



Geometrical correspondence between first and second corneal surfaces

Collaborators

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Spanish Ministry of Science through project

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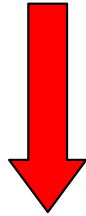


Initial Hypothesis

Healthy eyes

No corneal diseases

Uniform IOP distribution

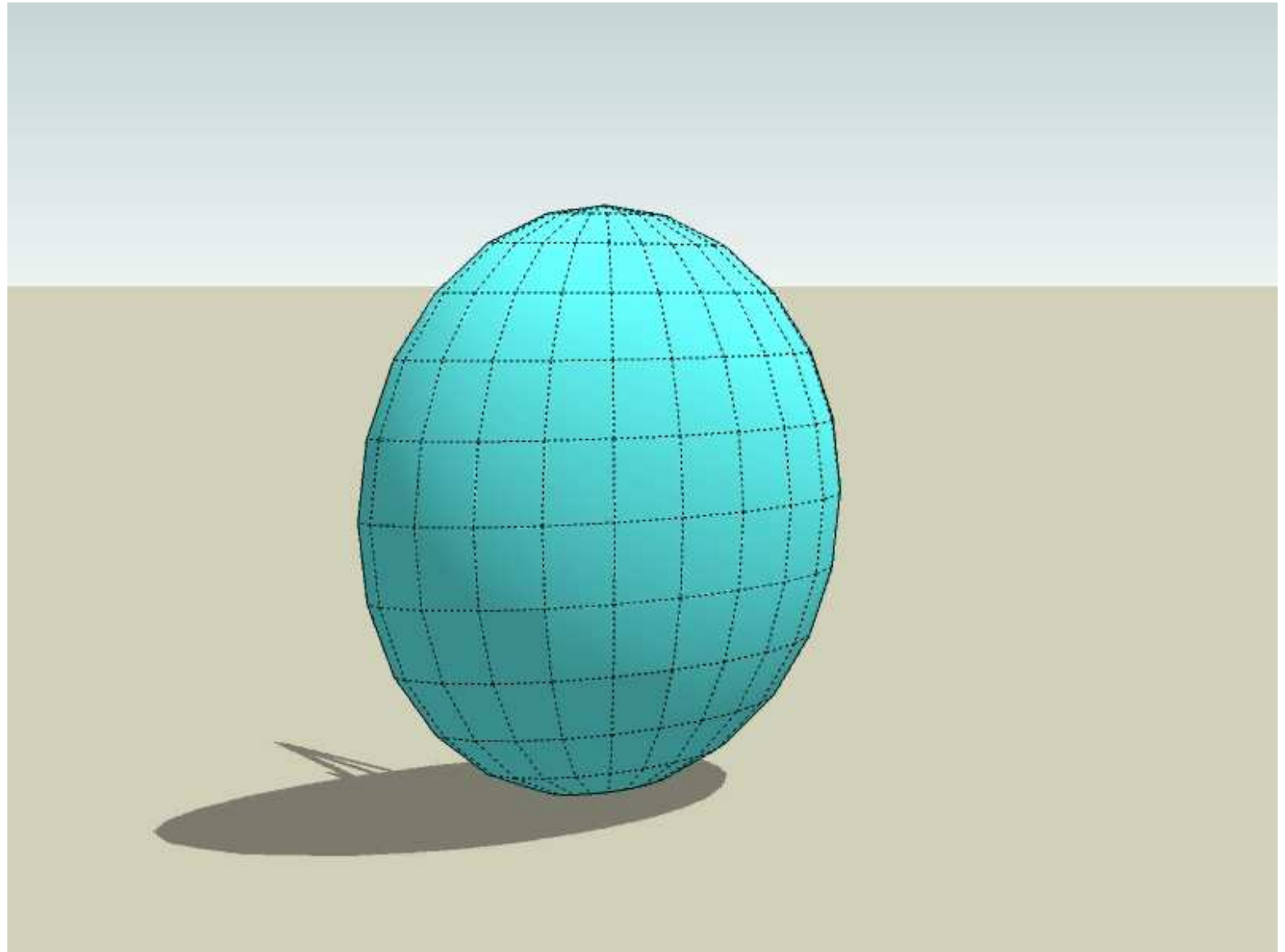


Corneal shape must be correlated:

Spherical and Astigmatic curvatures



Initial Hypothesis



Previous results:

Many authors have reported average curvature correspondence between first and second corneal surface:

Edmund (1994)

Garner (1997)

Oshika *et al.* (1998)

Lam & Douthwaite (2000)

Dubbelman *et al.* (2002) and (2007)

Atchison *et al.* (2008)



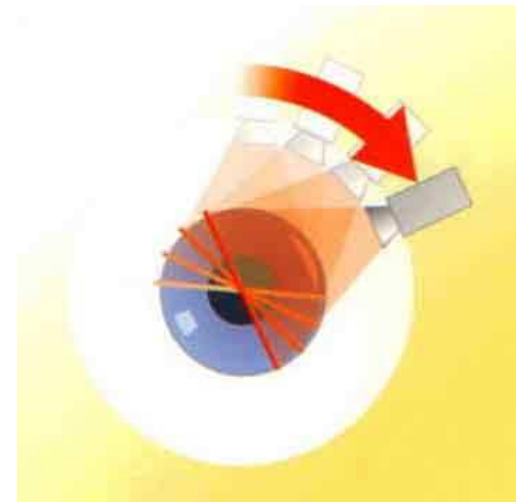
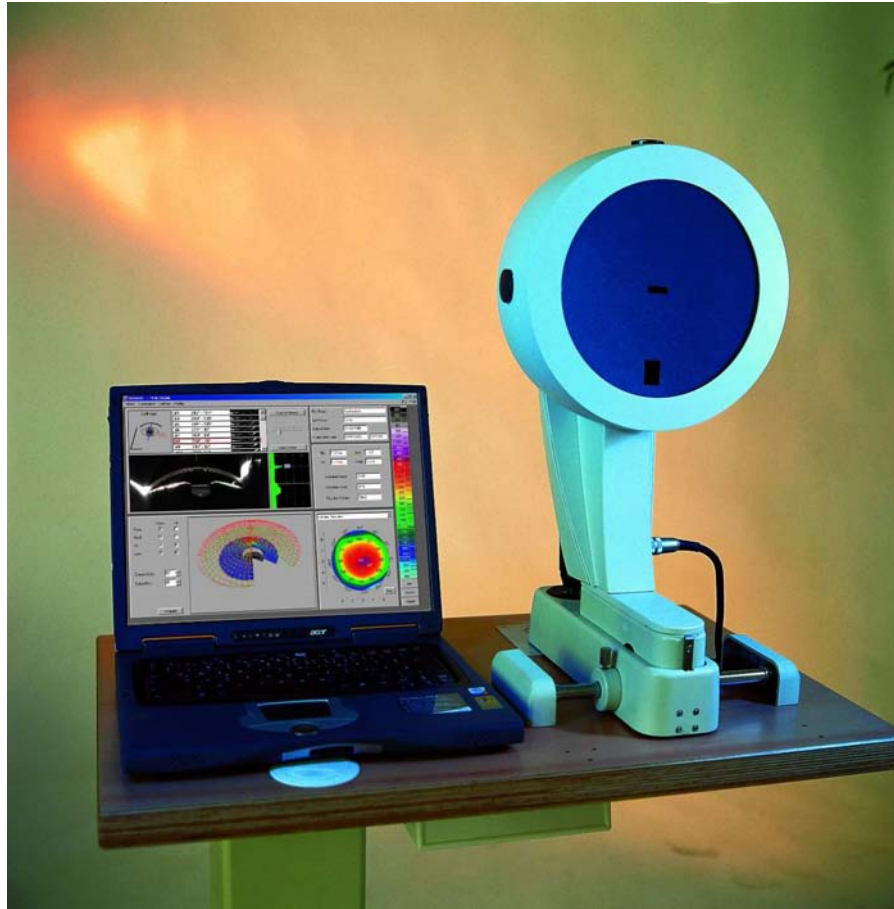
Subjects and methods:

