



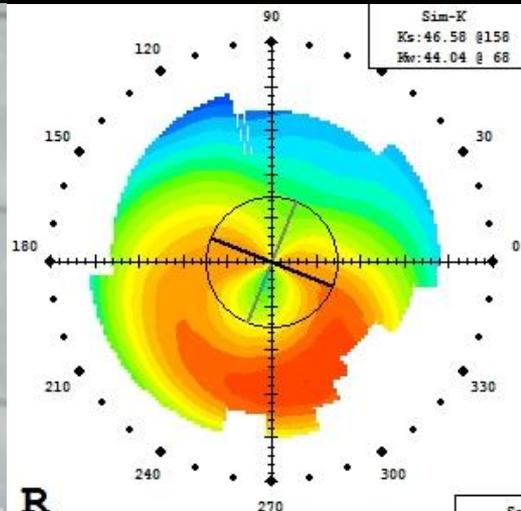
St Thomas' Hospital London



Kent County Ophthalmic
and Aural Hospital



Corneal imaging in refractive surgery workup



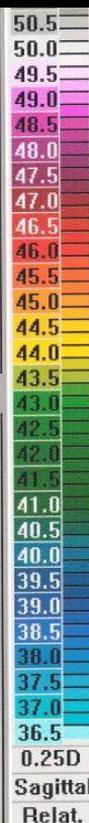
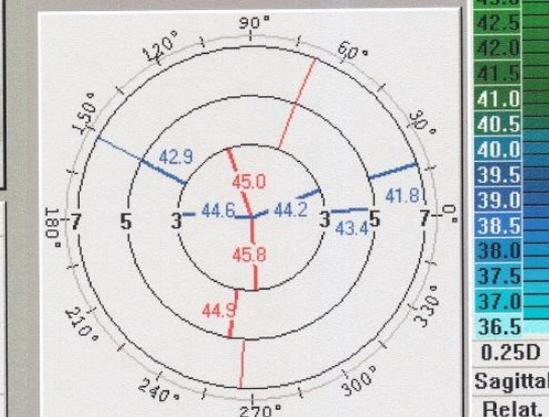
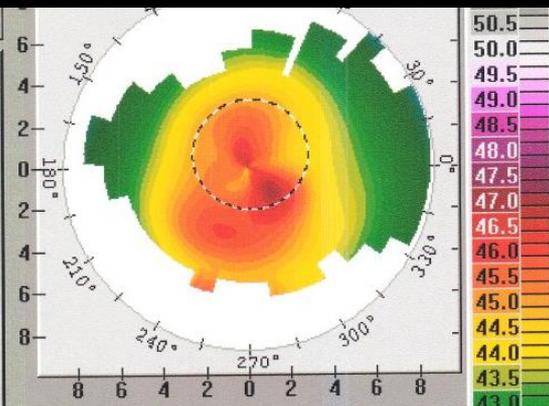
Decisions based on cornea imaging

- Cornea or lens surgery
 - Corneal Thickness
 - Anterior corneal surface - elevation
 - Posterior corneal surface – elevation
 - Corneal biomechanics

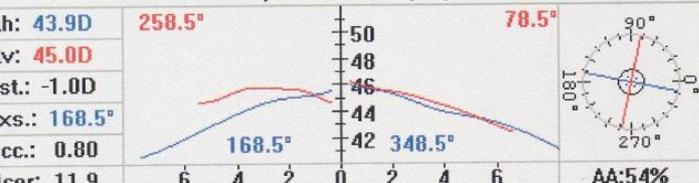


ΡΛΑCΙΔΟ ΤΟΠΟΓΡΑΦΙΑ ΚΕΡΑΤΟΕΙΔΟΥC

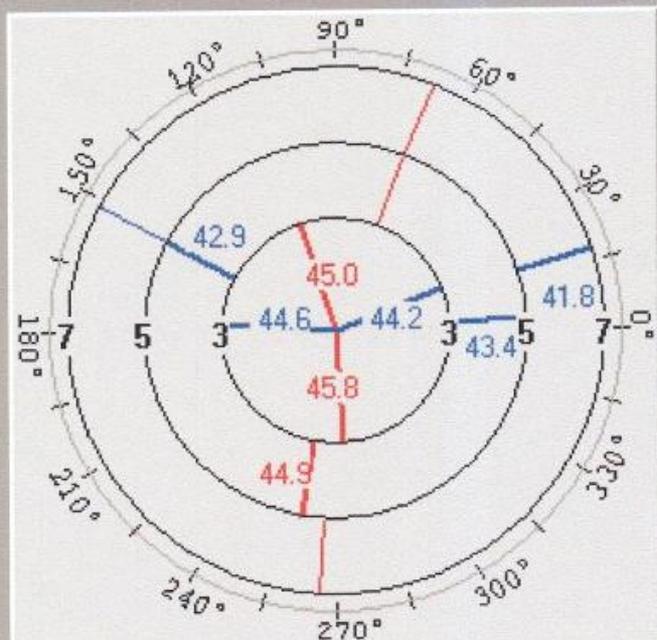
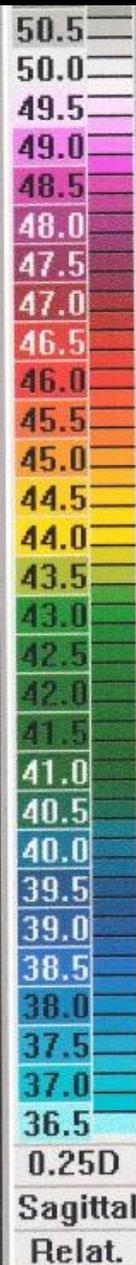
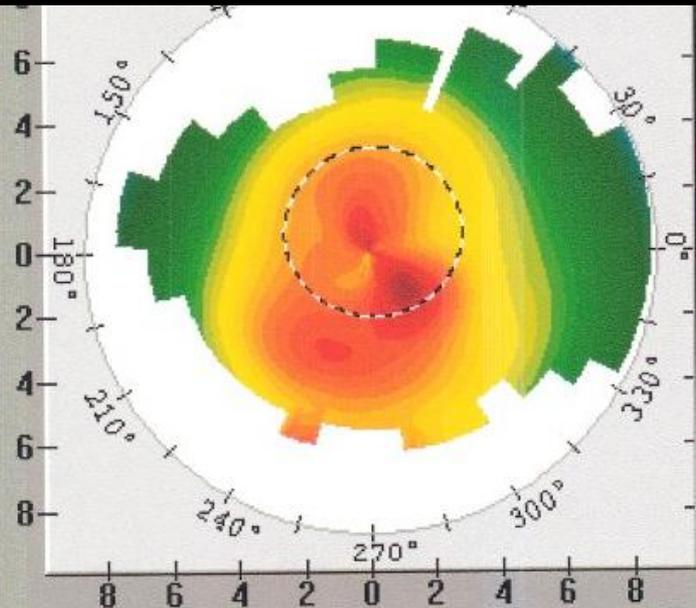
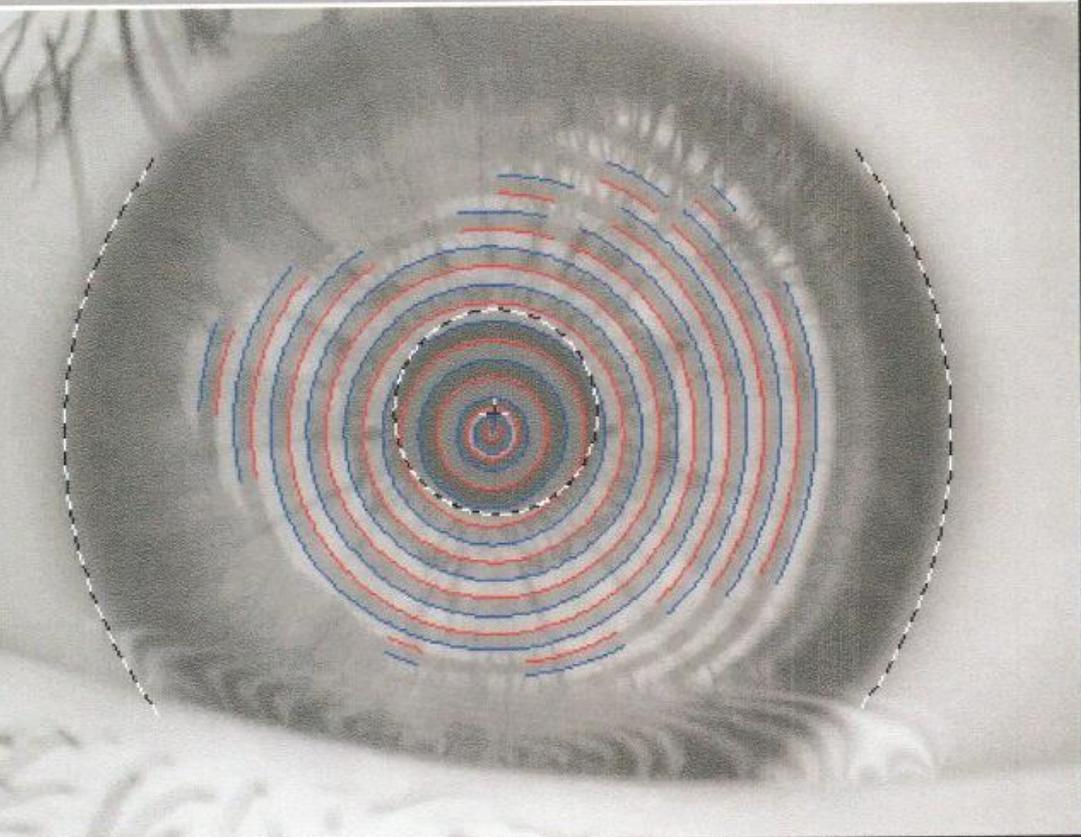
Pat. o.B.: 07.12.73 Eye: Left Exm. time: 18:25



Keratometric data : major meridians perpendicular (d=3mm)

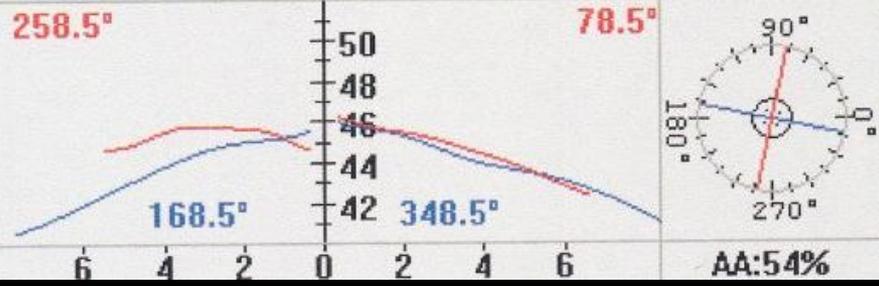


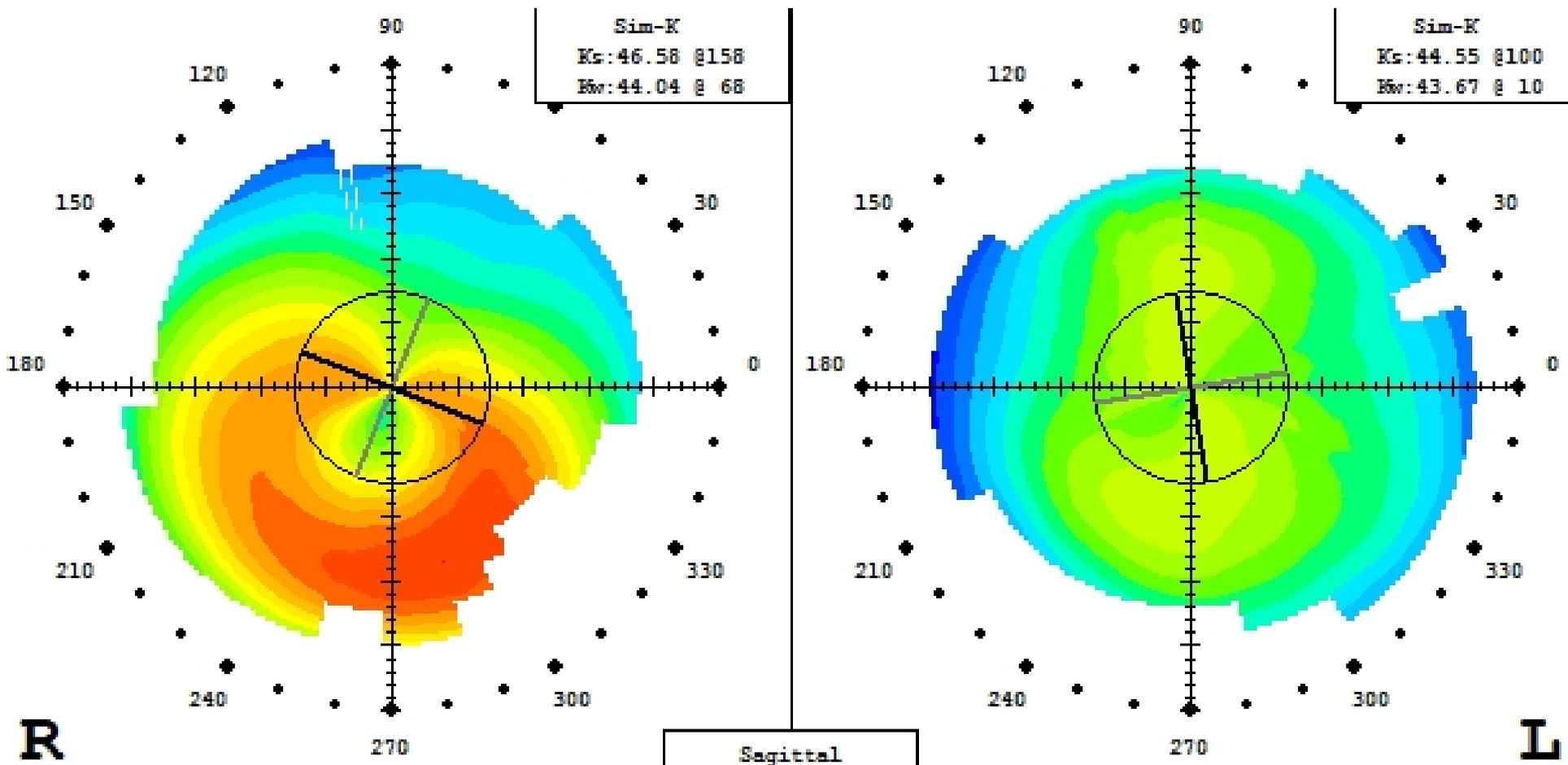
Dat. o.B.: 07.12.73 Eye: Left Exm. time: 18:25



