Task 0

I dont mind if the lecture is digital or physical, but I would really like if the lectures are recorded as the lecture collides with something else for me. I read the powerpoints but I dont feel like this is sufficent.

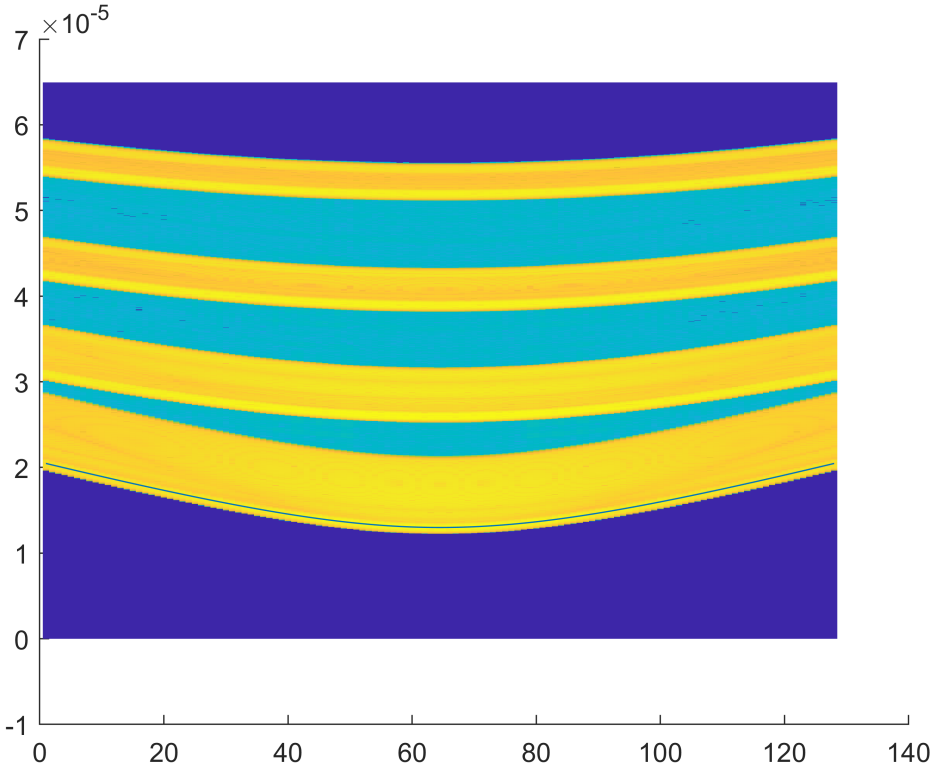
And I think either the assignments should be out earlier or the assignment lecture should be moved to monday or tuesday, as the time from getting the assignment to the assignment lecture/aid is very short.

Loading in the files and setting global variables given in assignment.

```
invivo_data = load("invivoData.mat");
sim_data = load("simdata.mat");
c = 1540;
```

