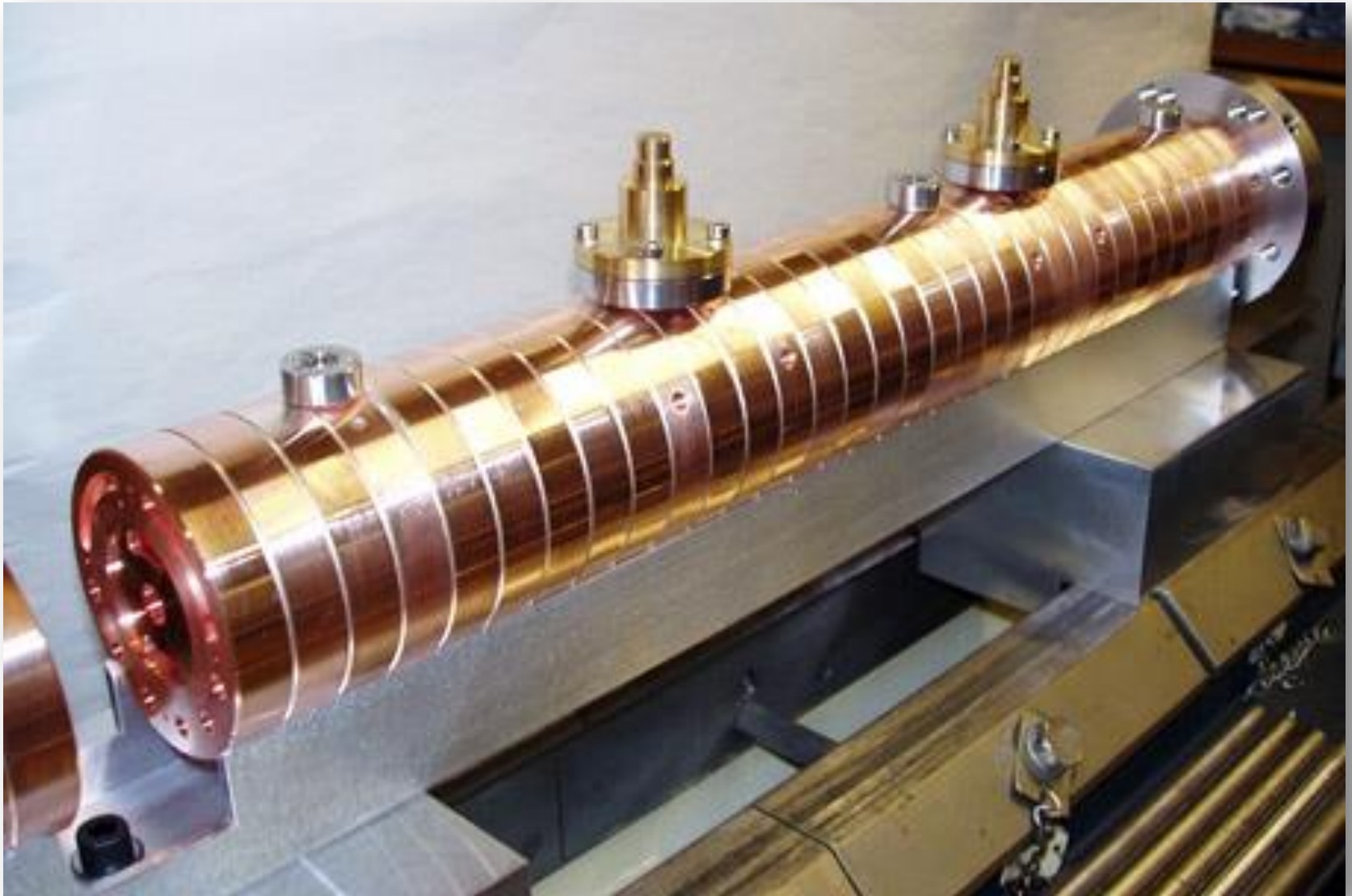


THE DESIGN & FABRICATION OF COPPER AND NIOBIUM RF CAVITIES

*A. Simonyan, V. Danielyan, V. Dekhtiarov,
Mechanical Engineering Group
Vacuum Technology Group
Mechanical Workshop*

COPPER CAVITIES

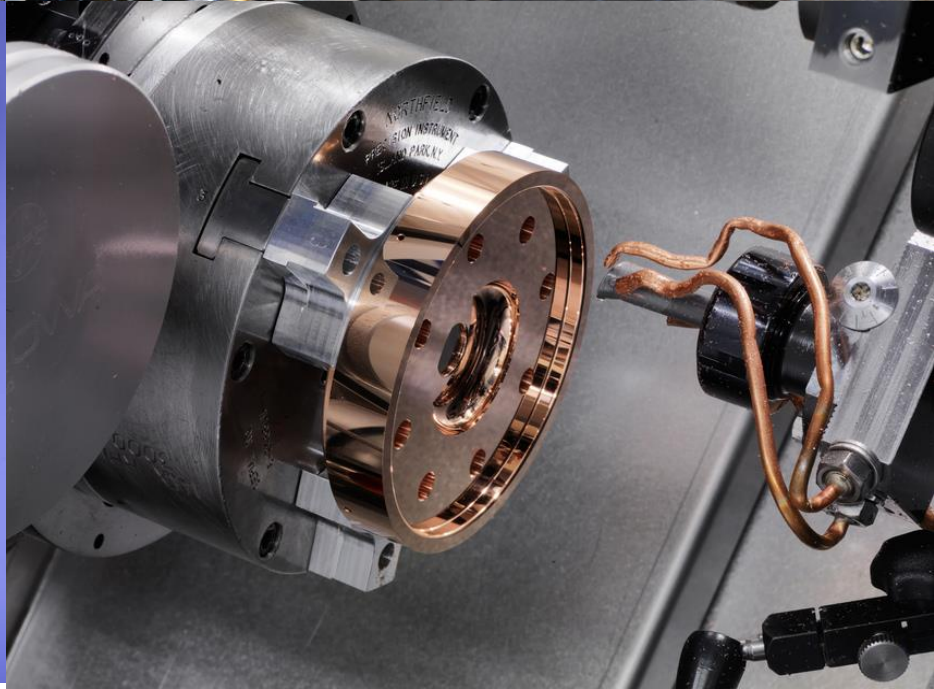
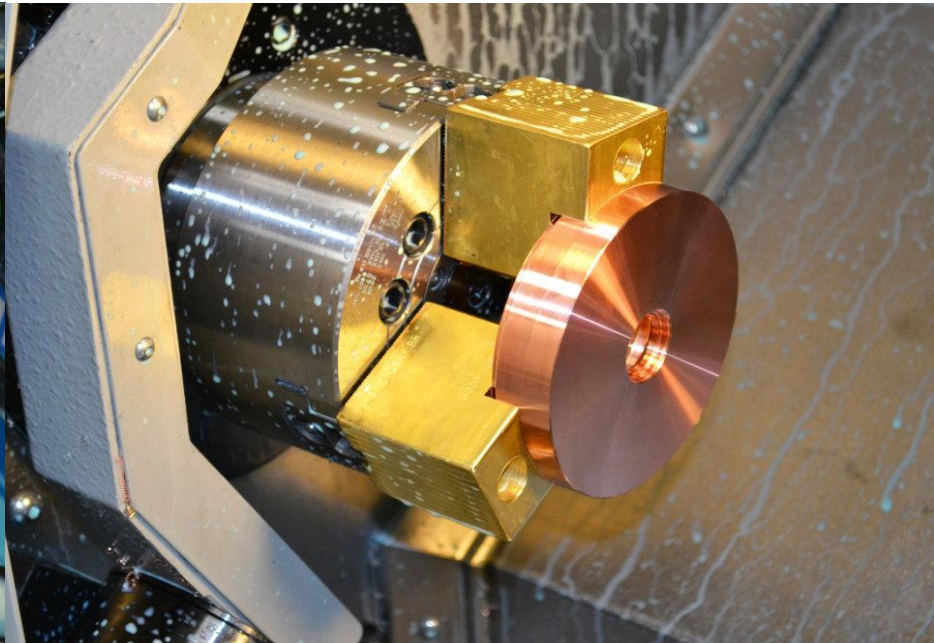
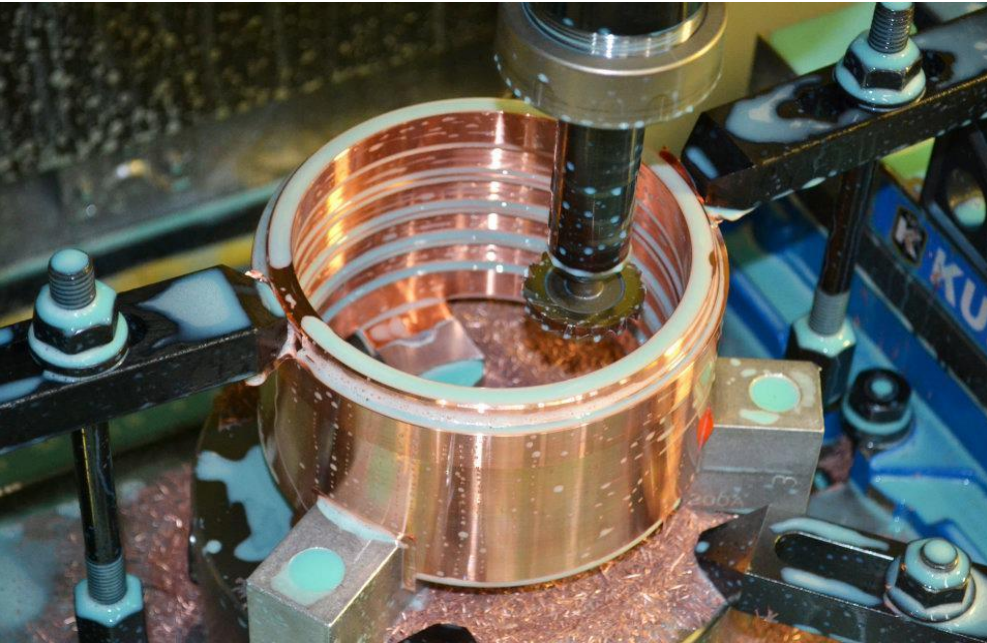


