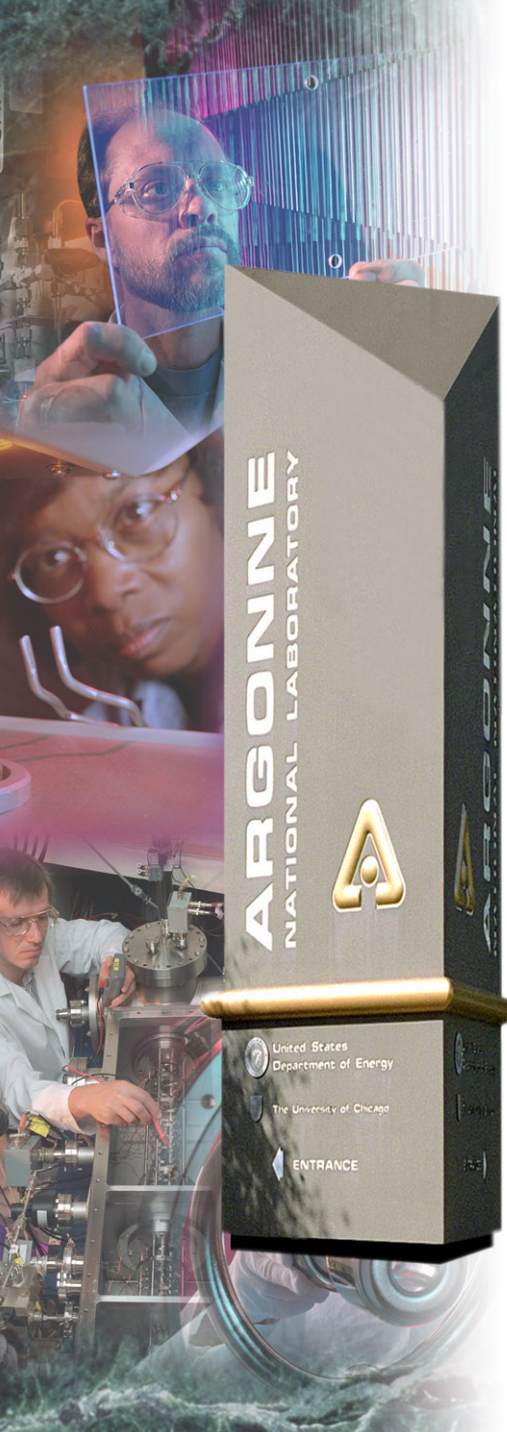




Drift-tube Cavities for RIA

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

THP05, THP06

Speaker: Mike Kelly

LINAC 2004

August 19, 2004

Other RIA papers from ANL:

MOP01 – Beam Intensity Adjustment in the RIA Driver Linac

MOP90 – Superconducting Linac Cryostat for RIA

TUP26 – Alternating Phase Focussing in Low-Velocity Heavy-Ion
Superconducting Linac

