Test Results of LANL/AAA β=0.175, 350-MHz, 2-Gap Spoke Cavities

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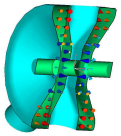
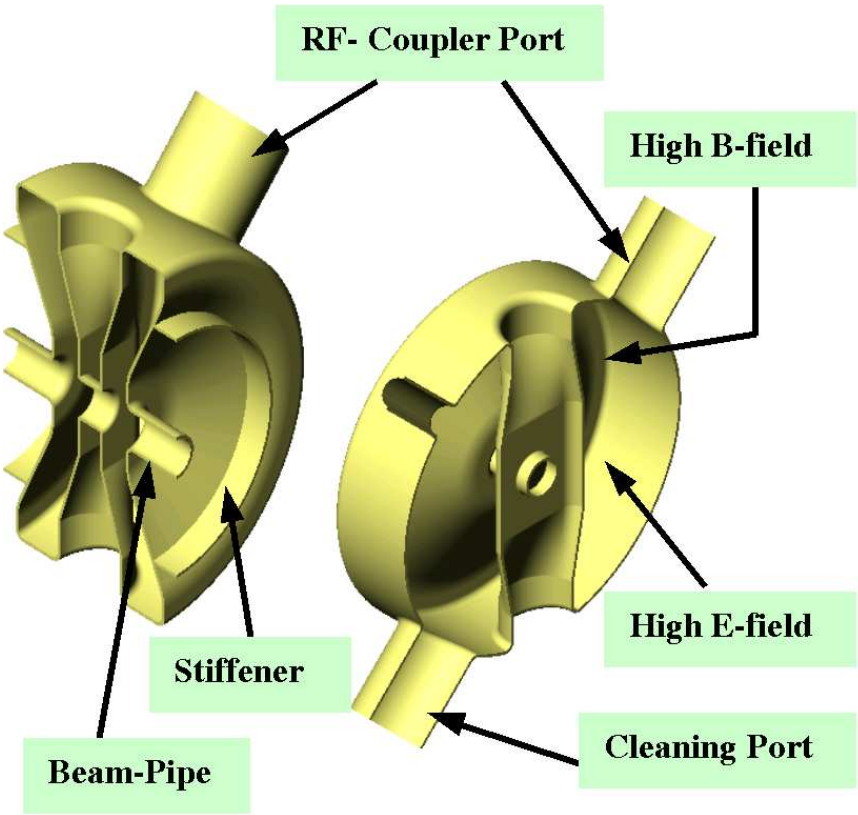
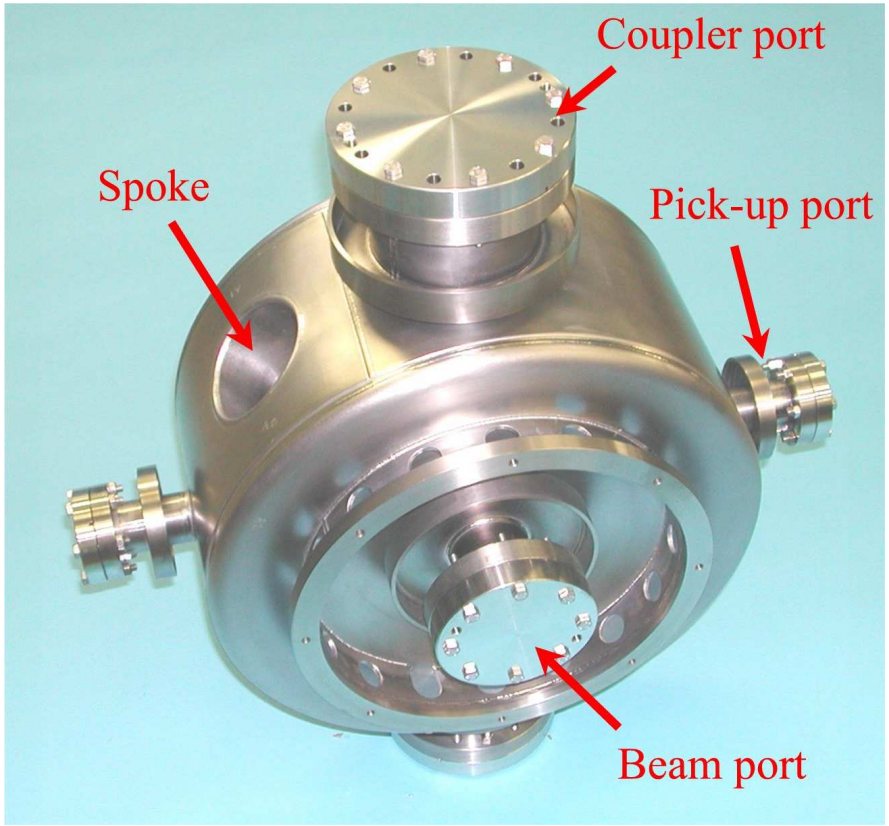


