Target Fabrication Advances at Gryphon Schafer Livermore Laboratory

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23rd Target Fabrication Meeting
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GRYPHON TECHNOLOGIES
Where Imagination and Technology Come Together

SCHAFER LIVERMORE LAB. HAS BEEN ACQUIRED BY GRYPHON TECHNOLOGIES

- We are no longer affiliated with Belcan
- We're still the same fun-loving bunch that you all know and love
- There is no change in our commitment to providing targets

Schafer

A Gryphon Technologies Company

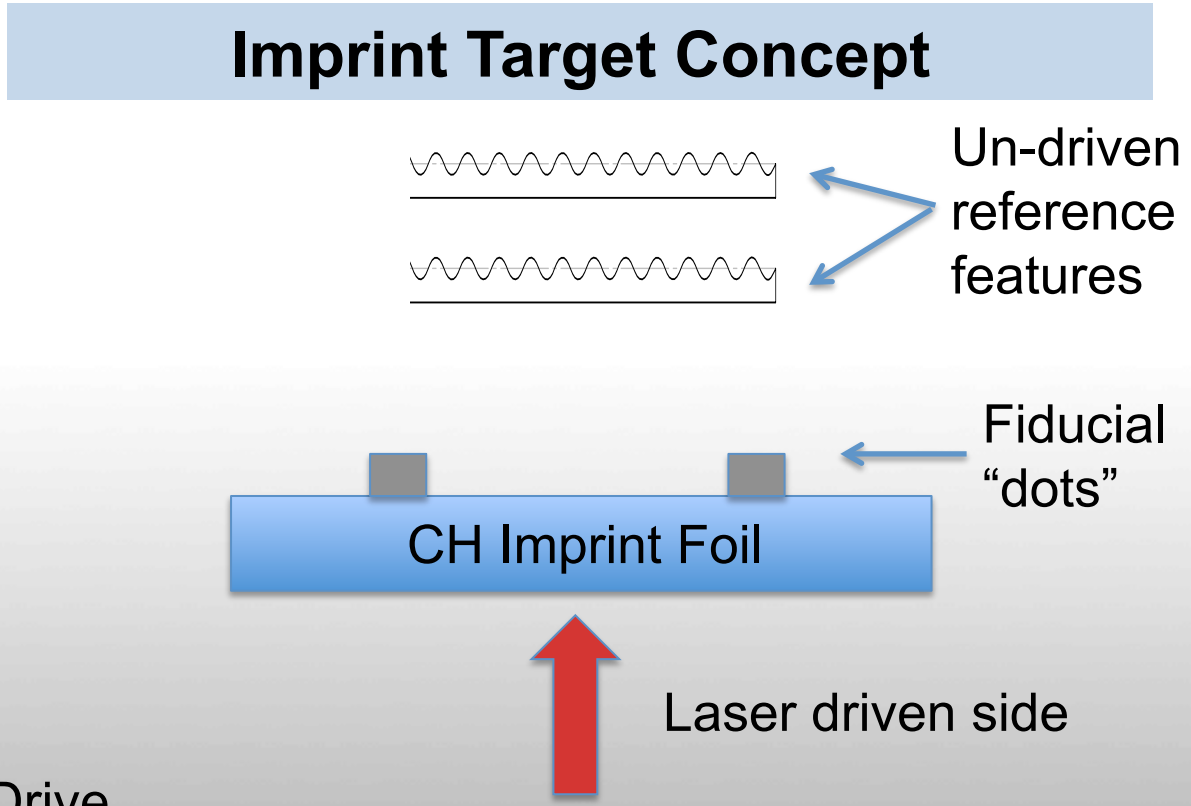
Two topics

1. Interesting targets developed, fabricated, and delivered

2. Work in progress: increased capabilities in response to target requests

THE MJDD* CAMPAIGNS STUDY FEASIBILITY OF NIF FOR DIRECT-DRIVE ICF

- LLE led collaboration
- Campaign of planar and spherical experiments
- One of the key issues is imprint

