# Autocorrelation Plots for ACQ164 ADC Noise

## 1.Formalism Followed:

**Autocorrelation plots are formed by**

- **Vertical axis: Autocorrelation coefficient**

$$R_h = C_h / C_0$$

**where $C_h$ is the autocovariance function**

$$C_h = \frac{1}{N} \sum_{t=1}^{N-h} (Y_t - \bar{Y})(Y_{t+h} - \bar{Y})$$

**and $C_0$ is the variance function**

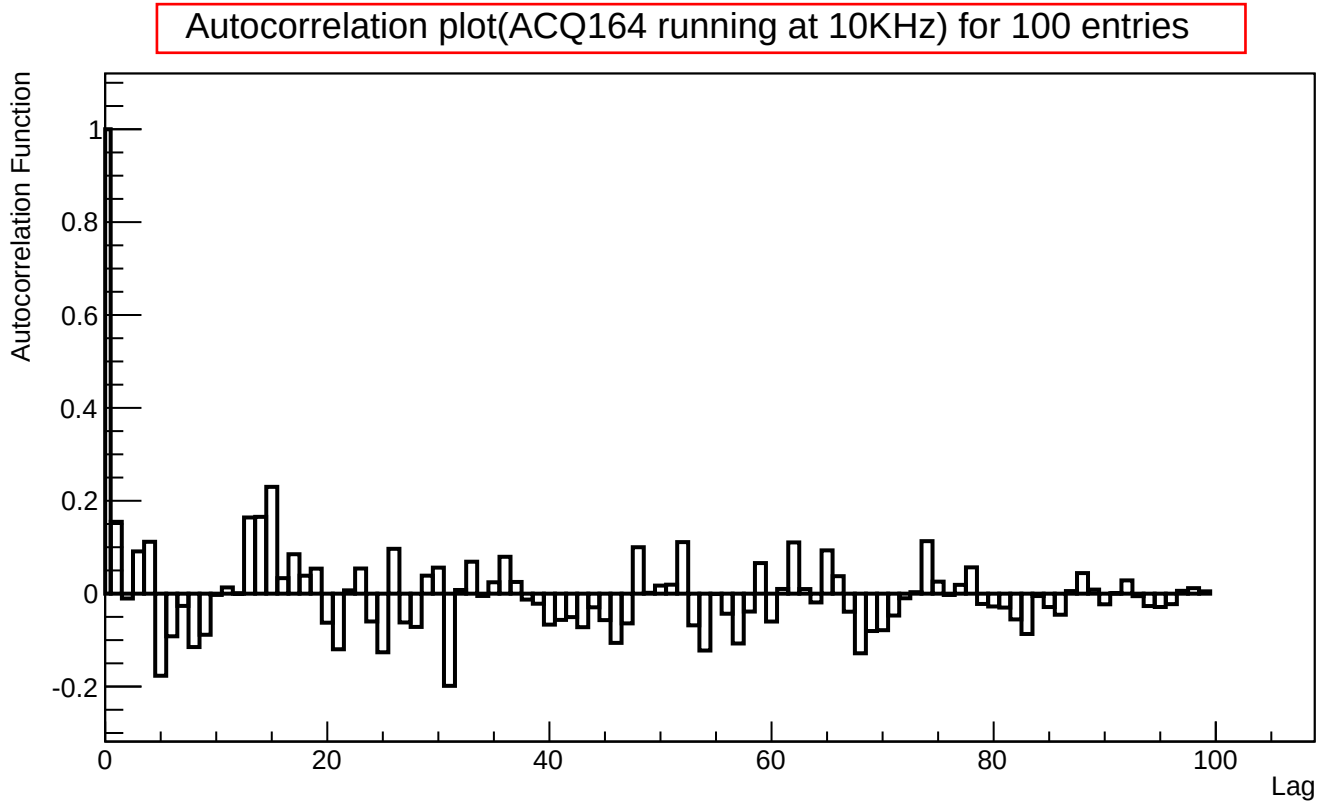
$$C_0 = \frac{\sum_{t=1}^{N} (Y_t - \bar{Y})^2}{N}$$

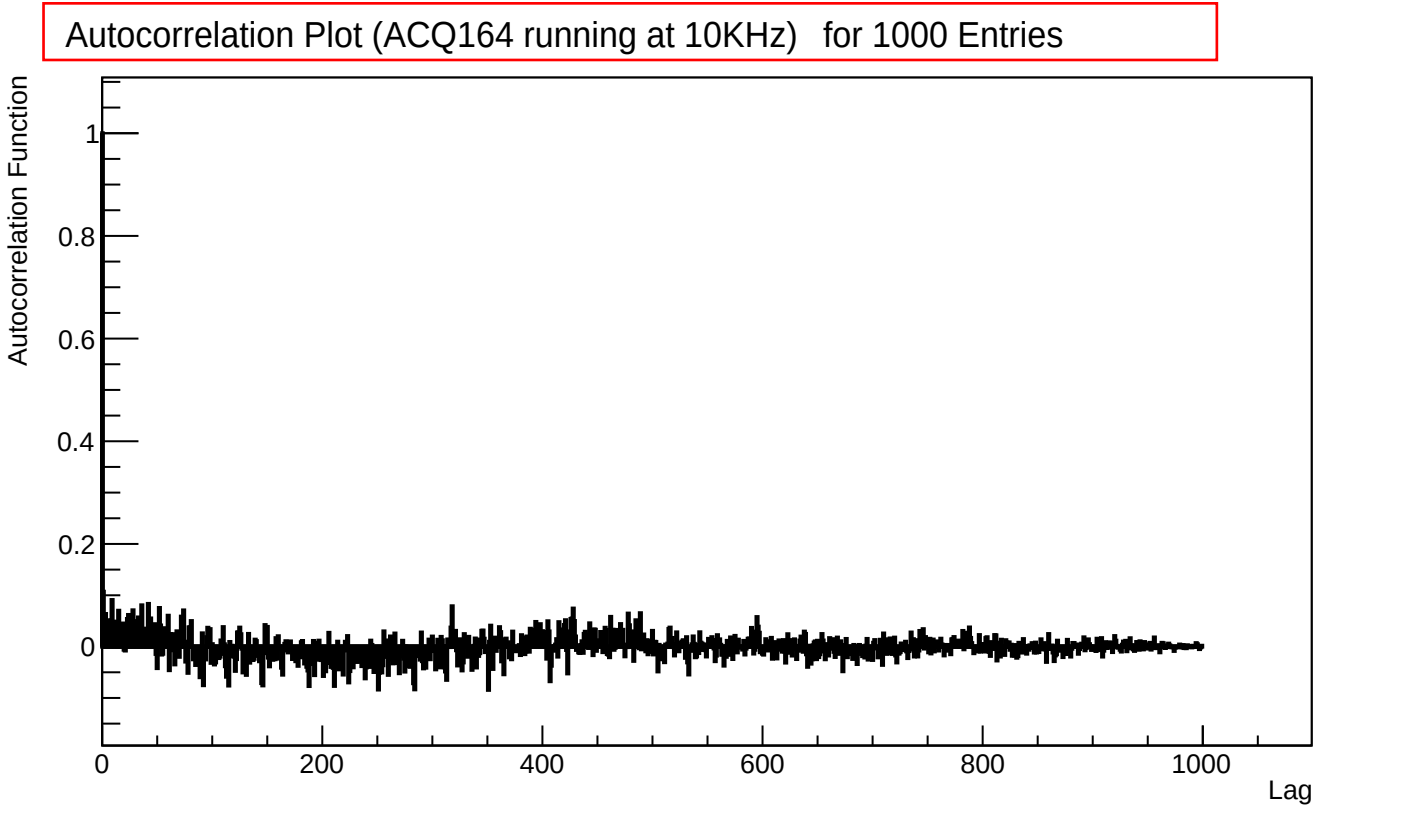
**Note that $R_h$ is between -1 and +1.**

