Test notes of 1.3GHz single-cell cavity TE1AES004 7th VT

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The purposes of this measurement:

1. To further verify the RF system of vertical test facility in A0.

After we replaced some RF components in A0 VT system, we added a power interlock in system, when the power exceed the threshold, the system will be triggered off. So we need a non-FE (won't trigger radiation interlock) and high gradient cavity to prove the RF threshold we set won't limit the cavity RF performance at high gradient.

2. To verify the quench location of TE1AES004.

This cavity has a huge pit on equator section, the previous vertical test in IB1 shows that pit location is only a heating point; the cavity quenched at other place. So we prepared 8 fast thermometers, and put them around the equator outside cavity.

The brief history of this cavity:

1.3GHz single-cell Cavity TE1AES004 was manufactured by AES Corporation, and BCP'd 107μm; EP'd 65μm; and baked 120C 48 hrs. A huge pit was found by Kyoto inspection machine. The 5th and 6th tests in IB1 show cavity gradient reached 39MV/m. After that test, the cavity was shipped to A0 under vacuum.

The process and result of test:

Before pumping down, the cable was calibrated. The cable loss factors are Cf=34.1, Cr=35.8, and Ct= 6.084. The data is closed to last 1.3GHz cavity test data. The average Qt value equal 4.95E12, which was measured 5 times from Eacc=3.73MV/m to 5.99 MV/m at 2K. During the Eacc vs. Q0 measurement, the X-ray started at 19.83MV/m, and first quench happened at 20.31MV/m, after that processing started and several quenches happened. The cavity finally quenched at 38.6MV/m, and Q0=4.61E9, X-ray radiation level is very low about 25 mRem/hr. During the quenching, none of fast thermometers show the temperature rising, but that doesn't mean the pit didn't induce the quench, we need to re-calibrate the fast thermometers. Fig1 is the Eacc vs. Q0 curve.

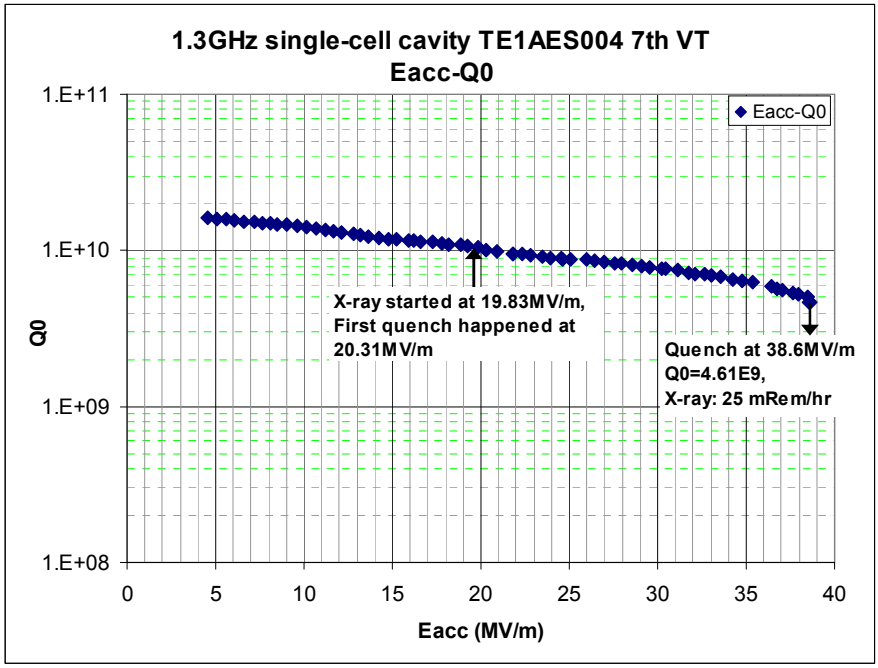
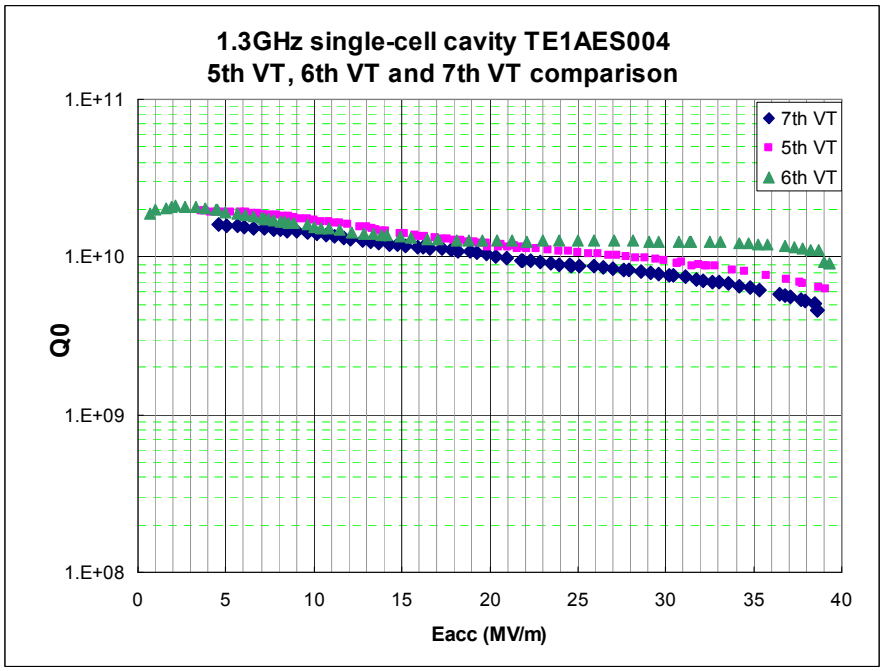


Fig.1 TE1AES004 Eacc-Q0 curve.

Comparison with previous VT results



Conclusion

1. The RF system is no problem for 40MV/m non-FE cavity.
2. We failed to find the quench location; the fast thermometers need to be re-calibrated.

Future works:

1. We need add more X-ray shielding, after that we need to verify the RF system with a FE and high gradient cavity.
2. Re-calibrate the fast thermometers.