Low Loss/ICHIRO shape cavity R&D at KEK

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KEK

ECFA-CLIC-ILC joint meeting
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KEK Low Loss/ICHIRO cavity strategies

1) Principle proof of High gradient

Fine Grain + ICHIRO + EP, based on CBP

S0-study at Jlab on ICHIRO#7 (full cavity) are on going.

End group singles R&D,

2) Cost reduction + best performance

Large Grain + ICHIRO + BCP, based on CBP

Multi-wire slicing techniques is in hand.

Single cell, 9-cell R&D are on going.

3) Further goal: High gradient, High yield, Low cost

Large Grain + ICHIRO + BCP, inner EBW, w/ or w/o CBP

Single crystal ingot R&D is started.

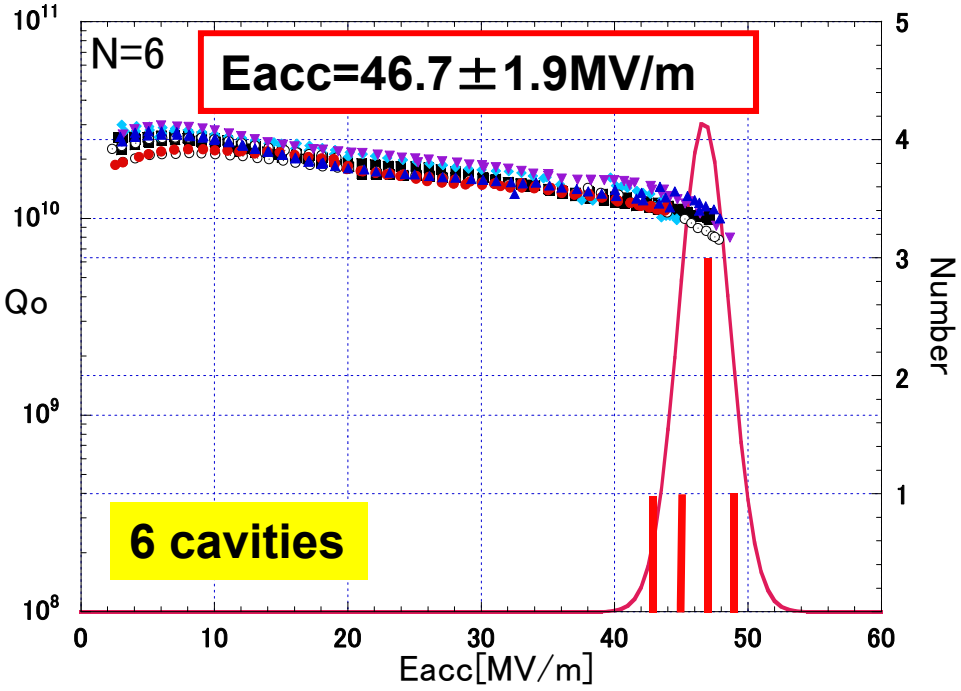
New LG full 9-cell will be delivered at end of November.

Post EP cleaning R&D on going.

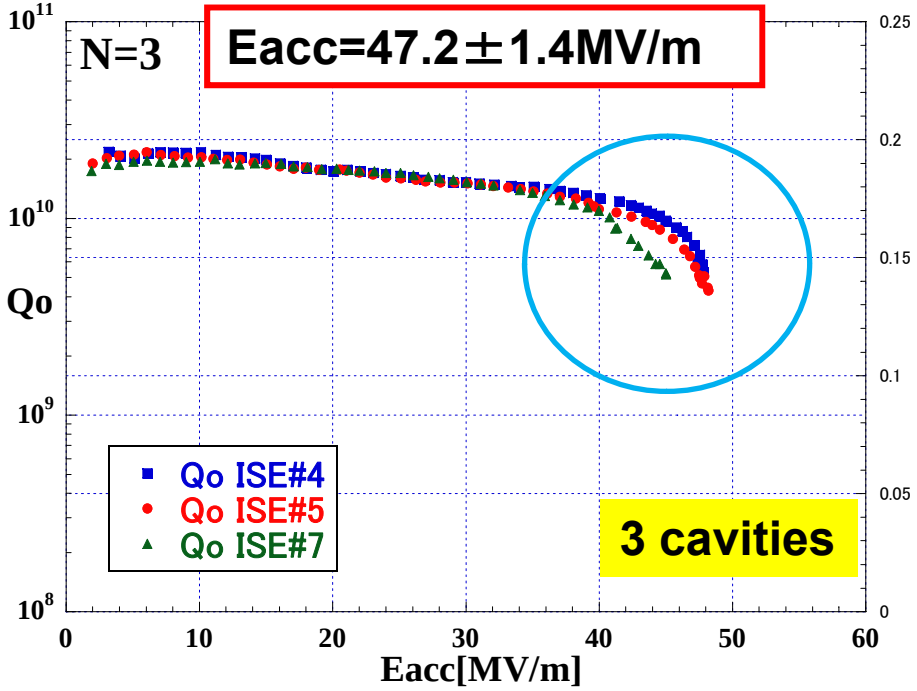
FG + ICHIRO+ EP

Single cell cavities, FG+EP

Center cell single



Full end group single



Current best recipe for ICHIRO

CBP+CP+AN+EP(80μm)+EP(20μm)+flash EP(3μm)
+Ethanol rinsing+Wiping+HPR+Bake

Q-slope issue remains.
R&D for post EP cleaning, DDC.

