Experiment HH-11: ECG ~ Simulations and Comparisons

Equipment Required

PC or Mac Computer

IXTA, USB cable, IXTA power supply

ROAM ECG

iWire-B3G

ECG-SIM files

Alcohol swabs

Disposable ECG electrodes

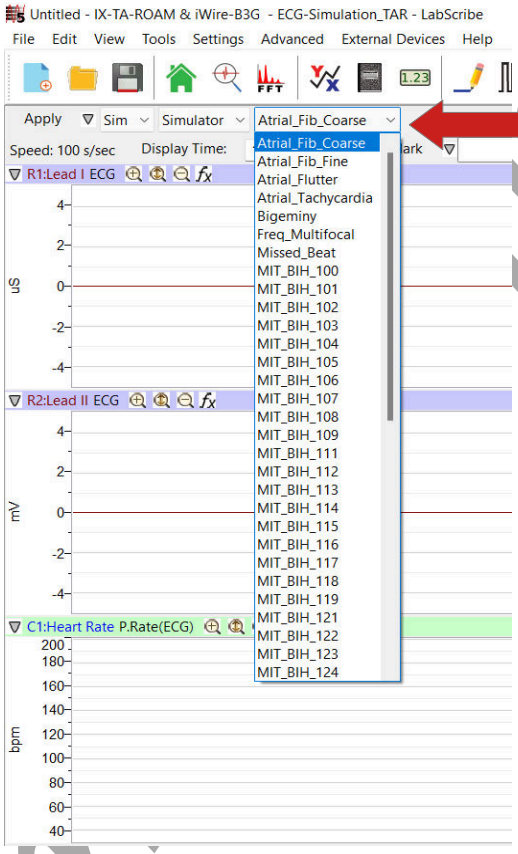
ROAM Setup

1. For this lab – plug the iWireB3G into the iWire one port and connect the leads to the Sim snaps on the TA as shown.

Figure HH-11-S1: The TA with the iWire-B3G connected to the iWire 1 port and the leads connected to the Sim snaps.

Using the Simulator Files

1. Click the drop down next to **Simulator**
2. Choose the cardiac simulation you wish to run.
3. Click Record.
4. The simulation will record for 30 seconds.
5. Repeat for any of the ECG Sim files.



Experiment HH-11: ECG ~ Simulations and Comparisons

Exercise 1: Using the iWorx ECG Simulator

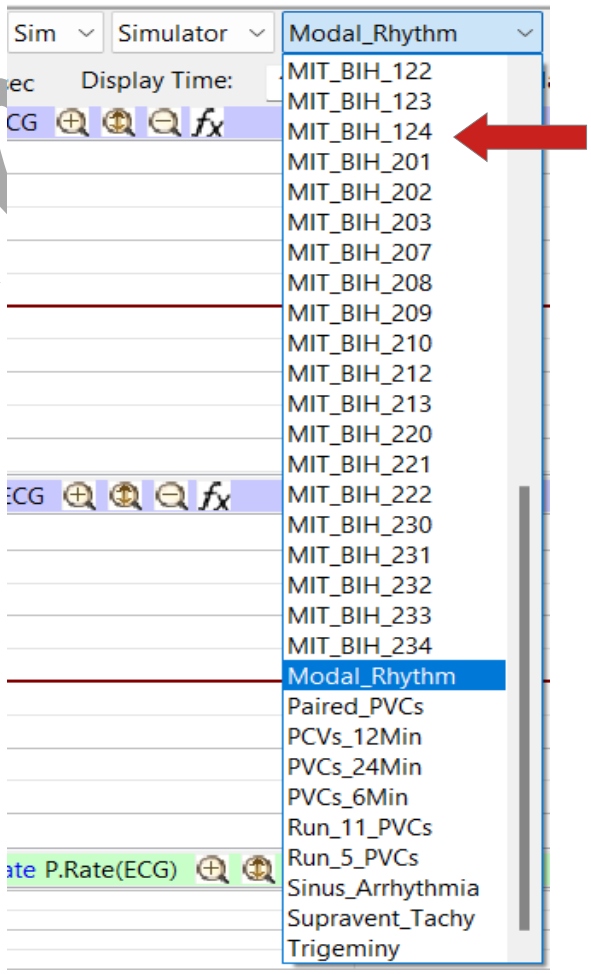
Aim: To observe and measure different ECG heart rhythms using the built-in electrocardiogram simulator.

