PHOTOVOLTAIC INVERTER

SOLAR HERO

TEAM MEMBERS

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CLIENT

- Dr. Venkata Yaramasu
- renewable energy
- high power converters
- variable-speed drives and electric vehicles

SCOPE OF THE PROJECT

Why choose Photovoltaic systems ?

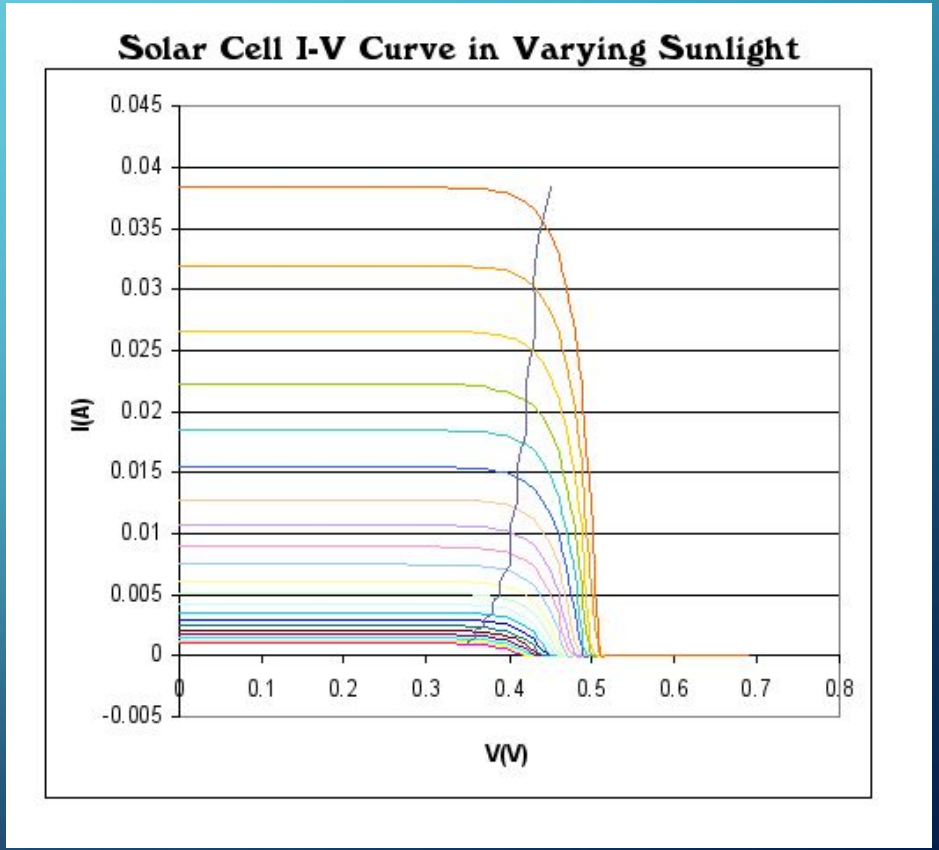
- Less dependence on fossil fuels
- Clean and reliable energy
- The prices for photovoltaic modules is decreasing

Background

- The partial shading on large-scale PV systems
- Affecting the power output to the grid
- Develop the next generation large scale PV system

MAXIMUM POWER POINT TRACKING (MPPT)

- The efficiency of power transfer from the solar cell
- Keep the power transfer at highest efficiency



MODULAR MULTILEVEL CONVERTER

- Converts DC To AC
- Used in industrial application, in high power and medium voltages
- MMC is the most advanced power converter topology for HVDC transmission.
- MMC known to have a flexible AC Transmission system

