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

```
<< PhysicalConstants`
m = {{10^9, 0}, {0, 10^3}};
```

Fix some data records that were garbled by Matlab

```
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]
```

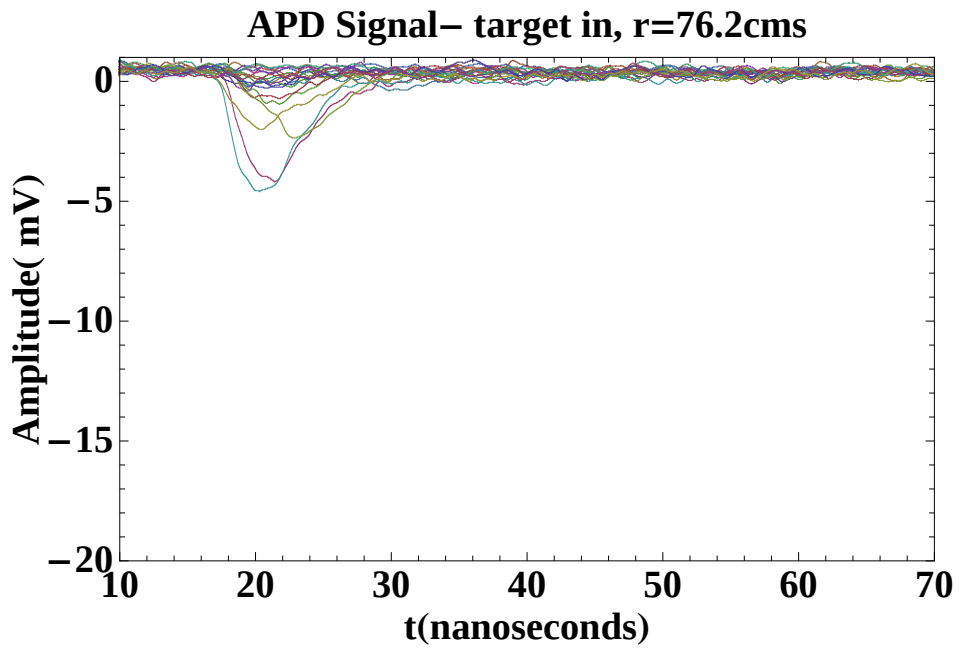
waveform2 holds the 20 waveforms at 1 position
newwave holds all 4 positions
Amps hold fitting results

```
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 = 2;
qmip = ElectronCharge[[1]] * 200 * 6000 * 10^12
```

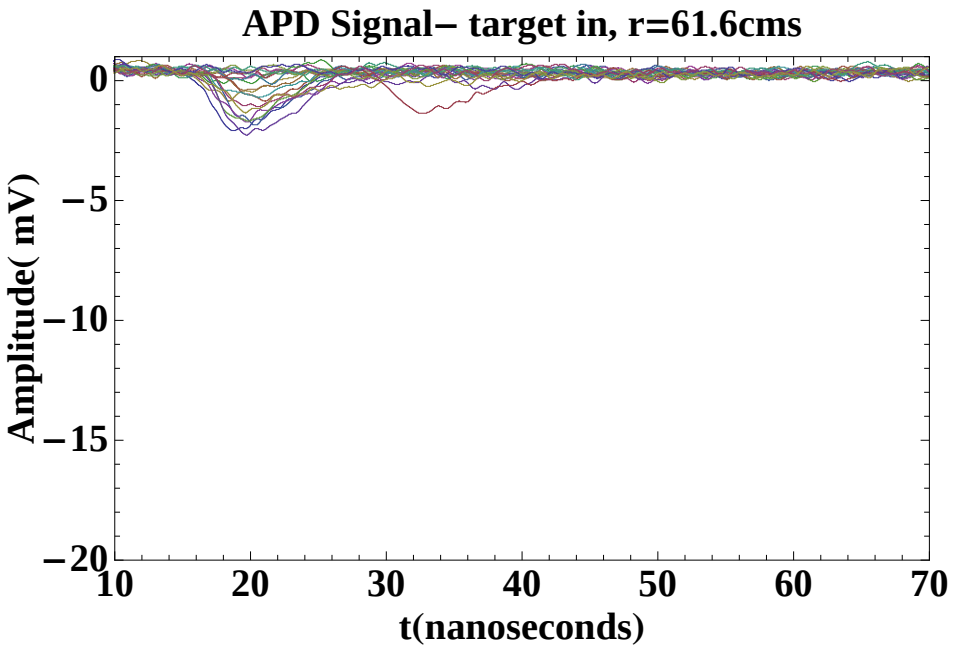
```
0.192261
```

```
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}]
```

