

S. Aderhold\*<sup>1</sup>, A. Burrill<sup>1</sup>, D. Bice<sup>2</sup>, C. Ginsburg<sup>2</sup>, C. Grimm<sup>2</sup>, T. Khabiboulline<sup>2</sup>, O. Melnychuk<sup>2</sup>, D. A. Sergatskov<sup>2</sup>, N. Solyak<sup>2</sup>, G. Wu<sup>2</sup>

<sup>1</sup>SLAC National Accelerator Laboratory, Menlo Park, CA

<sup>2</sup>Fermi National Accelerator Laboratory, Batavia, IL

## Introduction

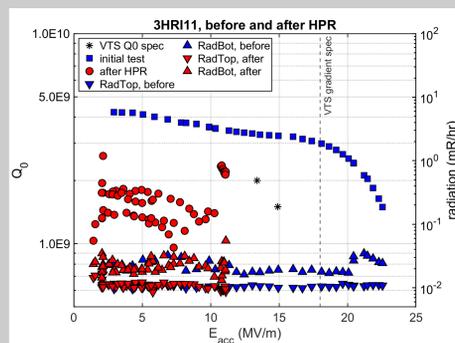
The main part of the SRF linac for the Linac Coherent Light Source II (LCLS-II) at SLAC will consist of 35 cryomodules with superconducting RF cavities operating at 1.3 GHz. In addition, two cryomodules with 3.9 GHz cavities will be installed and help to linearize the longitudinal phase space of the beam. During the design verification phase, four prototype 9-cell 3.9 GHz cavities have been built by industry and then processed, including chemical surface removal and heat treatment, and tested at Fermi National Accelerator Laboratory. Based on the resulting cavity treatment recipe, 24 cavities (for two cryomodules to be installed in the linac and one spare cryomodule) have been built by industry and tested at Fermilab prior to cryomodule string assembly.

## Design Verification Phase

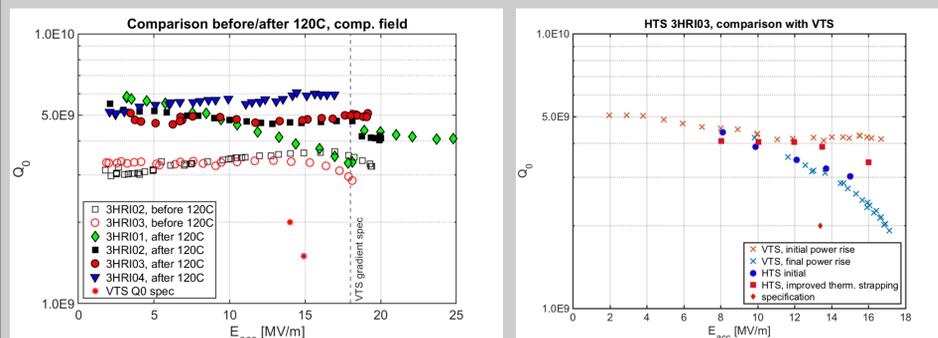
- 4 cavities were built for design verification
- Mechanical fabrication at vendor
- Chemical surface processing, heat treatment and VTS assembly at Argonne National Lab and Fermilab
- VTS testing before and after 120C bake to determine final recipe
- Decision for BCP removal and 120C bake for 48h
- Successful test in horizontal cryostat for verification of integrated cavity system performance
- High power input coupler
- Magnetic shielding
- Chimney heat load
- Tuner (slow and piezo)

## Cavity Production

- 24 cavities ordered from RI
- Surface treatment recipe:
  - 120µm bulk BCP
  - 800C degassing
  - 15µm final BCP
  - 120C bake for 48h
- Type A and type B
- Power coupler on opposite sides to minimize coupler kick in cryomodule
- 18 cavities delivered to date
- String assembly for first CM started



- Problems with cavity cleanliness in early production → field emission
- Improvements of HPR tool and clean room procedures made
- All cavities re-HPRed at Fermilab improved and qualified

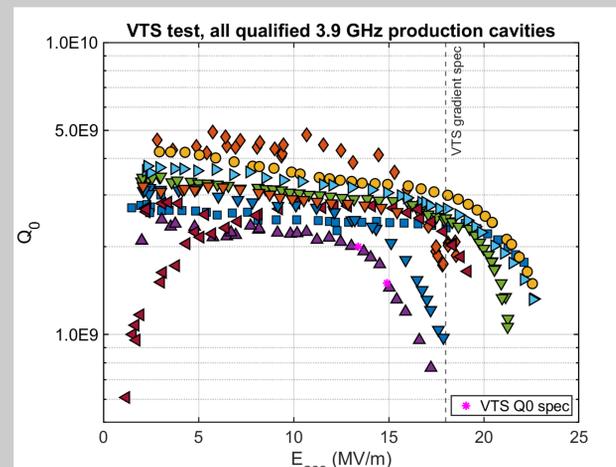
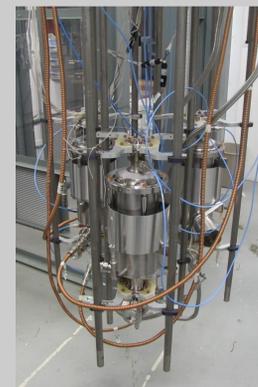


## Cavity Performance Requirements

Parameter	Value
Min. $E_{acc}$ in VTS acceptance test	18 MV/m
Min. $Q_0$ in VTS acceptance test	$2 \times 10^9$ @ 13.4 MV/m, $1.5 \times 10^9$ @ 14.9 MV/m
$E_{acc}$ in linac operation	13.4 MV/m (nominal), 14.9 MV/m (maximum)

## VTS Acceptance Testing

- Three cavities tested per cooldown
- 14 cavities RF tested to date
- 9 cavities accepted for string assembly
- 6 accepted "first pass": 43%
- Average  $E_{acc}$  of accepted cavities:
  - 19.7 MV/m
- Average  $Q_0$  of accepted cavities:
  - $2.8 \times 10^9$  @ 13.4 MV/m
  - $2.7 \times 10^9$  @ 14.9 MV/m



## Summary

- BCP + 120C bake recipe yields cavities with sufficient margin on  $Q_0$
- Production of 24 cavities almost complete
- Assembly of first string at Fermilab has started