# rrrrr BERKELEY LAB

# LBNL ENGINEERING DIVISION MECHANICAL FABRICATION CAPABILTIES

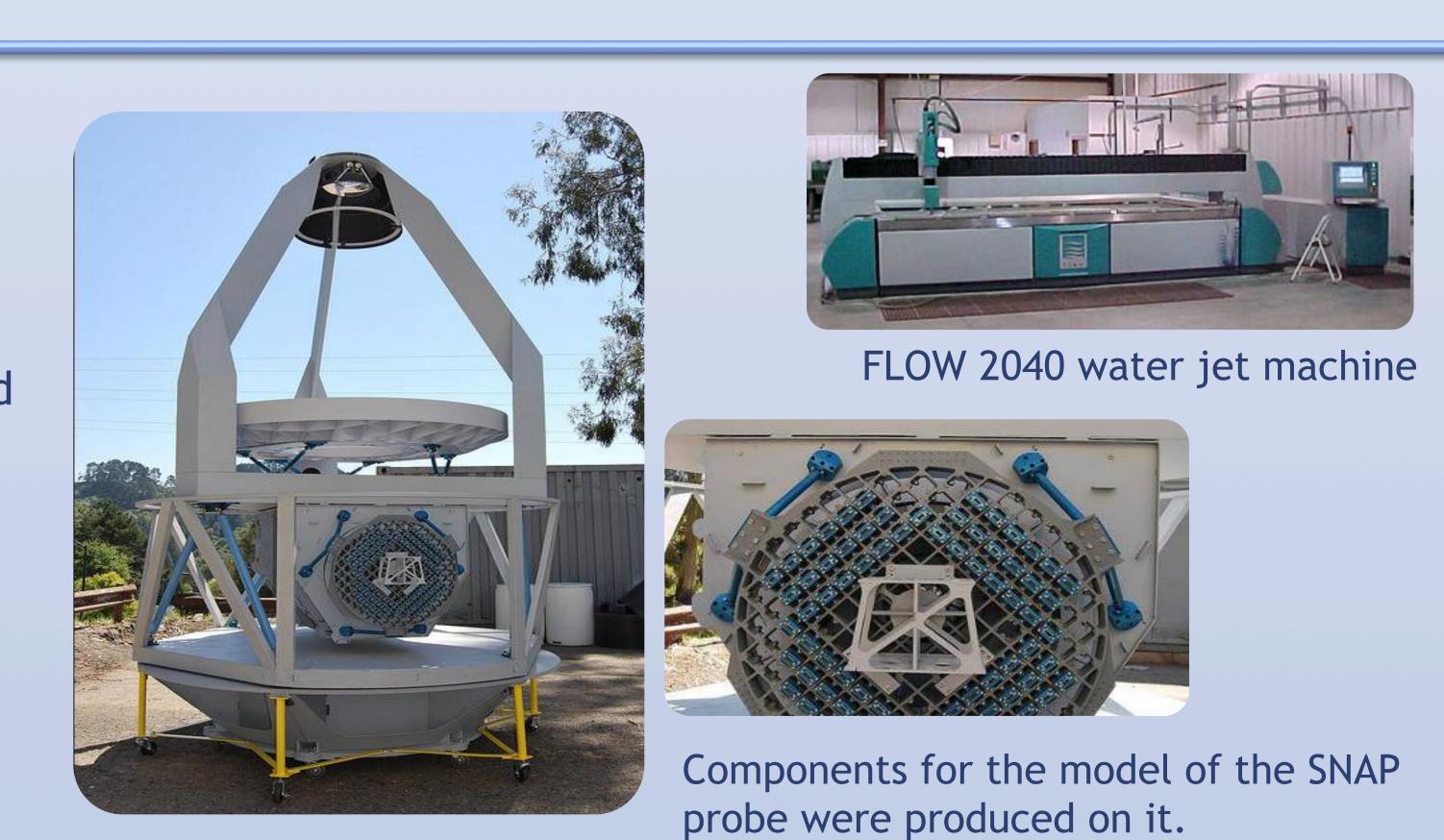
# ADVANCING SCIENCE THROUGH FABRICATION



#### CNC Waterjet

Precision cutting of many different material types including: wood, cardboard, aluminum, steel, stainless steel, plastics, carbon composites, and

4000mm x 2000mm x 250mm work envelope



#### Sheet Metal, R&D Fab, and Welding

Precision cutting, forming, and joining of thin materials

Metal spinning

Inert-atmosphere glove-box welding that allows for very delicate welds in a clean atmosphere.

