

# Respiratory Rate Determination by Non-Invasive Means

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## 1 Introduction

### 1.1 Background

(Penzel et al., 2000).

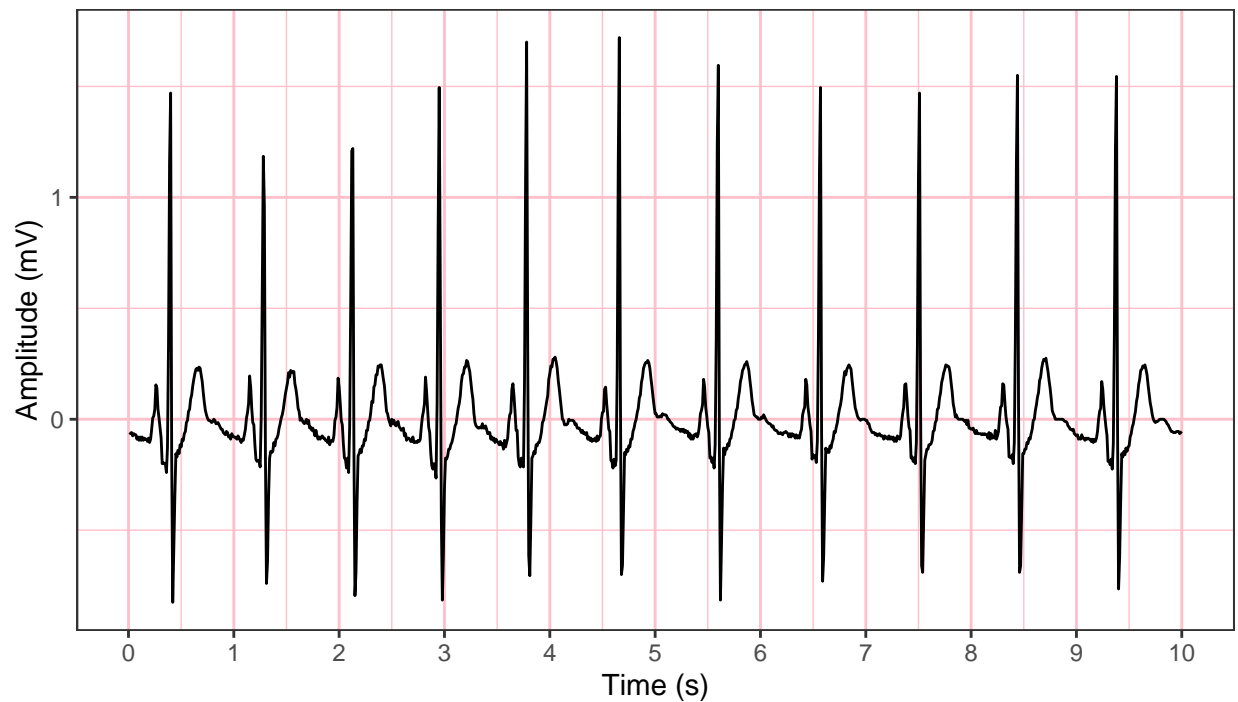
## 2 The data

### 2.1 Data source

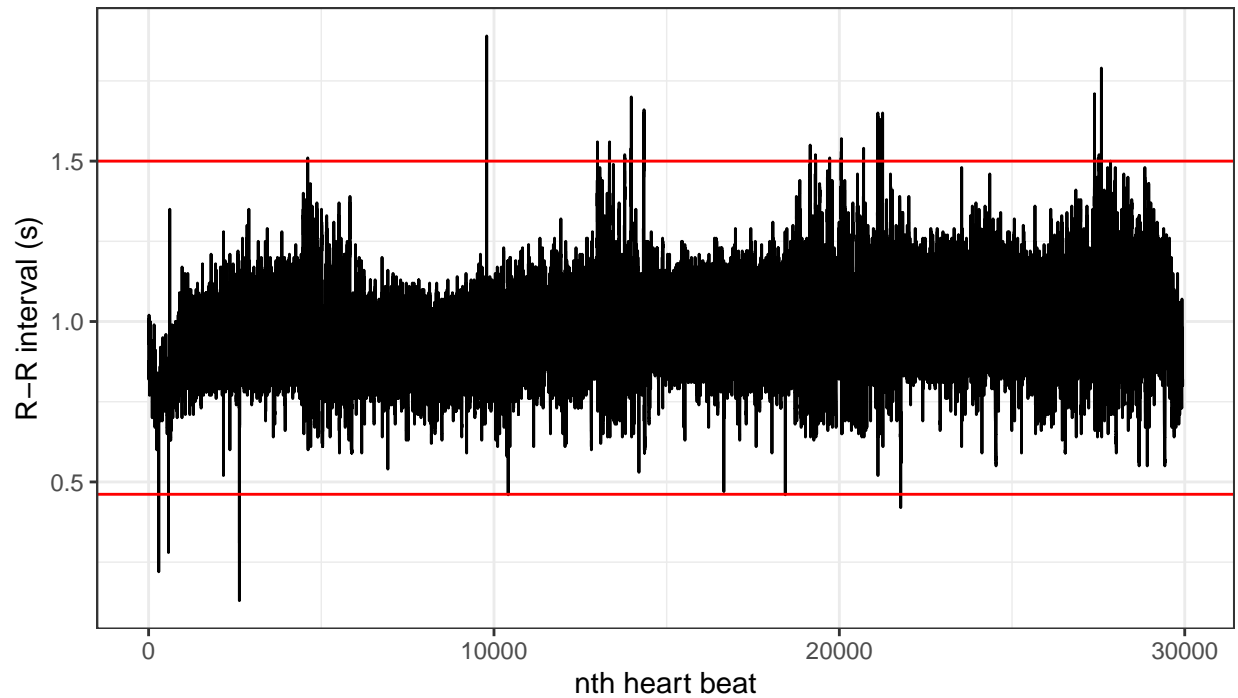
(Goldberger et al., 2000).

### 2.2 Sample plot

10-second sample of subject a01



### 8-hour R-R intervals of subject a01



```
interval <- rr_interval(data$voltage)
range(interval) ## Range of R-R intervals

#> [1] 0.13 1.89

60 / range(interval) ## Range of instantaneous heart rate per minute

#> [1] 461.53846 31.74603

abnormal_interval <- abnormal_rr(data$voltage, max_bpm = 130, min_bpm = 40)
length(abnormal_interval) ## Number of abnormal R-R intervals

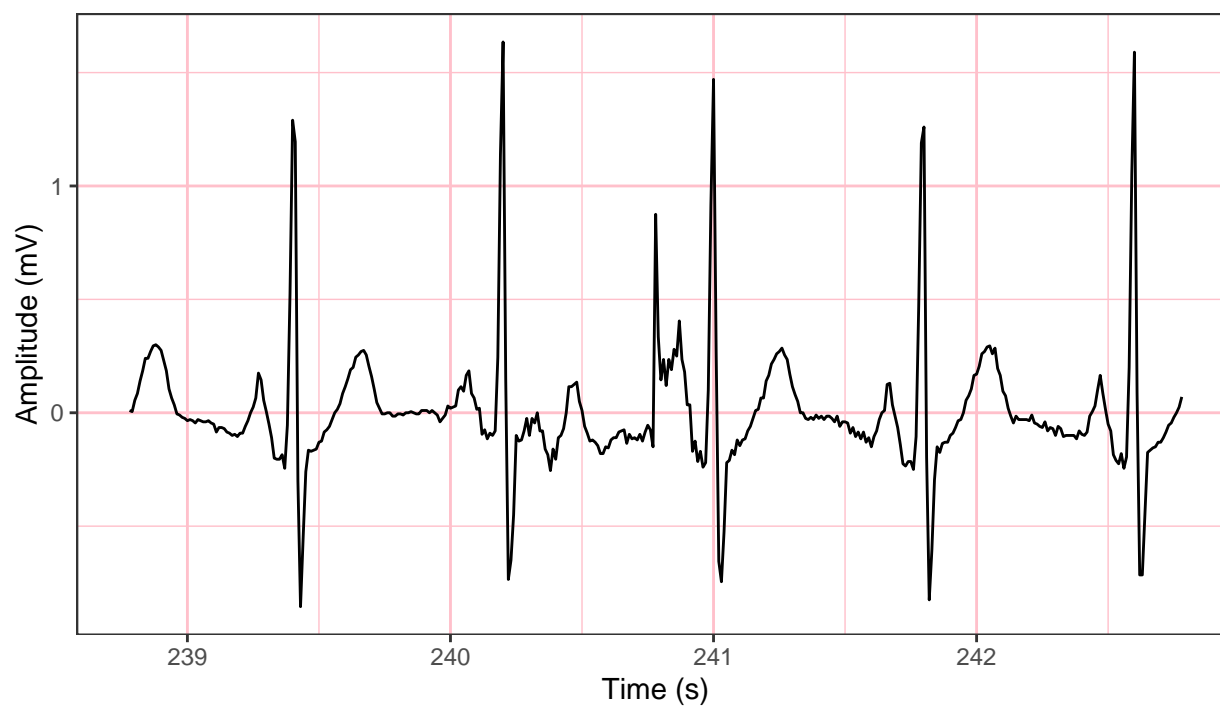
#> [1] 58

length(interval) ## Total number of heart beats

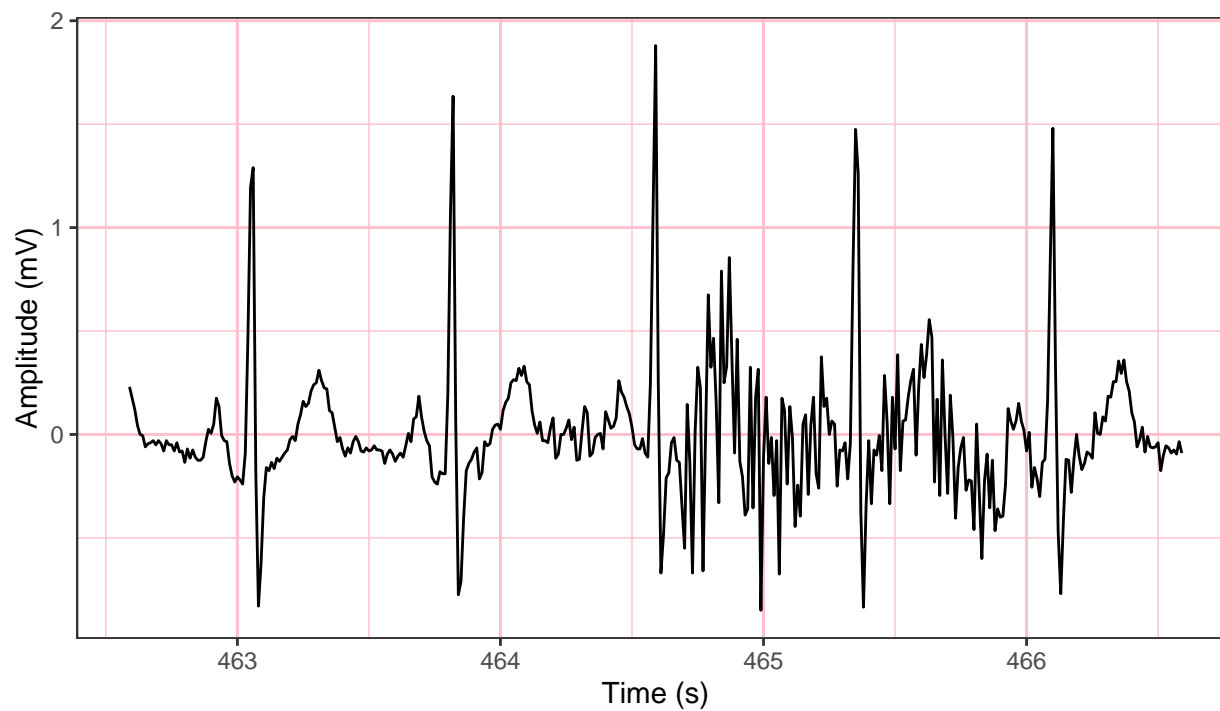
#> [1] 29941

invisible(map(seq_len(58), function(i) print(plot_abnormal_rr(data, i))))
```

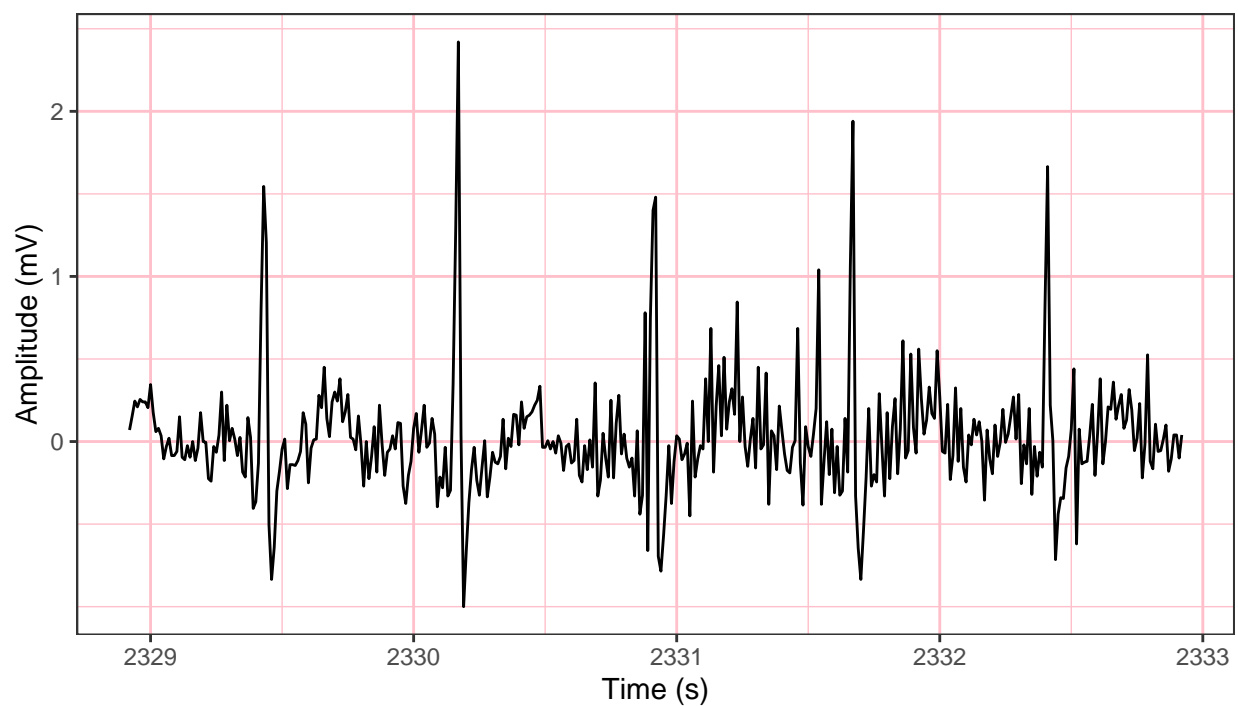
Recorded abnormal R-R interval of 0.22s



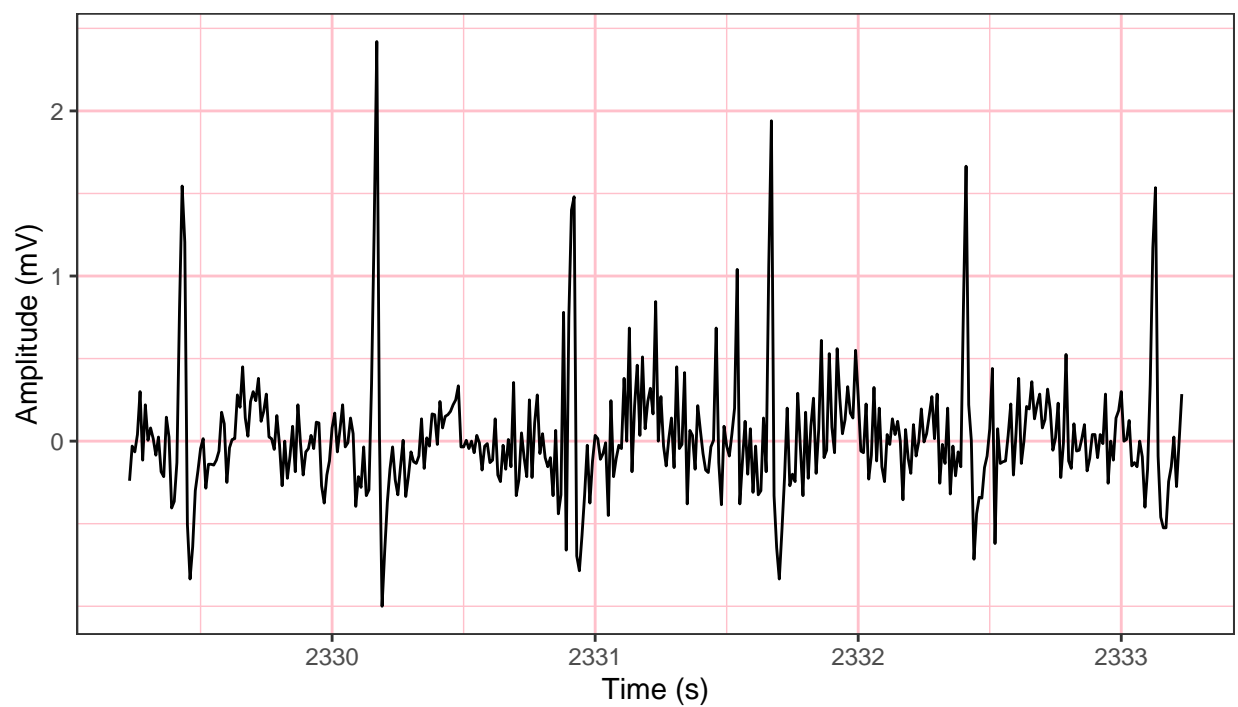
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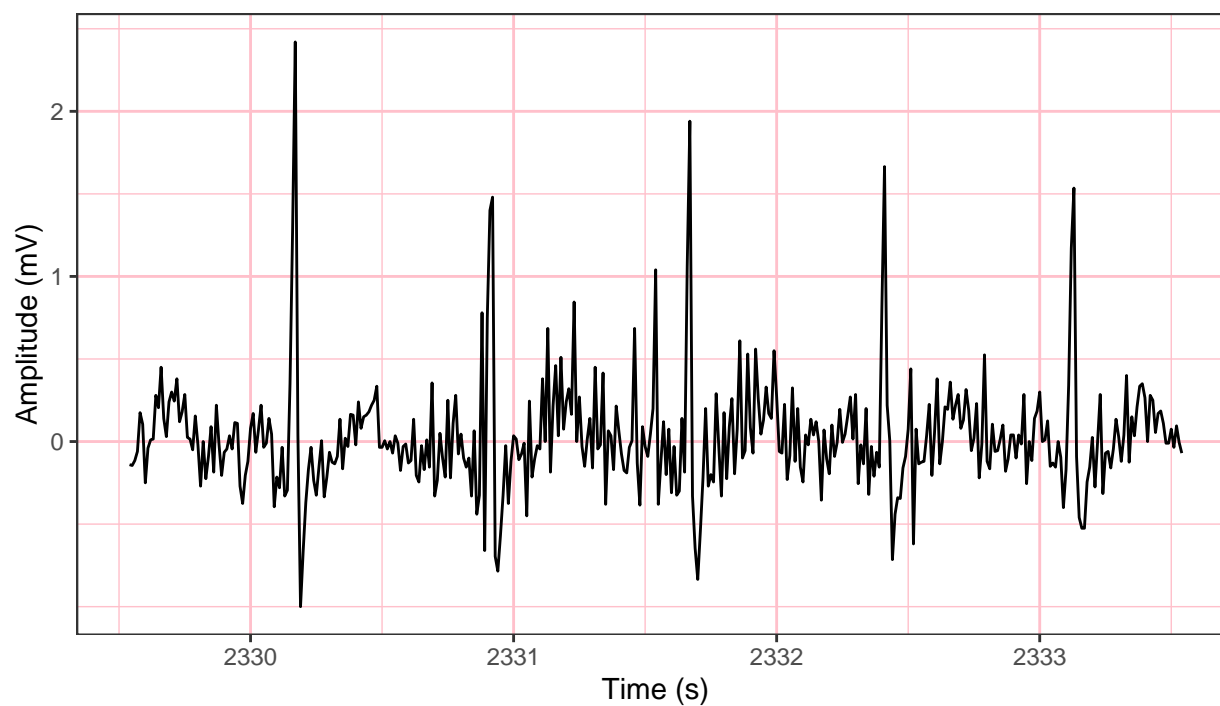
Recorded abnormal R-R interval of 0.31s



