DESY-KEK Collaboration meeting
March 19, 2012
DESY

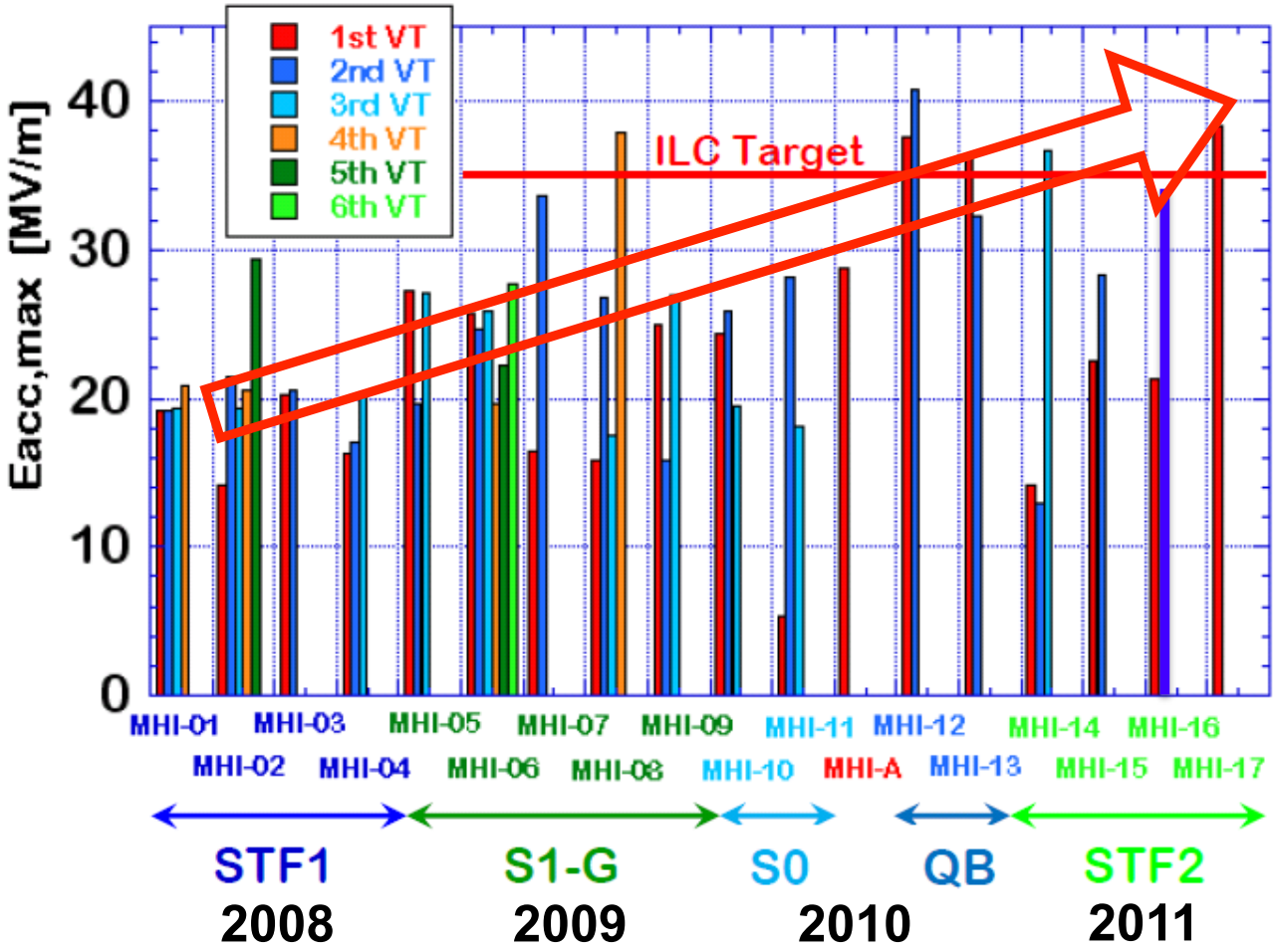
Recent SCRF Activities at KEK STF/CFF

Seiya Yamaguchi

Topics

1. HG performance and problems
2. Parameter search for EBW
3. HOM coupler for ERL cavity
4. Beam operation at STF

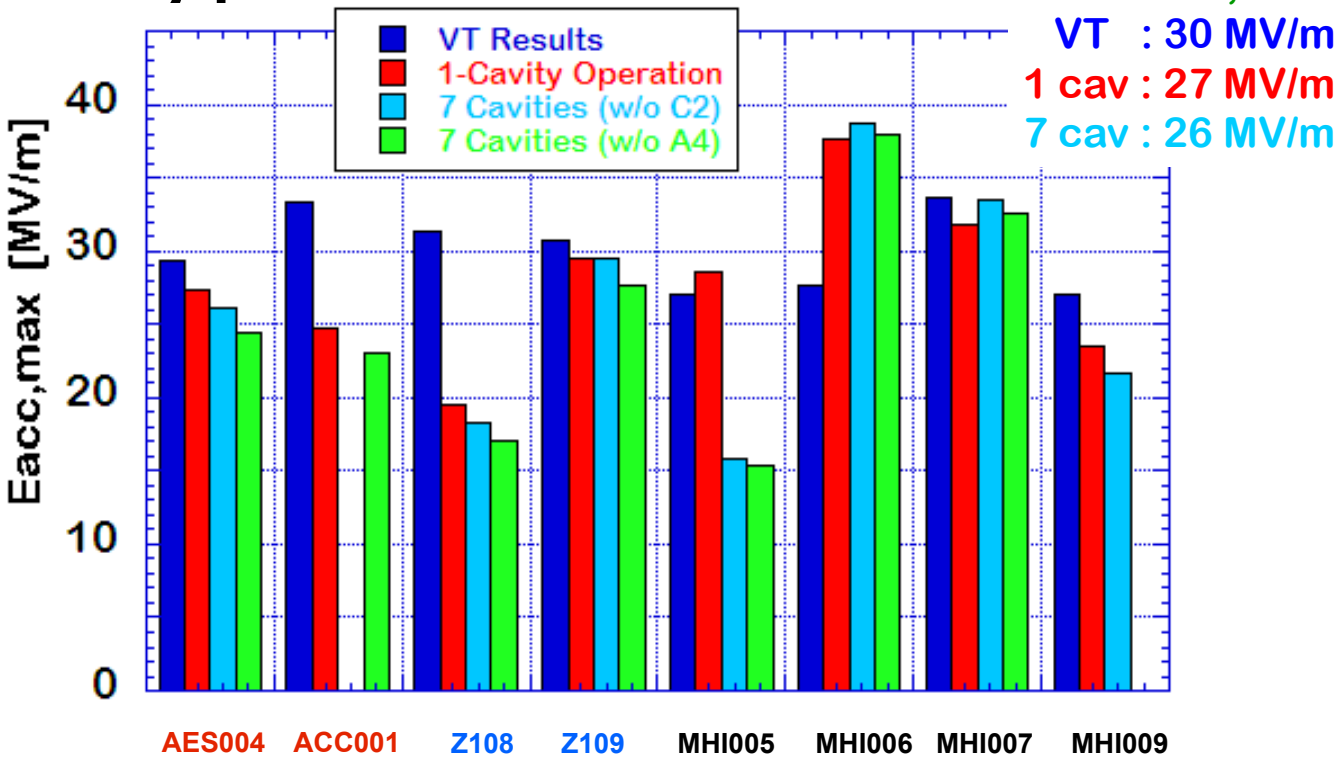
1. HG performance and problems



- Gradient is increasing step by step
- Problems - Degradation, defect after EP

Degradation problem

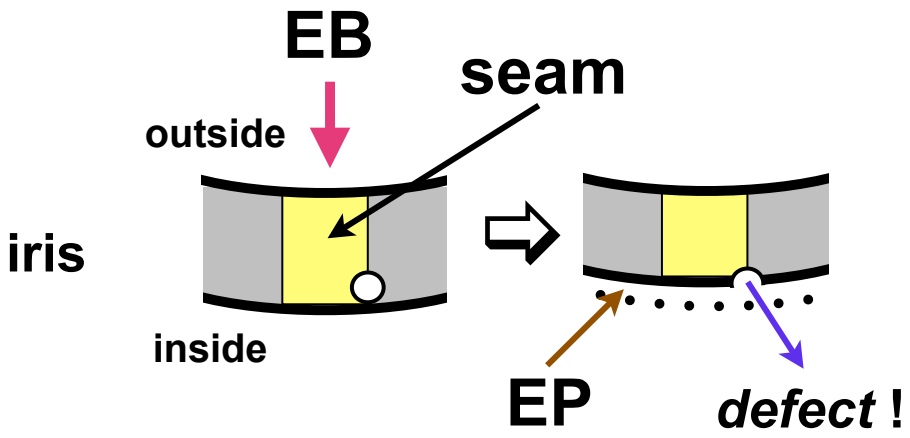
Cavity performance in S1-Global



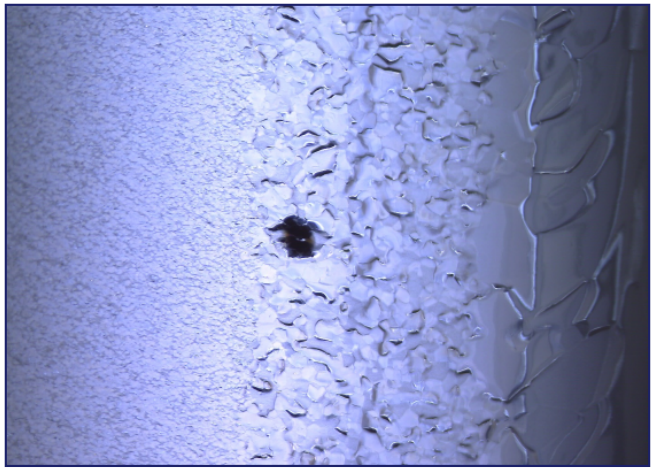
