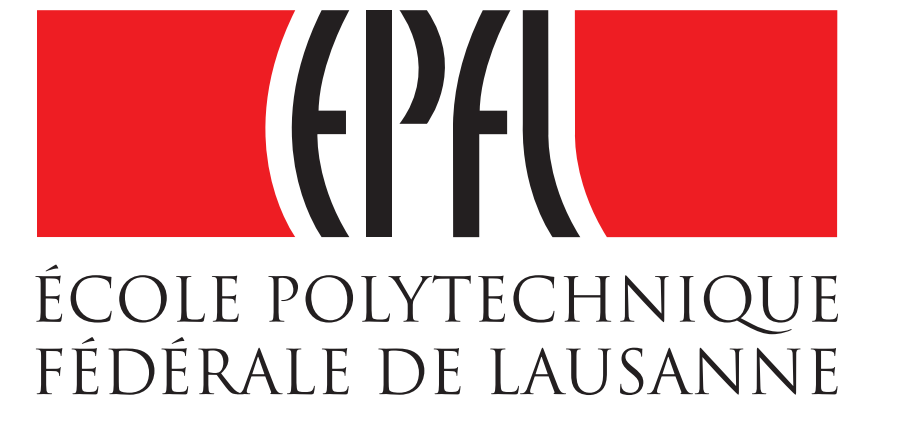


# Glycemic events inference from non-invasive sensors

Jean-Eudes Ranvier<sup>1</sup>, Fabien Dubosson<sup>2</sup>, Stefano Bromuri<sup>2</sup>,  
Jean Paul Calbimonte<sup>1</sup>, Michael Schumacher<sup>2</sup>, Juan Ruiz<sup>3</sup>, Karl Aberer<sup>1</sup>

EPFL<sup>1</sup> HES-SO Valais<sup>2</sup> Hopital Riviera Chablais<sup>3</sup>



Hes-SO VALAIS WALLIS



Glucose concentration level is usually measured using a drop of blood, and allow for detection and mitigation of glycemic events (Hypoglycemia, hyperglycemia). **Is it possible to accurately infer these glycemic events solely based on non invasive, off the shelves sensors?** D1namo propose to **fuse multiple sensors** from a wearable belt to build coherent representation of the user's state in order to detect glycemic events.

