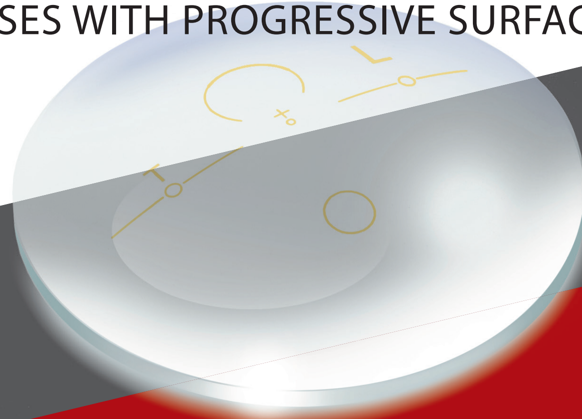
Optical Machines and equipment

PROGRESSIVE CAFE

PROGRESSIVE CAFE

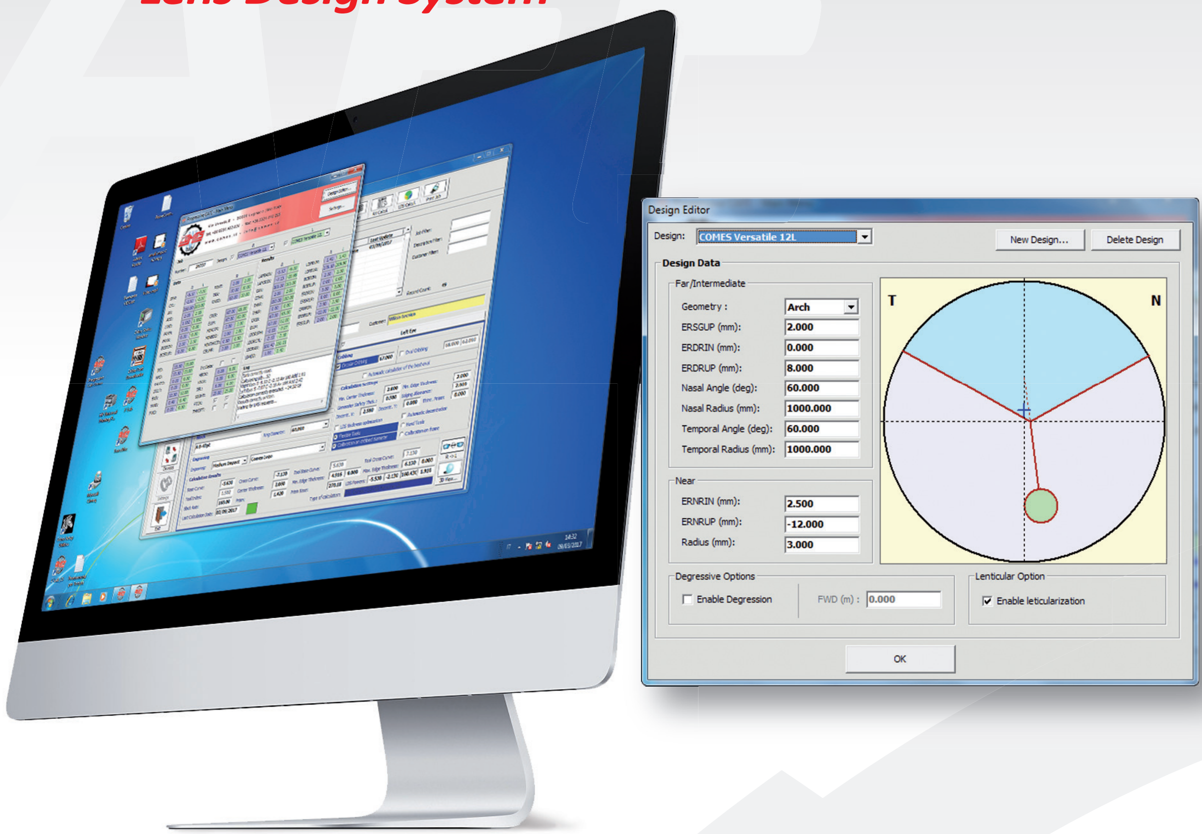
A NEW WAY TO PRODUCE LENSES WITH PROGRESSIVE SURFACE



COMES LDS

Computer **A**ided **F**reeform **E**ngineering

Progressive CAFE
Lens Design System



Thinking at progressive lenses outside the box

Freeform surfaces calculation software Progressive CAFE was created to provide unique value added to COMES offer for prescription laboratories.
The peculiarity of the system is in the way it calculates surfaces, not based on fixed designs but calculating every surface real time according to a set of parametric functions.
The parameters of these functions are the dioptric powers, sphere, cylinder, axis, prism, etc. and size of lines that trace the contours of the areas for distance and near vision, in such areas the surfaces are exactly toric, while sideways of the progression channel the sag data are calculated by means of mathematical functions that minimize the astigmatic aberrations while taking into account the need for a smooth progression of power from far to near.
Being not based on fixed designs, the equations grant a solution for any material and refractive index, is possible to adjust the length of the progression channel to any frame height, ideally from zero (anyway a lower limit is useful) to infinite, without the need of choosing different designs for different frames.
The user can customize the boundaries between various areas to adapt the lens to different uses; moreover, being such a task the one requiring experience and testing, COMES provides some ready-made sets of parameters for quick start production, characterized by the use (outdoor, business and all purpose) and the minimum recommended fitting height.

Value added

- No click fee required by COMES.
- Works for every refractive index.
- Works for every fitting height.
- Parametric custom design, quick start sets of parameters provided by COMES.*
- Sag data calculated via parametric continuous functions, secure solution for every combination of sphero, cylinder axis, addition, progression channel length, etc.
- VCA/OMA compliant.
- Transparent interface with Z-Lab LMS; custom interface for third party software on request.

Software available in two versions

CAFE OPEN (open design editor)

With design editor to customize distance vision area in size and form, near vision area in size, progression channel in length and other features.

* CAFE 3X

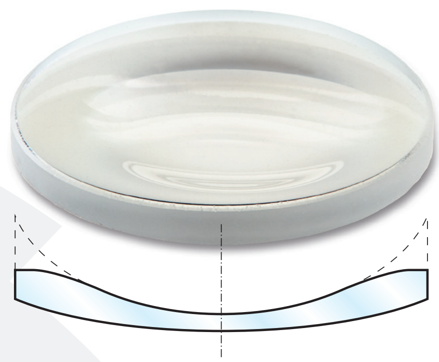
Standard designs only with three different progression channel lenght.

