How to Access and Contribute to Data Collection

One of the goals of this WG is to promote sharing data and signatures of various equipment failures. This document explains how to access the sample data collected by the report authors and how to contribute to data through the PQ Data Analytics WG.

1. How to Access Data

The data set related to the WG report is the one described in Section 4.5. The data are three-phase voltage and current waveforms collected over several days using a gapless recording device. Gapless recording means that the data is collected continuously nonstop and, unlike the continuous snapshot recording, there is no gap between the snapshots. Gapless recording is essential at this stage since we don't know what needs to be detected from the waveforms. Since the amount of data is huge, only 2 days of data are made available. The data format and location are described below:

1. Data format:
   - Two-day gapless data are provided here. They are stored in 48 ".mat" files (i.e. one file contains one-hour data) which can be opened with MATLAB. In order to reduce the space these files take, all the data are stored as single-precision floating point number.
   - There are 9 columns in each ".mat" file, which represent hour, minute, second, V_a, V_b, V_c, I_a, I_b, I_c, respectively. The hour, minute and second are derived from GPS time and can be used to determine the actual frequency. The units of voltage and current are volt and ampere, respectively.
   - Other information such as theoretical frequency, PT ratio is shown in section 4.4.2.

2. The location of the data is as follow:

   https://drive.google.com/open?id=0B82aih1d7VSTfjN3WkRKNkF3aVpBamc1VGdtWGt2QlJqeUtyY3lJYnJ5OUQ3V09tNjNNb0U

It is important to note that the data does not contain equipment failure events but it does contain abnormal waveforms that could be detected by various algorithms. The data can also be used for other research needs, such as algorithms for estimating frequency, supply system impedance, and interharmonics.

2. How to Contribute to Data Collection

By making this report and its data freely available to public, the PQ Data Analytics WG hopes to receive contributions from industry and academia to expand the collection of signatures of equipment failures. The effort needed to make a contribution is minimal, as explained below:

1. Prepare a simple one or two page description of the data/signature which include:
    - You name, affiliation and email
    - The equipment involved and what happened (An example is provided below)
    - A set of waveform or RMS value plots to show the signatures

2. Email the above document to:

    Current chair of the working Group

The submitted materials will be archived at the PQ DA WG website. If someone needs data, he/she will contact the contributors directly. If a contributor wants to send the data to the WG, please contact the current chair first.

Appendix: A Signature Submission Example

#Case 1: Incipient fault lasting over 9 months

Figure 1 shows an instance of a series of incipient faults occurred in a cable splice. During a period of over nine months, the cable splice experienced 140 cases of incipient faults whose peak fault current was about 5 to 6 times the RMS load current. Eventually, a catastrophic failure happened with a fault current of 2626 Amps RMS, resulting in a sustained outage. Customer called to report the outage event. The recorded voltage and current waveforms of the catastrophic failure, and associated phase analysis are shown in Figure 2.

Time domain analysis shows that the duration of the incipient faults lied between 0.25-0.47 cycles which were not detected by conventional relay algorithms. The fault inception angle with regard to the voltage peak was close to zero, with an average value of -1.16 degrees. There was an increasing trend in the normalized instantaneous peak fault current. Frequency domain analysis shows that a positive correlation existed between the DC, fundamental, 2^{nd} and 3^{rd} harmonic normalized currents and the failure.

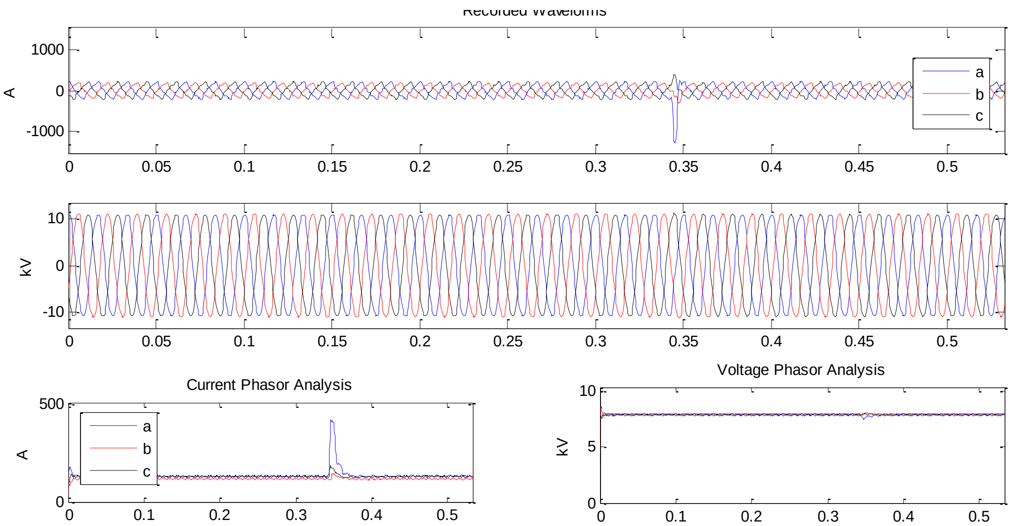


Figure 1: An instance of incipient cable splice failure.