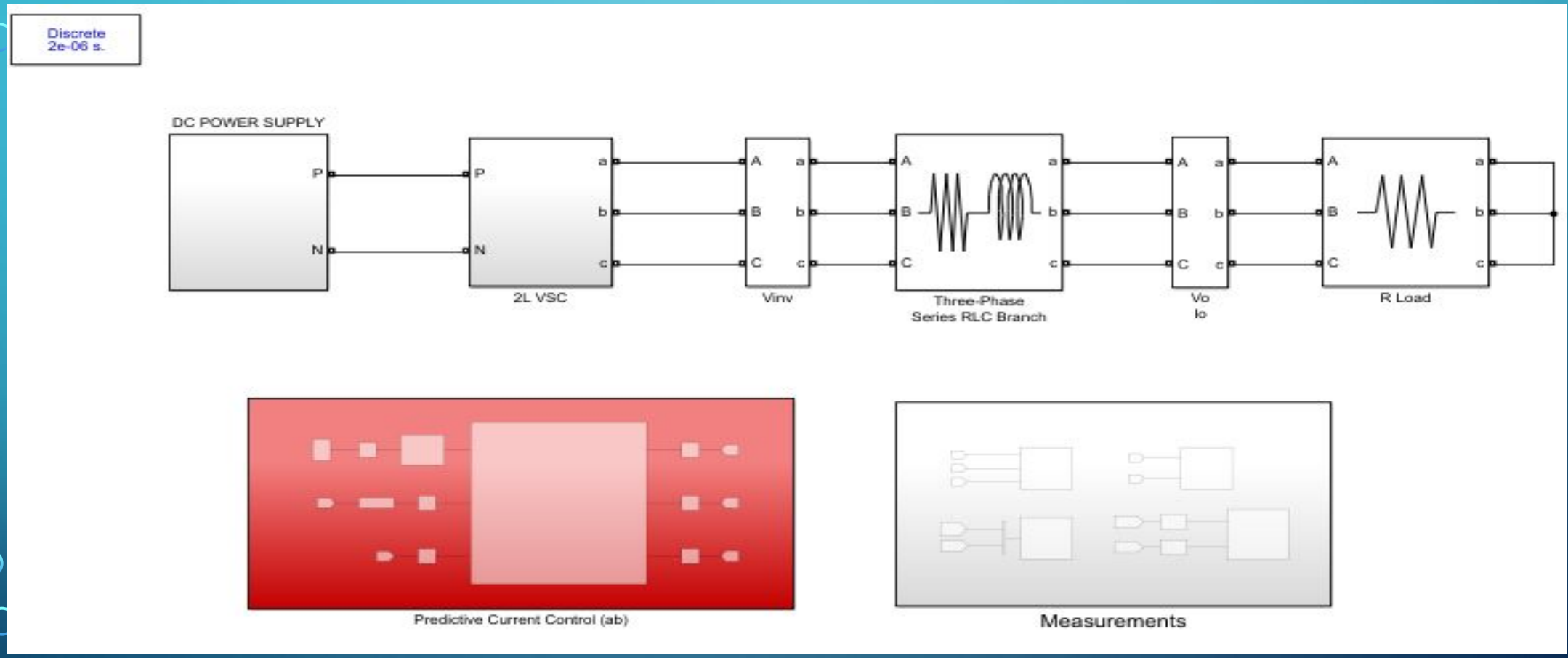
MODULAR MULTILEVEL CONVERTER

- Advantages
  - Reduced harmonic distortion
  - Input current with low distortion
  - Lower power Losses
- Disadvantages
  - Extra controller
  - Monitoring all capacitor

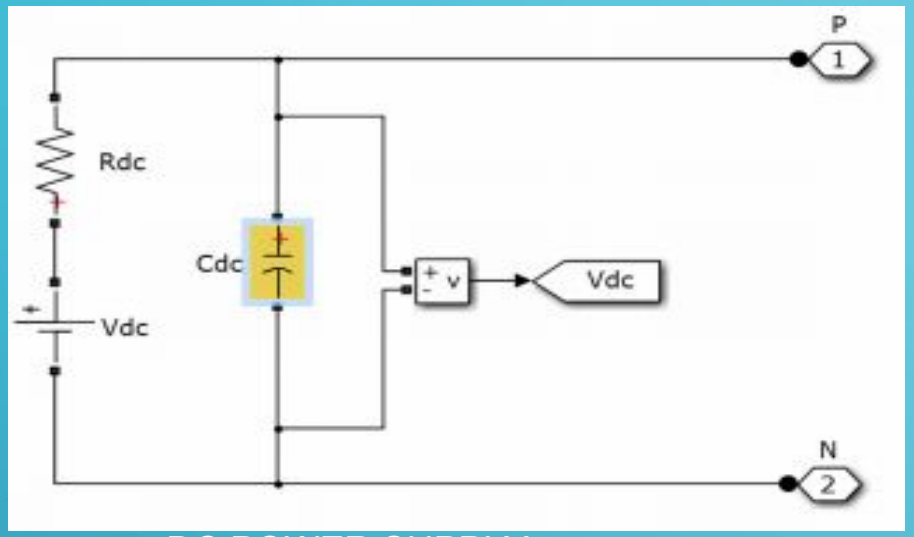
PROTOTYPE 1

- stationary (αβ) frame predictive current control (PCC) scheme for a two-level voltage source converter (2L-VSC) feeding an inductive-resistive (RL) load.
- One of the reasons to use PCC is that we will have the possibility to learn and predict the future behavior of all switching states.

