BESA Simulator

Abhishek Amit Raje:BM22BTECH1102

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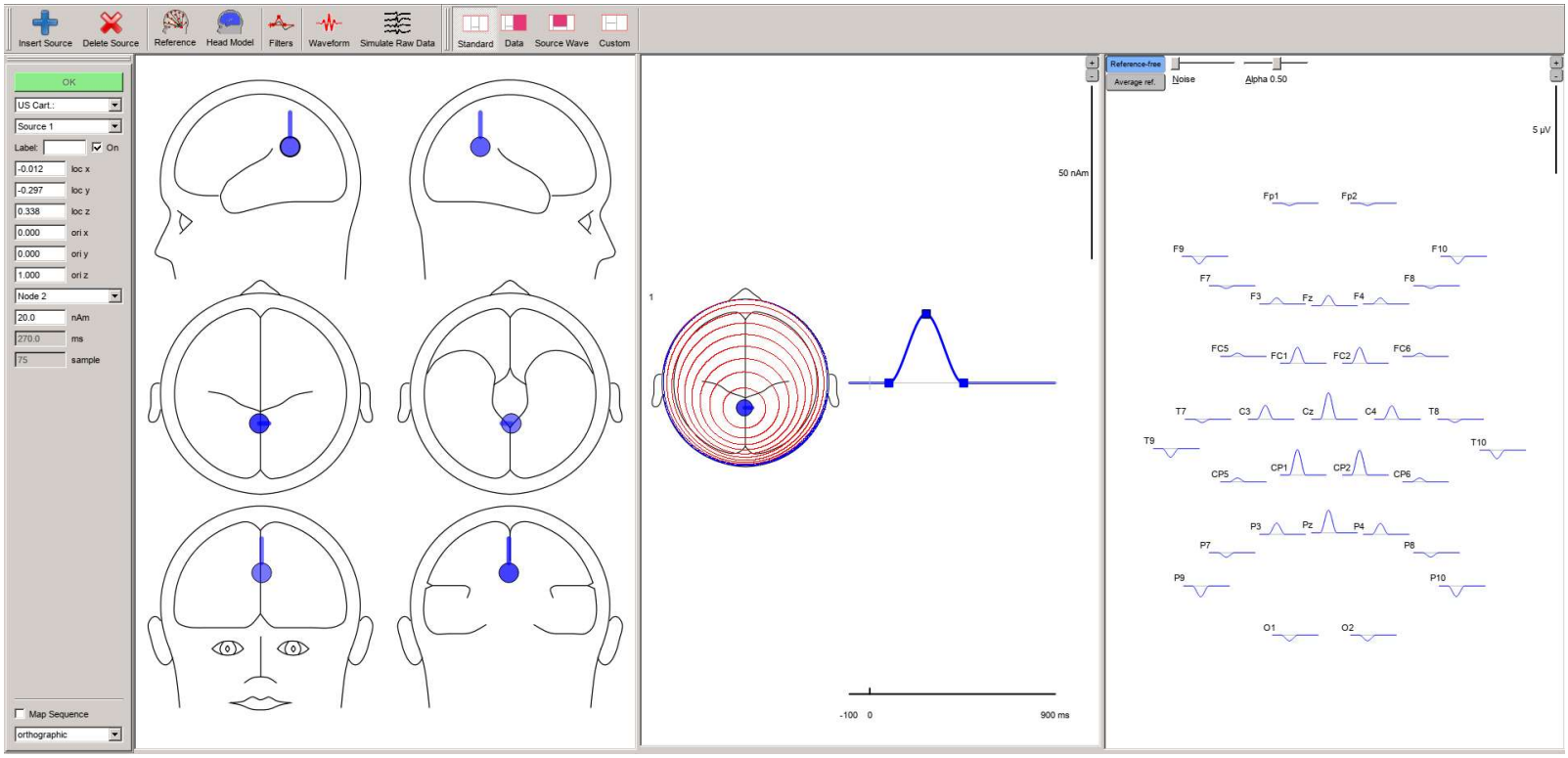
1. Simulate a source in S1 – postcentral gyrus



