

3D Imaging “Dome” Demonstrator Prototype

Preliminary 3D Print Design

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SLAC MAGIS Group Meeting

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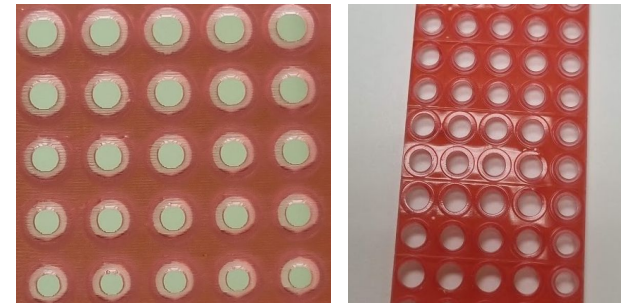
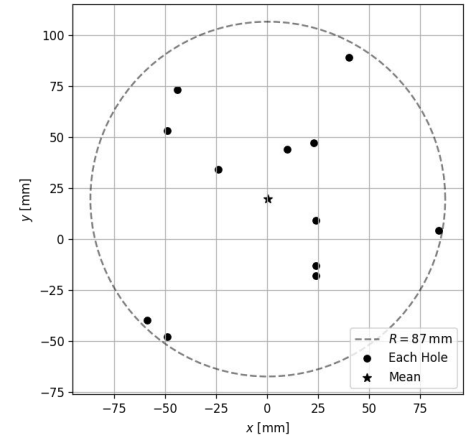


- 3D Imaging Demonstrator
 - First demonstrator of our 3D dome-shaped mirror arrangement concept
 - What we will use at SLAC & Stanford
 - SLAC: some target object
 - Stanford: atom cloud @ 10m atom interferometer
- 3D Imaging Prototypes
 - Prototypes for the demonstrator
 - There will be multiple rounds of prototyping
 - Test mechanics (e.g. mounting mechanism), optical alignment, etc.
 - Image simple target (e.g. tiny LED's)

Lessons from Tests So Far

- Two rounds of flat mirror array prototypes
- We learned a lot!
 - Friction holding won't work
 - With a support structure **pushing in** from the back, **we can get < 1deg alignments**
 - Depends on the exact pressure applied
 - Best alignment achieved was ± 0.64 deg span across 12 holes
 - Printing tolerance is our main source of error
 - Significant dependence on printing direction
- **We should just test the dome shape**

MHTestB 1.8mm Board with 1/64" Rubber Sheet
Control column (5.4mm, 0.8mm)



