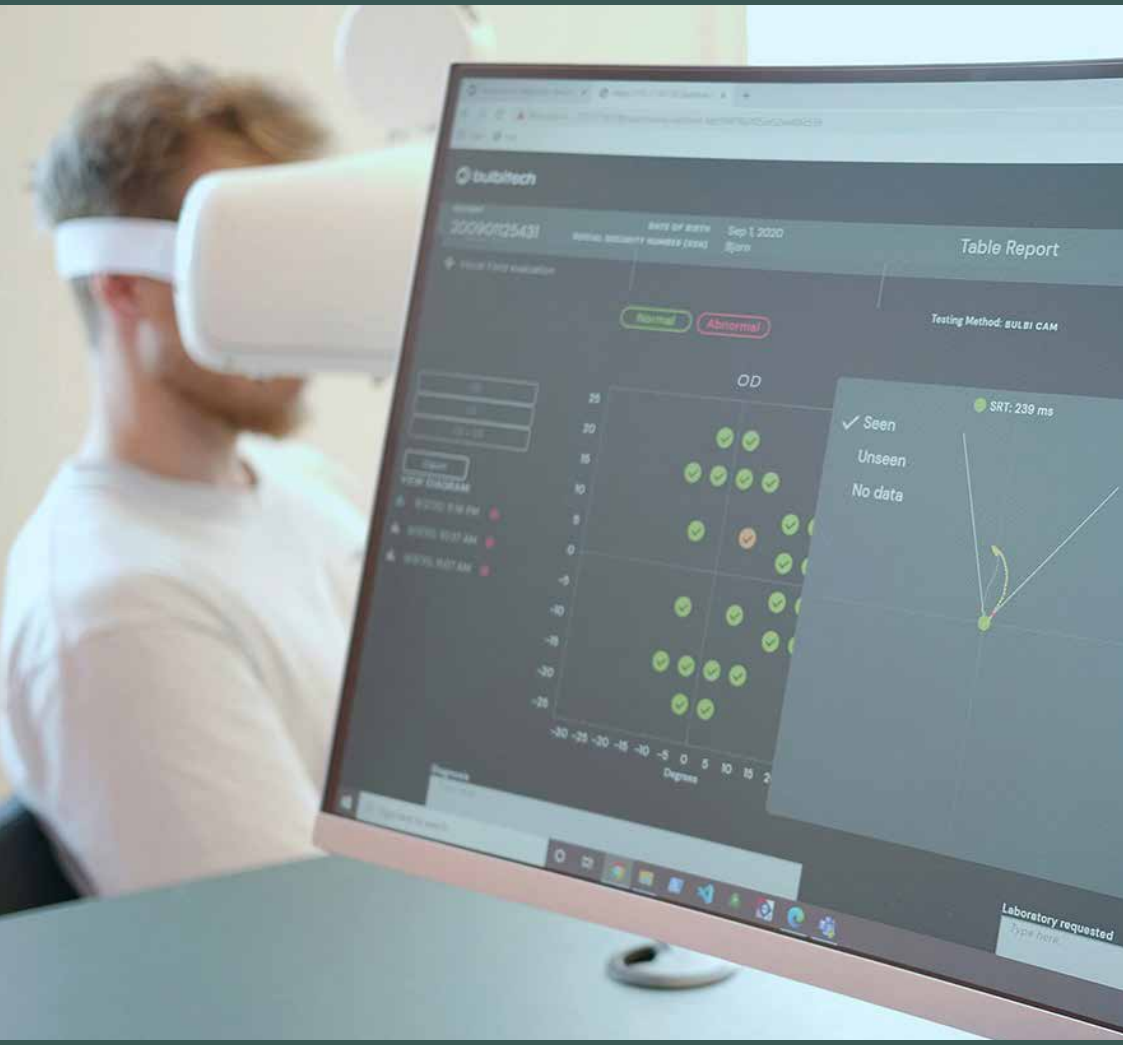
BulbiTech



17 Tests with 30+ Variables for Clinical Research and Use in Ophthalmology and Neurology

bulbitech
Neuro-ophthalmic examinations made easy

Our technology

Bulbitech introduces 17 functional tests to screen for ophthalmological, neurological, and neuro-ocular dysfunction, offering specialists access to over 30 variables.

The BulbiHUB software collects and presents test results in a clear and intuitive manner, facilitating comparisons, anomaly detection, and patient monitoring. Furthermore, Bulbitech aims to incorporate AI-based diagnostic algorithms into the BulbiHUB platform, enabling early detection of ophthalmological, neurological, and neuro-ocular dysfunctions.

Our user-friendly BulbiCAM provides objective results in a compact design, streamlining the examination process for clinicians. It allows tracking of one or both eyes, accommodating patients wearing mascara or using contact lenses/IOLs. Moreover, our self-supporting mounting system ensures patient comfort by alleviating weight and pressure from the neck, shoulders, and face.

Eye Movement Perimetry

Visual field defects, whether occurring in one eye or both, can arise from ocular or neurological disorders. Our objective is to examine the impact of these defects on saccadic reaction times across various parameters, such as stimulus size or brightness.

Method: Our method involves conducting eye movement perimetry tests that employ eye tracking technology. These tests assess the eye's ability to detect stimuli in the peripheral field while fixating on a central point. By measuring saccadic reaction times, we determine how quickly the eye responds and reaches the peripheral stimulus.