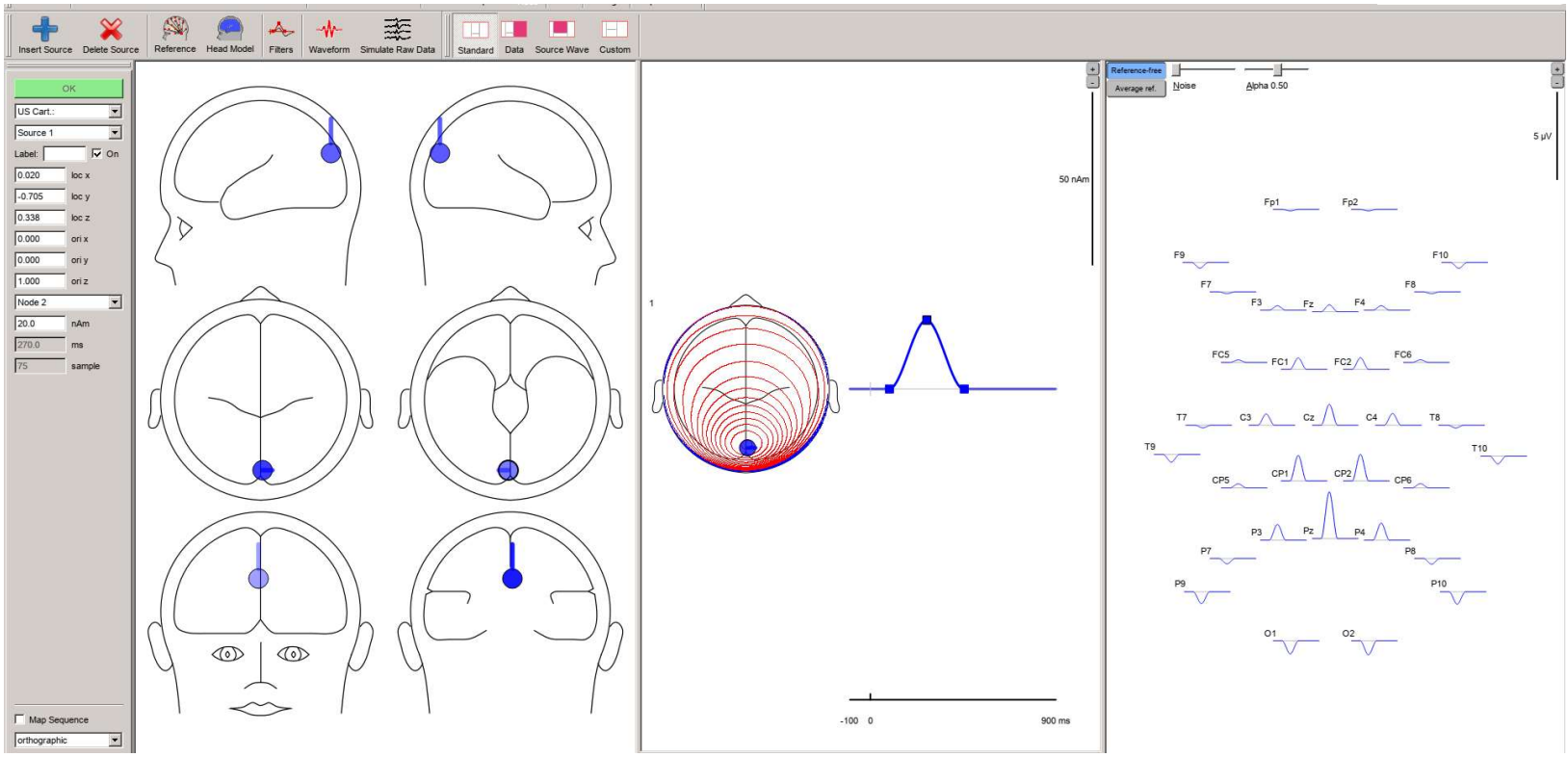
Source Simulation in the post central gyrus

a) How does the topographical plot look like? Where is the maxima activation and why?

- When we simulate a source at central sulcus, equipotential rings are observed with decreasing intensity from the source impulse .
- The primary region of activation is the central sulcus(C2,CP2,CP1).This is the central region of the brain separating the frontal and parietal lobe.