Progressive CAFE
Lens Design System

Main features:

- Progressive surfaces with distance and near vision through exactly toric surfaces.
- Thickness calibration for lens center, frame edge and safety outside the frame.
- Calculation of the ellipses of minimum area containing the frame.
- Thinning prism for minimum thickness differences on the edge, even combined with prescription prism.
- Decentered lenses for minimum blank size.
- Compensation for both faceform wrap and pantoscopic tilt in terms of powers, prism and Near
- Reference Point position.**
- Accounting of real back vertex – corneal apex distance and near vision distance.**
- Degressive designs with default far working distance or degression set by user.
- Lenticularization for edge thickness reduction. NEW

Example of CX Progressive Lens



Lenticularization for edge thickness reduction.

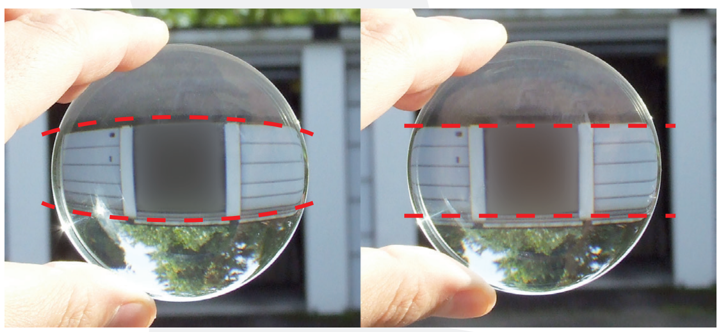
Extra features:

- Blank production: allows to calculate convex front surfaces and block on concave back surface. NEW
- Single vision aspheric and atoric (without compensation for faceform).** NEW

Services:

- Software updates including: ergonomic improvement for user interface, calculating times optimization, new features, new design parameter sets.
- Phone call assistance.
- Custom interface for third party software on request.

*** Features based on exact refraction calculation instead of approximated third-order theory.*



Comparison between regular +8.00D and aspheric.

The Progressive CAFE project started in the summer of 2008, and is subject to continuous development and the results will be regularly supplied to COMES customers as software updates. The ultimate goal is a system that, like CAD systems for general design, is able to simulate a lens to fit on the wearer accounting for every detail, from which the acronym CAFE, which stands for Computer Aided Freeform Engineering.

PROGRESSIVE CAFE

With LDS software by COMES, named Progressive CAFE, three basic designs are provided to fulfill most common tasks:

- **Office** — A design favoring near and intermediate vision, to be used in a professional environment.
- **Versatile** — A design granting the widest distance field of view, with a peculiar attention to peripheral view, but allowing a near vision clear enought, suitable for wrapping and sporty frames dedicated to outdoor lifestyle.
- **Open Air** — As its name suggests, is a design satisfying both distance vision needs and reading requirements, for those who need a comfortable vision in every situation.

Every design can be produced with three different progression channel lenghts, 9, 12 and 15 millimeters, to be chosen depending on size of the frame and addition.

12 millimeters channel is the best compromise, not requiring the wearer to turn the eye bulb too much downward in order to read and is characterized by a limited amount of aberration at the sides of the progression channel.

9 millimeters channel is affected by an higher aberration, affecting intermediate vision and peripheral view, but requires a lesser effort in turning the eye to read and can be applied also to very small frames.

15 millimeters channel allows more room for progression from distance vision to near vision, thus reducing aberrations at the sides of the progression channel and this can be an advantage for very high additions, anyway is suitable only for frames big enough to fit the higher layout of the design.

Degressive lenses

(not included in CAFE-3D version)

From 2015 Progressive CAFE benefits by the added option for degressive lenses calculation, therefore, as yet it was for progressive lenses, three basic designs are provided to cover most common conditions:

- **Meeting** — Is the design most similar to a progressive one and the only difference is the lack of an area for distance vision, replaced by an area for intermediate vision with a working distance of 4 meters; suitable for situations when face-to-face interaction is of high importance.
- **Workstation** — In this case the area for intermediate vision gets a circular shape and is displaced higher, with an intermediate working distance set to 2 meters; is a lens suitable for small offices, mainly dedicated to the use of desktop computers (thus the name) with enough depth of field for interaction with colleagues.
- **Detail** — Morphologically similar to the Workstation design but with wider intermediate and near vision areas, has an intermediate working distance set to 1 meter, for those who need to focus on details in a very narrow range.

Given the specific nature of the product, unlike progressive designs, for degressives lenses there is only a channel length for every design and is determined by the average excursion of the eye to move from intermediate vision position to the near vision one; anyway we remind that full version of the software allows to create designs with different characteristics, depending on the needs.

Intermediate and near vision areas characteristics well fit to the average offer on the market. The fitting cross is set 4mm over the prism reference point, intermediate reference point is set 8mm above the fitting cross, while the near reference point is 12mm below the fitting cross, such configuration corresponds to make the eye turn 15° up to look at intermediate direction and about 25° down to look at near objects; this is based on a principle (with minimal differences) shared by the majority of degressive lenses maker on the market.

Intermediate working distances listed above are those peculiar of the designs and are used by default if not specified otherwise by manually input a degression value in the prescription, being such option allowed by the system; we suggest therefore to chose the design according to the degression value optionally input manually, in other words, if you input high values of degression (e.g. 2,25D) Meeting design is to be preferred, Workstation design is the best choice for mid-range degressions and Detail design for lower degressions (e.g. 0,75D). If no degression is input, the right amount is automatically calculated by the software based on the addition and the default intermediate working distance associated with the chosen design.

Dispensing degressive lenses always requires distance power and addition, i.e. is not possible to input near power and degression only.

