

Bicoherence Run 5041

Channel : V1:Pr_B1_ACp

First Glance

THEORY

The bicoherence is a normalized form of the bispectrum, and is defined as,

$$b(k,l) = \frac{\langle X_k X_l X_m^* \rangle}{\sqrt{|X_k X_l|^2 |X_m|^2}} \quad - (1)$$

where, X_k , X_l and X_m are the Fourier components of the signal at the frequencies k , l and $m = k + l$. It is very helpful to think of each of the above amplitudes as a phasor signal.

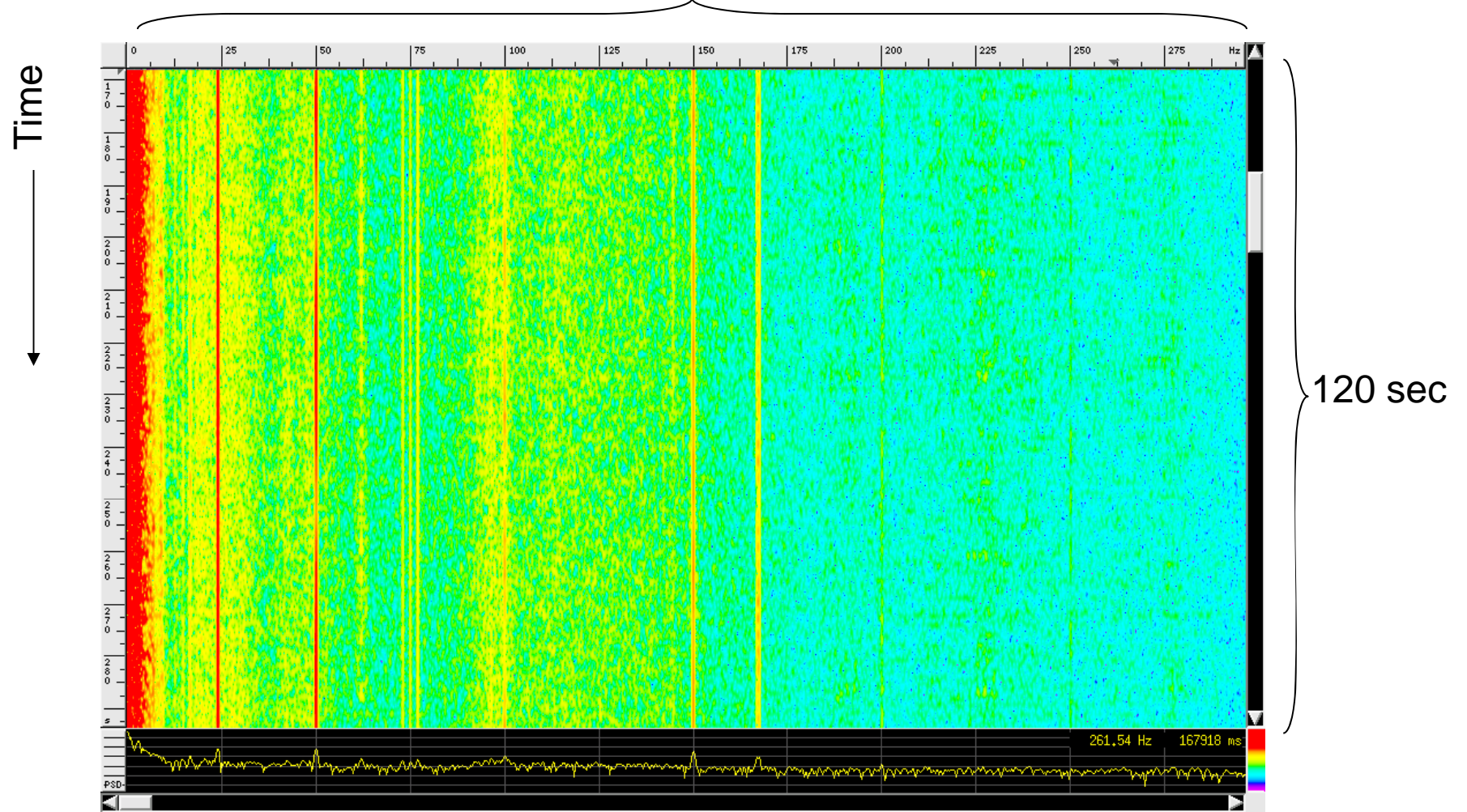
A simple explanation of what $b(k,l)$ computes is shown below. Consider a physical process, which puts out the value of the product of two signals at two different frequencies f_1, f_2 .

$$\text{Consider } x_1 = a_1 \cdot \sin(2 * \pi * f_1 * t + \phi_1), \quad x_2 = a_2 \cdot \sin(2 * \pi * f_2 * t + \phi_2).$$

The output signal will then be $Y(t) = x_1 + x_2 + k * x_1 * x_2 + noise$, where k is a coupling factor which in general could be frequency dependent. As we can expect, there will be two additional frequencies at $f_1 + f_2$, and $f_1 - f_2$.