- This is because the primary somatosensory cortex which is responsible for the sensing the skin impulses is located here.We also see relative negative deflections in the frontal and occipital regions showing the impact of the distance from the impulse from the stimulated region of the brain.

b) Move the dipole around to understand how topoplot changes with the dipole



Topological Plot on Moving dipole in the y direction

- On moving the dipole around in the *y* direction the Pz potential is most affected as the parietal lobe is responsible for the integration of sensory information from the somatosensory cortex.
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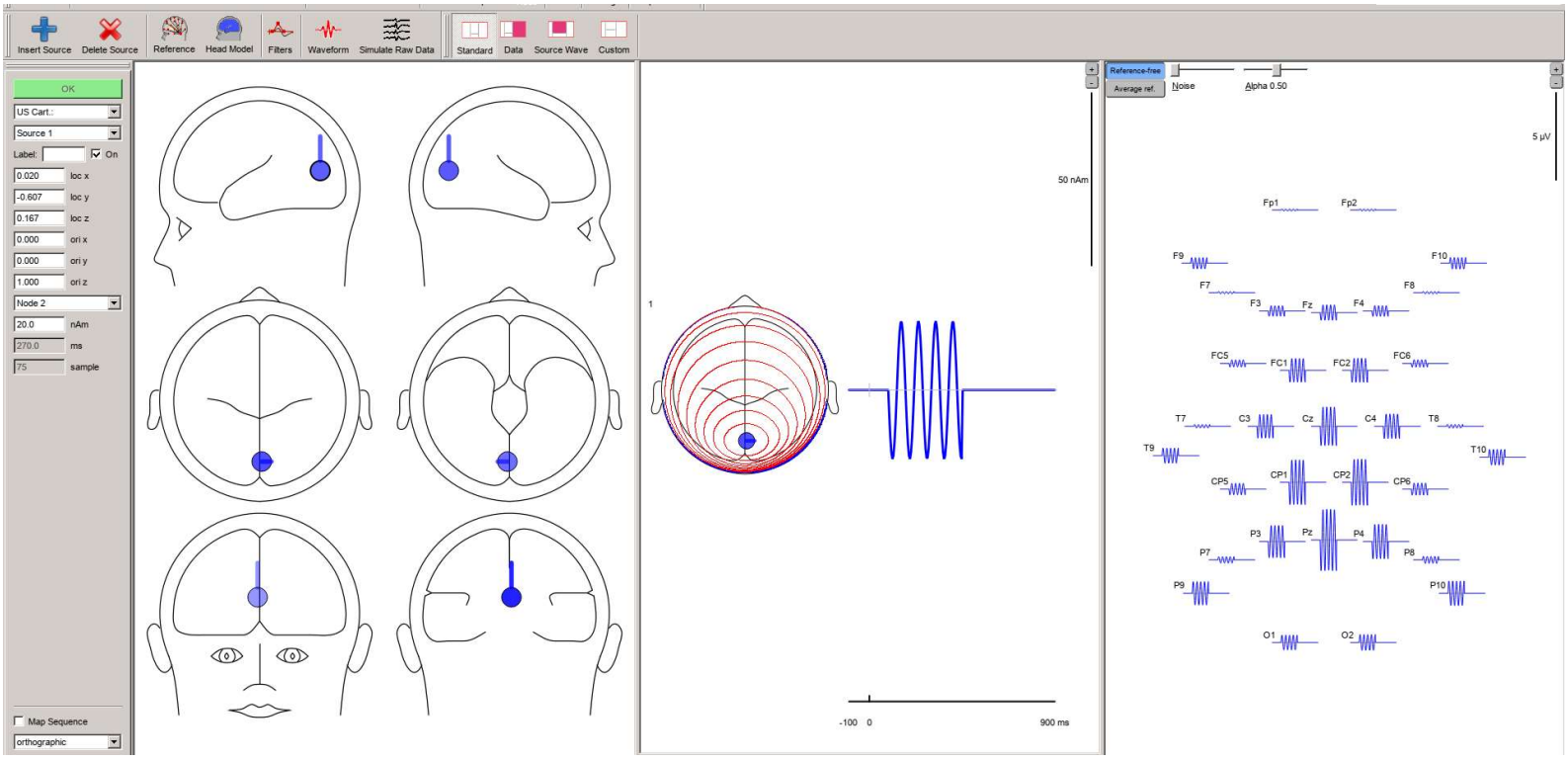
c) Can you reduce the topo-plot to a simple electric vector in each case?

- Yes, each of the topo plots can be considered a dipole activation of the pyramidal neurons due to collective behavior looking at the amplitude and the phase of the potential with reference to the stimulated impulse will make us understand the underlying dynamics of the specific regions due to activation of certain region of the brain.

