

***Modification and Preliminary
Testing of a Prototype Test
Rig Toward Qualification of
High-Strength HEPA Filters***

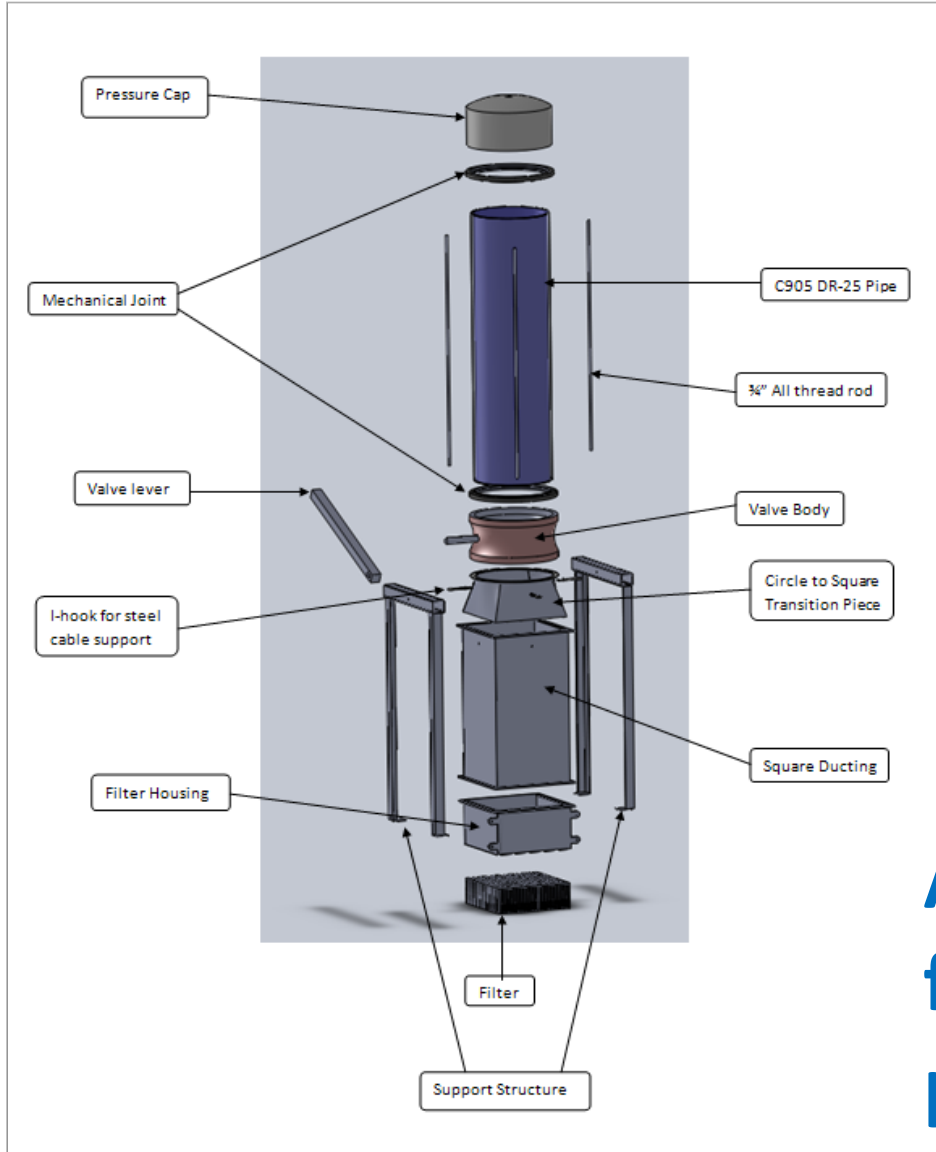
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Introduction

- **air cleaning systems are critical to safe operation of nuclear facilities**
- **rel. fragile HEPA filters play crucial role in nuclear air cleaning systems**
- **filter code section is lacking for filter adverse condition applications**

Project Objectives

- refine a prototype test rig for h-s HEPA filter qualification
- verify suitability of rig modification
- achieve goals within time, safety, and environmental constraints