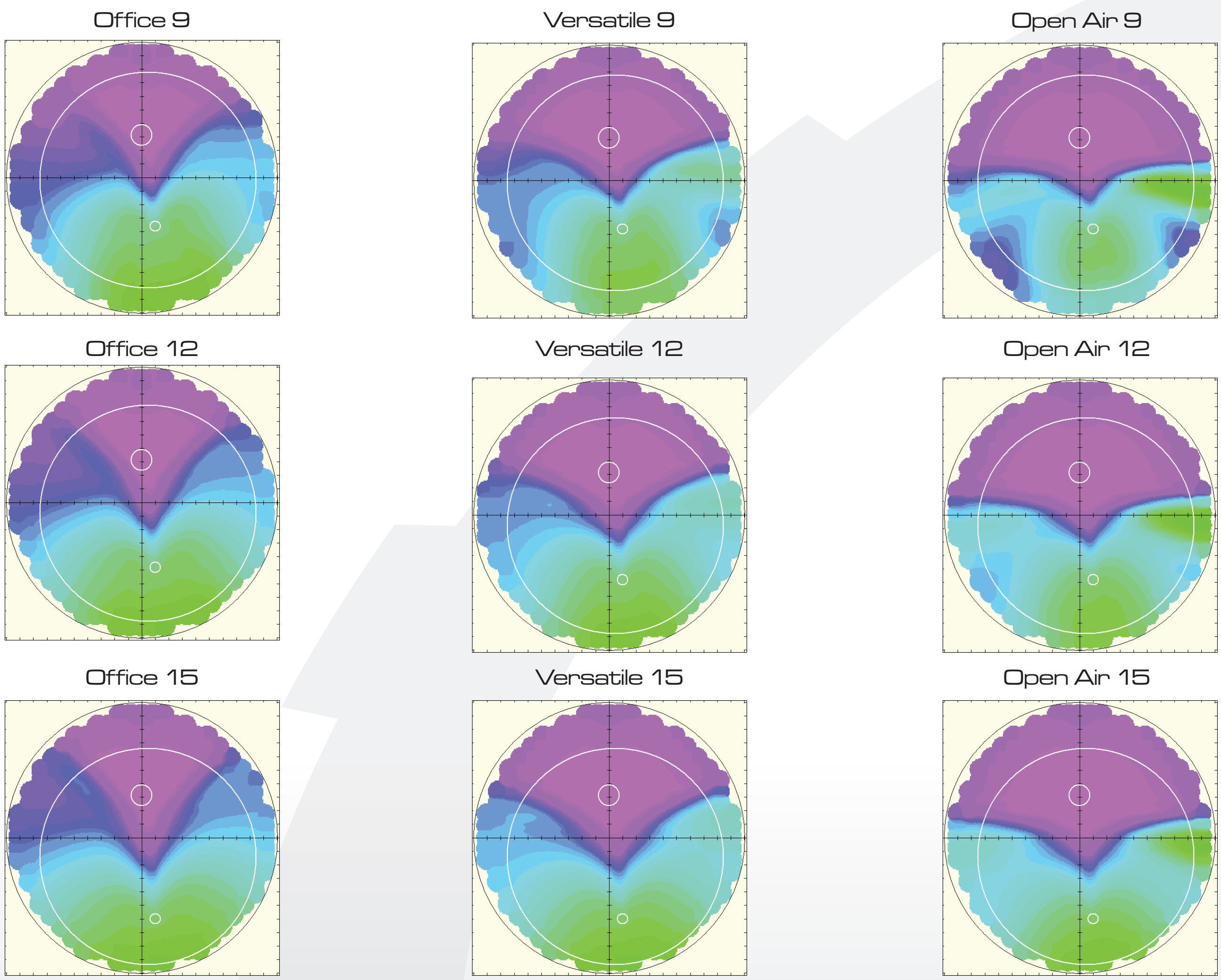
PROGRESSIVE CAFE

Principal power and astigmatism maps for progressive power lenses.

Following figures show distributions of progression of principal power and astigmatism at the sides of progression channel for the nine combinations of design and progression channel length, while in the table are indicated the numerical values of measured width of intermediate and near vision areas. Conventionally those measures are taken where astigmatism is less or equal to 1.00D from the prescribed cylinder power for a neutral spherical lens with addition 2.00D.

Design	Progression channel width [mm]	Near vision area width [mm]
Office 9	7.0	17.5
Office 12	8.5	18.0
Office 15	10.0	19.0
Versatile 9	5.5	13.0
Versatile 12	7.0	15.0
Versatile 15	8.5	16.5
Open Air 9	5.0	9.5
Open Air 12	6.5	12.0
Open Air 15	7.5	13.5

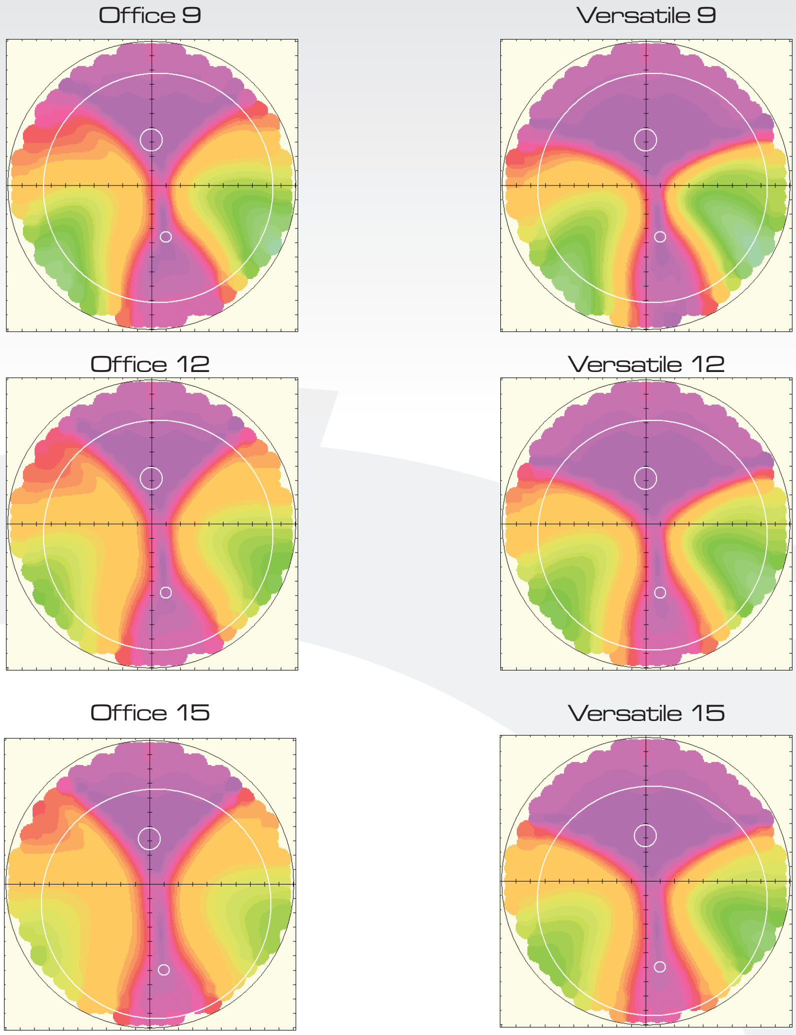
Principal power maps.



