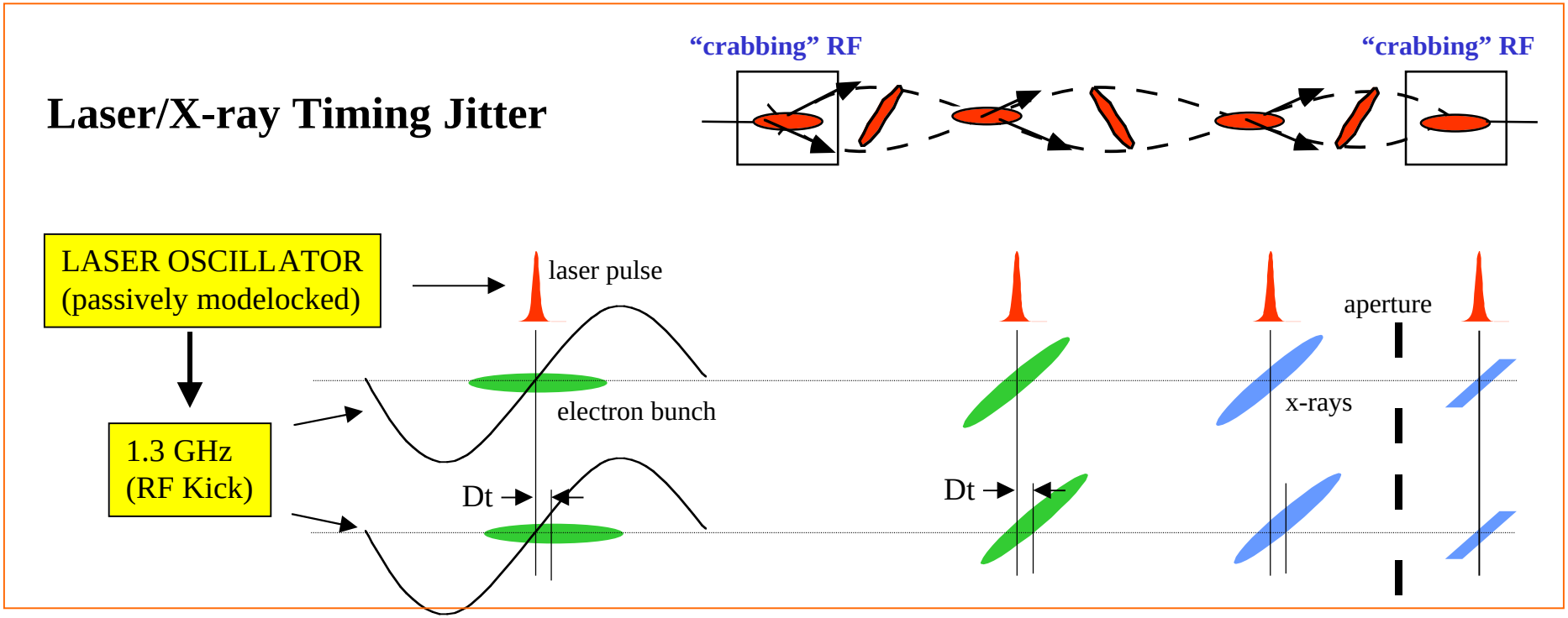
Synchronization of optical and x-ray pulses



Cavity stability

Superconducting RF structures typically have loaded Q's ~ 10^6

Resulting narrow bandwidth ~ 100 Hz

Similar parameters for our deflecting cavities

The cavities are thus sensitive to mechanical vibration (as well as Lorentz force detuning and ponderomotive oscillations)

Microphonics

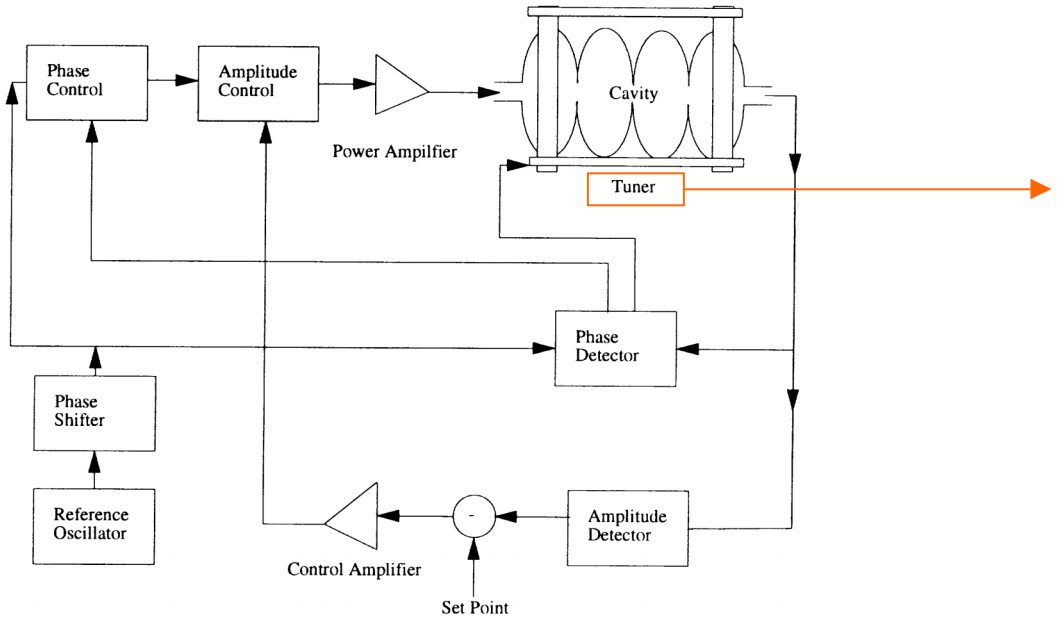
- Transmition of vibrations through the beamline, ground, supports, cryostat - to the cavity.
  - heavy machinery
  - vacuum pumps and compressors
  - pressure variations
  - boiling helium

