Introduction to PQView and PQWeb

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Vice President of International Sales & System Sales
Dranetz and Electrotek Concepts

Who Uses PQView Today?

United States/Canada

- American Electric Power
- Alabama Power Company
- Baltimore Gas and Electric
- CMS Energy
- CPS Energy San Antonio
- Con Edison New York
- Detroit Edison Company
- Dominion Virginia Power
- Duke Energy Corporation
- EnerNex Corporation
- Entergy Services
- EPRI
- FirstEnergy
- Georgia Power Company
- Hawaiian Electric Company
- Hydro One Networks
- Hydro Ottawa
- Maui Electric Company
- NIST
- Nebraska Public Power District
- Northeast Utilities
- Public Service Electric and Gas Company
  Public Service of New Hampshire
- Salt River Project
- San Diego Gas and Electric
- Southern California Edison
- Southern Company
- Tennessee Valley Authority
- United Illuminating Company
- Wisconsin Public Service
- Wireless from AT&T

Asia-Pacific

- Ausgrid Sydney
- Companhia de Electricidade de Macau (CEM)
- Guangdong Power Grid
- Guangxi Power Grid Company
- Hebei Electric Power Company
- Henan Power Company
- North China Power Grid
- Orion New Zealand
- Provincial Electricity Authority
- Shandong Provincial Electrical Power Corporation
- Shanghai Municipal Electric Power Company
- Shanghai Jiu Long Electric Power Science & Technology Company
- Shanxi Power Company
- Yunnan Power Grid Corporation
- Transpower New Zealand

Latin America

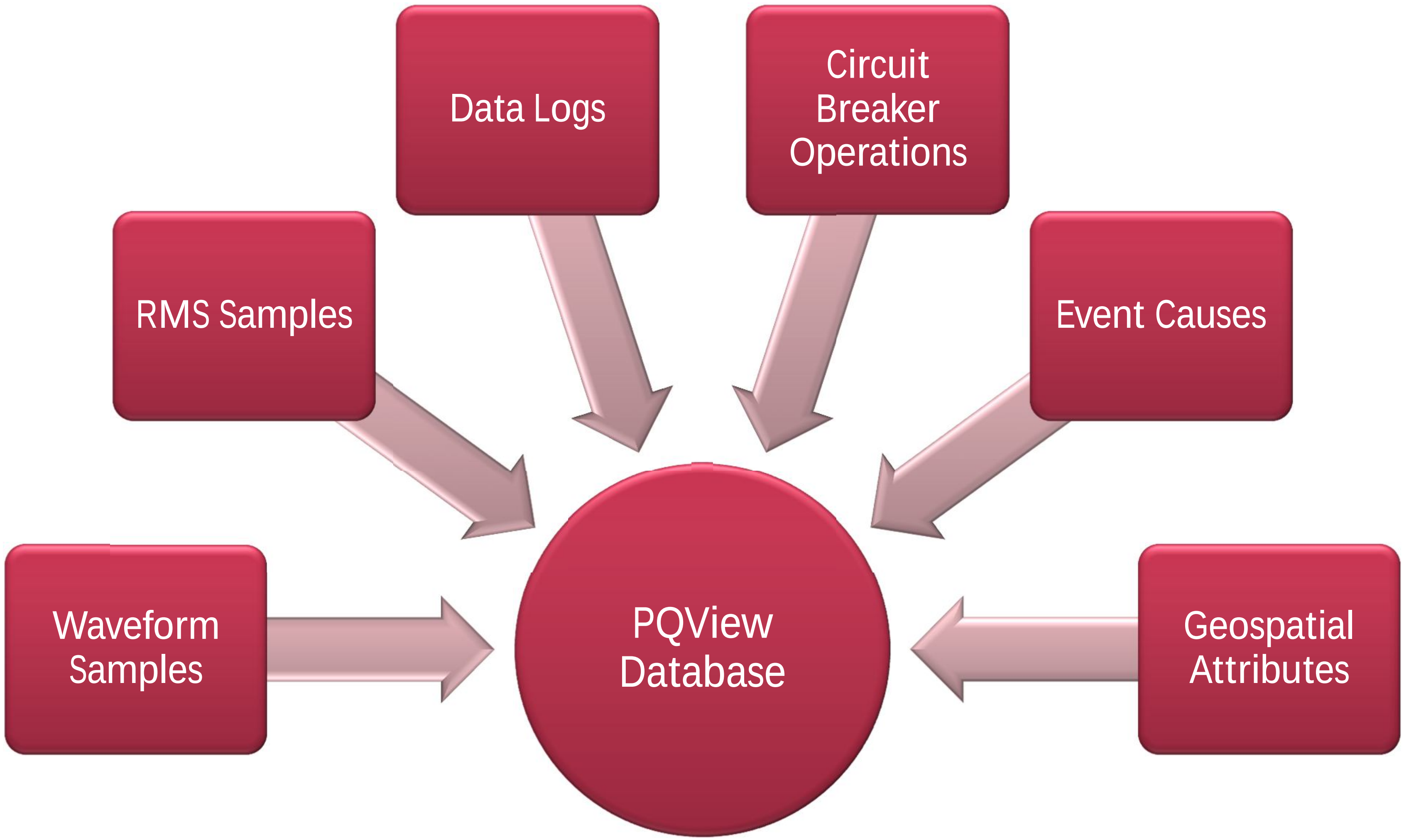
- Central Hidroeléctrica de Caldas
- Operador Nacional do Sistema Eléctrico

Europe

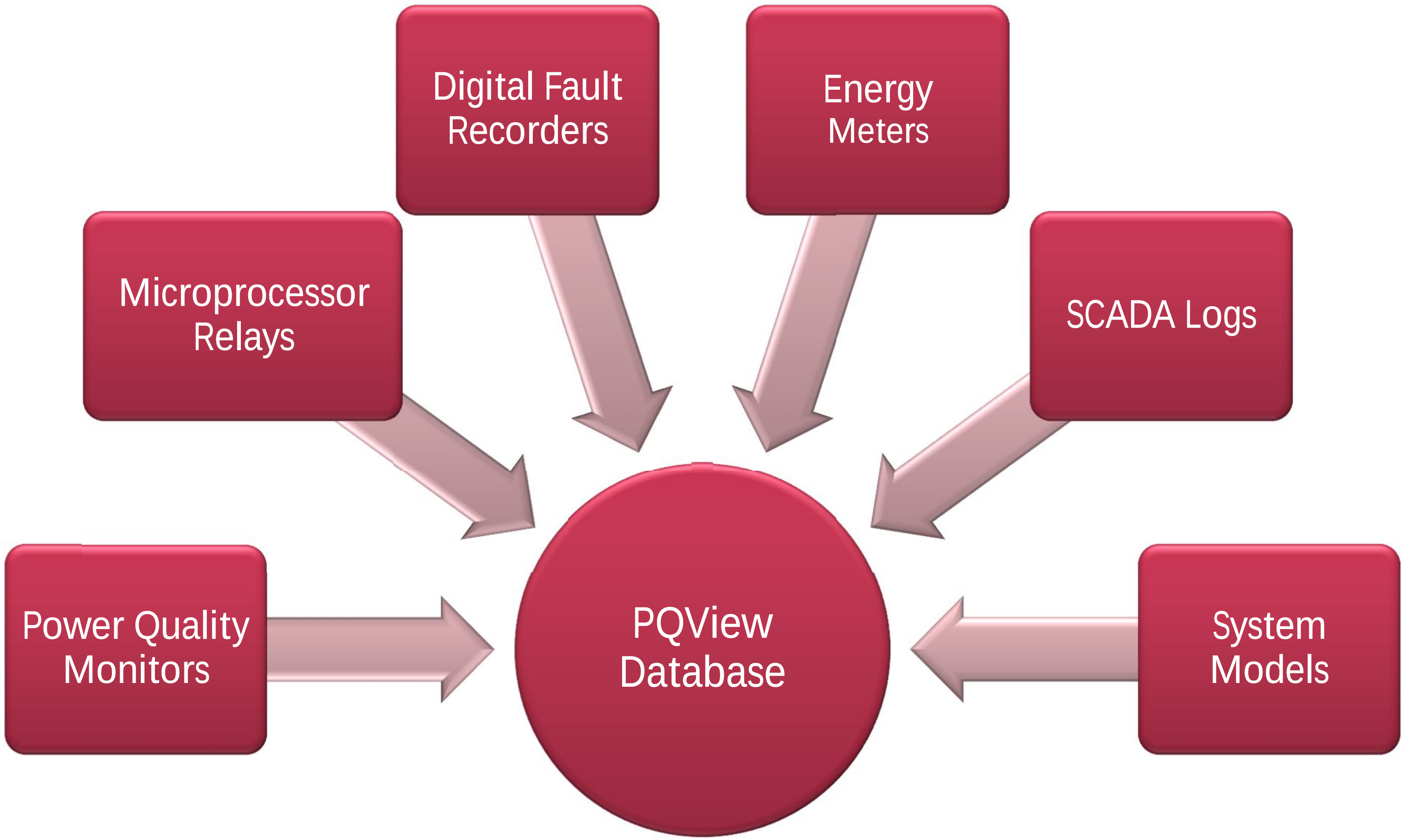
- Agder Energi Nett AS
- BKK Nett AS
- CEE Energiteknikk AS
- Central Networks (E.ON)
- DEM Slovenia
- Elektro Slovenia
- Elektrobistand
- Hålogaland Kraft AS
- Helgelandskraft AS
- Hydro Aluminium AS
- Hrvatska Elektroprivreda (HEP)
- Istad Nett AS
- Lyse Nett AS
- Nordmøre Energiverk AS
- Notodden Energi AS
- PSE-Operator
- Rødøy-Lurøy Kraftverk AS
- SFE Nett AS
- Skagerak Nett AS
- SINTEF
- Statnett
- StatoilHydro
- Sunnfjord Energi AS
- Sweco Grøner AS
- Tafjord Kraftnett AS
- Tussa Nett AS

ELECTROTEK CONCEPTS

What data is stored in a PQView Database?



What are the data sources for a PQView Database?



What analysis functions are offered by PQView?

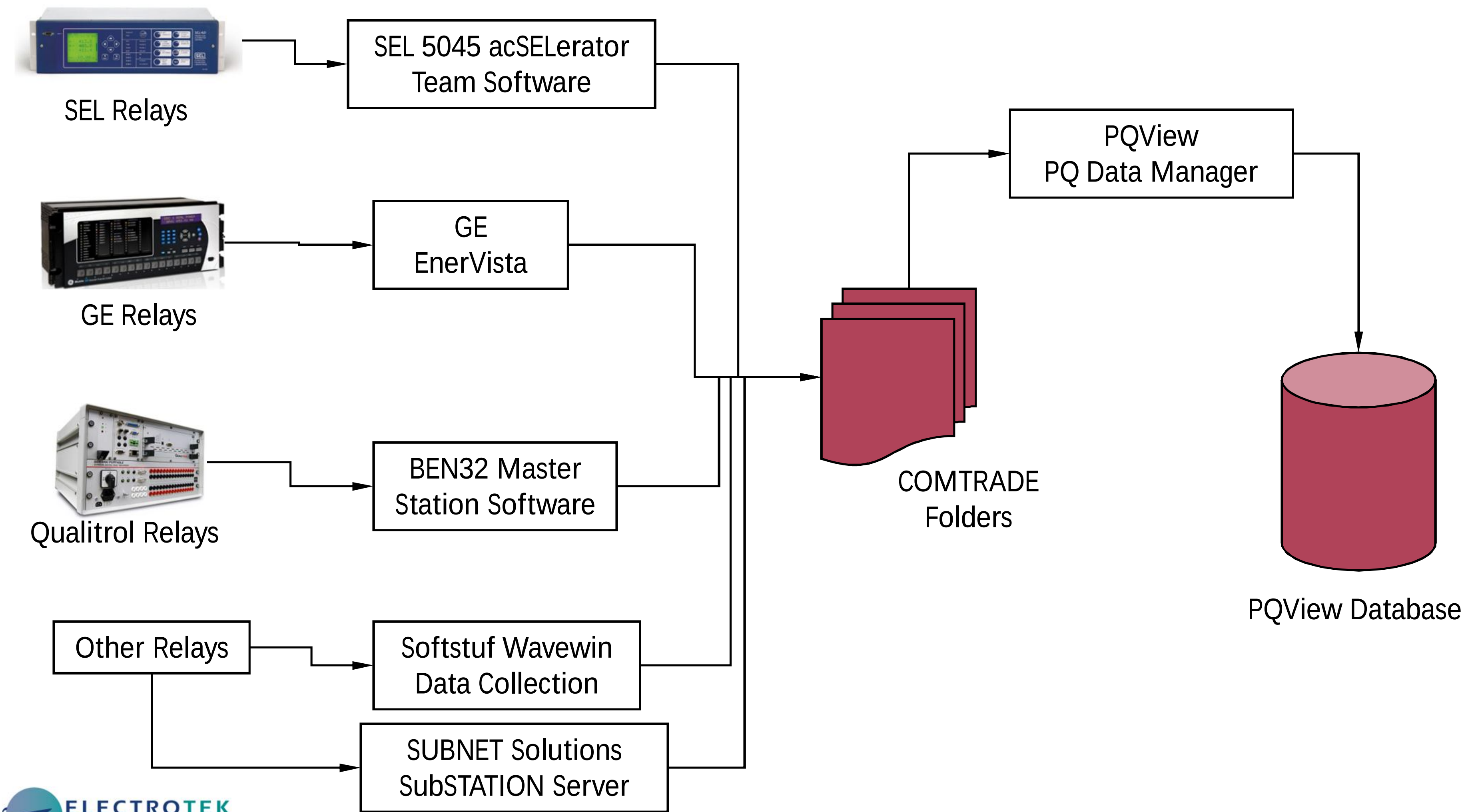
Components of PQView 3

- **Desktop Applications**
  - PQ Data Manager (PQDM)
  - PQ Data Analyzer (PQDA)
  - PQView Express
- **Web Applications**
  - PQWeb
  - WebPQView
  - GIS Fault Visualizer
- **PQView Database**
  - Microsoft Access
  - Microsoft SQL Server
- **Developer Tools**
  - Software Developers Kit (SDK)
  - PQDIF Library (PQDCOM4.DLL)
  - PQView ActiveX Libraries

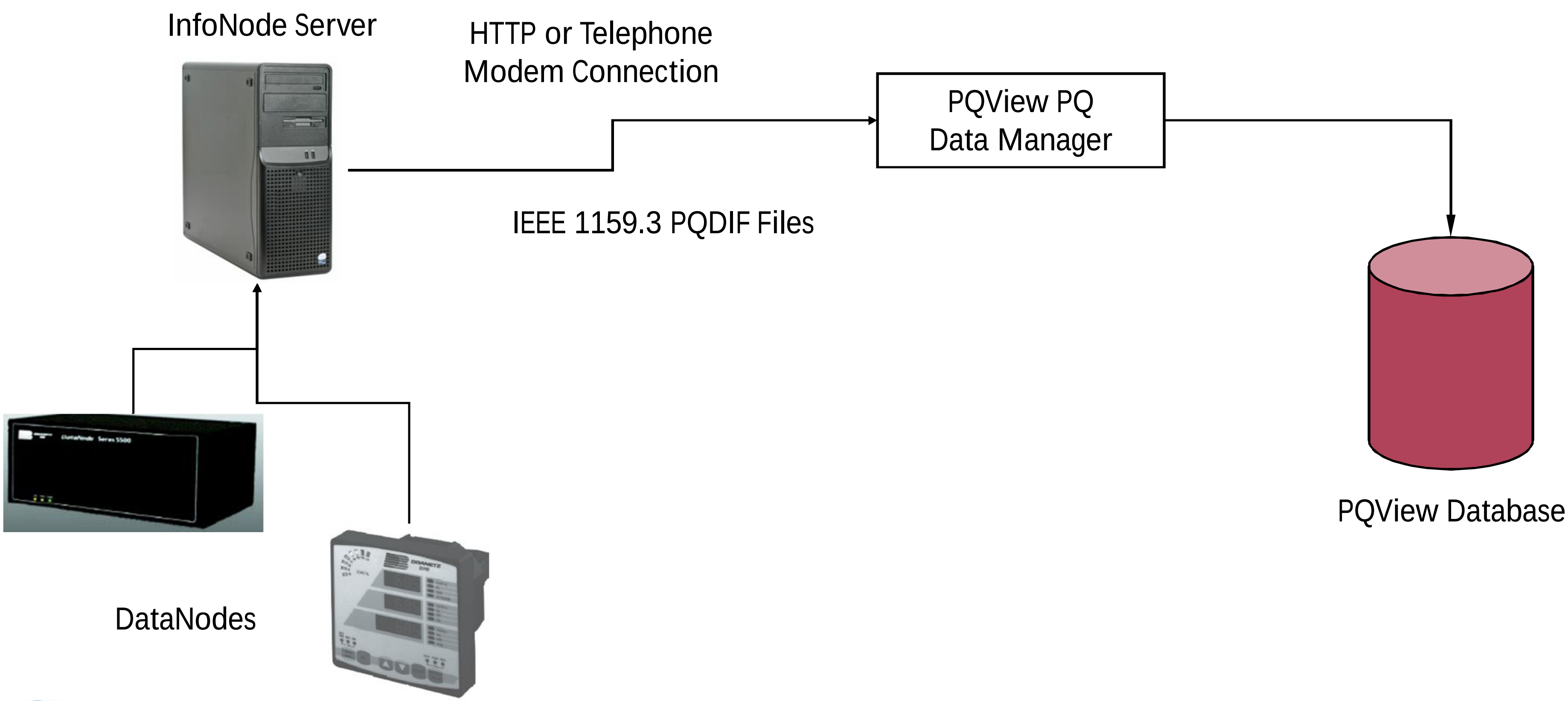
Companies that Produce Power System Sensors or Software Integrated by PQView Users Today

- Advantech®
- Arbiter® Systems
- Cooper Power Systems® CYME
- Dranetz®
- Edison Electric Institute®
- EDMI
- Electro Industries®
- Electrotek Concepts®
- E-MAX Instruments
- Fluke®/Reliable Power Meters
- General Electric®
- GL Industrial Group/Stoner Software® SynerGEE® Electric
- Gossen Metrawatt
- GridSense
- Grounded Power
- HIOKI®
- Landis+Gyr®
- Linbo
- OSIsoft®
- Power Monitors, Inc.® (PMI)
- PSL Power Standards Labs®
- Qualitrol®/LEM Instruments
- SATEC
- Schneider Electric®/Power Measurement®
- Schweitzer Engineering Laboratories® (SEL)
- Siemens®
- SoftSwitching Technologies®
- Unipower®
- Utility Systems Inc. (USI)