- 42 healthy eyes (21 LE, 21 RE) < 45 y.o.
- Pentacam: elevation
- Average of 6 corneal measurements
- Data analysis with MATLAB
- Pupil diameter 6 mm

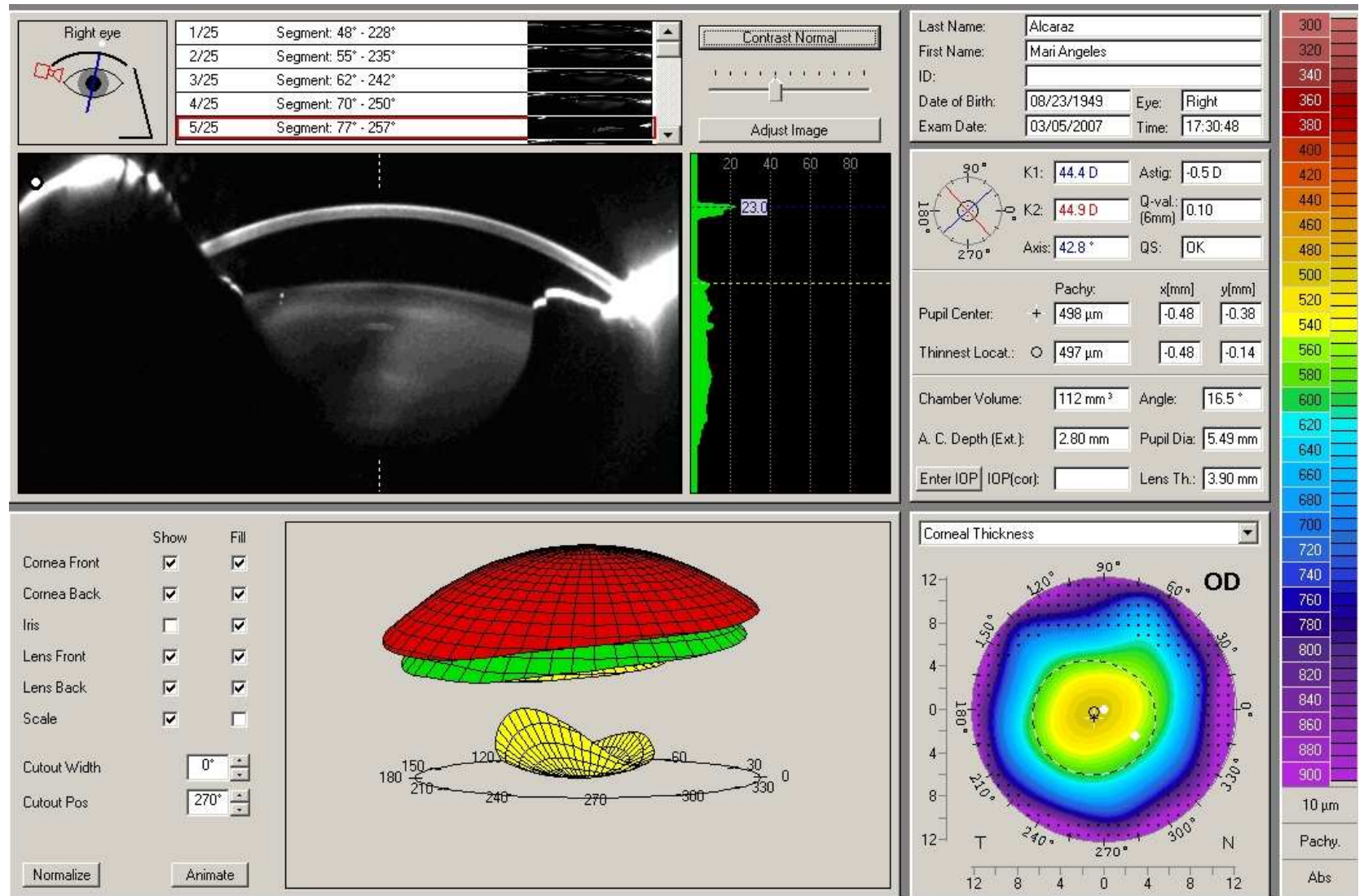
- Individual correlation of corneal shape:
 - 1st surface vs. 2nd surface



Subjects and methods:



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Subjects and methods:

Last Name: Alcaraz
 First Name: Mari Angeles
 ID:
 Date of Birth: 08/23/1949 Eye: Right
 Exam Date: 03/05/2007 Time: 17:30:48
 Exam Info:

