

# My Portfolio

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Candidate: Vikram Varadaraajan (Vik)

<https://patents.google.com/patent/WO2020176645A1>

My design on the cover of journal of thermal spray

Fig 1



Mohanty, P. S., Roche, A. D., Guduru, R. K., & Varadaraajan, V. (2010). Ultrafine particulate dispersed high-temperature coatings by hybrid spray process. *Journal of thermal spray technology*, 19(1-2), 484-494.

Fig 3

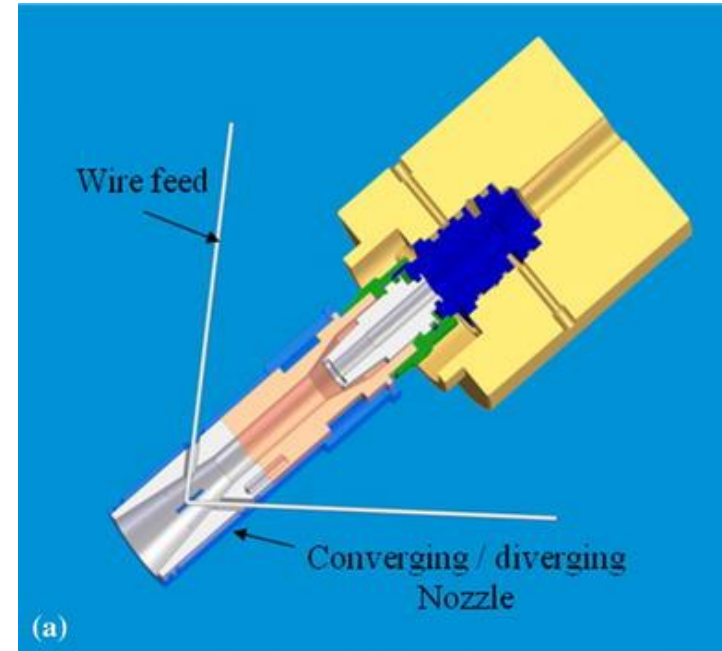
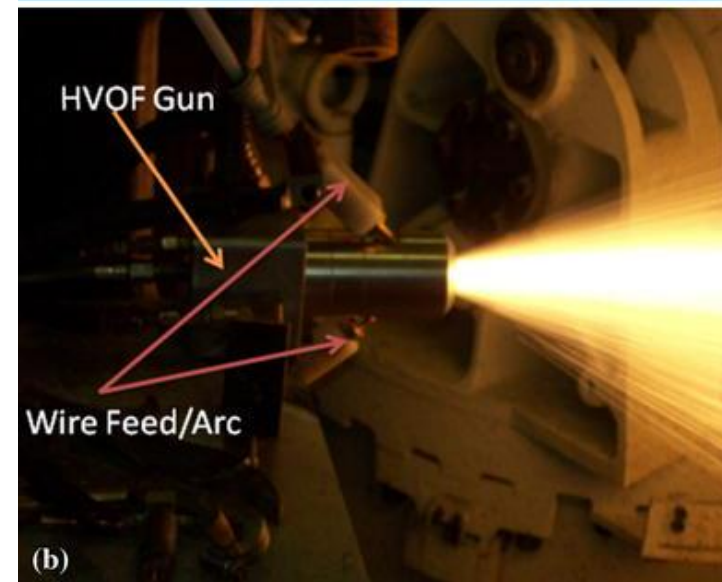


Fig 2



I designed and machined this assembly at UofM Provides wear resistant electrical contact (200A) while electrically isolating it from body of the spray nozzle

# CFD analysis

Fig 1

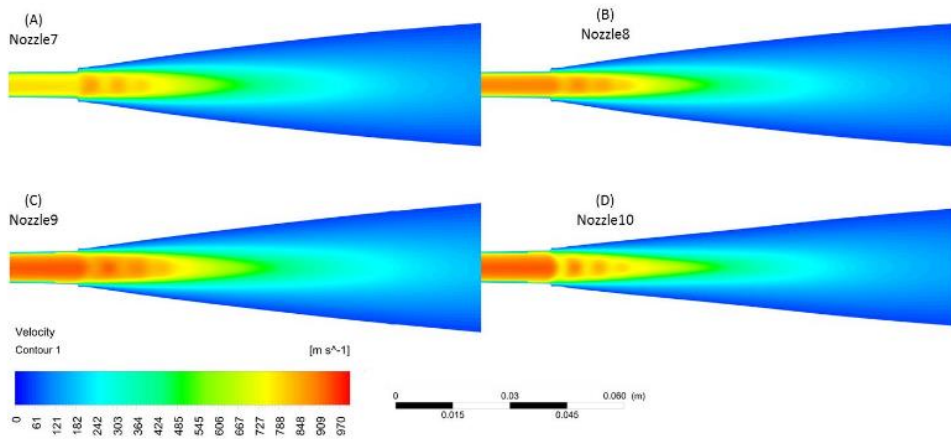


Figure 5: Gas velocity contours (X-Y plane, clipped  $>200\text{ m/s}$ ) at nozzle exit indicating the operating modes of the nozzle from perfectly expanded to overexpanded regimes (A to D)

Varadaraajan, V., & Mohanty, P. (2017). Design and optimization of rectangular cold spray nozzle: radial injection angle, expansion ratio and traverse speed. *Surface and Coatings Technology*, 316, 246-254.

Fig 2

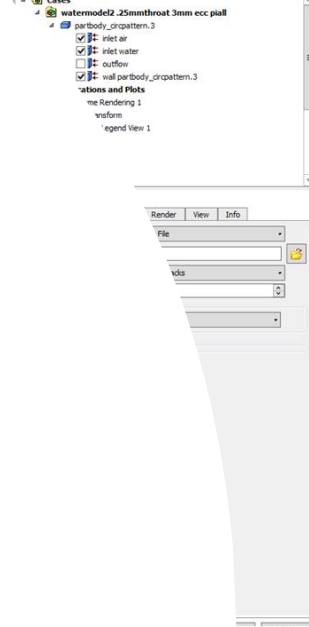
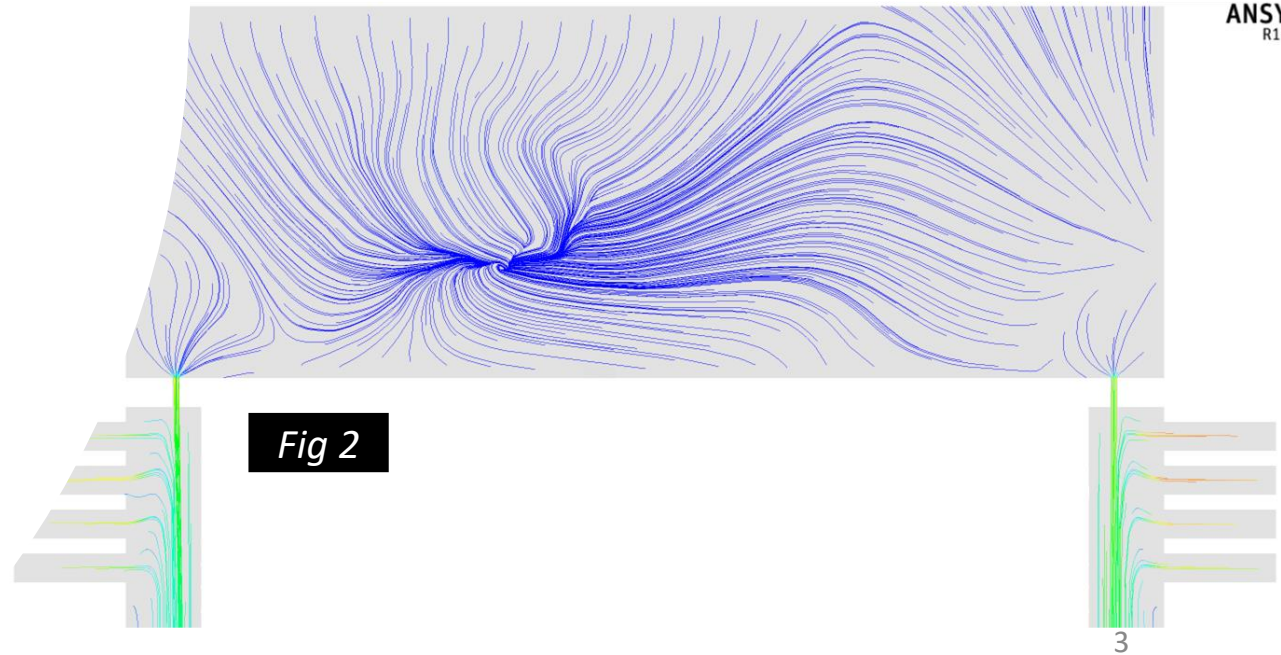
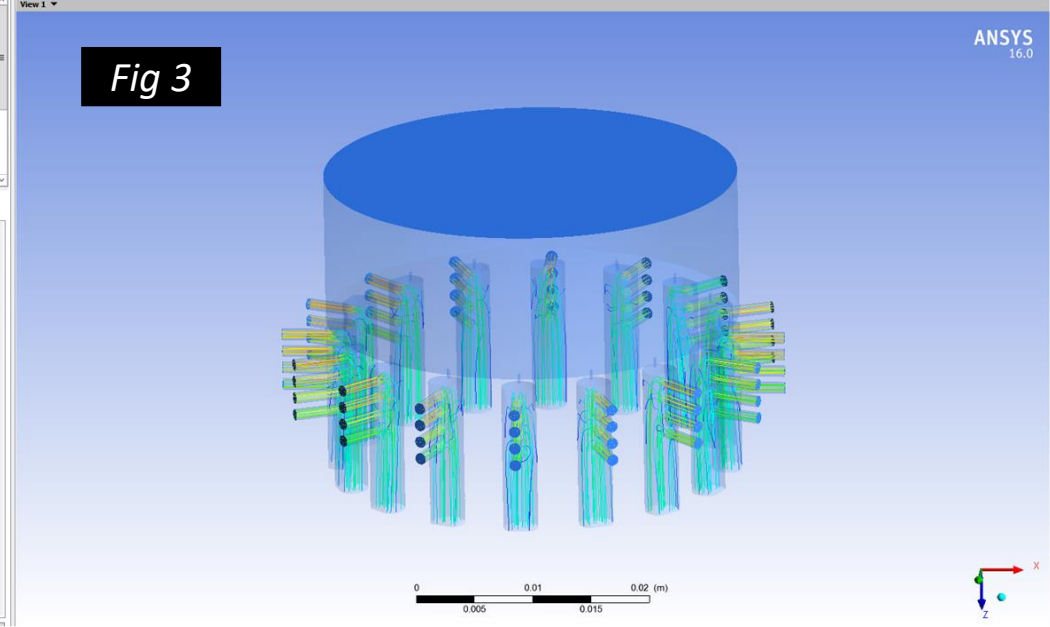


