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

```
Needs["Histograms`"]
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

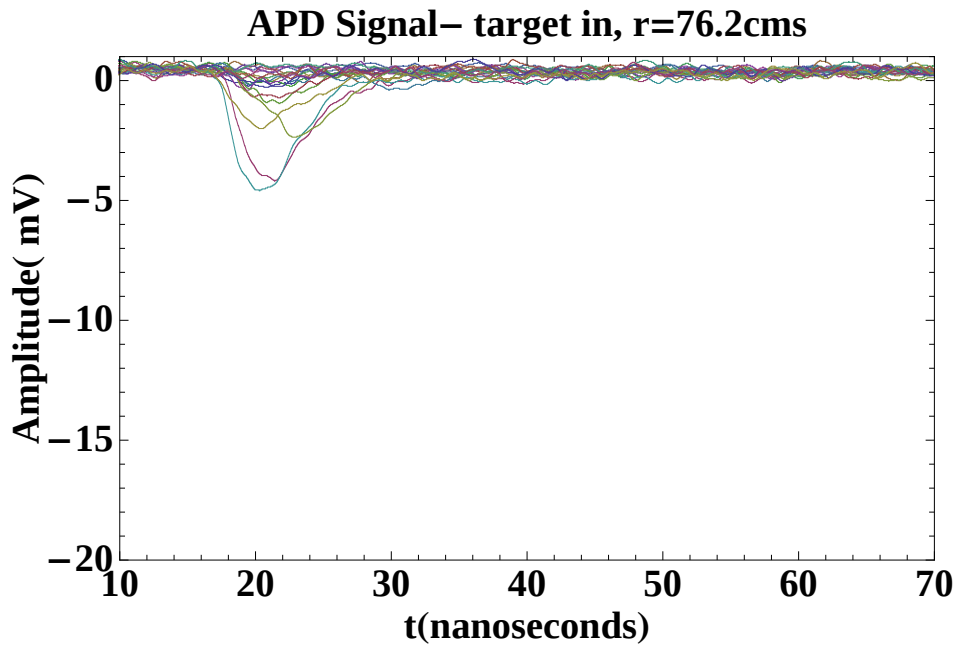
```
waveform = Array[0 &, {5000, 2}]; waveform1 = Array[0 &, {5000, 2}];
waveform2 = Array[0 &, {20, 5000, 2}];
aveAmp = ConstantArray[0, {2, 4}]; rmsAmp = ConstantArray[0, {2, 4}];
q = ConstantArray[0, {4, 20}]; h1 = Range[20]; h2 = Range[20];
Amplitude = Range[20];
state = {"out", "in"};
position = {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};
(*Traces[]:=Module[{newwave},*)
index = 2;
```

```
ipos = 1
Do[
 Print[iposition = iorder[[ipos]]]
  Print[ToString[1 + 40 * (iposition - 1) + 20 * (jtarget[[iposition, index]] - 1)]]
  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]]
    Print[q[[ipos, i]] = -(Sum[waveform2[[i, j, 2]], {j, 701, 1400}] - 700 * .52) * .02 / 50]
   , {i, 20}];
 Print[q[[ipos]]]
  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}}]]

 (*Print[Histogram[q[[iposition]],HistogramCategories→20,ApproximateIntervals→False]]*)
 , {ipos, 4}]
(*
index=2
  Do[Traces[]
   (*Evaluate[newwave[[iposition,index]]=waveform2]*)
   ,{ipos,4}]*)
```

