Analysis of Lu' s radioactive source data. Data set consists of 2001 time stamped waveforms recorded at 145 GSa/s.

```
SetDirectory["~white/Desktop/64mm^2"];
Drop[FileNames[], 1] // Length;
ntrace = %
```

Out[668]= 2001

In[669]:=
```
Namelist = Drop[FileNames[], 1];
Namelist[[1]]
```

Out[670]= T00157.csv

In[671]:=
```
time = Transpose[Import[Namelist[[1]], "Data"]][[1]];
Dimensions[time];
half = % / 2
```

Out[673]= {7993}

In[674]:=
```
front = Transpose[Import[Namelist[[1]], "Data"]][[2]];
offset = Mean[Take[front, 7693]]
```

Out[675]= −0.0023588

Front and Back are the 2 APDs which face eachother. Front is closest to the CO ^{60} source.
  The first 49 nanoseconds are used to extract the baseline correction which is typically ~1 mV.

```
offfront = ConstantArray[offset, 15 986];
front1 = Take[front - off, 7693];
time1 = Take[time, 7693];
back = Transpose[Import[Namelist[[1]], "Data"]][[3]];
offset = Mean[Take[back, 7693]]
offback = ConstantArray[offset, 15 986];
back1 = Take[back - offback, 7693];
```

Out[680]= −0.000907403

In[683]:=
```
dt = time[[2]] - time[[1]] // EngineeringForm
f = 1 / (time[[2]] - time[[1]]);
fftrange = f / 2
```

