Dwight Look College of ENGINEERING
TEXAS A&M UNIVERSITY

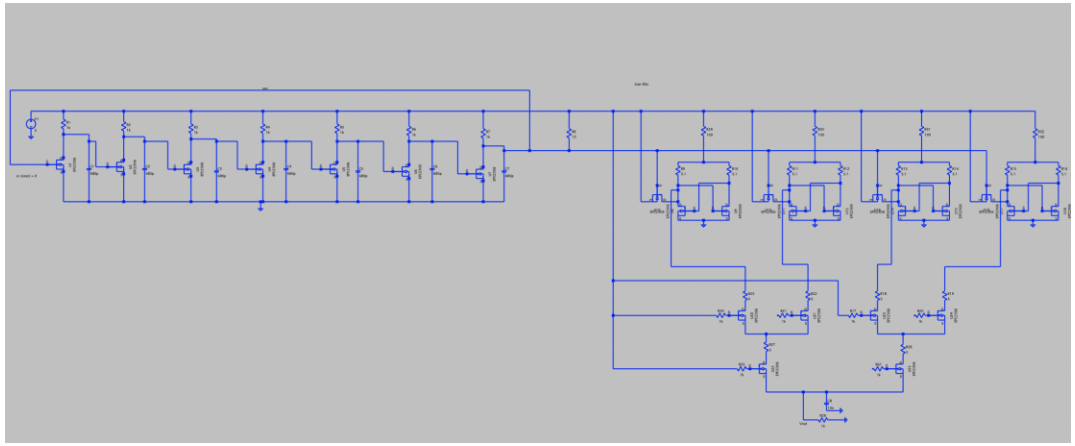
Team 1: Radiation Resilient Logic Circuit Study with WBG Devices
Bi-Weekly Update 4

Nia Baireddy, Kaylee Choate, Nomar Lebron
Sponsor: Sandia National Laboratories
TA: Eric Robles

