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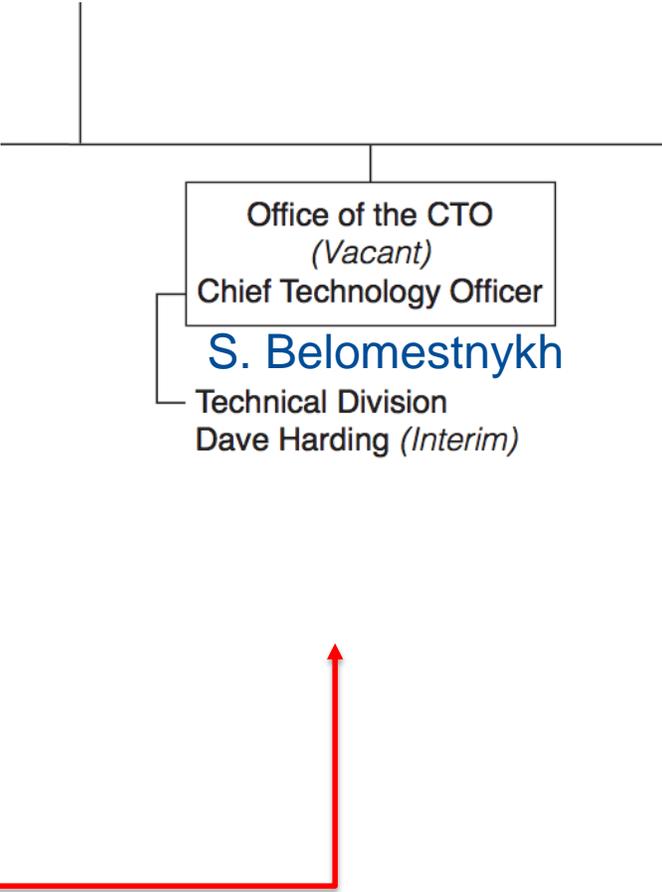
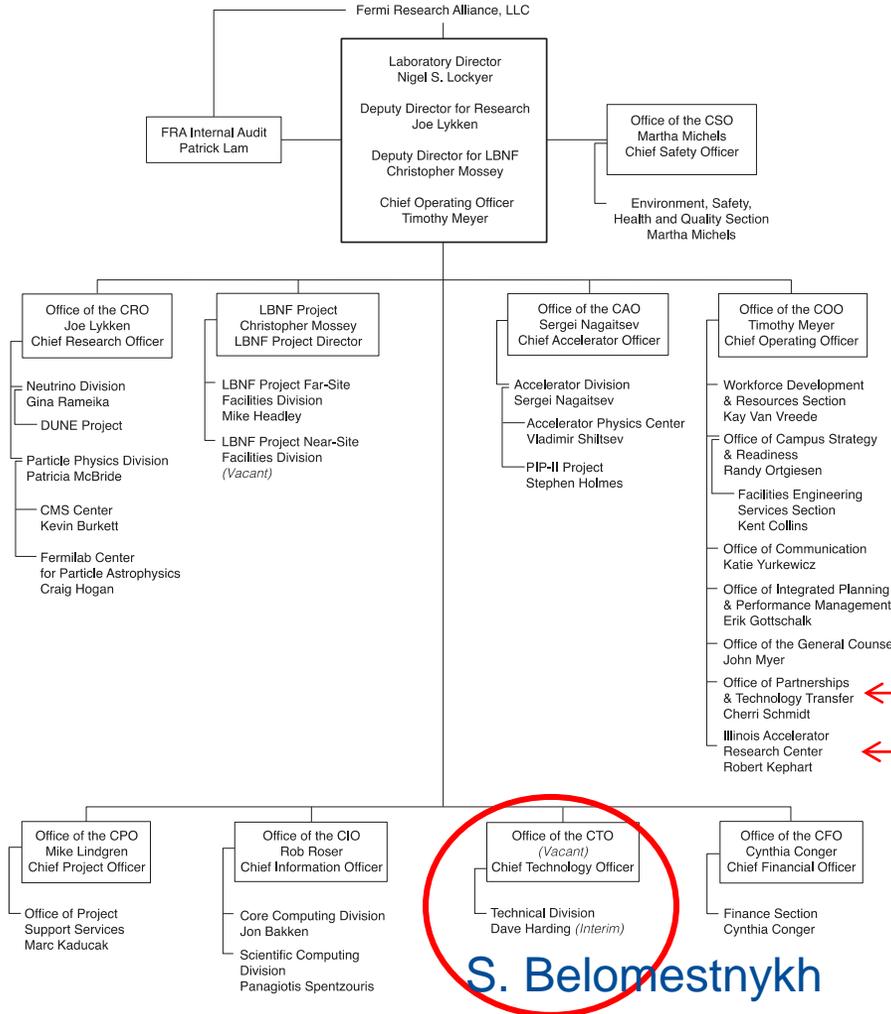
Fermilab SRF Facility Overview

