Kurtosis of TPS and airguns

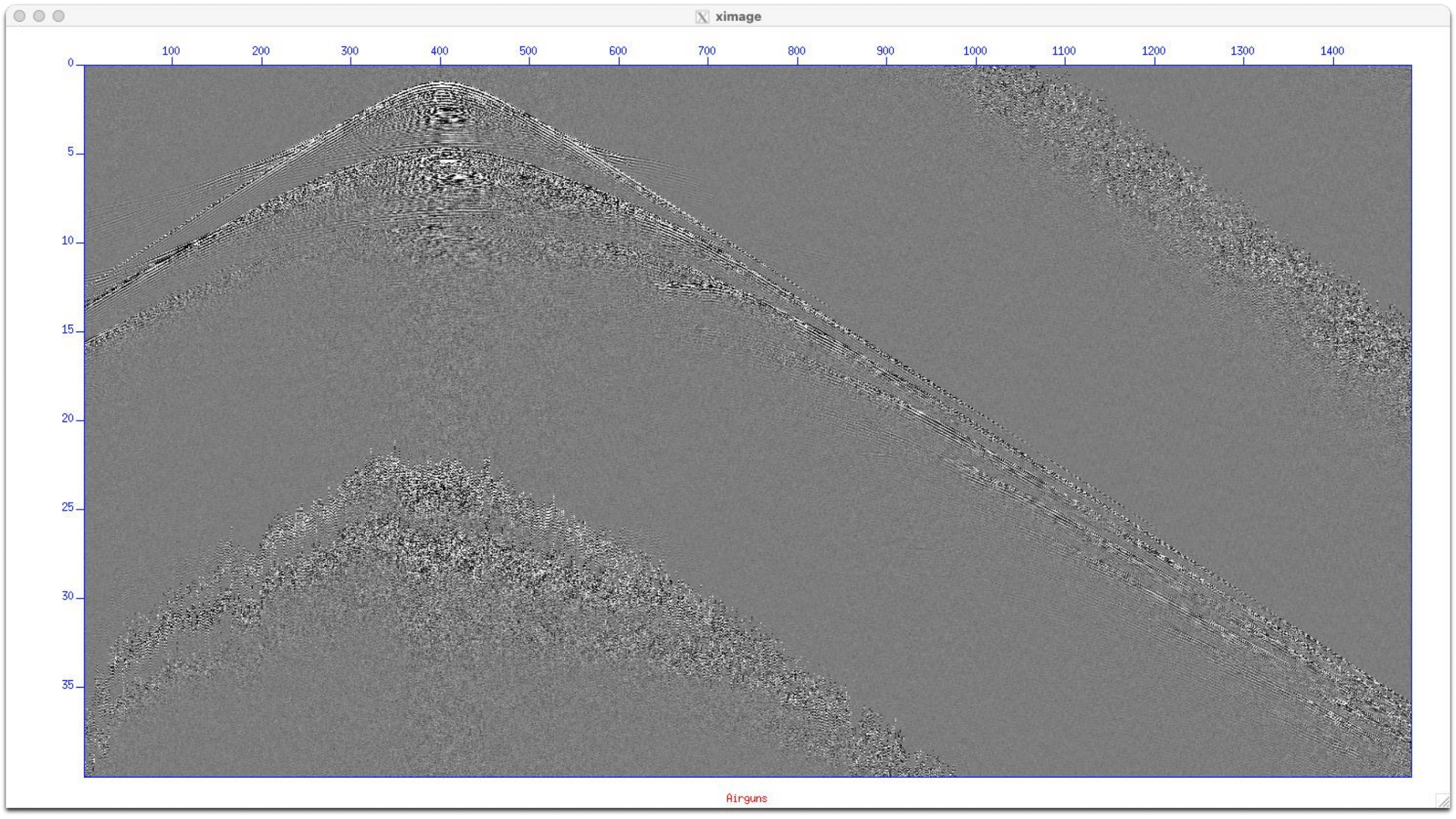
Kurtosis (Ref https://en.wikipedia.org/wiki/Kurtosis)