The test also incorporates visual tracing, and the results are conveniently presented in the output. Depending on the specific program utilized, the test can include varying quantities of points, providing comprehensive analysis of visual field performance.

16-point Test

Purpose: This test is designed to promptly investigate the impact of ocular motility limitations and large visual field defects on saccadic reaction times. Ocular and neurological disorders can lead to ocular motility disorders, resulting in a pseudo visual field defect where the eye struggles to move towards peripheral stimuli. Additionally, visible effects of significant visual field defects, such as those caused by damage to the visual pathways after a stroke, can be observed.

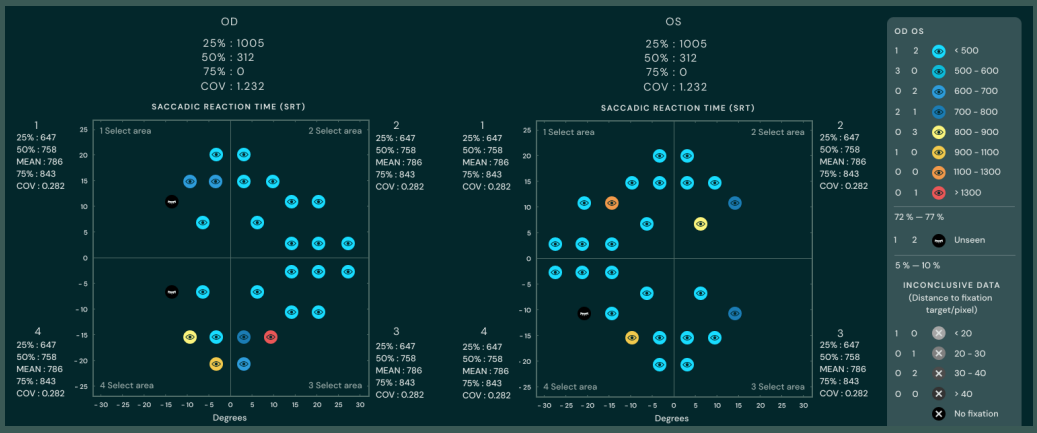
Method: The test evaluates saccadic reaction times at 16 carefully chosen positions to gauge the eye's response under these conditions. By analyzing saccadic reaction times, we can acquire valuable insights into the presence of ocular motility limitations and the extent of visual field loss associated with neurological disorders.

Test variables	Unit
Seen/unseen	Seen/unseen/no data
Saccadic reaction time	ms
Mean	ms
25%,50%,75% quartile	ms
Coefficient of variation	Scalar (0–1)

26-point Test

Purpose: The purpose of this test is to assess saccadic reaction times specifically in areas of the visual field that are indicative of glaucomatous visual field damage. These areas typically include superior and/or inferior paracentral and/or nasal defects. The test replicates the 24-2 glaucoma screening pattern commonly employed in standard automated perimetry, evaluating a total of 26 positions.

Method: By measuring saccadic reaction times at these specific positions, we can gather valuable information about the responsiveness of the visual system in areas susceptible to glaucomatous damage. This test provides insights into the early detection and monitoring of glaucoma, enabling effective screening and evaluation of visual field abnormalities.

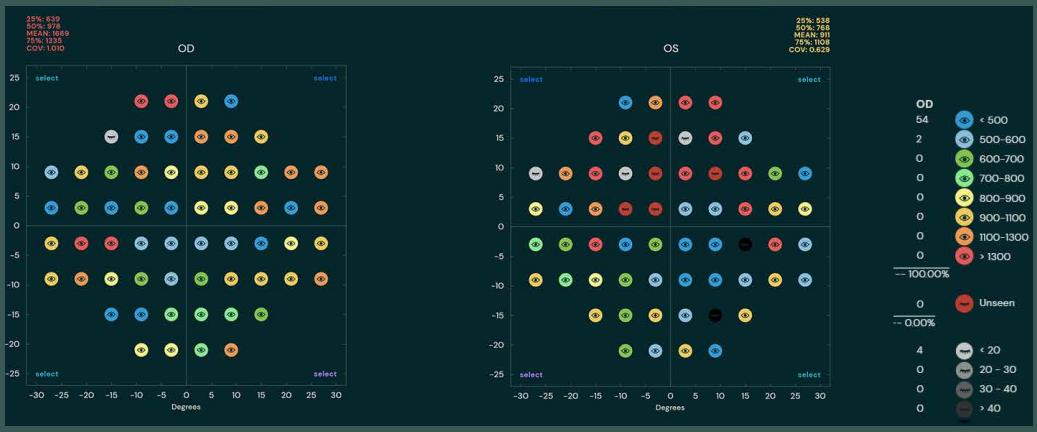


Test variables	Unit
Seen/unseen	Seen/unseen/no data
Saccadic reaction time	ms
Mean	ms
25%,50%,75% quartile	ms
Coefficient of variation	Scalar (0–1)

60-point Test

Purpose: This test aims to measure saccadic reaction times within a compact 60-position pattern. Its intended use is to investigate the impact of neurological disorders, particularly lesions along the visual pathways, on delayed reaction times.

Method: By analyzing saccadic reaction times in this densely spaced pattern, we can gain valuable insights into the effects of neurological conditions on the speed and efficiency of visual processing. This test provides a comprehensive assessment of delayed reaction times associated with specific neurological disorders, contributing to a better understanding of their impact on visual function.

