In[463]:=
```
<< PhysicalConstants`
SetDirectory["~white/Desktop/July8"];
```

In[465]:=
```
data = Import["RTF_1_matrix_SL1.dat", "Data"];
data2 = Import["RTF_1_matrix_SL2.dat", "Data"];
tdat = Import["RTF_2_matrix_Time.dat", "Data"];
time = 10^9 * tdat[[All, 1]];
```

In[469]:=
```
waveform2 = Array[0 &, {20, 3600, 2}];
waveform3 = Array[0 &, {20, 3600, 2}];
waveform4 = Array[0 &, {20, 3600, 2}];
```

In[471]:=
```
Do[waveform2[[i]] = Transpose[{time, 1000 * data[[All, i]]}],
  {i, 1, 20}];
Do[waveform3[[i]] = Transpose[{time, 1000 * data2[[All, i]]}],
  {i, 1, 20}];
```

Fitting Example

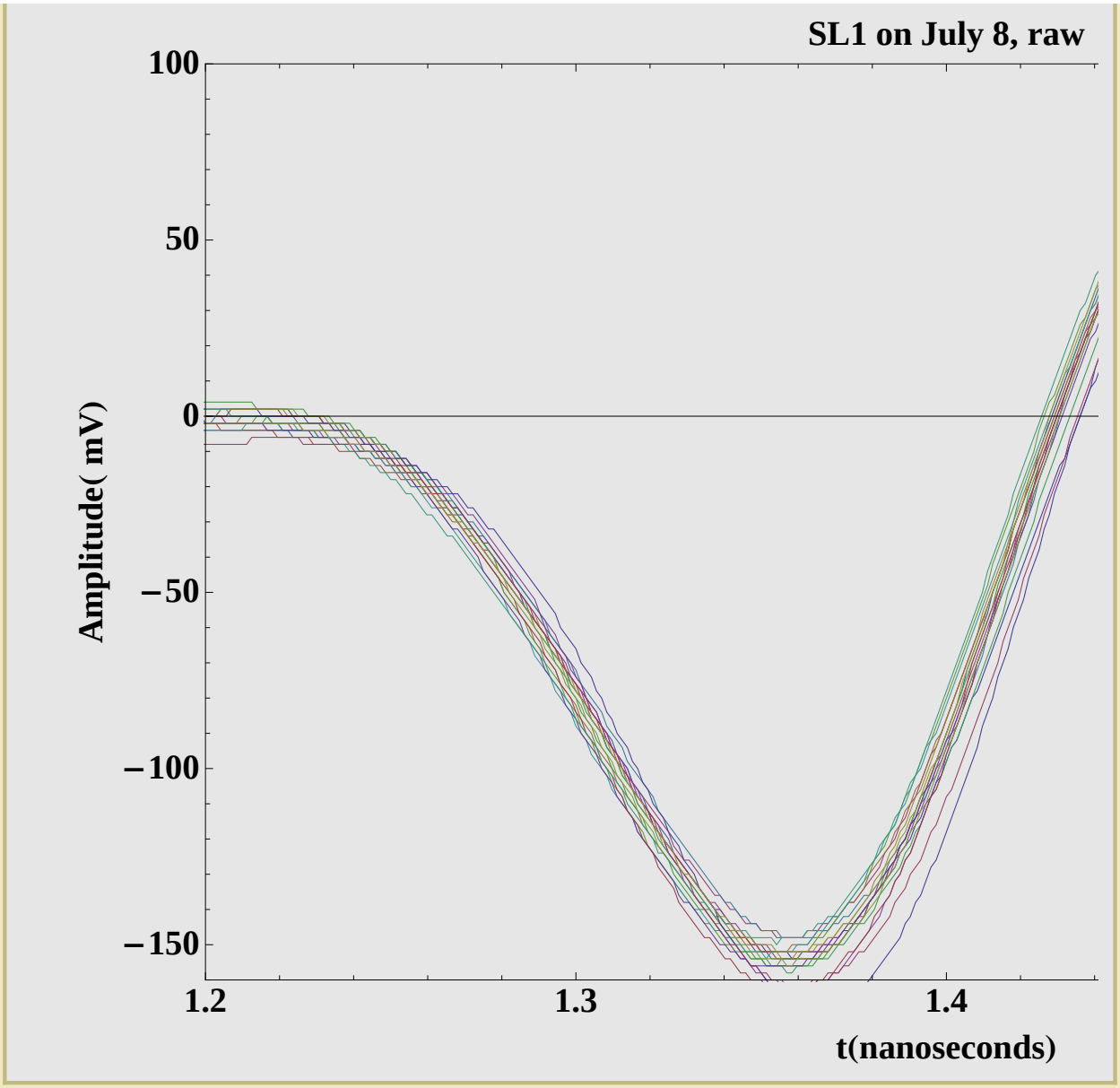
In[473]:=
```
(*a=Table[waveform2[[index]],{index,1,42}];
a1=Table[waveform2[[1,jndex]],{jndex,198,206}];
sc=2*Pi/(81.5-79.5);
model=Am*Sin[sc*(t-c)];
fit=FindFit[a1,model,{Am,c},t];
modelf=Function[{t},Evaluate[model/.fit]]
  Show[ListPlot[a1,Joined→True],Plot[modelf[t],{t,79.5,82}],
   PlotRange→{{79.5,81.5},Automatic}]*)
```

