

# Whose FAULT is it ?

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*Transmission Protection*

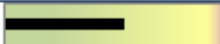
*Lower Colorado River Authority*

# Overview

- LCRA TSC Misoperation Statistics
- 138kV Line Fault Event
- Types of Ground Faults
- Event Analysis

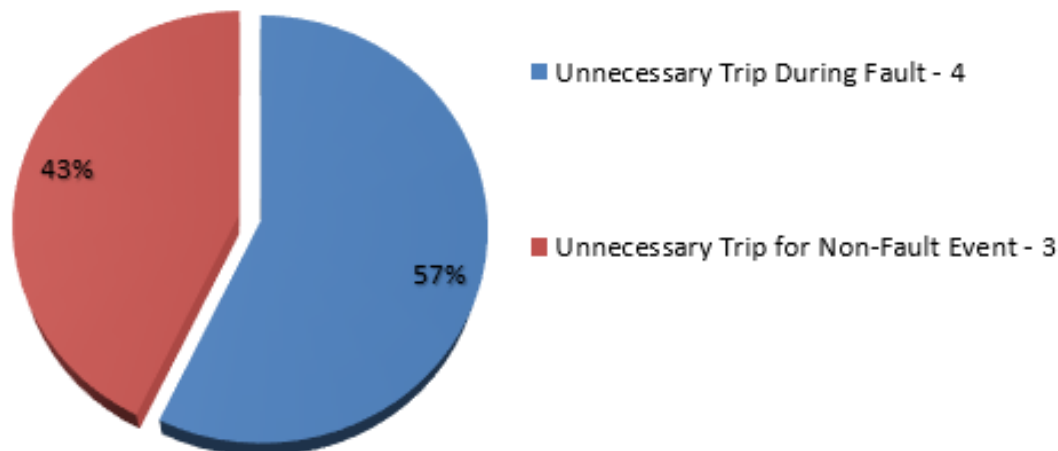


# LCRA TSC Misoperation Report

Reliability Metrics - FY 2016	Current Value	% of Goal	Performance
Misoperation Percentage	<b>3.83%</b>	<b>54.64%</b>	0% 
69kV Misop. Rate	2.38%	14.29% of Misops	-
138kV Misop. Rate	5.21%	71.43% of Misops	-
345kV Misop. Rate	2.22%	14.29% of Misops	-
Misoperations	<b>7</b>	-	-
Relay Operations	<b>183</b>	-	-
K-Factor	<b>0</b>	-	-

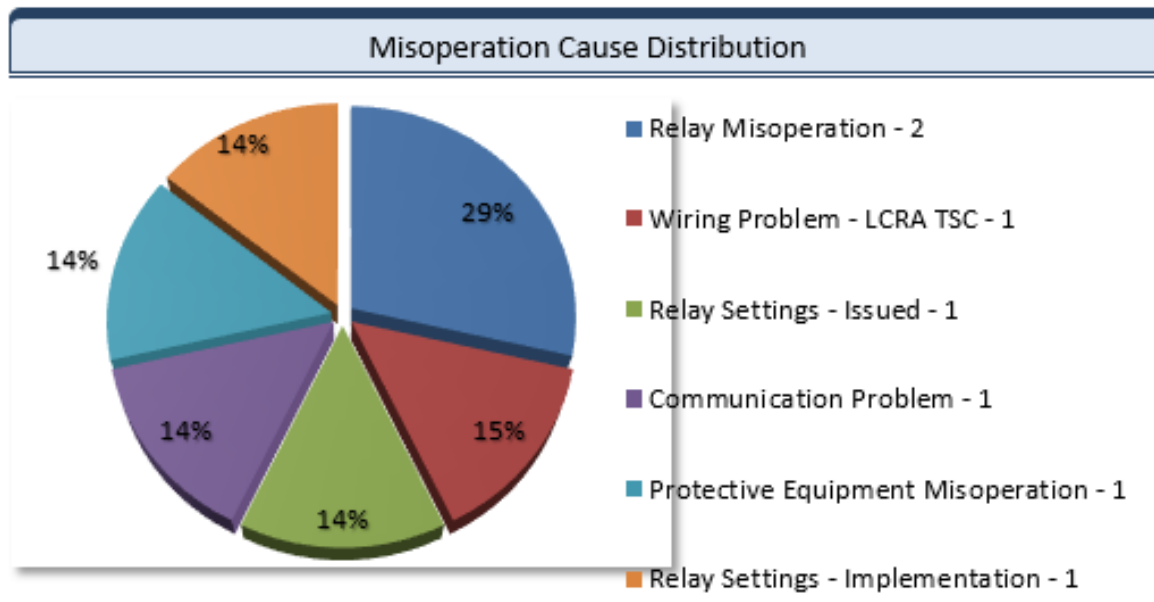
Enter Misoperation Rate Goal:  ← (Goal for FY 2016 is 7.00%)