IEEE COMTRADE Files

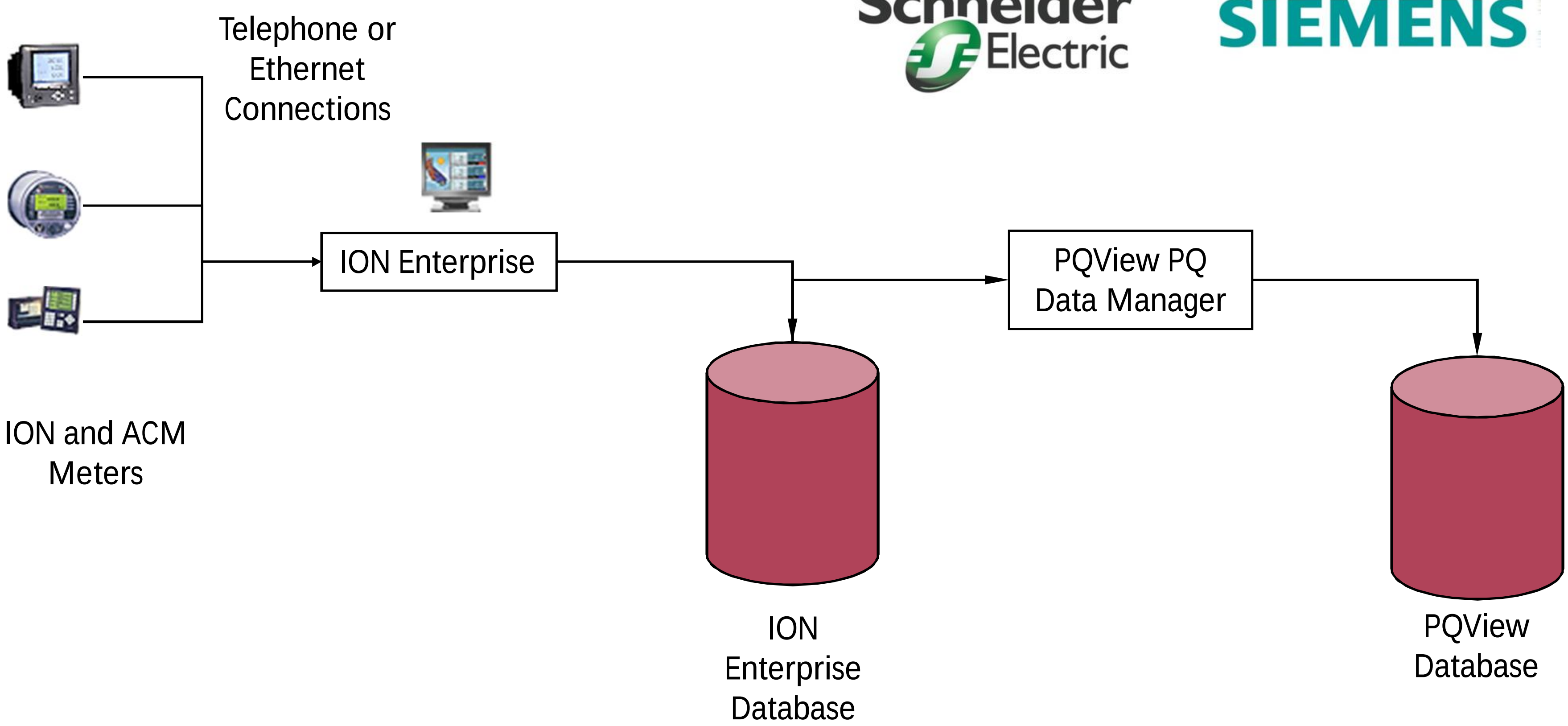


Signature System®/Encore Series



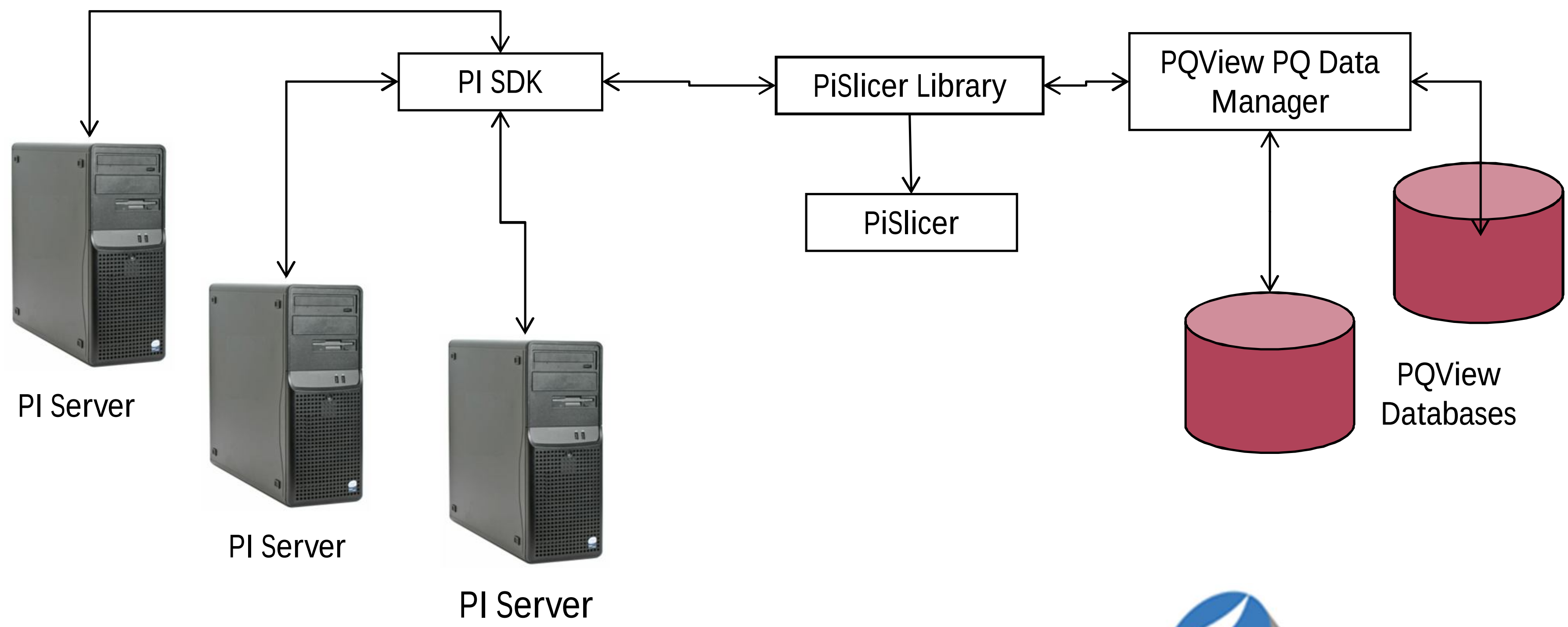
PQView Integration with ION Enterprise® or WinPM.Net Database

• Requires installation of optional ION Enterprise Database Data Handler

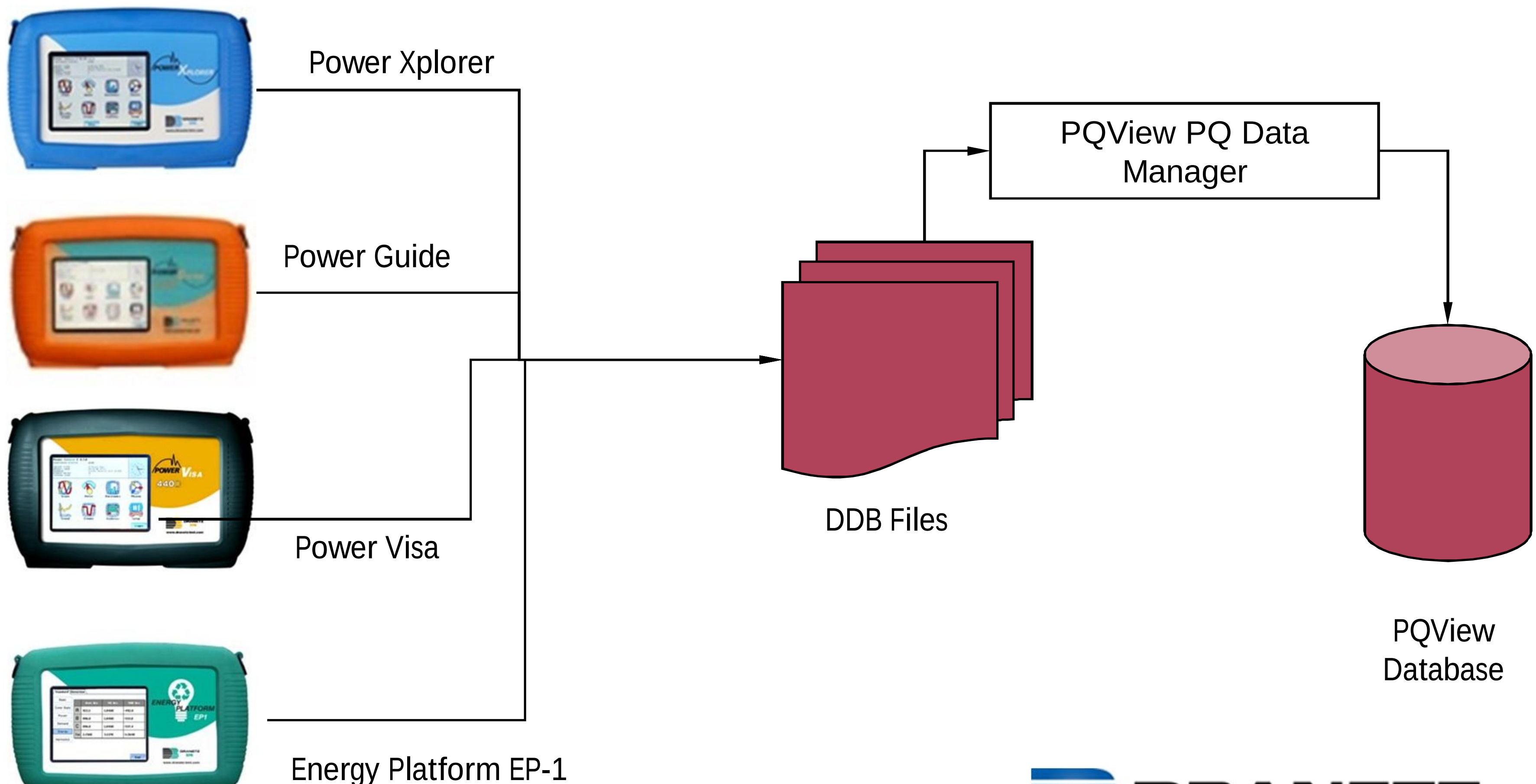


OSIsoft PI System

- Requires installation of optional OSIsoft PI SDK and Electrotek PiSlicer Library



PQView Integration with Dranetz Portable Monitors



More Data Sources

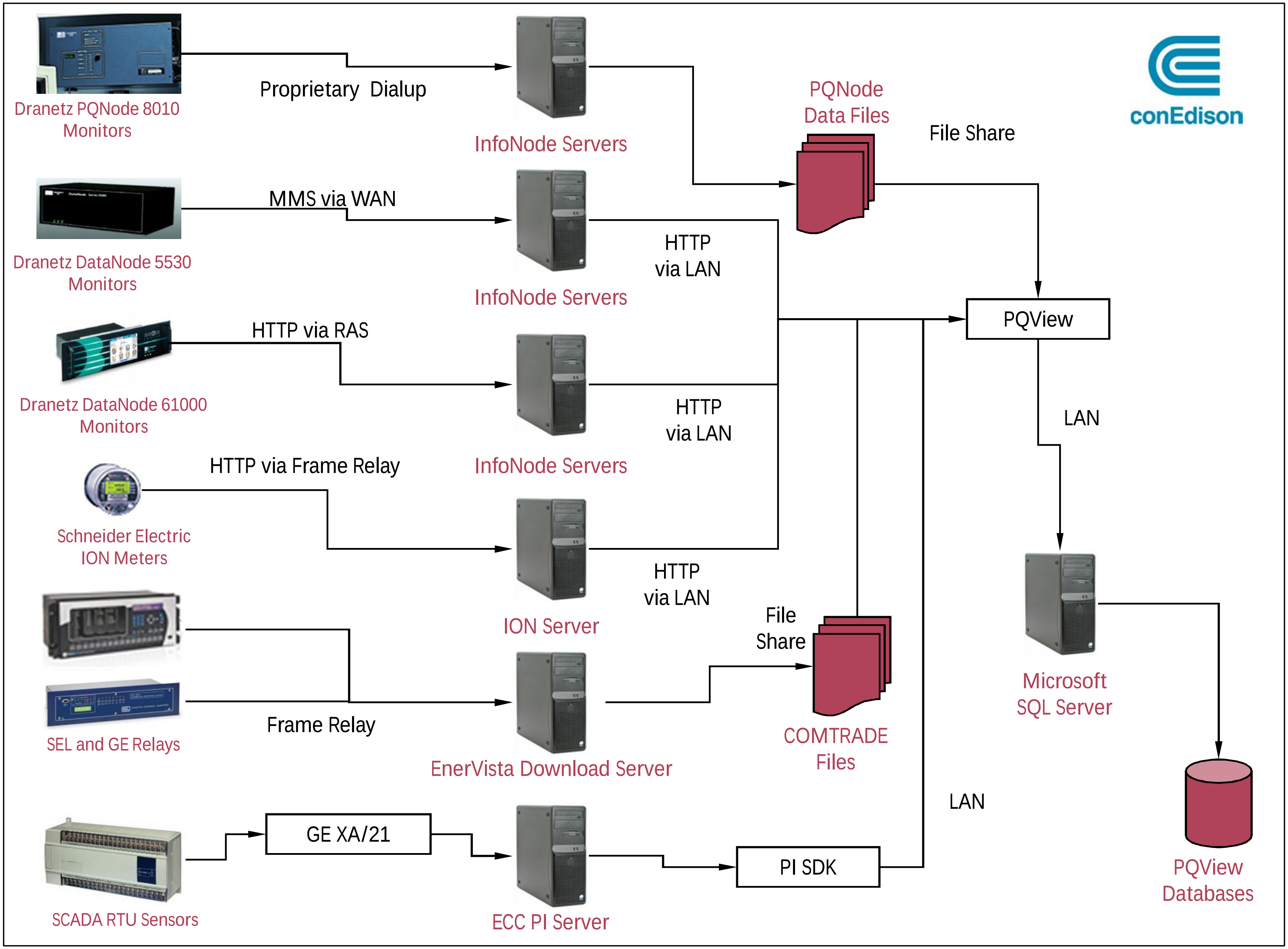
- Cooper Power Systems CYME
- Dranetz® PES Databases
- Electro Industries/General Electric Communicator Log EPM Files
- Fluke®/Reliable Power Meters (RPM) Omega and Scenario Databases
- GL Industrial Group/Stoner Software® SynerGEE
- Gossen Metrawatt Portable Monitors
- GridSense PowerView
- GroundedPower Text Files
- HIOKI® Text Files
- Landis+Gyr® Text Files
- PQView Text File Formats
- PQView Databases
- SATEC PAS Databases
- Siemens® SICARO PQ Manager Text Files
- SoftSwitching Technologies® I-Grid® Web Site

www.pqview.com/data-sources/

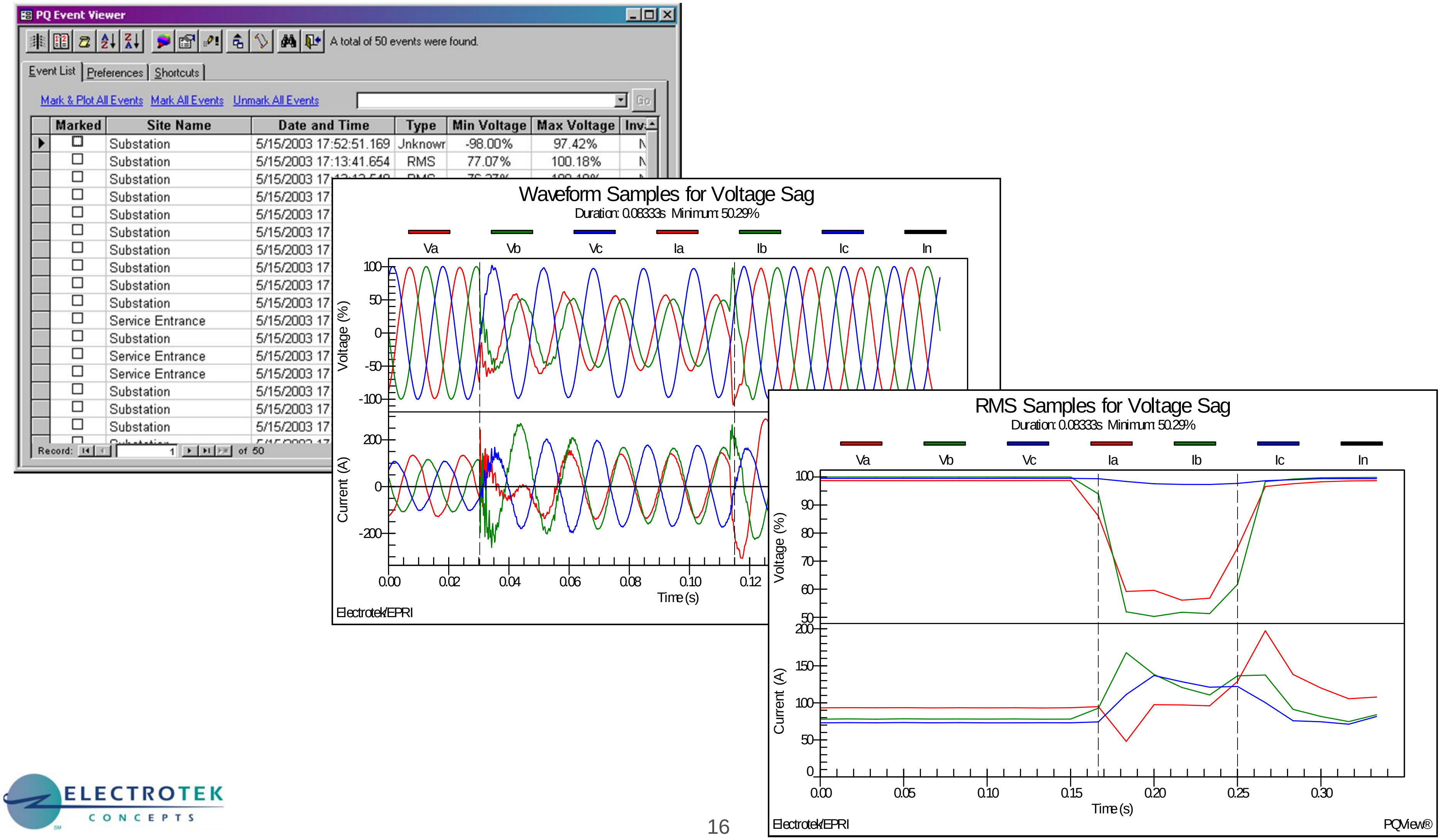
ELECTROTEK CONCEPTS

Custom Data Sources

- Alabama Power Company SCADA Database
- Con Edison AMR Databases
- Ergon Energy Australia AMR Database
- Progress Energy Feeder Management System Database
- Provincial Electric Authority (PEA) Thailand AMR Database


Dranetz PQNode 8010 Monitors
Proprietary Dialup
InfoNode Servers
PQNode Data Files
File Share
conEdison
Dranetz DataNode 5530 Monitors
MMS via WAN
InfoNode Servers
HTTP via LAN
Dranetz DataNode 61000 Monitors
HTTP via RAS
PQView
InfoNode Servers
HTTP via LAN
LAN
Schneider Electric ION Meters
HTTP via Frame Relay
ION Server
HTTP via LAN
File Share
Microsoft SQL Server
SEL and GE Relays
Frame Relay
EnerVista Download Server
COMTRADE Files
LAN
SCADA RTU Sensors
GE XA/21
ECC PI Server
PI SDK
PQView Databases

PQView Event Analysis

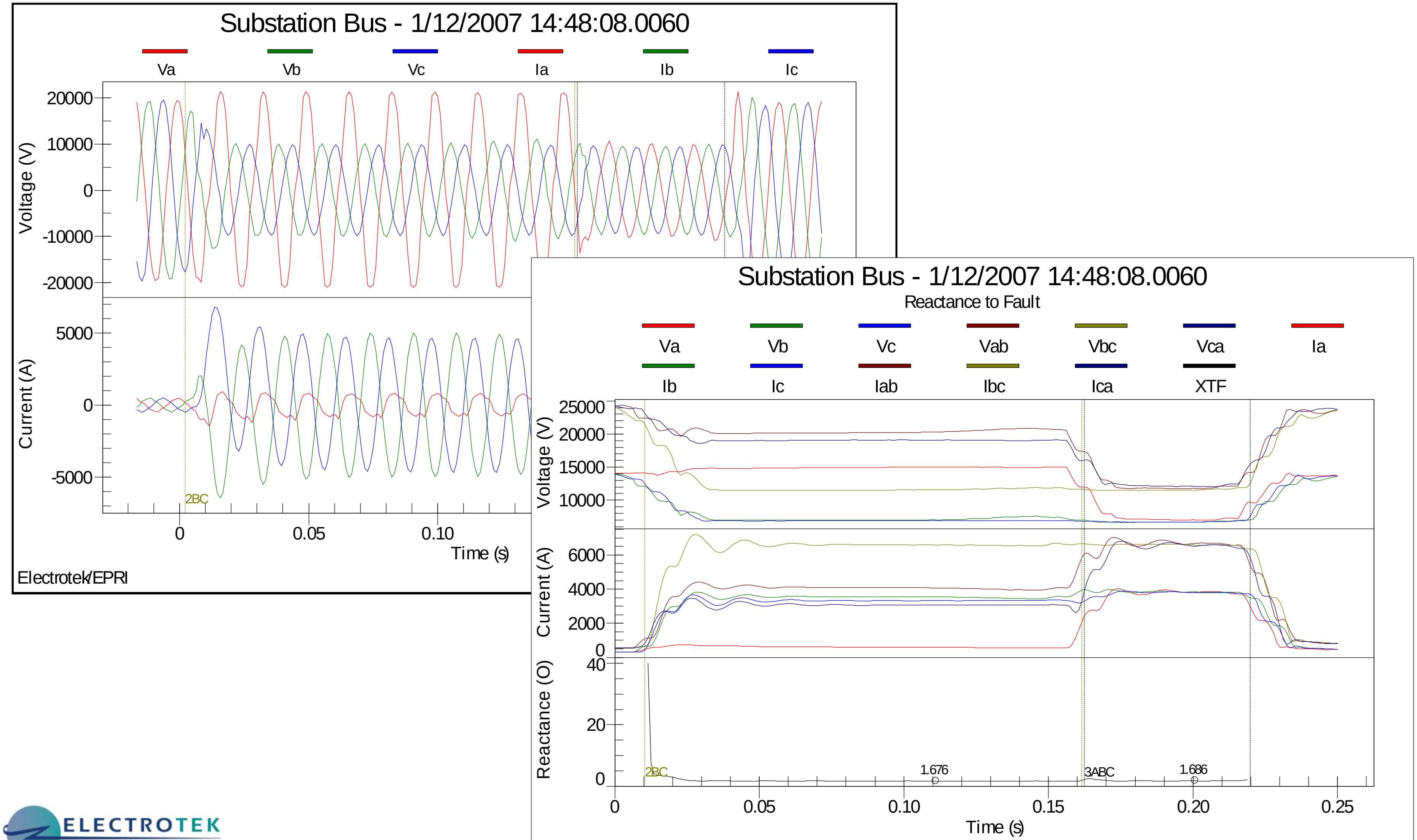


ELECTROTEK CONCEPTS

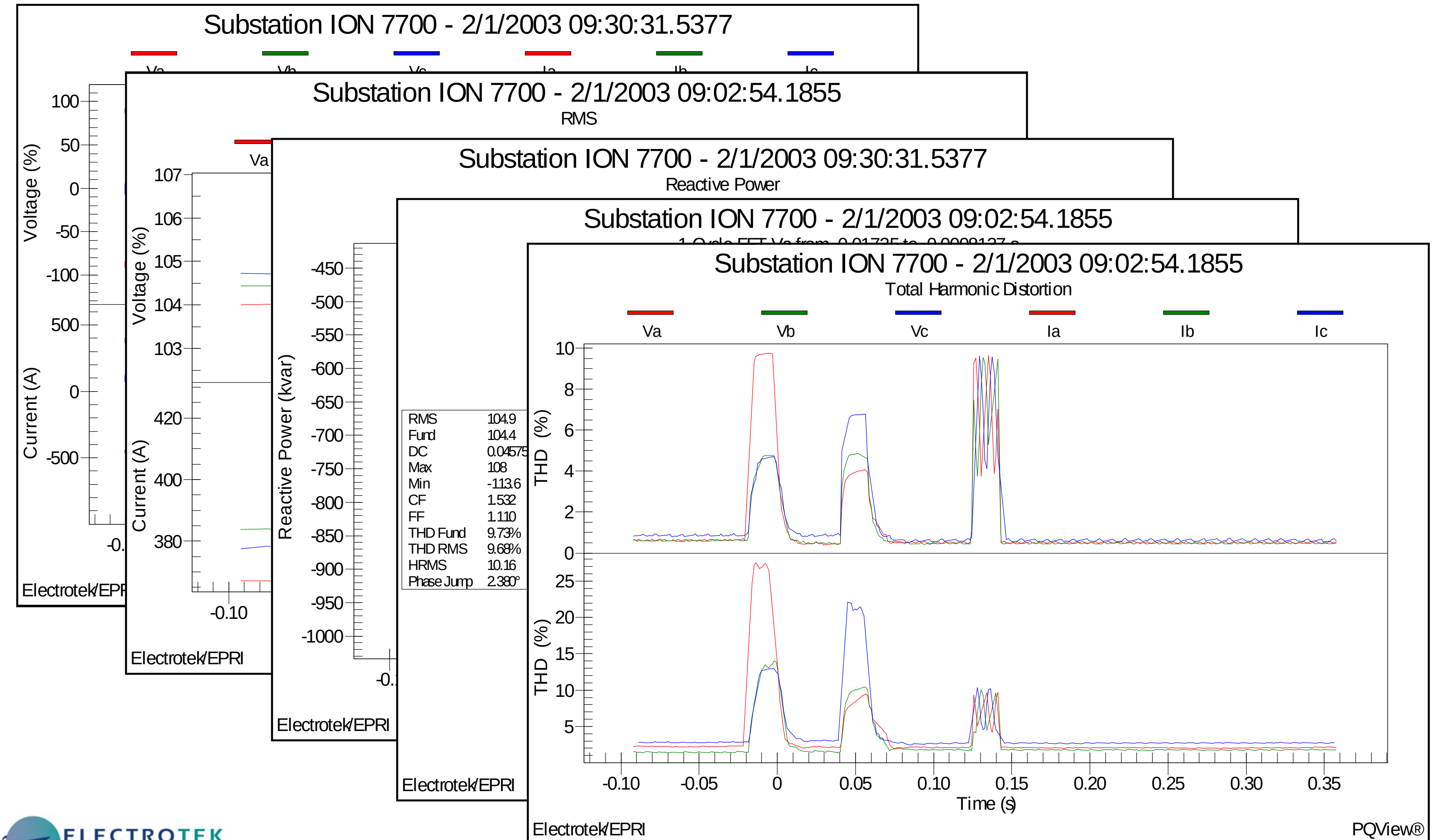
Derivations from Waveform and RMS Samples

