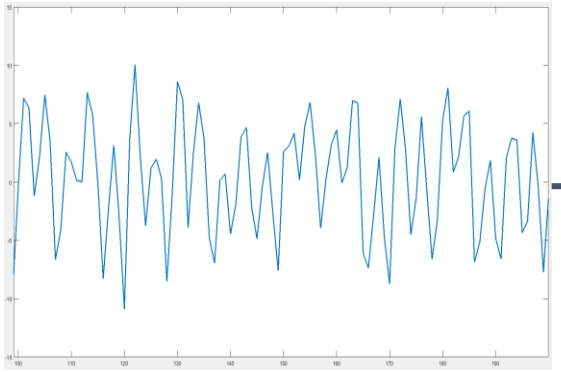
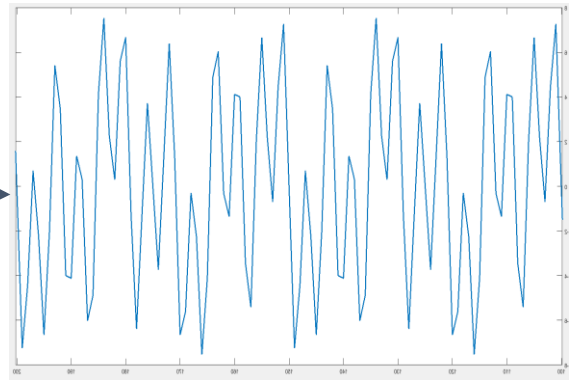
ECE 111: Final Project