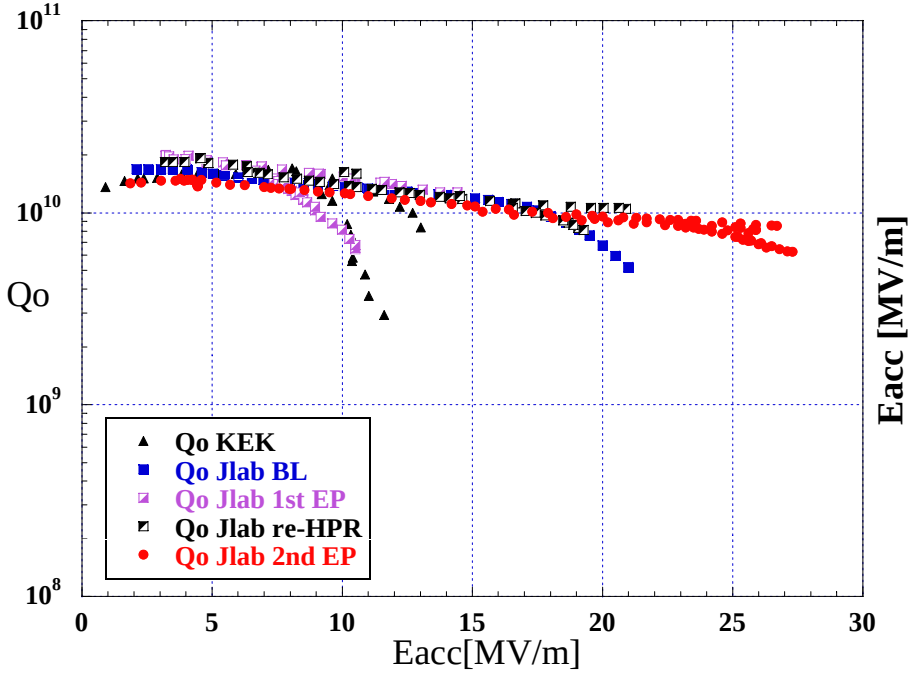
9-cell cavities, FG+EP

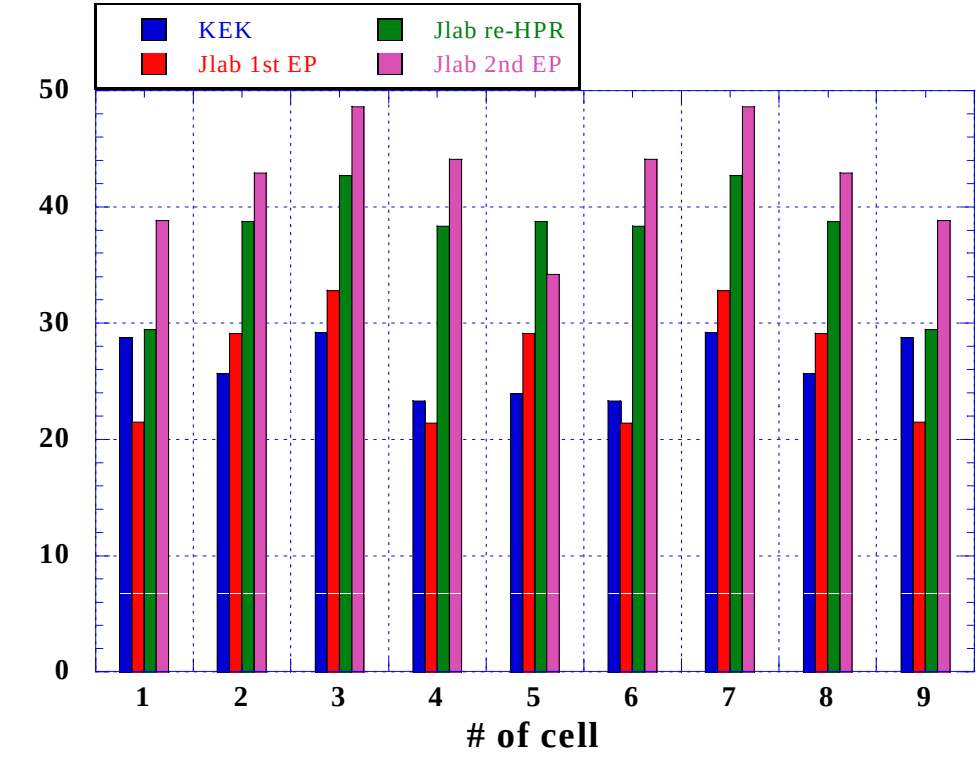
S0-study in 2010

Step-2 : full cavity

ICHIRO#7

Collaboration with Jlab/KEK in 2010, June~July, November~December.





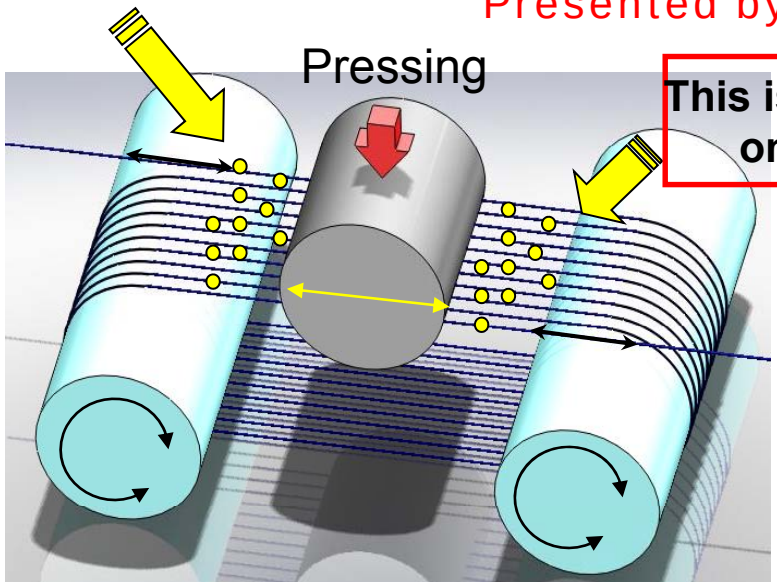
LG + ICHIRO + BCP

Multi-Wire slicing @KEK/Tokyo Denkai

Presented by K. Saito at SRF2009

Conventional Silicon wafer slicing machine

Tokyo Denkai already installed this machine.