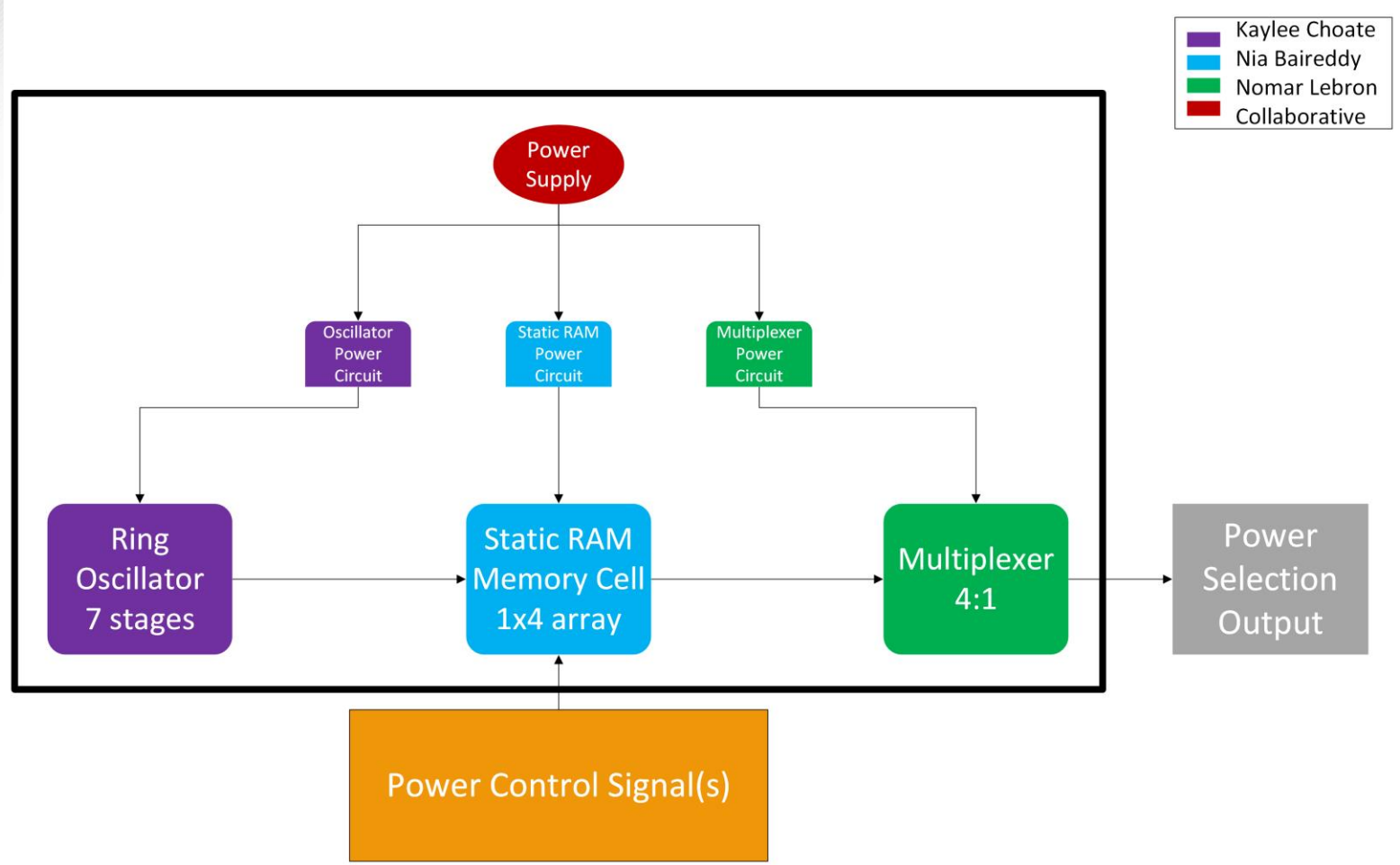
Project Summary and Solution

- Radiation effects on circuits are detrimental and must be mitigated for robust applications in space, military, and nuclear industries.

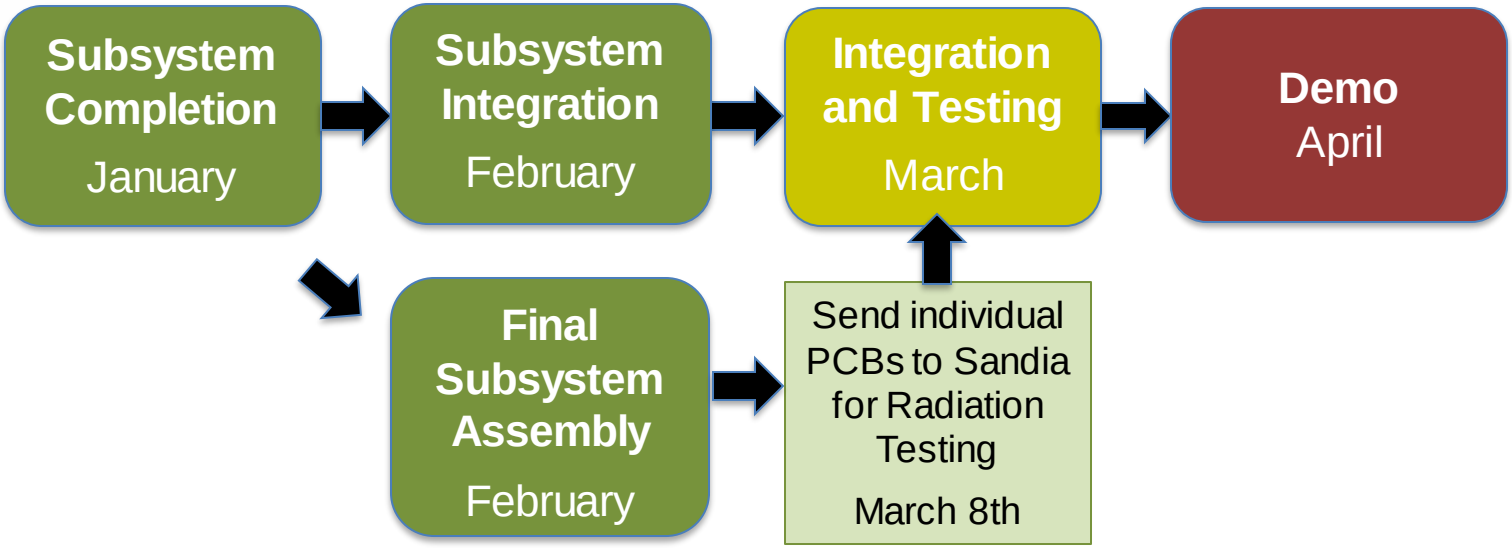
- Use radiation hardening by design techniques to modify various logic circuits for reliable operation in radiation environments.