Fig 3



# FEA and CFD

Fig 1

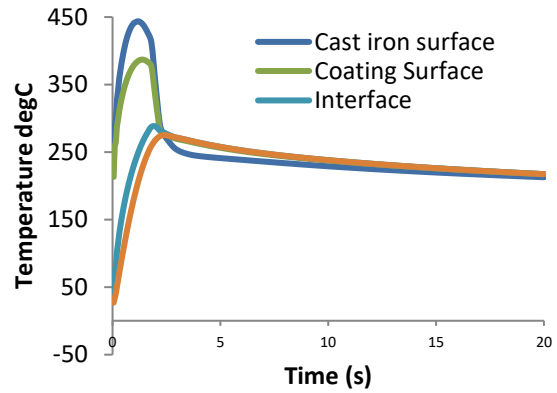


Fig 3

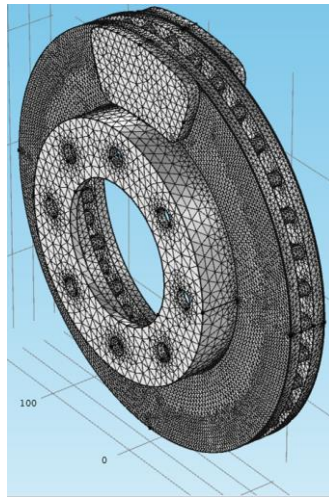


Fig 2

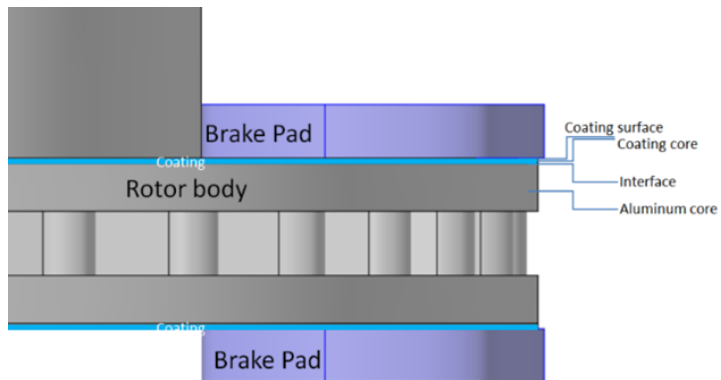


Fig 4

Conjugate heat transfer analysis rotating mesh

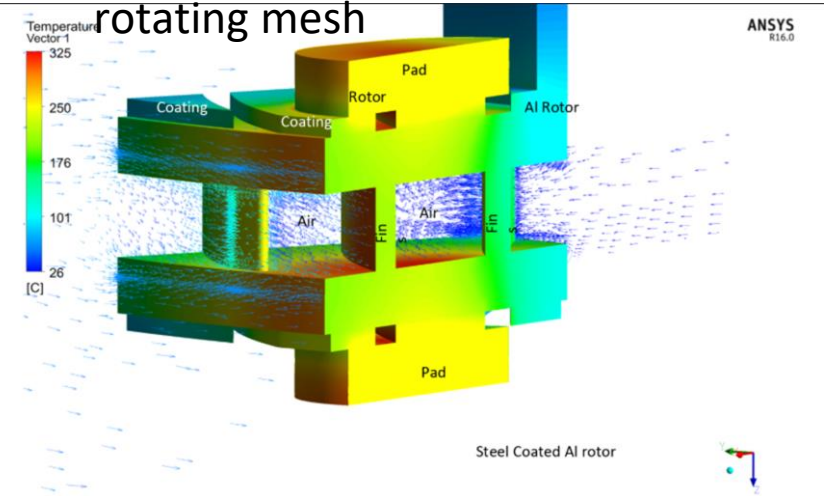
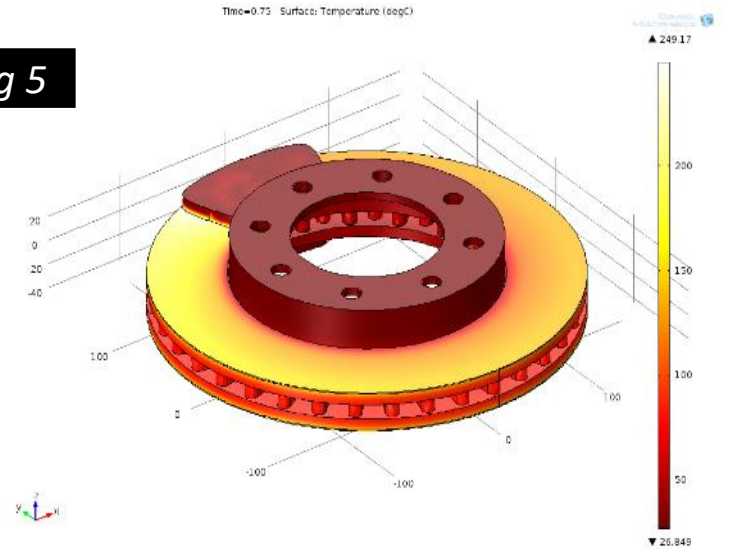
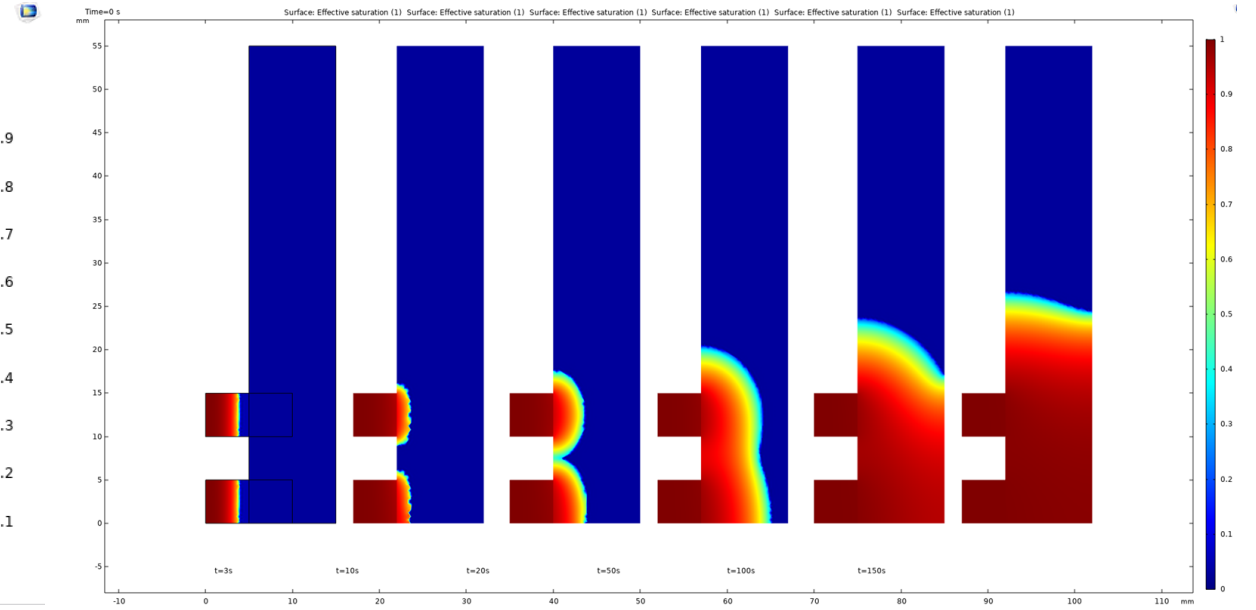
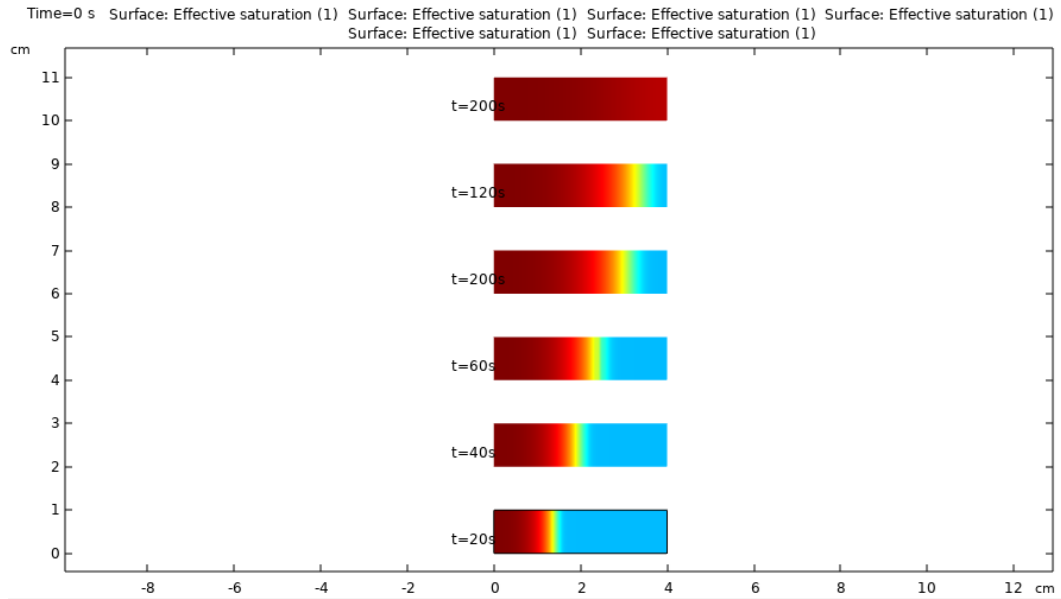