TIG/MIG Welding

TIG Brazing



Copper Tubes - Metal spun, welded in the glove box and gold plated for a vector magnet.

## Plating & UHV Cleaning

Ultra-High Vacuum cleaning

Steam Cleaning

Caustic Etching

Bright Dipping

Electro-polishing

Anodizing

Gold Iridate (Alodine)



ERNEST ORLANDO LAWRENCE

BERKELEY NATIONAL LABORATORY

Plating & UHV Cleaning Shop

Electro-polished rF Cavity

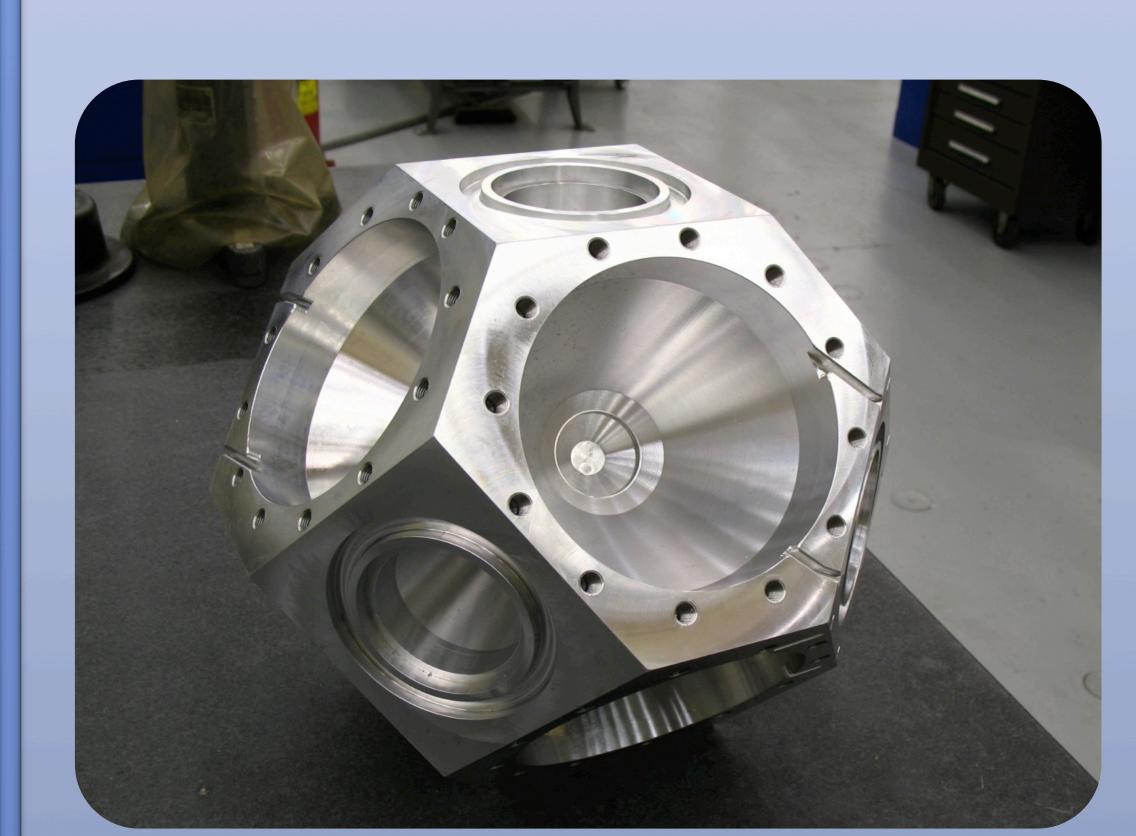
### General Machining

Broad range of CNC milling machines with work envelopes ranging from ~500mm<sup>3</sup> to 2500mm x 2000mm x 1000mm and spindle speeds up to 20,000 rpm. 3 axis, 3+2 axis, 4 axis, and 5 axis capabilities.

