Correlations

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Correlations

- Instrumental asymmetry, full setup
- Instrumental asymmetry ADC only.
- Up-Down asymmetry.

Covariance matrix

- For detector m, and pulse pair i, the instrumental asymmetry is:

$$A_{m,i}=Y^{+}_{i}-Y^{-}_{i}$$

- Covariance:

$$C_{m,n}=\frac{1}{N}\sum_{i=1}^{N}\left(A_{m,i}-\mu_m\right)\left(A_{n,i}-\mu_n\right)$$

- Correlation:

$$D_{m,n}=\frac{C_{m,n}}{\sigma_m\sigma_n}$$

The test

- $A_{m,i}$ are Gaussian random variables, hence

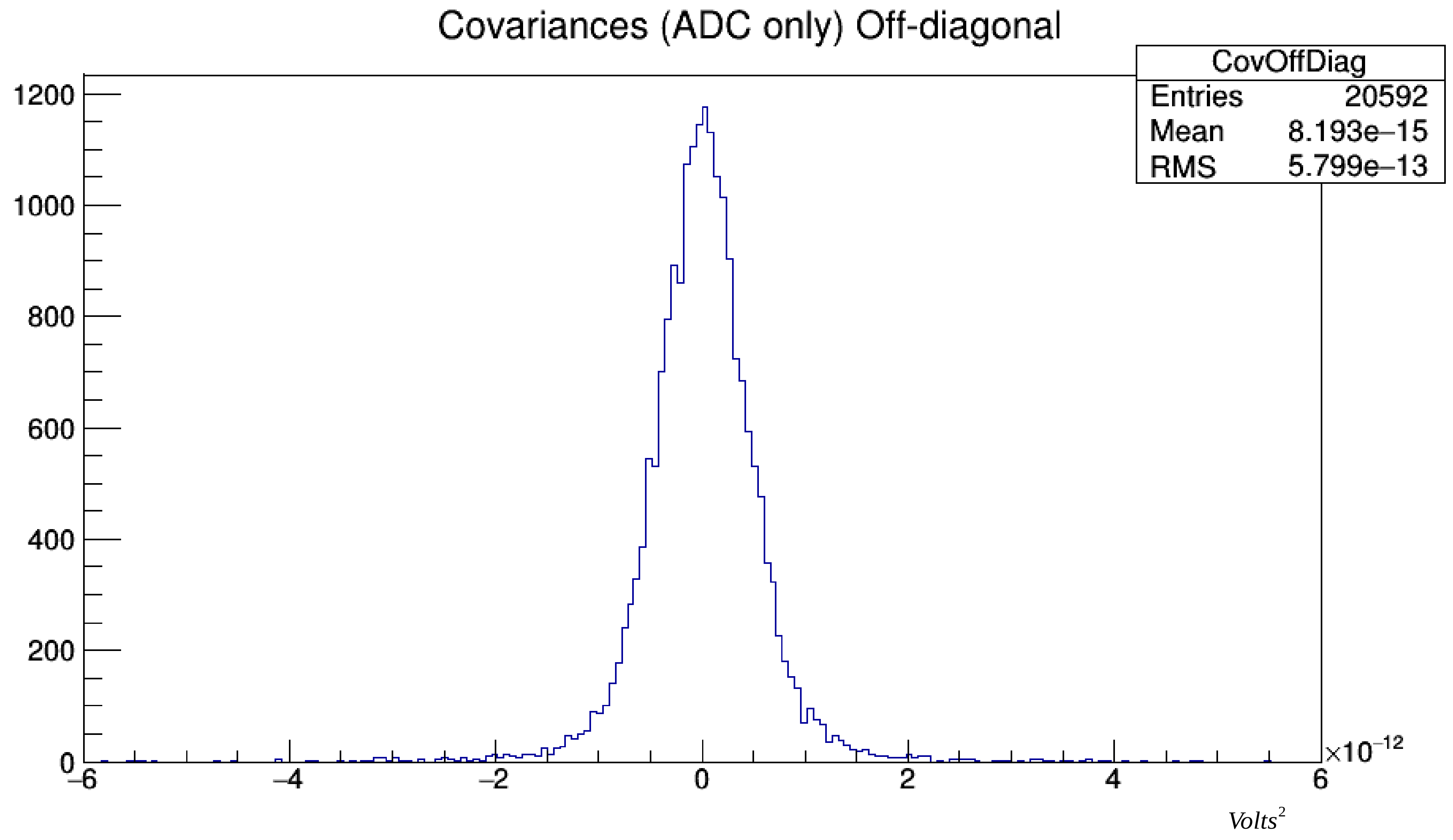
  $E(A_{m,i})=0$

- If detector m and n are independent, then $E(A_{m,i}\ A_{n,i})=E(A_{m,i})E(A_{n,i})=0$

