

5G and Satellite Network Coexistence in *FR3* Spectrum

Audrey W., Tulika P., Srishti H.

WINLAB 2025 Internship



Team Introduction



Audrey Wang

- Rising Sophomore at Rutgers-New Brunswick
- Studying CS & Math



Tulika Punia

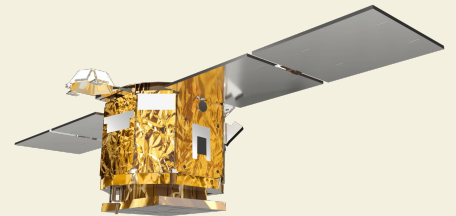
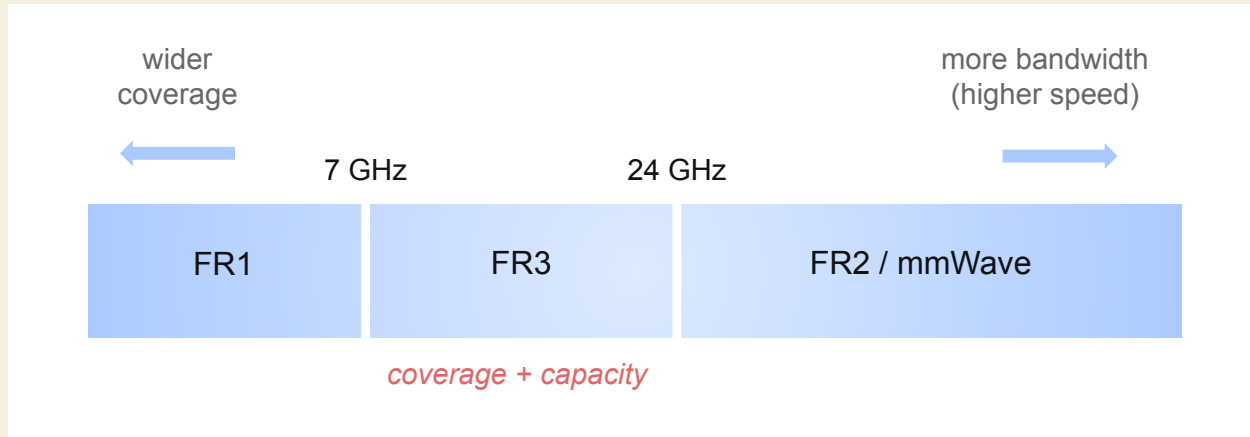
- Rising Junior at Central Jersey College Prep Charter School
- Interested in CS, DS, AI/ML



