Matlab Generated Section

PII at 6

Query user for logfile

```
[fnmb6,dnmb6] = uigetfile('*.csv');
fprintf('Reading logfile %s\n',fullfile(dnmb6,fnmb6));
[cfgb6,reqb6,scnb6,det6] = readMrmRetLog(fullfile(dnmb6,fnmb6));

[fnmt6,dnmt6] = uigetfile('*.csv');
fprintf('Reading logfile %s\n',fullfile(dnmt6,fnmt6));
[cfgt6,reqt6,scnt6,dett6] = readMrmRetLog(fullfile(dnmt6,fnmt6));
```

Pull out the raw scans (if saved)

```
rawscansIb6 = find([scnb6.Nfilt] == 1);
rawscansV_background6 = reshape([scnb6(rawscansIb6).scn],[],length(rawscansIb6))';
```

```
rawscansIt6 = find([scnt6.Nfilt] == 1);
rawscansV_target6 = reshape([scnt6(rawscansIt6).scn],[],length(rawscansIt6))';

scan_difference6 = abs(rawscansV_background6 - rawscansV_target6);
```

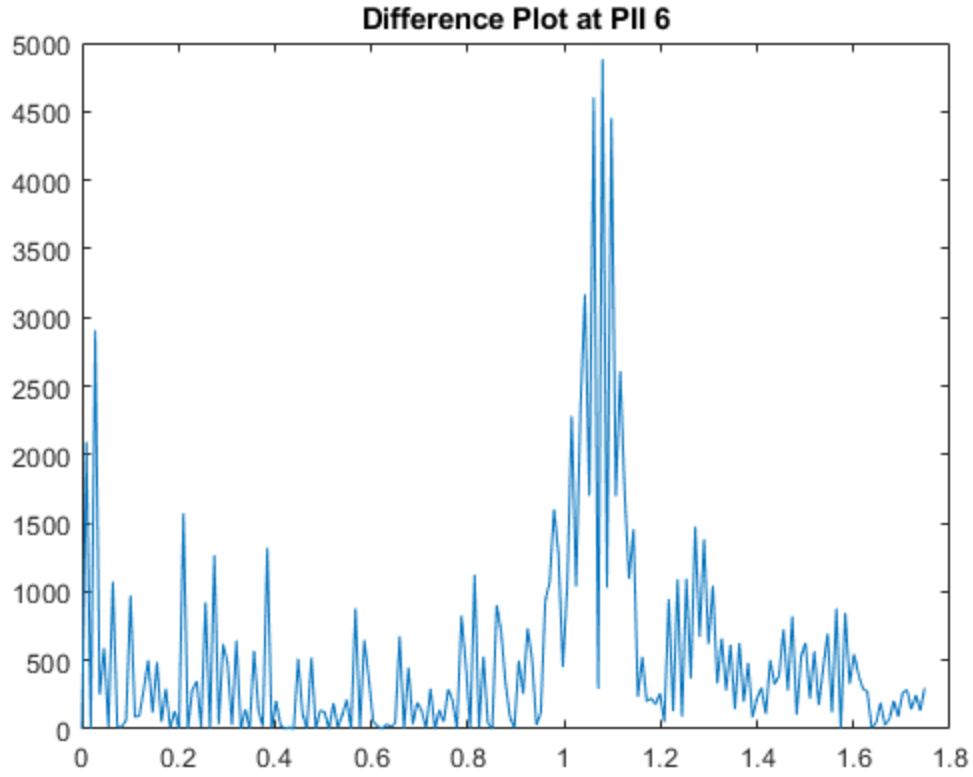
Create the waterfall horizontal and vertical axes

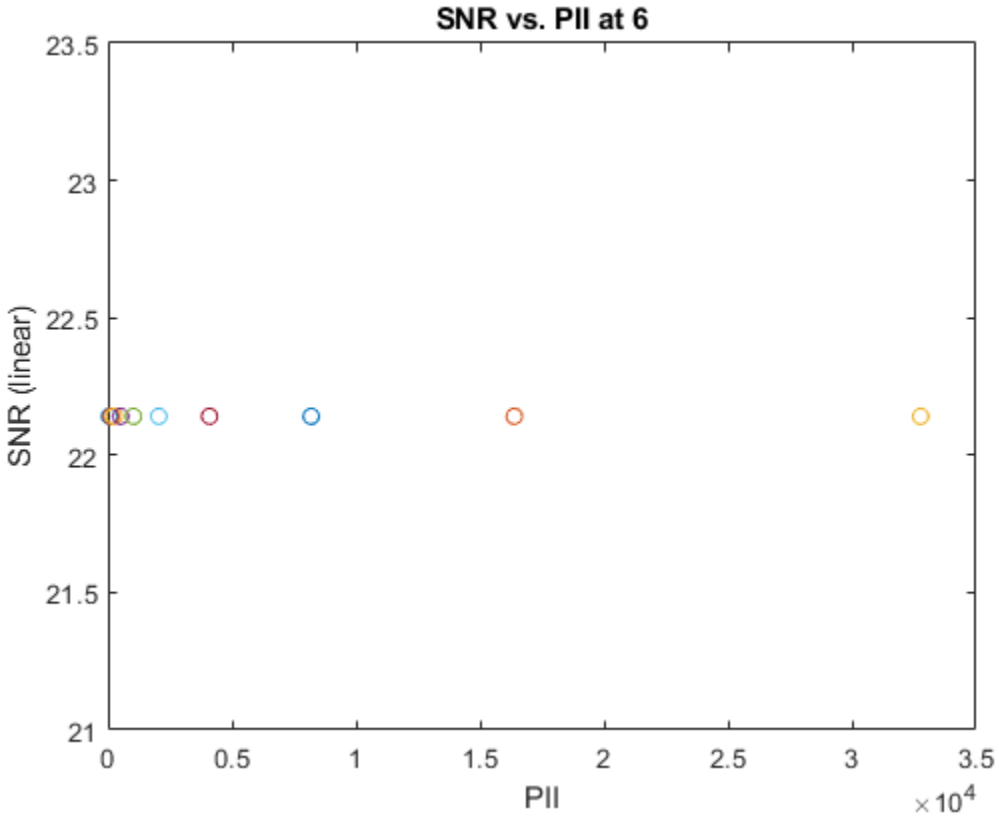
```
Tbin = 32/(512*1.024);  % ns
T0 = 0; % ns
c = 0.29979;  % m/ns
Rbin = c*(Tbin*(0:size(scan_difference6(1,:),2)-1) - T0)/2;% Range Bins in meters

%Background plot
%plot(Rbin,rawscansV_background(10,:)), title('Background Plot')
%Target plot
%figure; plot(Rbin,rawscansV_target(10,:)), title('Target Plot')
% Difference plot
figure(1);plot(Rbin,scan_difference6(10,:)), title('Difference Plot at PII 6')

%[a05,i] = max(scan_difference(10,100:122)); %In a range of distance values
%Rbin=i+99;                                  %100=0.9m, 122=1.1m
[a6,i]=max(scan_difference6(10,:));
%distance = Rbin(i)
noise_sample6 = scan_difference6(10,125:175); % 125:175 is just an example. it comes from Rbin,
the index of the distance range where you want to remove noise that's close to your 1m peak

noise_var6 = var(noise_sample6); % noise variance
SNR6= 10*log10(a6^2/noise_var6); % SNR in dB
```

Plot SNR values versus PII values

```
PII6 = 2.^(6:15);
figure(2);
plot(PII6, SNR6, 'o-');
title('SNR vs. PII at 6');
xlabel('PII');
ylabel('SNR (linear)');
```

```
Reading logfile
C:\Users\tonka\OneDrive\Documents\MATLAB\384_Lab\cw10_scans\Background\RetLog_6007.csv
Reading logfile
C:\Users\tonka\OneDrive\Documents\MATLAB\384_Lab\cw10_scans\Target\RetLog_6003.csv
```


Difference Plot at PII 6
5000
4500
4000
3500
3000
2500
2000
1500
1000
500
0
0
0.2
0.4
0.6
0.8
1
1.2
1.4
1.6
1.8


SNR vs. PII at 6
SNR (linear)
23.5
23
22.5
22
21.5
21
0
0.5
1
1.5
2
2.5
3
3.5
PII
×10^4

PII at 7

Query user for logfile

```
[fnmb7,dnmb7] = uigetfile('*.csv');
fprintf('Reading logfile %s\n',fullfile(dnmb7,fnmb7));
[cfgb7,reqb7,scnb7,det7] = readMrmRetLog(fullfile(dnmb7,fnmb7));

[fnmt7,dnmt7] = uigetfile('*.csv');
fprintf('Reading logfile %s\n',fullfile(dnmt7,fnmt7));
[cfgt7,reqt7,scnt7,dett7] = readMrmRetLog(fullfile(dnmt7,fnmt7));
```

Pull out the raw scans (if saved)

```
rawscansIb7 = find([scnb7.Nfilt] == 1);
rawscansV_background7 = reshape([scnb7(rawscansIb7).scn],[],length(rawscansIb7))';

rawscansIt7 = find([scnt7.Nfilt] == 1);
rawscansV_target7 = reshape([scnt7(rawscansIt7).scn],[],length(rawscansIt7))';

scan_difference7 = abs(rawscansV_background7 - rawscansV_target7);
```

