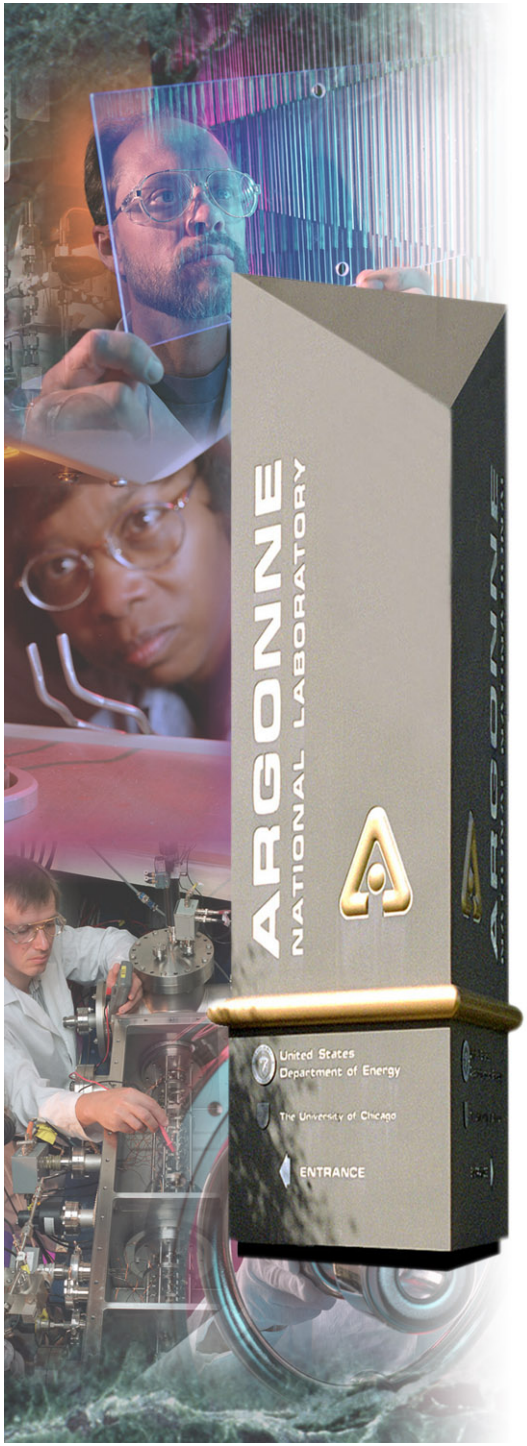


Processing and Test Results for SC Drift-tube Cavities

J.D. Fuerst, M. Kedzie , M.P. Kelly,
K.W. Shepard, Z.A. Conway

Speaker: Mike Kelly

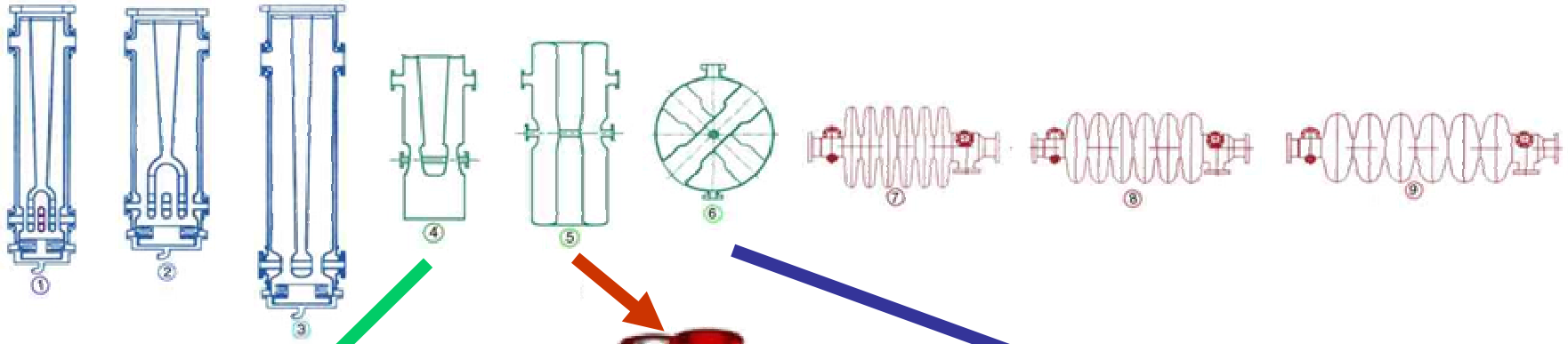
RFSC Limits Workshop ***September 23, 2004***

