Geometrical correspondence between first and second corneal surfaces

Collaborators

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Funding

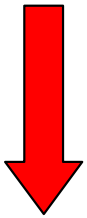
Spanish Ministry of Science through project FIS2005-05053

Initial Hypothesis

Healthy eyes

No corneal diseases

Uniform IOP distribution



Corneal shape must be correlated:

Spherical and Astigmatic curvatures

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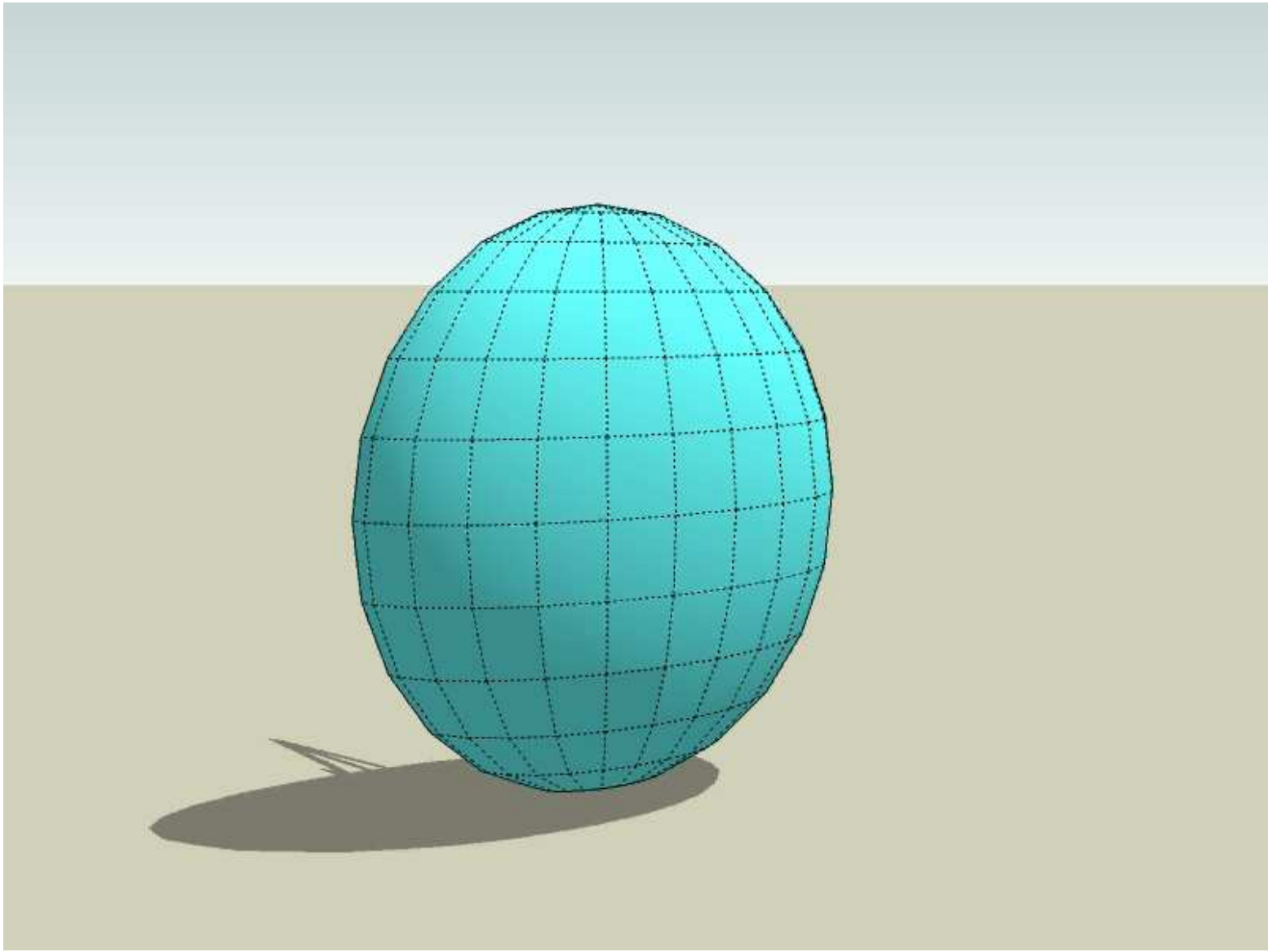
Initial Hypothesis



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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 (21LE, 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

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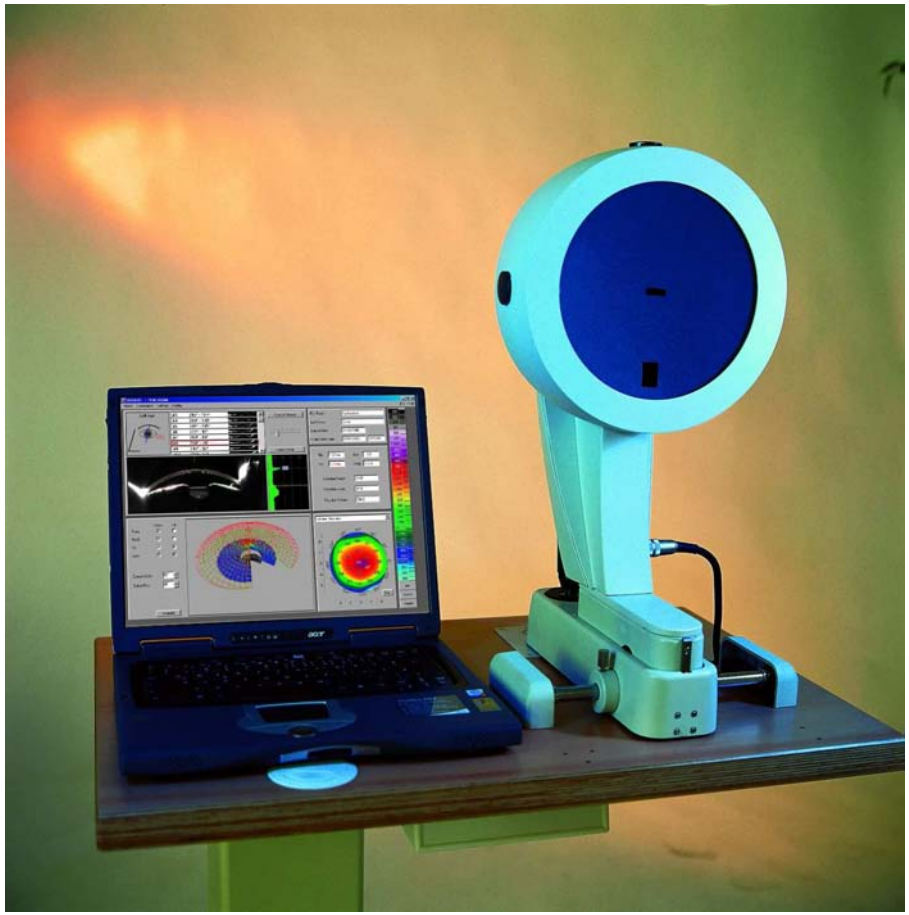
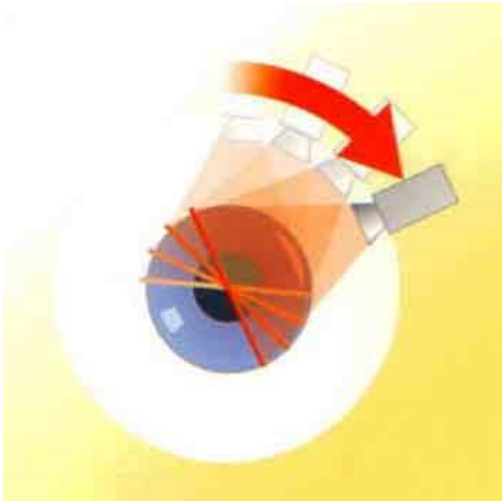
Subjects and methods:





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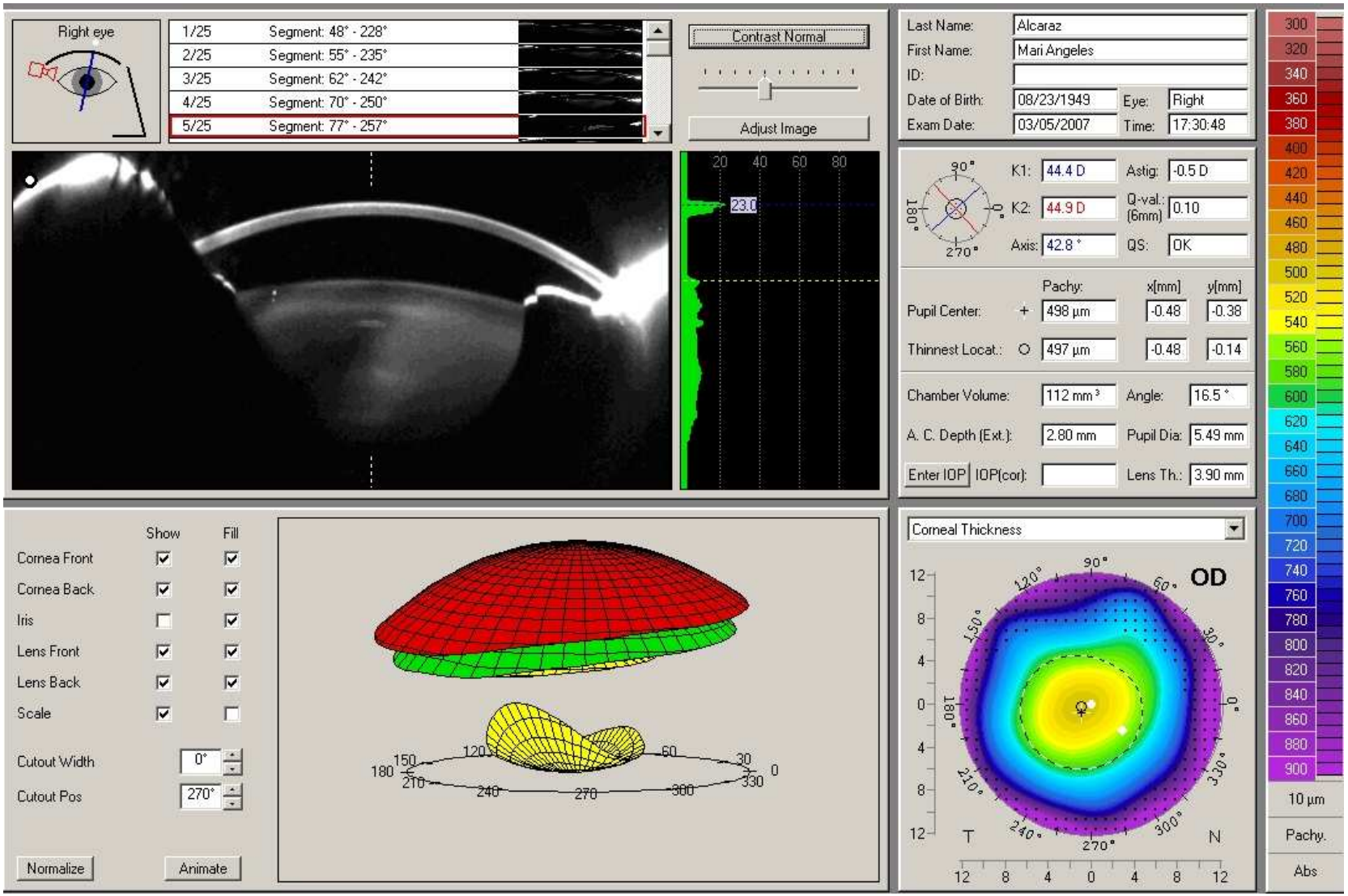

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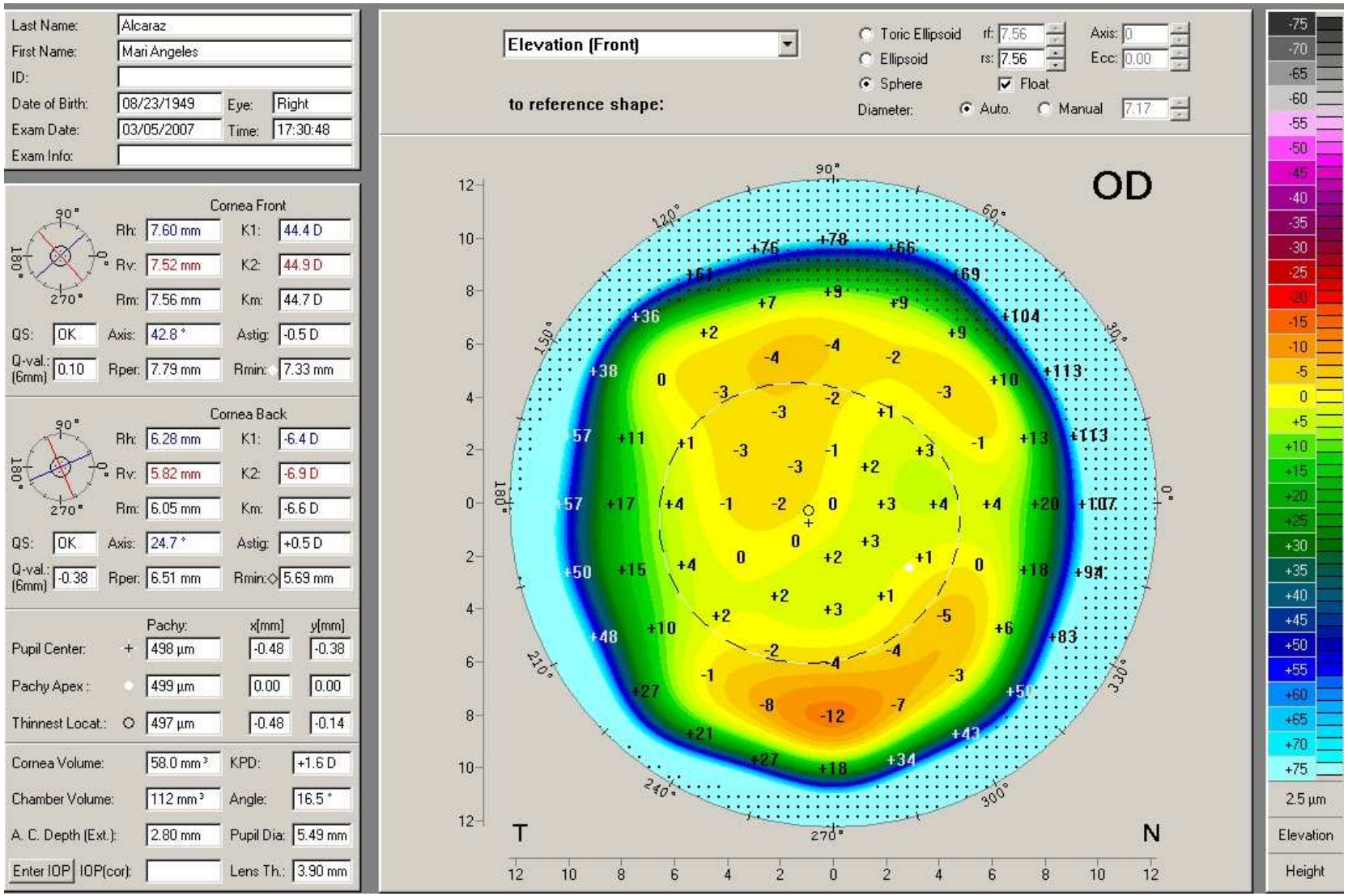