Create the waterfall horizontal and vertical axes

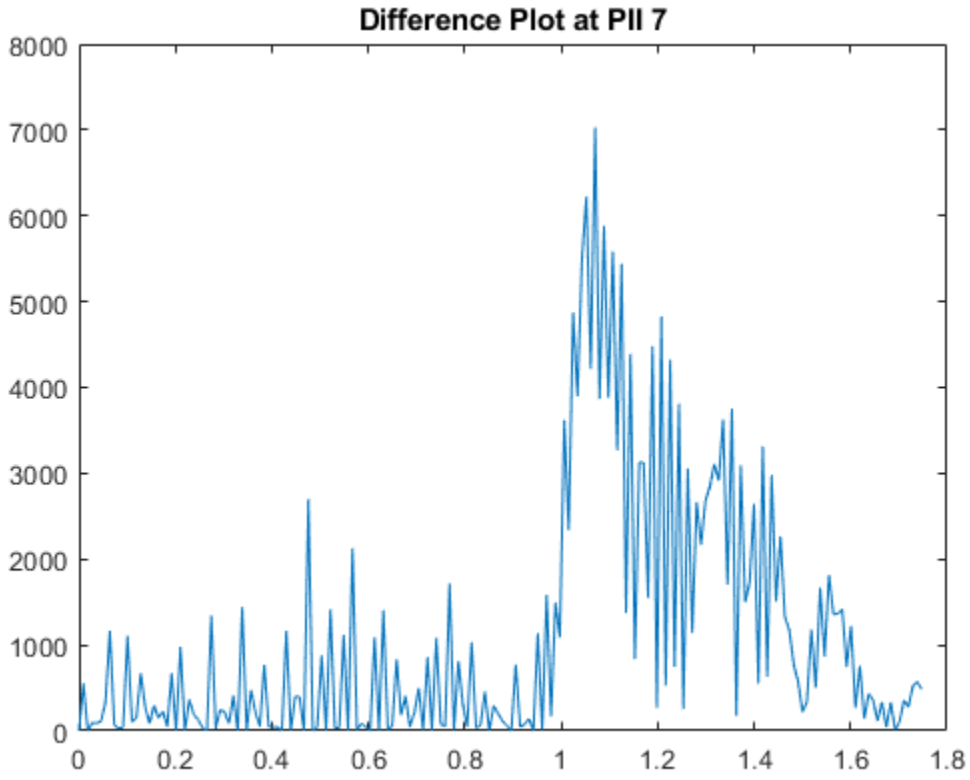
```
Tbin = 32/(512*1.024);  % ns
T0 = 0; % ns
c = 0.29979;  % m/ns
Rbin = c*(Tbin*(0:size(scan_difference7(1,:),2)-1) - T0)/2;% Range Bins in meters

%Background plot
%plot(Rbin,rawscansV_background(10,:)), title('Background Plot')
%Target plot
%figure; plot(Rbin,rawscansV_target(10,:)), title('Target Plot')
% Difference plot
figure(3);plot(Rbin,scan_difference7(10,:)), title('Difference Plot at PII 7')

%[a05,i] = max(scan_difference(10,100:122)); %In a range of distance values
%Rbin=i+99;                                  %100=0.9m, 122=1.1m
[a7,i]=max(scan_difference7(10,:));
%distance = Rbin(i)
noise_sample7 = scan_difference7(10,125:175); % 125:175 is just an example. it comes from Rbin,
the index of the distance range where you want to remove noise that's close to your 1m peak

noise_var7 = var(noise_sample7); % noise variance
SNR7= 10*log10(a7^2/noise_var7); % SNR in dB
```

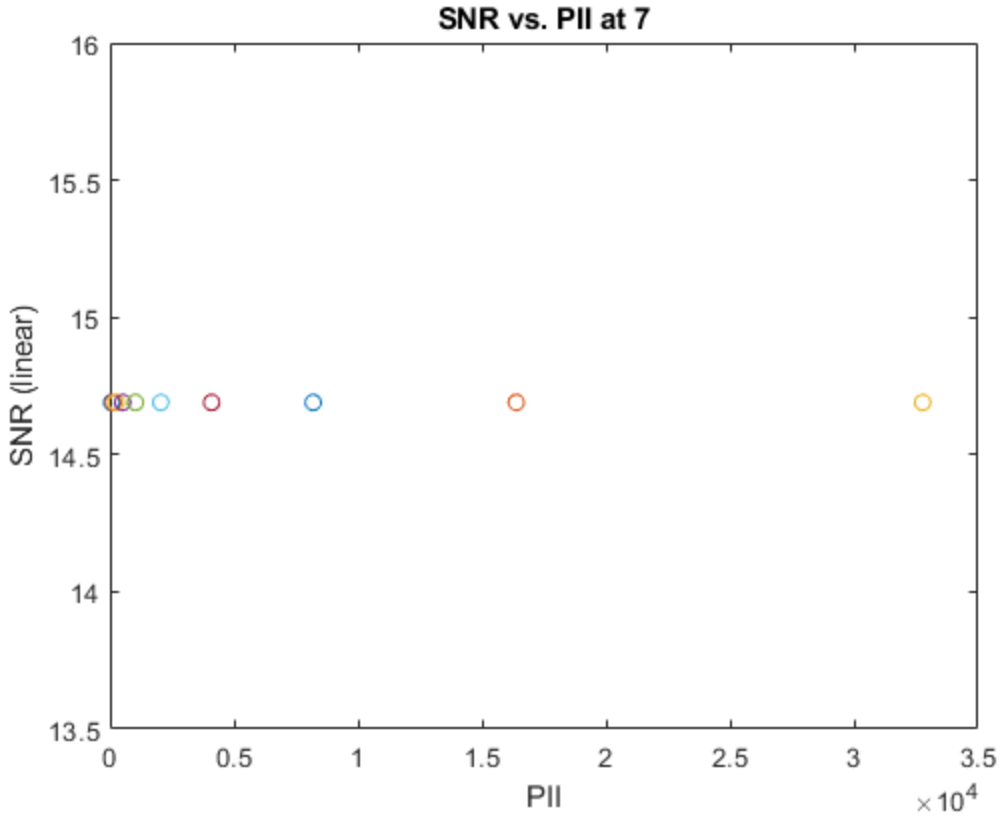
Plot SNR values versus PII values

```
PII7 = 2.^(6:15);
figure(4);
plot(PII7, SNR7, 'o-');
```

```
title('SNR vs. PII at 7');
xlabel('PII');
ylabel('SNR (linear)');
```

```
Reading logfile
C:\Users\tonka\OneDrive\Documents\MATLAB\384_Lab\cw10_scans\Background\RetLog_7008.csv
Reading logfile
C:\Users\tonka\OneDrive\Documents\MATLAB\384_Lab\cw10_scans\Target\RetLog_7010.csv
```





PII at 8

Query user for logfile

```
[fnmb8,dnmb8] = uigetfile('*.csv');
fprintf('Reading logfile %s\n',fullfile(dnmb8,fnmb8));
[cfgb8,reqb8,scnb8,det8] = readMrmRetLog(fullfile(dnmb8,fnmb8));

[fnmt8,dnmt8] = uigetfile('*.csv');
fprintf('Reading logfile %s\n',fullfile(dnmt8,fnmt8));
[cfgt8,reqt8,scnt8,dett8] = readMrmRetLog(fullfile(dnmt8,fnmt8));
```

Separate raw, bandpassed, and motion filtered data from scn structure

(only motion filtered is used)

Pull out the raw scans (if saved)

```
rawscansIb8 = find([scnb8.Nfilt] == 1);
rawscansV_background8 = reshape([scnb8(rawscansIb8).scn],[],length(rawscansIb8))';

rawscansIt8 = find([scnt8.Nfilt] == 1);
rawscansV_target8 = reshape([scnt8(rawscansIt8).scn],[],length(rawscansIt8))';

scan_difference8 = abs(rawscansV_background8 - rawscansV_target8);
```

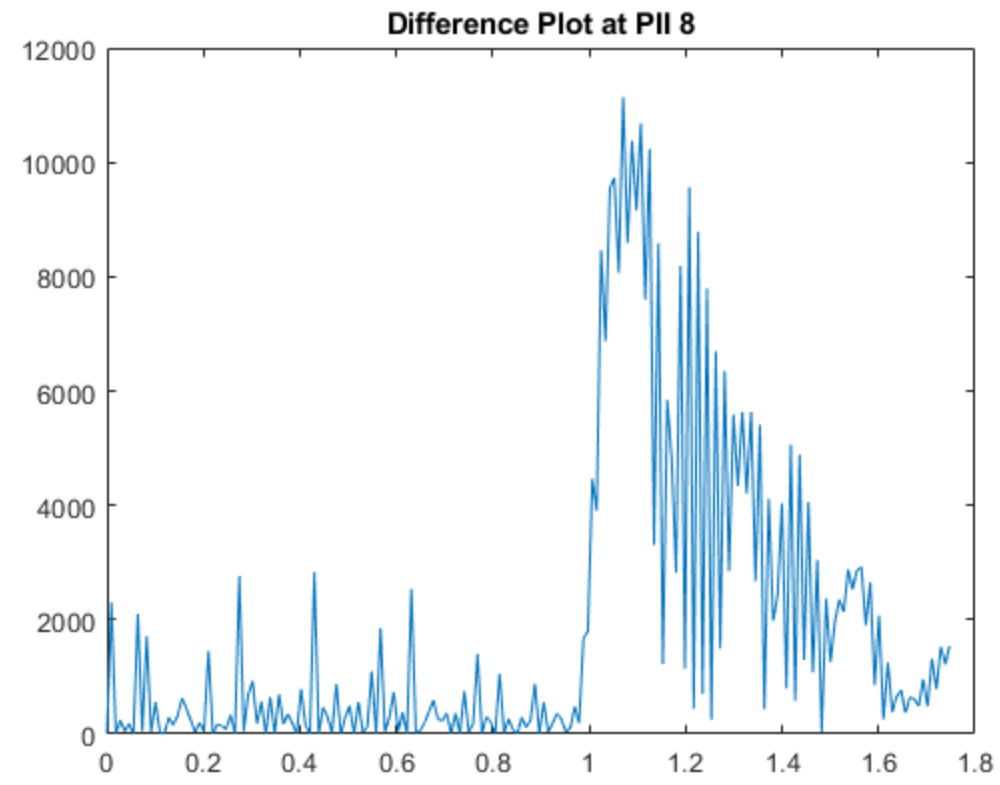
Create the waterfall horizontal and vertical axes

