Manufacturing Automation

Team 6:
Marissa Foreit
Kyler Kazmierski
Folaranmi Adenola
Olayinka Oladosu

Sponsor: Mr. Walker
Advisor: Dr. Moore
Professor: Dr. Gupta

Introduction

- Unison Industries
  - Subsidiary of GE
  - Special in electrical components for jet engines, ignition systems and generators
  - 80% of jet engines are installed with ignition systems produced by Unison Industries
- Capacitor Manufacturing Automation
  - Making a manual process automated in order to reduce assembly time

Needs Statement

- The project requires an automated system to be developed in order to assemble the capacitors. The capacitors consist of the following parts:
  - 4 individual capacitor sections that become stacked together
  - A layer of tape and insulator paper between each section
  - Electrical tabs for connections
  - Lead wires
- Insulation material wrapped around the assembly

Goal Statement

- Design and develop an automated process in order to improve the manufacturing and assembly of the ignition exciter

Objectives

- Gain ergonomic benefits
- Reduce labor time by 50%
- Improve the assembly time of the ignition exciter through some level of automation
- Create a more economical process
- Design and develop working prototype machinery to most efficiently manufacture the ignition exciters
- Design a method to check all three dimensions at once
- Stacking of individual sections to start assembly
- Soldering together electrical tabs from each section, and attaching lead wires by soldering
- Wrapping assembly in insulation material – 2 types, 2 directions

Background Research

- Capacitors store energy as an electrostatic field
- Options for slow, medium or high assembly lines
  - This project will likely use a medium or high speed assembly line
- Also options of fully automatic versus semi automatic
  - Fully automatic requires no operator
  - Semi automatic requires some use of the operator

