ATF APD Data Analysis

Data are organized as

4 Positions: (iposition=1,4)
each with 2 target states: (itarget=1,2)
each with 20 waveforms (iwaveform=1,20)
each is 1 file with 5000 points (ipoint=1,5000)
the first file name is : "RTF_0_APD.dat"
the next file name is : "RTF_1_APD.dat"
each point is a coordinate (time, Amplitude)

we convert time, Amplitude to nanoseconds, millivolts with the following matrix and subtract baseline

In[118]:=
```
<< PhysicalConstants`
m = {{10^9, 0}, {0, 10^3}};
```

Fix some data records that were garbled by Matlab

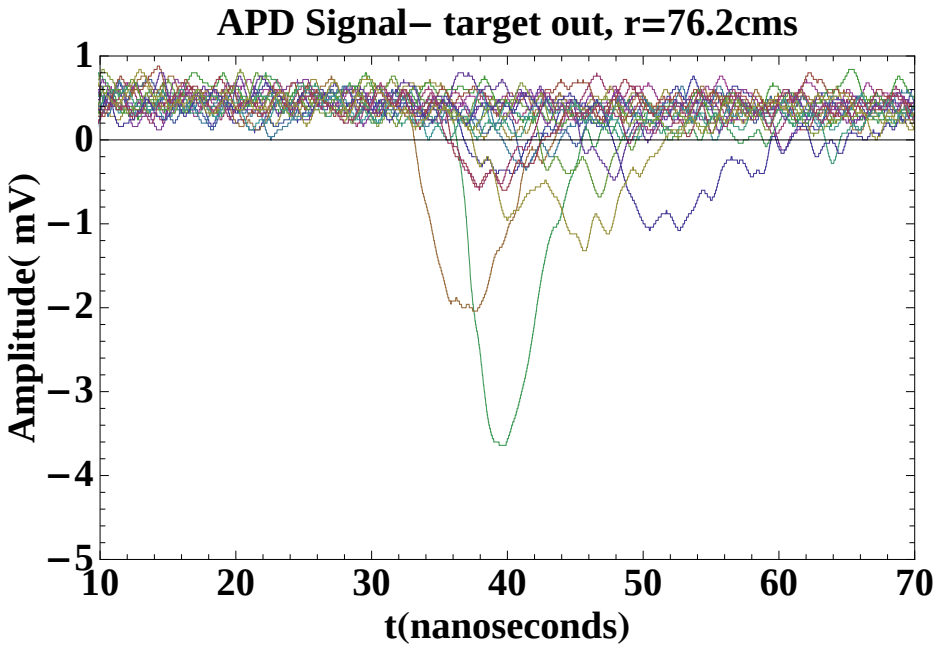
In[120]:=
```
spl[{s_String}] := Module[{loc = StringPosition[s, {"e-", "e+"}]},
                First[ImportString[
    StringTake[s, 4 + loc[[1, 1]]] <> " " <> StringDrop[s, 4 + loc[[1, 1]]], "Table"]] ]
spl[s__] := Identity[
  s]
```