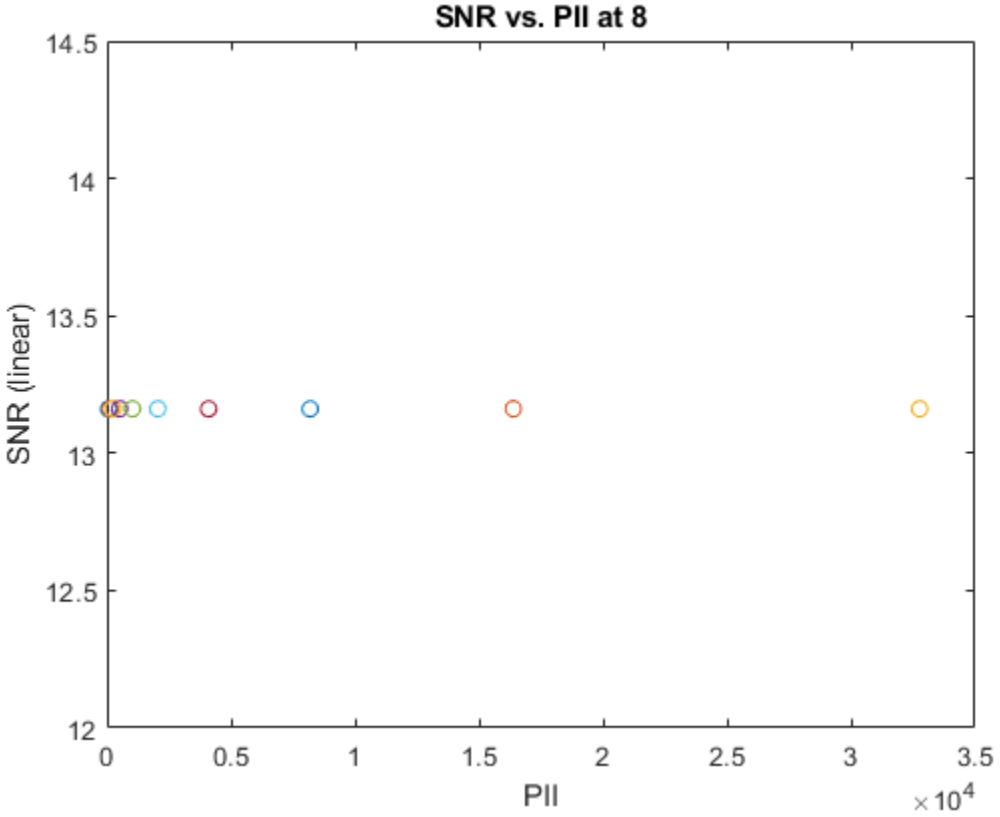
```
Tbin = 32/(512*1.024);  % ns
T0 = 0; % ns
c = 0.29979;  % m/ns
Rbin = c*(Tbin*(0:size(scan_difference8(1,:),2)-1) - T0)/2;% Range Bins in meters

%Background plot
%plot(Rbin,rawscansV_background(10,:)), title('Background Plot')
%Target plot
%figure; plot(Rbin,rawscansV_target(10,:)), title('Target Plot')
% Difference plot
figure(5);plot(Rbin,scan_difference8(10,:)), title('Difference Plot at PII 8')

%[a05,i] = max(scan_difference(10,100:122)); %In a range of distance values
%Rbin=i+99;                                  %100=0.9m, 122=1.1m
[a8,i]=max(scan_difference8(10,:));
%distance = Rbin(i)
noise_sample8 = scan_difference8(10,125:175); % 125:175 is just an example. it comes from Rbin,
the index of the distance range where you want to remove noise that's close to your 1m peak

noise_var8 = var(noise_sample8); % noise variance
SNR8= 10*log10(a8^2/noise_var8); % SNR in dB
```

Plot SNR values versus PII values

```
PII8 = 2.^(6:15);
figure(6);
plot(PII8, SNR8, 'o-');
title('SNR vs. PII at 8');
xlabel('PII');
ylabel('SNR (linear)');
```

```
Reading logfile
C:\Users\tonka\OneDrive\Documents\MATLAB\384_Lab\cw10_scans\Background\RetLog_8013.csv
Reading logfile
C:\Users\tonka\OneDrive\Documents\MATLAB\384_Lab\cw10_scans\Target\RetLog_8011.csv
```


Difference Plot at PII 8
12000
10000
8000
6000
4000
2000
0
0
0.2
0.4
0.6
0.8
1
1.2
1.4
1.6
1.8


SNR vs. PII at 8
SNR (linear)
14.5
14
13.5
13
12.5
12
0
0.5
1
1.5
2
2.5
3
3.5
PII
×10^4

PII at 9

Query user for logfile

```
[fnmb9,dnmb9] = uigetfile('*.csv');
fprintf('Reading logfile %s\n',fullfile(dnmb9,fnmb9));
[cfgb9,reqb9,scnb9,det9] = readMrmRetLog(fullfile(dnmb9,fnmb9));

[fnmt9,dnmt9] = uigetfile('*.csv');
fprintf('Reading logfile %s\n',fullfile(dnmt9,fnmt9));
[cfgt9,reqt9,scnt9,dett9] = readMrmRetLog(fullfile(dnmt9,fnmt9));
```

Separate raw, bandpassed, and motion filtered data from scn structure

(only motion filtered is used)

Pull out the raw scans (if saved)

```
rawscansIb9 = find([scnb9.Nfilt] == 1);
rawscansV_background9 = reshape([scnb9(rawscansIb9).scn],[],length(rawscansIb9))';

rawscansIt9 = find([scnt9.Nfilt] == 1);
rawscansV_target9 = reshape([scnt9(rawscansIt9).scn],[],length(rawscansIt9))';

scan_difference9 = abs(rawscansV_background9 - rawscansV_target9);
```

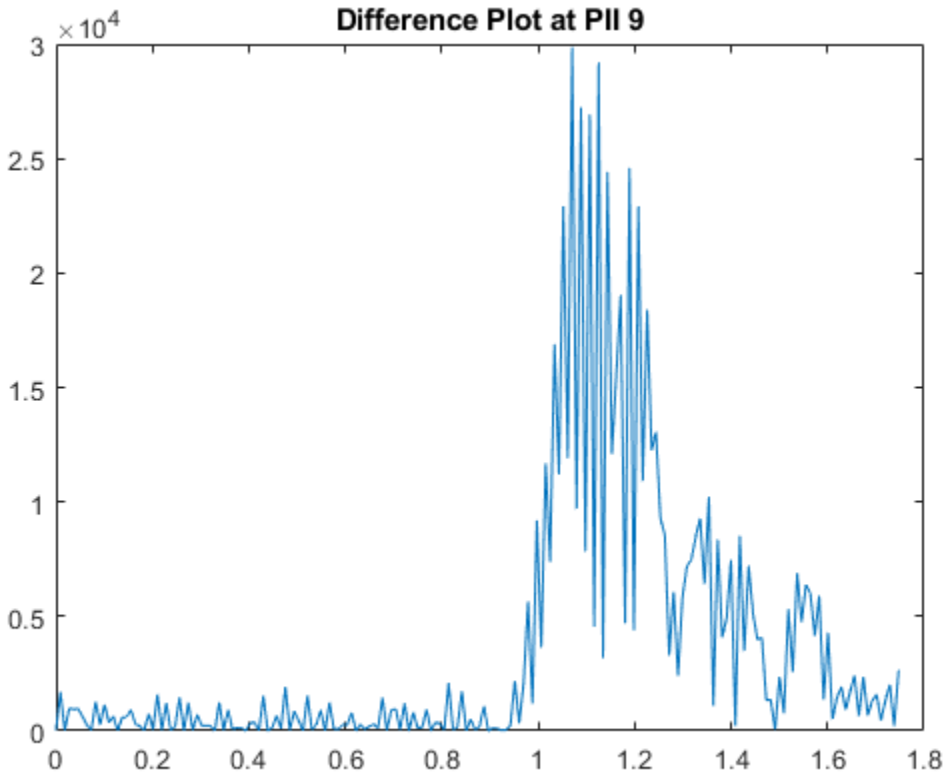
Create the waterfall horizontal and vertical axes

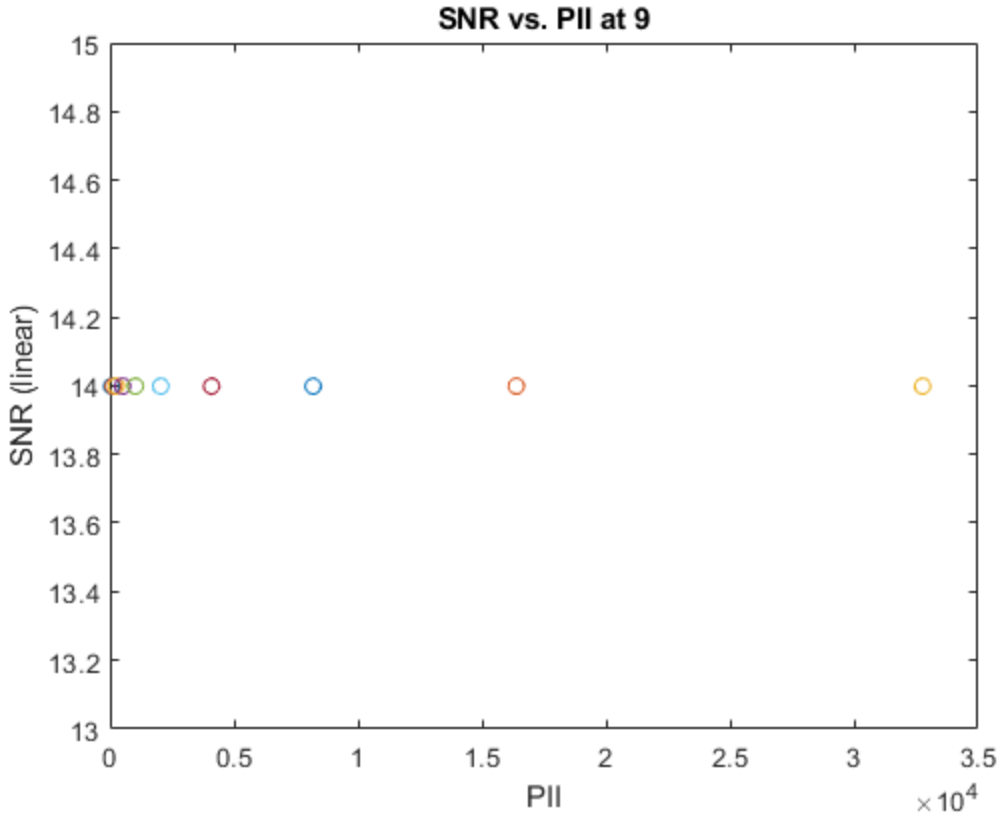
```
Tbin = 32/(512*1.024);  % ns
T0 = 0; % ns
c = 0.29979;  % m/ns
Rbin = c*(Tbin*(0:size(scan_difference9(1,:),2)-1) - T0)/2;% Range Bins in meters

%Background plot
%plot(Rbin,rawscansV_background(10,:)), title('Background Plot')
%Target plot
%figure; plot(Rbin,rawscansV_target(10,:)), title('Target Plot')
% Difference plot
figure(7);plot(Rbin,scan_difference9(10,:)), title('Difference Plot at PII 9')

%[a05,i] = max(scan_difference(10,100:122)); %In a range of distance values
%Rbin=i+99;                                  %100=0.9m, 122=1.1m
[a9,i]=max(scan_difference9(10,:));
%distance = Rbin(i)
noise_sample9 = scan_difference9(10,125:175); % 125:175 is just an example. it comes from Rbin,
the index of the distance range where you want to remove noise that's close to your 1m peak

noise_var9 = var(noise_sample9); % noise variance
SNR9= 10*log10(a9^2/noise_var9); % SNR in dB
```

