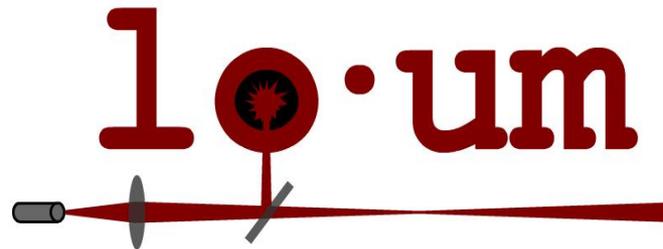


Adaptive optics as a tool to improve visual outcomes in refractive surgery

Pablo Artal

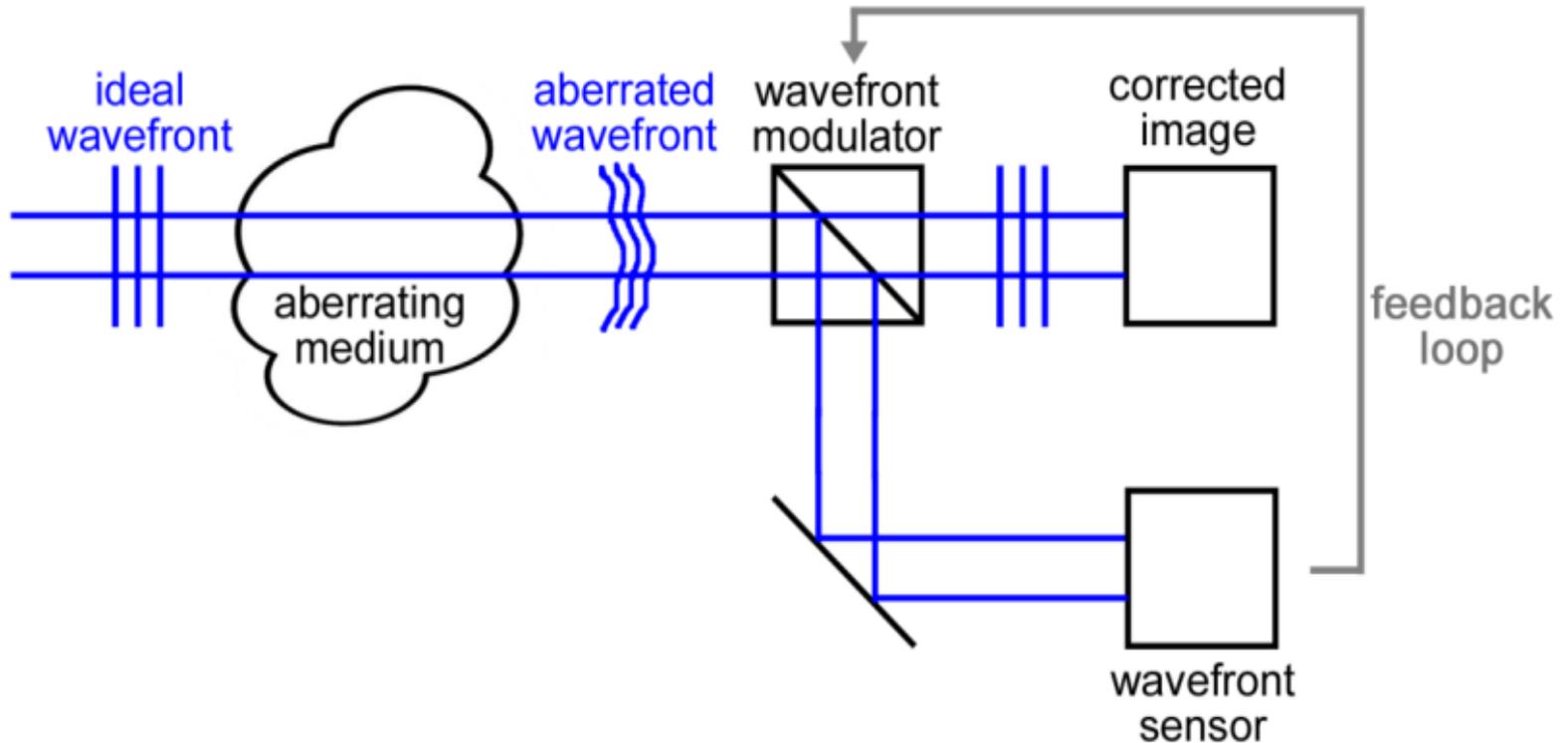
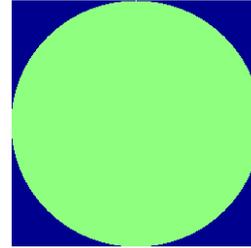
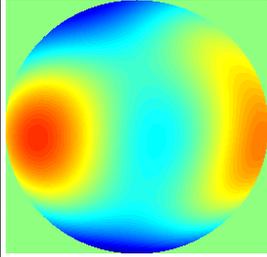
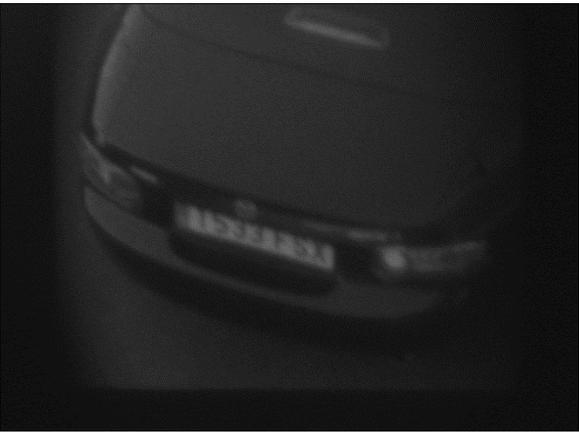
LABORATORIO DE OPTICA

