Progress Report and Update

Material Testing Fixture

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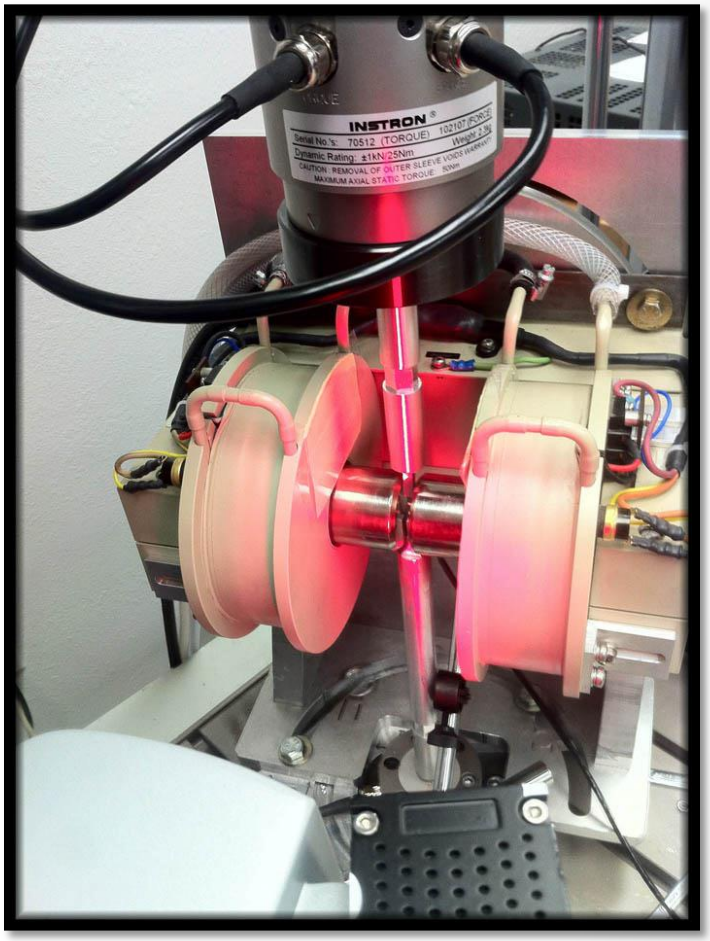
Overview

1. Problem Statement
2. Current Fixture
3. Previous Design
4. Proposed Fixture
5. Material Selection
6. Manufacturing
7. Analysis
8. Updated Timeline



Randy

Problem Statement

Need: *The eccentric loading of the test specimens causes fatigue failure.*

Goal: *Design an improved material testing fixture.*

Constraints:

1. Specimen size (3 x 3 x 20) mm
2. Exposed Length (12mm)
3. Grips cannot bite into specimen
4. Push rods and grips must be non-magnetic
5. Distance between magnets (10mm)
6. Magnetic Field (0.5 - 1.0 T)
7. Axial Alignment (50 µm)

Objectives:

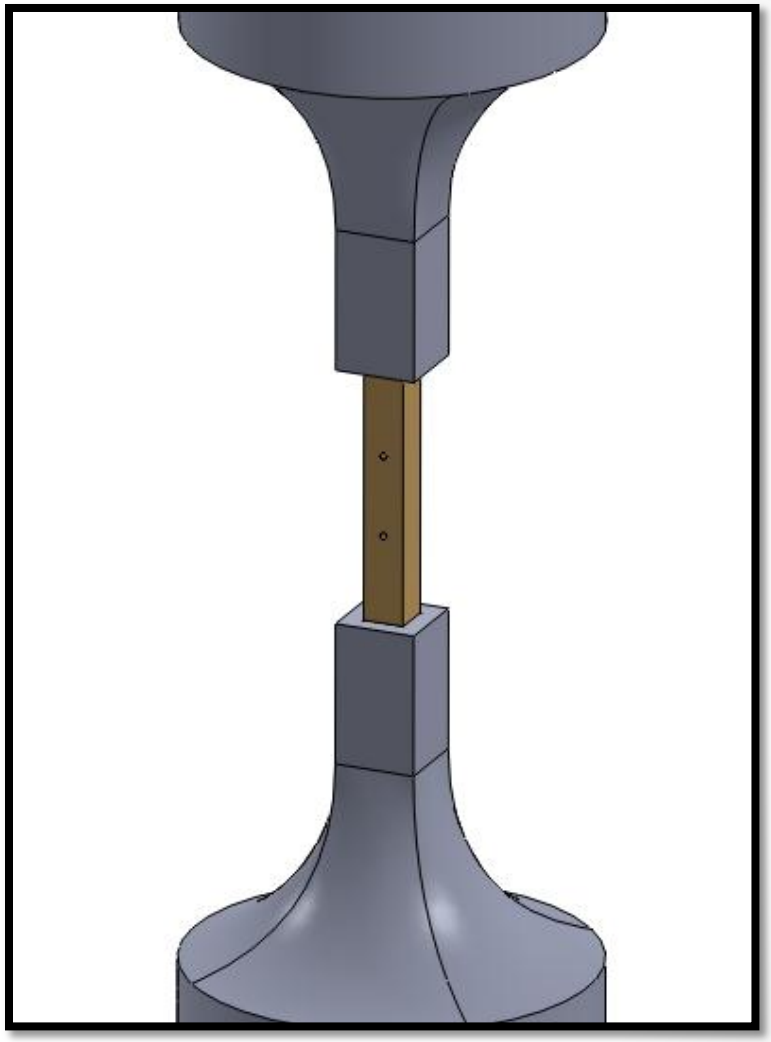
Objectives	Basis for Measurement	Units
Axially Aligned	Distance from Perfect Alginment	µm
Tension Compression Testing	Repeated Testing	# of Tests
Damage Specimen	Cost of Specimen Time to Replace	$$ / Month
Inexpensive	Machining Cost Material Cost	$$