THP15 – Spoke-loaded SC Cavities for the RIA Driver Linac

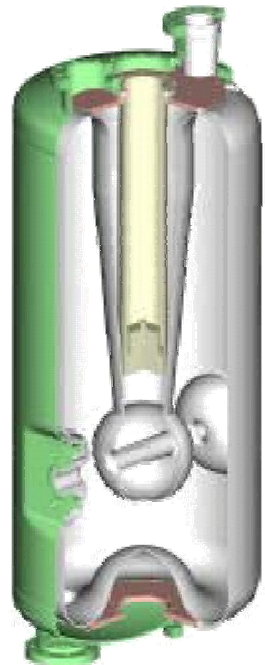
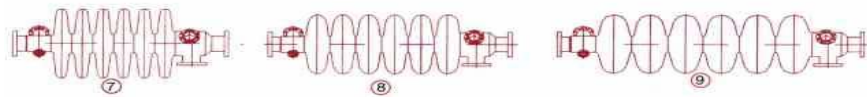
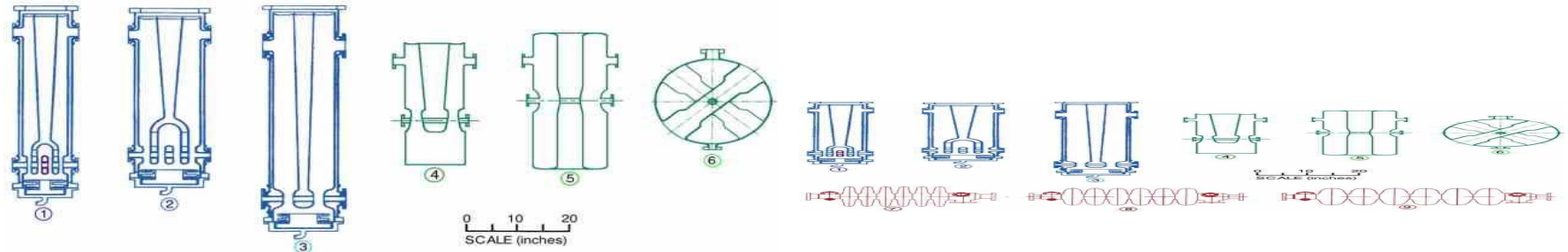
Argonne National Laboratory



