



MAS 961: Special Topics

"How To Make Something That Makes (almost) Anything"

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Spring Semester, 2004

Taxonomy of Devices

Historical & Theoretical Overview

Various Devices

Objects

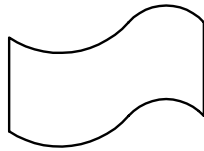


1952 – MIT Servo Lab

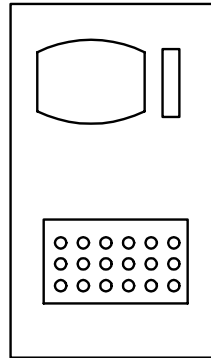
Numerically Controlled Machines

- *Began with the US Air Force*
- *The work Started at the Parsons Lab in the 1940s*
- *Developed the idea of Positional Data on Punch Cards*
- *1949 MIT Servomechanism Laboratory to develop a prototype*
- *The first NC machines was presented in 1952 – 3 Axis milling machine*
- *Work led to the development of the APT (Automatically Programmed Tooling)*

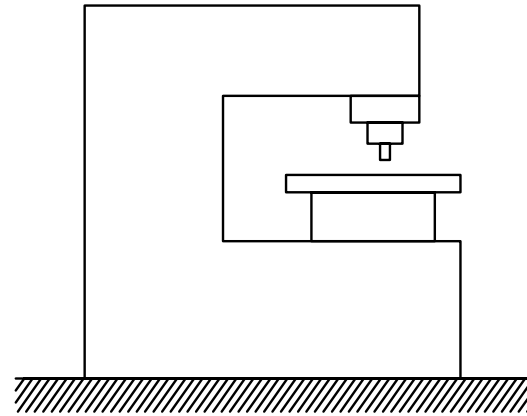
Basic Components of an NC Machine



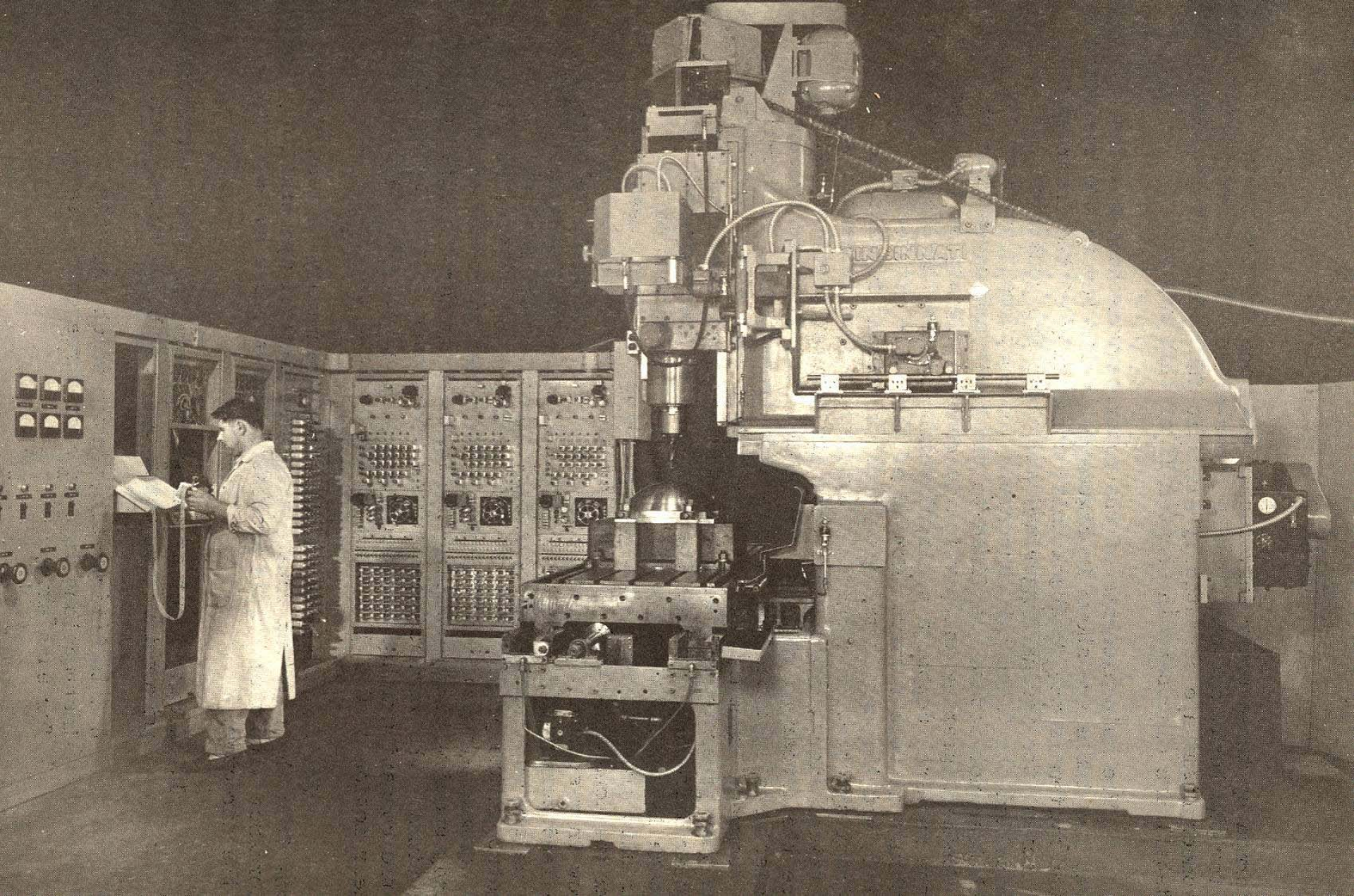
Program

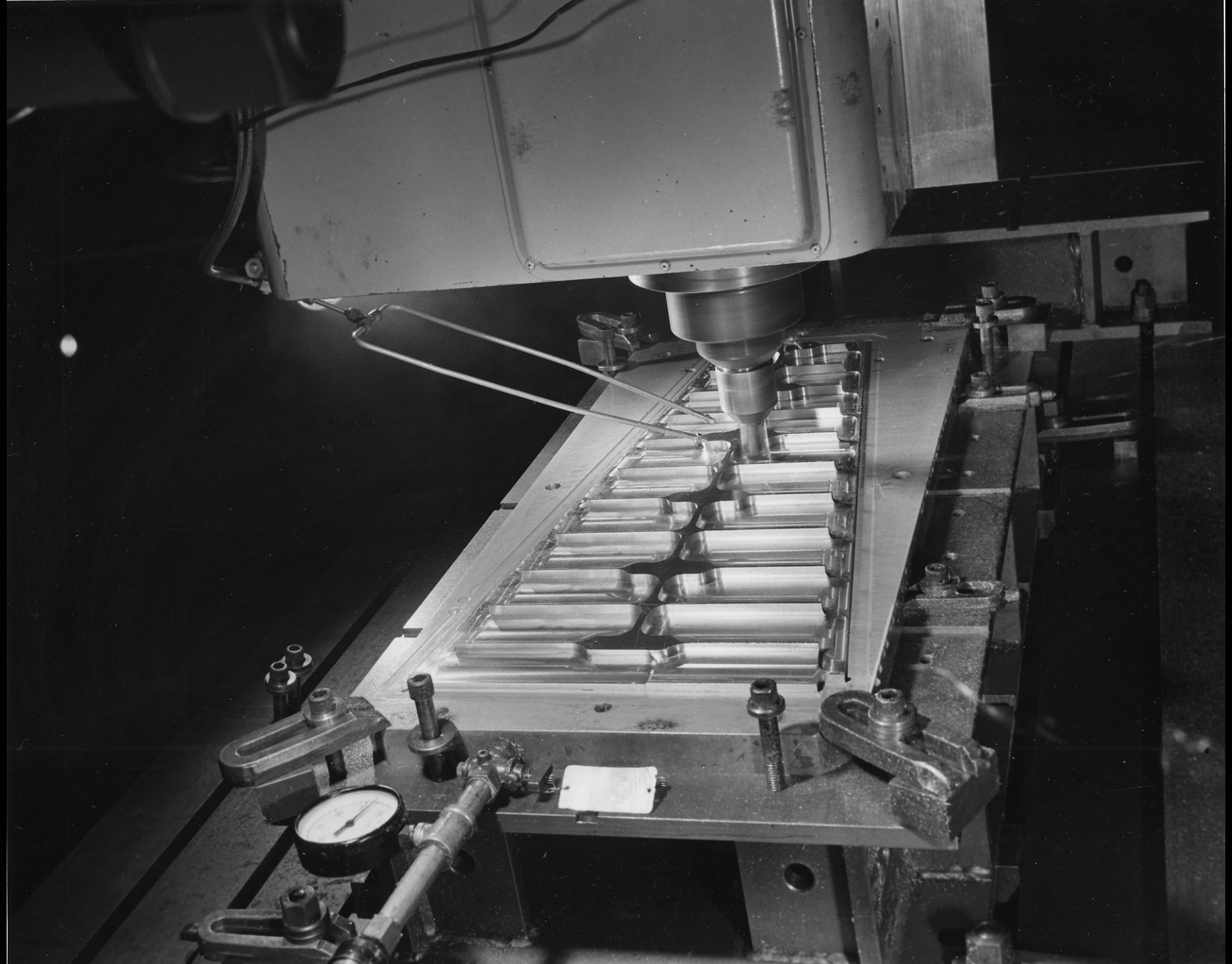


Machine Control Unit



Processing Equipment





ELECTRONIC SYSTEMS LABORATORY

DEPARTMENT OF ELECTRICAL ENGINEERING

M-I-T INNOVATIONS IN MANUFACTURING TECHNOLOGY

SPONSORED BY THE UNITED STATES AIR FORCE

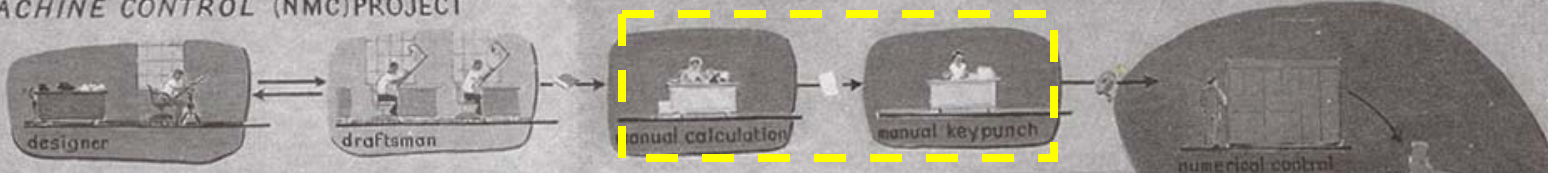
TRADITIONAL MANUFACTURING METHOD

PRIOR TO
1949



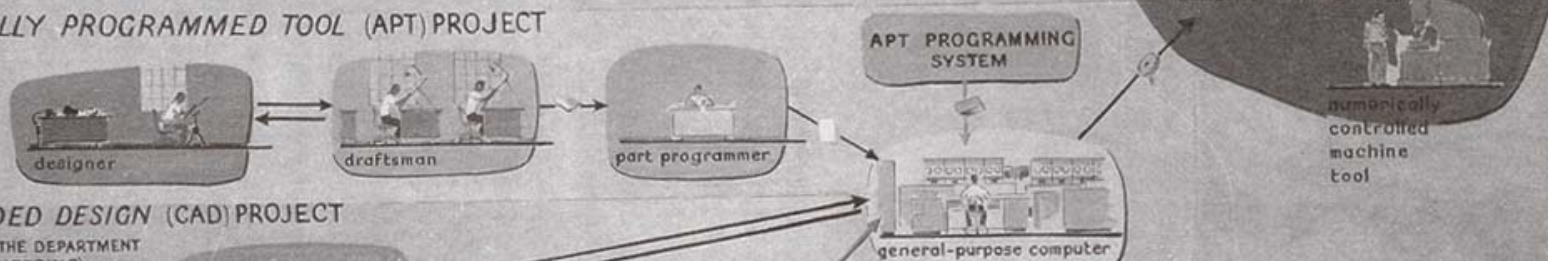
NUMERICAL MACHINE CONTROL (NMC) PROJECT

1949-1954



AUTOMATICALLY PROGRAMMED TOOL (APT) PROJECT

1955-1959



COMPUTER-AIDED DESIGN (CAD) PROJECT

(IN COOPERATION WITH THE DEPARTMENT
OF MECHANICAL ENGINEERING)

1960 —



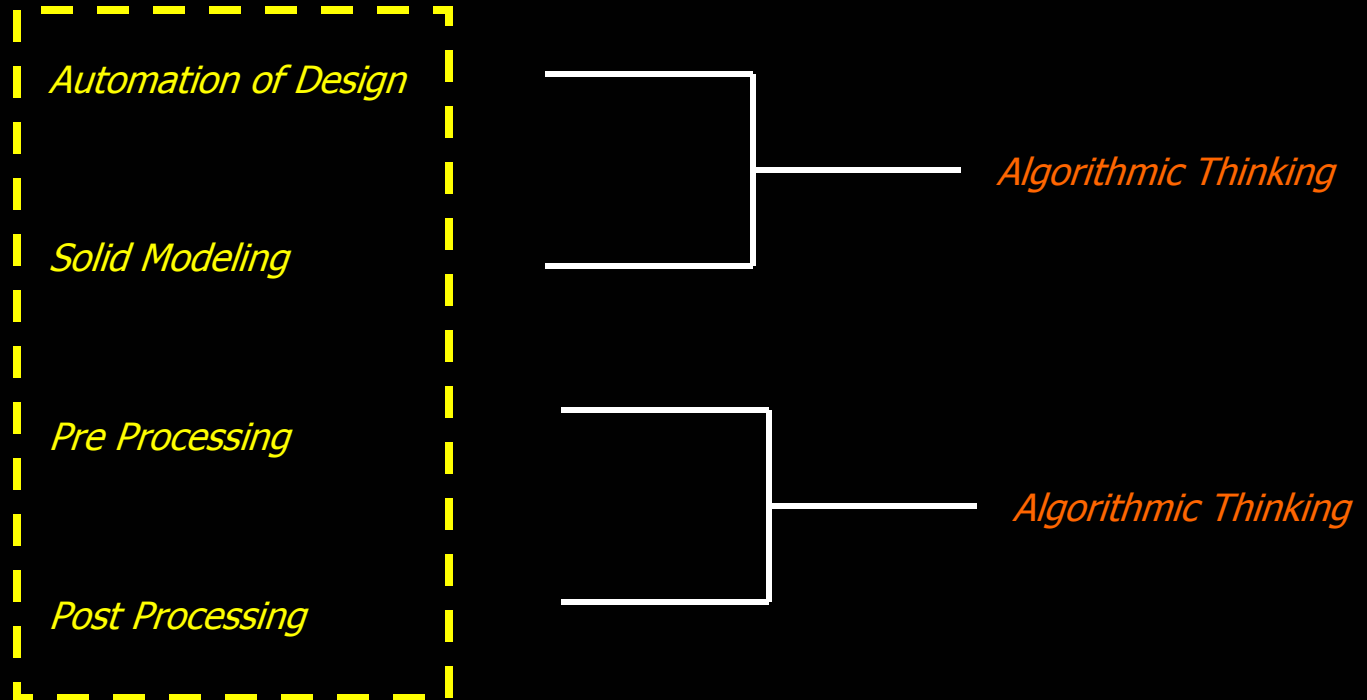




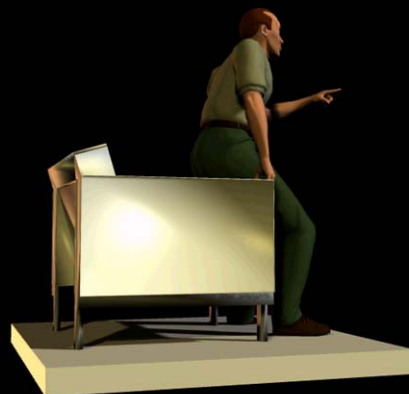
Origins of Rapid Prototyping

- *Refers to a layering process of materials from a CAD file*
- *The work was developed from solid modeling*
- *Charles Hull – Founders of 3M Systems – 1986 – StereoLithography*

Key Terms

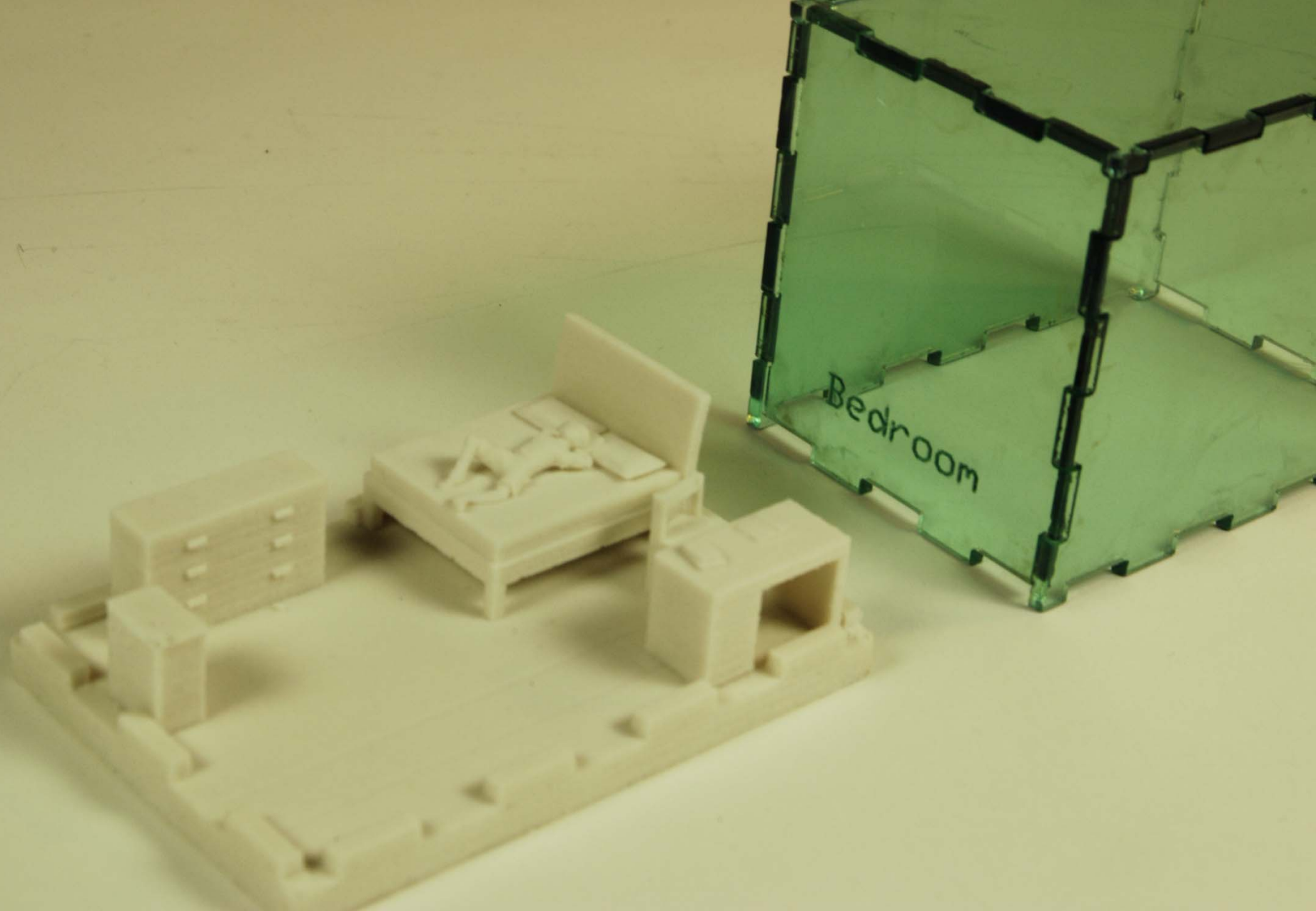












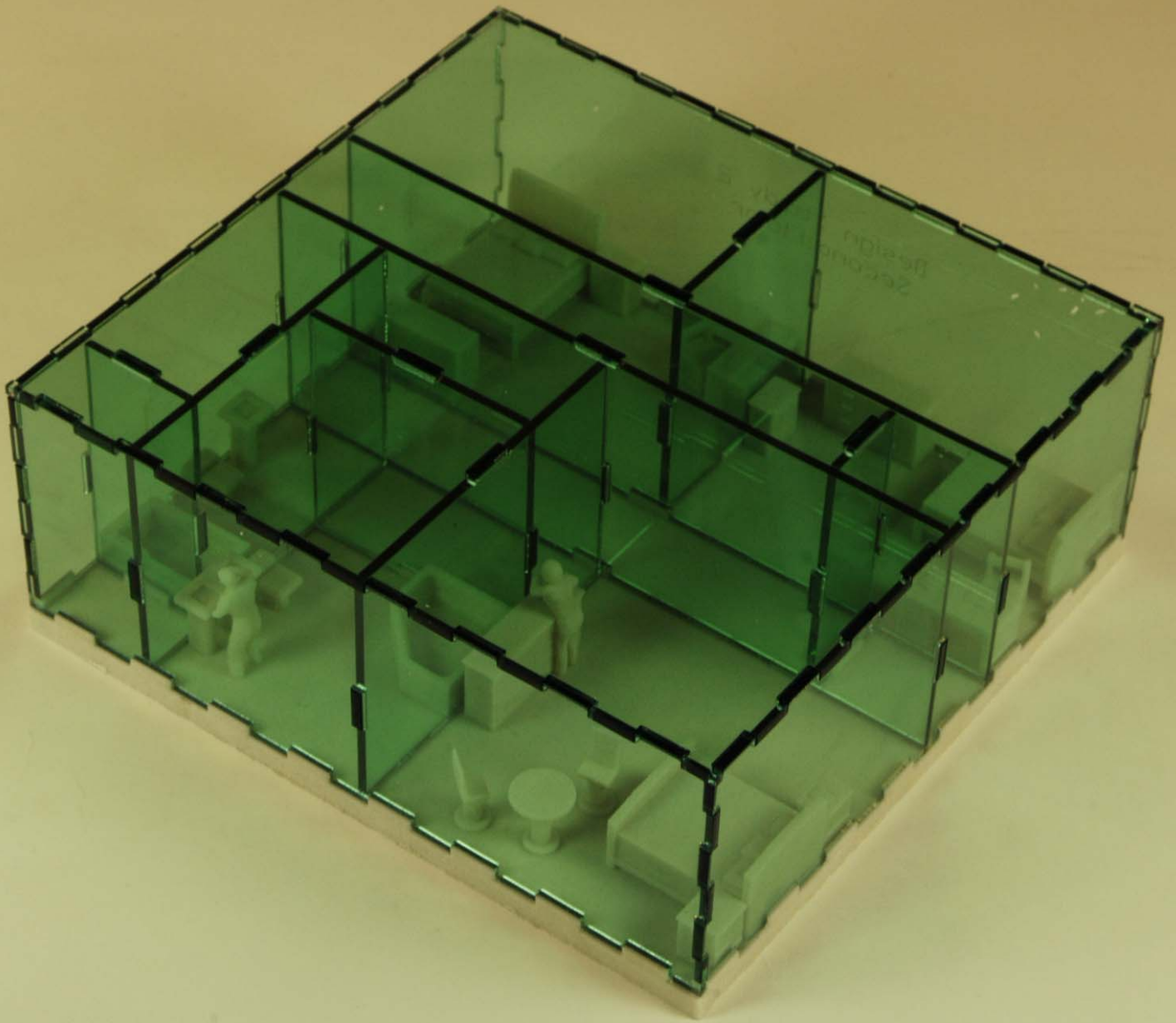
Design Descriptions (1)