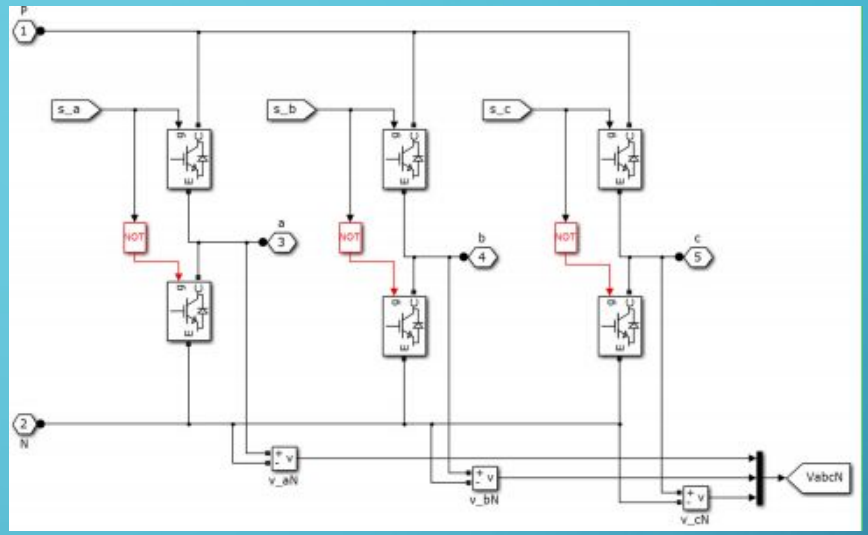
PROTOTYPE 1 SIMULINK



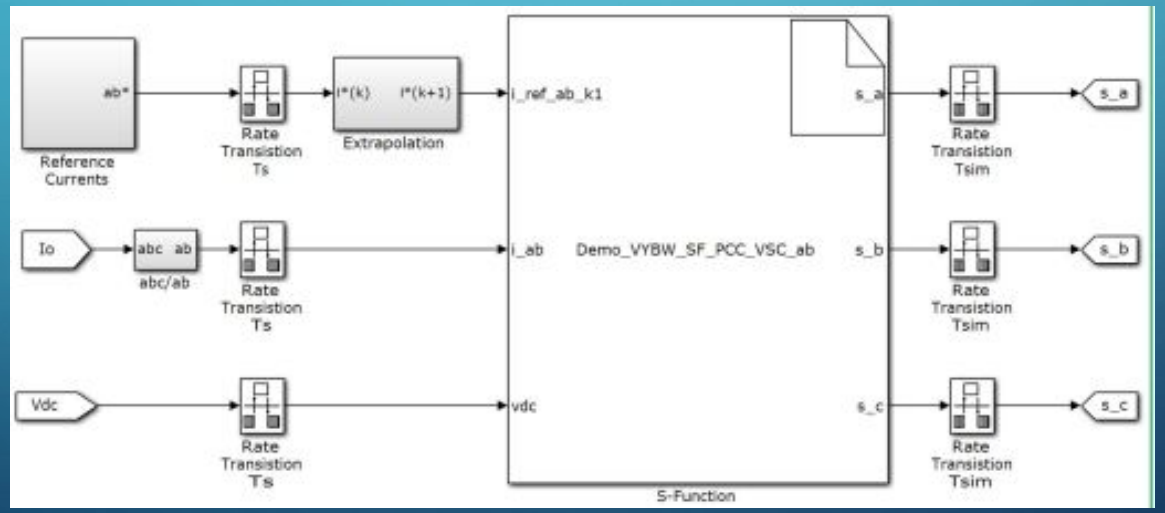
Demo File 1:Simulink model for PCC of 2L-VSC with RL load.