- Reactance-to-Fault
- Radial Fault Location
- Spectrum Charts
  - 1, 2, 3, 4, 5, 6, 10, and 12 Cycle Windows
- Phasors and Harmonic Phasors
- High-Pass Filter and Low-Pass Filter
- First Derivative , Second Derivative, Third Derivative, and Squared Value·Time
- Mean Values and RMS Values
- Load Resistance, Load Reactance, Load Impedance, and Load Impedance Angle
- Real Power, Reactive Power, Apparent Power, and Energy
- Delta Real Power, Reactive Power, Apparent Power, and Energy
- Characteristic Voltage
- Waveform Transformation
- Missing Voltage and Delta Current from First Cycle or from Ideal Waveform
- Symmetrical Components
- Delta Symmetrical Components
- Three-Phase Diode Rectifier Output
- Line Frequency during Event
- Total Harmonic Distortion (THD)
- DC Component, Fundamental Component, and Harmonic Trends during Event
- Links to Map Viewer and Trend Viewer
- IEEE P1159.2 RMS Characteristics
- IEEE P1159.2 Point-in Wave Characteristics
- IEEE P1159.2 Missing Voltage Characteristics
- Dranetz Event Characteristics
- Digital Status Changes
- Operations Summary

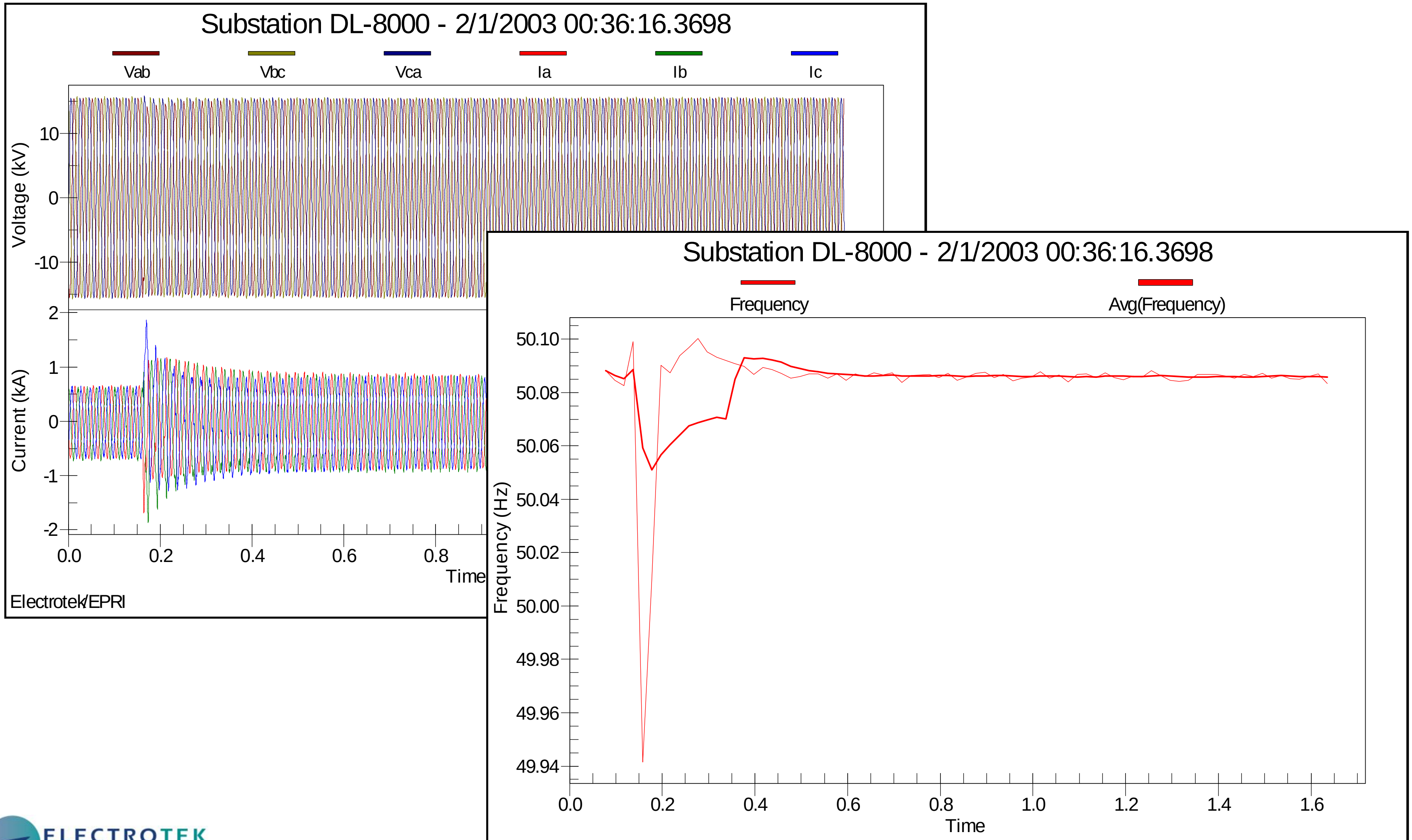
