VEGAS Subsystem and System Test Report

D. Anish Roshi[1] and others
[1] National Radio Astronomy Observatory, Green Bank & Charlottesville

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Version 0.0

1 VEGAS Mode 1

1.1 State Integration

The GBT simulator was used to test the state integration implemented in VEGAS. The AP was modulated with sig/ref or cal switching signal by connecting these signals to the trigger input. The 'pulsar attenuator' in AP was set to 0 dB and the 'output attenuator' was set to 30 dB. The AP signal was connected to the two ADC inputs of Bank A through a power splitter. The switching signal generator was configured by an observing script (see below). The manager was set up such that Bank A was the switching signal master. Fig. 1 shows a snap short of the noise switching along with the ADC histogram.

The script used for testing the State Integration is given below

```
vegas_config="""
receiver= 'Rcvr1_2'
obstype = 'Spectroscopy'
backend = 'VEGAS'
swmode = 'sp'
noisecal = 'off'
swtype = 'fsw'
swper = 1.0
swfreq = 0, 10
vframe = 'topo'
vdef = 'Radio'
pol = 'Linear'
dopplertrackfreq=1420.0
beam = 'B1'
bandwidth=1500
deltafreq=0
tint=2.0
vegas.vpol = "self"
restfreq = 1420.0
vegas.vfreq = [  {"restfreq": 1420.0,  "bank":"A"} ]
"""

Configure(vegas_config)
```

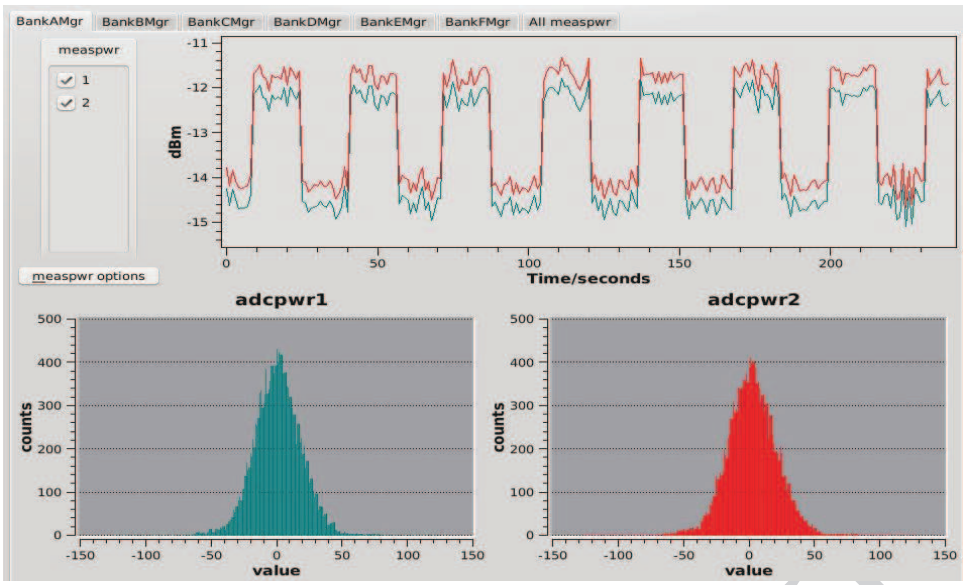

Figure 1: Noise modulation of AP by sig/ref signal as seen in the VEGAS data monitor. ADCpwr1 and ADCpwr2 correspond to the two polarization channels.

```
Catalog(pulsars_brightest_GBT)
Catalog(fluxcal)
calname = "3c48"
Slew(calname, beamName='1')
Track(calname, None, 60*30)
```

Fig. 2a shows the plot of power vs sample number when the AP is modulated with sig/ref signal. The power is obtained by averaging spectral values over channels 10 to 80. Sample numbers essentially identifies the spectra from VEGAS for each integration and each state. VEGAS is configured for 4 switching states for this test. They are sif/ref and cal on/off in each of the sig and ref states. Each sample in the plot corresponds to the power obtained from a spectrum corresponding to a state and integration. Since the AP is modulated with sig/ref signal the power will be same for cal on/off state. Fig. 2b shows the integration time recorded by VEGAS for each state vs sample number. The specified integration time in 2 sec and so the integration per state is about 0.5 sec. The change in integration seen is 0.5 msec, which corresponds to one hardware integration (ie the integration in the FPGA). A plot of the time stamp (UTCDELTA) for each spectrum against sample number is shown in Fig. 2c. The data used to make these plots are available at `/lustre/gbtdata/TVEGAS_34/VEGAS/2013_06_06_16:48:13A.fits`