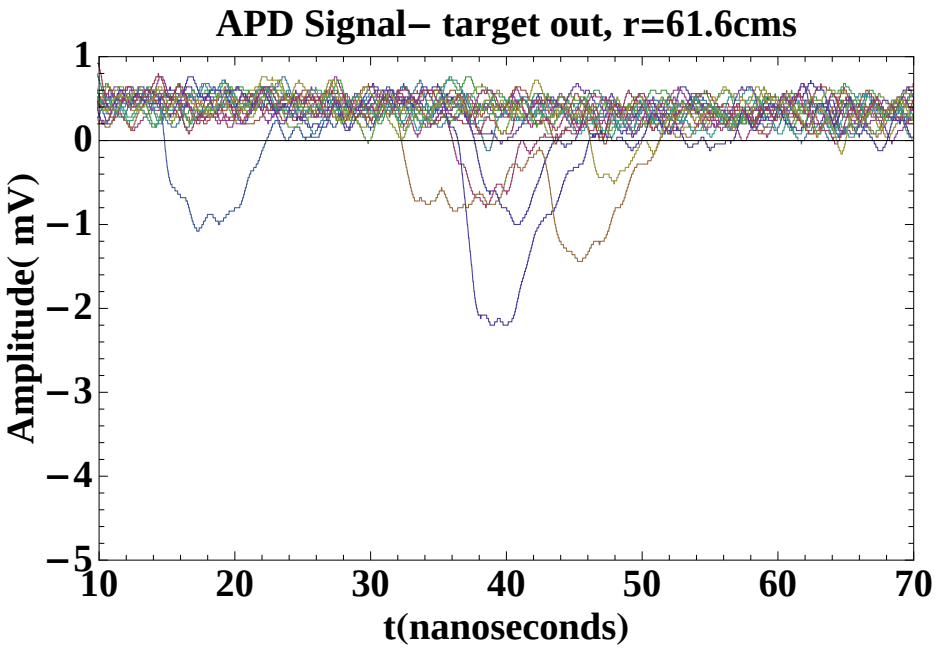
waveform2 holds the 20 waveforms at 1 position
newwave holds all 4 positions
Amps hold fitting results

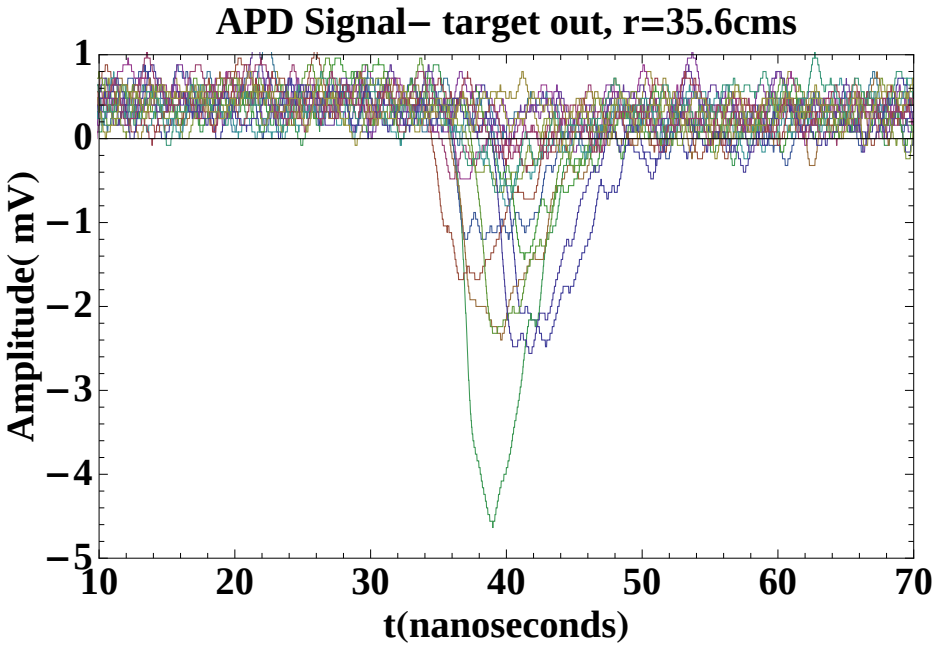
In[122]:=
```
waveform = Array[0 &, {5000, 2}]; waveform1 = Array[0 &, {5000, 2}];
waveform2 = Array[0 &, {20, 5000, 2}];
aveAmp = ConstantArray[0, {2, 4}]; rmsAmp = ConstantArray[0, {2, 4}];
q = ConstantArray[0, {4, 20}]; h1 = Range[20]; h2 = Range[20];
Amplitude = Range[20];
state = {"out", "in"};
position = {61.6, 35.6, 15.2, 76.2};
iorder = {4, 1, 2, 3};
jtarget = {{1, 2}, {2, 1}, {1, 2}, {2, 1}};
plotrange = {-5, -20};
index = 1;
qmip = ElectronCharge[[1]] * 200 * 6000 * 10^12
```