Overview

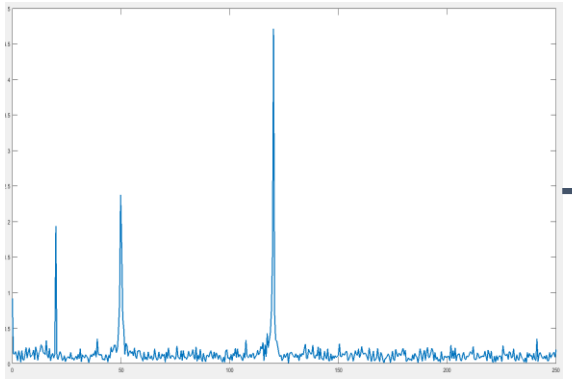
Time Domain



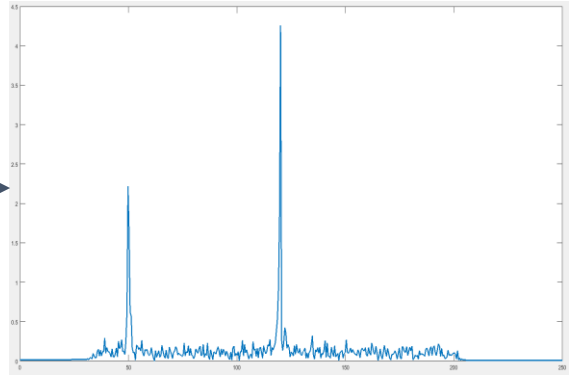
Band Pass Filter



Frequency Domain

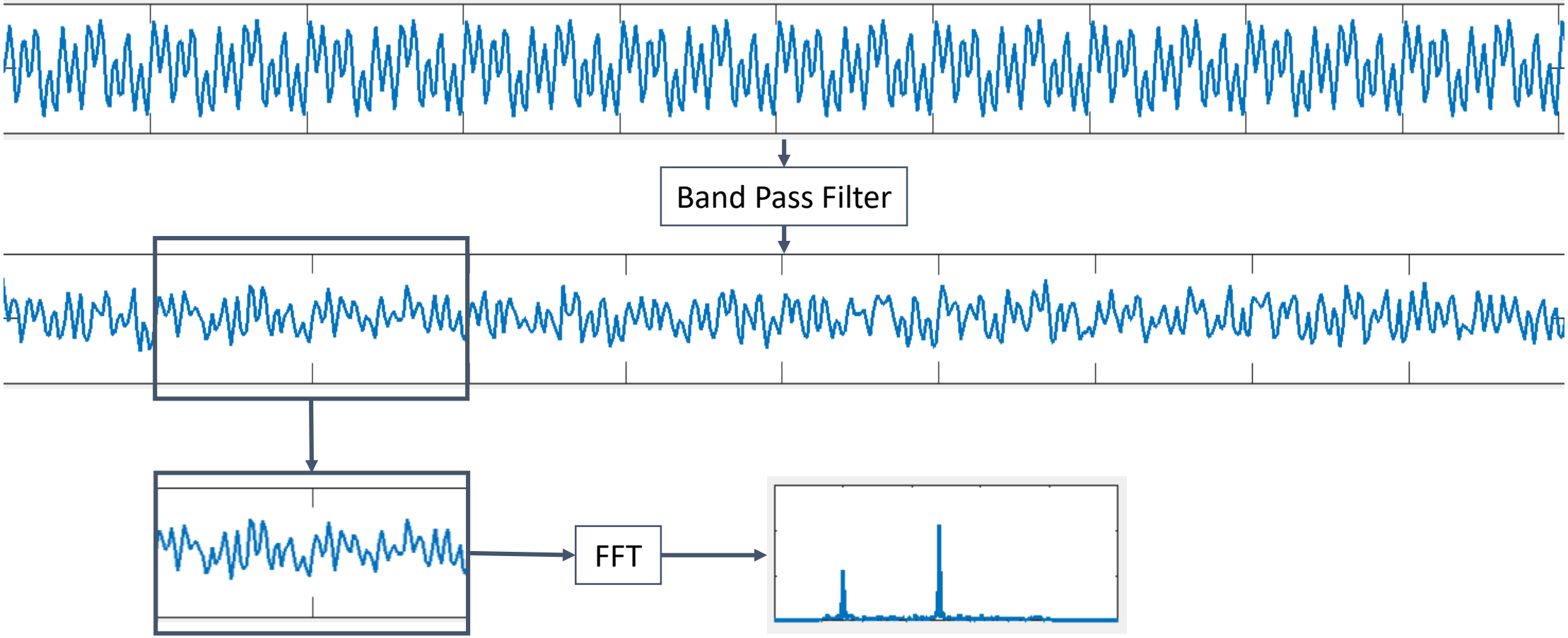


Band Pass Filter

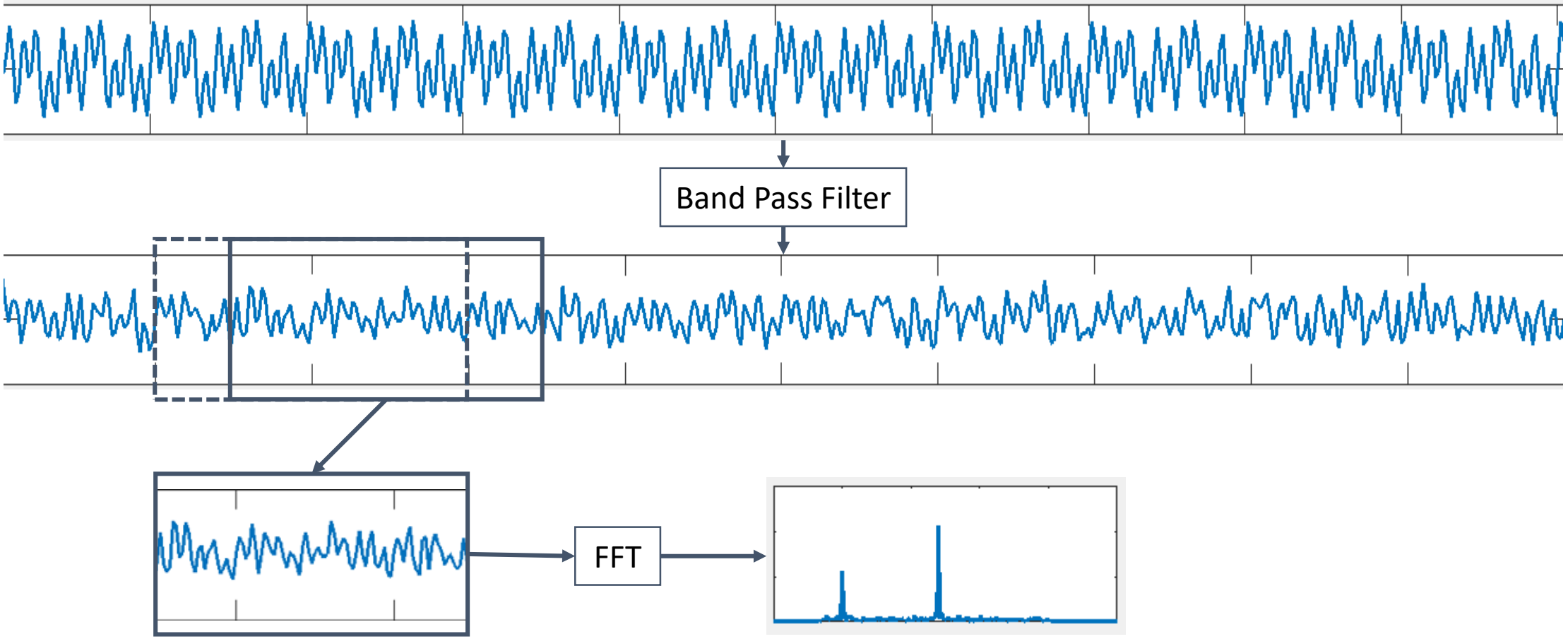


Steps

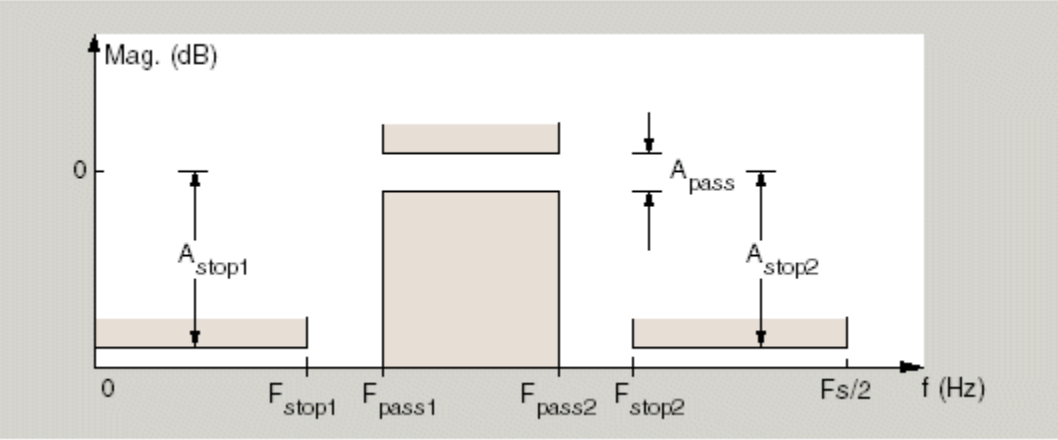
Noisy signal



Steps



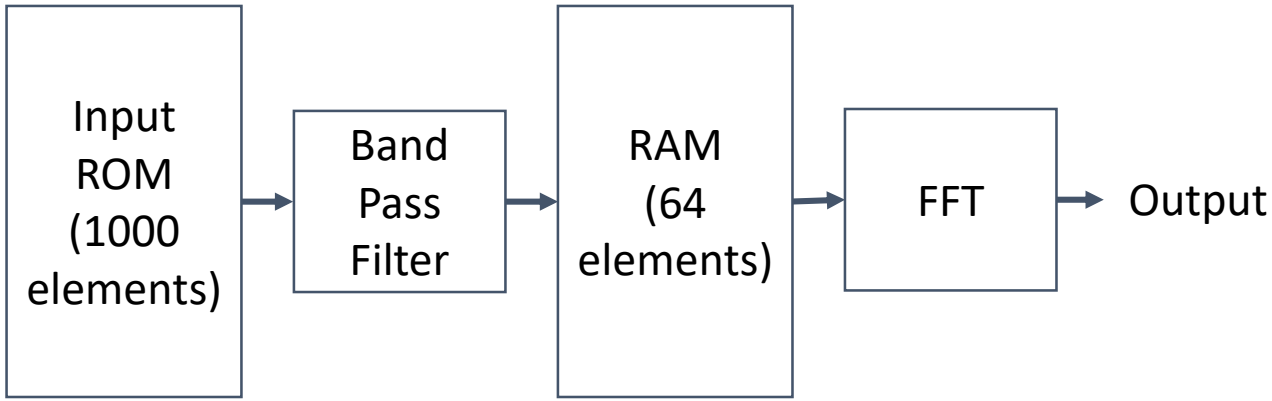
Design of the Filter




```
29  Fstop1 = 30;     % First Stopband Frequency
30  Fpass1 = 35;     % First Passband Frequency
31  Fpass2 = 200;    % Second Passband Frequency
32  Fstop2 = 205;    % Second Stopband Frequency
33  Astop1 = 60;     % First Stopband Attenuation (dB)
34  Apass  = 1;      % Passband Ripple (dB)
35  Astop2 = 60;     % Second Stopband Attenuation (dB)
36
37  filt_design = fdesign.bandpass('fst1,fp1,fp2,fst2,ast1,ap,ast2',
    Fstop1, Fpass1, Fpass2, Fstop2, Astop1, Apass, Astop2, Fs);
38  filt_mdl = design(filt_design, 'equiripple', 'FilterStructure',
    'dfsymfir','MinOrder', 'any');
39  filt_x = filt_mdl.filter(y);
```