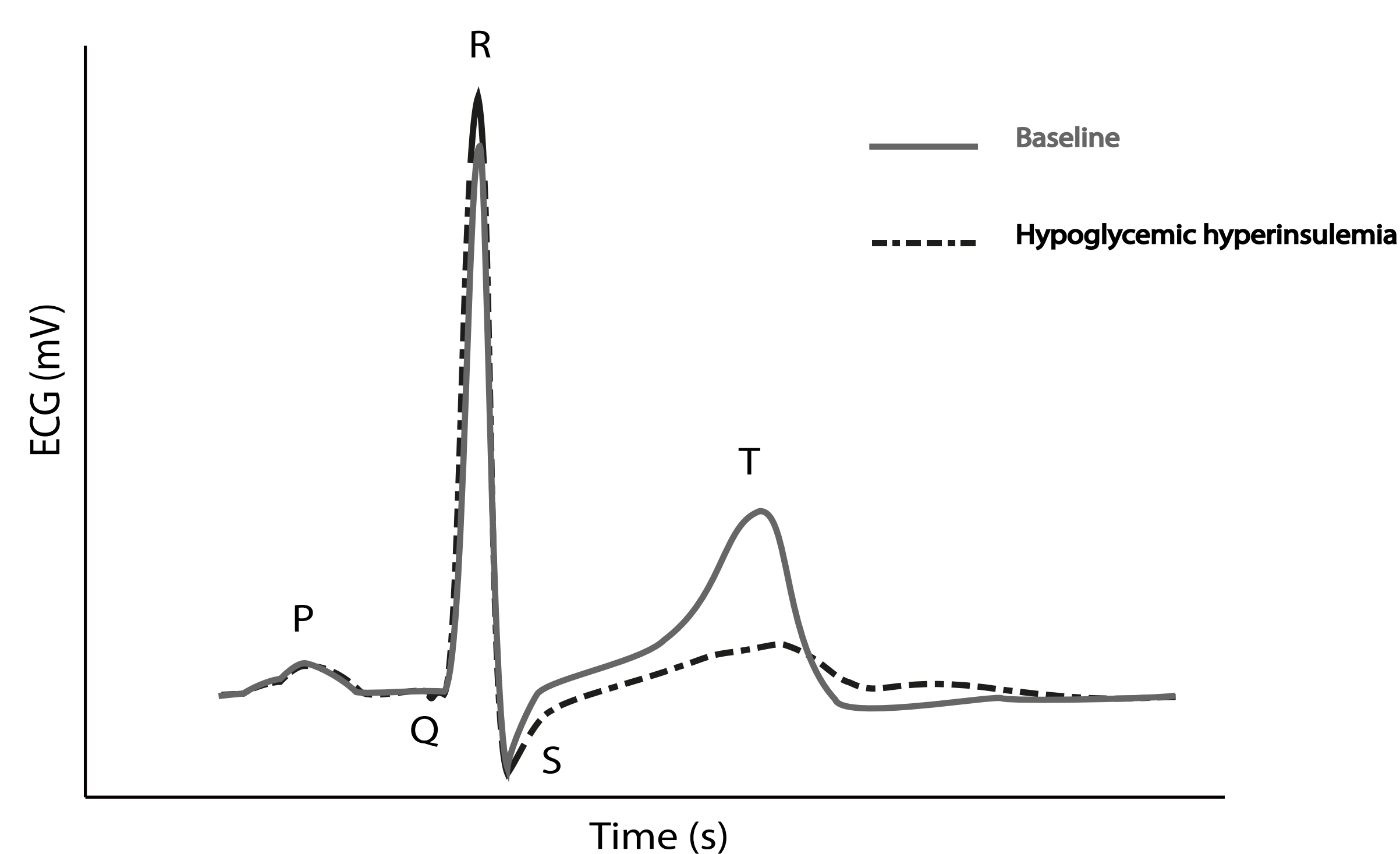
## Chest belt



Zephyr BioHarness

## ECG analysis

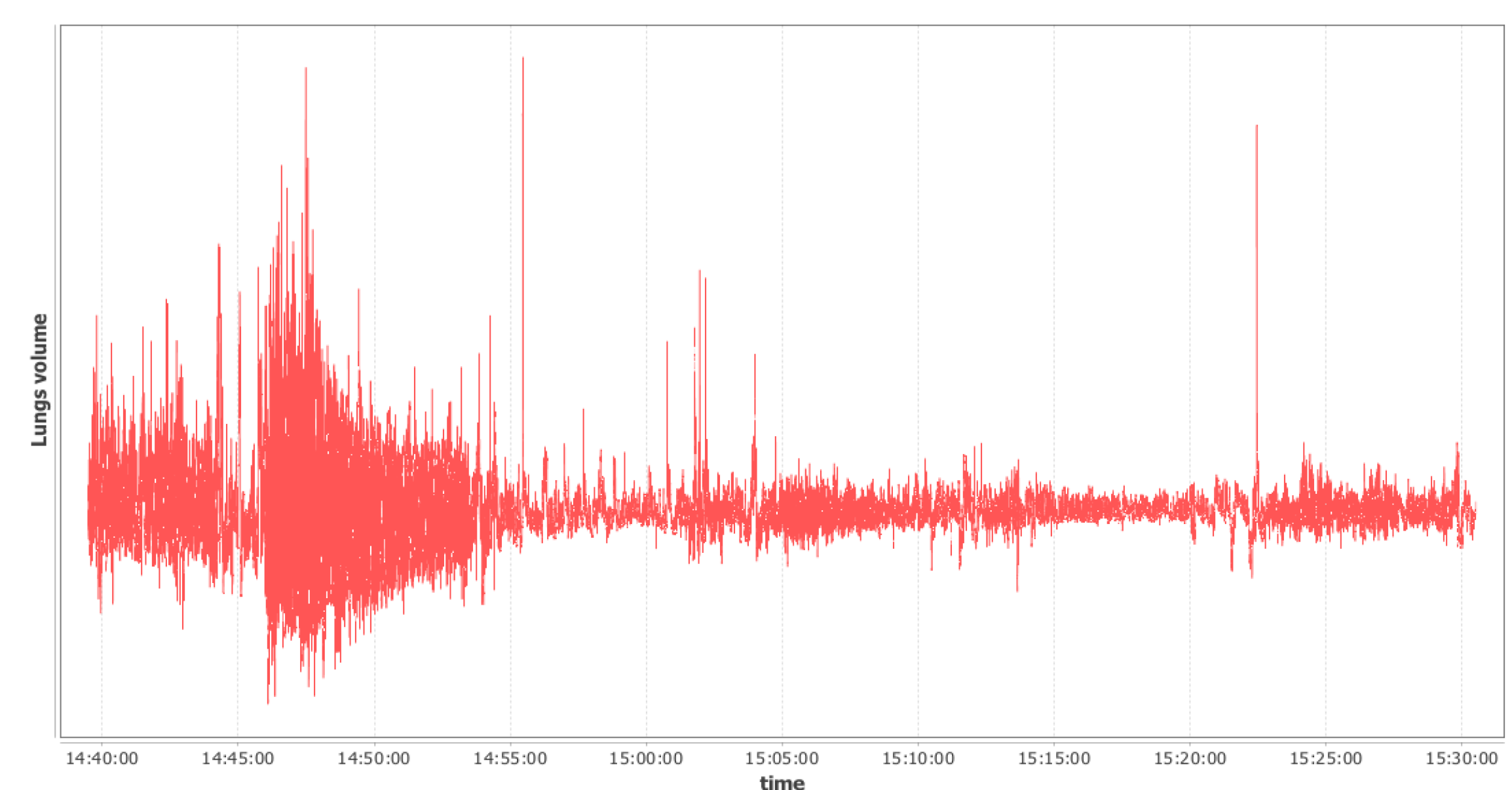
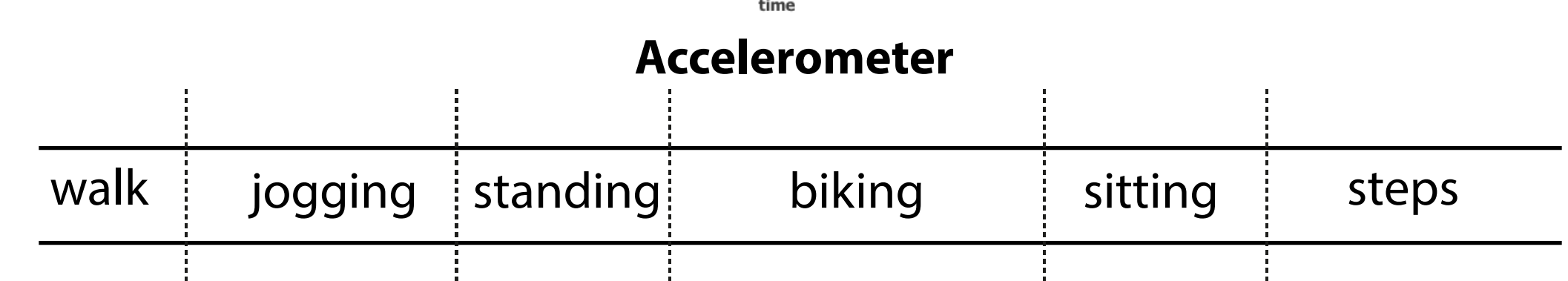