Plot SNR values versus PII values

```
PII9 = 2.^(6:15);
figure(8);
plot(PII9, SNR9, 'o-');
title('SNR vs. PII at 9');
xlabel('PII');
ylabel('SNR (linear)');
```

```
Reading logfile
C:\Users\tonka\OneDrive\Documents\MATLAB\384_Lab\cw10_scans\Background\RetLog_9015.csv
Reading logfile
C:\Users\tonka\OneDrive\Documents\MATLAB\384_Lab\cw10_scans\Target\RetLog_9016.csv
```





PII at 10

Query user for logfile

```
[fnmb10,dnmb10] = uigetfile('*.csv');
fprintf('Reading logfile %s\n',fullfile(dnmb10,fnmb10));
[cfgb10,reqb10,scnb10,det10] = readMrmRetLog(fullfile(dnmb10,fnmb10));

[fnmt10,dnmt10] = uigetfile('*.csv');
fprintf('Reading logfile %s\n',fullfile(dnmt10,fnmt10));
[cfgt10,reqt10,scnt10,dett10] = readMrmRetLog(fullfile(dnmt10,fnmt10));
```

Pull out the raw scans (if saved)

```
rawscansIb10 = find([scnb10.Nfilt] == 1);
rawscansV_background10 = reshape([scnb10(rawscansIb10).scn],[],length(rawscansIb10))';

rawscansIt10 = find([scnt10.Nfilt] == 1);
rawscansV_target10 = reshape([scnt10(rawscansIt10).scn],[],length(rawscansIt10))';

scan_difference10 = abs(rawscansV_background10 - rawscansV_target10);
```

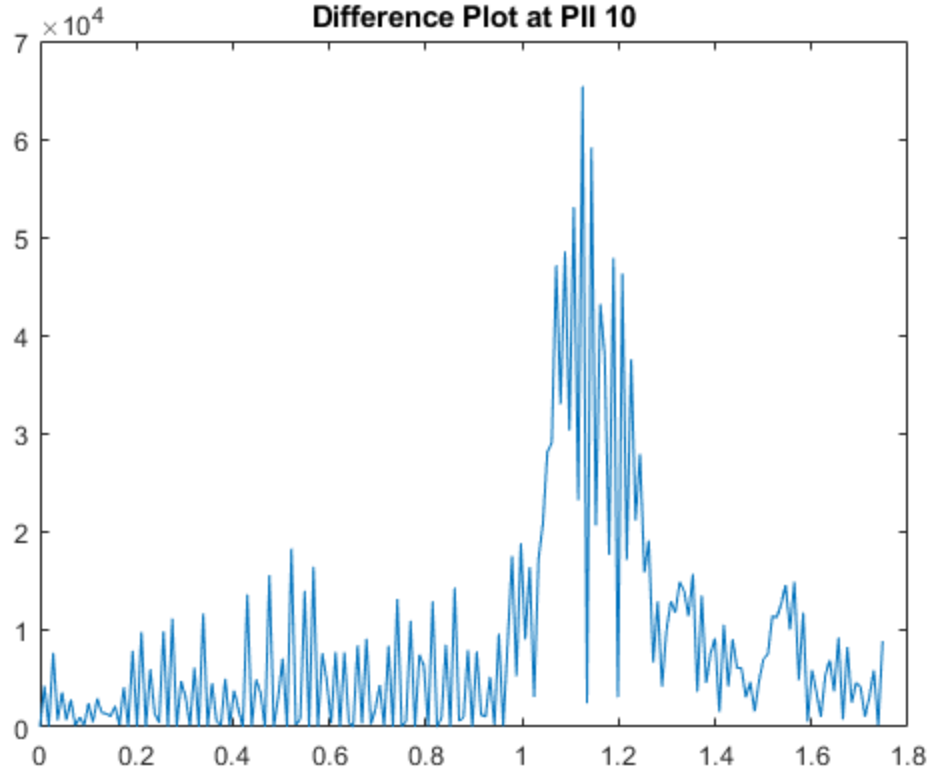
Create the waterfall horizontal and vertical axes

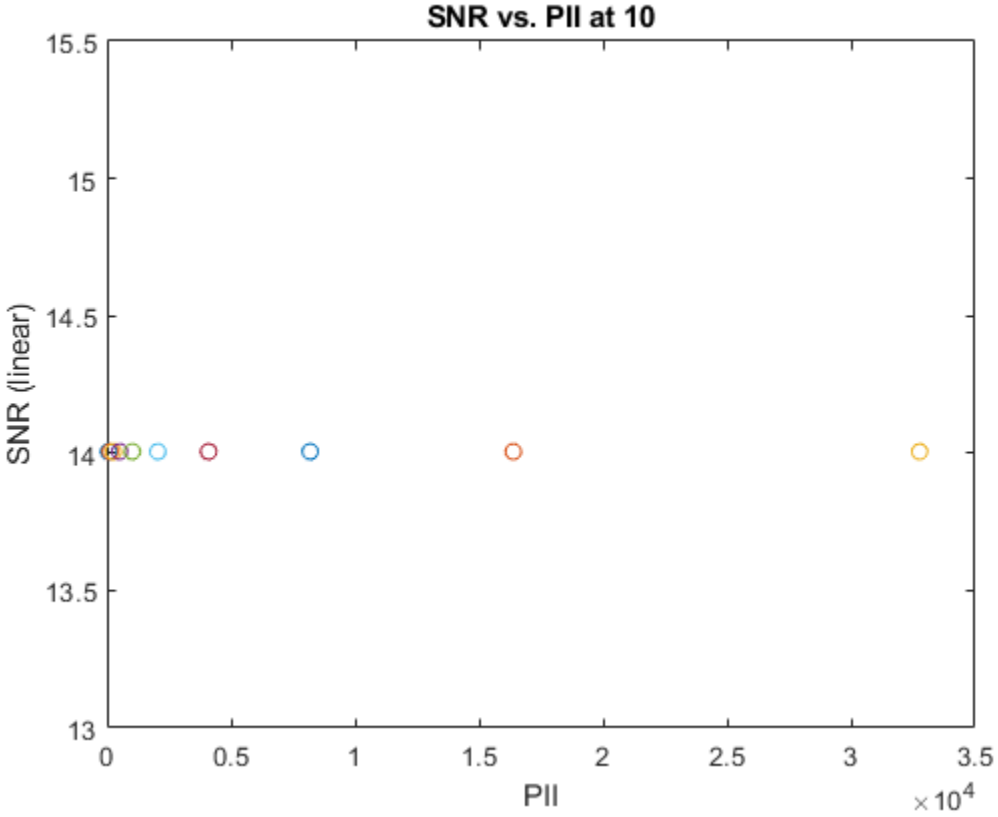
```
Tbin = 32/(512*1.024);  % ns
T0 = 0; % ns
c = 0.29979;  % m/ns
Rbin = c*(Tbin*(0:size(scan_difference10(1,:),2)-1) - T0)/2;% Range Bins in meters

%Background plot
%plot(Rbin,rawscansV_background(10,:)), title('Background Plot')
%Target plot
%figure; plot(Rbin,rawscansV_target(10,:)), title('Target Plot')
% Difference plot
figure(9);plot(Rbin,scan_difference10(10,:)), title('Difference Plot at PII 10')

%[a05,i] = max(scan_difference(10,100:122)); %In a range of distance values
%Rbin=i+99;                                  %100=0.9m, 122=1.1m
[a10,i]=max(scan_difference10(10,:));
%distance = Rbin(i)
noise_sample10 = scan_difference10(10,125:175); % 125:175 is just an example. it comes from Rbin,
the index of the distance range where you want to remove noise that's close to your 1m peak

noise_var10 = var(noise_sample10); % noise variance
SNR10= 10*log10(a10^2/noise_var10); % SNR in dB
```

Plot SNR values versus PII values

```
PII10 = 2.^(6:15);
figure(10);
plot(PII10, SNR10, 'o-');
title('SNR vs. PII at 10');
xlabel('PII');
ylabel('SNR (linear)');
```

```
Reading logfile
C:\Users\tonka\OneDrive\Documents\MATLAB\384_Lab\cw10_scans\Background\RetLog_10019.csv
Reading logfile
C:\Users\tonka\OneDrive\Documents\MATLAB\384_Lab\cw10_scans\Target\RetLog_10018.csv
```


Difference Plot at PII 10
×10^4
7
6
5
4
3
2
1
0
0
0.2
0.4
0.6
0.8
1
1.2
1.4
1.6
1.8


SNR vs. PII at 10
SNR (linear)
15.5
15
14.5
14
13.5
13
0
0.5
1
1.5
2
2.5
3
3.5
PII
×10^4