Keratometric data : major meridians perpendicular (d=3mm)

h: 43.9D
 v: 45.0D
 st.: -1.0D
 xs.: 168.5°
 cc.: 0.80
 cor: 11.9

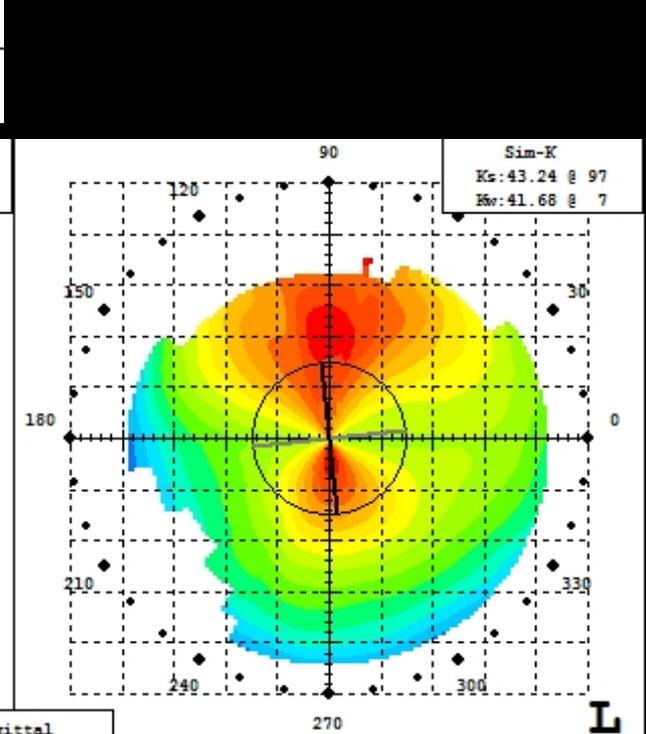
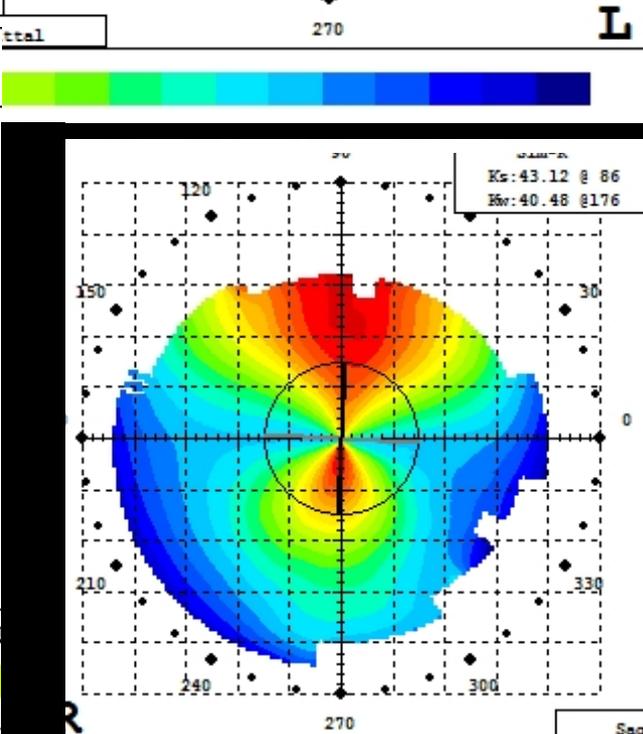
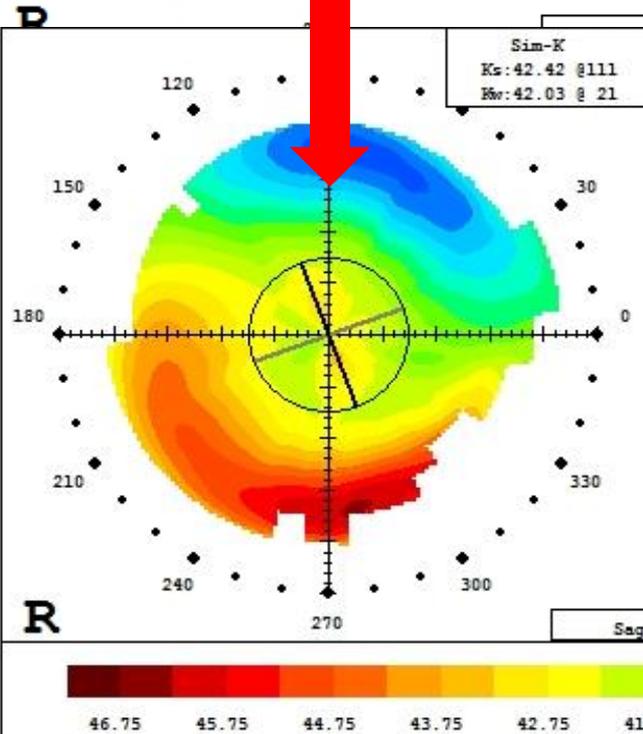
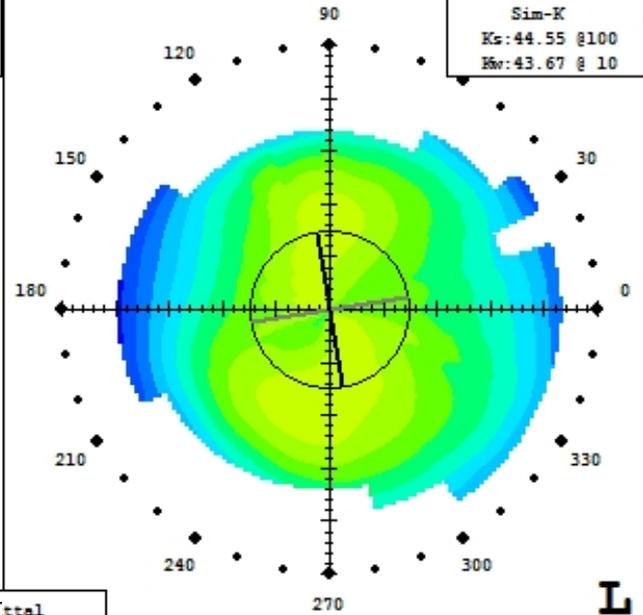
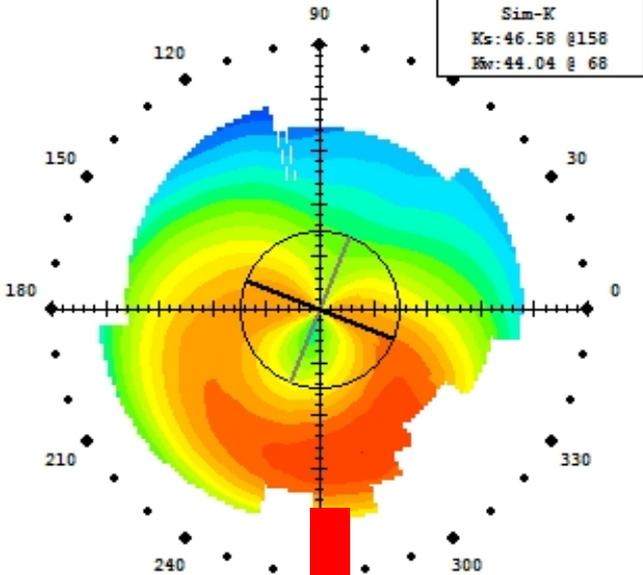




Decisions based on topography

- Normal or irregular cornea
 - Stroma or epithelium
 - Standard or Topo-guided profile
 - Pretreatment of the corneal surface
 - Contact lens free period





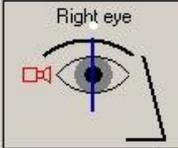
Oculus Pentacam rotating Scheimpflug camera





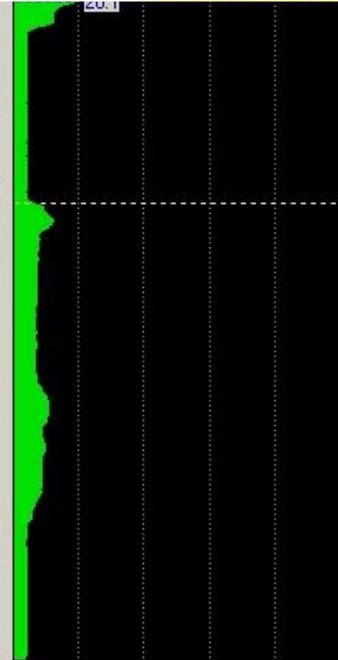
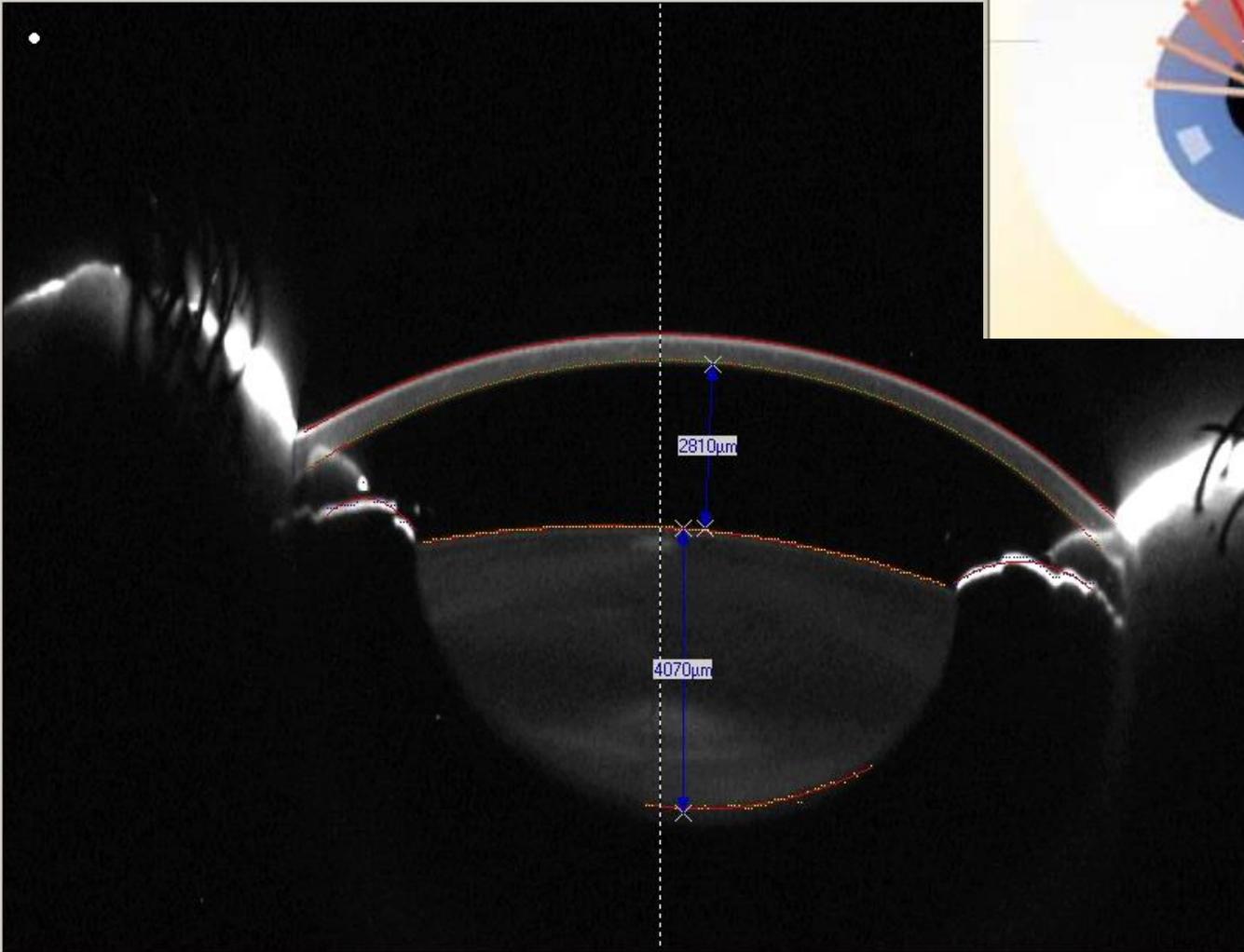
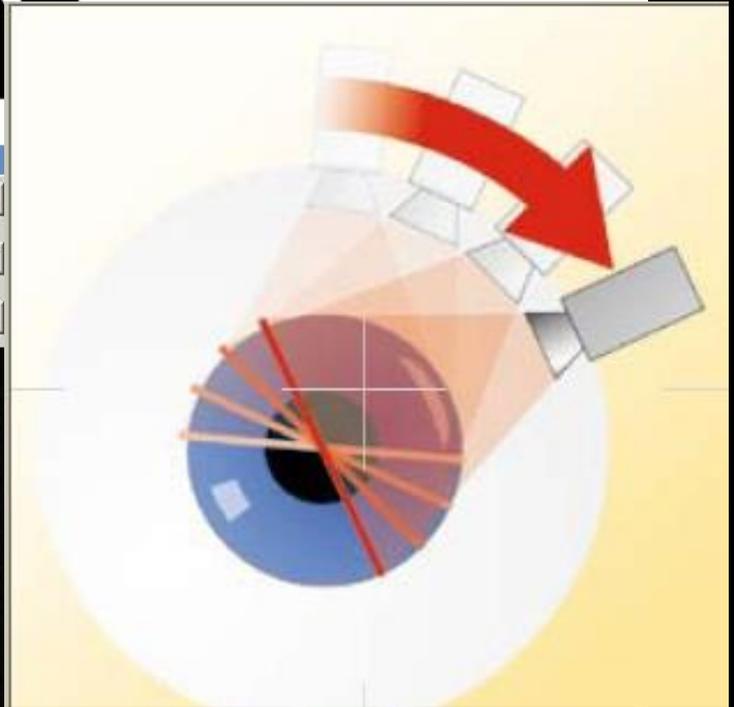
WaveLight®

WAVELIGHT - ALLEGRO OCULYZER

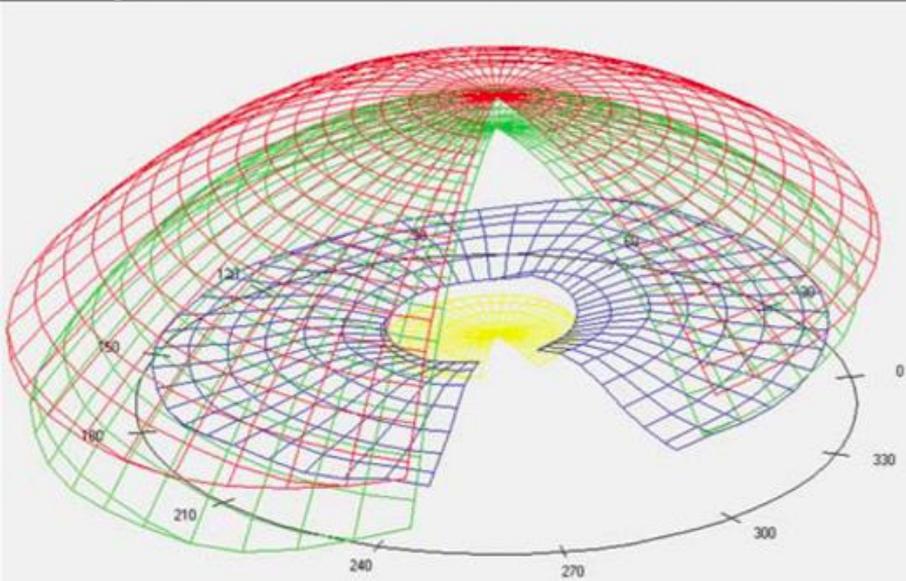
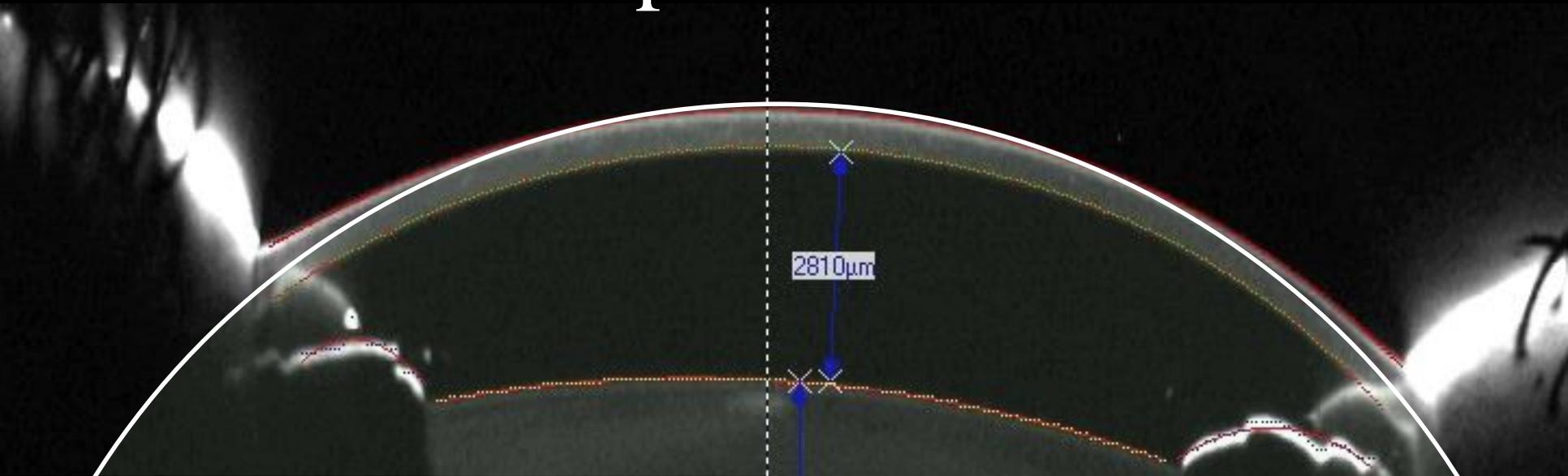


