

# EKG Project

## Objective :

1. To extract the signals from EKG
2. To extract the header from the EKG

# Sample of EKG as PDF

Last, First Name

ID:0934124203

16-FEB-2012 13:41:11

MGH CARDIOLOGY ECG DATABASE

22-JUN-1980 (35 yr)

Female

Room:  
Loc:101

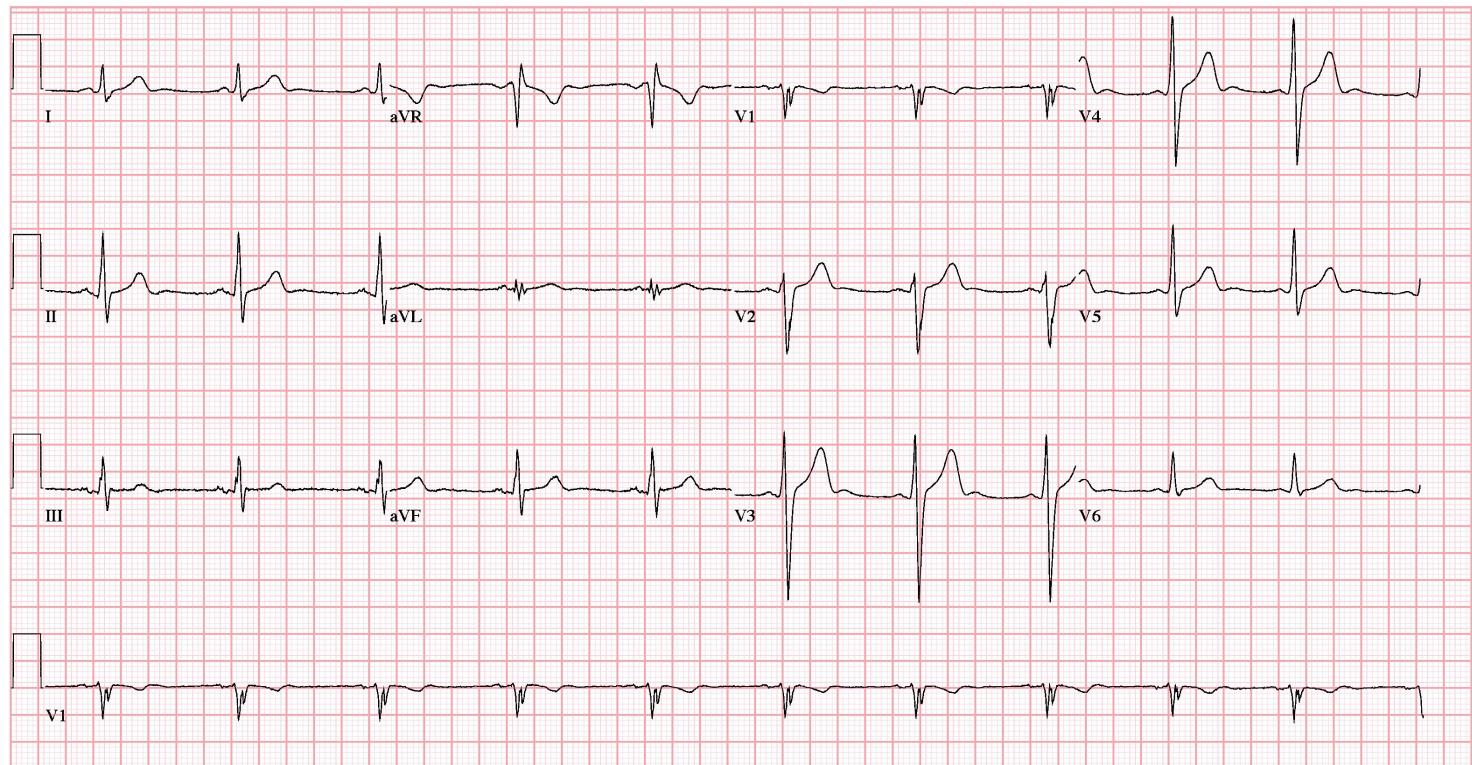
Vent. rate 62 BPM  
PR interval 140 ms  
QRS duration 114 ms  
QT/QTc 410/416 ms  
P-R-T axes 31 54 49

NORMAL SINUS RHYTHM  
NORMAL ECG  
NO PREVIOUS ECGS AVAILABLE

Technician: CHRISTINA D  
Test ind:

Referred by: STEVEN GARDNER

Confirmed By: PROCESS DO NOT READ



25mm/s 10mm/mV 150Hz 8.0 SP2 12SL 237 CID: 0

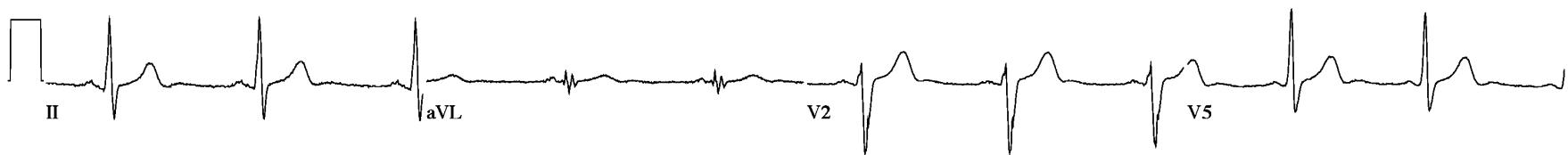
EID:202 EDT: 10:31 18-FEB-2012 ORDER:

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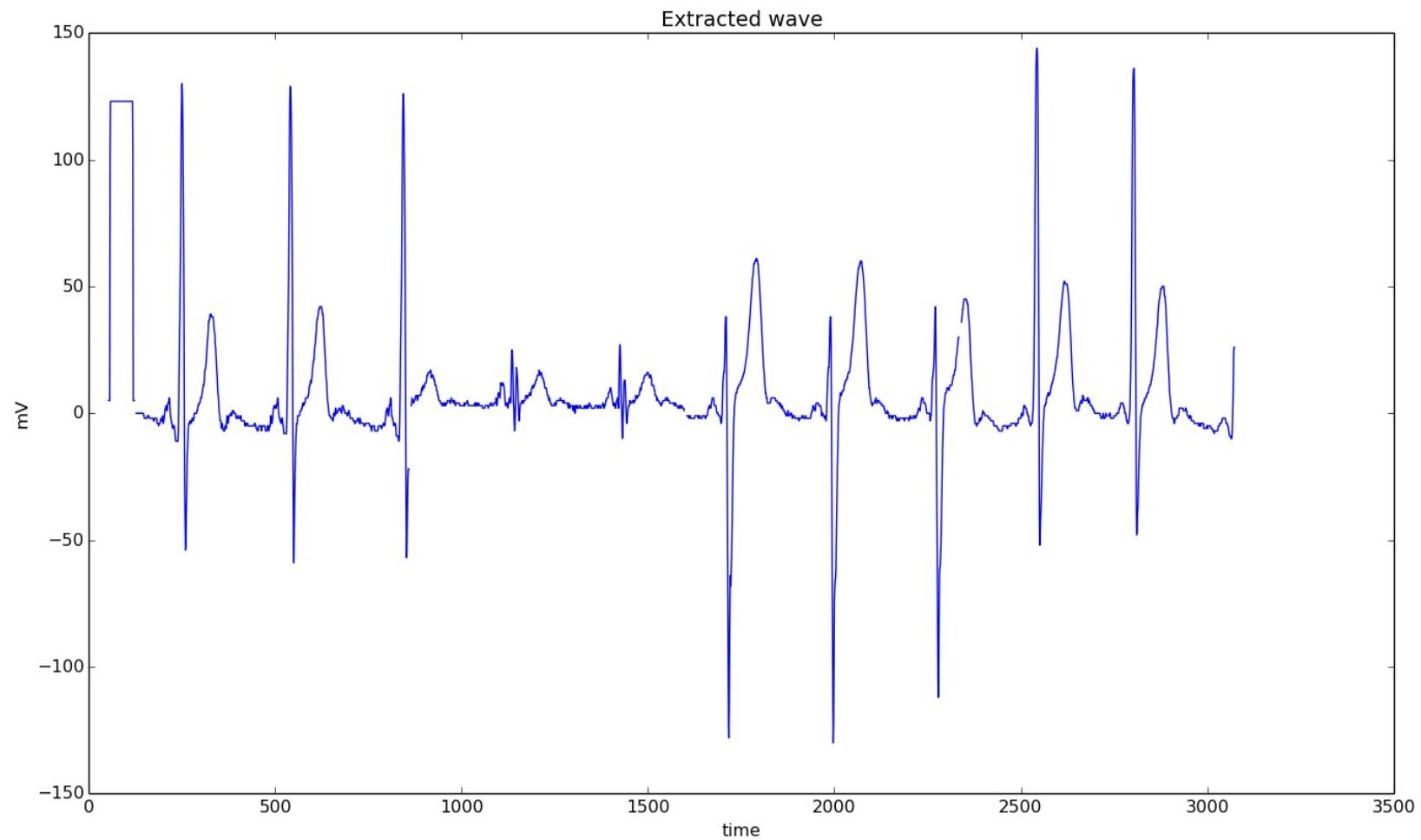
# one row of the EKG :extracted



