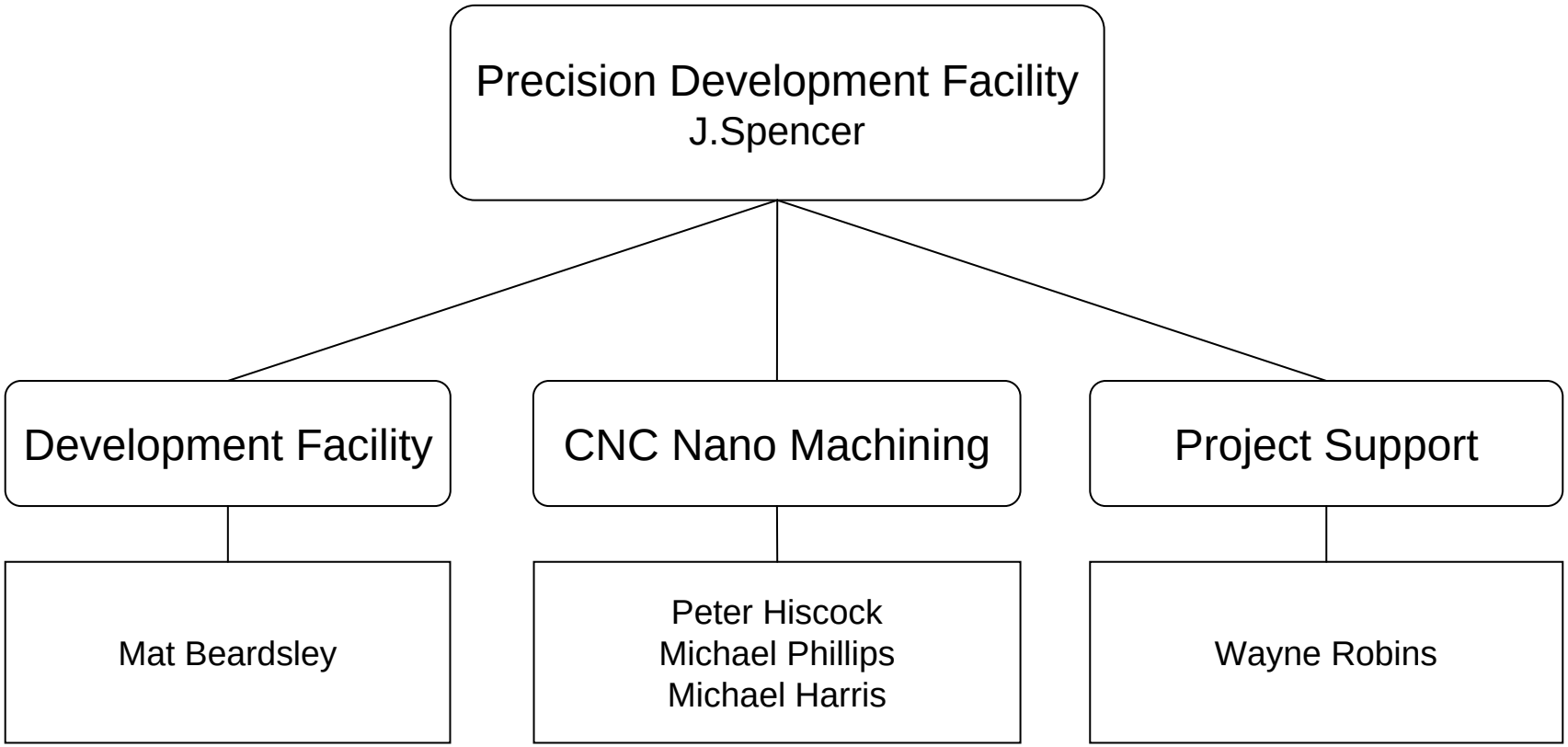
Using Innovation to Manufacture Novel Geometries

PDF Organagram



Objectives of the Facility

- **Primarily developing and manufacturing devices operating in the microwave frequency range.**
- Instrumentation located on radio telescopes at high altitude
- Weather balloons
- Space instruments used for earth observation

Development Facility

Development Facility

- Temperature Controlled
- Sodick AQ 327 CNC Wire-Cut EDM
- Two Mini Jig borers
- Micro Machining Mill
- Three Precision Lathes
- Non Contact Measuring
- Electroplating Facility
- Grid Winding Facility