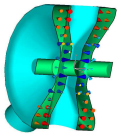
The LANL/AAA Spoke Cavity EZ01 and EZ02





The Cavity Dimensions

Cavity Radius	19.609 cm
Spoke Radius at Base	4.5 cm
Spoke Thickness at Aperture	3.5 cm
Spoke Width at Aperture	11.44 cm
Aperture Diameter	5.00 cm
Cavity Length (gap-to-gap)	9.99 cm
Cavity Overall Length	19.99 cm
Cavity Length (flange-to-flange)	28.6 cm
Coupler Port Diameter	10.3 cm
Pick-up Port Diameter	3.81 cm
Initial Nb thickness	3.5 mm



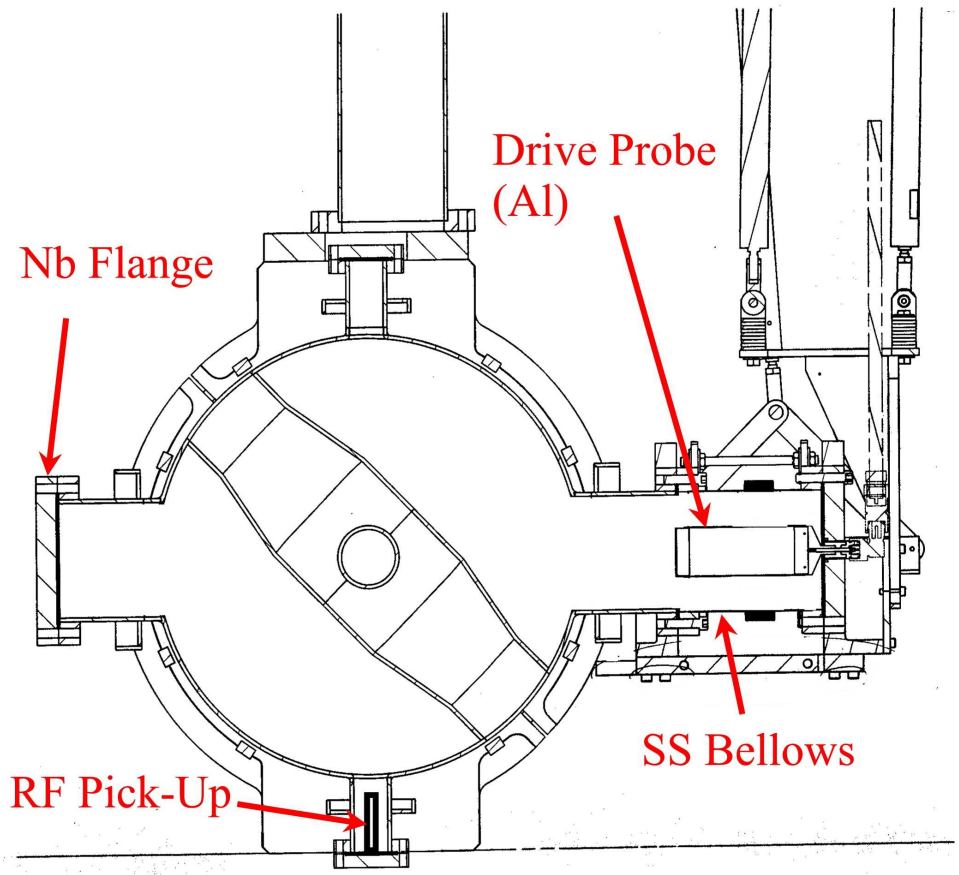
RF Parameters

Q_0 (4 K)	1.05E+09 (for 61 nΩ)
T (β_g)	0.7765 (β_g=0.175)
$T_{max}(\beta)$	0.8063 (@ β=0.21)
G	64.1 Ω
E_{pk}/E_{acc}	2.82
B_{pk}/E_{acc}	73.8 G/MV/m
P_{cav} (4 K)	4.63 W @ 7.5 MV/m
R/Q	124 Ω

Test Preparation (Brief explanation)

