Mid semester presentation for Master Thesis Project on

CONTACTLESS RADAR-BASED VITAL SIGN MONITORING

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Motivation

Contactless radar-based vital sign monitoring project can fulfill the need for remote, and continuous monitoring of a person's vital signs. Here are several compelling reasons for pursuing such a project:

- Patient Comfort and Safety
- Continuous Monitoring
- Reduced Healthcare Costs
- Home Healthcare

Fig.1.Current model to monitor vital sign

Objective

- Design a Radar system that can measure the breathe rate of single person without any contact.
- Design a Radar system that can measure the breathe rate of multiple person without any contact.
- Design a Radar system that can measure the breathe rate of new born babies without any contact.

Literature

Title	Applications	Publication year
Implementation of FMCW Radar by Using SDR S. Kaya, A. Ç. Yapıcı, B. Tıbıkoğlu and Ş. O. Yazıcı, "Implementation of FMCW Radar by Using SDR," 2021 *13th International Conference on Electrical and Electronics Engineering (ELECO)*, Bursa, Turkey, 2021, pp. 234-238.	Range detection of a object	2021
A Simple Radar Based on USRP Software Defined Radio B. Bleszynski, "A simple radar based on USRP software defined radio," 2017 *Signal Processing Symposium (SPSympo)*, Jachranka, Poland, 2017, pp. 1-4.	Range detection of a object	2017
Stationary and Moving Targets Detection on FMCW Radar Using GNU Radio-Based Software Defined Radio S. Aulia, A. B. Suksmono and A. Munir, "Stationary and moving targets detection on FMCW radar using GNU radio-based software defined radio," *2015 International Symposium on Intelligent Signal Processing and Communication Systems (ISPACS)*, Nusa Dua Bali, Indonesia, 2015, pp. 468-473.	Range detection of a object	2015

Mathematical Modelling

- Propagation Delay

$$\tau = \frac{2R}{c} \quad \ldots\ldots(1)$$

Where

R-Range of Object

c-Speed of light

- Range Resolution

$$\Delta R = \frac{c}{2B} \quad \ldots(2)$$

Where

B- Bandwidth

- Relation between range(R) and beat frequency (Δf)