Integrated System Diagram



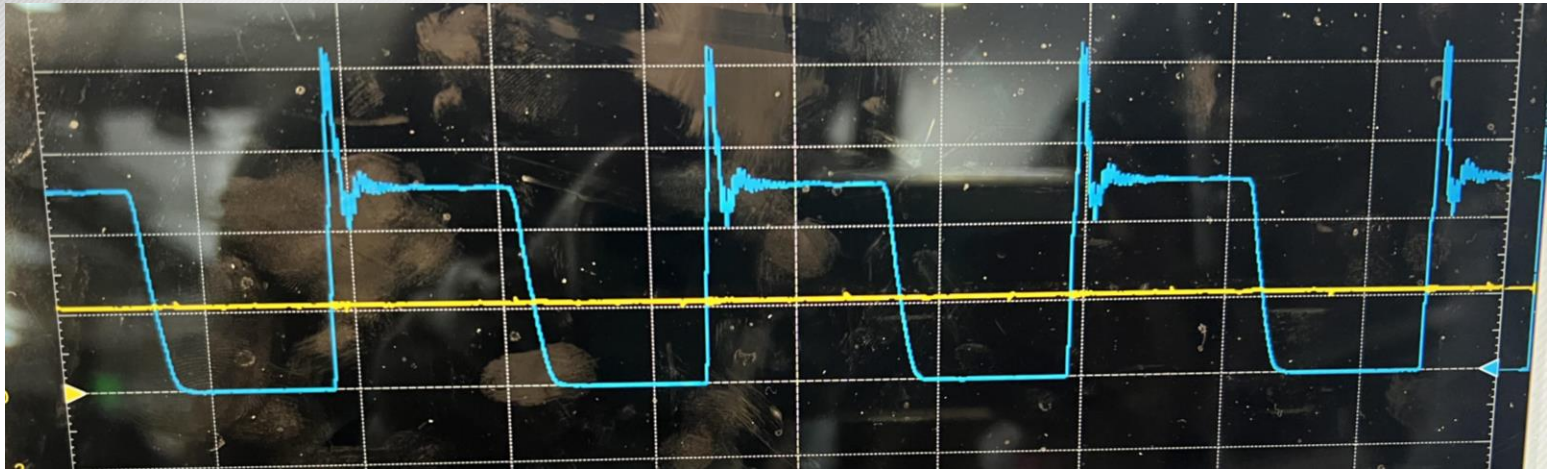
Project Timeline

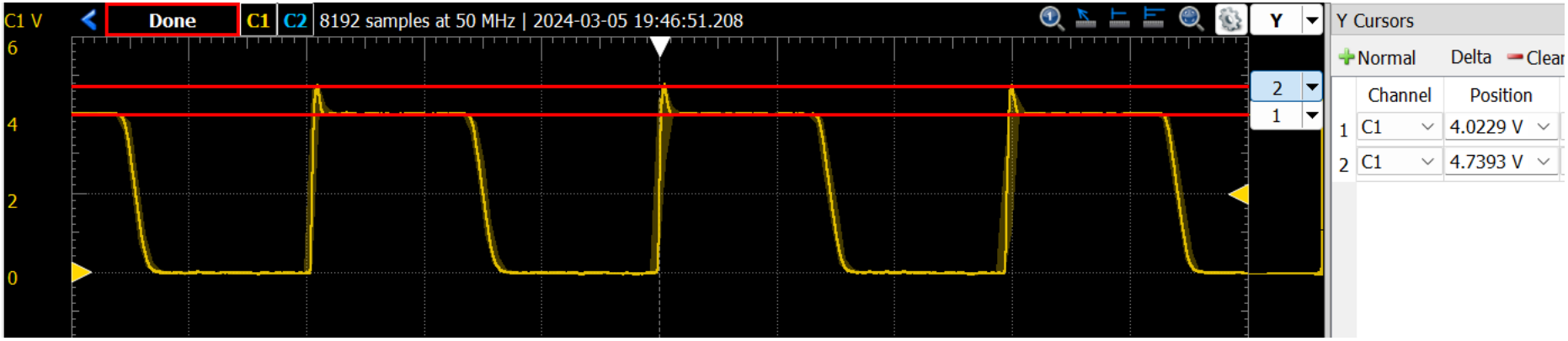


Kaylee Choate

Accomplishments since last update 20 hrs of effort	Ongoing progress/problems and plans until the next presentation
• Fully assembled and validated Ring Oscillator PCB for Sandia Testing • Fully assembled and validated "test board" for integrated PCB • Worked on integrated system Altium Design • Worked on User Manual for individual subsystem	• Complete User Manual for individual subsystem • Finalize and order integrated PCB • Begin assembly on integrated PCB

Kaylee Choate





Nia Baireddy

Accomplishments since last update 25 hrs of effort	Ongoing progress/problems and plans until the next presentation
