Oscilador Cuántico Forzados y Estados Coherentes

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Abstract

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KuPol Instrument Calibration

The calibration is achieved by measuring the isolation parameter, α, at different angles.

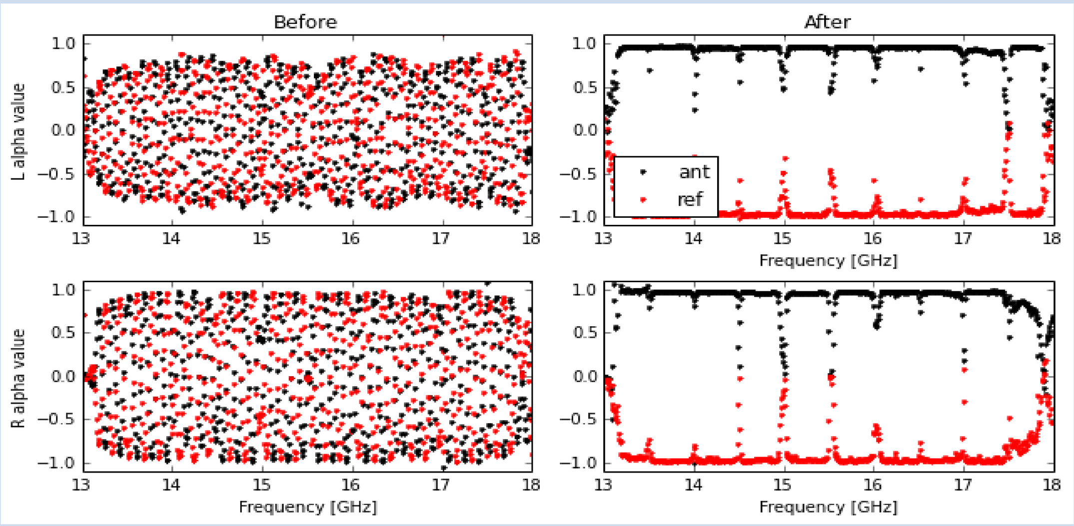

Figure 2. Plot comparing before/after α for 2016-01-18 Digital Model Calibration.

For the calibration procedure, we take spectra of quantities derived from voltages in each bin after the FFT with the noise diode on, and then with the noise diode off. We use this data to adjust for the varying gain and phase of the four RF chains, and hence calibrate the receiver output. The calibration procedure instrument is a three-step process, requiring three different firing of the noise diode, each with their own set of calculations.

1. Gain Correction. We calculate the gain correction for each RF channel. We assume that the noise diode injects a flat spectrum, and calculate the gain correction coefficients B_j for $j = 1 \ldots 4$.

$$B_j^2 = \frac{1}{|V_j|^2[on] - |V_j|^2[off]} \tag{1}$$

We can now apply the B_j to form the gain-corrected voltages:

$$V_{cj} = B_j V_j \tag{2}$$

2. Left/Right Phase Correction. We work out the phase difference between the two LCP chains, and two RCP chains. We use again the difference of the noise diode on/off powers to get at the phase difference we are after. Doing the algebra, we find

$$cos(\theta_L) = \frac{\Delta|L_A|^2 - \Delta|L_B|^2}{\Delta|L_A|^2 + \Delta|L_B|^2} \tag{3}$$

$$cos(\theta_R) = \frac{\Delta|R_A|^2 - \Delta|R_B|^2}{\Delta|R_A|^2 + \Delta|R_B|^2} \tag{4}$$

where A and B are the KuPol horns.

3. Polarization Angle Correction. We need to correct for the phase difference between the left channels and the right channels. We use the fact the noise diode, because it is injected with equal phase and amplitude into the left and right channels of horn A, is a pure Stokes Q signal, $I = Q = T_{NA}$, and $U = V = 0$. Taking the difference of the noise diode on and off spectra, we obtain the phase difference between the left and right channels:

$$\theta_p = \tan^{-1}\left(\frac{\Delta U_m}{\Delta Q_m}\right) \tag{5}$$

Acknowledgements

The OVRO 40m Telescope Fermi Blazar Monitoring Program is supported by NASA under awards NNX08AW31G and NNX11A043G, and by the NSF under awards AST-0808050 and AST-1109911.

