Fermilab SRF Program
(ILC, Project-X and SRF Accelerator)

Shekhar Mishra

ILC, Project-X & SRF Program

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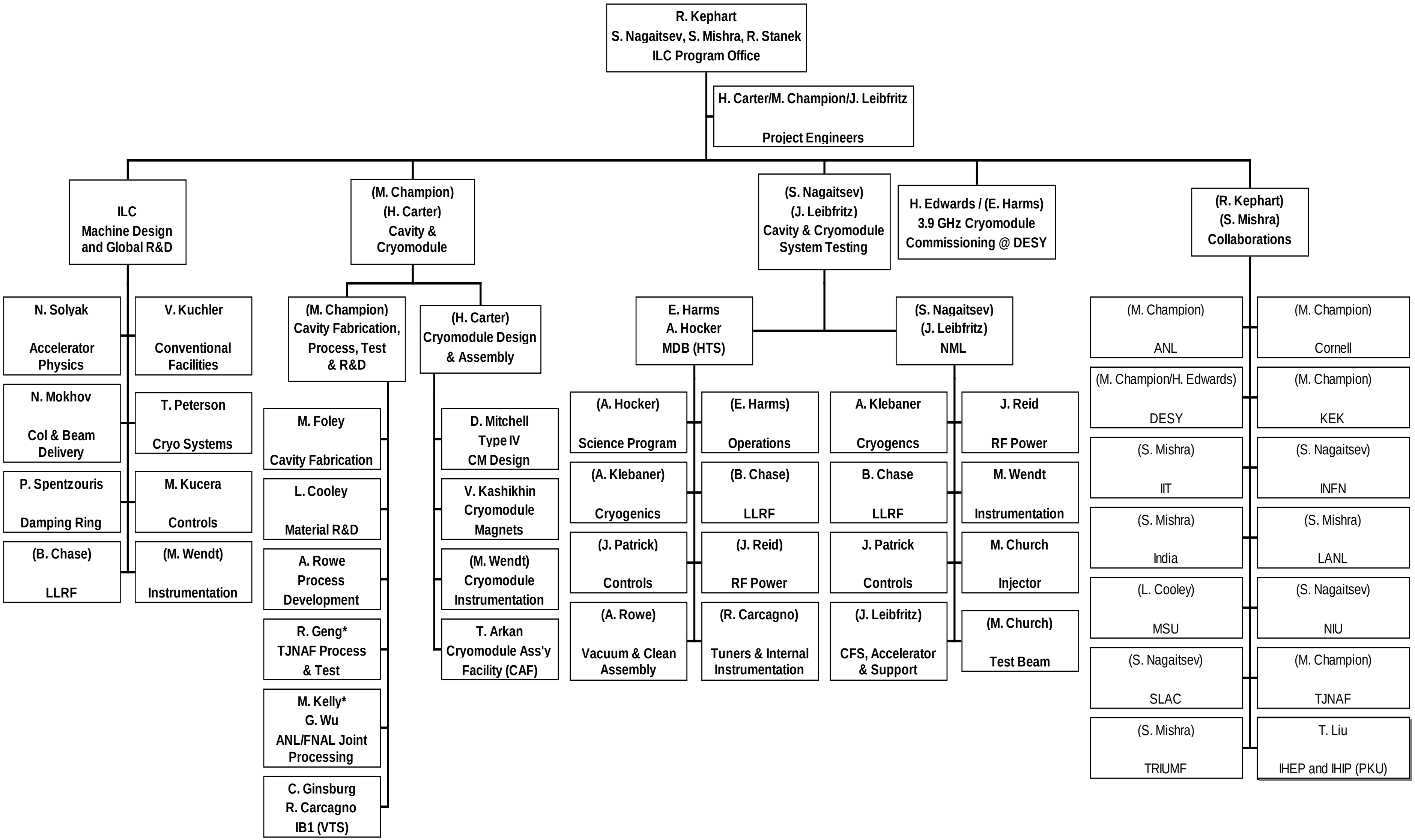
Outline

- Mission
- SRF efforts at Fermilab and high level goals
- Technical status (Slide 10-35)
- Budget (SWF and M&S) at High Level (Slide 35-49)
  - ILC
  - SRF
  - ARRA
- FY10 Budget guidance and its impact (Slide 50-51)
  - Request for future
- Summary

ILC/SRF Organization



SRF Mission Statement

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Mission:

- **Develop SRF infrastructure at FNAL and perform R&D to master the technology for future accelerator projects (e.g. ILC, Project X and future SRF accelerators)**

Goals:

- **Master fabrication & processing of cavities & cryomodules**
- **Build SRF infrastructure (difficult for industry to provide)**
  - **Large cryogenic & RF systems, cavity & cryomodule testing**
- **Operate facilities to acquire required expertise**
- **Transfer SRF technology to U.S. industry**
- **Participate in national & international collaborative R&D**

SRF Efforts at FNAL

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- There are several SRF related programs at FNAL:
  - ILC, SRF (including ARRA), 3.9 GHz, HINS, Project X
- SRF Program is being developed with current R&D and future project needs
  - What are the SRF needs of Project X ?
  - What does the ILC Global Design Effort (ART) need from the SRF effort at Fermilab?
- These needs set the scope of the SRF infrastructure
- The role of SRF management is to coordinate and manage these different Programs in the most efficient, cost effective manner
  - M&S funds are limited => cannot afford duplication
  - Labor pool of SRF-qualified personnel is limited

Project X R&D: SRF Deliverables

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Project-X planning

May 09

FY09-10

- **Test of β=1.0 Cryomodule #1 at Fermilab**
- **Completion of Type-4 CM design**
  - **Dress cavities for CM # 2**
- **Fabricate β=1 CM # 2 (1st CM with U.S. processed cavities)**
- **Order parts and dress cavities for CM #3 the first Type IV Cryomodule**

FY11

- **Test CM #2**
- **Fabricate, & install Px quadrupole package for CM #3**
- **Complete CM #3 and test**

FY12-13

- **Complete CM #4 (Project X β=1.0 Prototype) and test**
- **Complete and test Project X RF unit test**
- **Complete 1st β=0.8 cryomodule**
- **Viable U.S. vendors for Project X cavities and CM parts**
- **Good cavity processing yields at Project X gradients (25 MV/M)**
- **infrastructure capable of 1 Cryomodule per month output**
  - **Using ANL, JLAB, SLAC, and FNAL infrastructure**

ART R&D Program Deliverables (2012)

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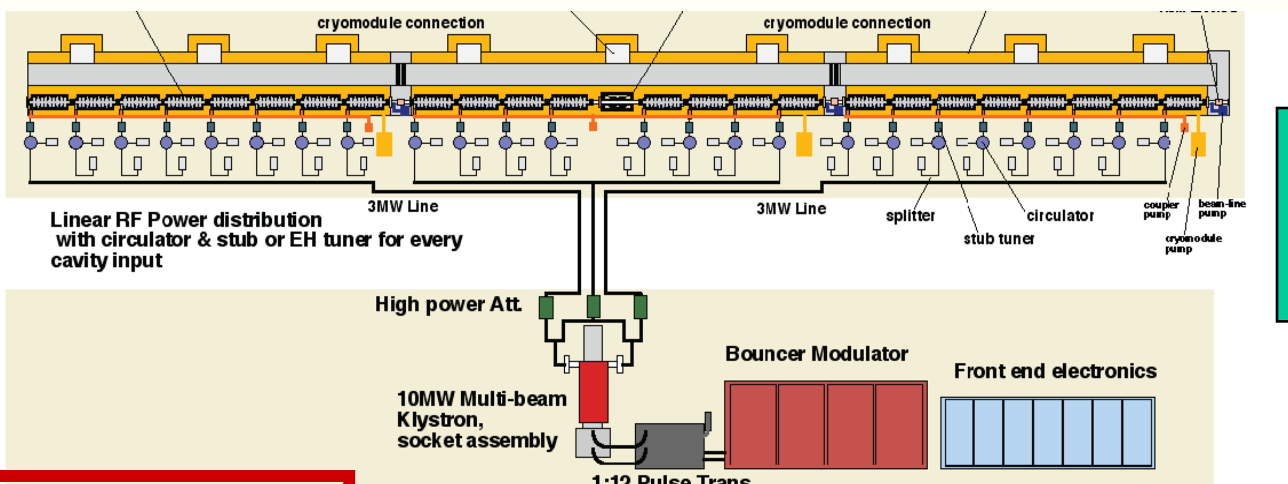
The highest priority activity in the ART program is SRF development which represents 50% of the total effort. Deliverables are:

FNAL

- High gradient cavity fabrication (35 MV/m, yield 80%) tech transfer to at least 2 North American vendors completed
- Cryomodule type 4 design, fabrication and horizontal testing completed for 3 cryomodules
- Solid state modulator, tunable power distribution system
- LLRF control
- String test of a complete, high gradient, RF unit; installed & operation started

SLAC

NML facility



ILC RF Unit: 3 CM, klystron, modulator, LLRF

Mike Harrison

Px and ILC R&D Deliverables Set the Scope

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- Cavity Gradient Goal: Master cavity processing & handling to achieve 35 MV/M gradient with 80% yield on 1st try, 90% yield after 2nd
- Project X: 1 CM/month = 96 good cavities a year (> 25 MV/M)
  - Requires U.S. vendors capable of fabricating 100 cavities/yr
  - Laboratory/industrial processing and test capability able to handle >200 process/test cycles per year (ANL, FNAL, JLAB)
  - Drives scope of planned ANL/JLAB EP and FNAL VTS upgrades
  - Drives the need for SRF materials and surface studies
- Project X & ILC R&D Goals: Cavity, Cryomodule and RF Unit test goals:
  - Require infrastructure to dress and HTS test cavities
  - Require infrastructure to build ILC Cryomodules at 1/month
  - Require infrastructure to test individual cryomodules
  - Require infrastructure to test Px or ILC RF units (NML)
- Large overlap in Project X and ILC R&D 1.3 GHz program needs

Combined SRF + CM Plan

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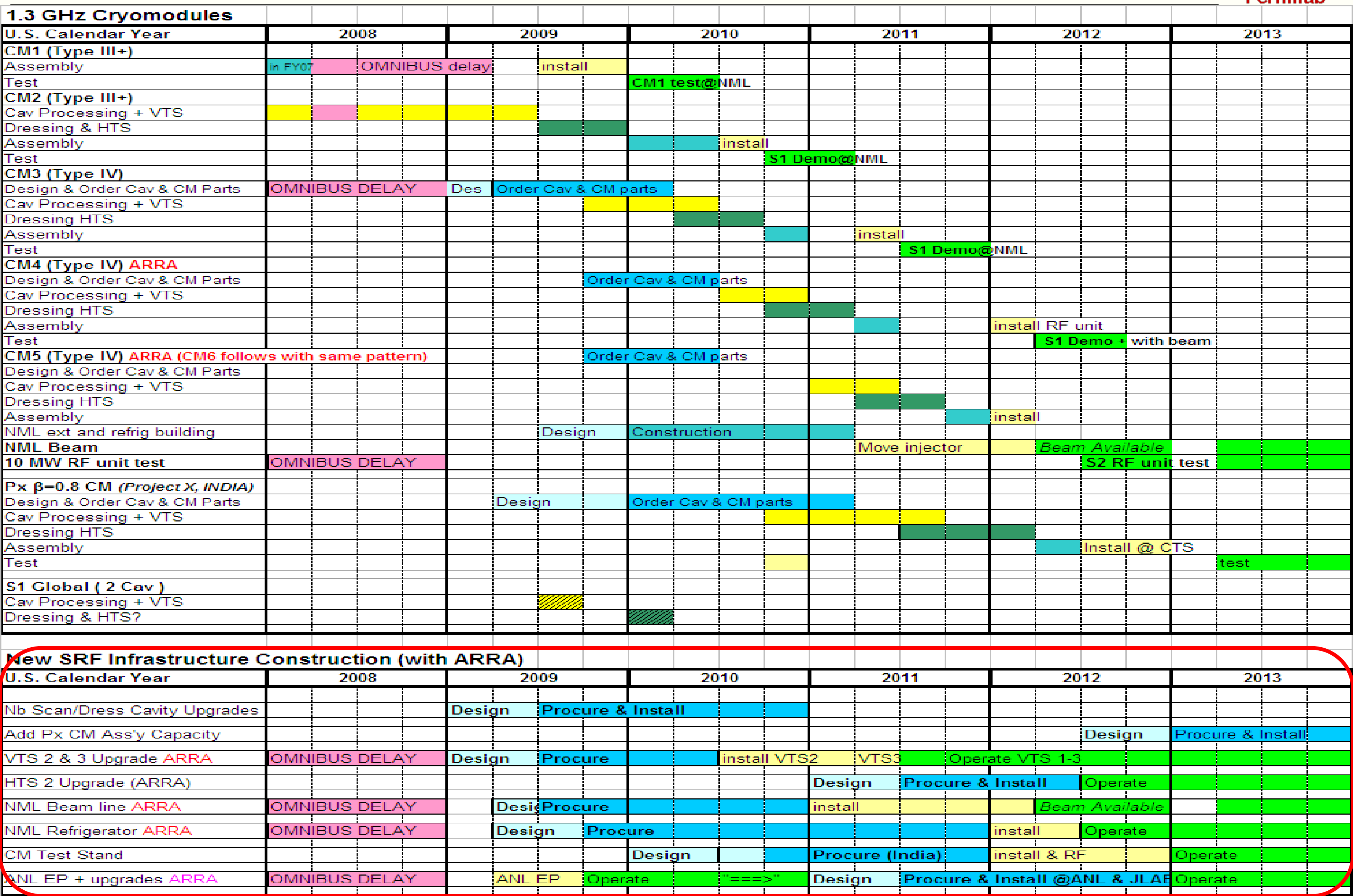