CNC Nano Machining Facility

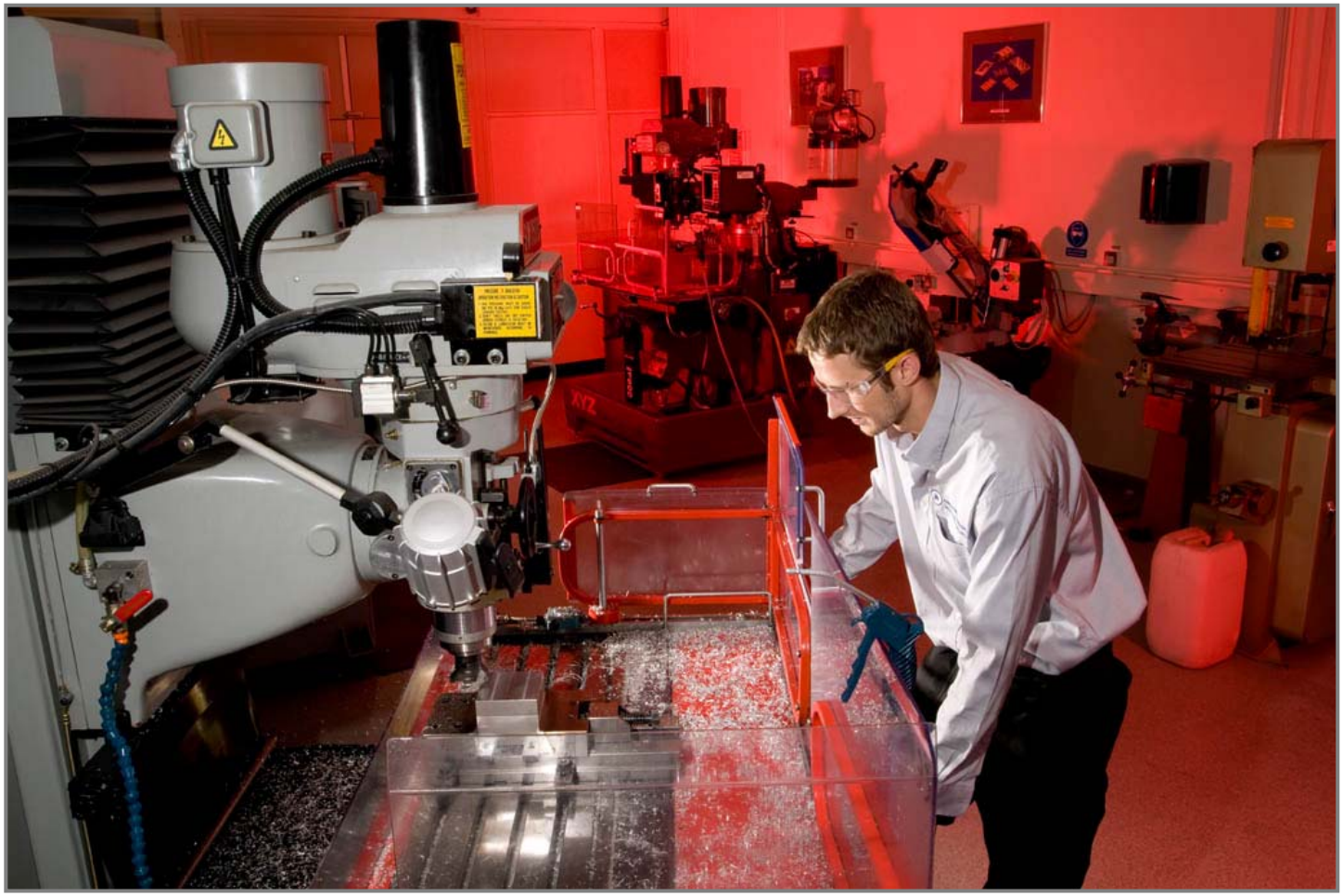
CNC Nano Machining Facility

- Temperature controlled
- KERN Micro 5 axis CNC Mill

  Positional accuracy 1 micron 40k RPM
- KERN Pyramid Nano

  Positional accuracy 0.3 micron 40k
- CNC Super Precision Hardinge Lathe
- Positional accuracy +/- 5 micron 8K RPM

