

Distribution System Voltage Dip Recordings

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1 Introduction

Voltage recording instruments were placed on ten distribution feeders in the Centerpoint distribution system. Recordings were obtained starting in 2011 and continuing through 2013.

The recorders are early-model PQube instruments manufactured by Power Sensors Limited. (www.powerstandards.com) These PQubes do not include high resolution time synchronization.

The recorders are set up to record the three phase voltages at the 480volt terminals of distribution transformers. The three voltages are recorded:

As point-on-wave values at 120 samples per second for 16 cycles seconds

At RMS values at 60 samples per second for 16 seconds

The PQube voltage terminals are connected line-to-ground; the base voltage for per unit purposes is 277 Volts.

A total of 1380 events were recorded. This large number of events was edited by a filter designed to reject noise bursts and events that did not exhibit delayed voltage recovery. This filter selected 317 events, many of which were of complicated form and were probably the result of local distribution-line events such as tree contacts. The set of 317 recordings is presented in accompanying files so that the range of forms of voltage disturbance can be seen.

Files accompanying this report contain plots of the recorded voltages: 317Files.xlsx Spread sheet giving date and time of each of the selected events 317FilesPDF Directory containing plots of the 317 events

2 Voltage dip filter

Figure 2.1 shows the filter used to select out events that could be construed as exhibiting "delayed voltage recovery". The filter is a profile of voltage-versus-time and is shown by the black line in the figure. If any of the three phase voltages goes below the filter profile the event is selected as being of interest for further examination. The event shown in figure 2.1 was selected as being of interest. Figure 2.2 shows an event that can reasonably be taken to include only 'good' samples but which was not selected.

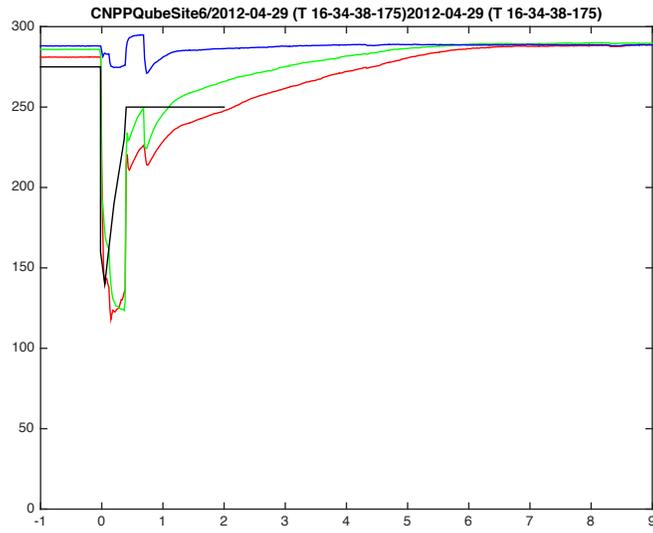


Figure 2.1: Event selection event and a selected event
 black - selection template
 red A phase
 green - B phase
 blue - C phase

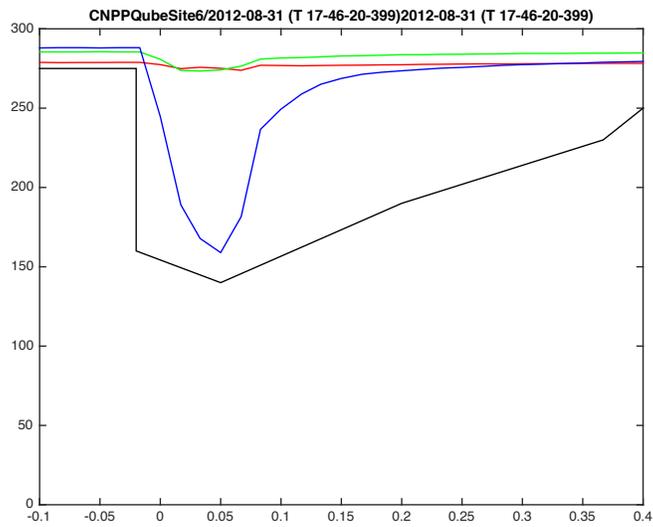


Figure 2.2: Event selection event and a non-selected event
 black - selection template
 red A phase
 green - B phase
 blue - C phase

3 Commentary on selected events

3.1 Event 291

Dip Duration	0.117 second (7 cycles)		
Initial voltage a,b,c	283.7	283.3	277.8
Final voltage a,b,c	287.4	281.1	277.7

