3D Imaging Dome In-air Demonstrator

3D Print Design

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SLAC MAGIS Group Meeting

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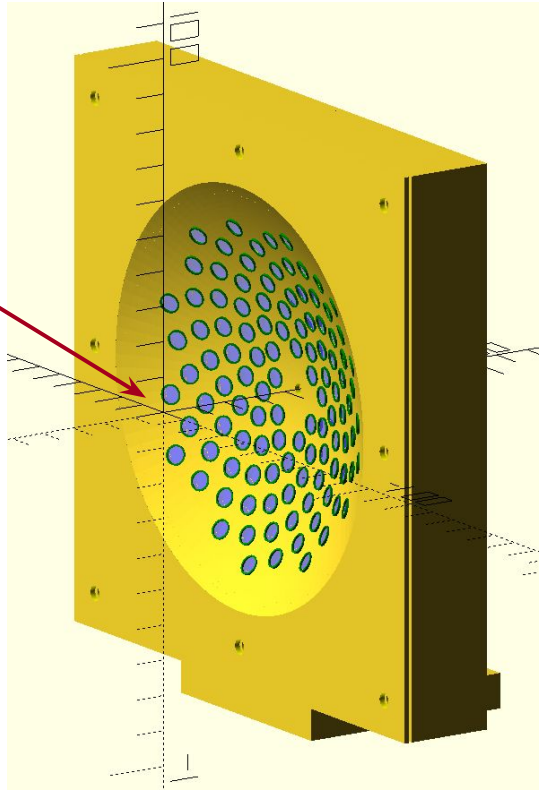
U.S. DEPARTMENT OF ENERGY
Office of Science

SLAC NATIONAL ACCELERATOR LABORATORY

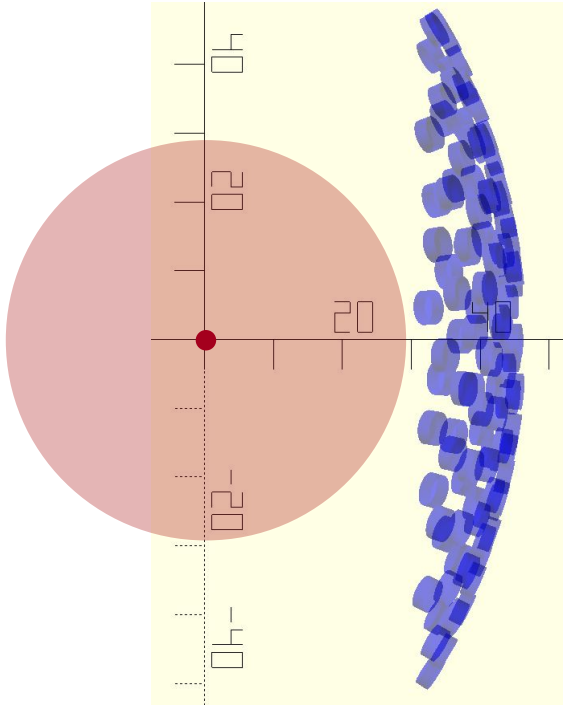
In-air Demonstrator: Definition

- Proof-of-Concept Demonstrator
  - 3D view & reconstruction
  - Light collection
- Will be tested with O(1mm) 3D targets
  - “DOE” letter cube
  - SLAC Logo
- Intermediate step for similar experiments at Jason’s lab and eventually MAGIS-100
  - In-air is the easier version
  - But we shouldn’t make it too easy
  - Try to keep things somewhat realistic
- Main piece for the first PoC, engineering paper