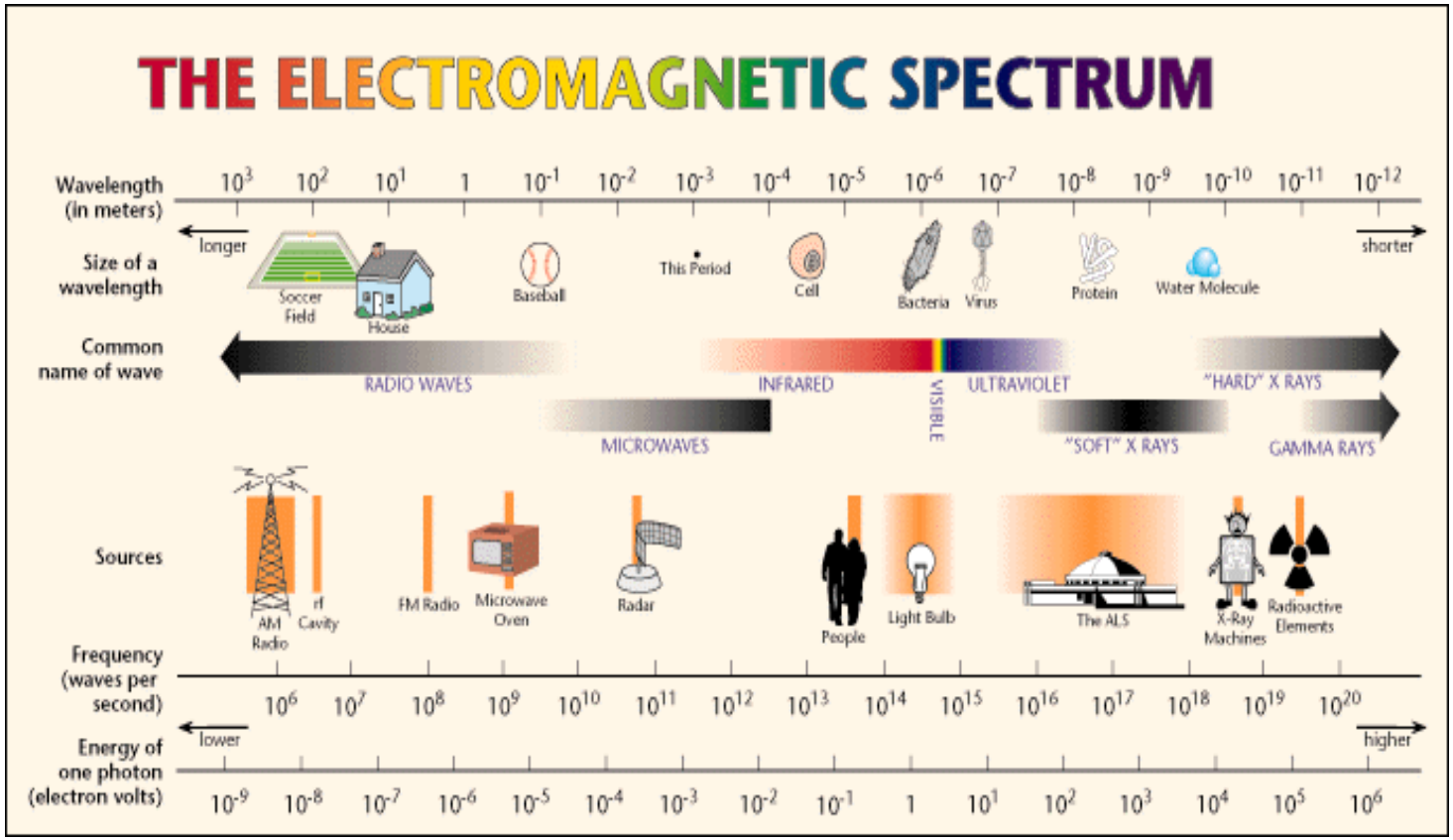
Project Support



Project Support

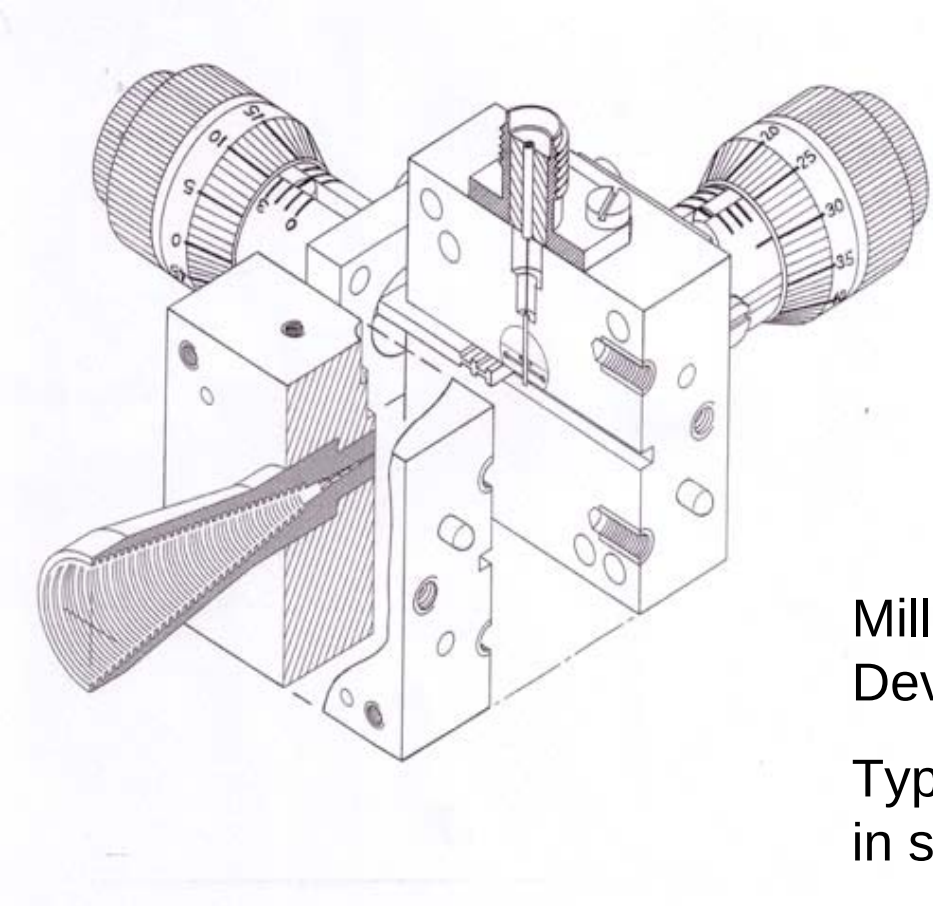
- Temperature controlled
- 2 HAAS Super Mini Mills
- Positional accuracy +/- 5 micron 15K RPM
- XYZ 1500 CNC Milling Machine
- XYZ 3500 CNC Milling Machine
- Colchester Lathe
- Surface Grinder
- Chop saw
- Band saw

