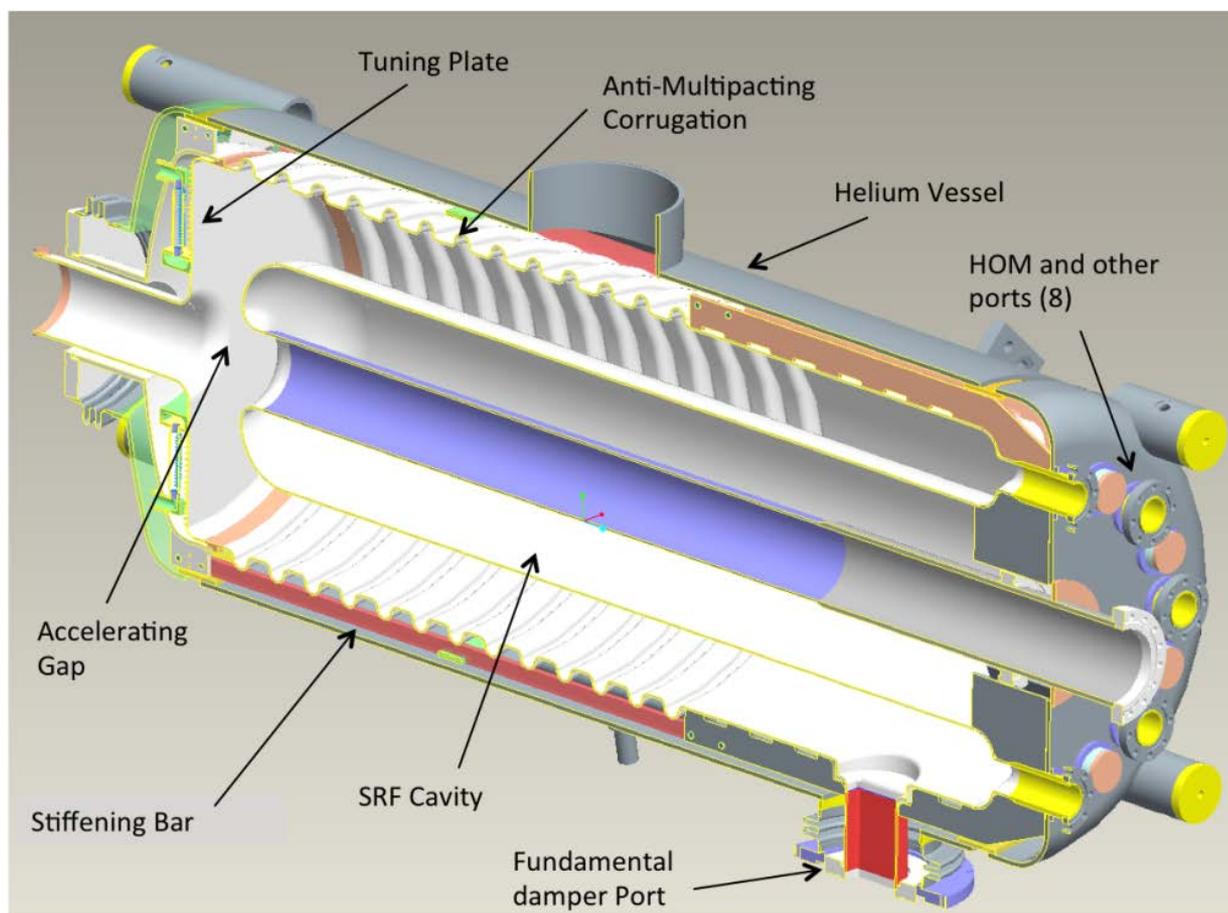


# 56 MHz SRF Cavity HOM Study

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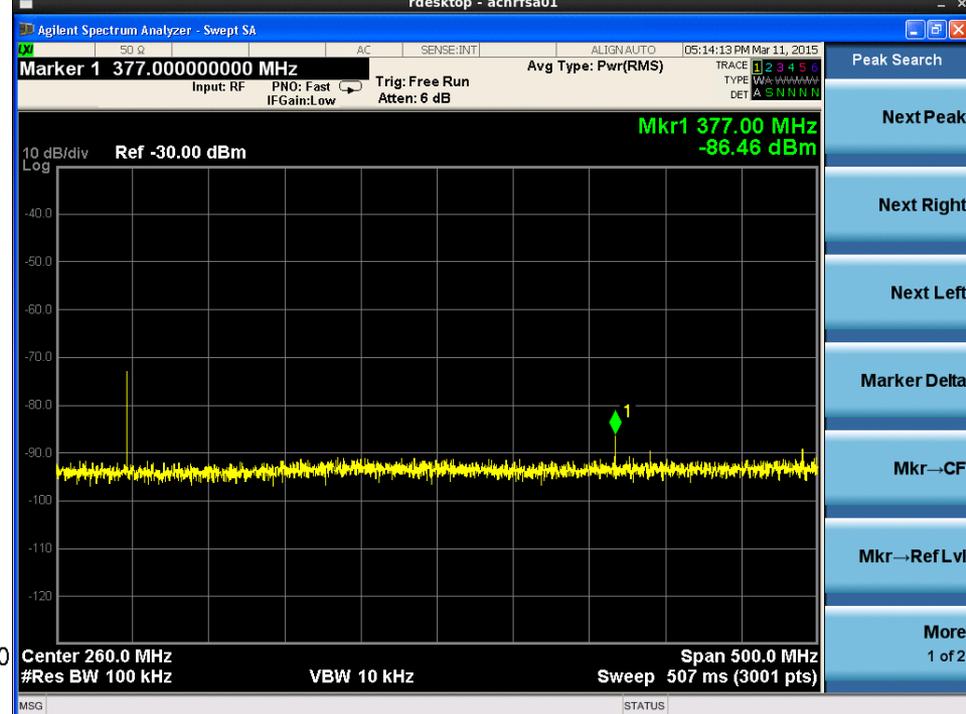
