PRINCIPLES OF VNG ANALYSIS

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Principles of VNG analysis

1. Set up for success
2. Clean up responses
3. Assess each result
4. Check your work

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1. Set up for success

- Goggle placement
  - Optimal data collection depends on optimal camera positioning!
- Video adjust
- Calibration
  - Range

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Goggle placement

1. Click on *Video Adjust*
   - View eyes while placing the camera
2. Loosen the back and top headbands on the goggles
3. Place the goggles on the bridge of the patient's nose and pull the back headband over the patient's head
4. Position the goggles so that pupils are center and level
5. Tighten the headbands
   - Goggles should be snug; patient may have "raccoon eyes" afterwards
6. Fine-tune the positioning with the knobs (H,F,V)

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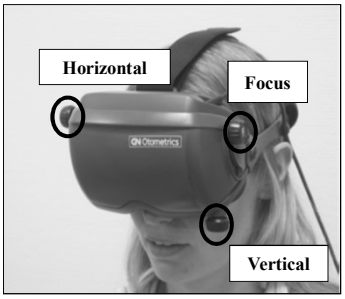
Goggle placement



Horizontal knob: adjusts the distance between the cameras

Focus knob: adjusts the distance between the cameras and the patient's pupils

Vertical knob: adjusts the camera up and down

***Most commonly used**

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Goggle placement tips

- Position the back headband as low as it can go
  - Below the inion if possible
  - The two straps of the back headband may be positioned so that one is above inion and other is below
- Make sure the top headband is straight
  - Generally need to leave this with as much length as possible
  - The top headband can assist with raising and lowering the goggles on the patient's face

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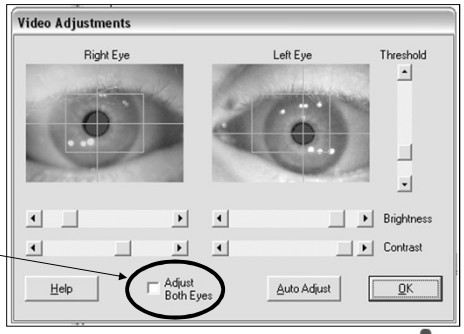
Video Adjust

- Auto-adjust is a good place to start
- Manual adjust should be used for optimizing the image
  - Brightness and Contrast can be done individually or for both eyes together; Threshold affects both eyes

Adjust Both Eyes is for manual adjustment of Brightness and Contrast



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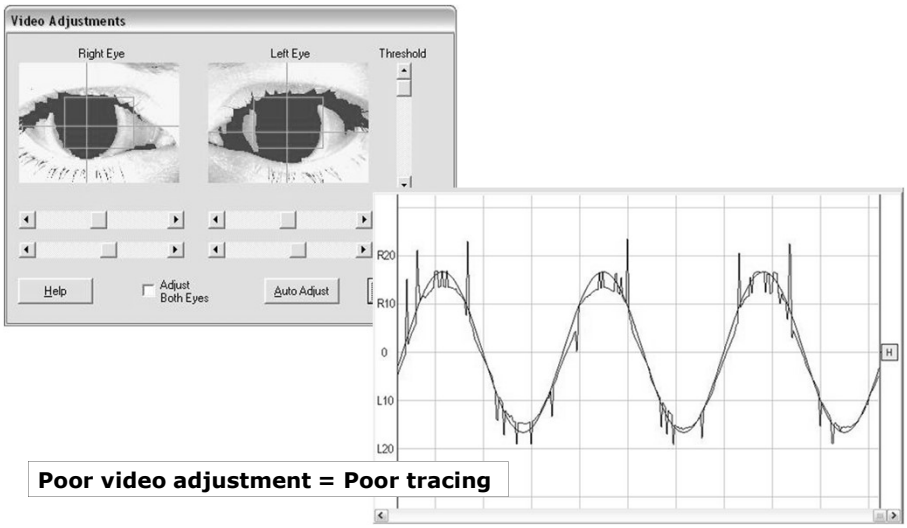
Video Adjust



Poor video adjustment = Poor tracing

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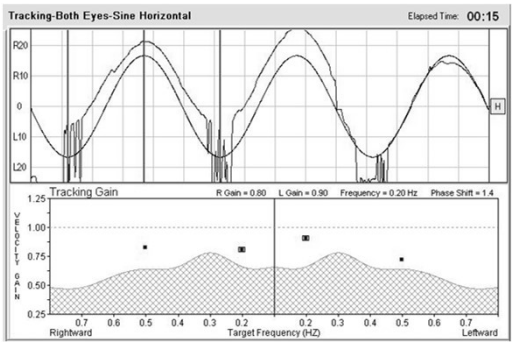
Video Adjust

- Watch the crosshairs as patient moves eyes side to side, up and down
  - Make sure crosshairs stay with pupils at extreme positions



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Video Adjust tips

- Dimly lit room is best for software to differentiate between pupil and iris
  - Light will affect software's ability to auto-adjust
  - **If there is a lot of light in the room, do the auto and manual adjust with the goggle cover closed**
- Adjustment settings are kept between patients
  - Auto-adjust not necessary for each patient
  - Manually tweak to optimize
- Consider obtaining:
  - Make-up remover
  - White eye-liner pencil
  - Eyelash curler

