



KEYSIGHT
TECHNOLOGIES

NATIONAL HIGH
MAGNETIC
FIELD LABORATORY

Senior Design II



Team 307

Keysight Narrow Band
“Oscilloscope” for High Power
Tuning of NMR Probes



FAMU-FSU Engineering

COMPUTER AND ELECTRICAL ENGINEERING

Presentation Outline

- Team Introduction
- Project Description
- Background
- Documentation
- Finished Prototype Demo
- Acknowledgements
- Summary

Introduction

Jonathan Burt

Programming Lead
Document Lead



Gabriel De Leon

Financial Advisor
Web Master



Emil Lobachev

Lead ECE
DGR



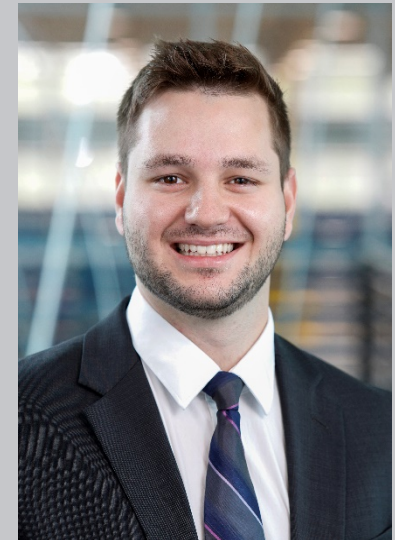
Asher Rich

Team Leader
Communications Lead



Kyle York

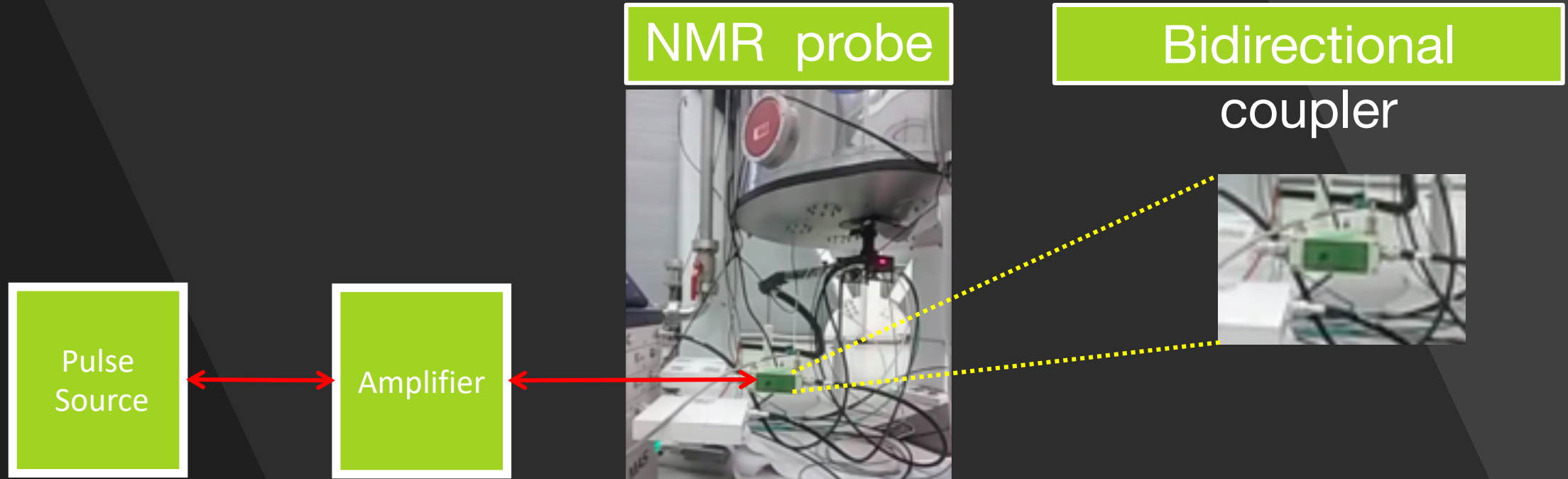
Research Lead
Circuit & Hardware
Assembly Lead



