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| Traveler Title | C75 Warm Cavity RF Tuning Measurements |
| Traveler Abstract | This traveler collects data for the warm RF measurements and tuning of C75 cavities. |
| Traveler ID | C75-CAV-TUNE |
| Traveler Revision  | R3 |
| Traveler Author | Gianluigi Ciovati |
| Traveler Date | 23-Dec-20 |
| NCR Informative Emails | kdavis, forehand |
| NCR Dispositioners | gciovati,marhause |
| D3 Emails | gciovati,marhause, forehand |
| Approval Names | G. Ciovati | D. Forehand | F. Marhauser | K. Macha |
| Approval Signatures |  |  |  |  |
| Approval Dates |  |  |  |  |
| Approval Title | Author | Reviewer | Reviewer | Project Manager |

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| References | List and Hyperlink all documents related to this traveler. This includes, but is not limited to: safety (THAs, SOPs, etc), drawings, procedures, and facility related documents. |
| [Qext calculator](https://jlabdoc.jlab.org/docushare/dsweb/Get/Document-231010/Coupling-cal%20a.xls)Worksheet to calculate Qext | [CP-C75-CAV-TUNE](https://jlabdoc.jlab.org/docushare/dsweb/Get/Document-231187/CP-C75-CAV-TUNE.docx)C75 cavity tuning procedure | [Flatness Calculation](https://jlabdoc.jlab.org/docushare/dsweb/Get/Document-231011/Flatness%20Calculation.xls)Worksheet to calculate field flatness |  |  |
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| Revision Note |  |
| R1 | Initial release of this Traveler. |
| R2 | Added Qext for probes calibration and increased frequency of HOMs |
| R3 | Added links to Procedure and Worksheets, added field flatness field, revised target frequencies |

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| Step No. | Instructions | Data Input |
| 1 | Record Cavity Serial Number | [[CAVSN]] <<CAVSN>>[[TUNEdate]] <<TIMESTAMP>>[[Technician]] <<SRFCVP>> |
| 2 | Describe the cavity status (After fabrication, after chemical processing, after CMM, after VTA test, etc.) | [[CavStatus]] <<COMMENT>> |
| 3 | * Record frequencies of all five modes
* Perform a bead pull at the pi-mode resonant frequency and record the result as an excel graph on the local computer. (Always use a pull direction from the FPC to the field probe end)
* Upload the file
* Calculate the Field Flatness using the Flatness Calculation worksheet and enter the value
 | [[RecvdPiMode]] <<FLOAT>>MHz[[Recvd4Pi5Mode]] <<FLOAT>>MHz[[Recvd3Pi5Mode]] <<FLOAT>>MHz[[Recvd2Pi5Mode]] <<FLOAT>>MHz[[RecvdPi5Mode]] <<FLOAT>>MHz[[RecvdFieldProfile]] <<FILEUPLOAD>>[[InitFF]] <<FLOAT>> % |
| 4 | Measure the Qext of the FPC body in accordance with C75-CAV-TUNE procedure Record all FPC data | [[FPCRecvdQL]] <<FLOAT>>[[FPCRecvdAttenuation]] <<FLOAT>>[[FPCRecvdDetunedReflected]] <<FLOAT>>mU[[FPCRecvdResonantReflected]] <<FLOAT>>mU[[RecvdFPCQext]] <<SCINOT>> |
| 5 | Inspect cavity and all sealing surfaces for visible defects. Note any irregularities. A detailed inspection is done in a dedicated CMM traveler. | [[Incoming\_Insp\_Comments]] <<COMMENT>>[[Incoming\_Insp\_Complete]] <<TIMESTAMP>>[[Insp\_Complete\_Technician]] <<SRFCVP>> |