Device Descriptions (2)

*Algorithmic
Approach*

Algorithmic Approach





Taxonomy of Devices

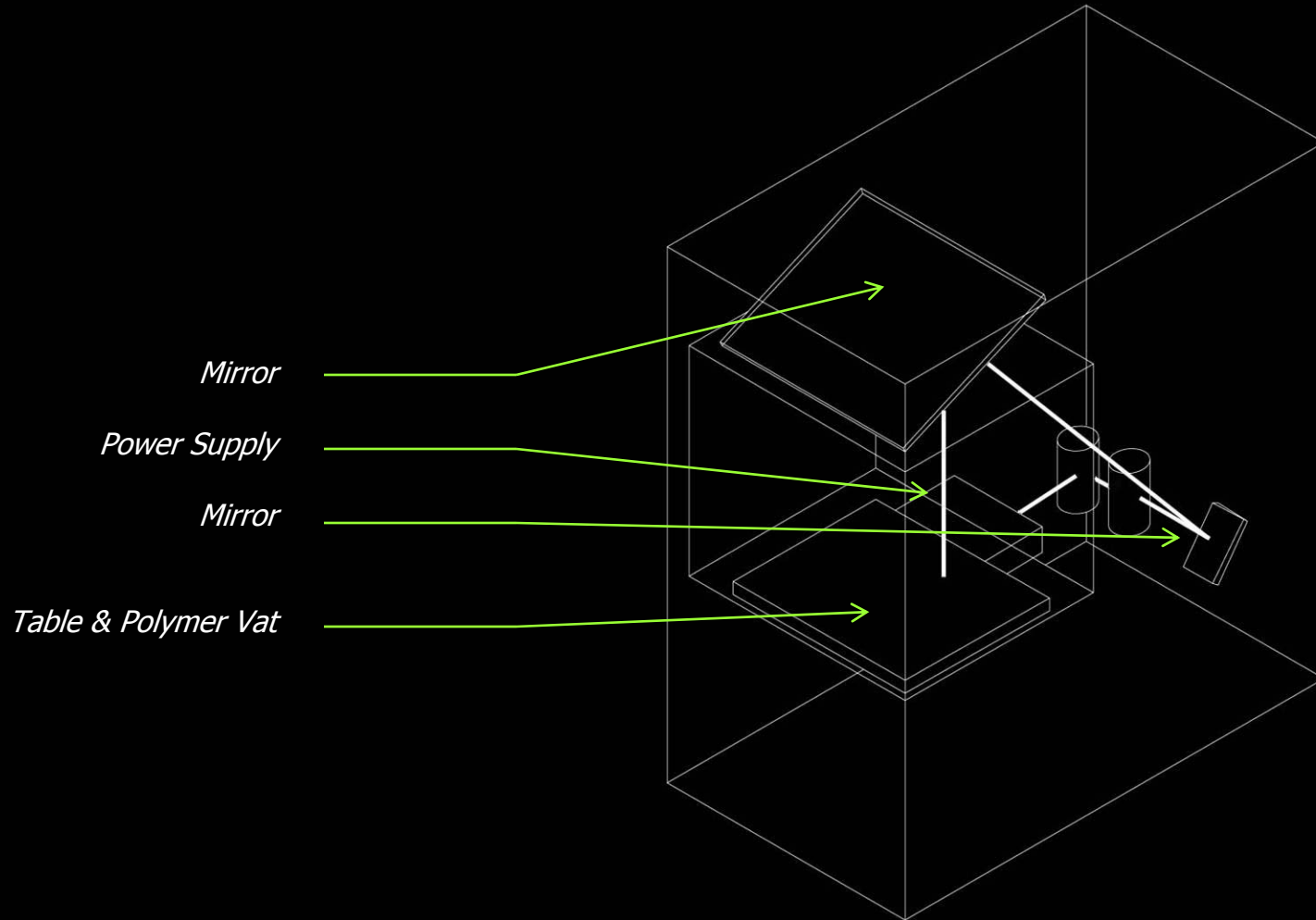
1. Building Devices
2. Cutting Devices
3. Drilling Devices

[1]