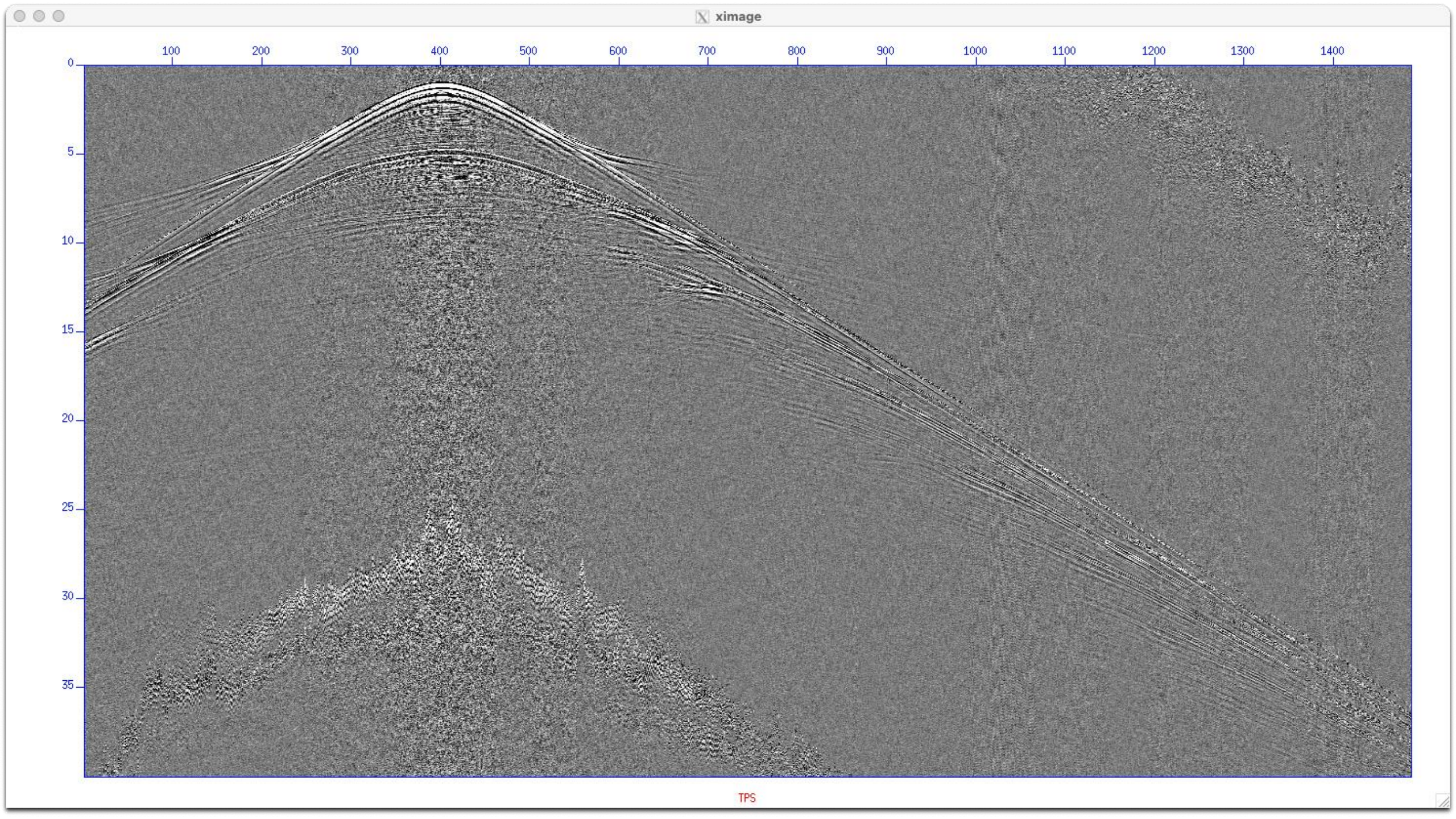
- A measure of “spikiness”
- The code on the right calculates
  - Pearson’s k = $\mu_4 / \sigma_2^2 - 3$
  - For a single spike, k = max (large)
  - For gaussian noise k = 0
  - For A sinusoid k = -1.5
  - Minimal k is -2
  - Blind to scale. That is the same for data and for 10*data
  - Blind to frequency content
  - Sensitive to zero padding. That is much larger kurtosis for zero-padded data