DC POWER SUPPLY

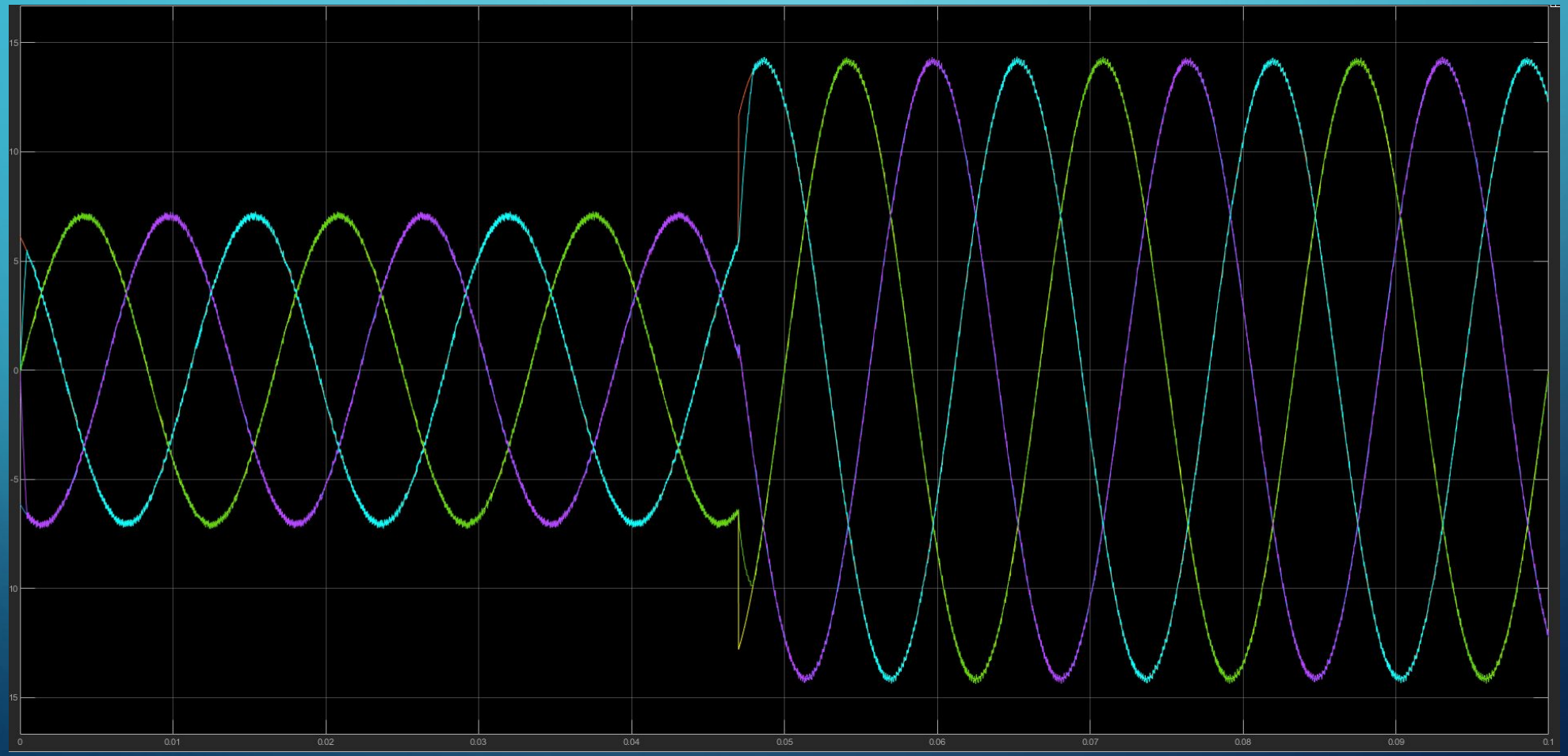


2L VSC

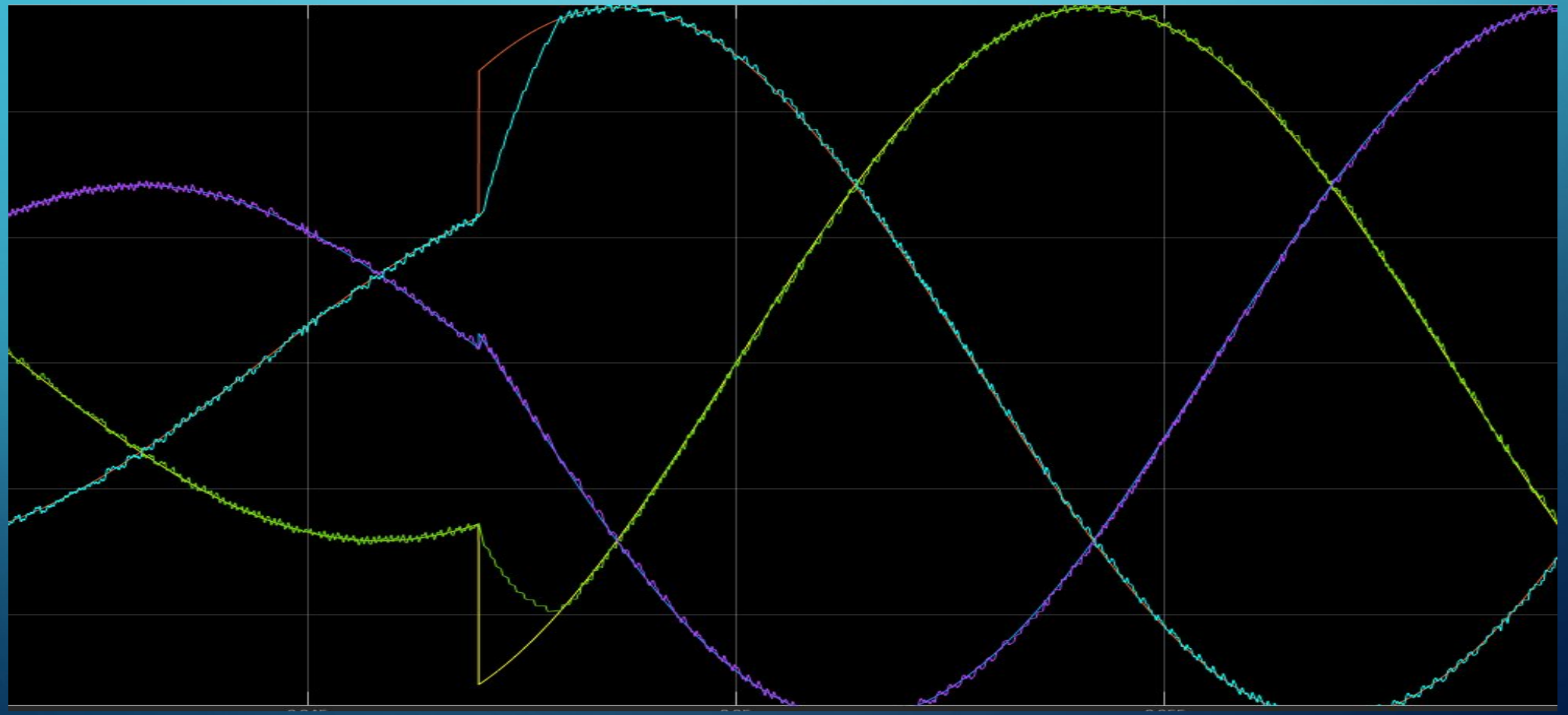


Predictive current control