- From the central limit theorem the PDF of $C_{m,n}$ is Gaussian.

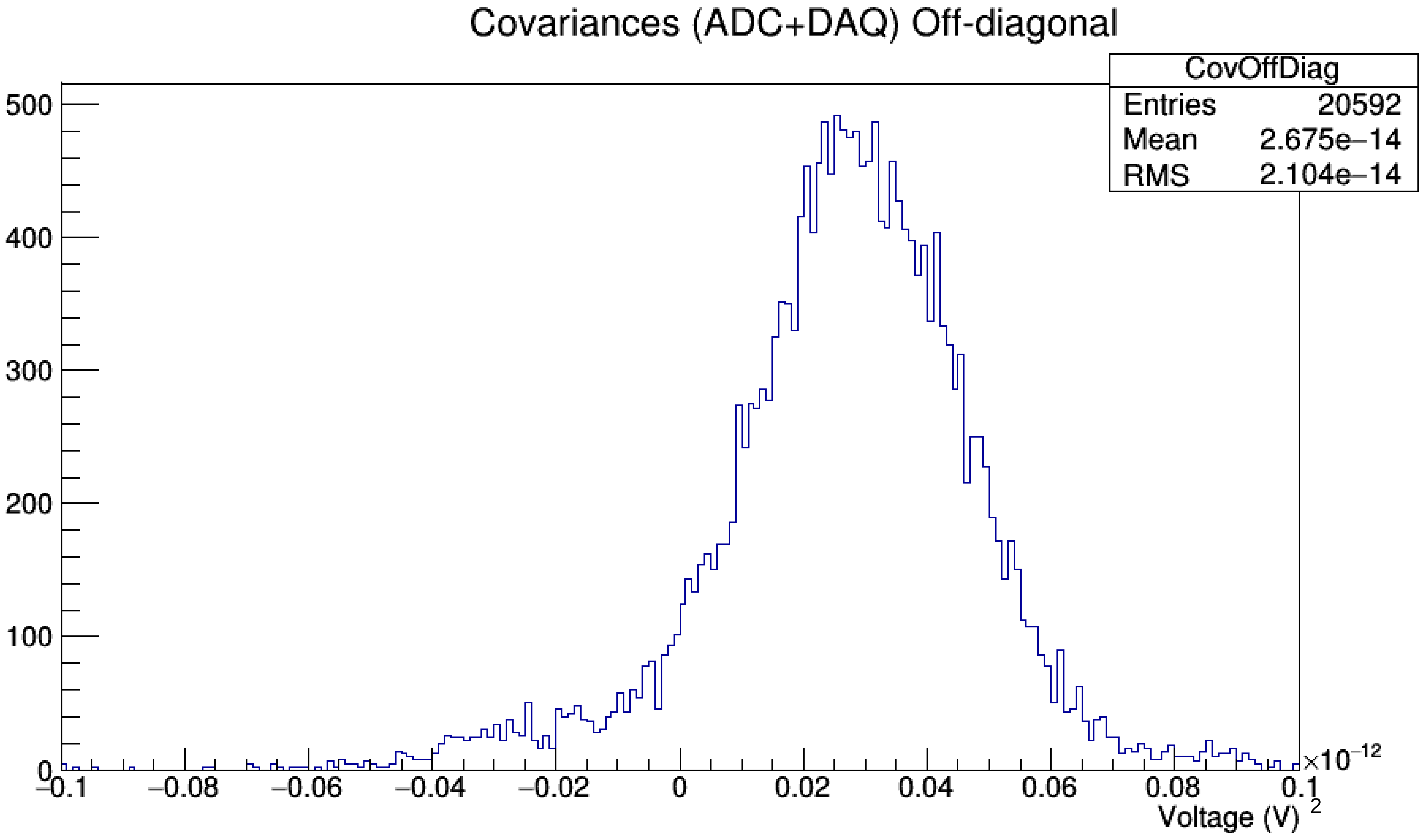
ADC only (24 hrs)

