



Channel Modeling for Dynamic Manufacturing Environments

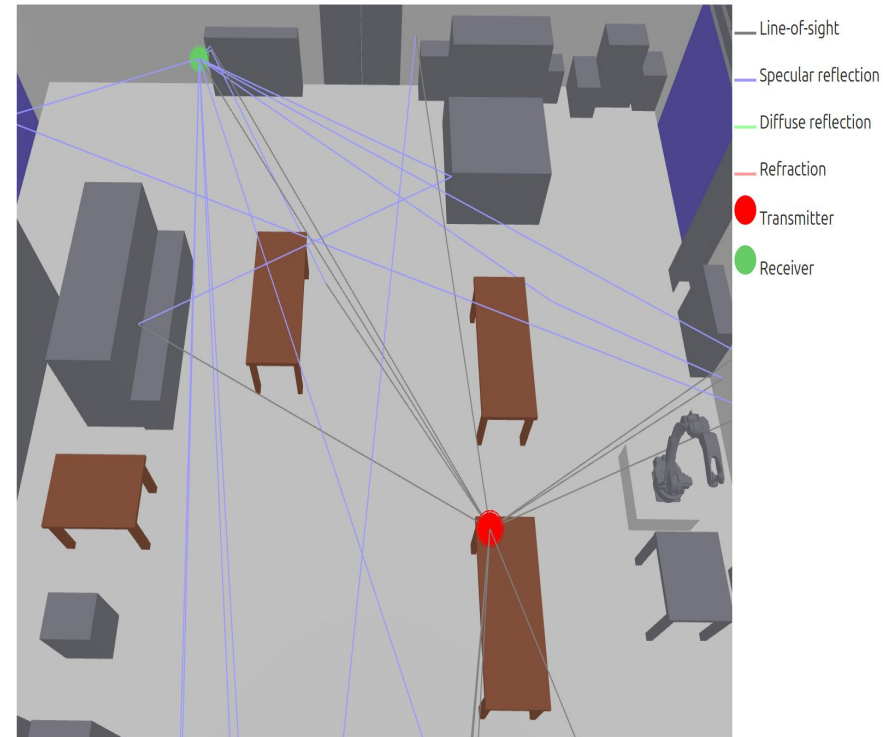
Digital Twin-Based Prediction of Indoor Channel Variability Due to Moving Objects in Manufacturing Environments Final Presentation

Project Goal and Overview:

- Predict how moving objects change wireless channel characteristics on an indoor factory floor
- Validate predictions against real measurements



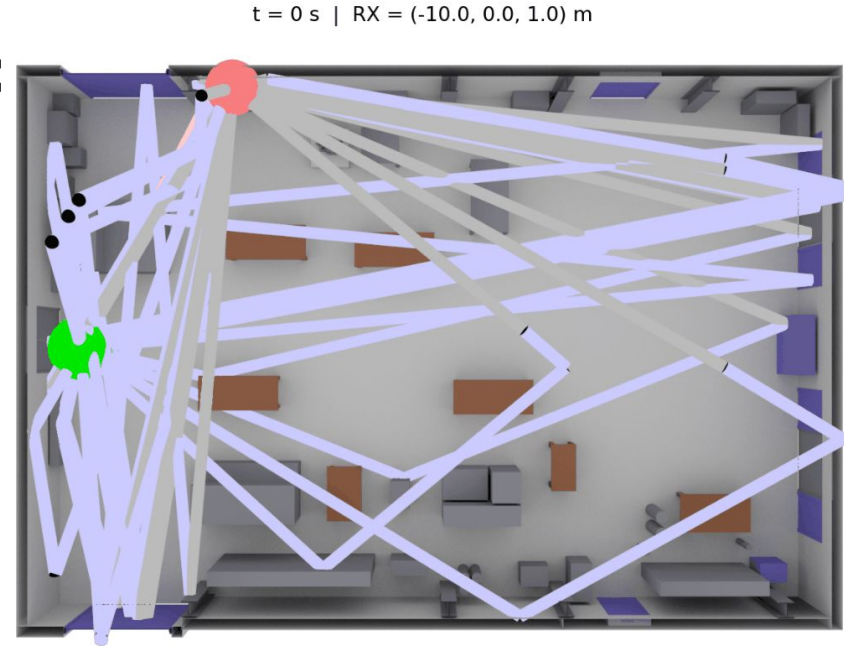
NJAMI Manufacturing Environment



Digital Twin of NJAMI Factory Floor

Background & Work (Sionna):

