Vertical Cavity Test Report

Cavity Name	TE1AES003	Test Date	11/12/2010	Author	J. Ozelis

Cavity History

Cavity TE1AES003 is a single-cell cavity manufactured by AES. The cavity received BCP processing and HPR at Cornell, then was tested there, reaching 28MV/m, limited by RF power (Q-drop). The cavity then was returned to FNAL, where it was HPR'd again and assembled for testing designed to measure the temperature dependence of medium field Q-slope in a BCP'd cavity. Cavity was also checked for Q-disease by performing a 100K/8hr hold, followed by re-test at 2K. No evidence of Q-disease was found, even though this cavity never received an 800°C heat treatment/H-degassing.

Last Cavity Process

Cavity was baked at 120°C for 48hrs.

Test Conditions

He bath temp	2.00 K	Dewar press	22.9 Torr	Top Plate	#1
Cavity vacuum	Isolated	LHe level	95"		

Calibration Data

Cal. field (MV/m)	3.4	Q_1 (ave)	5.66E9	% var	0.70
Cal. temp (K)	2.00	Q_2 (ave)	3.238E12	% var	0.88
Coupling (β)	+	τ (ave)	0.5718	% var	0..58
Ci	1403539 (Pin right)	C_r	273208	C_t	20.0 (Pt top)

Cavity Performance Summary

Low field Q_0	2.75E10	@ (MV/m)	4.2	FE onset (MV/m)	--
E_{max} (MV/m)	27.3	Q_0 @ E_{max}	3.29E9	Max rad (mR/hr)	--
Perf. limit	RF power	r_{s0} (nΩ)	--	P_{loss} (@ E_{max}, W)	28.99
P_{In} (@ E_{max}, W)	30.12	P_{ref} (@ E_{max}, W)	1.10	P_{trans} (@ E_{max}, W)	0.03

Cavity Test Notes

The cavity was again RF power (Q-drop) limited to 27MV/m. No FE present at any time. General improvement in Q_0 seen (pronounced "hump" between 3-6 MV/m) when compared to previous test (when cavity not baked). Onset of Q-drop increased from 19 MV to ~22MV/m, but strong Q-drop still present. See Figure 1.

Also performed measurements of Q_0 vs E at lower temperatures (1.9, 1.8, 1.7, and 1.6K) in order to accumulate medium-field Q-slope data. See Figures 2 and 3.

After warming to 300K, performed a cooldown to 100K, and held there for 8hrs, then cooled back down to 2K and repeated Q_0 vs E test. Result was identical – no performance degradation due to "Q-disease" observed. (Slight improvement is due to not zeroing power meters before test, leading to a systematically lower calculated power loss.) See Figure 4.

Medium field Q-slope over the range of temperatures studied does not seem to depend upon cavity processing history (BCP/EP bake/no bake). This is evident in Figure 5 which shows the medium field Q-slope for cavities AES003 and ACC005. On the other hand, the dependence of surface resistance (R_s) with peak surface magnetic field (B_p) does seem to depend upon cavity processing history (see Figure 6).

List of Figures

Figure 1	Q_0 vs E @ 2.0K (compared with previous test of un-baked cavity)
Figure 2	Q_0 vs E at various temperatures (log plot)
Figure 3	Q_0 vs E at various temperatures (linear plot)
Figure 4	Q_0 vs E @ 2.0K (before and after 100K/8hr hold)
Figure 5	Medium field Q-slope as a function of temperature
Figure 6	Dependence of R_s vs B_p as a function of temperature