Project Description

- Proposal
- Abstract
- Requirements

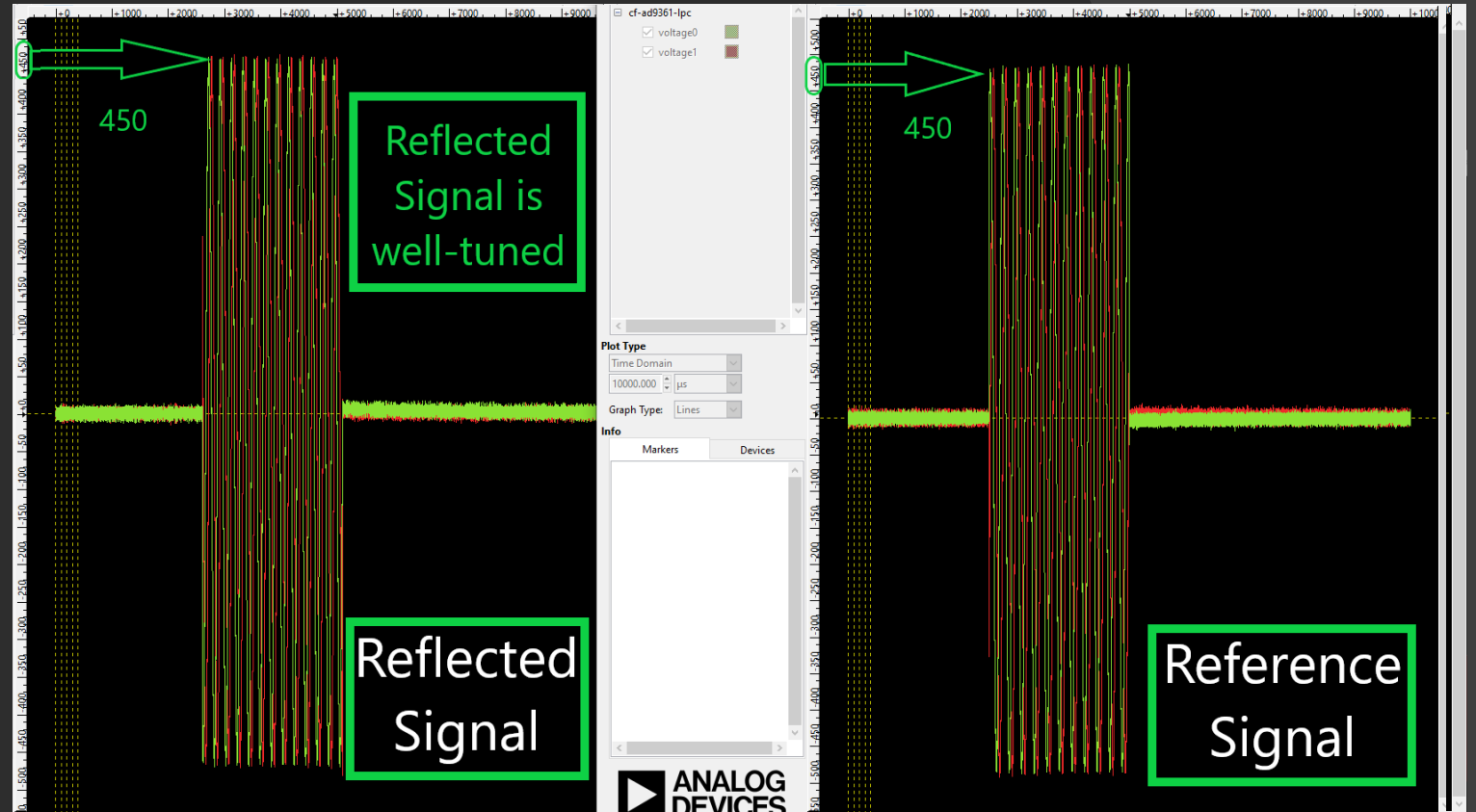
Proposal



Emil Lobachev

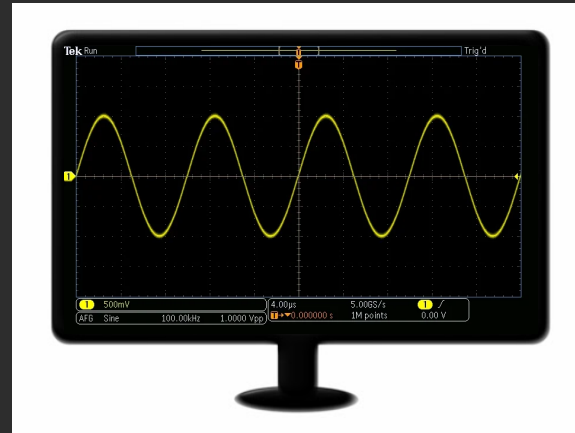
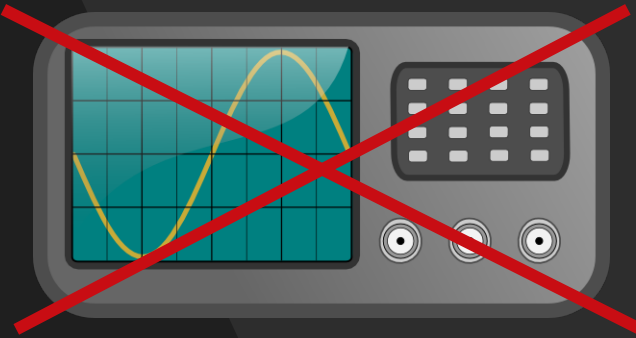
Proposal