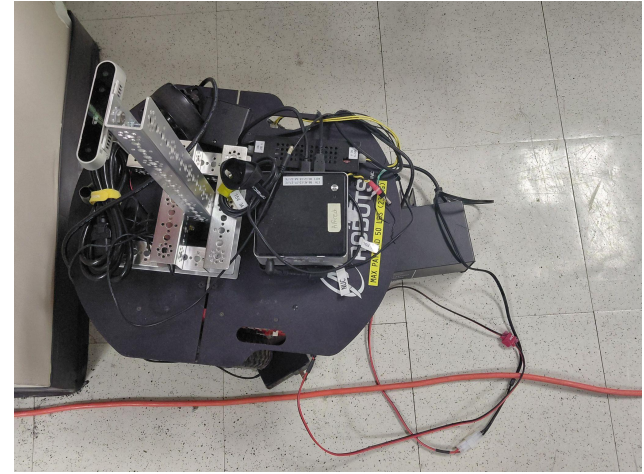
- Ray Tracing: Traces actual propagation paths through a model of the real environment
- Sionna is an open-source, online ray tracing tool; loop through frames, needs constant velocity



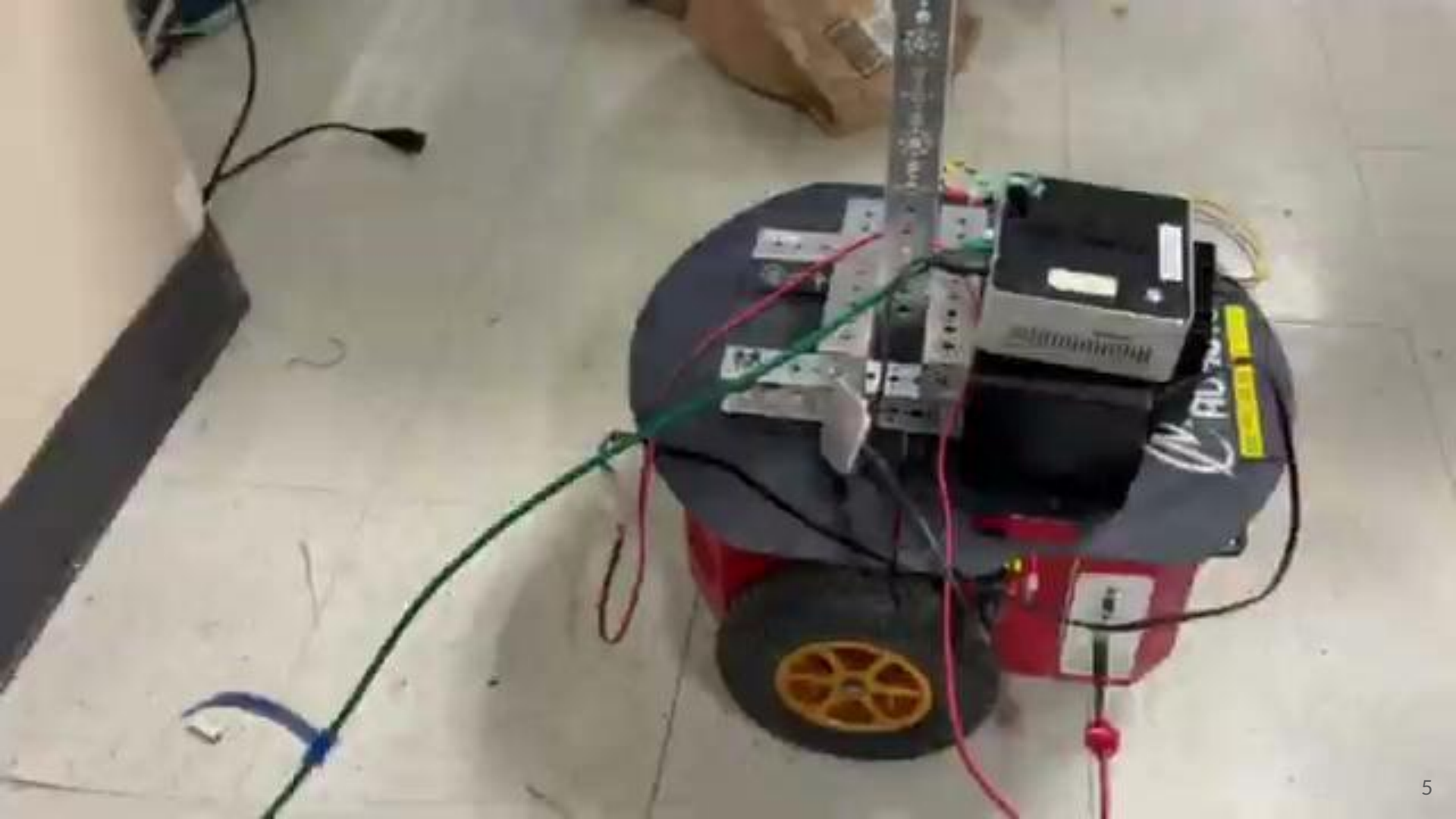
Green Circle: Receiver
Red Circle: Transmitter