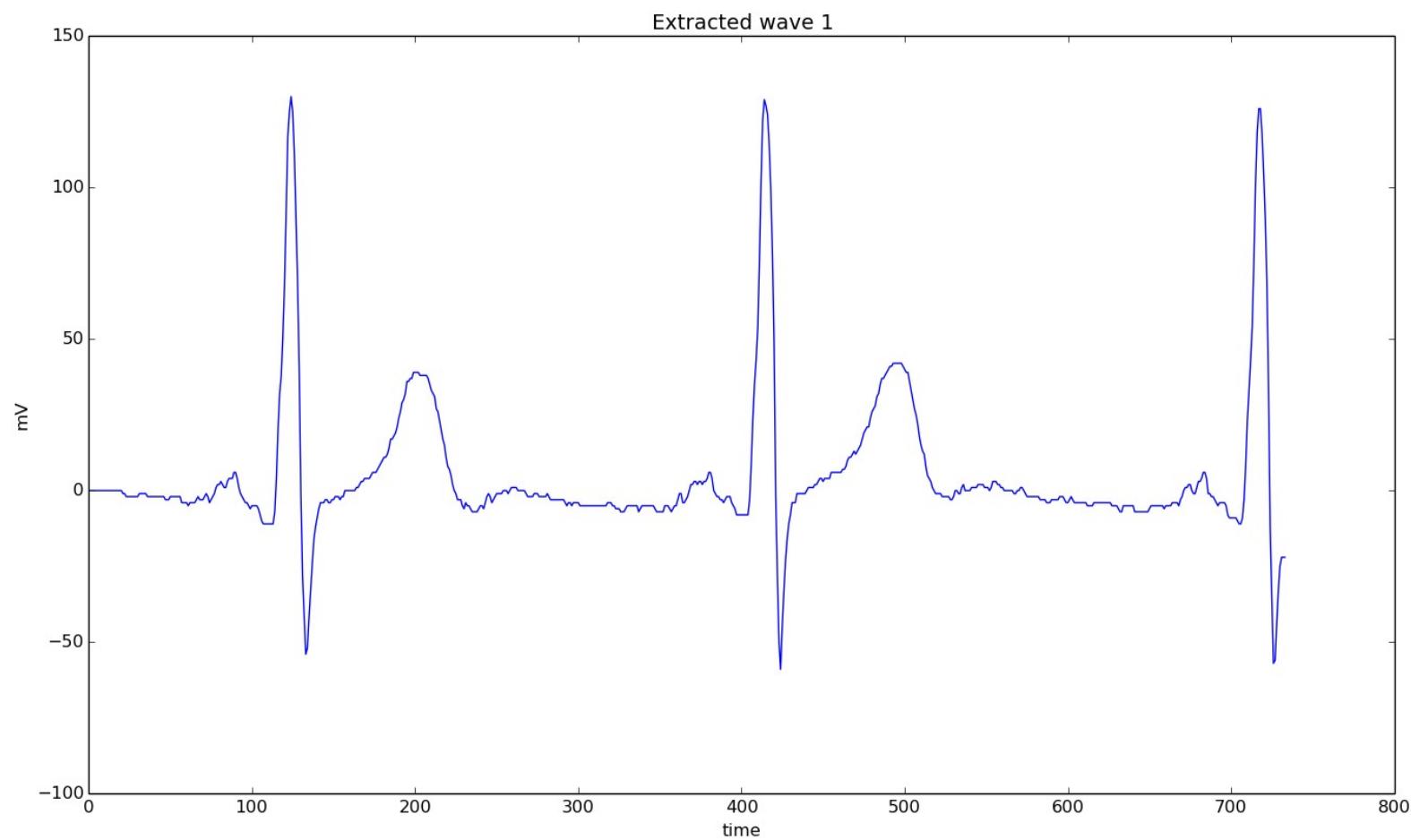
# Cleaning the image



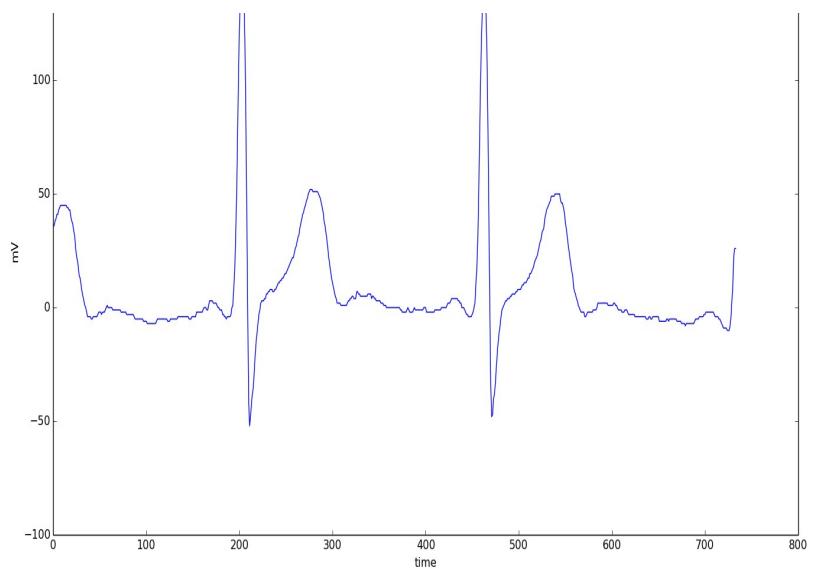
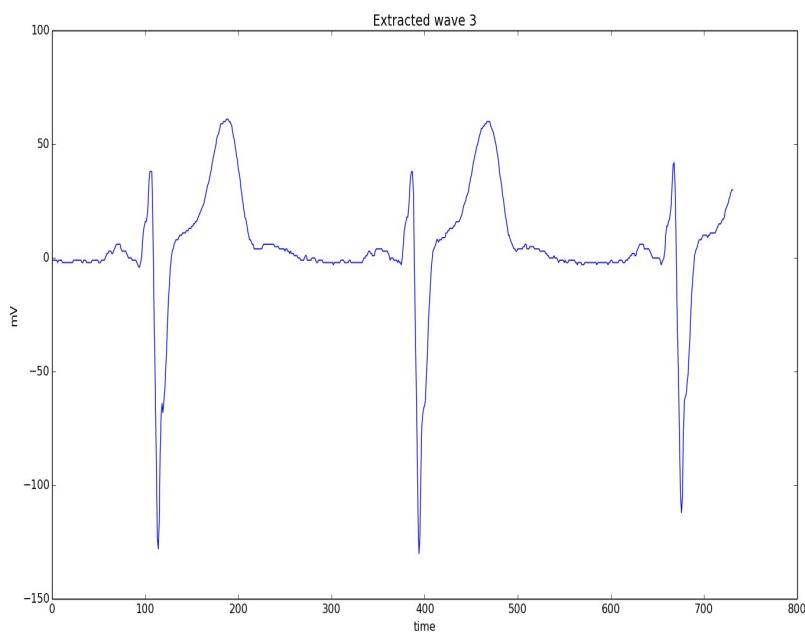
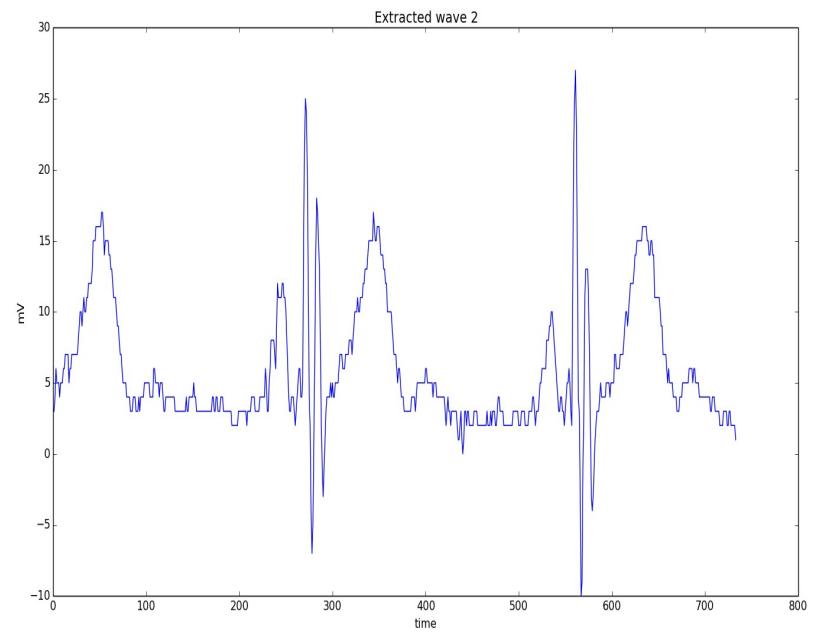
# Digitizing the signal