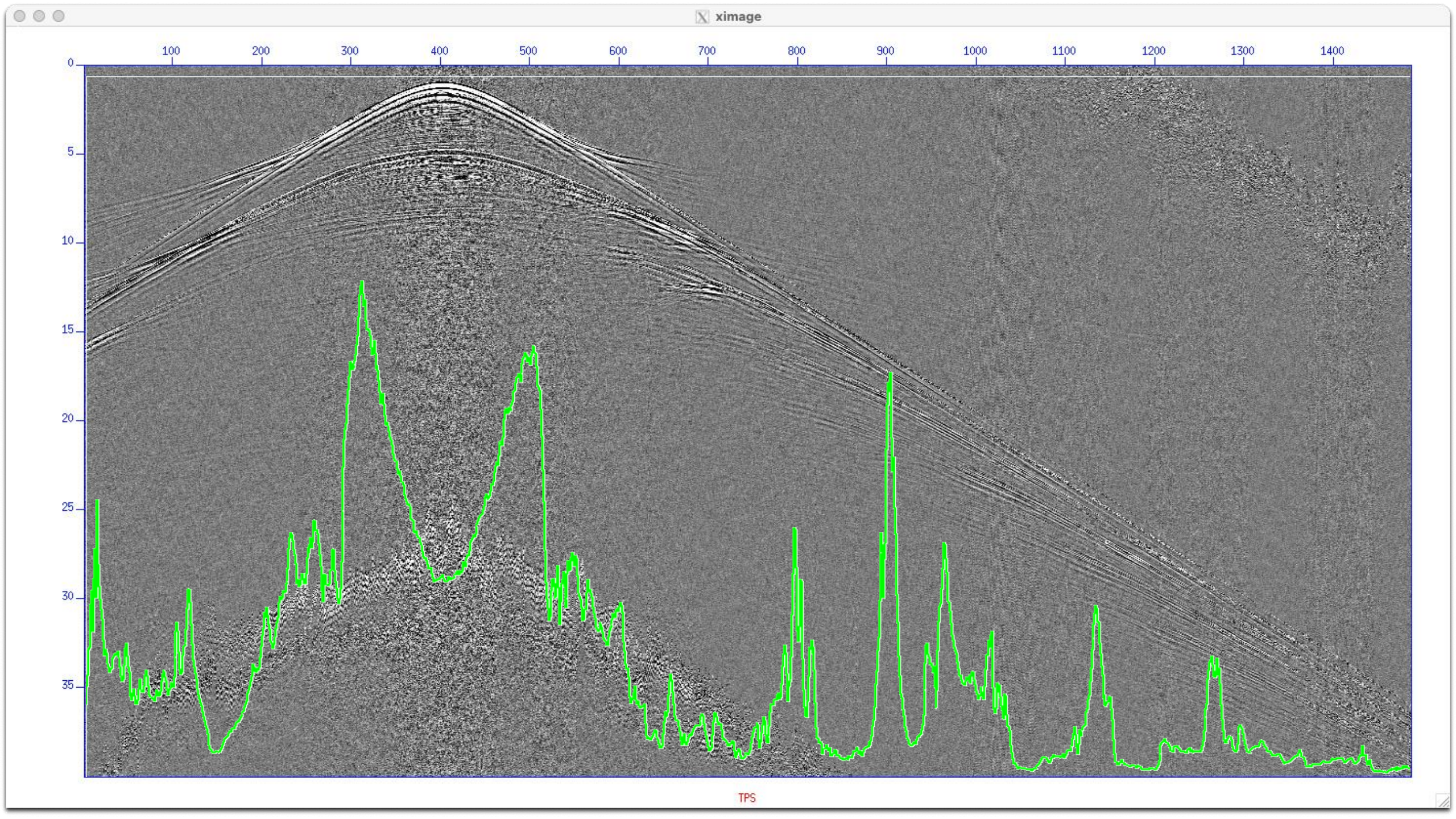
```
// Calculate the mean mu1
mu1 = 0.0;
for(i=0;i<nt;i++)  mu1 += tr.data[i];
mu1 /= nt;

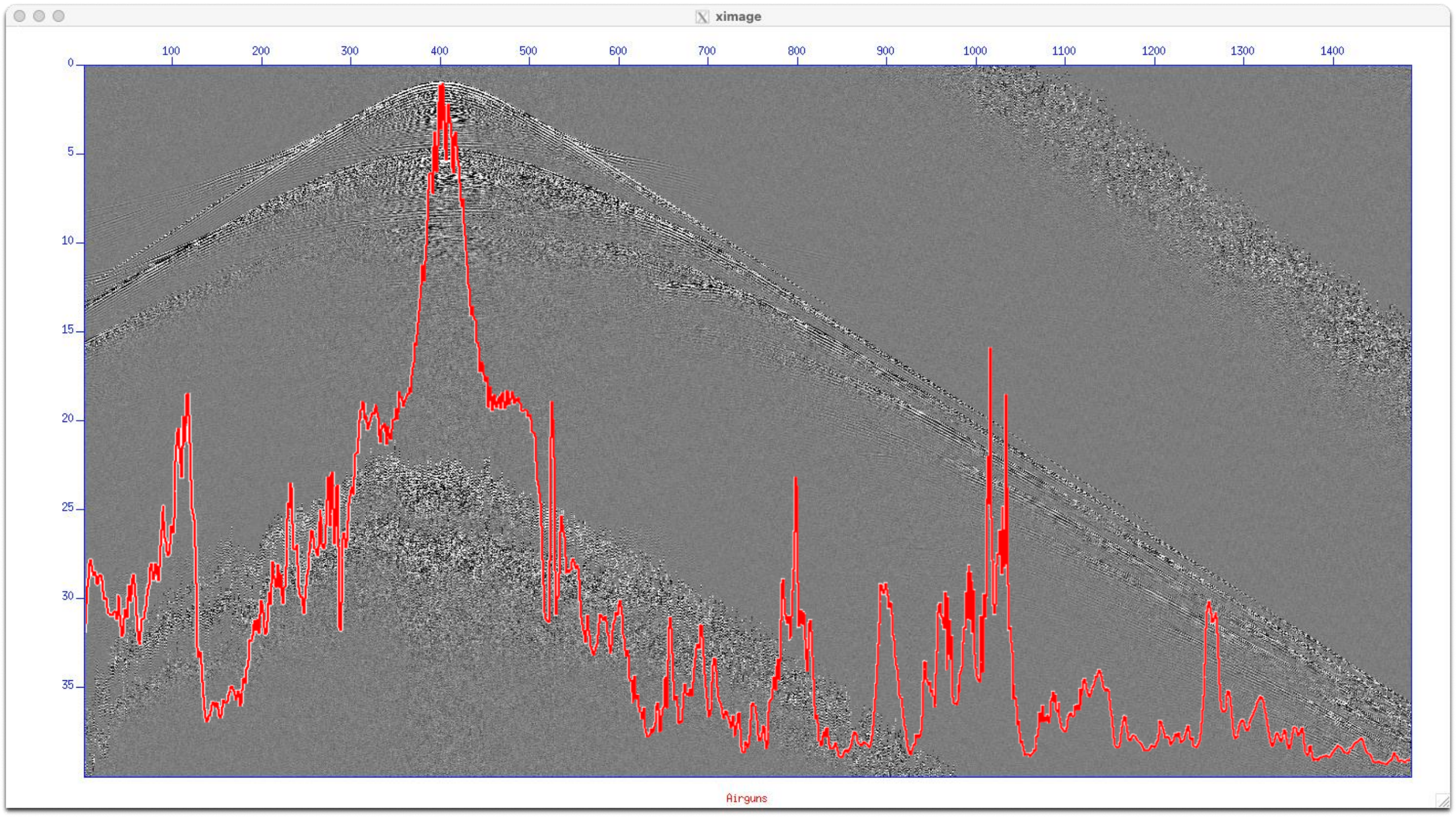
// Calculate the variance sigma and the 4th moment mu4
sigma2 = 0.0; mu4 = 0.0;
for(i=0;i<nt;i++) {
        double x = tr.data[i]-mu1;
        sigma2 += x*x;
        mu4 += x*x*x*x;
}
sigma2 /= nt; mu4 /= nt;

// Pearson’s  kurtosis
Assert(sigma2!=0.0)
kurtosis = mu4/sigma2/sigma2 - 3.0;
```