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Calibration

- Calibration adjusts the recording system so that deflections correspond to amplitude of eye movements
  - The position of the patient in relation to the light bar affects the amount of eye movement required to follow the calibration stimulus
- The required distance is 4 feet
  - Software assumes this distance during calibration
  - Sets outermost light at 30 degrees right/left (used for Gaze)
- Acceptable range 3'8" to 4'4"
  - Range function on light bar monitors distance during testing

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Calibration

- Can be done with tracking or saccadic stimulus
  - ICS Chartr 200 uses tracking stimulus (+/- 10 degrees)
- Instruct the patient to follow the target and only move his/her eyes
- Start the calibration and wait for the target and tracing to match up
- When at least one good cycle has recorded, click on “Accept” and the calibration will be immediately applied
- Record 2 more cycles to verify calibration

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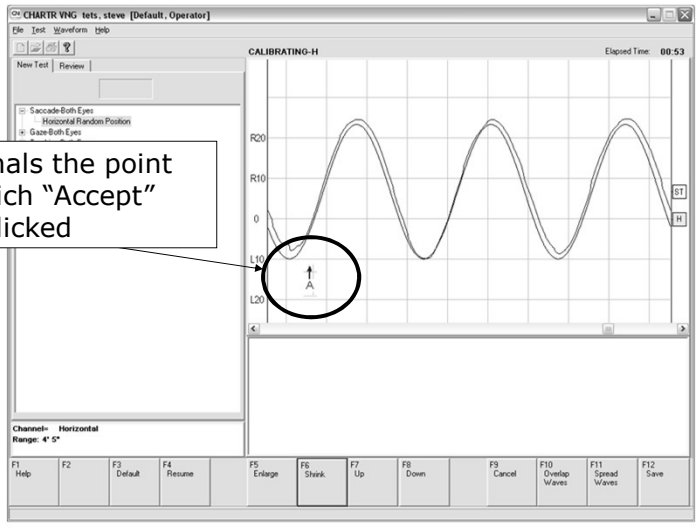
Calibration: GOOD



A signals the point at which “Accept” was clicked

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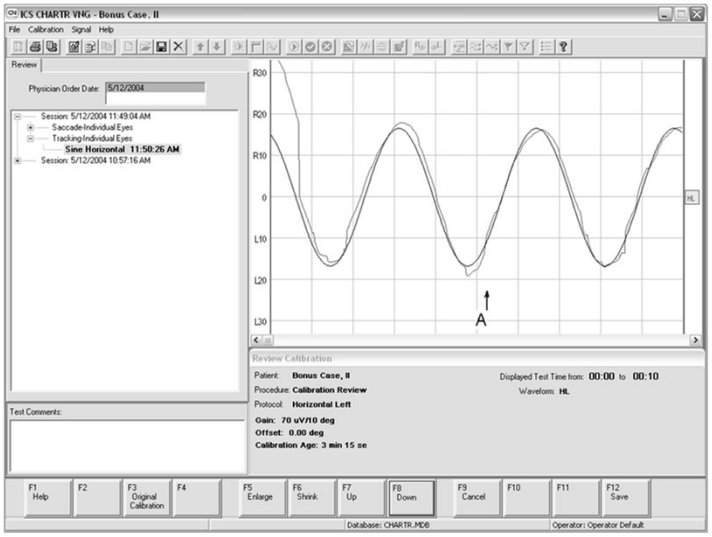
Calibration: GOOD



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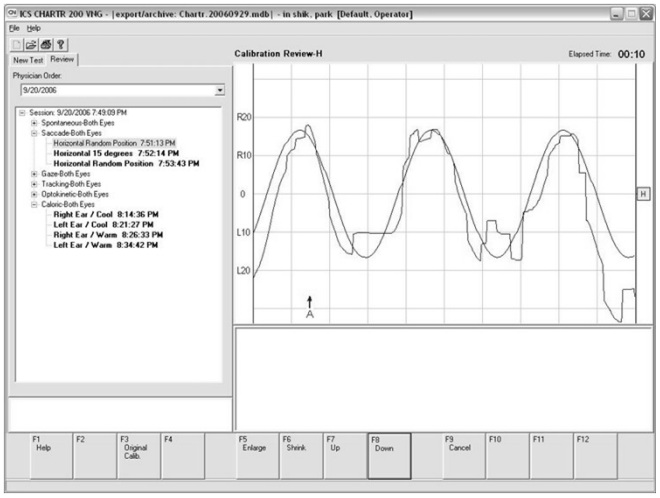
Calibration: POOR



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Calibration tips

- Calibrate once for VNG
  - Recheck/redo calibration if goggles are removed and replaced
  - Be aware of goggle position while moving the patient
- Avoid using the default horizontal calibration
  - No one is average
- Speed doesn't matter, so it's okay to slow down the stimulus if software allows it
  - Chartr 200 defaults to 30 deg/sec
  - Option to slow to 20 deg/sec

