New ANL/FNAL SRF Cavity Processing and Testing Facilities- Part 1

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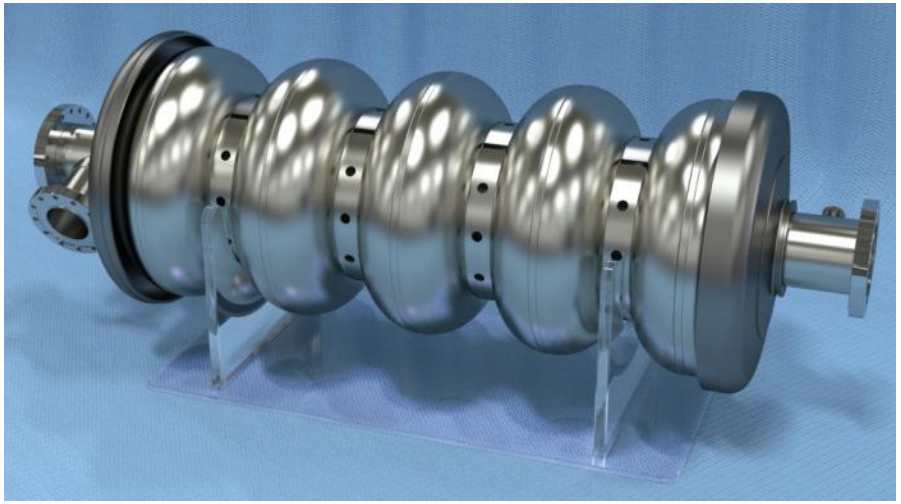


Outline

- ANL/FNAL SRF collaboration history
- Overview of collaboratively developed processing facilities
  - Processing recipe
  - Processing tools
- FNAL facility use of SCSPF
  - Cavity types
  - Throughput
- Planned use and need for expanded facilities
  - SSR dedicated HPR cleanroom facility
  - Production and R&D plans
- Mike Kelly—Part 2

ANL/FNAL SRF Collaboration History

- Began in CY 2002---Executive interest letters
- Leadership of Ken Shepard (ANL/Phy Div) and Helen Edwards (FNAL/Accel Div)
  - ANL desired expanded and improved facilities over G150
  - FNAL wanted to support 3.9 GHz CKM and 3rd Harmonic program—no existing chemical facilities at FNAL or supporting safety program
- FNAL began processing 3.9 GHz cavities in G150 in 2003

ANL/FNAL Collaboration History

- Superconducting Cavity Surface Processing Facility (ANL/FNAL SCSPF)development – Chemistry rooms 2003-2004, Cleanrooms 2005
- ILC Cold Technology Decision Jan. 1, 2005
- FNAL BCP System (later replaced) 2005-2006
- ANL/FNAL EP Tool for 1.3 GHz elliptical cavities 2006-2007
- FNAL cleanroom hardware (HPR tool, etc.) 2007-2008
- Full 1.3 GHz EP/HPR/Assembly work Jan 2009
- ANL EP Tool for QWR/650 MHz 2011-2012

Current Status of Collaboration

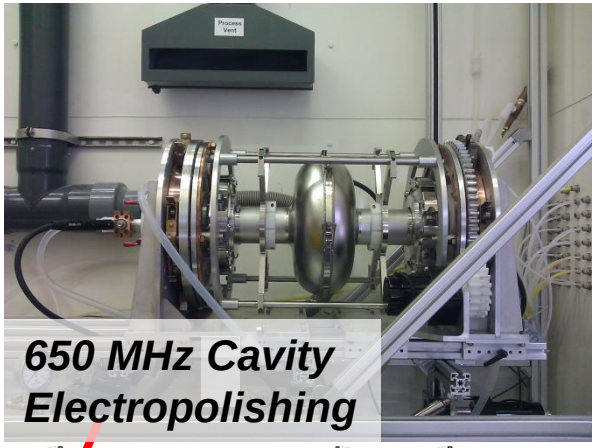
- SCSPF mutually operated and funded by ANL/FNAL.
- Technicians from FNAL are in permanent residence at SCSPF to perform all CR work. ANL—chemistry.
- Mutually agreed upon operating schedule manages facility and personnel resources.
- Diverse cavity processing program (FNAL and ANL push many types of resonators).
- Production and R&D cavity processing occur simultaneously.
- Test-bed for technology transfer to industry.