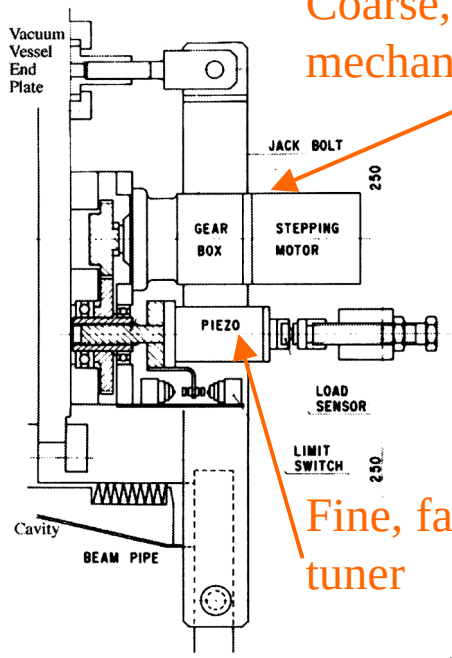
Cavity tuning

Cavity mechanical vibration modes are driven by the noise sources.

The resulting cavity deformations change the resonant frequency of the structure, resulting in phase and amplitude variations of the accelerating field.

This amplitude and phase jitter must be reduced by mechanical design constraints, active control of the resonant frequency,and rf feedback





Coarse, slow, mechanical tuner

Fine, fast, piezo tuner

CEBAF upgrade cavities

1.497 GHz, 7-cell structures, 12.5 MVm^{-1}, Q_0 $6.5x10^9$

MICROPHONICS TESTING OF THE CEBAF UPGRADE 7-CELL CAVITY
G. Davis, J. Delayen, M. Drury, T. Hiatt, C. Hovater, T. Powers, J. Preble,
TJNAF, Newport News, VA 23606, USA
PAC2001, Chicago, 2001

Measure FM of the cavity 1.5 GHz resonant mode due to microphonics:

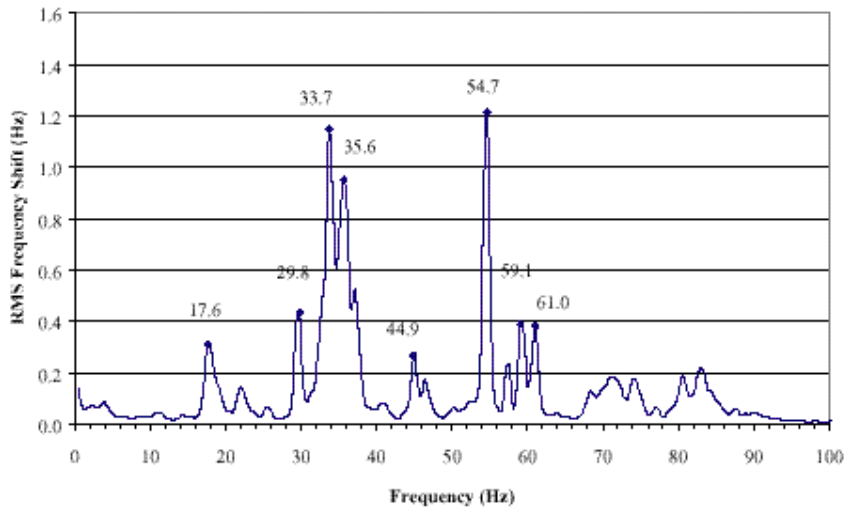


Figure 2: Cryomodule Response, Background Vibration.

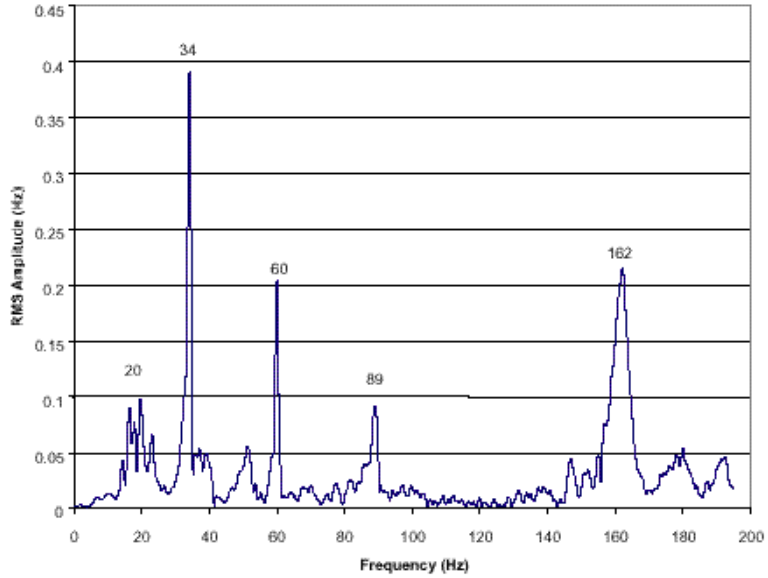


Figure 6: Cryomodule Impulse Response.

Integrate over spectrum to obtain rms frequency fluctuations of 2.5 Hz