# Extracting the first signal lead



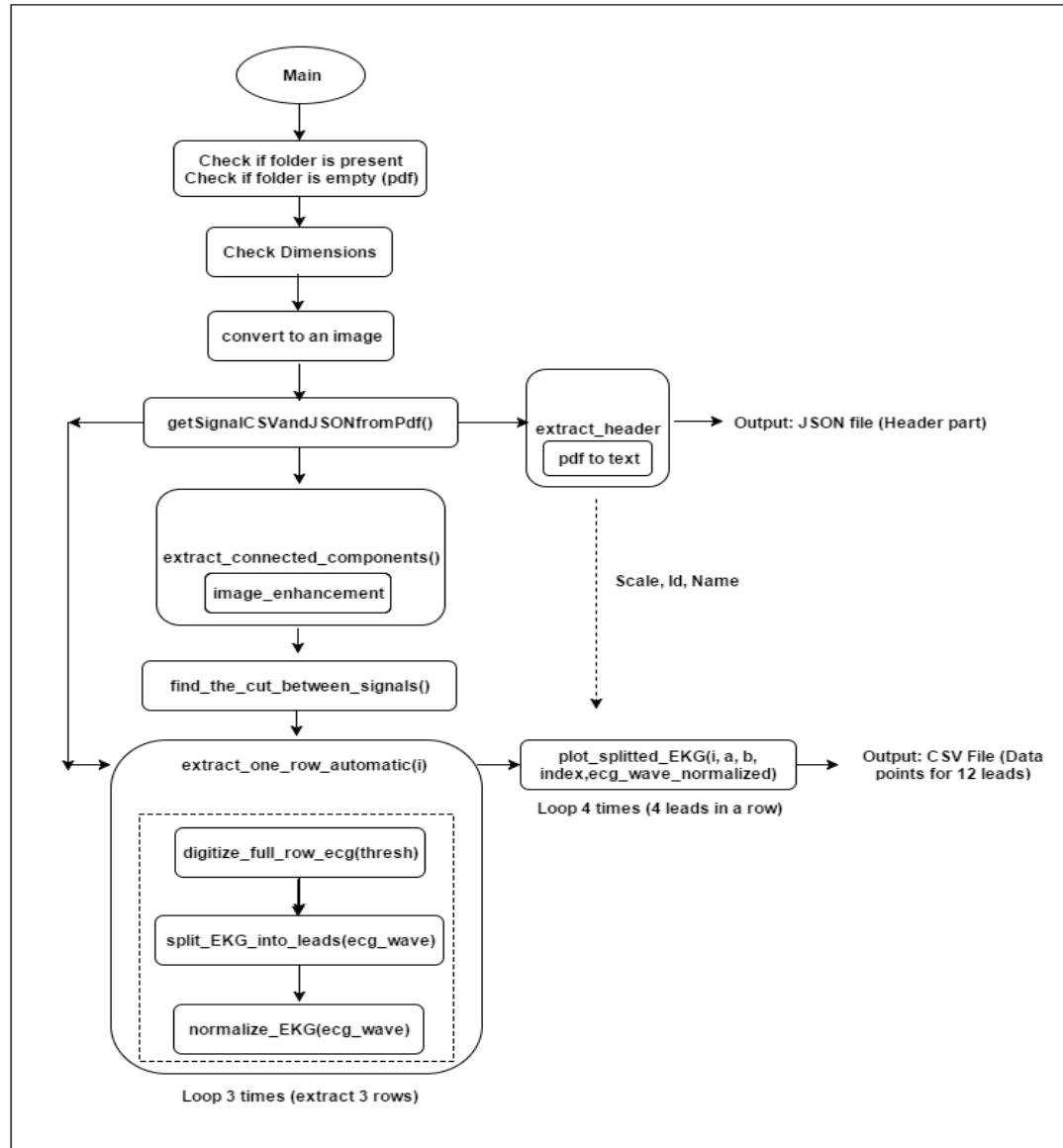
# Extracting the 4 leads in a row



# Header section extracted in JSON format

```
{  
  "Loc": " ",  
  "ACCOUNT": " ",  
  "Confirmed By": " TEST TEST,M.D.",  
  "Name": "TEST, TEN",  
  "Date": "23-MAY-2005 21:27:32",  
  "DOB": "05-MAY-1974 (31 yr)",  
  "SIGNAL": "40Hz",  
  "QRS_Duration": "84",  
  "PR_Interval": "158",  
  "QT_QTc": "372/429",  
  "Vent_Rate": "80",  
  "PRT": "49;49;50",  
  "Notes": " Sinus rhythm with frequent Premature ventricular complexes in a pattern of bigeminy. Right atrial enlargement. Early transition, increased R/S ratio in V1, consider posterior infarct. No previous ECGs available. ",  
  "BP": " ",  
  "Referred By": "",  
  "SCALE_X": "25mm/s",  
  "SCALE_Y": "10mm/mV",  
  "Sex": "Male",  
  "ID": "010318100",  
  "Room": "  
}  
"
```

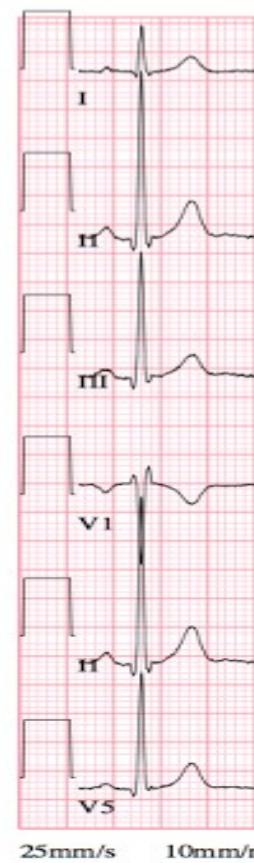
# Flow Diagram



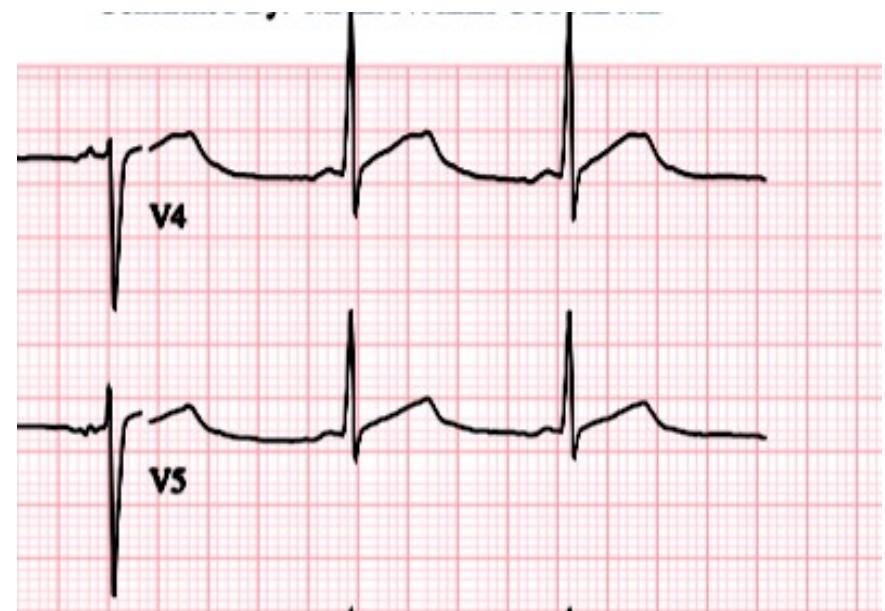
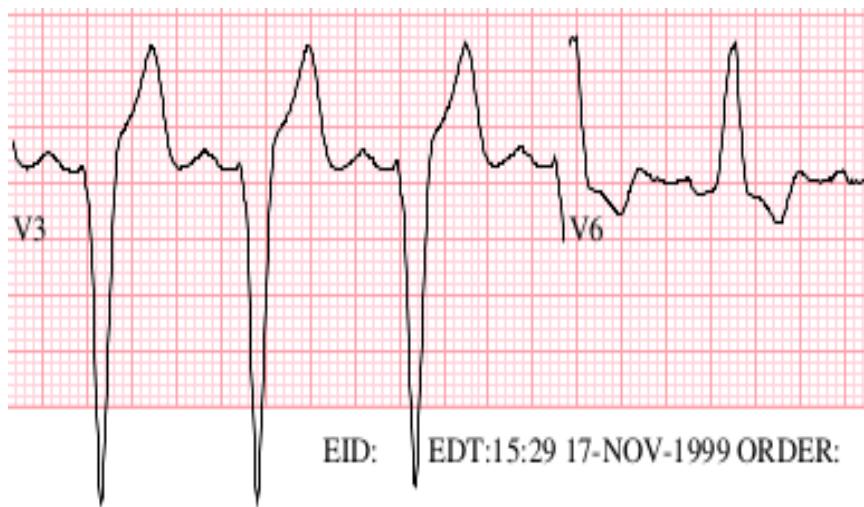
# Challenges

- Case 1 : Number of rows of signal can be different
- Case 2 : Signal going top of the grid area
- Case 3 : Signal going bottom of the grid area
- Case 4 : Signal overlap ( with out touching each other)
- Case 5 : Signal overlap ( Signal touch each other)
- Case 6 : Signal overlap with text