Genfa Wu

2015-11-16

Organizational Chart

Fermilab Organization

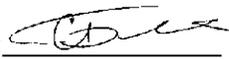


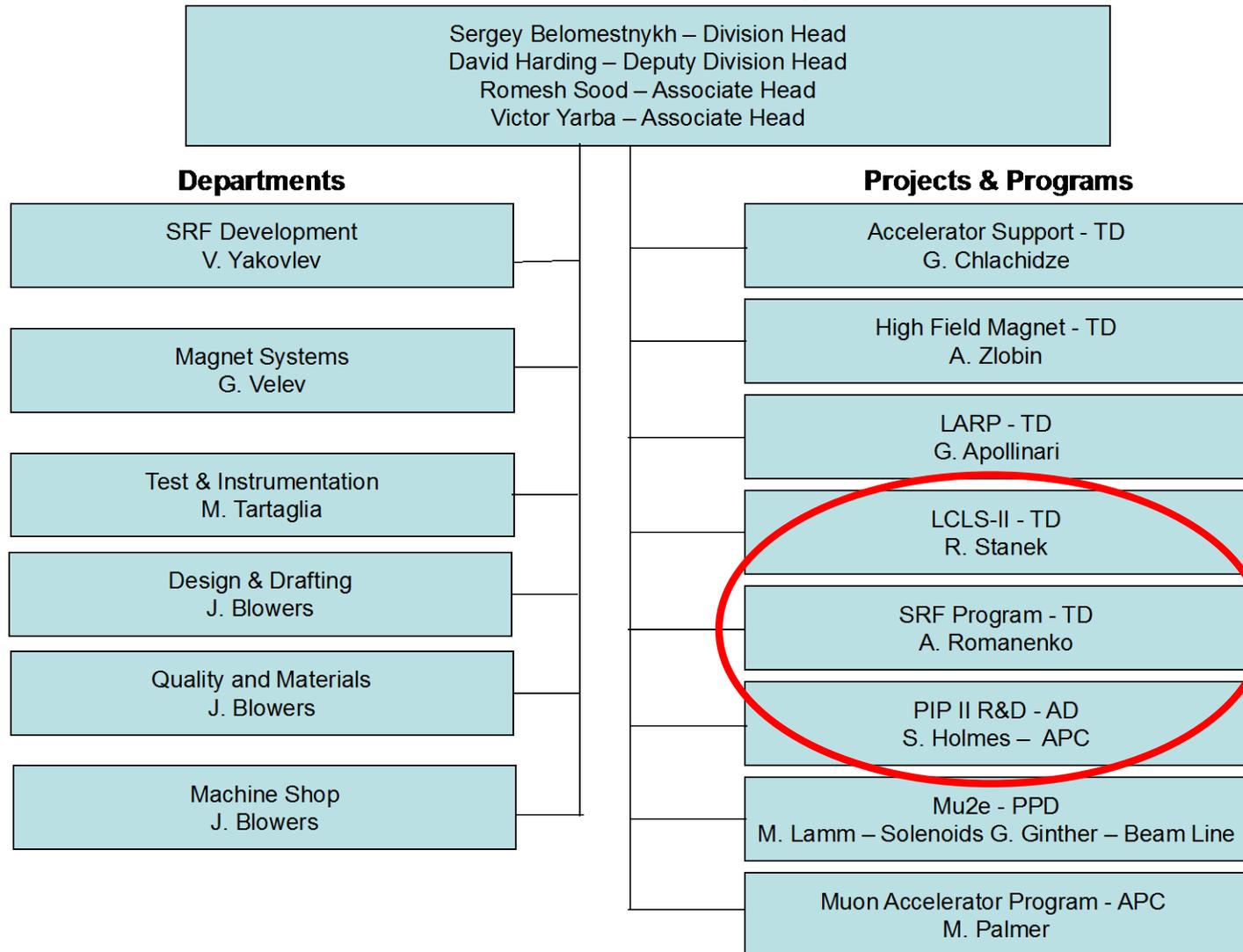
S. Belomestnykh



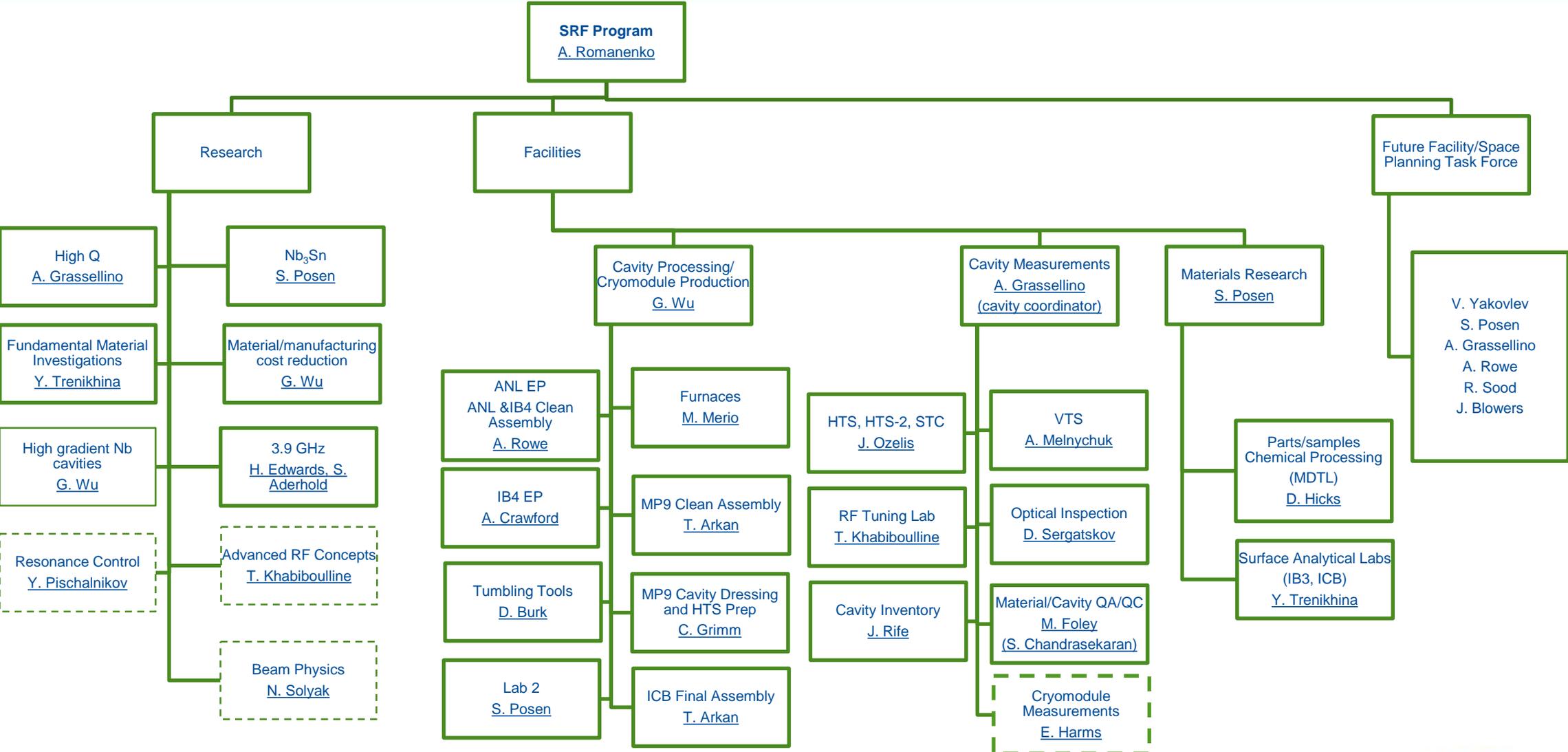
Organizational Chart

Technical Division – October 1, 2015

Approved: 



Organizational Chart



Facilities working model

- Many projects and programs competing for resources
 - LCLS-2
 - PIP-2
 - General Accelerator R&D (cavity performance improvements)
- Facility Scientists prioritizing work to assure all programs are successfully completed

