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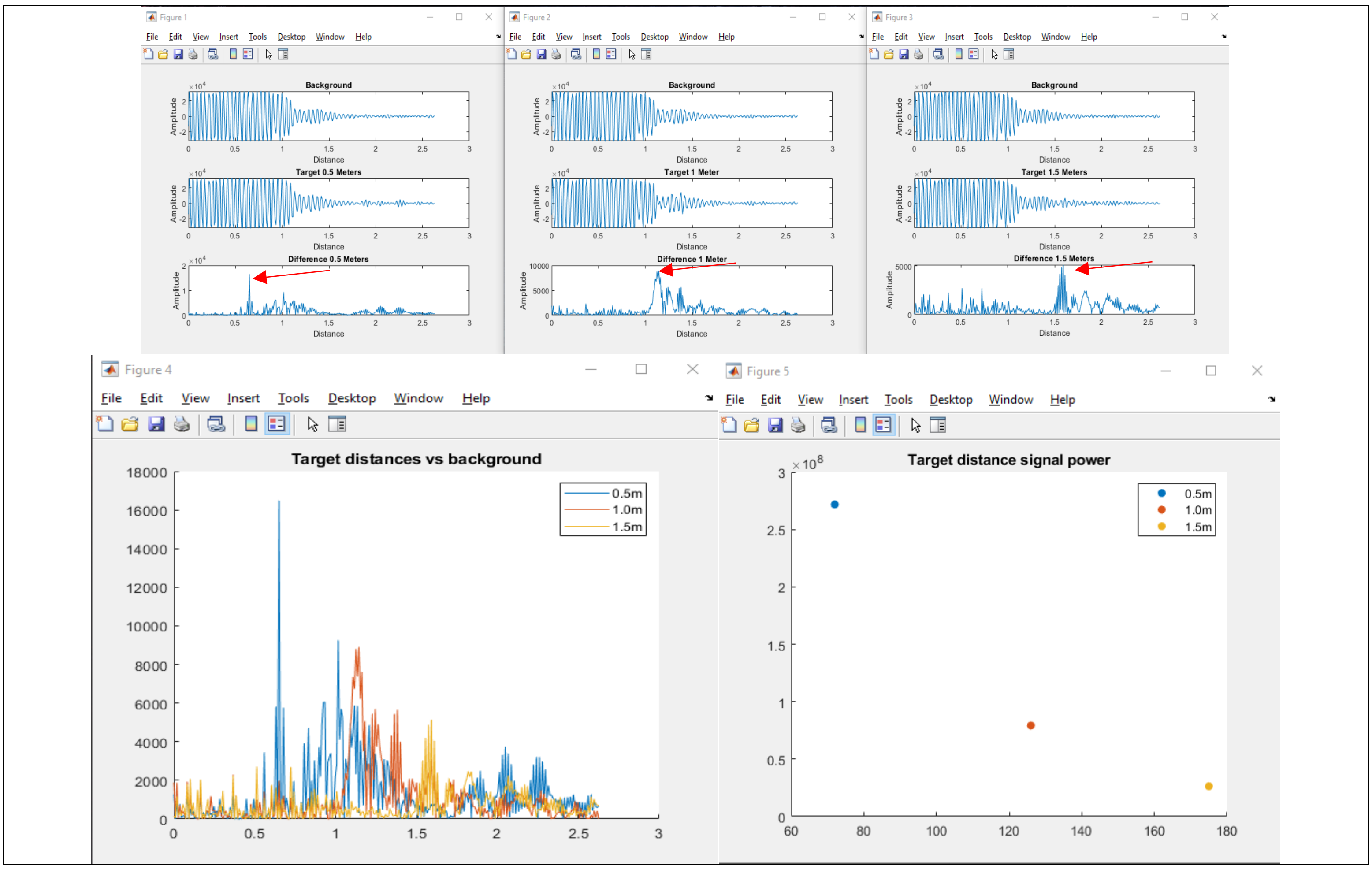
EE 384 Classwork 9 Due 17 October 2021

PDF Questions:

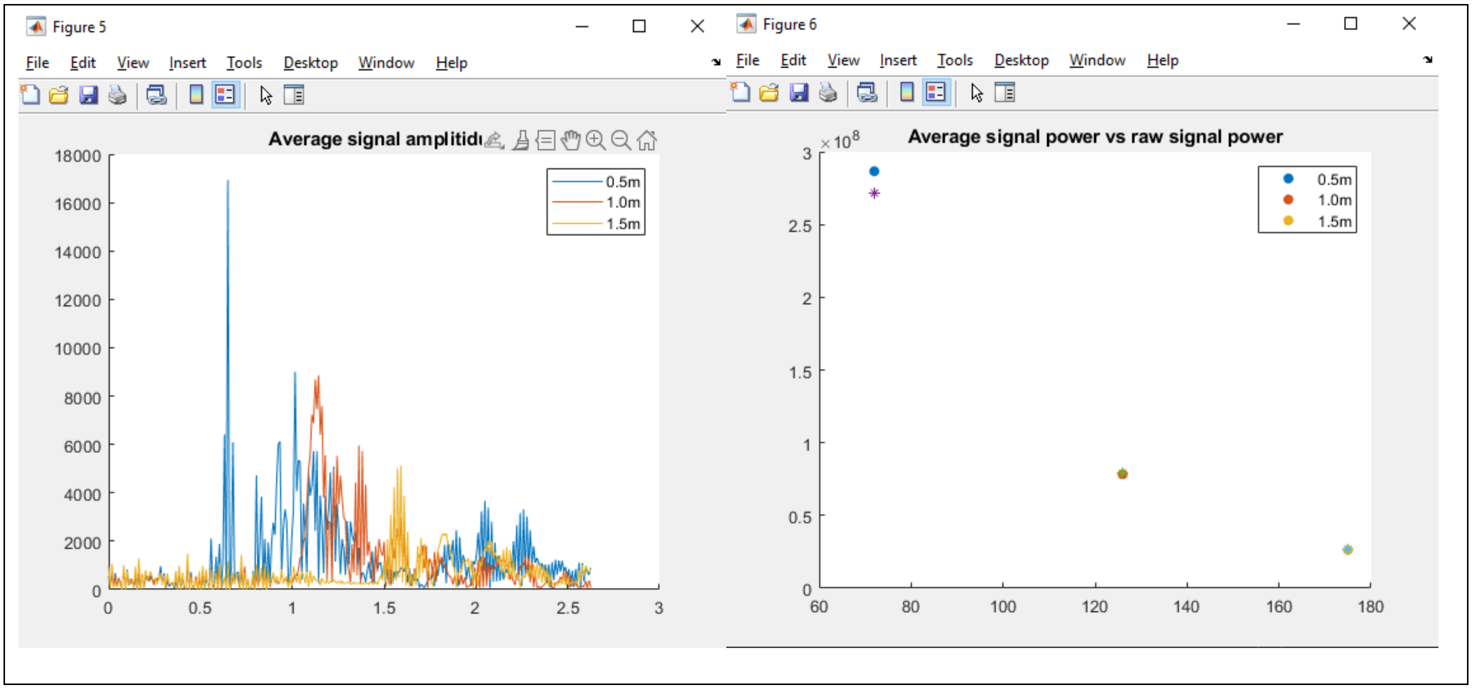
3:

10,000ps - 26666ps

7b:



MRM 8:



Questions and Further Explorations:

1. How closely did your measurements of received signal power follow the $1/R^4$ prediction? How could you improve these results?

My measurements followed the prediction closely, but not completely accurate. To improve my results I would need to be more careful and precise when taking measurements.

2. Based on your measurements of signal power as a function of target range, what would you predict the received signal power to be at a range of 10m? 30m? How could you increase the received signal power?

1 / (10m)^4 = 0.0001
1 / (30m)^4 = 0.0000012346

3. How did the received signal power vary with respect to the different targets? Did the received signal powers vary as you expected?

Yes. As the targets got further away the power dropped significantly from 0.5m – 1m and a bit less of a drop from 1m – 1.5m.