Assembly rendering for preexisting prototype test rig

Refinement Options

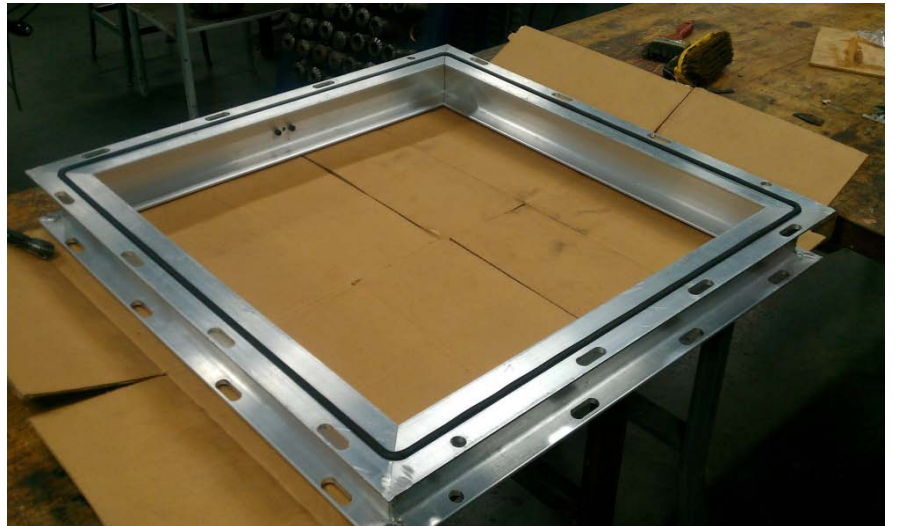
- load cells to measure force of water on filter
- alternative to falling water column
 - propelled water column
- position of pressure transducer
 - externally mounted on *Kiel* probe
 - internally mounted with flow guide

Pugh Matrix for Quick-Release Mechanism

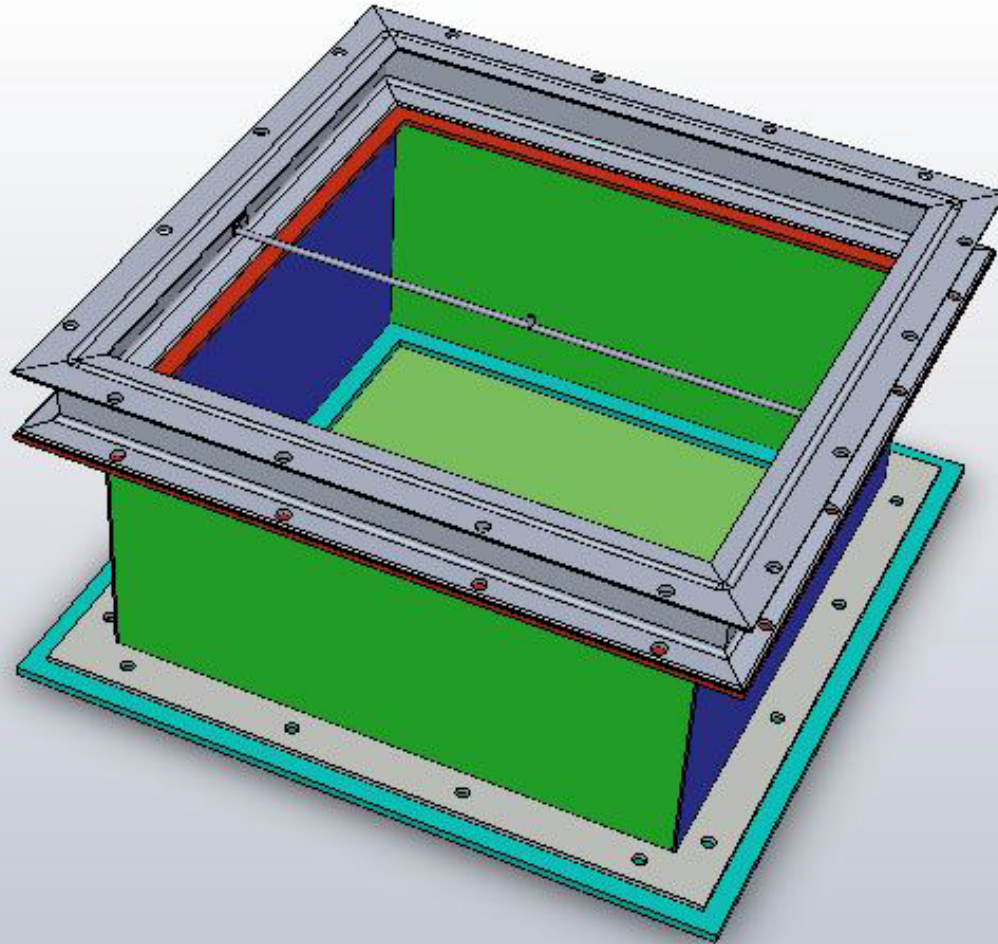
	Datum	1	2	3	4	5	6	7
	Concept 0: Current Set-up	Concept 1: Breakthrough Diaphragm	Concept 2: Two Doors	Concept 3: Four Doors	Concept 4: One Complete Falling Door	Concept 5: Retractable Door	Concept 6: Garage-type Door	Concept 7: Sub-Atmospheric Pressure
Cost	0	+	-	-	+	+	-	-
Length of Time to Complete	0	+	-	-	-	-	-	-
Difficulty of Completion	0	+	-	-	+	-	-	-
Precision of Data	0	0	0	0	+	0	0	0
Ease of Use	0	+	-	-	+	-	-	-
Repeated Use of Concept	0	-	+	+	+	+	+	-
Energy Required for this Concept	0	+	-	-	+	-	-	-
Number of Parts	0	+	-	-	+	-	-	-
Sum +'s	+ 0	6	1	1	7	2	1	0
Sum -'s	-0	1	6	6	1	5	6	7
Sum 0's	0	1	1	1	0	1	1	1
Net Score	0	5	-5	-5	6	-3	-5	-7
Rank	0	2	4	4	1	3	4	5