General SRF Cavity Processing Recipe

Step	Purpose	Location
Inspection (RF, Optical, Mech.)	QA/QC	FNAL IB4/ICB
Bulk Chemistry (EP/BCP)	Damage layer removal	SCSPF Chem Rooms
Post Chemistry Cleaning	Prep. for H2g Degas Bake	SCSPF Cleanrooms
High Temp. bake (600C, 800C)	H2g Degas	FNAL IB4/MP9
RF tuning	Field flatness and/or Freq. adj.	FNAL IB4
Light Chemistry (EP/BCP)	Final surface prep before VT	SCSPF Chem Rooms
Post Chemistry Cleaning	Prep. for HPR	SCSPF Cleanrooms
HPR and Assembly	Surface cleaning and assembly	SCSPF Cleanrooms
Slow Evacuation and leak check	Final VTS prep.	SCSPF Cleanrooms
VTS Testing	Performance test/qualification	FNAL IB1
Prep for cavity dressing	Prep for installing helium vessel	SCSPF Cleanrooms
Horizontal/CM Test Prep/HPR	Prep for installation into CM	SCSPF Cleanrooms

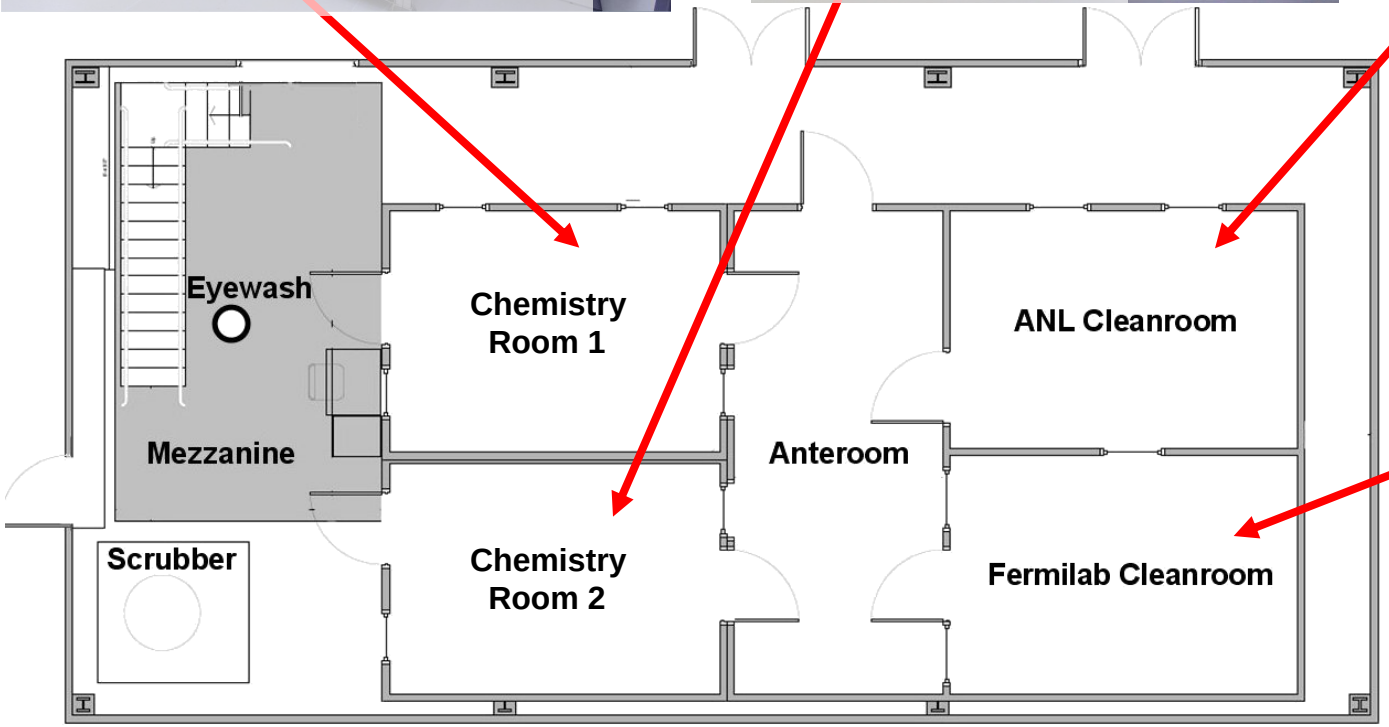
FNAL Use and Operations in SCSPF

1.3 GHz Cavity Electropolishing, 325 MHz BCP



650 MHz Cavity Electropolishing

SSR Cavity Rinsing

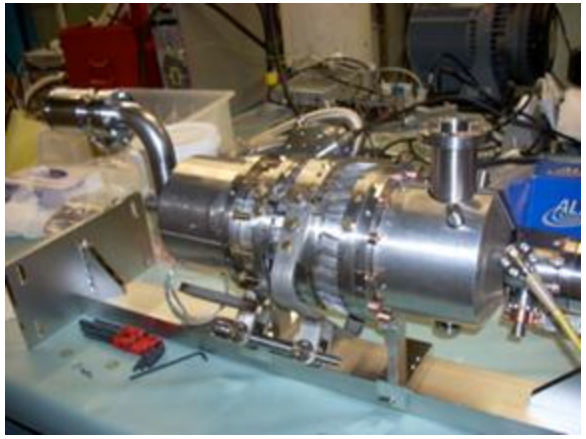


650 MHz, 1.3 GHz Cavity Rinsing/Assem

Bldg. 208 Rm B101

FNAL Elliptical Cavity Processing at ANL

- Ten 3.9 GHz 9-cell 3rd Harmonic cavities
  - BCP processed in G150 (CR work done at FNAL)
  - Developed 4 cavity CM at FNAL for DESY FLASH
  - Traded 4-cavity CM for TESLA 8-cavity 1.3 GHz CM kit



1.3 GHz TESLA/ILC/XFEL Cavities

- ILC Gradient and CM Development, GDE Statistics
- Project X CM Development
- FNAL ASTA Program
- High Q, thin films, NbN, Heat Treatment, CBP, Coatings, etc. R&D

