An Overview of the Target Fabrication Activities at Technical University Darmstadt

Thomas Heßling (GSI,TUD)
Dr. Gabriel Schaumann (RAL)
Prof. Dr. Markus Roth (TUD)

Talk by Dennis Schumacher (TUD)

An Overview of the Target Fabrication Activities at Technical University Darmstadt

TECHNISCHE UNIVERSITÄT DARMSTADT

- Reasons for the target facility at the TUD
- Possible target geometries
- Production steps
- Outlook

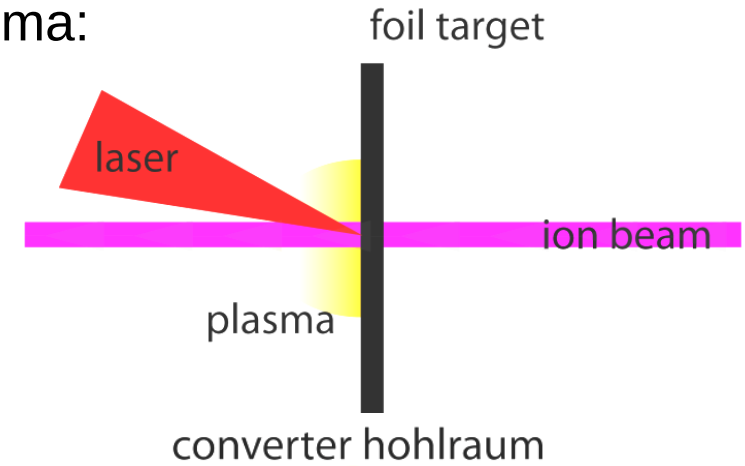
GSI

Reasons for the target facility at the TUD

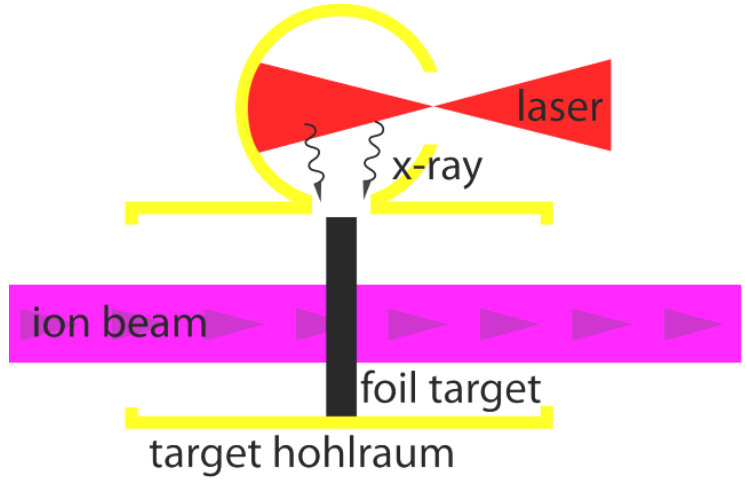
TECHNISCHE UNIVERSITÄT DARMSTADT

Energy loss of heavy ions in dense plasma:

