

## Salvaging of Shock Measurements

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Bodie Technology

This presentation explores how one can salvage some badly distorted shock measurements, particularly ones with rather bad zero shifts. This is referred to as “salvaging” and not data correction.

Data correction would apply techniques like LP (low pass) filtering to remove sensor resonance. We know the precise cause of the distortion and are removing it.

Salvaging is when your data does not pass credibility checks and you "map" the data into a credible form via some form of detrending or similar (here HP - high pass filtering is used to perform the detrending). In this case, you do not precisely know the cause of the distortion, but you know its result -- that velocity and displacement are implausibly drifting. The mapping removes the undesirable behavior in one of the kinematic views of the data. You can think of this along the same lines of doing linear regression or some other type of curve fit to data.

**Key Findings (Refer to “Exploring Salvaging of Beam Measurements from 2026\_04\_27” below)**

### 1. Objective of the Study

The study evaluated whether high-pass (HP) signal processing methods could “salvage” acceleration, velocity, and displacement measurements from beam impact tests that would otherwise drift or become unusable after integration. The author specifically notes that the goal was to determine whether the “VelDisp” HP salvaging algorithm would work effectively for this beam impact data.

### 2. Sensors Evaluated

Three accelerometer/sensor configurations were compared:

- PR\_7270A
- IEPE\_352A92
- PR\_727

### Raw Data Observations

#### PR\_7270A and PR\_727

The raw acceleration data for the PR sensors appeared relatively stable, but integrating to velocity and displacement introduced drift and low-frequency oscillations. The displacement traces still retained recognizable beam motion characteristics.

#### IEPE\_352A92

The IEPE sensor showed severe integration drift in the raw data:

- Velocity continually ramped upward over time
- Displacement grew unrealistically large
- Results became physically implausible
- This indicated strong low-frequency/DC bias contamination in the raw signal.

### **Effectiveness of Salvaging Methods**

The document compares several HP filtering strategies:

- salvaged\_via\_HP\_Accel
- salvaged\_via\_HP\_vel
- salvaged\_via\_HP\_disp
- salvaged\_via\_HP\_vel\_then\_disp

### **HP Applied Only to Acceleration**

Applying HP filtering only to acceleration improved the IEPE data somewhat, but displacement still exhibited large drift and unrealistic growth. The PR sensors improved modestly but still retained offset issues.

### **HP Applied to Velocity**

Filtering velocity produced significantly better displacement behavior for all sensors. Oscillatory beam motion became much more physically realistic and bounded.

### **HP Applied to Displacement**

Filtering displacement alone corrected some drift but could introduce distortions and instability, especially for the IEPE sensor. The IEPE displacement trace still became erratic near the end of the record.

### **Best Result: HP Velocity Then Displacement (“VelDisp”)**

The combined approach (HP\_vel\_then\_disp) produced the best overall results:

- All three sensors showed closely matching velocity and displacement responses
- Oscillations became stable and physically plausible
- Displacement remained bounded instead of drifting
- Cross-sensor agreement improved substantially

The author’s introductory conclusion that the “VelDisp” algorithm worked well for the beam impact data is supported by these comparison plots.

### **Cross-Sensor Comparisons**

Pages 19–21 compare all three sensors after the final salvage processing:

#### **Acceleration**

Acceleration traces became highly consistent across all sensors, with similar damping and oscillation patterns.

## **Velocity**

Velocity responses aligned closely in both phase and amplitude, indicating that the HP salvage method preserved meaningful dynamic content.

## **Displacement**

Displacement traces became nearly identical across sensors after processing, demonstrating successful recovery of low-frequency motion information.

## **PVSS (Pseudo Velocity Shock Spectrum) Results**

PVSS curves are compared before and after salvaging.

### **Raw PVSS**

The raw PVSS curves differed substantially at low frequencies, particularly for the IEPE sensor, due to drift contamination.

### **Salvaged PVSS**

After applying the HP\_vel\_then\_disp method:

- The PVSS curves aligned much more closely
- Low-frequency agreement improved dramatically
- Sensor consistency increased across the frequency range

This indicates that the salvage processing preserved the important shock response characteristics while removing integration artifacts.

## **Overall Conclusion**

The study concludes that:

- Raw beam shock measurements, especially from IEPE accelerometers, can contain significant low-frequency bias and integration drift.
- Simple integration alone is insufficient for reliable velocity/displacement recovery.
- The combined high-pass filtering approach applied sequentially to velocity and displacement (“VelDisp”) successfully salvages the data.
- After processing, all three sensors produced comparable and physically meaningful acceleration, velocity, displacement, and PVSS results.
- The findings support using the HP\_vel\_then\_disp salvage method for beam shock analysis and potentially other transient structural measurements.

# Exploring Salvaging of Beam Measurements from 2026\_04\_27

By: Ted Diehl, Bodie Technology, Inc.

Date: 12-May-2026 07:34:50

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- [Comparing all 3 sensors after salvaged\\_via\\_HP\\_vel\\_then\\_disp ⇒ Accel](#)
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- [Comparing all 3 sensors after salvaged\\_via\\_HP\\_vel\\_then\\_disp ⇒ Disp](#)
- [Comparing all 3 sensors after salvaged\\_via\\_HP\\_vel\\_then\\_disp ⇒ PVSS\\_Salvaged](#)
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## Overview ⇒ Introduction

Overview Raw salvaged\_via\_HP\_Accel salvaged\_via\_HP\_vel salvaged\_via\_HP\_disp salvaged\_via\_HP\_vel\_then\_disp Comparing all 3 sensors after salvaged\_via\_HP\_vel\_then\_disp

Introduction Test Setup

Beam Shock Analysis.

Data collected by Ted Diehl, Bodie Technology, Inc.

Kornucopia® ML™ analysis script by Ted Diehl, Bodie Technology, Inc.

Testing dates circa April 27, 2026.

Please refer to the following link for the terms and conditions governing our consulting services:

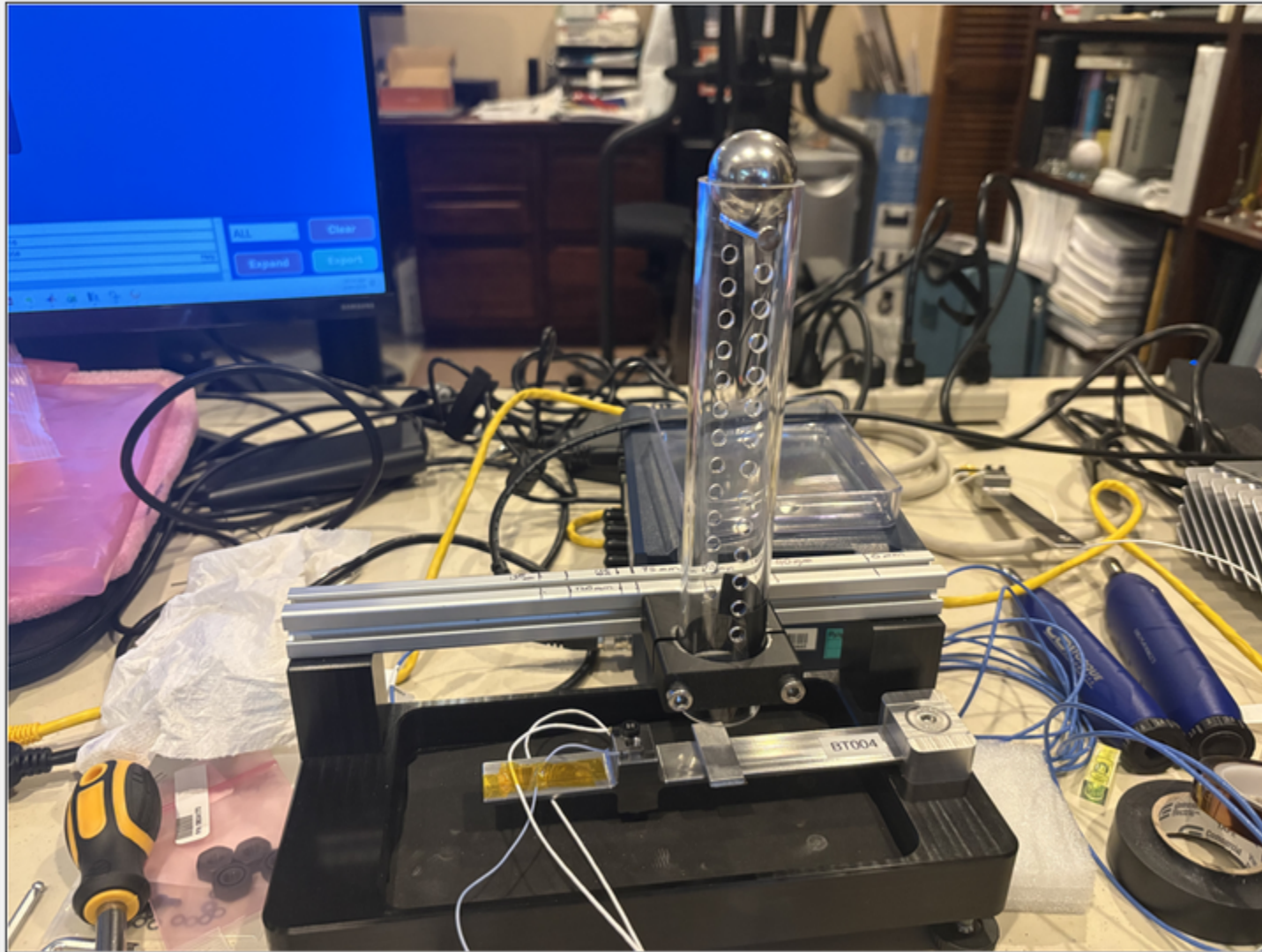
<https://bodietech.com/TermsConditions-Consulting>

This small study showed that for the beam impact that HP salvaging using the 'VelDisp' algorithm worked best for this data.