Task 1

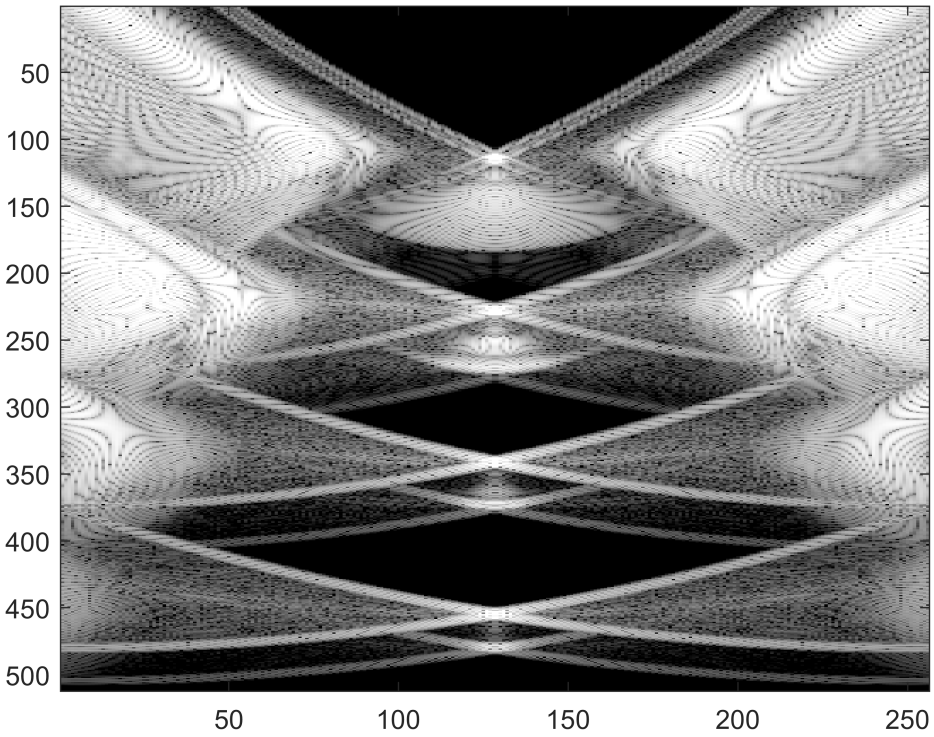
```
sim_elpos = sim_data.elPosX;
sim_Rf = sim_data.RFdata;
sim_Rf_t = sim_data.RF_t;
x1 = 0;
z1 = 0.01; %meter
TOF_sim = TOF(z1,c,x1,sim_elpos);
[sim_rows, sim_cols] = size(sim_Rf);
sim_xaxis = linspace(1,sim_cols,sim_cols);
%colormap(gray(256));
%imagesc(sim_Rf');
figure(1);
imagesc('XData',sim_xaxis,'YData',sim_Rf_t,'CData', log(abs(sim_Rf)));
hold on;
plot(TOF_sim);
```



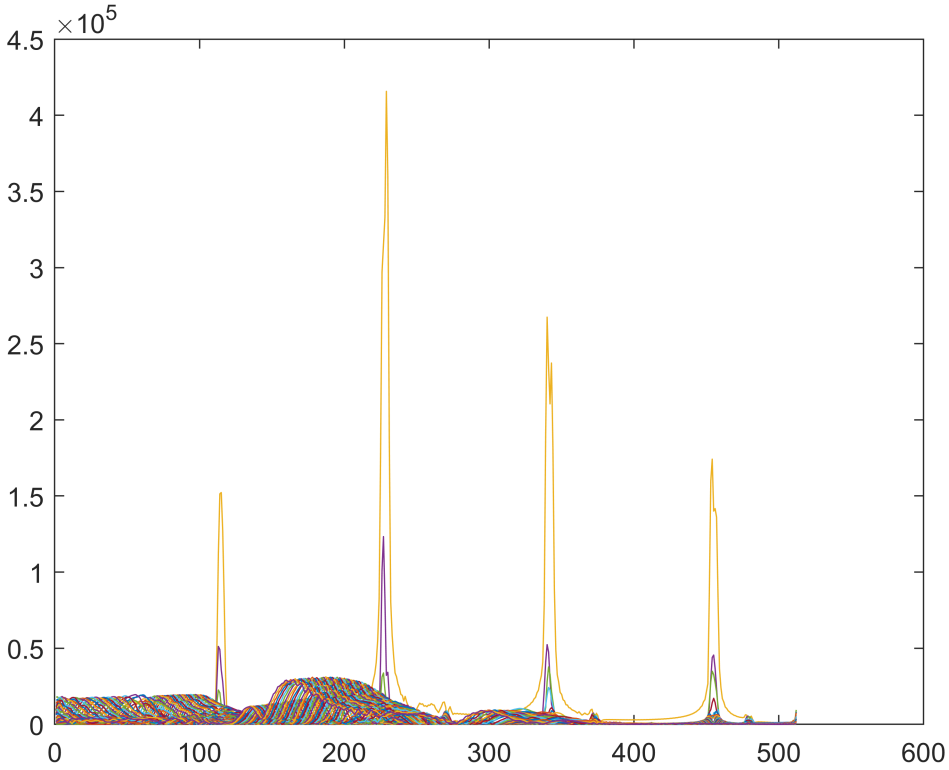

```
x = linspace( -2e-2, 2e-2, 256); %x-coordinates
zlen = 512;
z = linspace( 0, 4.5e-2, zlen).'; %z-coordinates
sim_elpos = permute(sim_elpos, [3 2 1]);
[X, Z] = meshgrid( x, z); %make X and Z matrices
% initialize TOF-matrix
%TOF_sim_0 = zeros( length(z), length(x), length(sim_elpos) );
TOF_sim_mat = TOF(z,c,x,sim_elpos);

%TOF_sim_mat = permute(TOF_sim_mat,[3,2,1])
```

