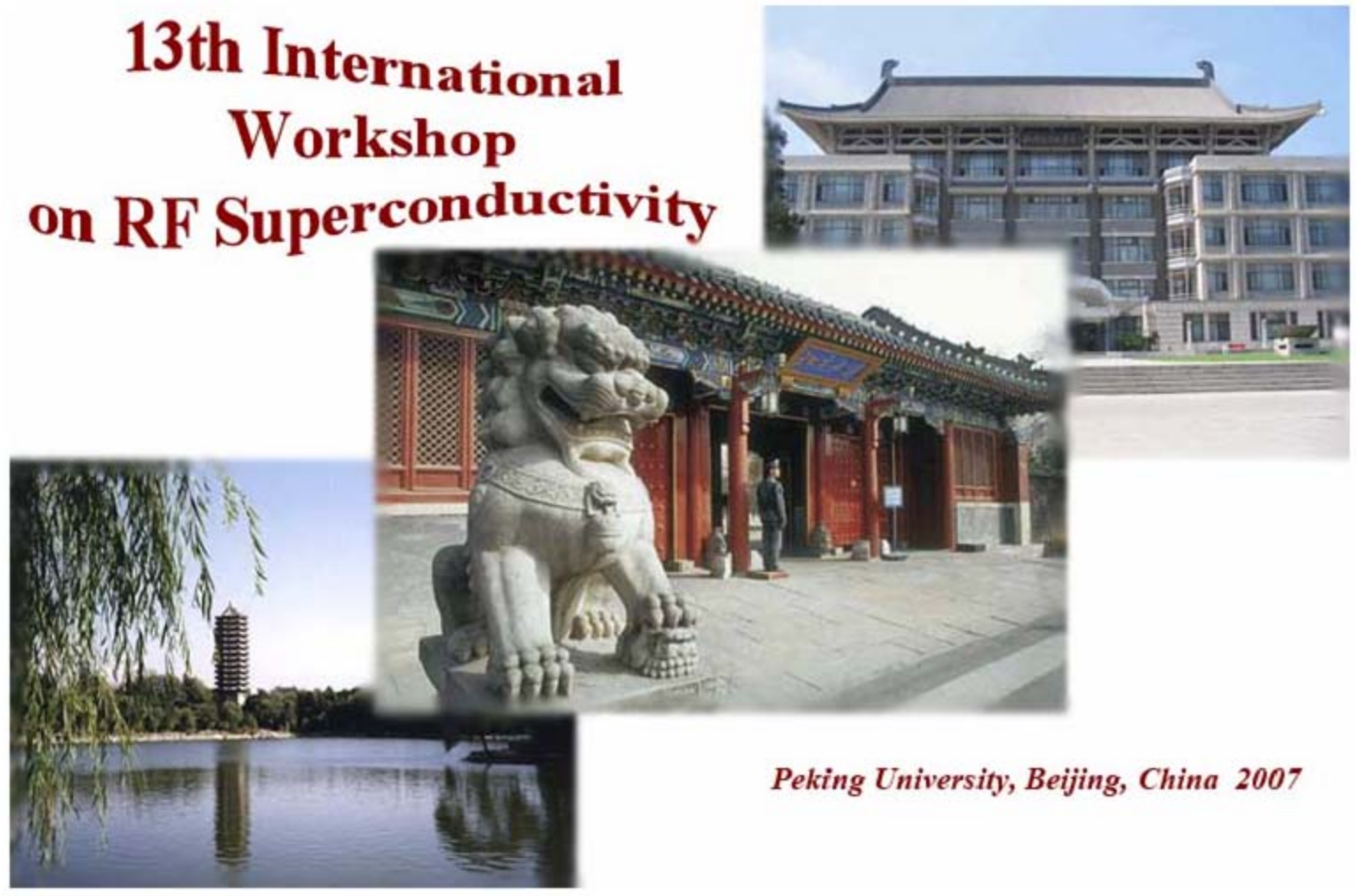
Summary of SRF2007 Workshop

Mark Champion



http://www.pku.edu.cn/academic/srf2007/

SRF2007 Workshop Program

	Sunday Oct.14	Monday Oct.15	Tuesday Oct.16	Wednesday Oct.17	Thursday Oct.18	Friday Oct.19
8:00- 8:30		Registration (8:00- 8:50)				
8:30- 9:00			Basic SRF Topics	Students and Young Researchers Session I (8:30- 9:20)	Advances in SRF technology III	Future projects and new ideas I
9:00- 9:30	Registration (9:00-23:00)	Opening address				
9:30-10:30		Progress Reports I (9:30- 10:40)		Students and Young Researchers Session II (9:20- 10:30)	Hot Topic I	
10:30-11:00		Coffee Break				
11:00-12:00		Progress Reports II	Advances in SRF technology I	Advances in SRF technology II	Hot Topc II	Future projects and new ideas II (11:00- 11:45)
12:00-13:00					Industrialization on SRF accelerators	Awards / Closing Ceremony (11:45- 13:00)
13:00- 14:00		Lunch				
14:00- 16:00		Progress Reports III	Poster I and Industry exhibition	Poster II and Industry exhibition	Excursion and Banquet (14:30- 20:00)	Lab Tours (14:15-)
16:00- 16:30		Coffee Break				
16:30- 18:00		Progress Reports IV	Poster I and Industry exhibition	Poster II and Industry exhibition		
18:00- 18:30			Entertainment (17:00- 21:30)			
18:30- 21:00	Welcome reception			IPC meeting (18:30- 21:30)		
21:00- 21:30						

272 participants

(190 from abroad)

168 posters

Tutorials program

	Thursday Oct.11	Friday Oct.12	Satyrday Oct. 13
8:30- 8:35	opening	**Tutorial 3a:** download **SC Cavities: Material, Fabrication and QA** W.Singer (DESY) **Tutorial 3b:** download **Tutorial on Cavity Preparation** A.Matheisen (DESY)	**Tutorial 5a:** download **Some Fundamentals of Cryogenic and Module Engineering with regard to SRF Technology** B.Petersen (DESY)