Software
Defined Radio



Emil Lobachev

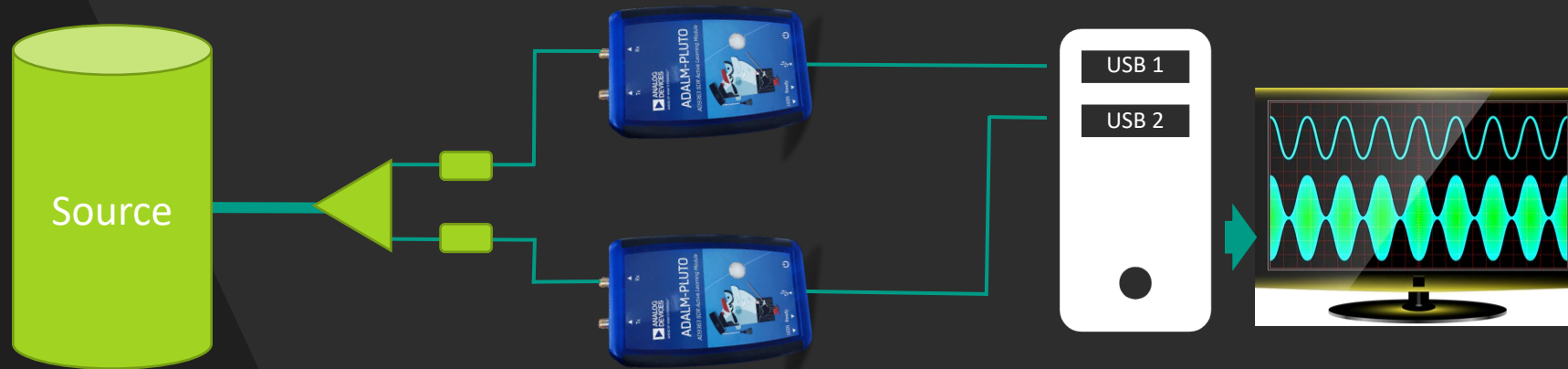
Project Description & Key Goals



- Design/Produce Working Prototype
- Reduce Cost of Envelope Detection
- Display Sweep Length and Control Frequency