Large Cavity Bases

- Various Cavities
- Very large cavity inventory – mostly 1.3 GHz



Bare 325 MHz SSR1 cavity



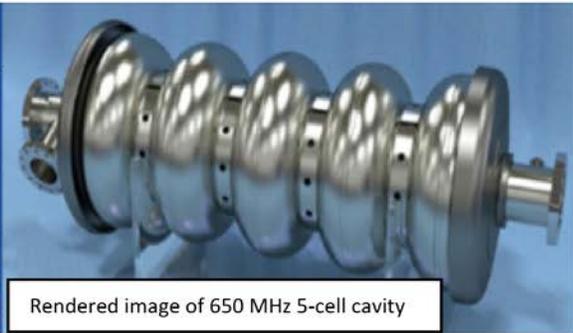
Dressed 325 MHz SSR1 cavity with tuner



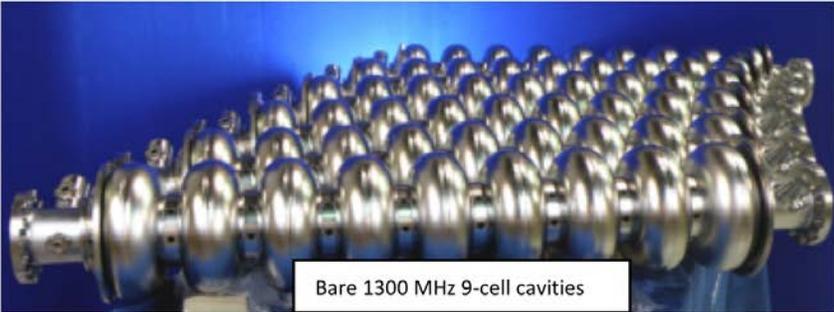
3.9 GHz Cavity



Bare 650 MHz 1-cell cavities



Rendered image of 650 MHz 5-cell cavity

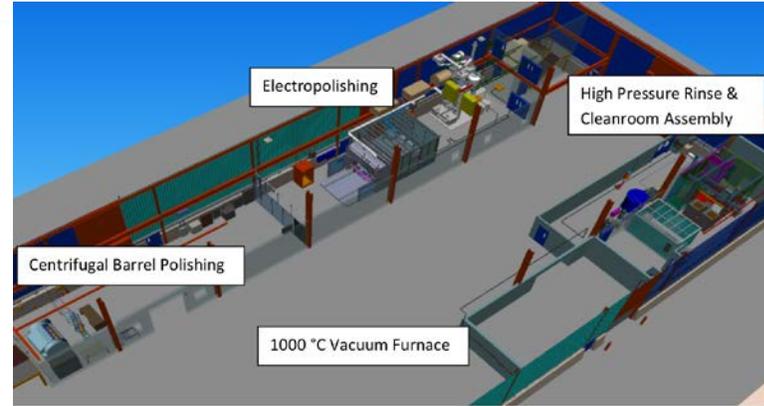


Bare 1300 MHz 9-cell cavities

Facilities - Processing



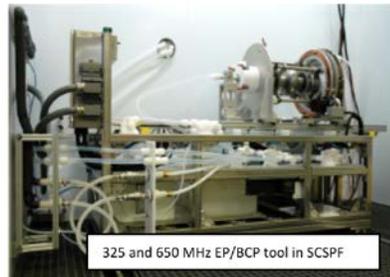
ANL location
funded by
Fermilab



Fermilab/IB4



Setting up for BCP in G150



325 and 650 MHz EP/BCP tool in SCSPF



CBP machine



EP cabinet in CPL



SSR1 cavity on HPR system



Loading 1300 MHz cavity into HPR

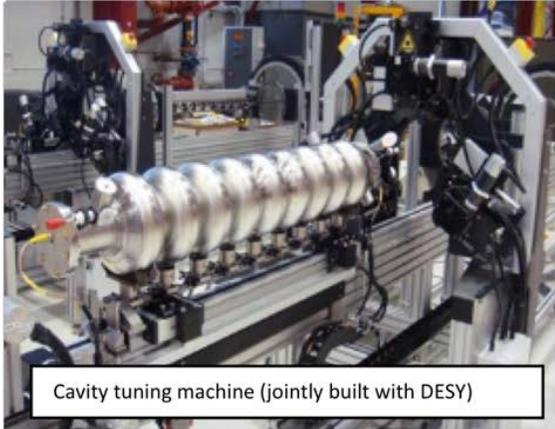


Mirror-like surface (after CBP) on 9-cell cavity

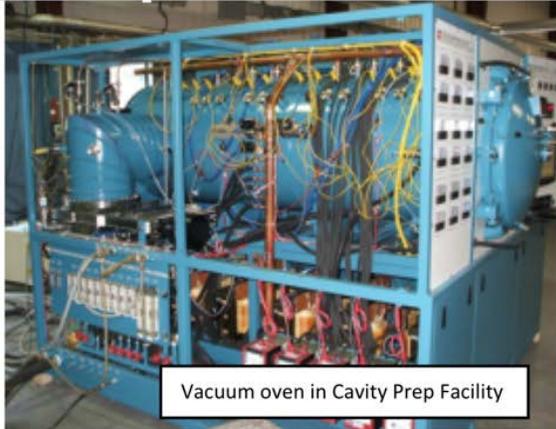