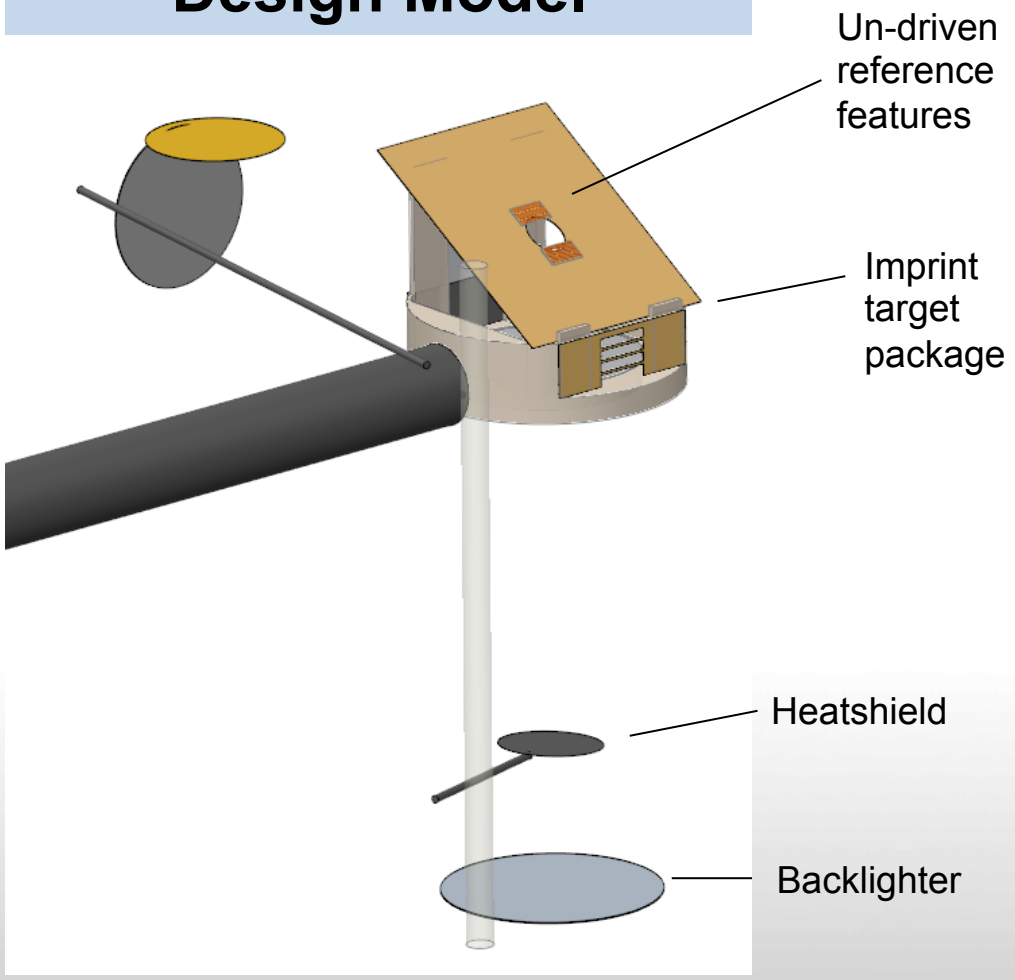


*MJDD – MegaJoule Direct Drive

IMPRINT TARGET

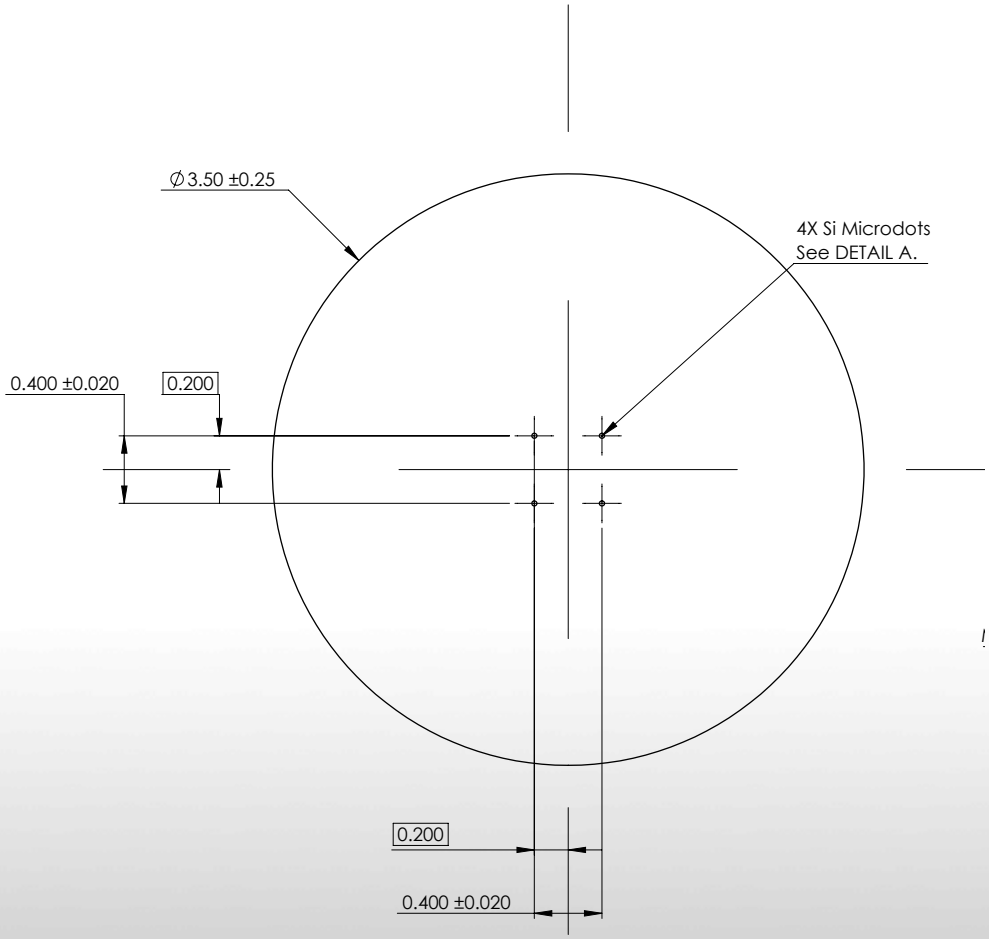
Target separation and geometry determined by beam interference

