# Note on Vertical Test Results of Cavity TE1ACC002

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Cavity TE1ACC002, a single-cell Tesla-shape cavity manufactured by ACCEL was tested at the Fermilab VCTF on 2/4/09. The cavity had never been processed or tested before arrival at FNAL. The cavity was optically inspected (interior) after arrival at FNAL, and then transported to ANL where it underwent EP, HPR, assembly, evacuation, and leak check. It was then transported back to FNAL, to the VCTF at IB1, where it was mounted on the test stand, connected to the pumping system, and instrumented with the prototype single-cell diode thermometry system

The cavity was cooled down from 4K to 2K, and some $Q_0$ vs T measurements were performed in the temperature region just above the λ-point transition. Once at 2.00K, CW measurements of $Q_0$ vs E were performed. The cavity exhibited a soft multipacting barrier at 22MV/m which was almost immediately breached, and then another barrier at 24-26MV/m was encountered. This second barrier required a more concerted effort to process thru.

Field emission was observed beginning at about 21.5MV/m, increasing to a maximum level of about 3mR/hr at maximum gradient. The maximum gradient reached was 33.1 MV/m, with a corresponding $Q_0$ of $1.5 \times 10^9$. Significant Q-drop was observed beginning around 25-26 MV/m, consistent with strong FE-loading (see Figure 1). The low-field $Q_0$ ($2 \times 10^{10}$) and shallow Q-slope would indicate that absent field emission, this cavity has the potential to reach >35M/m with relatively high $Q_0$. Additional HPR (perhaps with Ethanol rinsing) is recommended in order to eliminate/reduce the FE present in this cavity, and potentially improve its high field performance.

After CW measurements were performed at 2K, the He bath was pumped down to reach a temperature of 1.53K while $Q_0$ data were taken. From measurements of $Q_0$, we calculate a residual surface resistance of 6nΩ at 1.53K (see Figure 2). This is consistent with $R_s$ measured for other single cell cavities (2-7 nΩ).