Requirements and Design

- NI, Envelope, Trigger, Range
- Planning → Initial Design



Jonathan Burt

Basic Engineering Interpretation

● Most Basic Signal Flow Chart for the Project



Analog

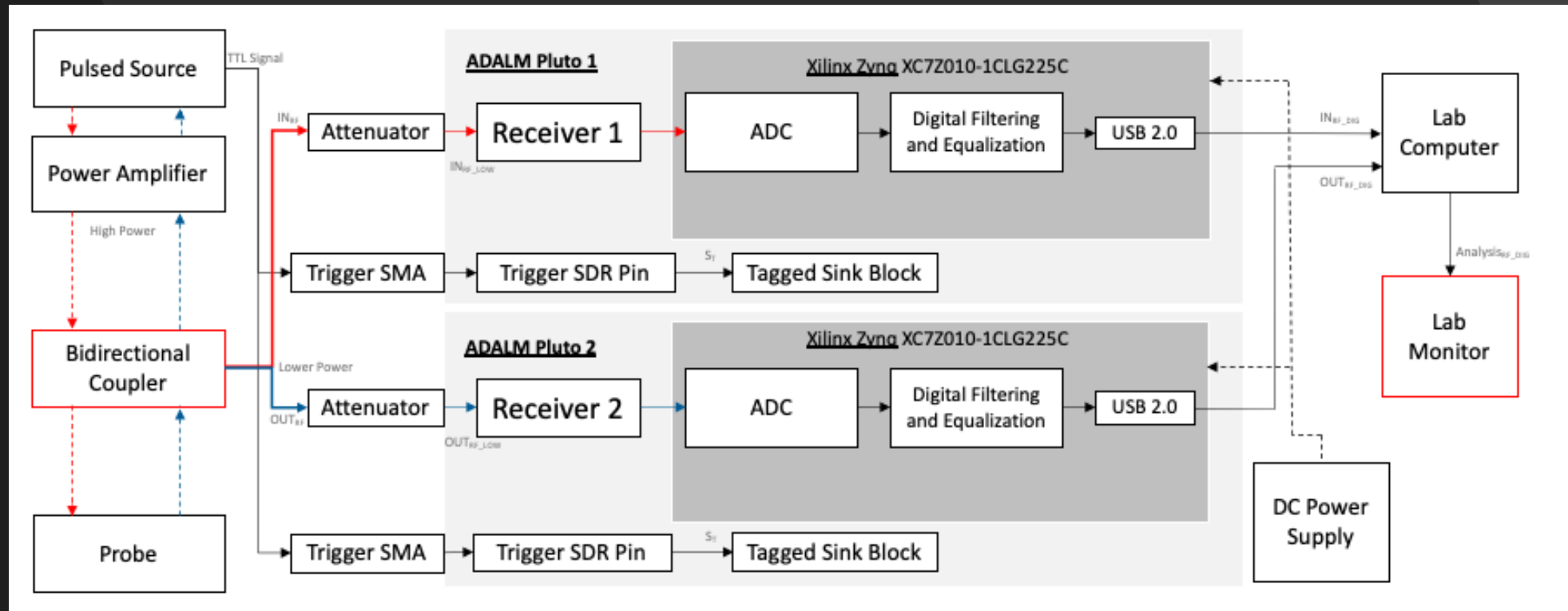
61.44 MSPS ADC

Digital

Emil Lobachev

Complex Engineering Interpretation

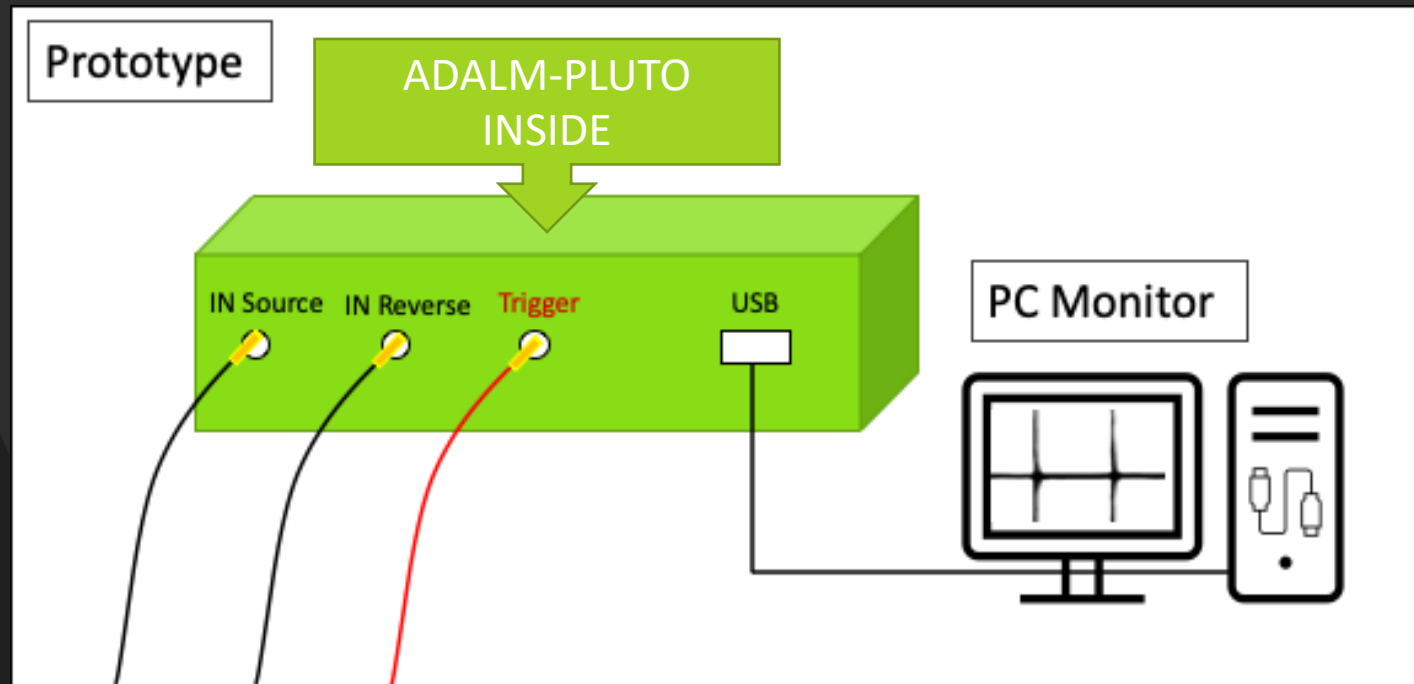
More Complex Signal Flow Chart for the Project



Emil Lobachev

Final Prototype Schematic

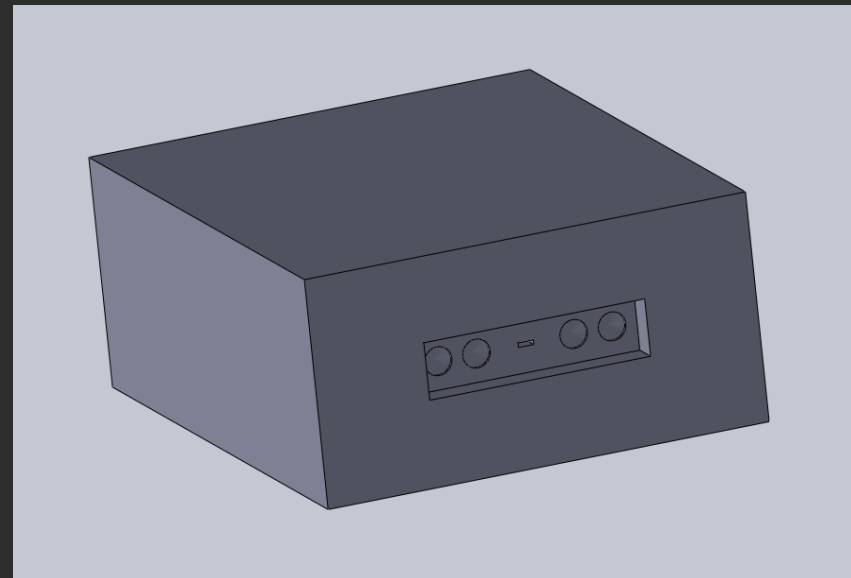
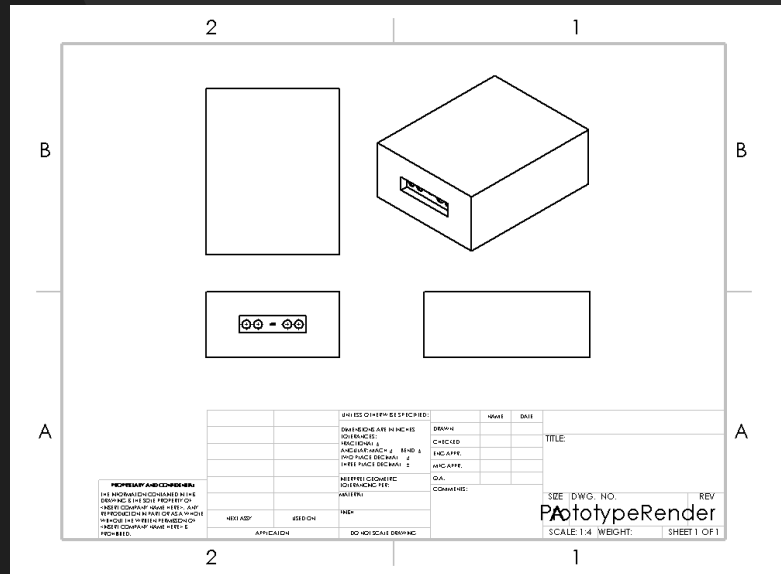
- First Prototype Model