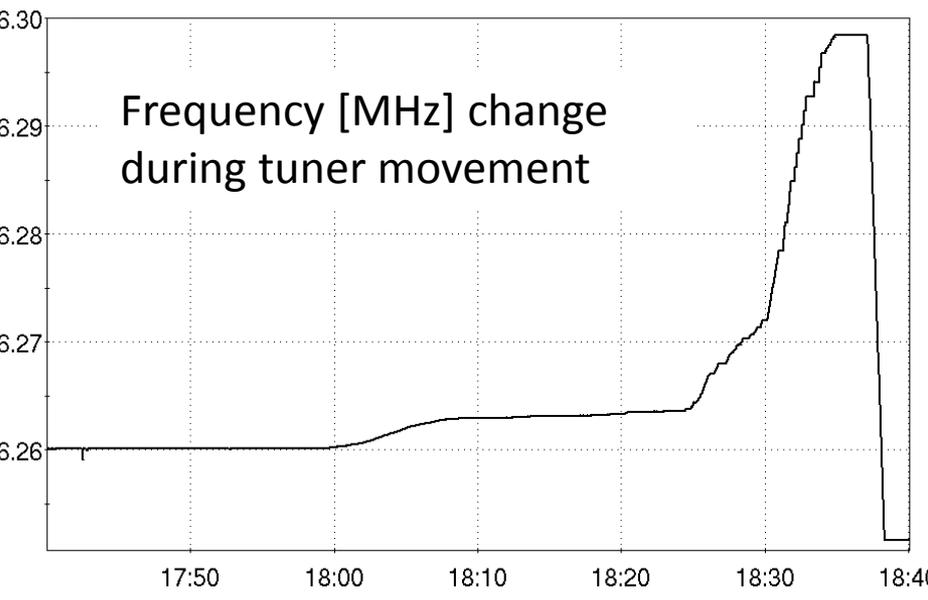
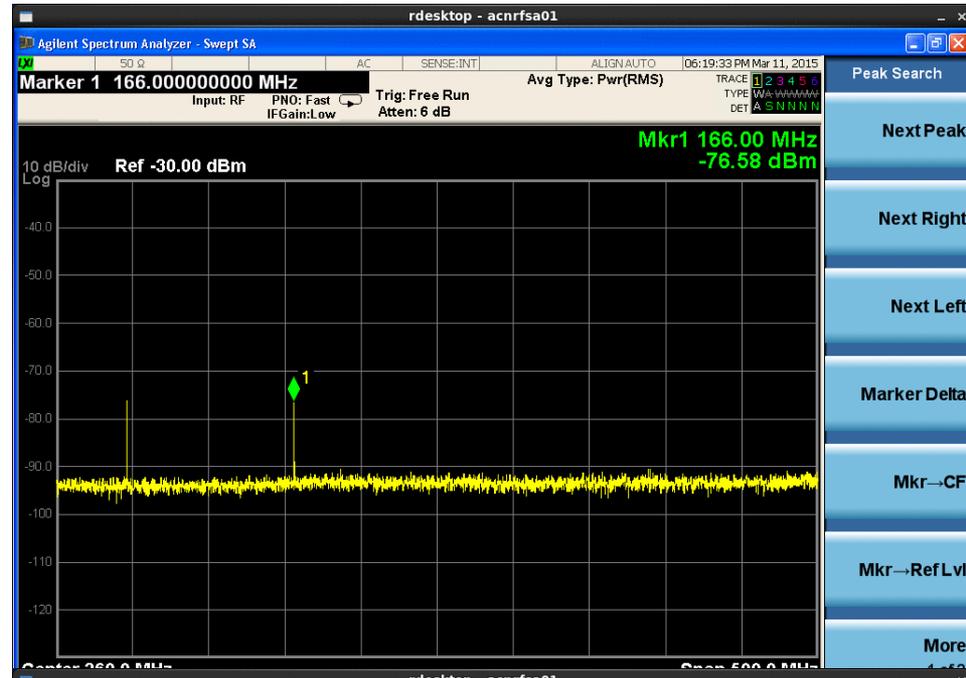
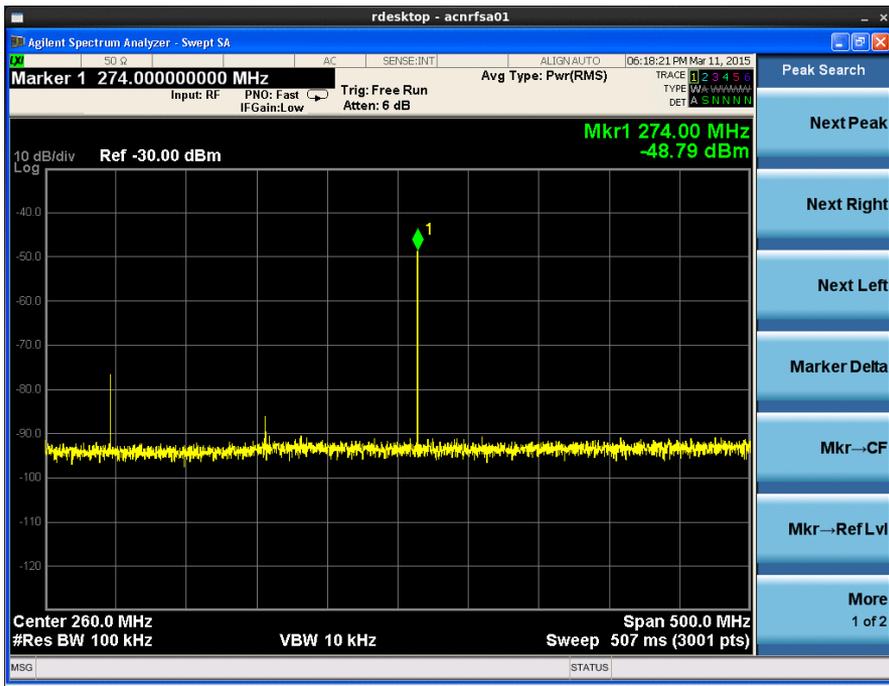