# Overview ⇒ Test Setup

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Introduction Test Setup

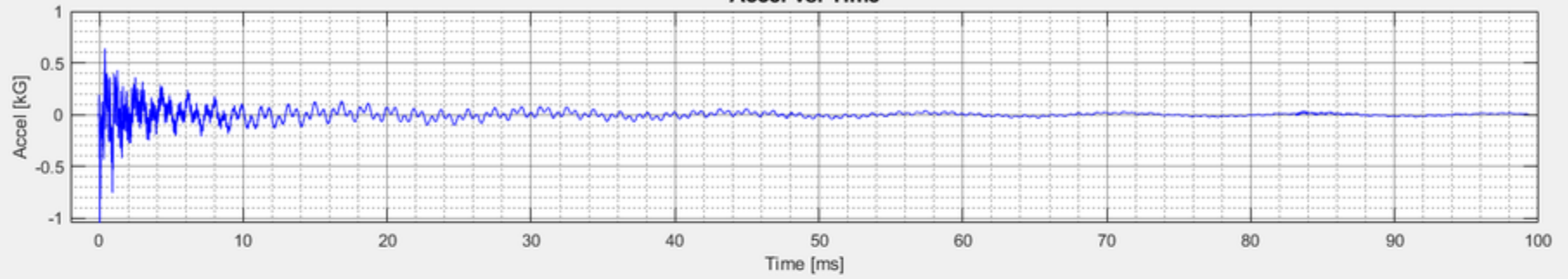


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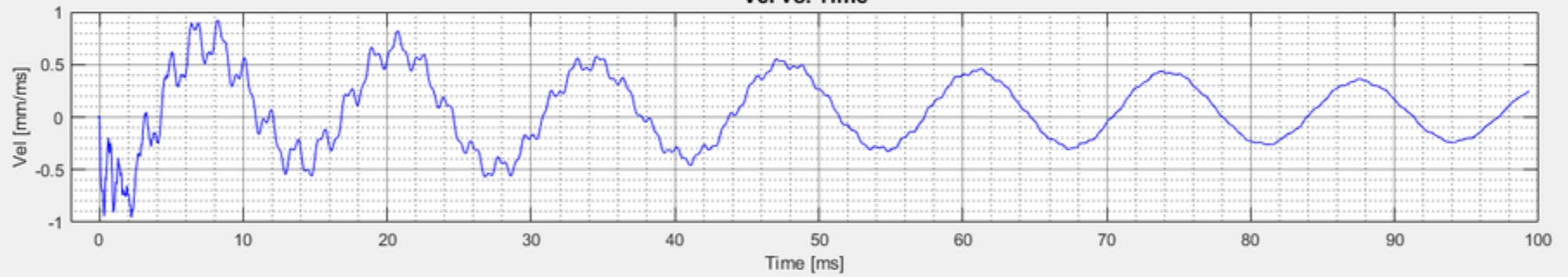
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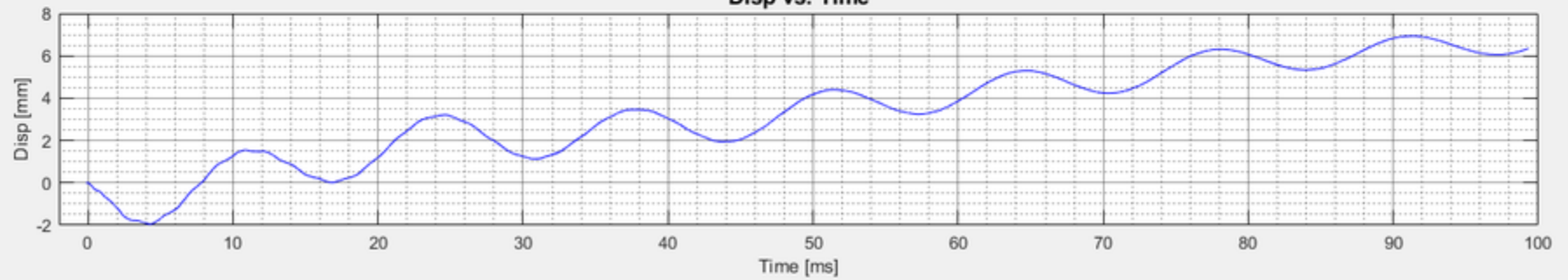
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### Vel vs. Time



### Disp vs. Time

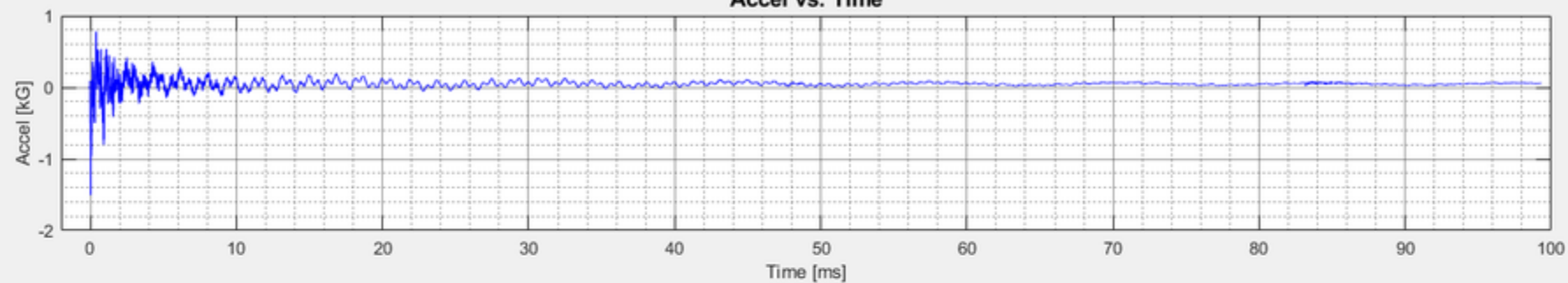


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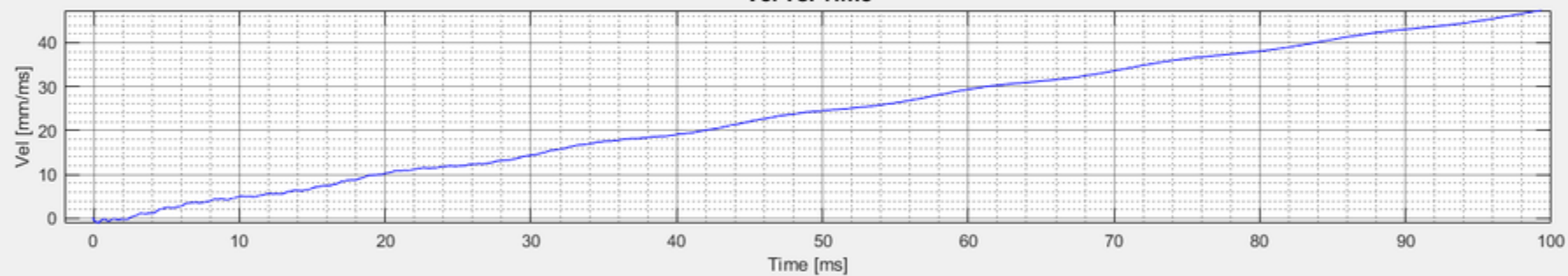
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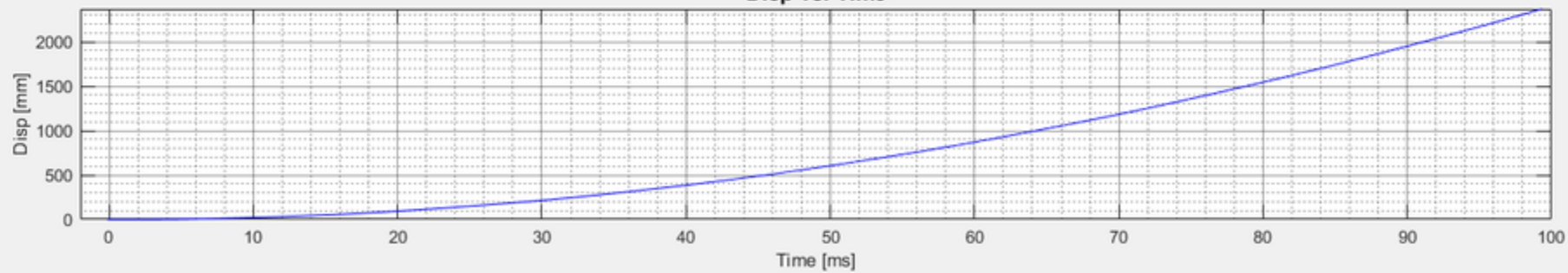
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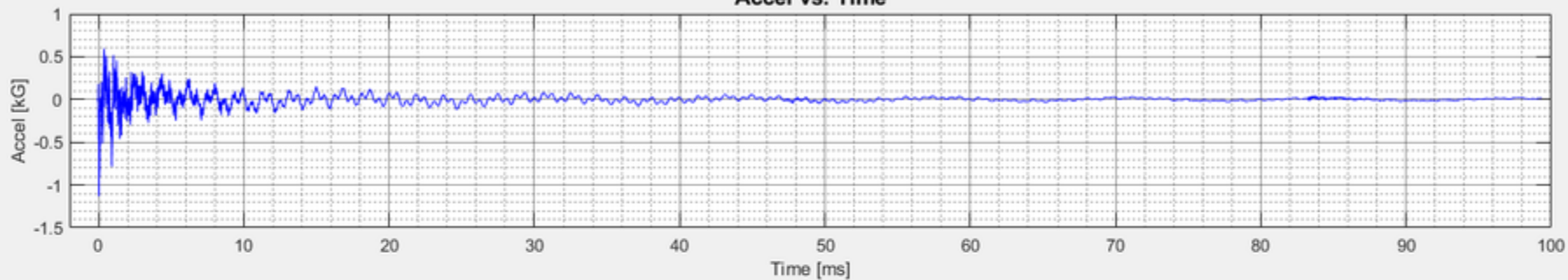
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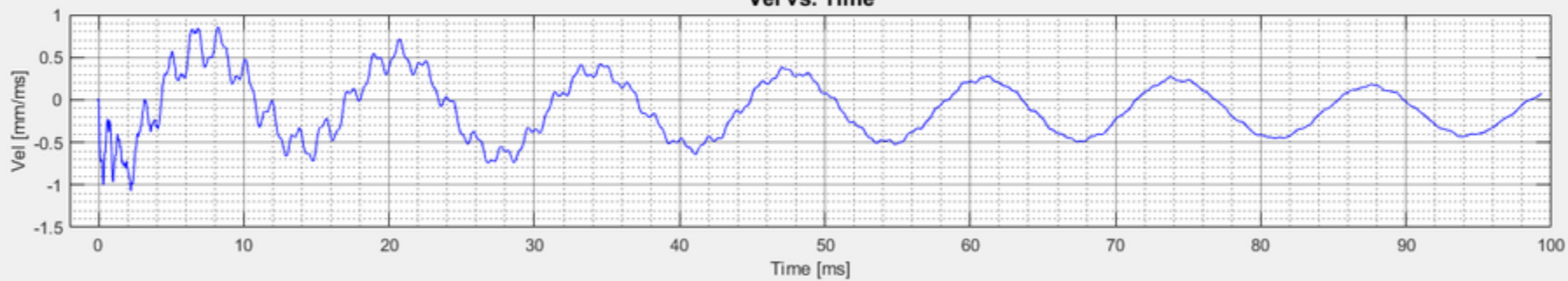
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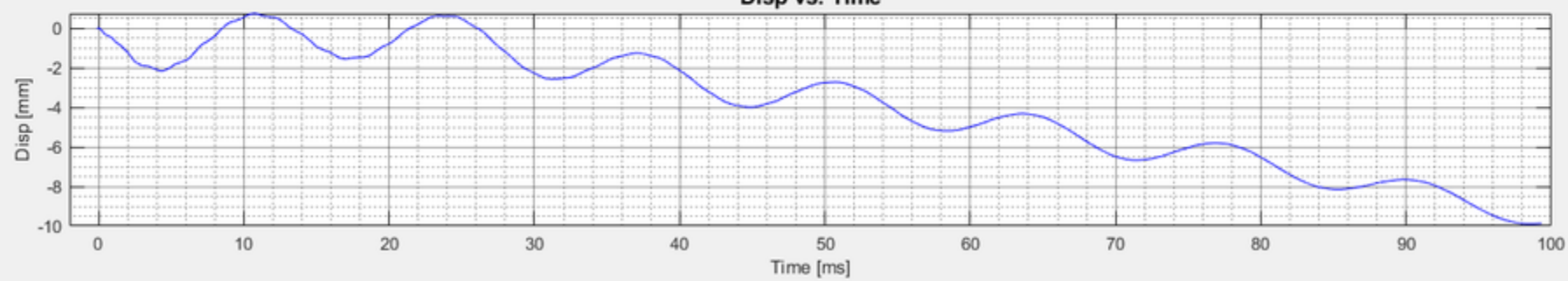
Accel vs. Time