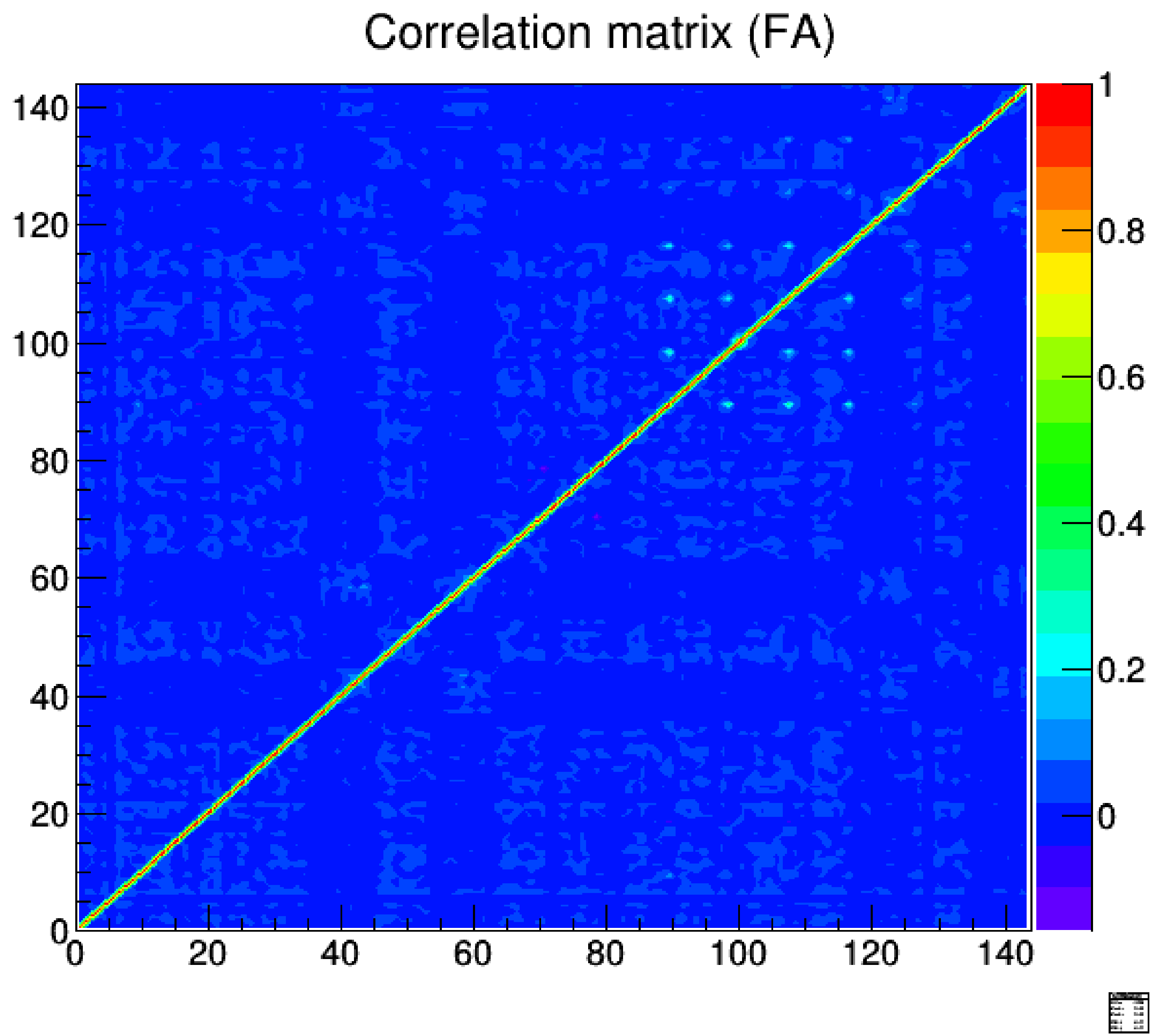
m!=n



Full setup (ADC+DAQ)

