Applicability of Synchrophasor Data for Fault Analysis

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Outline

- Introduction

- PMU data for fault analysis
  - Sequence components
  - Impedance based fault location algorithms

- Factor considered
  - Effect of the filter type (P/M)
  - Effect of the fault duration (Number of cycles)

- Conclusions

Introduction

- The synchrophasor standard C37.118.1a-2014 presents two performance class filters
  - P : ~2 cycle duration filter
  - M: ~5 cycle duration filter

- This presentation focuses on the applicability of the P and M class synchrophasor data for fault analysis purposes.

- The synchrophasor data captured from an industrial PMU implemented as per the latest PMU standard was used for this analysis.

- Data is captured using in-built PDC program available with the device.
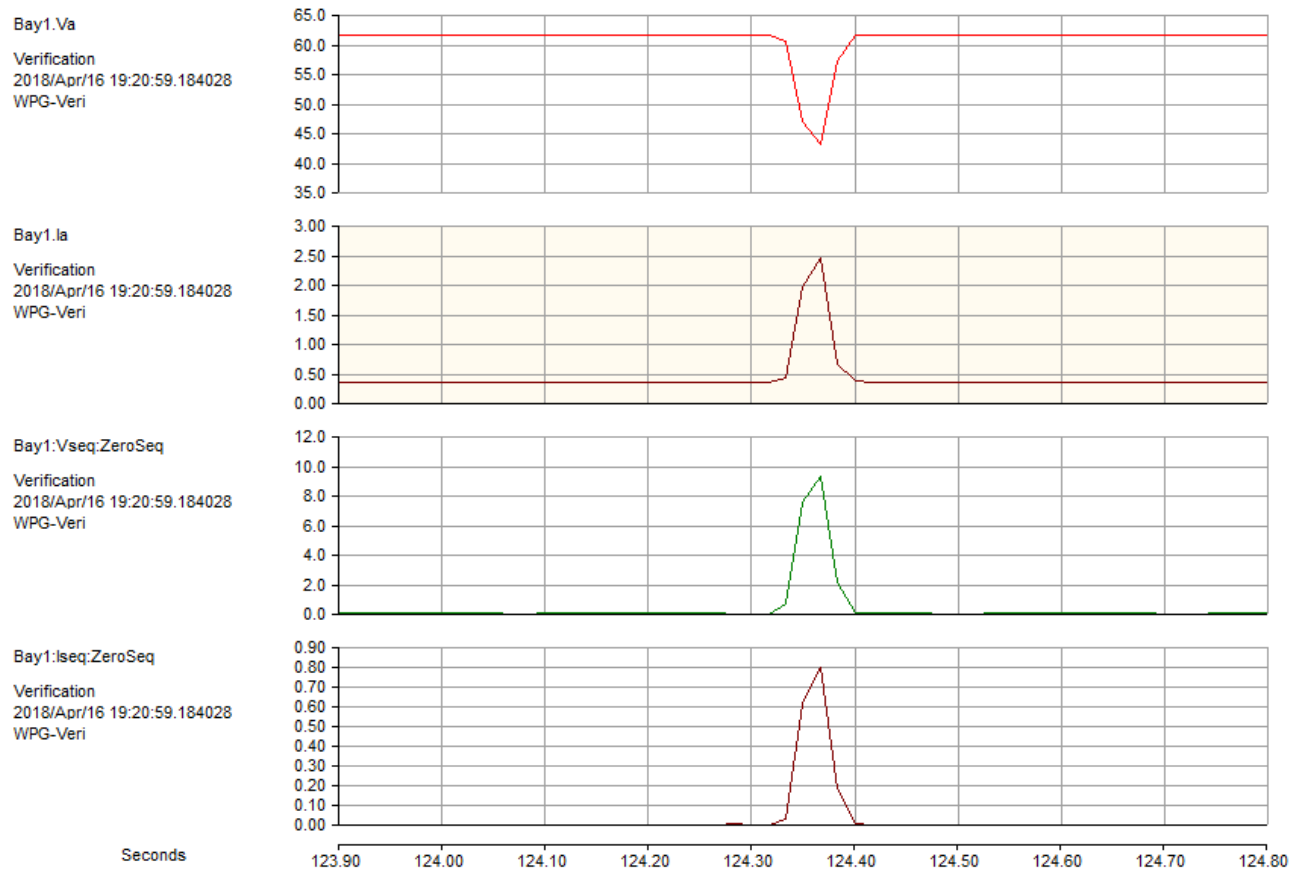
- 2 cycle faults

