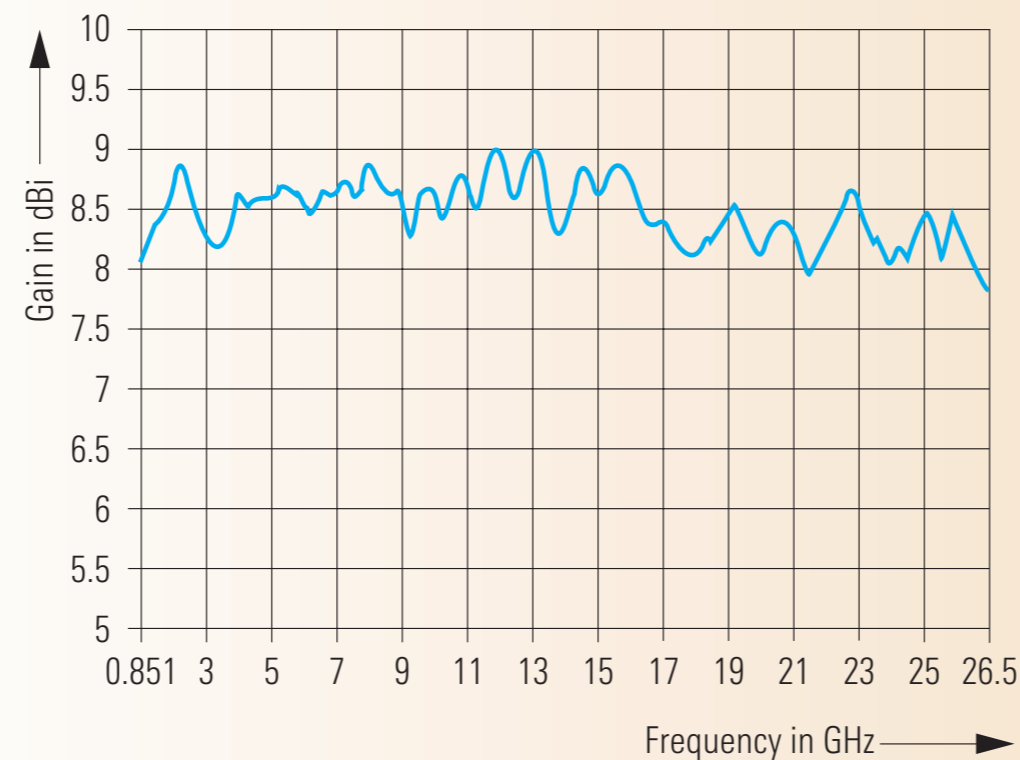


The MIDAS Experiment: Relative Calibration

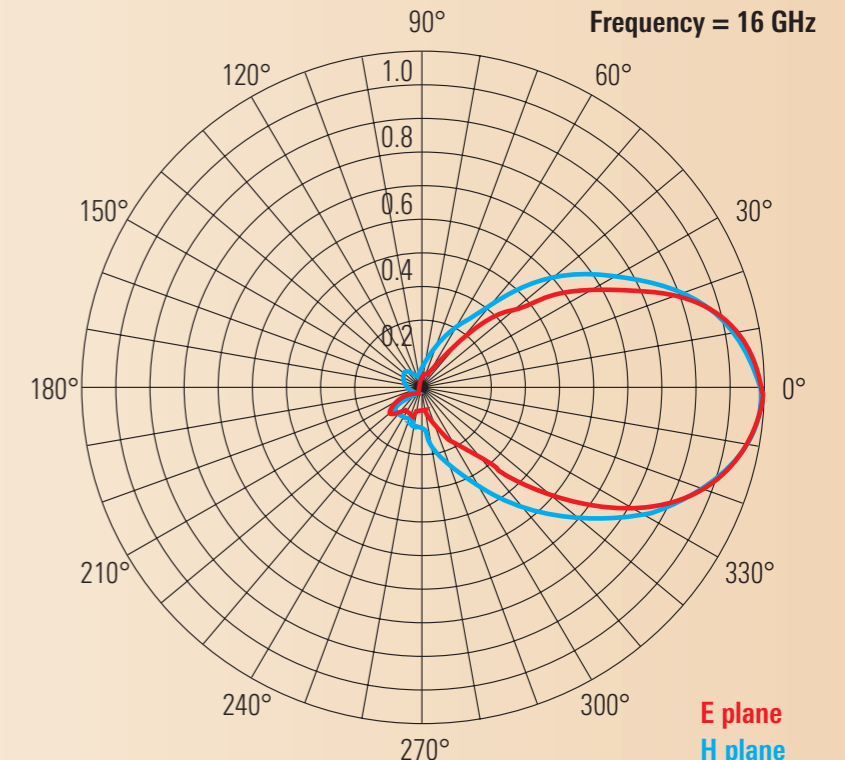
Christopher Williams, Nick Hollon

Antenna

- Rhode & Schwarz HL050
- Log-Periodic 850MHz-26.5GHz
- ~8.5dB gain over total BW
- Beam Width ~40° in both pols