Cornea Front

Rh: 7.60 mm K1: 44.4 D
 Rv: 7.52 mm K2: 44.9 D
 Rm: 7.56 mm Km: 44.7 D

QS: OK Axis: 42.8° Astig: -0.5 D
 Q-val: (6mm) 0.10 Rper: 7.79 mm Rmin: 7.33 mm

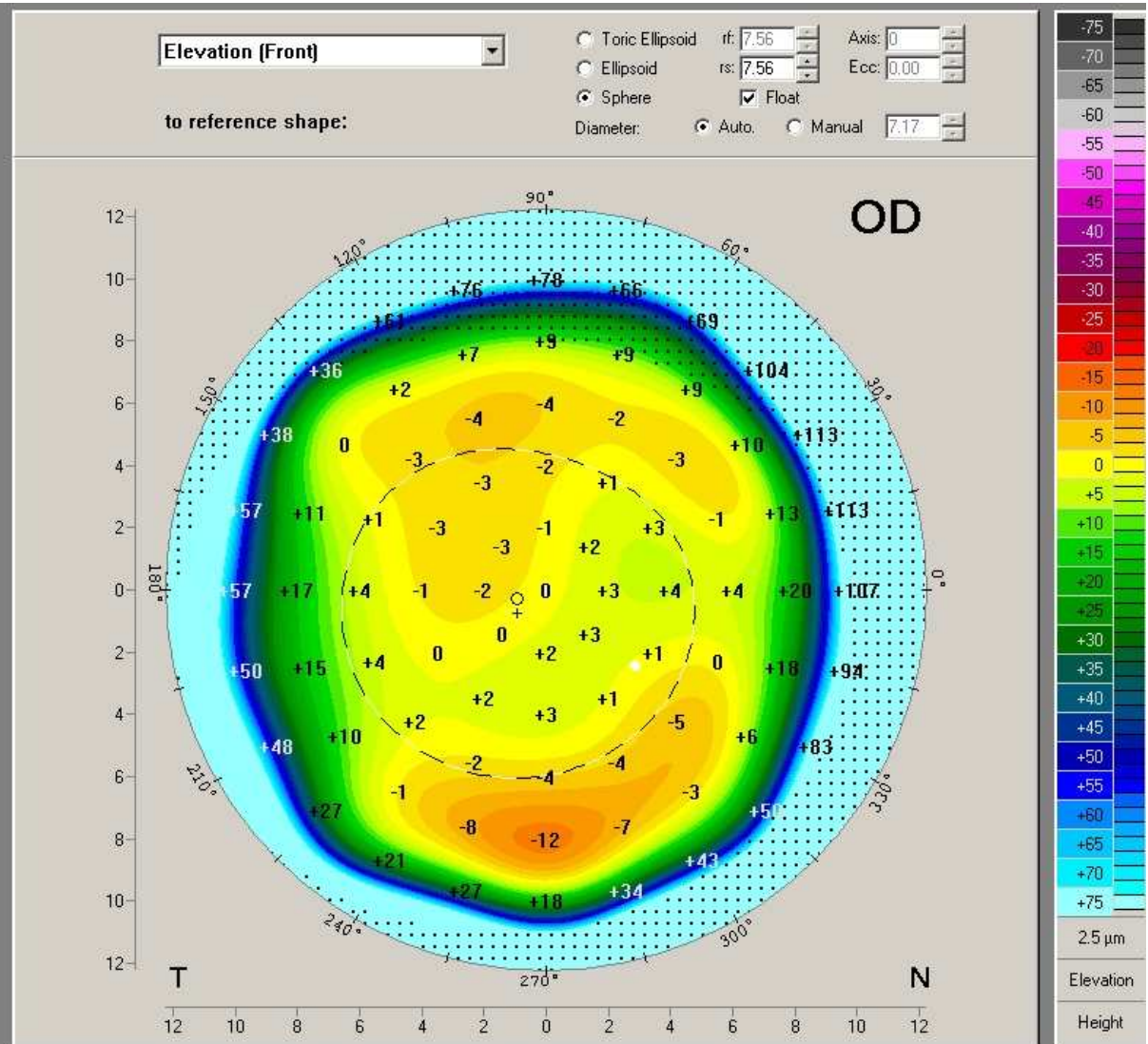
Cornea Back

Rh: 6.28 mm K1: -6.4 D
 Rv: 5.82 mm K2: -6.9 D
 Rm: 6.05 mm Km: -6.6 D

QS: OK Axis: 24.7° Astig: +0.5 D
 Q-val: (6mm) -0.38 Rper: 6.51 mm Rmin: 5.69 mm

Pupil Center: + Pachy: 498 μm x(mm) -0.48 y(mm) -0.38
 Pachy Apex: • 499 μm 0.00 0.00
 Thinnest Locat.: ○ 497 μm -0.48 -0.14

Cornea Volume: 58.0 mm³ KPD: +1.6 D
 Chamber Volume: 112 mm³ Angle: 16.5°
 A. C. Depth (Ext.): 2.80 mm Pupil Dia: 5.49 mm
 Enter IOP IOP(cor): Lens Th: 3.90 mm