PII at 11

Query user for logfile

```
[fnmb11,dnmb11] = uigetfile('*.csv');
fprintf('Reading logfile %s\n',fullfile(dnmb11,fnmb11));
[cfgb11,reqb11,scnb11,det11] = readMrmRetLog(fullfile(dnmb11,fnmb11));

[fnmt11,dnmt11] = uigetfile('*.csv');
fprintf('Reading logfile %s\n',fullfile(dnmt11,fnmt11));
[cfgt11,reqt11,scnt11,dett11] = readMrmRetLog(fullfile(dnmt11,fnmt11));
```

Pull out the raw scans (if saved)

```
rawscansIb11 = find([scnb11.Nfilt] == 1);
rawscansV_background11 = reshape([scnb11(rawscansIb11).scn],[],length(rawscansIb11))';

rawscansIt11 = find([scnt11.Nfilt] == 1);
rawscansV_target11 = reshape([scnt11(rawscansIt11).scn],[],length(rawscansIt11))';

scan_difference11 = abs(rawscansV_background11 - rawscansV_target11);
```

Create the waterfall horizontal and vertical axes

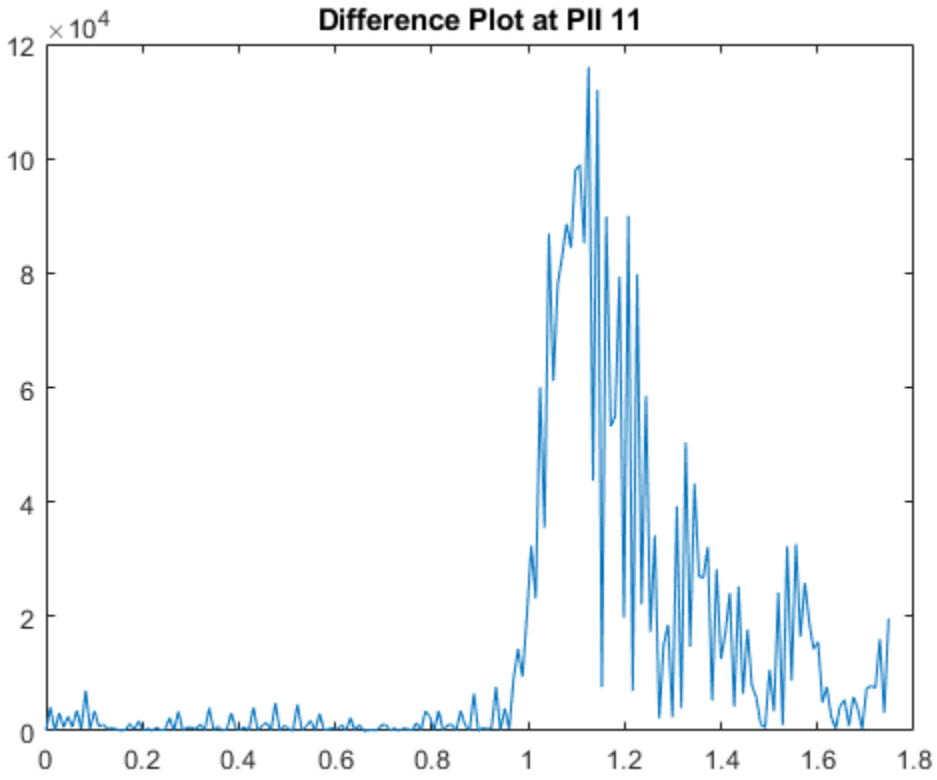
```
Tbin = 32/(512*1.024);  % ns
T0 = 0; % ns
c = 0.29979;  % m/ns
Rbin = c*(Tbin*(0:size(scan_difference11(1,:),2)-1) - T0)/2;% Range Bins in meters

%Background plot
%plot(Rbin,rawscansV_background(10,:)), title('Background Plot')
%Target plot
%figure; plot(Rbin,rawscansV_target(10,:)), title('Target Plot')
% Difference plot
figure(11);plot(Rbin,scan_difference11(10,:)), title('Difference Plot at PII 11')

%[a05,i] = max(scan_difference(10,100:122)); %In a range of distance values
%Rbin=i+99;                                  %100=0.9m, 122=1.1m
[a11,i]=max(scan_difference11(10,:));
%distance = Rbin(i)
noise_sample11 = scan_difference11(10,125:175); % 125:175 is just an example. it comes from Rbin,
the index of the distance range where you want to remove noise that's close to your 1m peak

noise_var11 = var(noise_sample11); % noise variance
SNR11 = 10*log10(a6^2/noise_var11); % SNR in dB
```

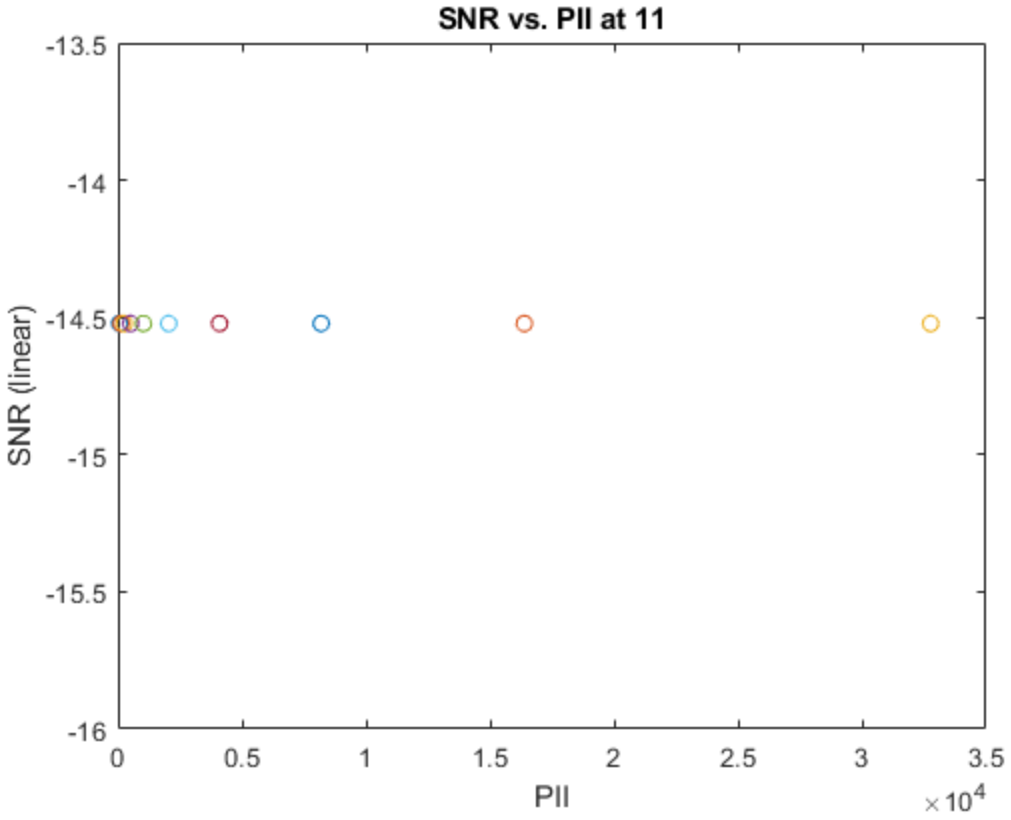
Plot SNR values versus PII values

```
PII11 = 2.^(6:15);
figure(12);
plot(PII11, SNR11, 'o-');
```

```
title('SNR vs. PII at 11');
xlabel('PII');
ylabel('SNR (linear)');
```

```
Reading logfile
C:\Users\tonka\OneDrive\Documents\MATLAB\384_Lab\cw10_scans\Background\RetLog_11021.csv
Reading logfile
C:\Users\tonka\OneDrive\Documents\MATLAB\384_Lab\cw10_scans\Target\RetLog_11022.csv
```





PII at 12

Query user for logfile

```
[fnmb12,dnmb12] = uigetfile('*.csv');
fprintf('Reading logfile %s\n',fullfile(dnmb12,fnmb12));
[cfgb12,reqb12,scnb12,det12] = readMrmRetLog(fullfile(dnmb12,fnmb12));

[fnmt12,dnmt12] = uigetfile('*.csv');
fprintf('Reading logfile %s\n',fullfile(dnmt12,fnmt12));
[cfgt12,reqt12,scnt12,dett12] = readMrmRetLog(fullfile(dnmt12,fnmt12));
```

Pull out the raw scans (if saved)

```
rawscansIb12 = find([scnb12.Nfilt] == 1);
rawscansV_background12 = reshape([scnb12(rawscansIb12).scn],[],length(rawscansIb12))';

rawscansIt12 = find([scnt12.Nfilt] == 1);
rawscansV_target12 = reshape([scnt12(rawscansIt12).scn],[],length(rawscansIt12))';

scan_difference12 = abs(rawscansV_background12 - rawscansV_target12);
```

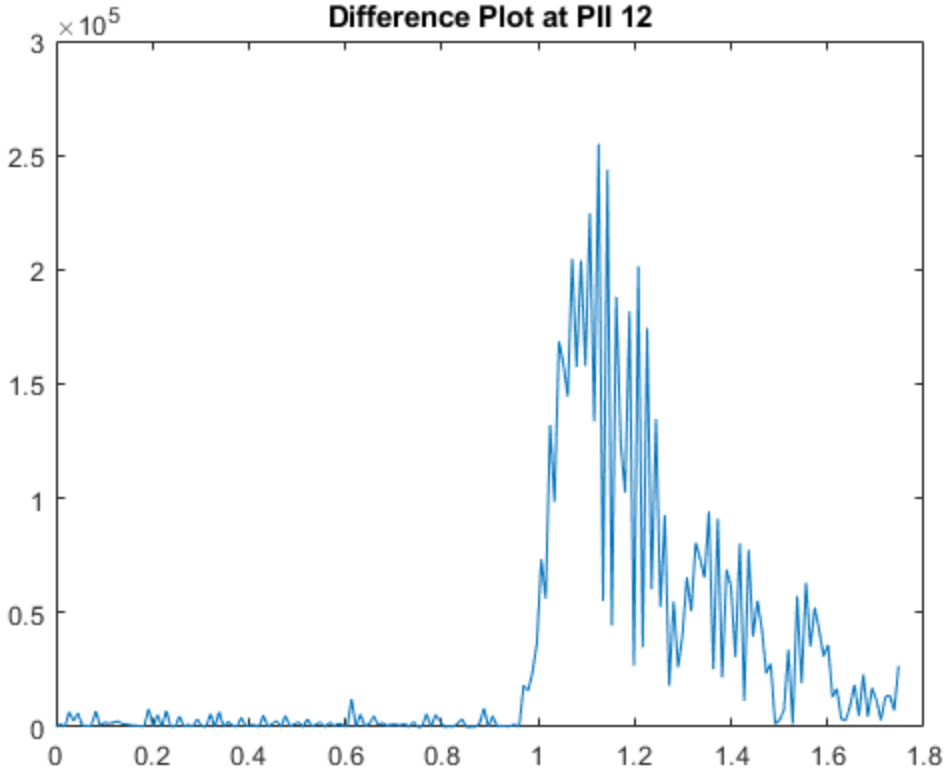
Create the waterfall horizontal and vertical axes