Before/After CBP - applied to 1-cell cavity

Facilities – Processing and Assembly



Cavity tuning machine (jointly built with DESY)



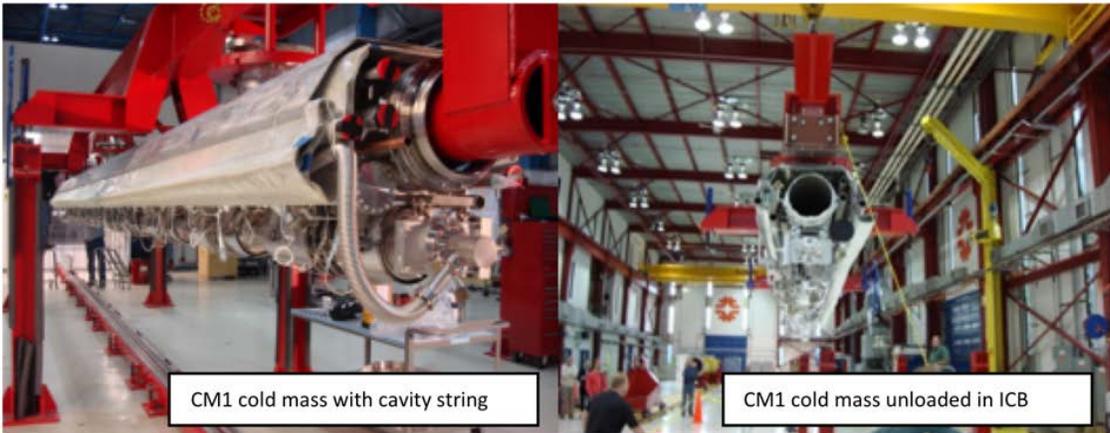
Vacuum oven in Cavity Prep Facility



Cryomodule Assembly Facility (MP9)



CM1 string assembly in Class 10 clean room



CM1 cold mass with cavity string

CM1 cold mass unloaded in ICB



CM1 cold mass being installed in vacuum vessel



CM1 complete and ready for installation

Facilities - Testing



VTS1 installed and operational



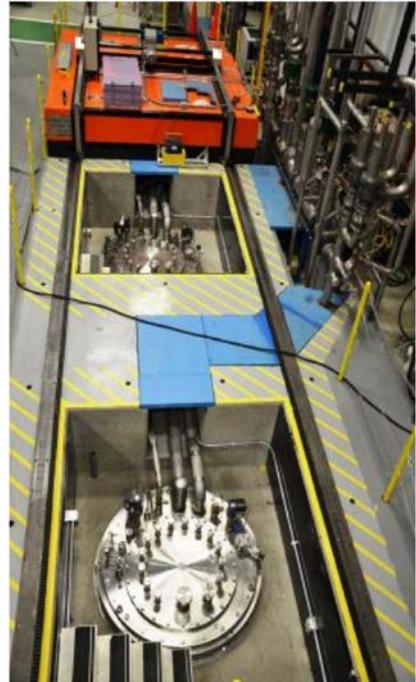
VTS3 cryostat ready for installation



VTS3 being installed



VTS1 insert with 1.3 GHz 9-cell



VTS2 and VTS3 installed in pit



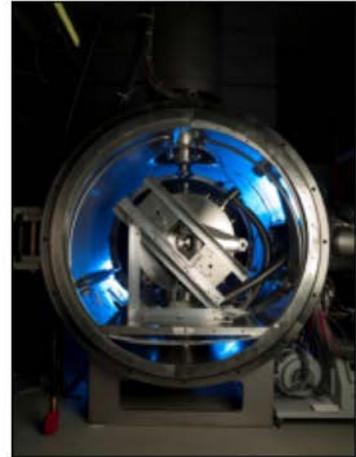
HTS1 with 1.3 GHz cavity installed



Horizontal Test Stand 1 (HTS1)

