

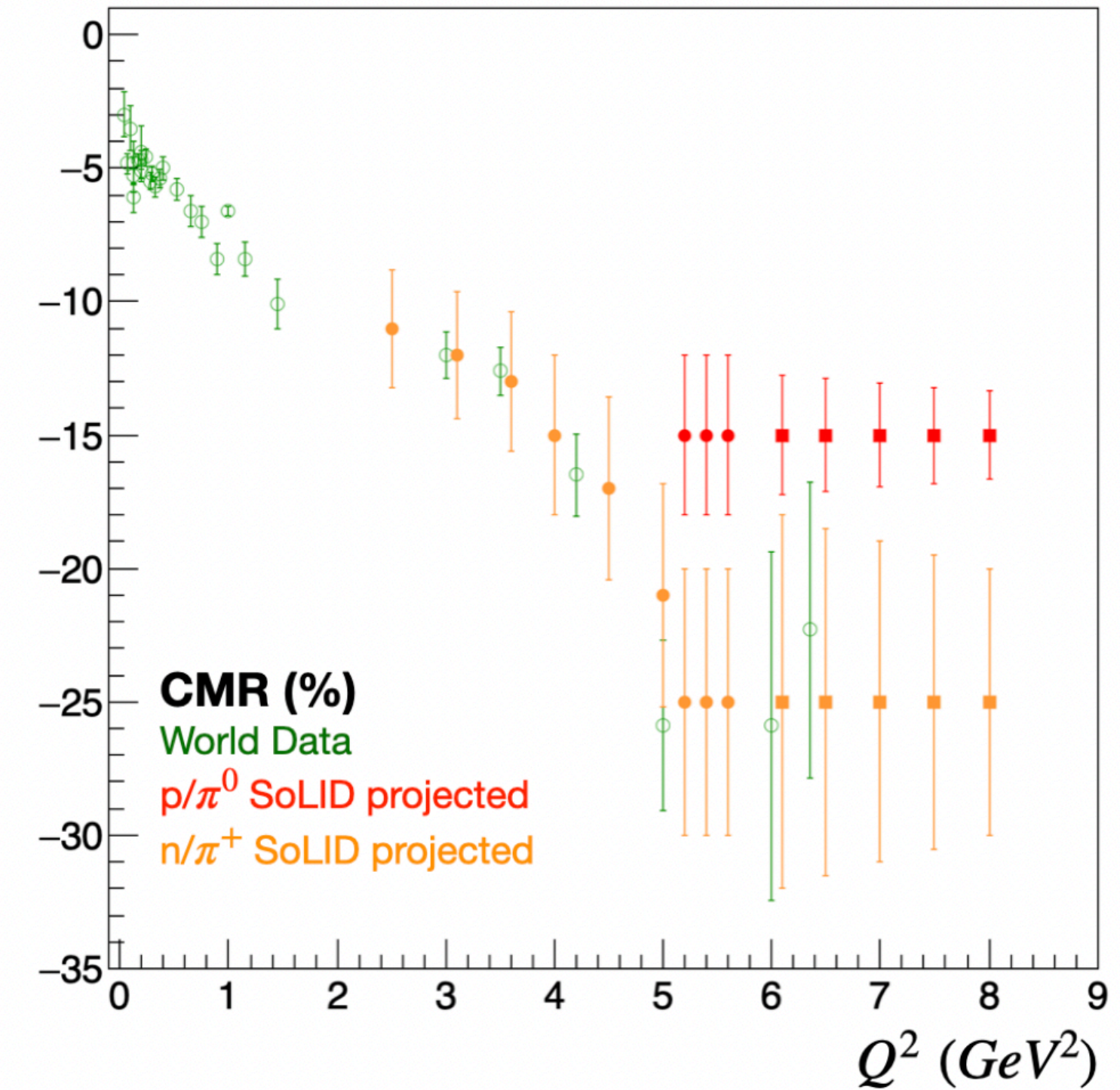
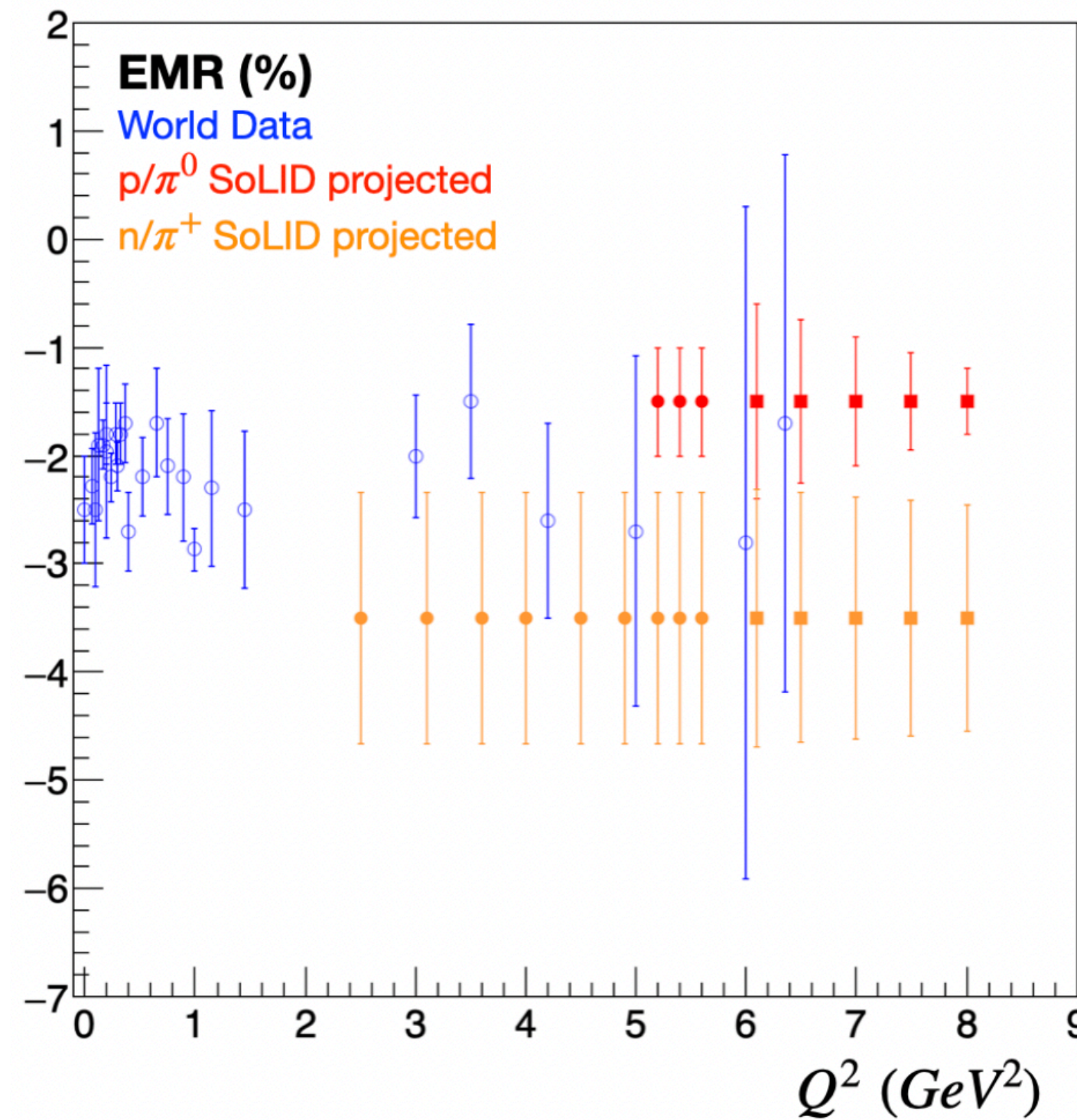
# LGC update+

SoLID collaboration meeting  
December 7-8, 2024

# A LOI was submitted to PAC-51: Measurement of the N to $\Delta$ Transition Form Factors with the SoLID detector

Measure  $H(e, e'\pi^+)n$  and  $H(e, e'p)\pi^0$  parasitically\* during  $J/\psi$  running with SoLID.