PMU Data During Faults : P Class
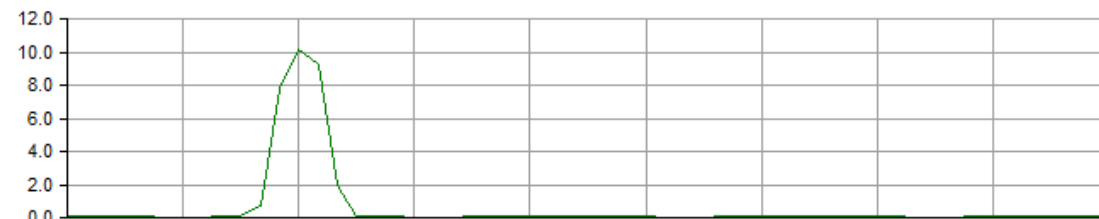
- 3 cycle faults

Bay1.Va
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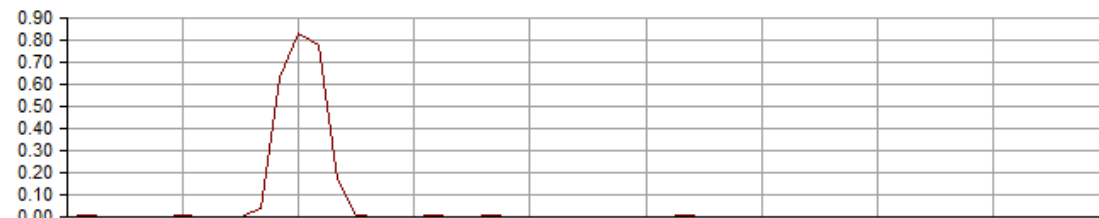2018/Apr/16 19:20:59.184028
WPG-Veri
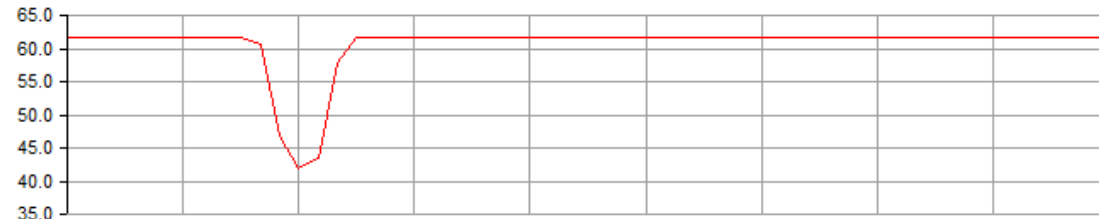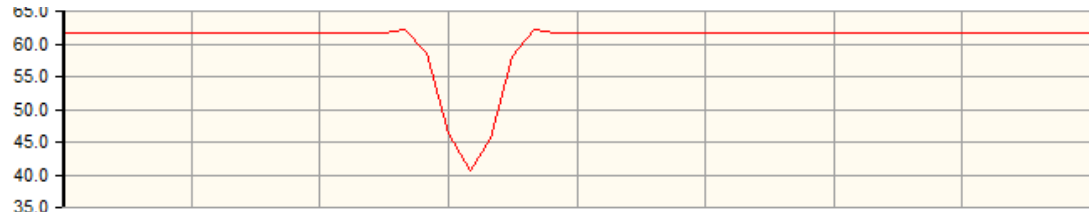