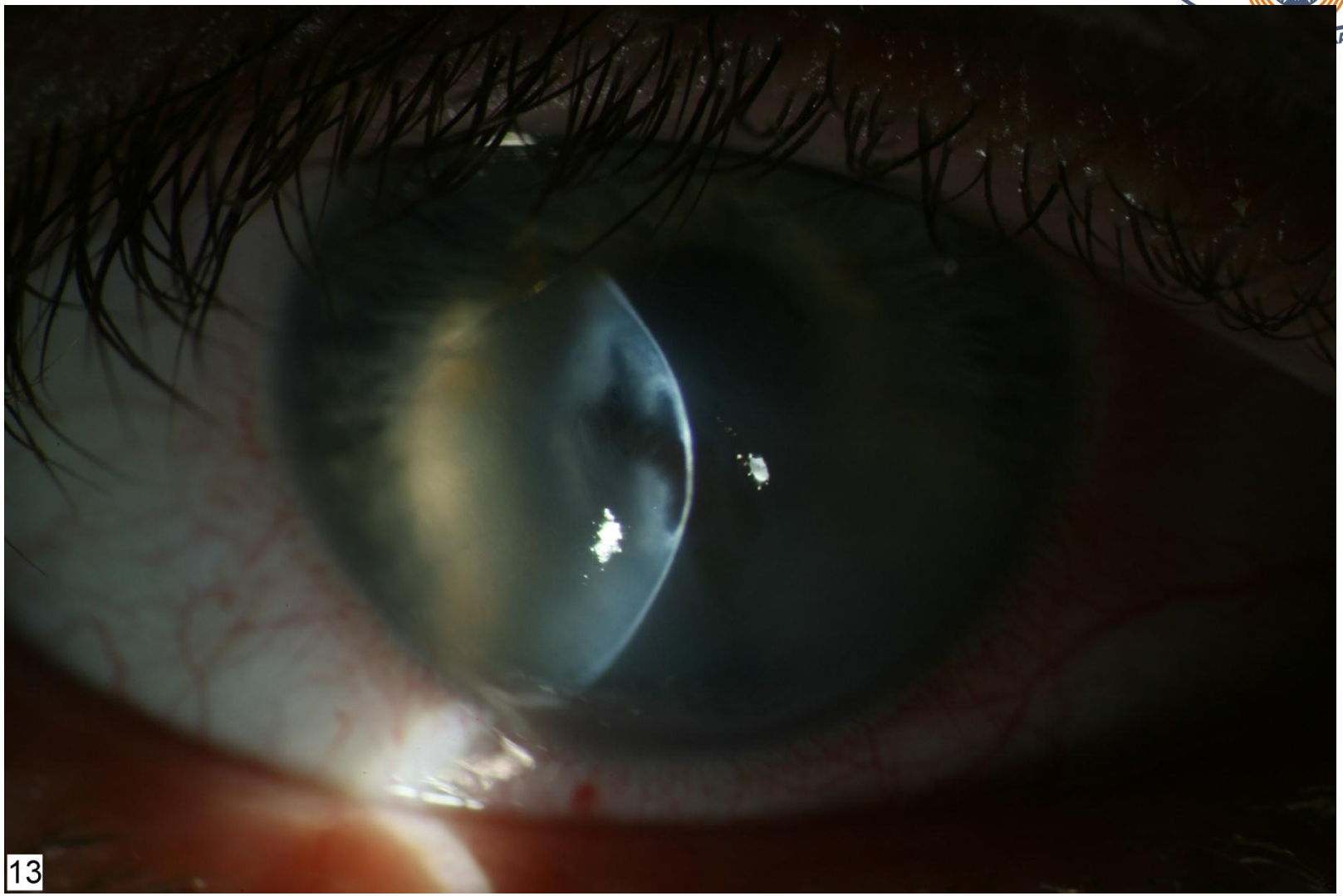


Case presentation: Comparison of different anterior segmant imaging modalities