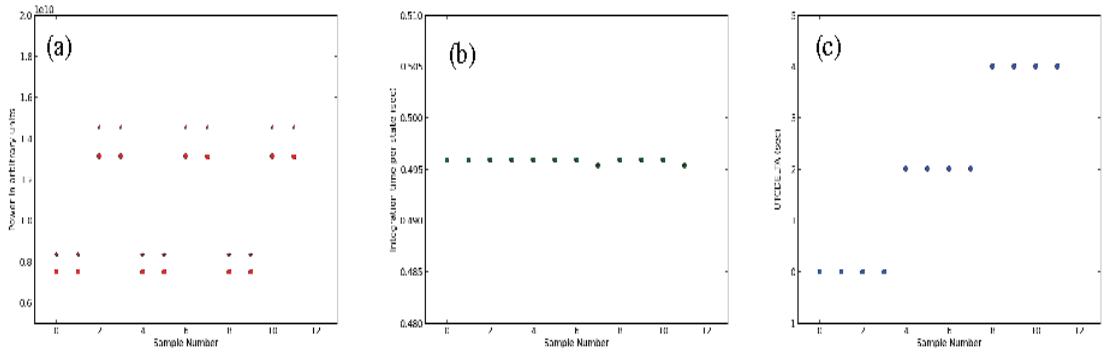

Figure 2: (a)Power vs sample number. The star and circle correspond to the two polarization channels. (b) Integration time recorded by VEGAS for each state vs sample number. The star and circle correspond to the two polarization channels. (c)UTCDELTA at the start of each integration vs sample number.

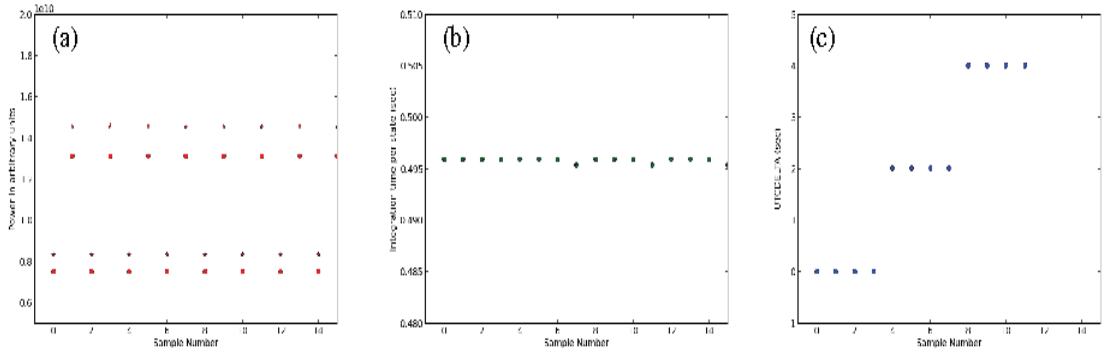

Figure 3: (a)Power vs sample number obtained through vegas when the AP is modulated with sig/ref signal. VEGAS is configured for 4 switching states. They are sif/ref and cal on/off in each of sig and ref states. Each sample in the plot corresponds to data integrated for a state. Since the AP is modulated with cal signal the power will change for every cal state. The star and circle correspond to the two polarization channels. (b) Integration time reported by VEGAS for each state vs sample number. The star and circle correspond to the two polarization channels. The change in integration seen is 0.5 msec, which corresponds to one hardware integration. (c) UTCDELTA at the start of each integration vs sample number.