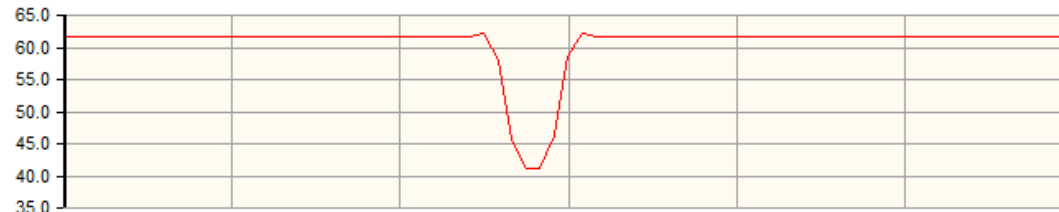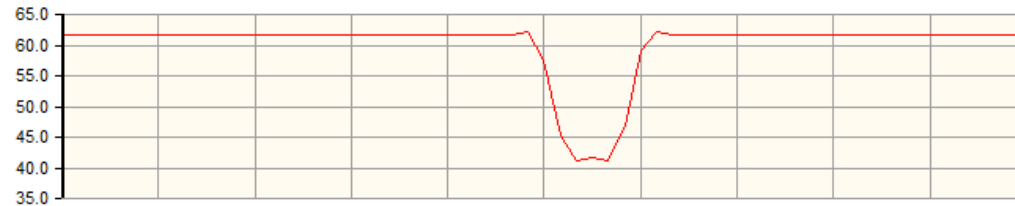
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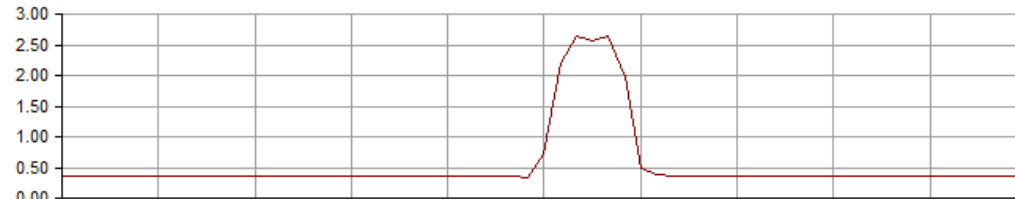
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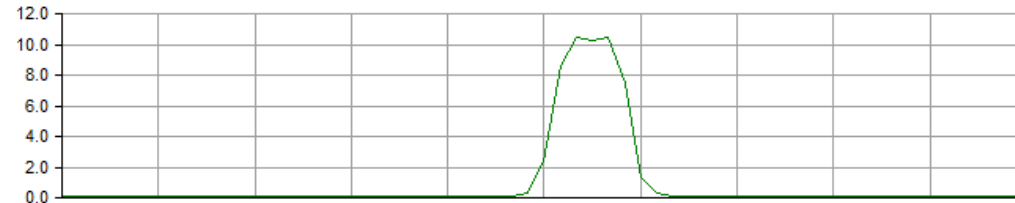
