

## Digital Filters

Each channel in LabScribe V1.6 or V1.8 has its own digital filter that can be used on- or off-line to isolate a specific range of frequencies from all the ones recorded. For example, the digital filter can be applied to a raw EEG signal to separate Alpha waves between 8-13 Hz from Beta waves between 14-30 Hz (Figure 1-1 on page 1).

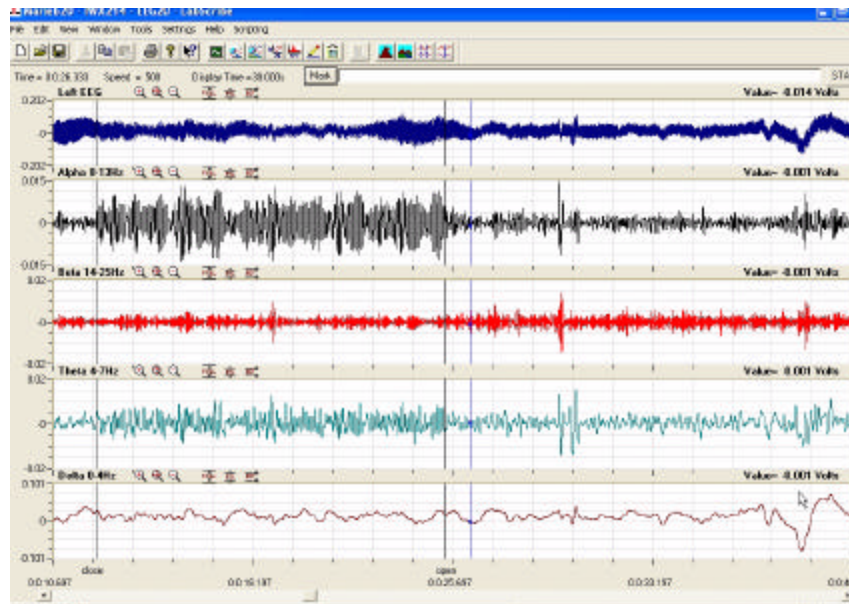


Figure 1-1: Raw EEG data displayed on Channel 1. With the digital filters programmed on four additional channels, the four wave types (alpha, beta, theta, delta) are extracted from the raw data.

When used on-line, LabScribe applies an 8-pole *Butterworth* filter, which reduces noise effectively on most smoothly varying signals. However, sharp voltage steps, like the ones used in a voltage clamp application, are not well tolerated by the on-line version of the digital filter. The solution for filtering sharp changes in voltage is to use a different type of filter off-line. When the **Stop** button is clicked, LabScribe recalculates the entire record as it applies a 20<sup>th</sup> order raised-cosine FIR filter.

To use the digital **Filter** function, **right-click** on the display area of the channel where the signal to be filtered is displayed. If you intend to display the filtered data on the same channel as the raw data, go to the **Set Raw Channel** function at the bottom of the **right-click** menu, and set the channel to take the raw data from itself. Select **Filter** from the **right-click** menu. In the **Set Filter** window, drag the boundaries of the filter to create the desired filter (Figure 1-2 on page 1). Click **OK**. No other setup is required.

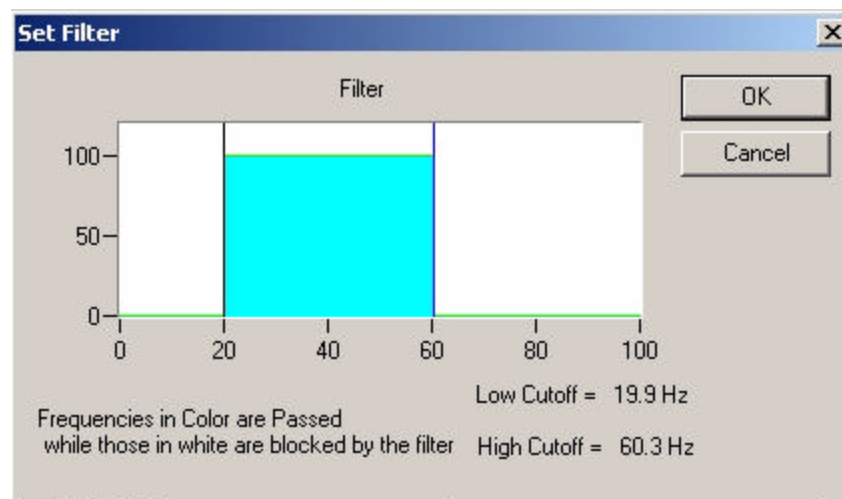


Figure 1-2: The digital (software) Filter dialogue window from the channel right-click menu.

The graphic interface in the **Set Filter** window is straight forward. The BLUE area corresponds to the frequencies that are passed, and the WHITE area corresponds to frequencies that are rejected. To remove high frequencies from the signal, click on the right boundary of the BLUE area and drag this boundary to the left. To remove low frequencies from the signal, click on the left boundary of the BLUE area and drag this boundary to the right. After clicking and dragging a boundary, it can be placed more accurately with the arrow keys on the keyboard. Boundaries can be placed in configurations that create High Pass, Low Pass, Band Pass, or Notch filters.

Notice that the **Filter** is subject to the *Nyquist* limitation of frequency. The maximum frequency in the **Set Filter** window is exactly half of the sample frequency.