Where We Fit In



Taken from the Ernest Orlando Lawrence Berkeley National Laboratory Website

Instrumentation

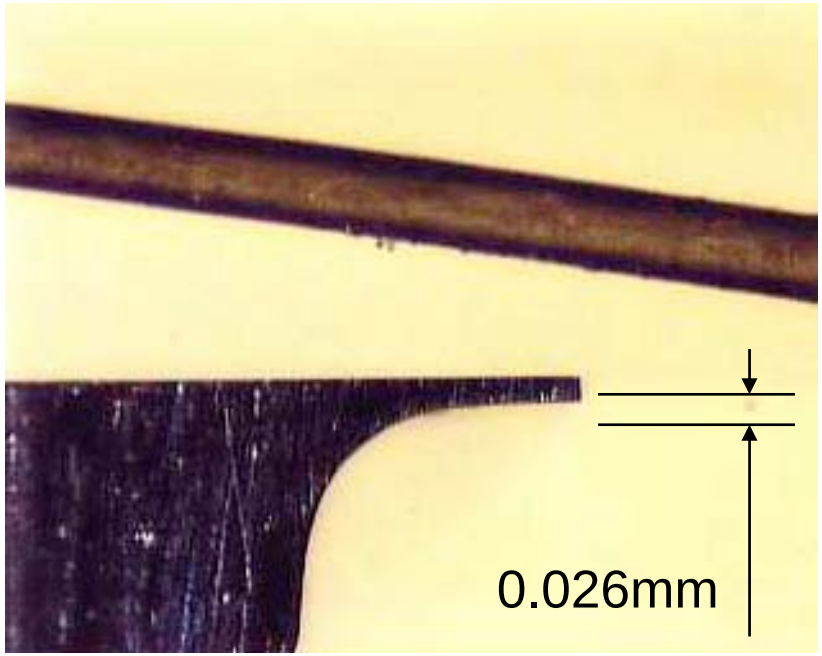


Millimetre Wave Mixer Device

Typically 25 mm cubed in size

Feedhorn Mandrel

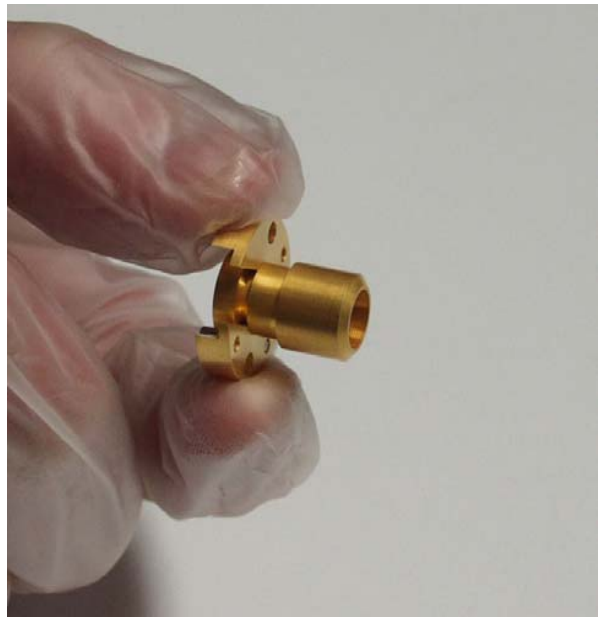
2.5 THz Tool for Corrugations



- 0.026 mm width
- High Speed Steel
- Polished Cutting Edge

Feedhorn Manufacture

Electroformed mandrel



Finished feedhorn

Objectives of the Facility

Close support role for other Departments at the Rutherford Laboratory and commercial companies

Development of novel machining techniques.

Production of miniature components.

Laser Department

Space Cooler Group

ISIS

OXSENSIS

THRUVISION

NASA

Close Support Development

Development of components in various materials

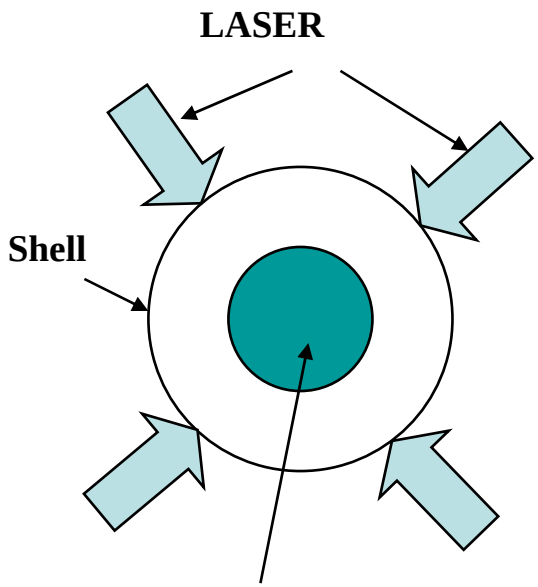
Part of the Rosetta Project ion trap.