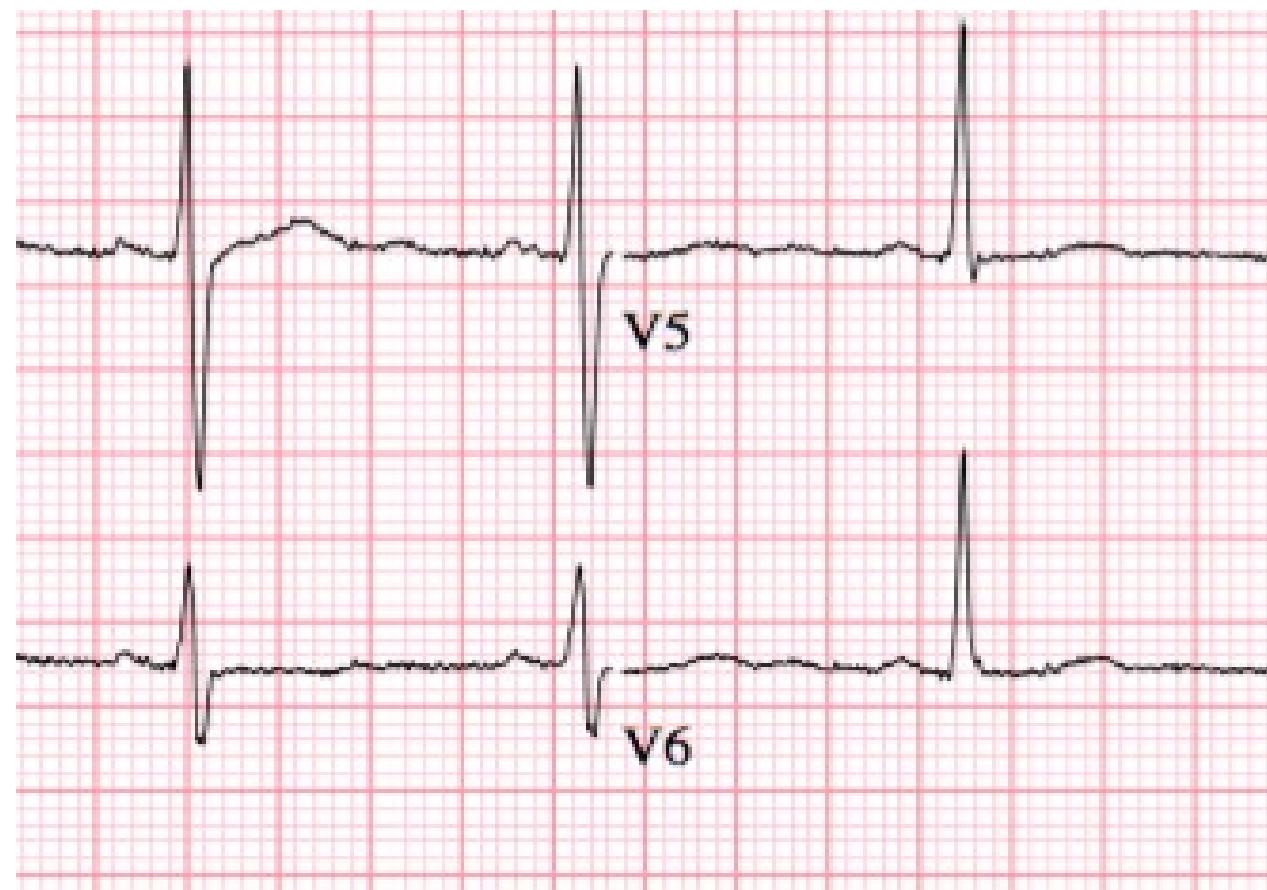
# Case 1 :Number of rows of signal can be different



## Case 2 & 3 : Signal outside Grid area



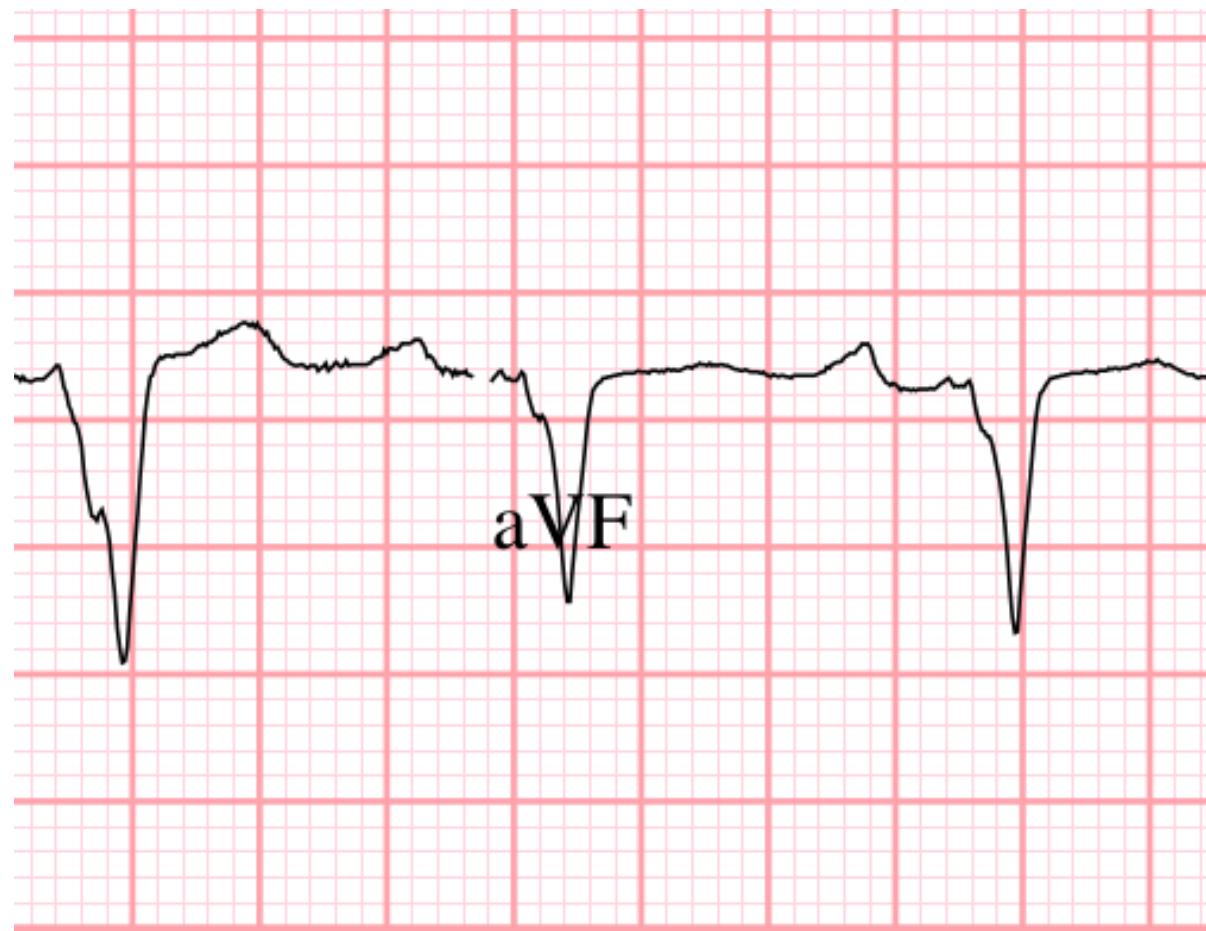
## Case 4 : Overlapping of signal ( with out touching each other)



# Case 5 : Overlapping of signal



## Case 6 : Overlapping with text



# Original image

TEST, TEN

05-MAY-1974 (31 yr)  
Male

Room:

ID:010318100

23-MAY-2005 21:27:32

BRIGHAM & WOMEN'S/FAULKNER HOSP.