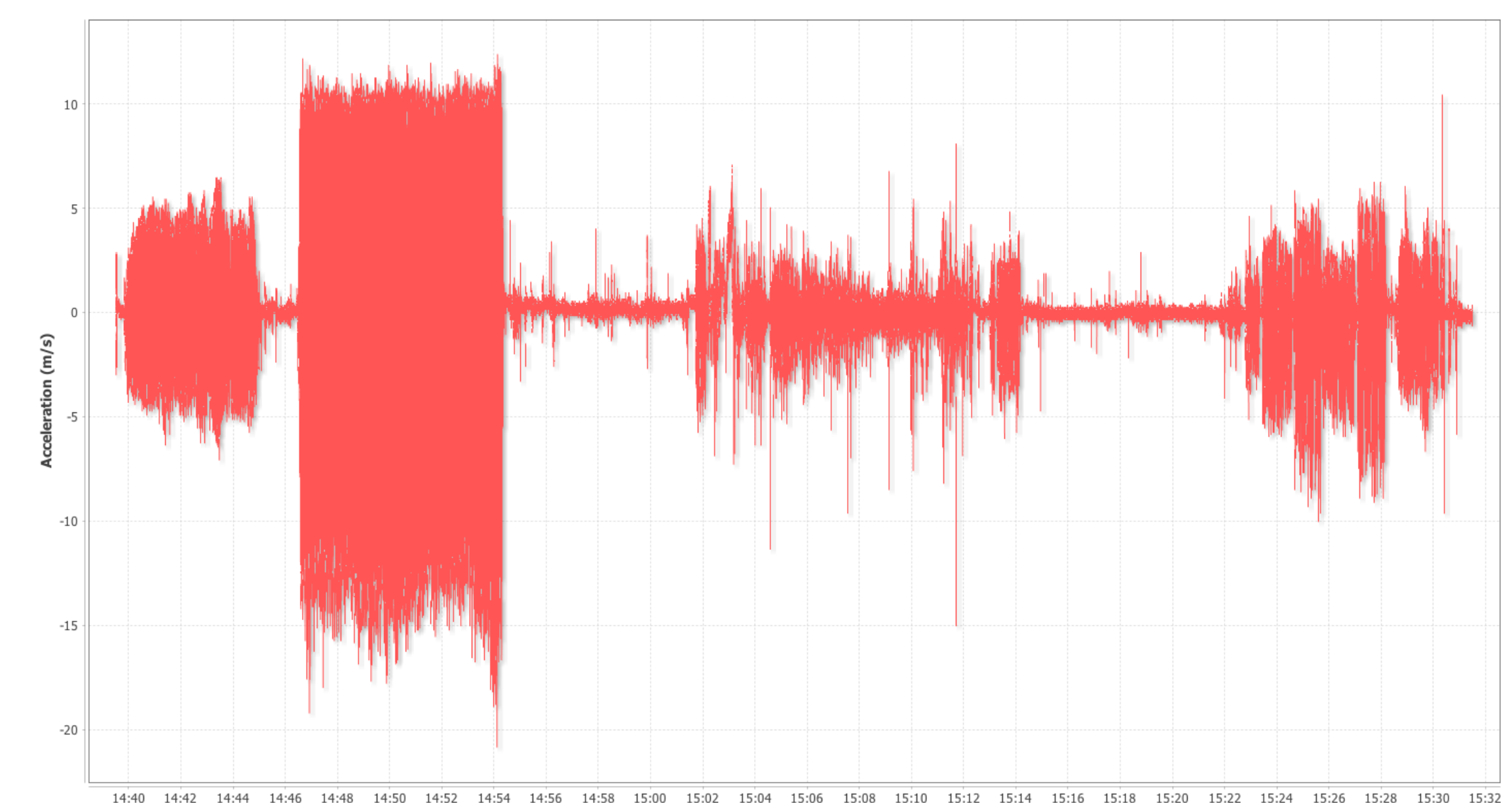
Laitinen et al. showed that the **ECG is altered during glycemic events**. We collect the ECG data provided by the chest belt to infer the glycemia of the patient using **signal processing analysis**. However, movements add **high amount of noise** in the ECG signal necessitating preprocessing.