Simulation results for three-phase and load current



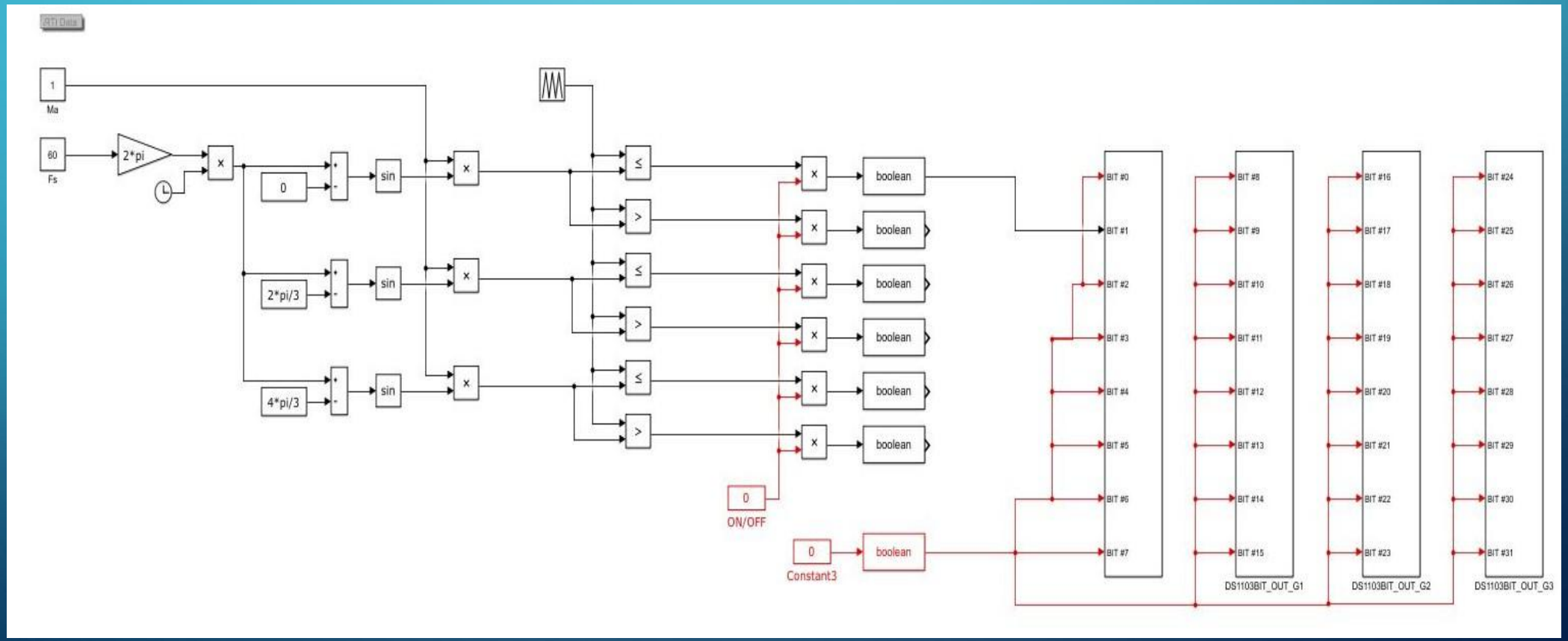
Simulation results for three-phase and load current