ave. Eacc,max
VT : 30 MV/m
1 cav : 27 MV/m
7 cav : 26 MV/m

- degradation is 13% (av.) , 40%(max)
- Need to identify the reason of degradation.
  Contamination?
  Which process?
- Is HT using CHECIA(-like) system useful?

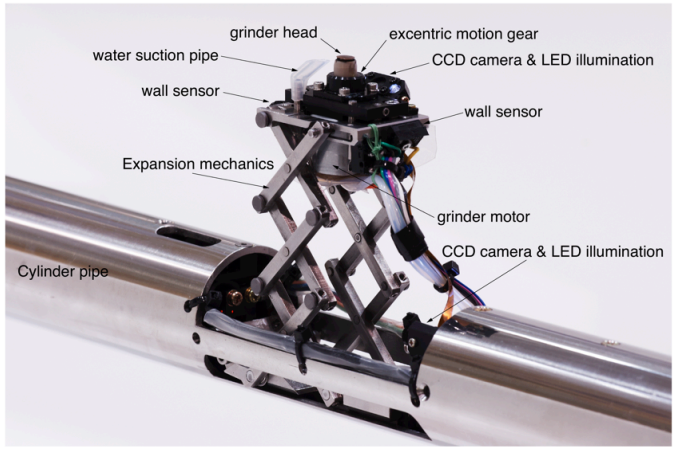
Defect after EP



schematic of the welding point



- **defects frequently appeared after EP**
- **defect is made during EBW(?)**
- **can be recovered by local grinding**
- **need establish optimum EBW condition**



Local grinder

2. Parameter search for EBW

CFF (Cavity Fabrication Facility)