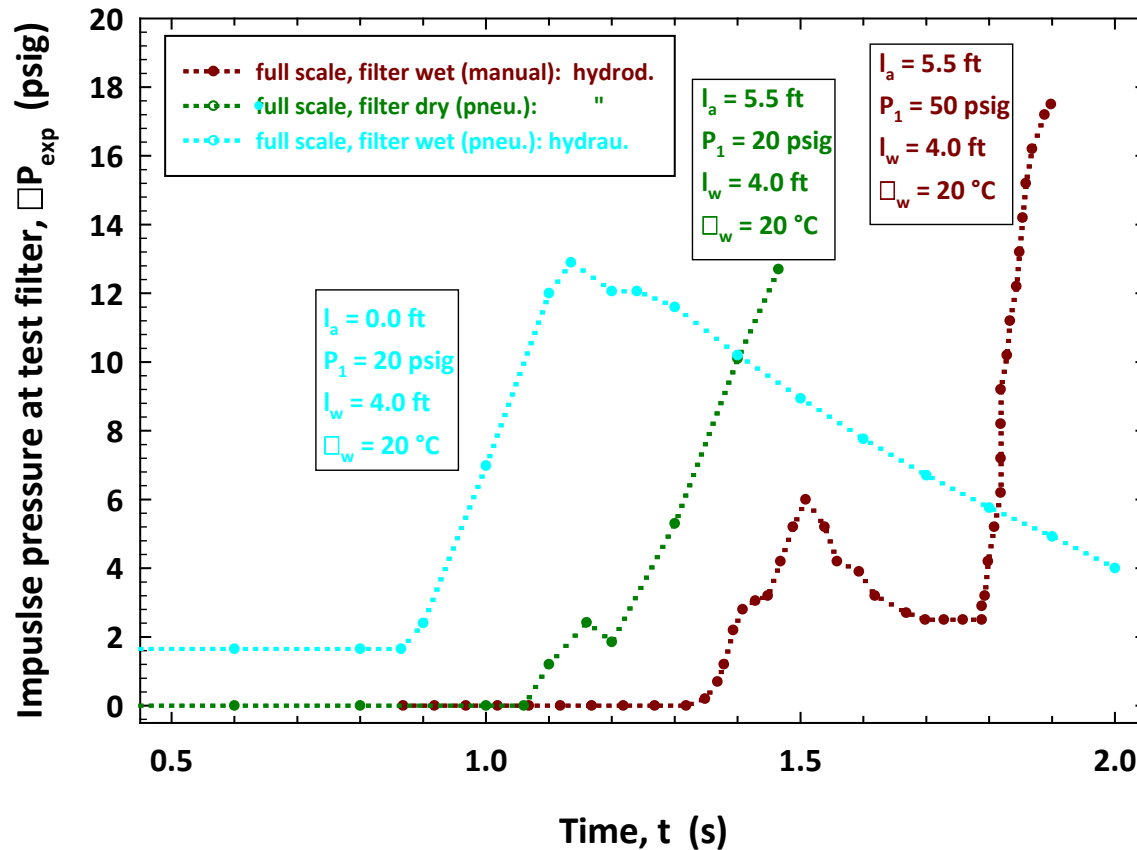
Figure 1: Pugh Decision Matrix for Testing Rig End Piece.