Building Devices



Stereolithography

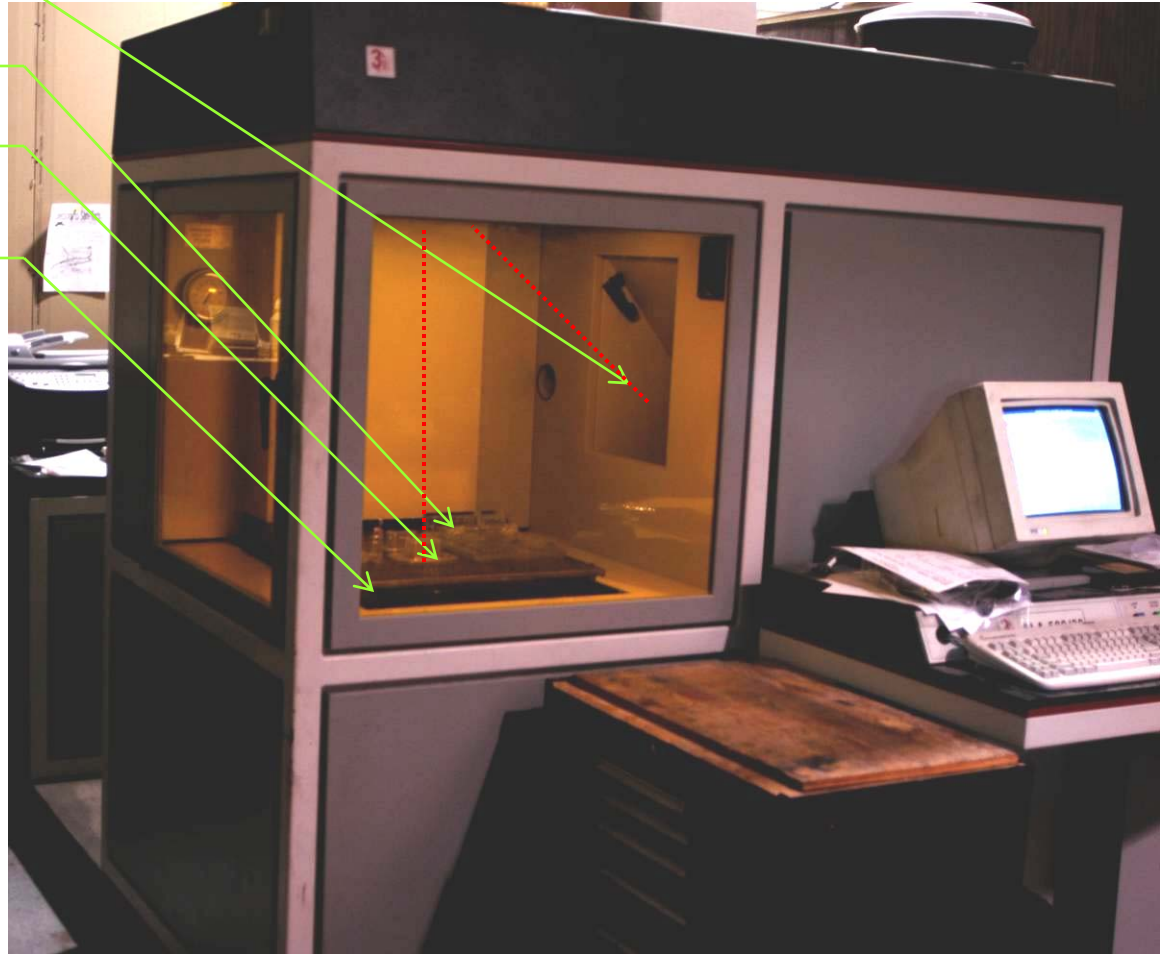


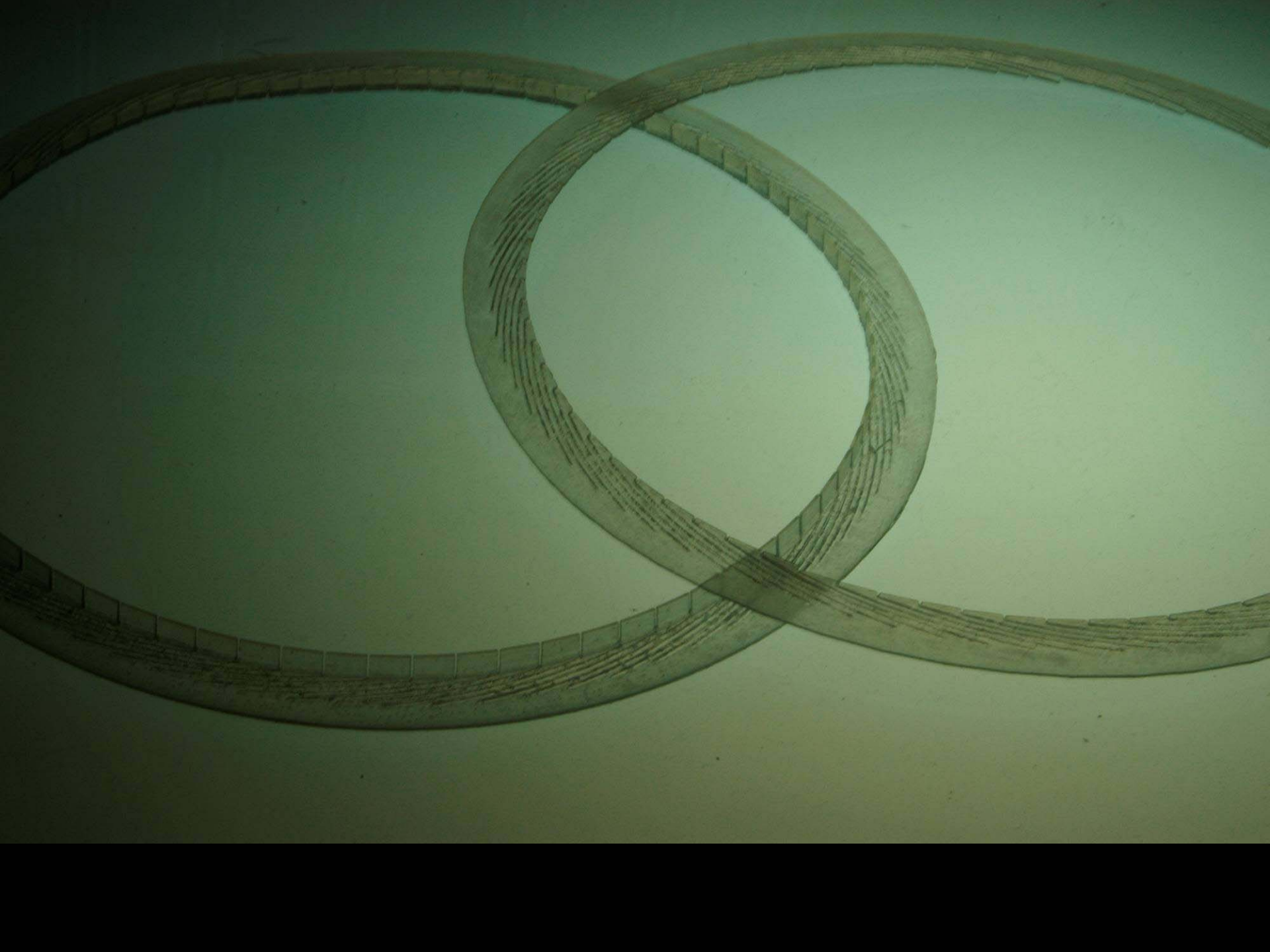
Laser Source

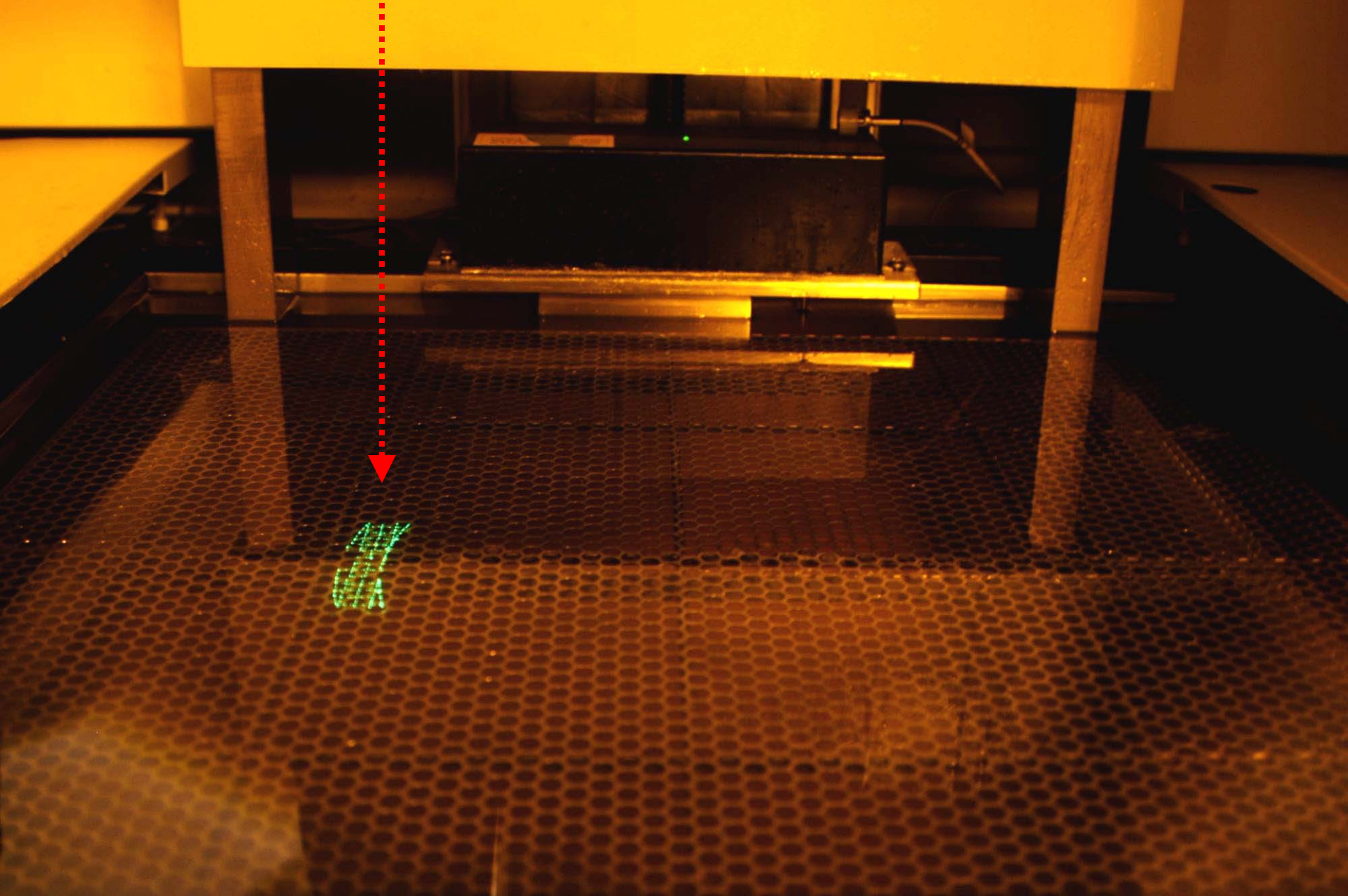
Models

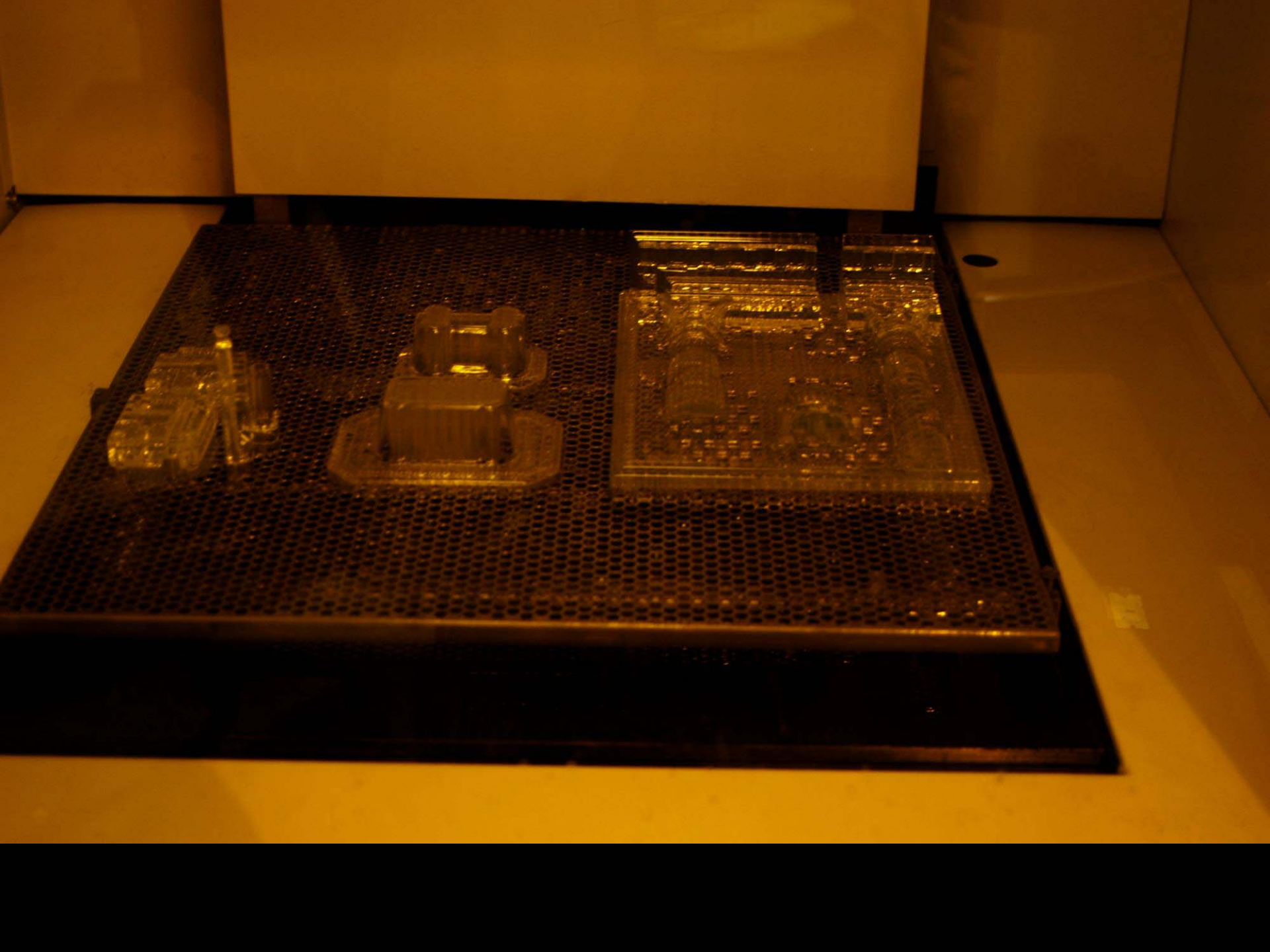
Table

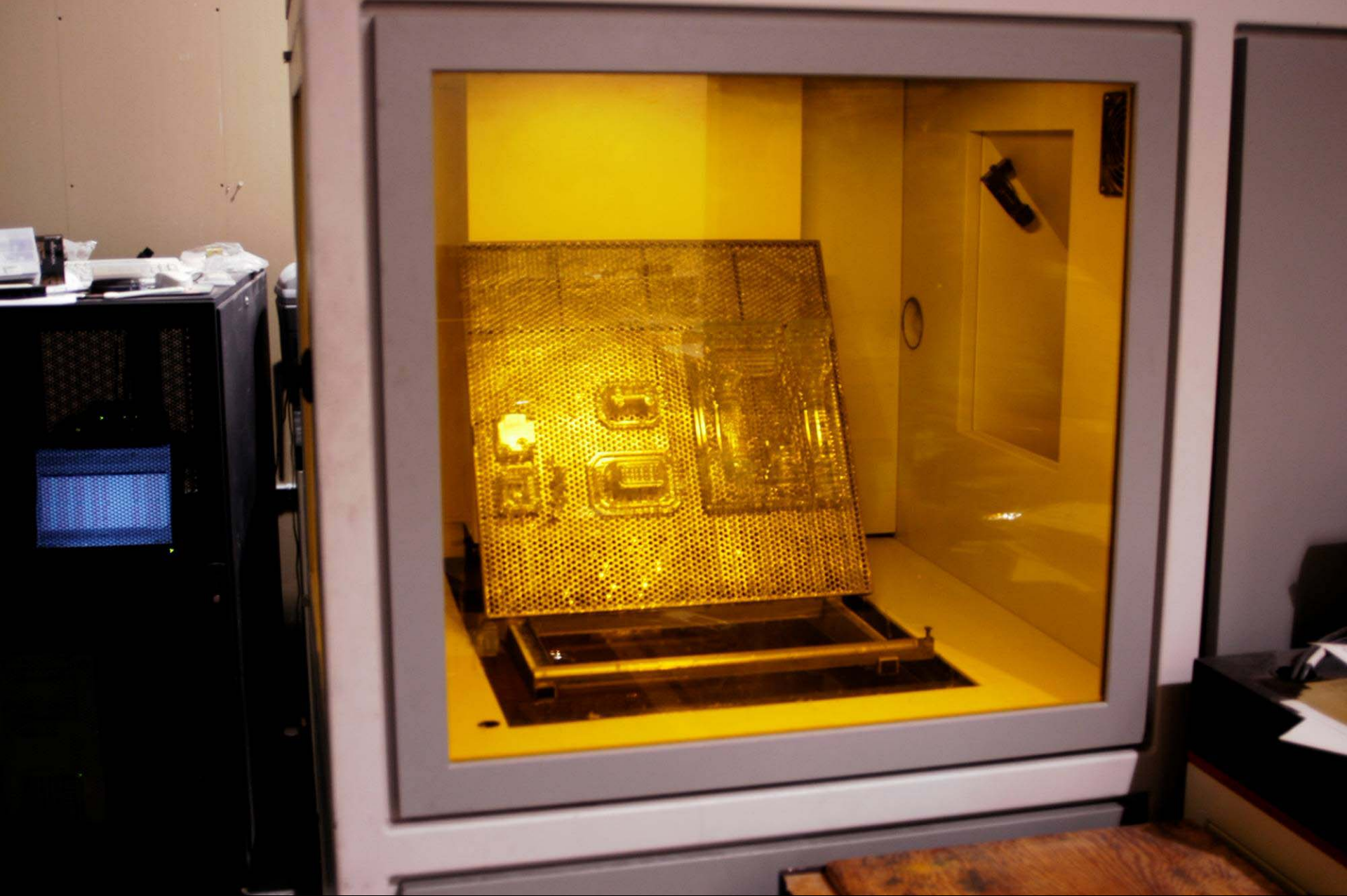
Vat

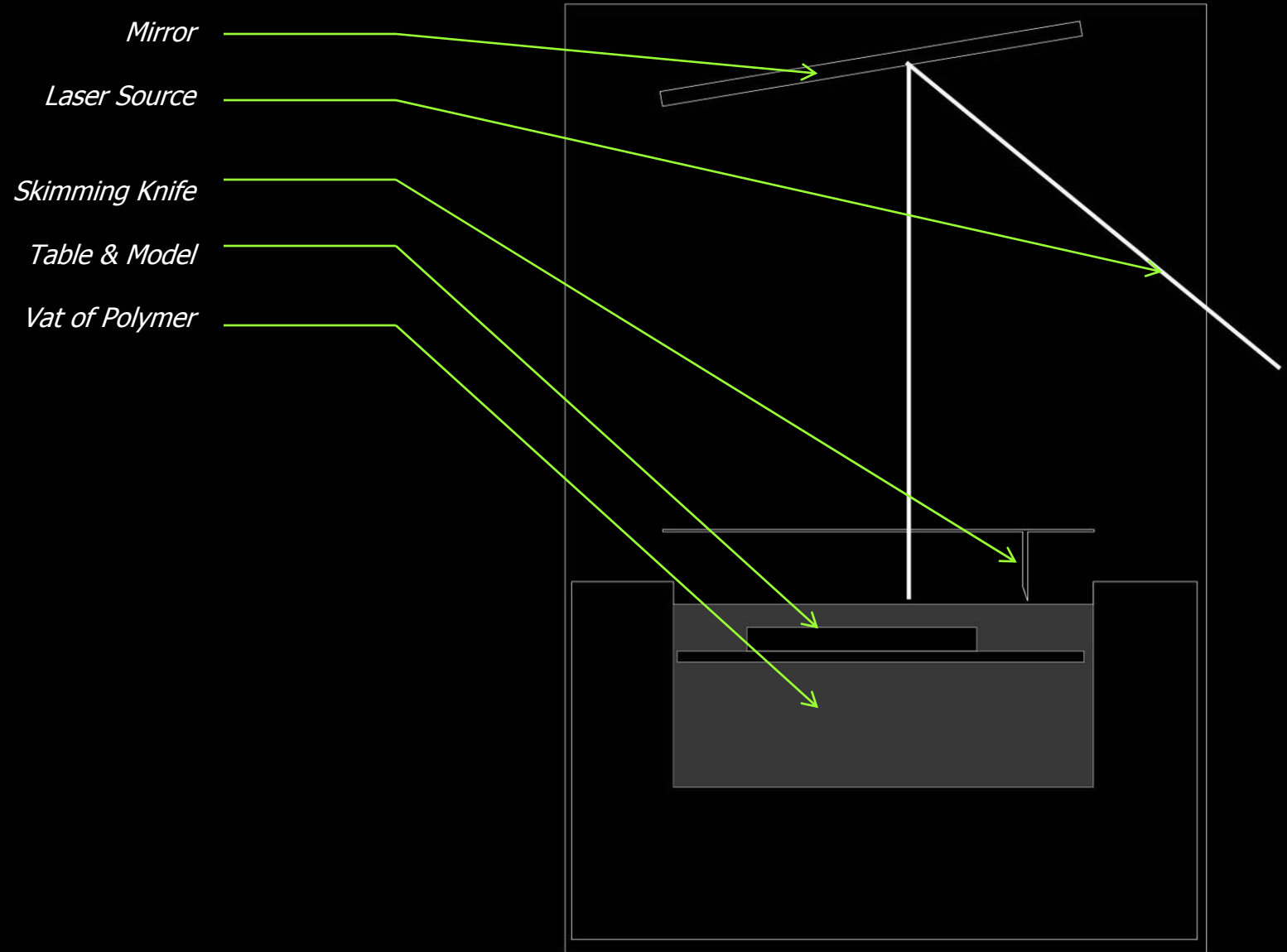


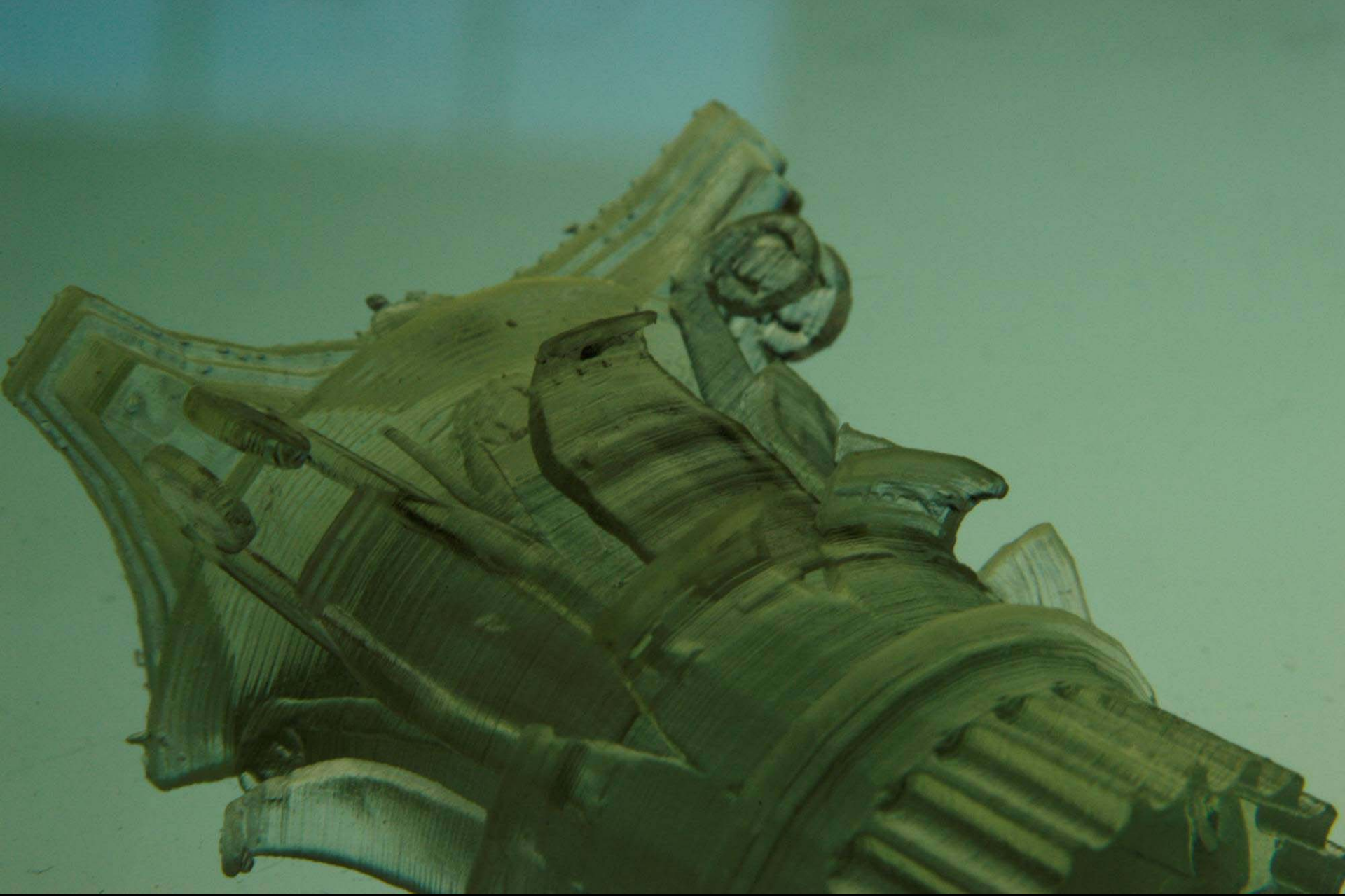




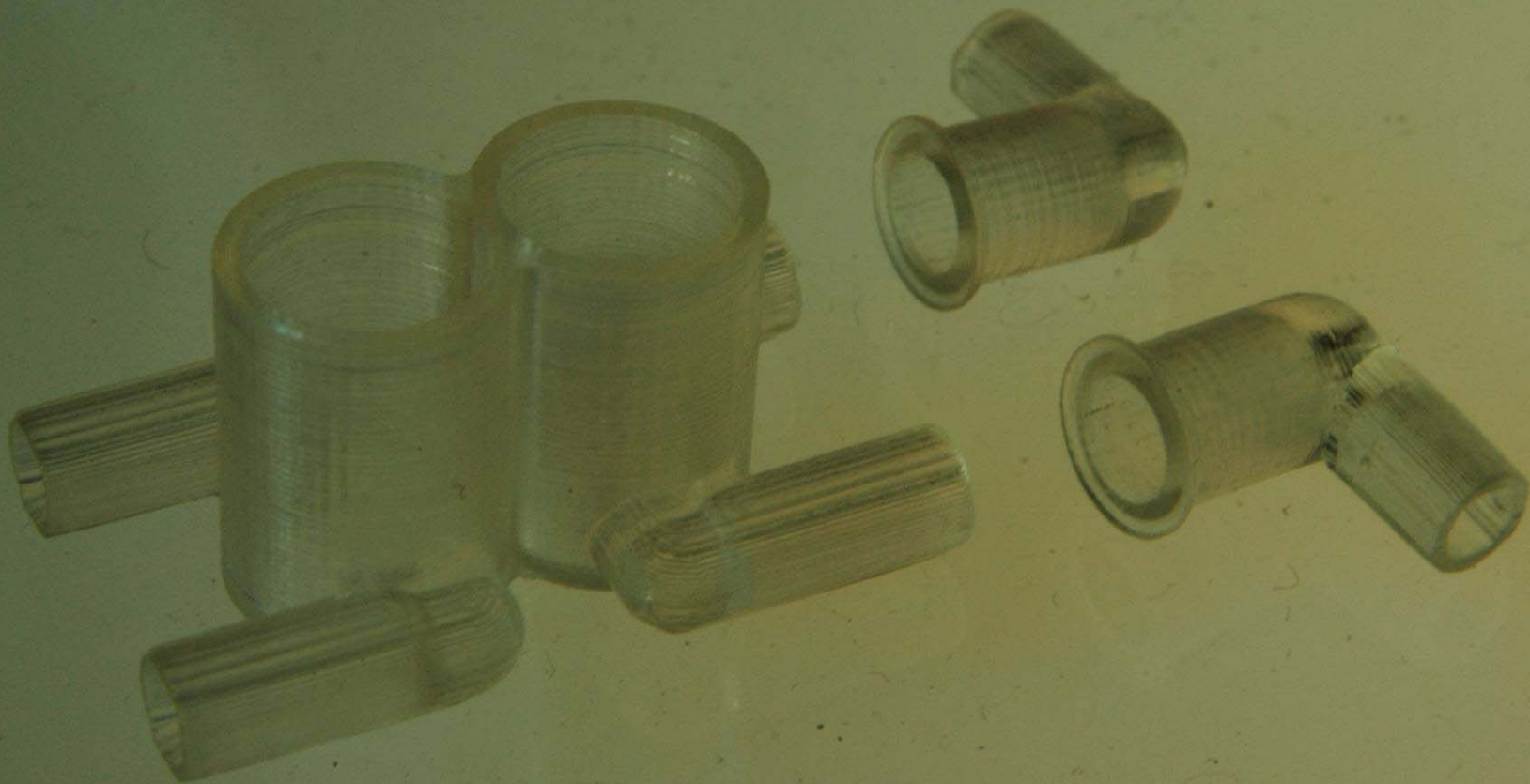


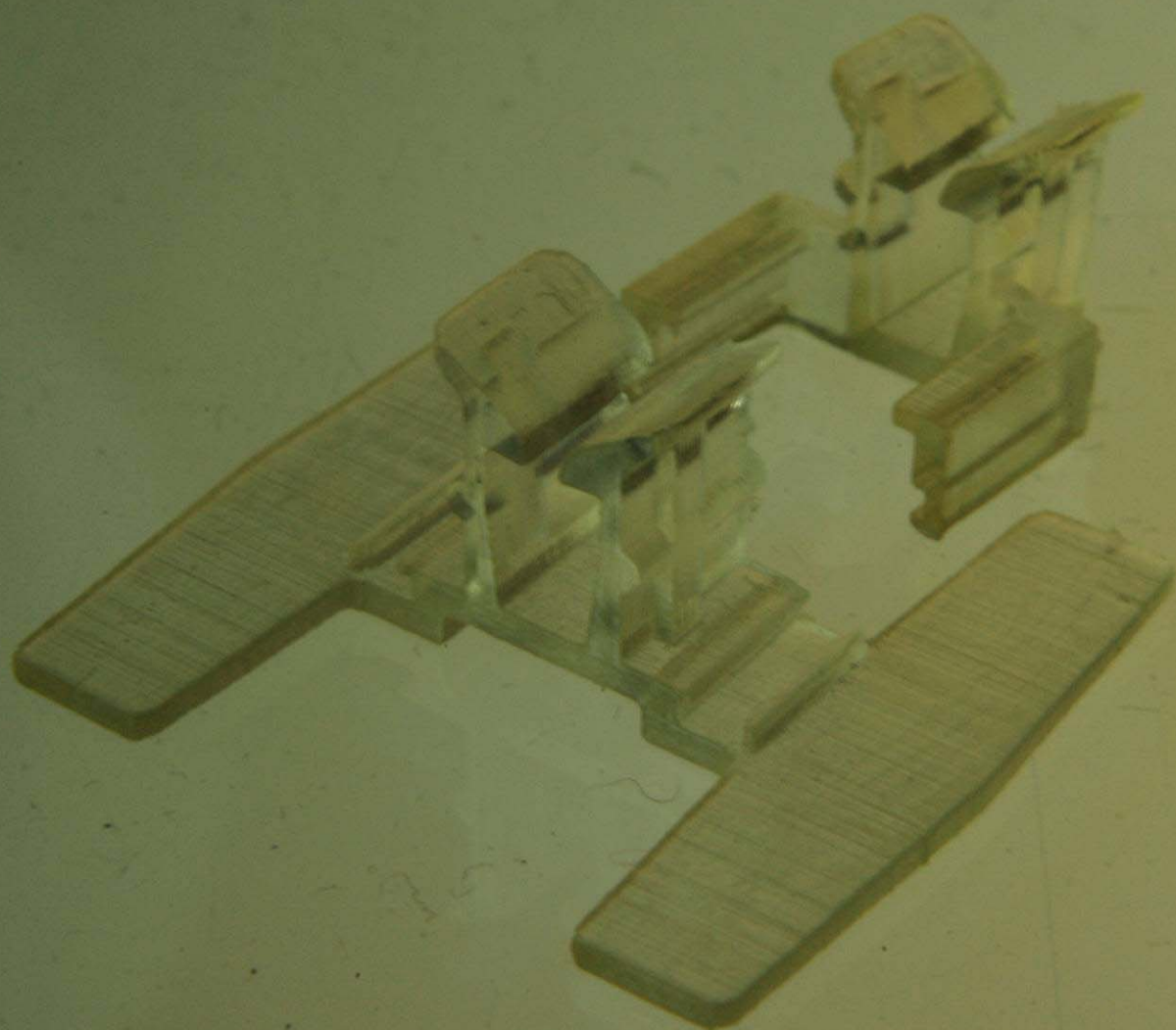


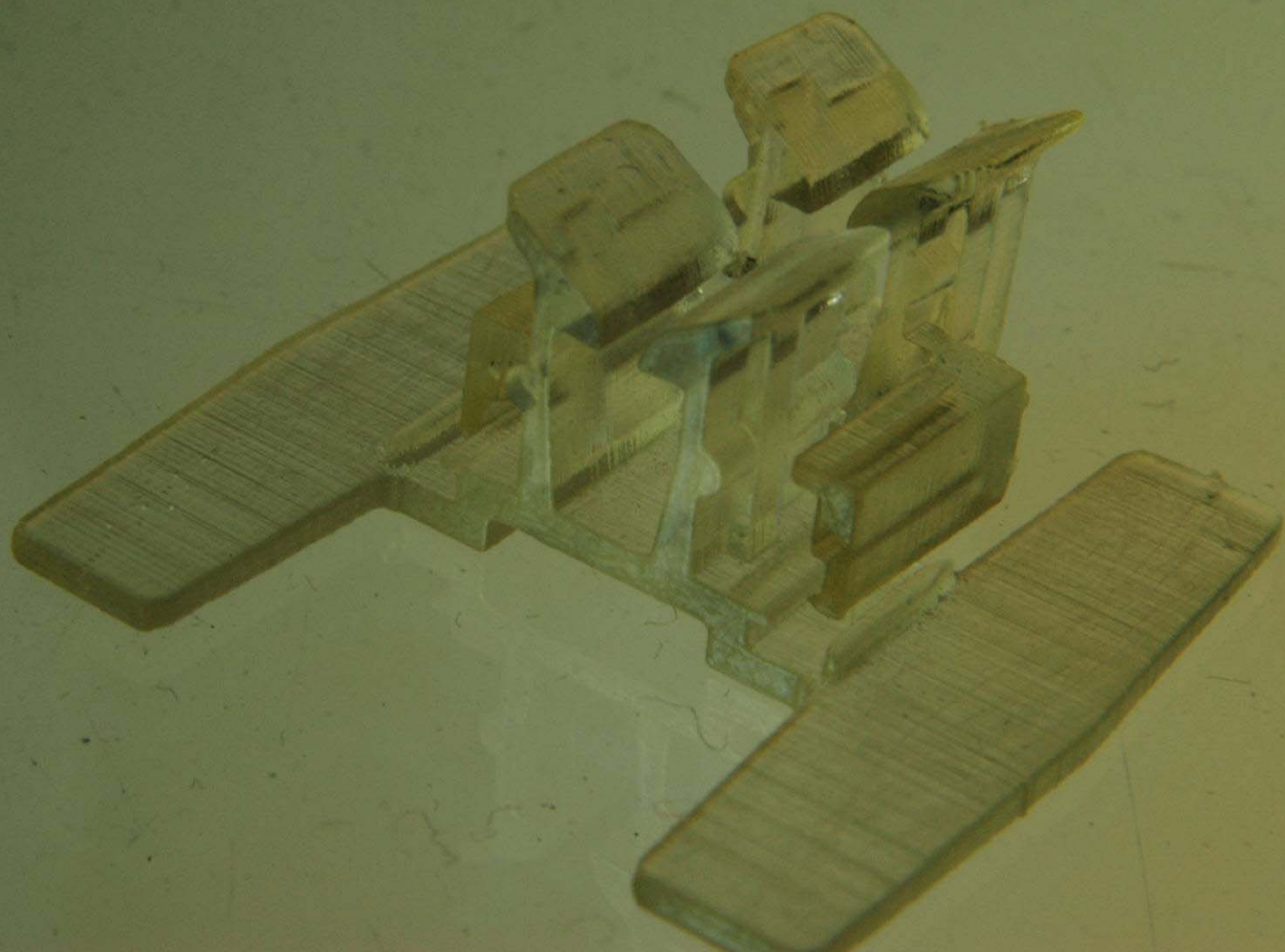








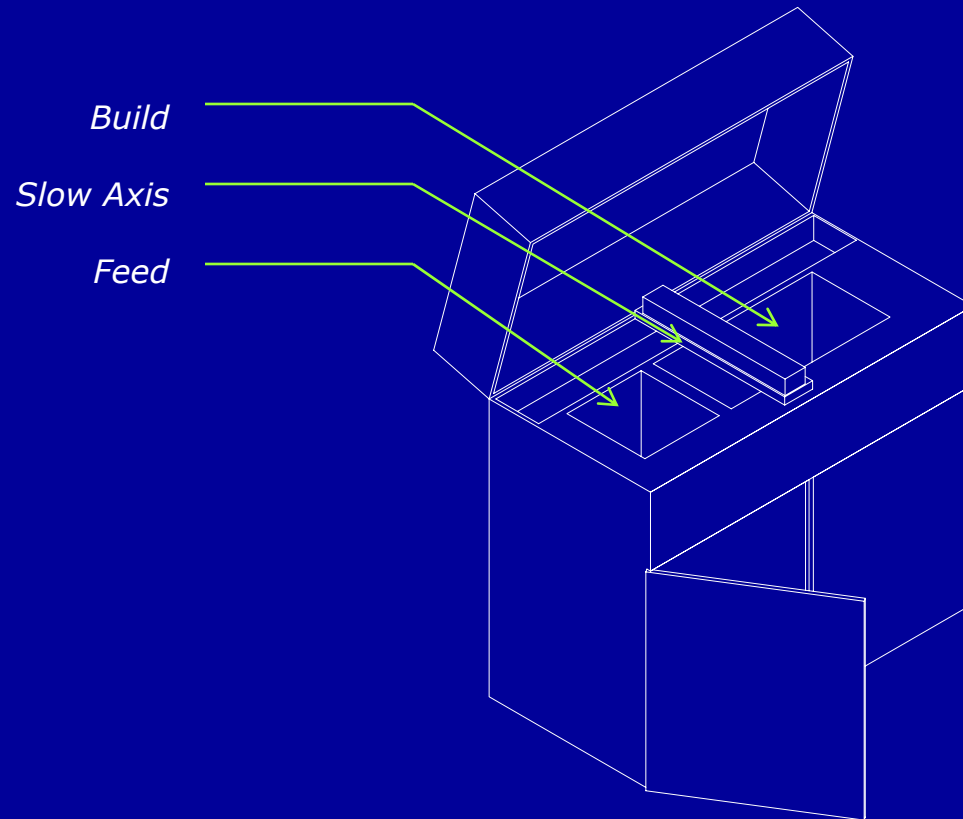




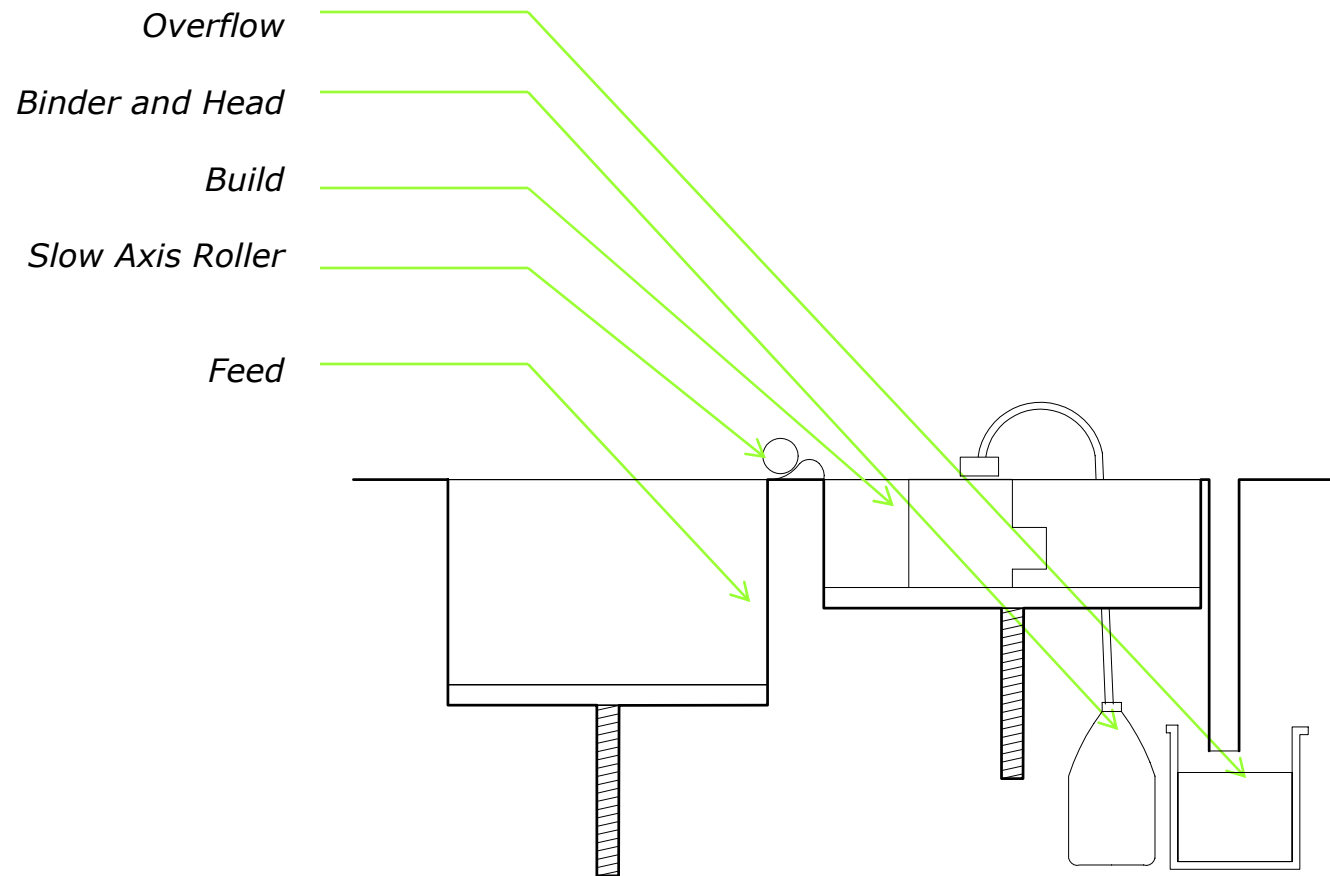