SRF Infrastructure Plan

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New SRF Infrastructure Construction (with ARRA)

U.S. Calendar Year	2008	2009	2010	2011	2012	2013
Nb Scan/Dress Cavity Upgrades		Design, Procure & Install				
Add Px CM Ass'y Capacity					Design	Procure & Install
VTS 2 & 3 Upgrade ARRA	OMNIBUS DELAY	Design, Procure	install VTS2	VTS3, Operate VTS 1-3		
HTS 2 Upgrade (ARRA)				Design, Procure & Install	Operate	
NML Beam line ARRA	OMNIBUS DELAY	Desig, Procure		install	*Beam Available*	
NML Refrigerator ARRA	OMNIBUS DELAY	Design, Procure			install, Operate	
CM Test Stand			Design, Proc end cap(India),Fab RF(FNAL)		install, Operate	
ANL & JLAB EP upgrades ARRA	OMNIBUS DELAY	ANL EP, Des	Procure	Operate		

- **FY08 Omnibus delayed our plan (financially) and affected our work force (still recovering personnel)**
- **Nevertheless very measurable progress on facilities**
- **Plan based on \$25M/yr (SRF B&R) for FY10 through FY13 plus the ARRA funds (\$52.67M total)**
  - **Will discuss Budget details and impact of FY10 guidance later**

Nb → Cryomodule

- Niobium purchased from Industry
- Nb QA/QC at Fermilab
- Cavity Fabricated by Industry
- Cavity QA/QC at Fermilab
- Cavity Processed and tested at Jlab, Cornell, ANL/FNAL
  - We are working to transfer the processing to industry
- Cavity Dressed (He vessel, Tuner, Coupler) at FNAL
  - This will be transferred to industy
- High Power Test at FNAL
- Cavity String and Cryomodule Fabrication at FNAL
- Cryomodule Testing at FNAL

1.3 GHz Joint Development Strategy

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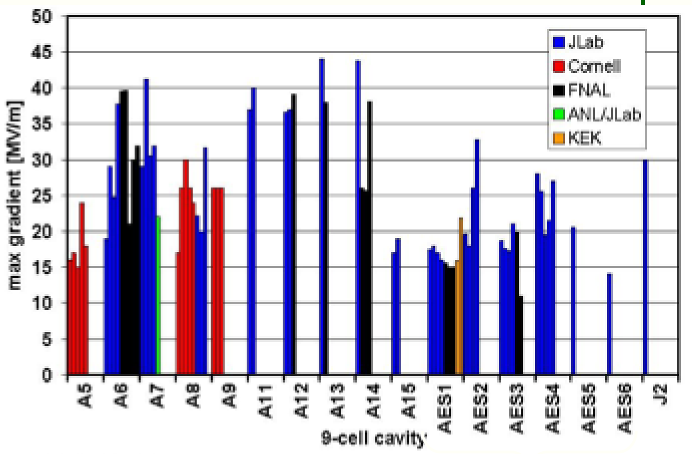
- **Project X shares 1.3 GHz technology with the ILC**
  - **Project X requires 46 ILC-like cryomodules. In detail they will not be identical to ILC:**
    - **Beam current: 20 mA × 1.25 msec × 2.5 Hz**
    - **Focusing required in all CMs**
    - **Gradient: 25 MV/m**
- **Close coordination of Project X and ILC R&D program**
  - **Developing U.S. cavity vendors**
  - **Cavity gradient and yield!**
  - **Shared facilities for assembly and testing**
  - **RF unit beam facility**



U.S.

- **4 year construction ➔1 CM/month**
  - **Building extensive infrastructure at FNAL for both Project X and ILC R&D**

FY08-09 ILC/SRF Accomplishments

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- Despite FY08 funding turmoil, good progress on SRF technology
  - Recovering from 8-12 month delays due to Omnibus and FY09 CR
- FNAL has several new SRF facilities now in full operation
  - New Vertical Test Stand; tests bare cavities (35 tests in FY08-09)
  - New Horizontal Test Stand; tests dressed cavities (5 tests in FY08)
  - Cryomodule Assembly Facility; 2 CM assembled in MP9 & ICB
- Other Infrastructure is being commissioned
  - Infrastructure to dress 1.3 GHz nine-cells (1st nine-cell finished)
  - ANL/FNAL Joint EP Processing; (10 single cell tests, 1st 9 cells)
  - RF unit test facility at New Muon Lab; under construction

FY08-09 ILC/SRF Accomplishments

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- FNAL has built a variety of SRF components
  - Cavities: 48 ordered, 22 from U.S. industry, ~30 delivered
  - Cryomodules: Assembled 2 cryomodules with CAF
    - CM1 = Type III$^+$ assembled from DESY kit of parts
    - Designed/assembled a 3.9 GHz CM for DESY
    - Parts in hand for cold mass of a 2nd type III$^+$ CM
    - Recently dressed 1st 9-cell cavity
    - Type IV CM design ~ complete and ordering parts in FY09
- SRF Materials program established
  - Single-cell program for U.S. cavity vendor development
  - EP process development for ANL/FNAL joint system
  - Improved diagnostics (thermometry, optical inspection)
  - Understanding reasons for poor performers (weld pits)

FY08-09 ILC/SRF Accomplishments

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- **Industrialization**
  - ILC cavities built by U.S. vendors (AES, Roark/Niowave)
  - Engaging several industrial vendors in cavity surface processing
  - Engaging several U.S. vendors to produce type IV CM parts
  - Limited thus far by funding but ARRA funds will change this

- **Growing network of collaborations**
  - For Px, ILC, HINS, and general SRF development
  - For SRF alone we have MOU's with 18 institutions

SRF Collaborations

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- **ANL:** EP development and cavity processing
- **Cornell:** Cavity processing & test, materials R&D
- **DESY:** 3.9 GHz, cryomodule kit, FLASH, S0 R&D
- **KEK:** Cavity R&D, ATF II, S0 R&D
- **MSU:** Px Beta=0.8 cavities, hydroform, TIG
- **TJNL:** EP cavity processing and test, S0 R&D
- **INFN:** tuners, HTS, NML gun cathodes
- **TRIUMF:** Vendor development
- **SLAC:** RF power, klystrons, couplers, distribution
- **CERN, DESY, KEK, INFN, etc:** Type IV CM design
- **India:** CM design, Px Beta= 0.8 cavities, infrastructure, etc
- **China:** Peking U, IHEP, cavity development
- **UC,NW,NHMFL, Cornell, DESY, KEK, etc:** SRF Materials

US Cavity R&D Infrastructure

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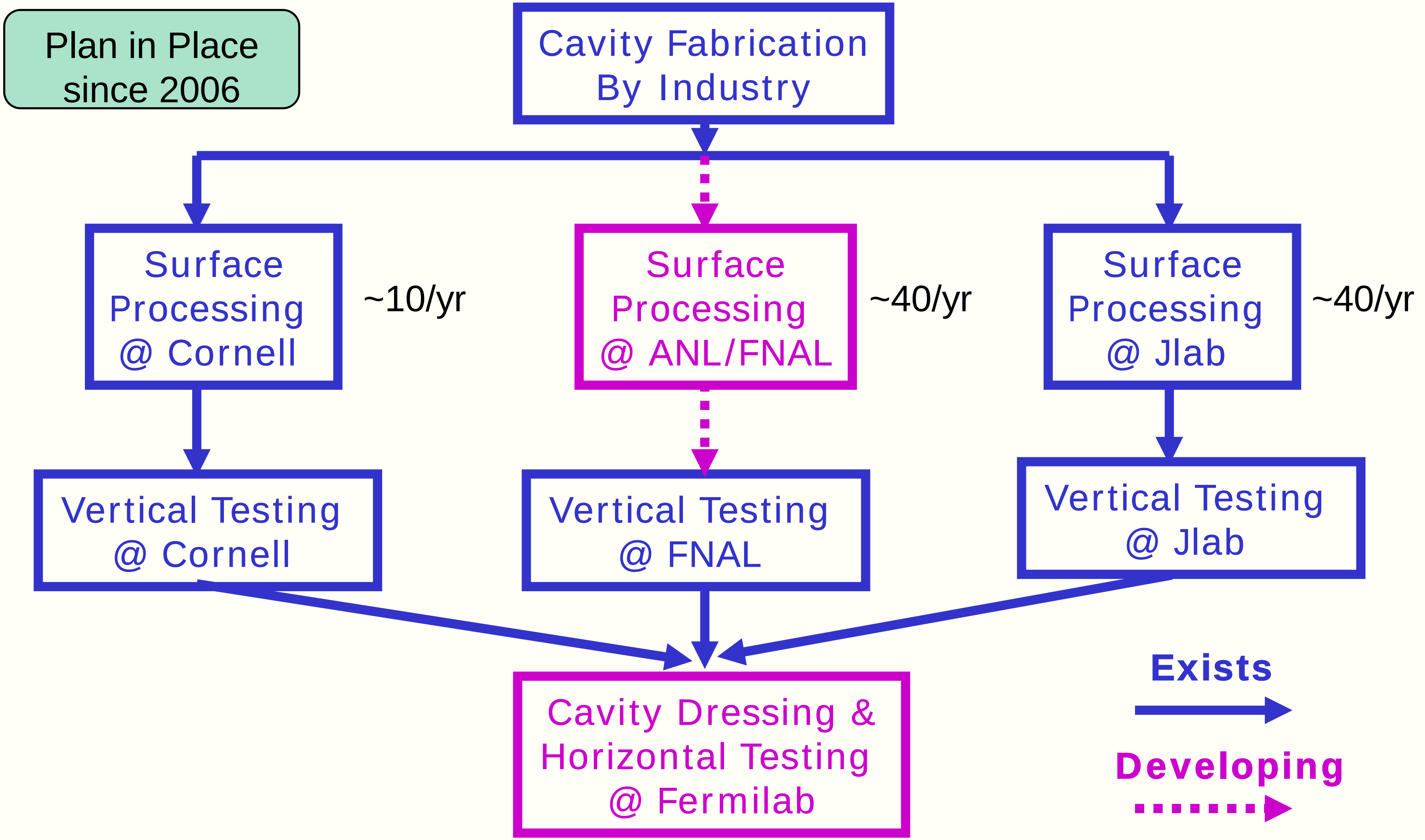

SRF:FNAL-ANL Cavity Processing Facility

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- ANL and Fermilab has jointly built and commissioned a processing facility at ANL.
- It provides a complete processing of 1.3 GHz cavities:
  - electro-polishing, ultrasonic cleaning, high-pressure rinse, assembly, etc.
- Three single-cell cavities and one 9-cell cavity electro-polished so far
  - Optimization of processing procedure is in progress

• Electro-polishing Room

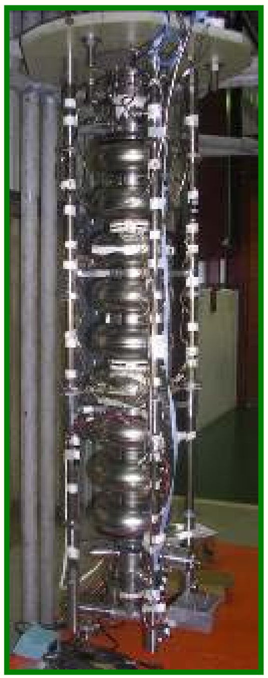
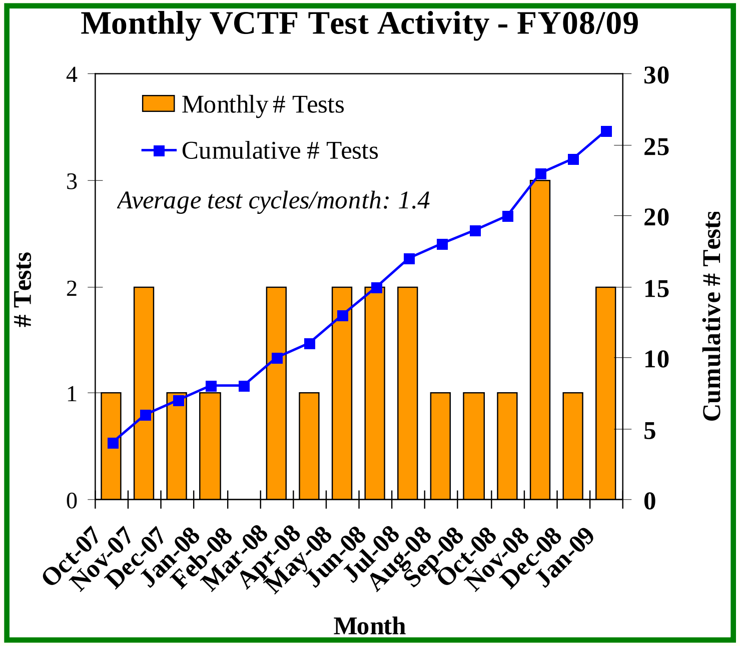
New Ultrasonic cleaning system