The Falling Door Concept had the highest net score of all the other concepts. As a result, this will be the concept we will select.



Filter Housing





Comparison of test results for propelled to those of falling water column

Conclusions

- implemented refinements can lead to likely improved test repeatability
- *propelled* water column concept tentatively identified as superior to *falling* water column
- pressure transducer type and mounting remains to be improved

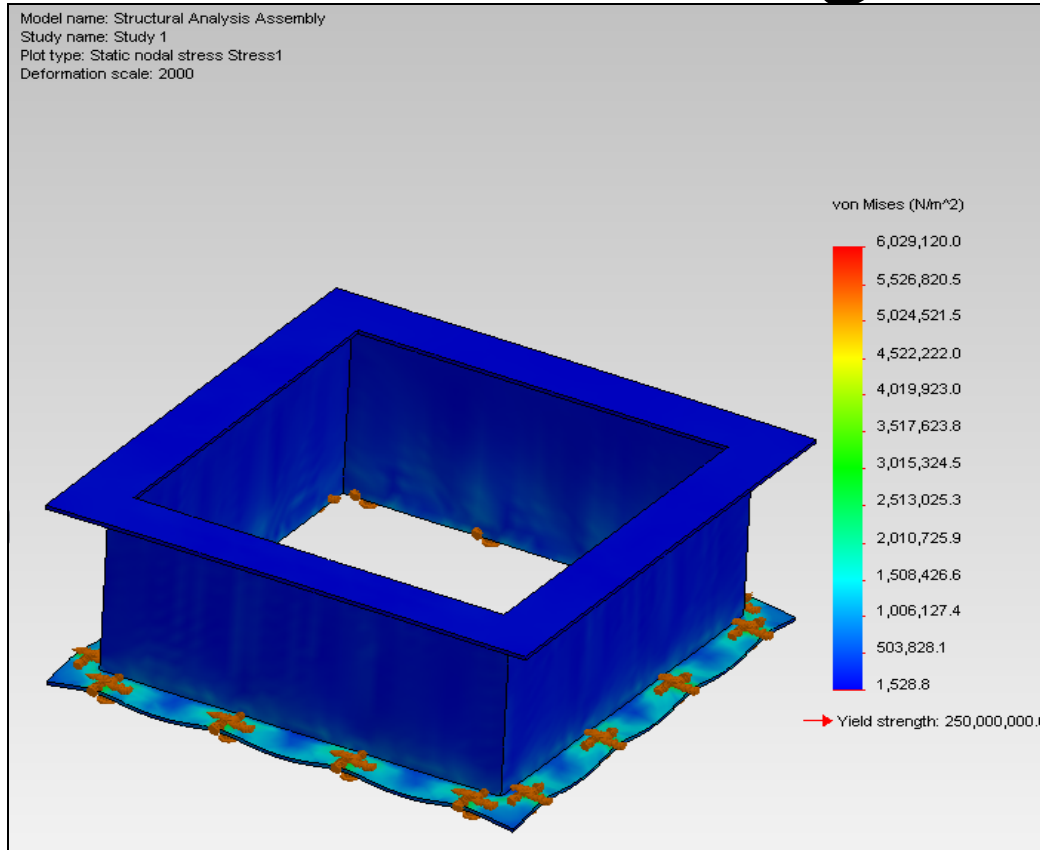
Acknowledgments

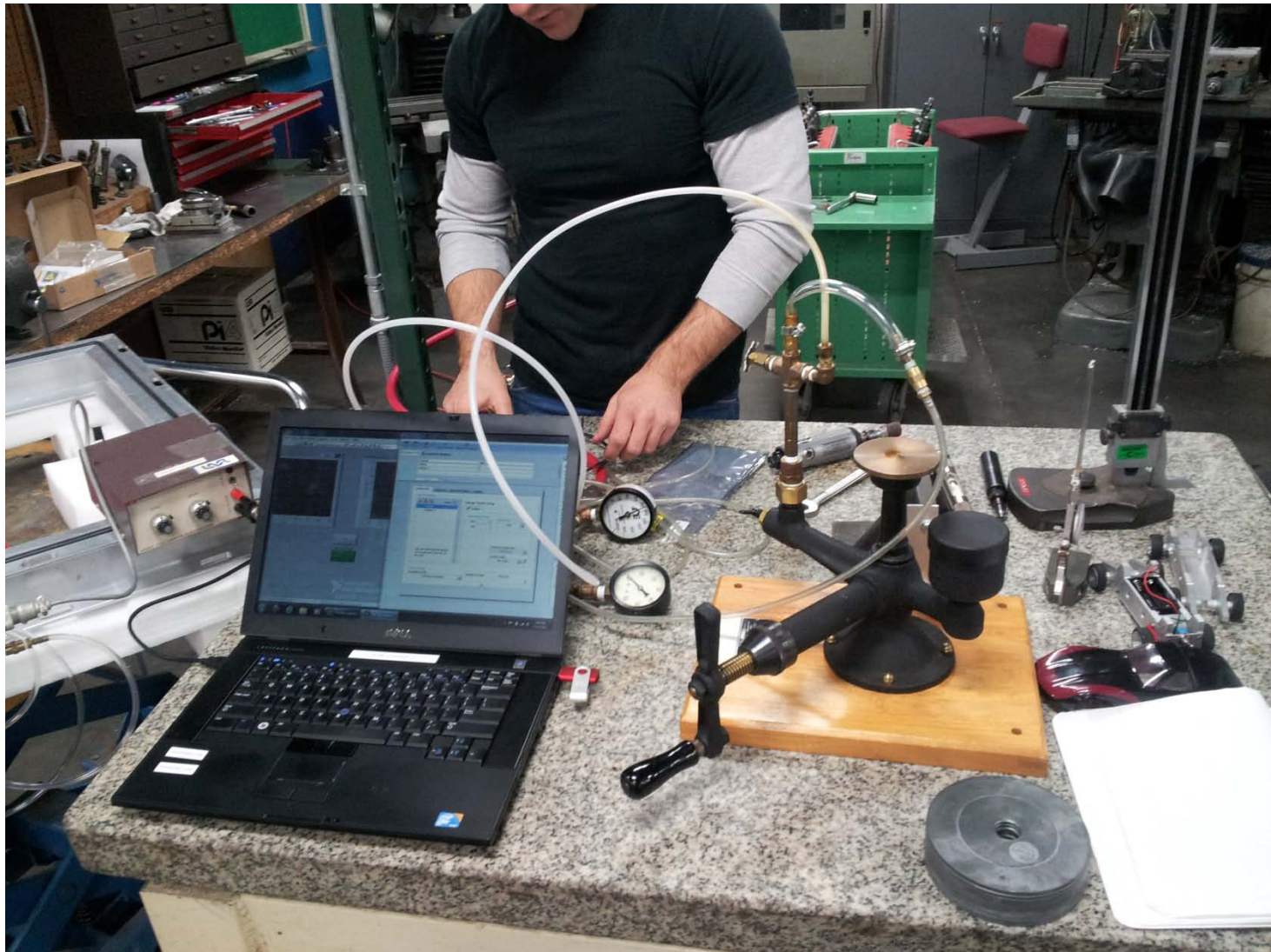
- *NMSU Engineering Staff.*
- *Gabriel Moreno and Jeffery Hutchinson, Co-Authors*
- *Richard Kilby and Bryan Carter, Senior Design Team Members*
- *My family and friends.*