8:35-10:00	**Tutorial 1a:** download **General Aspects of Superconductivity.** A.Gurevich (FSU)		
10:00- 10:05			discussion
10:05- 10:20	discussion		
10:20- 10:40	coffee break	coffee break	coffee break
10:40- 12:10	**Tutorial 1b:** download **Basics of Superconducting RF.** J.Knobloch (BESSY)	**Tutorial 3c:** download **Limits in cavity performance** D.Reschke (DESY)	**Tutorial 5b:** download **Operational Aspects of SC RF Cavities with Beam** M.Liepe (Cornell)
12:10- 12:30	discussion	discussion	discussion
12:30- 13:30	lunch	lunch	lunch
13:30- 15:00	**Tutorial 2a:** download **Superconducting High Beta Cavities.** J.Sekutowicz (DESY)	**Tutorial 4a** Low and Medium Beta Cavities and accelerators download	**Tutorial 6a:** download **Thin Film Review.** Enzo.Palmieri (INFN-LNL)
15:00-15:20	discussion		discussion
15:20- 15:40	coffee break		
15:40- 17:10	**Tutorial 2b:** download **Design and Fabrication Issues of High Power and Higner Order Modes Coupler for Superconducting Cavities.** W.Moeller (DESY)	**Tutorial 4b** LLRF Control systems and Tuning systems download	**Tutorial 6b:** download **SRF material other than Niobium.** A.Valente (JLAB)
17:10- 17:30	discussion		

Much Progress Since SRF-2005

- SNS commissioning reached design energy
  - 1 GeV protons
- TTF-II commissioning reached design energy
  - 1 GeV electrons
- Successful commissioning of SRF systems in storage ring light sources around the world
  - Taiwan Light Source, Canadian Light Source, SOLEIL, Shangai Light Source, Beijing Tau-Charm Factory and Light Source