Misoperation Type Distribution



# LCRA TSC Misoperation Report

	Most Recent Misoperations
150%	1/31/2016::BAKERSFIELD SWIT - Unnecessary Trip for Non-Fault Event
	11/11/2015::NORTH-MCCAMEY - Unnecessary Trip During Fault
	11/4/2015::CRANE-LCRA - Unnecessary Trip for Non-Fault Event
	10/30/2015::SAN-MARCOS - Unnecessary Trip for Non-Fault Event
	10/9/2015::FORT-MASON - Unnecessary Trip During Fault
	9/25/2015::ESCARPMENT - Unnecessary Trip During Fault
	7/13/2015::RIM-ROCK - Unnecessary Trip During Fault



# LCRA TSC 138kV Event

Date/Time: 08/02/15 19:56

Line: T256 - From LAGO-VISTA to MARSHALL-FORD 138kV

Event Type: Automatic - Protective devices (equipment) originated event

Fault Type: C-phase to ground

Voltage: 138kV - Transmission

Description of Event:

Lago Vista CB 5010 Trip/Close Auto

Marshall Ford CB 3220 Trip (Recloser normally OFF)/Close by SCADA

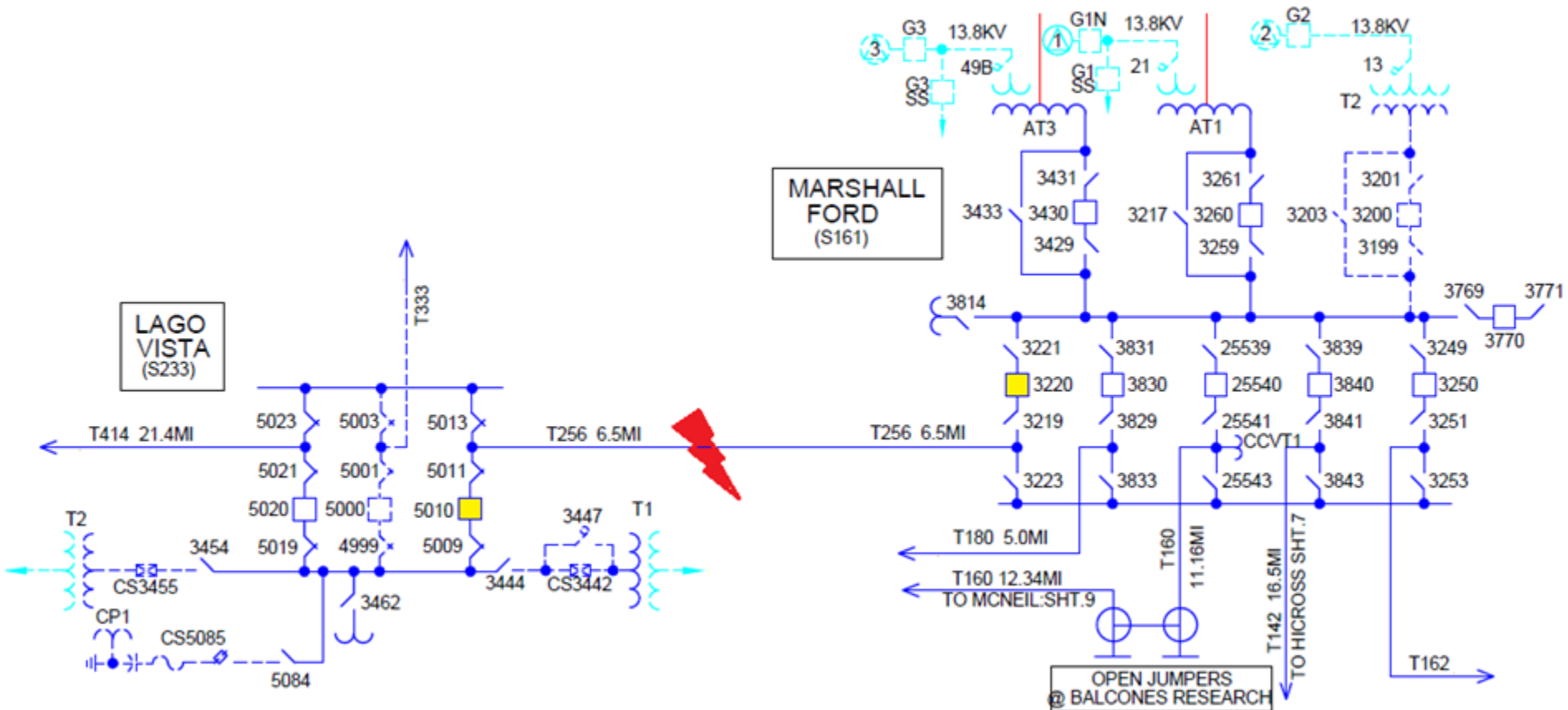
Distance to Fault:

LAGO-VISTA - miles

MARSHALL-FORD - 4.18 miles

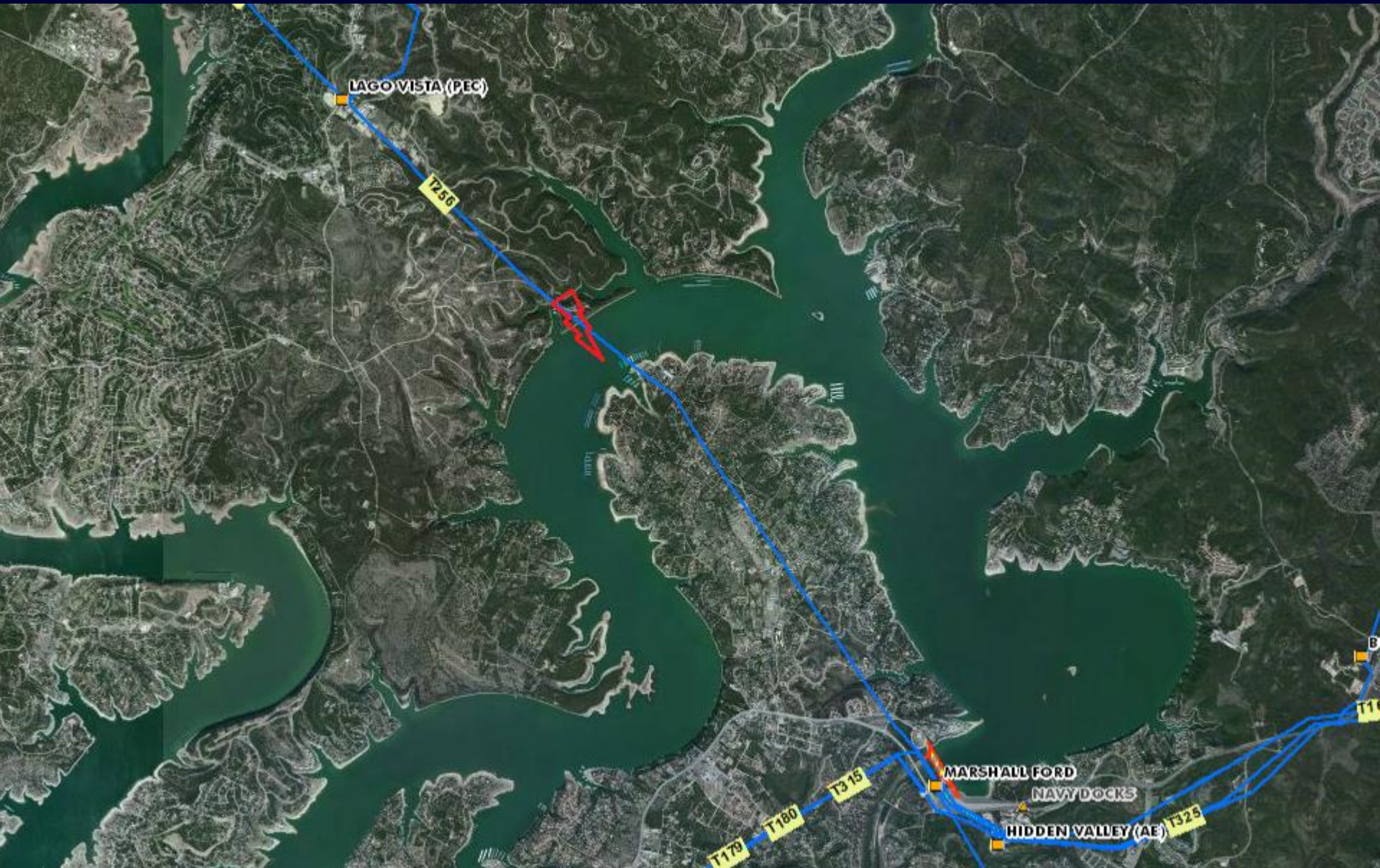


# System One-line Diagram



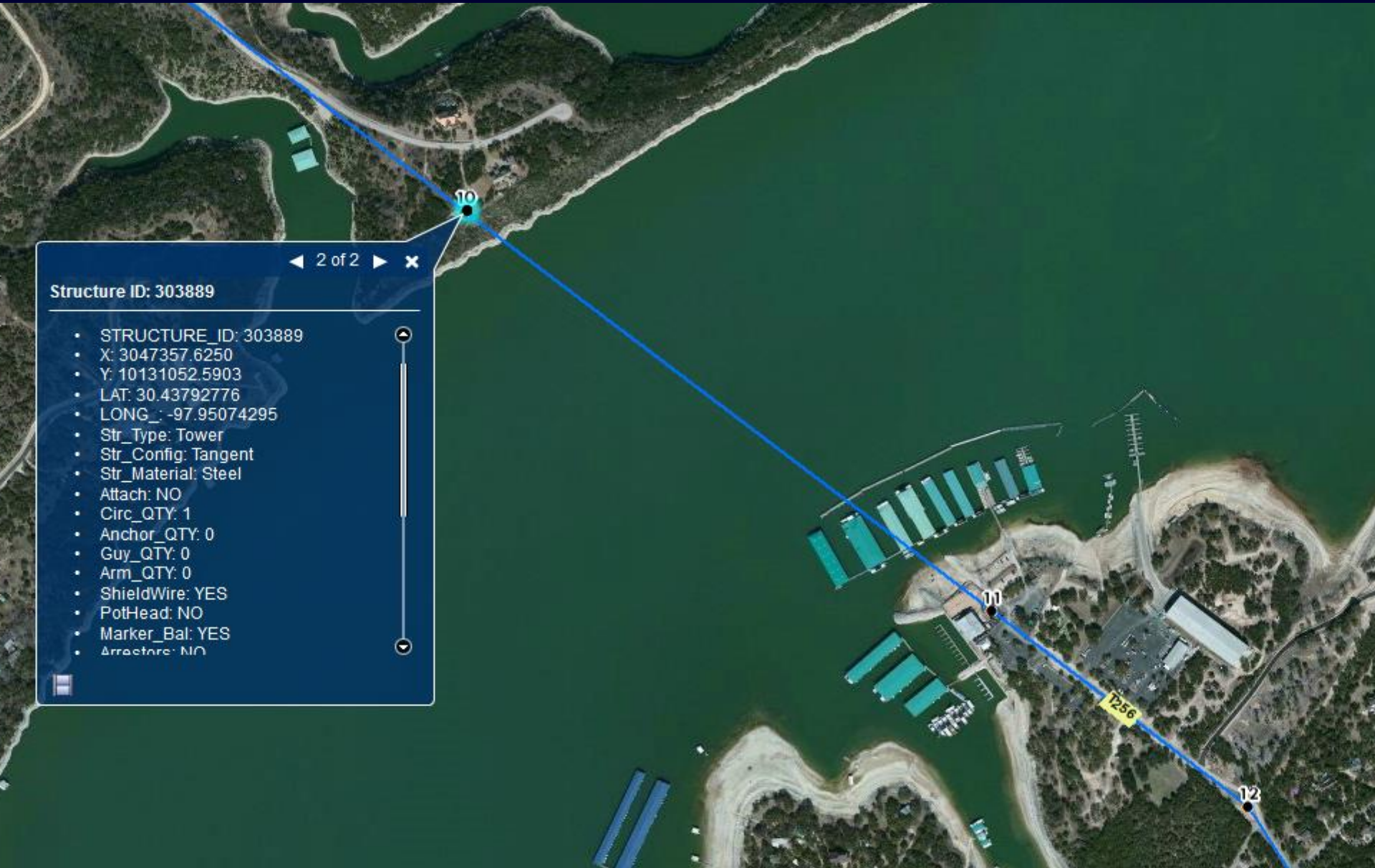


