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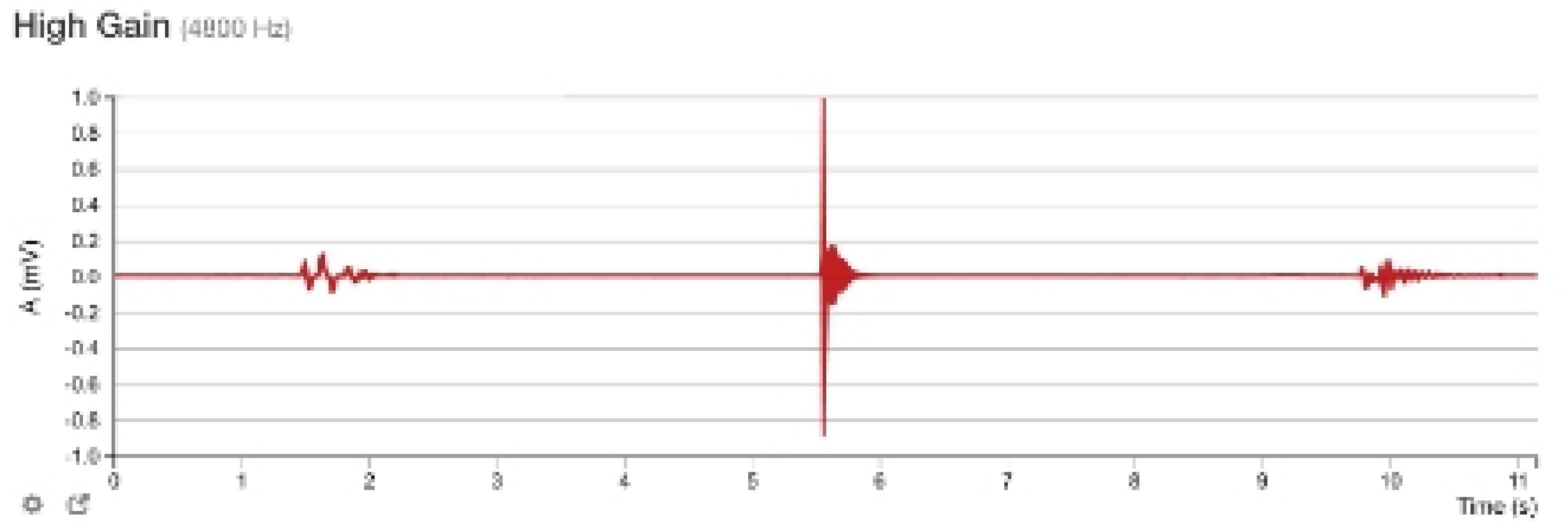
Lab 4: Induction Take Home Report (24 Points)

Part 1: Moving Magnets and Current (2 Points each)



1. **When the magnet falls through the loop there are 2 peak voltages in opposite directions. Why? Carefully compare these peak voltages. Are they exactly the same? Why or why not?**

When the magnet falls through the coil, there are two peak voltages in opposite directions because the magnetic flux changes direction as the magnet enters and exits the coil. These peaks are similar in magnitude but not exactly the same. The difference is due to variation in the magnet's speed and coil shape. In my data, the peak from the magnet leaving was slightly larger than the peak from it entering the coil, which is consistent with it moving faster on the way out.