- **Horizontal axis: Time lag $h$ ($h$ = 1, 2, 3, ...)**

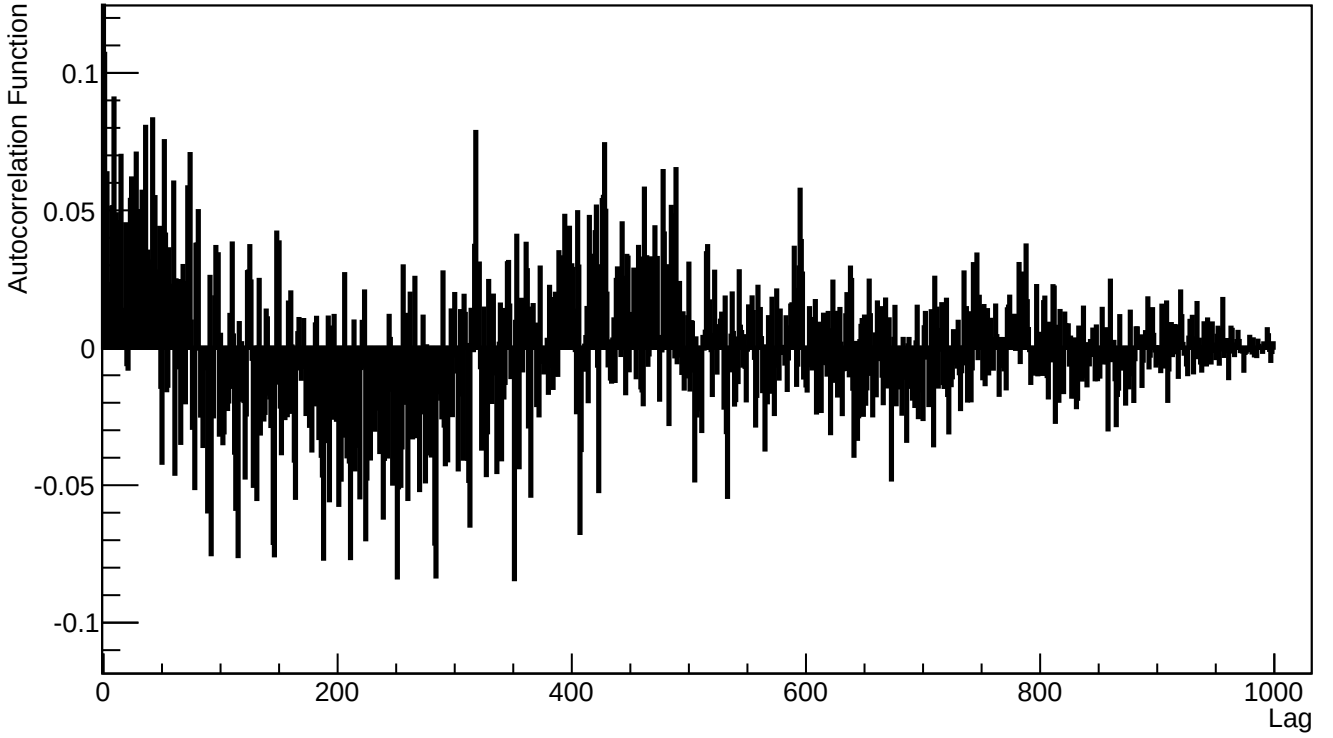
**2. In the data set there were few (3 or 4) values which were completely out of any scale ($10^9$ times out of scale), those ADC values were replaced by hand by the average of previous and next ADC value.**

