

Physical-Technical Institute, National Academy of Sciences of Belarus

Founded in 1931

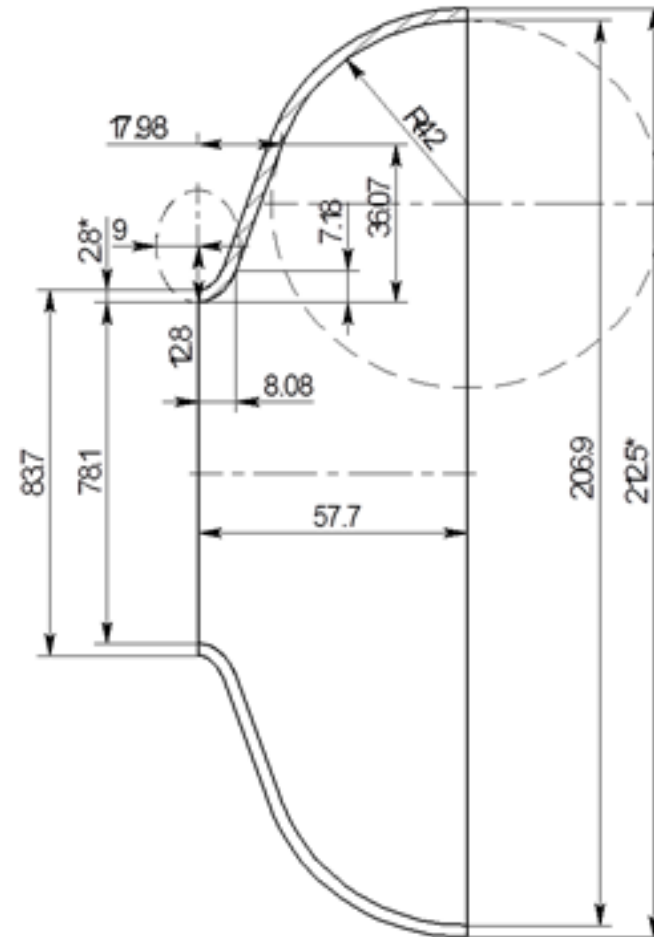
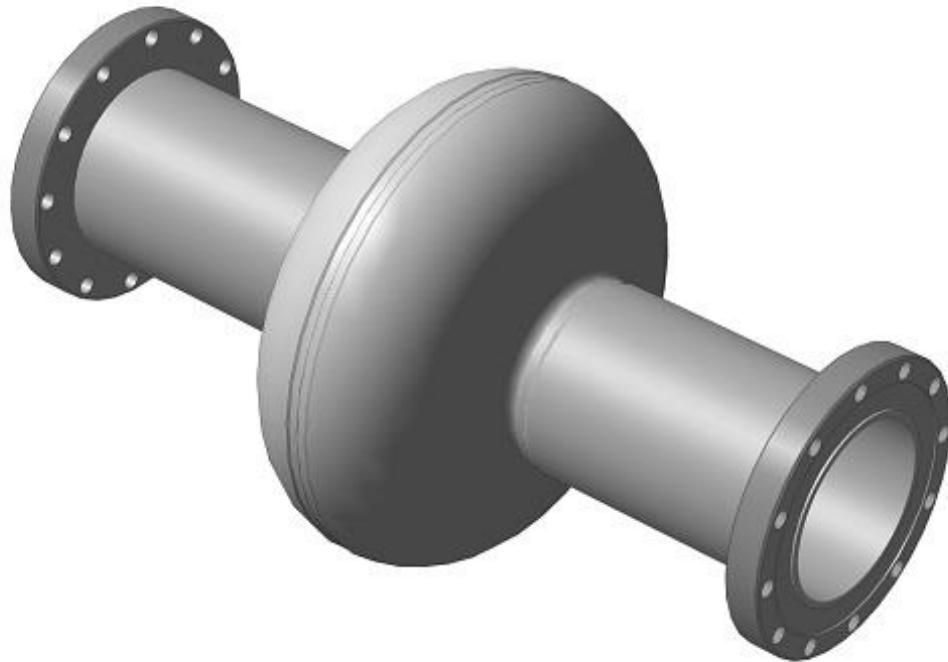