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2. Clean up responses

- Understand what you're measuring
- Delete stray data points
- Verify measurements
- Identify the peak of the response

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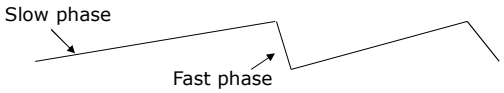
Understand what you're measuring



- Looking for nystagmus presence, absence, status change
- Intensity of nystagmus
  - Determined by the slow phase
  - What is the Slow Phase Velocity (SPV)?
- Direction of nystagmus
  - Determined by the fast phase
  - Is it horizontal, vertical, or torsional?
- Latency and duration of nystagmus
  - When does it start and how long does it last?

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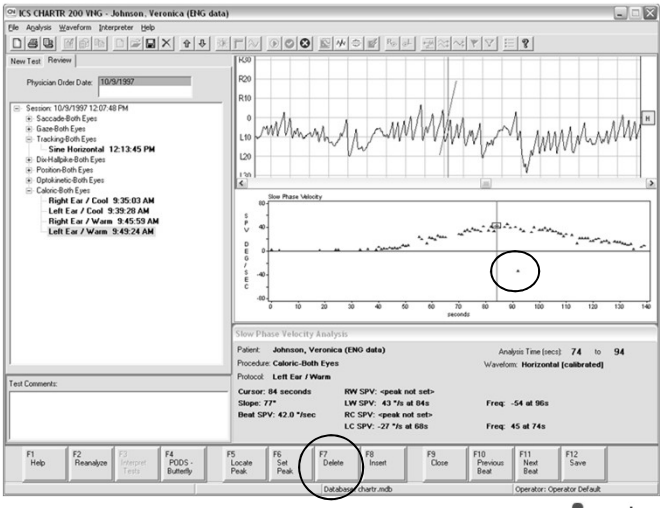
Delete stray data points



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Verify measurements

- Spot-check computer's measurement of nystagmus at logical points throughout the response
  - Scroll through measured beats
  - Click on waveform in desired spot to measure any beat
- Press "Ctrl" and R/L arrow keys to adjust amplitude of measured beat or measure new beat
- Click on "Insert" to make measurement permanent
  - For changing measurement AND for adding a new beat

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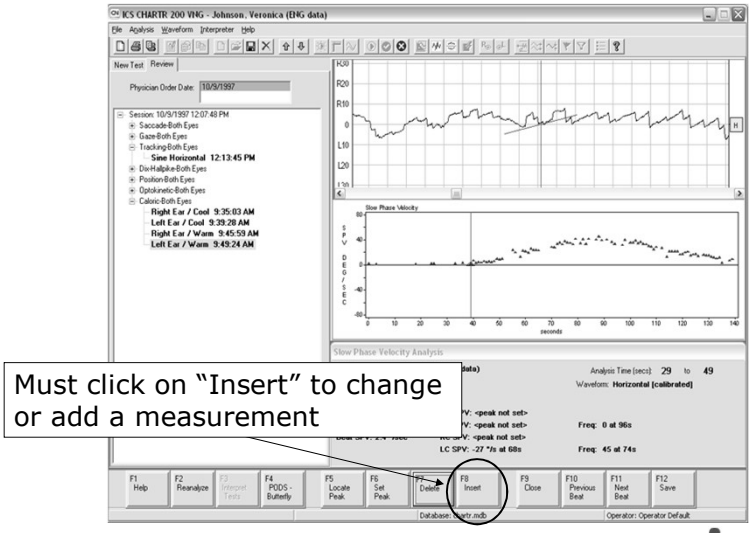
Verify measurements



Must click on "Insert" to change or add a measurement

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Verify measurements

- Assign primary
  - Allows operator to select which test will print with report or which caloric irrigation will be included in the Pods/Butterfly
  - **Example**: The operator tested RW twice because the first response was smaller than expected
- Rename tests
  - Allows operator to change the test name when data were collected in the wrong place
  - **Example**: The patient was positioned as body left but the operator accidentally recorded it in body right

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Identify the peak of the response

- Locate Peak: computer picks the peak of the response
- Set Peak: operator picks the peak of the response
  - Click on a beat at the peak of the response
  - Click on “Set Peak”
- **The peak of the response is an average of beats**
  - Software defaults to averaging 3 beats, but can be adjusted up to averaging 10 beats for each peak
  - The average is taken from the (3) largest beats in the 10-second window around the chosen beat