1/1 Segment: 90° - 270°

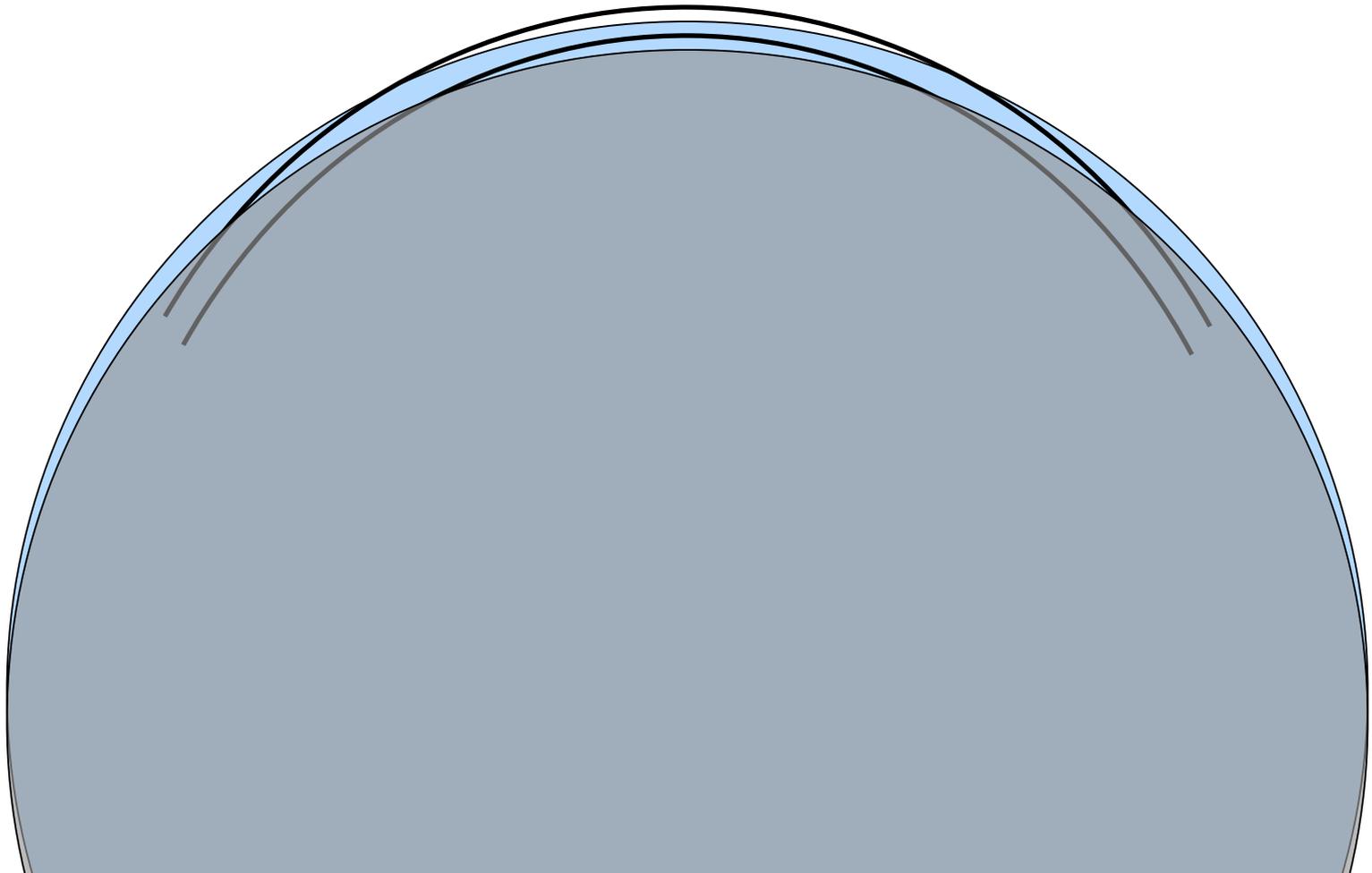
Zoom +
1:1
Zoom -



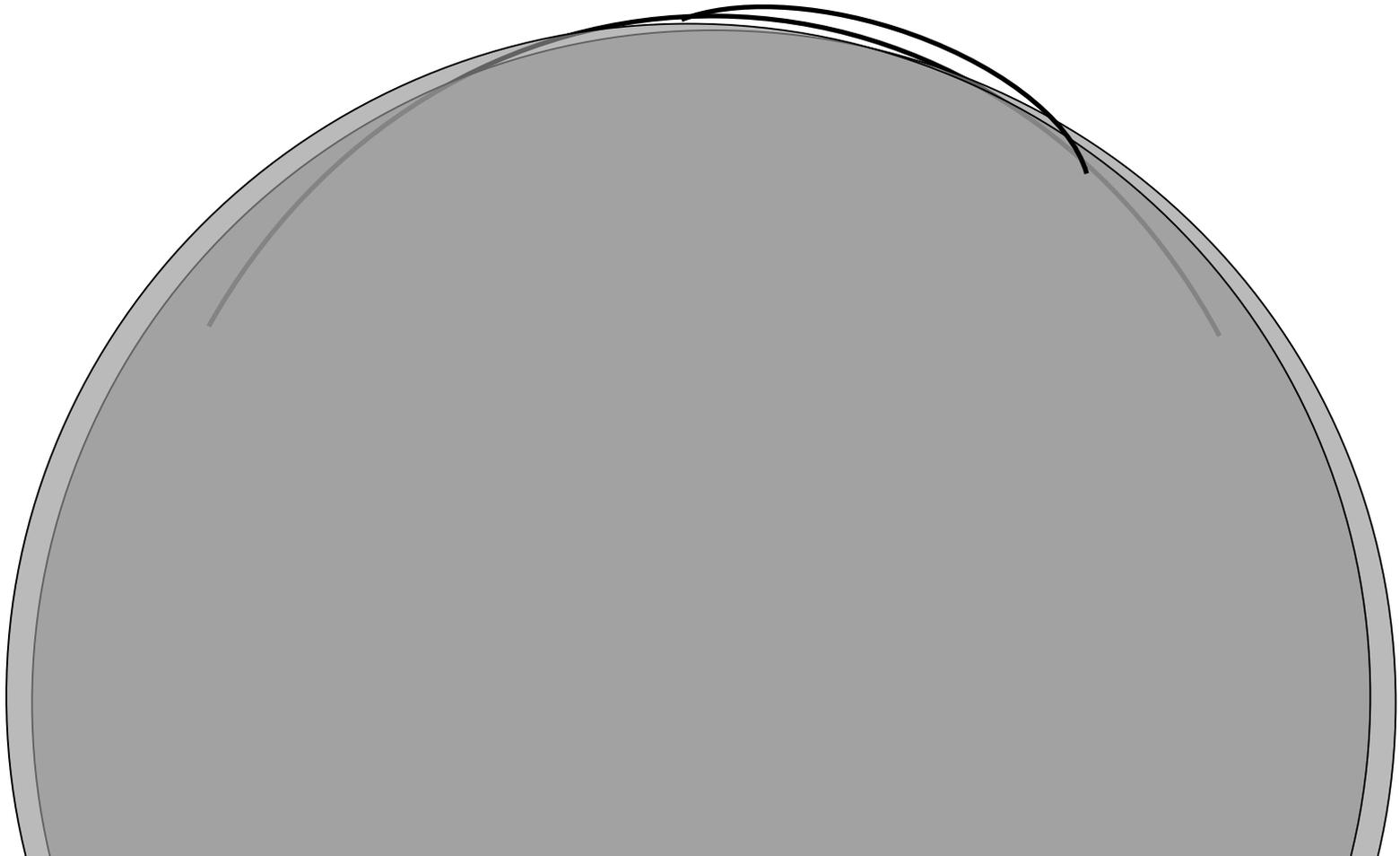
Anterior – posterior elevation



Anterior – posterior elevation



Anterior – posterior elevation



Decisions based on scheimpflug imaging

- Normal or irregular cornea
- Cornea thickness map
 - To treat or not to treat
 - Cornea or lens based surgery
 - Stroma or epithelium
 - CXL or not



Color Corneal Maps

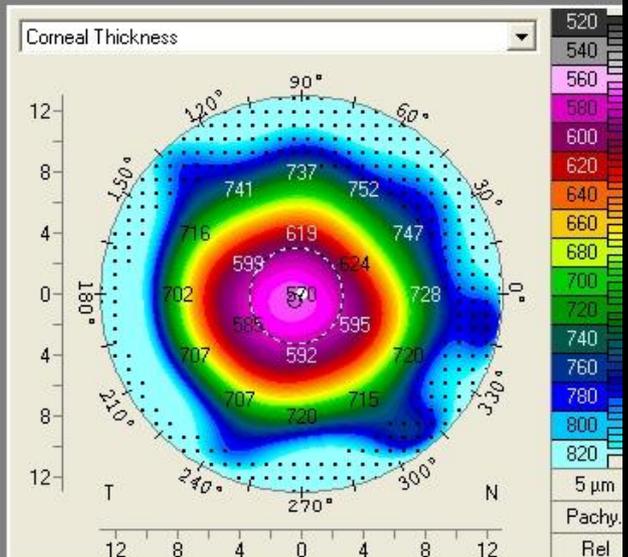
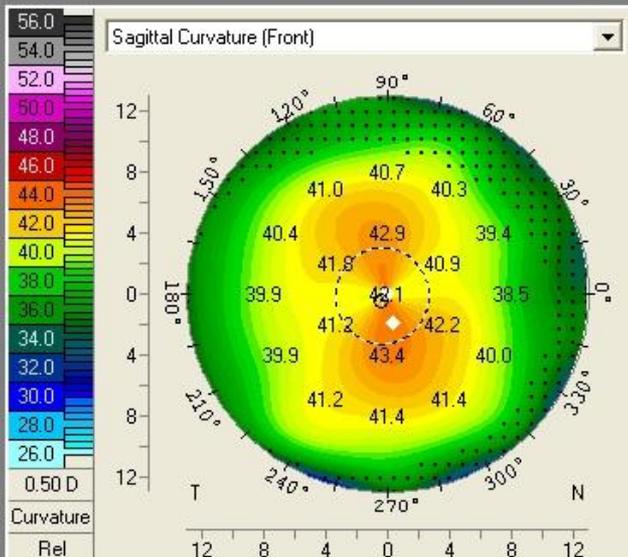
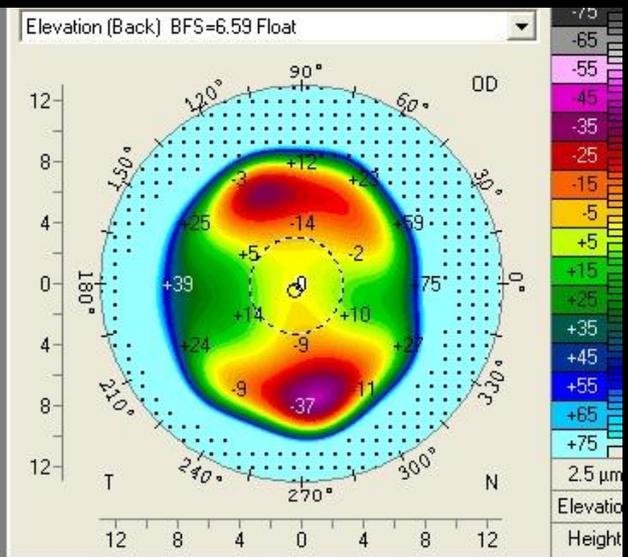
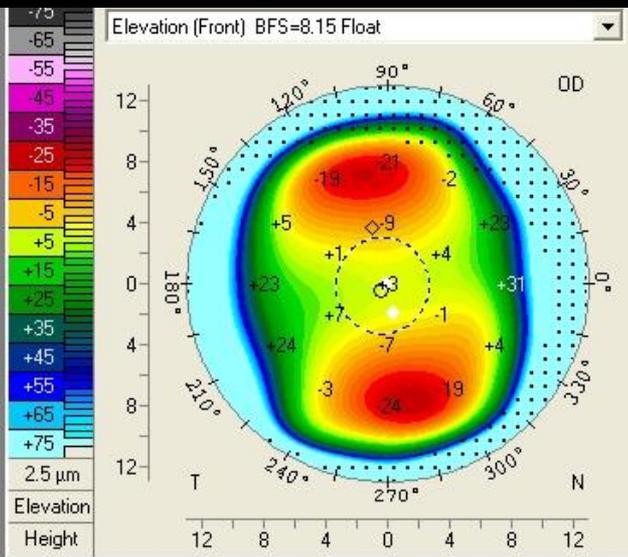
Normal Cornea

Last Name: _____
 First Name: _____
 ID: _____
 Date of Birth: _____ Right
 Exam Date: _____ 09:43:23
 Exam Info: _____



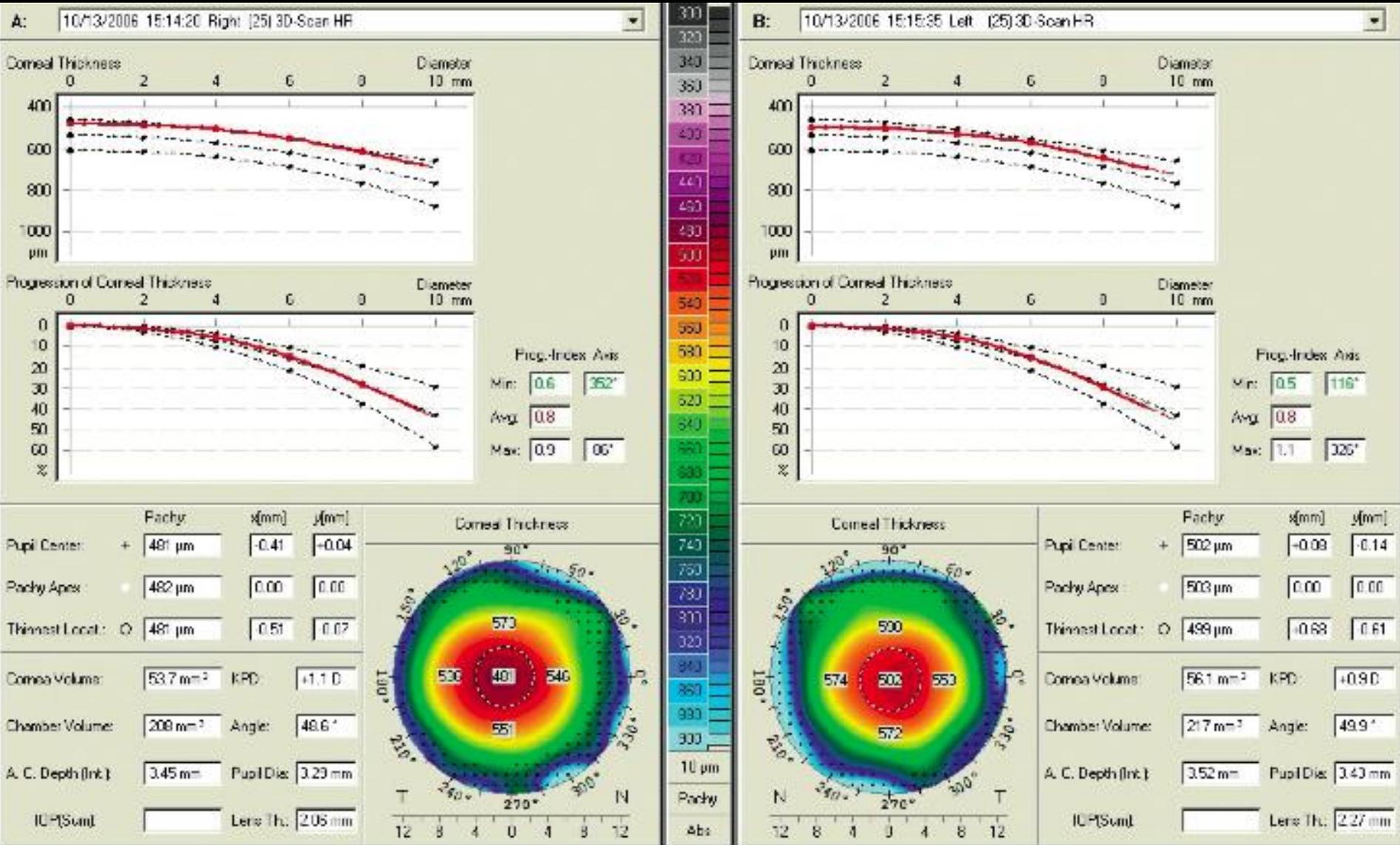
Pupil Center: + 570 μm x[mm] -0.18 y[mm] -0.06
 Pachy Apex: • 570 μm 0.00 0.00
 Thinnest Locat.: ○ 570 μm -0.22 -0.22

