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# Utilization of the ICS Impulse for Oculomotor Assessment in Videonystagmography

Presented by  
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## Overview




**Test Lists**

- Automatic Protocol
- Collected Tests
- Oculomotor**
  - Gaze
  - VOR
  - Skew Deviation
  - Saccade
- Head Impulse**
  - Head Impulse
  - SHIMP
- Positional**
  - Dynamic
  - Repositioning
- Caloric**
  - Caloric


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- ☒ Saccade-Both Eyes
- ☒ Gaze-Both Eyes
- ☐ Tracking-Both Eyes
- ☒ Dix-Hallpike-Both Eyes
- ☒ Position-Both Eyes
- ☒ Optokinetic-Both Eyes
- ☐ Caloric-Both Eyes




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### Learning objectives

- The participant will be able to describe the clinical relevance of the different assessments within the **ICS Impulse system**
- The participant will be able to visualize the vestibular and neurological pathways of varying assessments on the VNG and ICS systems
- The participant will be able to identify which VNG and ICS Impulse assessments are assessing the similar neurological pathways



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### Introduction to oculomotor assessment using videonystagmography

Videonystagmography (VNG):

- directly measures eye movement
- records eye movements (including nystagmus)
- used to differentiate between peripheral and central pathology




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**Oculomotor test battery comparison using ICS ChartR and ICS Impulse**

ICS ChartR VNG	ICS Impulse System
Calibration	Calibration
Saccades (Binocular)	Saccades (Monocular)
Tracking	Visually enhanced vestibulo-ocular reflex (VVOR)
Optokinetic	Vestibulo-ocular reflex suppression (VORS)

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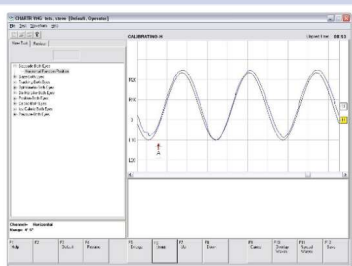

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**Calibration**

*Calculates a conversion factor between measured parameters and eye movements*

ICS ChartR VNG	ICS Impulse System
Tracking	Saccades

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## Saccades

### Saccade Pathways

Labels in the diagram:

- Supplementary eye fields
- Posterior parietal cortex
- Frontal eye fields
- Caudate nucleus
- Substantia nigra pars reticulata
- Mesencephalic and pontine reticular formations
- Superior colliculus