In the grid below, where are shown the distributions of astigmatic aberrations, is possible to notice how distance and near vision areas amplitudes vary (in violet) and how peak values of aberration (areas in colors varying from green to sky-blue) are harder or softer depending on the design and progression channel length. The color scale on the left shows astigmatism values corresponding to the colors represented in the following maps.

You can see how aberration lowers when moving to the left in the grid (Office design) and to the bottom (15mm channel), but with harm to the width of clear vision areas. In this regard, the Versatile 12 design, being in the centre, represents the best compromise solution and thus the one to be preferred unless there are specific needs.

Astigmatism maps.



Office

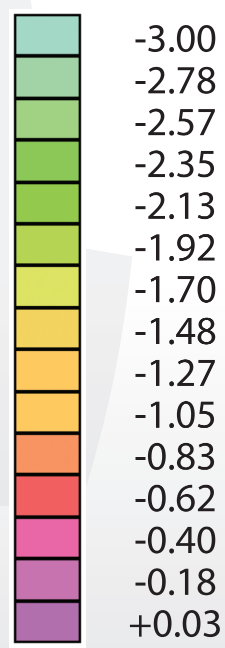
A design favoring near and intermediate vision, to be used in a professional environment.

Versatile

Design satisfying both distance vision needs and reading requirements, for those who need a comfortable vision in every situation.

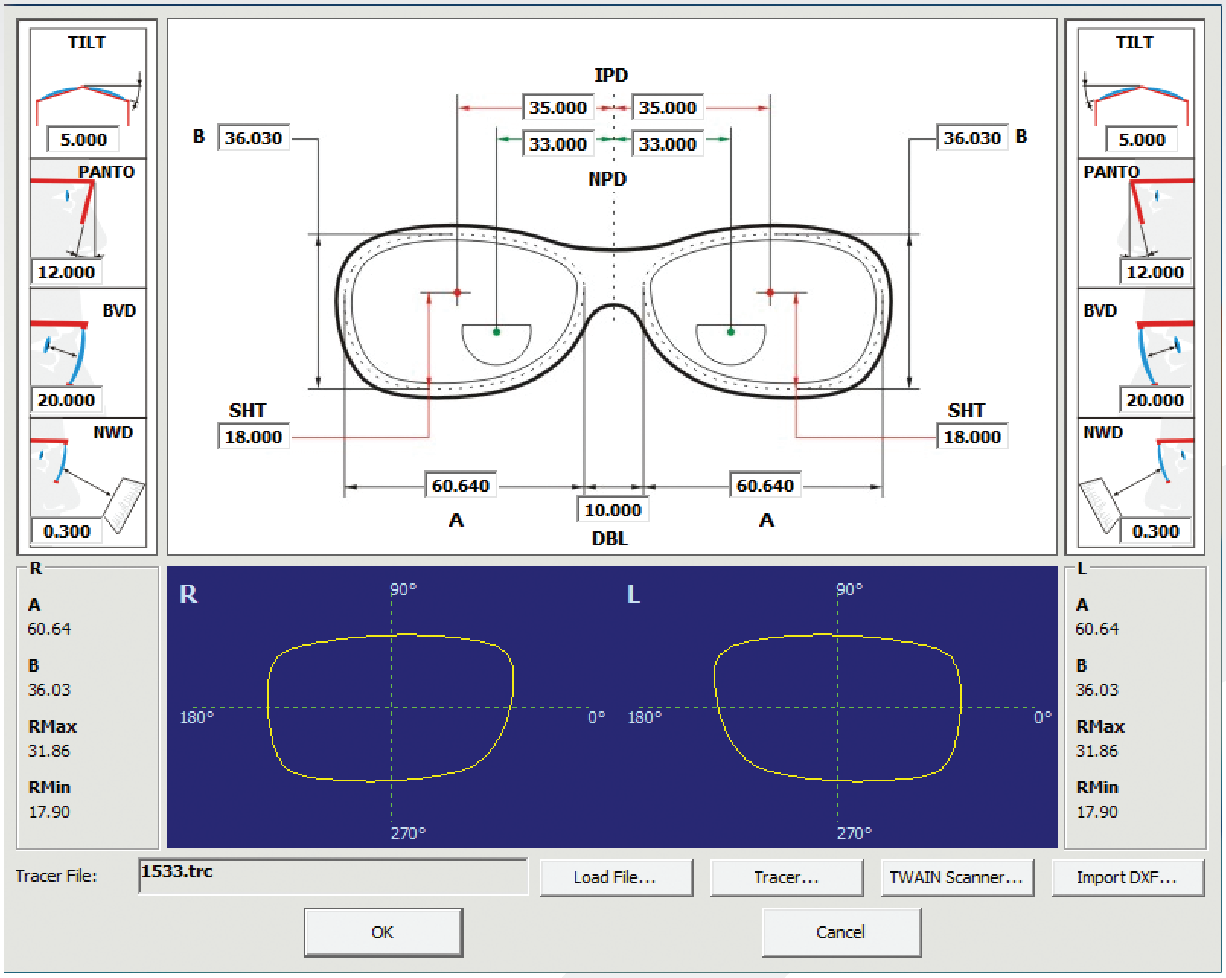
Open Air

A design granting the widest distance field of view, with a peculiar attention to peripheral view, but allowing a near vision clear enought, suitable for wrapping and sporty frames dedicated to outdoor lifestyle.



Dioptric power values.

Personalization parameters



Example of data input for personalization.

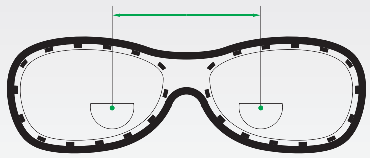
Apart from the chosen design, every lens can be personalized depending on the frame form, moreover is also possible to adapt the addition to various near vision distances.

