Preliminary Results from First Blade Tuner Tests in HTS

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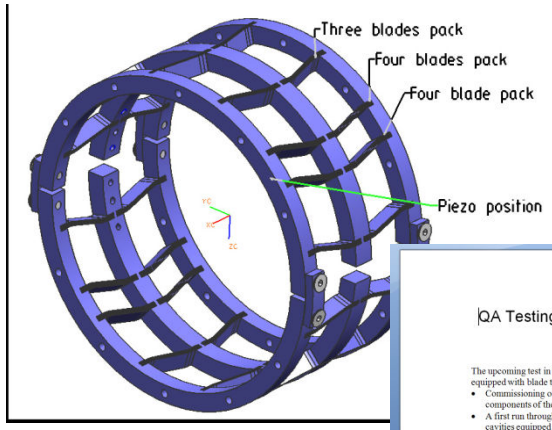
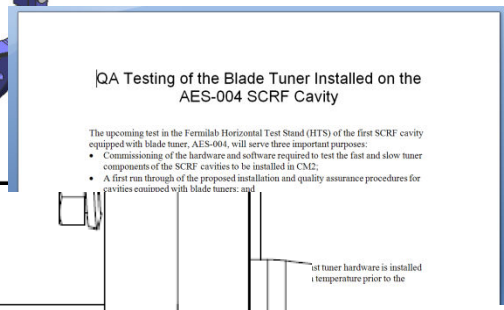
QA Testing of CM2 Tuners

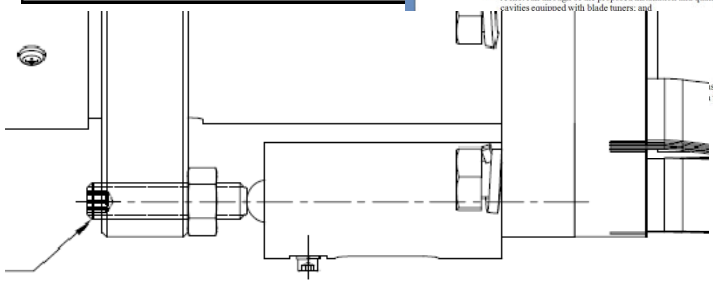
- CM2 cavities will be equipped with a coaxial blade tuner to limit Lorentz Force Detuning at high gradients
  - Tuner developed by INFN/Milan
  - Piezo mounts modified by FNAL
- First CM2 cavity has been undergoing testing in HTS
- Objectives
  - Commission new test system
  - Evaluate and finalize test proposed acceptance criteria for CM2 tuners

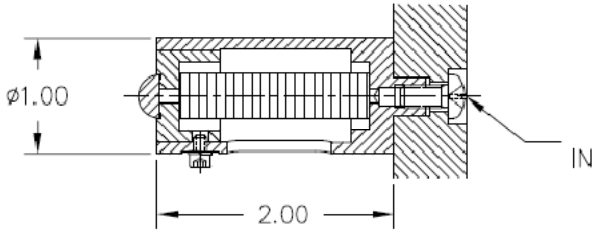



QA Testing of the Blade Tuner Installed on the AES-004 SCRF Cavity

The upcoming test in the Fermilab Horizontal Test Stand (HTS) of the first SCRF cavity equipped with blade tuner, AES-004, will serve three important purposes:

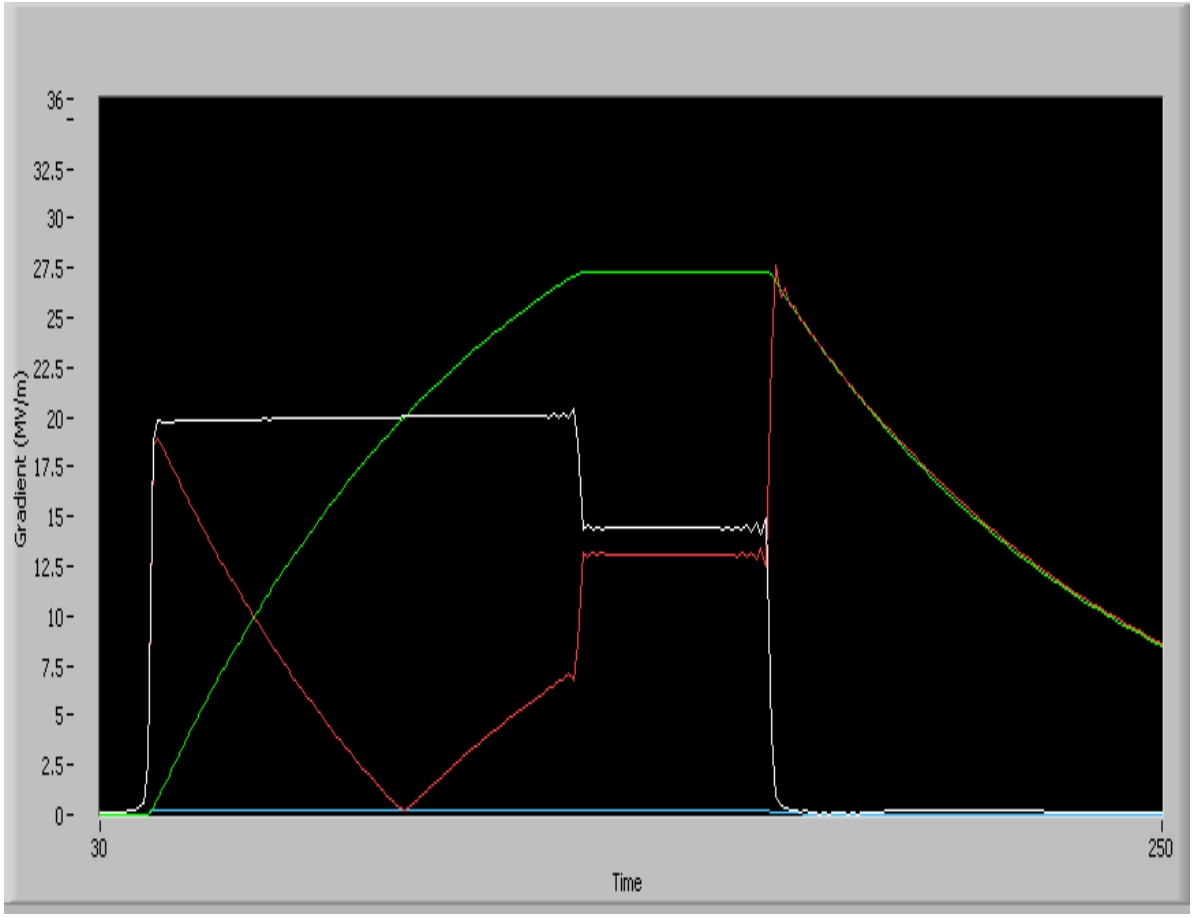
- Commissioning of the hardware and software required to test the fast and slow tuner components of the SCRF cavities to be installed in CM2;
- A first run through of the proposed installation and quality assurance procedures for cavities equipped with blade tuners; and





