

Field Experience with a Series Compensation Device

IEEE PES T&D Show

New Orleans, LA

Stephen Middlekauff

April 14, 1999





The Dynamic Voltage Restorer (DVR)

- Westinghouse/EPRI/Duke Power tailored-collaboration
- 50% Rated voltage injection
- Capacitor energy storage
- Installed to protect sensitive textile customer
- Installed August 26, 1996

Data Review 1997

- Total Events: 55
 - While DVR online: 40
 - While DVR offline: 15
- Number of Saves: 10
- Number of Events causing customer downtime: 7

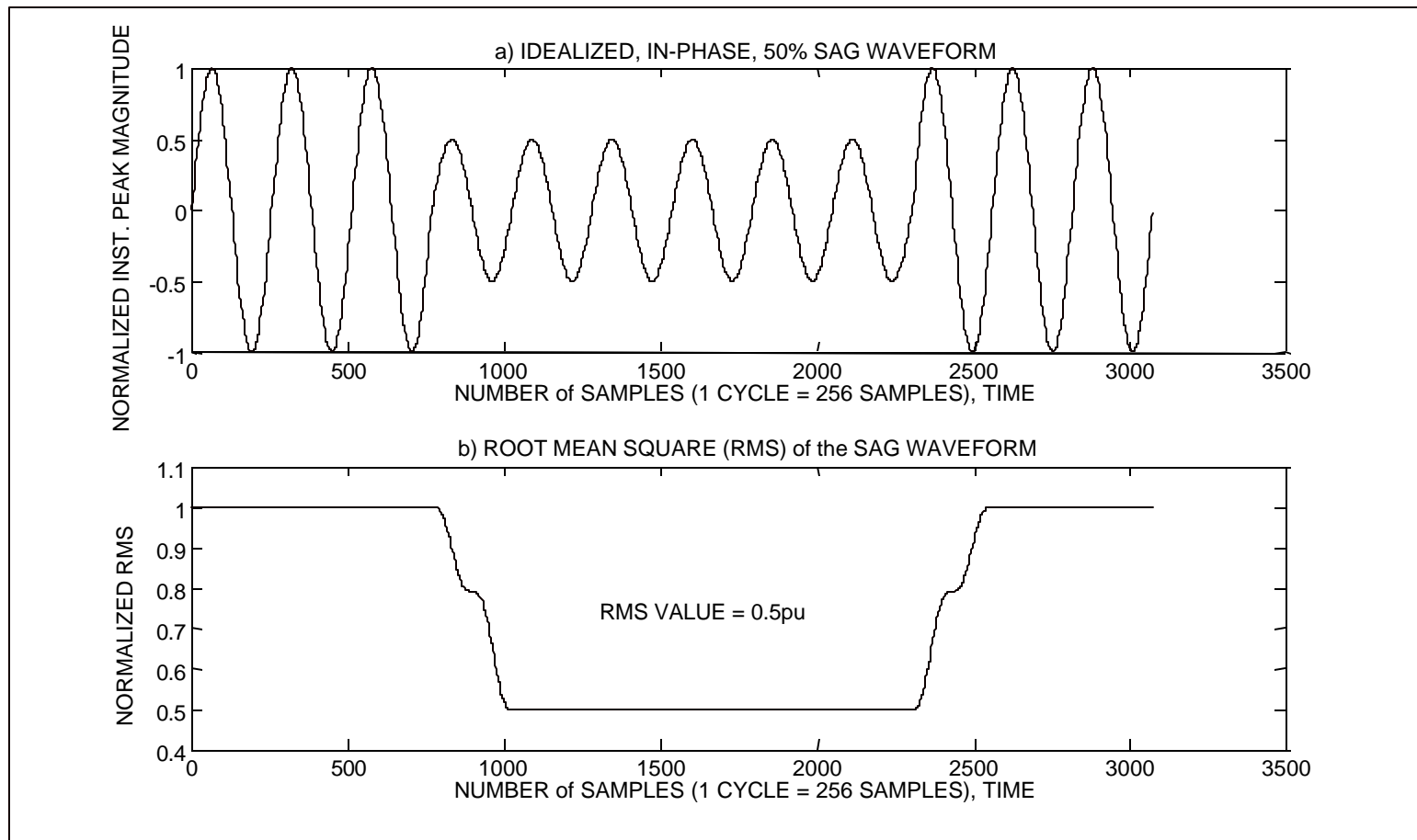


Data Review 1998

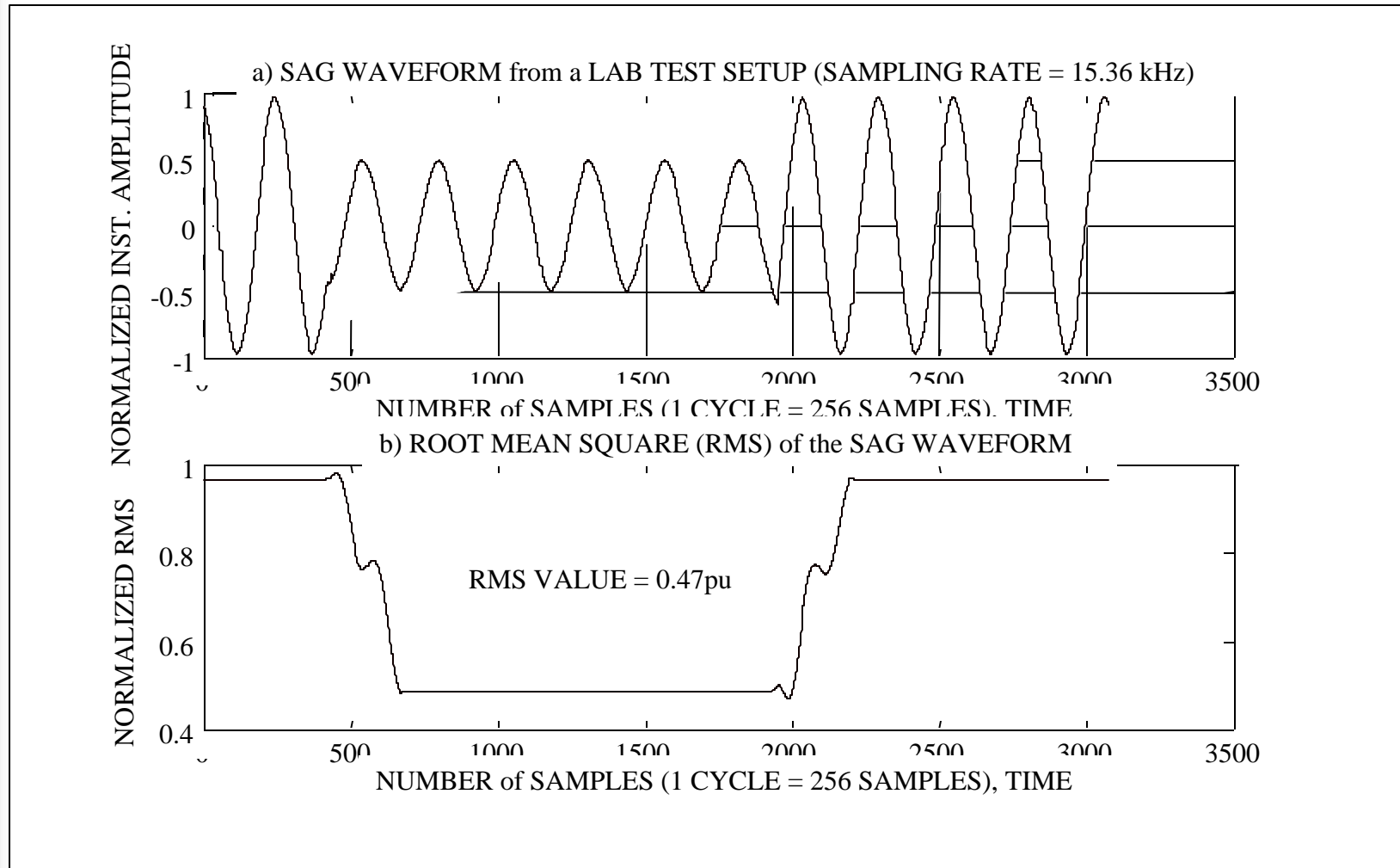
- Total Events: 91
 - While DVR online: 64
 - While DVR offline: 27
- Number of Saves: 8
- Number of Events causing customer downtime: 16