Cornea Volume: 61.5 mm³ KPD: +1.1 D
 Chamber Volume: 151 mm³ Angle: _____
 A. C. Depth (Int.): 2.82 mm Pupil Dia: 3.06 mm
 Enter IOP IOP(Sum) -1.8 mmHg Lens Th.: _____



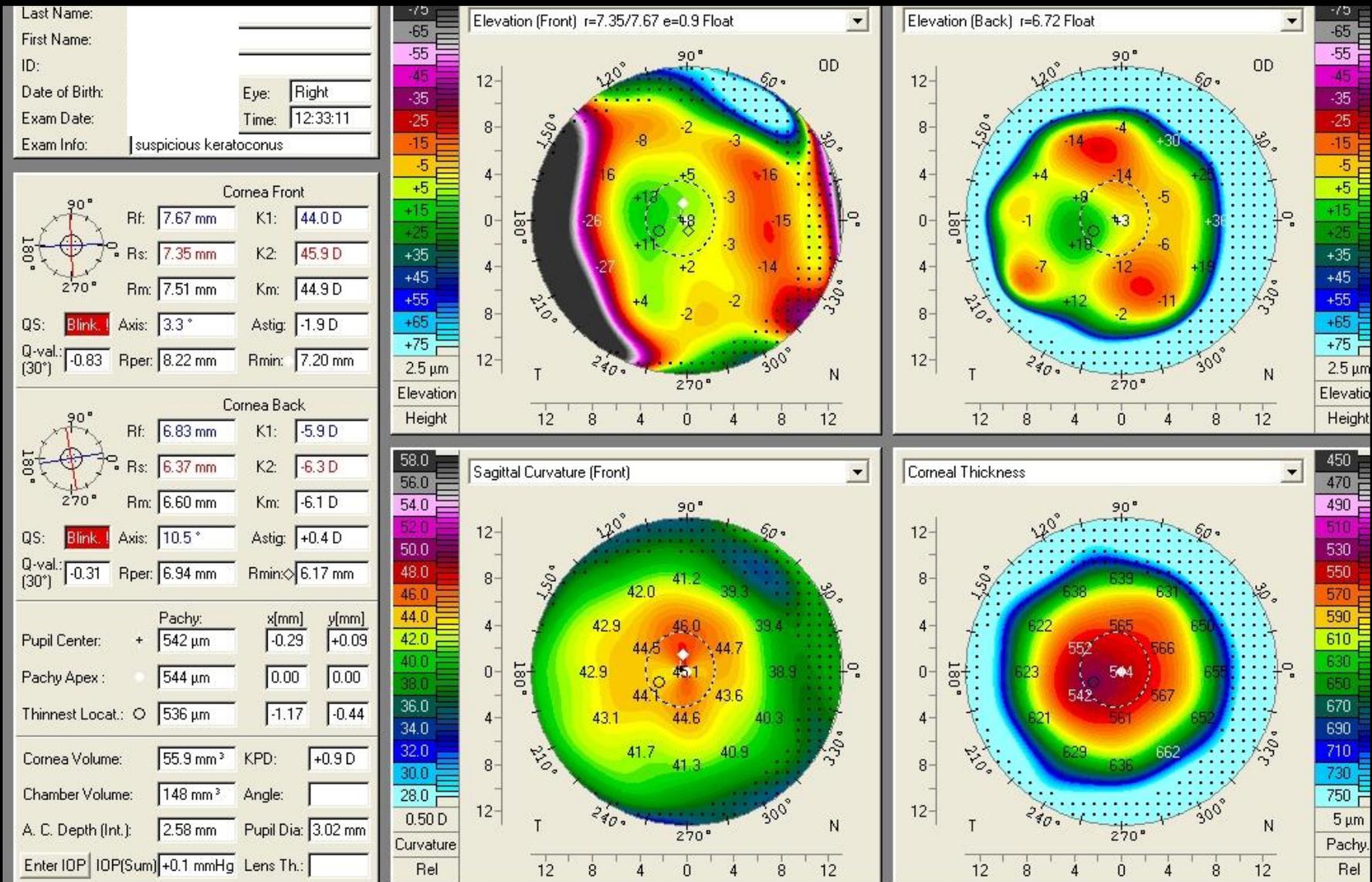
Corneal Thickness Analysis Tool

Normal Cornea



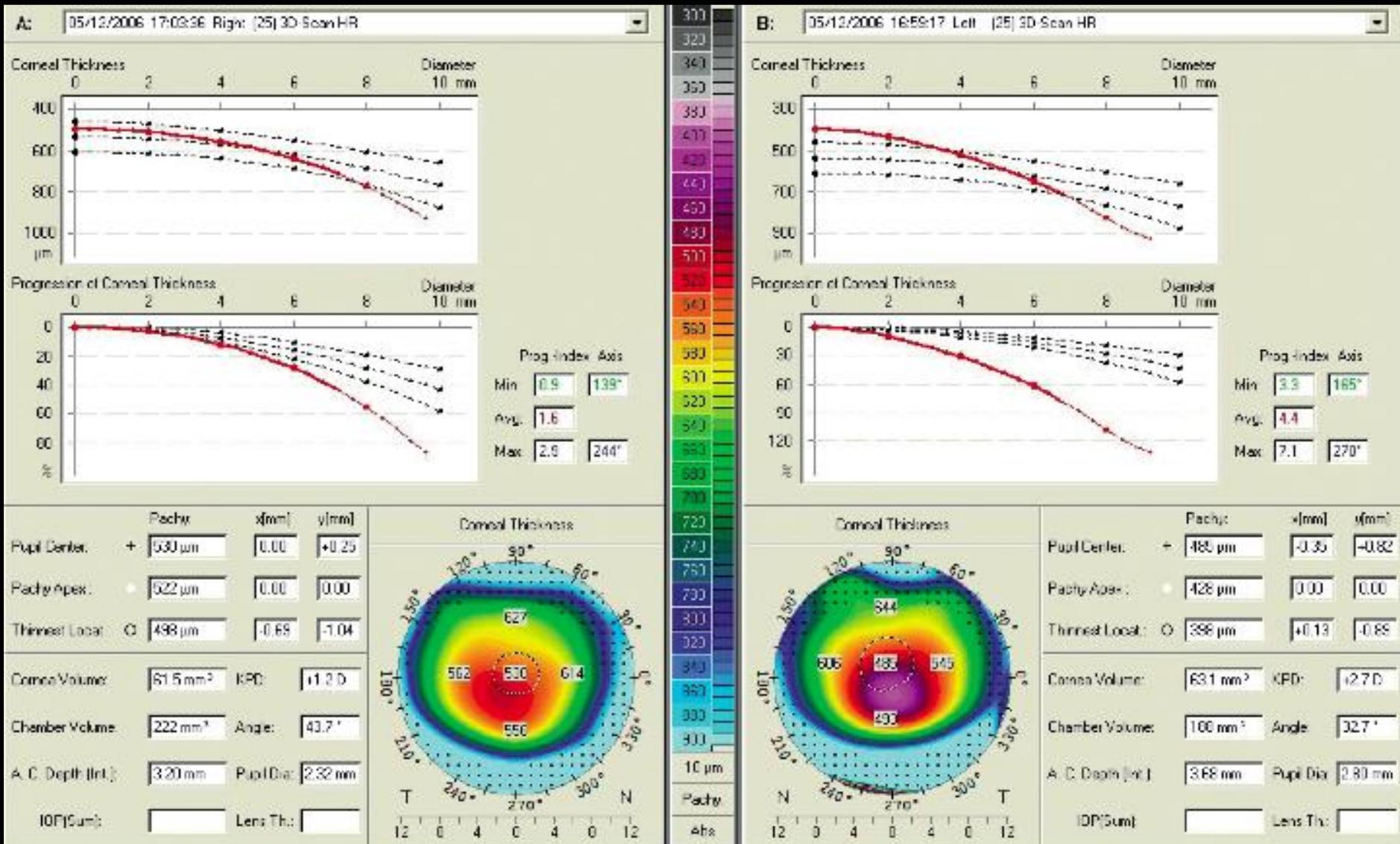
Color Corneal Maps

Abnormal Cornea



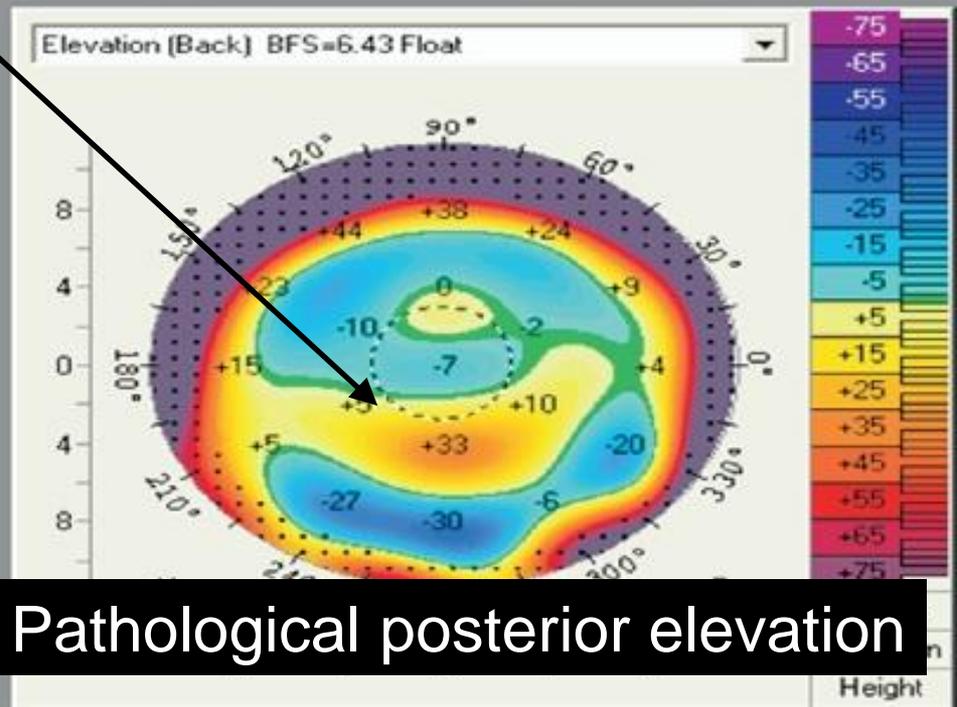
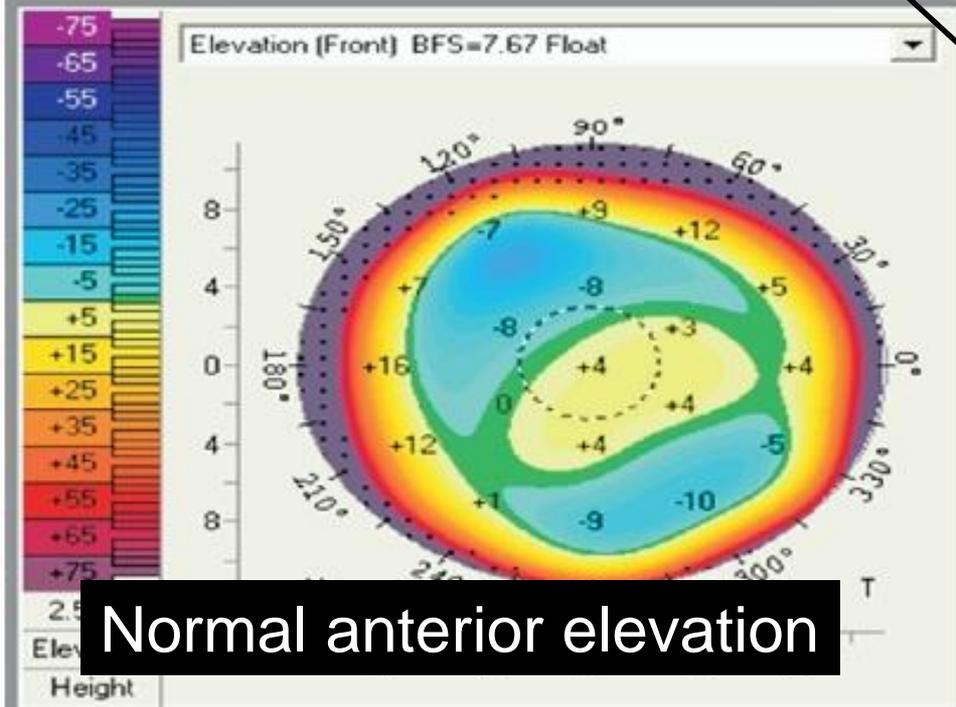
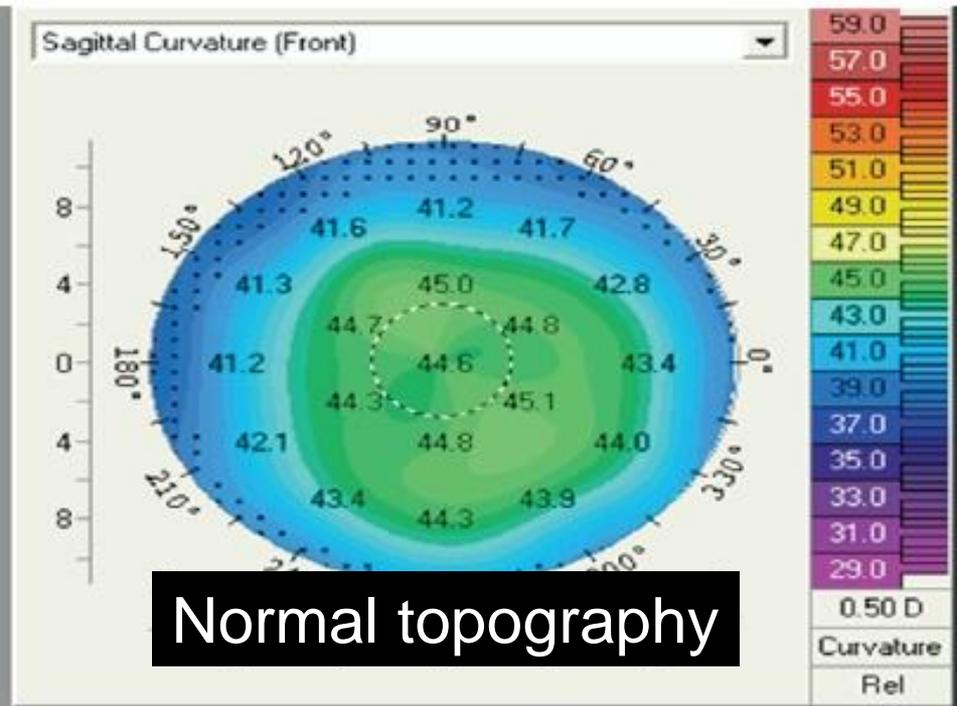
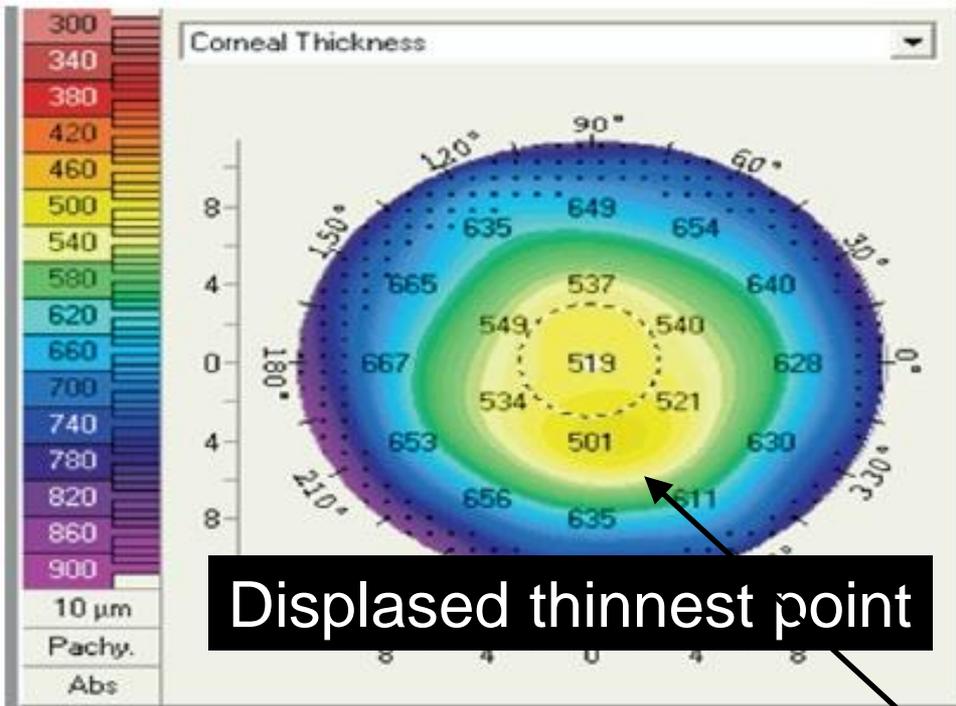
Corneal Thickness Analysis Tool