- Direct laser heated target



- Indirect heated target

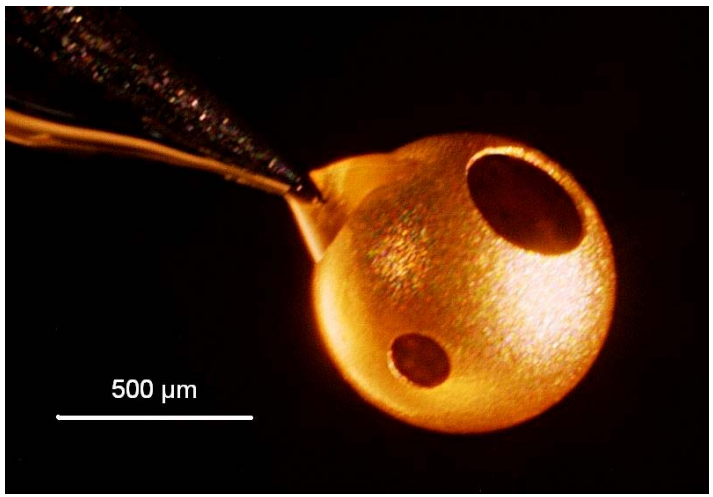


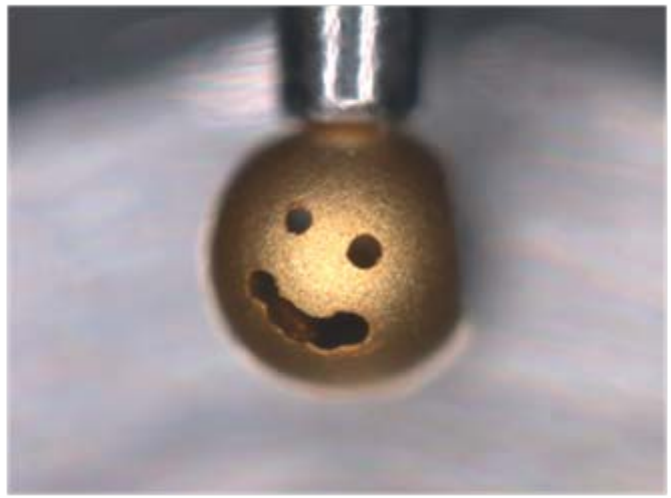
Possible target geometries

TECHNISCHE UNIVERSITÄT DARMSTADT

Spherical hohlraumtargets

- Diameter: 400μm – 1000μm
- Wall thickness: 10μm
- Different hole forms and sizes starting from 5μm diameter



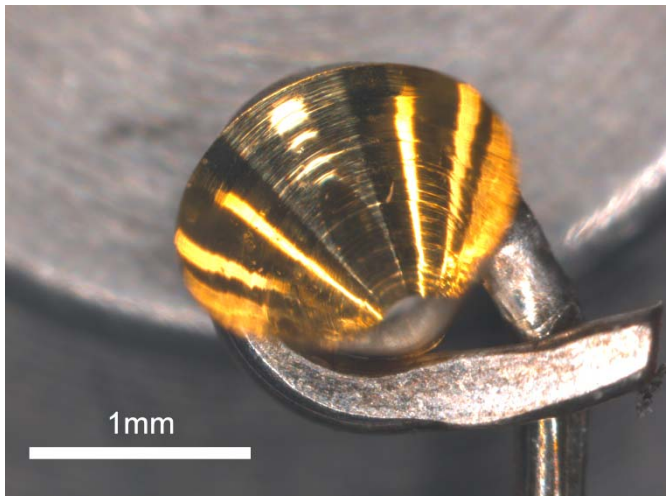


Possible target geometries

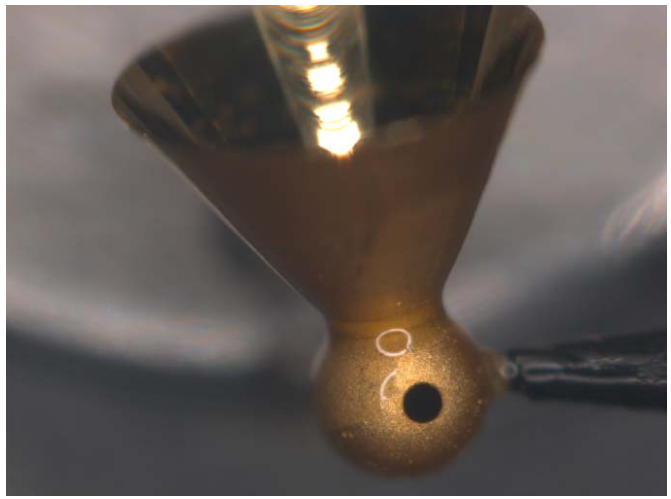
TECHNISCHE UNIVERSITÄT DARMSTADT

Cones

- Diameter (big end) 1.5 mm
- Wall thickness 10 µm



Compound targets

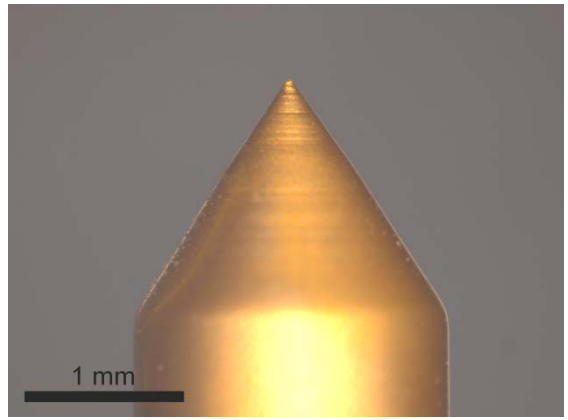


Production steps

Blank

Mandrel for cones

- Brass mandrel
- Fabricated with a lathe



Production steps

Electroplating and photo lithography

TECHNISCHE UNIVERSITÄT DARMSTADT

Electroplating with gold layer
- KCN Au complex
- Plating current density: 2mA/cm²
- Plating time: 80 min