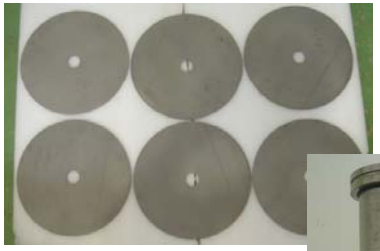


This is established technology on silicon wafer slicing.

Slicing used very thin piano wire (0.16Φ) and liquid abrasive

Experience of Multi-wire slicing

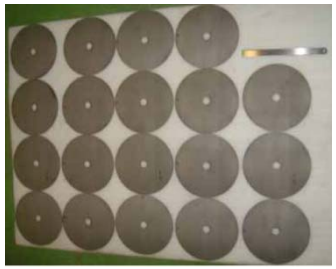
2008July 6 sheets(2.8t)
270Φ 20mmL



ISE-LG

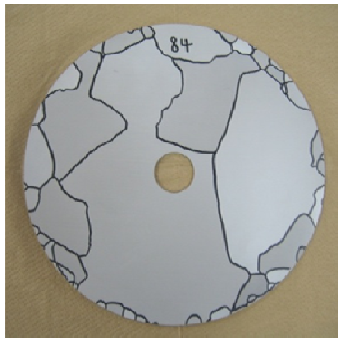
2008Sept. 58 sheets(3.2t for Jlab)
270Φ 201mmL