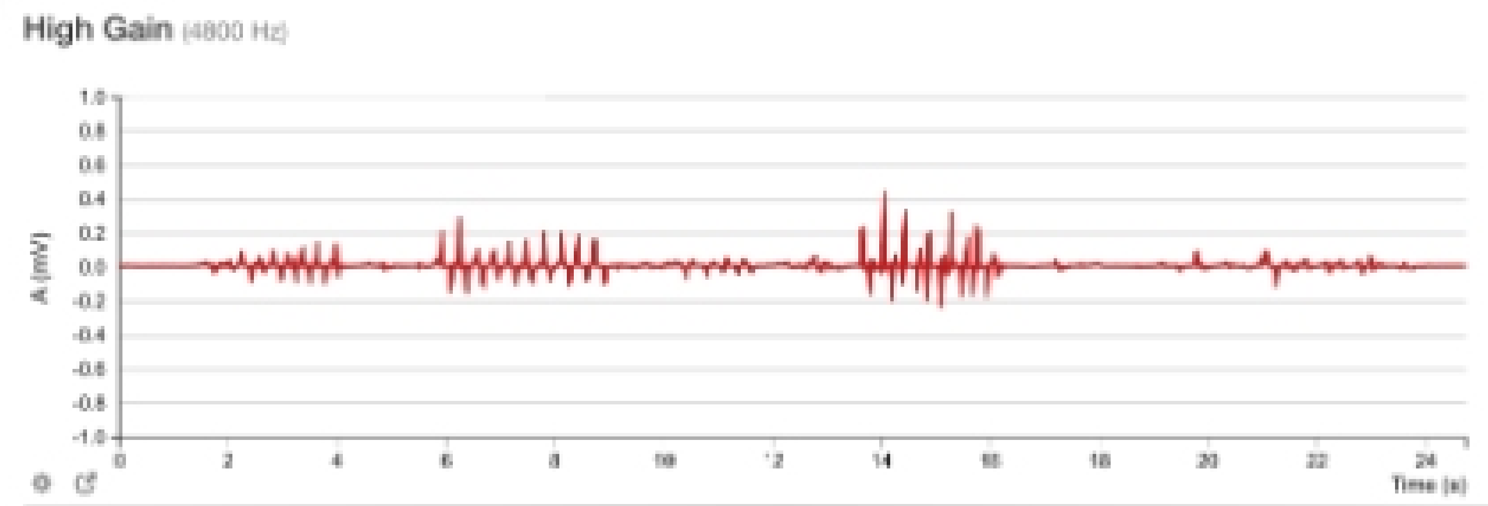
2. **What relationship exists between the magnet's speed and the voltage induced in the loop?**

As the magnet's speed increases, the induced voltage also increases. This is because a faster magnet causes the magnetic flux to change more quickly, producing a larger voltage. In my data, the tallest drop produced the highest voltage spike, while the smallest drop produced the smallest spike.

3. **What is the voltage if you place the magnet at rest in the loop? What does this indicate is necessary in order to get a current from a magnet?**

When the magnet is held at rest in the coil, the voltage is essentially zero. This shows that the magnetic field must be changing, either the magnet or the coil must move, in order to induce a current.

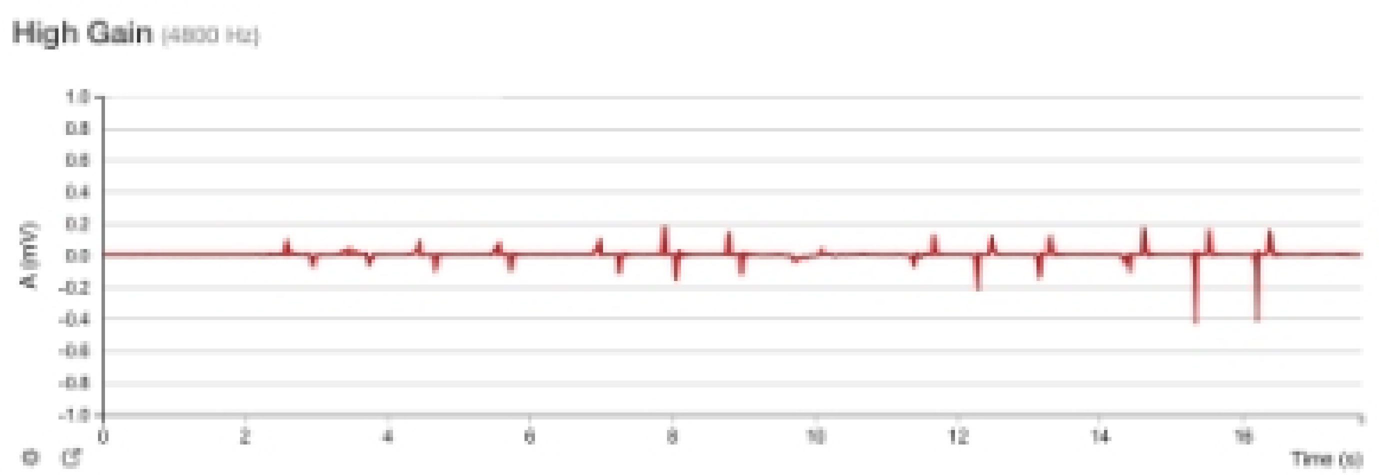
Part 2: Moving Coils and Current (2 Points each)