ZCORP *3D Printer*

MIT –Licensed Process

*Cornstarch
Plaster
Ceramics*

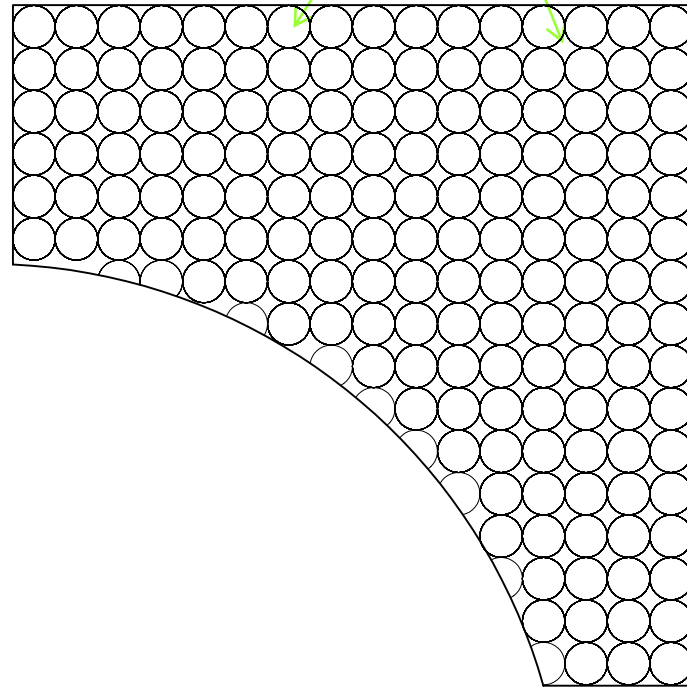






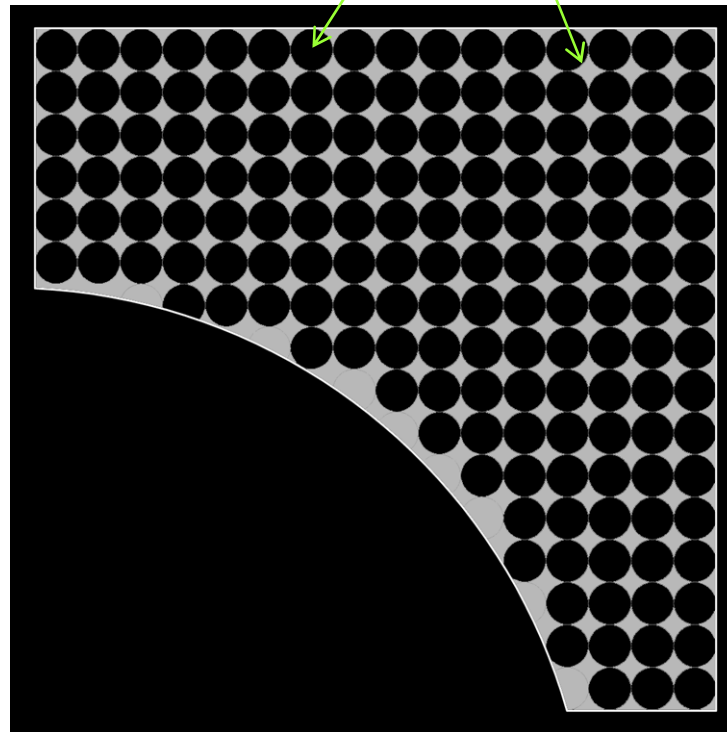
Open Spaces

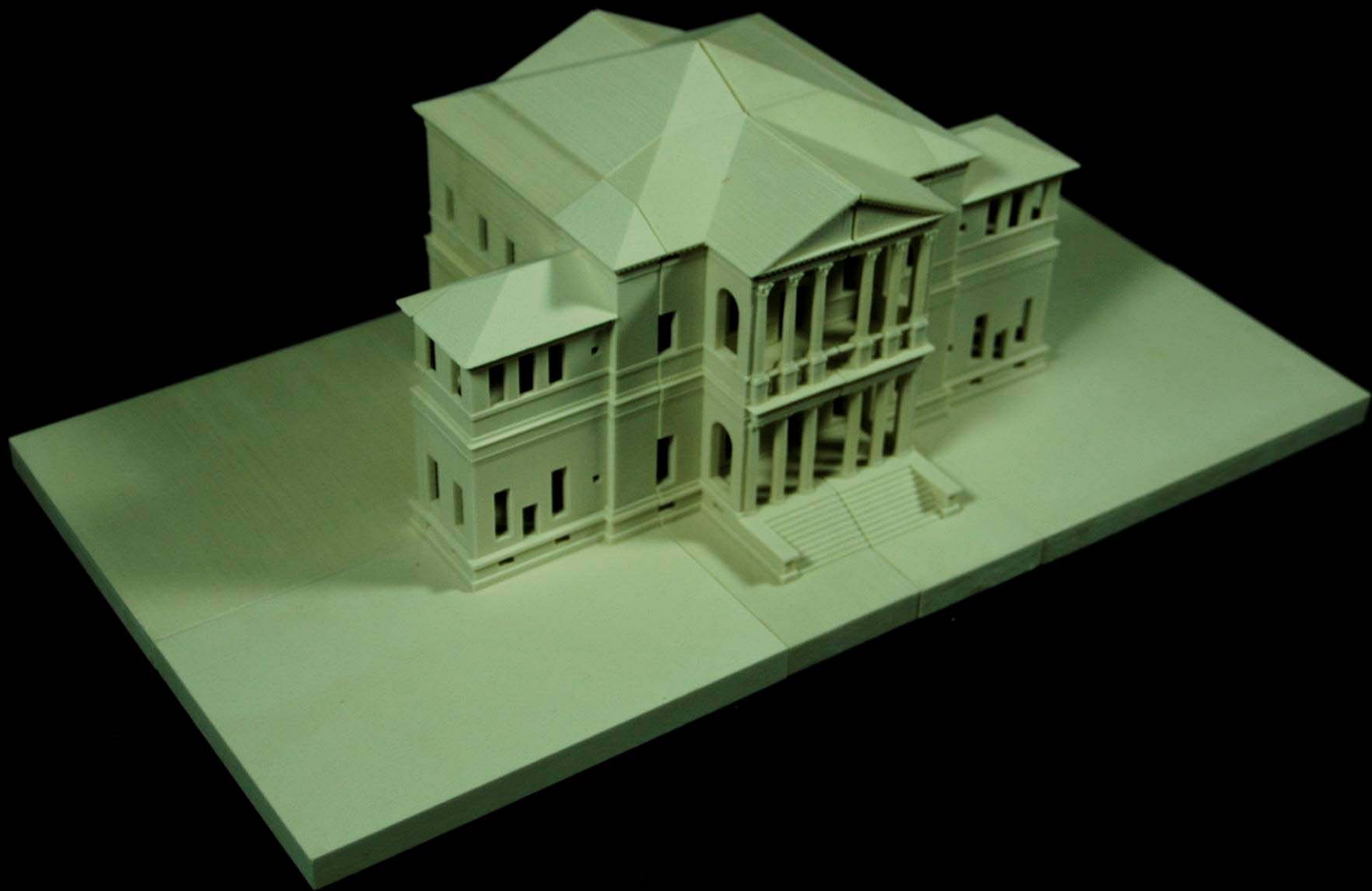
Plaster



Wax

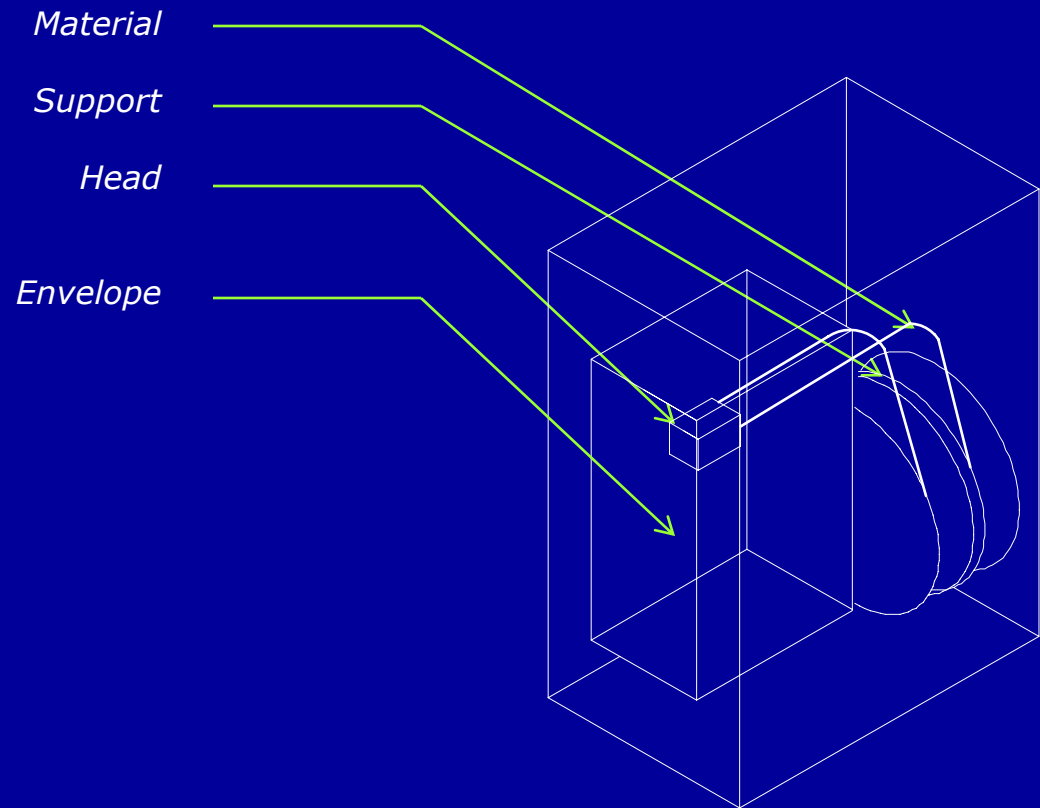
Plaster







Fuse Deposition Modeling



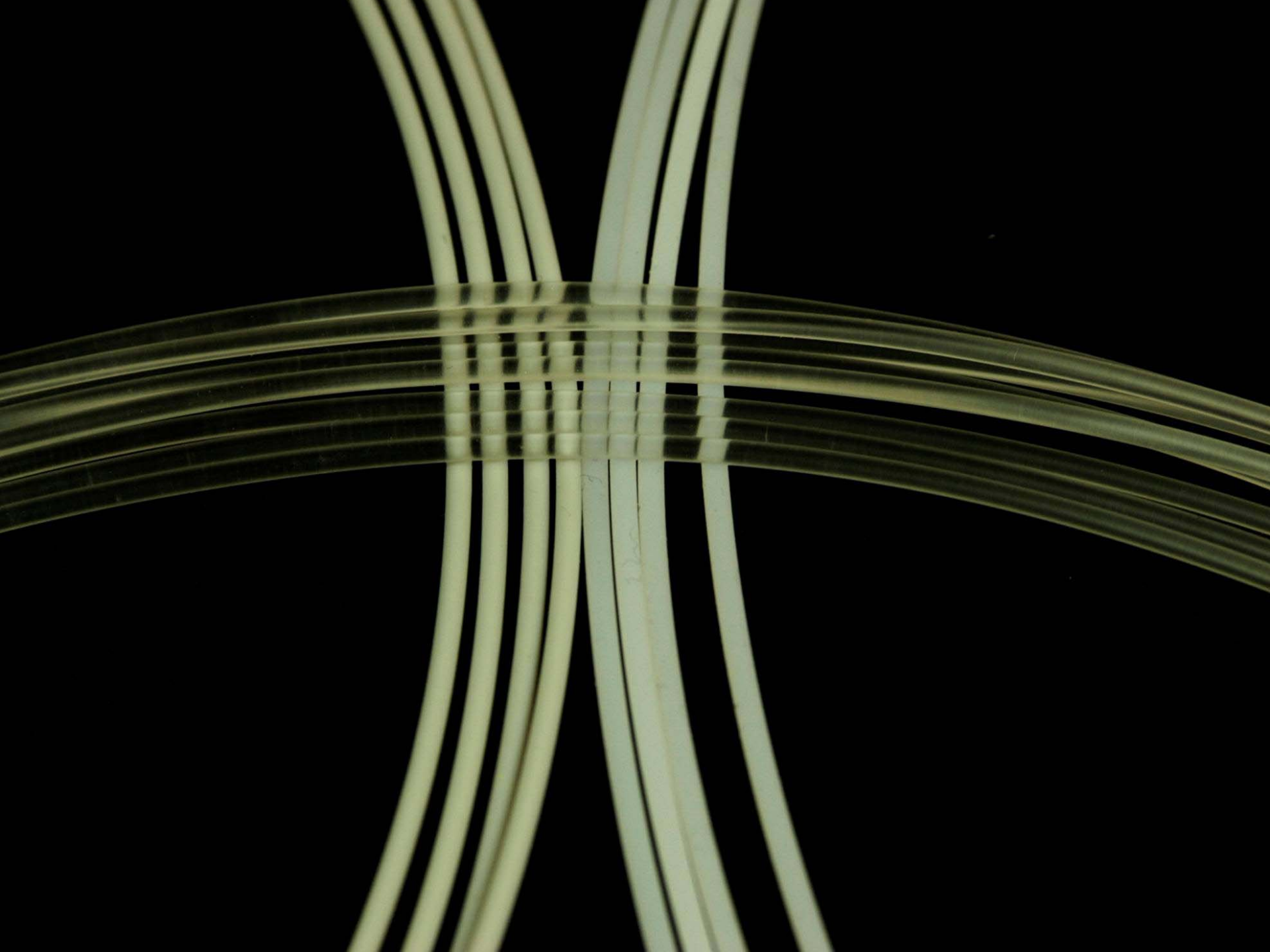
Temperature Gauges

Control Board

Envelope

Z Table





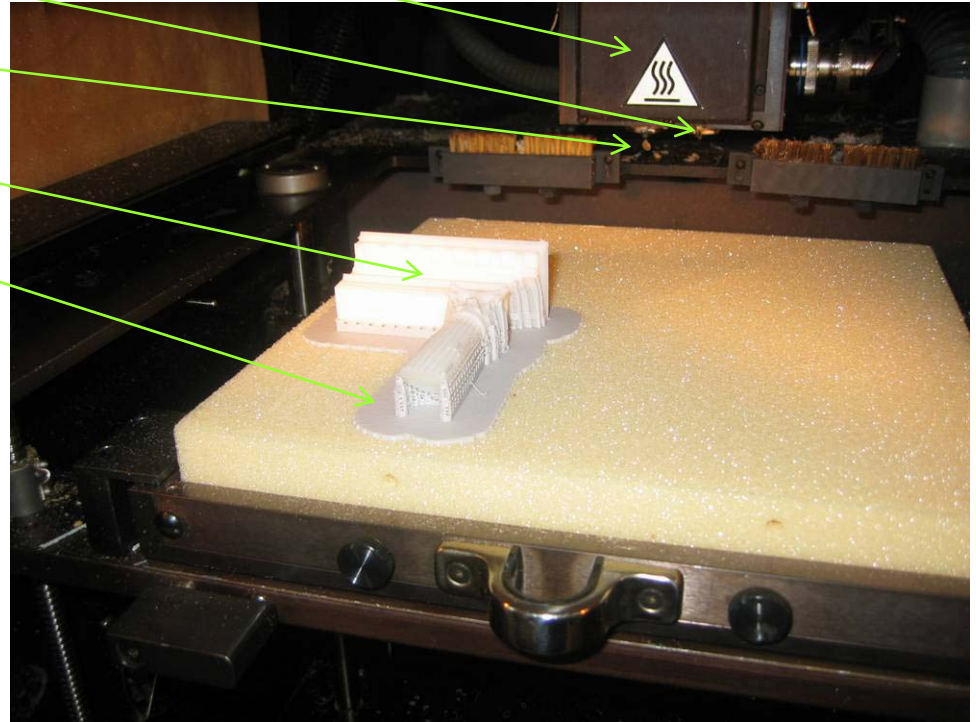
Head

Support

Material

Material

Support Base

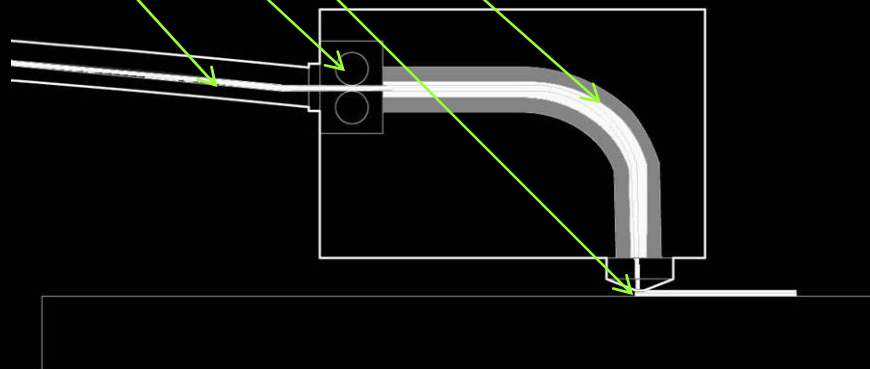


Heating Elements

Tips