FABRICATION OF COPPER CAVITIES

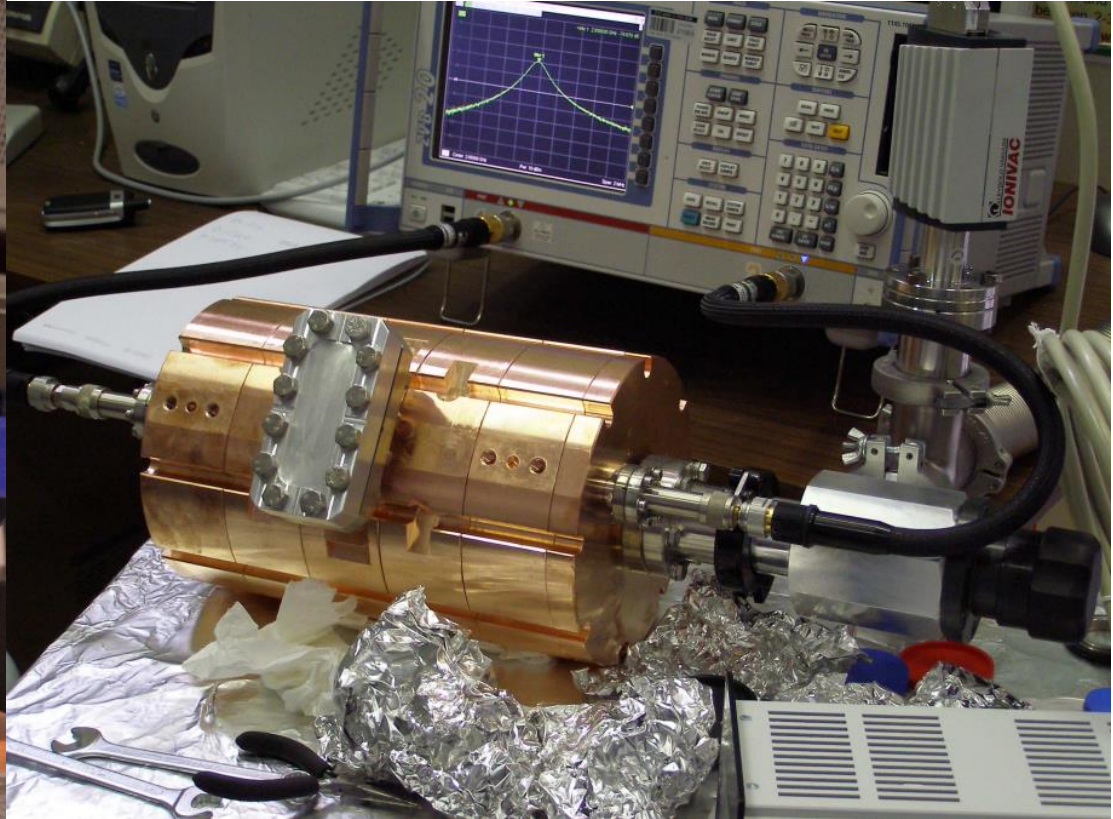
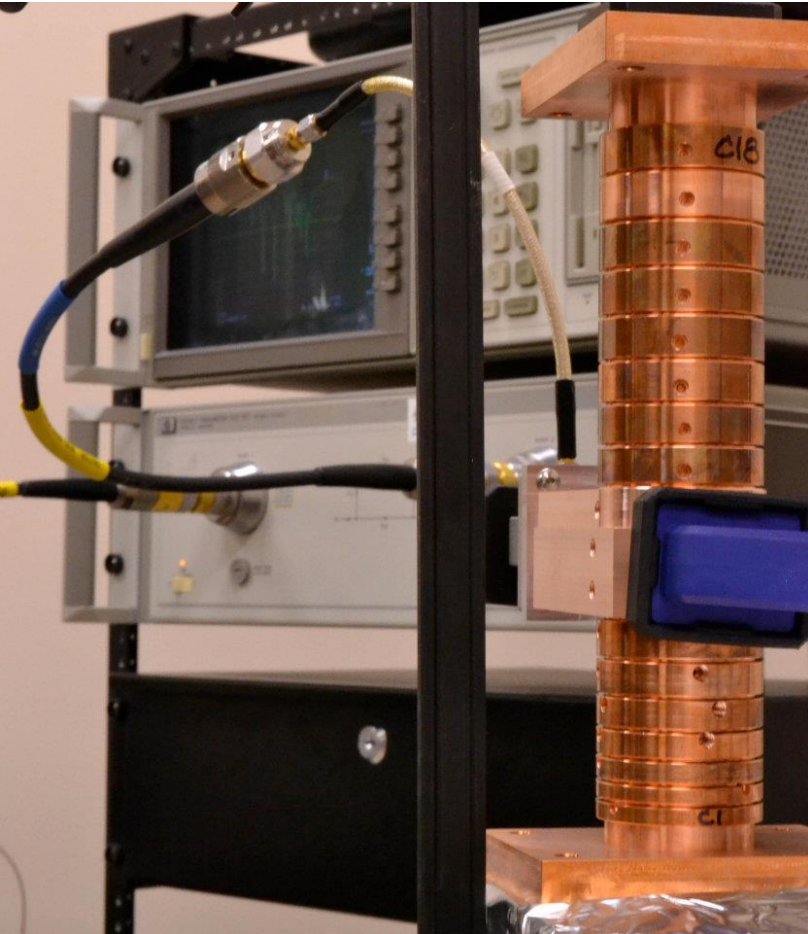
TECHNOLOGICAL PROCESSES

- 1. MATERIAL RESEARCH*
- 2. 3D DESIGN TOOLS*
- 3. PRESSING*
- 4. PRECISION TURNING & MILLING*
- 5. POLISHING*
- 6. CHEMICAL CLEANING*
- 7. HEAT TREATMENT-ANNEALING*
- 8. CELL QUALITY ASSURANCE*
- 9. EUTECTIC BRAZING*
- 10. RF TURNING*