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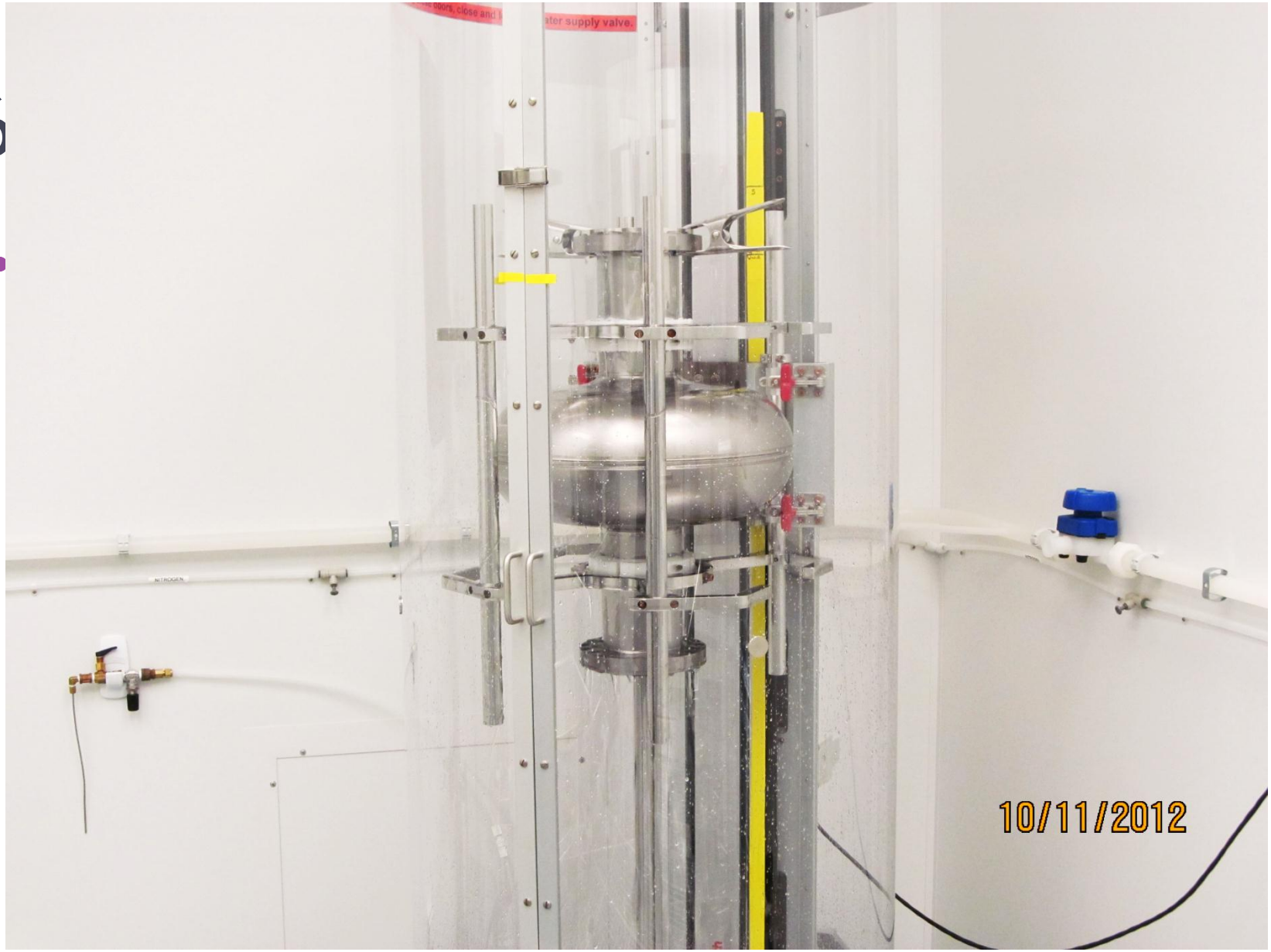
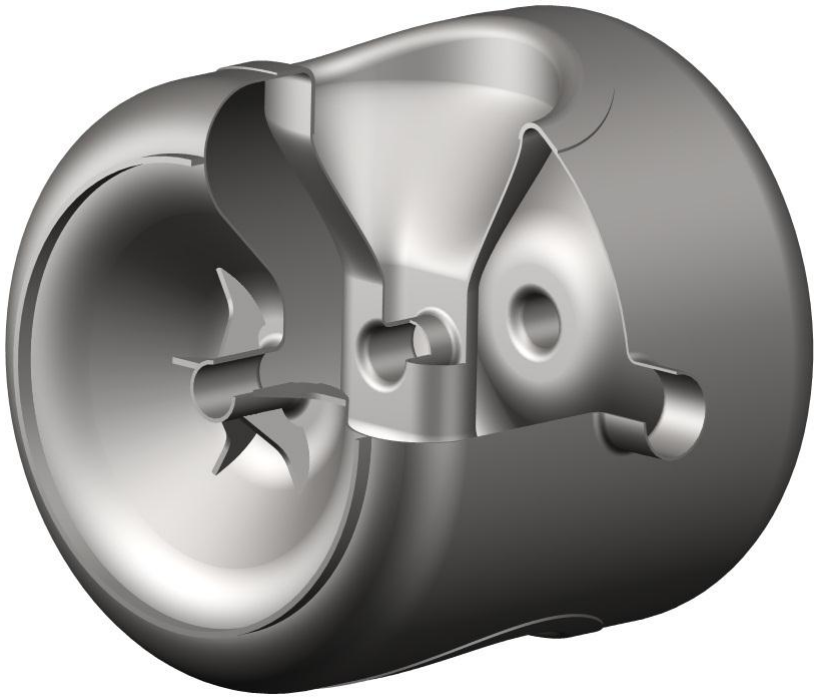


