VestibularVision

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Clinical Application Manual

1. Purpose and Intended Use

VestibularVision is a clinical application designed to assess the interaction between binocular vision and vestibular function under practical viewing conditions. The application quantifies diplopia behavior, vestibular modulation of gaze, the prism correction required and the constraints of prisms on the visual field.

The test is explicitly intended for two patient populations:

1.1 Patients with diplopia or diplopia-like complaints

Including patients with:

- constant or intermittent diplopia,
- visually induced dizziness or spatial disorientation,
- suspected vestibular contribution to binocular instability.

In this group, VestibularVision is used to:

- objectify diplopia behavior,
- assess vestibular influence on binocular alignment,
- determine clinically relevant prism correction.

1.2 Patients without diplopia (prism-induced testing)

Patients without spontaneous diplopia may undergo VestibularVision **with prism correction applied** in order to:

- provoke controlled binocular disparity,
- assess vestibulo-ocular reflex (VOR) stability under binocular stress,

- detect latent vestibular dysfunction.

This use case is intentional and fundamental to the design of the application.

2. Examiner Responsibility

The examiner is responsible for:

- selecting the practical test distance appropriate to the clinical goal,
- choosing appropriate display equipment (monitor or projection),
- correct calibration before the patient enters the room,
- providing correct patient instructions,
- validating patient performance and rejecting invalid tests,
- interpreting results within clinical context.

3. Test Distance and Display Equipment

3.1 Variable test distance (essential)

The test distance is not fixed. It must be chosen to correspond to the functional goal of the assessment, for example:

- reading distance,
- computer or screen work distance,
- intermediate distance,
- far distance (several meters to optical infinity).

All measurements, prism calculations, and visual field estimates are valid only for the selected distance.

3.2 Display requirements

Patients with large diplopia angles may perceive the secondary image far outside a standard monitor.

Therefore:

- large screens or
- projection systems (beamers)

are required for testing at large distances.

The examiner must ensure that both the primary image and the diplopic image remain visible on the display.

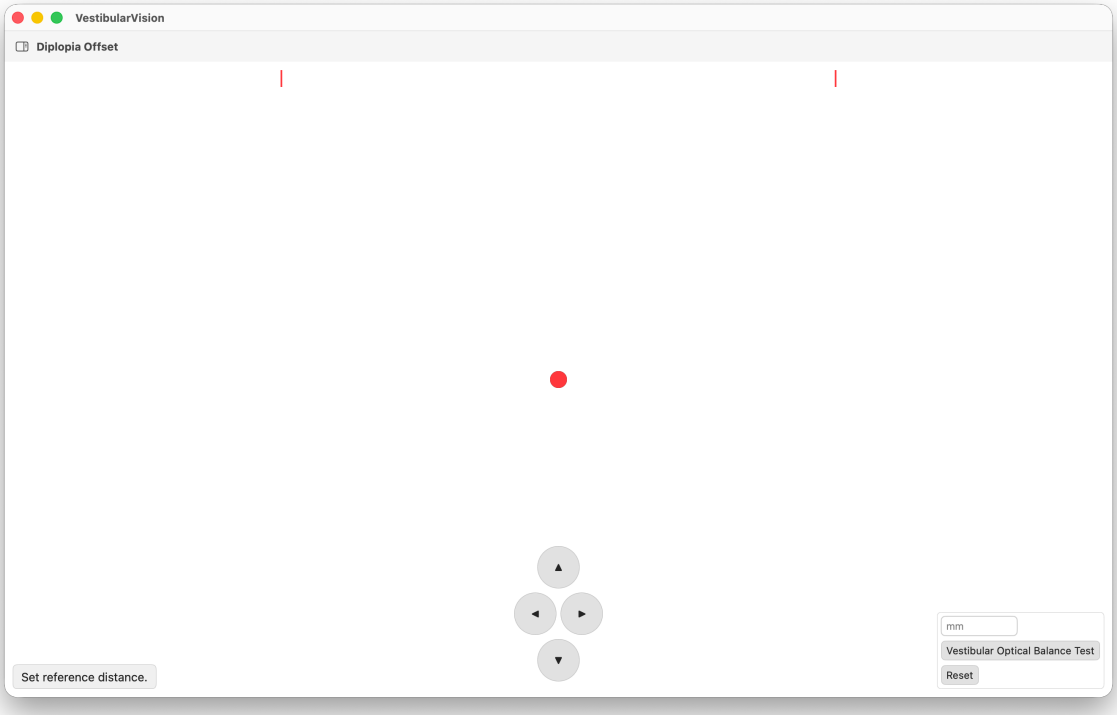
4. Calibration (Examiner Only)

Purpose

Calibration defines the geometric scale of the display so that all subsequent measurements are expressed in true millimeters.
Calibration is ideally performed before the patient enters the room.