Argonne National Laboratory

Office of Science
U.S. Department of Energy

A U.S. Department of Energy
Office of Science Laboratory
Operated by The University of Chicago

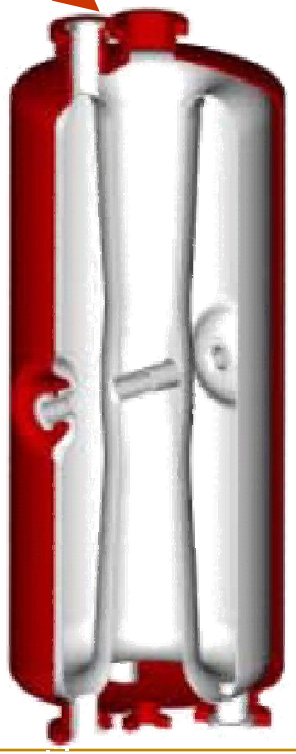
ANL Developed Cavities for 0.1<β<0.5



115 MHz
β=0.15

Quarter-wave

Cold Tested May 2004



172 MHz
β=0.25

Half-wave

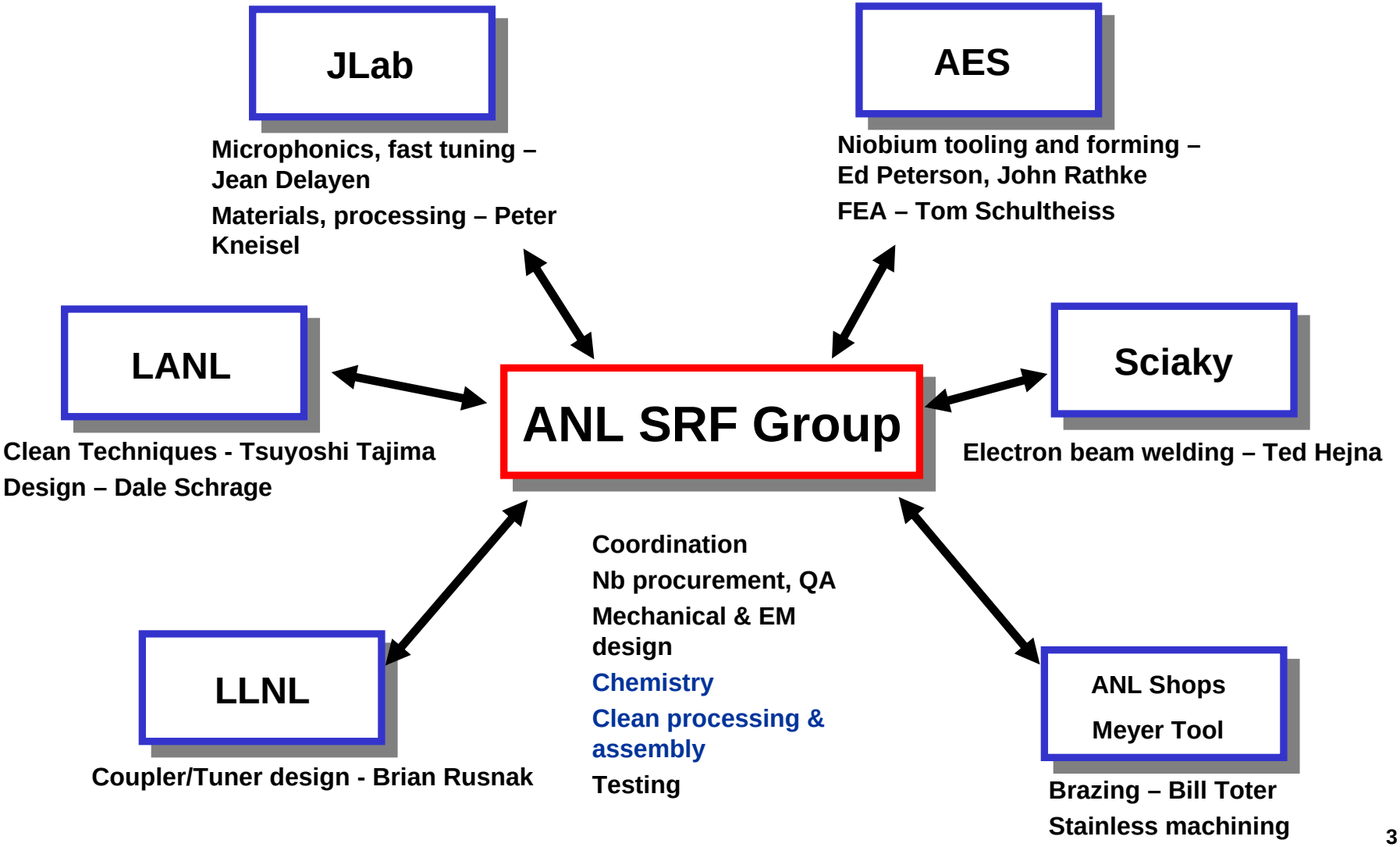
Cold Tested February 2004