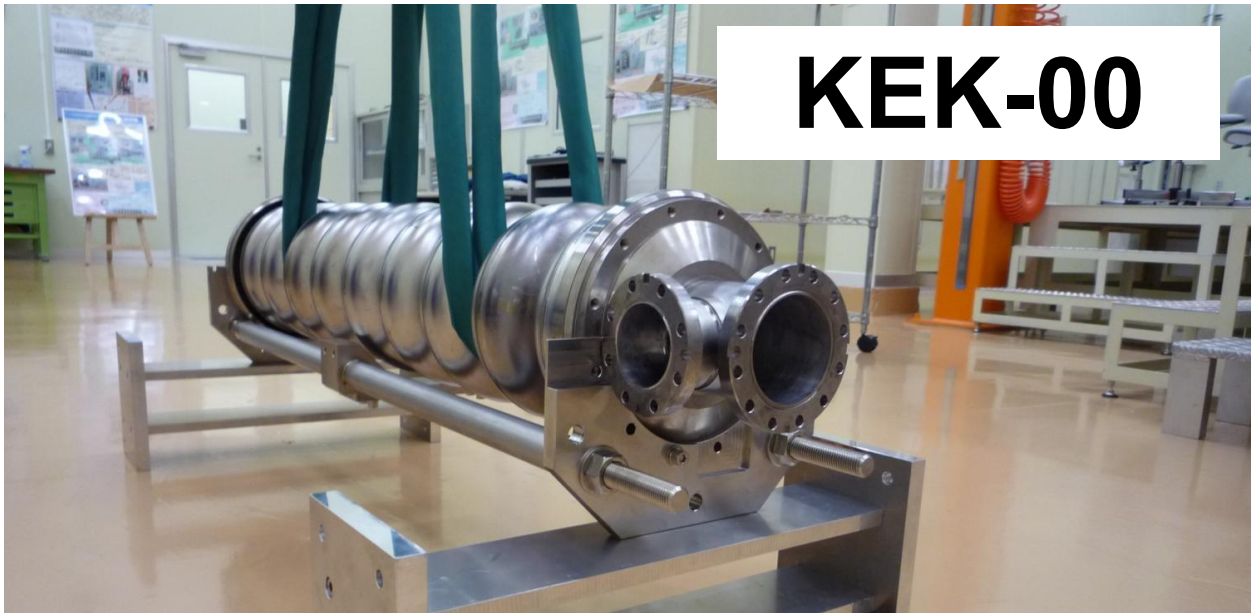
Clean room

Press machine

EBW

CP

vertical lathe

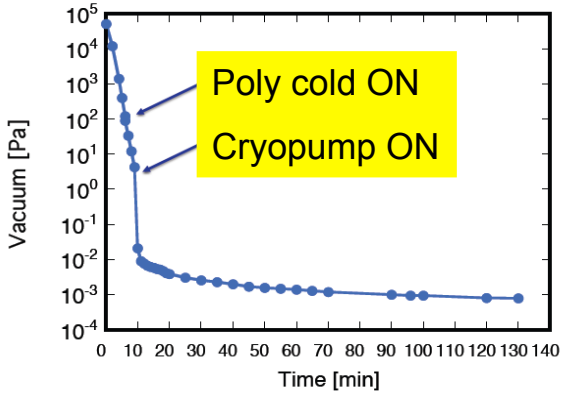


KEK-00

- EP was finished
- waiting for VT (March 29)

EBW machine

- 60-150 kV
- 0-100 mA
- 1,500(W) X 2,200(H) X 3,200 (D)
- 10 min. to reach 10^{-2} Pa
- gun position - ceiling, side wall (1m stroke)