Ectatic Cornea



Elevation criteria (Belin 9mm)

- Anterior elevation (island)
 - >14 (15) μm pathological
 - 12 – 14 (12 -15) suspicious
 - < 12 normal
- Posterior elevation (island)
 - > 20 pathological
 - 14 – 20 suspicious
 - < 14 normal
- Relative to the thinnest point
- $K > 48.5$



Astigmatism Keratoconus suspicion

Last Name:
 First Name:
 ID:
 Date of Birth: 13.08.1935 Eye: Right
 Exam Date: 29.08.2005 Time: 12:33:11
 Exam Info: suspicious keratoconus

Cornea Front

Rf: 7.67 mm K1: 44.0 D
 Rs: 7.35 mm K2: 45.9 D
 Rm: 7.51 mm Km: 44.9 D

QS: **Blink!** Axis: 3.3° Astig: -1.9 D
 Q-val.: (30°) -0.83 Rper: 8.22 mm Rmin: 7.20 mm

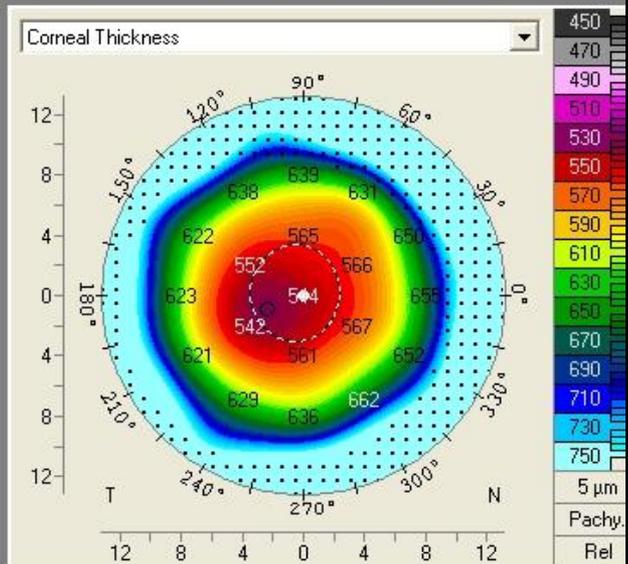
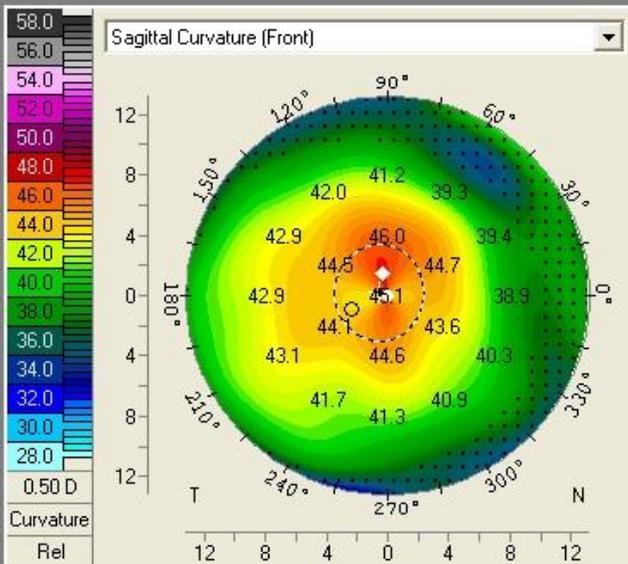
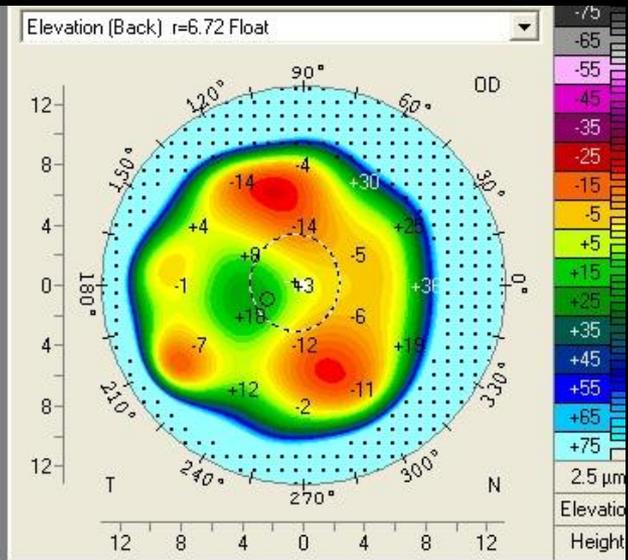
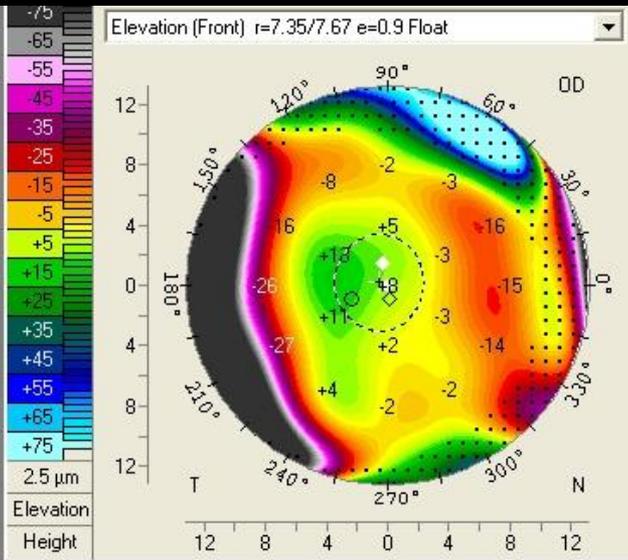
Cornea Back

Rf: 6.83 mm K1: -5.9 D
 Rs: 6.37 mm K2: -6.3 D
 Rm: 6.60 mm Km: -6.1 D

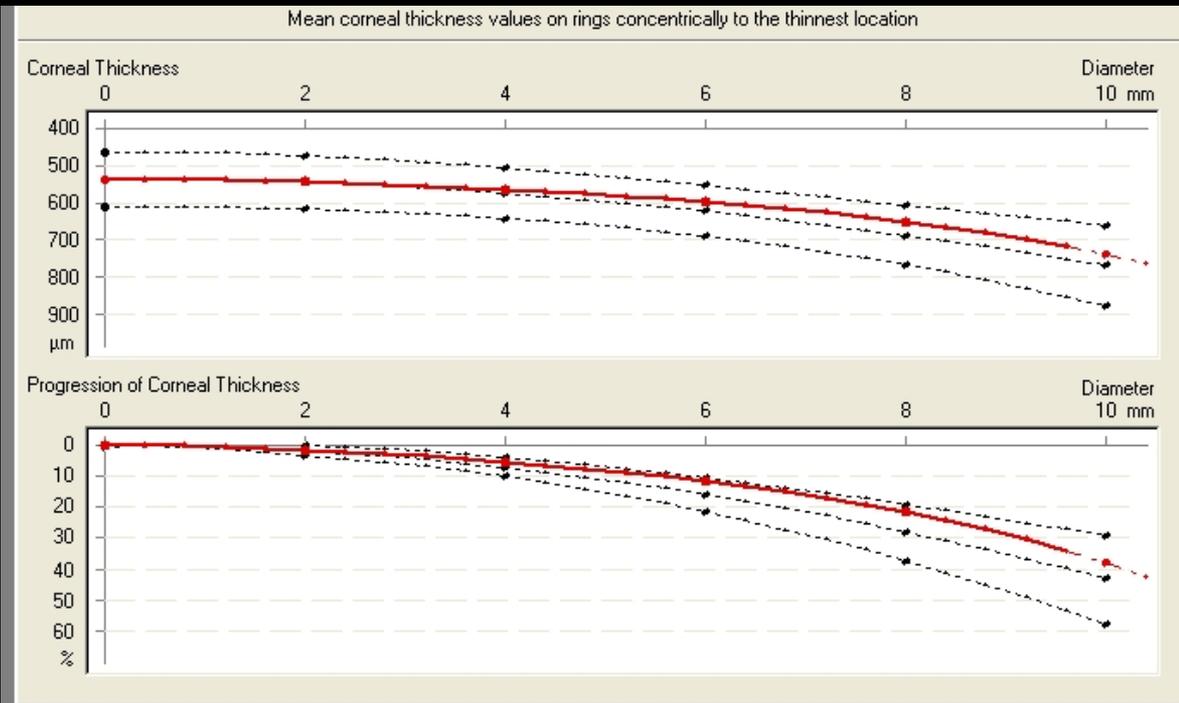
QS: **Blink!** Axis: 10.5° Astig: +0.4 D
 Q-val.: (30°) -0.31 Rper: 6.94 mm Rmin: 6.17 mm

Pupil Center: + Pachy: 542 μm x[mm] -0.29 y[mm] +0.09
 Pachy Apex: • 544 μm 0.00 0.00
 Thinnest Locat.: ○ 536 μm -1.17 -0.44

Cornea Volume: 55.9 mm³ KPD: +0.9 D
 Chamber Volume: 148 mm³ Angle:
 A. C. Depth (Int.): 2.58 mm Pupil Dia: 3.02 mm
 Enter IOP IOP(Sum) +0.1 mmHg Lens Th.:



Astigmatism Keratoconus suspicion



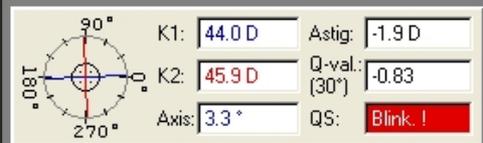
Name:

ID:

Date of Birth: 13.08.1935 Eye: Right

Exam Date: 29.08.2005 Time: 12:33:11

Exam Info: suspicious keratoconus



Pupil Center: + Pachy: x[mm] y[mm]

542 μm -0.29 +0.09

Thinnest Locat.: ○ 536 μm -1.17 -0.44

Chamber Volume: 148 mm³ Angle:

A. C. Depth (Int.): 2.58 mm Pupil Dia: 3.02 mm

Enter IOP IOP(Sum) +0.1 mmHg Lens Th.:

	0 mm	2 mm	4 mm	6 mm	8 mm	10 mm
C. Thickness / μm	536 ± 0	544 ± 2	565 ± 9	598 ± 27	651 ± 52	740 ± 78
Progression / %	0 ± 0	1 ± 0	5 ± 3	12 ± 9	21 ± 20	38 ± 35

Prog.-Index Axis

Min: 0.4 30°

Avg: 0.7

Max: 1.1 214°

Indices (in 8mm zone)

ISV: 36 IHA: 10.7

IVA: 0.25 IHD: 0.013

KI: 1.03 RMin: 7.20

CKI: 1.02 ABR: 1.4

Keratoconus Level Topogr.

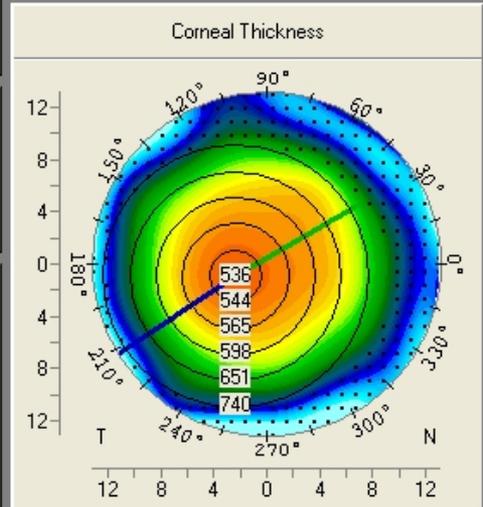
-

Corneal Volume

Dia 3 mm: 3.9 mm³

Dia 5 mm: 11.2 mm³

Dia 7 mm: 23.5 mm³



Keratoconus

First Name: Ilias
 ID:
 Date of Birth: 08.12.1969 Eye: Right
 Exam Date: 21.03.2008 Time: 10:40:56
 Exam Info:

Cornea Front

Rh: 7.19 mm K1: 46.9 D
 Rv: 6.62 mm K2: 51.0 D
 Rm: 6.91 mm Km: 48.9 D

QS: OK Axis: 142.2° Astig: -4.0 D
 Q-val: (30°) -1.42 Rper: 8.44 mm Rmin: 6.14 mm