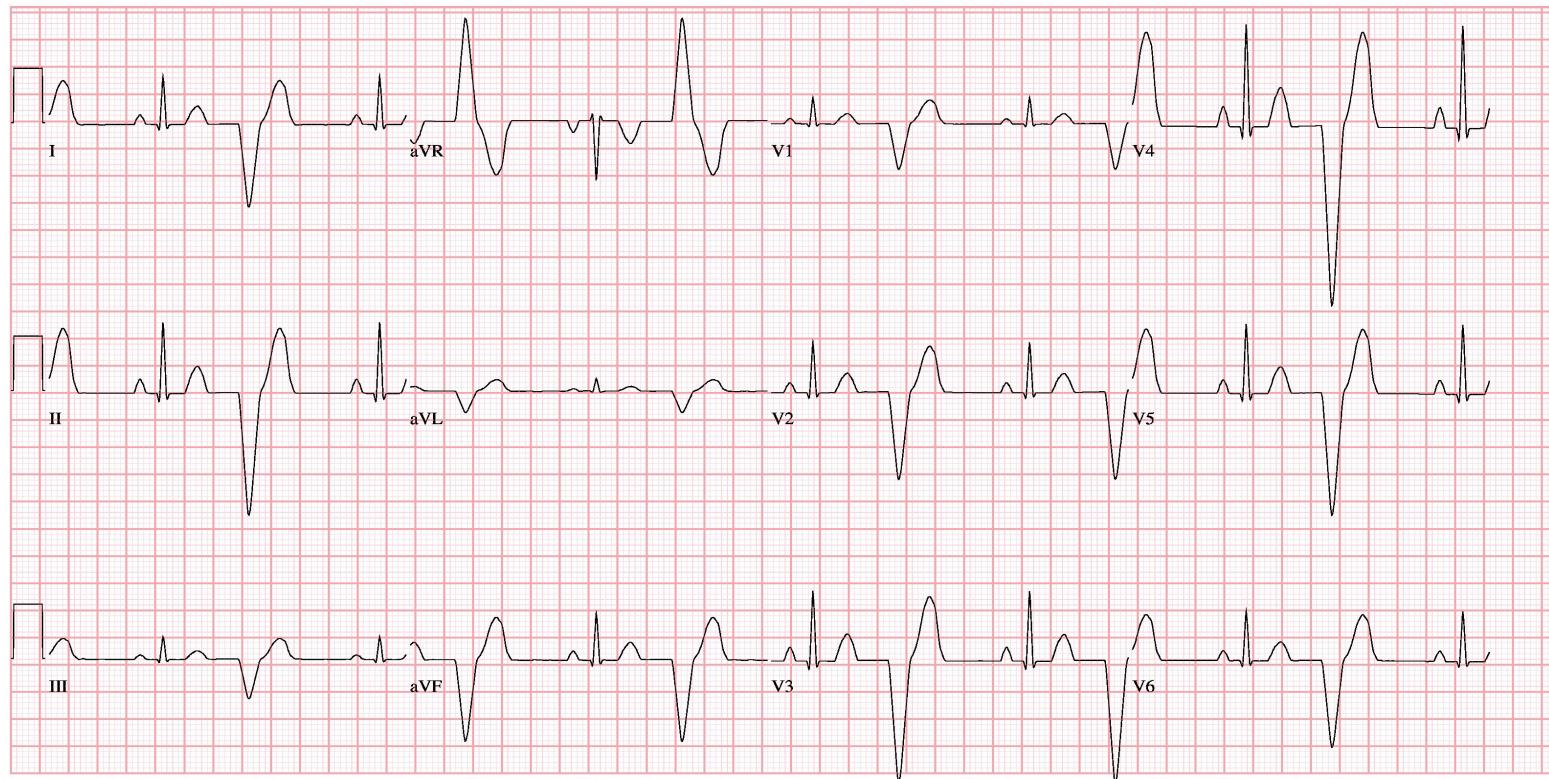
Vent. rate 80 BPM  
PR interval 158 ms  
QRS duration 84 ms  
QT/QTc 372/429 ms  
P-R-T axes 49 49 50

Sinus rhythm with frequent Premature ventricular complexes in a pattern of bigeminy  
Right atrial enlargement  
Early transition, increased R/S ratio in V1, consider posterior infarct  
Abnormal ECG  
No previous ECGs available

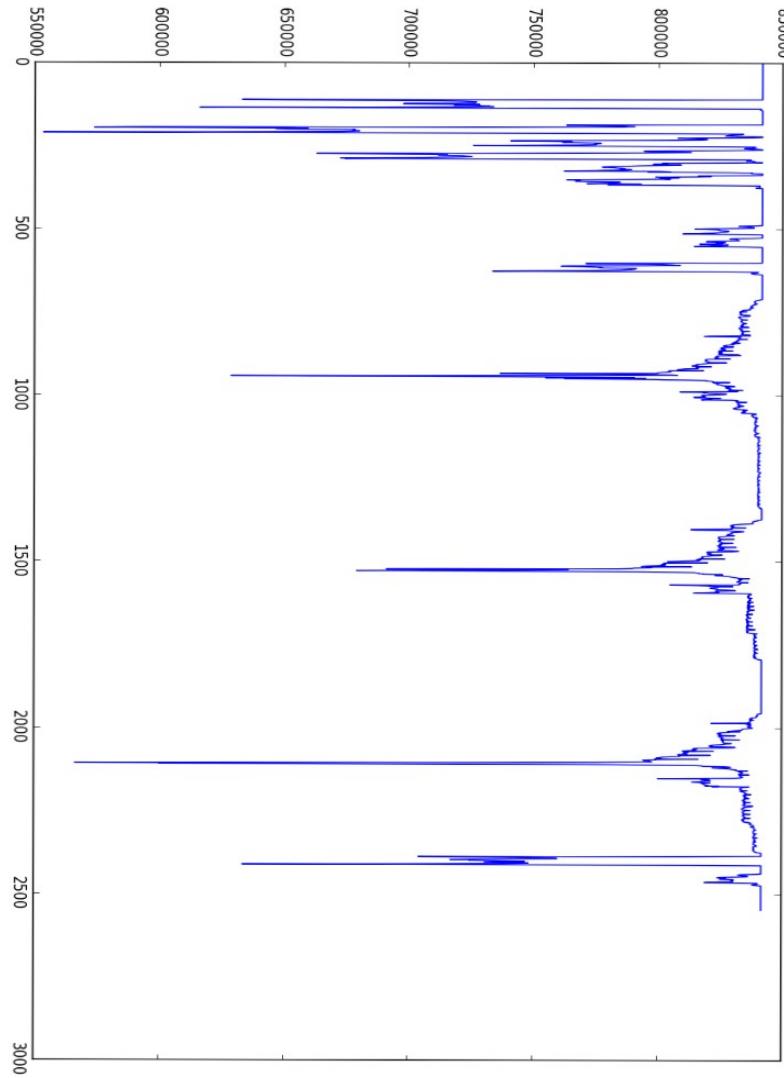
Technician:  
Test ind:41.44

Referred by:

Confirmed By: TEST TEST,M.D.



# Identifying the gap between signals



TEST, TEN  
05-MAY-1974 (31 yr)  
Male  
Room:

ID:010318100  
23-MAY-2005 21:27:32

BRIGHAM & WOMEN'S/FAULKNER HOSP.

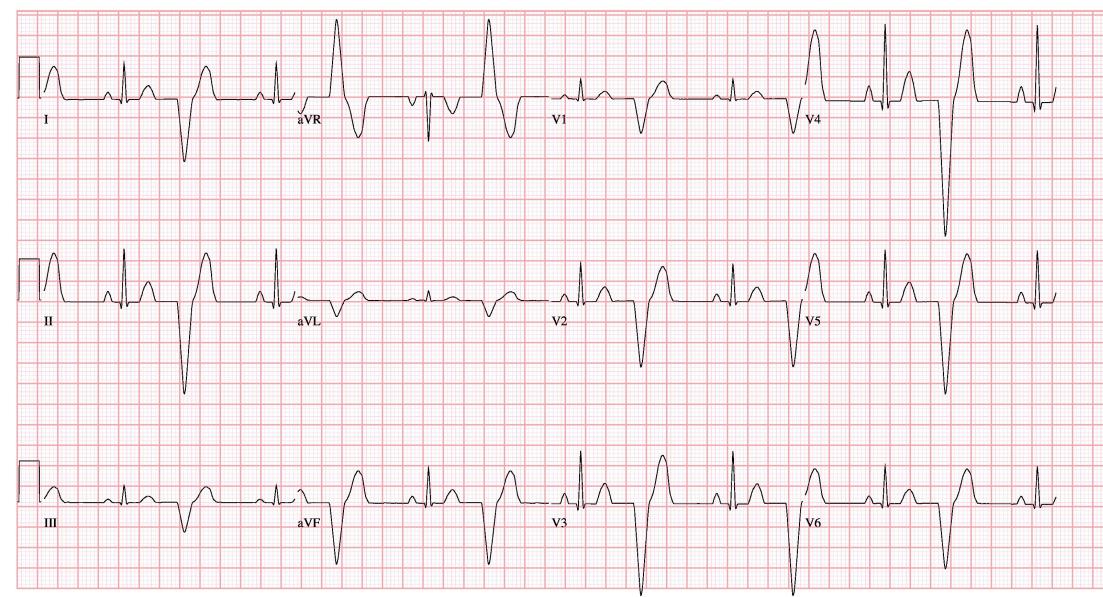
Vent. rate 80 BPM  
PR interval 158 ms  
QRS duration 84 ms  
QT/QTc: 372/429 ms  
P-R-T axes 49 49 50

Sinus rhythm with frequent Premature ventricular complexes in a pattern of bigeminy  
Right atrial enlargement  
Early transition, increased R/S ratio in V1, consider posterior infarct  
Abnormal ECG  
No previous ECGs available

Technician:  
Test ind:41.44

Referred by:

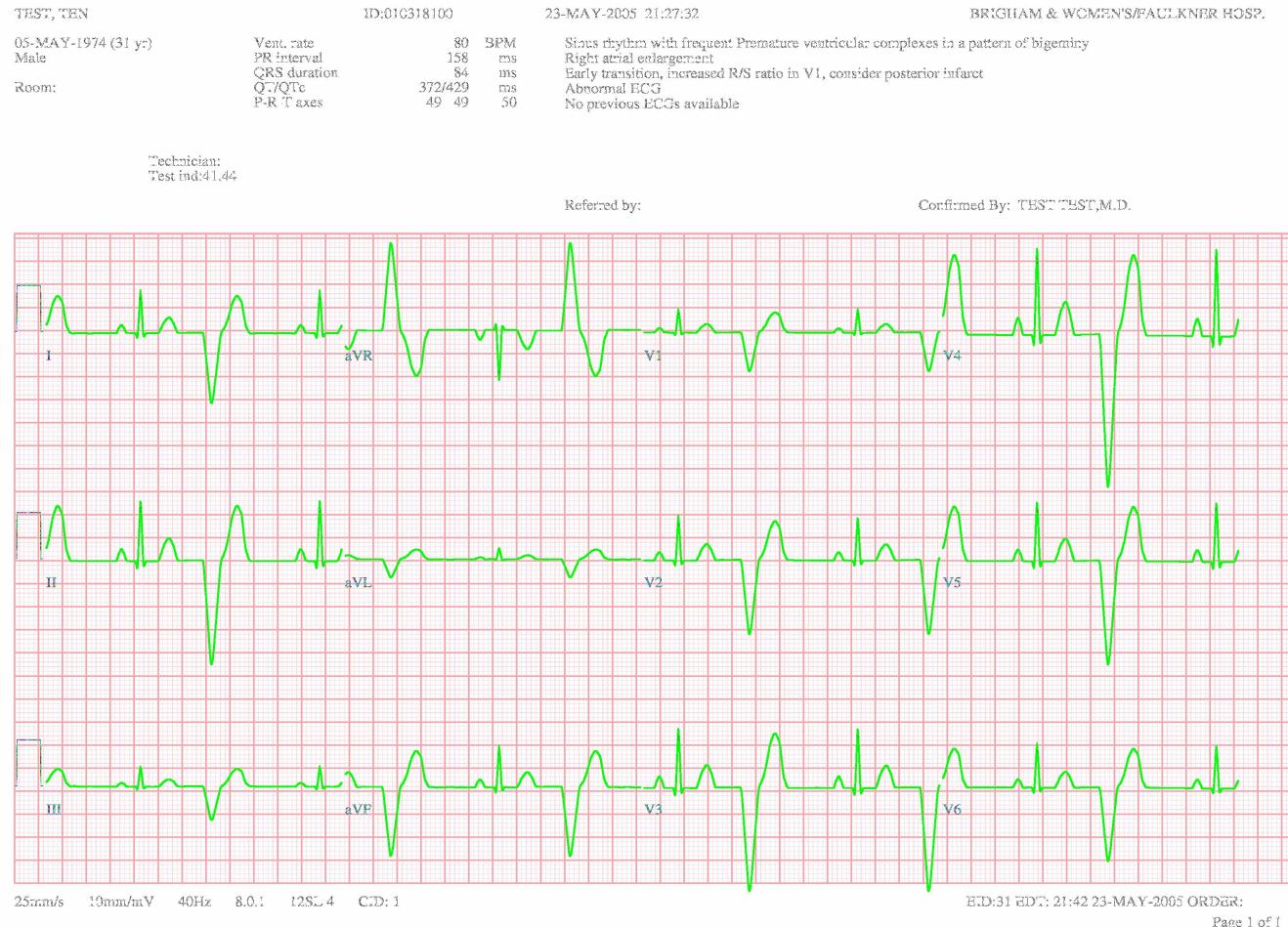
Confirmed By: TEST TEST,M.D.

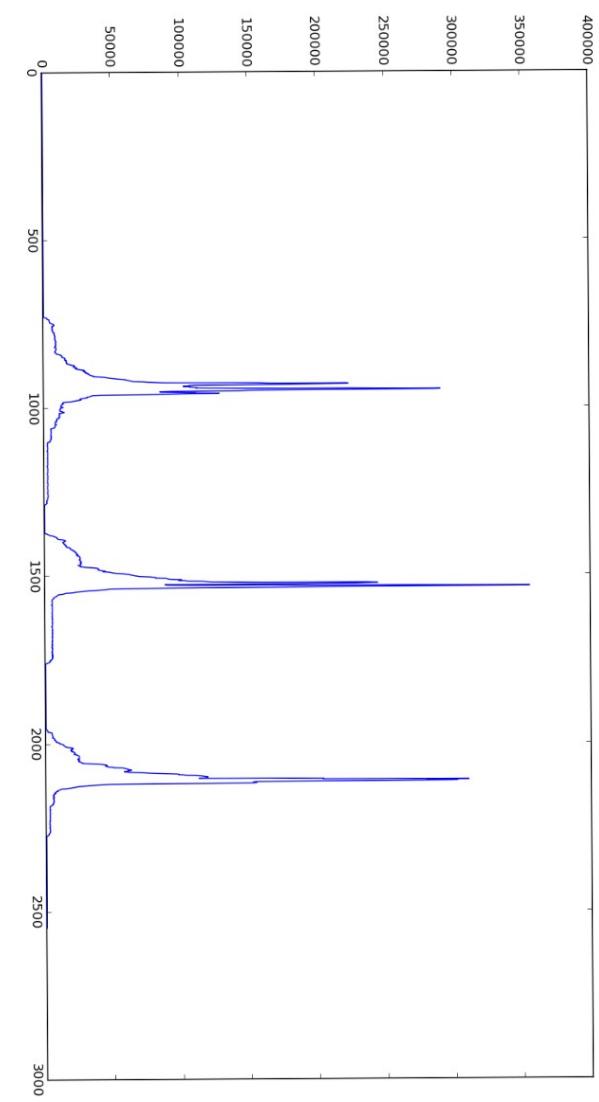


25mm/s 10mm/mV 40Hz 8.0.1 12SL 4 CID: 1

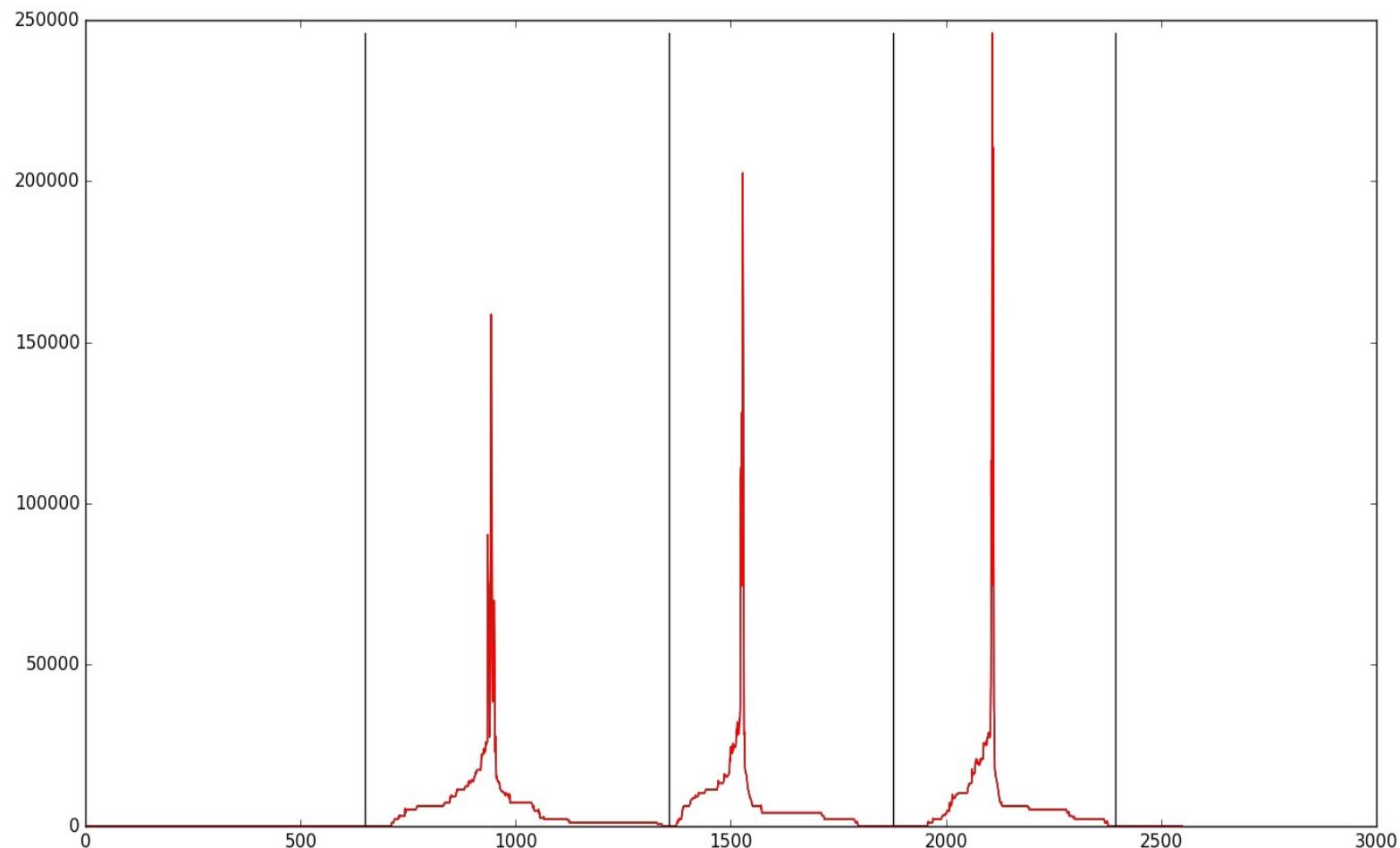
EID:31 EDT: 21:42 23-MAY-2005 ORDER:  
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# Extraction based on connected component method