If the frame shape is known is possible to calculate the lens optimizing the thickness at said frame shape, so could be useful to provide such data to the production lab in different ways:

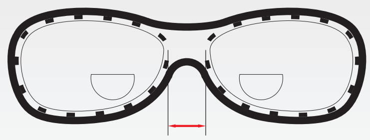
1. sending a file from a frame tracer (*.TRC)
2. sending a CAD file (*.DXF) optionally supplied by the frame manufacturer
3. copying the contour of a demo lens on a white sheet of paper and sending it via fax, ensuring it is sent in 1:1 scale; the drawing so obtained can be acquired by a scanner.

For a complete personalization is possible to input other data regarding frame form and wearer face:

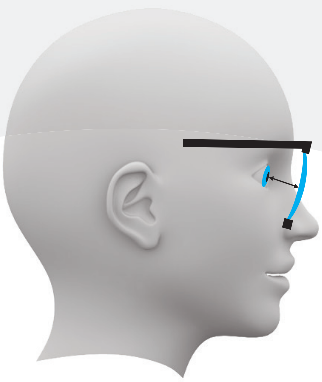
interpupillary distance for far (IPD)



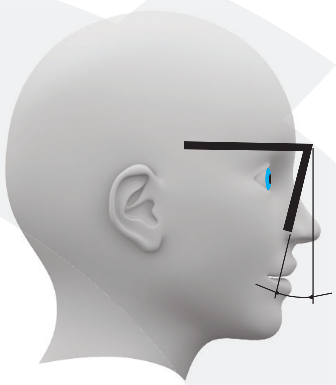
interpupillary distance for near (NPD)



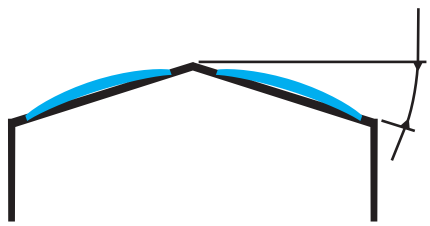
frame bridge width as distance between lenses (DBL)



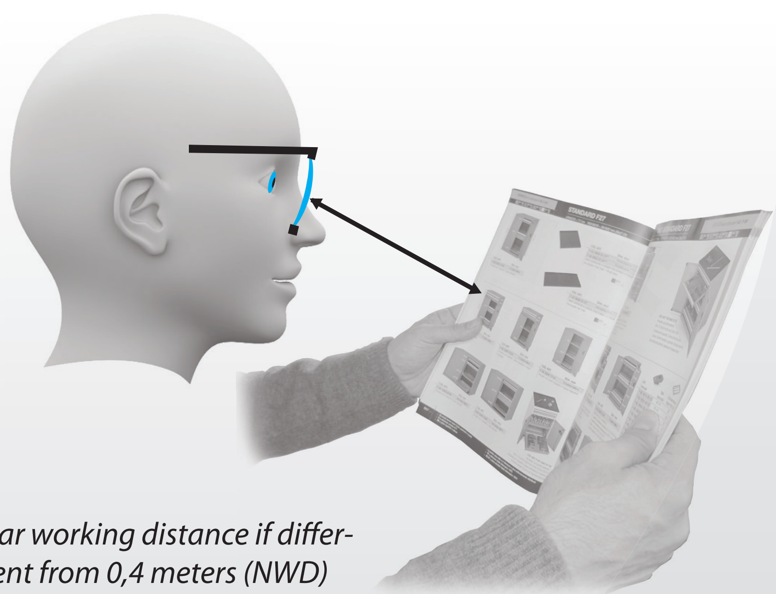
corneal apex to back vertex distance if different from 12 millimeters (BVD)



pantoscopic angle (PANTO)



wrap angle (TILT)



near working distance if different from 0,4 meters (NWD)

Technical note

Consider those parameters listed above are used to calculate the lens surface and optimize it in order to make the wearer eye be reached by a wavefront with the characteristics described by the prescription, this means the powers measured by a lensmeter or a lens mapper may differ even strongly from the prescribed ones. During the quality control of lenses, then, is necessary to account for those differences; values to be measured by a lensmeter are provided by the software at the end of the calculation.

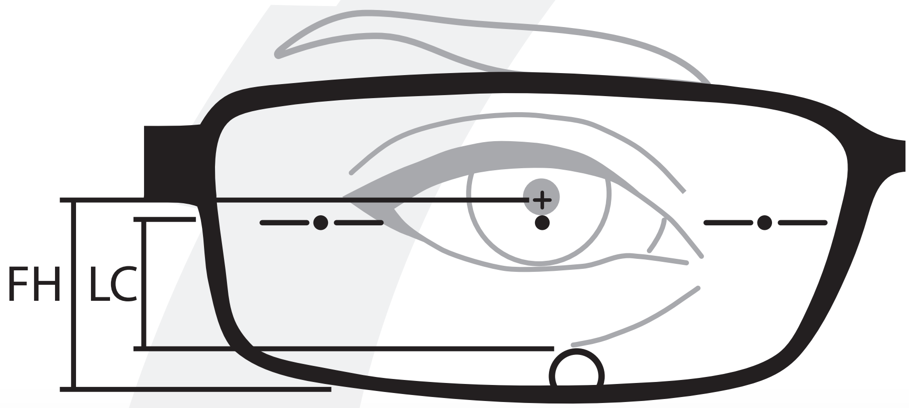
Fitting height for progressive lenses

Accounting for the fact that every COMES basic design has the fitting cross placed 2 millimeters above the starting point of progression channel, i.e. the prism reference point PRP, and the need for at least 2 more millimeters in height for the near vision area, we can calculate the minimum fitting height to allow is equal the progression channel height plus 4 millimeters.

Moreover, for those cases where you want to favor near vision is useful to add something more to fitting height.

