

Advances in refractive surgery

Nebraska Optometric Association Sept 2004

Mark Johnston MD FRSC
nebraskaeye.com

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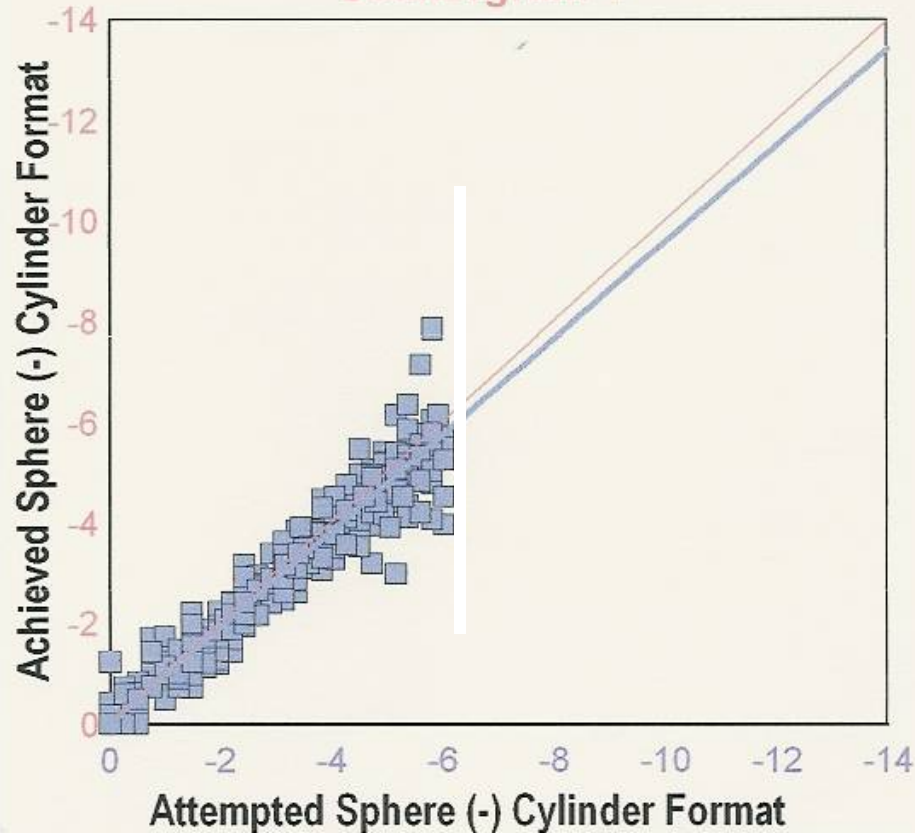
Results Visx wide zone with blend

(correction less than 6 diopters)

All Eyes

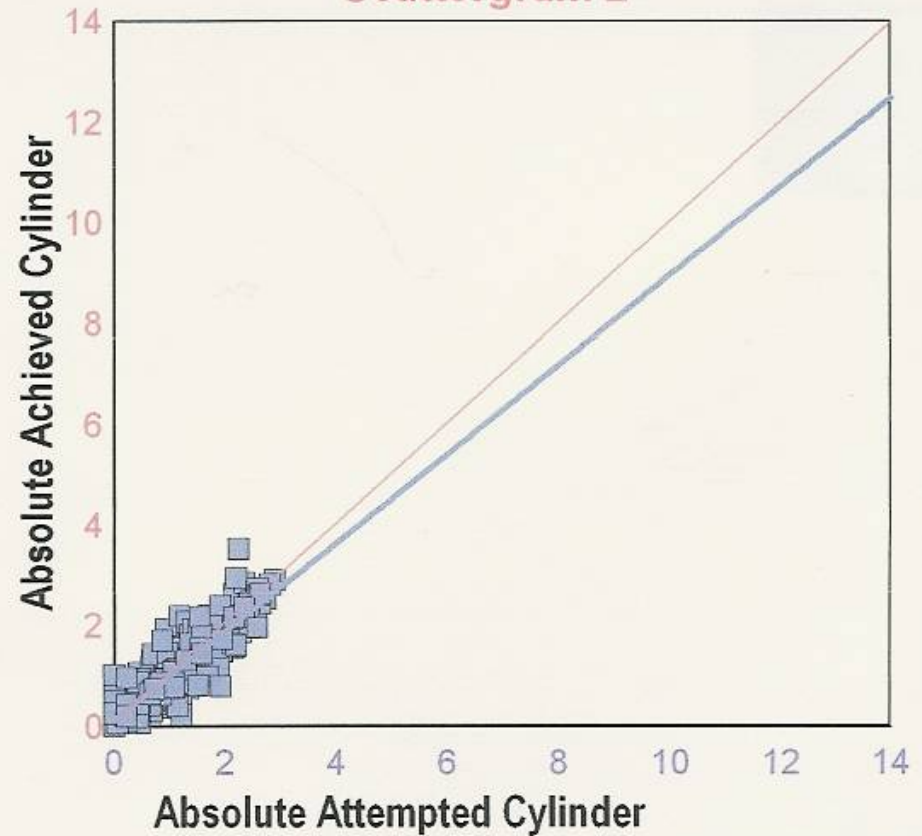
3 Months

Scattergram 1



458 Eyes Presented

Scattergram 2



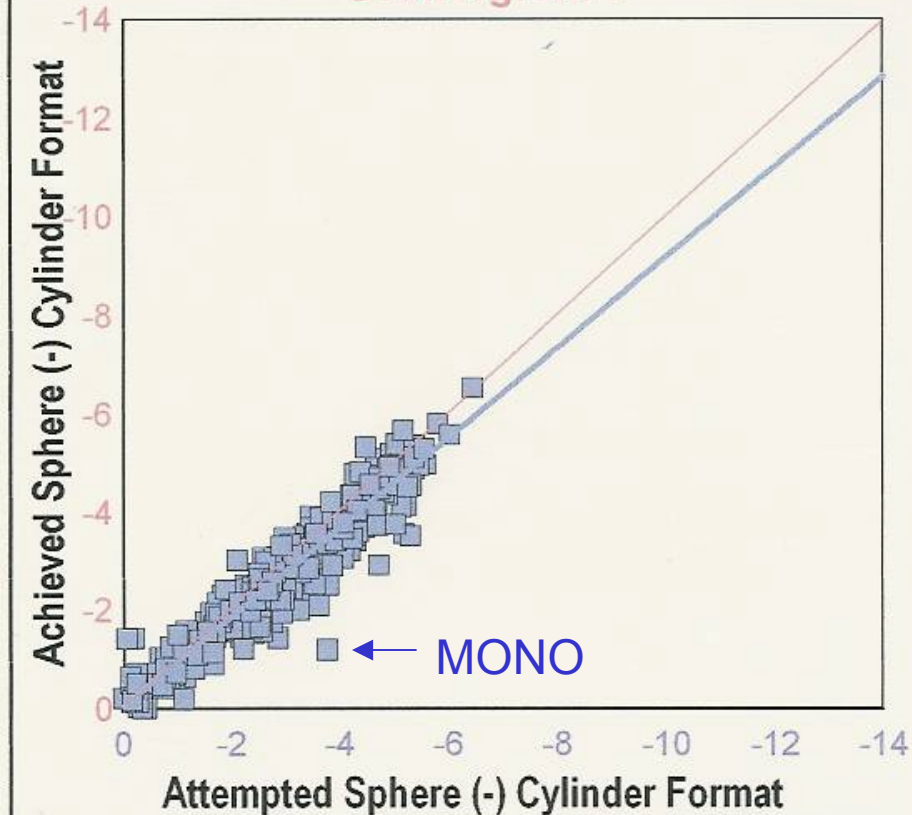
458 Eyes Presented

Results Visx Wavefront

All Eyes

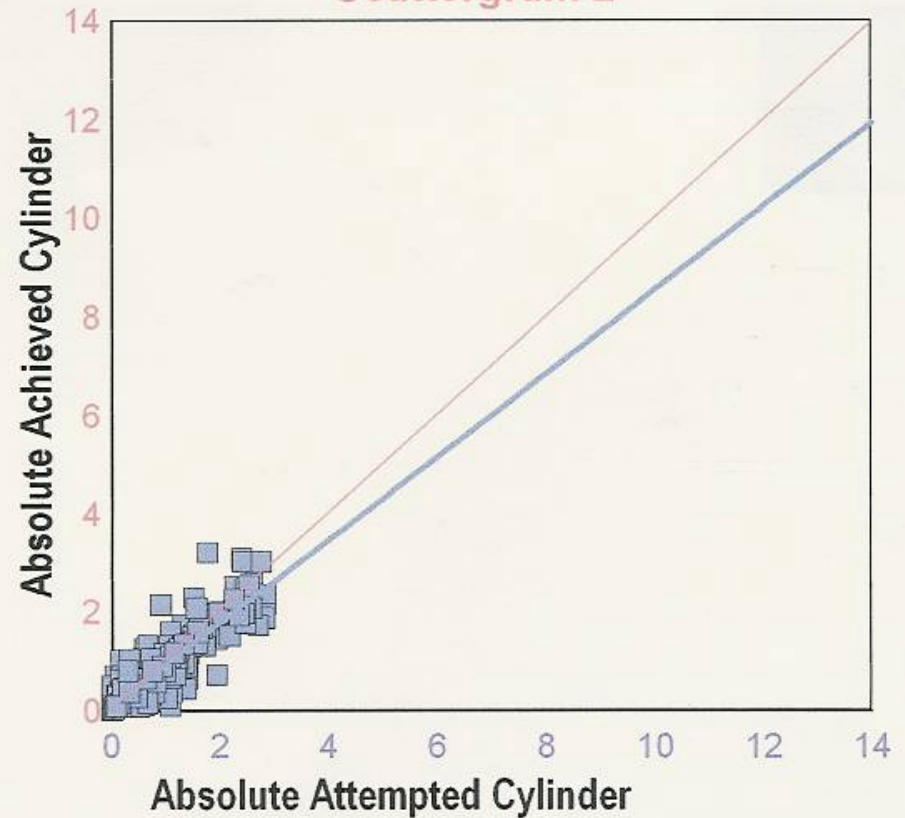
3 Months

Scattergram 1



412 Eyes Presented

Scattergram 2



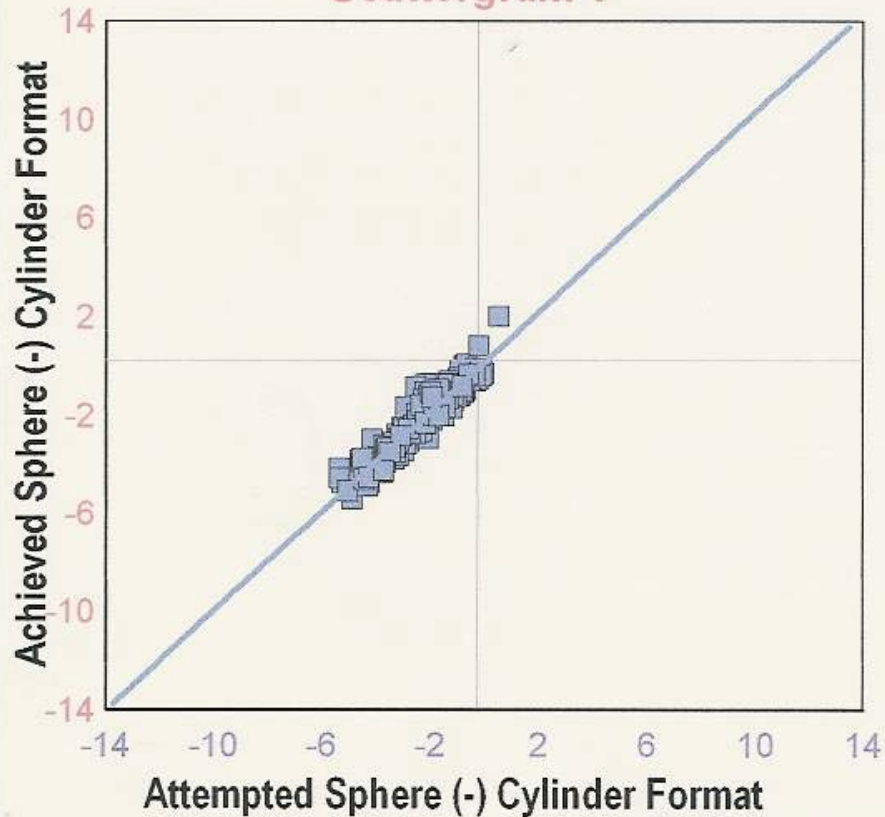
412 Eyes Presented

Outcome B&L Zyoptix

All Eyes

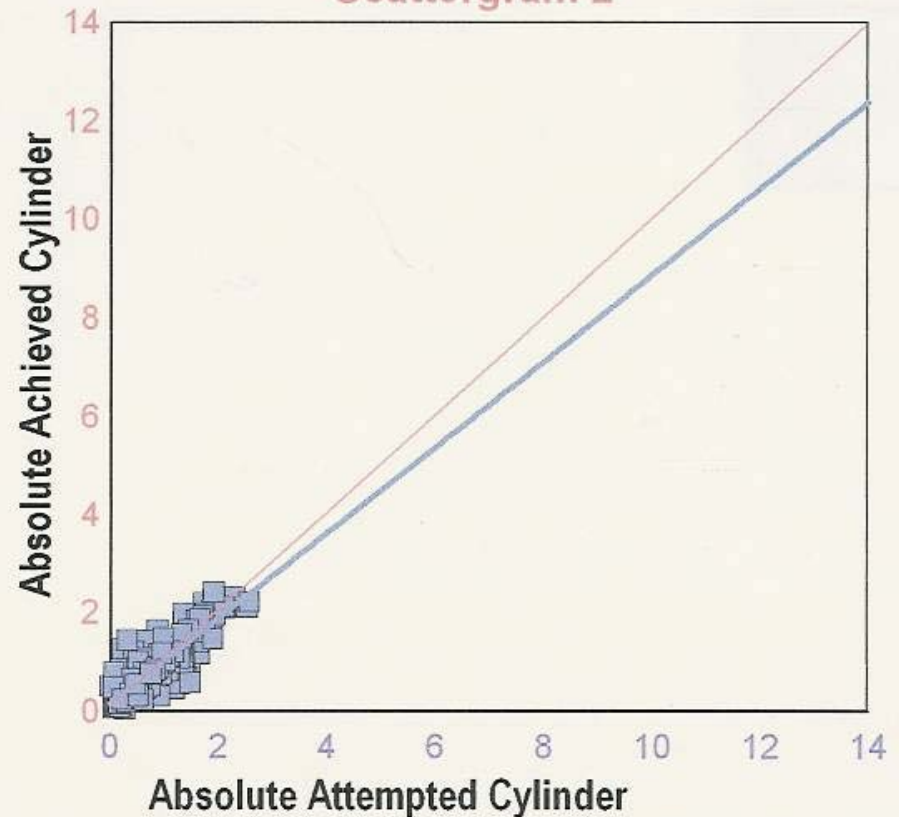
3 Months

Scattergram 1



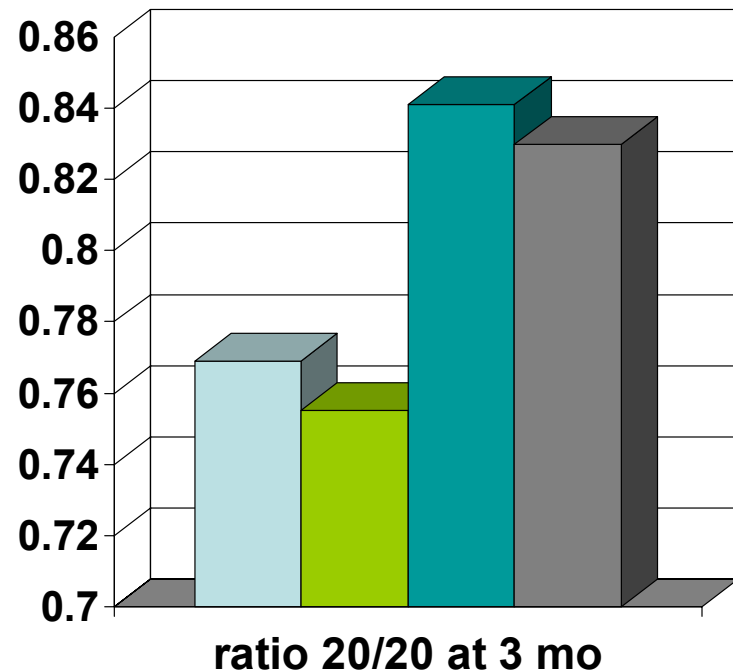
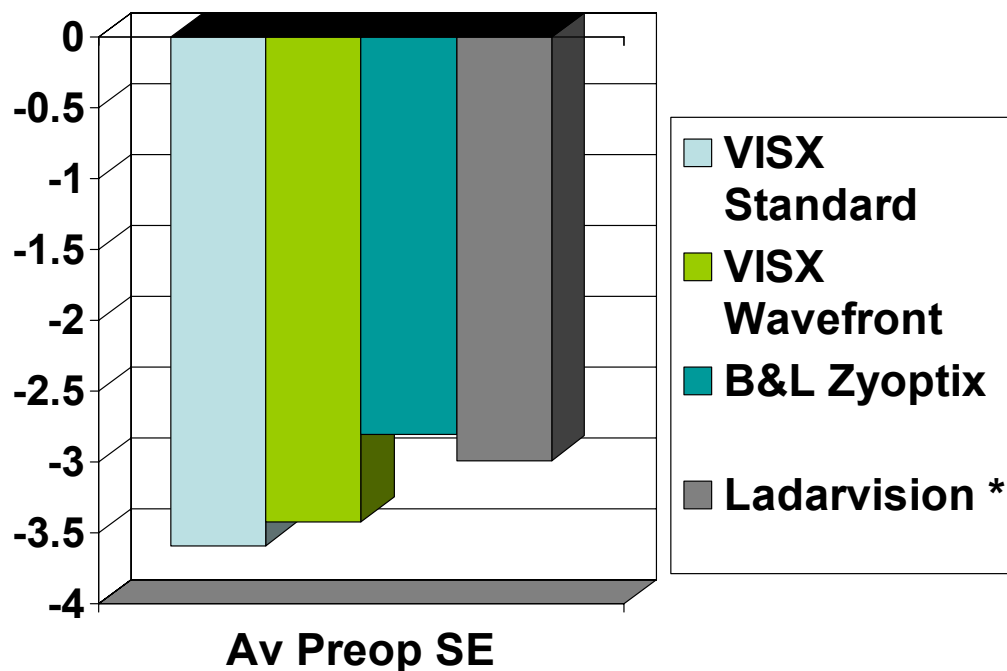
301 Eyes Presented

Scattergram 2



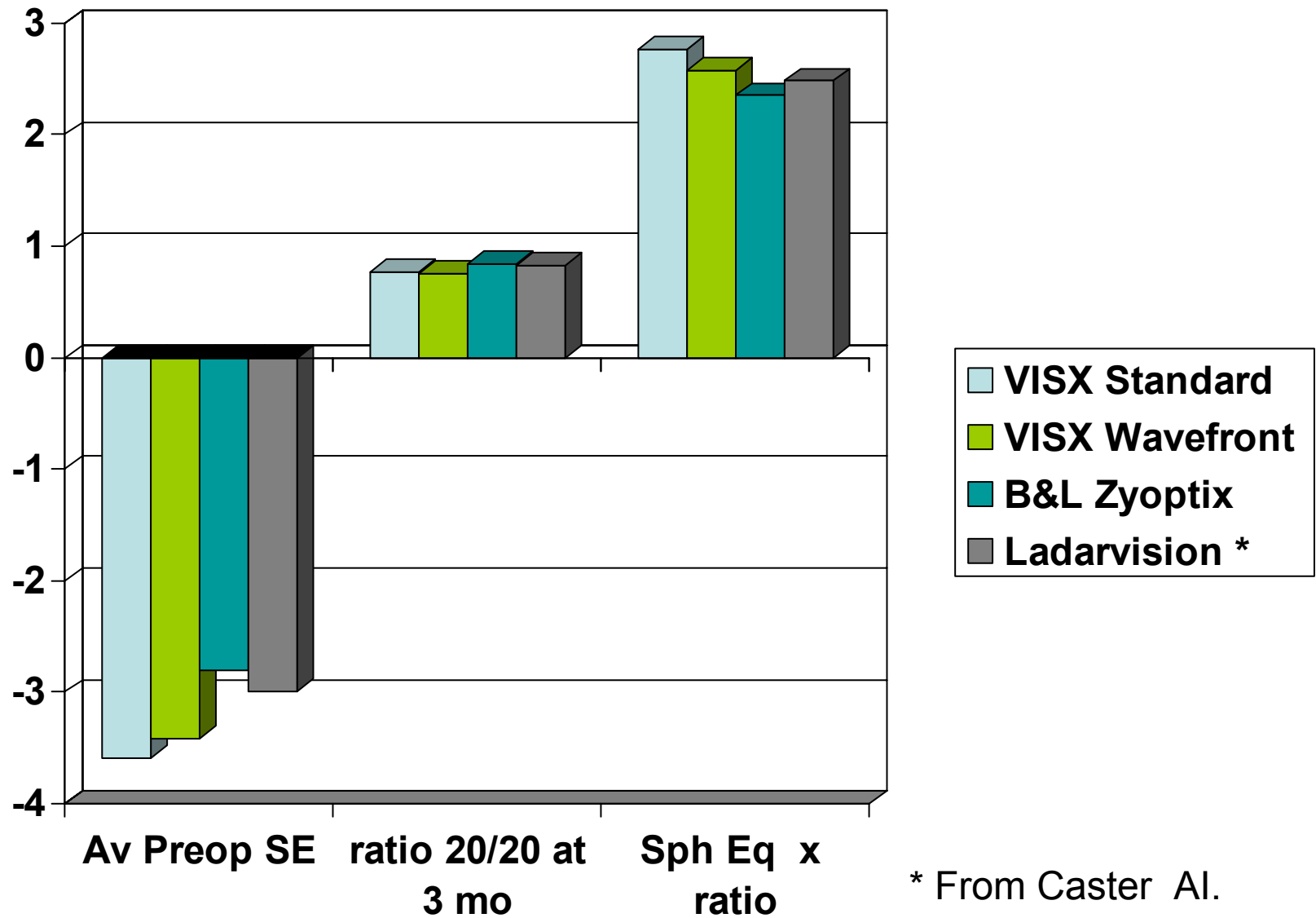
301 Eyes Presented

Outcome comparison



Data from James Johnston at
nebraskaeye.com

* From Caster AI.
Nomogram with
Ladarvision.JRS2004;20:364-
370 (vertex 0)