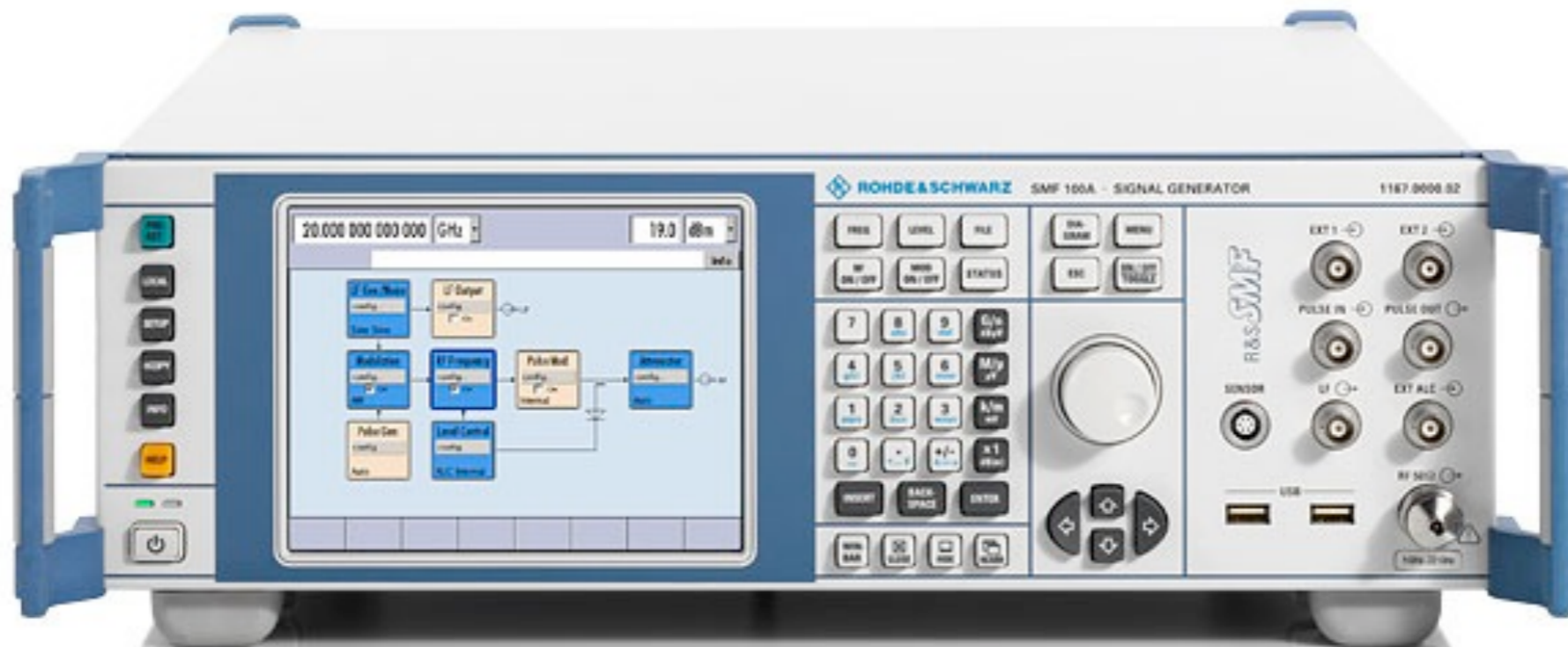
Typical gain



Typical radiation pattern

Pulse Generator

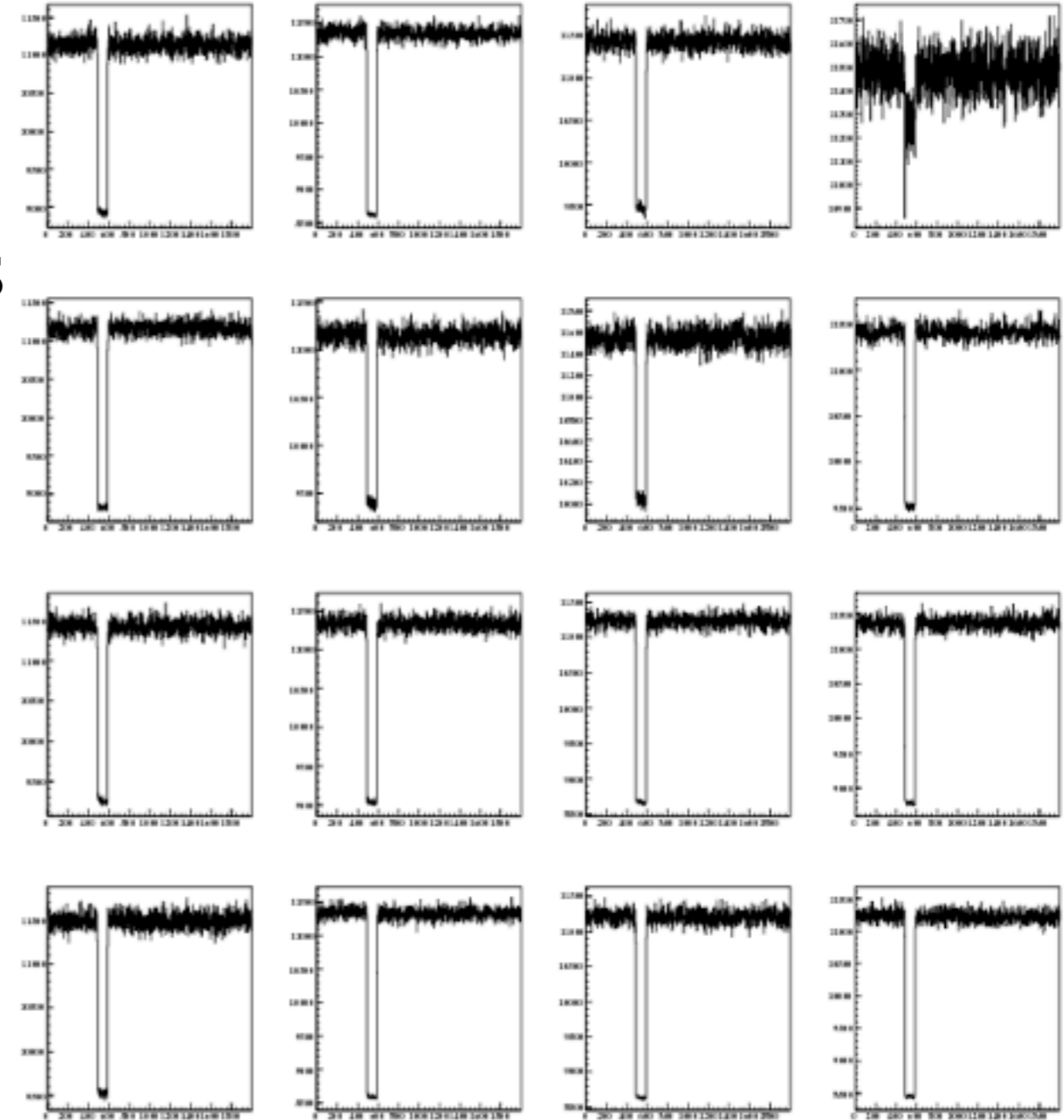
- Rhode & Schwarz SMF100A
- 1GHz to 22GHz
- -130 dBm to +30 dBm
- Pulse Width 5ns to 100s
- Controlled via ethernet





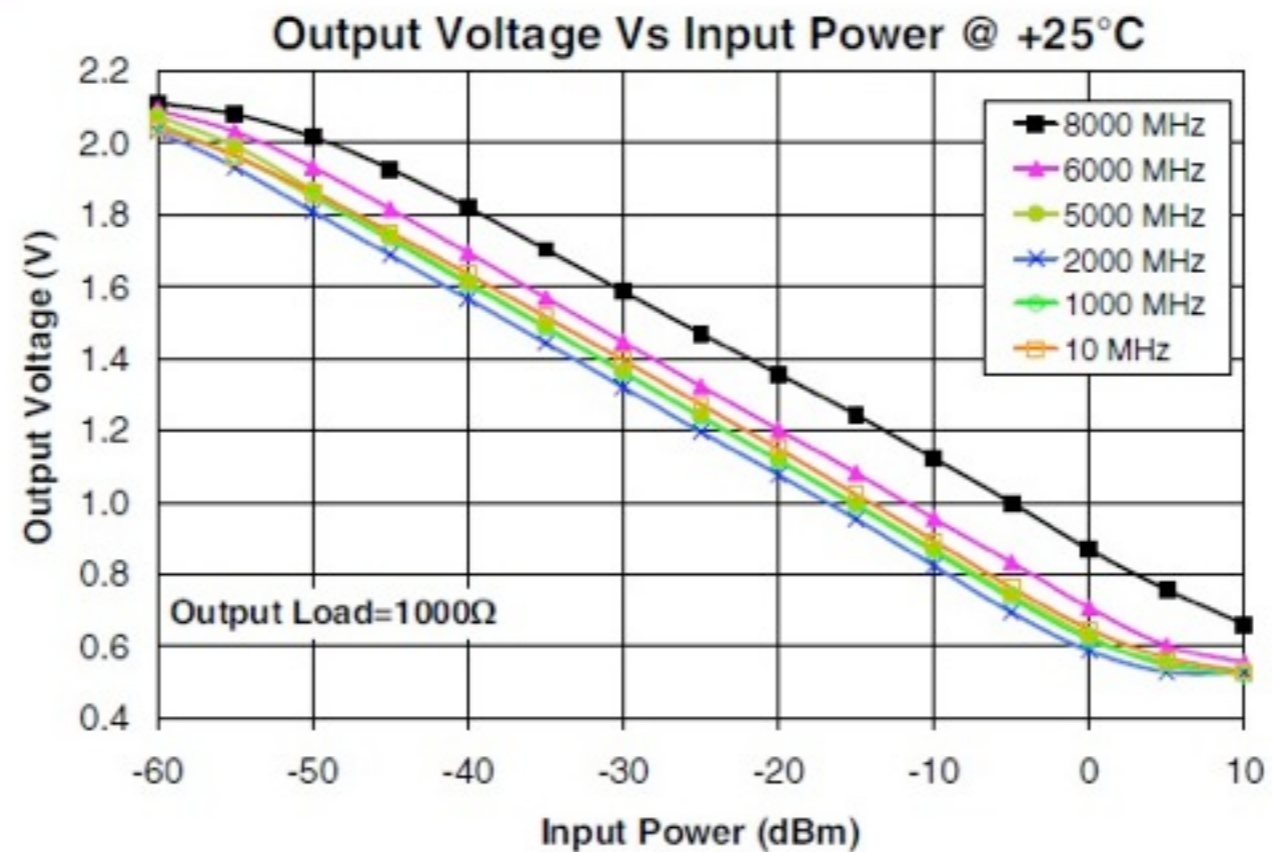
Relative Calibration Method

- 5 μs Pulse
- Wide beam width illuminates camera uniformly
- Large dynamic range allows for calibration of power constant
- Provides check on system timing