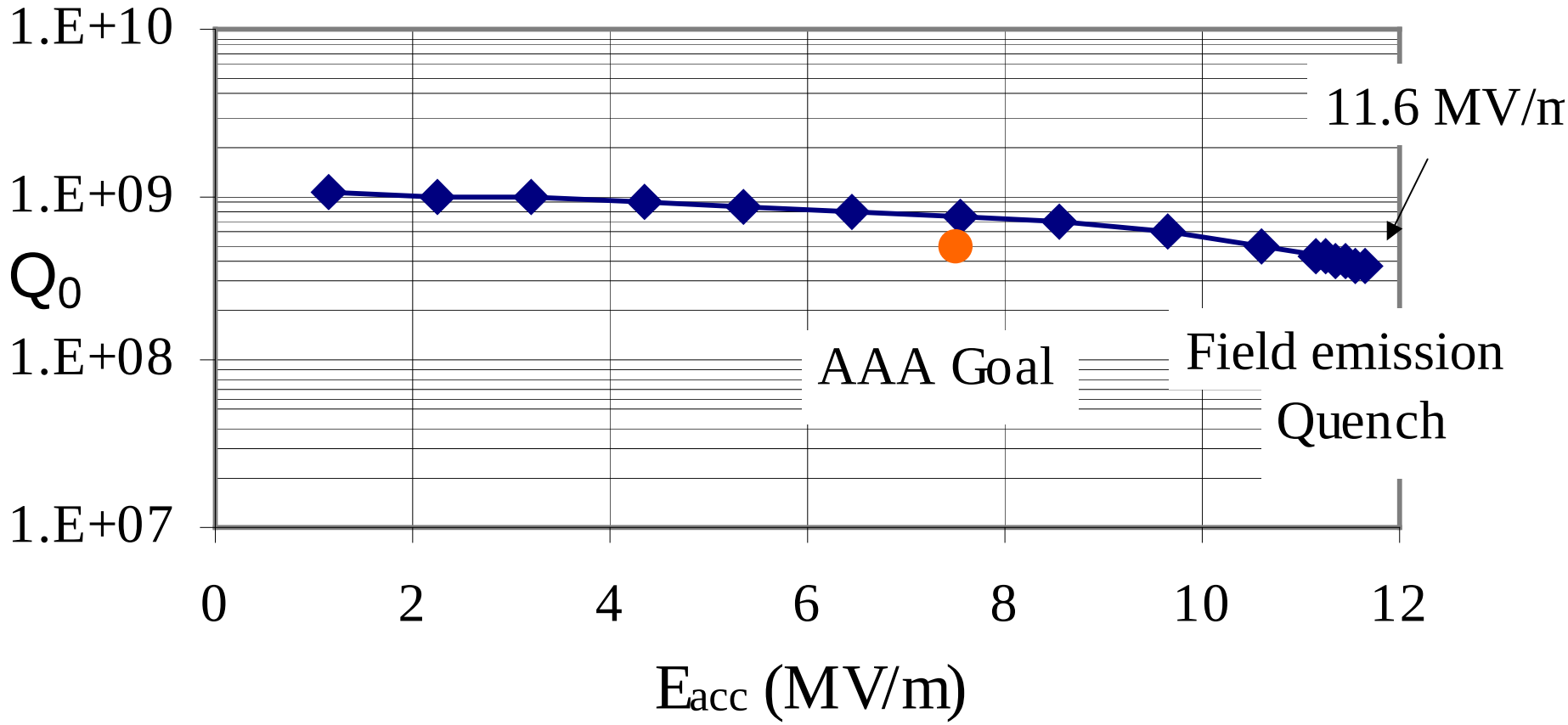
- Buffered Chemical Polishing (BCP) ~ 150 μm with $HF:HNO_3:H_3PO_4$=1:1:2 by volume.
- High Pressure Rinsing (HPR) at 1000 – 1200 psi (69 – 83 bar) for a total of ~50 min.
- Set up on the cryostat insert, pump down and baking at 100 – 110 ºC for ~ 2 days.
- Details will be shown in another talk.