Background & Work (ROS):

- The Robot Operating System is used in many fields and labs to work with robots
- Coded straight movement at constant velocity & receive from a transmitter

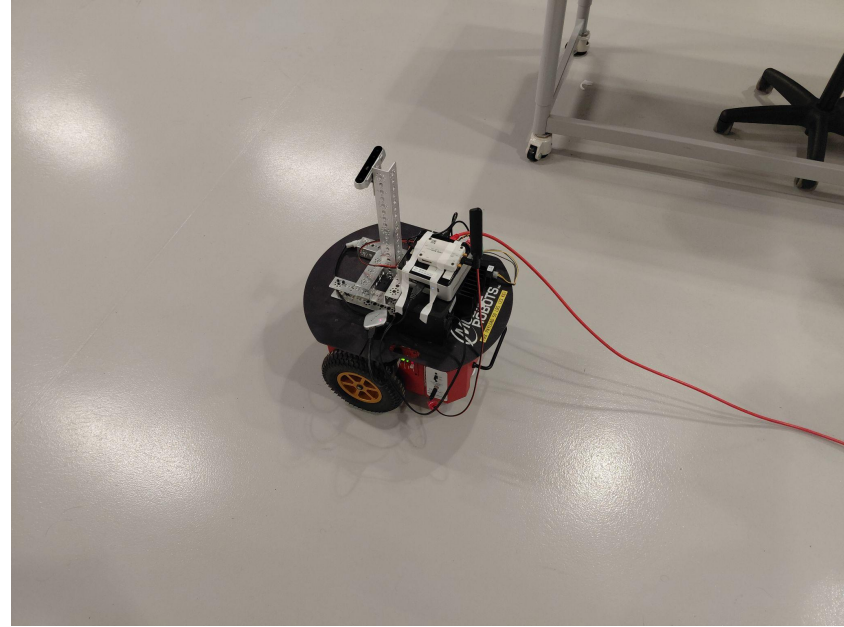