FNAL 325 MHz SSR Cavity Processing at ANL

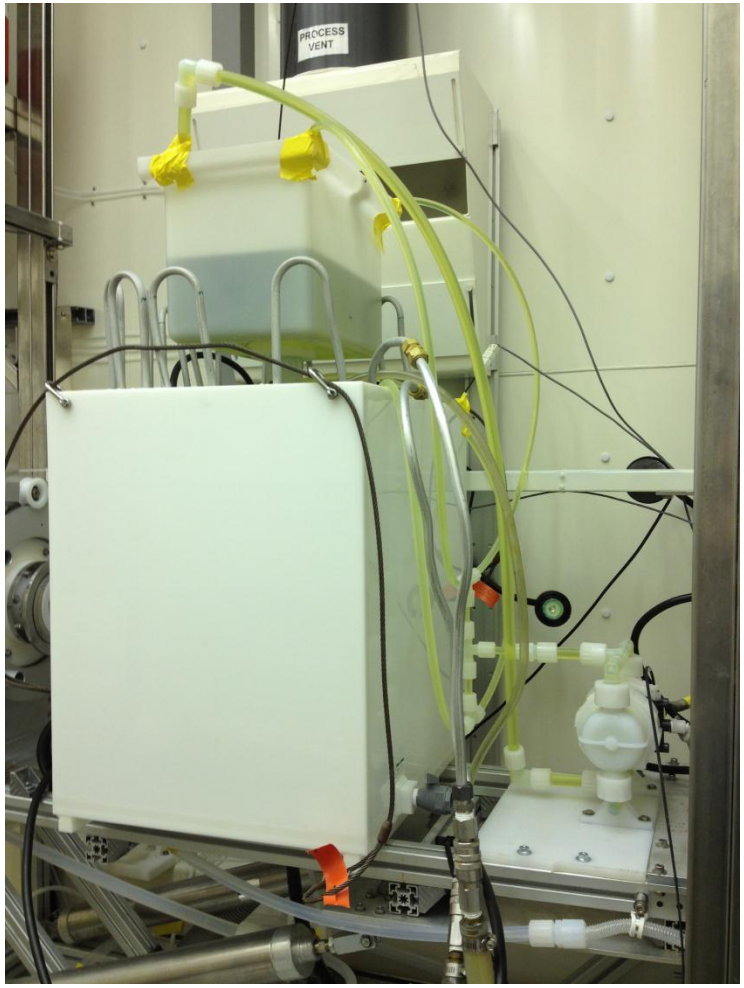
Dressed SSR1 Renderings



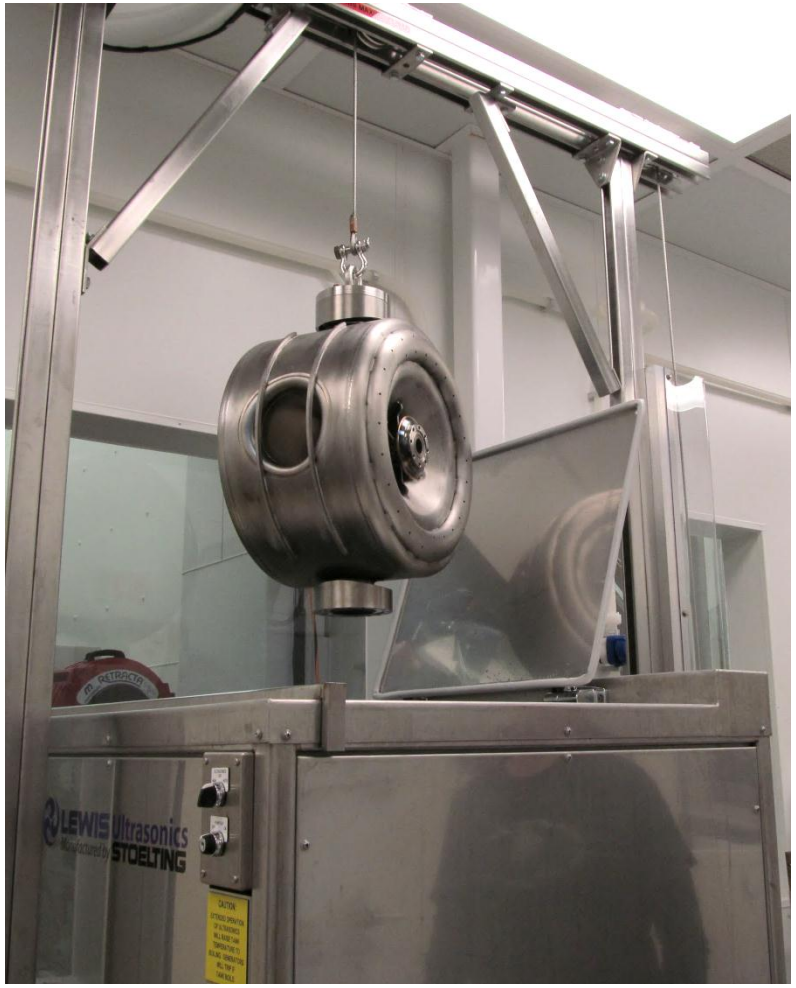
