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| **Science frame sample rates for PEM channels** |
|  |
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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.

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| --- | --- | --- |
| **Sensor type** | **Frame sample rate (per second)** | **Comments** |
| Radio frequency spectrum monitors | 16384 | Two types: * narrowband receivers at modulation frequencies
* broadband RF antenna
 |
| 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 [16258](https://alog.ligo-wa.caltech.edu/aLOG/index.php?callRep=16258). |
| 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)** |
|  |   |   |  |   |
| **RADIO** |  |   |   |  |   |
| Broadband | 16384 | 4 | 262.1 | 0 | 0.0 |
| Narrowband | 16384 | 4 | 262.1 | 4 | 262.1 |
|  |  |   |   |  |   |
| **MICROPHONES** |  |   |   |  |   |
| End stations (both) | 16384 | 6 | 393.2 | 4 | 262.1 |
| Corner station | 16384 | 9 | 589.8 | 7 | 458.8 |
|  |  |   |   |  |   |
| **MAGNETOMETERS** |  |   |   |  |   |
| 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 |
|  |  |   |   |  |   |
| **ACCELEROMETERS** |  |   |   |  |   |
| 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 |
|  |  |   |   |  |   |
| **SEISMOMETERS** | 256 | 12 | 12.3 | 12 | 12.3 |
|  |  |   |   |  |   |
| **TILTMETERS** | 256 | 9 | 9.2 | 9 | 9.2 |
|  |  |   |   |  |   |
| **INFRASOUND MIC** | 256 | 3 | 3.1 | 3 | 3.1 |
|  |  |   |   |  |   |
| **MAINS MONITORS** | 1024 | 12 | 49.2 | 12 | 49.2 |
|  |  |   |   |  |   |
| **TEMPERATURE Sensor** | 256 | 4 | 4.1 | 4 | 4.1 |
|  |  |  |  |  |  |
| **TOTALS (MB/sec)** |   | **3.60** |   | **2.58** |

### 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](https://alog.ligo-wa.caltech.edu/aLOG/index.php?callRep=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**