Array of waveforms

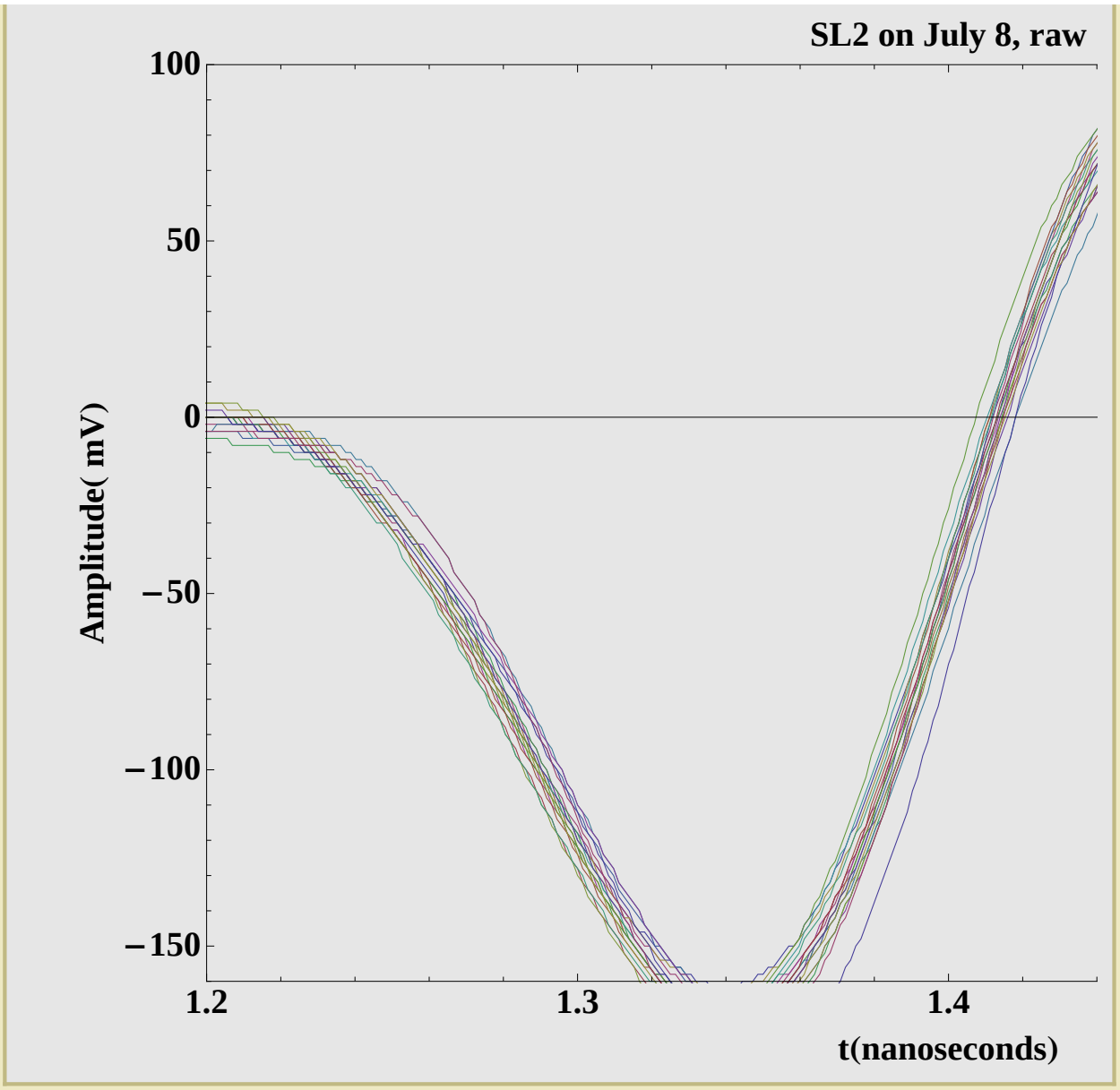
In[474]:=

```
aa = ConstantArray[0, 20];
Do[aa[[i]] = Table[waveform2[[i, jndex]], {jndex, 1, 3600}],
  {i, 1, 20}];
ListPlot[aa, PlotRange → {{1.2, 1.6}, {-160, 100}},
 ImageSize → {500, 300}, Frame → True,
 Joined → True, PlotStyle → PointSize[.01],
 FrameLabel → {Style["t(nanoseconds)", 18],
   Style["Amplitude( mV)", 18], Style["SL1 on July 8, raw", 18]},
 LabelStyle → Directive[Black, Bold, FontSize → 18]]
bb = ConstantArray[0, 20];
Do[bb[[i]] = Table[waveform3[[i, jndex]], {jndex, 1, 3600}],
  {i, 1, 20}];
ListPlot[bb, PlotRange → {{1.2, 1.6}, {-160, 100}},
 ImageSize → {500, 300}, Frame → True,
 Joined → True, PlotStyle → PointSize[.01],
 FrameLabel → {Style["t(nanoseconds)", 18],
   Style["Amplitude( mV)", 18], Style["SL2 on July 8, raw", 18]},
 LabelStyle → Directive[Black, Bold, FontSize → 18]]
```