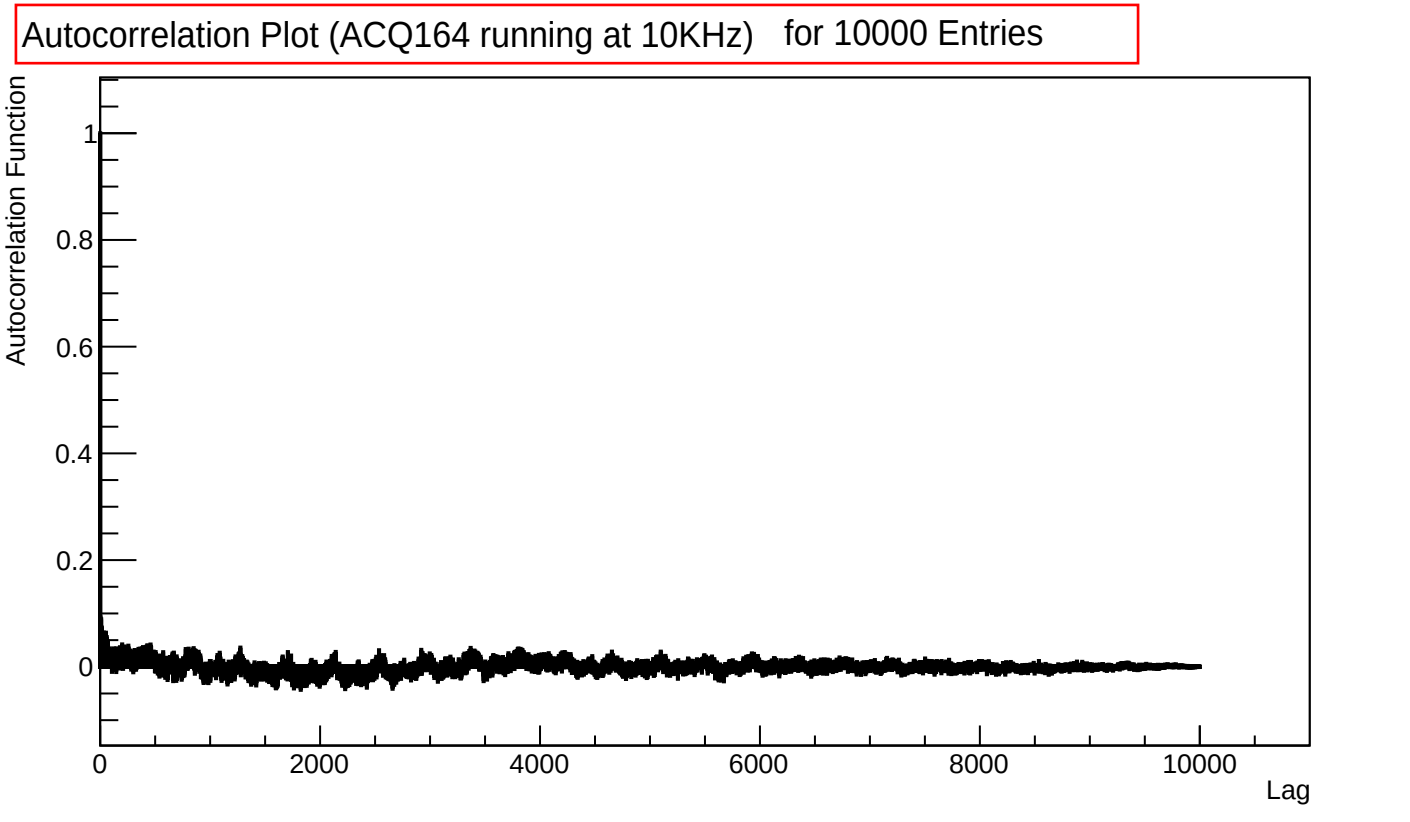
**3. X-axis unit: 1 lag= 100 micro second(for 10Khz) or 20 micro second (for 50KHz), Y-axis unit: Unitless**

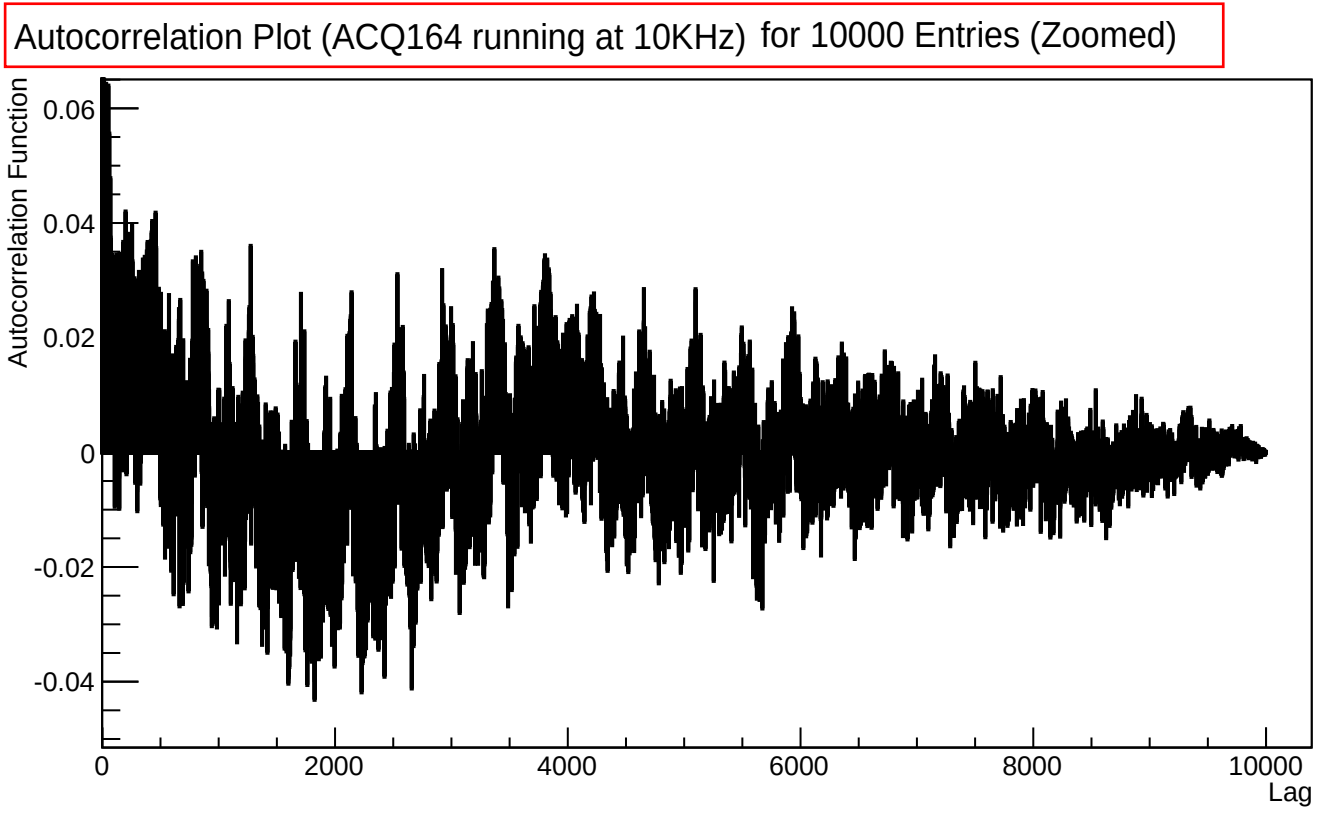

Autocorrelation plot(ACQ164 running at 10KHz) for 100 entries
Autocorrelation Function
1
0.8
0.6
0.4
0.2
0
-0.2
0
20
40
60
80
100
Lag