```
1
```

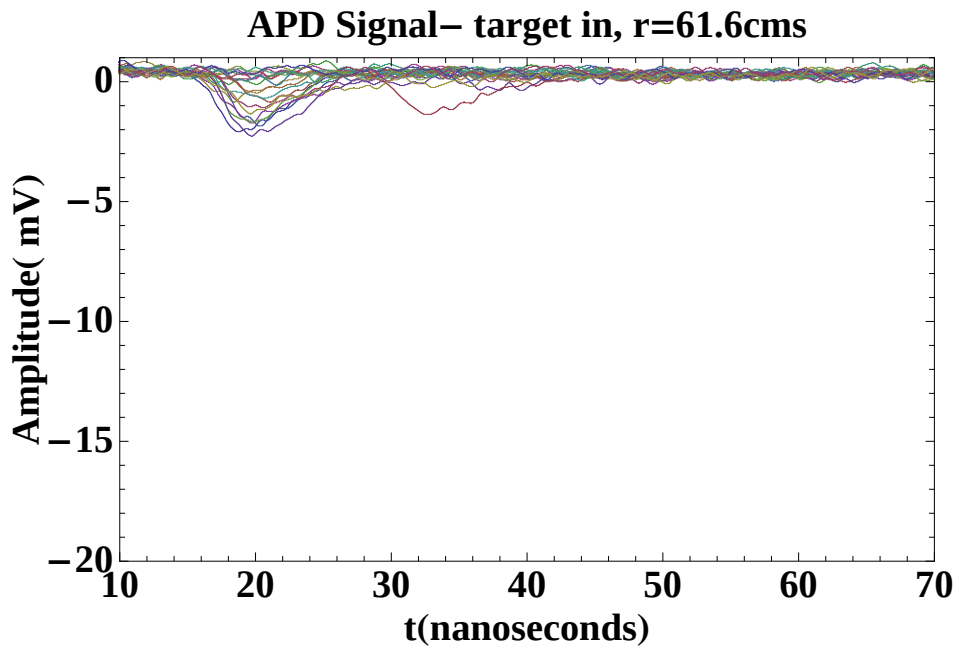
```
4

121

0.104112

0.552784

0.061296

0.061648

0.00464

0.023712

0.0176

0.058624

0.094256

0.077904

0.037616

0.153184

0.60224

-0.000064

0.152448

0.348272

-0.021376
```

```
0.07864

0.051712

0.306832

{0.104112, 0.552784, 0.061296, 0.061648, 0.00464, 0.023712, 0.0176, 0.058624, 0.094256, 0.077904,
 0.037616, 0.153184, 0.60224, -0.000064, 0.152448, 0.348272, -0.021376, 0.07864, 0.051712, 0.306832}
```




```
1

21

0.319312

0.03896

0.142096

0.065856

0.275376

0.026864

0.106576

0.061488

0.069008

0.29624

0.159776

0.261072

0.140864

0.373888

0.049264
```

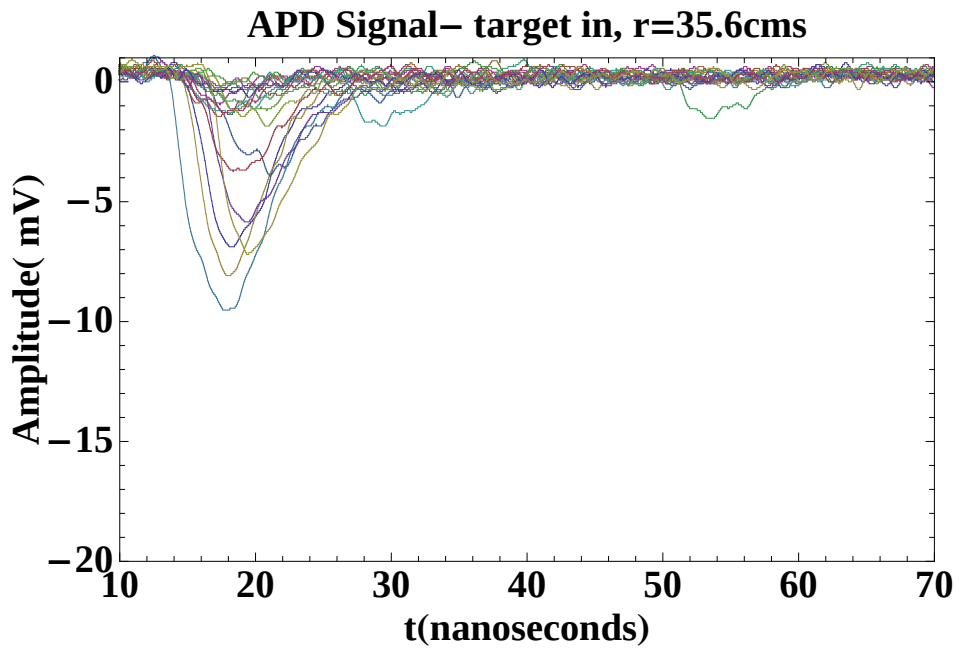
```
0.032608

0.021856

0.016384

0.213968

0.264784

{0.319312, 0.03896, 0.142096, 0.065856, 0.275376, 0.026864, 0.106576, 0.061488, 0.069008, 0.29624,
 0.159776, 0.261072, 0.140864, 0.373888, 0.049264, 0.032608, 0.021856, 0.016384, 0.213968, 0.264784}
```