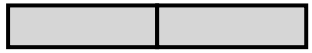


Parameter search for EBW

Configuration

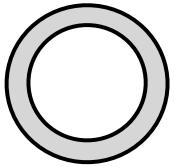
(A) simple plate

(B) plate, head on



(C) plate, step joint

(D) simple pipe



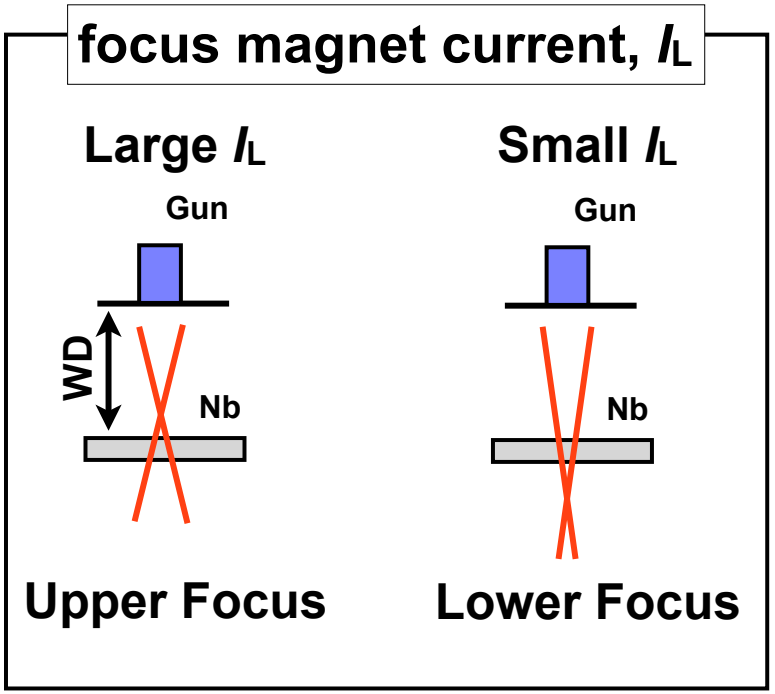
Beam parameters

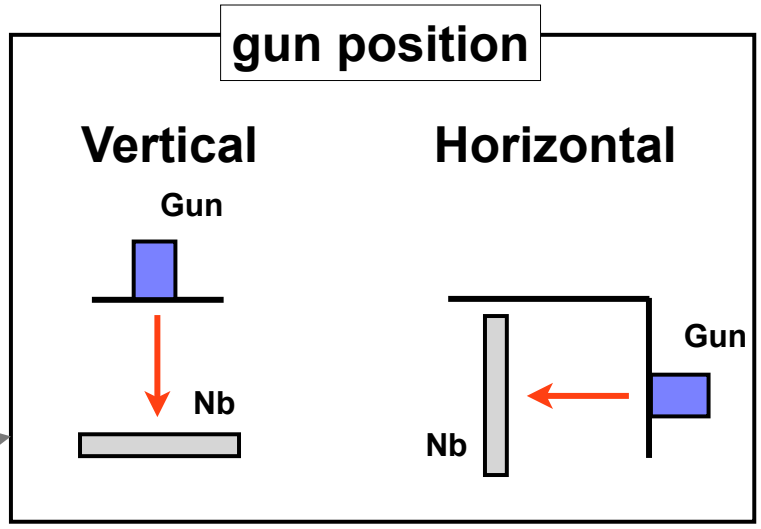
variable

- focus magnet current, I_L
- beam current, I_B
- acceleration voltage

fixed

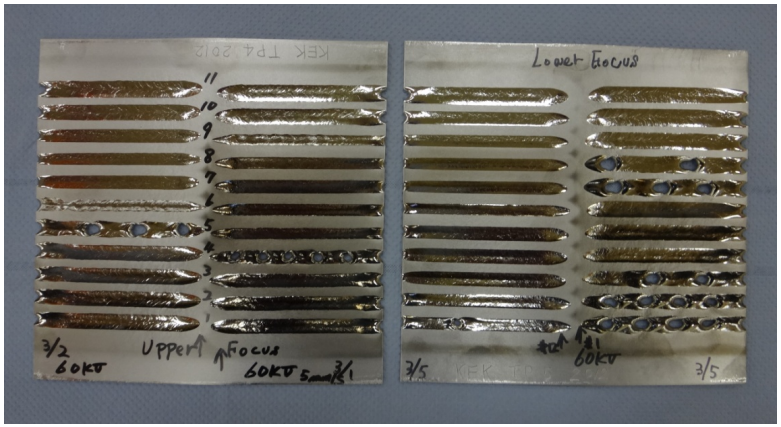
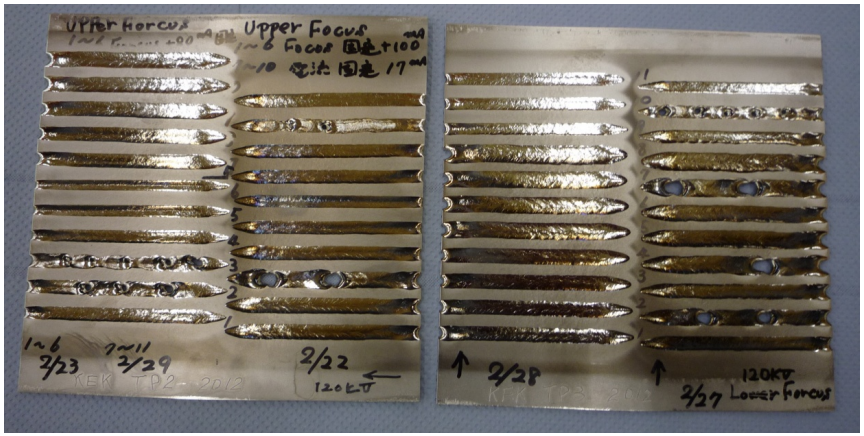
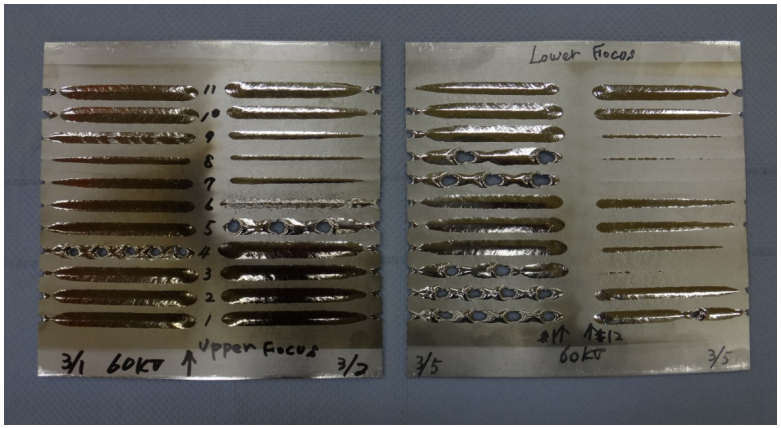
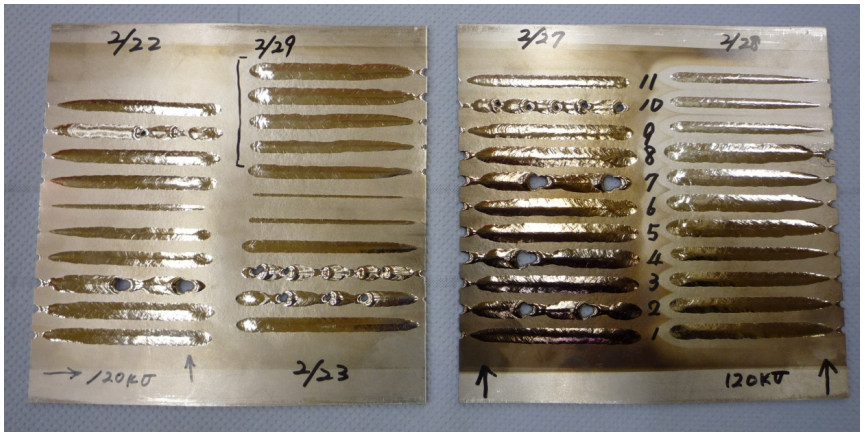
- WD = 500 mm
- moving speed = 5 mm/s
- gun position-vertical