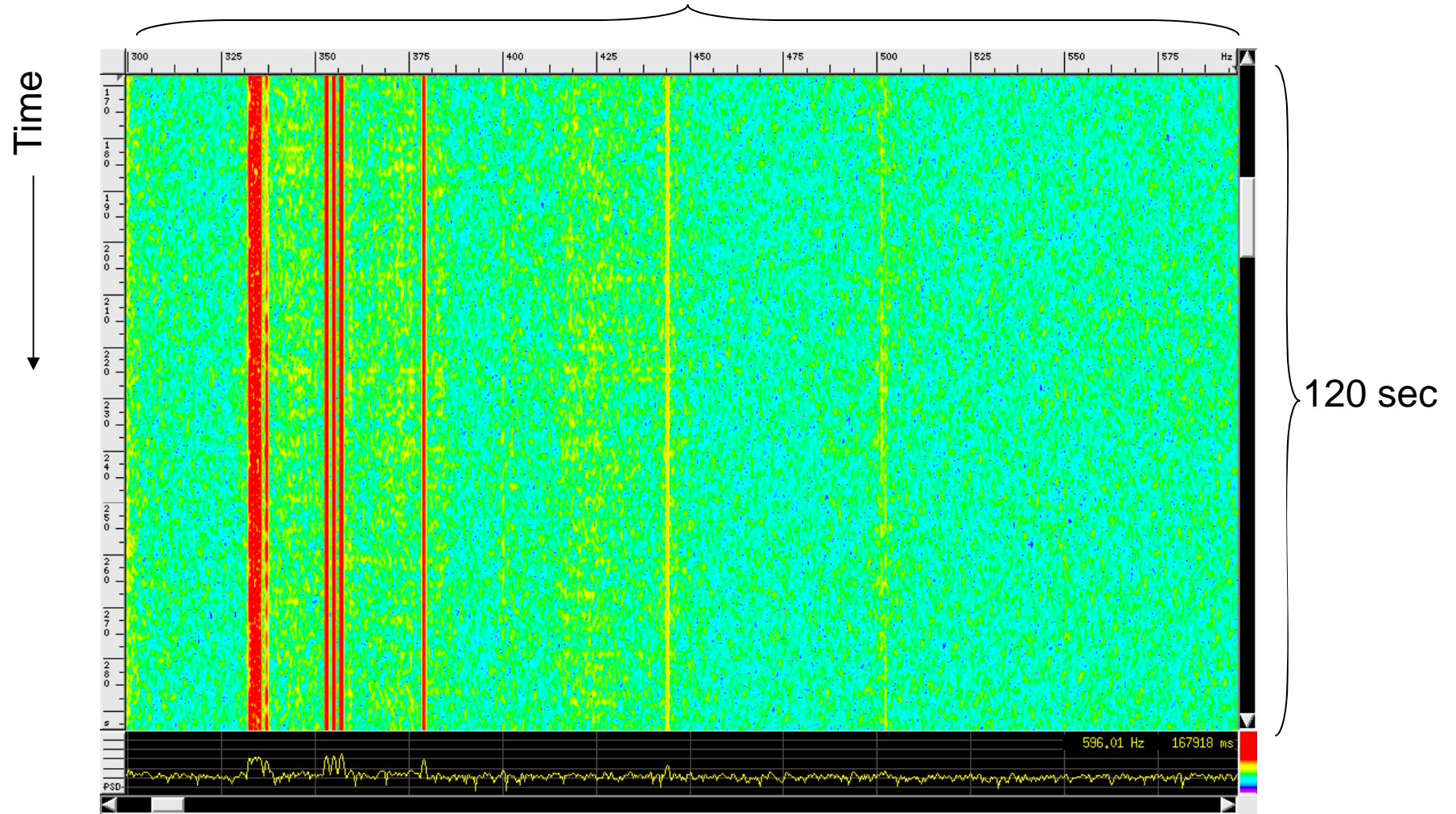
Time-Frequency Spectrum

0-300 Hz



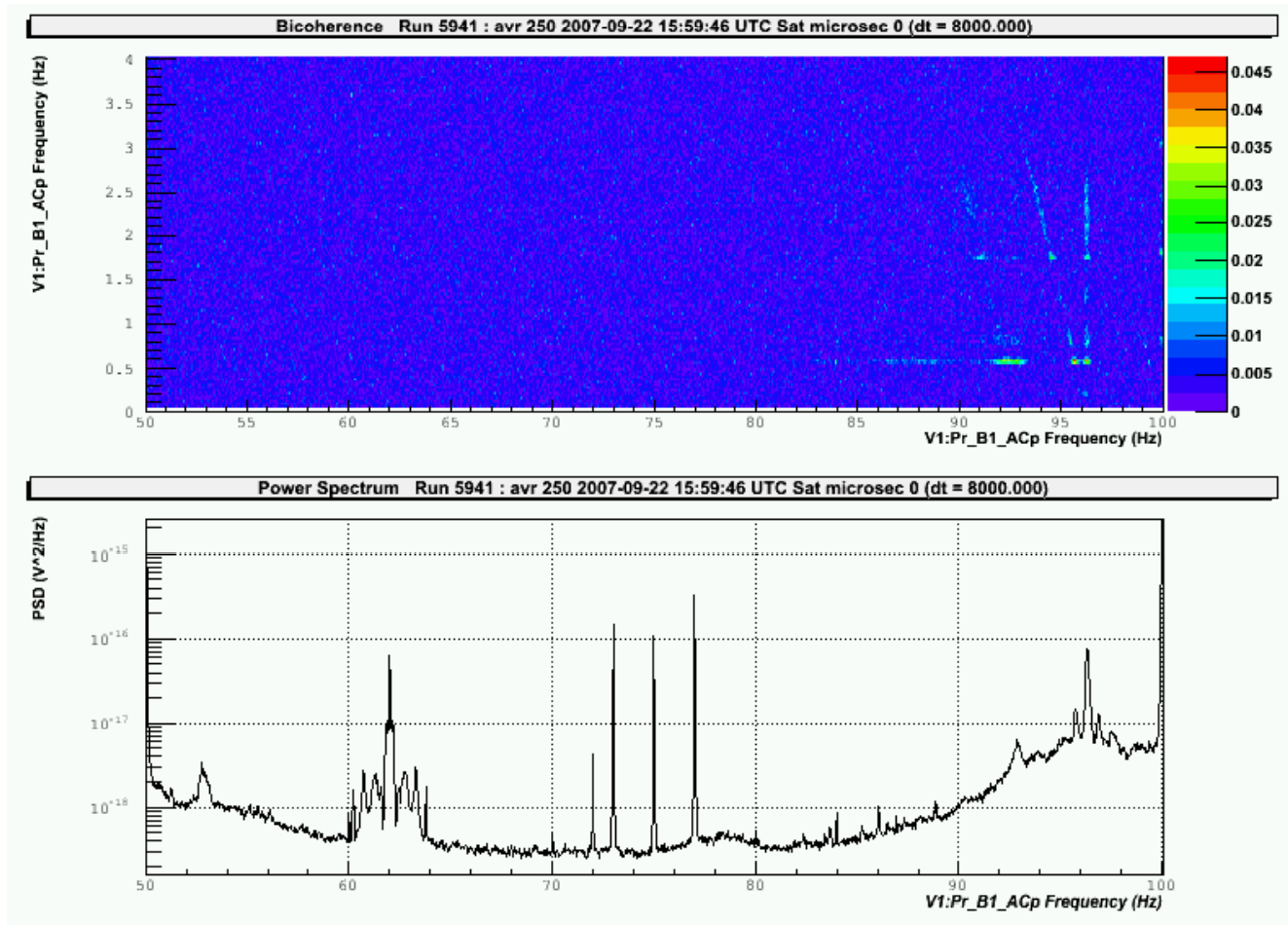
Time-Frequency Spectrum

300-600 Hz



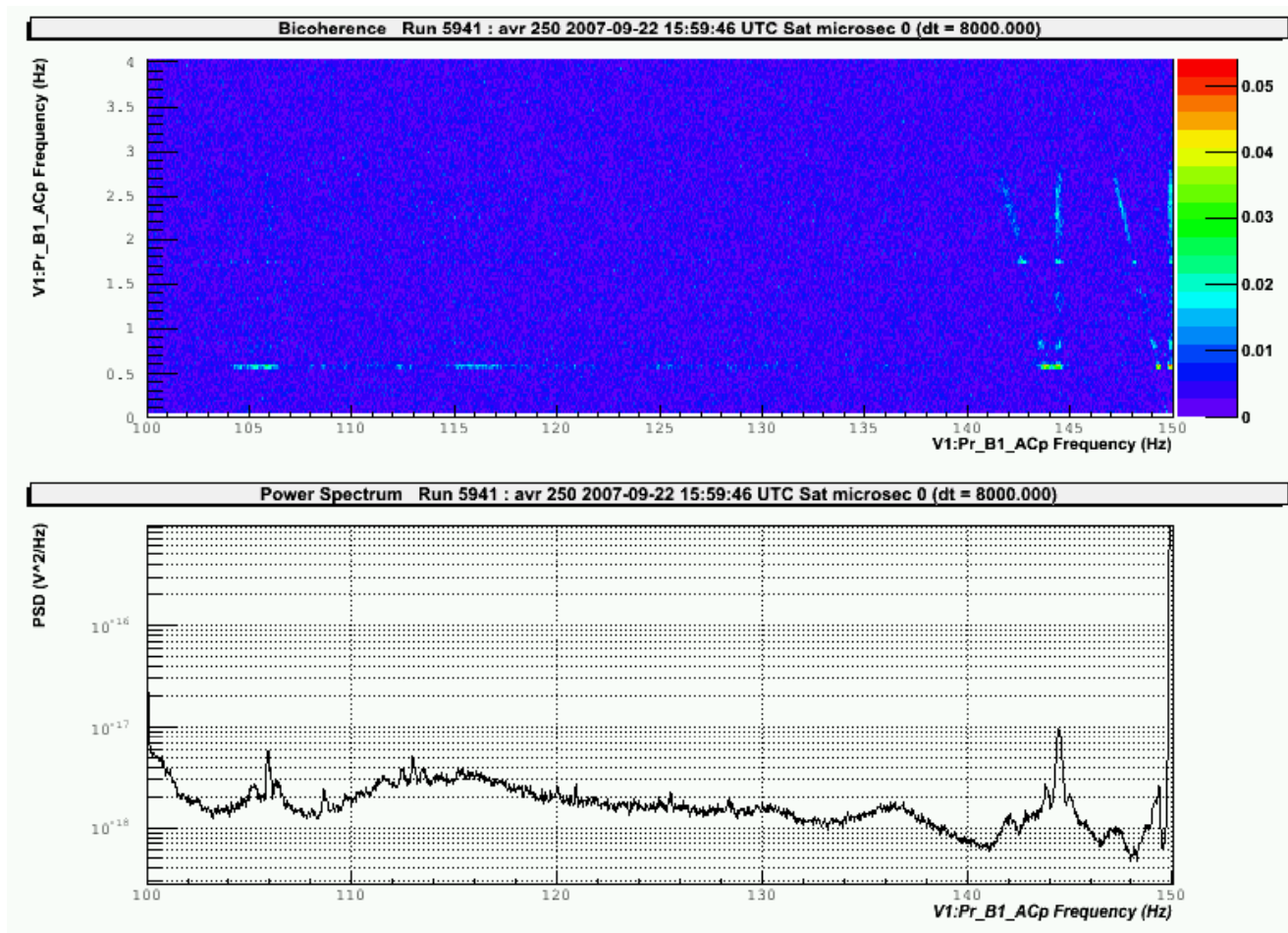
Bicoherence

50-100 Hz x 0-4 Hz



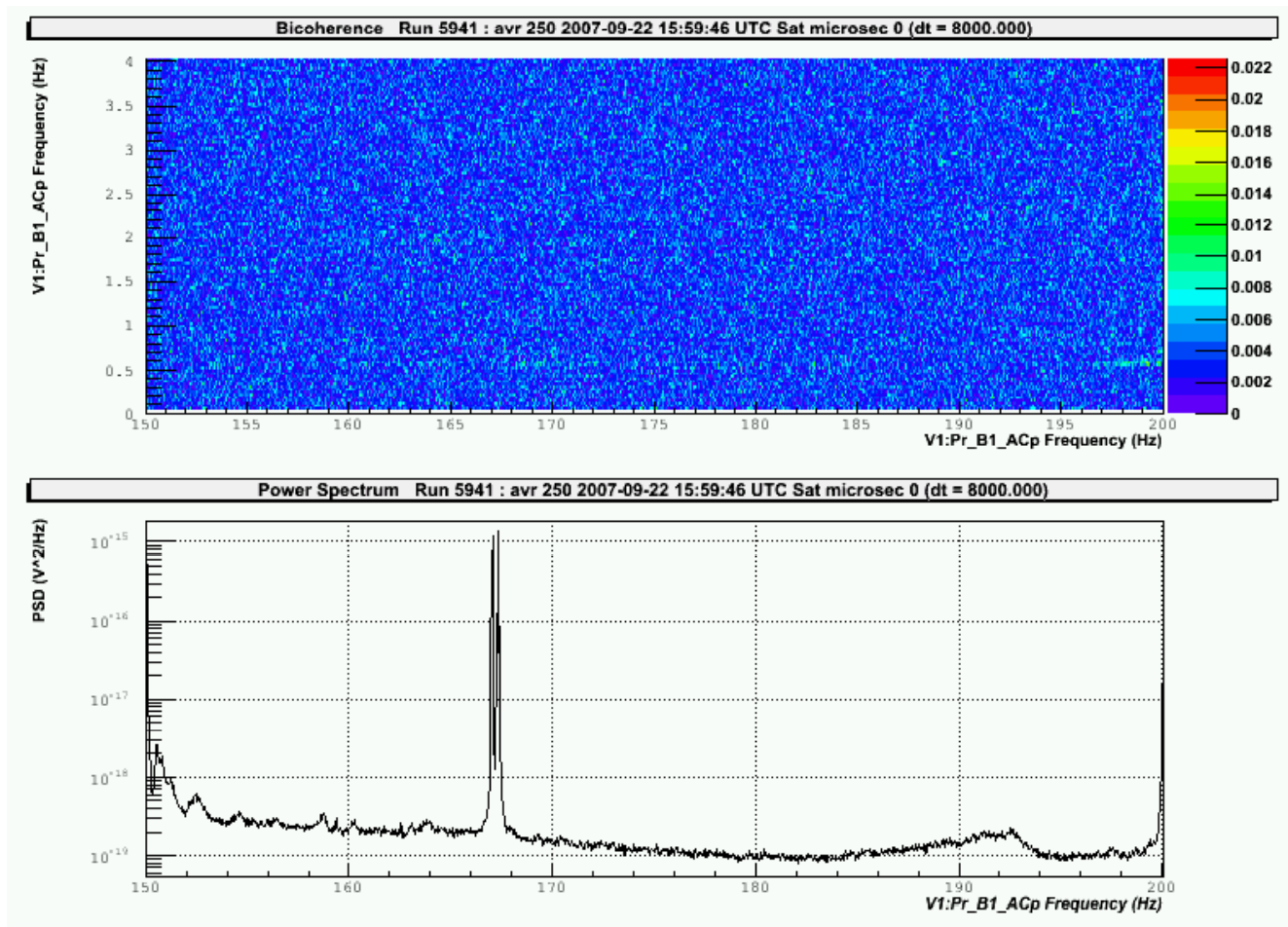
