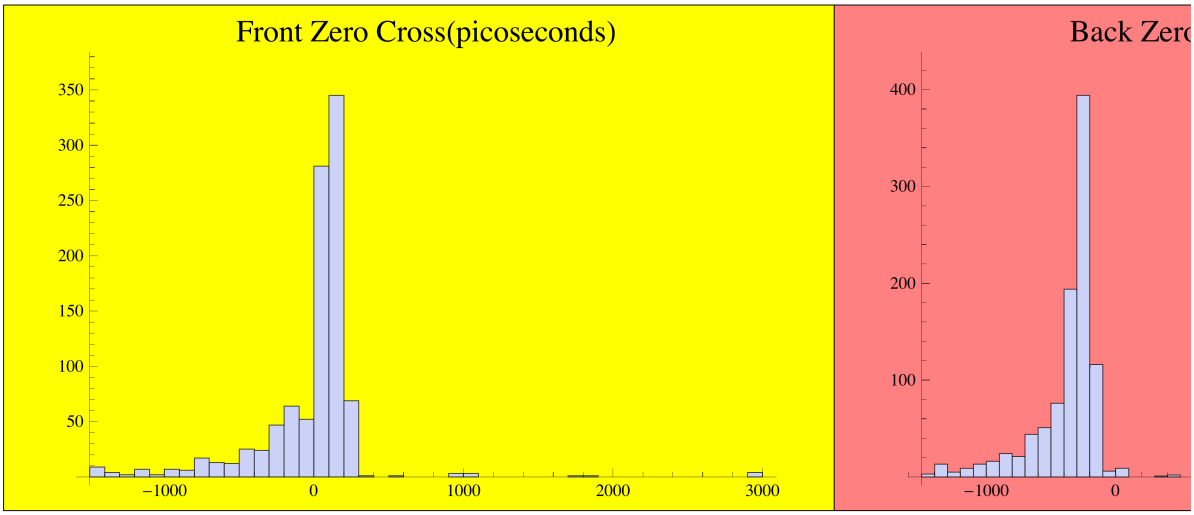
Post - processing of analysis of raw waveforms where :
1) baseline restoration done
2) Spline interpolation function applied to scope data points
3) roots of functions found in region of 2 nd zero - cross

S. White, April 9,2012

In[444]:=
```
SetDirectory["~white/Desktop"];
frontback = Import["frontback.csv", "Data"];
front = Transpose[frontback][[1]] × 10^12;
back = Transpose[frontback][[2]] × 10^12;
GraphicsRow[{Histogram[front, PlotLabel → "Front Zero Cross(picoseconds)"],
  Histogram[back, PlotLabel → "Back Zero Cross(picoseconds)"]},
 Frame → All, Background → {Yellow, Pink}]
```

Out[448]=



Deal with 9 cases out of 1000 where Roots of Interpolation function were not found for waveform. These were cases where scope triggered early and the roots are far from the initial search region.

In[449]:=
```
list = ConstantArray[0, 0]; ndrop = 0;
Do[
 If[front[[i]] == 0, ndrop++; AppendTo[list, i];
  Print["i=", i, "   front=", front[[i]], " back=", back[[i]]],]
 ,
 {i,
  1000}]
```

```
i=126   front=0 back=0

i=167   front=0 back=0

i=220   front=0 back=0

i=221   front=0 back=0

i=222   front=0 back=0

i=223   front=0 back=0

i=333   front=0 back=0

i=584   front=0 back=0

i=815   front=0 back=0
```

