PQ Dashboard Updates at TVA

Tony Murphy

April 25, 2018

Multiple Fault Locations

Fault Location Reports

Fault Inception Time: 2018-03-10 23:15:26.7511875
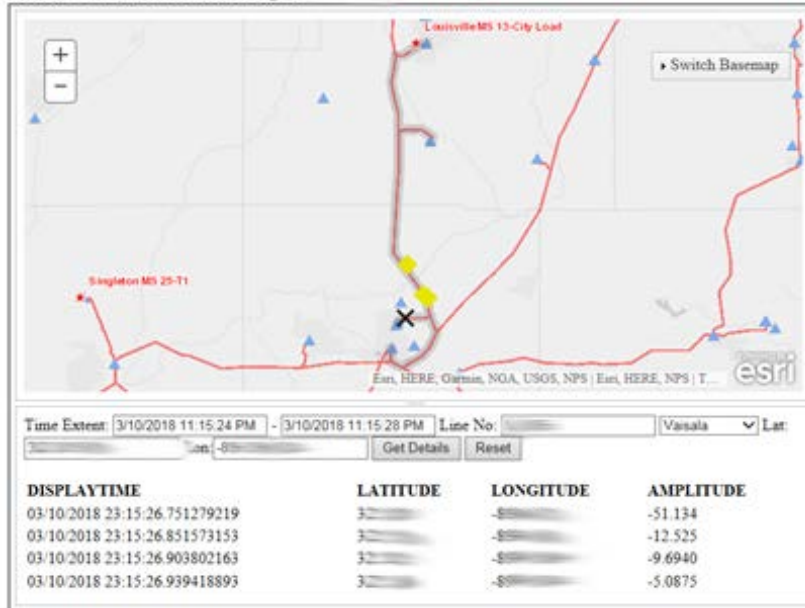**Fault Duration:** 5.49 cycles / 91.13 ms
Fault Type: CA
Location: 9.66 miles from ▒▒▒▒▒▒▒▒ on P▒▒▒▒▒▒▒▒▒▒ 161kV Line (L5855)
Tree Probability: Undetermined
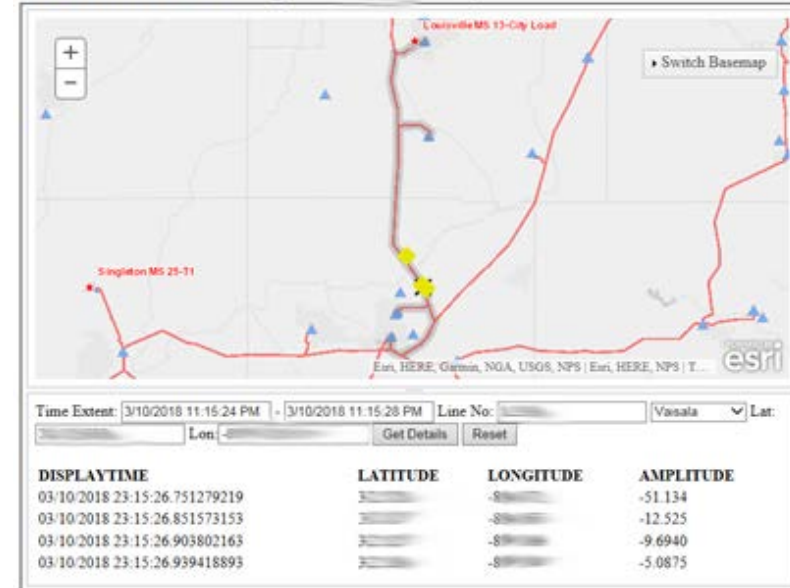**View:** Miles TeleGyr Quick BSL Search

2 structures found matching distance criterial
Solution 1 Nearest Structure: 616 @ (3▒▒▒▒▒▒▒▒▒)

DISPLAYTIME	LATITUDE	LONGITUDE	AMPLITUDE
03/10/2018 23:15:26.751279219	3▒▒▒	-8▒▒▒	-51.134
03/10/2018 23:15:26.851573153	3▒▒▒	-8▒▒▒	-12.525
03/10/2018 23:15:26.903802163	3▒▒▒	-8▒▒▒	-9.6940
03/10/2018 23:15:26.939418893	3▒▒▒	-8▒▒▒	-5.0875

