Summary Working Group 8
Cavity and Cryomodule Testing

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Radiation measurement and comparison between VT/CM tests

- Radiation measurement and comparison VT/CM for CEBAF upgrade (M. Drury)

- Cornell experience with cavity performance changes from vertical to module test (ERL 7-cell) (D. Gonella)

- Radiation measurements at KEK-STF (K. Yamamoto)

- Radiation measurement and comparison VT/CM at cERL (H. Sakai)

- Radiation measurement and comparison VT/CM for XFEL (D.Reschke)

=> VT X-ray instrumentation:

- x-ray detectors on top of the cryostat (off / on axis)
- DESY/XFEL: x-ray detector below vertical cryostat => very helpful
- cERL: additional x-ray mapping + radiation profile monitors (16 PIN diodes)

=> Cryomodule X-ray instrumentation:

- Different positions of x-ray detectors (on/off axis; below/on-top of module)

- cERL: radiation profile monitors; x-ray spectrometry; simulations for emitter localisation

Conclusion:

X-ray data of different Labs very hard to compare

(Convenors question: Systematic measurements with a source or a travelling cavity? (Old proposal))

=> Changes from VT to Module

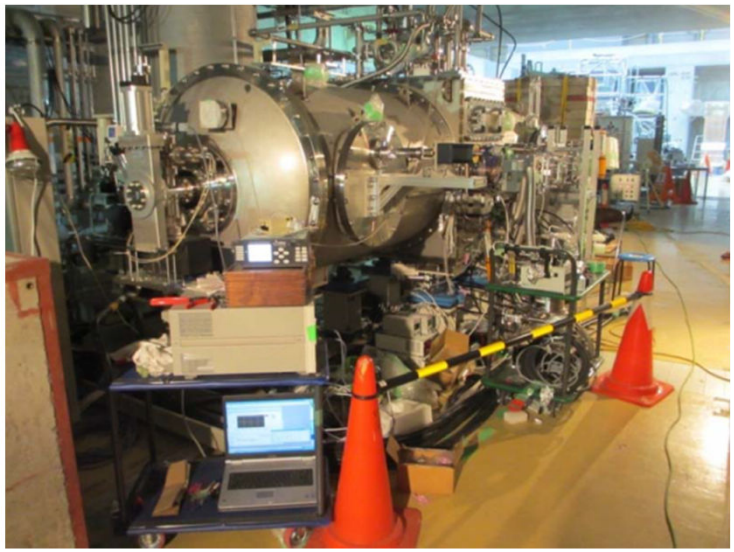
- enhanced field emission from VT to cryomodule probably caused by assembly processes

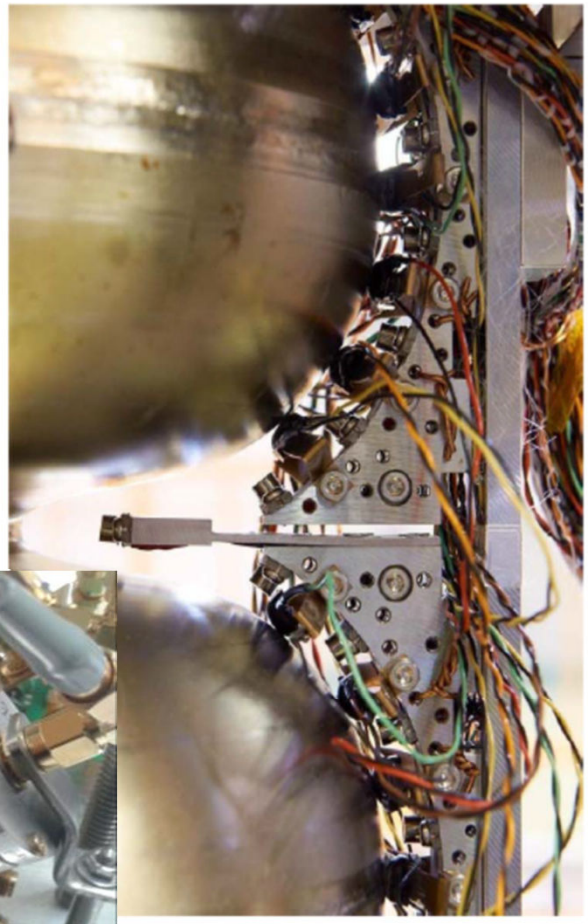
- Cornell: increased Q-value in cryomodule and after 10K cycle