CNC lathes allow precision turning of components from .025mm to 700mm diameter and lengths to 600mm.

Fully integrated CAD/CAM software for precise geometry replication.

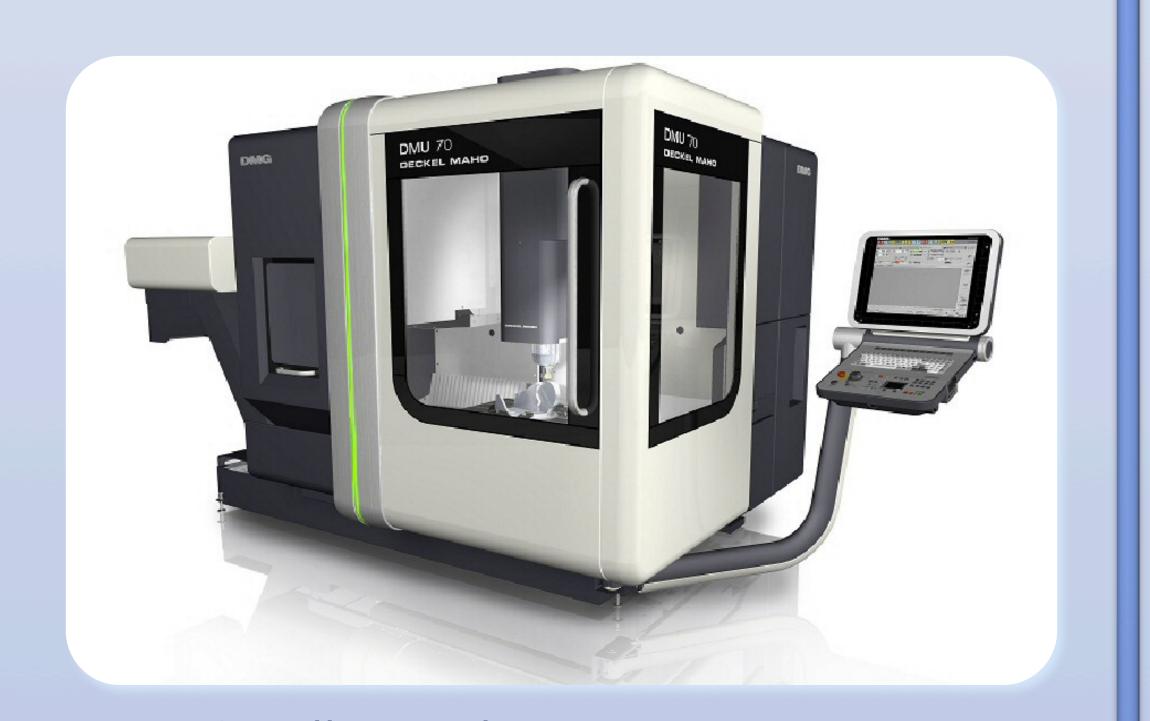
Complementary conventional machine tools, including large surface grinders, Bullard type turning machines with capacities for turning to nearly two meters diameter, a pipe lathe with a 250mm headstock bore, grinders, lathes, and milling machines.