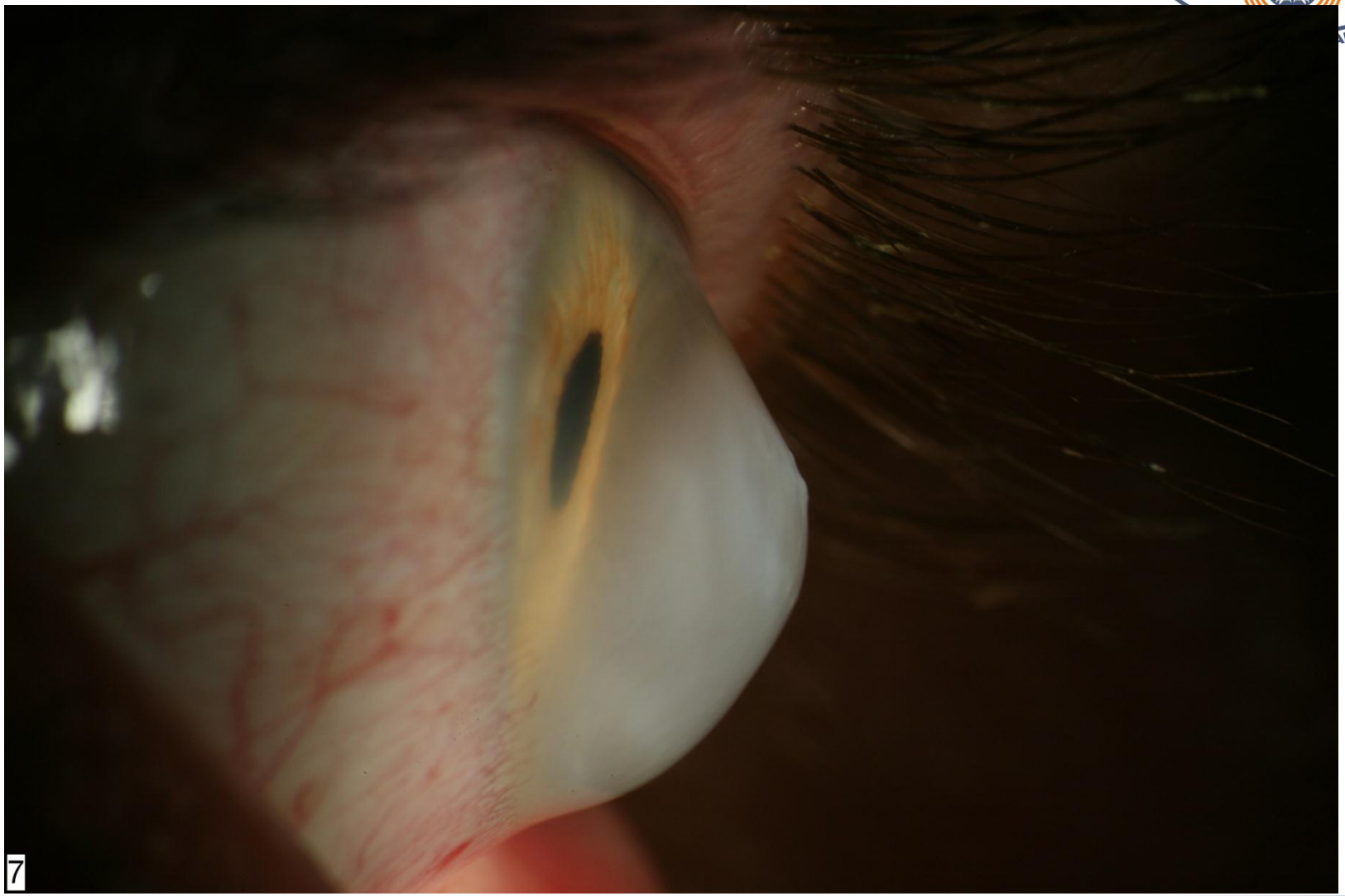
Extreme keratoconus with scarring – slit lamp overview