\*Would require a more loose trigger



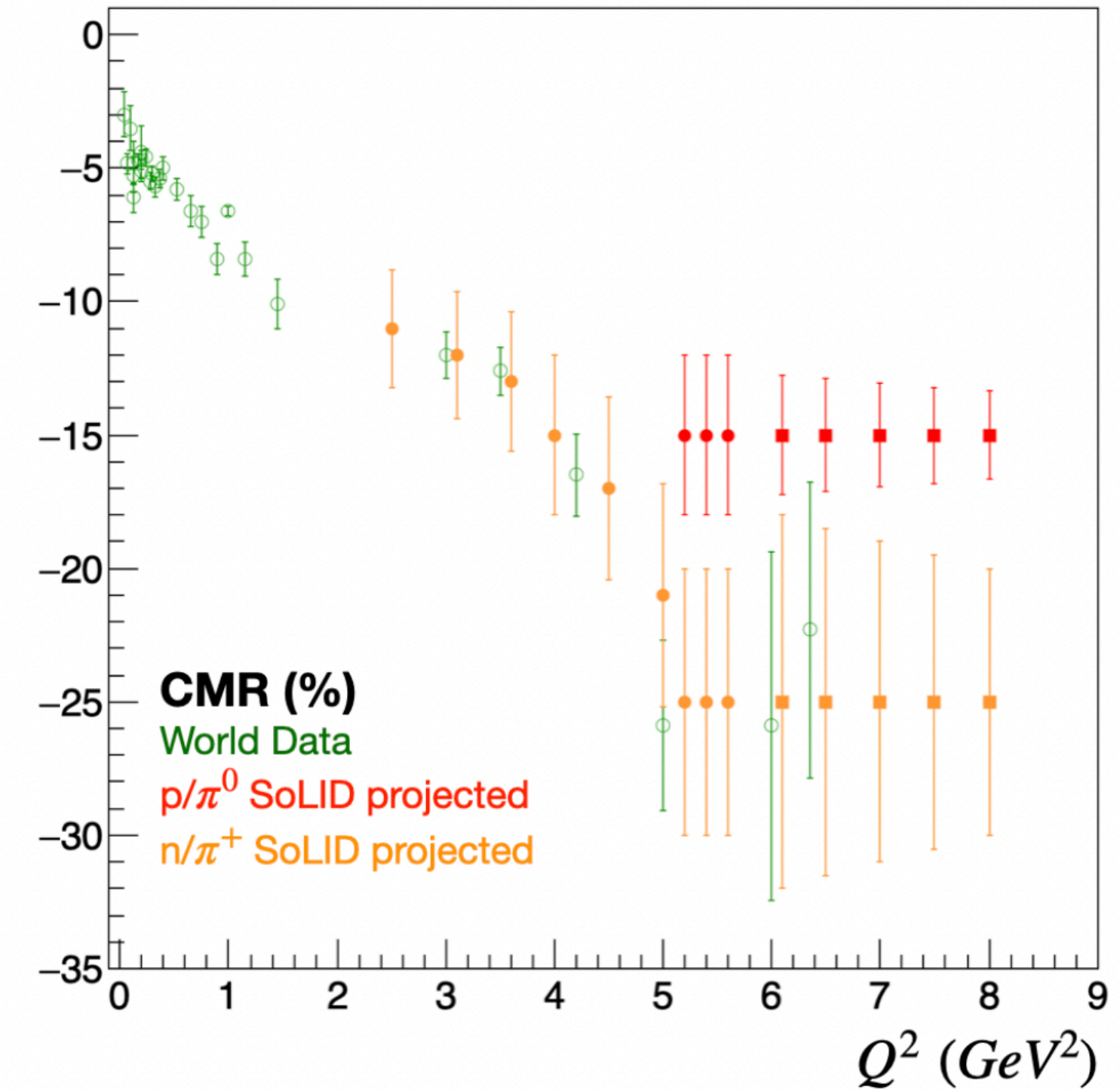
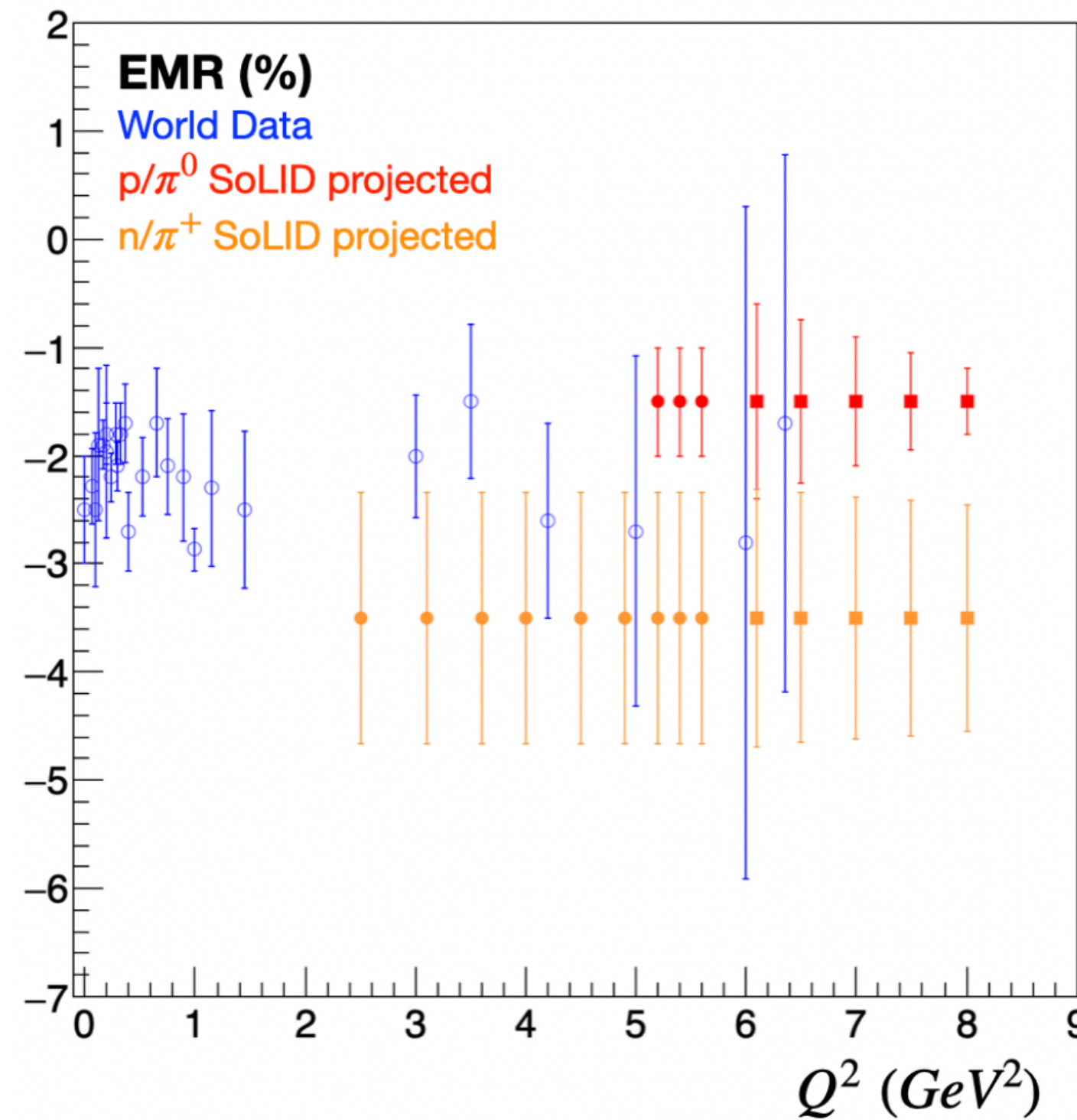
[Summary of comments from SoLID collaboration review:](#)

- An exploration of additional comparisons beyond pQCD predictions at large  $Q^2$ , like direct lattice comparisons or even TFF GPD extractions.
- A better exploration of the data that will be available with the CLAS12 program, and the expected precision of EMR and CMR extractions from that program.
- Explore the benefits of a dedicated "N-Delta" setup with the SoLID detector, and what advantages might be gained by de-coupling the experimental settings from the  $J/\psi$  settings.
- Perform a more careful study of possible background channels and how they may radiate into the acceptance.
- For the largest  $Q^2$  available, rate estimates become more critical. Explore other models for pion electroproduction at large  $Q^2$  and compare extrapolations from MAID or SAID.

# A LOI was submitted to PAC-51: Measurement of the N to $\Delta$ Transition Form Factors with the SoLID detector

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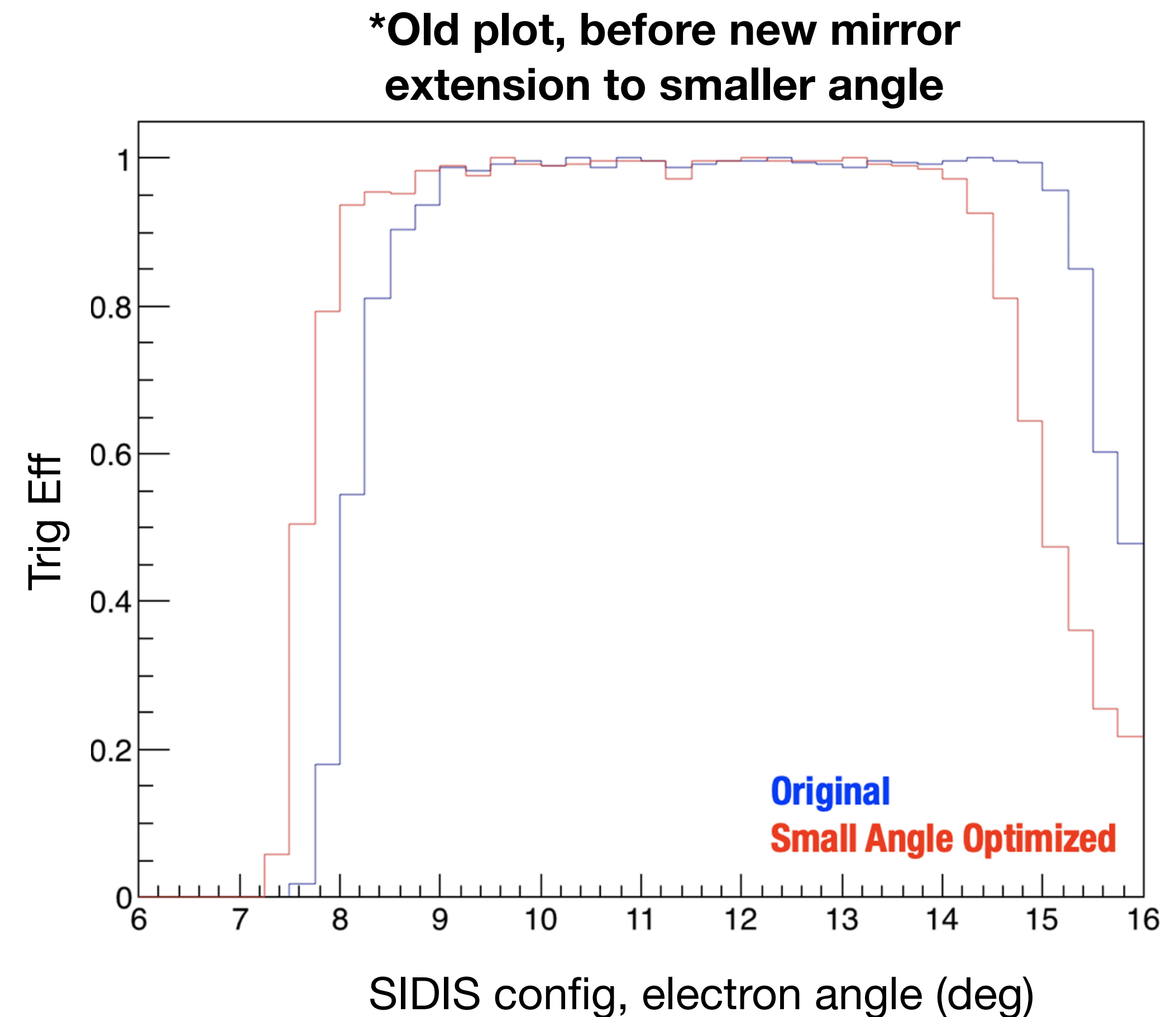
**Issues:** The TAC theory report, while supportive of the group submitting a full proposal, highlights the importance of refining the physics case. The PAC concurs with this assessment. The measurement promises to run “parasitically”, but it must still be proved that the additional trigger will not have an impact on data taking of E12-12-006. Additional action items have been indicated by the SoLID collaboration that require solution.