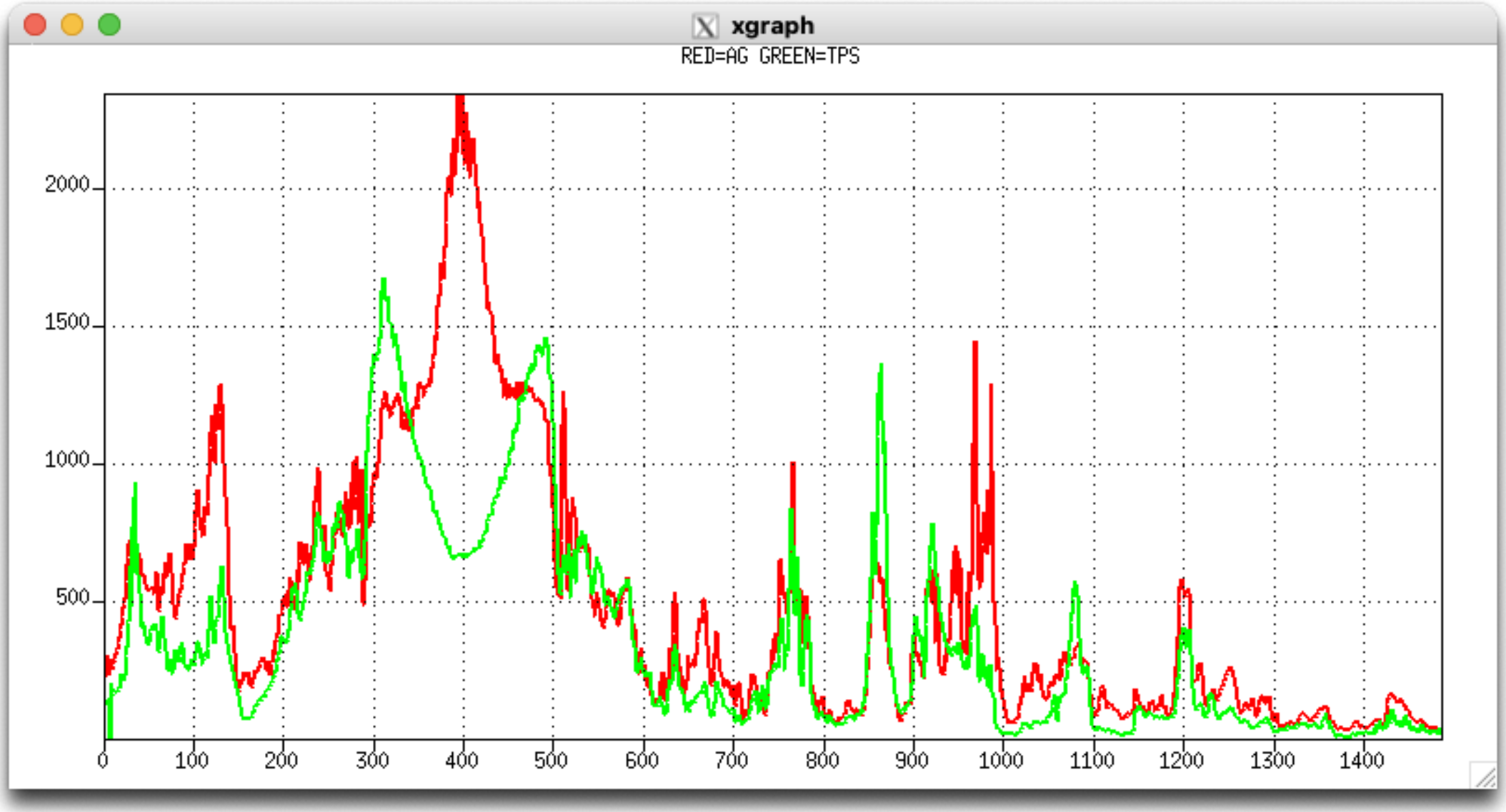

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Airguns


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TPS


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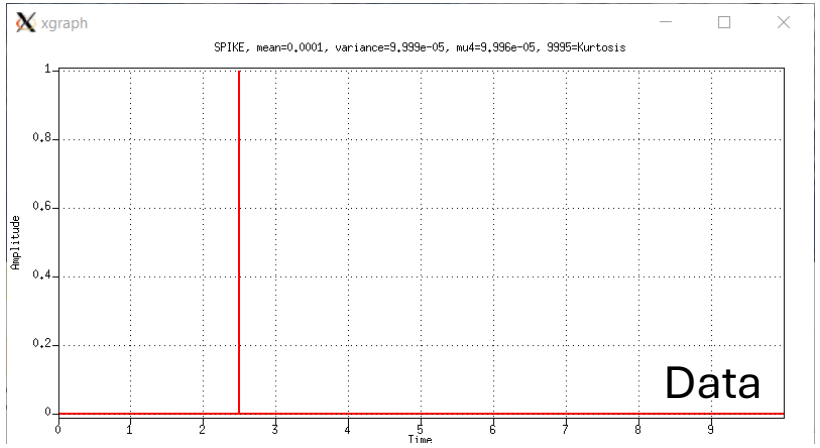

