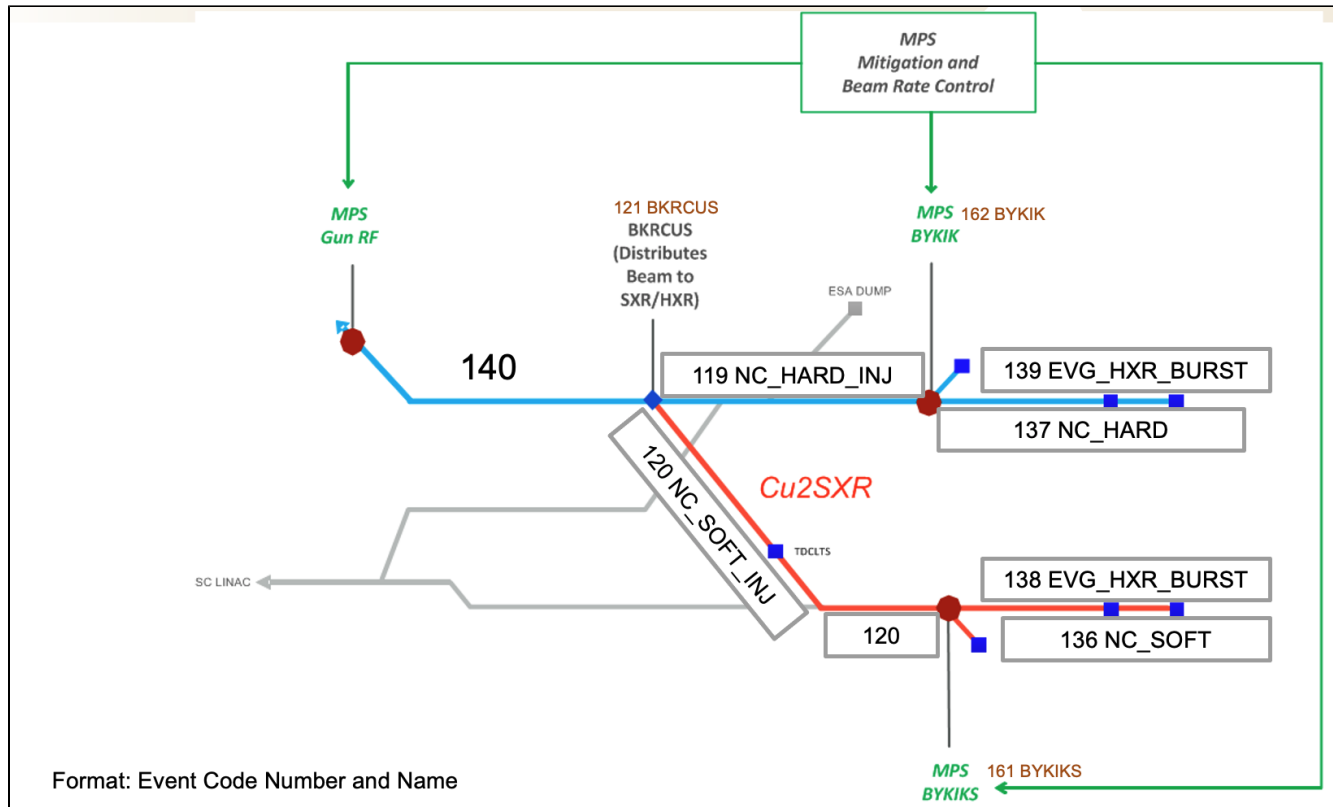# Event Codes for the Cu beam
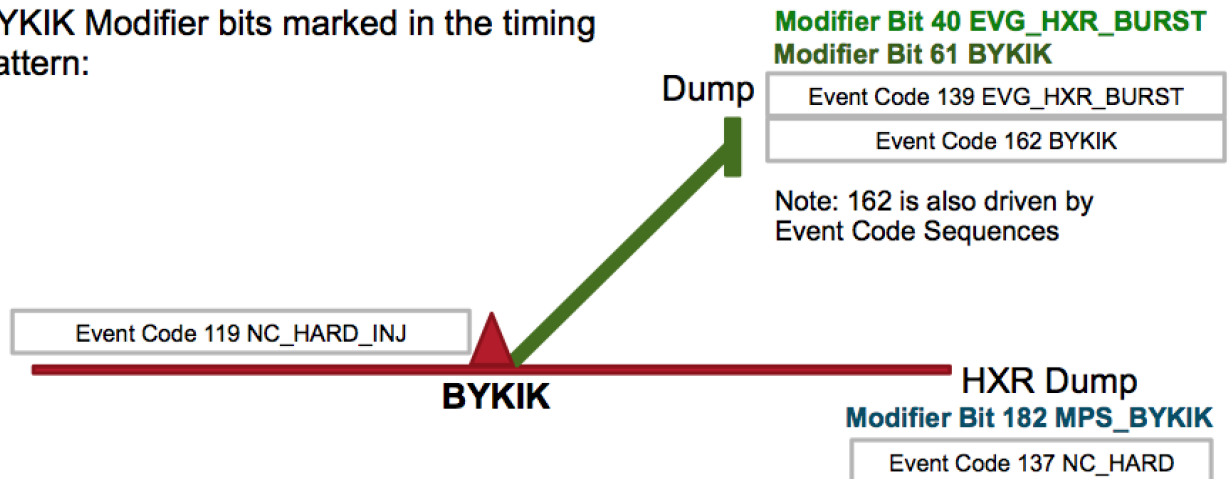
Main event codes for HXR/SXR running (with permission from Carolina Bianchini Mattison):

