VERTICAL ELECTROPOLISHING OF 704MHZ RESONATORS USING NINJA CATHODE: GRADIENTS OVER 40MV/M ACHIEVED ON ESS SINGLE-CELL CAVITY

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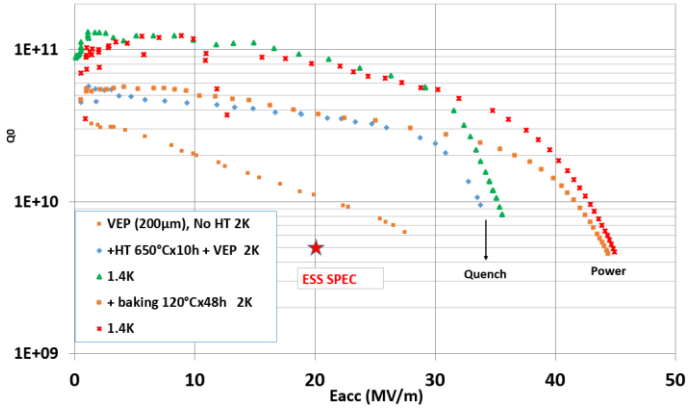

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704MHZ ACTIVITIES AT CEA

ESS Cryomodule assembly at CEA SACLAY On-going

Cryomodule Assembly

Treatment of β=1 SPL Cavity (2014) (EuCard): Electropolishing (EP)

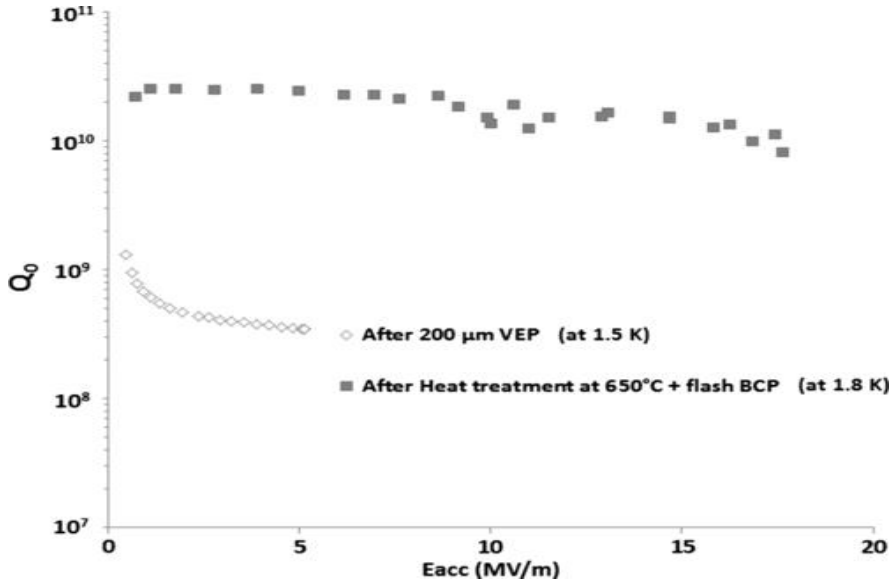
Treatment of ESS proto M-beta (2016): Standard 'BCP' Chemical polishing

Cavity Preparation

Goal of the presented study:

- Improving the performance of 704MHz resonators for future applications
- Demonstrating superiority of Electropolishing Vs Standard Chemical treatment
- Investigate effect of heat treatments

PREVIOUS EXPERIENCE WITH SPL CAVITY VERTICAL EP WITH ROD CATHODE (2014)



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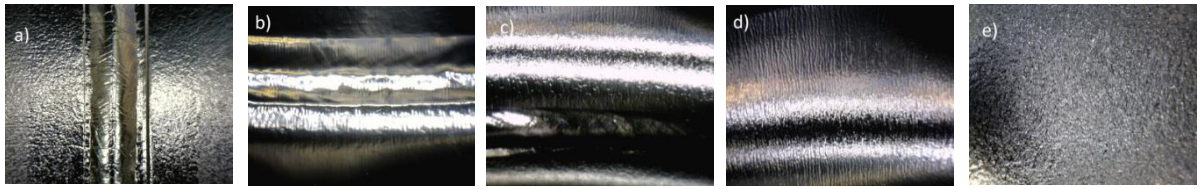


20mm

Typical surface morphologies after >100µm VEP at different locations.
- The weldings at a) equators, and b) irises are smooth.
- Bubbles stripes are observed at the proximity of irises c) and d).
- In the areas between equators and irises e) the surface is rougher.