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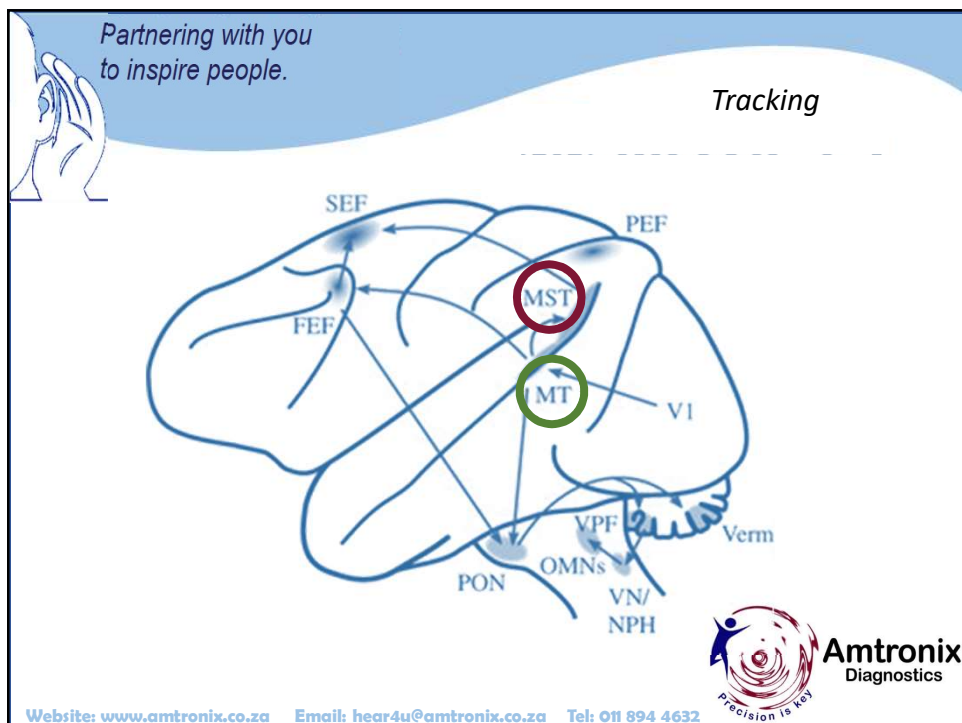
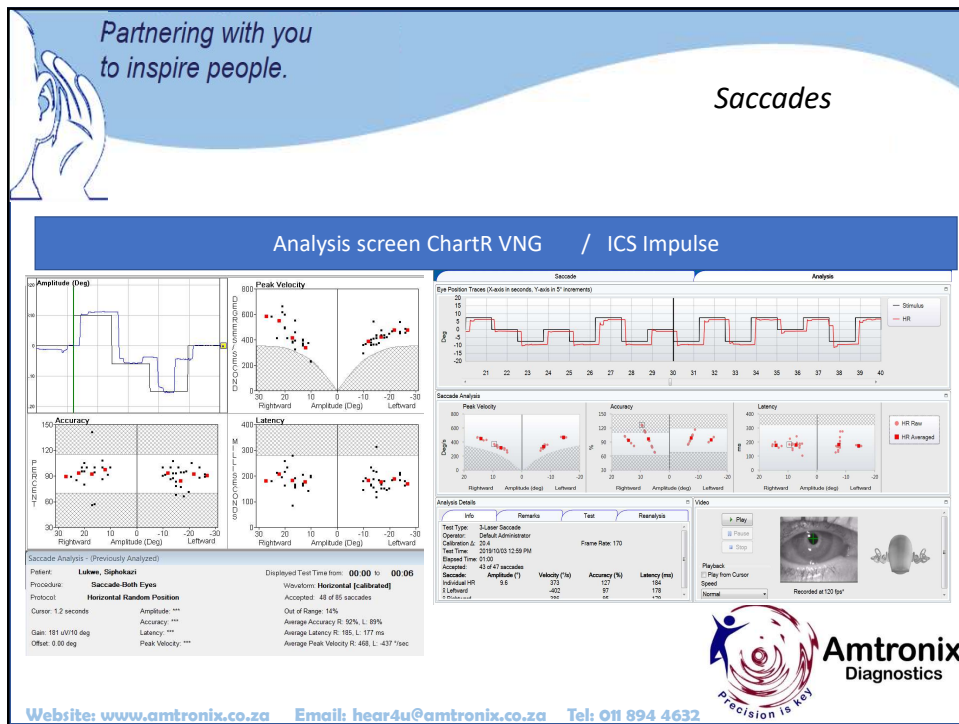
## Saccades

### Test procedure

- Purpose: To examine the patient's ability to make fast eye movements
- Record eye movements as the patients looks back and forth between targets in the horizontal plane
- Stimulus:
  - Generated on a light bar / wall using targets moving at randomized amplitudes and directions
- Run the test for at least one minute to collect enough data
- Ask the patient not to anticipate target movements
- Ask the patient to avoid head movement
- Look for the patient's best performance

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Tracking

Test procedure

- Purpose: To evaluate the smooth pursuit pathways by examining the patient's ability to generate slow foveal tracking eye movements
- Record eye movements as the patient follows a visual target moving smoothly back and forth in the horizontal plane
- Stimulus
  - Generated on a light bar using sinusoidal waveforms with peak-to-peak amplitude of 30deg at frequencies of 0.2-0.7 Hz
- Run two full series unless first cycle is very clean
- Ask the patient to avoid head movements
- Look for the patient's best performance

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Tracking

Analysis screen ChartR VNG


Tracking Analysis - (Previously Analyzed)

Patient: Lukwe, Sipheleazi	Displayed Test Time from: 00:00 to 00:15
Procedure: Tracking Both Eyes	Waveform: Horizontal [calibrated]
Protocol: Sine Horizontal	Accepted: 25 of 42 cycles
Frequency = 0.20 Hz	Out of Range: 1%
Phase Shift = 1.5	Average Rightward Gain = 0.89
Gain: 181, uV/10 deg	Average Leftward Gain = 0.74
Right Gain = 1.00	
Left Gain = 0.90	
Offset: 0.00 deg	