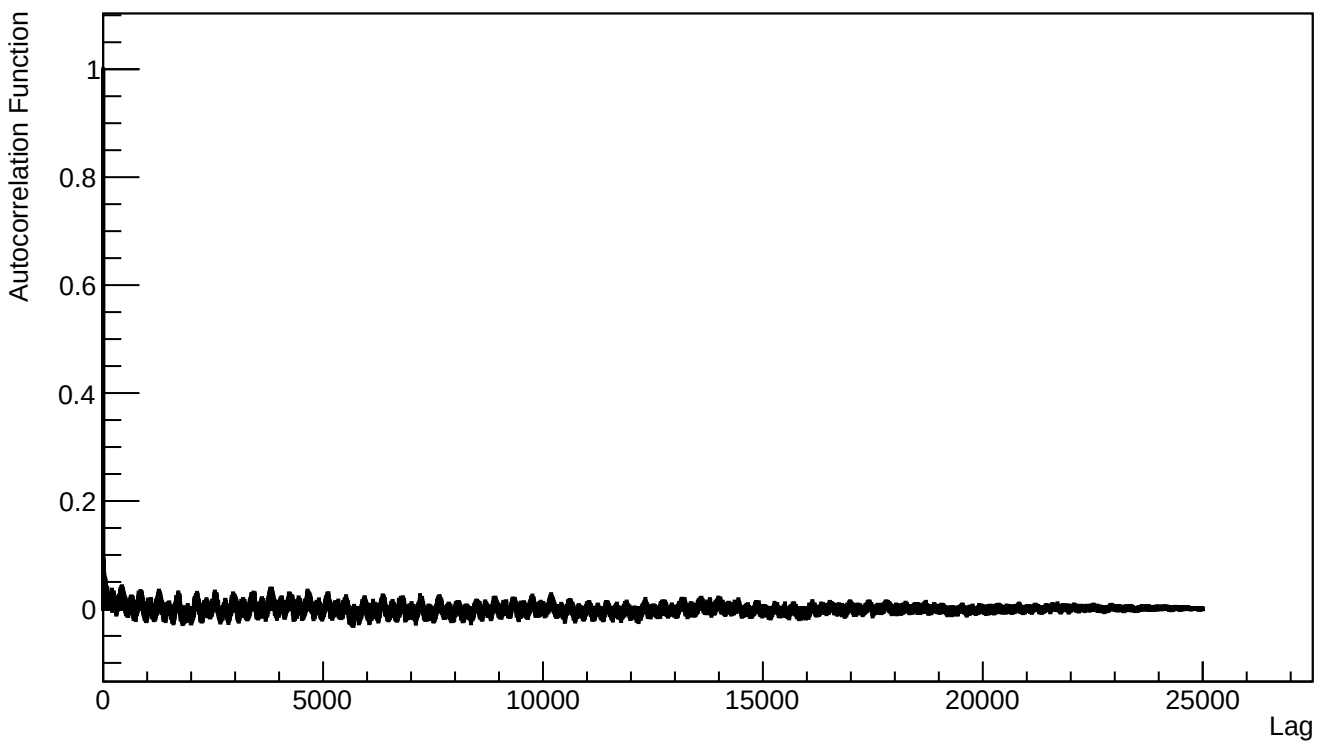

Autocorrelation Plot (ACQ164 running at 10KHz) for 1000 Entries
Autocorrelation Function
1
0.8
0.6
0.4
0.2
0
0
200
400
600
800
1000
Lag

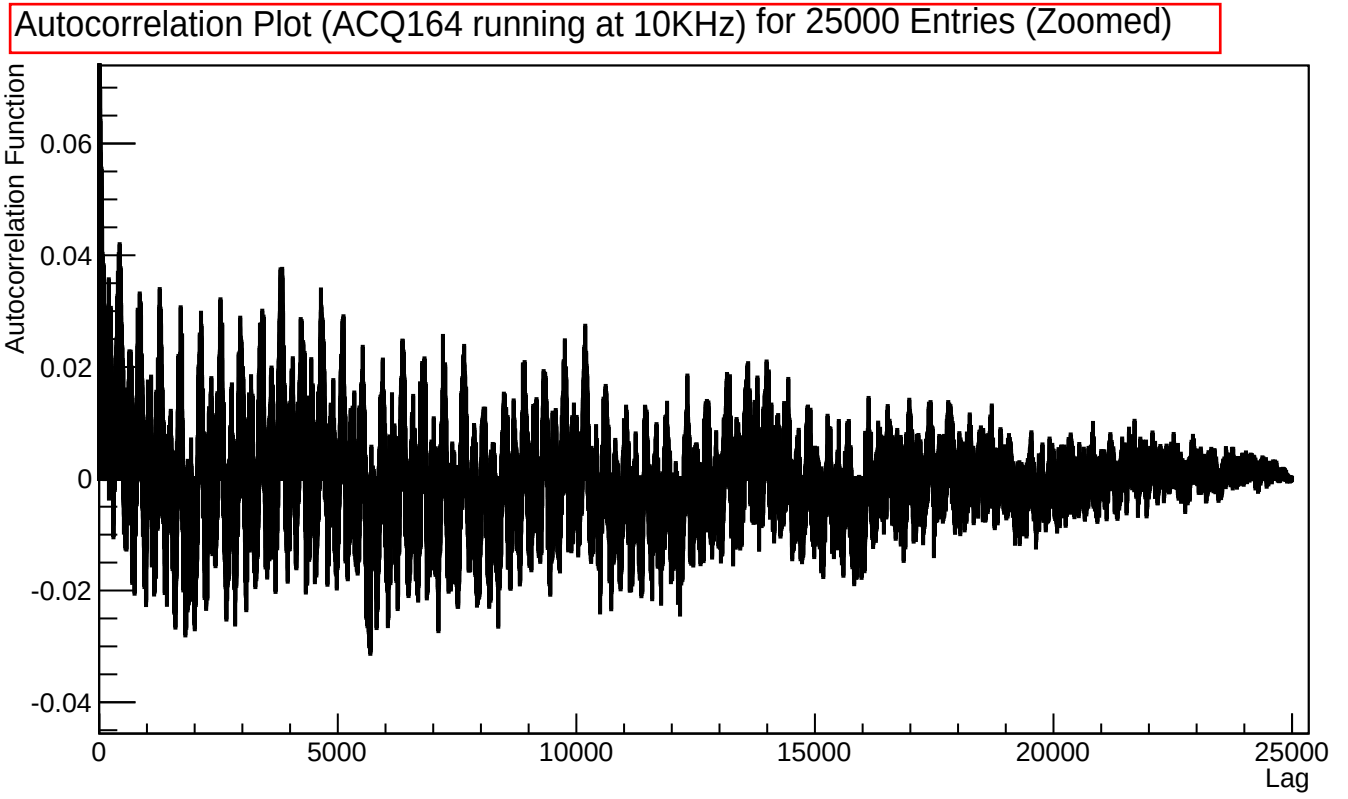
Autocorrelation Plot (ACQ164 running at 10KHz)  for 1000 Entries (Zoomed)