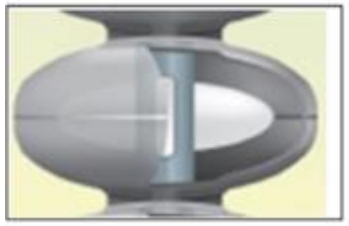
IMPROVEMENT OF HYDROGEN EVACUATION MANDATORY

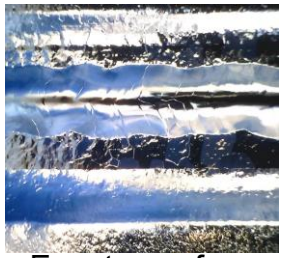
NEW APPROACH: ROTATING CATHODE COLLABORATION CEA/KEK/MARUI

1-Cell cavity on VEP set-up

ESS β=0.86 geometry, 1-cell

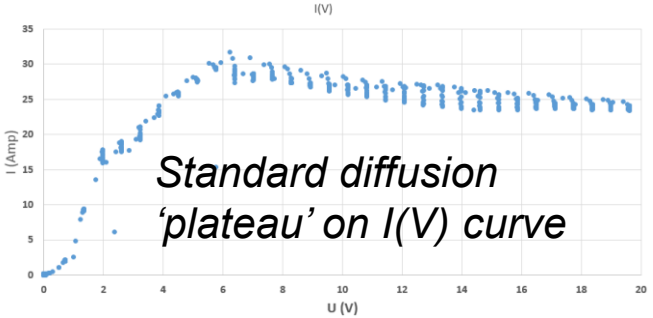
- Supplier: Zanon RI
- Nb: Tokyo Denkai Fine grain RRR>300
- VEP with rotating Ninja cathode
- Surface quality > BCP
- Symetric removal





Equator surface
(80µm average removal)

ROTATING TECHNOLOGY
'Ninja' Cathode



Standard diffusion 'plateau' on I(V) curve

Working Parameters:

- U: 20V
- Acid flowrate: >15L/min
- T<15°C
- External Cooling of cavity wall
- 20rpm rotation

Cavity has been tested at 2K before any heat treatment (200µm total removal)

RESULTS AFTER HEAT TREATMENTS

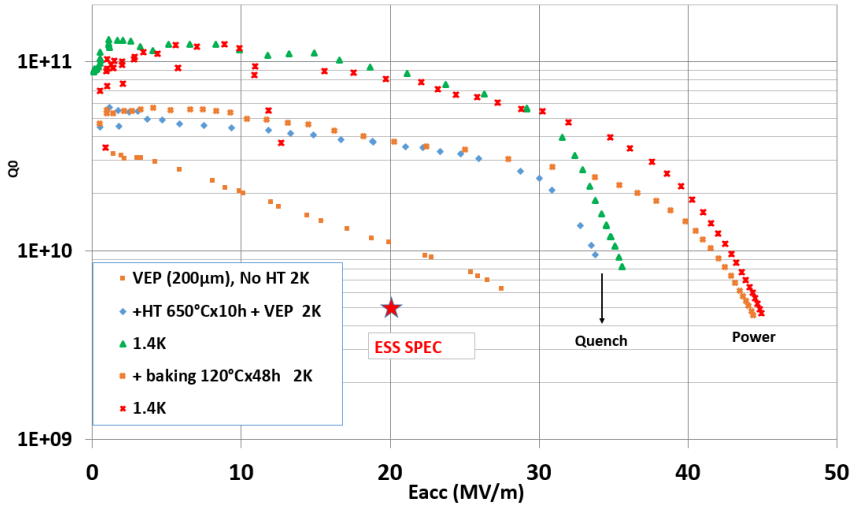
Excellent RF Performance achieved after Heat Treatments:

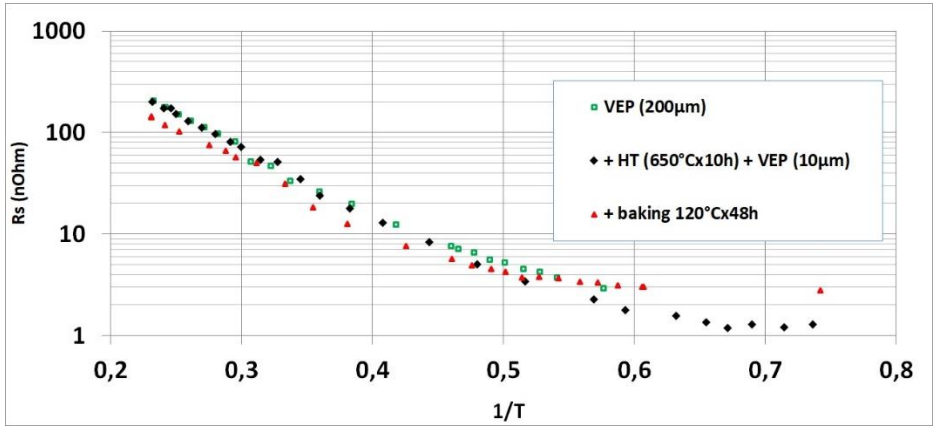
- Quench @ 33MV/m (2K) after Heat treatment at 650°Cx10h + Excellent Rs.

