

FTPMAN Timestamp Anomaly

Statement of the problem

Thu, Aug 21, 1997

Symptom observed

When plotting 15 Hz data from Linac local stations on a Vax console, sometimes the data points are not plotted; the display seems to freeze for some length of time before continuing to plot, as if the data is being ignored.

What is going on

FTPMAN timestamps are in units of $100 \mu\text{s}$ since the last 02 clock event. The 02 clock event occurs every 5 seconds, recently derived from a crystal rather than counting 15 Hz line-locked accelerator cycles. This means that the time of the 02 clock event, relative to the time of 15 Hz cycles as seen from Linac local stations, will drift over time, depending on how close the power line frequency is to 60 Hz.

Linac local stations do not have a clock event detection logic as IRMs do. But the Linac klystron stations (nodes 620–627) have clock detection hardware, for 16 selected clock events, that is interfaced as digital status bits. The occurrence of one of these selected clock events sets the status bit, which is subsequently cleared by the start of the next 15 Hz accelerator cycle. If the clock event occurs soon after the start of the cycle, its status will be properly read by the local station software. But if the clock event occurs late in the cycle, after the normal sampling of status bits takes place, the status indication of that event may be cleared before it is seen by the software. When the system was originally installed, the 02 clock event always occurred every seventy-five 15 Hz accelerator cycles, so it was always seen properly via this digital status interface. But now, since the 02 clock event is no longer in synchronization with the accelerator clock events, but rather occurs at a crystal-driven 5-second period, there will be times when the 02 clock event is completely missed. So, the Linac stations do not have a reliable means of knowing when the 02 clock event occurs.

The logic inside of FTPMAN that handles timestamp support for 15 Hz FTPMAN requests was modified since it was installed in the Linac local stations. The old version, still running in the Linac local stations, pays attention to a multicast message, sent about every 4 minutes by one of the klystron local stations, that announces the number of cycles since the last 02 event as detected via its digital status interface. The old FTPMAN logic remained in synchronization with this counter. But the FTPMAN logic was changed so that the latest version works differently, in that it accepts with the original FTPMAN data request a starting value for the number of 15 Hz cycles since the last 02 event, and it maintains this count throughout the duration of the request, incrementing the count each cycle and resetting it to 0 when it reaches 75. This method is independent of any synchronizing logic to the occurrence of 02 events, and it relies on being able to predict the continuing occurrence of 02 events every 75 accelerator cycles. Unfortunately, with the new 02 clock event system being crystal-driven, this method no longer works, exactly. In time, the internal 02 timestamps will depart from the real 02 events.

So, what do we have here? The latest FTPMAN logic for support of 15 Hz timestamps is invalid *vis-a-vis* the new crystal-driven 02 clock events. There is logic in one of the klystron stations that can provide synchronization to the real 02 events, but its digital status reading of the 02 event occurrence is unreliable. What to do?

Finally, the reason that the points are not plotted on the Vax console is surmised to be that

the timestamps drift so far away from reality that the plot package refuses to accept them as valid.

Solution

If the klystron station that builds a count of the number of cycles since an 02 event were able to have a correct count, then its logic of sharing the value of that count every few minutes with the other Linac stations should be ok. (We may want to do it a bit more often than every 4 minutes, however.) The old version of `FTPMAN` in these stations includes logic that notices the shared value and synchronizes the counter inside its request block to it. The new version of `FTPMAN` would have to have such logic added, so that it could also work in Linac stations in the future.

An IRM has proper clock detection hardware that will work for the asynchronous 02 events, as it does for any event. If an IRM were to create an analog channel whose reading is the count of 15 Hz cycles since the last 02 event—just as the klystron station now does—it could send this value to the klystron station periodically. We can remove the part of the klystron station logic (in the Data Access Table) that builds the count channel, but leave in the part that periodically shares the value of the count with the other Linac stations. The reason that an IRM cannot send the information to the Linac stations is that we don't yet have IP multicast functionality working from ethernet to token ring. (As of this time, the router/switch software needs an update.)