Examples of PQView Event Derivations



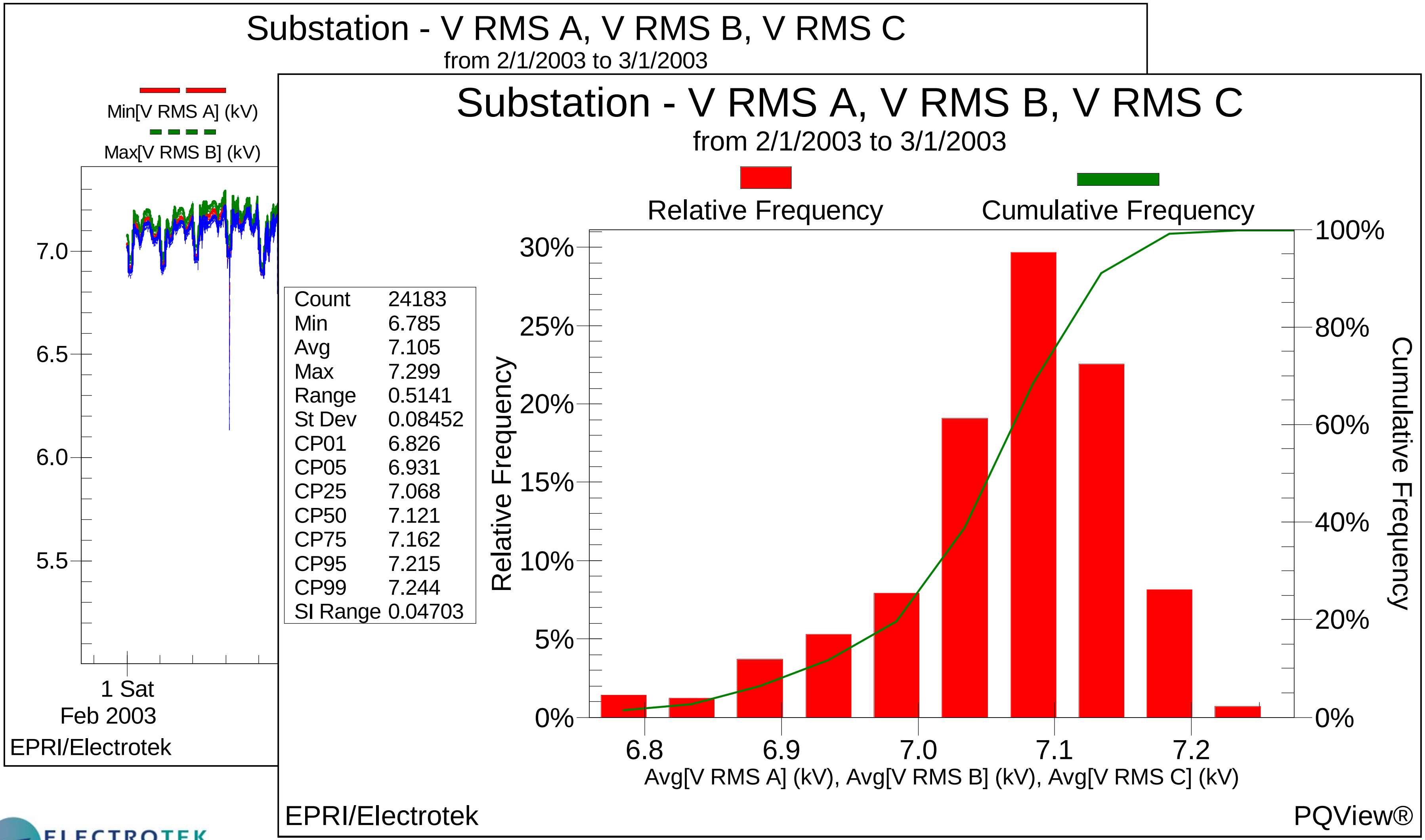
Examples of PQView Event Derivations



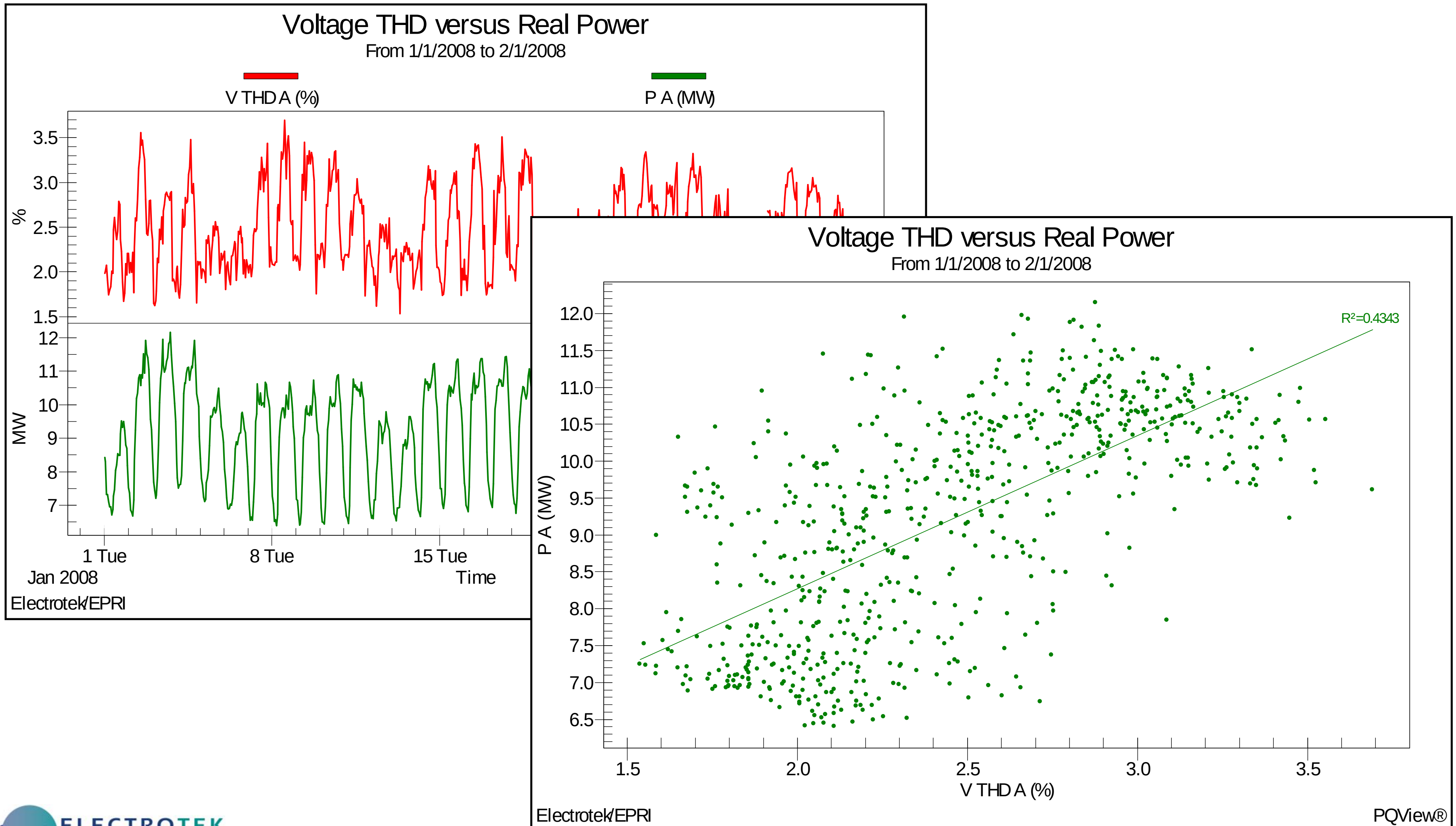
Examples of PQView Event Derivations



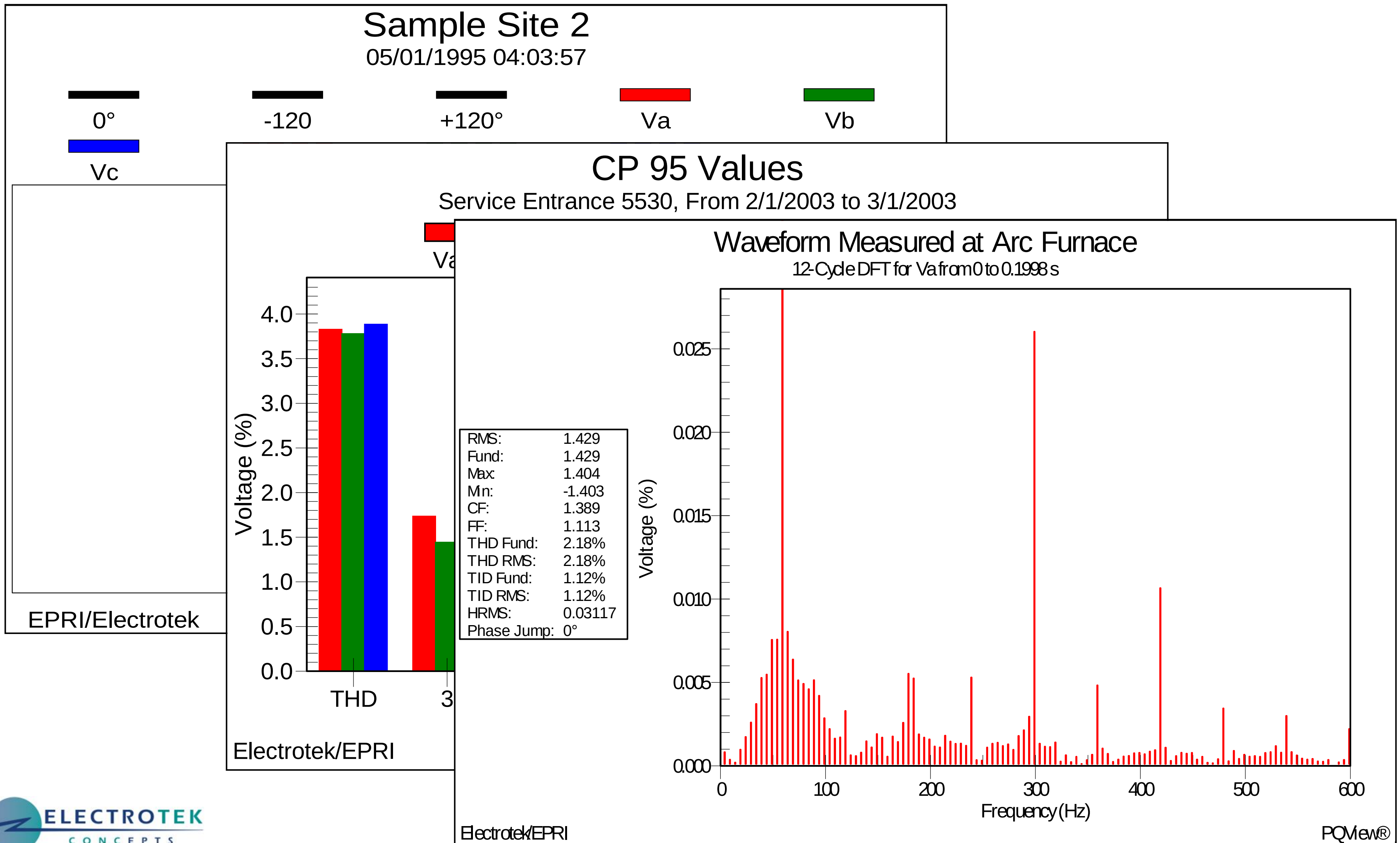
Analysis of Data Logs



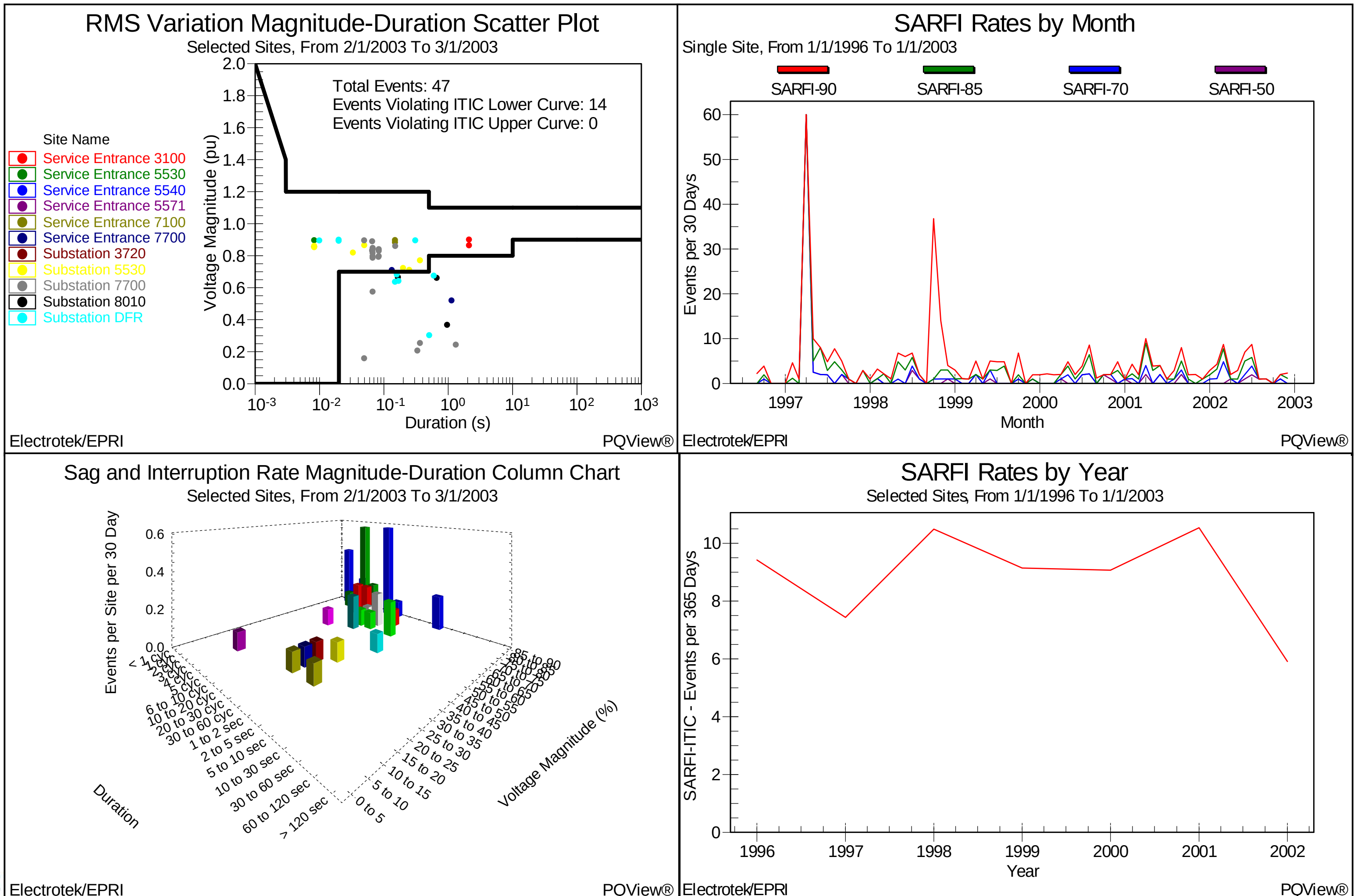
Analysis of Data Logs



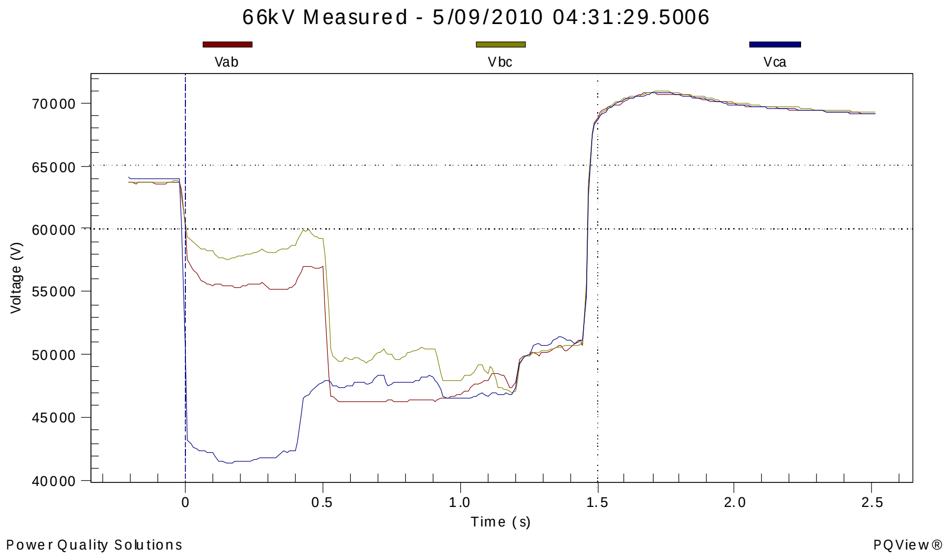
Phasor and Harmonic Analysis

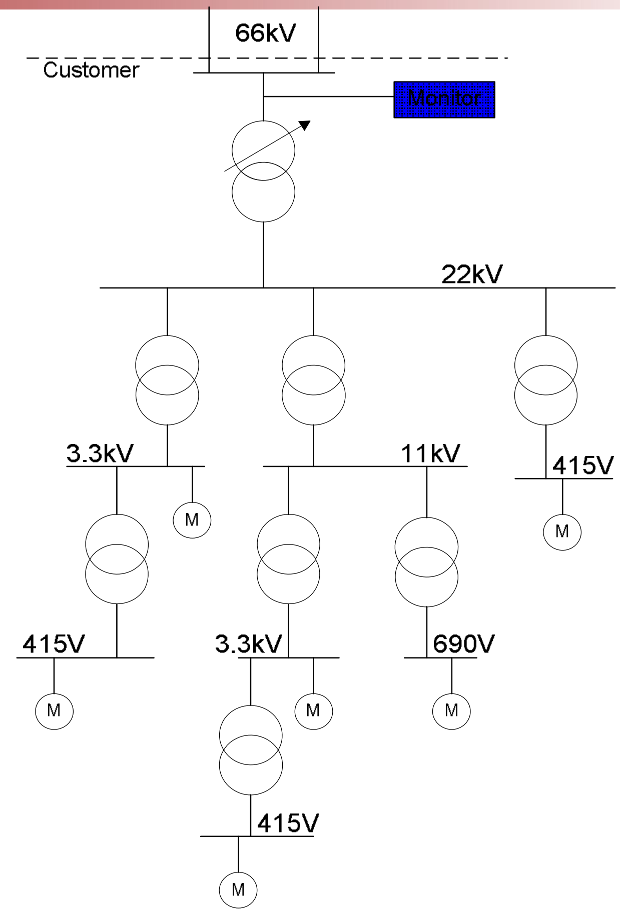


RMS Voltage Variation Analysis

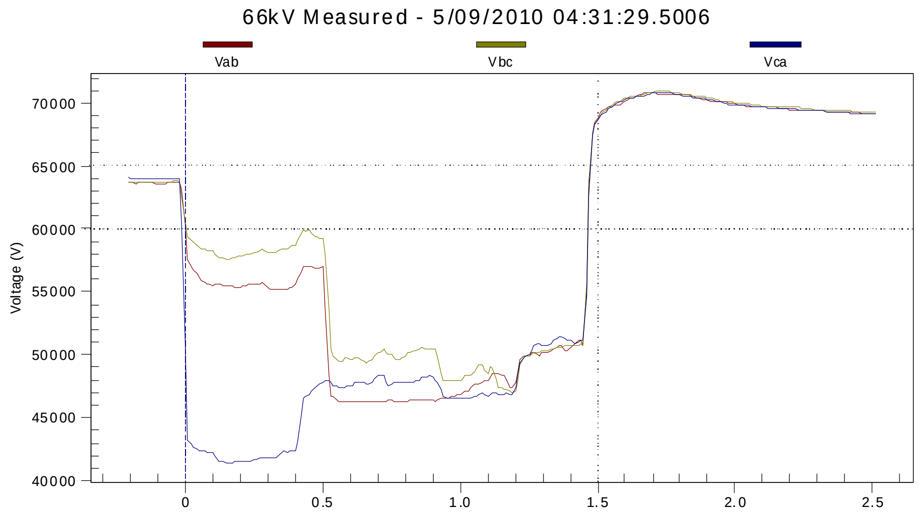


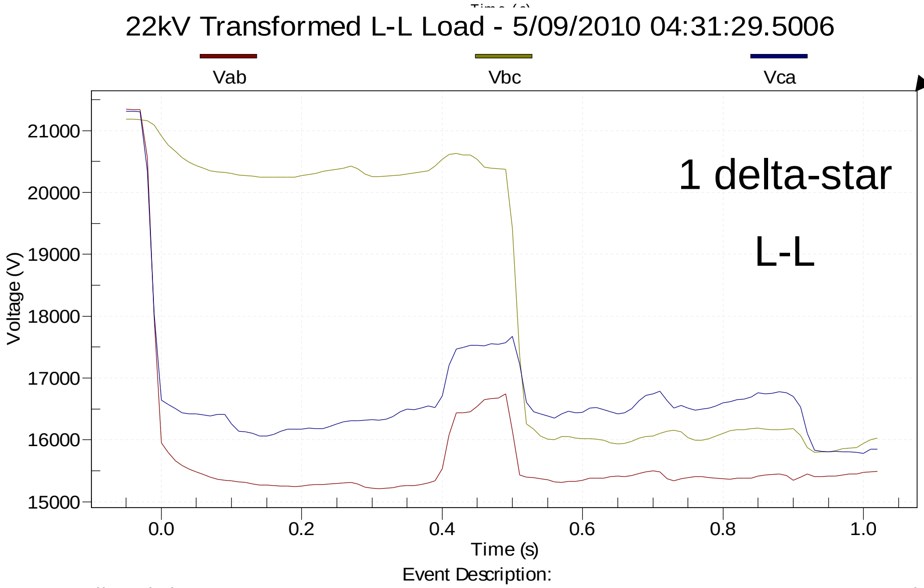
Transformed waveforms

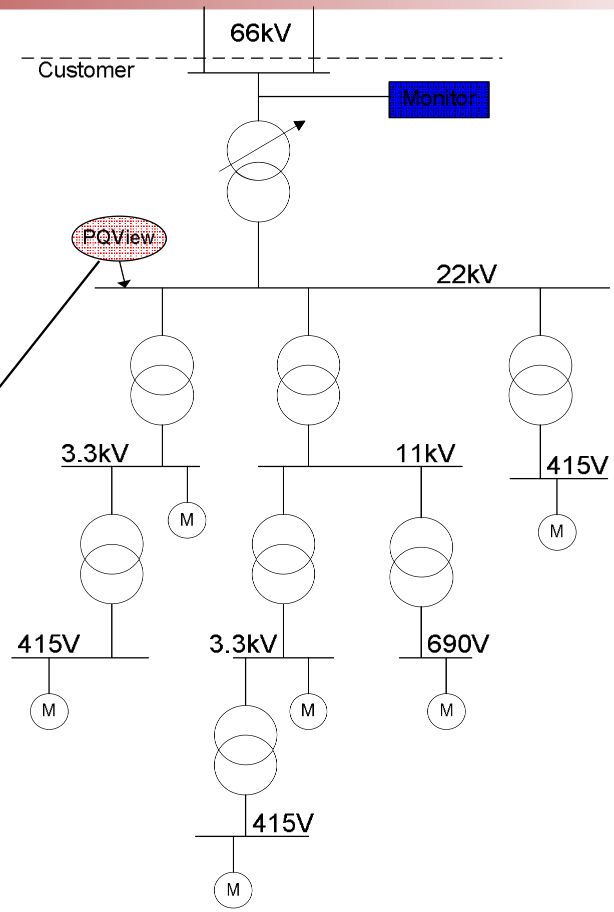




Transformed waveforms







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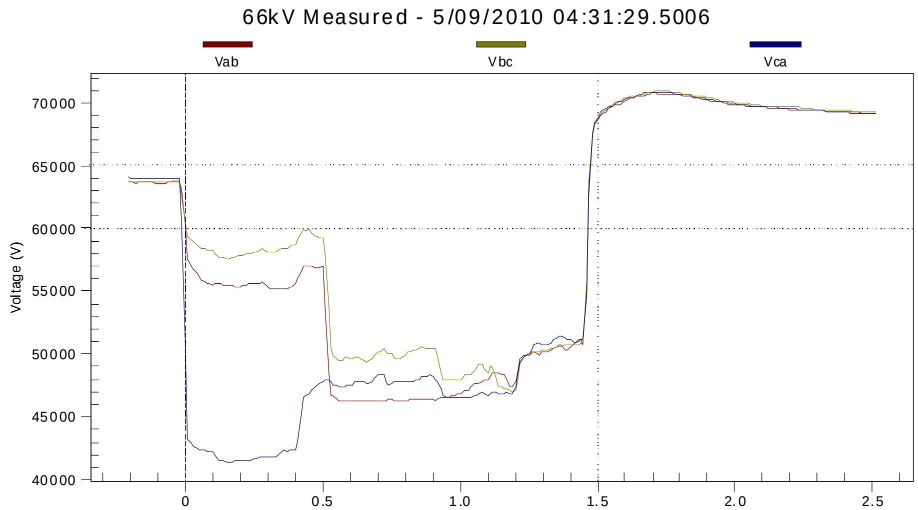

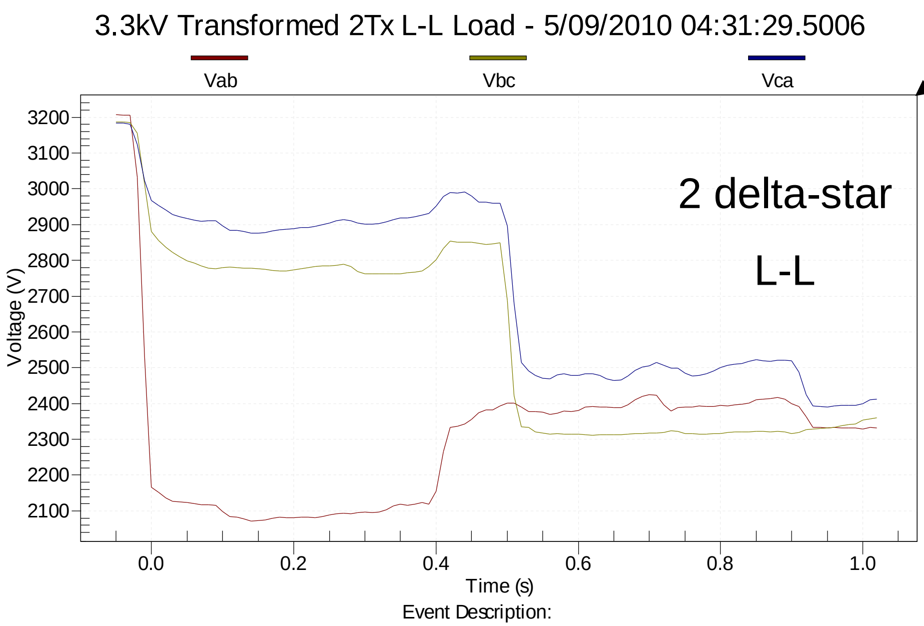

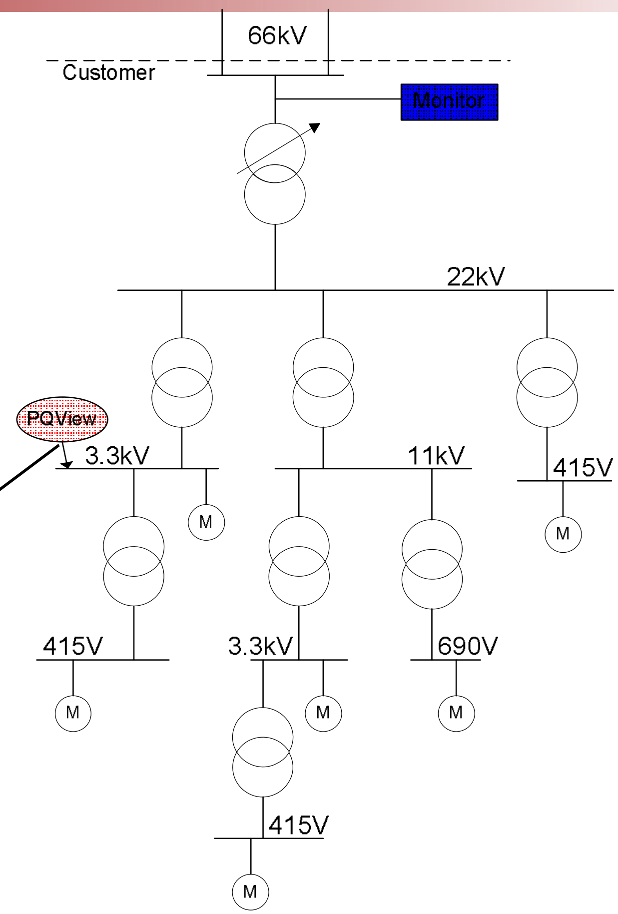

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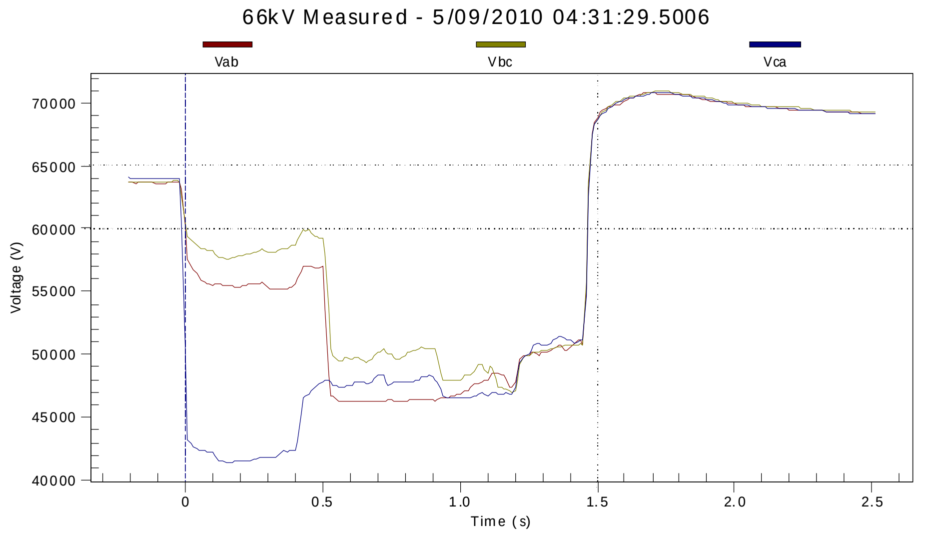
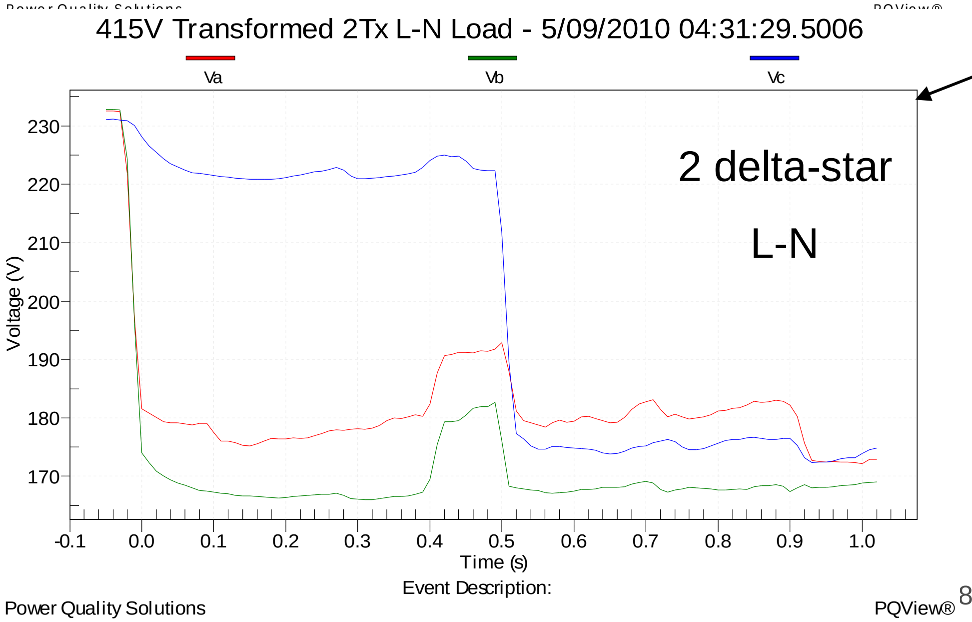
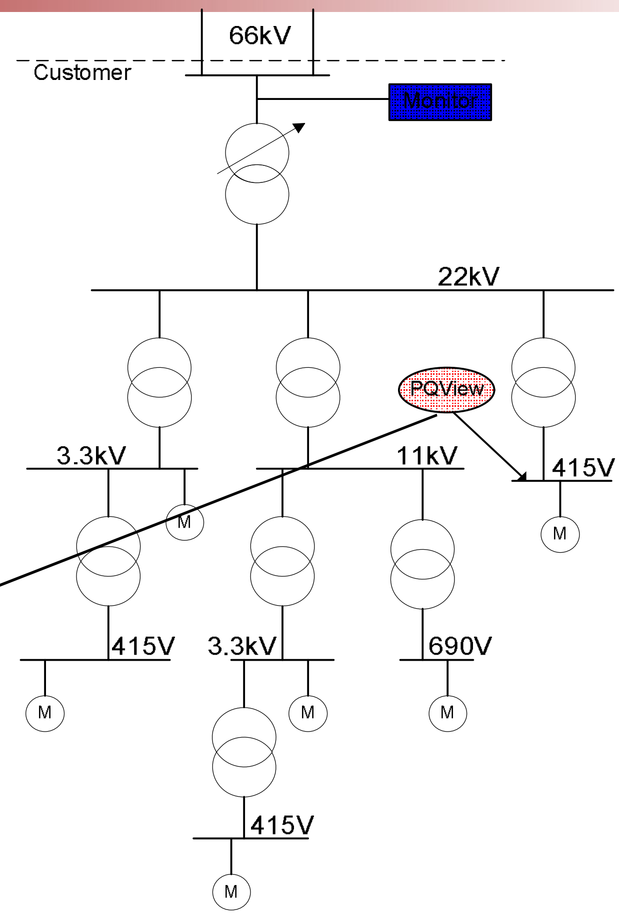
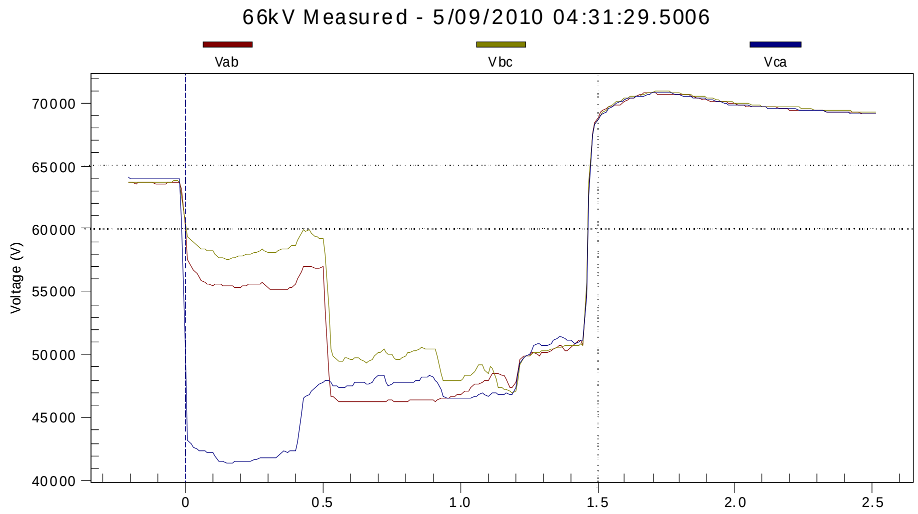
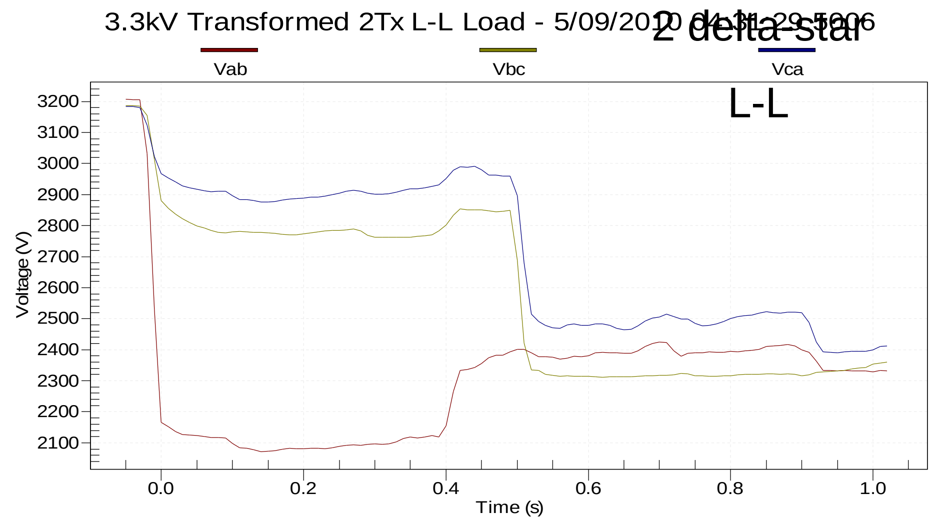