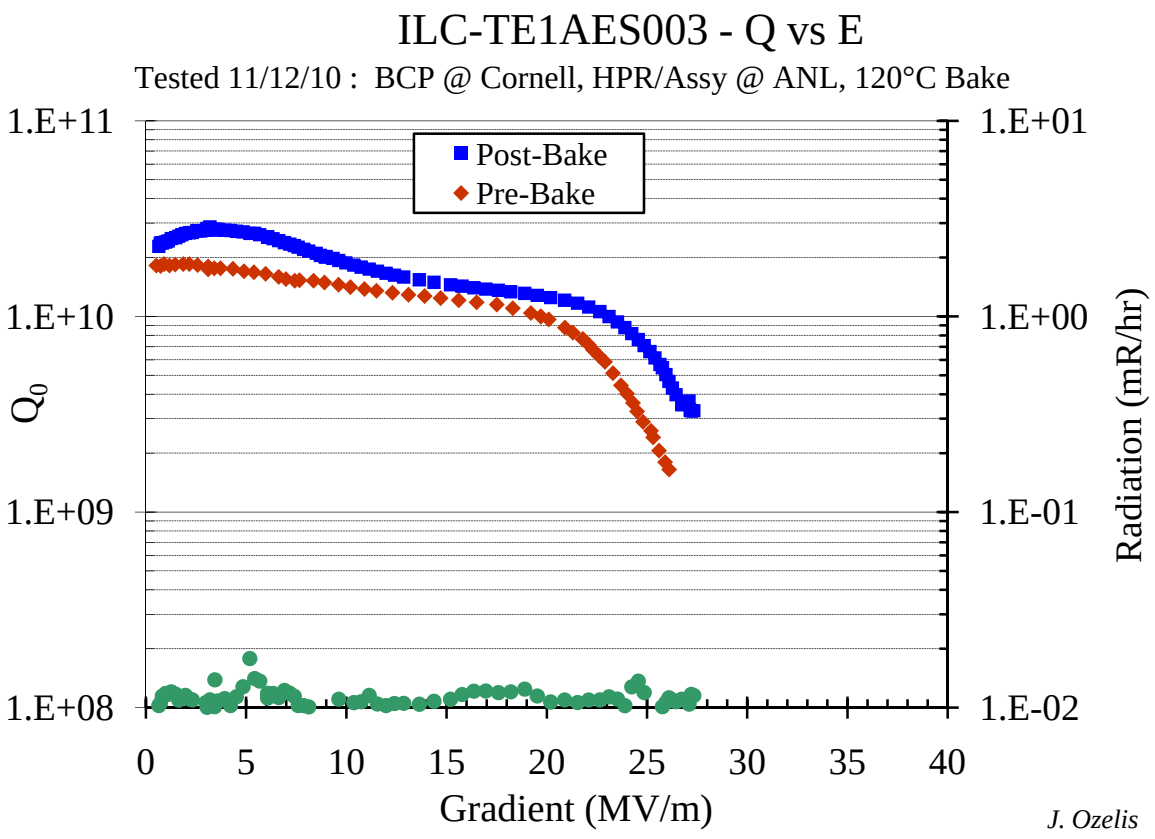

Figure 1. Q_0 vs E @ 2.0K (compared with previous test of un-baked cavity)

