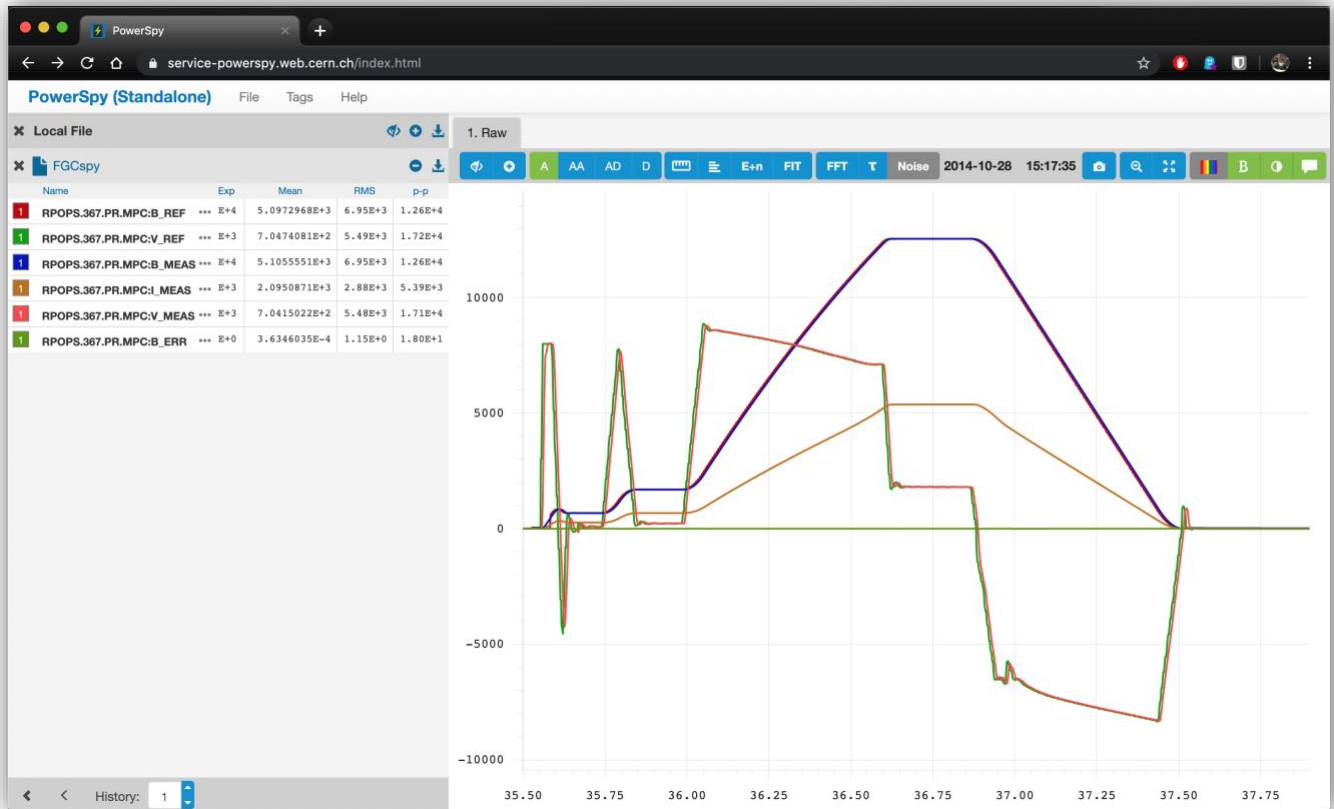# CERN PowerSpy Data Viewer

PowerSpy is a graphing tool, targeting the needs of power converter experts at CERN. It can display analogue and digital time-series signals, text data and CERN power converter event logs. While it was developed for CERN, it could certainly be of interest to power converter experts at other labs.

 For now, for the time-series signals must have a **fixed sampling rate** with all the signals in a buffer sharing the same time base (but with an optional time-shift per signal). In a future release, the time base will not have to have a fixed sampling rate.

PowerSpy is very fast and is designed to handle large datasets. Input is in the form of ASCII CSV or json formats. It can comfortably handle 10+ buffers with 100+ signals and 20M+ samples. The maximum input file size is about **230MB**, but multiple files can be imported. The main limitation is memory on the host computer. Note that one file will normally contain one buffer, but it is possible to have multiple buffers in the same file.