EZ02 – The First Test

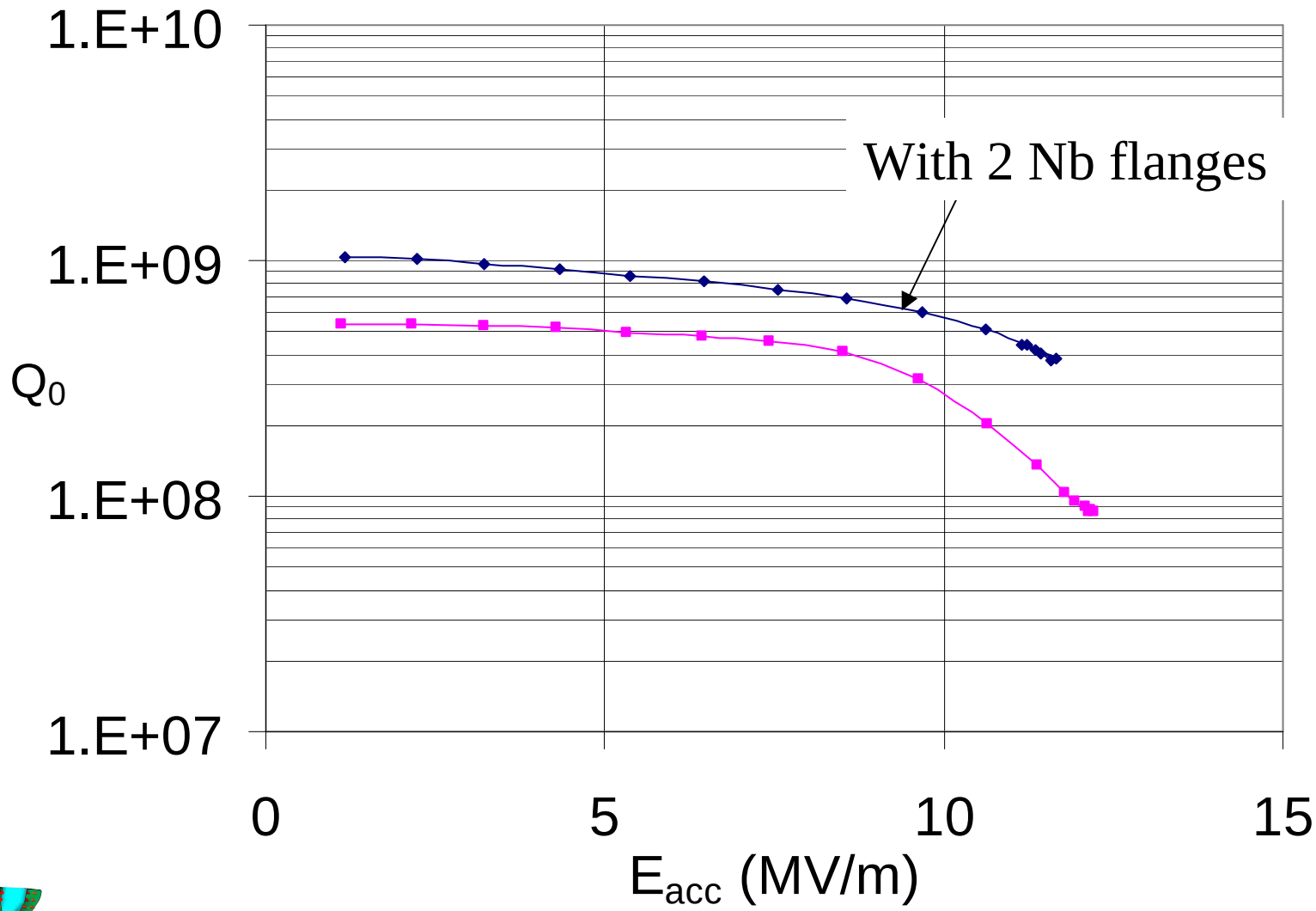


- Tried to couple from the nominal coupler port.
- Loaded Q was 1E6 – 1E7 and could not carry out measurement
- RF loss at SS bellows and Al probe ??

