Testing and Analysis of ‘Bare’ Superconducting RF Cavities

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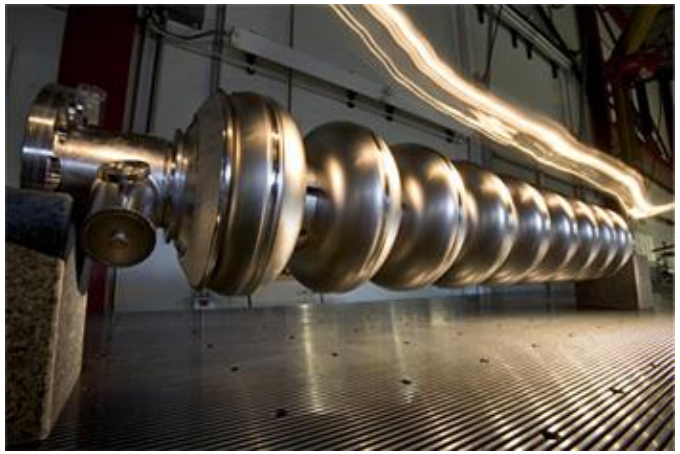
SRF Over Conventional RF Cavities

- High Purity Niobium versus Copper
  - T_{crit}=9.25K
- Lower Surface Resistance
- Higher Quality Factor, $Q = \frac{\omega U}{P}$
  - Promote Larger Accelerating Gradients, $E_{acc} = Z\sqrt{QP}$
    - $Z = \frac{1}{L_{eff}}\sqrt{\frac{R_{sh}}{Q_0}}$
- Technology of Choice
  - LHC, Project X, ILC

Research Outline

- Perform Vertical Single Cavity Tests at A0
  - 1.3 and 3.9 GHz Single Cell, 3.9 GHz 9 Cell
- Data and Performance Analysis
  - R&D – BCP vs. EP
  - Thermal Analysis if Time Permits
- Create one Unified LabVIEW VI for Cavity Tests

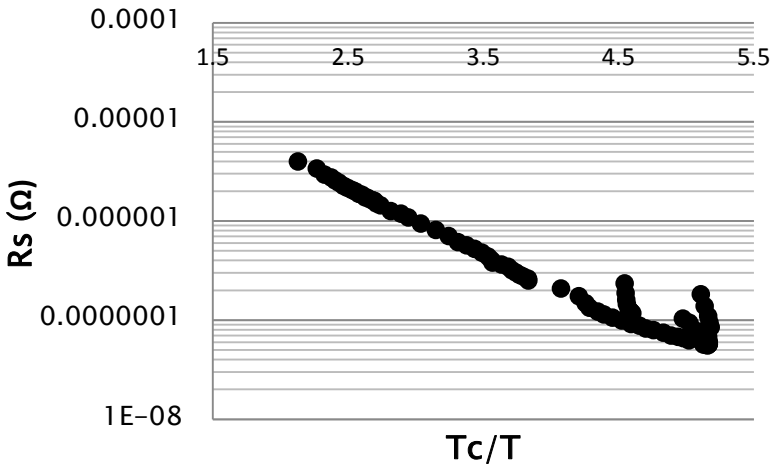


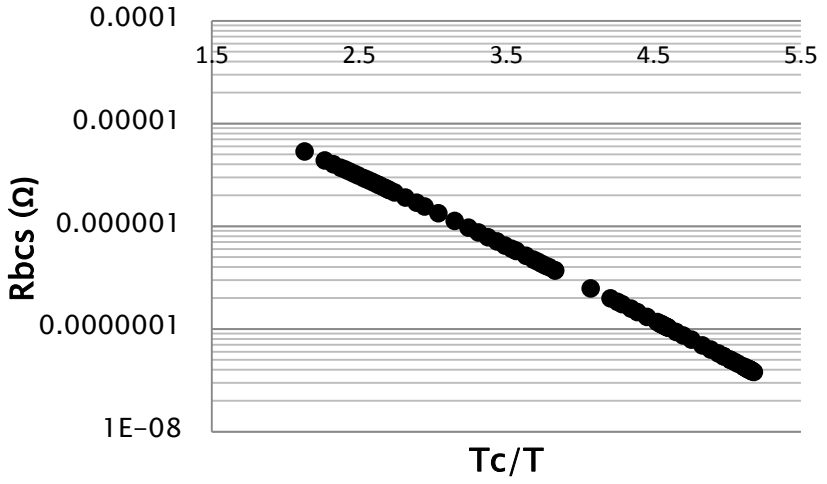
Picture found at
http://projectx.fnal.gov/superconducting-rf.shtml