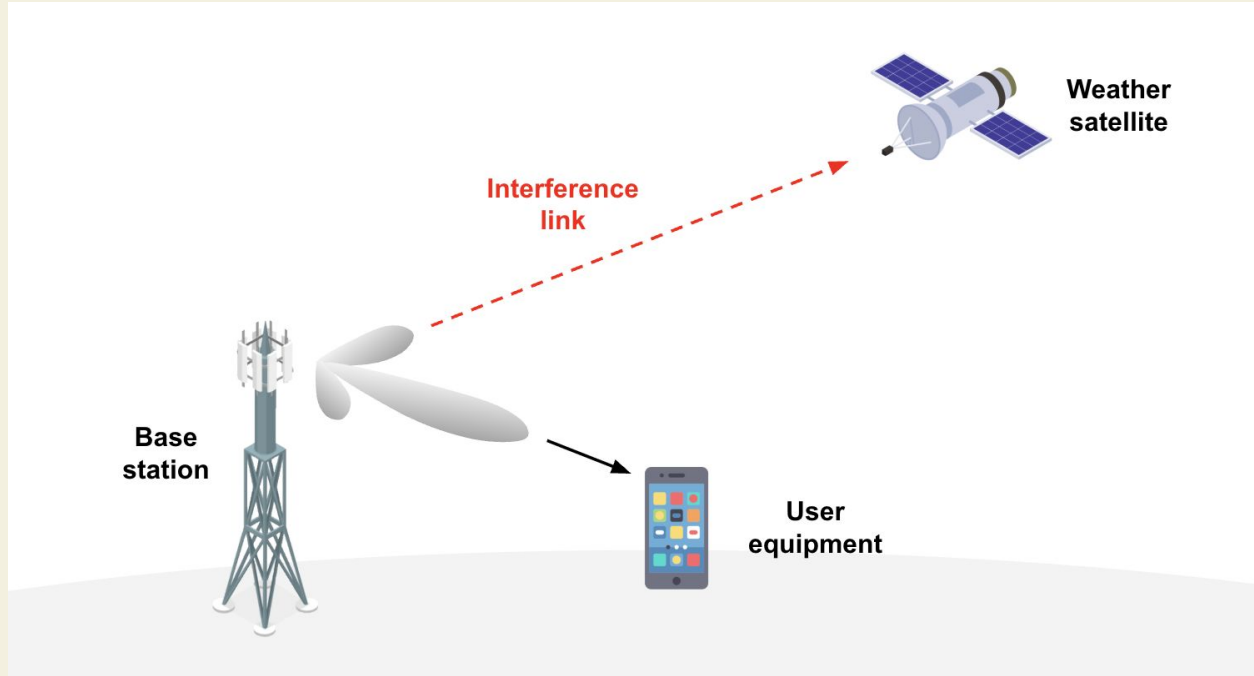
Srishti Hazra

- Rising Senior at Edison Academy Magnet School
- Interested in AI/ML, CS

Project Overview

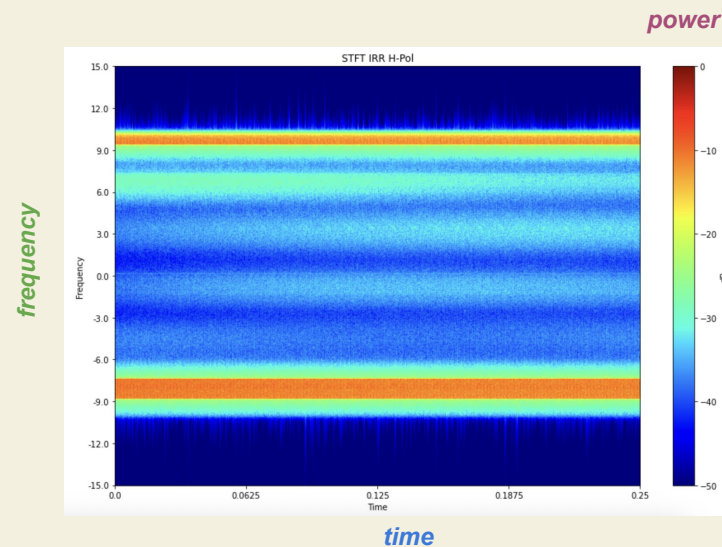
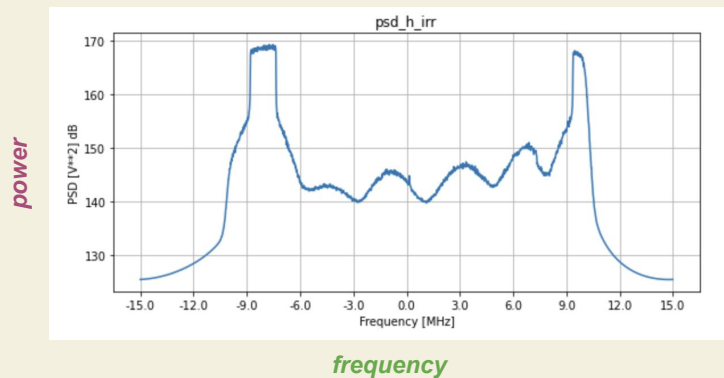


Interference (RFI)



Project Aim

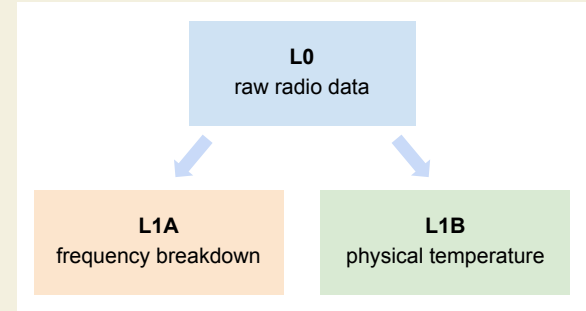
Goal: use ML to *detect*  and *mitigate* Radio Frequency Interference (RFI)