Vel vs. Time



Disp vs. Time

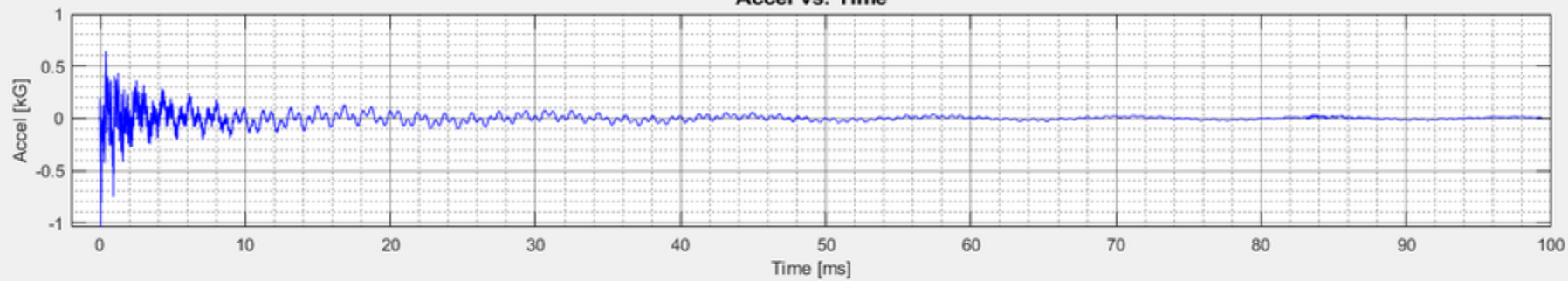


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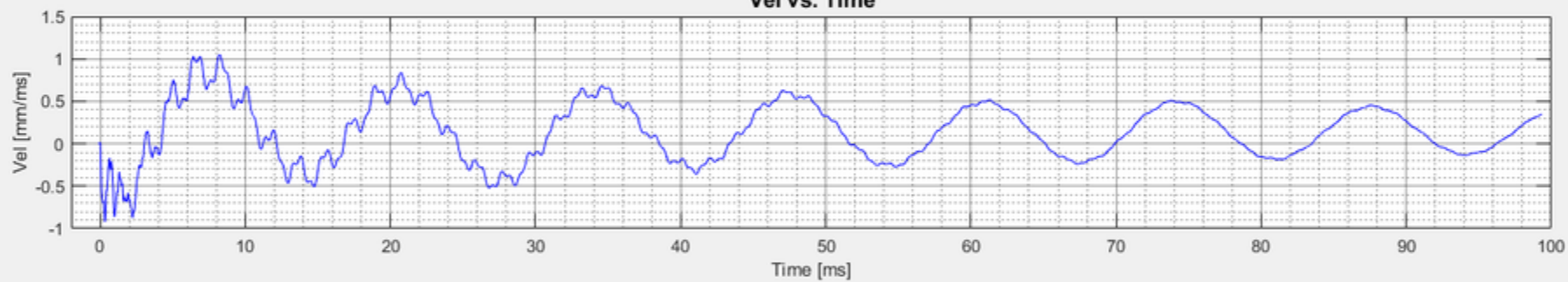
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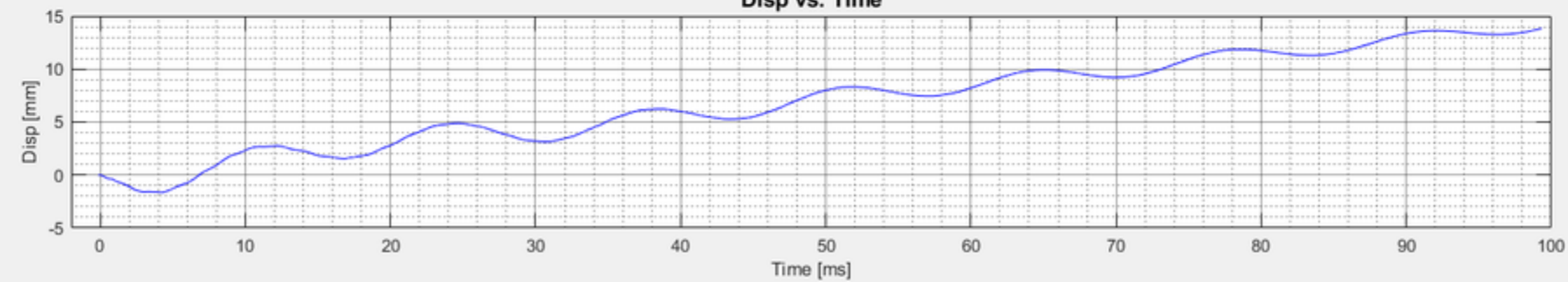
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### Vel vs. Time



### Disp vs. Time

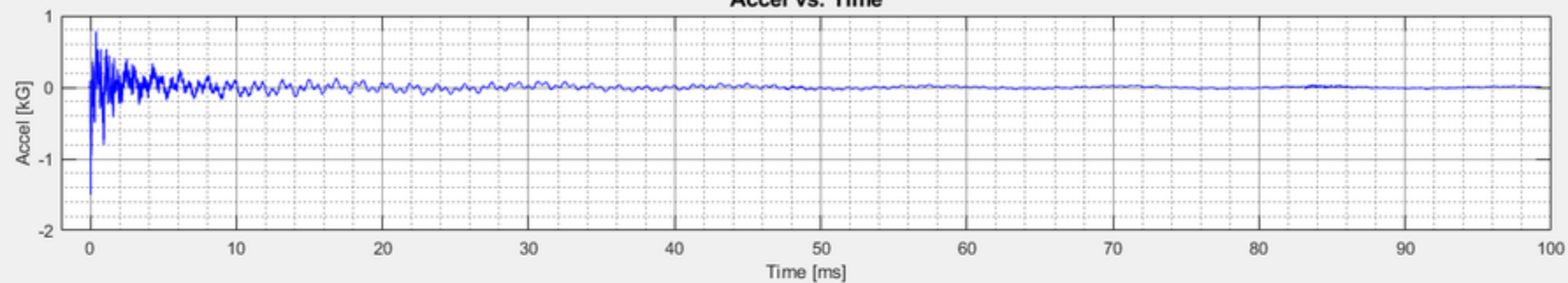


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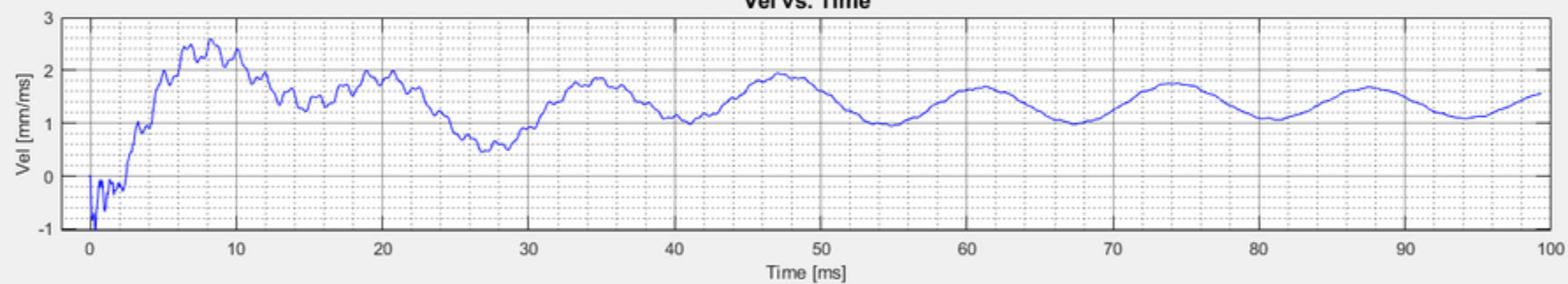
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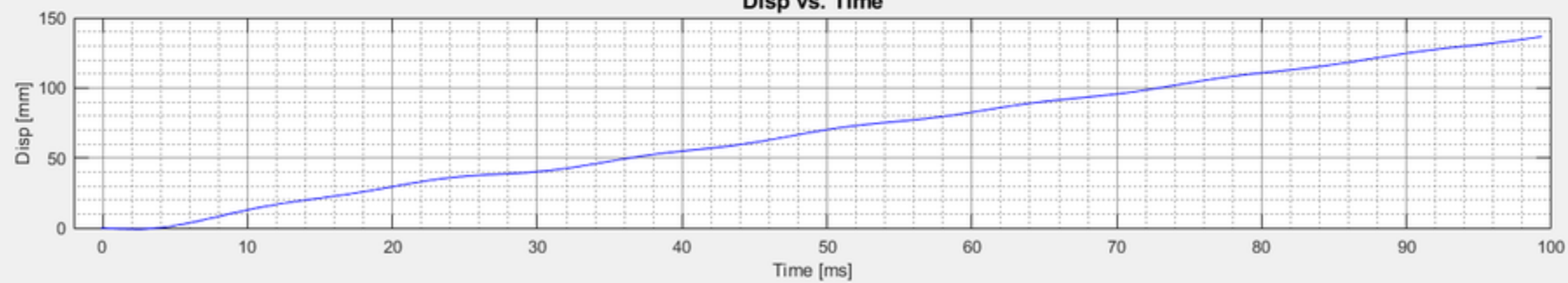
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### Vel vs. Time



### Disp vs. Time

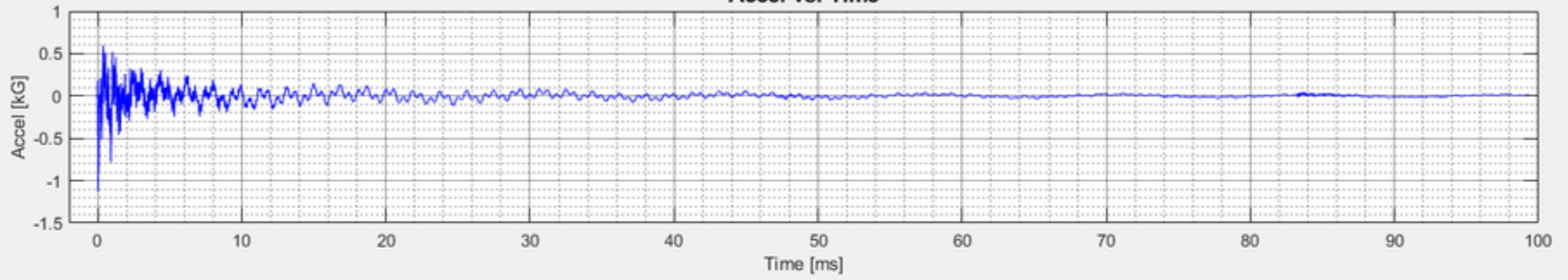


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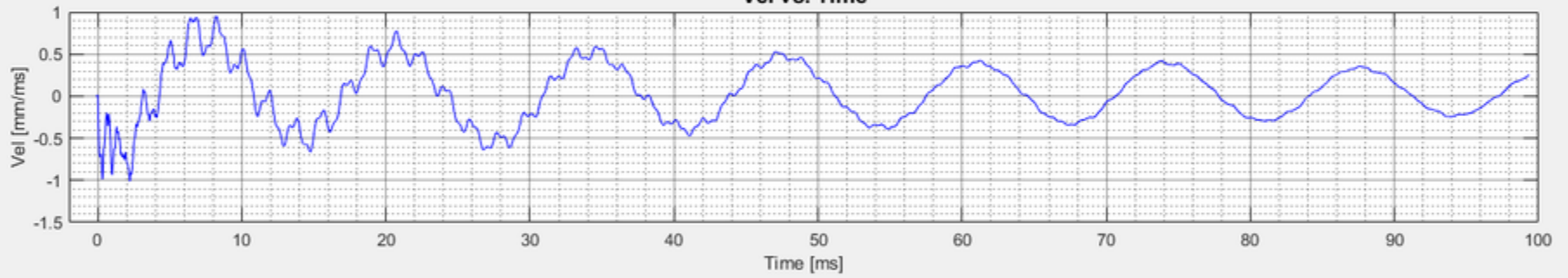
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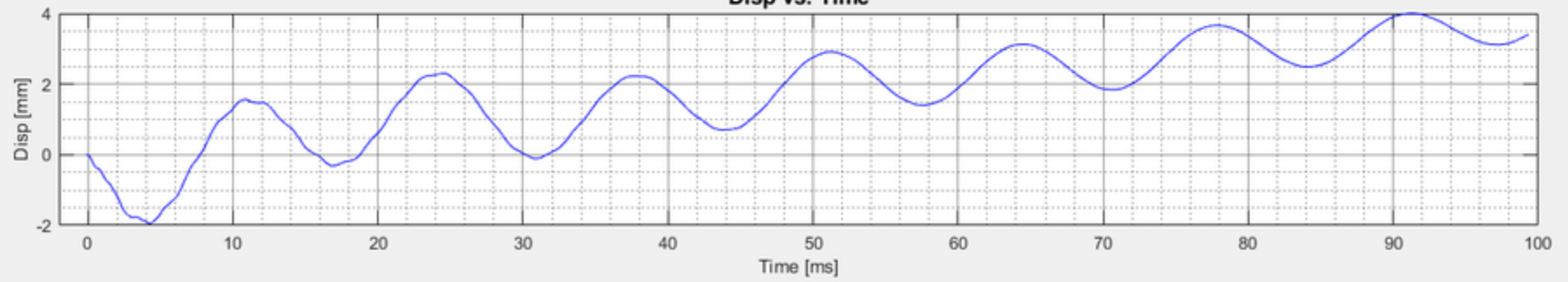
### Accel vs. Time