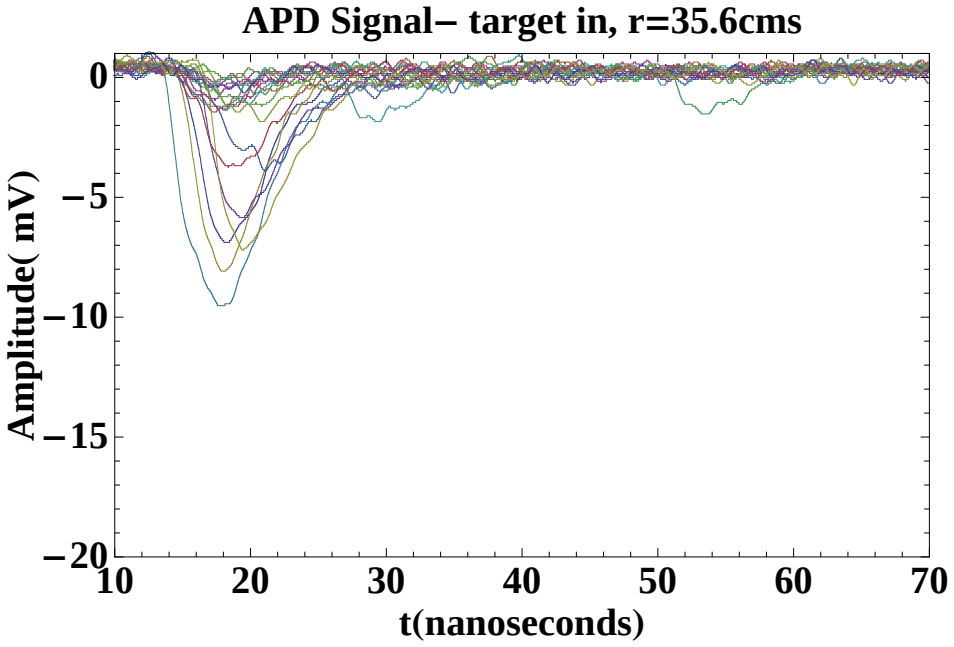
```
{0.541513, 2.87517, 0.318816, 0.320647, 0.0241338, 0.123332,
 0.0915421, 0.304919, 0.49025, 0.405199, 0.195651, 0.79675, 3.13241,
 -0.000332881, 0.792921, 1.81145, -0.111182, 0.409027, 0.268967, 1.59591}
```



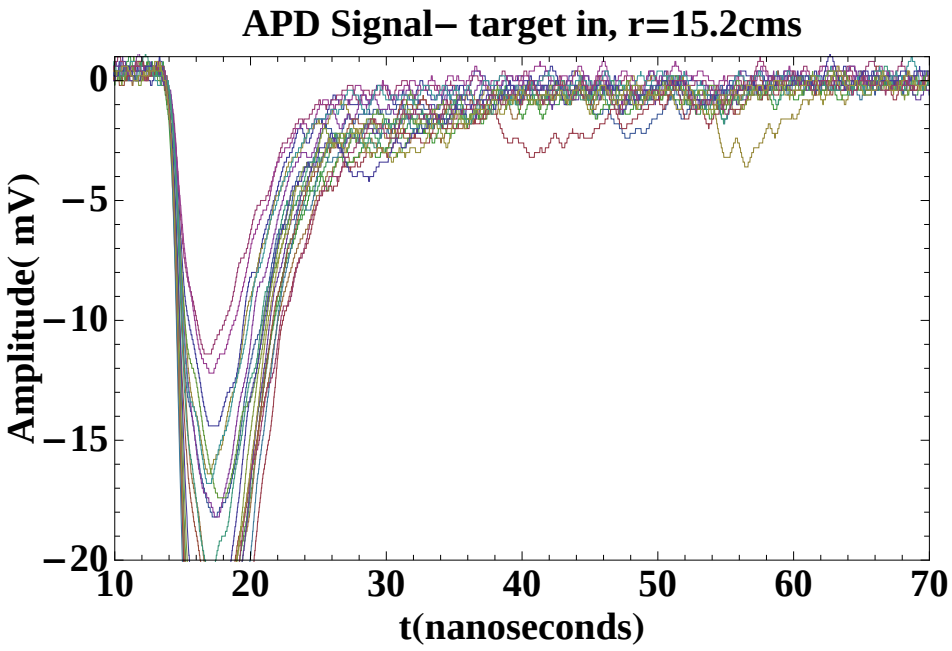

```
{1.66082, 0.202641, 0.739078, 0.342534, 1.4323, 0.139727, 0.554329, 0.319815, 0.358928, 1.54082,
 0.831036, 1.3579, 0.73267, 1.94469, 0.256235, 0.169603, 0.113679, 0.0852174, 1.1129, 1.37721}
```