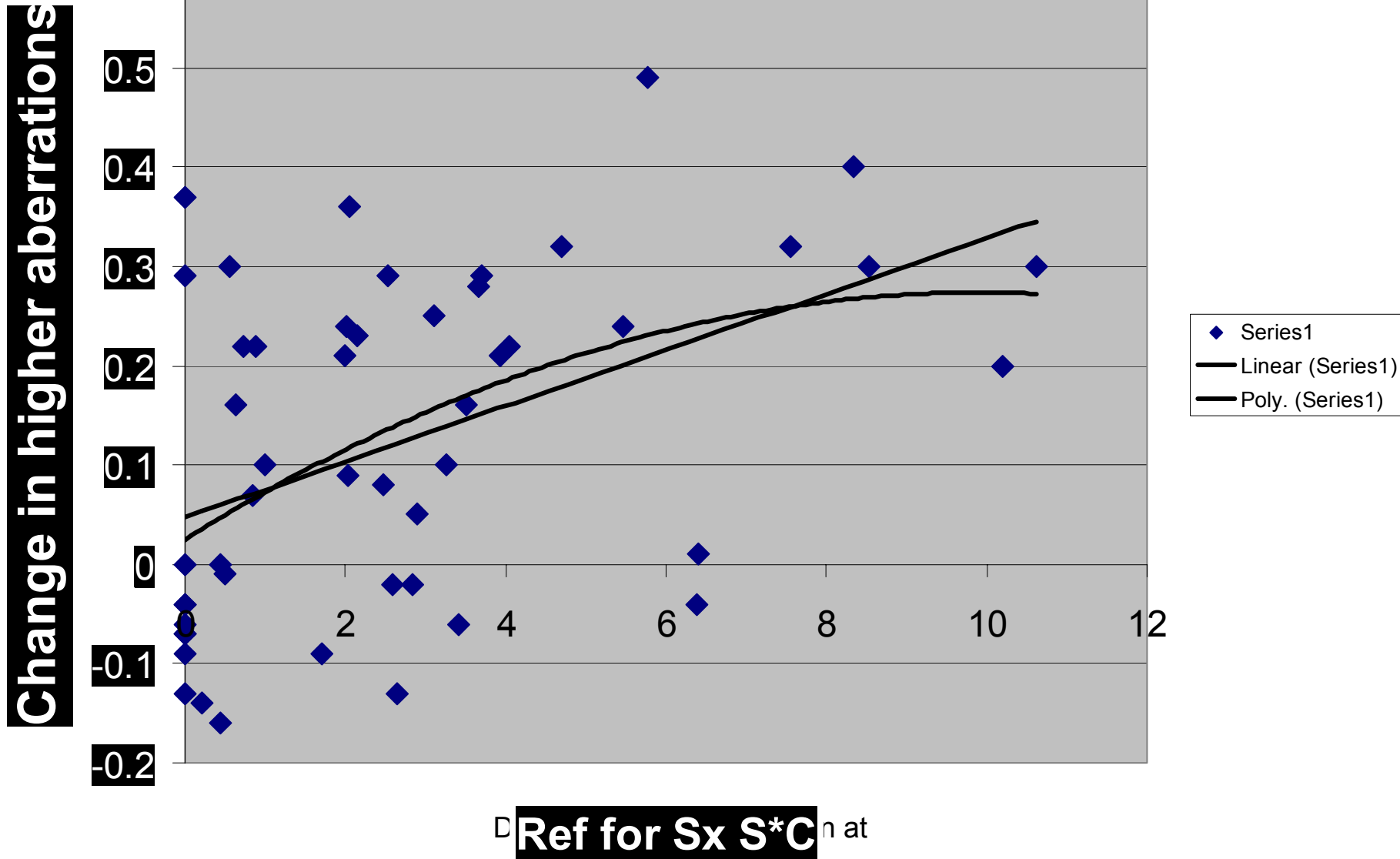
Data from James Johnston at
nebraskaeye.com