The main features of PowerSpy are:

- Digital and Analog signals
- Interactive panning, zooming and control of signal visibility and signal name visibility
- Black or white chart background
- Optional bold lines and larger font
- Chart image capture
- Signal color picker
- Dual chart option with two views on the analog signals or analog and digital signals
- Absolute and relative time axis
- Measurement tool
- Exponential scaling
- Subtraction of a first order least-squares fit
- Fast Fourier Transform
- First order exponential response analysis
- Noise analysis
- Scatter plot
- Mean, RMS and peak-peak analysis
- Signal history
- Saving of signal logs to local CSV files

The full version of PowerSpy is available within CERN at https://cern.ch/PowerSpy. This can read log data directly for CERN's power converter controllers or from archived data in files.

A standalone version is freely available outside CERN at https://cern.ch/service-powerspy. This is only able to display data from local files. For a full version, please write to Nick Ziogas at Nicholas.Ziogas@cern.ch.to discuss how to have PowerSpy available on an Apache2 web server at your site.

Choice of Browser

PowerSpy works with Chrome, Firefox, Edge, Safari and probably Opera. It **does not work** with Internet Explorer.

Chrome is the only browser that will detect if a file is updated and automatically re-read the contents. That can be a useful feature, but it only works if the file is immediately complete. This requires an application to write the new file with a temporary name, and then rename the file to replace the original file. Unfortunately, this uses a feature that risks to be depreciated by Google at some point in the future, so it might not work in the long term.

Example files of the different PowerSpy Data Formats

The PowerSpy data formats are described in detail in PowerSpyDataFormat.pdf.

Download the example data file or files that you want to view. Use the "Open Local File" option of the File menu or simply drag and drop the file(s) onto the PowerSpy interface to display the contents.

Example files are included in files.zip or the files directory:

simplest.csv

Example of a simple hand-edited "FGCspy" format file. FGCspy was the predecessor to PowerSpy and its file format is the simplest format that PowerSpy can use.

The first element of the first column must be "TIME". The sampling period is calculated from the difference in the first two time column values. The rest of the time column values are ignored and are zero in this example to make that clear. This will change in a future release to use the time column for all samples.

The time column is treated as UTC values, so if the time starts at zero, the samples will be shown as being from about the start of 1970.

Note that PowerSpy shows the time axis in local time, while the data is always treated as UTC.

For compatibility with FGCspy, if a signal name contains "REF" or "ERR", it will be shown with trailing step interpolation.

FGCspy.csv

Real FGCspy data file recorded in 2014. This contains six signals from the controller of the main magnets circuit power converter of the CERN PS accelerator. The controller was regulating the field measurement (B_MEAS), while also recording the current measurement (I_MEAS) and several other signals.

It is interesting to make only these two signals visible and to then use the Scatter signal menu option (mouse over the "..." after the signal name) to plot B_MEAS against I_MEAS. This shows the effects of magnet saturation and hysteresis.

sps_mbi/* and sps_mbi.zip

This folder or zip file contains PowerSpy files acquired and saved using PowerSpy in 2018. It contains buffers from the controller of the CERN SPS main bending dipoles circuit power converter. If you load all the files at the same time into PowerSpy, you will have a large number of signals. It can be helpful to hide the signal names for buffers that you are not interested in.

amps-fil-4.5-1.14/* and amps-fil-4.5-1.14.zip

This folder or zip file contains PowerSpy files generated by the CCLIBS test program called ccrt. This is an example of how PowerSpy can be used to display data created by a program. The list of files includes _CONFIGURATION.csv and _DEBUG_DATA.csv, which contain text data. This shows how PowerSpy can display text data in tabular form.

1_signal_500_ksamples.csv
1_signal_5_Msamples.csv
60_signals_250_ksamples.csv

These files were generated to test the performance of PowerSpy with large data sets. The file **60_signals_250_ksamples.csv** contains 15M samples and is 215MB in size, which is close to the maximum files size supported by PowerSpy. It can take several seconds to import the file, but once the data is resident, zooming and panning on a reasonably recent machine is acceptably fast.