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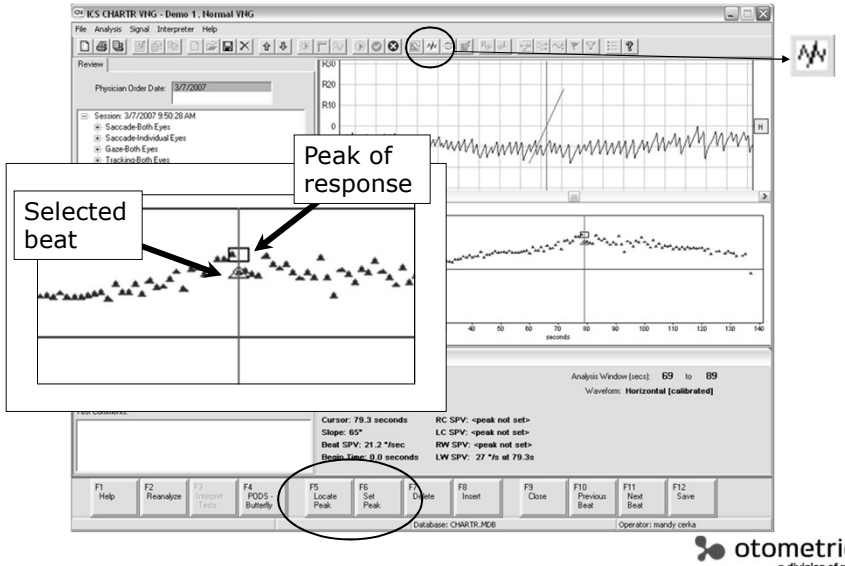
Identify the peak of the response



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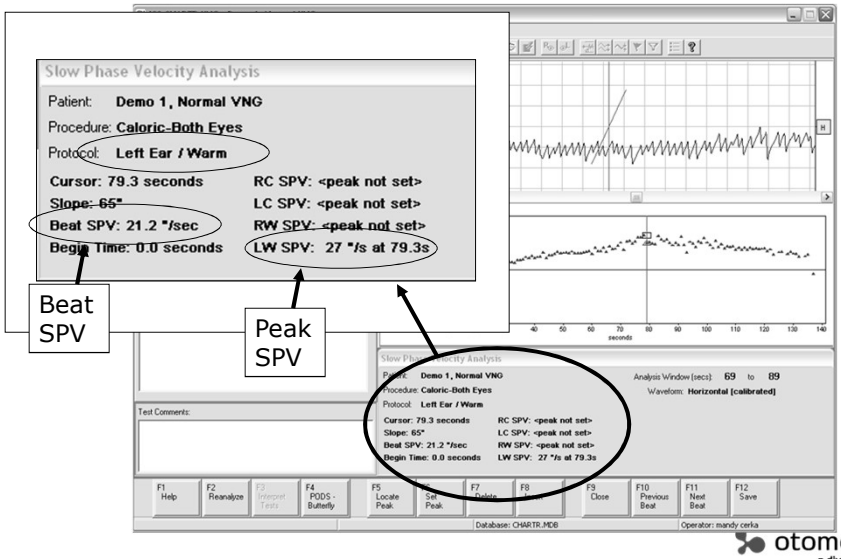
Identify the peak of the response



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3. Assess each response

- Analyzing Saccade and Tracking results
- Analyzing Optokinetic (OPK) results
- Analyzing Gaze and Positional results
- Analyzing Caloric results

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Analyzing Saccade and Tracking results

- Delete stray data points
- Need enough raw data points accepted to have at least 3 averaged points for movements in each direction (leftward and rightward movements)
- Normative data depends on the age of the patient
  - Ages 10 and older
  - Normative data from ENG testing
- Data points will be rejected if the patient response is too far off of the target
  - Not paying attention
  - Anticipating the target

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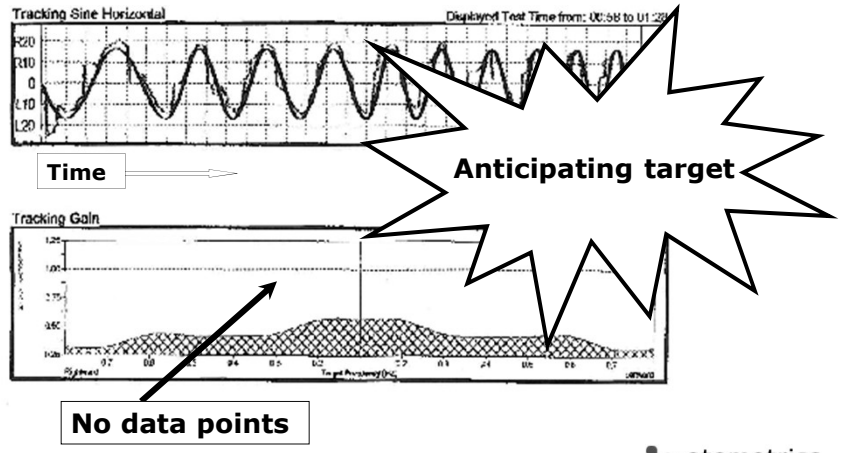
Analyzing Saccade and Tracking results



