

## FFT spectrometer for (sub)mm radiometer applications

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### ABSTRACT

The FFT spectrometer is one of 5 types of spectrometers being considered for space based (sub)millimetre heterodyne systems. The advantages of the digital autocorrelation and FFT spectrometers compared to Chirp Transform, Acousto Optical and Filterbank spectrometers are; stability, compactness, high reliability and variability in bandwidth and resolution. FFT spectrometers based on the latest generation of FPGA devices now promise a cost effective alternative for low to medium bandwidth applications with high resolution requirements.



Omnisys has an FFT spectrometer design optimized for ground based applications. It follows the single Eurocard standard size and provides up to 2 GHz bandwidth and 1-4 inputs. With four inputs, the maximum processed bandwidth is 500 MHz.

Configurations with polyphase filtering, polarization processing and variable resolution over the processed band have also been tested. Results will be shown.

Omnisys FFT board provides 2 GHz processed bandwidth with a power budget of less than 20W. It seems possible to reduce this number to about 10-12 W in the short term for low power applications and to 5-7 W in a few years time.

A radiation tolerant design is in the pipeline. The main issue will be the power supply as providing a well conditioned 1.2 V rail with 8-10 A as well as 1.8, 2.5, 3.3 and 5 V will be a challenge with rad tolerant components.

For the SuperCAM imaging system, 16 boards will be used in two single height 19" crates to provide 64 spectrometers. It could be upgraded to provide 64 times 1 GHz by simply adding two crates. Test results will be shown in the conference.

In the picture to the right, we have 8 FFT boards providing up to 32 x 2048 channel spectrometers.

These can be housed in one single height 19" crate together with IF systems and embedded computers providing flexible interfaces to front-ends as well as flexible interfaces for switch synchronization, data readout and other forms of control. The default interface is 100 MBit/s Ethernet.

This is a breakthrough for future imaging applications as we can provide spectrometers for 5 kEuro each (in reasonable volume).