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

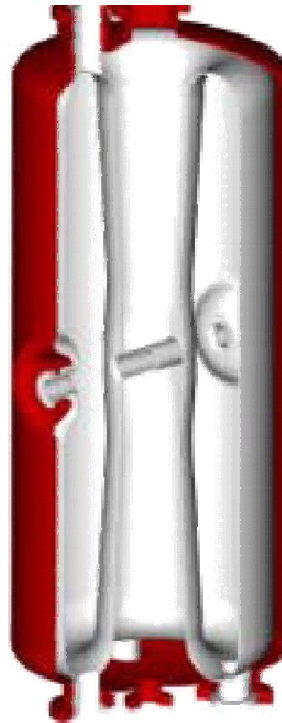


ANL Developed Cavities for $0.1 < \beta < 0.5$



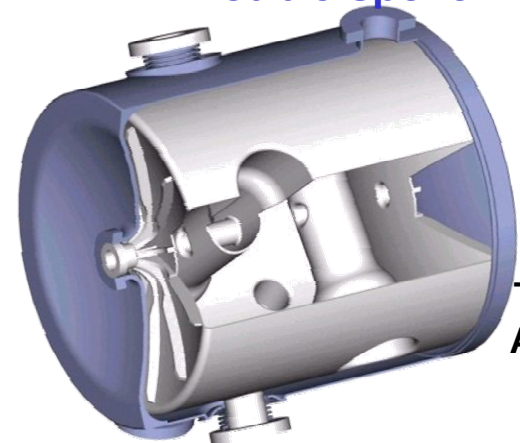
115 MHz
 $\beta=0.15$
Quarter-wave

Cold
Tested
May
2004



172 MHz
 $\beta=0.25$
Half-wave

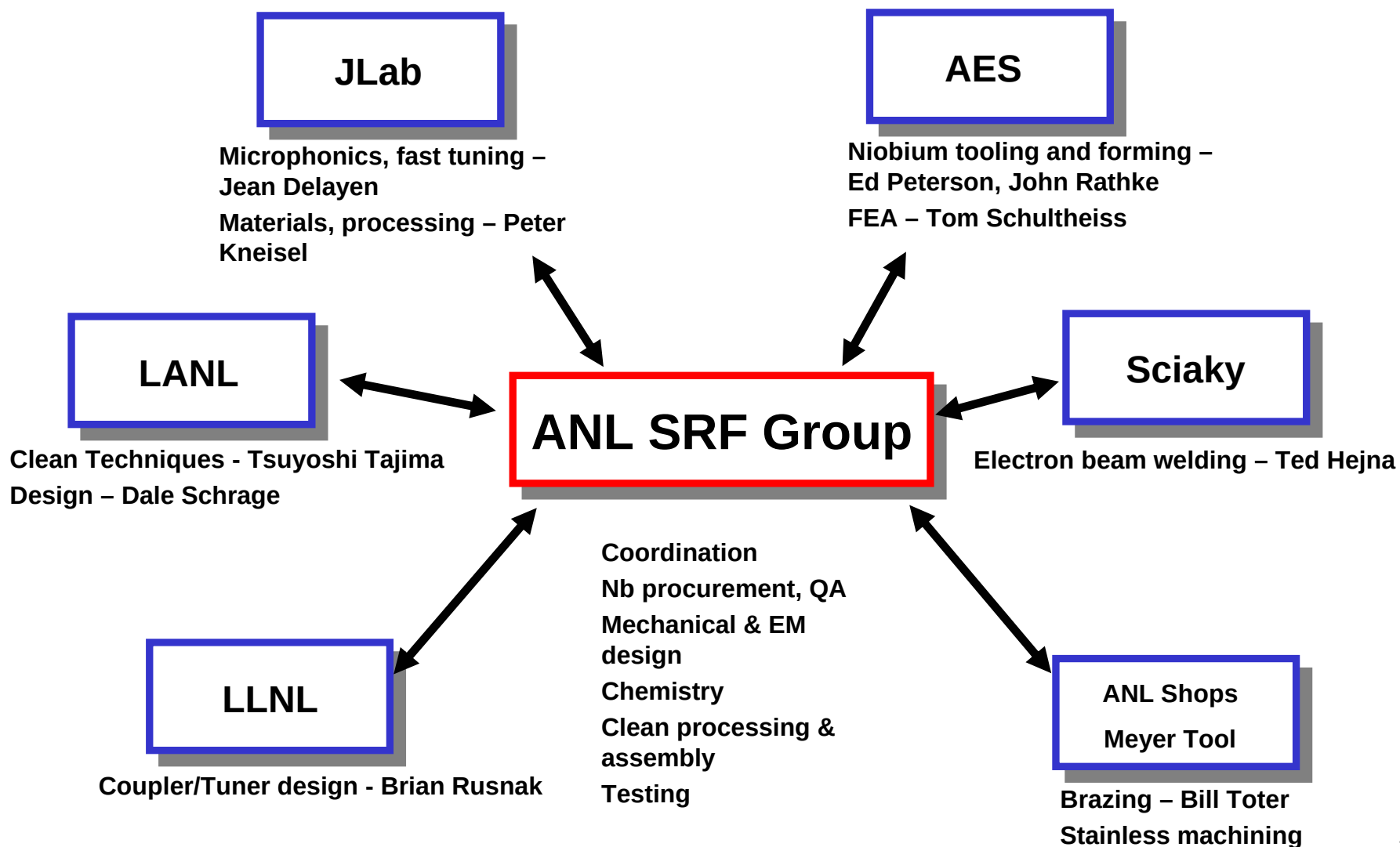
Cold
Tested
February
2004



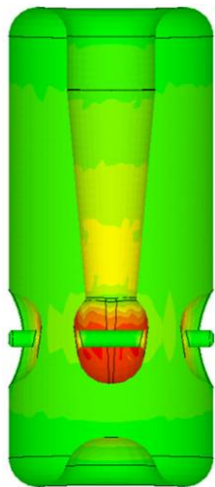
345 MHz
 $\beta=0.4$
Double-spoke

Cold
Tested
August
2003

RIA Drift-tube Cavity Team/Collaborators



An Outline of the Fabrication Process



Designed using Microwave Studio and ProE

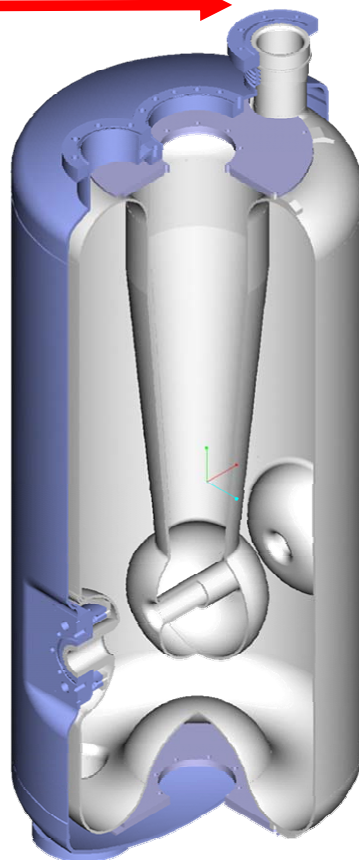
Niobium-to-stainless steel
brazed → stainless-steel
helium vessel