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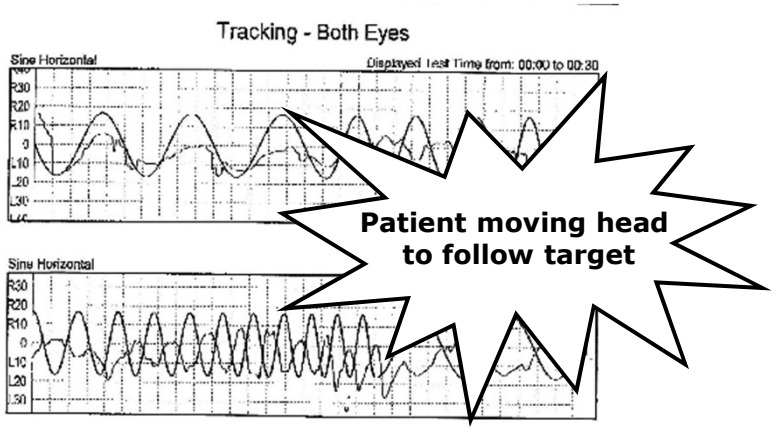
Analyzing Saccade and Tracking results



Operator reported patient's eyes were barely moving!

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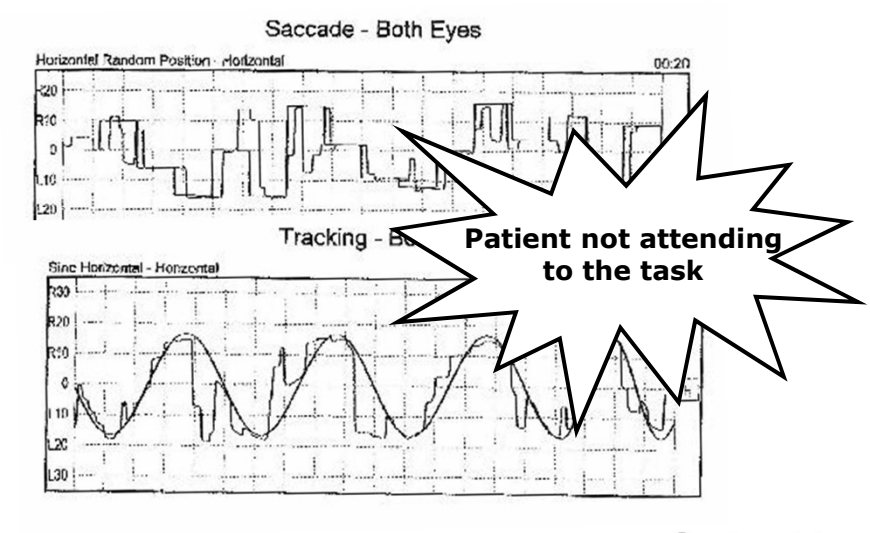
Analyzing Saccade and Tracking results



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Analyzing Optokinetic (OPK) results

- The appearance of the nystagmus will vary according to directions given
  - Watch each dot as it goes through the center
  - Follow the dot from one side of the light bar to the other
- The patient should perform equally in each direction
  - Nystagmus SPV should be greater than 75% of the target velocity for each direction
  - For stimulus at 40 deg/sec, patient should perform at 30 deg/sec or better in each direction
- Analyze the patient's best performance

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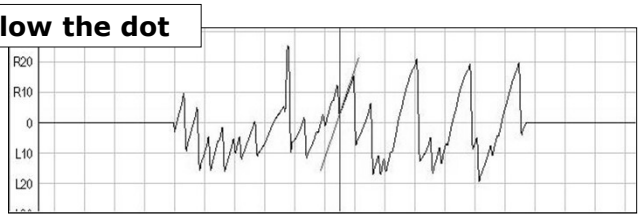
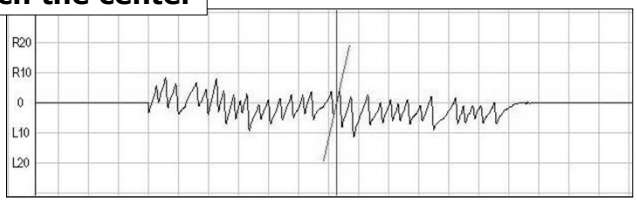
Analyzing Optokinetic (OPK) results

Follow the dot



Watch the center



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Analyzing Gaze and Positional results

- Scroll to where analysis should begin, then click **Begin**
  - Allows analysis for 140 seconds after the “Begin” point
- Delete beats that are likely artifact
  - Disorders result in consistent abnormalities
  - Artifacts are common if patient is not attending to the task
- Measure and insert data points
- “Locate” or “Set” peak

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Analyzing Caloric results

- Scroll to where analysis should begin, then click **Begin**
  - Allows analysis for 140 seconds after the “begin” point
- Delete stray data points
  - Normal caloric response will grow and subside gradually
  - Onset of fixation light can cause eyes to jump
- Measure and insert data points
- “Locate” or “Set” peak