(A) simple plate

bead on Nb simple plate

	60 kV	120 kV
front		
back		

(A) simple plate

$\triangle I_L$ =0:just focus

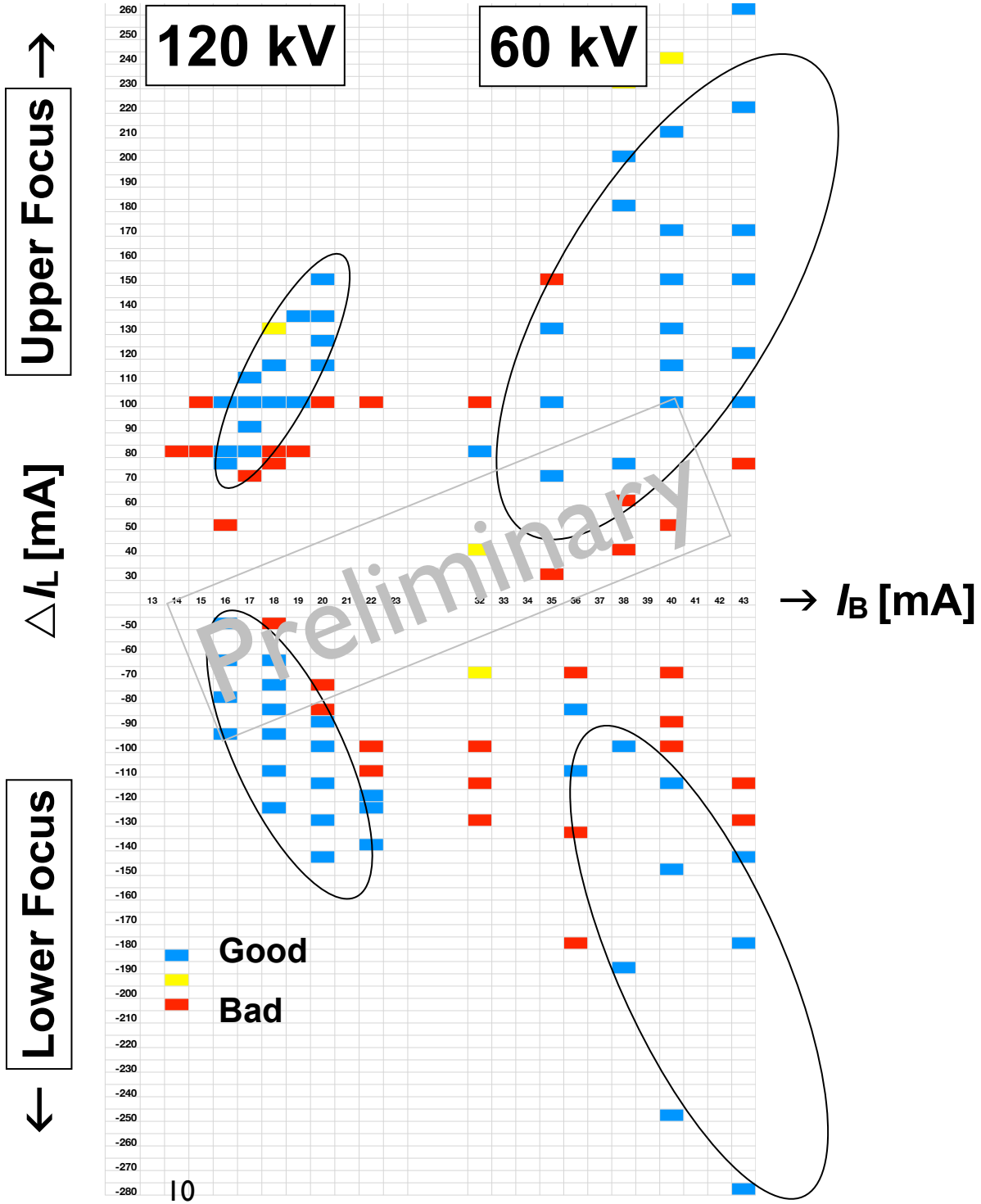
- Lower voltage has wider area of good condition.
- dependency on focus current shows opposite tendency.

Plan:

vary parameters more

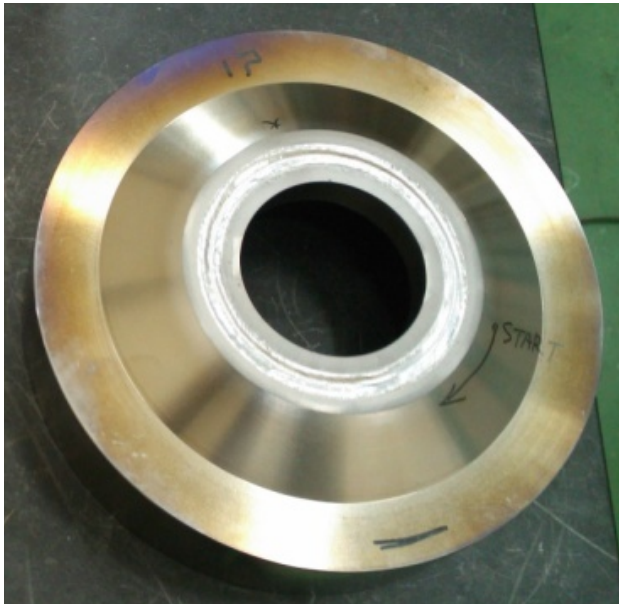
- HV(90 kV, 150 kV, ...)
- WD
- moving speed
- gun position
- etc.