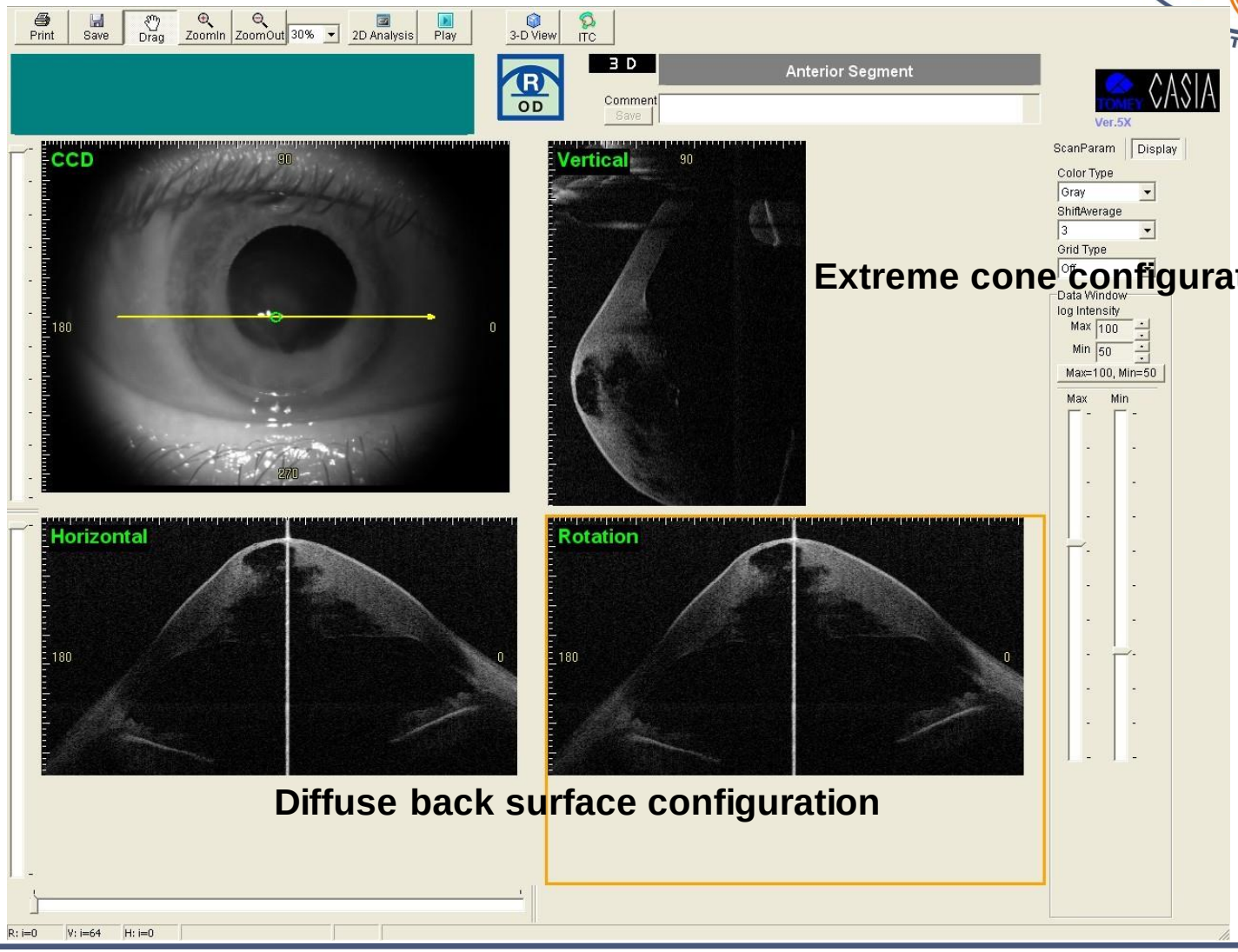
Slit lamp examination – cone profile



Munson sign – side view



