Report from SNS on HOM Coupler

May 18, 2006
ILC technical status meeting

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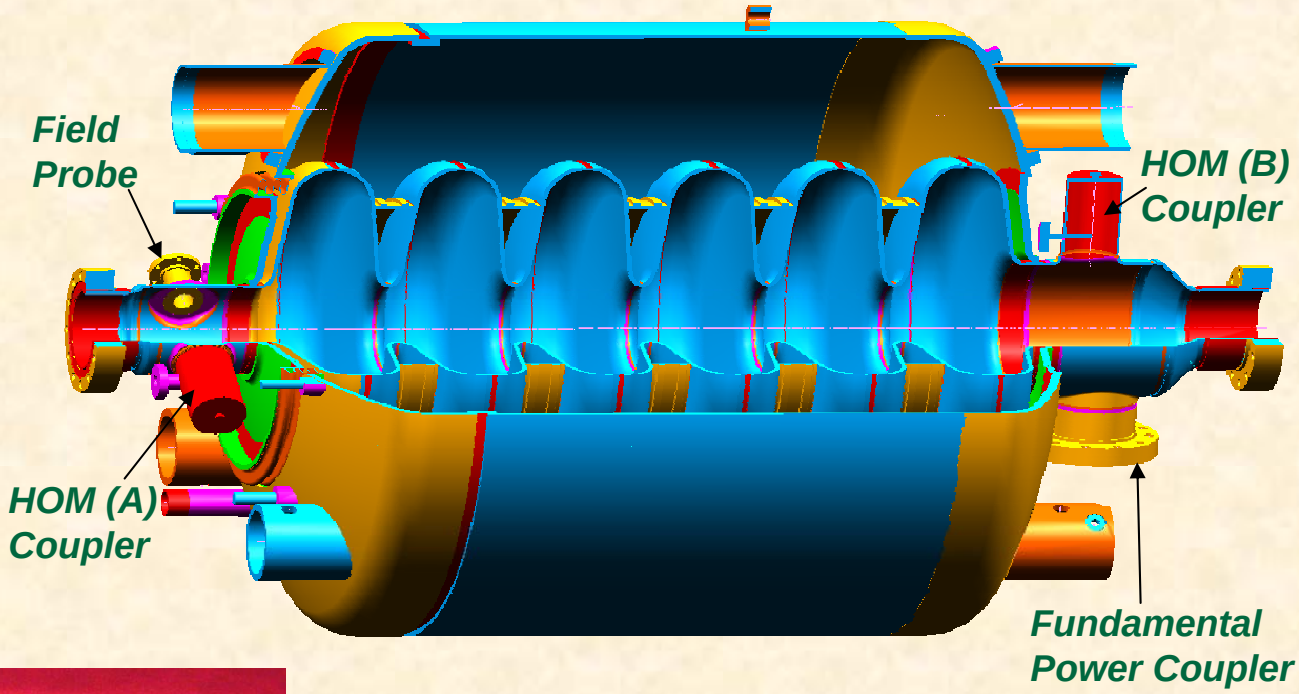
SNS SRF cavity