Summary of comments from PAC review:

**Summary:** The PAC finds that several open issues need clarification. The proponents should argue what will be learned from the  $N \rightarrow \Delta$  transition at high  $Q^2$  beyond what has been already learnt from the nucleon from factors in that kinematic region. To strengthen the physics case, the group may want to enhance collaboration with theory groups. Additionally, certain feasibility and technical concerns raised by the SoLID collaboration should be carefully addressed. The PAC recommends the proponents to proceed to a full proposal only after careful consideration of these issues.

## Optical design of the LGC mirrors is unchanged for 1 year+

- Some notes:
  - **Focusing is optimized for mid-angle acceptance**
    - Small/large angle acceptance could also be optimized at the expense of the other side.
      - This requires translational adjustment of the mirrors and ROC changes.
      - With a fixed ROC, some translational adjustment could focus better at small/large angle, but this is prohibitively complex for mounting design/engineering, especially considering the adjustable mirror angle.
        - Only very small gains are achievable by adjusting mirror angle alone.
  - **Bottom line: angular acceptance optimization will become fixed once the LGC is constructed.**



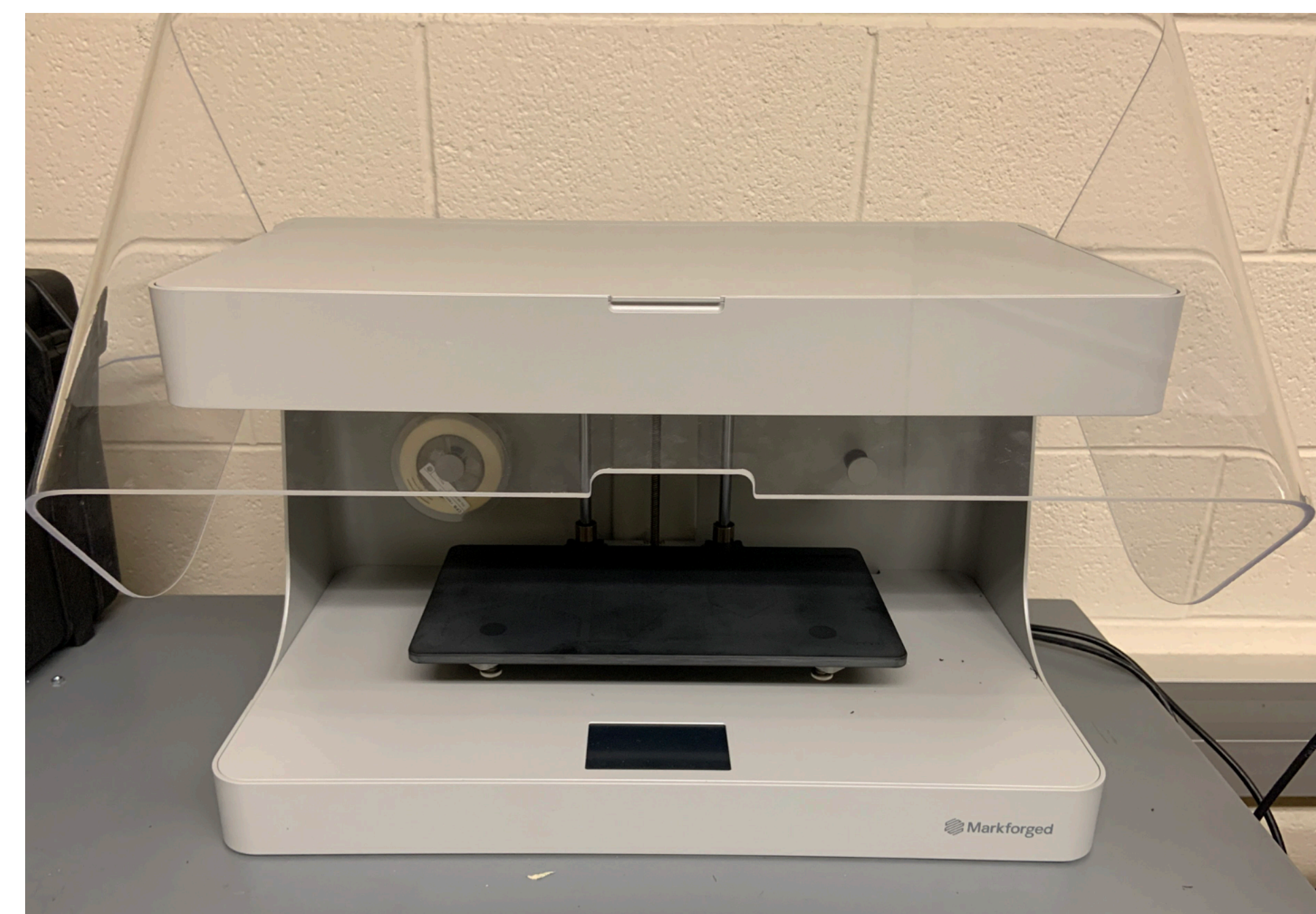
## Pre-R&D updates on mirror fabrication

- Pre-fabricated blanks:
  - As proof-of-principle and a basis for development, half-size blanks have been ordered from Allred Inc.
    - Blanks will be tested for:
      - Geometric specification tolerances
      - Deformation tolerances
      - Lexan application
    - Items are waiting for me now at NMSU