UNIVERSIDAD DE MURCIA, SPAIN

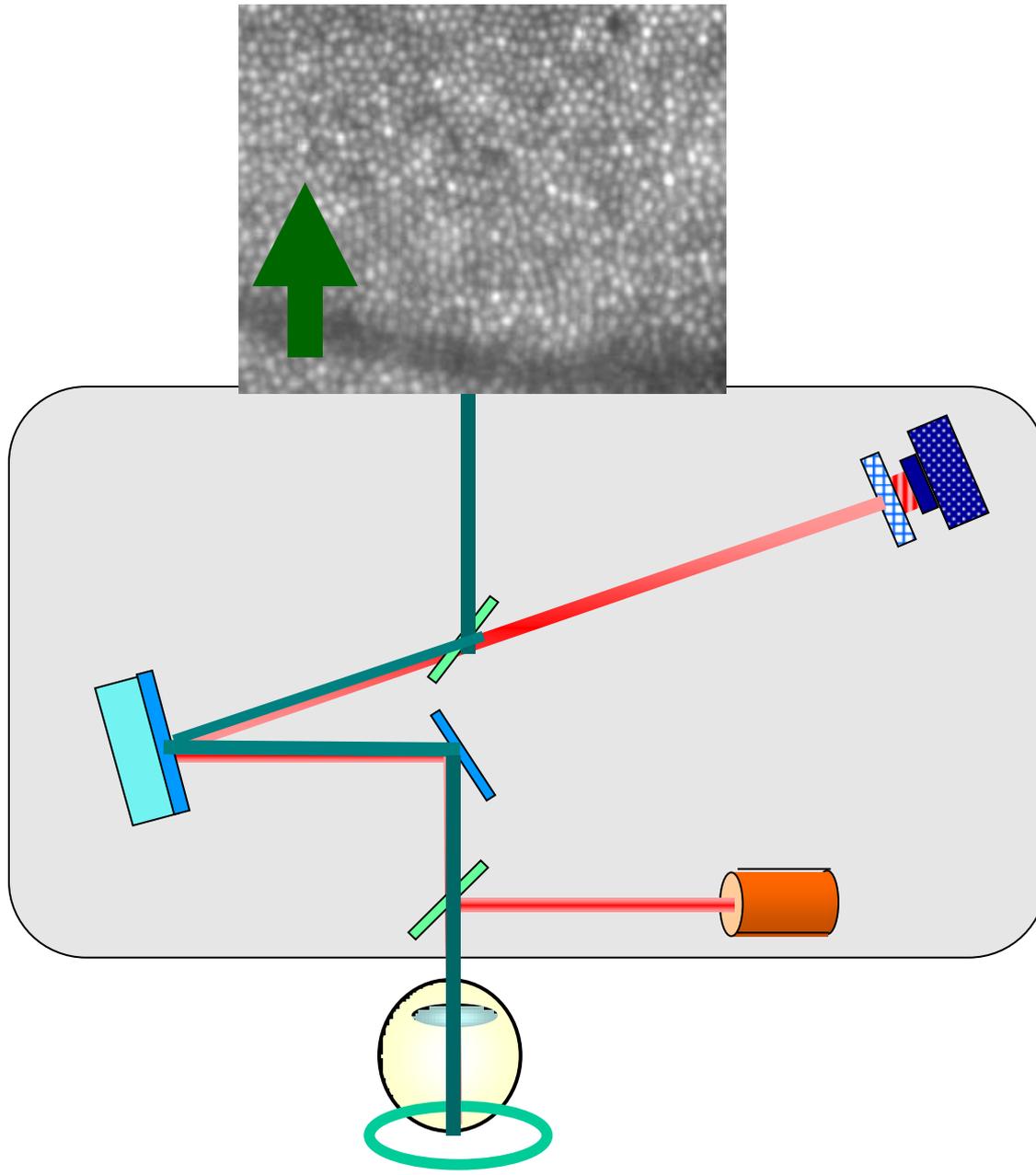


15th international Schwind symposium,
Vancouver, Canada, July 2014

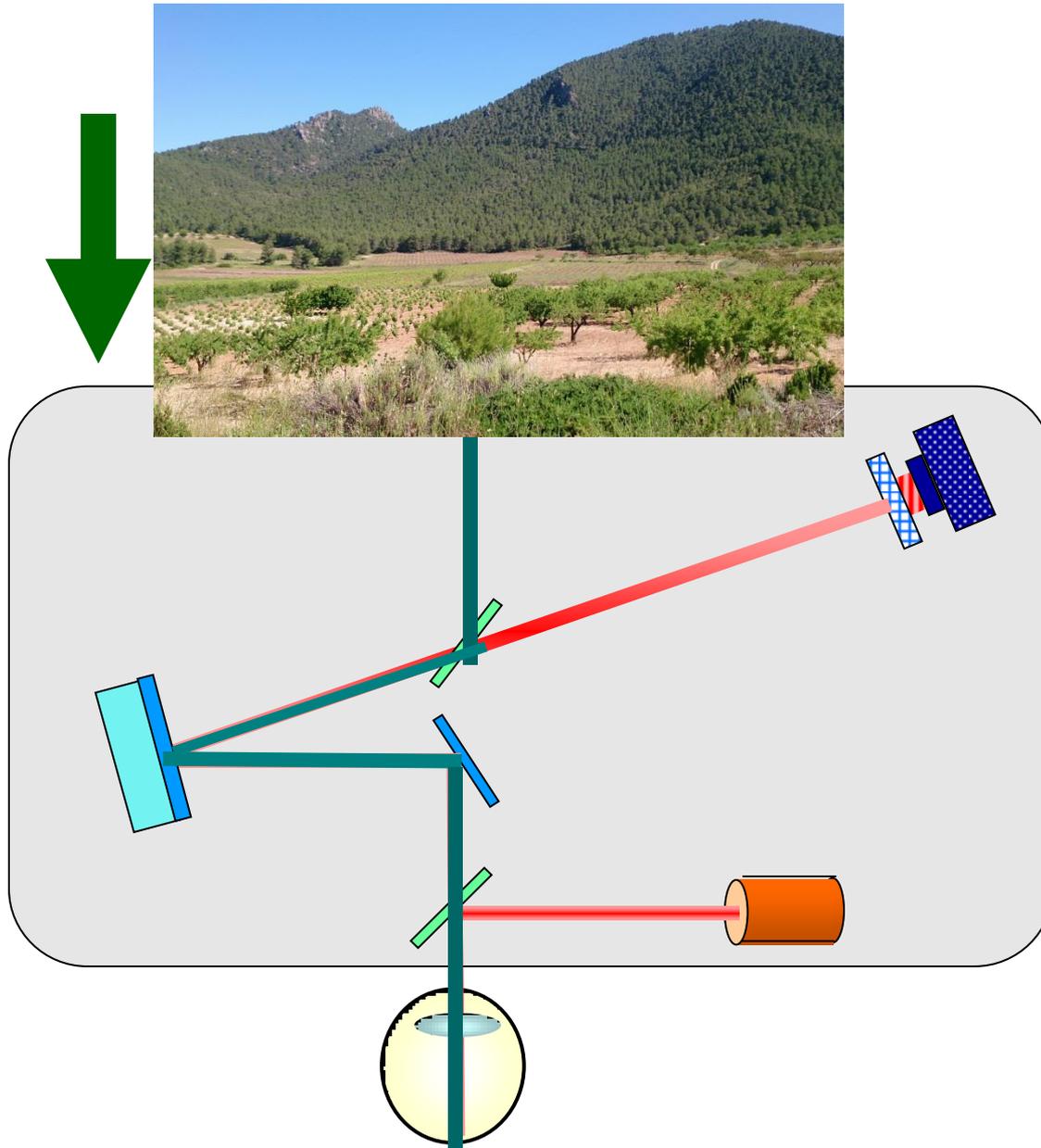
Adaptive Optics



Adaptive Optics in the eye

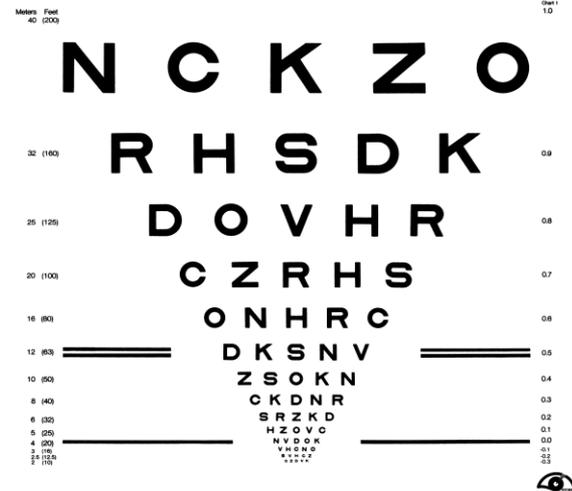
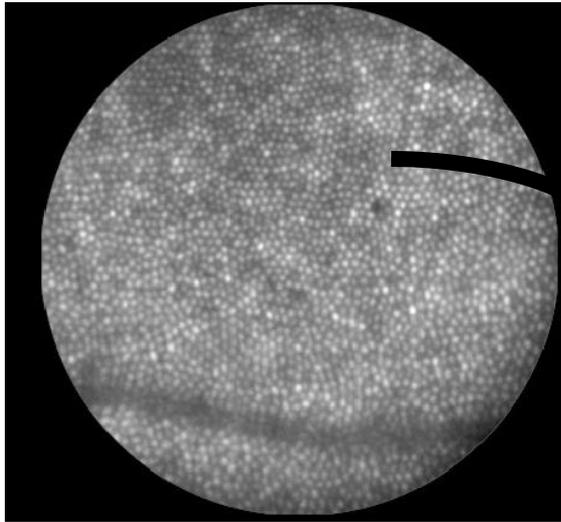


