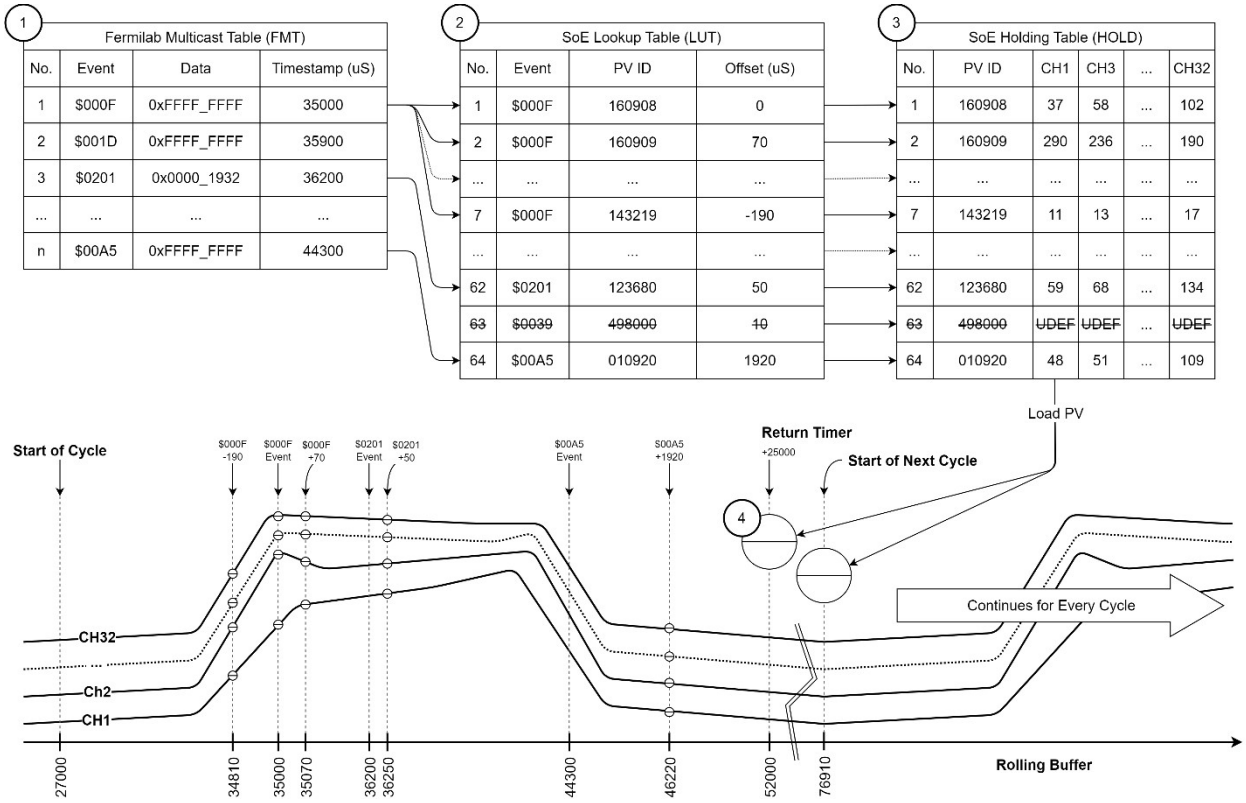
Sample on Event Functional Specifications

The following *suggested implementation* outlines Sample on Event (SoE) functionality for the XRM. This functionality allows for dynamic sampling of waveforms on machine timing 'Events', without integrated access to the timing network. This functionality updates at a minimum of 30~40Hz (2x the machine cycle rate) to maintain feed-forward control functionality.