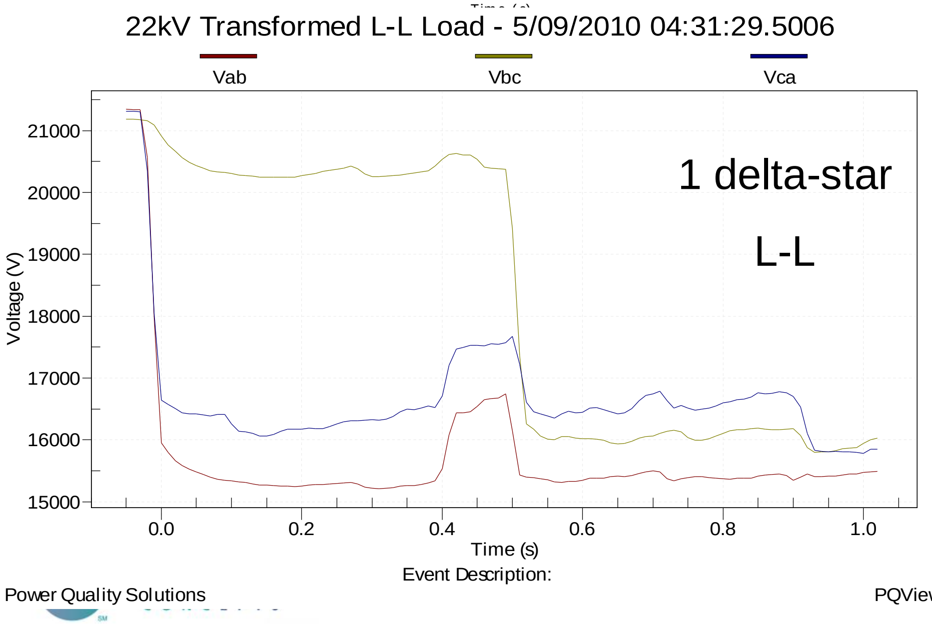


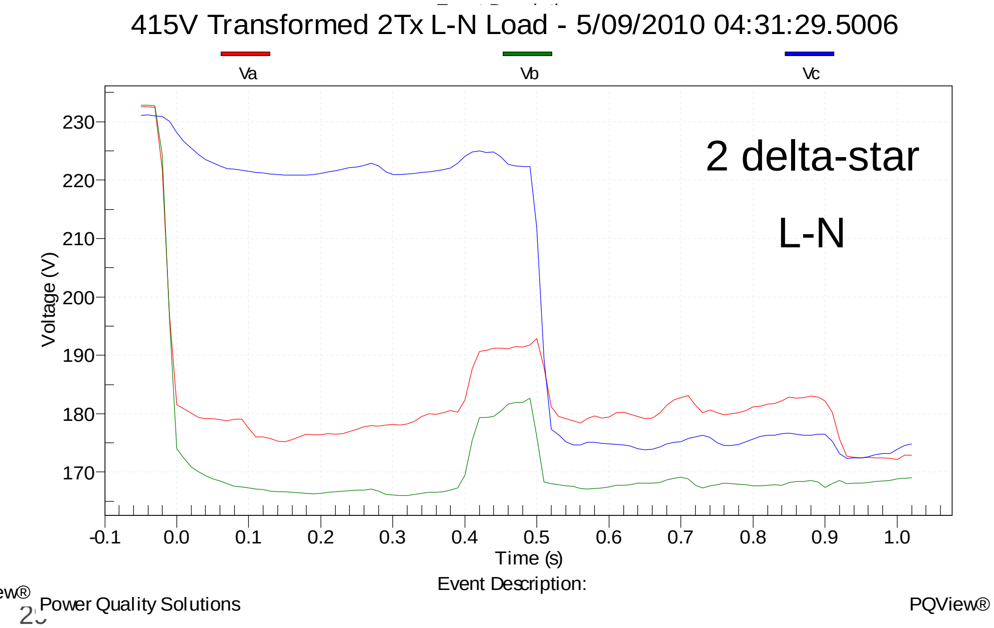


Transformed waveforms

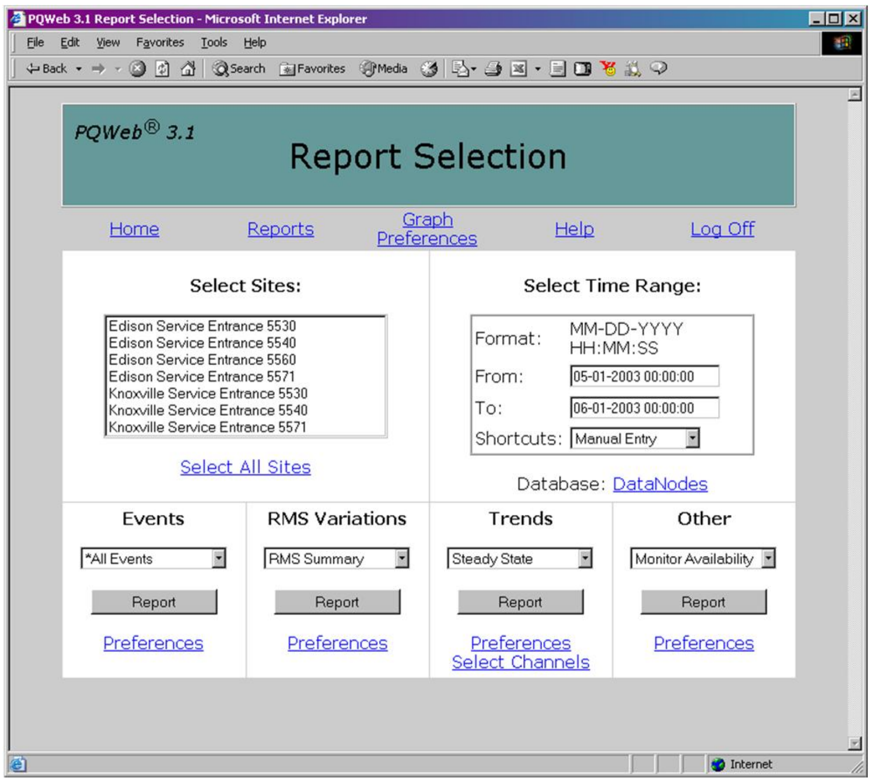


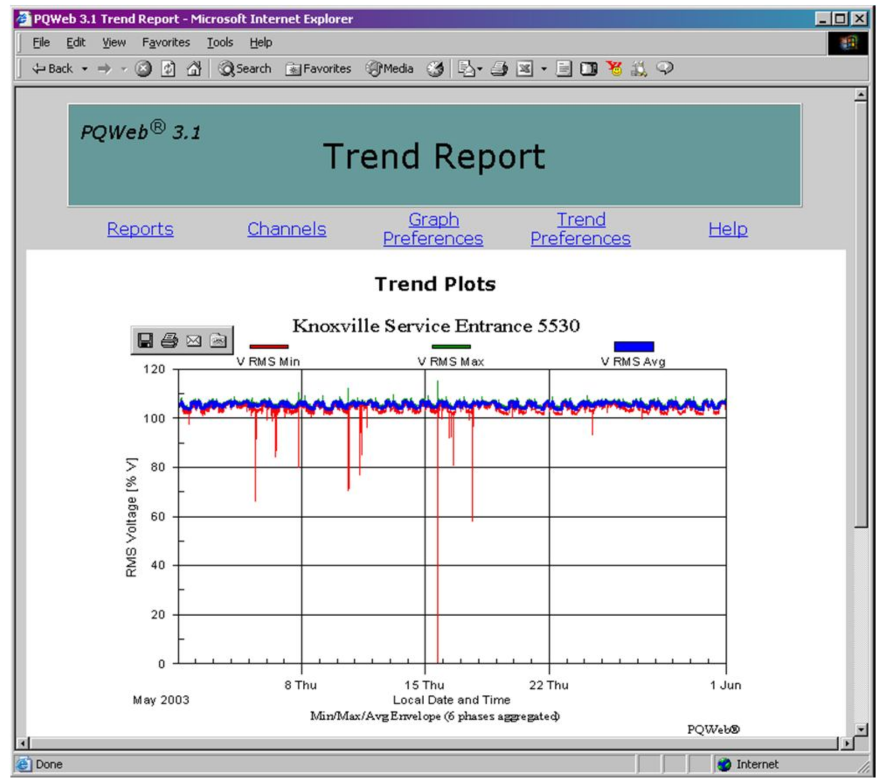




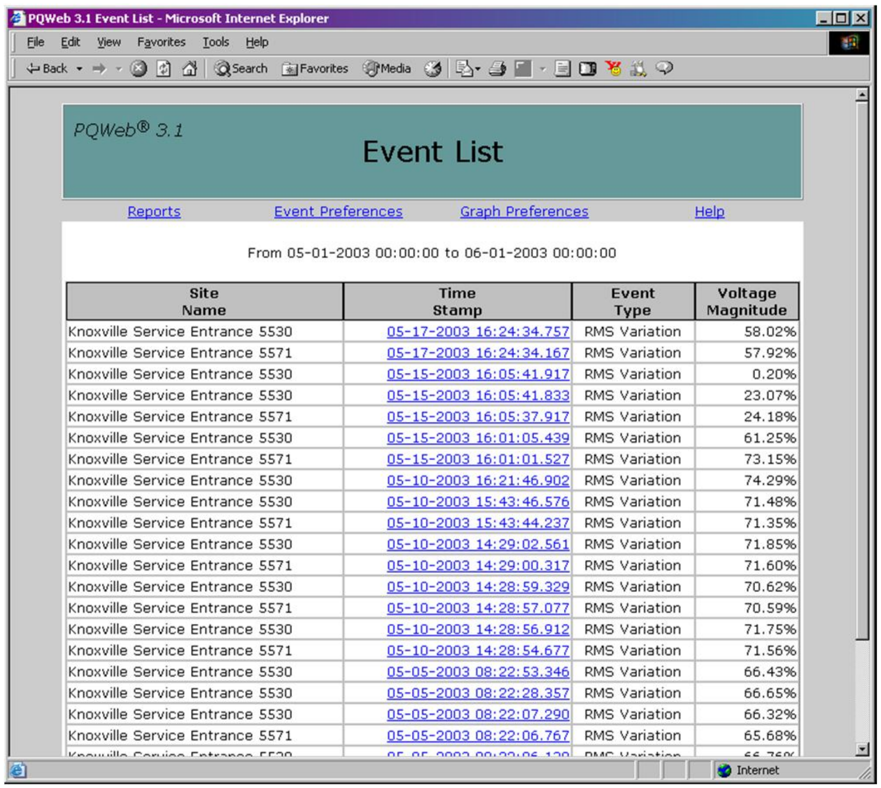


PQWeb Analysis via Internet





PQWeb Analysis via Internet


PQWeb 3.1 Event List - Microsoft Internet Explorer

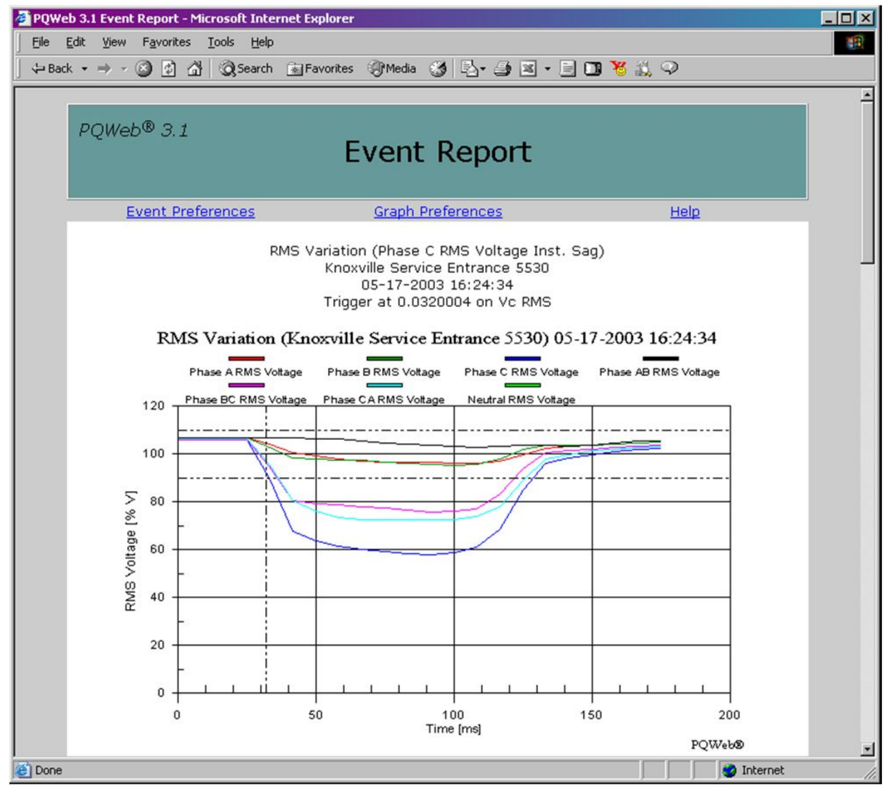
PQWeb® 3.1

Event List

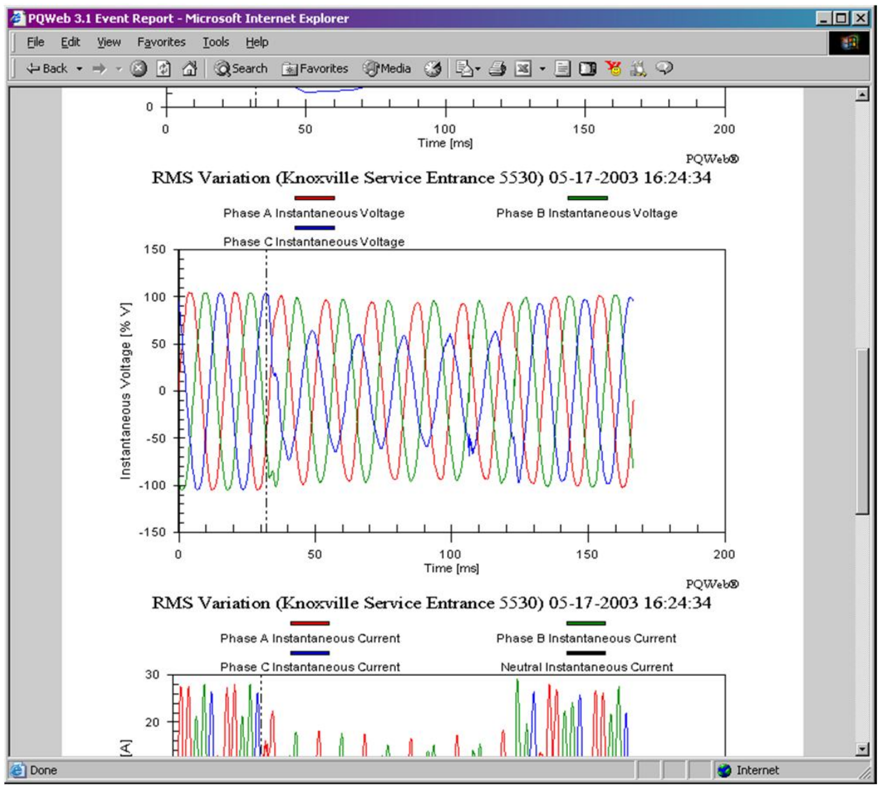
Reports | Event Preferences | Graph Preferences | Help

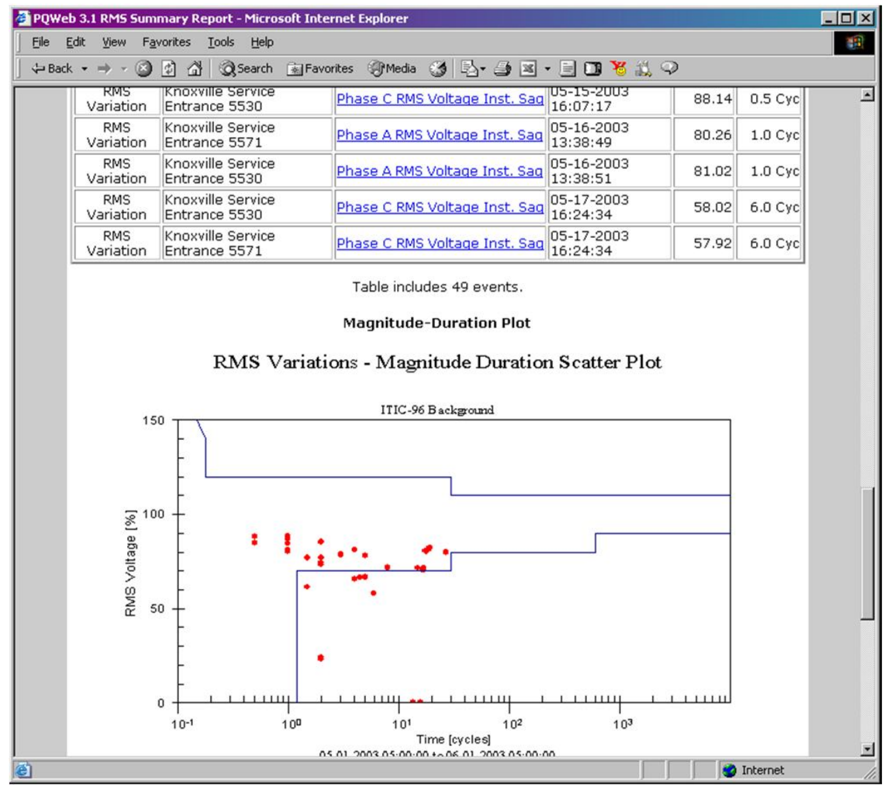
From 05-01-2003 00:00:00 to 06-01-2003 00:00:00

Site Name	Time Stamp	Event Type	Voltage Magnitude
Knoxville Service Entrance 5530	05-17-2003 16:24:34.757	RMS Variation	58.02%
Knoxville Service Entrance 5571	05-17-2003 16:24:34.167	RMS Variation	57.92%
Knoxville Service Entrance 5530	05-15-2003 16:05:41.917	RMS Variation	0.20%
Knoxville Service Entrance 5530	05-15-2003 16:05:41.833	RMS Variation	23.07%
Knoxville Service Entrance 5571	05-15-2003 16:05:37.917	RMS Variation	24.18%
Knoxville Service Entrance 5530	05-15-2003 16:01:05.439	RMS Variation	61.25%
Knoxville Service Entrance 5571	05-15-2003 16:01:01.527	RMS Variation	73.15%
Knoxville Service Entrance 5530	05-10-2003 16:21:46.902	RMS Variation	74.29%
Knoxville Service Entrance 5530	05-10-2003 15:43:46.576	RMS Variation	71.48%
Knoxville Service Entrance 5571	05-10-2003 15:43:44.237	RMS Variation	71.35%
Knoxville Service Entrance 5530	05-10-2003 14:29:02.561	RMS Variation	71.85%
Knoxville Service Entrance 5571	05-10-2003 14:29:00.317	RMS Variation	71.60%
Knoxville Service Entrance 5530	05-10-2003 14:28:59.329	RMS Variation	70.62%
Knoxville Service Entrance 5571	05-10-2003 14:28:57.077	RMS Variation	70.59%
Knoxville Service Entrance 5530	05-10-2003 14:28:56.912	RMS Variation	71.75%
Knoxville Service Entrance 5571	05-10-2003 14:28:54.677	RMS Variation	71.56%
Knoxville Service Entrance 5530	05-05-2003 08:22:53.346	RMS Variation	66.43%
Knoxville Service Entrance 5530	05-05-2003 08:22:28.357	RMS Variation	66.65%
Knoxville Service Entrance 5530	05-05-2003 08:22:07.290	RMS Variation	66.32%
Knoxville Service Entrance 5571	05-05-2003 08:22:06.767	RMS Variation	65.68%