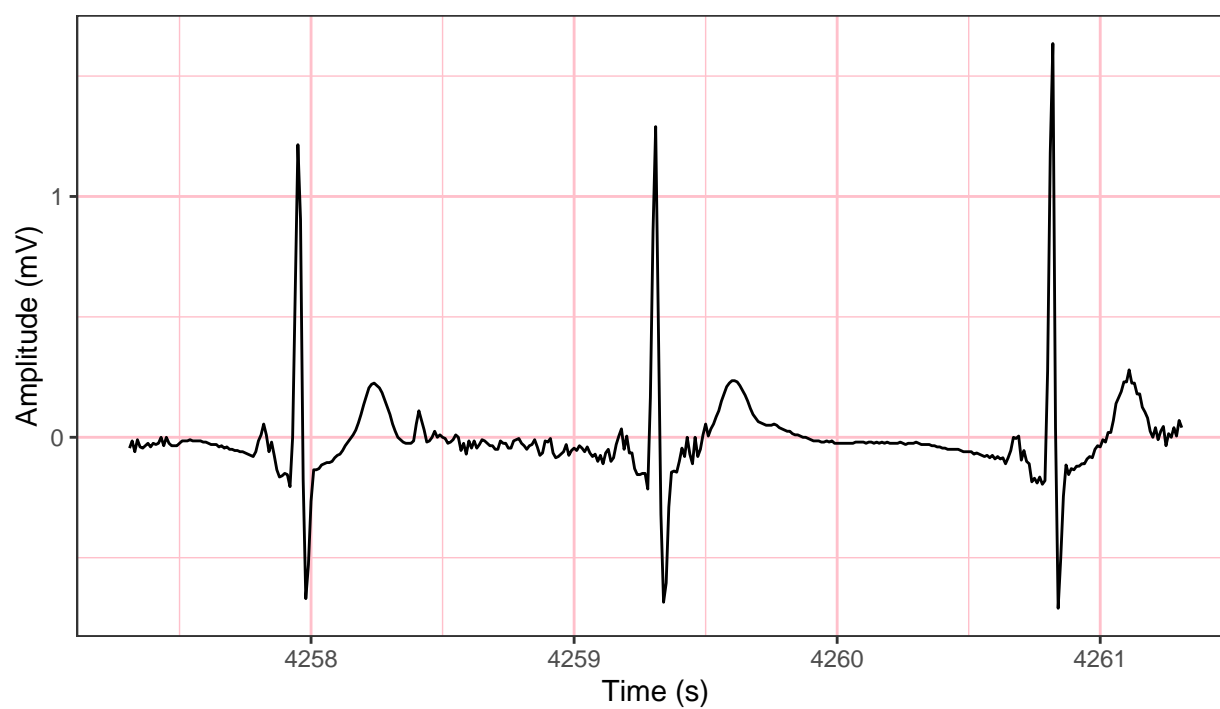
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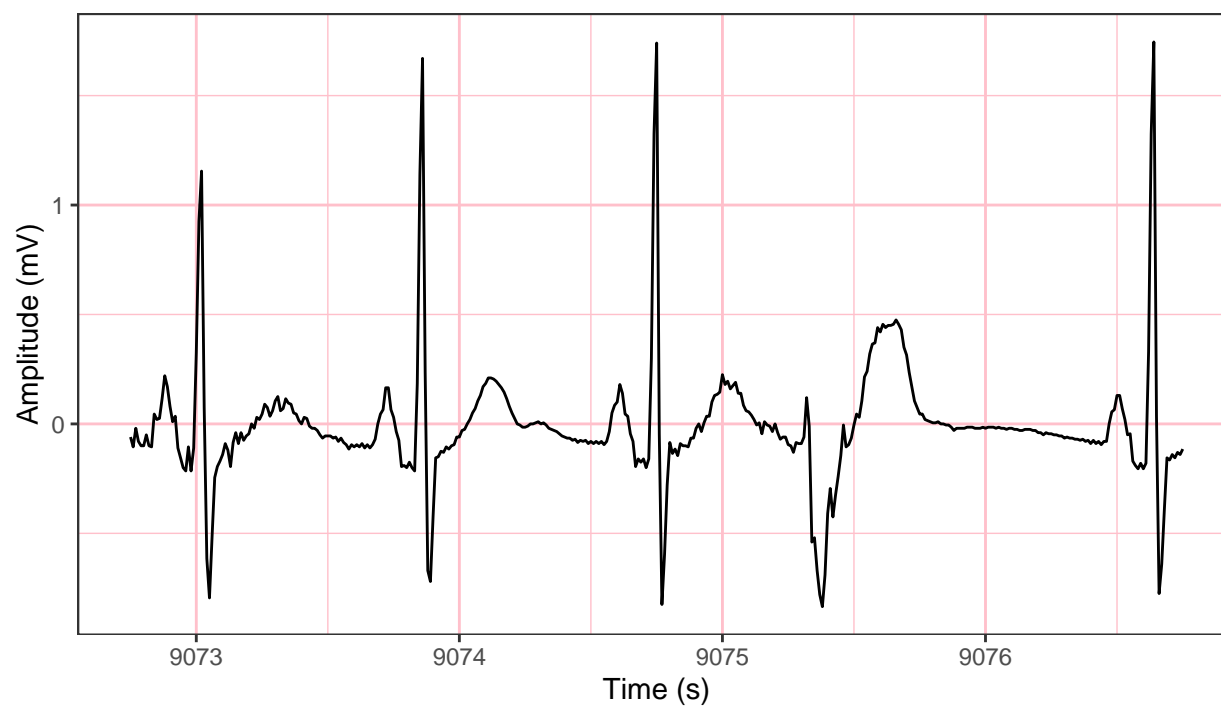
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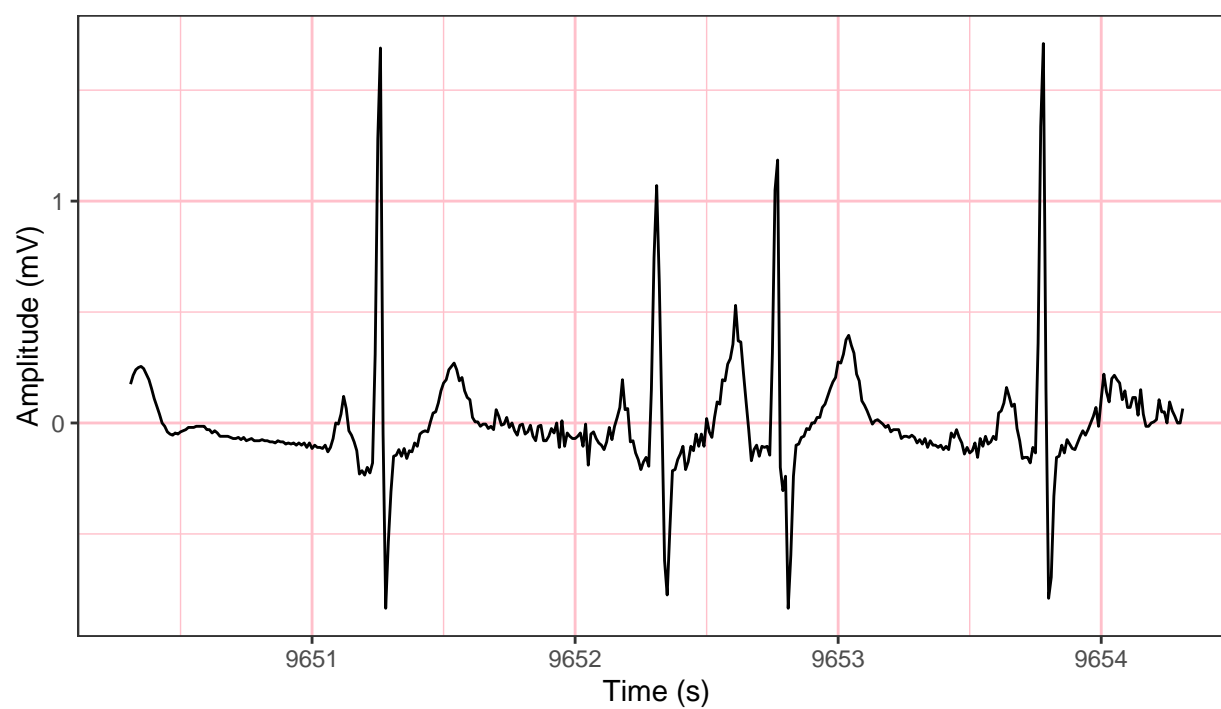
Recorded abnormal R-R interval of 1.51s



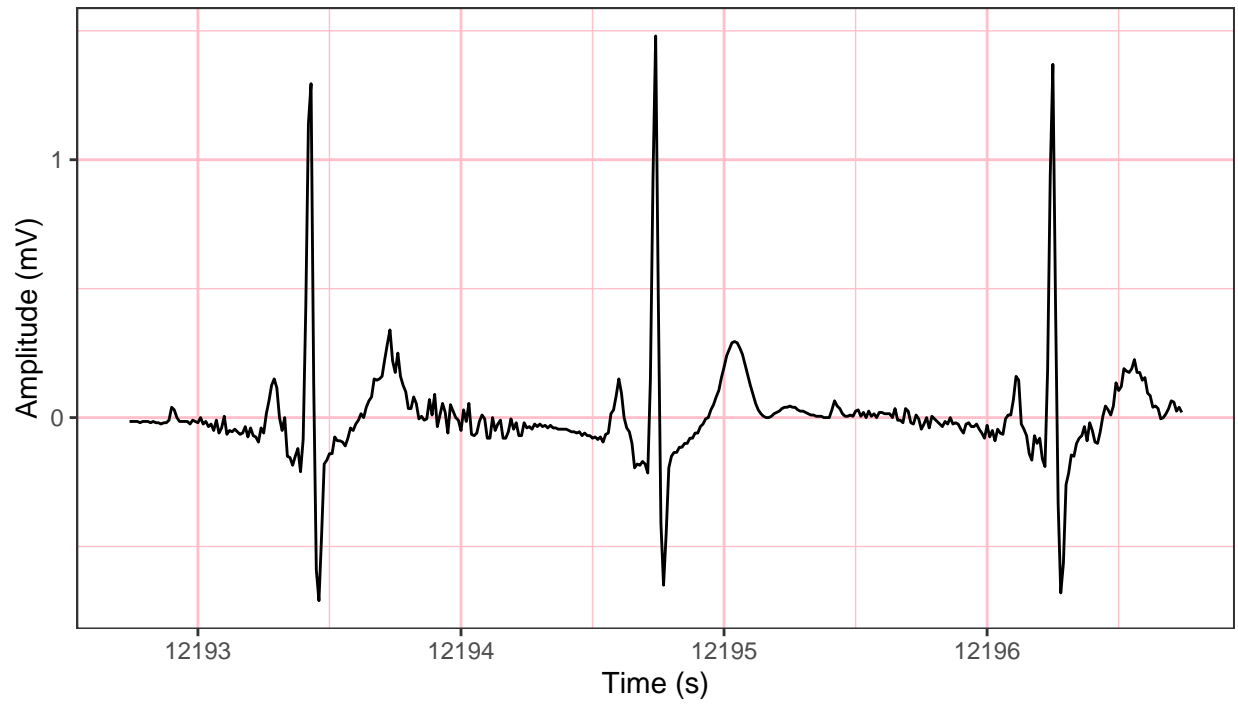
Recorded abnormal R-R interval of 1.89s



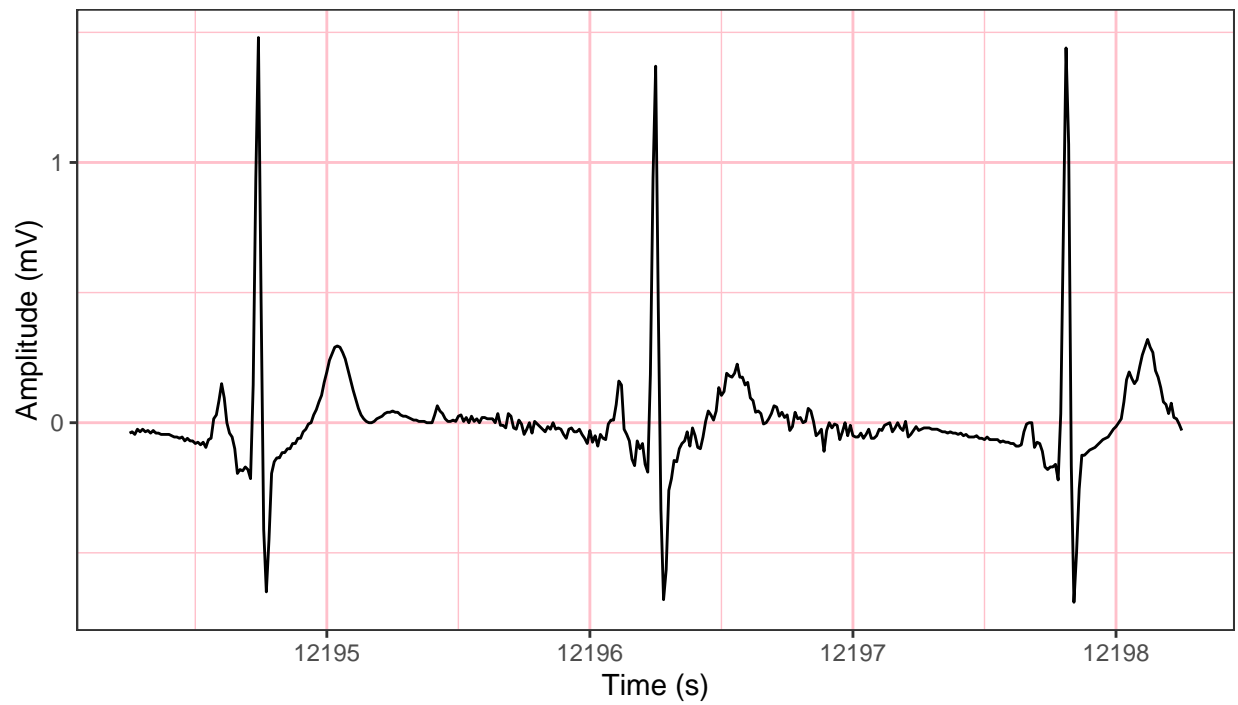
Recorded abnormal R-R interval of 0.46s



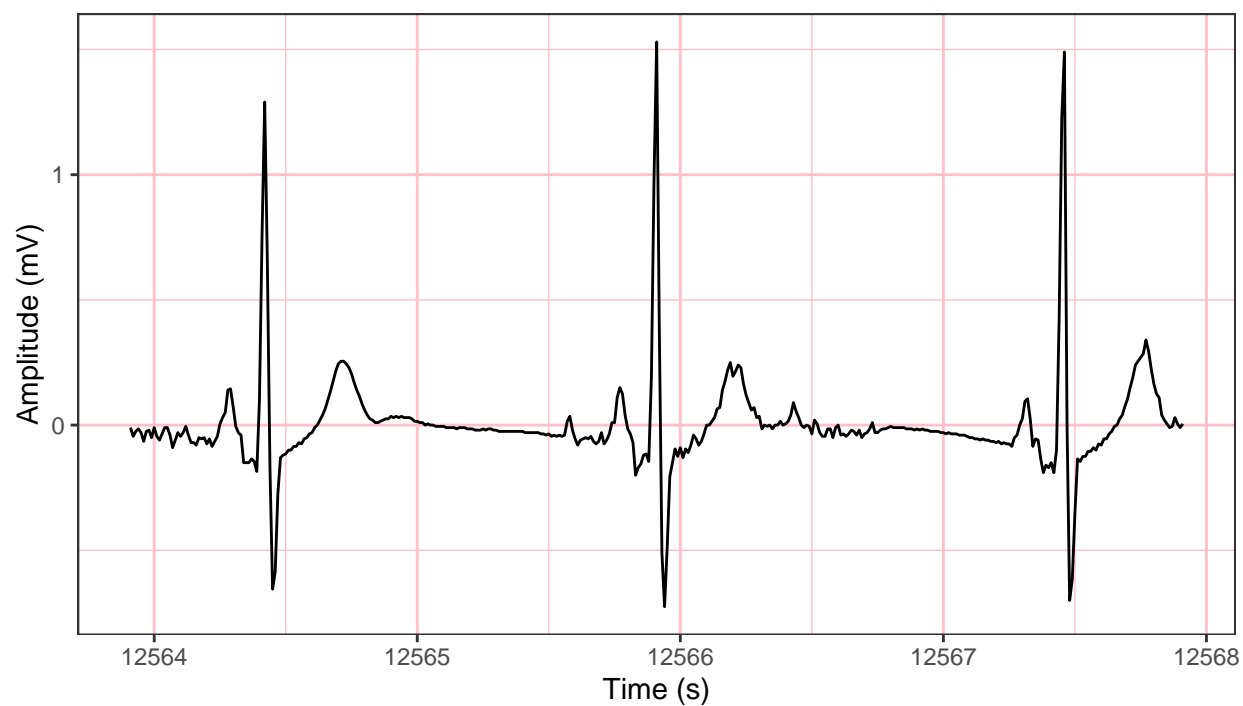
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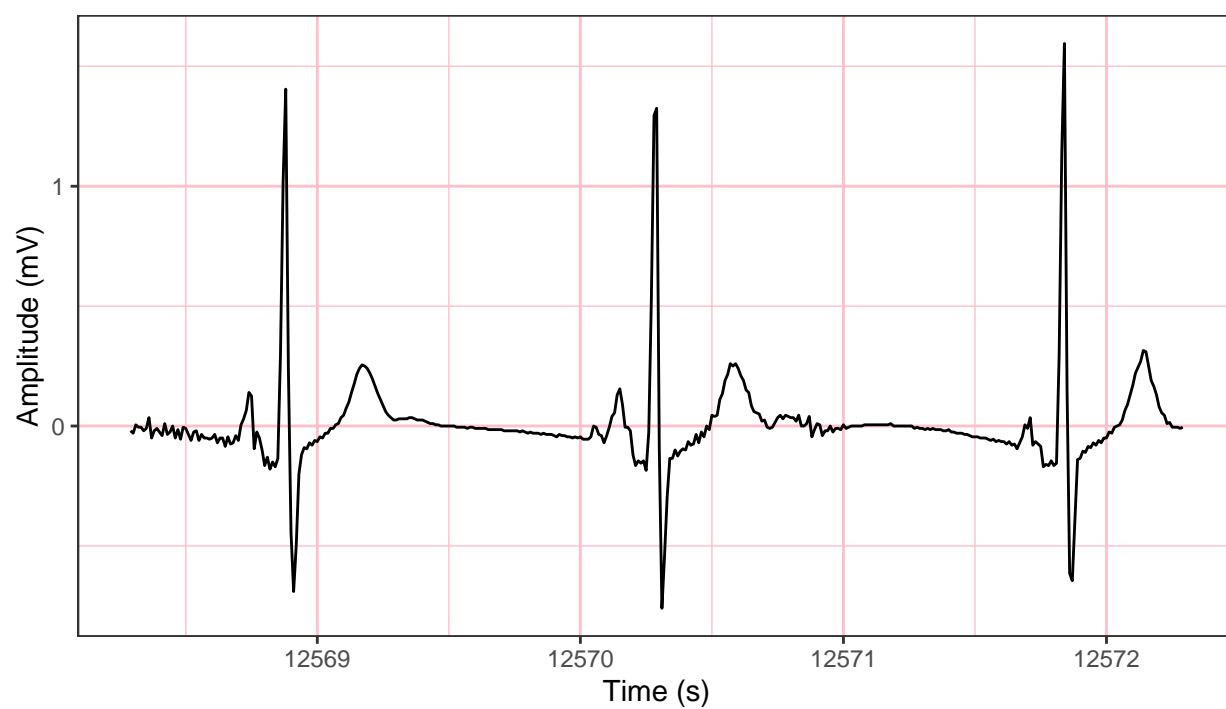
Recorded abnormal R-R interval of 1.51s