Design	Progression channel length in mm (LC)	Minimum suggested fitting height in mm (FH)
Office	9	15
Office	12	18
Office	15	21
Versatile	9	14
Versatile	12	17
Versatile	15	20
Open Air	9	13
Open Air	12	16
Open Air	15	19

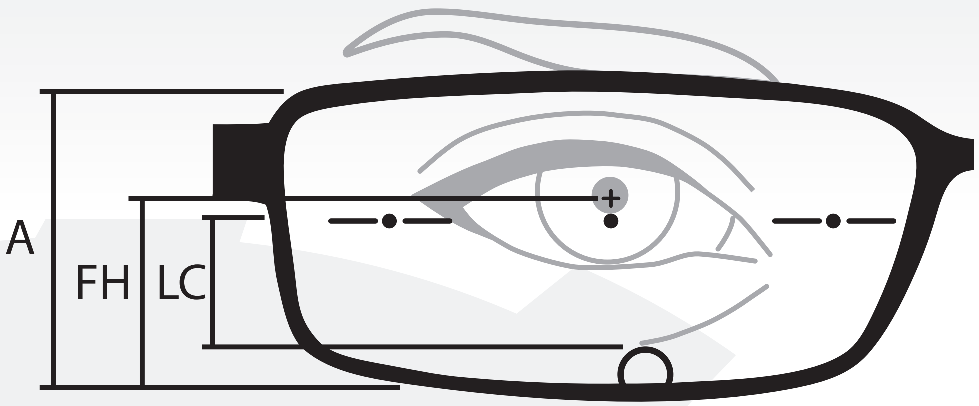
The table shows minimum suggested fitting heights for Comes designs.



Clearly, a fitting height higher than the minimum suggested helps even more near vision.

Fitting height for degressive lenses (not included in CAFE-3D version)

A peculiarity of degressive lenses is that in vertical direction they have a sort of symmetry, that is intermediate and near vision importance is very similar if not even the same, so compared to progressives, beyond prescribing a minimum fitting height is also necessary to prescribe a minimum frame height, for the sake of avoiding to cut out the intermediate vision area.



Design	Progression channel length in mm (LC)	Minimum suggested fitting height in mm (FH)	Minimum suggested frame height in mm (A)
Detail	8	16	FH+12
Workstation	8	18	FH+12
Meeting	8	16	FH+10

Meeting design, then, requires a total minimum height of the lens of 26mm. This is due to the fact that this is the model with the less importance of near vision, where intermediate vision faces greater distances, so in a lower height is possible to focus taller subjects anyway, like attendance in a meeting (thus the name of the model).

Workstation design is the one with the higher suggested lens height (30mm) because for near vision the need is to focus on objects filling a great part of the field of view, like the page of a document, while for intermediate vision the farthest working distance is closer than that of Meeting design, then is necessary a wider clear vision area above the degression channel, in fact closer objects occupy a greater part of the field of view.

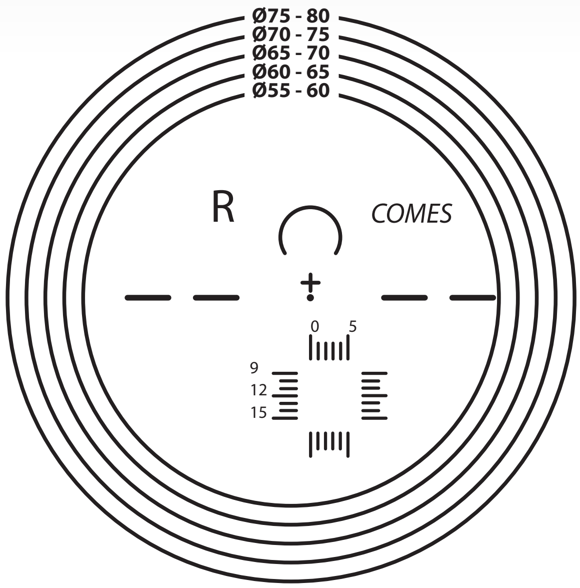
Finally, in Detail design the minimum suggested lens height is reduced in comparison to that of Workstation design because the lesser extent of degression allows per se to frame objects at both intermediate and near distance in wider areas comprising even part of the degression channel; in such case is given peer importance and extent to both intermediate and near vision areas, while in other designs near vision area is greater than that for intermediate.

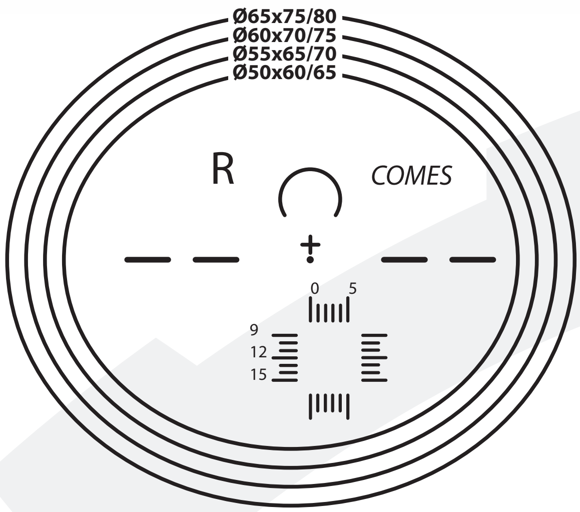
Clearly, a fitting height higher than the minimum suggested helps even more near vision and the same goes for the total height of the lens about what concerns intermediate vision.

Standard centration charts and optimied calibration for lenses produced vith Progressive CAFE

Progressive lenses centration charts

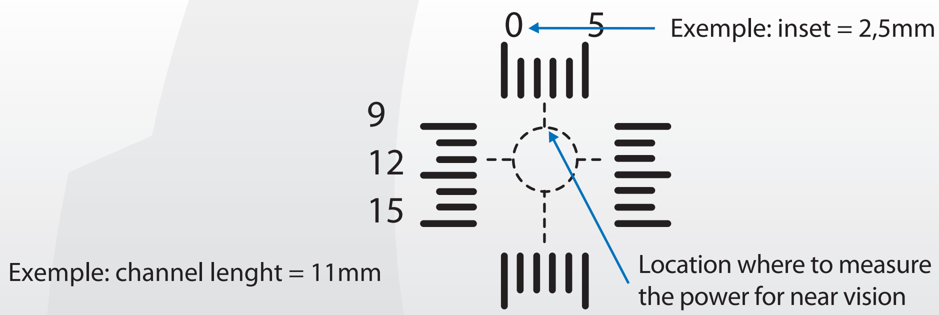
Following are shown some example of charts to determine the minimum diameter (or the minimum elliptical shape) of the lens, in case you have data about frame and its shape (glasses), but you don't want to use the optimized calibration procedure according to the following paragraph.