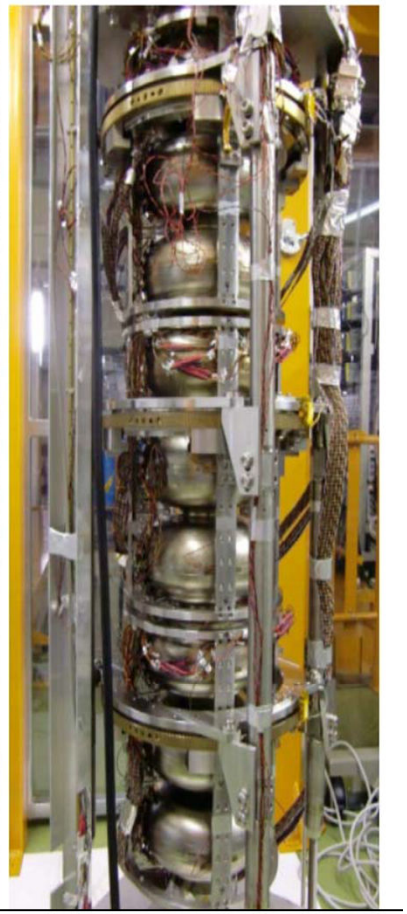
Components and methods of Cavity/CM tests

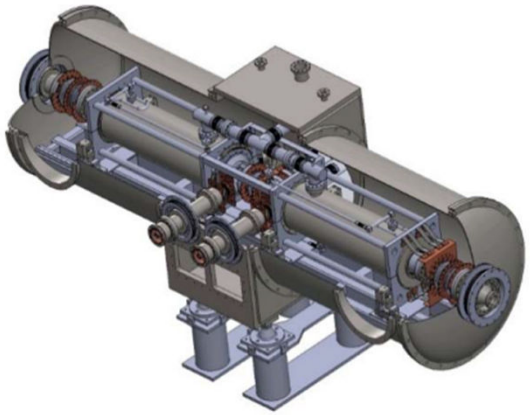
What tools for in situ diagnostic of SRF cavities quench? (M. Fouady)

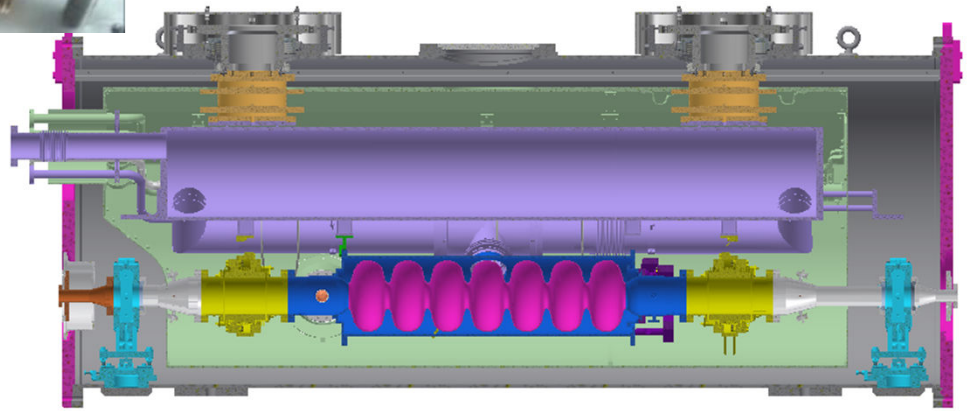
- Development of "LOw REsponse TIme REsistive Thermometers" (Cernox)
- Development of a "Second Sound Resonator"
- Characterization of Quench Detectors (OST's + Cernox)
- No deviation from literature Second Sound velocity observed
=> Confirmed by Cornell, but deviations at high power densities under discussion
=> "Wrong" localization of quenches caused by interpretation of trigger RF signal?











Working Group 8 Summary: Tuners and High Q0 tools/techniques

- Tuners
  - DESY/XFEL (Lilje)
  - FNAL (Solyak)
- High Q0 test conditions (partially joint with WG2)
  - @ Cornell (Gonnella)
  - @ FNAL (Grassellino/Sergatskov)
  - @ JLab (Palczewski)
  - @ DESY (Sekutowicz)
  - @ HZB (Kugeler)
  - Measurement precision (Sergatskov)