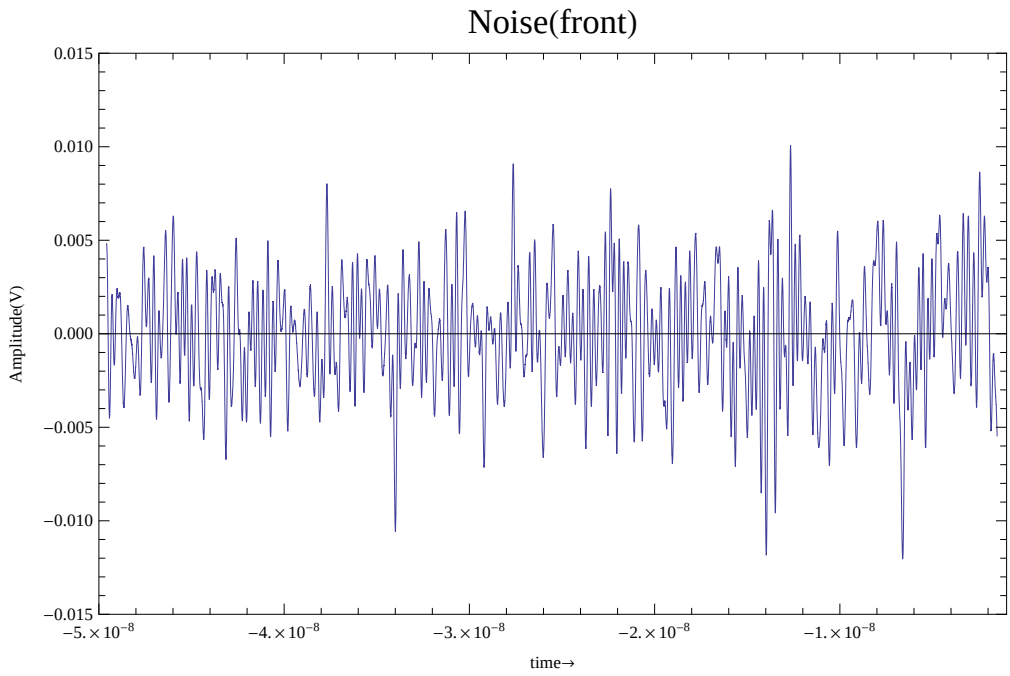
Out[683]//EngineeringForm=
6.3×10^{-12}

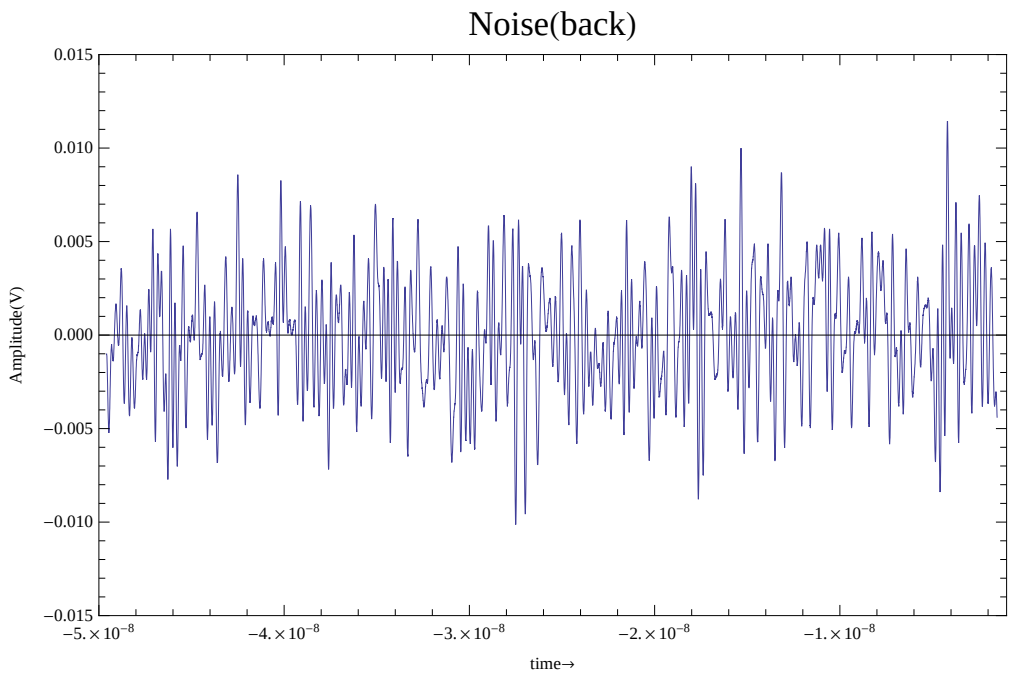
Out[685]= 7.93651×10^{10}

In[686]:=

```
GraphicsColumn[{ListPlot[Transpose[{time1, front1}], Joined → True, Frame → True,
   FrameLabel → {{"Amplitude(V)",}, {"time→", "Noise(front)"}},
   PlotRange → {{-0.00000005, -0.000000001}, {-.015, .015}}],
  ListPlot[Transpose[{time1, back1}], Joined → True, Frame → True,
   FrameLabel → {{"Amplitude(V)",}, {"time→", "Noise(back)"}},
   PlotRange → {{-0.00000005, -0.000000001}, {-.015, .015}}]}]
```