345 MHz
β=0.4

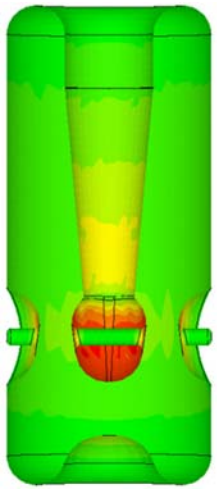
Double-spoke

Cold Tested August 2003

RIA Drift-tube Cavity Team/Collaborators



Fabrication: Processing and Clean Techniques

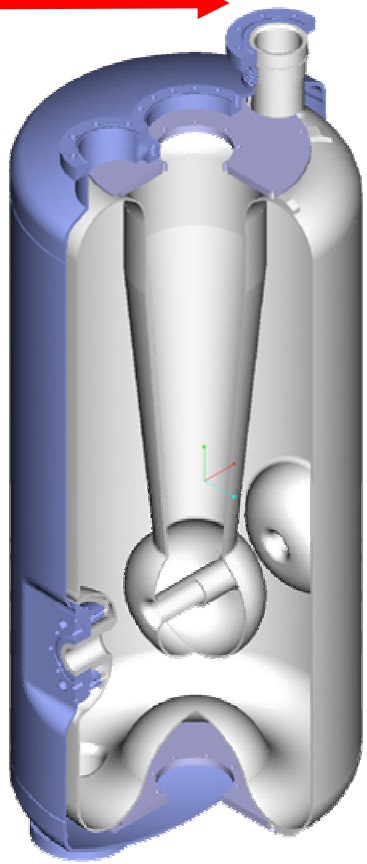


Designed using Micro-wave Studio and ProE

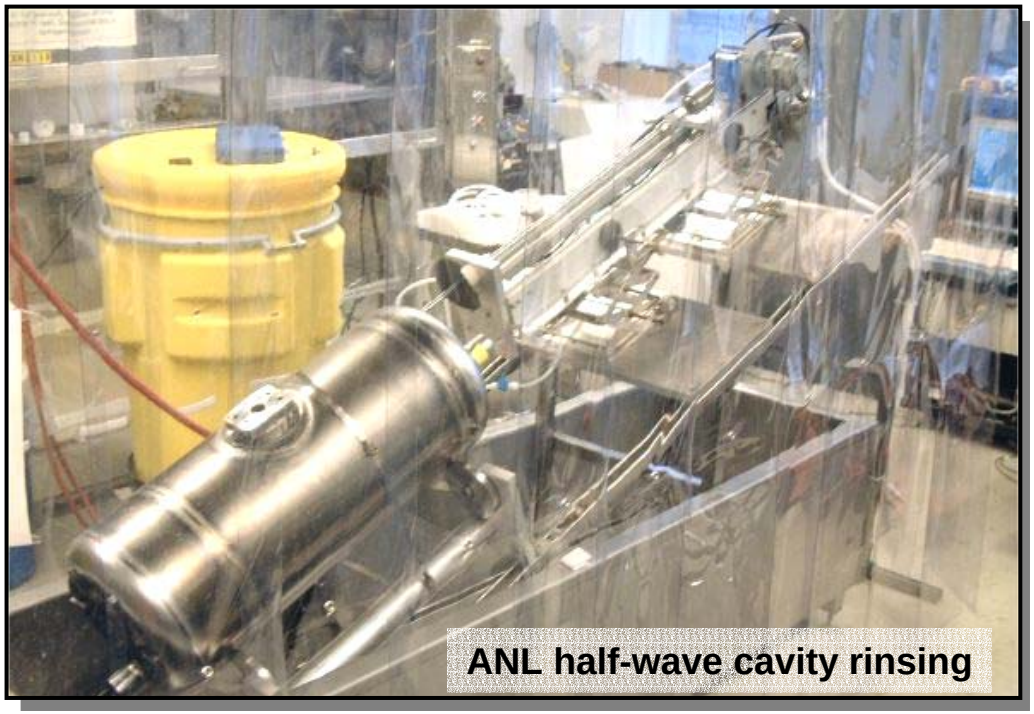
Niobium-to-stainless steel braze → stainless-steel helium vessel