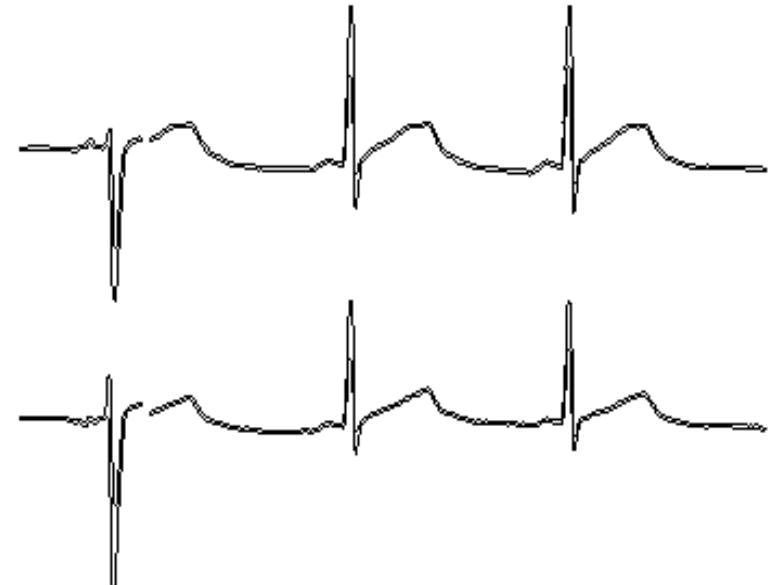
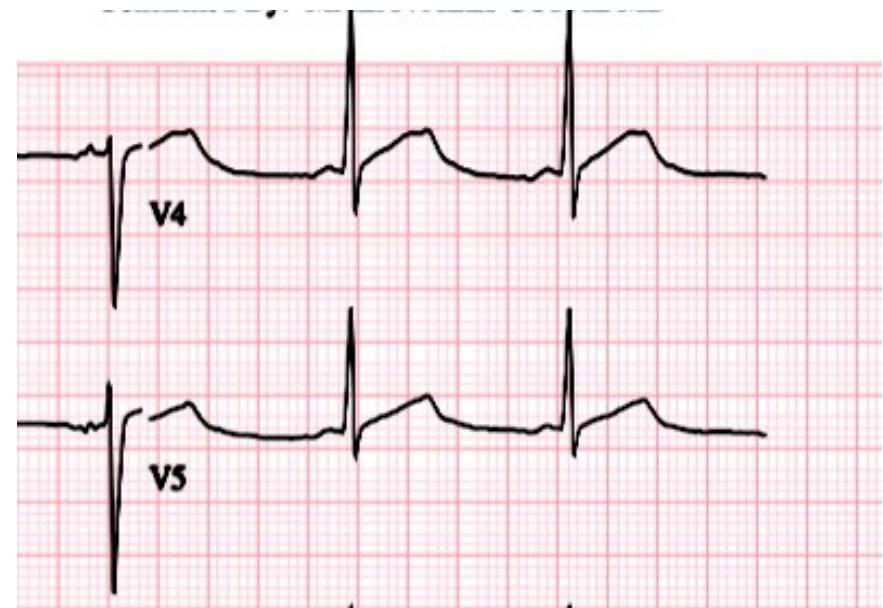
# Finding where to split in a normal EKG



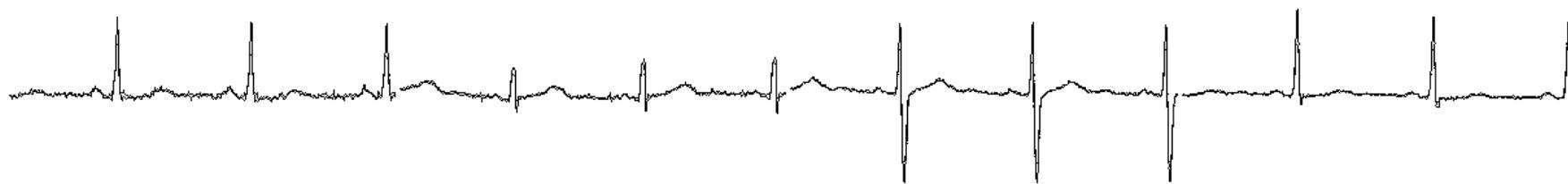
# Finding where to split in a normal EKG