### Vel vs. Time



### Disp vs. Time

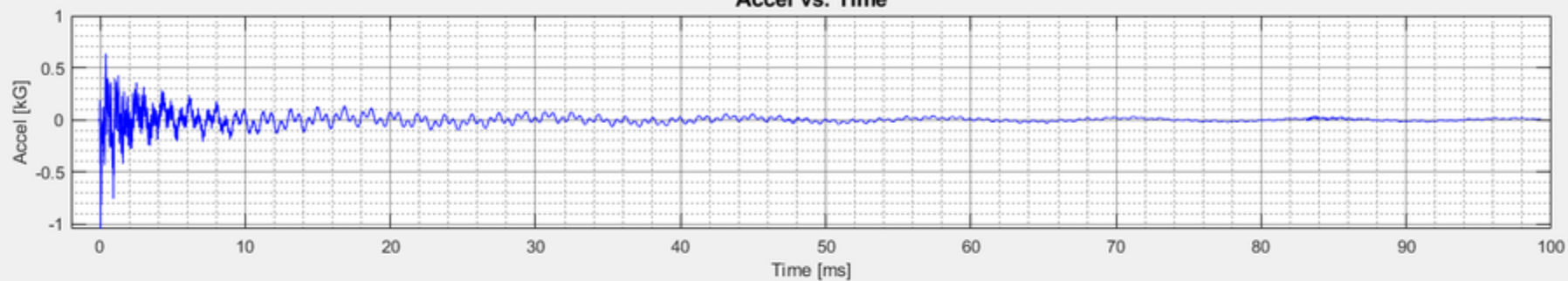


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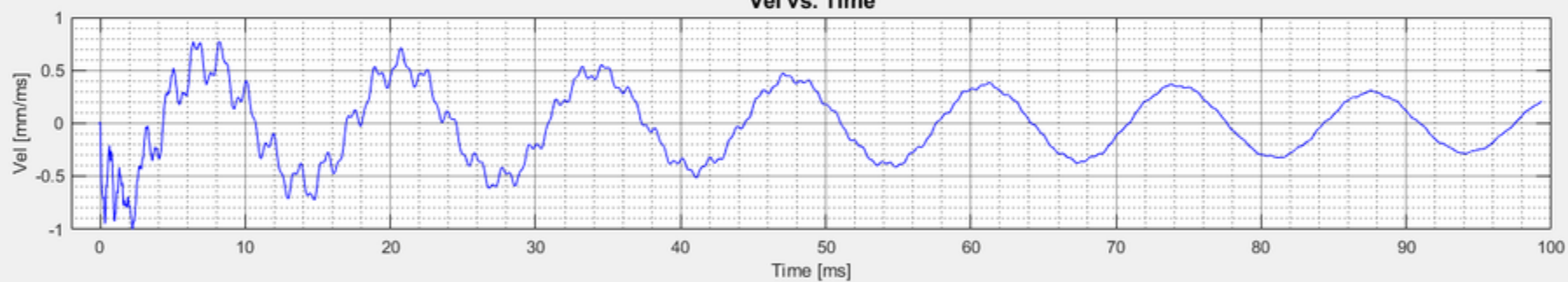
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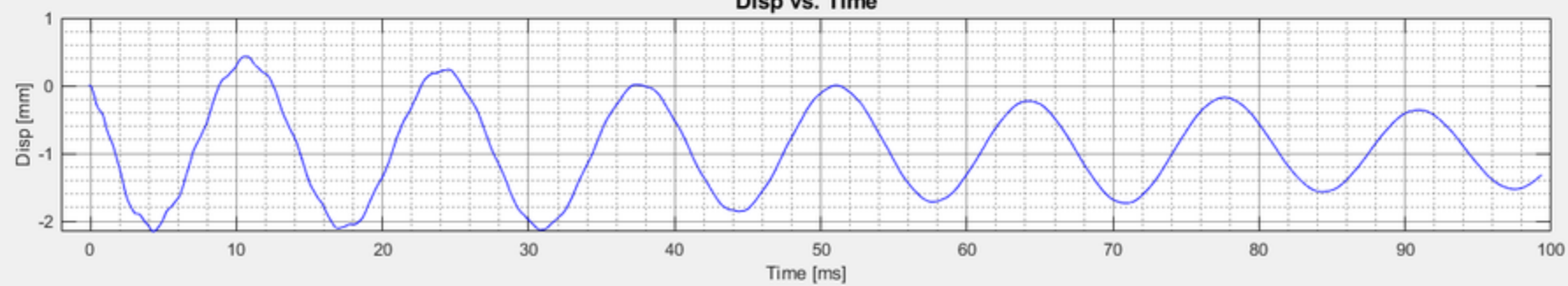
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### Vel vs. Time



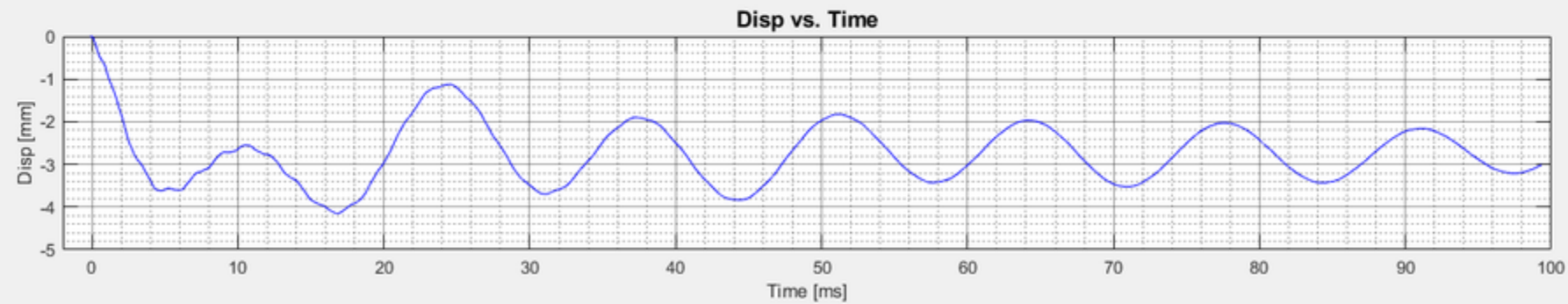
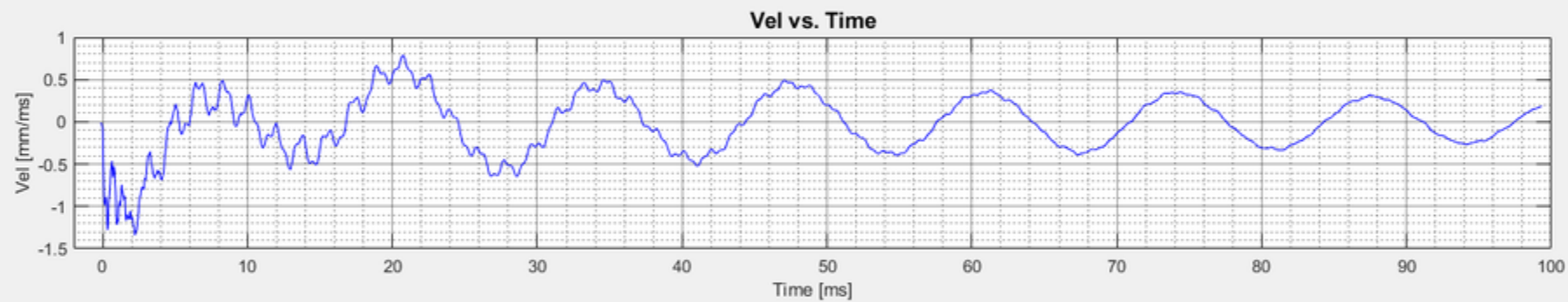
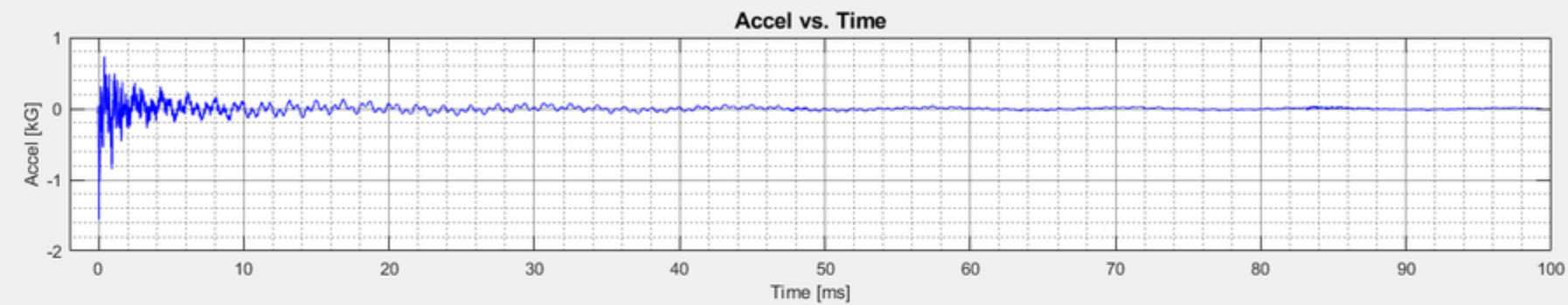
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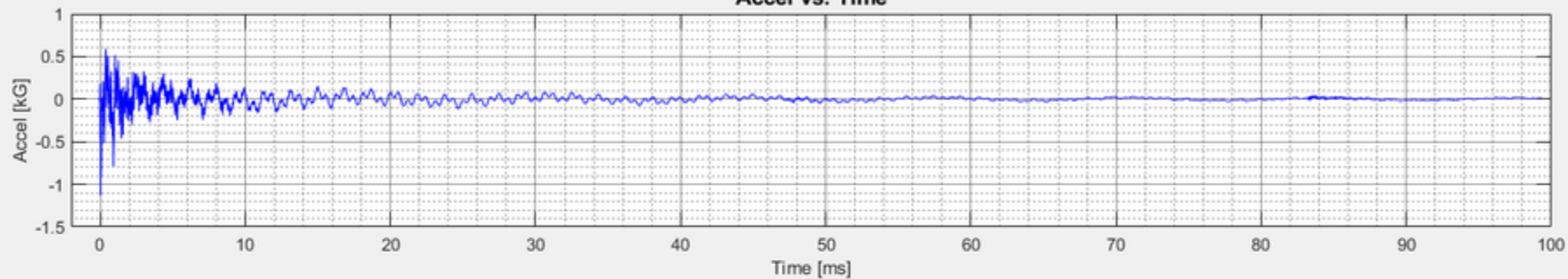


