# Impact Point

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## 1 Introduction

We are interested in finding the row index when the ball impacts the bat. We will plot acceleration in different axis against time to analyze the data and arrive at the impact point.

## 2 One dimension case

Before attempting to answer the problem lets see what would happen in a one dimensional case. Imagine a car is moving with constant acceleration of 1 $ms^{-1}$ and collides with a wall. Plotting the car's acceleration against time will reveal a sharp deceleration in a very short time and settle to 0 $ms^{-1}$ subsequently. The massive impulse $J$ provided by the wall in the opposite direction of motion will appear as a sharp drop in acceleration time plot.

$$J = \int_{t1}^{t2} F dt$$

## 3 Plots for baseball data

Lets look at Az,Ay and Wz plots.

Figure 1 reveals that at row index 873 the acceleration in z direction experiences a sharp jump. This point is potentially the impact point and other plots should show a similar behavior at this point.

Figure 2 also shows a sharp jump at point 873.

Figure 3 also shows a sharp jump at point 873.

## 4 Impact point

From the plots one can deduce that the impact happens at 873. To do this using a program one will have to scan the data for the first sharp jump. The helper functions written in the coding challenge will come handy in iteratively scanning the data points. A data set without any impact will help in deciding on the initial parameters (window length and threshold sizes) to start with. The rate of change of values will give an idea where the curve is heading (up/down) and parameters (window length and threshold sizes) can be adjusted using that.

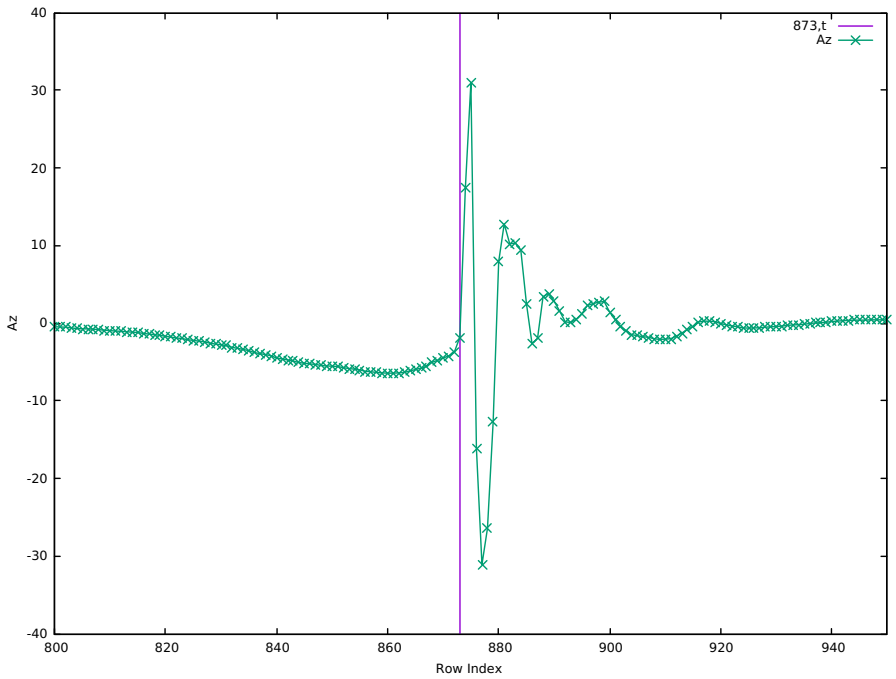


Figure 1: Az vs row index plot.

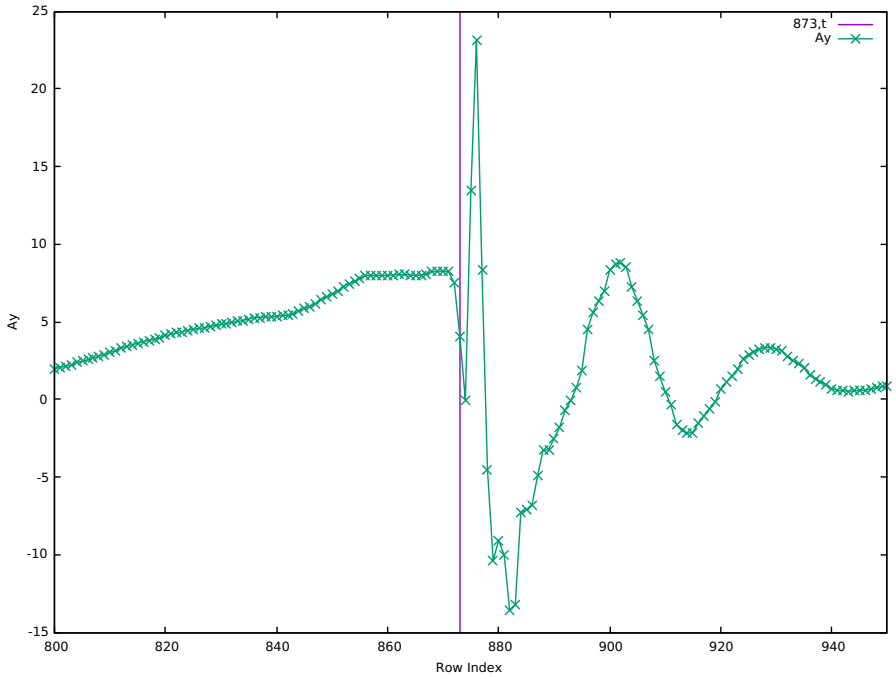


Figure 2: Ay vs row index plot.

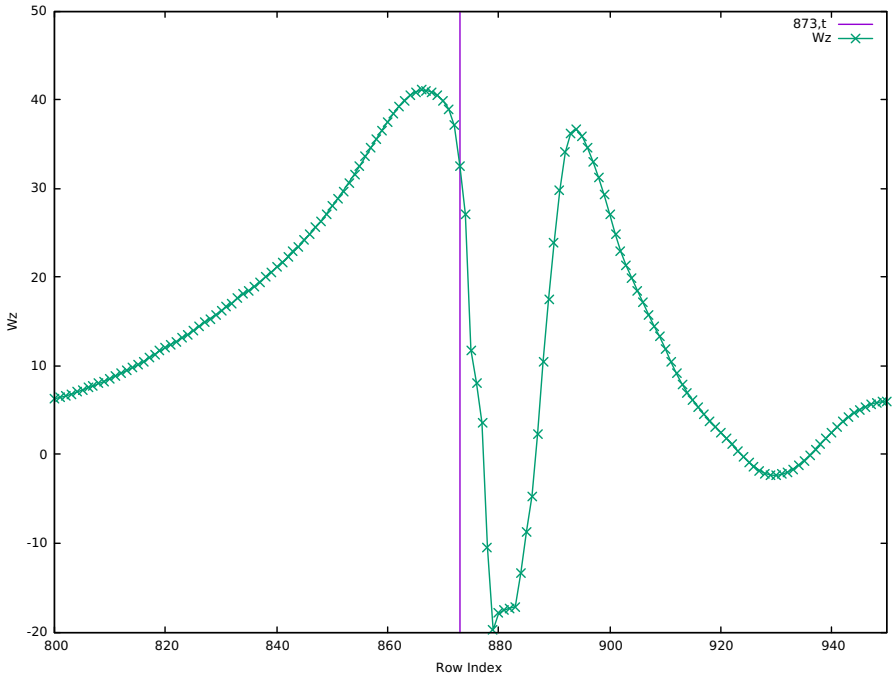


Figure 3: Wz vs row index plot.