1/8” RRR=250 niobium sheet

Hydroformed, EB-welded, and electropolished



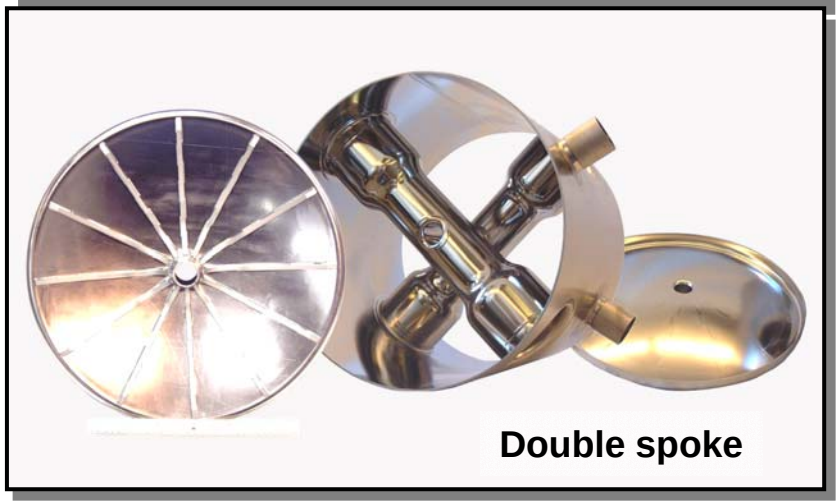
Facilities: Clean Processing for SRF Cavities


ANL half-wave cavity rinsing


ANL half-wave cavity assembly

- Clean techniques from DESY and Jefferson Lab
- Ultrapure high-pressure water rinse in clean area
  18 MΩ DI water @120 bar for 1-2 hours
- Clean room assembly of cavity, cryostat, couplers