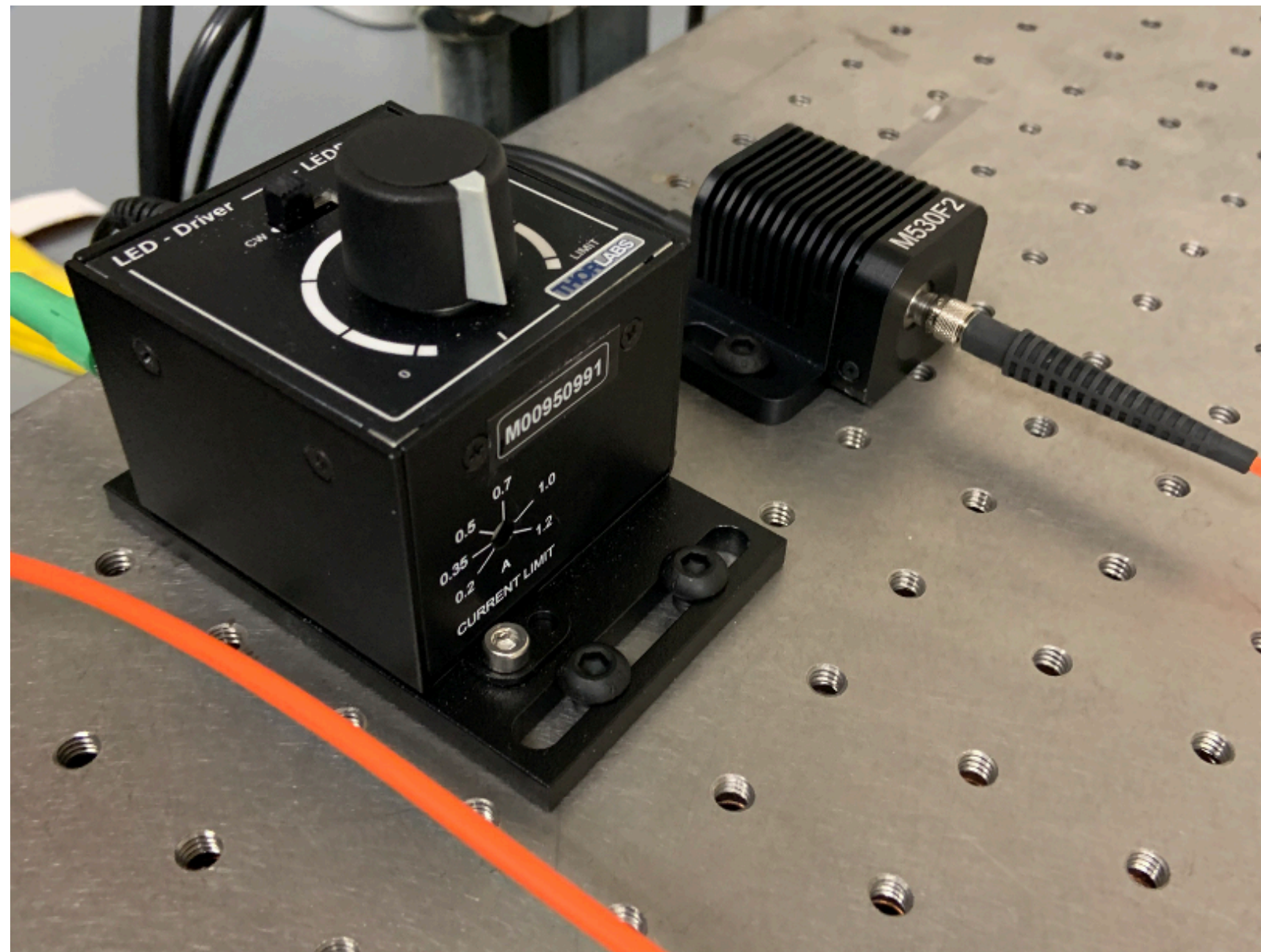


## Pre-R&D updates on mirror fabrication

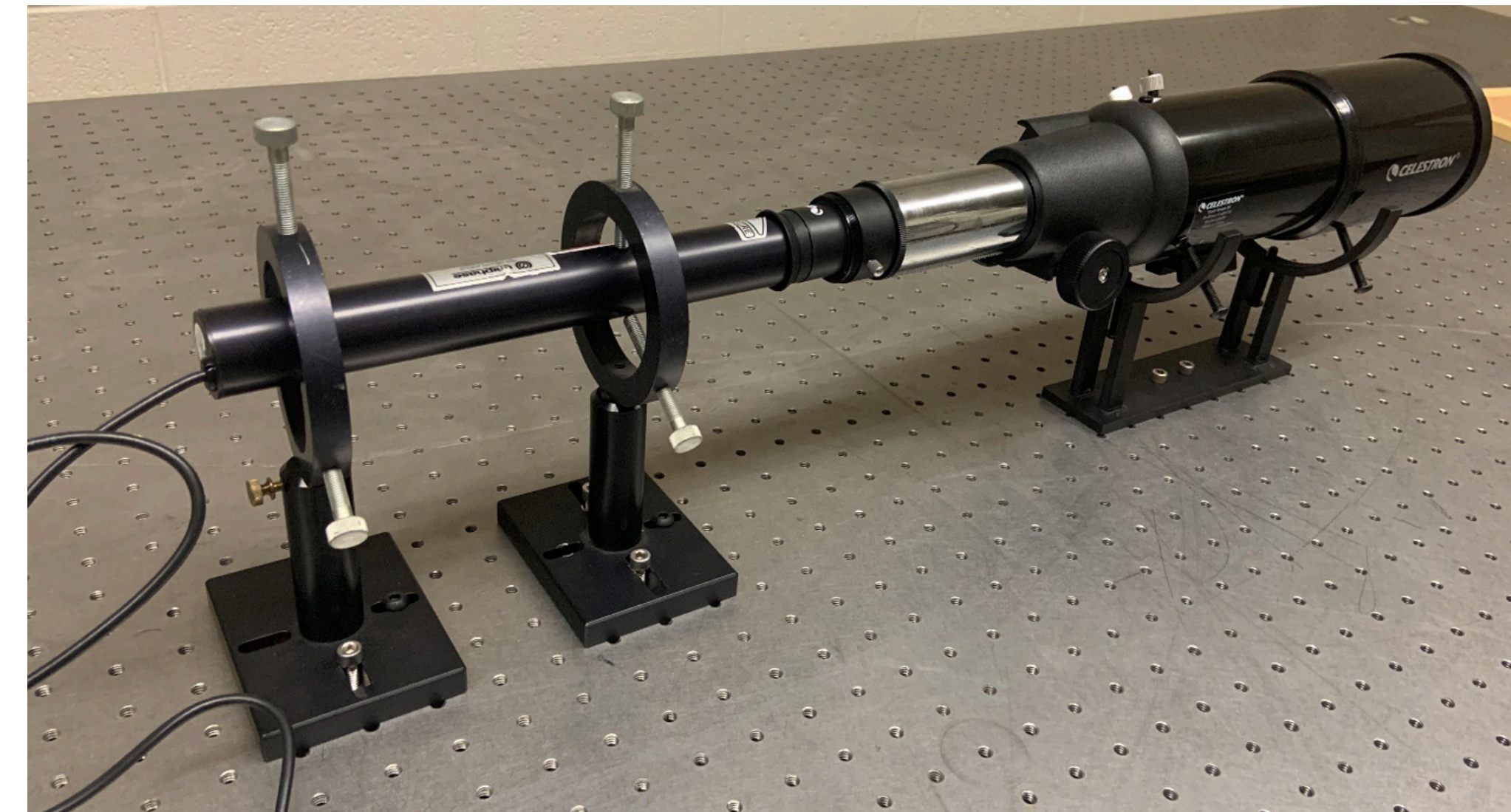
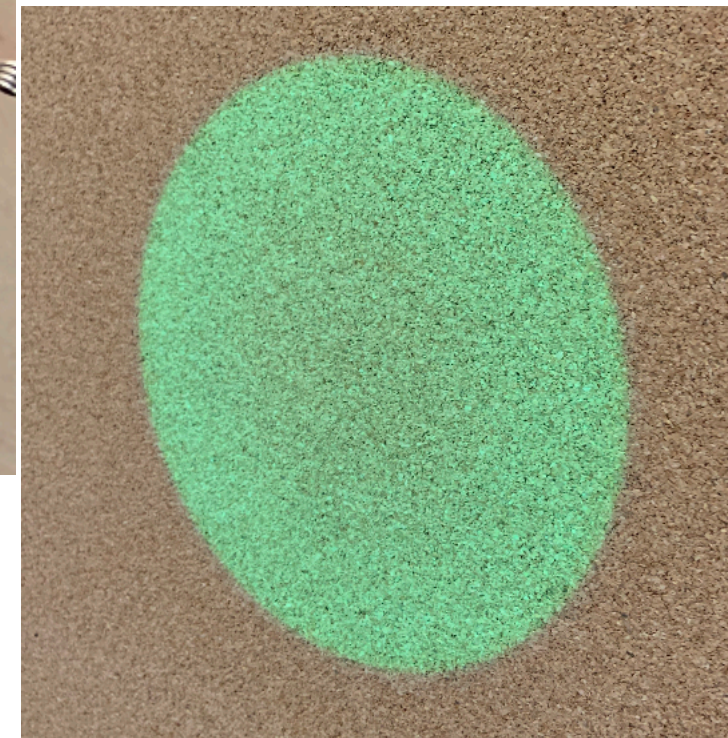
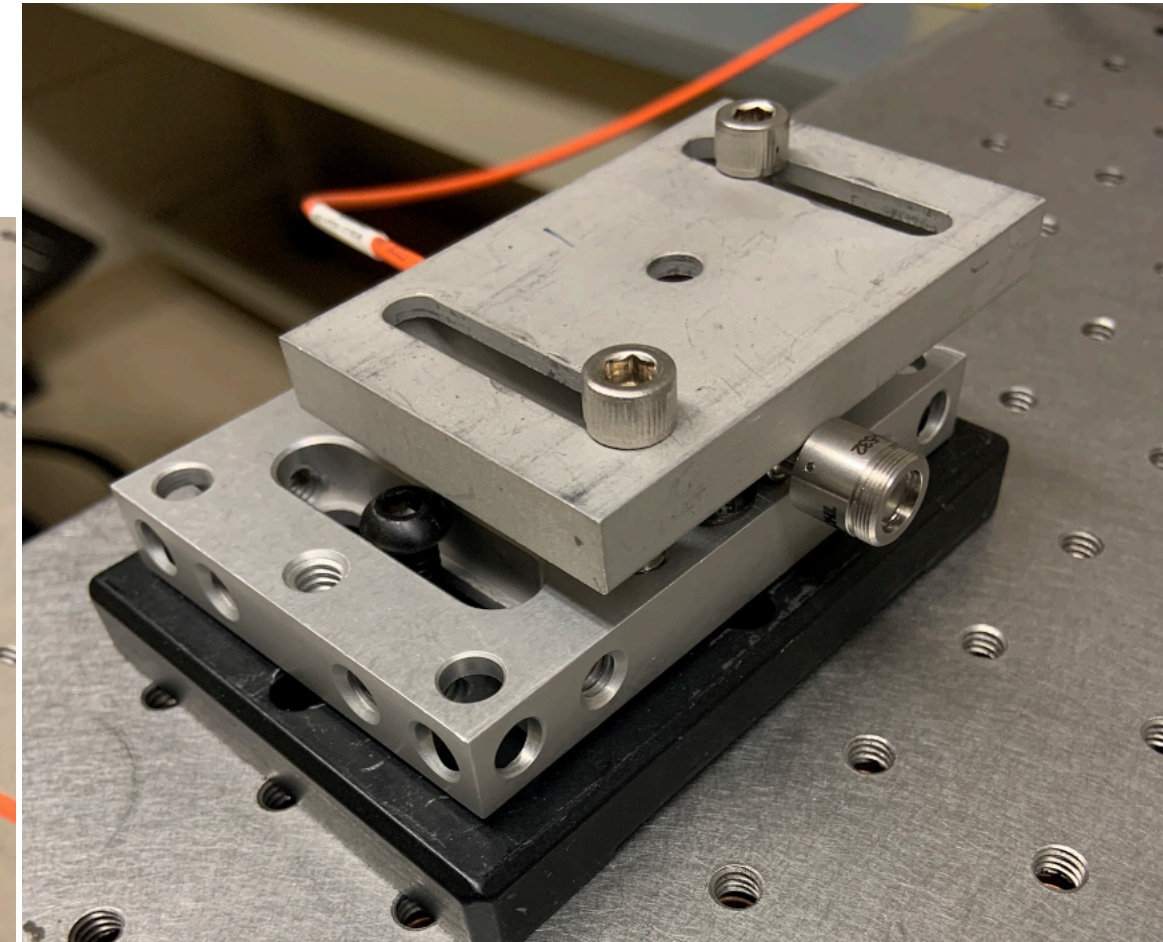
- 3D printed blanks:
  - CFRP printed blanks are being tested for feasibility.
  - Optical set-up to test reflected spot-size.



**Mark Forged Mark II: Continuous carbon fiber printing capable**



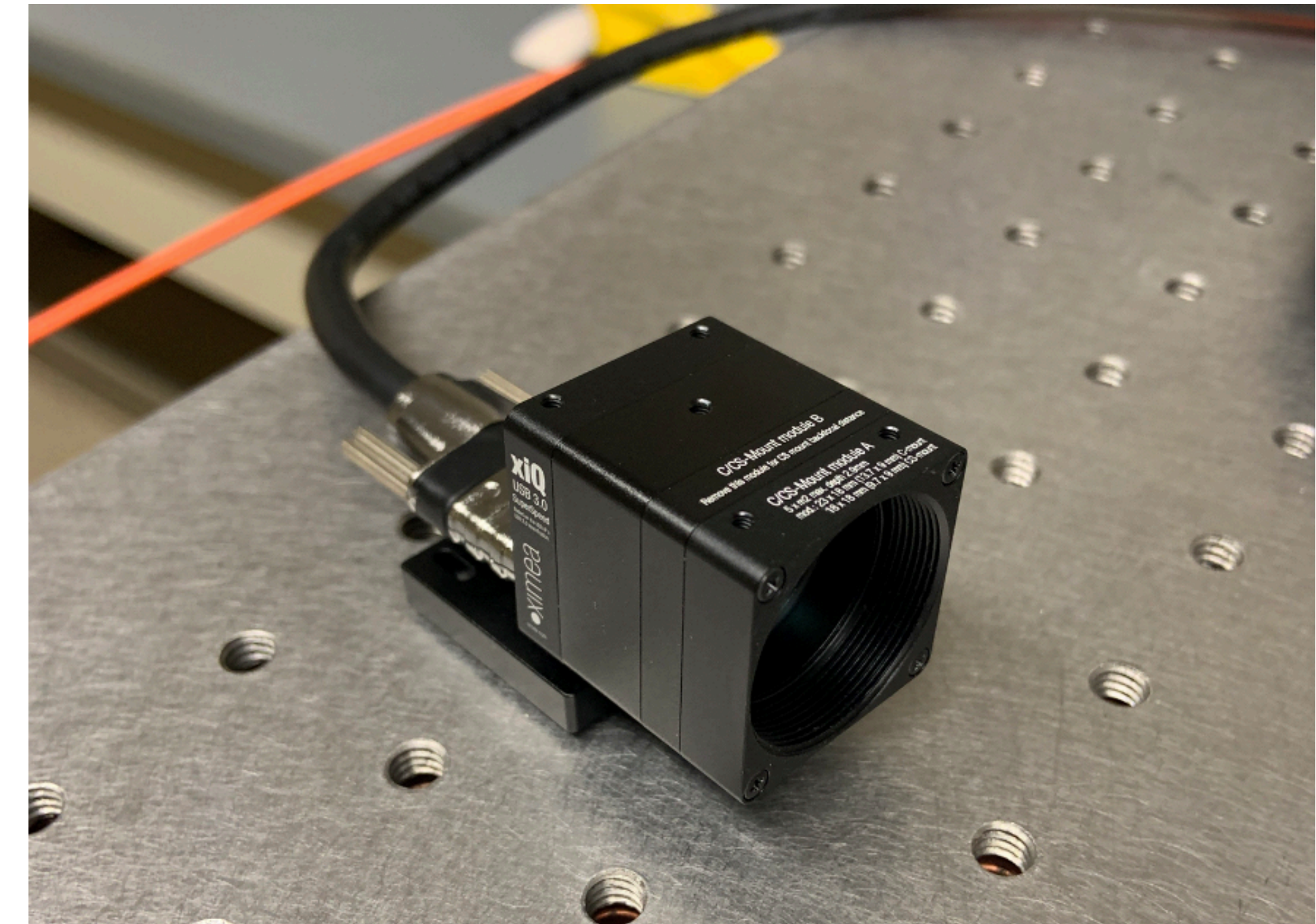
**Optical cable coupled LED to Collimator lensed output**