Approximate Time: 30 minutes

Procedure

1. Follow the procedure as shown in the setup document. Either
    - leave the ROAM in the dock, OR
    - connect the iWire-B3G as shown with:
        - the red and black electrodes connected to Sim 1
        - the brown and white electrodes connected to Sim 2

2. Click the drop down to the right of **Simulator**
3. Scroll down the list and click on the Modal Rhythm.
4. Click the Apply button on the left.
5. Click on the Record button.
6. The signal will automatically record for 30 seconds.
7. Click on the AutoScale All.
8. Select Save in the File menu on the LabScribe window.



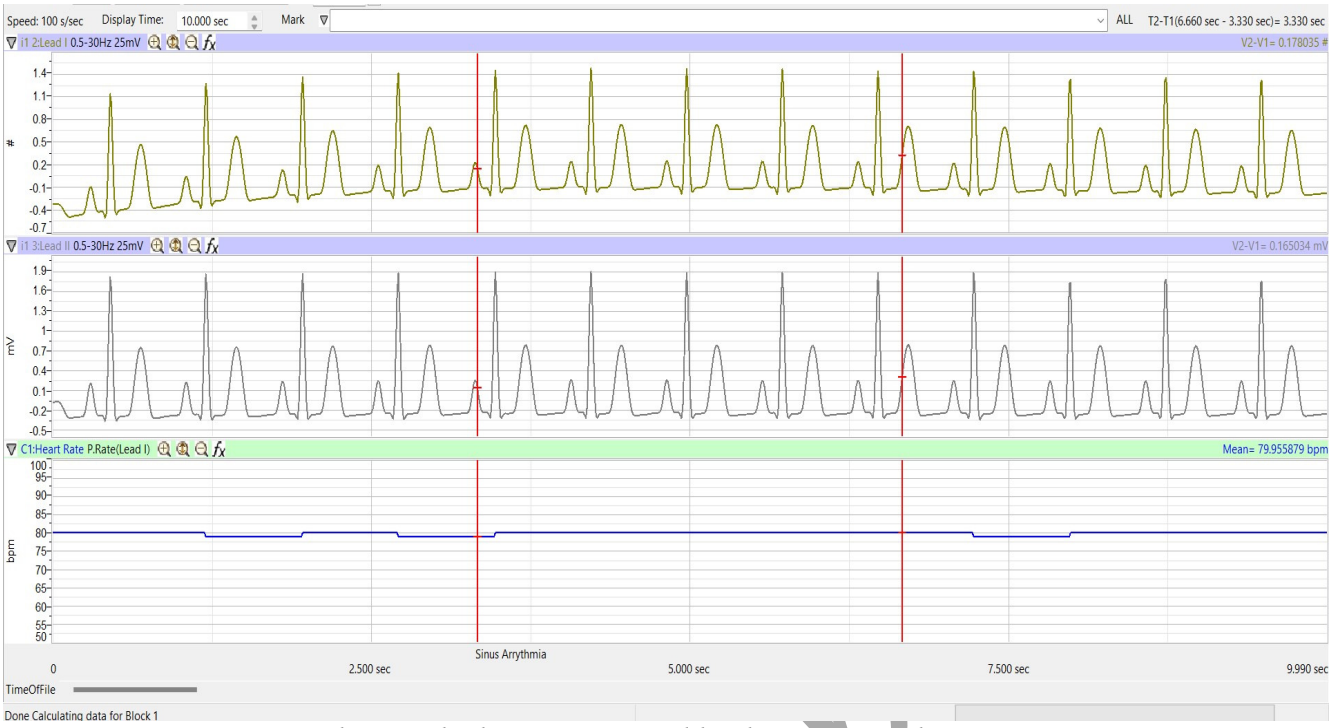


Figure HH-11-L1: Normal sinus rhythm as generated by the ECG simulator.

Data Analysis

1. Scroll through the recording and find a section of data with ten ECG cycles.
2. Use the Display Time icons to adjust the Display Time of the Main window to show the complete ECG cycles on the Main window.
3. Data can be collected from the Main window or the Analysis window. If you choose to use the Analysis window, click on the Analysis window icon in the toolbar.
4. The mathematical functions, V2-V1, T2-T1 and Mean should appear on screen. Values for V2-V1, T2-T1 and Mean on each channel are seen in the table across the top margin of each channel in the analysis window, or to the right of each graph in the main window.

