Waveform Access

Swift digitizers

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Fast digitizer waveforms can be accessed in several ways by the software that runs in the Linac-style systems, including the PowerPC-based front ends that support the Linac today and the 68040-based IRMs that are used as front ends in some Booster projects. This note describes these access options.

Hardware options

Several different hardware options are used for support of waveform access.

1. Swift digitizer, 6–800 KHz. (snapshot)
2. Quick digitizer, 1–10 MHz. (snapshot)
3. Quicker digitizer, 1-10 MHz. (snapshot)
4. IRM KHz digitizer, up to 1 KHz. (continuous, snapshot)
5. HRM Slow Data digitizer, up to 10 KHz. (continuous, snapshot)
6. Generic 15 Hz from data pool. (continuous, snapshot)

Access via Classic

Fast digitizers often have a dedicated waveform buffer into which the hardware writes the digitized samples. Hardware examples include the Swift, Quick, and Quicker digitizers. A Classic protocol client can access this dedicated buffer directly. The client "just knows" the digitize rate. The Macintosh Parameter page application can get the location of the waveform buffer by examining the analog control field of a given channel, when that field is used to hold the base address of that buffer. This scheme is used for its "Memory Plot" windows.

Support of the 1 KHz or 10 KHz digitized data as provided by IRM or HRM hardware can be done via listype 82, which the Macintosh Parameter page uses for "Fast Time Plot" windows. Any sample rate can be specified; the software will sample the hardware buffer to give its "best shot" at providing the data at the specified rate. This method of access is designed to collect a continuous stream of data. By specifying a clock event in addition to an analog channel, one can get time stamps that are relative to the last occurrence of the clock event. Without a clock event, the time stamps are relative to the time of request initialization.

Access via `RETDAT`

If a request is made for a device that is configured in the usual way as relating to an analog channel using listype `0x00`, one normally gets what is stored in the Reading field of the `ADATA` table entry for that channel. For such a request, the `length` specified is 2 bytes. But if the `length` is specified as more than 2 bytes, or if the `offset` specified is nonzero, the request is treated as asking for a piece of the associated waveform for that channel, assuming that a `CINFO` table entry exists to relate that channel to a waveform buffer. The `offset` is in units of bytes. For example, one can request 400 bytes of waveform data (200 points) starting at the 21st point in the waveform buffer by specifying an offset value of 40 bytes.

A variation of this scheme can be made in order to increase the chance of collecting waveforms at 15 Hz. The variation is selected by the reply period being specified at 7.5 Hz. In this case, the reply data consists of the waveforms from two successive 15 Hz cycles, preceded by a 4-byte header that specifies the number of waveforms in the buffer (either 1 or 2) and a 15 Hz cycle number, which is derived from cycle counter included in the clock event multicast message. The client must interpret this structure appropriately, but it permits obtaining 15 Hz waveform data that can be correlated across multiple front ends. The

motivation for this scheme came from the need to acquire correlated Booster BLM waveform data at 15 Hz. (The normal Acnet client cannot reliably collect 15 Hz data, because the application samples a data pool at only an approximate 15 Hz rate that is not synchronized with the 15 Hz accelerator.)

A `RETDAT` request can also specify listype 82 in the `SSDN`, which permits access to IRM or HRM digitizer data at any implied rate. The rate requested is implied in that it is dependent upon the number of bytes of data requested and the reply period. Suppose a client program wanted to request 300 Hz data from a channel that is measured by the IRM 1 KHz digitizer. By using listype 82, or `0x52`, in the `SSDN`, with the channel number and optional clock event, the requested `length` at a reply period of 5 Hz, say, would be 8 + 60*4 = 248 bytes. An 8-byte header is included that indicates the base time stamp that is to be added to the 2-byte time stamp that is associated with each 2-byte data point. For this example, there are 60 points to be sampled in three 15 Hz cycles. The time stamps, when a clock event is specified, are relative to the last occurrence of the clock event. The 8-byte header also includes a nonzero time stamp of the most recent clock event, if it occurred during the sampling of data comprising the reply buffer. If a client is plotting the data that it receives, and it notices that the time stamp of a data point has exceeded this value, it should subtract this value from the time stamps so that the points are plotted more near to the “left hand side” of the plot.