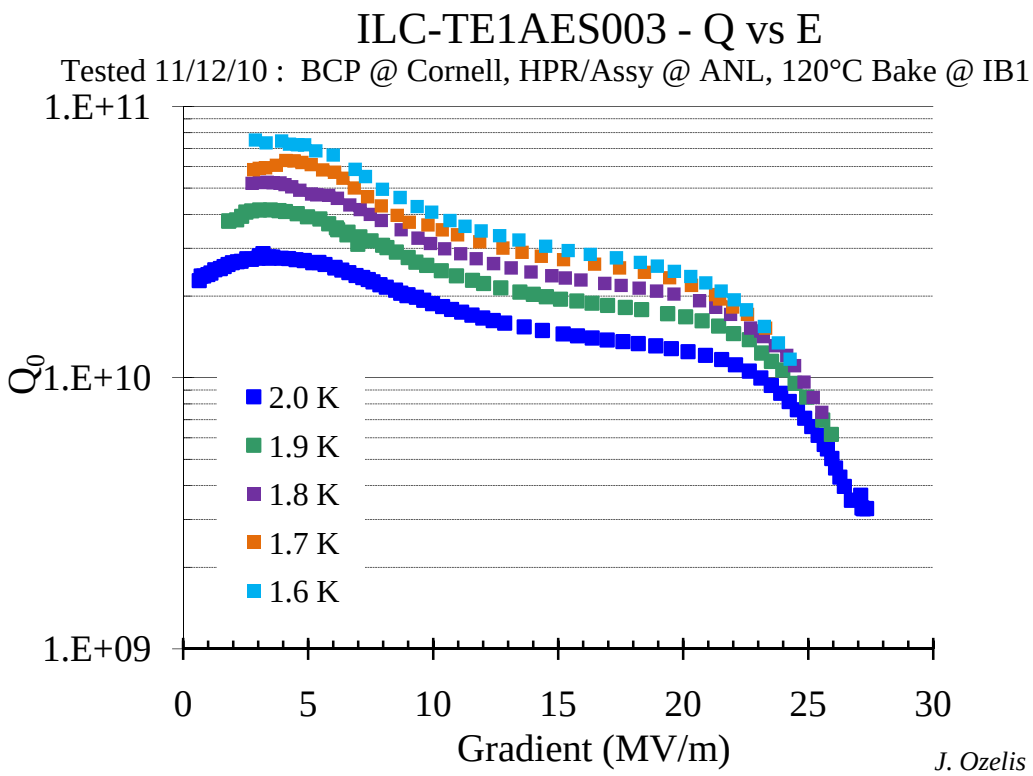

Figure 2. Q_0 vs E at various temperatures (log plot)

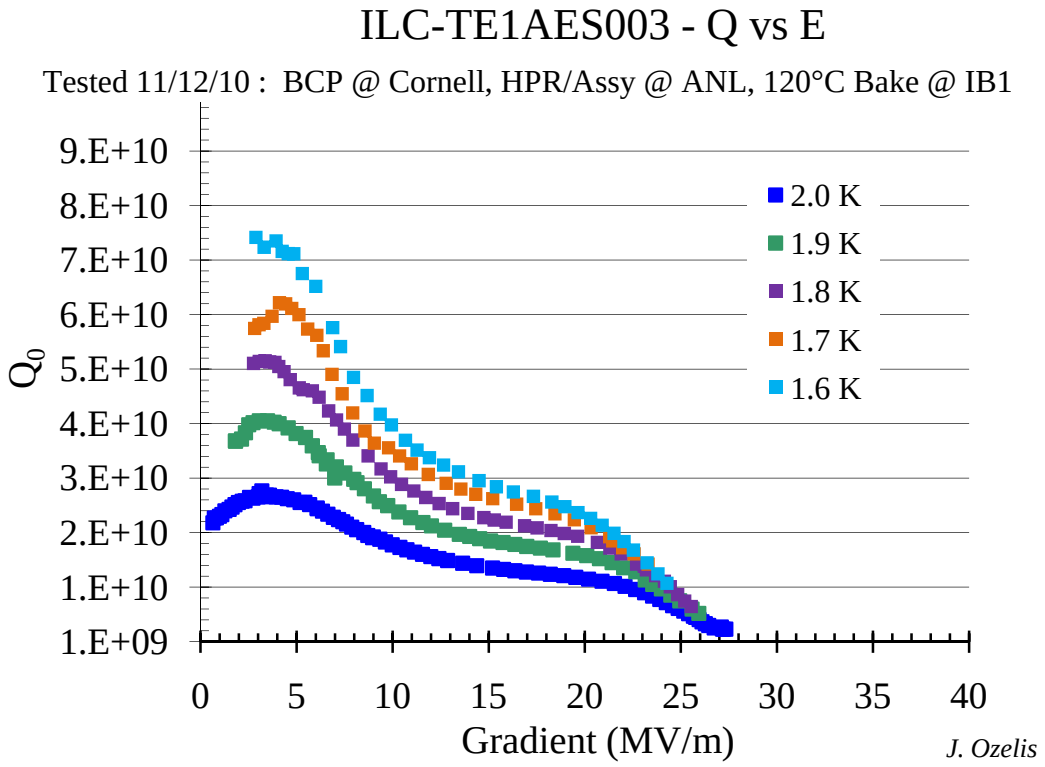

Figure 3. Q_0 vs E at various temperatures (linear plot)