$$R = \frac{c.\Delta f.T_s}{2B} \quad \ldots\ldots\ldots\ldots(3)$$

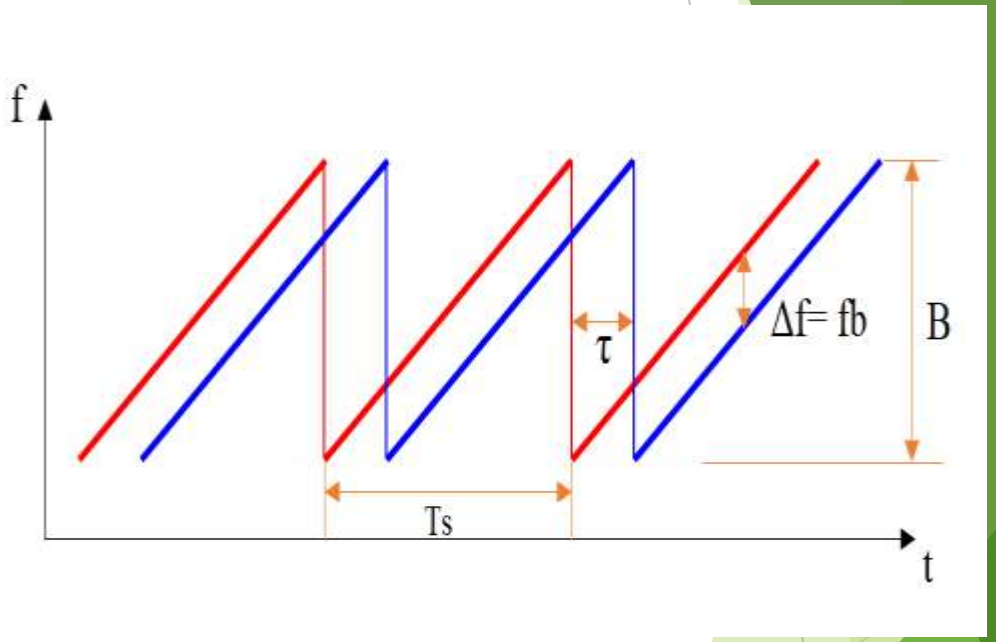


Fig.2.FMCW Radar chirp signal

Simulink Setup

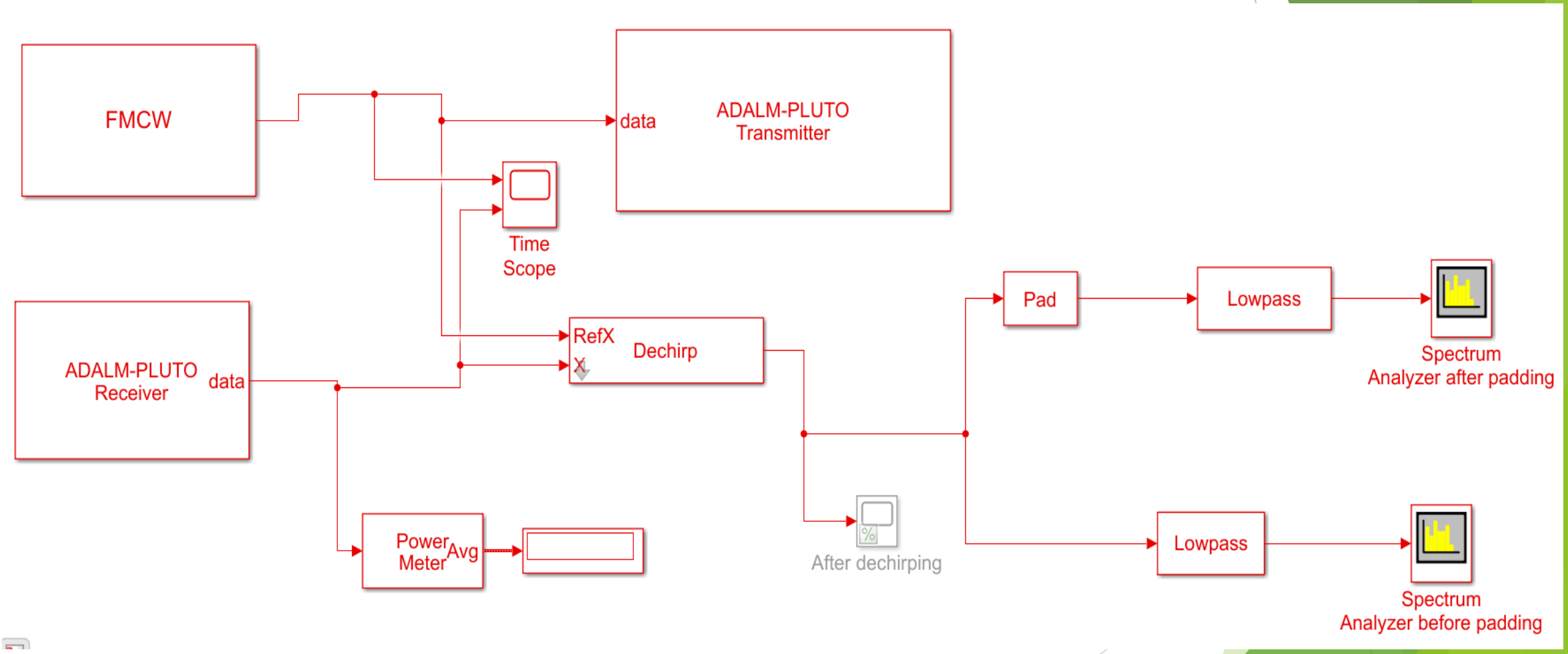


Fig.3.Block Diagram of FMCW Radar

Test Setup

Fig.4.Setup at 4 meter distance from object

Simulated Results