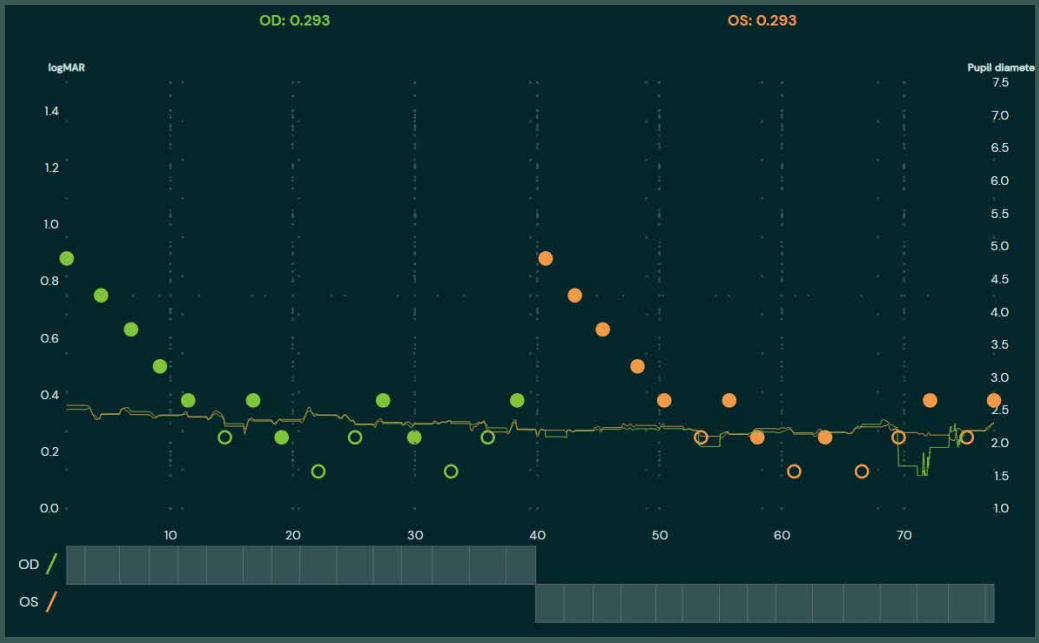


Test variables	Unit
Seen/unseen	Seen/unseen/no data
Saccadic reaction time	ms
Mean	ms
25%,50%,75% quartile	ms
Coefficient of variation	Scalar (0-1)

Dynamic Visual Acuity

Purpose: The test serves to determine the highest visual acuity values achieved under optimal refractive conditions for the eye. Various ocular and neurological conditions can lead to a decline in visual acuity. By conducting this test, we can gain valuable insights into the impact of these pathologies on visual acuity and assess the effectiveness of refractive corrections.

Method: The best corrected visual acuity test is designed to assess the eye's visual perception and tracking ability by presenting a high-contrast moving stimulus that gradually decreases in size. The subject's achieved thresholds are measured and represented using the logMAR scale.



Test variables	Unit
Visual acuity	LogMAR

Contrast Sensitivity

Purpose: The primary purpose of this test is to determine the highest achieved contrast sensitivity values under optimal refractive conditions for the eye. Additionally, it allows for the examination of how specific retinal pathologies impact contrast sensitivity. By conducting this test, we can gain insights into the eye's sensitivity to contrast and further our understanding of the effects of retinal conditions on visual perception.

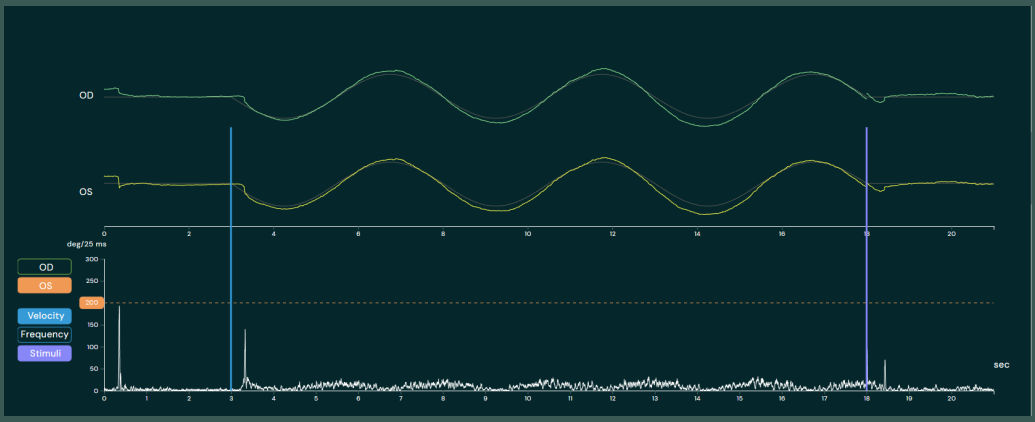
Method: The contrast sensitivity test is designed to assess the eye's capacity to perceive and track a moving stimulus with decreasing contrast levels.
By establishing thresholds, we quantify the subject's ability, and the measurements are represented using the Pelli Robson scale.

Test variables	Unit
Contrast sensitivity	Pelli Robson score

Smooth Pursuit Metrics

Purpose: The test aims to evaluate the ability of the eye to smoothly pursue a target. In certain neurodegenerative disorders, individuals may experience decreased smooth tracking abilities, leading to catch-up saccades.
By conducting this test, we can detect and quantify the dynamics of eye pursuit, shedding light on potential abnormalities in pursuit movements.