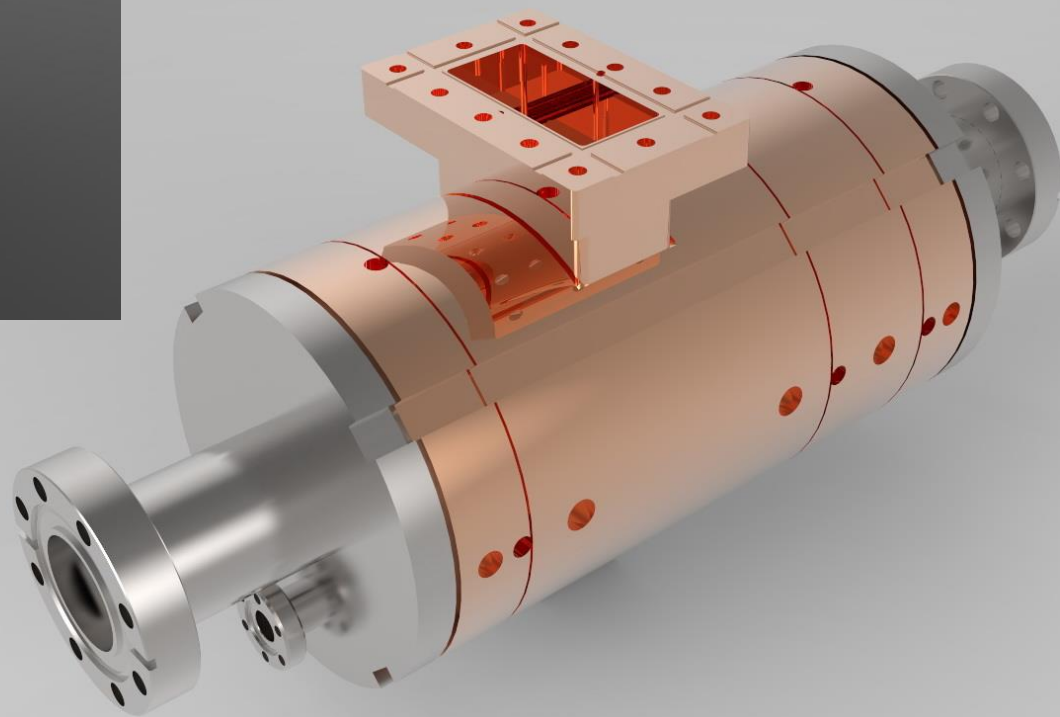
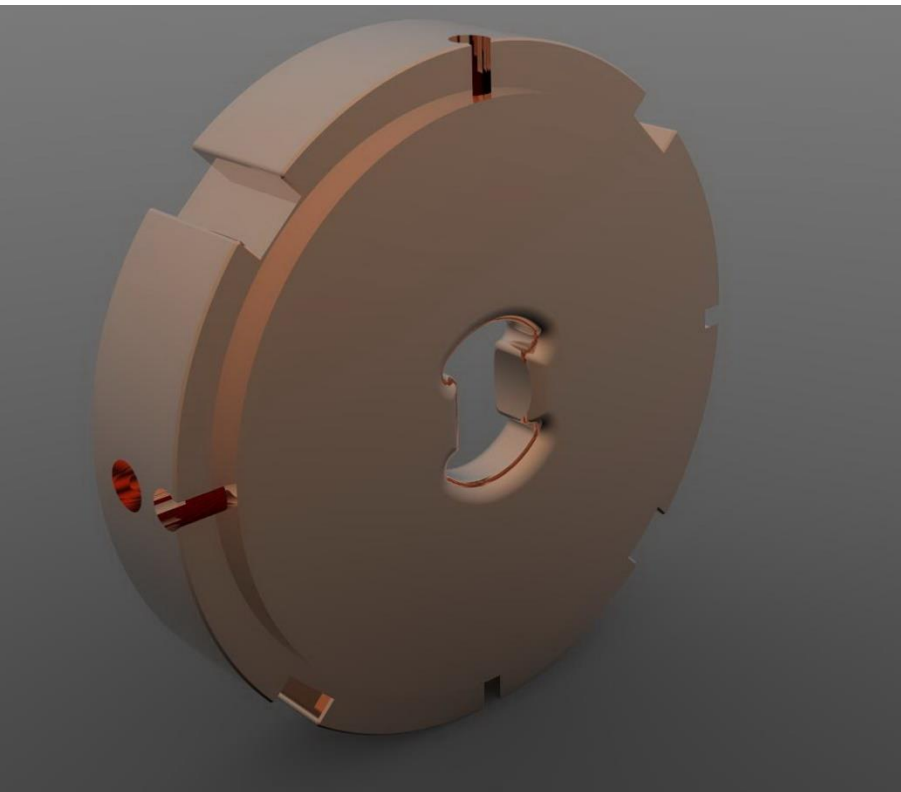
PRECISION TURNING & MILLING