observe bead cross section



Parameter for Ti-Nb EBW

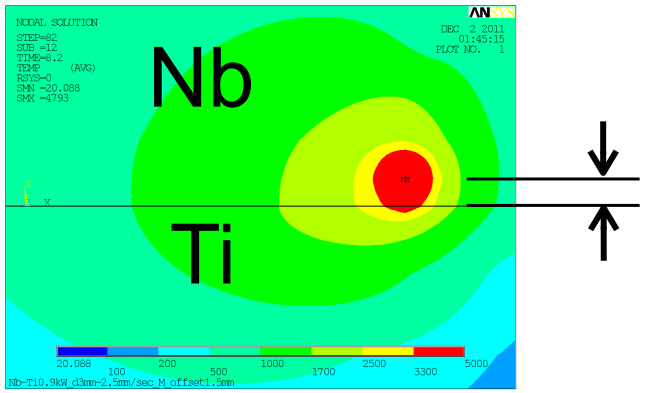
End plate(Ti) + Nb ring



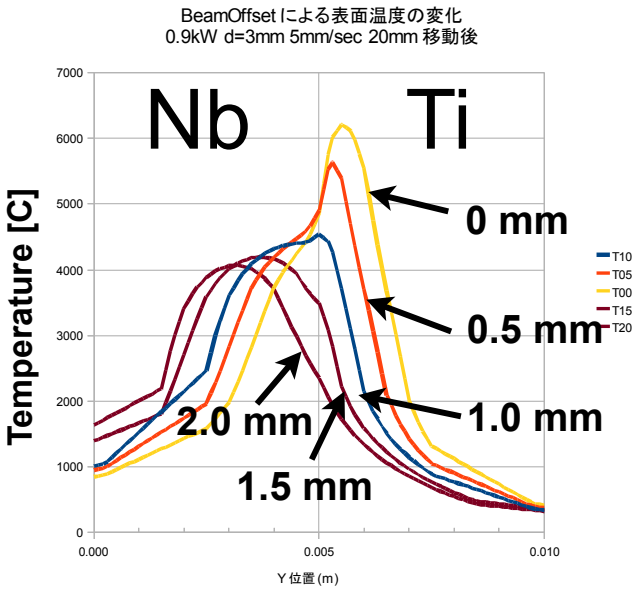
melting point:
Nb 2415 ℃
Ti 1668 ℃

→ offset is necessary
1.5 mm is optimum.

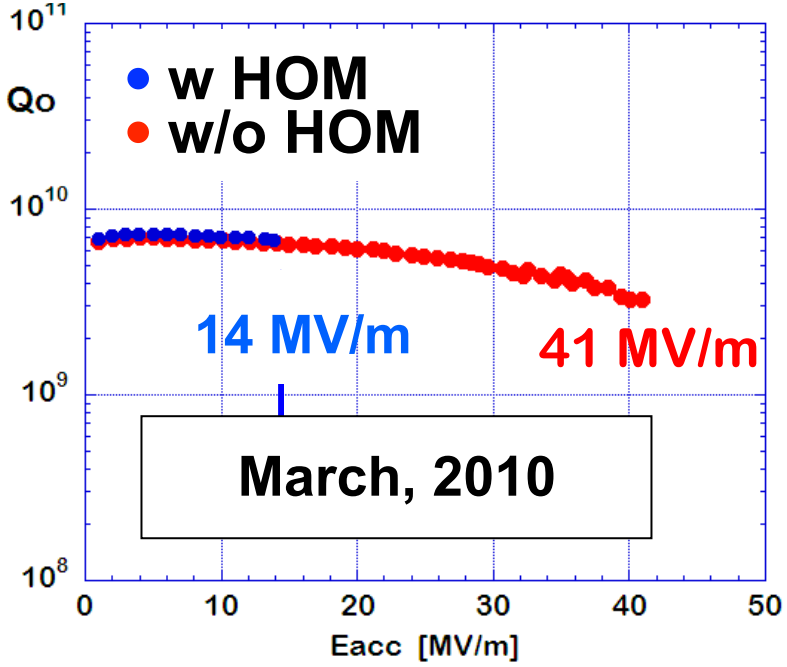
Temperature distribution near Ti-Nb joint (ANSYS)