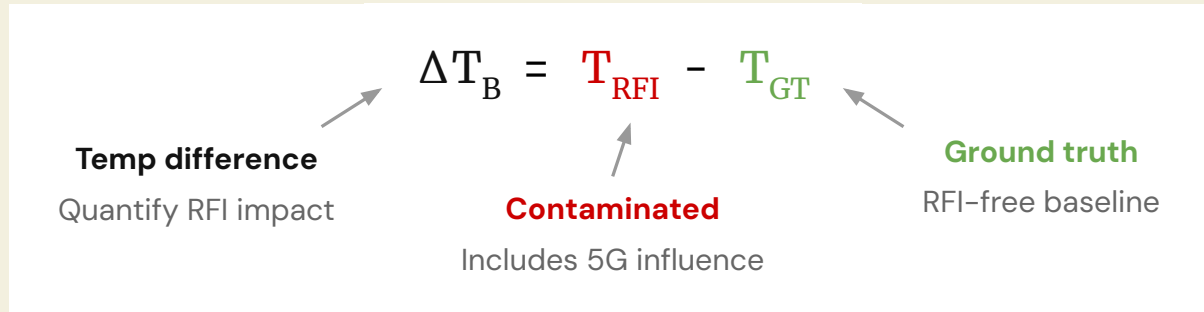
Testbed Dataset

L1A → generate graphs (spikes, stripes = RFI)

L1B → quantify RFI through temp change

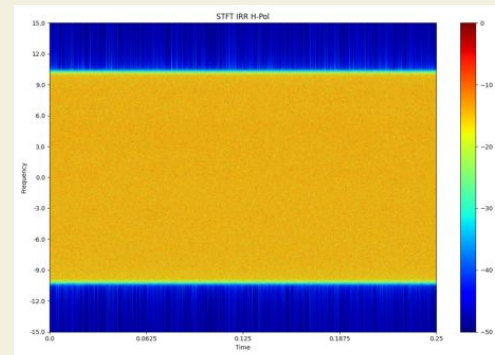
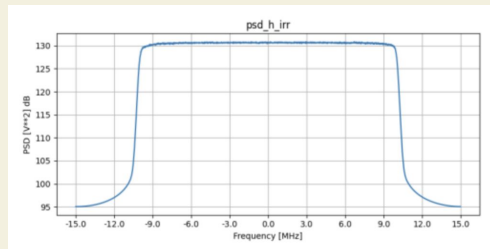


Radiometer: interpret all received power as thermal radiation

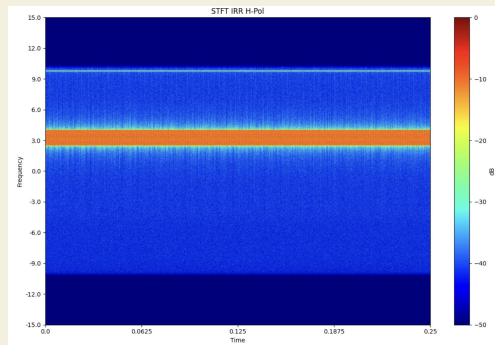
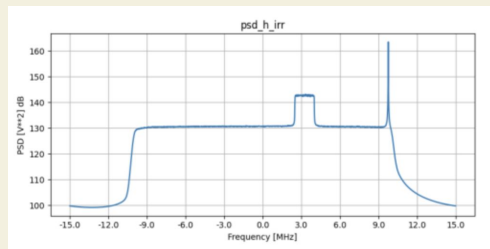


Binary Labeling

$T_B = 0.025$
Clean (0)

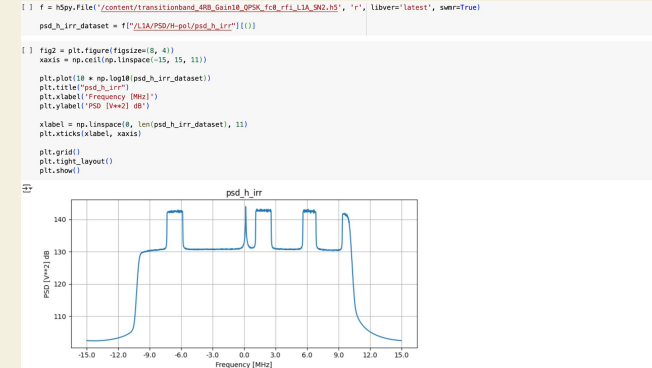


$T_B = 568.05$
RFI (1)



