THIAKI01

Cavity Production and R&D in U.S. Industry

Special Session on International Industrial Forums for ILC

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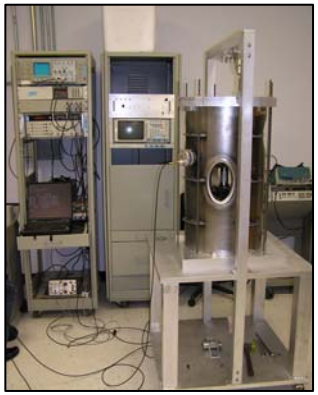
Putting Accelerator Technology to Work

Overview

- Three US Companies Have Expressed Interest in Cavity fabrication for ILC - All 3 have put significant infrastructure in place to address the need for superconducting cavity fabrication
  - Advanced Energy Systems, Inc (AES), Medford, NY - Has been fabricating cavities since 1998 and has produced all US cavities to date
  - Niowave, Inc.,Lansing, MI – Spin-off company in 2005 out of Michigan State University NSCL
  - Roark Custom Metal Fabrication, Brownsburg, IN – Small Specialty Production EB welding and manufacturing company
- Four DESY-Style Cavities and One 9-cell Reentrant Cavity of Cornell's Shape Have Been Produced in US Industry by AES
- Six Additional "Symmetrical" DESY 9-Cell Cavities are Currently In Production at AES – Delivery late 2007
- Seven Single-Cell Test Cavities are also in Production at AES – Delivery August 2007

Advanced Energy Systems, Inc.

- High-tech spin-off in 1998 from Northrop Grumman Research – 29 Employees – Most with more than 15 years with AES
- Certified to ISO 9001:2000 with Design
- In-house Superconducting cavity fabrication capability
  - EB welding
  - CNC machine shop
  - Forming at local vendor – AES supervised
  - Light BCP facility & Ultra-pure water system
  - RF tuning & Test lab
  - Design & Analysis



Niowave, Inc.

- High-tech spin-off in 2005 from Michigan State University's National Superconducting Cyclotron Laboratory Located in Lansing, MI – 20 employees
- Infrastructure to manufacture SRF cavities & cryomodules is operational at Niowave's headquarters
  - Class 10 cleanroom (15'x50')
  - Ultra-pure water system
  - Chemistry facility
  - CNC machine shop
  - Use Sciaky electron beam welder
  - Cryogenic & microwave test systems
  - RRR Measurements
  - Testing & Qualification of Cryomodules