- Macor ceramic
- 0.5mm centre bore
- 0.1mm channels for wire

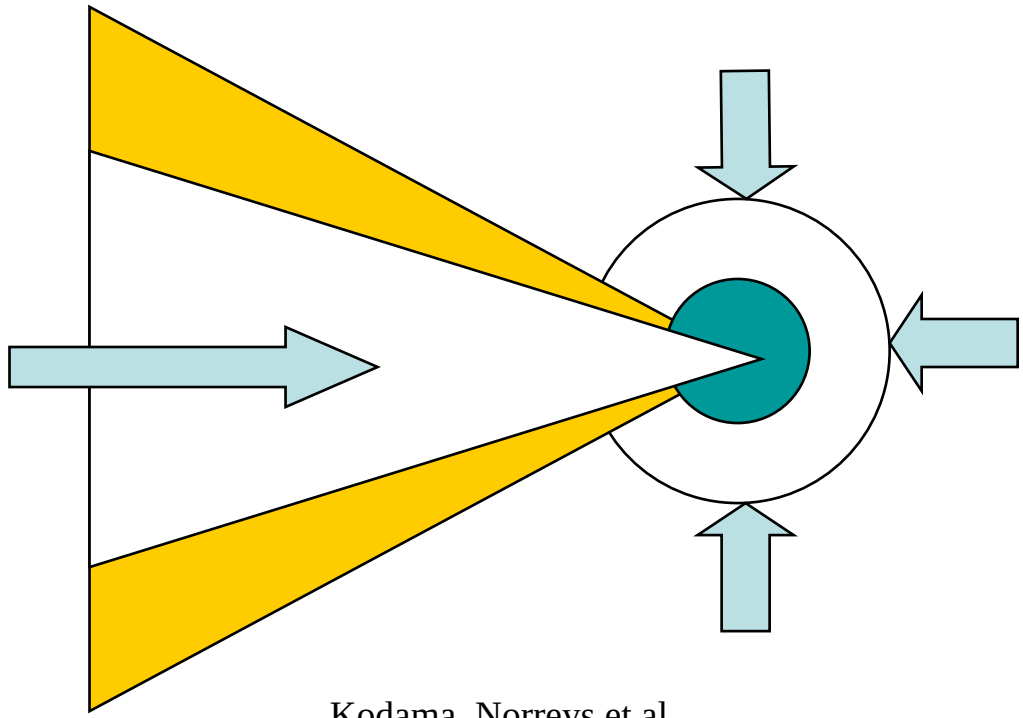
Cryogenic cooler development

- Titanium
- Wall thickness of 0.1mm

Application For Cone Targets



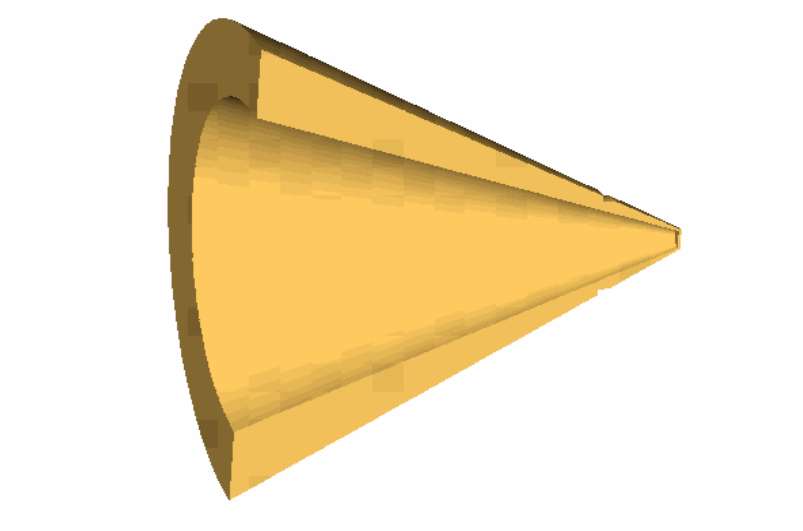
STANDARD



Kodama, Norreys et al
Nature 412, 798 (2001)

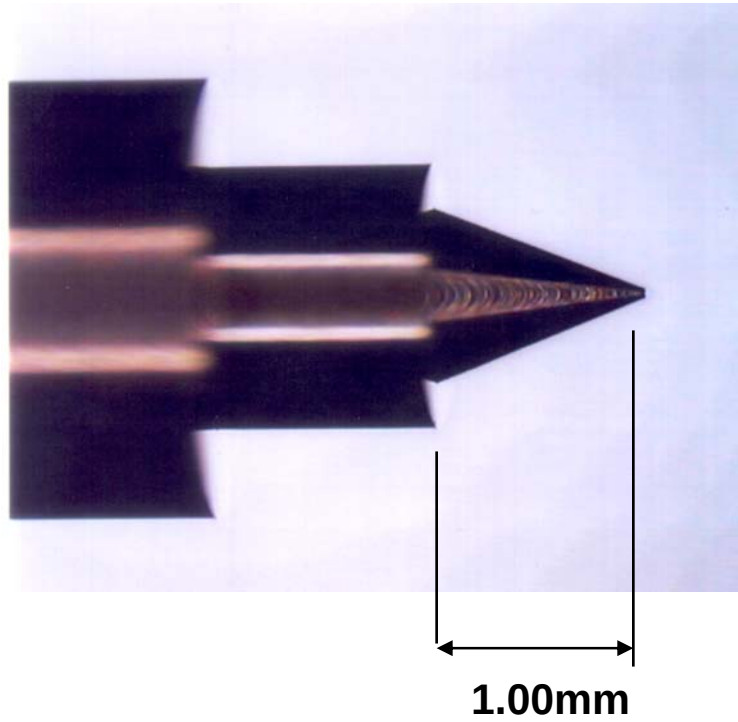
Novel Geometries for Laser Target Fabrication Group

- Task
- Conical shape
- Pure gold
- Base 950µm diameter
- 1mm high
- Wall thickness at tip 3µm or less



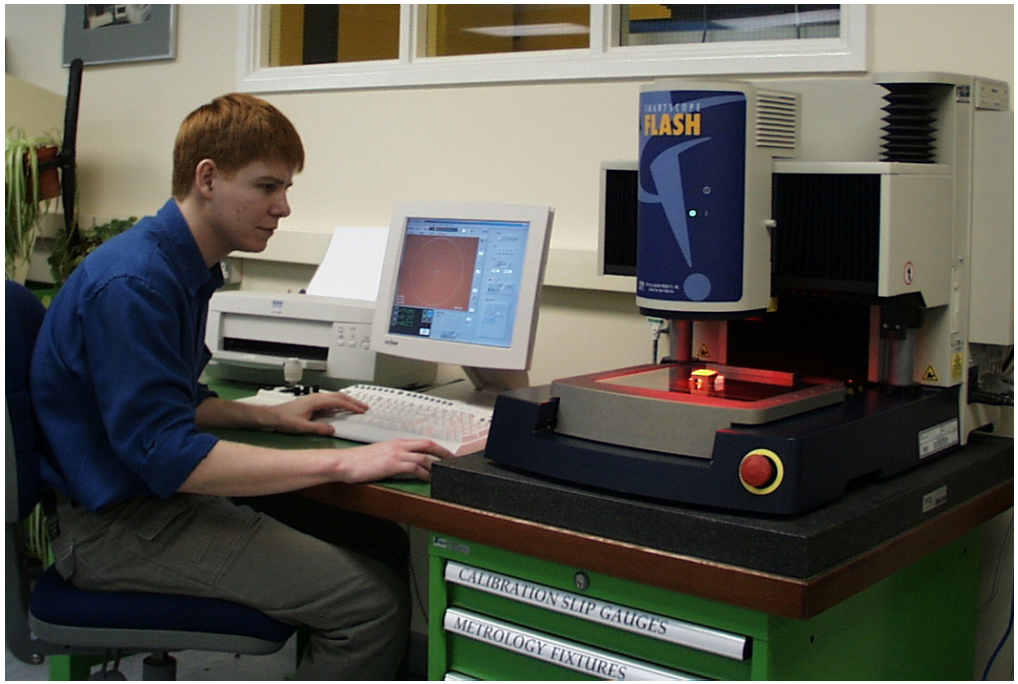
Process : Stage 1

- **MANUFACTURE COPPER MANDREL**
- Reference features.
- Concentricity.
- Tool geometry.