Major Specifications:
E_a=10.1, 15.9 MV/m
at β=0.61, 0.81

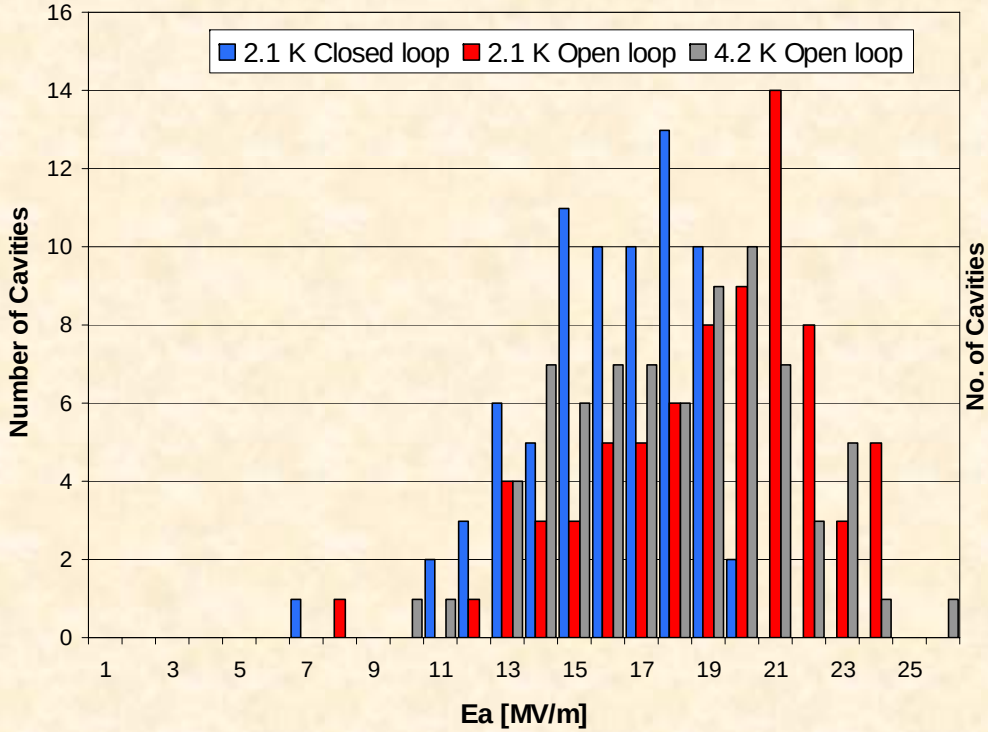


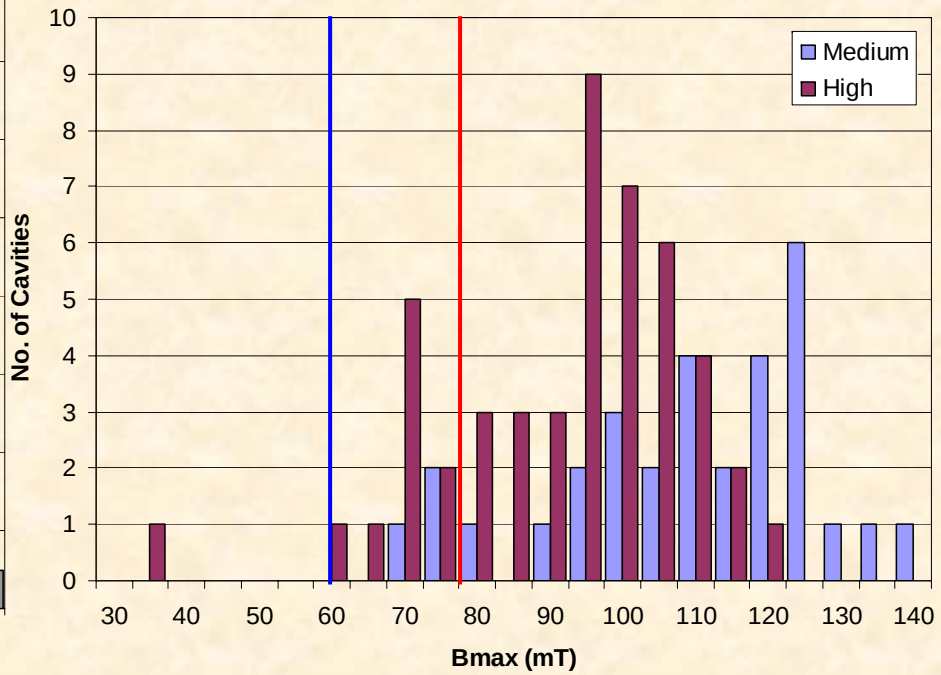
Cavity Performances

Maximum fields achieved
in the installed cavities.

Operational fields are kept in general
at the 75-80% of the maximum fields

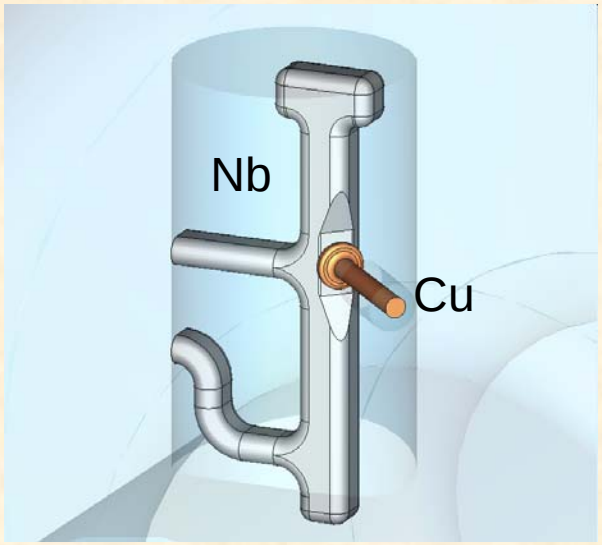
High beta cavities are limited at lower Bmax
and show lower FE threshold.
→implies cavities are mainly limited
by other factors rather than quenching