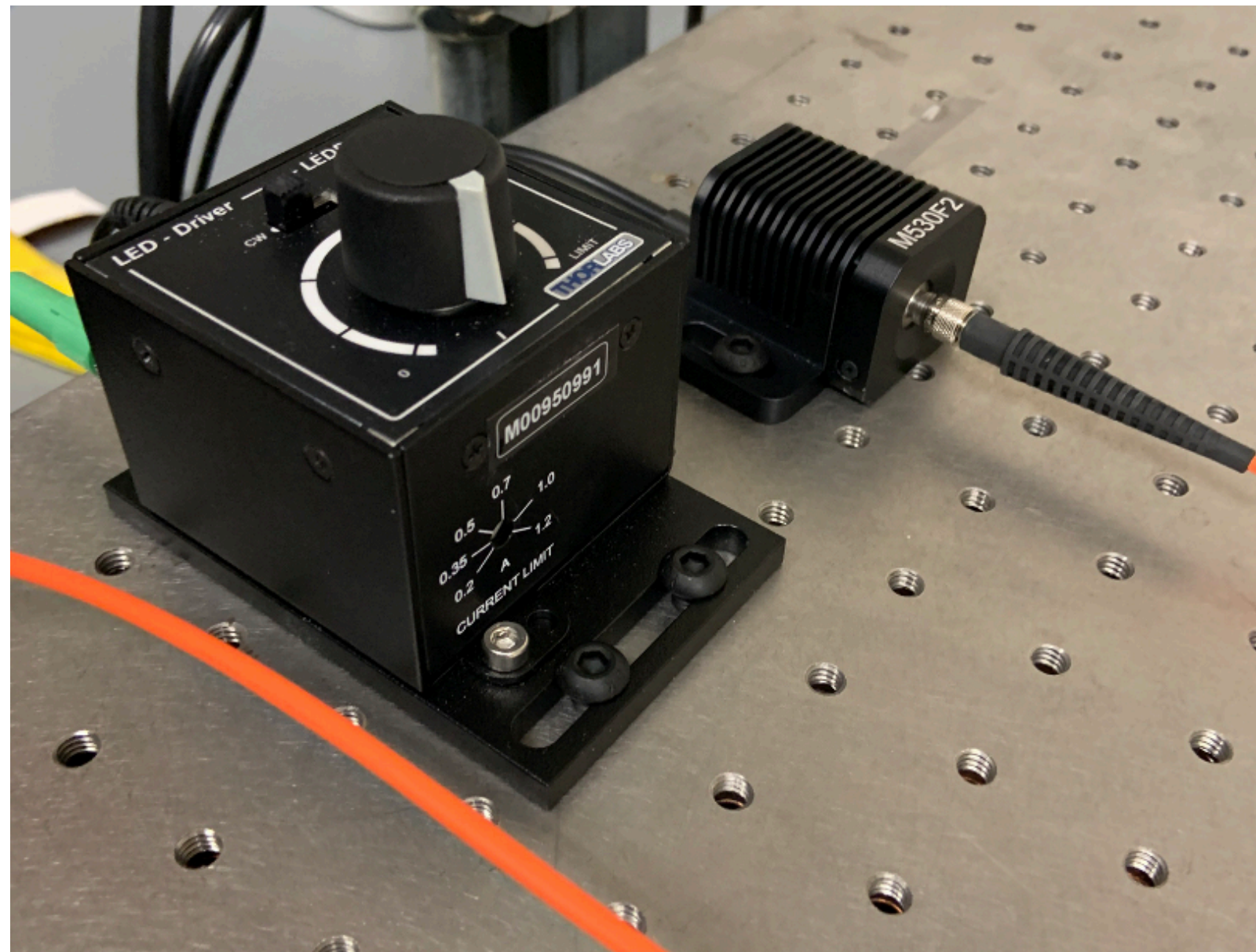
**Laser with beam expander**

## Pre-R&D updates on mirror fabrication

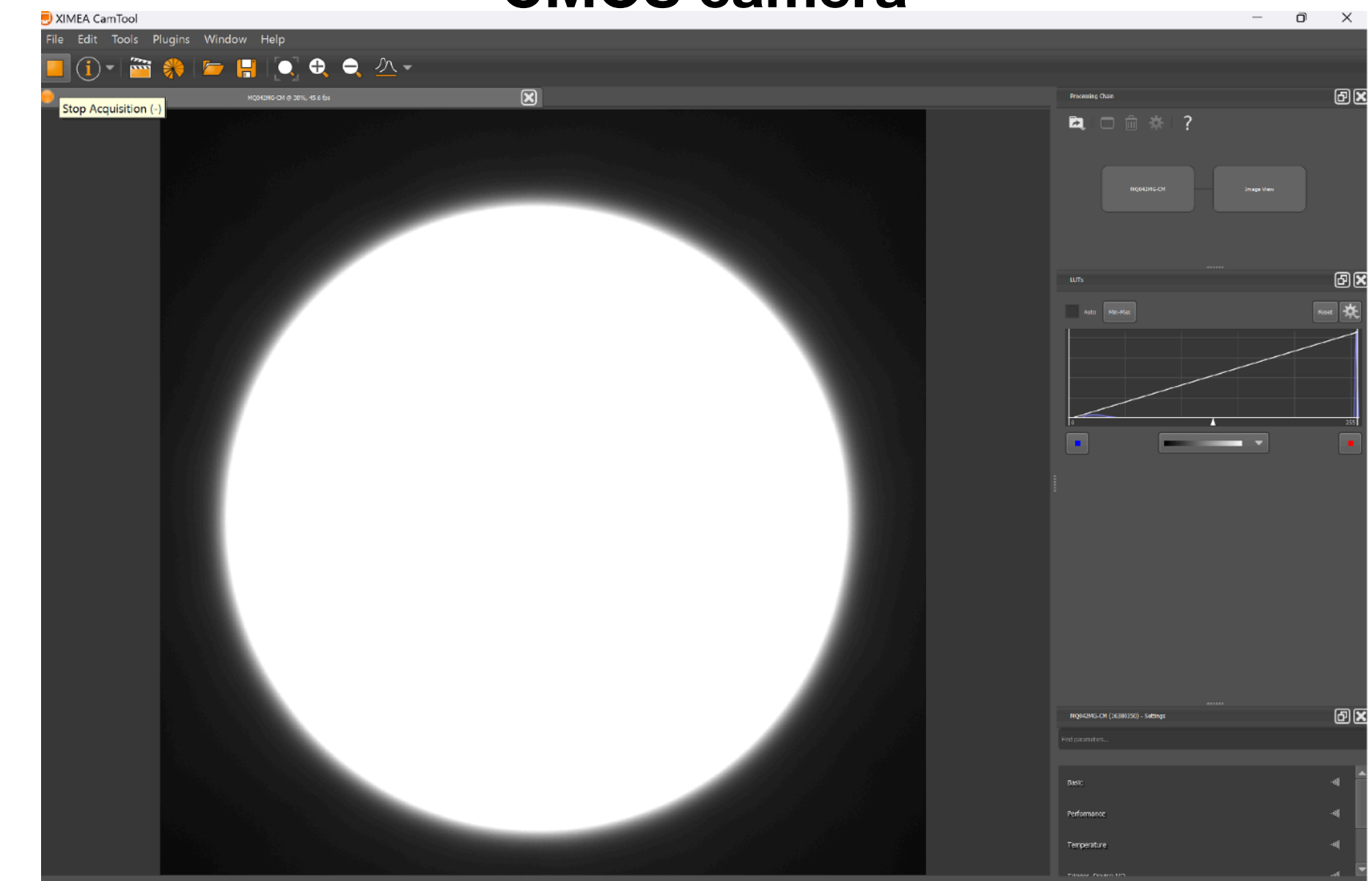
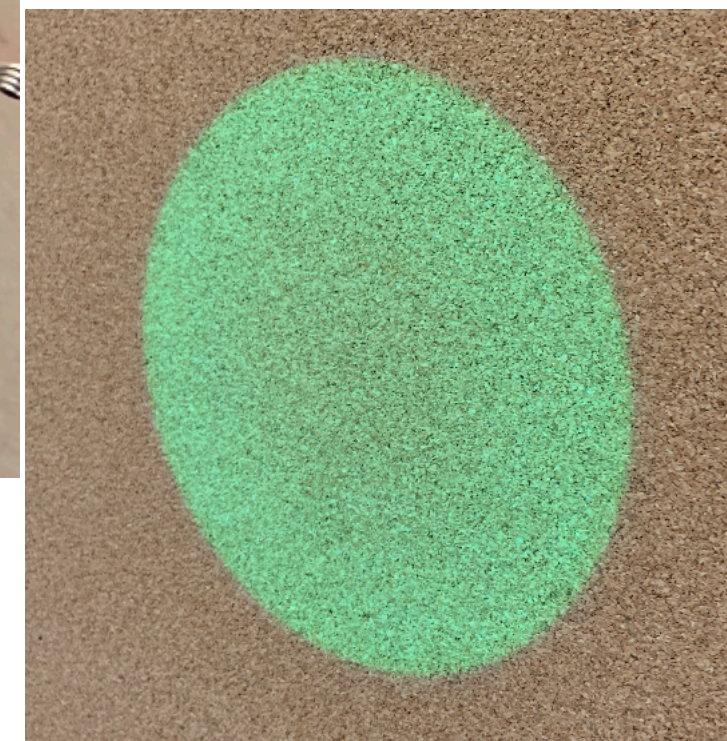
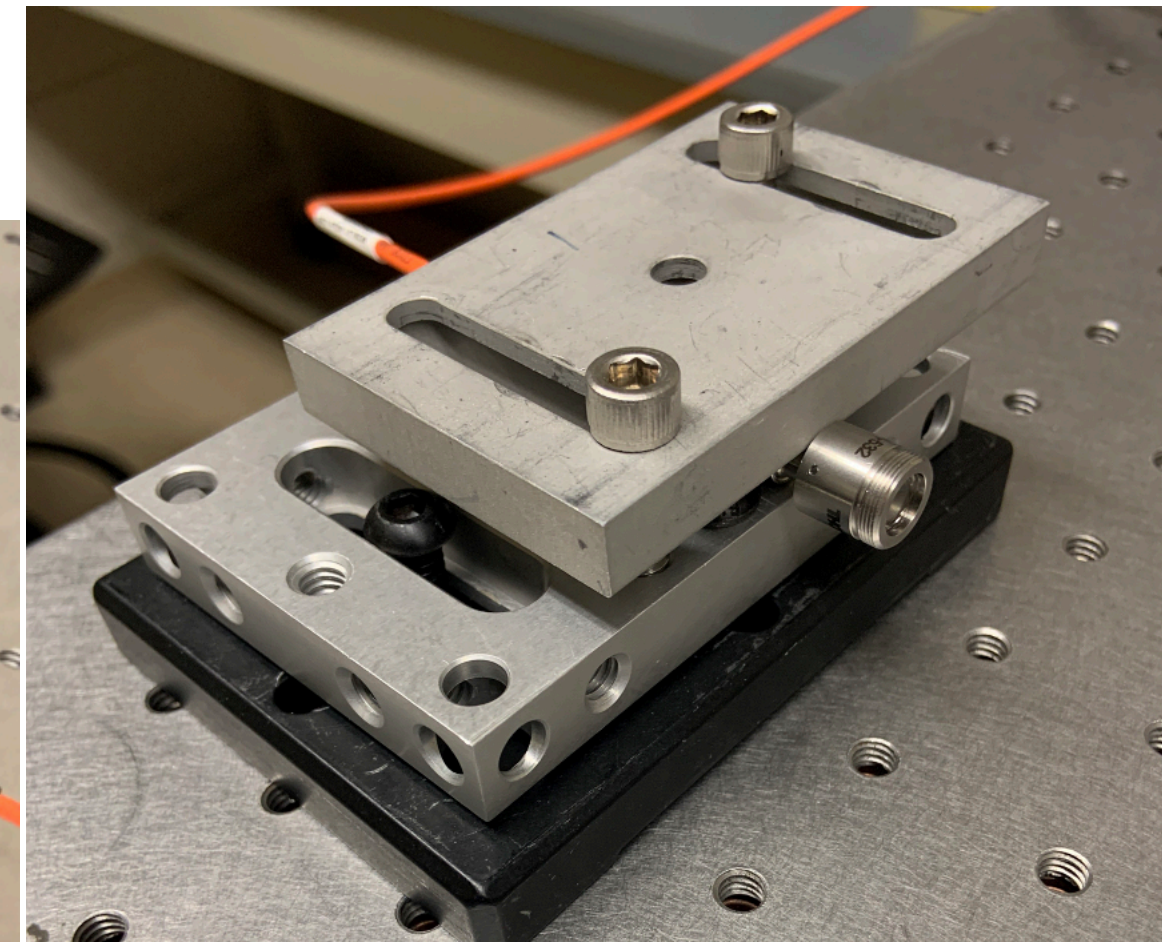
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Ximea 1cm x 1cm active area  
CMOS camera