Recorded abnormal R-R interval of 1.55s

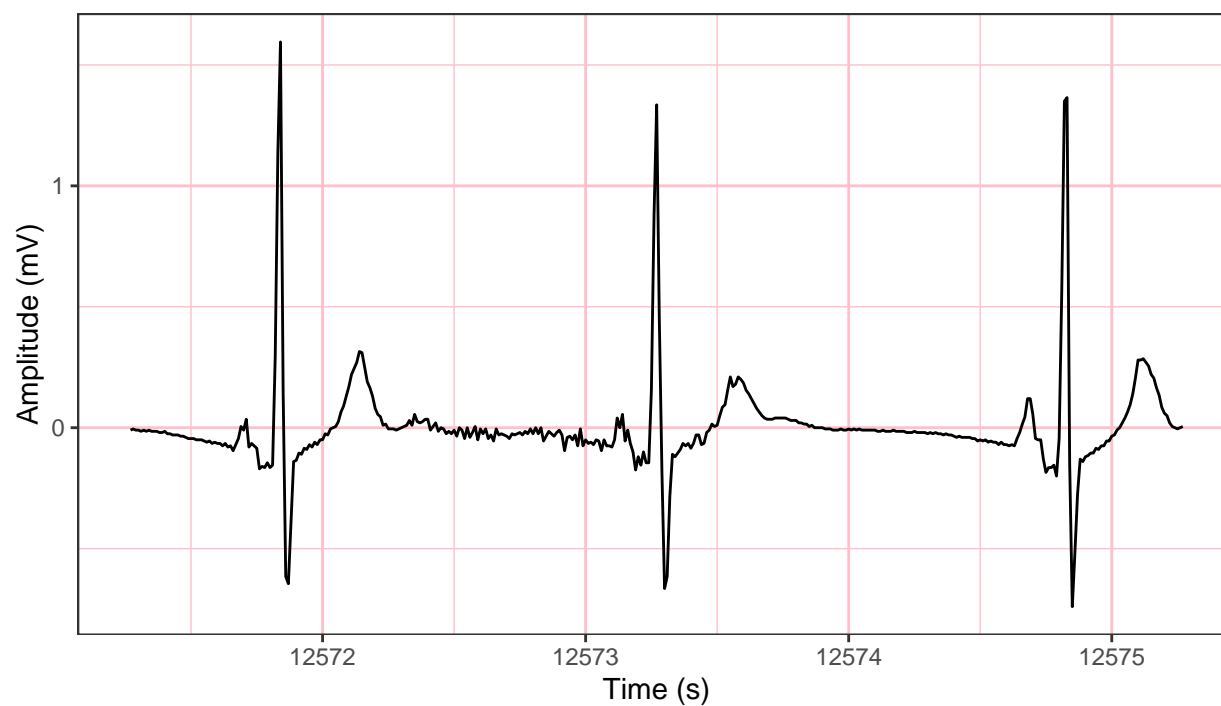


Recorded abnormal R-R interval of 1.55s

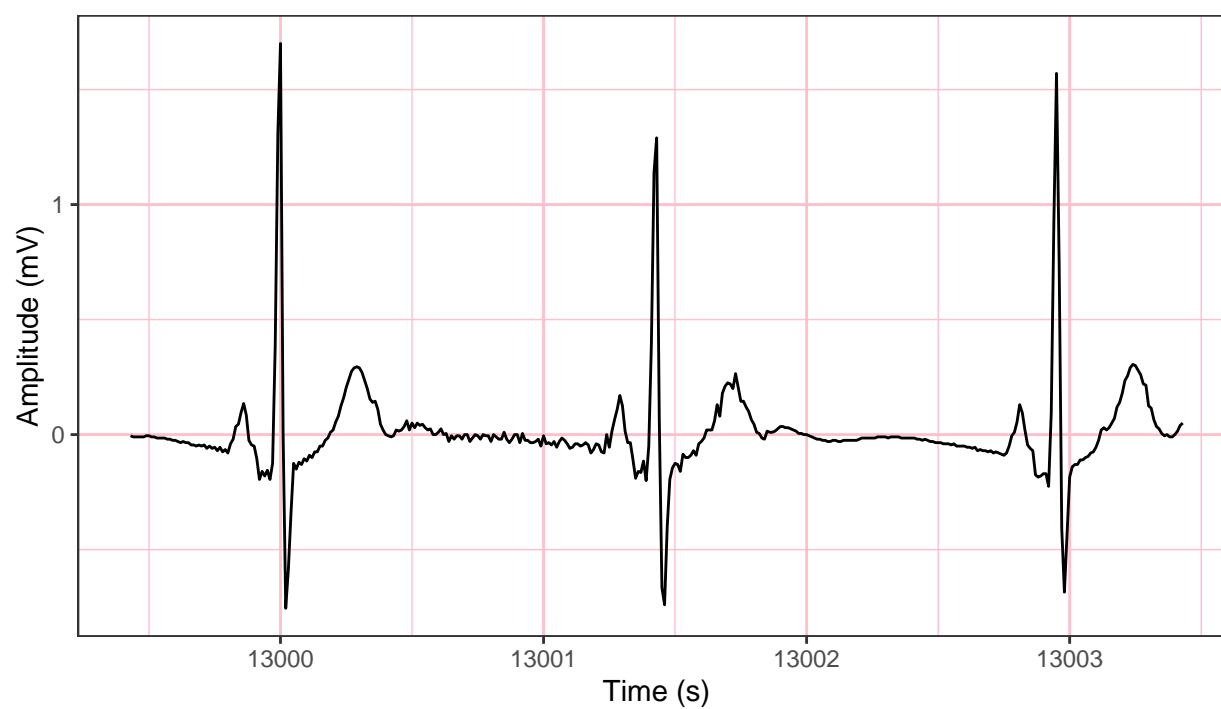




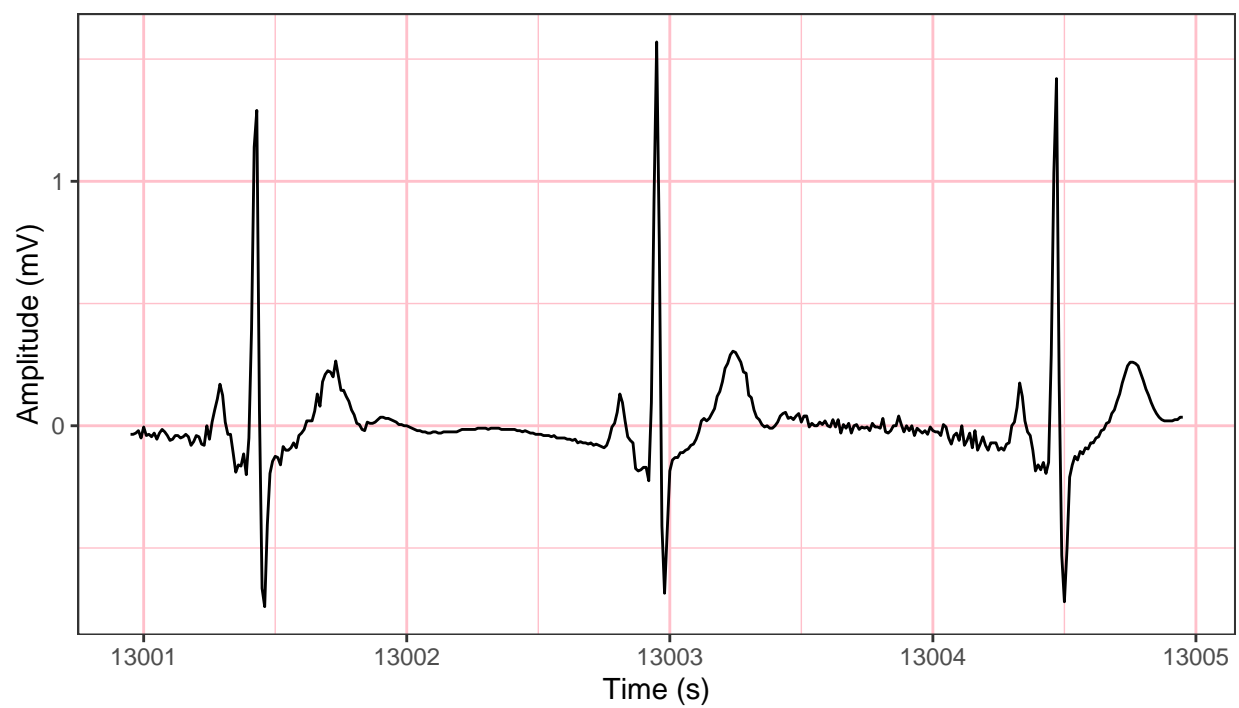
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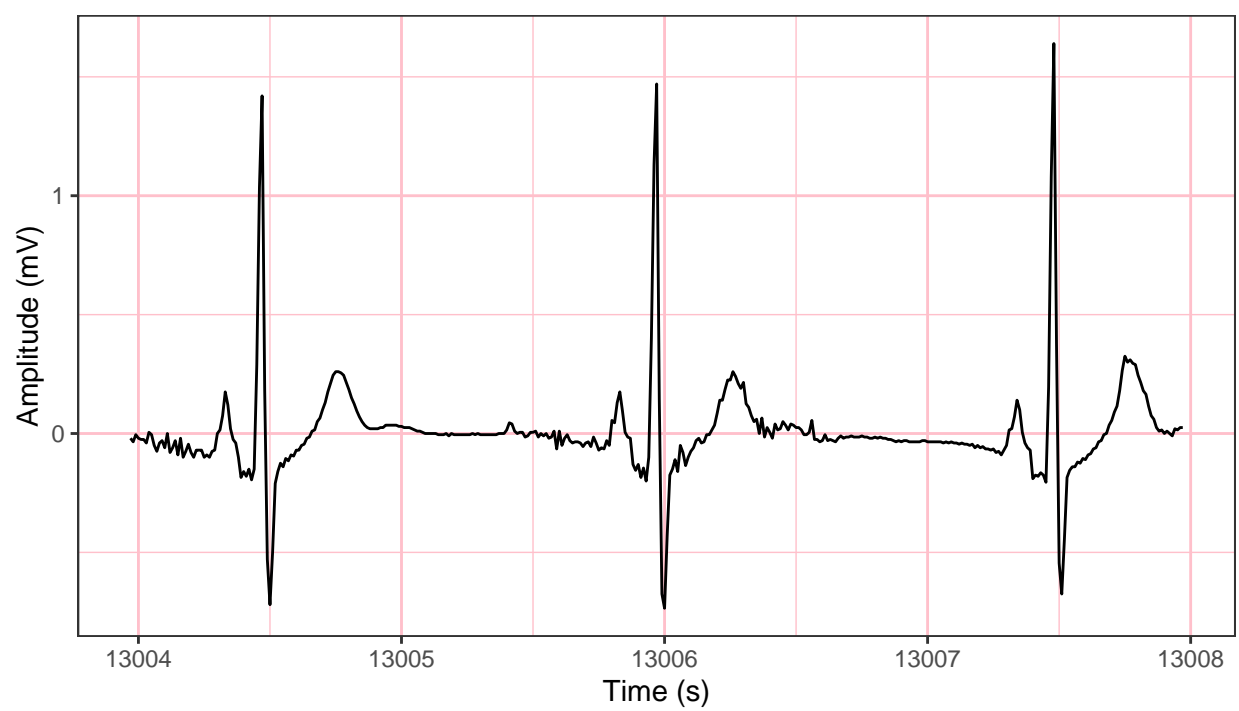
Recorded abnormal R-R interval of 1.52s



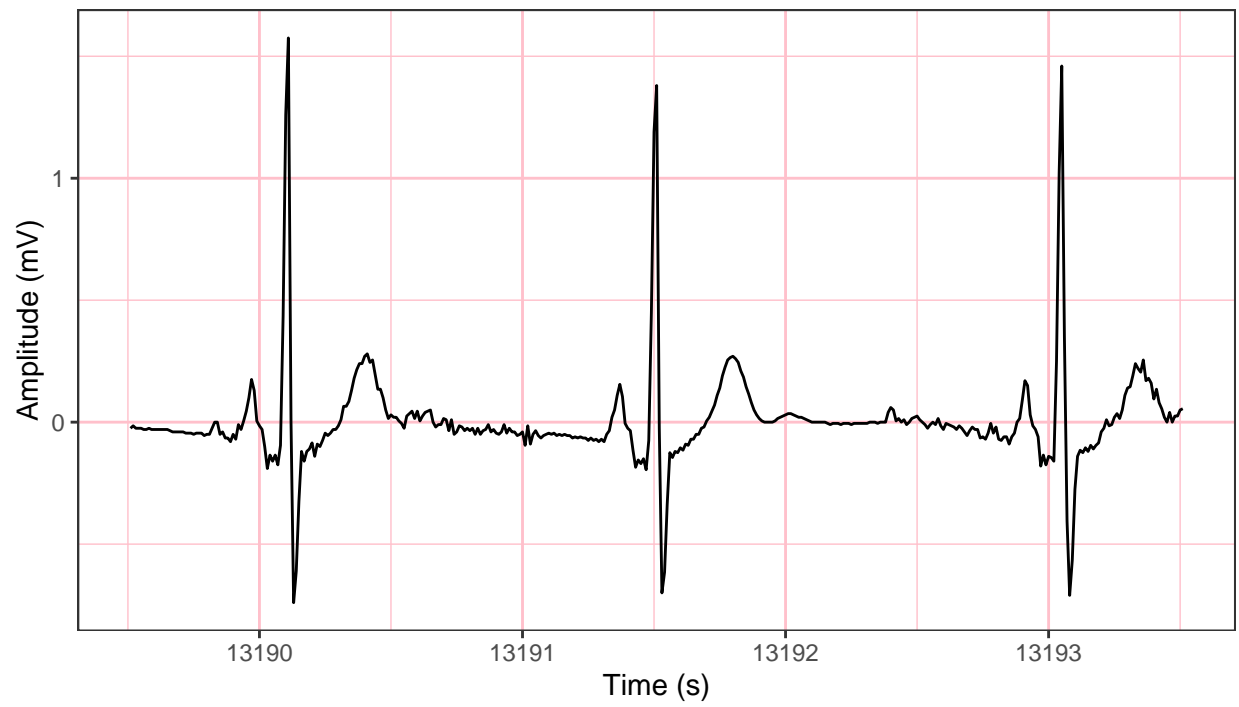
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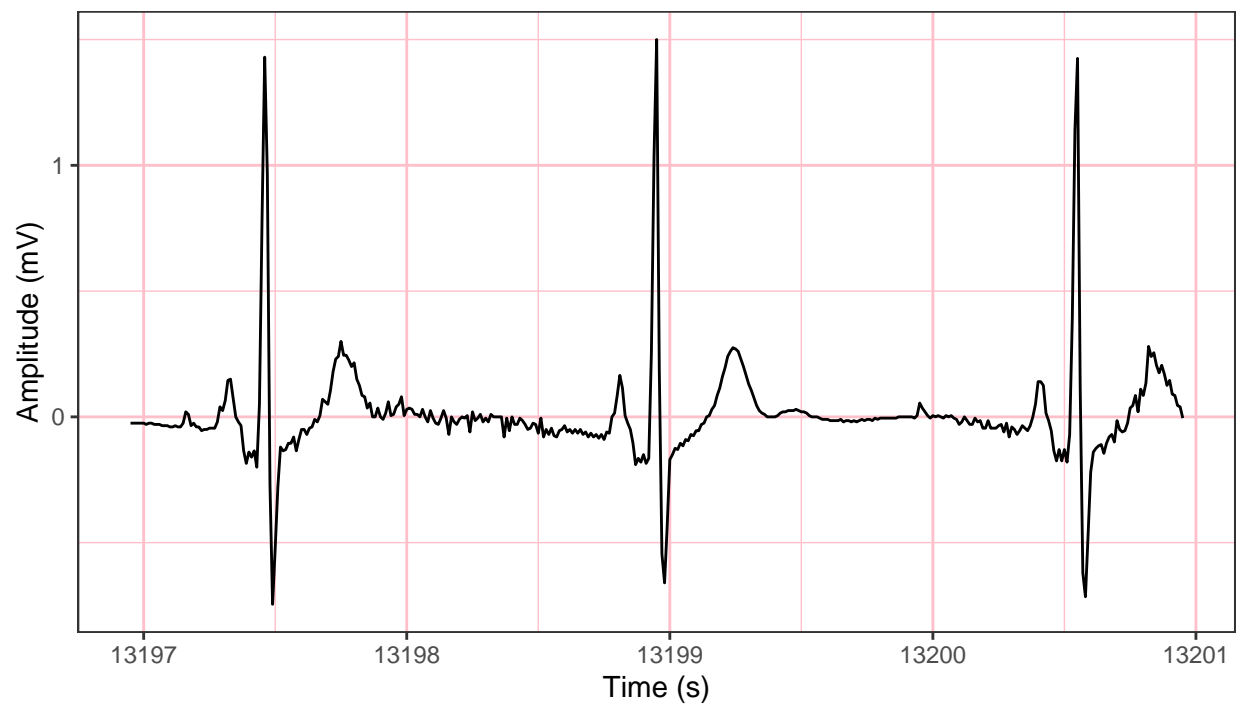
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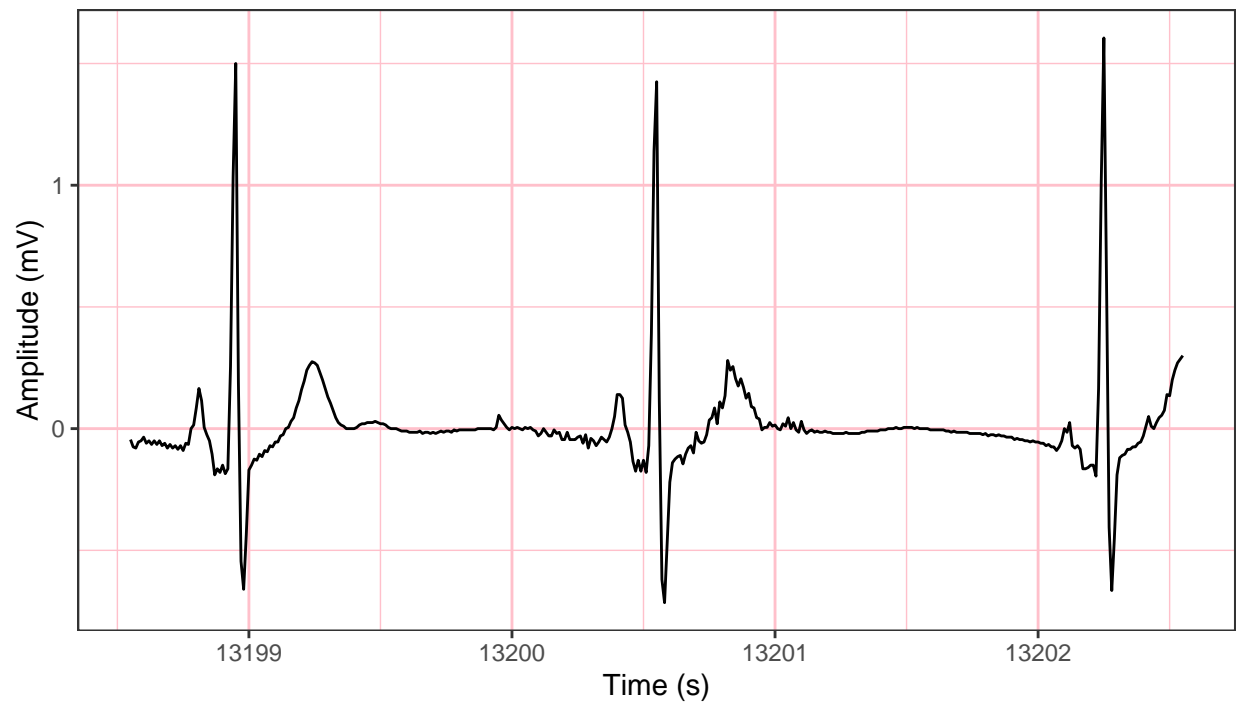
Recorded abnormal R-R interval of 1.54s