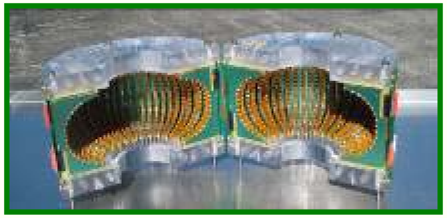
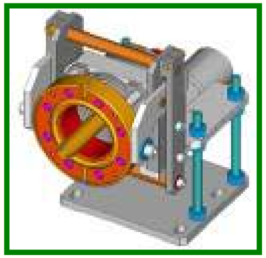
New High-pressure rinse system

SRF: Vertical Cavity Test Facility

- 26 cavity tests in FY08/FY09, where “test” = cryogenic thermal cycle
  - Performance tests for 9-cell & single-cell elliptical cavities, and a SSR1 HINS cavity
  - Cavity tests dedicated to instrumentation development, e.g., variable coupler, thermometry, cavity vacuum pump system
  - Cavity tests dedicated to facility commissioning, e.g., for ANL/FNAL CPF




SRF: Optical Inspection System

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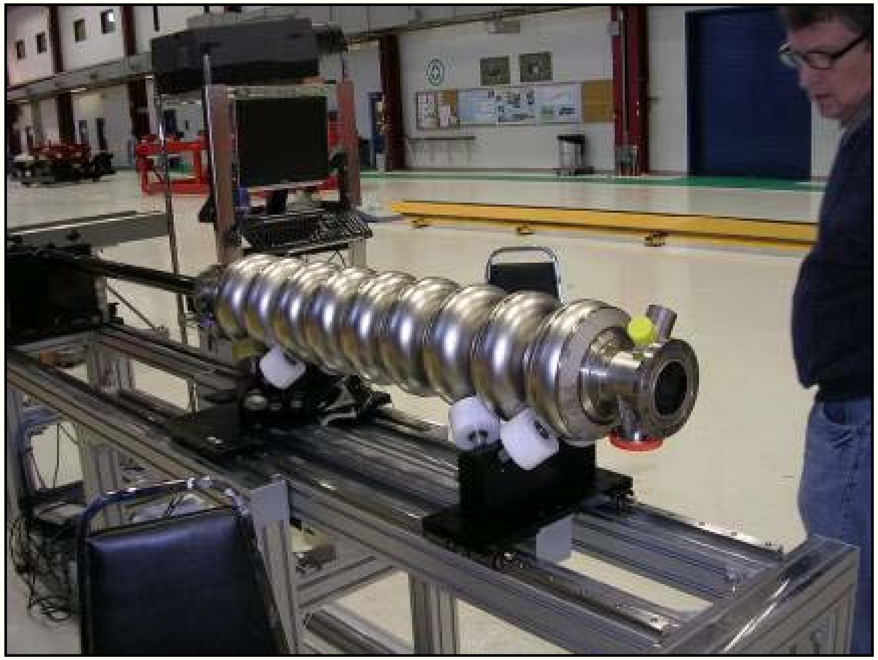
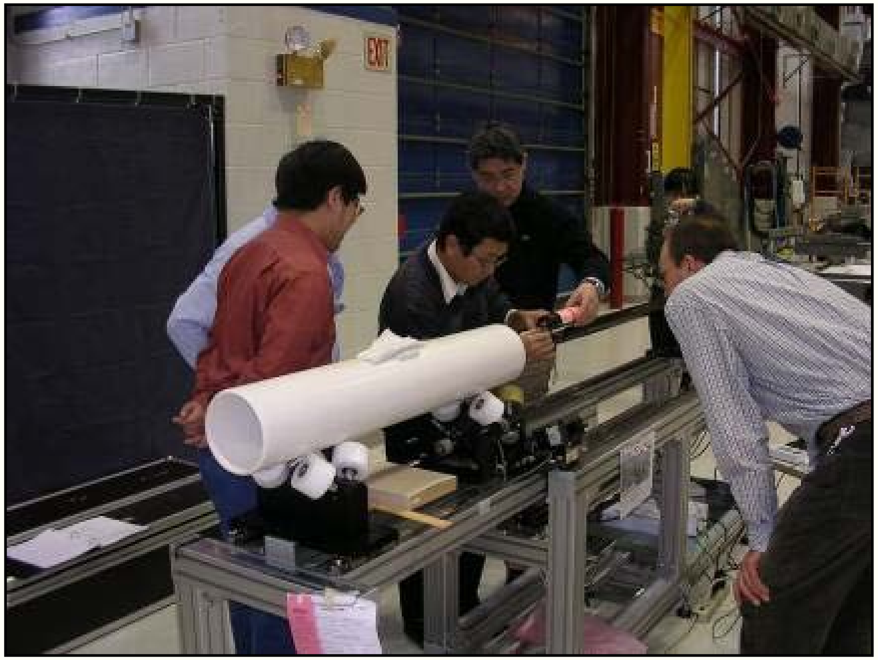
- KEK/Kyoto inspection system delivered, installed, commissioned early in 2009
- Expert assistance to optimize system in March 2009
- In routine use; software development underway



Accel7 on the optical inspection stand

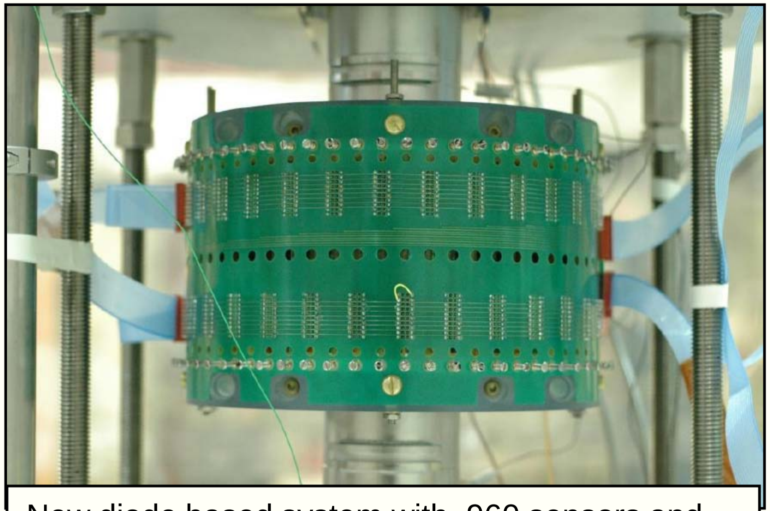


Optical inspection optimization

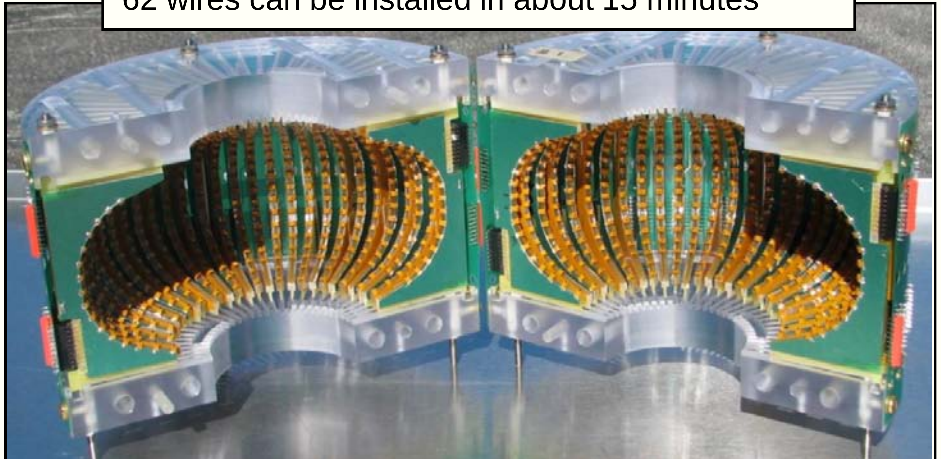
SRF: New Temperature Mapping

New single-cell temperature mapping system uses multiplexed diodes as sensing elements

Traditional carbon resistor based system

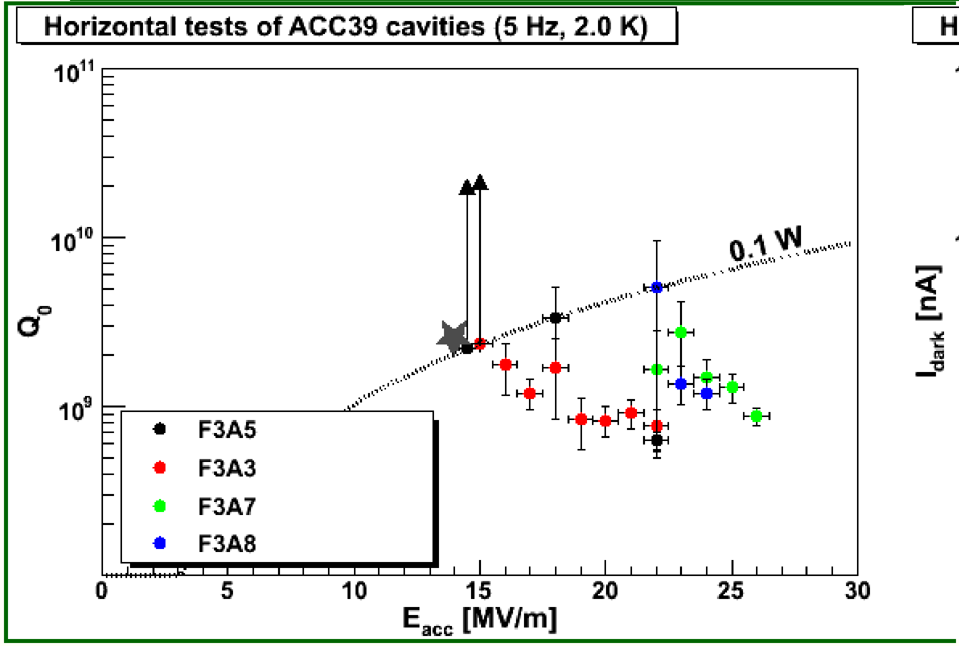


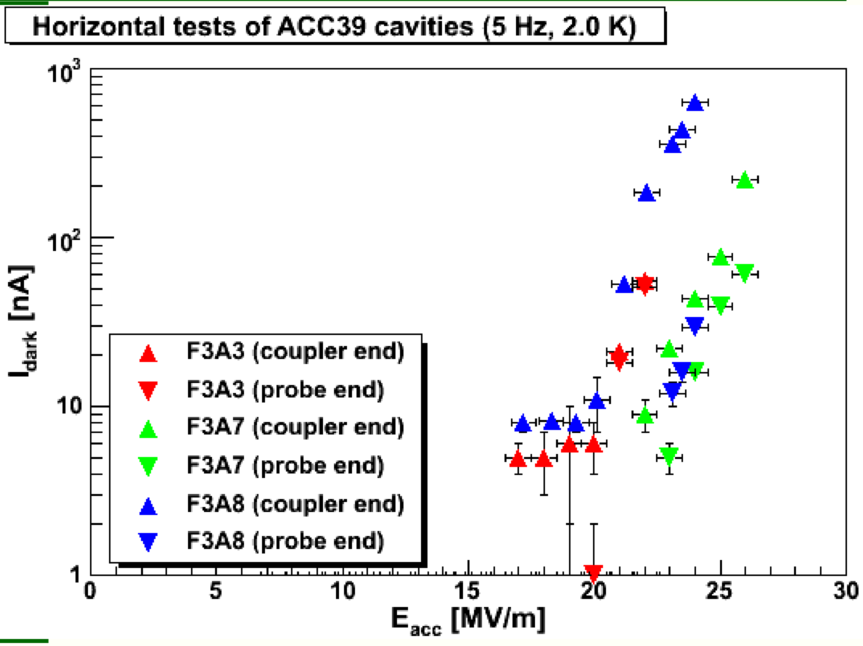
New diode based system with 960 sensors and 62 wires can be installed in about 15 minutes



SRF: Horizontal Test Stand

- Commissioned in 2007 with 1.3 GHz dressed cavity
- Operational in 2008, tested four 3.9 GHz cavities
  - First cavity: 8 months between cavity's arrival and departure (Commissioning)
  - Fourth cavity: 2 weeks between cavity's arrival and departure (turnaround time goal achieved)





SRF: Industrial Collaboration

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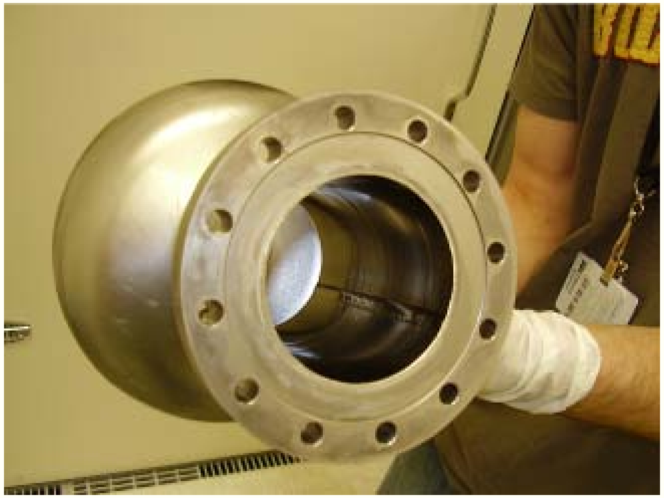
- Processing
  - Cabot
    - Small effort in progress to assess their process on flat samples
    - ARRA funds will enable us to apply this process to single cell and 9-cell cavities
  - Able Electropolish, Inc.
    - CRADA for development of their ability to process cavities
    - Exploring alternative method of full immersion EP



1.3GHz Single Cell Full Immersion EP at Able

3.9GHz Single Cell EP Tool at Able

SRF: What limits cavity performance?