- coefficients = filt_mdl.Numerator;
- Length of filter coefficients depends on the difference between {Fstop1, Fpass1} and {Fstop2, Fpass2}
- First simulate in Matlab with different values to design the filter such that the final output is free of noise and dc values.
- Write the coefficients in a coe file and use it in your FPGA design

Block Diagram

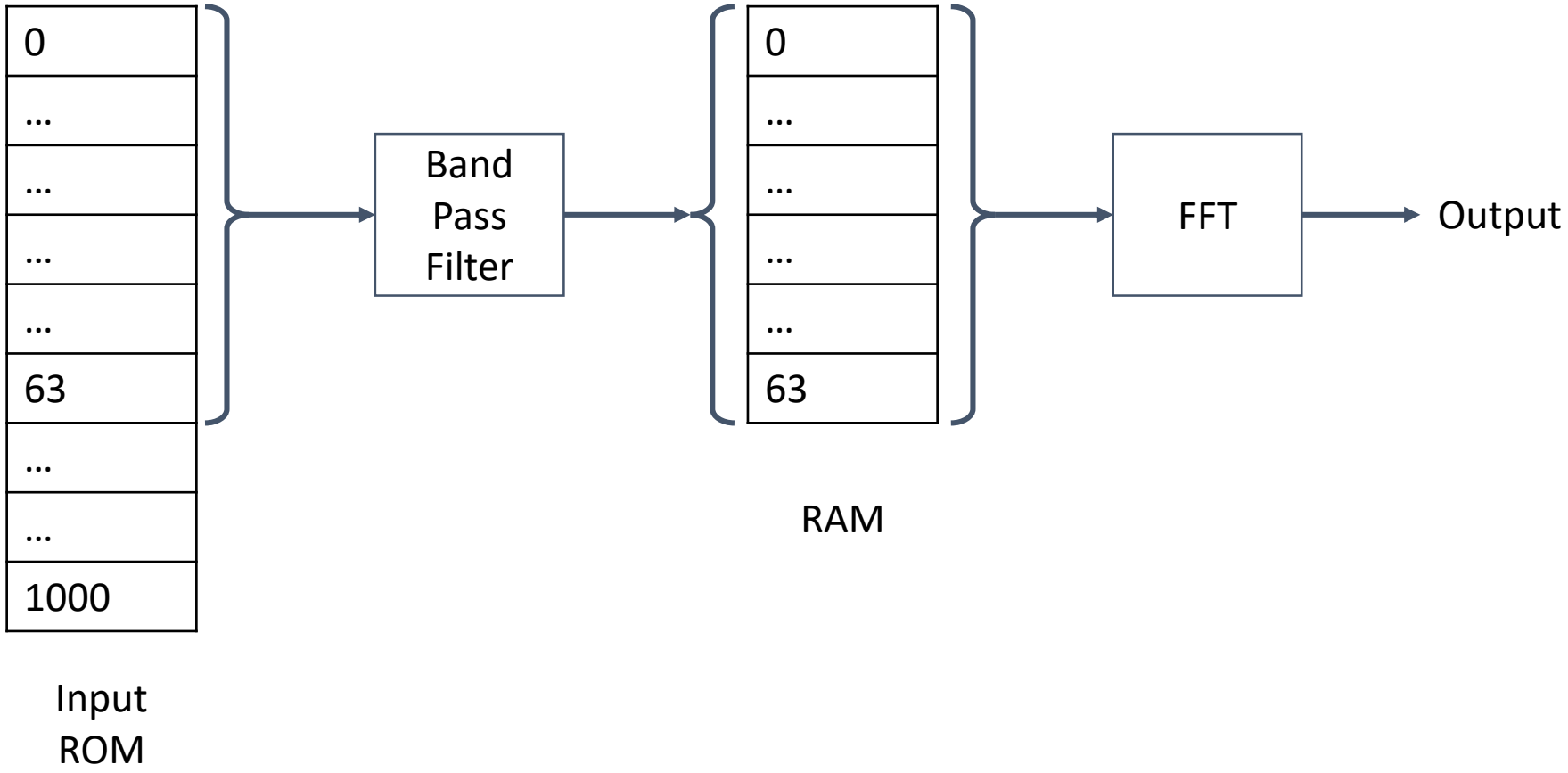


One Way of Windowing

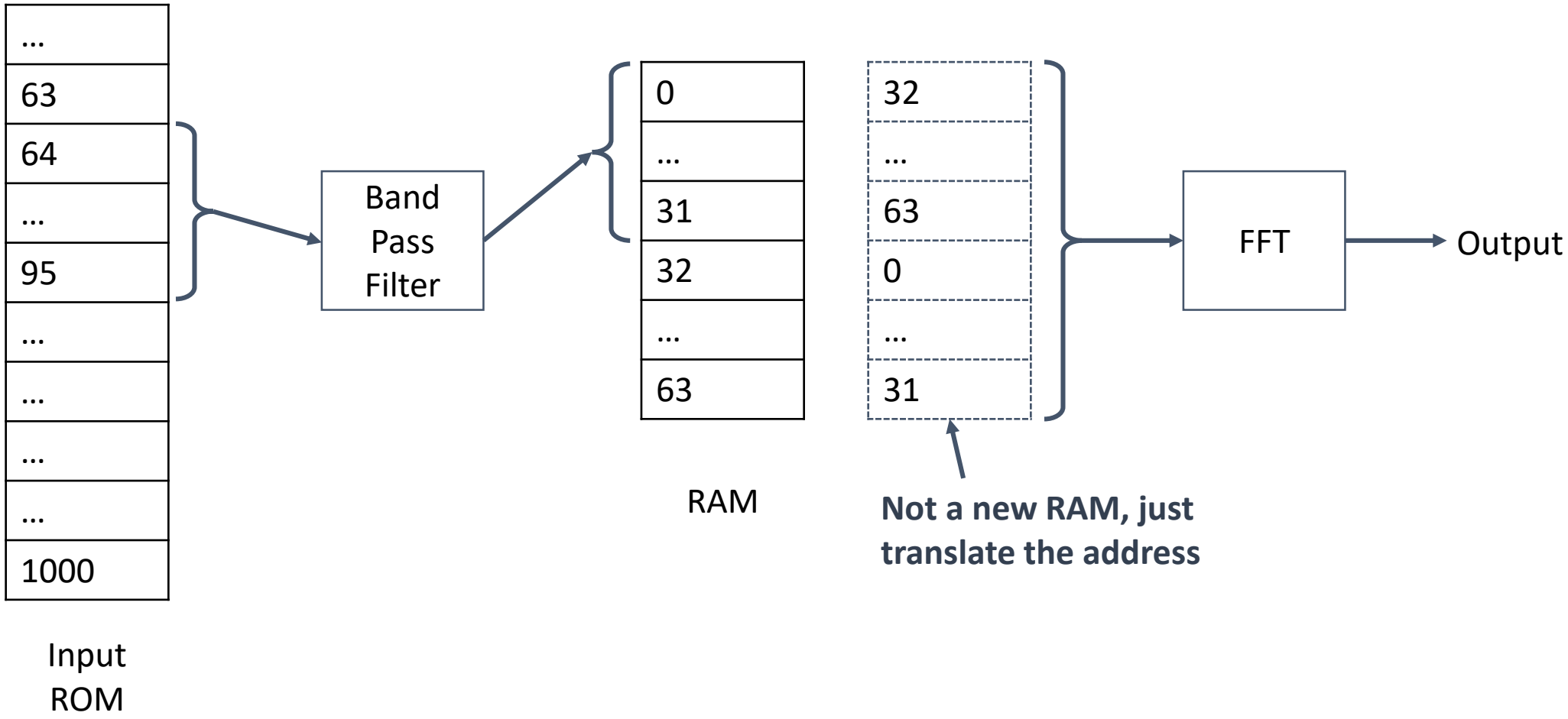
Say the window length is 64 and each window has 50% overlap with the adjacent ones