# System Map





# System Map





# Field Report

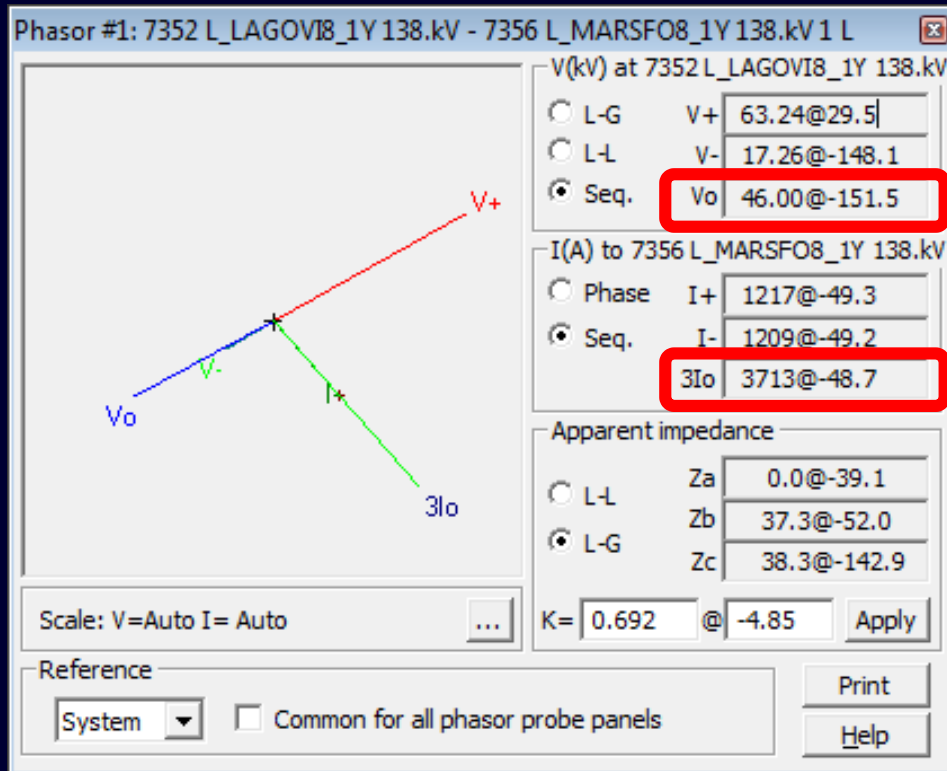
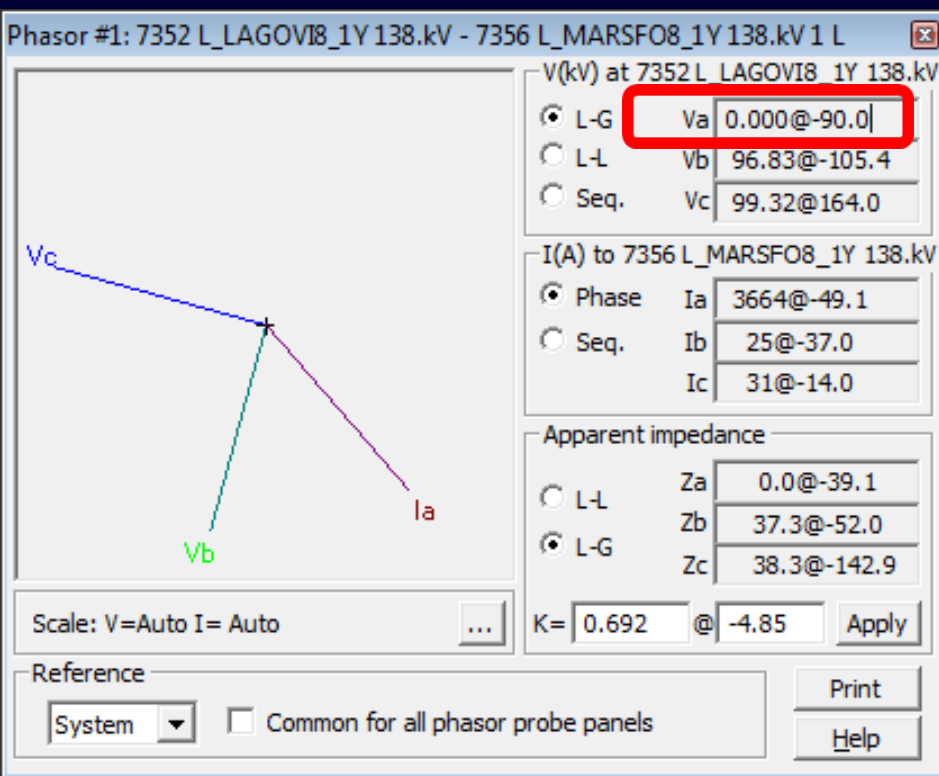