Data Processing

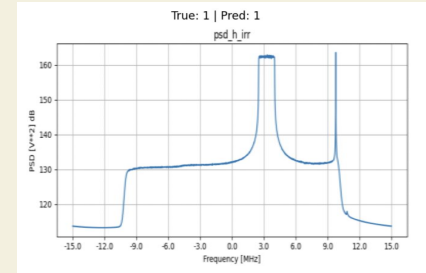
1. Generated graphs using *Python* libraries
2. Storing processed data in a 2D array
 - 400+ rows for different RFI scenarios



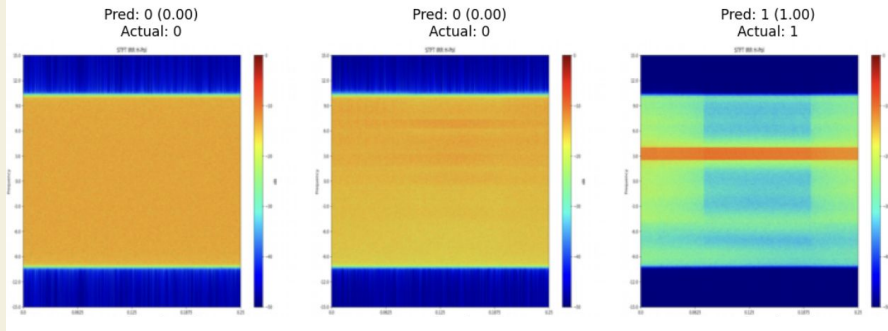
File Name	PSD	Spectrogram	T_B Difference	Binary RFI Label
"out_fc3_4RB_Gain10"			"0.02534"	"0" = no RFI

Classification Models

1. Trained CNN and SVM with >96% accuracy
 - ResNet18 w/ classification layer retrained
2. Performed cross-validation to prevent overfitting



CNN

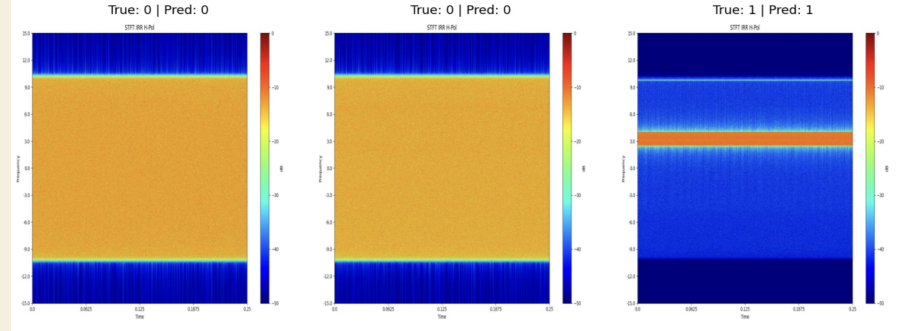


Ex. 1

Ex. 2

Ex. 3

SVM



Ex. 4

Ex. 5

Ex. 6

ML Pipeline

Current Developments

Waveform Generation (T_x)



Feature Extraction

Leaked signal
spectrograms in
L-band

CNN Prediction

Regression-based
estimation of brightness
temperature T_B

RFI Detection

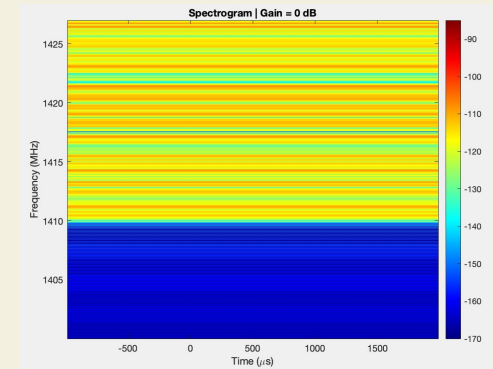
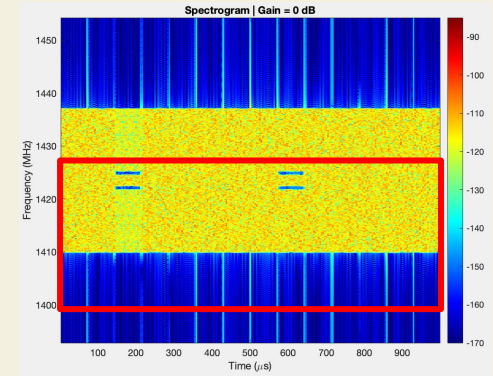
Determine **RFI**
existence based on
 T_B threshold