Method: The smooth pursuit test is employed to assess the eye's precision in smoothly tracking a visual target. It measures the gain (%) variable, which indicates the eye's level of accuracy in following the moving target in a controlled and fluid manner.

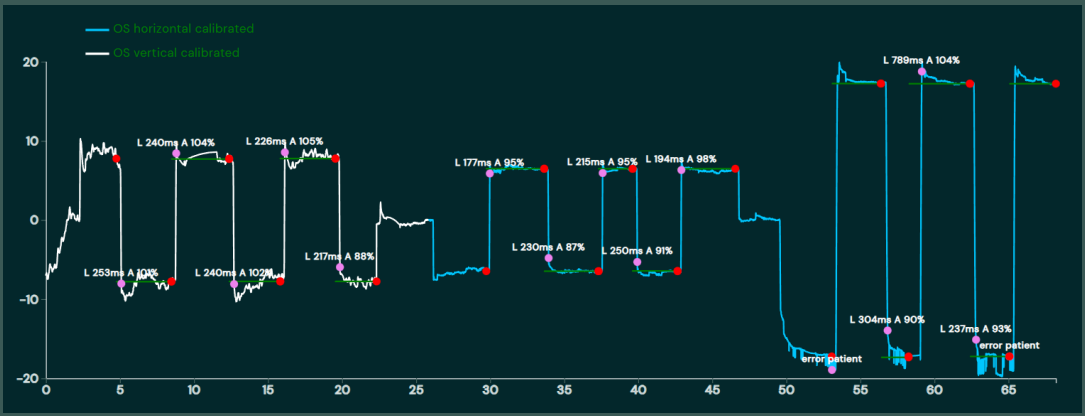


Test variables	Unit
Gain (velocity target/eye)	%
Timeshift	Second
Phaseshift	Second

Saccade Metrics

Purpose: Saccade metrics are measurements used to study and analyze eye movements, specifically saccades. Saccades are rapid, jerky movements of the eyes that shift the line of sight between different points of interest in the visual field. Saccade metrics provide quantitative information about these eye movements and can be used for various purposes, including: Research, diagnosis of ocular diseases, and evaluation of neurological diseases through signs of hyper- or hypometric eye movements.

Method: During a visual search task this test presents stimuli both horizontally and vertically. It is the patient's task to search the presented stimuli and move the eyes towards it.

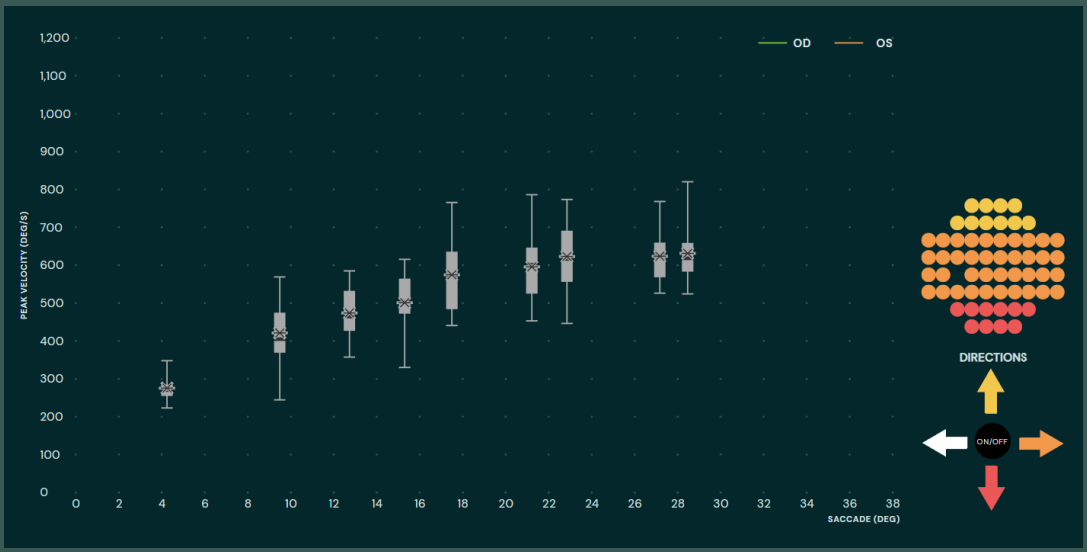


Test variables	Unit
Latency	ms
Accuracy	%
Peak velocity	deg/sec

Saccade Main Sequence

Purpose: Using this test, researchers can gain a deeper understanding of the underlying neural processes and control mechanisms involved in saccades. This information is crucial for investigating various aspects of oculomotor function, such as the impact of brain regions, neurological disorders, injuries, and external factors on eye movement behavior.

Method: The saccade main sequence graphically displays the relationship between the duration and amplitude of eye movements. The saccadic data are harvested from the visual field tests the patient has performed.



Test variables	Unit
X-axis: Amplitude of eye movements (distance between stimuli)	Degrees
Y-axis: Peak rotational speed of the eye movement	Degrees/second

Light Adaptation

Purpose: The primary purpose of this test is to examine the light-adaptive capabilities of the photoreceptors and retinal neurons in the foveal area, which corresponds to the central part of the retina responsible for main vision.
By conducting this test, we can gain insights into the functionality of the central retinal area and identify any potential impact caused by certain retinal disorders. This evaluation helps us better understand how these disorders affect visual perception.