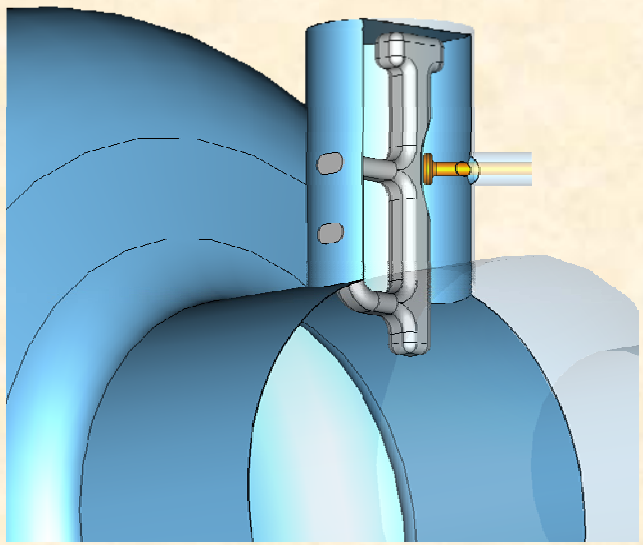




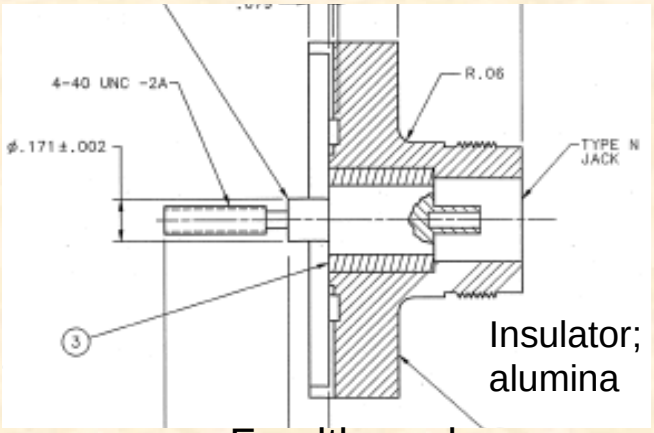
HOM coupler

- Baseline cavities have coaxial HOM coupler at each side
- Two cavities are not operational due to the HOM coupler
- Many installed cavities (~10) are showing abnormal signals
  - zero coupling and rep. rate dependent abnormal signal
  - electron loading
  - power level changes
- HOM coupler should not have problems with the fundamental mode