Vertical Cavity Tests and Analysis

- Bath of Liquid Helium
- Powers Measured
- Q vs. Eacc

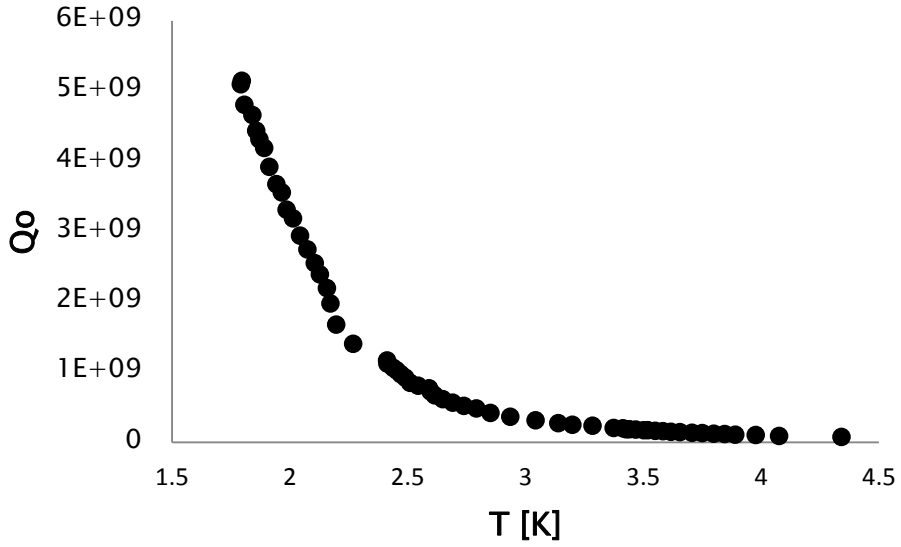
- R&D
  - Buffered Chemical Polishing (BCP) versus Electropolishing (EP)
- Thermal Analysis if Time Permits