340 employees, 5 Departments



Task of the Physical-Technical Institute in the IFAST WP9

Providing four copper electron beam welded elliptical 1.3 GHz cavities



Manufacturing of Al, Cu and Nb 1.3 GHz cavities. Experience

ULTRA-PURE NIOBIUM
SHEETS
290X290X2.8 MM

Mechanical
properties

Ultimate tensile
strength

Yield stress

Elongation

Microhardness

Average grain
diameter

RESIDUAL
RESISTIVITY
RATIO (RRR)

Input check

Half-cell stamping

Turning machining

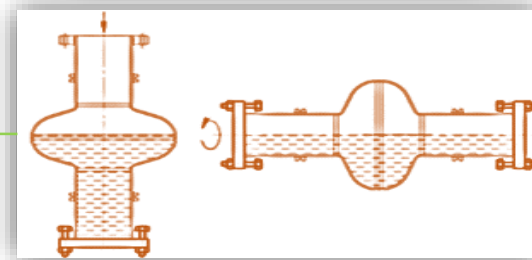
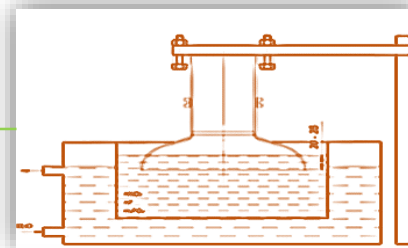
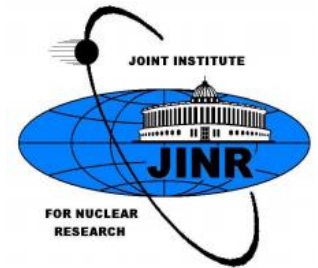
Chemical etching (BCP)

ELECTRON-BEAM WELDING

Chemical polishing

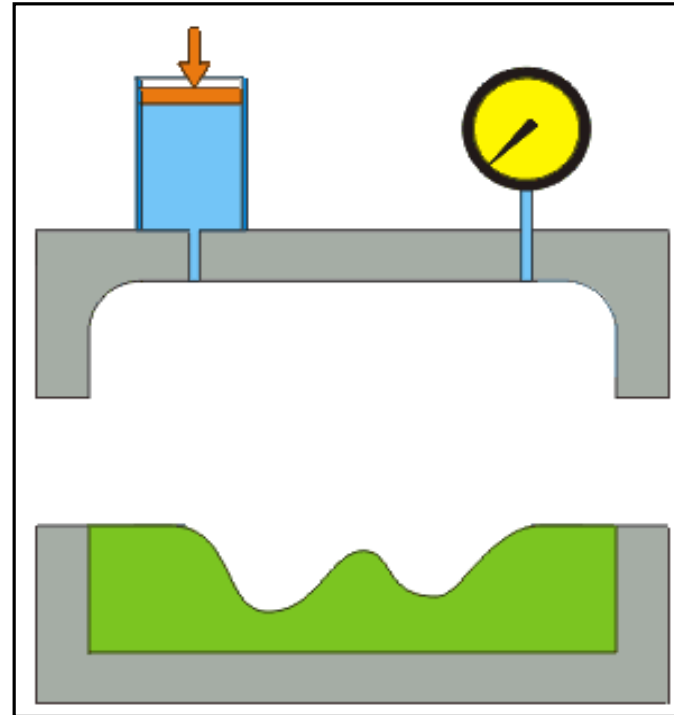
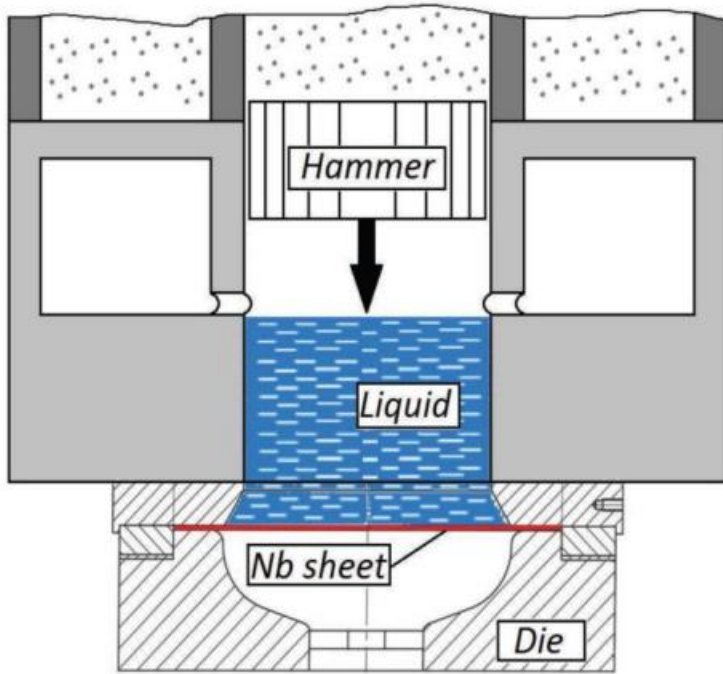
Quality control

