CURRENT STATUS OF DUBNA-MINSK ACTIVITY ON THE CREATION OF SUPERCONDUCTING NIOBIUM CAVITIES

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In 2011 Dubna-Minsk collaboration started an activity on the development and manufacture the series of superconducting niobium cavities in the enterprises in Belarus.

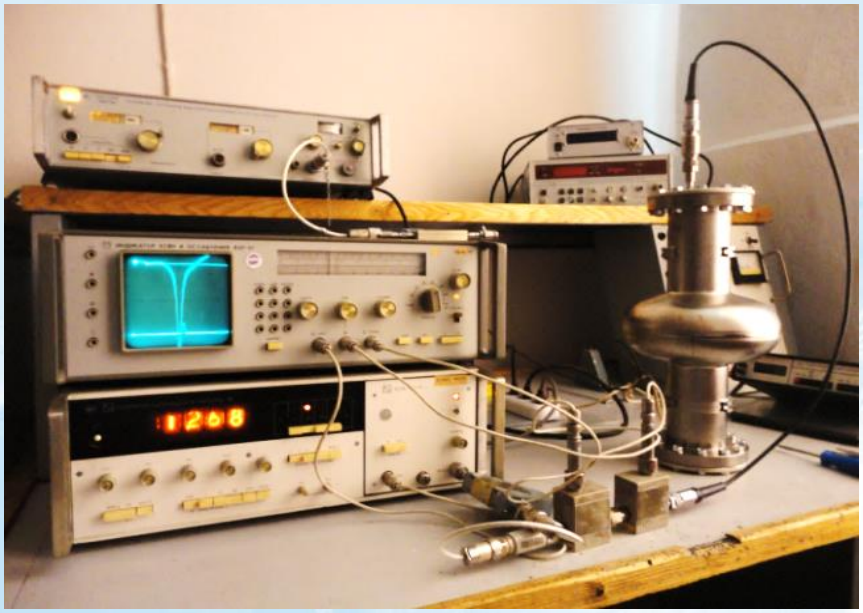
Belarus State University of Informatics and Radioelectronics (BSUIR) – computer simulations

State Scientific and Production Amalgamation Scientific-Practical Materials Research Centre of NAS of Belarus (SSPA SPMRC NASB) – cryogenic support

Research Institute for Nuclear Problems of Belarusian State University (INP BSU) – RF measurements

Physical-Technical Institute of National Academy of Sciences of Belarus (PhTI NASB) – cavity manufacturing (deep drawing, electron-beam welding, chemical treatment)