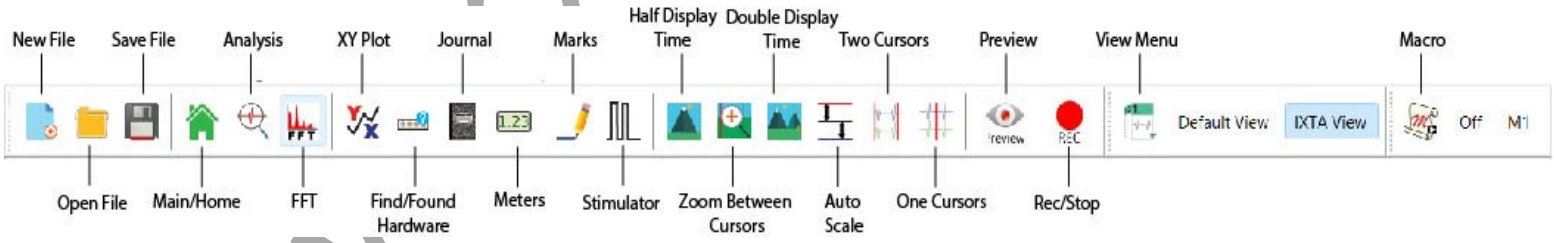


Figure HH-11-L2: The LabScribe toolbar.

5. Use the mouse to click on and drag the cursors to specific points on the ECG/Pulse recording to measure the following (measure 5 ECG cycles):
    - The R-wave amplitude. Place one cursor on the point of the Q wave that precedes the R wave and the second cursor on the peak of the R wave. The value for V2-V1 on the ECG channel is this amplitude.
    - The beat period, which is the time interval between two adjacent R waves. Place one cursor on the peak of an R wave and the second cursor on the peak of the adjacent R wave. The value for T2-T1 is the beat period.
    - The P-wave amplitude. Place one cursor on the baseline that precedes the P wave and the second cursor on the peak of the P wave. The value for V2-V1 on the ECG channel is this amplitude.
    - The T-wave amplitude. Place one cursor on the peak of the T wave and the second cursor on the baseline immediately after the T wave. The value for V2-V1 on the ECG channel is this amplitude.
    - The P-R interval. Place one cursor at the beginning of the P wave and the second cursor at the beginning of the QRS complex. The value for T2-T1 is the P-R interval.
    - The Q-T interval. Place one cursor at the beginning of the QRS complex and the second cursor immediately at end of the T wave. The value for T2-T1 is the Q-T interval.
    - The T-P interval. Place one cursor at the end of the T wave and the second cursor at the beginning of the next P wave. The value for T2-T1 is the T-P interval.