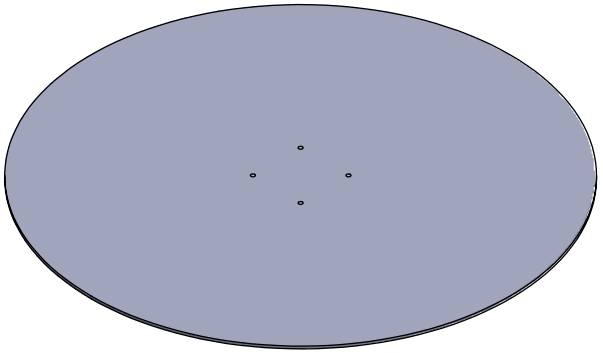
Design Model

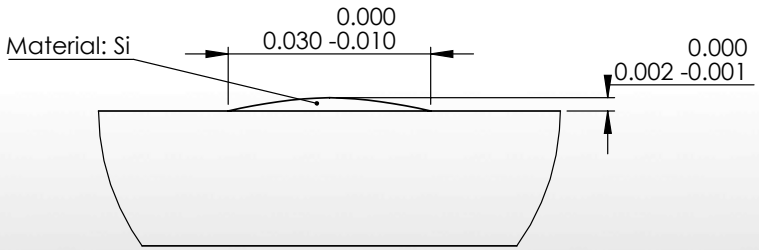


*MJDD – MegaJoule Direct Drive

"DOT" LOCATION AND SIZE ARE IMPORTANT

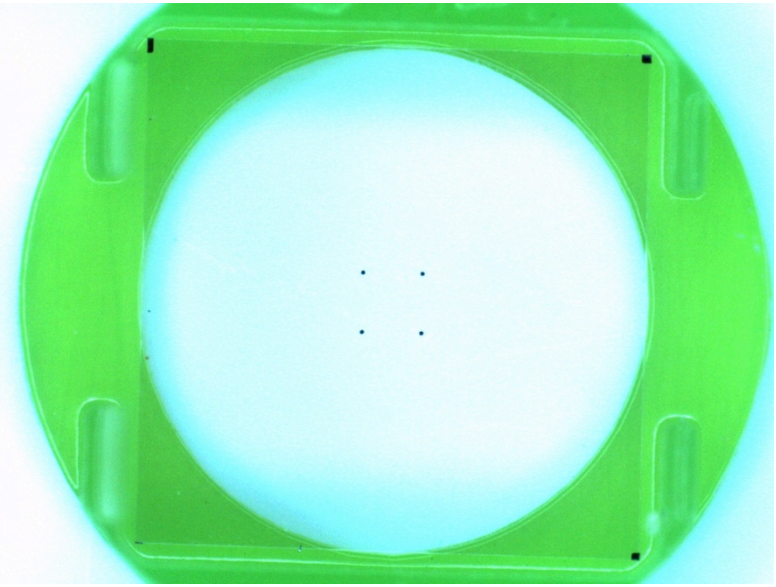


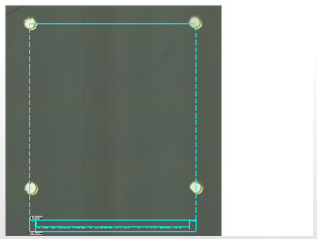


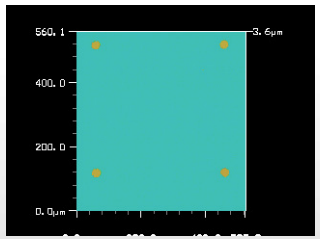