House of Quality

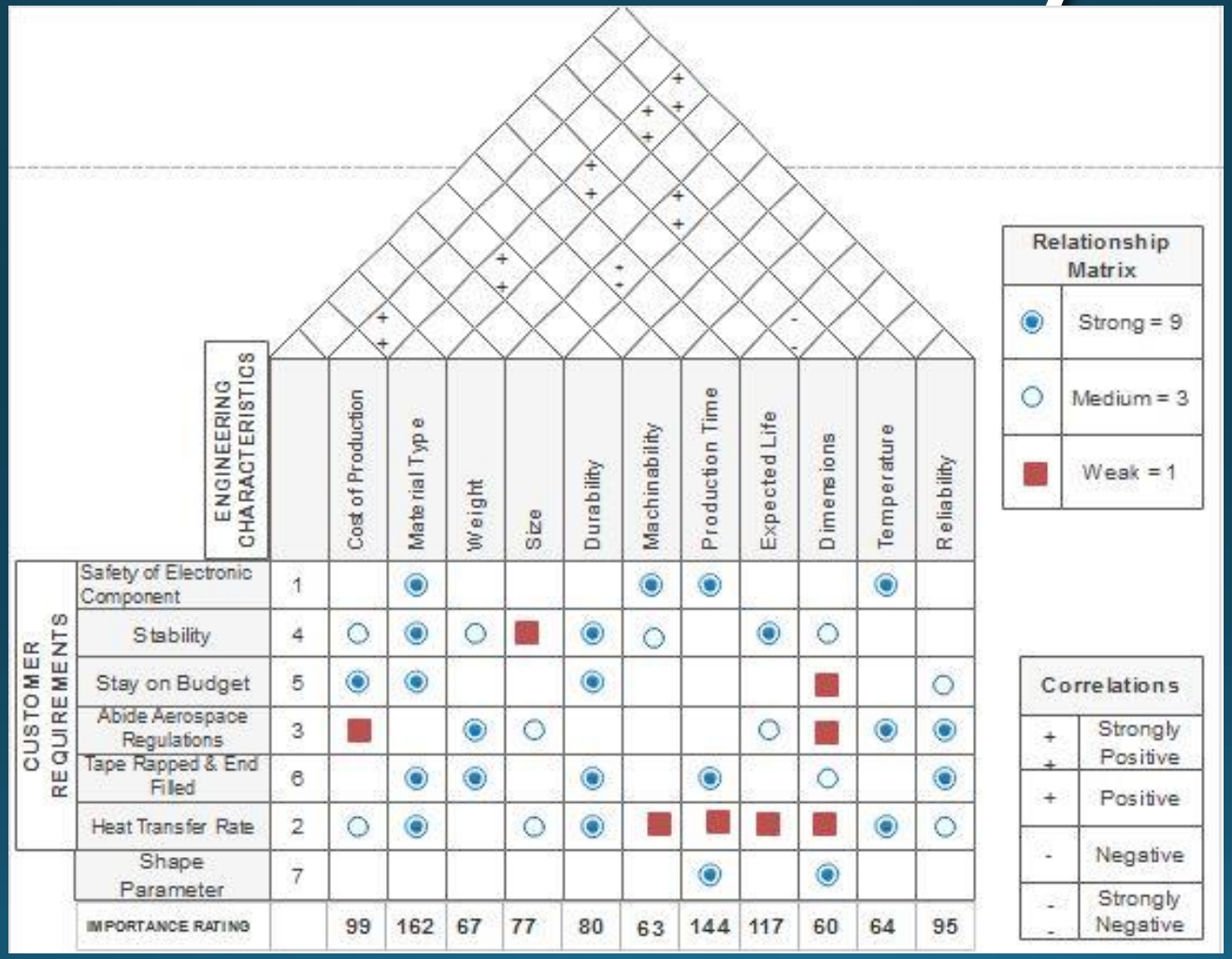


Table 1: HOQ

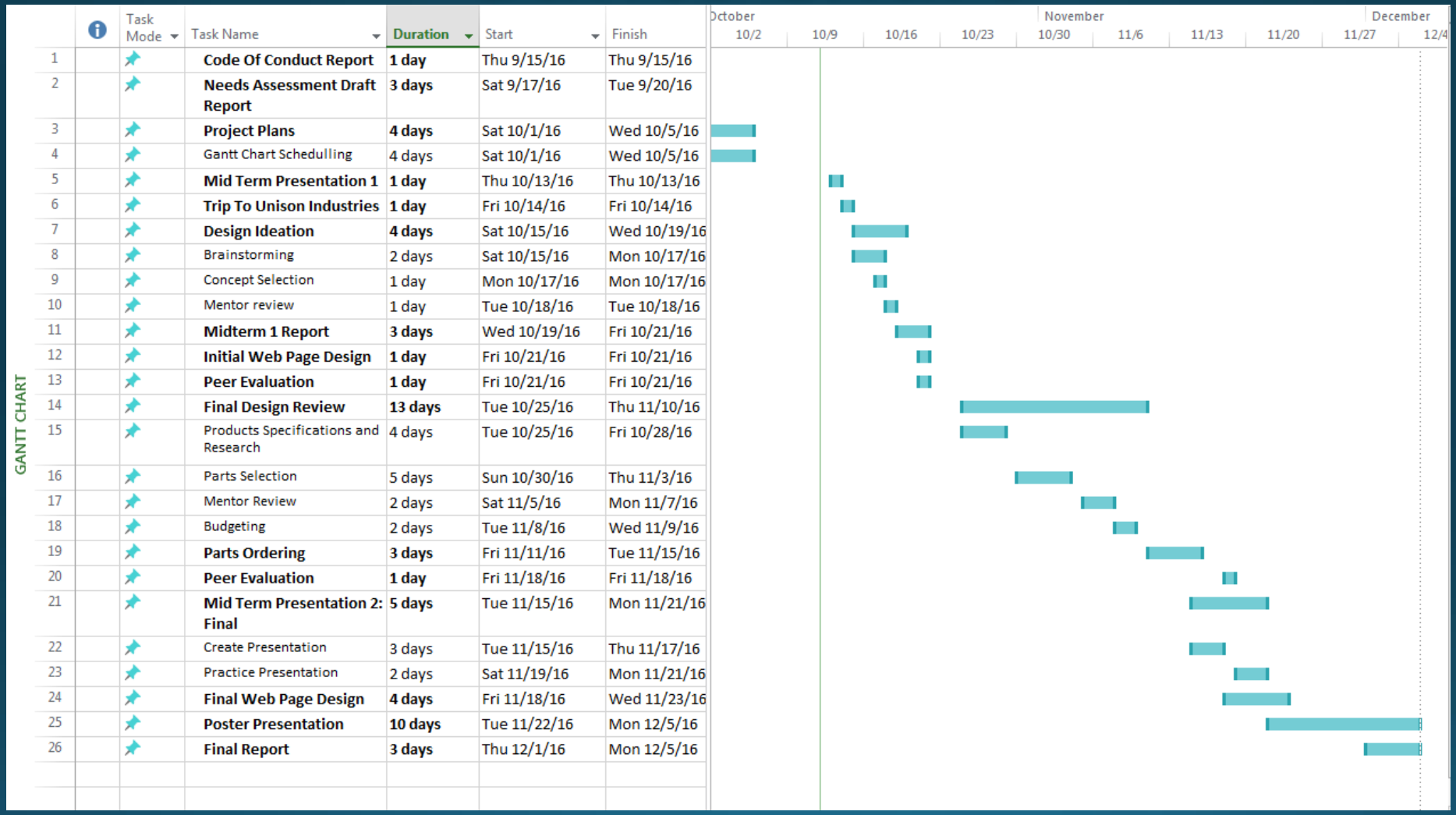
Constraints

- Machinery built must be both practical and economical
- The process and machinery created must comply with any applicable safety regulations
- Project must be completed by the end of the Spring 2017 semester

Project Planning

- Trip to Jacksonville, Fl for tour of plant
- Have initial web design completed by October 21st
- Have the final design of prototype completed by December 2016
- Start to build and test prototype early Spring 2017 semester

Gantt Chart



GANTT CHART

	Task Mode	Task Name	Duration	Start	Finish
1		**Code Of Conduct Report**	**1 day**	Thu 9/15/16	Thu 9/15/16
2		**Needs Assessment Draft Report**	**3 days**	Sat 9/17/16	Tue 9/20/16
3		**Project Plans**	**4 days**	Sat 10/1/16	Wed 10/5/16
4		Gantt Chart Schedulling	4 days	Sat 10/1/16	Wed 10/5/16
5		**Mid Term Presentation 1**	**1 day**	Thu 10/13/16	Thu 10/13/16
6		**Trip To Unison Industries**	**1 day**	Fri 10/14/16	Fri 10/14/16
7		**Design Ideation**	**4 days**	Sat 10/15/16	Wed 10/19/16
