

March 30, 2015

## Science frame sample rates for PEM channels

LIGO-T1400768-v3  
Peter Fritschel

The purpose of this memo is to define the baseline sample rates for the PEM science frame channels. The following table lists the proposed science frame data rates for each type of PEM sensor. Note that accelerometer signals are stored at 4096 samples/sec, which is higher than in iLIGO, but 2x lower than the rate requested by R Schofield. With the large number of accelerometer axes (around 40 per site), storing them at 8192 Hz would significantly increase the total data rate. In addition: the DAQ decimation filters will be changed in the future to increase the preserved bandwidth to at least 90% of the Nyquist frequency (1850 Hz for accelerometers); vibrations at higher frequencies should be sensed by the microphones.

Sensor type	Frame sample rate (per second)	Comments
Radio frequency spectrum monitors	16384	Two types: <ul style="list-style-type: none"> <li>narrowband receivers at modulation frequencies</li> <li>broadband RF antenna</li> </ul>
Microphones	16384	Same rate as in iLIGO
Magnetometers		(X,Y,Z) quadrature sum is useful but redundant: store at lower rate
Individual axes	8192	
Quad. sum channels	4096	
Accelerometers		Follows R Schofield's study and recommendation found in LHO log <a href="#">16258</a> .
Individual axes	7 ch @ 16384 All others @ 2048	
Seismometers	256	Incl. quad. sum
Tiltmeters	256	Same as in iLIGO
Infrasound microphones	256	New in aLIGO
Mains monitors	1024	Incl. quad. Sum; increased to see harmonic content
Temperature sensors	256	

The following table shows the resulting data rates, given the number of PEM sensors deployed at LHO and LLO at the end of 2014. This is not necessarily the final configuration, but should be close.

		LHO		LLO	
Per channel sample rate (Hz)		No. chans	data rate (kB/s)	No. chans	data rate (kB/s)
<b>RADIO</b>					
Broadband	16384	4	262.1	0	0.0
Narrowband	16384	4	262.1	4	262.1
<b>MICROPHONES</b>					
End stations (both)	16384	6	393.2	4	262.1
Corner station	16384	9	589.8	7	458.8
<b>MAGNETOMETERS</b>					
End stations (both)					
single axis	8192	18	589.8	12	393.2
quad sum	4096	6	98.3	4	65.5
Corner station					
single axis	8192	15	491.5	9	294.9
quad sum	4096	5	81.9	3	49.2
<b>ACCELEROMETERS</b>					
End stations (both)					
chambers/fast	16384	2	131.1	2	131.1
others	2048	5	41.0	4	32.8
Corner station					
fast	16384	5	327.7	5	327.7
others	2048	31	254.0	27	221.2
<b>SEISMOMETERS</b>	256	12	12.3	12	12.3
<b>TILTMETERS</b>	256	9	9.2	9	9.2
<b>INFRASOUND MIC</b>	256	3	3.1	3	3.1
<b>MAINS MONITORS</b>	1024	12	49.2	12	49.2
<b>TEMPERATURE Sensor</b>	256	4	4.1	4	4.1
<b>TOTALS (MB/sec)</b>			<b>3.60</b>		<b>2.58</b>

## Fast Accelerometer Channels

Robert Schofield has identified the following accelerometer channels for sampling at 16384 Hz: 5 in the corner station and 1 at each end station. See LHO log entry [16258](#) for details.

*LHO:*

H1:PEM-CS\_ACC\_PSL\_PERISCOPE\_X  
H1:PEM-CS\_ACC\_BEAMTUBE\_MCTUBE\_Y  
H1:PEM-CS\_ACC\_BSC1\_ITMY\_Y  
H1:PEM-CS\_ACC\_BSC3\_ITMX\_X  
H1:PEM-EY\_ACC\_BSC10\_ETMY\_X  
H1:PEM-EX\_ACC\_BSC9\_ETMX\_Y  
H1:PEM-CS\_ACC\_HAM6\_OMC\_Z

*LLO:*

L1:PEM-CS\_ACC\_PSL\_PERISCOPE\_X  
L1:PEM-CS\_ACC\_HAM6\_OMC\_Z  
L1:PEM-EY\_ACC\_BSC5\_ETMY\_X  
L1:PEM-EX\_ACC\_BSC4\_ETMX\_Y  
L1:PEM-CS\_ACC\_BSC3\_ITMX\_X  
L1:PEM-CS\_ACC\_BSC1\_ITMY\_Y  
L1:PEM-CS\_ACC\_HAM2\_PRM\_Z