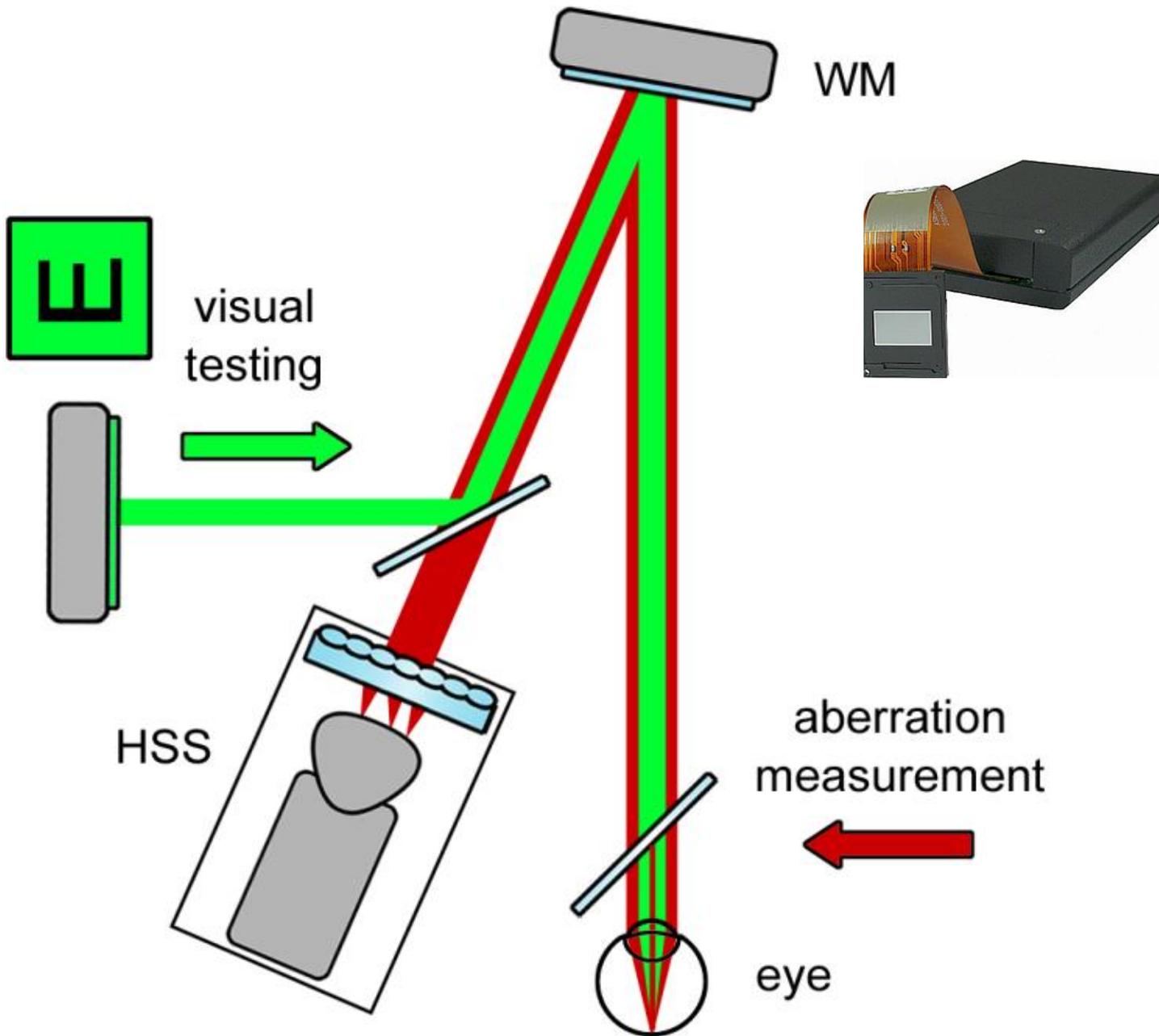
Adaptive Optics in the eye



Adaptive Optics in the eye

from retinal imaging...
to visual evaluation



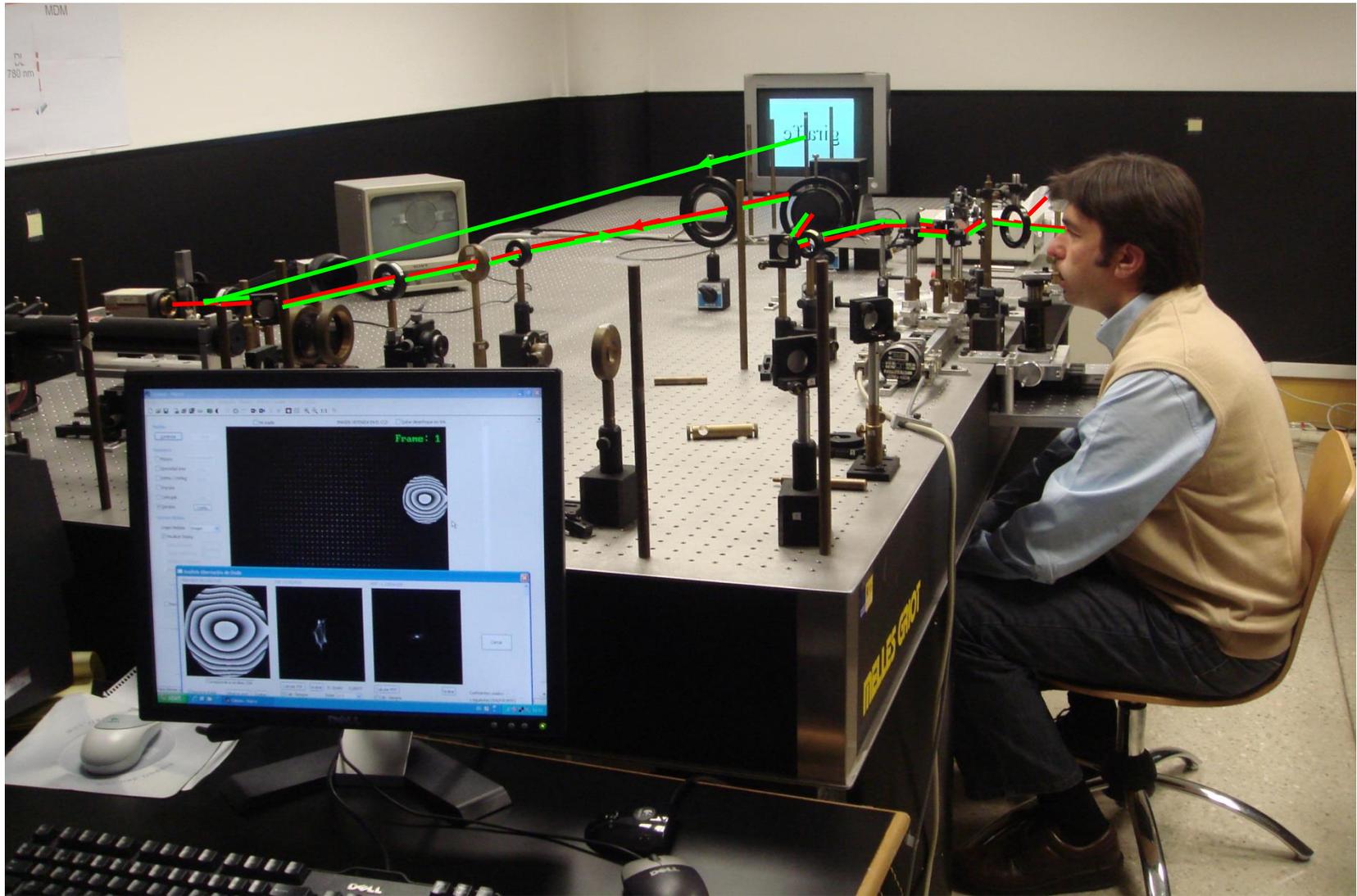


Adaptive Optics in the eye

from the lab to the clinic

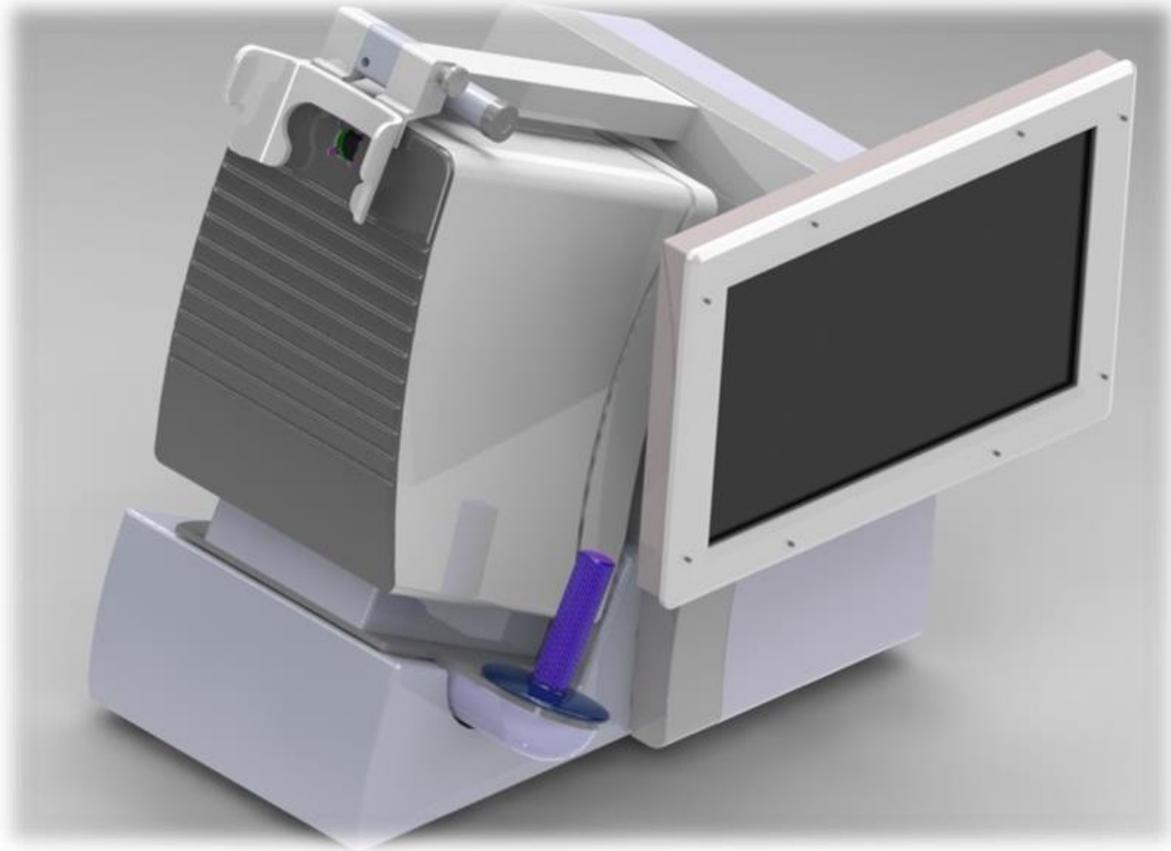
...toward practical applications

Early laboratory version of the AO Vision Analyzer



2005

Voptica clinical compact version of the AO Vision Analyzer



2013

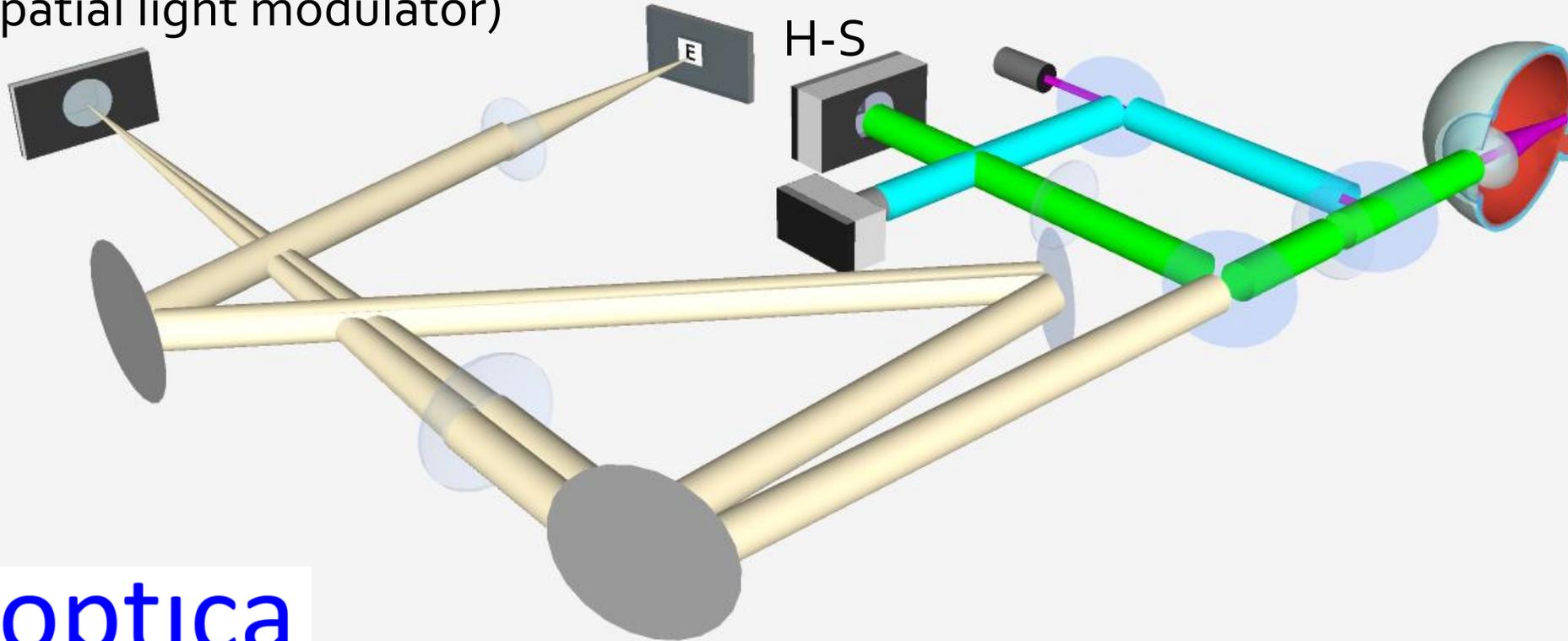
voptica
visual
smartoptics

Adaptive Optics Vision Analyzer (AOVA)

LCOS
(spatial light modulator)

Micro-display

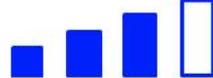
H-S



I. Objective HS refraction and aberrations measurements

AOVA - Adaptive Optics Vision Analyzer

bastida, antonio **Anonymous**

Activity Ranking  

Patients' Opinion  

Objective Refraction

Sphere(D) : Cylinder(D) : Axis(°) :

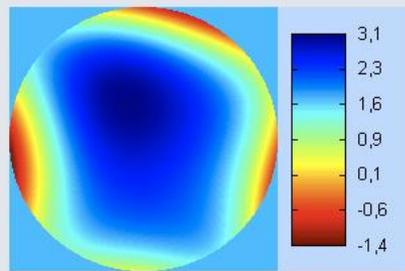
Pupil Radius (mm)

Degree

Comments

 Save Results  Print

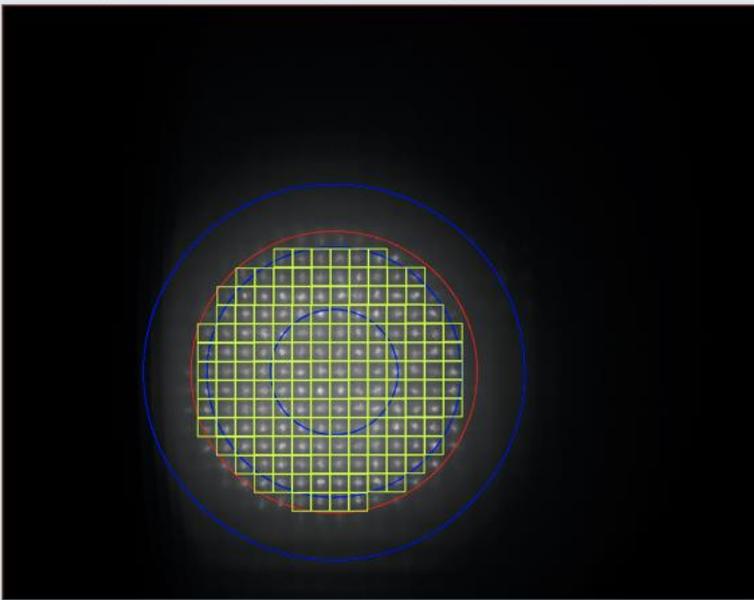
H-S Live



RMS

Total (μm): **0,89**

High Order (μm): **0,38**



   Save Image

Change the view [Go to Vision Test](#)