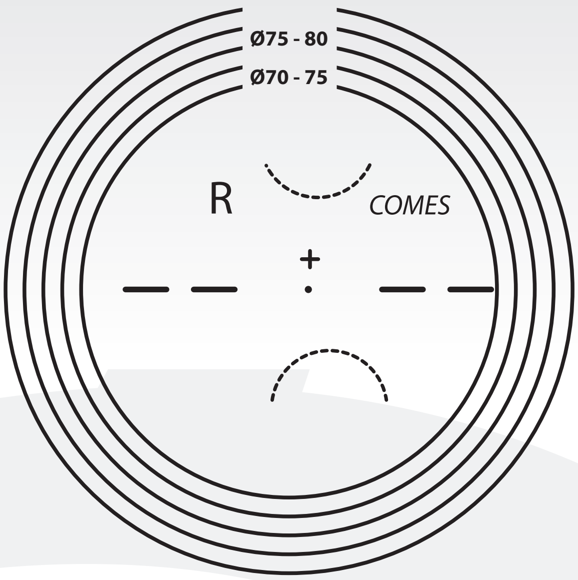


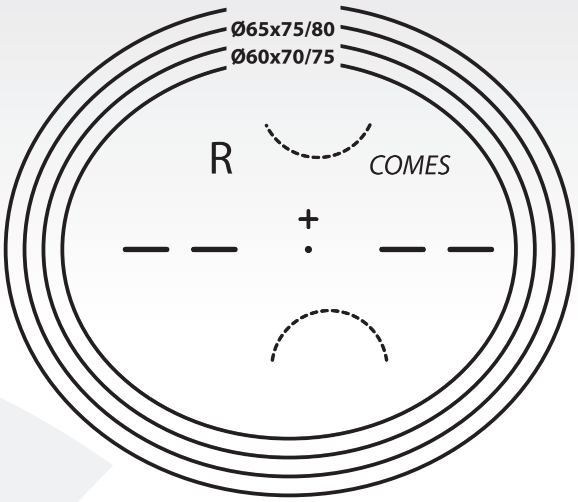
The two images shows the centration charts for a standard offset of 2,5mm and are represented in 1:1 scale (printing the page to original size), so they can be used to chose the frame size in a classical way, laying a demo lens or the frame over the image.

Centration charts are universal for every progressive design, every progression channel length and distance-near inset, in fact, the area for the measuring of near is bound by a grid allowing to identify the measurement point as intersection of a horizontal line determined by the progression channel length and a vertical line determined by the inset (see following example). The lines of the grid are spaced by 1mm intervals, in this manner is also possible to measure the extent of near vision area from the end of progression channel to the edge of the frame.



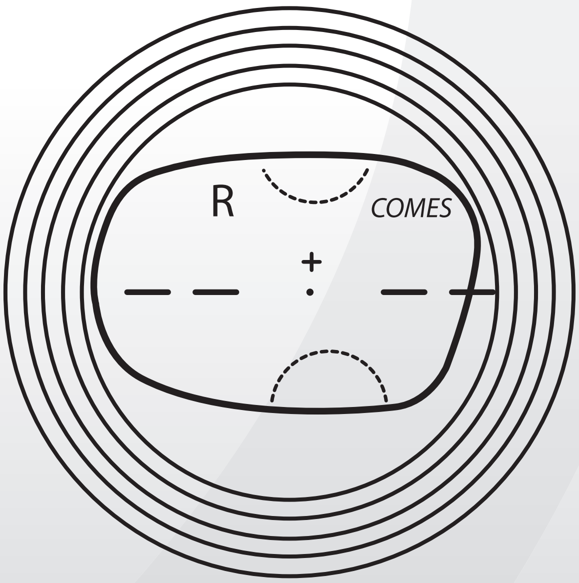
Degressive lenses centration charts (not included in CAFE-3D version)





Above are shown the centration charts for a standard offset of 2,5mm and are represented in 1:1 scale (printing the page to original size), so they can be used to chose the frame size in a classical way, laying a demo lens or the frame over the image.

Centration charts are universal for every degressive design despite their distinctive features; measuring of powers for intermediate vision have to be made over the dotted curve in the upper part of the lens; likewise, measuring of powers for near vision have to be made under the dotted curve in the lower part of the lens and for Meeting design is better to keep near to the center of the line because such design has the narrowest of near vision area. The outermost points of said dotted lines have also a secondary meaning, in fact their vertical position is that of the minimum suggested height of the frame regarding the Workstation design which, as already explained, is the one requiring the maximum height of the lens (30mm), therefore is generally useful having the shape of the frame not touching both dotted curves, as in the following example; is acceptable to let it happen by a limited amount if the chosen design is Meeting or Detail.



Optimized calibration

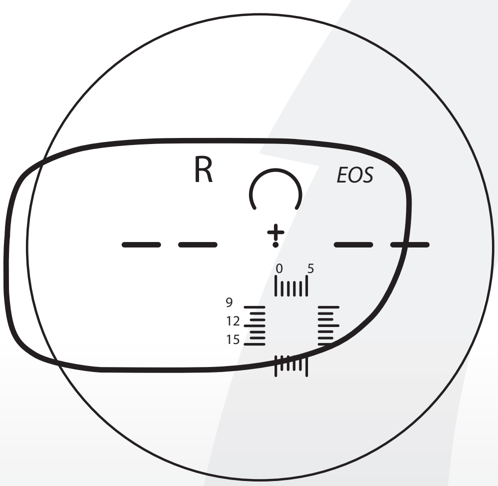
In case some customer is facing some hard situation in matching the frame with the lens, or simply wants to transfer calibration to the lab, is possible to design lenses with an assortment of circular or elliptical cribbing and offset optimized for thickness reduction.

Typical cases are positive lenses, where final thickness is largely affected by the gap between the size of the edged lens and the cribbed profile, or lenses intended for sport frames, i.e. those of great size, where an offset of 2,5mm could be not enough to contain the edged shape even inside the largest of blanks.

