

What are VEPs?

Visual Evoked Potentials are responses from the cerebral cortex elicited by visual stimulation. These responses are evoked using visual patterns on a light array covering a particular area of the field of view; and are acquired using surface electrodes from the patient's scalp.

The visual responses can be observed in negative peak N75, positive peak P100 and Negative Peak N145, normally found at 75, 100 and 145 milliseconds from the time of stimulation, respectively. Depending on the electrode configuration, positive peaks and negative peaks may appear reversed. Variations in latencies and amplitudes of these peaks can provide diagnostic information about optical nerve function, based on the provided stimulus.

Why acquire VEPs?

VEP testing can help provide valuable diagnostic information about conditions such as optic neuritis, optic tumors, retinal disorders, and demyelinating diseases such as multiple sclerosis.

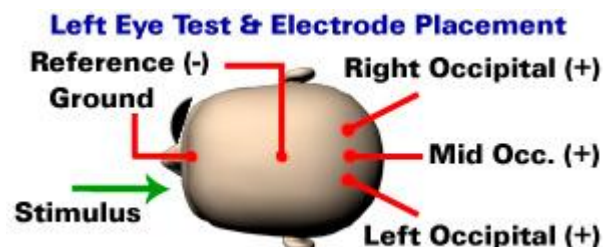
Patient Preparation

The patient must be placed in a comfortable, dark, and quiet environment; where the patient sits upright on a comfortable chair. The patient should be fully awake and well rested. The patient should also wear corrective glasses or contact lenses as needed. Surface electrodes and stimulators may be placed in the following configuration:

- Non-Inverting (+) 1 (Blue): Mid-occipital (Oz); 2 inches above inion. OR
- Non-Inverting (+) 2, 3 (Blue): Right-occipital (O2) and Left-occipital (O1); 2" lateral to Oz.
- Inverting (+) (Red): Central (Cz);
- Ground: High Forehead (Fpz).

- Stimulator: 55cm to 60cm from eye for full-field testing, 34 to 19cm for half field.

Only one eye can be tested at a time. The eye not being evaluated should be occluded with a patch. The use of a headrest or a chin rest is recommended to avoid the introduction of muscular artifact into the recording.



The distance from the patient's eye to the stimulator is given by the formula: $\beta = 3450 a/b$ where a, is the size of one light element (from 5mm on the IHS VEP stimulator), b is the distance from the eye to the stimulator, and β are the minutes of arc covered. The recommended minutes of arc value for full field stimulation is 28-31'; for half field stimulation it is 50-90'. Larger light elements will yield different stimulator distances.

Setting up SmartEP

Complete the following steps to set up SmartEP for VEP acquisition:

- On the SmartEP main menu, select **Stimulus > Modality > VEP**.
- Click on the Set Page (PP) menu, and change the plot start time to -20 if necessary.
- Click on the **EEG and Amplifier** button in the Control Panel and set the filters and notch filter as desired for each channel. Edit the Artifact Rejection Region settings to prevent artifact while allowing normal EEG activity.
- In order to select the correct stimulus to be applied, click on the **Pattern** button in the control panel.

VEP Testing Using SmartEP

- Select the correct pattern from the drop down list. Turn ON the center dot.
- Close the window.
- Choose side, rate, and number of sweeps.
- Click Acquire to start testing.

Carefully select your filter settings in the EEG and Amplifier dialog box. Lack of filtering may result in excessive artifact, excessive filtering may result in waveforms that are too smooth to assess correctly and lack the detail that may show important information.

Recommended Settings

It is recommended to run this test two to four times, using the following settings:

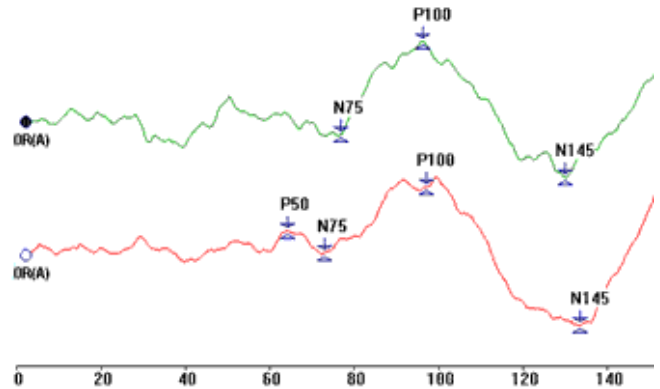
Stimulus	Full Field or Half Field Pattern Reversal Checkerboard (Patt. 17)
Rate	1 - 2 per second
Centering Point	ON
Stimulator	VEP LED Box
Filters	1 - 300 Hz
Notch Filter:	OFF. ON, only if there is excessive electrical line noise present.
Amplification	100x
Analysis Time Window	500 milliseconds.
Sweeps	100 - 200 for full field 200 for half field
Electrode Montage	As previously indicated in patient preparation section.

Marking Peaks

To diagnose a condition accurately, you may need to place the applicable labels on the recently acquired recording. N75, P100, and N145 may be marked when recognizable follow these steps for each of the labels:

- Right click at the point of the recording where the label is to be placed.
- Select "Mark Other Peak..."
- Select the peak to be marked from the selection window.
- Drag the top and bottom markers into position as needed.

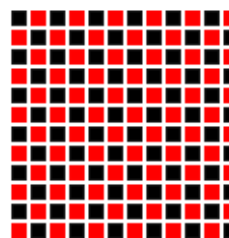
The following graph shows suggested label placing for an acquired VEP.



Since label placement is subjective, all results must be evaluated by a medical professional trained in VEP techniques.

The Stimulator Box

The IHS VEP stimulator provides with visual patterns that can be programmed to stimulate full, half or quarter field. The box also includes a centering point to facilitate test subject focusing; the centering point can be turned ON or OFF from the software interface. Patterns vary in size and position; the SmartEP software comes pre-programmed with over 130 different patterns.



Full Field



Left Half Field



Right Half Field



Quarter Field