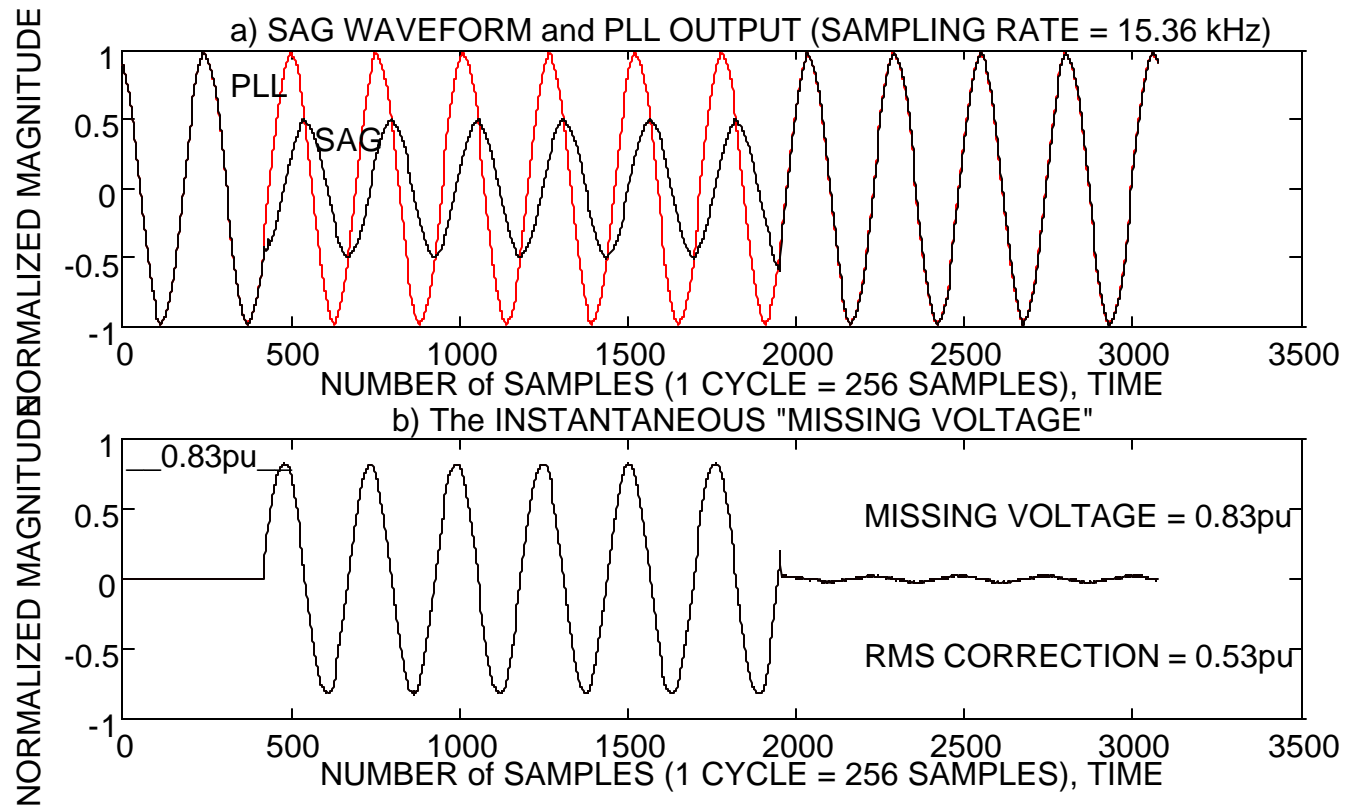
50% Sag, No Phase Shift