ES  10:46 08/04/2013

II. Visual testing (VA, CSF, etc...) under any optics and different object distances...

AOVA - Adaptive Optics Vision Analyzer

barreda, juan luis Anonymous

Activity Ranking: [Bar chart with 4 bars of increasing height]

Patients' Opinion: [4 stars, 3 filled, 1 empty]

Visual Acuity Reading Acuity Astigmatism Test LogMAR CHART LANDOLT CHART

Contrast Sensitivity REAL SCENES GLARE DISABILITY PUPILOMETRY COLOR TEST

ES 13:27 09/04/2013

II. Visual testing (VA, CSF, etc...) under any optics and different object distances...

AOVA - Adaptive Optics Vision Analyzer

bastida, antonio Anonymous

Activity Ranking Patients' Opinion

Estimated Radius: 2.25 *Patient sees the test through Subjective Refinement*

Astigmatism Refinement . Push button and ask the patient...

40 cm 60 cm Infinity

Low Order Subjective Refraction
Sph (D): 0 Cyl (D): 0 Axis (°): 0

High Order Subjective Refraction
Z6.Trefoil 0,050

ES 10:48 08/04/2013

Eye's Optics

Objective characterization



Adaptive Optics Vision Analyzer

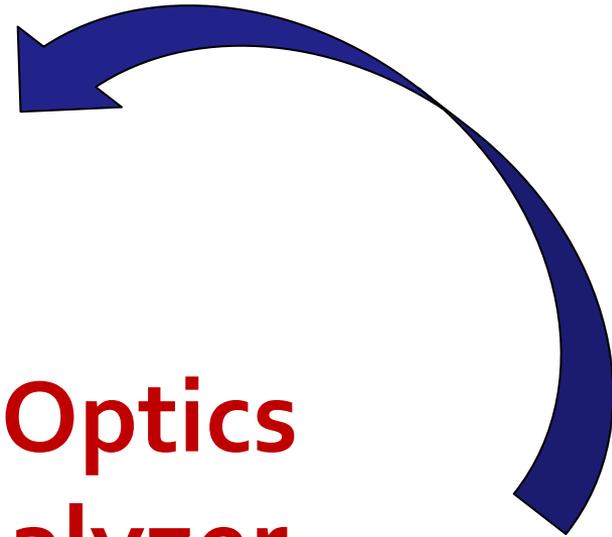
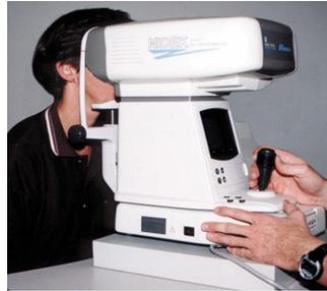
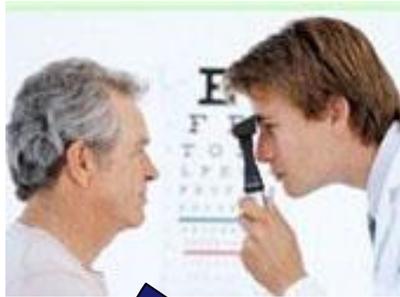