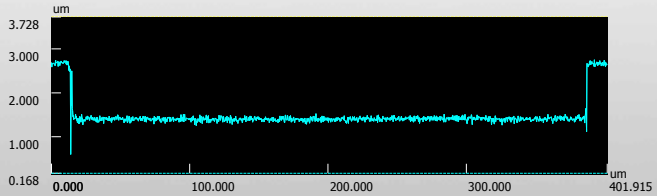
DETAIL A
SCALE 1000 : 1

Planar Imprint Target

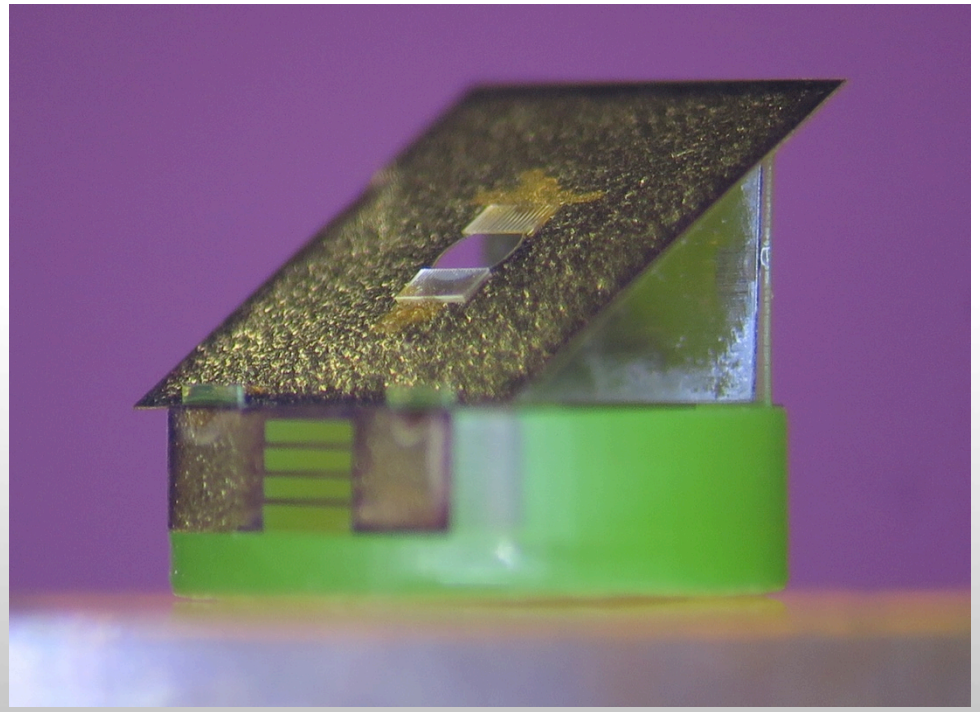




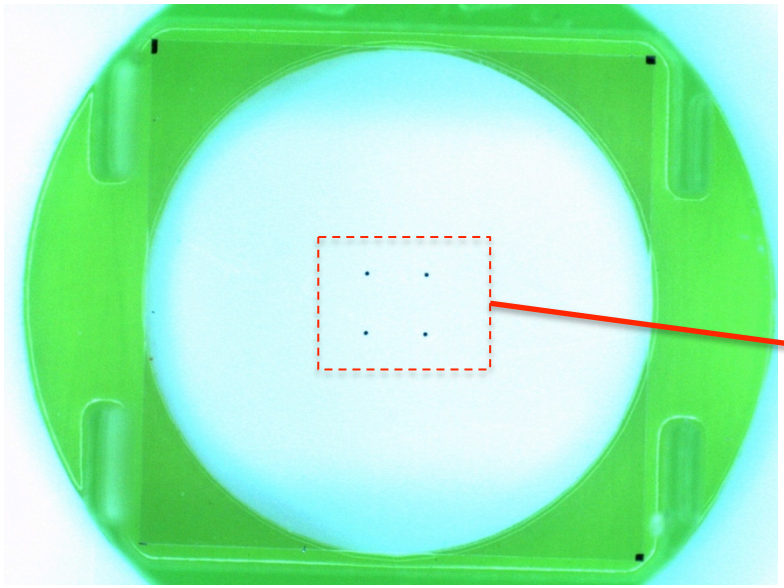


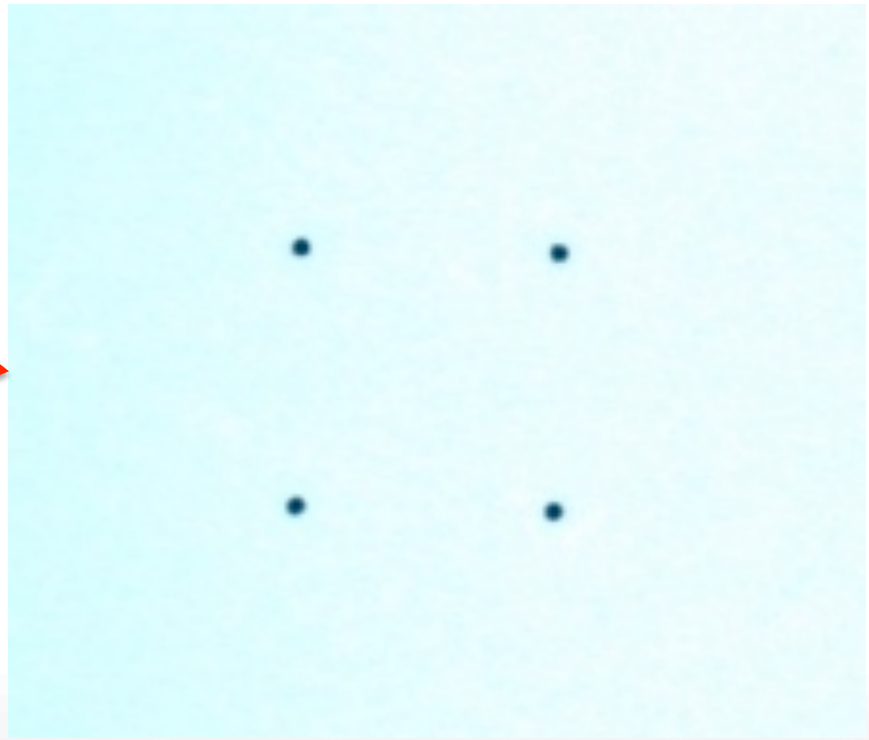


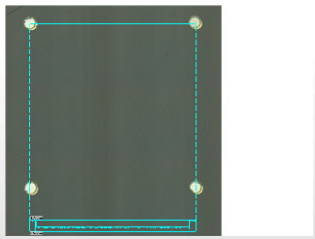
- Silicon features are to specification
- The rest of CH film featureless