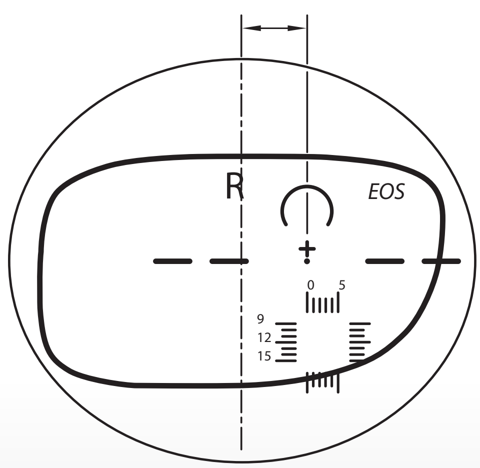
For optimized calibration is necessary to provide the lab with following data:

- Monocular pupillary distance, at least that for far; if also that for near vision is given is possible to optimize also the inset, otherwise this is calculated at the default value of 2,5mm.
- Fitting height FH.
- Bridge size of frame.
- Lens shape to be edged in 1:1 scale, as a digital file or as a paper drawing, as long as the original scale is respected; **is mandatory to know the shape, height and width data are not enough!**

With such set of data is possible to reconstruct the geometry of the frame and simulate the lens as it will be when generated and edged and so verify it can be obtained from the blank and with how much offset and cribbing:

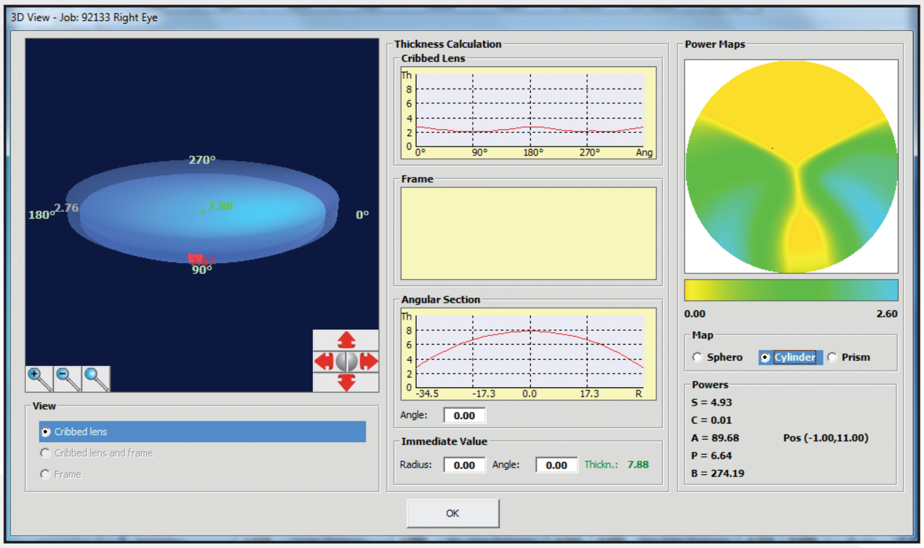


Example of a lens not obtainable with a standard offset.



Offset and crib ellipse are optimized by the laboratory, by means of Progressive CAFE software, based on frame specifications.

Power Maps Function



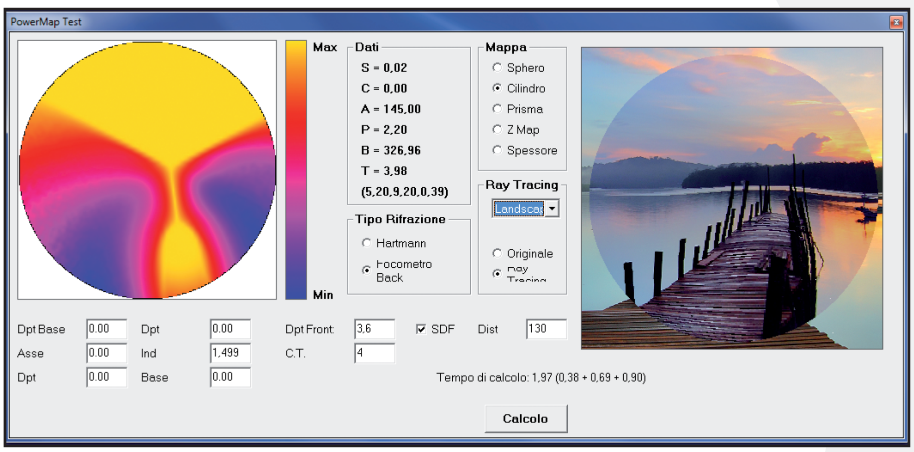
A new feature, combined with Z-LAB LMS Software, was introduced to permit the analysis of each lens project.

This function permits a preview of the maps (Sphere, Cylinder and Prism) with the possibility to check the power in every single point of the lenses; for sure a global preview offers to the operator the chance to evaluate the design of a progressive lenses before producing it.

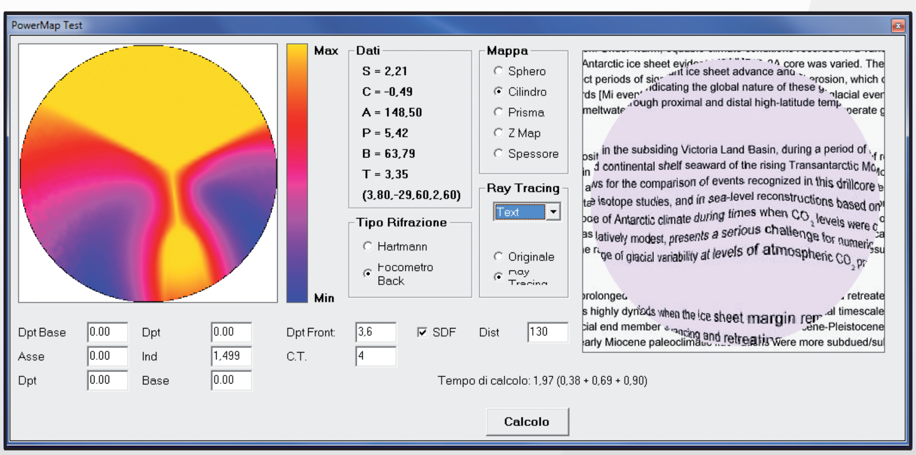
All maps of the POWER MAPS are mouse sensitives, in the sense that the mouse passage on each single point will show the exact punctual diopters power value.

Power Maps function, combined with COMES FreeForm Graphic Modelling module (included into CAFÉ OPEN version), grants the possibility to analyze every new design and compare it with an existing one offering this way a great aid for the creation of a new design based on an existing one.

A Vision Simulator, based on real optical refraction single point calculations, permits to evaluate the effects of each design or each single lens thanks to a preview of the final vision effects for:



Far vision evaluation (open air / landscape watching)



Near vision evaluation (texts reading)

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