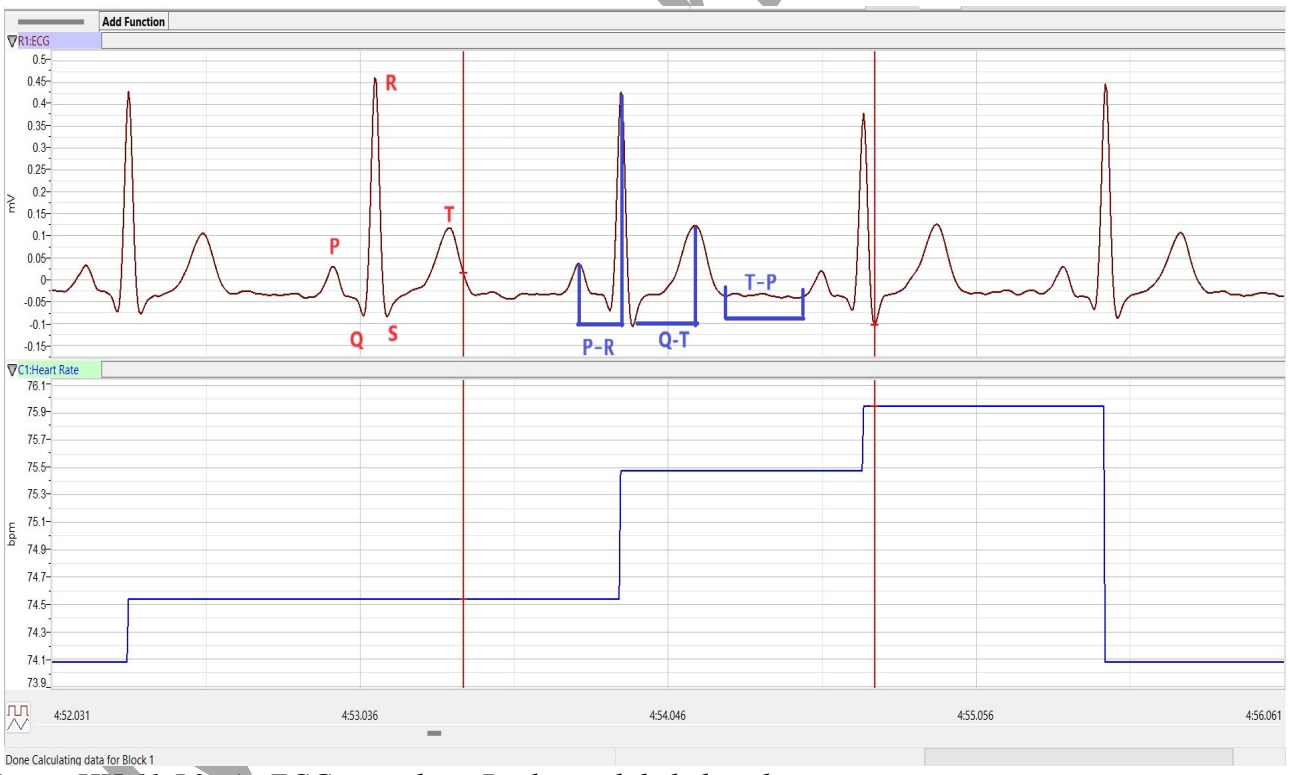


Figure HH-11-L3: An ECG recording. Peaks are labeled to show cursor positions.

6. Once the cursors are placed in the correct positions for determining the specific values for each ECG cycle, the values can be recorded in the on-line notebook of LabScribe by typing their names and values directly into the Journal, or on a separate data table.
    - To use these functions:
        - Place the cursors at the locations used to measure the amplitudes and period of the ECG/Pulse cycle.
        - Transfer the names of the mathematical functions used to determine the amplitudes and time interval to the Journal using the Add Title to Journal function in the ECG Channel pull-down menu.
        - Transfer the values for the amplitudes and beat period to the Journal using the Add Ch. Data to Journal function in the ECG Channel pull-down menu.
7. Calculate the following values and record your results into the Journal or on the data tables below:
    - The average beat period, in seconds/beat.
    - The heart rate, which is expressed in beats per minute and calculated from the average beat period by using the following equation:

Heart Rate (beats/minute) = 60 seconds/minute / # seconds/beat

Note: *Heart Rate can also be determined by looking at the Mean function on the Heart Rate Channel. The more data on screen - the more accurate the Mean heart rate. Double the display time to 30 seconds of data on screen for a more accurate heart rate measurement.*

- The average P-R interval.
- The average Q-T interval.
- The average T-P interval.

Questions

1. What electrical and mechanical events take place during the R wave? P wave? T wave?
2. What other events are taking pace in the cardiovascular system during these individual waves?
3. What are the physiologic responses associated with the events in a cardiac cycle?
4. Explain how glands in the body can affect the cardiac cycle.
5. What external factors have an influence on normal cardiac rhythms?

Exercise 2: Using the Simulator to Record Other Cardiac Rhythms

Aim: To measure a variety of other cardiac rhythms using the electrocardiogram simulator.

Approximate Time: 15 minutes per rhythm measured

Procedure

Repeat Exercise 1 by testing at least three other abnormal cardiac rhythms.

1. Click the drop down to the right of **Simulator**
2. Click on the button of the rhythm you would like to test, ex: Atrial Fibrillation.
3. Click the Apply button every time you make a change to the rhythm you are choosing.
4. Type the name of the rhythm in the Mark box.
5. Click on the Record button and immediately click the Mark button.
6. The signal will automatically record for 30 seconds.
7. Click on the AutoScale All.
8. Select Save in the File menu on the LabScribe window.
9. Options include:
    - Sinus Tachycardia
    - Toursade
    - Atrial Flutter and <u>many</u> others

Data Analysis

Analyze the data for each abnormal cardiac rhythm using the same techniques used in the previous exercise.