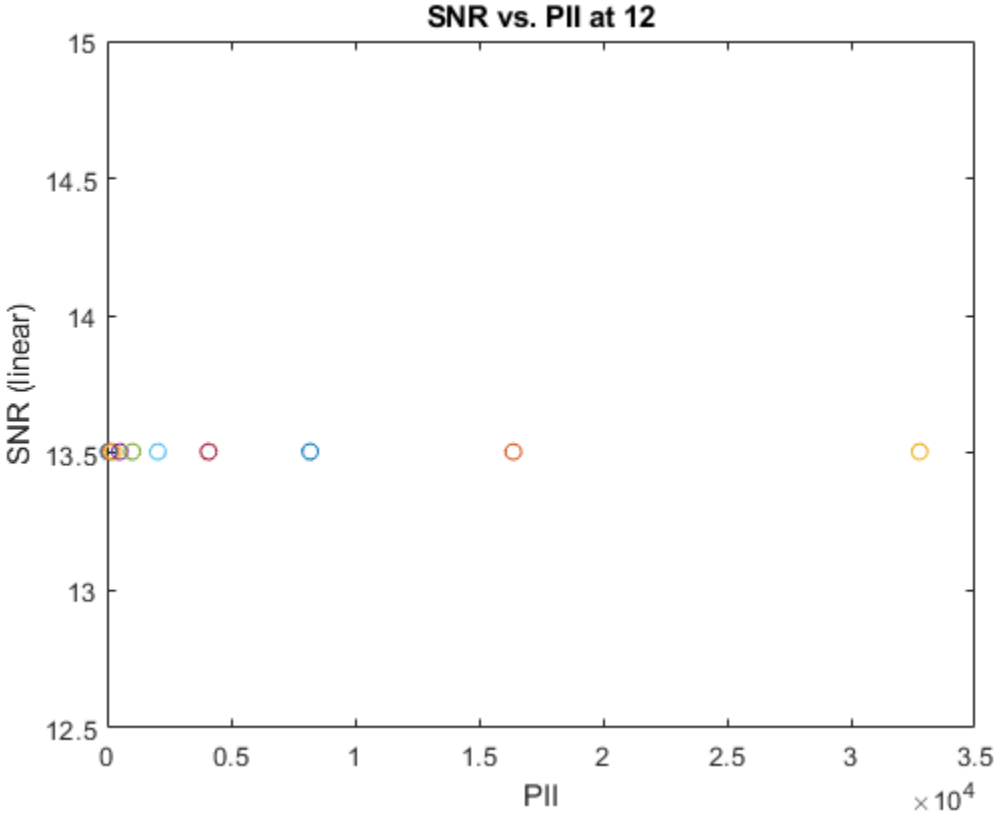
```
Tbin = 32/(512*1.024);  % ns
T0 = 0; % ns
c = 0.29979;  % m/ns
Rbin = c*(Tbin*(0:size(scan_difference12(1,:),2)-1) - T0)/2;% Range Bins in meters

%Background plot
%plot(Rbin,rawscansV_background(10,:)), title('Background Plot')
%Target plot
%figure; plot(Rbin,rawscansV_target(10,:)), title('Target Plot')
% Difference plot
figure(13);plot(Rbin,scan_difference12(10,:)), title('Difference Plot at PII 12')

%[a05,i] = max(scan_difference(10,100:122)); %In a range of distance values
%Rbin=i+99;                                  %100=0.9m, 122=1.1m
[a12,i]=max(scan_difference12(10,:));
%distance = Rbin(i)
noise_sample12 = scan_difference12(10,125:175); % 125:175 is just an example. it comes from Rbin,
the index of the distance range where you want to remove noise that's close to your 1m peak

noise_var12 = var(noise_sample12); % noise variance
SNR12 = 10*log10(a12^2/noise_var12); % SNR in dB
```

Plot SNR values versus PII values

```
PII12 = 2.^(6:15);
figure(14);
plot(PII12, SNR12, 'o-');
title('SNR vs. PII at 12');
xlabel('PII');
ylabel('SNR (linear)');
```

```
Reading logfile
C:\Users\tonka\OneDrive\Documents\MATLAB\384_Lab\cw10_scans\Background\RetLog_12025.csv
Reading logfile
C:\Users\tonka\OneDrive\Documents\MATLAB\384_Lab\cw10_scans\Target\RetLog_12024.csv
```


Difference Plot at PII 12
×10^5
3
2.5
2
1.5
1
0.5
0
0
0.2
0.4
0.6
0.8
1
1.2
1.4
1.6
1.8


SNR vs. PII at 12
SNR (linear)
15
14.5
14
13.5
13
12.5
0
0.5
1
1.5
2
2.5
3
3.5
PII
×10^4

PII at 13

Query user for logfile

```
[fnmb13,dnmb13] = uigetfile('*.csv');
fprintf('Reading logfile %s\n',fullfile(dnmb13,fnmb13));
[cfgb13,reqb13,scnb13,det13] = readMrmRetLog(fullfile(dnmb13,fnmb13));

[fnmt13,dnmt13] = uigetfile('*.csv');
fprintf('Reading logfile %s\n',fullfile(dnmt13,fnmt13));
[cfgt13,reqt13,scnt13,dett13] = readMrmRetLog(fullfile(dnmt13,fnmt13));
```

Pull out the raw scans (if saved)

```
rawscansIb13 = find([scnb13.Nfilt] == 1);
rawscansV_background13 = reshape([scnb13(rawscansIb13).scn],[],length(rawscansIb13))';

rawscansIt13 = find([scnt13.Nfilt] == 1);
rawscansV_target13 = reshape([scnt13(rawscansIt13).scn],[],length(rawscansIt13))';

scan_difference13 = abs(rawscansV_background13 - rawscansV_target13);
```

Create the waterfall horizontal and vertical axes

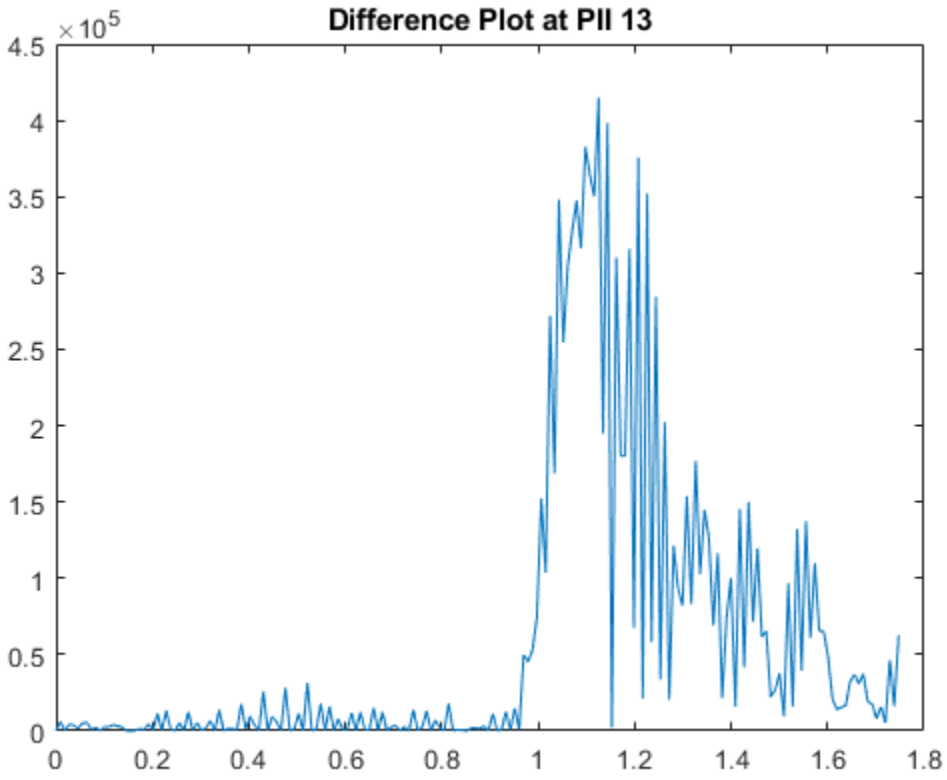
```
Tbin = 32/(512*1.024);  % ns
T0 = 0; % ns
c = 0.29979;  % m/ns
Rbin = c*(Tbin*(0:size(scan_difference13(1,:),2)-1) - T0)/2;% Range Bins in meters

%Background plot
%plot(Rbin,rawscansV_background(10,:)), title('Background Plot')
%Target plot
%figure; plot(Rbin,rawscansV_target(10,:)), title('Target Plot')
% Difference plot
figure(15);plot(Rbin,scan_difference13(10,:)), title('Difference Plot at PII 13')

%[a05,i] = max(scan_difference(10,100:122)); %In a range of distance values
%Rbin=i+99;                                  %100=0.9m, 122=1.1m
[a13,i]=max(scan_difference13(10,:));
%distance = Rbin(i)
noise_sample13 = scan_difference13(10,125:175); % 125:175 is just an example. it comes from Rbin,
the index of the distance range where you want to remove noise that's close to your 1m peak

noise_var13 = var(noise_sample13); % noise variance
SNR13 = 10*log10(a13^2/noise_var13); % SNR in dB
```