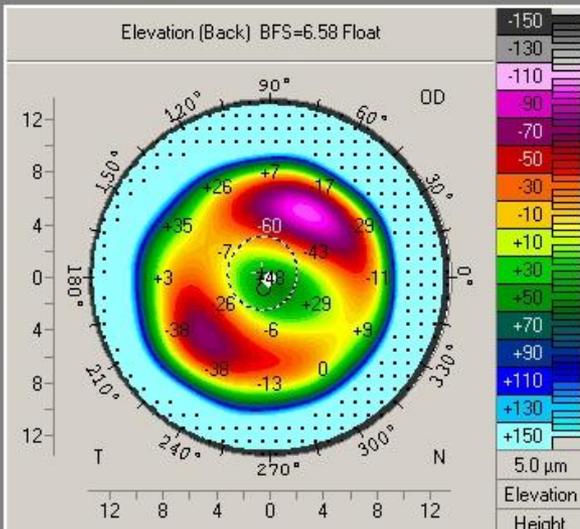
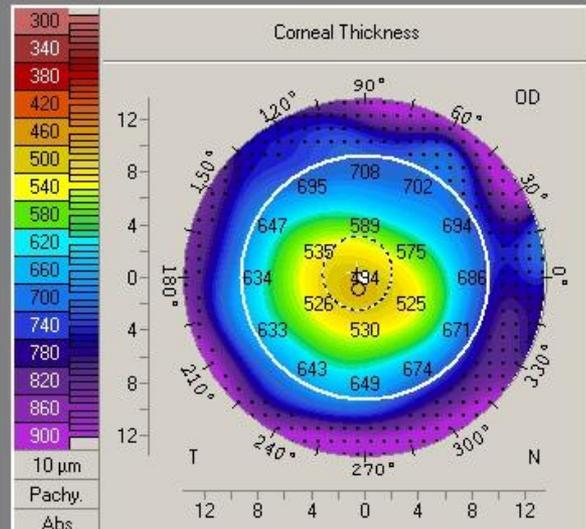
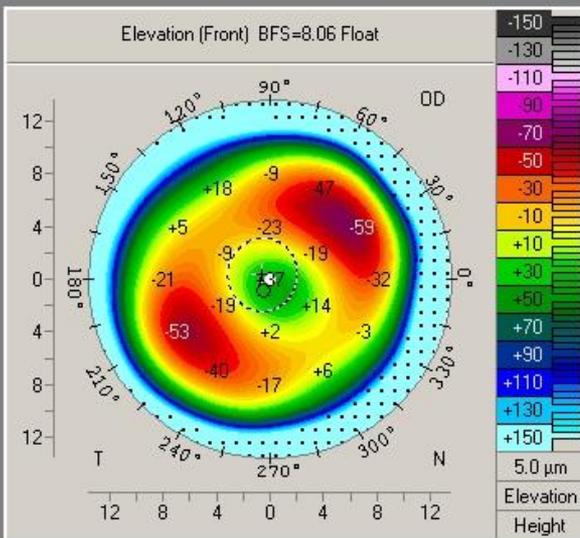
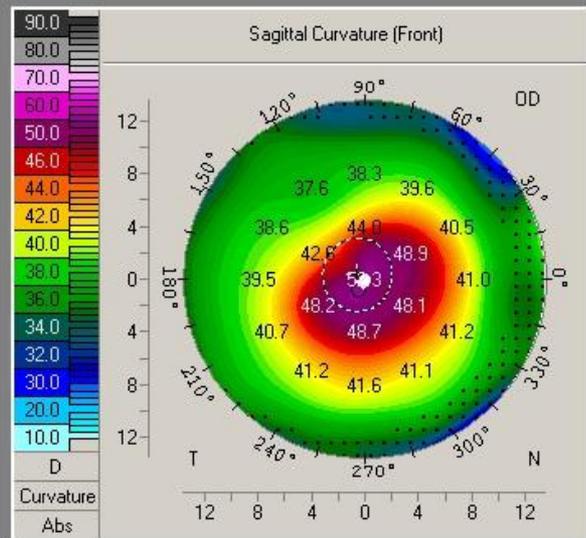
Cornea Back

Rh: 5.96 mm K1: -6.7 D
 Rv: 5.14 mm K2: -7.8 D
 Rm: 5.55 mm Km: -7.2 D

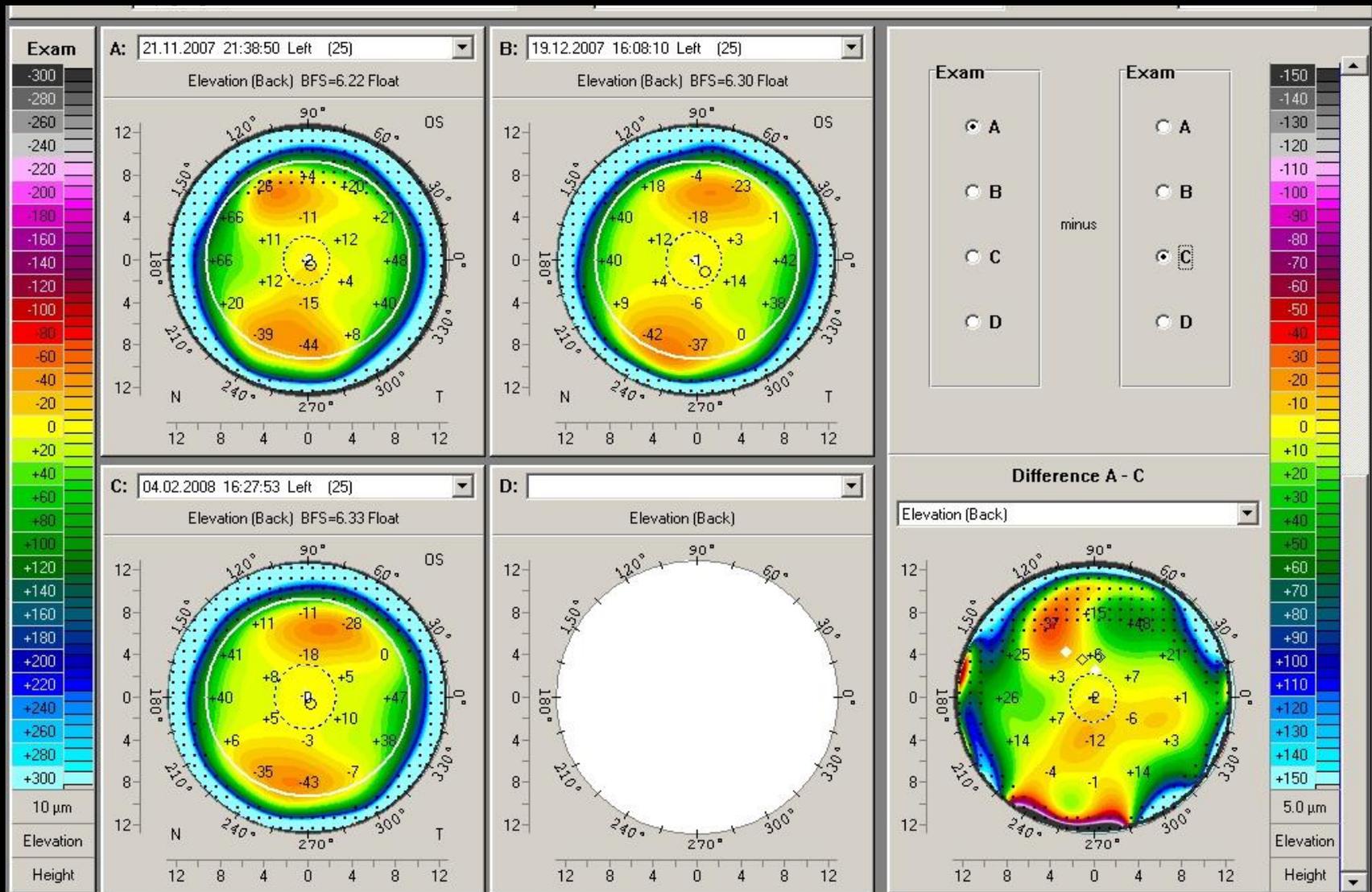
QS: OK Axis: 150.9° Astig: +1.1 D
 Q-val: (30°) -1.64 Rper: 7.31 mm Rmin: 4.59 mm

Pupil Center: + Pachy: 496 μm x[mm] -0.29 y[mm] +0.17
 Pachy Apex: • 494 μm 0.00 0.00
 Thinnest Locat.: ○ 490 μm -0.23 -0.45

Cornea Volume: 56.3 mm³ KPD: +1.9 D
 Chamber Volume: 190 mm³ Angle: 33.8°
 A. C. Depth (Int.): 3.00 mm Pupil Dia: 2.65 mm
 Enter IOP IOP(Sum): +3.6 mmHg Lens Th.:



Posterior surface change Gas permeable contact lenses



Hyperopic astigmatism angle Kappa

WAVELIGHT - ALLEGRO OCULYZER

Last Name:
 First Name:
 ID:
 Date of Birth: **03.02.1954** eye:
 Exam Date: 18.01.2008 Time: 11:46:52
 Exam Info:

Cornea Front

Rh: 7.71 mm K1: 43.8 D
 Rv: 7.52 mm K2: 44.9 D
 Rm: 7.62 mm Km: 44.3 D

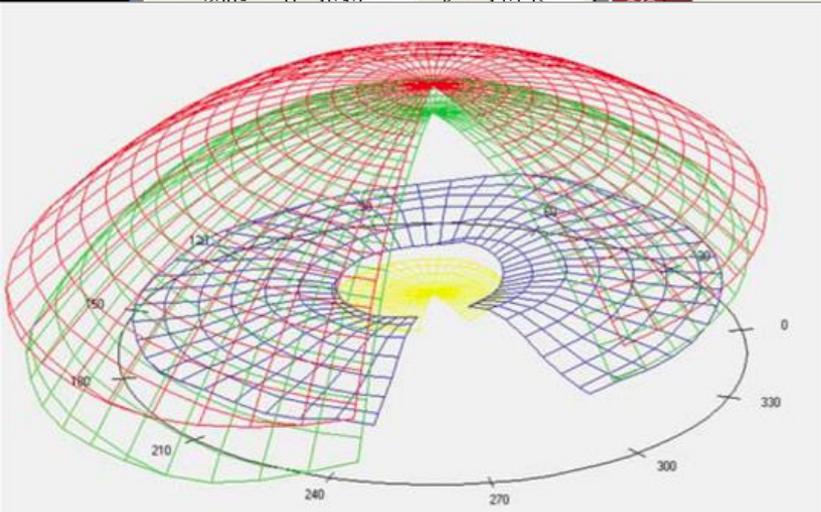
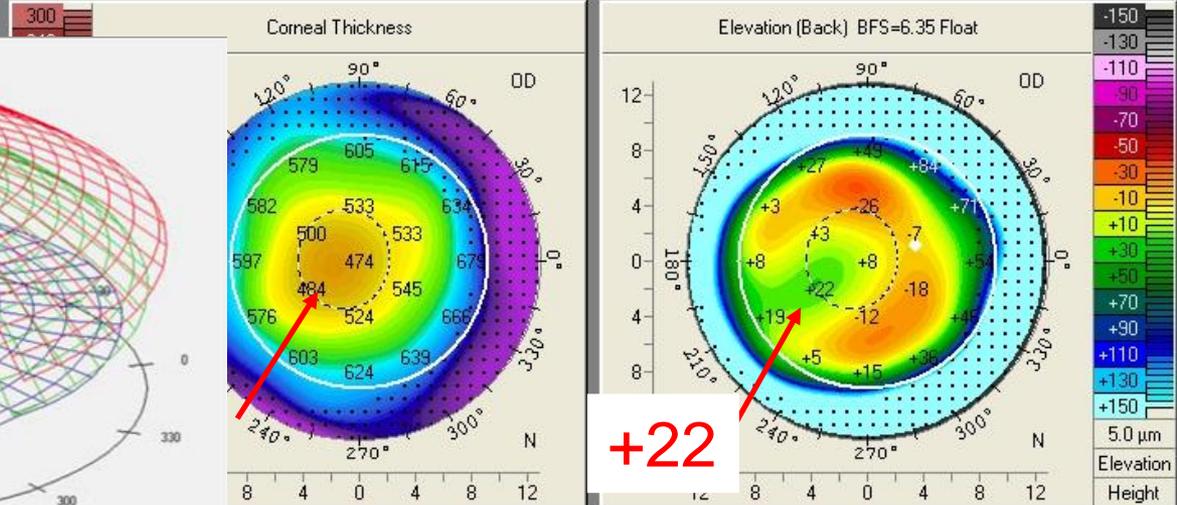
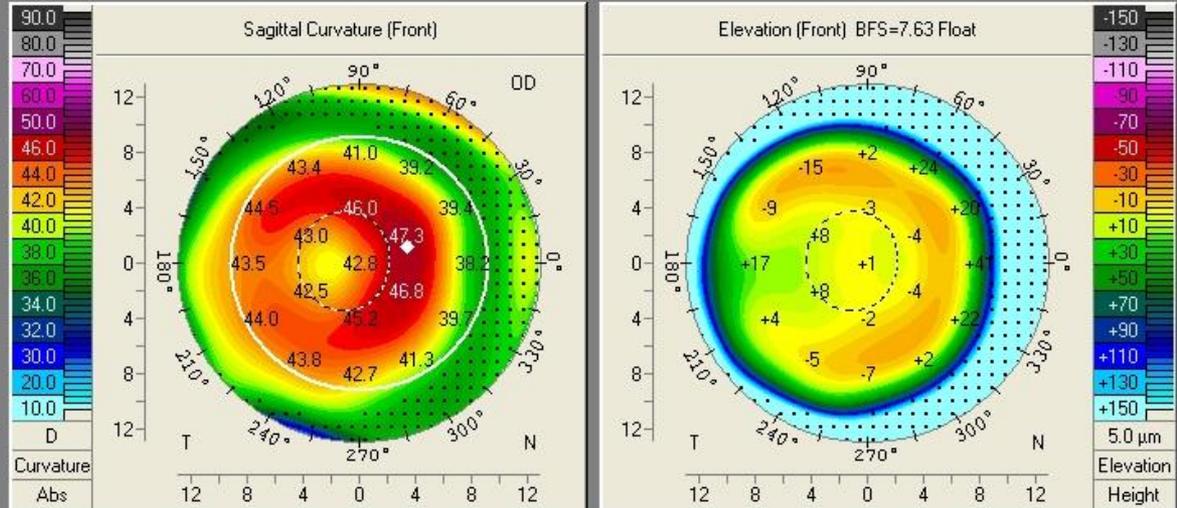
QS: Axis: 4.4° Astig: -1.1 D