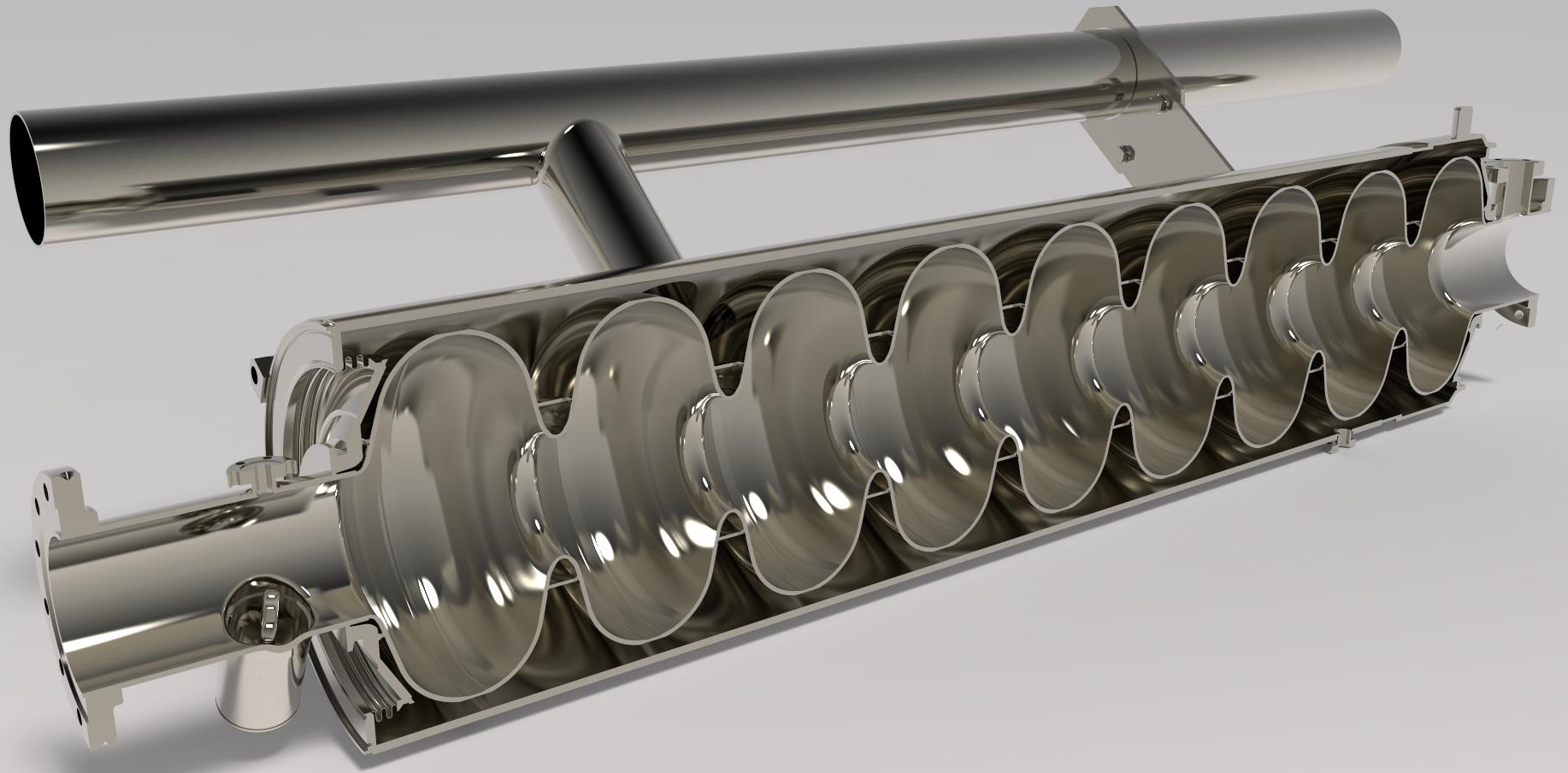
RF TUNNING



RF DEFLECTING CAVITY



SUPERCONDUCTING NIOBIUM CAVITIES



FABRICATION OF NIOBIUM CAVITIES

TECHNOLOGICAL PROCESSES

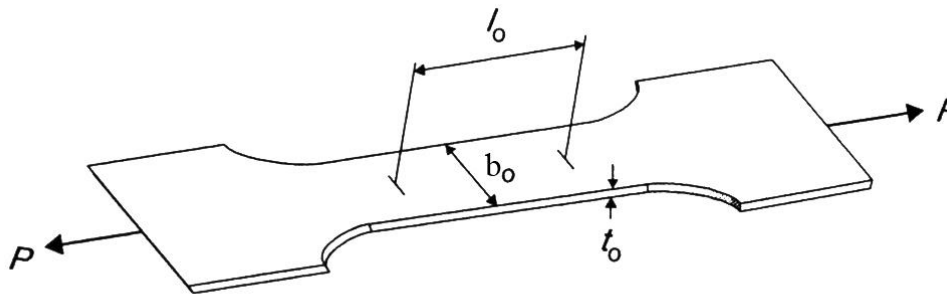
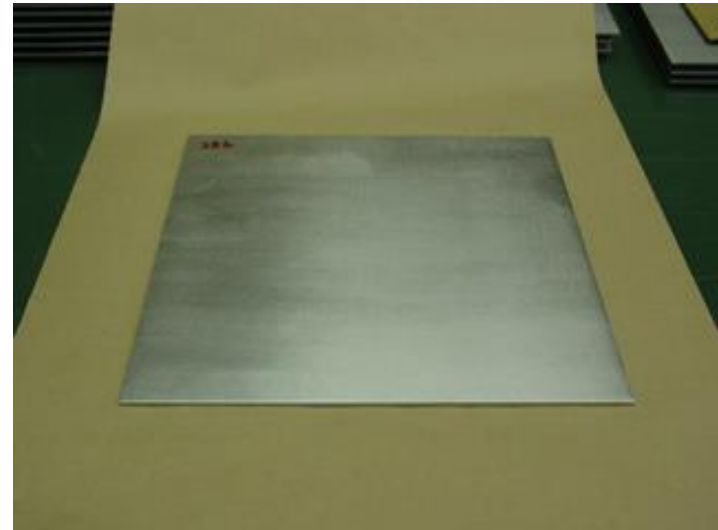
- 1. MATERIAL RESEARCH***
- 2. BLANKING (SHEARING)***
- 3. DEEP DRAWING OR HYDROFORMING***
- 4. PRECISION TURNING & MILLING***
- 5. CELL QUALITY ASSURANCE***
- 6. E-BEAM WELDING***
- 7. POLISHING & CHEMICAL CLEANING***
- 8. HEAT TREATMENT-ANNEALING***
- 9. RF TUNING***
- 10. 3D DESIGN TOOLS***

MATERIAL RESEARCH

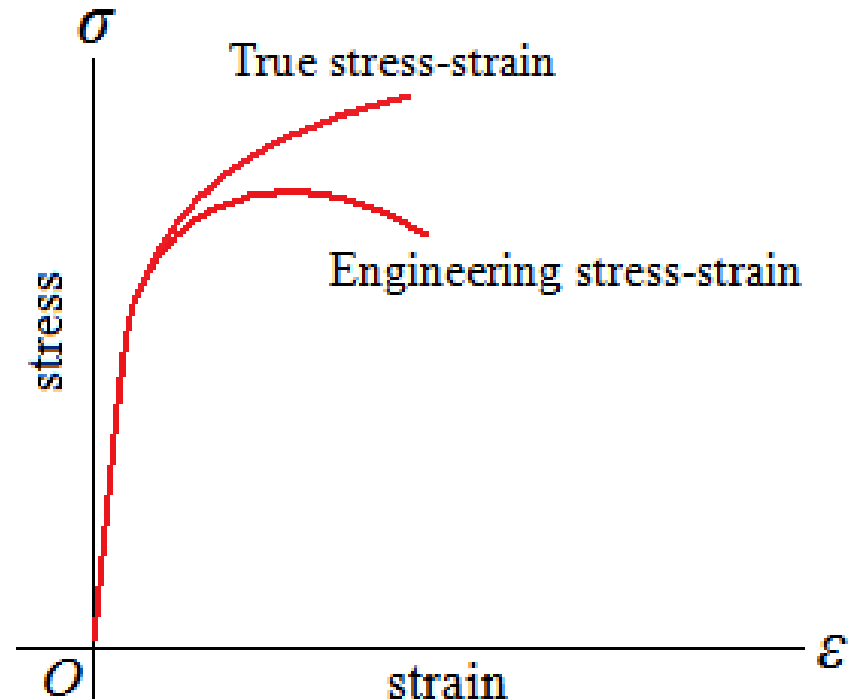
ANALYTICS & QUALITY CONTROL OF Nb SHEET

- ***LOCAL DEFECTS, SMALL SPOTS, THERMAL BREAKDOWN (QUENCH)***
- ***O, N, C, Ta, H DESIGN TOOLS DETERMINATION***
- ***NON-DESTRUCTIVE ELEMENT ANALYSIS***
- ***VISUAL INSPECTION***
- ***PHYSICO-MECHANICAL PROPERTIES***

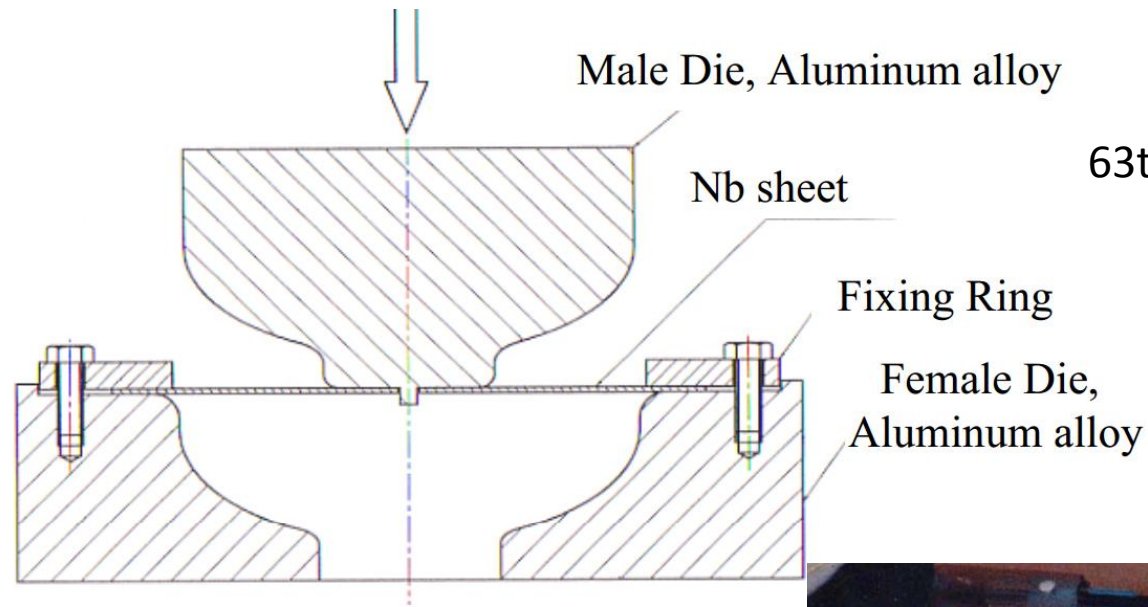
Nb RESEARCH



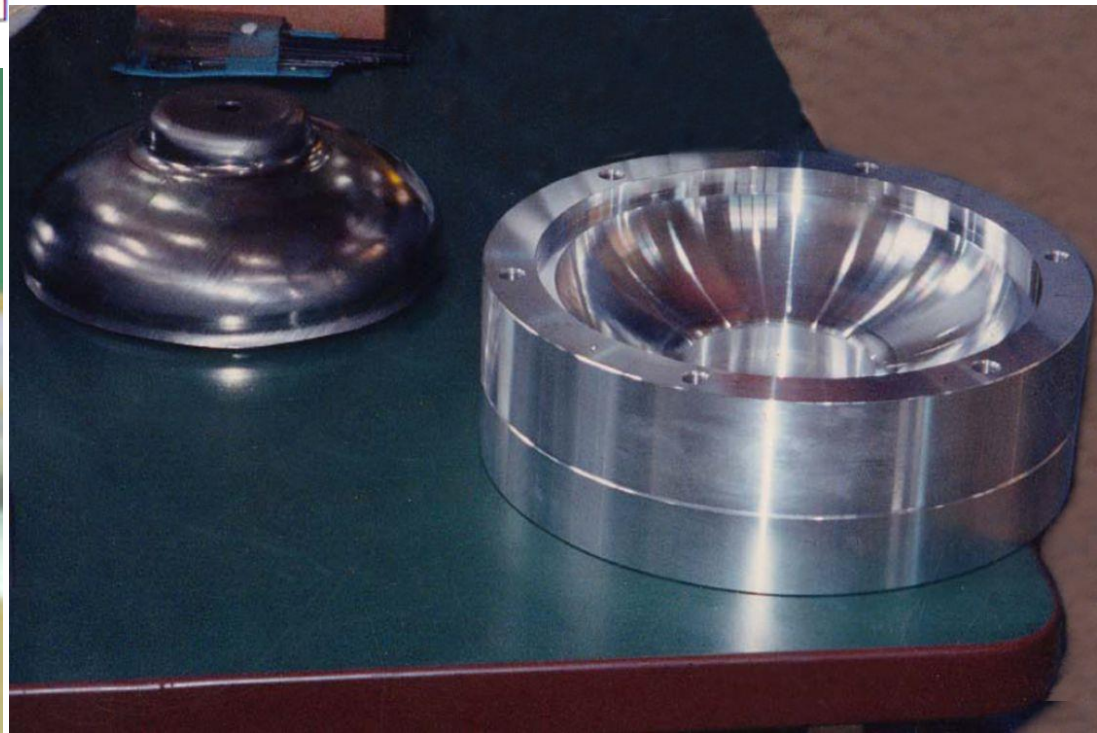
Yield Strength --- 70-80 N/mm²
Tensile Strength --- 164-168 N/mm²
Elongation --- 55 -58 %