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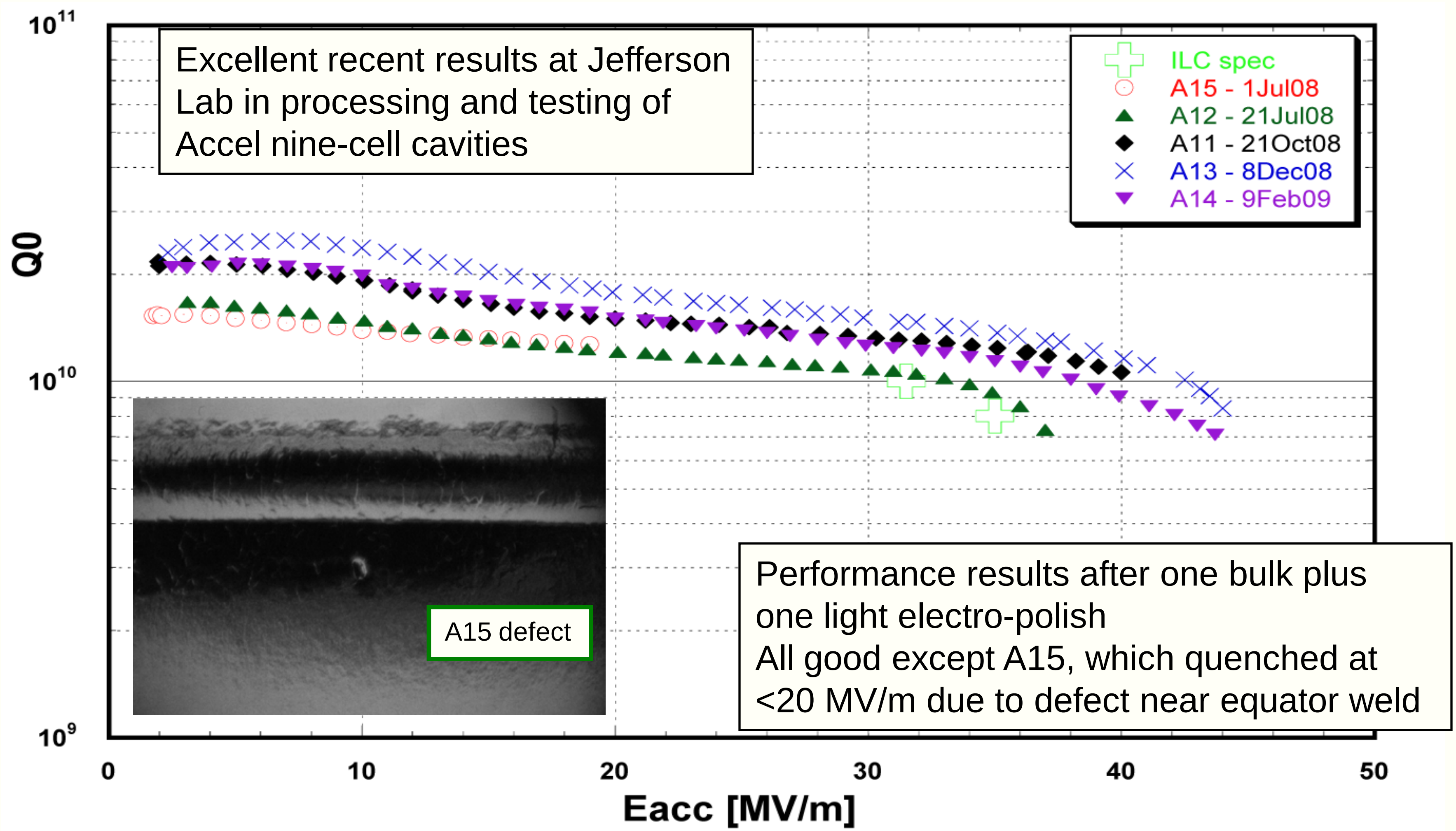
Usually field emission or defect-correlated quench



SRF: R&D to Improve Gradient and Yield

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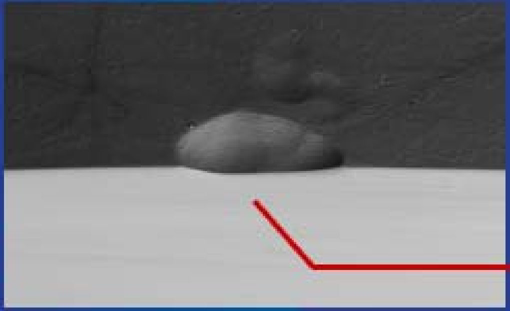
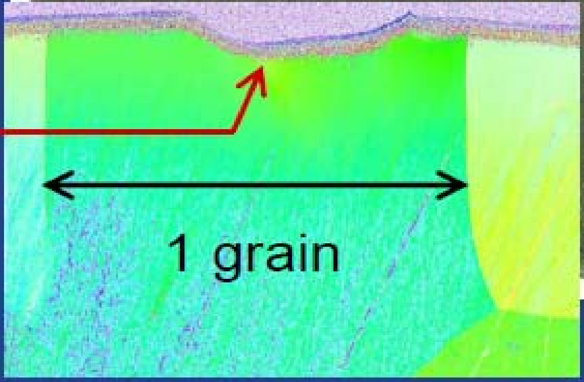
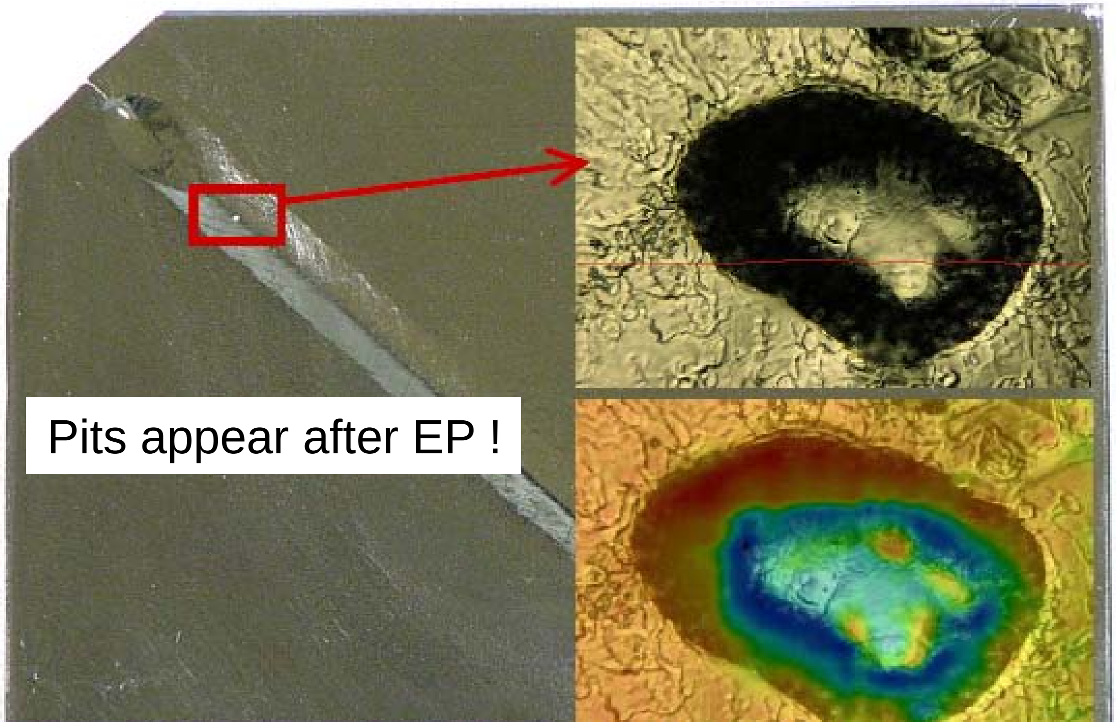
FNAL succeeded at making weld defects in the lab. This achievement dramatically widens the range of characterization that is possible and increases the information gain.





Cross-section of defect cut, polished, and imaged by orientation microscopy at Florida State