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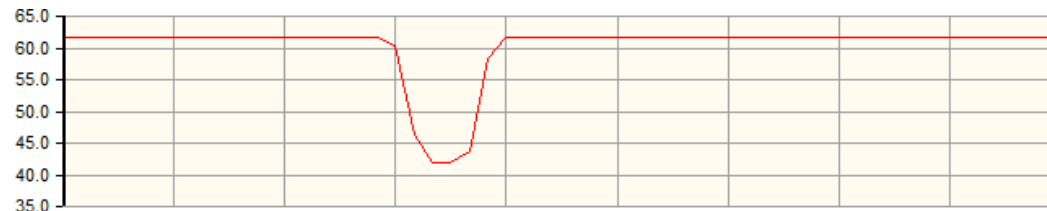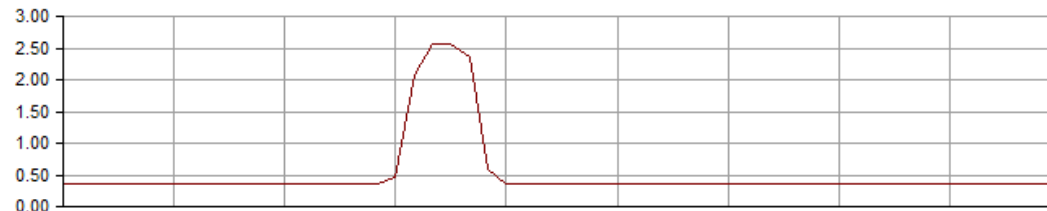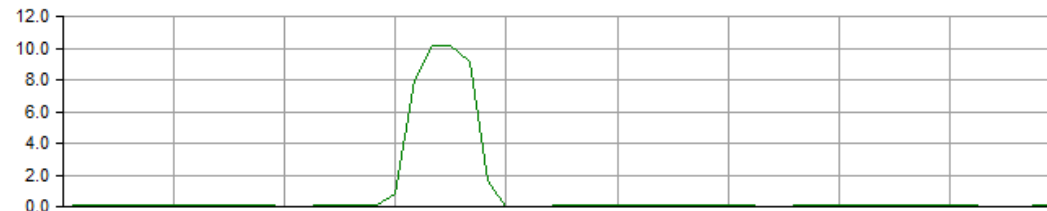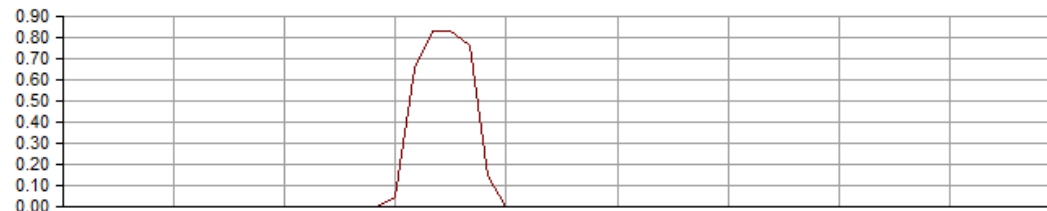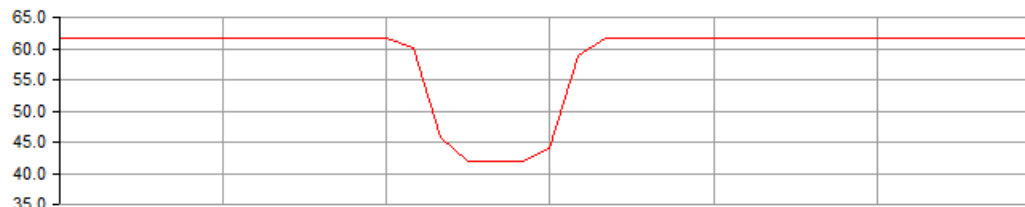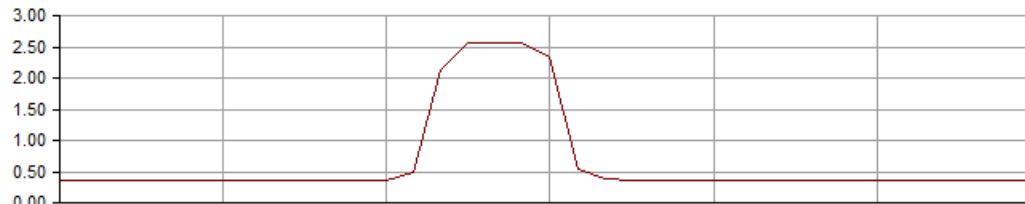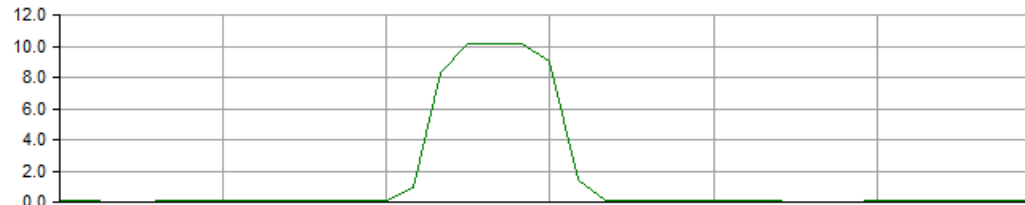