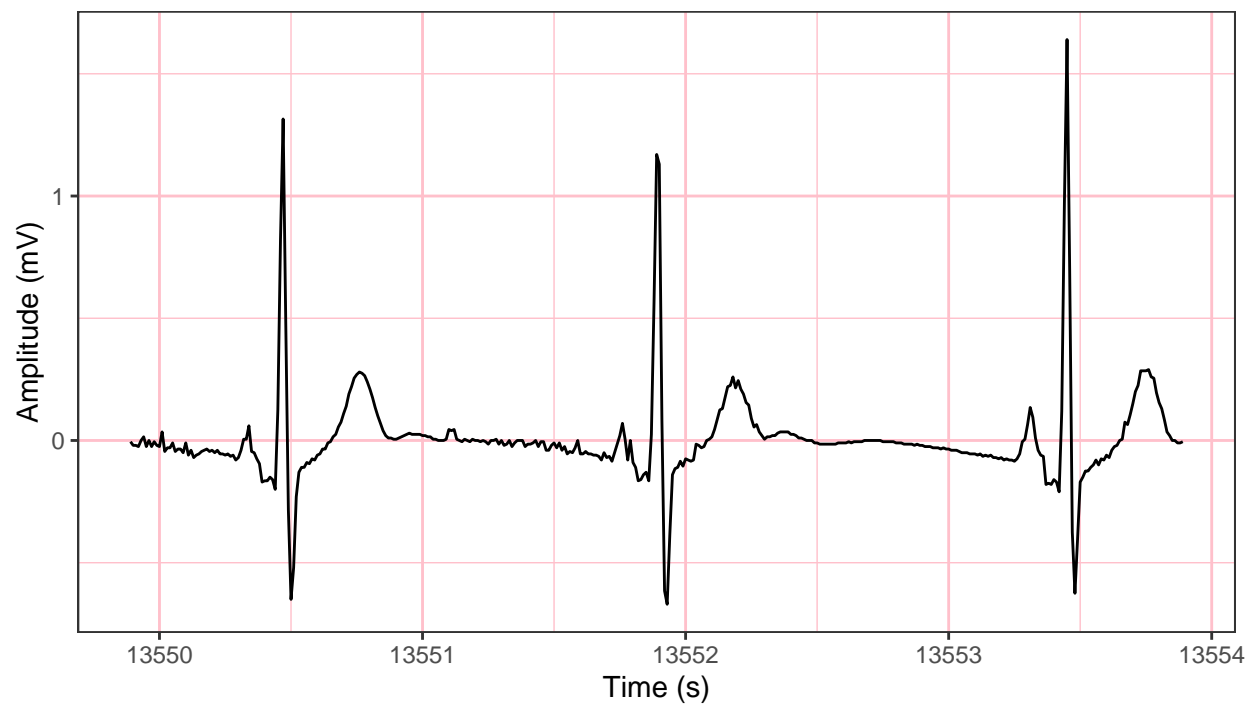
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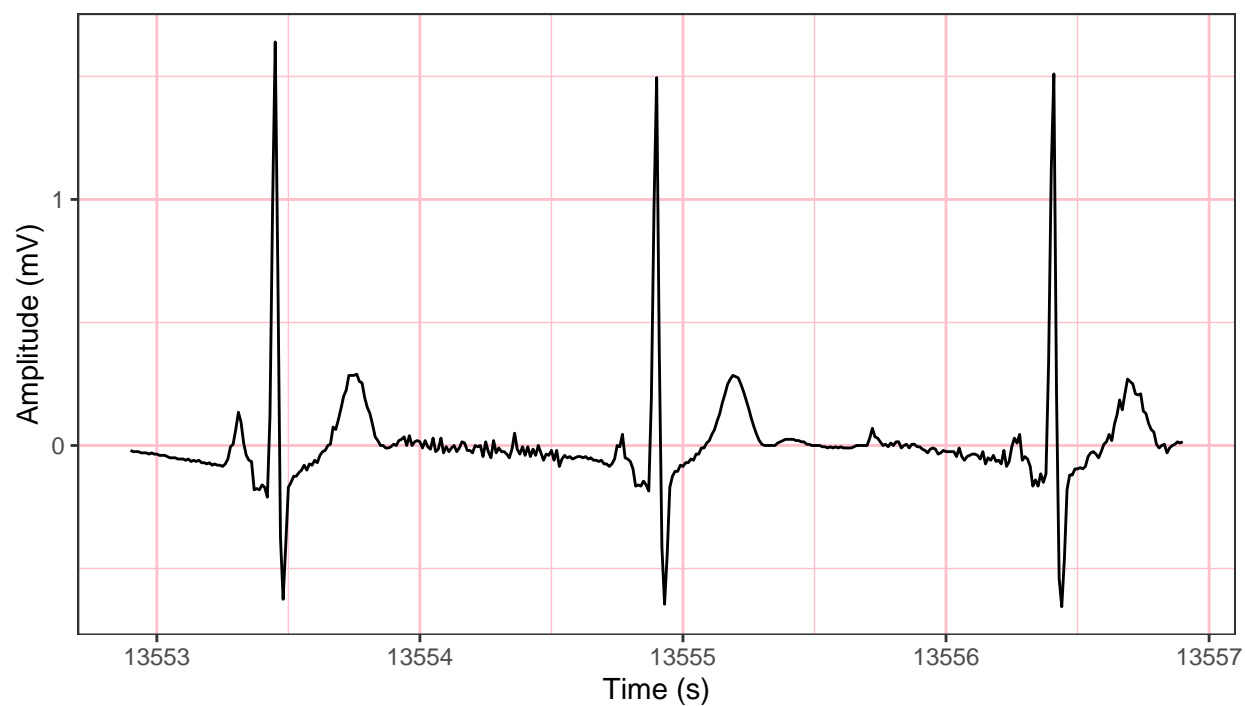
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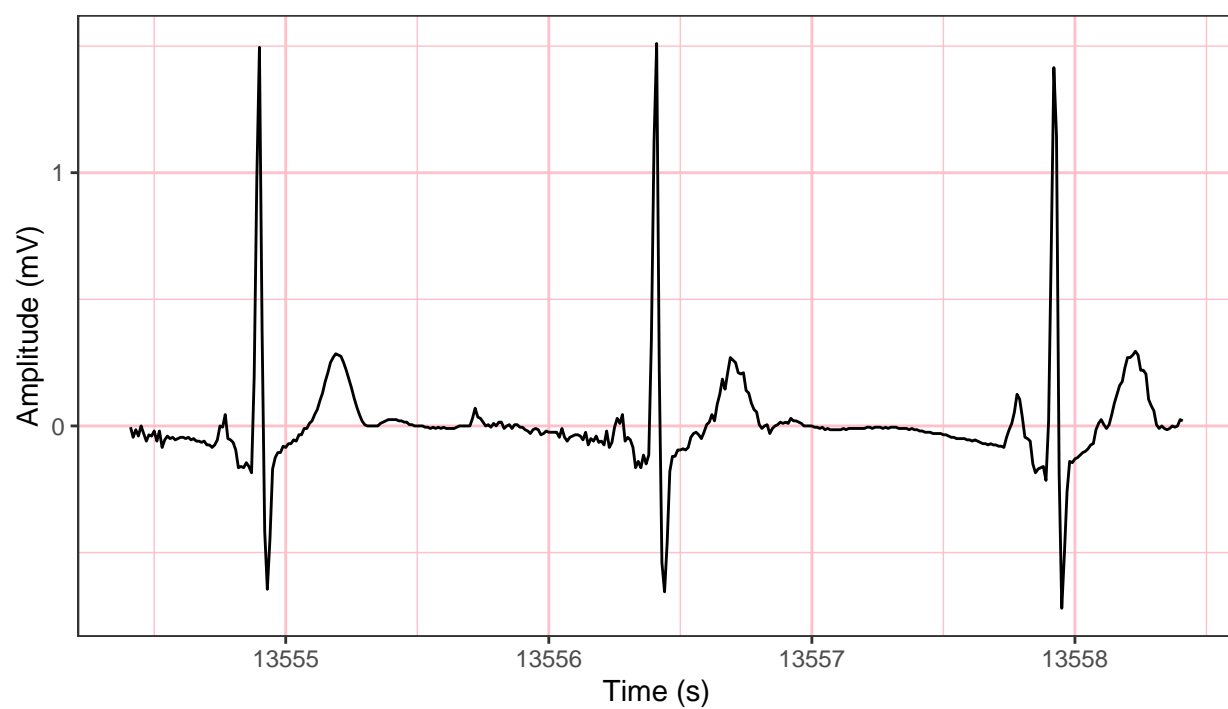
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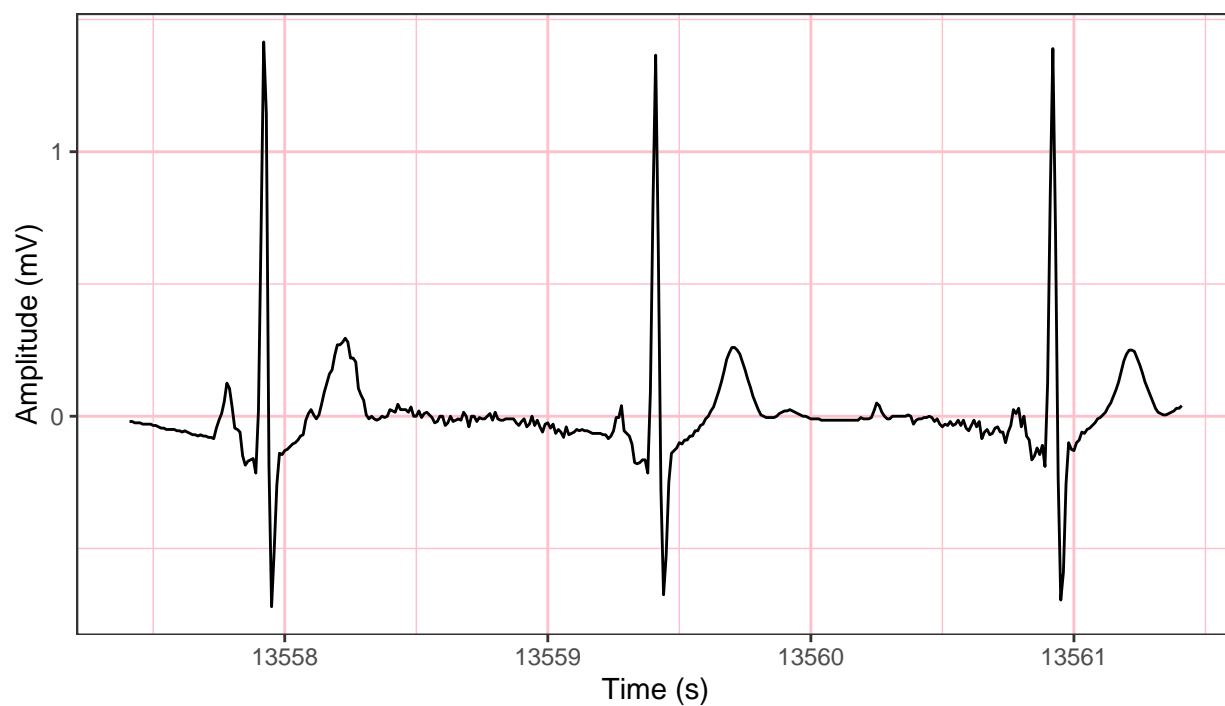
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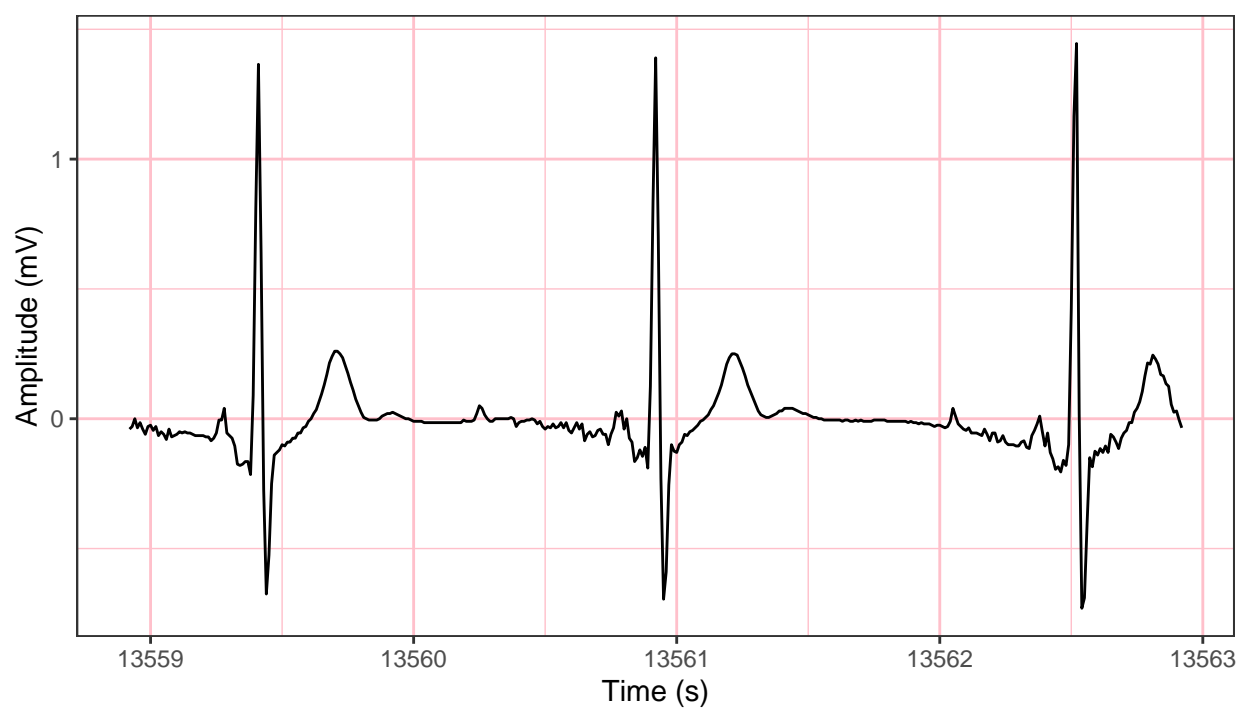
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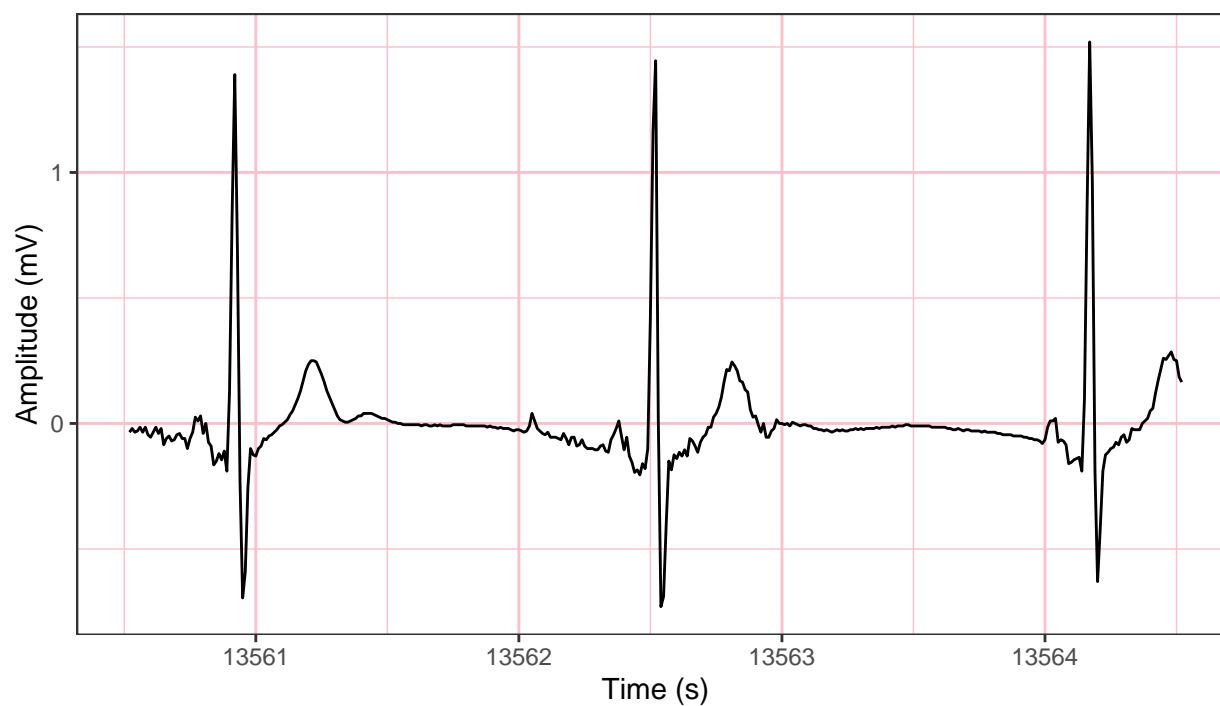
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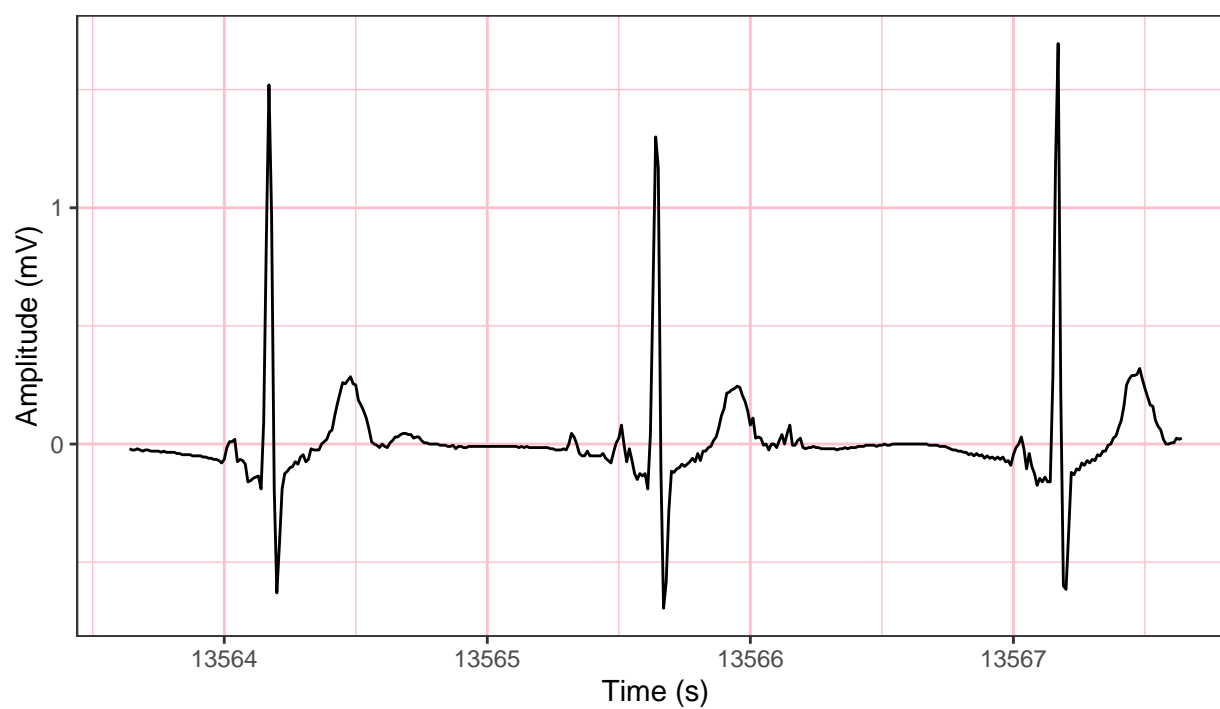
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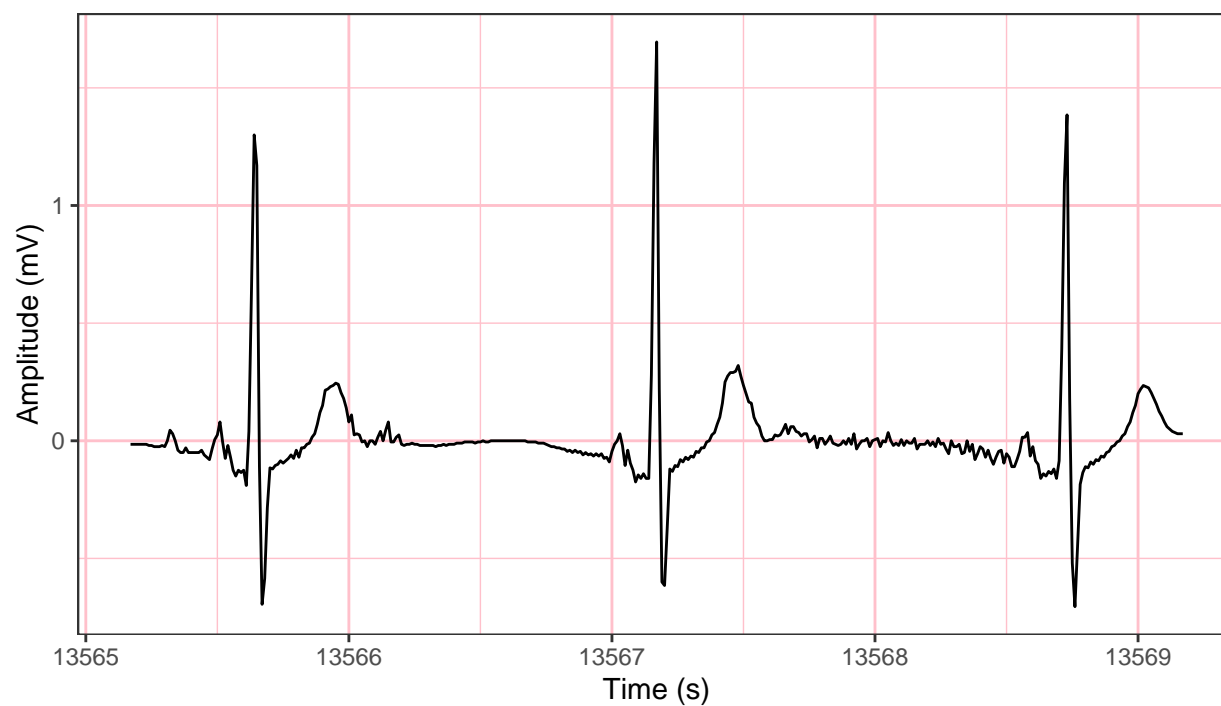
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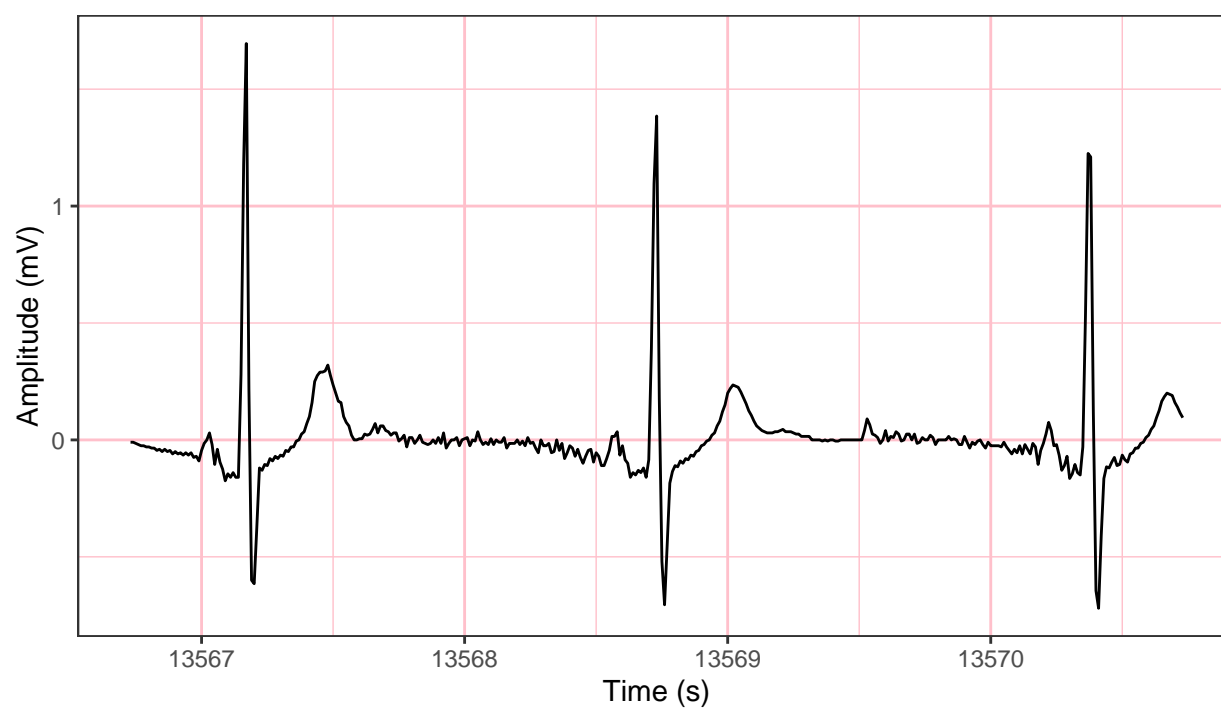
Recorded abnormal R-R interval of 1.53s