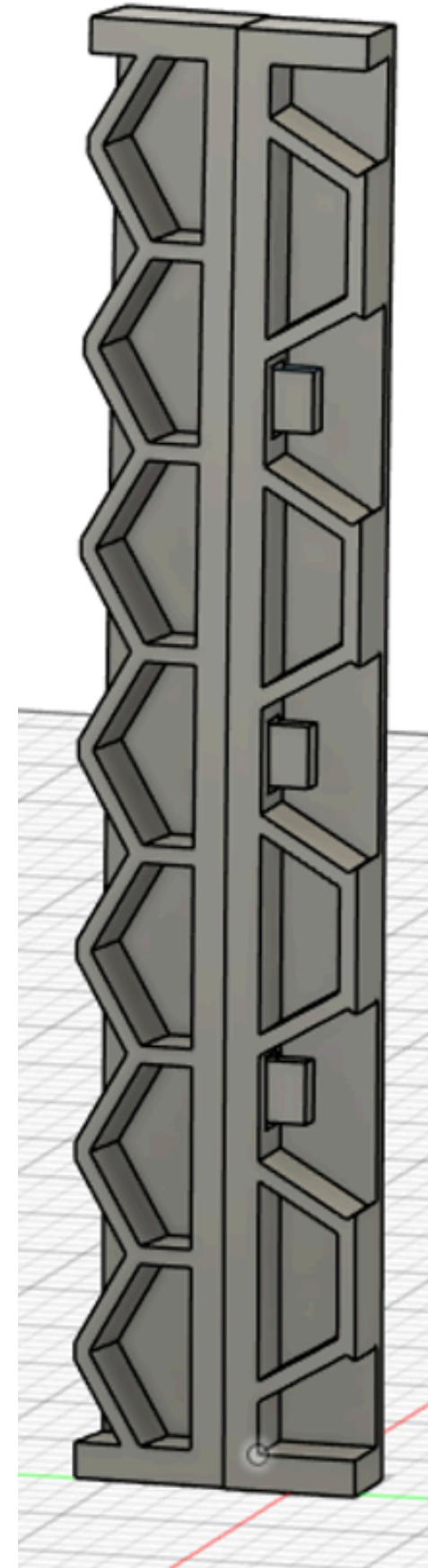


Optical cable coupled LED to  
Collimator lensed output

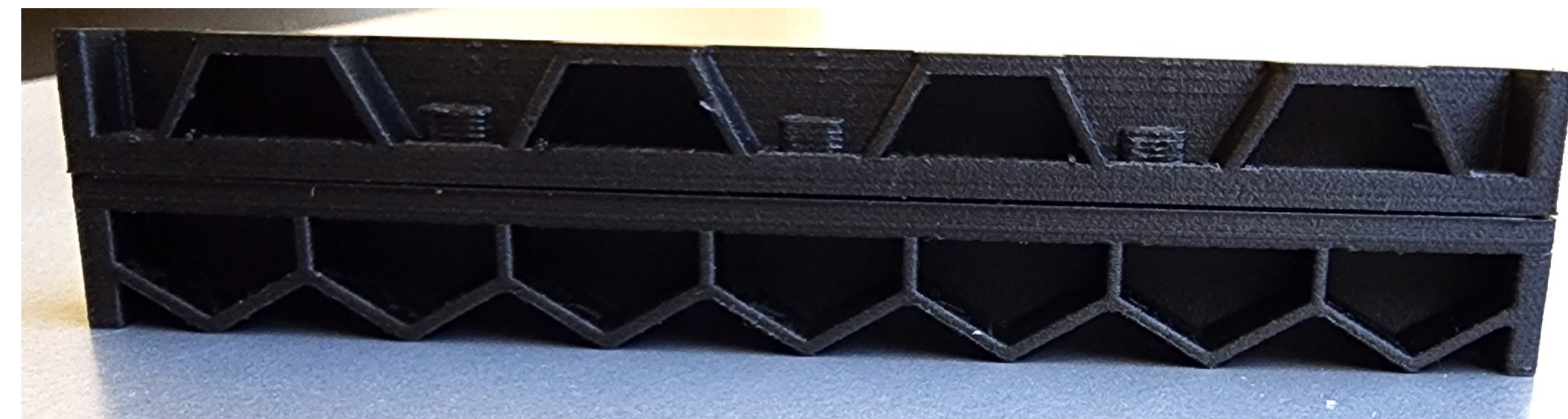
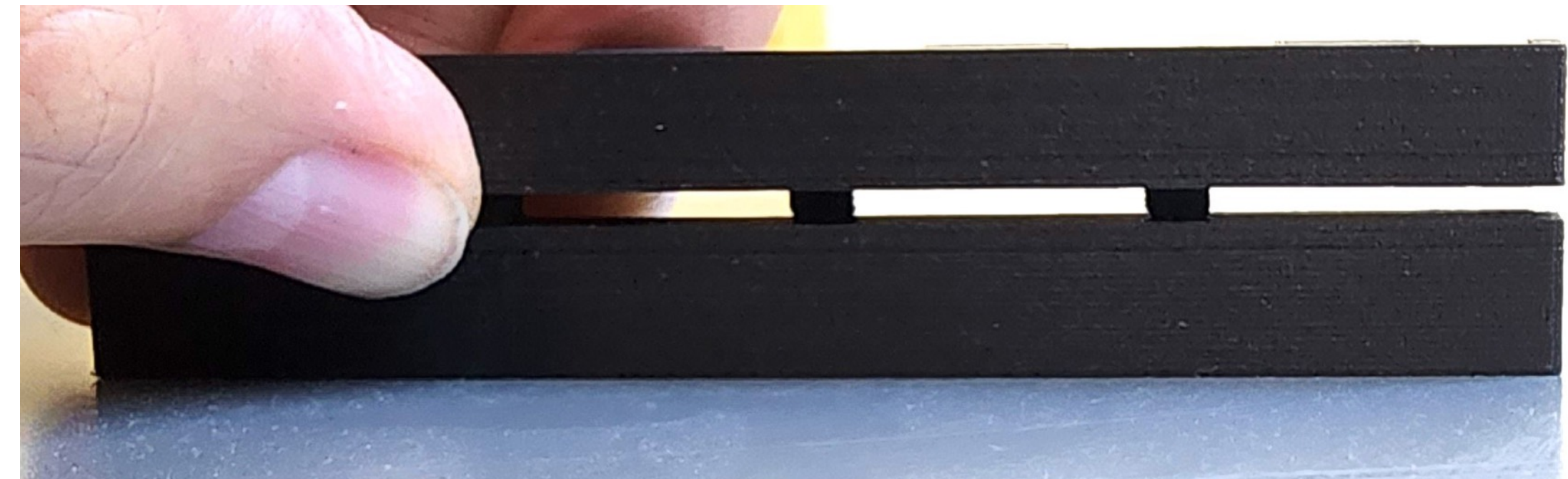