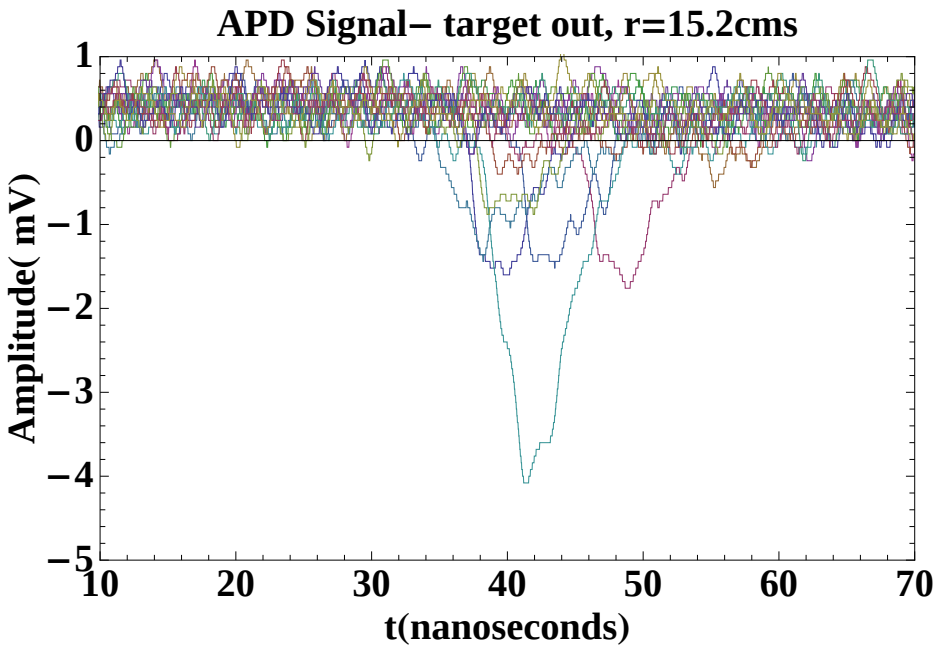
Out[132]=
```
0.192261
```

In[133]:=
```
ipos = 1;
Do[
 iposition = iorder[[ipos]];
 Do[waveform = Import[ToFileName[NotebookDirectory[], "RTF_" <> ToString[
        i + 40 * (iposition - 1) + 20 * (jtarget[[iposition, index]] - 1)] <> "_APD.dat"], "Table"];
waveform1 = Map[spl, waveform];
  waveform2[[i]] = Map[(m.# &), waveform1];
  waveform2[[1, 1000]];
  q[[ipos, i]] = -(Sum[waveform2[[i, j, 2]], {j, 701, 1400}] - 700 * .52) * .02 / 50 / qmip;
  , {i, 20}];
 Print[ListPlot[Table[waveform2[[i]], {i, 20}], ImageSize → {500, 300},
   Frame → True, Joined → True, PlotStyle → PointSize[.05], FrameLabel →
    {Style["t(nanoseconds)", 18], Style["Amplitude( mV)", 18], Style["APD Signal- target " <>
        state[[index]] <> ", r=" <> ToString[position[[iposition]]] <> "cms", 18]},
   LabelStyle → Directive[Black, Bold, FontSize → 18],
   PlotRange → {{10, 70}, {plotrange[[index]], 1}}]]
 ,
 {ipos,
  4}]
```