Calibration Screen

The Diplopia Offset test displays two red reference lines at the top of the app.



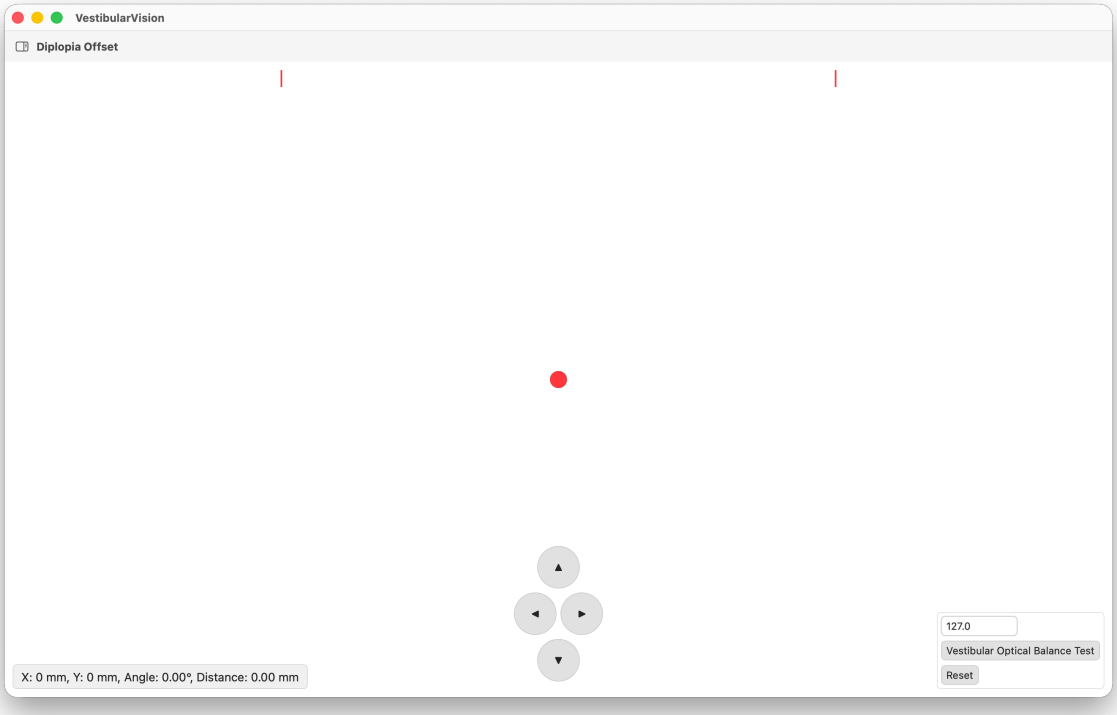
Calibration Procedure

The examiner:

1 Measures the physical distance between the two red lines using a ruler or caliper.

2 Enters this value (mm) into the calibration field at the bottom-right of the screen.

3 Confirms the value by pressing enter.



Any change in:

- screen size,
- resolution,
- orientation,
- display device

requires recalibration.

5. Initial Diplopia Check (Entry Screen)

General visual perception requirement

During all test phases, the patient must not attempt to actively focus, fuse, or correct the perceived images.
Active visual effort may reduce observable diplopia through suppression or voluntary fusion, leading to systematic underestimation of binocular disparity.

The test is designed to assess natural gaze behavior and maximal diplopia, not corrected or compensated vision.

Purpose

To determine whether spontaneous diplopia is present at the selected test distance.

Patient Instruction

“Look at the screen. Describe how many dots you see.”

Examiner Validation

- One dot: no diplopia present → testing may proceed only with prism-induced mode.
- Two dots: diplopia present → proceed with standard diplopia alignment test.

If the patient reports inconsistent perception, the test must be repeated.