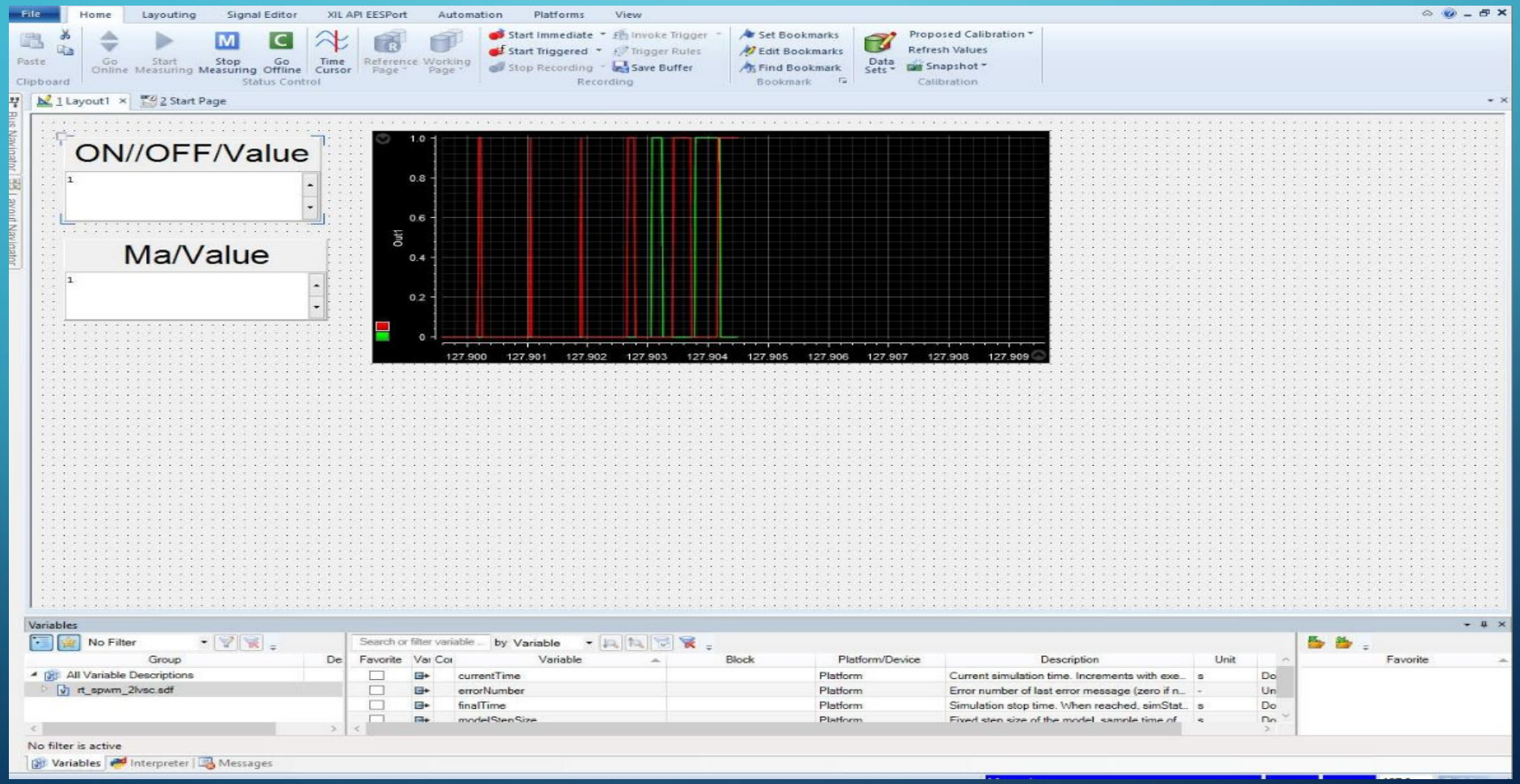
PROTOTYPE 2

- Implementing SPWM (Sine Pulse Width Modulation)
- Sending signals from SIMULINK to dspace