- Be sure to keep track of what is different about each of the rhythms.
- Record this data is your own data table or in the Journal.

Questions

For each of the options chosen:

1. What is the major difference between this recording and the one of a normal ECG?
2. Explain what could be happening physiologically to cause the abnormality.
3. Explain what can be done to a patient experiencing this abnormal rhythm to get him/her back to a normal sinus pattern.

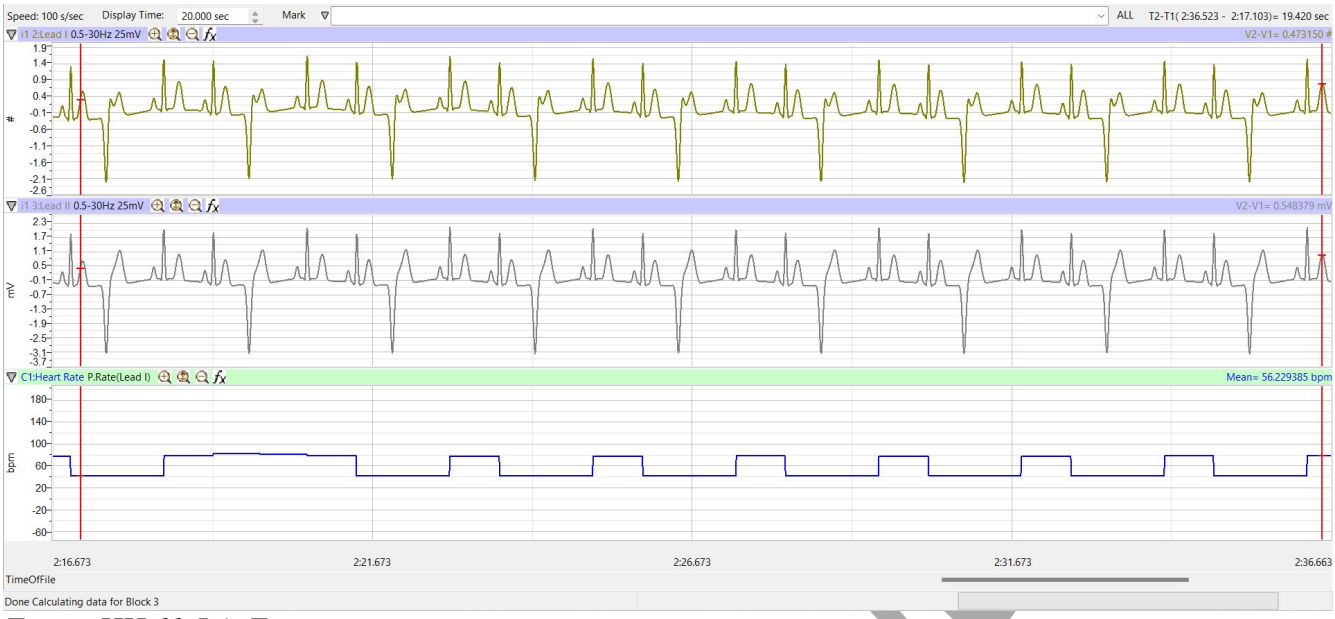


Figure HH-11-L4: Trigenimy

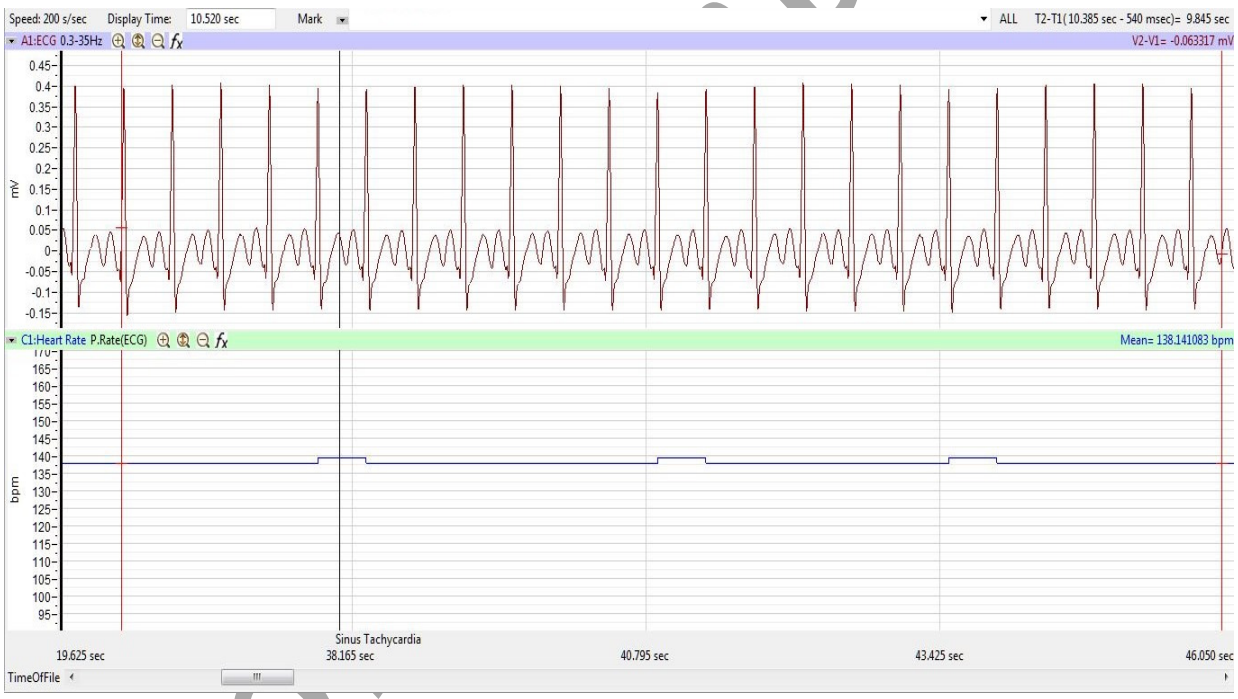


Figure HH-11-L5: Sinus Tachycardia – Note Lead II is missing in this image.