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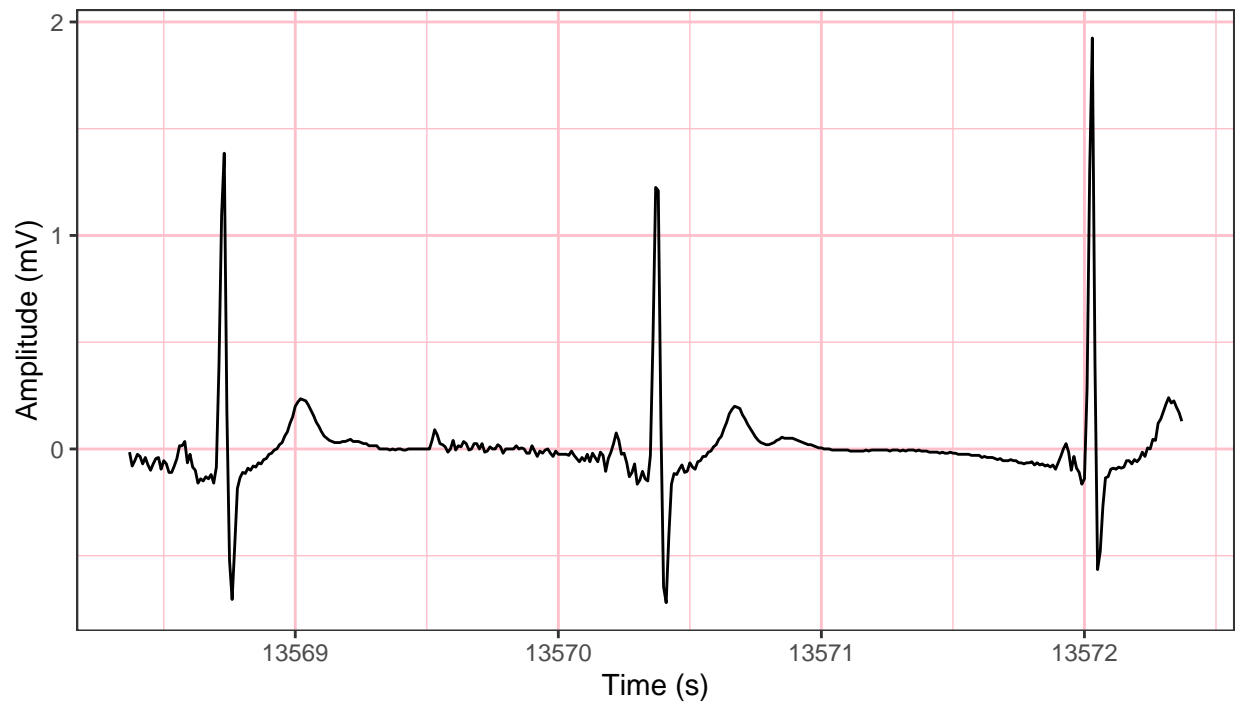


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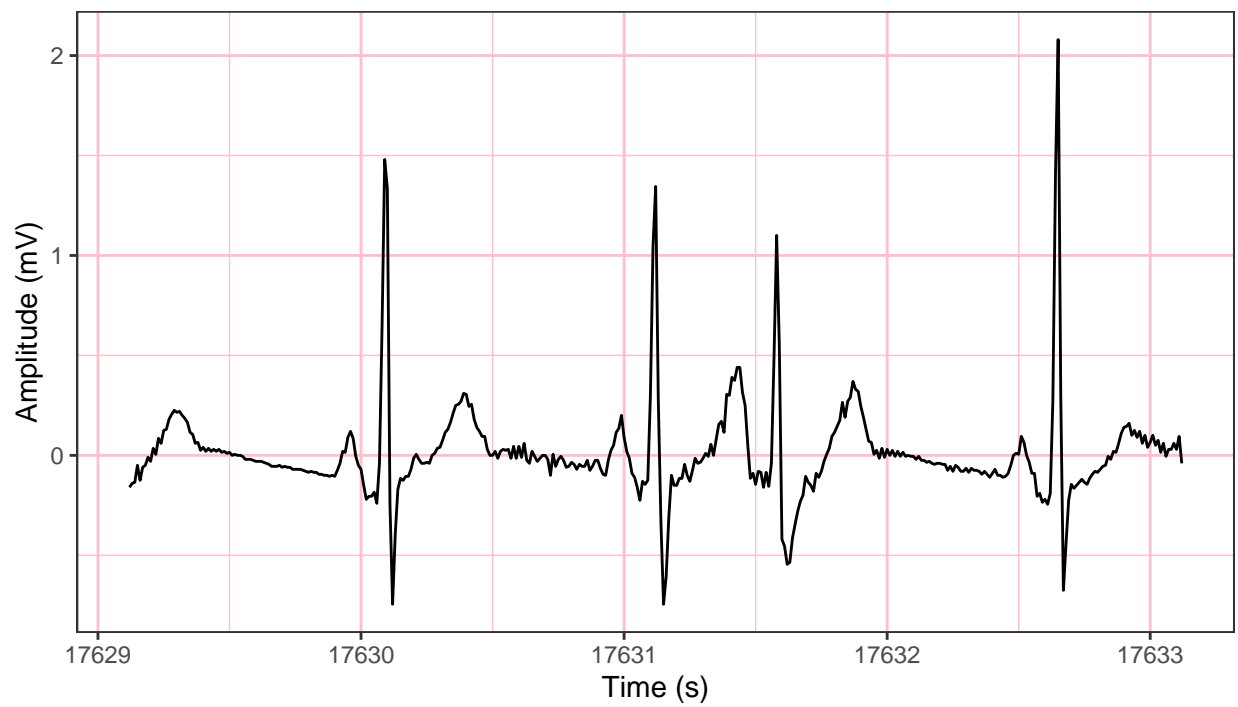




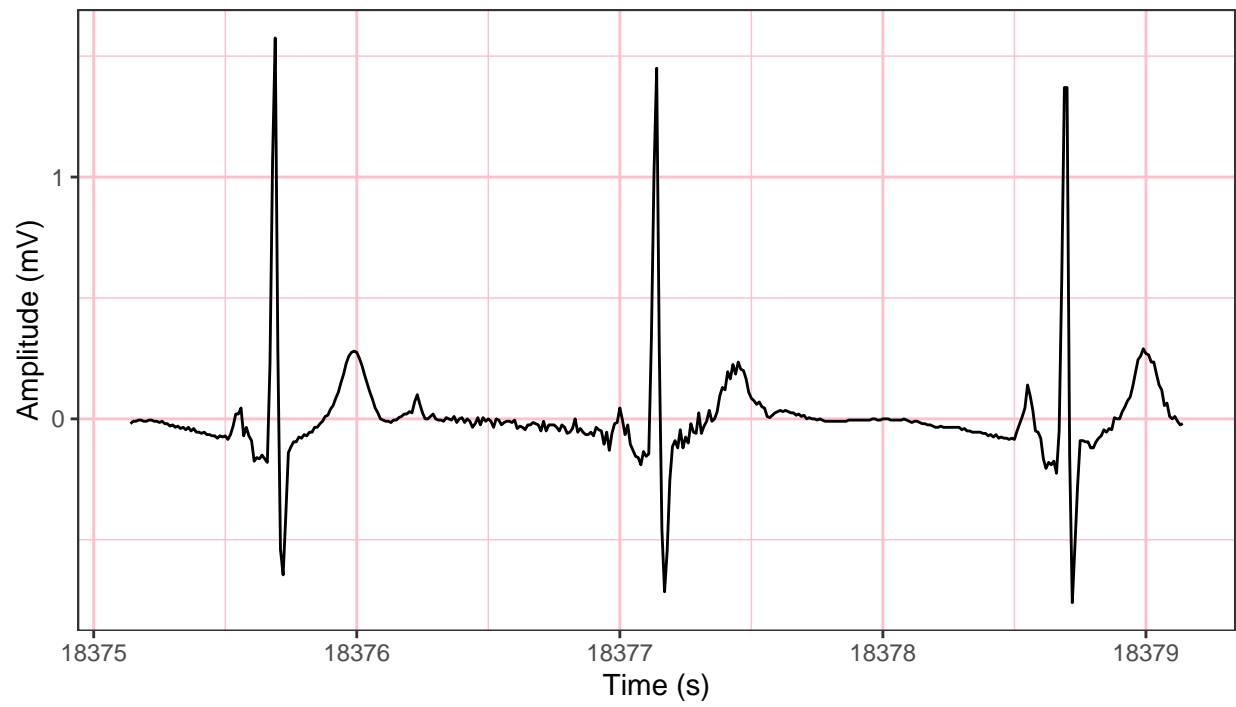
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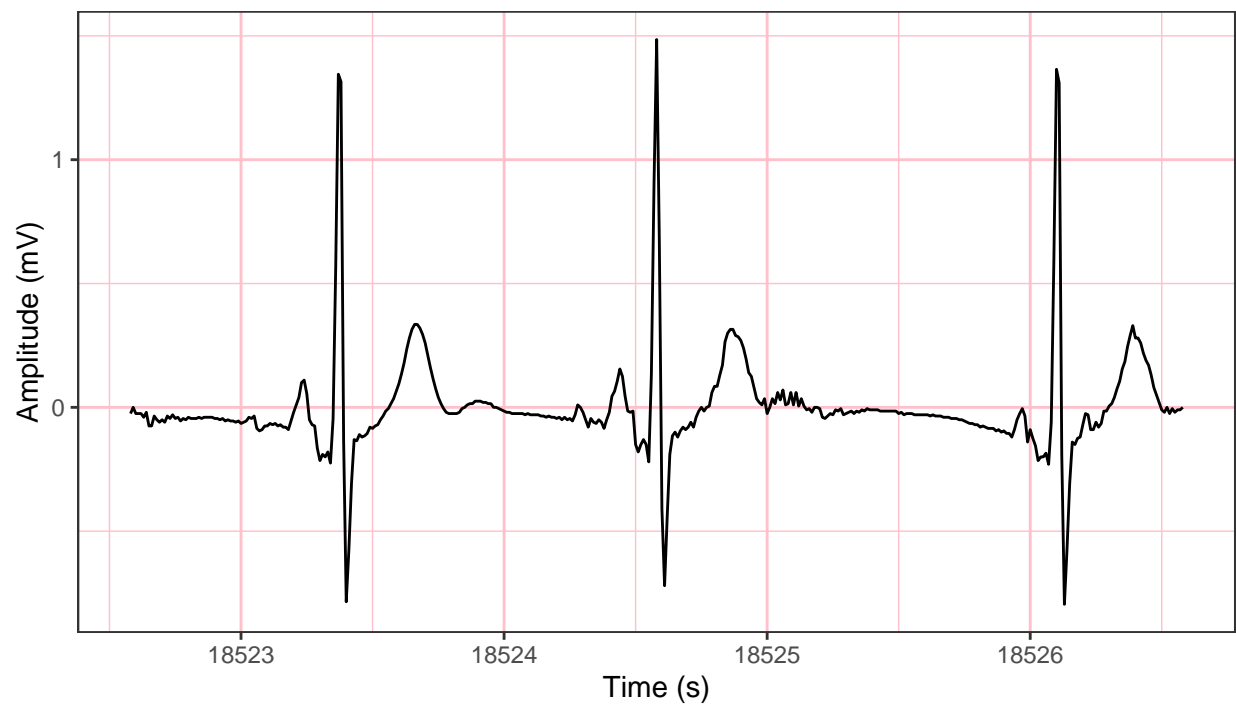
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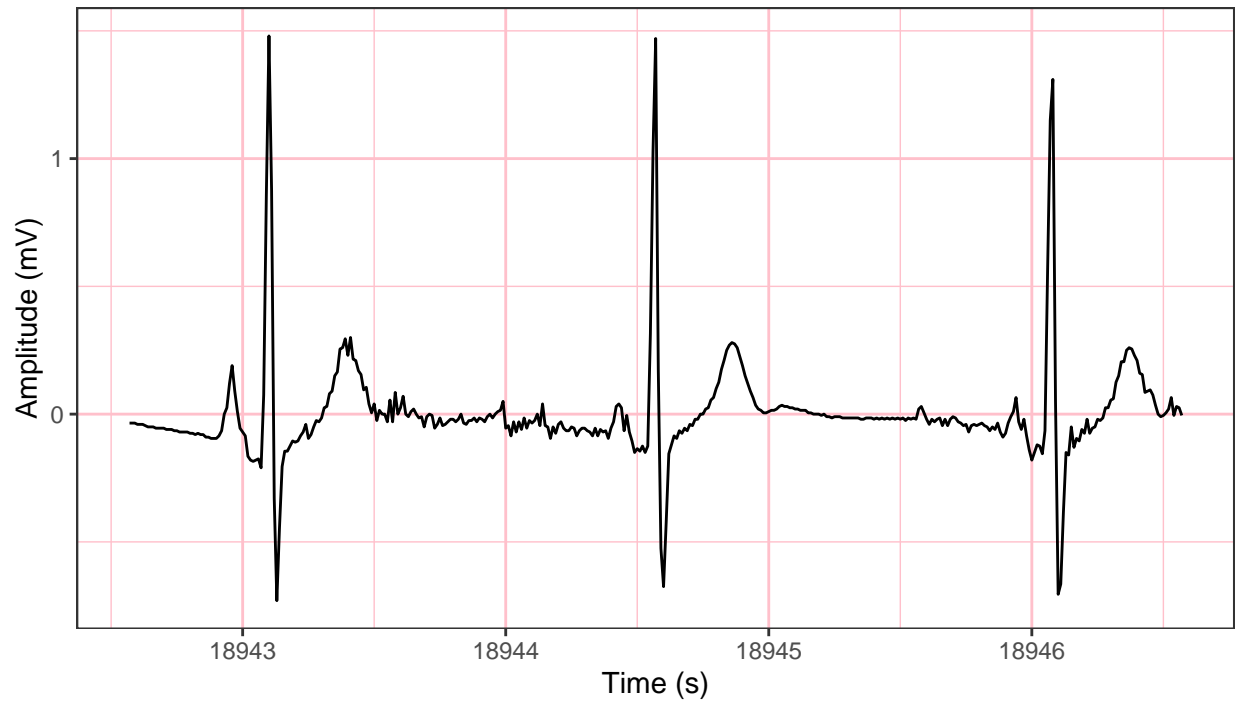
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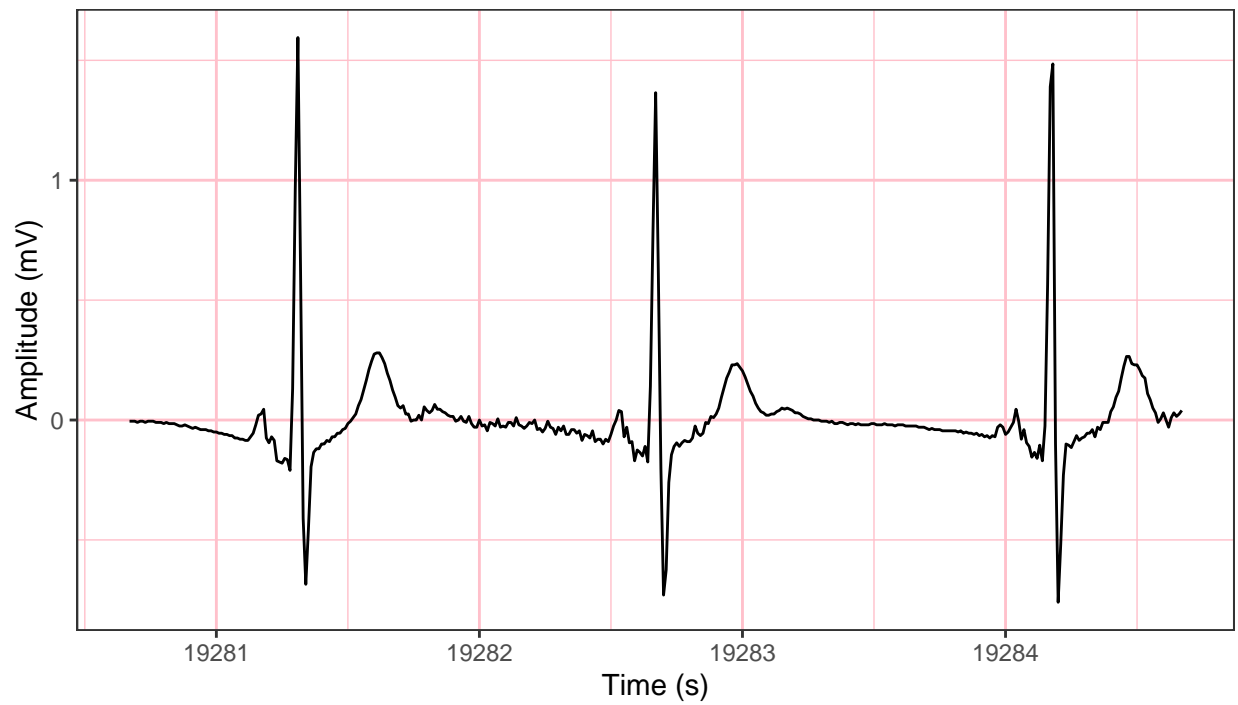
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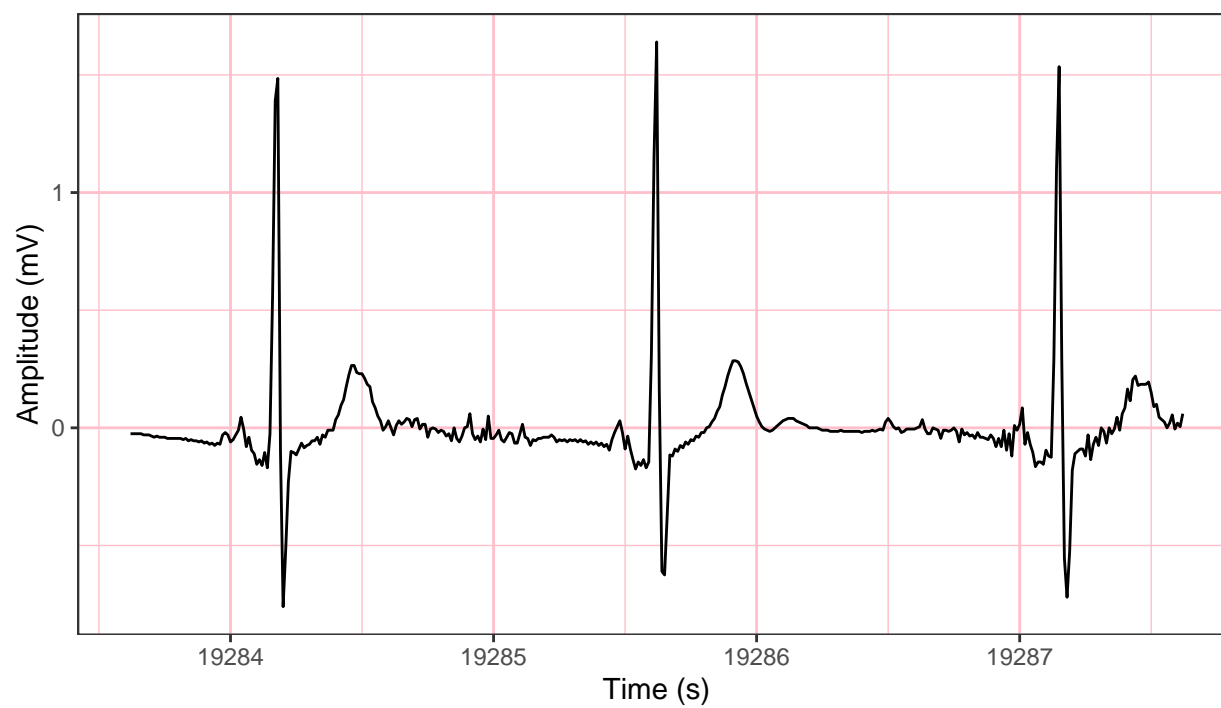
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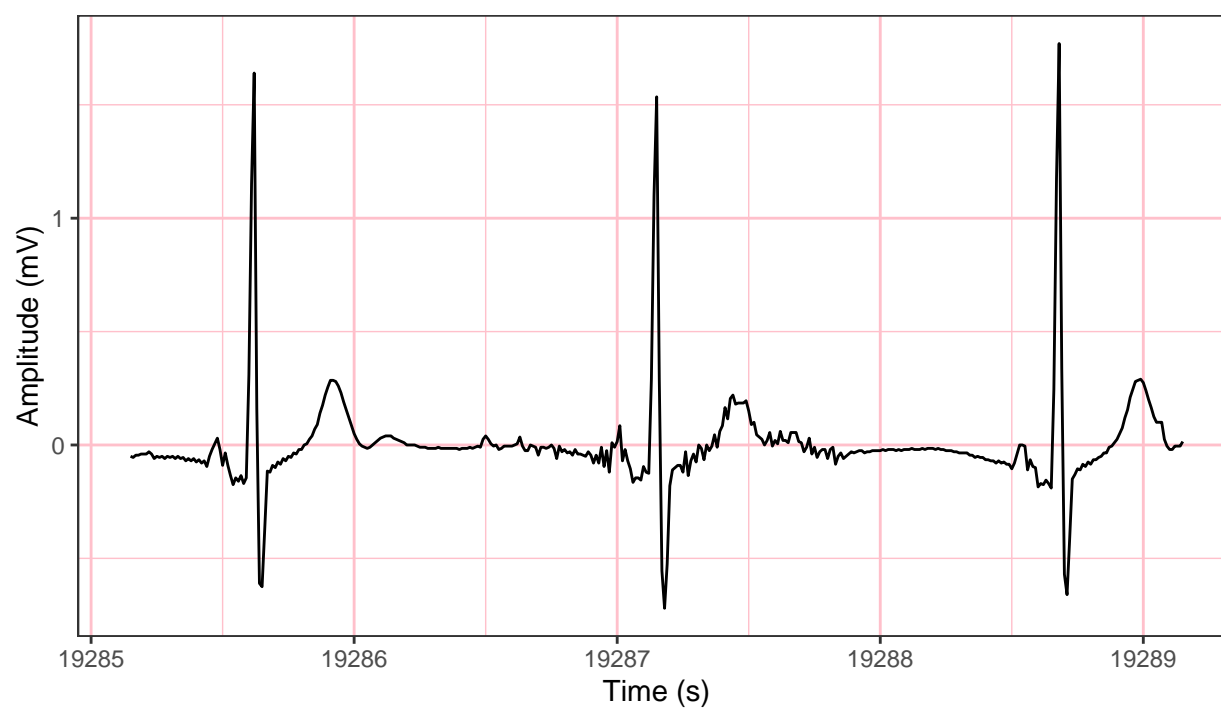
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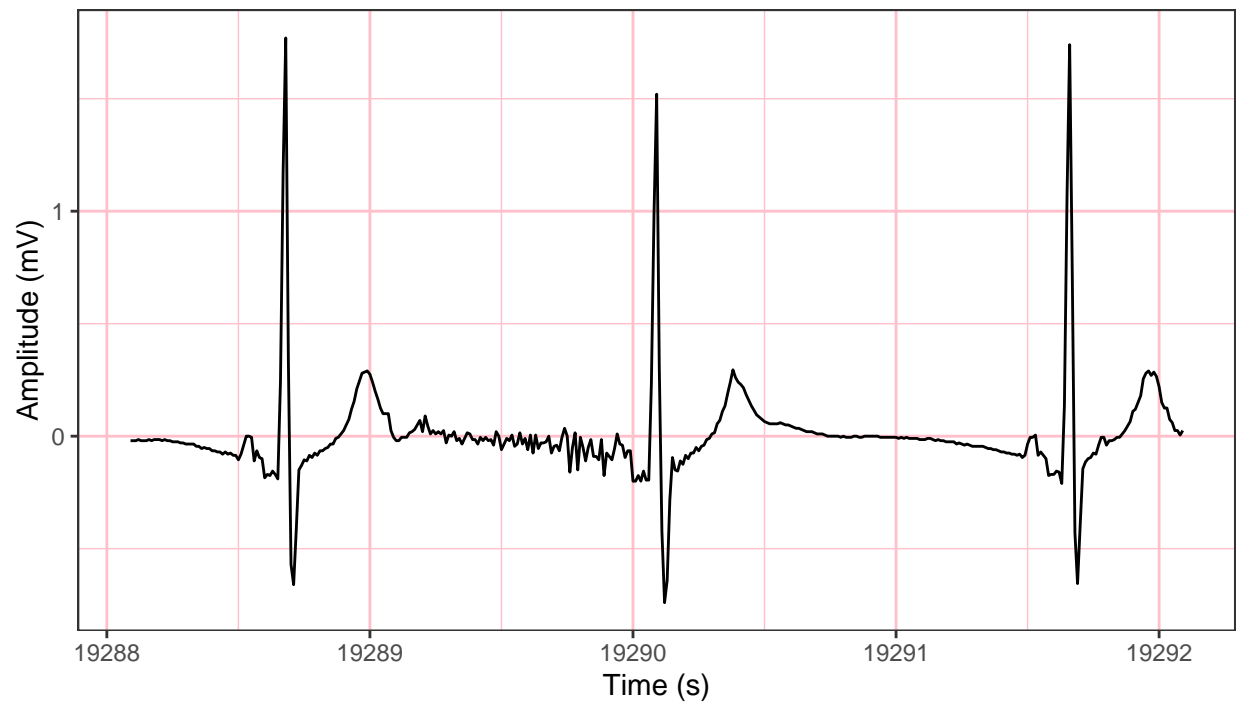
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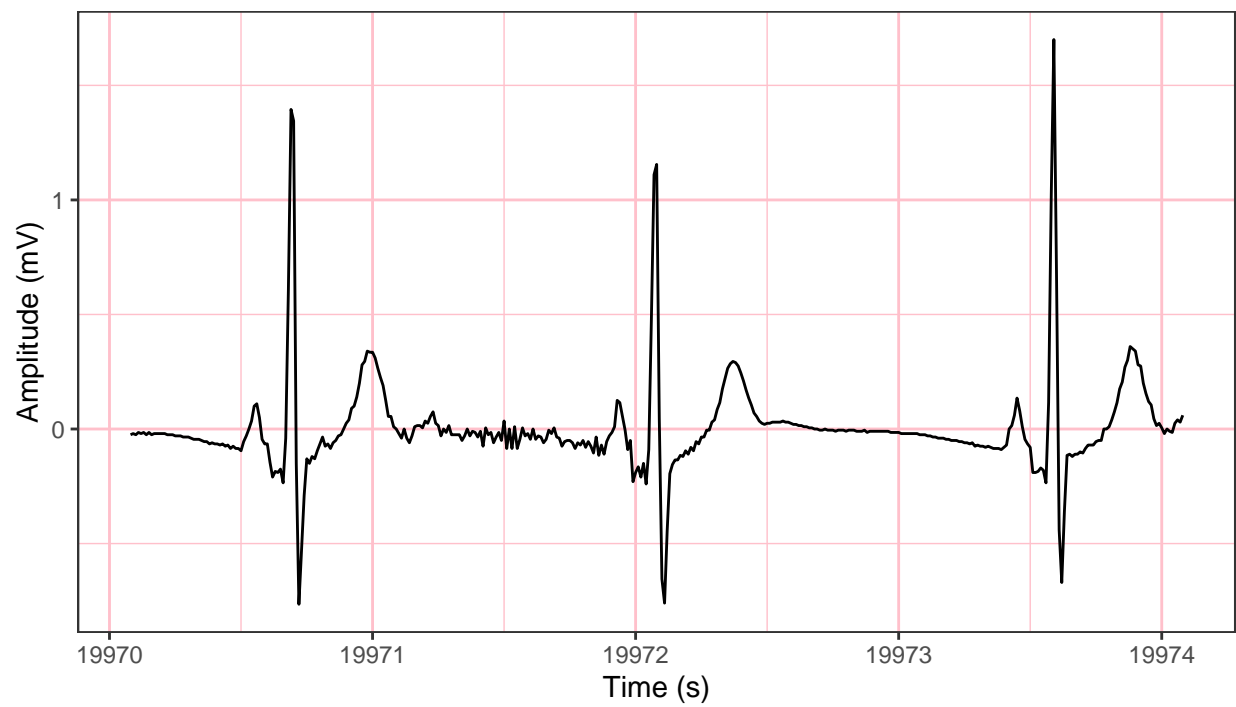
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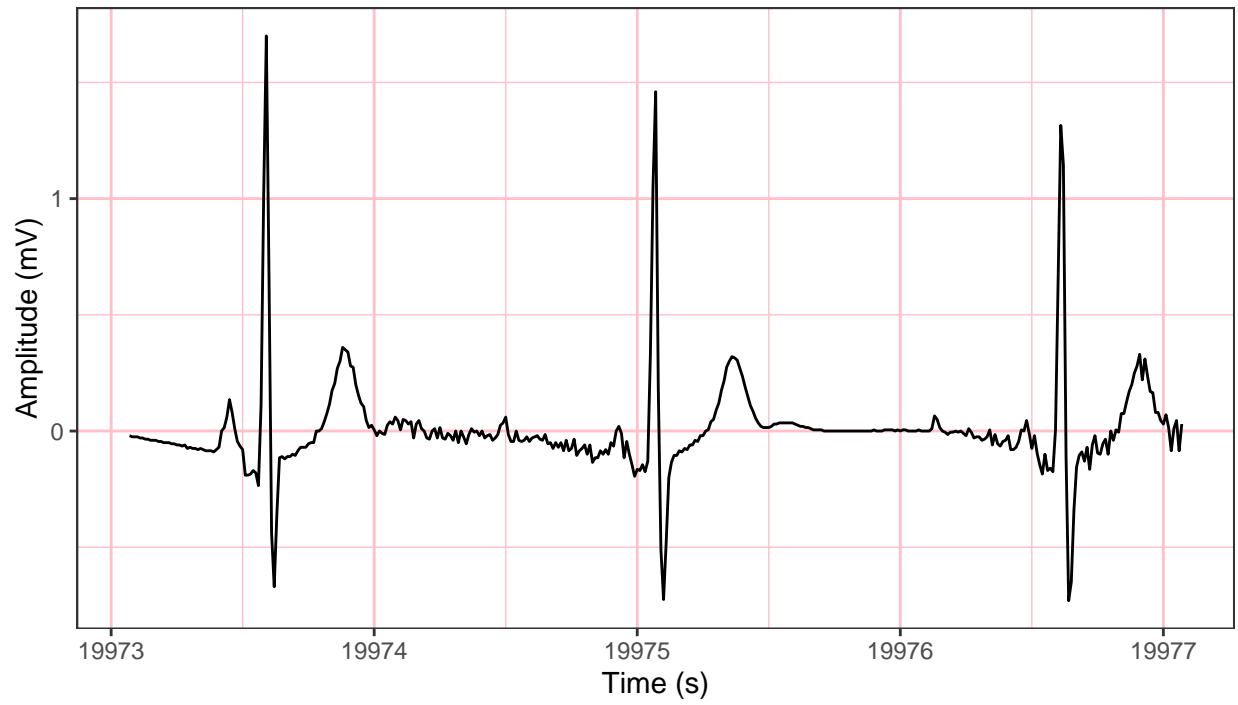
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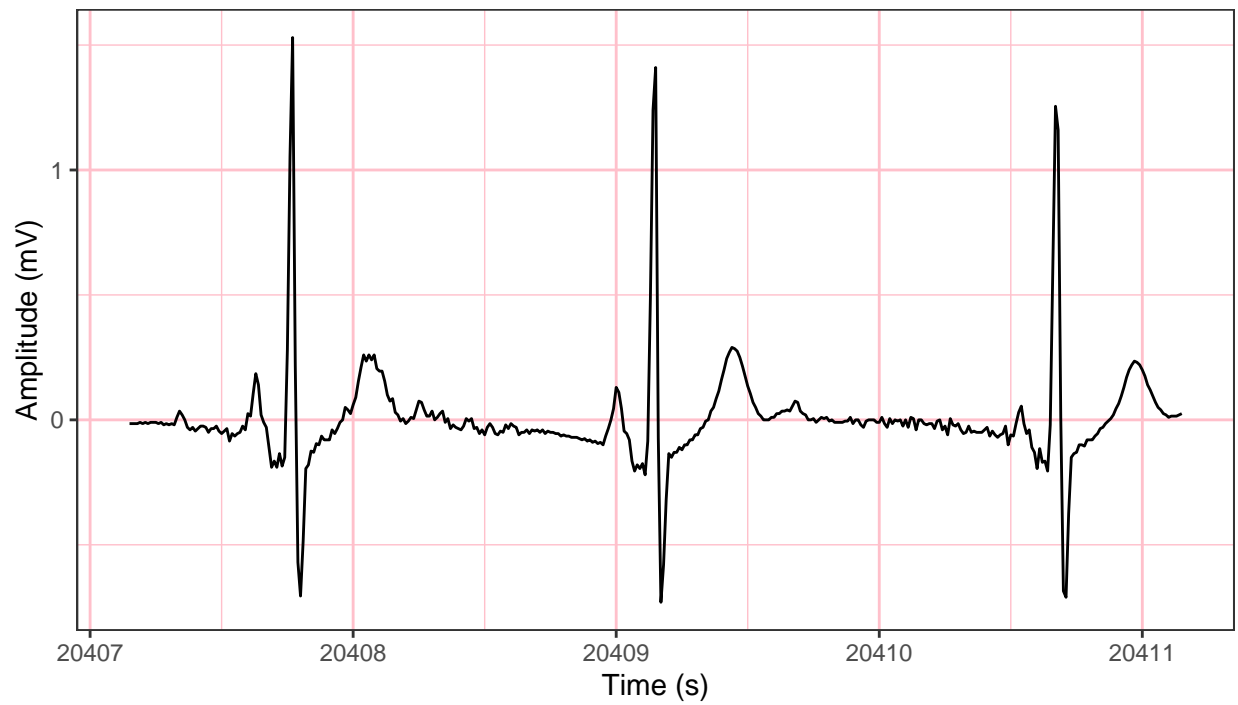
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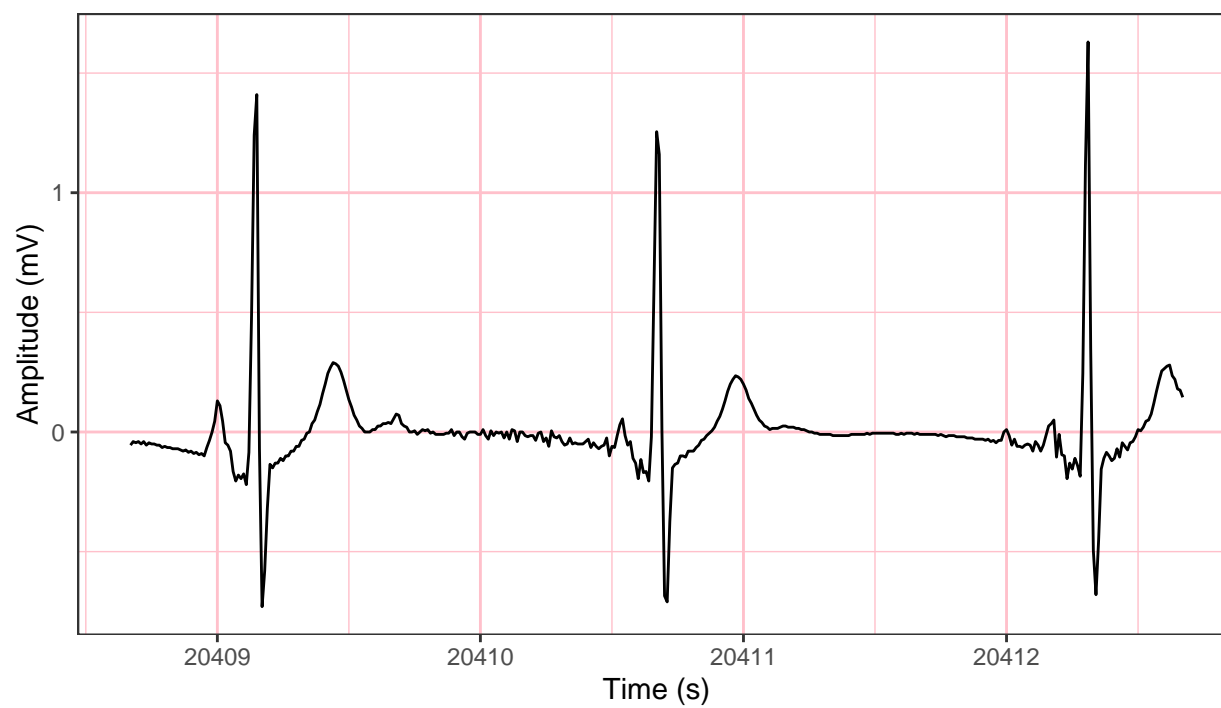
Recorded abnormal R-R interval of 1.54s