8		Brainstorming	2 days	Sat 10/15/16	Mon 10/17/16
9		Concept Selection	1 day	Mon 10/17/16	Mon 10/17/16
10		Mentor review	1 day	Tue 10/18/16	Tue 10/18/16
11		**Midterm 1 Report**	**3 days**	Wed 10/19/16	Fri 10/21/16
12		**Initial Web Page Design**	**1 day**	Fri 10/21/16	Fri 10/21/16
13		**Peer Evaluation**	**1 day**	Fri 10/21/16	Fri 10/21/16
14		**Final Design Review**	**13 days**	Tue 10/25/16	Thu 11/10/16
15		Products Specifications and Research	4 days	Tue 10/25/16	Fri 10/28/16
16		Parts Selection	5 days	Sun 10/30/16	Thu 11/3/16
17		Mentor Review	2 days	Sat 11/5/16	Mon 11/7/16
18		Budgeting	2 days	Tue 11/8/16	Wed 11/9/16
19		**Parts Ordering**	**3 days**	Fri 11/11/16	Tue 11/15/16
20		**Peer Evaluation**	**1 day**	Fri 11/18/16	Fri 11/18/16
21		**Mid Term Presentation 2: Final**	**5 days**	Tue 11/15/16	Mon 11/21/16
22		Create Presentation	3 days	Tue 11/15/16	Thu 11/17/16
23		Practice Presentation	2 days	Sat 11/19/16	Mon 11/21/16
24		**Final Web Page Design**	**4 days**	Fri 11/18/16	Wed 11/23/16
25		**Poster Presentation**	**10 days**	Tue 11/22/16	Mon 12/5/16
26		**Final Report**	**3 days**	Thu 12/1/16	Mon 12/5/16

