**1. INTRODUCTION**

As part of NL-12 decommissioning, tuner testing was conducted on cavities 1 and 2 to determine the tuning sensitivity and backlash with planetary gear box added to the original CEBAF tuner system (JLAB-TN-08-056). Now the same test is carried out on C50-CM7 Cryomodule which is being commissioned. The input test data is the same as the previous experiment (JLAB-TN-08-056). Thus with similar input conditions it is possible to compare the performance of the gear box mechanism on the installed commissioned device with a decommissioned device.

**2. PERFORMANCE OF GEAR BOX MECHANISM ON C50-CM7 CRYOMODULE**

The difference between the frequency values from the experiment and the pressure compensated frequency is negligible. Hence the frequency values from the experiment have been taken to plot the graphs.

a. **Cavity 1**

![Figure 1: Frequency (MHz) Vs Microsteps for Cavity 1](image-url)

Figure 1: Frequency (MHz) Vs Micro steps for Cavity 1
With the gear box installed the slope is 0.03 Hz/µstep and without gear box is 0.09 Hz/µstep. The hysteresis with the gear box installed on tuner mechanism is one third of the value without the gear box installed. Thus the 3:1 ratio stepper motor is performing as expected.

b. Cavity 2

With the gear box installed the slope is 0.03 Hz/µstep and without the gear box installed is 0.09 Hz/µstep. The hysteresis with the gear box installed on tuner mechanism is one third of the value without the gear box installed. Thus the 3:1 ratio stepper motor is performing as expected.

![Figure 2: Frequency (MHz) Vs Microsteps for Cavity 2](image-url)
3. COMPARISON OF GEAR BOX PERFORMANCE BETWEEN C50-CM7 AND C50-NL12 CRYOMODULE

a. Cavity 1

The major concern during the test conducted on NL-12 cryomodule was the large amount of backlash present at the time of change in the direction of rotation of the motor. So the test was conducted on the C50-CM7 which has all commissioned parts installed in it. The previous test was performed on NL-12 Cryomodule which is a decommissioned cryomodule as some parts are not functioning according to required specifications.

The results for the tests performed on cavity 1 for the two cryomodule are compared in Figure 3. The curve for NL-12 Cryomodule with gear box shows a large amount of backlash at direction reversal, while the curve for CM7 cryomodule with gear box shows an acceptable...
amount of backlash. This indicates that the large amount of backlash in the decommissioned cryomodule is not because of the gear box. It could be a result of some improperly functioning parts in the decommissioned cryomodule.

b. Cavity 2

Figure 4: Comparison between C50-7 and C50-NL-12 Cryomodules on Cavity 2

Figure 4 shows data for the test performed on cavity 2. The data for NL-12 and CM7 cryomodules with and without gear box is available. Similar conclusion can be drawn from the plots. Large backlash is observed on the decommissioned cryomodule while commissioned cryomodule shows negligible backlash.
4. CONCLUSION

The 3:1 gear box facilitated three times higher torque output with an increased number of rotations to achieve the same frequency change. This increases the sensitivity of the results.

The backlash produced is a result of some improperly functioning parts in the decommissioned Cryomodule. The gear box has no impact on the backlash produced.