2008Sept. 19 sheets (2.8t)
270Φ 61mmL



LG-I9#9

2009Aug. 102 sheets(2.8t)
265Φ 307mmL

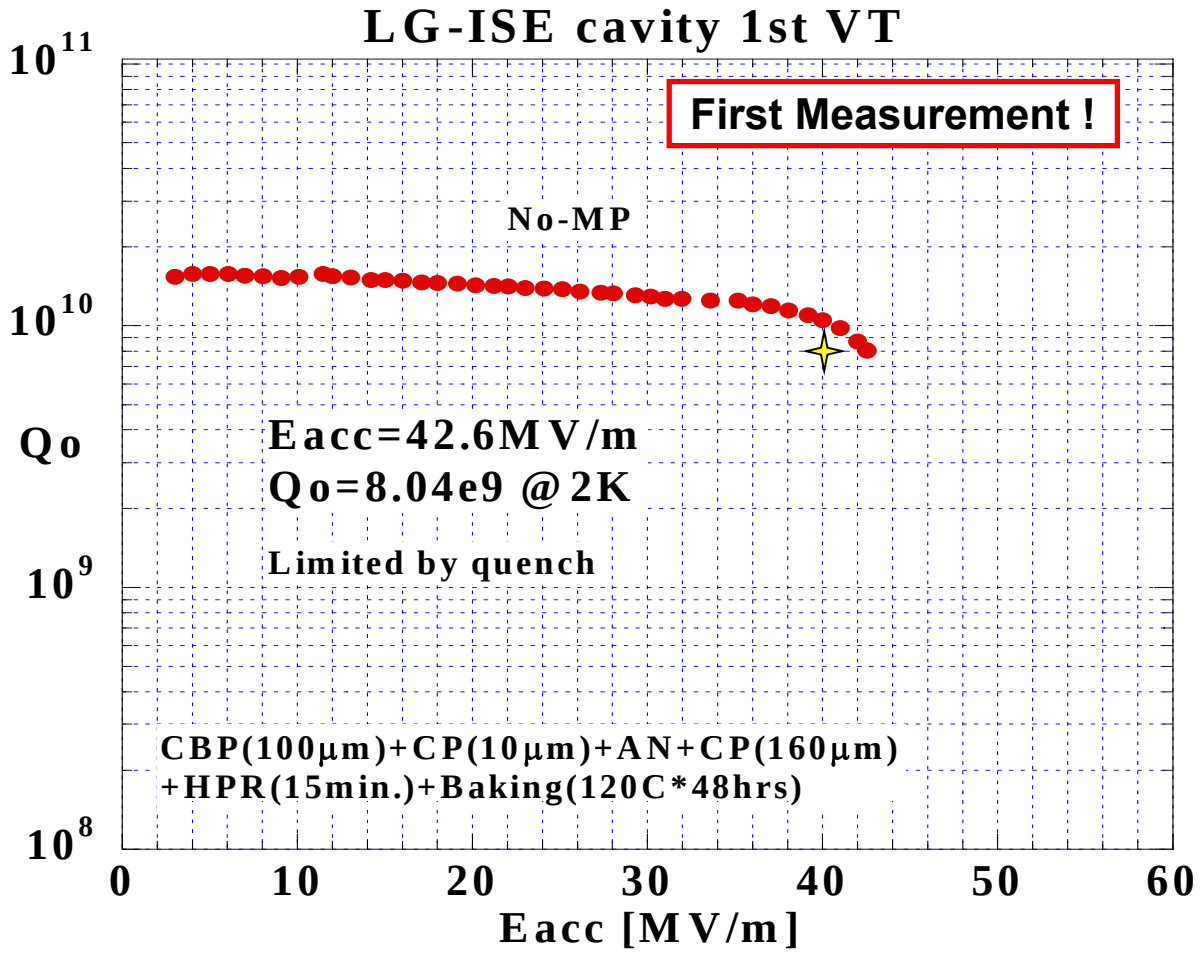


LG-I9#10, 11

Single cell, sliced LG Nb + BCP

bland new LG cavity + BCP

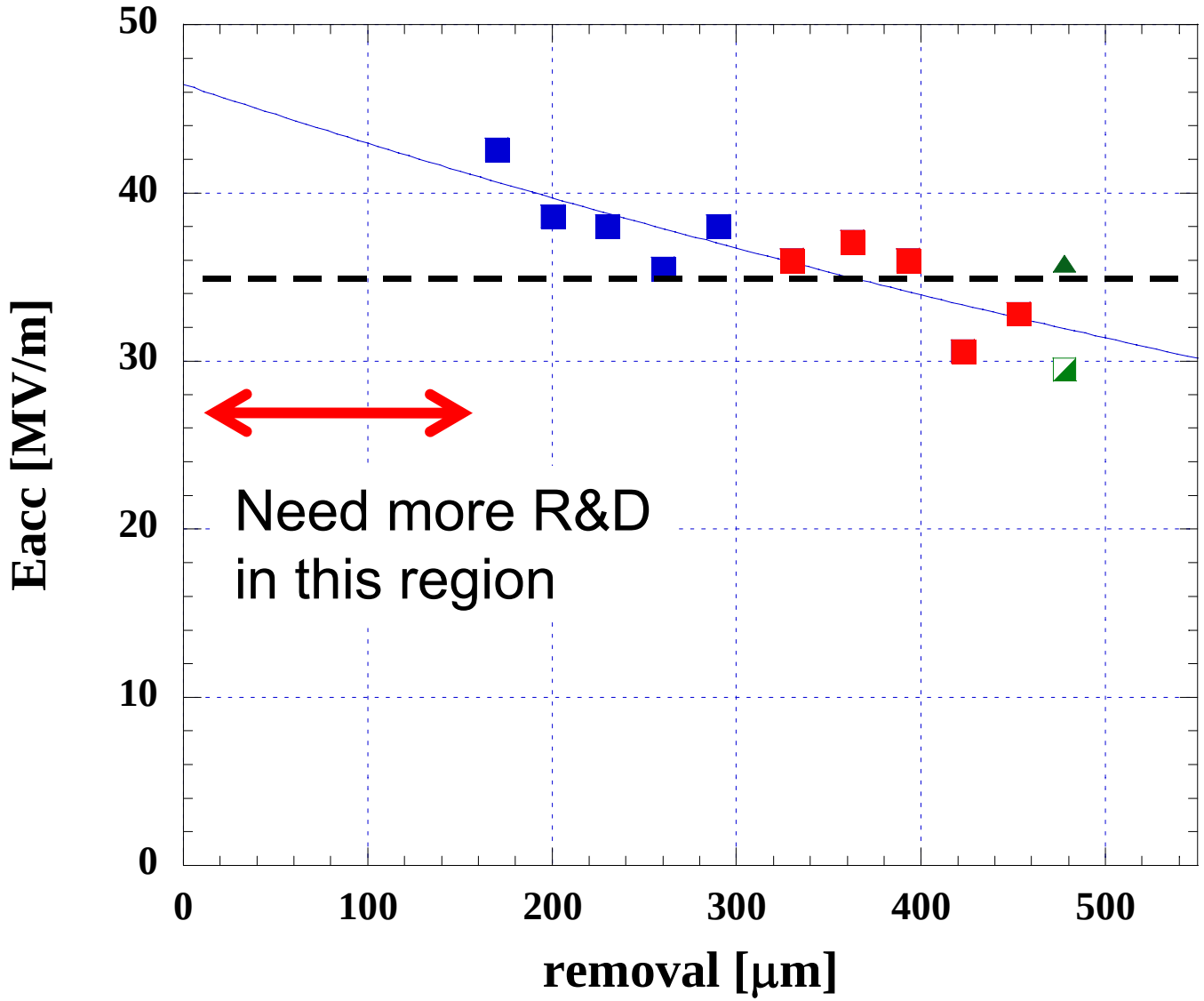
bland new
LG-ISE



Recipe

CBP(80μm)+CP(10μm)+AN(750C*3hrs)+CP(160μm)
+HPR(15min.)+Baking(120C*48hrs)