# Types of Ground Fault ?

- Single Phase to Ground
- Phase to Phase to Ground

# Types of Ground Fault ?

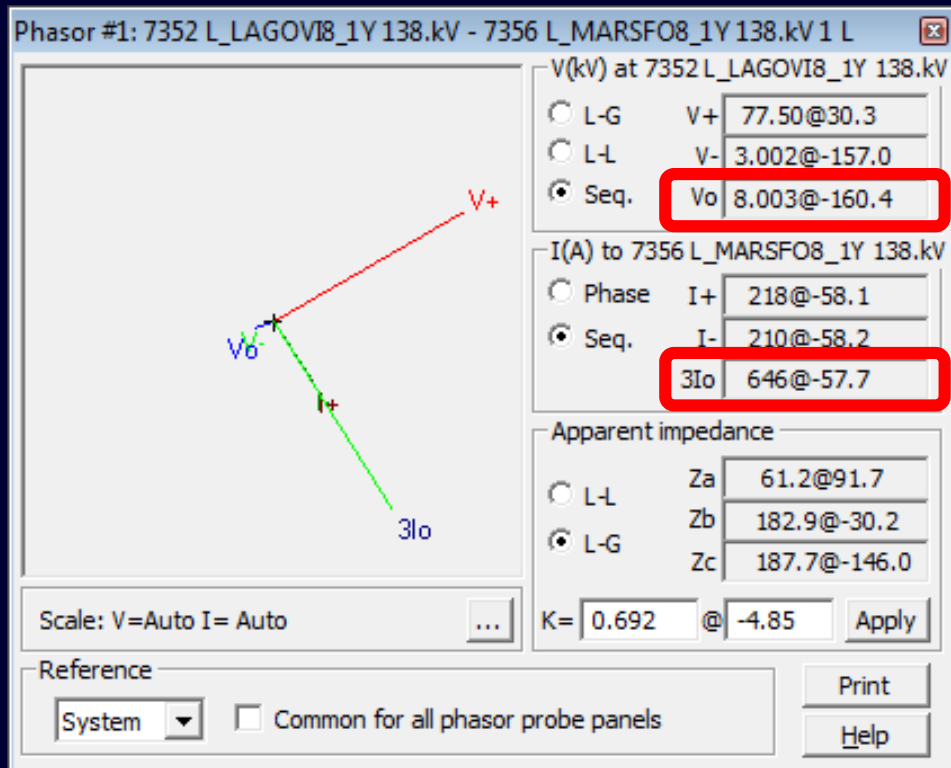
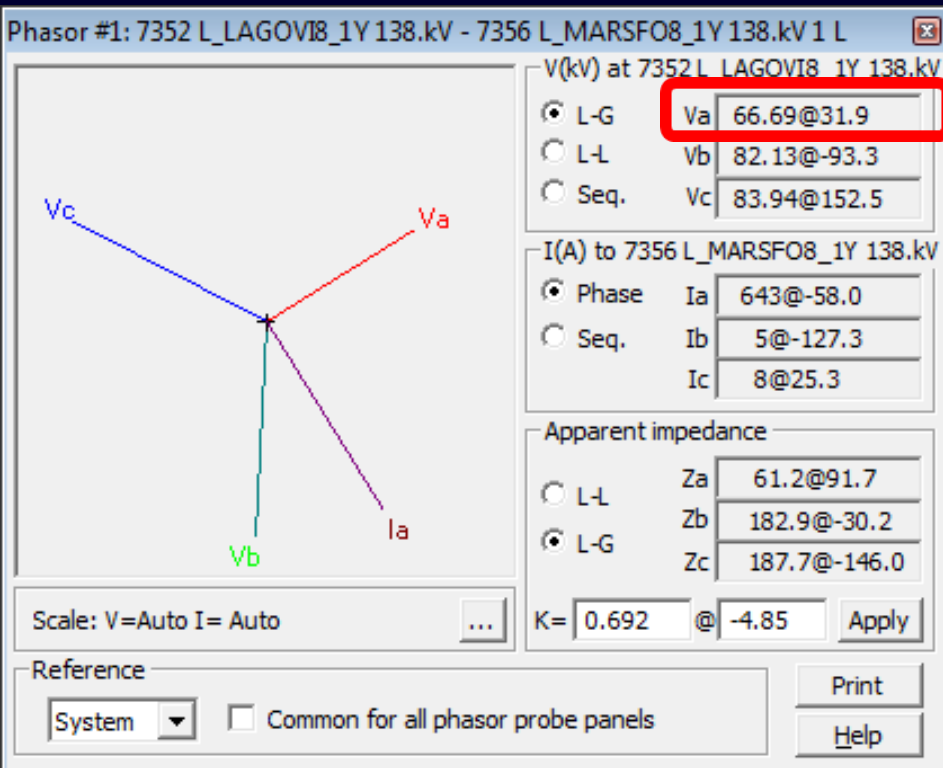
- Low Impedance / Bolted Faults
  - ◆ Readily detectable – presence of zero sequence current & voltage