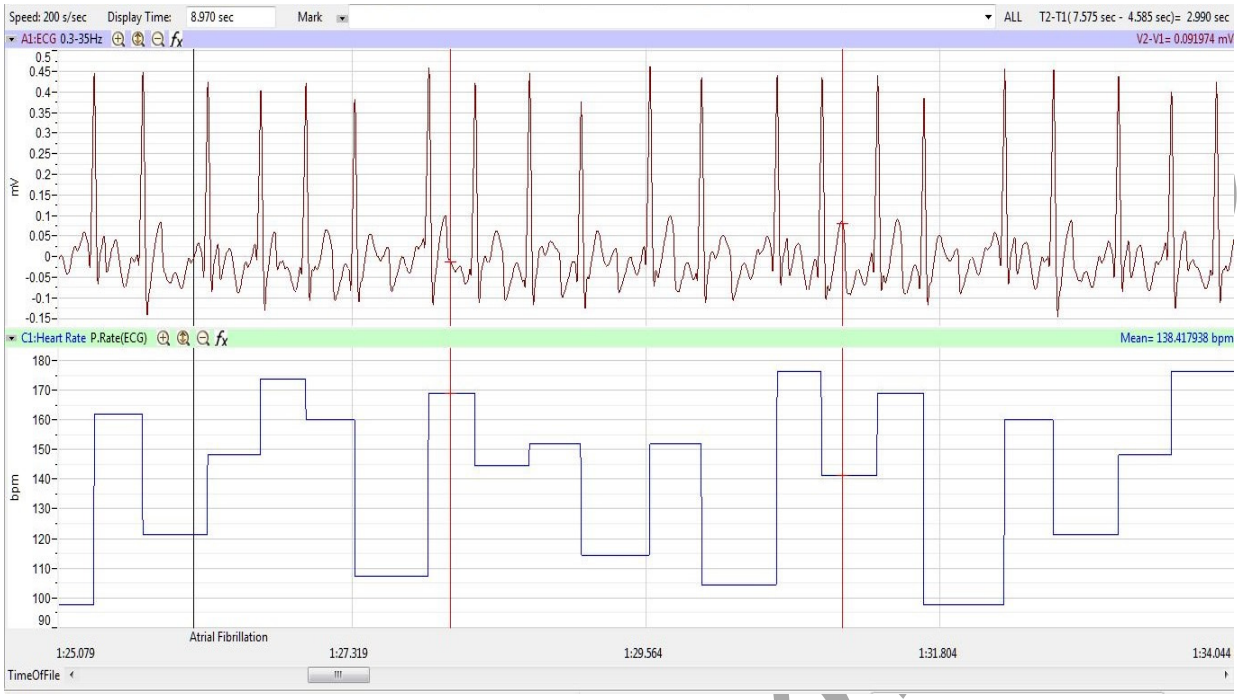


Figure HH-11-L6: Atrial Fibrillation - Note Lead II is missing in this image.

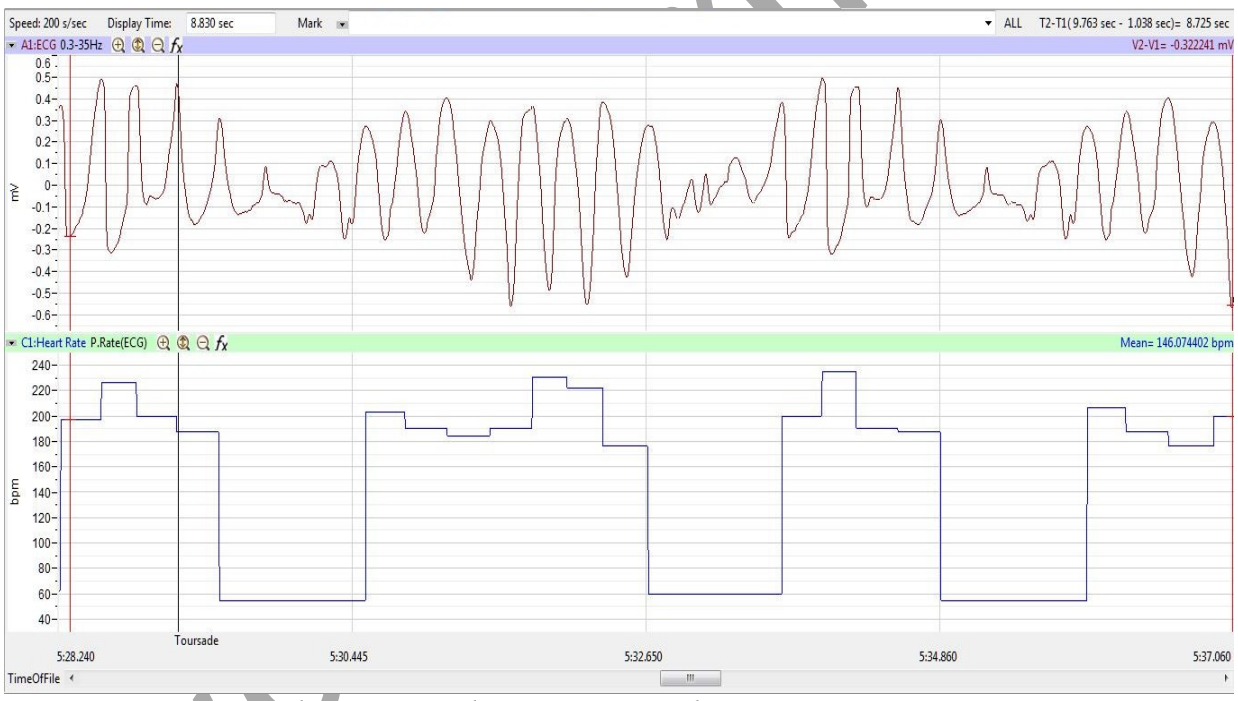


Figure HH-11-L7: Toursade - Note Lead II is missing in this image.

ECG Scavenger Hunt

Procedure

1. Repeat Exercise 2 using the MIT files.
   - Note that these files are from actual patients and present different cardiac arrythmias.
   - Click Apply each time you change rhythms.
   - Type the name of the MIT file in the Mark box.
   - Click on the Record button and immediately click the Mark button.
2. Try to record and identify as many of the anomalies as possible.
3. Analyze the data as you have done previously.