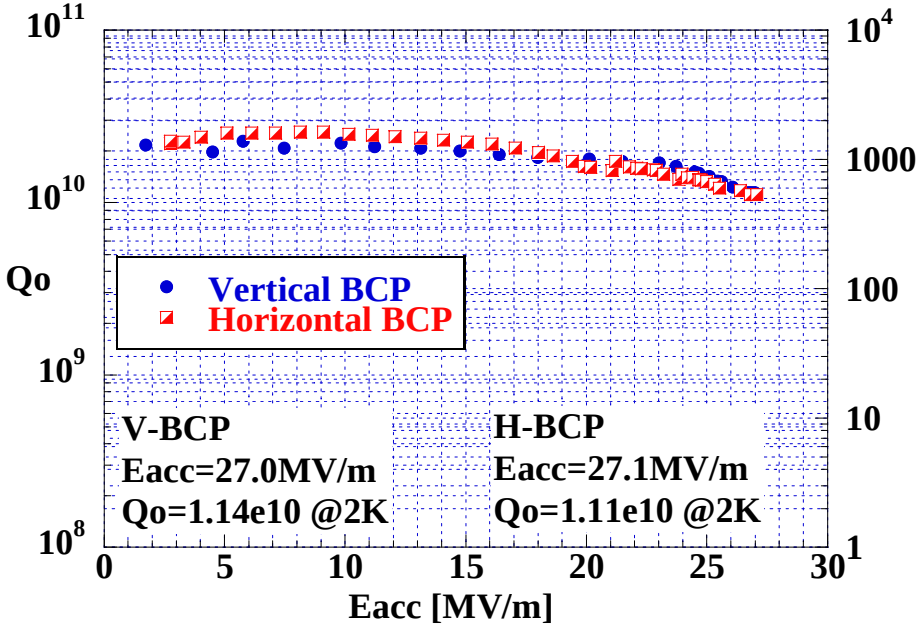
LG single + BCP, Tight loop study

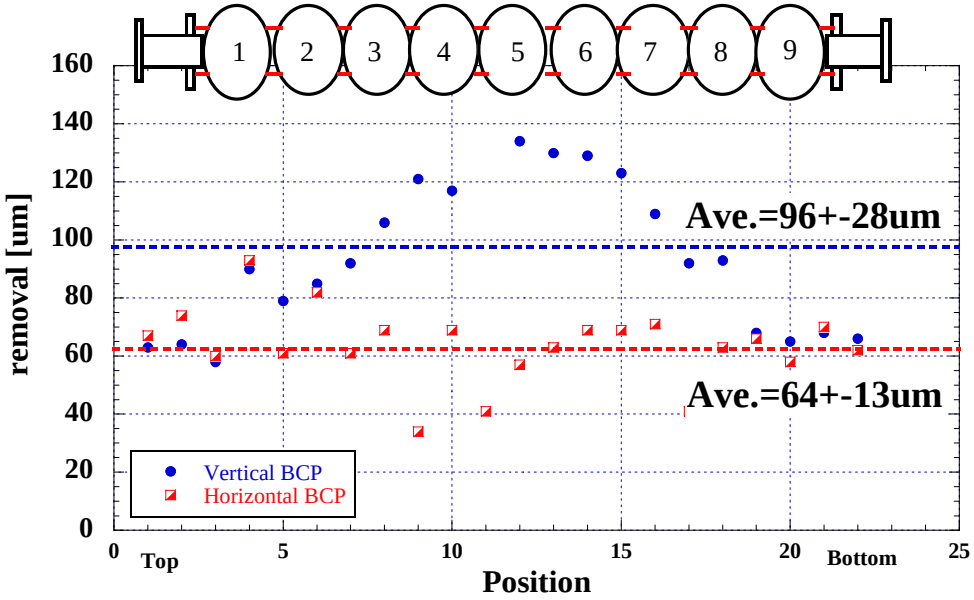


LG ICHIRO 9-cell + BCP

ICHIRO#9

w/o end group

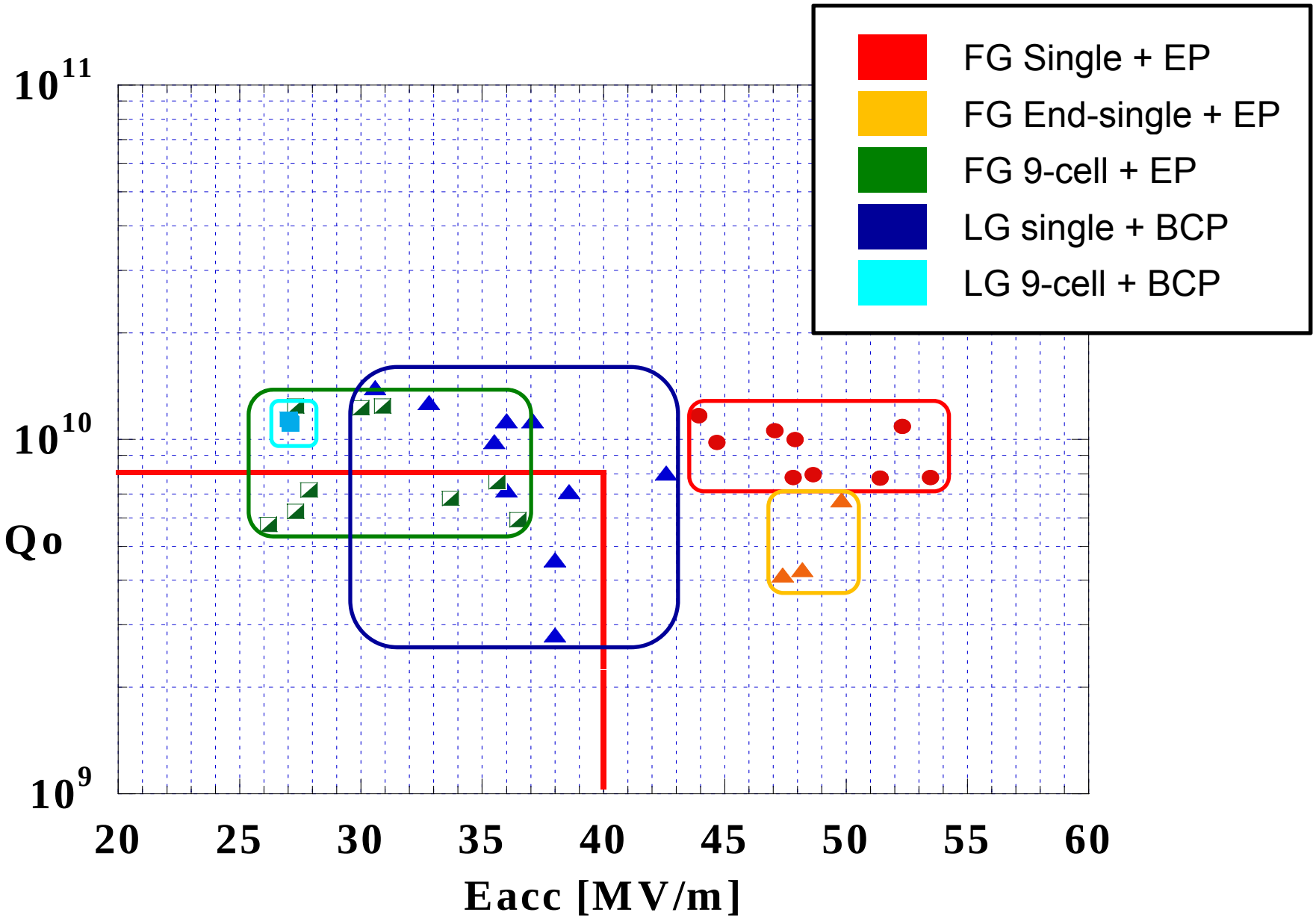




Horizontal BCP produced uniform removal.