Out[686]=





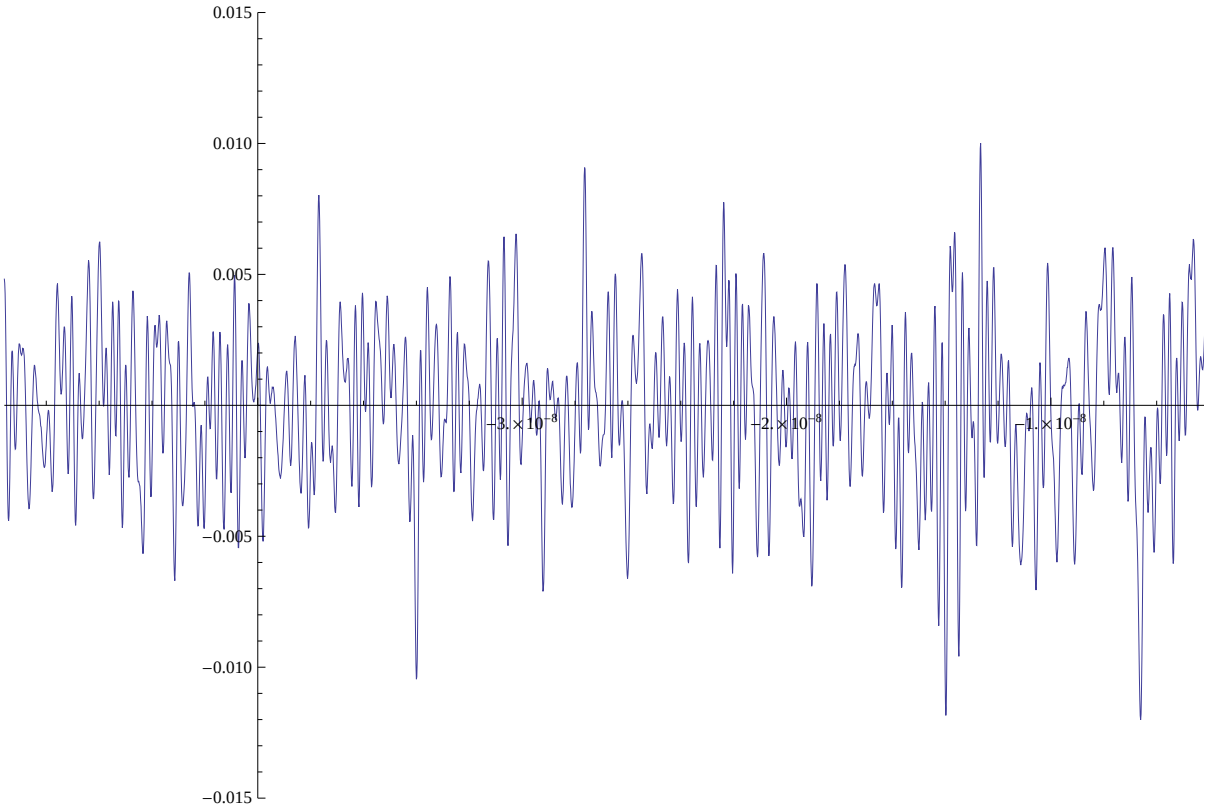
Noise Waveform as a function for later use

```
Ff = Interpolation[Transpose[{time1, front1}], Method → "Spline"]
Fb = Interpolation[Transpose[{time1, back1}], Method → "Spline"]
Plot[Ff[x], {x, -4.9586 × 10^-8, -1.5117 × 10^-9},
 PlotRange → {{-4.9586 × 10^-8, -1.5117 × 10^-9}, {-.015, .015}}]
```

Out[687]= `InterpolatingFunction[{{-4.95867 × 10^-8, -1.5117 × 10^-9}}, <>]`

Out[688]= `InterpolatingFunction[{{-4.95867 × 10^-8, -1.5117 × 10^-9}}, <>]`

Out[689]=



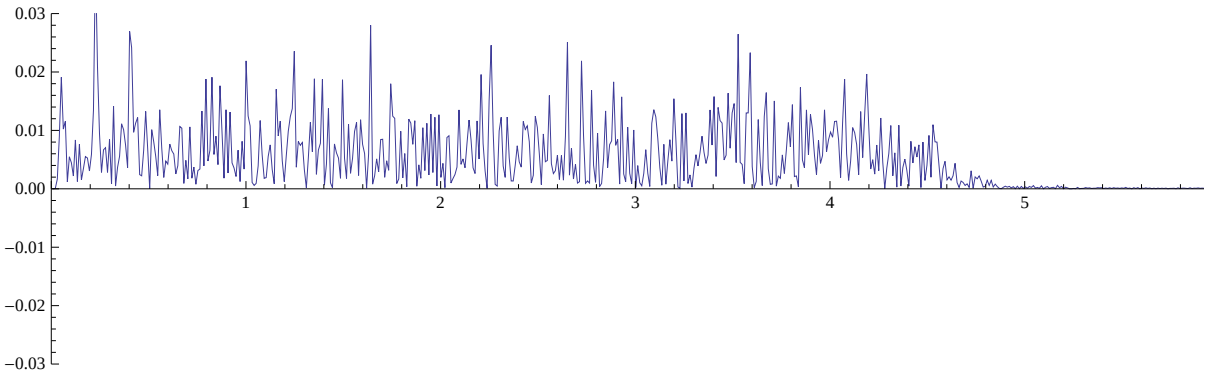
In[690]:=
```
fftout1 = Abs[ FourierDCT[front1]];
df = fftrange / 7693;
```

