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| **C75 Warm Tuning Procedure during Cryounit Assembly** |
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| **Document Owner:** | John Fischer | **Department Owner:** | SRF Ops |
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# Purpose and Scope

*This procedure contains the necessary steps and reference information to properly setup the C75 tuners during Cryounit assembly. This effort uses the VTA 2K cold cavity frequency, the attached calculation spreadsheet, and several article dimensions to define where to set the tuner limit switches and hard stops during final adjustment. This preset is intended to correct for the warm to cold shift referred to in the Cavity Recipe. It assumes the Cavity tuning sensitivity is similar to the CEBAF and C50 cavities. See the attached Documents and Tech Note for further details.*

***NOTE: the tuning sensitivity values used for setting the limit switches (5 kHz/mil) and hard stops (40 kHz/mil) are rough estimates obtained by scaling the C50 values with some measured values of cavity tuning sensitivity. Such values will be updated in a future refined version of the procedure, once more data from C75 Cryomodule tests become available.***

# References

These are hyperlinked documents which will be used for reference and calculation as this Procedure is performed.

[C75 Tuning Sensitivity Tech Note](https://jlabdoc.jlab.org/docushare/dsweb/Get/Document-211761/C75%20cavity%20stiffness%20and%20tuning%20sensitivity_TN%2017-017.pdf)

[C75\_CavityFrequencyRecipe](https://jlabdoc.jlab.org/docushare/dsweb/Get/Document-211747/C75_CavityFrequencyRecipe.xls)

[C75 Tuner Offset Calculation Worksheet](https://jlabdoc.jlab.org/docushare/dsweb/Get/Document-211800/C75_TUNER%20OFFSET%20CALCULATION%20WORKSHEET.xls)

[C75 NWA Worksheet](https://jlabdoc.jlab.org/docushare/dsweb/Get/Document-211801/C75%20NWA%20Worksheet.jpg)

[JLAB-TN-06-006](https://jlabdoc.jlab.org/docushare/dsweb/Get/Document-211751/JLAB-TN-06-006.pdf)

[C50 Cavity Frequency Recipe-R3](https://jlabdoc.jlab.org/docushare/dsweb/Get/Document-211749/CavityFrequencyRecipeR3%20%281%29.xls)

# Terms and Definitions

NWA- Network Analyzer

C75- New cell shape cavities capable of 75 MeV in a completed CM

C50- Refurbished CEBAF C20 Cryomodule 50 MeV

C20- Original CEBAF Cryomodule

Cavity Frequency Recipe- Frequency tracking during processes

# Roles and Responsibilities

The following roles have responsibilities described in this document. The following actions are to be performed by knowledgeable, authorized Technicians only. Consult the Group Lead for details.

# Procedure

***C75 Warm Tuning Procedure***

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|  **1** | Retrieve the cold VTA Frequency numbers from the log file/traveler: **C75-CPR-VTRF** |
| **2** | Calculate the limit switch and hard stop offsets using the linked spreadsheet. [C75 Tuner Offset Calculation Worksheet](https://jlabdoc.jlab.org/docushare/dsweb/Get/Document-211748/2007_C50_FREQ%20TRACKING.xls)**LIMIT SWITCH**1. Measure nominal switch width (~0.6”) and record.
2. Take cold VTA frequency value and subtract 1497MHz.
3. Divide this difference by 5 (kHz/mil). This equals the amount of limit-switch-disc offset from center.
4. Example: 1497.344MHz – 1497MHz = 0.344MHz = 344kHz
* = (344kHz) / (5kHz/mil) = 0.184” from center.
1. Calculate offset from nominal switch width center.
* 0.6” - 0.125”(thickness of G-10 disc) = 0.475”
* 0.475” / 2 = 0.2375”
* 0.2375” – 0.0685” (from above) = **0.169”** from inner switch
* 0.2375” + 0.0685” = **0.306”** from outer switch

**HARD STOP**1. Measure nominal hard stop width (~0.75”) and record.
2. Take cold VTA frequency value and subtract 1497MHz.
3. Divide this difference by 40 (kHz/mil); this equals the hard stop offset from center.
4. Example: 1497.344MHz – 1497MHz = 344kHz
* 344 kHz / 40 (kHz/mil) = 0.0086" from center.
1. Calculate offset from nominal hard stop width:
* 0.750”- 0.5” (strut mount plate width) = 0.250”
* 0.250”/2 = 0.125”
* 0.125” - 0.0086” (from above) = **0.116”** from inner stop
* 0.125” + 0.0086” = **0.134”** from outer stop
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| **3** | Install RF waveguide onto Dogleg of appropriate cavity. |
| **4** | Hookup Network Analyzer to cavity. |
| **5** | Record warm frequency. Acceptable range 1494.980-1494.780. |
| **6** | Adjust tuner to remove slack from the assembly. This may require several turns of drive screw.1. Turn the drive screw in the clockwise direction to lower the cavity frequency. This assumes the cavity operating range is below the received value.
2. While monitoring the network analyzer, continue to turn drive assembly until noticeable frequency change is seen. (~25-50 KHz)
3. Once slack is removed from the tuner assembly, secure drive to prevent adjustment. Piece of tape should be adequate.
4. This is the point where all offsets are adjusted
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| **7** | Set hard stops with the larger value inboard of the strut spacer, cavity will be compressed for normal operation. Set spring tension (1.7”) after all hard stops have been set. |
| **8** | Set the limit switch, with the smaller value on inboard of G-10 spacer. |
| **9** | Repeat process to adjoining cavity.  |

# **Release and Revision History**

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| Rev # | Revision or update: | Effective: |
| A | Document has been adapted from C50  | 4/16/2020 |
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# **Approvals**

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