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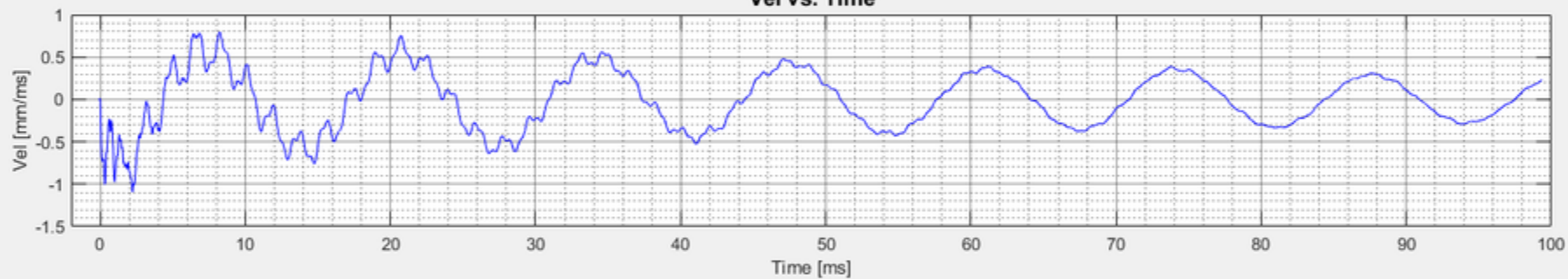
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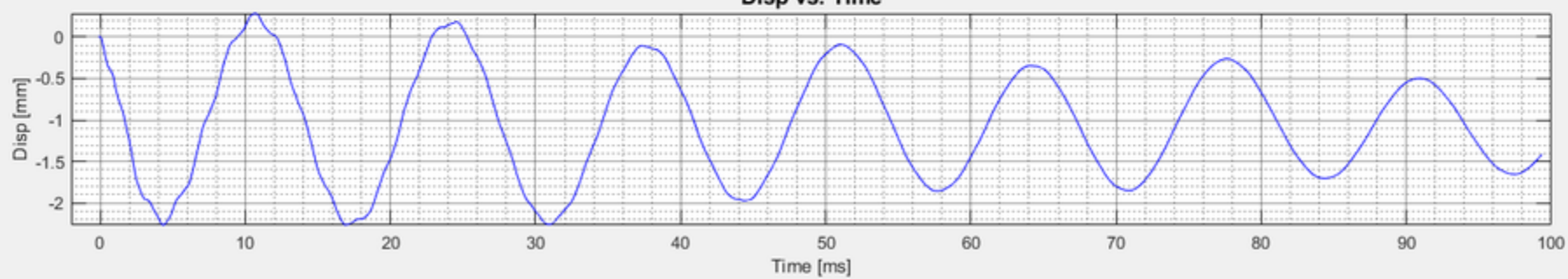
### Accel vs. Time



### Vel vs. Time



### Disp vs. Time

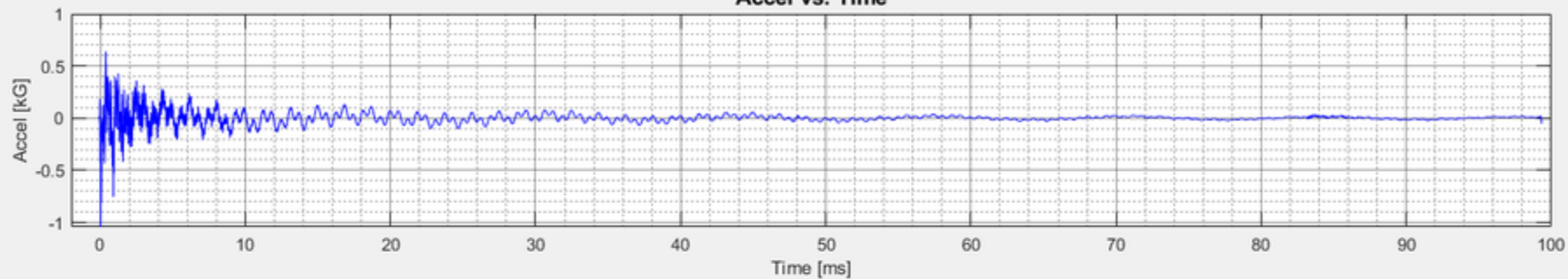


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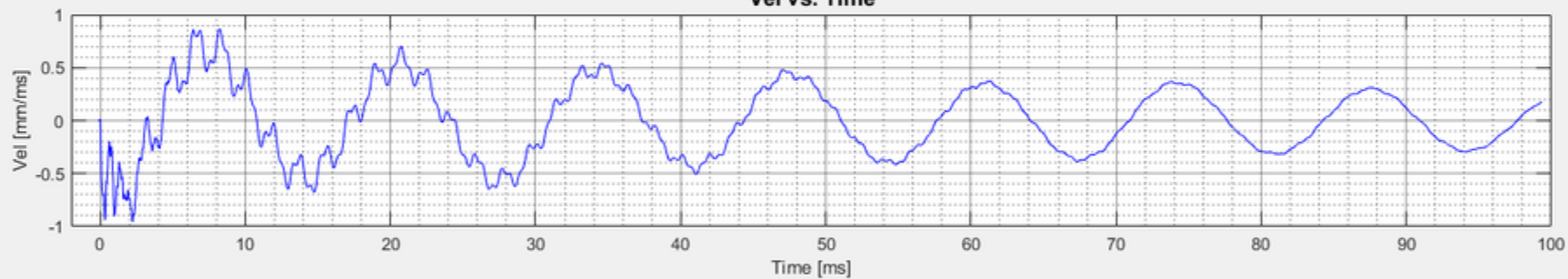
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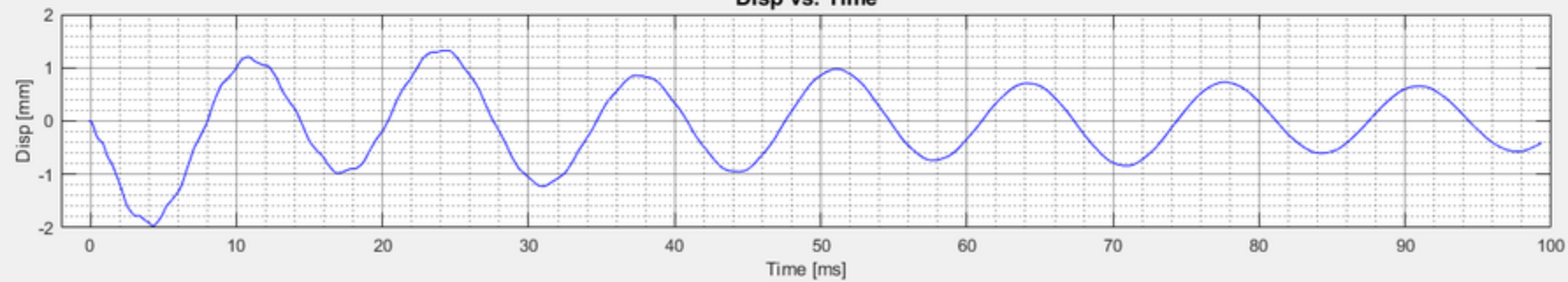
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### Vel vs. Time



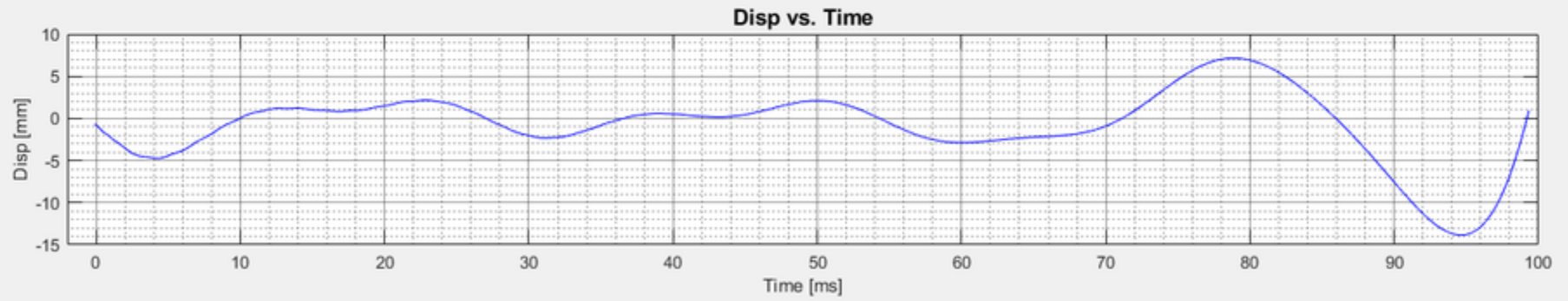
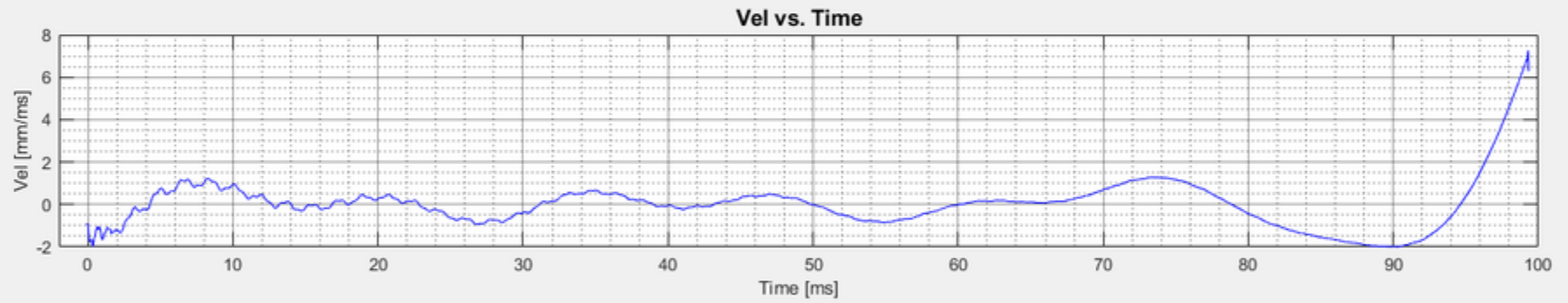
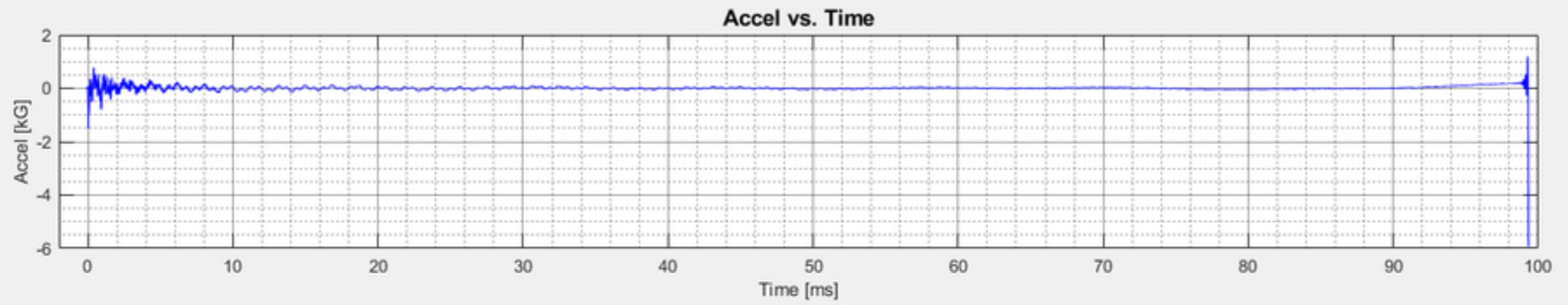
### Disp vs. Time



# salvaged\_via\_HP\_disp ⇒ IEPE\_352A92

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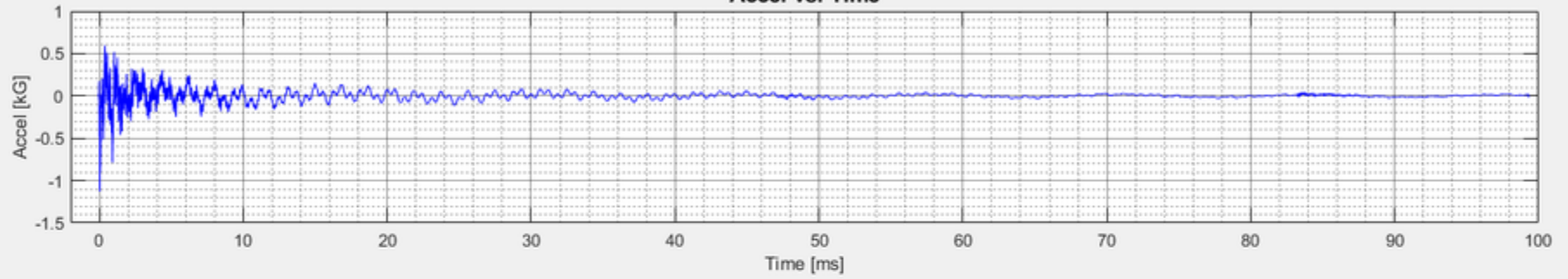