PQWeb Analysis via Internet

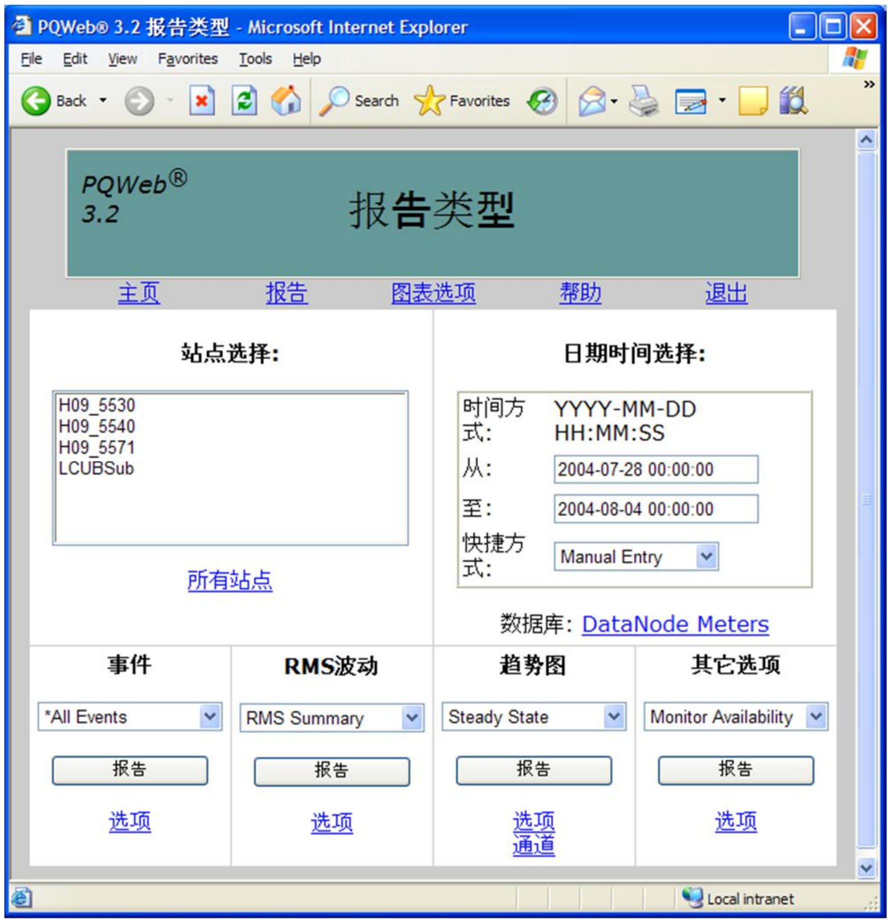




ELECTROTEK CONCEPTS

PQView Application Study
Guangdong Power, Guangzhou, China

广东省广电集团有限公司
电力试验研究所



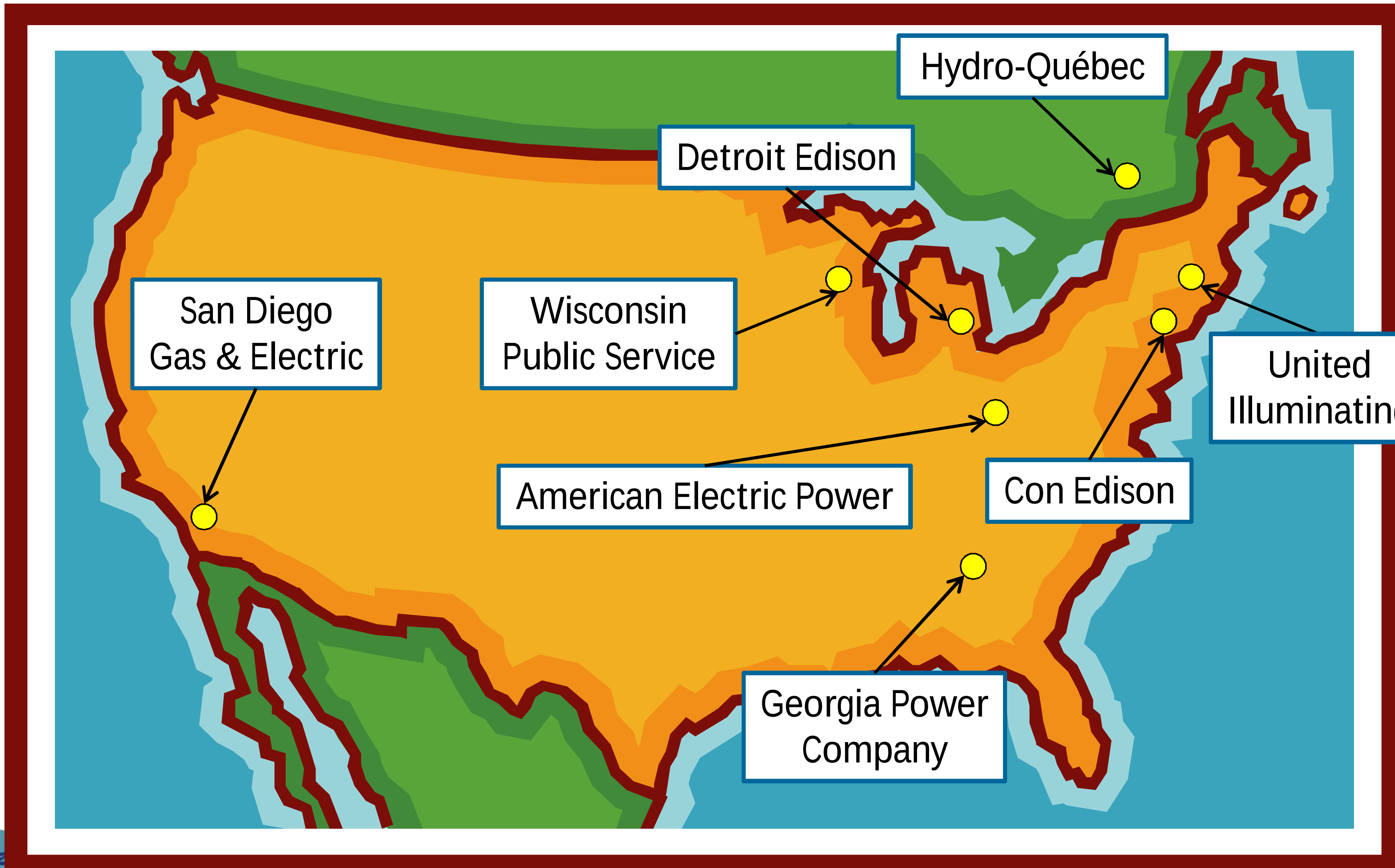
- Provides transmission service for 38GW of load to Guangdong Province in Southeast China
- Monitors network with Dranetz-BMI DataNodes and Power Measurement ION meters
- Measurements available on intranet with Chinese user interface
- Measurements record DC transmission line performance during monopole ground return mode

ELECTROTEK CONCEPTS

PQView Application Examples

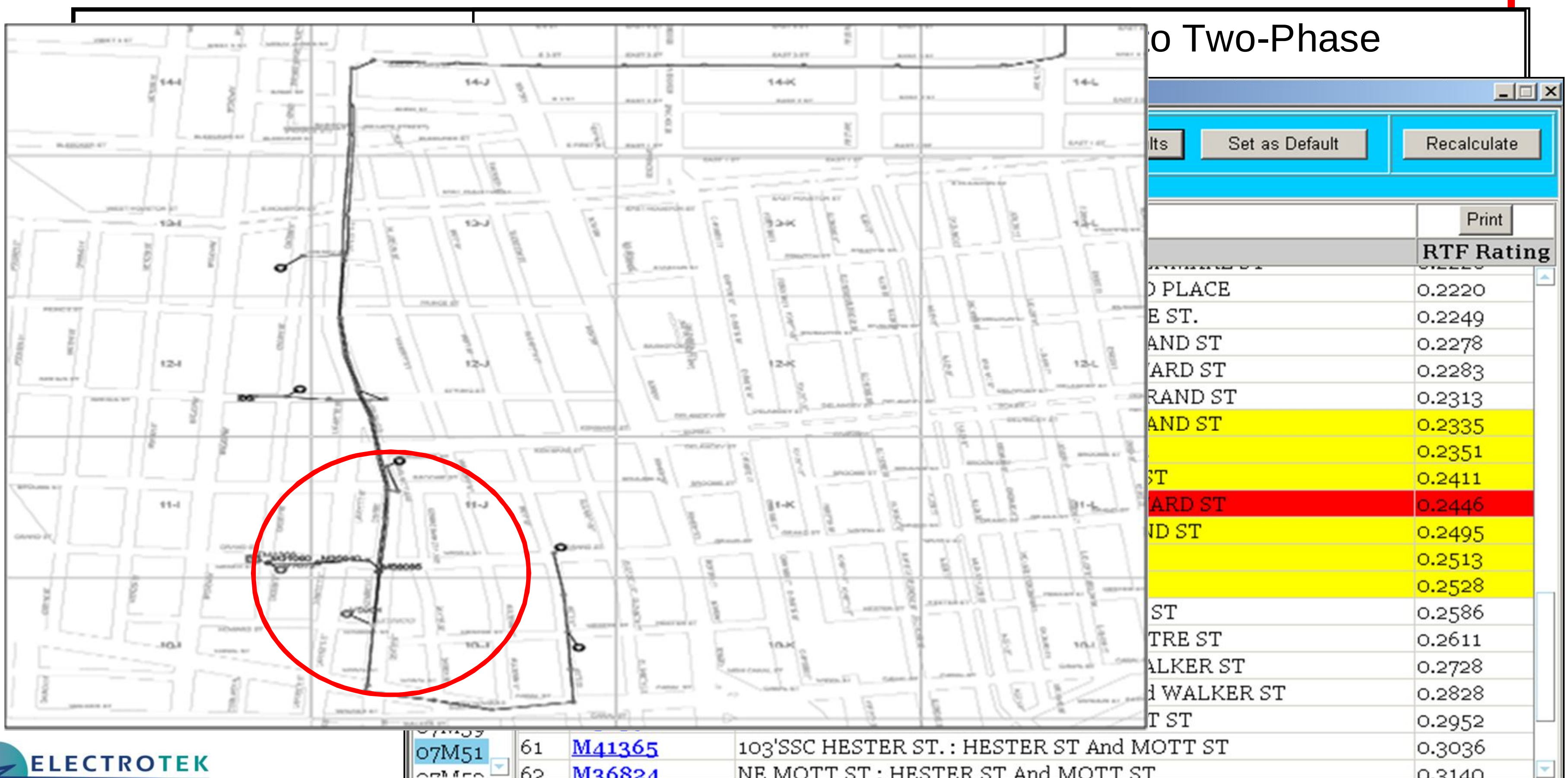
- **Fault Location**
- System Performance
- Integration of Power System Measurements with GIS
- Standards Compliance

Fault Location Systems with PQView



Fault Locating Process at Con Edison

Feeder Trips due to Fault → PQ Meter Captures Waveforms → PQView Calculates Reactance → Match Reactance To Feeder Model



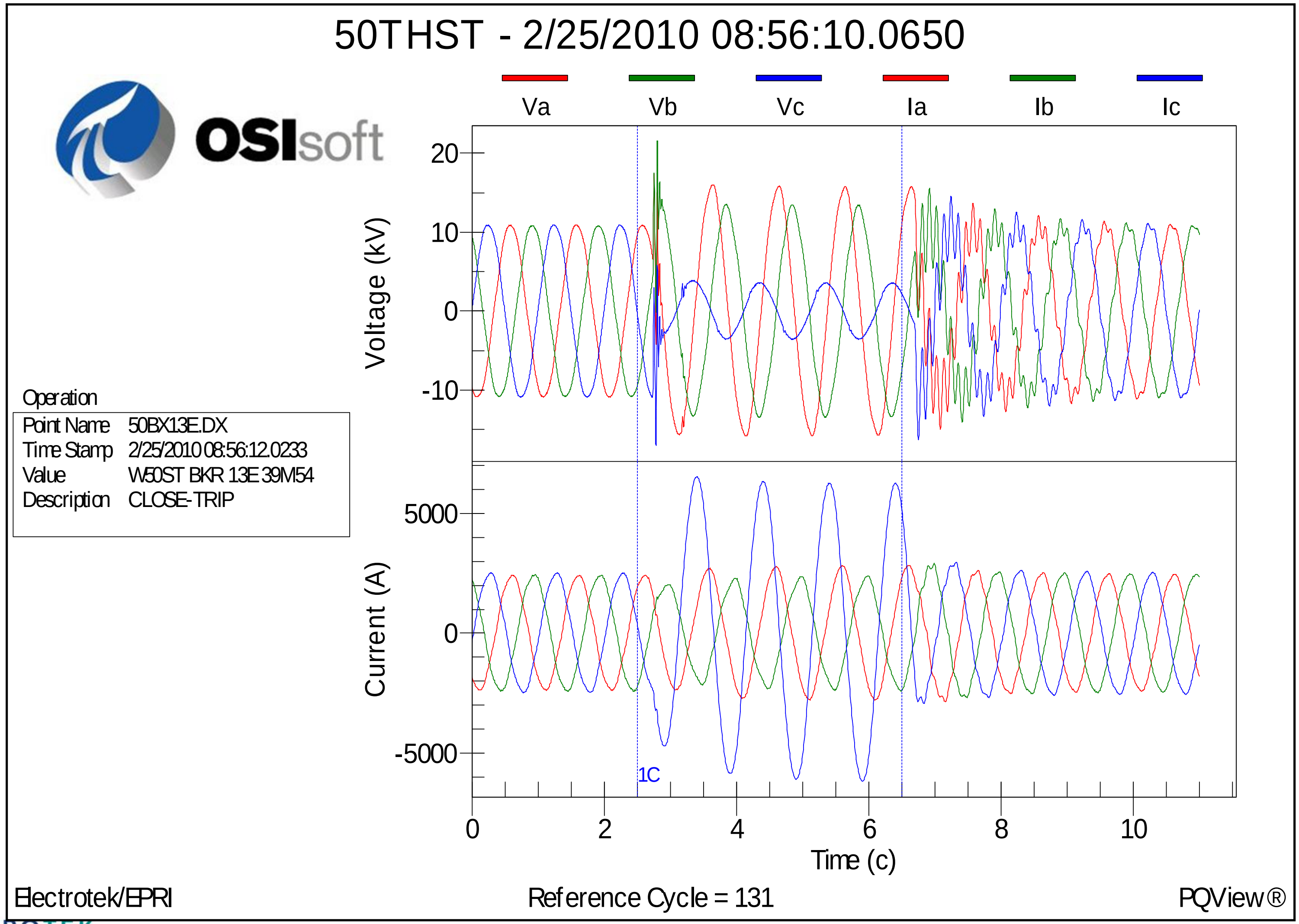
RTF Performance

- On average, use of the Reactance-to-Fault for fault location saves one hour per feeder restoration job because it saves use of capacitive discharge thumpers and DC hi-pot
- Recent Results for Manhattan:

Year	0-1 MH	1-3 MH	3-5 MH	5-10 MH	> 10 MH
2009	64%	24%	5%	2%	6%
2010	67%	14%	5%	3%	11%
2011	64%	20%	8%	3%	5%
Summer 2012	76%	14%	4%	4%	1%

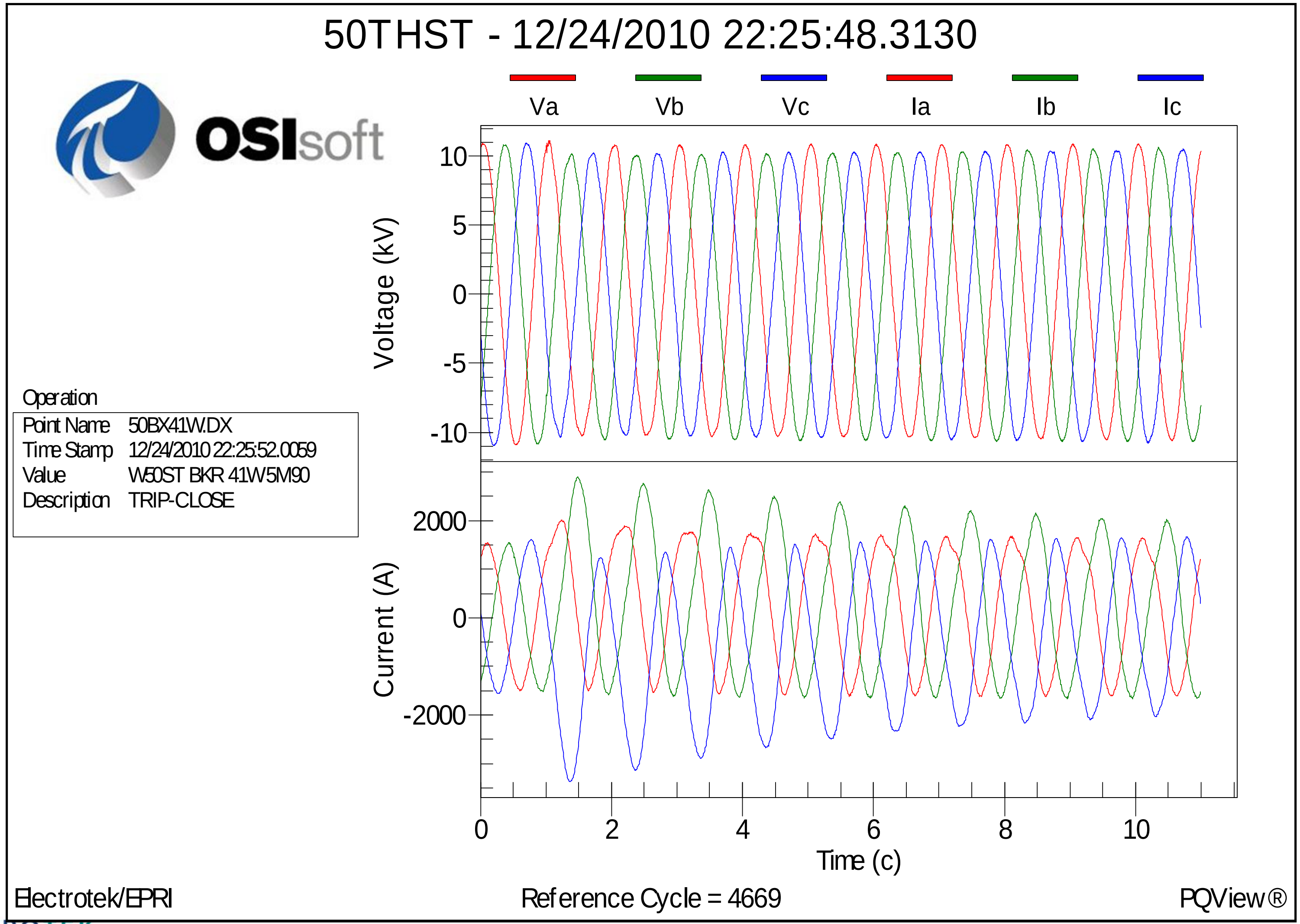
Example Correlation of Feeder Fault Event with PI Event from SCADA Operation

conEdison, inc.



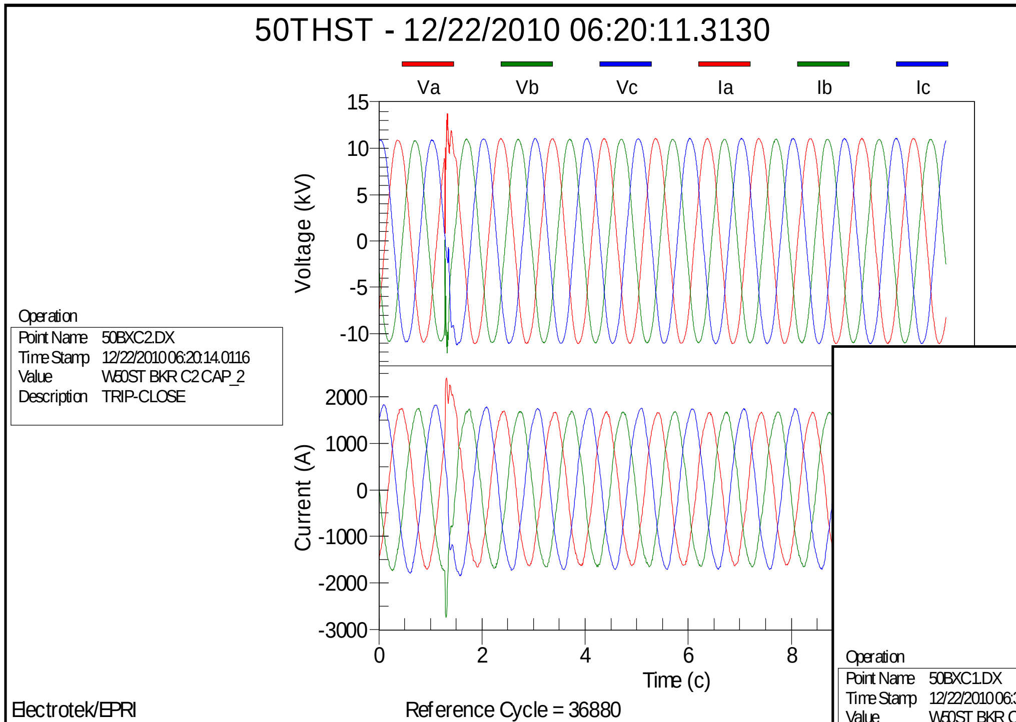
ELECTROTEK CONCEPTS

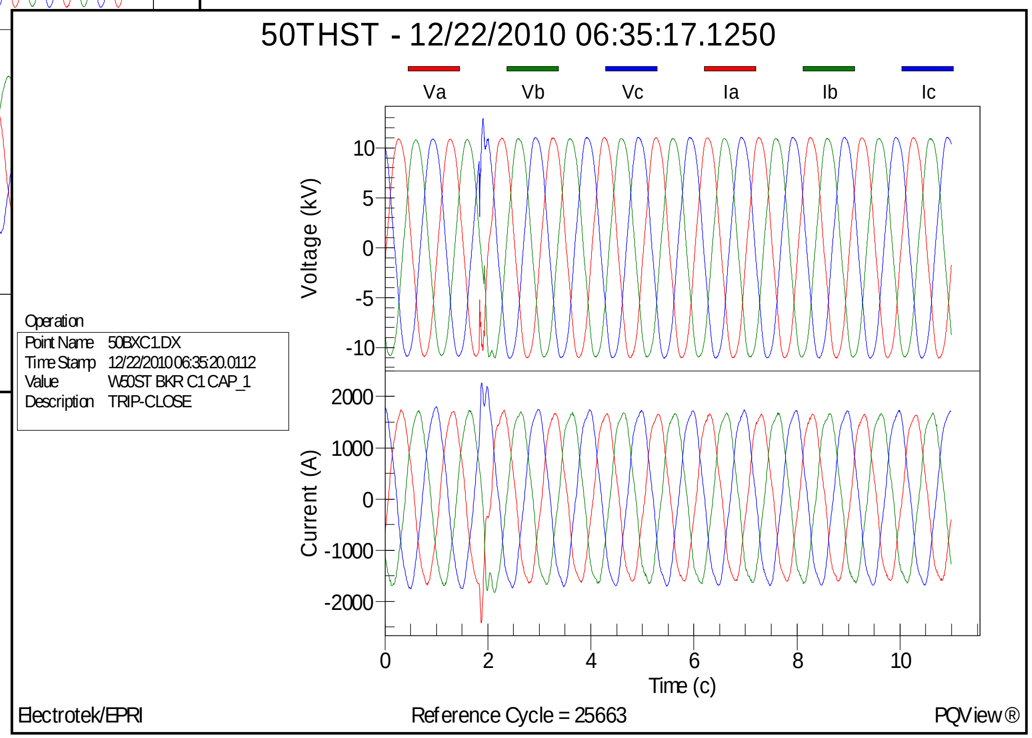
Example Correlation of Feeder Reclose Event with PI Event from SCADA Operation



Example Correlations of Capacitor Energizing Event with PI Event from SCADA Operation

conEdison, inc.