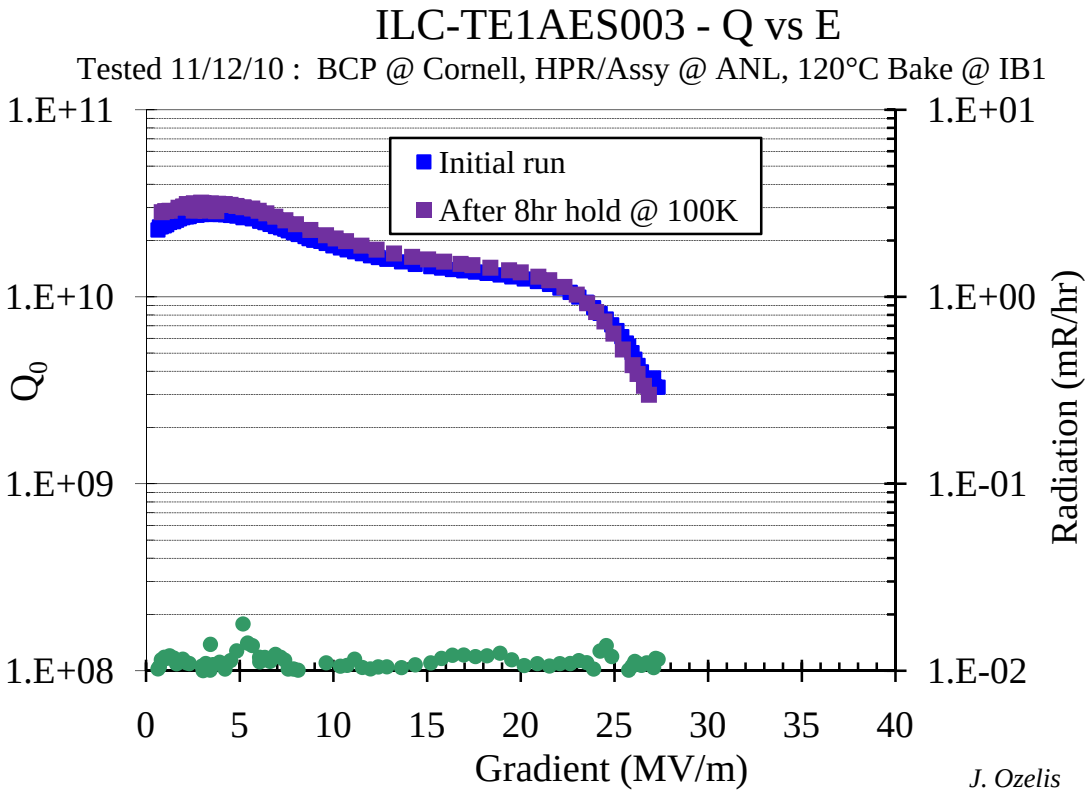

Figure 4. Q_0 vs E @ 2.0K (before and after 100K/8hr hold)