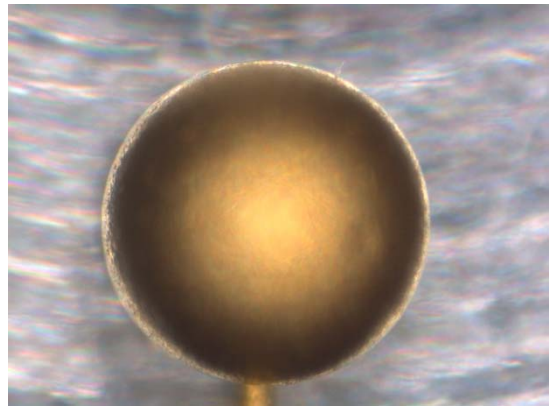
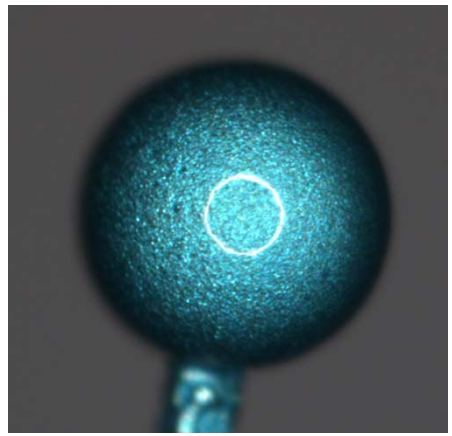


Photo lithography
- Photo resist is deposited by electroplating
- 3d surfaces can be coated
- Resist thickness depends on:
  - voltage
  - two additives in the resist solution
  - temperature
- Thickness range: 2μm to 40μm
- Positive resist



GSI

Production steps

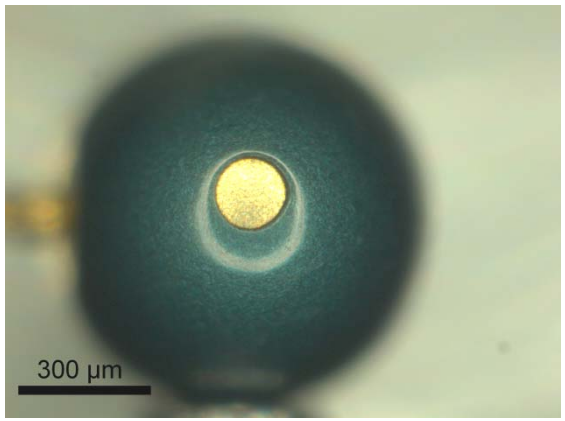
Exposure

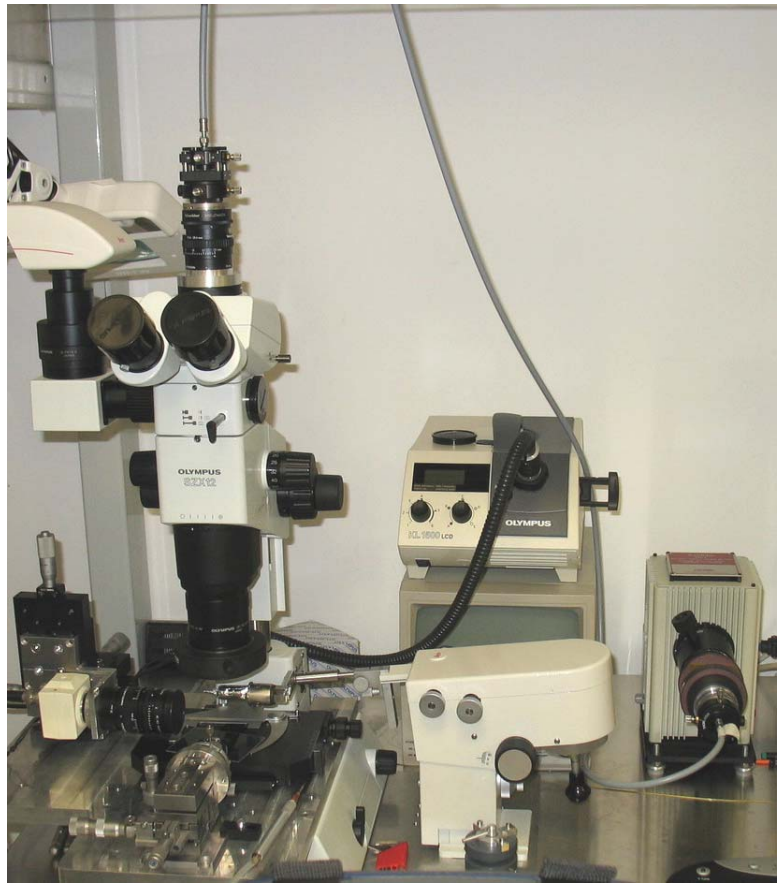
TECHNISCHE UNIVERSITÄT DARMSTADT

Exposure under microscope

- Sensitive to wavelengths shorter than 420nm
- UV light by mercury lamp
- Conducted by glass fibre
- Aperture for different sizes and forms
- Demagnified by microscope optics