Solution 2 Nearest Structure: 628 @ (3▒▒▒▒▒▒▒▒▒)

DISPLAYTIME	LATITUDE	LONGITUDE	AMPLITUDE
03/10/2018 23:15:26.751279219	3▒▒▒	-8▒▒▒	-51.134
03/10/2018 23:15:26.851573153	3▒▒▒	-8▒▒▒	-12.525
03/10/2018 23:15:26.903802163	3▒▒▒	-8▒▒▒	-9.6940
03/10/2018 23:15:26.939418893	3▒▒▒	-8▒▒▒	-5.0875

SOE Alarm Integration

Fault Location Reports

Fault Inception Time: 2018-03-10 23:15:26.7511875
Fault Duration: 5.49 cycles / 91.13 ms
Fault Type: CA
Location: 9.66 miles from ▨▨▨▨▨ MS (S▨▨▨) on ▨▨▨▨▨▨▨▨▨le 161kV Line (L▨▨▨)

SOE | Time Window (s): 2 ∨ Filter (remove selected): ☐ABNORMAL ☐Failure ☐NORMAL ☐RECEIVED ☐Run ☐Start ☐Stop ☐Trip

Refresh

Time	Alarm	Status
3/10/2018 11:15:27 PM	▨▨▨▨▨ PCB 944 SS RELAY FAILURE	ABNORMAL
3/10/2018 11:15:27 PM	▨▨▨▨ PCB 1014 LOSS OF AC VOLTAGE	ABNORMAL
3/10/2018 11:15:27 PM	▨▨▨▨ PCB 1024 LOSS OF AC VOLTAGE	ABNORMAL
3/10/2018 11:15:27 PM	▨▨▨▨ DFR RUNNING	Run
3/10/2018 11:15:27 PM	▨▨▨▨ PCB 944 SS RELAY FAILURE	NORMAL
3/10/2018 11:15:27 PM	▨▨▨▨ DFR RUNNING	Stop
3/10/2018 11:15:27 PM	▨▨▨▨ PCB 1014 LOSS OF AC VOLTAGE	NORMAL

SOE | Time Window (s): 60 ∨ Filter (remove selected): ☑ABNORMAL ☐Close ☑Failure ☑NORMAL ☑RECEIVED ☑Run ☑Start ☑Stop ☐Trip

Refresh

Time	Alarm	Status
3/10/2018 11:15:22 PM	▨▨▨ PCB 924 ▨▨▨▨▨	Trip
3/10/2018 11:15:24 PM	▨▨▨▨ PCB 924 ▨▨▨▨▨	Close
3/10/2018 11:15:27 PM	▨▨▨ PCB 918 ▨▨▨▨▨ SS B2	Trip
3/10/2018 11:15:27 PM	▨▨▨ PCB 914 ▨▨▨▨ SS B1	Trip
3/10/2018 11:15:31 PM	▨▨▨ PCB 918 ▨▨▨▨ SS B2	Close
3/10/2018 11:15:31 PM	▨▨▨ PCB 914 ▨▨▨▨ SS B1	Close

TVA

SIDA & PQWeb Correlation

Fault Location Reports

Fault Inception Time: 2018-03-19 18:43:44.5940972
Fault Duration: 4.48 cycles / 74.35 ms
Fault Type: AN
Location: 2.12 miles from A_____ (S____) on _____ 161kV Line (L____)
Tree Probability: Medium (Rf=10.96)
View: Miles TeleGyr Quick BSL Search

Corresponding SIDA Reports	SIDA Event Number	Event Time	Equipment Name	kV	Duration (HH:MM)	OM Office	Cause	Subcause
	456733	2018-03-19 18:43:44.0000000		161	0:0	MURF	TORNADO	DEBRIS

PQWEB Reports

PQWeb® 3.2.2

Event List

Reports   Event Preferences   Graph Preferences   Help

From 3/19/2018 6:42:44 PM to 3/19/2018 6:44:44 PM

Site Name	Time Stamp	Event Type	Voltage Magnitude
_____ 161-T1-T2 ION	03-19-2018 18:43:44.595	RMS Variation	78.02%

Table includes 1 events.