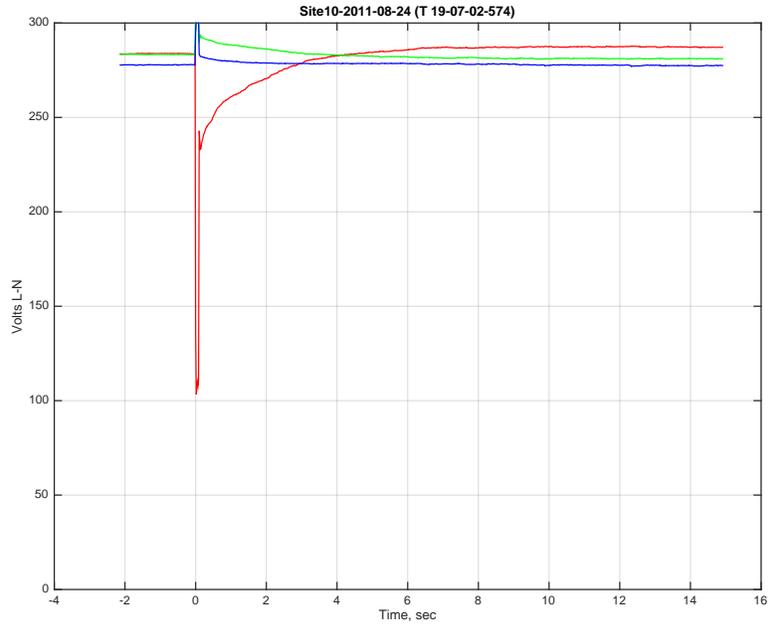


Figure 3.1: Event 291 7 cycle voltage depression
red A phase
green - B phase
blue - C phase

3.2 Event 265

Dip Duration	0.067 second (4 cycles)		
Initial voltage a,b,c	284.5	283.7	275.4
Final voltage a,b,c	296.4	280.3	277.7

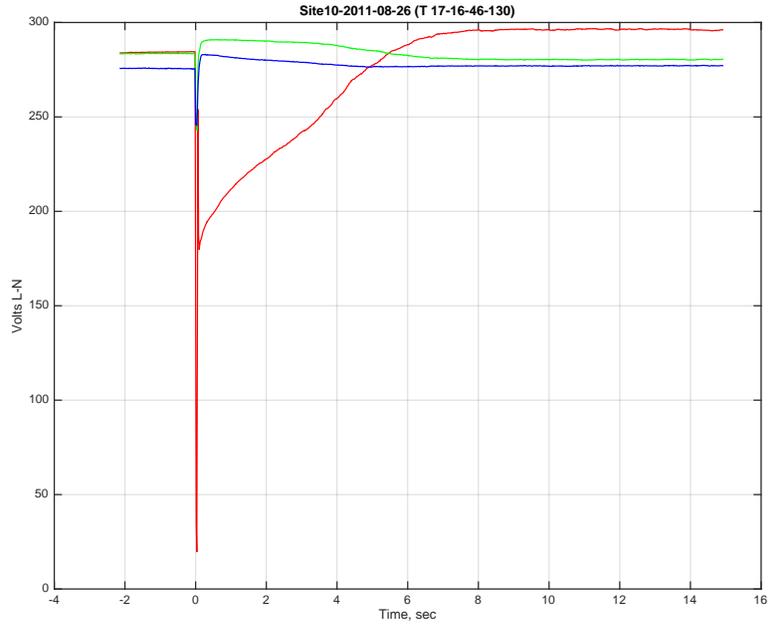


Figure 3.2: Event 265 4 cycle voltage depression
red A phase
green - B phase
blue - C phase

3.3 Event 55

Dip Duration	0.4 second	(24 cycles)		
Initial voltage a,b,c	278.9	282.1	285.2	
Final voltage a,b,c	289.2	296.9	298.5	

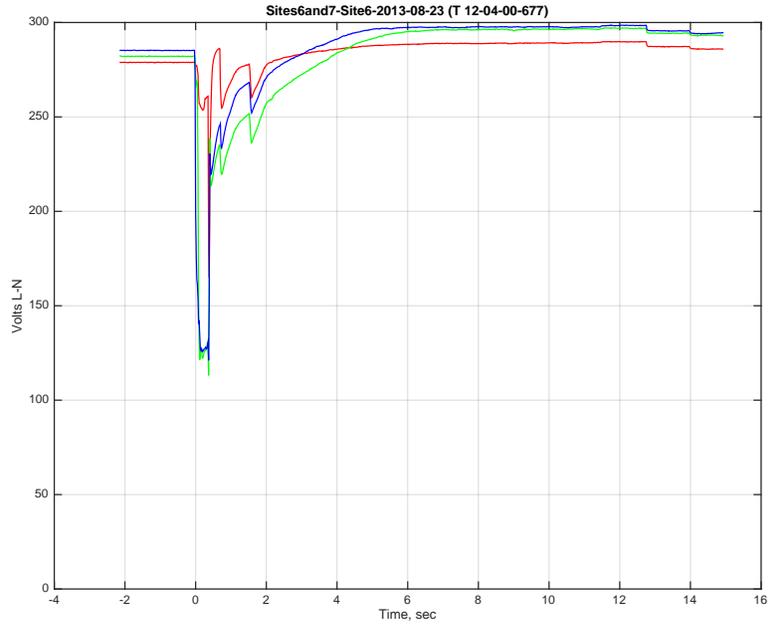


Figure 3.3: Event 55 24 cycle voltage depression
red A phase
green - B phase
blue - C phase