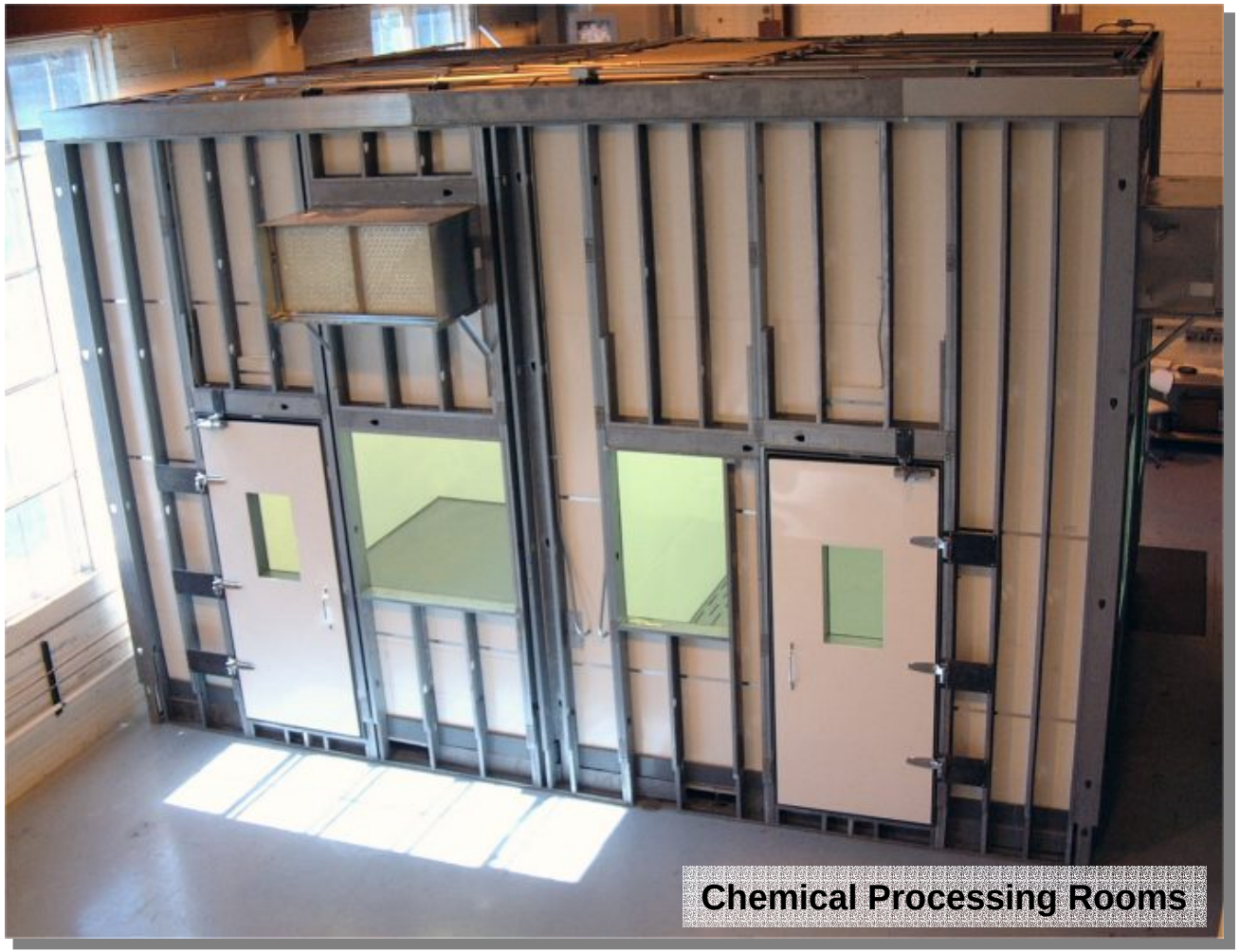
Electropolishing at ANL



Electropolishing yields:

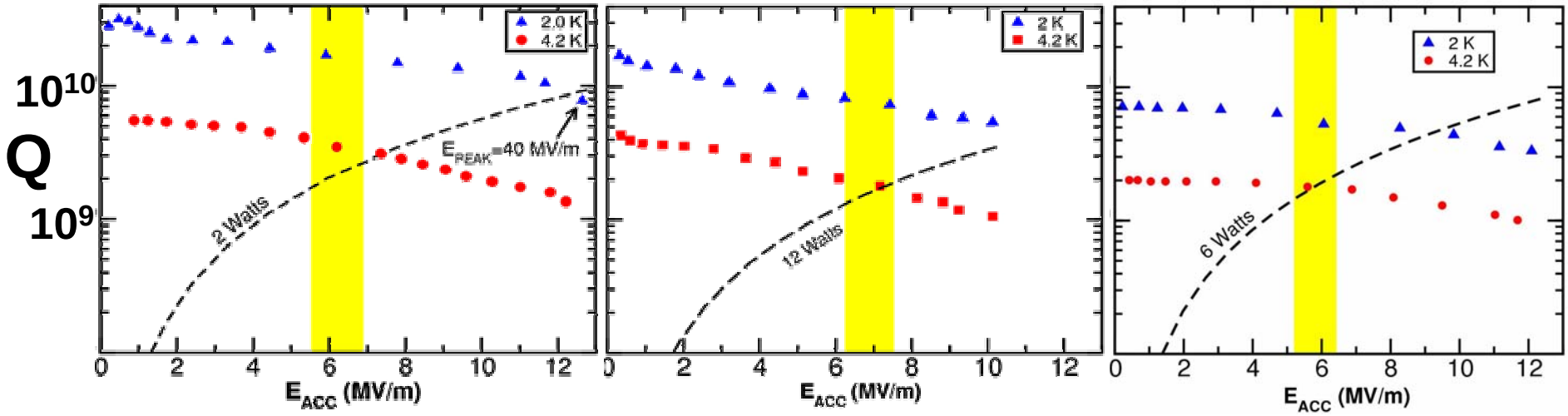
- **Typically sub-micron surface roughness**
- **Lower rf losses and less "Q-slope" at 4 K**