1. The XRM shall have access to the Fermilab Multicast Table (FMT).
    a. The FMT shall be transmitted at a minimum of 120~160Hz (8x the cycle rate).
    b. The FMT shall be transmitted asynchronously to the actual machine cycles.
    c. The FMT shall hold all timing Events that occurred during the preceding transmit.
    d. The FMT shall timestamp each Event with a timestamp of 1uS accuracy.
    e. The FMT shall contain the corresponding data for each Event, where available.
2. The XRM shall have a SoE Lookup Table (LUT) to configure Sample on Event parameters
    a. The LUT shall have a minimum 64 SoE configuration options available.
    b. The LUT shall hold each configuration option as a PV (some may be unconfigured).
    c. The LUT shall reference a unique Identifier correlating to the PV configuration.
    d. The LUT shall reference an Event on which to Sample on Event for each PV.
    e. The LUT shall reference an Offset that may be applied to the Event for each PV.
    f. The LUT shall utilize microseconds (uS) for the Offset configuration.
    g. The LUT shall interpolate between offset and nearest sample index internally.
    h. The LUT shall be capable of holding multiple of the same Event w/ different Offsets.
    i. The LUT shall be configured entirely by the consumer.
3. The XRM shall have a SoE Holding Table (HOLD) to retain Sample on Event readings.
    a. The HOLD shall have a number of PV's corresponding to the LUT's configured PV's.
    b. The HOLD shall reference a unique Identifier corresponding to the LUT's Identifier.
    c. The HOLD shall have a number of Channels corresponding to Channels in the slot.
    d. The HOLD shall populate every available Channel each Event/Offset pair.
    e. The HOLD shall update on every Multicast Update Table received.
    f. The HOLD shall clear after the Return PV is updated.
    g. The HOLD shall have no value for events not received during the previous cycle.
4. The XRM shall update its Return PV at each Cycle Trigger *and* Return Timer (30~40Hz rate)
    a. The XRM shall have an acquisition Cycle Trigger designating the start of each cycle.
    b. The XRM shall have an internal Return Timer designating the middle of each cycle.
    c. The XRM shall have variable delays from 1~49mS (1ms inc.) for the Return Timer.
    d. The XRM shall update the Return PV within 1mS of Cycle Trigger or Return Timer.
    e. The XRM shall retain the preceding 1 second (30 or 40) of Return PV's internally.
    f. The XRM shall make any of the available return PV's available upon request.
    g. The XRM shall index return PV's from 0 to -39, with 0 being the most recent PV.

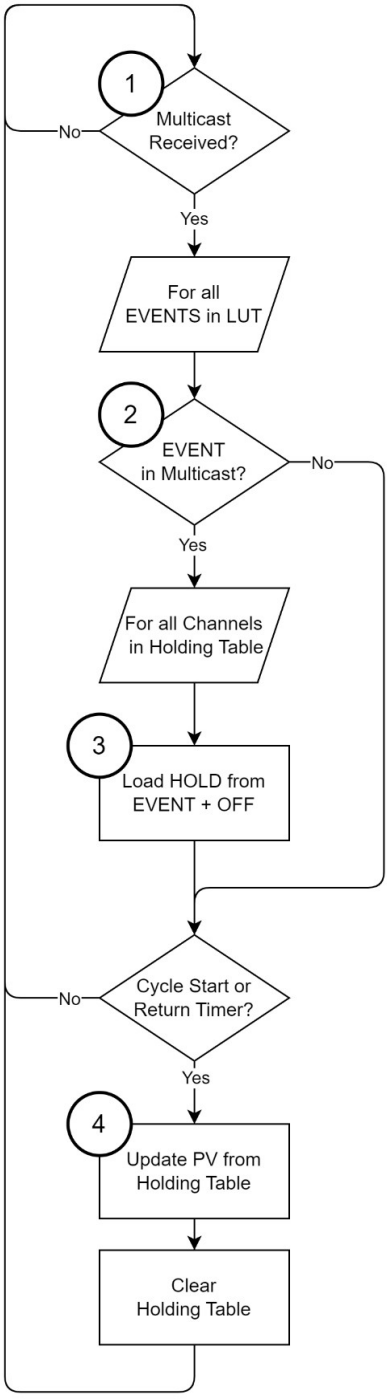


Graphical Depiction of Sample on Event Functional Specifications.

Sample on Event Functional Description

The above scenario operates as follows:

1. The XRM receives the Fermilab Multicast Table containing Events and Timestamps.
    a. For example, the $000F occurred at time 35000, the $0001D at 35900, etc.
    b. The FMT arrives asynchronously to cycle markers, multiple arrive between cycles.
2. The XRM references the LUT for corresponding Events and Offsets.
    a. Events are correlated to the FMT~ the $000F is to be sampled at 35000 and 35070.
    b. The $0039 event doesn't occur during the preceding period and will not be updated.
3. The XRM populates its HOLD table from the signal buffers at each data point.
    a. For each channel, the value at time 35000 is loaded into the Holding Table.
    b. For each channel, the value at time 35070 is loaded into the Holding Table, etc.
4. The XRM receives a Return Timer, or Cycle Trigger
    a. The Return PV is loaded from the Holding Table.
    b. The Return PV is buffered for one second internally and provided upon request.



Logical Depiction of Sample and Hold Functional Specifications.