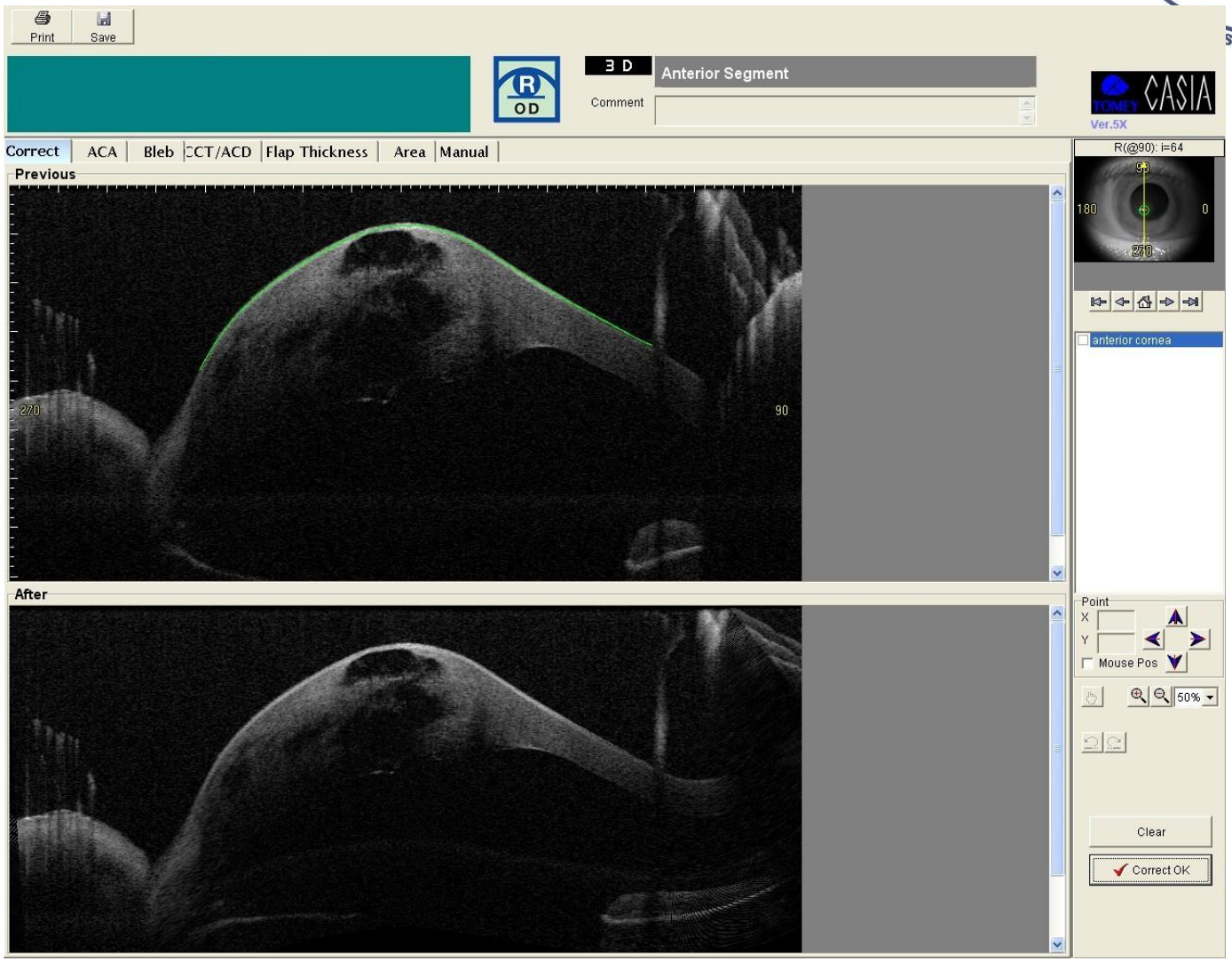
Casia imaging – cross section