Fig 5





## LFA development



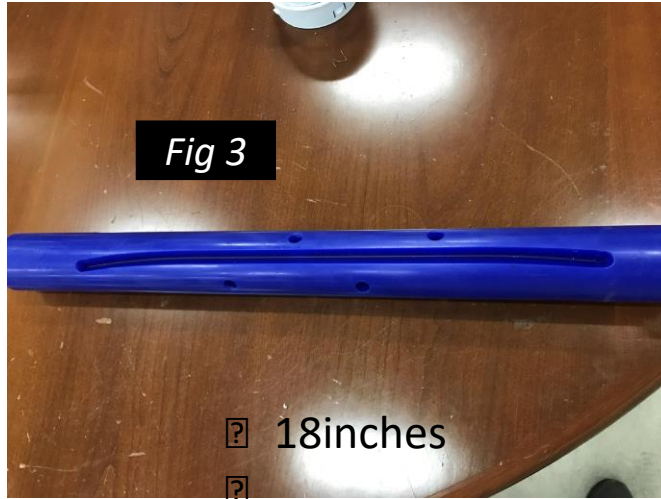
- During lockdown this year, I lent a hand to my company's, bio-engineering team to use their technology in paper based covid test strips – with CFD analysis – to enable membrane material selection and dimensioning
- Shown is progress of the analyte on a paper based membrane over time.

Prototype test cell

Fig 1



CNC machined wax mold for casting



Precision machined component  
Stainless steel, Acrylic, FDM printed



Precision machined prototype spinning at 15K rpm

Fig 5

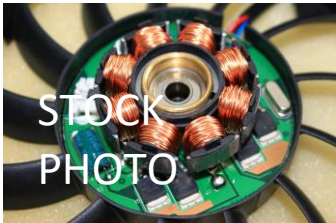
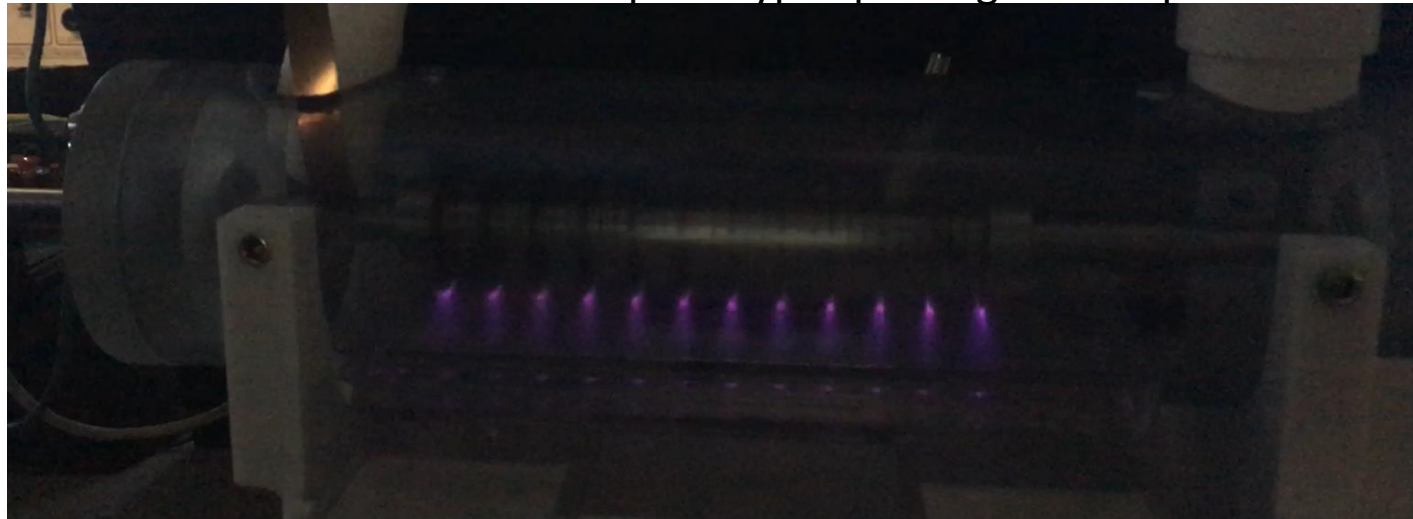
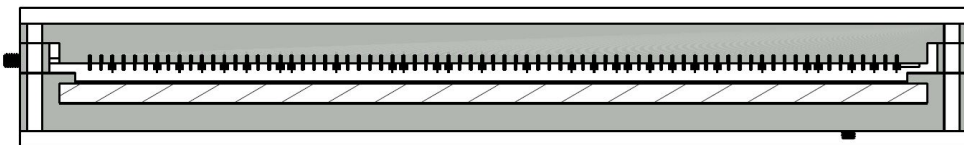
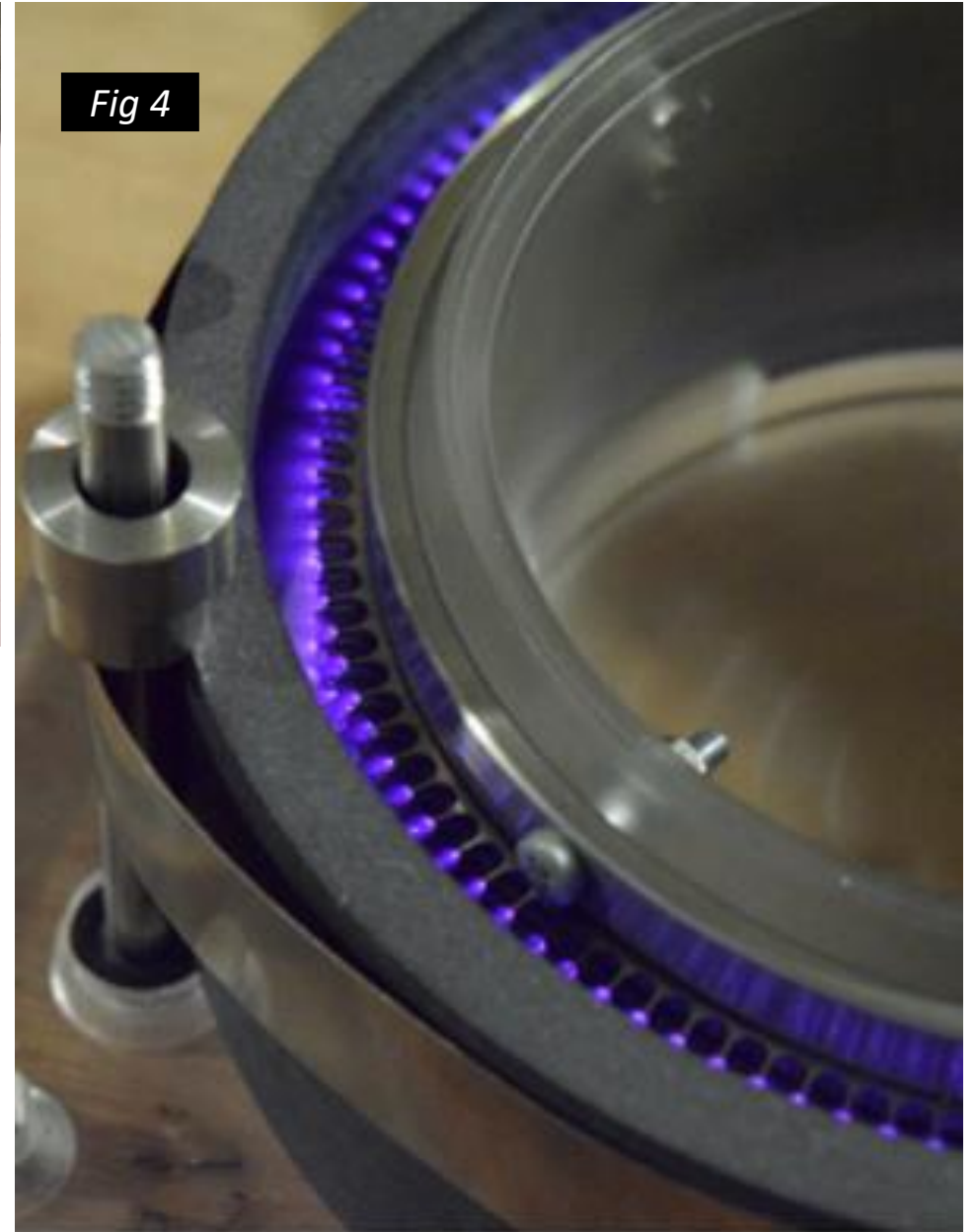
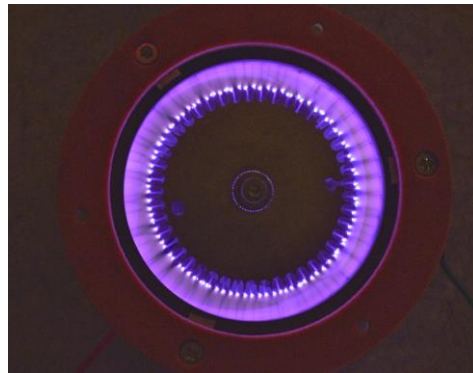
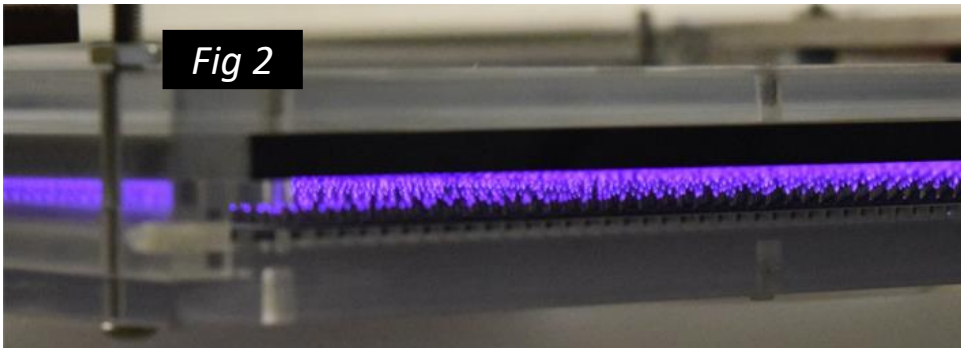
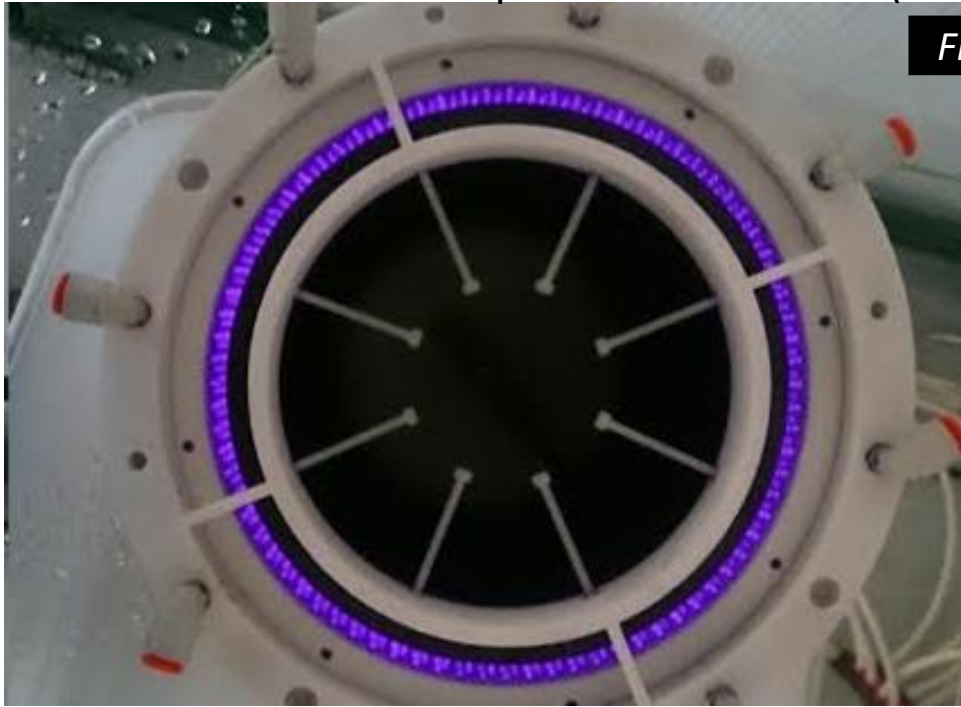