* From Caster Al.
Nomogram with
Ladarvision.JRS2004;20:364
-370

Visx Wide-Zone

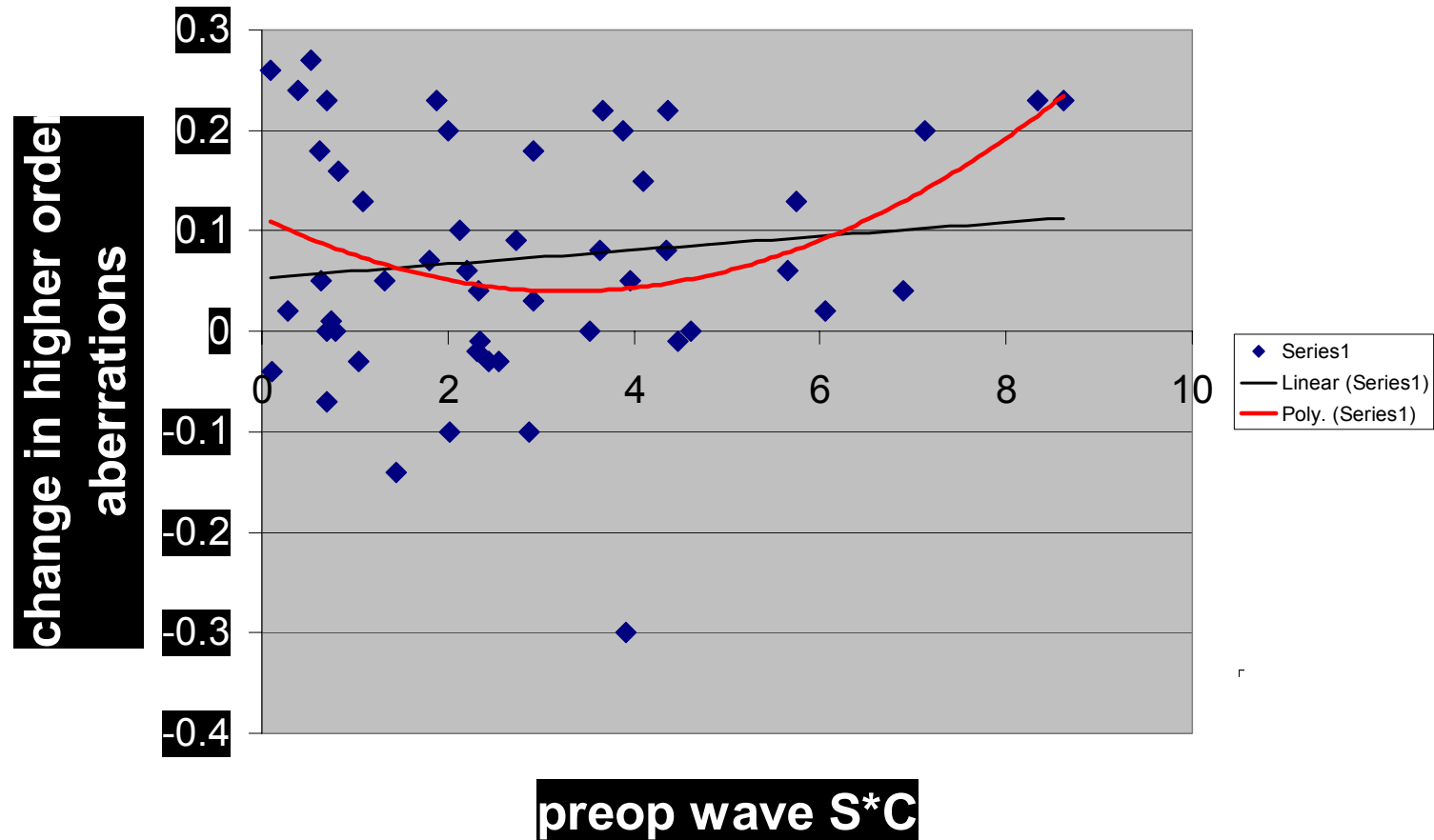
s4

Higher Order Aberrations



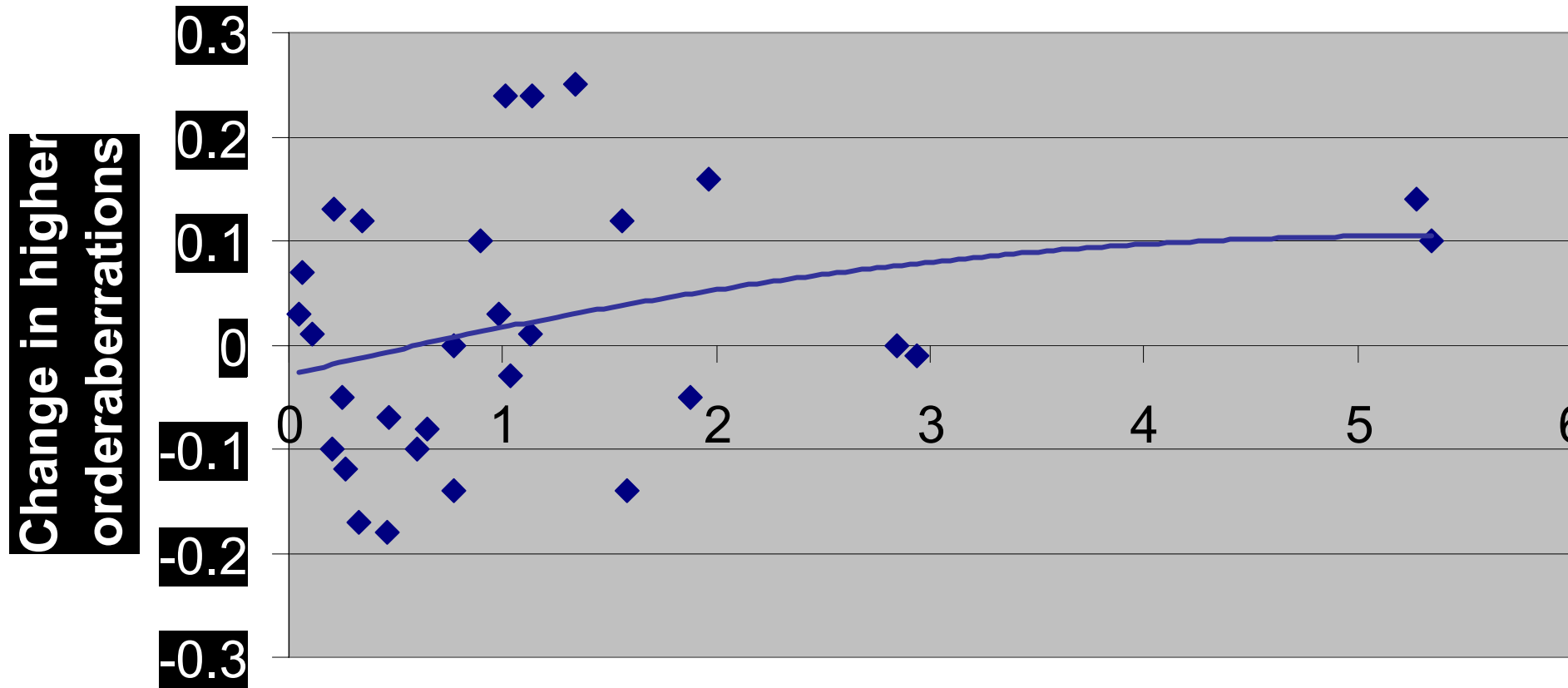
Visx Wavefront

Higher –order aberrations related to product of sphere and cylinder



Data from James Johnston at
nebraska.com

Zyoptix

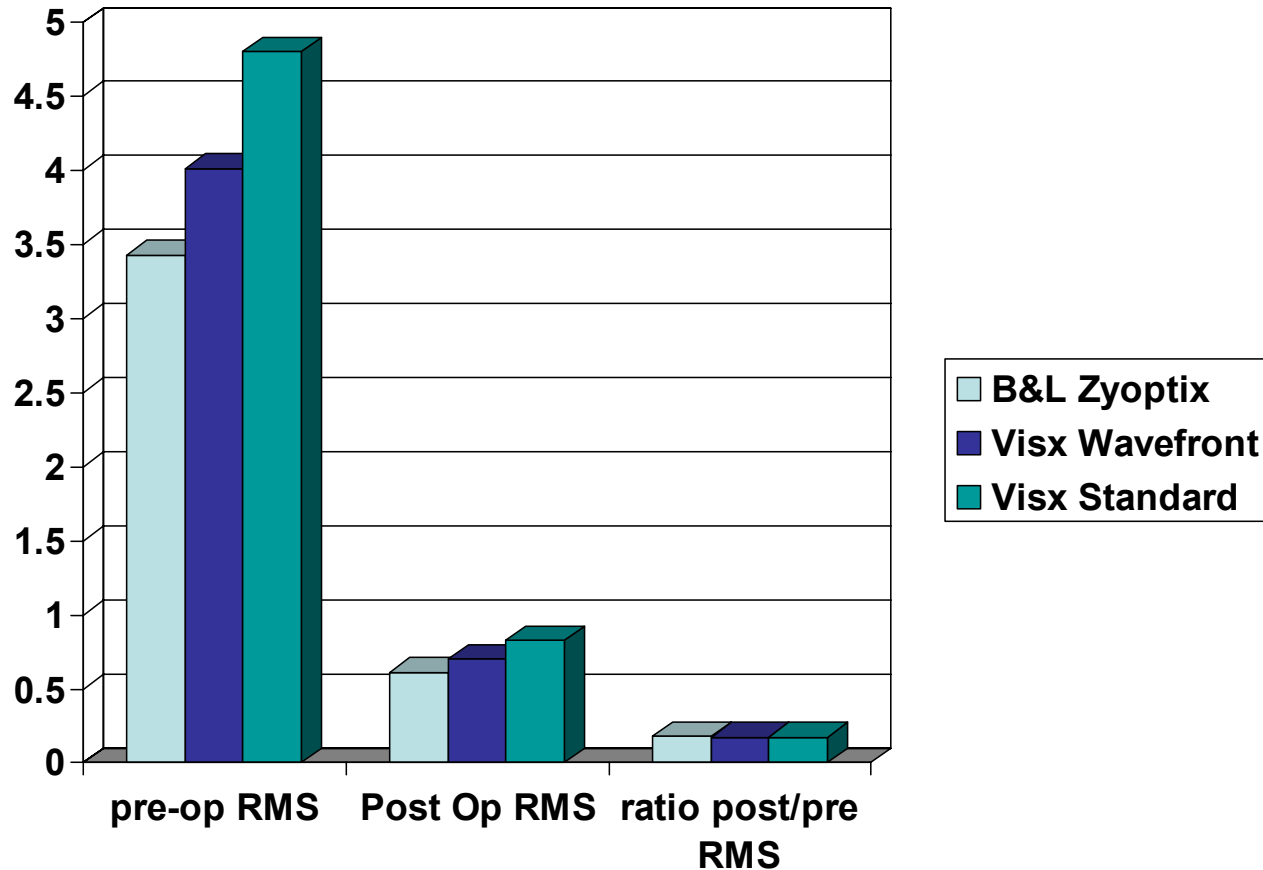


Sphere times cylinder

data from James Johnston at
nebraskaeye.com

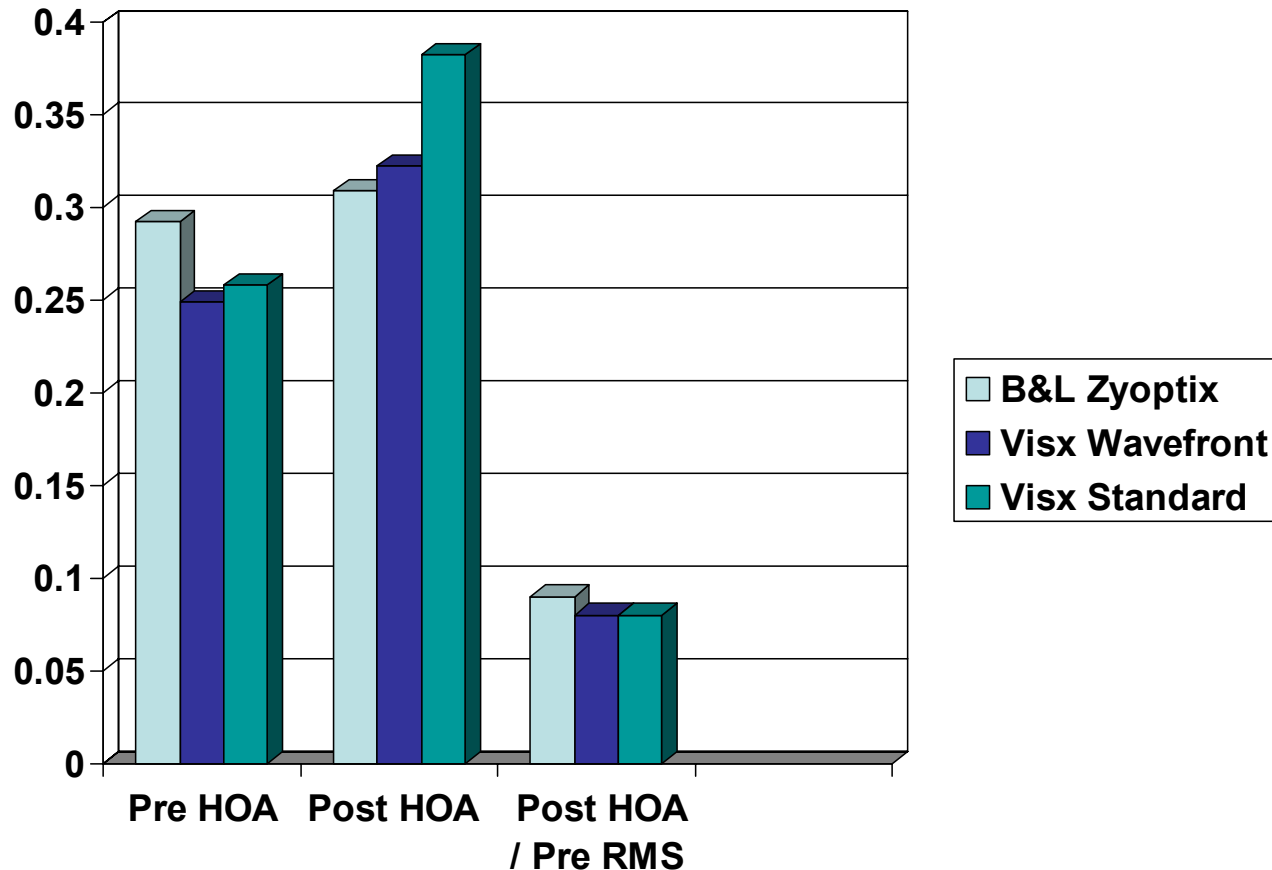
Total RMS

refractive error and higher order aberrations



Data from James Johnston at
nebraskaeye.com

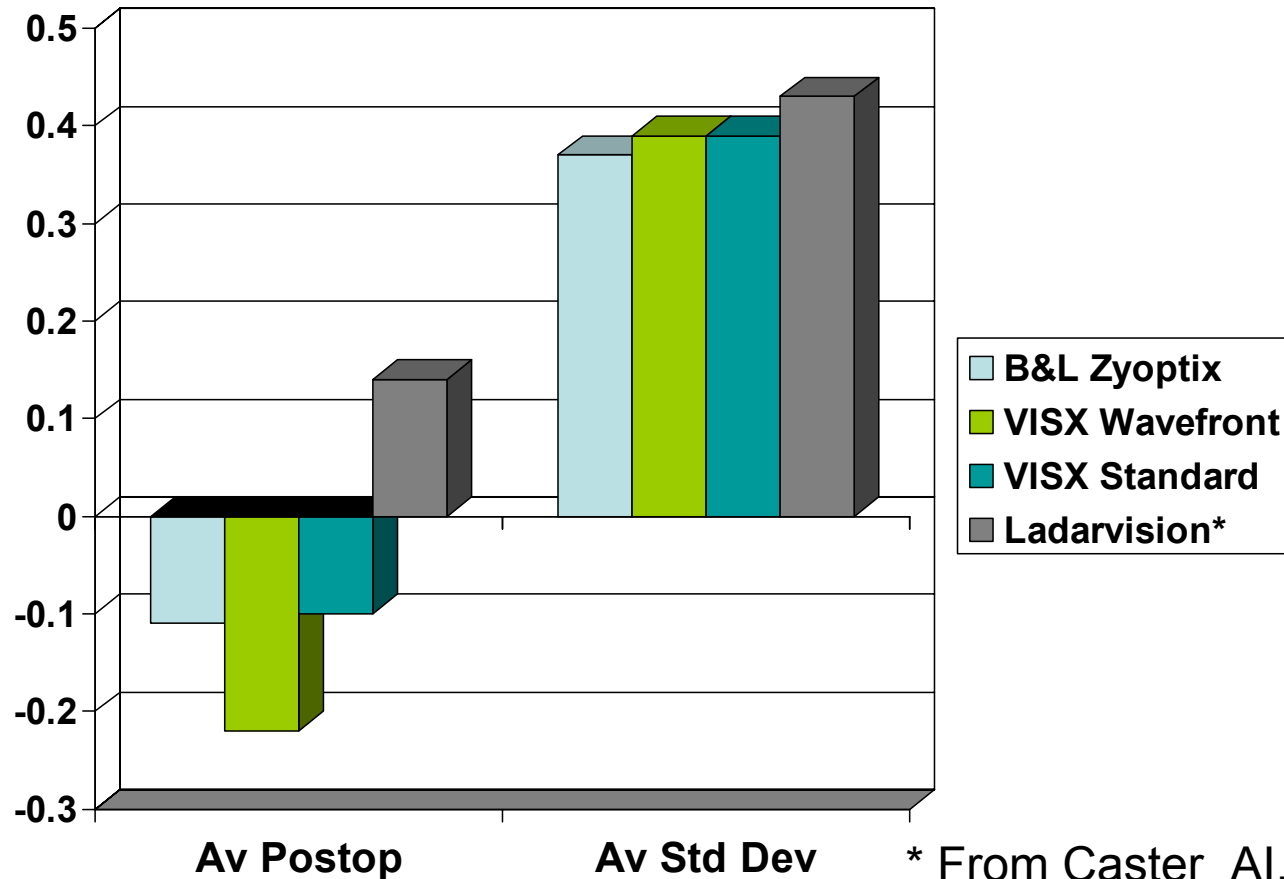
Higher Order aberrations



Data From James Johnston
nebraskaeye.com

Note: B&L done
with dilated pupil

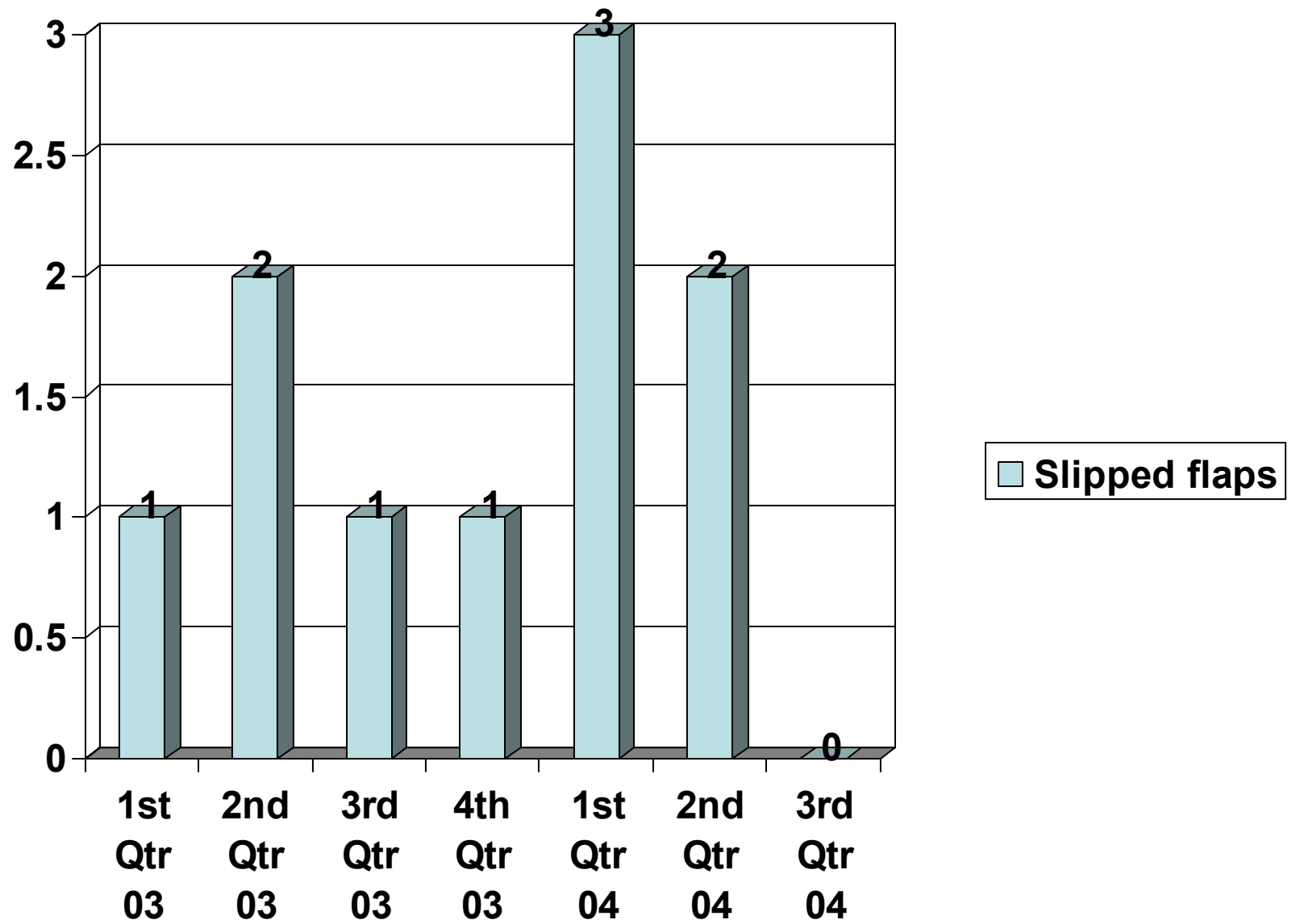
Average Outcomes



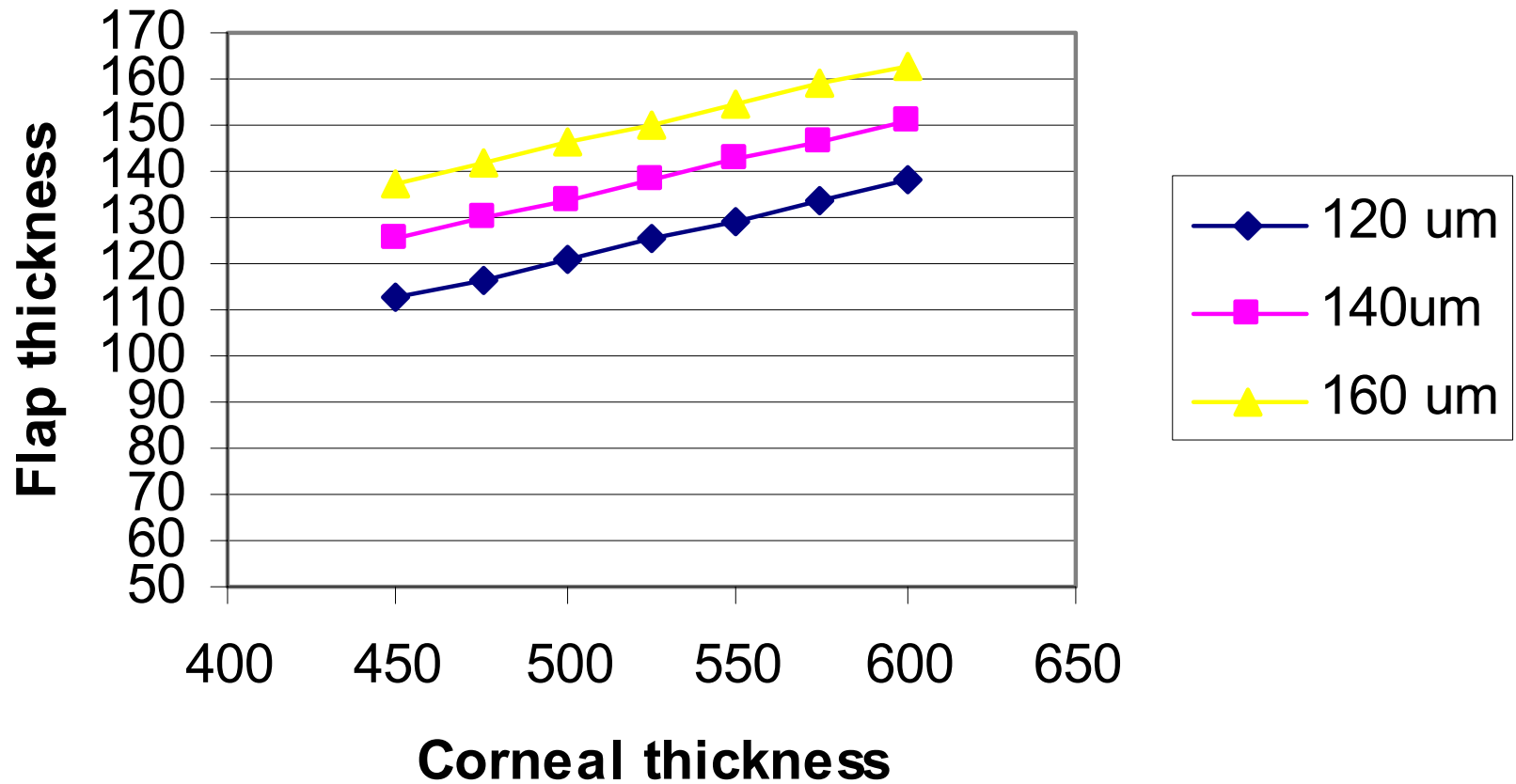
* From Caster AI. Nomogram with

Data from James Johnston at
nebraska.com

Ladarvision.JRS2004;20:364-370

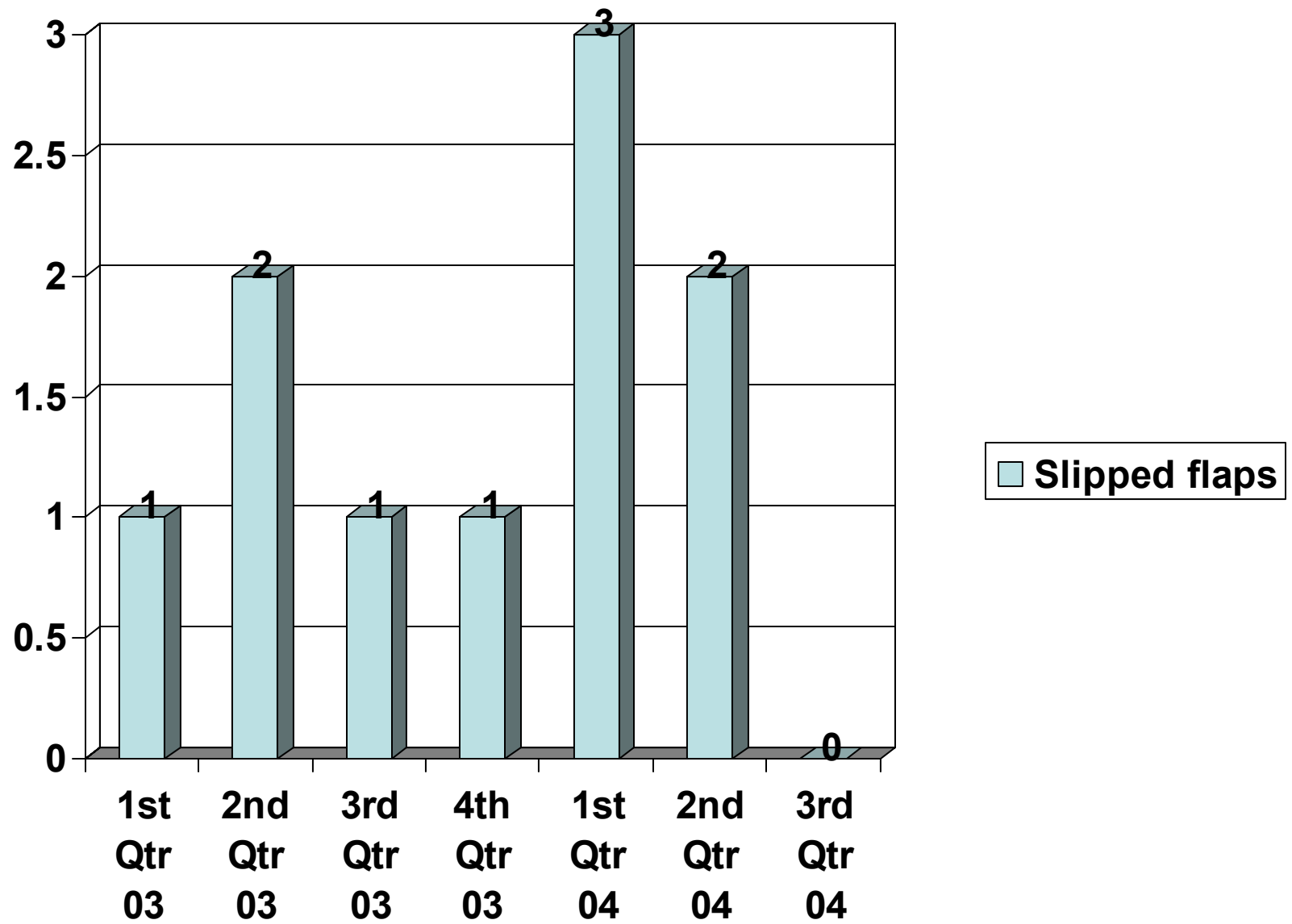


Expected flap thickness



Slipped flaps: Prevention

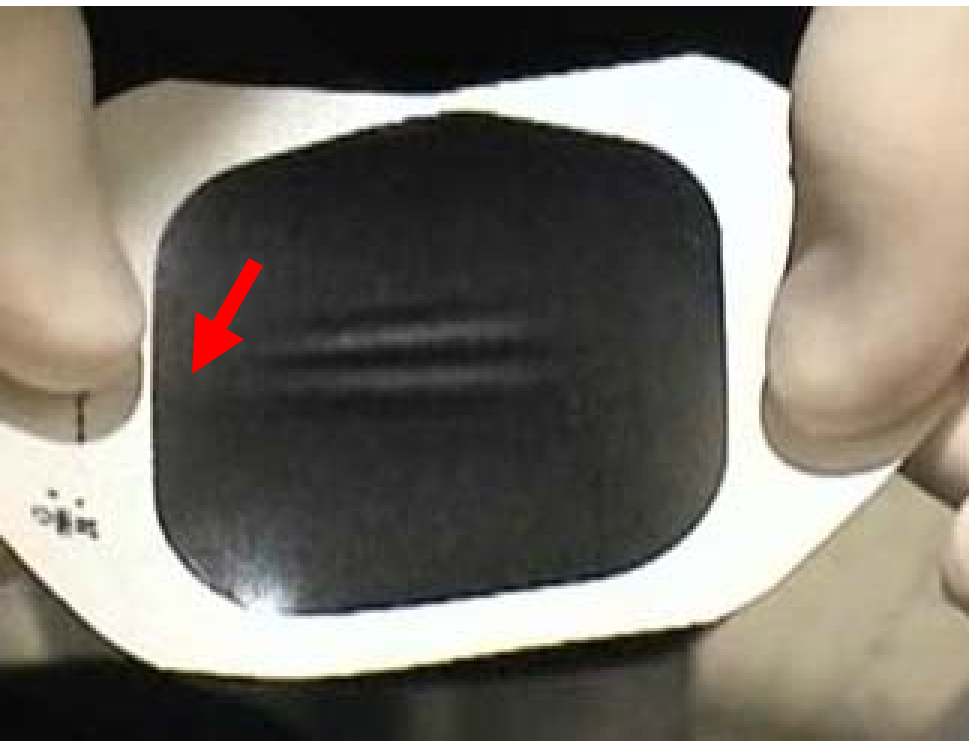
- Avoid keratomes that cuts thin
 - Minimum targeted thickness 130 μ m
 - Use nomogram that takes initial corneal thickness into account
- Meniscus flap
- New blade second eye
 - Thin cornea
 - Steep cornea
 - High cylinder
- Punctal plugs
 - Routinely use:
 - 0.3 mm collagen plug in the inferior punctum
 - 0.2 mm collagen plug in the superior punctum



Mechanical characteristics of LASIK flap wrinkling

Mark E Johnston MD FRCSC
ASCRS

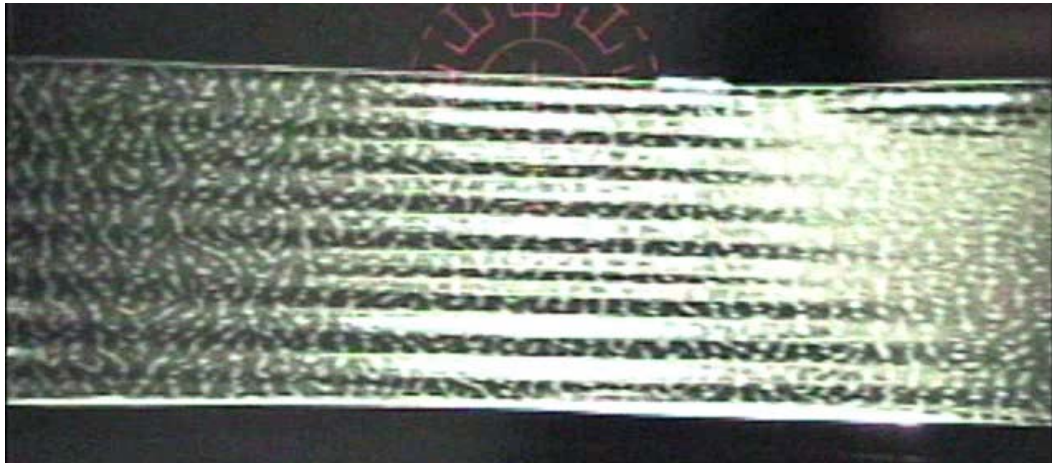
San Diego May 2004
www.nebraskaeye.com



- No folds until a critical amount of displacement is achieved
- Wavelength is proportional to the fourth square root of the displacement

Wrinkling of thin elastic sheets

E. Cerda, K. Ravi-Chandar, L. Mahadevan, Nature **419**, 10, 579 (2002)



Slide shows stretched 3M Tagaderm

Föppl-Von Karman Equations

$$\lambda \sim (tl)^{1/2} / \gamma^{1/4}$$

Wavelength is proportional to the square root of the product of thickness and length divided by the fourth root of the displacement (strain)

Flaps made with the 160 um head
are 3.12 more likely to have
microstriae than flaps made with the
180 um head

-Hansatome

Prevention of Microstriae and Microfolds

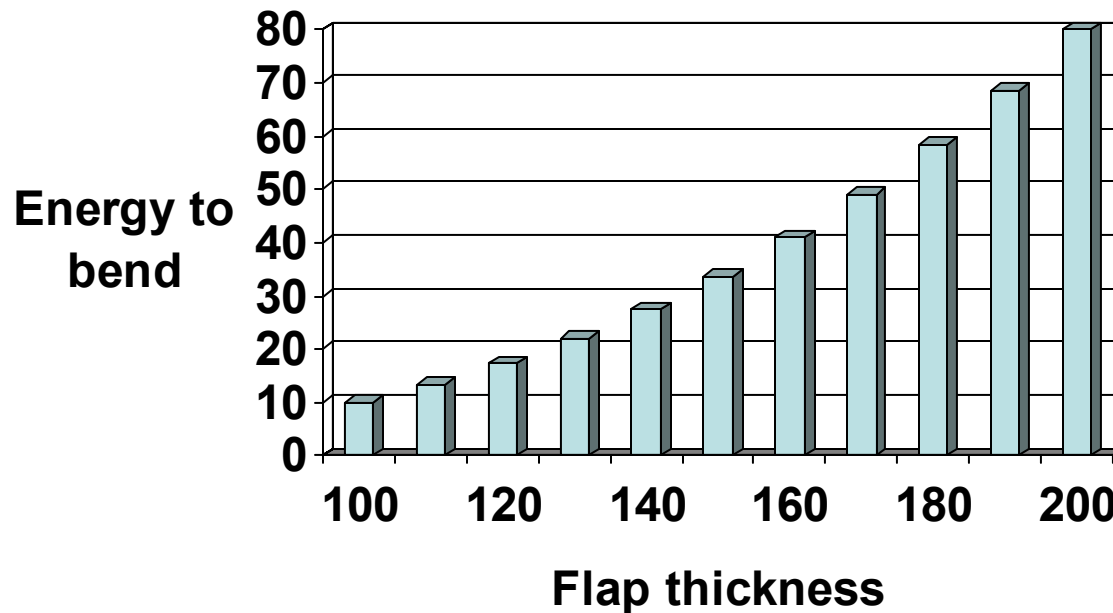
Mark E Johnston MD FRCSC

American Society of Cataract and Refractive Surgery

San Francisco April 2003

Corneal bending

Corneal bending



$$E^B \sim k \cdot t^3$$

Energy of bending is proportional to the thickness to the third power

Doubling thickness increases the energy need to bend by a factor of eight

The energy needed to bend a 180 um flap is almost twice that required to fold a 160 um flap

Slipped flap compression folds less than 250 μm

Red arrow 1000 μm



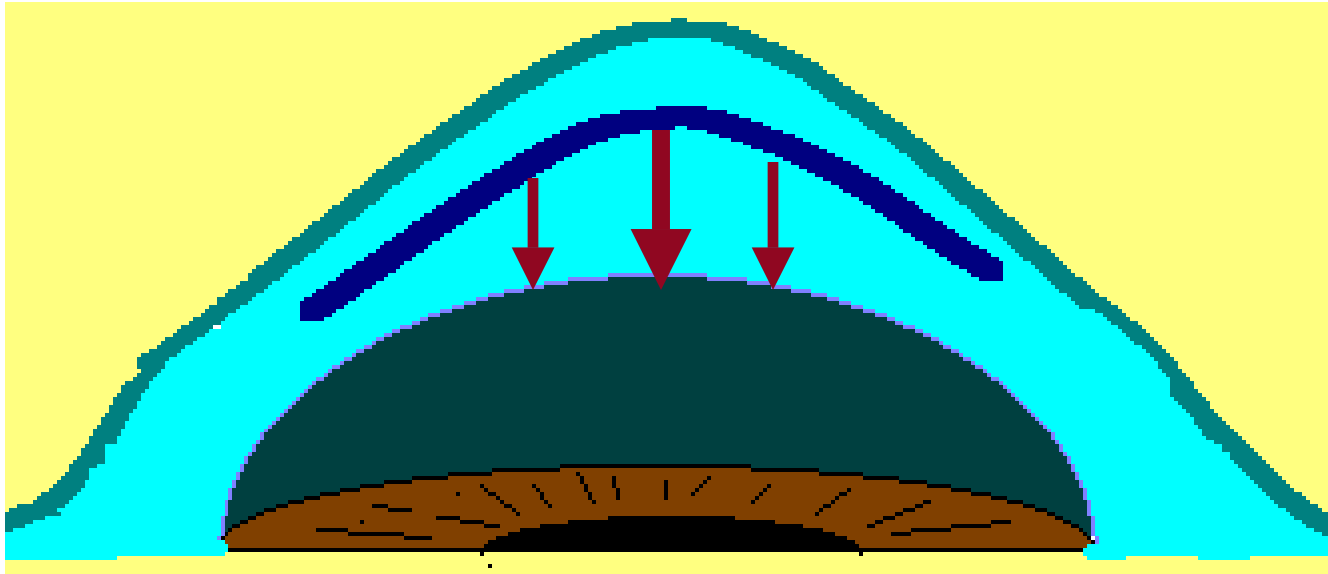
Red arrow 1000 μm



Folds that are spaced about the thickness of the flap are consistent with compression/displacement of the flap tissue

Central Microstriae: Related to over-hydration

Corneal hydrostatic pressure and aspiration of fluid and debris into the LASIK Interface,
Mark E. Johnston ,Highlights ASCRS, 1999 Annual Meeting. Boston: Ophthalmology
Interactive;1999.[CD-ROM]



The looser posterior cornea and central cornea swell more than the tighter anterior and peripheral cornea

When the epithelium heals, the cornea dehydrates and the flap tissue infolds with secondary microstriae of the cornea.