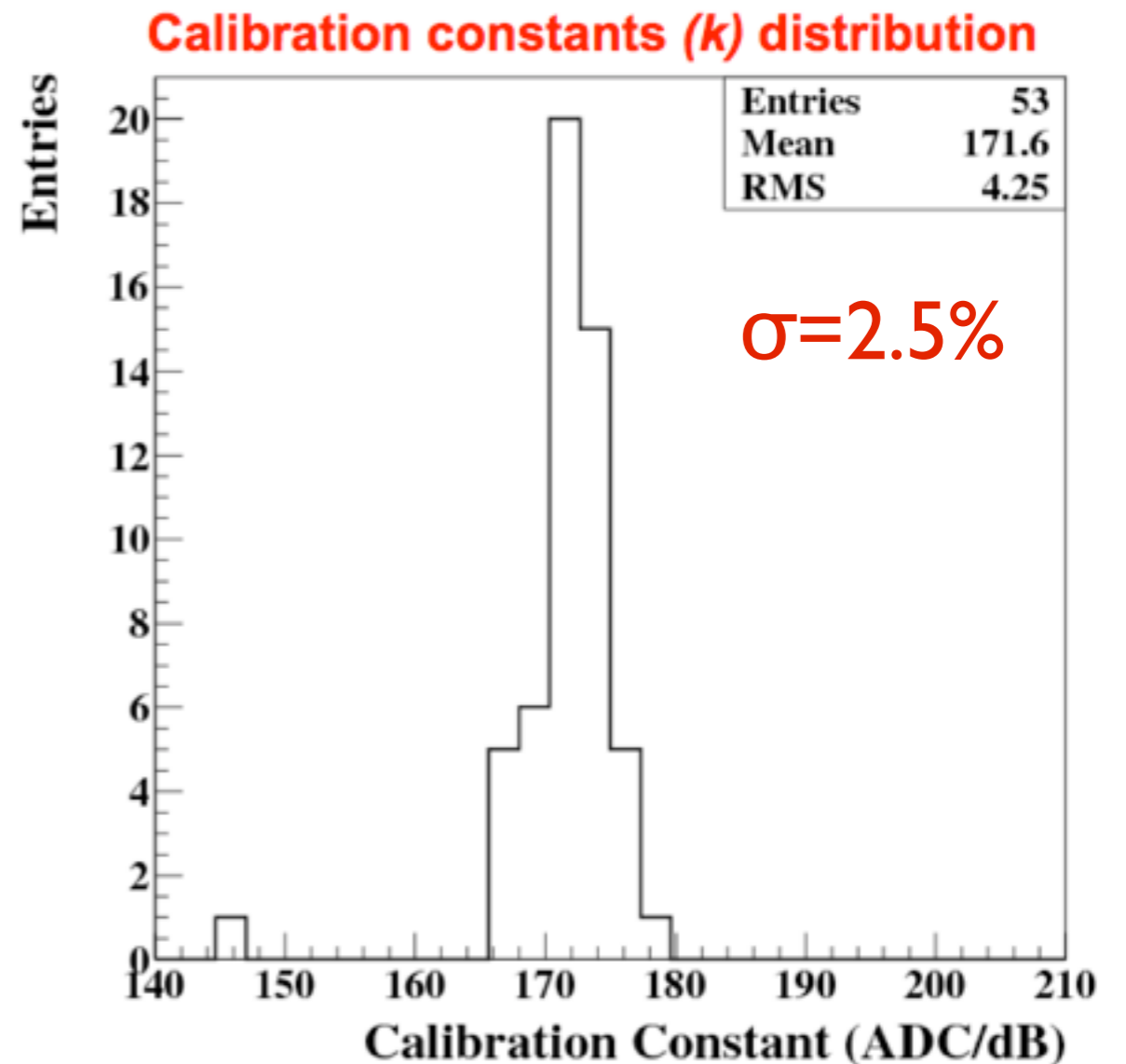
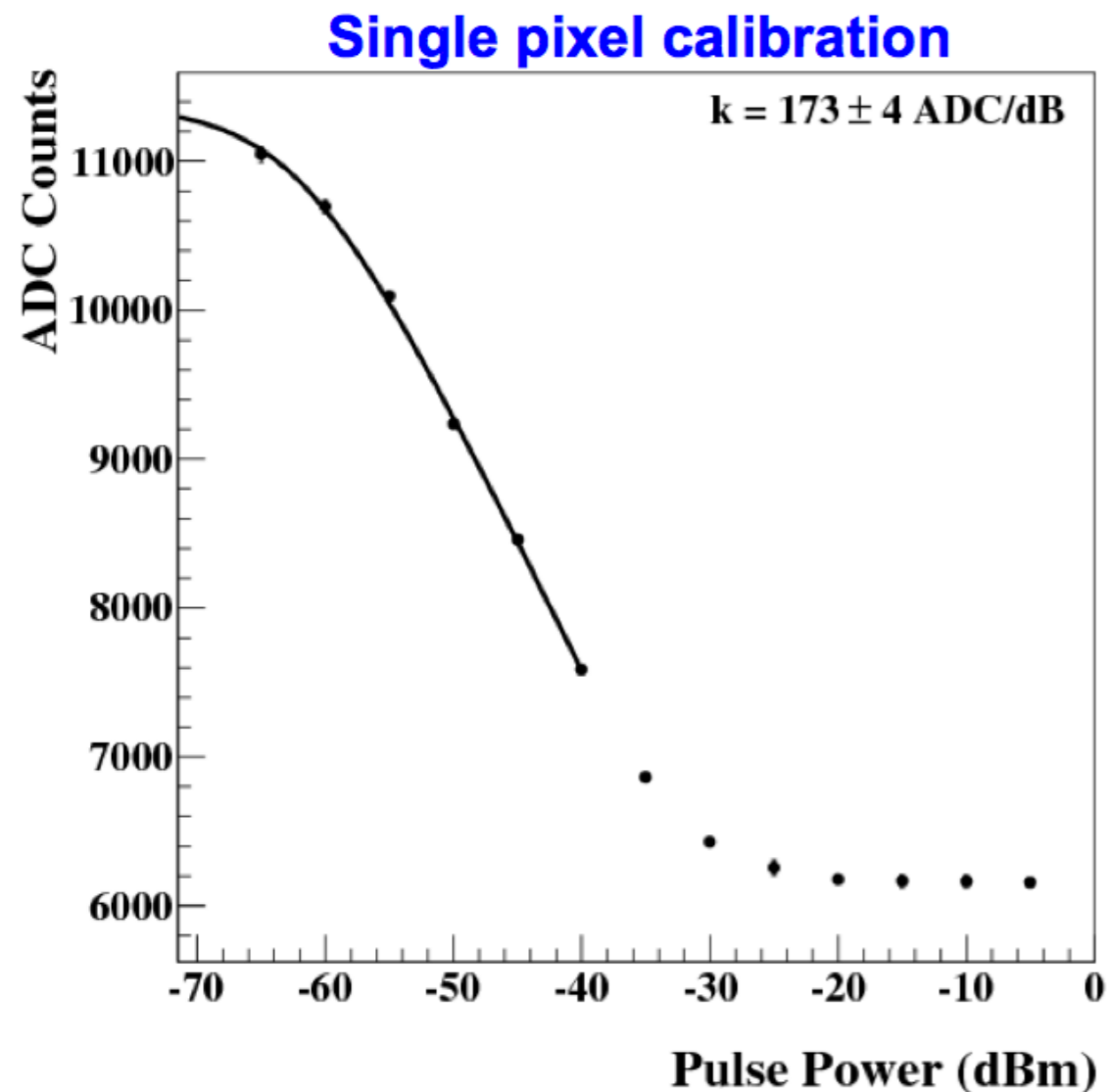
Power detector

0-2 V DC output, log response
10MHz to 8GHz bandwidth
100 ns time resolution



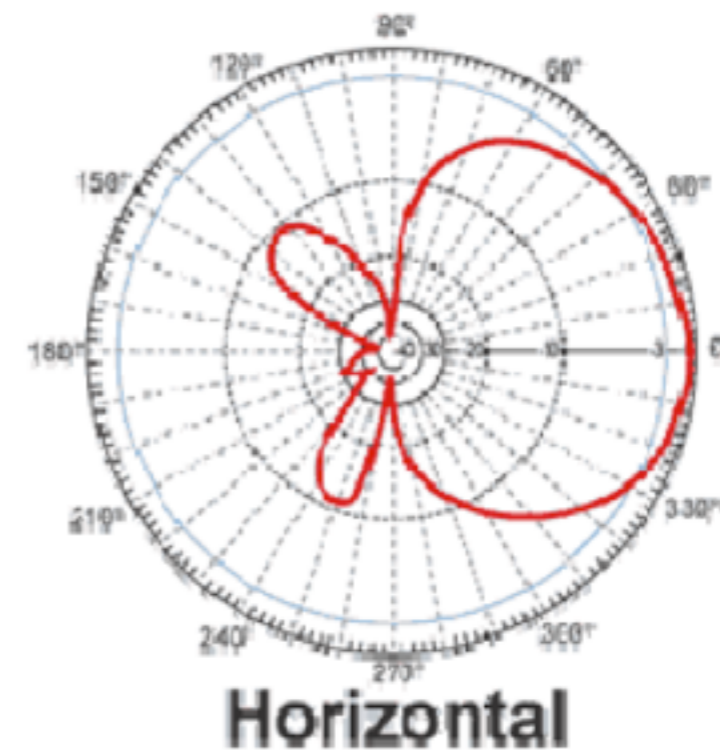
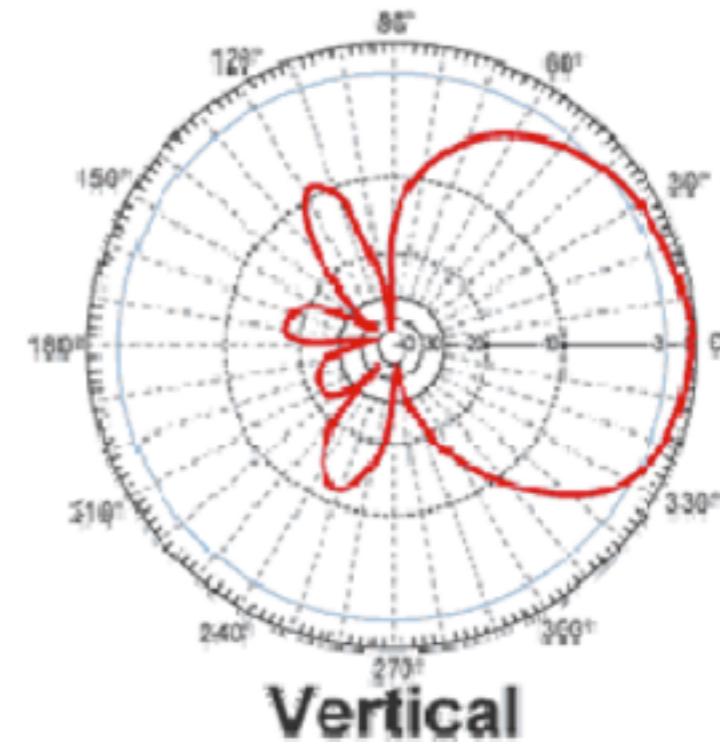
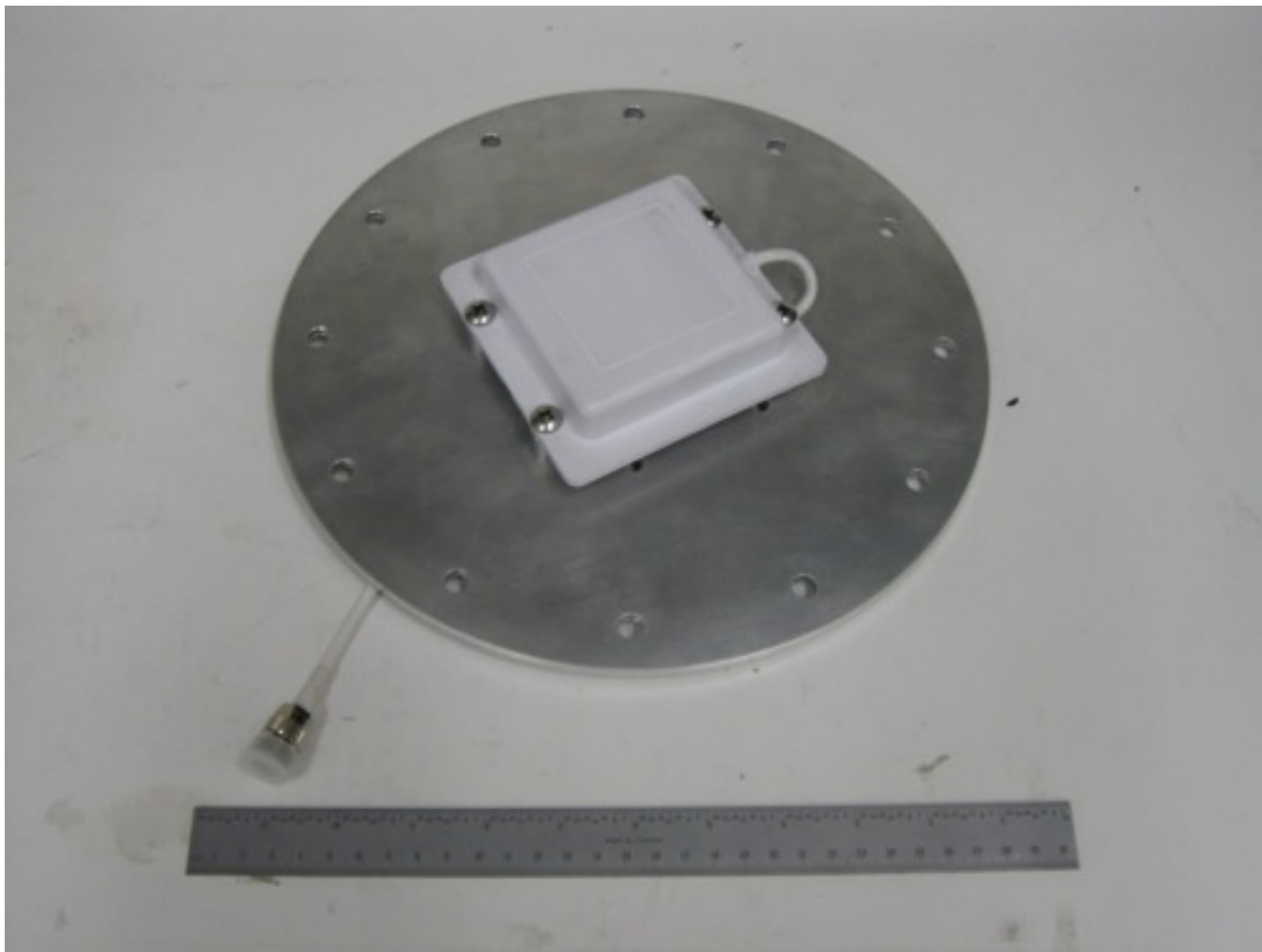
Calibration Constant