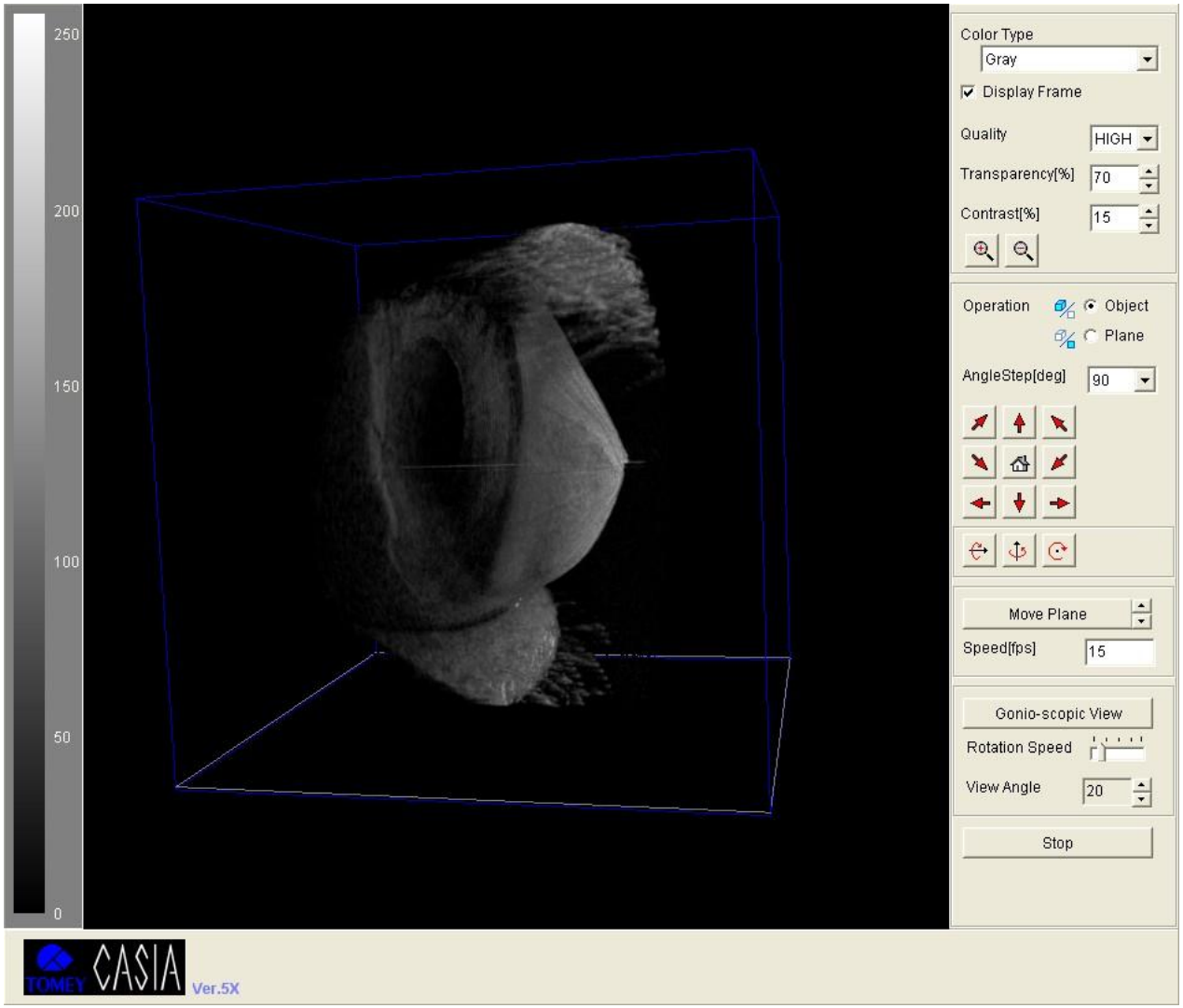
Extreme cone configuration

Diffuse back surface configuration