2. Simulate an oscillating sinusoidal source (8-12 Hz) in the visual cortex



10 Hz sine wave at Occipital Lobe

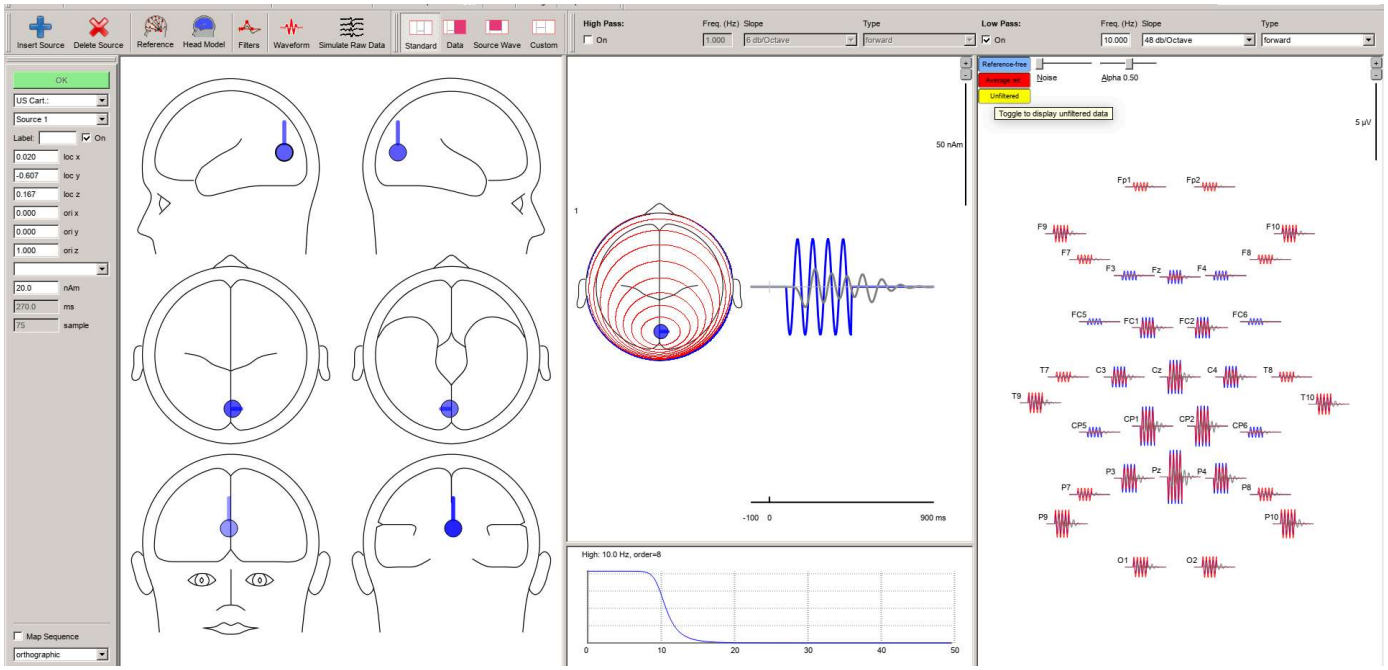
a) How does the topographical plot look like? Where is the maximal activation and why?

- The result of inserting the stimulus in the primary visual cortex results in the increased activity in the occipital cortex and the parietal lobe.This is because the primary processing of visual information happens in the occipital lobe and occurs in that location while the net processing occurs in the parietal lobe