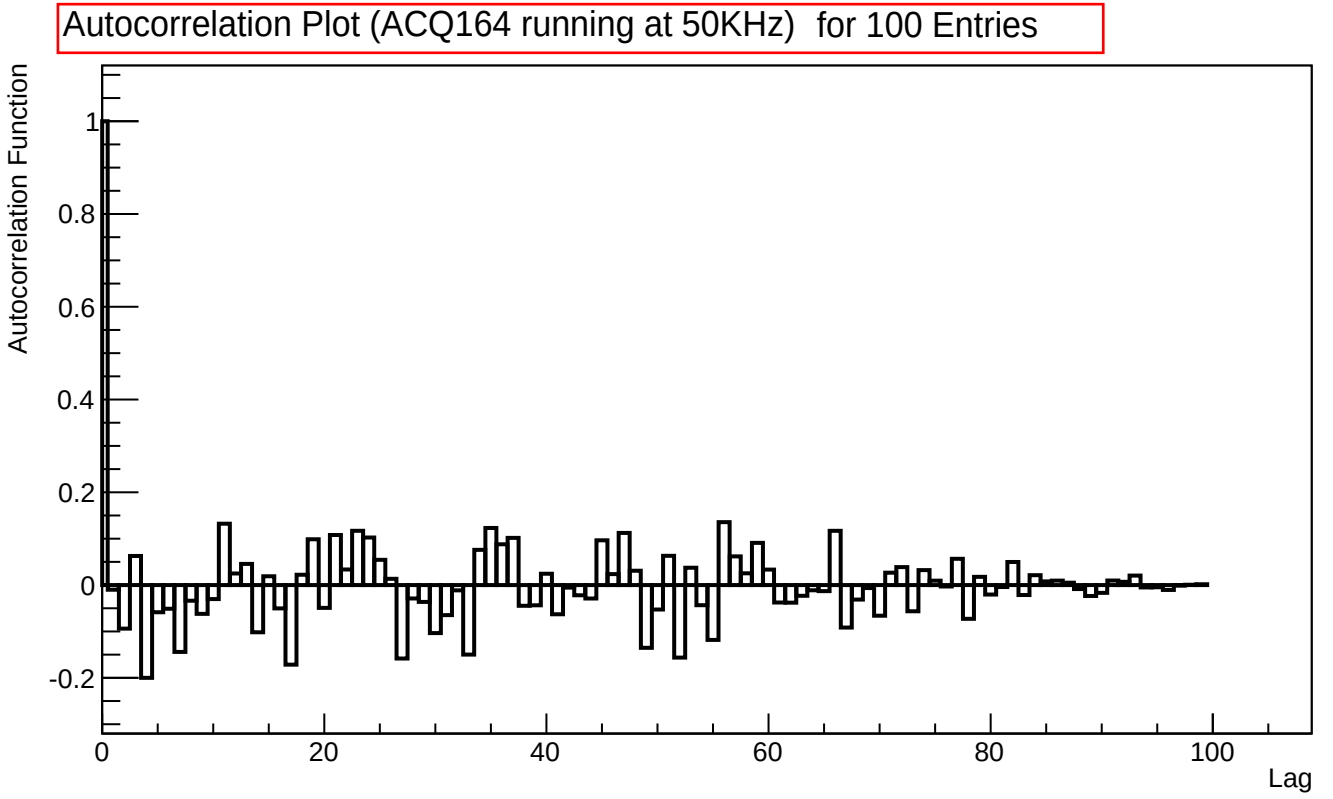


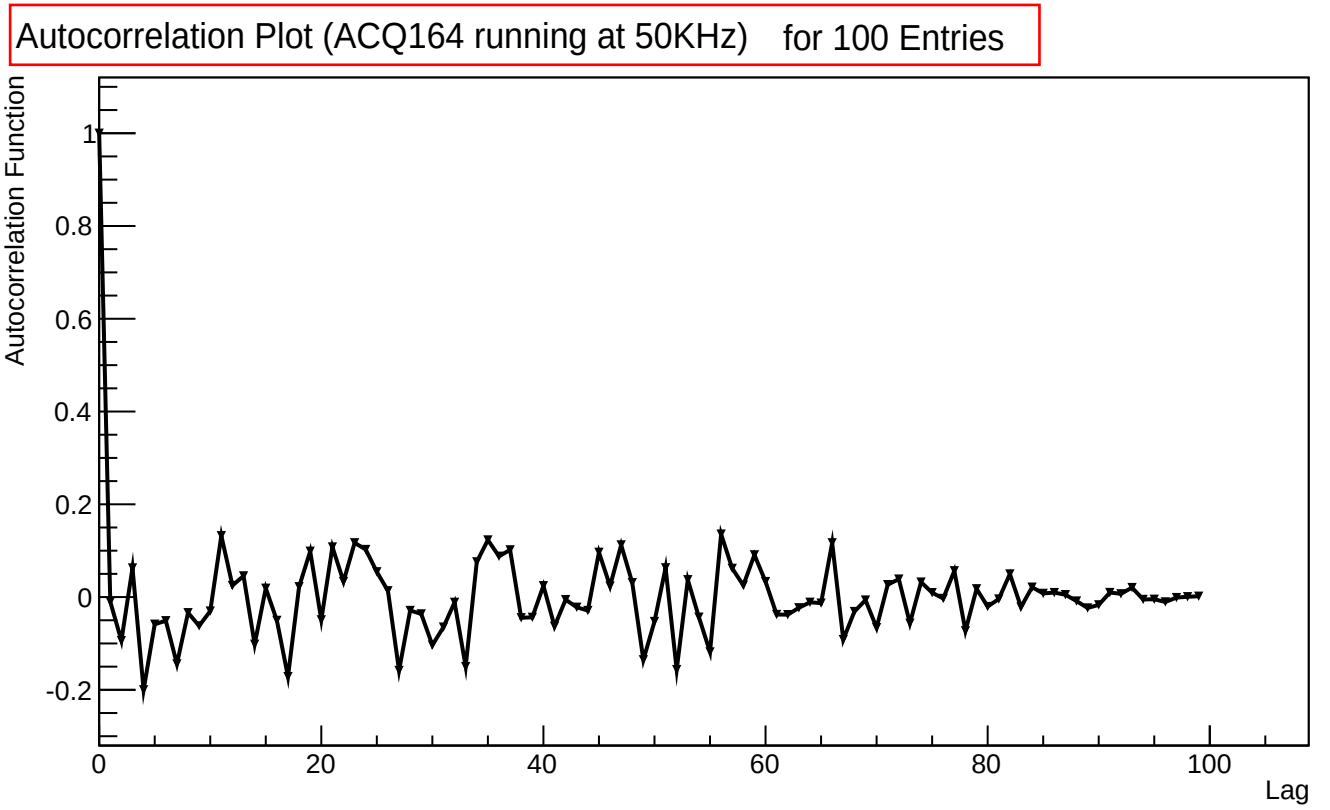

Autocorrelation Plot (ACQ164 running at 10KHz) for 10000 Entries
Autocorrelation Function
1
0.8
0.6
0.4
0.2
0
0
2000
4000
6000
8000
10000
Lag