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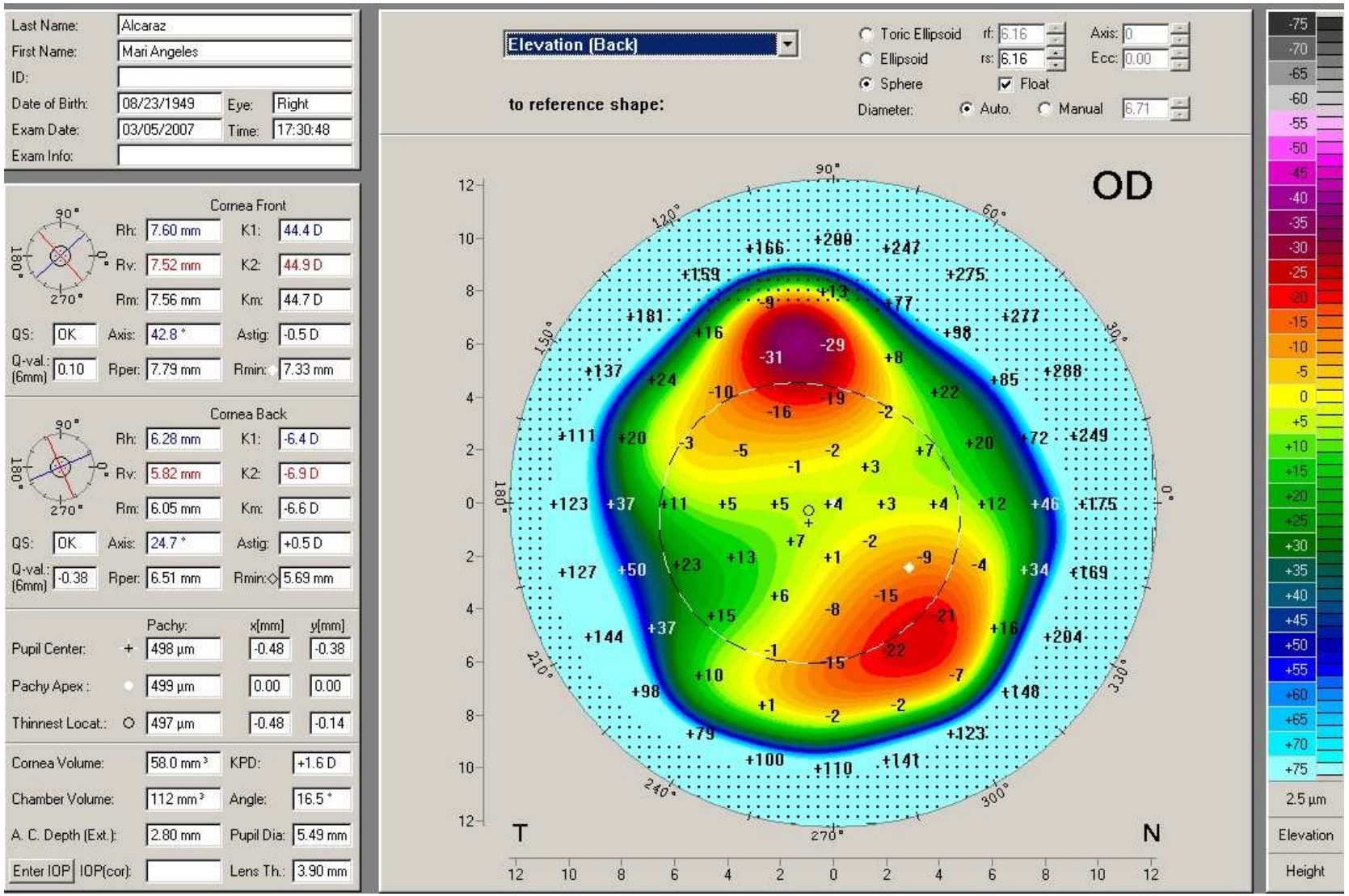

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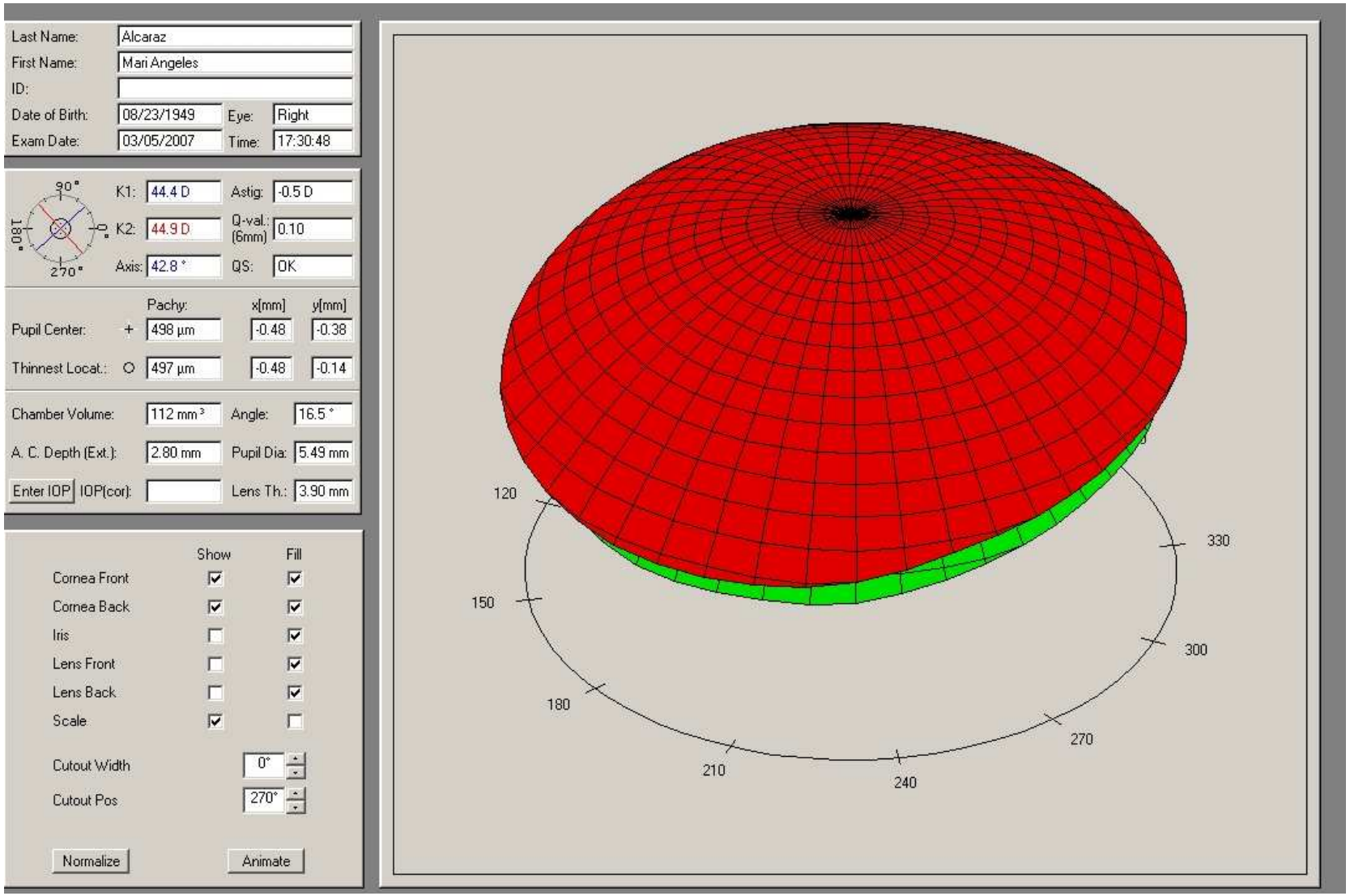