- Melodic, ROS1
- Pioneer 3DX
- B205mini & B210

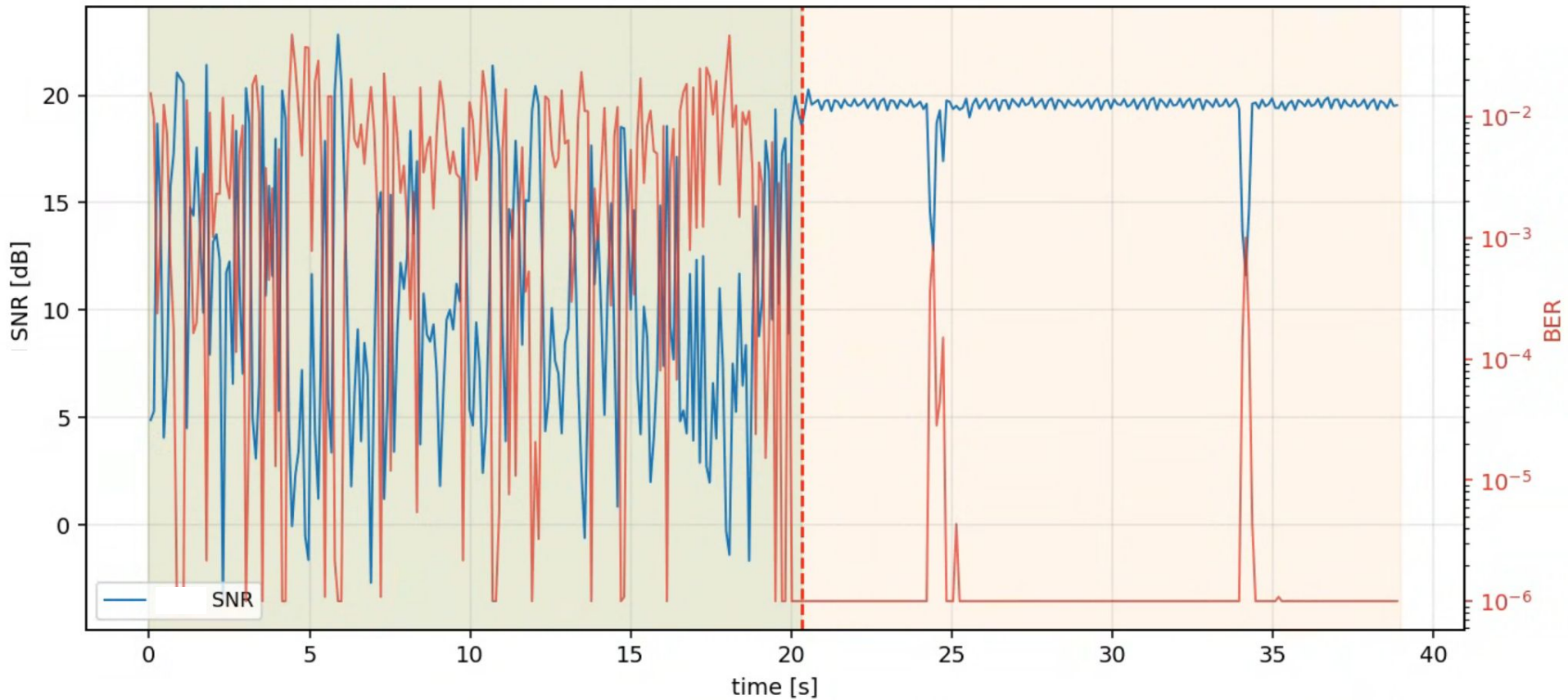


Data Collection at NJAMI

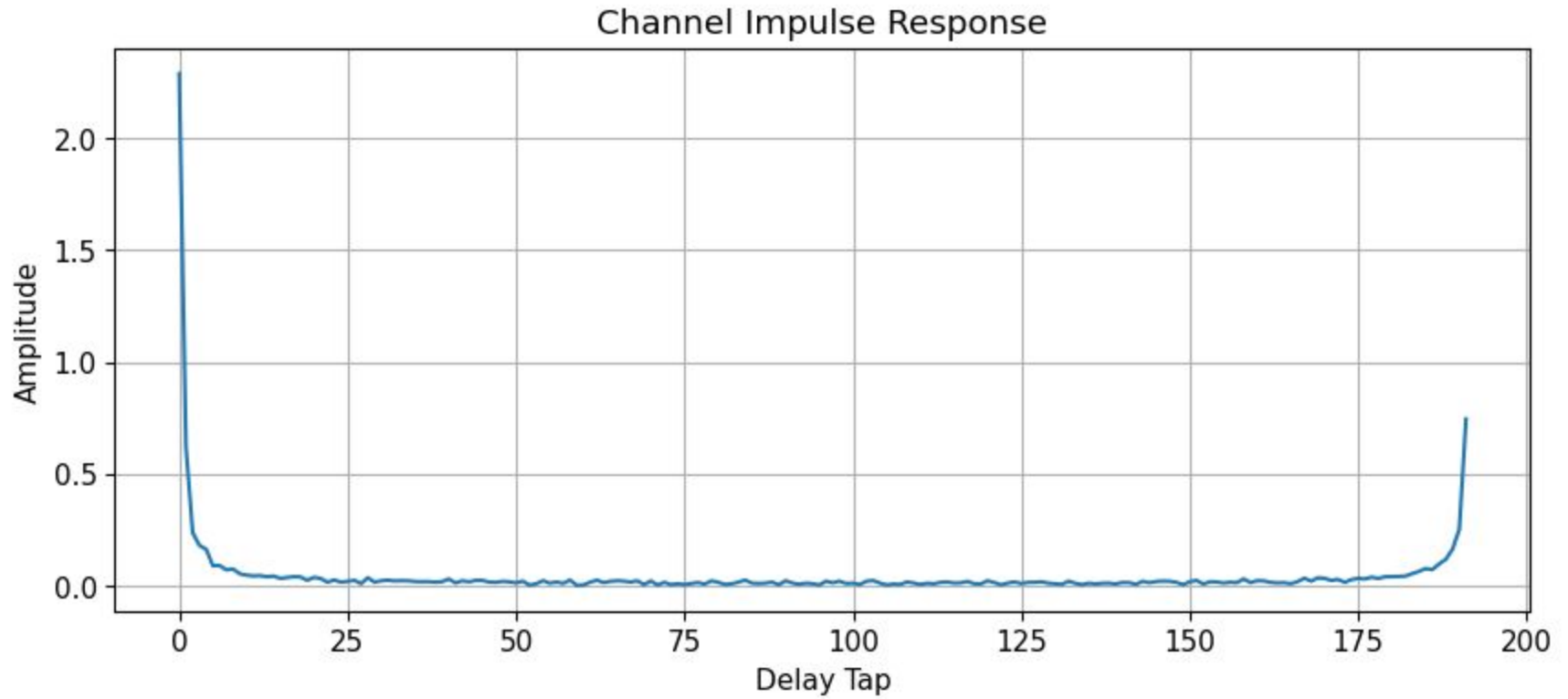
- Multiple runs at various speeds (one end of room to the other)