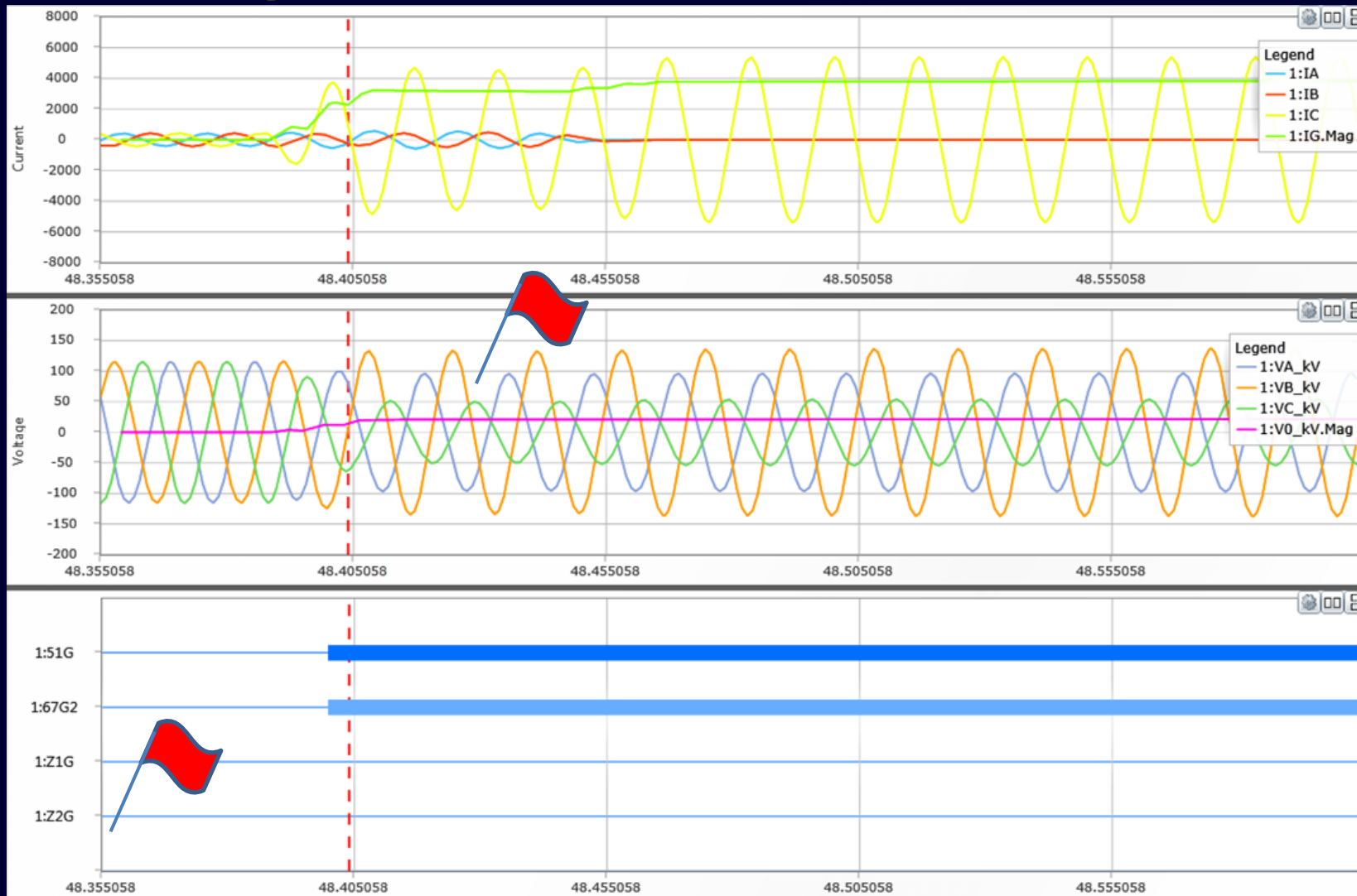


# Types of Ground Fault ?

- High Impedance / Resistive Faults
  - ◆ Difficult to detect – low zero sequence current & voltage