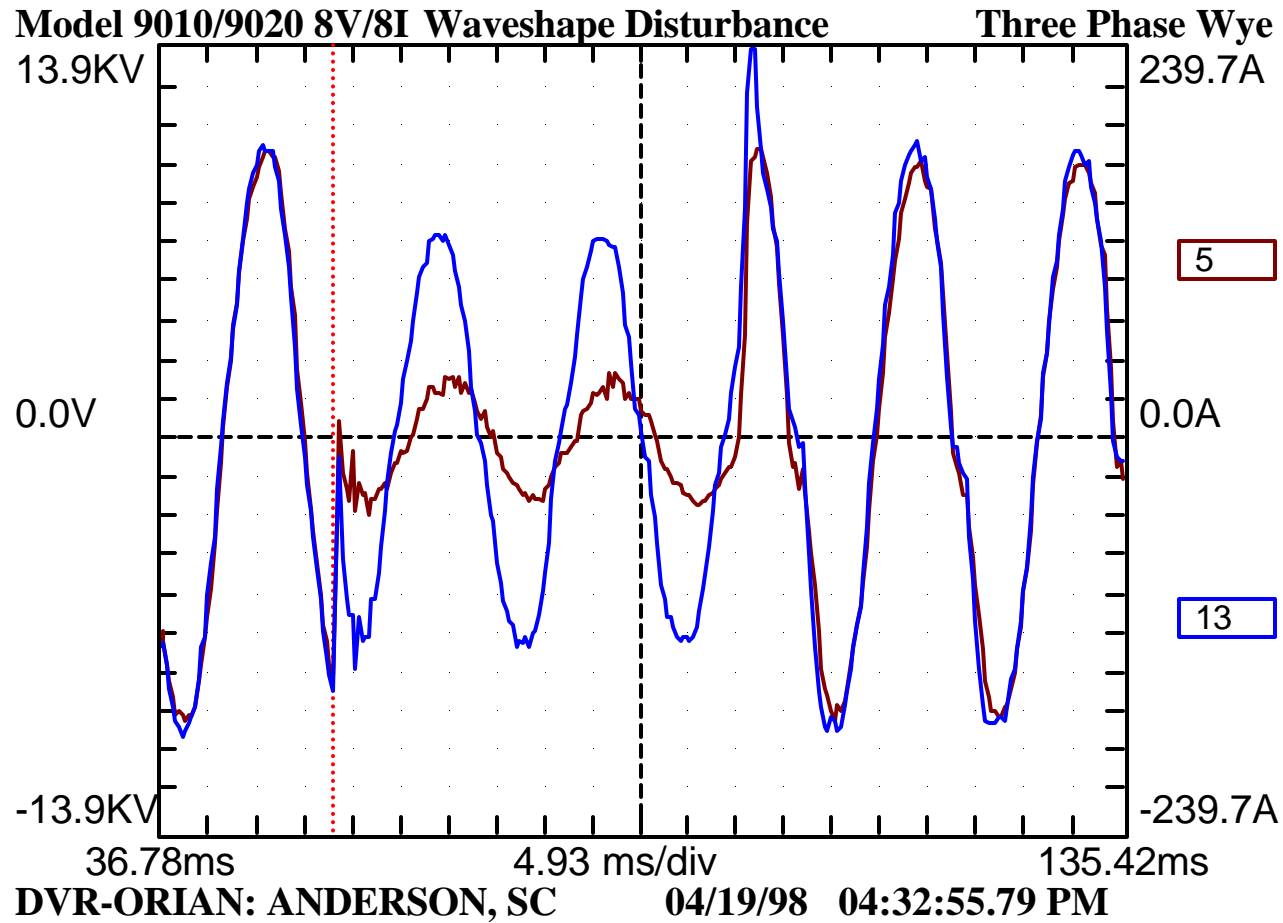
50% Sag, Slight Phase Shift