SNR and BER vs time (moving 0.0-20.3 s (52% of capture))



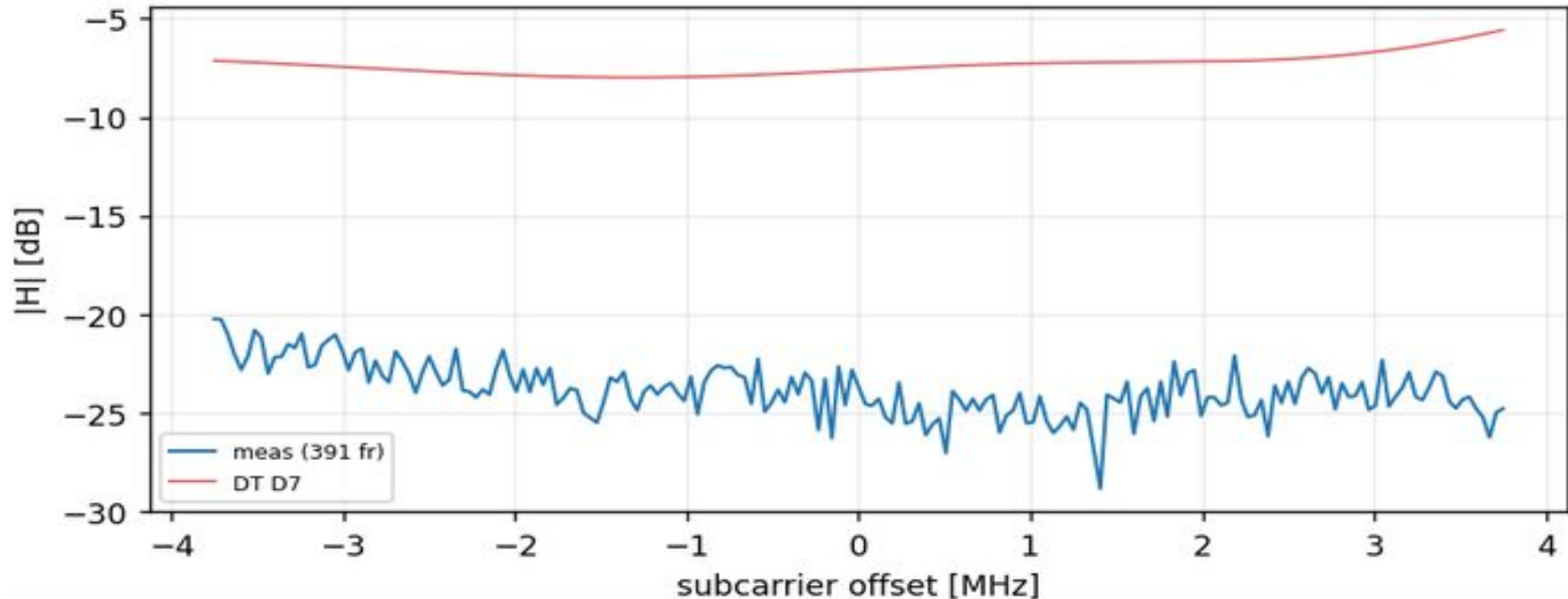
Measuring: Signal to Noise Ratio (BLUE) , and Bit Error Rate (RED)



Measuring: Channel Impulse Response

Sionna CFR Results & Comparison to Real Data

$s = 16.0$ m — CFR





Future Work

- Additional tests
- Prediction Software



QUESTIONS?