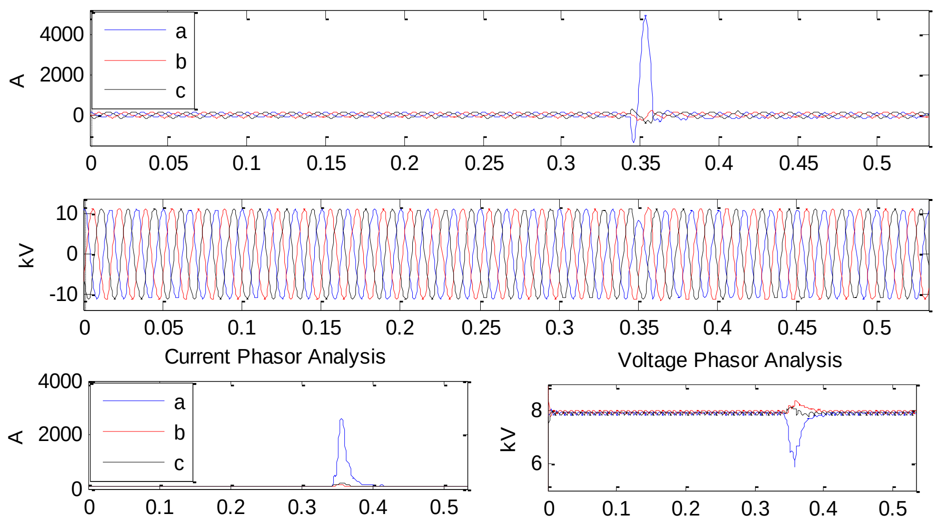
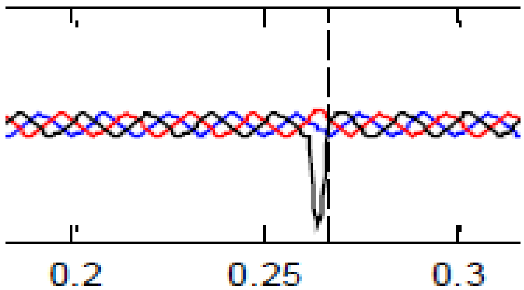


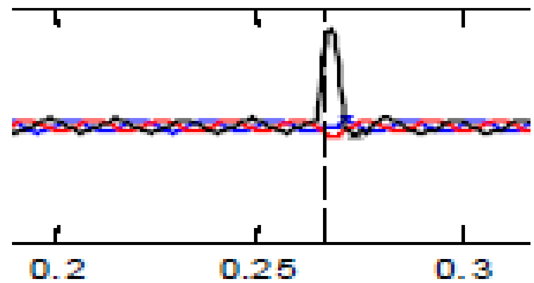
Figure 2: Recorded waveforms of the catastrophic failure.

#Case 2: Incipient fault lasting 3 hours

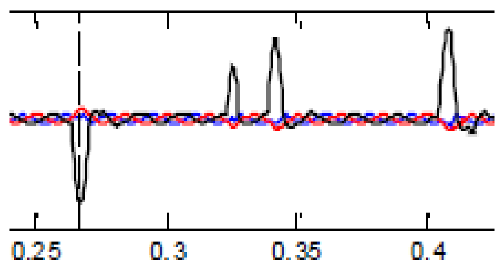
Figure 3(a) show the first instance of a series of incipient faults occurred in a 1000mcm cable run. Its fault current was 1108 Amps RMS and no outages or customer calls resulted. After this initial Phase-C incipient fault happened, the cable run experienced 6 single blips whose fault current lied between 1600-2438 Amps RMS with the fault duration being less than a half cycle. Then, nine multiple blips occurred whose fault current was between 2776-4274 Amps RMS. Figure 3(b)-(c) present the illustrative examples of single blip and multiple blip, respectively. About three hours later after the first incipient fault, a permanent fault happened and resulted in a sustained outage. The recorded current waveform of the permanent failure is shown in Figure 4.



(a) Initial incipient fault



(b) Single blip



(c) Multiple blip

Figure 3: Incipient failures.

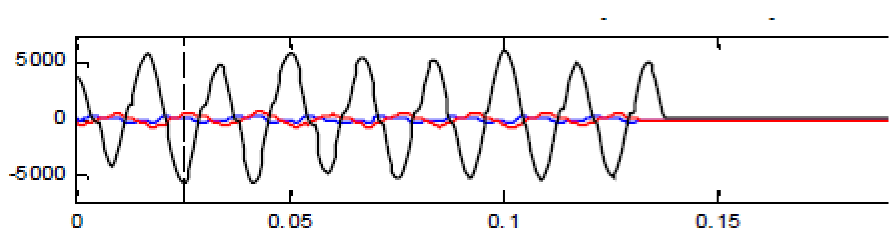


Figure 4: Catastrophic failure.