- Removal of the exposed resist by a weak caustic soda solution





GSI

Production steps

TECHNISCHE UNIVERSITÄT DARMSTADT

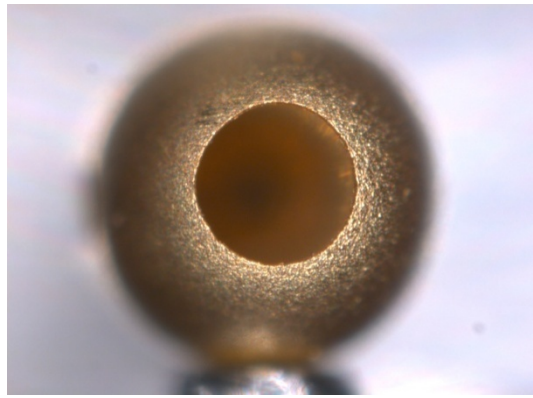
Exposure

Gold etching
- Etched by potassium iodide-iodine solution

Removal of the photo resist
- Removed by a strong caustic soda solution

Brass etching
- Etched through the holes with nitric acid

Stainless steel etching
- Etched with hydrochloric acid



GSI

Production steps

Assembling

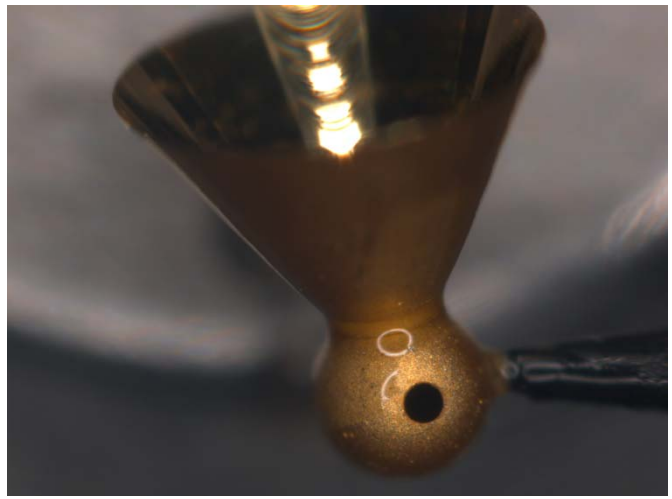
TECHNISCHE UNIVERSITÄT DARMSTADT

Assemble different Targets together

- Alignment by micro assembly station and microscope
- Glued together with a UV curing glue

Double hohlraumtarget:

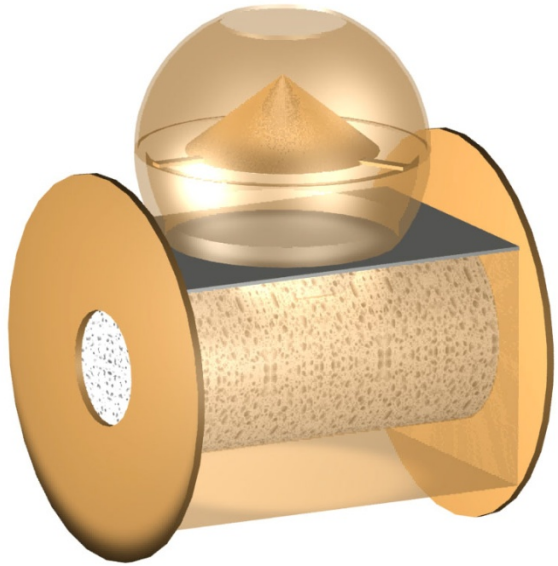
Cone with hohlraumtarget:



Outlook

TECHNISCHE UNIVERSITÄT DARMSTADT

- Laser drilled holes with titan:sapphire Laser
- Barrel plating
- Stainless steel blank
  - Better surface
  - More diameters available
  - Chrome oxide layer
  - More difficult to etch
- Foil and foam filled hohlraumtargets
- Cone in a spherical target



GSI

TECHNISCHE UNIVERSITÄT DARMSTADT

Thank you for your attention

GSI