• Assembled and fully validated SRAM array PCB • Worked on integrated PCB • Started writing User Manual for individual subsystems	• Assemble integrated PCB • Test integrated PCB according to validation parameters • Finish writing comprehensive User Manual

Dwight Look College of ENGINEERING
TEXAS A&M UNIVERSITY

Nia Baireddy

1x4 SRAM Cell Array

Testing Equipment:

- DC Power Supply
- Analog Discovery 2 (or alternative AC waveform generator and oscilloscope)
- 4 Power Supply Wires (2 pairs)
- 6 Breadboard Wires for AD2 (or alternative wires for AC waveform generator and oscilloscope)
- Breadboard (optional)
- DC Multimeter (optional)
- Screwdriver

Board Layout:

Signal Inputs

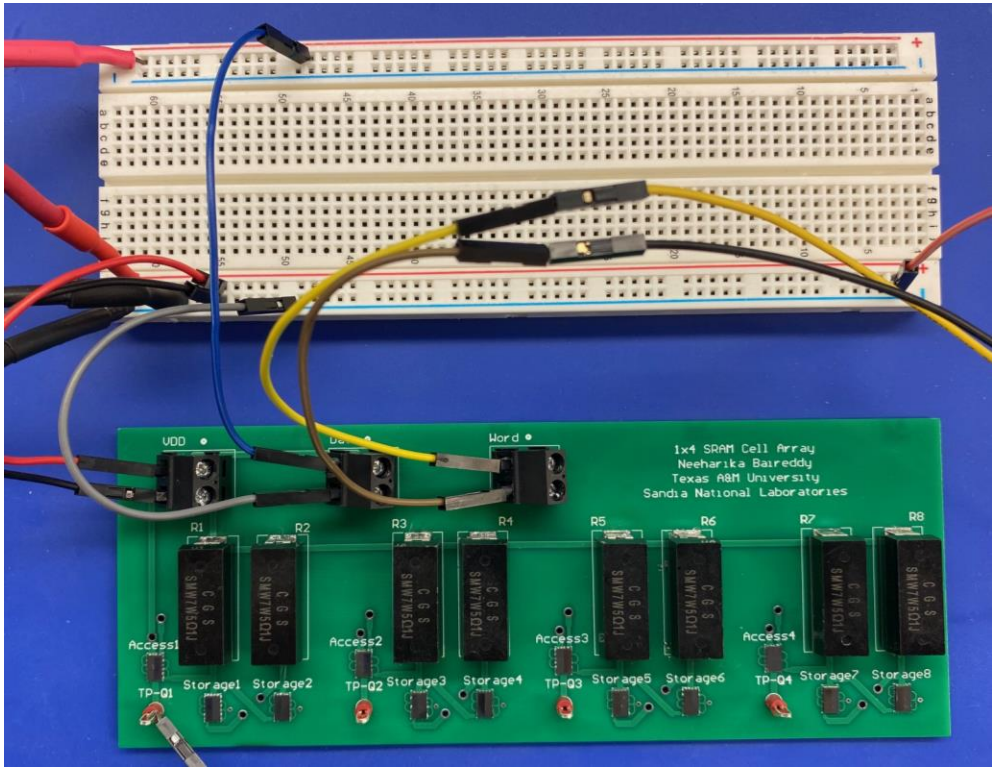
Cell Outputs (Test Points 1-4)