Randy

Current Fixture

Problem Fixture

- Two aluminum pushrods
- No securing device
- Poor axial alignment

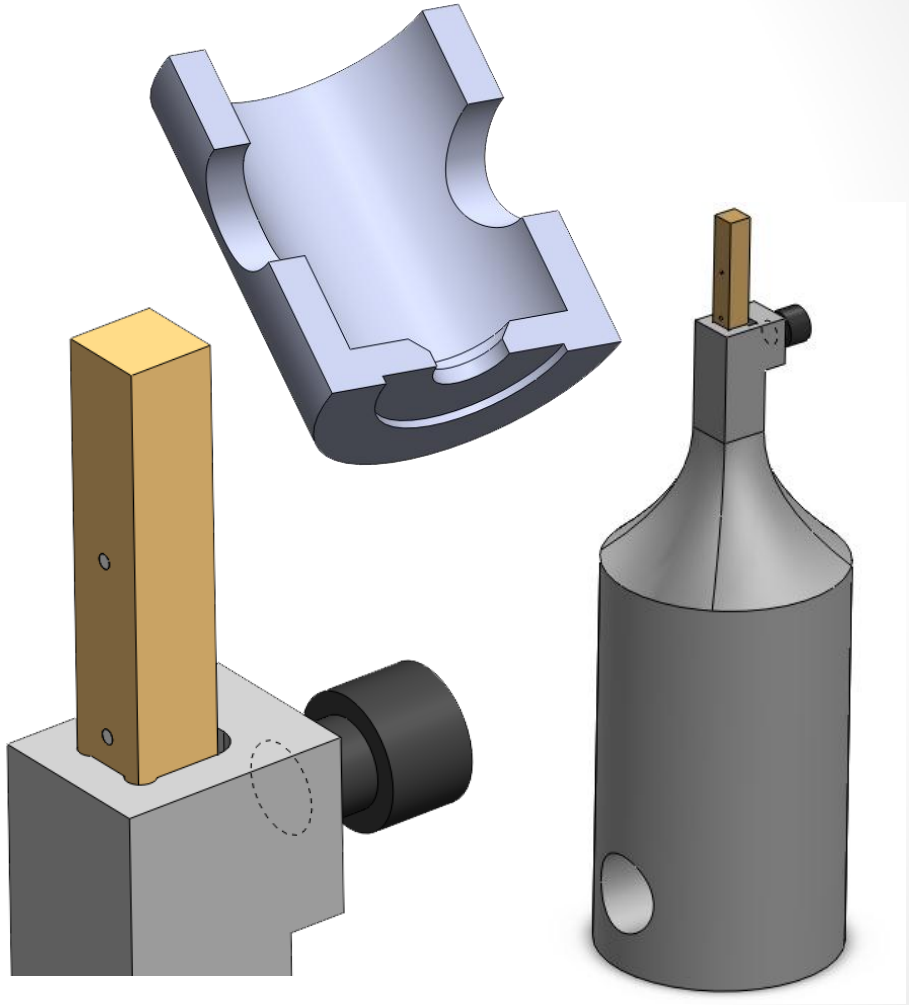


Qian

Previous Design

Last Semester

- Did not allow for varying specimen sizes
- More pieces leads to less reliable alignment
- Some features meet requirements