4. **Is it necessary for a magnet to move to get a current from a loop? Why or why not?**

No, the magnet does not need to move to get a current from the coil. If the magnet is stationary and the coil is moved towards or away from it, there is still a change in magnetic flux through the coil. This change induced a voltage and current according to Faraday's Law.

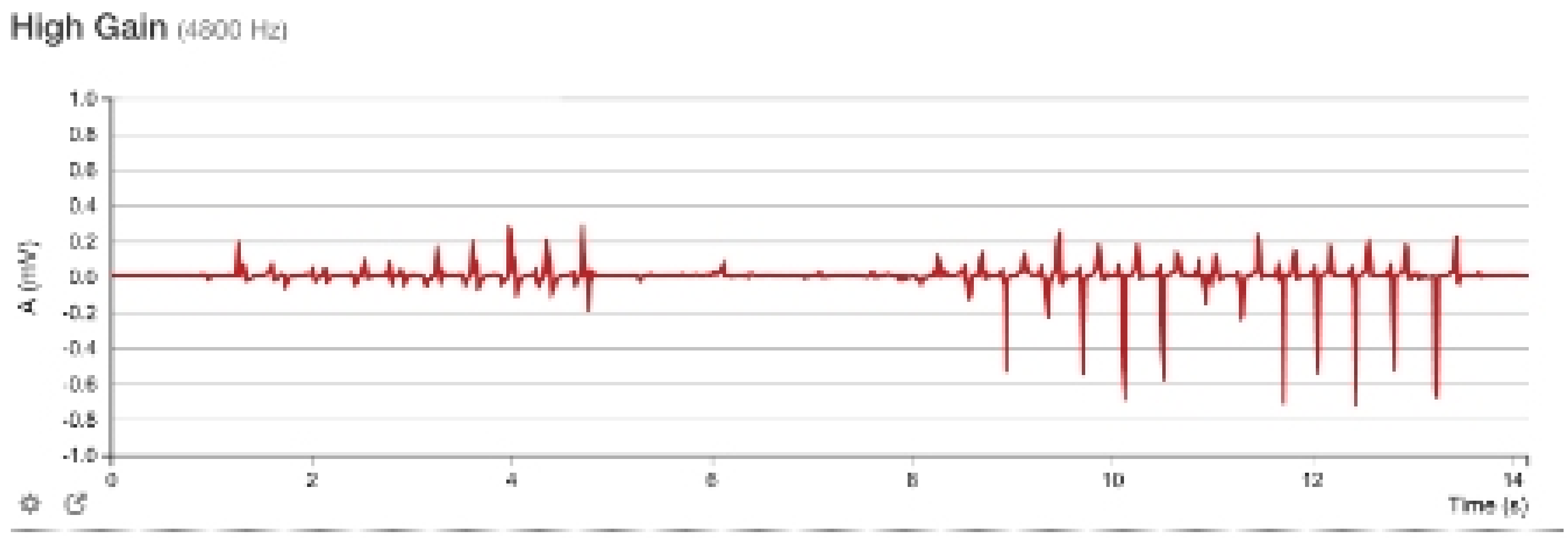
5. **What is different about the voltage when you bring the loop near one pole of the magnet as opposed to the other pole?**



The voltages are similar in size but opposite in polarity. When the coil approaches one pole, the voltage first rises then falls; when it approaches the opposite pole the voltage first falls and then rises. This happens because the direction of the magnetic field is opposite for the two poles.