$$n_{adc} = n_{sys} - 10 k \log \left[1 + f \frac{P_{pulse}}{P_{sys}} \right]$$



Patch Antenna

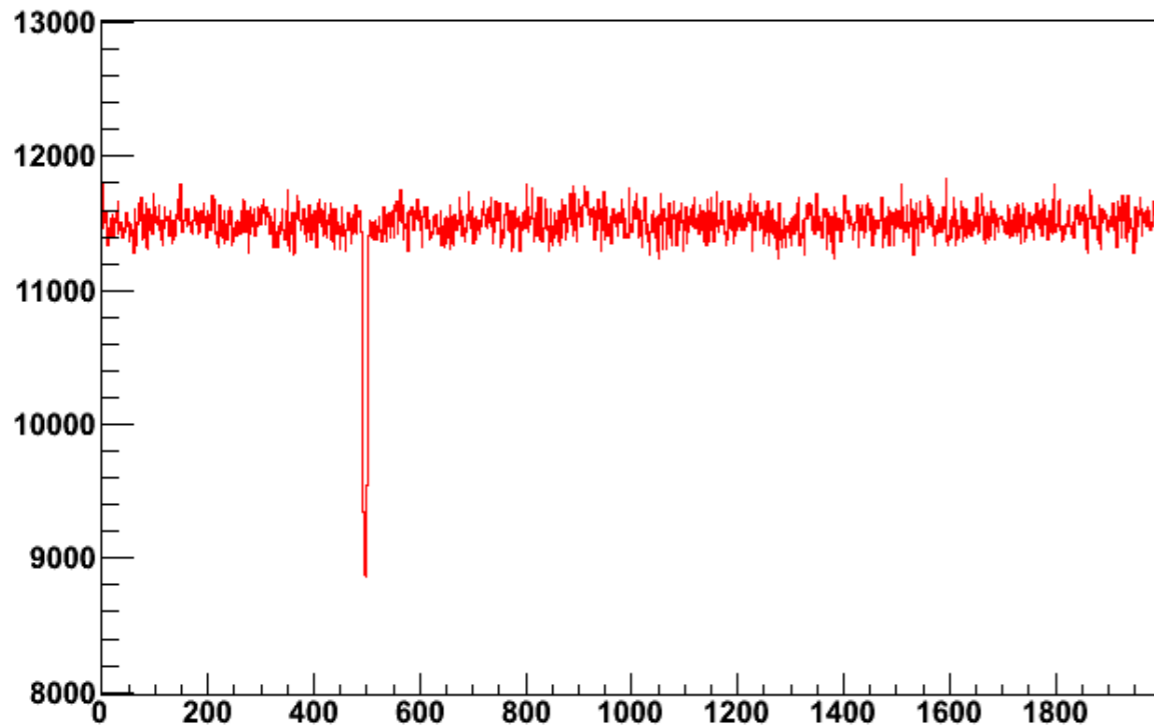
- Hyperlink HG3509P-NF
- 3.35GHz to 3.7GHz
- ~8dB gain
- Beam Width $75^{\circ}\text{H} \times 65^{\circ}\text{V}$