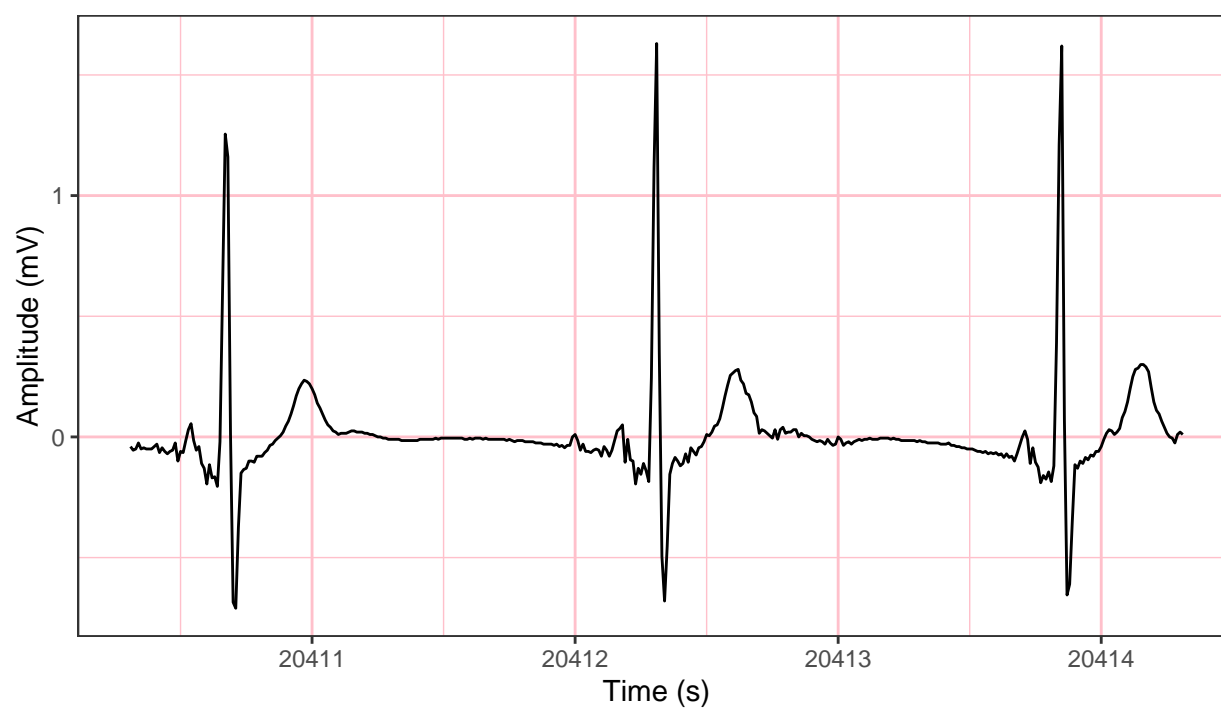
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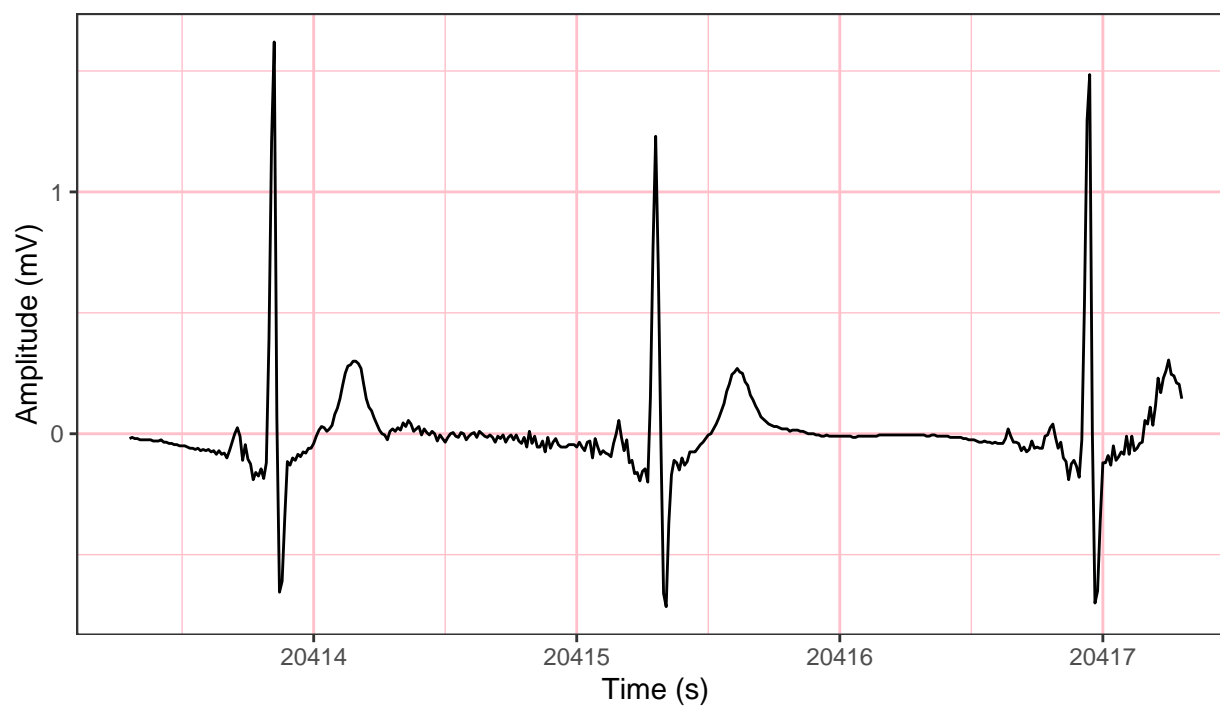
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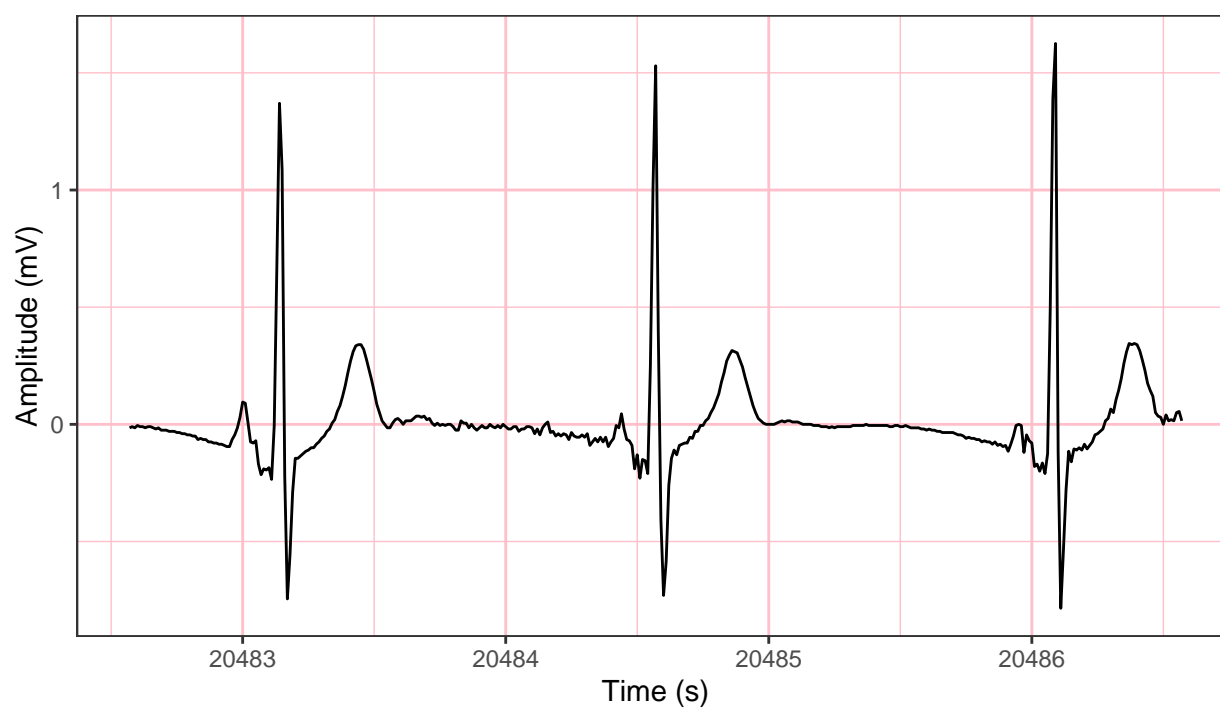
Recorded abnormal R-R interval of 1.64s