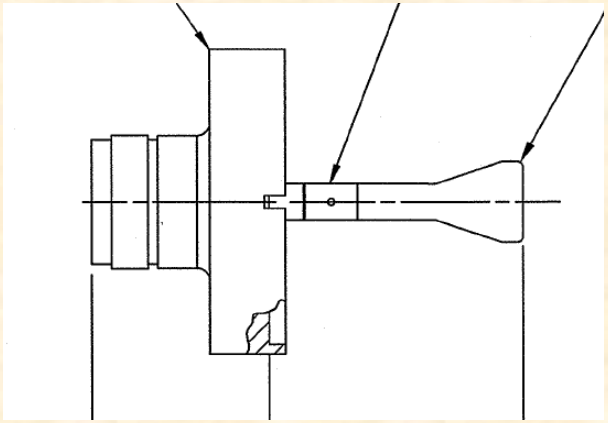




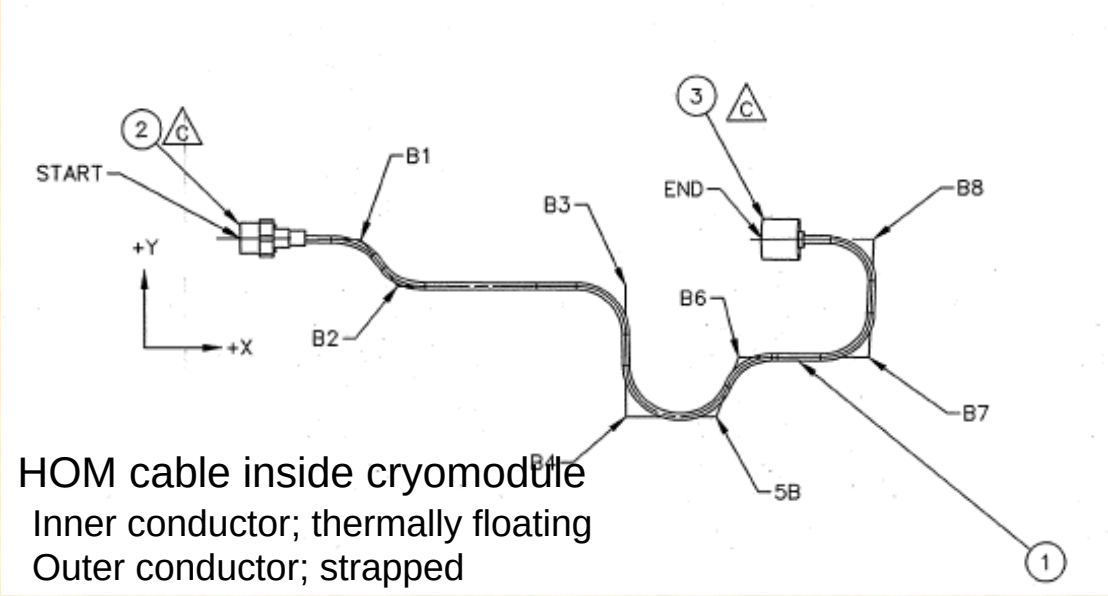
Feedthrough & Cable



Feedthrough

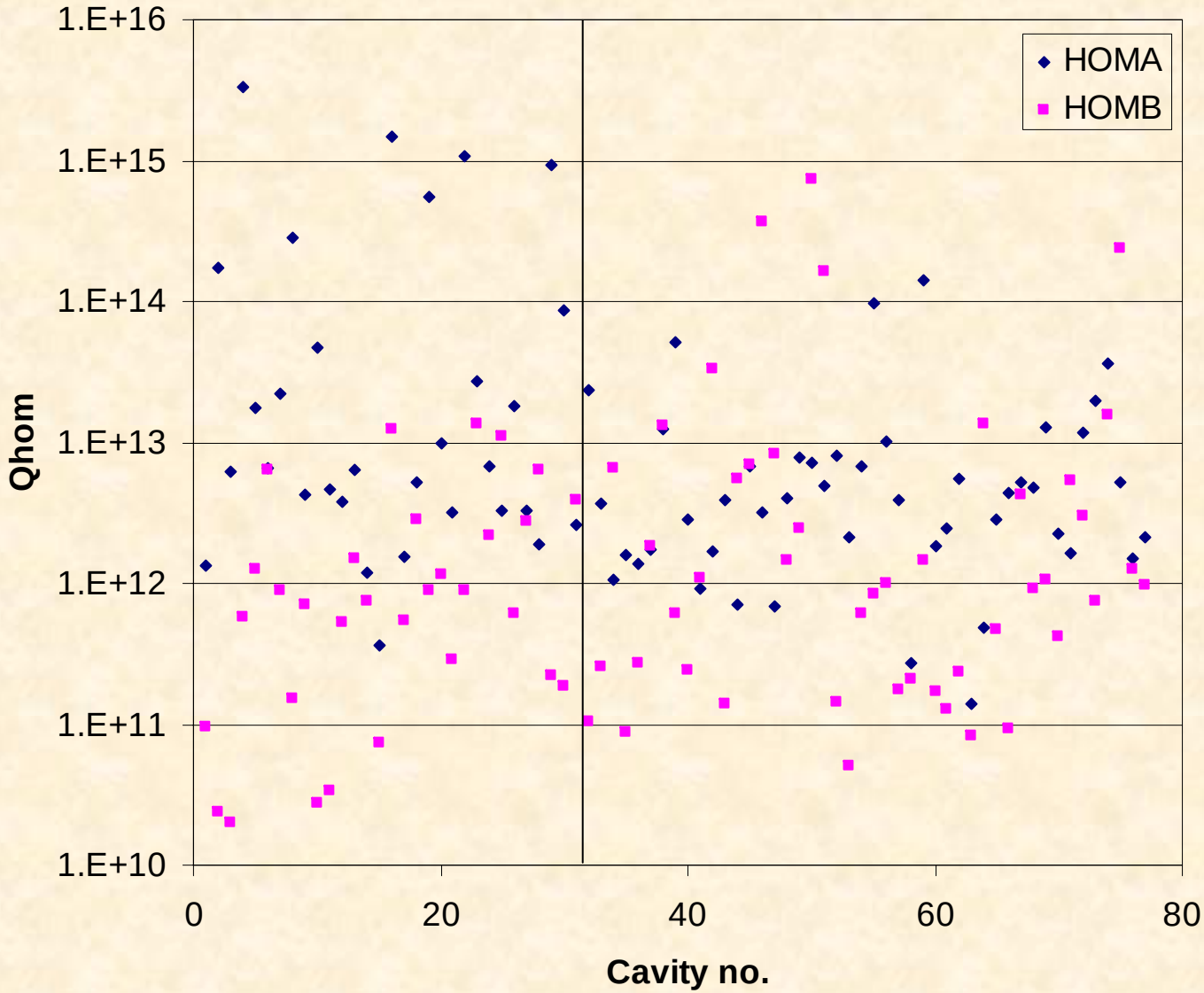


FT End
Some are Screwed,
Some are soldered



HOM cable inside cryomodule
Inner conductor; thermally floating
Outer conductor; strapped