Visual testing

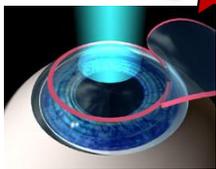
Subjective analysis

Eye's Optics

Objective characterization



Adaptive Optics Vision Analyzer



Vision correction
OpticalSolutions



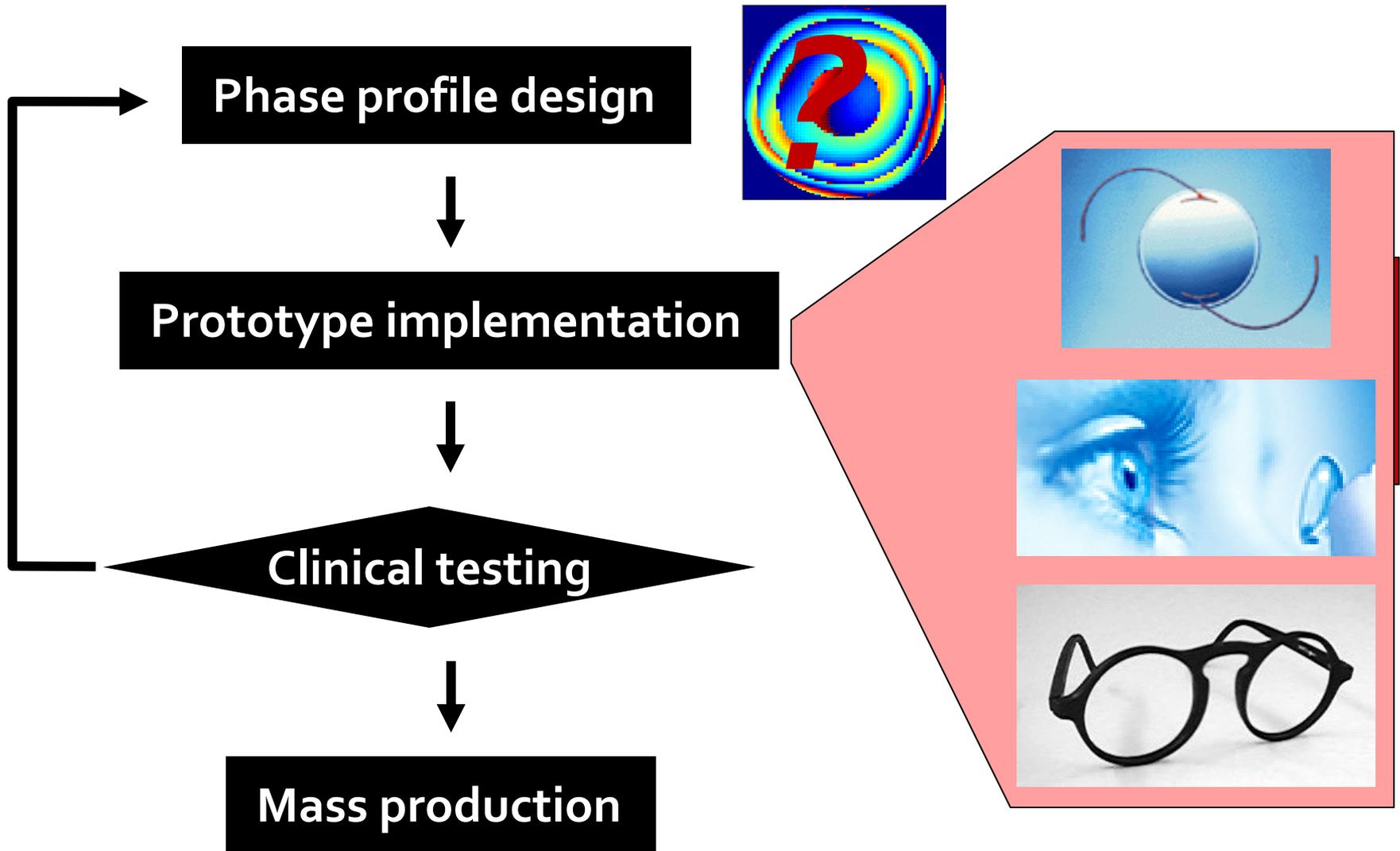
Visual testing

Subjective analysis

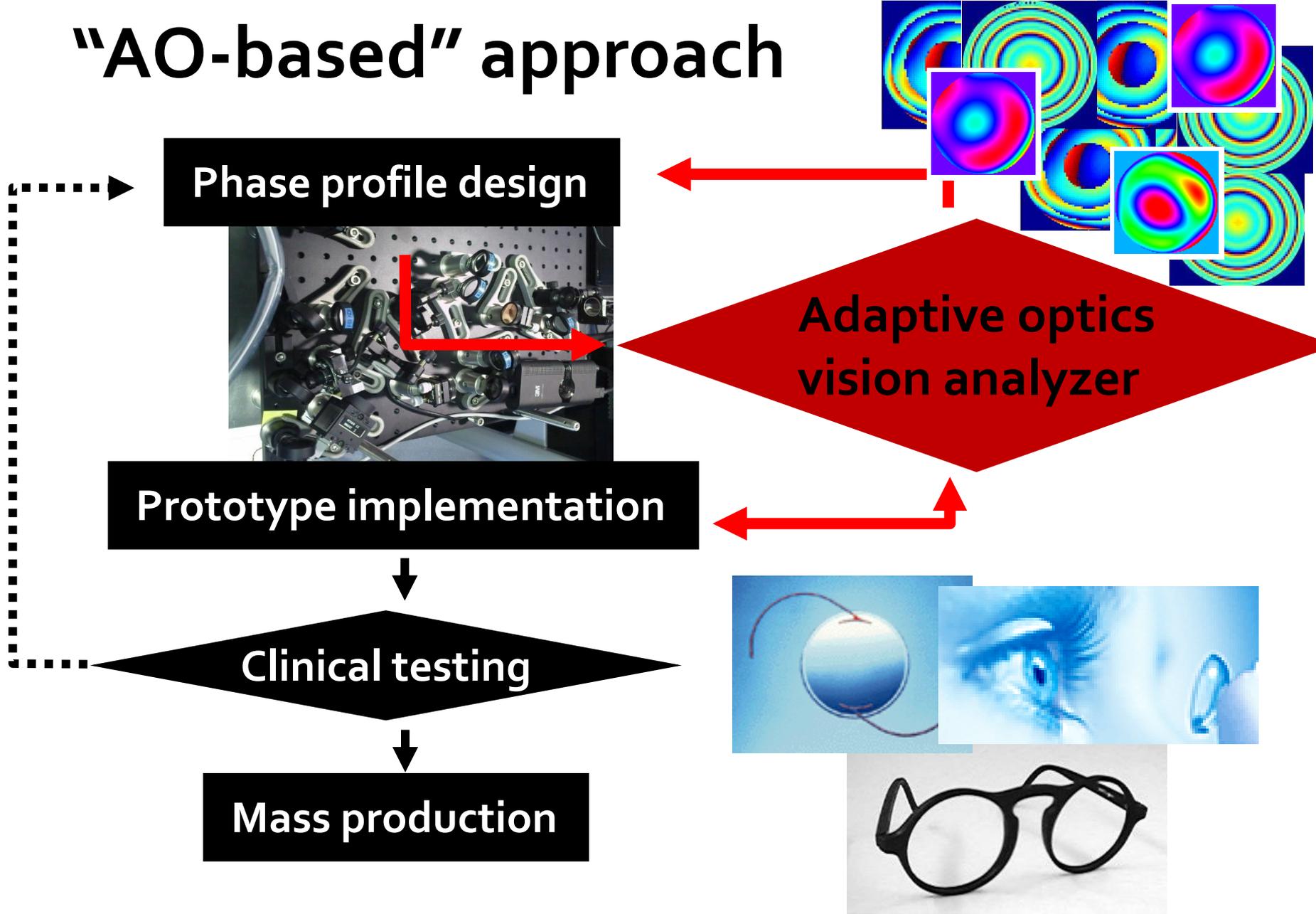
Applications of adaptive optics in vision and ophthalmic research

- New (or revisited) experiments
- **Interactive design of new ophthalmic solutions**
- Visual function assessment
- Surgery outcomes optimization

“Traditional” approach



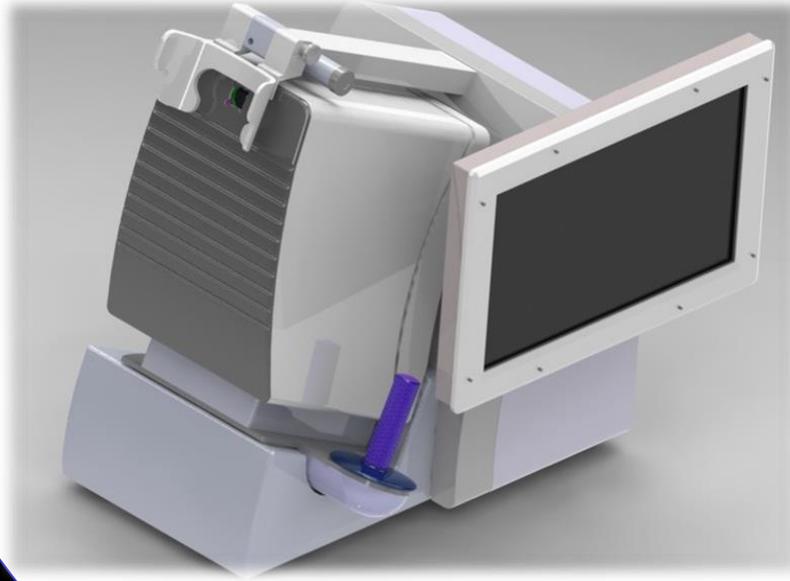
“AO-based” approach



Applications of adaptive optics in vision and ophthalmic research

- New (or revisited) experiments
- Interactive design of new ophthalmic solutions
- **Visual function assessment**
- Surgery outcomes optimization