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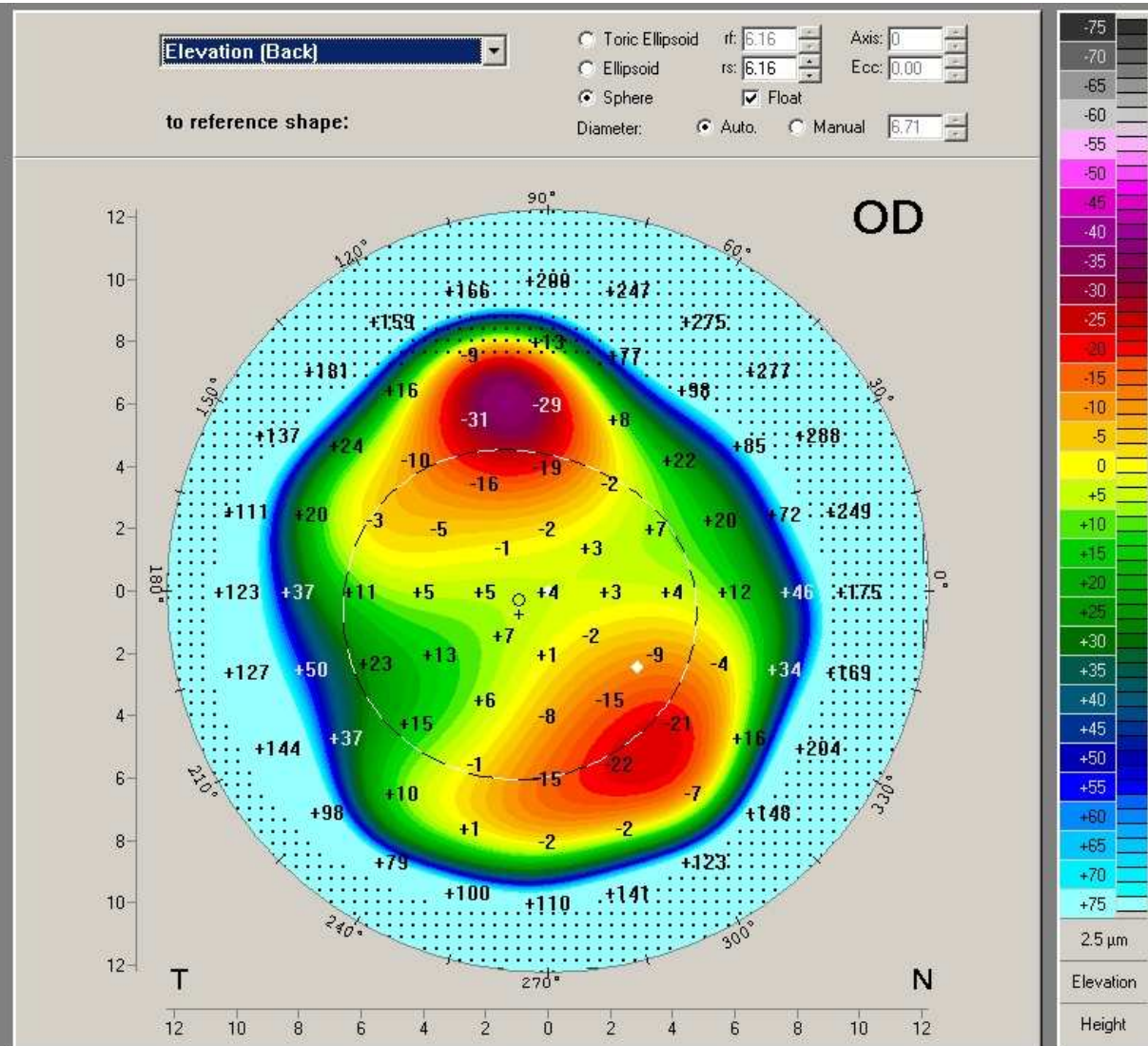
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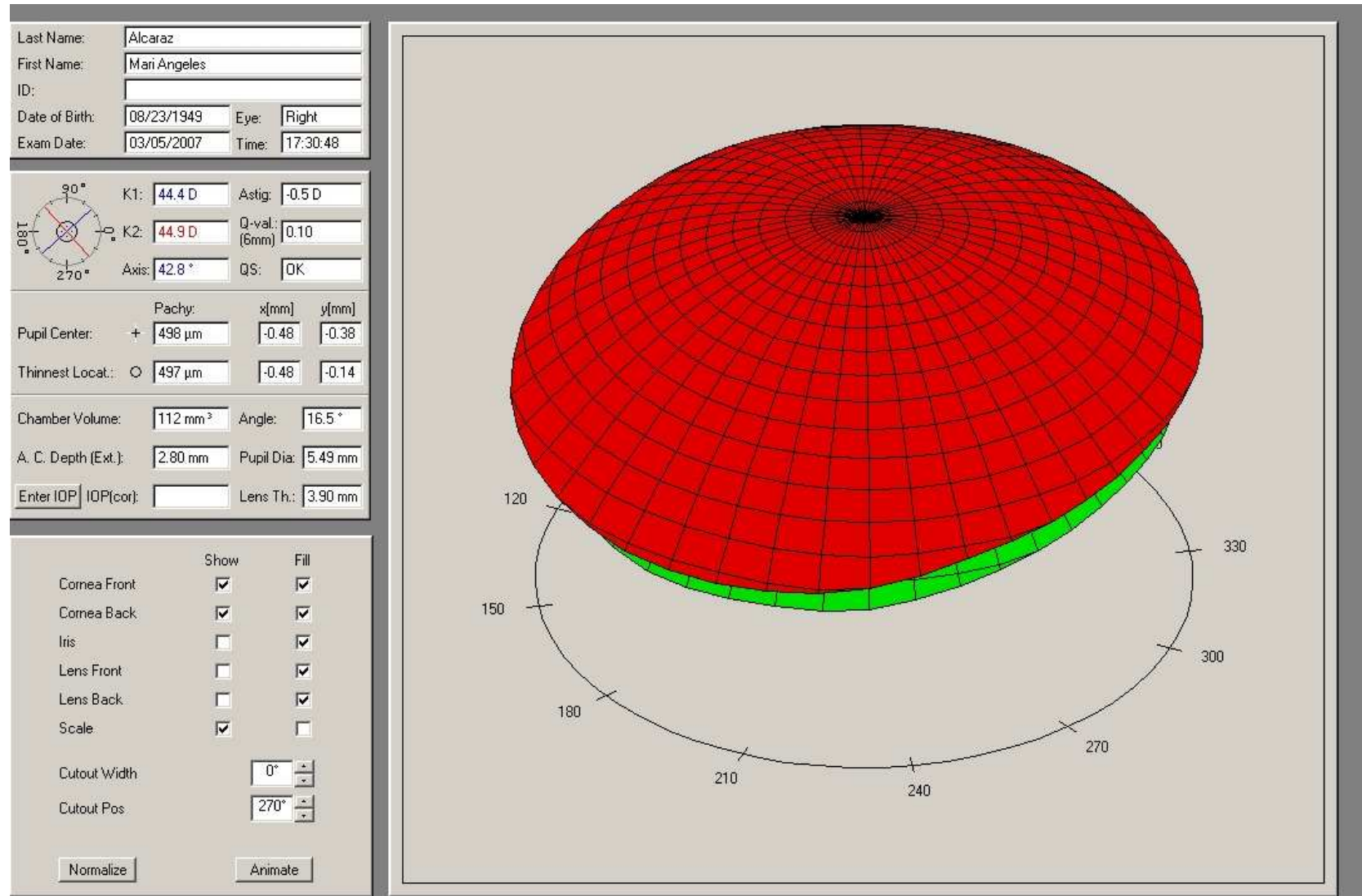
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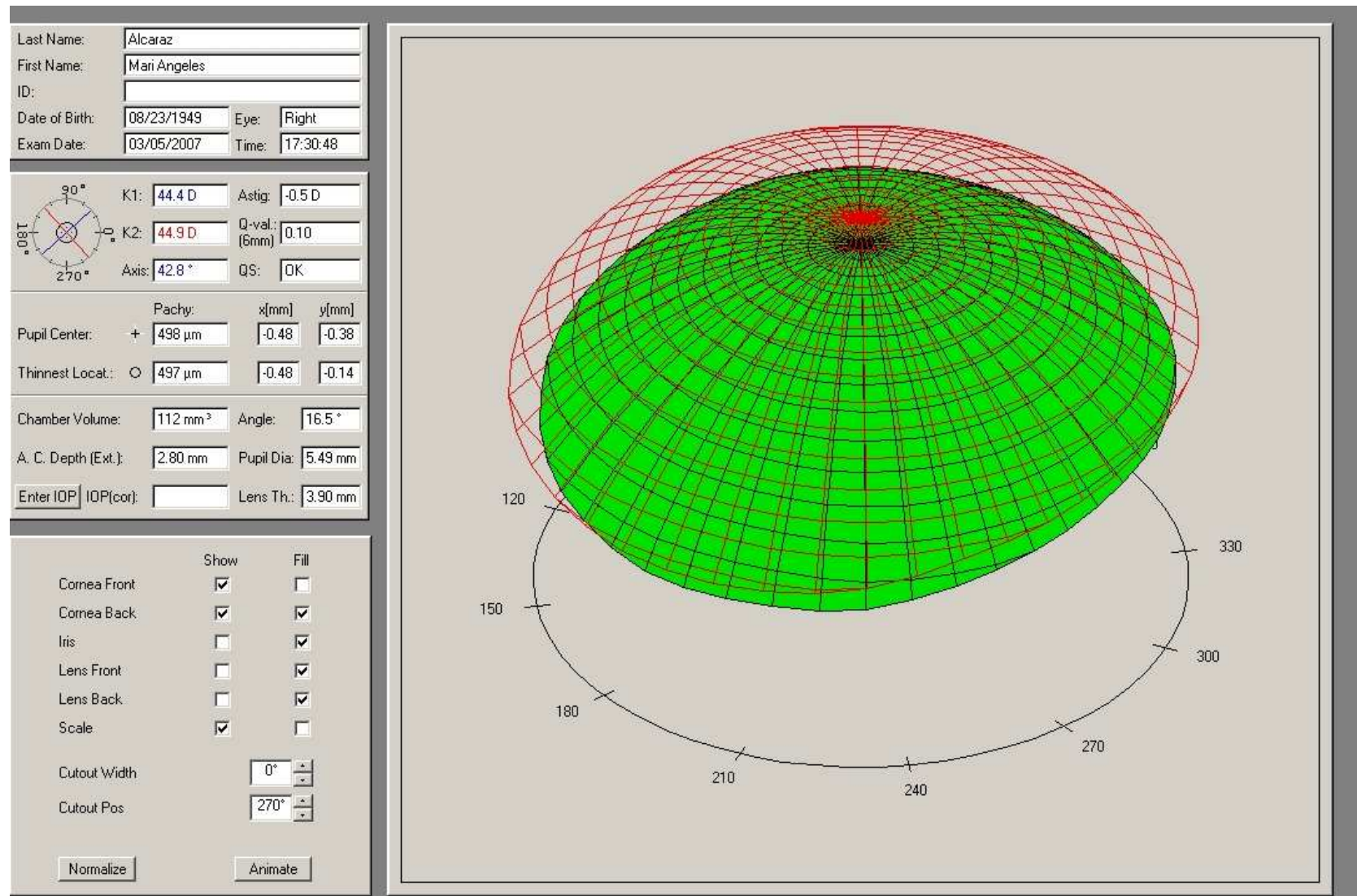
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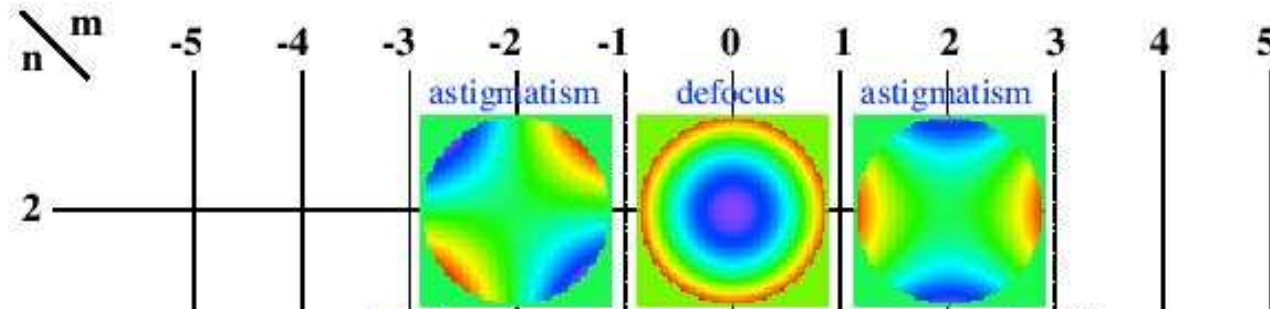