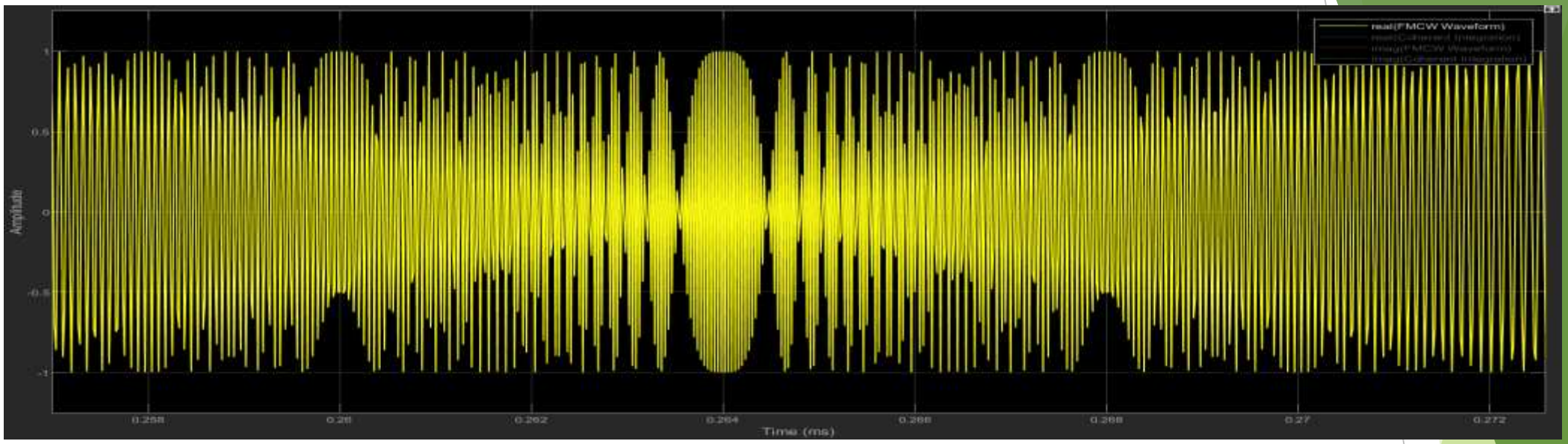


Fig.5(a).Real Transmitted Waveform

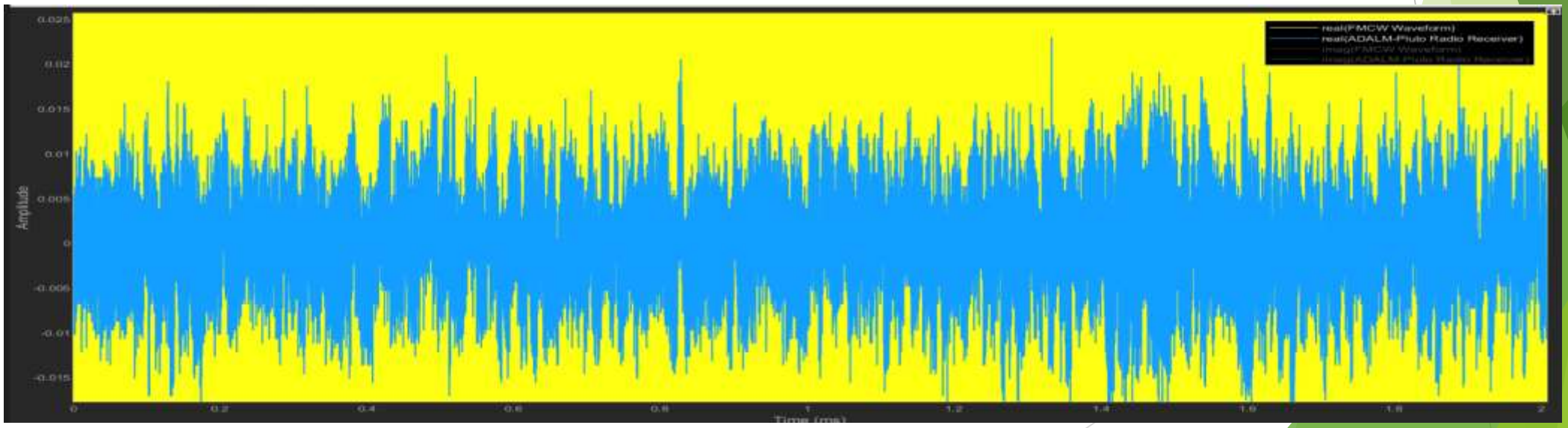


Fig.5(b).Real Received Waveform

Simulated Results

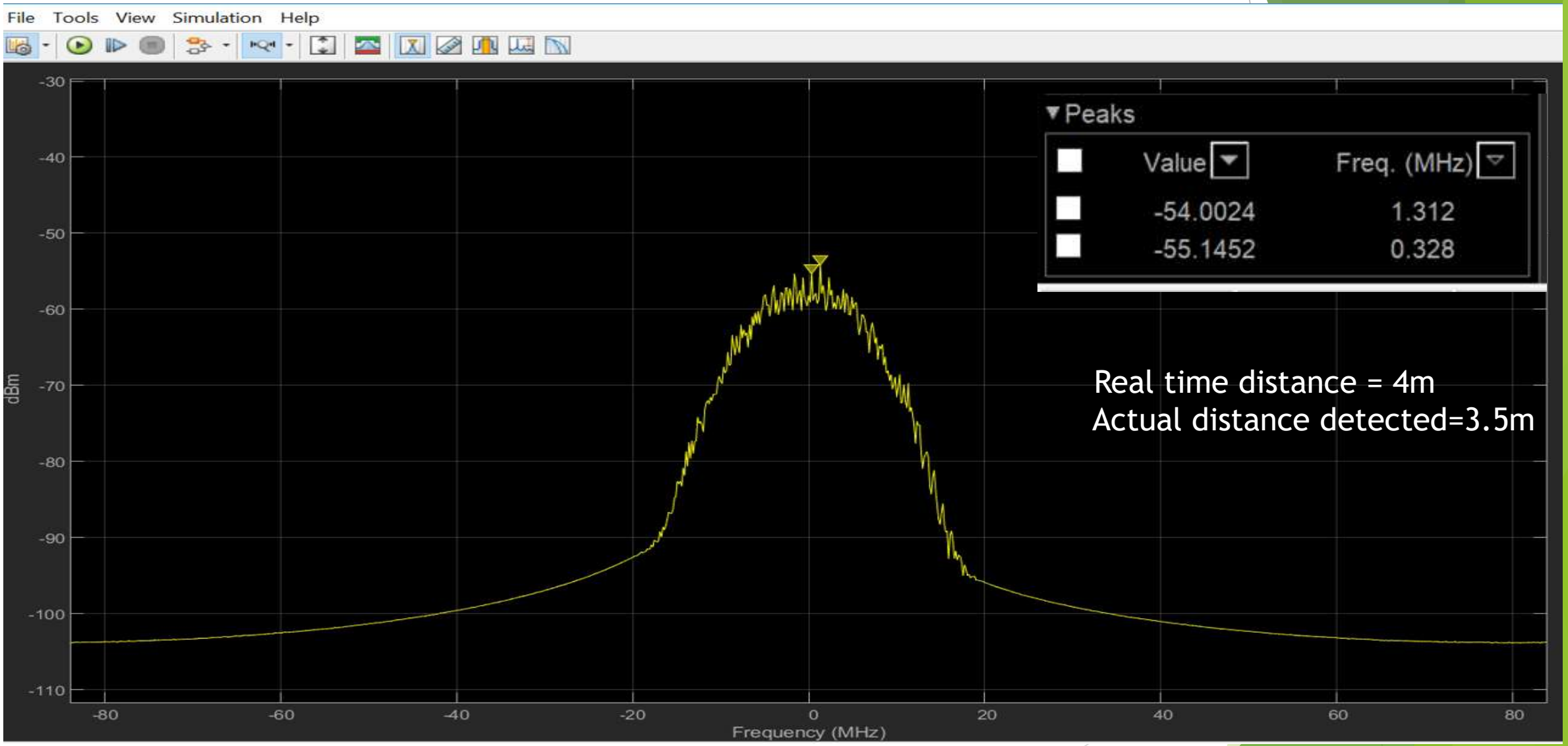
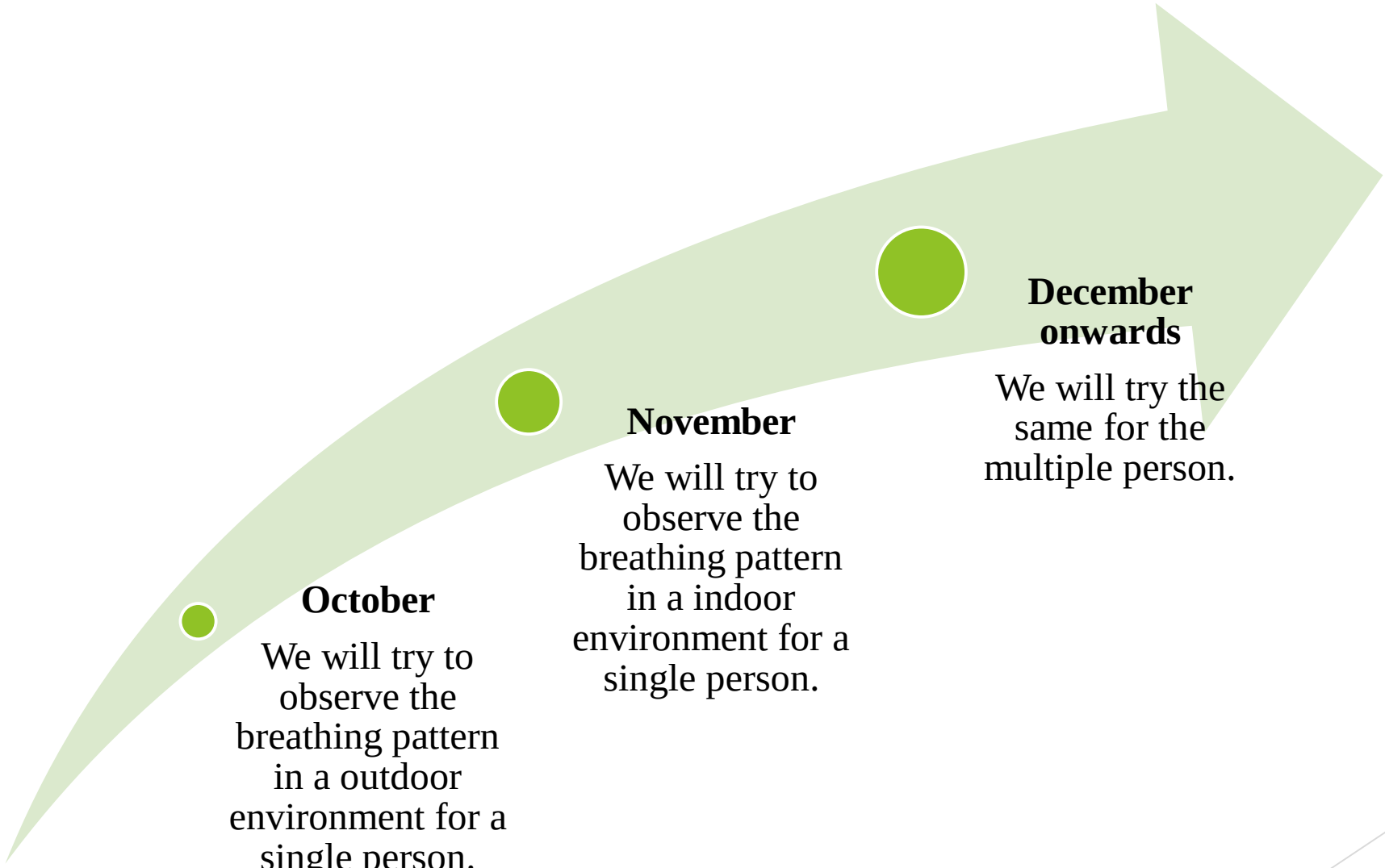


Fig.6.Real time beat Frequency detection by performing FFT on beat signal

Future Work Time line



October

We will try to observe the breathing pattern in a outdoor environment for a single person.

November

We will try to observe the breathing pattern in a indoor environment for a single person.

December onwards

We will try the same for the multiple person.

Conclusion

- Till now we have approximately detected the range of a static object.
- Range detection of a static object in indoor system is difficult to achieve due to multipath components.
- To achieve high accuracy of range detection we have to use directional antenna.
- Due to limited bandwidth of Adalm Pluto Radio(56MHz) , range resolution of FMCW radar will be less.


THANK
YOU !