```
2

41

0.890272

0.09552

1.00643

0.241024

0.608352

0.098048

0.101792

0.074464

1.43402

0.192896

0.2456

0.24272

0.265888
```

```
0.814016

0.560992

0.271072

0.110176

0.138464

0.209664

0.948896
```

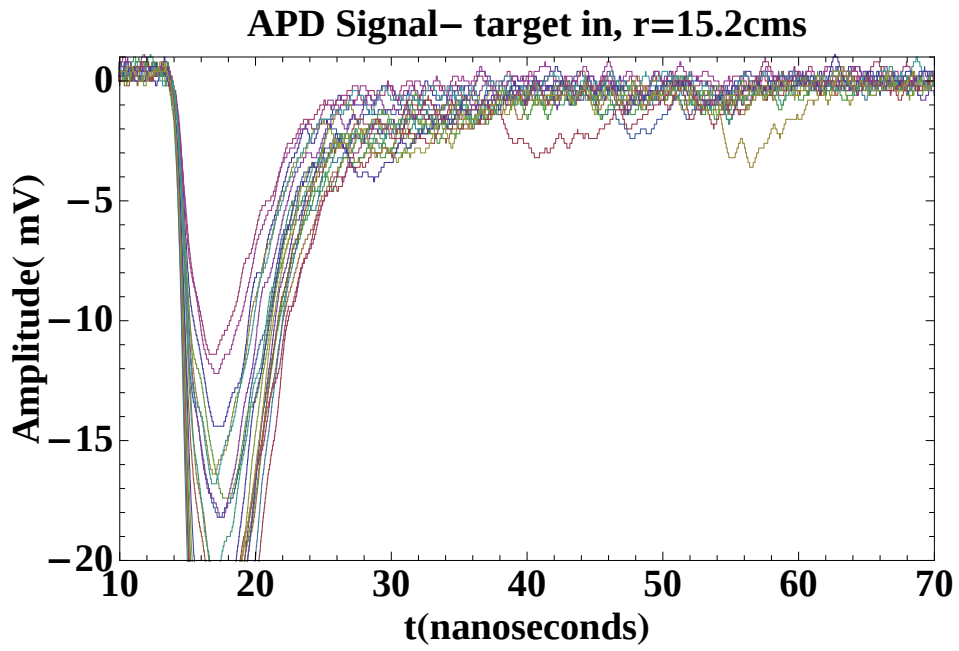
```
{0.890272, 0.09552, 1.00643, 0.241024, 0.608352, 0.098048, 0.101792, 0.074464, 1.43402, 0.192896,
 0.2456, 0.24272, 0.265888, 0.814016, 0.560992, 0.271072, 0.110176, 0.138464, 0.209664, 0.948896}
```



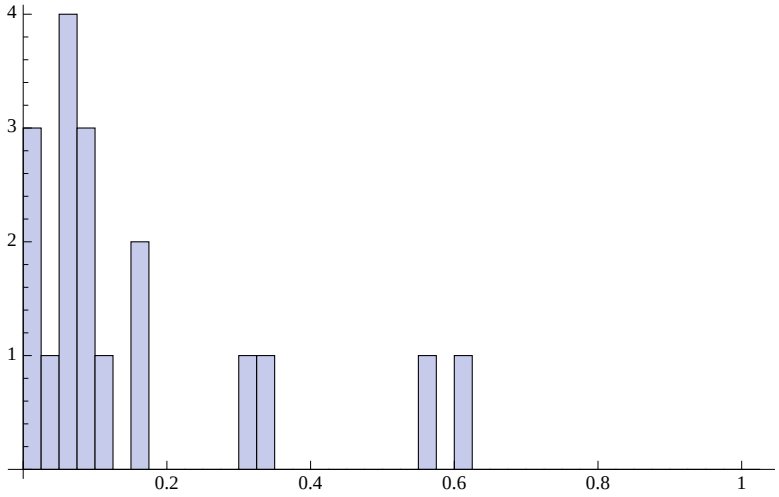