Etiology Microstriae

1. Thin flaps

- Maximize flap thickness (both centrally and peripheral)
- Avoid thin (and planar) flaps

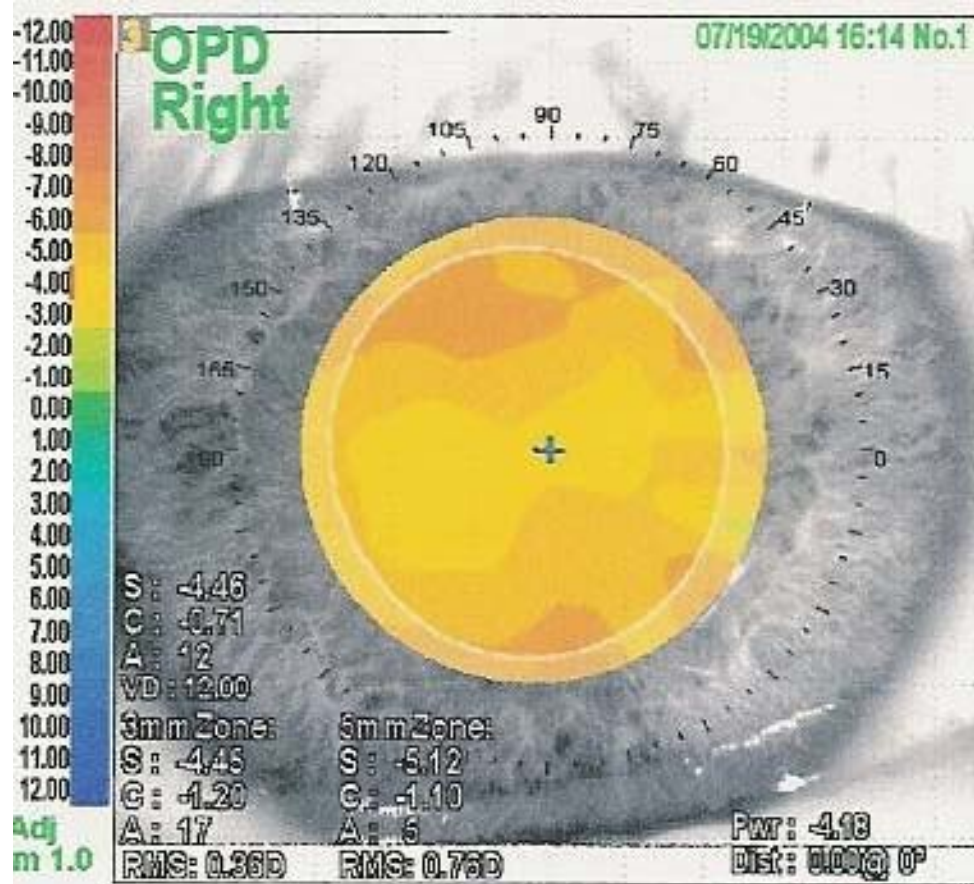
2. Flap displacement

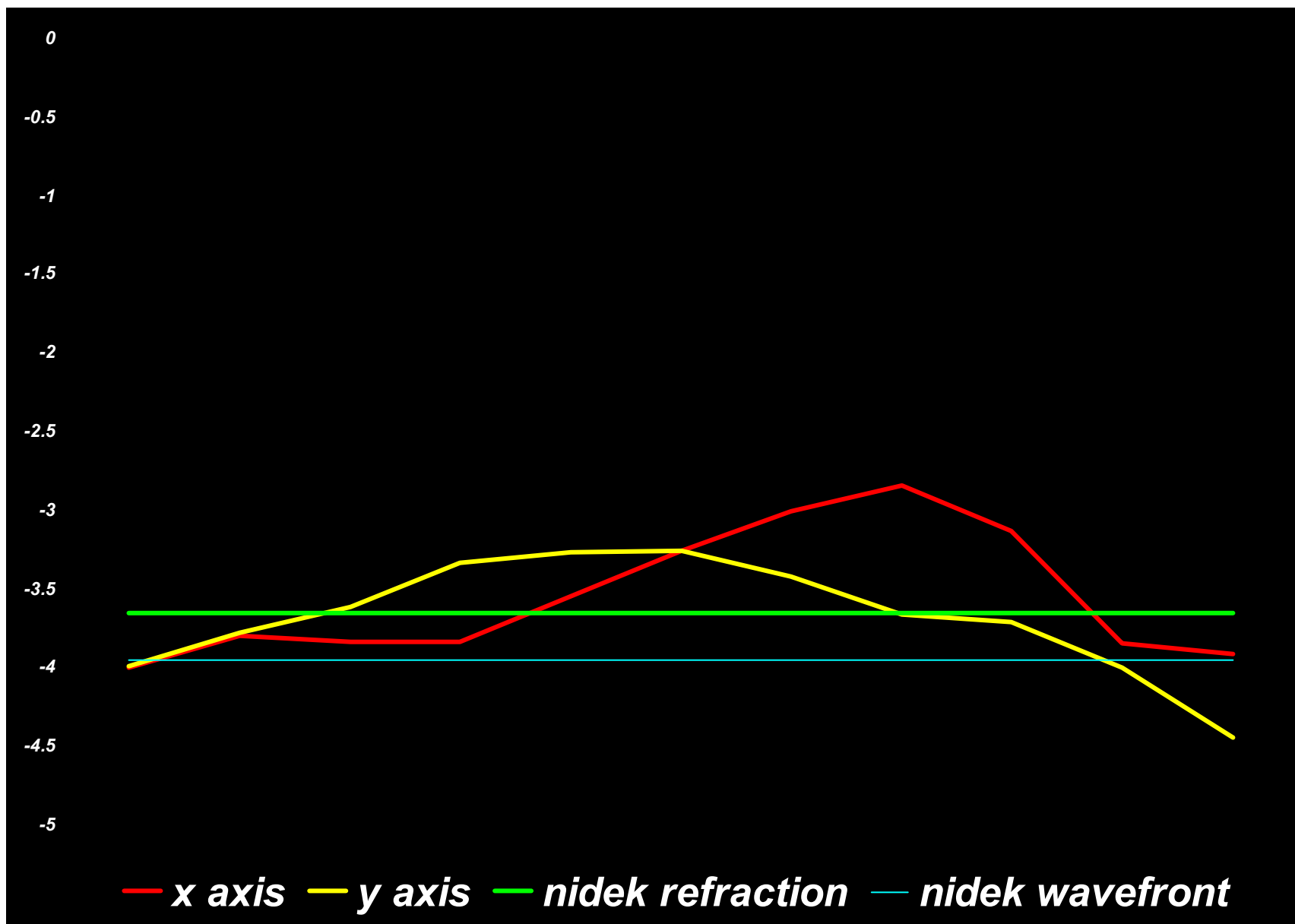
- Pre-mark the cornea

3. Overhydration of the stromal bed

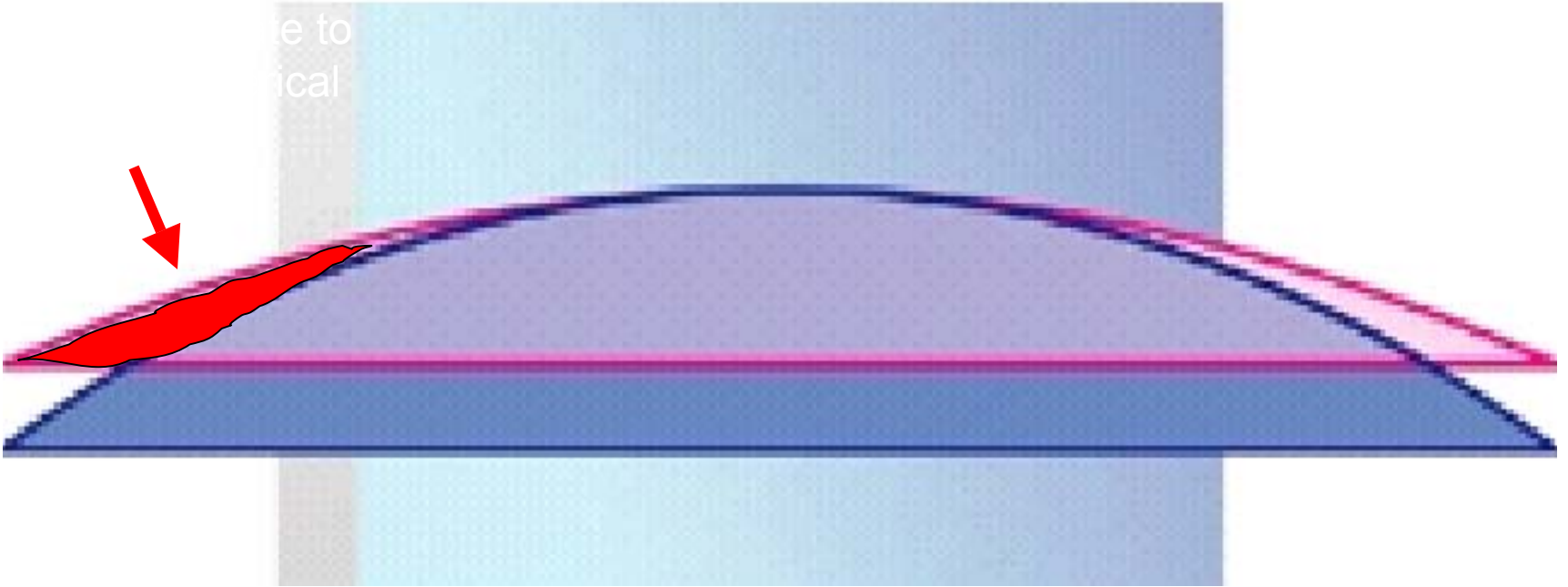
Cheng, Xu et.al..(2004)Predicting subjective judgement of best focus with objective image quality metrics. Journal of Vision,4,310-321

- Central power
-4.18
- Nidek refraction
(Central wavefront)
-4.46-0.71 x 12
SE -4.81
- Wavefront RMS
(over complete pupil area)
-4.35 -1.35 x 13
SE -5.02





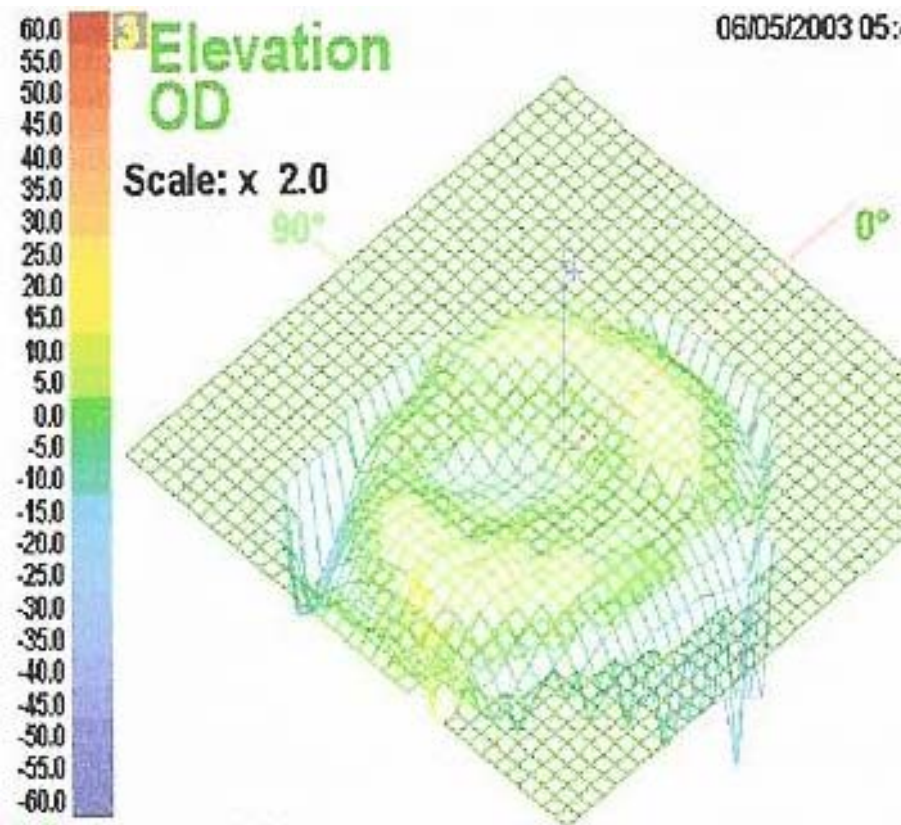
te to
ical



06/05/2003 05:49 No.1

**Elevation
OD**

Scale: x 2.0



Adj
om 5.0

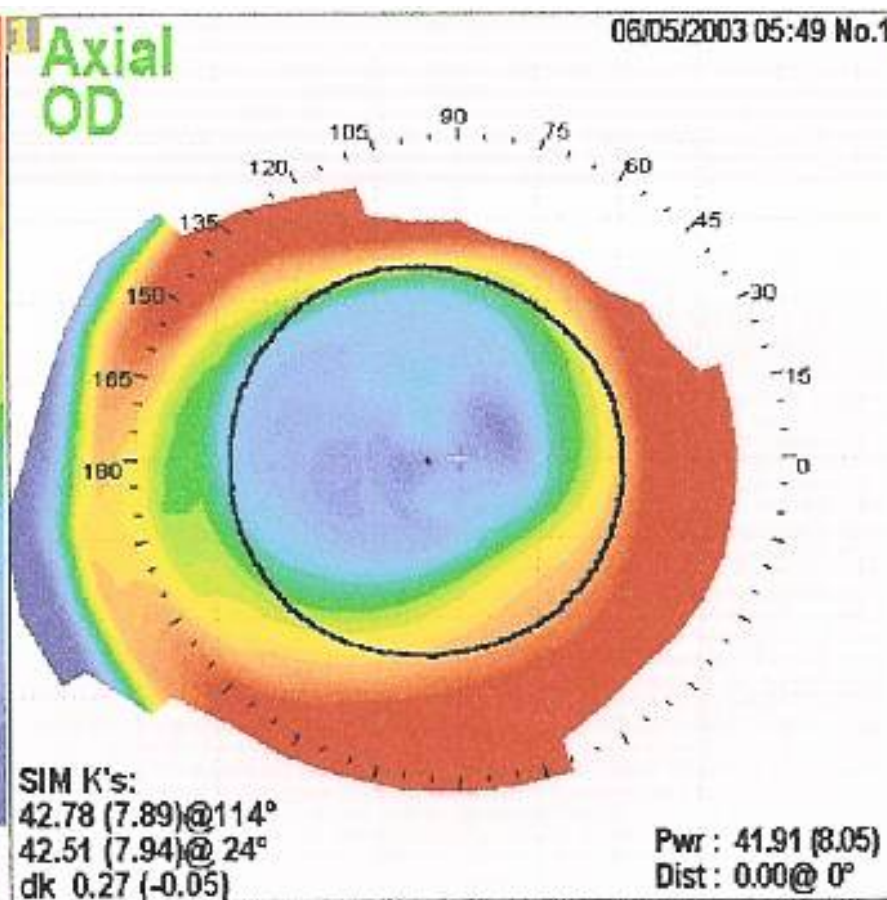
BFS : 7.84
Zone : 6.8

06/05/2003 05:49 No.1

**Axial
OD**

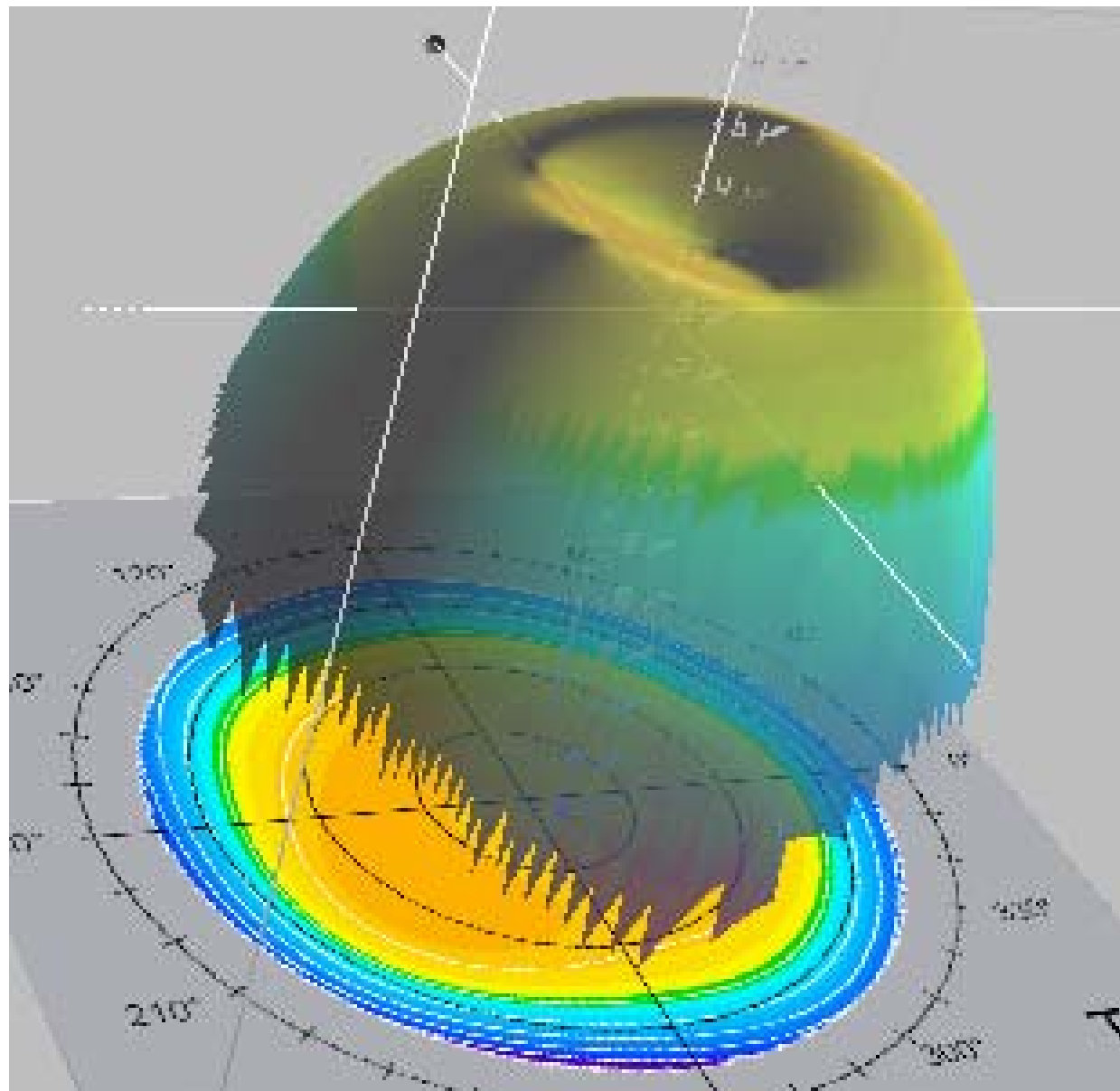
44.25
44.13
44.00
43.88
43.75
43.63
43.50
43.38
43.25
43.13
43.00
42.88
42.75
42.63
42.50
42.38
42.25
42.13
42.00
41.88
41.75
41.63
41.50
41.38
41.25