Out[476]=


SL1 on July 8, raw
100
50
0
−50
−100
−150
Amplitude(mV)
1.2
1.3
1.4
t(nanoseconds)

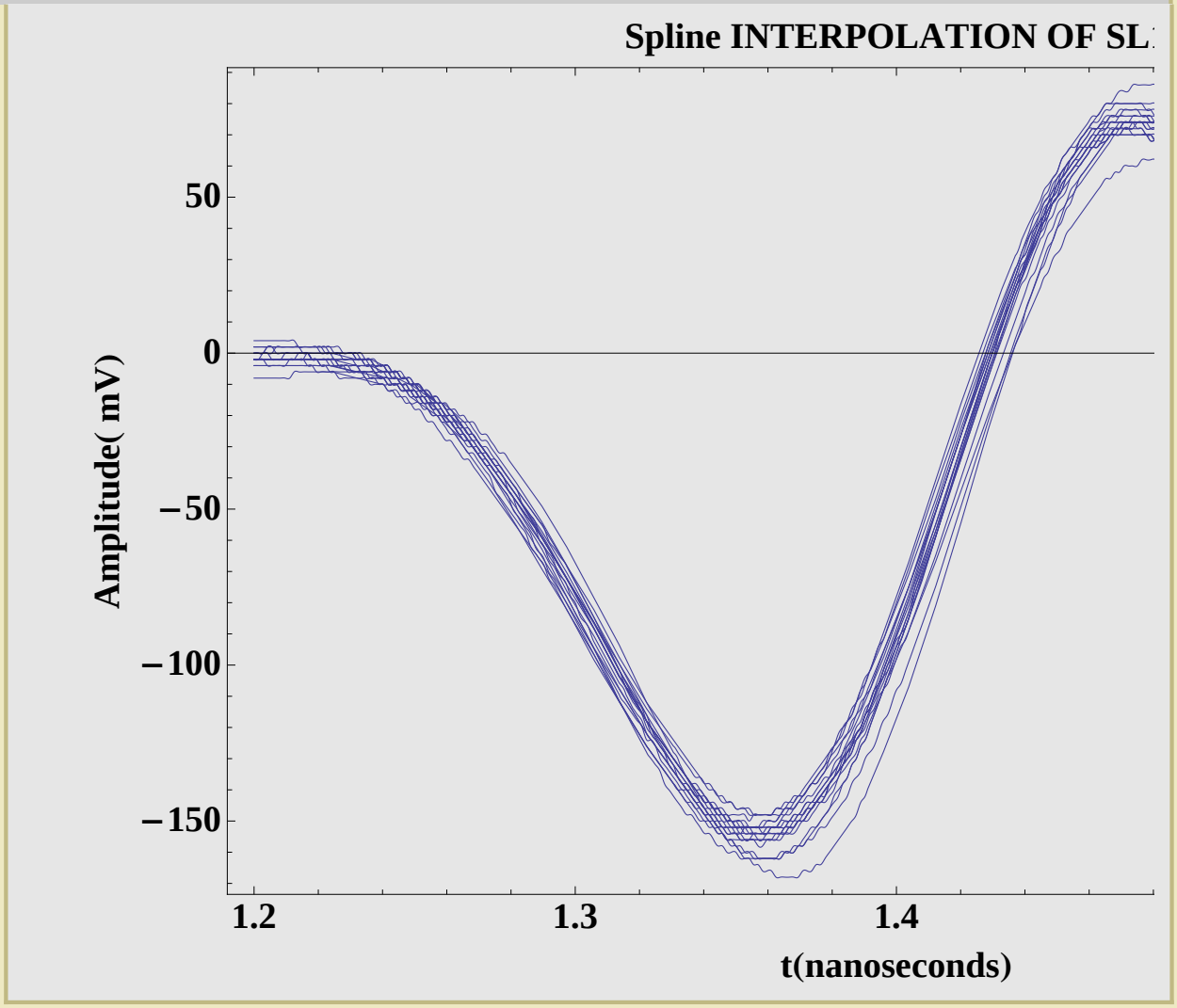
Out[479]=


SL2 on July 8, raw
100
50
0
−50
−100
−150
Amplitude(mV)
1.2
1.3
1.4
t(nanoseconds)

Spline Interpolation

```
Ff = ConstantArray[0, 20];
Do[
  Ff[[i]] = Interpolation[aa[[i]], Method -> "Spline"], {i, 1, 20}];
Plot[Table[Ff[[i]][x], {i, 1, 20}],
 {x, 1.2, 1.6}, ImageSize → {500, 300}, Frame → True,
 PlotStyle → PointSize[.01], FrameLabel →
  {Style["t(nanoseconds)", 18], Style["Amplitude( mV)", 18],
   Style["Spline INTERPOLATION OF SL1", 18]},
 LabelStyle → Directive[Black, Bold, FontSize → 18]]
Zeroes = x /. FindRoot[Ff[[#]][x], {x, 1.41}] & /@ Range[20];
Do[Zeroes[[ii]] = Zeroes[[ii]] - 1.4361, {ii, 1, 20}]
```