Bicoherence

100-150 Hz x 0-4 Hz



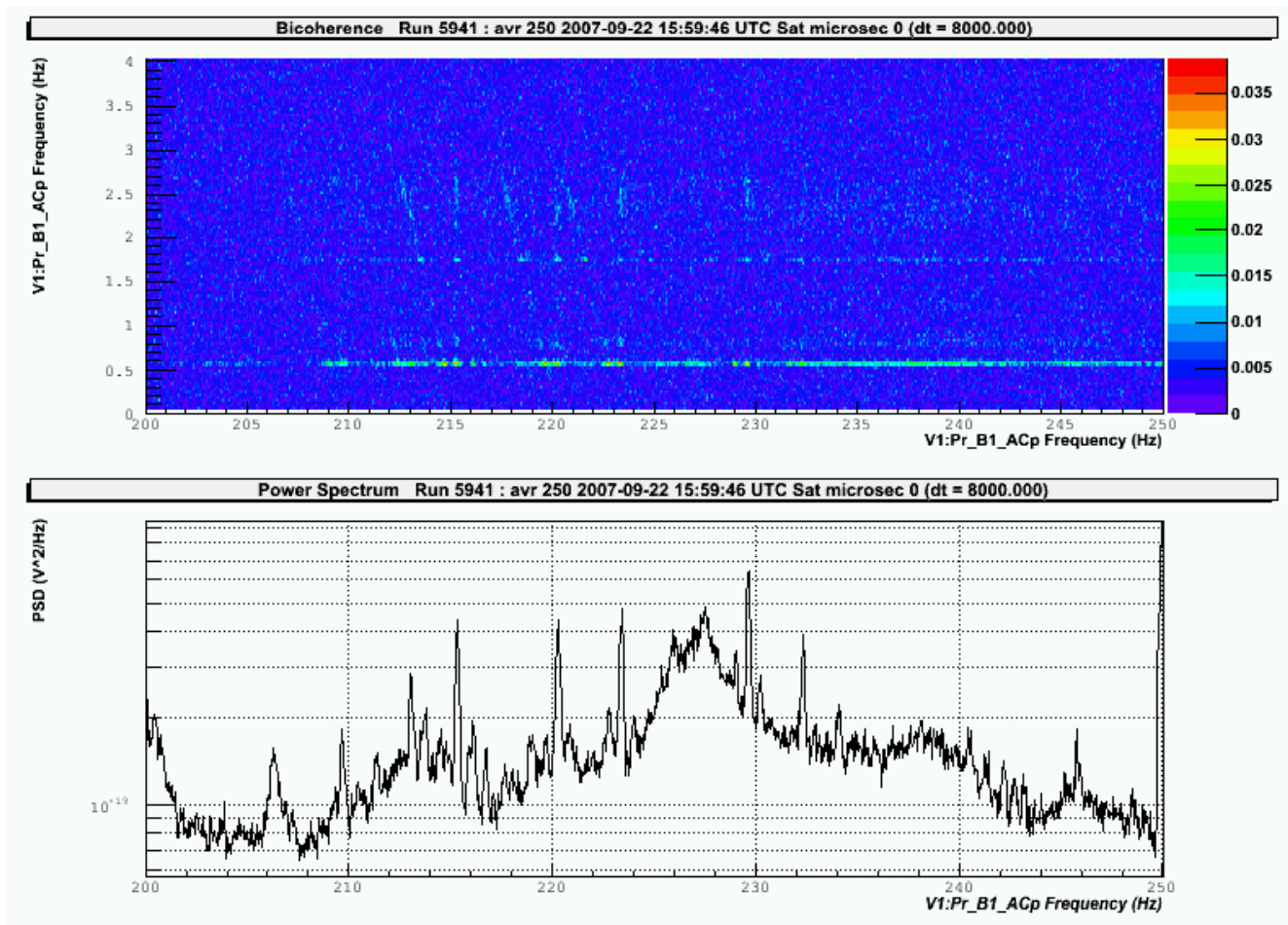
Bicoherence

150-200 Hz x 0-4 Hz



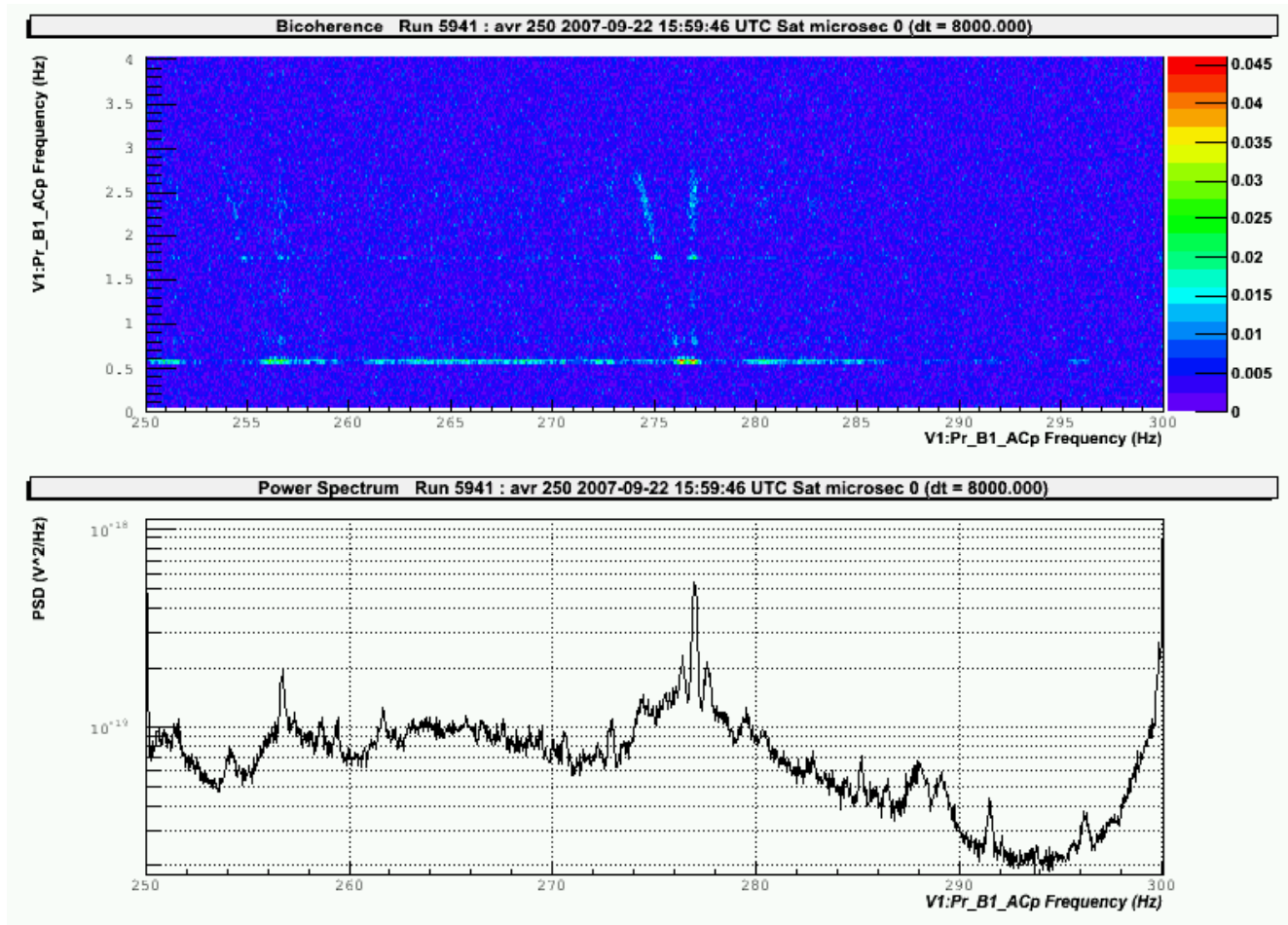
Bicoherence

200-250 Hz x 0-4 Hz



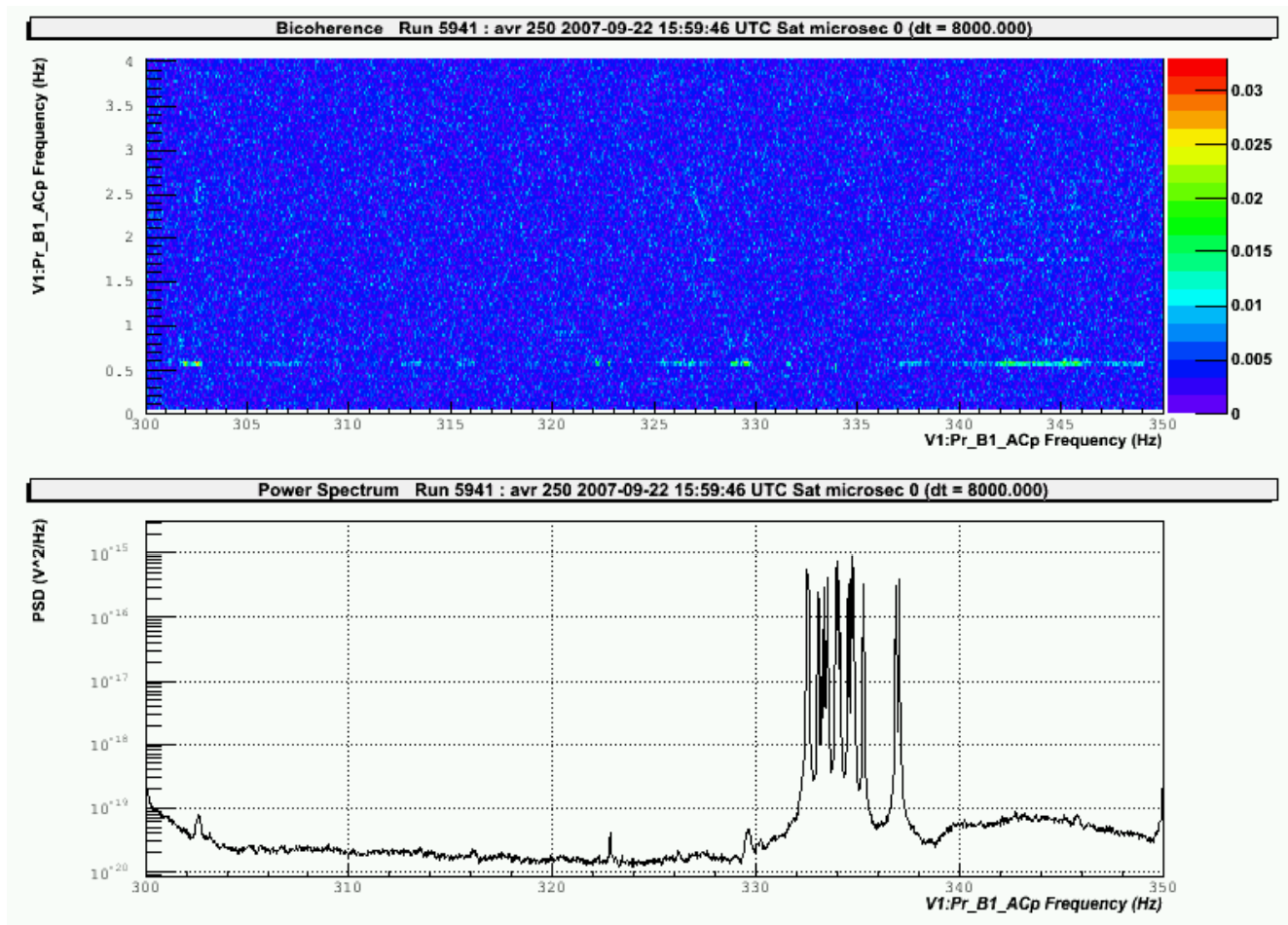
Bicoherence

250-300 Hz x 0-4 Hz