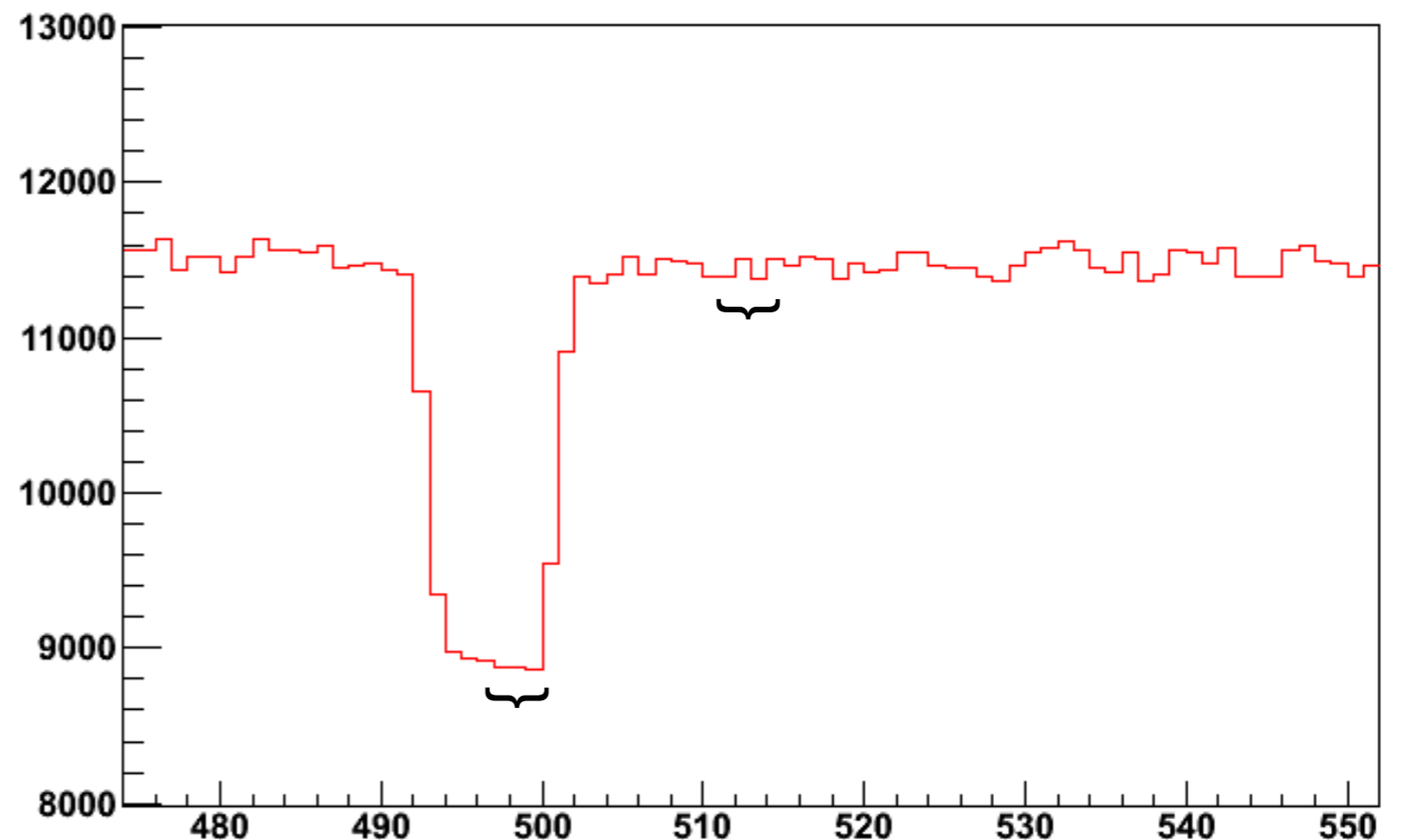


Relative Calibration

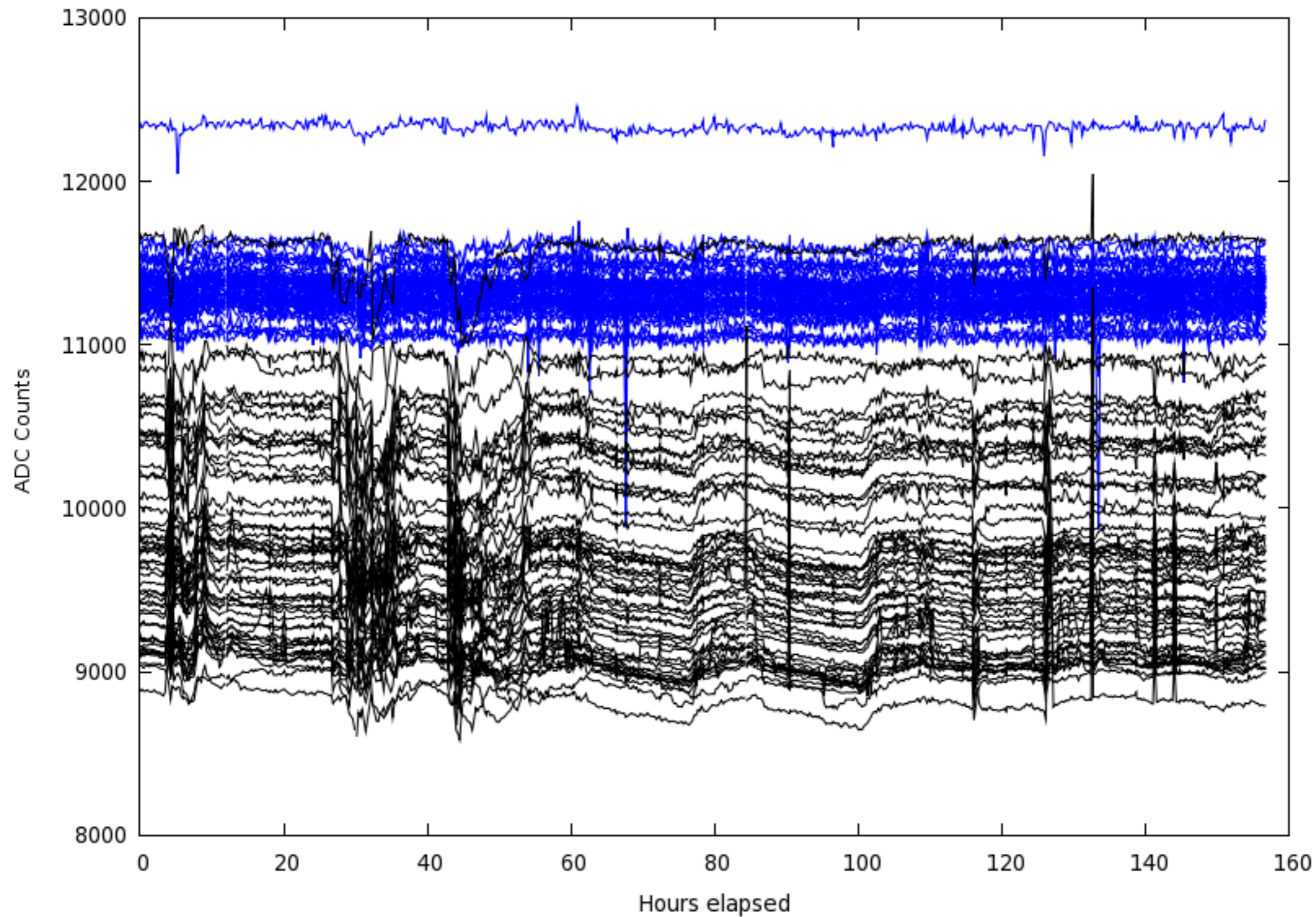


- Every 15 minutes, antenna pulses 10 times, $f \sim 4$ Hz
- Pulse duration $1 \mu\text{s}$
- Calibration events recorded to separate file

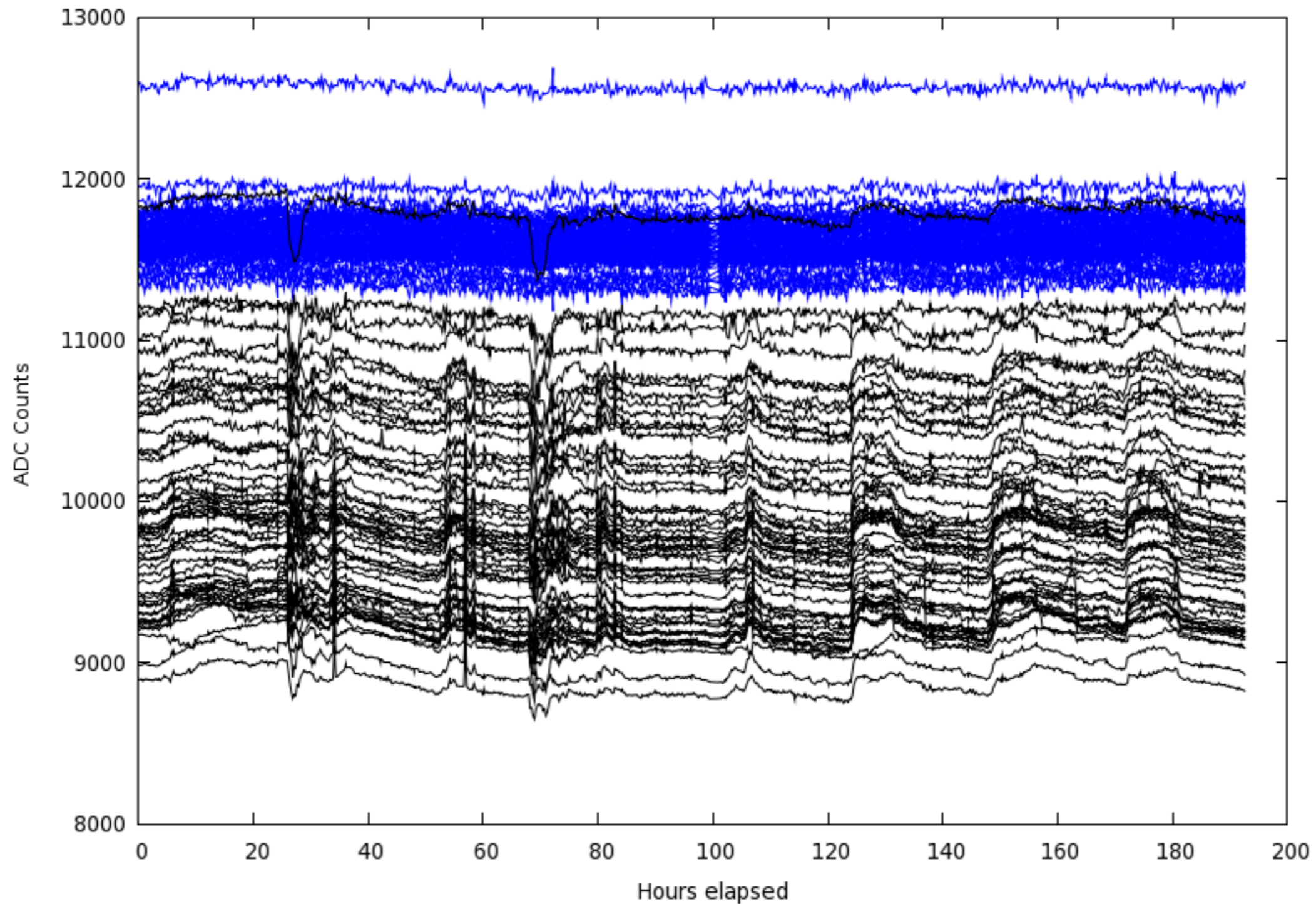
Baseline & antenna signal sampled over 3 bins, averaged over 10 pulses



Without Band Pass Filter (1 Sep – 7 Sep)