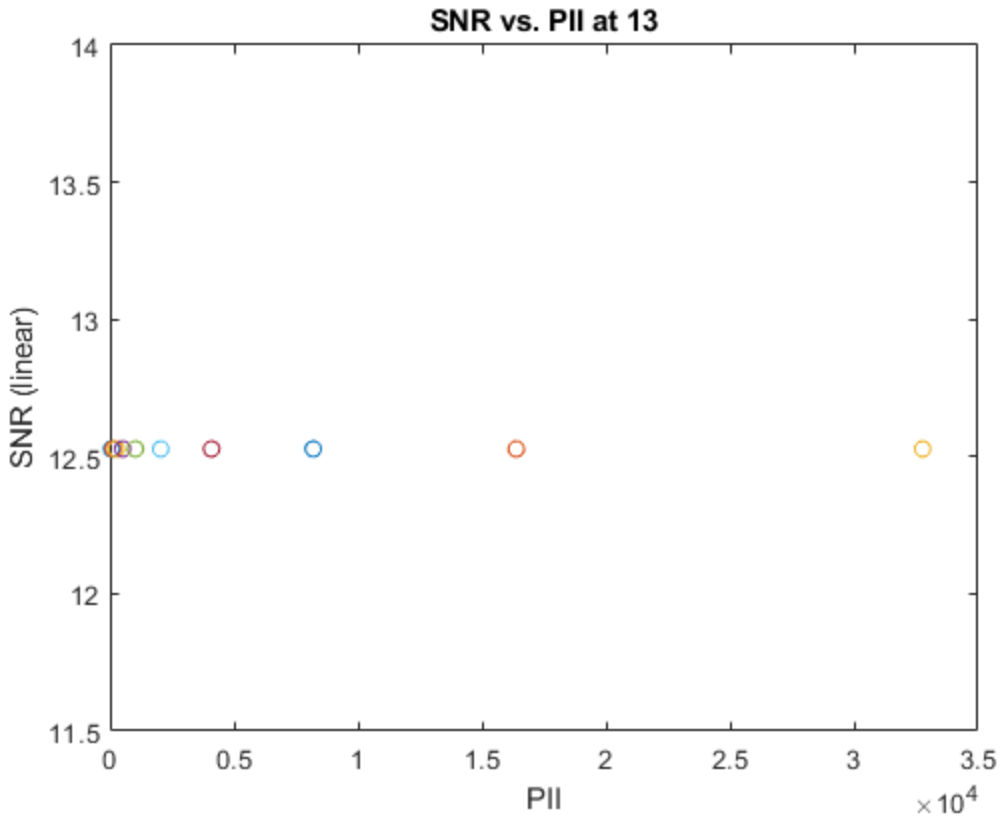
Plot SNR values versus PII values

```
PII13 = 2.^(6:15);
figure(16);
plot(PII13, SNR13, 'o-');
```

```
title('SNR vs. PII at 13');
xlabel('PII');
ylabel('SNR (linear)');
```

```
Reading logfile
C:\Users\tonka\OneDrive\Documents\MATLAB\384_Lab\cw10_scans\Background\RetLog_13027.csv
Reading logfile
C:\Users\tonka\OneDrive\Documents\MATLAB\384_Lab\cw10_scans\Target\RetLog_13028.csv
```





PII at 14

Query user for logfile

```
[fnmb14,dnmb14] = uigetfile('*.csv');
fprintf('Reading logfile %s\n',fullfile(dnmb14,fnmb14));
[cfgb14,reqb14,scnb14,det14] = readMrmRetLog(fullfile(dnmb14,fnmb14));

[fnmt14,dnmt14] = uigetfile('*.csv');
fprintf('Reading logfile %s\n',fullfile(dnmt14,fnmt14));
[cfgt14,reqt14,scnt14,dett14] = readMrmRetLog(fullfile(dnmt14,fnmt14));
```

Separate raw, bandpassed, and motion filtered data from scn structure

(only motion filtered is used)

Pull out the raw scans (if saved)

```
rawscansIb14 = find([scnb14.Nfilt] == 1);
rawscansV_background14 = reshape([scnb14(rawscansIb14).scn],[],length(rawscansIb14))';

rawscansIt14 = find([scnt14.Nfilt] == 1);
rawscansV_target14 = reshape([scnt14(rawscansIt14).scn],[],length(rawscansIt14))';

scan_difference14 = abs(rawscansV_background14 - rawscansV_target14);
```

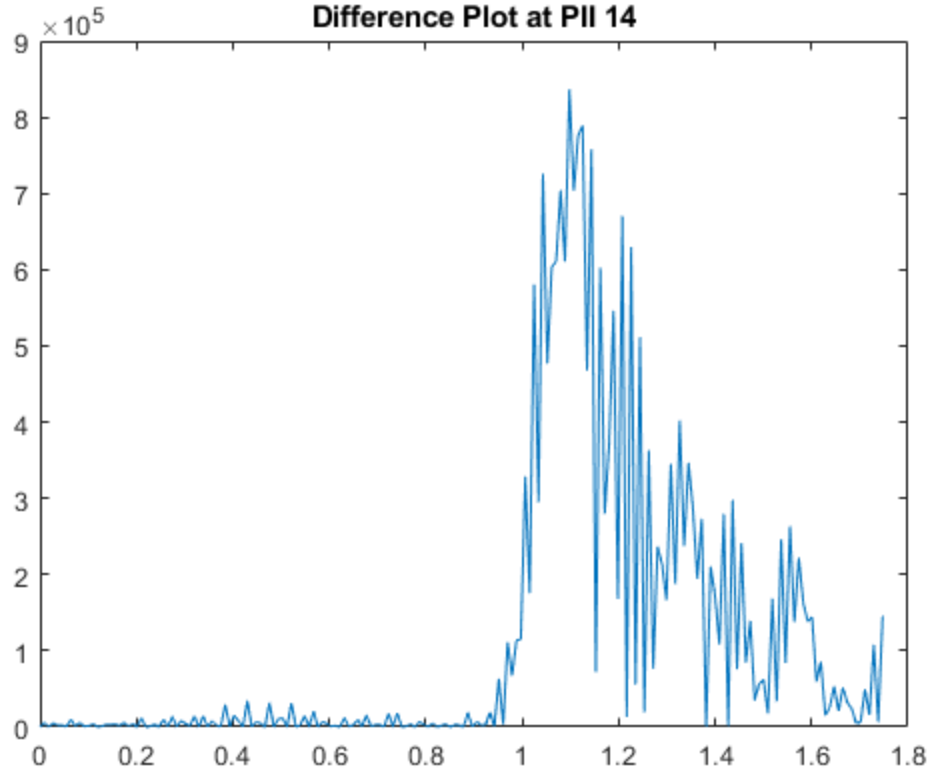
Create the waterfall horizontal and vertical axes

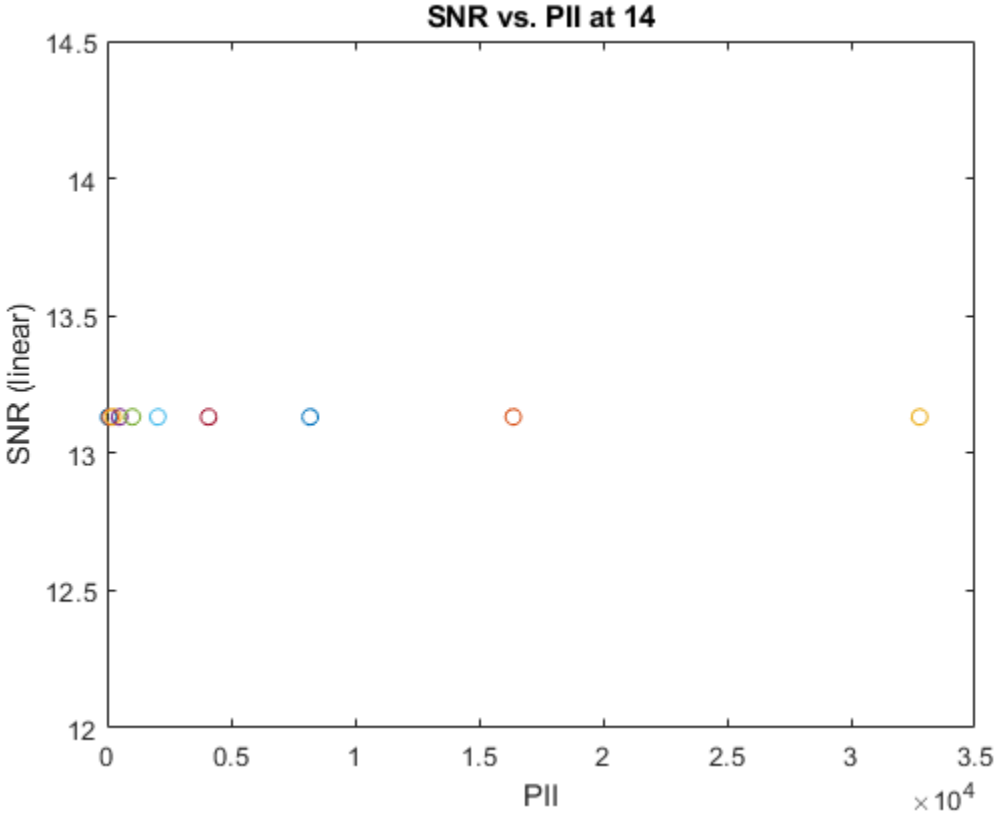
```
Tbin = 32/(512*1.024);  % ns
T0 = 0; % ns
c = 0.29979;  % m/ns
Rbin = c*(Tbin*(0:size(scan_difference14(1,:),2)-1) - T0)/2;% Range Bins in meters

%Background plot
%plot(Rbin,rawscansV_background(10,:)), title('Background Plot')
%Target plot
%figure; plot(Rbin,rawscansV_target(10,:)), title('Target Plot')
% Difference plot
figure(17);plot(Rbin,scan_difference14(10,:)), title('Difference Plot at PII 14')

%[a05,i] = max(scan_difference(10,100:122)); %In a range of distance values
%Rbin=i+99;                                  %100=0.9m, 122=1.1m
[a15,i]=max(scan_difference14(10,:));
%distance = Rbin(i)
noise_sample14 = scan_difference14(10,125:175); % 125:175 is just an example. it comes from Rbin,
the index of the distance range where you want to remove noise that's close to your 1m peak

noise_var14 = var(noise_sample14); % noise variance
SNR14 = 10*log10(a15^2/noise_var14); % SNR in dB
```