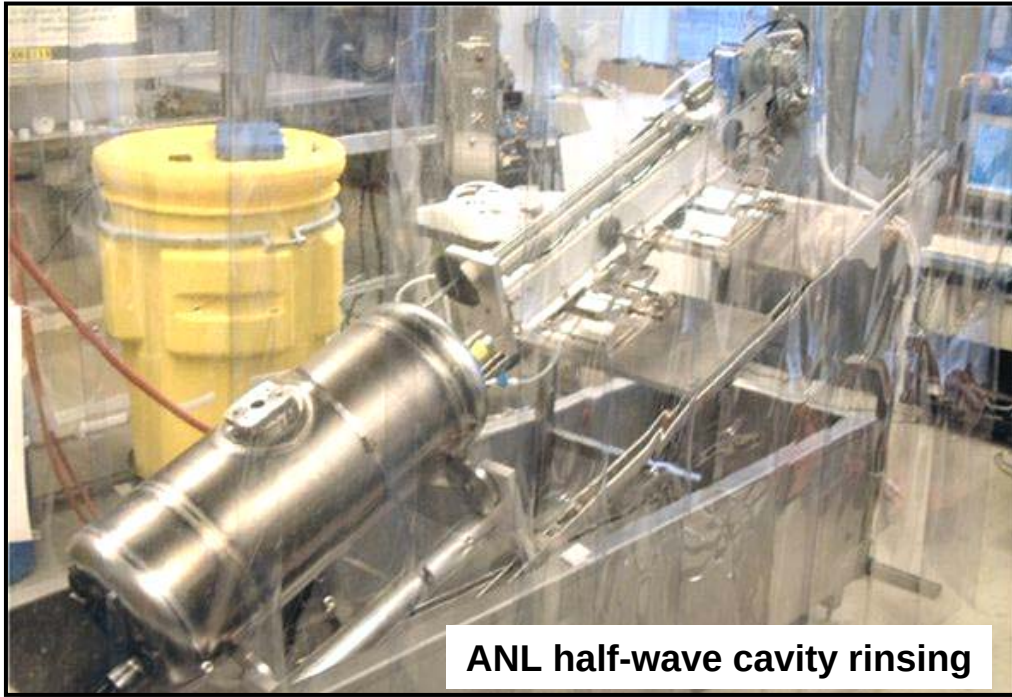
3 mm RRR=250
niobium sheet



Hydroformed, EB-welded,
and electropolished

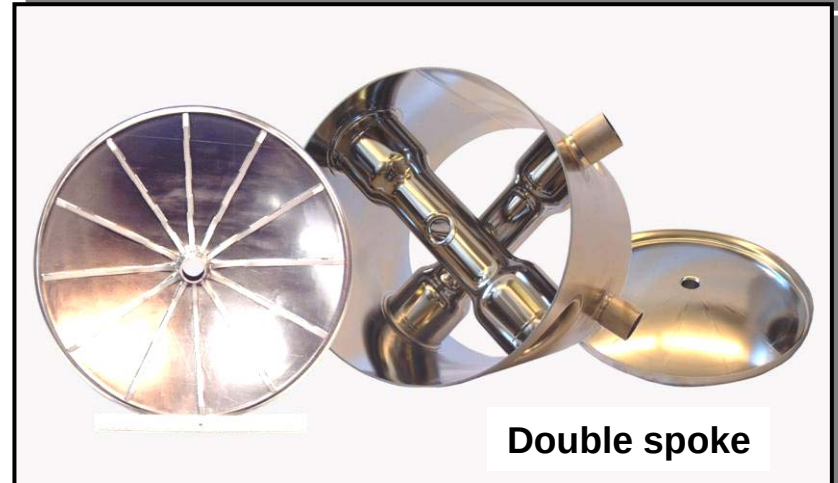


Facilities: Clean Processing for SRF Cavities



- Clean techniques from DESY and Jefferson Lab
- Ultrapure high pressure water rinse in clean area
- Clean room assembly of cavity, couplers, vacuum systems