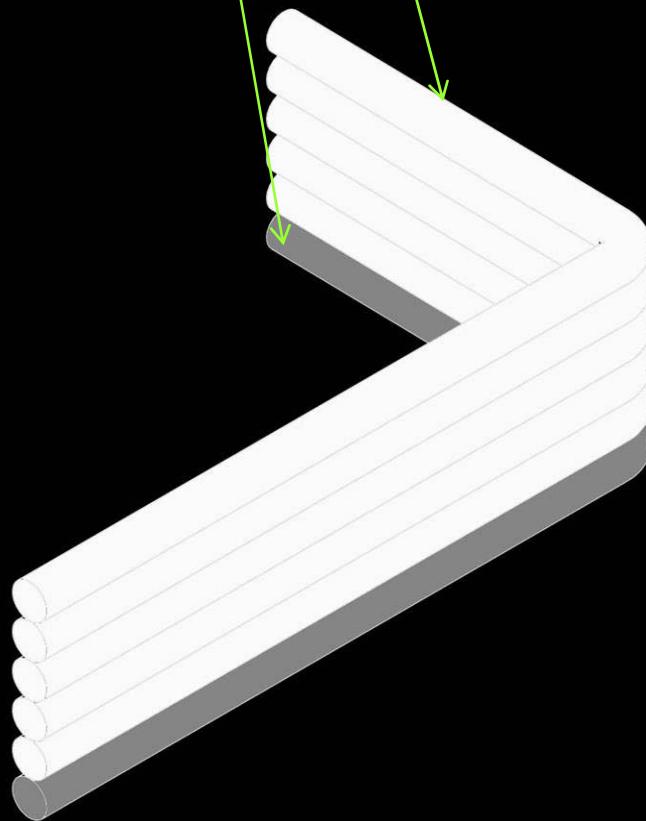
Drive Wheels

Filament



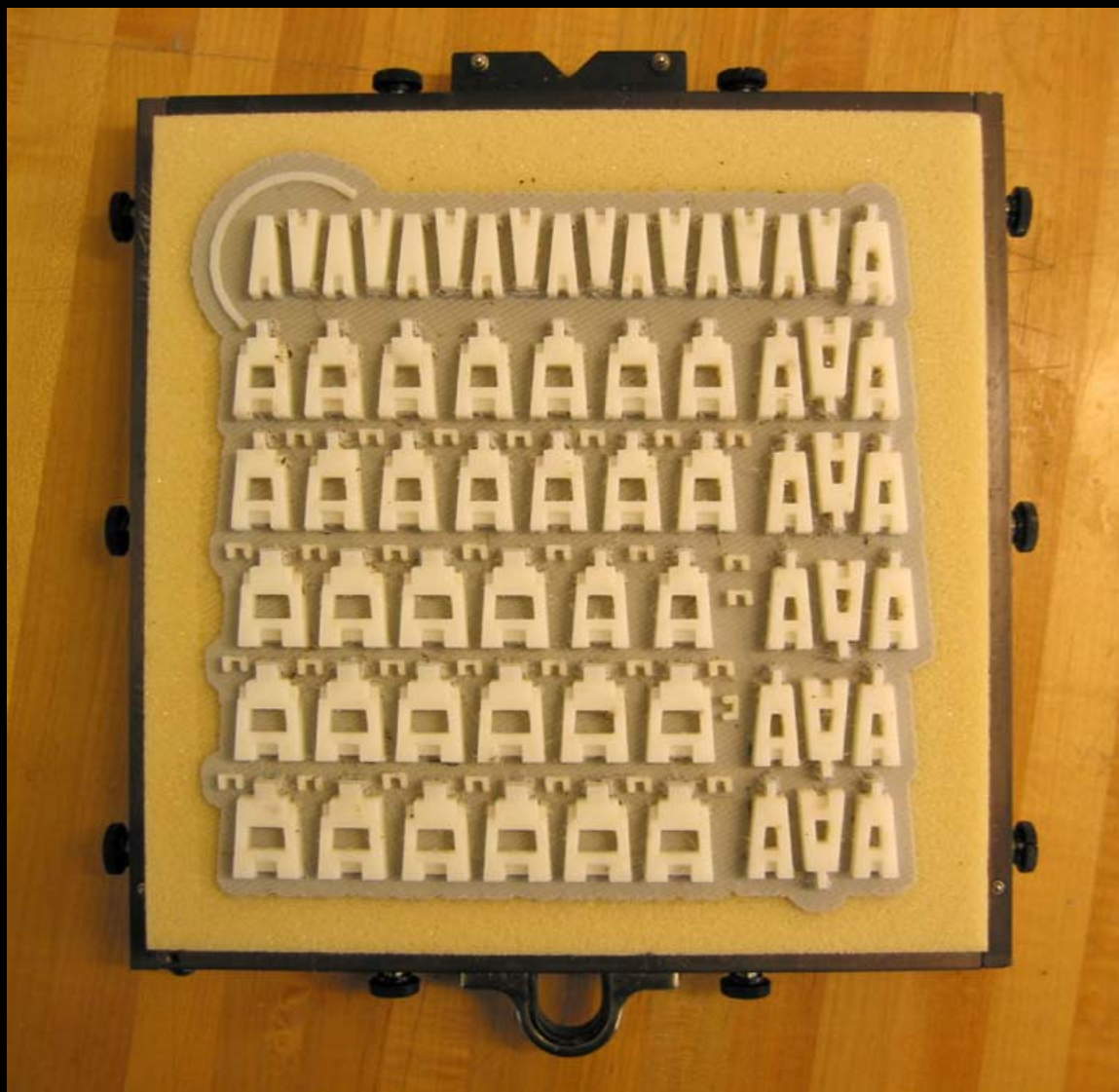
ABS Material .010

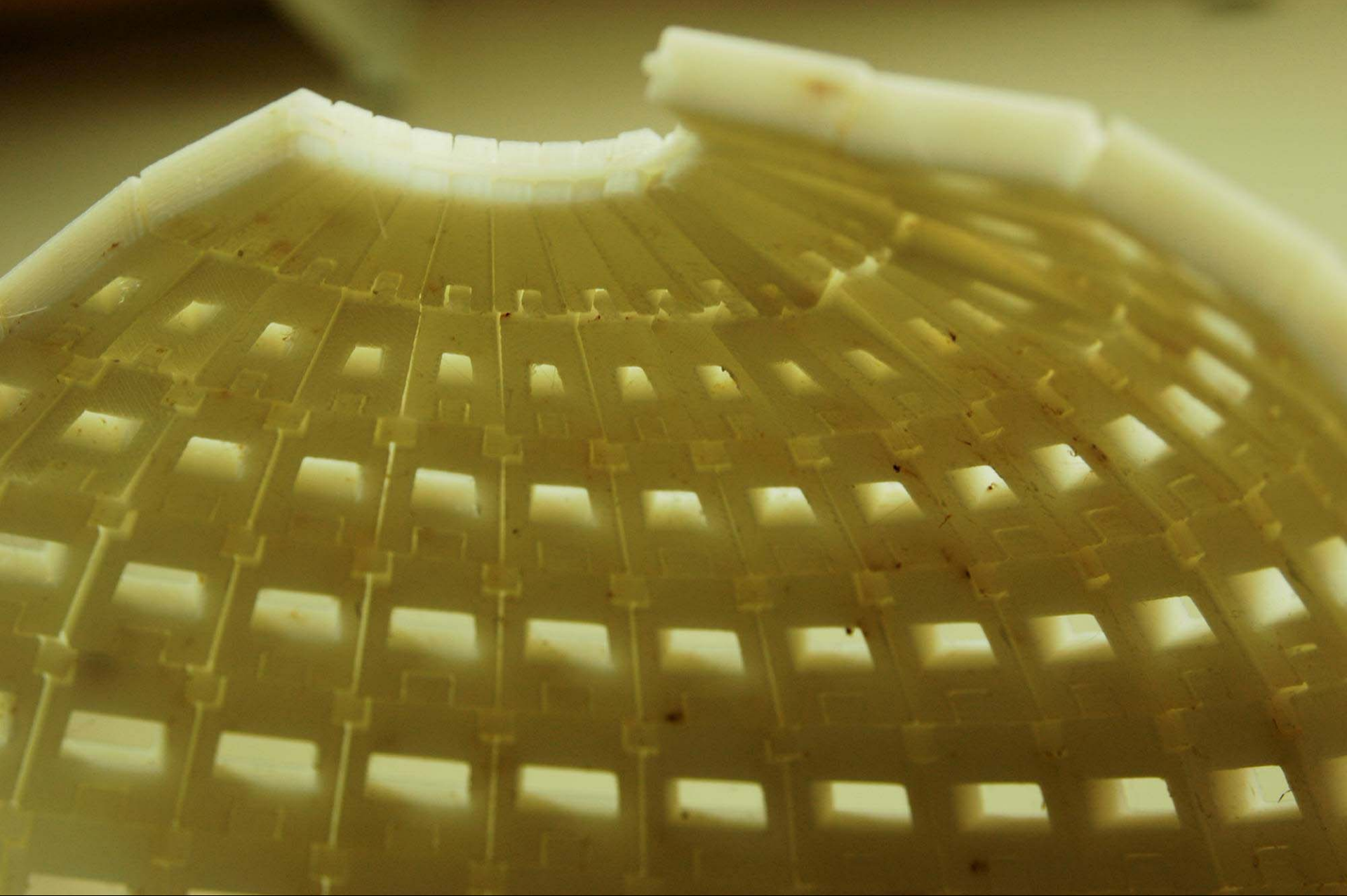
ABS Support Base .010



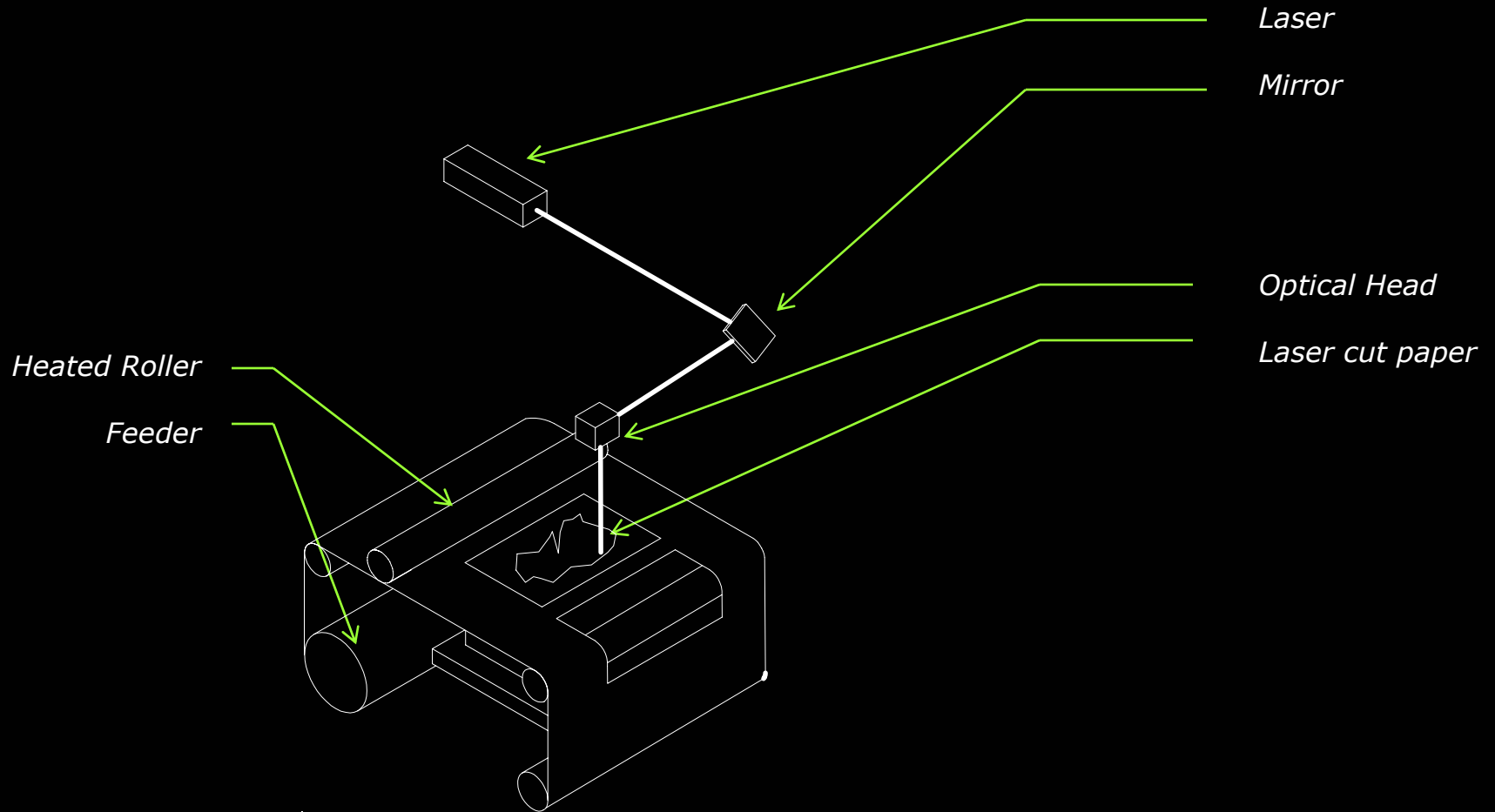








Laminated Object Manufacturing





Building Devices

Stereo Lithography (STL)

1986 – Charles Hull and 3M Systems

Fuse Deposition Modeling (FDM)

Stratasys

3D Printing

ZCORP

3D Systems

Solid Scape

Laminated Object Manufacturing (LOM)

2001 - Gone

Selective Laser Sintering (SLS)

Carl Deckard 1989

Pro Metal Systems

MIT-Licensed

Solid Ground Curing

[2]