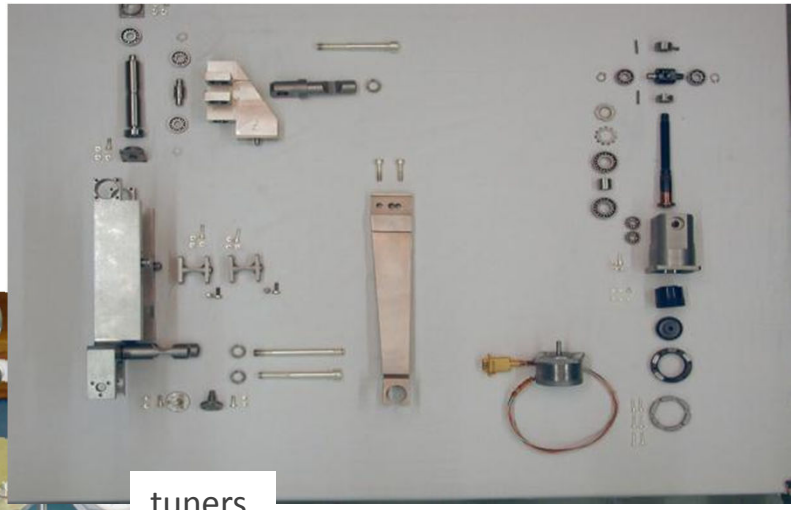
Working Group 8: tuner tests/operational experience/lifetime

- Which issues must be considered for slow tuners?
  - Motor cost, lifetime
  - Industrialization
    - Fabricability, cost
  - Harmonic drive vs. planetary gear hysteresis issues?
  - What issues must be considered for slow tuner lifetime?
    - Lubricating coatings
    - Load
    - What lifetime can be estimated for future projects?
- What quality control tests are necessary?
- What issues must be considered for piezos?
  - Avoid shear forces
  - Duplicate piezos, planning for failure risk
- For which applications are access ports necessary?

Working Group 8: High Q0 experimental tools/techniques

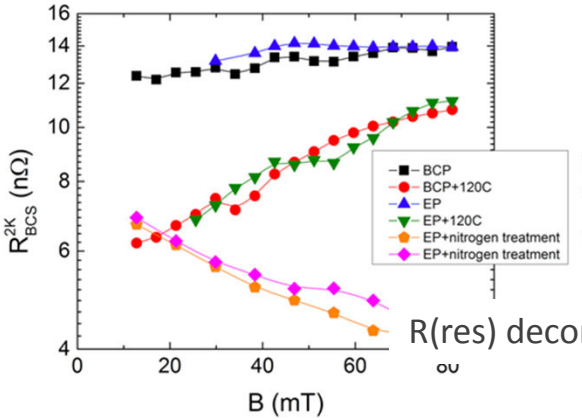
- Cooldown rate affects Q0
  - Why are dressed cavities different from bare cavities? Are they?
  - What is slow/fast, and what T range around Tc(Nb) is important?
    - Do the effects depend on the remanent field?
  - Are all labs doing the Rs deconvolution functionally the same?
  - Are we estimating our measurement errors as well as possible?
    - Incl errors associated with poor directivity for unmatched coupling?
  - Is there a geometric T affect associated with flux sweeping?
  - Many experiments are planned to clarify these topics before the next TTC meeting; great collaboration among TTC labs
- Minimizing remanent field by “magnetic hygiene”
  - Many components must be considered: RAV, SMA connectors, cryostat welds, bolts, washers, cables, etc.
    - Slightly magnetic 304/316L SS components can be demagnetized by heat treatment

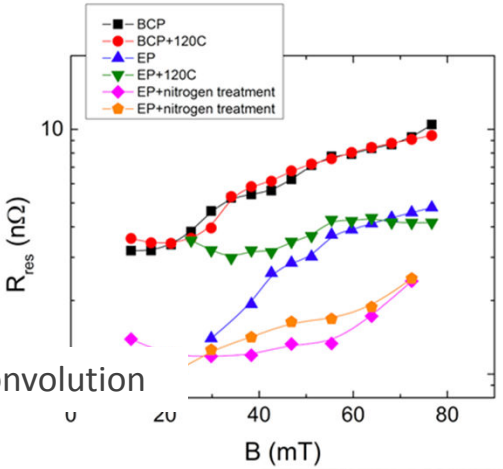
Working Group 8: Tuners and High Q0 tools/techniques



tuners

Fluxgate magnetometers





R(res) deconvolution

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Test infrastructure and their programs