Q-val. (30°): -0.79 Rper: 8.12 mm Rmin: 7.12 mm

Cornea Back

Rh: 6.38 mm K1: -6.3 D
 Rv: 5.88 mm K2: -6.8 D

Refractive

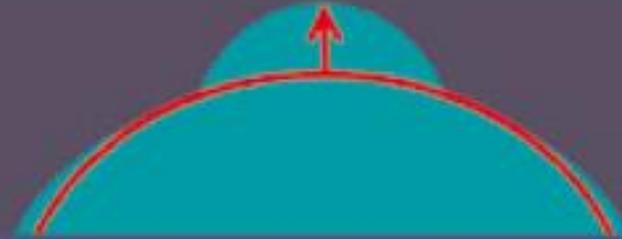


Belin Ambrosio Display



Keratoconus fit with
Best Fit Sphere

VS



Keratoconus fit with
New Reference Shape



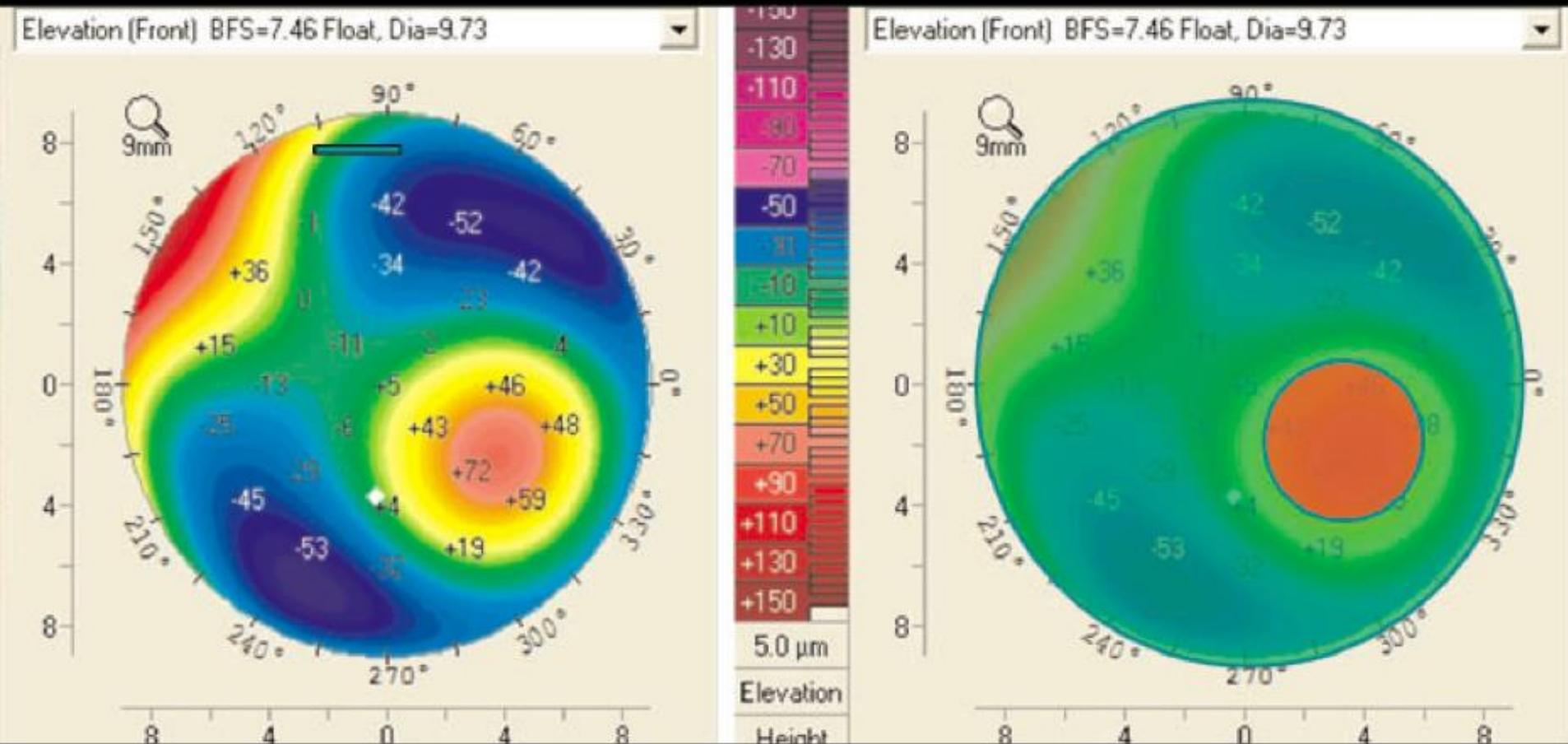
Normal fit with Best
Fit Sphere

VS

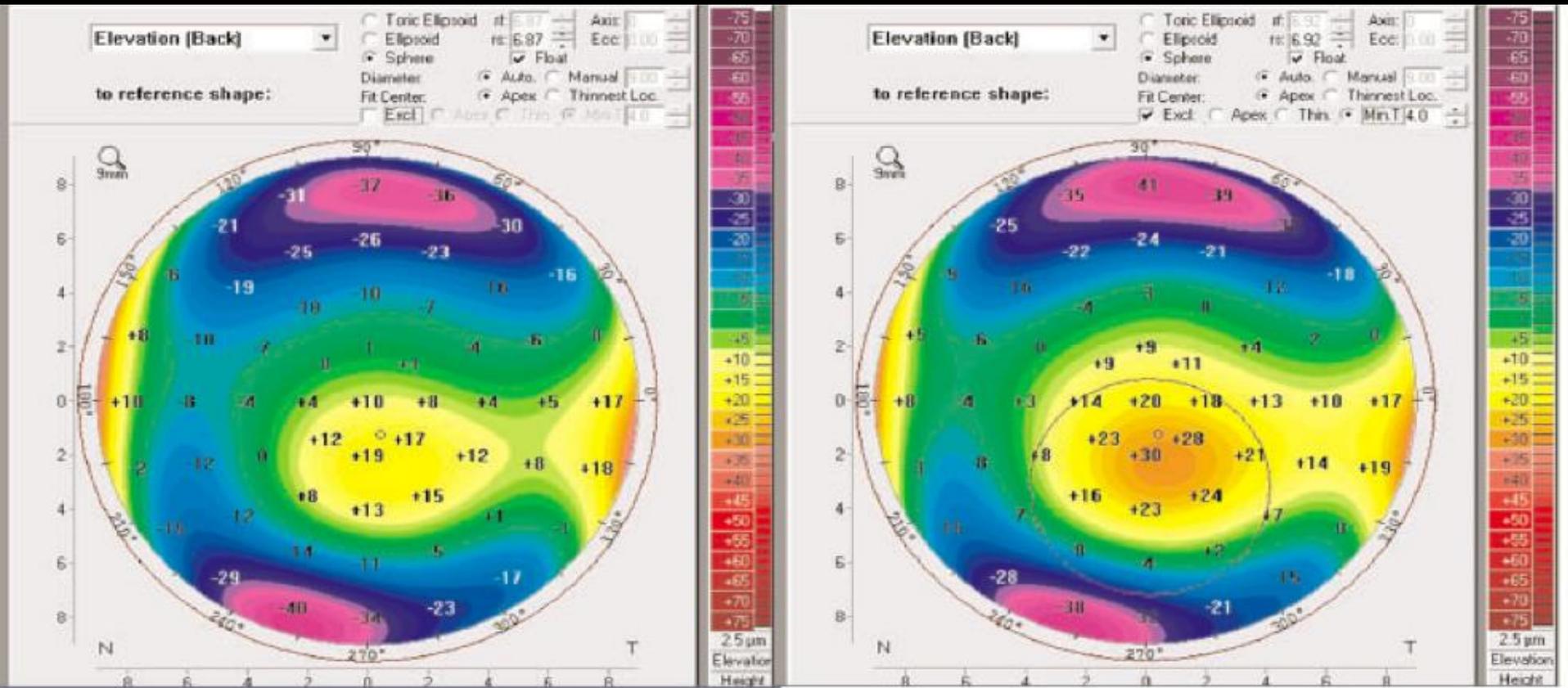


Normal fit with new
Reference Shape

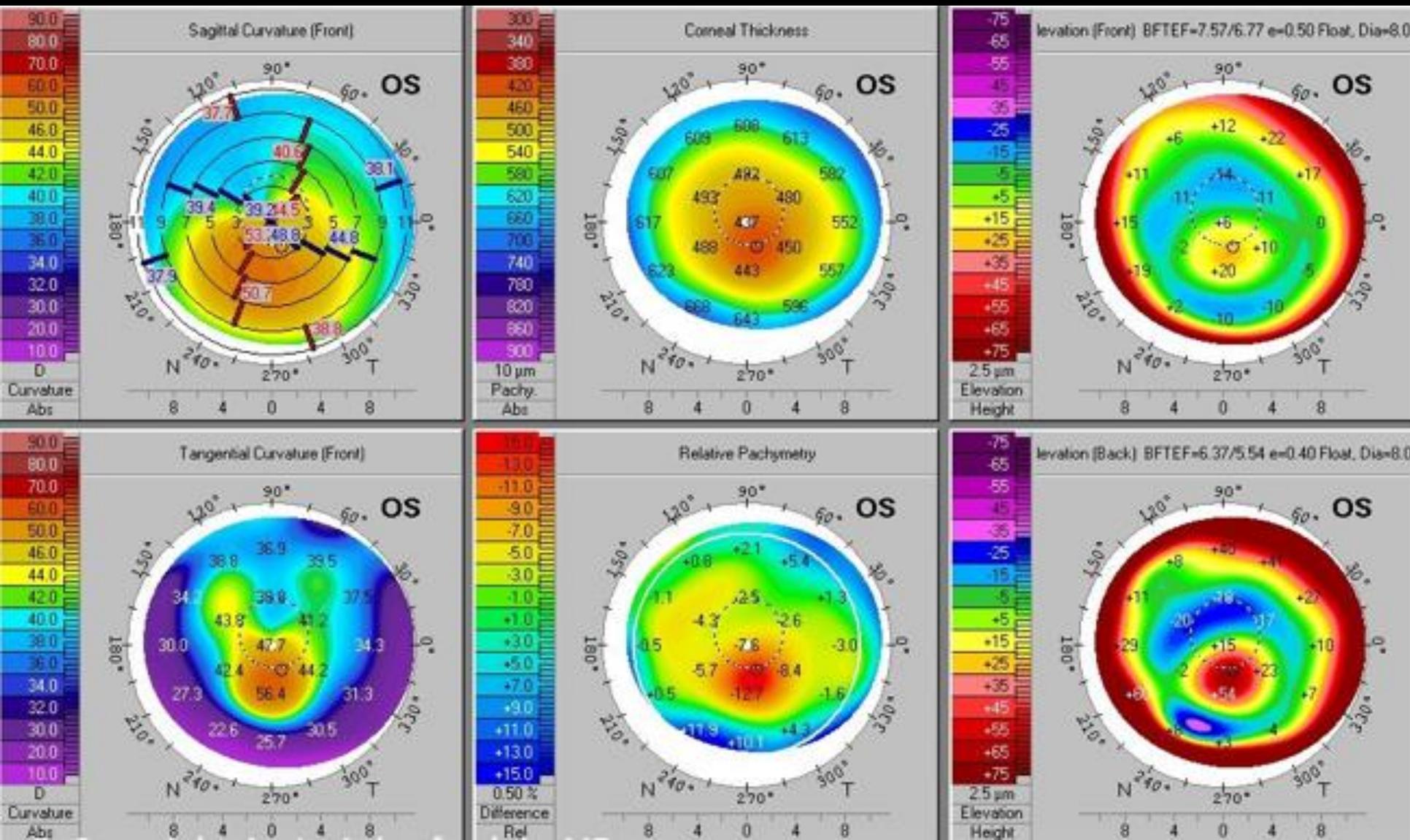
Belin Ambrosio Display



Belin Ambrosio Display



Pentacam Keratoconous

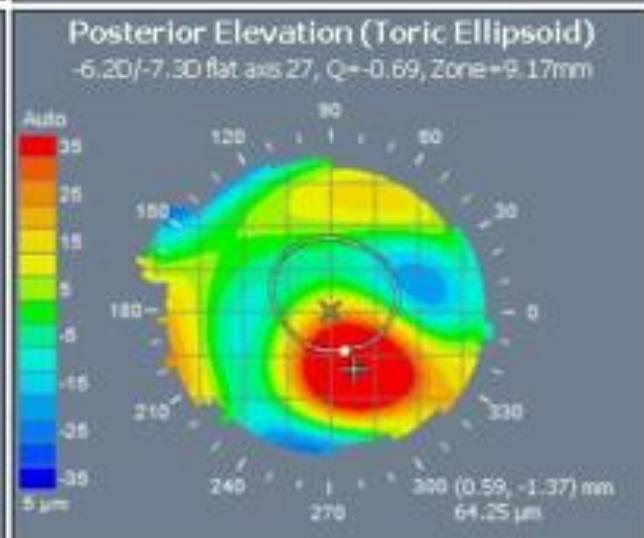
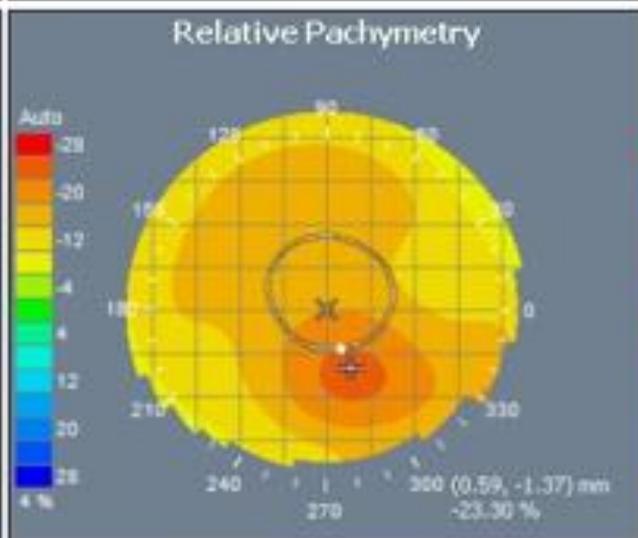
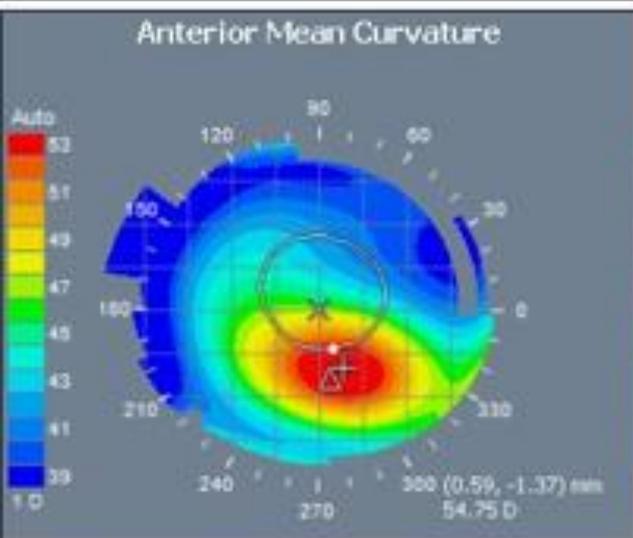
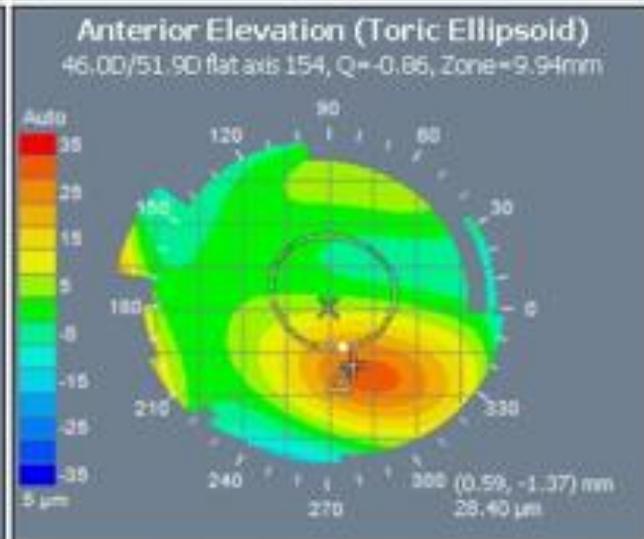
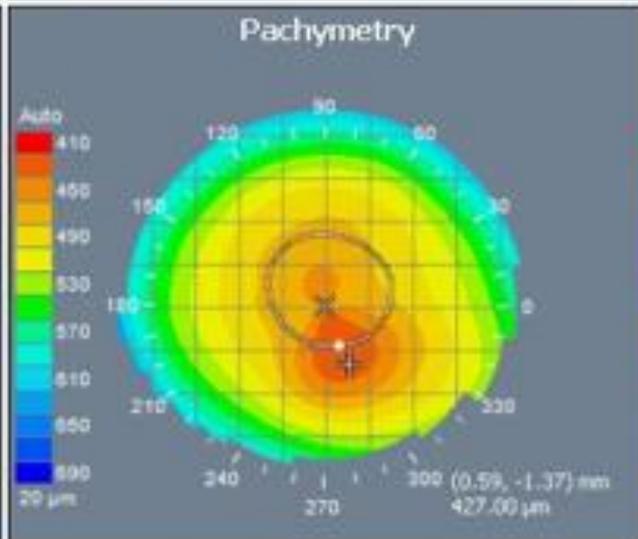
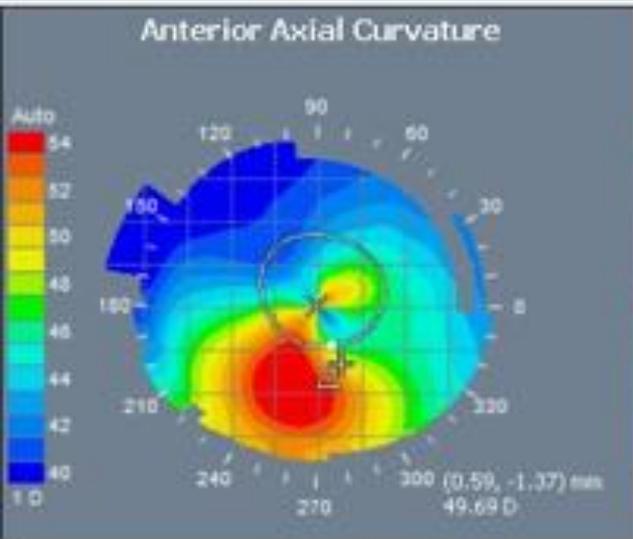