## Pre-R&D updates on mirror fabrication

- Some printing advances:
  - Alignment of mirror during printing affects front-surface smoothness:



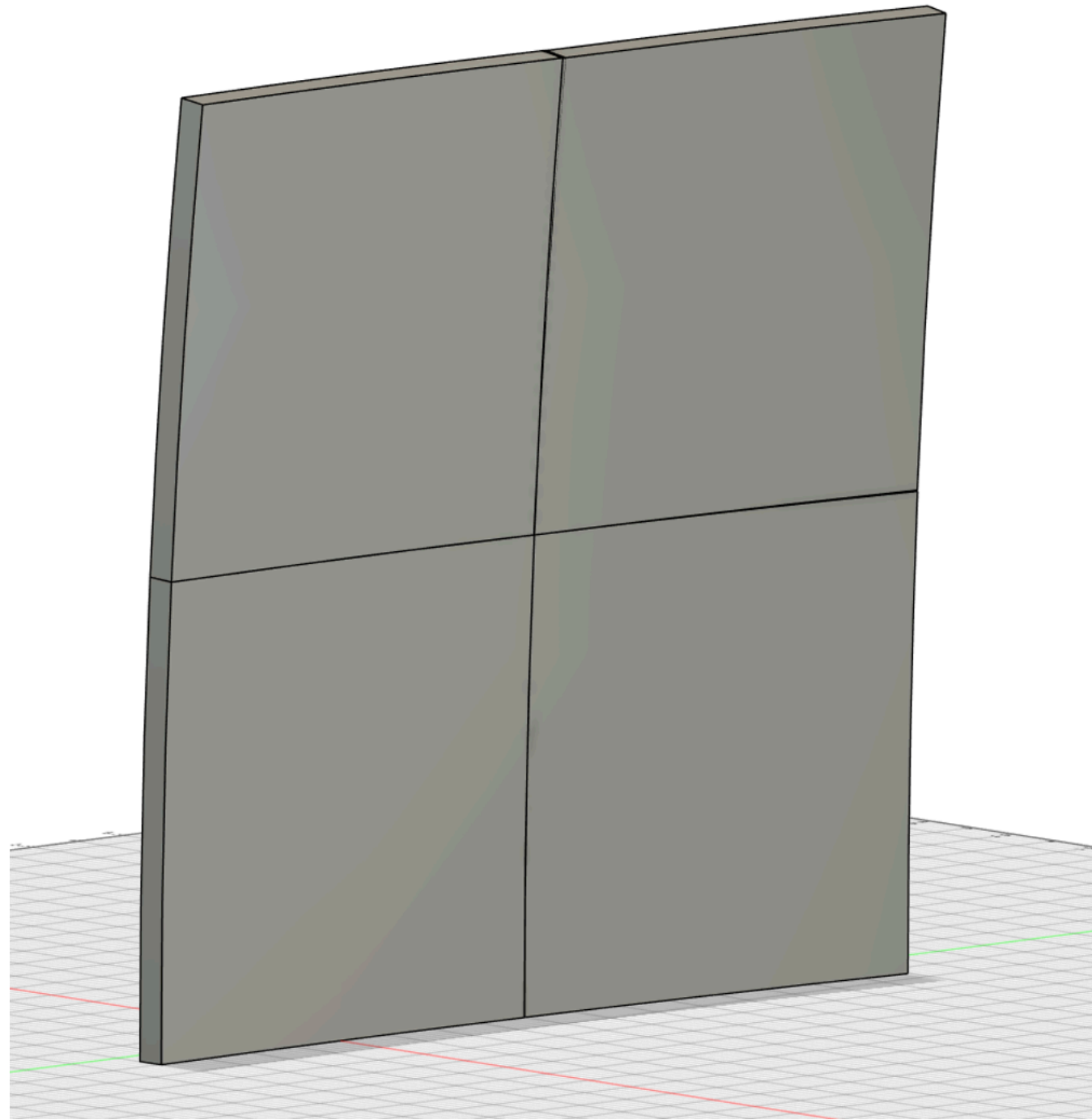
Design and prototype of edge locking mechanism:



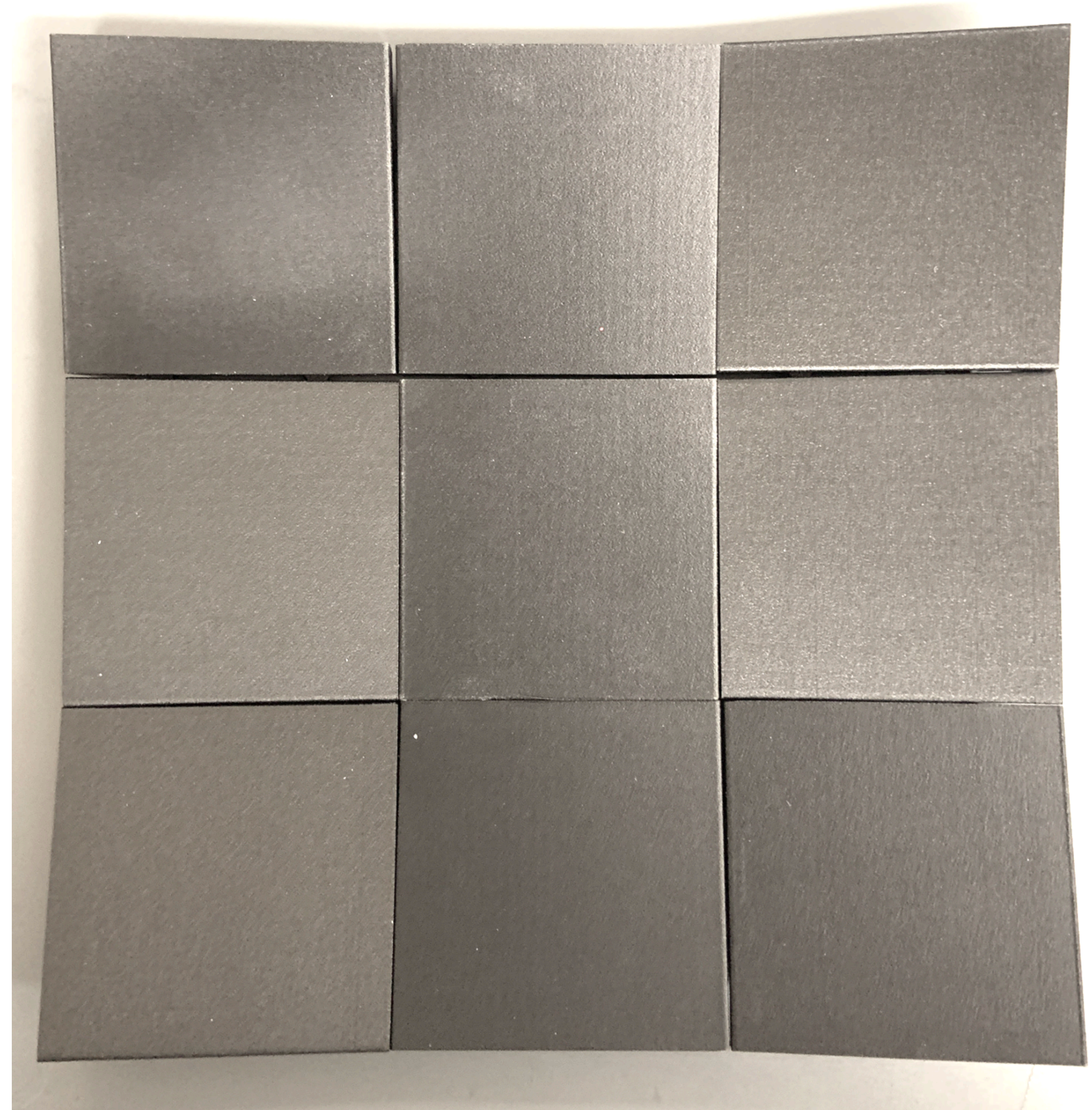


## Pre-R&D updates on mirror fabrication

- Some printing advances:
  - Small scale interlocking:

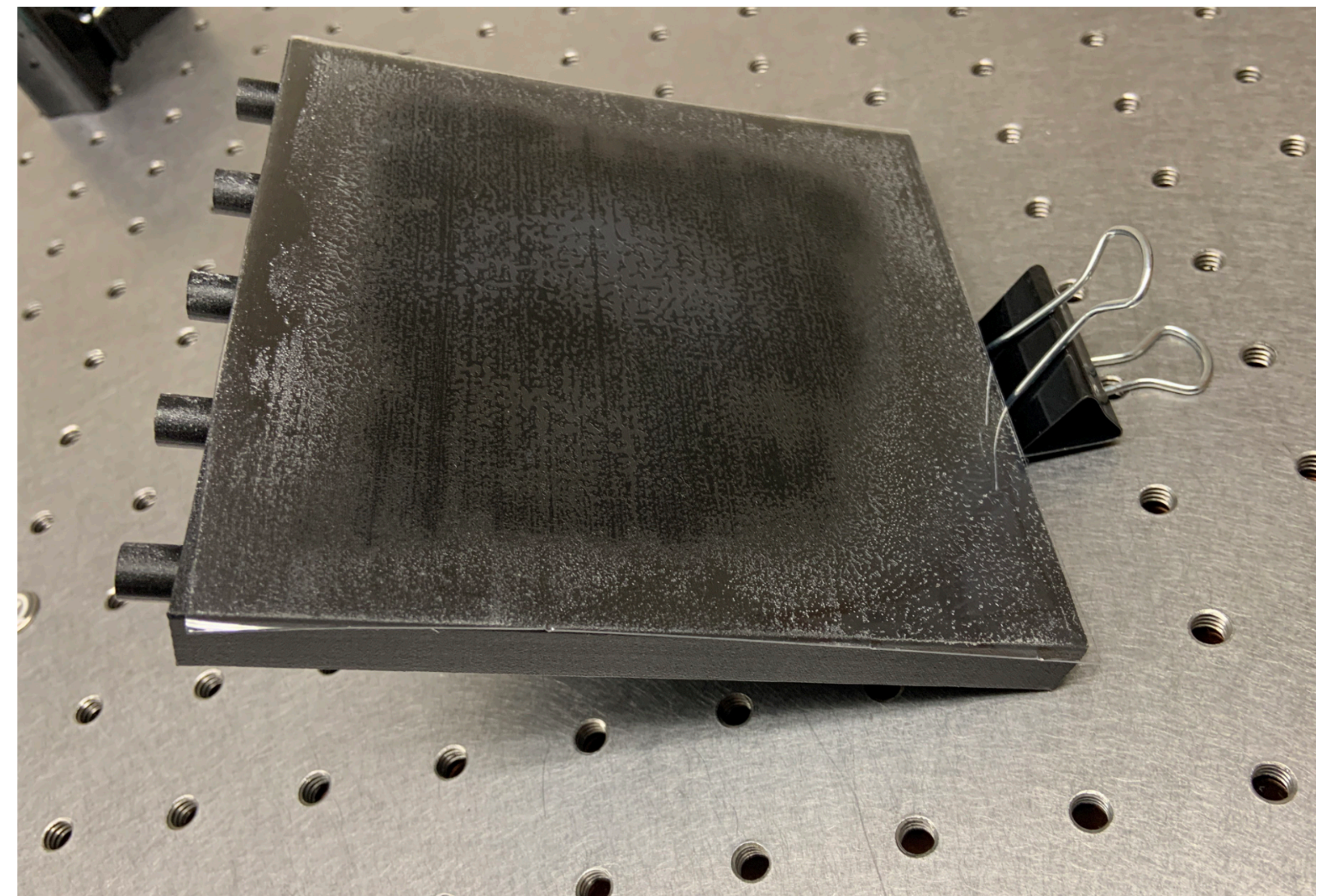


**Note: Unsecured connections! Next step is to use adhesive to lock parts together!**



## Pre-R&D updates on mirror fabrication

- Some printing advances:
  - Reflective film:
    - Basic thermoforming process is up and running.
    - We are in the first steps of forming to a curved blank, and then applying that film to the blank.
    - Still need to test quality of forming and curvature.
    - Also need to test methods of uniform adhesion of film.



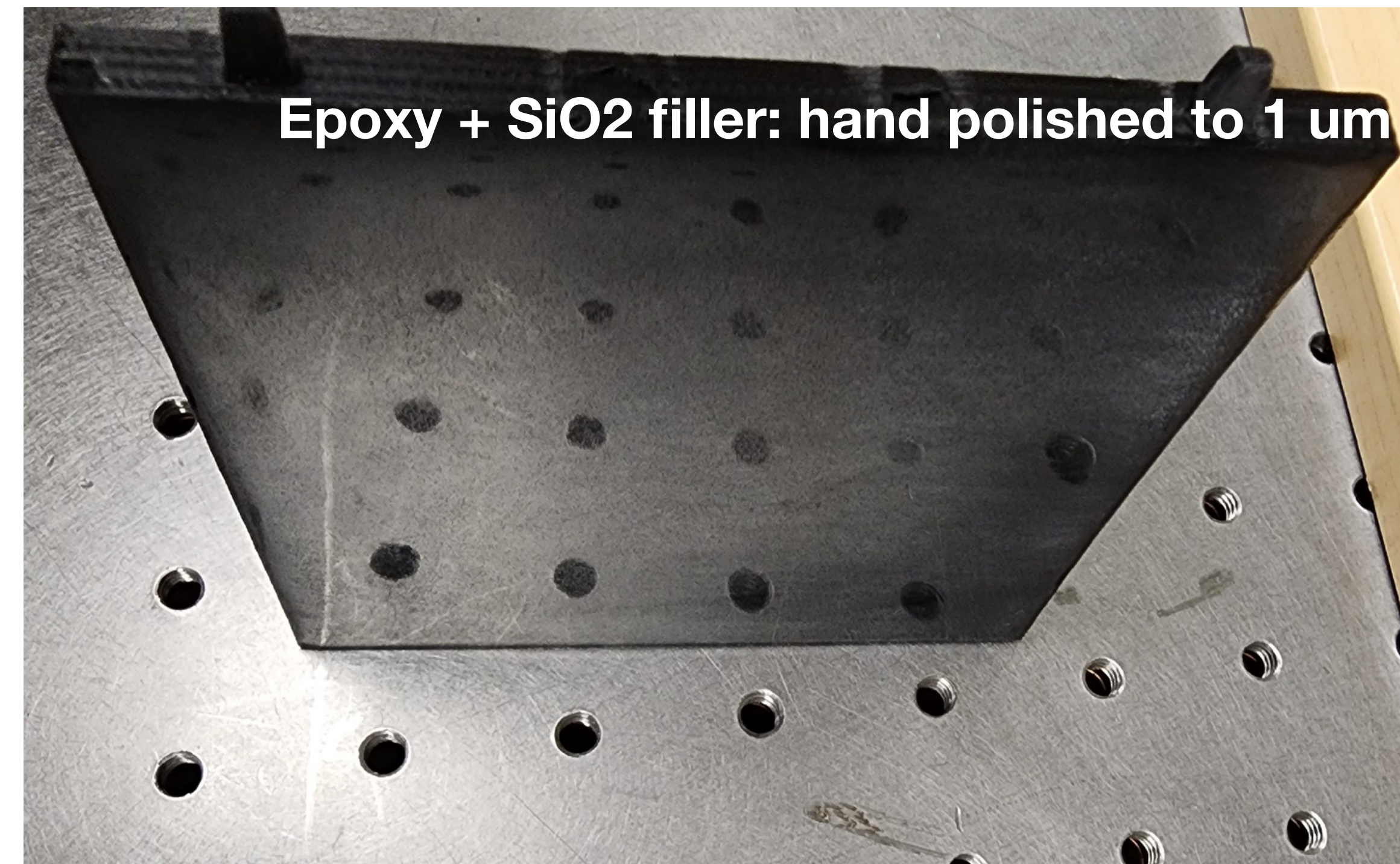
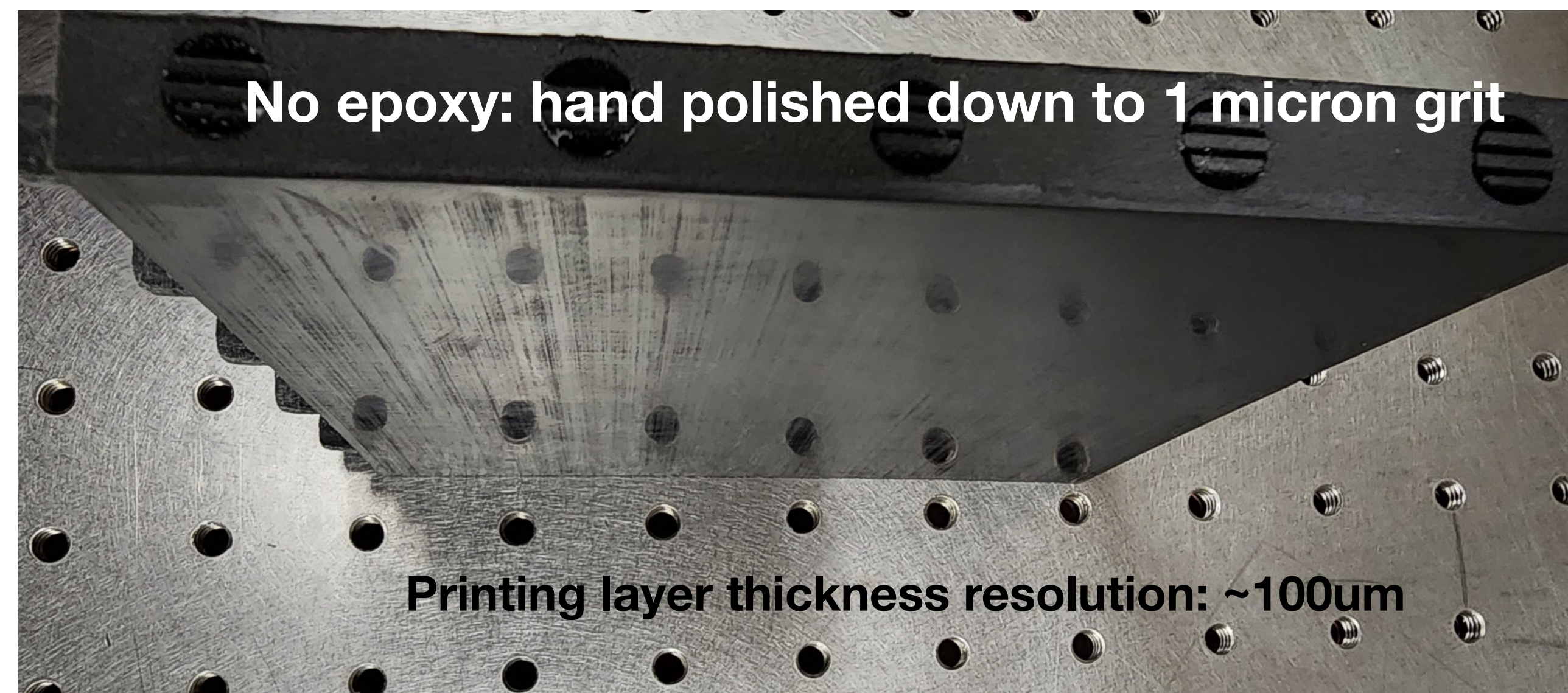
**Thermoformed film attached with basic spray adhesive**

Thermoforming procedure for our cheap Amazon polycarbonate (12 x 12 x 0.02 inch):

- Place sheet in frame and frame in oven
- Dry polycarbonate for ~ 1hour at 150 F
- Heat prep forming at ~ 200 F (sheet begins to sag)
- Put mold on vacuum box and remove sheet from oven
- Press sheet into mold (for about 5 seconds)
- Cut out molded polycarbonate with a pair of scissors

## Pre-R&D updates on mirror fabrication

- Some printing advances:
  - Polishing:
    - I have looked into some methods of polishing a 3D blank before attaching film or even possibly coating directly.



## Pre-R&D updates on mirror fabrication

- Still a lot left to do:
  - Refine thermoforming techniques
    - Need a proper mold
    - Test higher-quality polycarbonate (Lexan)
    - Explore industrial options
  - Test adhesion methods for spherically curved surfaces
  - Test adhesion methods and geometrical configurations for connecting printed pieces
  - Refine spot-size analysis - Reference mirror testing
  - Full mirror composite design
    - Testing of tolerances