Norm
ndv .12

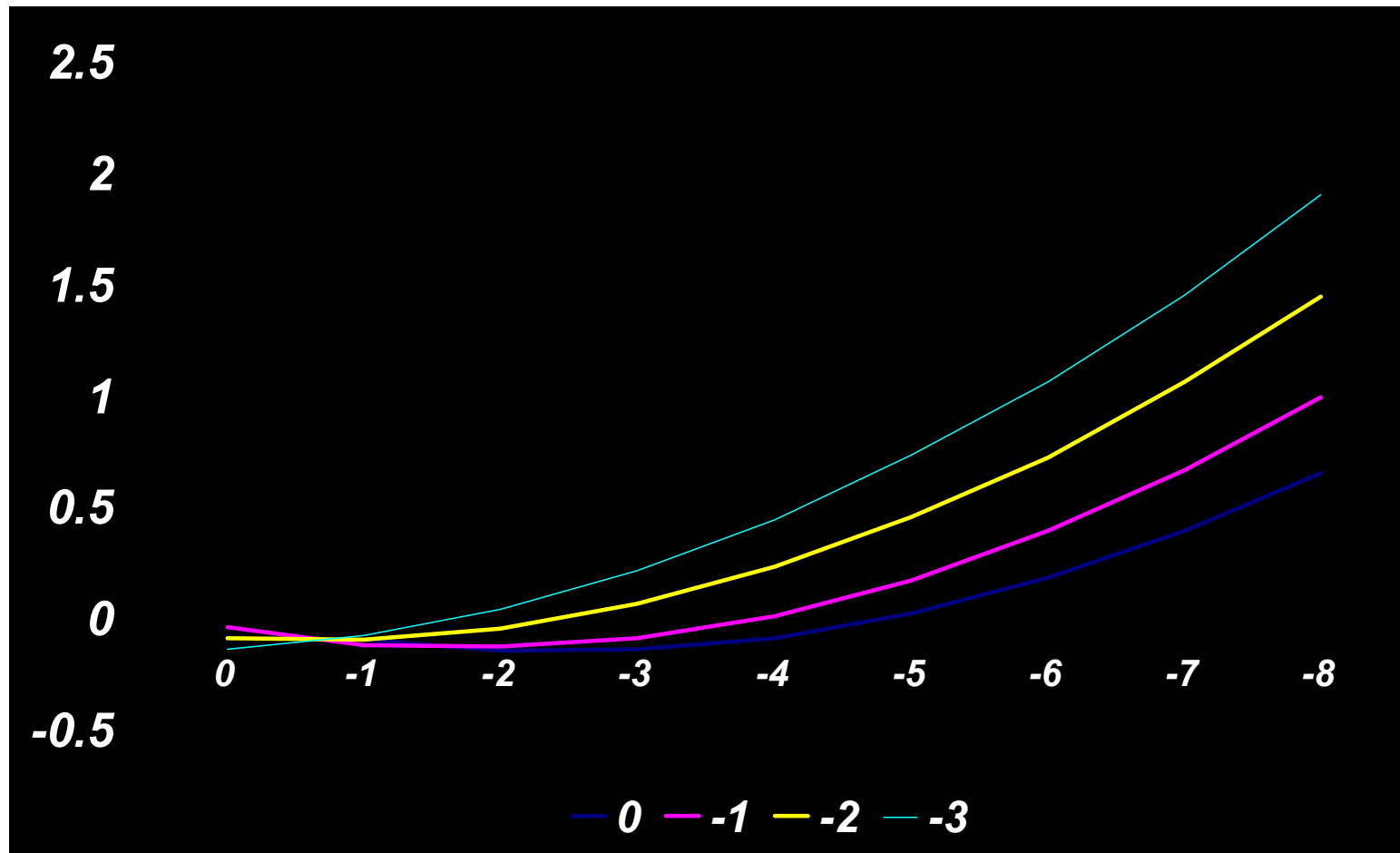


SIM K's:
42.78 (7.89)@114°
42.51 (7.94)@ 24°
dk 0.27 (-0.05)

Pwr : 41.91 (8.05)
Dist : 0.00@ 0°

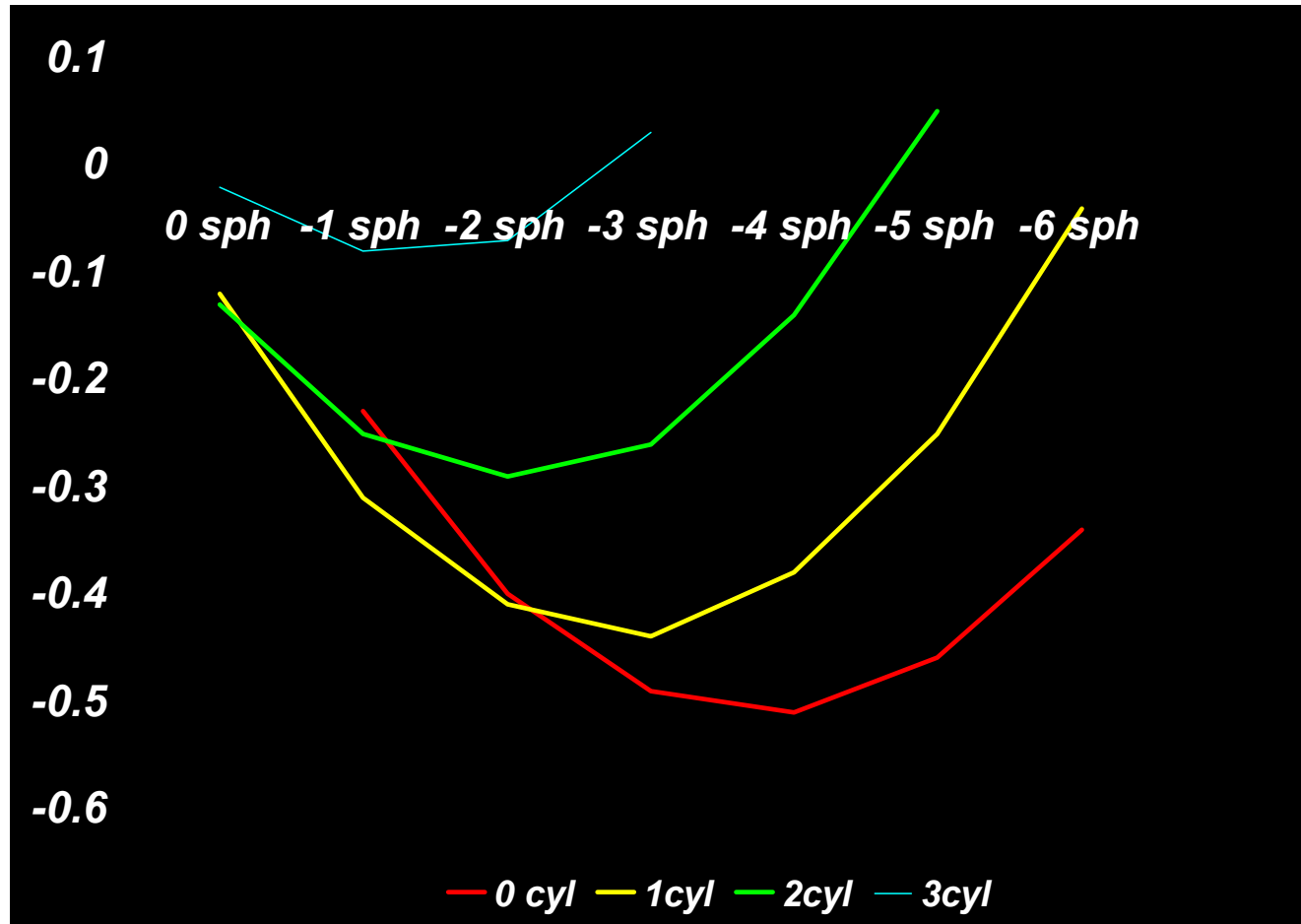


Outcome with standard Lasik (assuming no adjustment)

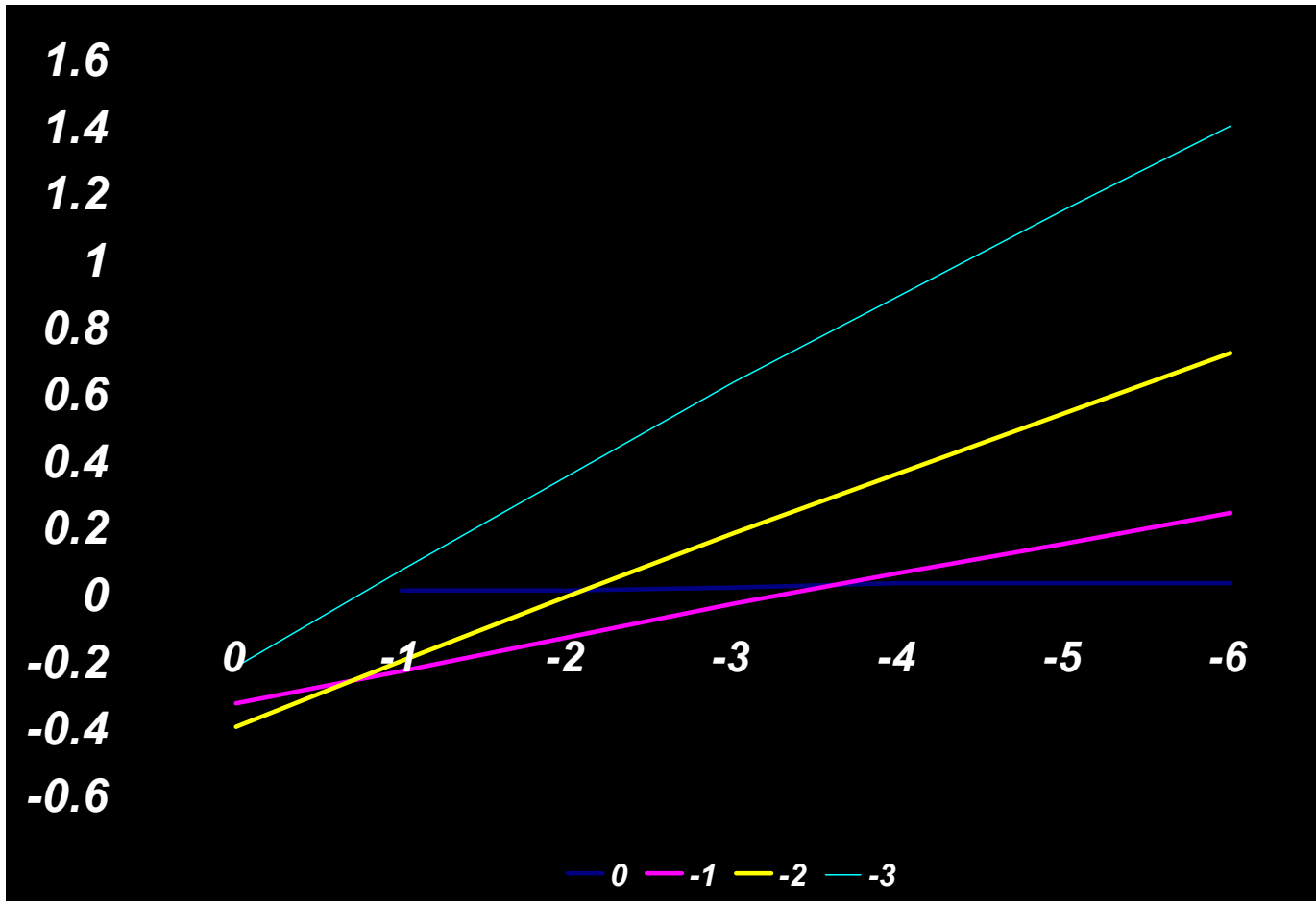


Visx Wavefront outcomes

(assuming no adjustment)

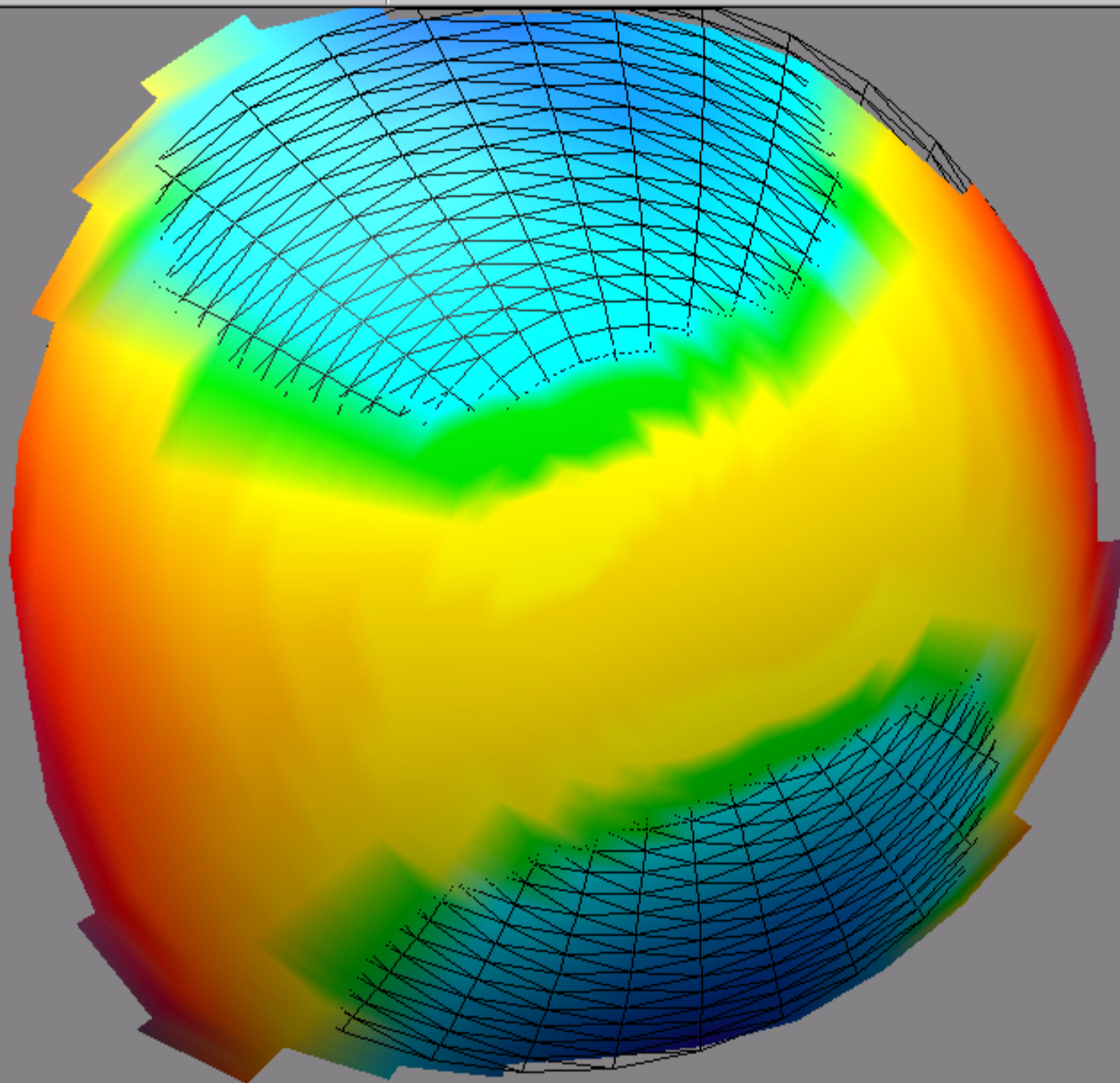


Results with Zyoptix





Job OD
st: 5.7
both:
both:
both:
both:
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wing

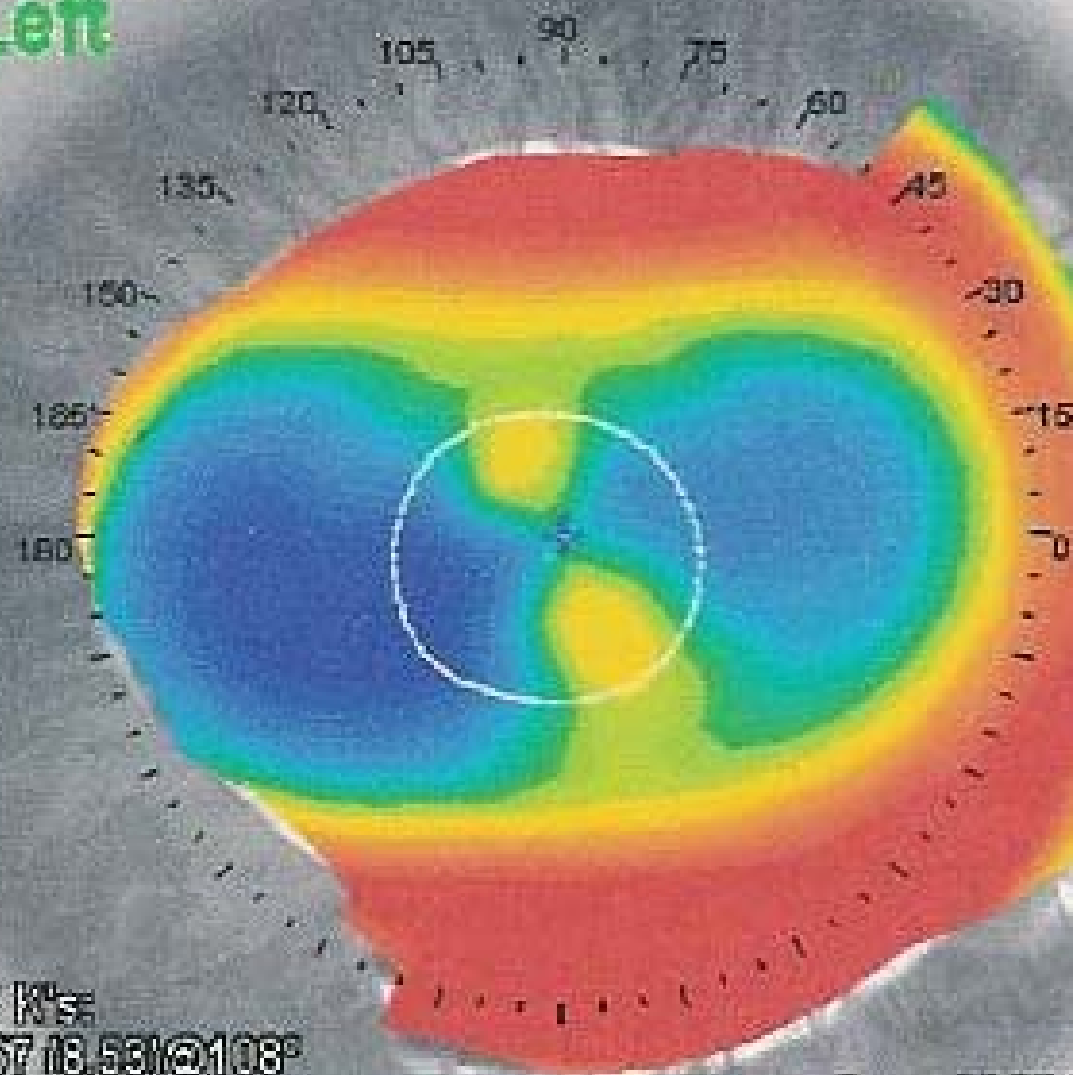


40.75
40.63
40.50
40.38
40.25
40.13
40.00
39.88
39.75
39.63
39.50
39.38
39.25
39.13
39.00
38.88
38.75
38.63
38.50
38.38
38.25
38.13
38.00
37.88
37.75