TVA

Faults Other Than Line Faults

- Capacitor Banks
- Transformer Banks
- Generators
- Busses
- Customer Loads

Line #:	S5A93S
Name:	161/23kV Transformer Bank 1
kV:	161
Thermal Rating:	947
Length:	0.05
R0:	1.02647
X0:	22.01557
R1:	1.02647
X1:	25.90067

TVA

Probability of Tree Faults

Fault Location Reports

Fault Inception Time: 2011-10-16 18:19:24.2538194
Fault Duration: 14.34 cycles / 238.11 ms
Fault Type: CN
Location: 3.66 miles from ▒▒▒▒ TN (S▒▒▒▒) on ▒▒▒▒ Road 161kV Line (L▒▒▒▒)
Tree Probability: Medium (Rf=19.84)
View: Miles TeleGyr Quick BSL Search

Fault Imp. Vector

Fault Distance

2011-10-16 18:19:24.4676180
Simple: 15.35
Reactance: 3.50
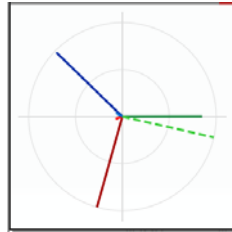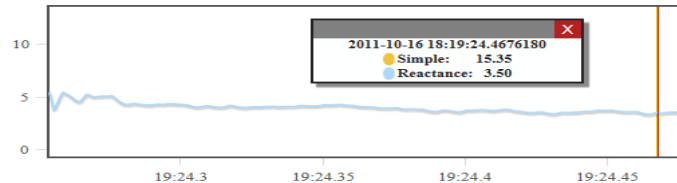
Loop Imp (LG)			
ZS (Ohm)	Ang (Deg)	RS (Ohm)	XS (Ohm)
18.022	77.664	3.8510	17.6055
1.395	-	0.2981	1.3627

Tree Fault Probability

Tree Probability Low
Tree Probability Medium
Tree Probability High

Reactance / Simple Ratio

Fault Distance (miles out line)

Fault Resistance
1Ω
10Ω
20Ω
30Ω
40Ω
50Ω

$$R_F = \sqrt{(X_S D_S)^2 - (X_S D_R)^2} - R_S D_R$$

where:
R_F = Fault Resistance of Tree (Ω)
R_S = Line Loop Resistance (Ω/mile)
X_S = Line Loop Reactance (Ω/mile)
D_S = Calculated Fault Location using
    Simple Method (miles)
D_R = Calculated Fault Location using
    Reactance Method (miles)

TVA

Fault Notification: Custom Email Templates

Customer Account Manager Email:

Subject: Fault detected on Paradise FP-Hopkinsville 161kV Line 1 (L5619)

Fault 1

|	
Faulted Line:	161kV Line 1 (L
Fault Type:	B-phase to C-phase
Fault Time:	2017-11-19 13:26:15 (CT)
Fault Clearing:	1.4cyc a
Tree probability:	Undetermined
Click for fault reports:	1066662

Disturbance 1

Customers and equipment affected:

Customer	Area	Section	Component Model	Manufacturer	Series	Component Type	Magnitude (pu)	Duration (s)
	Standard	1668	12C-10	ABB	General Purpose	Ice Cube Relay	0	0.009

Linemen SMS Text Message:
(Fault Detected) 161kV Line 4 (L) @ 2018-04-16 03:32:53CT,
Type AN @ S372 Tree = Low