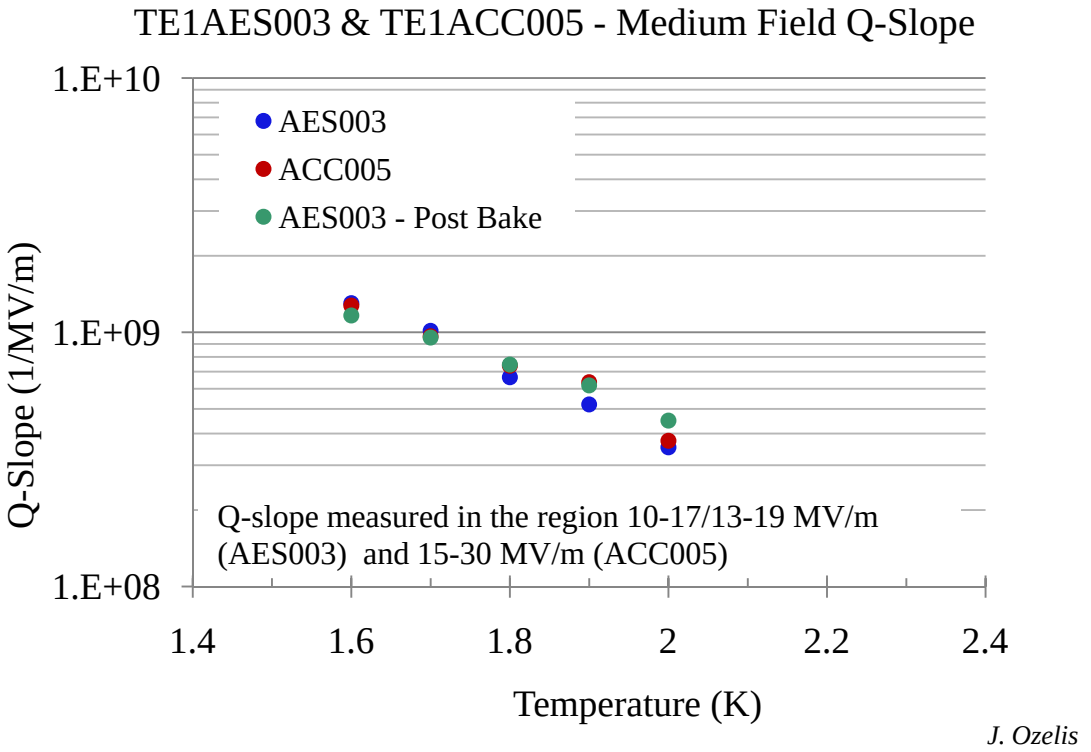

Figure 5. Medium field Q-slope as a function of temperature

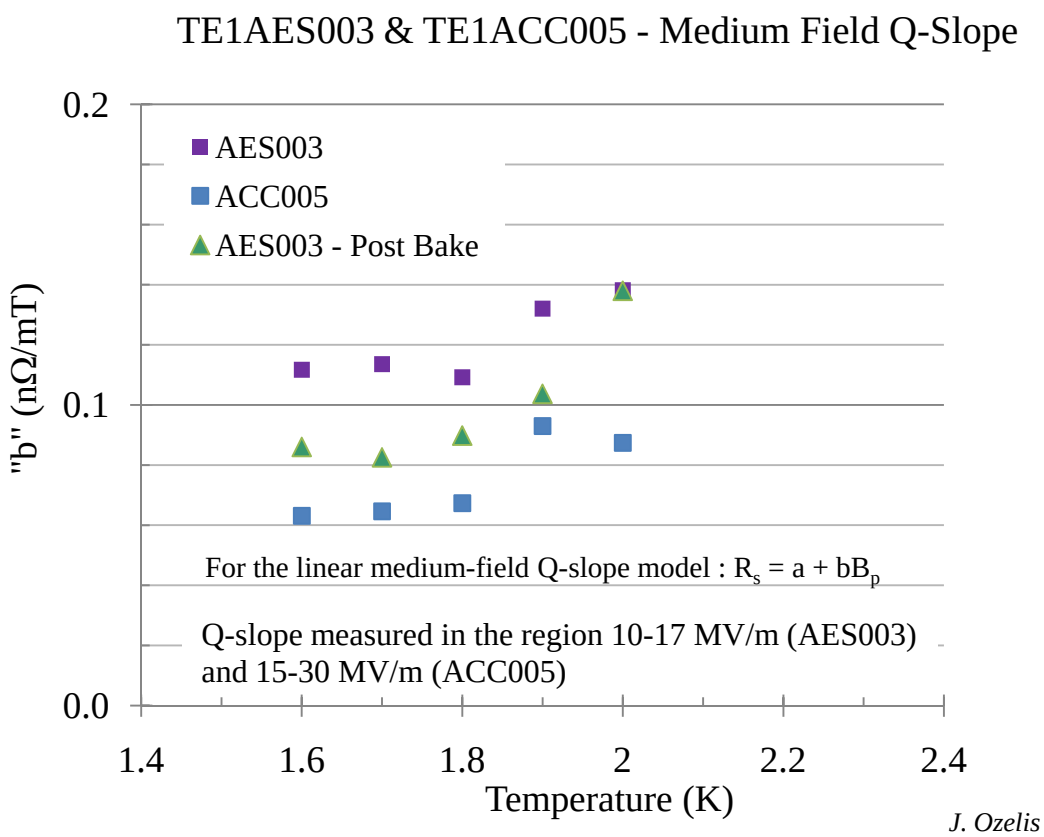

Figure 6. Dependence of R_s vs B_p as a function of temperature