Design Aspects to Keep in Mind

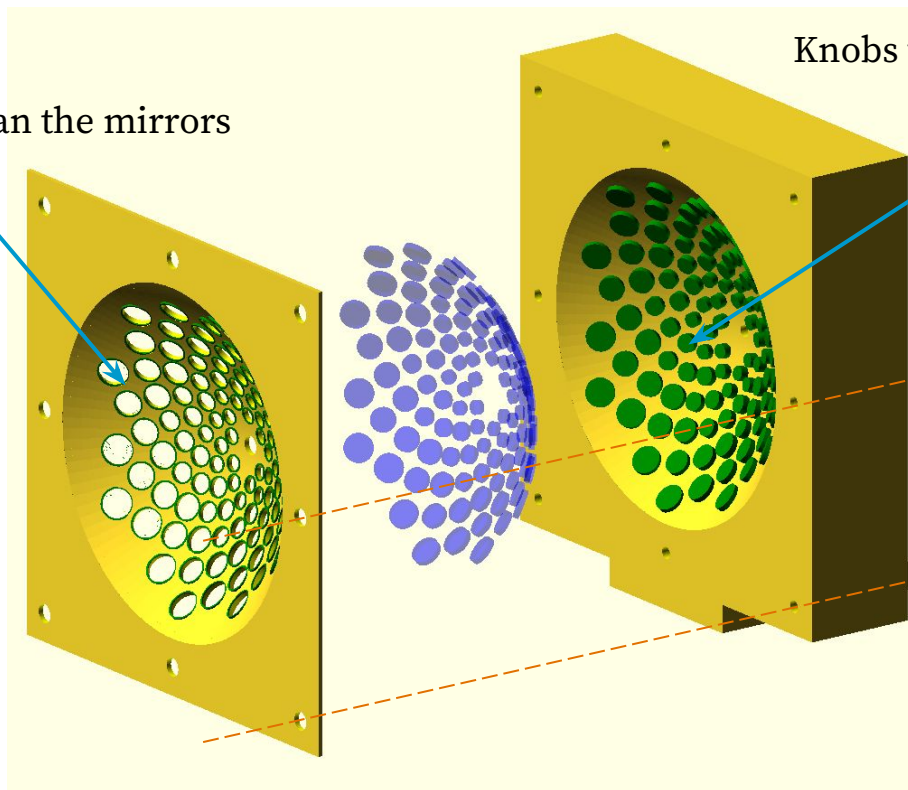
Two board structure

- Front board
 - Slightly thinner than the mirrors (2mm)
 - Holes slightly larger than the mirrors
 - Vertical: 0.3mm or 0.4mm, sometimes a little tight
 - Horizontal: 0.3mm seems more than sufficient
 - Front-stops define the mirror front surface
 - Front-stop overlaps
 - Vertical: at least 0.4mm, if not 0.6mm
 - Horizontal: 0.3mm might be sufficient
- Local support board
 - Thick, sturdy
 - Applies flat, uniform pressure on each mirror
- Two boards screwed together
- Some cushion/buffer between them (e.g. rubber sheets)

CAD Design: Exploded Overview

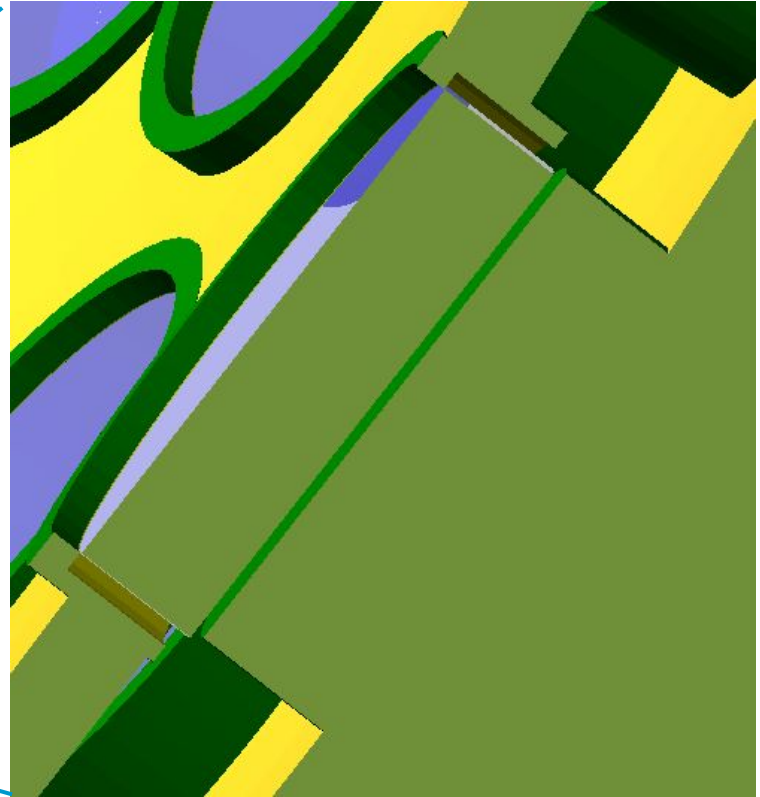
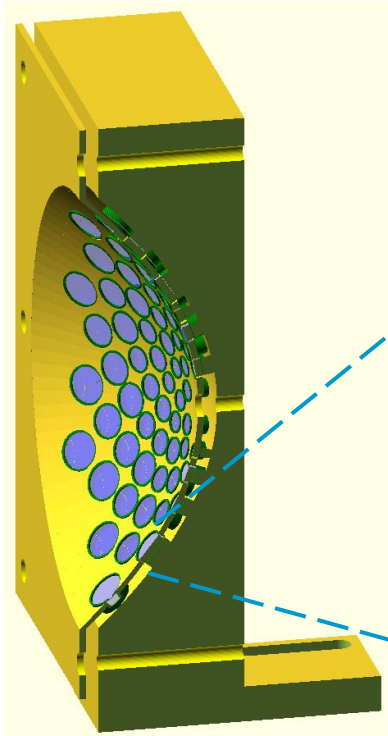
Holes 0.3mm bigger than the mirrors