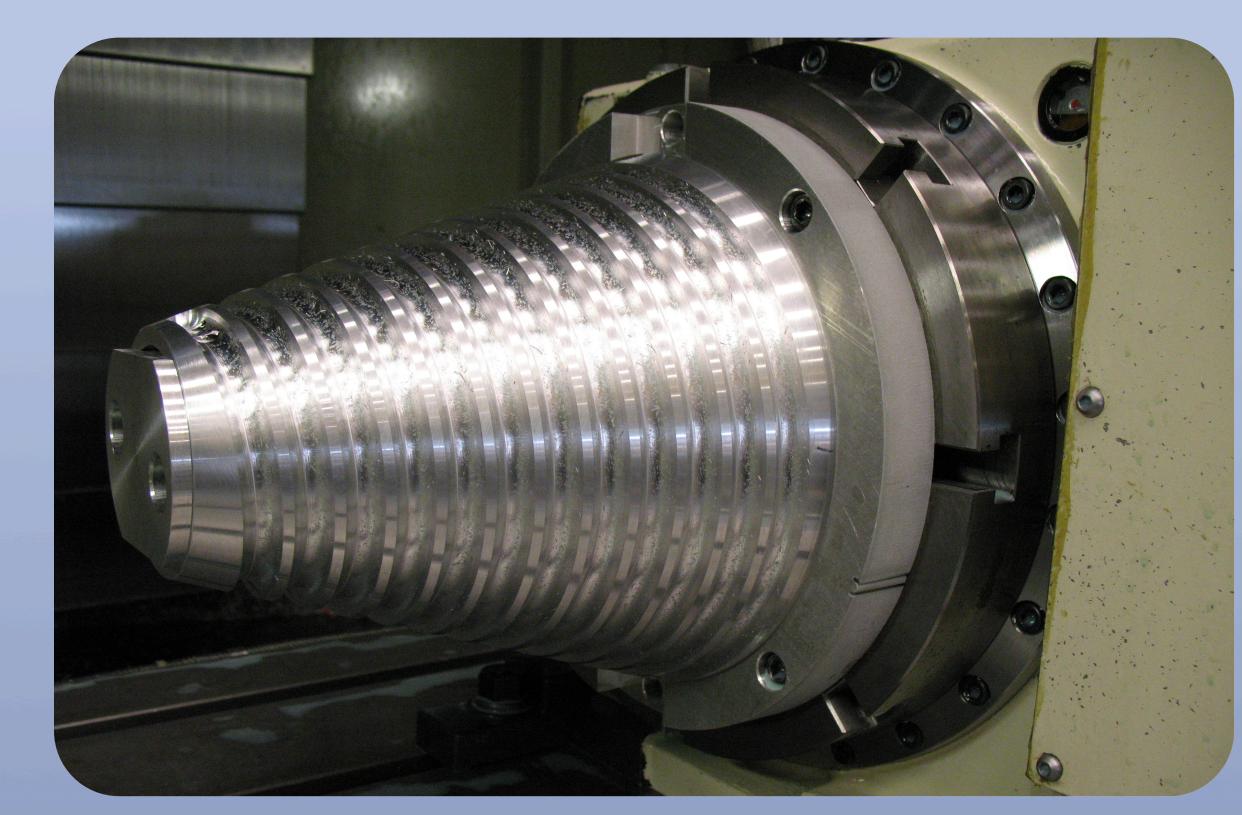
DMU-50T Machining Center 3+2 axis machined vector magnet core



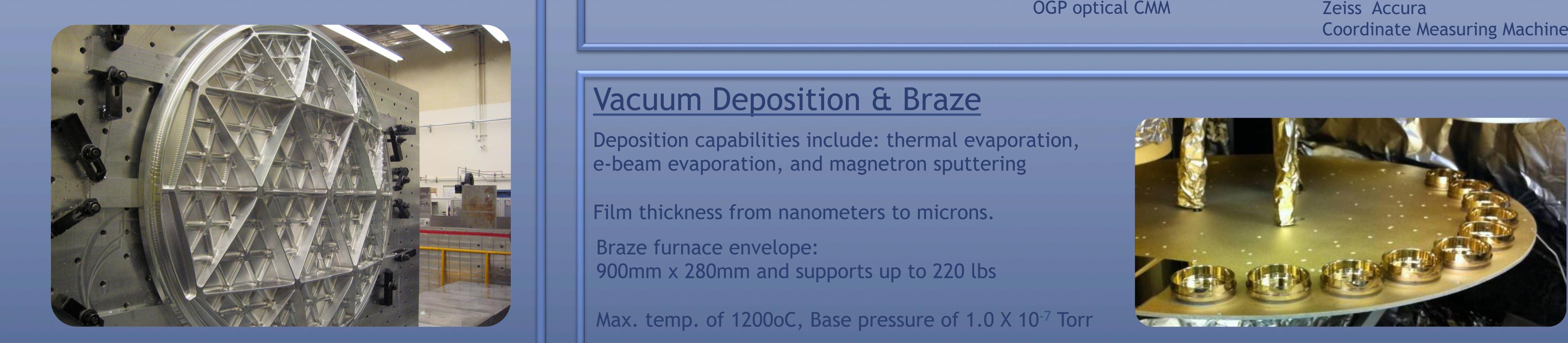
NL20005Y Turn/Mill Machining Center Capability to add features both radially and axially in cylindrical parts in one set-up.