SRF: Laser Melting of Nb Surface

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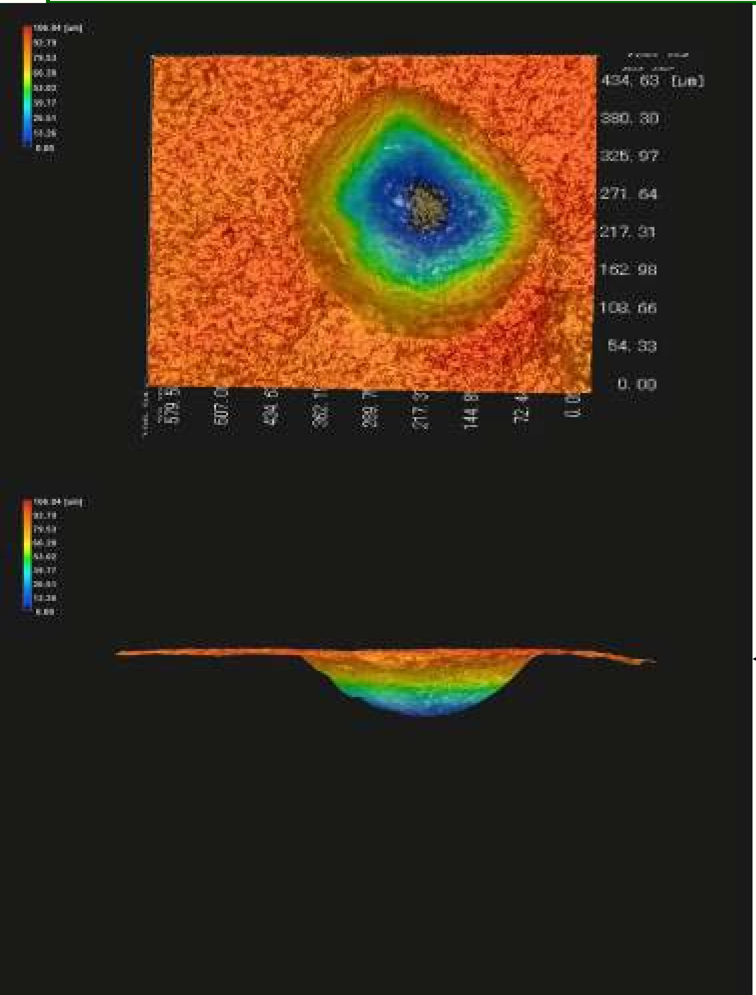
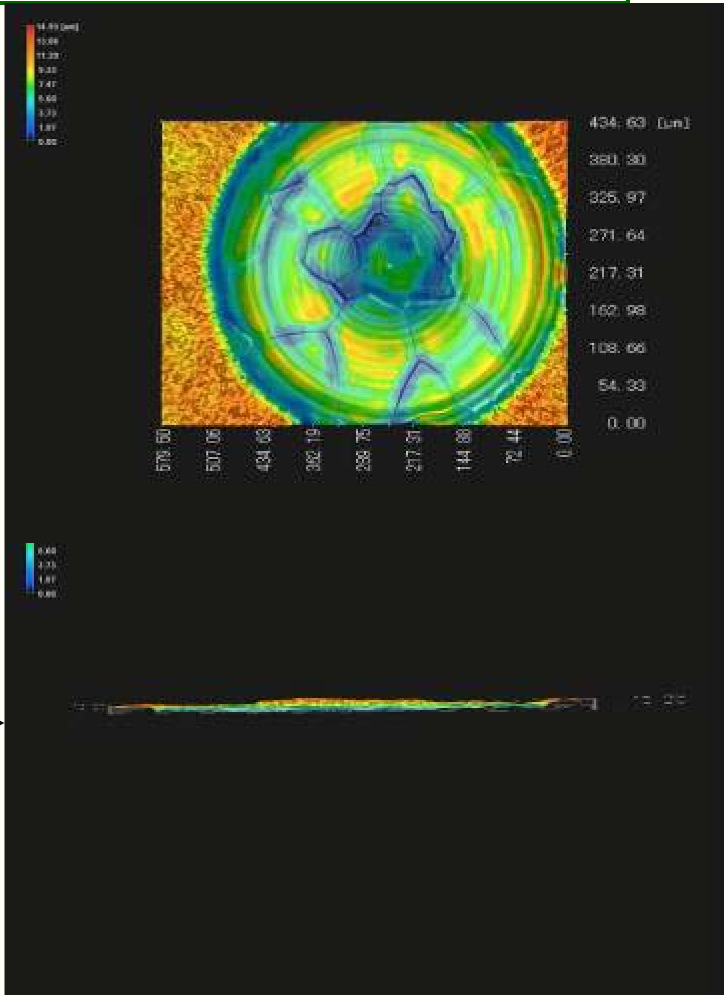
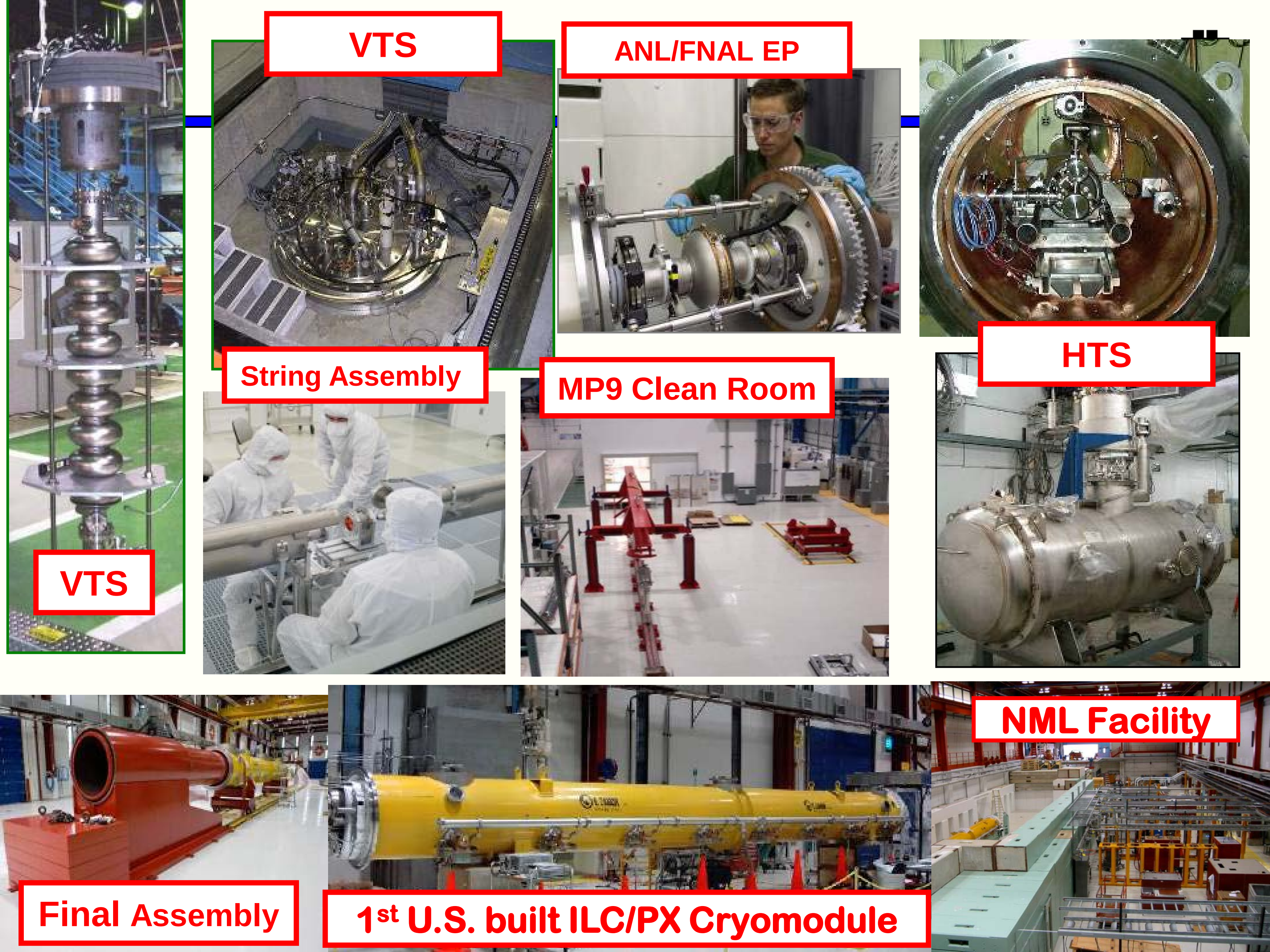
- Preliminary experiments show a pit cannot be removed by BCP or EP, even after ~150 um removal
- Fermilab is investigating: Laser Melting



100 µm

14 µm



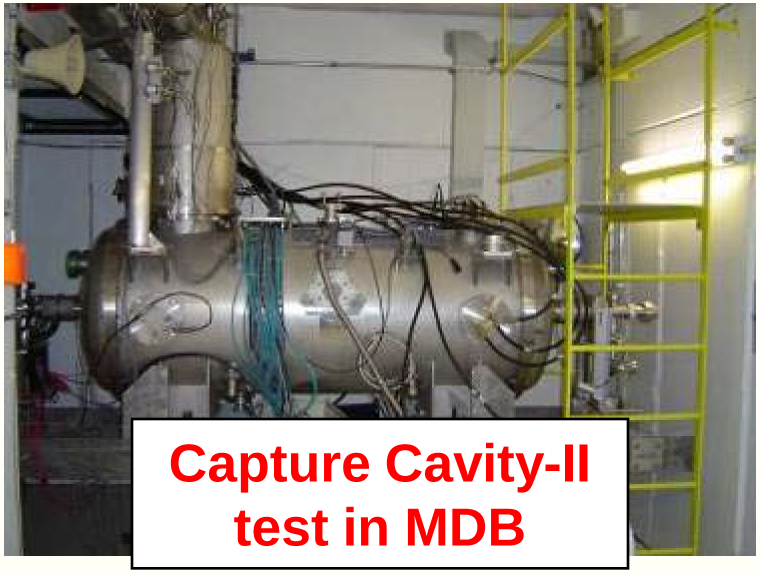

VTS
VTS
ANL/FNAL EP
HTS
String Assembly
MP9 Clean Room
NML Facility
Final Assembly
1st U.S. built ILC/PX Cryomodule

SRF: MDB Infrastructure

RF Power for HTS

Cryogenics transfer lines in MDB

Large Vacuum Pump for 2K



Capture Cavity-II test in MDB

SRF: Cryomodule Assembly Facility

- Goal: Dress cavities; Assemble Cryomodules
- Where: MP9 and ICB buildings
  - MP9: 2500 ft^2 clean room, Class 10/100
  - Cavity dressing and string assembly
  - ICB: final cryomodule assembly
- Infrastructure:
  - Clean Rooms, Assembly Fixtures
  - Clean Vacuum, gas, water & Leak Check
- DESY Cryomodule "kit" and 3.9 CM assembled

ICB: Final Assembly fixtures

MP9 Clean Room

String Assembly

Cavity string for 1st CM

1st FNAL built Cryomodules

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Cryomodule 1
From DESY kit

3.9 GHz Cryomodule
Designed/built at FNAL for DESY

Cryomodule 2: cold mass parts in hand, from Europe, Need 8 dressed cavities

Phase-1 Layout of NML

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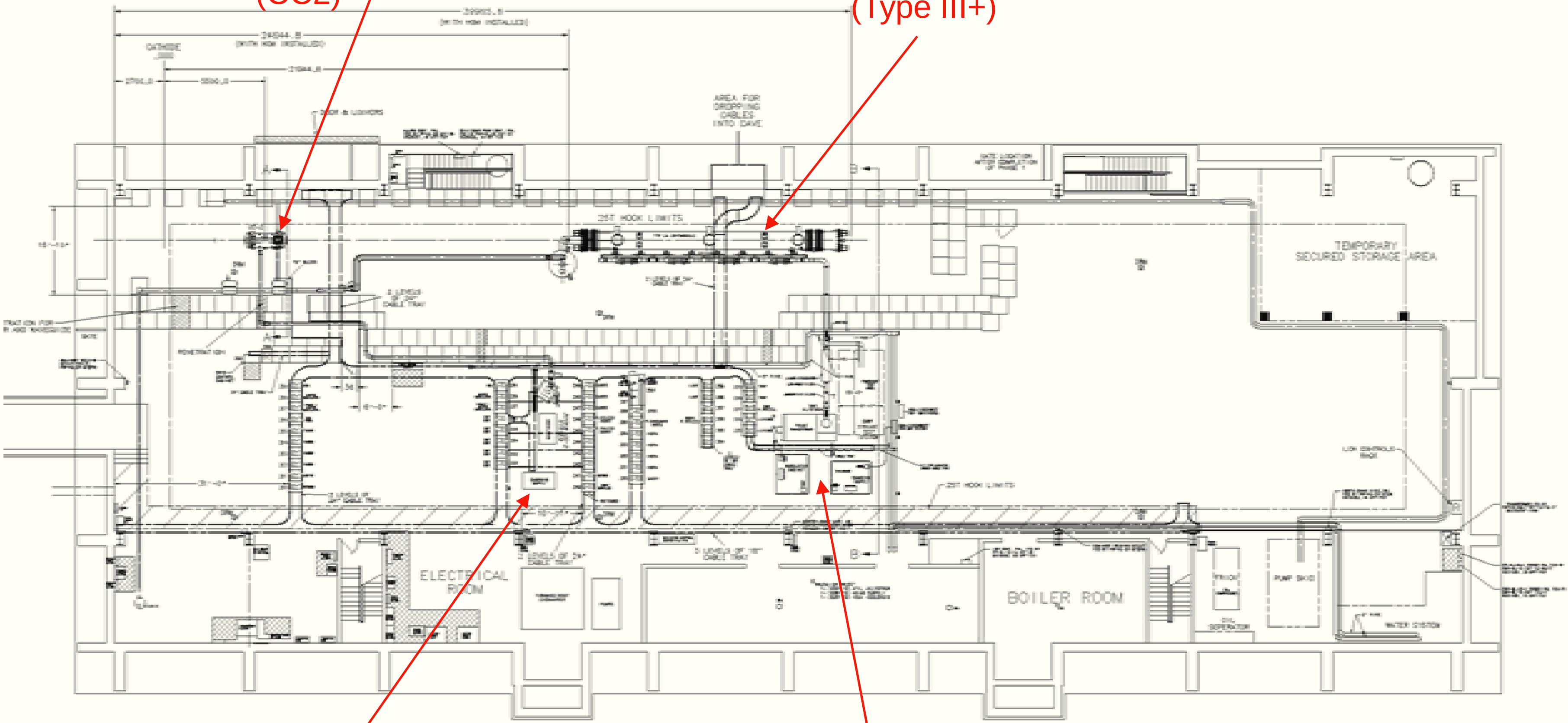
Capture Cavity 2 (CC2)

Cryomodule-1 (CM1) (Type III+)