orm
iv .12

1 Axial
Left

07/27/2004 17:00 No.1

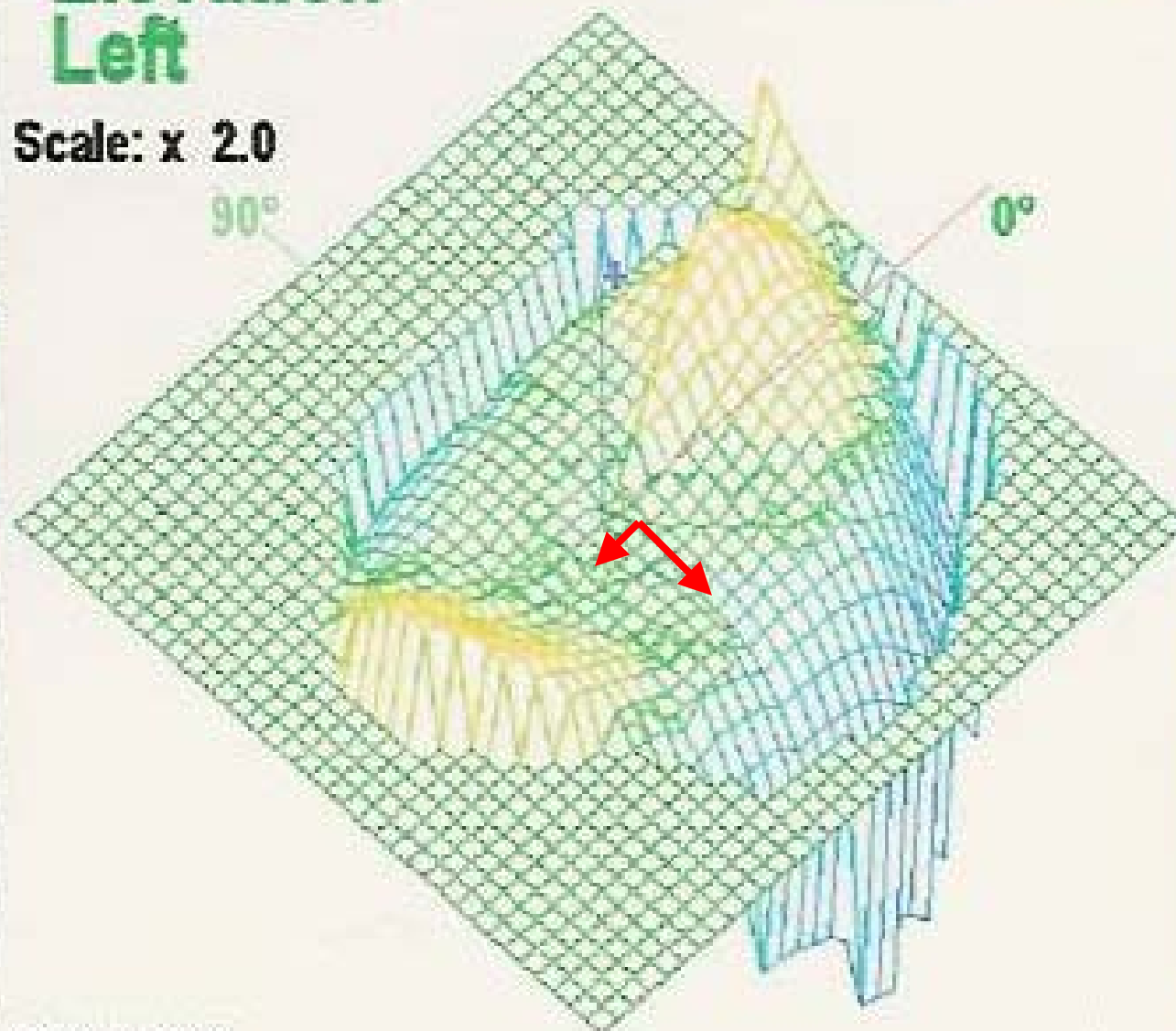


Offsets: 0.07 @ 270

Elevation Left

07/27/2004 17:00 No.1

Scale: x 2.0

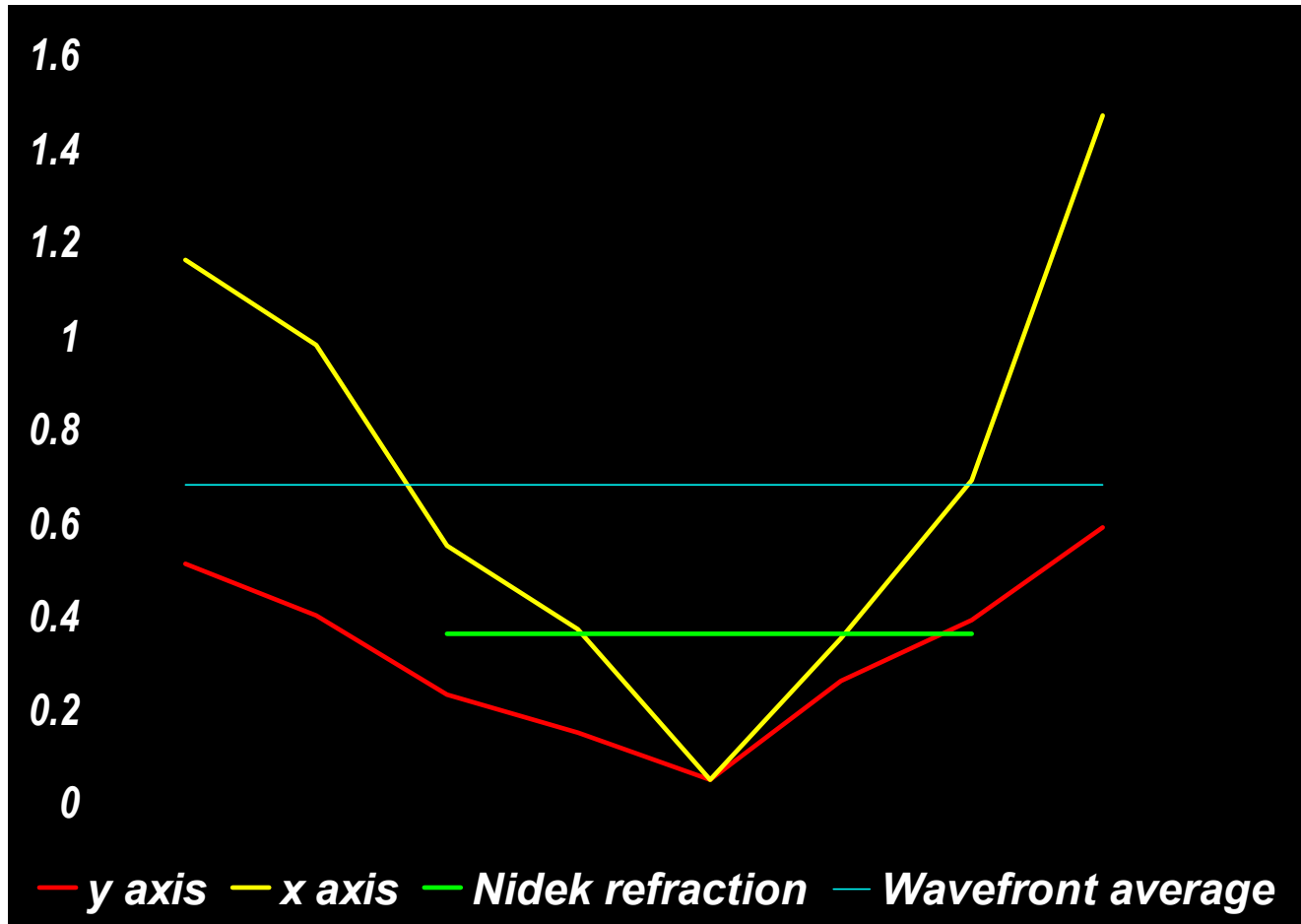


BFS : 8.61
Zone : 7.3

Adj
Com 5.0

Post op Visx Wavefront

High pre-op cylinder



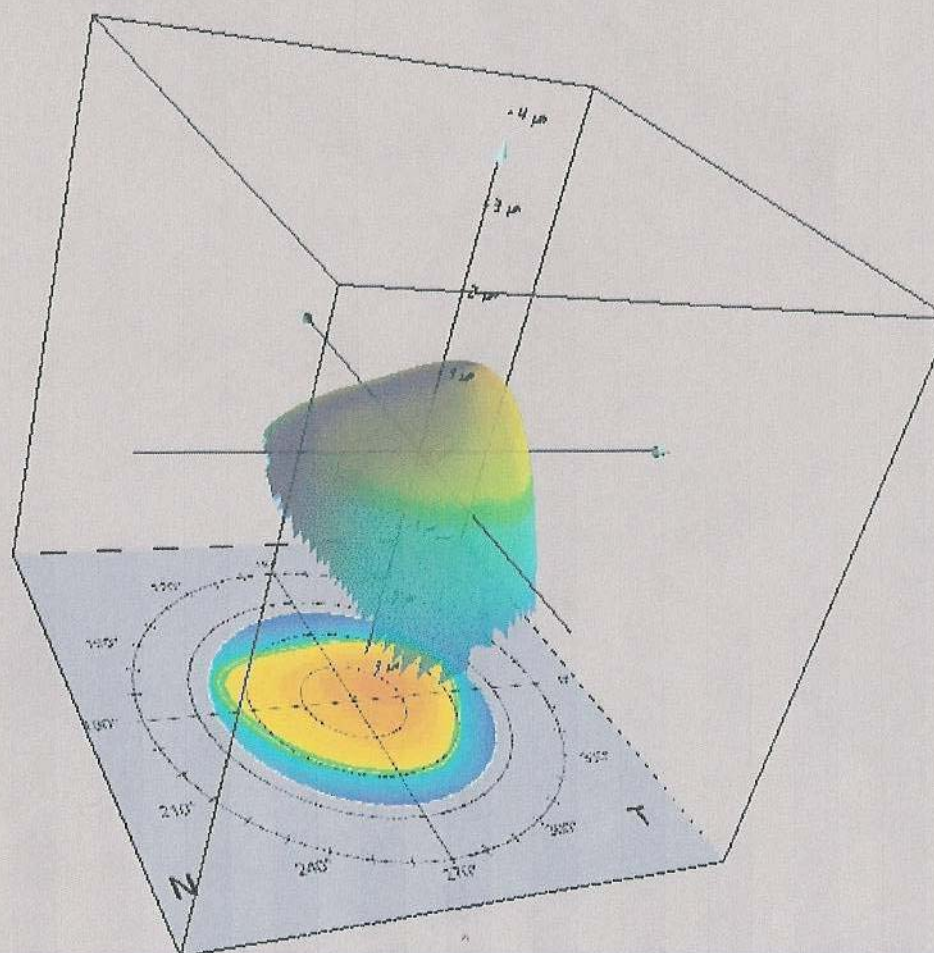


Examination view ▾

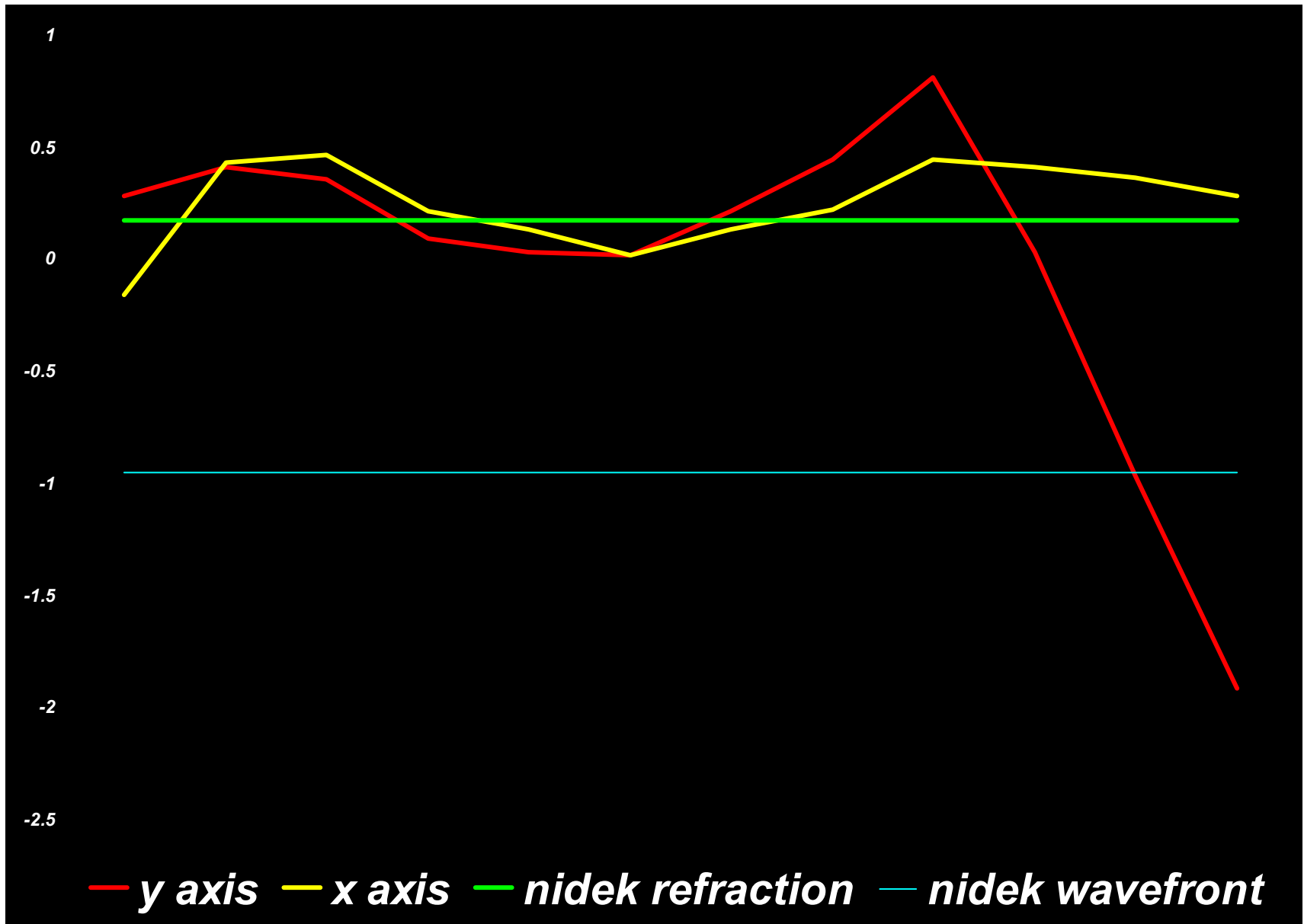
saewert, jen

Summary | 2D Plot | PPR vs. Pup.size | Higher order PSF | 3D View | Raw data

OS (left eye) 02.09.2004 17:06 PPR: -0.38 / -0.14 / 28°



Post -op Visx Wavefront





Back to main
menu



Select patient



Select
examination



Export
wavefront data



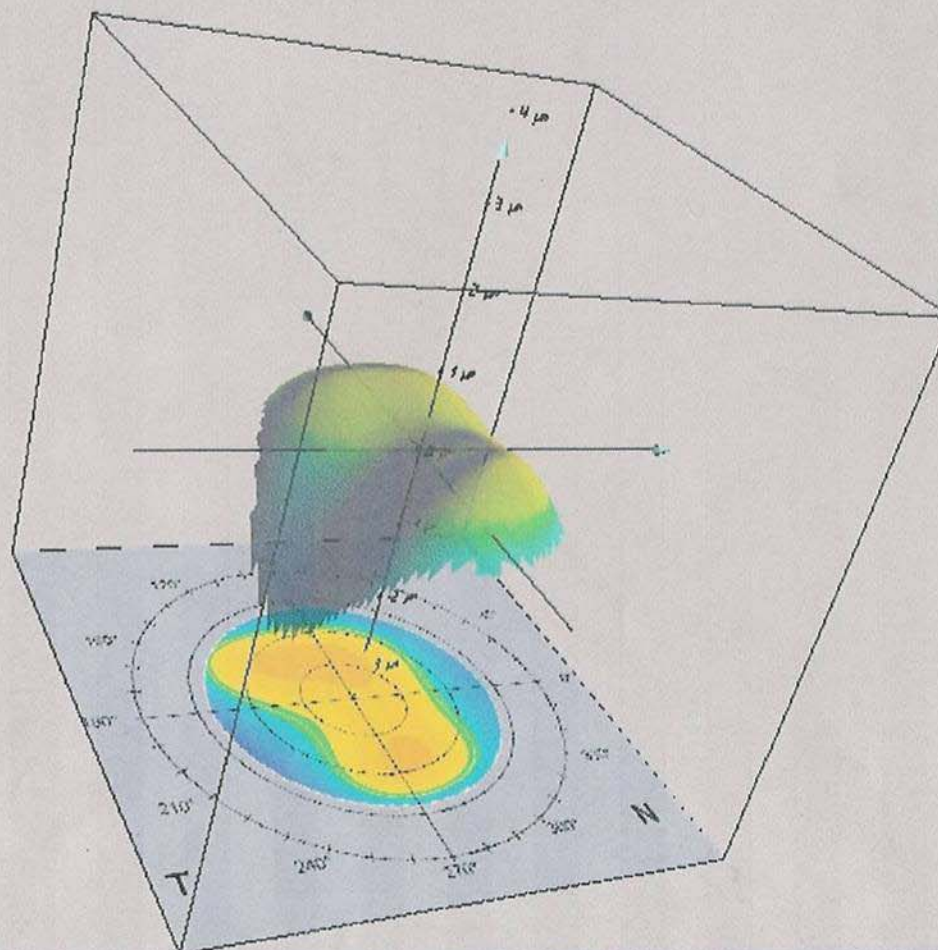
Print wavefront
data

Examination view

saewert, jen

Summary | 2D Plot | PPR vs. Pup.size | Higher order PSF | 3D View | Raw data

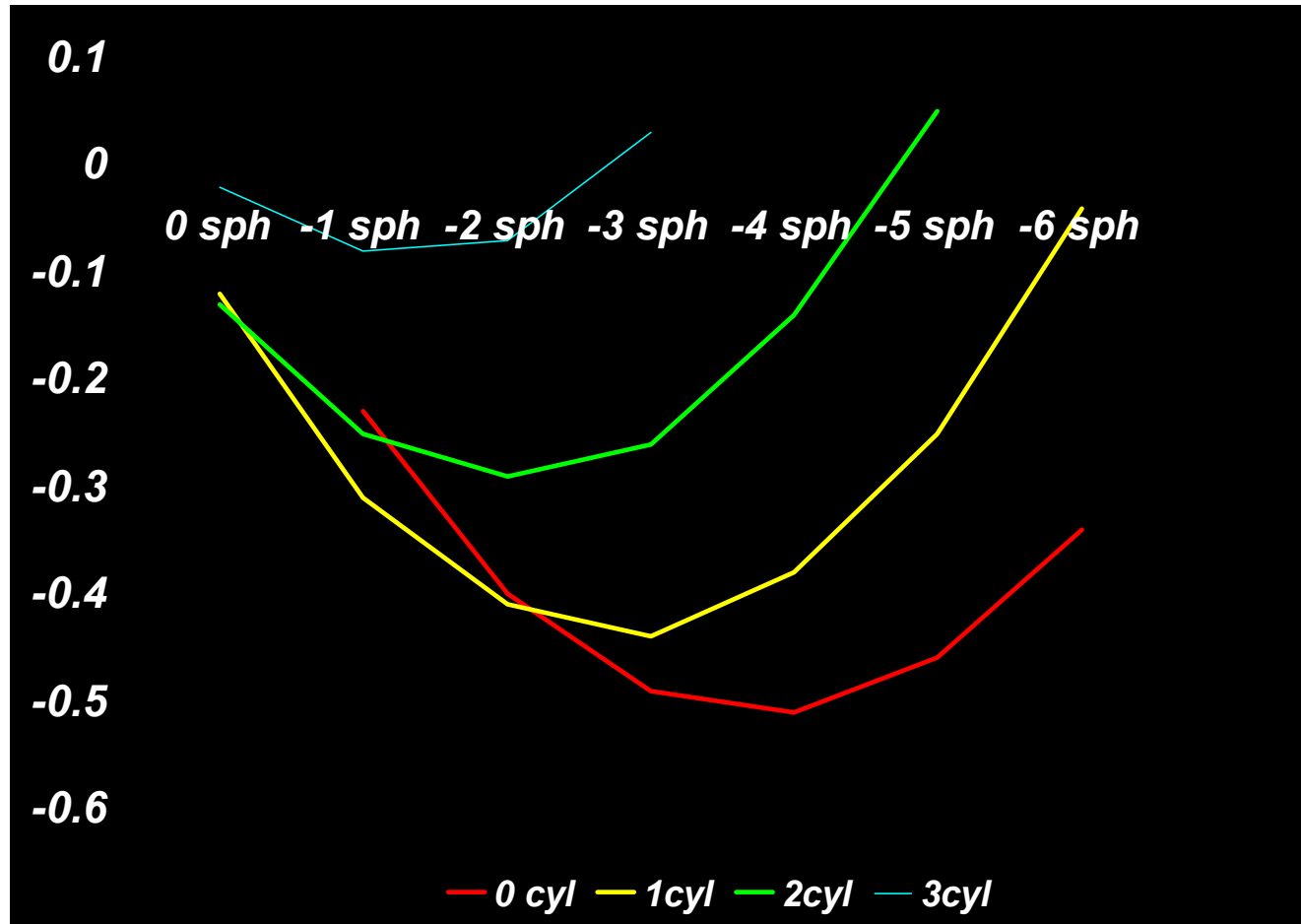
OD (right eye) 02.09.2004 17:04 PPR: +0.05 / -0.47 / 102°



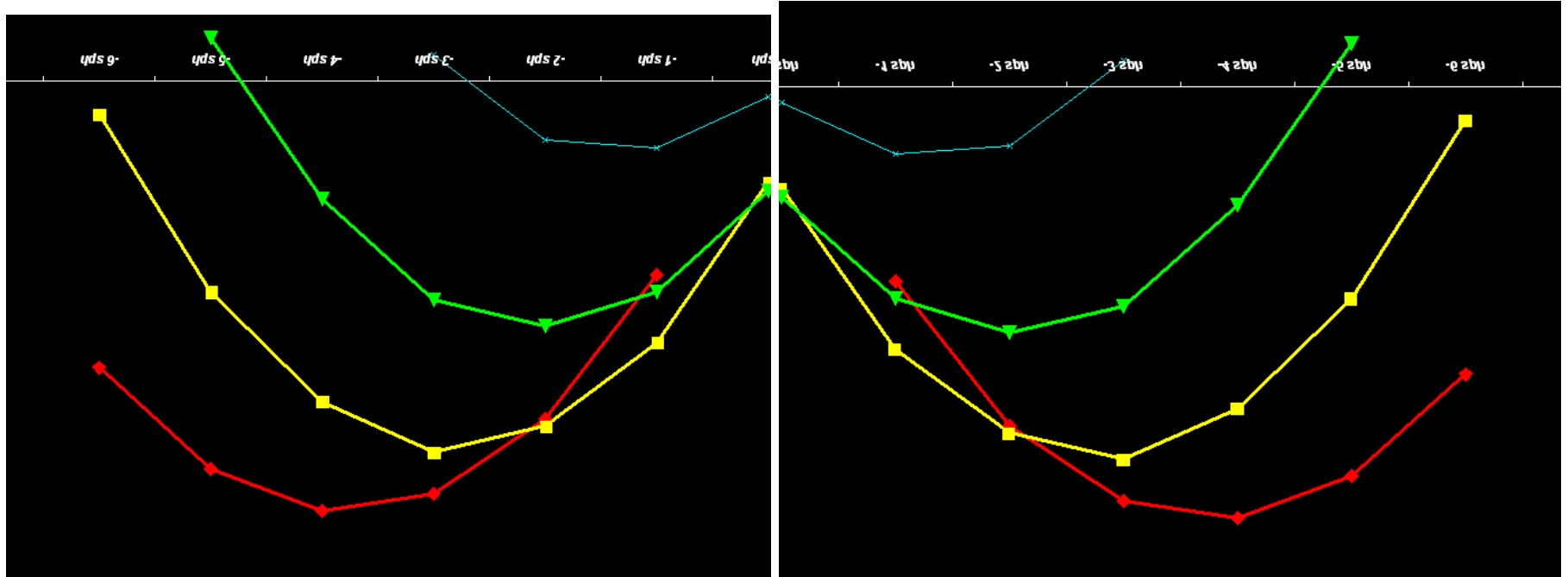
Go back to main menu.