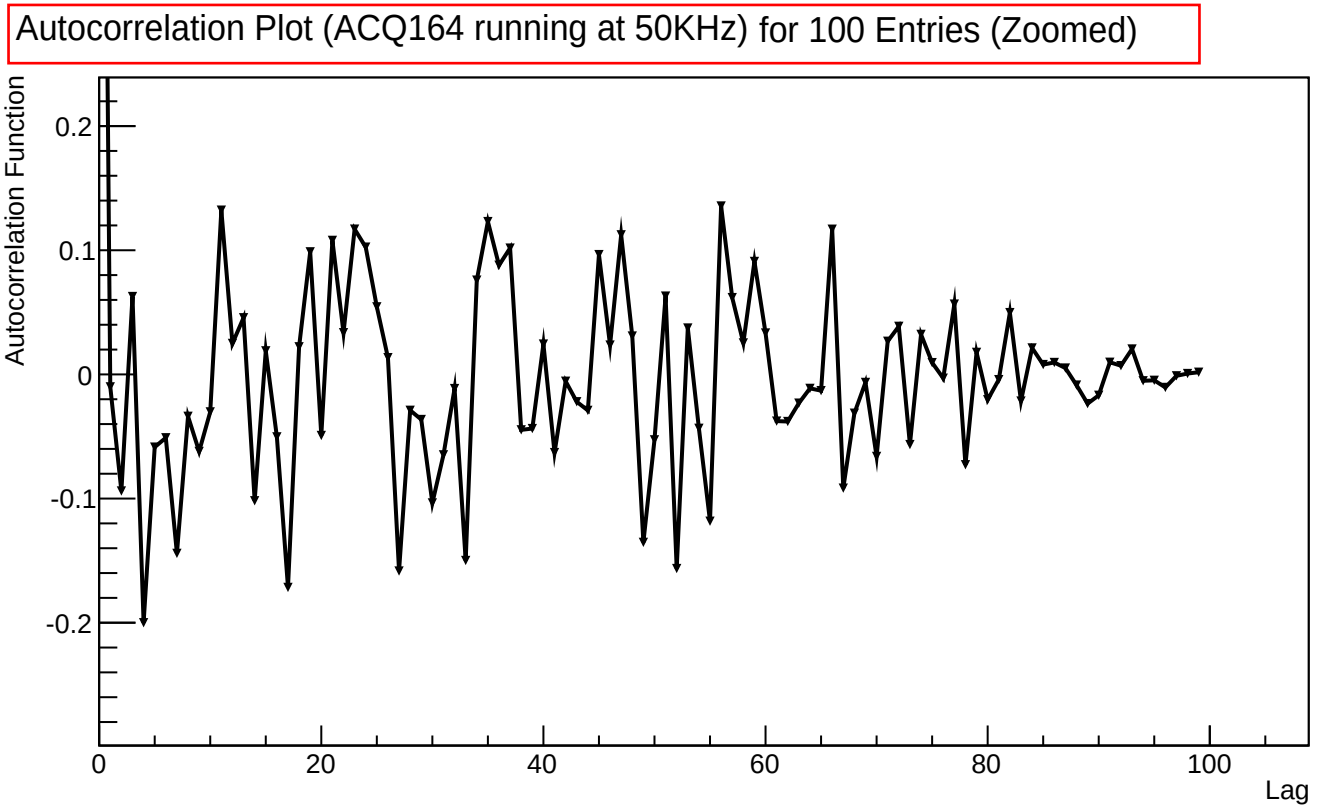

Autocorrelation Plot (ACQ164 running at 10KHz) for 10000 Entries (Zoomed)
Autocorrelation Function
0.06
0.04
0.02
0
-0.02
-0.04
0
2000
4000
6000
8000
10000
Lag