Warm RF Measurements



Resonant frequency

f_0 = 1.273 GHz

Quality factor

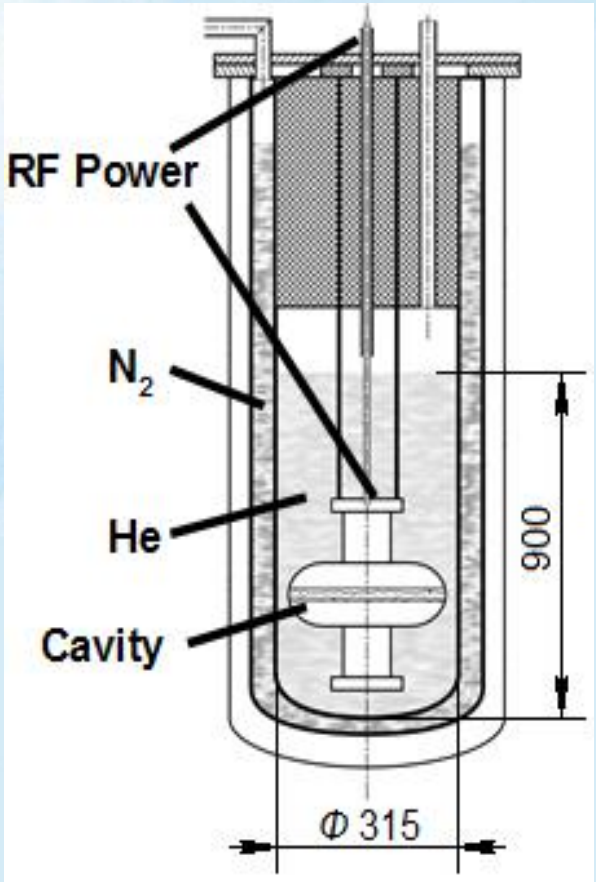
Q = 28193

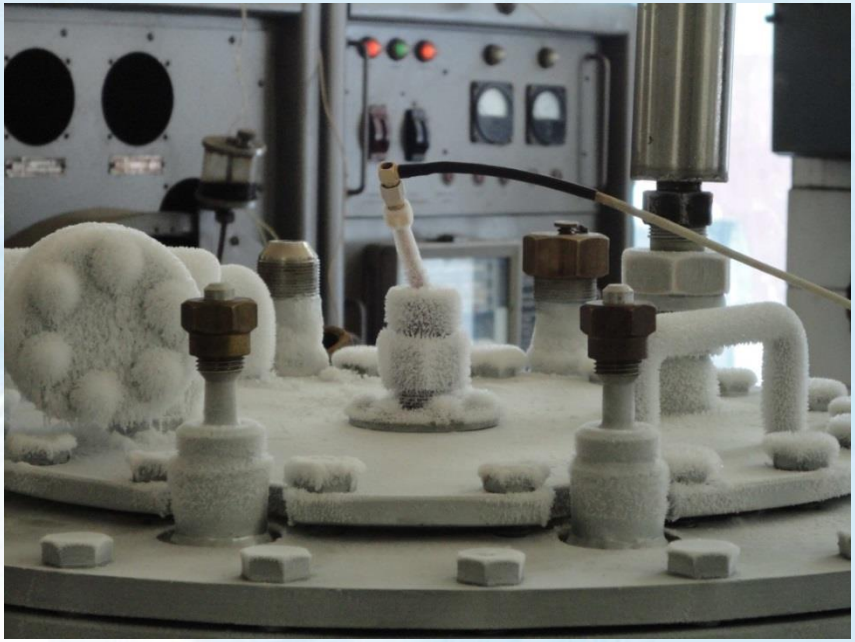
SWR = 1.01

Cryogenic RF Measurements

Cryogenic setup is manufactured and successfully tested at operation temperature of 4.2 K.

Parameter	Value
Operating temperature	4.2 K
Helium vessel volume	70 l
Nitrogen vessel volume	25 l
Helium evaporating rate	0.65 l/h
Nitrogen evaporating rate	1.25 l/h





Resonant frequency

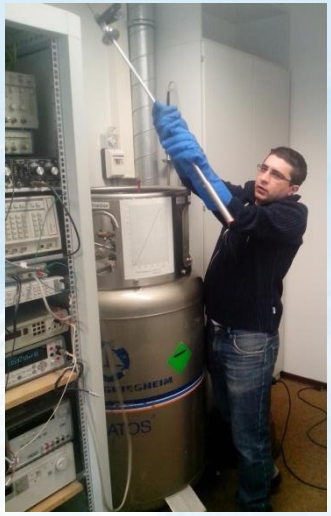
f_0 = 1.285 GHz

Quality factor

$Q > 10^8$

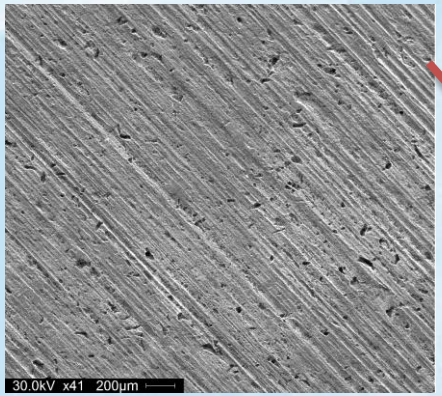
Choose of Nb-material

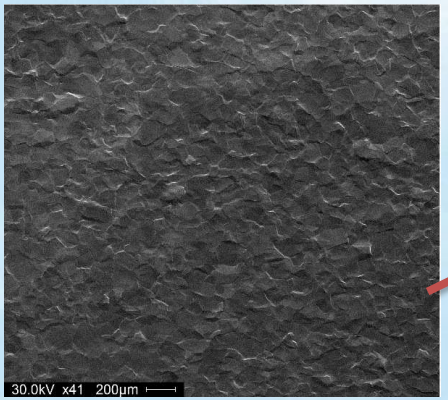
Nb-manufacturer	*RRR*
Russia	40
Kazakhstan	60
China	300-350