m!=n



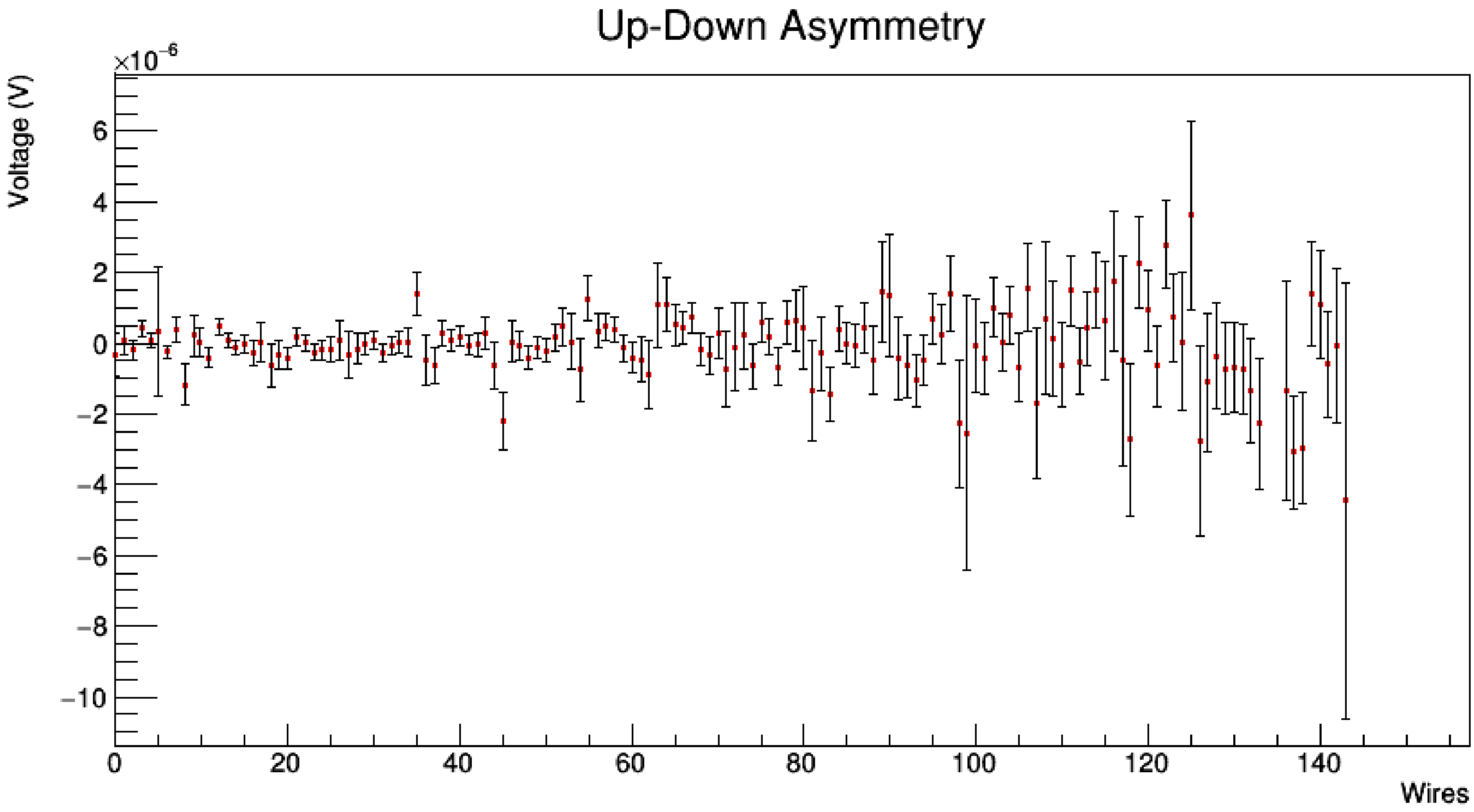

Correlation matrix (FA)
140
120
100
80
60
40
20
0
0
20
40
60
80
100
120
140
1
0.8
0.6
0.4
0.2
0

Up-Down Asymmetry

- Runs #20100- #20250
- Normalized using the sum of all the detectors.
- Discard dropped pulses and the next 8 pulses.