3. Effect of filtering on evoked potential

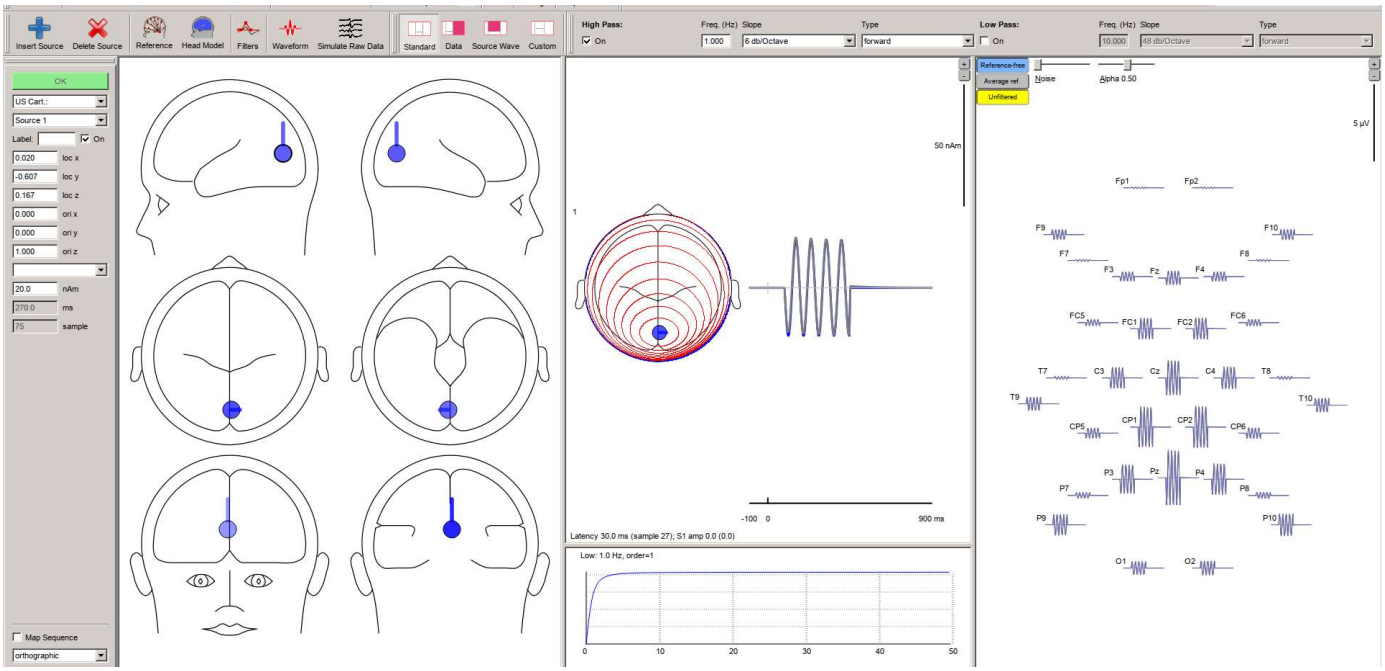
Filter

Low Pass Filter



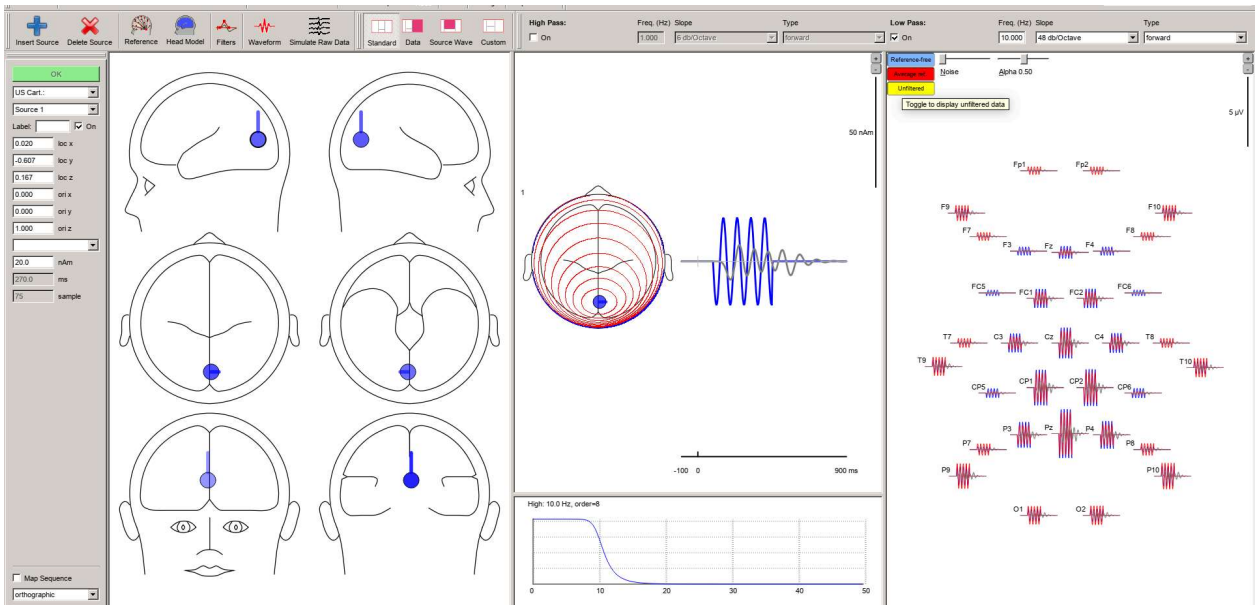
8th order low pass forward filter