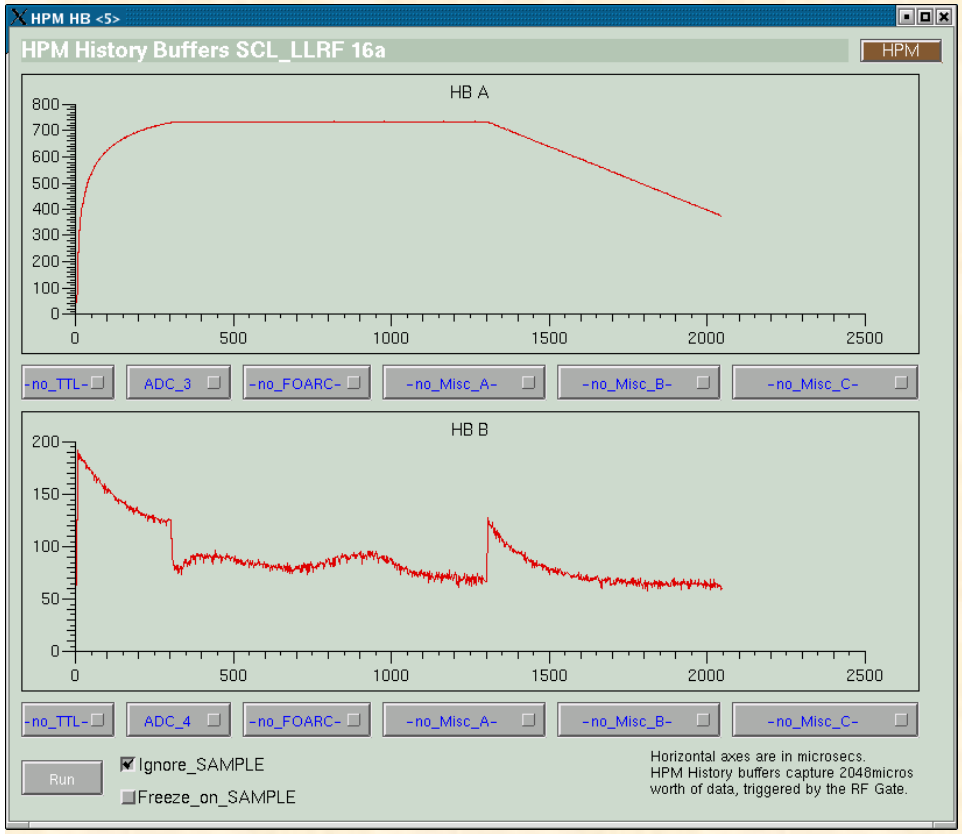
HOM Qex's (low power measurement)



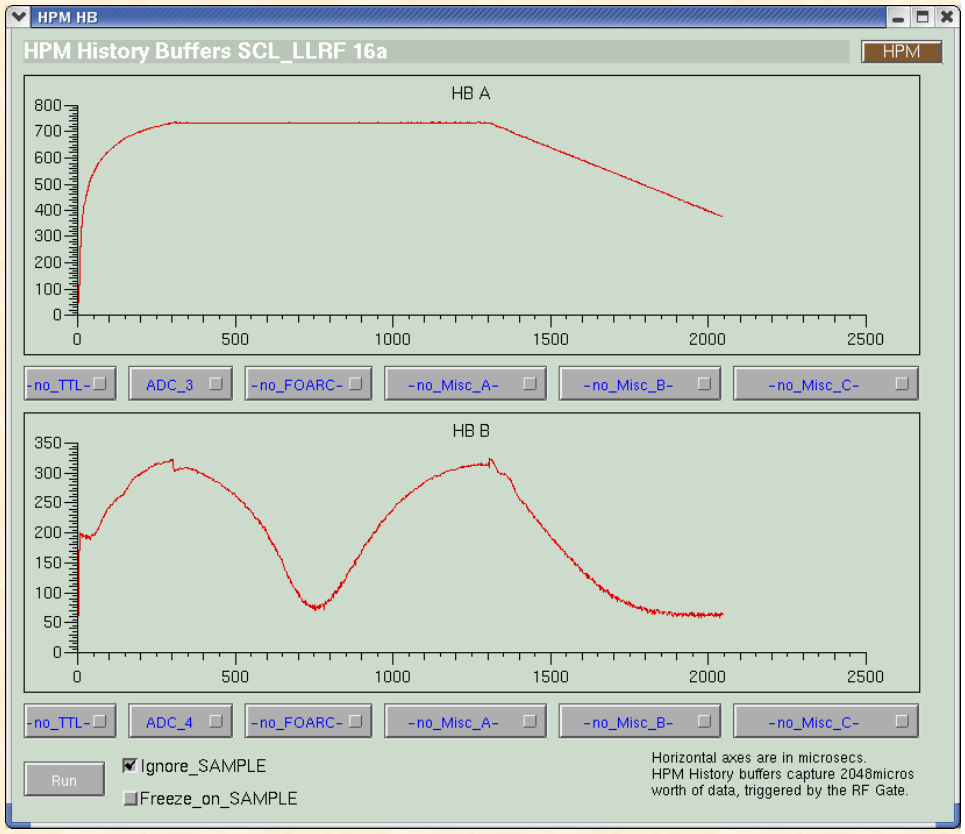
Case (I)