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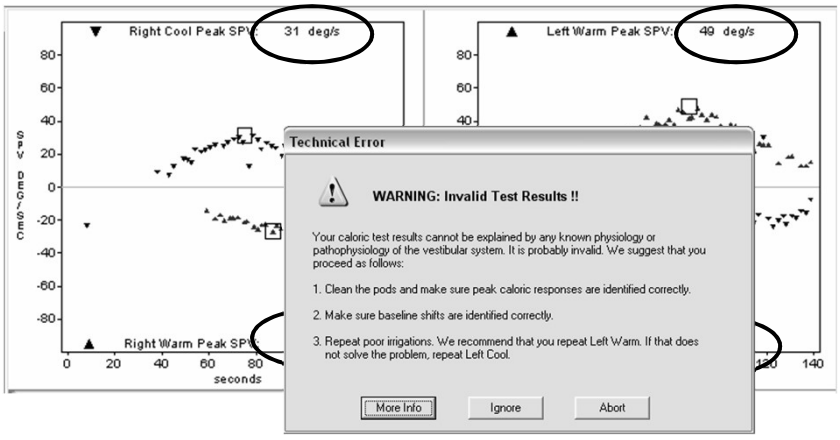
Analyzing Caloric results



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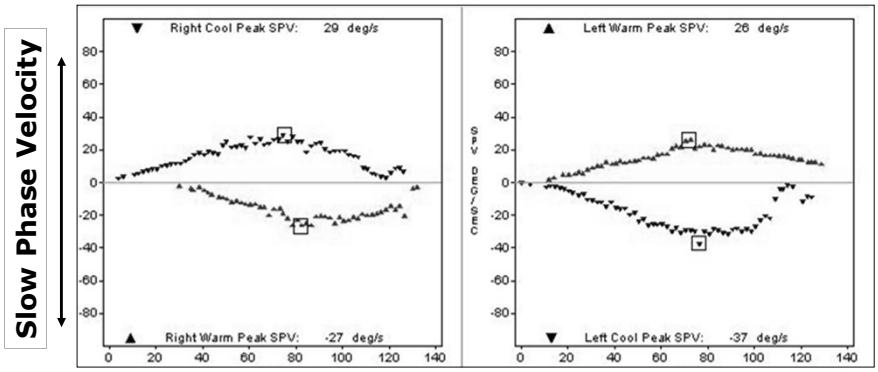
Pods Display

Pods = SPV graph of the four irrigations



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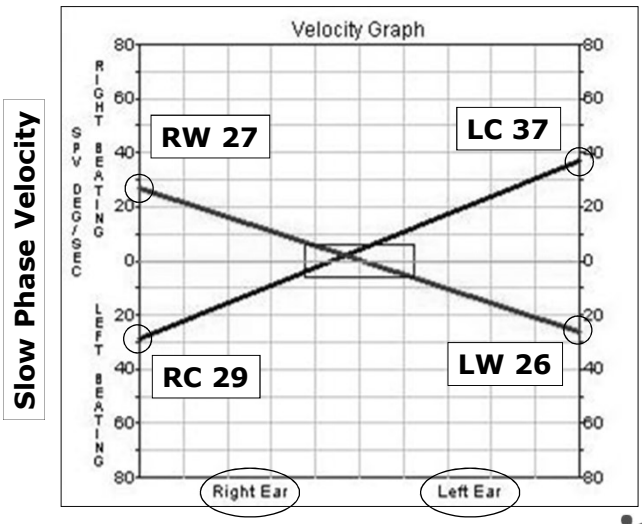
Butterfly Display



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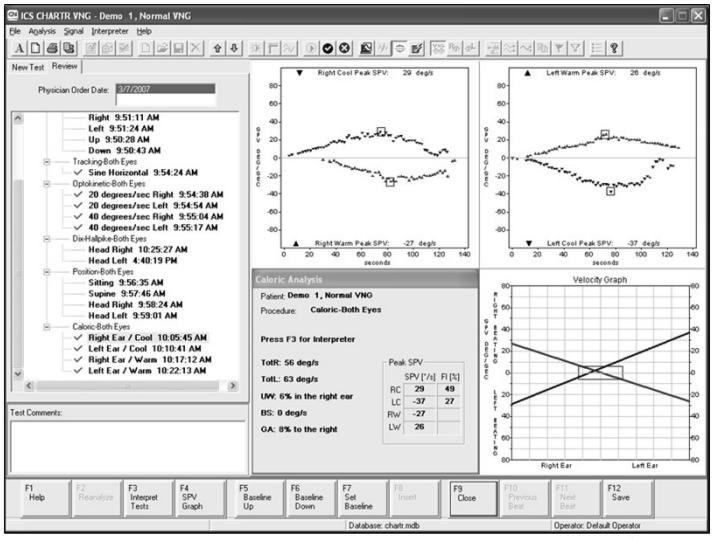
Bithermal Caloric Test: Normal Result



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Analyzing Caloric results

	Warm	Cool	Difference
Right	27	31	**4**
Left	49	28	**21**

- The warm/cool results for each ear should be similar
- If Left Cool were 49, then there would be a UW of 26%
- If Left Warm were 28, then the results would be WNL
- The computer will not make this decision for you

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4. Check your work

- Cross-check key elements
  - Patient information
  - Tracking and OPK
  - Gaze and Positionals
  - Positionals and Calorics
- Interpretation Assistant™
  - Positionals
  - Calorics

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Use patient information to check results

- Compare results with patient's description of problem
  - Does the problem occur upon standing up quickly?
  - Does the problem occur upon rolling over in bed?
  - Is the problem described as a general imbalance?
- Compare results with patient's subjective responses
  - Does the patient report feeling dizzy during any particular test?
- Compare results with patient's health history
  - Is the patient taking seizure medications? Anti-depressants?
  - Has the patient suffered a head trauma in the past?
  - Is the patient an alcoholic?