In[451]:=
```
ndrop
```

Out[451]= 9

In[452]:=
```
Export["droplist.csv", list]
list
```

Out[452]= droplist.csv

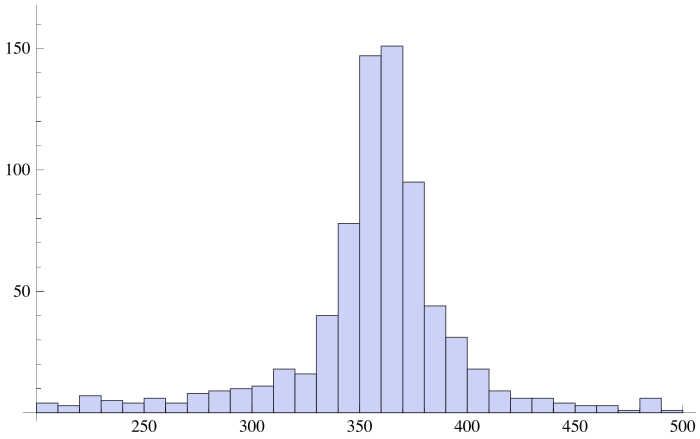
Out[453]= {126, 167, 220, 221, 222, 223, 333, 584, 815}

In[454]:=
```
Do[
 front = Drop[front, {list[[ndrop + 1 - i]]}];
 back = Drop[back, {list[[ndrop + 1 - i]]}];
 , {i, ndrop}]
```

In[455]:=
```
Diff = front - back;
```

In[456]:=
```
Histogram [Diff, {200, 500, 10}]
```

Out[456]=

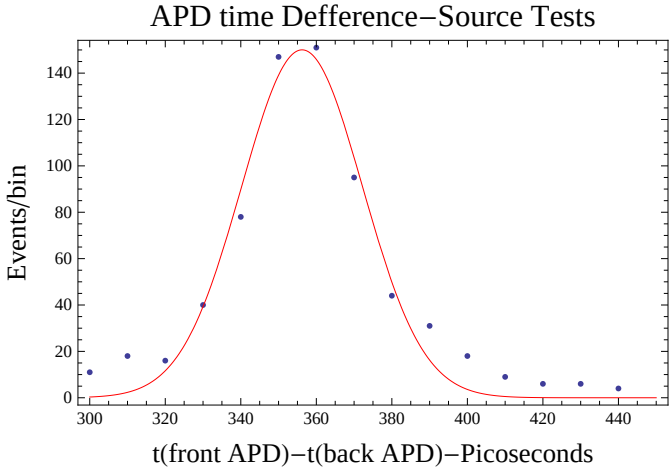


In[457]:=
```
bc = BinCounts[Diff, {300, 450, 10}];
bc2 = Transpose[{Range[300, 300 + 10 * (Length[bc] - 1), 10], bc}];
ff1 = FindFit[bc2, {amp1 * s1 * PDF[NormalDistribution[m1, s1], x],
    320 < m1 < 400, 4 < s1 < 50},
  {{m1, 360}, {s1, 15},
   {amp1, 10^2}},
  x]
```

Out[459]= {m1 → 356.225, s1 → 16.0175, amp1 → 376.085}

In[460]:=
```
fittedcurvea = amp1 * s1 * PDF[NormalDistribution[m1, s1], x] /. ff1;
Show[ListPlot[bc2], Plot[fittedcurvea, {x, 300, 450}, PlotStyle → Red],
 PlotRange → All, Frame → True,
 FrameLabel → {{"Events/bin",}, {"t(front APD)-t(back APD)-Picoseconds",
    "APD time Defference-Source Tests"}}]
```

Out[461]=



In[462]:=
```
lpp = Plot[fittedcurvea, {x, 300, 450}, PlotRange → {{300, 450}, {0, 160}},
   Frame → True, LabelStyle → Directive[Black, Bold, FontSize → 14],
   FrameLabel → {Style["t(front APD)-t(back APD)-Picoseconds", 16],
     Style["", 4], Style["t(front APD)-t(back APD)-Picoseconds", 16]},
   PlotStyle → Thick, Epilog → {Directive[PointSize[Medium], Red], Point[bc2]}];

pt = TableForm[{m4, s4} /. ff4},
  TableHeadings → {{"peak 1"}, {"mean(nsec)", "s.d.(nsec)"}}];
```