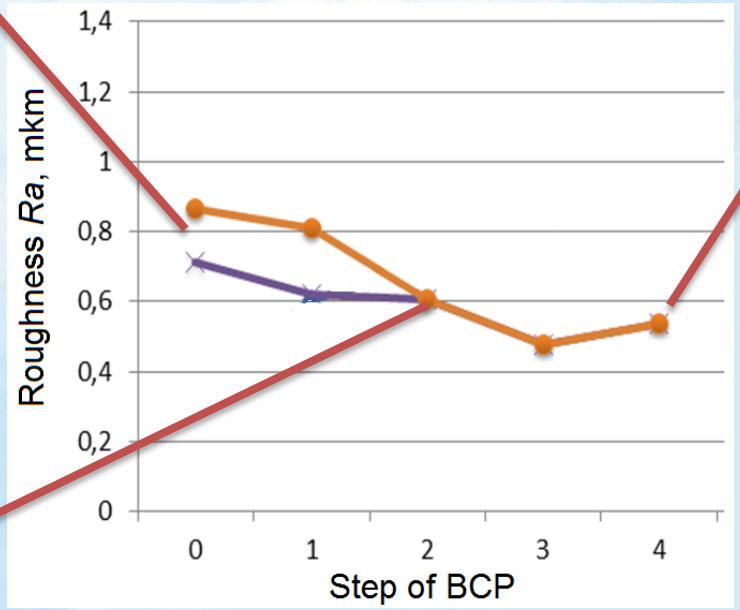


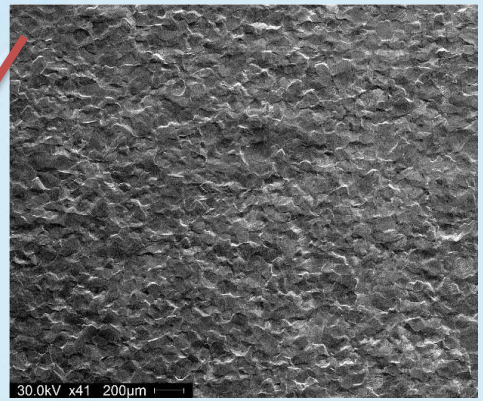
DESY

MINSK



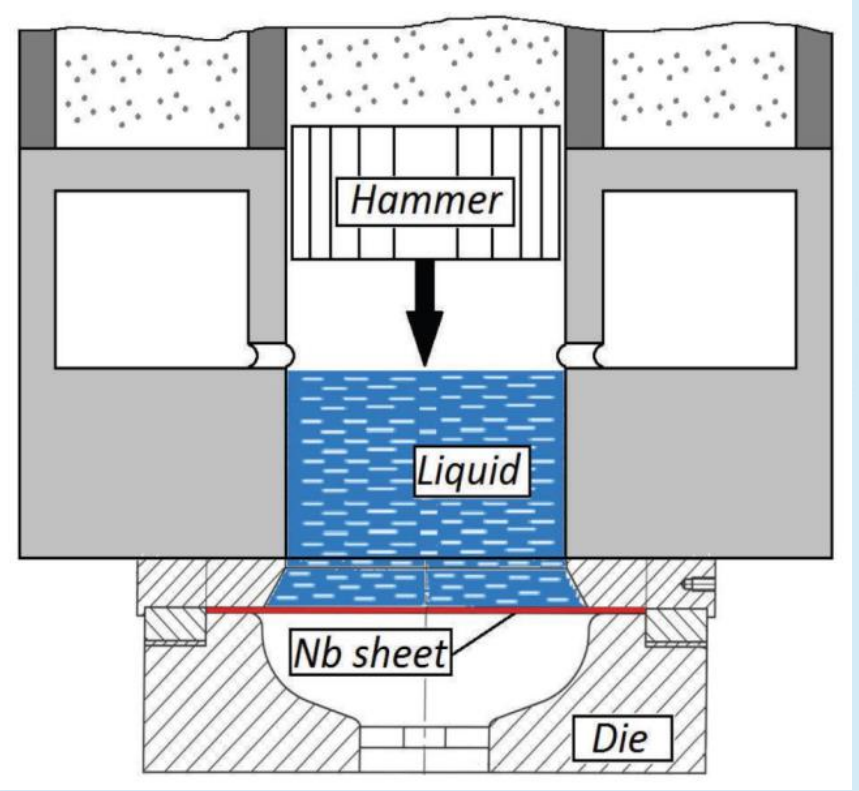






Hydraulic Deep-Drawing

Deep Drawing of half-cells is made by the hydraulic punch-free stamping method. This method allowed to avoid the possible damaging of the cavity shape. PhTI NAS of Belarus have equipment for this technology and reach experience in this deal.