Method: The light adaptation test is designed to assess the adaptive mechanisms of the central part of the retina. This is achieved by presenting a moving stimulus to the eye in darkened conditions while periodically exposing the eye to a fixed or variable frequency light source. The highest threshold at which the stimulus remains visible to the eye is measured and quantified using either the Pelli Robson (contrast) or Hz (frequency) scale.

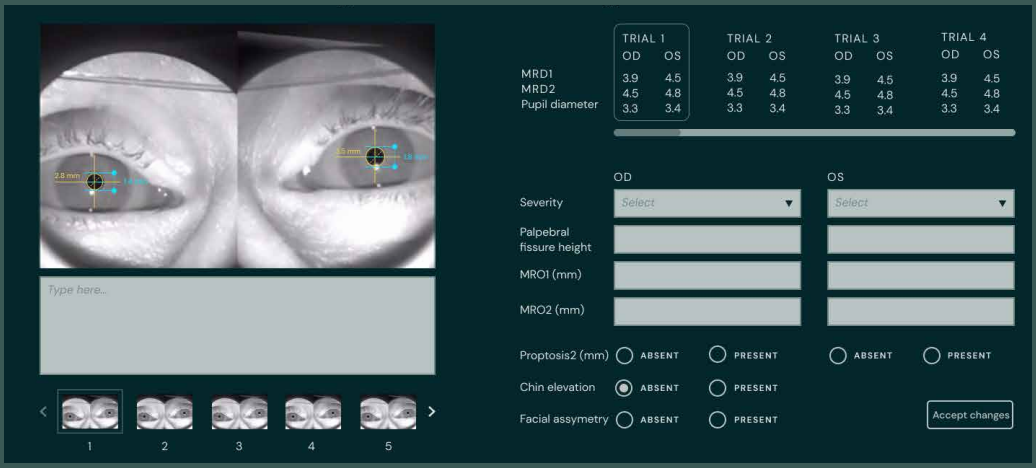
Test variables	Unit
Fixed contrast	Hz
Fixed frequency	logCon


“The only thing worse than being blind is having sight but no vision.”
– Helen Keller

Eyelid/Ptosis Metrics

Purpose: The primary objective of this test is to assess the position of the eyelids in relation to the center of the eye, as well as to measure the diameter of the pupil. By conducting this evaluation, we can gain valuable insights into any potential abnormalities or malpositions of one or both eyelids, as well as detect any asymmetry in pupil size. These observations may be indicative of ocular, neurological, endocrinological, or other types of disorders that can impact eyelid positioning and pupil symmetry.

Method: The ptosis test involves capturing images of both eyes and subsequently quantifying the positioning of the upper and lower eyelids relative to the cornea and pupil. Measurements are taken to determine the distance between the eyelid edges and the center of the pupil, as well as the diameter of the pupil itself.

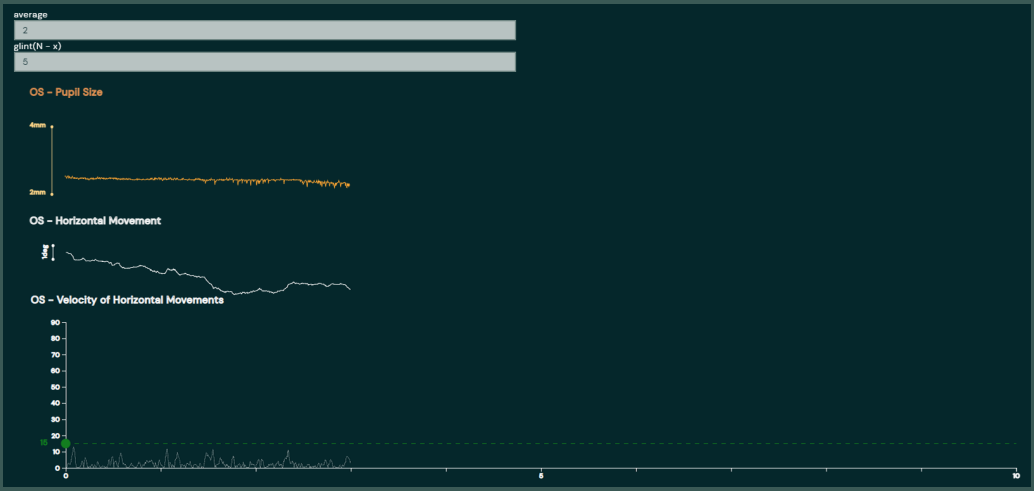


Test variables	Unit
MRD1	mm
MRD2	mm
Pupil size	mm

Fixation Stability Analysis

Purpose: The primary purpose of this test is to assess the eye's fixation capabilities. Specifically, it aims to detect and quantify any deviations in fixation that may occur, particularly in individuals with neurodegenerative disorders. By conducting this evaluation, we can gain valuable insights into the impact of such disorders on the ability to maintain steady fixation on an object.

Method: The Fixation Stability Analysis evaluates the ability of an eye to maintain steady fixation on a stationary target, without the occurrence of intrusive saccades. The test measures two key parameters: the span, which refers to the range of eye movements, and the peak velocity, which quantifies the maximum speed of these movements in degrees.