DEEP DRAWING



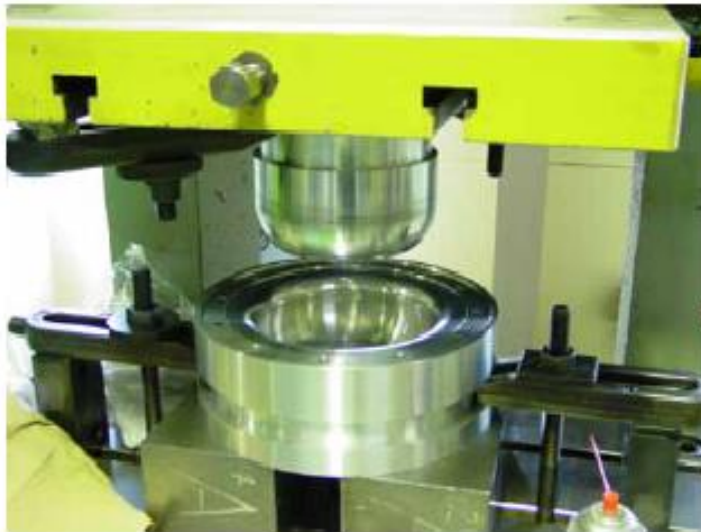
63t press for 2.8t Nb half cell (1300MHz)



Fabrication of ICHIRO Cavity in KEK(1)

Pressing Nb plate

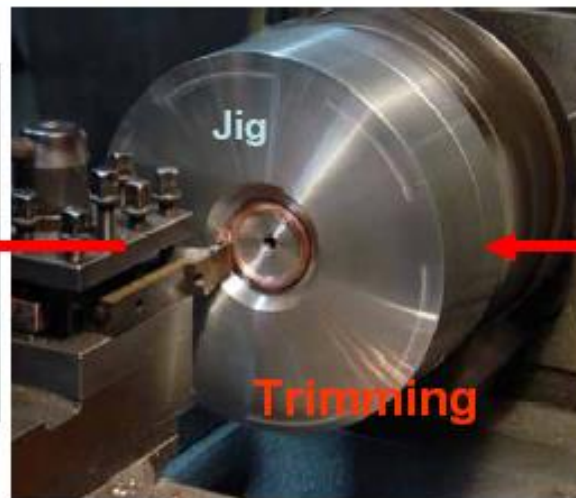
56 half-cells were pressed in a few hours



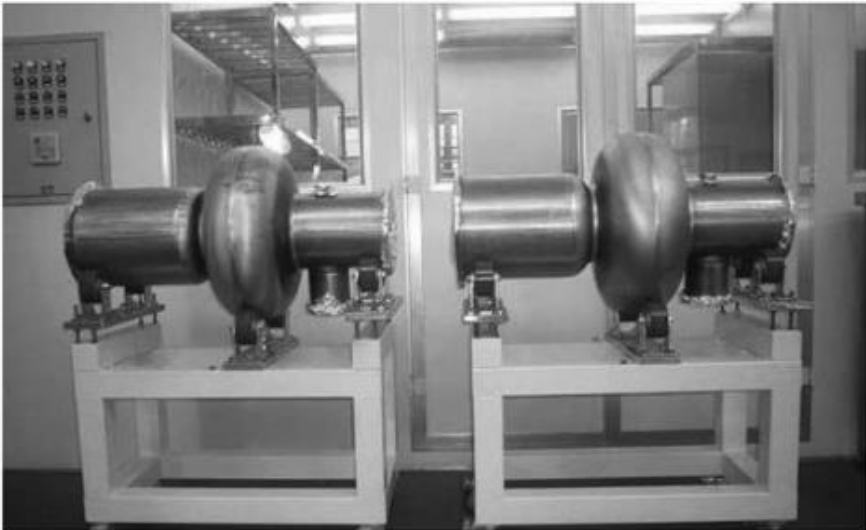
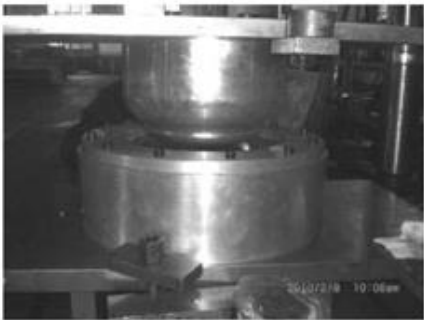
21 February 2005



After trimming



After pressing



Broken part of half-cell during deep drawing

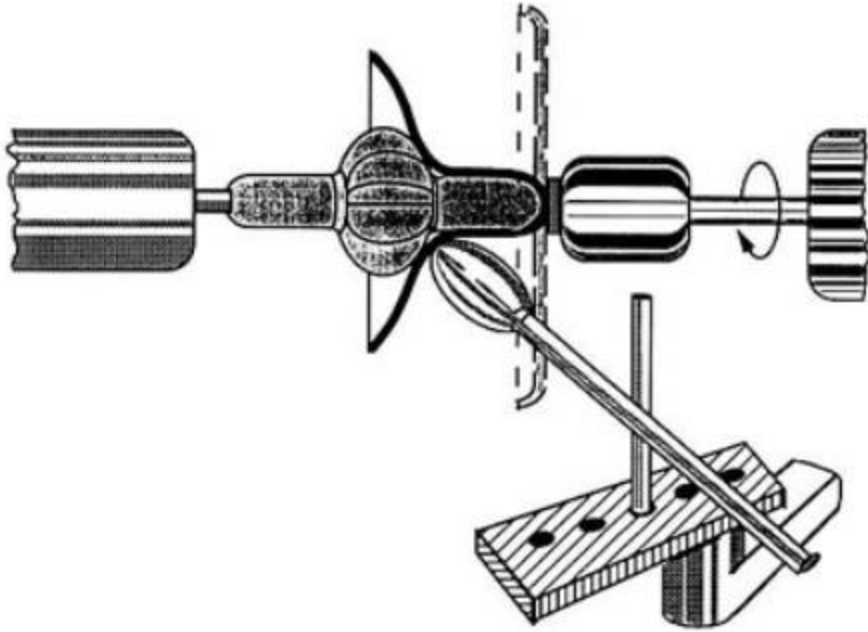


Broken part of beam-pipe transition

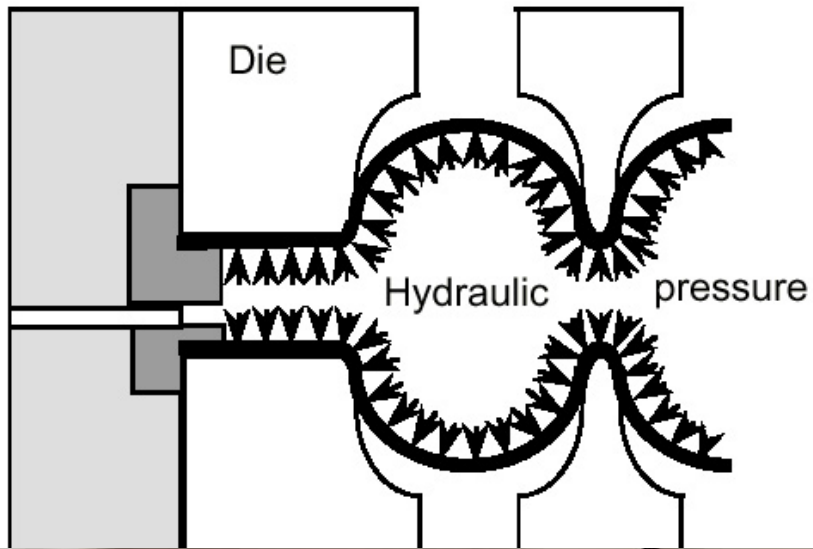


Half-cell after deep drawing.