Fig 2

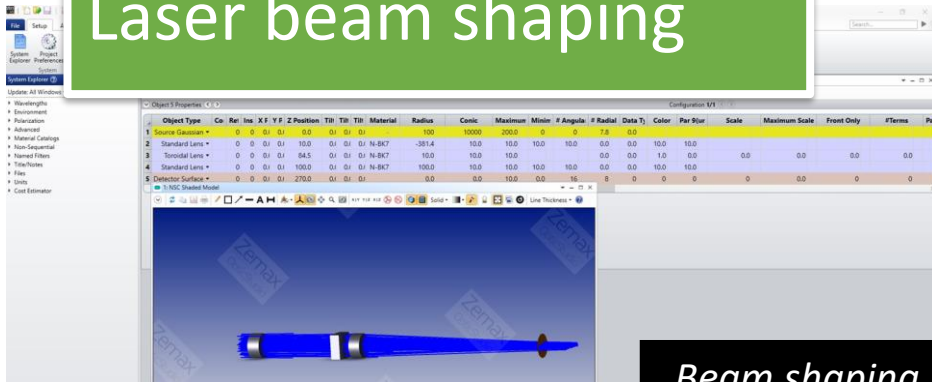
DIY IP69K rating  
I design fixtures to carefully disassemble components to apply conformal coating for waterproofing

# 3d printed bezel chuck (self centering)

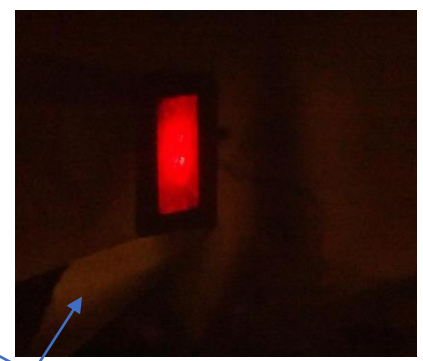
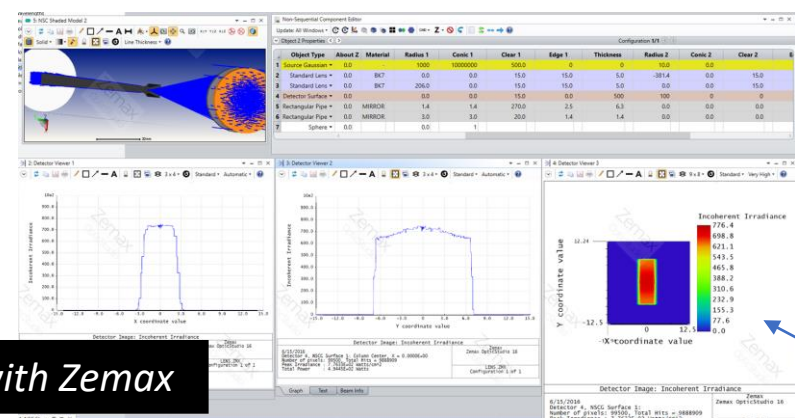


Made designs for precision machining and assembly

# Laser beam shaping



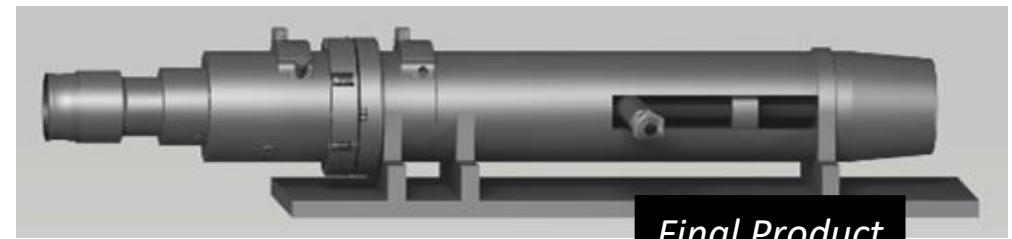
*Beam shaping with Zemax*



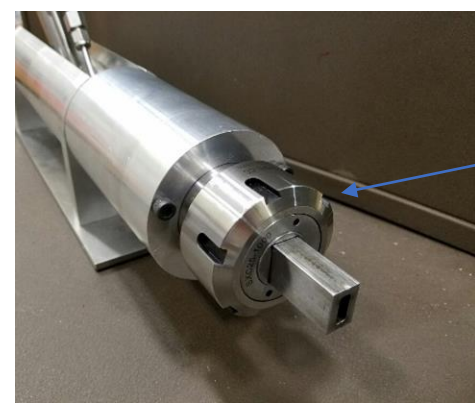
Simulation vs actual



*Optical assembly prior to anodization*



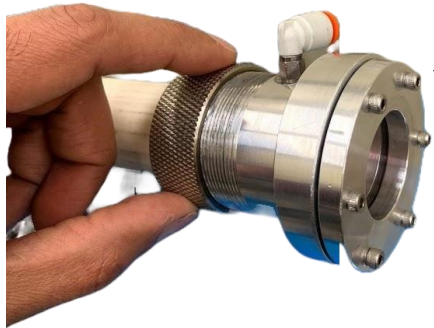
*Final Product*



*Designed a ER40 collet style system to align a rectangular nozzle and laser beam across 12inches*

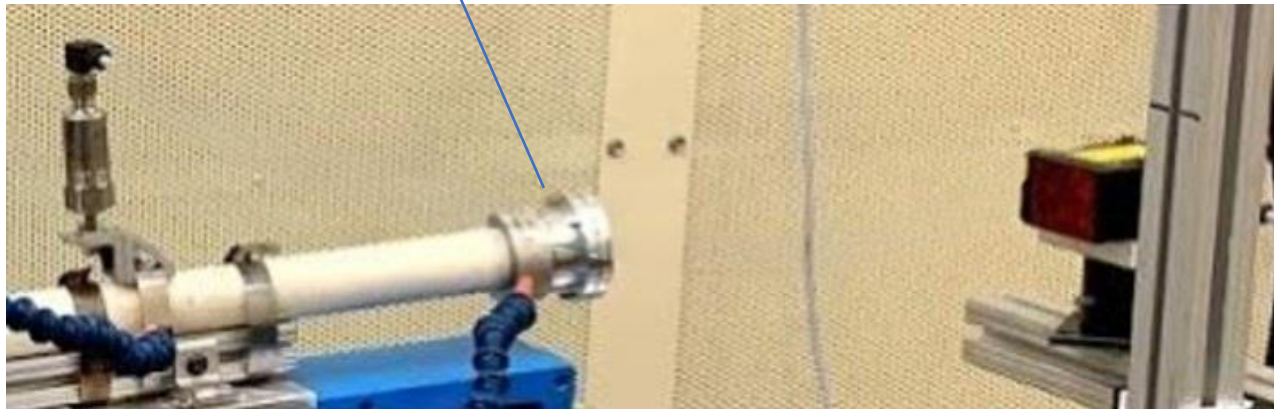


# Optical window design



*AR coated wedged optical window for  
Laser distance sensor*

Application: Determine the location of a crucible in a tube furnace hotspot for an automated push-pull furnace



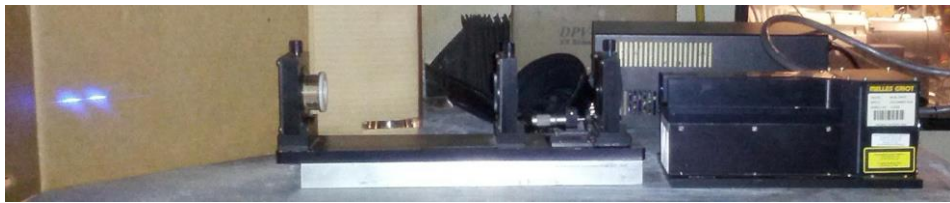
*Serviceable  
AR coated wedged optical window  
500psi, 600degC*