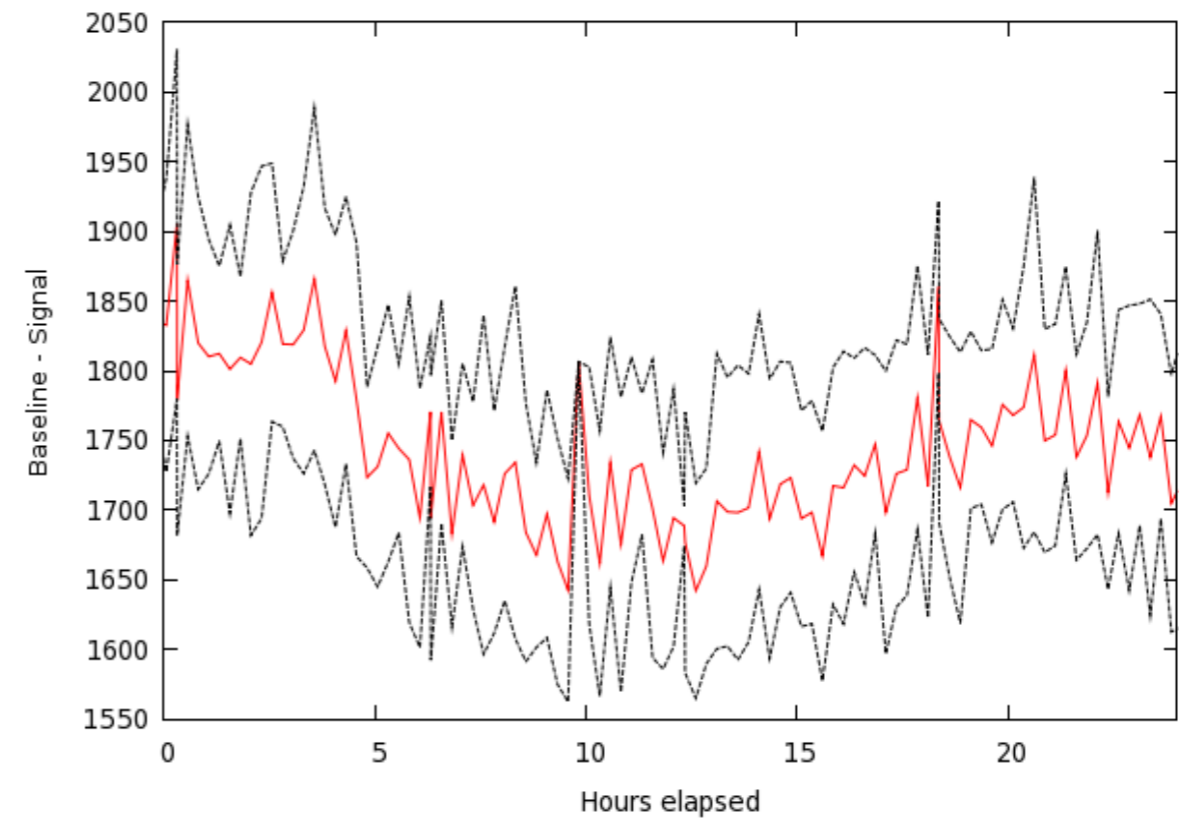
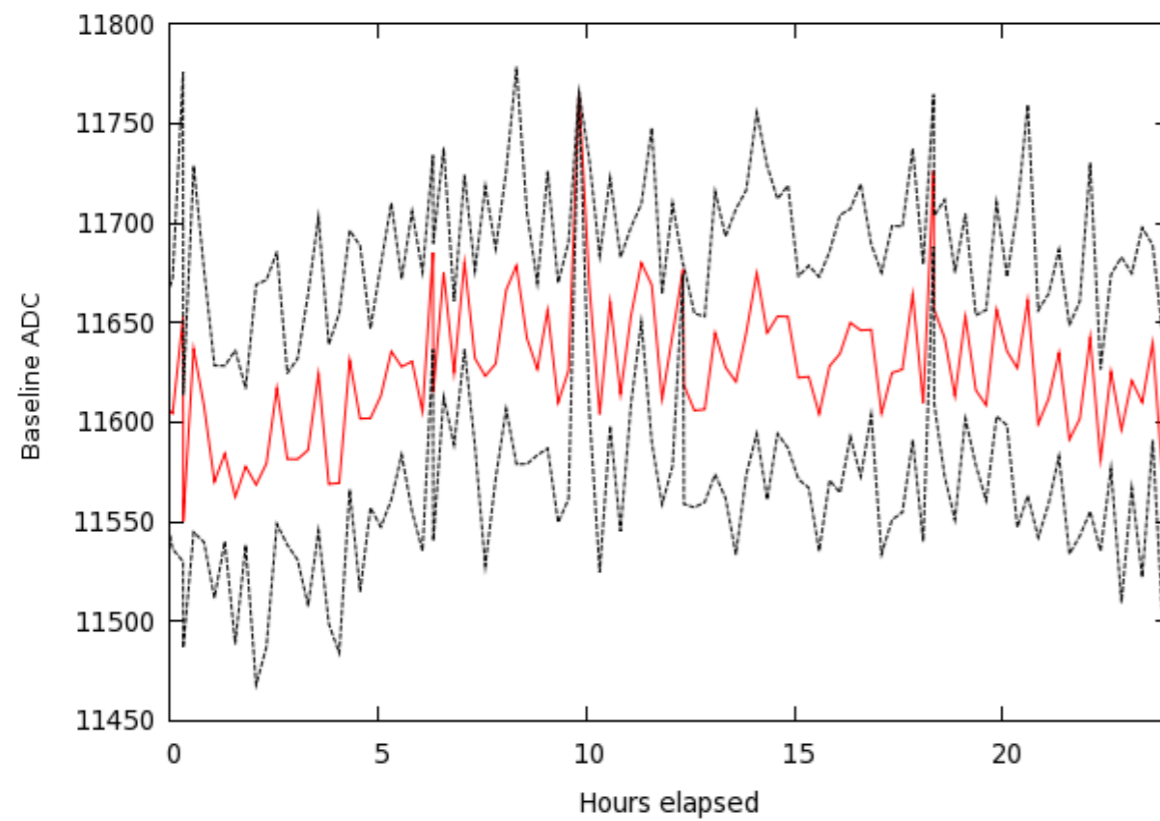
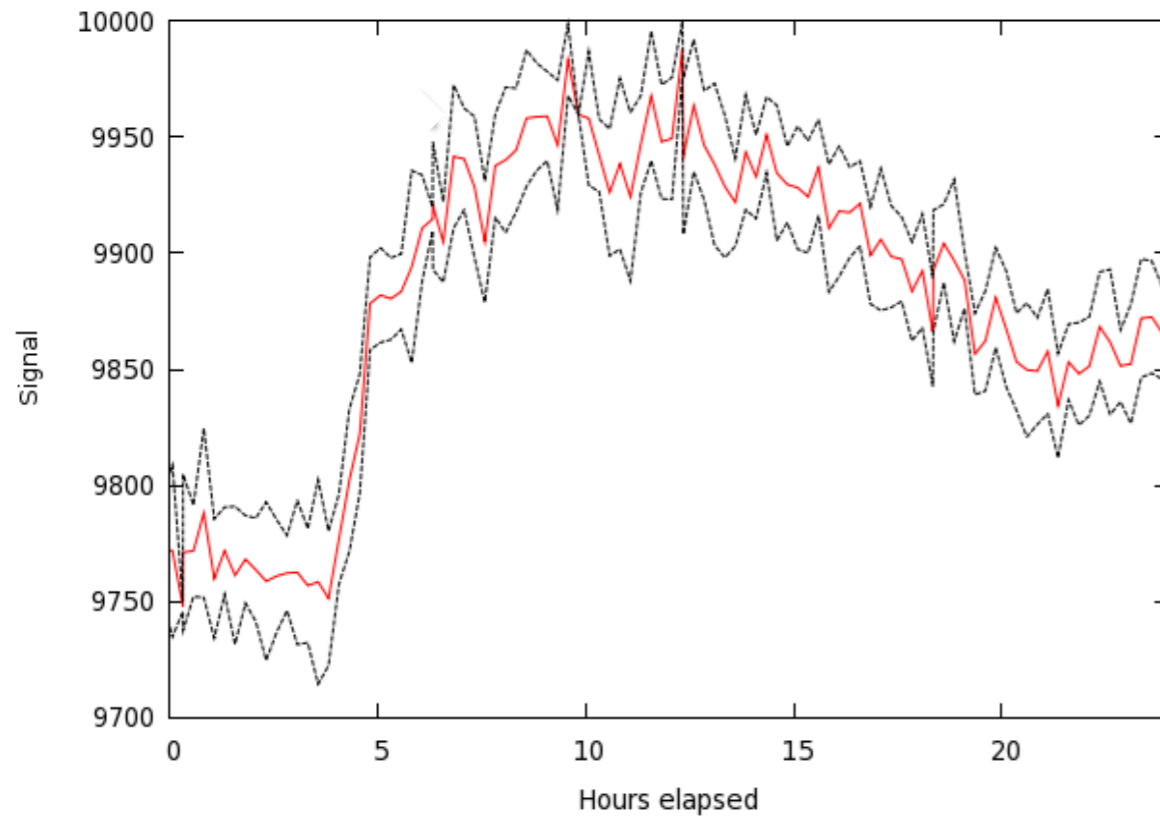
With Band Pass Filters (23 Sep – 30 Sep)

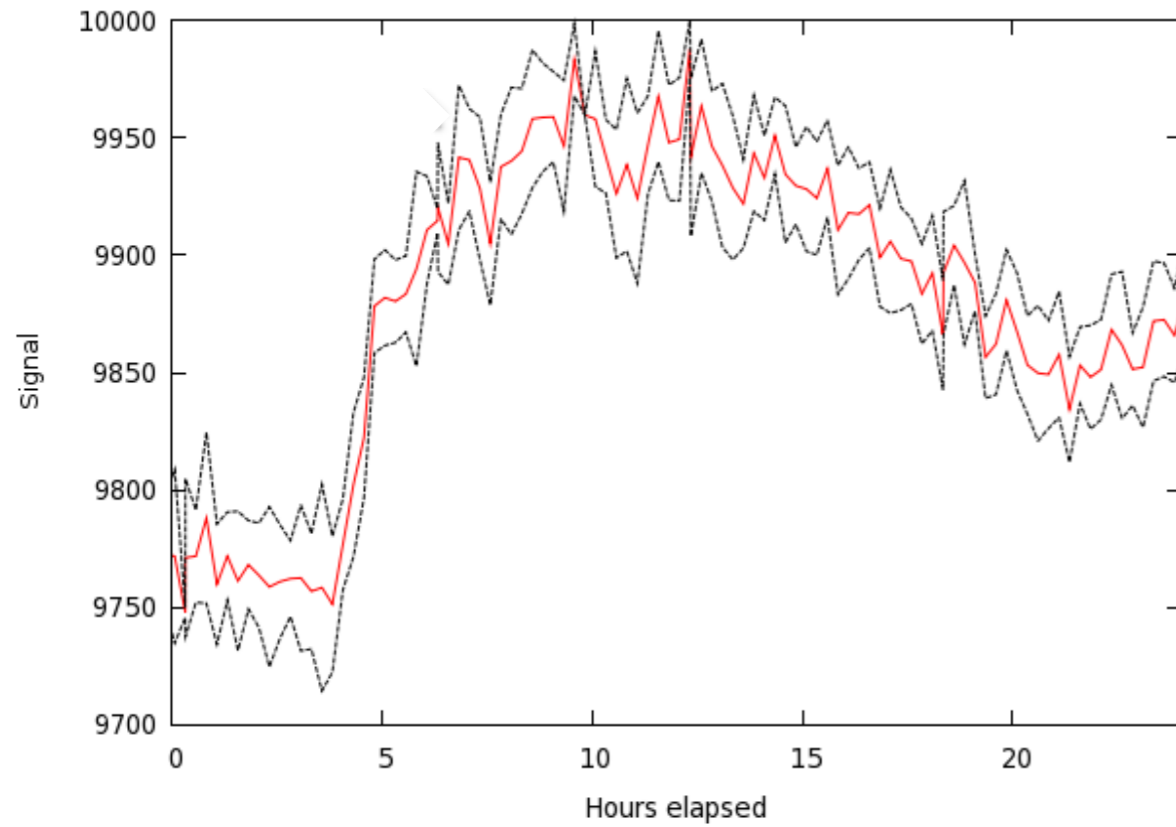


Noise reduction; global decrease in power (increased ADC)