SSR2 for RISP/ Project X

M. Merio, P. Berrutti

SCSPF SSR Processing

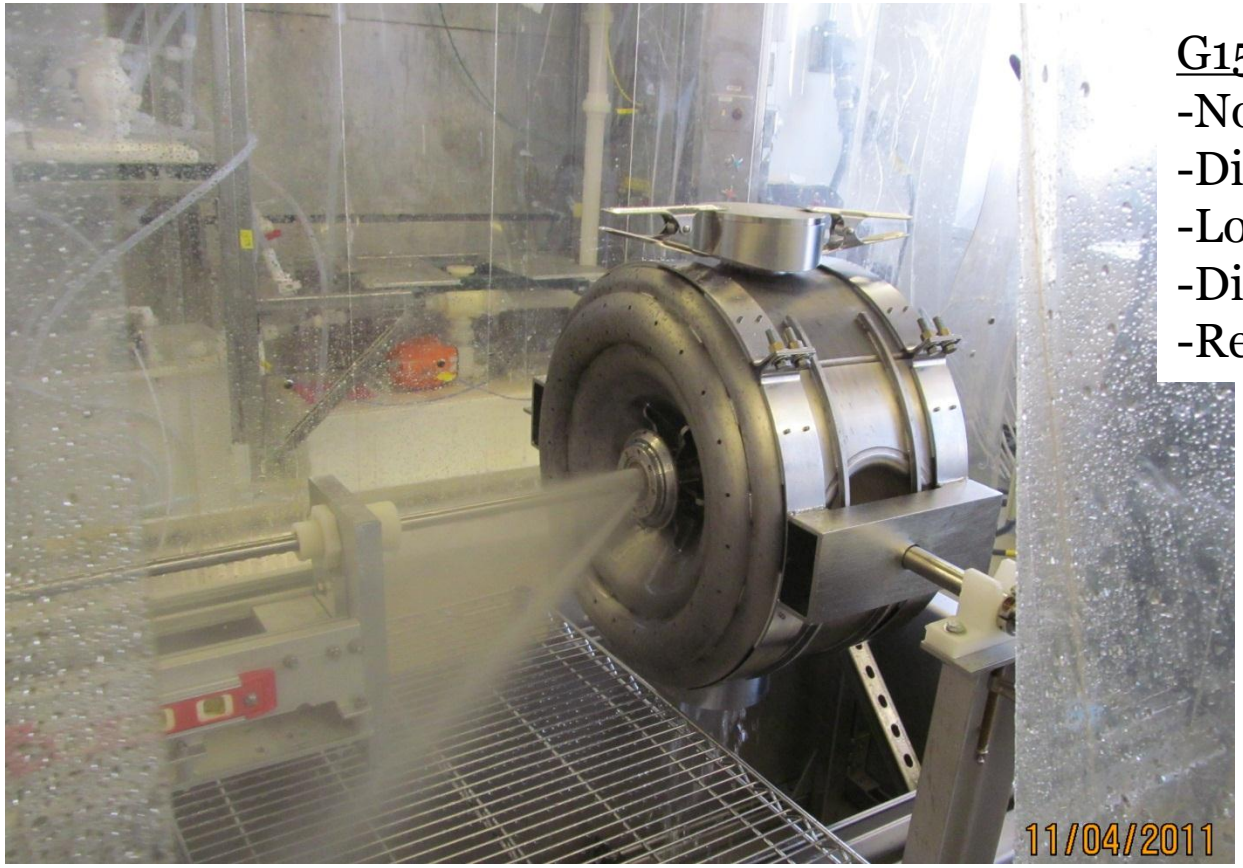


SSR1 BCP on 1.3 GHz EP Tool
(T. Reid, R. Murphy)