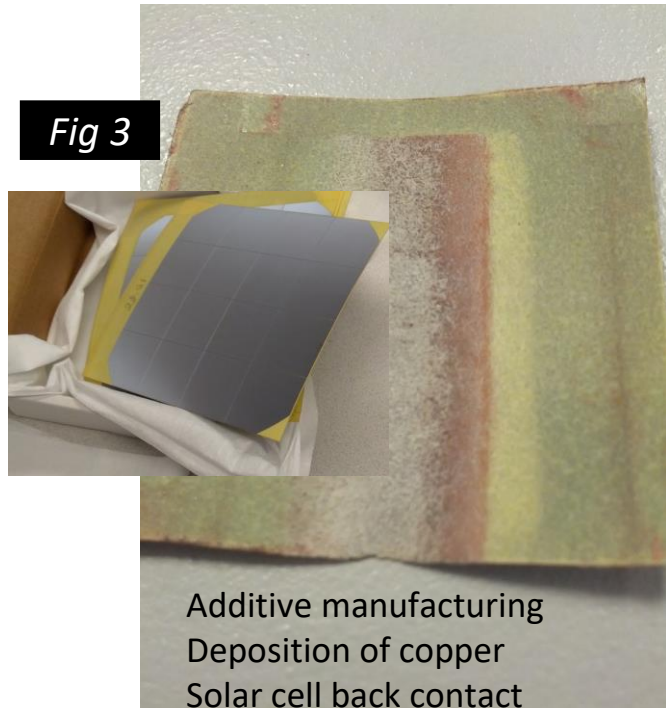
Troubleshooting a diode laser **Fig 1**



Developed a light sheet for PIV  
Zemax, Edmunds and Thorlabs **Fig 2**



\*This is a dual beam laser



Bond tensile testing using FM!000 epoxy



Fig 1

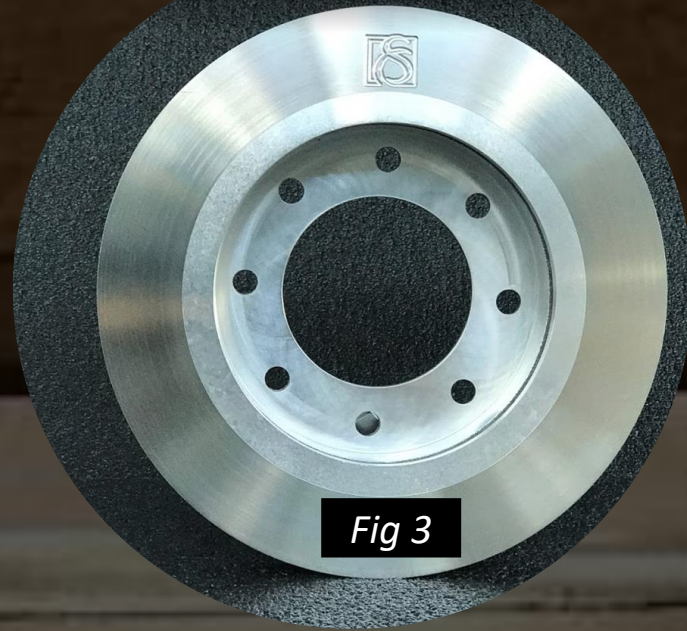


Fig 3

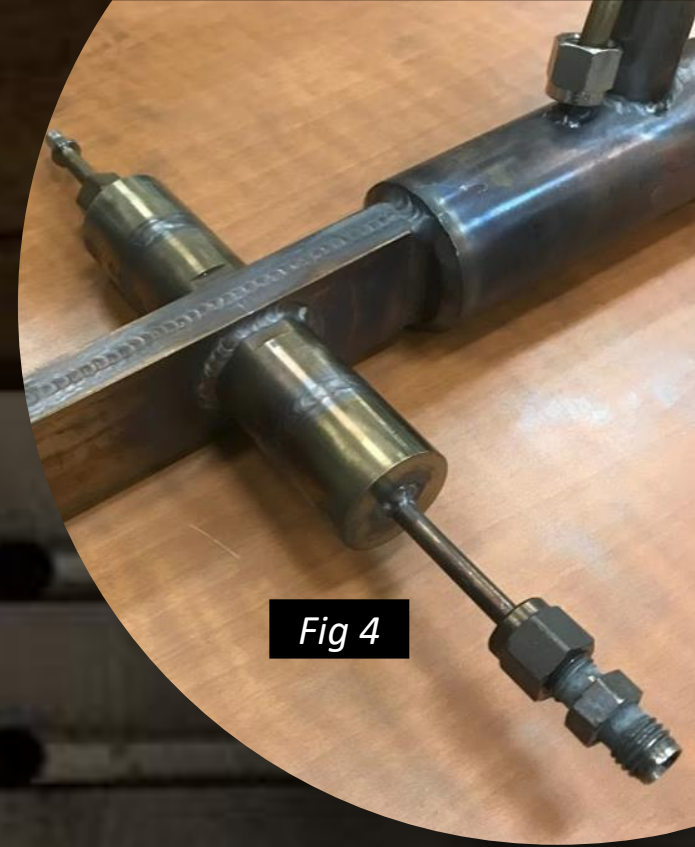


Fig 4

Fig 2

Designing complex tool heads  
for coating deposition

# Built closed looped PLC control systems



Fig 1



Fig 2

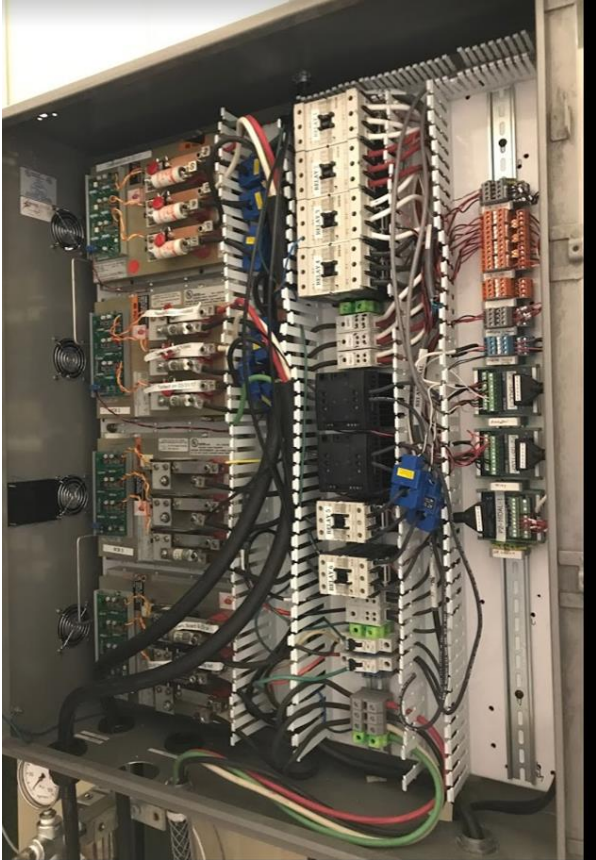


Fig 3



Fig 4 HMI programming



Fig 1

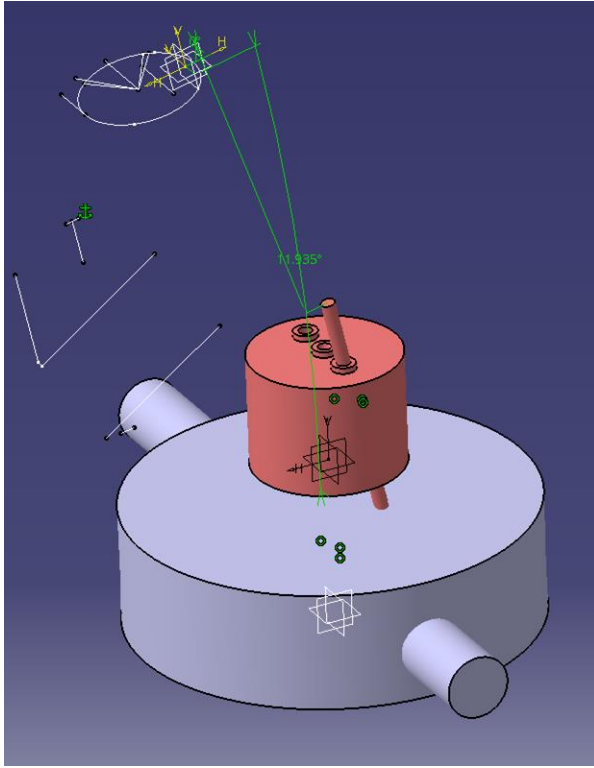


Fig 2

Angle	X	Y	
8.656	0.494305	-0.322	0.321995
16.935	0.478318	0	
8.656	0.494305	0.322	
16.935	0.478318	0	0
10.391	0.4918	0.267	34.317
10.391	0.4918	-0.267	34.317
Tilt	X	Y	Rot
16.935	0.464	0	0
10.391	0.659	0.267	34.317
10.391	0.659	-0.267	(-)34.317
Tilt	X	Y	Rot
16.935	0.464	0	0
10.391	0.659	0.267	33.817 CW
10.391	0.659	-0.267	67.754 CCW