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Check Optokinetic (OPK) results with Tracking results

- OPK tested on a light bar tests visual pursuit system
  - Results (normal/abnormal) should be consistent with tracking findings
- If OPK results don't match tracking results…
  - Did the patient have trouble understanding the directions?
  - Did the patient have trouble attending to the task?
  - Can the patient do the task at a slower rate?
- If the patient can do the OPK task long enough to get 5-6 beats in a row, you can stop the test
  - There's no need to run it for a long period

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Check Gaze results with Positional results

- If Gaze testing reveals some nystagmus with vision, try testing without vision
  - Does the nystagmus get larger when vision is denied?
  - Does the nystagmus stay the same or get smaller when vision is denied?
- You should see the same nystagmus in the positional testing with vision
  - If you don't see it initially in the positionals with vision, ask the patient to look at a particular point
  - Intentional gaze in Gaze and Positional testing should match

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Check Positional results with Caloric results

- Spontaneous nystagmus
  - Nystagmus that beats in the same direction with same amplitude in all positions
  - This bias creates a directional preponderance in the caloric testing
  - Baseline shift to account for it
  - Any bias left after shifting baseline is true Gain Asymmetry
- Positional nystagmus
  - Nystagmus that changes in direction or amplitude with different positions
  - This is not likely to create a significant trend in the caloric testing
  - No need to baseline shift

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A word about the baseline…

- A guideline or starting point for comparison
- We assume the starting point for caloric responses is from 0 deg/sec

HOWEVER…

- If the patient has spontaneous nystagmus, the starting point has shifted in the direction and at the amplitude of the spontaneous nystagmus

SO,

- We have to shift the baseline to account for the patient's actual starting point

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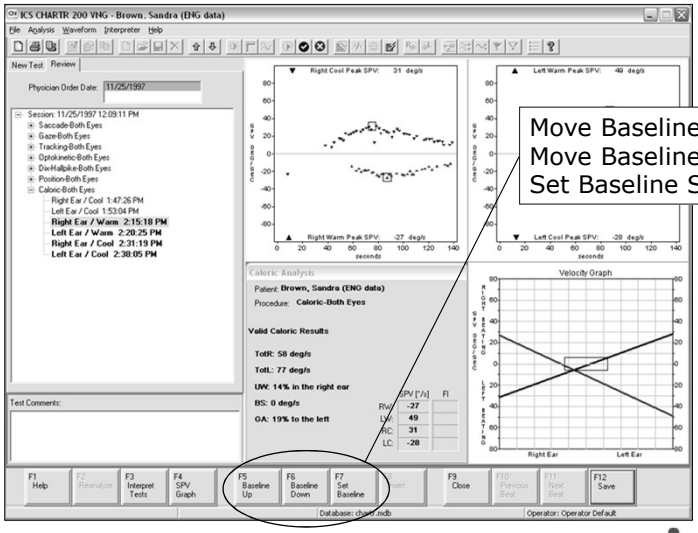
A word about the baseline…



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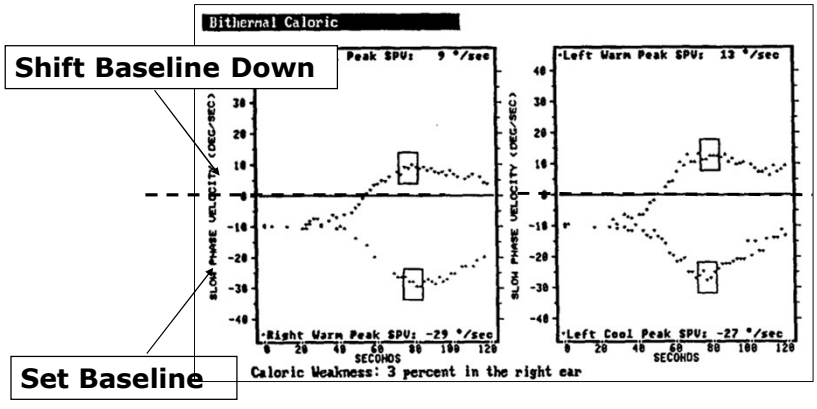
A word about the baseline…



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Interpretation Assistant™

- Interpretation Assistant™ will validate and analyze the results of the testing
  - Available for positional and caloric testing
- Option found in the **Review** mode after analyzing
  - Analyze the data of each position with vision and without vision, collected separately
  - Collect responses for all four caloric irrigations and analyze the data
- The output of the validation and analysis is displayed to the clinician and can be pasted into the VNG/ENG report