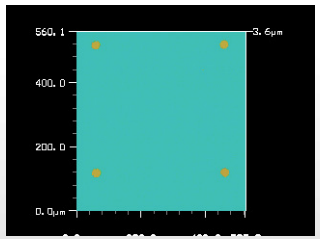


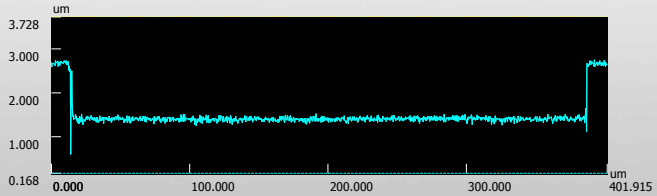
Planar Imprint Foil



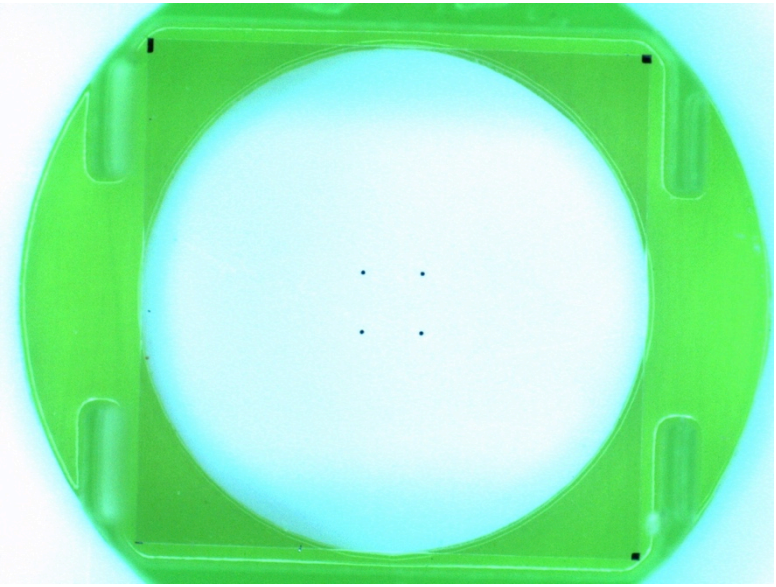


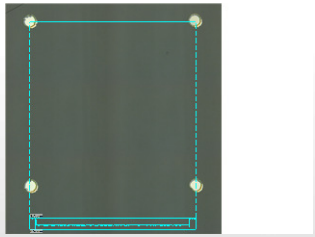


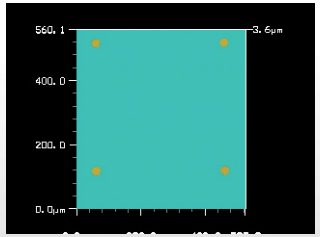


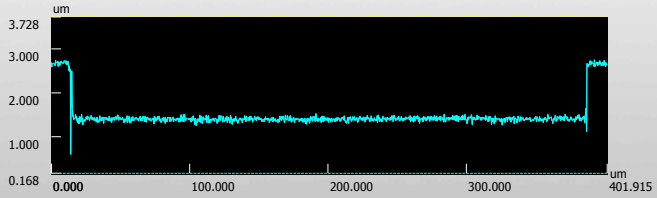


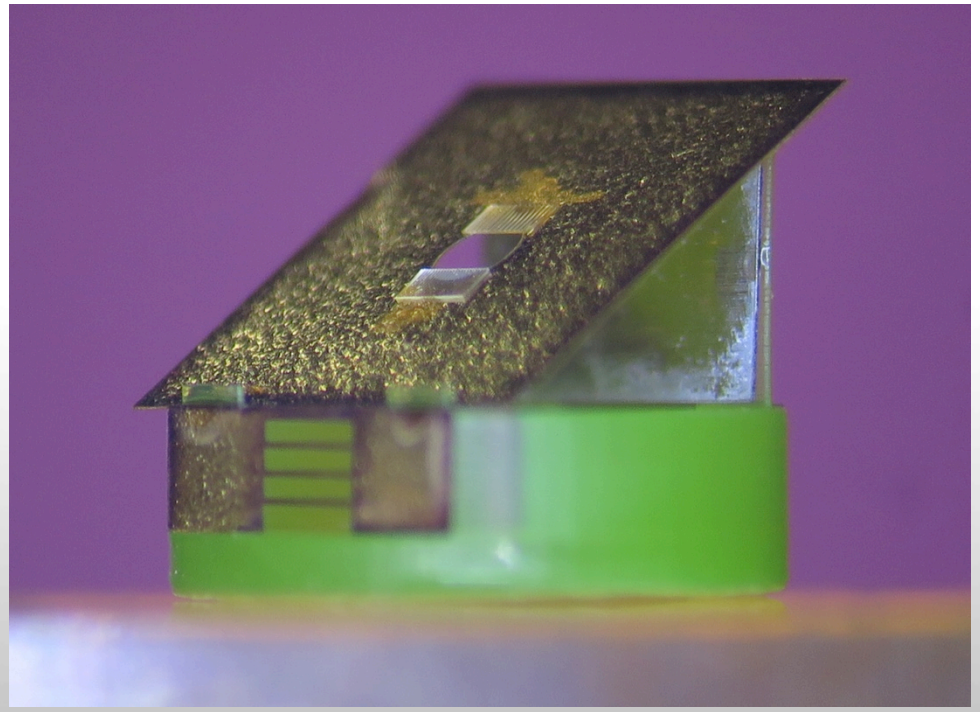
PLANAR IMPRINT TARGET





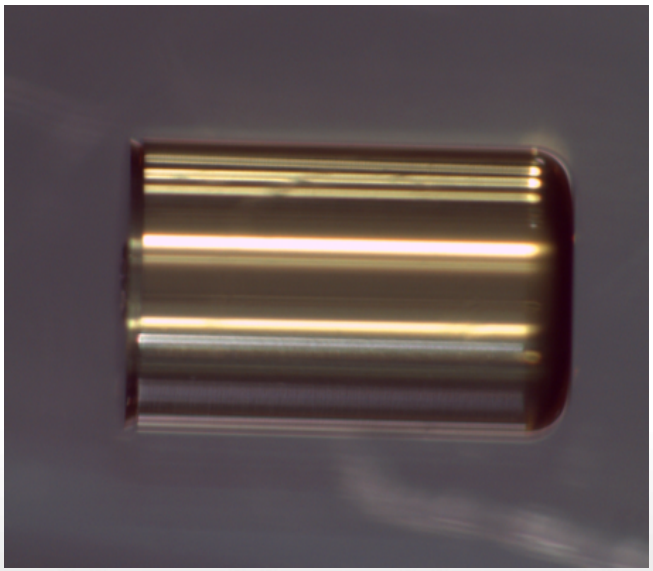