Mode #	Freq [MHz]	Total Tuning [kHz]
1	56.3126	46.5
2	166.233	848.4
3	273.7679	299.2
4	376.7558	447.0
5	474.2038	420.5

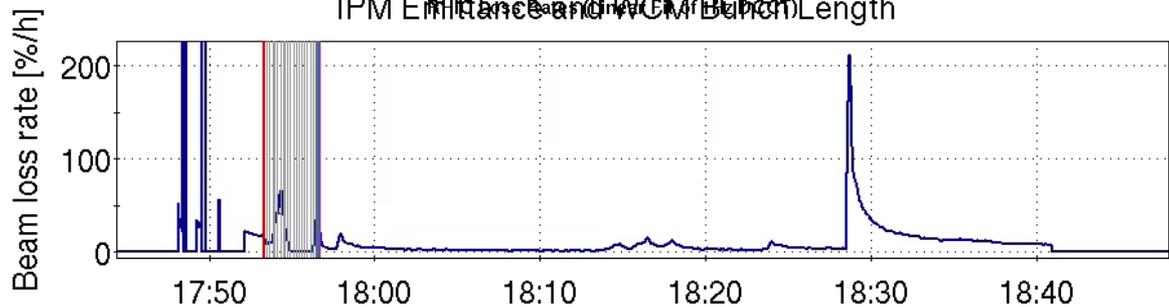
# Cavity Experiment with Beam

- APEX on March 11, 13:00-19:00
- 5 successful fills, with two at injection and three at store.