Task 2

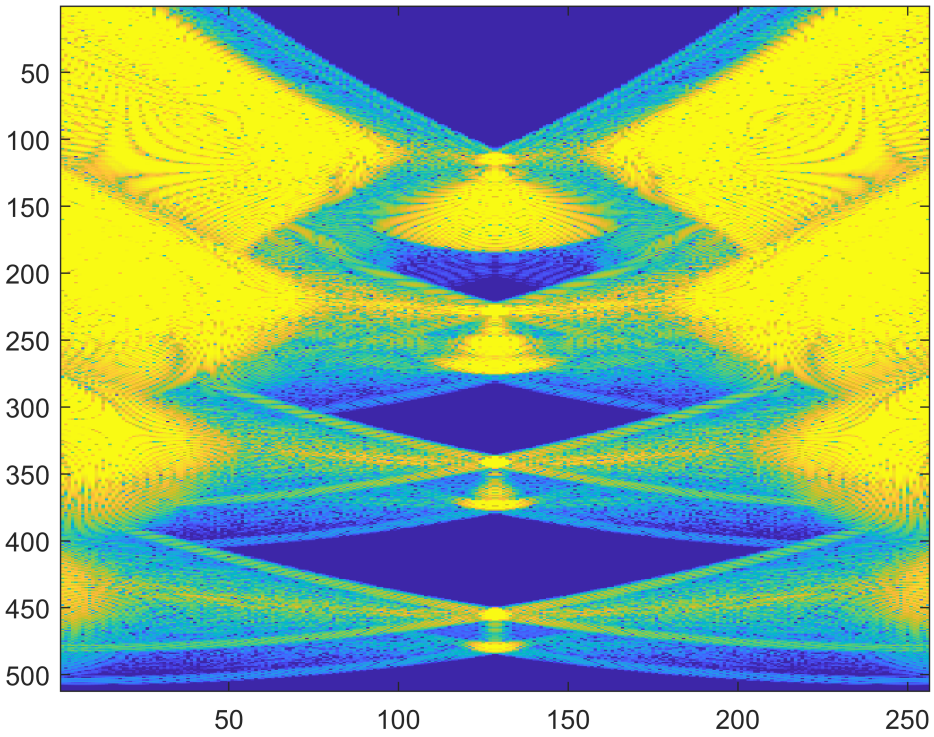
```
gain = -80;
dyn = 80;
delayed_data = interpTOF(sim_Rf, sim_Rf_t, TOF_sim_mat);
bf_sim_rf = squeeze(sum(delayed_data,1));
figure(2), imagesc( 20*log10( abs( bf_sim_rf) ) )
caxis([-dyn 0]-gain);
colormap("gray");
```



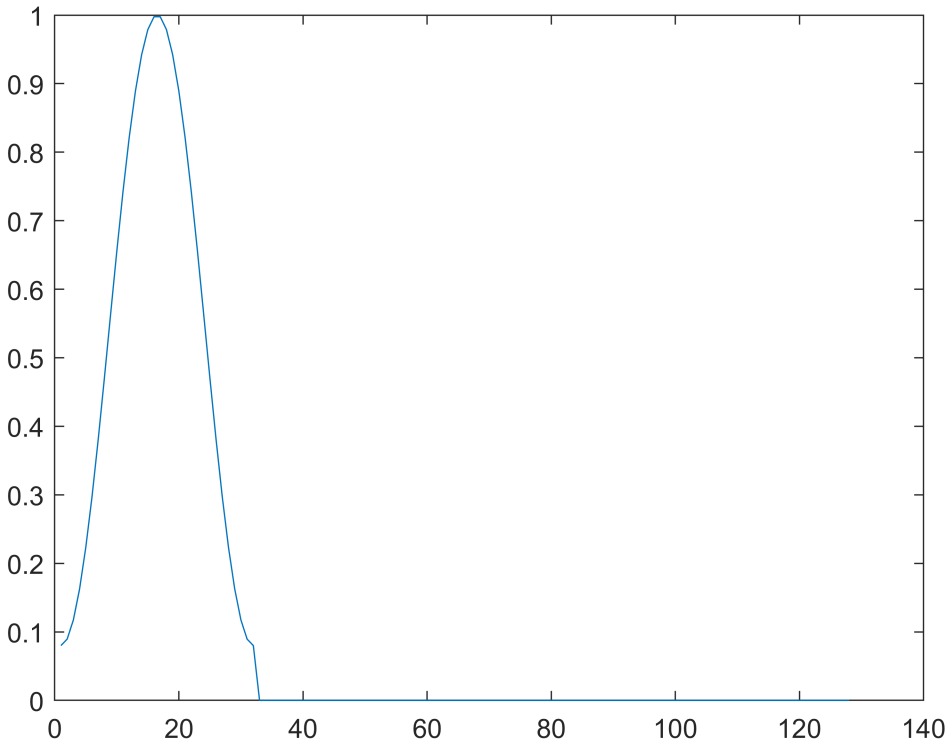

```
sim_envelope = abs(hilbert(bf_sim_rf));
figure(3);
plot(sim_envelope);
```