= **Superiority Vs BCP**

Eacc = 45MV/m after mild baking 120°Cx48h

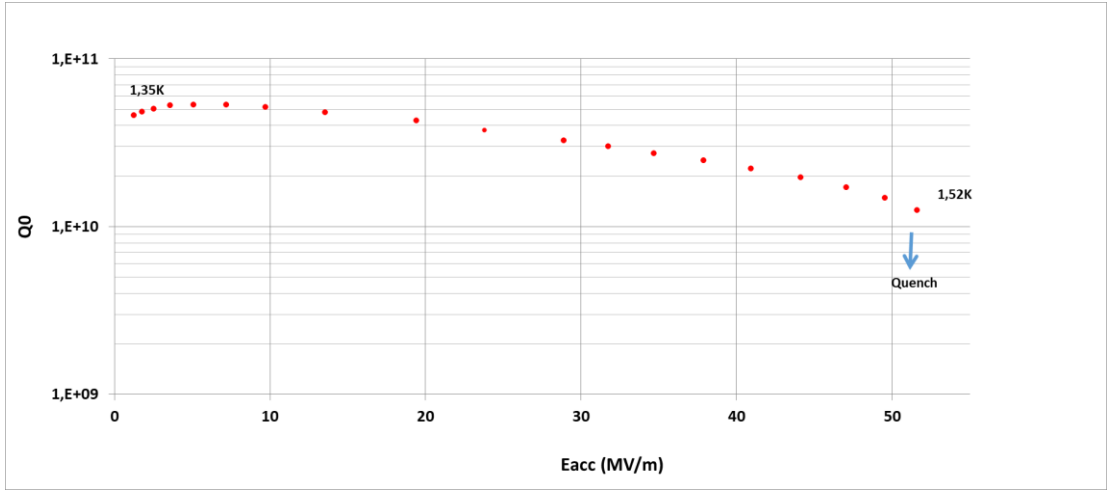
Heat Treatment @ 650°C done at IJCLab Irène Joliot-Curie



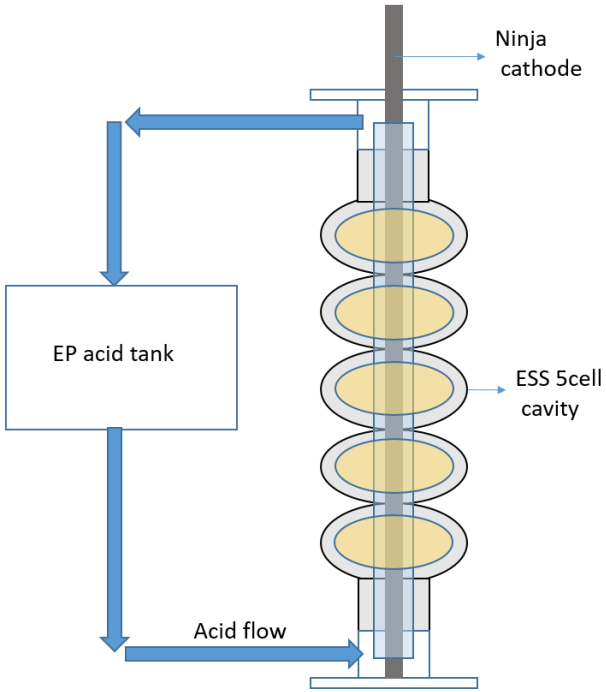


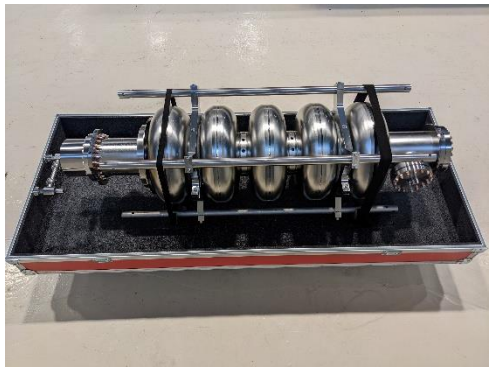
ONGOING VEP ACTIVITIES

- Remove the Q-slope observed on 1-Cell
- Scale the process to 5-Cell β=0.86 ESS cavity. Cavity and cathode available
- Test 2-step baking on 1-Cell and 5-Cell cavities



Excellent RF Peformance after VEP + '2-step baking' (FERMILAB recipe) at 75°C-120°C on Tesla 1300MHz single-cell cavity





HB03 ESS-prototype cavity to be treated by VEP with dedicated cathode.

THANKS