DMU-70T Milling Machine 5 axes of simultaneous cutter motion



OKK VM7 with 4th axis Machined bifilar channels.



G&L 450 Horizontal CNC Boring Mill Large format machined Atacama telescope mirror

## Precision Machining

Ultra High Precision Machining, accuracies to within 3 microns and extremely fine surface finishes

Full 5 axis, 50,000 rpm, high speed machining

Meso-scale machining capability

Submerged Wire and Sinker EDM, 5 axis "Turn and Burn"



Mitsubishi FA20-VS Wire EDM



Yasda YBM 950 High Precision machining center



5 axis machining center

#### Metrology

Large format Coordinate Measuring Machine (CMM)

Optical CMM, laser and featherweight touch probe options

3 axis standard, 4<sup>th</sup> axis upgrade in process

Portable CMMs (FARO Arms)

Reverse Engineering capabilities



OGP optical CMM



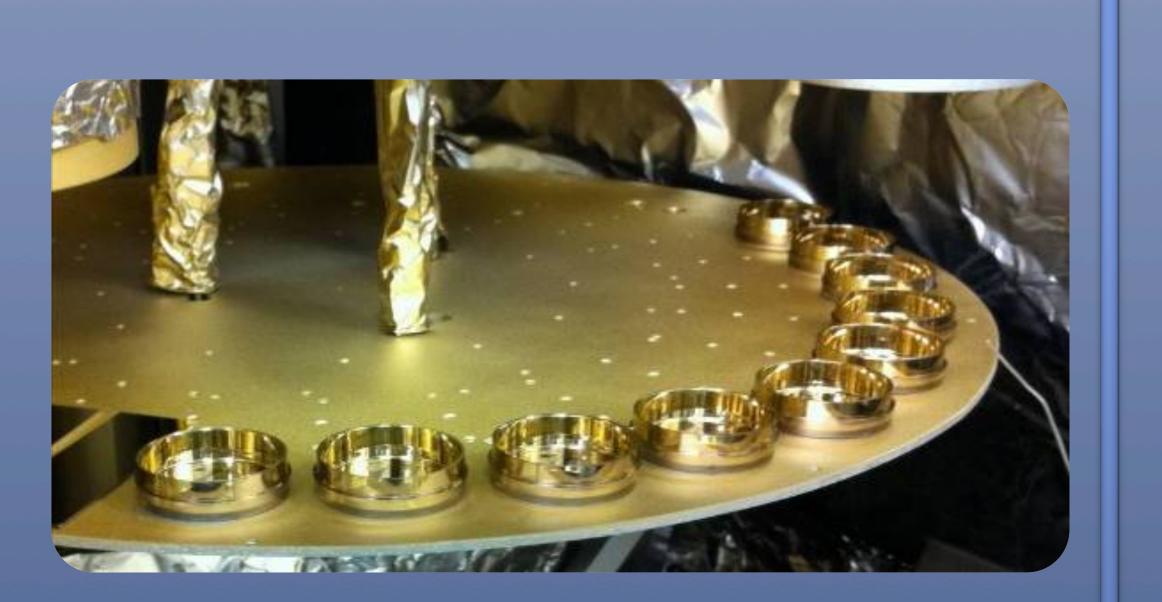
Zeiss Accura Coordinate Measuring Machine

# Vacuum Deposition & Braze

Deposition capabilities include: thermal evaporation, e-beam evaporation, and magnetron sputtering

Film thickness from nanometers to microns.

Braze furnace envelope: 900mm x 280mm and supports up to 220 lbs



50nm Gold film deposited in petri dishes for cell media