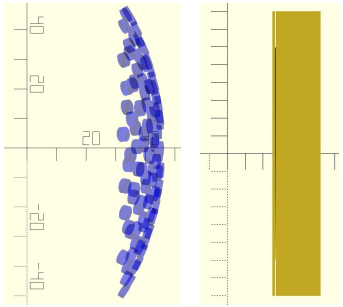
In-air Demonstrator: Overview

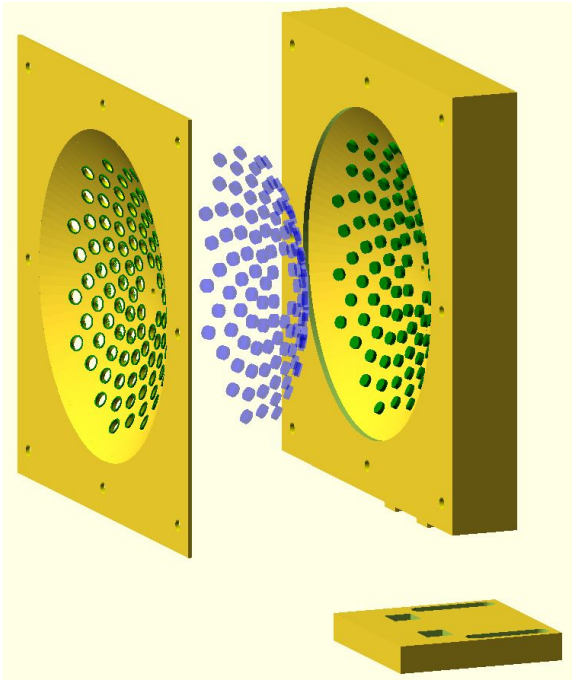
- Based on MDProto2
- Overall board dimension:
- 111 mirrors total
  - Fixed diameter: 5mm
  - Same λ/4 mirror used during prototyping
  - Transverse span: ~50mm in radius
  - Maximum view angle: 55deg
- Minimum distance from the object
  - Not technically necessary for in-air
  - Required for real atom interferometers (clearance for vertical lasers)
  - Mirrors lying between 30mm and 47mm in x-direction



3D Print Design: Overview

- Front & Local Support boards
  - Transverse radius of the dome: 60mm
  - Overall dimensions: 140mm × 140mm × 25mm
  - ★ #8 screws: 0.1640”, 4.1656mm
    - Good enough? Something bigger?
- Base board
  - Same as MDProto2
- Clearance from the object location
  - 30mm for the mirrors
  - ~25mm for the front-most board surface

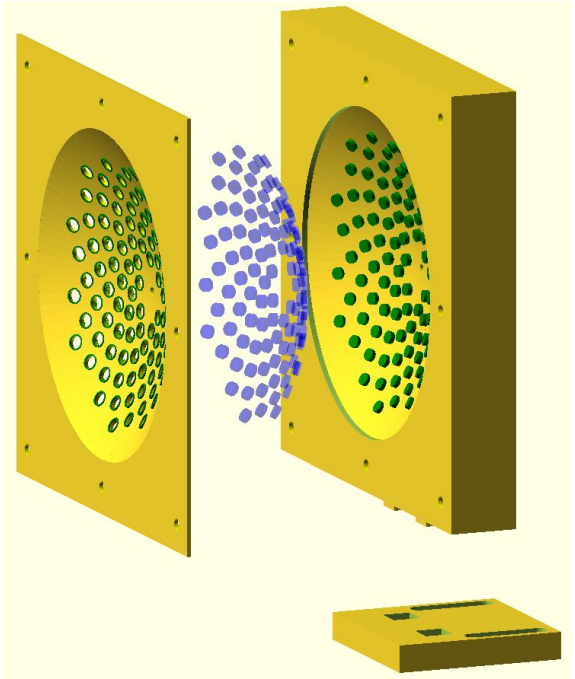




★ = main discussion point

3D Print Design: Printing Material

- Latest results from MDProto2
  - Knobs are not always pushing in very well
    - ★ Knobs not long enough
      - Longer knobs
      - Rubber (or other) pads in between
    - Front board flexing (∵ screws only at edges)
      - Add central screw(s)
    - Simple printing error
- ★ Mirror hole
  - 5.2mm felt a little loose
  - 5.1mm? Haven't tried yet…
- Front-stop
  - {0.2, 0.3} mm



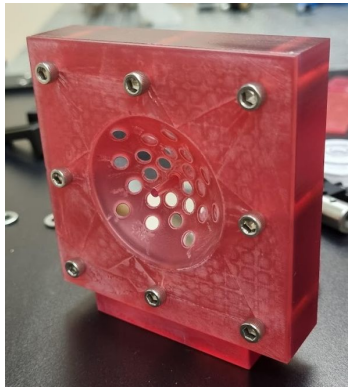
★ = main discussion point

3D Print Design: Printing Company & Material

SLAC

Applied Rapid Technologies, ART

- MDProto1 material = SOMOS® ProtoTherm 12120
  - Red, slightly transparent
  - Initially recommended for high-precision parts
- MDProto2 material = SOMOS® Taurus
  - Black, more matte
  - Happened to be available for MDProto2
  - Felt a little less accurate than MDProto1
    - Possibly due to expansion?



Stratasys Direct Manufacturing

- New company suggested by Greg
- Wider range of technologies: SLA, PolyJet, Laser Sintering, etc.
- Even additive metal technologies
  - Direct Metal Laser Sintering

Summary

- In-air demonstrator design is basically read for order
  - Minor remaining issues
    - Back knob length, screw sizes, mirror hole diameter
- But how should we actually make it?
  - ART
    - Mostly quite fast, reasonably cheap
    - Familiar with its quality and errors
    - Had some occasional problems
  - Stratasys
    - More options
    - Seems more advanced
    - Possibly (probably) more expensive?
  - Suggestion: I'll email Stratasys today, get some recommendations / quotes