PROTOTYPE 2 SIMULINK



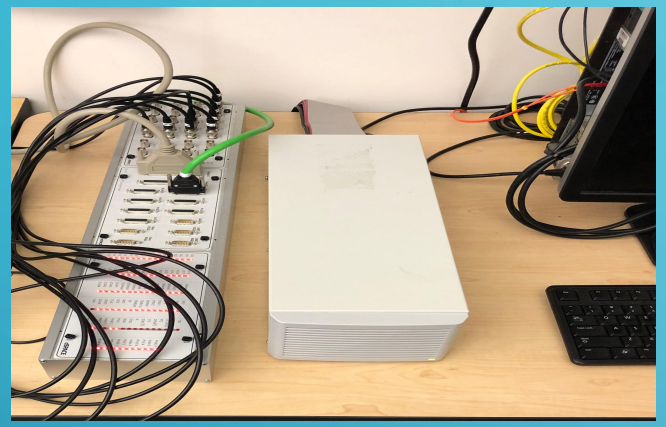
DSPACE Signalling

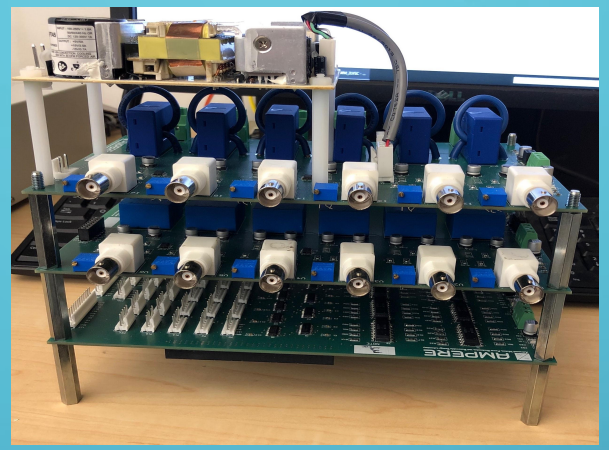


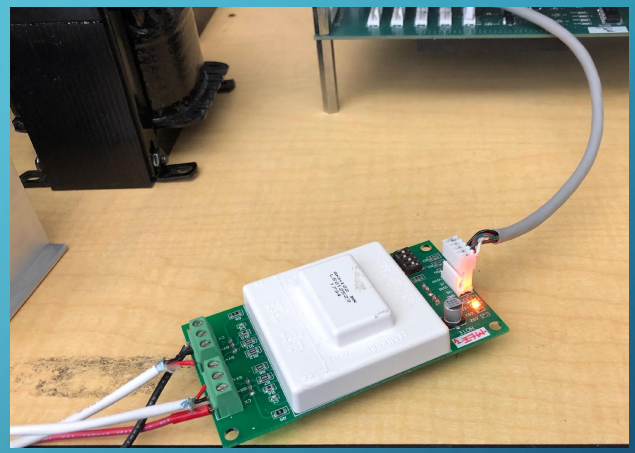
PROTOTYPE 3

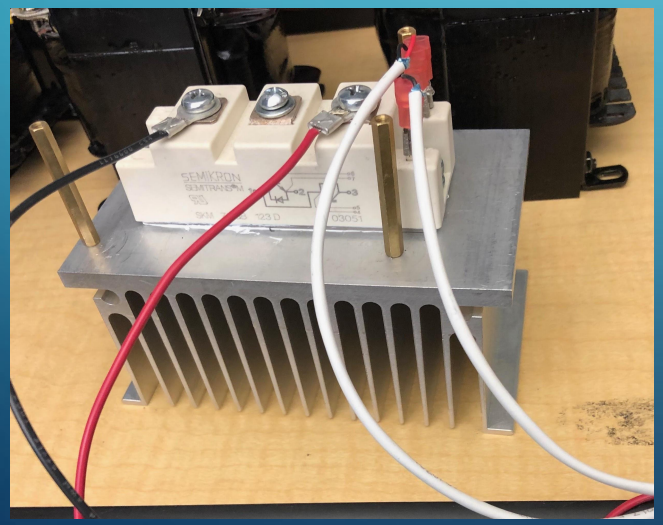
- Testing IGBT (Insulated-gate bipolar transistor)
- Testing the gating signals
- Testing different output Pins on the interface board