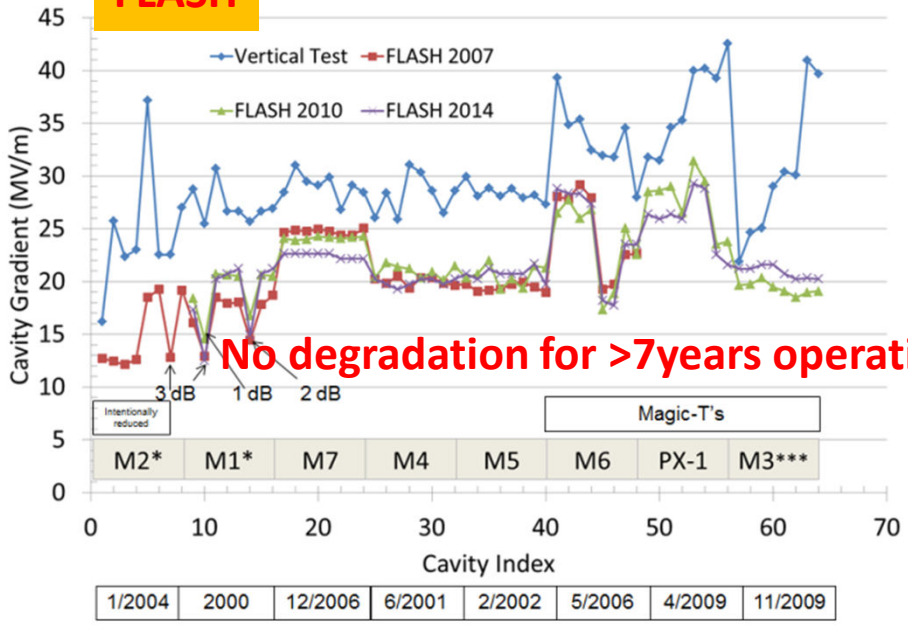
Session provided an very nice overview the various capabilities at all the laboratories

- as host: AMTF for XFEL at DESY (Petersen)
- 3.9 GHz at INFN Milan and AMTF (Sartore)
- cavity & module testing at J-Lab (Palczewski/Drury)
- HZB vertical and horizontal test infrastructure (Kugeler)
- Test infrastructure and test programs for CM2 at FNAL (Ginsburg)
- Test infrastructure and test programs at KEK-STF (Y. Yamamoto)
- Infrastructure and test programs at CERN (Therasse)
- Infrastructure and test programs at Cornell (Hofstaetter)
- Expected testing of the ESS SRF cavities (Darve)

Cavity performance change under beam operation and recovery method

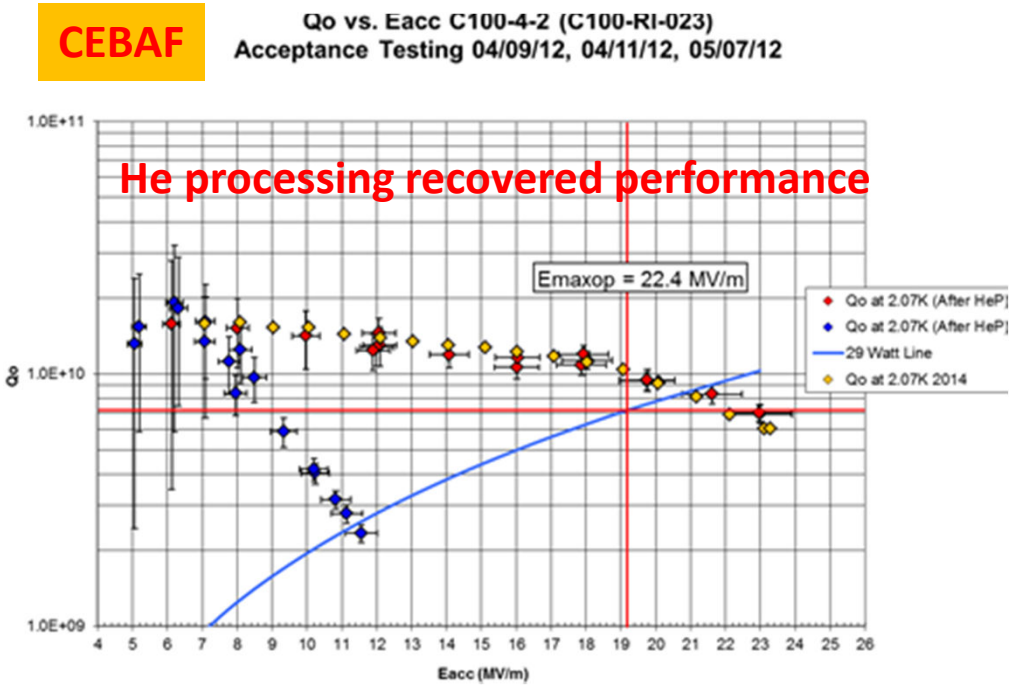
	Performance change during beam operation	Recovery method
FLASH(DESY) S. Siegfried	**No degradation** **No sign of increasing F.E.**	
STF-QB (KEK) Y. Yamamoto	**No degradation** **No sign of increasing F.E.**	
CEBAF (C100) M. Drury	**Degradation during assembly** → introduce **heavy F.E.**	**He processing** help to recover performance drastically
Cornell ERL injector G. Hoffstaetter	**Decrease of intrinsic Qo during beam operation** → contribution from dust of ferrite dumper **No sign of increase F.E.**	After disassemble and applying **HPR**, initial performance was recovered
cERL main linac (KEK) H. Sakai	**Degradation during assembly** → introduce **heavy F.E.** **Some activation of F.E. during beam operation**	**Pulse processing** help to reduce radiation
KEKB K. Umemori	**Degradation during beam operation** **Increase F.E.**	**HHPR(Horizontal HPR)** help to recover performance