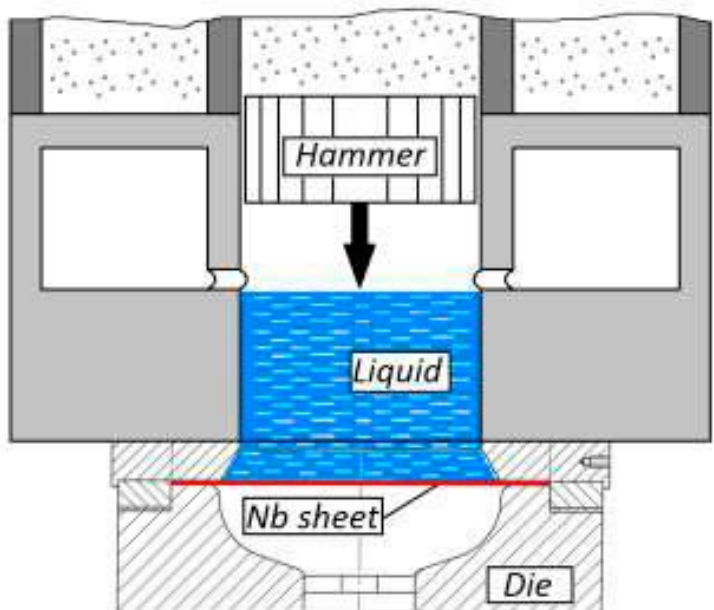
SPINNING PROCESS



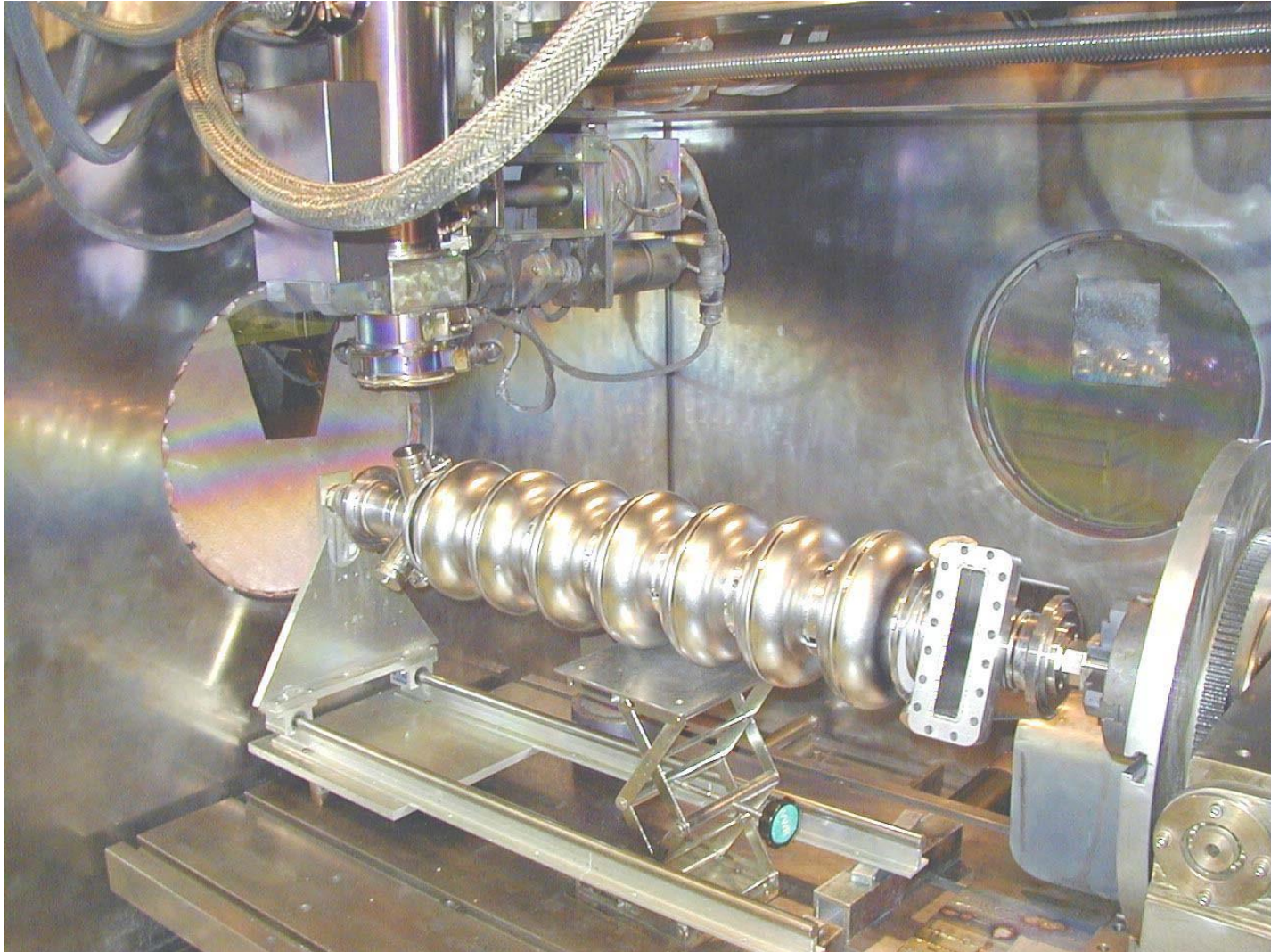
HYDROFORMING PROCESS



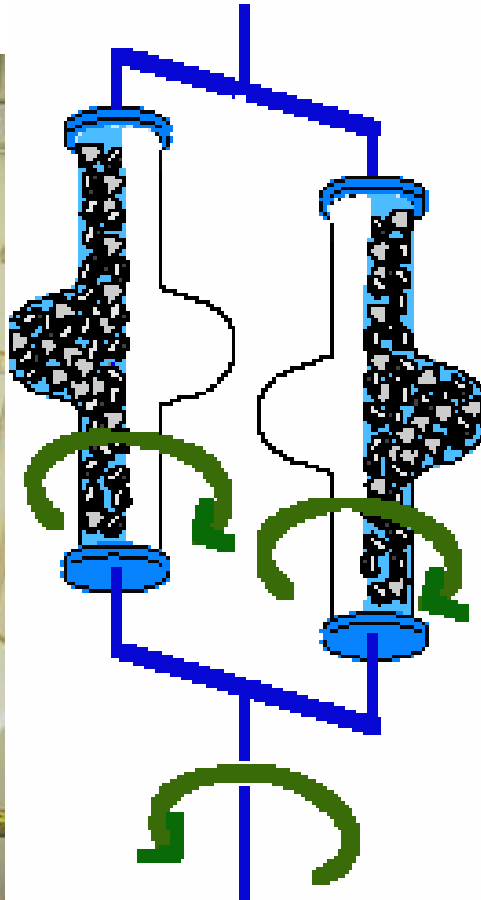
HYDRAULIC DEEP DRAWING



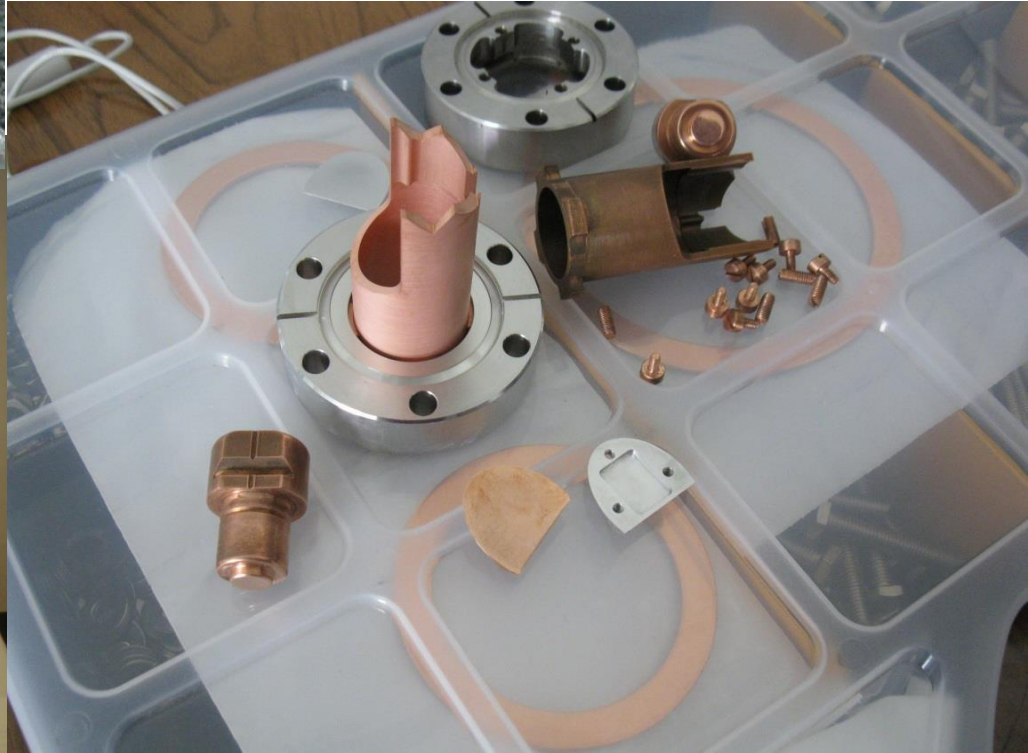
E-BEAM WELDING



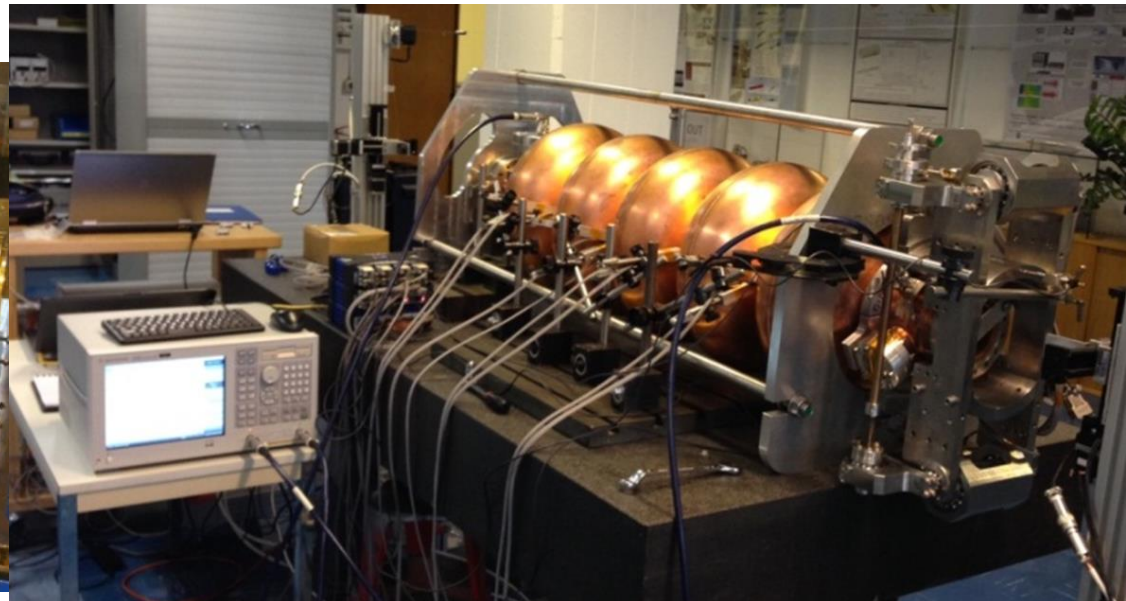