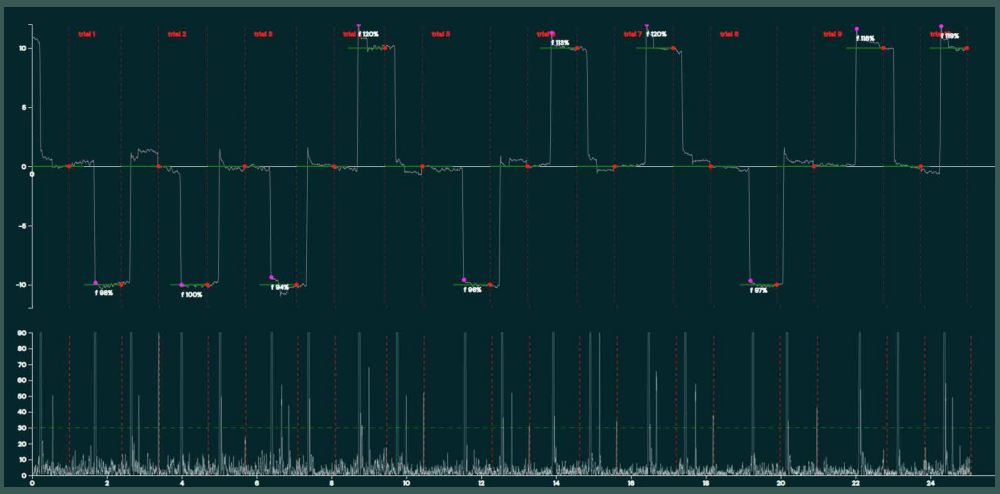
Test variables	Unit
Stability	mm
Duration	ms
Fixations/min	Number/min
Saccade amplitude	Degree

Test variables	Unit
Pupil mean diameter	mm
Pupil max	mm
Pupil min	mm

Pro-saccade Analytics

Purpose: The primary objective of this test is to assess the performance of saccadic eye movements. It aims to measure the values associated with fast eye movements, providing valuable information about their latency, accuracy, and peak velocity. By conducting this assessment, we can detect and quantify any abnormalities in saccadic movements, particularly those observed in individuals with neurodegenerative disorders.

Method: The pro-saccade test is conducted to evaluate the characteristics of fast eye movements, specifically saccadic latency, accuracy, and peak velocity. This test analyzes both short and long saccades.

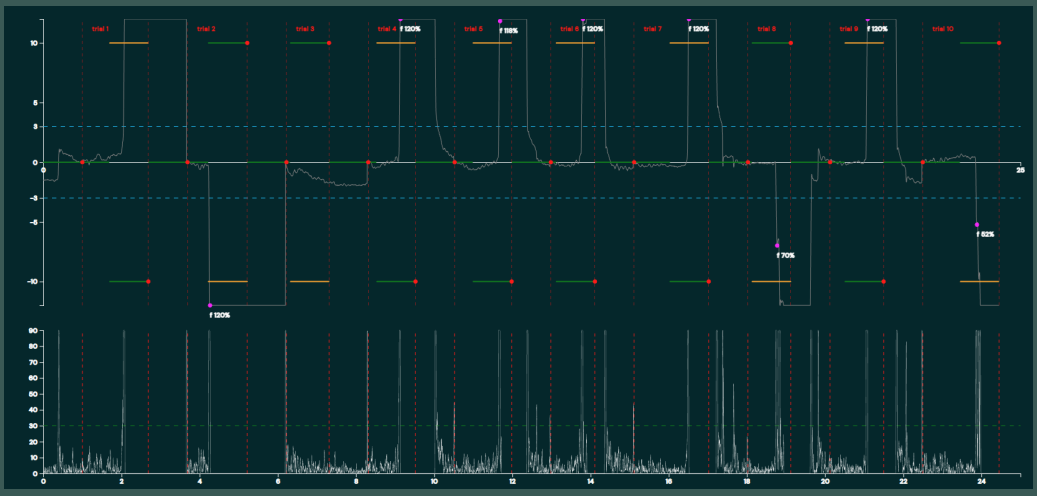


Test variables	Unit
Latency	ms
Accuracy	%
Peak velocity	Degree/sec

Anti-saccade Analytics

Purpose: The primary purpose of this test is to evaluate the performance of anti-saccades, which involve inhibiting reflexive saccades and intentionally shifting the gaze away from a given target. By conducting this assessment, we aim to study the test subject's ability to suppress automatic eye movements and exhibit voluntary control. This evaluation is particularly valuable in understanding the impact of certain neurodegenerative disorders on the individual's ability to effectively regulate eye movements.

Method: The anti-saccade test is designed to assess various characteristics of fast eye movements, including latency, accuracy, and peak velocity.
It accomplishes this by evaluating the gaze shift in the opposite direction from a presented target, both for short and long saccades.