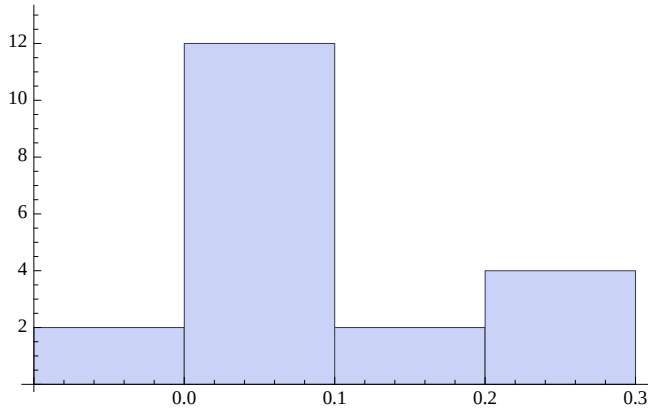

APD Signal– target out, r=61.6cms
Amplitude(mV)
t(nanoseconds)
1
0
−1
−2
−3
−4
−5
10
20
30
40
50
60
70

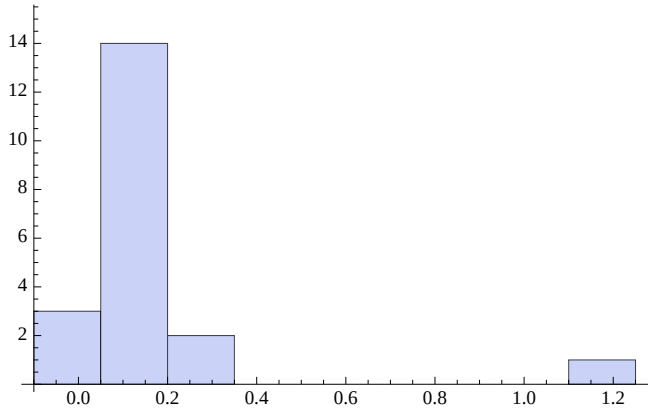

APD Signal– target out, r=35.6cms
Amplitude(mV)
t(nanoseconds)
1
0
−1
−2
−3
−4
−5
10
20
30
40
50
60
70

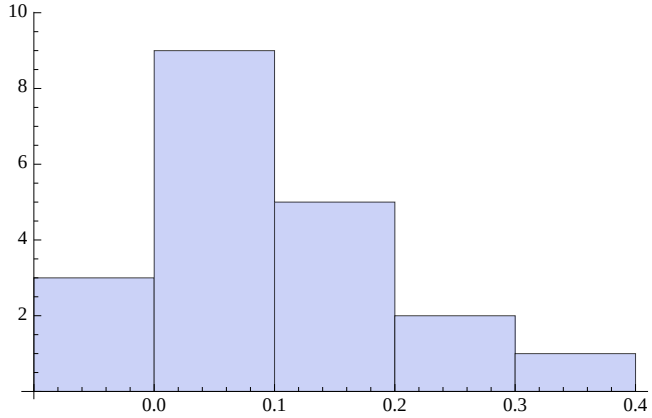


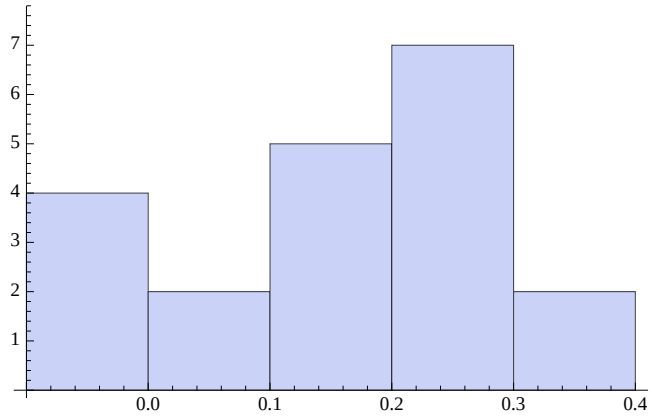
In[135]:=

In[136]:=
```
Do[Print[Histogram[q[[jj]], 20]], {jj, 4}]
```


12
10
8
6
4
2
0.0
0.1
0.2
0.3


14
12
10
8
6
4
2
0.0
0.2
0.4
0.6
0.8
1.0
1.2


10
8
6
4
2
0.0
0.1
0.2
0.3
0.4


7
6
5
4
3
2
1
0.0
0.1
0.2
0.3
0.4

In[137]:=