The 40m Telescope

KuPol is contributing to estimate the location for the high energy emission on these AGNs and to study potential spectral fluctuations that may arise during the flaring events. The uncertainty on the degree of correlation between different energies reduces when the data span for long periods and is rich in sampling, hence the rationale for this program and we therefore advocate for similar observing modes at other frequencies.

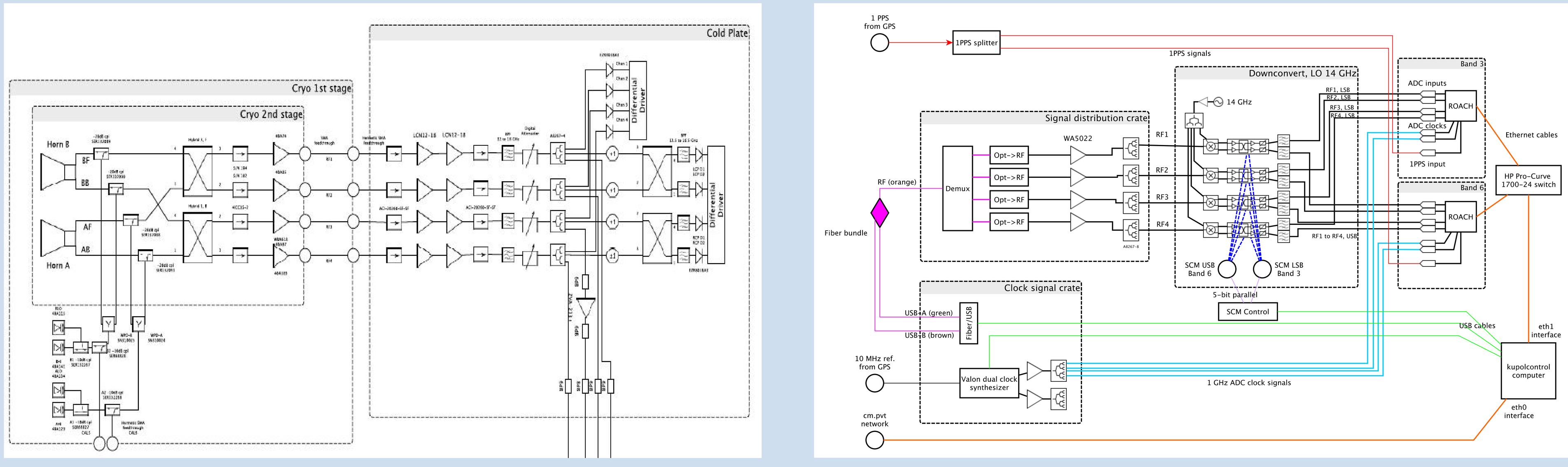

Figure 1. Left side, diagram analog instrument. Right side, diagram digital instrument.

The KuPol instrument is a dual-beam receiver for the 40m telescope at OVRO. It is, in fact, a hybrid of two separate instruments called the analog and the digital instrument. The **Analog Instrument** is a dual-polarization, beam-differencing radiometer that is designed to produce identical data to the previous Ku-band, instrument that KuPol replaces. It is composed by the Cryostat, the Cold Plate, and UBE. The **Digital Instrument** is a digital spectropolarimeter that processes the band between 13 to 18 GHz in 500 MHz wide chunks with 8 MHz resolution. In this instrument is performed the signal distribution, downconversion, digitization and processing, and data readout and archiving.

Blazar study with PSD estimation for unevenly sampled data

The Power Spectral Density (PSD) of a signal is the spectral decomposition of a signal into different frequency components, as a function of power at each frequency bin.

The PSD is usually estimated by means of an FFT, and it can be used to characterize the time variability of the blazar flux. The analysis requires regularity in the signal sampling, which is seldom the case. The PSD can also be estimated by a periodogram, which is the convolution between a window function and the signal. We are trying Blackman-Harris window function in order to minimize the spectral sidelobes introduced in the analysis.