Detection w/ Tx signals

1. Cropped spectrograms:
 - Focus on leaked portion (1400-1427 mHz)
 - Created new data table

<i>RFI scenario</i>	<i>Cropped T_x spectrogram</i>	<i>Measured T_B</i>
---------------------	---	----------------------------------

2. Predict T_B using regression
 - Extract more features from graphs



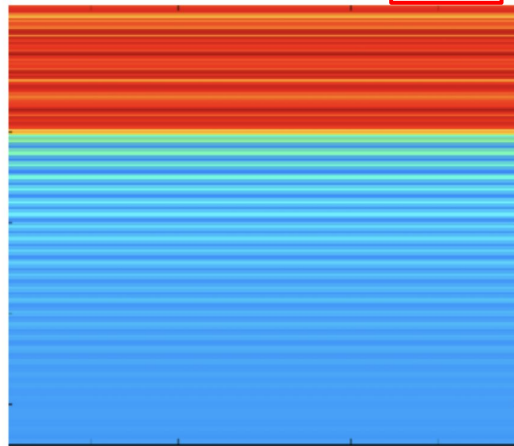
Regression Results

- Identify *RFI* based on predicted T_B :
 - $T_B > 10(\text{Kelvin}) = \text{inference}$

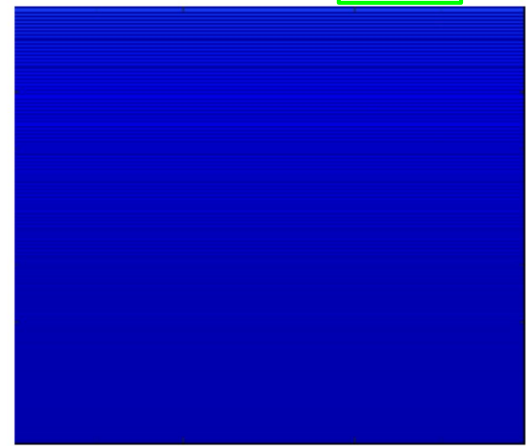
Predicted: 2446.8787, Actual: 4256.8320, RFI: True