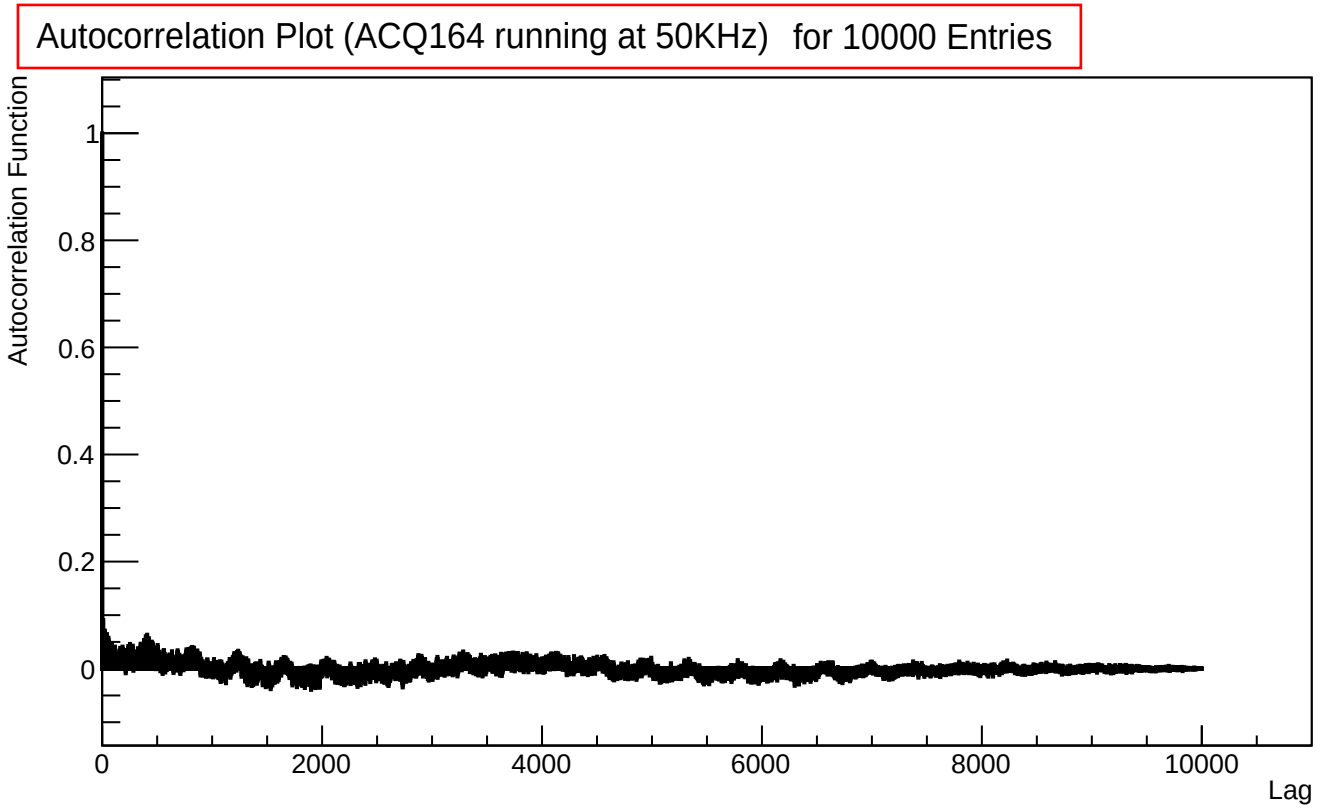

Autocorrelation Plot (ACQ164 running at 10KHz) for 25000 Entries
Autocorrelation Function
1
0.8
0.6
0.4
0.2
0
0
5000
10000
15000
20000
25000
Lag

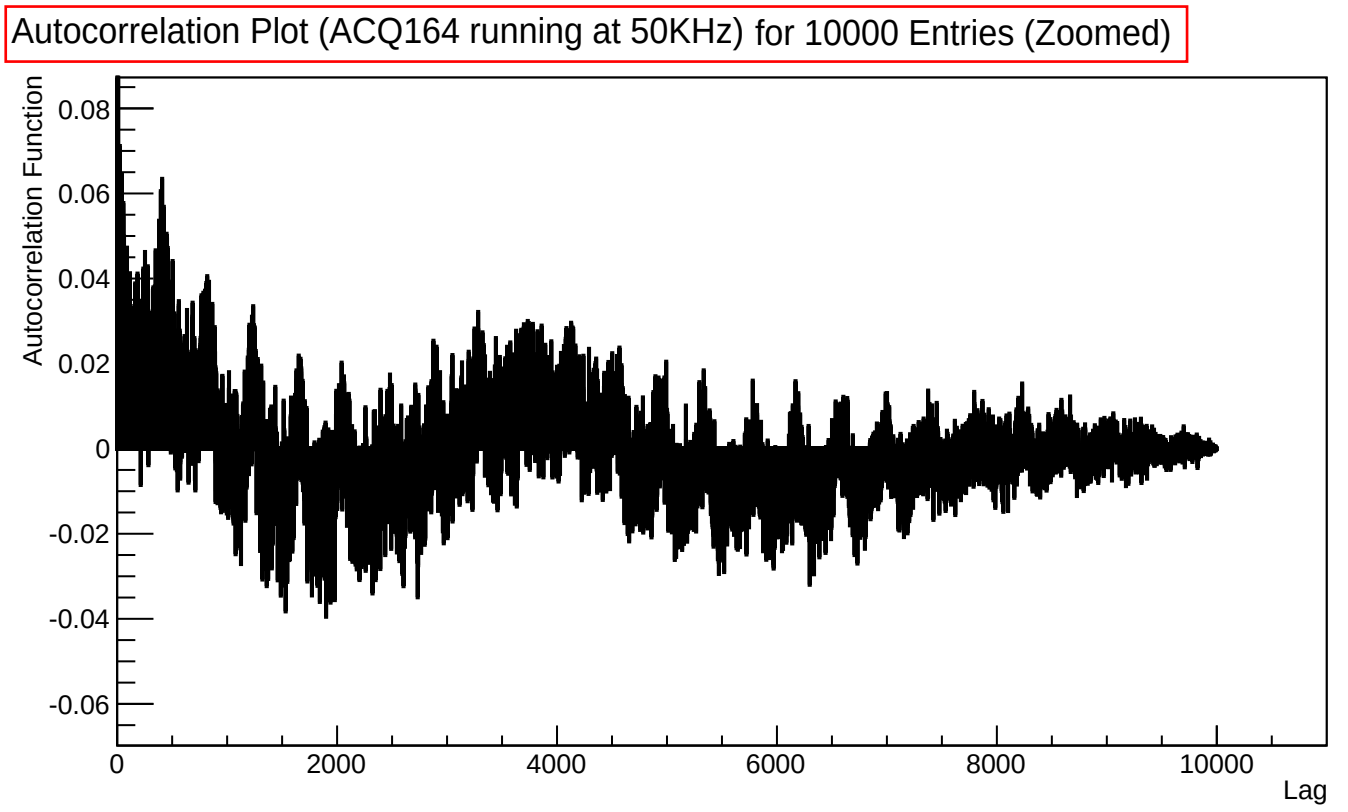

Autocorrelation Plot (ACQ164 running at 10KHz) for 25000 Entries (Zoomed)
Autocorrelation Function
0.06
0.04
0.02
0
-0.02
-0.04
0
5000
10000
15000
20000
25000
Lag