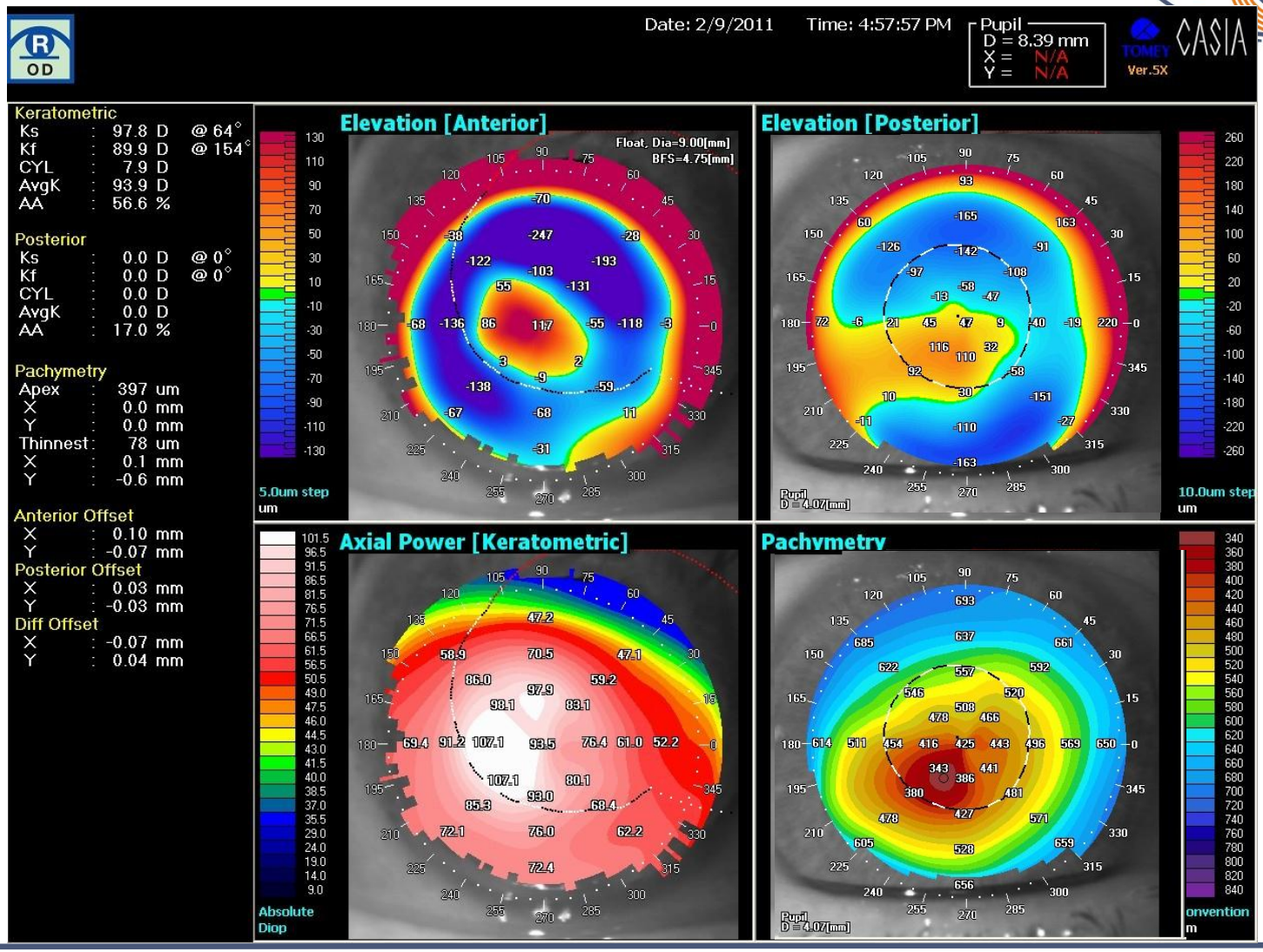
Comparison of different anterior segment imaging modalities