EZ02 with Nb flanges on the arge radial ports – 4 K test

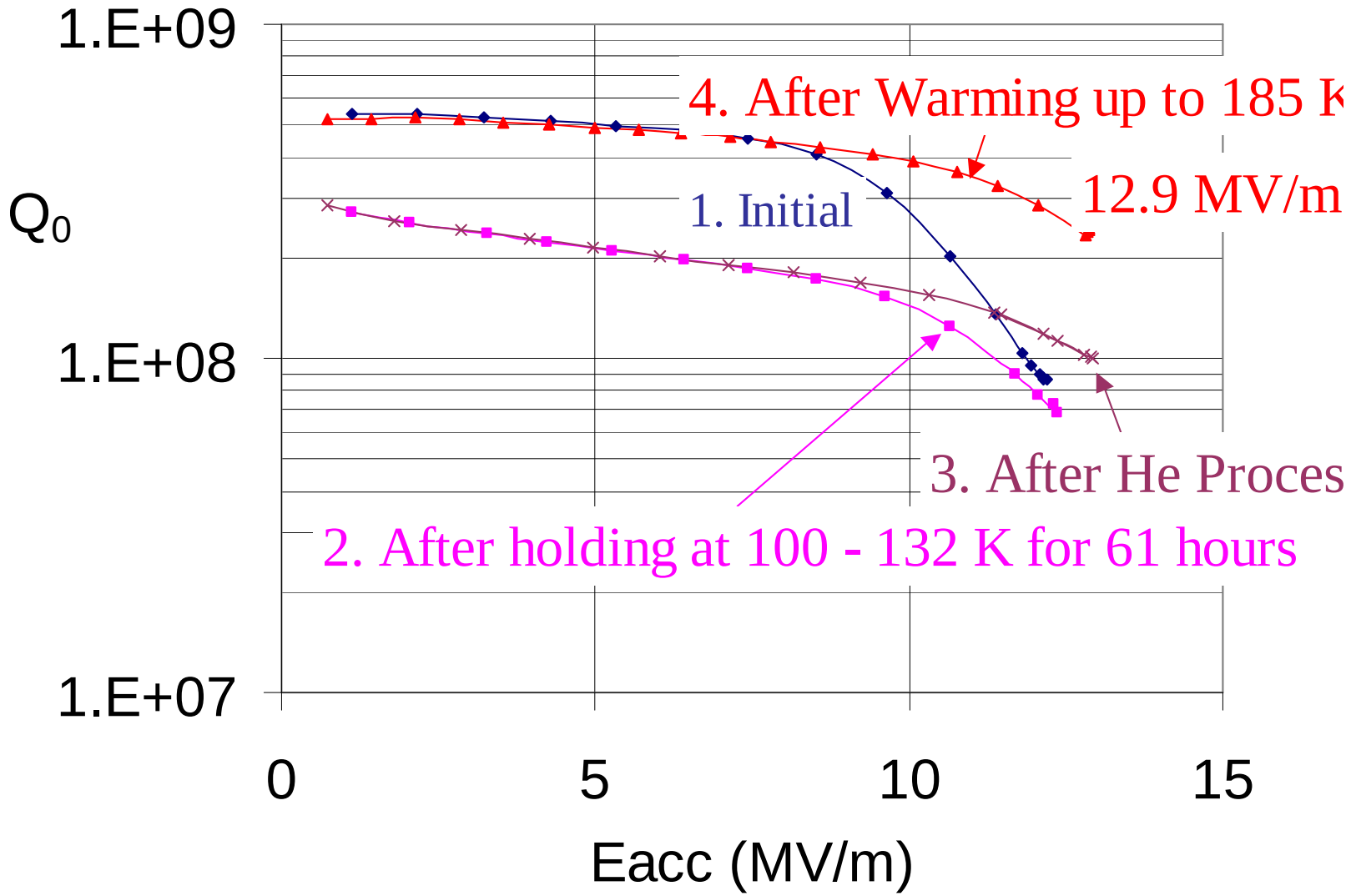


EZ02 with 1 Nb flange and 1 SS bellows on the large radial ports – 4 K



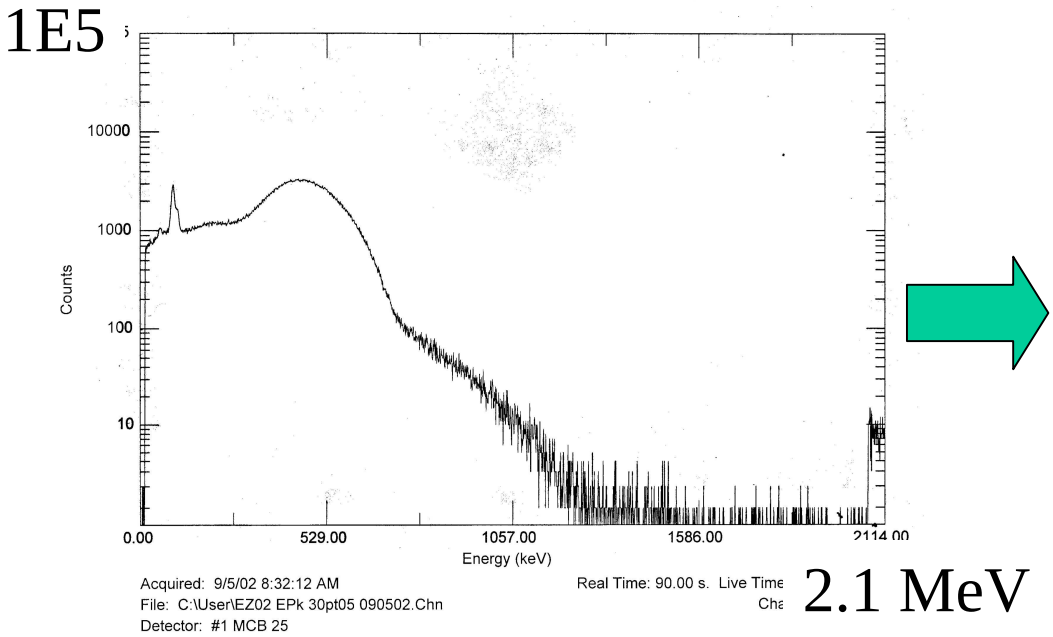
- 48 % decrease of Q_0 at low field.
- Need another test to clarify discrepancy with calculations (4 - 5 %)

