

# Frequency-switched Observations

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Frequency-switched observations for the heterodyne instruments at the CSO was originally implemented by fast-switching the second LO frequency in the 1–2 GHz IF pass using the FPGA-controlled hardware. It is not possible to frequency-switch in the same way with the current spectrometers (AOS5, FFTS1, and FFTS2), since they are designed for the 4–8 GHz IF and have their own IF processor.

A newly implemented FSWITCH command allows frequency-switched observations by “slowly”-switching the first LO frequency. The basic command syntax is as follows:

```
FSWITCH <Separation(MHz)> [<Cycles>]
```

For example, to repeat 3 second integration each of  $\pm 10$  MHz offset pair 5 times, issue the following UIP commands:

```
UIP> uip\spectrometer 3  
UIP> uip\fswitch 10 5
```

Please note that the shortest possible integration time for the AOS5 and FFTS1 is 0.5 seconds. However, it has been reported that *short integration time (1–2 seconds)* causes the FFTS1 to crash. Three (3) second and longer integration seems to work without problems.

Scans taken using the FSWITCH command are saved as regular (position-switched) scans in a CLASS data file. In order to be able to “fold” them, a header section used by the FOLD command needs to be added by the MODIFY SWITCH\_MODE command. Set the SWITCH\_MODE to FREQUENCY and specify the offset frequency in MHz, integration time in seconds, and weight of two phases:

```
LAS\MODIFY SWITCH_MODE FREQUENCY 2 <Offset_1(MHz)> <Time_1(s)> 1 <Offset_2(MHz)> <Time_2(s)>
```

For example, for the scan taken using the above UIP commands ( $\pm 10$  MHz offset and  $5 \times 3$  second integration per phase), use the following CLASS commands:

```
LAS> las\modify switch_mode frequency 2 10 15 1 -10 15 -1  
LAS> las\fold
```

Baselines may need to be taken out *before or after* folding scans.