Assembly Procedure:

Note: For this testing procedure, an Analog Discovery 2 module is used for AC square wave generation and oscilloscope output detection. Alternatively, an AC wave generator and external oscilloscope can be used instead.

1. Connect a 5V DC Power Supply to one positive and negative rail pair of the breadboard (Red: Positive, Black: Negative), and 3.3V DC Power Supply to the other rail pair.

2. Connect the breadboard wires to the three terminal blocks labeled VDD and Data at the top. VDD is connected to the 3.3V rail and Data is connected to the 5V rail.



Nomar Lebron

Accomplishments since last update ~20 hrs of effort	Ongoing progress/problems and plans until the next presentation
• Verified Operation of 4:1 MUX for Sandia Testing • Worked on Integrated Altium PCB • Created User Manual for Testing	• Finish Integrating Subsystems on PCB • Order Integrated PCB • Begin Assembly on Integrated PCB

Nomar Lebron

4:1 Multiplexer

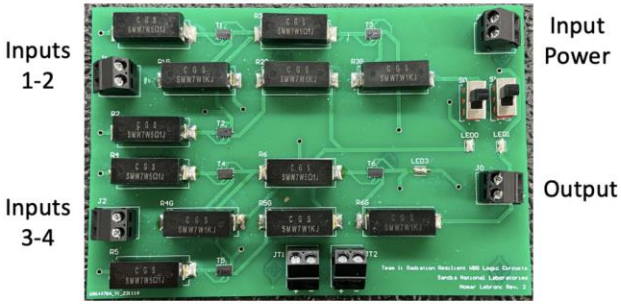
Testing Equipment:

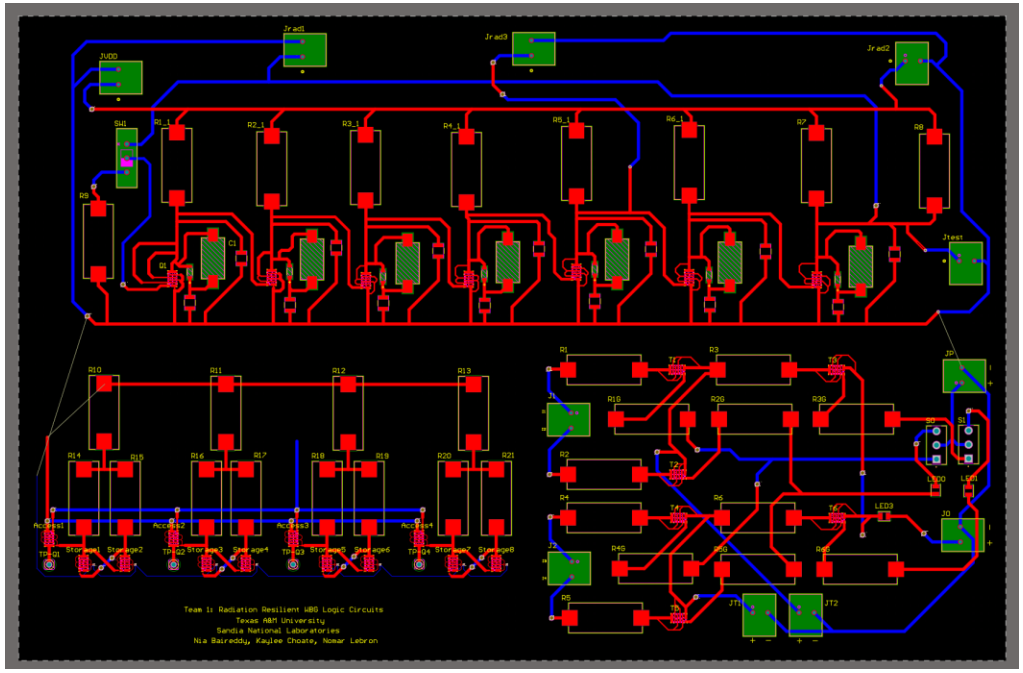
- DC Power Supply
- Digital Multimeter
- Breadboard
- 2 Power Supply Wires
- 2 Digital Multimeter Probes
- 6 Breadboard Wires
- Screwdriver