High Pass Filter

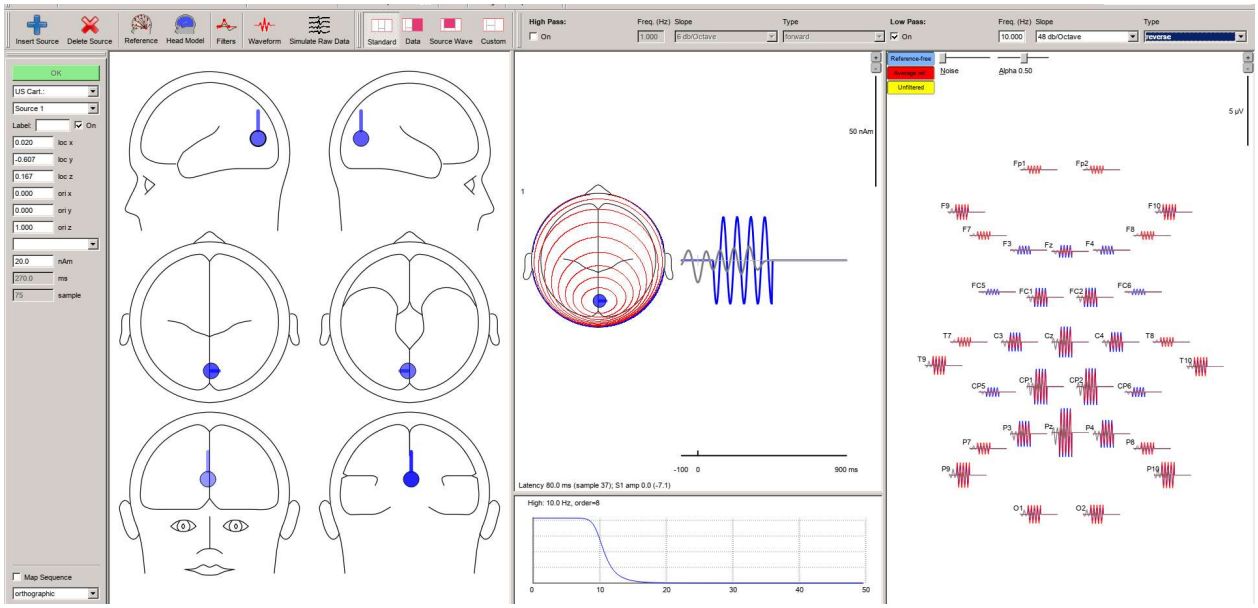


Phase Delay

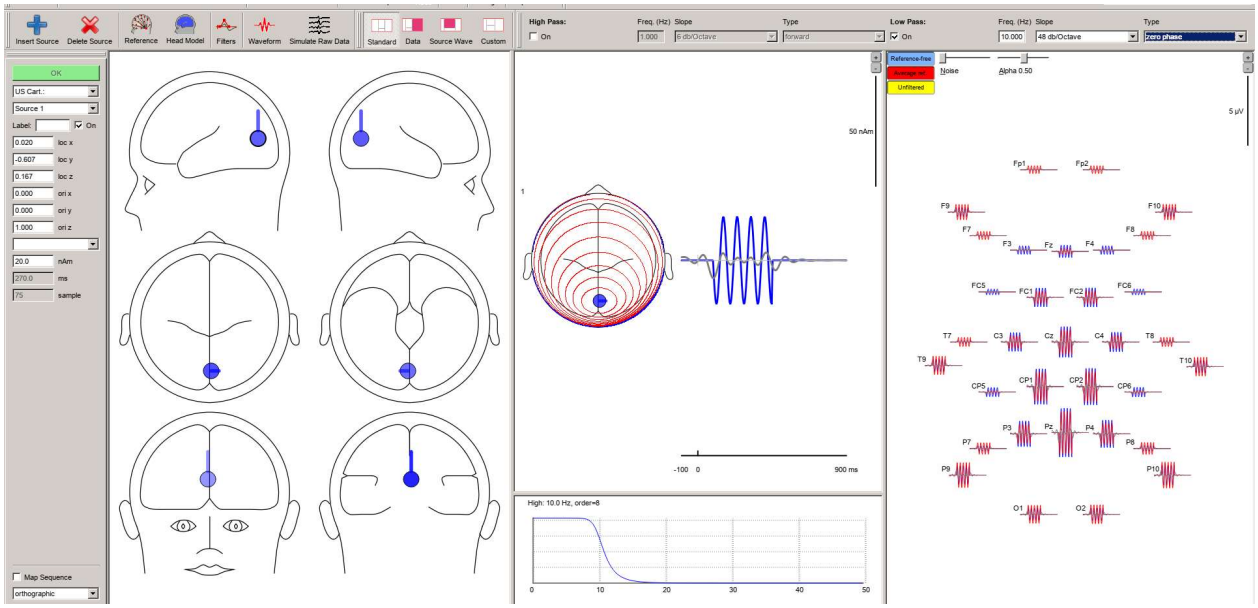
8th order high pass forward filter



Low pass forward filter



Low pass reverse filter