Asher Rich

Final Prototype Schematic

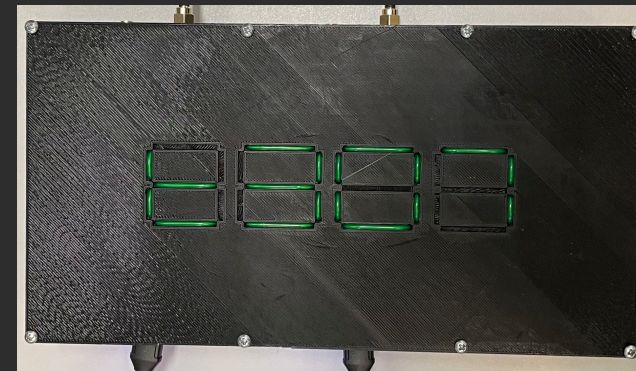
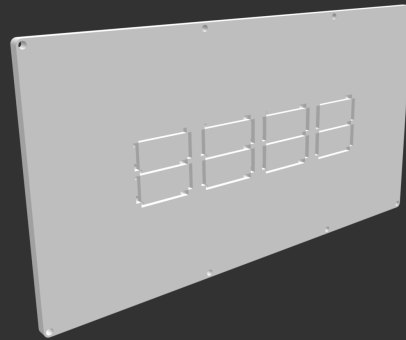
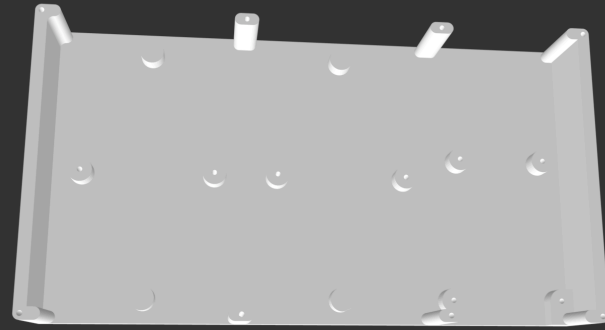
First SOLIDWORKS 3D Model



Asher Rich

Final Prototype Assembled

Finished Model



Asher Rich

Background

- ADALM PLUTO SDR
- IIO-Oscilloscope
- Test Signals

Software Defined Radio (SDR)

- Radio communication system

- Used for visualizing RF signals in this project



Gabriel De Leon

ADALM PLUTO SDR

● ADC resolution: 12 bit



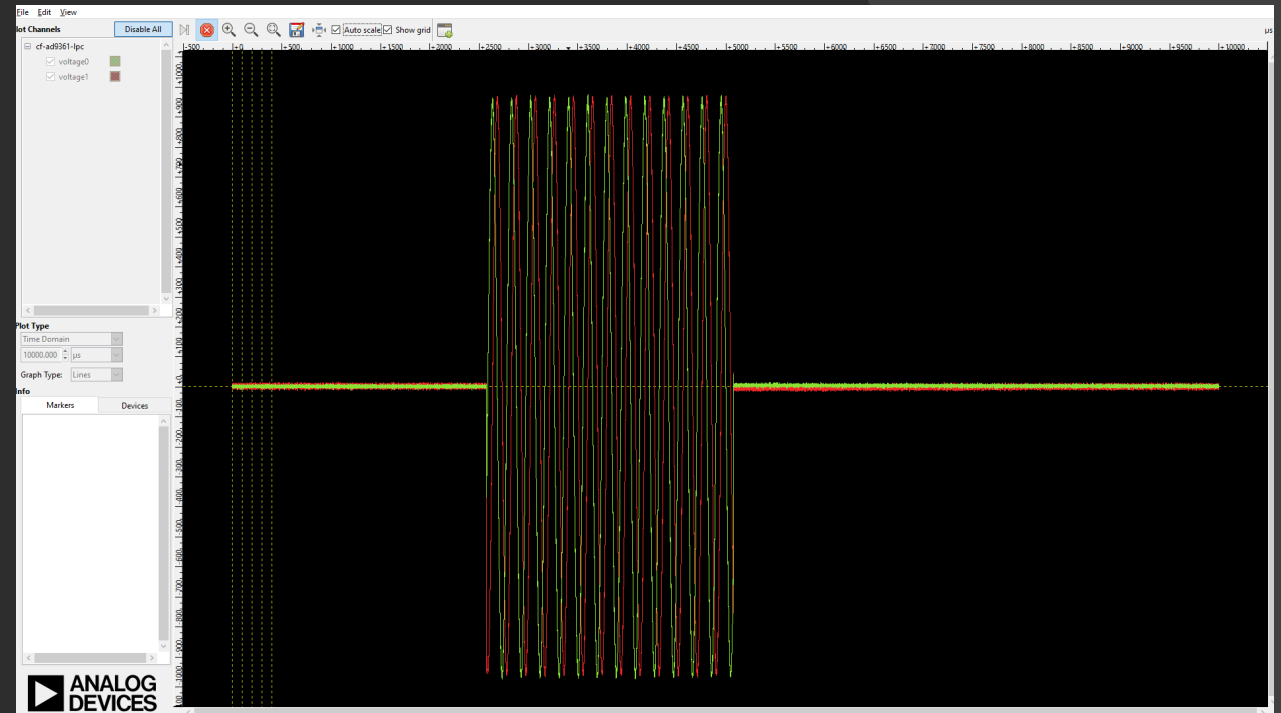
● Sampling rate: up to 61.44 MSPS



IIO-Oscilloscope

- Plot forward/reverse RF signals

- Displays ADC Code



Gabriel De Leon



IIO-Oscilloscope

- RF Bandwidth
10 MHz
- Sample Rate
11 MSPS
- Tune-in Freq
500 MHz
- HW Gain
5 dB

