# Wideband FPGA Spectrometers and Correlators

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At the Center for Astronomy Signal Processing and Electronics Research, we have developed a modular and highly configurable approach to building wideband high-resolution spectrometers and correlators. These instruments are rapidly designed from a library of configurable Simulink blocks and compiled for FPGA. The CASPER library provides great flexibility for designing small, high-bandwidth instruments as well as more scalable instruments that can be easily updated as the number of antennas in an array grows. We present recent spectrometer and correlator architectures developed by CASPER using this reconfigurable framework.

We have developed small correlators providing 3GHz of bandwidth for 3 antennas, and a 128 million channel, 200MHz bandwidth FPGA-based spectrometer. We also present the design of a 400MHz spectrometer on intended for pulsar studies using coherent dedispersion, and provide preliminary results from the deployment of a prototype instrument at the Nancay Radio Telescope.

We present architectures using commercial 10 Gigabit Ethernet switches to solve the interconnect problem between FPGA boards and high bandwidth readout to a computer. This general purpose switching architecture removes the need for a custom interconnect for each instrument and is easily upgradeable as the system grows. For correlator development, this architecture solves the N^2 interconnect problem, enabling the rapid development of large-N correlators. We also present a general purpose astronomy signal processor that breaks up a large bandwidth into 256 channels and uses distributes them to a cluster of CPUs or GPUs.