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Airguns

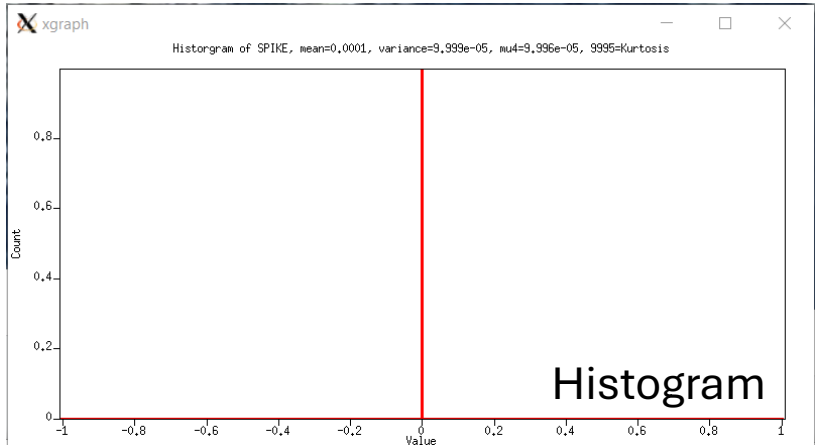
Pearson’s Kurtosis of TPS (green) and Airguns (red)



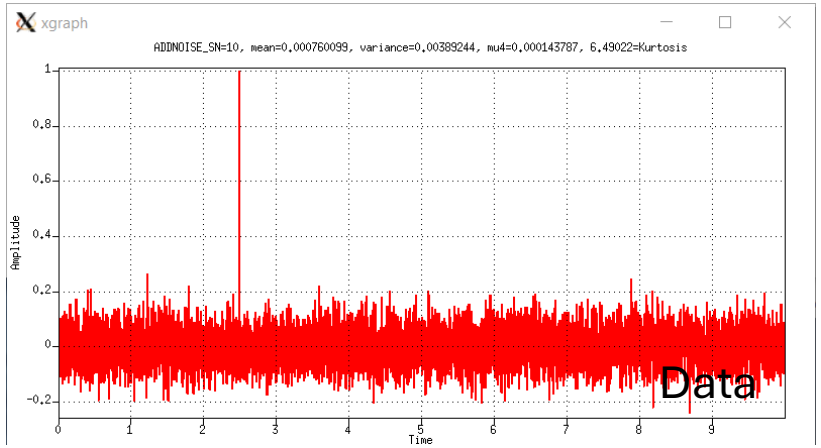
Kurtosis of a Spike + Gaussian noise, SN = ∞, 10, 1

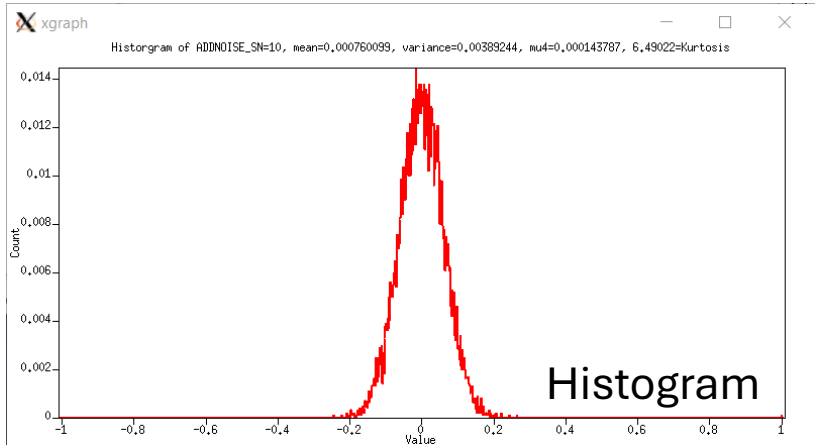
K = 9995 (nt=10000)