Fig 3

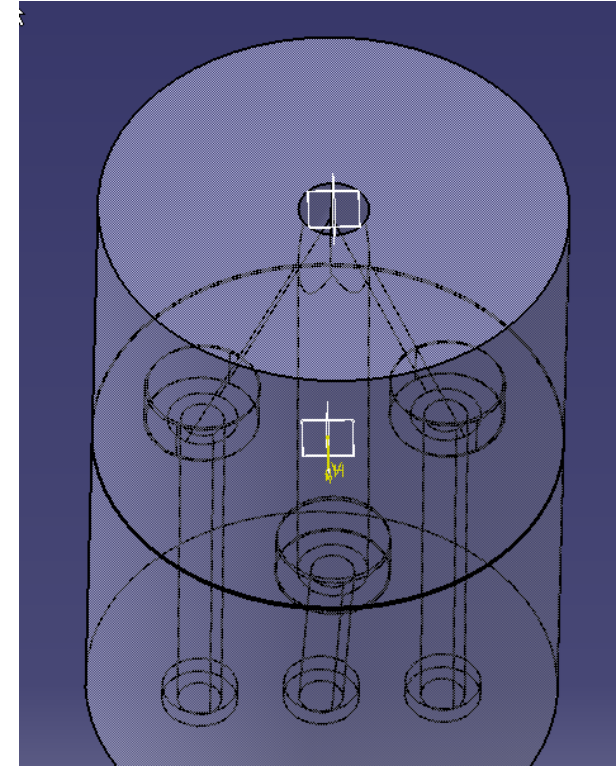


Fig 4

Splitter design  
to solve hard to weld  
areas

- Machined using manual calculation

Designed precision 3 axis gantry system for piezo electric and  $\mu$  valves based inkjet printing. (Aerrotek linear motors 200mm/s)

Fig 1

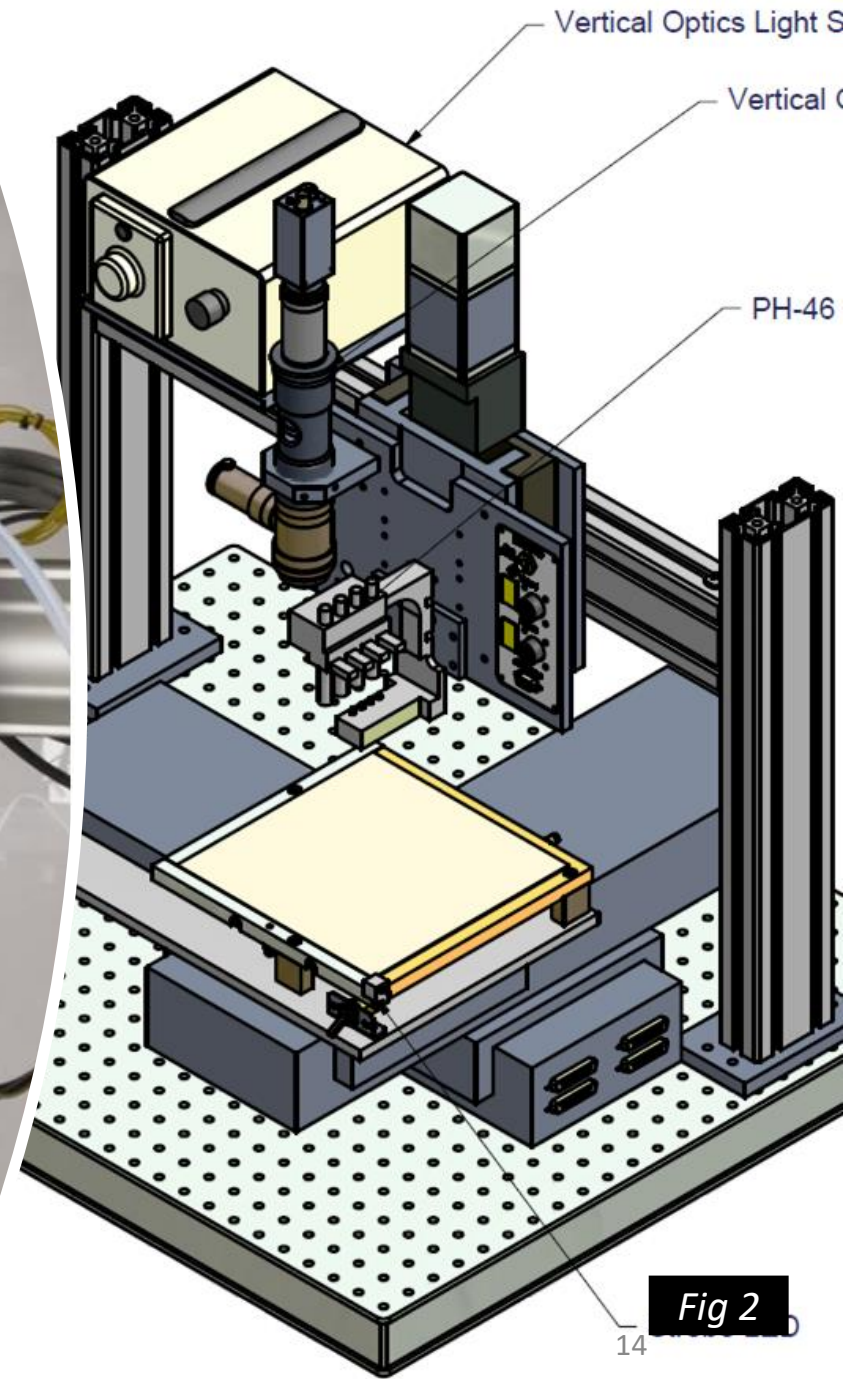


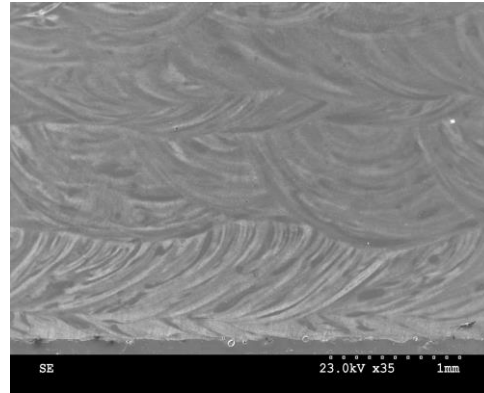
Fig 2

# Materials

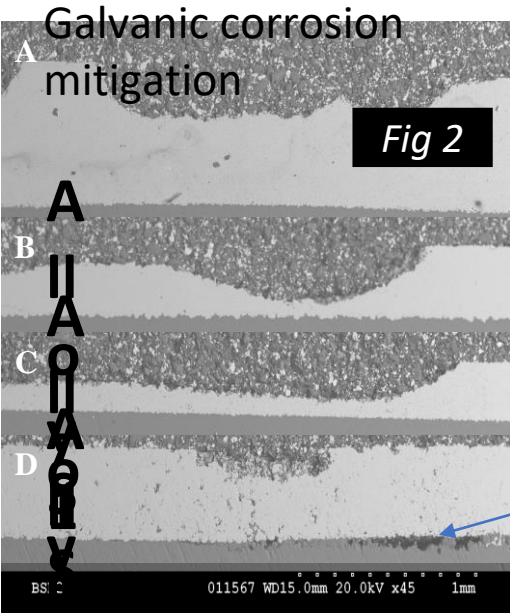
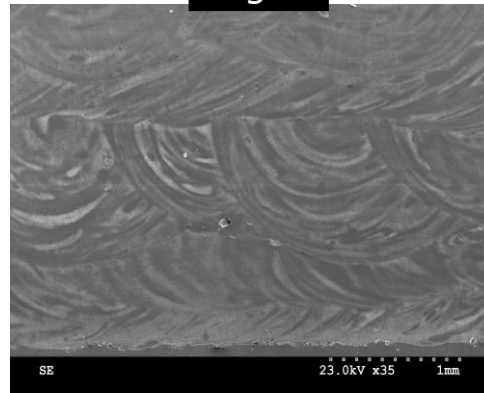
**Fig 1**



