Target Fabrication at the University of Michigan

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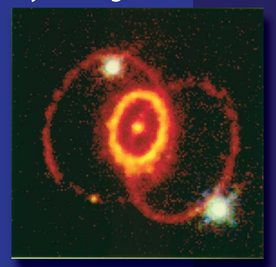
Overview- Laboratory Astrophysics

We produce processes relevant to astrophysical phenomenon, such as supernovae, in a laboratory setting.

By precisely scaling our experiments to observed phenomena such as Supernova 1987a, we can create similar conditions as those found in the astrophysical systems.

This process allows laboratory data to improve our understanding of astrophysical phenomenon in a quantitative manner.



Supernova 1987a

What We Build

Targets for High-Energy-Density Experiments are named according to the dynamics we plan to study.

Supernova Rayleigh-Taylor

Radiative Gas

Kevin-Helmholtz

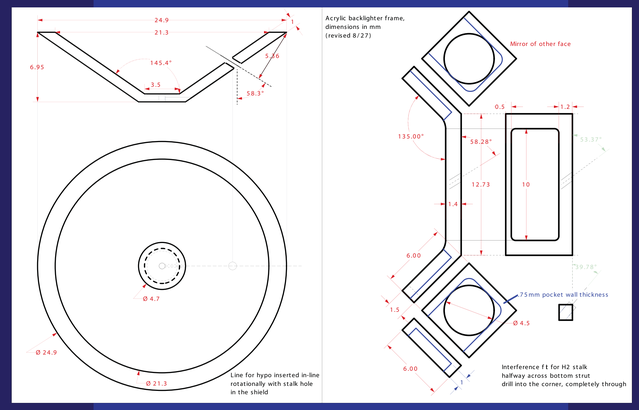
Design Process

Each target is tailored to the specific experiment based on the hydrodynamics we plan to observe.

A graduate student is assigned an experiment and leads the design process.

Different approaches are discussed at meetings where the entire lab group is involved.

Deliver Documents



Examples of technical drawings showing target design specifications

How We Build Targets

Parts are either purchased from vendors, such as General Atomics, machined on our microdrill/microlathe, or manufactured by our in-house machinist, Robb Gillespie.

For orientation and assembly of parts, we use the Target Fabrication System.

The Fabrication System

The Fabrication System contains two sets of stages and allows for both linear and rotational movement. These movements are highly precise, accurate to within tens of microns.

This setup is used in both building and metrologizing the targets.

The Build Process

Targets are constructed by undergraduates with an experienced supervisor.

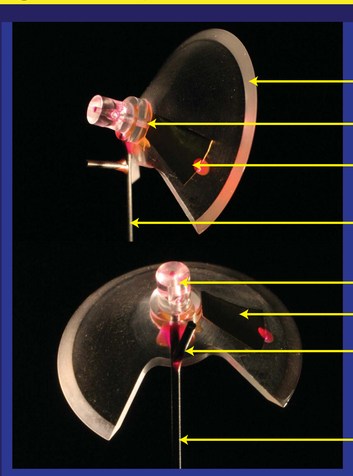
The construction method includes material preparation, assembling various components, and metrology steps throughout to ensure target quality and reproducibility.

Metrology and Target Characterization

The graduate student leading the design process metrologizes the targets to insure that the placement of components are within appropriate tolerances. These measurements are important in both quantifying experimental conditions and for target alignment on shot day.

Specific key features of the target geometry are used in the alignment process, so the target can be precisely oriented relative to the diagnostics and laser drive beams.

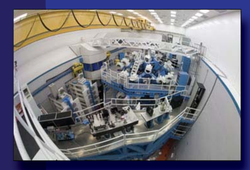
Target Components



Running the Experiment

Experiments are run every three to four months.

Targets are transported to the Omega Laser Facility in Rochester, NY.

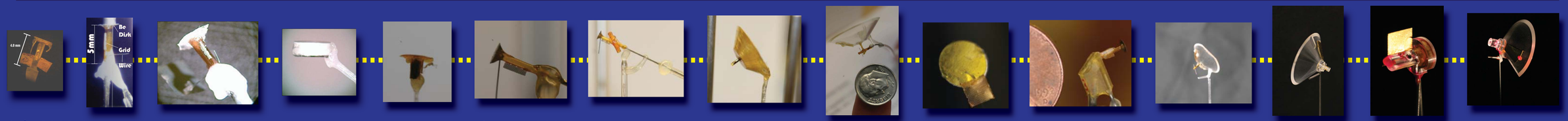


Inside the Omega Laser Facility

Diagram of the Omega Laser

The experiments are driven by lasers and diagnosed in a variety of ways, including VISAR, SOP, Thomson scattering, and X-ray radiography.

How We've Progressed



July 2003 — August 2005 — August 2006 — Present