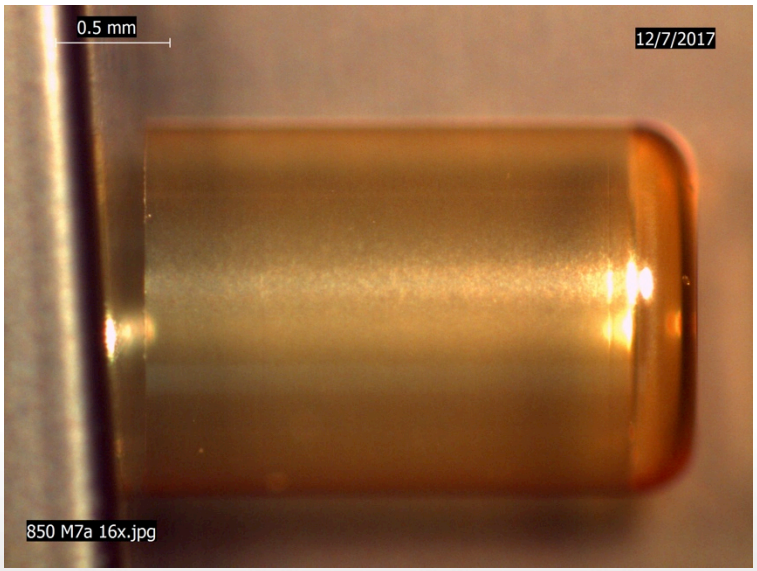




D_2 Radiography "Cryo Cups"

Challenge: create a cylindrical CH cup with a thin, tailored wall thickness profile (20 - 50 um thickness)

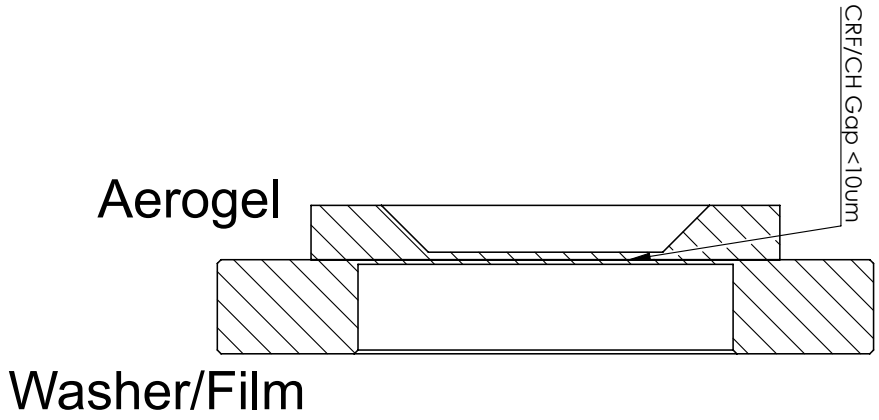




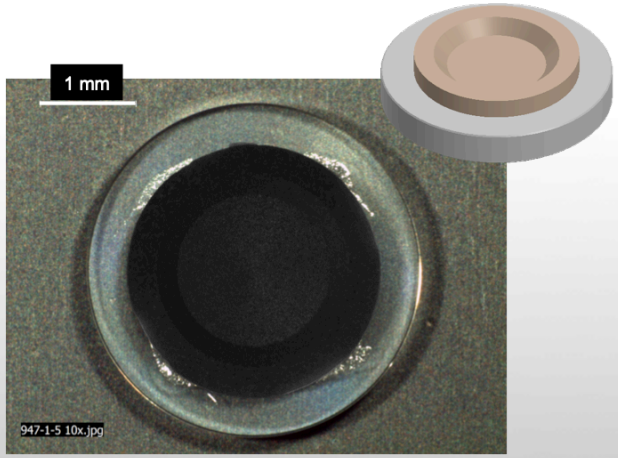
See Poster: Letts et al., "Fabrication of Cylindrical Structures using GDP coating on Mandrels"

OHRV & Foam Imprint Targets

Washer-Film Design (mm)