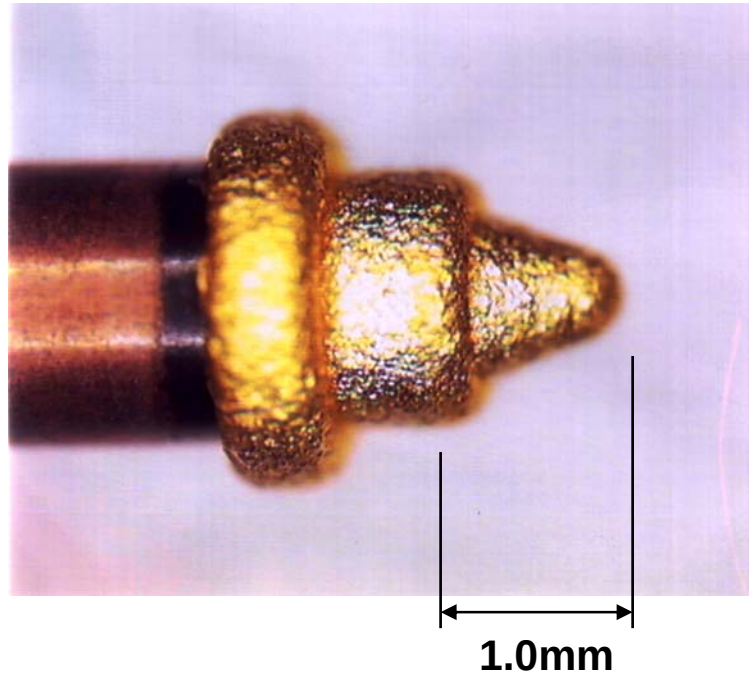
Process: Stage 2

- **INSPECTION**
- Visual inspection using very high magnification microscopes
- Measured on computer controlled non-contact measuring machine
- Accurate to 1 micron
- Data recorded



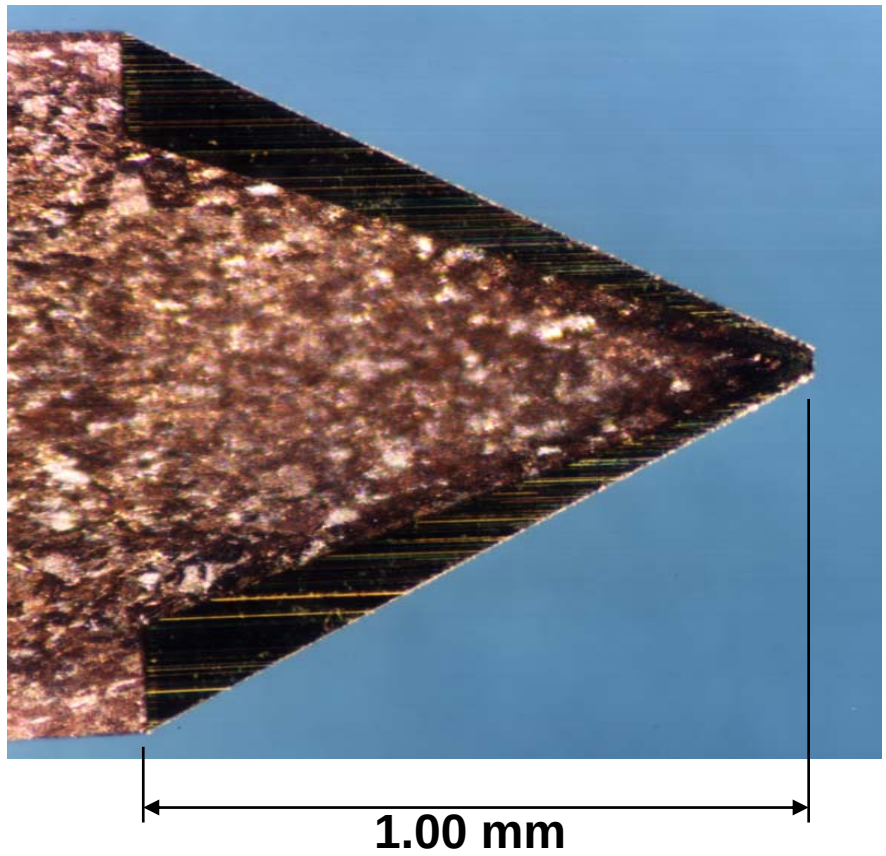
Process: Stage 3

- **GOLD PLATING**
- Mandrel masked off just exposing area to be gold plated.
- 175 microns of gold.
- Plating time 1 week.



