

| V101 Num (Priority) | SNS Event Num | Event Name    | Trigger Event | Delay From Trigger                      | Delay To Gate      | Gate          | Comments   |
|---------------------|---------------|---------------|---------------|---|--------------------|---------------|--|
| 0                   | 0             | ----          | ----          | ----                                    | ----               |               | Not Used   |
| 1                   | 39            | Extract       | 1             | 5050                                    | ----               | A2            | 60 Hz. Generated by V123S. Defines the end of the time-critical section of the timeline. Re-enables soft event delivery.   |
| 2                   | 1             | Cycle-Start   | 63            | 1                                       | ----               | A1            | 60 Hz. Generated by V123S. Defines the start of the time-critical section of the timeline.   |
| 3                   | 63            | Pre-Pulse     | ----          | ----                                    | ----               | Sync Gen      | 60 Hz. Generated by V123S. Triggered from master reference generator. Disables soft event delivery until the next Extract cycle. Will be eliminated in next V123S Rev.   |
| 4                   | 3             | MPS-Reset     | ----          | ----                                    | ----               | MPS AR Out    | Single-Shot. Triggered by MPS Auto-Reset signal.   |
| 5                   | 4             | MPS-Latch     | ----          | ----                                    | ----               | MPS Latch Out | Single-Shot. Triggered by MPS Latch signal.  |
| 6                   | 43            | RTDL-Xmit     | ----          | ----                                    | ----               | A4            | 60 Hz. Triggered by timing master sequencer after all the RTDL frames for the next cycle have been loaded. Triggers the gate that starts the RTDL transmission.  |
| 7                   | 44            | RTDL-Valid    | 43            | $6 \times (\text{Num RTDL Frames}) + 1$ |                    | A7            | 60 Hz. Signals the end of the RTDL transmission.   |
| 8                   | 27            | Source-On     | 1             | 2 Turns                                 | 3747 to 5046 Turns | A8            | Variable Rep-Rate. Controls ion source rep-rate only. Event location remains fixed. Gate width and delay are set in the MPS Master IOC (which generates the Ion Source Gate). Can be independent, or made coincident with the Warm-HPRF or Warm-LLRF events.   |
| 9                   | 37            | Beam-Ref      | 1             | 1050-2109                               | 2939               | B1            | 60 Hz. Event controls where the start of beam occurs.  |
| 10                  | 36            | Beam-On       | 37            | 2                                       | 2937               | B2            | Variable Rep-Rate. Event controls the beam rep-rate. Can be independent, or made coincident with Source-On, or Warm-LLRF. Event will be inhibited if the Kicker-Charge event did not fire on the previous cycle.   |
| 11                  | 47            | Diag-Fast     | 36            | 2                                       | 2935               | B3            | 6 Hz. (Nominal) Always occurs on same cycle as Beam-On event. Actual rep-rate is determined by Beam-On rep-rate and the fact that the timing master sequencer guarantees that there will always be at least 166.7 milliseconds between pulses. So, for example, if the Beam-On rep-rate is 10 Hz, the Diag-Fast rep-rate will actually be 5 Hz (since at 10 Hz there is only 100 milliseconds between pulses). Nominal rep-rate can be adjusted. |
| 12                  | 46            | Diag-Slow     | 47            | 2                                       | 2933               | B4            | 1 Hz. (Nominal) Always occurs on same cycle as Diag-Fast event. Actual rep-rate is determined by the actual Diag-Fast rep-rate and be the fact that the timing master sequencer guarantees that there will always be at least one second between pulses. Nominal rep-rate can be adjusted.   |
| 13                  | 45            | Diag-Demand   | 46            | 2                                       | 2931               | B5            | Single-Shot. Always occurs on same cycle as Diag-Slow and Diag-Fast events.  |
| 14                  | 48            | Diag-No-Beam  | 39            | 1                                       | 2931               | B6            | 6 Hz. Not necessarily coincident with anything. This is a 6 Hz. event that can be used to test diagnostic triggers when there is no beam. Trigger and delay put the gate outside the beam acceleration/accumulation/extraction part of the machine cycle, so you are guaranteed not to have any beam. Rep-rate is the same as the Diag-Fast nominal rep-rate.  |
| 15                  | 40            | Kicker-Charge | 39            | 12 Turns                                | 1 SubRev           | B7            | Variable Rep-Rate<br>Instructs the extraction kickers to begin charging. Must occur at least 13 milliseconds before extraction. Consequently, this gate must fire after the Extract event of the <u>previous</u> cycle.<br>Rep-rate tied to Beam-On rep-rate. Occurs one cycle before Beam-On event. If beam is inhibited, this event will not be generated. Beam-On event will be inhibited if this event did not fire on the previous cycle.   |
| 16                  | 38            | End-Inject    | 1             | 5048 Turns                              | ----               | B8            | 60 Hz. Occurs 2 cycles before Extract. This event signals the fixed end point for all beam and RF gates.   |
| 17                  | 28            | Warm-HPRF     | 1             | 530-2109 Turns                          | 2939 Turns         | C1            | Variable Rep-Rate. Controls the warm linac high-power RF gate width and rep-rate. Can be independent, or made coincident with the Source-On event.   |
| 18                  | 29            | Warm-LLRF     | 1             | 790-2109 Turns                          | 2939 Turns         | C2            | Variable Rep-Rate. Controls the warm linac low-level RF gate width and rep-rate. Always occurs on the same cycle as the Warm-HPRF event.   |
| 19                  | 30            | Cold-HPRF     | 1             | Oct-09 Turns                            | 2939 Turns         | C3            | Variable Rep-Rate. Controls the super-conducting linac high-power RF gate width and rep-rate. Can be independent, or made coincident with the Source-On event or the Warm-HPRF event.  |
| 20                  | 31            | Cold-LLRF     | 1             | 270-2109 Turns                          | 2939 Turns         | C4            | Variable Rep-Rate. Controls the super-conducting linac low-level RF gate width and rep-rate. Always occurs on the same cycle as the Cold-HPRF event.   |

