Observing Bit Mode

There are 3 available bit modes available while observing with the station. 4, 8 and 16-bit, each of which describe the size of the signed word of each beamlet sample. 8-bit is the standard mode used for observations with I-LOFAR.

Adjusting the bit mode of the station varies the number of beamlets (pointings, frequencies) that can be formed at a given time, allowing for a trade off between digitisation accuracy and observing bandwidth.

Bitmode	Beamlets	Bandwidth (MHz)
16	244	47.65625
8	488	95.3125
4	976	190.625

The bitmode can be set using the `rspctl` command and the `--bitmode` flag, as demonstrated below.

```
user1@lcu$ rspctl --bitmode=16
user1@lcu$ rspctl --bitmode=8
user1@lcu$ rspctl --bitmode=4
```

4-bit Mode

4-bit mode is rarely used as unlike 8-bit mode, during the reduction operation from 8-bit to 4-bit data is not fully reduced to fit in the -8,7 range, resulting in samples being clipped. This can be compensated for by increasing the RCU attenuation, but requires analysis on a source-by-source basis due to the highly variable sky temperature at low frequencies. Data produced in this mode needs to be extracted in a special way, as each sample takes up the upper or lower half of a single byte.

When used correctly, it can allow for an extremely large sky coverage, or observations across multiple observing modes, at the cost of some sensitivity.

8-bit Mode

8-bit mode is the standard for all HBA and most LBA observations at I-LOFAR, offering up a 95MHz bandwidth for observers to cover an entire observing mode with the 200MHz clock (excluding parts of the Nyquist zones at multiples of 100MHz or 80MHz, depending on your clock mode).

16-bit Mode

16-bit mode is sometimes used for LBA observations to slightly increase the sensitivity at lower frequencies. This is often a useful trade-off due to the significant amount of RFI present below 30MHz from ionospheric reflections and local sources (AM radio, FM radio about 80MHz, etc, making sizeable fractions of the bandwidth unusable).

Revision #4
Created 3 July 2020 19:45:13 by David
Updated 12 July 2021 19:21:28 by David