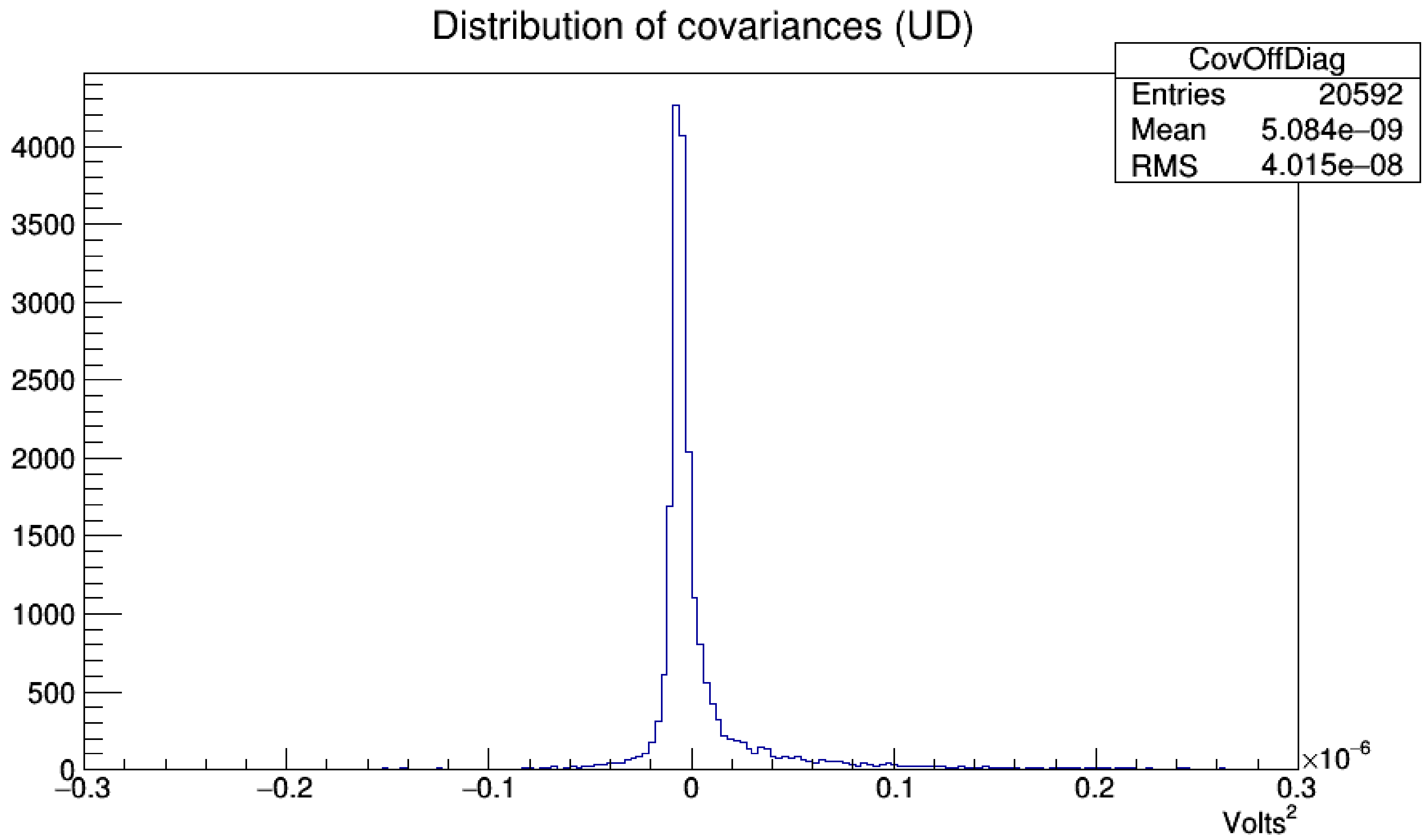
$$A_{m,i} = \frac{Y_i^+ - Y_i^-}{Y_i^+ + Y_i^-} \qquad C_{m,n} = \frac{1}{N} \sum_{i=1}^{N} \left(A_{m,i} - \mu_m \right) \left(A_{n,i} - \mu_n \right)$$