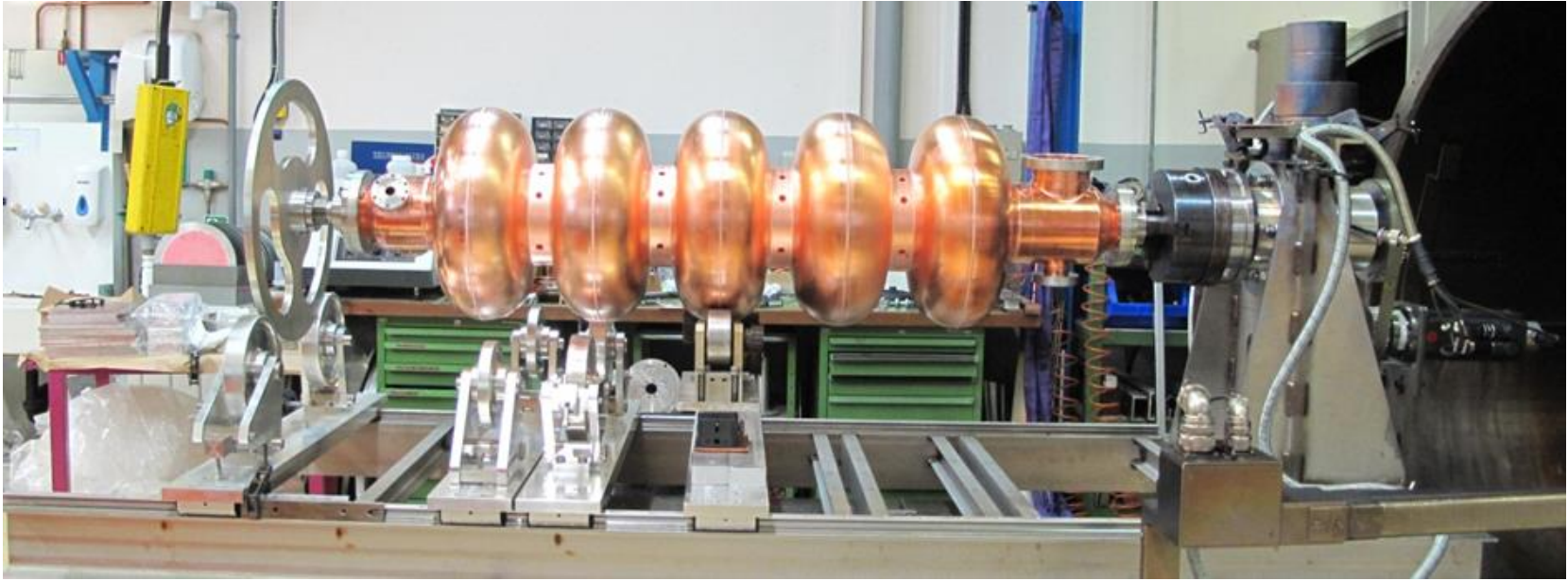
POLISHING & CHEMICAL CLEANING



ACCELERATOR COMPLEX PRECISION DETAILS

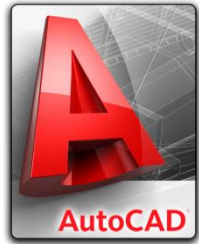


RF TUNNING



3D DESIGN TOOLS

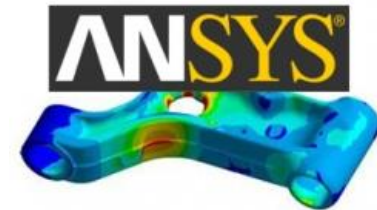
CAD



CAM

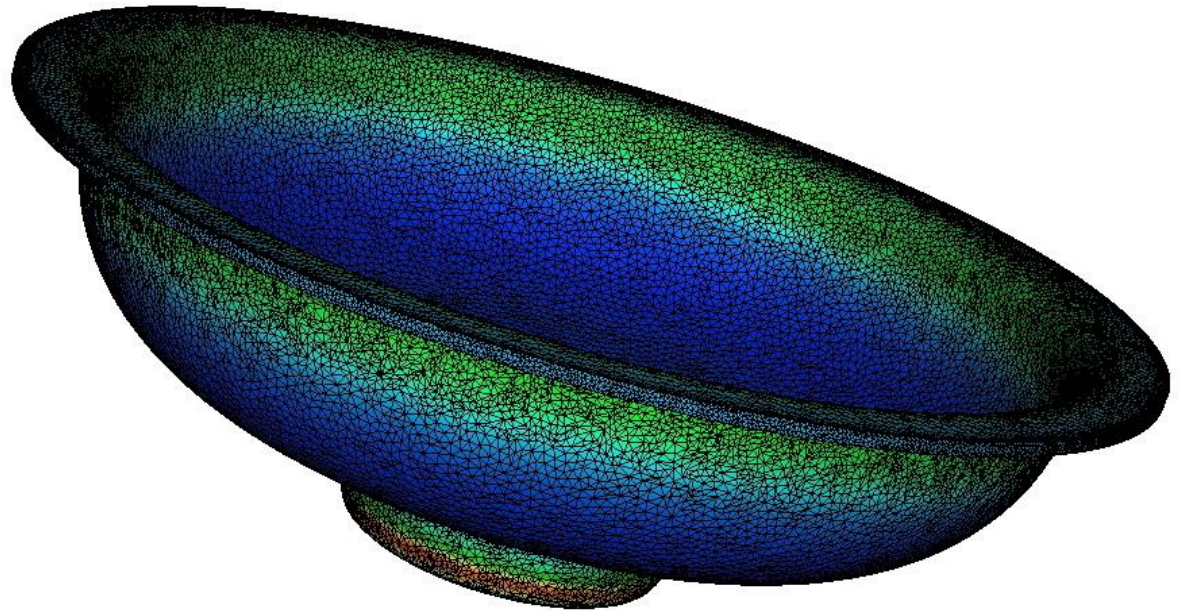
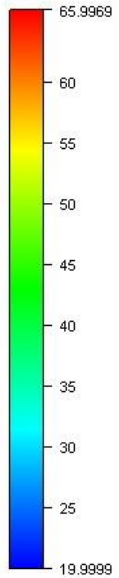


