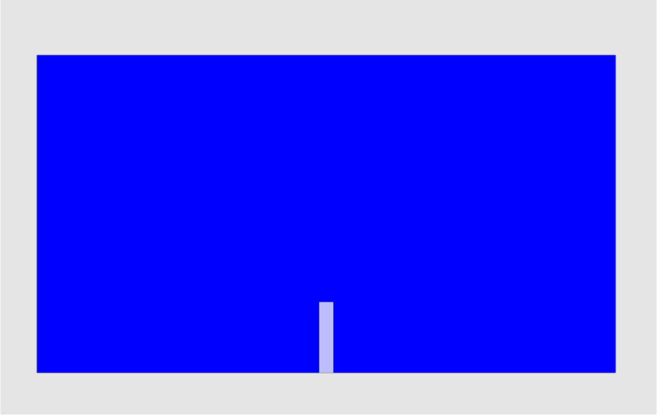
B-Scan Simulation result and plot for Steel Sheet Using Onscale

Experimental Setup:

The experimental setup is as shown below:



The parameters used are as per the tutorial in link (https://support.onscale.com/hc/en-us/articles/360022005111-Simulating-Wave-Propagation-in-a-Steel-Plate-with-a-Defect)

As can be seen from the tutorial time domain signal is obtained at X=20mm and Y=0mm but for this work X has been chosen to be X=40.5mm(end of the plate) and Y varying from 0 to 22.5 mm.

Note 1: * Here X is the horizontal axis and Y is the vertical axis

Note 2: * The Y position of receiver has been changed in increments of 0.2mm

Importing libraries for data set up and plotting

```
In [1]: import pandas as pd
        import numpy as np
        import matplotlib.pyplot as plt
        import matplotlib as ml
        import os
```

Selecting files from folder,writing it to a file and removing unwanted files manually

Note: * Uncomment the lines if list file needs to be rewritten

In [2]:

```
directory='/home/kushal/Desktop/Simulation/b_scan_simulation/steel_plate_onscale/'
subdir_tuple=os.walk(directory)
subdir_list=[x[0] for x in subdir_tuple]
selected_list=[]
for i in range(0,226,2):
    for subdir in subdir_list:
        if subdir.find('wave_prop'+str(i)+'-')>=0 and subdir.find('/1')>=0:
            selected_list.append(subdir)
print(len(selected_list))

#with open('selected_directories.txt','w') as f:
#    for selected_dir in selected_list:
#        f.write("%s\n" % selected_dir)
```

```
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```

Loading selected files:

In [3]:

```
final_list=[]
with open('selected_directories.txt','r') as f:
    for line in f:
        final_list.append(line.rstrip())
```

Loading data and creating dataframe

In [4]:

```
num_a_scans=len(final_list)
dictionary_scans={}
for i,subdir in zip(range(0,226,2),final_list):
    temp_df=pd.read_csv(subdir+'/pos'+str(i)+'.csv',header=None)
    if i==0:
        dictionary_scans['time_stamp']=temp_df.iloc[:,0]
        dictionary_scans['pos0']=temp_df.iloc[:,1]
    else:
        dictionary_scans['pos'+str(i)]=temp_df.iloc[:,1]

data=pd.DataFrame.from_dict(dictionary_scans)
data
```

Out[4]:

	time_stamp	pos0	pos2	pos4	pos6	pos8	pos10	pos12	p
0	5.327882e-08	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.00
1	1.065576e-07	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.00
2	1.598365e-07	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.00
3	2.131153e-07	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.00
4	2.663941e-07	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.00
5	3.196729e-07	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.00
6	3.729517e-07	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.00
7	4.262306e-07	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.00
8	4.795094e-07	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.00
9	5.327882e-07	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.00
10	5.860670e-07	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.00
11	6.393458e-07	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.00
12	6.926247e-07	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.00
13	7.459035e-07	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.00
14	7.991823e-07	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.00
15	8.524611e-07	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.00
16	9.057400e-07	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.00
17	9.590187e-07	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.00
18	1.012298e-06	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.00
19	1.065576e-06	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.00
20	1.118855e-06	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.00
21	1.172134e-06	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.00
22	1.225413e-06	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.00
23	1.278692e-06	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.00
24	1.331971e-06	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.00
25	1.385249e-06	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.00
26	1.438528e-06	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.00
27	1.491807e-06	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.00
28	1.545086e-06	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.00
29	1.598365e-06	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.00
...	...	...	...	...	...	...	...	...	...
1847	9.845926e-05	0.020321	0.020321	0.016477	0.016477	0.011730	0.011730	0.012660	0.01
1848	9.851254e-05	-0.000039	-0.000039	-0.003105	-0.003105	-0.004887	-0.004887	-0.002707	-0.00
1849	9.856582e-05	-0.021772	-0.021772	-0.023422	-0.023422	-0.021795	-0.021795	-0.017843	-0.0
1850	9.861910e-05	-0.042440	-0.042440	-0.042209	-0.042209	-0.037058	-0.037058	-0.031107	-0.0

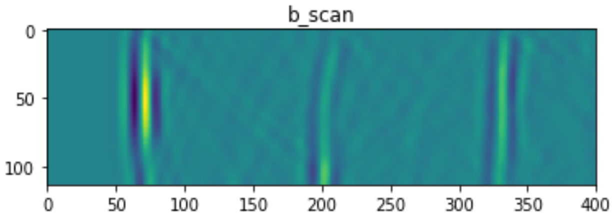
Preparing data for plot with region of interest selected between 100 and 500(first reflection of ultrasound waves)

In [5]:

```
b_scan=(np.array(data.iloc[:,1:114].values)).T
b_scan=b_scan[:,100:500]
#b_scan=b_scan[:,500:900]
b_scan=np.flipud(b_scan)
```

In [6]:

```
fig=plt.figure()
ax=fig.add_subplot(111)
ax.set_title('b_scan')
plt.imshow(b_scan)
plt.show()
```


b_scan