EZ02 Test on Q Disease and He Process

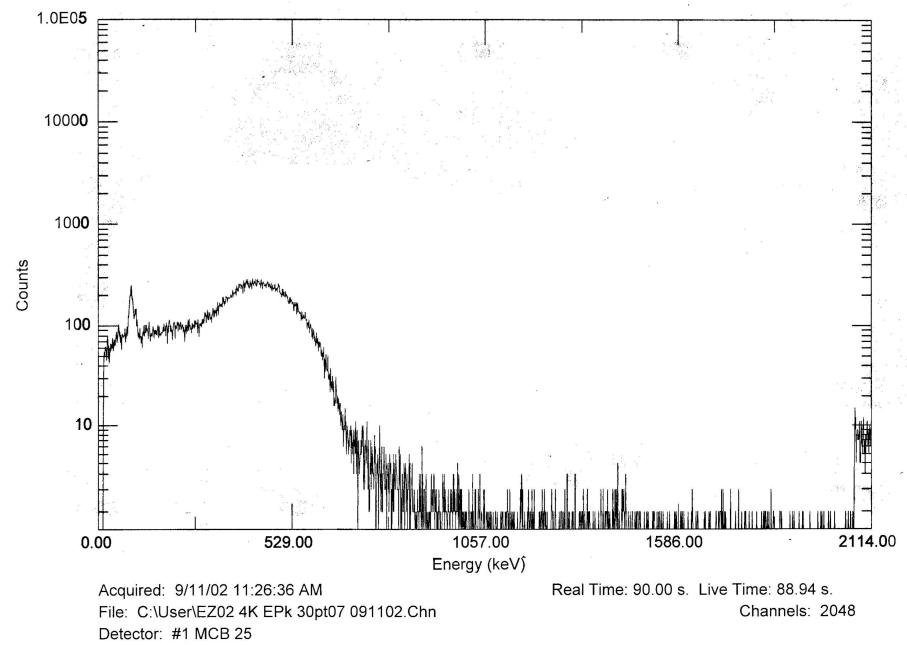


Reduction of X-ray due to He Processing

Before



After He Processing

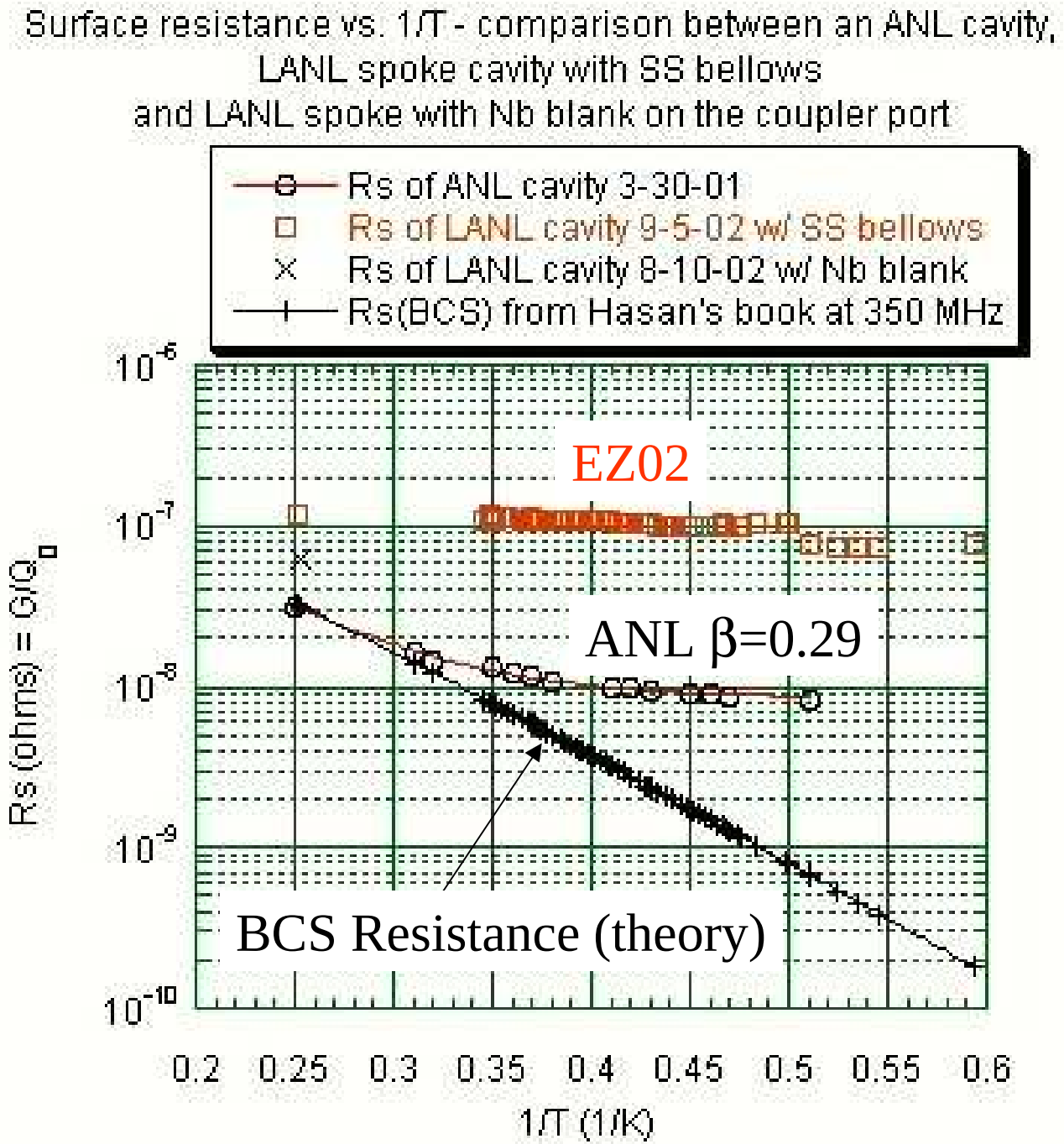


At E_{acc} = 10.6 MV/m

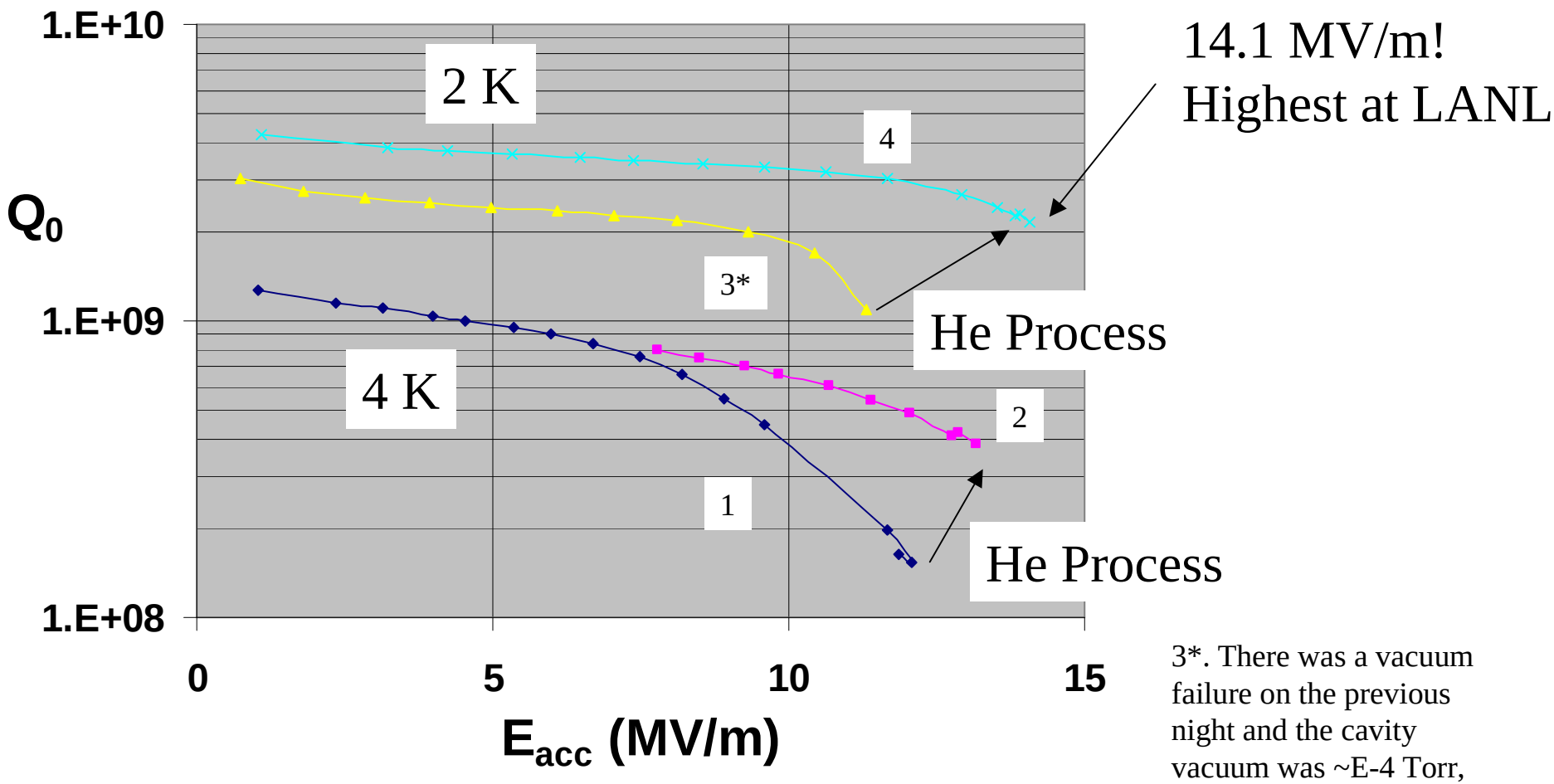
X-ray counts for 90 seconds

EZ02 with SS bellows - Temperature Dependence of Surface Resistance

Rs is insensitive to temperature => suggests normal conducting loss

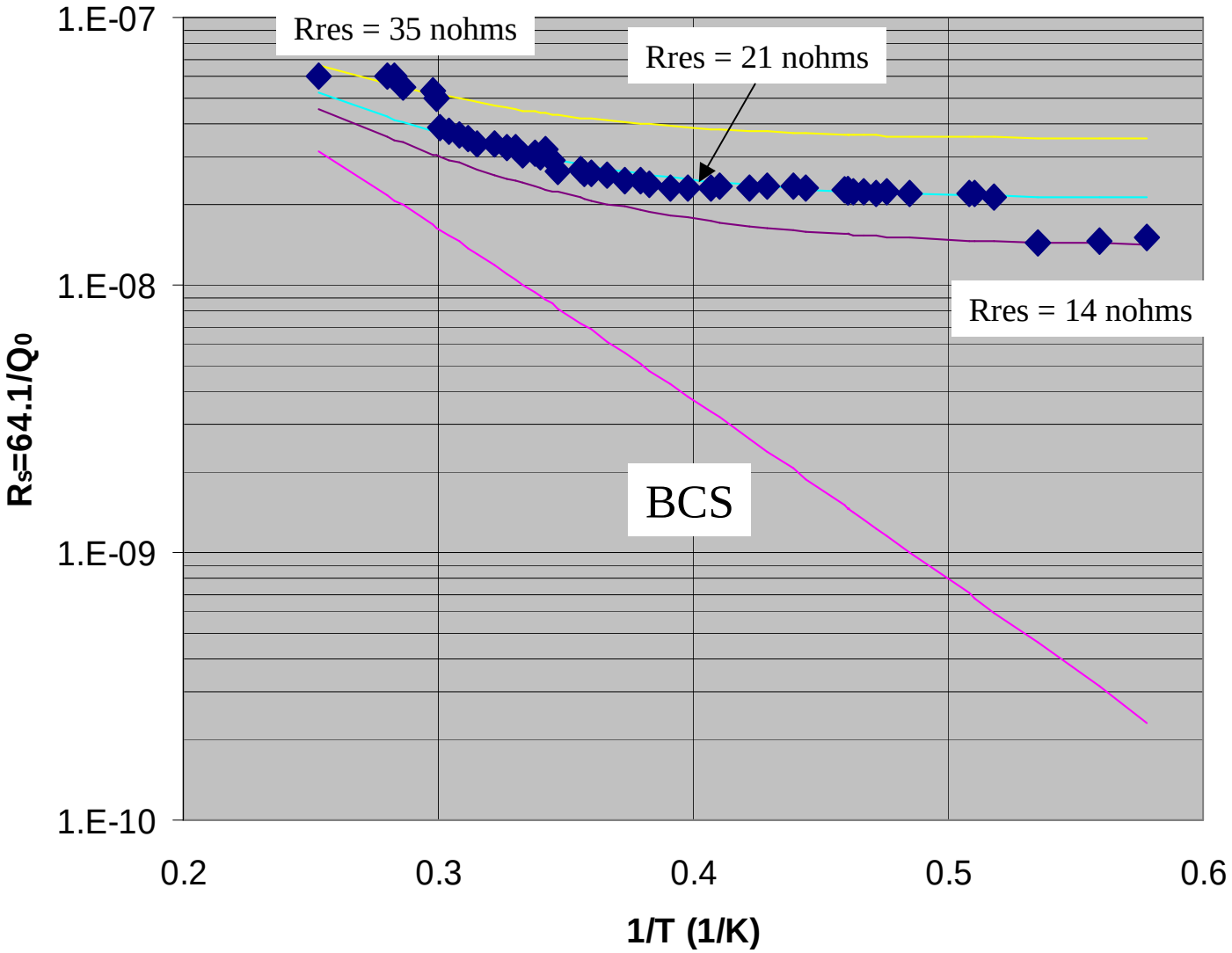


EZ01 First Test with Nb Flanges on the Large Radial Ports

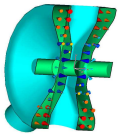


3*. There was a vacuum failure on the previous night and the cavity vacuum was ~E-4 Torr, although it recovered before this test.

EZ01- Surface Resistance vs. 1/T



Residual resistance was reduced during measurement possibly due to RF processing after vacuum failure (~E-4 Torr).

Summary and Future Plans

- The LANL/AAA cavities reached Eacc=12.9 MV/m (EZ02) and 14.3 MV/m (EZ01) as compared to present AAA ADTF design 7.5 MV/m
- Normal-conducting losses at large radial ports need to be studied further.
- The LANL/AAA cavities seem to need more conditioning (MP processing) as compared to ANL-type cavity => This needs to be further studied.
- Q disease occurred on EZ02 after holding at 100 – 132 K for 61 hours, but recovered after warming up to ~ 185 K => More systematic study is planned.