Subjects and methods:



We check:

Wavefront mode for each Zernike polynomial



Shape correspondence:

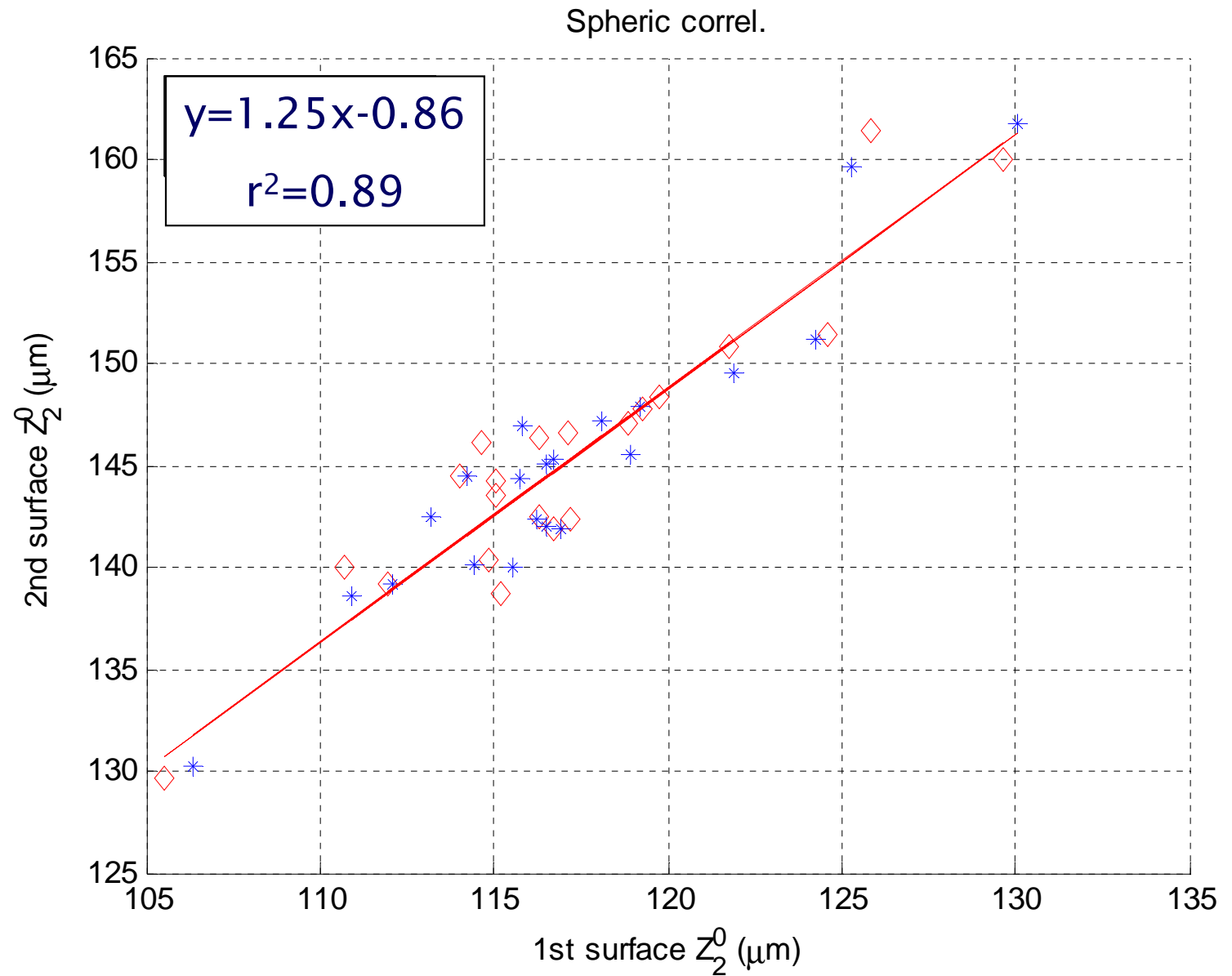
- sphere: Z_2^0

- x- and y- astigmatism: Z_2^{-2} , Z_2^2

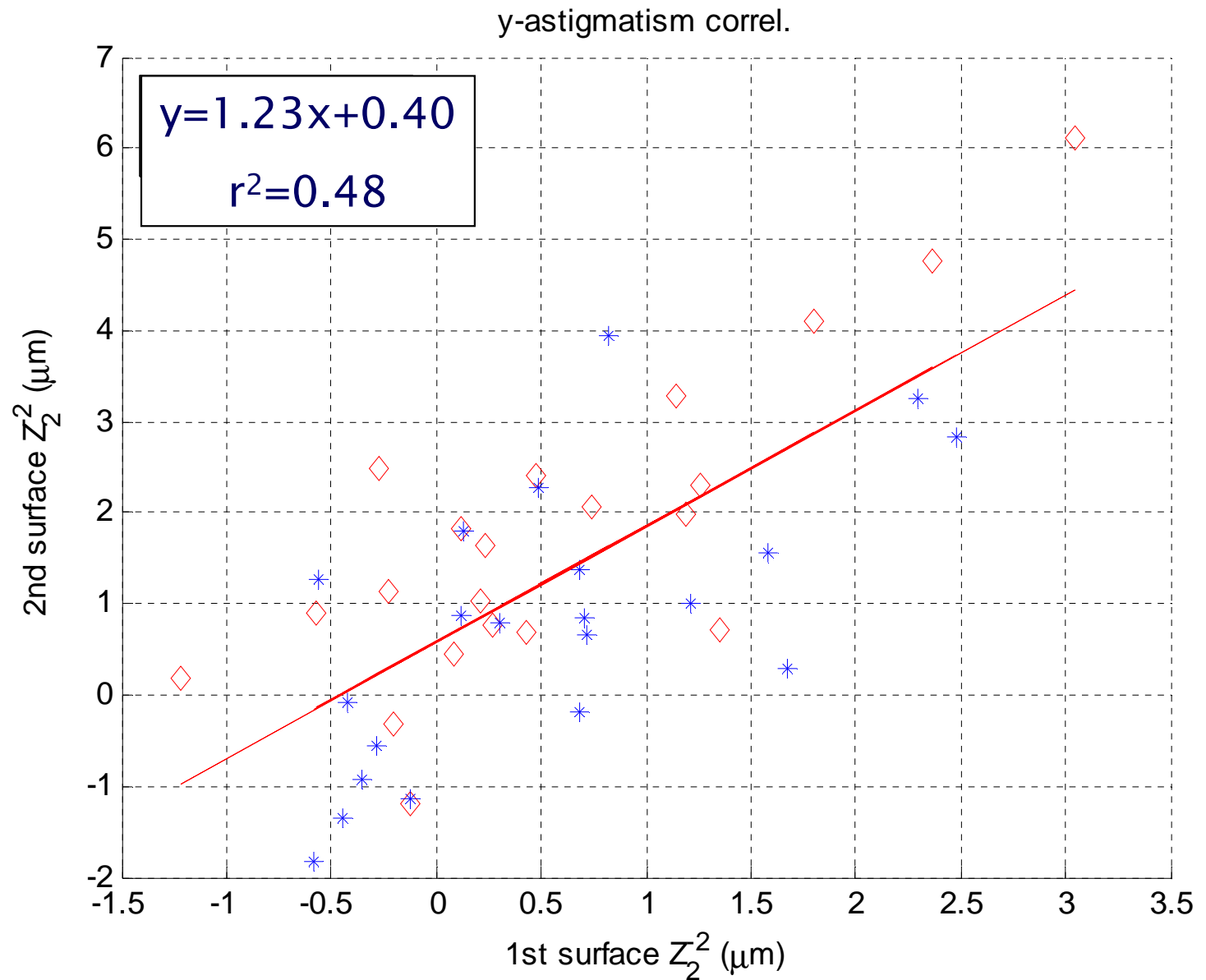
- x- and y- tilt: Z_1^1 , Z_2^{-1}