(When prism-induced viewing is necessary, select prisms that create a noticeable separation between the dots. Based on the testing distance, we recommend maintaining a minimum of 10 cm between the dots, which corresponds to a requirement of 10 prism diopters at a distance of 1 meter. If the distance is increased to 2 meters, 10 prism diopters will result in a separation of 20 cm between the dots. Conversely, at a distance of 0.5 meters, the separation will be reduced to 5 cm. In summary, as the testing distance decreases, a higher prism value is needed to achieve the desired effect.)

6. Diplopia Alignment Test (Baseline)

Purpose

To quantify diplopia and establish baseline binocular alignment.

Patient Instruction

“You will see a dot in the centre of the screen and a second "ghost" dot, elsewhere on the screen. Use the arrow controls to move the red dot onto the ghost image.” (Repeat this test to see if the input of the patient is consequent)

The controls may be:

- on-screen buttons controlled by mouse input,
- or keyboard arrow keys.

Expected Visual Sequence

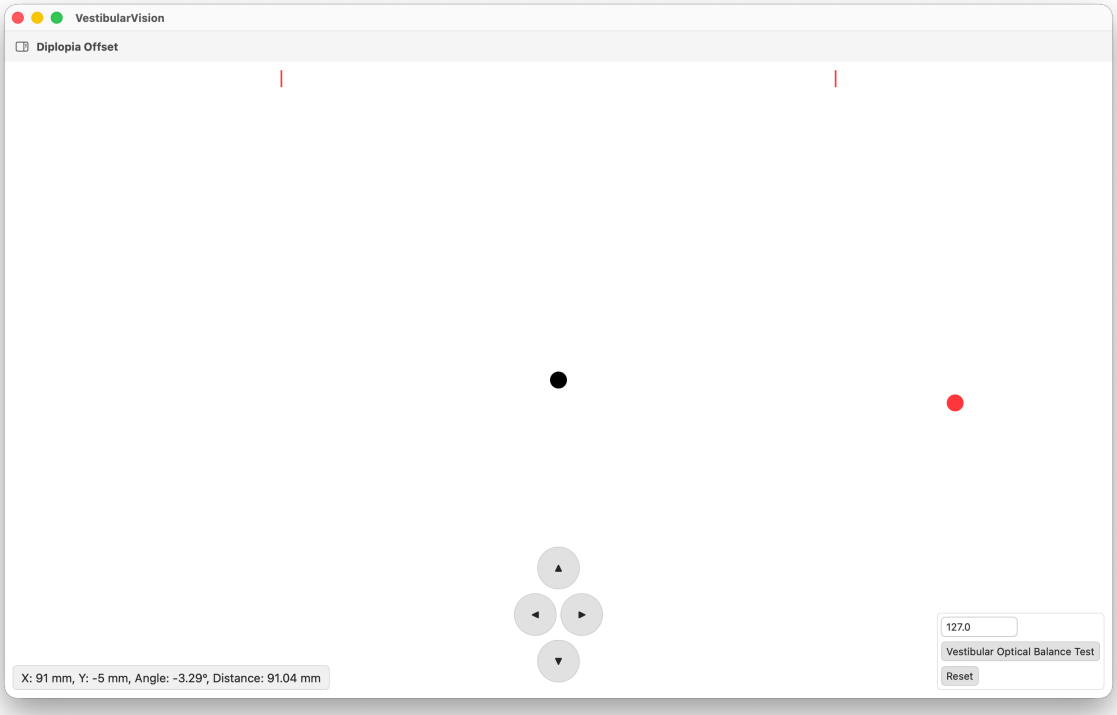
Ask the patient in what order he/she sees the dots? Correct execution results in the following perception at the centre:

1 a black dot,

2 then a red/black overlapping dot,

3 finally a single red dot.

Examiner Validation (critical)



- If the patient reports two black dots followed by two red dots, the task is incorrectly executed → test invalid.

Note: the examiner can't visually verify the results of this test.

7. Static Head Tilt Test

Purpose

To assess vestibular modulation of binocular alignment.

