[A Refresher On …]

Tools for Matlab Analysis of DAQ Data

[from the 9ma Experiments]

Ned Arnold

October 2009

Interactive analysis of DAQ Data using Matlab

- Learning Curve Questions ...
  - How do you know which DAQ data directory to use?
  - How do you know what valid timeframes of data are in a particular directory?
  - How do you know the channel names archived in the DAQ?
  - What do you do if you get an error from daq_fetch?
  - What is the structure of the data returned for a channel from daq_fetch?
    - DAQ_data{n}(x,y,z)
  - How do you know the sub-channels of a channel ...
    - How many and what do they represent (I, Q, Amplitude, Phase, X, Y, Klystron parameters, etc)
  - Since the number of samples returned varies from channel to channel, how do you align them?
    - Answer: correlate the sample #s stored in daq{n}(:,:,1) ... (easily said!)
  - How do you know which sample #'s are supposed to have beam (i.e. valid diagnostic data)?
  - How do you decipher the TIME array returned by daq_fetch?
  - "I'm sure someone has had to implement this algorithm, where can I find an example?"

Interactive analysis of DAQ Data using Matlab

- Existing Tools…
  - daq_fetch.m (Michael Davidsaver)
    - Calls DESY-provided *daq_read_svr()*
    - Input arguments: list of channel_names, Tstart, Tend
      - DAQ directory hard-coded in daq_fetch.m
    - Output arguments: list of channel names (+ time), DAQ data (dlbl, daq)

  - daq_fetch_v2.m (enhanced by Ned Arnold)
    - Calls DESY-provided *daq_read_svr()*
    - Input arguments: list of channel_names, Tstart, Tend, DAQ directory, retry flag
    - Output arguments: list of channel names (+ time), daq data [dlbl, daq], prints channels which are missing data

  - DESY's DAQ DATA GUI
    - Finds channel names which exist in DAQ repository for a specific time period
    - Basic plotting and viewing of DAQ data

Interactive analysis of DAQ Data using Matlab

- Existing Tools…
  - DOI Version 1 - Matlab GUI to retrieve DAQ data

    - Entry fields for Tstart, Tend, DAQ Directory
    - Select channels using predefined "channel group" files
    - Estimates amount of data being requested
    - On daq_fetch error, searches for the channel that is missing data

    - Store results in a local file (for interactive analysis)

    - Provides a framework for writing analysis programs that are "time frame independent"
    - Introspection of analysis scripts to discover channels used by script
      - (i.e. selecting an analysis script puts those channels on the list to be fetched)

    - Select analysis script, select time frame, execute … (2 mouse clicks)

Interactive analysis of DAQ Data using Matlab

- New Tools (under development, but already <somewhat> useful) …
  - A Wiki site where you can get your questions answered AND contribute your own answers to common issues
    - http://www.linearcollider.org/wiki/doku.php?id=9ma:daq_page_v2

  - A database of DAQ channels as of 2009-09-20 11:16:34 (the last time the DAQ was restarted during the September run)
    - Search by ….
      - System, Channel Name (or partial name), Description, Type (spectra, scalar, bitmap)
    - For a selected channel, the tool displays …
      - Units, type, # of samples/pulse, sample pattern, etc
      - A description of the channel
      - Sub-channels of data and their descriptions (e.g. I / Q)

    - Extracted channel info from *linac_main_run4453_chan_dscr.xml* … how accurate is this?
      - Not 100% consistent with experience of DAQ data
        - » *Some channels return no data (Halo, dipoles, etc)*
      - Looking for better descriptions of sub-channels
      - Need help!

Interactive analysis of DAQ Data using Matlab

- Proposed Tool
  - DOI Version 2 …
    - Retrieves information from the Channel Database for # of subchannels, size, etc
    - Allows channel list editing (deletion/addition of individual channels) before the fetch

    - Allows use of "nicknames" (with the help of the Channel Database)
    - Retrieves information from the Channel Database to know how to "pre-process" certain channels (i.e. calculate phase/amplitude from I/Q, pre-alignment of diagnostic data, etc)

    - Requires …
      - A commitment to maintain the Channel Database …