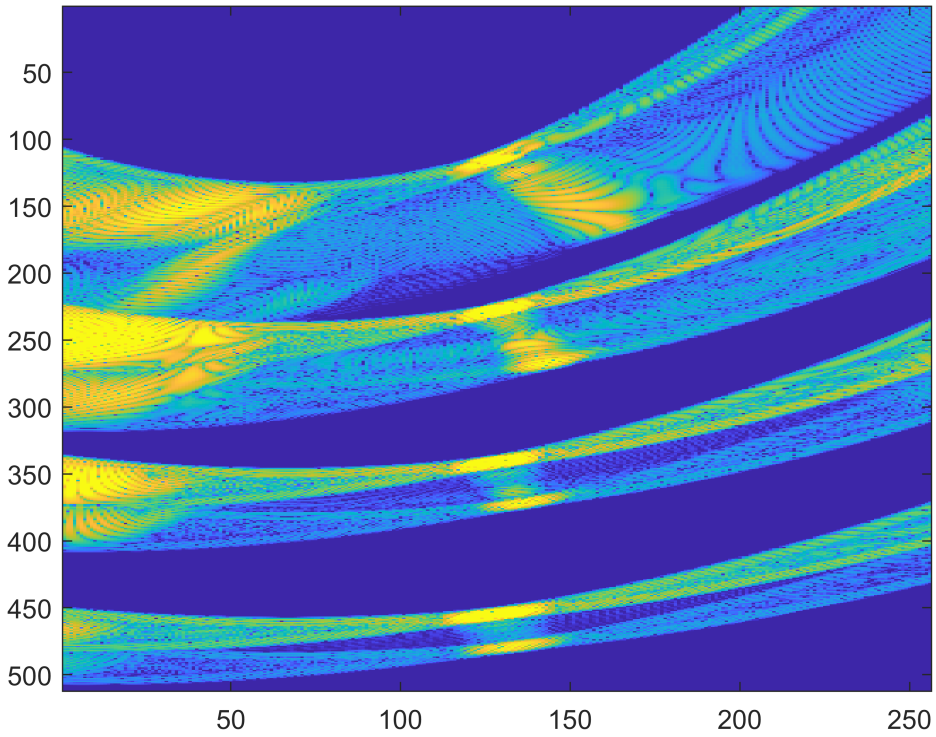

```
apod = hamming( size( delayed_data, 1) );
bf_sim_rf_apod1 = squeeze( sum( delayed_data.*apod) );
figure(4), imagesc( 20*log10( abs( bf_sim_rf_apod1) ) );
%colormap("gray");
dyn = 80;
gain = -60;
caxis([-dyn 0]-gain);
```



