Correlators for (sub)mm radiometer applications

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ABSTRACT

Two (sub)mm space interferometers are currently in various stages of development, the JPL GeoStar and the Omnisys/SES (ESA) GeoMS instruments. GeoStar is focused on the 53 and 183 GHz bands while 53, 89, 118, 155, 183, 340 and 380 GHz are considered for the GeoMS instrument but with 53 and 183 GHz as the core frequency bands. Omnisys is currently under contract to study cross correlators for both instruments and the results will be presented in this conference.

The autocorrelation spectrometer is one of 5 types of spectrometers being considered for space based (sub)millimetre heterodyne systems. The advantages of the digital autocorrelation spectrometer 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. The Omnisys FFT spectrometers are presented in a separate poster.

Omnisys has designed and implemented several generations of autocorrelation chip sets and spectrometers. This range from the ODIN satellite spectrometers now in LEO to our current 8 GHz single chip spectrometer under development.

The ODIN chip set was a breakthrough at the time (1998). The power consumption was lowered by a factor of 50 compared to state of the art. Since then we have further improved the power consumption with a factor of 40, and we are now reaching 8 GHz of bandwidth for a single spectrometer chip.

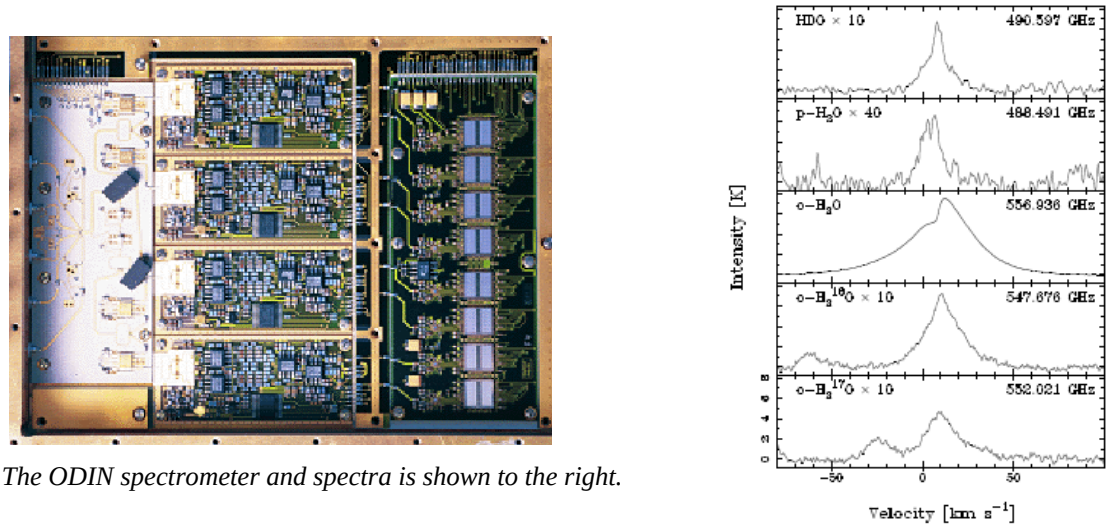

Fig 1 The ODIN spectrometer and spectra is shown to the right.

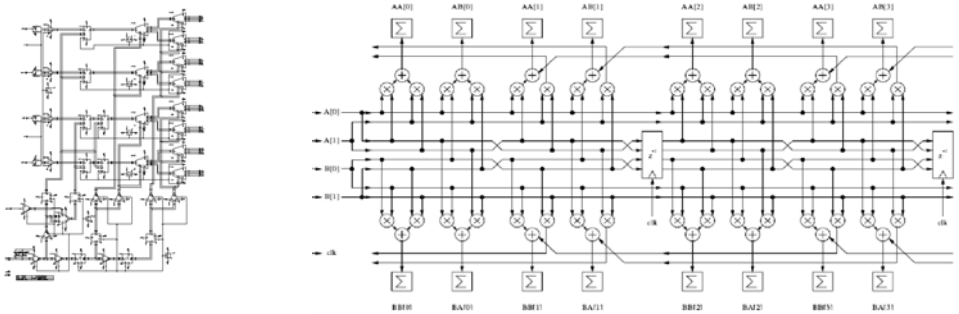

Fig 2. Digitiser and correlator schematics for the 8 GHz / 1024 channel single chip spectrometer.

Omnisys has now a tape out of a single chip spectrometer with 8 GHz bandwidth and 1024 channel resolution. The ADC is integrated on chip and can be configured for both real sampling as well as with complex sampling to facilitate an optimized IF downconverter architecture. This spectrometer can be configured for operation with 256, 512, 768 and 1024 channels. The maximum power consumption with 1024 channels at 8 GHz is estimated to be 2.8 W and with 256 channels, we will have a power consumption of about 1 W. Test results will be presented.