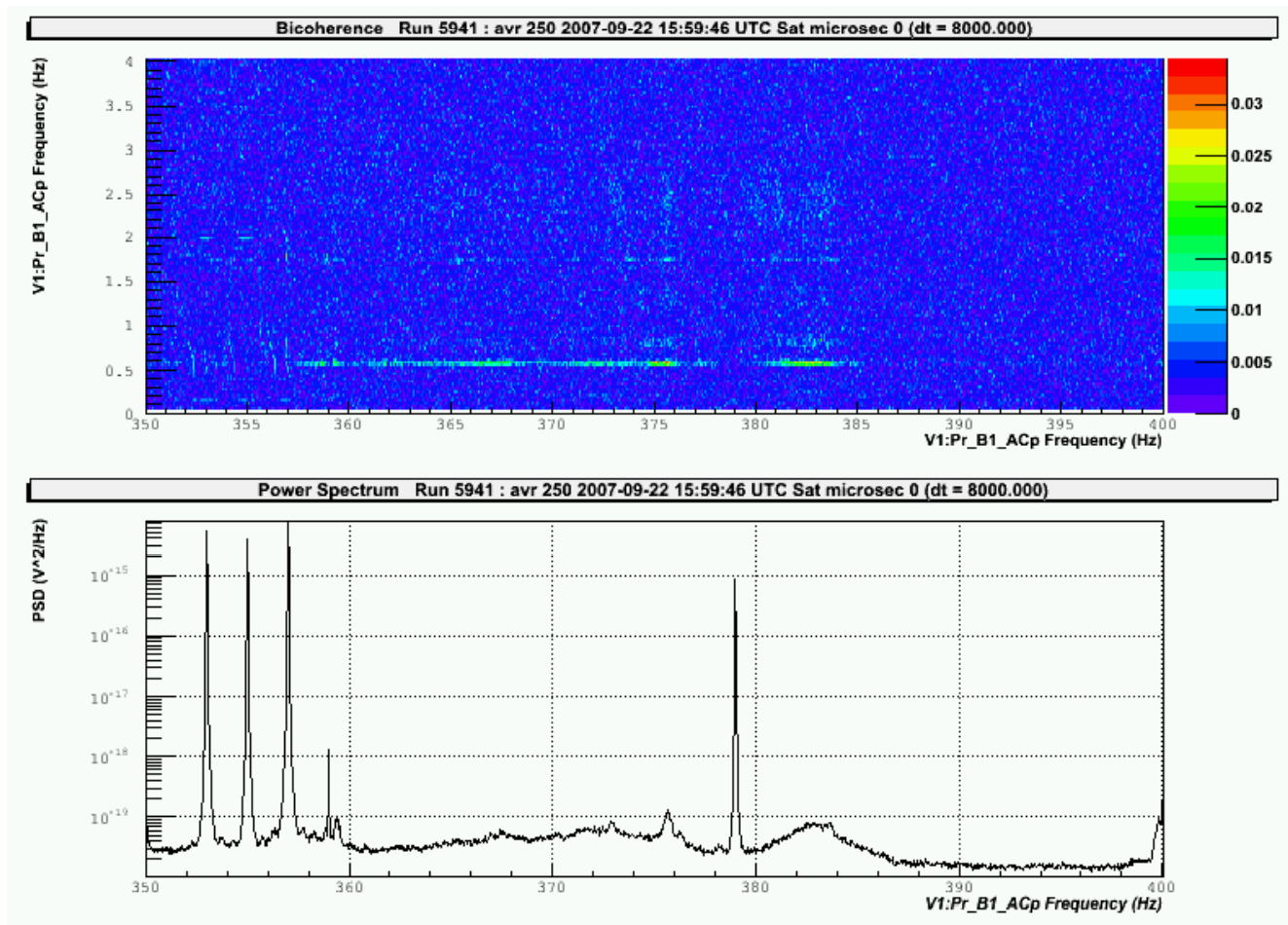
Bicoherence

300-350 Hz x 0-4 Hz



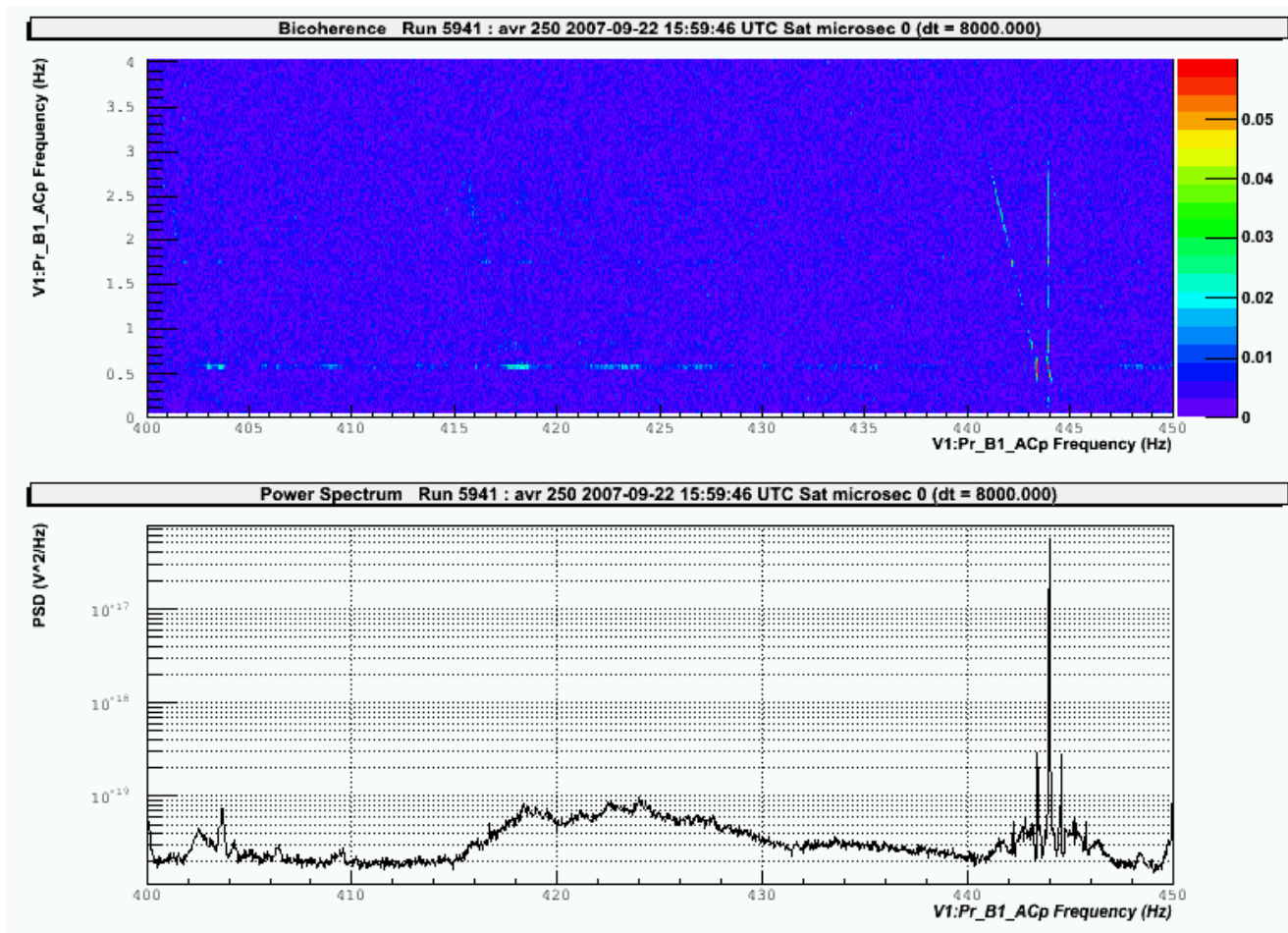
Bicoherence

350-400 Hz x 0-4 Hz



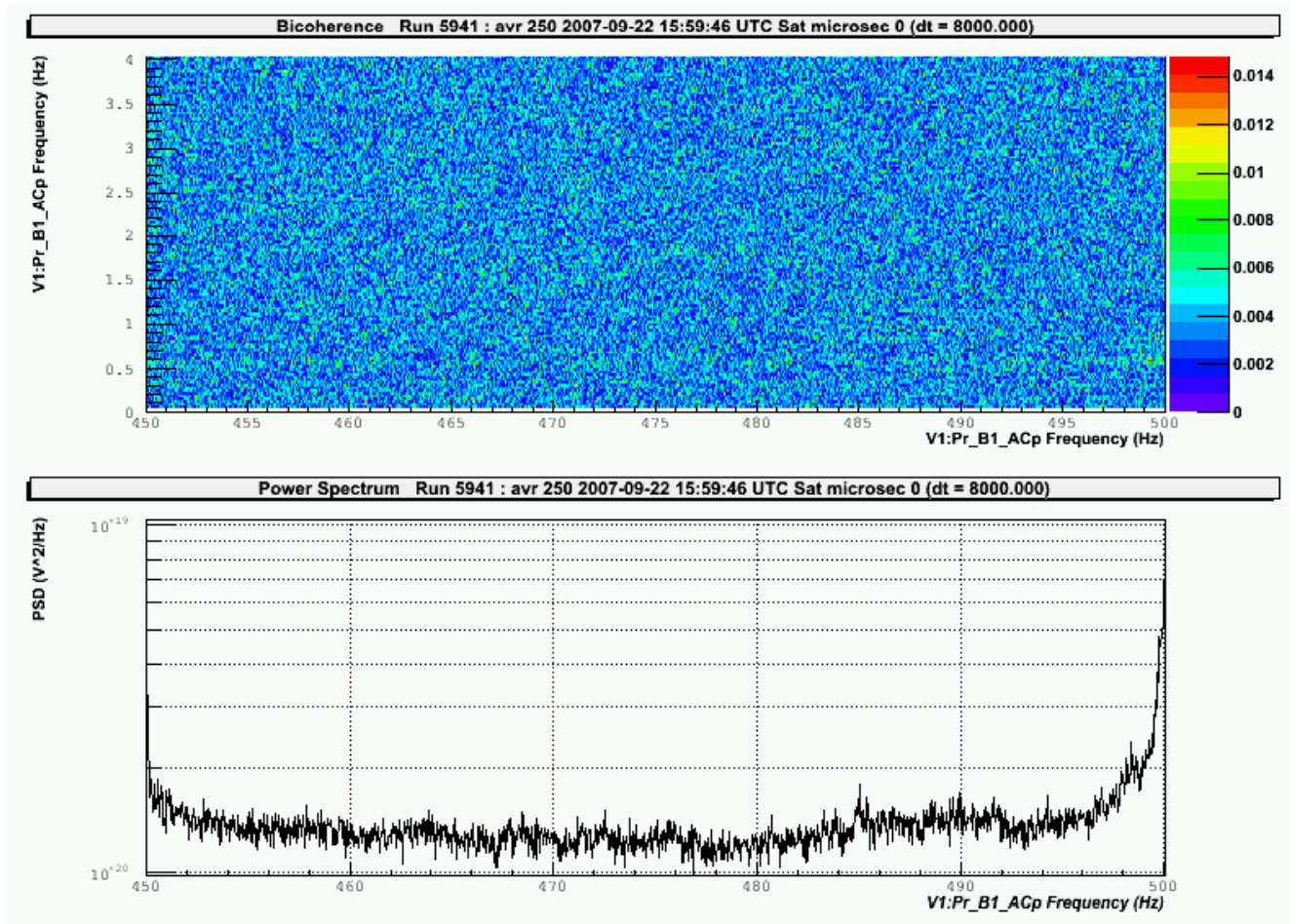
Bicoherence

400-450 Hz x 0-4 Hz



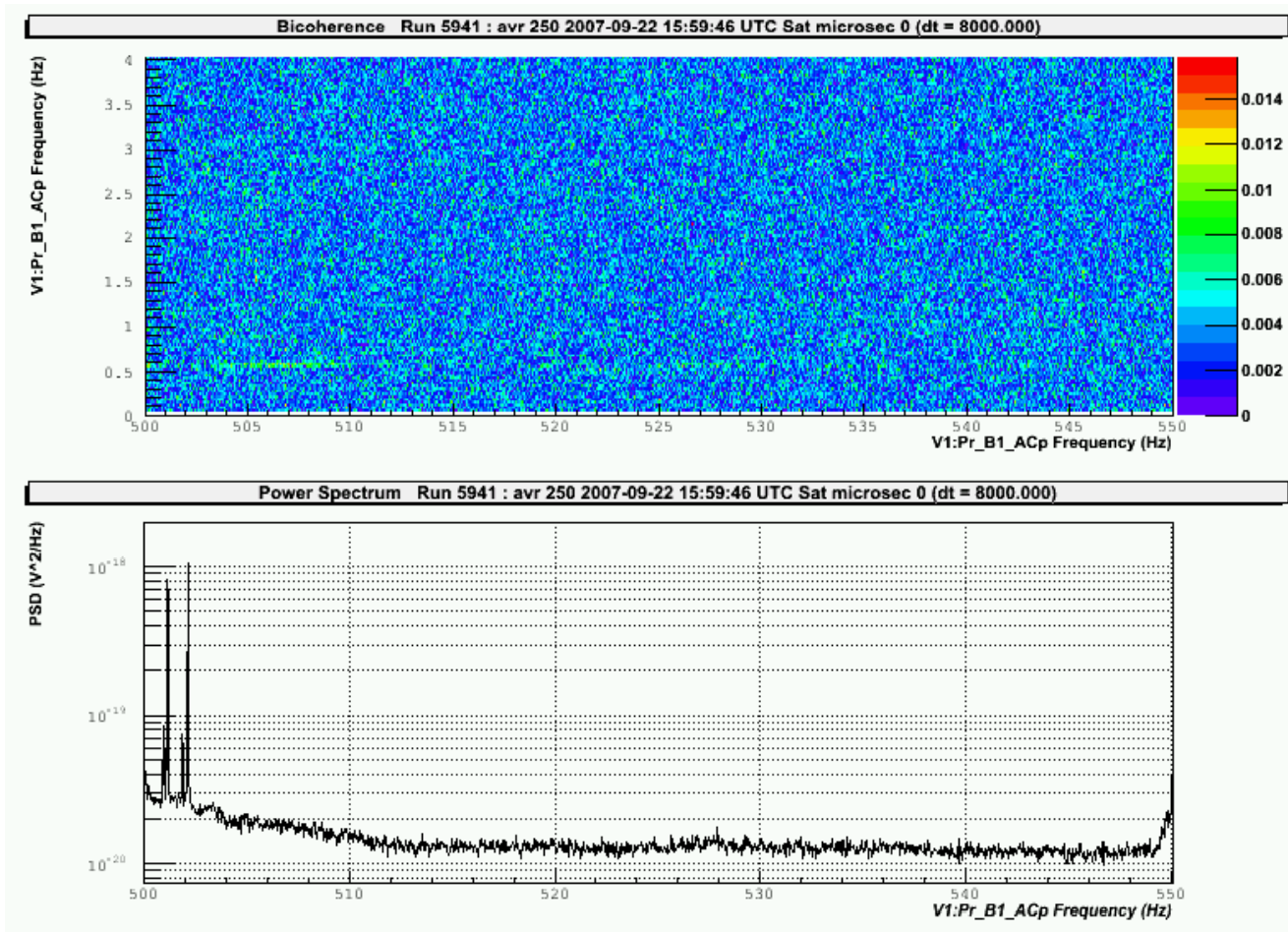