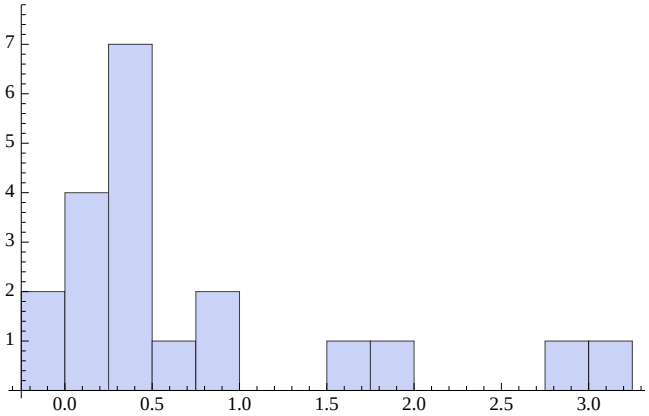
{4.63053, 0.496824, 5.23471, 1.25363, 3.1642, 0.509973, 0.529446, 0.387306, 7.45869, 1.0033,
1.27743, 1.26245, 1.38295, 4.23391, 2.91786, 1.40992, 0.573054, 0.720187, 1.09052, 4.93545}

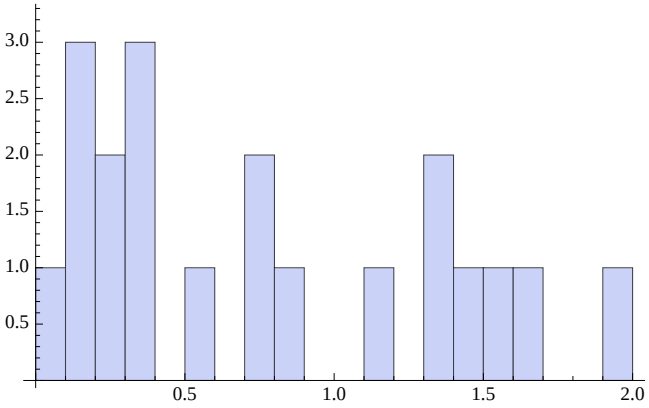


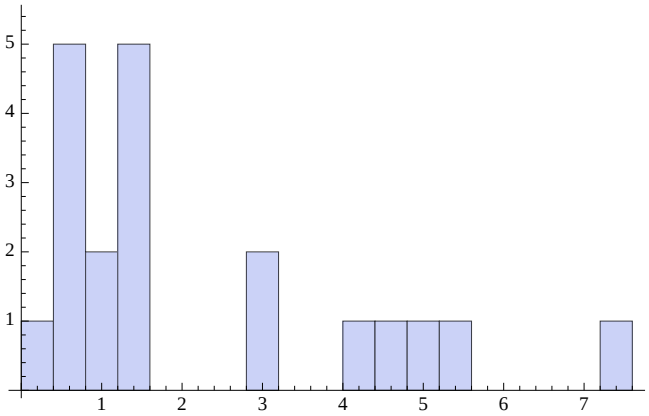
{9.93107, 7.76777, 10.978, 19.8509, 13.3564, 8.41272, 17.557, 20.2891, 22.675, 12.4052,
17.0081, 13.2873, 11.1107, 19.4789, 23.833, 17.5253, 14.4874, 16.5175, 20.6211, 18.4965}

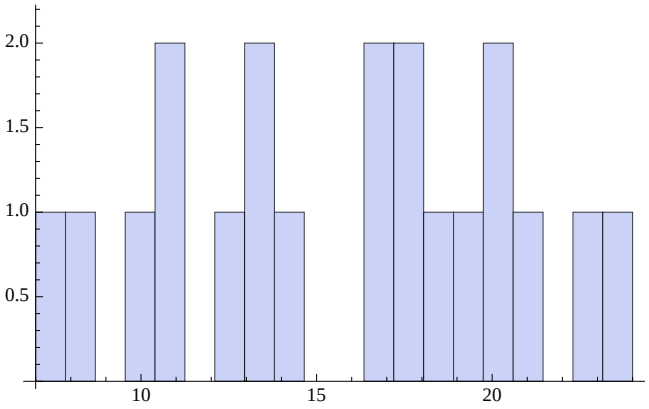



```
Do[Print[Histogram[q[[jj]], 20]], {jj, 4}]
```


7
6
5
4
3
2
1
0.0
0.5
1.0
1.5
2.0
2.5
3.0


3.0
2.5
2.0
1.5
1.0
0.5
0.5
1.0
1.5
2.0


5
4
3
2
1
1
2
3
4
5
6
7


2.0
1.5
1.0
0.5
10
15
20