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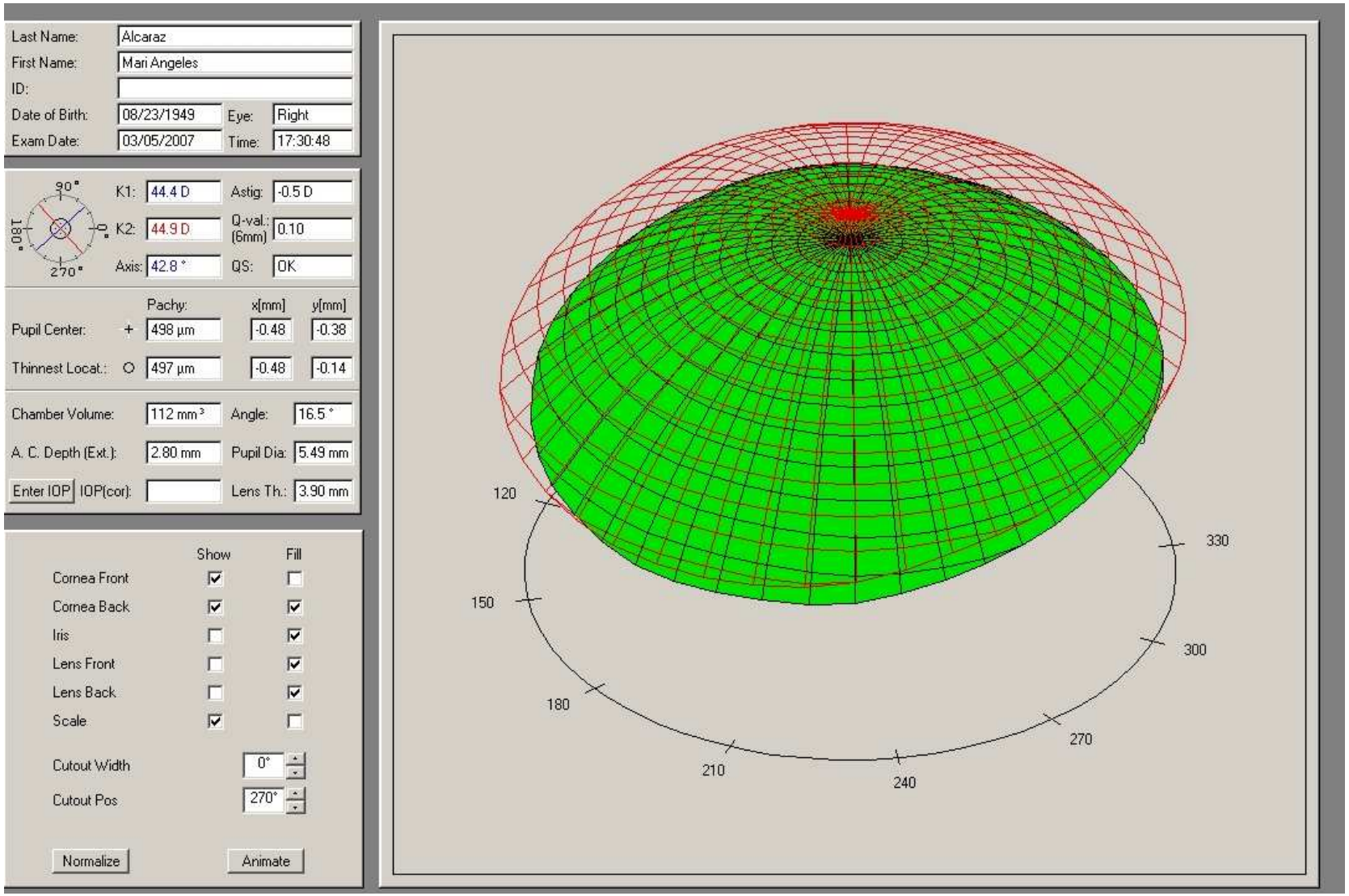
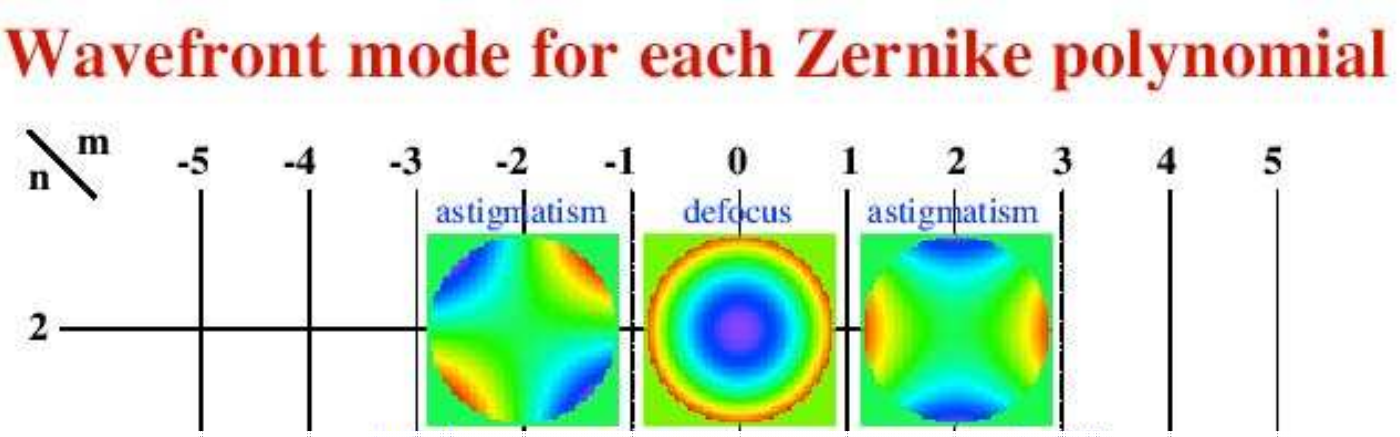