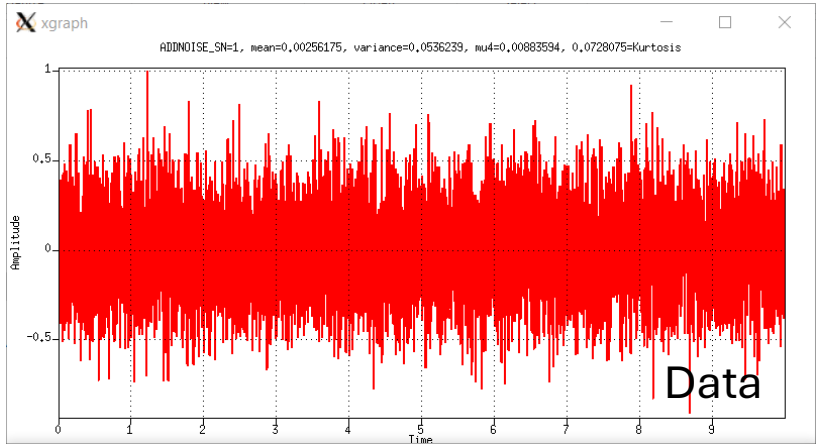


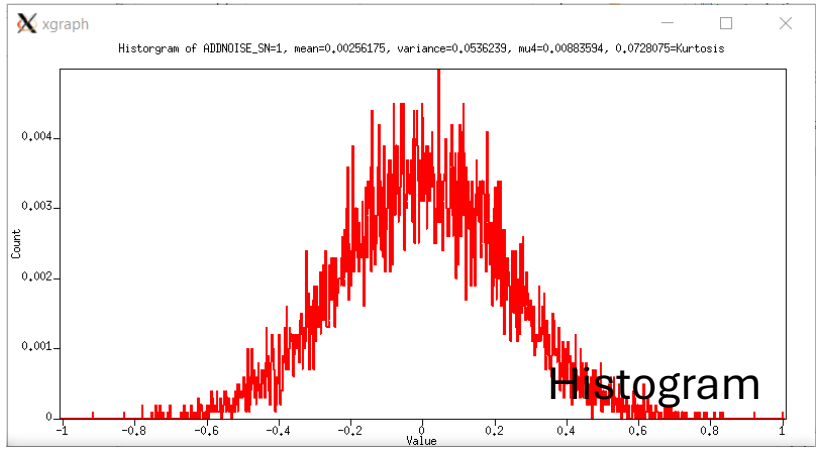
K = 6.5





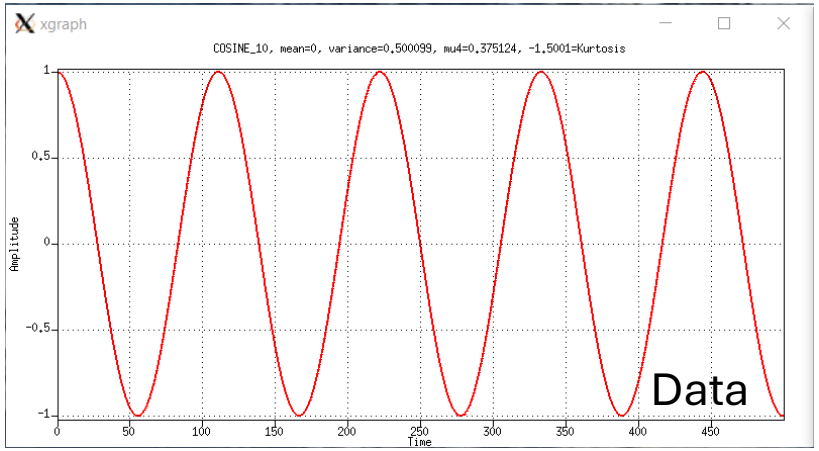
K = 0.07

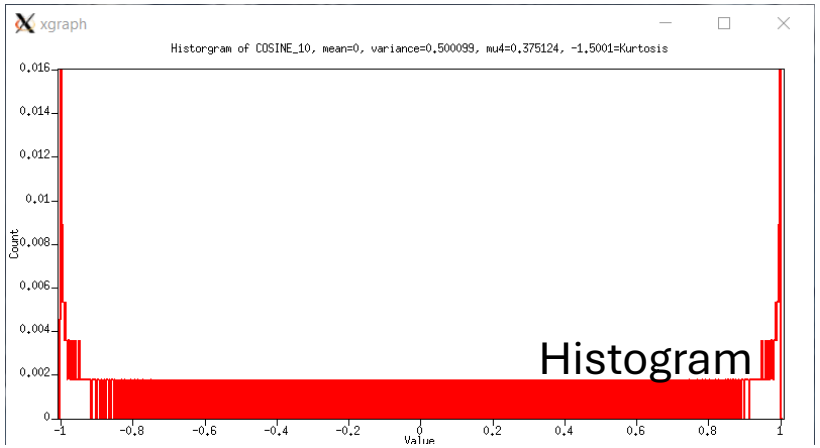




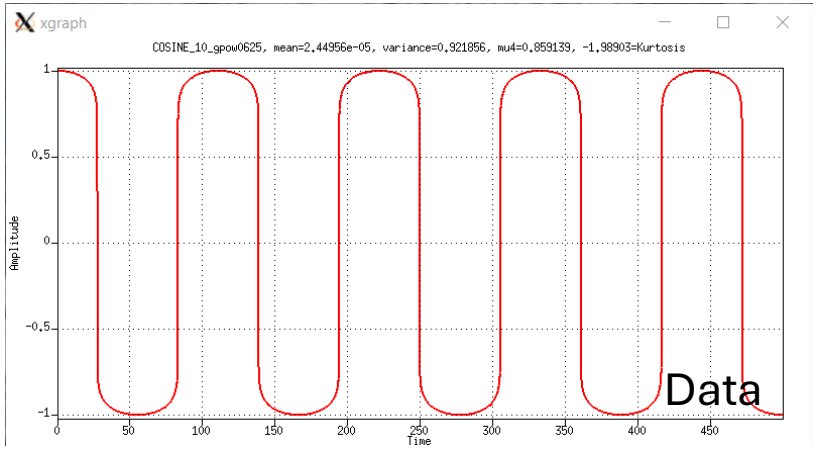
Kurtosis of sinusoid^{g}; g = 1, 1/16, 1/1000000

