

Chained Stimuli Responses

using SmartEP

What is Chained Stimuli?

Chained Stimuli is a method of acquiring AEP responses at multiple intensities in a concurrent manner. When stimulating using this method, the different stimulus intensities are presented either in a sequence or randomly. The method is useful when running a threshold search.

Create or load patient file

- **For a new patient:** from the main menu go to **[PATIENT > NEW]**. Enter the first name and last name in the fields provided. Fill any other necessary information. Click **[OK]** to finish.
- **For a returning patient:** from the main menu, go to **[PATIENT > OPEN]**. Find the patient file, then load it by clicking **[OK]**. Click **[OK]** again to confirm.

Preparing the patient

1. Clean and prepare the electrode placement locations; see Fig.1 for suggested placement. Follow all applicable procedures for skin prep safety.
2. If using snap electrodes, snap them into the leads before placement.
3. Adhere the electrodes to the prepped skin; use surgical tape to hold them in place if necessary.
4. Check impedance by rotating the switch of the amplifier to the different positions. On large amplifiers, use the buttons that correspond to each position.
5. Once the impedances are verified, make sure the amplifier is set to the ON position.
6. Connect the transducers to the patient using an appropriate coupler, such as a foam tip for insert earphones.

USBLite hardware users: keep in mind that impedance checking is done in the software in the EEG & Amplifier window, and the unit does not have an ON/OFF switch.

Electrode Placement

Electrodes may be connected using the following configurations as shown below. Inverting electrodes may be placed at the mastoid or ear lobe. See SmartEP manual for additional placement options.

- **Right Inverting (-):** right ear (M2) or (A2).
- **Left Inverting (-):** left ear (M1) or (A1).
- **Non-Inverting (+):** joined channels to high forehead (Fpz) or vertex (Cz).
- **Ground:** low forehead.

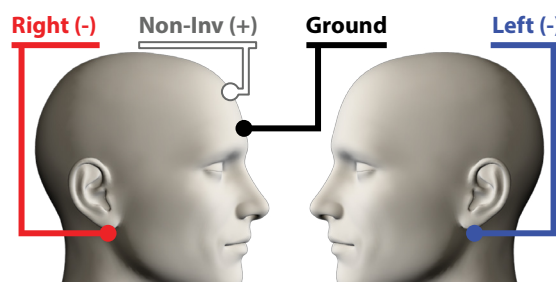


Fig.1 - Dual channel setup for Duet.

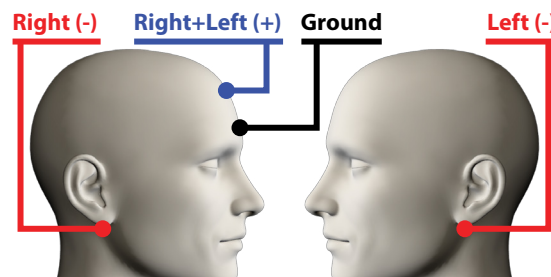


Fig.2 - Dual channel setup for USB and USBjr.

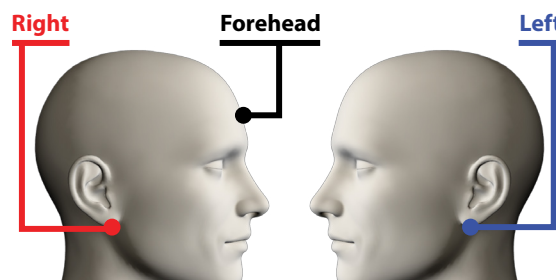


Fig.3 - Single channel setup for USBLite.

Keep in mind that using different electrode locations will yield recordings with slightly different wave morphology.

Electrode Usage

Surface electrodes are sufficient for acquiring ABR recordings. Clean and prepare electrode sites in order to reduce the impedance and acquire a clearer recording.

Set Up the Chain

1. From the main menu, choose **[PROTOCOL > MODALITY > AUDITORY CHAINED STIMULUS]**.
2. Accept the default parameters, then click on **[SETUP CHAIN]**; the top left button on the control panel.
3. Activate or deactivate buffers to keep only as many intensities as you need. Always keep Buffer 0 active. The intensity field values can be changed to best fit your protocol.
4. Change the 'Mean Rate' to a value with a decimal point component. We suggest one of these values: 19.3 for slow acquisition, 39.1 for moderate acquisition, or 57.8 for fast acquisition.
5. Use the same value as the 'Mean Rate' in the 'Maximum' and 'Minimum' fields; and keep the 'Stand. Dev' field as 0. These should only be different when jitter is wanted.
6. Select 'Sequential' presentation for the buffers to be presented in order from 0 to 9; select 'Random' for the buffers to occur in no particular order.
7. Save the chain for future use by hitting the **[SAVE]** button and giving the file a meaningful name.
8. Click **[OK]** to close the setup window and confirm the changes.
9. Set all the other parameters in the Control Panel including: ear, mode, phase, stimulus, sweeps, filters, and gain.
10. To save all parameters for future use, click on the **[SAVE SETTINGS]** button from the control panel. For the next session that uses the same parameters, simply click on **[LOAD SETTINGS]** to load that file and skip all the previous steps.

Starting acquisition

1. Click on the **[AMPLIFIER]** button from the side panel and verify that the patient EEG is normal.
2. Start acquisition manually by clicking on the **[ACQUIRE]** button from the control panel.

Acquisition may be stopped at any point if it looks like the recordings are not improving any more.

Marking Peaks

To accurately diagnose a condition, it is usually necessary to obtain latencies and amplitudes by marking peaks:

1. Select the recording by clicking on its handle, small circle to the far left.
2. Click on the peak label you wish to mark from the SmartEP tool bar, it will turn red when chosen.

3. Click the location on the waveform where the label should be placed.
4. Once placed, drag the top marker of the labels (arrow pointing down) to the top of the peak, if not already there. This will provide a latency reading. The exact position of the top markers may also be adjusted while selected using the keyboard arrow keys, hold **[ALT]** while using the arrow keys to adjust the bottom marker.
5. To obtain waveform amplitudes, or any other amplitude based calculations, drag the bottom marker (triangle pointing up) to the valley following the peak.

Additional peak labels may be placed by selecting the recording, then right-clicking at the location where the label is to be placed. From the pop-up menu choose **[MARK OTHER PEAK]**, then click on the button corresponding to the label to be placed. Repeat these steps for every buffer, as needed.

Save Report

Save the report to save format into the SmartEP system for future reference. Either click on **[SAVE REPORT]** button from the tool bar, or click on **[REPORT > SAVE REPORT]** from the main menu. You may also save page or report to PDF for an electronic version.

Printing

Select Print Report or Print Page from the SmartEP main menu to print a report of the currently displayed waveforms.

Additional Steps

- Make sure to carefully remove electrodes and the stimulator from the patient.
- Discard the disposable materials as per your local regulations.
- Don't forget to power off the equipment, including the amplifier.

References

Hamill, et al. "Threshold Estimation using the 'Chained Stimuli' Auditory Brain Stem Response Technique." *Ear and Hearing* 13 (1992) 165-172

Hamill, et al. "Rapid Threshold Estimation using the 'Chained Stimuli' Auditory Brain Stem Response Measurement." *Ear and Hearing* 12 (1991) 229-234