Antenna calibration for 30 September

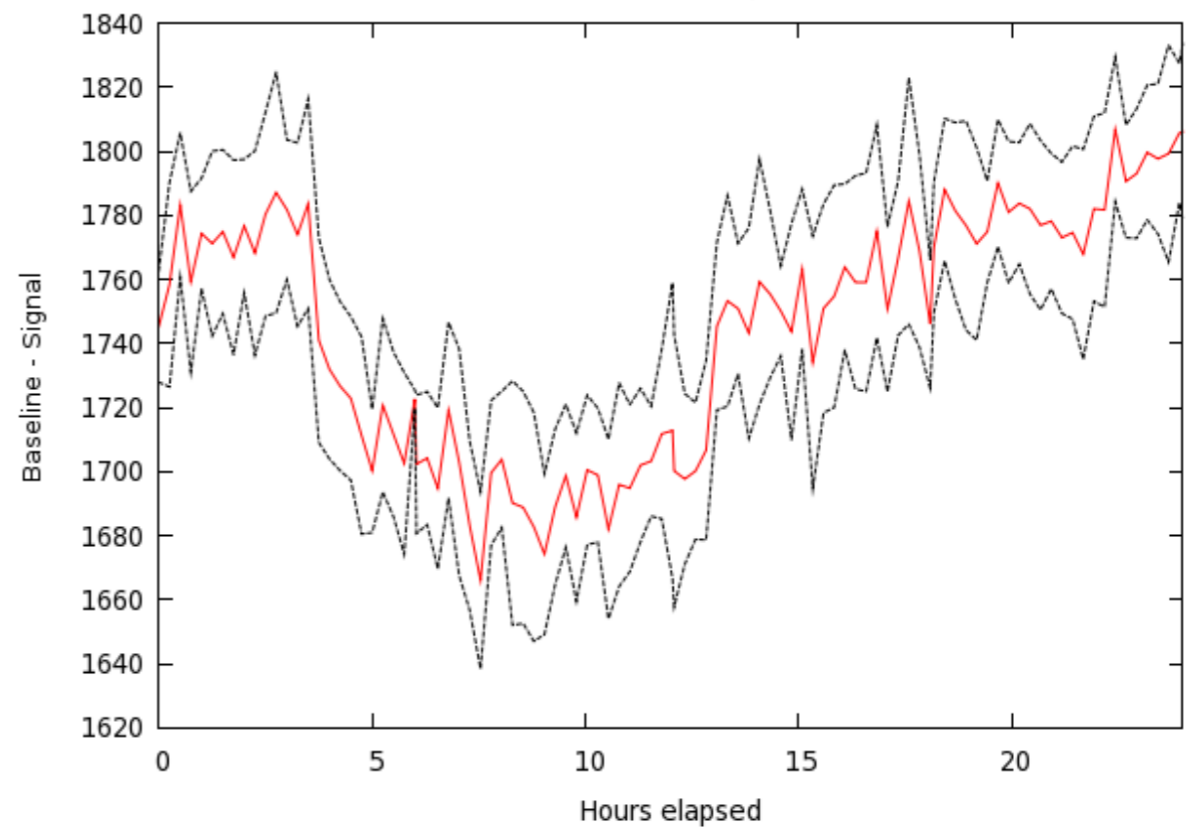
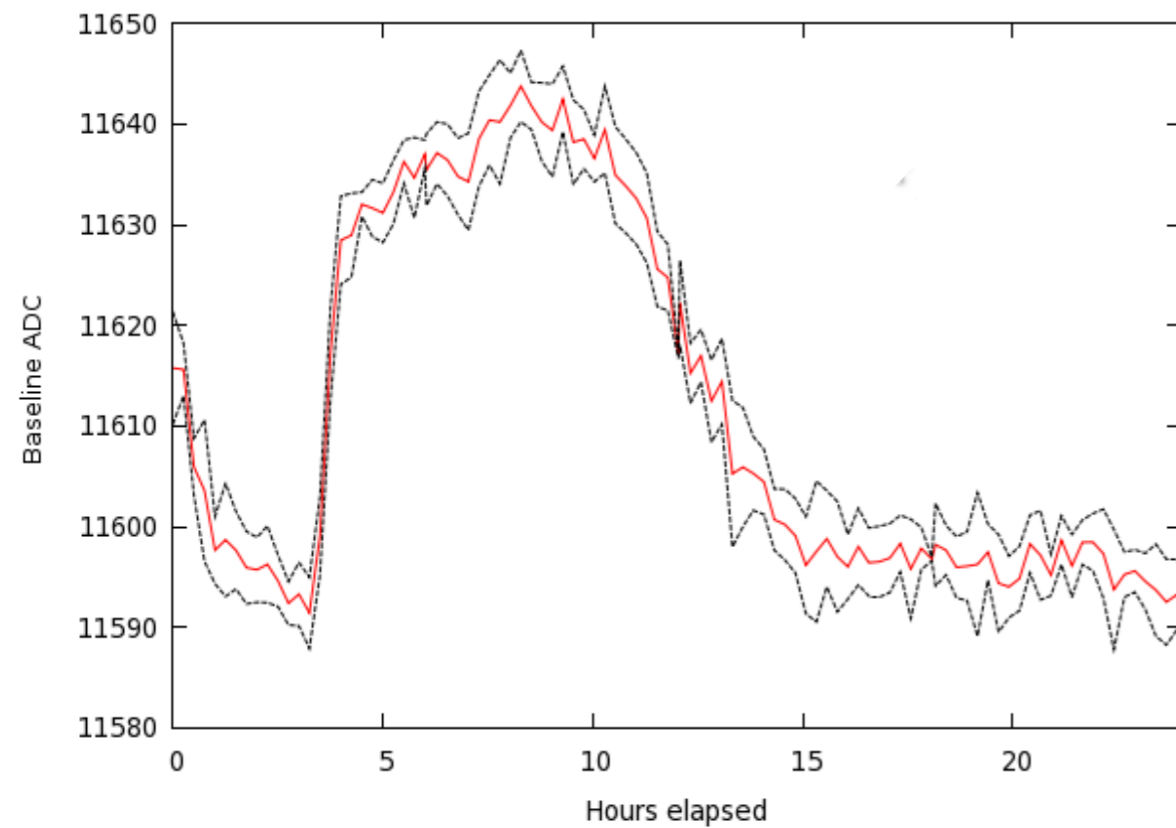
- Dotted lines are $1\text{-}\sigma$ errors (over group of 10 events)
- Signal and baseline sampled over 3 bins
- Errors can be reduced by increasing pulse duration



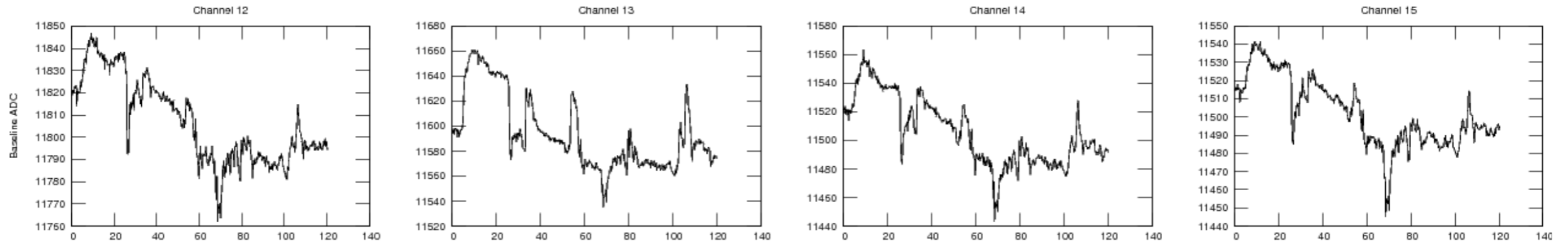


Antenna calibration for 30 September

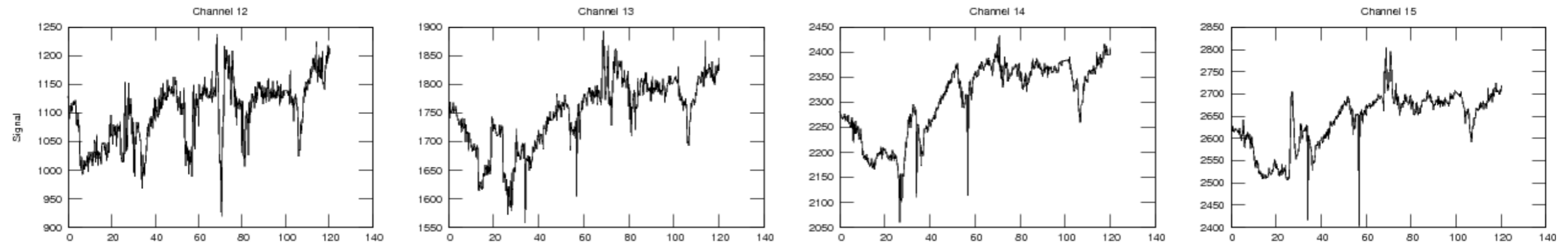
- Baseline sampled over 1000 bins



Baseline (23 Sep – 30 Sep)