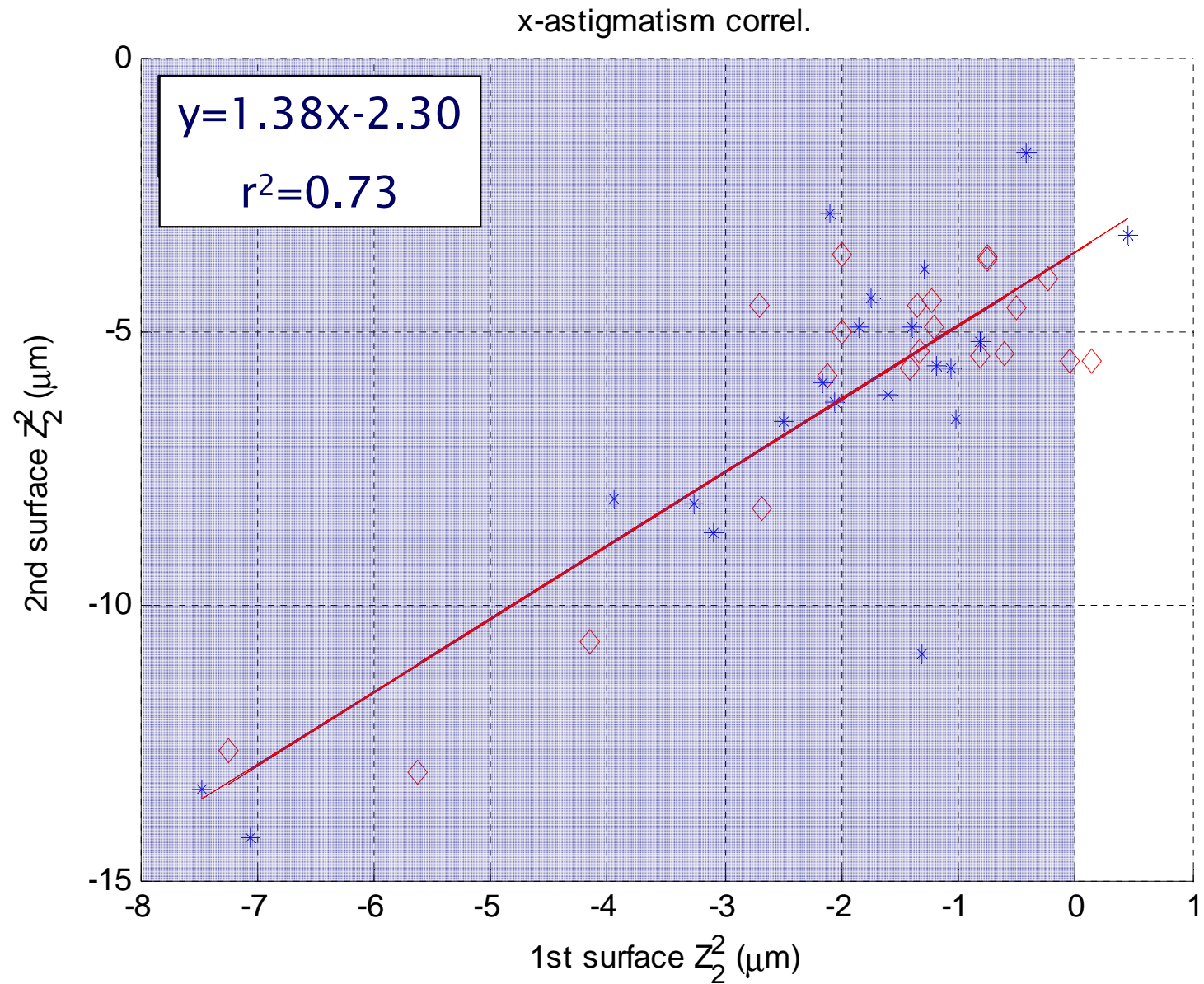
Geometrical correspondence: sphere



Geometrical correspondence: y-astigmatism



Geometrical correspondence: x-astigmatism

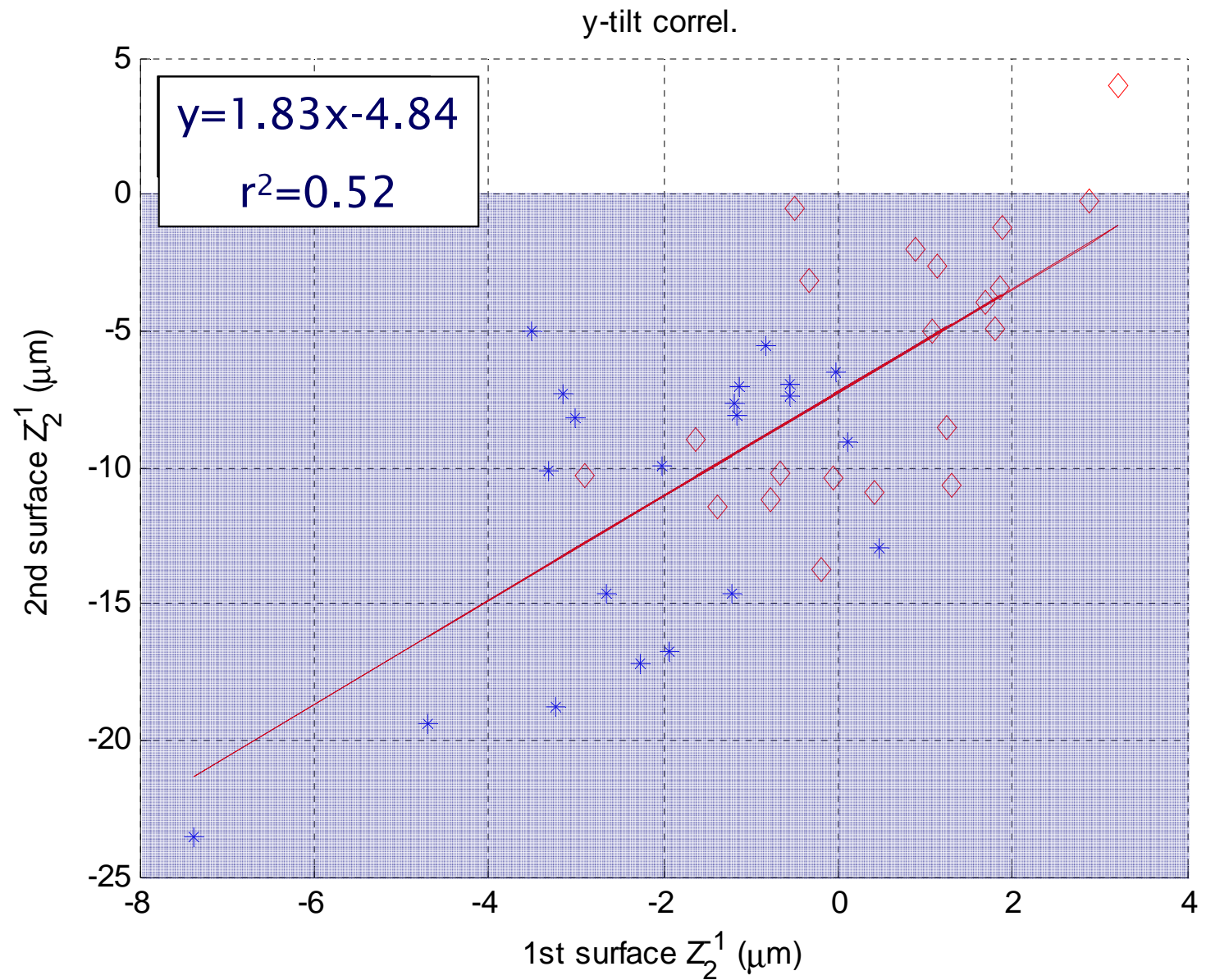


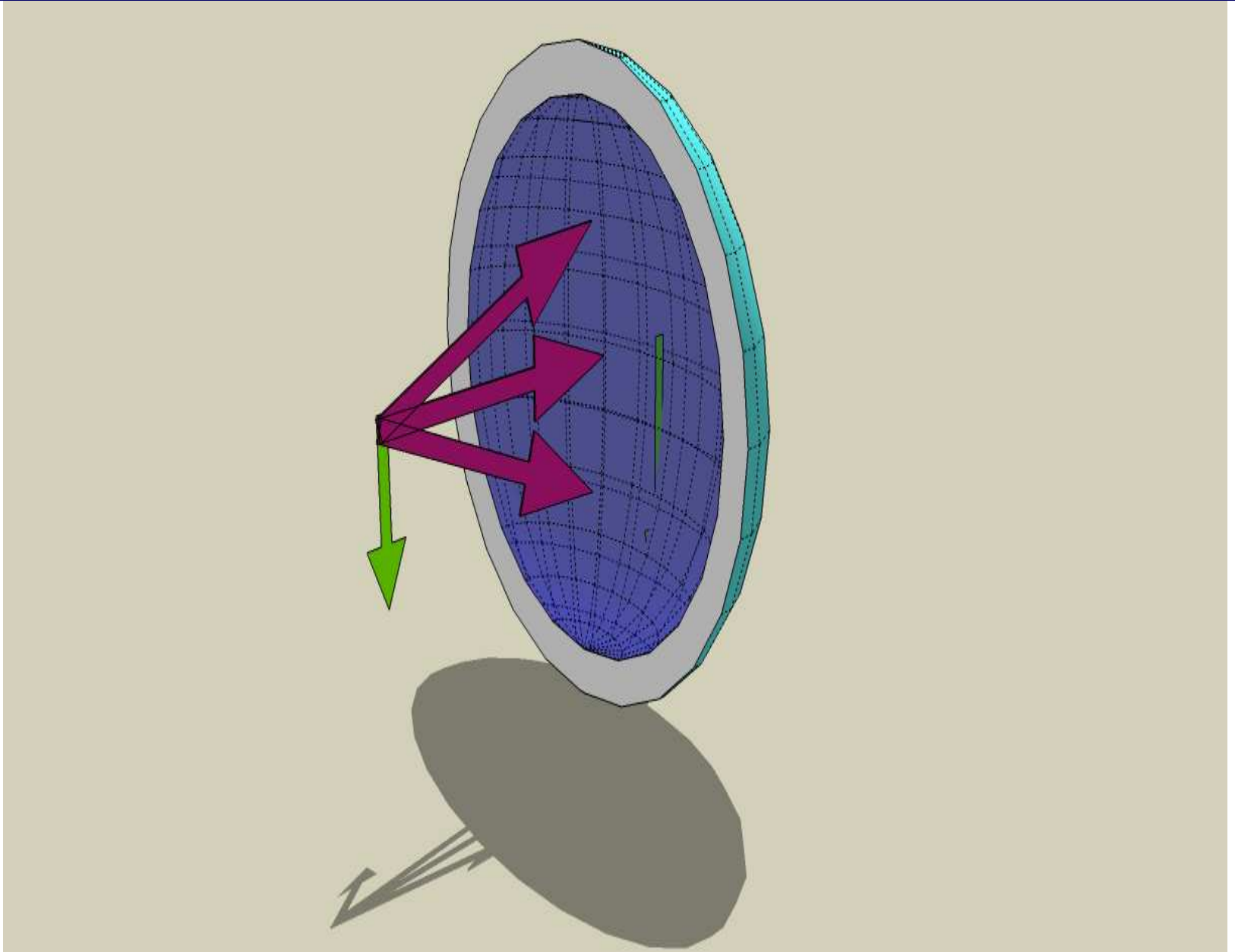