We check:



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}

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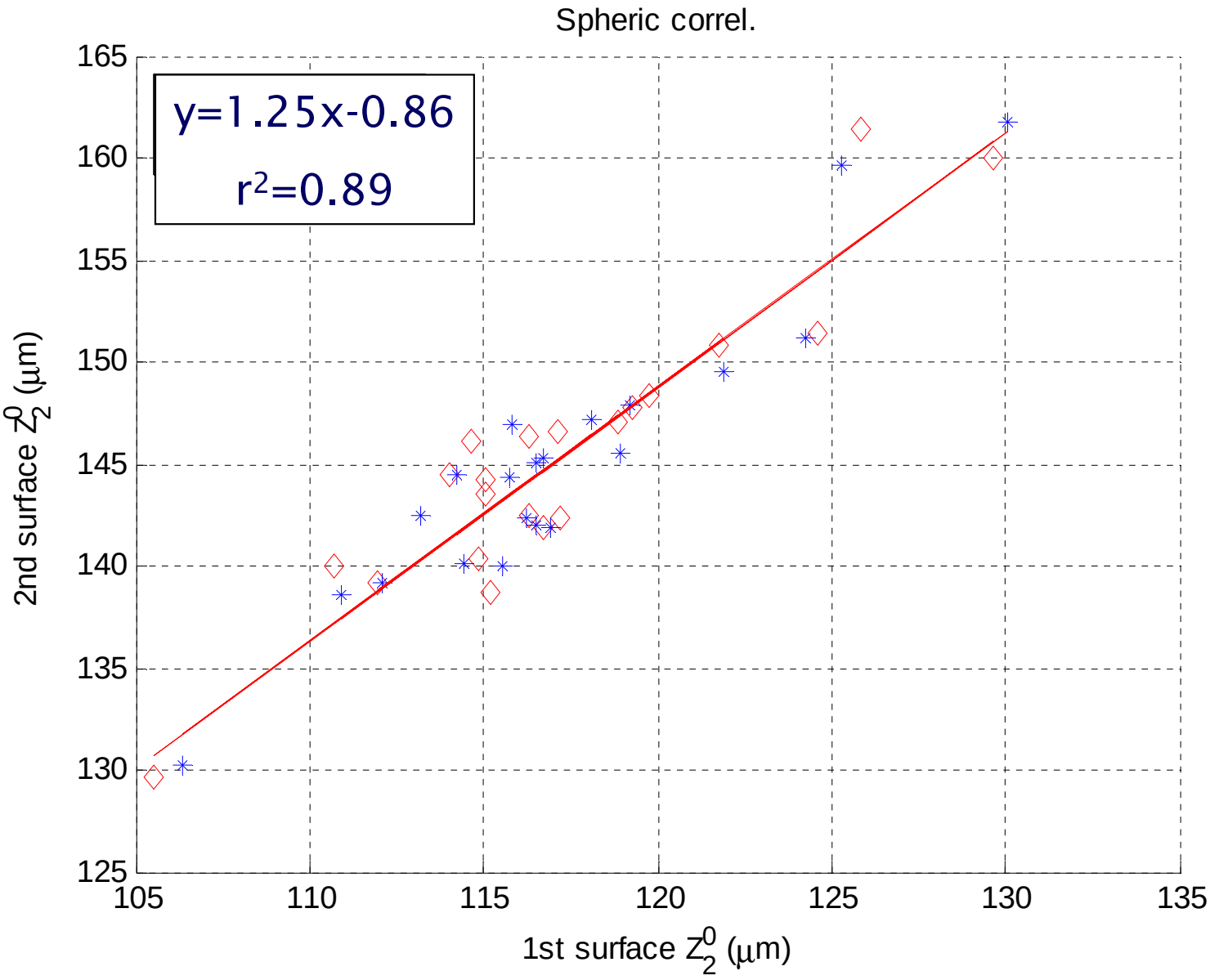
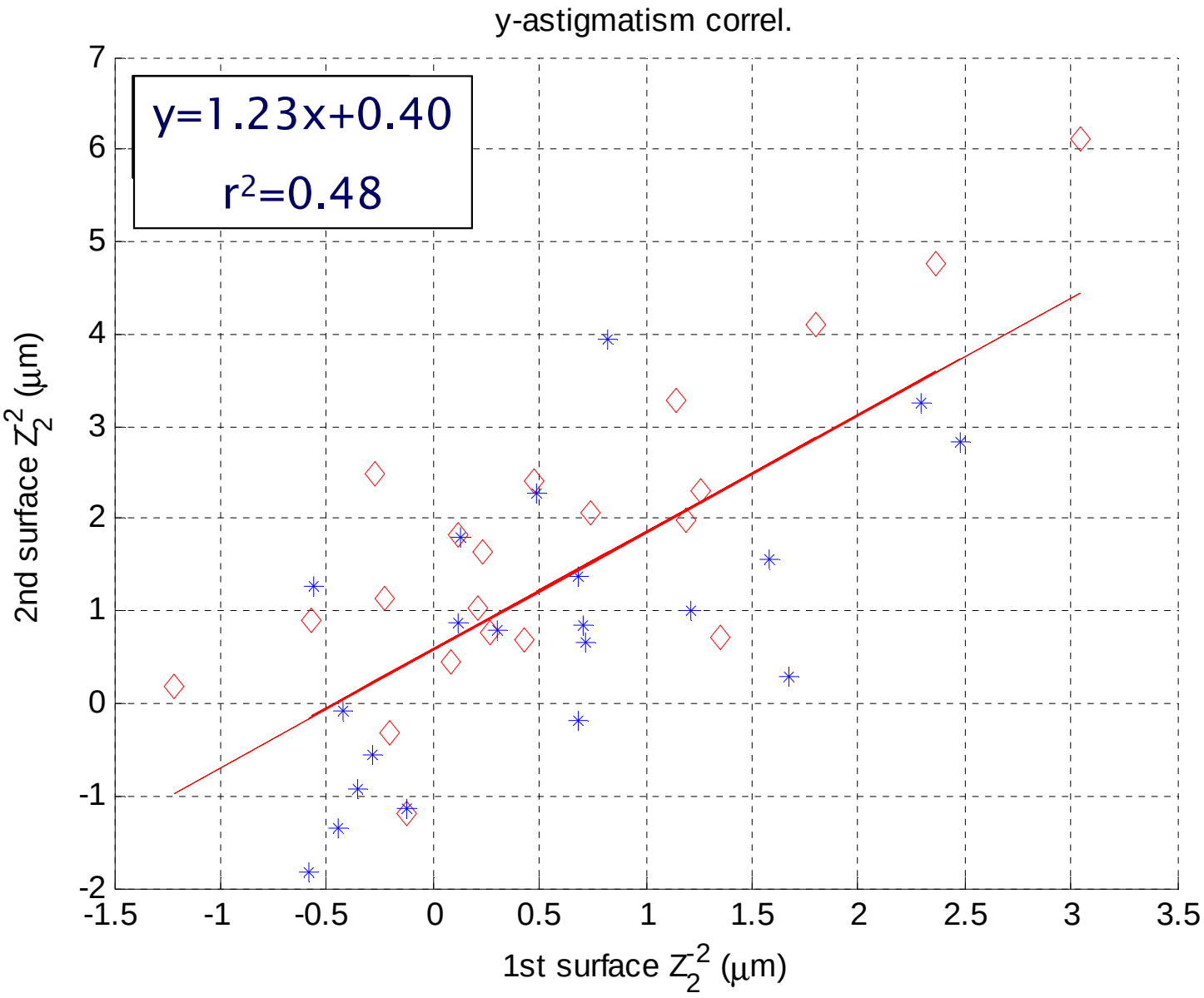
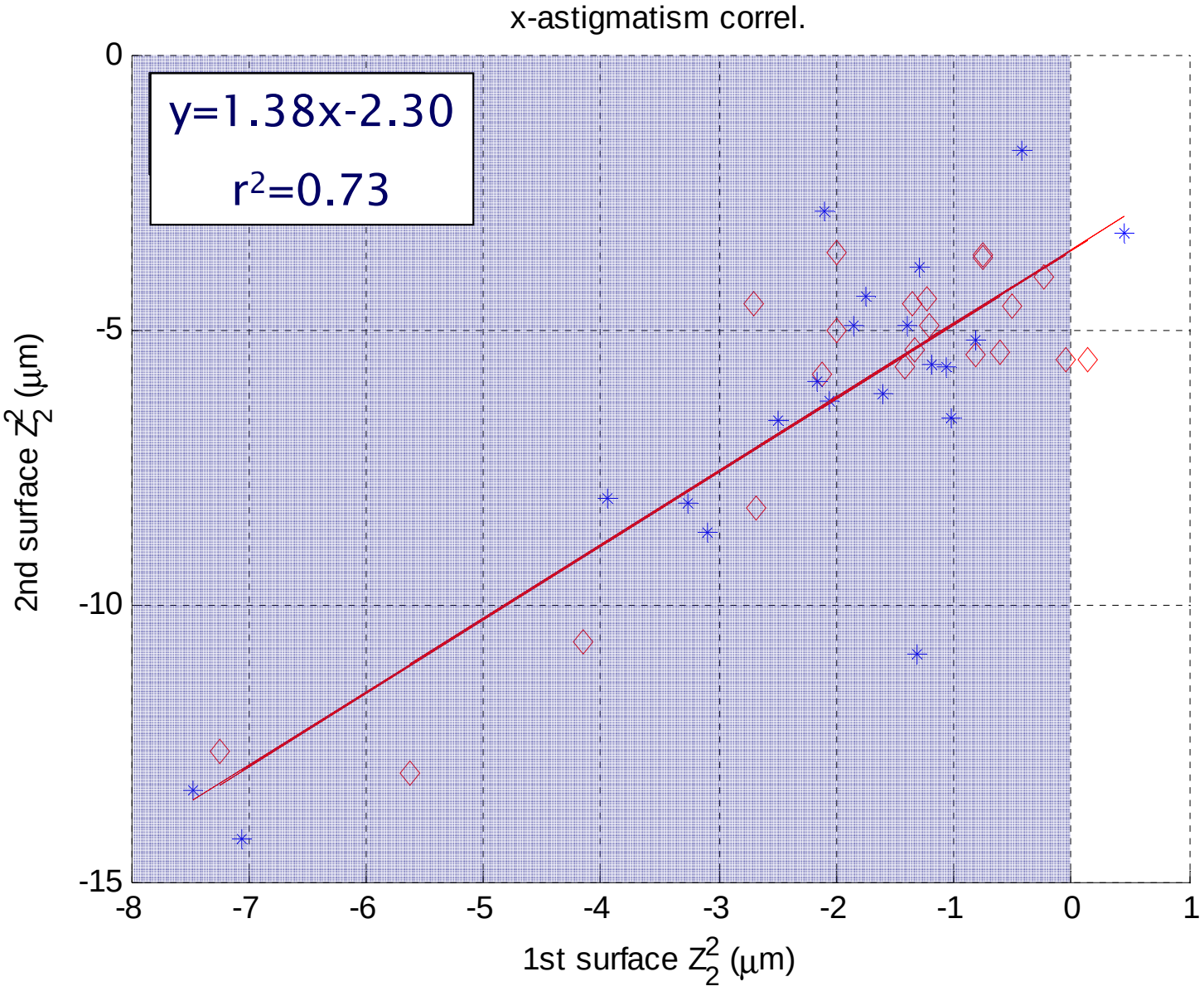
Geometrical correspondence: sphere