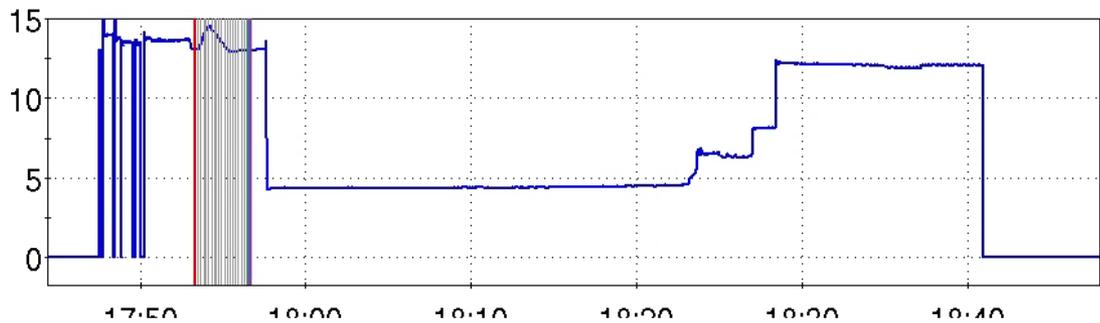
Fills	1	2	3	4	5
Energy	Injection	Injection	Store	Store	Store
Total intensity (blue/yellow)	2.28e12 2.30e12	2e12 1.9e12	2.2e12 2.2e12	5.8e12 0	2.4e12 0
Bunch number (blue/yellow)	12x12	12x12	12x12	28x0	11x0
Cavity voltage at end of fill [kV]	500	6	2	0.8	15
What we did	Pulled out FD, observe beam while moving tuner towards resonance	Turned on reset in RF for cavity to line up with RHIC after turned on	Bunch is much shorter after rebucketing. Moved tuner with freq scan ~3.8kHz. Cavity is 40kHz below resonance	Moved tuner slowly towards resonance	Moved tuner even slower with lower bunch intensity, swept through full tuning range.
What we observed	Longitudinal instability after pulling out FD	More stable after pulled out FD, but beam is very unstable at end	Beam had large degradation twice as tuner moved	Observed 474MHz, 377 MHz, 167MHz HOMs came up in power on the spectrum analyzer	Observed all four monopole HOMs below 500MHz showed up with the full travel of tuner, no dipole or higher observed.



