41st SYMPOSIUM ON THE SEARCH FOR EXTRATERRESTRIAL INTELLIGENCE (SETI) – The Next Steps (A4)
SETI 1: SETI Science and Technology (1)

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AN ENHANCED PIGGYBACK MODE FOR SETI OBSERVATIONS

Abstract

On April 1998 the Seti-Italia program officially started with the installation of a 2,5 MHz bandwidth 4-million channels Serendip IV module at the 32 m VLBI dish antenna in Medicina (Bologna). Up to now observations have been carried out with the SERENDIP IV system connected in a piggyback mode (namely in parallel to the ongoing activities) to the 32 m VLBI dish at the Medicina station. The piggyback mode allow us to perform SETI observations 24h a day and 365d a year at an extremely low cost. The same backend can monitor the radiofrequency interference scenario in order to keep clean the protected radio astronomical bands. In order to be able to face observations in SETI and spectral-line programs, a new extremely fast and reconfigurable data acquisition processing system was designed. The new spectrometer has been developed for the ITASEL program using the hardware derived from the collaboration of Medicina and (recently) Noto radiotelescopes within the CASPER consortium. It was realized on top of the ROACH board characterized by two analog inputs (up to 500 MHz) and processes time-domain data in real time to obtain power spectra by mean of a Polyphase Filter Bank algorithm on a Virtex 5 Xilinx FPGA. A new prototype has already been developed. It currently digitizes two independent analog streams of 16MHz bandwidth each and performs PFB and FFT to get spectral data. The instrument can actually interface to the Field System in order to operate with the radiotelescope. We propose a new "enhanced piggyback mode" for SETI observations based on SERENDIP philosophy: it makes use of whatever observing plan (sequence of frequencies, sky coordinates, polarizations) is under way at its host observatory. In addition to the two key elements of SERENDIP (automated data acquisition system and off-line post-processing analisys to reject RFIs), we introduce a new set of features: 1) separated power spectrum long time-average (several seconds or minutes) within every nodding cycle phase (this will maximize the radiometric sensitivity of each spectrum channel, assuming to carefully compensate the Doppler WRT target barycenter; 2) a new dynamic adapted thresholds (to reject or not the averaged data) based on available time-average, spectral radiometric sensitivity and distance of the target. Moreover, during the VLBI sessions we intend to develop a specific correlation processing of the data coming from Medicina and Noto antennas, with the aim to reject any interference and strongly confirm possible candidate signals.