SIMULATION AND MEASUREMENTS OF CRAB CAVITY HOMS AND HOM COUPLERS FOR HL-LHC*  
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INTRODUCTION
As part of the High Luminosity Large Hadron Collider (HL-LHC) project, 16 crab cavities are to be installed in the LHC in 2025. The two crab cavity designs are the Double Quarter Wave (DQW) and Radio Frequency Dipole (RFD). Preliminary beam tests in the Super Proton Synchrotron (SPS) are planned for both cavity types, with the DQW scheduled for testing in 2018.

Here, simulation and measurements of the SPS DQW HOM coupler spectral analysis are presented along side first measurements of the dressed cavity HOMs.

CAVITY MEASUREMENTS

HOM Coupler Test-Boxes  
- Analyse full spectral response of DQW HOM coupler

VTF Spectral Measurements  
- For two cavities with HOM couplers

Cavity Mode Characterisation  
- Are the Damping Deviations Predictable?

TEST-BOX MEASUREMENTS

Goal of test boxes:  
- Analyse frequency dependent transmission response of HOM couplers.

Two test boxes designed:  
- L-Bend Transmission  
- Coastal Chamber

L-Bend Transmission used to measure each SPS DQW HOM coupler.

Transmission response of the DQW HOM Coupler:

CAD cross-section (left) and photograph of SPS DQW HOM coupler.

COMPARISONS

Test-Boxes  
- The spectral response of all HOM couplers to be used on the cavity.  
- Compared the broad-band transmission response of each coupler.

Cavity Tests  
- Full spectral measurements of both the NW-DQW-001 and CERN-DQW-001 partially dressed cavity tests taken.

Individual HOM measurements for each mode.

Comparisons for CERN-DQW-001 Results  
Can deviations in damping be predicted?

1. A large increase in external Q at 749 MHz was observed from measurements.

- This was predicted by the test-box responses by the consistent decrease of the frequency of 362 MHz.

2. First two modes - where the HOM coupler response is a sharp peak, the external Q decreases.

- If the change in HOM coupler S0 is taken for the mode frequency shift - reduction in damping predicted.

- If test-box measurements are scaled to 2K frequencies, peak broadening is seen which explains the increase for the second mode.

- Still reduction of initial mode (but to lesser extent) - mode coupling ratios to be incorporated.

FUTURE ANALYSIS

With the measured frequency and external Q-factor data from CERN-DQW-001, the change in HOM power as a result of the beam spectrum will be evaluated.

In addition to different bunch types, tolerance studies on both mode frequency and beam parameters can then be applied and the effect of these changes on HOM power evaluated.

REFERENCES AND ACKNOWLEDGEMENTS

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