Out[482]=



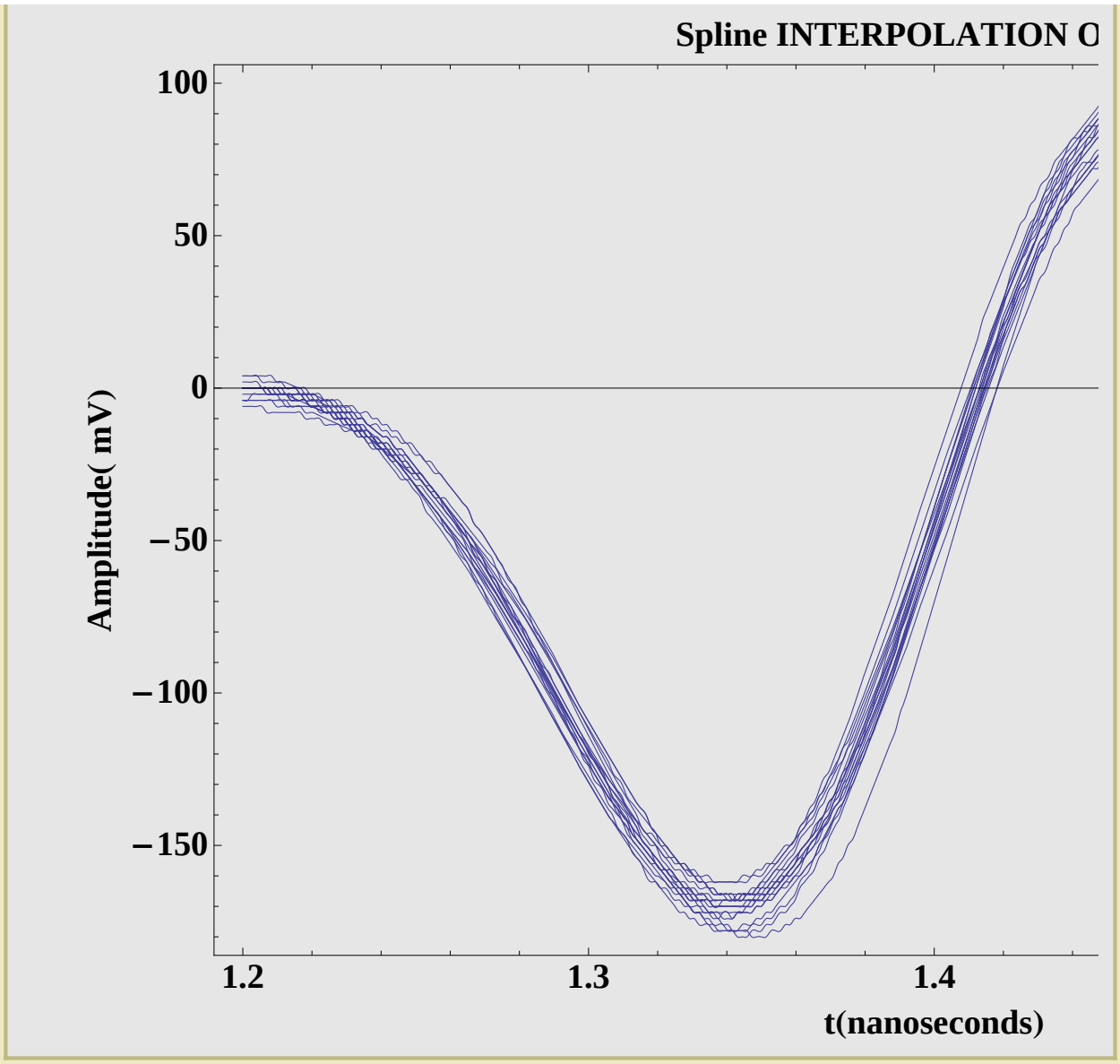
Out[483]=

```
{1.43611, 1.42917, 1.42847, 1.43333, 1.42847, 1.42987, 1.42917, 1.42986, 1.43056, 1.43056,
 1.42986, 1.42639, 1.42778, 1.43125, 1.42988, 1.43056, 1.42569, 1.43611, 1.43543, 1.42778}
```

In[485]:=

```
Fg = ConstantArray[0, 20];
Do[
 Fg[[i]] = Interpolation[bb[[i]], Method -> "Spline"], {i, 1, 20}]
Plot[Table[Fg[[i]][x], {i, 1, 20}],
 {x, 1.2, 1.6}, ImageSize → {500, 300}, Frame → True,
 PlotStyle → PointSize[.01], FrameLabel →
  {Style["t(nanoseconds)", 18], Style["Amplitude( mV)", 18],
   Style["Spline INTERPOLATION OF SL2", 18]},
 LabelStyle → Directive[Black, Bold, FontSize → 18]]
Zeroes1 = x /. FindRoot[Fg[[#]][x], {x, 1.41}] & /@ Range[20]
Do[Zeroes1[[ii]] = Zeroes1[[ii]] - 1.4361, {ii, 1, 20}]
Zeroes1[[1]]
Histogram[{Zeroes, Zeroes1}, {0.001},
 ChartStyle → {Red, Blue}, ChartLayout → "Overlapped",
 ChartLabels → Placed[{Style["SL1", 18], Style["SL2", 18]}, Above],
 Frame → True, FrameLabel → {Style["Zero Cross Time (nsec", 18],
   Style["", 18], Style["zero-cross time distributions", 18]}]
```