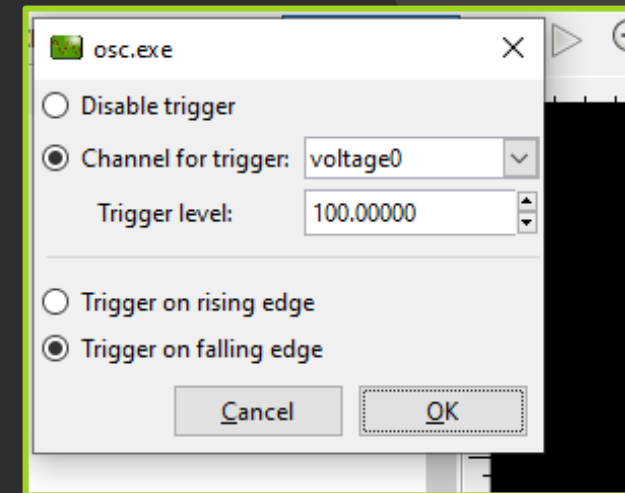
The screenshot shows the ADI IIO Oscilloscope software interface. The 'Global Settings' section is at the top, with 'Active ENSM' set to 'fdd' and 'Calibration Mode' set to 'auto'. Below this, the 'AD9361 / AD9364 Receive Chain' section is visible, with 'RF Bandwidth(MHz)' set to 10.000, 'Sampling Rate (MSPS)' set to 10.999999, and 'RX LO Frequency(MHz)' set to 500.000000. The 'Hardware Gain(dB)' is set to 5.00. The 'AD9361 / AD9364 Transmit Chain' section shows 'RF Bandwidth(MHz)' set to 18.000 and 'Sampling Rate (MSPS)' set to 10.999999. The 'FPGA Settings' section at the bottom shows 'Transmit / DDS' settings, including 'Sampling Rate (MSPS)' set to 10999999 and 'DDS Mode' set to 'One CW Tone'.

The screenshot shows the ADI IIO Oscilloscope software interface. The 'Global Settings' section is at the top, with 'Active ENSM' set to 'fdd' and 'Calibration Mode' set to 'auto'. Below this, the 'AD9361 / AD9364 Receive Chain' section is visible, with 'RF Bandwidth(MHz)' set to 10.000, 'Sampling Rate (MSPS)' set to 11.000000, and 'RX LO Frequency(MHz)' set to 499.999998. The 'Hardware Gain(dB)' is set to 5.00. The 'AD9361 / AD9364 Transmit Chain' section shows 'RF Bandwidth(MHz)' set to 18.000 and 'Sampling Rate (MSPS)' set to 11.000000. The 'FPGA Settings' section at the bottom shows 'Transmit / DDS' settings, including 'Sampling Rate (MSPS)' set to 11000000 and 'DDS Mode' set to 'One CW Tone'.