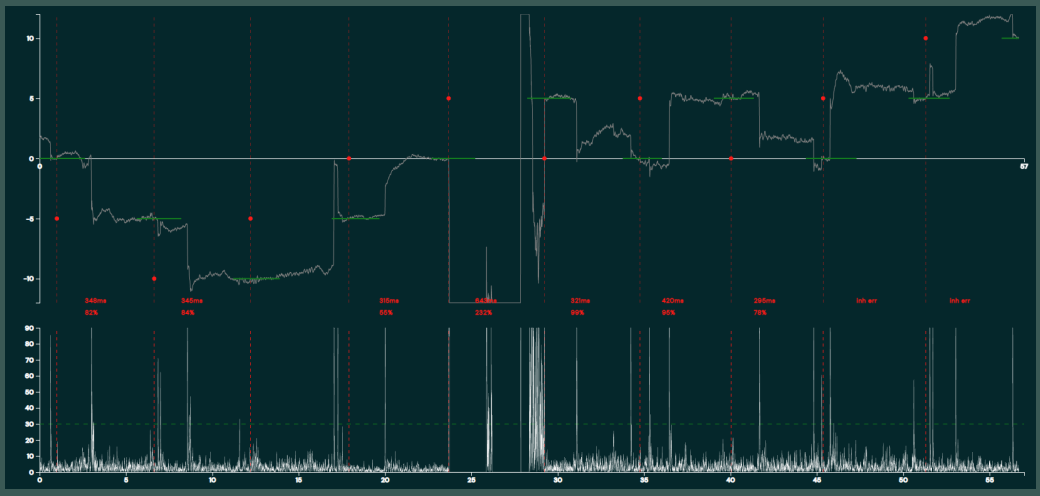


Test variables	Unit
Latency	ms
Amplitude	Degree
Peak velocity	Degree/sec
Number of gaze errors	Quantity

Memory Saccade Analytics

Purpose: The primary objective of this test is to study the performance of memory-guided saccades. Specifically, it aims to evaluate the test subject's capability to retain and utilize short-term visual memory for accurate eye movements. This assessment is particularly useful in understanding the impact of certain neurodegenerative conditions on short-term visual memory and the associated implications for eye movement control.

Method: The memory saccade test is designed to assess the transsaccadic memory of a test subject. It involves presenting a stimulus at a specific position and then measuring the individual's ability to accurately return their gaze to the same position after the stimulus disappears. The test measures both the latency (time taken) and accuracy of the gaze shift.



Test variables	Unit
Latency	ms
Accuracy	%
Number of gaze errors	Quantity

Express Nystagmus Analysis

Purpose: The primary purpose of this test is to investigate nystagmus, a condition characterized by involuntary eye movements. By utilizing video recording, the test aims to detect, characterize, and quantify these involuntary eye movements, which can arise from various ocular and neurological conditions.

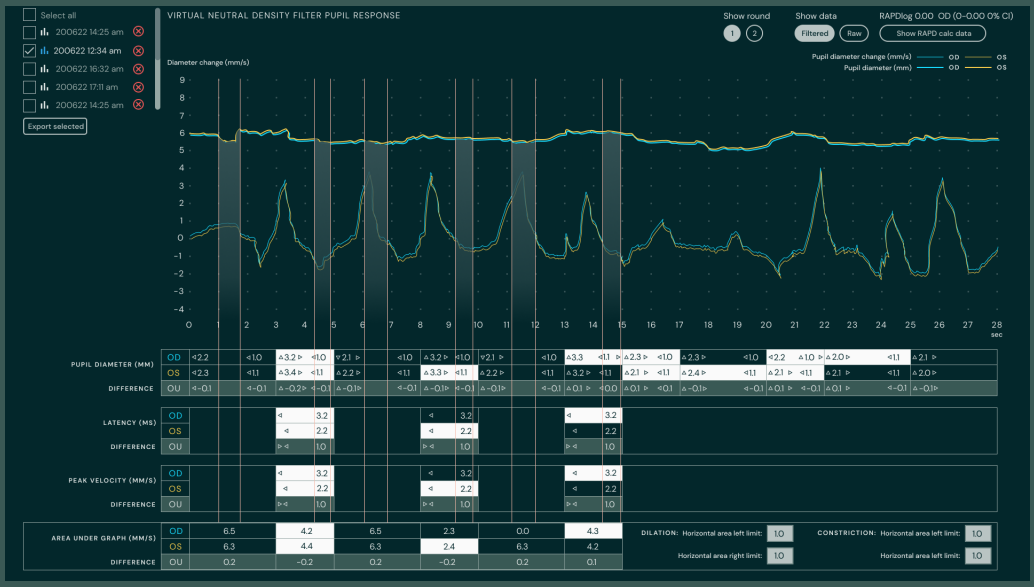
Method: The nystagmography test employs a video-based oculography technique to analyze involuntary eye movements. This comprehensive assessment involves measuring eye movements in 9 cardinal directions at both near (40 cm) and far (6 m) distances. The test provides output that displays essential information, including eye movement amplitude, frequency, and axis.

Test variables	Unit
Frequency	Hz
Amplitude	Degree
Axis	Degree

Dynamic Pupillometry

Purpose: The primary objective of this test is to assess the pupillary light response. It aims to appreciate the reaction of the pupil to changes in light and explore its correlation with Relative Afferent Pupillary Defect (RAPD).
This evaluation is particularly helpful in understanding how certain ocular and neurological disorders can affect the pupillary light response, leading to deficiencies in the form of monocular or bilateral pupillary defects.

Method: The pupil test examines the pupillary light responses by observing changes in the diameter of the pupil. This is achieved by exposing each eye to varying screen brightness levels simultaneously. The measurement output provides valuable information including pupil diameters, latency, and peak velocity under different light conditions.