AO vision analyzer



Refraction!

beyond
Phoropters

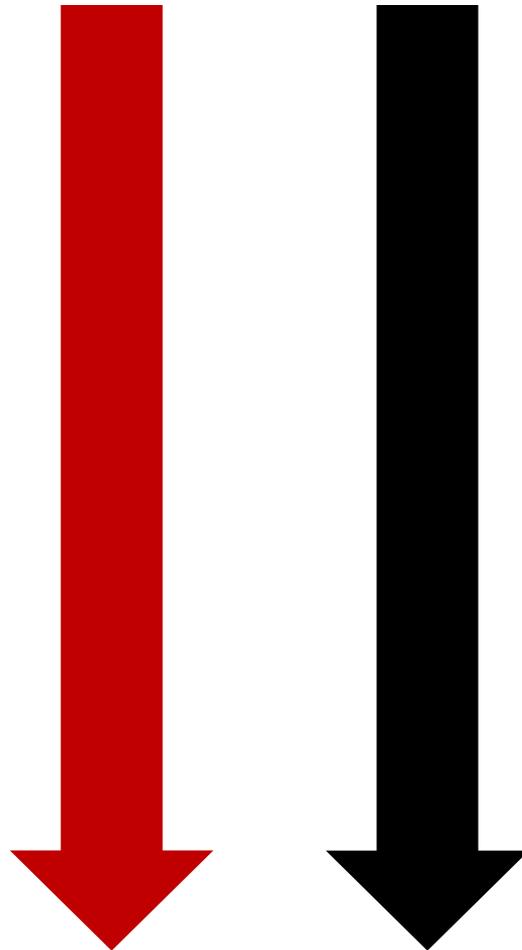
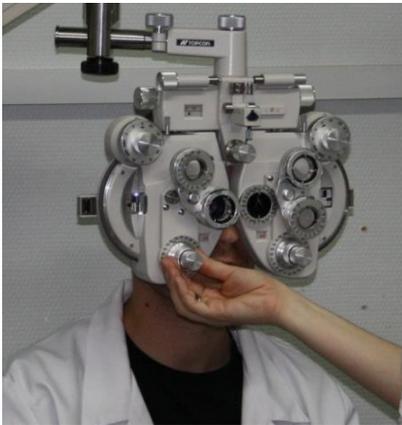


Comparison of AO-guided refraction and "standard" phoropter

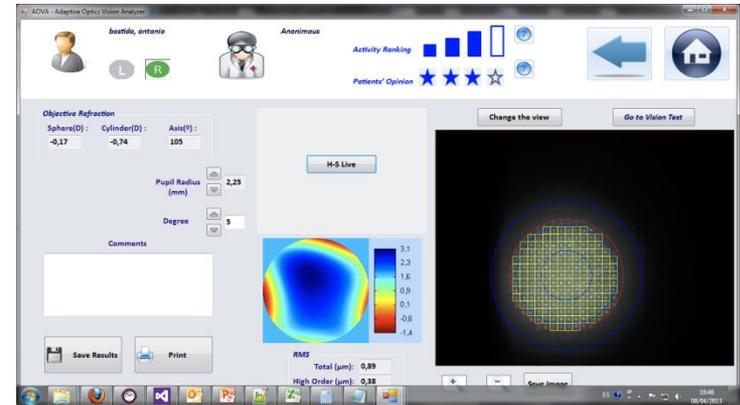
AutoRefractometer



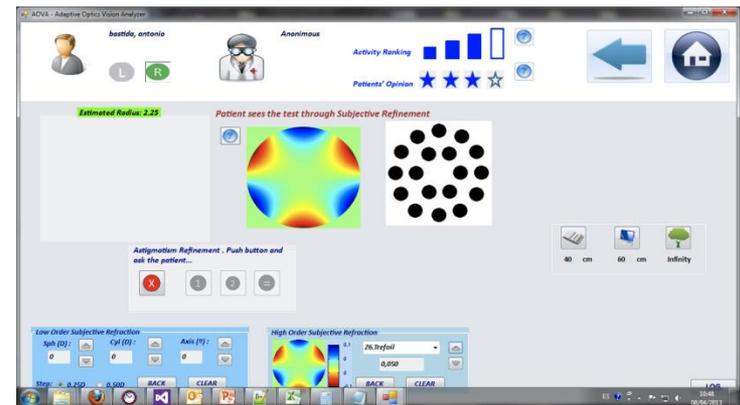
Phoropter



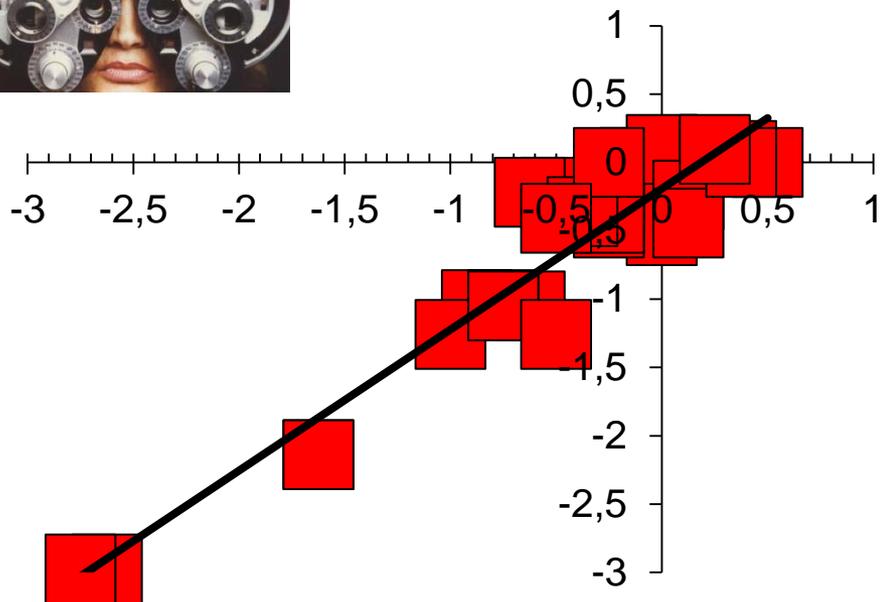
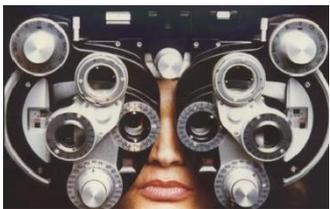
HS objective refraction



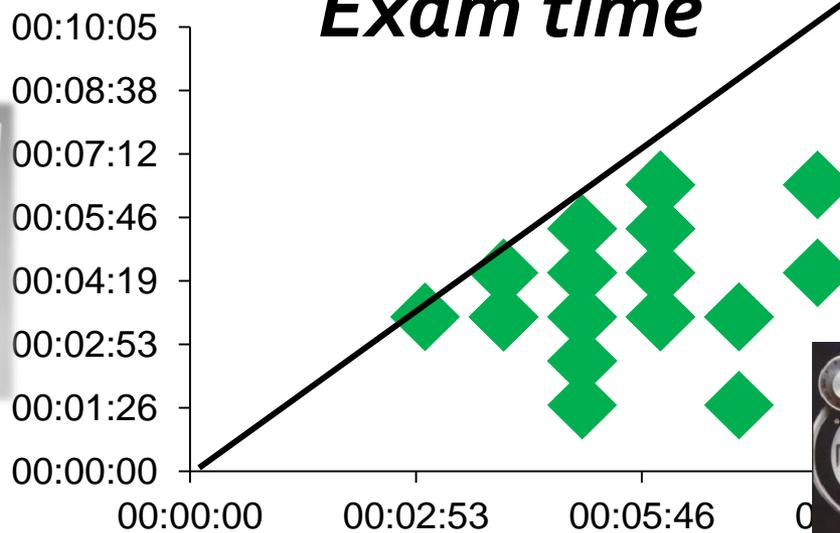
AO-Guided refinement



Spherical equivalent (D)