«WARM» AND CRYOGENIC
RF TESTS



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Deep-drawing of half-cells (pulse hydroforming)



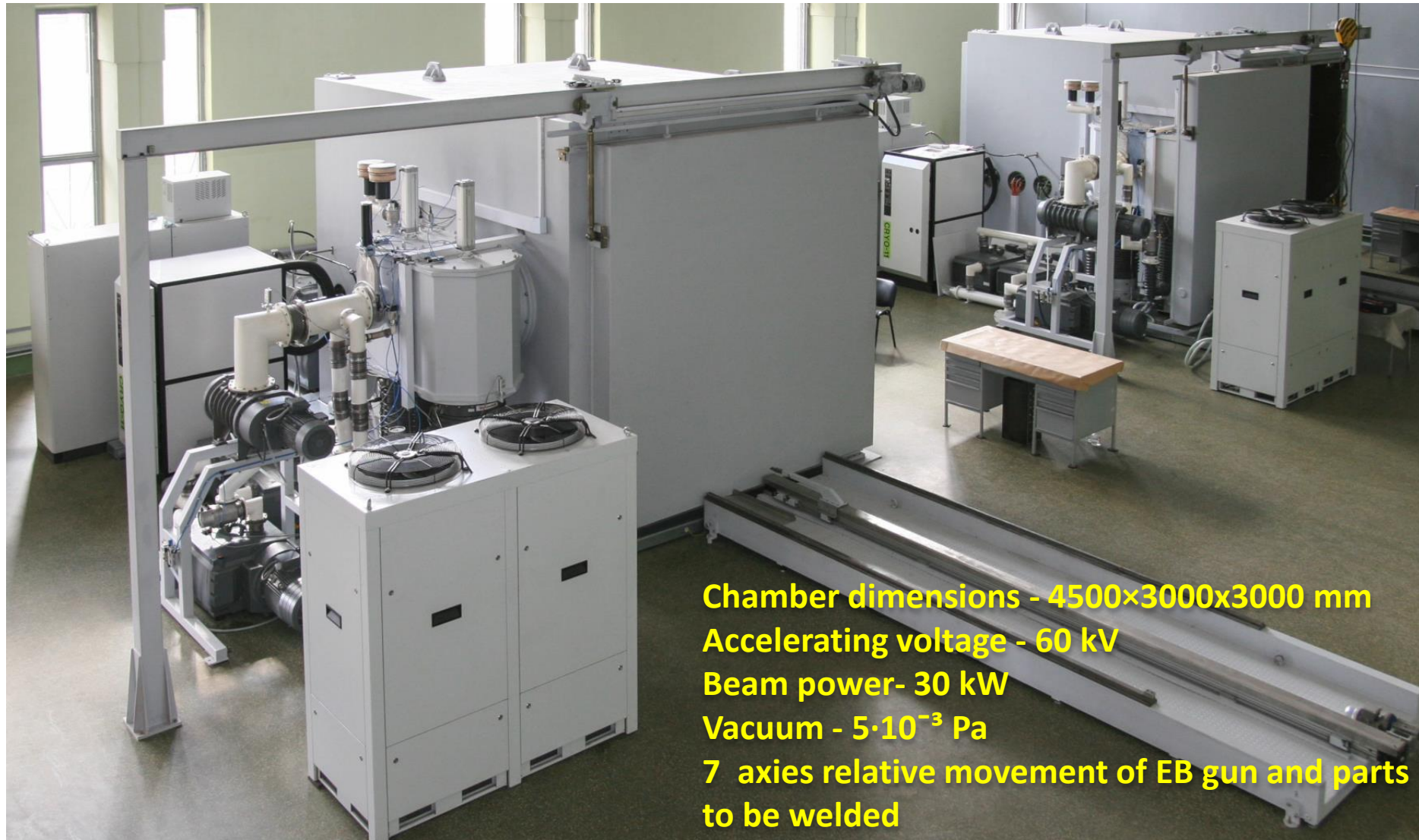
Scheme of pulse hydraulic deep drawing

Equipment for the pulse hydroforming

Experience: parts to be joined

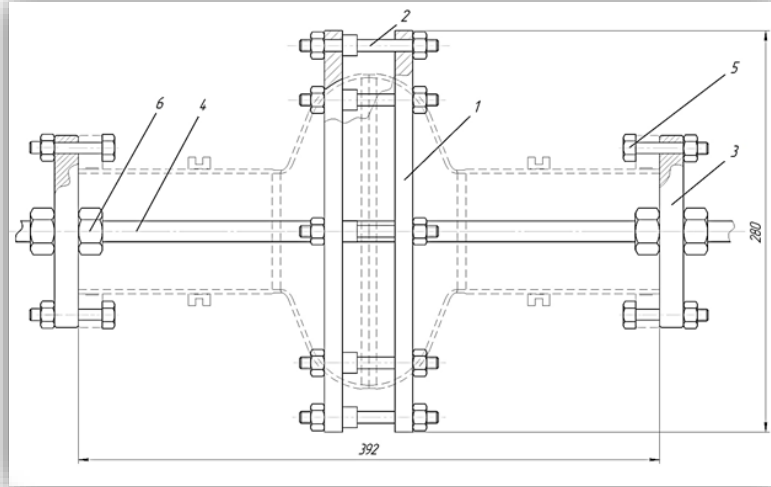


Characteristics of the EBW machines