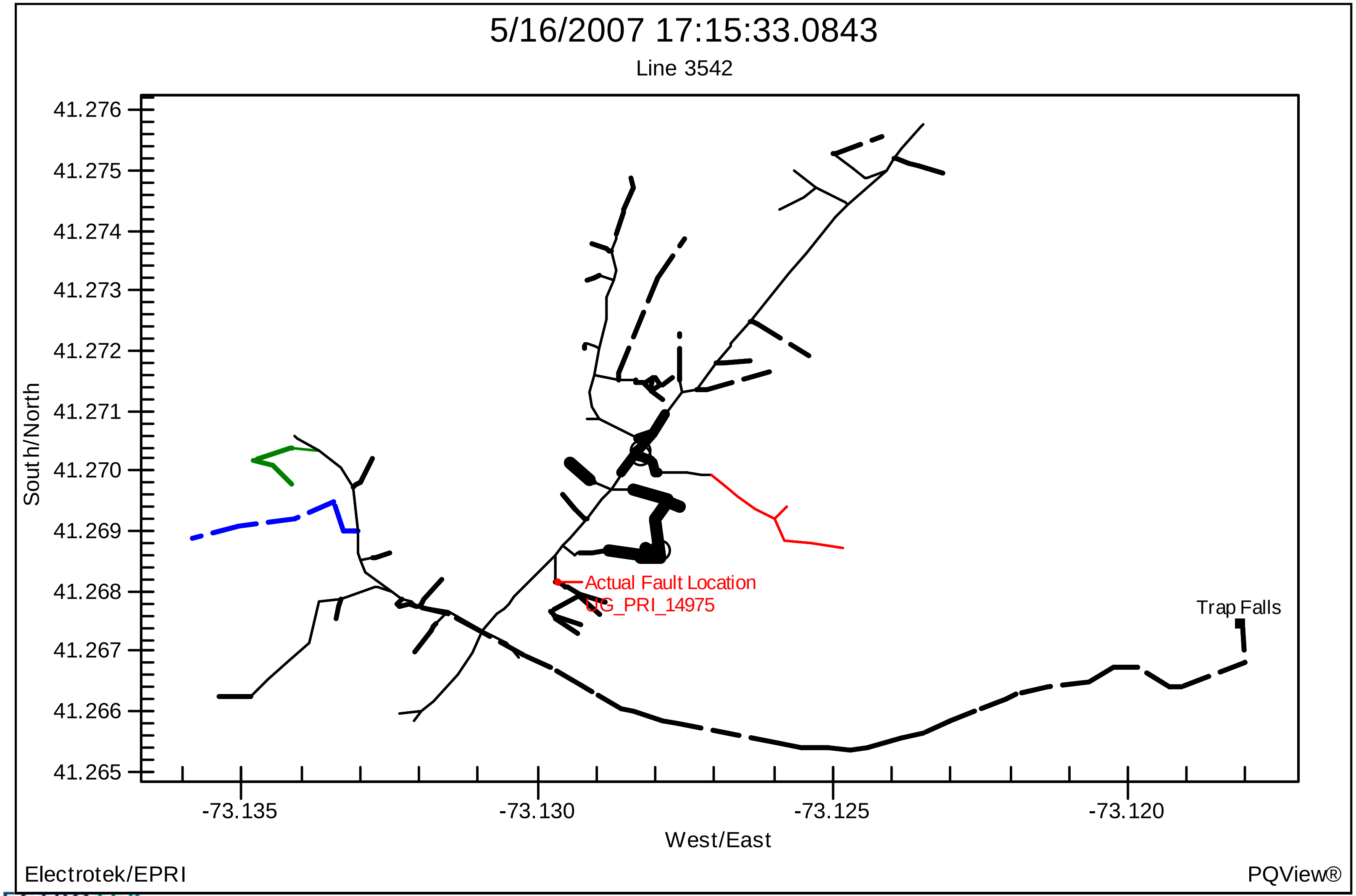




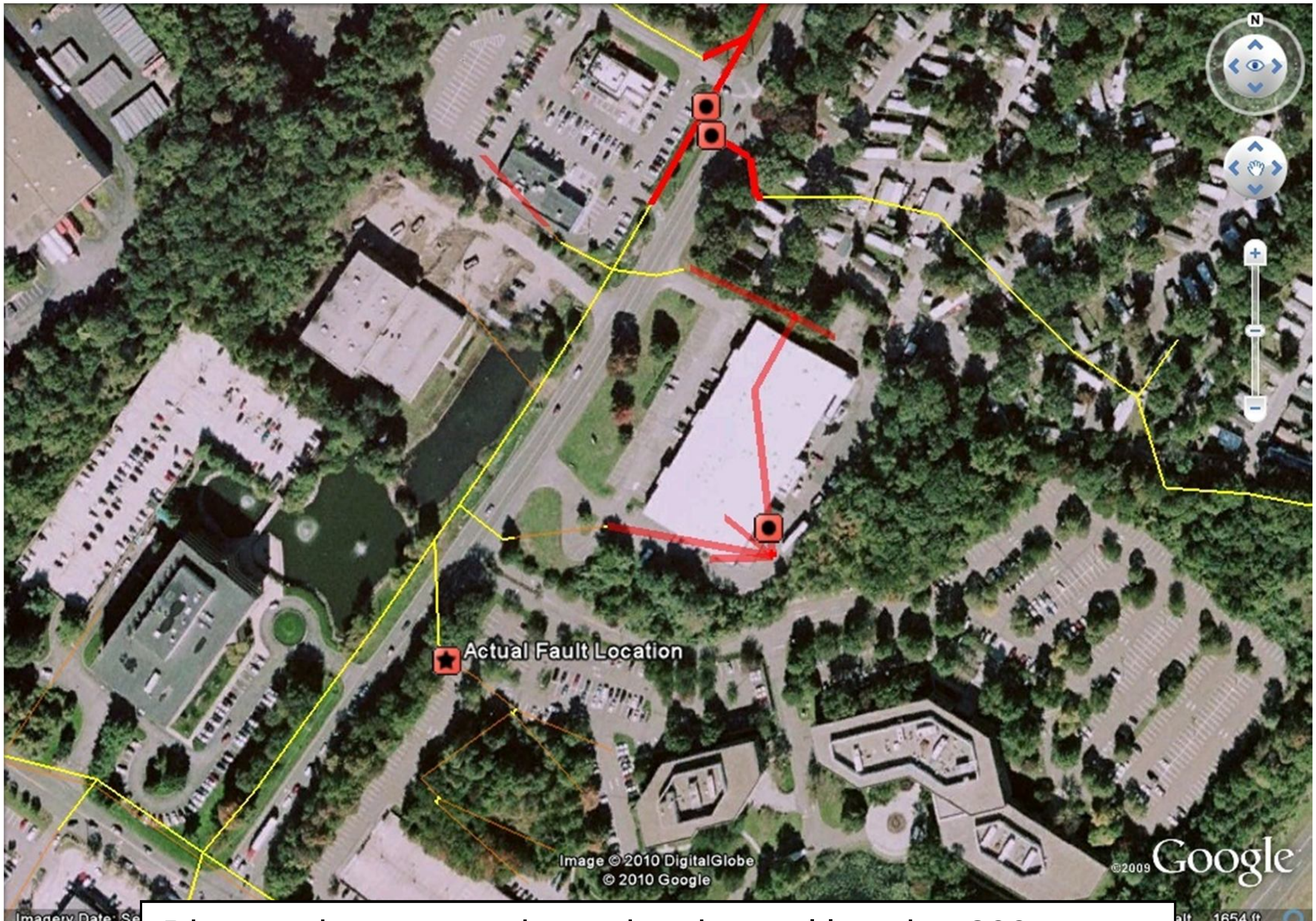
OSIsoft

ELECTROTEK CONCEPTS

One-Line Diagram of Estimated and Actual Location in PQView and WebPQView



One-Line Diagram with Aerial Map of Estimated and Actual Location

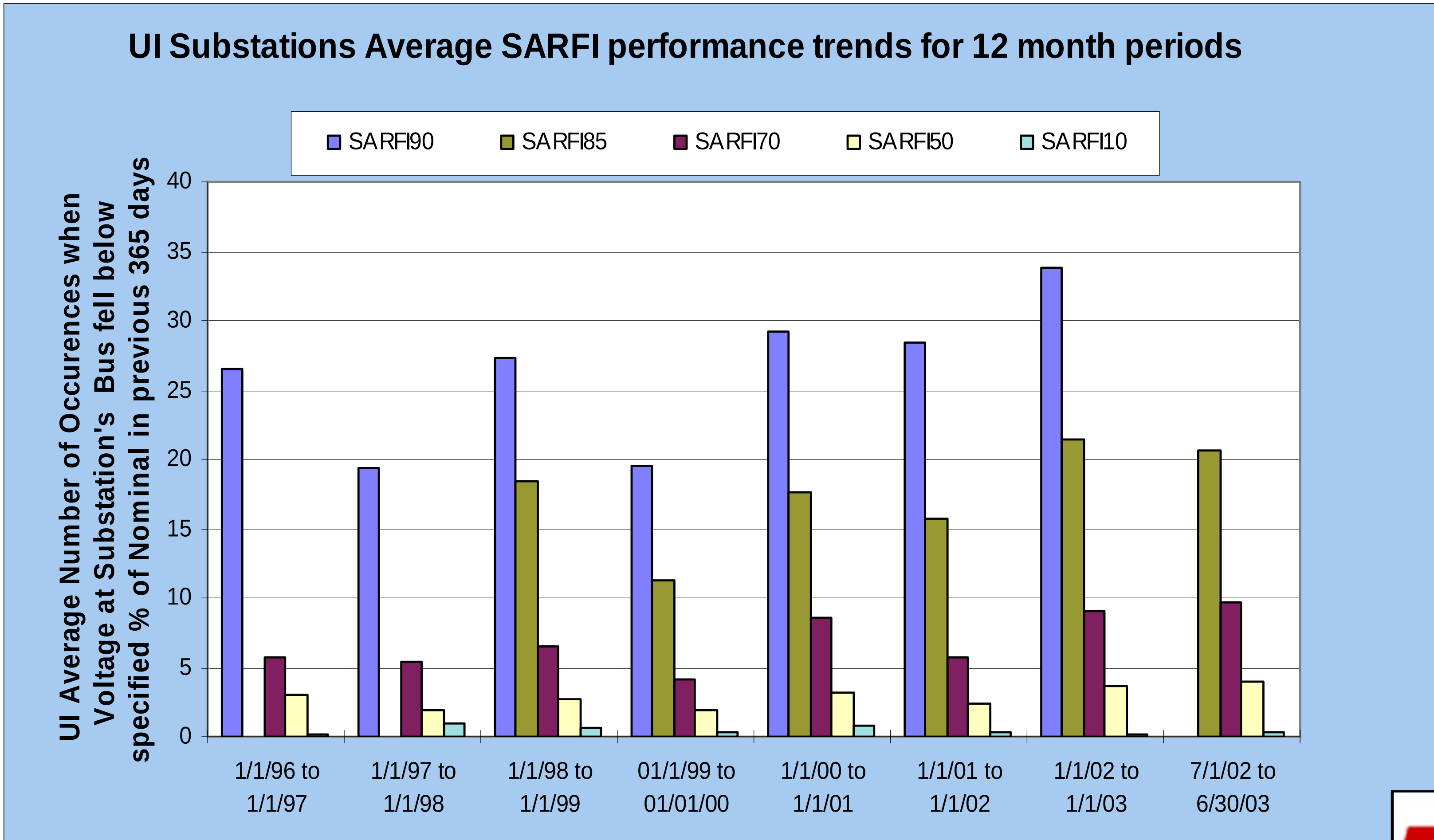


Distance between estimated and actual location:200 meters

PQView Application Examples

- Fault Location
- **System Performance**
- Integration of Power System Measurements with GIS
- Standards Compliance

PQView Application Study
SARFI Performance for UI Company

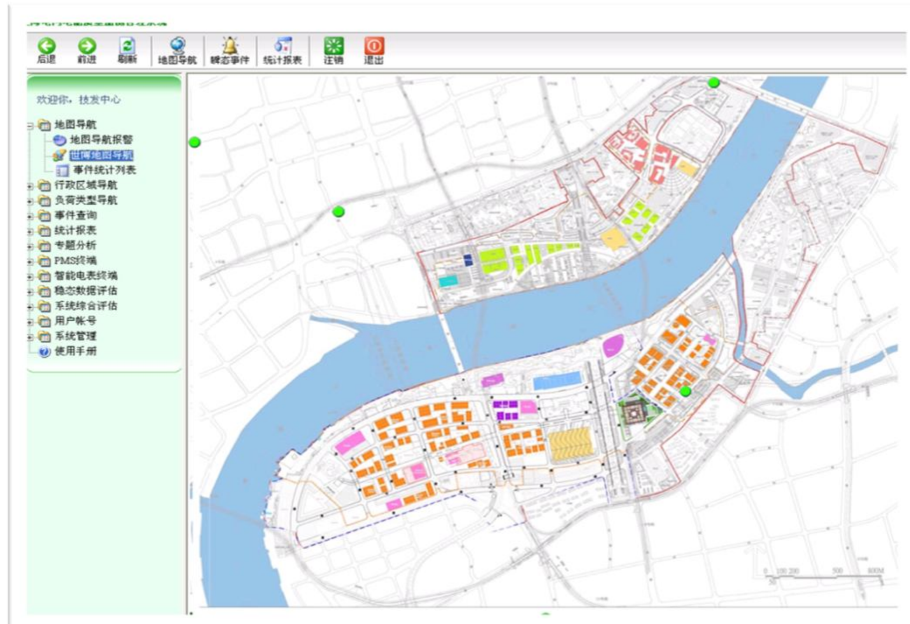


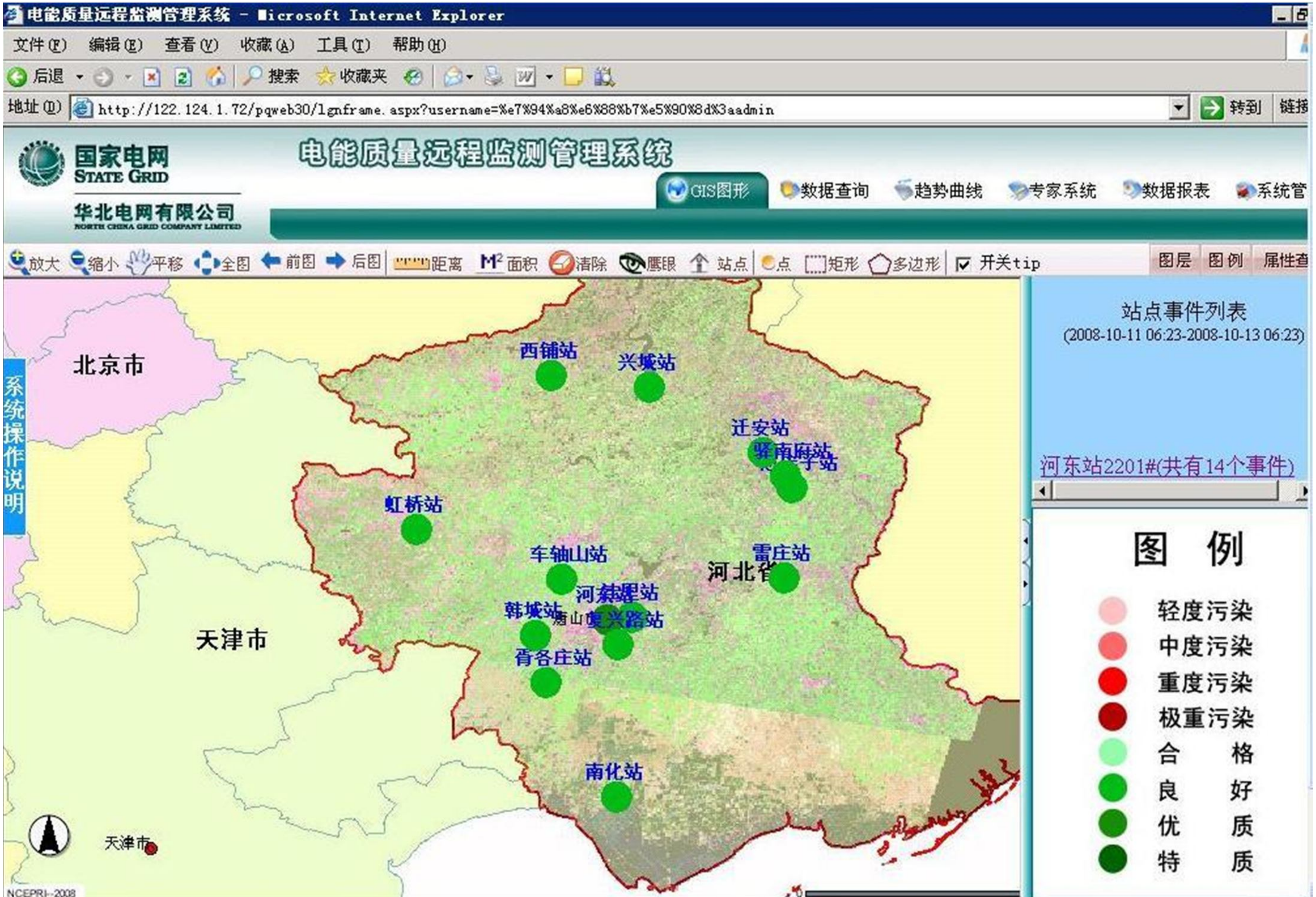
How are some electric utilities using these system-wide monitoring databases?