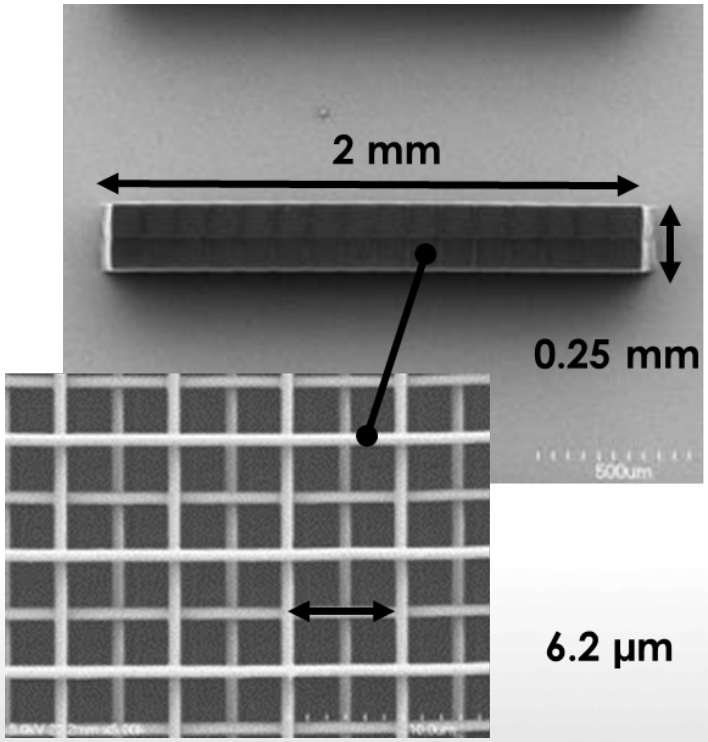
Assembly

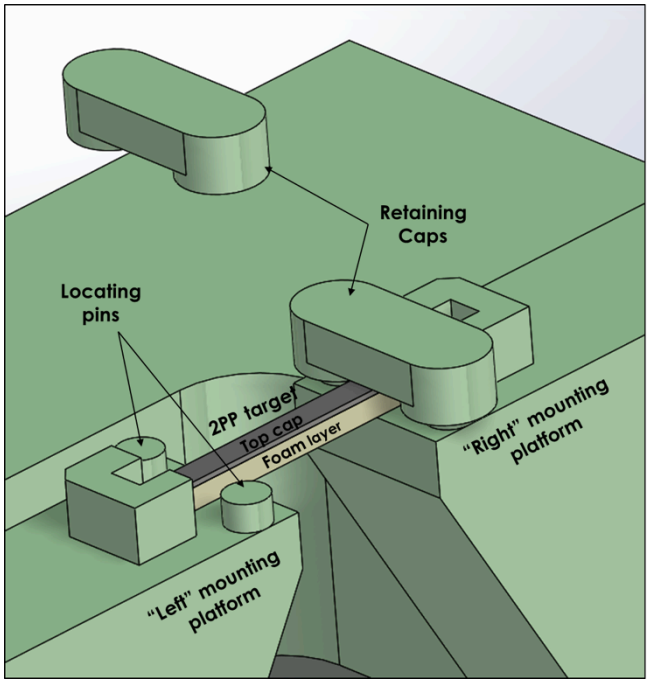


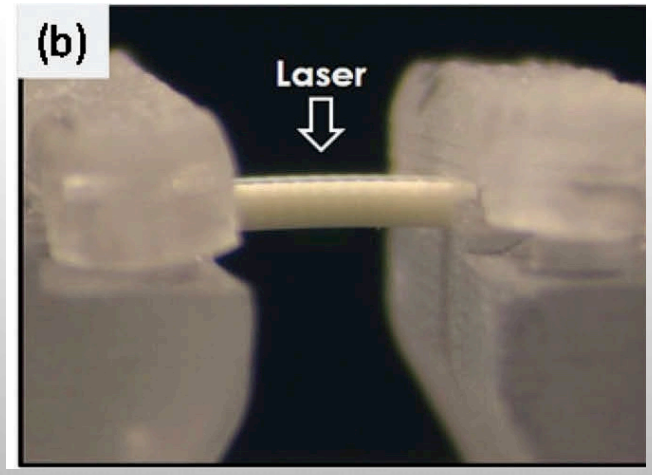
See poster by Streit, Bennett, et al.
"Fabrication of Machined Foam-Film Assemblies for Laser Imprint Reduction"

Schafer/UNL provides precision target components "printed" using 2-Photon Polymerization ("2PP")