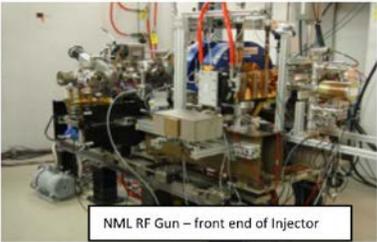
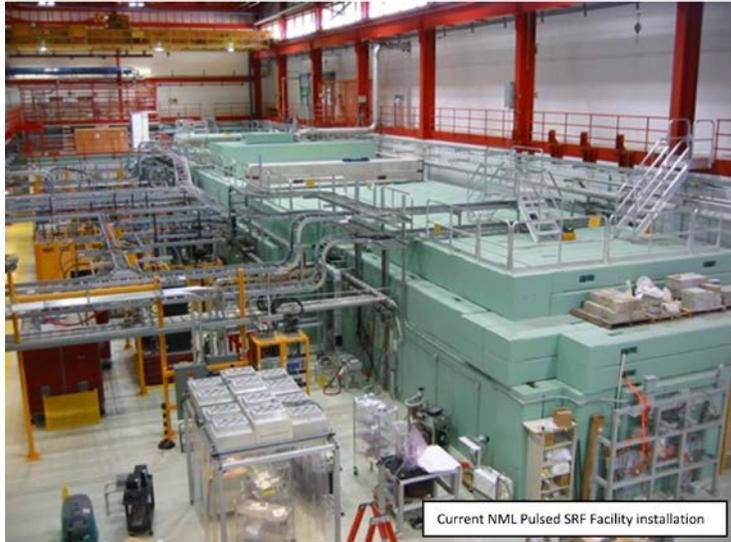
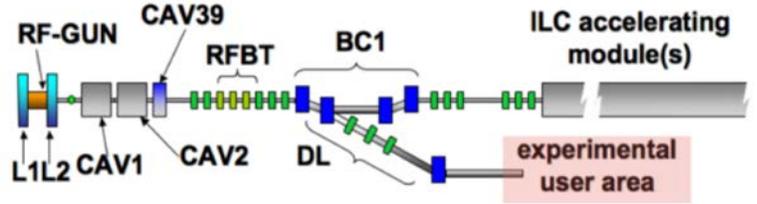


Spoke Test Cryostat (STC)