Recorded abnormal R-R interval of 1.65s

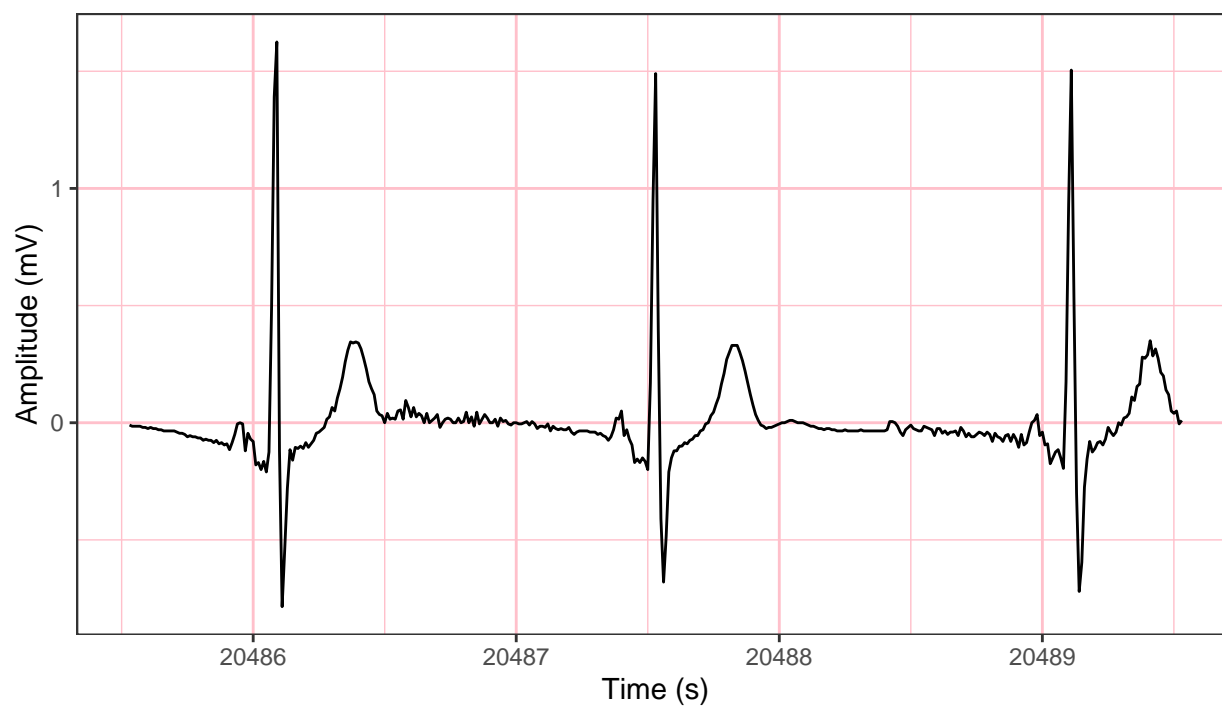


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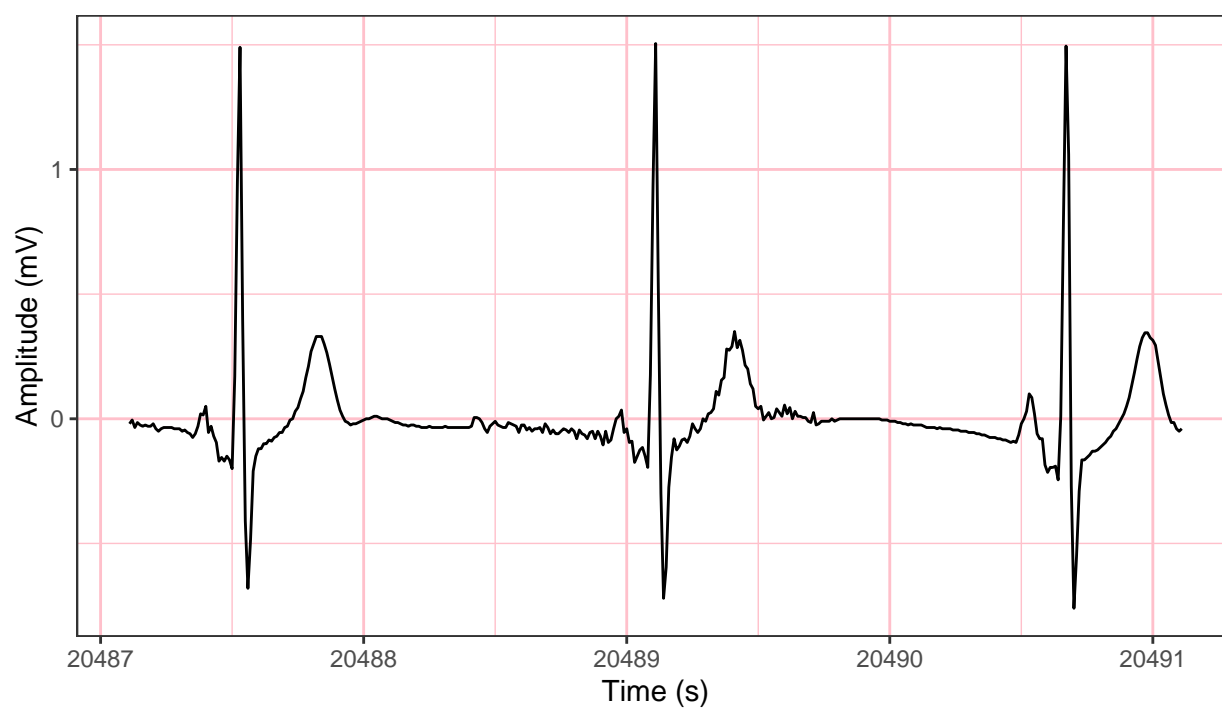




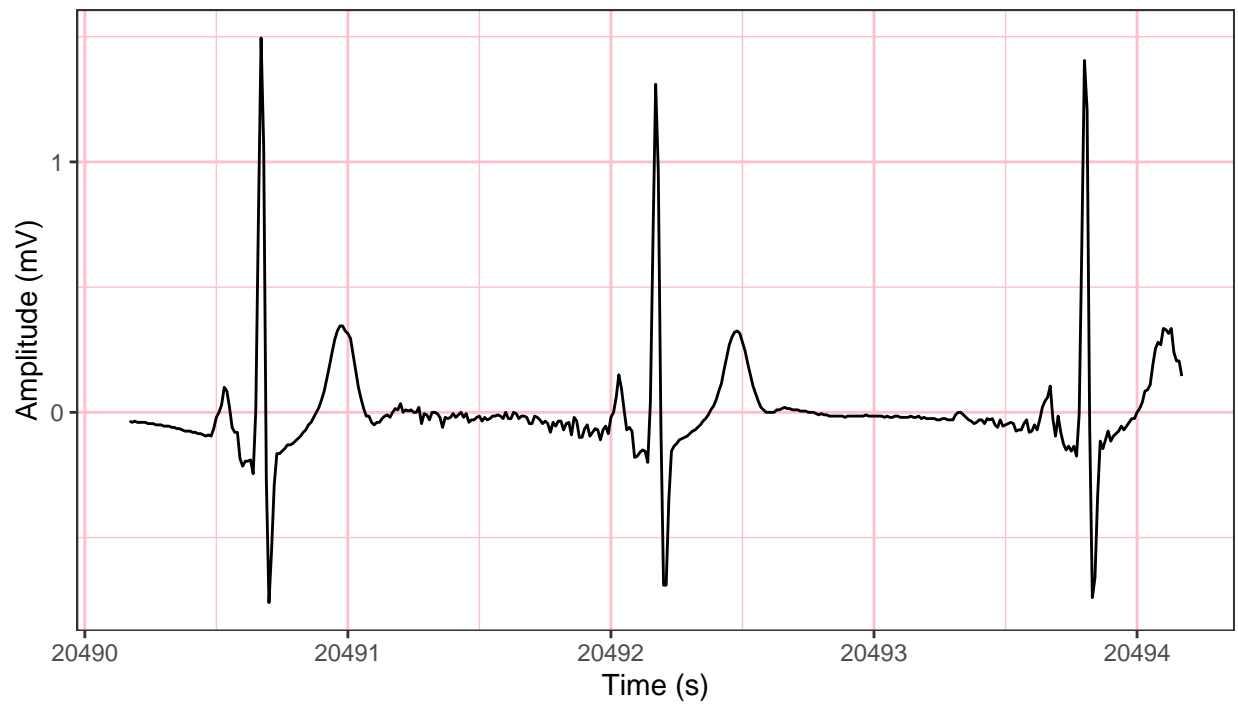
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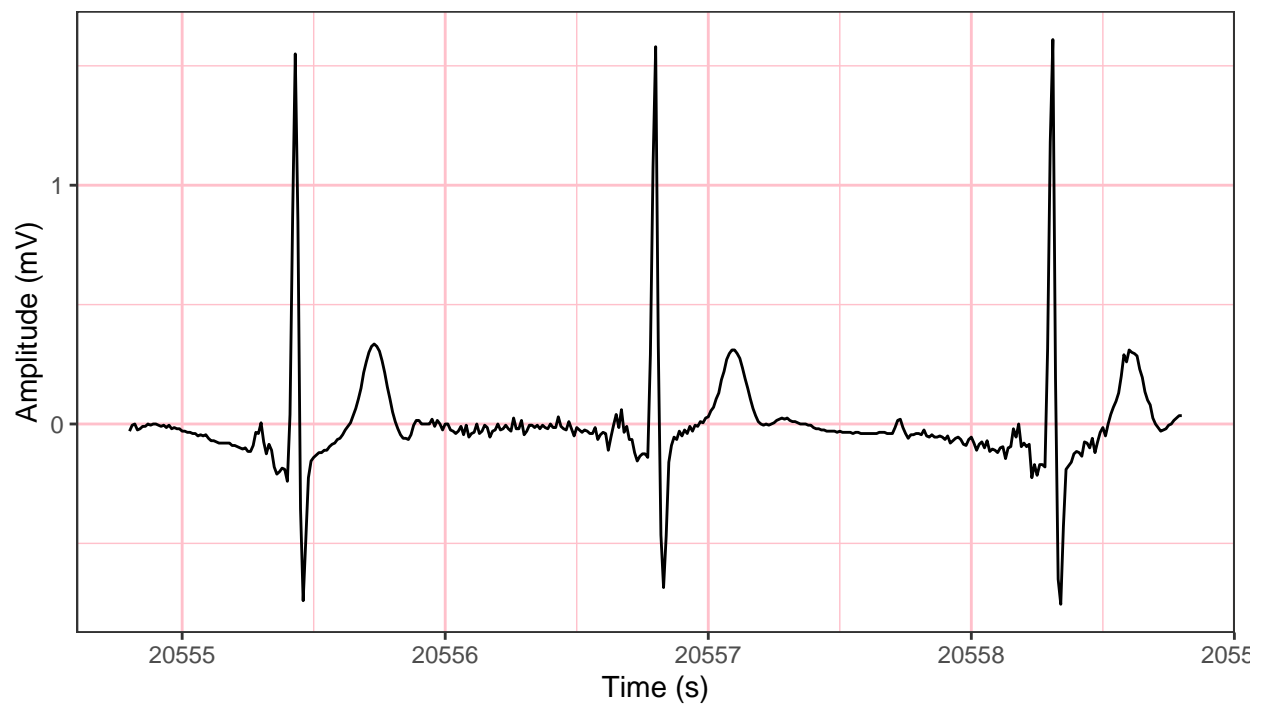
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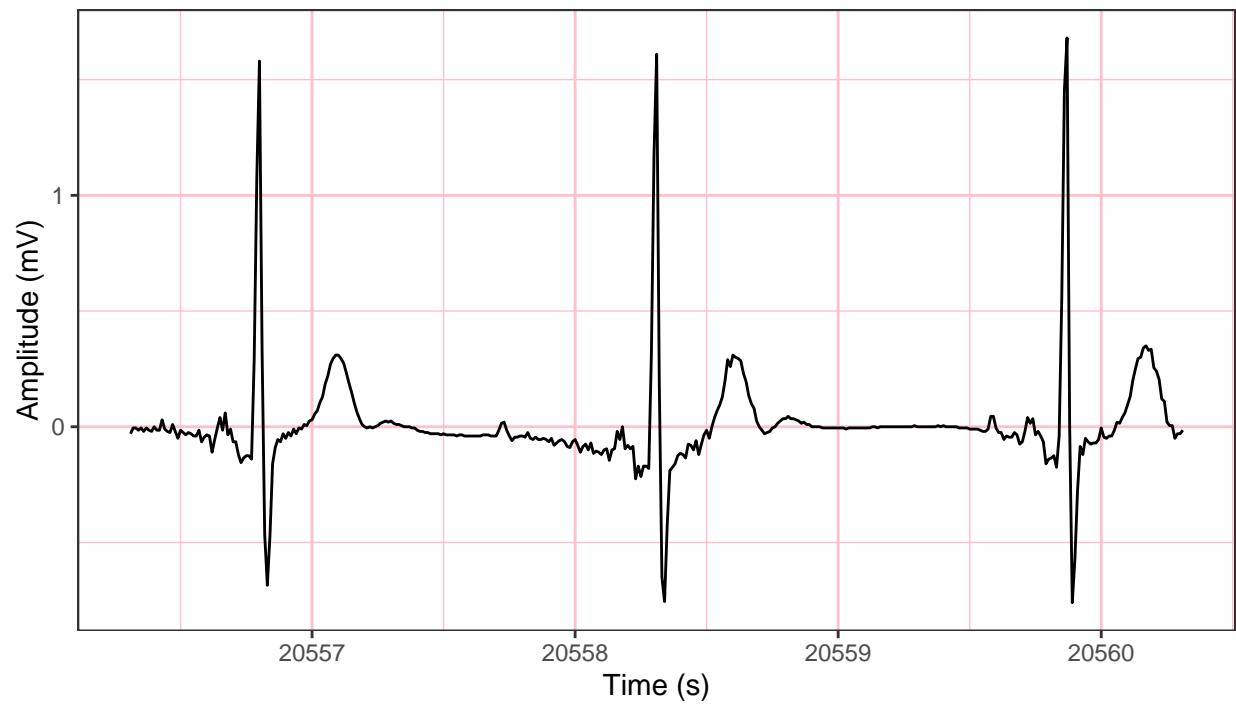
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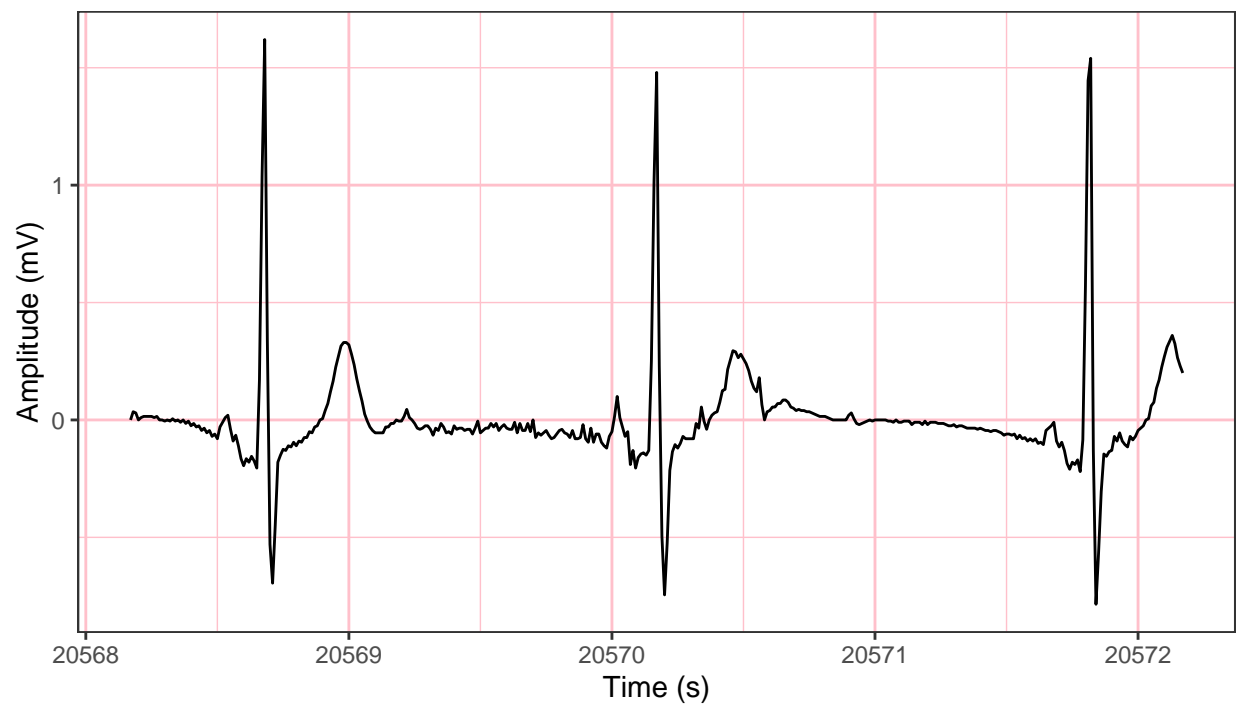
Recorded abnormal R-R interval of 1.51s