CC2 RF System

5 MW RF System for CM1

Expansion of NML Facility

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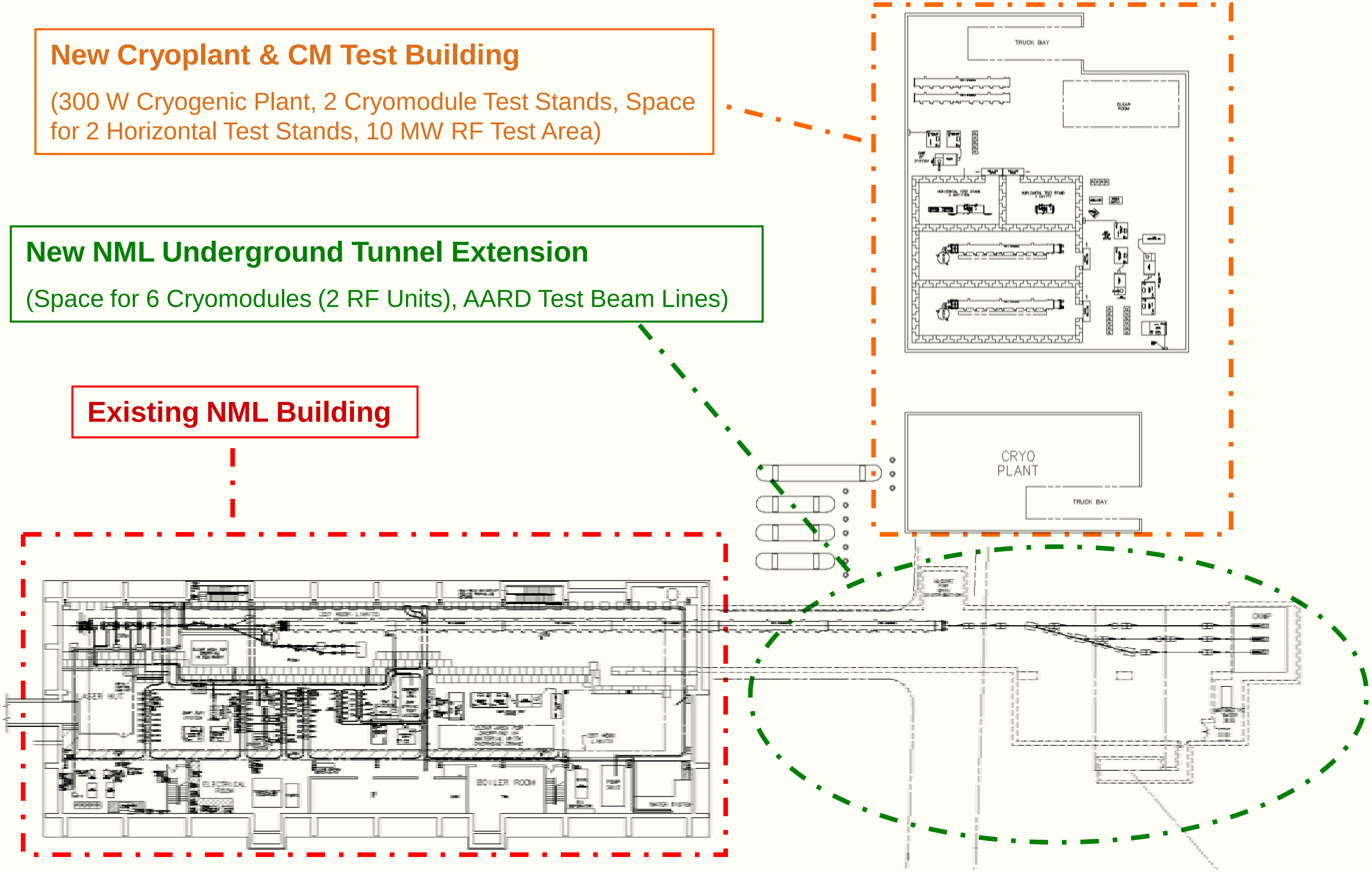
New Cryoplant & CM Test Building

(300 W Cryogenic Plant, 2 Cryomodule Test Stands, Space for 2 Horizontal Test Stands, 10 MW RF Test Area)

New NML Underground Tunnel Extension

(Space for 6 Cryomodules (2 RF Units), AARD Test Beam Lines)

Existing NML Building



RF Unit Test Facility at NML

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Progress at NML

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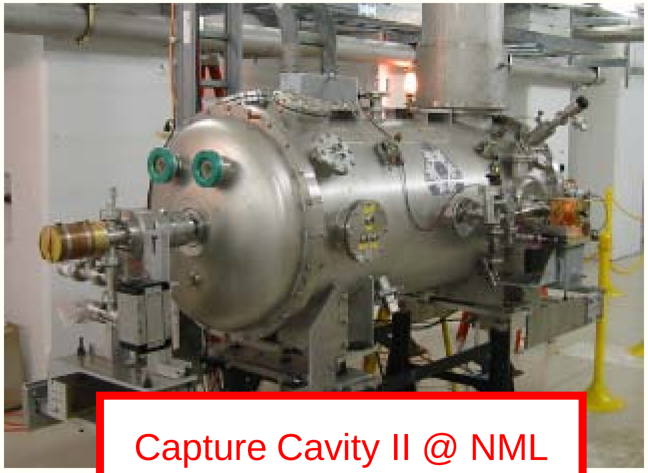
1st Cryomodule Test fit


CM Feed Can


Large Vacuum Pump


Control Room


Capture Cavity II @ NML


He Refrigerator

NML Facility Milestones

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• Phase-1 Cryogenic System Operational	(Aug. 2007)
• Delivery of First Cryomodule to NML	(Aug. 2008)
• Begin Civil Construction of NML Expansion	(Summer 2009)
• First Cryomodule Ready for Cooldown*	(Fall 2009)
• Cold RF Testing of First Cryomodule*	(Winter 2009)
• Delivery of 2nd Cryomodule to NML (S1)	(2010)
• Install Gun and Injector	(2011)
• First Beam	(2012)
• Cryoplant Operational	(2012-13)
• Full RF Unit Testing (3 Cryomodules) (S2)	(2012-13)
• Cryomodule Test Stand (CTS) Operational	(2012-13)

*Significant project delays occurred due to funding cuts in 2008

Financial Management

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- Work at FNAL is planned and budgeted via an internal set of Project and Task Numbers
  - ILC, SRF & 3.9 GHz share common Project # (Project 18)
  - HINS, Project X, FNPL and ARRA have distinct Project #
  - All data is available via the Lab's accounting system
- Task Numbers point to elements of the Lab WBS
  - Also reference the ILC ART work packages where appropriate
- Lab WBS relates to the DOE B&R codes
- Creates a system that can be parsed and reported in various combinations
  - Task Leaders understand the importance of working to budget and capturing costs in the appropriate Task Number
  - Allows us to understand what a facility costs to build/operate and how to estimate future similar work

ILC & SRF Programs

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Level 3	FY06	FY07	FY08	FY09 Budget	ARRA 2009	FY10 Guidance	FY11 Guidance	FY12 Guidance	FY13 Guidance
Prog Mgmt	$2,059	$3,817	$829	$3,570	$0	$3,070	$2,650	$2,650	$2,691
Cav & CM Ass'y Facility	$1,589	$2,303	$744	$1,457	$0	$1,774	$1,305	$1,438	$2,126
Vertical Test Facility	$1,369	$3,626	$1,052	$3,612	$2,330	$3,854	$2,496	$1,820	$1,820
Horizontal Test Facility	$4,465	$3,612	$774	$1,060	$1,610	$1,961	$2,871	$3,427	$1,928
NML RF Unit Test Facility	$3,797	$11,523	$3,449	$10,133	$29,300	$12,973	$13,676	$8,049	$5,032
CM Test Stand	$0	$0	$0	$0	$0	$1,267	$1,996	$5,927	$5,927
ANL/FNAL Proc Facility	$675	$1,224	$494	$518	$899	$429	$429	$429	$429
New Cavity Proc Facility	$0	$0	$0	$0	$5,813	$1,241	$1,223	$2,408	$5,610
RF Support	$1,392	$1,782	$425	$66	$1,698	$66	$66	$66	$66
Material R&D	$1,054	$1,507	$518	$1,438	$0	$1,288	$1,211	$1,211	$1,216
Cavity Purchase	$1,846	$2,441	$2,785	$339	$4,120	$450	$450	$950	$1,530
Cav Proc & Test	$0	$0	$0	$943	$0	$1,437	$1,437	$1,437	$1,437
CM Program	$940	$2,670	$1,173	$5,271	$6,902	$3,865	$3,865	$3,865	$3,865
TOTALS	**$19,186**	**$34,505**	**$12,243**	**$28,406**	**$52,672**	**$33,677**	**$33,677**	**$33,677**	**$33,677**

- **What do the ILC & SRF Programs look like in spreadsheet form?**
  - **Captures accurate history and guidance for the future**
  - **Includes present and future facilities**
  - **Does not include non-SRF ILC activities (CFS, Global Systems)**
- **This is as presented to DOE SRF review May 09.**
  - **Will discuss the impact of FY10 guidance later**

Infrastructure/Facility Plan

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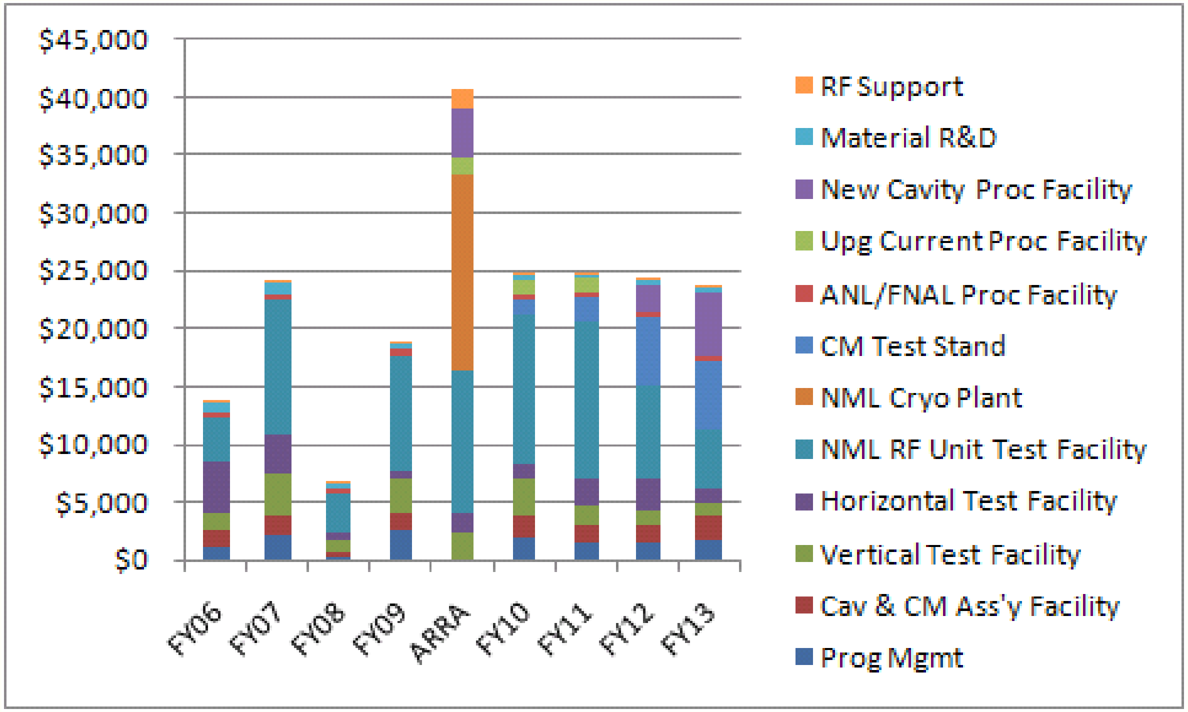

- **Funding sources**
  - **SRF**
  - **ARRA**
  - **ILC**

Includes Construction and Operations

- **Cost estimates for the new infrastructure done by Task Leaders using data from actual purchases, vendor quotes, engineering estimates and scaling from similar tasks**
  - **Cost estimates have additional back up information**