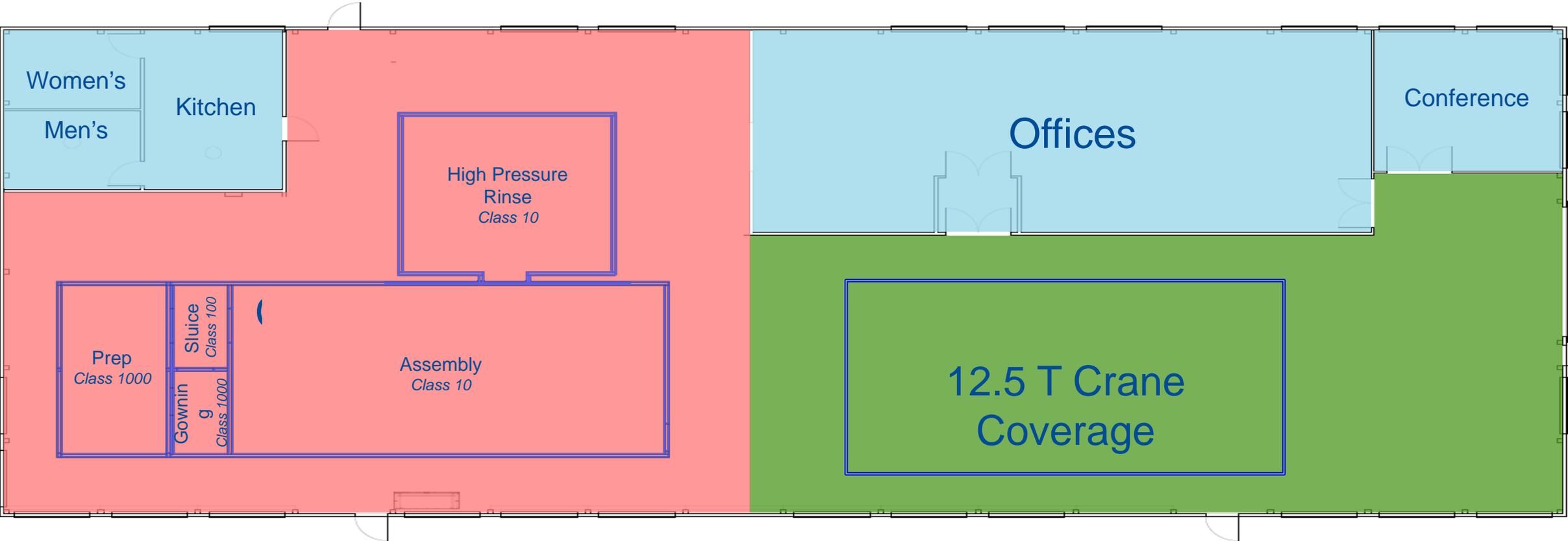
STC with 325 SSR1 cavity installed

Facilities – Cryomodule Testing

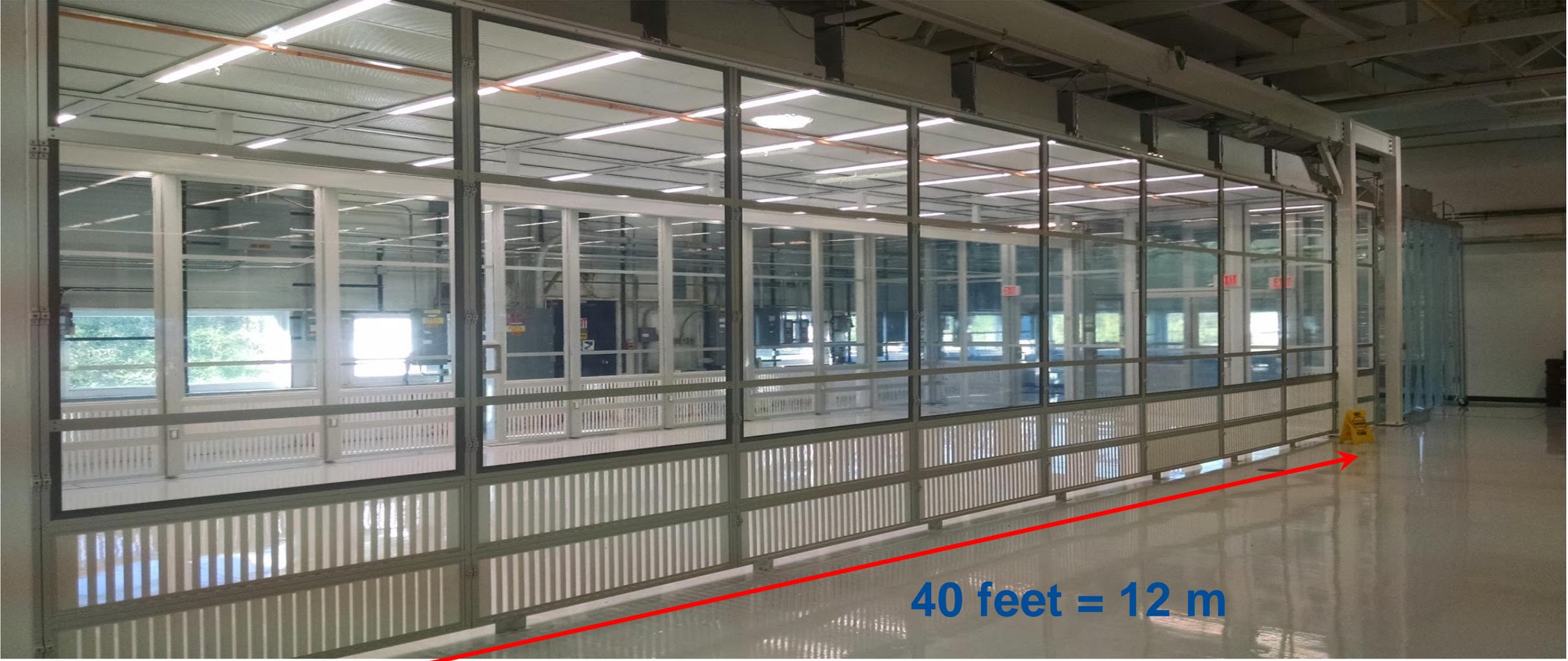


New Facility: Lab 2

10 ft



New Facility: Lab 2 New Class 10 Cleanroom



40 feet = 12 m

New Facility: Lab 2 New 12.5 T Crane





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Tesla Technology Collaboration High Gradient Working Group

