

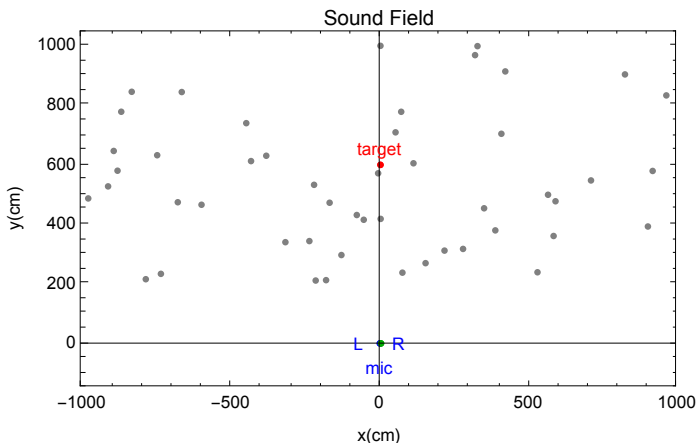
Coordinates

```

In[1427]:= soundSpeed = 340 * 102; (* 340m/s *)
micDist = 4; (* 4cm *)
near = 200; far = 1000; (* 1m to 10m *)
magnify =  $\left(\frac{\text{far}}{2}\right)^3$ ;
labelShift = 50;
nSource = 50;
micCoord = {{-  $\frac{\text{micDist}}{2}$ , 0}, {  $\frac{\text{micDist}}{2}$ , 0}};
tarCoord = {0,  $\frac{3}{5}$  far};
envSource = Transpose[RandomReal[#, nSource - 2] & /@
  {{-1, 1} far (* xRange *), {near, far} (* yRange *)};
AppendTo[envSource, {0, far}];
points = {envSource, {tarCoord}, {micCoord[[1]]}, {micCoord[[2]]}};
ListPlot[points, PlotStyle -> {Gray, Red, Blue, DarkerBlue},
  AspectRatio -> Automatic, PlotLabel -> "Sound Field",
  FrameLabel -> {"x (cm)", "y (cm)"}, AxesOrigin -> {0, 0},
  PlotRange -> {{-far, far}, {-3 labelShift, far + labelShift}},
  Epilog -> {Inset[Style["target", Red], tarCoord + {0, labelShift}],
    Inset[Style["L", Blue], micCoord[[1]] + {0, labelShift}],
    Inset[Style["R", DarkerBlue], micCoord[[2]] + {0, labelShift}]}];

```

Out[1435]=



Source Wave Forms

```
In[1436]:= wave[amp_, f_,  $\phi$ _, t_] := amp Sin[2  $\pi$  f t +  $\phi$ ];  
ampRange = {500, 1000};  
fRange = {50, 20 000} (* 50Hz~20kHz *);  
 $\phi$ Range = {0, 2  $\pi$ };  
randWavePar = {randAmp, randFreq, randPhase} =  
  RandomReal[#, nSource] & /@ {ampRange, fRange,  $\phi$ Range};  
randWaves = wave[#[[1]], #[[2]], #[[3]], t] & /@ Transpose[{randWavePar, #} & /@ Range[nSource]];  
Plot[randWaves, {t, 0, 2 Pi / fRange[[2]]}]
```



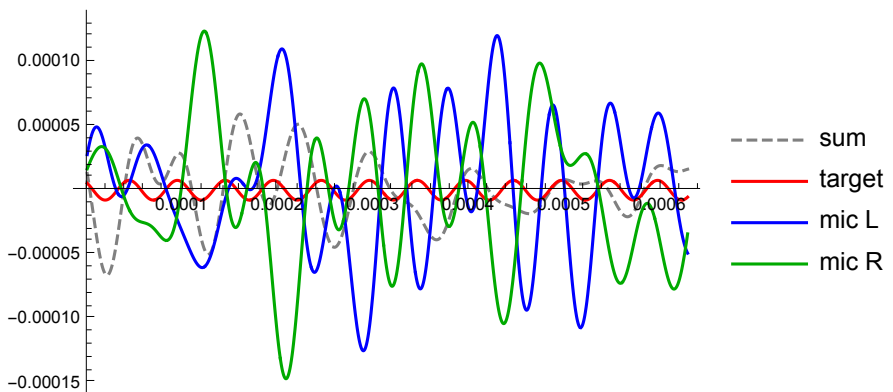
Received Waves

```

In[1441]:= dist = N@Table[
  EuclideanDistance[#, micCoord[[c]]] & /@ Append[envSource, t],
  {c, 1, Length[micCoord]};
recAmp = randAmp / #^3 & /@ dist;
recPhase = (* needs to be checked *)
  Table[Mod[2  $\pi$  #[[1]]  $\frac{\#[[2]]}{\text{soundSpeed}}$  + #[[3]], 2  $\pi$ ] & /@
    {1, Length[micCoord]};
recWavePar = Table[{recAmp[[i]], recPhase[[i]]}, {i, 1, Length[micCoord]};
recWaves =
  Table[wave#[[1]], #[[2]], #[[3]], t] & /@ Transpose[recWavePar, {2, 1}];
compare = Total[#] & /@ {randWaves / magnify,
  {randWaves[[-1]] / magnify, recWaves[[1]], recWaves[[2]]}};
styles = {{Dashed, Gray}, Red, Blue, Darker@Green};
legends = {"sum", "target", "mic L", "mic R"};
Plot[compare, {t, 0,  $\frac{2 \pi}{10 \text{ far}}}$ , PlotStyle → styles,
  PlotLegends → LineLegend[styles, legends]]