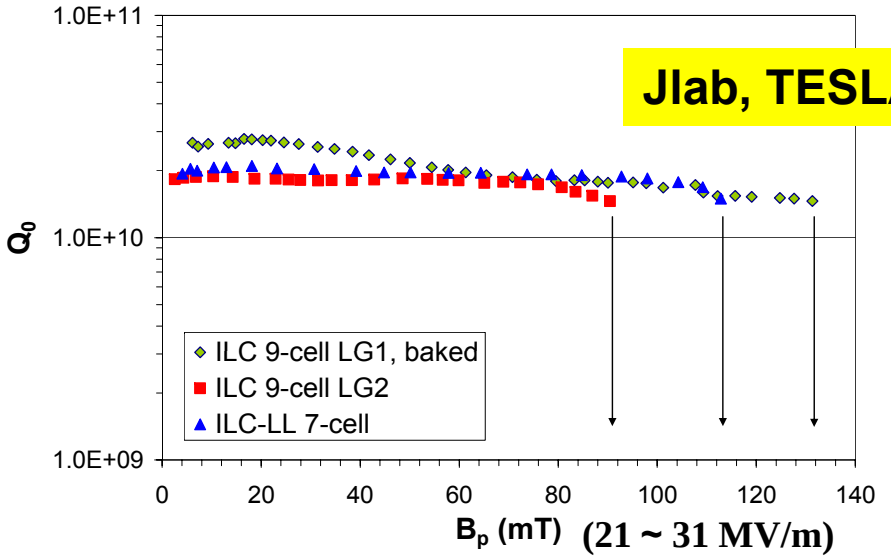
Gradient was same as vertical BCP so far. We will continue H-BCP and VT.

Current status of ICHIRO cavities



Encouraged LG results from Jlab and DESY at SSTIN10

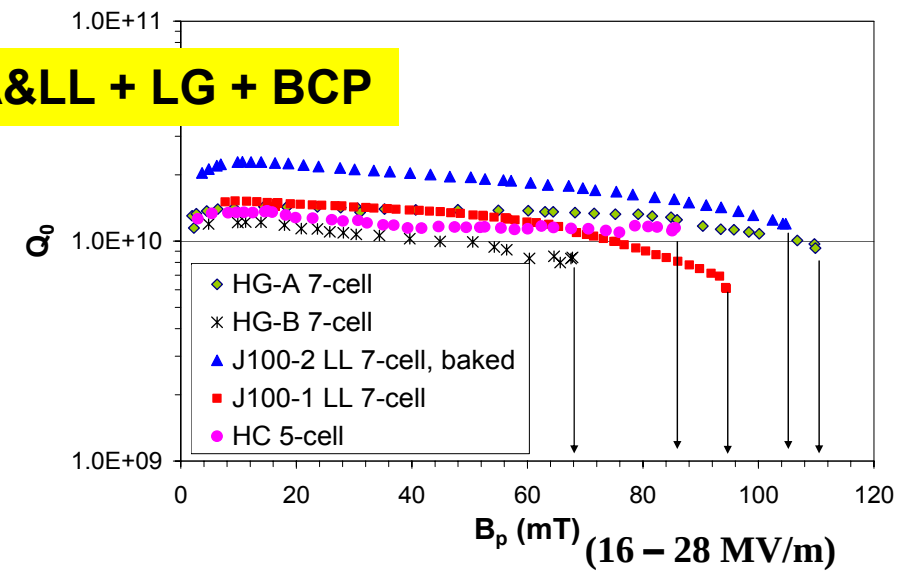
Test Results: 1300 MHz cavities



(21 ~ 31 MV/m)

Jlab, TESLA&LL + LG + BCP

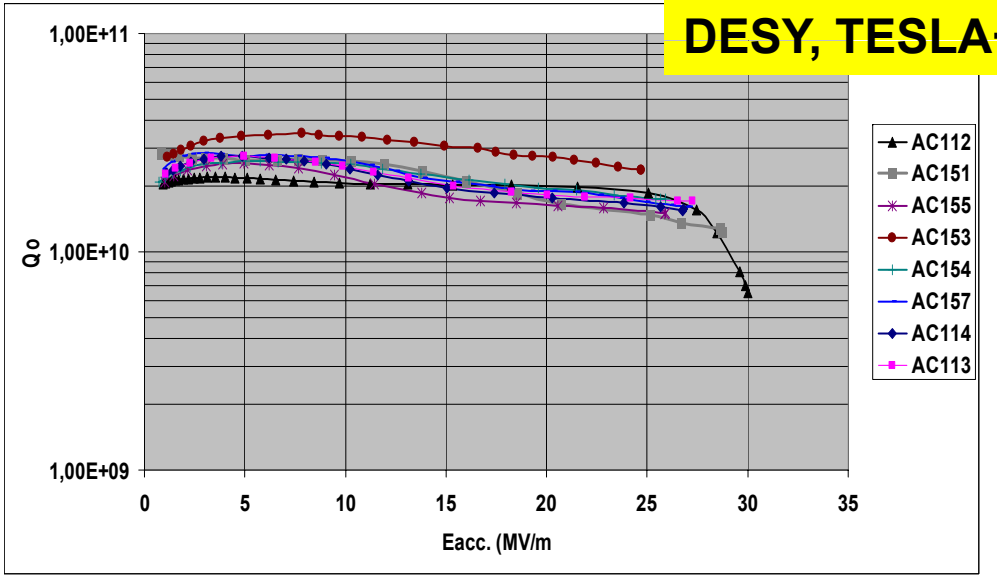
Test Results: 1497 MHz cavities



(16 – 28 MV/m)

Presented by Gianluigi Ciovati

DESY, TESLA+LG+BCP



DESY, LG 9-cell cavities
(AC112 was not baked)