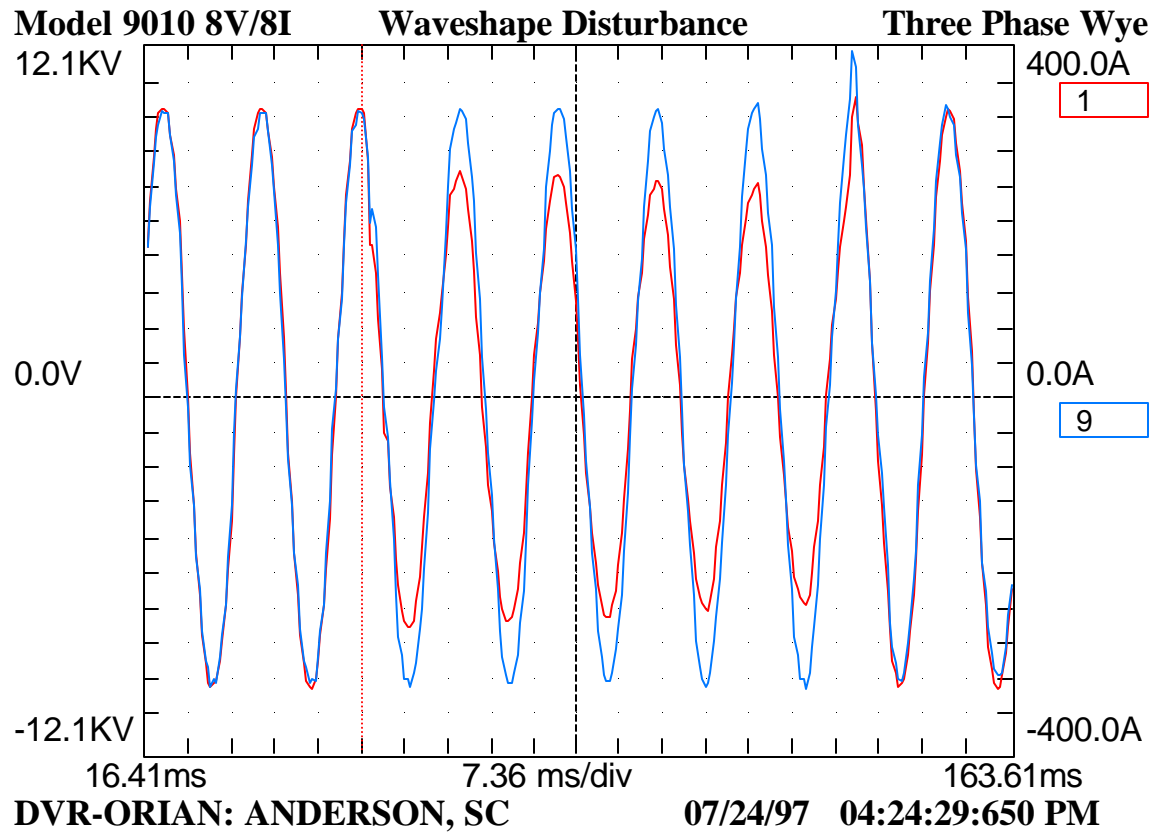
Missing Voltage Calculation