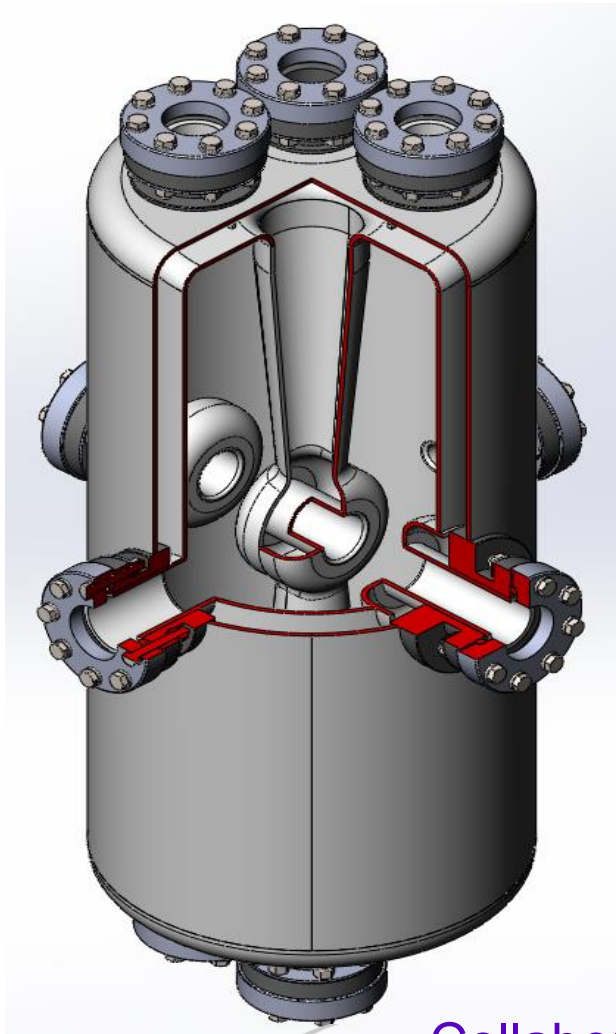


Chamber dimensions - 4500×3000×3000 mm
Accelerating voltage - 60 kV
Beam power- 30 kW
Vacuum - $5 \cdot 10^{-3}$ Pa
7 axes relative movement of EB gun and parts
to be welded

Electron beam welding



SC HWR cavities for the Nuclotron NICA project



Collaboration of PTI NAS Belarus, JINR (Dubna), MEPhI (Moscow), INP BSU (Minsk)

