Fermilab 1.3 GHz Superconducting RF Cavity and Cryomodule Program for Future Linacs

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Fermilab 1.3 GHz SRF Overview

- International Linear Collider motivated substantial infrastructure development and progress
- Project X builds on this
  - 3 GeV CW linac requires high $Q_0$ at gradients $15 < E_{acc} < 20$ MV/m; studies use 1.3 GHz cavities
  - 3-8 GeV pulsed section is 1.3 GHz, ILC cavities at $E_{acc} \sim 25$ MV/m
- Cavity preparation and qualification
  - Cavity inspection, surface processing, clean assembly, low-power bare cavity tests and pulsed high-power dressed cavity tests
  - Peripheral hardware, e.g., tuners and couplers, under development
- Cryomodule assembly
  - Well performing cavities assembled into cryomodules for pulsed high-power tests, and will be tested with beam.
- Status, accomplishments and plans
ANL/Fermilab 1.3 GHz cavity proc’ing infrastructure

- Electropolishing
- Clean assembly
- High-pressure rinse
- Ultrasonic rinse
- Tumbling machine
- Vacuum furnace
- New R&D EP tool at FNAL
Fermilab test and assembly infrastructure

- VTS1
- cavity tuning machine
- HTS
- vertical test
- VTS2 Dewar (=VTS3)
- cavity inspection (Kyoto/KEK)
- Class-10 string assembly
- cold mass assembly
- final cryomodule assembly
International cavities from established vendors using established processes. 2nd pass yield for >35 MV/m for integrated sample is (57 ± 8)% for 2010-2012 alone is (69 ± 13)%. 

C.M. Ginsburg et al., KILC12, Daegu, S. Korea

http://ilcagenda.linearcollider.org/contributionDisplay.py?contribId=85&sessionId=36&confId=5414
ILC 1.3 GHz Cavity Performance Benchmark

International cavities from established vendors using established processes
2nd pass yield for >25 MV/m for integrated sample is (80+7)%
for 2010-2012 alone is (92+7)%
Fermilab stewardship for 80 ILC cavities plus 1-cell prototypes

Cavity vendor qualification
- AES (done), Niowave-Roark, PAVAC (ongoing)

Excellent performance achieved
- Strong collaboration with JLab, Cornell, ...
- Infrastructure development
1.3 GHz cryomodule assembly

CM1 (8-cavity + dummy magnet)
- Assembled at Fermilab from a DESY “kit” which included all parts from DESY and INFN
- Was operated at NML

CM2 string (8-cavity + magnet)
- Cavities were processed and vertically tested at JLab
- Dressed and horizontally tested at FNAL
- Assembled and leak checked at FNAL
- Good chance for first ILC spec CM in US

CM3 is next
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• Please see the following related talks/posters
  - V. Yakovlev MO1A03
  - A. Grassellino MOPB078
  - S. Henderson TU1A01
  - A. Yamamoto TH3A01