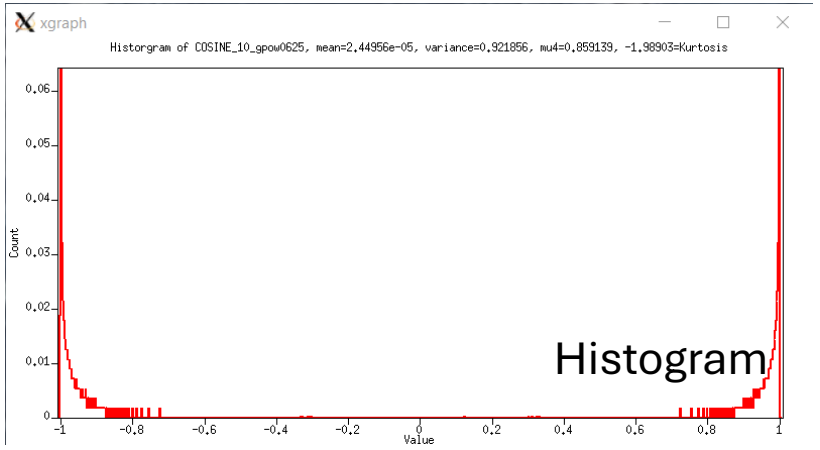
K = -1.5



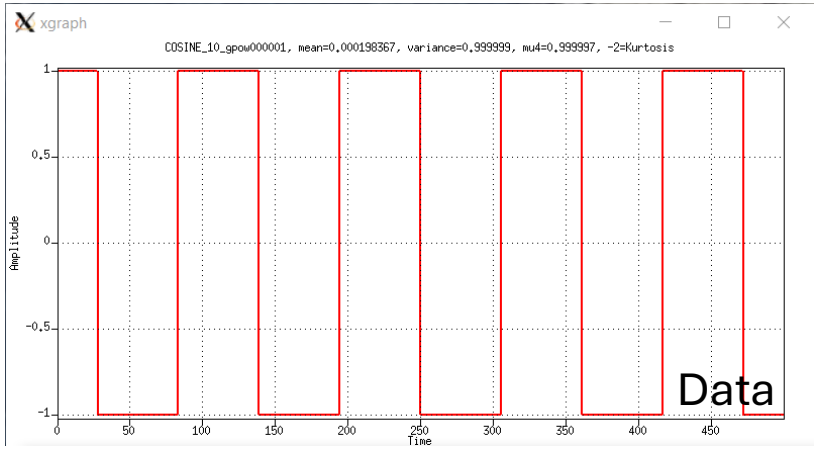


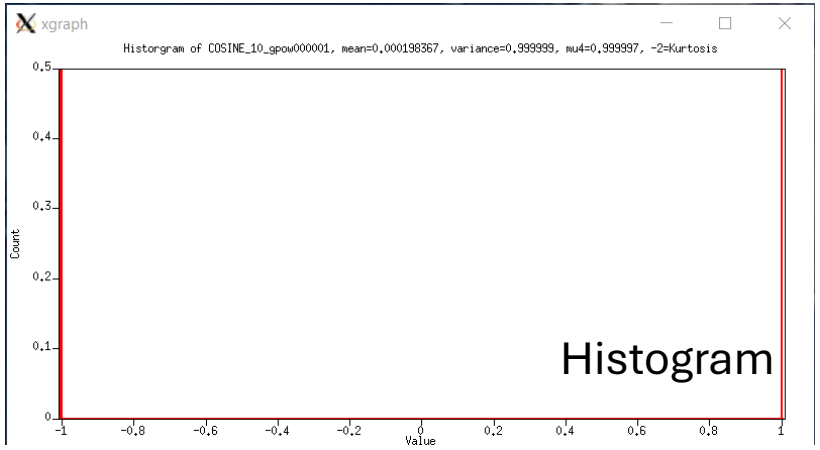
K = -1.99





K = -2





Kurtosis of Vibroseis sweep: unpadded and padded