```
3

101

1.90936

1.49344

2.11064

3.81656

2.56792

1.61744

3.37552

3.9008

4.35952

2.38504

3.27
```

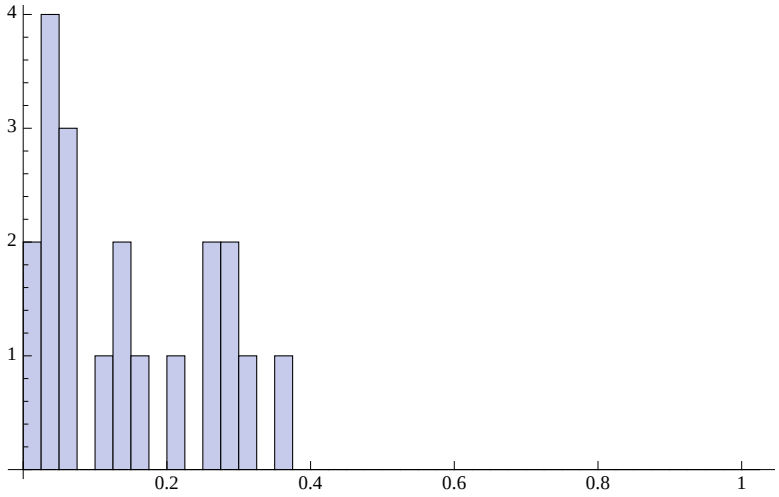
```
2.55464

2.13616

3.74504

4.58216

3.36944

2.78536

3.17568

3.96464

3.55616
```

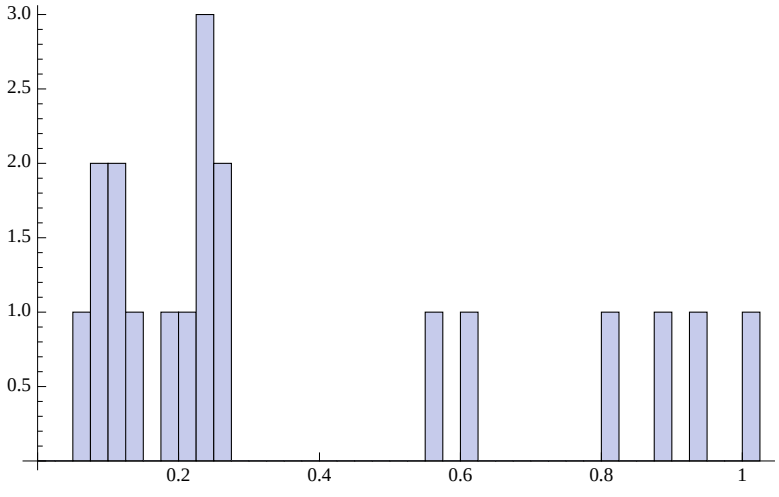
```
{1.90936, 1.49344, 2.11064, 3.81656, 2.56792, 1.61744, 3.37552, 3.9008, 4.35952, 2.38504,
 3.27, 2.55464, 2.13616, 3.74504, 4.58216, 3.36944, 2.78536, 3.17568, 3.96464, 3.55616}
```

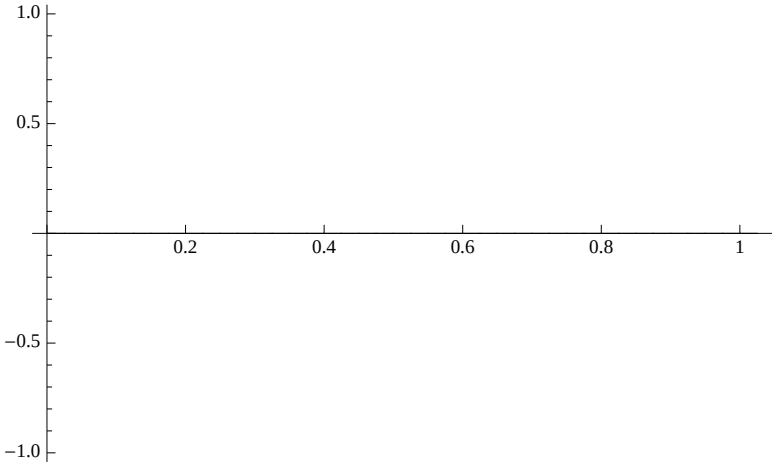



```
h1 = Table[q[[1, i]], {i, 20}];
h2 = Table[q[[2, i]], {i, 20}];
Histogram[q[[1]], HistogramRange → {0, 1}, HistogramCategories → 40]
Histogram[q[[2]], HistogramRange → {0, 1}, HistogramCategories → 40]
Histogram[q[[3]], HistogramRange → {0, 1}, HistogramCategories → 40]
Histogram[q[[4]], HistogramRange → {0, 1}, HistogramCategories → 40]
```


4
3
2
1
0.2
0.4
0.6
0.8
1


4
3
2
1
0.2
0.4
0.6
0.8
1


3.0
2.5
2.0
1.5
1.0
0.5
0.2
0.4
0.6
0.8
1


1.0
0.5
0.2
0.4
0.6
0.8
1
−0.5
−1.0