In[692]:=
```
freq = Range[df, fftrange, df] / 1 000 000 000.;
```

In[693]:=
```
fftnew = Transpose[{freq, fftout1}];
```

In[694]:=
```
ListPlot[fftnew, Joined → True, AspectRatio → 0.3, PlotRange → {{0, 6}, {-.03, .03}}]
```

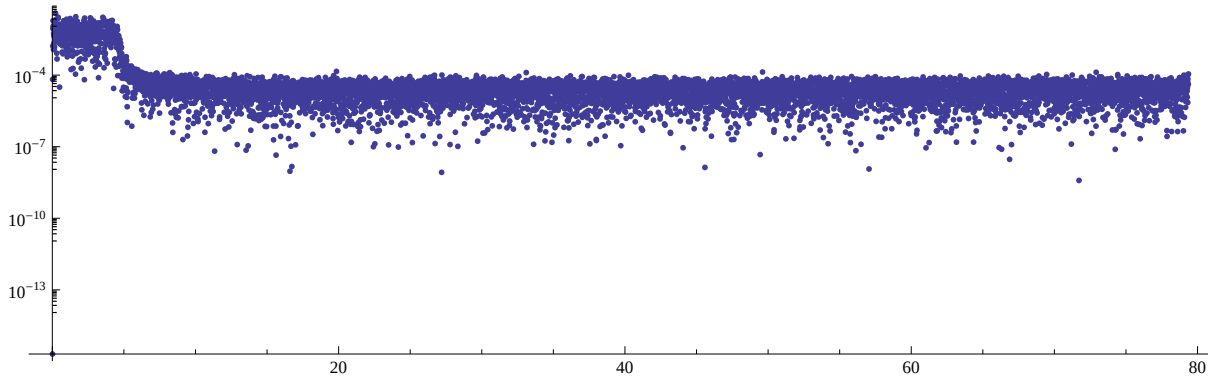
Out[694]=



This has zero frequency in element 1. The 7693- th element corresponds to 1/2 the sampling frequency.After that aliassing takes over and the frequency heads back to zero.

In[695]:=
```
ListLogPlot[fftnew, AspectRatio → 0.3, PlotRange → All]
```

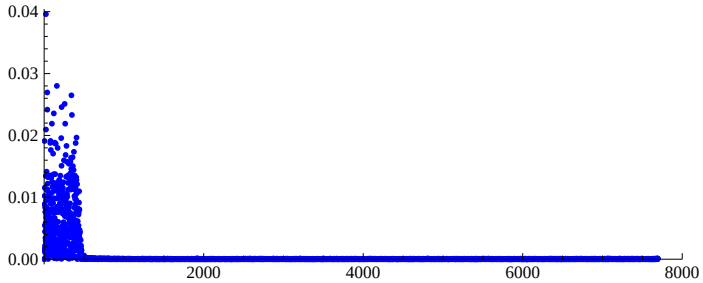
Out[695]=



Separate Real and Imaginary components.

In[696]:=
```
ListPlot[{Re[fftplot], Im[fftplot]}, AspectRatio → 0.4, PlotRange → {{0, 8000}, All},
  PlotStyle → {Blue, Red}, Joined → {False, True}]
```

Out[696]=



In[697]:=
```
ListPlot[{Transpose[{time, front}], Transpose[{time, back}]}, Joined → True,
 PlotStyle → Thick, PlotRange → {{-0.000000001, 0.000000005}, {-.6, .04}}]
```

Out[697]=