# Lago Vista T256 Fault Event



- Relay indicated C-G fault
- High zero sequence current but low zero sequence voltage



# Lago Vista T256 21G



- Relay 21G calculated fault impedance is above Z1G and Z2G


# Event Analysis / Findings

- Lago Vista T256 Z1G should have tripped
- Possible PT wiring issues
  - ◆ Missing ground connection
  - ◆ Multiple ground connections

# Event Analysis / Findings

- Measure the impedance between the neutral connection of each relay and a good ground reference. The impedance should be close to zero.
  - ◆ The measured value was 0.2 ohms.
  - ◆ There is a ground connection

# Event Analysis / Findings

- Disconnect the PT ground by lifting a known ground connection. Measure the impedance between the neutral connection a good ground reference. The impedance should be infinite.
  - ◆ The measured value was 0.2 ohms
  - ◆ There are multiple grounds 





# LCRA TSC 138kV 2<sup>nd</sup> Event

Date/Time: 08/21/15 19:26

Line: T256 - From LAGO-VISTA to MARSHALL-FORD 138kV

Event Type: Automatic - Protective devices (equipment) originated event

Fault Type: C-phase to ground

Voltage: 138kV - Transmission

Description of Event:

08/21/15 19:26 CB 5010 at Lago Vista Trip/Closed/ Auto and CB 3220 at Marshall Ford Tripped (Recloser normal off) Closed by SOCC (By EMS) This is the Lago Vista - Marshall Ford 138kV Line T-256.

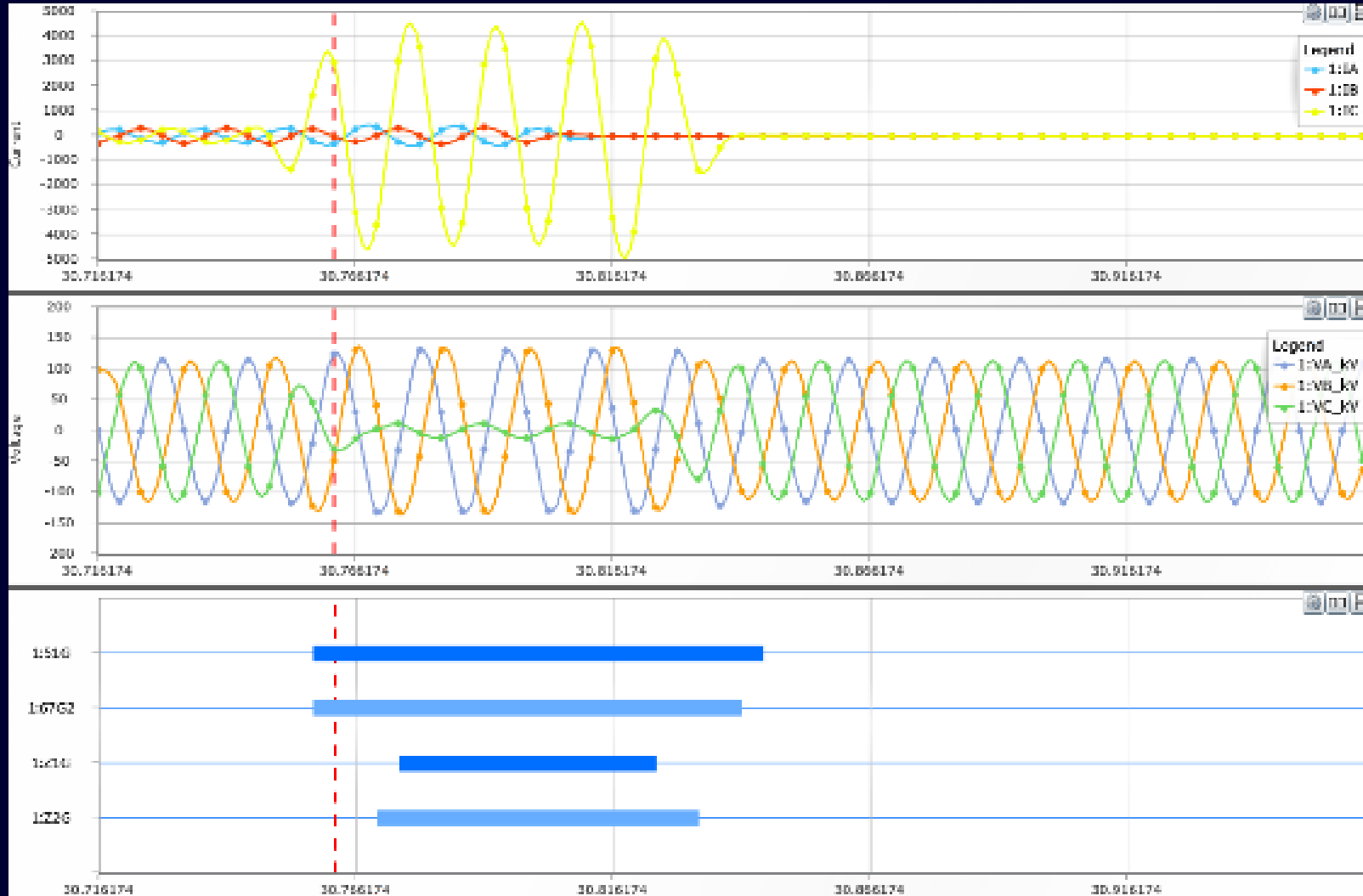
Note: There did not appear to be any weather in the area at the time of the operation. SubWan Showed a C-Phase to Ground fault 4.19 miles From Marshall Ford 2.49 miles from Lago Vista