TVA
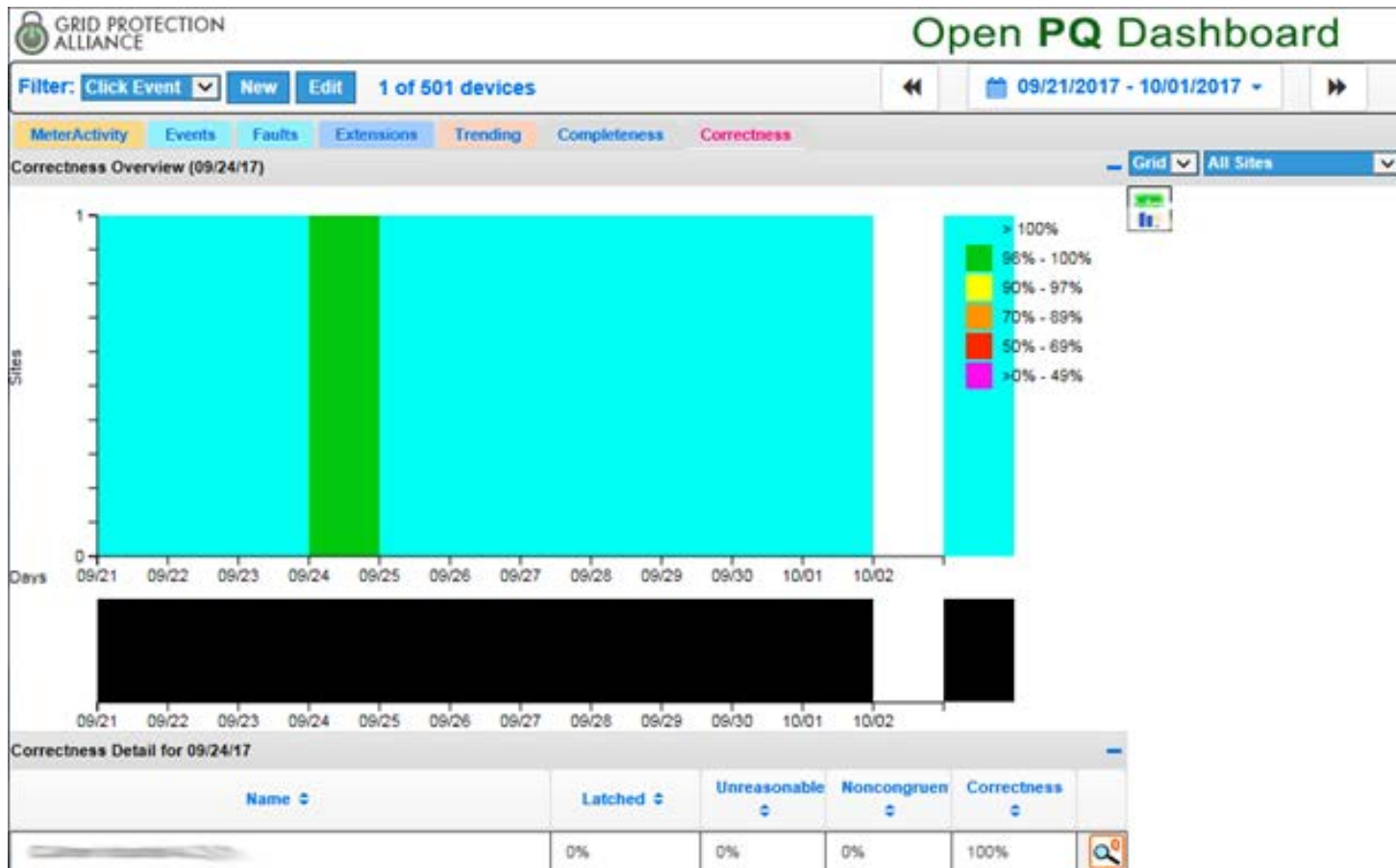
Completeness and Correctness Use Case

Completeness and Correctness Use Case

Channel Name ⇕	Type ⇕	Characteristic ⇕	Phase ⇕	Expected ⇕	Good ⇕	Latched ⇕	Unreasonable ⇕	Noncongruent ⇕	Duplicate ⇕	
V RMS A	Voltage	RMS	AN	144	114	0	0	0	0	STB
V RMS B	Voltage	RMS	BN	144	113	1	0	0	0	STB
V RMS C	Voltage	RMS	CN	144	114	0	0	0	0	STB
V THD A	Voltage	TotalTHD	AN	144	114	0	0	0	0	STB
V THD B	Voltage	TotalTHD	BN	144	114	0	0	0	0	STB
V THD C	Voltage	TotalTHD	CN	144	114	0	0	0	0	STB
I RMS A	Current	RMS	AN	144	114	0	0	0	0	STB
I RMS B	Current	RMS	BN	144	114	0	0	0	0	STB
I RMS C	Current	RMS	CN	144	114	0	0	0	0	STB