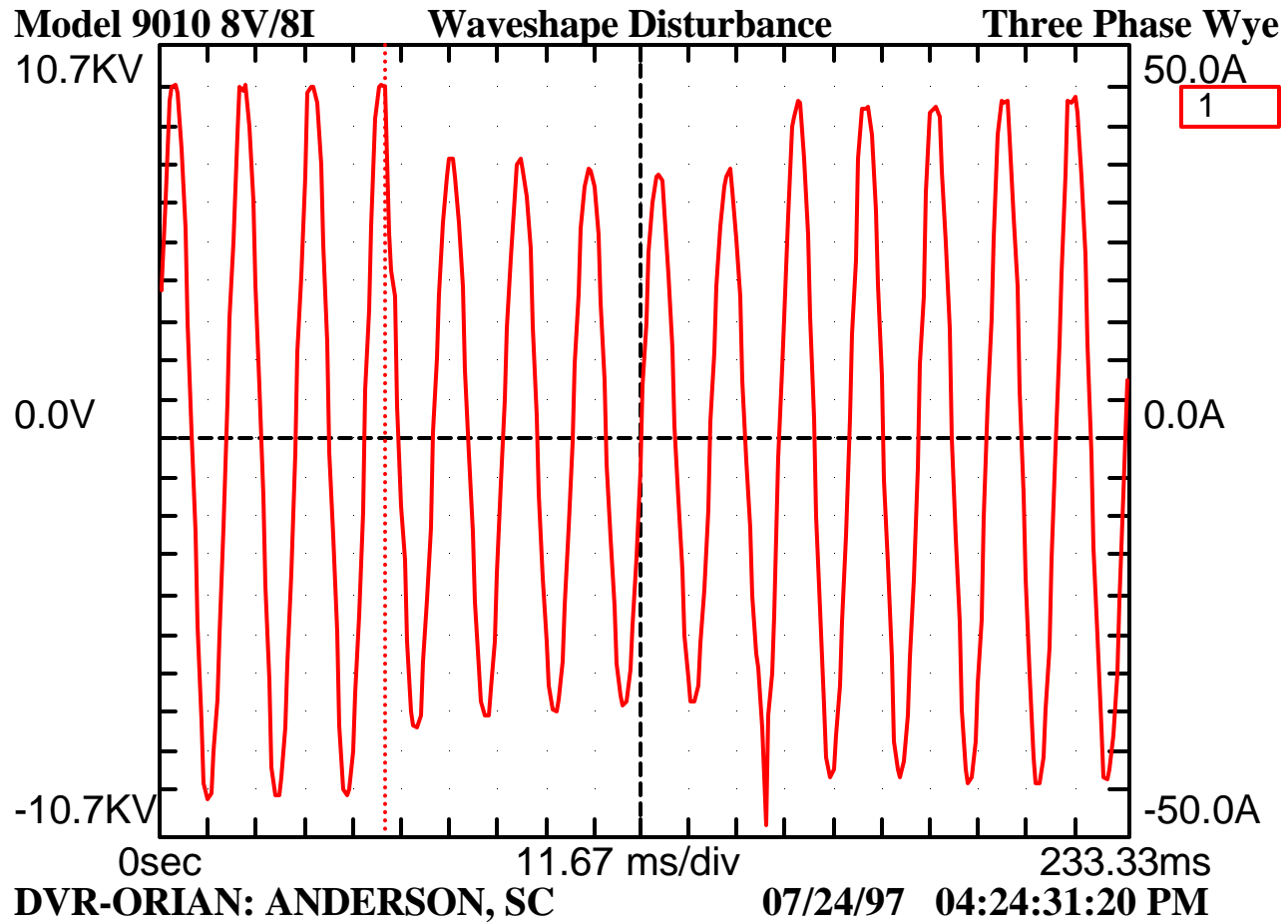
Actual Waveform:



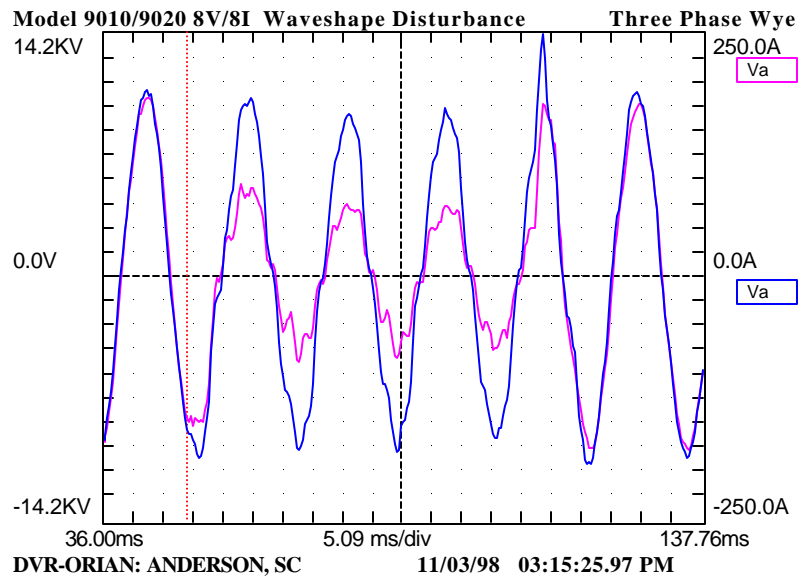
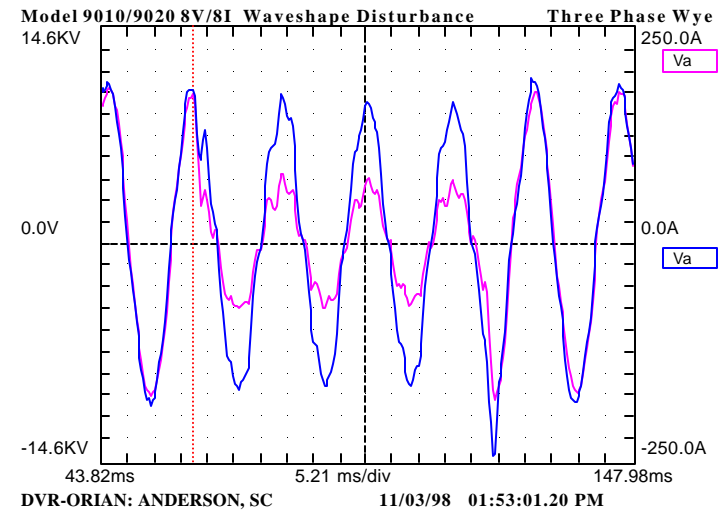
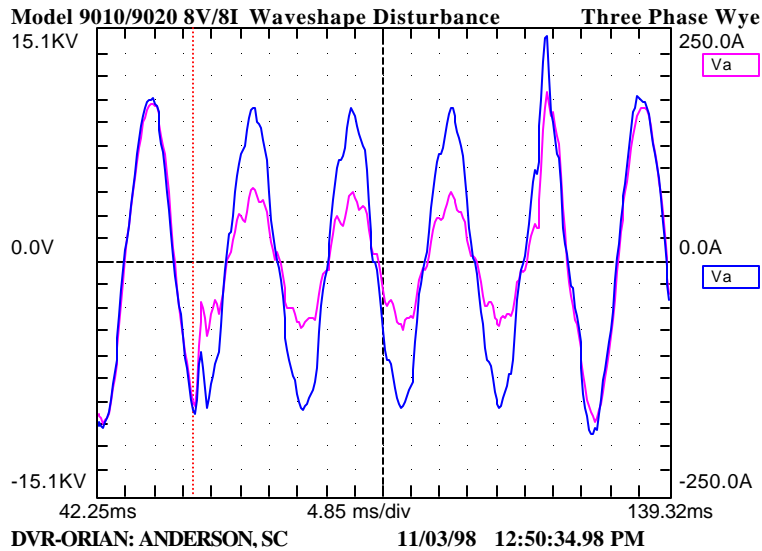
Define 'Event'



2 Seconds Later:



Another Example





Monitor, monitor, monitor

- The Three R's of Monitoring:
 - Reliability
 - Readability
 - Redundancy
- Benefits
 - Interest of Customer, Utility, and Equipment Manufacturer
 - Indices



Conclusions

- Technically, better than expected
- Monitoring is the key
- Event definition
 - CPTF application guide
- Phase shift is real