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| 6 | * Tune cavity to a frequency of 1495.200 MHz (+/- 100 kHz) with a field flatness of 95% or higher if the cavity was received just after fabrication.
* Tune cavity to a frequency of 1494.600 MHz (+50 kHz, -0 kHz) with a field flatness of 95% or higher if the cavity is ready for pair assembly.
* Record frequencies of all five modes after tuning
* Take a bead pull at the resonant frequency and record the result as an excel graph on the local computer. (Always use a pull direction from the FPC to the field probe end)
* Upload the file.
* Calculate the Field Flatness using the Flatness Calculation worksheet and enter the value
 | [[Tuned\_Pi\_Mode]] <<FLOAT>>MHz[[Tuned\_4Pi\_5\_Mode]] <<FLOAT>>MHz[[Tuned\_3Pi\_5\_Mode]] <<FLOAT>>MHz[[Tuned\_2Pi\_5\_Mode]] <<FLOAT>>MHz[[Tuned\_Pi\_5\_Mode]] <<FLOAT>>MHz[[Tuned\_Field\_Profile]] <<FILEUPLOAD>>[[TunedFF]] <<FLOAT>> %[[Cavity\_Tuned\_Comment]] <<COMMENT>>[[Tuning\_Technician]] <<SRFCVP>>[[Tuning\_Date]] <<TIMESTAMP>> |
| 7 | If the cavity is being prepared for a single-cavity test, calibrate the input and field probe antennae. The coupling configuration should be as follows:* Field probe from beamline, FPC side, Nb flange, QextFP=(1-5)e12
* Input antenna from beamline, HOM side, SS flange with pumpout, QextInput=(5-8)e9
 | [[QextInput]] <<SCINOT>>[[QextFieldProbe]] <<SCINOT>> |
| 8 | Tune FPC body to a Qext value of 2.0e7 +/- 15% in accordance with C75-CAV-TUNE procedure Record tuned FPC data | [[FPC\_QL]] <<FLOAT>>[[FPC\_Attenuation]] <<FLOAT>>[[FPC\_Detuned\_Reflected]] <<FLOAT>>mU[[FPC\_Resonant\_Reflected]] <<FLOAT>>mU[[FPC\_Qext]] <<SCINOT>>[[FPC\_Tuned\_QL]] <<FLOAT>>[[FPC\_Tuned\_Attenuation]] <<FLOAT>>[[FPC\_Tuned\_Detuned\_Reflected]] <<FLOAT>>mU[[FPC\_Tuned\_Resonant\_Reflected]] <<FLOAT>>mU[[FPC\_Tuned\_Qext]] <<SCINOT>> |

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| 9 | * Record Field Probe Feedthru Serial Number
* Set new field probe length in accordance with C75-CAV-TUNE procedure to achieve Qext,FP = 8e11 +/- 50% (4e11 – 1.6e12).
* Using Field Probe Measuring tool (dwg.CRM088-2015-1023), measure the length of the new setting for the field probe
* Record new field probe data
 | [[FPFTSN]] <<FPFTSN>>[[FP\_Reset\_QL]] <<FLOAT>>[[FP\_Reset\_Attenuation]] <<FLOAT>>[[FP\_Reset\_Detuned\_Reflected]] <<FLOAT>>mU[[FP\_Reset\_Resonant\_Reflected]] <<FLOAT>>mU[[FP\_Reset\_Qext]] <<SCINOT>>[[FP\_Serial\_Number]] <<FPFTSN>>[[FP\_Tip\_Length]] <<FLOAT>>[[Tuned\_FP\_FPC\_Comments]] <<COMMENT>>[[Tuned\_FP\_FPC\_Technician]] <<SRFCVP>>[[Tuned\_FP\_FPC\_Date]] <<TIMESTAMP>> |
| 10 | **Measure field profiles of trapped TE111-like Higher Order Modes (HOMs)*** Attach coaxial-to-waveguide ‘tophat’ to FPC waveguide flange and terminate with 50 Ohm load.
* Record frequencies of all HOMs up to 2050 MHz. Above 1.9 GHz, leave the HOM waveguides open ended.
* Store two S21 transmission spectra (in dB) in a single Excel spreadsheet with beam tube antenna either both in vertical or horizontal direction, respectively (two Excel worksheets, name: S21\_H and S21\_V).
* Set up bead pull measurement to measure all TE111-like HOMs up to 2050 MHz. Attach raw data and result graph for each HOM to Excel spreadsheet in new worksheet (name sheets: HOM\_#, # is integer in sequence of increasing HOM frequency). Always use a pull direction from the HOM waveguide endgroup to the FPC waveguide endgroup.
* Upload the Excel file containing all data
 | [[HOM\_1Mode]] <<FLOAT>>MHz[[HOM\_2Mode]] <<FLOAT>>MHz[[HOM\_3Mode]] <<FLOAT>>MHz[[HOM\_4Mode]] <<FLOAT>>MHz[[HOM\_5Mode]] <<FLOAT>>MHz[[HOM\_6Mode]] <<FLOAT>>MHz[[HOM\_7Mode]] <<FLOAT>>MHz[[HOM\_8Mode]] <<FLOAT>>MHz[[HOM\_9Mode]] <<FLOAT>>MHz[[HOM\_10Mode]] <<FLOAT>>MHz[[HOM\_11Mode]] <<FLOAT>>MHz[[HOM\_12Mode]] <<FLOAT>>MHz[[YYYY\_MM\_DD\_CAV\_ID\_Excel\_TE111\_HOMs.xlsx]] <<FILEUPLOAD>> |