# Solved Case 2 & 3 : Signal outside Grid area

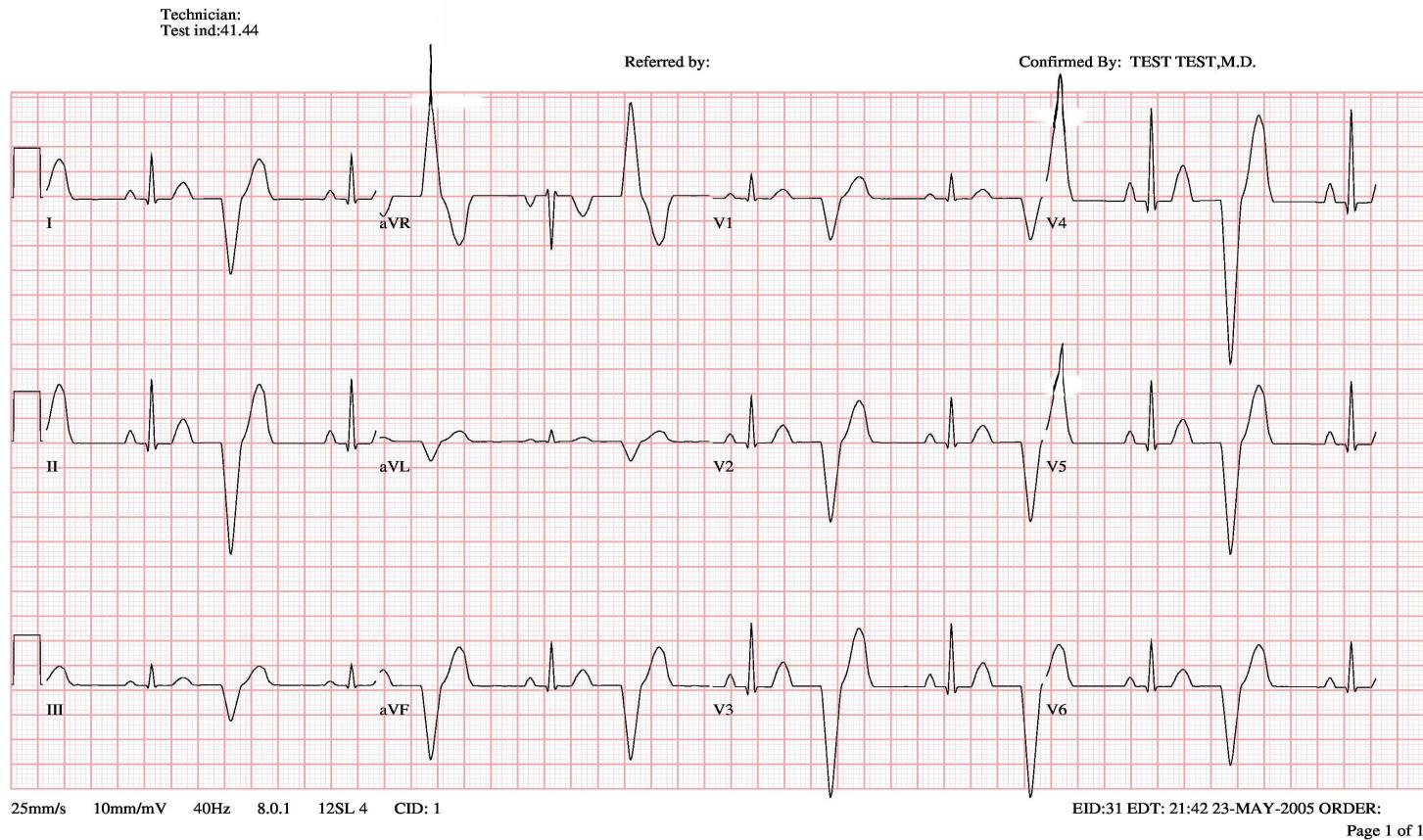


# Solved Case 4 : Solved with connected component extraction method

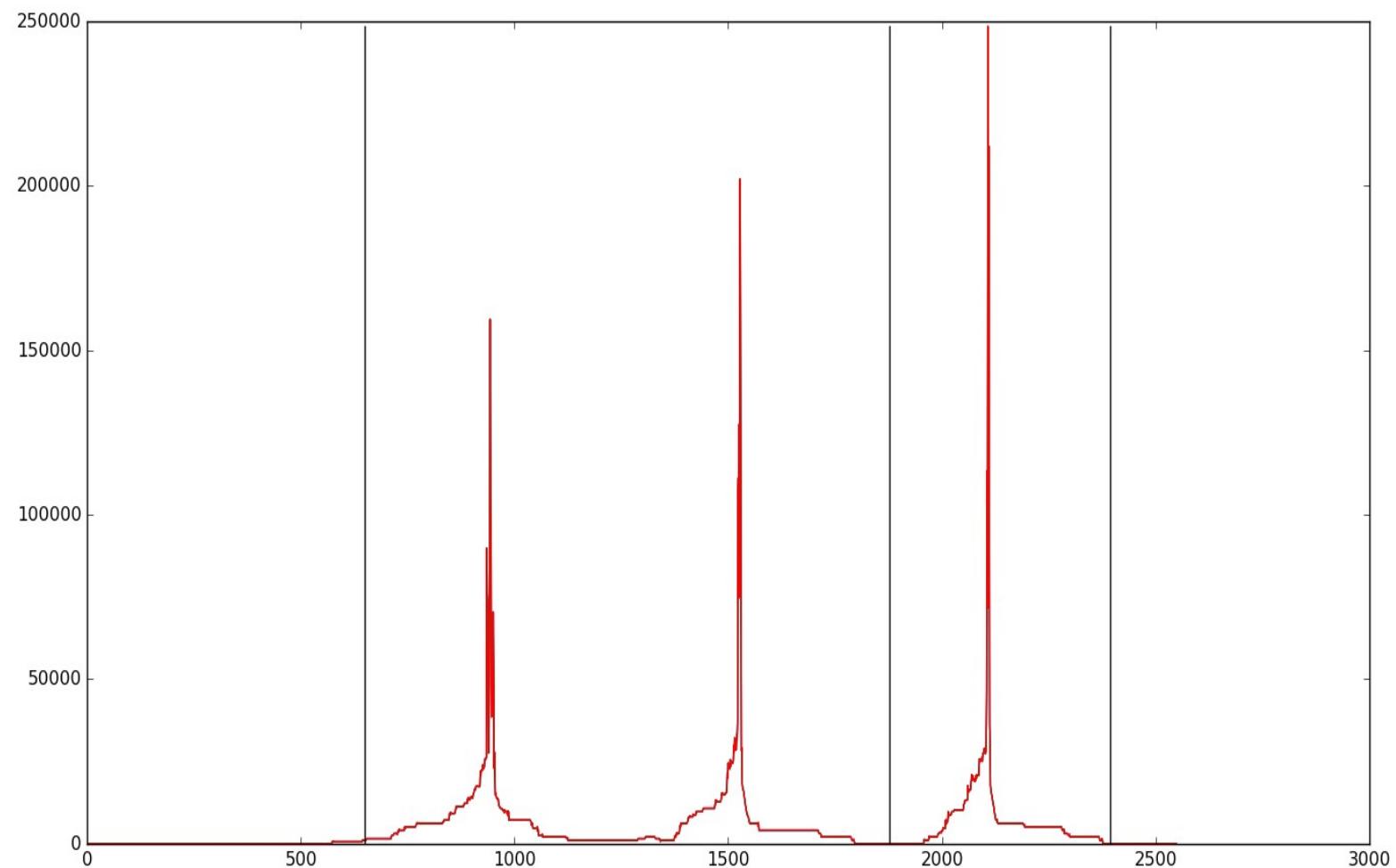


# Overlap (case 4) example

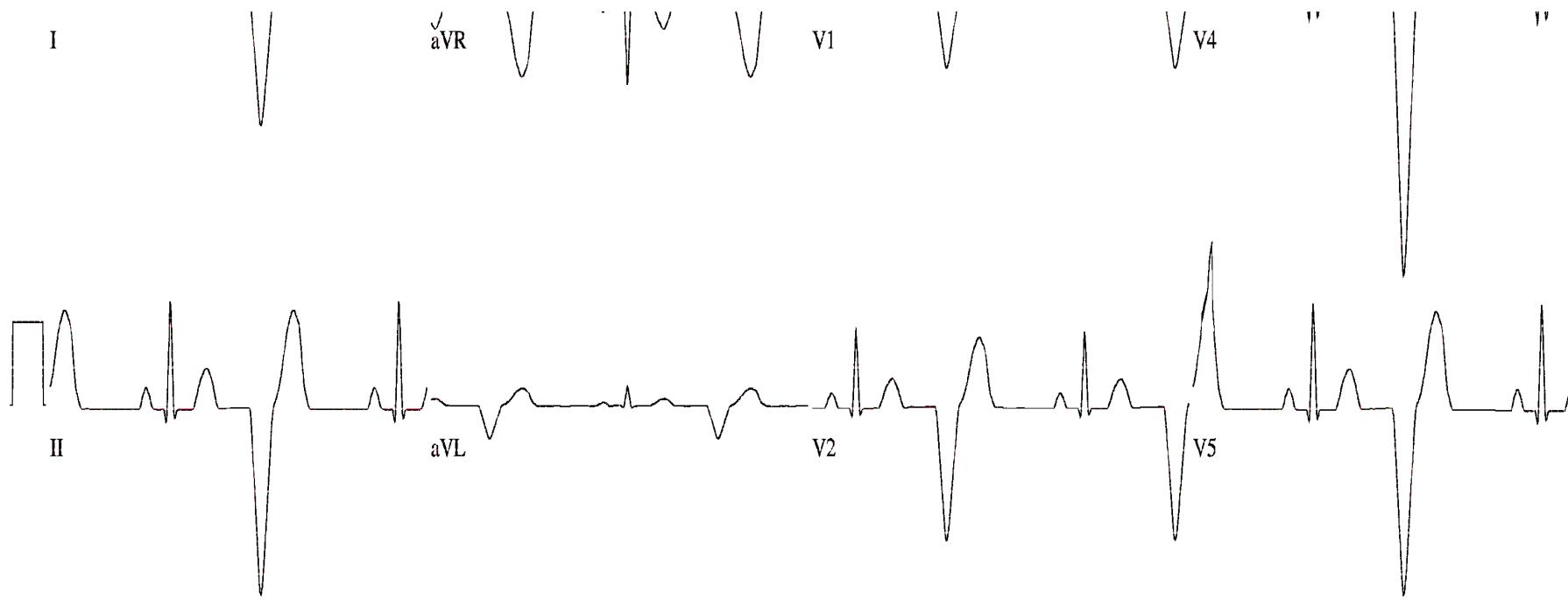
TEST, TEN  
ID:010318100  
23-MAY-2005 21:27:32  
BRIGHAM & WOMEN'S/FAULKNER HOSP.  
05-MAY-1974 (31 yr)  
Male  
Room:  
Technician:  
Test ind:41.44  
Vent. rate 80 BPM  
PR interval 158 ms  
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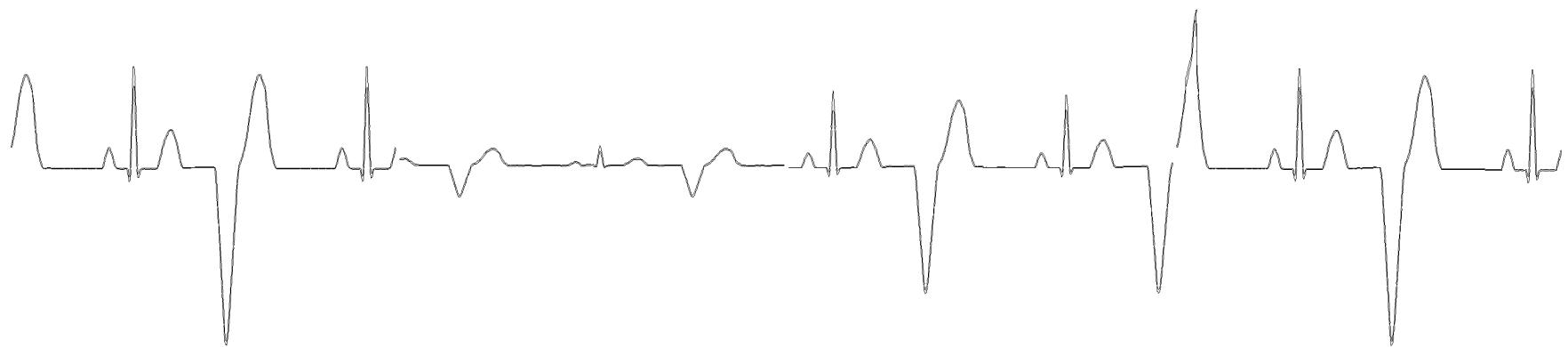
# Overlap (case 4)



# Overlap (case 4) region : extracted row



# Overlap issue solved (case 4)



# To Do List

- **Integration of the function which solves case 4 to the new version**
- **EKG Header extraction minor issues**
- Case 5 can be approximated ( Got idea)
- Case 6 is only solvable by removing the entire text. Working on that.
- Signal traversal algorithm.
- Clara pointed a new case (noise in the extracted signal)