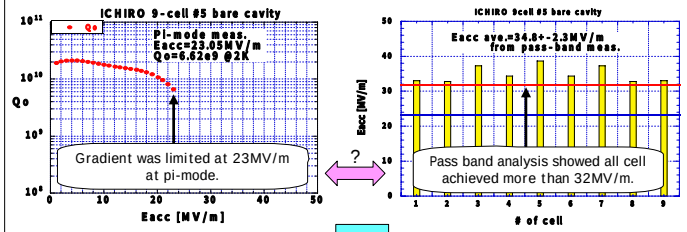
SRF2009 THPPO083

Field Flatness degradation problems and cure

Fumio Furuta, Kenji Saito
KEK, High Energy Accelerator Research Organization 1-1 Oho, Tsukuba 305-0801, Japan

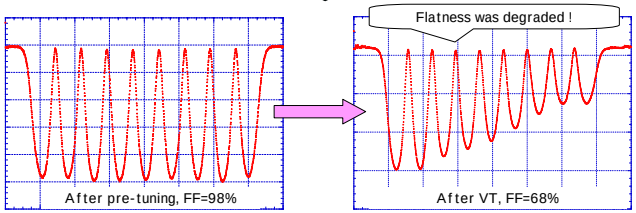
Field flatness problem of ICHIRO 9-cell cavities.

Inconsistency between pi-mode meas. and pass-band meas.



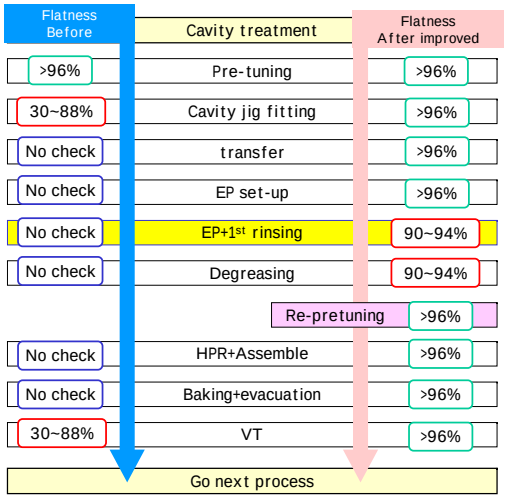
Check flatness after VT.

Flatness was degraded after VT.

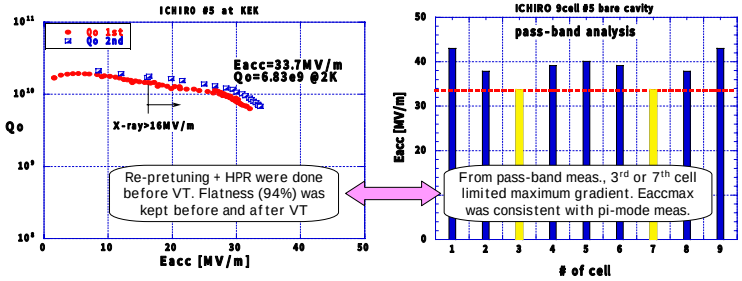


Cure of filed flatness degradation

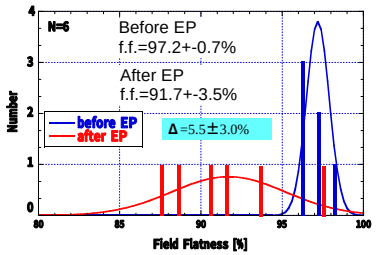
We checked the flatness after each process between pre-tuning and vertical test.
Cavity jig fittings and EP process made degradation of flatness.
We improved jig and fitting procedures, now those has no effect on flatness.



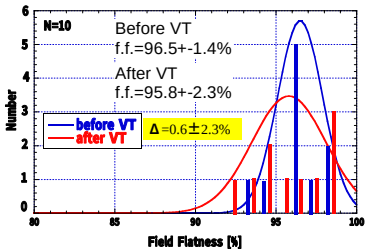
Flatness degradation by EP process was not yet improved, we are investigating it now.
To cure the flatness degradation, we tried re-pretuning on EP'ed cavity.
It worked well, no problem for cavity performance.



Recent statistics of flatness.



Before/After EP process



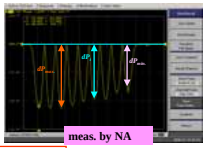
Before/After VT

Measurement of Field Flatness

$$\text{field flatness [\%]} = \left(1 - \frac{E_{cmax.} - E_{cmin.}}{\frac{1}{N}\sum E_{ci}}\right) \times 100\%$$

$$E_{ci} \propto \sqrt{df_i} \propto \sqrt{dP_i}$$

E_{ci} : peak axial electric field in the ith cell
$df_i = |f_\pi - f_i|$: frequency change in the ith cell
dP_i : phase angle change in the ith cell

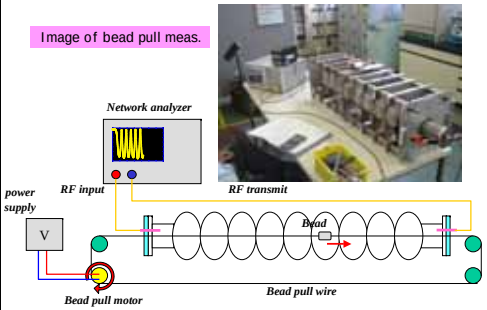


$$\text{field flatness [\%]} = \left(1 - \frac{\sqrt{dP_{max.}} - \sqrt{dP_{min.}}}{\frac{1}{N}\sum \sqrt{dP_i}}\right) \times 100\%$$

ILC requirement >96%

Flatness of 100% means all cell have same peak axial electric field.

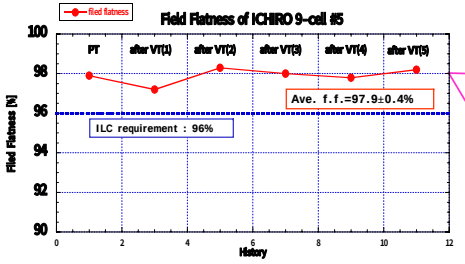
Image of bead pull meas.

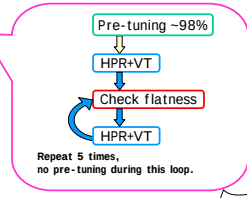


Pre-tuning machine & field flatness meas.

flatness mesa. at horizontal and vertical position

Tight loop test of flatness preservation





Summary

Flatness degradation of ICHIRO 9-cell was caused by jig fittings and EP process.

We improved jig and fitting procedures, no degradation happen by jig now.

EP jig fittings and filling/dumping of water to cavity brought no degradation.
Only EP process made ~5% degradation of flatness. We are investigating why degradation happen, and how to prevent it and cure.

Current way of cure is re-pretuning, If flatness is degraded less than 95% after EP process, we pre-tune cavity again, then go to final rinsing, HPR.
This re-pretuning process seems no effects on cavity performance so far.

Field Flatness of > 96% is in hand.