Control User Interface:

- Input 1: 00
- Input 2: 10
- Input 3: 01
- Input 4: 11

Board Layout:

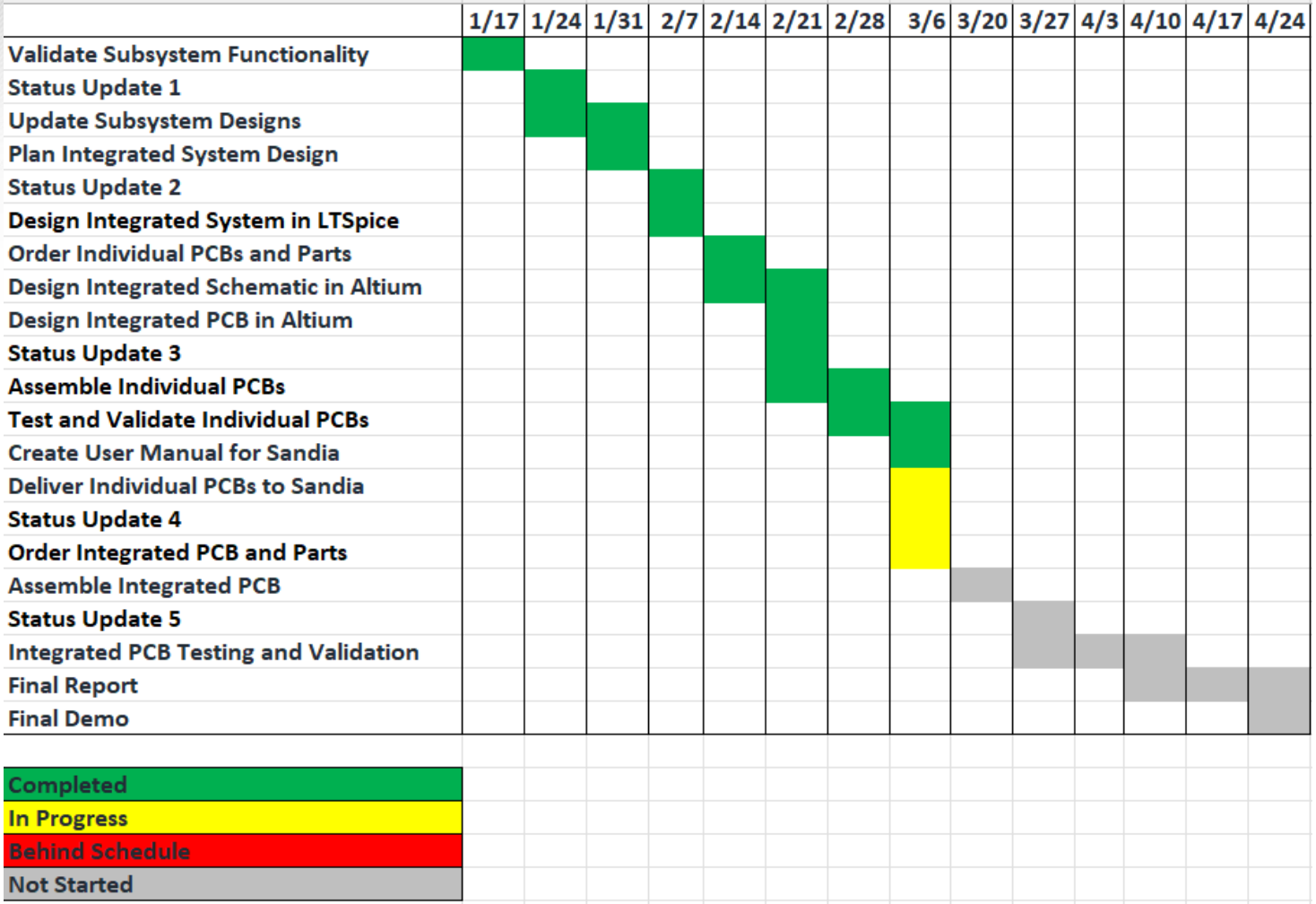




Assembly Procedure:

1. Connect 5V Power Supply to Breadboard positive and negative rails (Red: Positive, Black: Negative)
2. Connect the 6 Breadboard wires to the two terminal blocks on the left side and the top right terminal block on the PCB (Bottom terminal blocks not used)
3. Connect the 4 Green Input Wires to the negative rail of the breadboard

Execution Plan



Validation Plan

Ring Oscillator Task	Specification	Result (Sim)	Result (PCB)	Owner	Date
Voltage Input (max)	5V	Pass		Kaylee	3/27/2024
Square Wave	yes/no	Pass		Kaylee	3/27/2024
Frequency Range	100kHz	Pass		Kaylee	3/27/2024
Magnitude Variation	0-5V	Pass		Kaylee	3/27/2024
Power Consumption	~ 10 mW	Pass		Kaylee	3/27/2024
Supply Voltage Variation Test	Vdd +/- 10%	Pass		Kaylee	3/27/2024
Voltage Spike	50V	Pass		Kaylee	3/27/2024
Voltage Build Up	50V	Pass		Kaylee	3/27/2024
Current Spike	5A	Pass		Kaylee	3/27/2024
Current Build Up	5A	Pass		Kaylee	3/27/2024