Bicoherence

450-500 Hz x 0-4 Hz



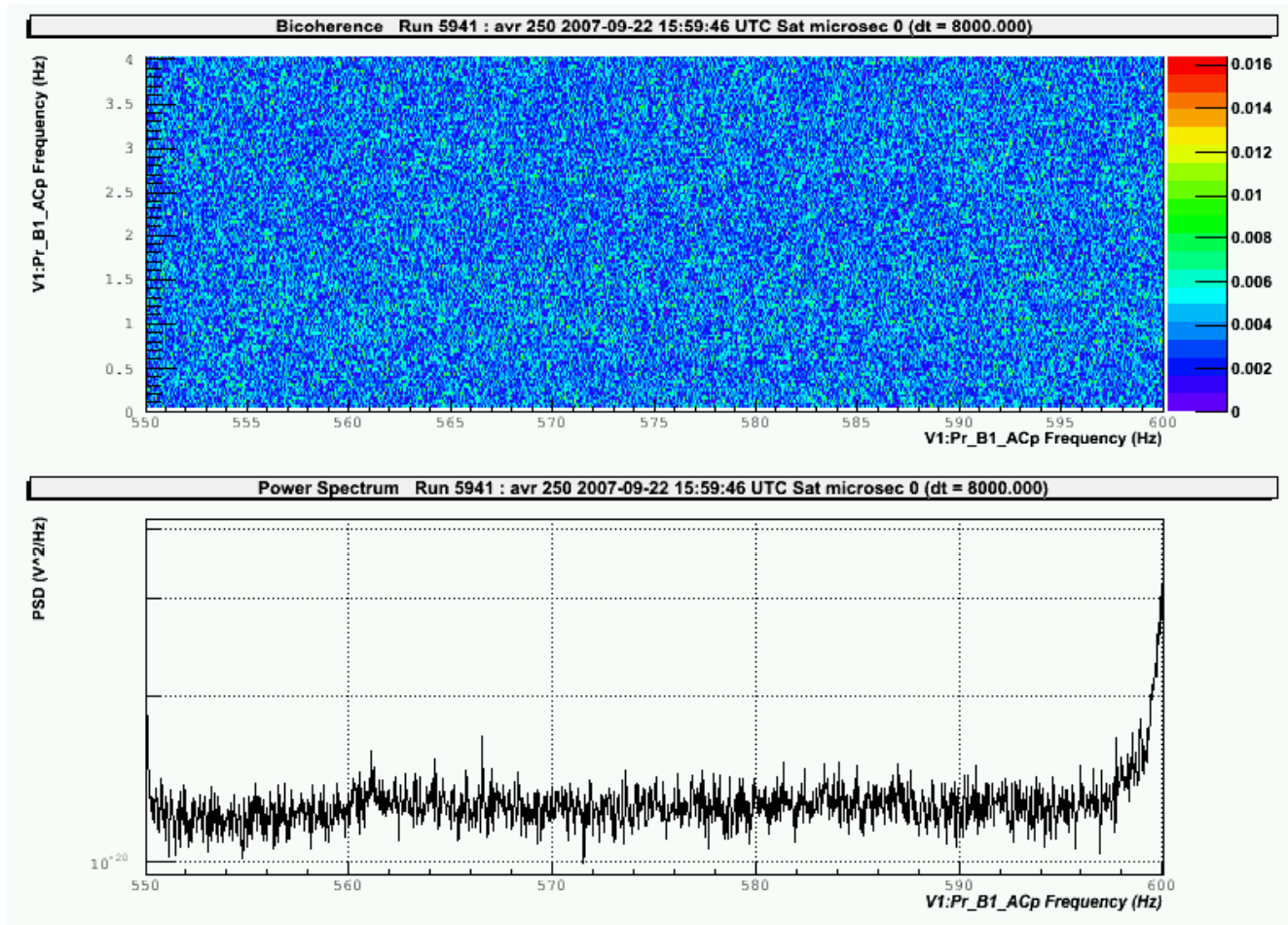
Bicoherence

500-550 Hz x 0-4 Hz



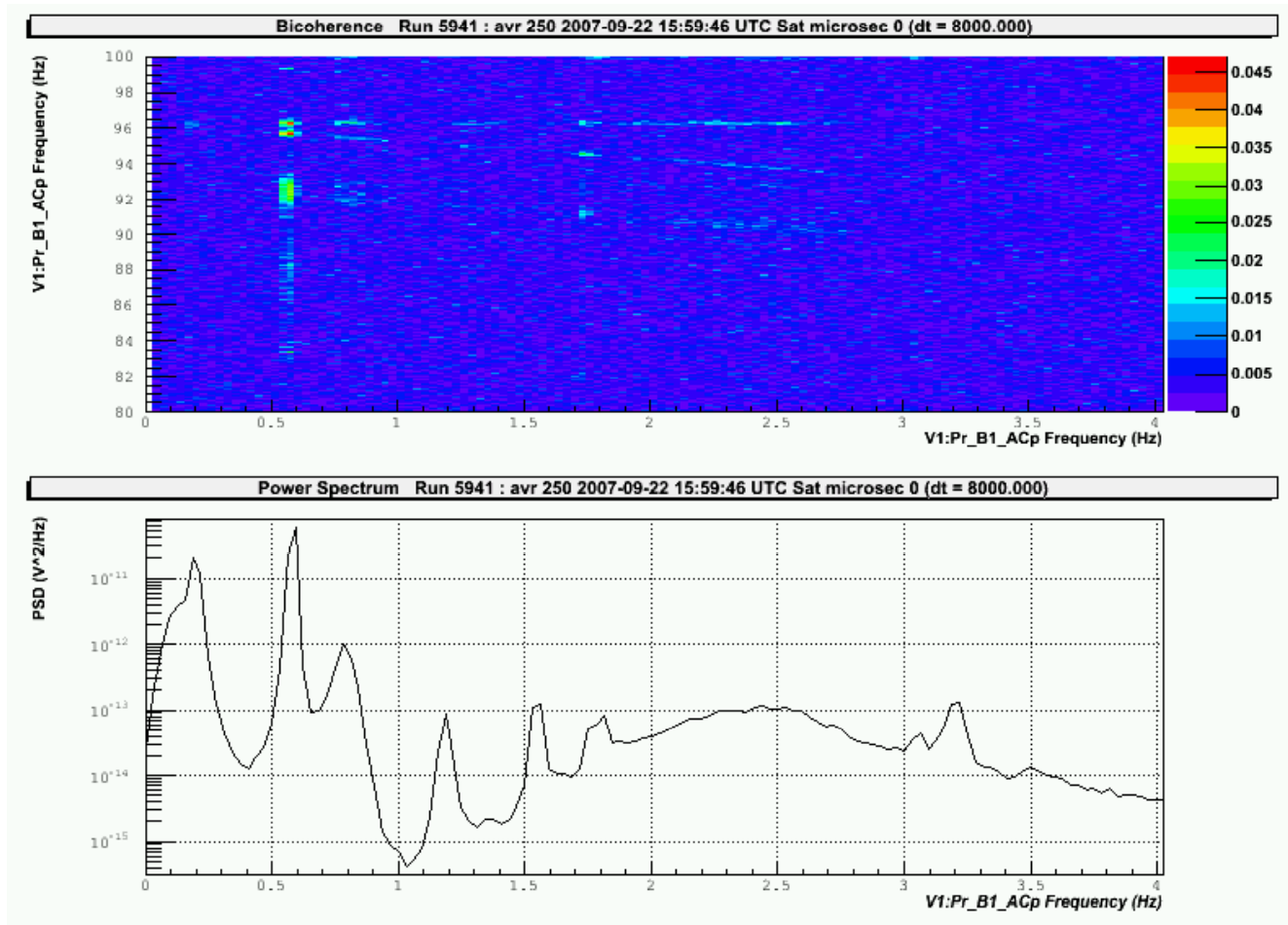
Bicoherence

550-600 Hz x 0-4 Hz



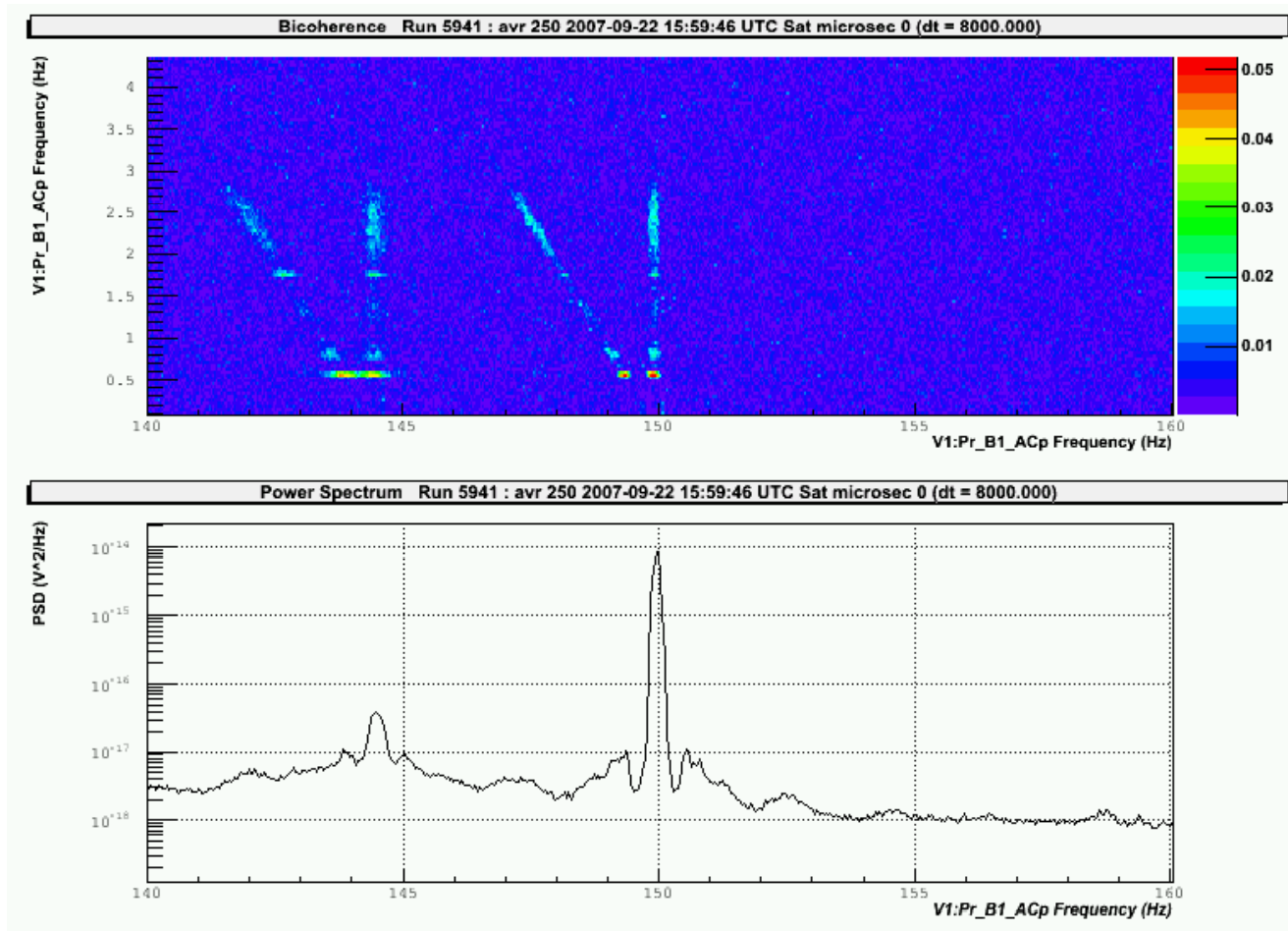
Bicoherence