SSR1 Ultrasonic cleaning in B101

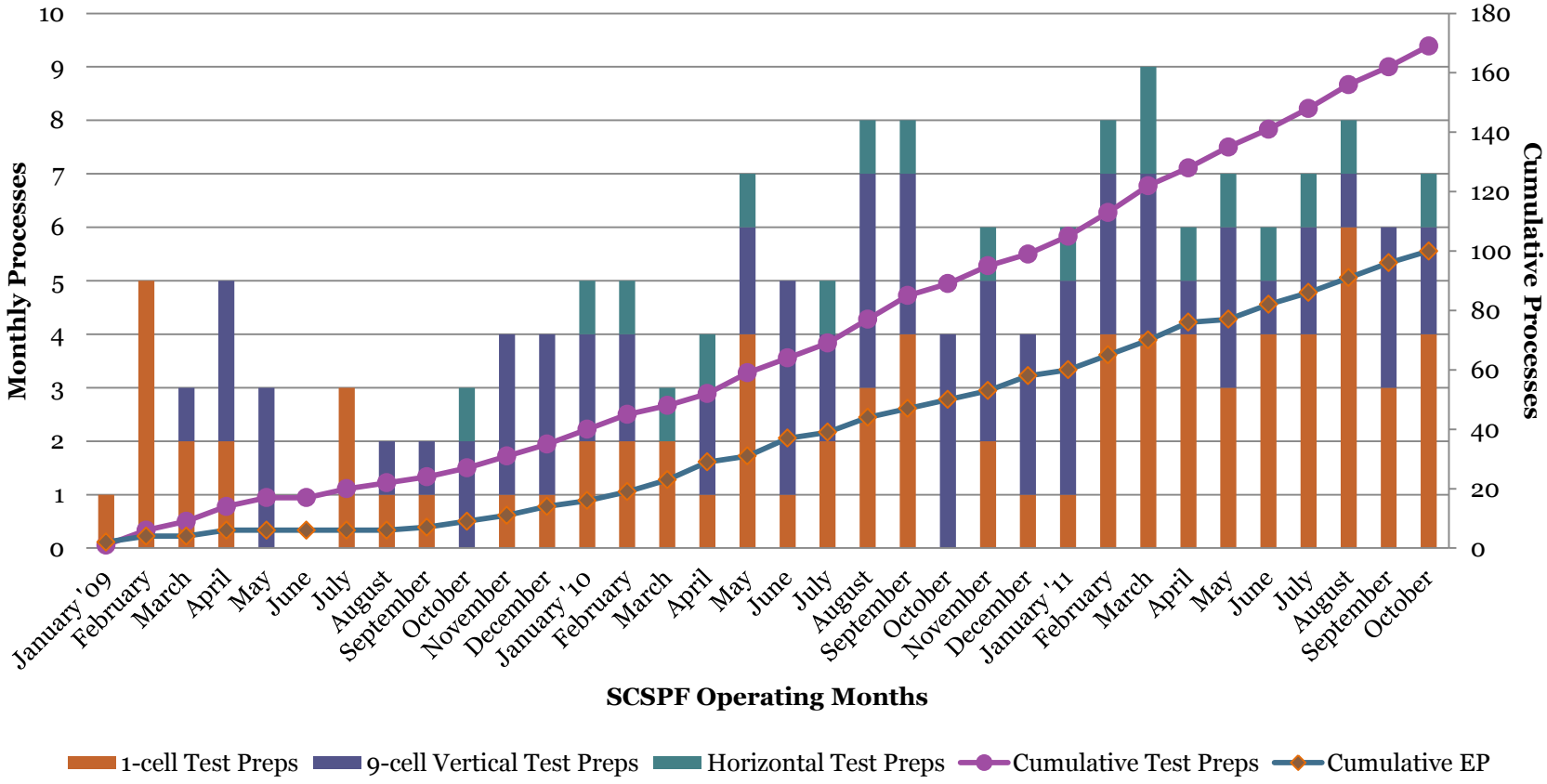
Bldg 203 Rm G150---1st HPR only—Horiz. orientation



G150 CR Ops
-Not Class 10
-Difficult cavity handling
-Low throughput
-Disconnected from SCSPF
-Requires 2nd HPR in B101

B101 SSR 2nd HPR—Vert. orientation—ANL HPR Tool

ANL/FNAL SCSPF Cumulative 1.3 GHz Throughput—through FY 2011



Production and R&D Plans

- PXIE CM – eight 325 MHz SSR1
  - Full BCP sequence
- ILC/ASTA CMs – twenty 1.3 GHz 9-cell cavities
  - Light EP through dressing
- RISP – two 325 MHz SSR2 (new cavity type)
  - Full BCP sequence
- Project X 650 MHz – six 1-cell, five 5-cell B=0.9
  - EP/BCP combination
- 1.3 GHz R&D – two cavities/week average
- Possible work for others – European Spallation Source, Next Generation Light Source

Case for SCSPF CR Facility Expansion

- Variety of cavities in FNAL program increasing.
- R&D expanding beyond high E_{accel} to high Q for CW.
- Desire to maintain dedicated elliptical cavity cleanroom areas to improve work function.
- SSR1 (PXIE, Project X), SSR2 (RISP, Project X) work increasing substantially.
- Minimize overlap in cleanroom use---ANL CR multi-functional and subject to schedule squeeze.
- SSR processing improvements with facility designed around process requirements—multi-directional HPR tool, specialized assembly setup, for example.