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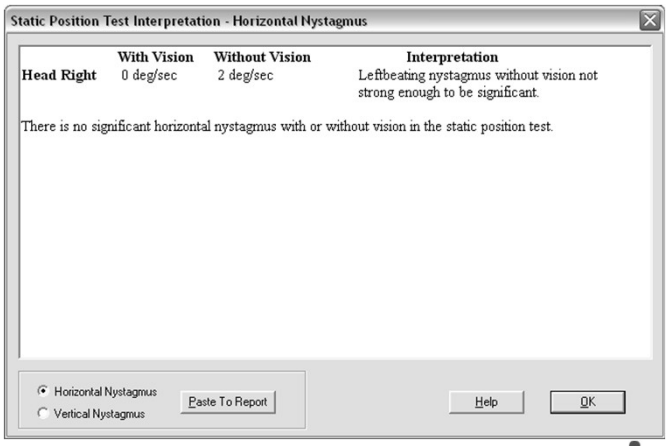
Positional Interpretation Assistant™

- Valid results



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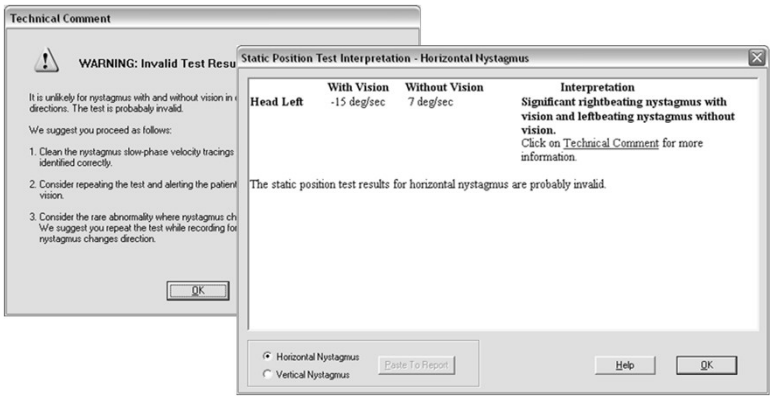
Positional Interpretation Assistant™

- Invalid results



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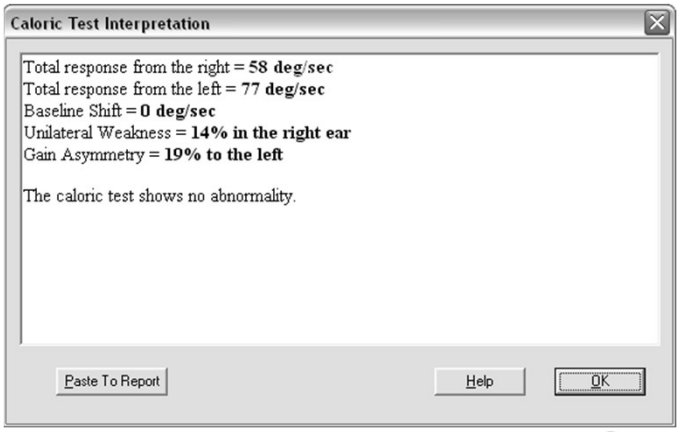
Caloric Interpretation Assistant™

- Valid results



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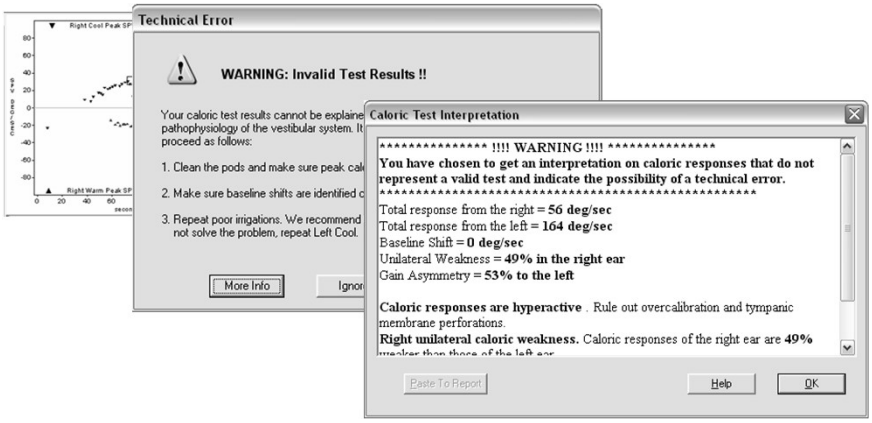
Caloric Interpretation Assistant™

- Invalid results



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Data Analysis Tips

- Normative data available for ages 10 and older
  - Saccades (age)
  - Tracking (age and gender)
- "Abnormal" areas represented by hash marks
- Analyze vertical channel if needed for upbeat/downbeat nystagmus
  - Click on the vertical waveform handle ("V"), then click Analyze
- Delete artifacts
- Press "Ctrl" and R/L arrow keys to adjust amplitude of measured beat or measure new beat
  - Click on "Insert" to make measurement permanent
  - For changing measurement AND for adding a new beat

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Thank you! Questions?

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