0-4 Hz x 80-100 Hz



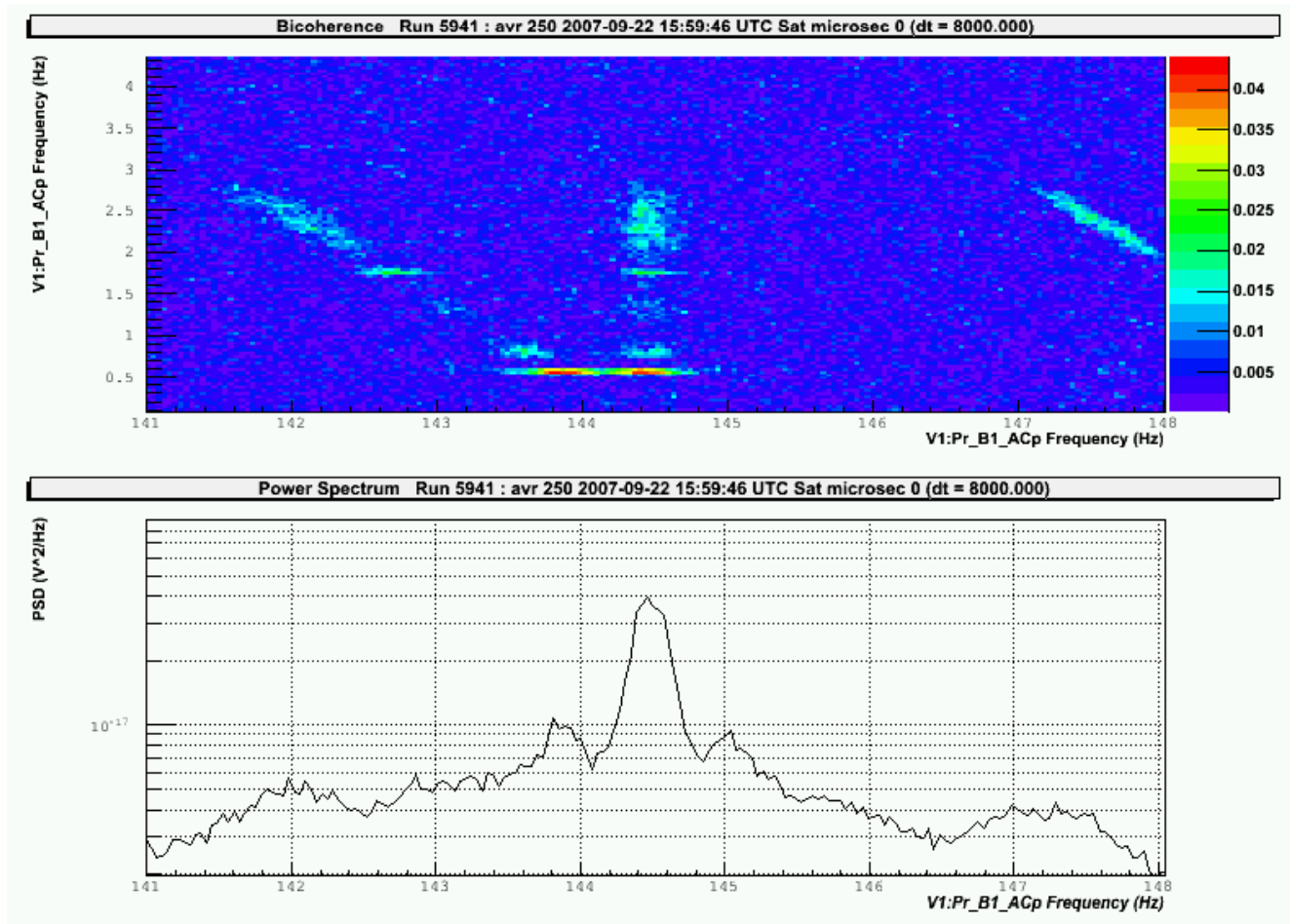
Bicoherence

140-160 Hz x 0-4.5 Hz



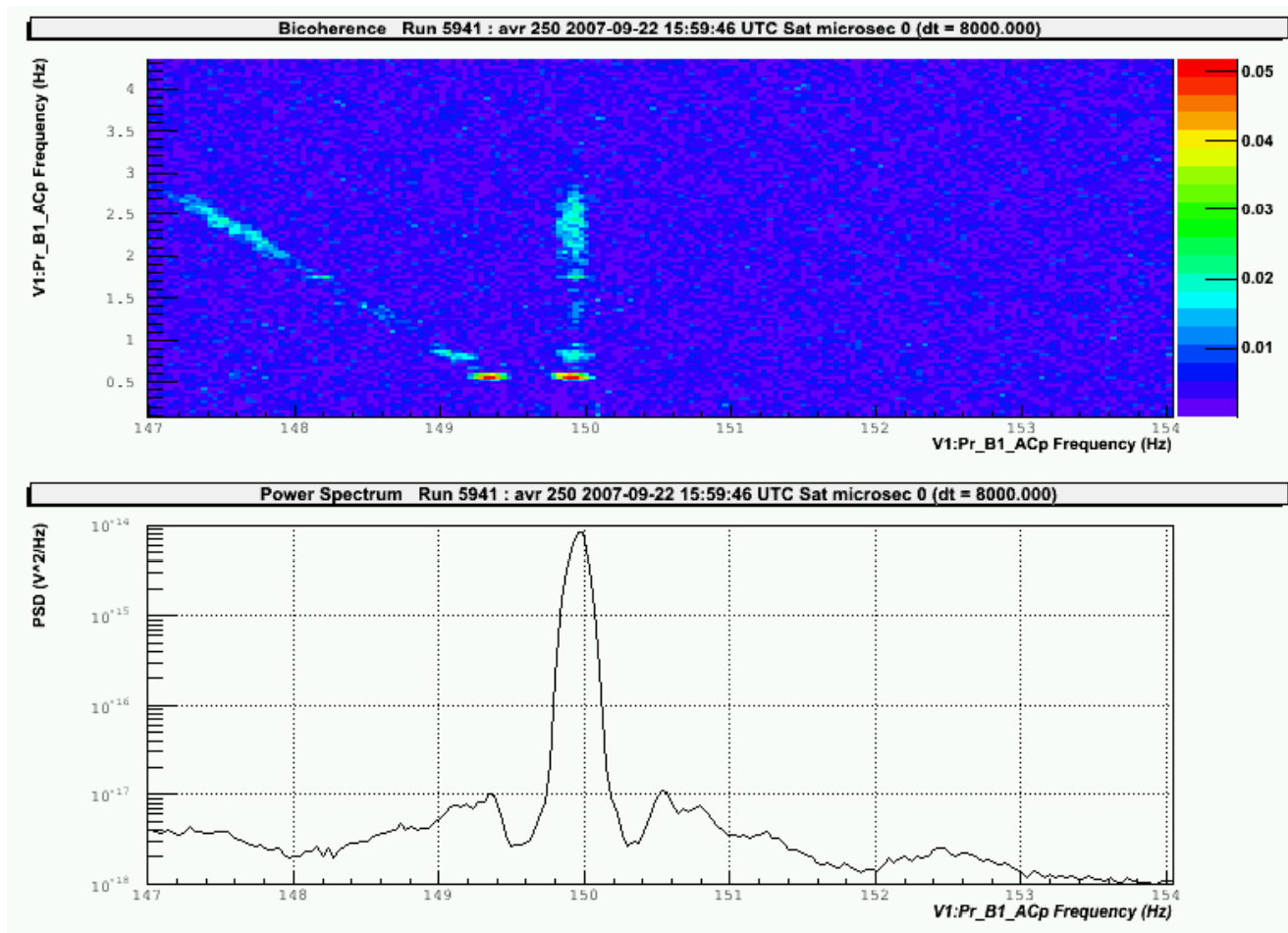
Bicoherence

141-148 Hz x 0-4.5 Hz



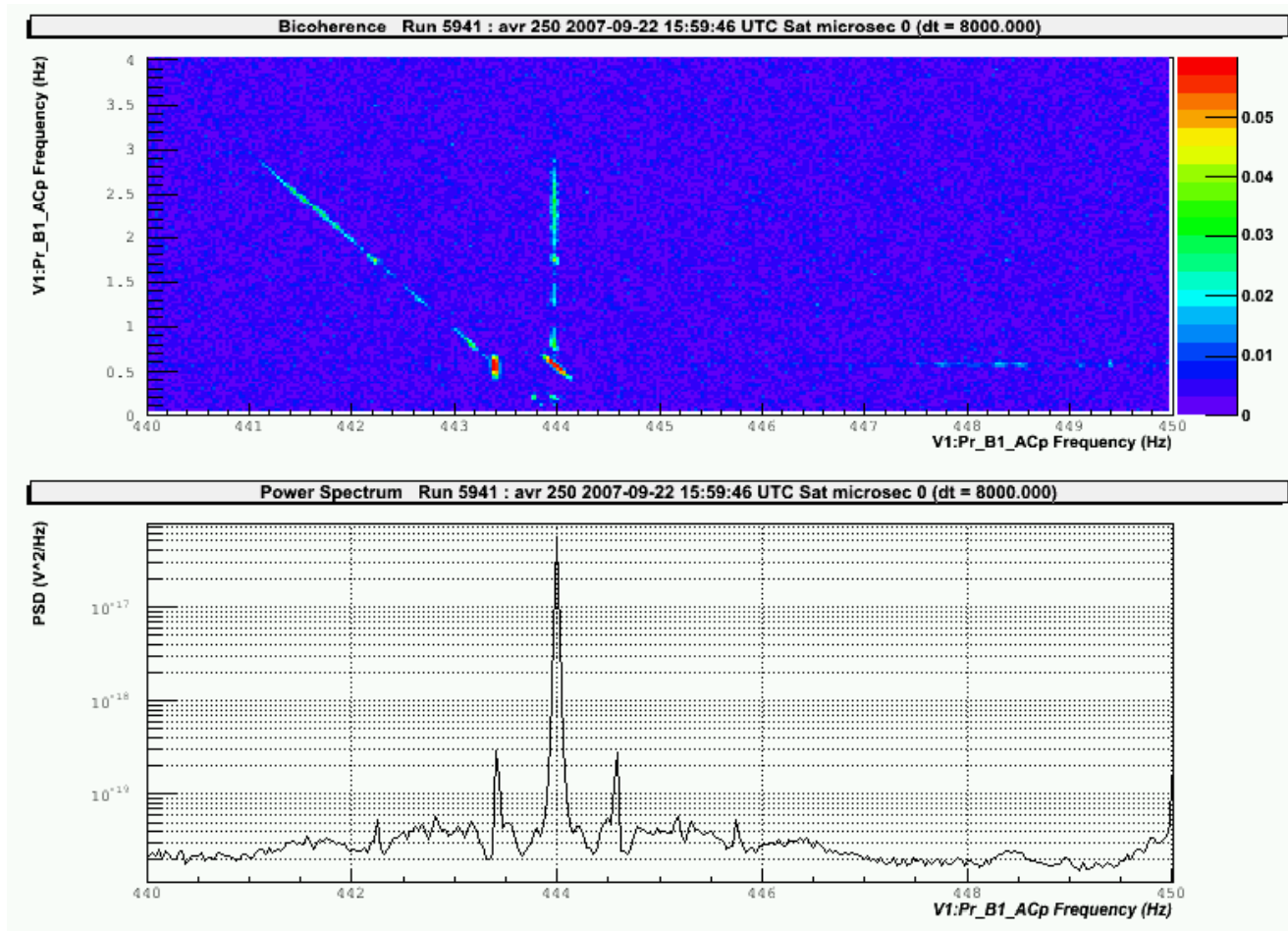
Bicoherence

147-154 Hz x 0-4.5 Hz