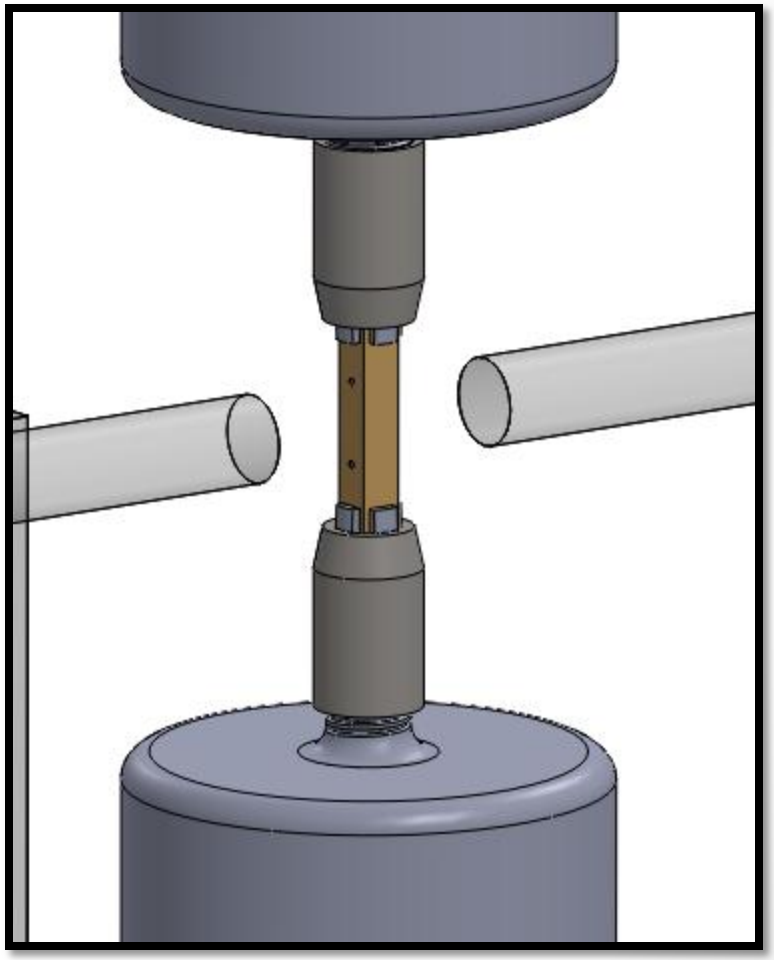


Qian

Proposed Fixture

New Design

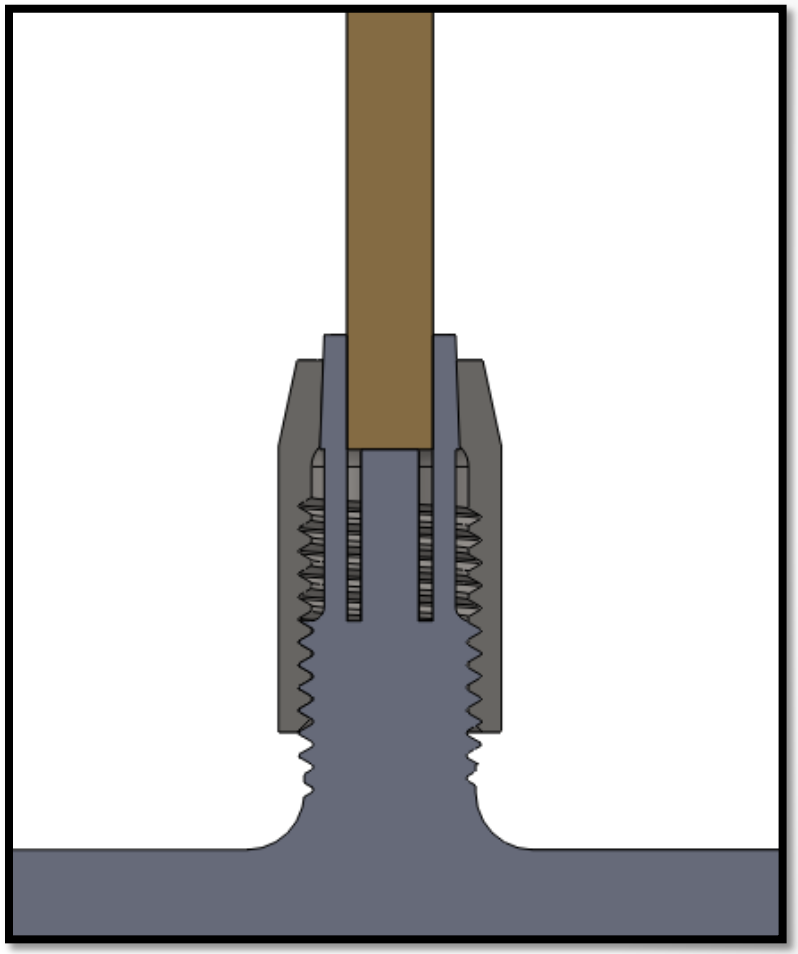
- Tension 18N
- Compression 60N
- Collet tip allows variation in specimen size
- Axial Alignment



Qian

Proposed Fixture – Cont.

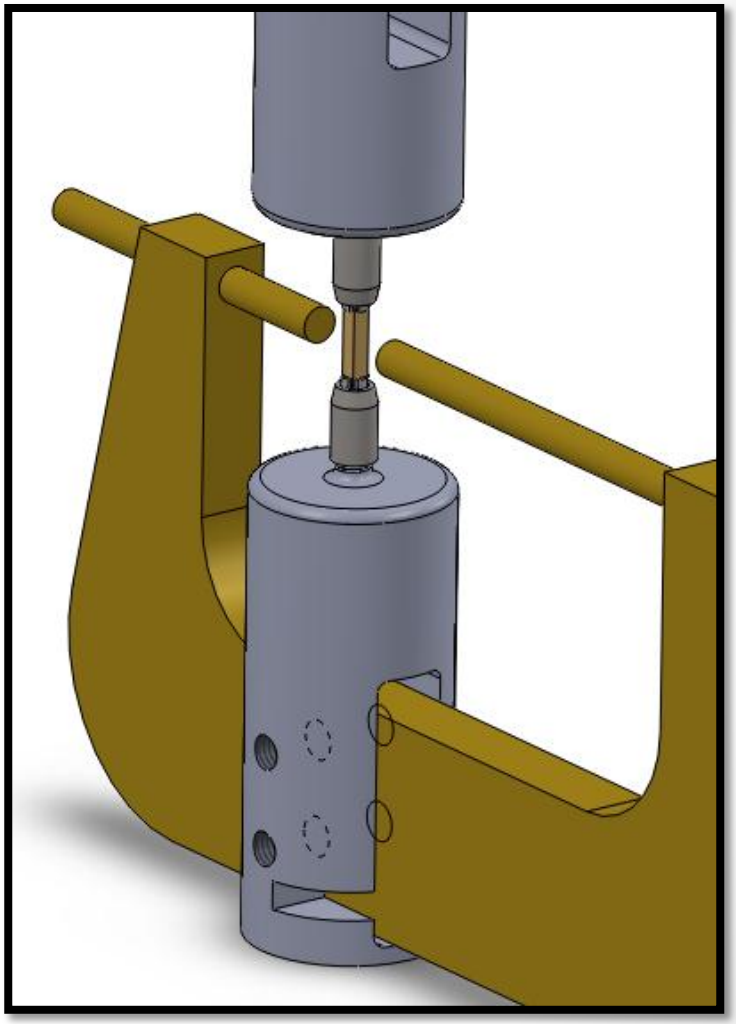
- Collet Tip
- Tension / Compression Compatible
- Secures specimen uniformly
- Taper presses equally on all sides



Jeremy

Proposed Fixture – Cont.