Plot SNR values versus PII values

```
PII14 = 2.^(6:15);
figure(18);
plot(PII14, SNR14, 'o-');
title('SNR vs. PII at 14');
xlabel('PII');
ylabel('SNR (linear)');
```

```
Reading logfile
C:\Users\tonka\OneDrive\Documents\MATLAB\384_Lab\cw10_scans\Background\RetLog_14031.csv
Reading logfile
C:\Users\tonka\OneDrive\Documents\MATLAB\384_Lab\cw10_scans\Target\RetLog_14030.csv
```


Difference Plot at PII 14
×10^5
9
8
7
6
5
4
3
2
1
0
0
0.2
0.4
0.6
0.8
1
1.2
1.4
1.6
1.8


SNR vs. PII at 14
SNR (linear)
14.5
14
13.5
13
12.5
12
0
0.5
1
1.5
2
2.5
3
3.5
PII
×10^4

PII at 15

Query user for logfile

```
[fnmb15,dnmb15] = uigetfile('*.csv');
fprintf('Reading logfile %s\n',fullfile(dnmb15,fnmb15));
[cfgb15,reqb15,scnb15,det15] = readMrmRetLog(fullfile(dnmb15,fnmb15));

[fnmt15,dnmt15] = uigetfile('*.csv');
fprintf('Reading logfile %s\n',fullfile(dnmt15,fnmt15));
[cfgt15,reqt15,scnt15,dett15] = readMrmRetLog(fullfile(dnmt15,fnmt15));
```

Pull out the raw scans (if saved)

```
rawscansIb15 = find([scnb15.Nfilt] == 1);
rawscansV_background15 = reshape([scnb15(rawscansIb15).scn],[],length(rawscansIb15))';

rawscansIt15 = find([scnt15.Nfilt] == 1);
rawscansV_target15 = reshape([scnt15(rawscansIt15).scn],[],length(rawscansIt15))';

scan_difference15 = abs(rawscansV_background15 - rawscansV_target15);
```

Create the waterfall horizontal and vertical axes

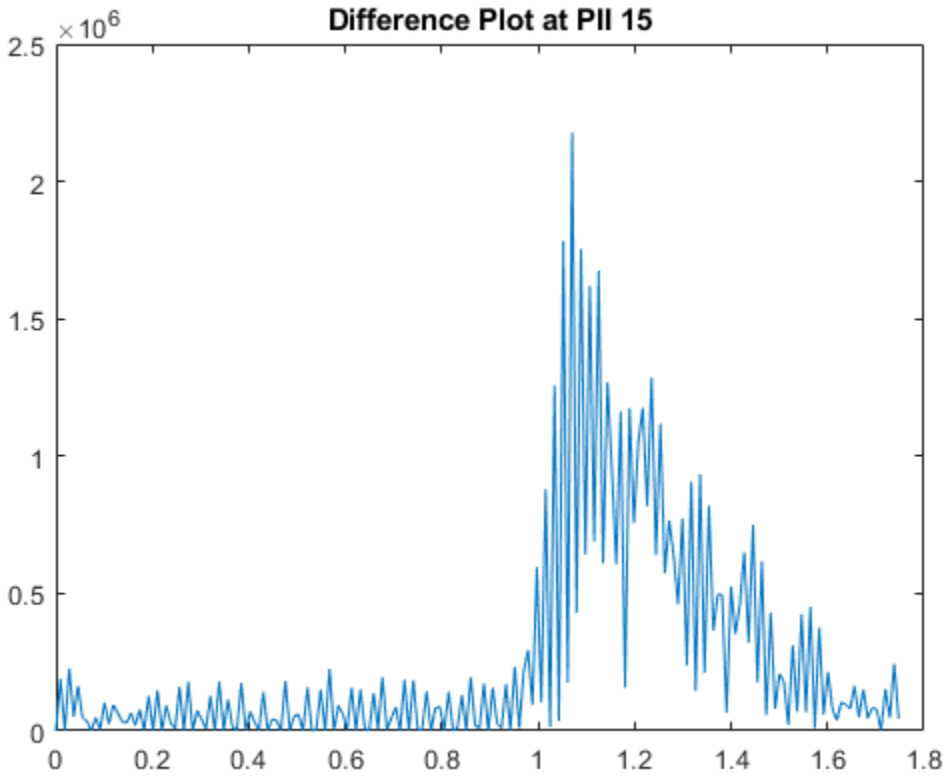
```
Tbin = 32/(512*1.024);  % ns
T0 = 0; % ns
c = 0.29979;  % m/ns
Rbin = c*(Tbin*(0:size(scan_difference15(1,:),2)-1) - T0)/2;% Range Bins in meters

%Background plot
%plot(Rbin,rawscansV_background(10,:)), title('Background Plot')
%Target plot
%figure; plot(Rbin,rawscansV_target(10,:)), title('Target Plot')
% Difference plot
figure(19);plot(Rbin,scan_difference15(10,:)), title('Difference Plot at PII 15')

%[a05,i] = max(scan_difference(10,100:122)); %In a range of distance values
%Rbin=i+99;                                  %100=0.9m, 122=1.1m
[a15,i]=max(scan_difference15(10,:));
%distance = Rbin(i)
noise_sample15 = scan_difference15(10,125:175); % 125:175 is just an example. it comes from Rbin,
the index of the distance range where you want to remove noise that's close to your 1m peak

noise_var15 = var(noise_sample15); % noise variance
SNR15 = 10*log10(a15^2/noise_var15); % SNR in dB
```

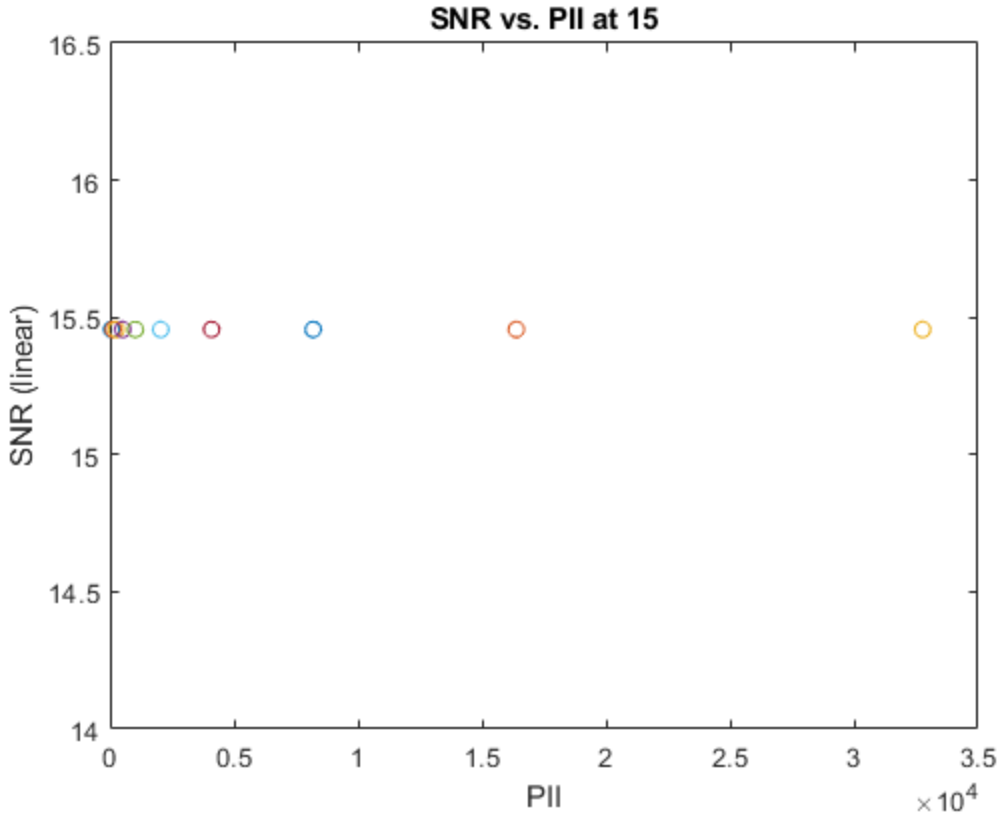
Plot SNR values versus PII values

```
PII15 = 2.^(6:15);
figure(20);
plot(PII15, SNR15, 'o-');
```

```
title('SNR vs. PII at 15');
xlabel('PII');
ylabel('SNR (linear)');
```

```
Reading logfile
C:\Users\tonka\OneDrive\Documents\MATLAB\384_Lab\cw10_scans\Background\RetLog_15033.csv
Reading logfile
C:\Users\tonka\OneDrive\Documents\MATLAB\384_Lab\cw10_scans\Target\RetLog_15034.csv
```





Published with MATLAB® R2022b

Question Section

1. Looking at the difference plots as the PII increases you can see more and more noise in them. It seems to generally follow the trend of increasing by 3 dB. One way to improve the results is to do more noise reduction and double check for any errors in the math used to get the noise from the signal.

2. As PII increases time should also increase as its acquiring more integration points. However ours seemed to relatively stay at the same time or was faster. Part this could have been due to human error of not exactly starting and stopping the stopwatch at the same instant of when the scan was started and stopped.

Background	Target	Time	Distance
6007	6003	7.11	1.0796
7008	7010	6.25	1.0704
8013	8011	7.15	1.0704

9015	9016	6.65	1.0704
10019	10018	6.76	1.1253
11021	11022	7.13	1.1253
12025	12024	6.61	1.1253
13027	13028	6.78	1.1253
14031	14030	6.75	1.0979
15033	15034	6.91	1.0704