Geometrical correspondence: y-astigmatism



Geometrical correspondence: x-astigmatism



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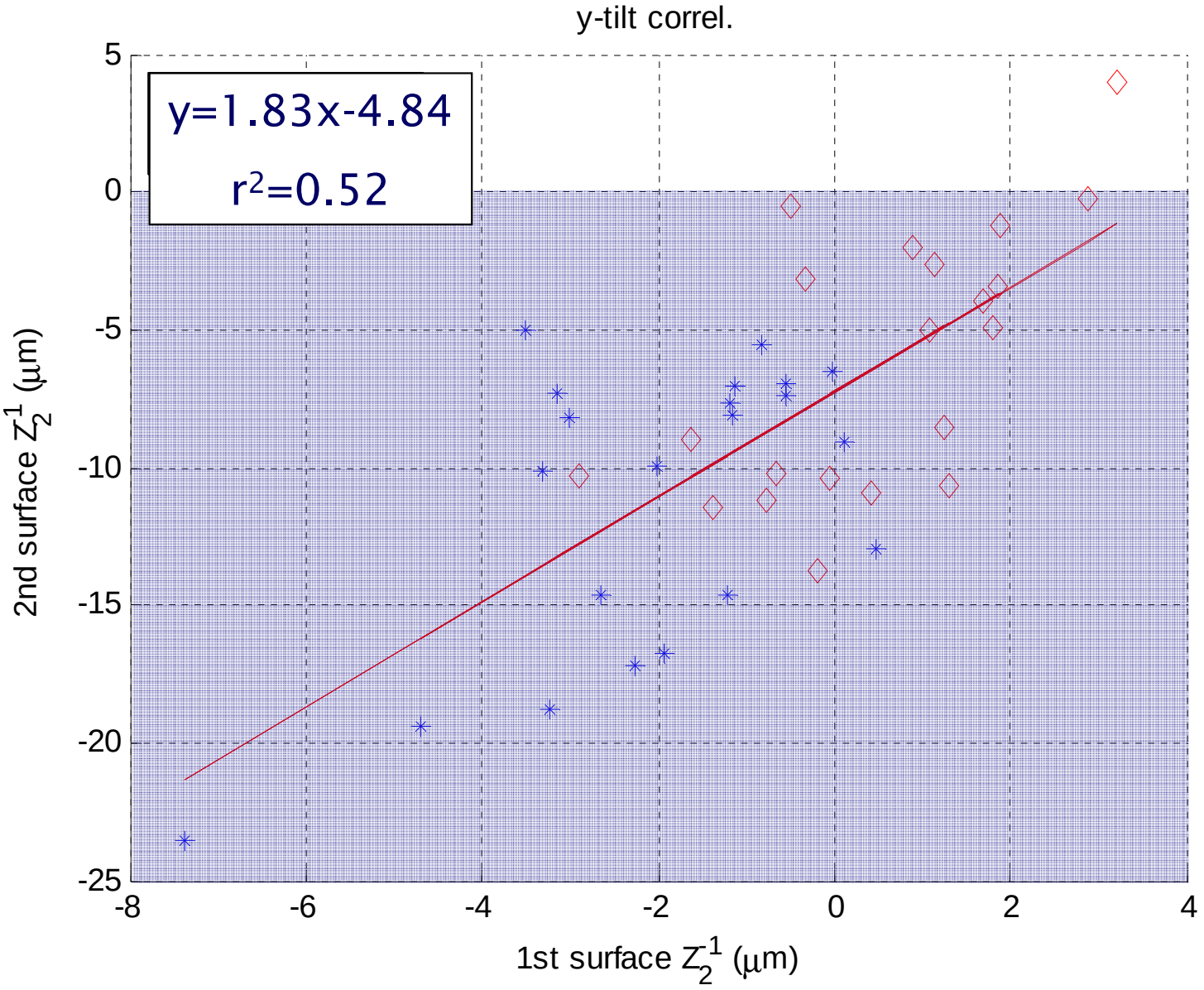
Geometrical correspondence