Laser clad microstructure with nital etchant



**Fig 3**



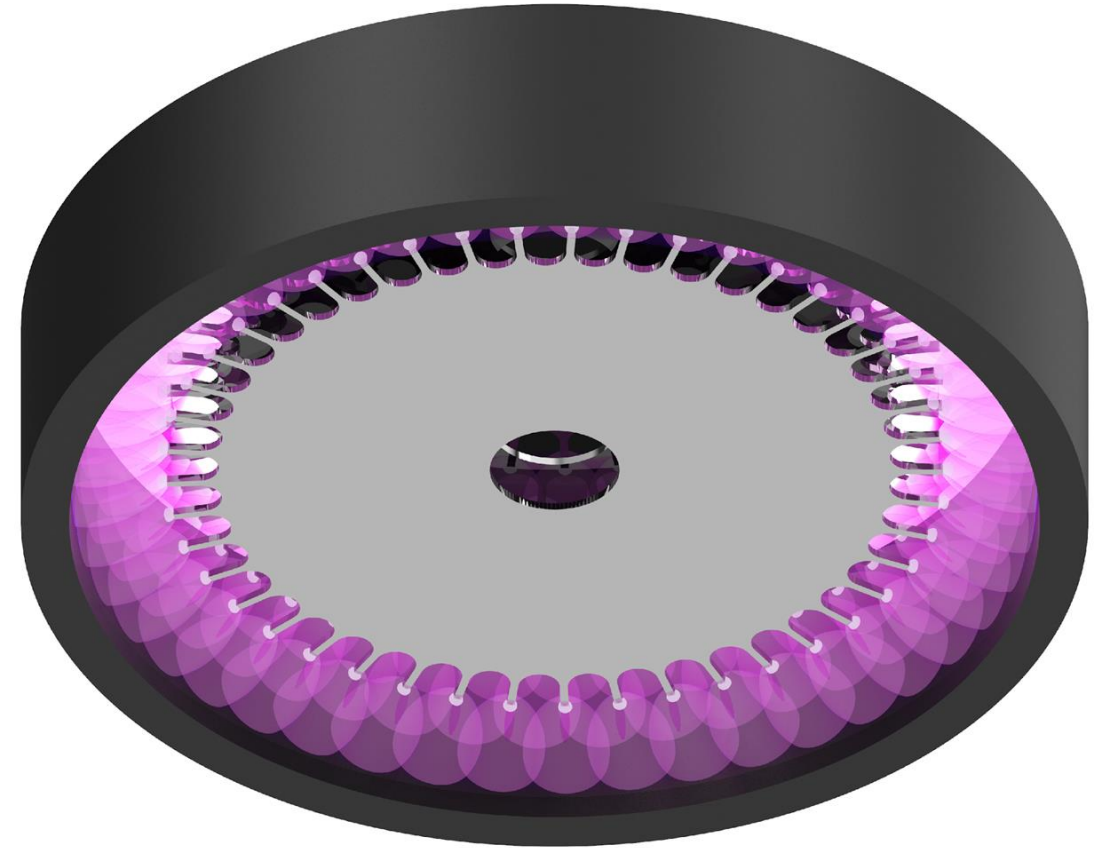
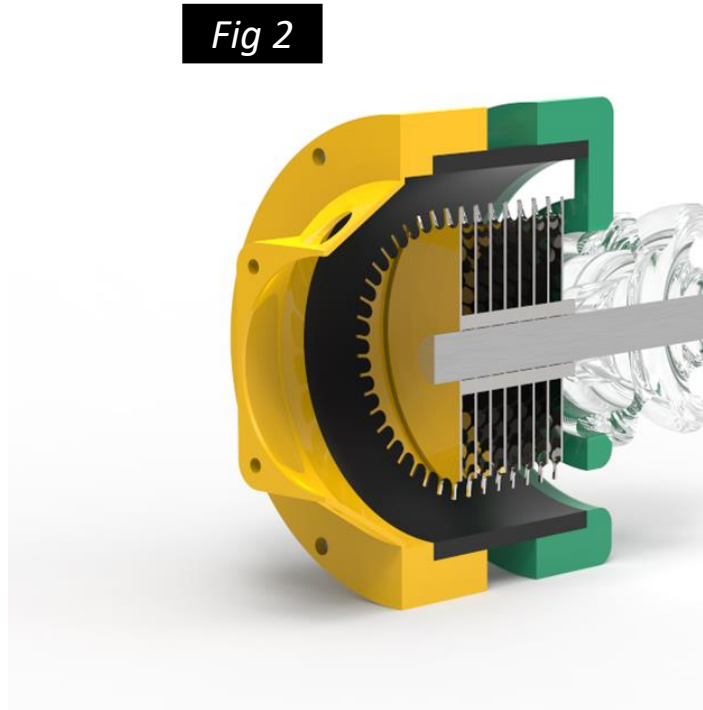
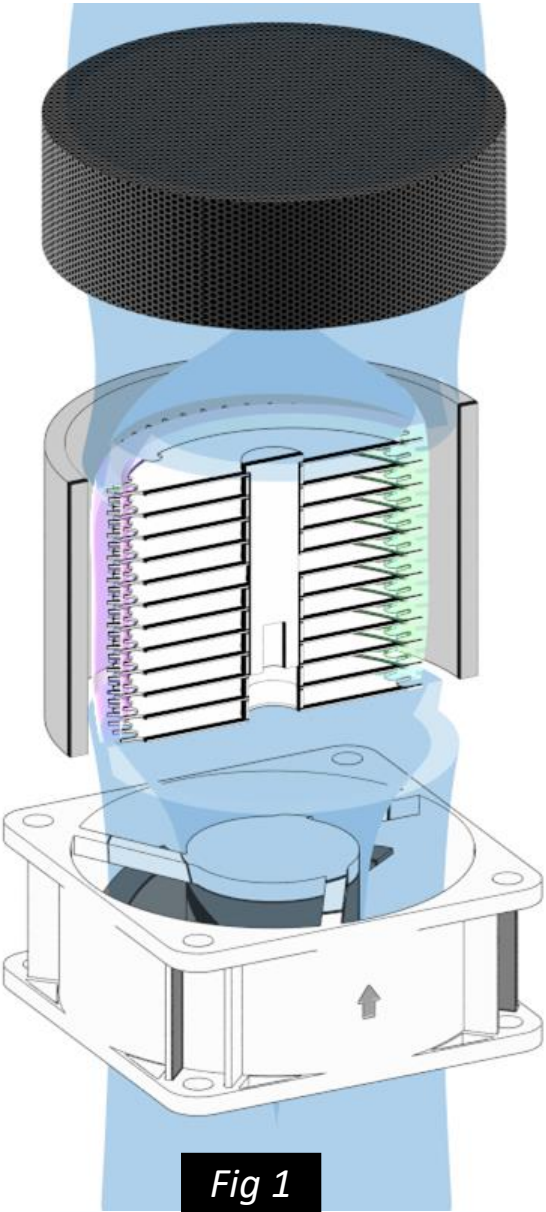
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**Fig 4**

3D metal printer at U of M  
My responsibilities included maintaining the machine, servos, drivers, laser system