Knobs to push/support the mirrors



#8-32 screw holes for board connection

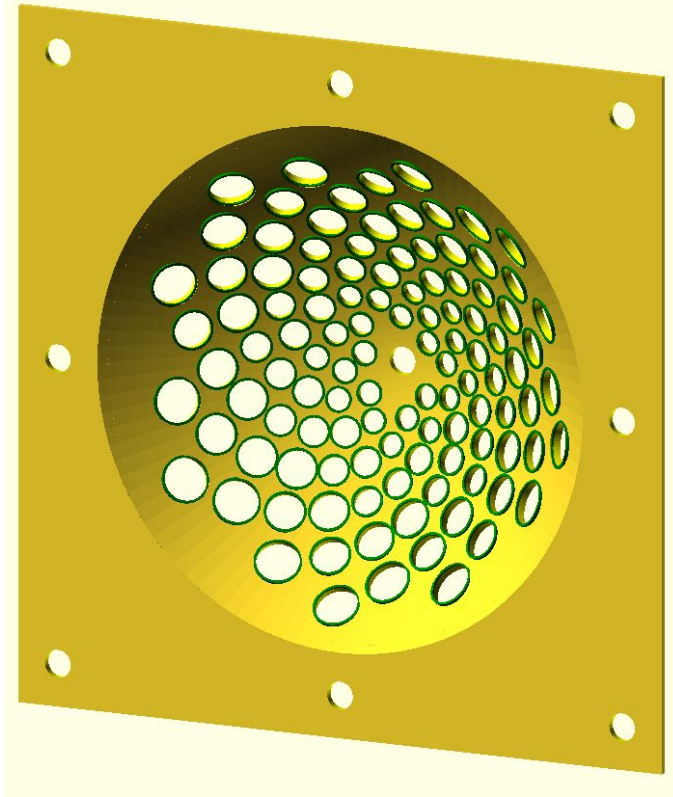
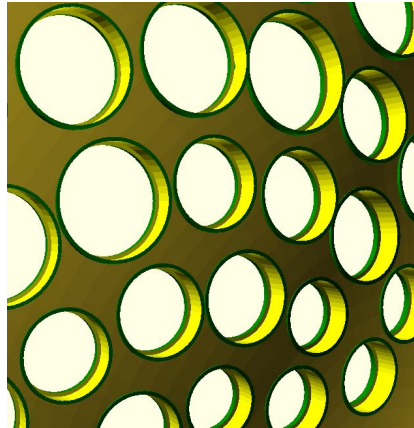
CAD Design: Mounted Overview



CAD Design: Front Board

Perimeters to think about:

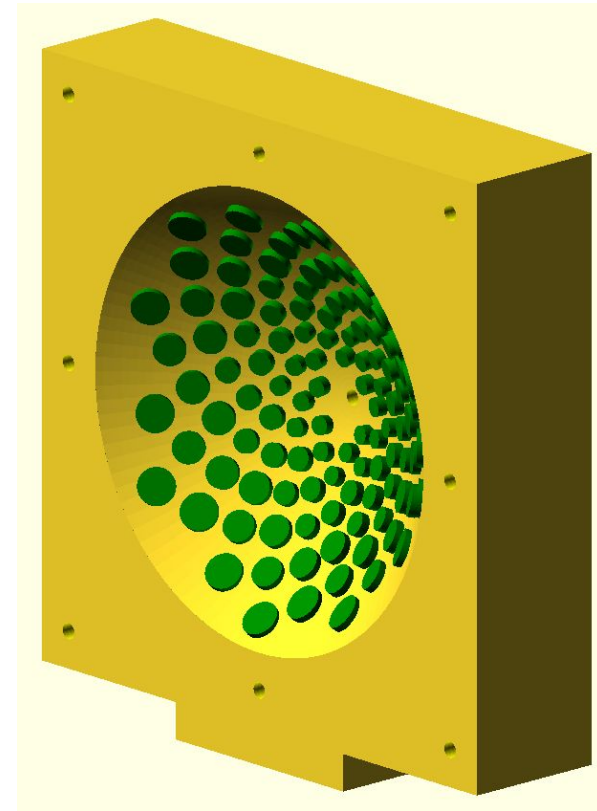
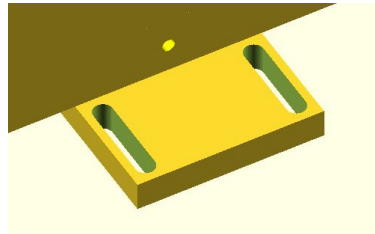
- Overall board thickness
Mirror thickness \pm some margin
- Hole size
Mirror size + some margin
 - {0.2, 0.3, 0.4} mm
- Front-stop overlap radius
 - {0.2, 0.3, 0.4} mm



CAD Design: Local Support Board

Perimeters to think about:

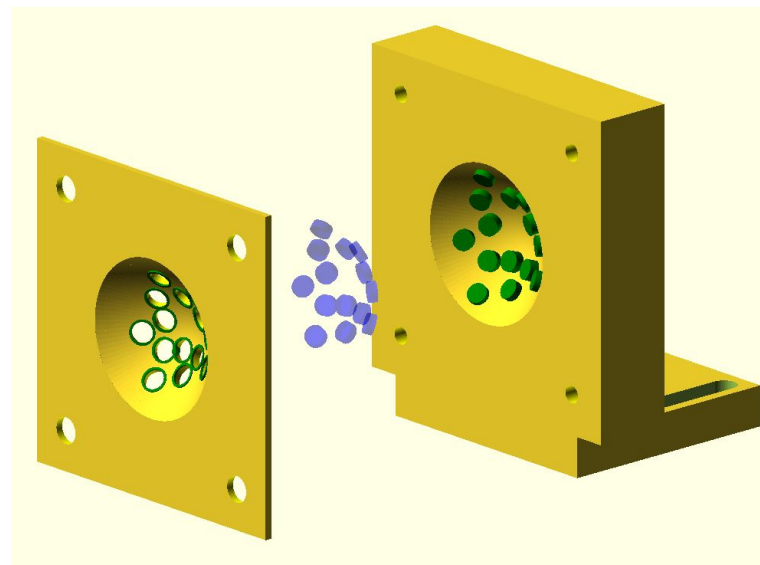
- Knob thickness/depth
 - Not terribly important
 - Large enough is good enough?
- Knob diameters
 - Mirror diameter or slightly smaller
- Overall thickness
 - Determined by mirror arrangement
 - This image: 4cm
- Base
 - $\frac{1}{4}$ "-20 screw holes
 - Width: 2" + some margin
 - Depth: 1" + some margin
 - Height: 1cm



First Prototype for Lab Testing

First prototype:

- 35mm lens @ 0.15x mag
- Only 5mm mirrors
- Cheaper, readily available set-up
- Much smaller system
- Test mechanical design
 - Stability, loading procedure, angular, alignment
- Test optical performance
 - Do all views fall onto the sensor as we want?



Summary

- 3D dome prototyping
 - Two-board, push-in mechanism
 - **CAD design almost done!**
 - OpenSCAD code seems to **work with various configurations**
 - 35mm small test prototype config
 - 58mm final demonstrator config
- **Almost ready to submit order**
 - Mirror removal: some mirrors overlap or are too close
 - Detailed parameter discussion
 - What parameter range?
 - How many different boards should we get?
- Rubber cushion
 - Overarching sheet?
 - Individual disk for each mirror?