Visx Wavefront outcomes

(assuming no adjustment)

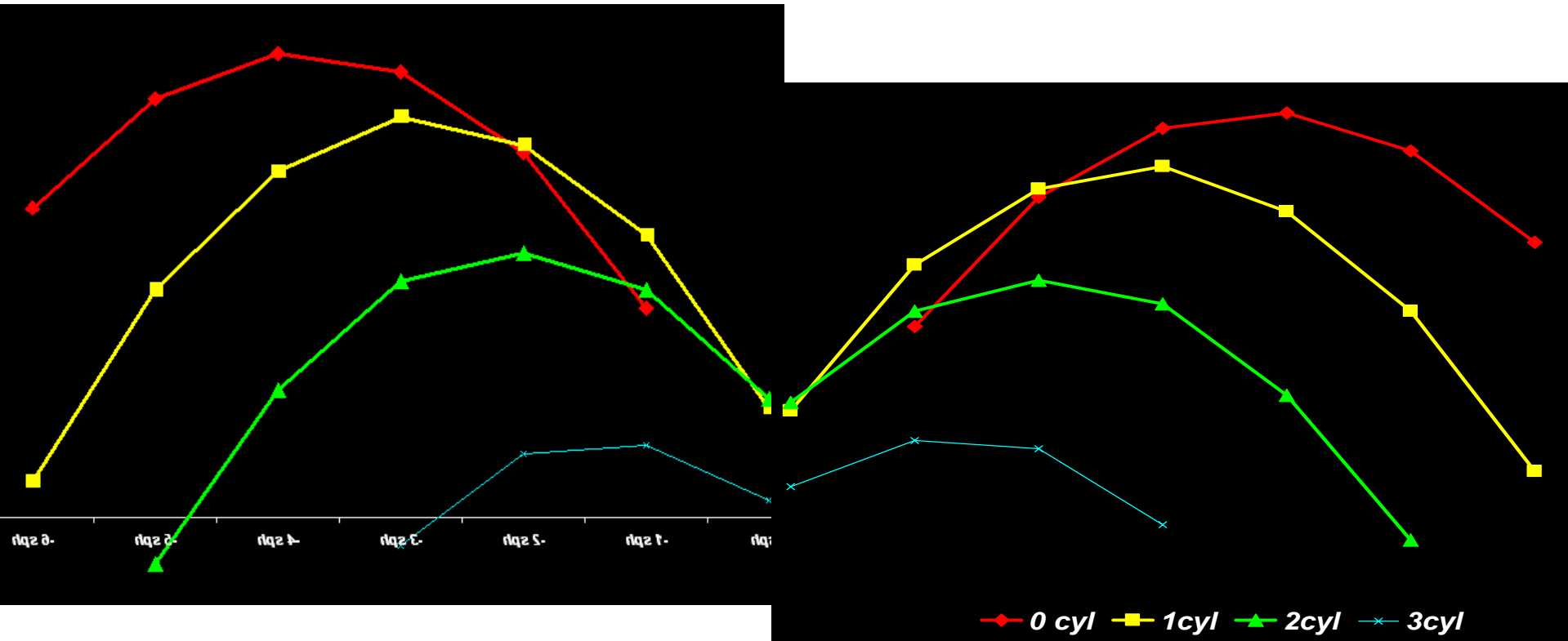


Visx Wavefront outcome with mirror image



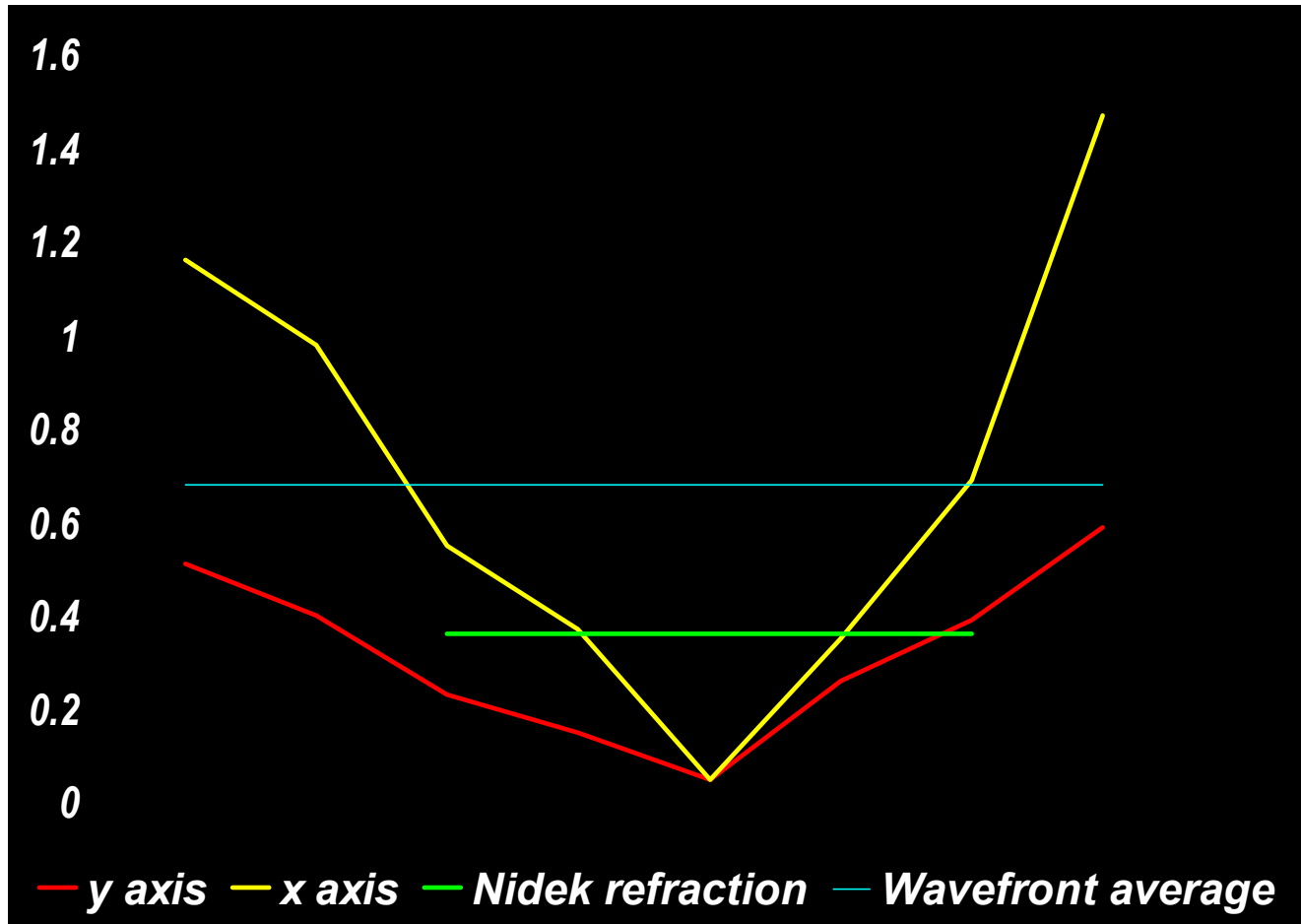
Theoretic Corneal power map

Post Visx Wavefront

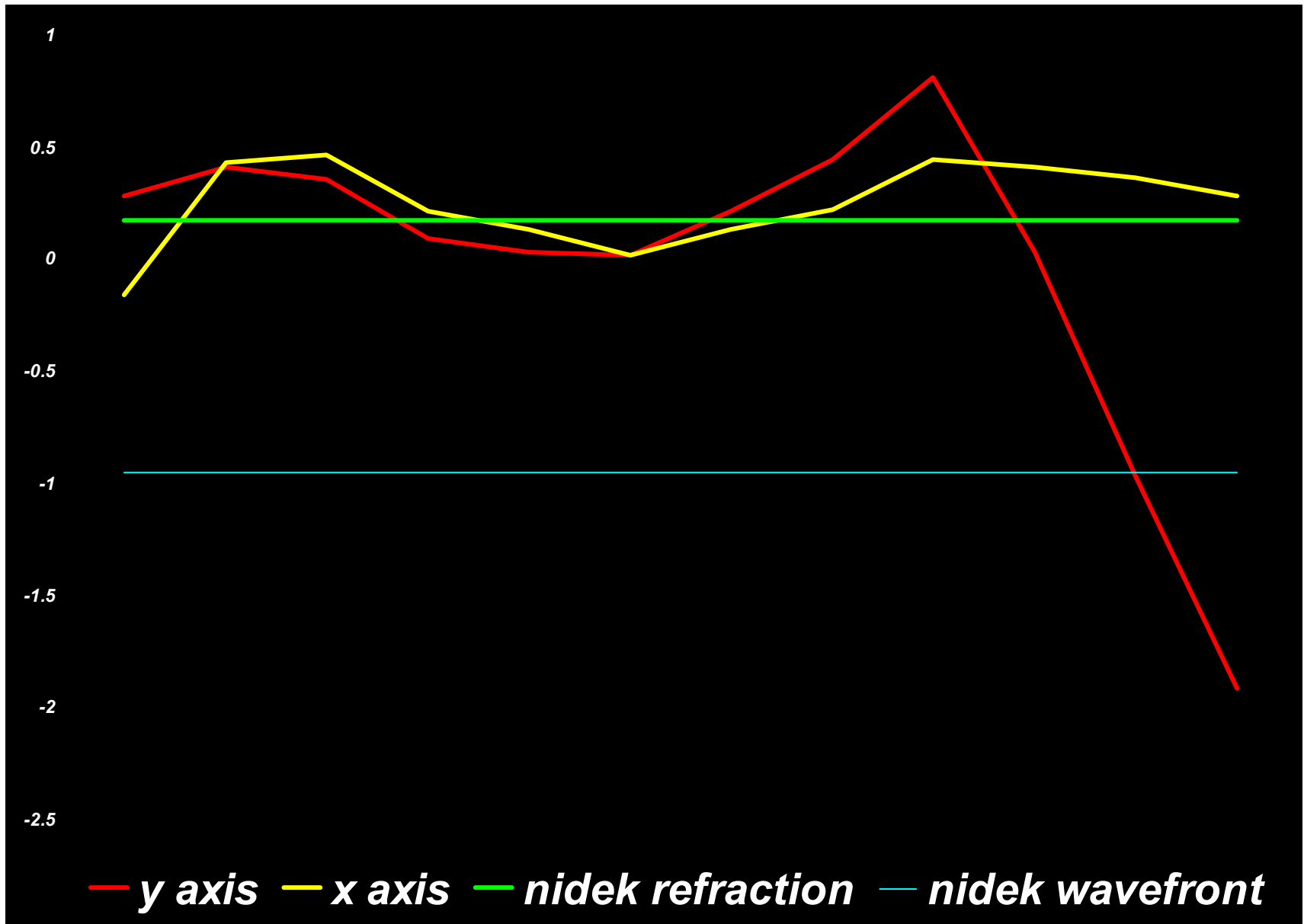


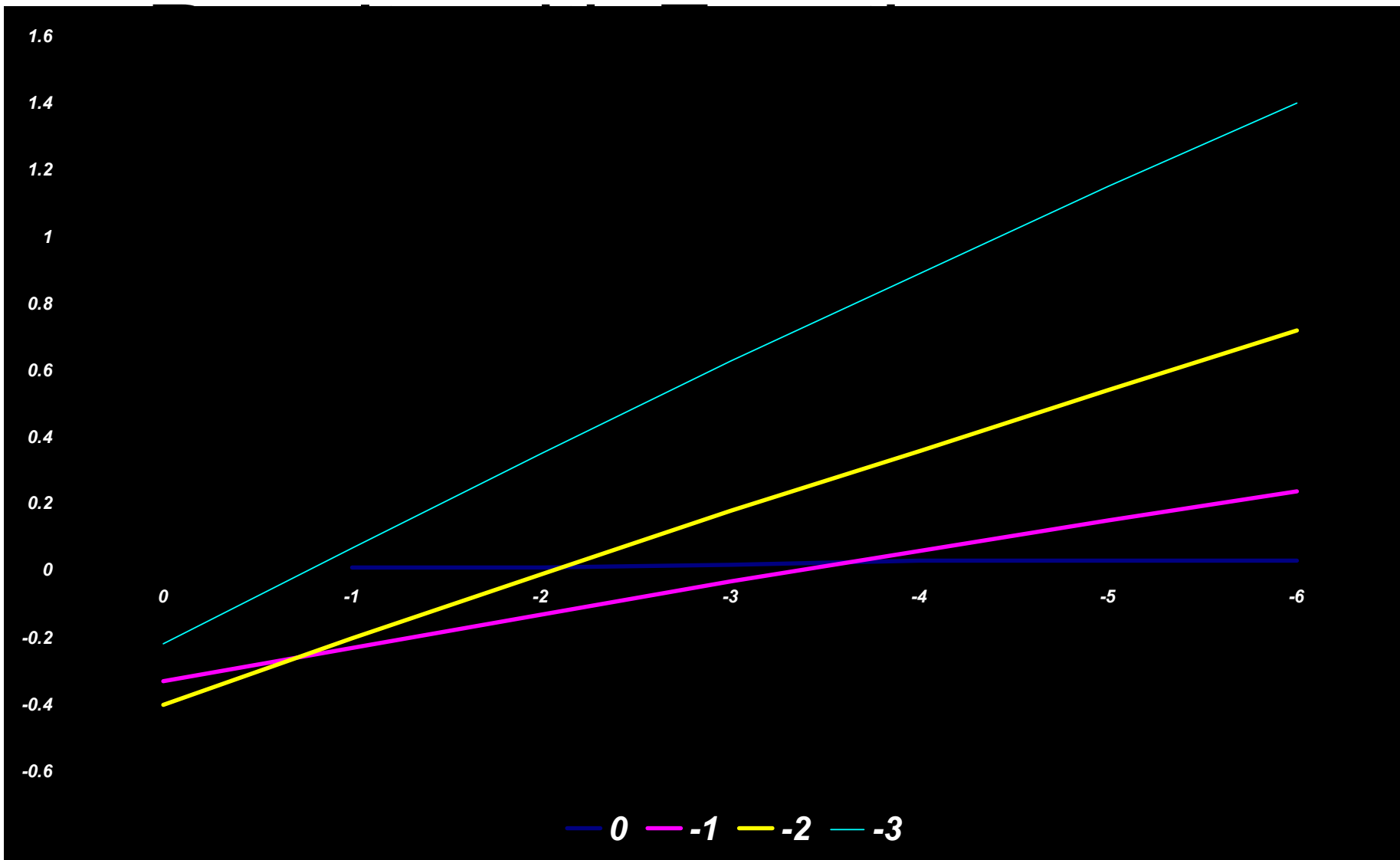
Post op Visx Wavefront

High pre-op cylinder

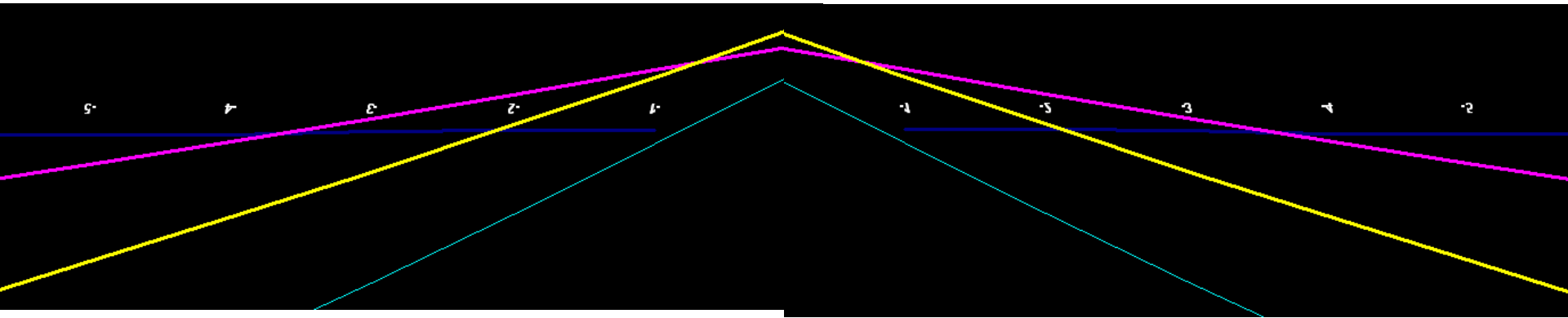


Post -op Visx Wavefront

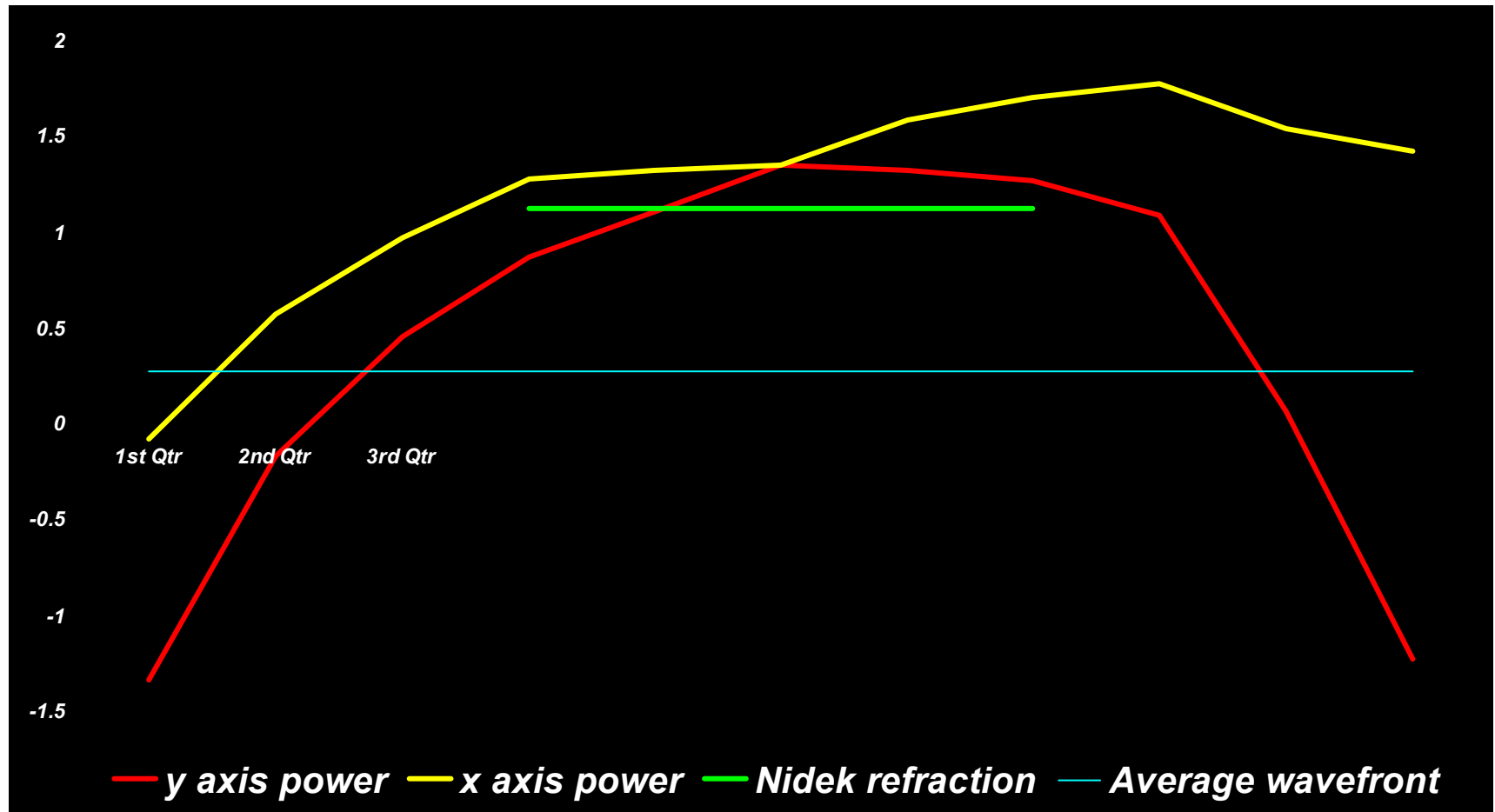




Zyoptix: predicted profile corneal power



Post-Zyoptix Central Corneal Power



Back to main menu

Select patient

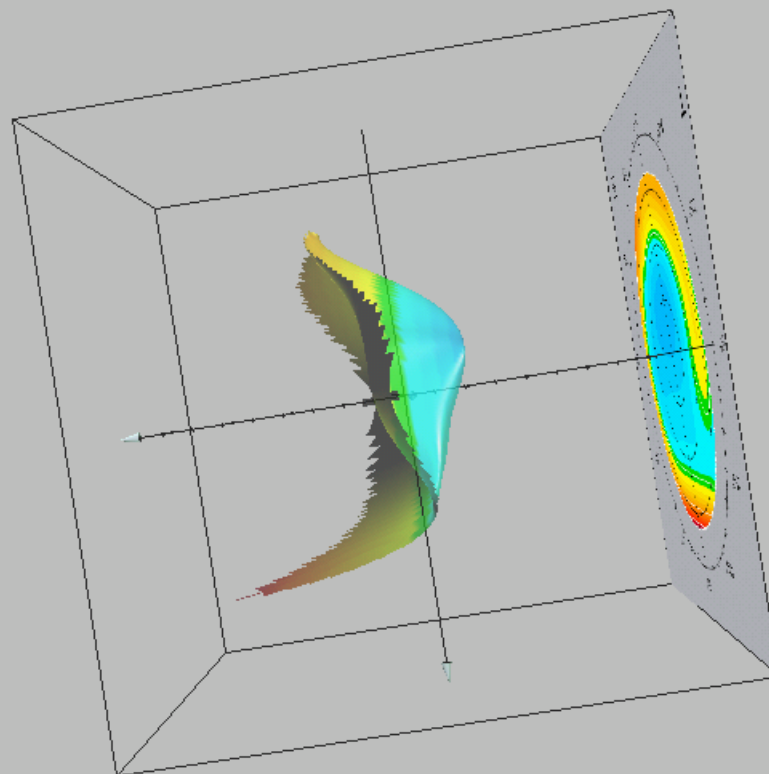
Select examination

Export wavefront data

Print wavefront data

Summary | 2D Plot | PPR vs. Pup.size | Higher order PSF | 3D View | Raw data

OD (right eye) 05.11.2003 06:18 PPR: +0.54 / -0.18 / 6°





Back to main menu



Select patient



Select examination



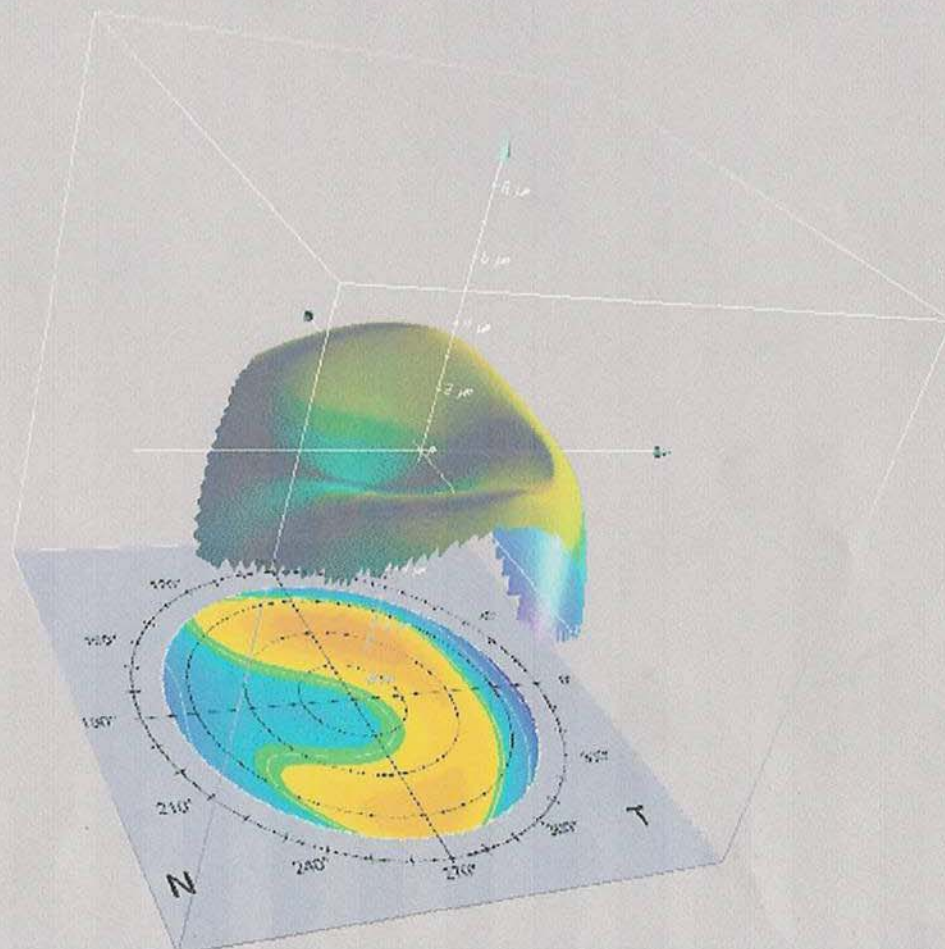