Presented by: B. Spaniol

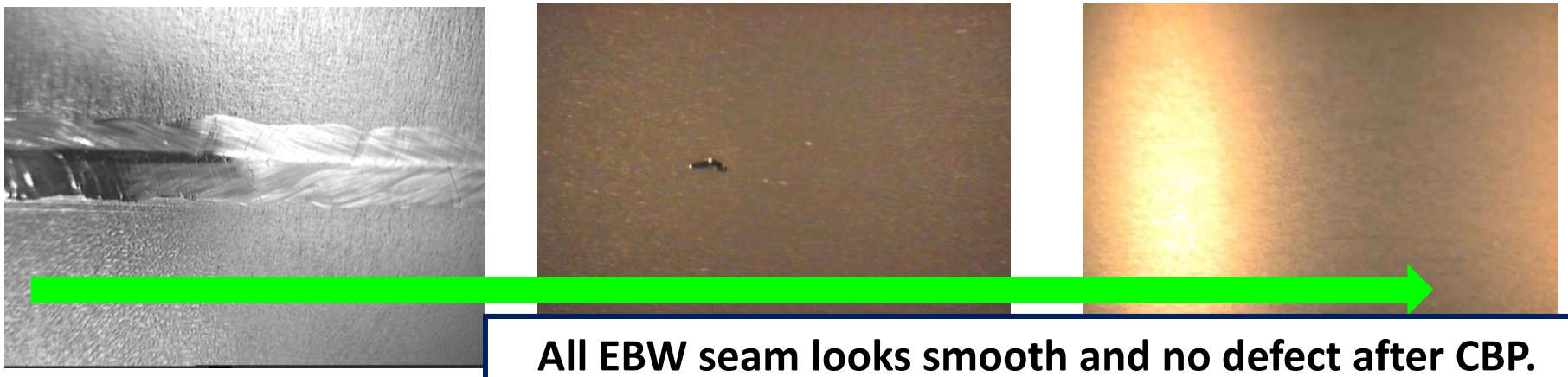
Further R&D

1) Inner EBW

2) Single crystal ingot

Technical issue on EBW

As outer EBW typical | **After 1st CBP** | **After final CBP**

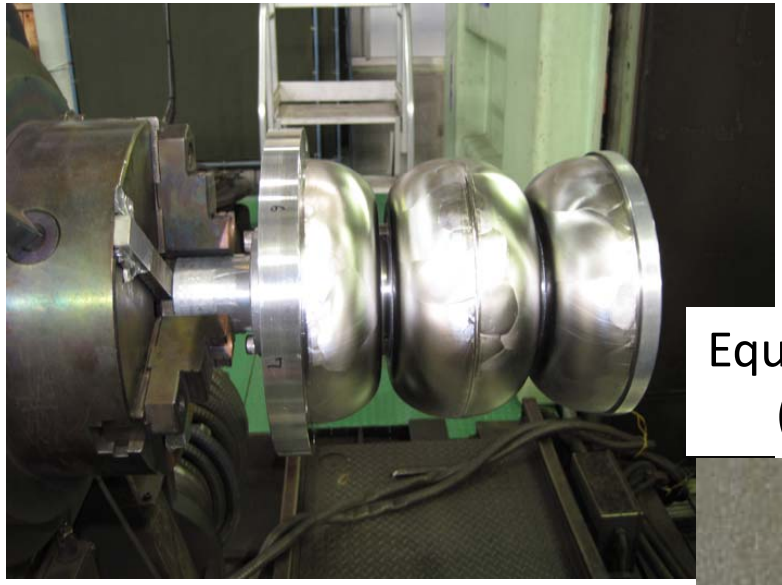


All EBW seam looks smooth and no defect after CBP.

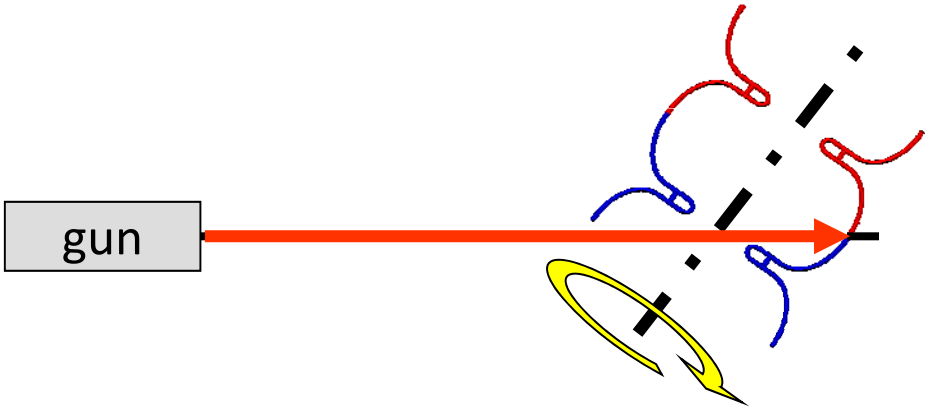
After heavy EP (total~140μm), several defects were emerged at equator.

Our EBW is not yet qualified,
sometimes very deep defect was there(~200um).

Inner EBW for all equator and iris



Equator seam
(inside)



All equator and iris parts can be welded by inner EBW.