Head Positions

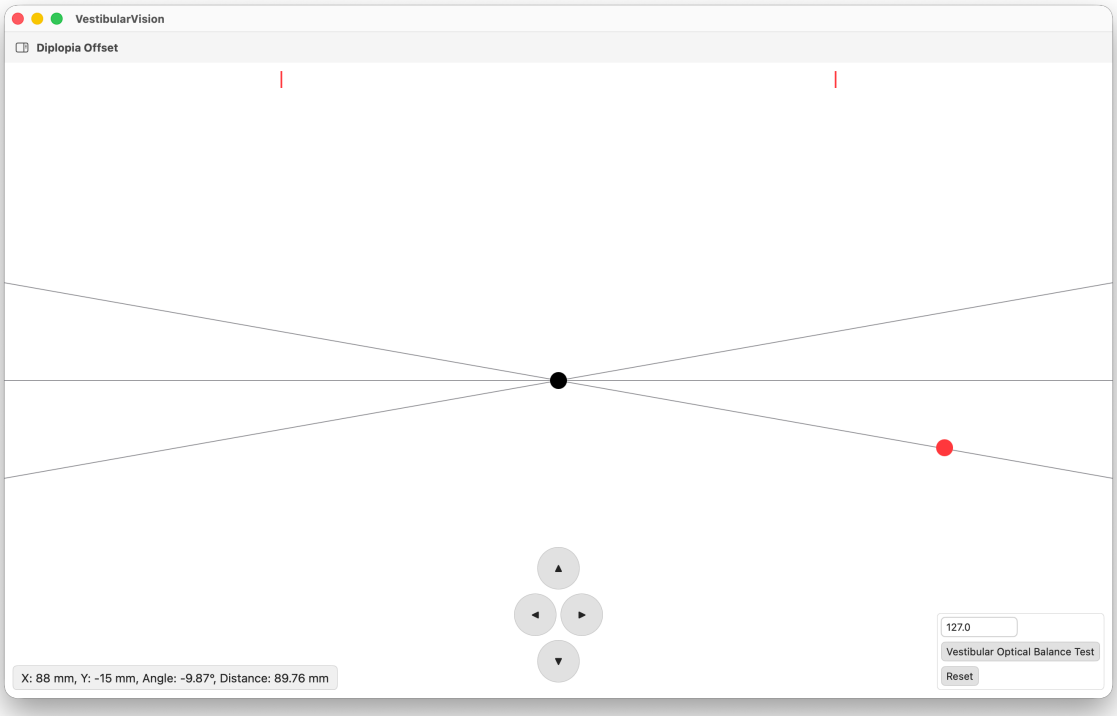
- Static head tilt of 10° left.
- Static head tilt of 10° right.

Patient Instruction

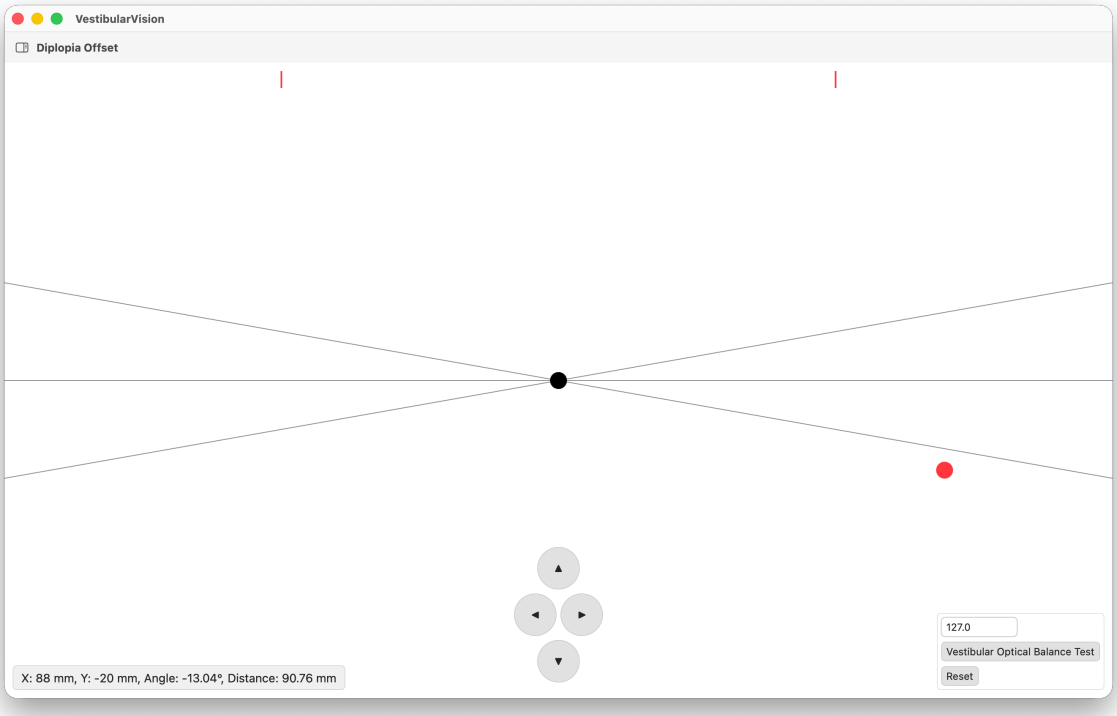
“Keep your head tilted in such a way that you see one angled line. Then move the red dot so that it covers the off centre black ghost image. You now should see a black dot in the centre of the screen, then a red/black dot and then a red dot whereby the line goes exactly through the centre of each dot”