Component Plan

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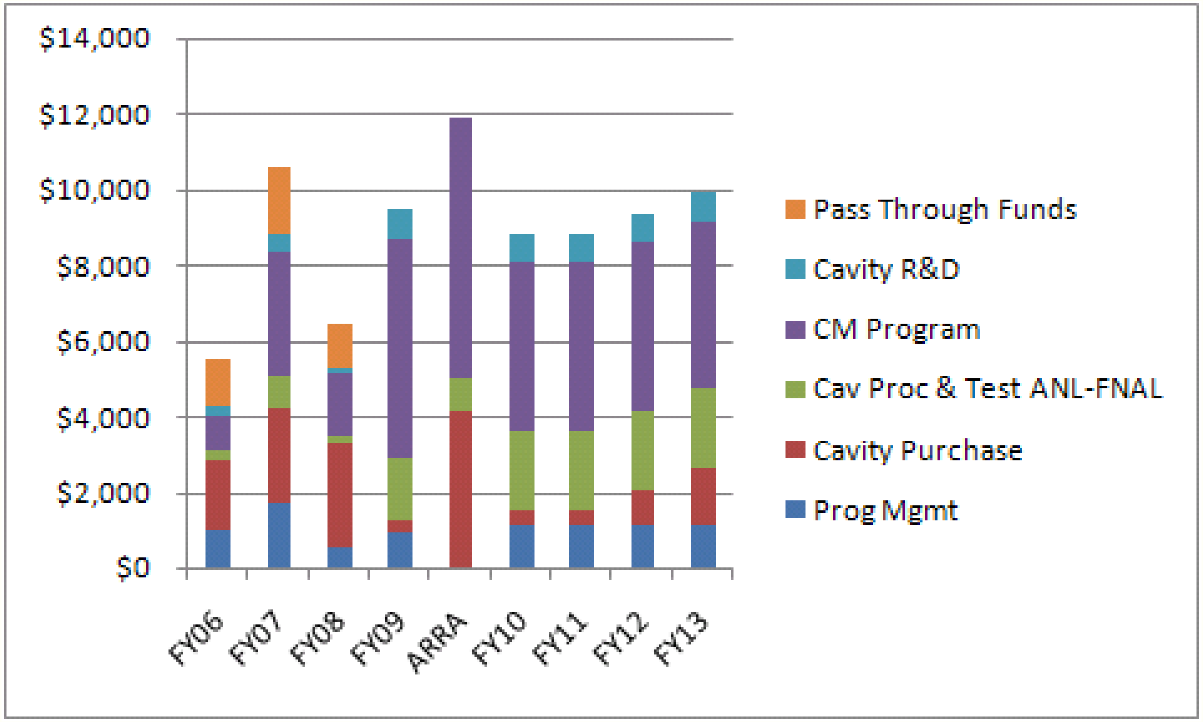
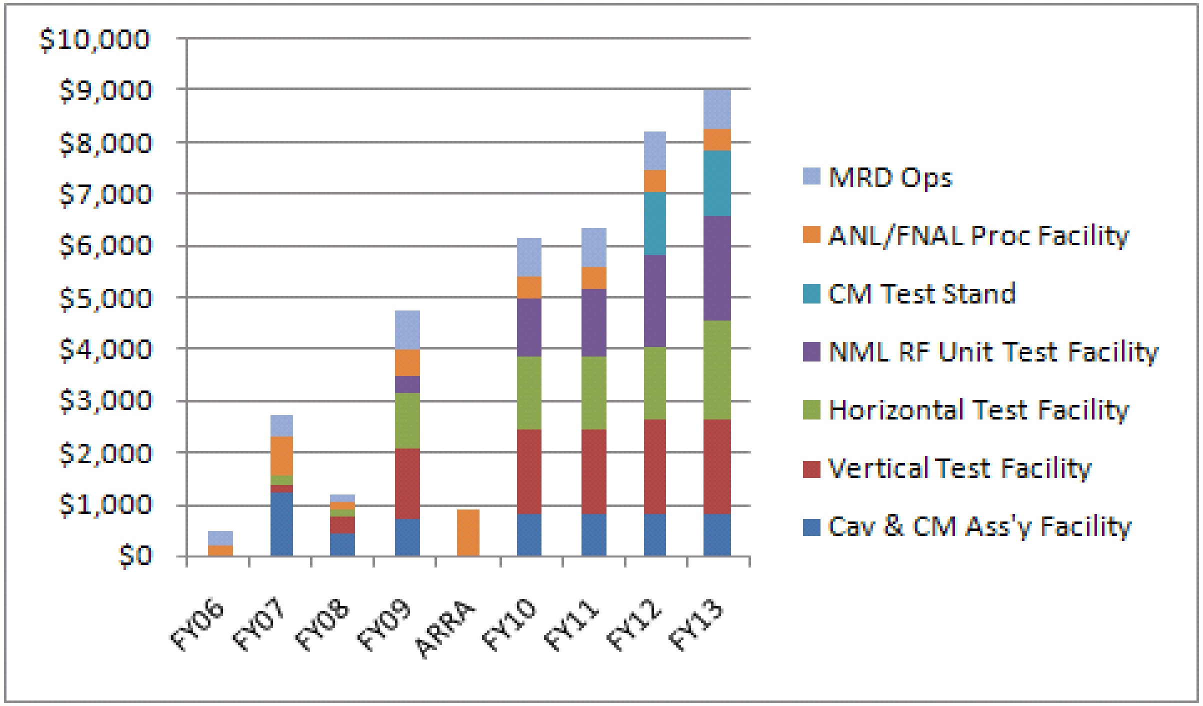


- Funding sources
  - SRF
  - ARRA
  - ILC

- **Majority of funding comes from ILC for component testing and assembly (ARRA has large impact)**
- **Approximate constant spending on cavities & CM**

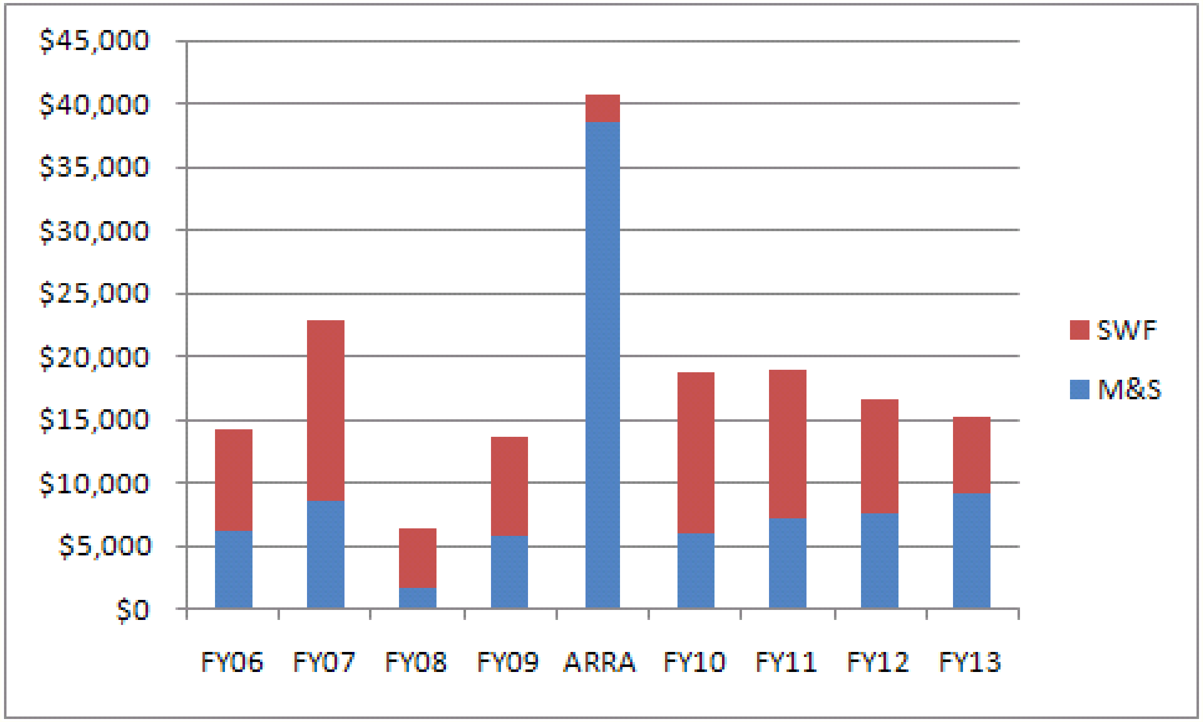
Operating Costs



- **Funding sources**
  - **SRF**
  - **ARRA**
  - **ILC**

- **Operating costs increase as facilities come "on line"**
- **Operations explicitly not part of the 2007 SRF Plan**
  - **Expected ILC would pay for operations**
- **ILC/SRF (like most projects) only pays incremental costs**
  - **Need a source of Ops funds after FY13 (SRF Plan completed, TeV off)**

Facility Construction



- **Funding sources**
  - **SRF**
  - **ARRA**
  - **ILC**

- **Includes M&S + SWF**
- **Obvious why ARRA (essentially all M&S) is such a big contributor to the overall SRF Plan**

Labor Resources

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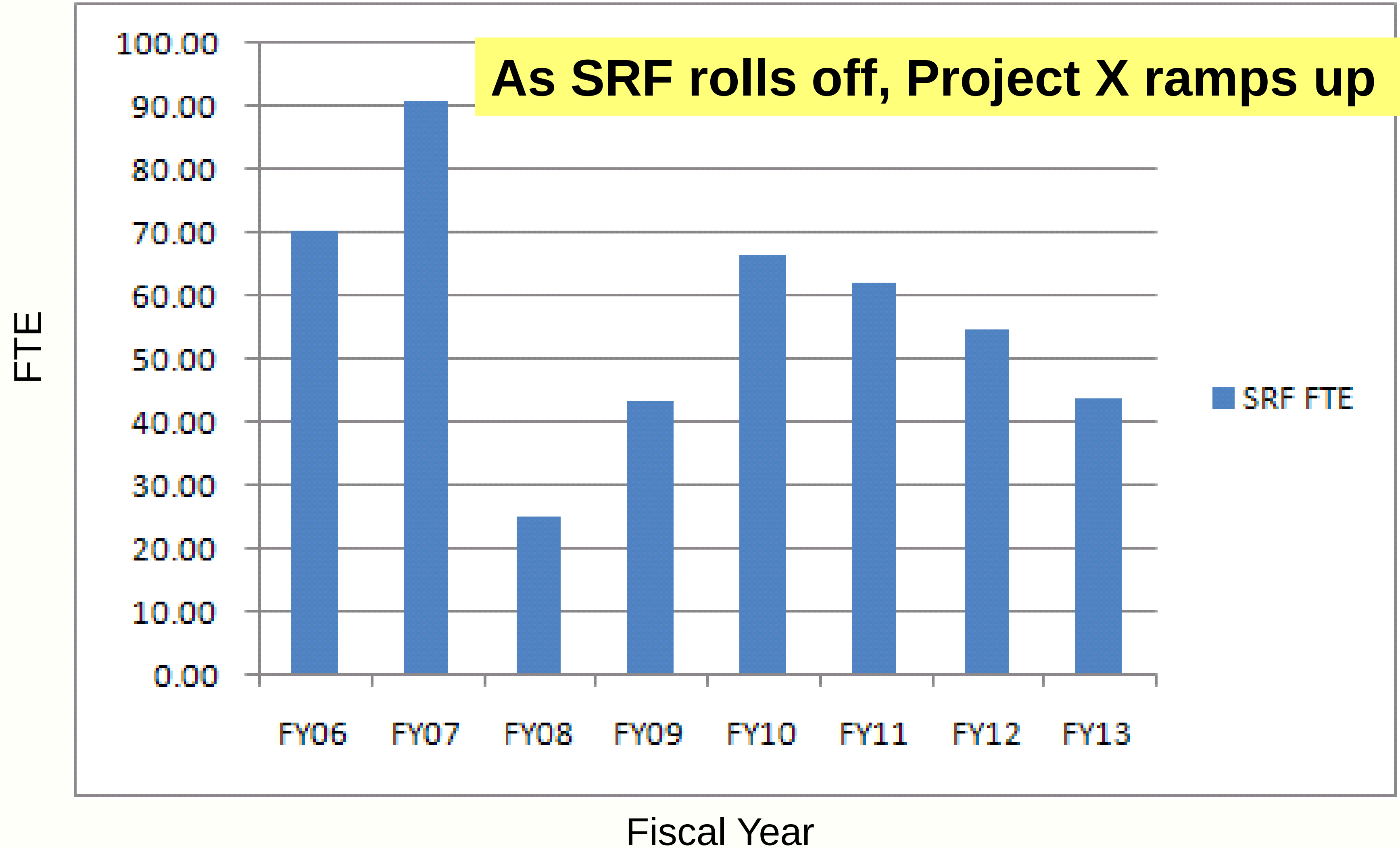
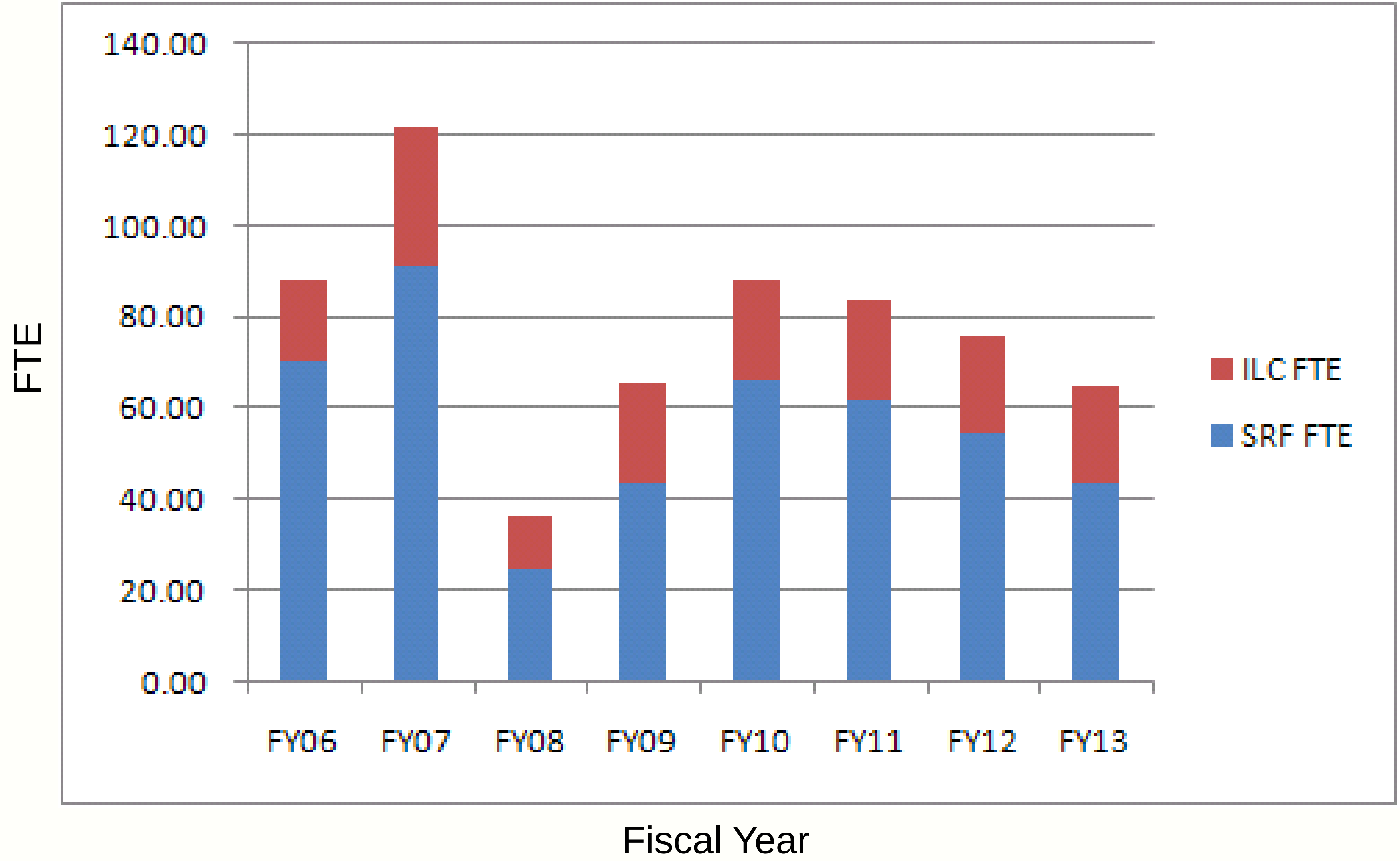
- Labor resources are limited
  - In FY09, have SWF budget for ~89 FTE (combined ILC + SRF)
    - Currently have ~70 FTE working on these tasks
  - Current FY09 SRF labor ~ half of FY08 Q1 FTE
    - Finishing 3.9 GHz will help
    - Need to add more people to the effort to stay on schedule
- Supplement internal staff with contract employees
  - Works well for general purpose needs
  - In some cases, using contract employees is difficult especially when experience is essential
    - Cryogenic engineers
    - RF engineers
    - High vacuum technicians
- Also adding consultant help
  - H Padamsee, P Kelley…