Predicted: 887.1404, Actual: 1050.1112, RFI: True

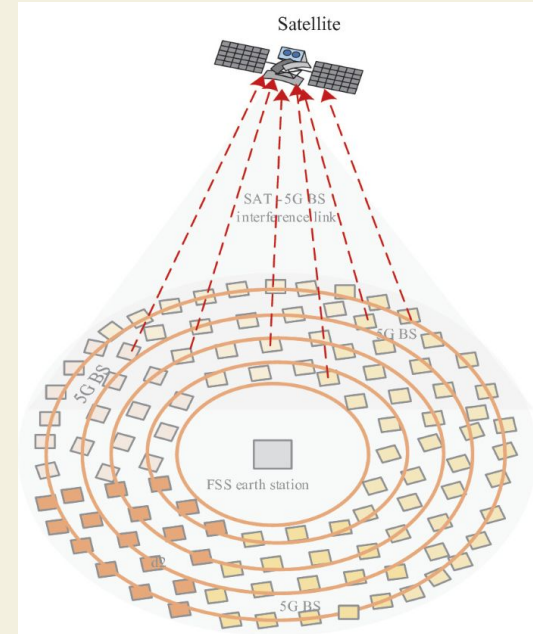


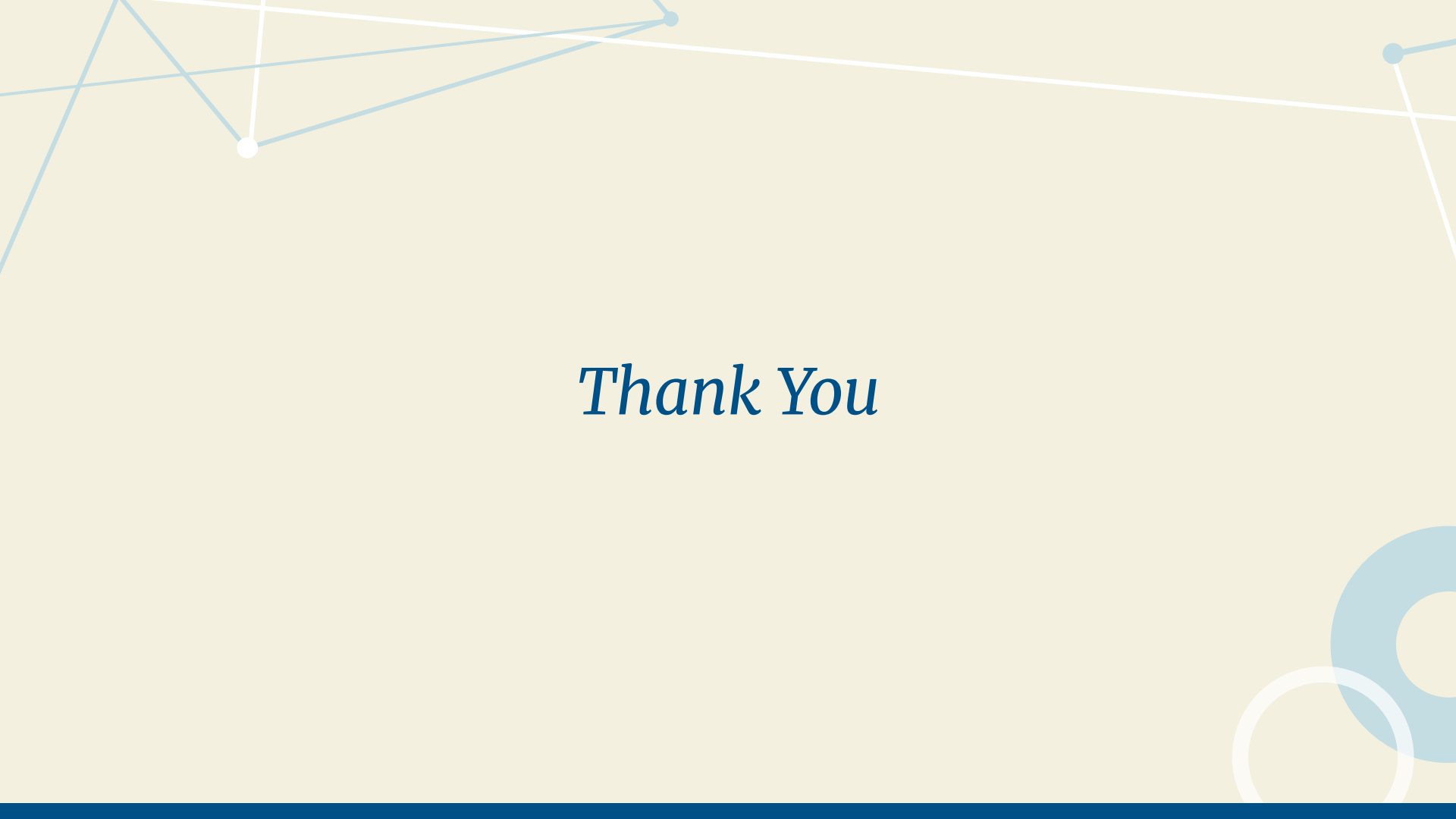
Predicted: 0.1618, Actual: 0.1505, RFI: False



Future Work

1. Test model on unseen data
2. Optimize signal generation code
 - Mimic real-world conditions
3. Progress to *mitigation* stage:
 - Develop ML-based precoding algorithm



The slide features a light beige background. In the top left corner, there are several thin, light blue and white lines forming a network of triangles and polygons. Some lines have small circular dots at their vertices. In the bottom right corner, there are two overlapping circles: a larger, solid light blue one and a smaller, white one with a light blue outline. A solid dark blue horizontal bar runs across the entire bottom of the slide.

Thank You