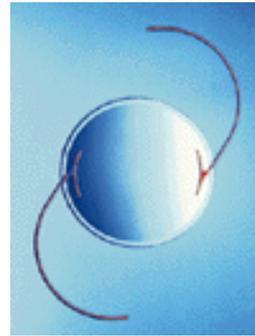
Exam time



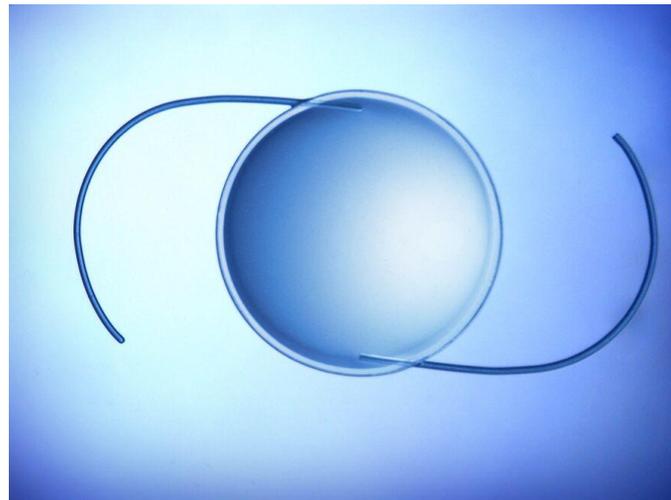
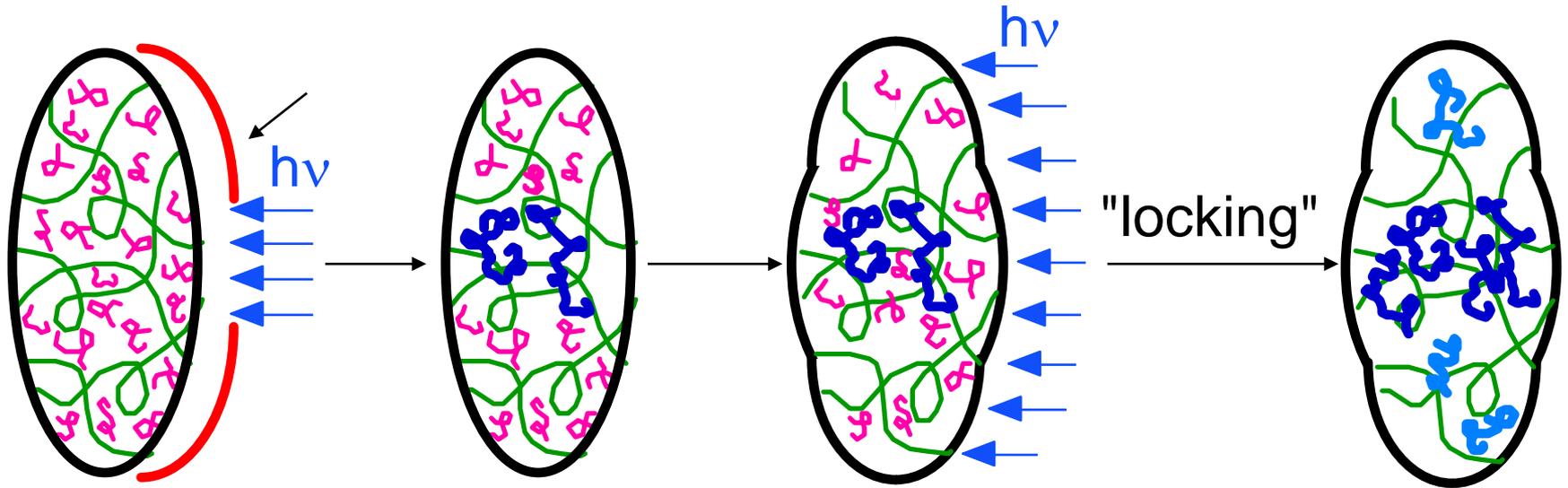
Applications of adaptive optics in vision and ophthalmic research

- New (or revisited) experiments
- Interactive design of new ophthalmic solutions
- Visual function assessment
- **Surgery outcomes optimization**

*Quality of vision under any optical solution...
with AOVA*

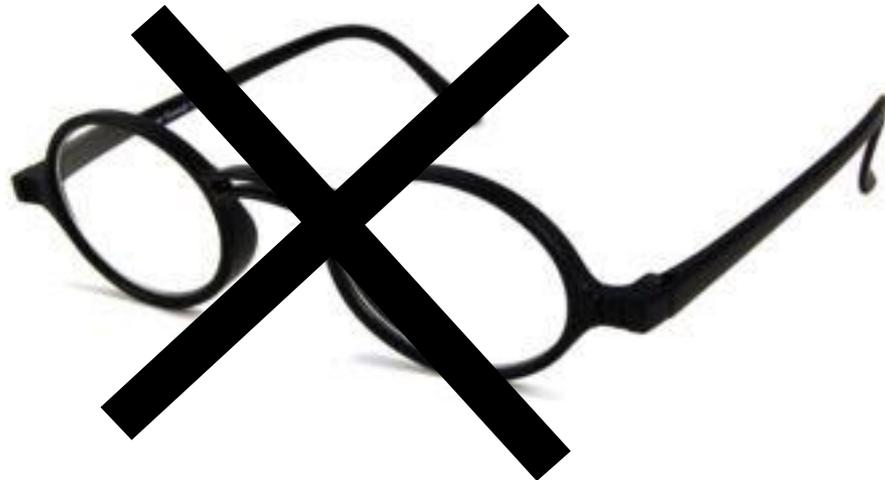


Light adjustable intraocular lenses (LALs) allow optimum refractive outcomes

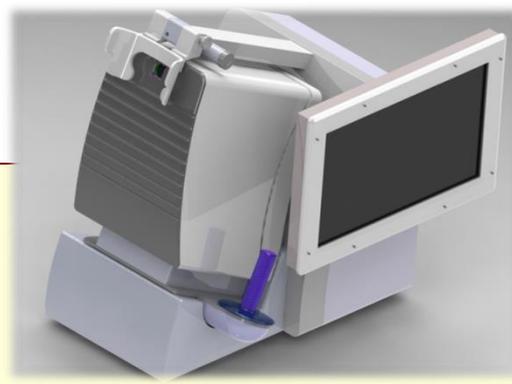


Light adjustable intraocular lenses (LALs) allow
optimum refractive outcomes,
but also...

*customized near vision providing good quality
of vision at all distances and patients' spectacle
independence!*

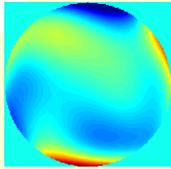


Voptica Adaptive Optics Vision Analyzer

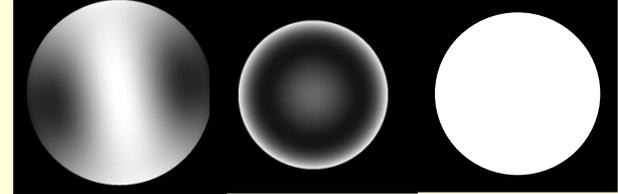
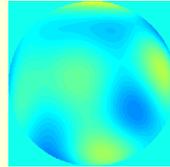