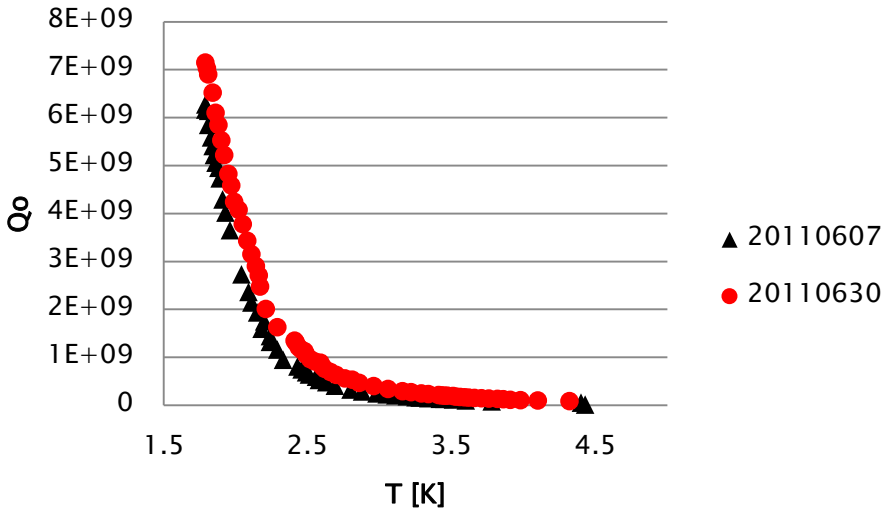
Results on F3A9

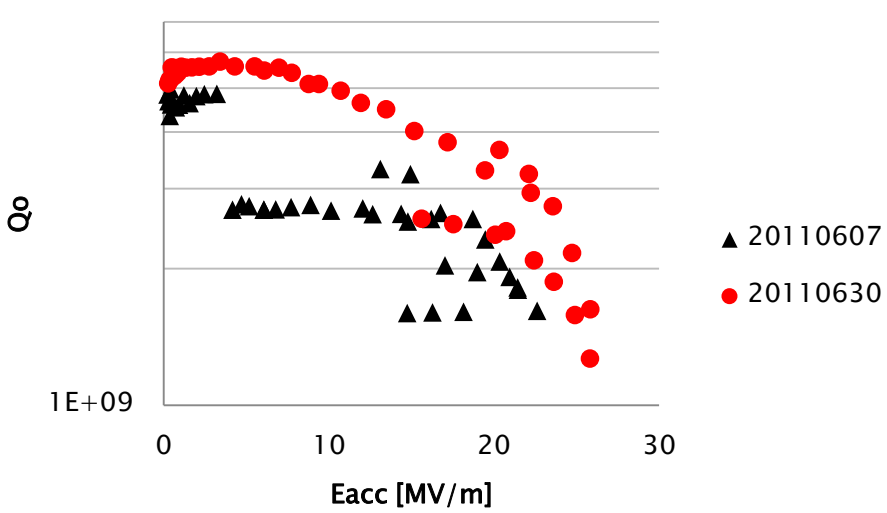
- 3.9 GHz 9 Cell
- Maximum Quality Factor: 5.7E9
- Maximum Accelerating Gradient: 25.8MV/m
  - Quench Limited
- X-Rays produced



Comparison of Data Sets

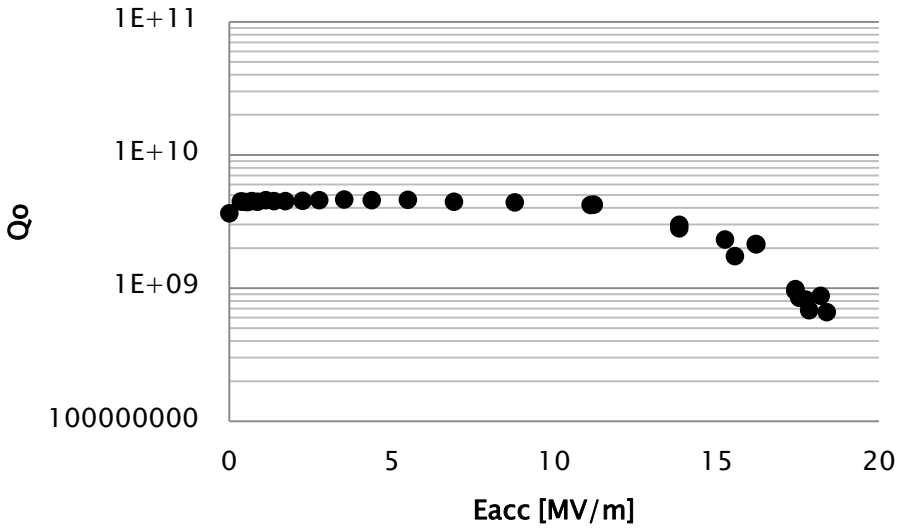
- Took Data on F3A9 on Two Different Days
- Cavity Preformed Better on Second Day

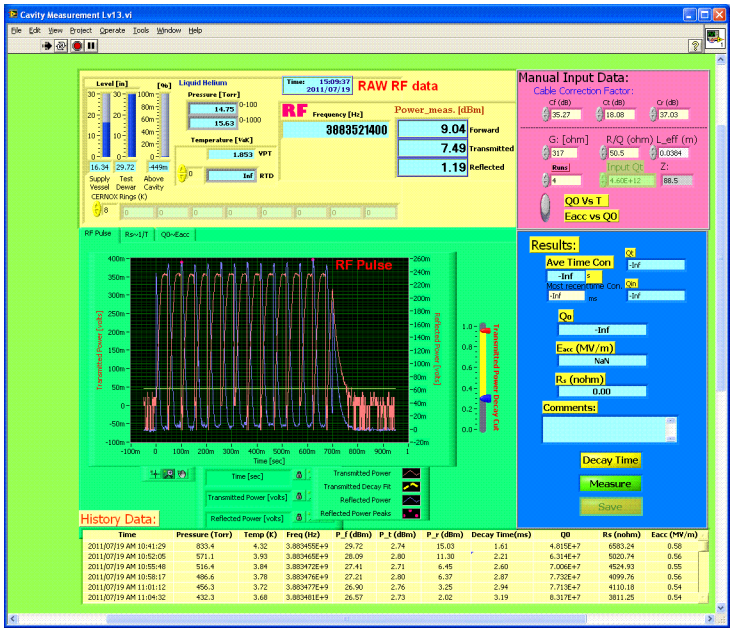




Results on T31F003

- 3.9 GHz Single Cell
- Maximum Quality Factor: 4.6E9
- Maximum Accelerating Gradient: 18.4MV/m
  - Quench Limited





Further Work

- Create an Unified LabVIEW VI
  - Identified Problem
- Thermal Analysis