3.9 GHz CRAB Cavities

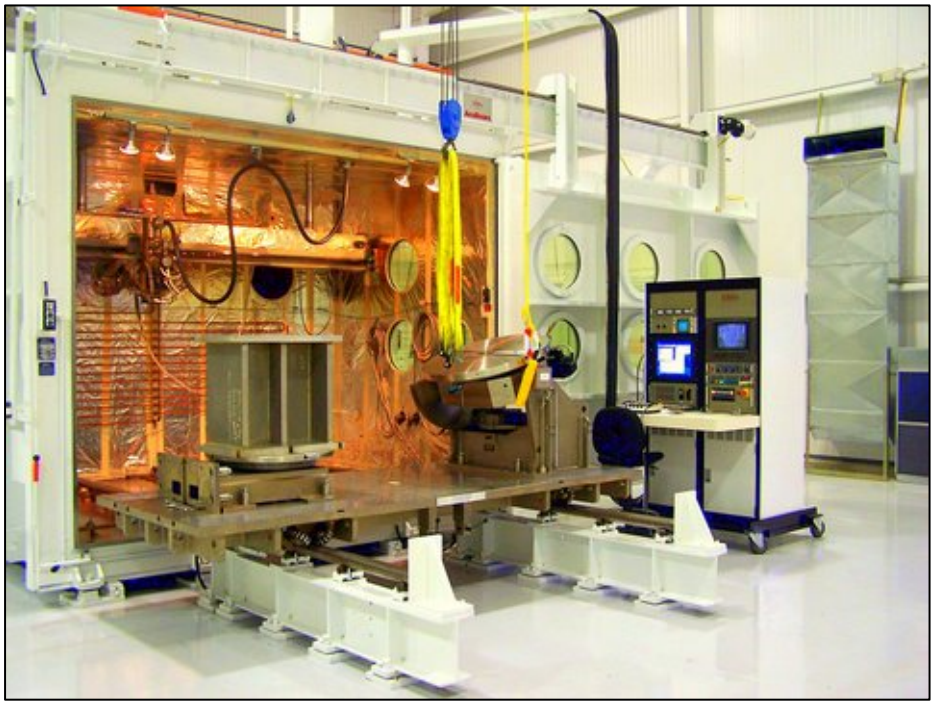
1.3 GHz β=0.81 seven-cell cavities

Roark Custom Metal Fabrication

- Small family-owned business with 70 employees specializing in Production of Specialty Metal Components for Aerospace, Automotive, and Scientific markets
- Located in Brownsburg, IN for 50 years
- Large in-house EB welding capability as well as forming, machining, and pre-weld Buffered Chemical Processing, and Ultra Pure Water system
- Certified to AS9100, ISO 9001:2000, and Nadcap

3.9 GHz Cavities

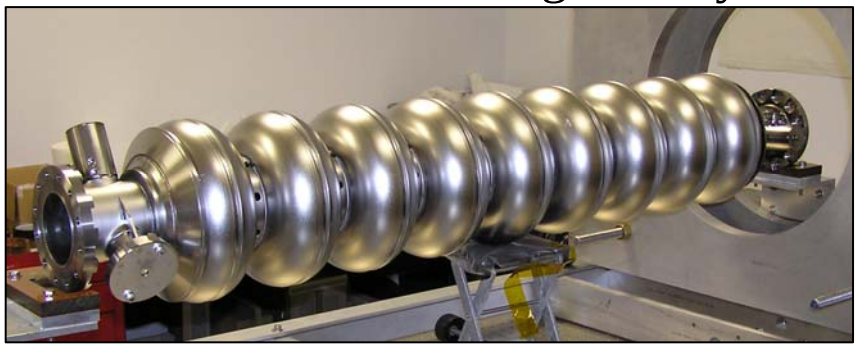
Single Spoke Center Conductor



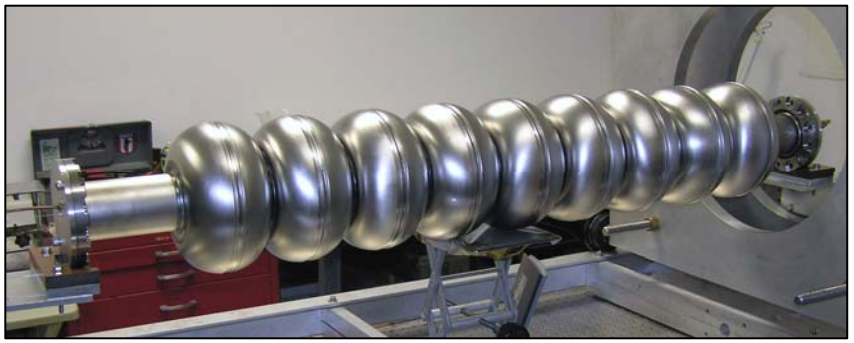
Sciaky VX138 x 107 x 108 at Roark – one of 4 EB Welders

Cavity Testing

- 4 AES Fabricated DESY-Style cavities are at Jefferson Lab undergoing testing (AES-1 actually at LANL for tour)
  - All cavities tuned at AES to better than 3% flatness
- All 4 have undergone Electropolishing per the S0 recipe
  - A few glitches occurred in processing & testing
  - AES-1 has undergone 4 rounds of testing
  - AES-2 and AES-3 have each been tested once
  - AES-4 is being prepared for testing
- One AES fabricated re-entrant cavity is at Cornell
  - Cavity has been vertically electropolished
  - Scheduled for testing in early/mid July