CAE(FEM)

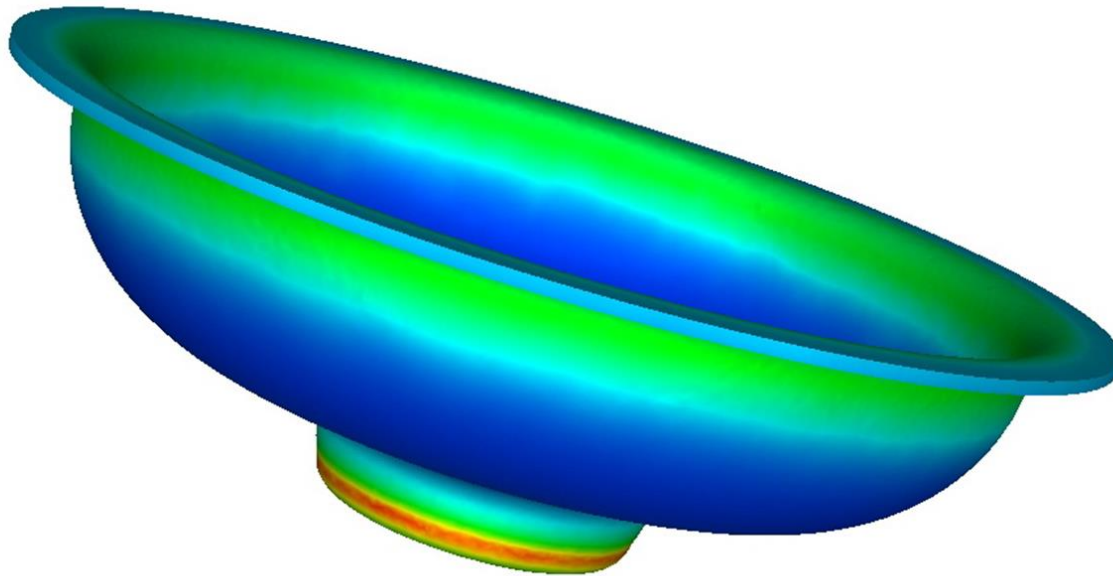
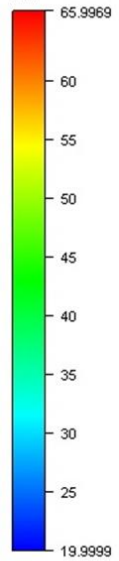


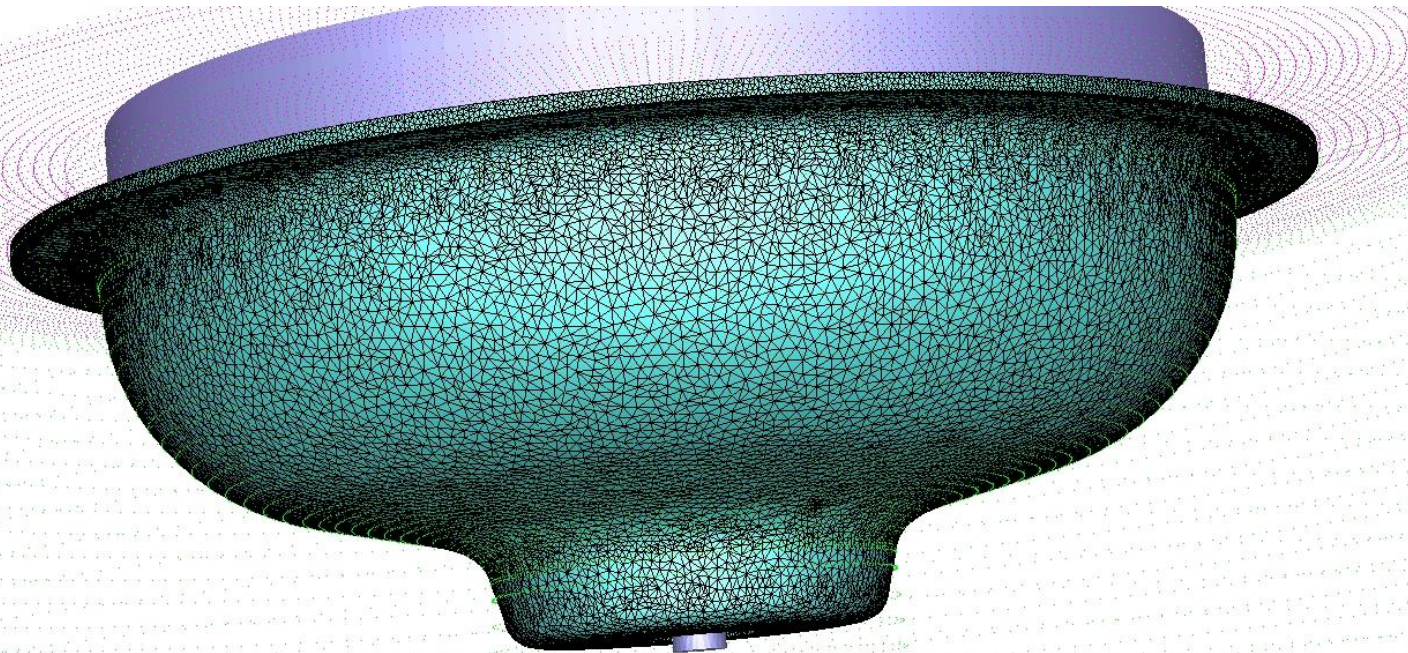
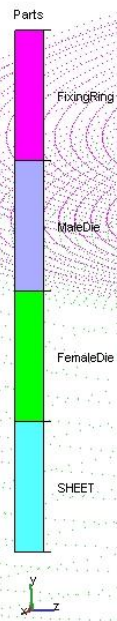
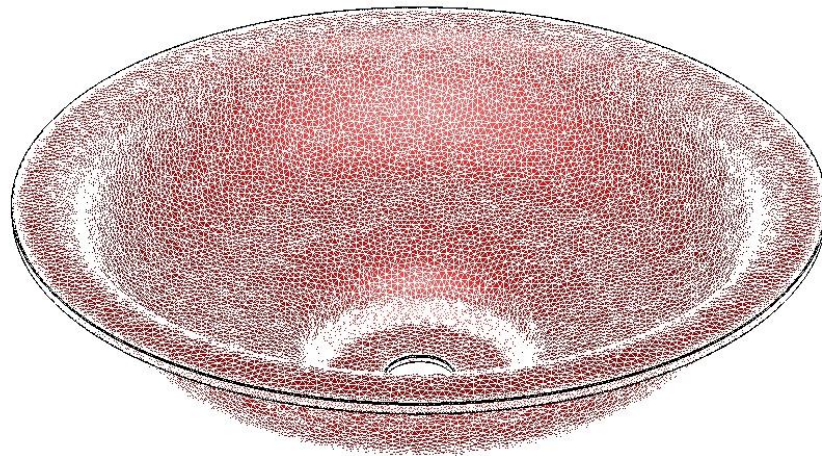
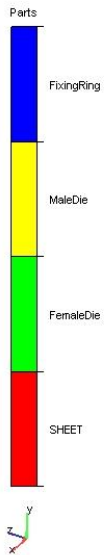
TEMPERATURE DISTRIBUTION

TEMPERATURE [node]
Unit: Celsius
Fmin



TEMPERATURE [node]
Unit: Celsius
Fmin





THANK YOU FOR ATTENTION



***THANKS TO
KLAUS FLOETTMANN & WALDEMAR SINGER
DESY GERMANY***