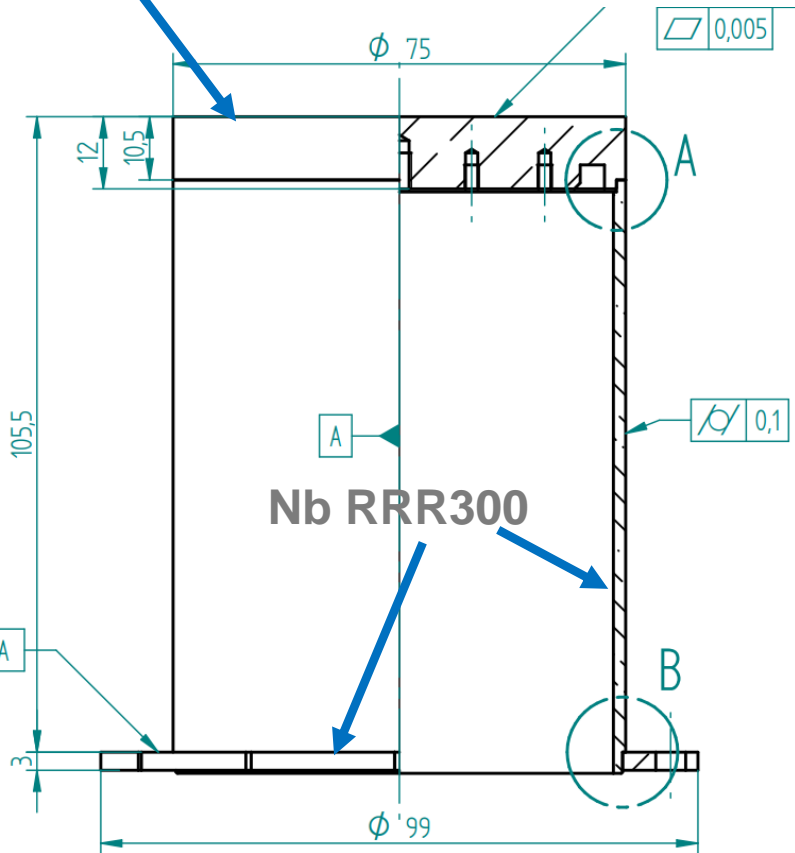


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Joint investigations with the Helmholtz-Zentrum Berlin, 2021.

Joining of Cu and Nb for QPR using EB heating

OFHT Cu

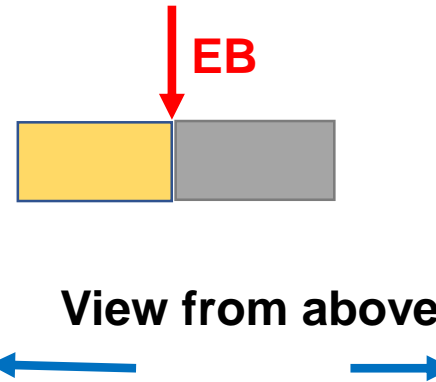


$T_{\text{melt}}, \text{ }^\circ\text{C}:$

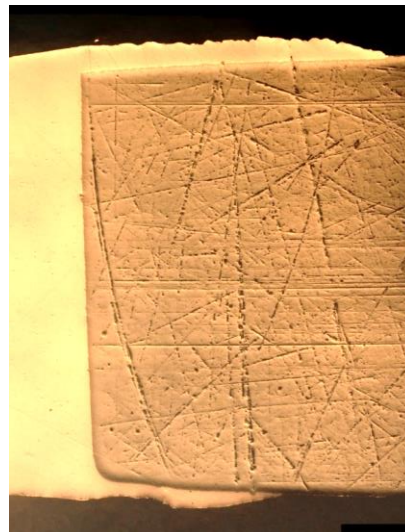
Cu - 1085 Nb - 2477



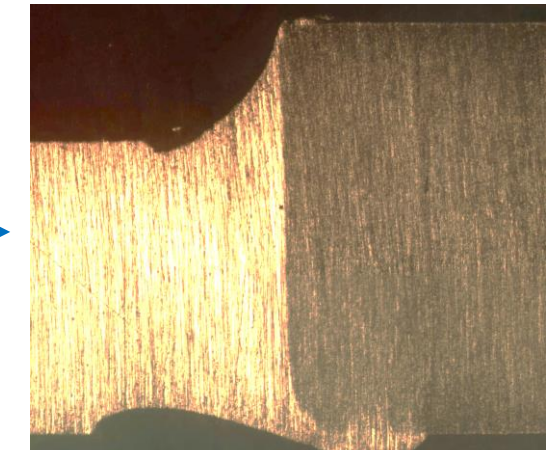
Cu, Nb RRR300,
3.0 mm 2.8 mm



OFHT Cu, Nb RRR300,
2.0 mm 2.8 mm



Joint cross section



Properties	Cu	Nb
$T_{\text{melt}}, \text{ }^{\circ}\text{C}$	1085	2477
Heat conductivity, $\text{W}/(\text{m}\cdot\text{K})$	394	54

Thank you!