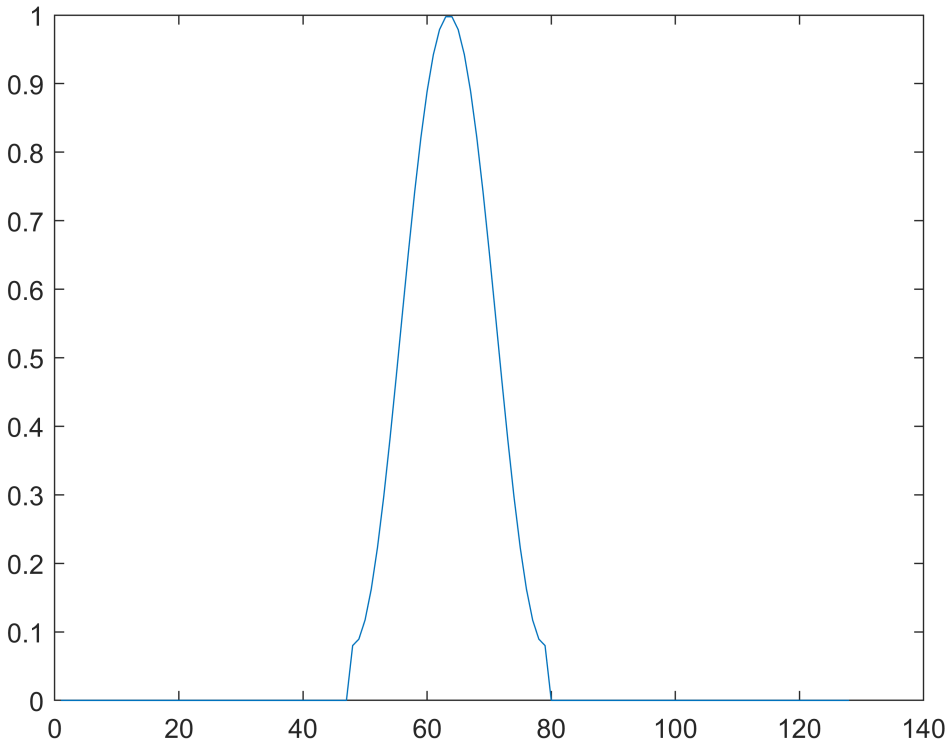

```
apod_32_first = zeros(size( delayed_data, 1),1);
apod_32_first(1:32) = hamming(32); %this didnt look right,
% but didnt quite understand how it should be done
bf_sim_rf_apod2 = squeeze( sum( delayed_data.*apod_32_first) );
figure(5);
plot(apod_32_first)
```



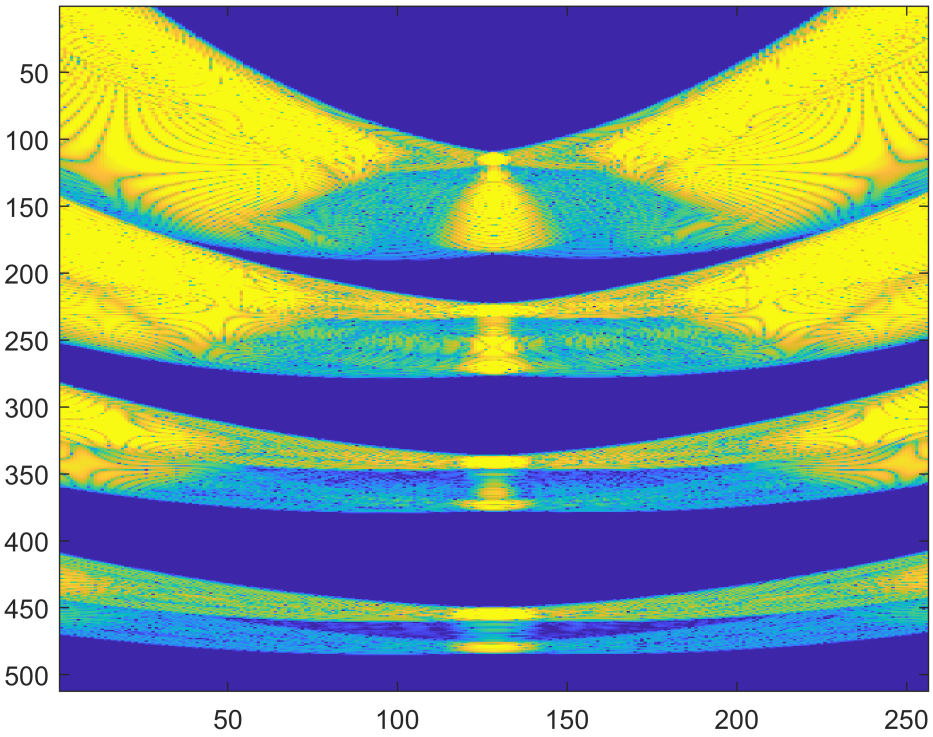

```
figure(6), imagesc( 20*log10( abs( bf_sim_rf_apod2) ) ); %dont know why
% sometimes the color is blue and yellow and sometimes black and white.
dyn = 80;
gain = -60;
caxis([-dyn 0]-gain);
```




```
apod_32_center = zeros(size( delayed_data, 1),1);
apod_32_center(48:79) = hamming(32); %ich center
bf_sim_rf_apod3 = squeeze( sum( delayed_data.*apod_32_center) );
figure(7);
plot(apod_32_center)
```