Acknowledgements

FNAL
- C. Baker
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- B. Stone

ANL
- S. Gerbick
- M. Kelly
- R. Murphy
- T. Reid

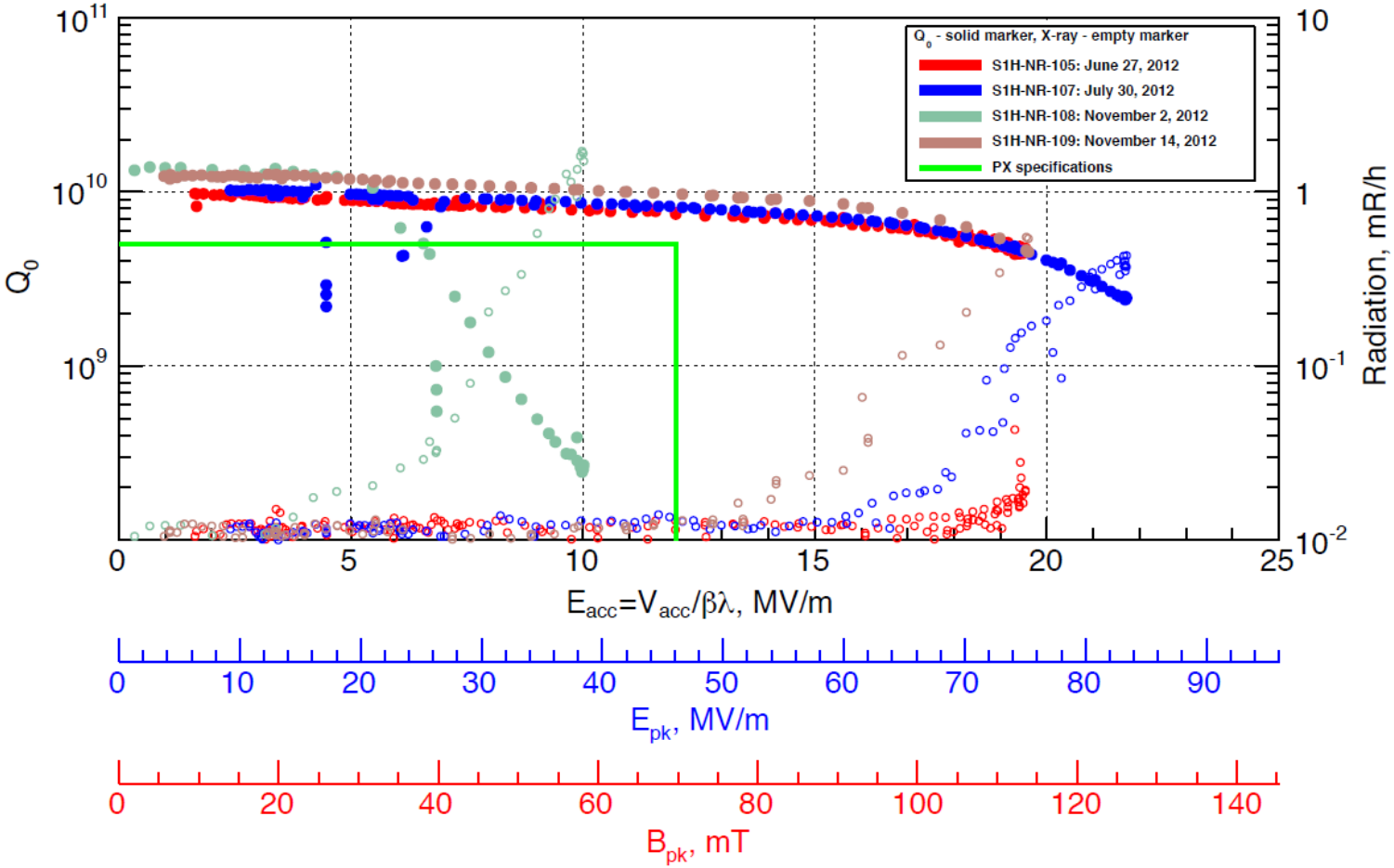
Backup slides

SSR Cavity Processing Recipe

1. Inspection – RF & Optical	9. Evacuate + 120C Bake 48 hrs
2. Bulk BCP (flip at 60 um)	10. Vertical Test
3. HPR	11. Helium Vessel Dressing
4. 600C 10 hrs < 5C/min ramp rate	12. HPR
5. RF Tuning	13. Assemble
6. Light BCP	14. Evacuate + 120C Bake 48 hrs
7. HPR	15. Horizontal Test
8. Assemble	16. Ready for String

Vacuum baking should improve VT multipactor processing time.

SSR Performance



IB4 Facility Developments

- FNAL IB4 CPL 1.3 GHz Facility Operational