|    |    |           |    |                    |              |    |   |
|----|----|-----------|----|--------------------|--------------|----|---|
| 21 | 50 | RF-Sample | 29 | 1329-4249<br>Turns | 608<br>Turns | C5 | Single-Shot.<br>Triggers RF diagnostic gate. Always occurs on the same cycle as a Warm-LLRF event. Gate timing can be set to occur anywhere from 1000 turns before the start of the Warm-LLRF gate to 1900 turns after the start of the Warm-LLRF gate. |
| 24 | 10 | Spare 0   | 1  | 4 Turns            | 5044-width   | D2 | Spare RF event -used only for testing and conditioning. Position is fixed and only rep-rate is controlled.  |
| 25 | 11 | Spare 1   | 1  | 5 Turns            | 5043-width   | D3 | Spare RF event -used only for testing and conditioning.   |
| 26 | 12 | Spare 2   | 1  | 6 Turns            | 5042-width   | D4 | Spare RF event -used only for testing and conditioning.   |

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|---------------------------|---------------------|-------------------|------------------|--------------------------|---------------------|------|---|
| Soft                      | 251                 | Compute-Rep-Rate  |                  |                          |                     |      | Signals that a new rep-rate pattern computation has begun in the timing master IOC. |
| Soft                      | 252                 | New-Rep-Rate      |                  |                          |                     |      | Signals that new rep-rate patterns have been set in the timing master IOC.          |
| Soft                      | 253                 | MPS-Error-Reset   |                  |                          |                     |      | Reset error counters on all MPS chassis.  |
| Soft                      | 254                 | Util-Error-Reset  |                  |                          |                     |      | Reset error counters on all SNS Utility Modules.                                    |
| Soft                      | 255                 | super-cycle start |                  |                          |                     |      | Marks the first cycle of a super cycle  |