Low pass zero phase filter

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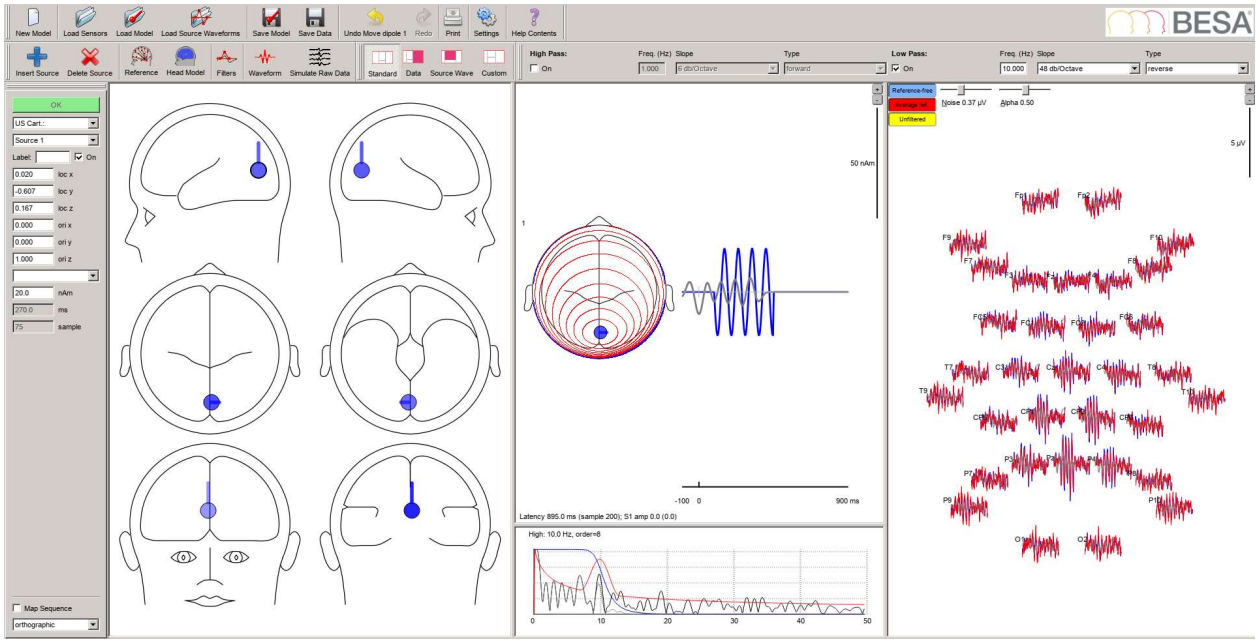
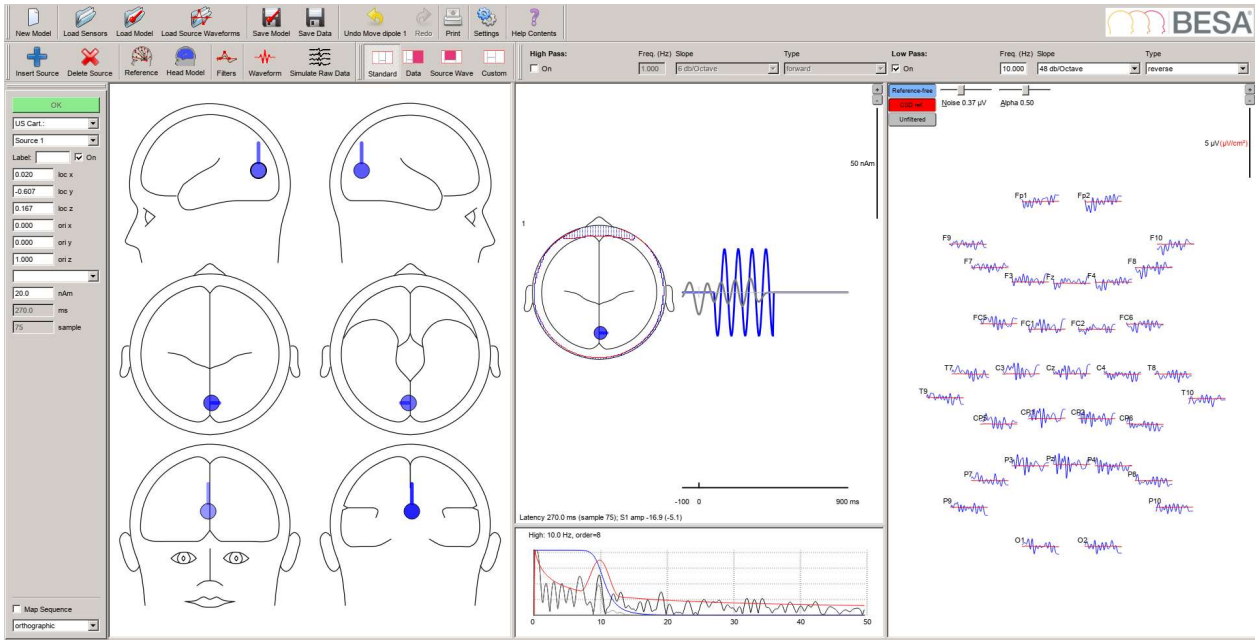
4. Visualize , Copy Report