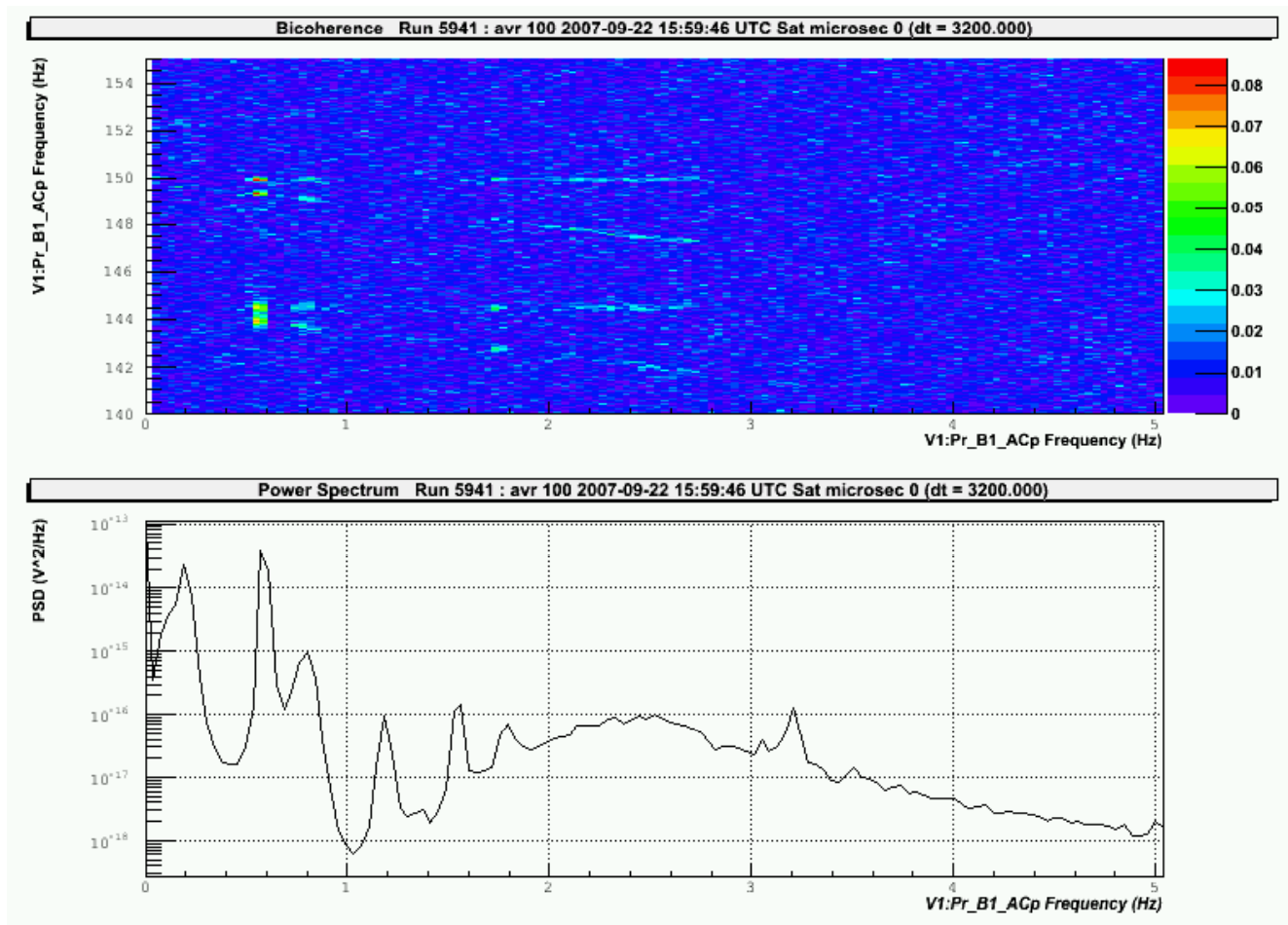
Bicoherence

440-450 Hz x 0-4 Hz



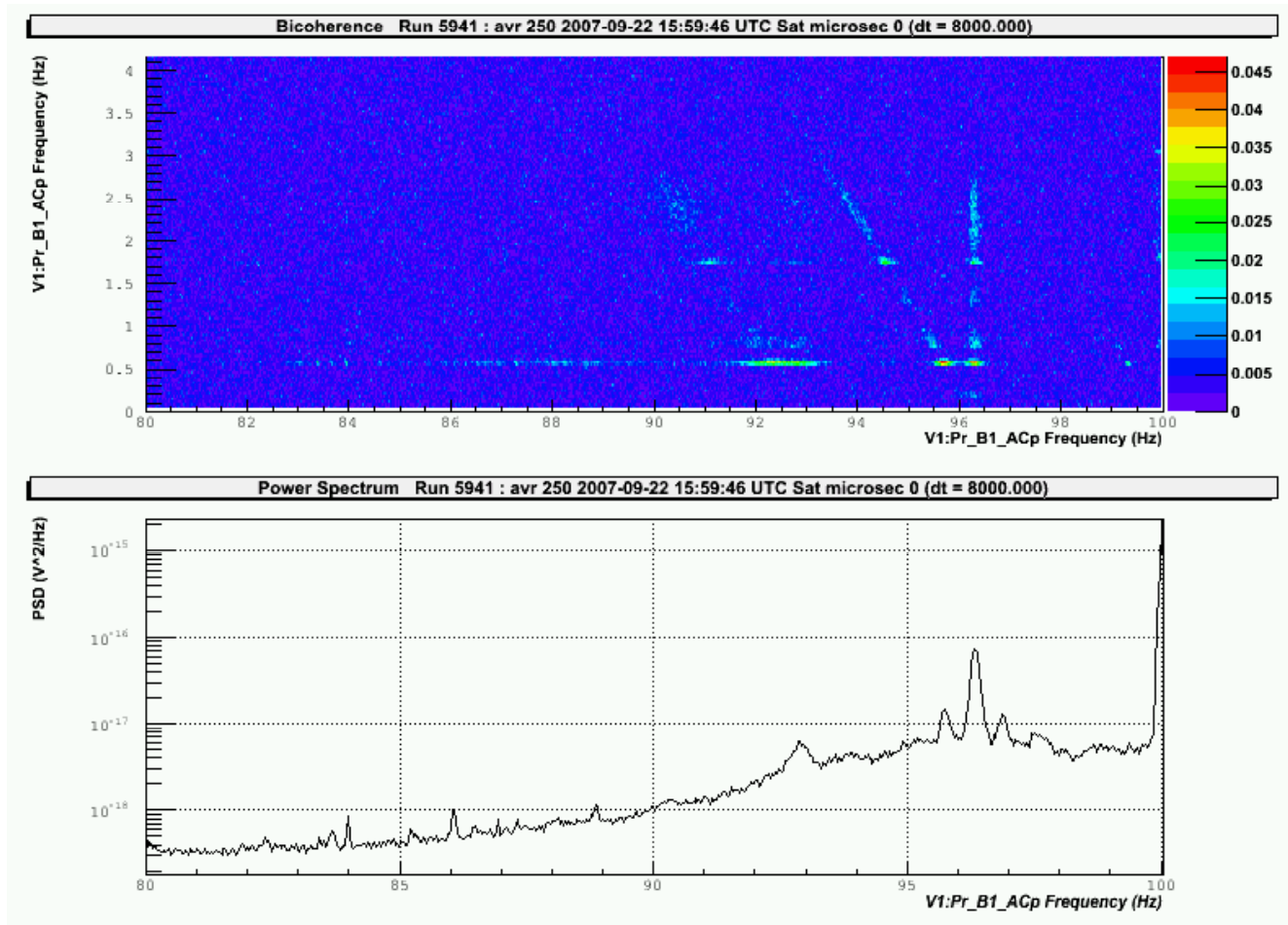
Bicoherence

0-5 Hz x 140-154 Hz



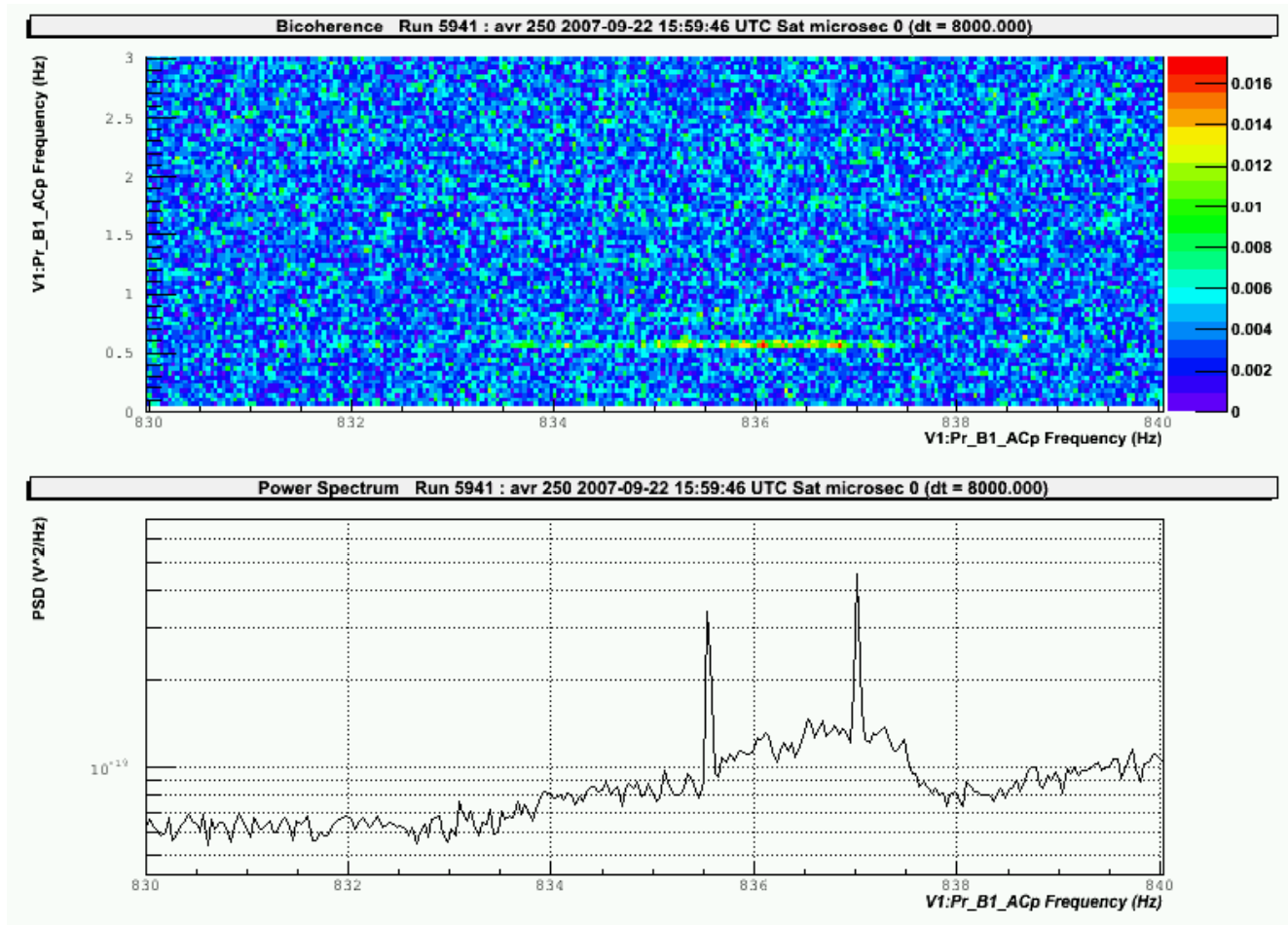
Bicoherence

0-5 Hz x 140-154 Hz



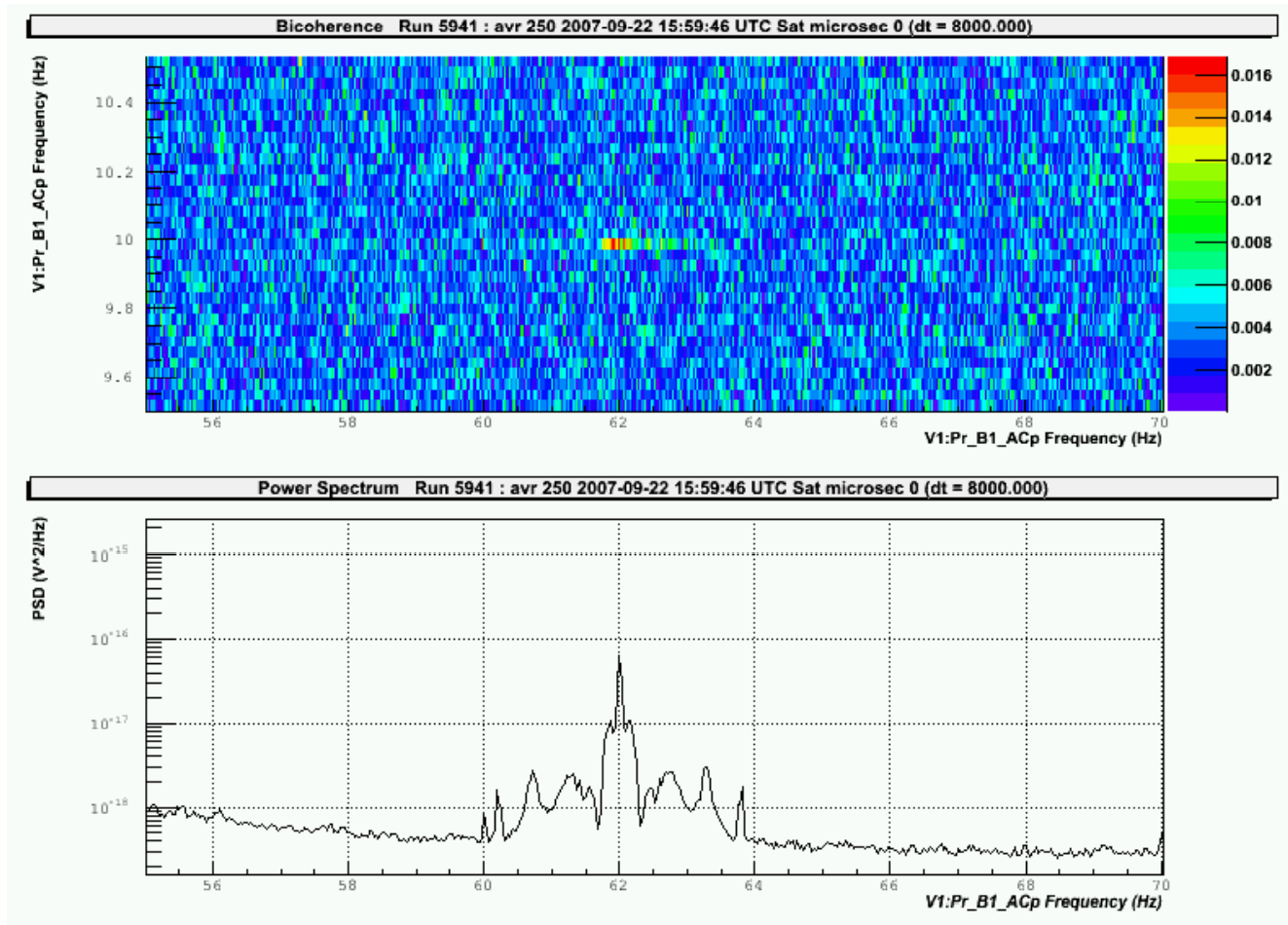
Bicoherence

