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AUTOMATIC DATA PROCESSING AND DATA DISPLAY SYSTEM FOR THE HERMES III ACCELERATOR*

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Introduction:

This paper describes a new software program for processing and displaying the output shot data from a HERMES III accelerator test. The HERMES III accelerator is a gamma ray simulator at Sandia National Laboratories, New Mexico. HERMES III and generates 370 data channels per shot averaging 6 shots per day. An automated method for analyzing all probe signals quickly and accurately is necessary. Our new data processing and display (DPAD) program will combine the user friendly features of Lab VIEW together with the data analysis and display tools of Python. The data processing and display routines originate from a text based input configuration file (CF) allowing users to uniquely process any data channel and customize its displayed format. The Python data processing routines will be posted in a shared location allowing users to examine all post processing details providing maximum transparency of processing algorithms employed.

Poster Layout

This Data Processing Program and Display Program (DPAD) is a work in progress software program and this poster provides an example of the PDAP "program flow" using HERMES III DAQ shot data and the following assumptions:

1. The HERMES III DAQ data file contains two data channels named "MTG-West" and "MTG-East".
2. The present configuration file (CF) keywords linked to Python programs are shown in Table 1.
3. The example CF file contents are shown in figure 1.

Table 1: Configuration File Keywords linked to Python Programs

Config keyword	Python program	Python program information
*offset	Py_offset	Offset correct baseline
*calib	Py_calib	Multiply Y-values by calib-#
*atten	Py_atten	Multiple Y-values by atten-#
*droop	Py_droop	Apply droop formula to data (RC#)
*report-H3	Py_report-H3	Start HERMES III report program
*asci-folder	Py_ascii	Create ASCII data set . Specify folder if
*asci-file		
*mplot	Py_mplot	Create an X-Y plot overlay

MTG_config.ini *

```
[MTG-West]
processing = "*offset, *calib, *delay"
ascii-foldername = "MTG"
ascii-filename = "MTG-West"
mplot-name = "MTG-signals"
mplot-Tstart = 100.0e-9
mplot-Tend = 1.100e-6

[MTG-Eeast]
processing = "*offset, *calib, *delay"
ascii-foldername = "MTG"
ascii-filename = "MTG-East"
mplot-name = "MTG-signals"
mplot-Tstart = 100.0e-9
mplot-Tend = 1.100e-6

[Section 3]
report-type = "*report-H3-MTG"
```

Figure 1: Example Configuration File

Data Processing and Display Program Flow

The Example configuration file contains 3 separate sections, the first two pertain to specific data channels followed by the last section containing a keyword that we recognize as a report generation program.

When the DPAD program is run in batch mode the program steps taken are:

- First, the DPAD extracts all configuration file (CF) channel section names.
- Next, the DPAD compares CF section name with DAQ channel names.
- The first section name "MTG-West" is an exact match so extract keywords:
  - "processing" keyword value = "*offset, *calib, *delay" defines 3 Python programs to be executed.
  - "ascii-foldername" keyword value = "MTG" defines the ASCII sub-folder name.
  - "ascii-filename" keyword value = "MTG-West" defines the ASCII data file name.
  - Create the ASCII data file in sub-folder with appropriate filename.
  - "mplot-name" keyword value = "MTG-signals" defines the waveform plot image filename.
  - "mplot-Tstart" keyword value = 100.0e-9 defines the graph start time.
  - "mplot-Tend" keyword value = 1.100e-6 defines the graph end time.
  - Create mplot plot overlay and save as image file.
- The second section name "MTG-Eeast" is misspelled and is not a match to any DAQ channel name.
- The last section contains the keyword "*report-H3-MTG". This keyword is linked to "Py_report-H3-MTG" so the DAP program starts the HERMES III MTG report generation program.

- Had "MTG-Eeast" been correctly spelled then: 1) that DAS channel would have been processed, 2) an ASCII data file created and 3) its waveform data plotted together with the "MTG-West" data.

---------- end of example ----------

Under normal circumstances and in batch mode processing after a typical full machine HERMES III accelerator test, our configuration file will contain 370 channel sections followed by the report generation section. At the end of a DPAD batch mode program run will have:

1. Created 370 ASCII data files each data channel processed and named per CF instructions.
2. Archived the 370 ASCII data files into 15 sub-folders per CF instructions.
3. Plotted the 370 processed data channels into 65 separate graphs and saved as JPG image files. After execution the user can view the processed shot data simply by using any image viewer.

When run in manual mode, the DPAD program will operate much like the present data viewer program except that, as in batch mode, Python routines will do all data calculations.

Summary

This data process and display program is a work in progress, and will allow the user to process and view any and all HERMES III datasets thereby providing us with a much-needed data visualization tool. The processing and display of the 370 probes signals will assist the DAS and machine operators to quickly access machine performance guiding corrective actions.

The method for introducing processing instructions at the data channel name level will provide users with useful and flexible data processing and display tools using intuitive keyword commands. This method is expandable and as time permits more advanced Python programs will be developed and assigned new keyword names.

The grouping together of data sets for plotting together with the ability to define these plot time windows will allow user to quickly assess and compare data channels within these groups.

This method provides another tool and will allow users to analyze HERMES III accelerator shot data by simply viewing the processed image files created.

Acknowledgements

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