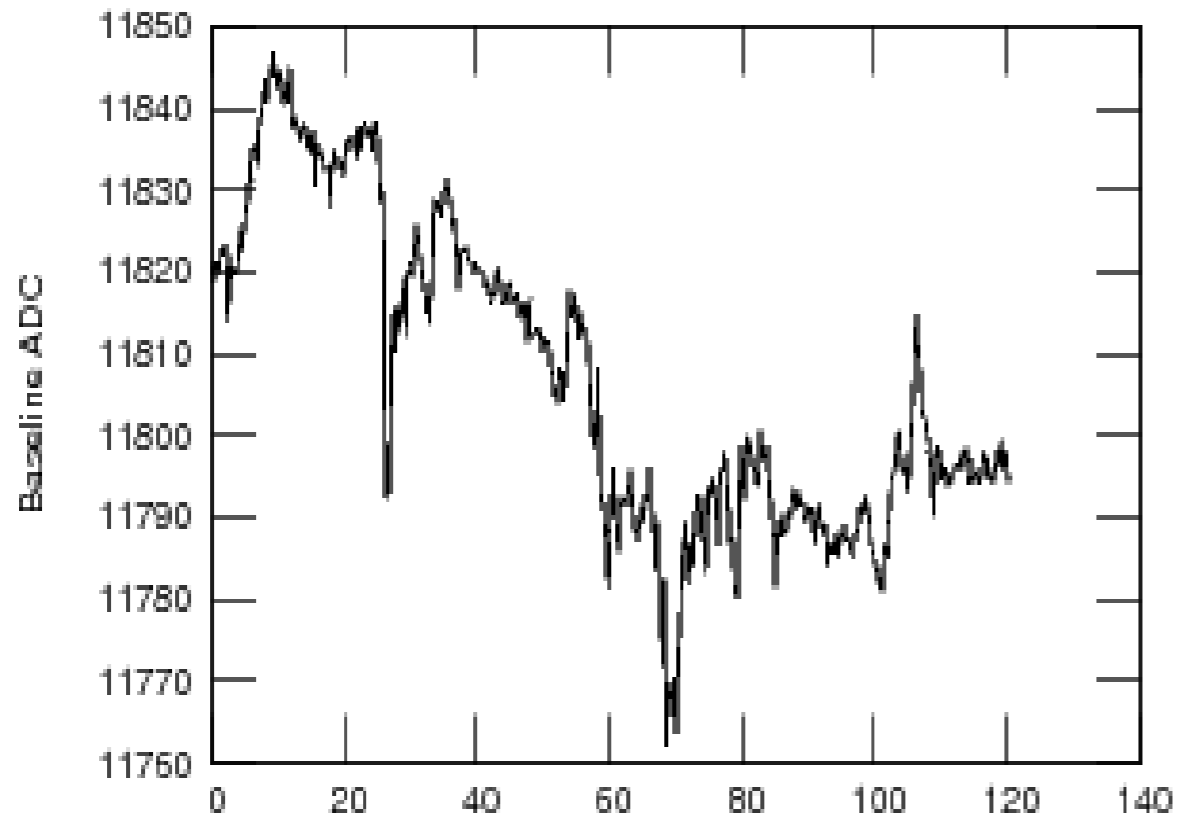


Baseline - Signal (23 Sep – 30 Sep)

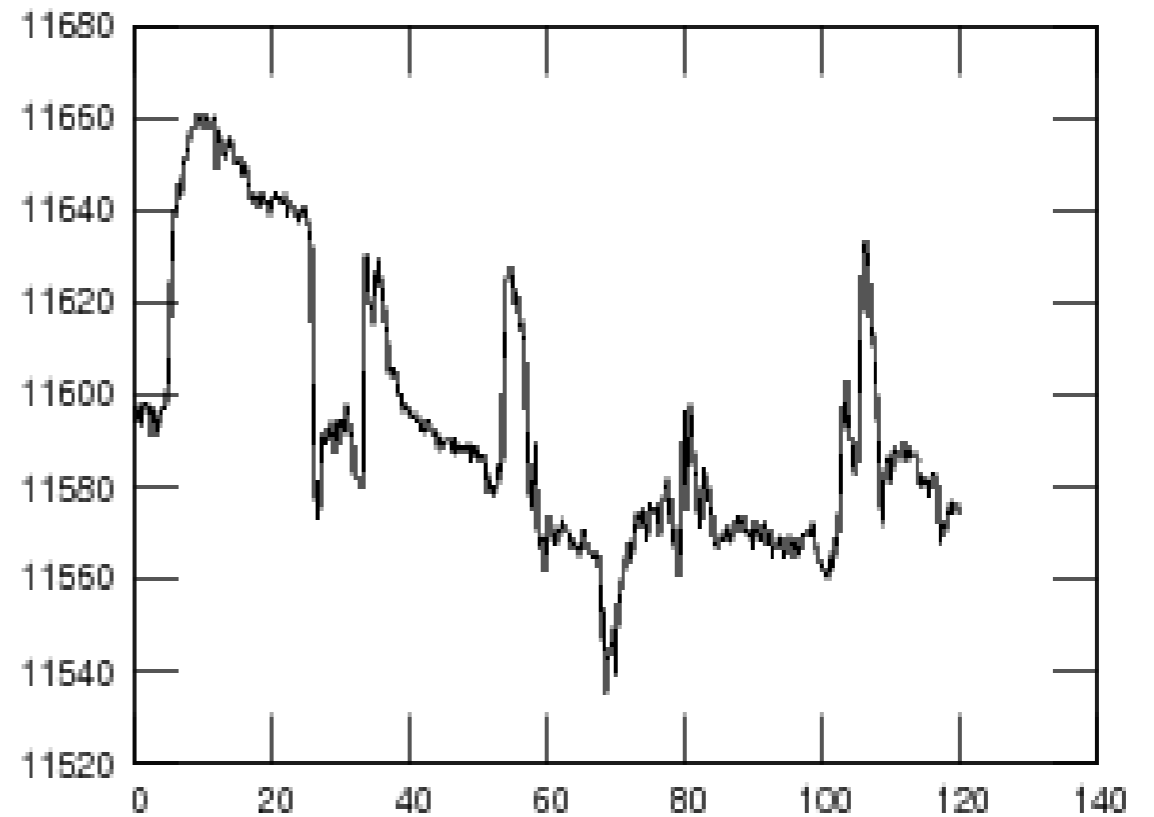


- Large scale baseline fluctuations consistent across detector
- Baseline generally peaks around midday
- Next step: convert ADC to dBm, eliminate baseline variations from signal

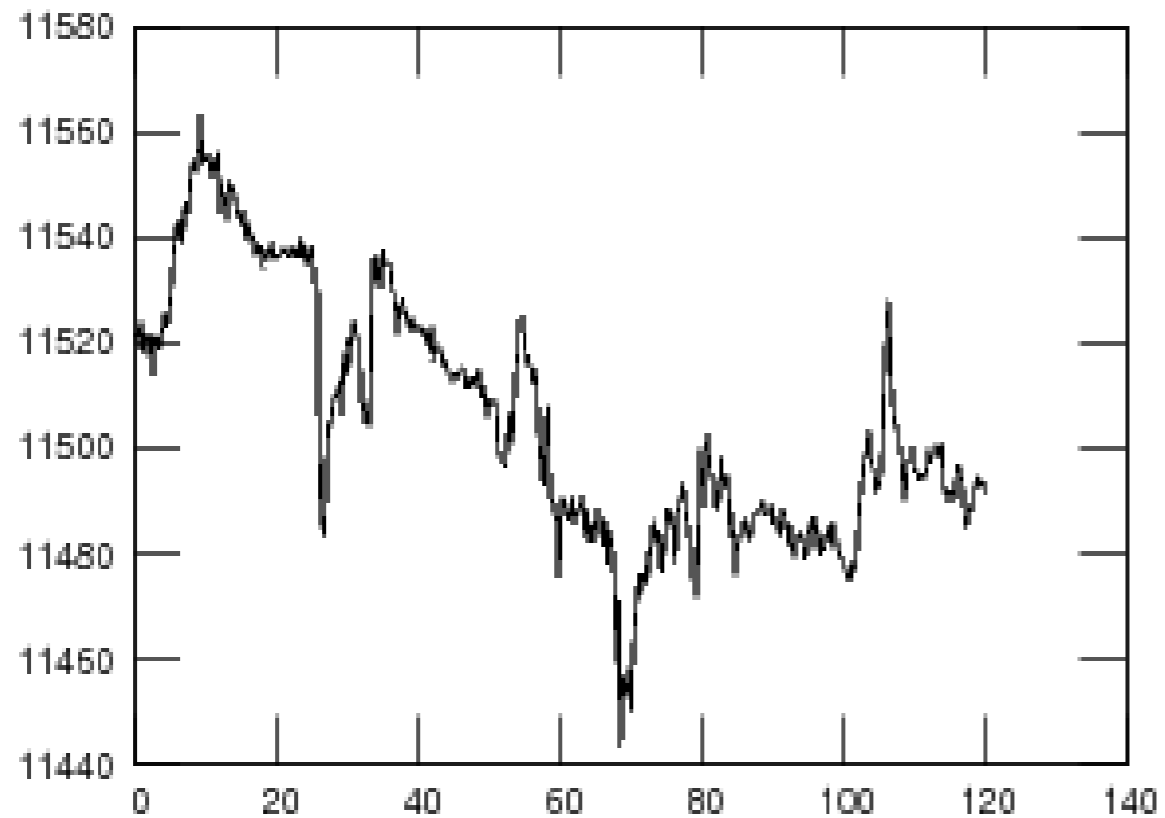
Channel 12



Channel 13



Channel 14



Channel 15