I. First compute 64 samples of filter output and store them in addresses [0-63] in the RAM
II. Then compute the FFT of the samples in addresses [0-63] in the RAM
III. Then compute the next 32 samples of filter output and store them in addresses [0-31] in the RAM
IV. Then compute the FFT of the samples in addresses [32-63, 0-31] in the RAM, in that order
V. Then compute the next 32 samples of filter output and store them in addresses [32-63] in the RAM
VI. Go back to step II and repeat

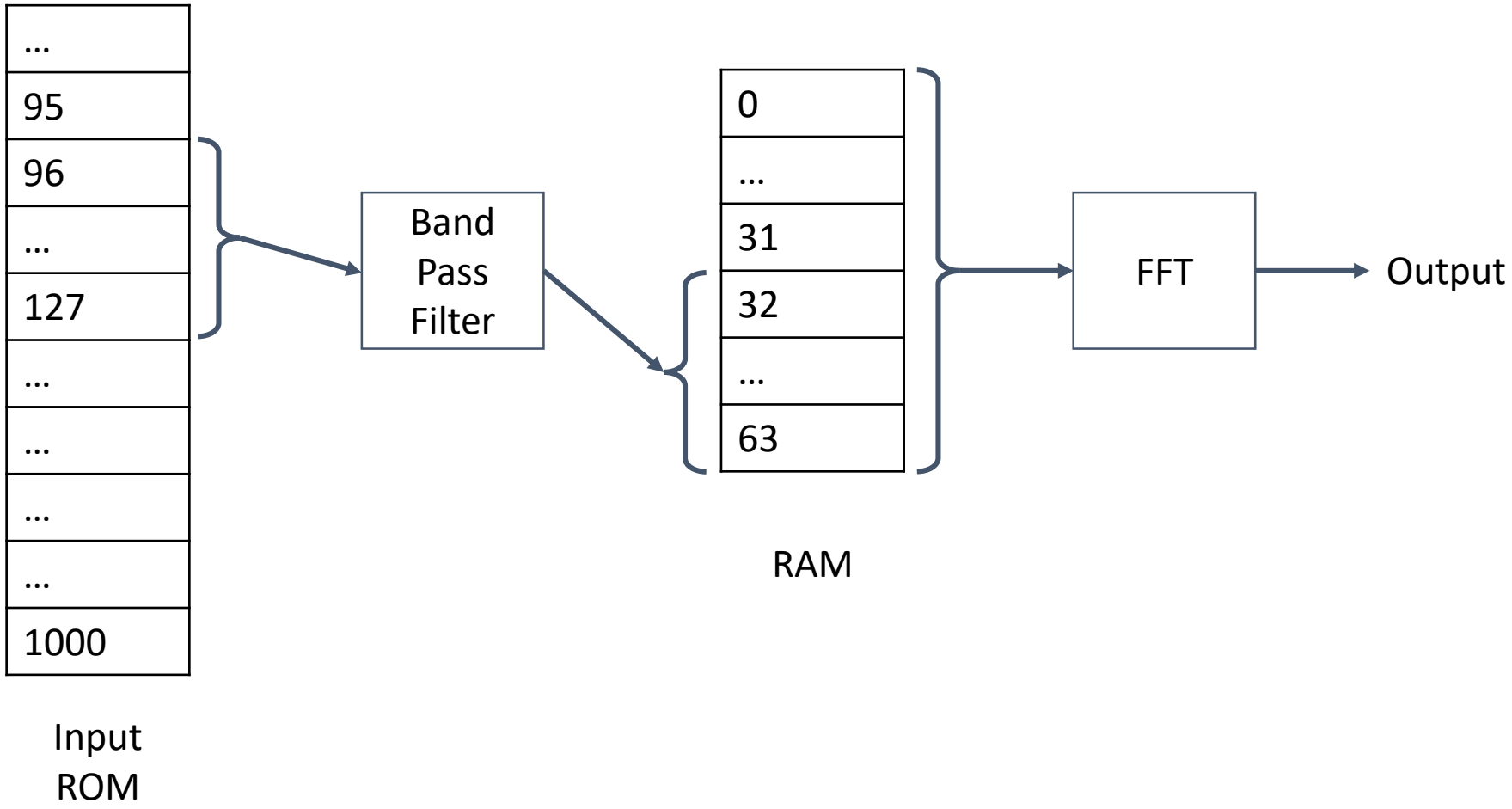
One Way of Windowing



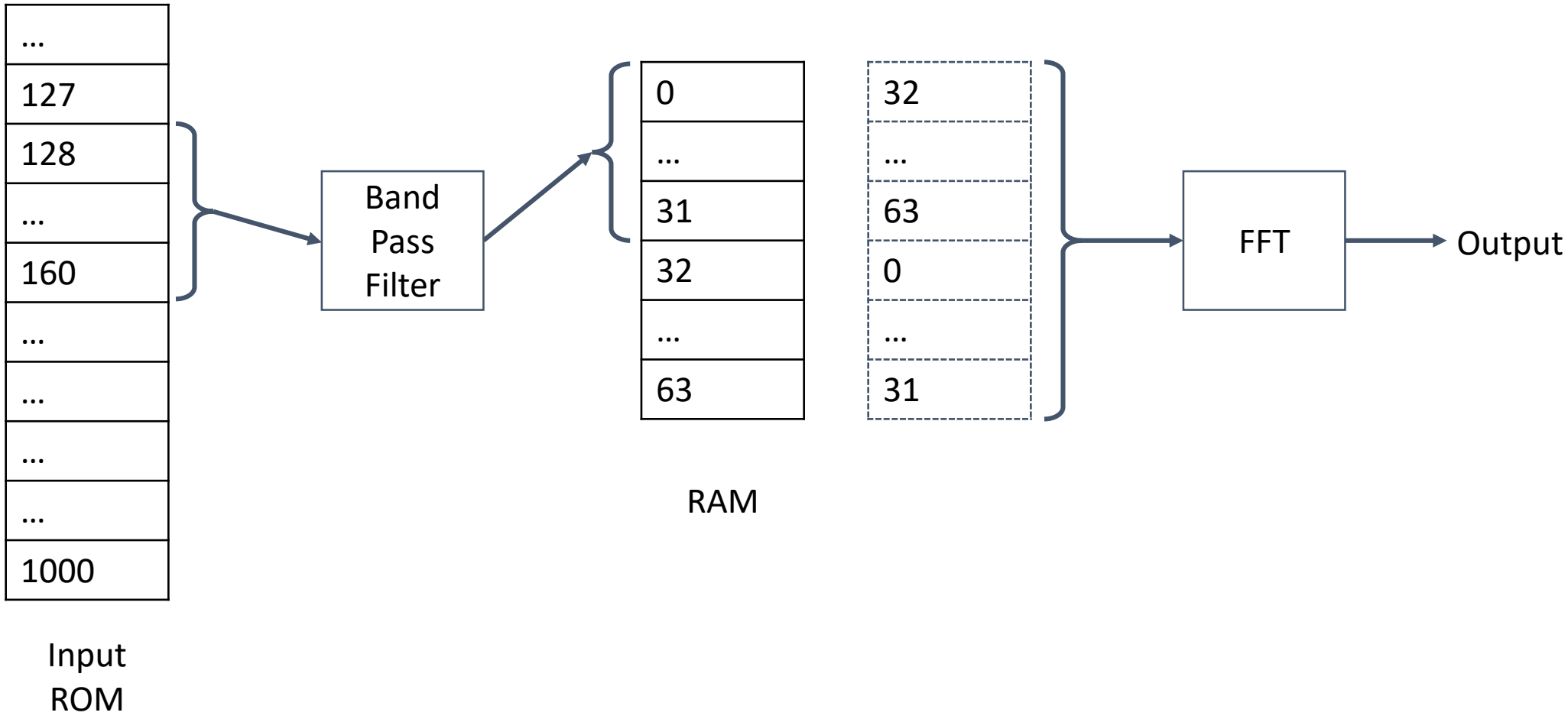
One Way of Windowing



One Way of Windowing



One Way of Windowing



How to Generate Input/Output

- Write the noisy input (y in example.m) in a coe file and store it in a ROM of 1000 elements
- Write the output of the first 5 windows in a Matlab file and plot it.