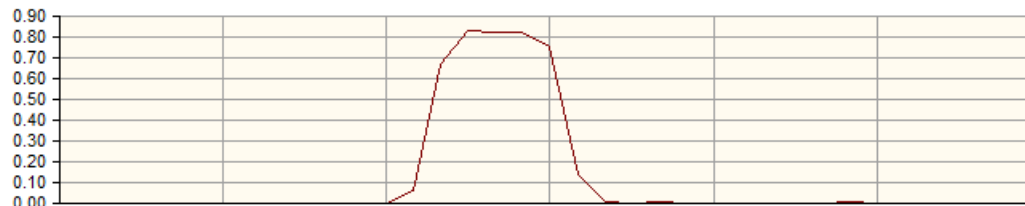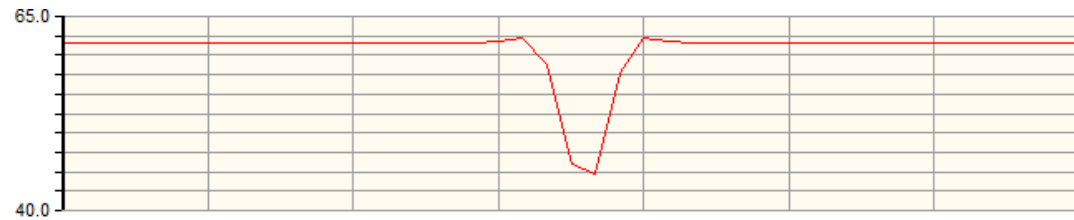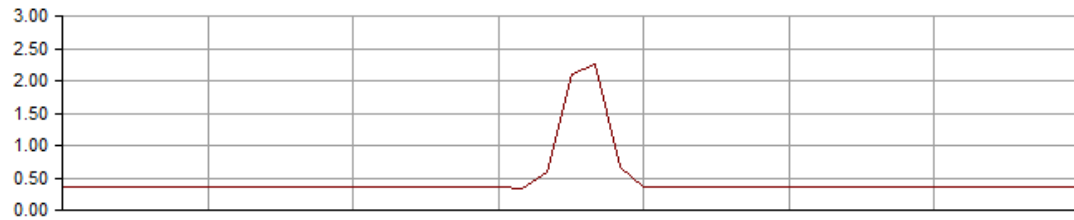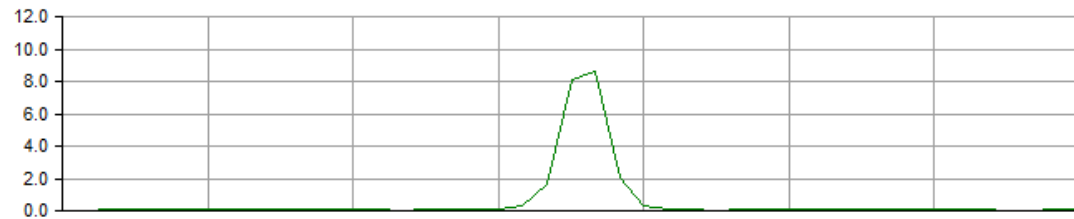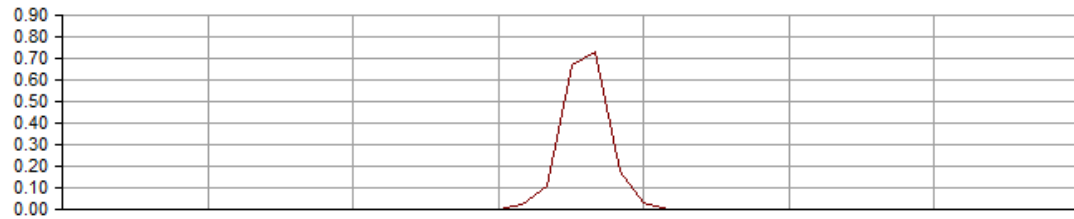Verification
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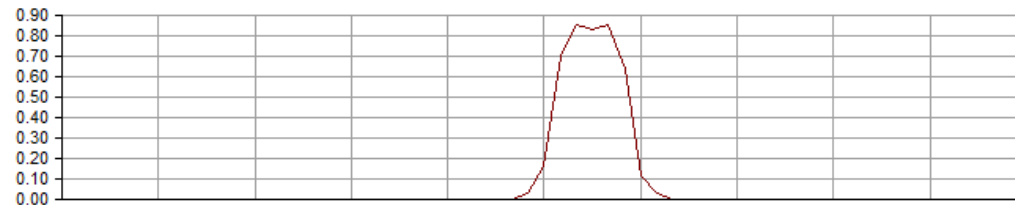
Seconds