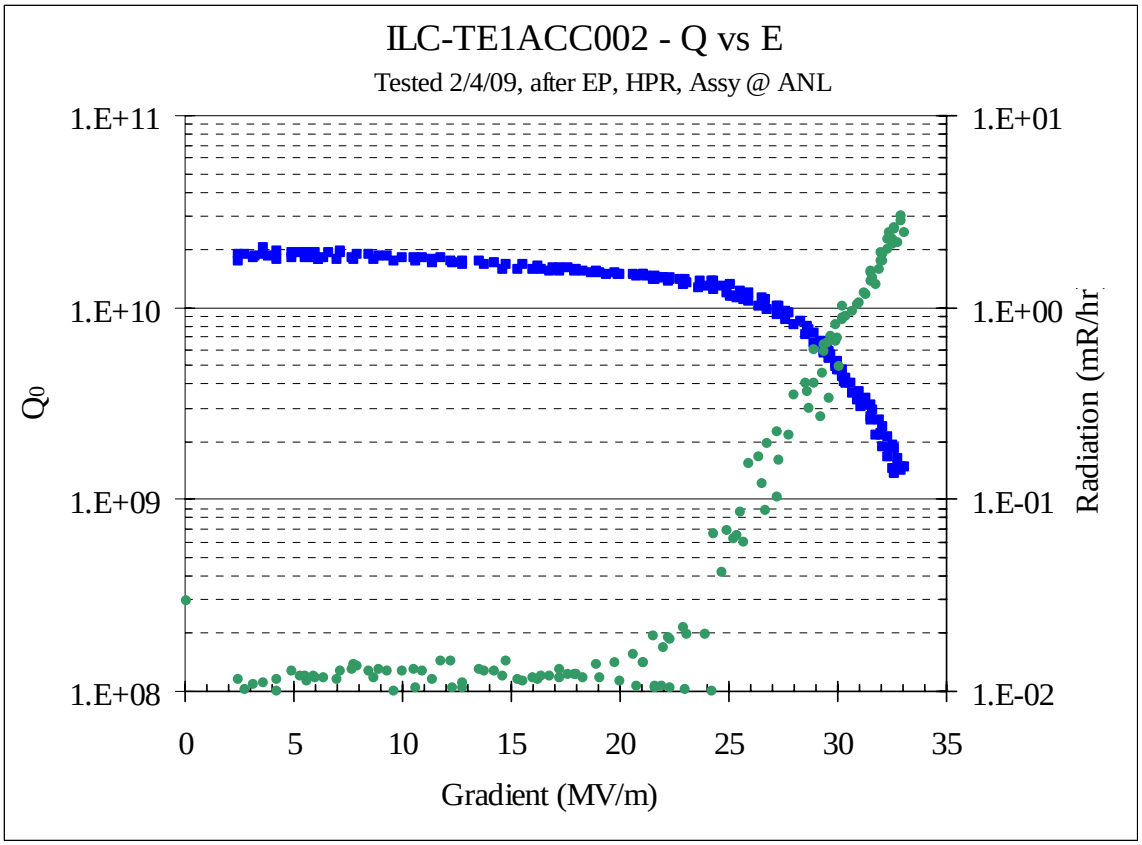


Figure 1.) $Q_0$ vs E run at 2K

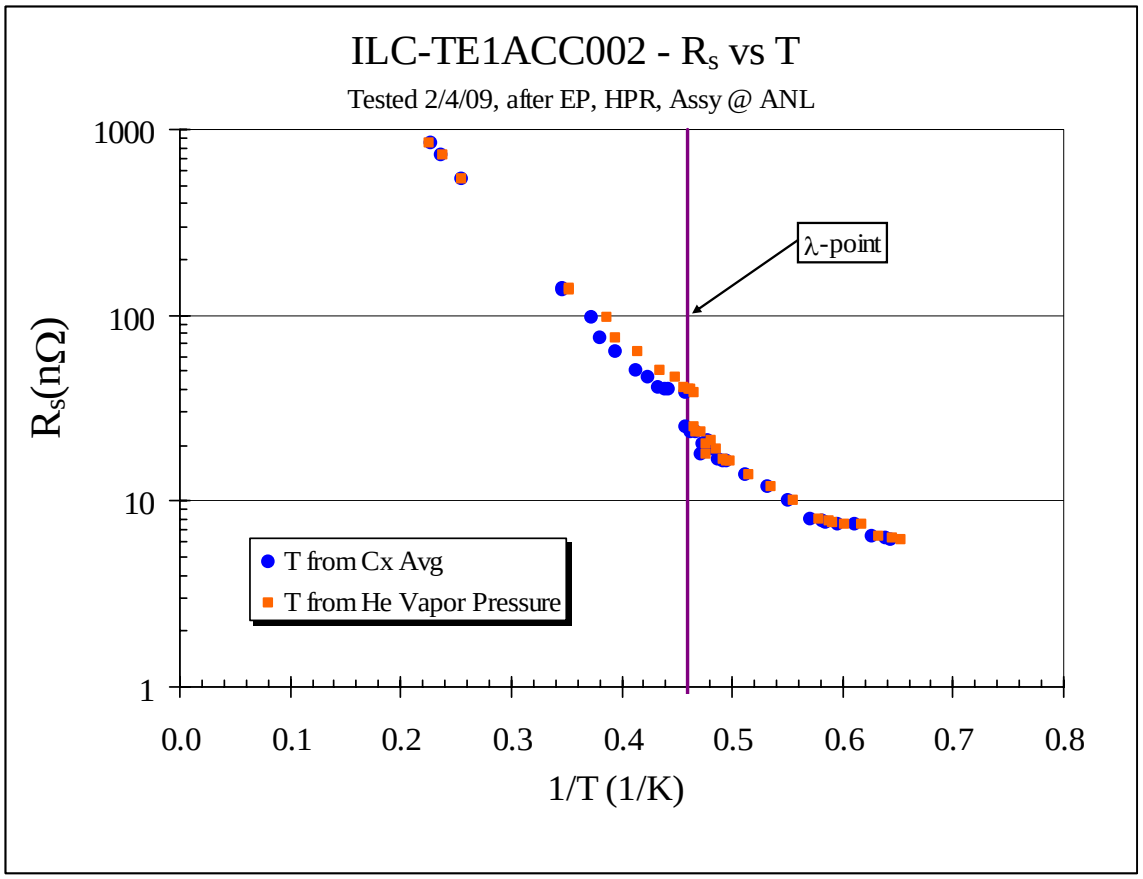


Figure 2.) $R_s$ vs 1/T. The temperature data are from the average of four Cernox sensors on the cavity and from conversion of the He vapor pressure measured by the VTS Dewar manometer, for comparison. Except for the region 2.2K < T < 2.7K (where they differ by up to 100mK), they typically agree to within 10-20mK. This discrepancy does not affect the accuracy of measurements of residual surface resistance. The discontinuity in $R_s$ (and hence, $Q_0$) at the λ point, as reported earlier, is again seen.