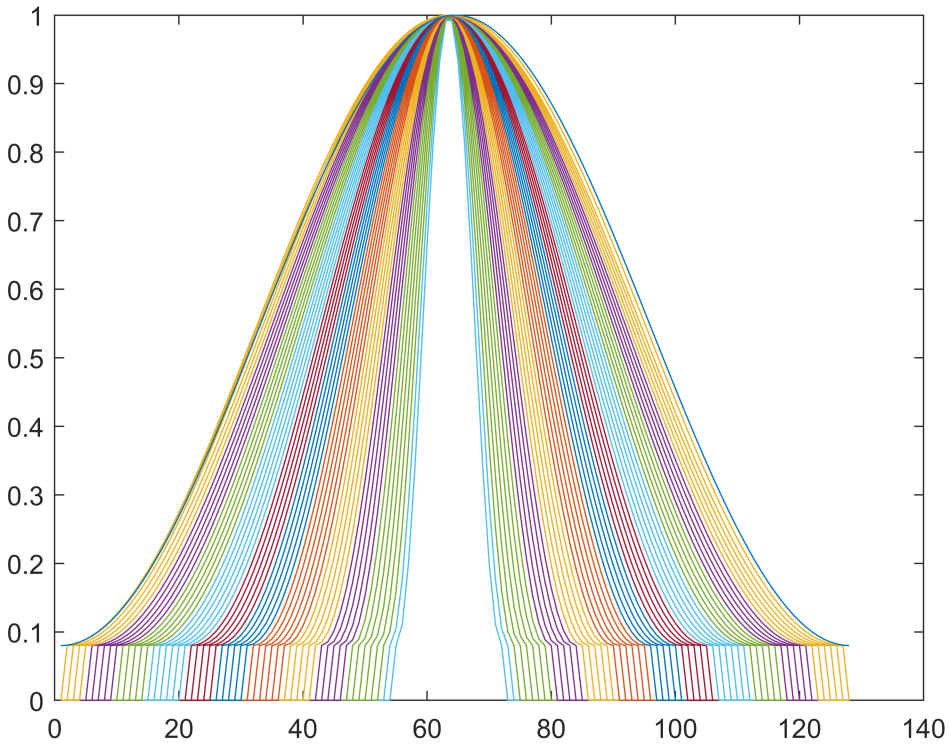

```
figure(8), imagesc( 20*log10( abs( bf_sim_rf_apod3) ) ); %dont know why
% sometimes the color is blue and yellow and sometimes black and white.
dyn = 80;
gain = -60;
caxis([-dyn 0]-gain);
```



It seems like we are squeezing the image in different directions. And changing the size of the sidelobes.

Task 3

```
%for x = 0 amd fnumber = 1
apod1 = generateApod(sim_elpos, 0, z, 1);
figure(9);
plot(apod1);
```




```
% for xpos = x
%     apod4 = generateApod(sim_elpos, xpos,z,0.5)
%     bf_sim_rf_apod4= squeeze( sum( delayed_data.*apod4) );
%     figure(), imagesc( 20*log10( abs( bf_sim_rf_apod4) ) ); %dont know why
% % sometimes the color is blue and yellow and sometimes black and white.
%     dyn = 80;
%     gain = -60;
%     caxis([-dyn 0]-gain);
% end
```

Task 4

```
%expanding_apod = ? %havent got the expanding apod working.
% bf_sim_rf_apode= squeeze( sum( delayed_data.*expanding_apod) );
% figure(), imagesc( 20*log10( abs( bf_sim_rf_apode) ) );
% dyn = 80;
% gain = -60;
% caxis([-dyn 0]-gain);
```

Functions

```
function t = TOF(z,c,x,elposx)
    t_tx = z/c;
    t_rx = (sqrt((x-elposx).^2 + z.^2))/c;
```

```
    t = t_tx+t_rx;
end
```