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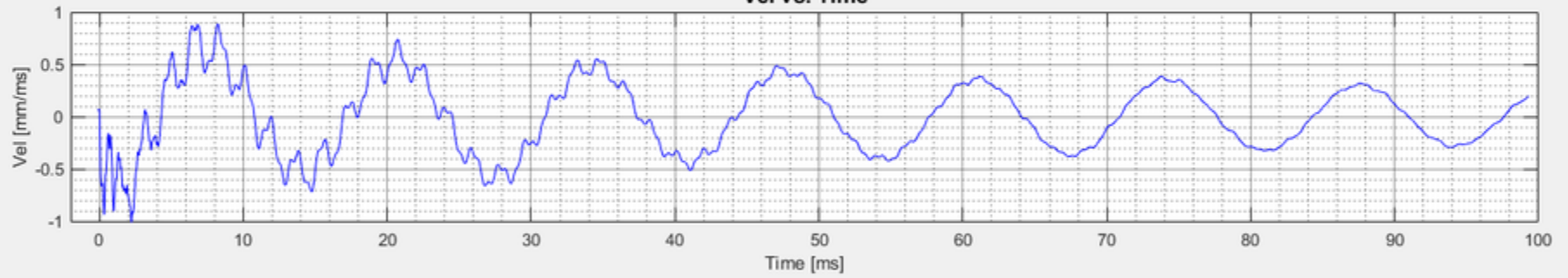
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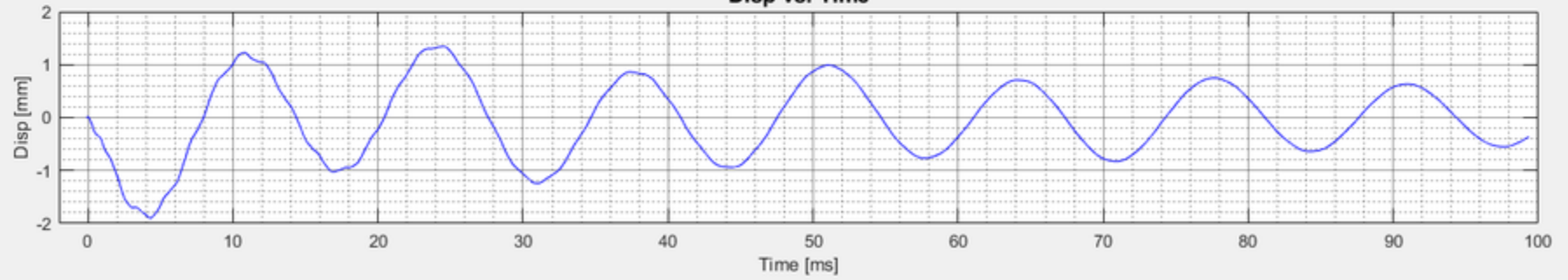
### Accel vs. Time



### Vel vs. Time



### Disp vs. Time

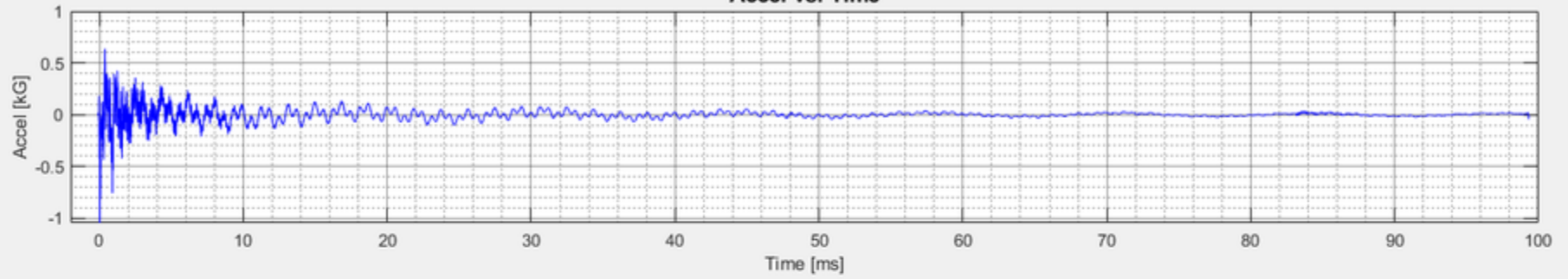


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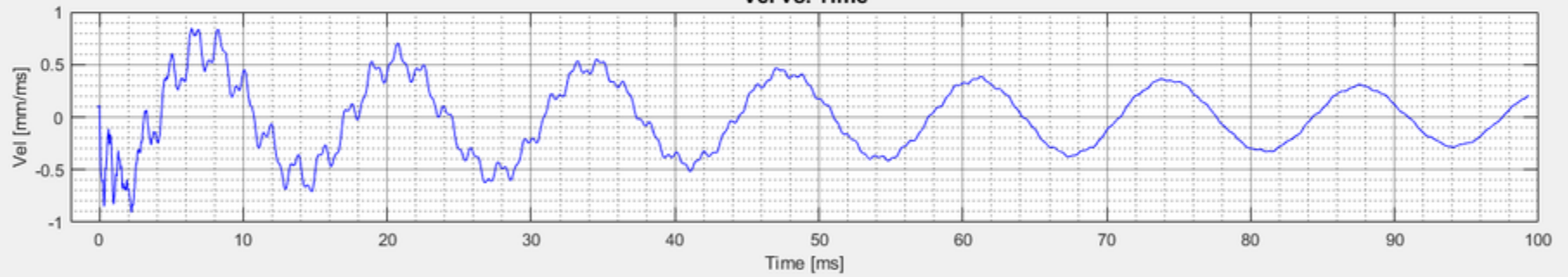
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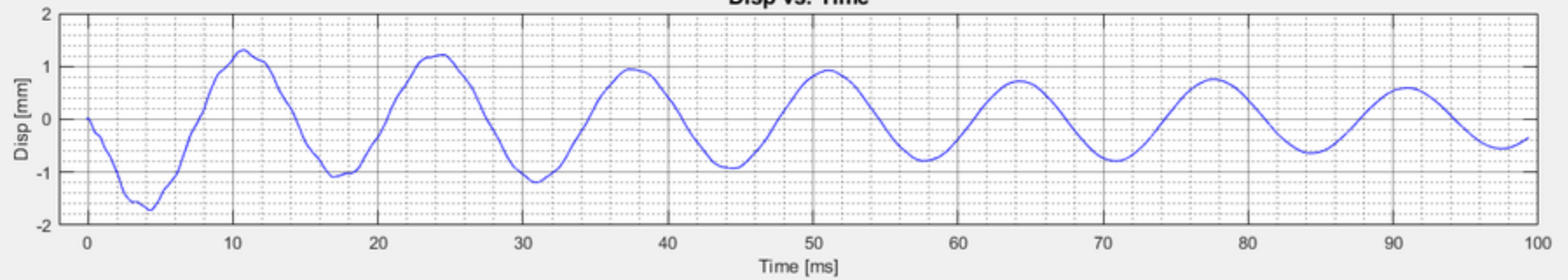
### Accel vs. Time



### Vel vs. Time



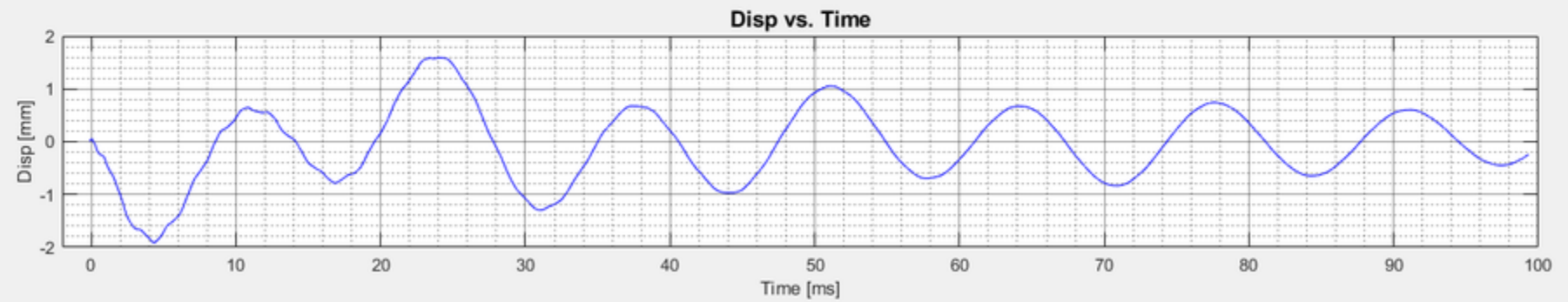
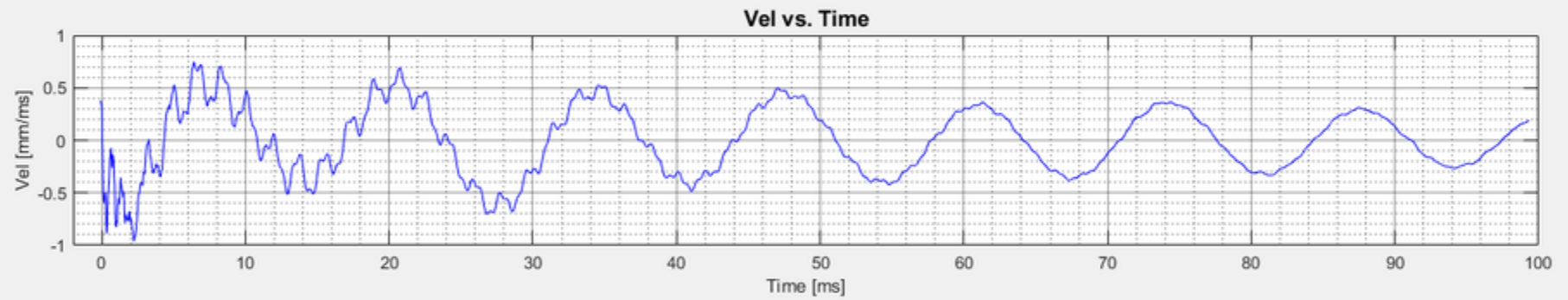
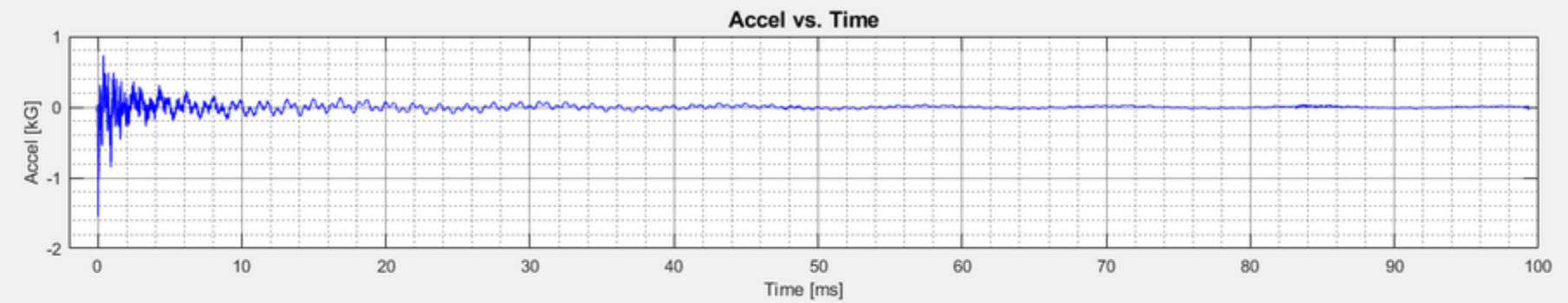
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# salvaged\_via\_HP\_vel\_then\_disp ⇒ IEPE\_352A92