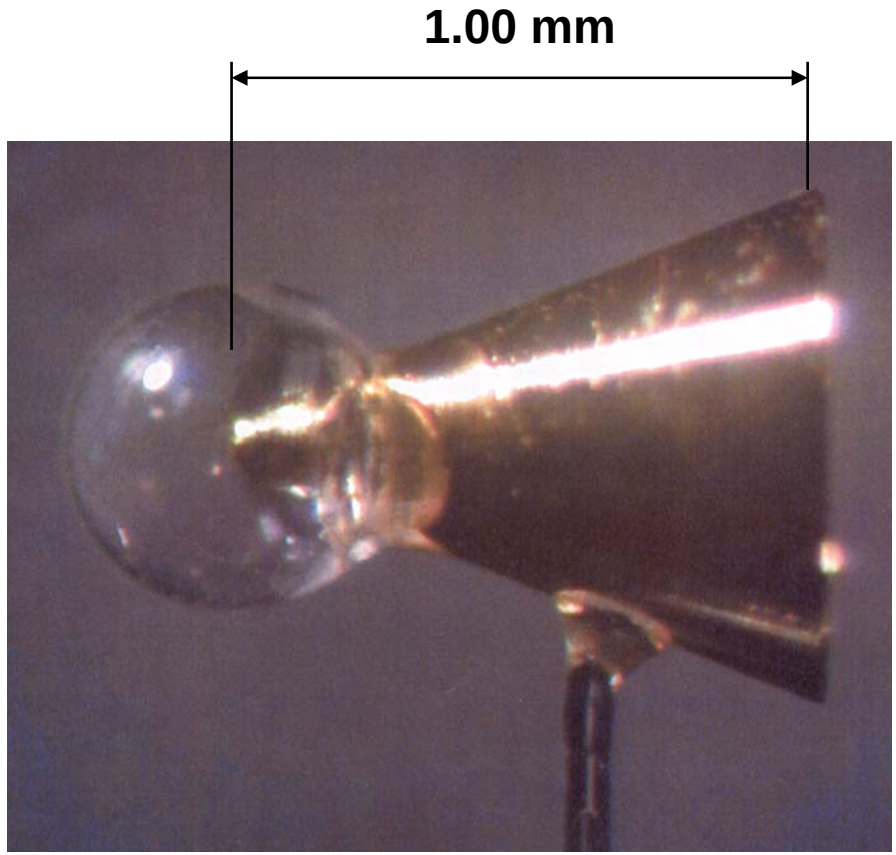
Process: Stage 4

- **PROFILING**
- Machine profile to obtain 3 micron wall thickness.
- Tool geometry.
- Part off and place cone in nitric acid to etch copper.
- Sectioned sample to verify wall thickness.



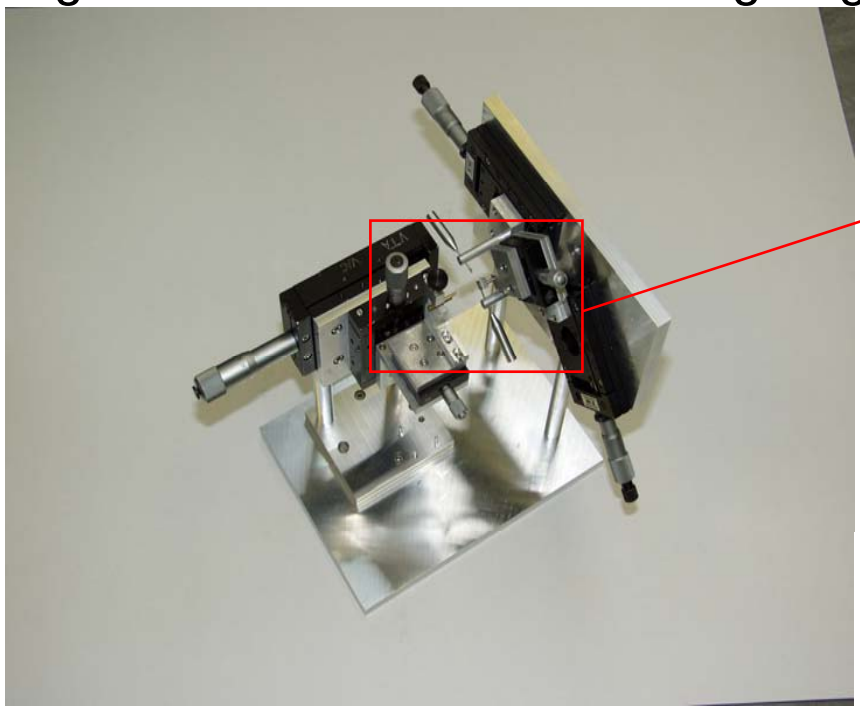
Final Assembly

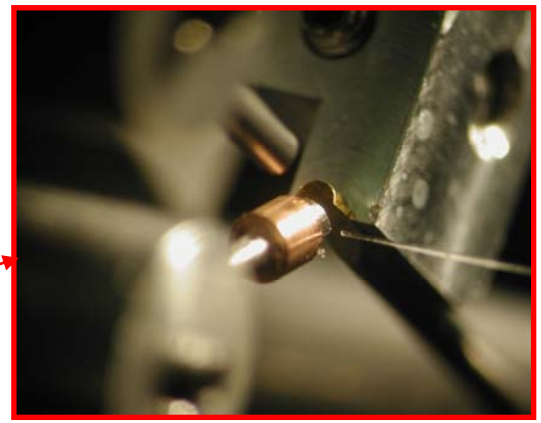
- Cone mounted on 0.080 mm glass stalk
- Hollow ball fixed to apex of gold cone