Geometrical correspondence

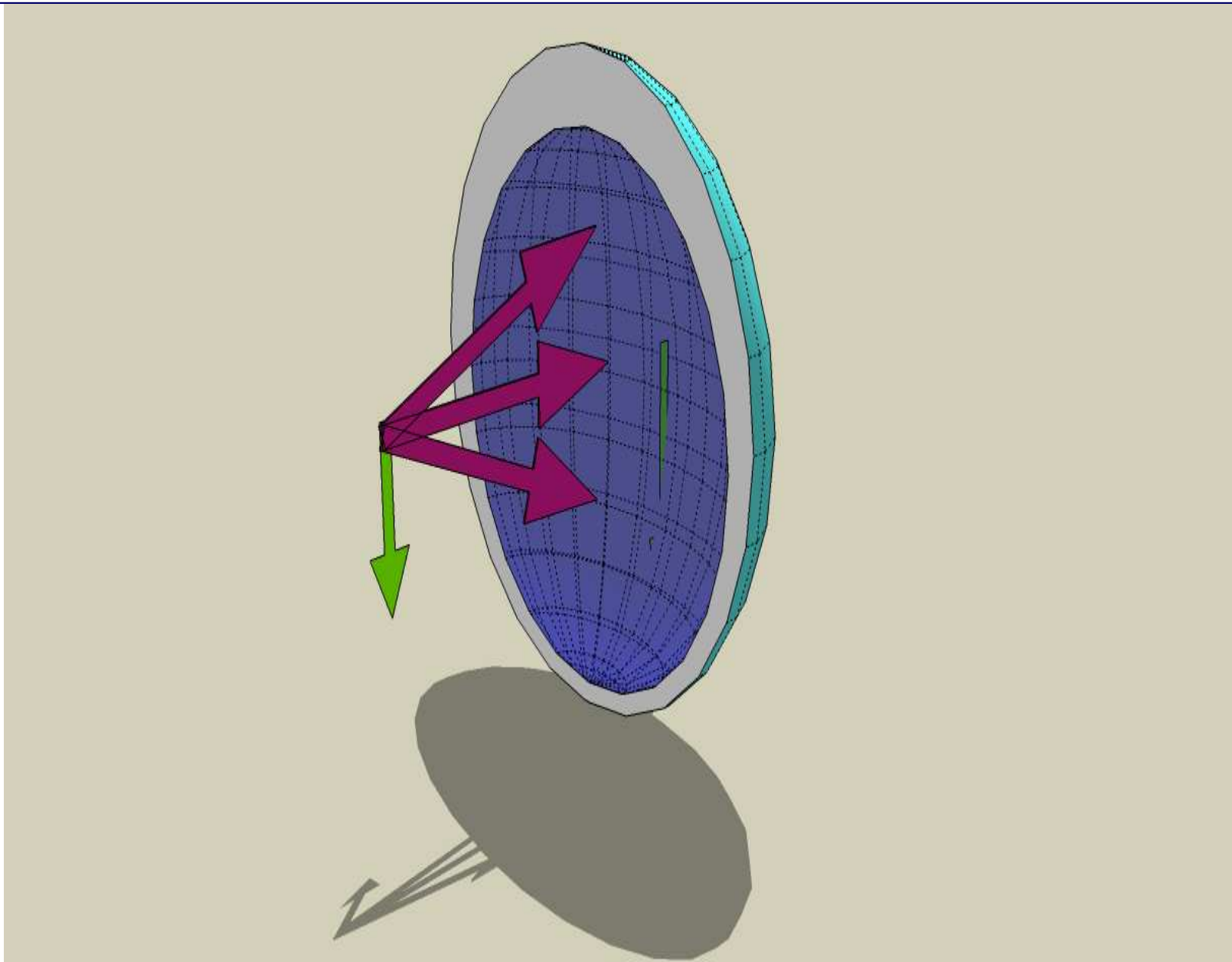
- Very good shape correspondence:
 - Spherical : $r^2=0.89$
 - Astigmatism: $r^2>0.5$
- Precise 2nd surface modeling from 1st surface videokeratometric data
- Lack of correspondence: corneal disease?