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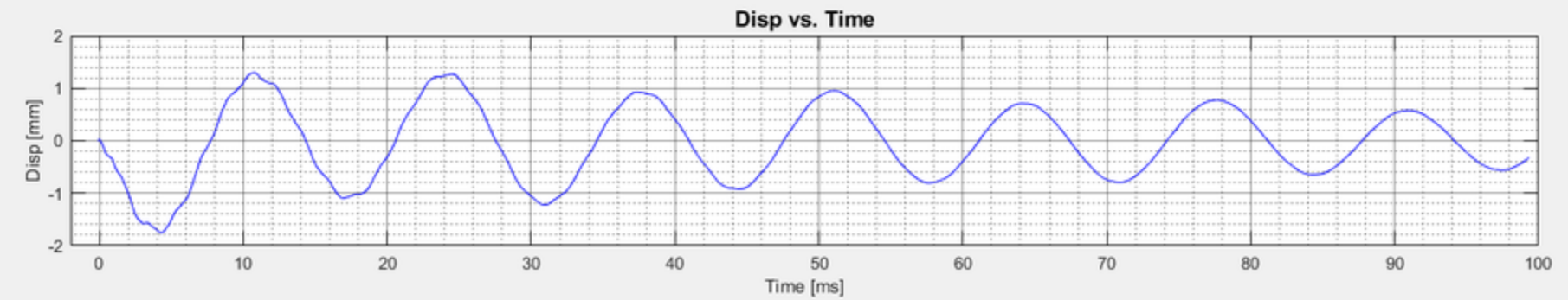
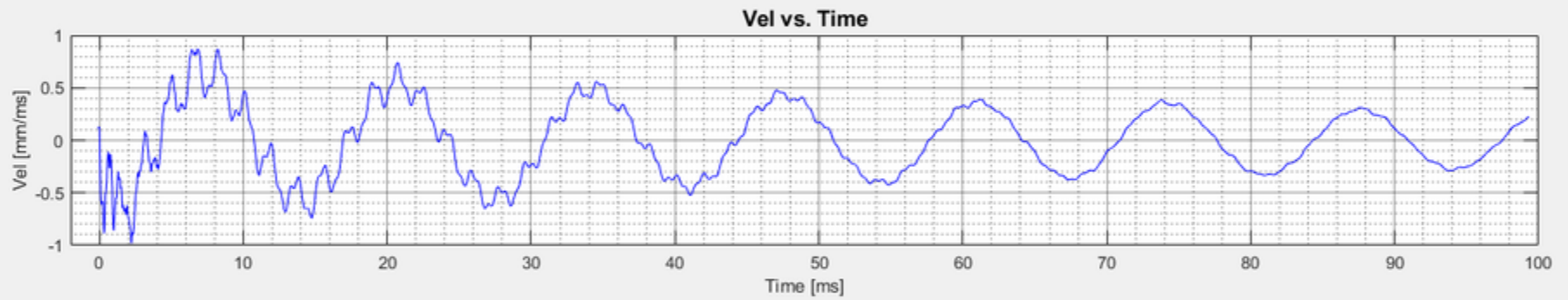
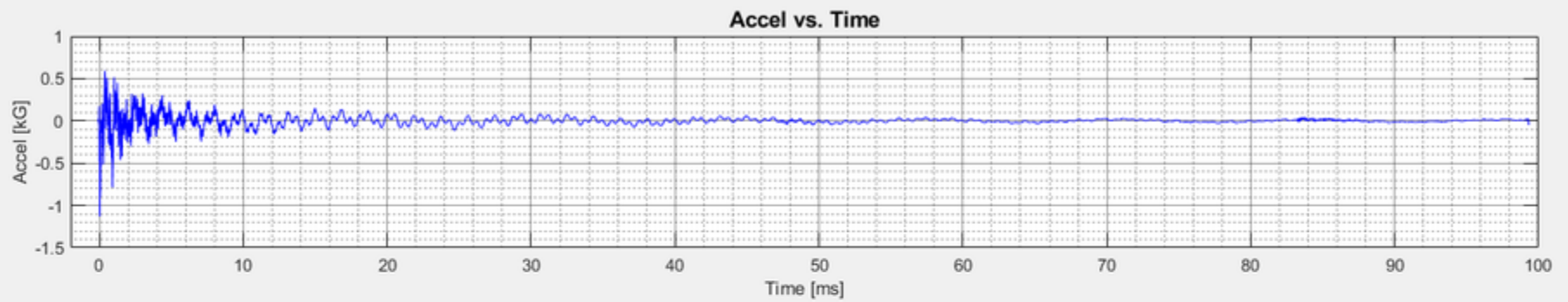
PR\_7270A IEPE\_352A92 PR\_727



# salvaged\_via\_HP\_vel\_then\_disp ⇒ PR\_727

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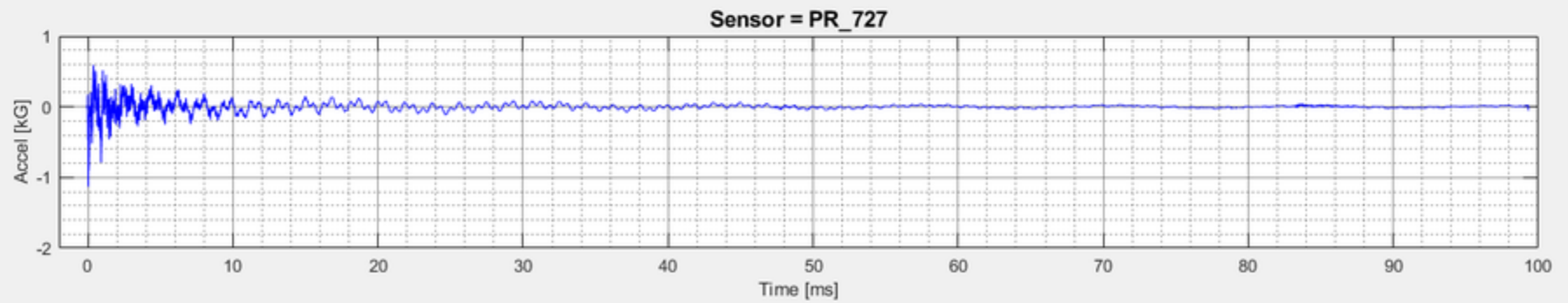
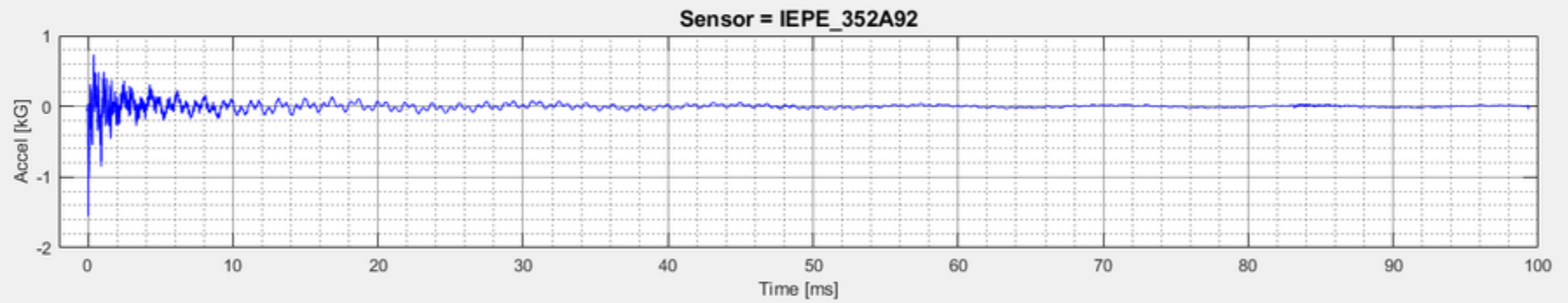
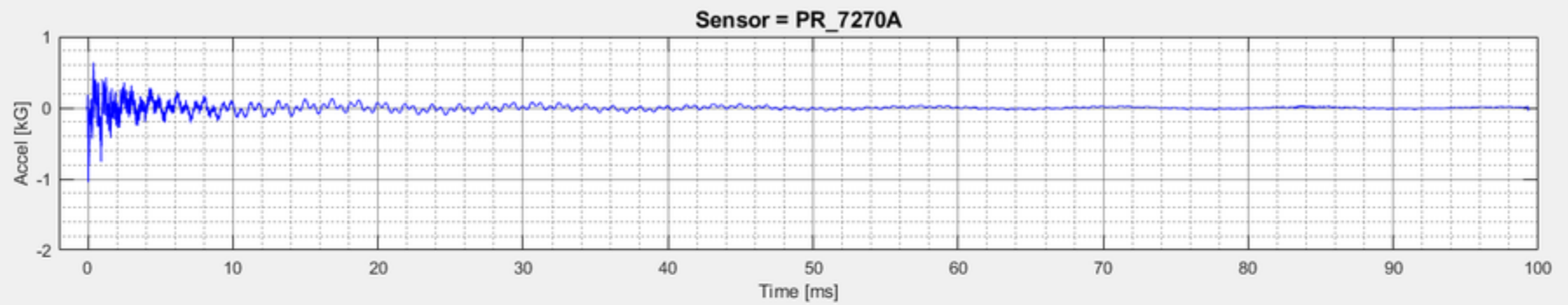
PR\_7270A IEPE\_352A92 PR\_727



# Comparing all 3 sensors after salvaged\_via\_HP\_vel\_then\_disp ⇒ Accel

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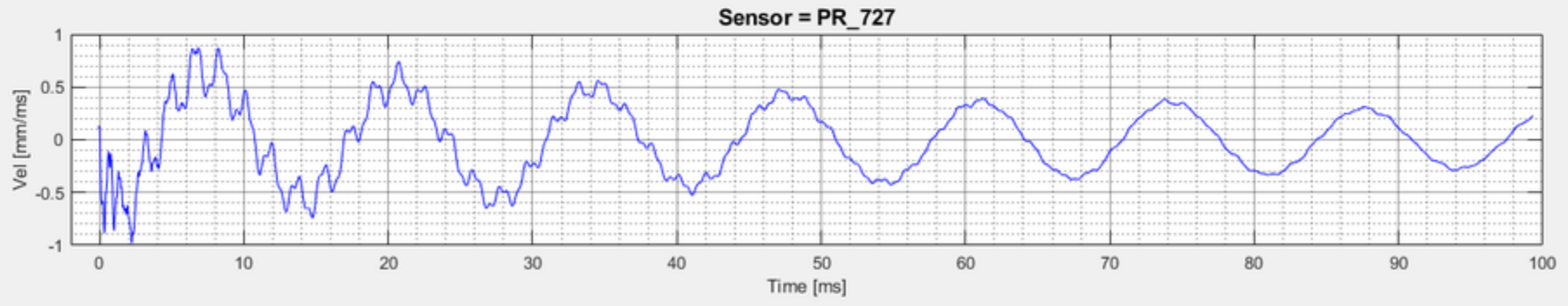
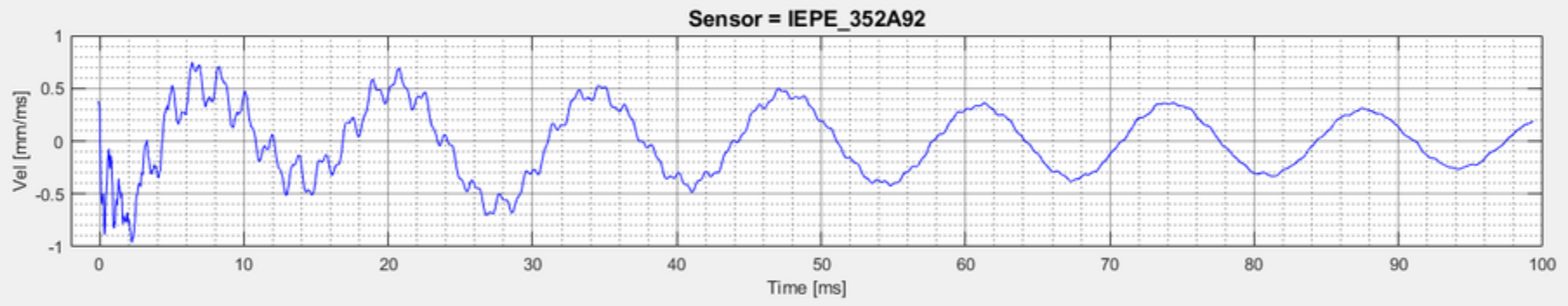
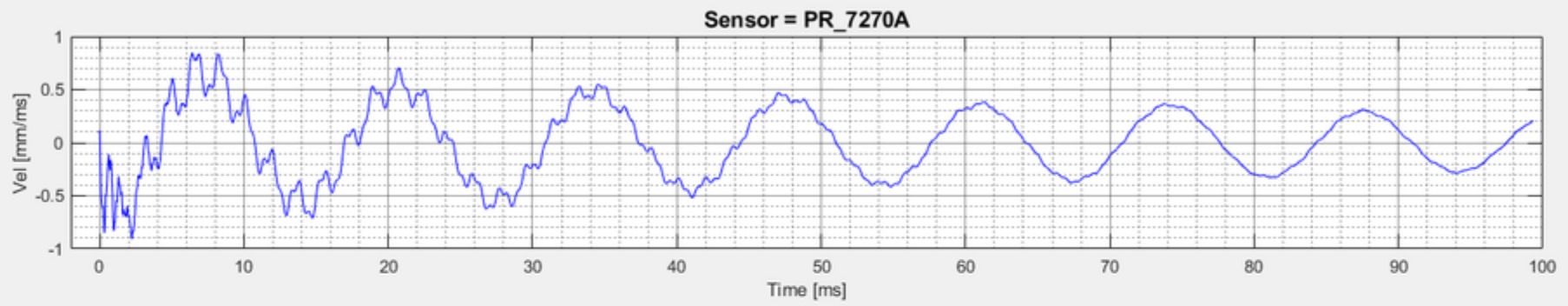
Accel Vel Disp PVSS\_Salvaged PVSS\_Raw