Gabriel De Leon

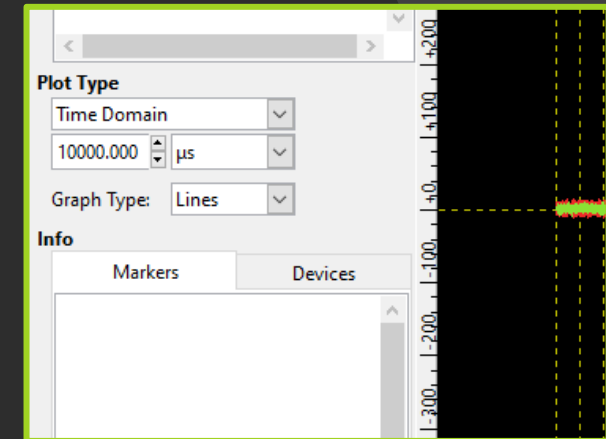
IIO-Oscilloscope

Trigger settings



IIO-Oscilloscope

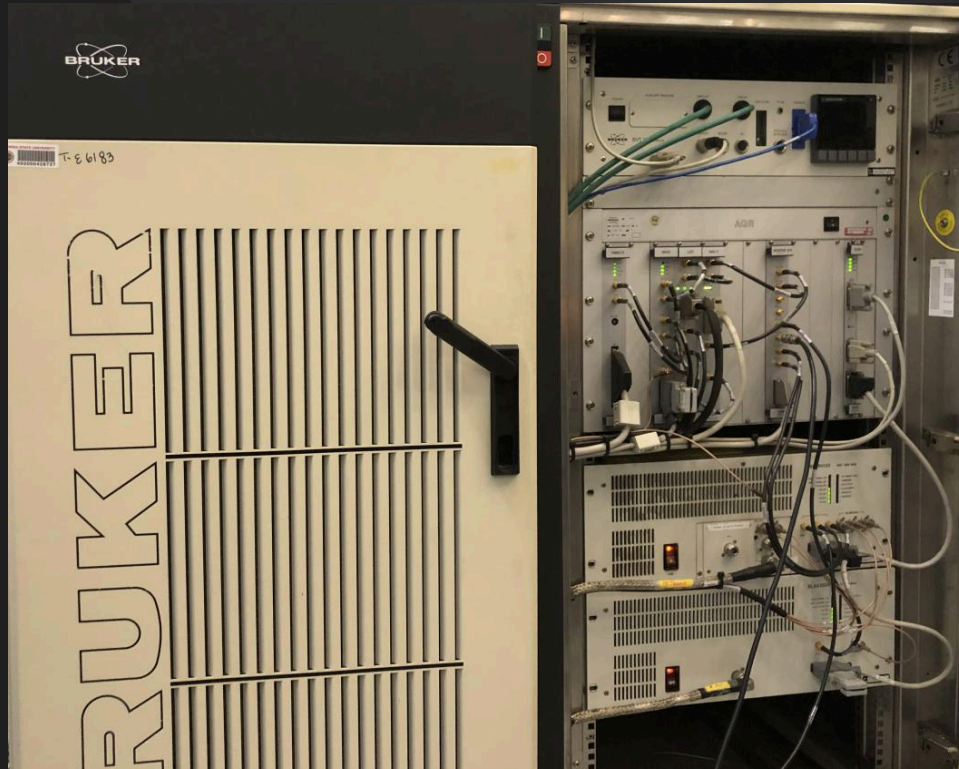
● Time Scale Settings on Plot



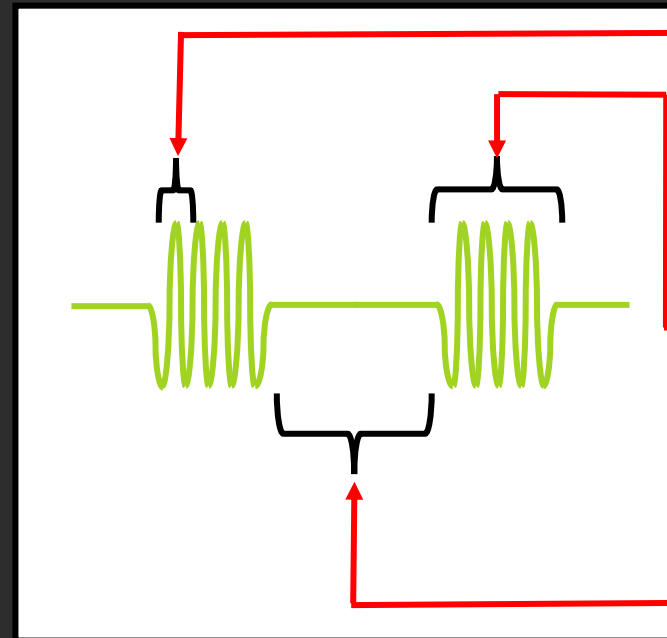
Gabriel De Leon

Test Signals

Pulse Generator



Test RF Signal Settings:



500 MHz Frequency

2.5 ms Pulse Trains

200 ms Delays

Asher Rich

Documentation

- Testing and Validation
- Team Website
- Operation Manual
- Final Report

Emil Lobachev, Jonathan Burt, Asher Rich, & Kyle York


Testing and Validation



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Testing & Validation

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Test Types

Unit Tests



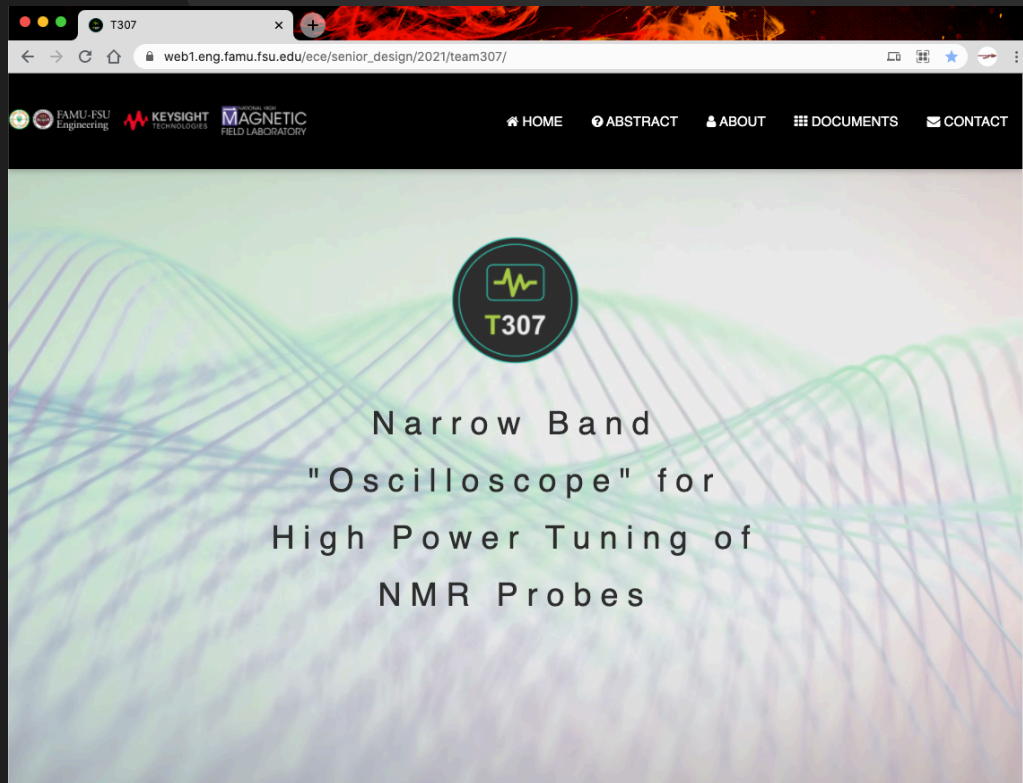
Integration Tests



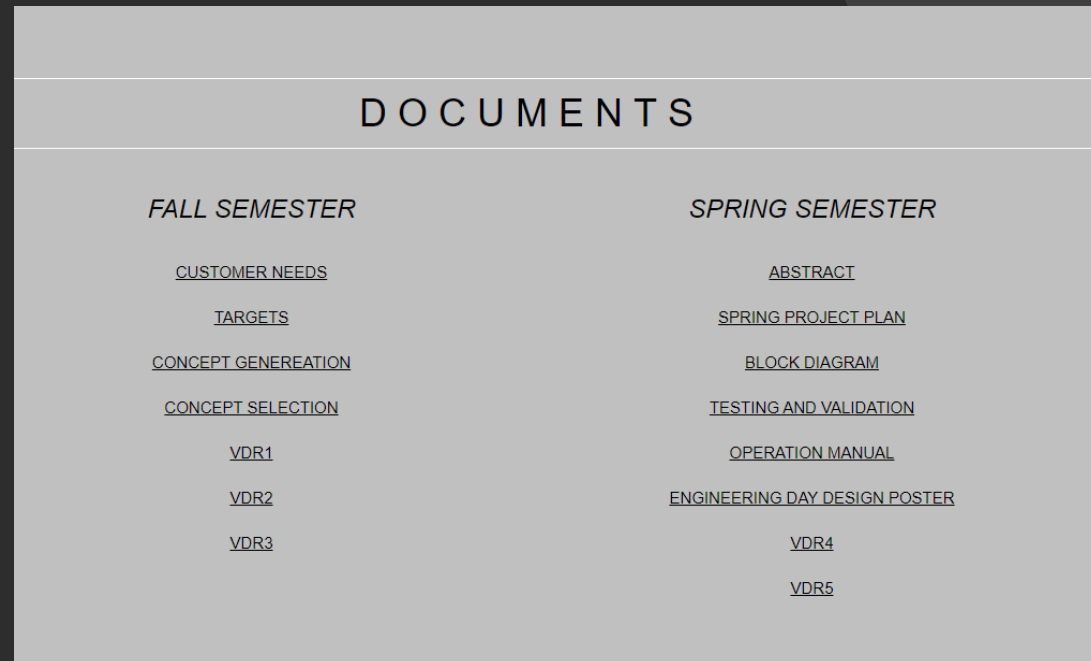
Acceptance Tests

Team Website

Here's how it looks



Access to all related documents



Jonathan Burt

Operation Manual

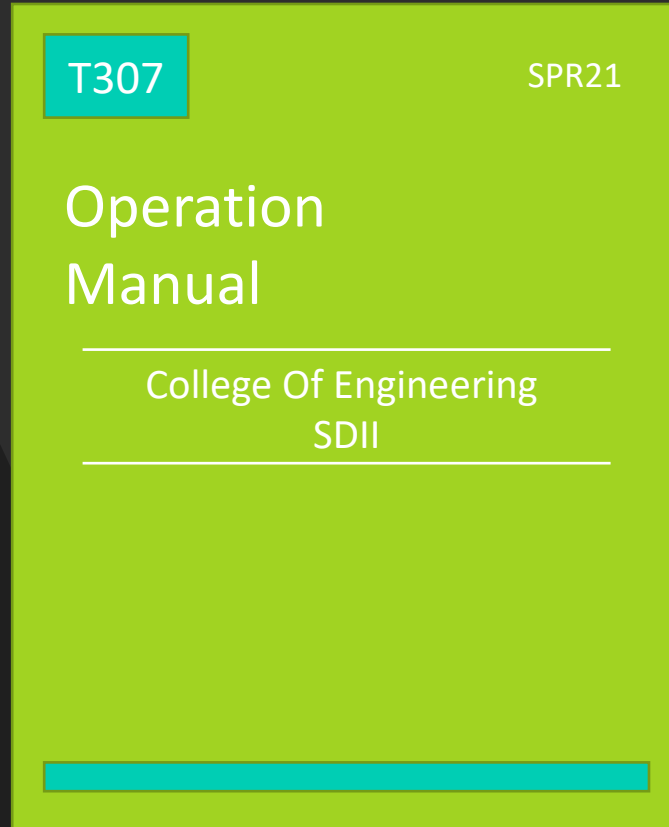


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Final Report



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Final Report Document

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Finished Prototype Demo

—● Video Demonstration

Prototype Final Demonstration

—● Final Demo

<https://www.youtube.com/watch?v=xZnUgrdPSTs>

Acknowledgements

- Dr. William Brey
- Dr. Rajendra Arora
- Paul Holcomb
- Dr. Samuel Grant



Jonathan Burt

Summary

- Team Introduction
- Project Description
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- Finished Prototype Demo
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References

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Questions