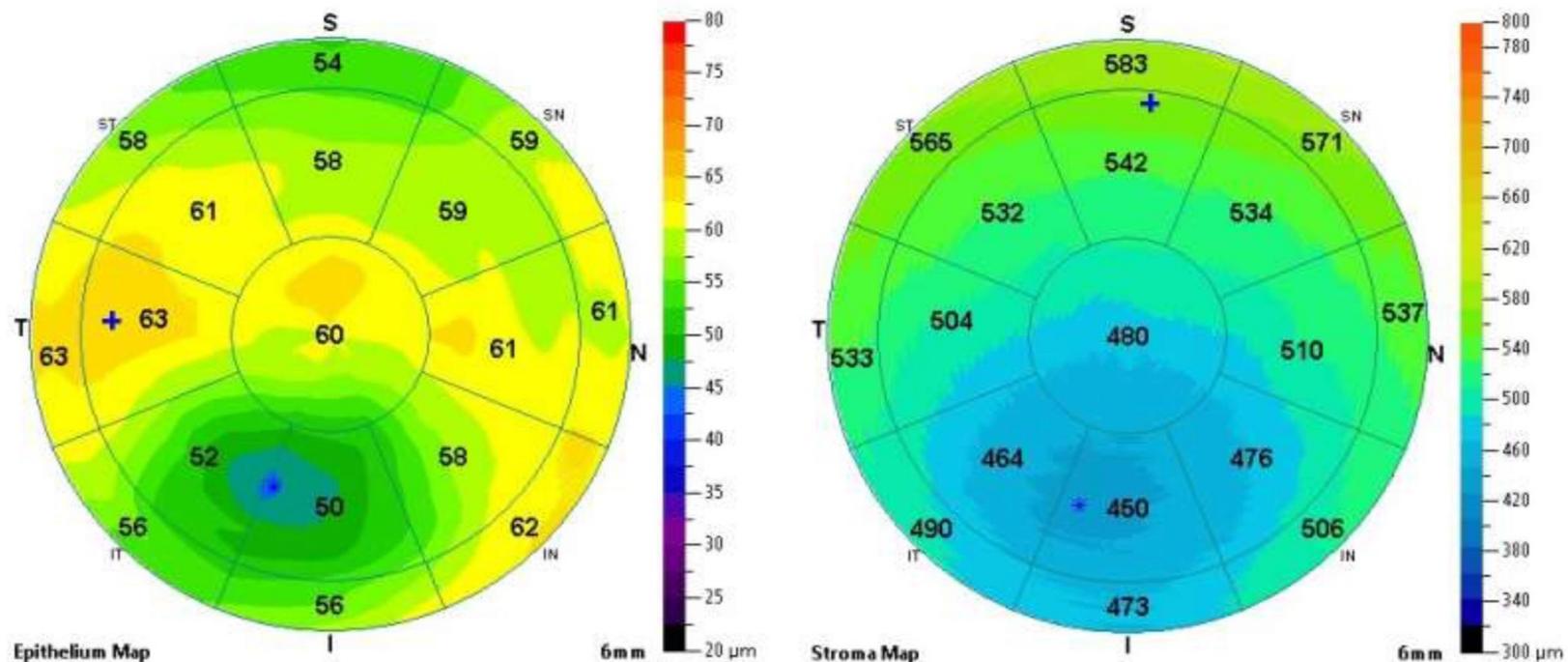
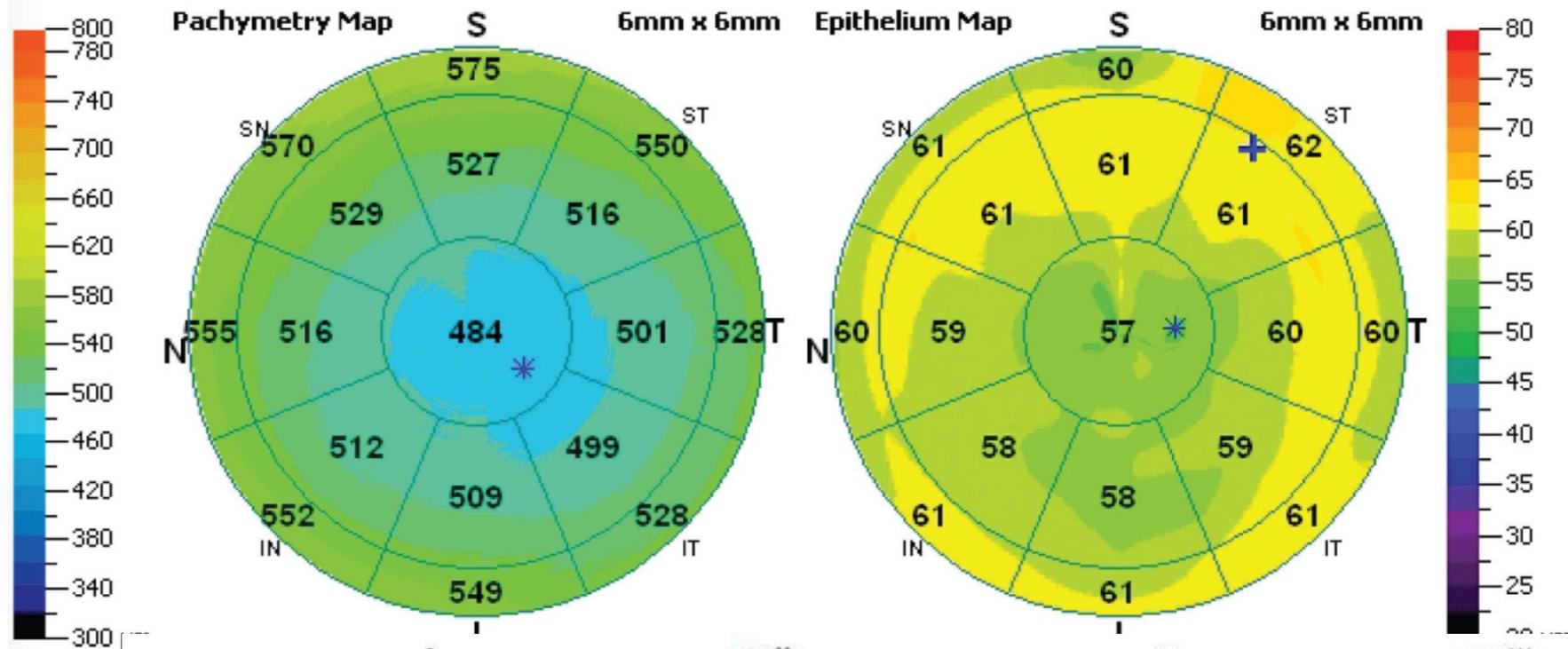
Visante Keratoconous

Simulated Keratometry:
 Steep K: 49.38 D @ 56 Astig: +5.50 D @ 56
 Flat K: 43.88 D @ 146 Mean K: 46.63 D

4.5 mm Zone: **Asphericity Q: -0.83**
 Steep K: 49.20 D @ 55 Astig: +5.80 D @ 55
 Flat K: 43.40 D @ 145 Mean K: 46.30 D

Pachy Min: 422 μ m **WTW:** No Data
Pupil Dia: 2.7 mm
Spherical aberration Z(4,0): 0.014 μ m (@ 6mm)





Decisions based on cornea imaging

- Cornea or lens surgery
- Cornea surgery after lens surgery (bioptics)
- Lasik (femto) or PRK
- IntraOP cross linking or not (lasik or PRK)
- Lens surgery AFTER cornea surgery

-11/-4.87x70

Glasses

-9.75/-5.00x70 9/10

Contacts

• Intolerance

Glasses

• Impossible to use

[OD(Right) Data]

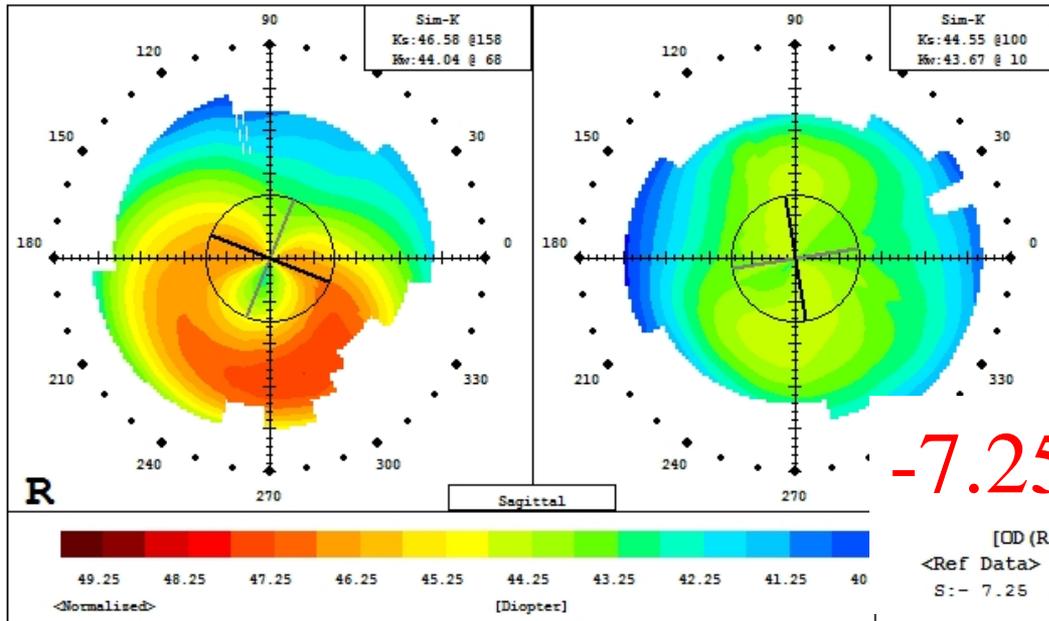
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S:-11.00 C:- 4.87 A: 70

[OS(Left) Data]

<Ref Data>

S:- 8.62 C:- 1.12 A:176



-7.25/-0.62x79

[OD(Right) Data]

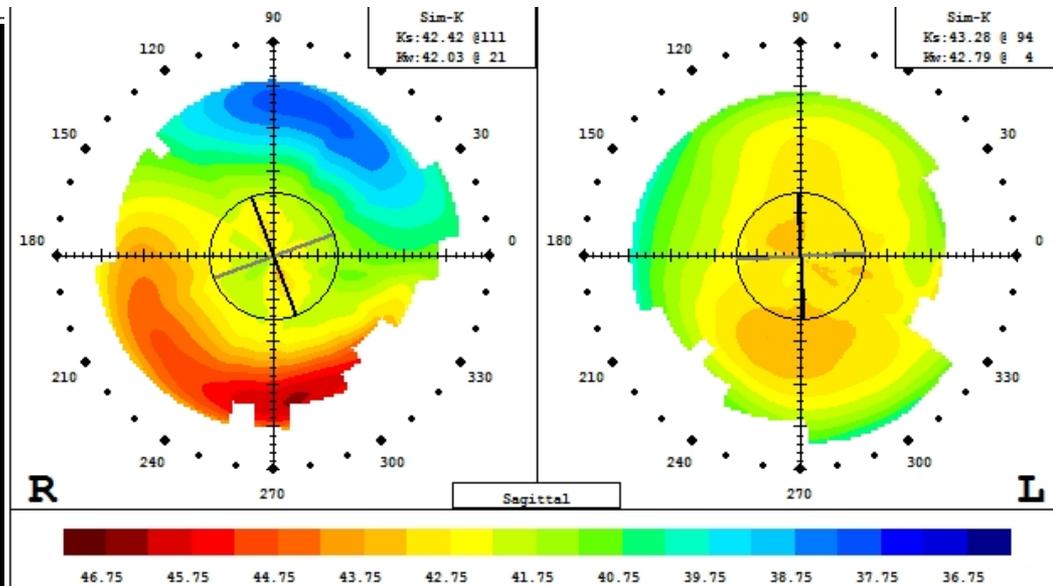
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S:- 7.25 C:- 0.62 A: 75

[OS(Left) Data]

<Ref Data>

S:- 7.87 C:- 0.25 A: 9



-7.50/0.00x0.00 7/10

-7.00/-0.50x90 7+/10

1 month Post OP

3 monthly visits post OP

Possible solutions after cornea surgery

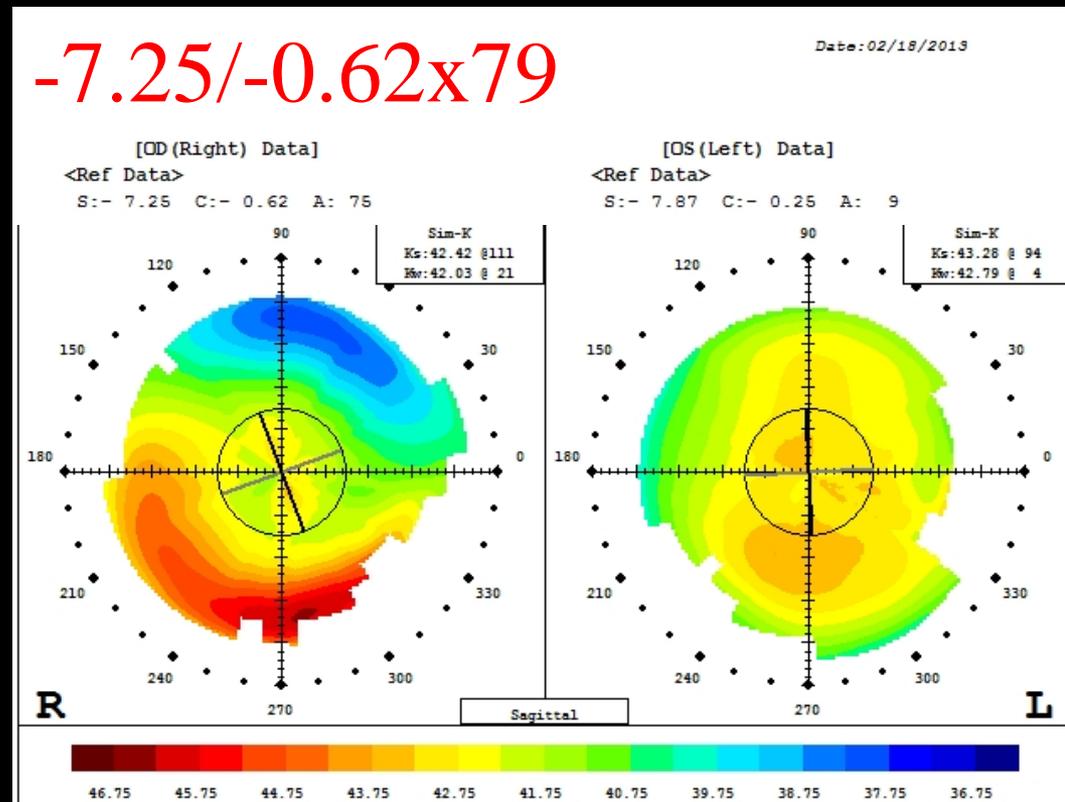
Glasses (no anisometropia)

Contacts

Phacic IOL

Clear Lens Extraction

-7.50/0.00x0.00 7/10
-7.00/-0.50x90 7+ /10



Decisions based on cornea imaging BE UP TO DATE

- Range of solutions available
- Ophthalmic community knowledge – agreement between surgeons at the time of surgery
- Evolving list of imaging modalities and criteria
- Evolving list of surgical solutions