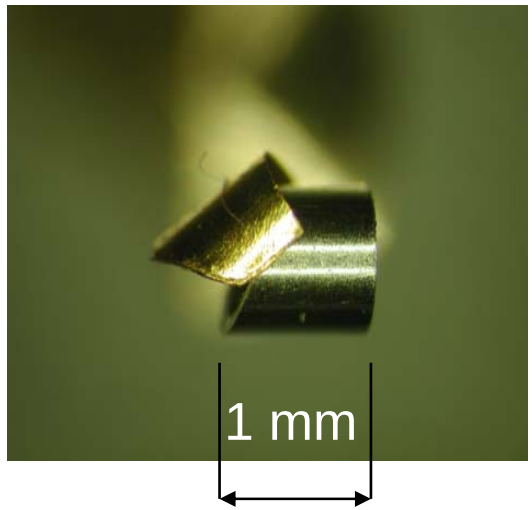


Jigs and Fixtures

- Jigs and fixtures for assembling targets



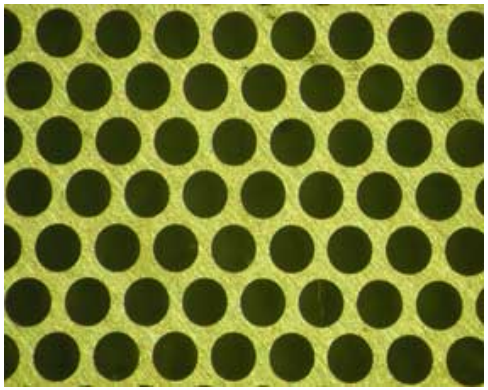




- Rapid prototyping

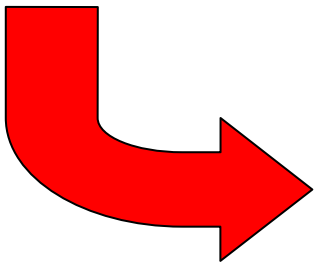
Micro Drilling

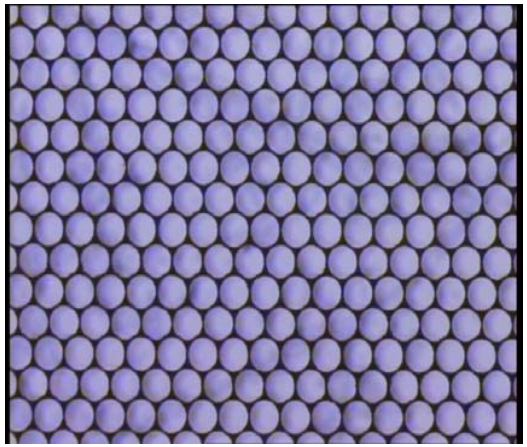
Target manufacture for
CLF Drill size 0.05mm



Component for the **A**tacama **L**arge **M**illimetre **A**rray (ALMA) project

Drill size 0.32mm spacing 0.5mm





Drill size 0.12mm spacing 0.13mm

Future for PDF

Why use a lathe?

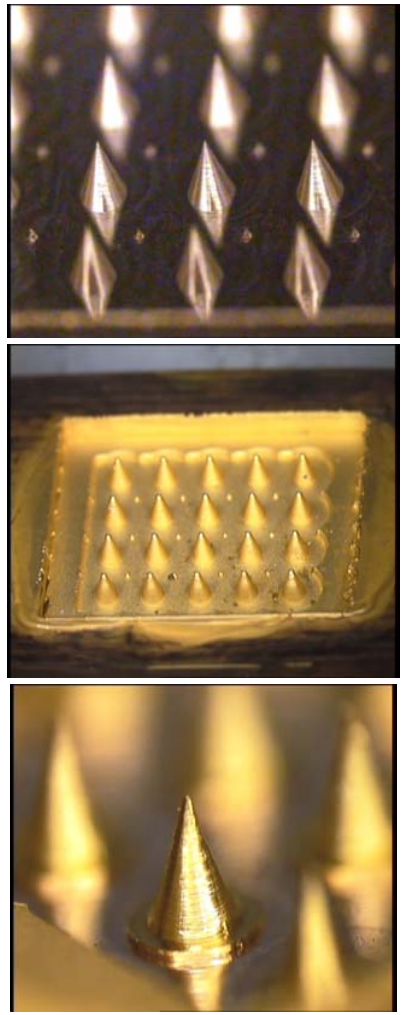
Targets produced on latest CNC mill.

Gold plated.

Same plating time higher yield.

Reset on jig and outside profile machined.

STILL UNDER DEVELOPMENT



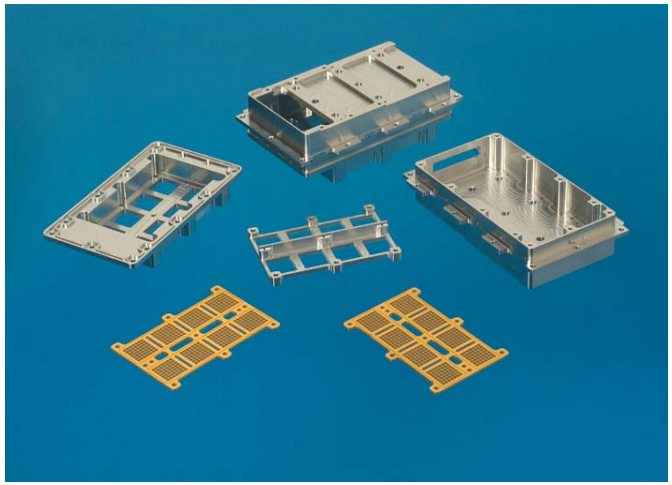
ALMA Project

ALMA at Chajnantor
(Courtesy NAOJ)

ESO PR Photo 14/01 (6 April 2001)

Future for PDF

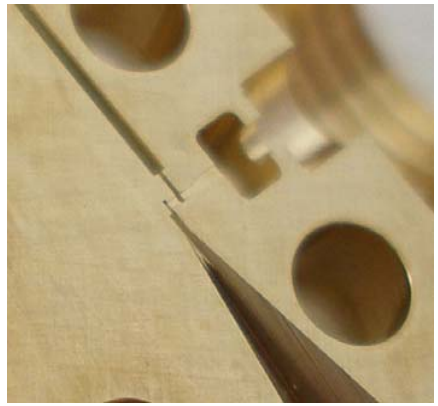
Larger high accuracy space components



High production levels

Continue to develop new machining methods for miniature components and push the boundaries of manufacturing.

New designs possible using 5 axis machining



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millimetre-wave technology

MMT