PMU Data During Faults : P Class

- 4 cycle faults

PMU Data During Faults : P Class

- 5 cycle faults

PMU Data During Faults : P Class

- Summary

Duration (cycles)	Zero Seq. Voltage (V)	Zero Seq. Current (A)
2	9.5 V	0.72 A
3	10.1 V	0.83 A
4	10.1 V	0.83 A
5	10.1 V	0.83 A

PMU Data During Faults : M Class

- 2 cycle faults

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- 3 cycle faults

- 4 cycle faults

- 5 cycle faults

PMU Data During Faults : M Class

- 6 cycle faults
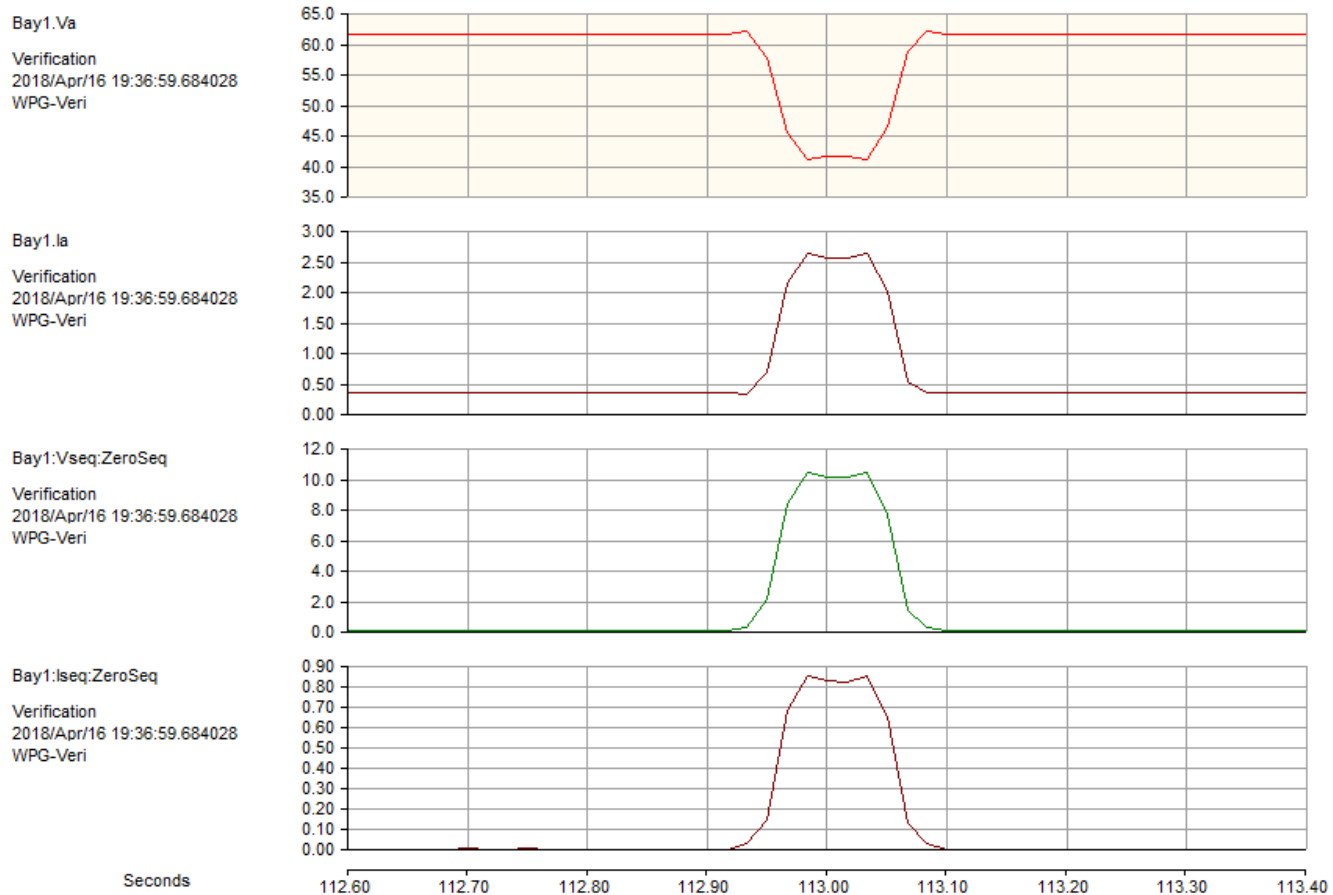
PMU Data During Faults : M Class

- Summary

Duration (cycles)	Zero Seq. Voltage (V)	Zero Seq. Current (A)
2	8.2 V	0.71 A
3	10.9 V	0.9 A
4	10.4 V	0.87A
5	10.1 V	0.83 A
6	10.1 V	0.83 A