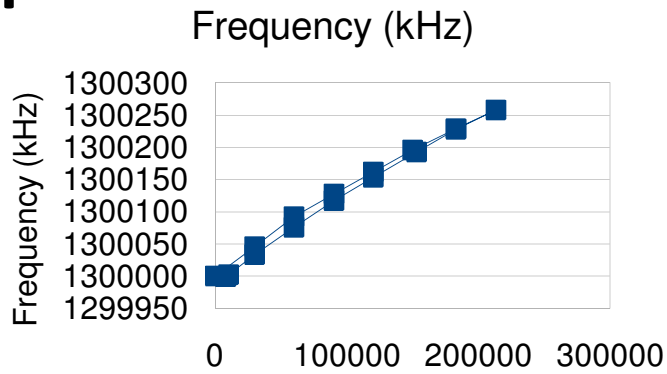
Test System Commissioning

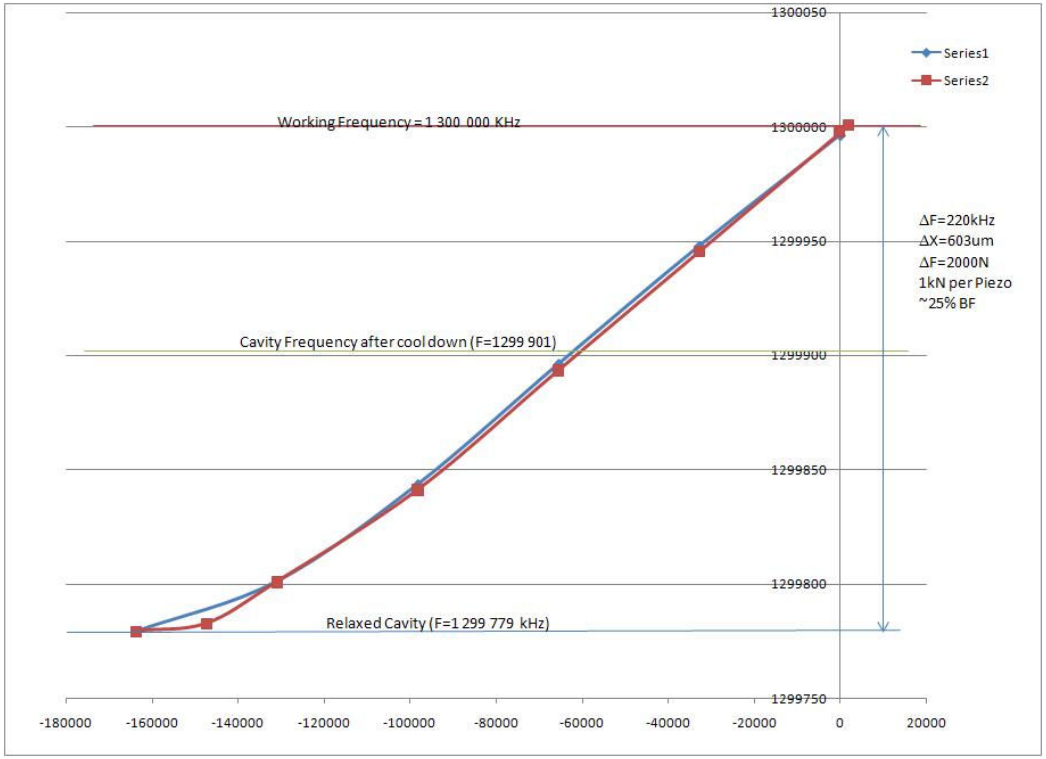
- Can calculate dynamic detuning from LLRF signals
- Need to check and monitor the LLRF signals for
  - Contamination
  - Saturation
  - Linearity
- Residual uncertainty after correction is a few percent



Slow Tuner Response

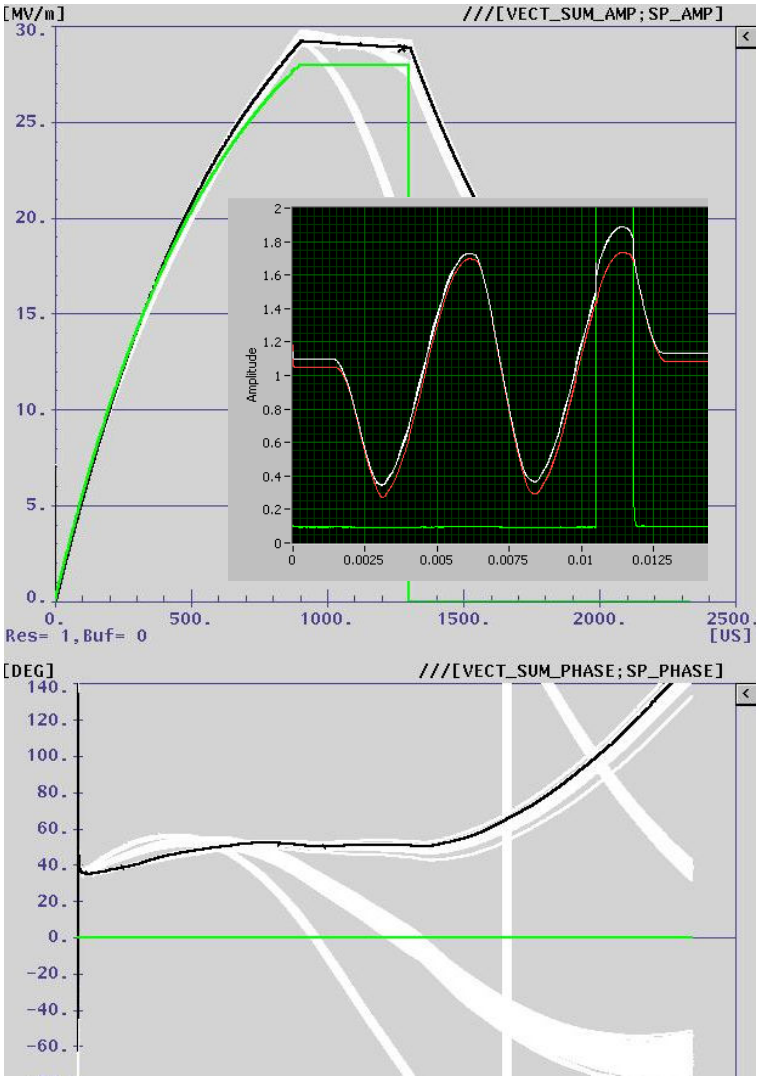
- Run the stepper motor and record the resonant frequency
- Warm cavity tuned approximately 0.2 MHz higher than INFN recommendation
- During installation, the warm piezo preload was reduced to minimize stresses on the cavity and tuner during cool-down
- Tuner range and cold piezo preload still acceptable