Fig. 3 shows the plot of power vs sample number when the AP is modulated with the cal signal. All other parameters are as described above. The data used to make these plots are available at `/lustre/gbtdata/TVEGAS_34/VEGAS/2013_06_06_17:28:44A.fits`. A plot of the same data for 150 samples is shown in Fig. 4

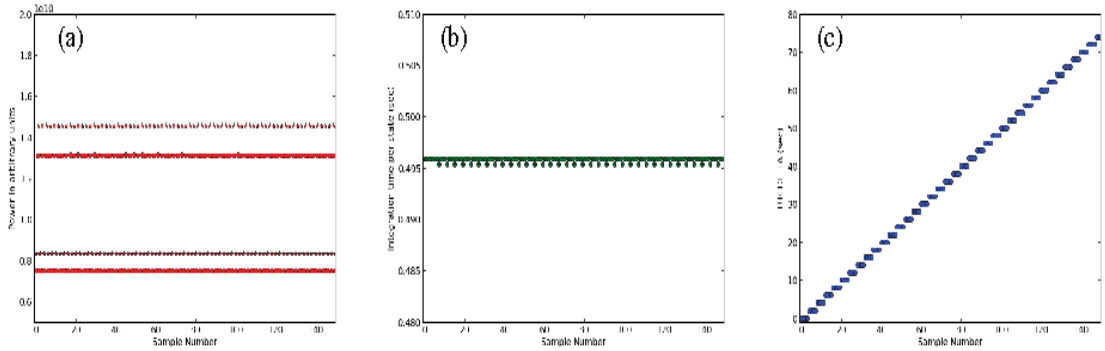

Figure 4: Same as Fig. x but plotted up to 150 samples numbers to show the stability of the system.

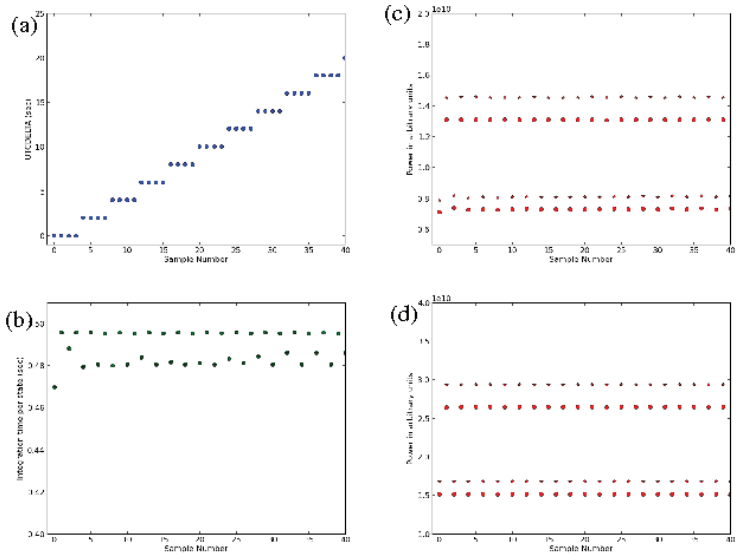

Figure 5: Plots are obtained with AP signal connected to the input of VEGAS and modulated by the cal signal. LO blanking signal was connected to the switching signal distributor. VEGAS is configured for 4 switching states. They are sif/ref and cal on/off in each of sig and ref states. Each sample in the plot corresponds to data integrated for a state. Since the AP is modulated with cal signal the power will change for every cal state. (a) UTCDELTA at the start of each integration vs sample number. (b) Integration time recorded by VEGAS for each state vs sample number. The star and circle correspond to the two polarization channels. The change in integration time by about 18 msec is due to LO blanking. As expected, the LO blanking signal appears only at the boundary of sig/ref state and not at the cal switching states within the sig and ref state. (c) Power obtained through VEGAS vs sample number. The variation in power for a given state is due to change in integration time. As seen in (d) the variation goes away when the Power is normalized by the integration time recorded by VEGAS. The star and circle correspond to the two polarization channels.

Fig. 5 shows the plot of power vs sample number when the AP is modulated with the cal signal but the GBT local oscillator (LO) switching was controlled using VEGAS. LO blanking signal was connected to the switching signal distribution box. For this test, the astrid script given above was run from the GBT M&C system. The data used to make these plots are available at `/lustre/gbtdata/TGBT13A_504_10/VEGAS/2013_06_06_20:10:34A.fits`.