# CAD model Rendering



Creating animation



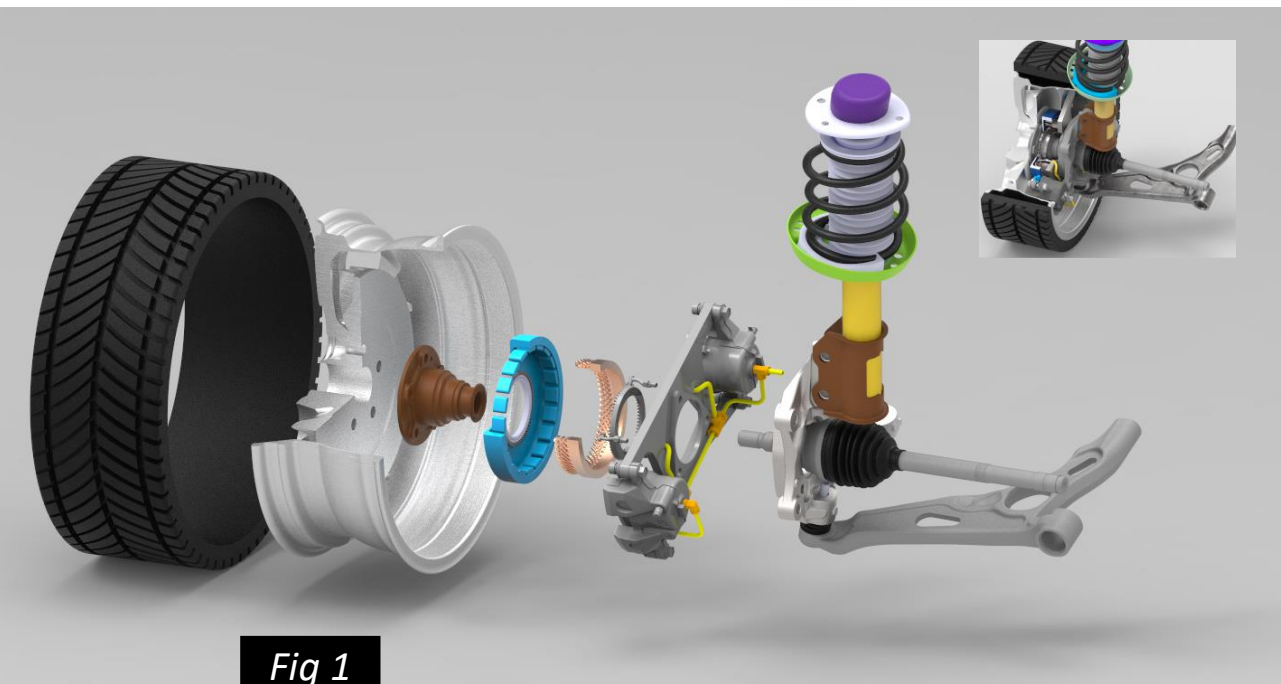


Fig 1

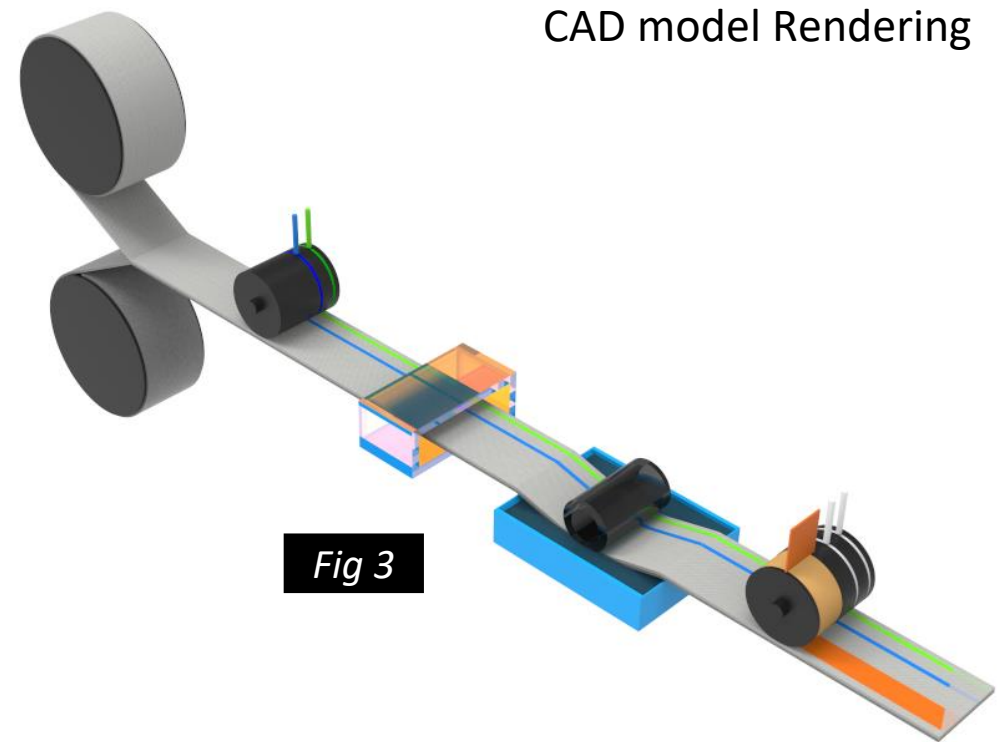


Fig 3

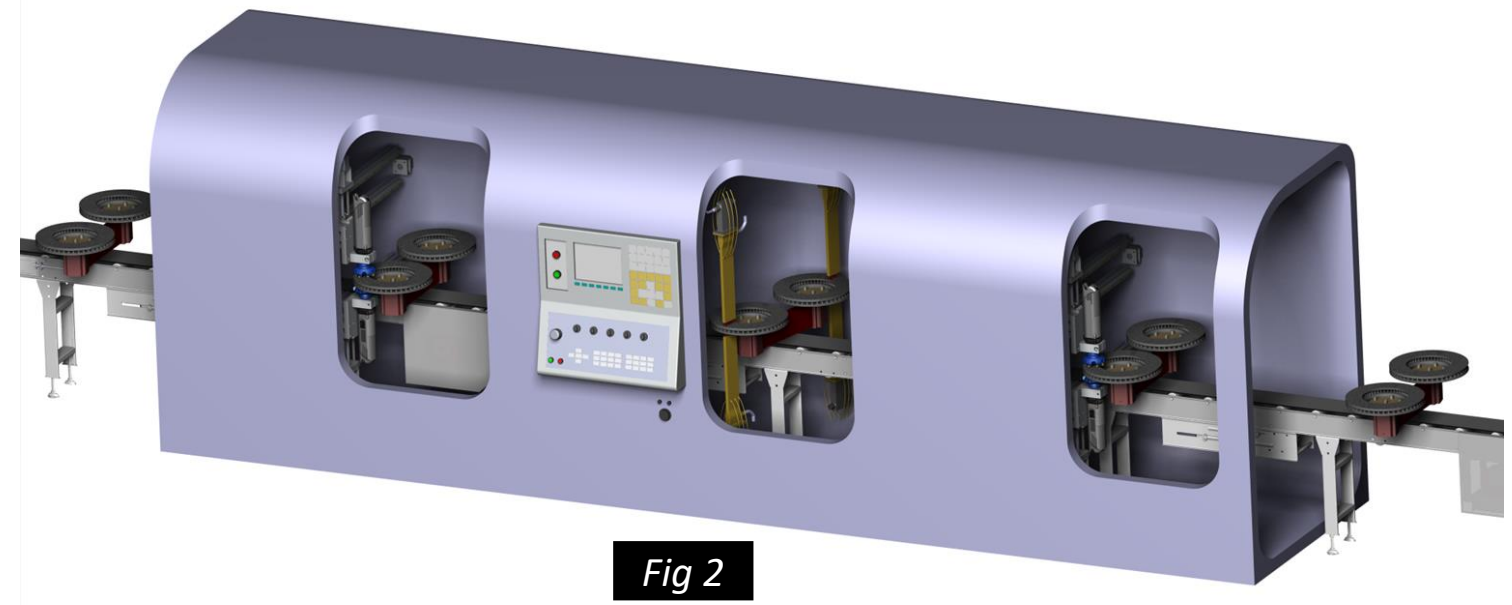


Fig 2

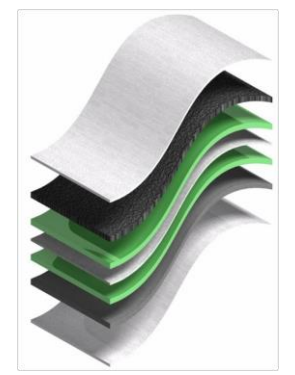
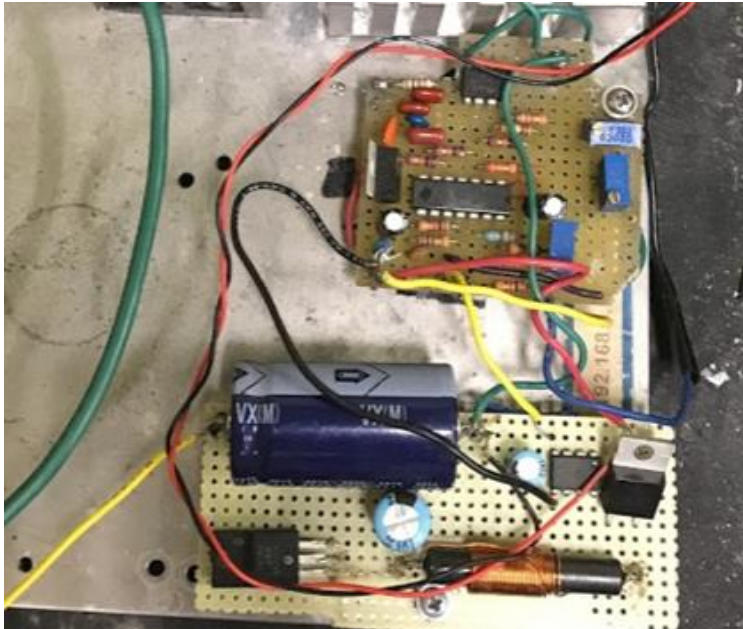


Fig 4

Rendered using KeyShot

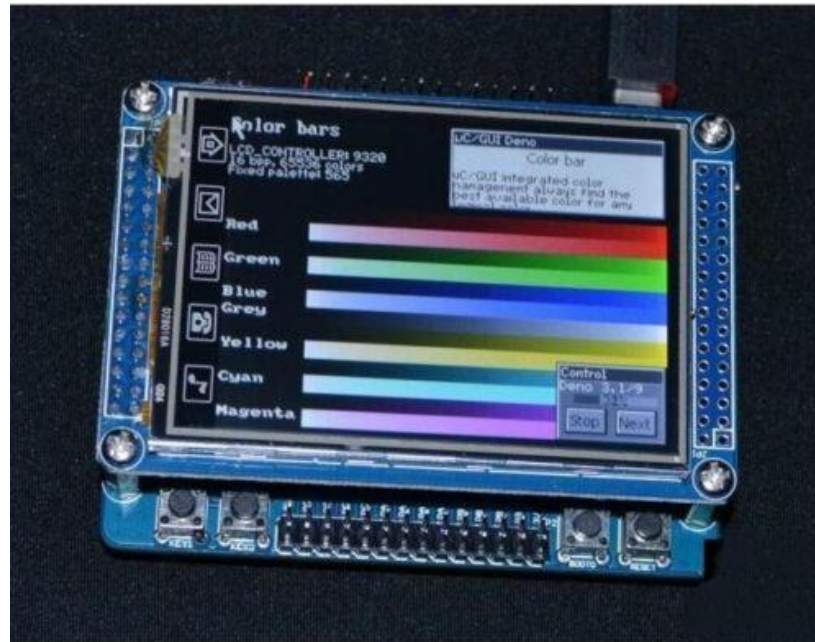
# Hobby-tronics

Fig 1



Soldering a buck converter circuit  
Mosfet is not shown

Fig 2



Low-cost (eBay) Programmable  
touchscreen device C++  
GPIO, Analog, RS232 etc.

Fig 3



Similar handy device, use it as a programmable  
touchscreen device to send/read analog data from  
sensors, data log to  $\mu$ SD, oscilloscope etc.



Control arm bushing replacement

**Fig 1**

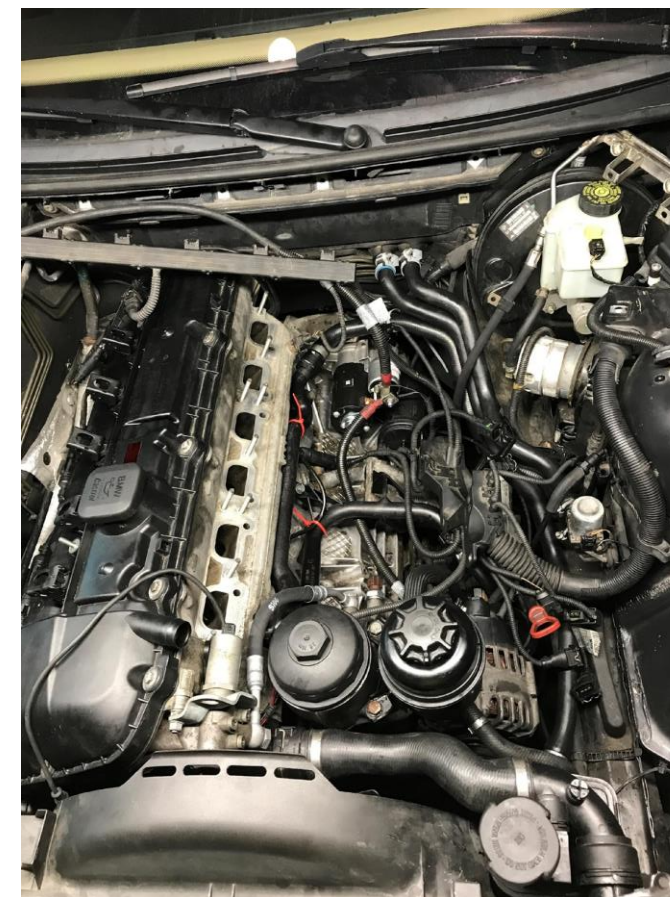


**Fig 2**



**Fig 3**

My E46 project car

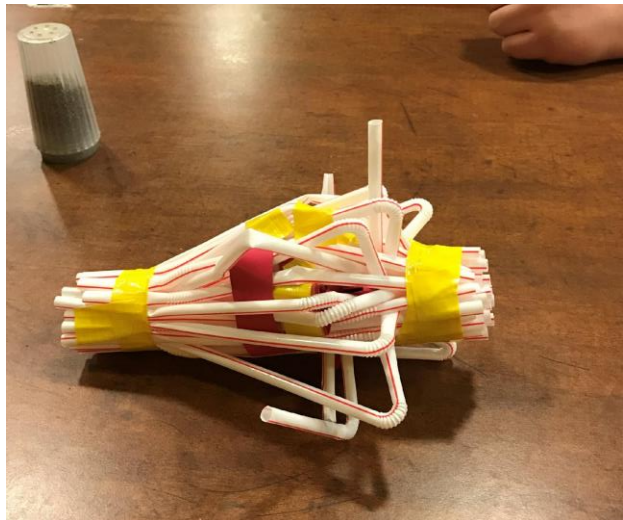


**Fig 4** Intake manifold overhaul



Inspired art work *"No fitting left behind"*

Thank you!



Egg drop mission specialist  
Are you ready for a challenge 😊