Out[487]=



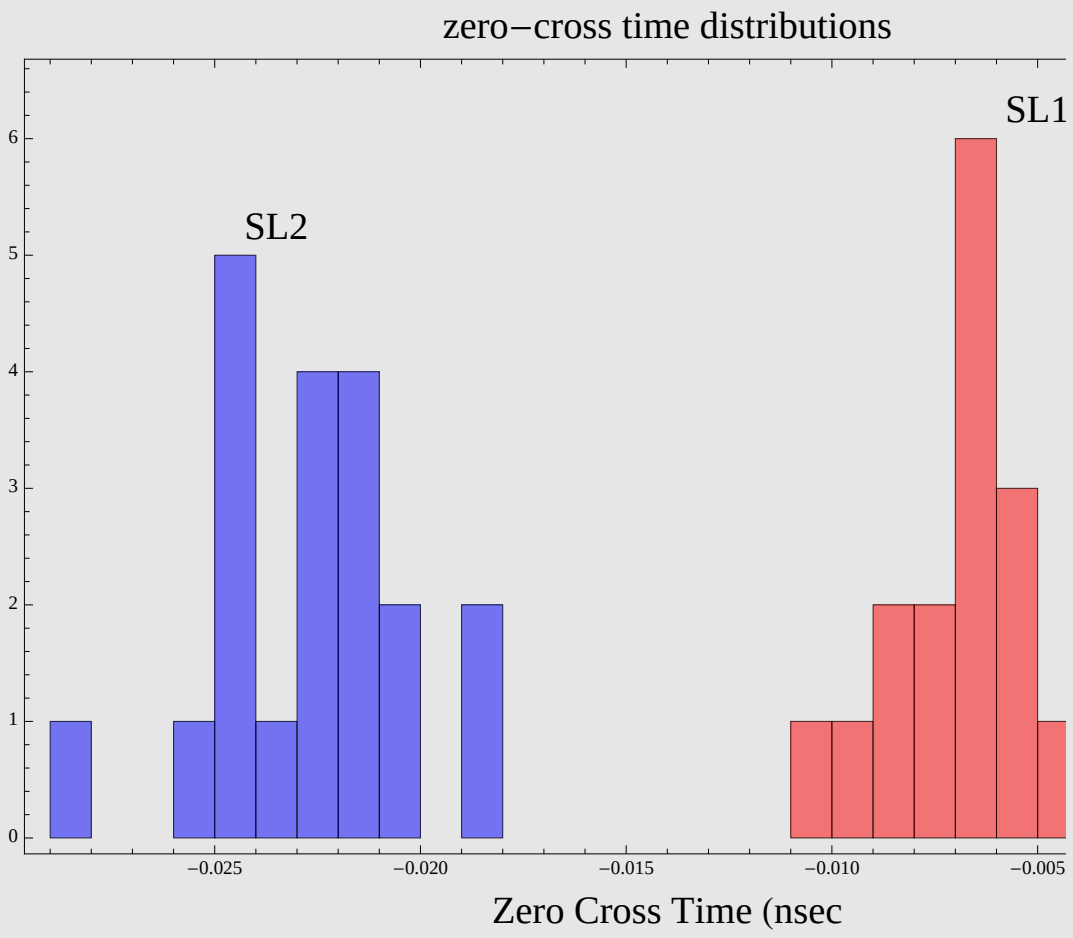
Out[488]=

```
{1.41327, 1.41204, 1.41111, 1.41436, 1.41183, 1.41341, 1.41458, 1.41311, 1.41806, 1.41389,
 1.41111, 1.40743, 1.41043, 1.41604, 1.41297, 1.41458, 1.41159, 1.41806, 1.4148, 1.41528}
```