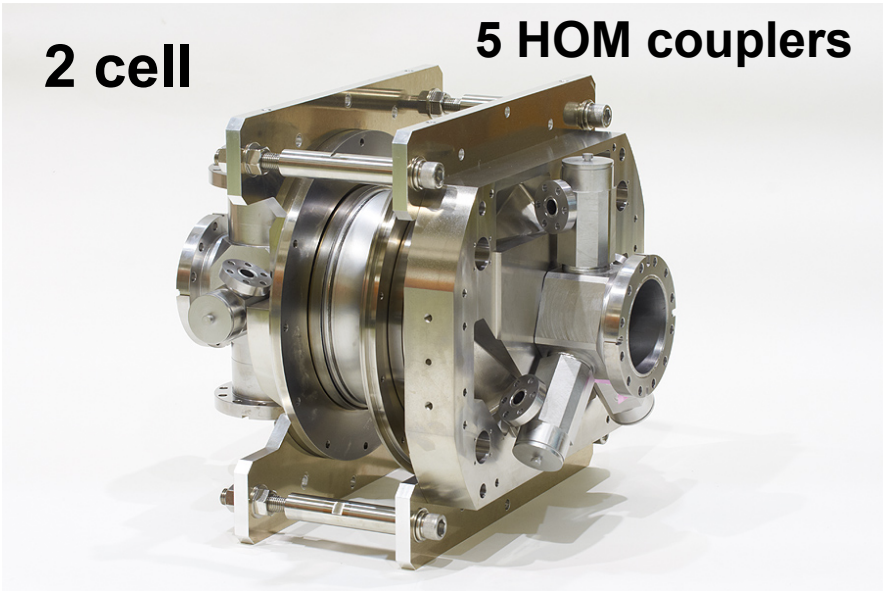


off set 1.5 mm



3. HOM coupler for ERL-injector cavity



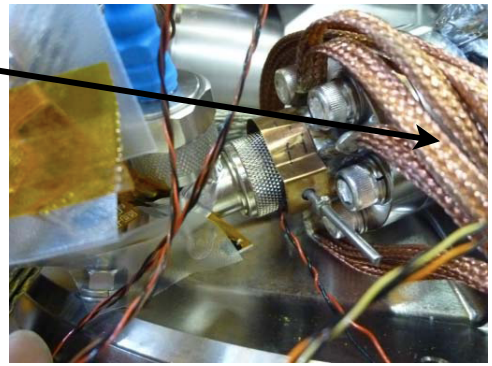


- design value for ERL:15 MV/m
- E_{acc} is limited by heat at HOM coupler

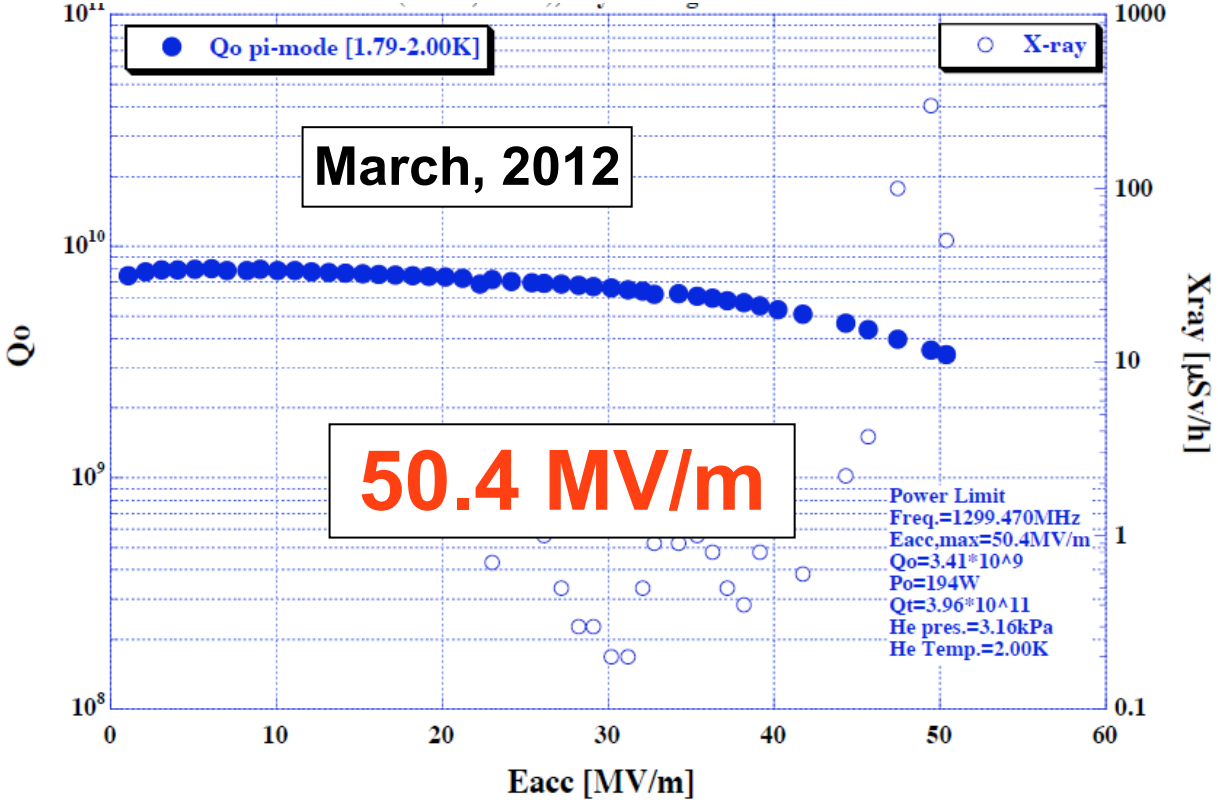
	cavity	beam pipe
TESLA	"TESLA"	84 mm
ERL		88 mm

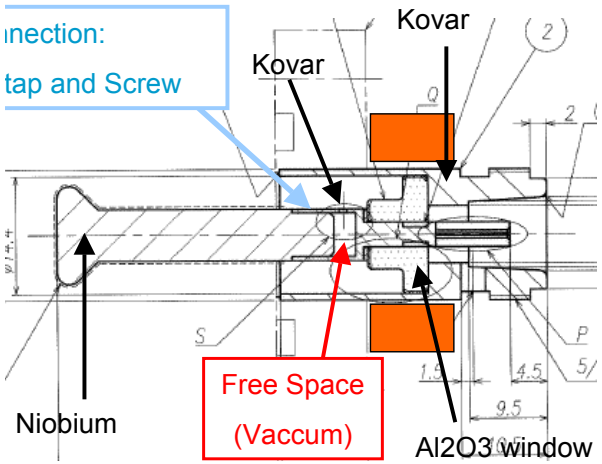
antenna of HOM coupler

- thermal anchor to Lq. He
- inner con. : Kovar to Mo
- outer con. : Kovar to Cu
- CP around brazing point