# Comparing all 3 sensors after salvaged\_via\_HP\_vel\_then\_disp ⇒ Vel

Overview Raw salvaged\_via\_HP\_Accel salvaged\_via\_HP\_vel salvaged\_via\_HP\_disp salvaged\_via\_HP\_vel\_then\_disp Comparing all 3 sensors after salvaged\_via\_HP\_vel\_then\_disp

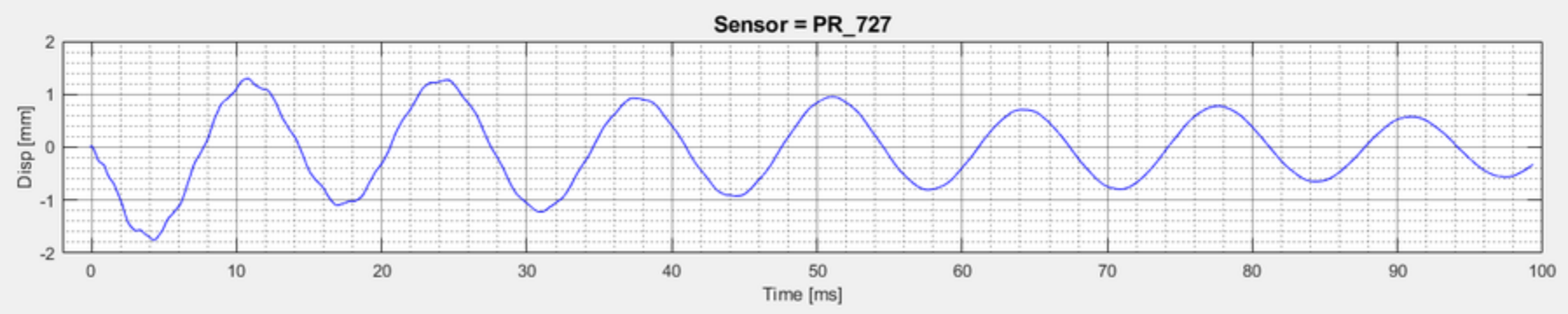
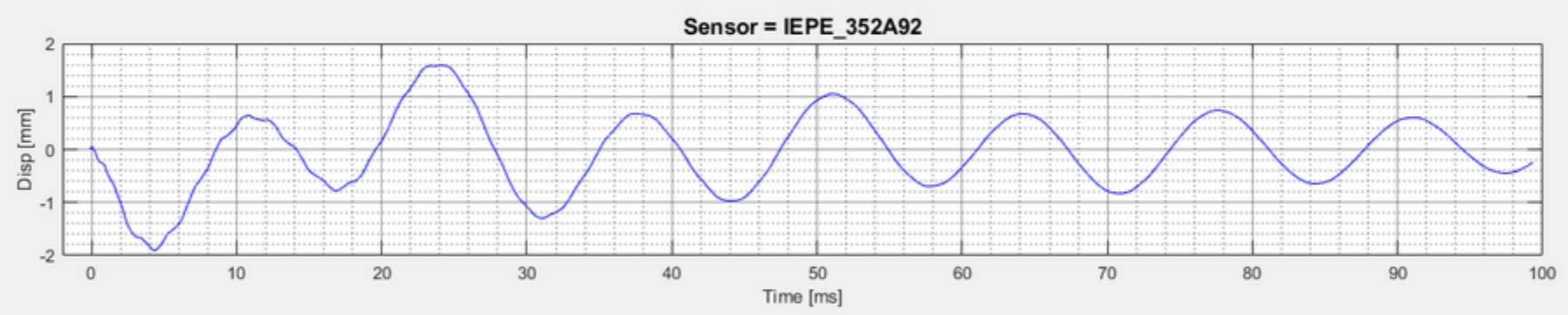
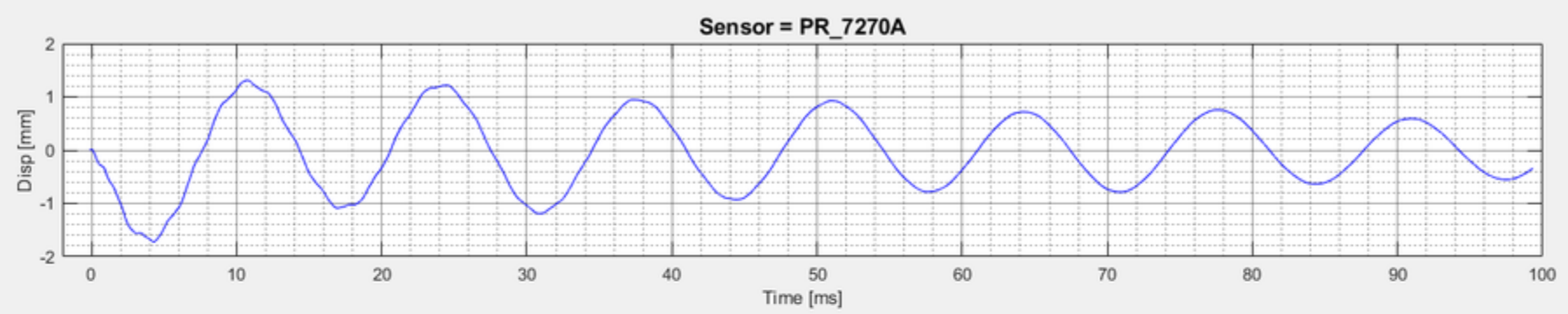
Accel Vel **Disp** PVSS\_Salvaged PVSS\_Raw



# Comparing all 3 sensors after salvaged\_via\_HP\_vel\_then\_disp ⇒ Disp

Overview Raw salvaged\_via\_HP\_Accel salvaged\_via\_HP\_vel salvaged\_via\_HP\_disp salvaged\_via\_HP\_vel\_then\_disp Comparing all 3 sensors after salvaged\_via\_HP\_vel\_then\_disp

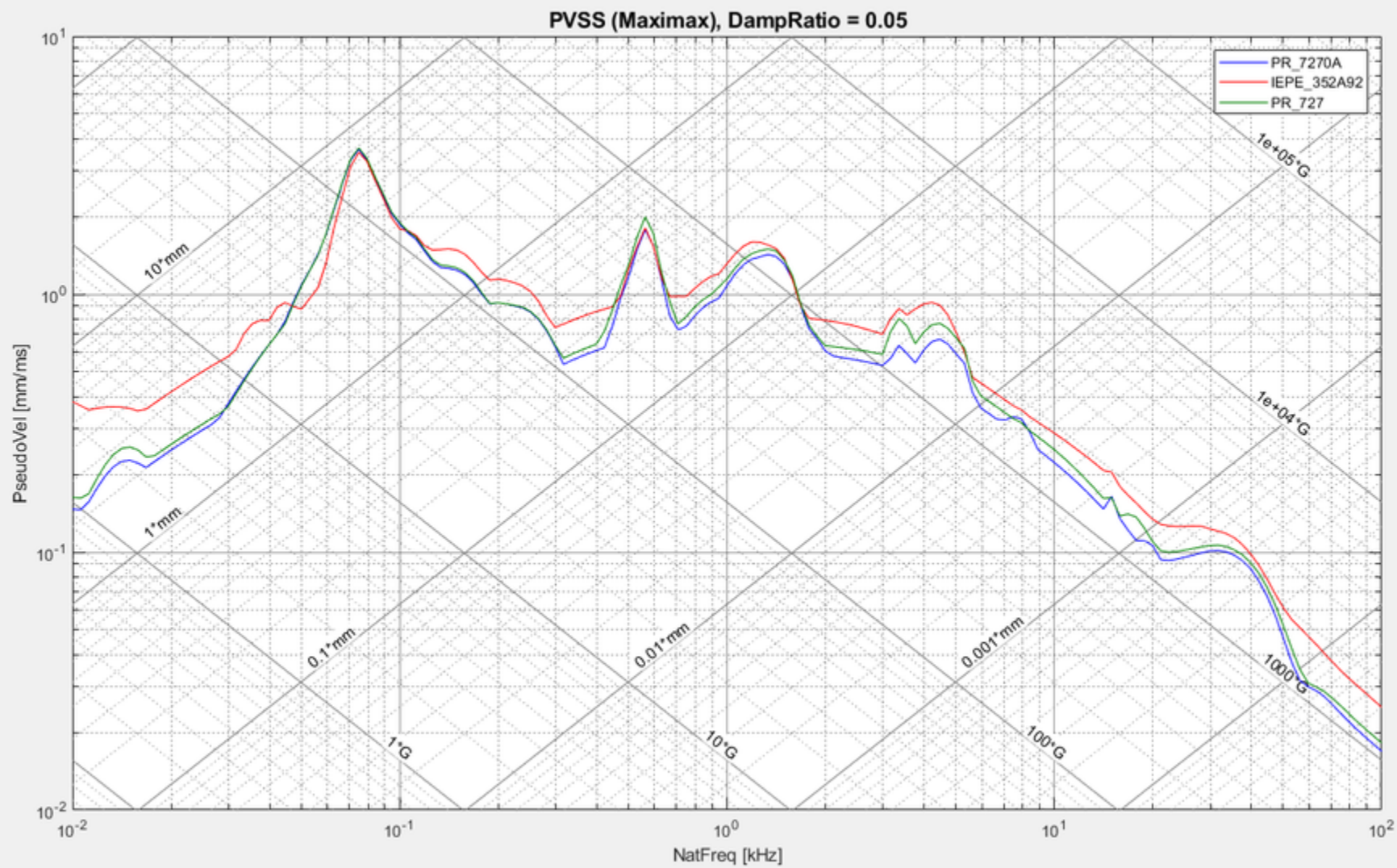
Accel Vel Disp PVSS\_Salvaged PVSS\_Raw



# Comparing all 3 sensors after salvaged\_via\_HP\_vel\_then\_disp ⇒ PVSS\_Salvaged

Overview Raw salvaged\_via\_HP\_Accel salvaged\_via\_HP\_vel salvaged\_via\_HP\_disp salvaged\_via\_HP\_vel\_then\_disp Comparing all 3 sensors after salvaged\_via\_HP\_vel\_then\_disp

Accel Vel Disp PVSS\_Salvaged PVSS\_Raw



# Comparing all 3 sensors after salvaged\_via\_HP\_vel\_then\_disp ⇒ PVSS\_Raw

Overview Raw salvaged\_via\_HP\_Accel salvaged\_via\_HP\_vel salvaged\_via\_HP\_disp salvaged\_via\_HP\_vel\_then\_disp Comparing all 3 sensors after salvaged\_via\_HP\_vel\_then\_disp

Accel Vel Disp PVSS\_Salvaged PVSS\_Raw