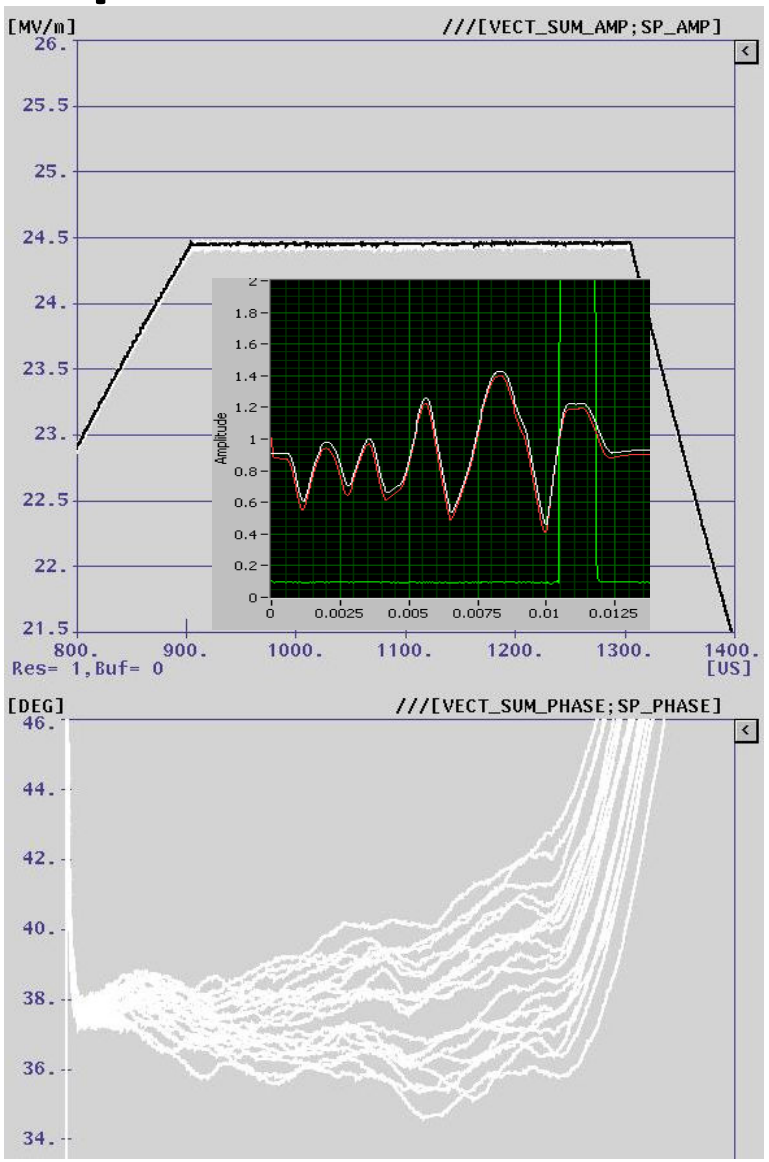
Fast Tuner Response

- Manual adjustment of pulse parameters
  - Flat phase during flattop at 33 MV/m
  - Demonstrates that cavity can be tuned at high gradients
- Appears that high gradients might require piezo with longer stroke
  - Need to compare to INFN results in more detail
- Somewhat subjective for acceptance testing