A Joint ANL/FNAL Chemistry Facility


Chemical Processing Rooms

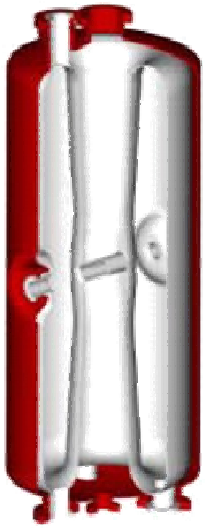

Air Scrubber

Test Performance of the RIA Mid-beta Cavities

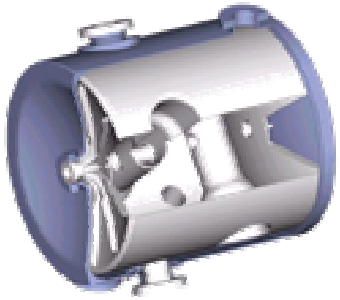


β=0.1 → β=0.5

115 MHz
β=0.15
Quarter-wave



172 MHz
β=0.25
Half-wave



345 MHz
β=0.4
Double-spoke

Surface Resistance in SRF Drift-tube Cavities

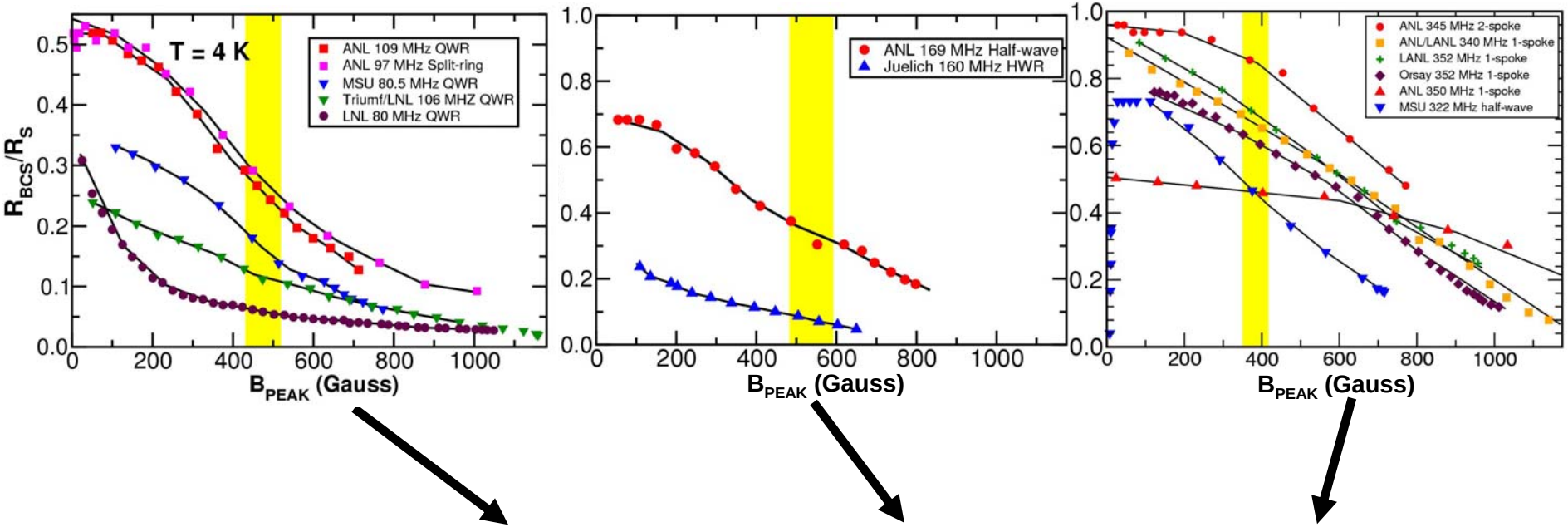


	Figure 1.	Figure 2.	Figure 3.
Frequency	80 - 109 MHz	160 - 169 MHz	322 – 352 MHz
Geometrical Factor	15 – 18 Ω	26 - 58 Ω	61 – 101 Ω
BCS Resistance	2 – 3.5 nΩ	8.7 - 11.3 nΩ	31 – 39 nΩ

Summary

- **Cavities substantially exceed the RIA performance goal**
- **Low rf losses (R_{RES}~3-8 nΩ), little "Q-slope", no significant field emission**
- **Current prototype cavities, couplers and tuners are realistic production designs**
- **Clean techniques may be used to repeatably achieve high gradients in drift-tube cavities**
- **Set a new standard for drift-tube cavity performance**