Examiner Validation

- Two dots on one straight line: valid.



- If the red dot is visibly off-line: invalid.



Invalid trials must be rejected and repeated.

8. Prism Calculation Module

Purpose

To determine the clinically required prism correction for the selected test distance.

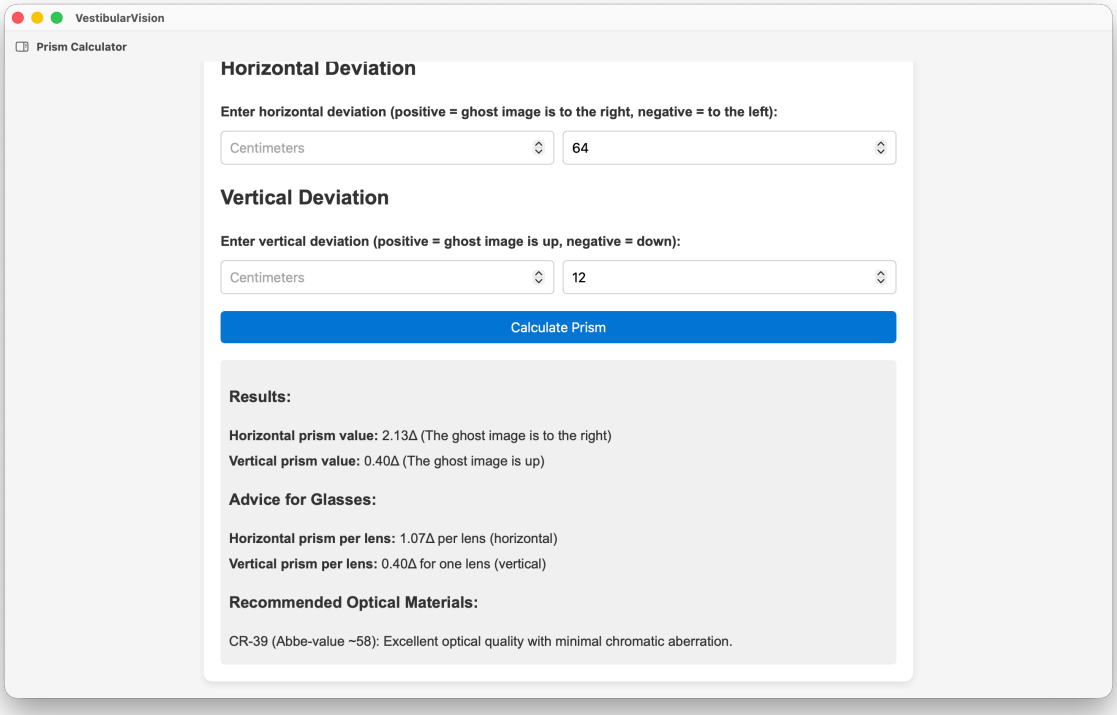
Procedure

The examiner enters:

- horizontal diplopia value,
- vertical diplopia value,
- test distance.

The application calculates the corresponding prism correction.

This step translates measured diplopia into practical optical correction.