Same cavity at the same gradient

1 Hz

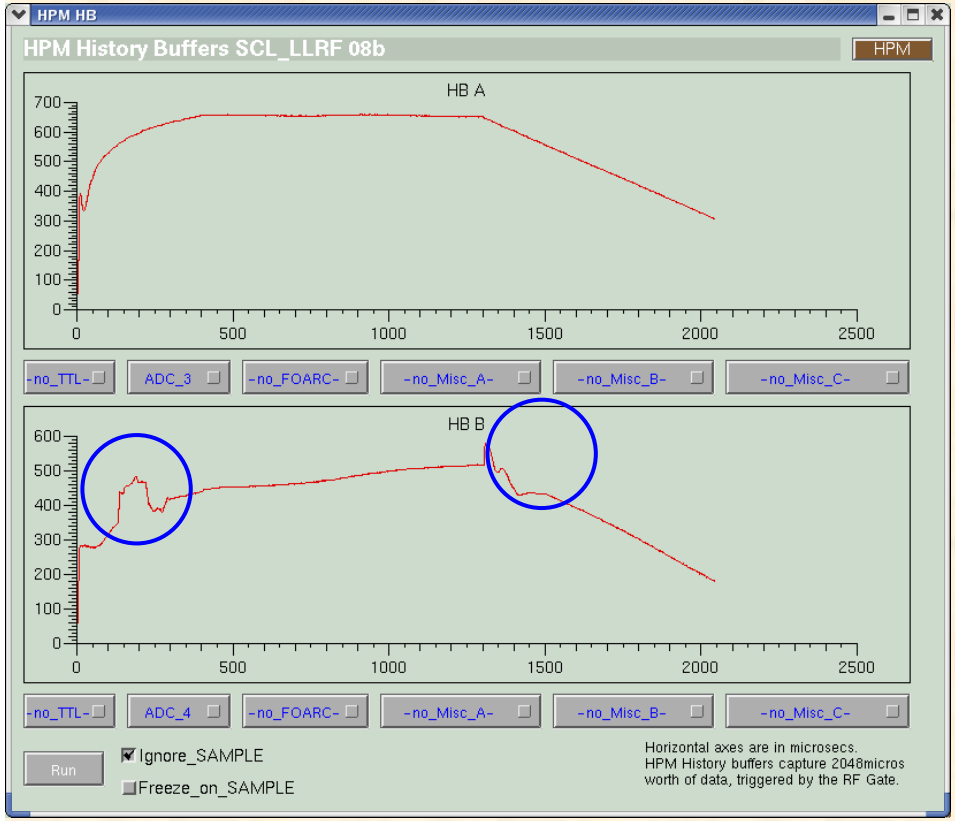


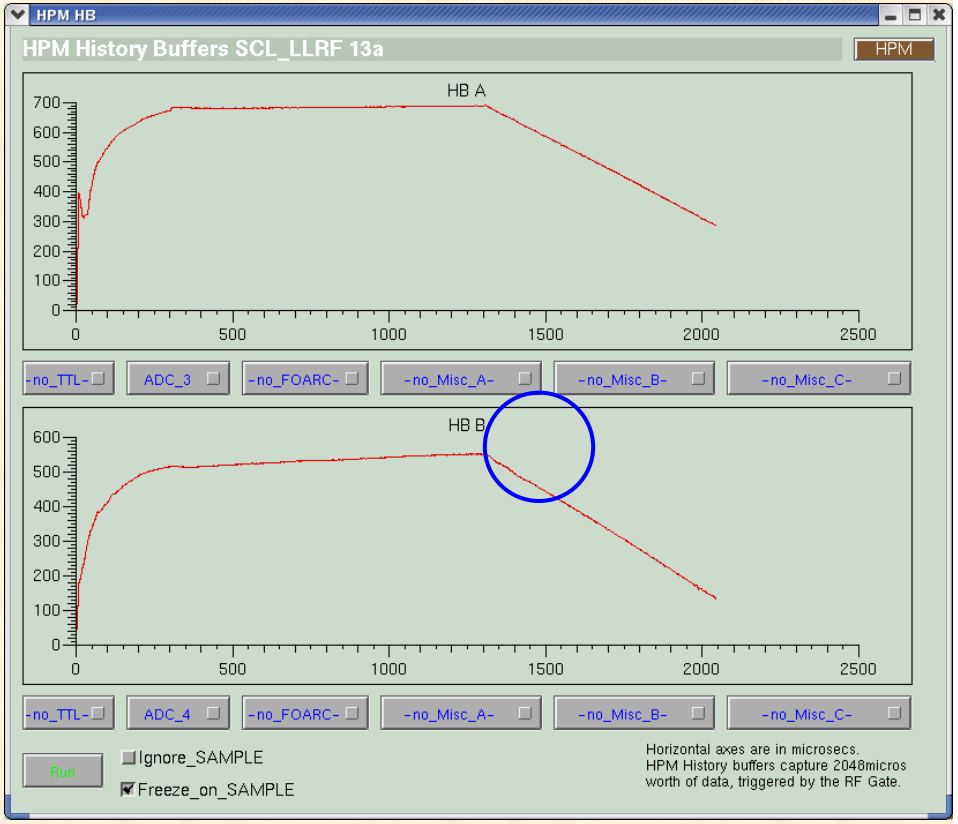
10 Hz



Case (II)

Electron Loading