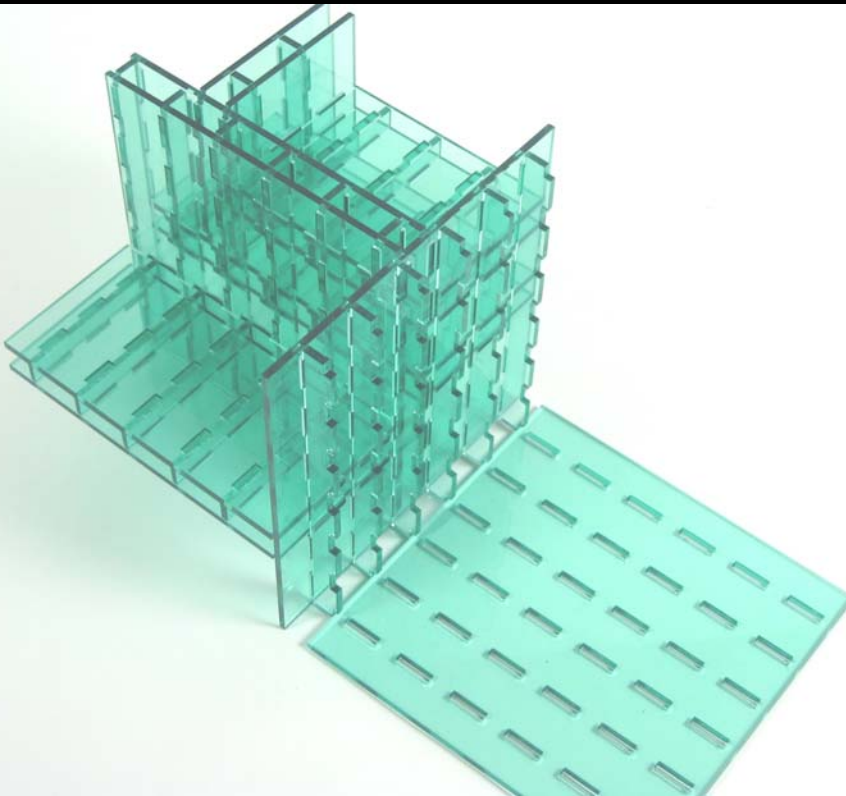
Cutting Devices

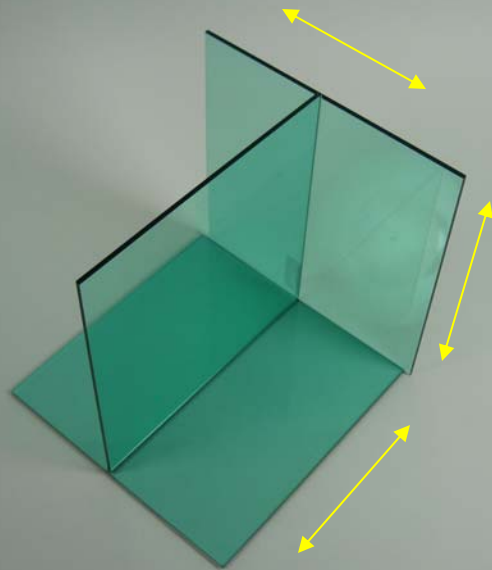


Laser Cutter



Assembly Methods





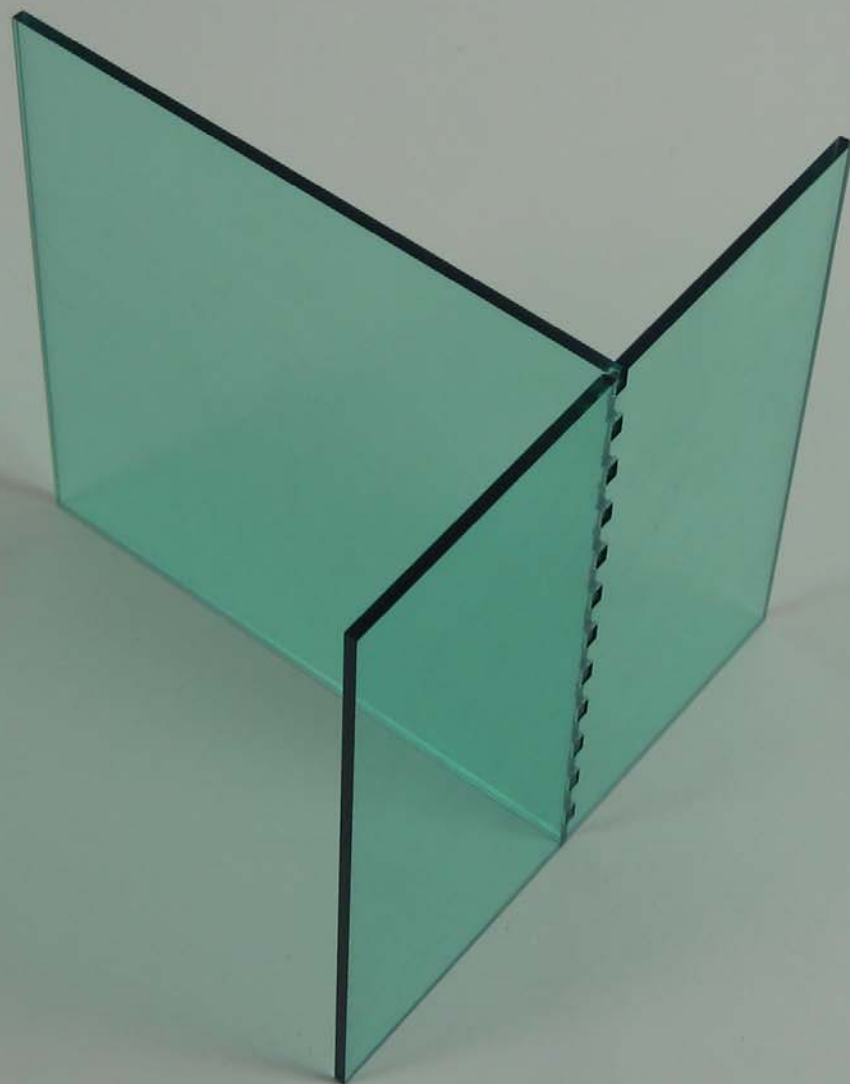
Assembly of Building Components using digital devices

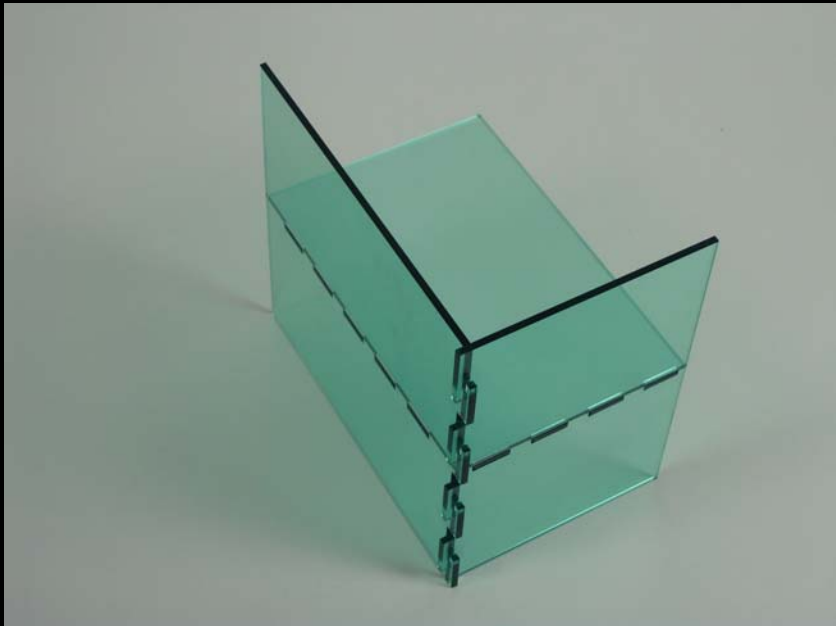
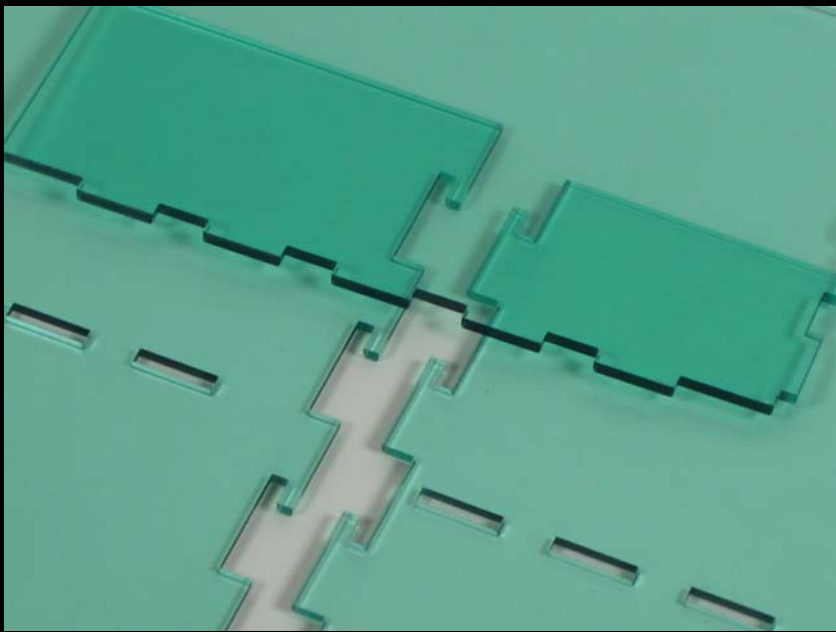
Incorporate the natural features of CAM

Precise cuts

Control of tolerance

Variations in cutting and or build



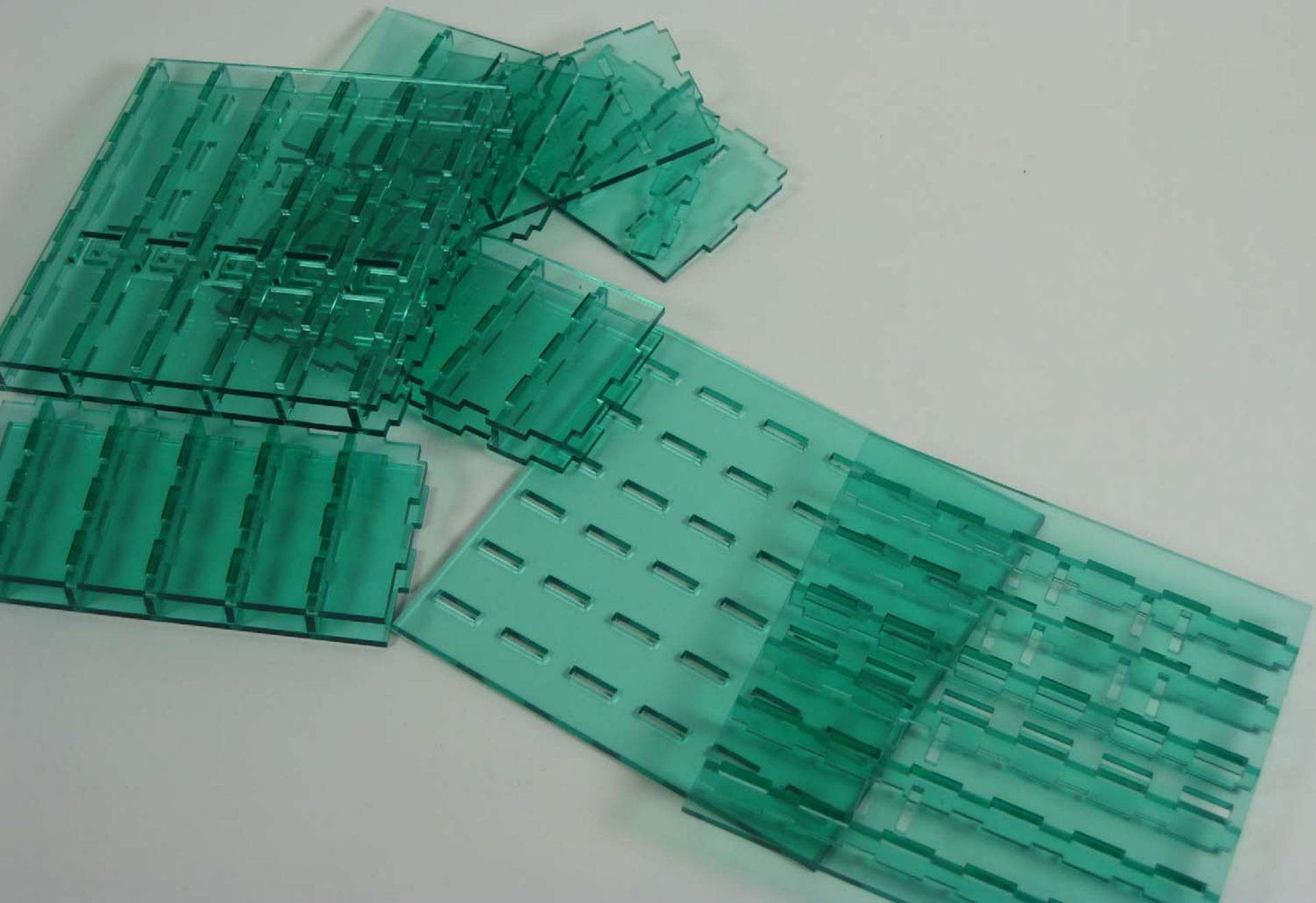


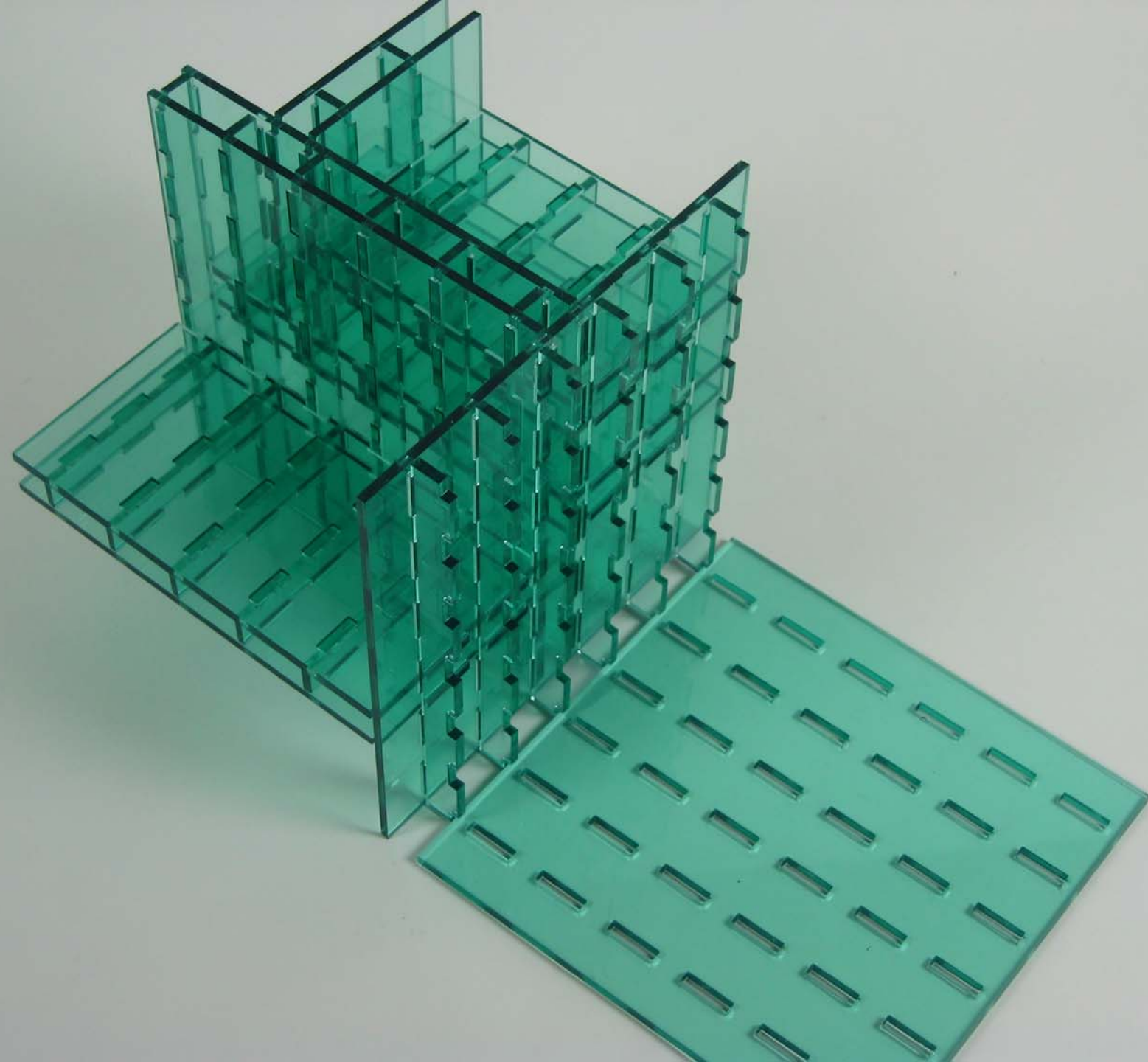
Methods

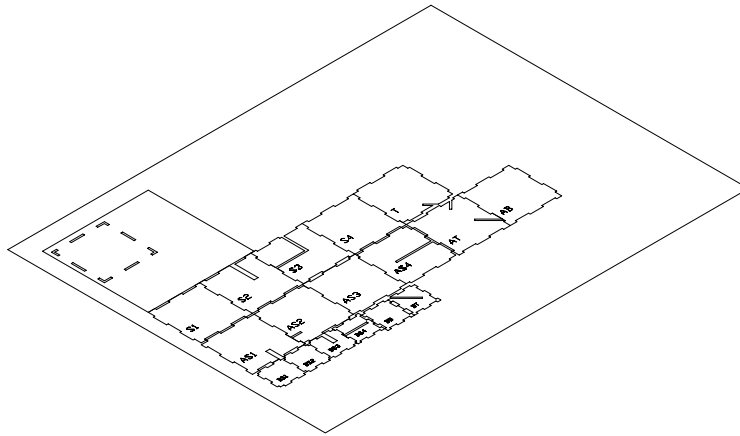
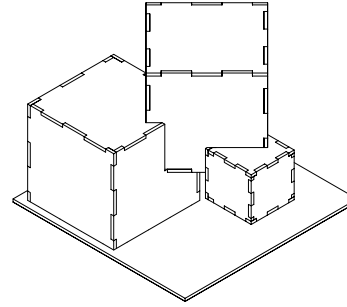
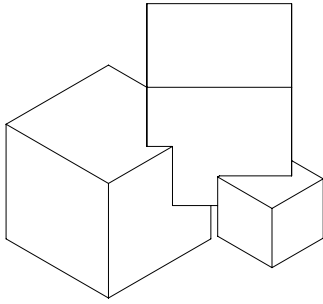
Build in 3 dimensions