Table 2: Gantt Chart

Product Specs

- 4 individual sections
  - Layer of insulation paper and double sided tape in between
- Electrical tabs soldered together
- Insulation material wrapped around whole thing
- Dimensions:

4.25”H x 2.6”L x 1.38”W

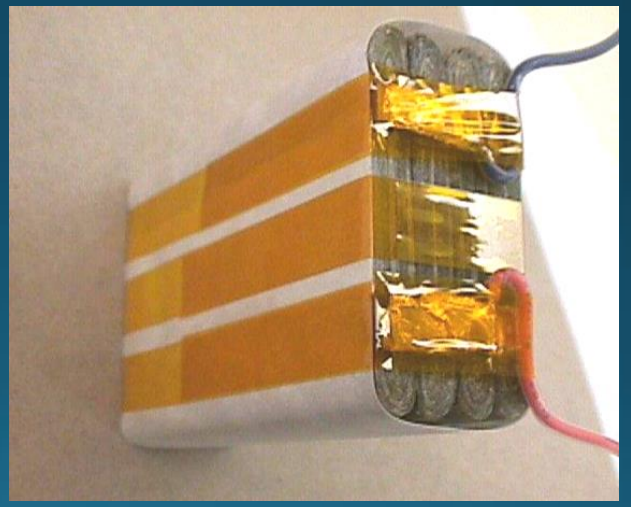


Figure 1: Assembly wrapped with insulation material

Steps for Design

1) Break down assembly process into individual steps
2) Examine amount of time for each step
   a) Discuss potential ways to reduce time for each time
3) Create scoring system to assess the different methods and chose best option
4) Ensure that overall assembly time has been reduced from 27 minutes to 15 minutes