Electron-Beam Welding

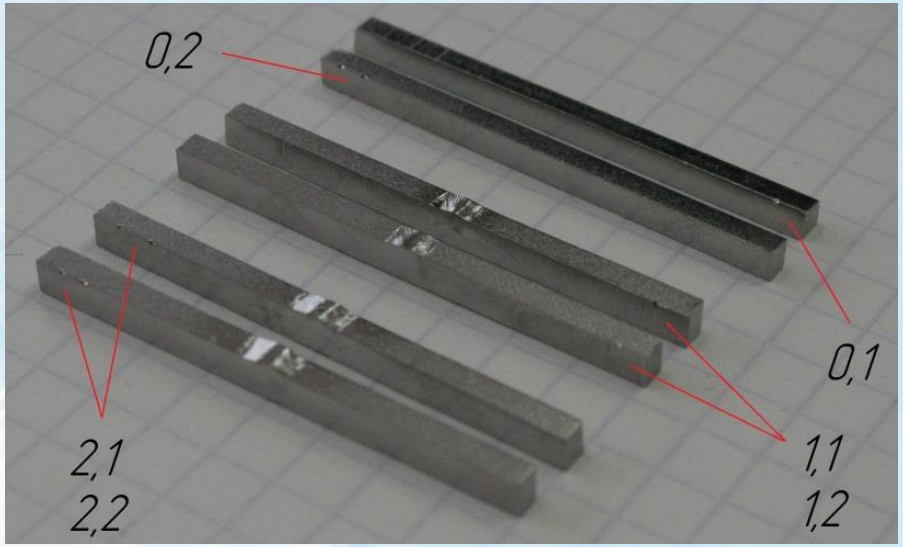
Electron-Beam Welding of half-cells will be made in PhTI NAS RB – is the leader in EBW technology in Republic of Belarus. They have a EBW-machine, developed infrastructure and reach experience in EBW technics.

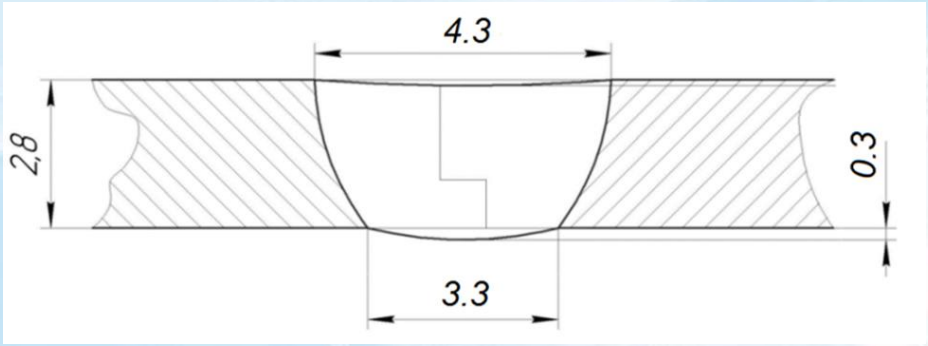
Parameters of EBW setup in PhTI:

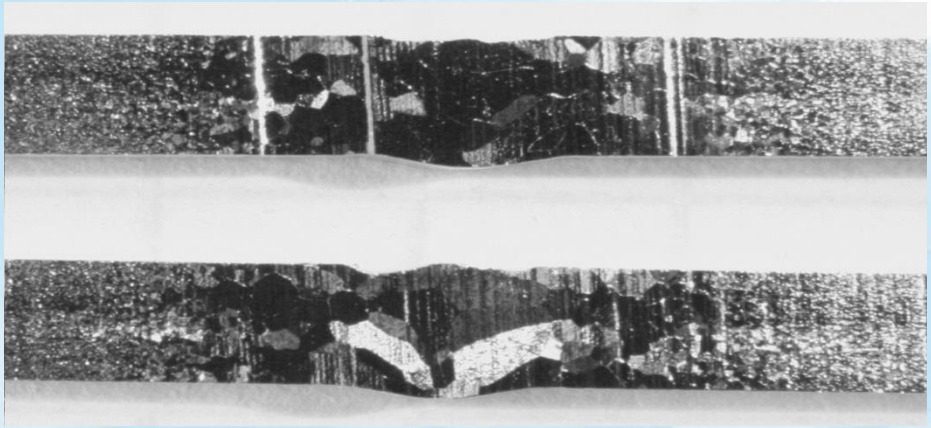
- vacuum chamber - ø1350×2500 mm;
- electron gun power - 15 kW;
- electron beam current - 250 mA;
- electrons energy - 60 keV.
- vacuum $5 \cdot 10^{-3}$ Pa (now ~10^{-4} Pa)