Distance to Fault:

LAGO-VISTA - 2.49 miles

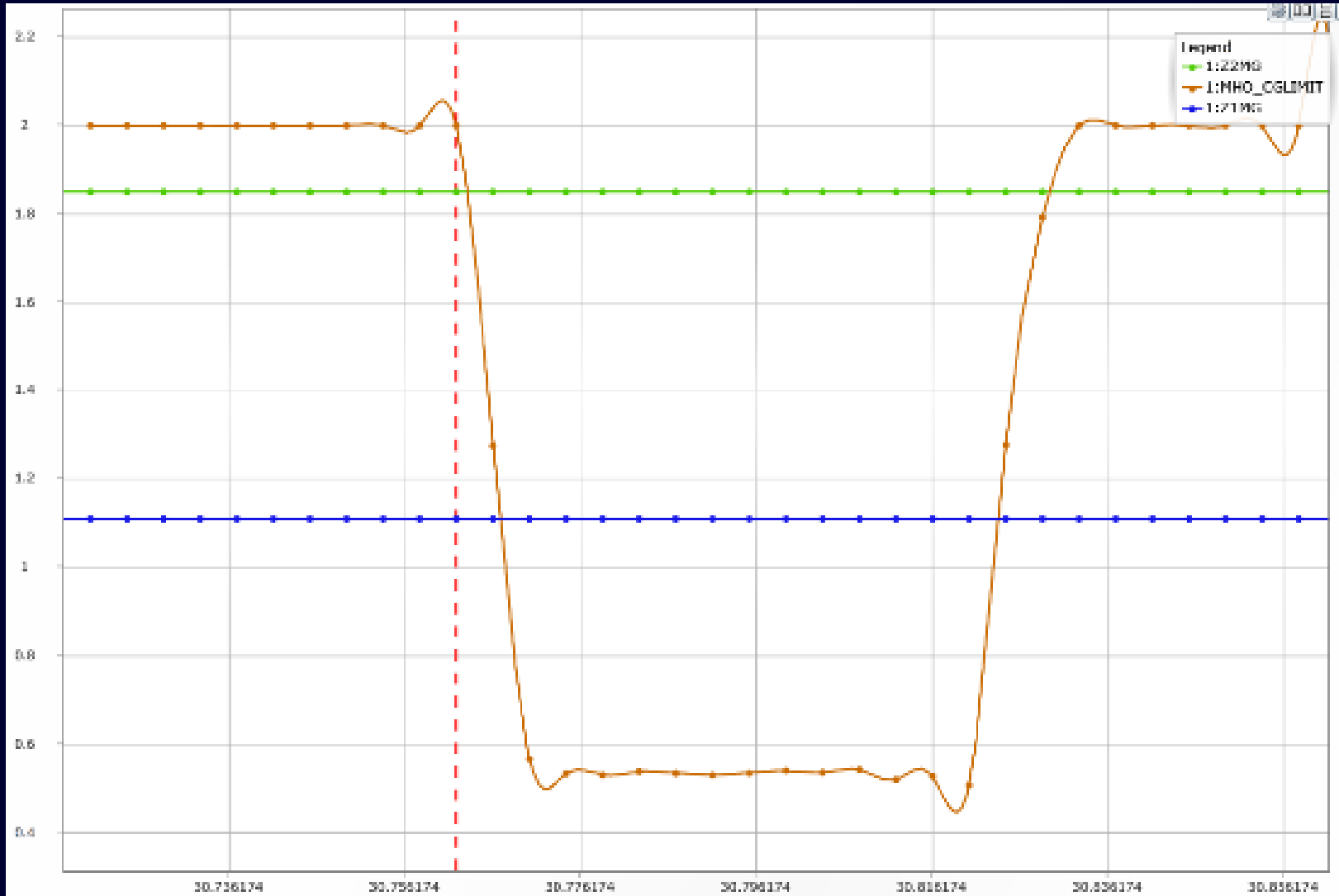
MARSHALL-FORD - 4.19 miles

# Lago Vista T256 Fault Event



- Relay indicated C-G fault
- Faulted C-phase voltage is depressed

# Lago Vista T-256 21G



- Relay 21G calculated fault impedance goes below Z1G and Z2G

# Conclusion

- Reviewed a 1LG fault event involving PT wiring issues
- Identified testing procedures to verify correct PT wiring
- Resolved similar PT wiring problems at two other substations
- Raised awareness with LCRA field, design, & relay staff, and ERCOT SPWG

**Questions ?**