Out[490]=

```
-0.0228326
```

Out[491]=



In[517]:=

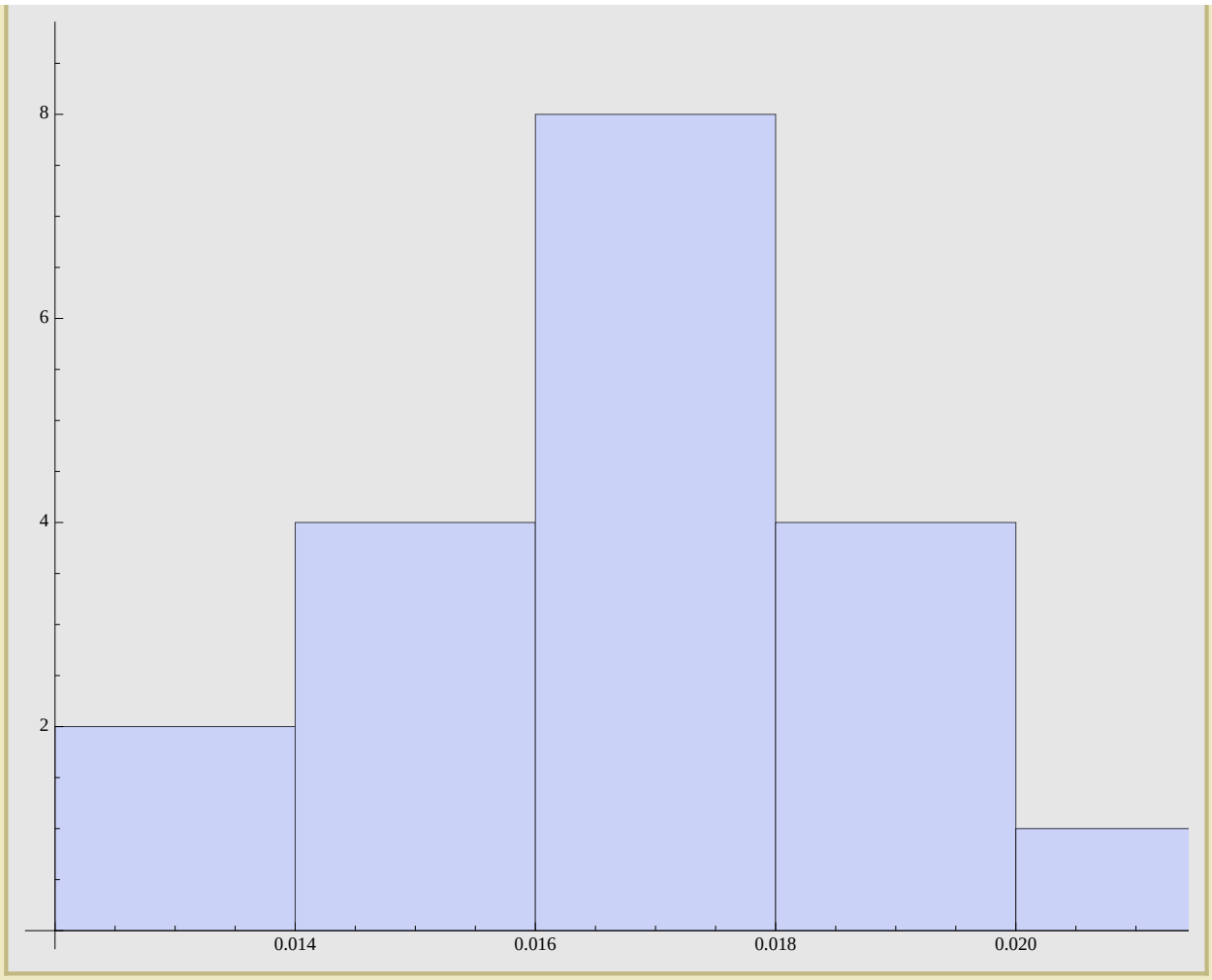
```
Fdiff = ConstantArray[0, 20];
StandardDeviation[Zeroes]
StandardDeviation[Zeroes1]
Do[Fdiff[[i]] = Zeroes[[i]] - Zeroes1[[i]], {i, 1, 20}];
StandardDeviation[Fdiff]
Histogram[Fdiff]
Histogram[Fdiff, {0.002}, ChartStyle → {Blue}, ChartLabels →
  Placed[{Style["difference", 18]}, Above], Frame → True,
 FrameLabel → {Style["Zero Cross Time Difference(nsec)", 18],
   Style["", 18], Style["zero-cross time distributions", 18]}]
```

