

CASIMIR Fast Fourier Transform Spectrometer (FFTS2)

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Originally developed for the CASIMIR/SOFIA mission, a new FFT spectrometer (called FFTS2 or CASIMIR FFTS) is now available for experimental use with the CSO facility wideband heterodyne receivers. Its specifications are summarized below:

Signal Processing	Non-windowed FFT
Total Bandwidth	4×2000 MHz
Resolution	4×8192 channels
Channel Spacing	269 kHz (0.350 km s^{-1} at 230 GHz)
Channel Response	$\propto \text{sinc}^2$

The FFTS2 can have up to four IF processor modules and eight FFT modules. Currently it has two IF processor modules and four FFT modules installed. Each IF processor module can process 4 GHz-wide (4–8 GHz) IF signal. Each IQ-sampling FFT module covers 2200 MHz (band-limited to 2000 MHz) IF segment with 8192 channels. Nominal LO signal frequencies are 5 GHz and 7 GHz for the 4–6 GHz section and 6–8 GHz section of the IF, respectively.

Currently 4–8 GHz and 8–12 GHz segments of the 4–16 GHz IF of the wideband 230 GHz receiver (called Z-Rex or Frank Rice’s receiver) or full 4–8 GHz IF of the wideband 345 GHz receiver (called T-Rex or Barney) can be utilized with the FFTS2. For the Barney, the second 4–8 GHz (8–12 GHz) IF channel is active but without any real input signal.

In CLASS data files, four 2 GHz segments are identified as *TELESCOPEs* CSO FFTS 2B1, CSO FFTS 2B2, CSO FFTS 2B3, and CSO FFTS 2B4 (for the 4–6, 6–8, 12–10, and 10–8 GHz IF segments, respectively).

In FFTS2 spectra, there will be spikes at well-known channel positions. They should be avoided by carefully placing your target spectral lines. For example, the center channel of each 2 GHz segment is bad, so you should avoid centering your lines, especially narrow ones, at 5, 7, 9, or 11 GHz IF. Those channels are *not* marked as bad in CLASS data files.

The following UIP command

UIP> SPECTROMETER /FFTS2

will start the FFTS2 with four FFT modules aligned at the nominal IF center frequencies of 5, 7, 5 (11), and 7 (9) GHz (the 8–12 GHz segment of Frank Rice's receiver's IF is inverted), and the UIP command below

UIP> SPECTROMETER /FFTS2 0.2 -0.2 0 0

will realign four FFTS modules at 5.2, 6.8, 5 (11), and 7 (9) GHz, thus changing the IF coverage to 4.2–7.8 and 4–8 (8–12) GHz, with increased overlap between the first 4–6 and 6–8 GHz segments.