Correctness Detail for _____ for 9/24/2017

Completeness and Correctness Use Case
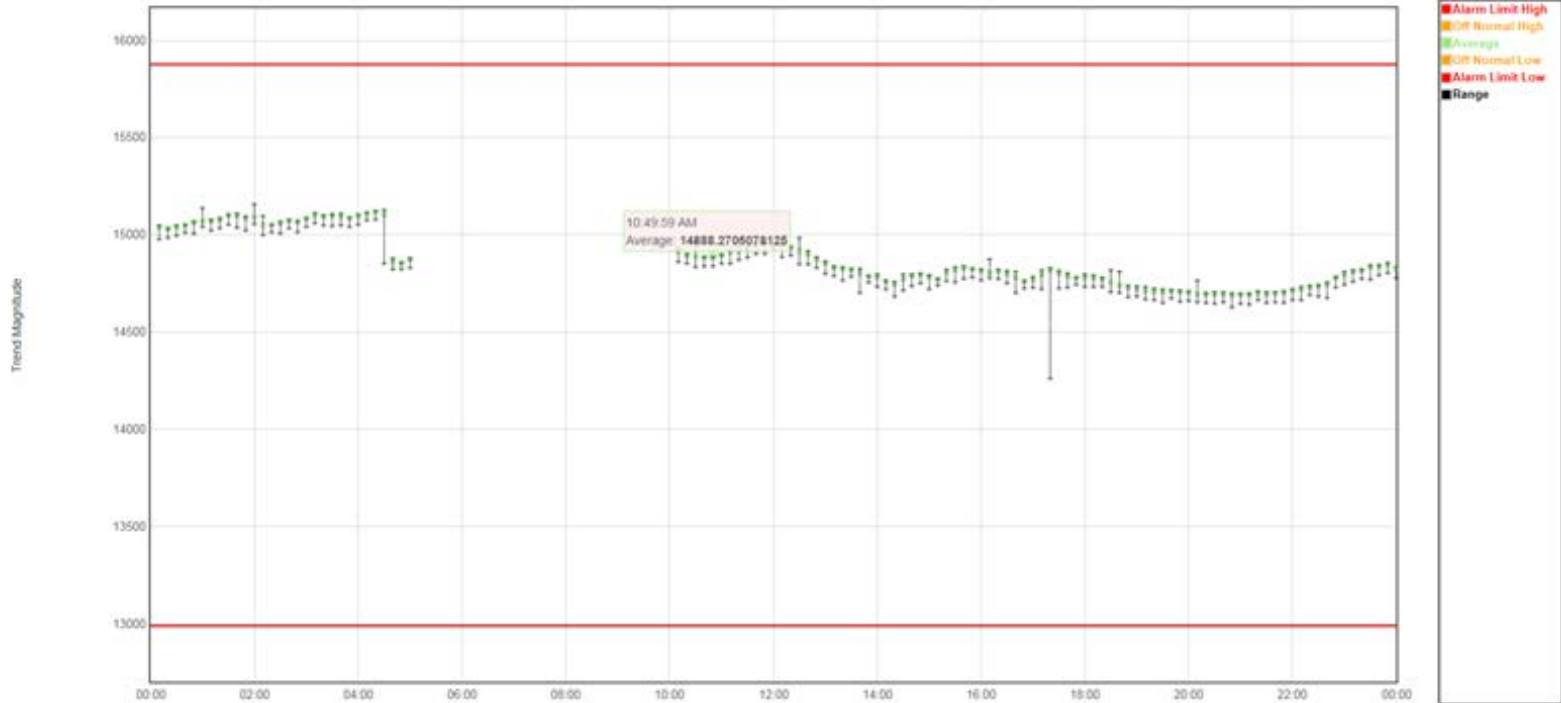
Looking Ahead

- Fault Location Accuracy Improvements
  - Include Mutual Impedances
  - Adjust Cycle in Fault for Location Calculations
- Integrating SCADA Points from Dataware/eDNA
- Improve Fault Suppression Logic
- DFR Timestamp Correction
- Email Subscription / Management
- Addition of Other Element Types (Capacitors, etc)
- New CSA DLL and OpenEAS
- Predict Other Fault Causes (Smoke, Arrester, etc)

Questions?