Matlab code:

```
% plotMrmRetLog.m
```

```matlab
% This script prompts the user for a MRM-RET logfile, reads, parses, and
% produces a "waterfall plot" of the motion filtered scans and detection
lists
% in the logfile
clear all; close all; clc

%% Query user for logfile
%dnm = '.'; fnm = 'MRM_002.csv';
[fnmb,dnmb] = uigetfile('*.csv');
fprintf('Reading logfile %s\n',fullfile(dnmb,fnmb));
[cfgb,reqb,scnb,det] = readMrmRetLog(fullfile(dnmb,fnmb));

[fnmt,dnmt] = uigetfile('*.csv');
fprintf('Reading logfile %s\n',fullfile(dnmt,fnmt));
[cfgt05,reqt05,scnt05,dett05] = readMrmRetLog(fullfile(dnmt,fnmt));

[fnmt,dnmt] = uigetfile('*.csv');
fprintf('Reading logfile %s\n',fullfile(dnmt,fnmt));
[cfgt1,reqt1,scnt1,dett1] = readMrmRetLog(fullfile(dnmt,fnmt));

[fnmt,dnmt] = uigetfile('*.csv');
fprintf('Reading logfile %s\n',fullfile(dnmt,fnmt));
[cfgt15,reqt15,scnt15,dett15] = readMrmRetLog(fullfile(dnmt,fnmt));

%% Pull out the raw scans (if saved)

[diff05, back05, tar05] = readscan(scnb, scnt05);
[diff1, back1, tar1] = readscan(scnb, scnt1);
[diff15, back15, tar15] = readscan(scnb, scnt15);

%% Plot difference, background, target.
[Rbin05, distance05, pow05, i1, a05] = RbinPlot(diff05, back05, tar05, '0.5
Meters');
[Rbin1, distance1, pow1, i2, a1] = RbinPlot(diff1, back1, tar1, '1 Meter');
[Rbin15, distance15, pow15, i3, a15] = RbinPlot(diff15, back15, tar15, '1.5
Meters');

figure
hold on;
plot(Rbin05,diff05(10,:));
plot(Rbin1,diff1(10,:));
plot(Rbin15,diff15(10,:));
legend('0.5m', '1.0m', '1.5m');
title('Target distances vs background');

figure
hold on;
scatter(i1,pow05, 'filled');
scatter(i2,pow1, 'filled');
scatter(i3,pow15, 'filled');
legend('0.5m', '1.0m', '1.5m');
title('Target distance signal power');

%% Create the waterfall horizontal and vertical axes
[avg05, new_distance05, max05, i] = difference(diff05, Rbin05);
```

```
[avg1, new_distance1, max1, j] = difference(diff1, Rbin1);
[avg15, new_distance15, max15, k] = difference(diff15, Rbin15);

%% Create the amplitude plot.
figure;
hold on;
plot(Rbin05, avg05);
plot(Rbin1, avg1);
plot(Rbin15, avg15);
legend('0.5m', '1.0m', '1.5m');
title('Average signal amplitidue');

%% Get the power of each Measurement.
figure;
hold on;
powavg05 = max05^2;
powavg10 = max1^2;
powavg15 = max15^2;
scatter(i,powavg05, 'filled');
scatter(j,powavg10, 'filled');
scatter(k,powavg15, 'filled');
scatter(i1,pow05, '*');
scatter(i2,pow1, '*');
scatter(i3,pow15, '*');

legend('0.5m', '1.0m', '1.5m');
title('Average signal power vs raw signal power');

%% Functions
function[diff, back, tar] = readscan(scnb, scnt)
    rawscansIb = find([scnb.Nfilt] == 1);
    back = reshape([scnb(rawscansIb).scn],[],length(rawscansIb))';

    rawscansIt = find([scnt.Nfilt] == 1);
    tar = reshape([scnt(rawscansIt).scn],[],length(rawscansIt))';

    diff = abs(back - tar);
end

function[Rbin, distance, pow, i, a05] = RbinPlot(diff, back, tar, name)
    Tbin = 32/(512*1.024);  % ns
    T0 = 0; % ns
    c = 0.29979;  % m/ns
    Rbin = c*(Tbin*(0:size(diff(1,:),2)-1) - T0)/2;
    target = append('Target', ' ', name);
    difference = append('Difference',' ', name);
    %Background plot
    figure
    subplot(3,1,1);
    plot(Rbin,back(10,:)), xlabel('Distance'), ylabel('Amplitude'),
title('Background')
    %Taget plot
    subplot(3,1,2);
    plot(Rbin,tar(10,:)), xlabel('Distance'), ylabel('Amplitude'),
title(target)
```

```
    % Difference plot
    subplot(3,1,3);
    plot(Rbin,diff(10,:)), xlabel('Distance'), ylabel('Amplitude'),
title(difference)

    [a05,i]=max(diff(10,:));
    distance = Rbin(i);

    pow =a05^2;
end

function[avg, distance, c, i] = difference(diff, Rbin)
    avg = zeros(1,length(diff(1,:)));
    for i=1:10
        avg = avg + diff(i,:);
    end
    avg = avg / 10;
    [c, i] = max(avg);
    distance = Rbin(i);
end
```