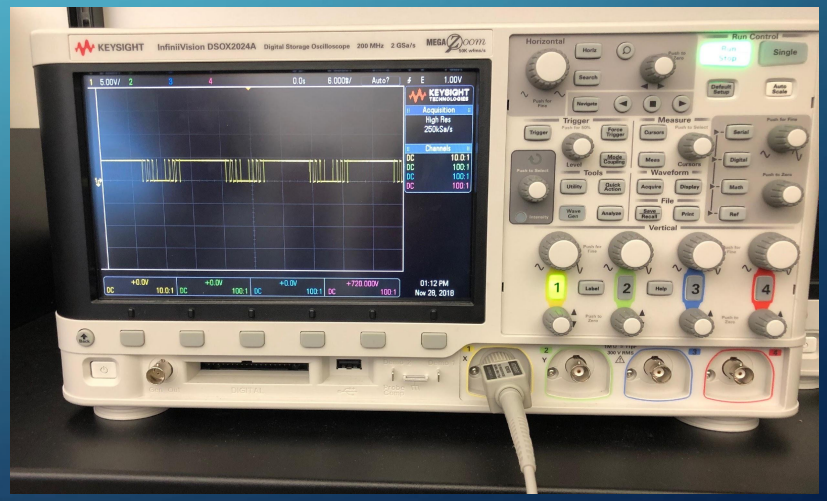
PROTOTYPE 3 GATING AND IGBT TESTING







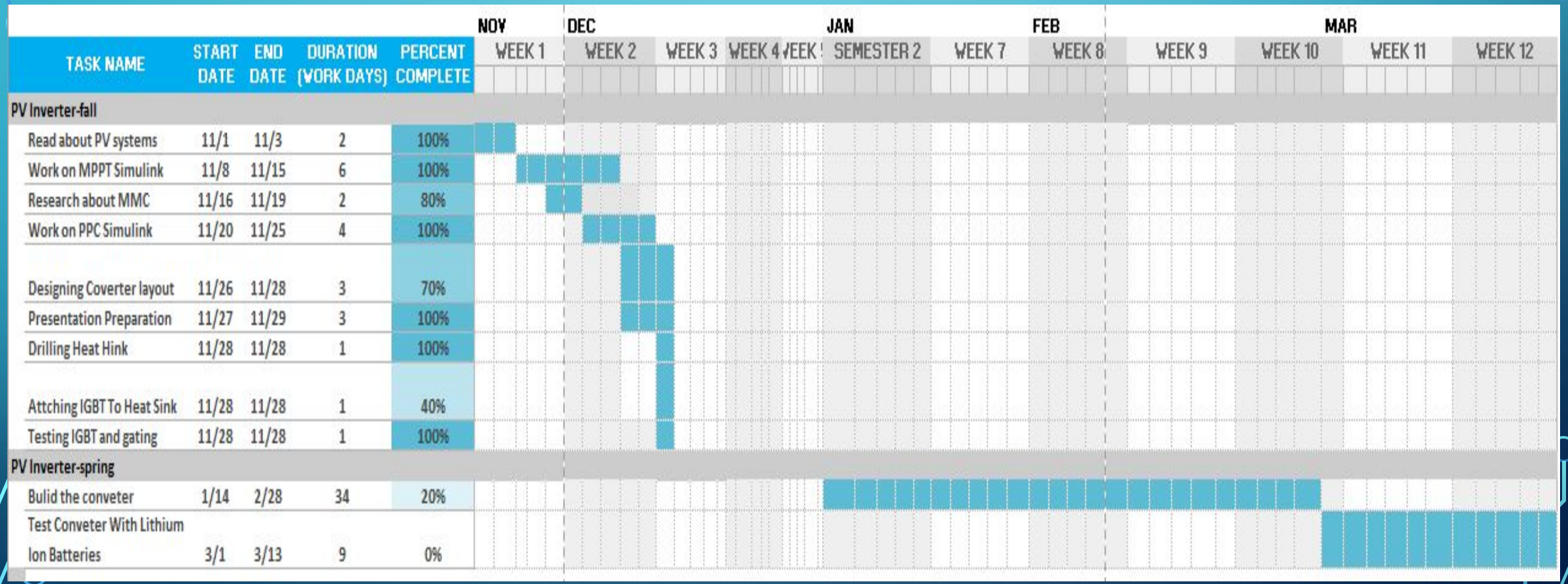




Overall design

- 12 IGBT’s
- 12 Capacitors
- 6 (2.5mH) Inductors
- 3 (5mH) Inductors
- 12 Gate driver’s
- 12 current sensor
- 12 voltage sensor
- 1 interface board
- wires

Schedule



TASK NAME	START DATE	END DATE	DURATION (WORK DAYS)	PERCENT COMPLETE
PV Inverter-fall				
Read about PV systems	11/1	11/3	2	100%
Work on MPPT Simulink	11/8	11/15	6	100%
Research about MMC	11/16	11/19	2	80%
Work on PPC Simulink	11/20	11/25	4	100%
Designing Coverter layout	11/26	11/28	3	70%
Presentation Preparation	11/27	11/29	3	100%
Drilling Heat Hink	11/28	11/28	1	100%
Attching IGBT To Heat Sink	11/28	11/28	1	40%
Testing IGBT and gating	11/28	11/28	1	100%
PV Inverter-spring				
Bulid the conveter	1/14	2/28	34	20%
Test Conveter With Lithium Ion Batteries	3/1	3/13	9	0%

References:

[1] Dr.Venkata Yaramasu , EE499/599 Renewable Energy System, Lab 6 : grid-connected Photovoltaic Energy Conversion System with MPPT control.

[2] Dr.Venkata Yaramasu and Bin Wu , Model Predictive Control of Wind Energy Conversion Systems, ISBN: 9781118988589, Hoboken, NJ: Wiley-IEEE Press, Dec. 2016.

[3] E. G. Eggum, “Application of Modular Multilevel Converter for Interfacing Grid-Connected Photovoltaic Conversion Plants,” thesis, 2015.

[4]B. Wu, Power conversion and control of wind energy systems. Piscataway, NJ: IEEE Press, 2011.

Thank you ^^

And any question?