9. Visual Field Assessment

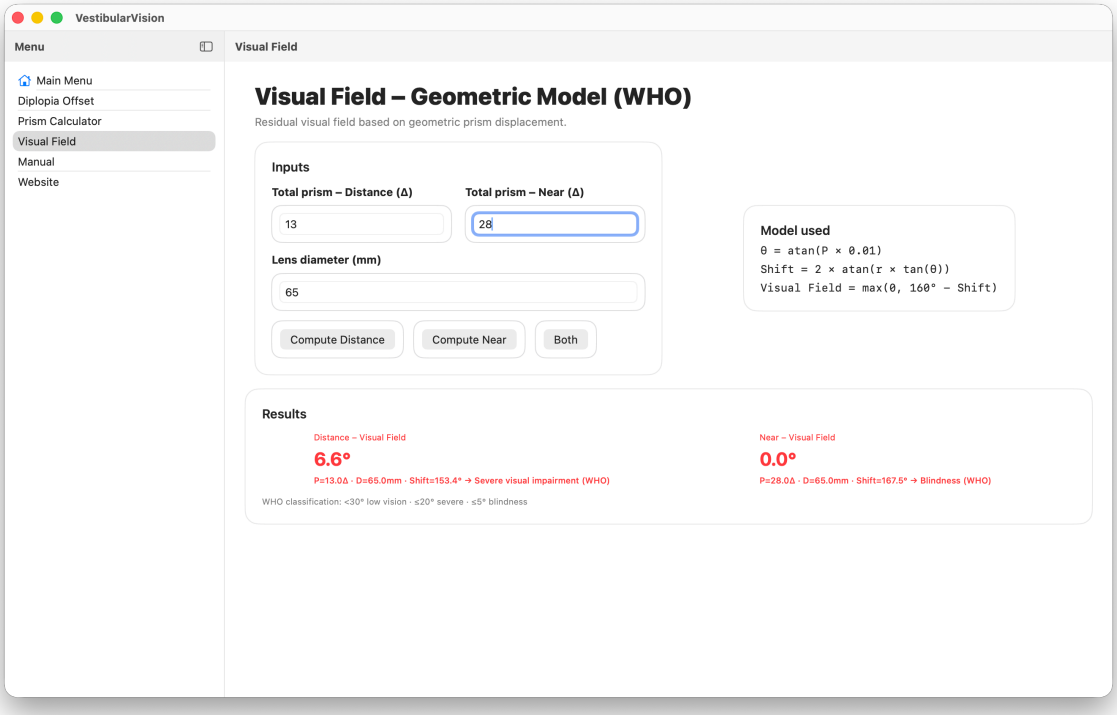
Purpose

To assess the functional visual field resulting from the calculated prism correction.

The application indicates whether the resulting visual field corresponds to:

- normal or mildly reduced field,
- low vision,
- severe visual impairment,
- blindness.

This assessment reflects the functional consequences of prism correction at the selected distance.



10. Interpretation of Diplopia Distance (mm)

Diplopia change	Interpretation
0–2 mm	Normal vestibular contribution
2–4 mm	Mild vestibular dysfunction
4–8 mm	Moderate vestibular dysfunction
8–15 mm	Severe vestibular dysfunction
>15 mm	Near-complete or complete vestibular failure

These thresholds apply to the distance between the horizontal and the static 10° head tilt.

The referenced thresholds describe associations reported in the literature and are provided for contextual interpretation only. This software does not determine vestibular function.

11. Scientific Basis

The protocol aligns with established research demonstrating:

- otolith-driven gaze control,
- vestibulo-ocular reflex involvement in binocular stability,
- diplopia behaviour as a marker of vestibular dysfunction.

Key references include Angelaki & Cullen, Leigh & Zee, Collewijn et al., and Wetzel et al.

12. Validity and Rejection Criteria

The test must be rejected if:

- calibration is incorrect,
- display size or distance changes,
- patient reports incorrect dot patterns,
- dot alignment is not exact,
- inconsistent responses occur.

13. Summary

VestibularVision is a practical, application-based clinical tool that:

- quantifies diplopia,
- evaluates vestibular modulation of gaze,
- determines clinically relevant prism correction,
- assesses functional visual field consequences.

Correct use requires strict adherence to setup, calibration, patient instruction, and examiner validation.

⚠ Low Vision Warning

The software provides a warning when the calculated prism correction indicates a substantial reduction of the unobstructed viewing angle.

An unobstructed viewing angle of 30° or less corresponds to the WHO definition of Low Vision.
An unobstructed viewing angle of 5° or less corresponds to the WHO definition of blindness.

These classifications may have practical consequences under local regulations, such as driving eligibility, reporting obligations, or access to specific support measures or reimbursements.

It is the responsibility of the professional to assess and communicate these implications in accordance with applicable local rules and guidelines.