EBW parameters:

- Beam current – 53 mA
- Beam energy – 60 keV
- Welding velocity – 10 mm/s

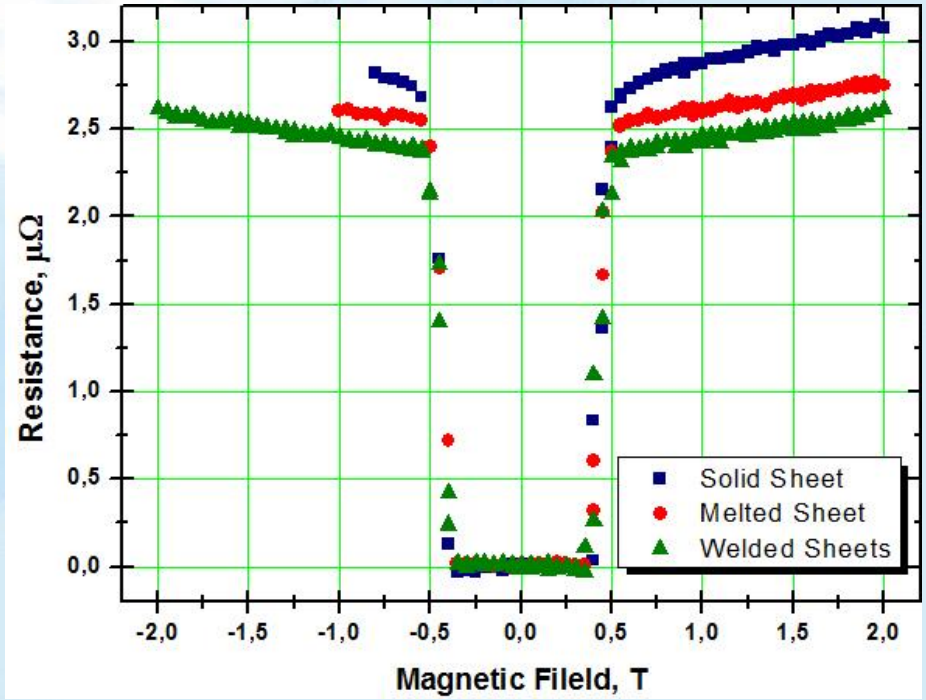




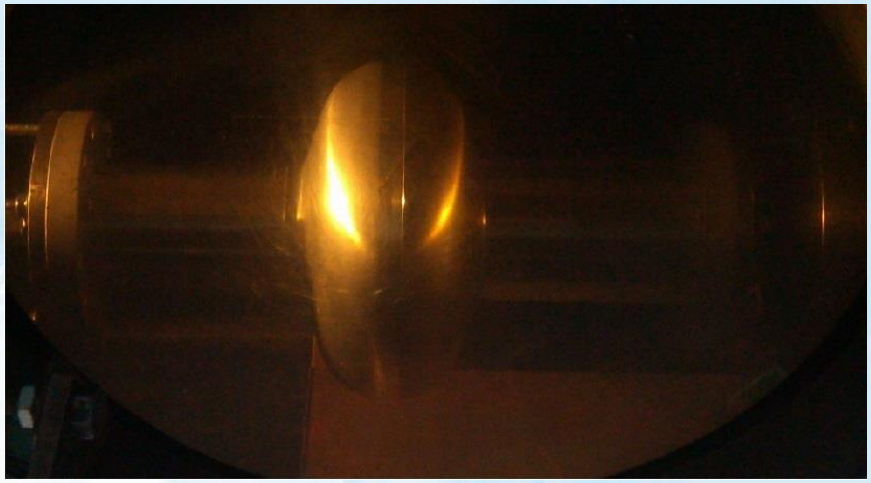


$R_1 = 0.91R_0$ (9% decrease)

$R_2 = 0.86R_0$ (14% decrease)



First our Complete Cavity made of Al



First production series of 1.3 GHz superconducting niobium single-cell cavities will be manufactured in Minsk by 2015. After the tests in Minsk and Dubna these cavities will be presented to international ILC community for the expertise.

ACKNOWLEDGMENT

We would like to thank our colleagues from FNAL who have kindly supply our research with etalon single-cell niobium cavity and our colleagues from DESY as well who provide us with valuable information on the cavity production technology. We would like to thank personally Xenia and Waldemar Singer from DESY.

Thank You for Attention !