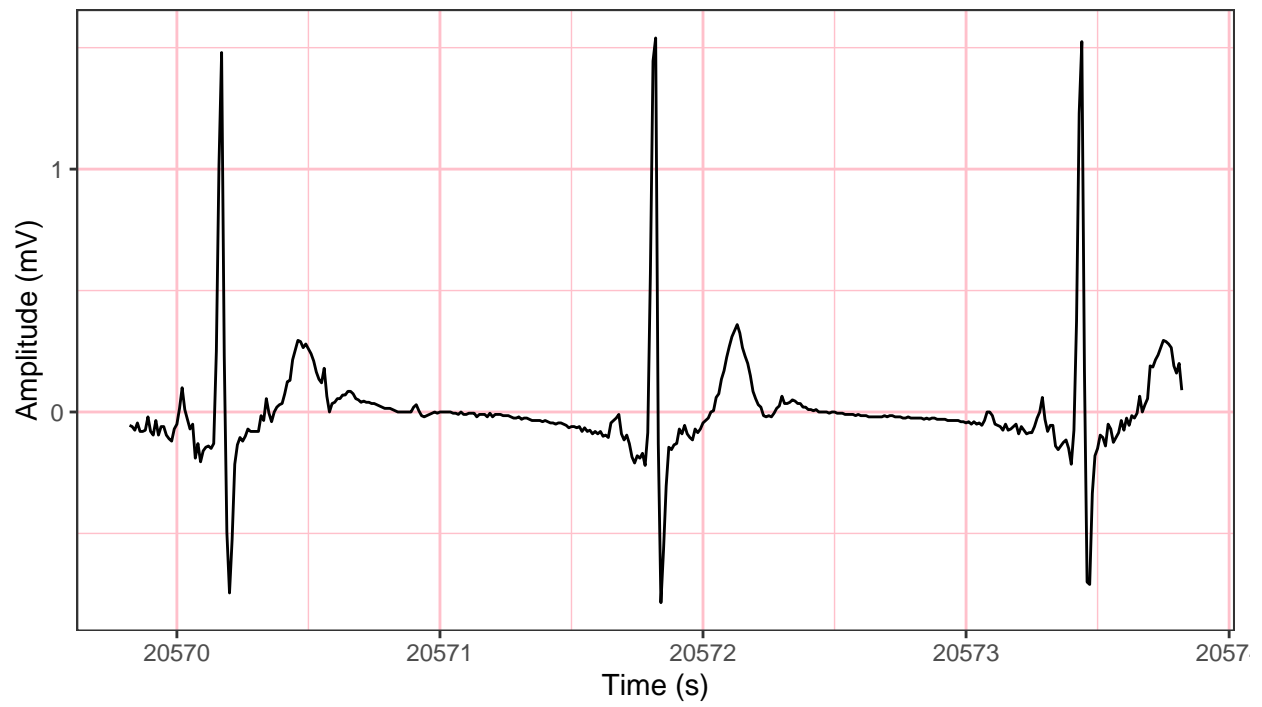
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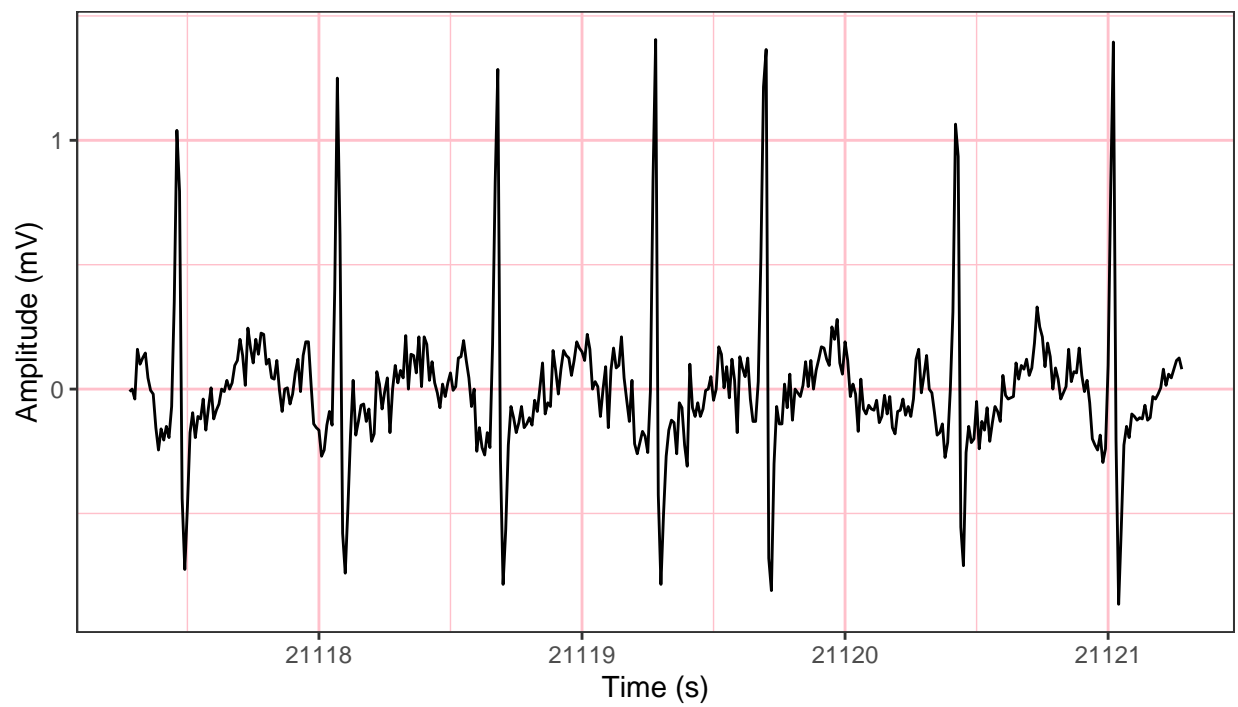
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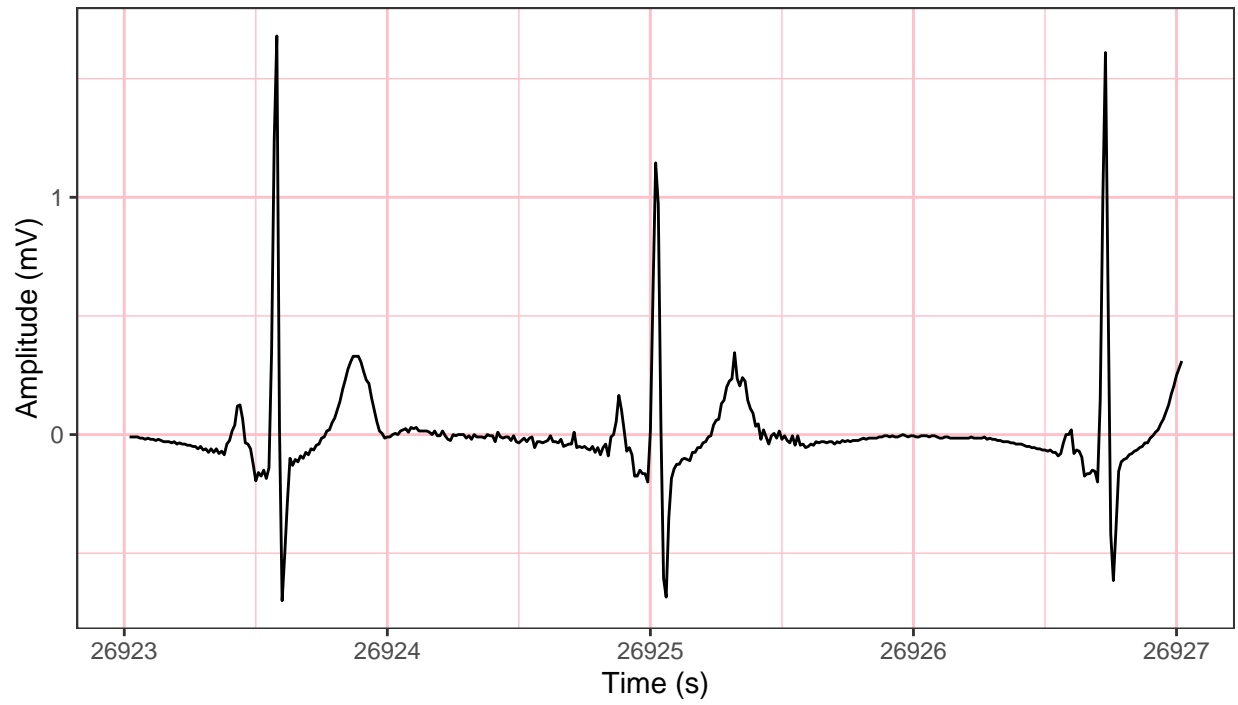
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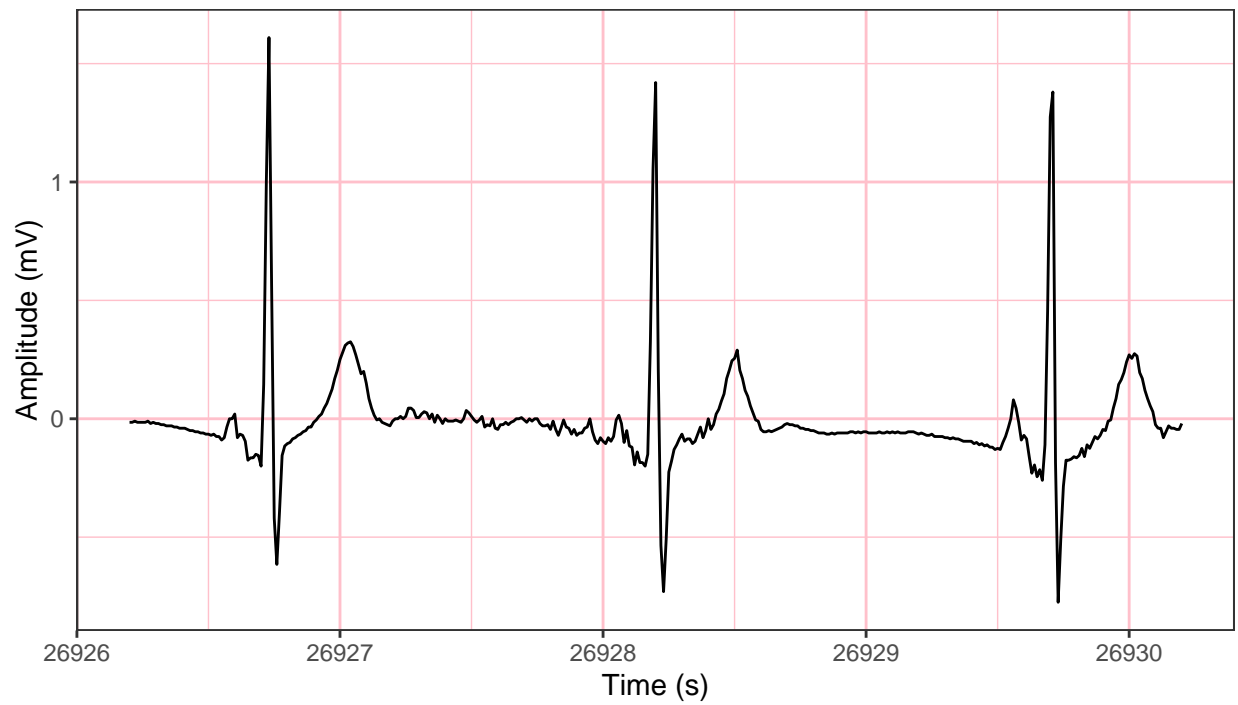
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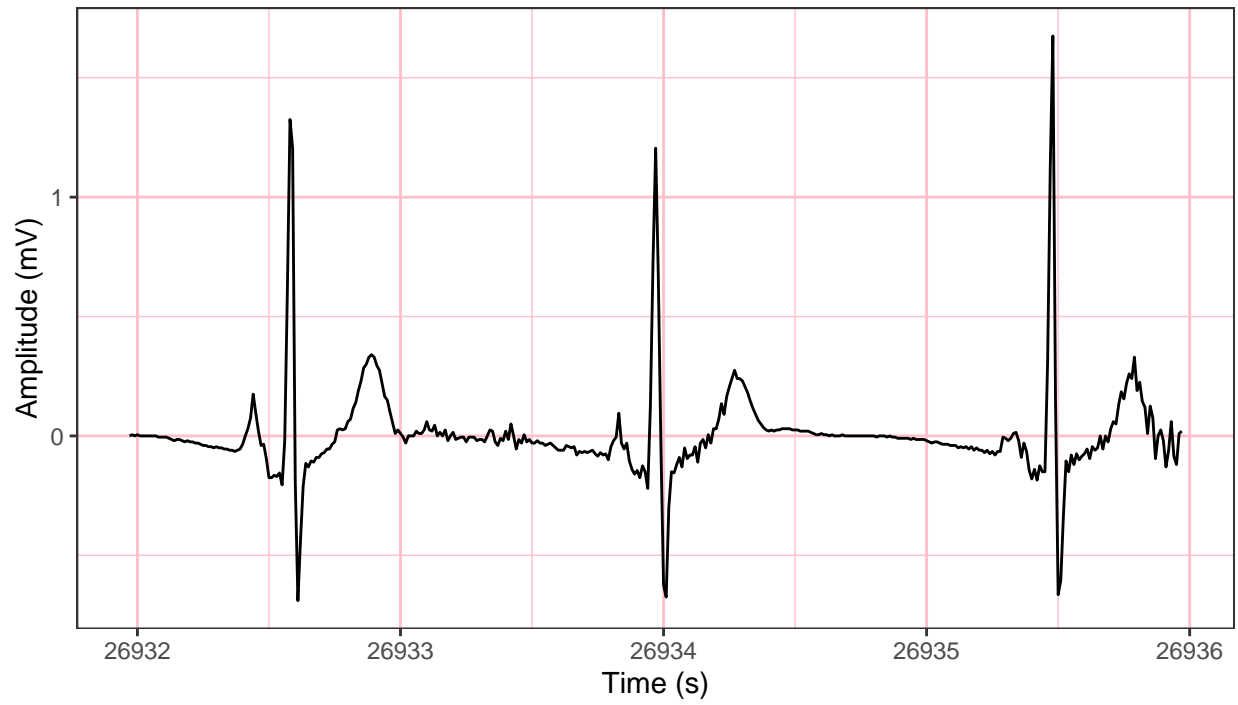
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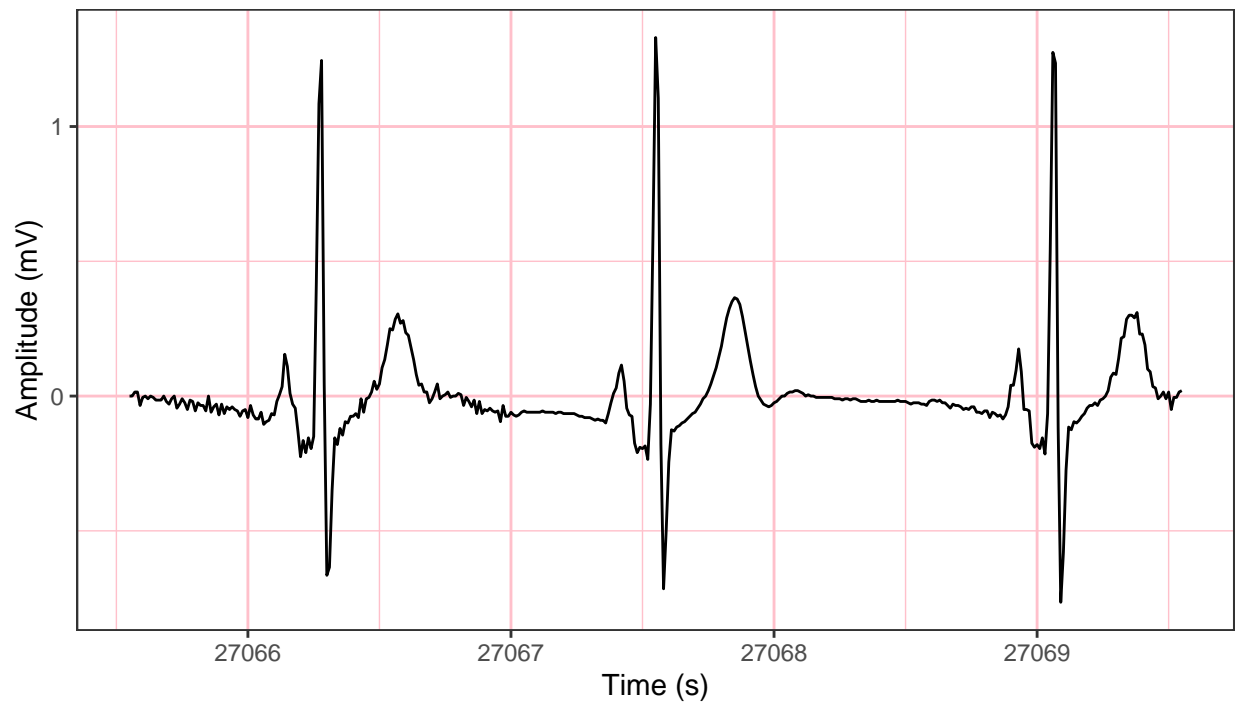
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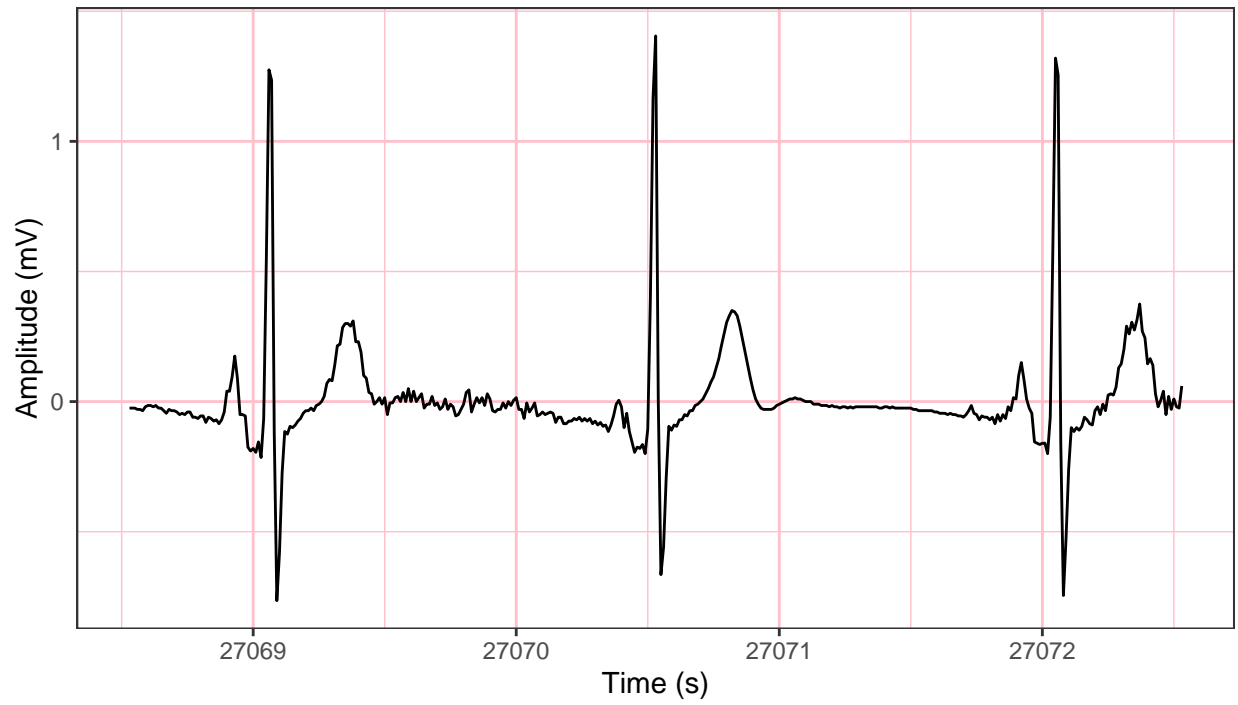
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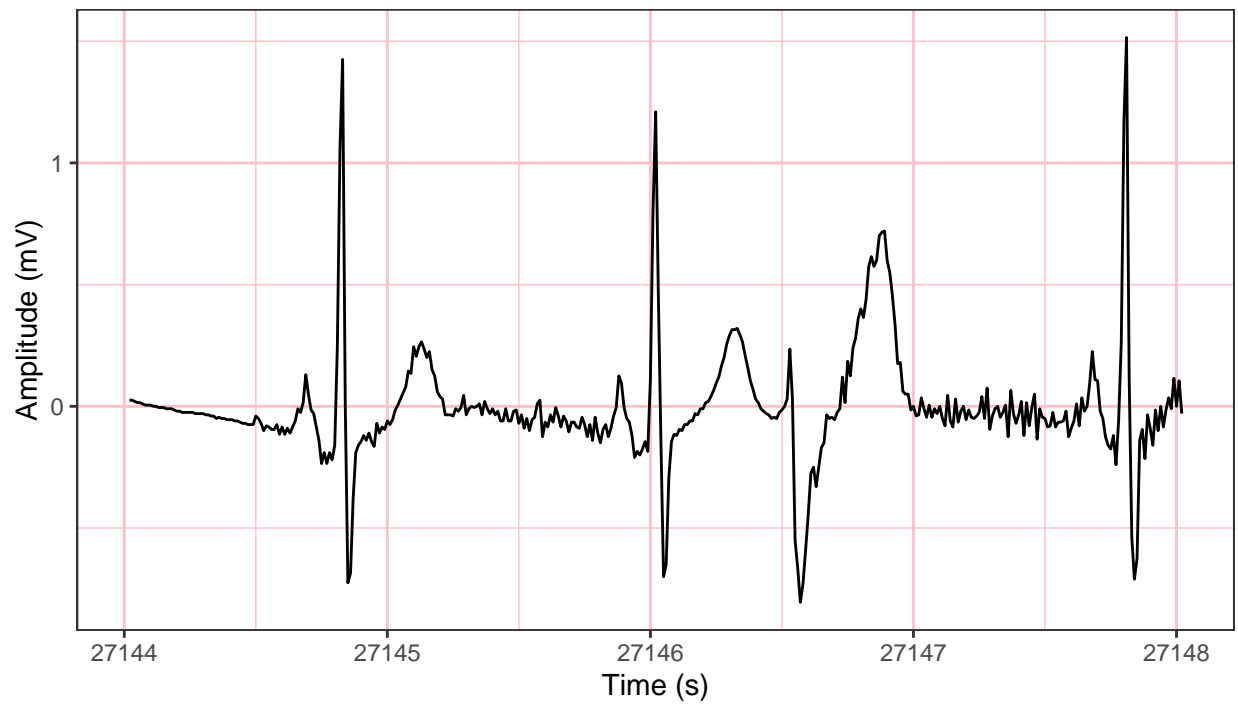
Recorded abnormal R-R interval of 1.51s



Recorded abnormal R-R interval of 1.52s



Recorded abnormal R-R interval of 1.79s



## References

- Goldberger, A. L., Amaral, L. A., Glass, L., Hausdorff, J. M., Ivanov, P. C., Mark, R. G., Mietus, J. E., Moody, G. B., Peng, C.-K., & Stanley, H. E. (2000). Physiobank, physiotoolkit, and physionet. *Circulation*, *101*(23), e215–e220.
- Penzel, T., Moody, G. B., Mark, R. G., Goldberger, A. L., & Peter, J. H. (2000). The apnea-ecg database. *Computers in Cardiology 2000*, 255–258.