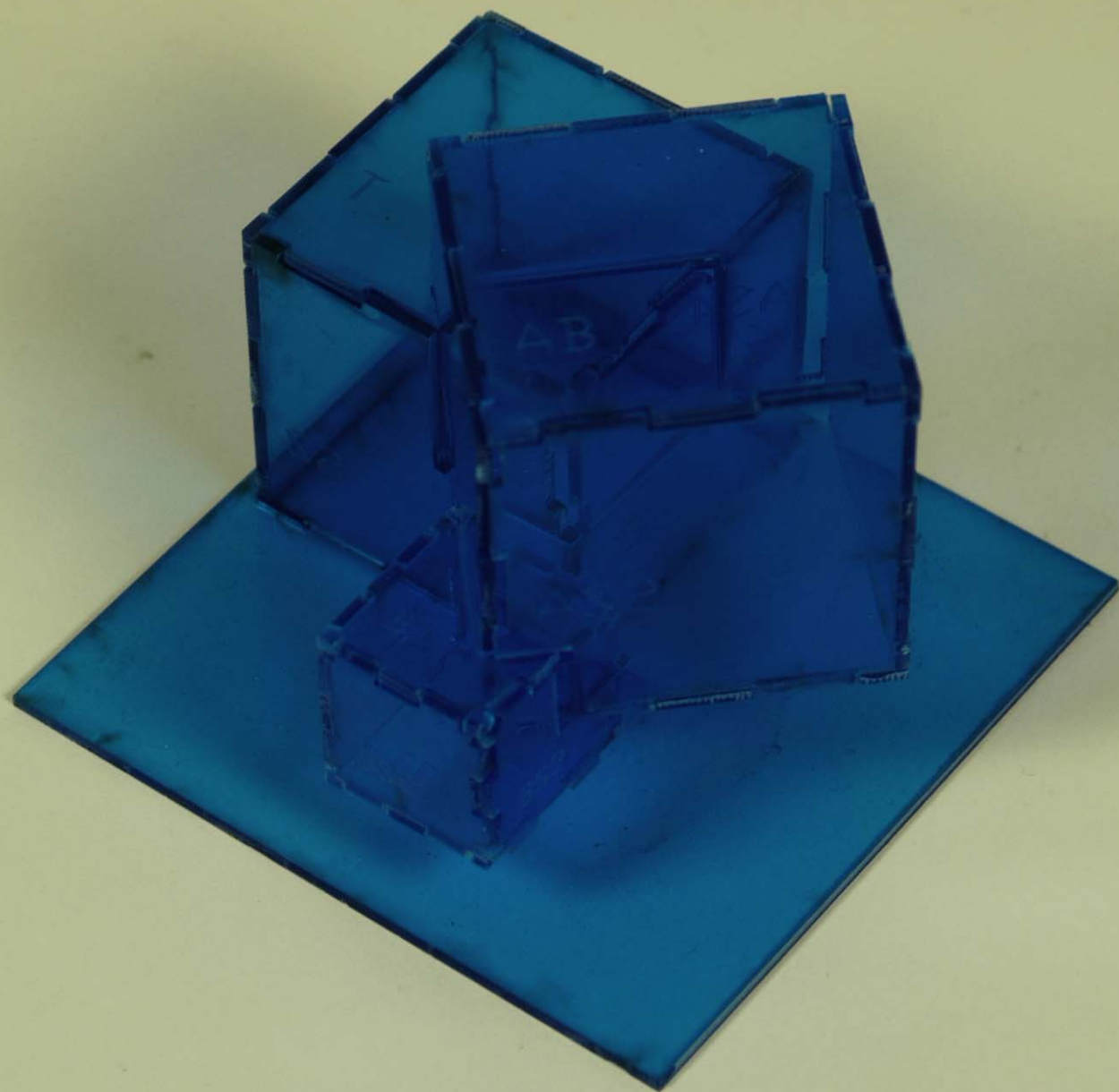
Fabricate in 2 dimensions

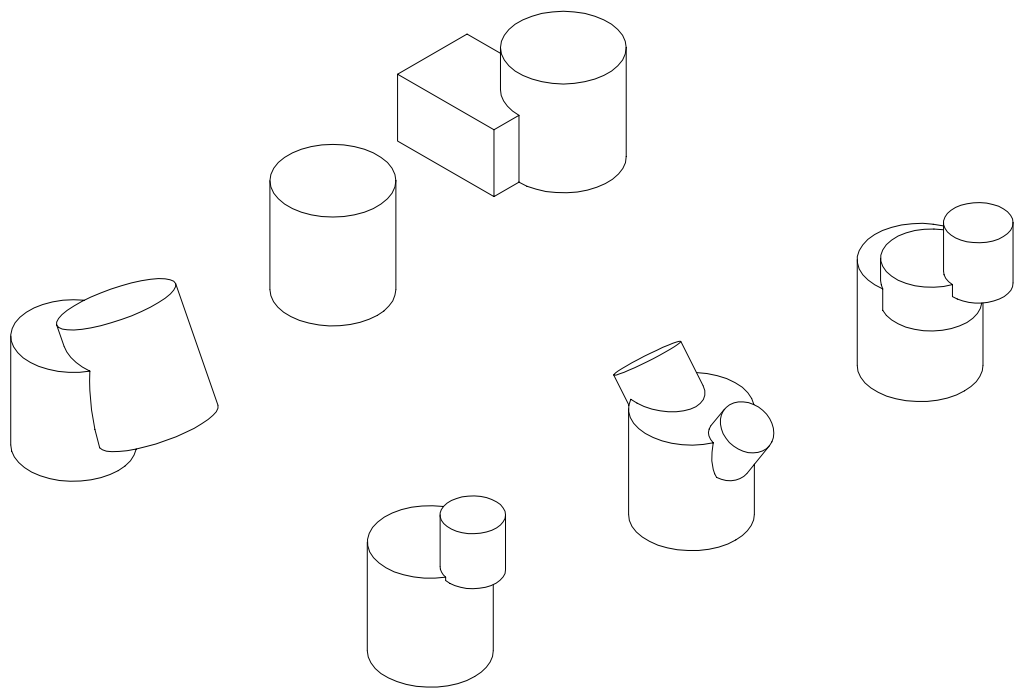


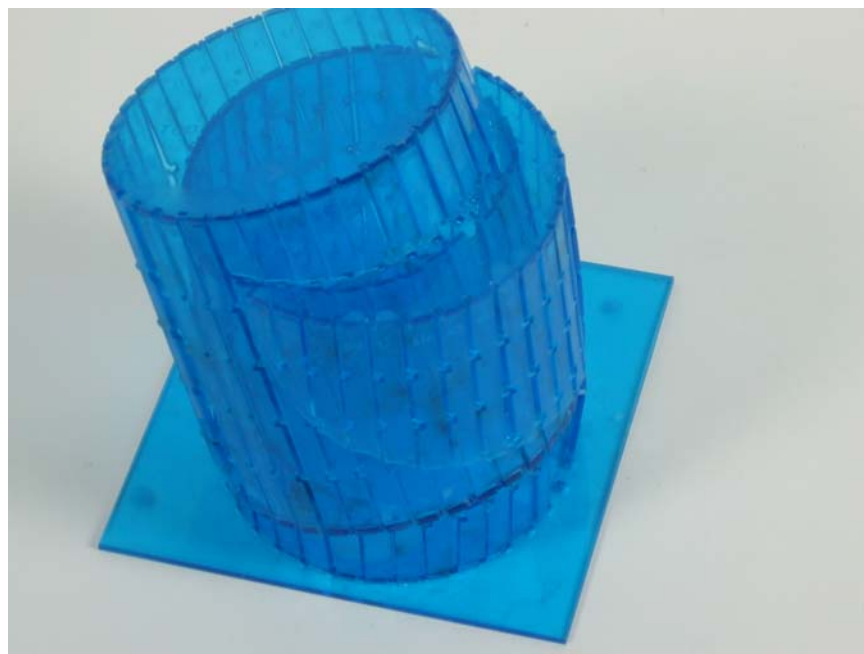
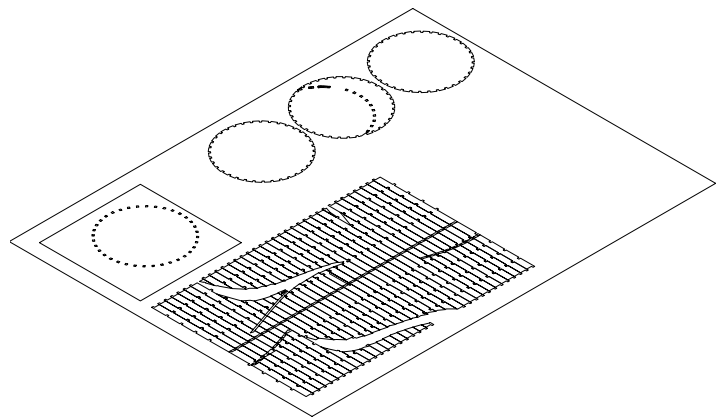
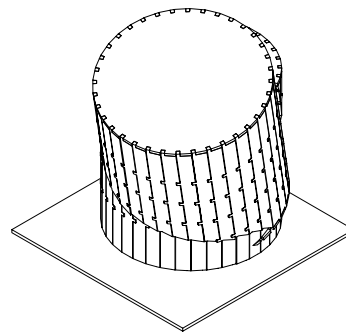
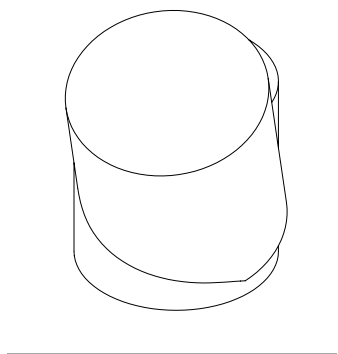