Impedance Based Fault Location : M Class

- Method: Takagi Algorithm
  - PMU data (120 samples/sec = 2 samples/cycle)
  - M class (C37.118.1a-2014)

- 3 cycle fault
  - Actual: 3 km; Estimated: 6.7 km

Impedance Based Fault Location : M Class
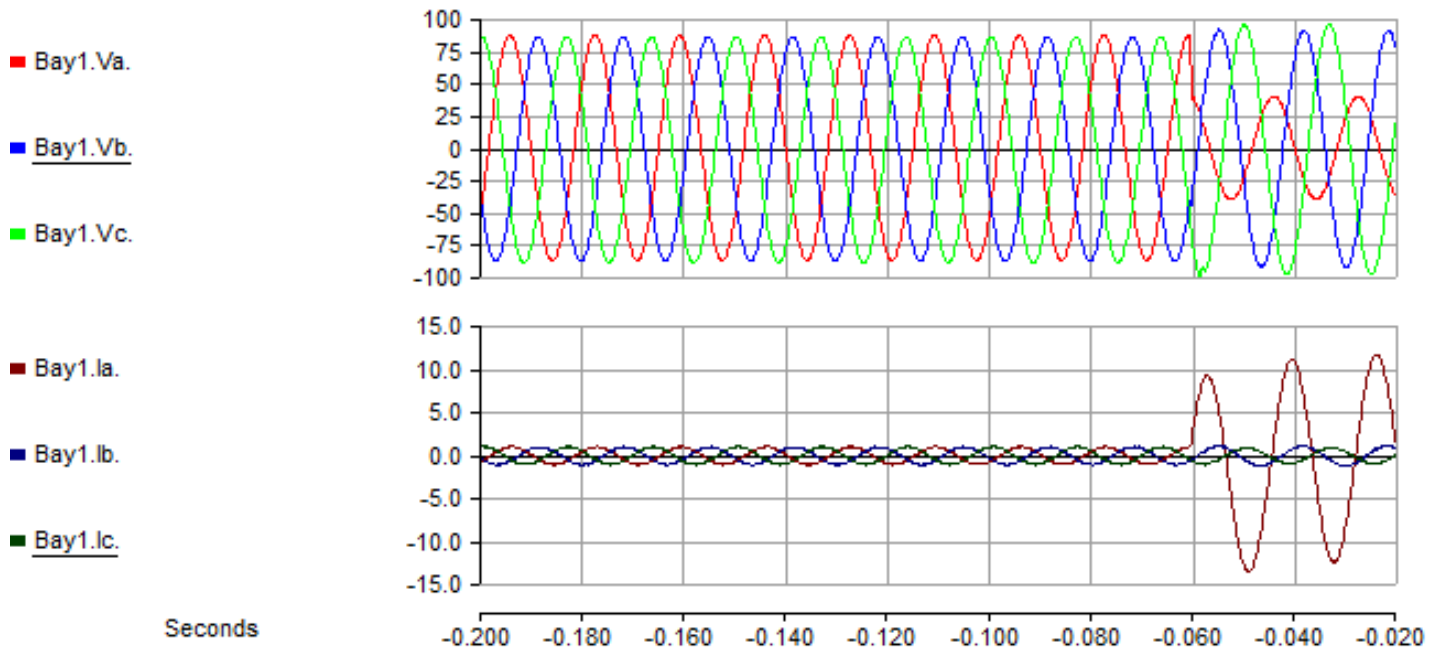
- Effect of the fault duration (single phase to ground fault)

Duration (cycles)	Actual Distance (km)	Estimated Distance (km)
3	3.0 km	6.7 km
4	3.0 km	3.8 km
5	3.0 km	3.9 km
6	3.0 km	4.0 km

Summary

- Use of synchrophasor data for fault analysis purposes was investigated for both P and M filters (C37.118.1a -2014)
  - Sequence components for fault level detection
  - Impedance based fault location estimation

- Summary for P Class filters
  - 2 cycle data provides less than 5% error
  - 3 cycle data provides less than 1% error

- Summary for M Class filters
  - 4 cycle data provides less than 5% error
  - 5 cycle data provides less than 1% error

Thank you !
Questions ?