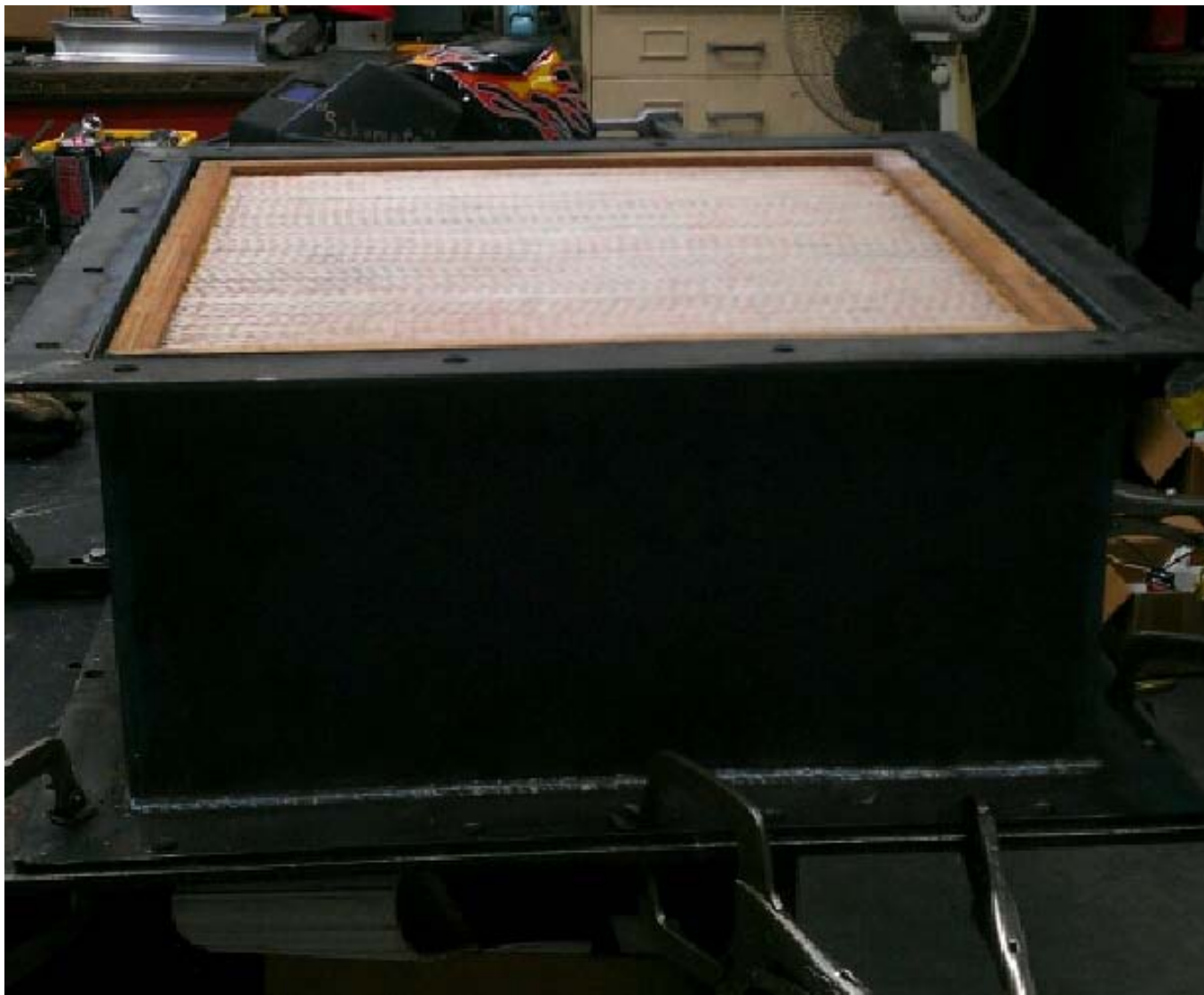
Thank You

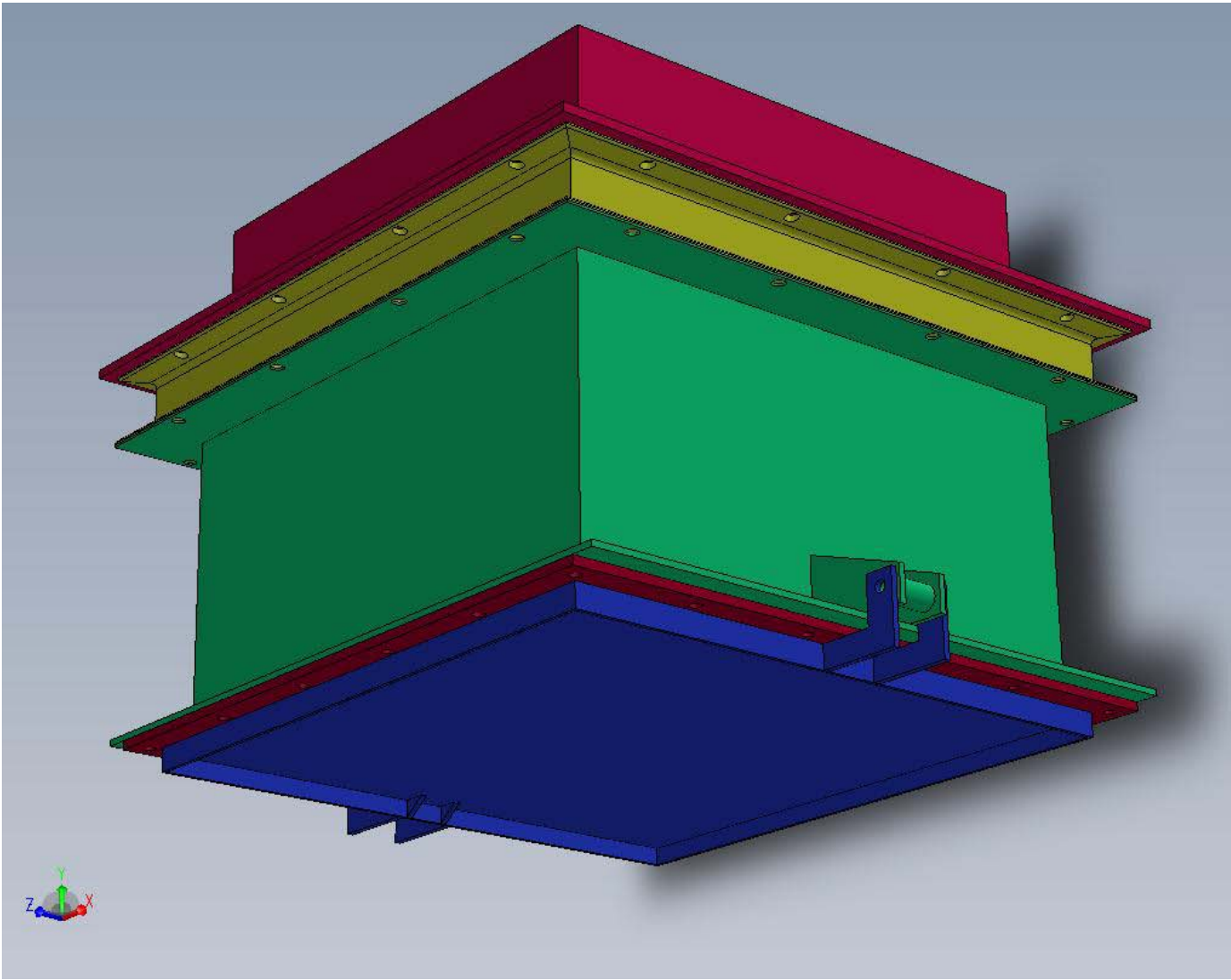
Questions?

Structural Analysis on Filter Housing









Assembly Procedure