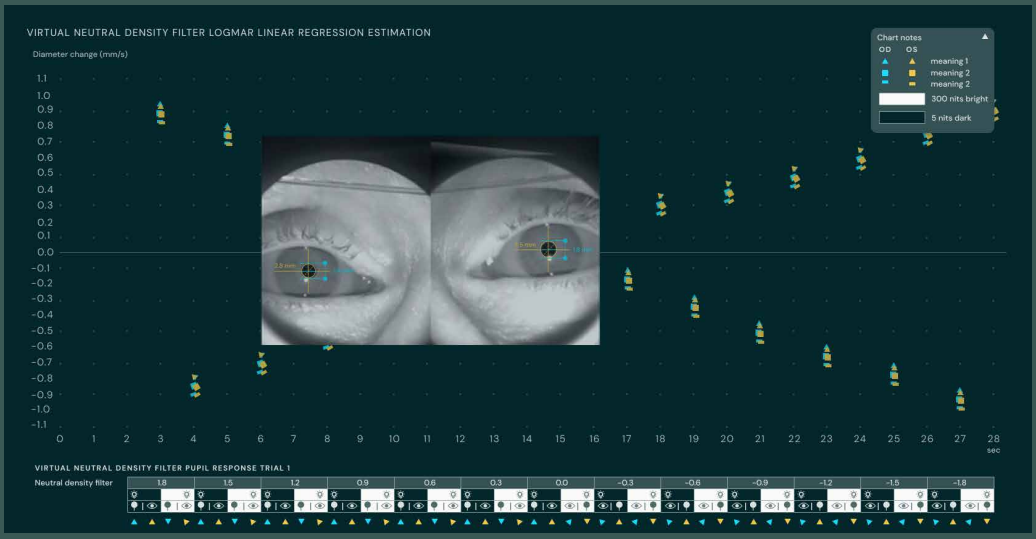


Test variables	Unit
Diameter min/max	mm
Peak velocity	mm/s
Latency	ms

RAPDlog Quantification

Purpose: The primary purpose of the RAPD test is to detect and accurately quantify a relative afferent pupil defect (RAPD). It aims to identify differences in how the two eyes respond to light and dark environments. This test is particularly valuable in detecting unilateral or asymmetrical signal transmission losses, which can occur due to conditions such as heavy retinal opacities or unilateral optic nerve dysfunction.

Method: The RAPD test involves stimulating the pupillary responses in each eye separately. This is achieved by alternating between a varying degrees of bright light to elicit pupil constriction and exposing the pupil to darkness to induce pupil dilation.



Test variables	Unit
RAPD score	RAPDlog units

BulbiHUB

The BulbiHUB is an eye and brain examination software platform for the screening of ophthalmological and neurological disorders. Paired with a BulbiCAM eye-tracking device, it enables the user to analyse the measured patient data of 15 tests with 30+ different variables.

BulbiHUB benefits

- Our solution offers swift and accurate clinical measurements, catering to the needs of research, ophthalmology, and neurology fields.
- The test results are presented in intuitive visual formats, making it easy to comprehend and analyze.
- With a single unified dashboard, you can conveniently access and explore comprehensive data on both the eye and brain.
- Our system seamlessly integrates with third-party ophthalmological diagnostic devices, enhancing its functionality and versatility.

BulbiCAM

The BulbiCAM is a state-of-the-art medical eye-tracker capable of accurately monitoring eye and pupil movements at a high frame rate of 400-600 frames per second. This head-mounted display comprises two small screens, one for each eye, as well as LED illuminators and an infrared eye-tracking camera. The device can project stimuli for both monocular and binocular vision tests, and it eliminates the need for calibration, ensuring ease of use. Additionally, the BulbiCAM offers the convenience of remote operation. Its primary application lies in functional vision testing, enabling the generation of valuable eye and brain biomarkers.

BulbiCAM benefits

- Developed for daily clinical usage
- Multiple types of tests in one device
- AI-powered eye tracking
- Individual compensation of refractive errors and head shape
- CE-certified & FDA-registered

Technical specifications

- Refractive error correction range: -10 to +4
- Interpupillary distance: 49 mm - 75 mm
- Adjustable for multiple head shapes, including children
- 400-600 fps eye tracking
- Stimulus synchronization: Typically +-18 ms, worst case +-38 ms
- BulbiCAM HMD weight: 2.5 kg
- CE certified, FDA registered

Included in the package

- BulbiCAM HMD eye tracker
- Compact PC with pre-installed BulbiHUB software
- Rehadapt adjustable arm table mount
- Adaptor DisplayPort 1.2 male to HDMI female

- Set of 5 lens holders without lenses
- Set of 5 lens holders with +6.0 lenses
- Lens holder dust cover
- Set of 3 adult face masks
- Face mask for children

- Organiser for lens holders
- Organiser for face masks
- Calibration tool
- Contrast measuring tool
- Lens calibration tool

Benefits of our technology

- Our innovative system enables rapid and comprehensive testing of both the afferent visual function and efferent system in patients.
- It combines the functionalities of a perimeter, pupillograph, and nystagmograph into a single device, streamlining the testing process.
- By using our system, healthcare professionals can detect ophthalmological and neurological conditions at an early stage, facilitating timely interventions.
- Moreover, the system provides objective data on the afferent visual function and efferent system, eliminating the need for manual examinations. This not only saves time but also allows patients to actively participate in the testing process.
- The system is designed to be user-friendly and can be operated by ophthalmic nurses, tech staff, or even remotely, enhancing its accessibility and convenience.

Disclaimer

BulbiCAM is intended for research purposes only and should, by itself, not be used for diagnostic purposes. Results from this device should not be used as the sole basis for any diagnosis, treatment, or medical decision. BulbiCAM and its tests support in diagnostic decision making, a decision that always needs to be taken by a medical doctor.

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