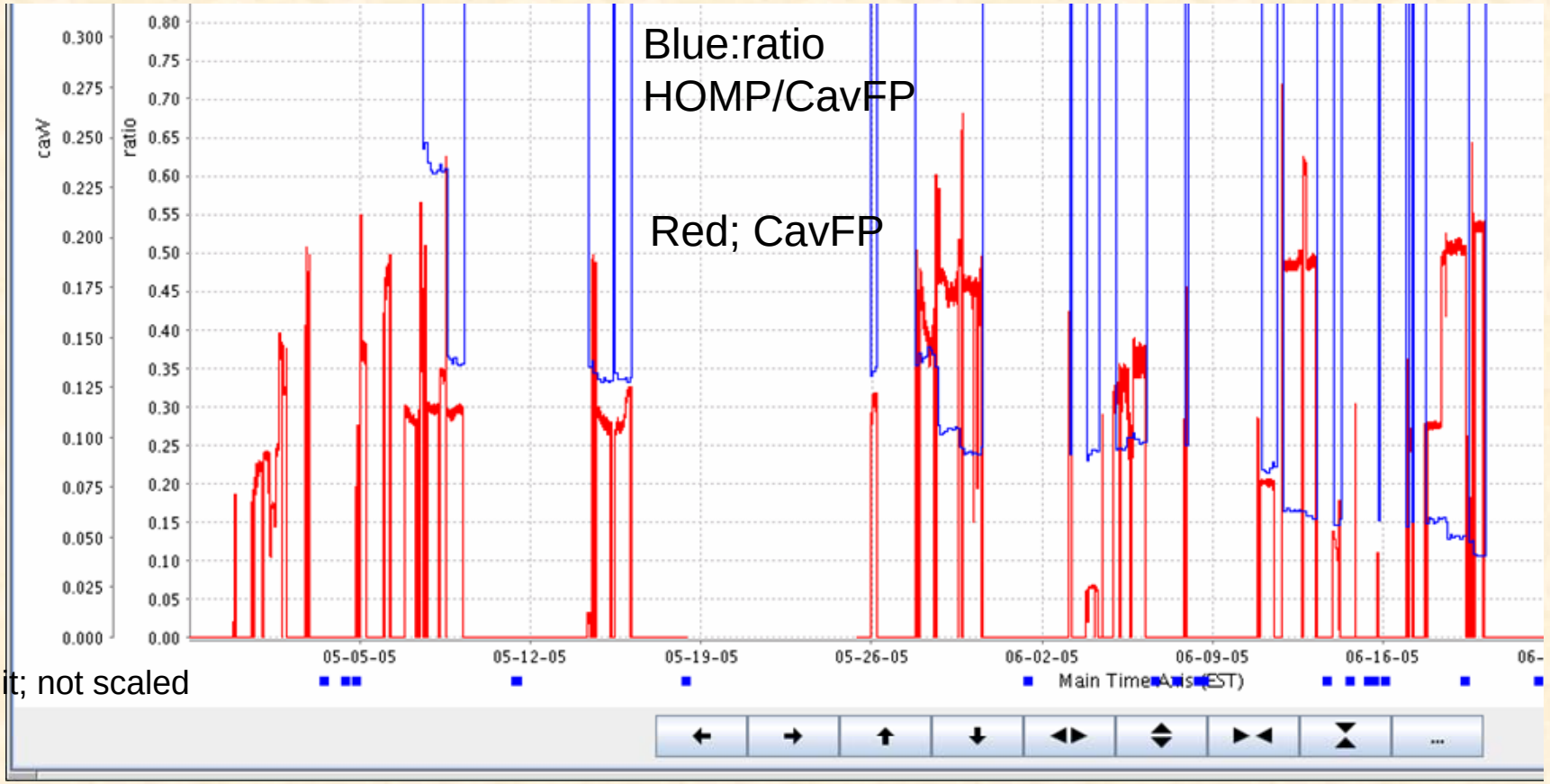




It is not clearly seen here, but observed big spikes only from HOM signals (blue circled)
→ vacuum excursion (trip)