- We observed that the low and high pass filter affect the evoked potential in the same way as the input stimulus.The corresponding frequency components are amplified or attenuated based on the strength of frequency.
- We also see how the filtered affect the phase of the evoked potential.Since we do not want any phase difference between the input and the corresponding output zero phase filtering is preferred.

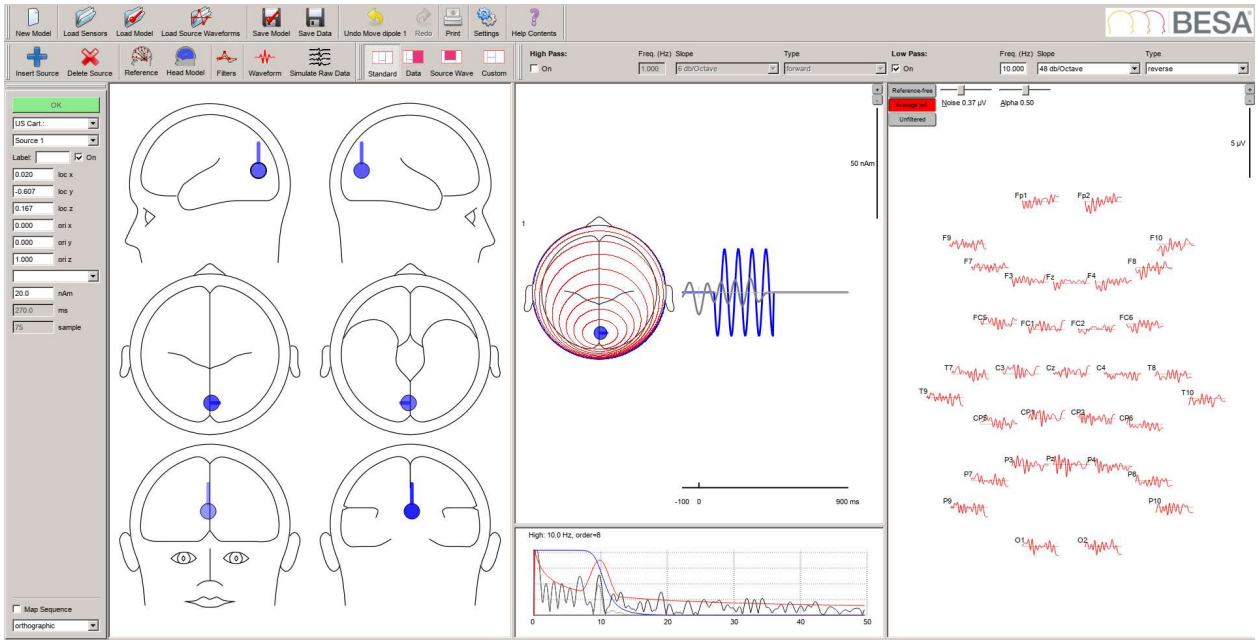
5. Effect of noise on re-reference techniques



Adding random noise to the system



CSD referencing



Averaging Referencing

- From the above Plots the averaging referencing seems to provide the best filtering mechanism for noise via ensemble averaging.