SRF Labor Profile

As SRF rolls off, Project X ramps up



SRF + ILC Labor Profile



Labor Needs

- Current Labor Force working on the just SRF part of the Program ~ 48 FTE (slightly increasing each month)
- SRF Plan calls for ~ 57 FTE/yr (on average/based on 4 yrs) with a peak of ~ 67 FTE needed in FY10 / ~ 63 FTE in FY11
- With 3.9 GHz winding down ~10 FTE free up
- Must increase the work force (in certain disciplines) as well as redirect people to work on specific tasks
  - Cryogenic and mechanical engineering
  - RF engineering
  - Need to train additional techs for clean room environment and to work with chemical processing equipment
- Utilize contract personnel
- Continue to integrate new people into the Program as they become available

Strategy for ARRA funds

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- **Restore scope** that was removed from the SRF program as a result of the FY08 Omnibus Bill
- **Fund big ticket Infrastructure items** that could not be funded in a timely way: New NML buildings and large 1.8 K NML refrigerator
- **Fund new scope** Cavity & EP industrialization, Industrial cryomodule parts, develop HF free process
- **Advance infrastructure and industrialization needed to be ready for Project X by 2013 or ILC participation ~2018**
  - 1 CM/ month capability
  - Upgrade EP facilities at ANL and JLAB to ~200 process/test cycles per year for BOTH Project X construction and ILC R&D
  - Gain experience by building and operating cryomodules
  - Support SLAC effort on industrial RF coupler development

Impact of ARRA on SRF

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- **American Recovery and Reinvestment Act of 2009 (ARRA) presents an opportunity to**
  - **Accelerate parts of the current SRF Program**
  - **Restore elements thought to be financially unachievable**
  - **Begin to incorporate U.S. industrialization**
- **ARRA has goals and conditions that match up well with our SRF Plan**
  - **Get money into U.S. industry to stimulate the economy**
  - **Create or save jobs**
  - **Choose procurements that can be obligated quickly**
  - **Target actions towards high tech applications**
    - **This has a longer lasting stimulus effect**
- **SRF part of ARRA is targeted towards U.S. Industry**

Elements of ARRA SRF Plan

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Task	Estimated Cost
Cryogenics for NML Test Facility	$ 16,813
Vertical Test Stand Components	$ 2,330
Vacuum Oven Components	$ 1,676
NML RF Unit Test Area Components	$ 12,487
Industrial Cavity Development	$ 4,120
Horizontal Test Stand RF Components	$ 1,610
Industrial Infrastructure and Electro-polish of Cavities	$ 2,160
Fabricate Improved Cryomodule in Collaboration with Industry	$ 4,359
Labor for Cavity Processing at ANL	$ 899
Cavity Processing/Test/Infrastructure at JLAB	$ 897
RF Distribution for Cryomodule at SLAC	$ 482
Couplers for Cryomodules for FNAL & Value Engineering at SLAC	$ 2,543
Components for 10 MW 1.3 GHz RF Power Source	$ 1,216
Develop Eco-friendly Cavity Processing	$ 1,080
Total	**$ 52,672**

- **ARRA planning assumed ILC and SRF B&R lines continue to be funded per OHEP Guidance**

Schedules and Milestones

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- **SRF Program Office manages individual elements of the Plan by setting scope of work, budget and high level milestones**
  - **Individual parts of the program have project schedules and more detailed lower level milestones**
- **Technical progress on critical systems is monitored and reported weekly**
  - **via standing management & coordination meetings**
- **All of this information is fed into our planning process ➔ results in our SRF Budget Plan**

Example VTS System Upgrade

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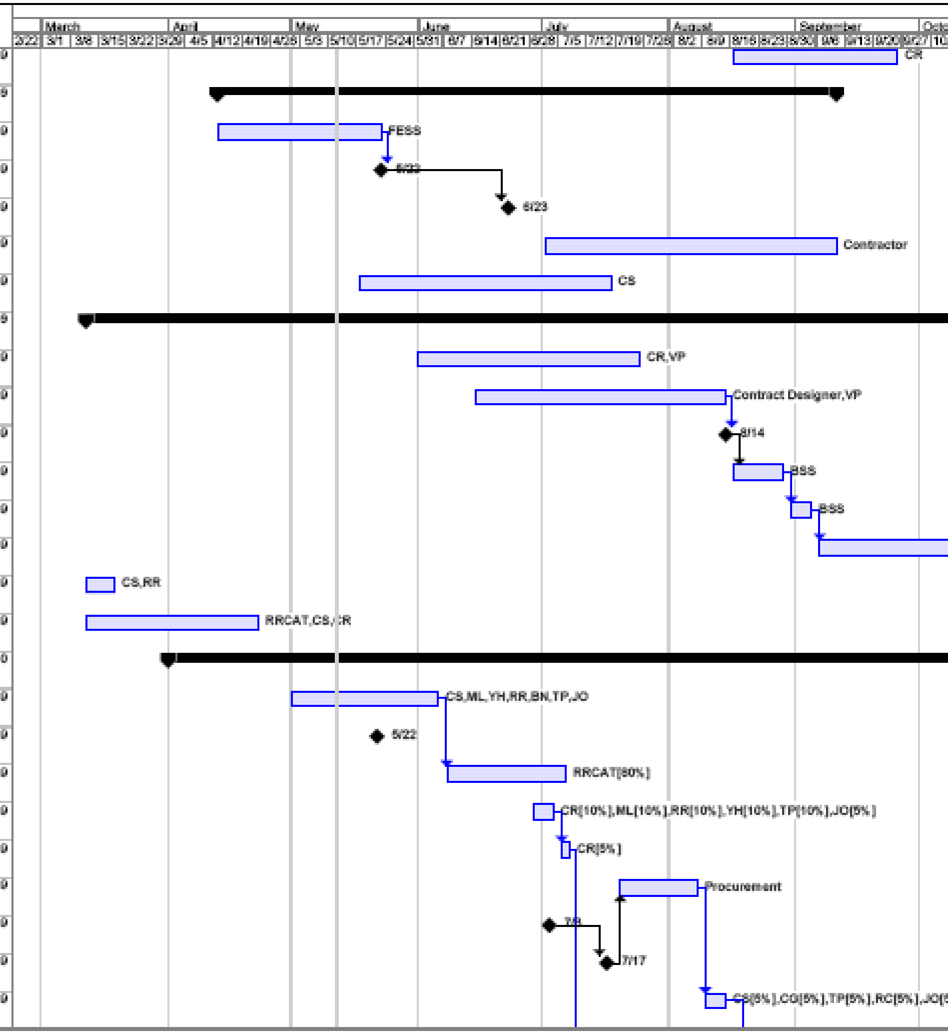
ID		Task Name	Duration	Start	Finish
27		Piping modeling/layout	30 days	8/17/09	9/25/09
28		Civil Construction (VTS)	109 days	4/13/09	9/10/09
29		Complete PDR	30 days	4/13/09	5/22/09
30		Prepare Bid packages	0 days	5/22/09	5/22/09
31		Award Contract	0 days	6/23/09	6/23/09
32		Civil Construction	51 days	7/2/09	9/10/09
33		Purchase Fermilab Supplied Items	45 days	5/18/09	7/17/09
34		Staging Area	172 days	3/12/09	11/6/09
35		Develop Layout	40 days	6/1/09	7/24/09
36		Generate detail Drawings	45 days	6/15/09	8/14/09
37		Generate Purchase Requisition	0 days	8/14/09	8/14/09
38		Prepare Bid Packages	10 days	8/17/09	8/28/09
39		Evaluate Bids and Award Contract	5 days	8/31/09	9/4/09
40		Fabricate	45 days	9/7/09	11/6/09
41		Develop process and instrumentation diagram	5 days	3/12/09	3/18/09
42		Develop conceptual design	30 days	3/12/09	4/22/09
43		Cryostat	288 days	4/1/09	5/7/10
44		Develop Technical Specification for Bidders	28 days	5/1/09	6/5/09
45		Preliminary Design review of Vertical Cryostat Assembly	0 days	5/22/09	5/22/09
46		Develop Detail Drawing Package	21 days	6/8/09	7/6/09
47		Design Review and Procurement Plan	5 days	6/29/09	7/3/09
48		Copy drawings	2 days	7/6/09	7/7/09
49		Vendor bidding of Cryostat Assembly	15 days	7/20/09	8/7/09
50		Approved Requisition to Procurement	0 days	7/3/09	7/3/09
51		Release Vertical Cryostat Assembly drawings with RFP	0 days	7/17/09	7/17/09
52		Review Bids	5 days	8/10/09	8/14/09



This particular schedule has labor resources identified

Impact of FY10 SRF Budget Guidance

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- The SRF plan presented at the DOE review of the SRF program assumed a constant funding of $25M/yr FY09-FY13.
- The present guidance for FY10 is $19.7M.
  - $16.8M (SWF)
  - $2.9M (M&S), significant M&S expenses is available in FY10 from ARRA funds.
- In FY10 SRF budget line would only provide M&S for operating the facilities.
- In FY10 SRF budget will not provide any M&S funds for
  - Facility Development
  - US Industrial vendor development and collaboration
  - No infrastructure development for spoke cavities and CM
  - No Cavity purchase

SRF Budget FY10 and Beyond

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- We can work with reduced FY10 budget due to availability of ARRA funds for SRF infrastructure development.
- The SRF funds should be restored to $25M/yr (FY11-13) to complete the 1.3 GHz infrastructure plan.
- Additional funds will be required for development of the 325 MHz SRF infrastructure.

Summary

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- In FY06-09 Fermilab has made significant progress towards design, development, construction, commissioning and operation of SRF Infrastructure.
  - Minimum infrastructure is in place (or will be in place shortly
    - Nb QC, Materail R&D, Cavity Processing, VTS, HTS, CM Assembly and Testing
- Plan is in place and developments are in progress to build SRF infrastructure to support the construction of Project-X.
  - Addition of 325 MHz infrastructure is needed.
- The SRF Program while developing Fermilab infrastructure effectively uses available US laboratory capacity and is working to develop US industrial capabilities.