Dimensional Check Design 1

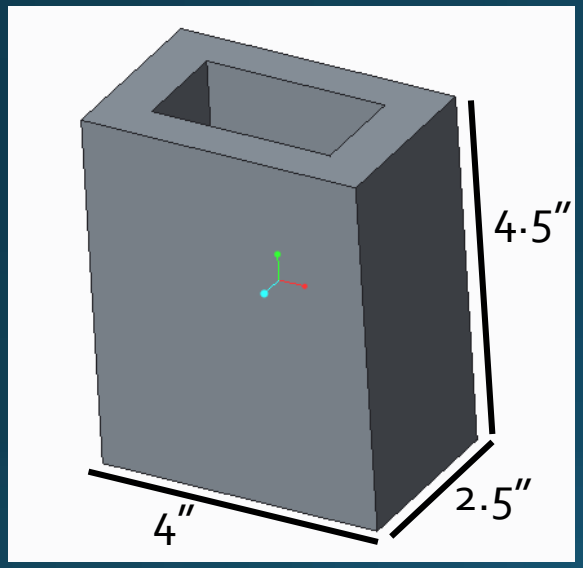


Figure 2: Gauge block with cut-out of the capacitor dimensions

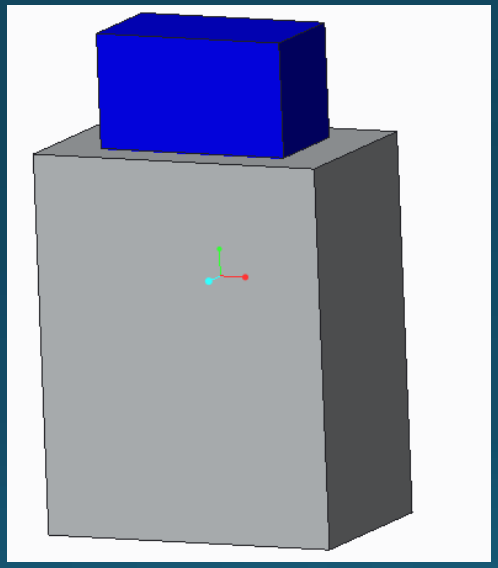


Figure 3: Capacitor sliding into gauge block

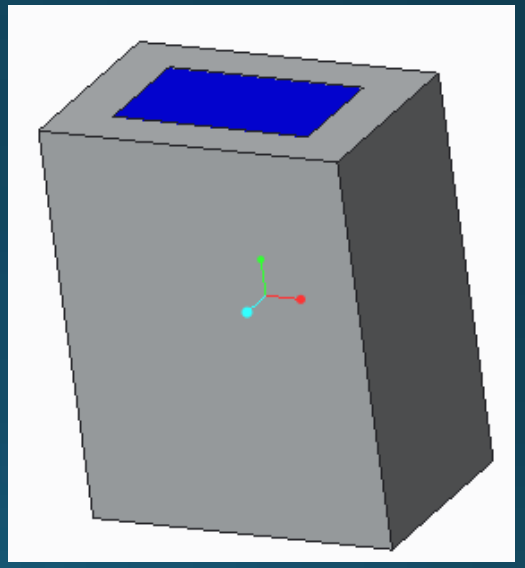


Figure 4: Capacitor fully in gauge block

Dimensional Check Design 2

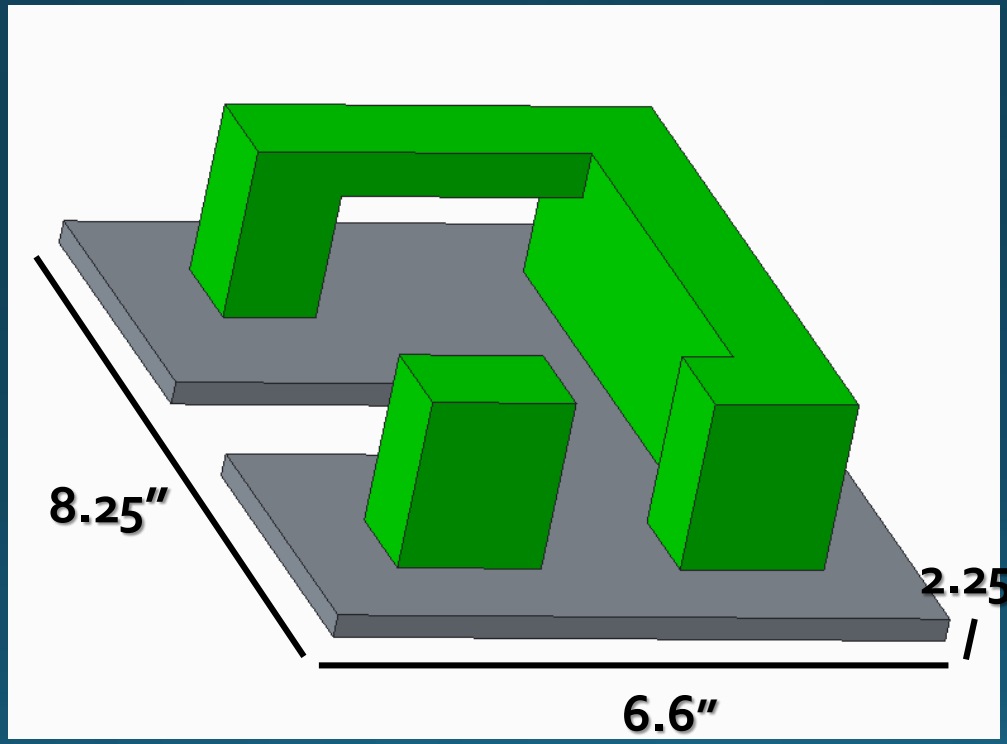


Figure 5: Gauge block without capacitor

Dimensional Check Design 2

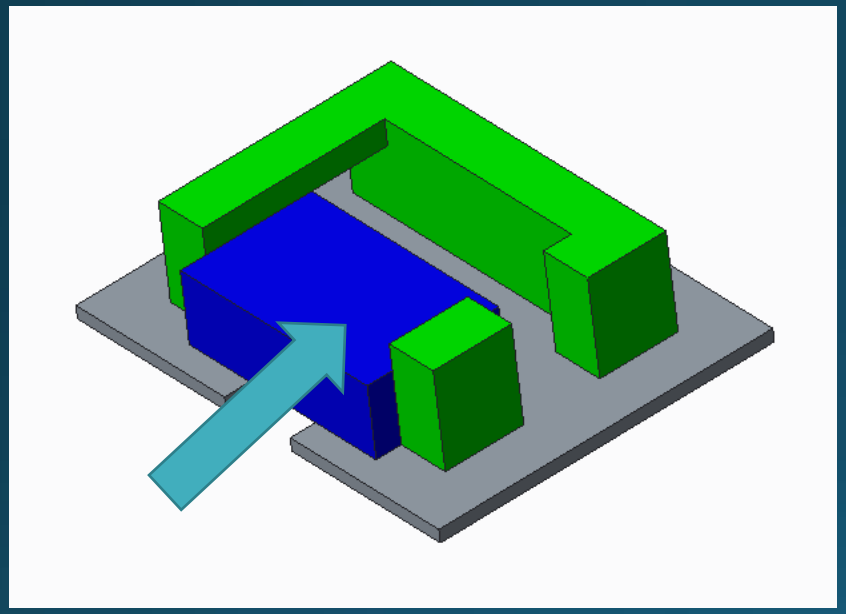


Figure 6: Capacitor sliding in to check height

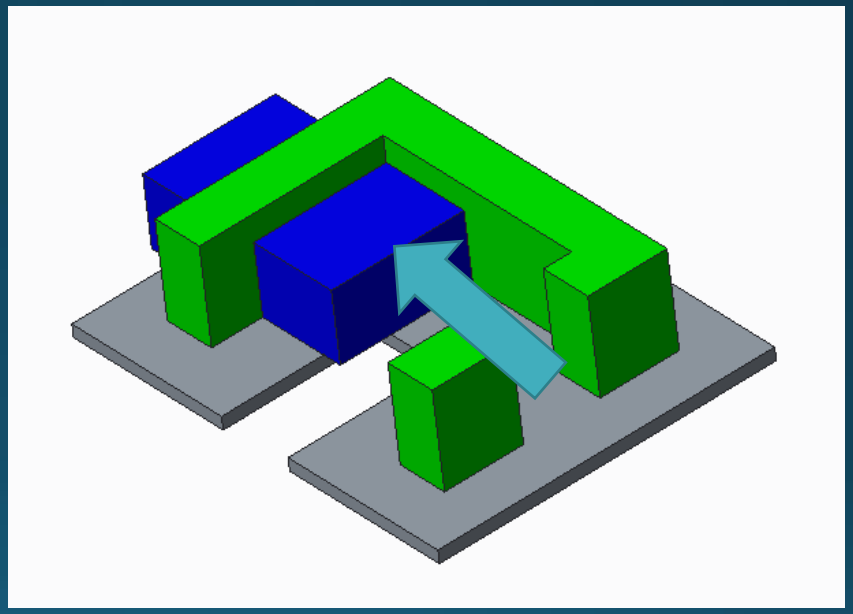


Figure 7: Capacitor sliding out to check width and length

Pros and Cons of Dimensional Check 1

- Pros
  - Easily checks all 3 dimensions at once
  - Easy to manufacture
  - Small size
- Cons
  - Assembled part might be hard to get back out of the gauge

Pros and Cons of Dimensional Check 2

- Pros
  - Easier to get part out of the gauge than Design 1
  - Has cut-outs to help guide capacitor
  - Base can be bolted to table
- Cons
  - Harder to manufacture than Design 1
  - 2 step process to check dimensions
  - Bigger base

Conclusion and Future Steps

- Trip to Unison Industries in Jacksonville
- Determine the automation process to be used
- Create CAD drawings for prototype
- Purchase Prototype raw materials

Questions?