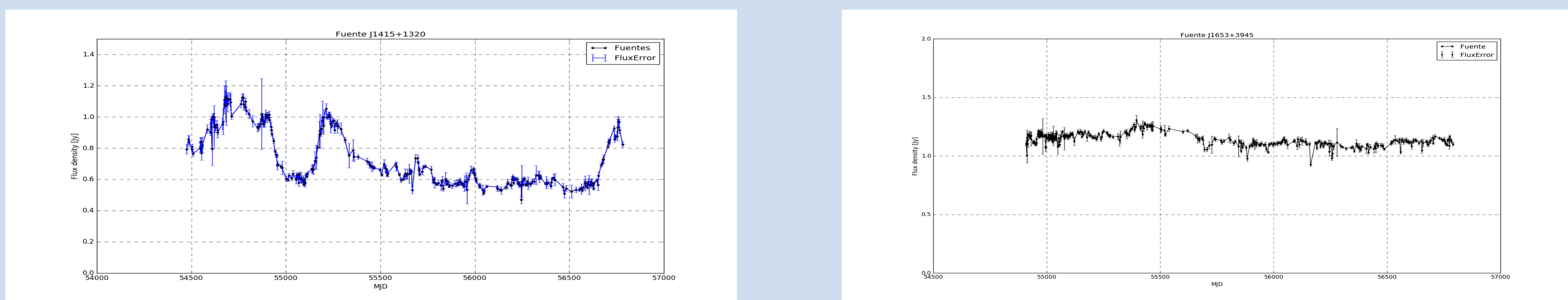

Figure 3. The first and second plot correspond the sources of J1415+1320 and J1653+3945, respectively, observed by the OVRO program.

The next step to determine the PSD, is to calculate the Fourier Transform of the window function and the curve separately and convolve, which is analogous to convolve the signal with the window function and apply Transform.

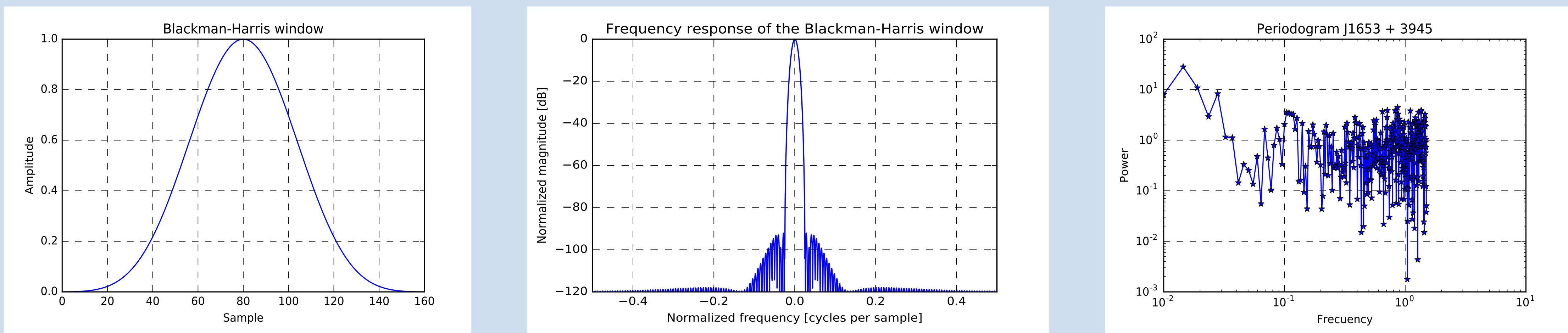

Figure 4. The first and second plot correspond the Blackman-Harris window function, without FFT and with FFT, respectively. The third plot is FFT of light curve J1653+3945, calculated exclusively by Lomb-Scargle periodogram.

Conclusion

With the PSD analysis and by looking for correlations in the variability, we hope to better understand the emission mechanisms at the hearts of Active Galactic Nuclei. The work is under development and we are in search of the best method to estimate the PSD. On the other hand we have presented and defined the KuPol calibration method. From this in the coming weeks we will obtain calibration results of the 40m receiver.