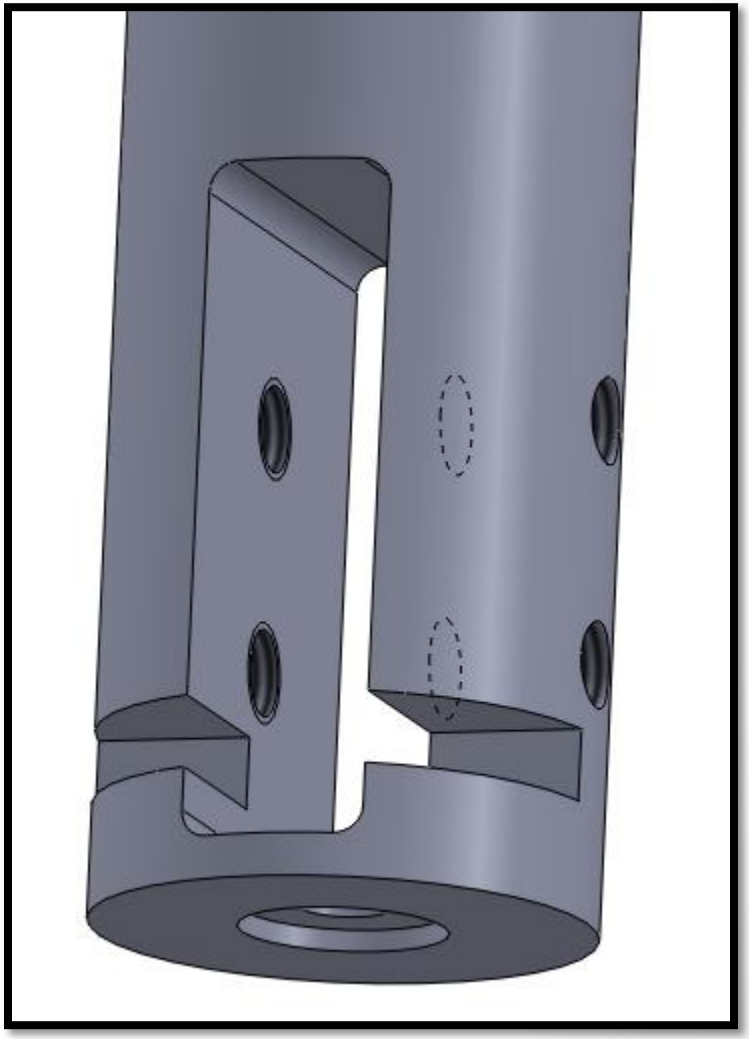
- Reduced # of part (8 - 4) means better alignment
- Minimized overall length improves alignment (from 200mm to 100mm)
- Micrometer addition also allows lateral loading of the specimen



Jeremy

Proposed Fixture – Cont.

- Lower cut out to make room for the micrometer
- Set screws for securing micrometer
- Tightening slot for wrench
- Previous alignment feature