Up-Down Asymmetry



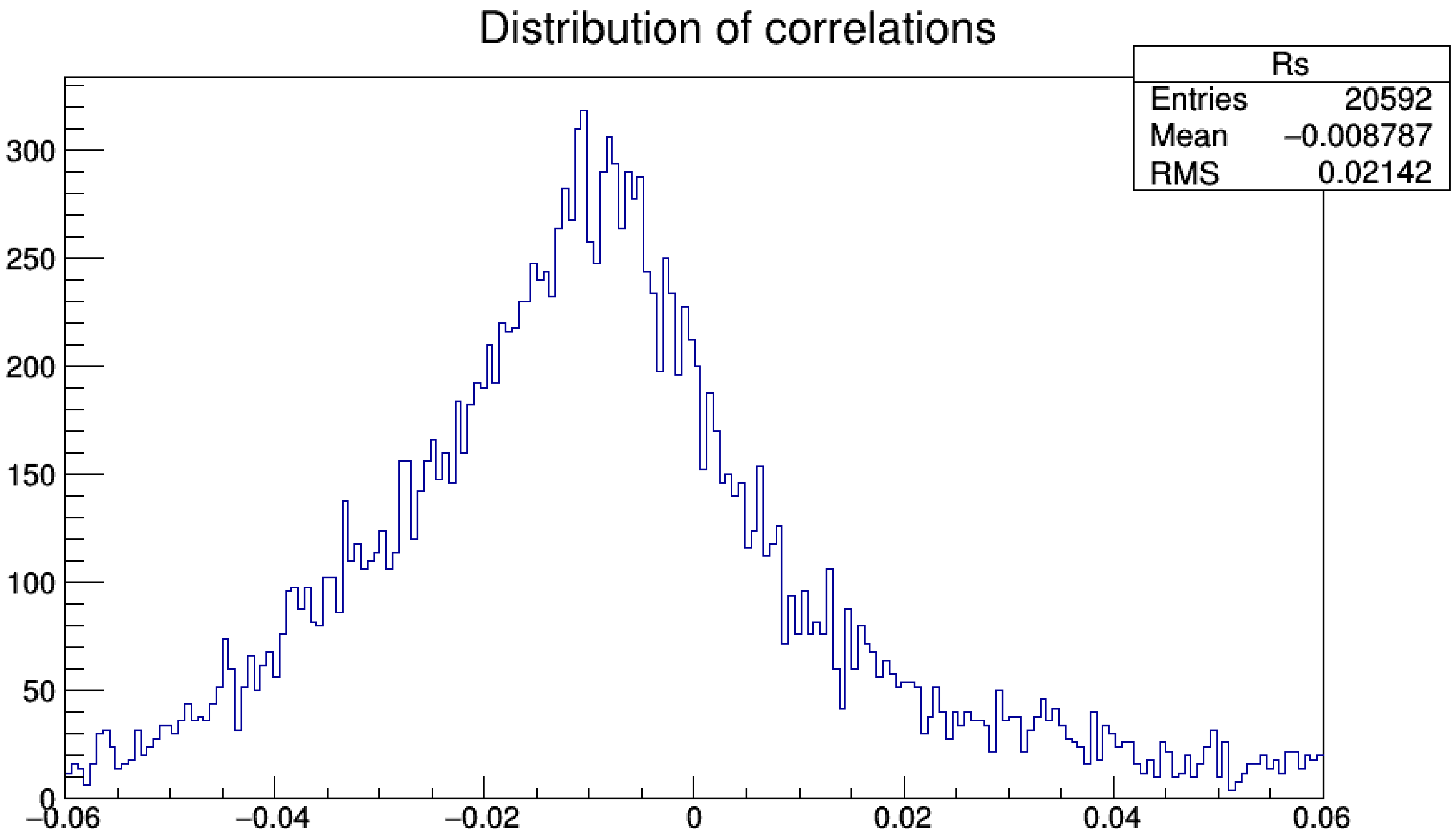
UD= -4.95×10^{-8} (+/-) 6.69×10^{-7}

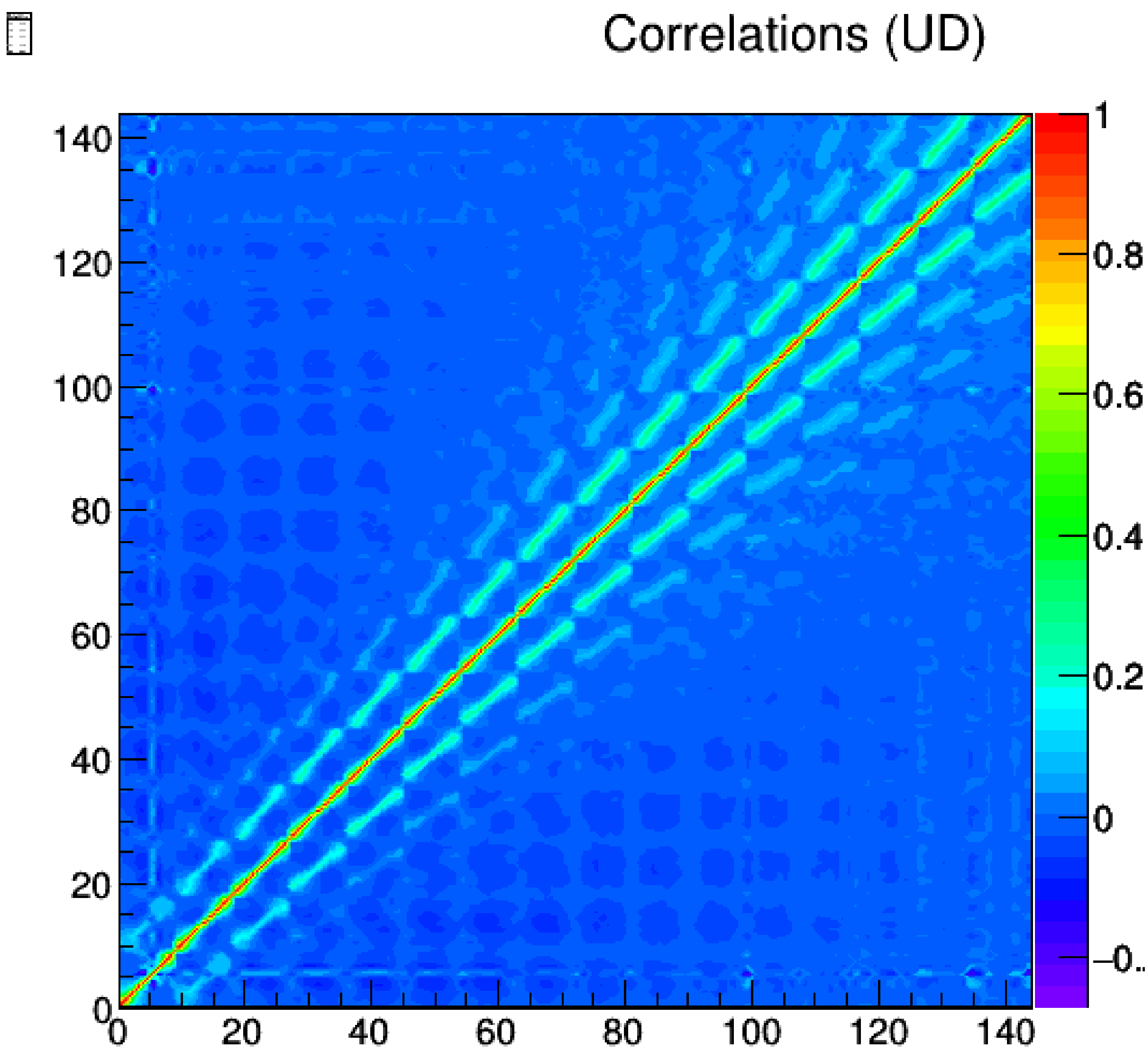
Covariance



Distribution of covariances (UD)
CovOffDiag
Entries 20592
Mean 5.084e−09
RMS 4.015e−08
4000
3500
3000
2500
2000
1500
1000
500
0
−0.3
−0.2
−0.1
0
0.1
0.2
0.3
×10−6
Volts2

Normalized


Distribution of correlations
Rs
Entries 20592
Mean −0.008787
RMS 0.02142
0
50
100
150
200
250
300
−0.06
−0.04
−0.02
0
0.02
0.04
0.06



Correlations (UD)
140
120
100
80
60
40
20
0
0
20
40
60
80
100
120
140
1
0.8
0.6
0.4
0.2
0

The end