```

Out[1449]=



Filtering

In[1514]:= (*tuneDist= $\frac{4}{5}$ far;*)

```
filtered = Table[If[recPhase[[1, i]] == recPhase[[2, i]],
    recWavePar[;;, i], Nothing], {i, nSource}];
```

```
effect = Prepend[wave[#[[1]], #[[2]], #[[3]], t] & /@ filtered[
    randWaves[[-1]] / magnify];
```

```
styles = {Red, Blue, Darker@Green};
```

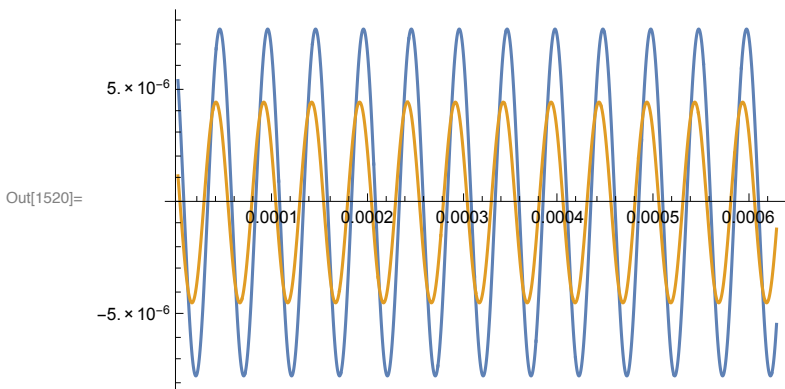
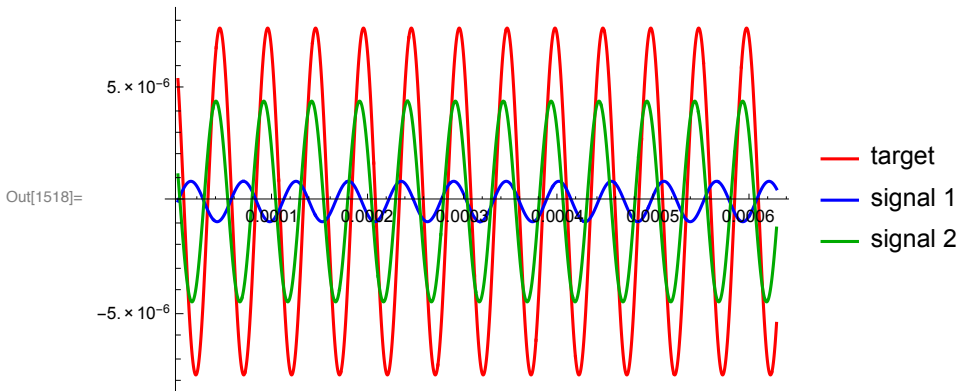
```
legends = {"target", "signal 1", "signal 2"};
```

```
Plot[effect, {t, 0,  $\frac{2\pi}{10 \text{ far}}$ }, PlotStyle → styles,
```

```
PlotLegends → LineLegend[styles, legends]]
```

```
major = SortBy[filtered, First][[-1, 1]];
```

```
Plot[{randWaves[[-1]] / magnify,
    wave[#[[1]], #[[2]], #[[3]], t] & /@ {major}}, {t, 0,  $\frac{2\pi}{10 \text{ far}}$ }]
```



```

In[1533]:= Play[Total[randWaves], {t, 0,  $\frac{2\pi}{f_{far}}$ }]

Play[Total[recWaves[[1]]], {t, 0, 10  $\frac{2\pi}{f_{far}}$ }]

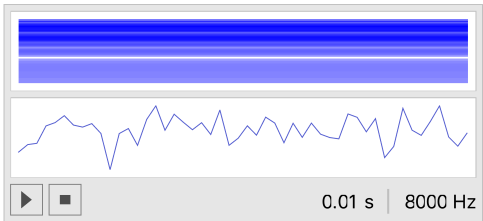
Play[randWaves[[-1]], {t, 0, 10  $\frac{2\pi}{f_{far}}$ }]

Play[Total[effect[[2 ;;]]], {t, 0, 10  $\frac{2\pi}{f_{far}}$ }]

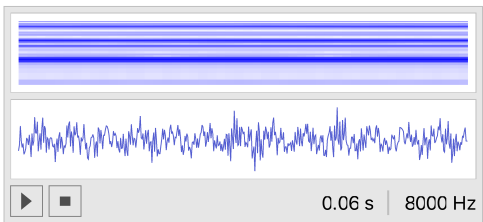
Play[(wave[#[[1]], #[[2]], #[[3]], t] &

```

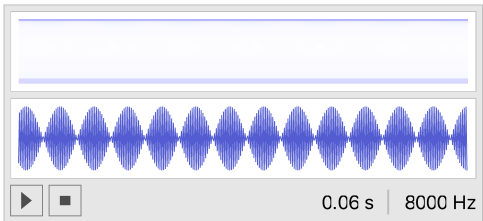
Out[1533]=



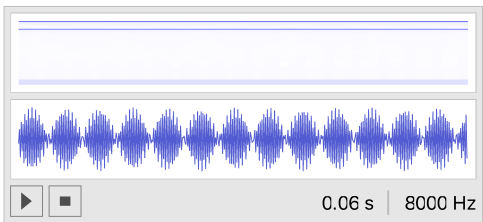
Out[1534]=



Out[1535]=



Out[1536]=



Out[1537]=