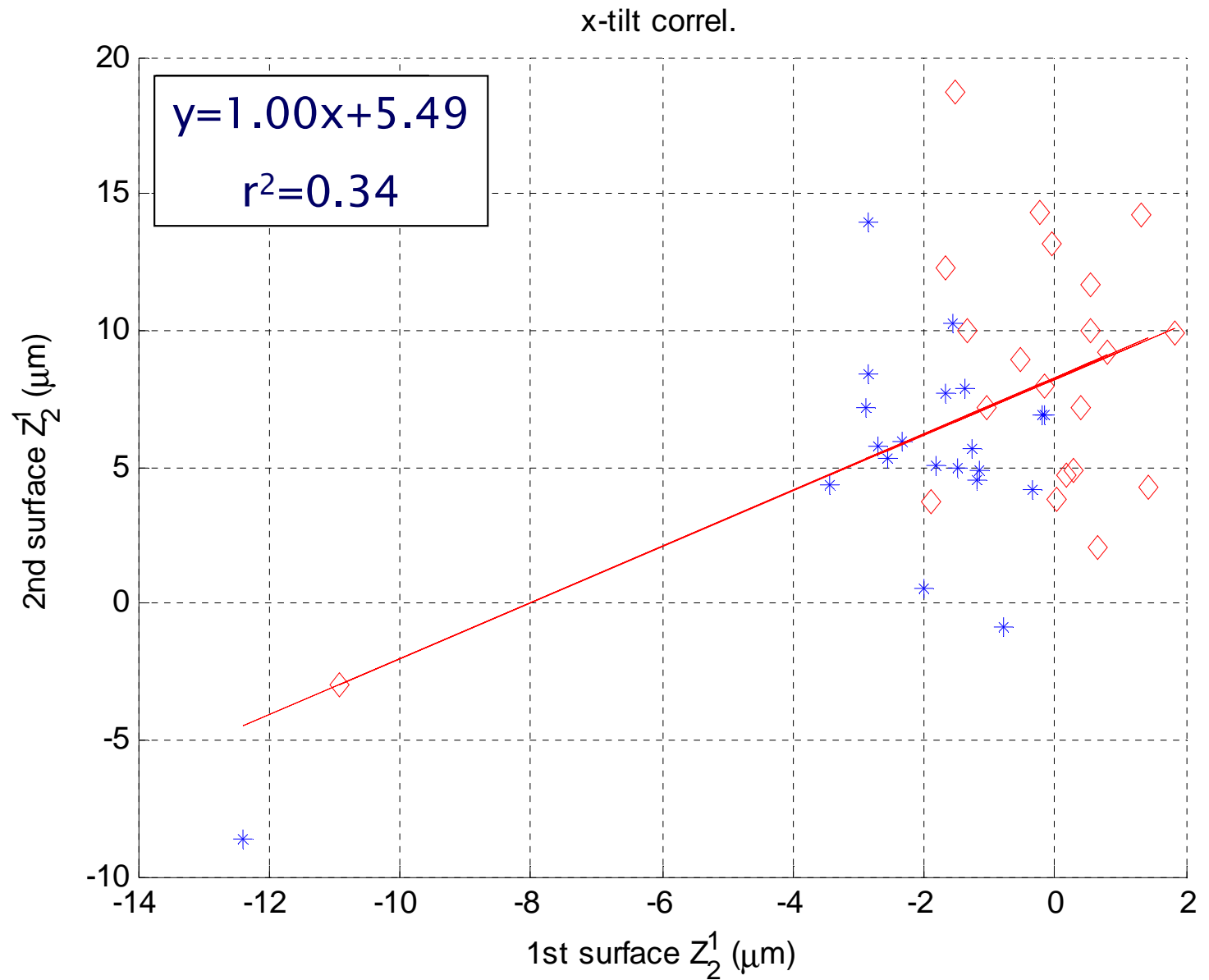
Geometrical correspondence: y-tilt







Geometrical correspondence: x-tilt



Conclusions

	Left eye			Right eye			Both eyes		
	m	n	r^2	m	n	r^2	m	n	r^2
Z_2^0	1.26	-2.85	0.90	1.23	0.77	0.87	1.25	-1.02	0.89
Z_2^{-2}	1.11	0.21	0.43	1.39	0.98	0.66	1.27	0.58	0.52
Z_2^2	1.37	-3.48	0.69	1.31	-3.62	0.76	1.34	-3.55	0.72
Z_1^{-1}	1.73	-7.69	0.36	2.04	-7.25	0.42	1.90	-7.26	0.52
Z_1^1	1.07	7.65	0.37	<u>0.82</u>	<u>8.77</u>	<u>0.18</u>	1.03	8.23	0.31

We found a very good correspondence between first and second corneal surfaces



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Tilt correspondence is also good: Alignment effect?

Second surface is tilted downwards: gravity?



Conclusions

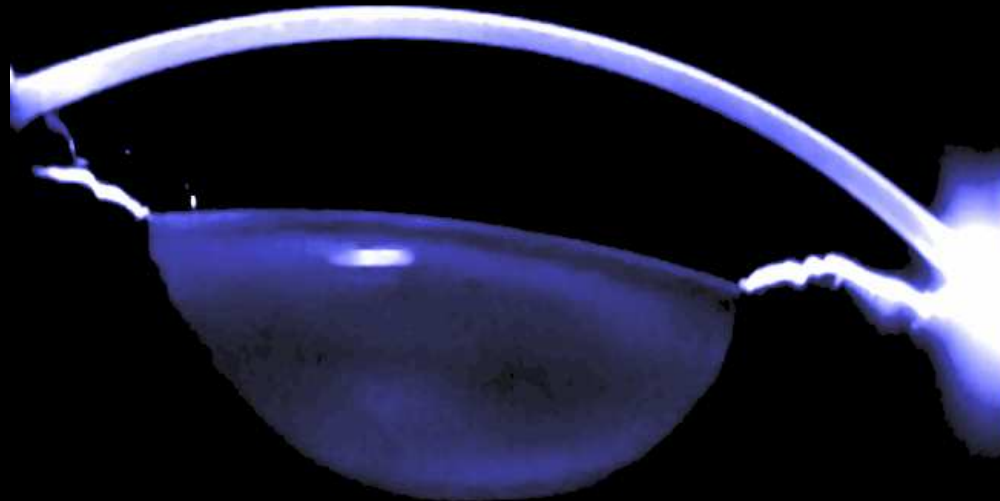
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Left eye correlates worse than right eye: dominance?





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Universidad de Alicante



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