Jeremy

Material Selection

Previous Design:
Aluminum T-6061

New Design:
Stainless Steel T-316 CR
Greater yield strength

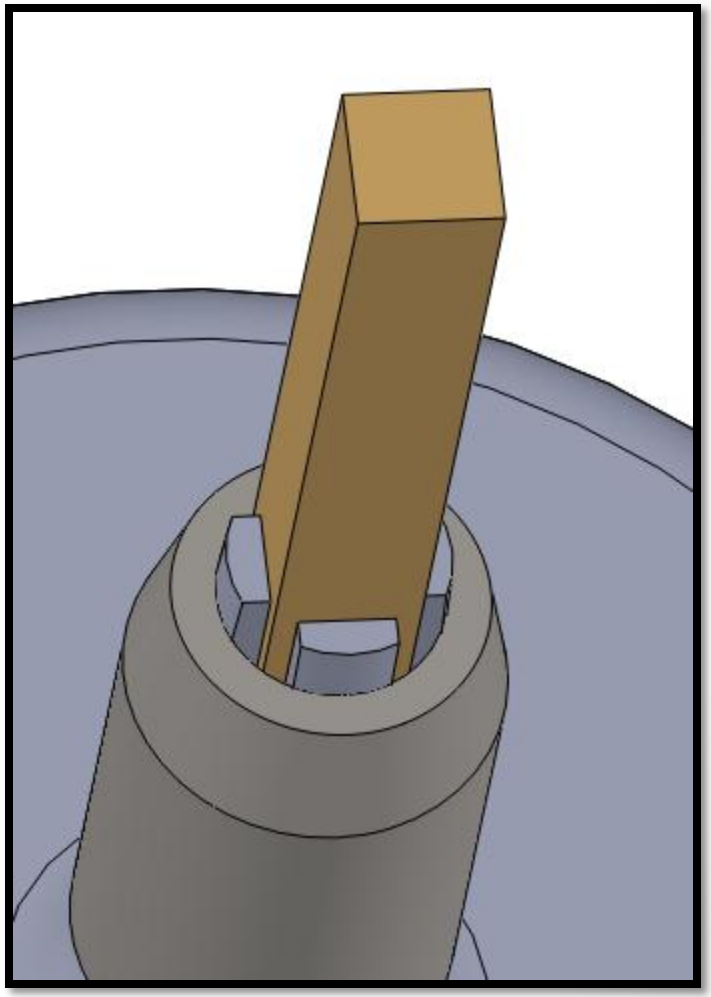
Amount:
D = 40mm, L = 300mm

Cost: $50
Source: http://www.onlinemetals.com/

Hui

Material Selection – Cont.

- Silicon Rubber Sleeve
- Prevents damage to specimen
- Accounts for variable specimen size



Hui

Material Selection – Cont.

- Set Screws
- M7 x 10mm
- Black Oxide – Standard
- Readily available

Hui

Manufacturing

- Small scale causes difficult manufacturing

- Tolerances are critical

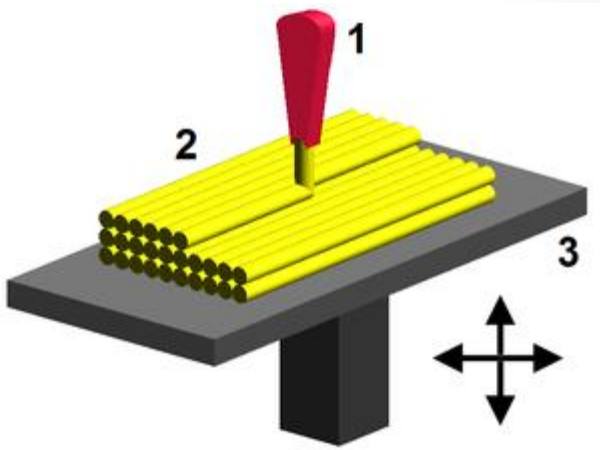


Figure 1: FDM

Prototype

- FDM – Fused Deposition Modeling

Final Product

- EDM – Electro Discharge Machining

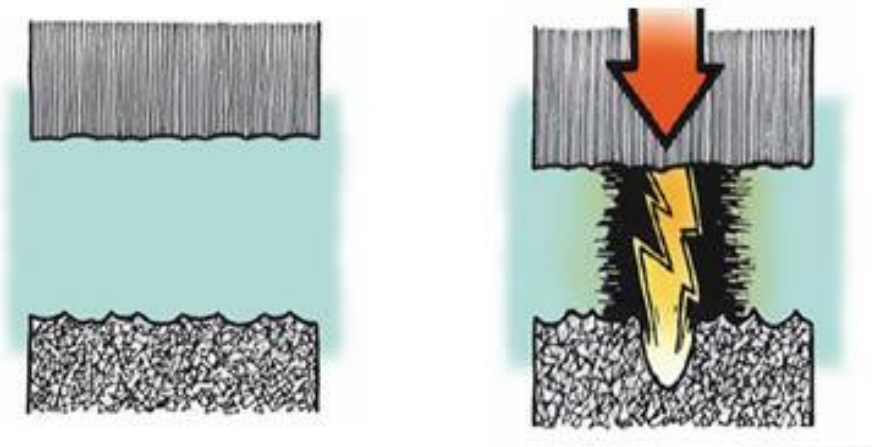


Figure 2: EDM

Matt

Analysis

- Bending ----- Collet tip analysis
- Tension / Compression ------ Overall fixture
- Fatigue ----- Repetition of tightening and loosening on tip
- Screw ----- Thread stress and yield points