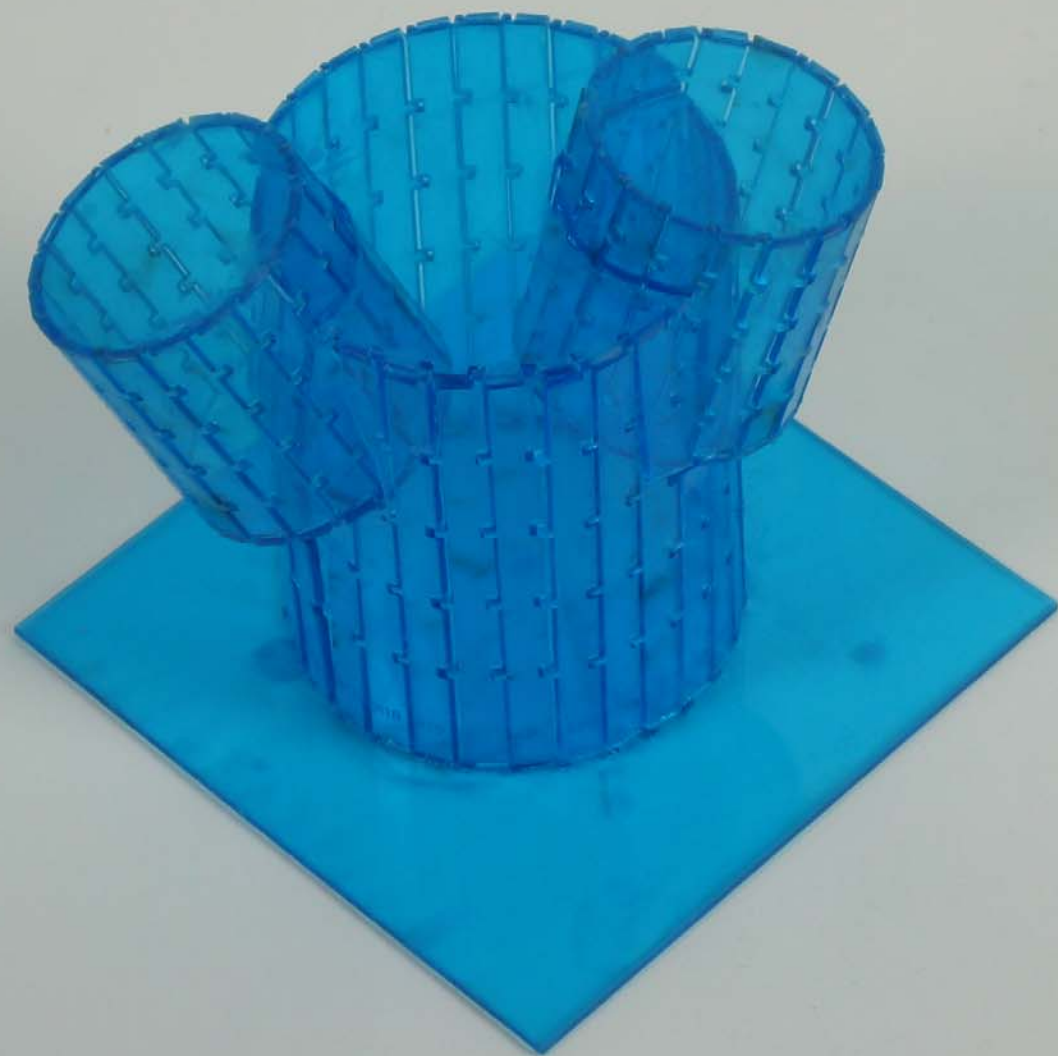


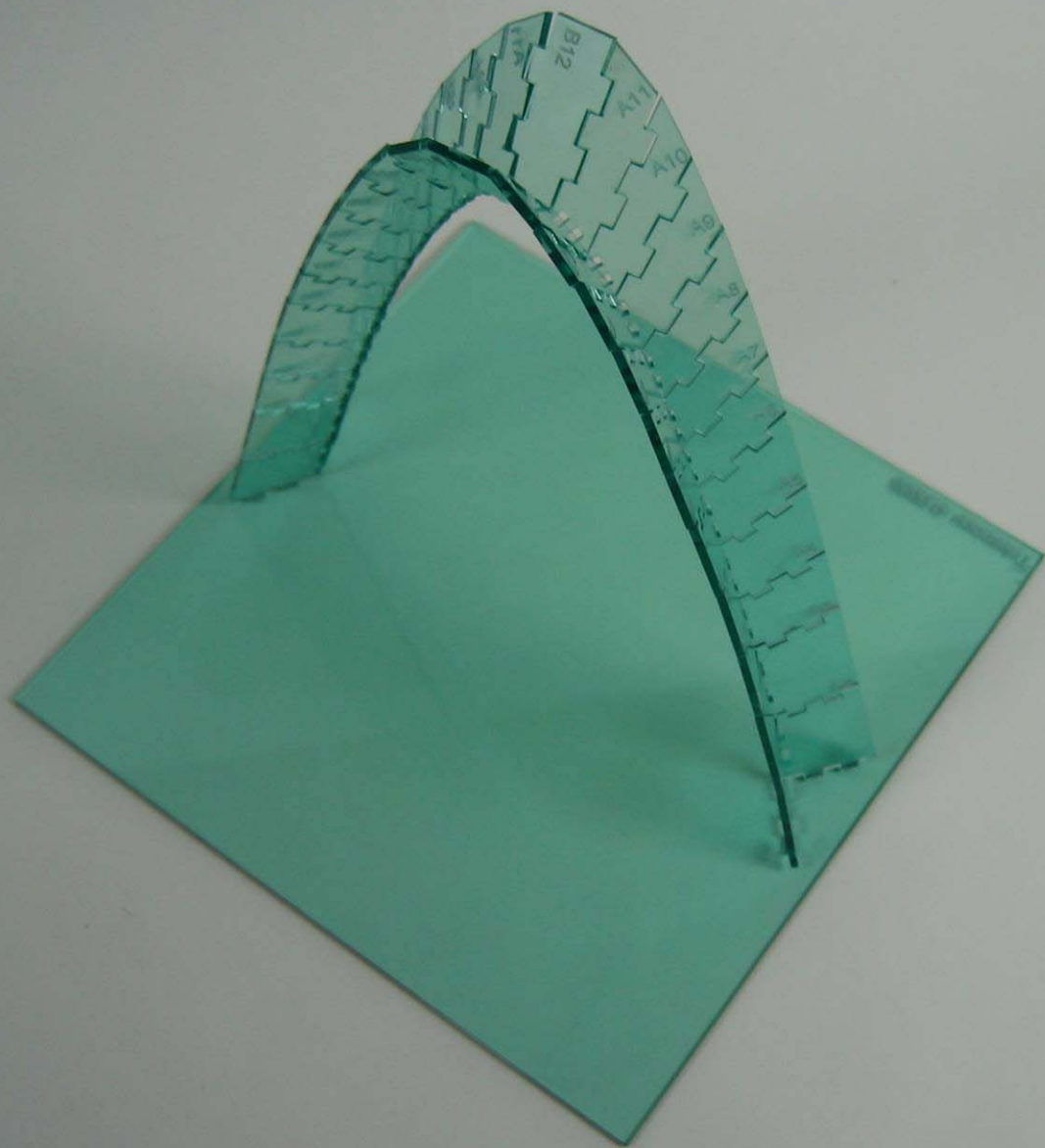


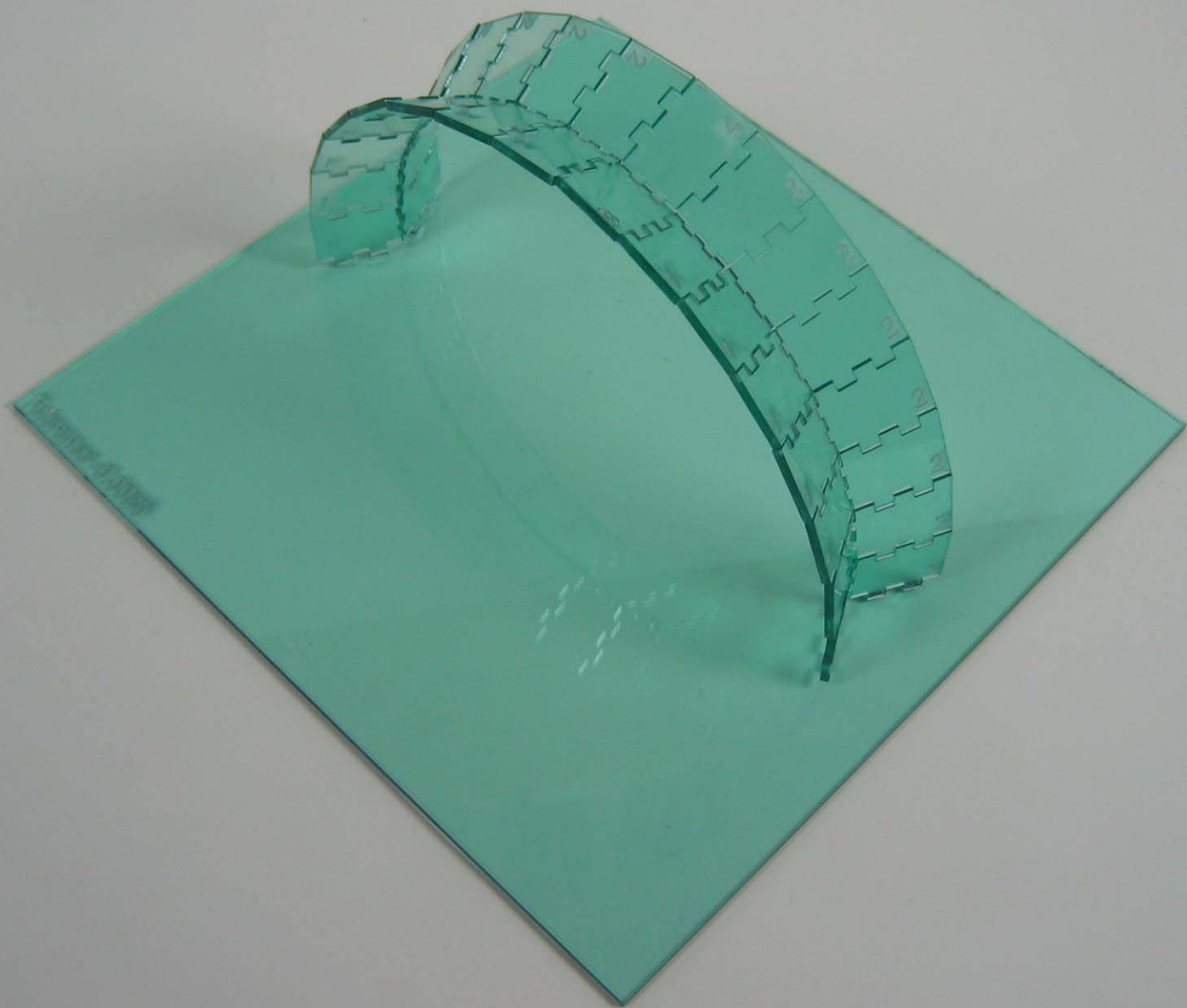


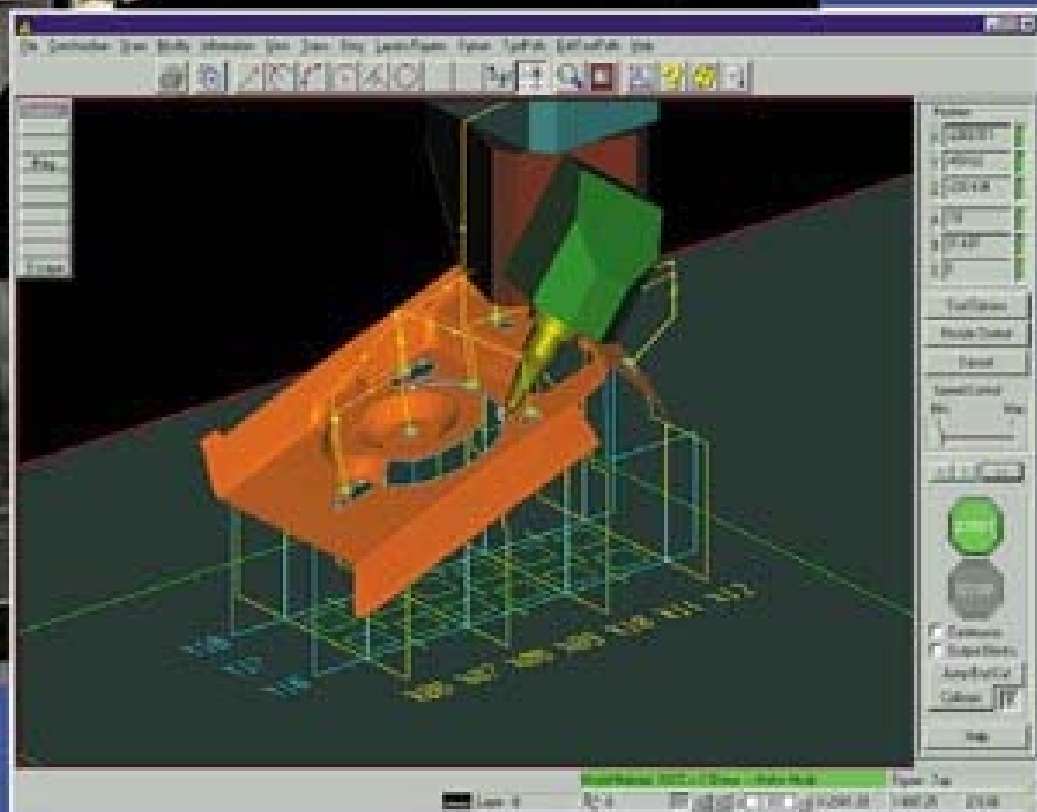


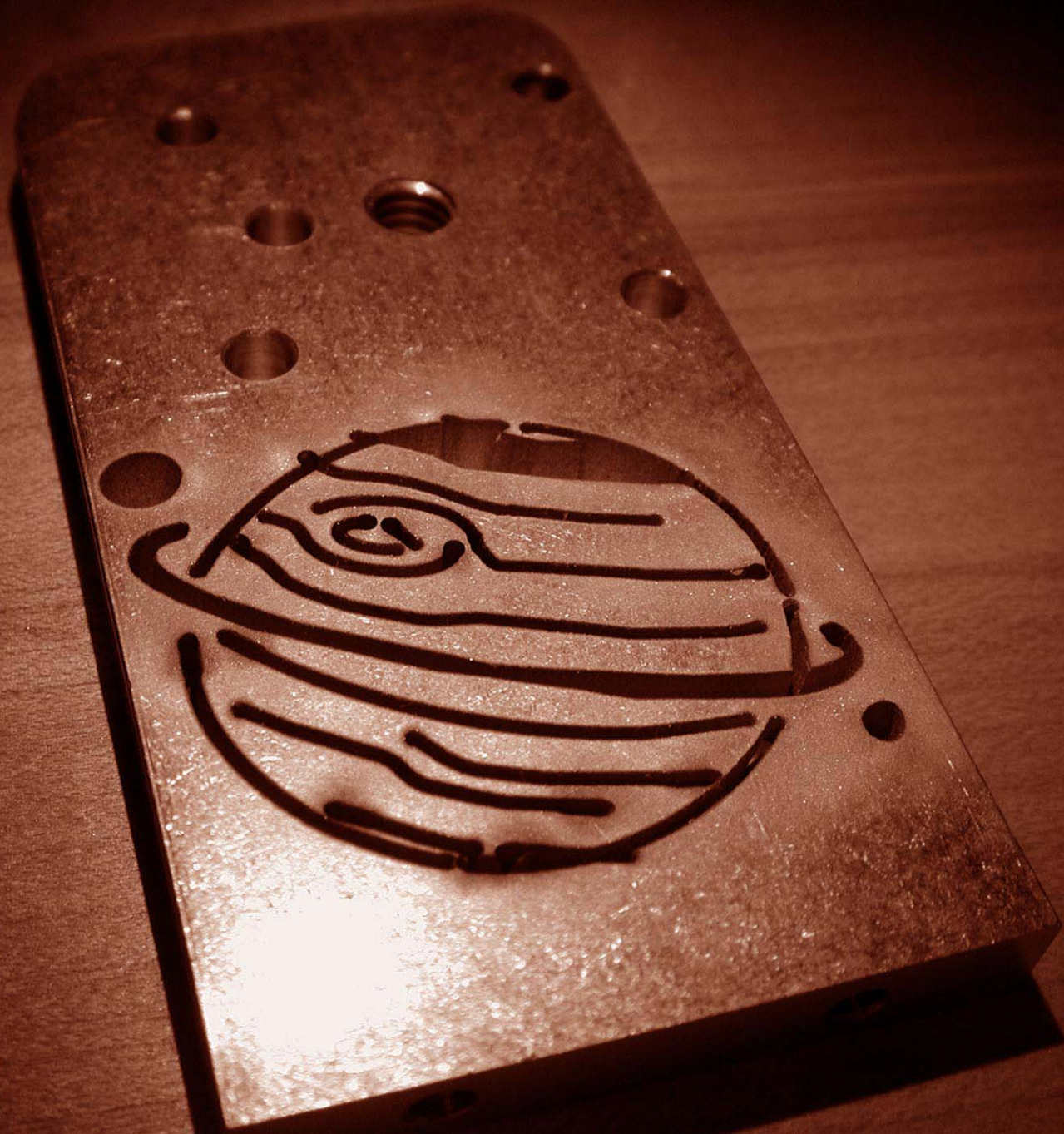






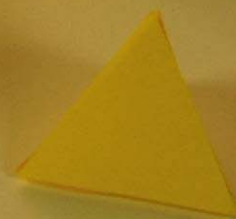
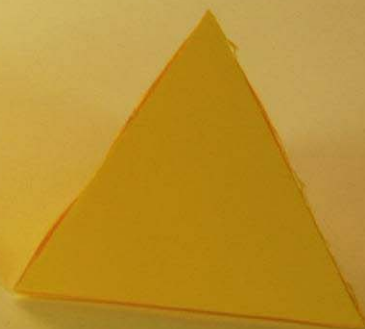
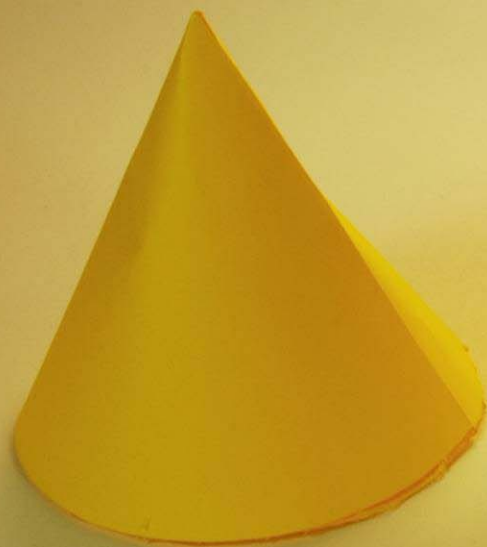




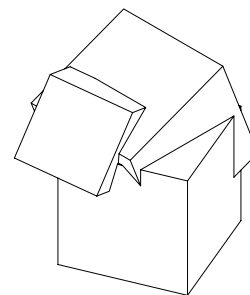
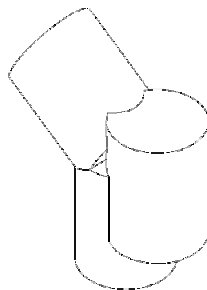
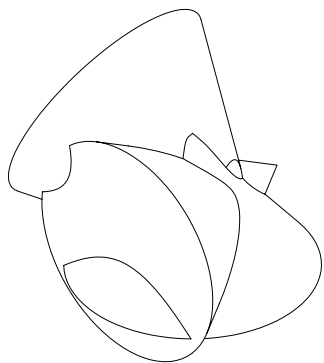


CAMM Paper Cutter











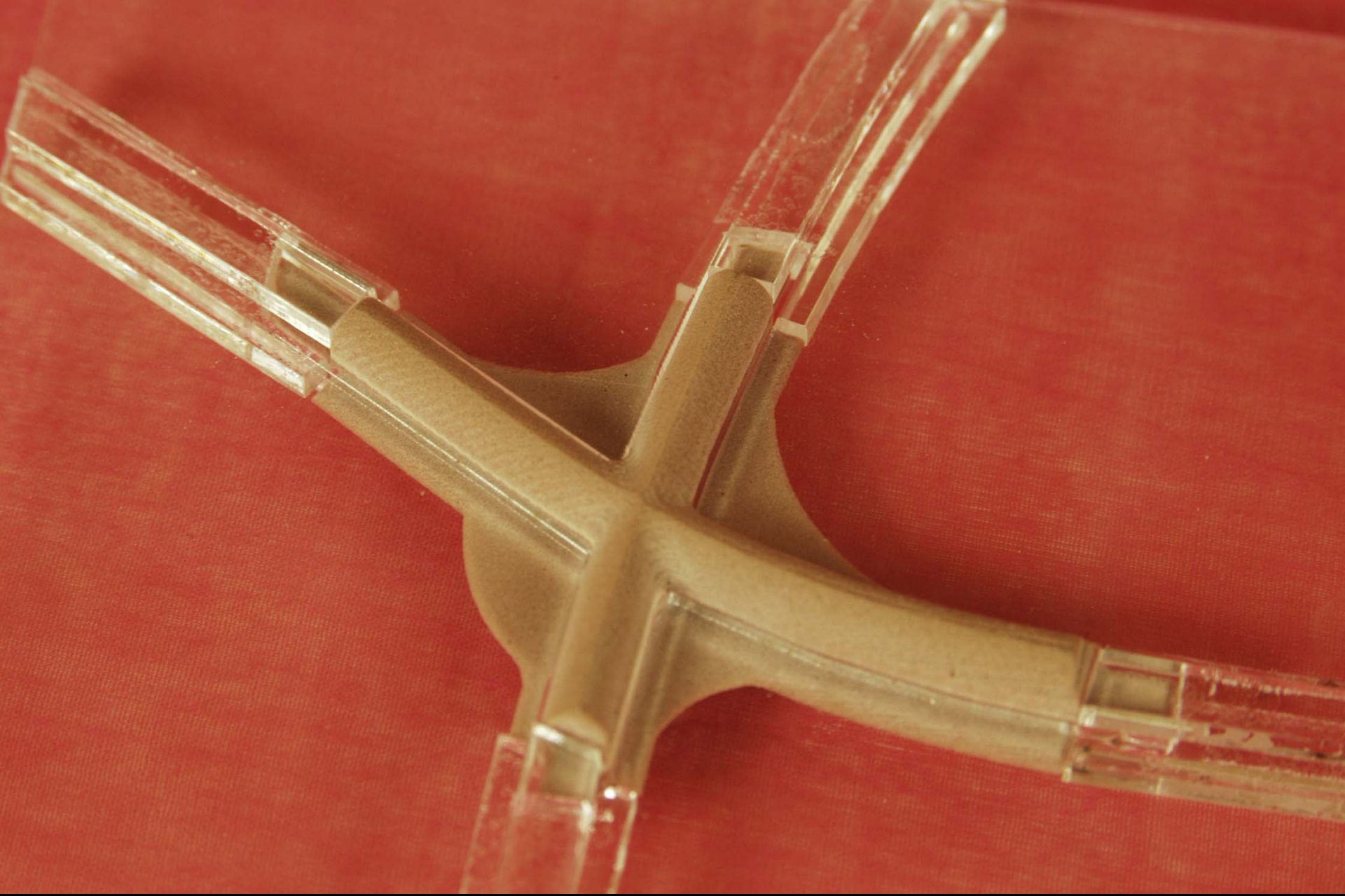
[3]

Milling



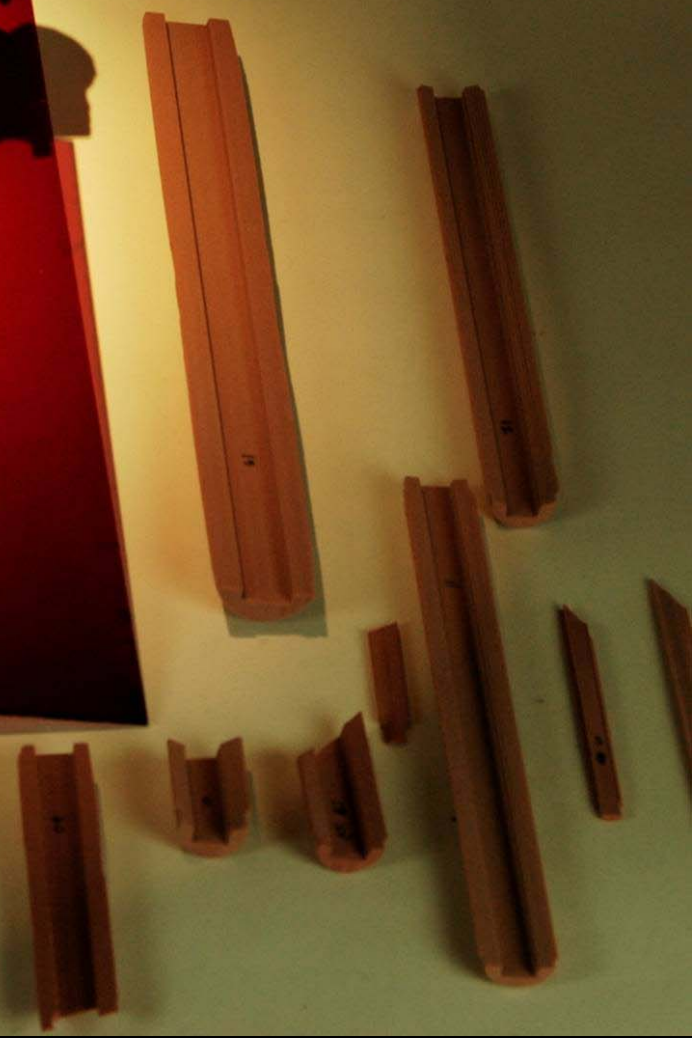
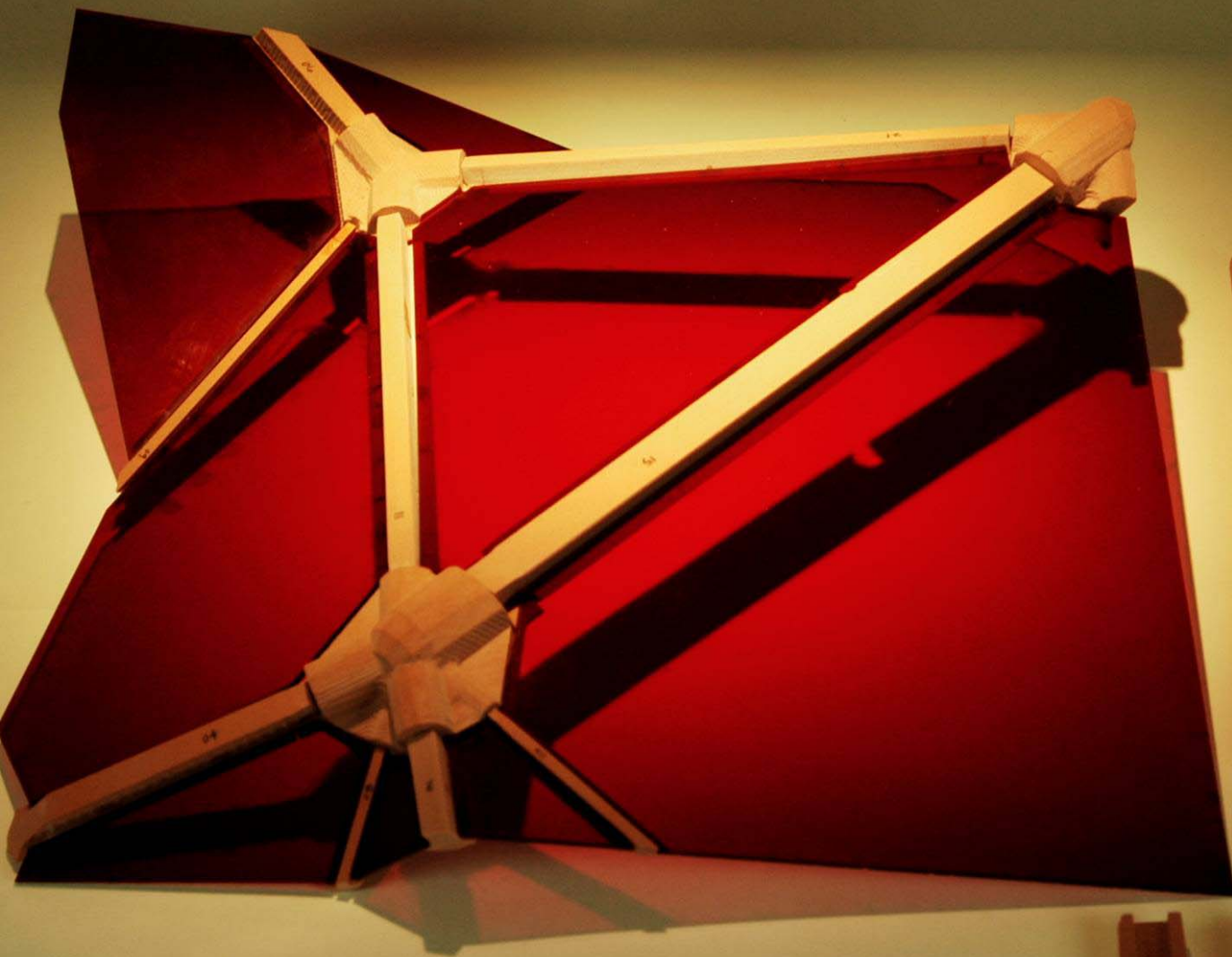


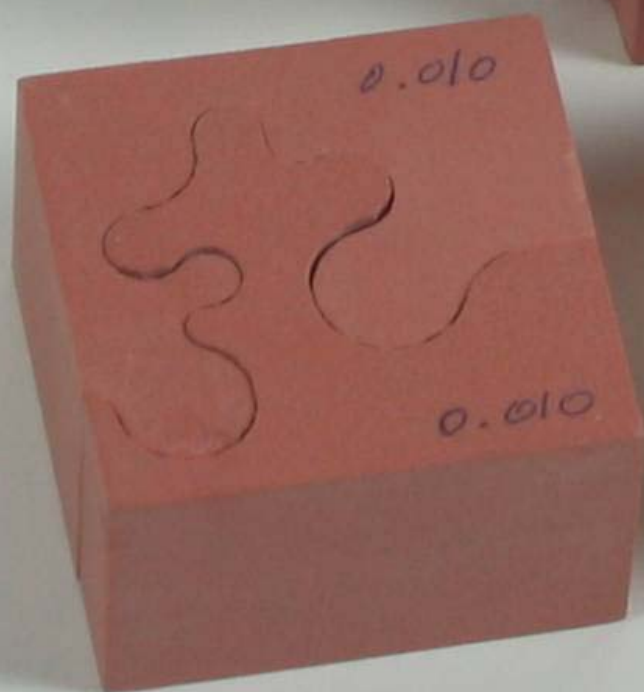


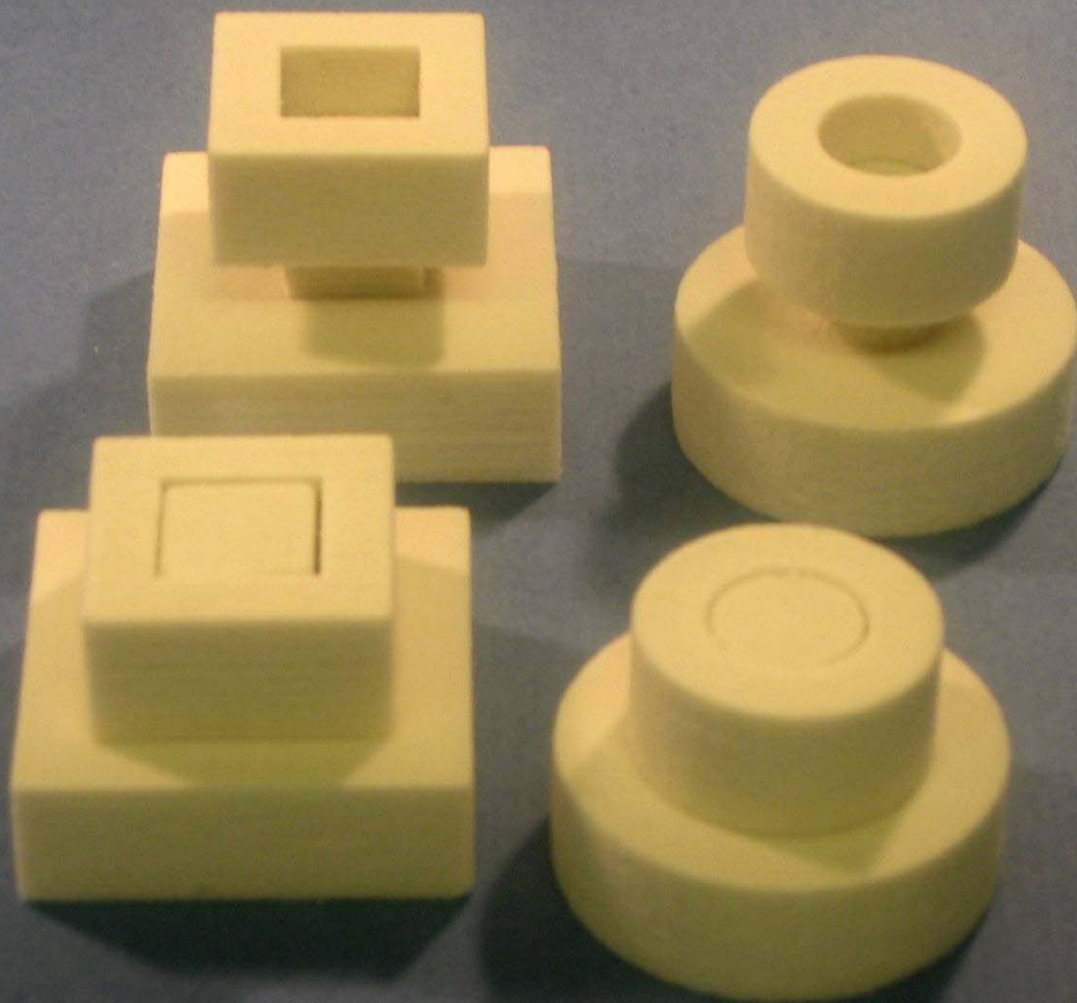












References

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