Example: low density foam for NRL







Process development is also continuing

Work in Progress

PHYSICS PACKAGES WITH METAL OXIDE FILMS

An example: Iron oxide

- But there are several varieties, none of which come as pure thin films

FeO - Wustite

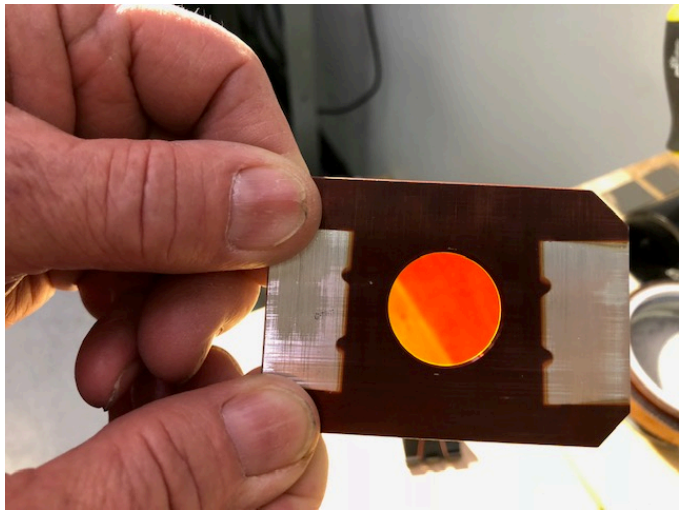
Fe_3O_4 – Magnetite

Fe_2O_3 – Hematite

Increasing oxidation levels →

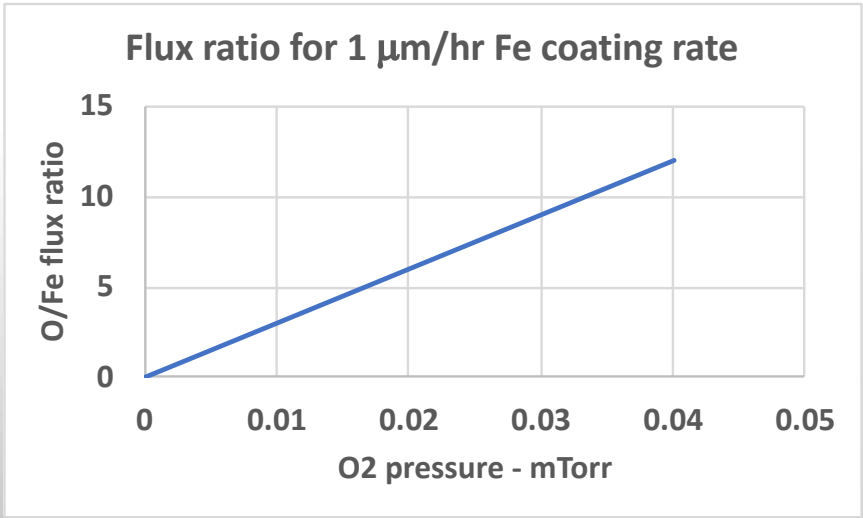
Initial results from e-beam evaporation of Fe in O_2 background onto glass substrate look promising

- By appearance it's a clear transparent layer of Fe_2O_3
- Measured index of refraction is consistent with full bulk density
- *However,* the desired material is FeO



Can O_2 background pressure be adjusted to give FeO?

- At chamber residual pressure (mid 10^{-7} Torr), get pure Fe
- At ~ few x 10^{-4} Torr, get Fe_2O_3
- Work in progress

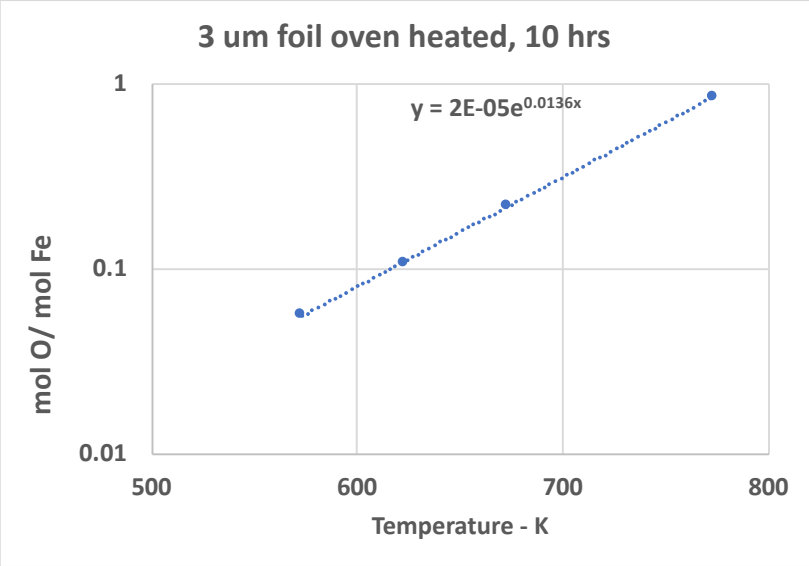


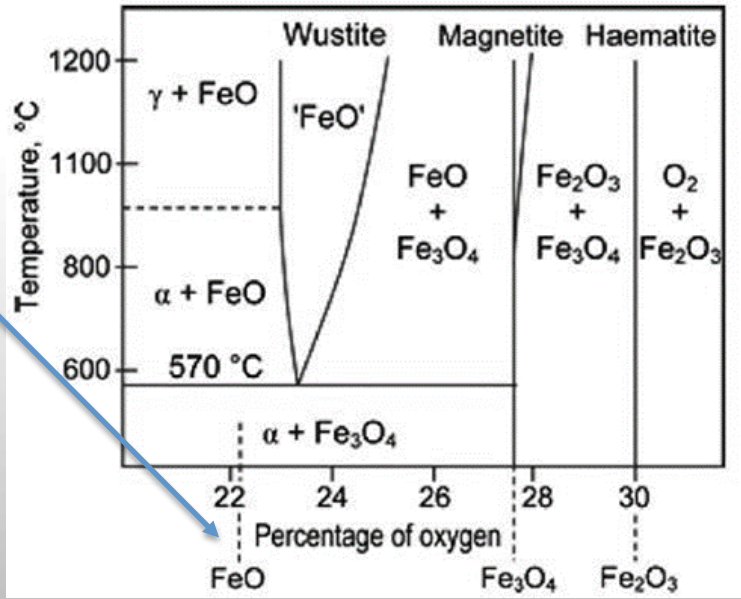
2nd approach: Oxidation of pure Fe coated layers

- PVD pure Fe onto substrate
- Furnace oxidize
- Oxidation rates determined from weight gain

However:

- The phase stability diagram is complex
- Notice that stoichiometric FeO is not a stable phase
- We are experimentally assessing the effects of temperature and atmospheric composition to give FeO





Acknowledgements

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GA – Kelly Youngblood