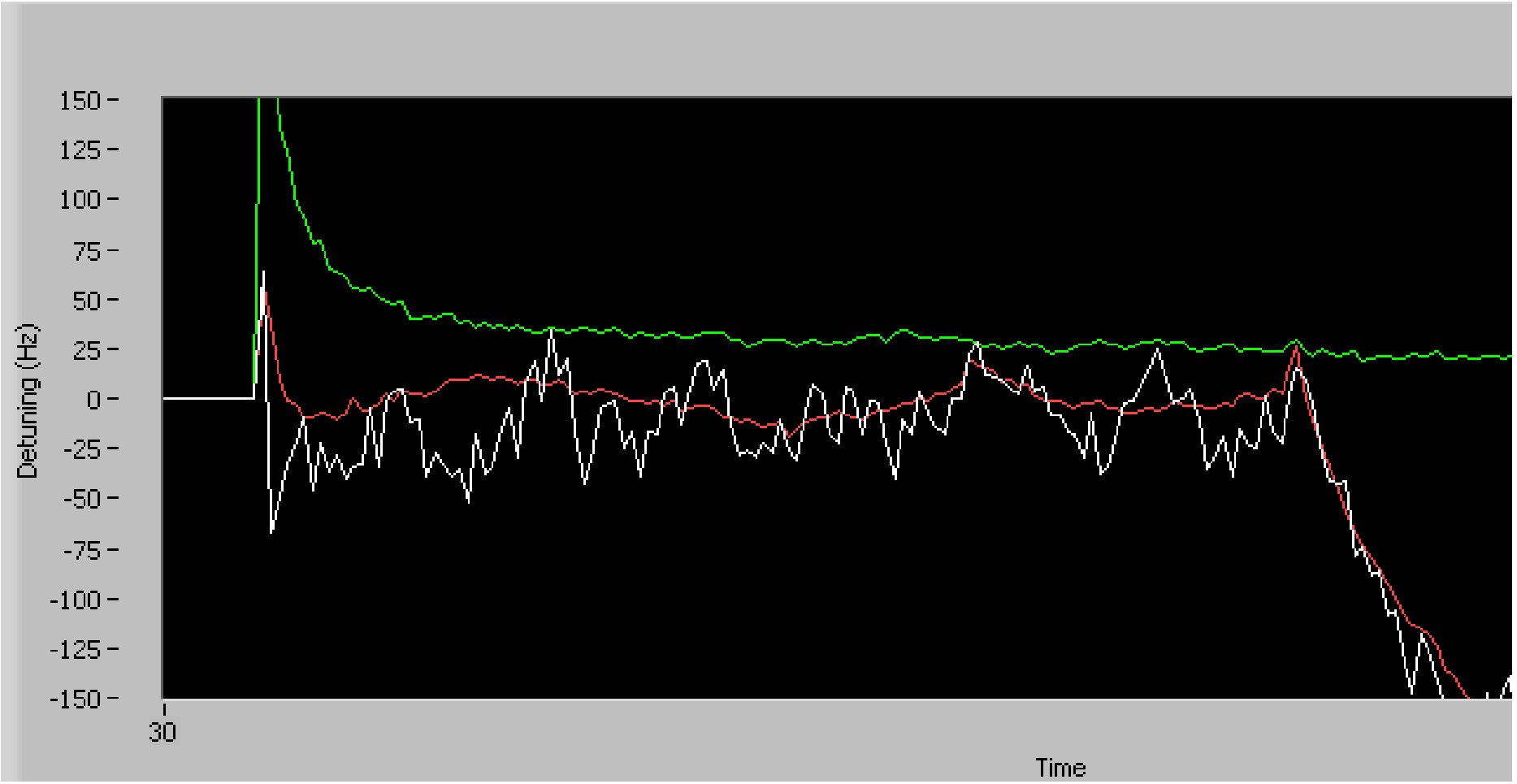


Adaptive LS Compensation

- Implemented an adaptive version of the LS procedure that worked successfully in CCII
- Able to maintain flat phase during both fill and flattop
- Able to track the resonance as cavity was ramped down from 27 MV/m to 20 MV/m and back up again
- May provide less subjective acceptance criteria
- Hope to repeat this at 35 MV/m today



LFD Compensation at 27 MV/m



Proposed Acceptance Criteria for CM2 Tuners

- Slow tuner response
  - Slope and range within INFN specs
- Fast tuner response
  - Maximum detuning during fill and flattop
    - Online monitoring looks very positive
  - LFD Detuning coefficient
    - Analysis in progress
  - Piezo to Detuning Transfer function
    - Still do not have acceptable TF measurements after several attempts
- Final criteria pending completed analysis of data

Summary

- Tuner test system successfully commissioned and operational
- Preliminary assessment of blade tuner performance is very positive
  - Able to limit detuning at 27 MV/m to less than about 25 Hz during both fill and flattop
  - Hope to repeat this at 35 MV/m
- May require piezo with longer stroke
  - Need to complete data analysis and compare our results with in more detail with INFN measurements
  - Would have no impact on tuner design