- 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



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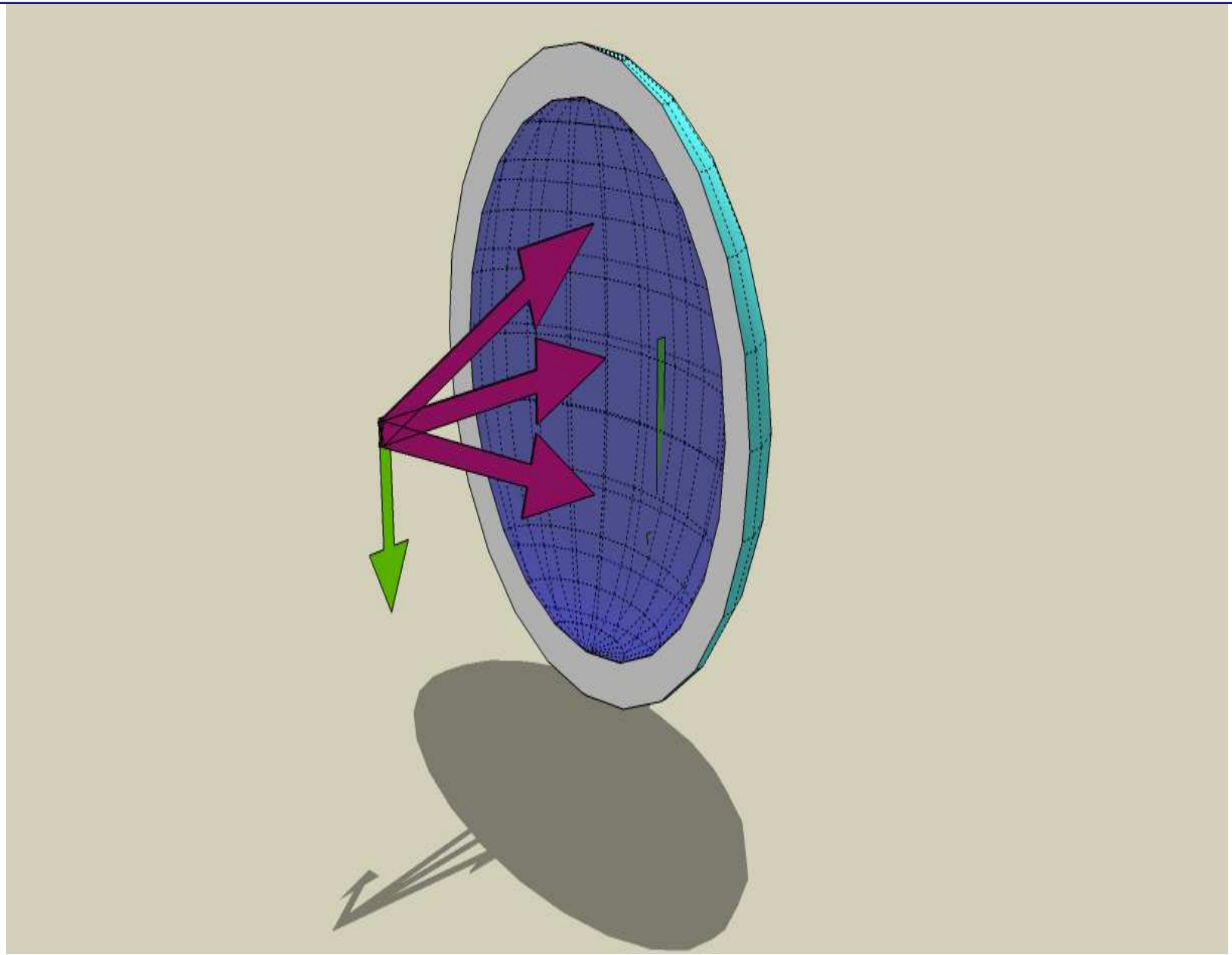
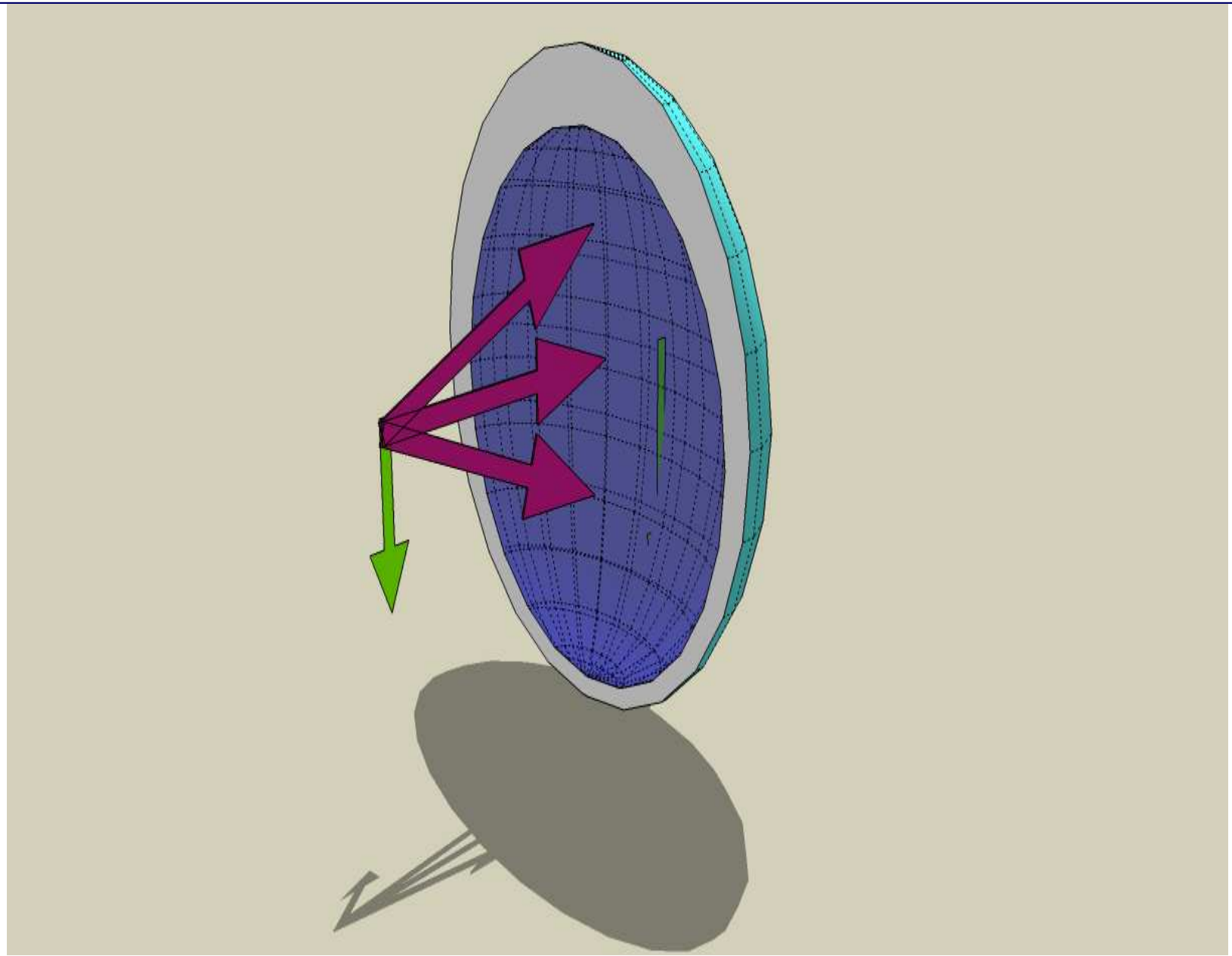
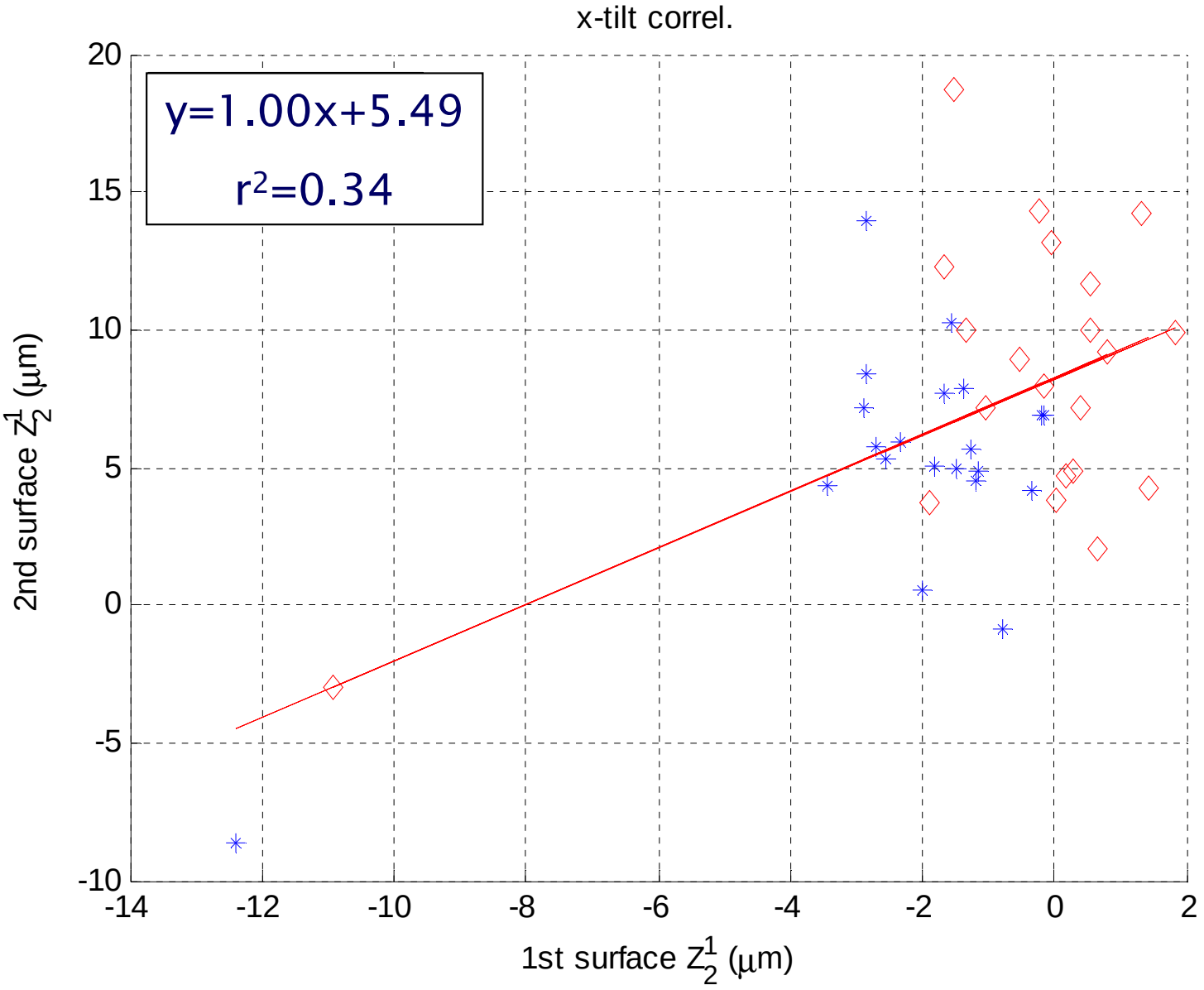