Export wavefront data



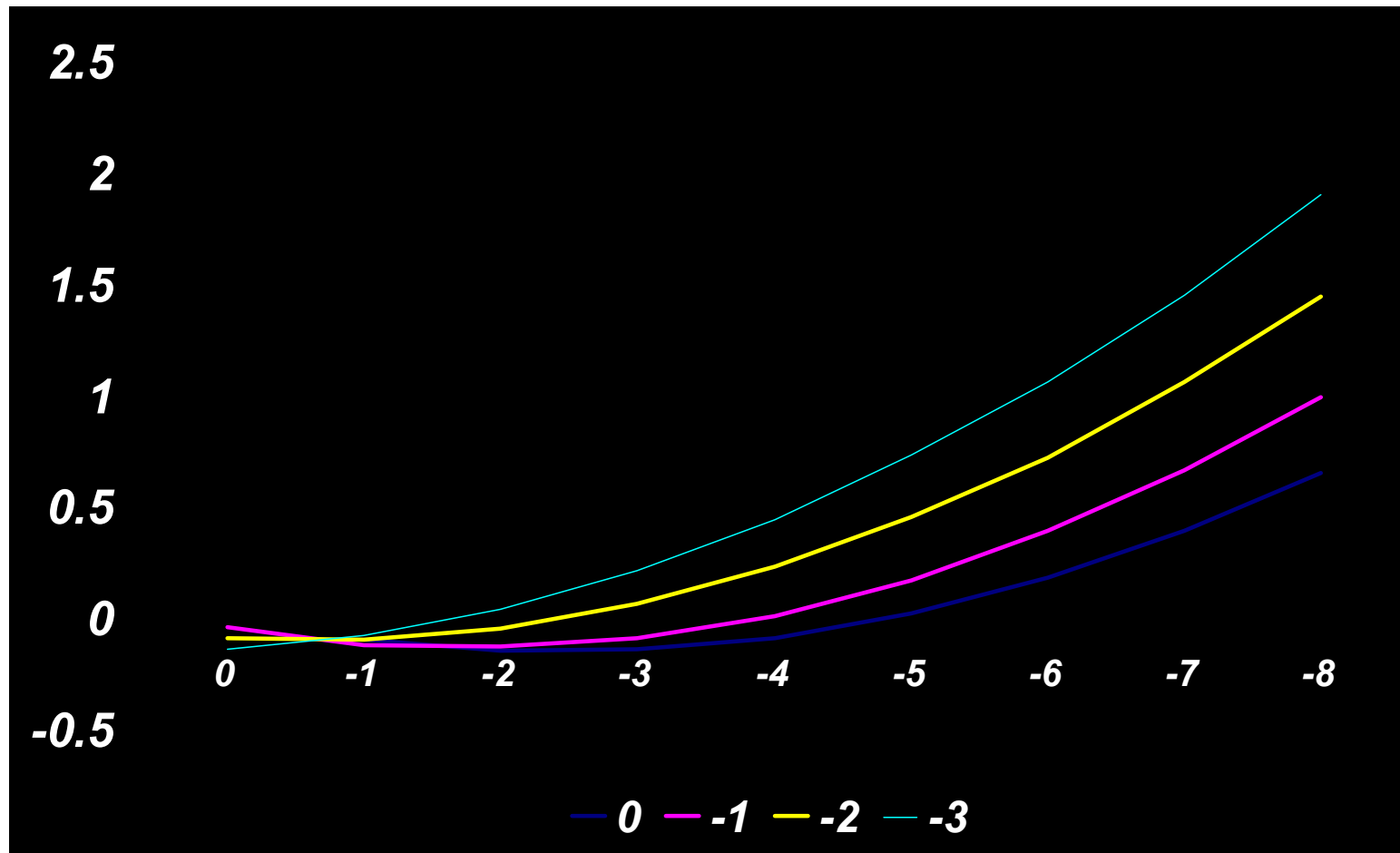
Print wavefront data

Summary | 2D Plot | PPR vs. Pup. size | Higher order PSF | 3D View | Raw data

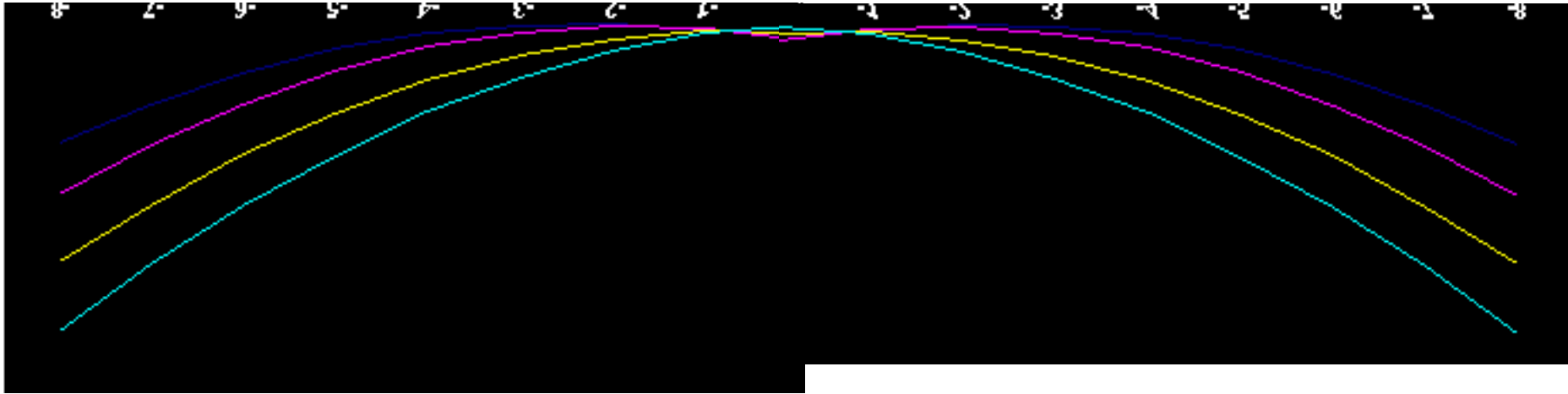
OS (left eye) 03.09.2004 14:09 PPR: +0.74 / -0.59 / 91°



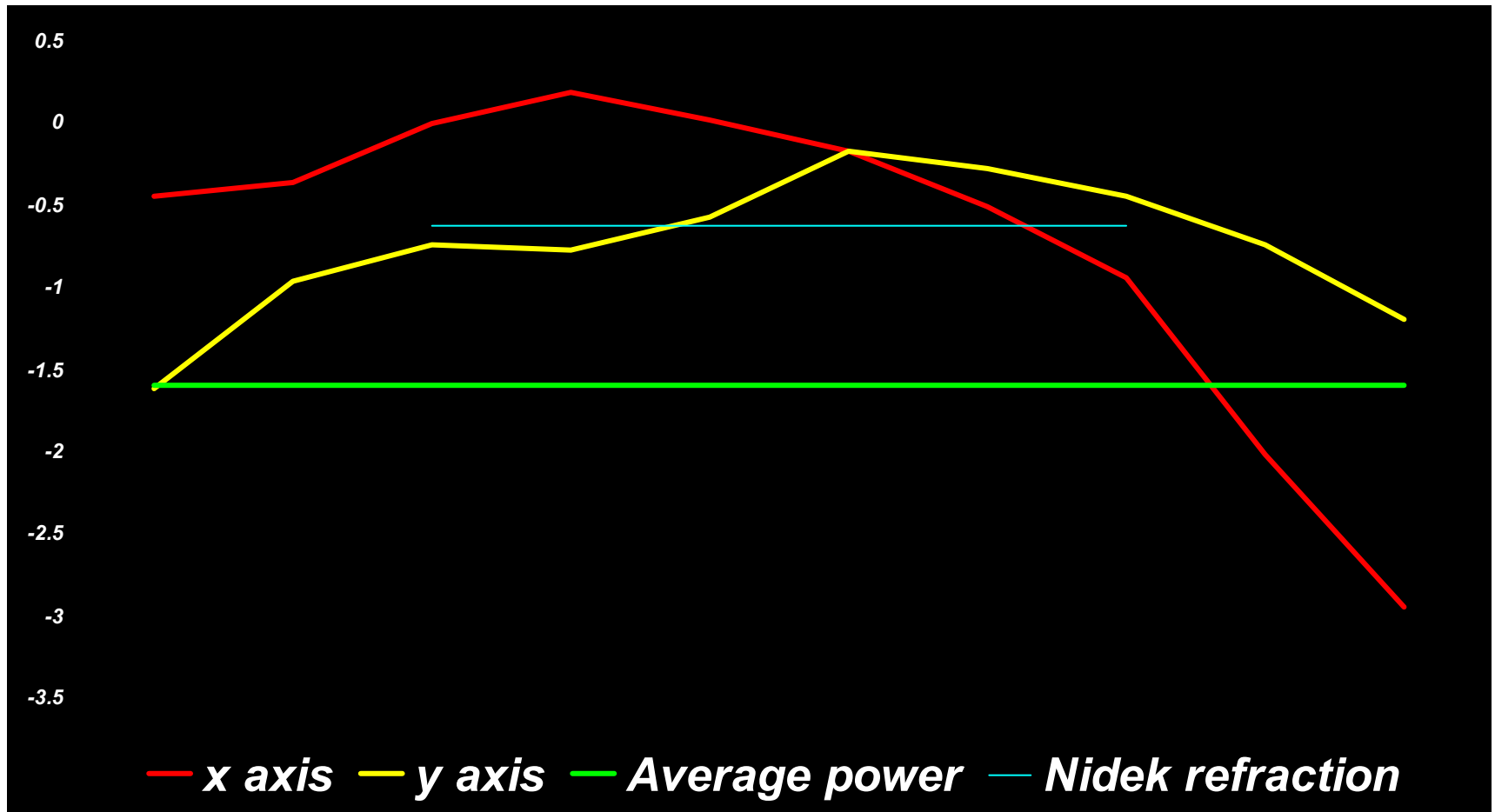
Outcome with standard Lasik (assuming no adjustment)



Outcome with standard Lasik (assuming no adjustment)



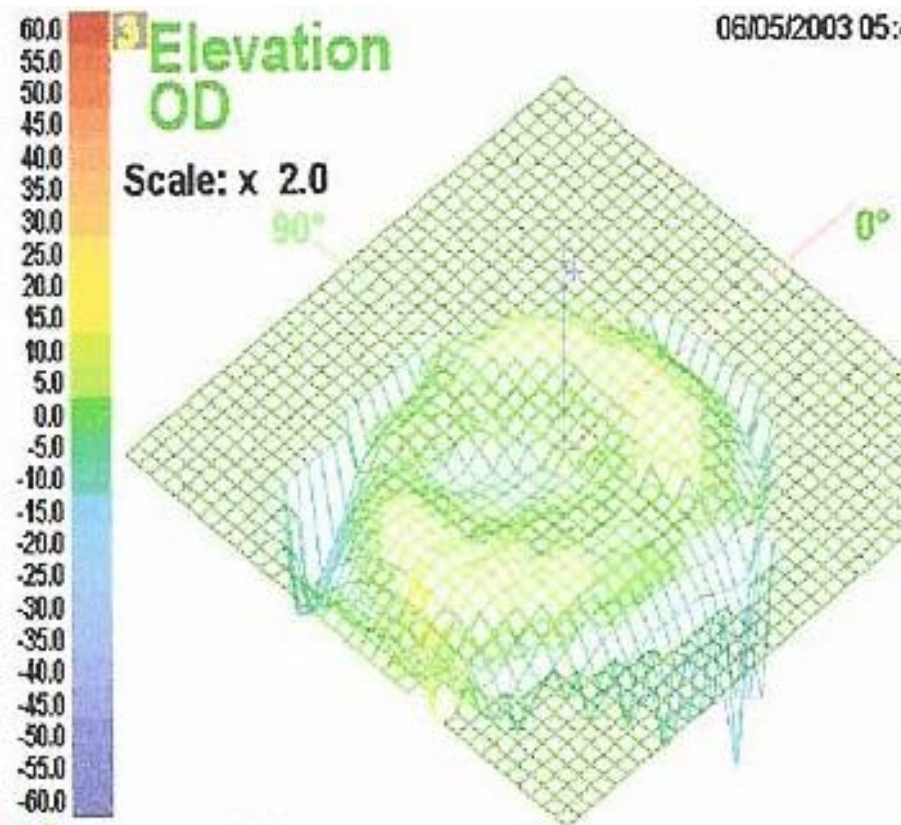
Corneal Power post VisxS2



06/05/2003 05:49 No.1

**Elevation
OD**

Scale: x 2.0



Adj
om 5.0

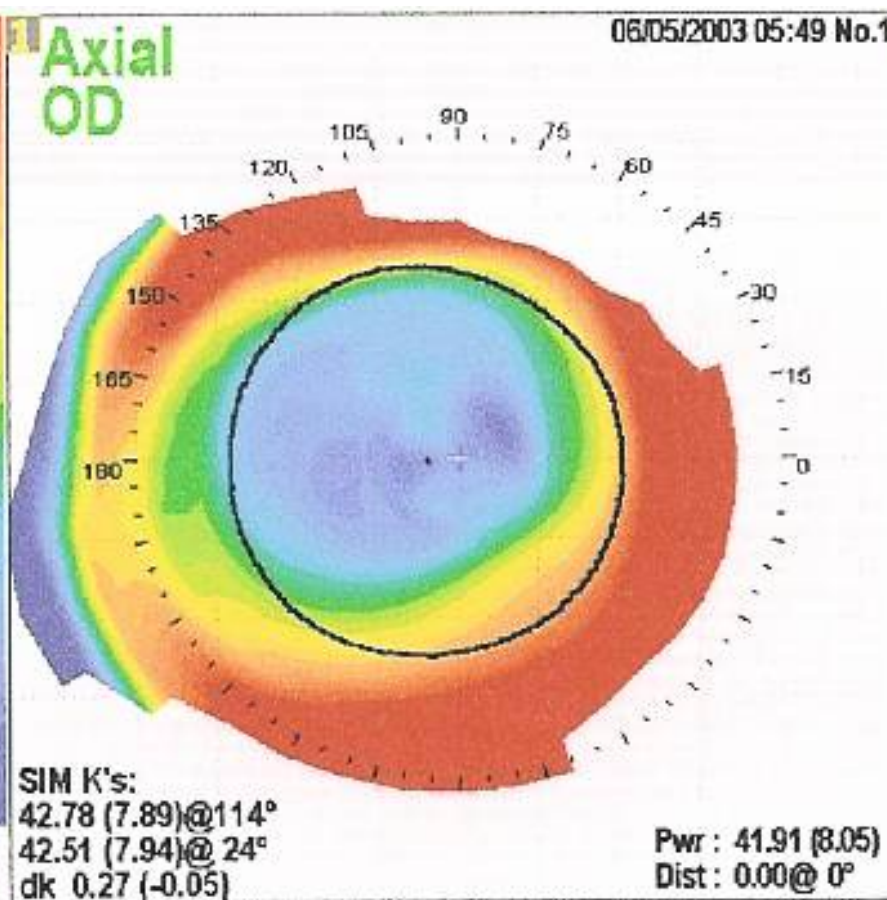
BFS : 7.84
Zone : 6.8

06/05/2003 05:49 No.1

**Axial
OD**

44.25
44.13
44.00
43.88
43.75
43.63
43.50
43.38
43.25
43.13
43.00
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42.13
42.00
41.88
41.75
41.63
41.50
41.38
41.25

Norm
ndv .12



SIM K's:
42.78 (7.89)@114°
42.51 (7.94)@ 24°
dk 0.27 (-0.05)

Pwr : 41.91 (8.05)
Dist : 0.00@ 0°