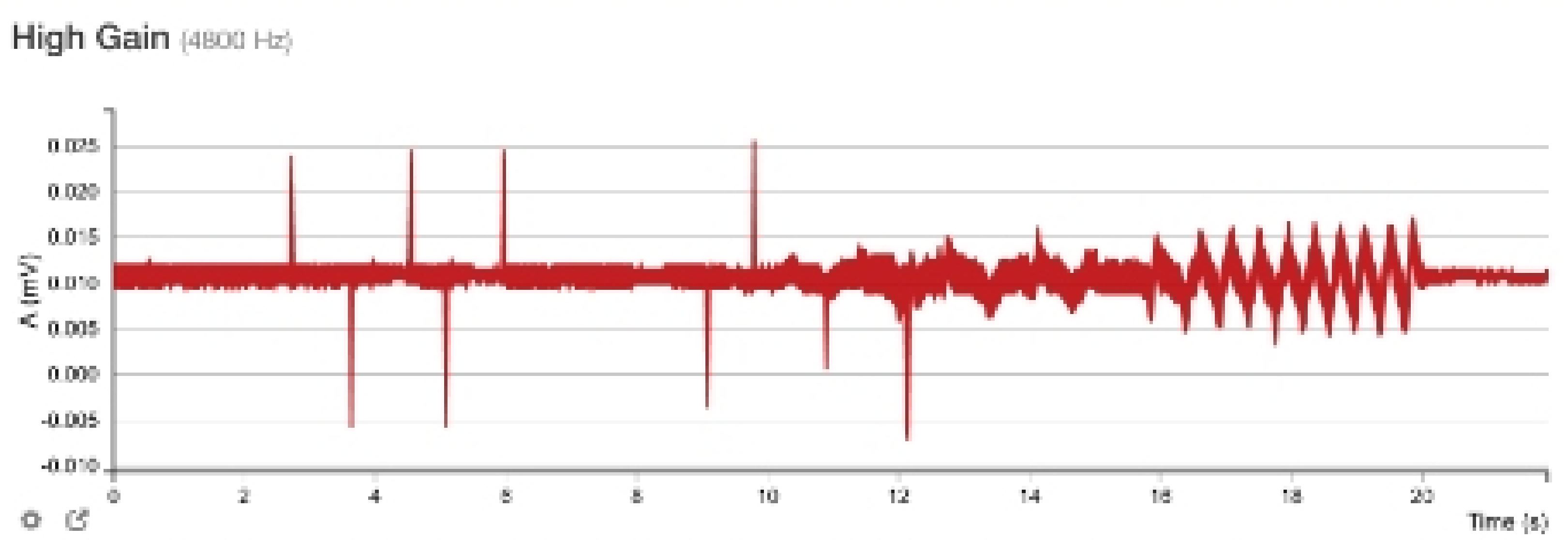
6. **What happens when you push one pole of the magnet toward the top of the loop as opposed to when you push the same pole of the magnet toward the bottom of the**

loop? What does this difference have to do with the magnetic field?



The voltages are similar in size but reversed in sign. Moving the top of the coil towards the pole causes an initial increase in voltage followed by a decrease, while moving the bottom of the coil toward the same pole causes an initial decrease followed by an increase. This is because the orientation of the coil relative to the magnetic field lines changes the direction of the induced current.

Part 3: Circuits and Current (3 Points each)



7. **How is turning the power off different from turning it on?**

Turning the power off causes the voltage to spike in the opposite direction compared to turning it on. Tuning the power off creates a negative voltage while turning the power on creates a positive voltage. This is due to switching the power and changing the direction of the change in magnetic flux through the pickup coil.

8. **What changes when you reverse the direction of the inductor and turn the power on and off? Why does it change?**