Genfa Wu

On behave of Fermilab High Gradient Development

2015-11-16

Outline

- TTC HG Working Group Structure
- Goals and Milestones
- Activities Summary

TTC HG Working Group

- TTC HG Working Group Structure
 - High Gradient Niobium Cavity
 - Nb₃Sn Cavity
 - Six international laboratories organized initially by H. Padamsee



TTC HG Working Group

- TTC HG Working Group Goals and Milestones
 - Establish routine high gradient (45-55 MV/m) within one year
 - Establish high usable gradient (45-55 MV/m high quality factor and low field emission) within two years
 - Achieve high yield of high usable gradient cavities within 3-4 years

 - Establish single cell Nb₃Sn high gradient (>50 MV/m) within 3-5 years
 - Establish multi cell Nb₃Sn high gradient within 10 years
 - Establish high yield Nb₃Sn high gradient within 10-15 years

Nb₃Sn, see S Posen presentation

Dream of the dreamers

TTC HG Working Group Collaboration Activities

- Collaboration bases
 - Cornell University has the re-entrant cavities for both 1-cell, 3-cell and 9-cell cavities.
 - MSU/FRIB has many ichiro 1-cell and 9-cell cavities
 - JLAB has 1-cell Low Surface Field (LSF) cavities
 - KEK has fabrication capabilities
 - DESY has testing resources (support/funding)
 - Fermilab has testing resources (support/funding)
- MSU/FRIB supplies the ichiro cavities to Fermilab
- Fermilab is fabricating a 2.6 GHz low loss 1-cell

TTC HG @Fermilab

New shapes

- MSU/FRIB supplies the ichiro cavities to Fermilab
- Fermilab is fabricating a 2.6 GHz low loss 1-cell

Usable Gradient

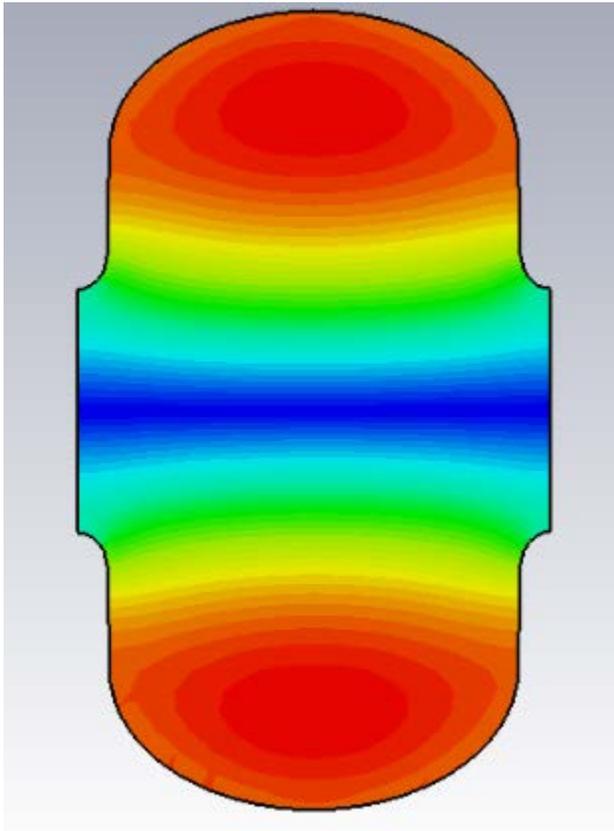
- Fermilab Field Emission Studies
 - Robotic arm assisted cavity assembly
 - Thin film coating for field emission suppression
 - Field Emission sample analysis
- Fermilab high Q at high Field

Low Cost Development

- Niobium coating on Copper

Fermilab single cell 2.6GHz low loss cavity

- An optimized low loss shape was designed. We have obtained a batch of 2.2mm niobium sheets and will start fabricate several 2.6GHz single cell cavities very soon.



Preliminary

f_0 (TM ₀₁₀)	2.58 GHz
G	285
R/Q	137
B_{pk}/E_{acc} (mT/MV/m)	3.63
E_{pk}/E_{acc}	2.12
Aperture (mm)	34

For easier surface treatments,
we enlarged the low loss shape wall slope angle

Work inspired by the
discussion with M. Harrison

Cavity design by Yi Xie
Slide made by Yi Xie

High Q avoids the global
thermal instabilities

Fermilab is superiorly prepared for any dream accelerator

- World Leading Team of SRF Science and Technology
- Proven Engineering Supremacy
- Fully Trained Technical Staff in Cavity Preparation, Cryomodule Assembly and Testing
- World Class Infrastructure for Cutting Edge Research and Large Project for SRF