ECG representation of a heartbeat in different glycemic conditions

## Activity level recognition

Glucose level is highly dependent on the **food income** and **energy expenditure**. We use 3-axis accelerometer, breathing and heart rate data provided by the chest belt **to determine an activity level** which can be translated into energy expenditure of the patient.

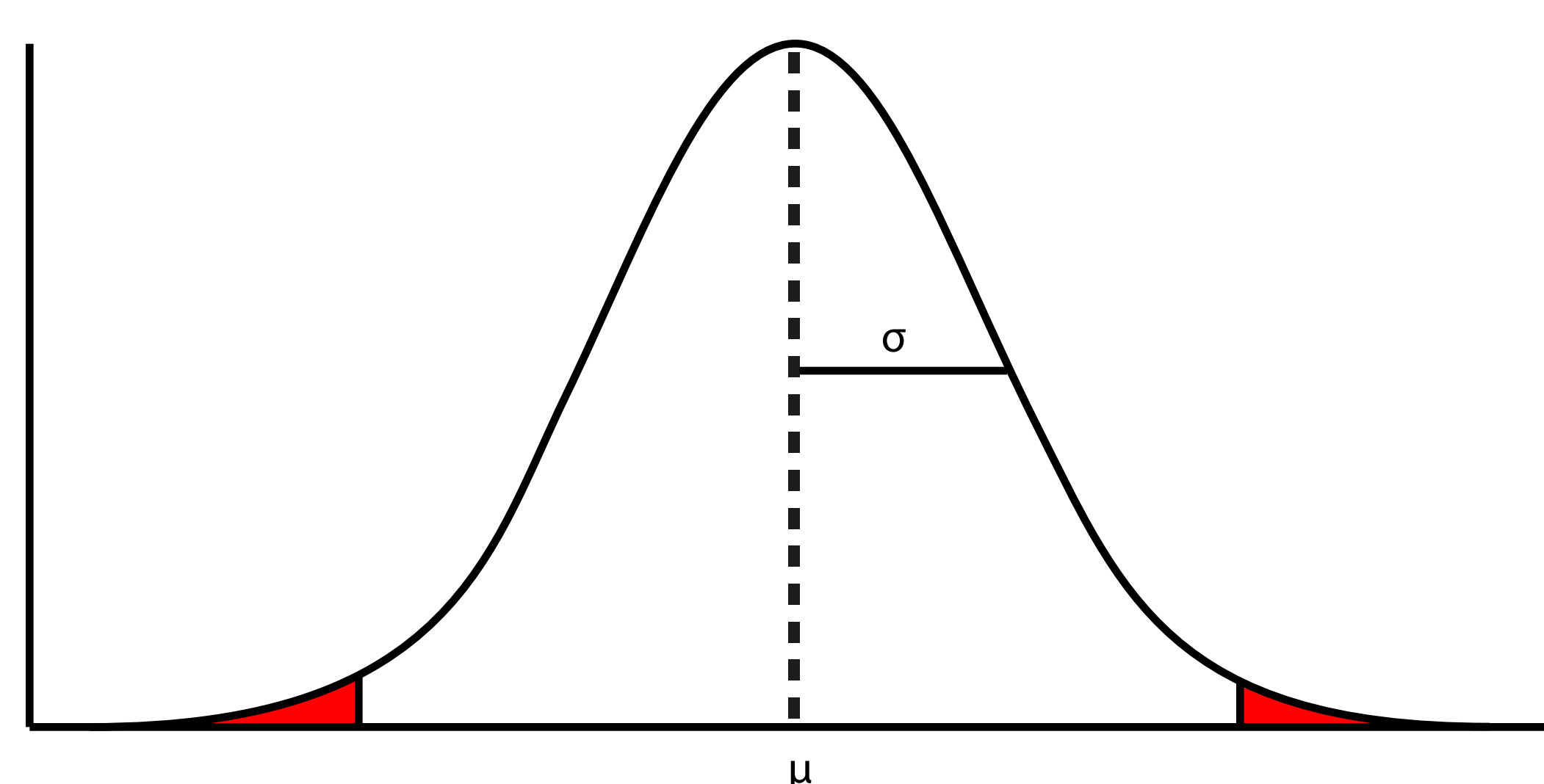


Breathing rate

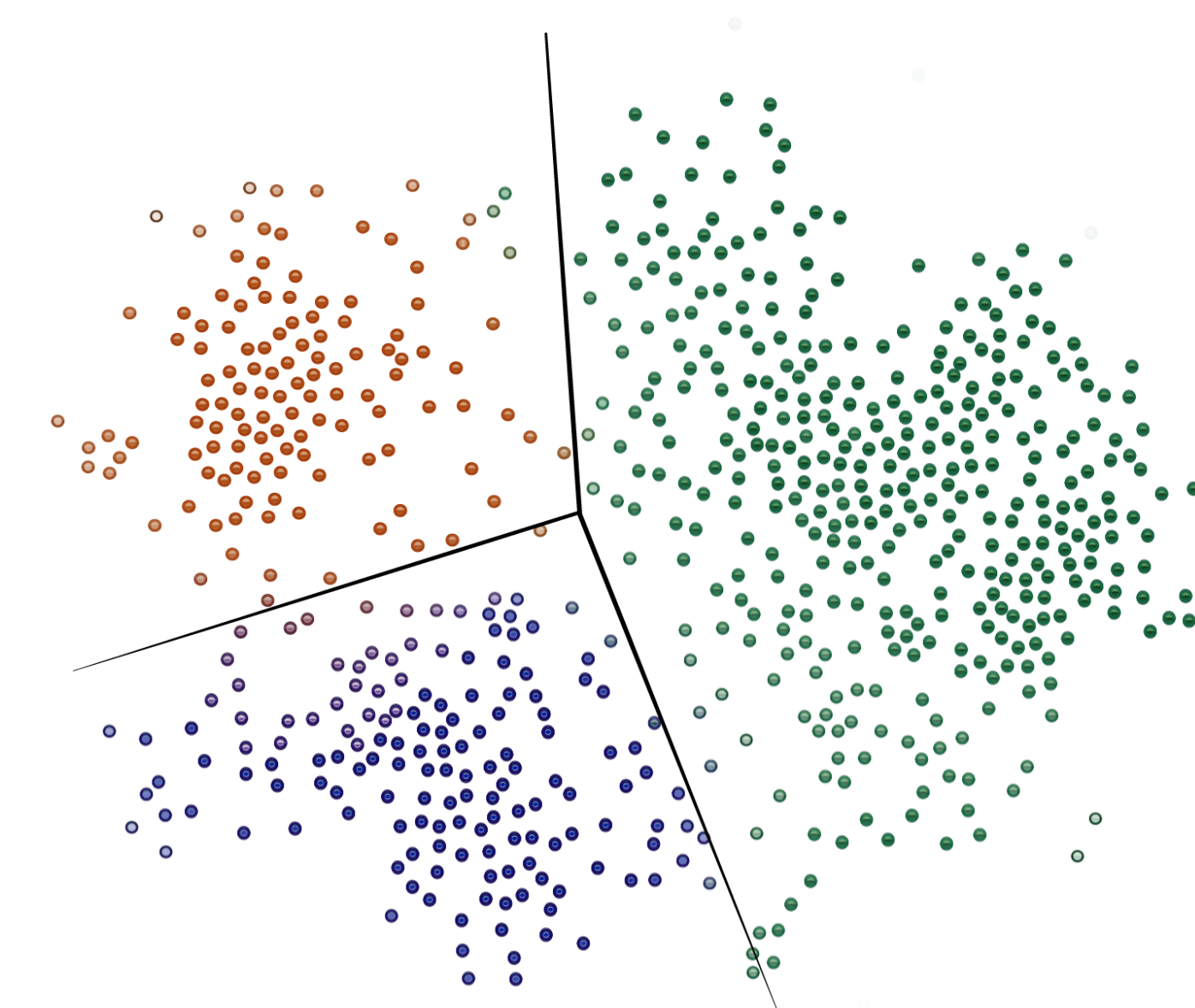
Activity level based on sensor readings

## Fusion of the features and detection of glycemic events

**Anomaly detection** is first used to counter balance the **overwhelming amount of data collected in absence of glycemic events**. It helps detecting glycemic events which can then be **classified into hypo and hyper-glycemia** based on their ECG features and activity level defined above.



Anomaly detection to balance the different classes



Discrimination of glycemic events using machine learning