VT result (5th) for ERL 2cell cavity with HOM

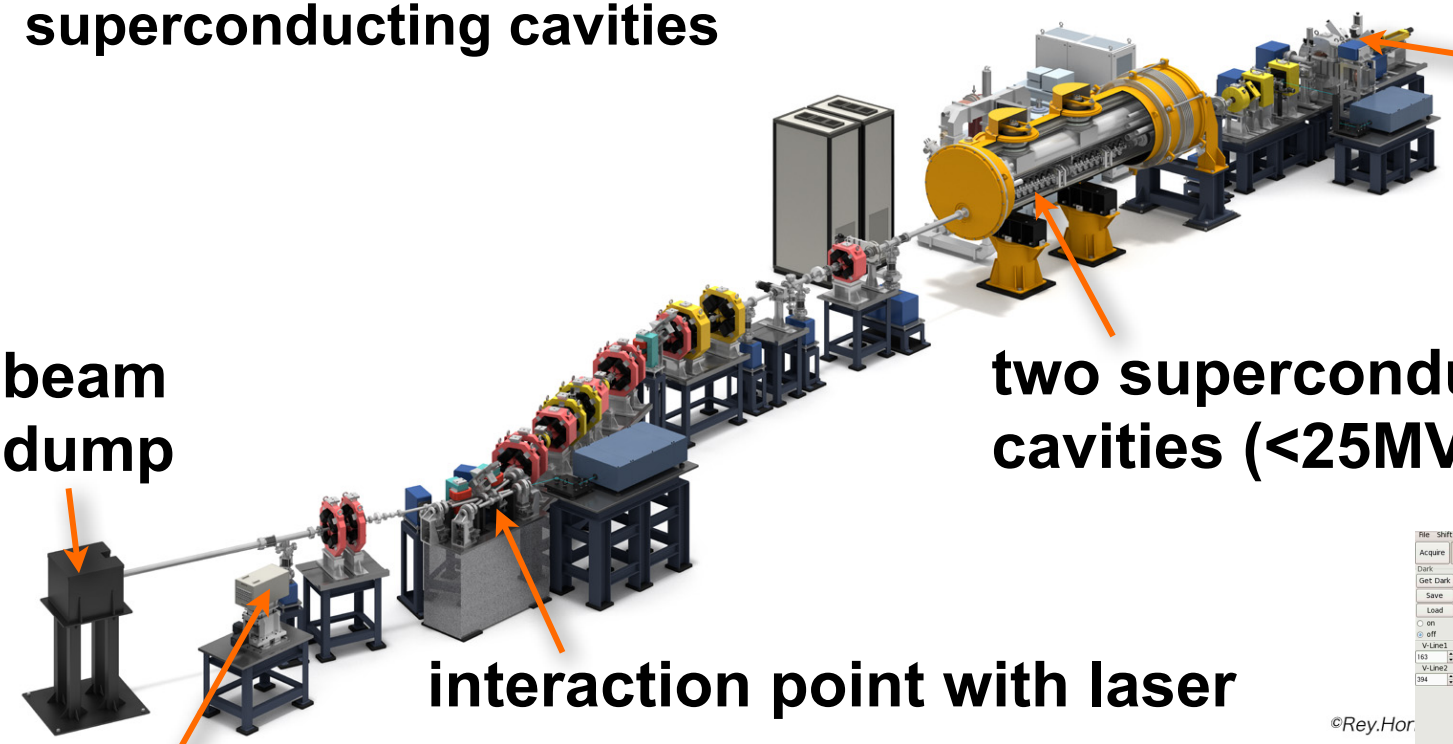




4. Beam operation - 1

Quantum Beam technology project (2008-2012)

- **demonstration of compact X-ray source using superconducting cavities**



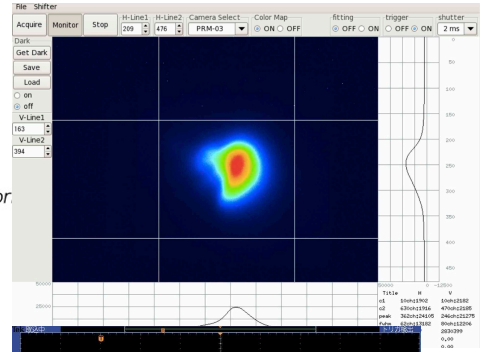
RF gun

beam dump

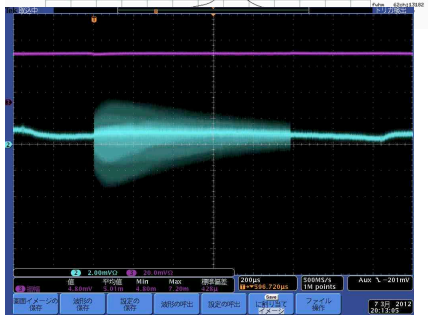
two superconducting cavities (<25MV/m)

interaction point with laser

X-ray detector



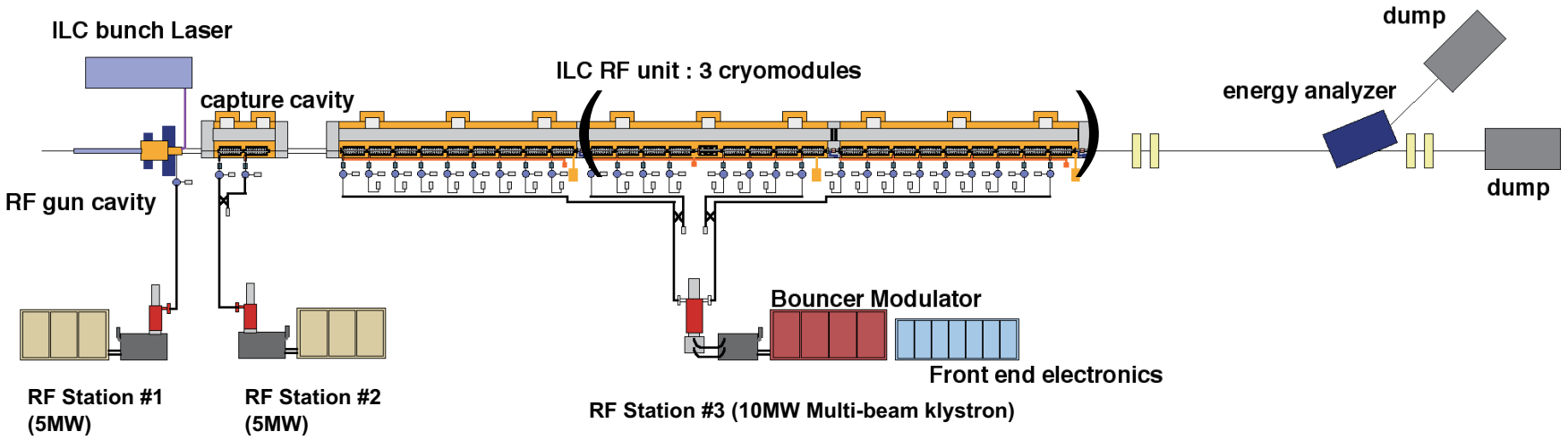
©Rey.Hor



Feb. 27 First beam !
Mar. 7 1 ms beam
Apr. Beam acc. by SC
Oct. X-ray expt.

Beam operation - 2

STF Phase 2 (2012-2014)



RDR 1 RF unit = 1 MBK+3 CM →1 CM

20x2+31.5x8 → 292MeV

3.2 nC x 2,625 bunch → 9mA, 5Hz

schedule:

VT (2012), Assemble (2013), Beam test (2014)

Summary

- **E_{acc} is increasing step by step, but there are two problems - degradation and defect.**
- **Started parameter search for EBW.**
- **ERL 2-cell cavity achieved 50 MV/m by improvement of HOM coupler.**
- **Started beam operation at STF.**