Casia imaging – 3D view

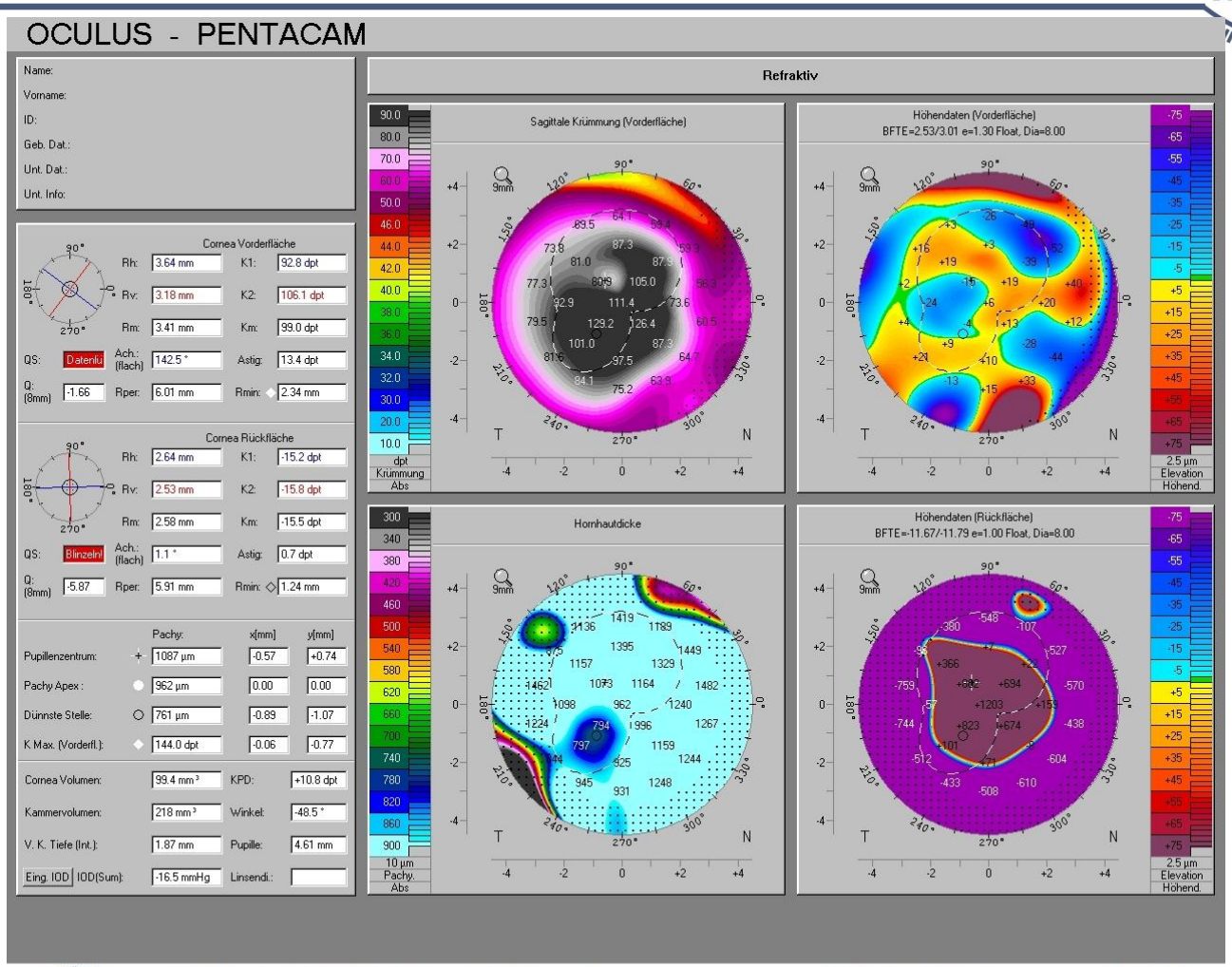


Casia imaging – topography map



Realistic values for surface elevation, axial power and pachymetry

Pentacam HR imaging – topography map



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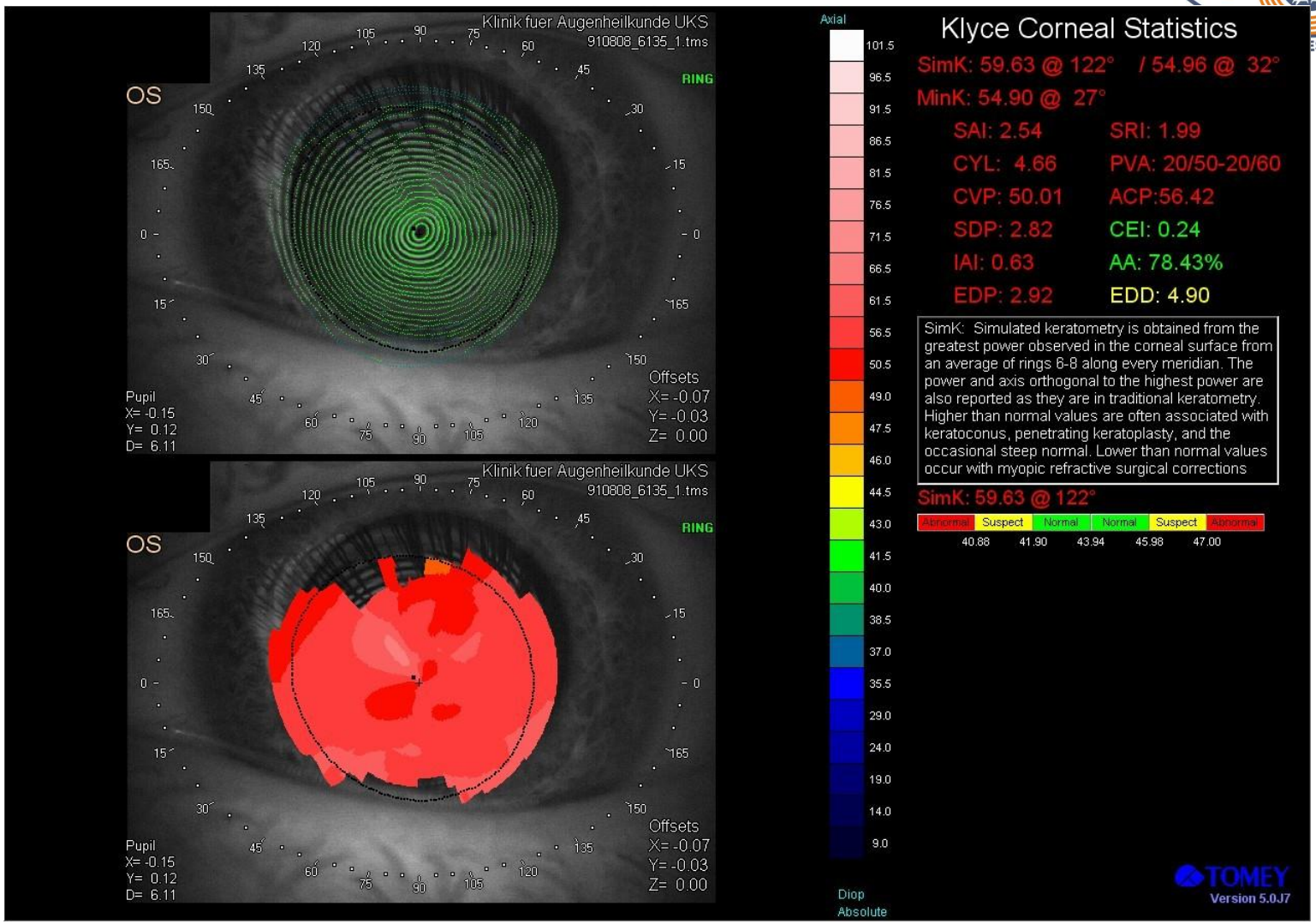
http://www.uks.eu/augenklinik

Realistic values only for axial power, but not for surface elevation or pachymetry

TMS-5 imaging – corneal topography and Klyce statistics



TMS-5 imaging – corneal topography and Klyce keratoconus screening