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Optokinetic

Test procedure

- Record eye movements as the patient watches a series of visual images moving first to the right and then to the left in the horizontal plane on the light bar
- Stimulus:
  - Constant velocity movements at 20-40 deg/sec
- Record until you have at least 5 good nystagmus beats for each direction
- Ask the patient to avoid head movement
- Look for the patient's best performance



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Optokinetic

Analysis screen ChartR VNG / Manually obtained

The screenshot displays the ChartR VNG software interface. The top section shows a graph of Slow Phase Velocity (SPV) in degrees per second (°/sec) over time in seconds. The y-axis ranges from -80 to 80, and the x-axis ranges from 0 to 140. A blue line represents the SPV, showing a series of peaks and troughs. Below this graph is a 'Slow Phase Velocity Analysis' section with the following data:

Patient:	Demo 1, Normal VNG	Analysis Window (secs):	0 to 7
Procedure:	Optokinetic-Both Eyes	Waveform:	Horizontal [calibrated]
Protocol:	40 degrees/sec Right		
Cursor:	2.6 seconds		
Slope:	75°		
Best SPV:	37.3 °/sec	Peak SPV:	45 °/s at 2.6s
Begin Time:	0.6 seconds		

On the right side of the interface, there is a 'Controls' section with tabs for 'Test Setup', 'Calibration', 'Collection', and 'Remarks'. The 'Test Setup' tab is active, showing a camera view of a patient's eye. A blue arrow points to the 'Other' option under the 'Collection' tab. The 'Other' option is selected, and the 'Torsional Reference Frame' section shows 'Capture' and 'OK' buttons.

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VVOR

Visually-enhanced vestibular ocular reflex

Test procedure

**Purpose:** Record eye movements as the patient sustains fixation on a stationary target while the head is being moved smoothly back and forth in the horizontal plane

**Stimulus**  
Stationary dot on the wall

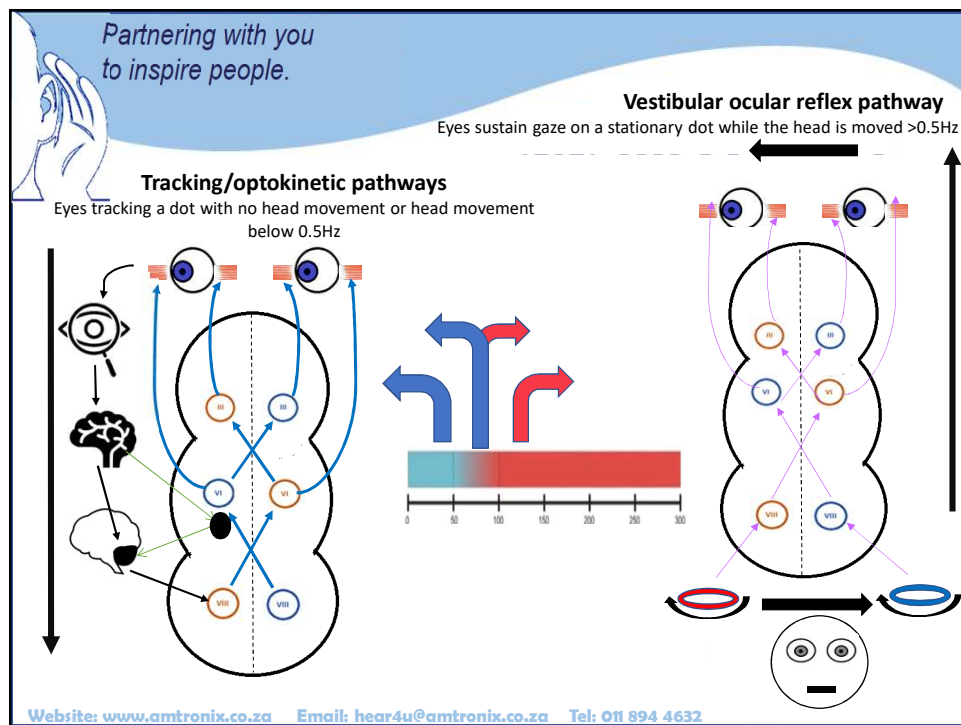
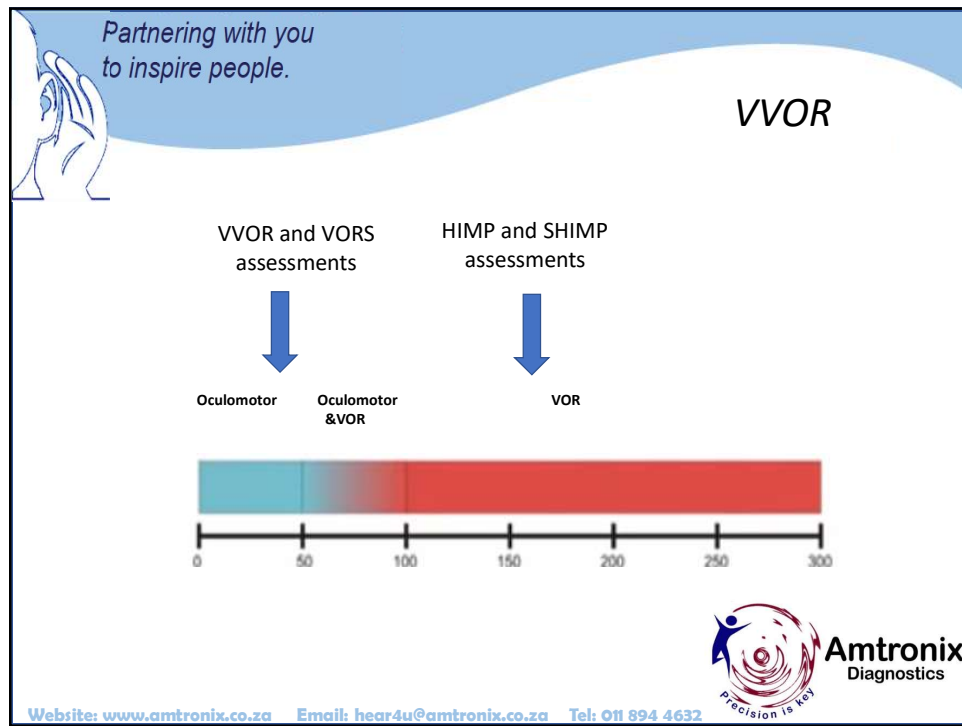
Look for the patient's best performance