Matt

Conclusion

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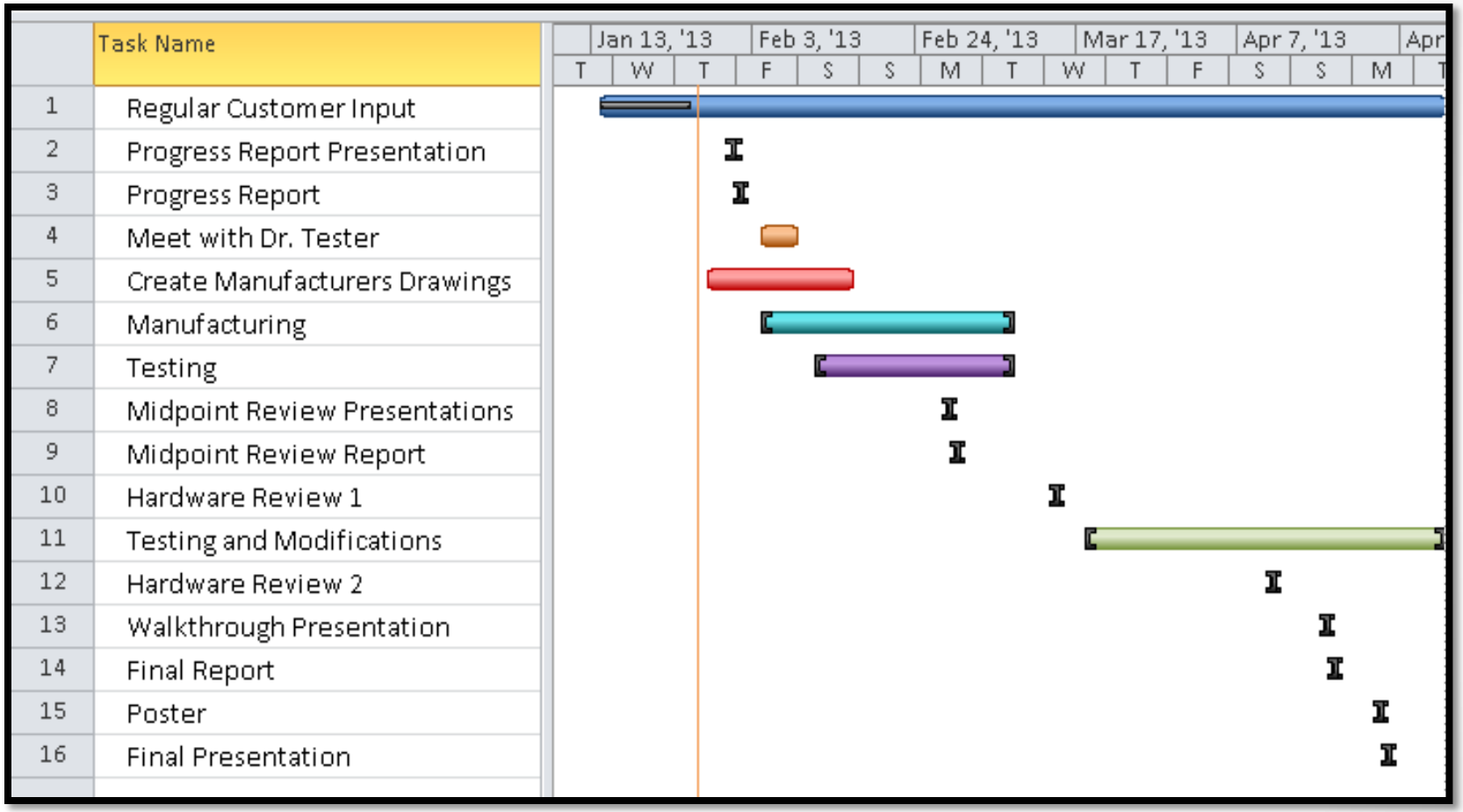
Matt

Updated Timeline



Matt

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Dr. Constantin Ciocanel