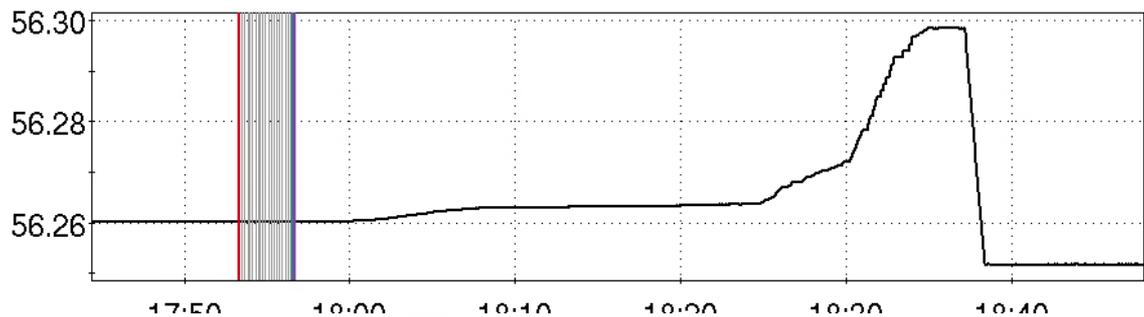
IPM Emittance and WCM Bunch Length



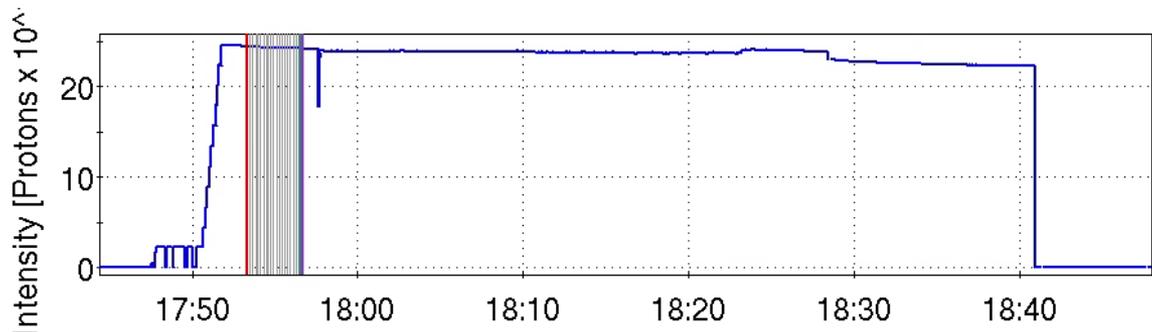
Beam loss rate [%/h]



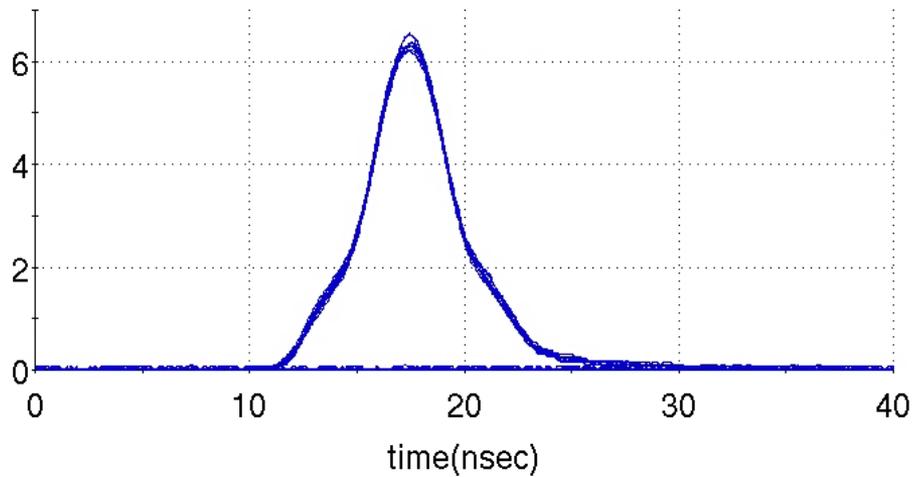
Bunch Length [ns]



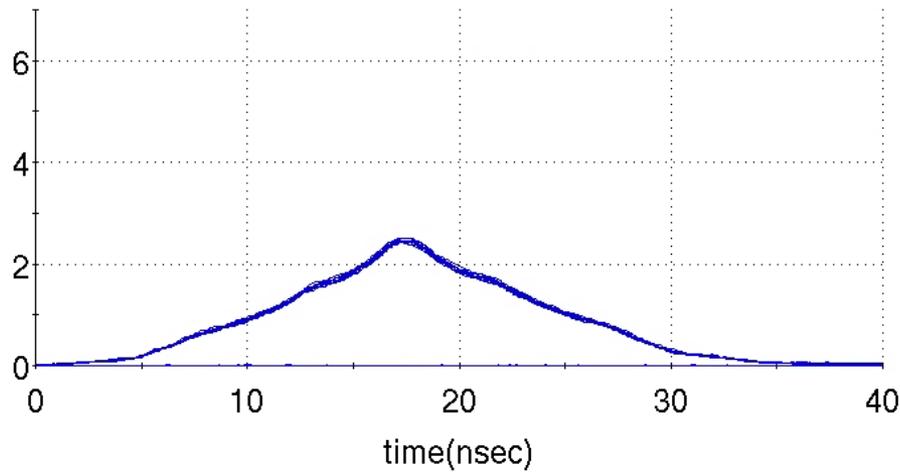
Cavity Freq [MHz]



Proton Intensity [x10<sup>11</sup>]



Beam profile **before**  
we swept through  
multiple (5) HOM  
resonance lines



Beam profile **after** we  
swept through  
multiple HOM  
resonance lines

# Summary

- The effect from Fundamental damper extraction to the proton beam is negligible, with feedback loop turned on.
- The cavity frequency sweeps through first four monopole HOM resonance lines within the full tuning range.
- No observation of excited dipole/quadrupole HOMs.
- Beam is affected greatly by the excited HOMs in the cavity.
- We need HOM damper(s).