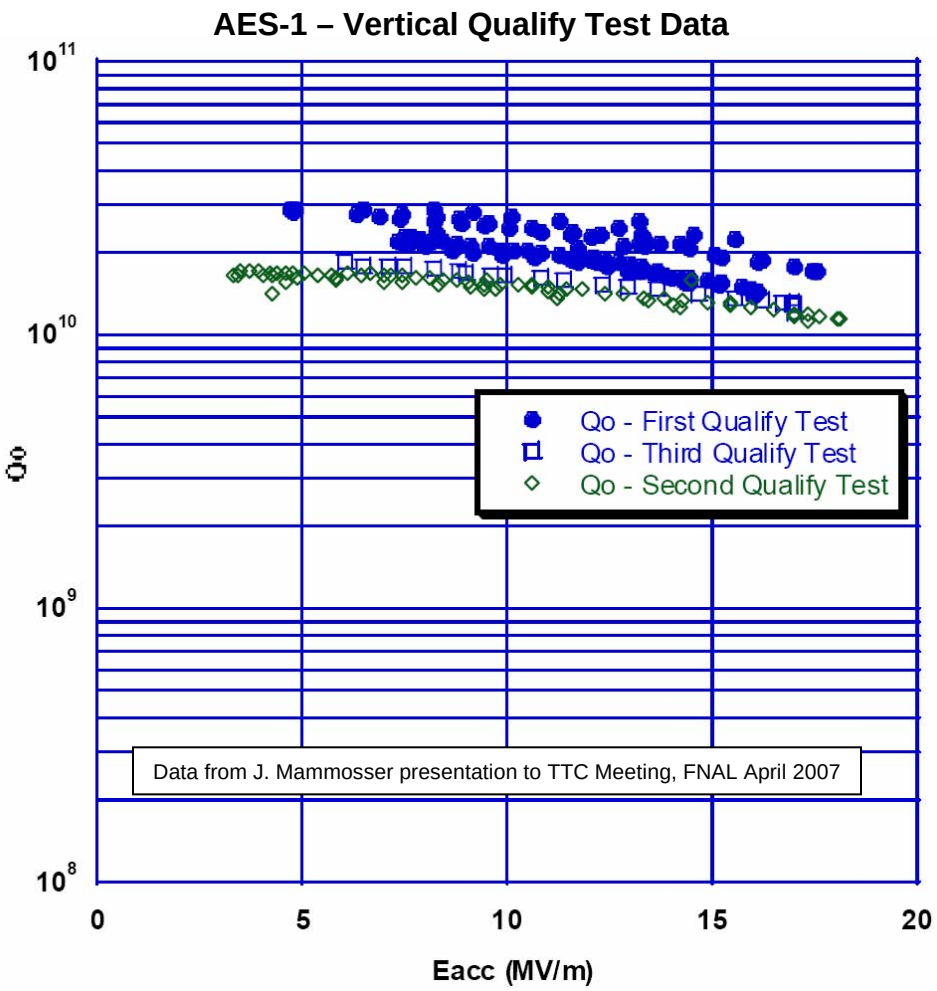
AES-1 DESY-Style Cavity

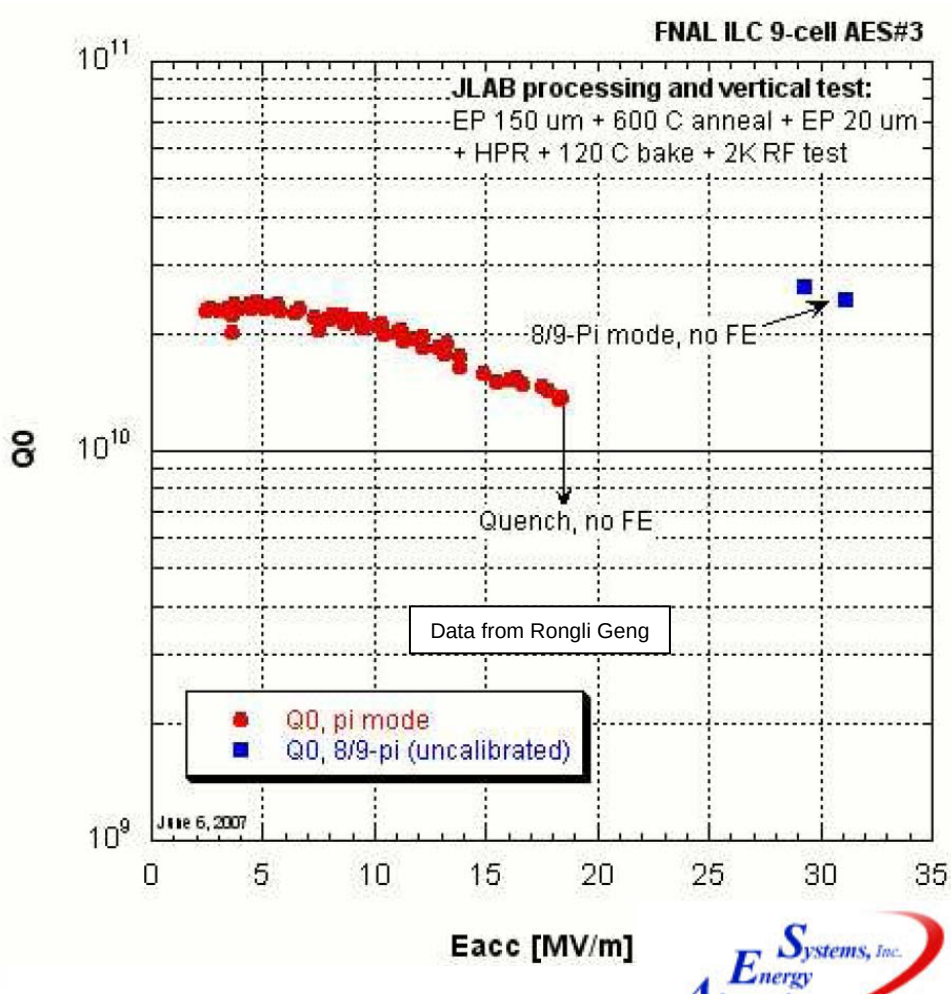


Cornell Reentrant Cavi

Test Results So Far

- AES-1, AES-2, and AES-3 have all been tested at JLAB
- All 3 exhibited hard quench at ~16 - 19 MV/m with no FE





Test Results So Far (cont)

- All 3 cavities have been tested in the "nπ/9" modes and show cells that go well over 30 MV/m
  - AES-1 is limited by cell 3 or 7
  - AES-2 seems to be limited by cell 5 (need further tests)
  - AES-3 is limited by cell 4 or 6
- Cause of quench is under discussion – further testing required
- Possibilities include:
  - Problem with a weld
  - Multipacting near equator
    - DESY and KEK collaborators have indicated this is a real possibility
    - These cavities are known to have a MP band in this field region
    - These tests characteristically exhibits no high radiation – just quench
- Visual Inspection yields no clues – Appearance equivalent to JLAB and Accel cavities

The Future

- Further testing of AES-1 through 4 will be done to determine root cause
- The Cornell Cavity will also yield important information
- AES-5 through AES-10 and Single-Cells will be fabricated wholly within AES (not using EB welding subcontractor). Allows better control.
- FNAL Plans to purchase more cavities this year and many more over the next few years
- FNAL also Plans to get all 3 US companies involved soon

➢ **Performance will be Achieved through Experience and Collaborative Lab/Industry Technology Transfer!**