3.4 Event 243

Dip Duration	0.3 second	(18 cycles)		
Initial voltage a,b,c	279.4	284.5	286.5	
Final voltage a,b,c	283.1	284.3	287.6	

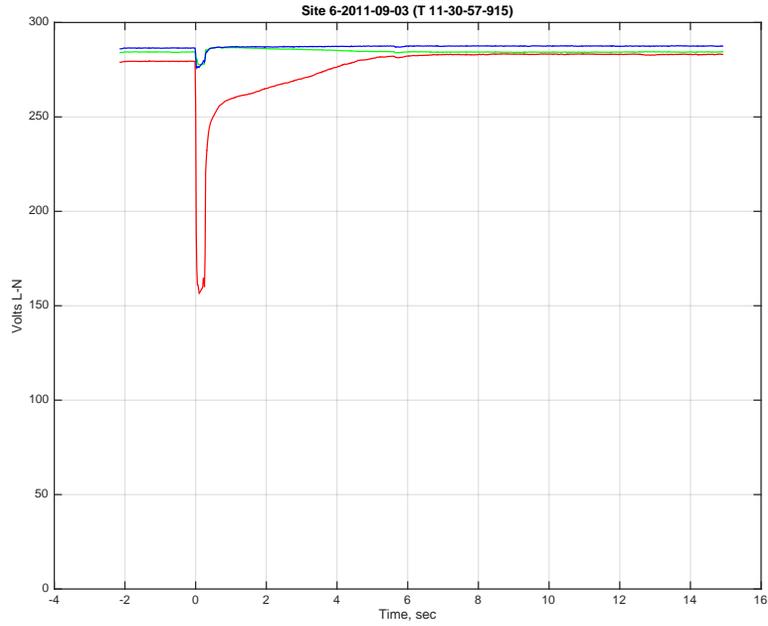


Figure 3.4: Event 243 18 cycle voltage depression
red A phase
green - B phase
blue - C phase

3.5 Events 126 and 139

Figures 3.5 and 3.6 show recordings from sites 6 and 5 on the afternoon of 29 May 2012. The time tags on these recordings differ by 2 minutes. No other events were recorded at any of the sites in the several minutes preceding and following 16:35 on the day. It can reasonably be construed that the two recordings are observations of a single event and that the difference in time tags reflects difference in settings of the PQube clocks.

Dip Duration	0.4 second	(24 cycles)		
Initial voltage a,b,c	281.1	285.8	288.0	
Final voltage a,b,c	288.7	288.7	288.7	

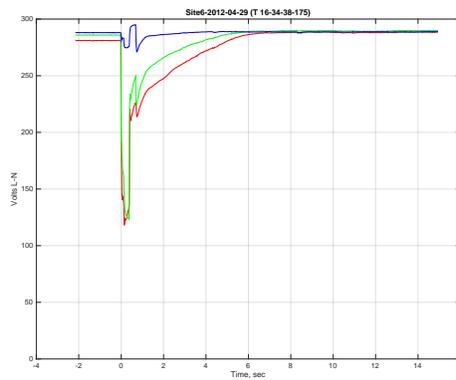


Figure 3.5: Site 6 recording - tagged at 16-34-38-175

Dip Duration	0.4 second	(24 cycles)		
Initial voltage a,b,c	280.5	282.3	285.5	
Final voltage a,b,c	285.2	286.4	286.9	

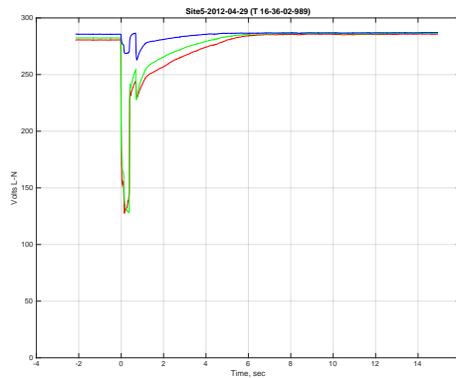


Figure 3.6: Site 5 recording - tagged at 16-36-02-989