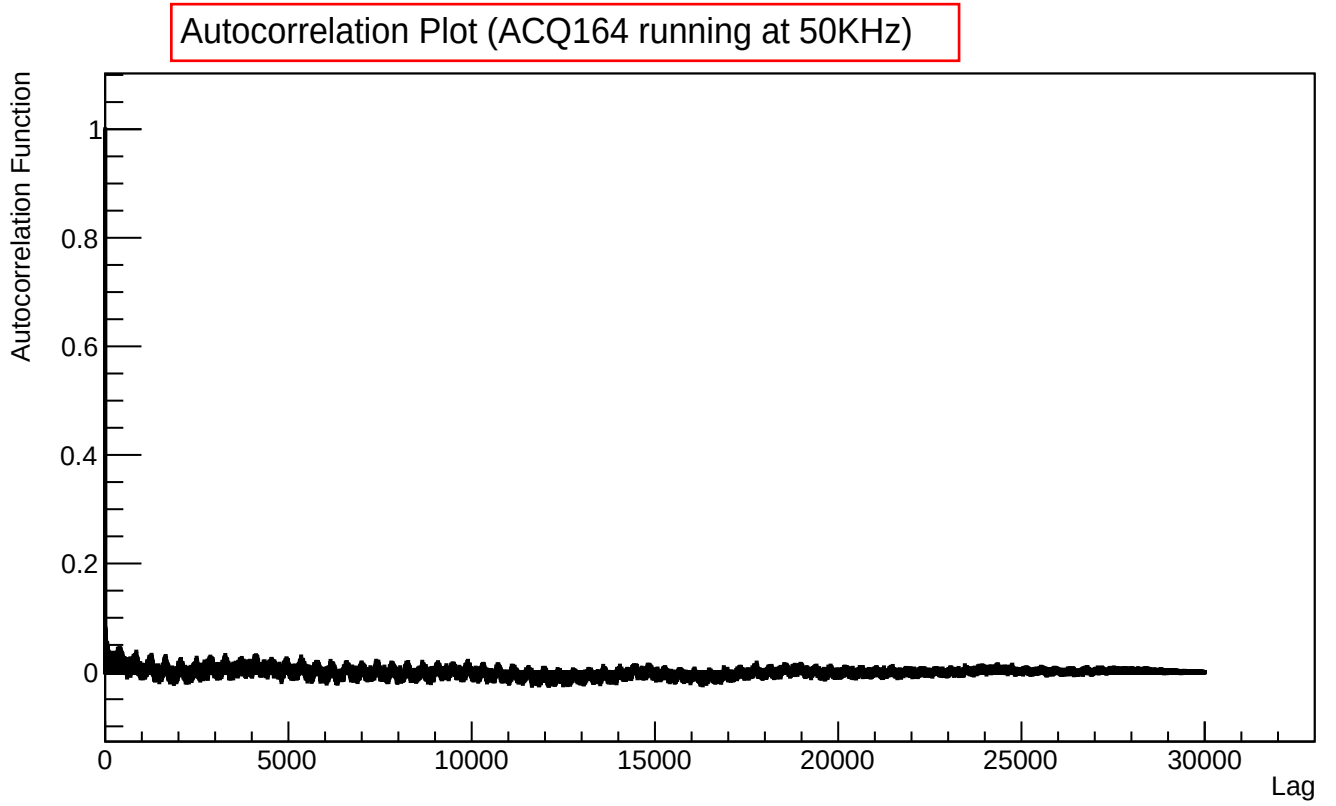

Autocorrelation Plot (ACQ164 running at 50KHz) for 100 Entries
Autocorrelation Function
1
0.8
0.6
0.4
0.2
0
-0.2
0
20
40
60
80
100
Lag

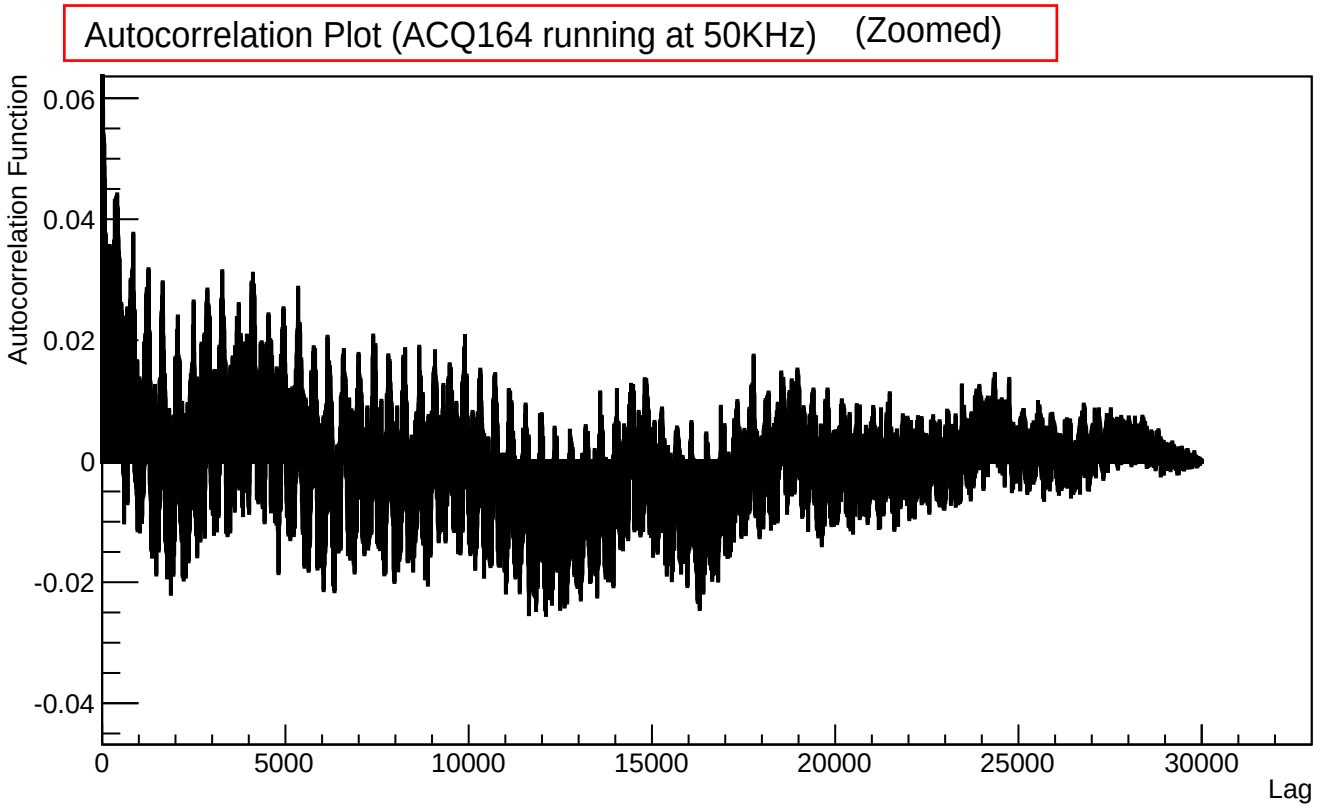

Autocorrelation Plot (ACQ164 running at 50KHz) for 100 Entries
Autocorrelation Function
1
0.8
0.6
0.4
0.2
0
-0.2
0
20
40
60
80
100
Lag


Autocorrelation Plot (ACQ164 running at 50KHz) for 100 Entries (Zoomed)
Autocorrelation Function
0.2
0.1
0
-0.1
-0.2
0
20
40
60
80
100
Lag


Autocorrelation Plot (ACQ164 running at 50KHz) for 10000 Entries
Autocorrelation Function
1
0.8
0.6
0.4
0.2
0
0
2000
4000
6000
8000
10000
Lag


Autocorrelation Plot (ACQ164 running at 50KHz) for 10000 Entries (Zoomed)
Autocorrelation Function
0.08
0.06
0.04
0.02
0
-0.02
-0.04
-0.06
0
2000
4000
6000
8000
10000
Lag


Autocorrelation Plot (ACQ164 running at 50KHz)
Autocorrelation Function
1
0.8
0.6
0.4
0.2
0
0
5000
10000
15000
20000
25000
30000
Lag


Autocorrelation Plot (ACQ164 running at 50KHz) (Zoomed)
Autocorrelation Function
0.06
0.04
0.02
0
-0.02
-0.04
0
5000
10000
15000
20000
25000
30000
Lag