EBW benefit on LG material

Fine grain

As EBW

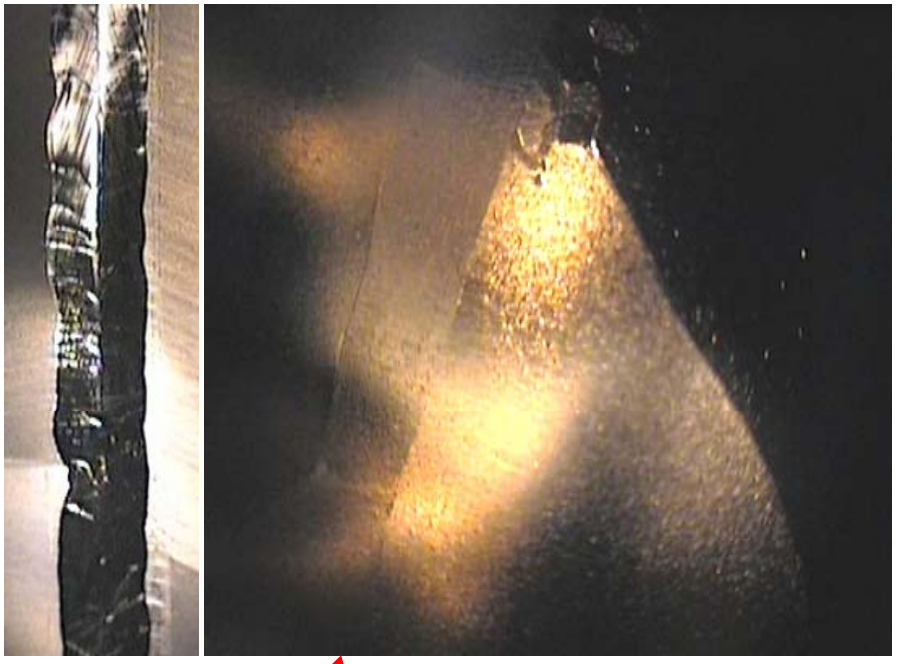
After CBP
+light BCP (10um)

Equator seam

Large grain

As EBW

After CBP
+light BCP (10um)

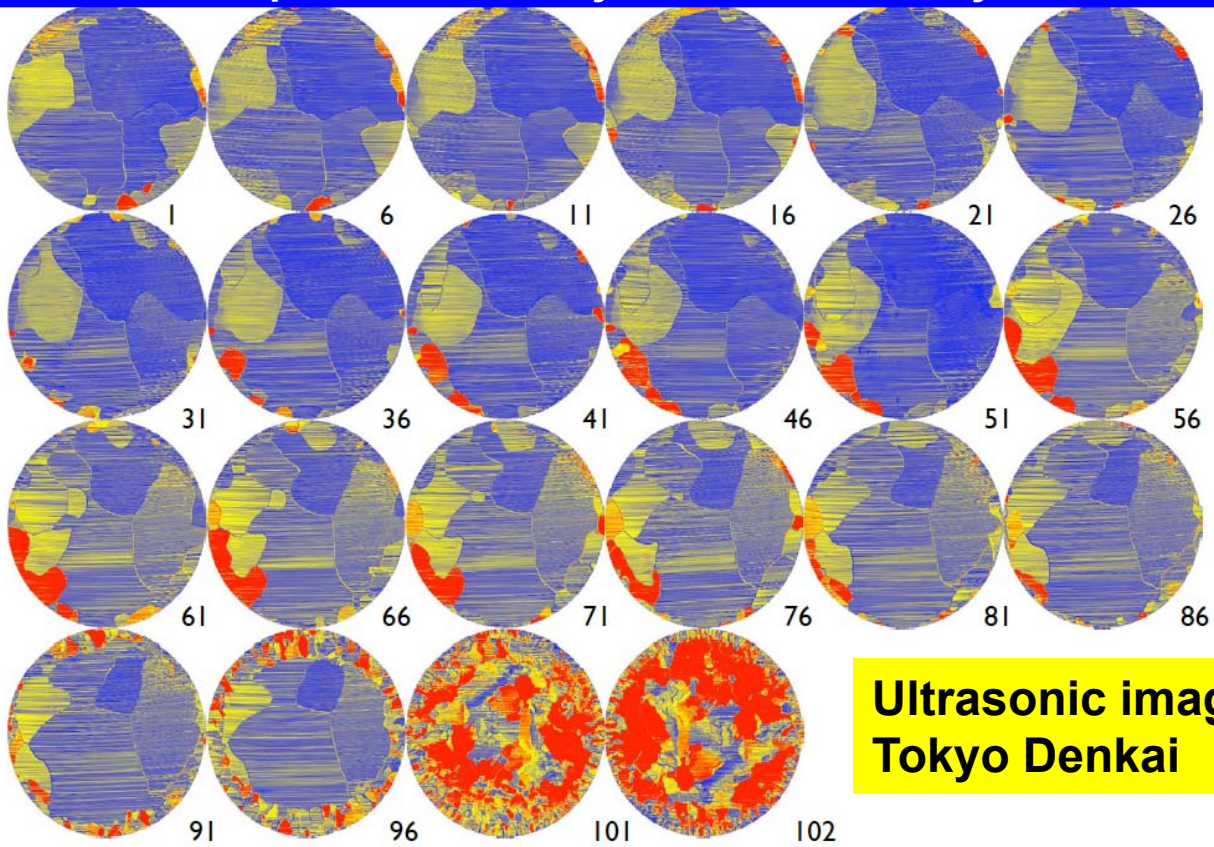


Equator seam

Improvement of LG Ingot at Tokyo Denkai

Single Crystal

Improvement of crystallization at Tokyo Denkai



Grain grow column like in EBM

Make a seed plate for single crystal ingot

Ultrasonic image by H.Umezawa Tokyo Denkai

Summary

Short term issue

Proof of high gradient with FG+ICHIRO+EP

S0 study on ICHIRO#7(FG+EP) is on going in collaboration with Jlab/KEK.

Proof of high gradient with LG+ICHIRO+BCP.

Post EP cleaning for end-group will be essential for 50MV/m.

Long term issue

Qualified cavity fabrication, EBW is main issue.

Reliable EBW technology by Inner EBW+LG.

R&D of single crystal ingot is on going in collaboration with KEK/Tokyo Denkai. The key is the seed material.

Final goal

High gradient, high yield, low cost by the combination of LG/SC + LL/ICHIRO shape + BCP, inner EBW.