- Distribution Fault Location
- System Performance
- **Integration of Power System Measurements with GIS**
- Standards Compliance

Web-Based Power Quality Monitoring System Management Software

- Map Navigation
- Executive-Level Reports
- Transient Event Alarms
- Transient Event Analysis
- Steady-State Trends Analysis
- Statistics Reports
- Power Quality Event Categorization
- Load Analysis
- Steady-State Power Quality Assessment
- Background Harmonic Analysis
- Data Integrity Reports
- Power Quality Report Generation




电能质量远程监测管理系统 - Microsoft Internet Explorer
文件(F) 编辑(E) 查看(V) 收藏(A) 工具(T) 帮助(H)
后退 搜索 收藏夹
地址(D) http://122.124.1.72/pqweb30/lgnframe.aspx?username=%e7%94%a8%e6%88%b7%e5%90%8d%3aadmin
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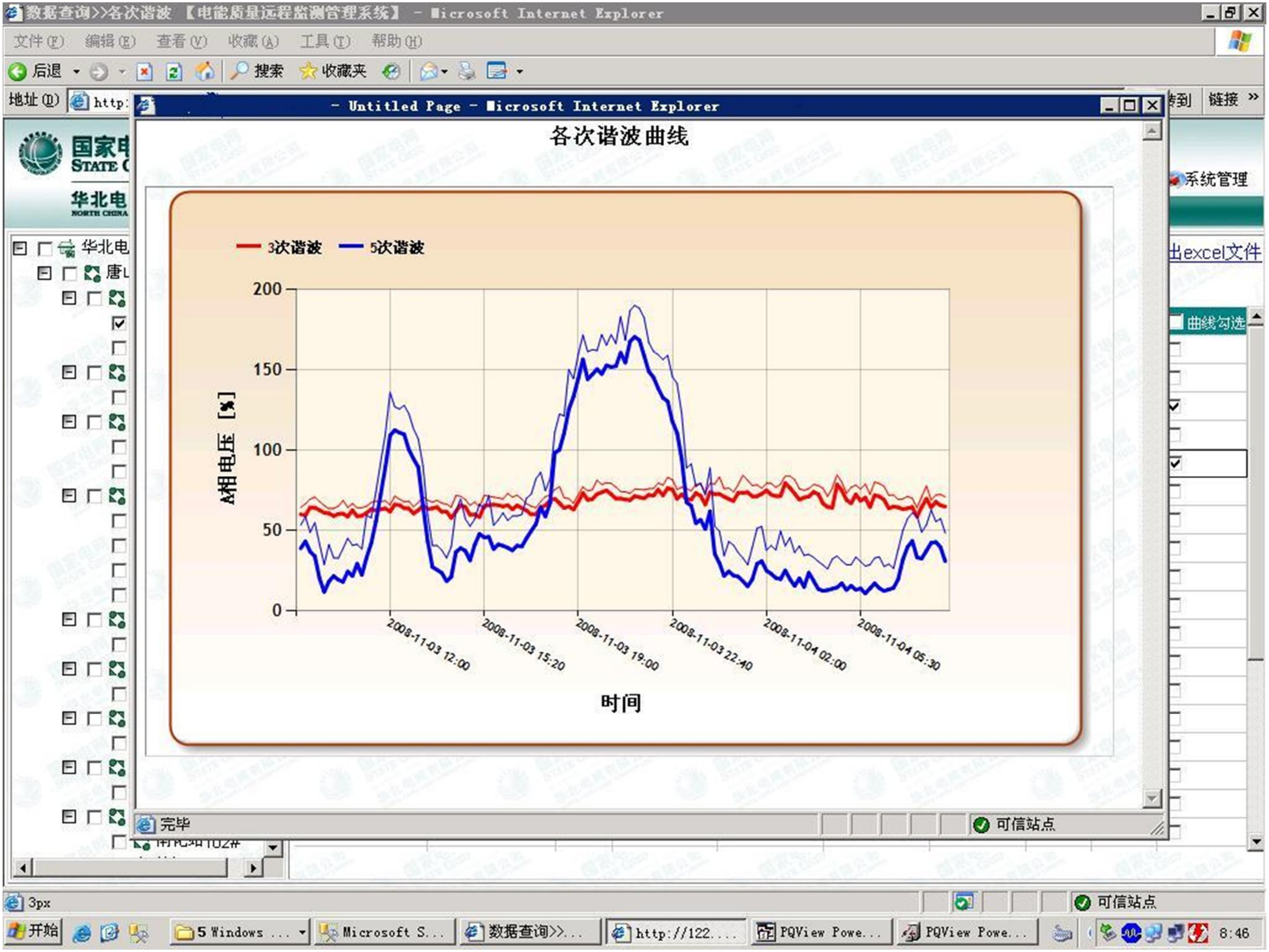
国家电网
STATE GRID
华北电网有限公司
NORTH CHINA GRID COMPANY LIMITED
电能质量远程监测管理系统
GIS图形 数据查询 趋势曲线 专家系统 数据报表 系统管
放大 缩小 平移 全图 前图 后图 距离 面积 清除 鹰眼 站点 点 矩形 多边形 开关tip
图层 图例 属性查
系统操作说明
北京市
天津市
河北省
西铺站
兴城站
迁安站
虹桥站
车轴山站
雷庄站
韩城站
胥各庄站
南化站
天津市
NCEPRI--2008
站点事件列表
(2008-10-11 06:23-2008-10-13 06:23)
河东站2201#(共有14个事件)
图 例
轻度污染
中度污染
重度污染
极重污染
合 格
良 好
优 质
特 质



数据查询>>各次谐波 【电能质量远程监测管理系统】 - Microsoft Internet Explorer
文件(F) 编辑(E) 查看(V) 收藏(A) 工具(T) 帮助(H)
后退
搜索
收藏夹
地址(D)
链接
- Untitled Page - Microsoft Internet Explorer
各次谐波曲线
3次谐波
5次谐波
200
150
100
50
0
A相电压 [%]
2008-11-03 12:00
2008-11-03 15:20
2008-11-03 19:00
2008-11-03 22:40
2008-11-04 02:00
2008-11-04 05:30
时间
系统管理
出excel文件
曲线勾选
完毕
可信站点
3px
可信站点
开始
5 Windows ...
Microsoft S...
数据查询>>...
http://122....
PQView Powe...
PQView Powe...
8:46

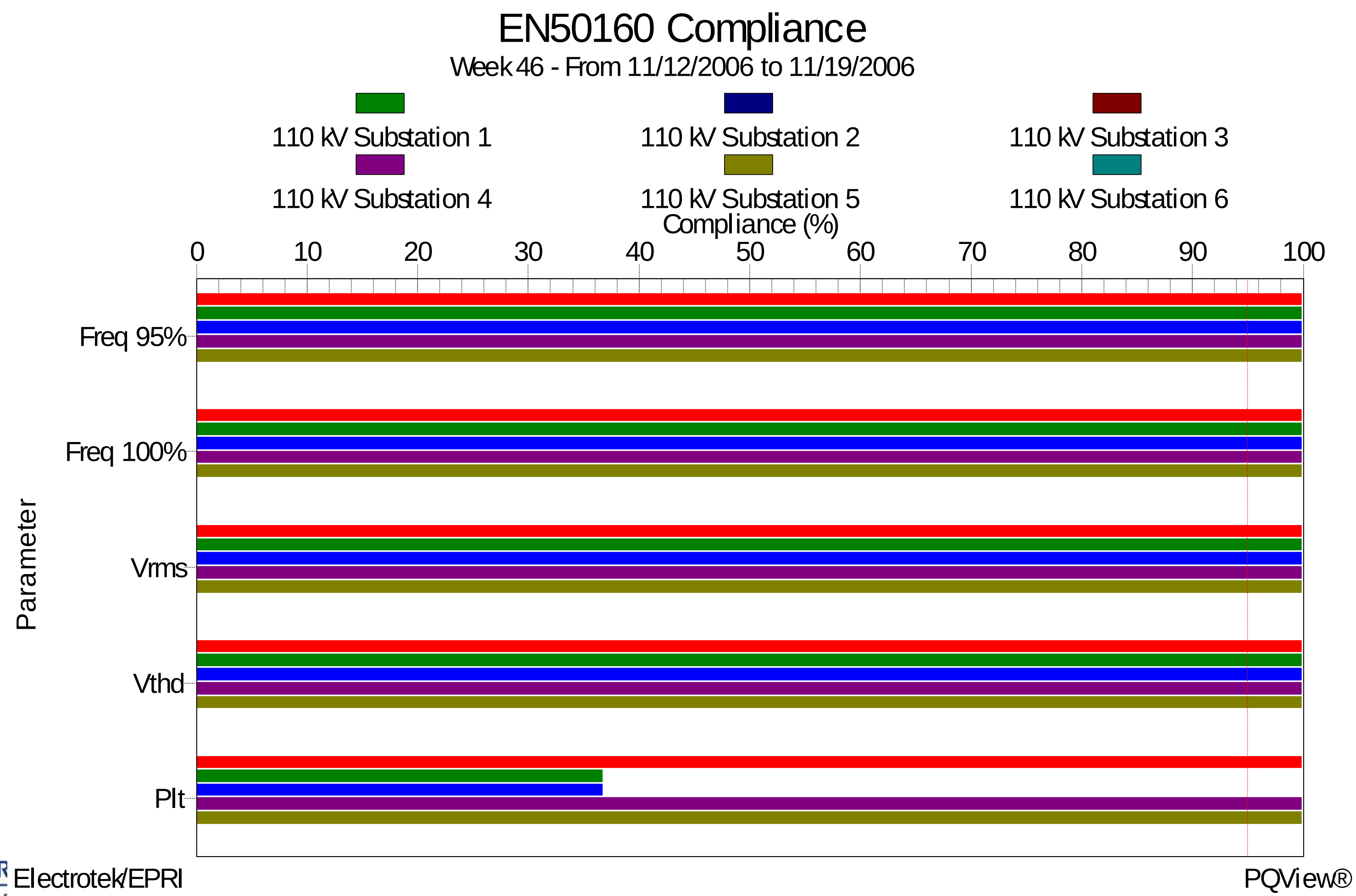
Web-Based Power Quality Monitoring System Management Software

PQView Application Examples

- Distribution Fault Location
- System Performance
- Integration of Power System Measurements with GIS
- **Standards Compliance**

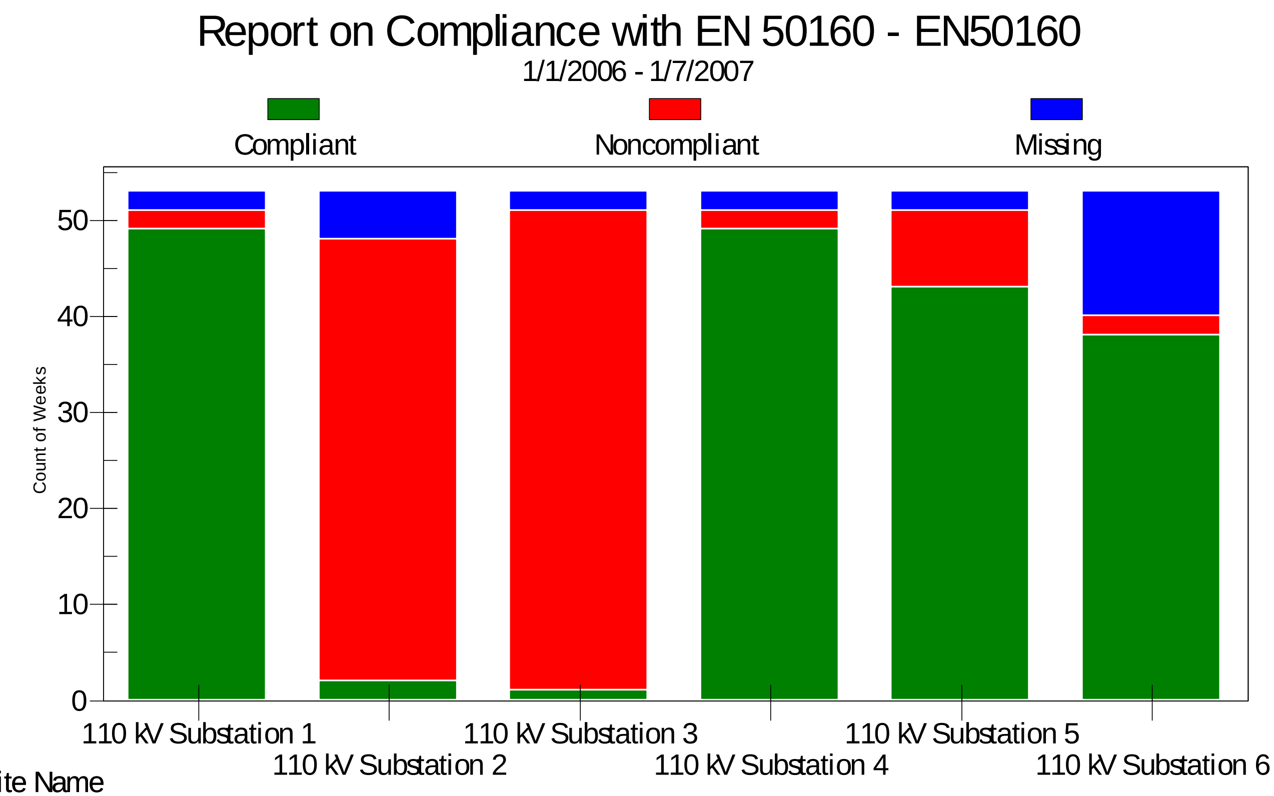
EN 50160 Compliance

- Typical Weekly Report by PQView in Croatia, Slovenia, &Poland



EN 50160 Compliance

- Typical Annual Report by PQView in Croatia, Slovenia, & Poland



	110 kV Substation 1	110 kV Substation 2	110 kV Substation 3	110 kV Substation 4	110 kV Substation 5	110 kV Substation 6
Compliant	49	2	1	49	43	38
Noncompliant	2	46	50	2	8	2
Missing	2	5	2	2	2	13

Area Substation Voltage Control

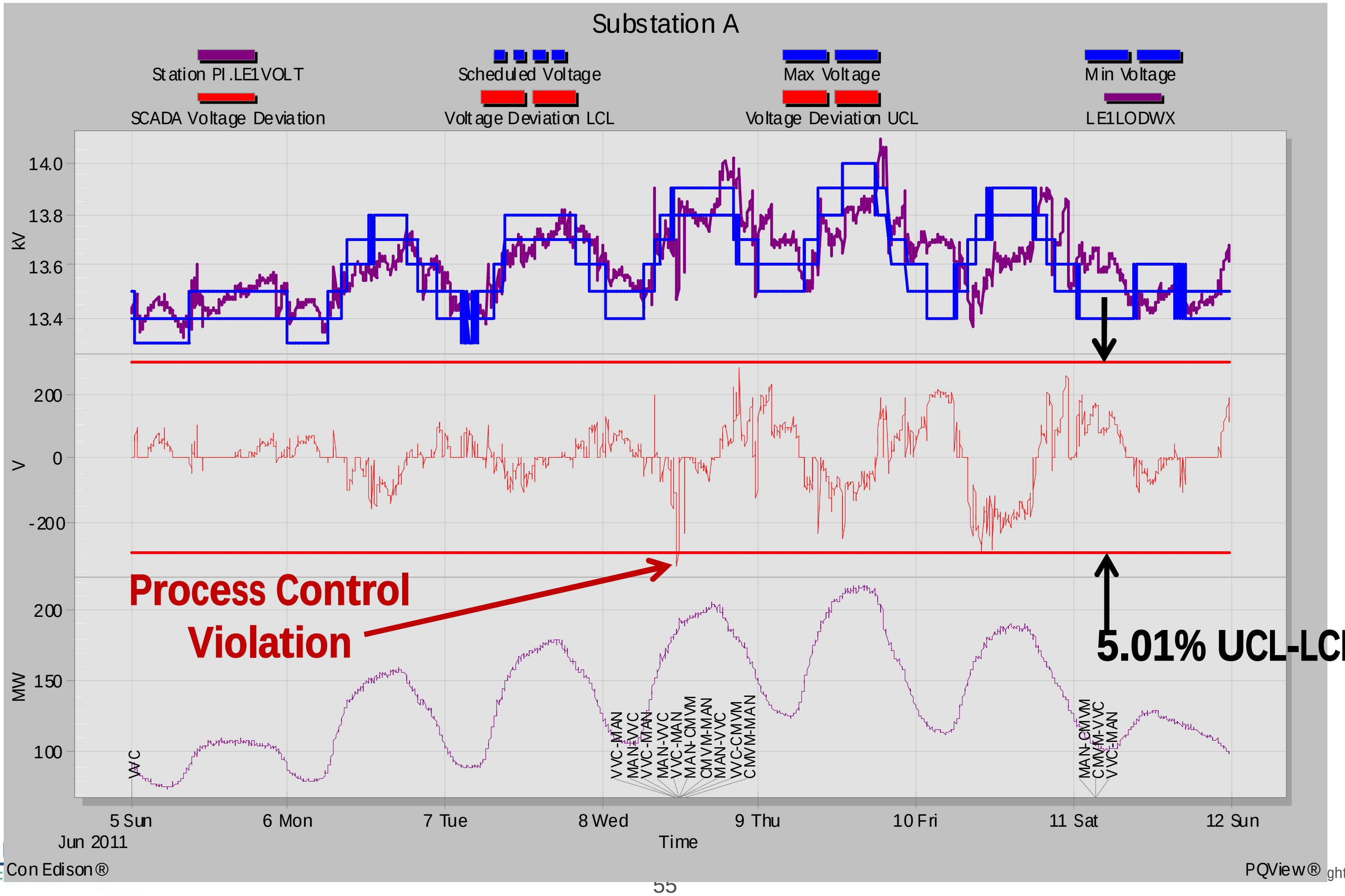
- The amount of MW load determines what the voltage should be at the area substation following a set of rules called the “voltage schedule”.
  - Whether the voltage can be above or below the scheduled voltage depends upong the time of day and the day of week
- Methods of Controlling Area Substation Voltage
  - Voltage Var Control (VVC Mode)
  - Local Tap Changer Control System (CMVM Mode)
  - Manual Adjustment of Transformer Taps

Area Substation Voltage Control

Voltage Control and Optimization

- Process Control Tool Development
  - Control Variables
    - Voltage Deviation from Schedule
    - Range of Tap positions on Parallel Transformers
    - Range of Mvar Load on Parallel Transformers
  - Apply control chart methods to develop upper and lower control limits

Voltage Deviation Control Chart



Voltage Regulation Control Weekly Report

StationSPeC

Home Create External Data Database Tools

Station	Week	Volt Dev SPC	Tap Range SPC	Mvar Range SPC	Avg Voltage Deviation	Zero Volt Deviation	Tap Range Avg	Tap Range Max	Mvar Range Avg	Mvar Range Max	PF Range Avg	PF Range Max	Reg Ctrl Mode VVC	Reg Ctrl Mode CMVM	Reg Ctrl Mode Man
East 29th Street	07/11/2011	Yes	Yes	Yes	27.35	48.31%	0.07	4.00	0.65	8.10	0.97	1.00	99.16%	0.25%	0.60%
East 36th Street	07/11/2011	Yes	Yes	Yes	20.07	52.78%	0.46	2.00	0.39	2.88	0.97	1.00	98.61%	0.00%	1.39%
East 40th Street 1	07/11/2011	Yes	Yes	Yes	29.68	48.71%	0.59	3.00	1.50	5.84	0.98	1.00	100.00%	0.00%	0.00%
East 40th Street 2	07/11/2011	Yes	Yes	Yes	27.34	56.65%	1.06	7.00	1.27	13.80	0.97	1.00	96.92%	2.98%	0.10%
East 63rd Street 1	07/11/2011	Yes	Yes	Yes	-0.79	58.58%	9.45	21.00	5.91	23.50	0.96	1.00	98.07%	0.55%	1.39%
East 63rd Street 2	07/11/2011	Yes	Yes	Yes	24.77	53.47%	8.02	17.00	6.02	16.90	0.98	1.00	90.87%	2.03%	7.09%
Hell Gate	07/11/2011	Yes	Yes	Yes	5.95	62.95%	2.50	13.00	4.46	11.86	1.00	1.00	81.55%	5.85%	12.60%
Murray Hill	07/11/2011	Yes	Yes	Yes	15.65	52.88%	1.16	3.00	0.94	3.20	0.95	1.00	100.00%	0.00%	0.00%
Parkview	07/11/2011	Yes	Yes	Yes	8.09	64.34%	0.00	0.00	0.24	1.00	0.97	0.99	100.00%	0.00%	0.00%
Plymouth Street	07/11/2011	Yes	Yes	Yes	26.80	58.33%	0.48	7.00	1.94	20.67	0.97	1.00	98.31%	0.79%	0.89%
Seaport 1	07/11/2011	Yes	Yes	Yes	13.74	58.43%	4.59	6.00	1.69	7.60	0.97	1.00	100.00%	0.00%	0.00%
Seaport 2	07/11/2011	Yes	Yes	Yes	26.12	49.45%	3.97	6.00	3.06	11.26	0.96	1.00	99.26%	0.74%	0.00%
Sherman Creek	07/11/2011	Yes	Yes	Yes	33.18	50.10%	3.83	15.00	13.92	30.72	0.99	1.00	0.00%	15.58%	84.42%
Trade Center 1	07/11/2011	Yes	Yes	Yes	11.02	57.89%	2.68	9.00	2.58	12.80	0.95	1.00	86.66%	13.14%	0.20%

Navigation Pane

Form View Num Lock

Each cell is interactive. When you double-click on a cell, you see the five-minute samples for that week in an interactive window.

ELECTROTEK CONCEPTS

Automatic Capacitor Analysis Procedure

- Record voltage and current waveforms at substation transformers using a power quality monitor
- Correlate each transient event with the SCADA operation events stored in OSIsoft PI System
- Calculate change in voltage total harmonic distortion (THD), power factor, and reactive power (kvar) by phase for each transient
- Calculate peak voltage and parallel resonant frequency for each transient
- Analyze each transient for synchronous closing performance
- Analyze each transient for restrike characteristics
- Determine if the transient is upline or downline using an algorithm based on wavelet analysis

ELECTROTEK CONCEPTS

Trend Charts Possible

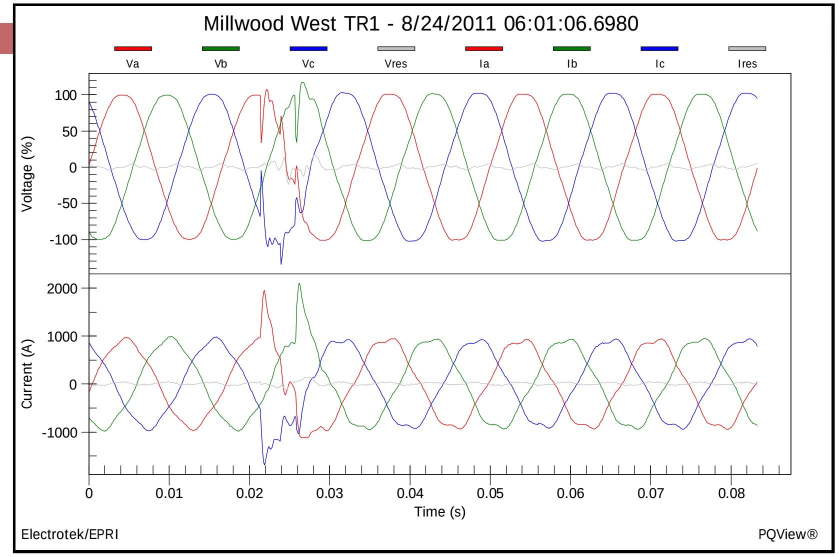
- Maximum Peak Voltage
- Delta Voltage THD
- Max Delta Voltage THD
- Delta Reactive Power
- Delta Power Factor
- Delta Reactive Power Range
- Delta Power Factor Range
- Parallel Resonant Frequency

Synchronous Closing Methods

- Grounded-wye connected capacitor banks are controlled by closing the three phases at three successive phase-to-ground voltage zeros, giving 60° separation between transients.
- Ungrounded-wye capacitor banks are controlled by closing the first two phases at a phase-to-phase voltage zero and then delaying the third phase 90 degrees, which is at the phase-to-ground voltage zero.
- PQView's new module is able to analyze how closely the closing was to these ideal closing times.
  - Closing Time
  - Closing Angle
  - Synchronous Status: Early, Synchronous, Delayed,

Synchronous Closing Assessment Methods

- New module in testing to analyze how measured closing time was to the ideal closing time
  - Early, Synchronous, Delayed
- A special version of the module was developed using Con Edison measurements to analyze switching method employed by Joslyn



Manhattan Station	Joslyn Banks
Avenue A	C3
Parkview	C1
Astor	C1A, C2, C3
Murray Hill	C3
Seaport No. 1	C1, C2, C3
Trade Center No. 1	C1, C2, C3

Staten Island Station	Joslyn Banks
Woodrow	C1

Bronx/Westchester Station	Joslyn Banks
Cedar Street	C1
East 179th Street	C1
Millwood	C1
Ossining	C1
Pleasantville	C1
White Plains	C1, C2, C3