830-840 Hz x 0-3 Hz

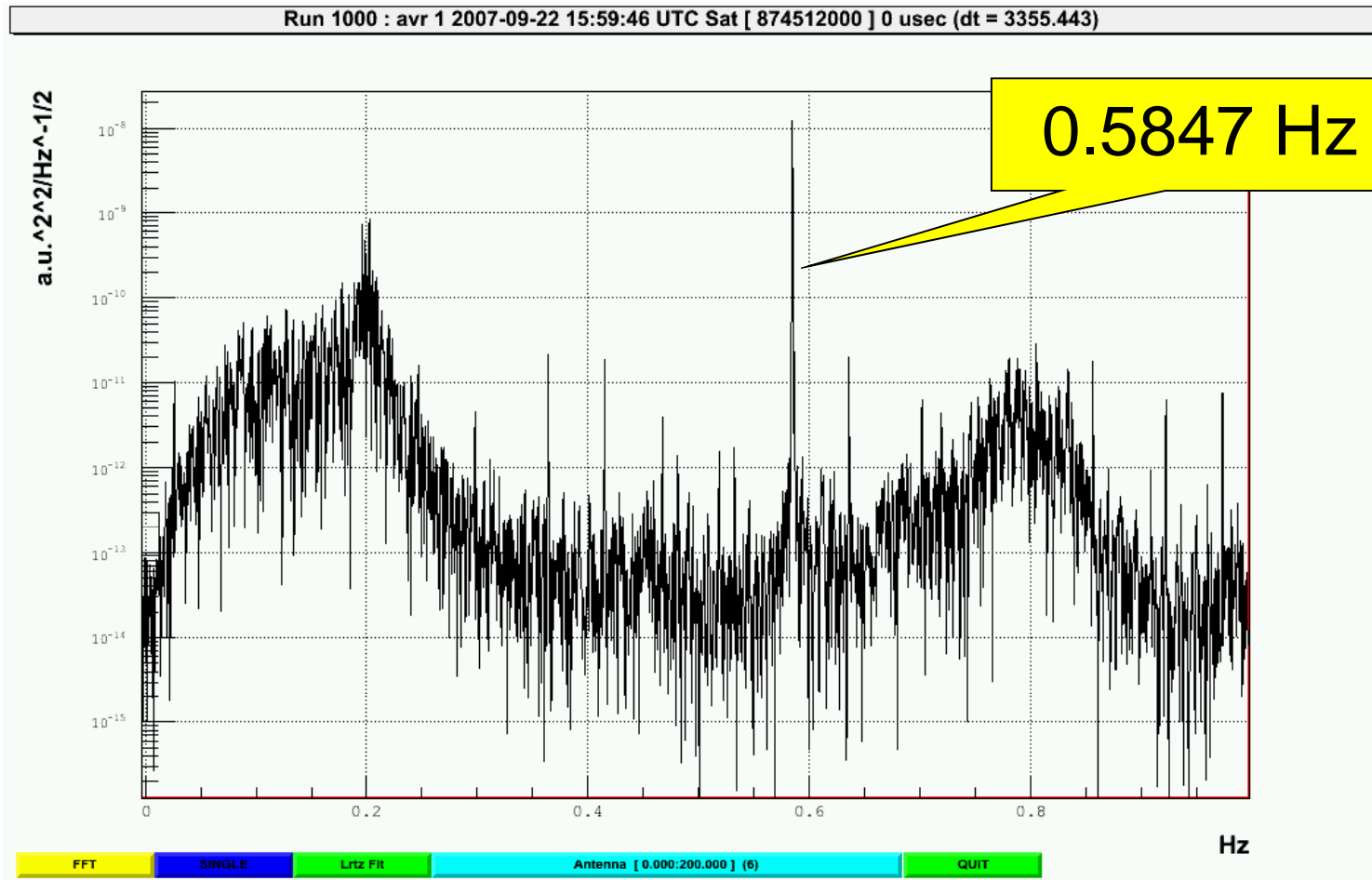


Bicoherence

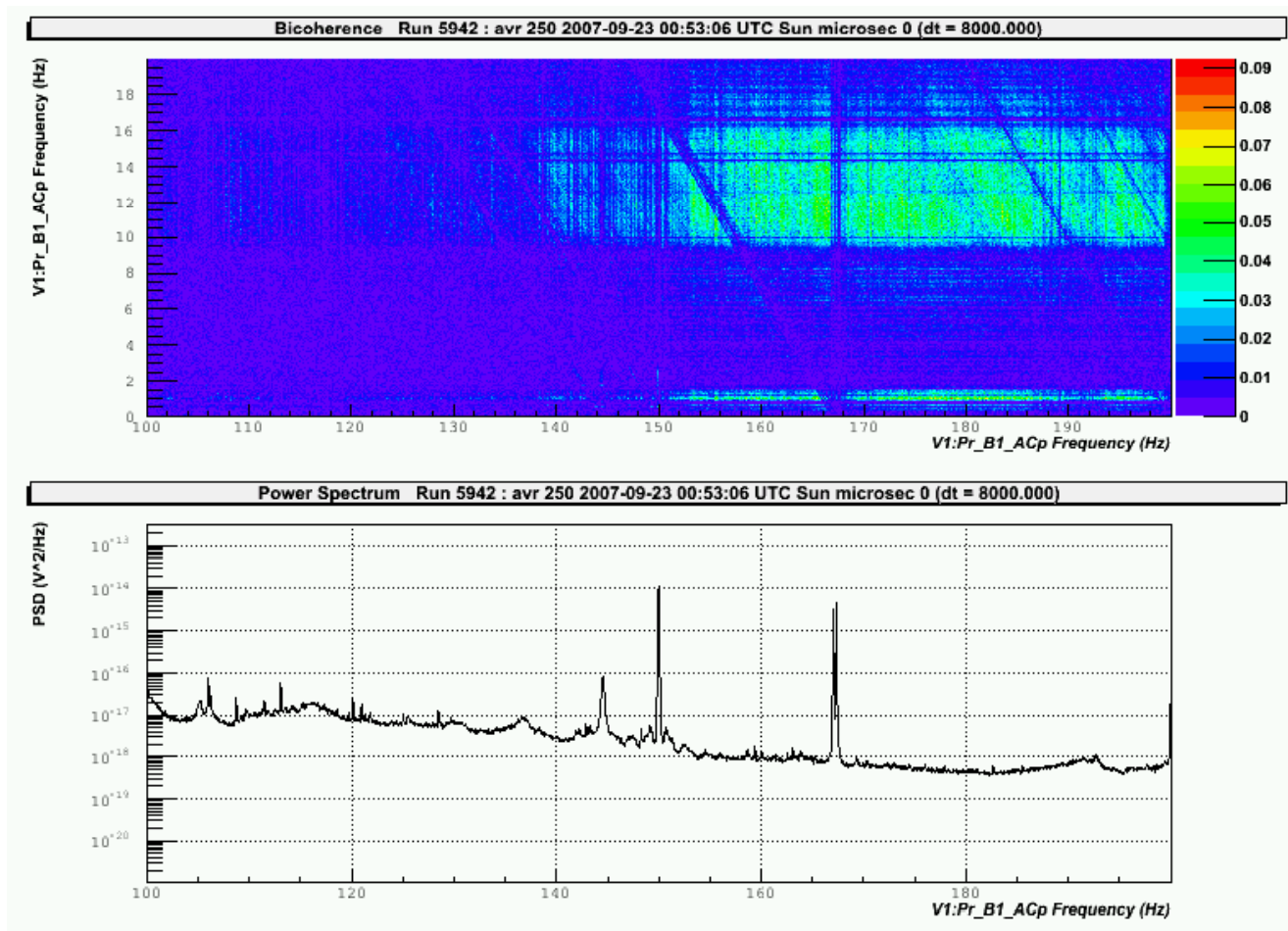
55-70 Hz x 9.5-10.5 Hz



Power Spectrum 0-1Hz



Bicoherence (Earthquake) 100-200 Hz x 0-20 Hz



Bicoherence (Earthquake) 800-860 Hz x 0-20 Hz

