

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

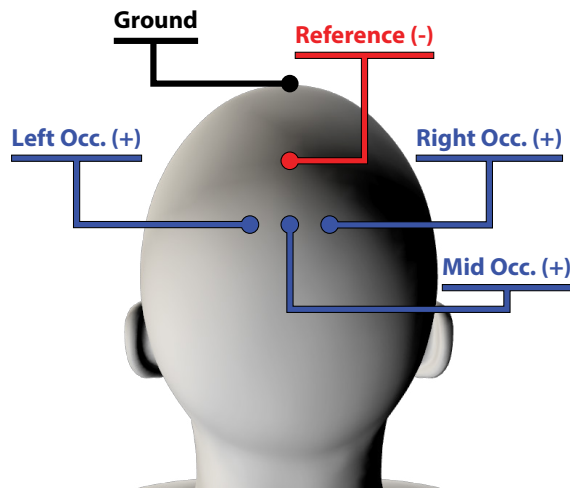


Fig.1 - Suggested electrode placement

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.

$$D = W / (2 \times \tan(\theta/2))$$

The distance from the patient's eye to the stimulator is given by the formula above. Where W, is the width of the pattern in mm (90mm for IHS VEP stimulator using the entire field), and θ is the total field size (angle of coverage). Half field and quarter field patterns will yield different distances for the same angle.

Setting up SmartEP

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

1. On the SmartEP main menu, select **[PROTOCOL > MODALITY > VEP]**.
2. Click on the Set Page (PP) menu, and change the plot start time to -20 if necessary.
3. Click on the **[AMPLIFIER]** button in the side 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.
4. In order to select the correct stimulus to be applied, click on the **[PATTERN]** button in the control panel.
5. Select the correct pattern from the drop down list. Turn ON the center dot.
6. Close the window pattern selection window.

7. Choose side, rate, and number of sweeps.
8. 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:** 100K.
- **Analysis Time Window:** 0 to 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:

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

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

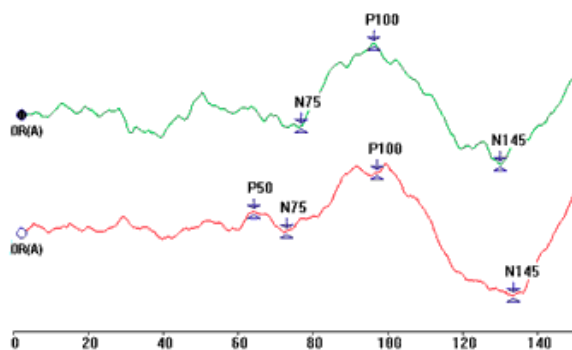


Fig.2 - Sample VEP recordings

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 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.

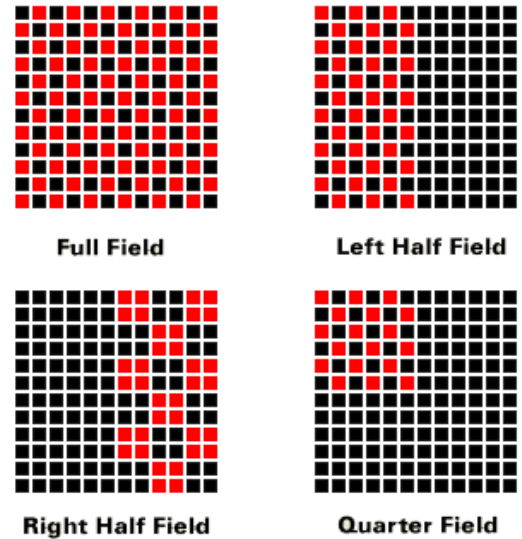


Fig.3 - Sample VEP LED patterns