Out[518]= 0.002933

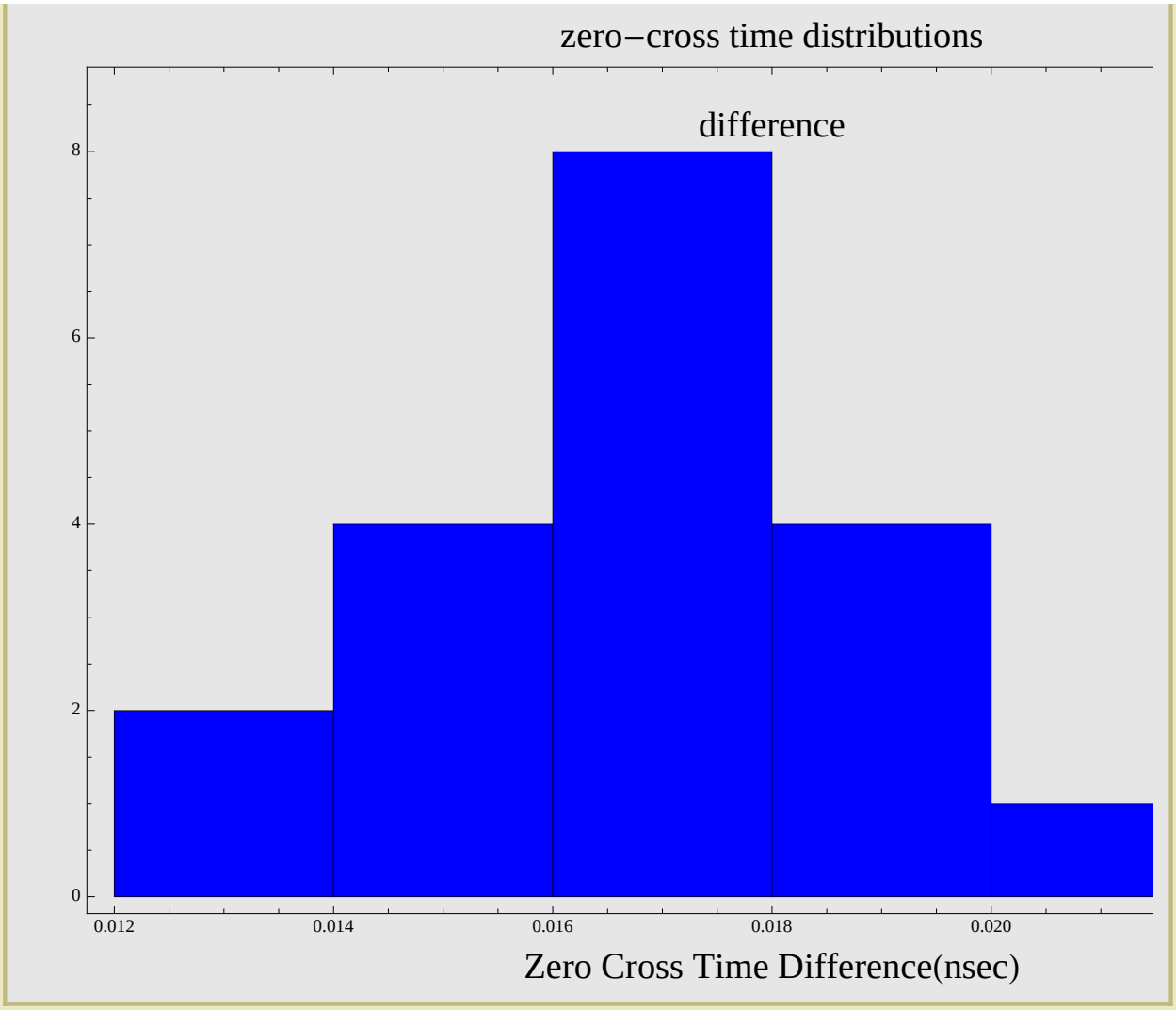
Out[519]= 0.0025398

Out[521]= 0.00250231

Out[522]=



Out[523]=


zero−cross time distributions
difference
8
6
4
2
0
0.012
0.014
0.016
0.018
0.020
Zero Cross Time Difference(nsec)