1x4 SRAM Memory Cell Array Task	**Specification**	**Result (Sim)**	**Result (PCB)**	**Owner**	**Date**
Voltage Input Max (Vdd)	5V	Pass		Nia	3/27/2024
Read/Write Speed	~ 10 ns	Pass		Nia	3/27/2024
Read/Write Disturb	< 10 cycles	Pass		Nia	3/27/2024
Hold and Setup Time	~ 5 ns	Pass		Nia	3/27/2024
High/Low Voltage	Vdd +/- 10%	Pass		Nia	3/27/2024
Read/Write Stability Margin (Voltage)	Vdd +/- 10%	Pass		Nia	3/27/2024
Power Consumption (active)	~ 10 mW	Pass		Nia	3/27/2024
Power Consumption (idle)	~ 10 uW	Pass		Nia	3/27/2024
Data Recovery Test	~ 10 ms	Pass		Nia	3/27/2024
4:1 Multiplexer Task	**Specification**	**Result (Sim)**	**Result (PCB)**	**Owner**	**Date**
Voltage Input (max)	5V	Pass		Nomar	3/27/2024
Select Line Test	4 inputs	Pass		Nomar	3/27/2024
Data Stability	Vdd +/- 10%	Pass		Nomar	3/27/2024
High/Low Voltage	Vdd +/- 10%	Pass		Nomar	3/27/2024
Power Consumption Test	< 6W	Pass		Nomar	3/27/2024
User Interface Testing	Switches	Pass		Nomar	3/27/2024
User Interface Testing	LEDs on/off	N/A		Nomar	3/27/2024
Supply Voltage Variation Test	Vdd +/- 10%	Pass		Nomar	3/27/2024

Thanks and Gig ‘Em!

Questions?