Surgery

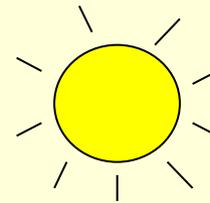
Two weeks



Corneal
estabilization

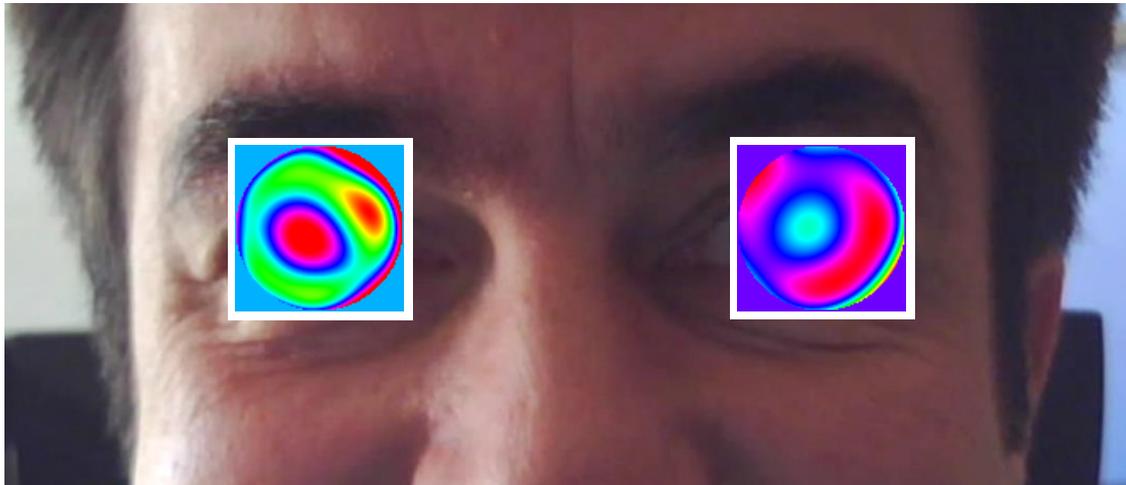


adjustment + lock-ins



*Patients implanted **bilaterally** with **LALs***

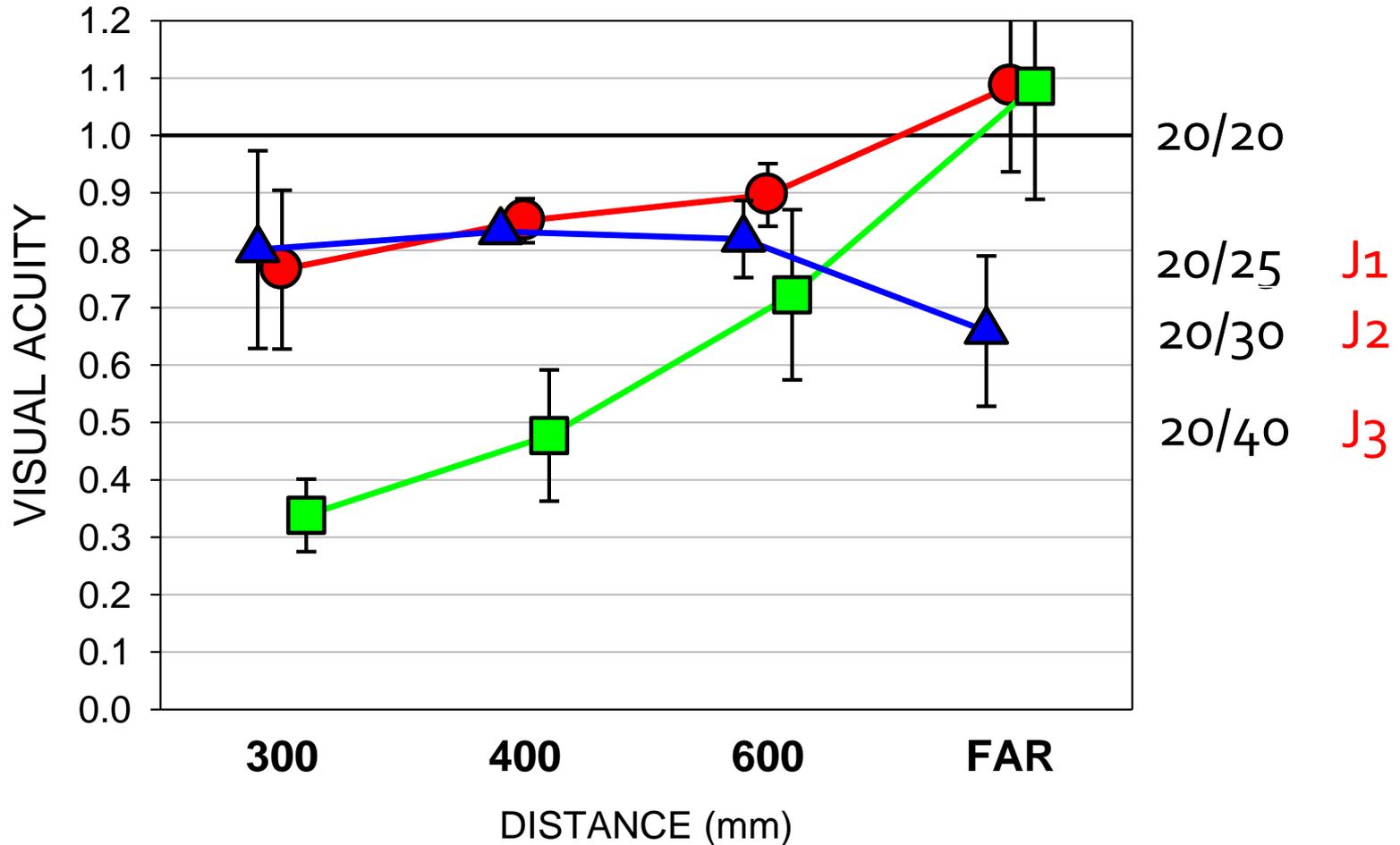
*One eye was set to near emmetropia and the fellow targeted to a value of **spherical aberration** to extend depth of focus.*



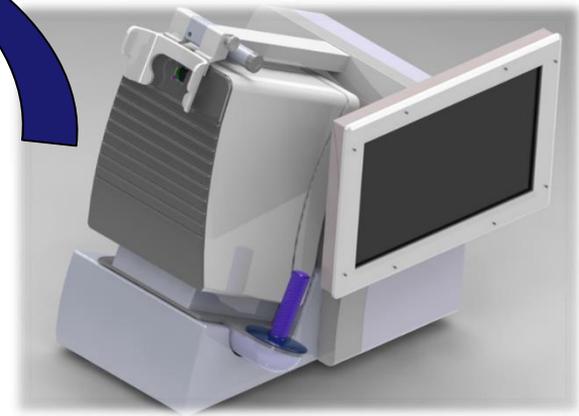
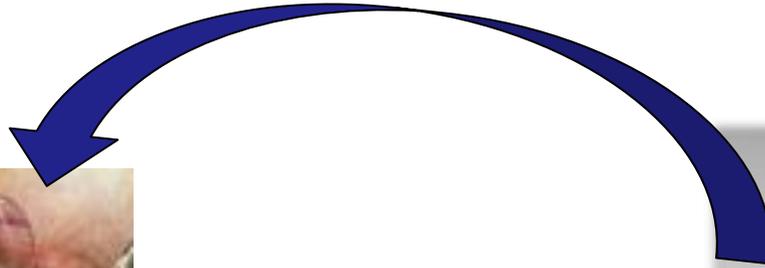
Monocular ("far" eye)

Monocular ("near" aspheric eye)

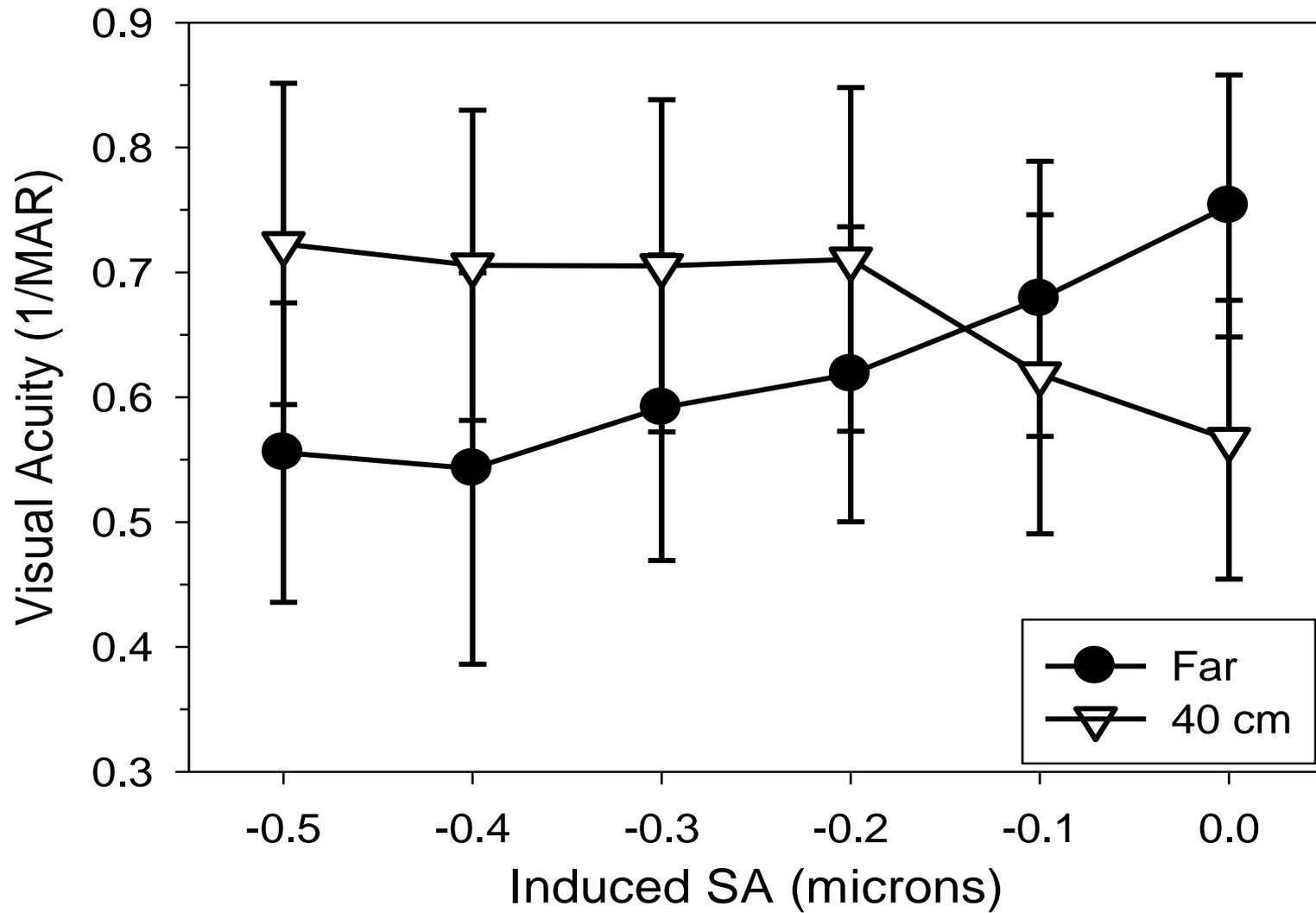
Binocular vision



*Potential of AO-guided presby-LASIK
(collaboration with Prof. F. Malecaze)*



*Optimum induced corneal asphericity for each
patient based in the customized AO
assessment!*



- *Adaptive optics for ophthalmic applications is reaching maturity both for retinal imaging and visual testing.*
- *This technology is already available for improved outcomes in refractive surgery within clinical environments.*

Thank you for
your attention,

Pablo Artaç