Geometrical correspondence: x-tilt



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	0.82	8.77	0.18	1.03	8.23	0.31

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

Conclusions

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Tilt correspondence is also good: Alignment effect?

Second surface is tilted downwards: gravity?

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Left eye correlates worse that right eye: dominance?

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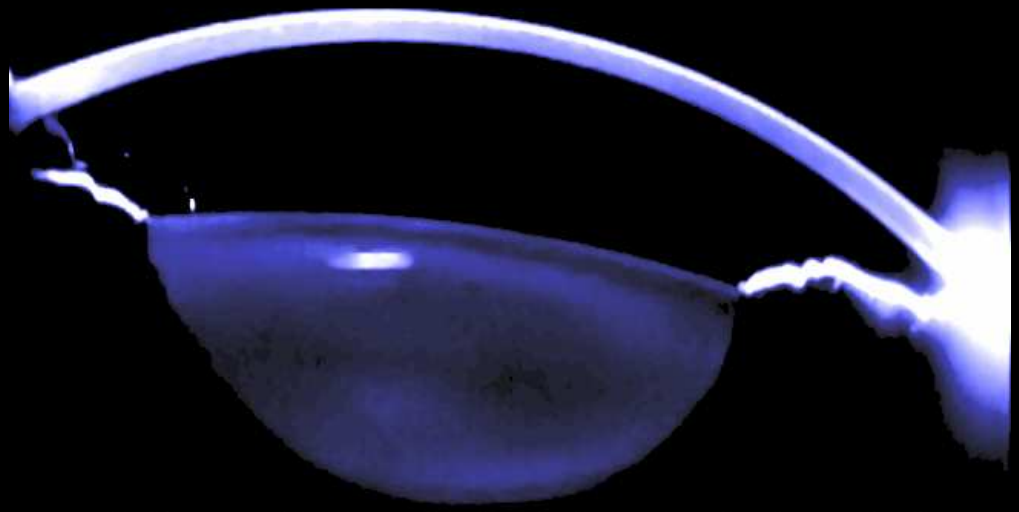

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