The image shows a person wearing a VOR device, which is a head-mounted display with a camera. The person is looking at a stationary dot on a wall. The device is designed to record eye movements while the head is moved smoothly back and forth in the horizontal plane.

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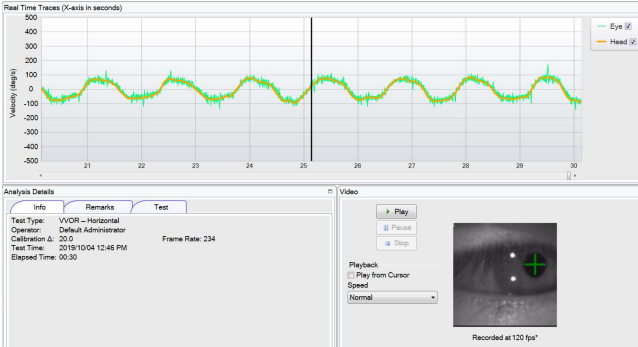




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VVOR

Analysis screen ICS Impulse



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VVORS

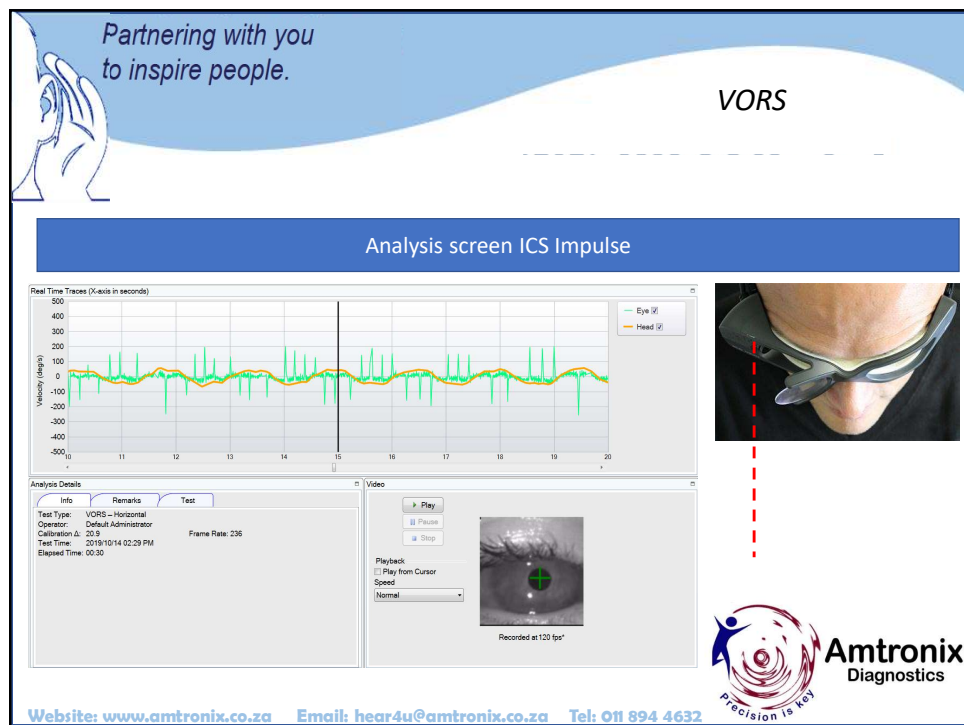
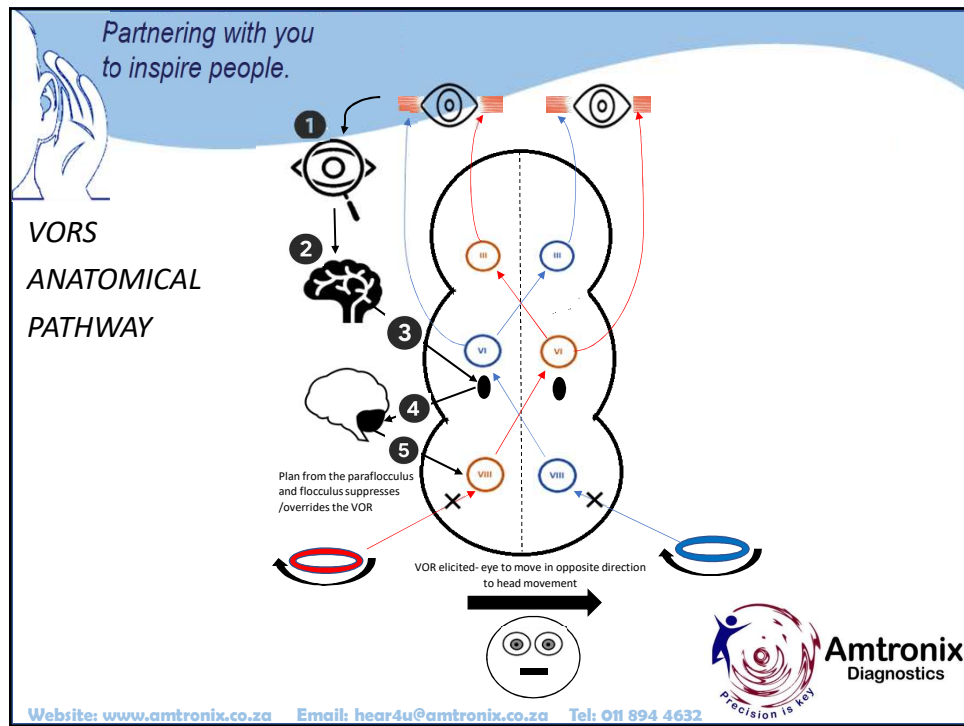
Test procedure

- Purpose: Record eye movements as the patient's head is being moved from side to side in the horizontal plane at 0.5Hz and sustaining fixation on a laser dot which is beaming from the Impulse goggles (moving with the head)
- Look for the patient's best performance





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**DISADVANTAGES OF ICS IMPULSE**

- *INO missed*
- *Right eye abnormalities*
- *VVOR and VORS is analysed subjectively where as tracking is analysed objectively*
- *Frequency of head movement is subjectively controlled by the tester which makes it difficult to obtain frequency specific information like what is obtained in tracking assessment using the ChartR VNG system*
- *Peripheral pathology can affect test results (Ramos et al, 2018)*




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**ADVANTAGES OF ICS IMPULSE**

- *Portable*
- *Comprehensive assessment of both the central and peripheral vestibular system*
- *Modular*
- *Monitoring*
- *Goggle design*
- *S-L-O-W motion video recording with playback*



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Summary and conclusion




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