Detailed picture of event codes and modifier bits

BYKIK Modifier bits marked in the timing pattern:

Dump

Modifier Bit 40 EVG_HXR_BURST
Modifier Bit 61 BYKIK

| Event Code 139 EVG_HXR_BURST |
| Event Code 162 BYKIK |

Note: 162 is also driven by Event Code Sequences

| Event Code 119 NC_HARD_INJ |

BYKIK

HXR Dump
Modifier Bit 182 MPS_BYKIK

| Event Code 137 NC_HARD |

Modifier bits 182 come out on the pulses going past BYKIK.
Modifier bit 40 and 61 comes out in the timing pattern for pulses aborted to BYKIK.

Relative timing of the event codes

LCLS timing operates at 360 Hz; each 360 Hz interval is called a "time slot". The time slots iterate from 1 to 6 and then cycle back to 1 again. So, time slot 1 (or any particular time slot) occurs every 6 360Hz intervals or 60 Hz. In addition to that, a set of markers are generated to distinguish the consecutive sets of time slots. A 60 Hz marker is attached to every set of 6 time slots; a 30 Hz marker is attached to every other set of 6 time slots; a 10 Hz marker is attached to every 6th set of time slots, and so on down to 0.5 Hz. Thus, the sequence of time slots and markers looks like

60 Hz	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
30 Hz	x	x	x	x	x	x							x	x	x	x	x	x							x	x	x	x	x	x							x	x	x	x	x	x						
10 Hz	x	x	x	x	x	x																															x	x	x	x	x	x						
5 Hz	x	x	x	x	x	x																																										
1 Hz	x	x	x	x	x	x																																										
0.5 Hz	x	x	x	x	x	x																																										
Time Slot	1	2	3	4	5	6	1	2	3	4	5	6	1	2	3	4	5	6	1	2	3	4	5	6	1	2	3	4	5	6	1	2	3	4	5	6	1	2	3	4	5	6	1	2	3	4	5	6

I hope you get the idea...

A set of event codes maps to the occurrence of these time slots in the following manner.

	60Hz	30Hz	10Hz	5Hz	1Hz	0.5Hz
TS1	11	12	13	14	15	16
TS2	21	22	23	24	25	26
TS3	31	32	33	34	35	36

TS4	41	42	43	44	45	46
TS5	51	52	53	54	55	56
TS6	61	62	63	64	65	66

There are also event codes 10, 20, 30, 40, 50, 60. These are generated such that 10 = 11+41, 20=21+51, 30=31+61, 40=11+41, 50=21+51, 60=31+61; i. e. they are all 120 Hz and occur for two different timeslots each.

Shared Beam Timing

When the copper LINAC is setup to deliver beam to both soft and hard x-ray lines it does so by preferentially sending hard x-ray beam on time slot 4 and soft x-ray beam on time slot 1. LCLS only uses time slots 1 and 4 to deliver beam. To get more than 60 Hz beam to either line requires the other time slot (1 or 4) to be used. So, the shared delivery modes should look like so

60Hz	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
30Hz	x	x			x	x			x	x			x	x			x	x			x	x
10Hz	x	x											x	x								
5Hz	x	x																				
1Hz	x	x																				
0.5 Hz	x	x																				
Time Slot	1	4	1	4	1	4	1	4	1	4	1	4	1	4	1	4	1	4	1	4	1	4
60H /60S	S	H	S	H	S	H	S	H	S	H	S	H	S	H	S	H	S	H	S	H	S	H
90H /30S	S	H	H	H	S	H	H	H	S	H	H	H	S	H	H	H	S	H	H	H	S	H
110H /10S	S	H	H	H	H	H	H	H	H	H	H	H	S	H	H	H	H	H	H	H	H	H
115H /5S	S	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H

and so on. I hope you get the idea. The general rule is that the lower rate beam line will always be delivered on its time slot (1=SXR, 4=HXR) and its beam rate marker (0.5 .. 60Hz), and the other beam line will consume the remainder of the time slots 1 and 4.

Special Event codes

Event code	meaning
162	BYKIK - see above
163	kicker to A-line (parasitic running with Endstation A - has not been done recently) It has been observed that the presence of code 163 means that you can have beam even on event code 162! There is no reason for you to see this event code (it was on for some test w/o realizing the consequences for a beamtime in run 20) event code 137 correctly shows if beam is present.
164	HXR test burst - request burst via event sequencer being NOT the beam owner
150	HXR burst- request burst via event sequencer being the beam owner w/ correct setup in ACR