FLASH



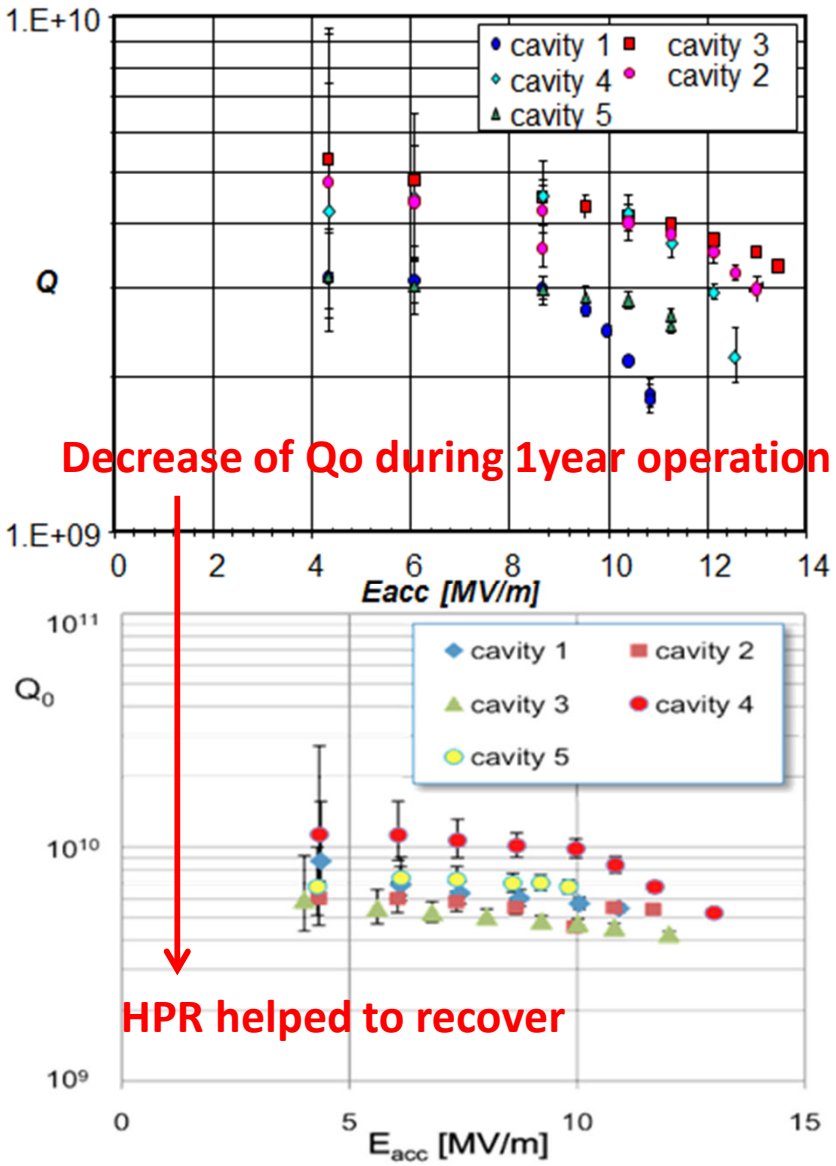
No degradation for >7years operation

CEBAF



He processing recovered performance

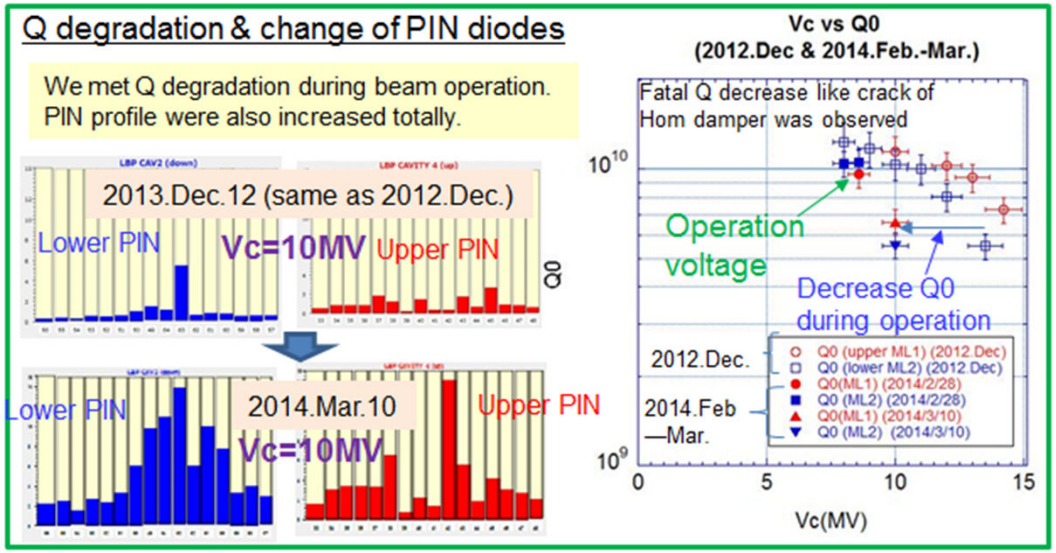
Cornell 2-cell injector



Decrease of Qo during 1year operation

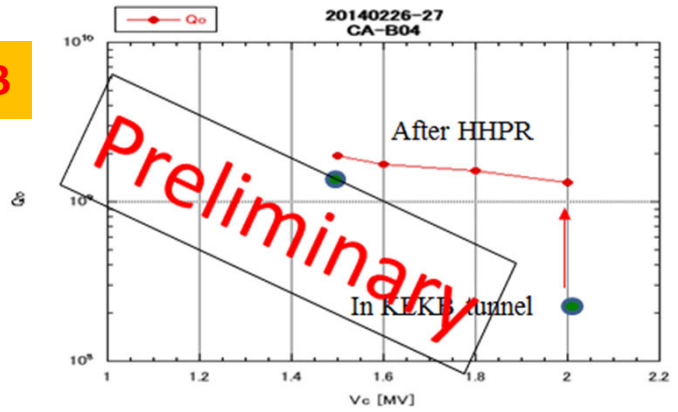
HPR helped to recover

cERL 9-cell main linac

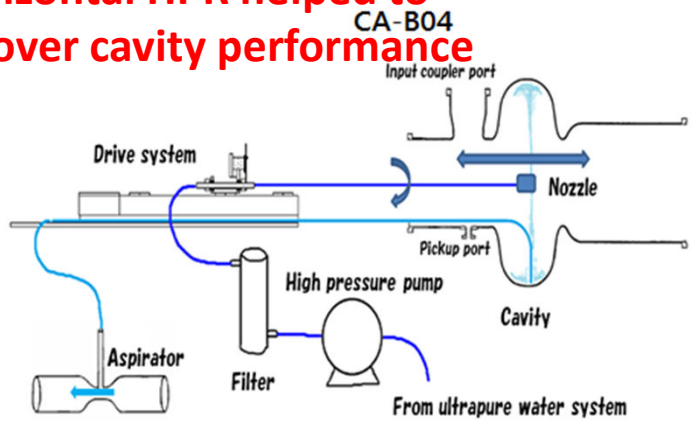


Qo dropped due to field emission
Angular distribution of radiation is observed

KEKB



Horizontal HPR helped to recover cavity performance



Comments

- We need to check more carefully about SRF cavity performance change, e.g. Qo and radiation(F.E.), during beam operation. CW operation is more risky?
- We need to establish recovery method against performance degradation. Methods without disassembly are desirable.