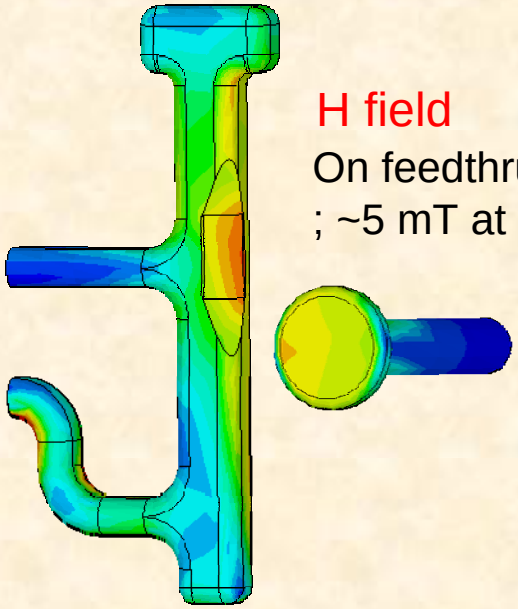
Case (III)

Coupling changes



Unit; not scaled

Possible Causes

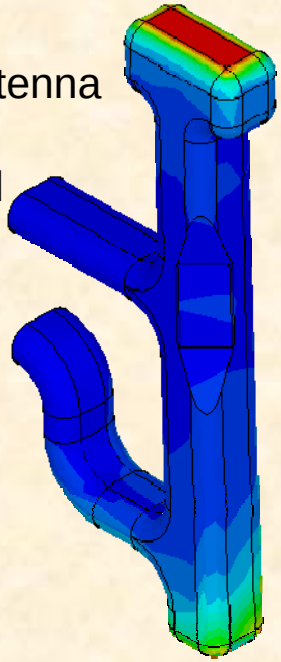


H field

On feedthru tip (Cu)
; ~5 mT at nominal flat field

E field

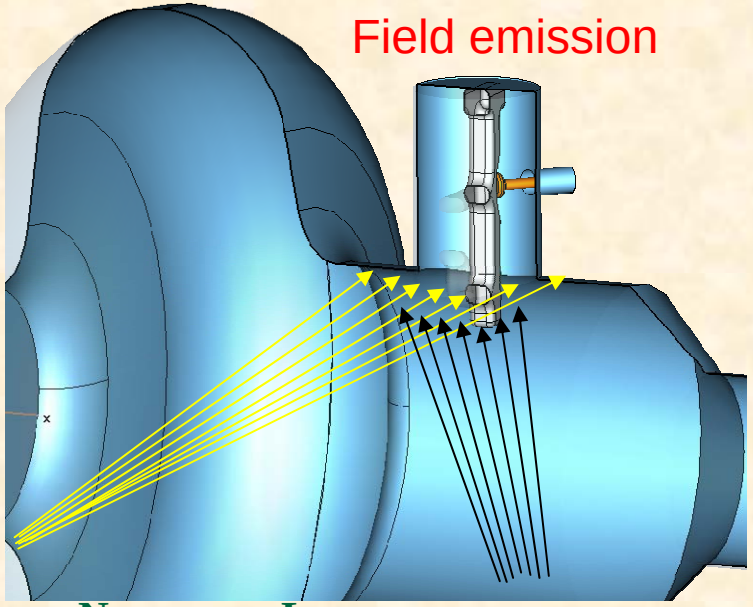
At both ends of antenna
~10 MV/m
at nominal flat field



Field enhancements

Field tilt
gap distance uncertainty

Field emission



Local Vacuum

Warm (hot) feedthrough
Leak

Surface Cleanness

Electron loading

Options for HOM coupler

Option1

More robust HOM couplers
are being developed.

Jlab; SC feedthru
- Feedthru w/ Sapphire insulator
- Feedthru tip geometry
- Additional cooling

DESY; SC feedthru
- Nb tip attached to HOM antenna

Option2

If HOM coupler is not an essential device, we can think of removing it.

Physics concerns are still same
No beam dynamic issue (D. Jeon)
HOM power issue; higher beam current
but statistically about same

Major Concerns (other than HOM damping)
Evaporation of Cu
Damaging ceramic
Degradation of cavity performance

Benefit
vs.
Risk, Statistical reliability & impact on operational availability

Studies are under progress including prototype test