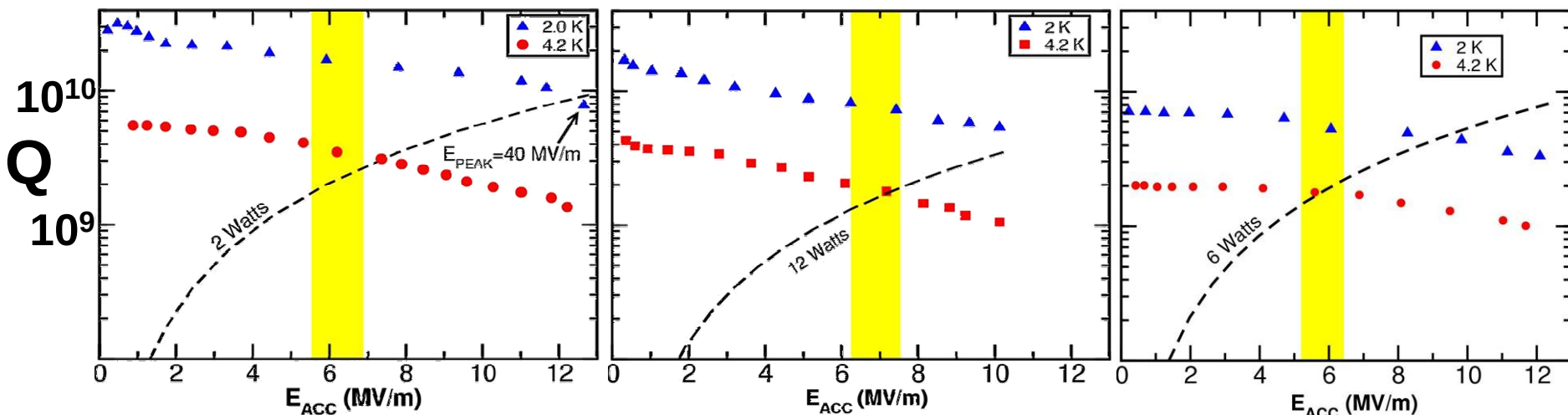
Electropolishing at ANL



Electropolishing yields:

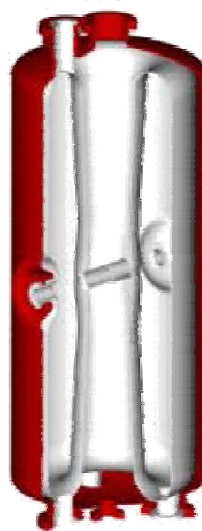
- **A smoother surface**
- **Lower rf losses and less “Q slope” at 4 K**

Test Performance of the RIA Mid-beta Cavities

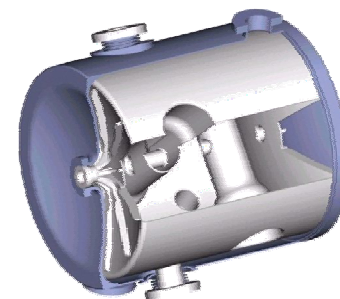


Microphonics at
accelerating field

$\sigma = 3$ Hz RMS



$\sigma = 2$ Hz RMS



$\sigma = 5$ Hz RMS



Pioneering
Science and
Technology

LINAC 2004

August 19, 2004

Michael Kelly, ANL Physics Division

Office of Science
U.S. Department
of Energy



Summary

- Cavities substantially exceed the RIA performance goal
- Low rf losses ($R_{\text{RES}} \sim 5\text{-}10 \text{ n}\Omega$), little “Q-slope”, no significant field emission
- Established the team & techniques needed to build the RIA cavities
- Current prototype cavities, couplers and tuners are realistic production designs
- Clean techniques may be used to repeatably achieve high gradients in drift-tube cavities
- All cavity Q values at or above 10^9 in 4 K operation *over the full operating range*