Introductory Remarks - Hasan Padamsee, Cornell

The Future is Ready

- New project : 20 GeV XFEL approval : the largest SRF project to date.
  - LEP-II was 3.5 GeV installed
- New light sources : FELs and ERLs
- New SRF infrastructure under installation around the world for ILC and other projects:
  - KEK, Fermilab/Argonne, SNS upgrade

Introductory Remarks - Hasan Padamsee, Cornell

Challenges for SRF Community

- Improve basic understanding for performance limitations
  - Q-slopes, especially high field Q-slope
  - Sources of quench and field emission
- Improve the yield for highest gradient performance
  - How can we get to 90% or better yield at 35 MV/m for ILC?
    - Must continue the fight against common enemies of the past :
    - field emission and quench
- Improve the Q for CW applications
- Increase industry presence
  - 1000 cavities, 100 cryomodules for XFEL
  - 16,000 cavities, 2000 cryomodules for ILC
- Niobium is fast reaching its theoretical limit (whatever that may be?)
  - Where is the new road?

Introductory Remarks - Hasan Padamsee, Cornell

Oct. 15 (Monday)

09:00-09:30	**Opening Ceremony** (Sunny Hall, Yingjie Exchange Center) **Chairman: D. Proch (DESY)** download
Session MO1: Progress Reports I (Sunny Hall, Yingjie Exchange Center) **Chairman: H. Padamsee (Cornell University).** Each presentation includes 5 minutes for discussion	
09:30-10:00	The Growth of SRF in China, Jia-er Chen (IHIP, School of Physics, Peking University) download
10:00-10:40	XFEL: Plans for 100 Cryomodules, Lutz Lilje (DESY) download
10:40-11:00	**Coffee Break**
Session MO2: Progress Reports II(Sunny Hall, Yingjie Exchange Center) **Chairman: C. Pagani (INFN).** Each presentation includes 5 minutes for discussion	
11:00-11:30	SNS Commissioning and Upgrade Plans, Isidoro Campisi (ORNL/SNS) download
11:30-12:00	Status of the Cornell ERL Injector Cryomodule, Matthias Liepe (Cornell University) download
12:00-12:30	ERLP and 4GLS at Daresbury, Peter McIntosh (STFC Daresbury Laboratory) download
12:30-13:00	FLASH Progress Report, Elmar Vogel (DESY) download
13:00-14:00	**Lunch**
Session MO3: Progress Reports III (Sunny Hall, Yingjie Exchange Center) **Chairman: M. Kelley (ANL).** Each presentation includes 5 minutes for discussion	
14:00-14:30	Review of SRF Linac-based FELs, Jens Knobloch (BESSY) download
14:30-15:00	Superconducting RF in Storage-Ring-Based Light Sources, Sergey Belomestnykh (Cornell University) download
15:00-15:25	SRF ACTIVITES AT IUAC, NEW DELHI AND OTHER LABORATORIES IN INDIA, Amit Roy (Inter-University Accelerator Centre) download
15:25-15:55	MSU Re-accelerator - the Reacceleration of Low Energy RIBs at the NSCL, Xiaoyu Wu (MSU/NSCL) download
16:00-16:30	**Coffee Break**
Session MO4: Progress Report IV (Sunny Hall, Yingjie Exchange Center) **Chairman: C. Antoine (Saclay).** Each presentation includes 5 minutes for discussion	
16:30-16:55	The Spiral 2 Project: Construction Progress and Recent Developments on the SC Linac Driver, Tomas Junquera (GANIL (CEA-CNRS)) download
16:55-17:15	Recent Progress in the Superconducting RF Program at TRIUMF/ISAC, Robert Laxdal (TRIUMF) download
17:15-17:35	Development of the superconducting CH-cavity and application to proton and ion acceleration, Holger Podlech (IAP, Frankfurt University) download
17:35-18:05	ALPI QWR and Superconducting RFQ Operating Experience, Giovanni Bisoffi (INFN – LABORATORI NAZIONALI DI LEGNARO) download
18:05-18:25	Construction and Commissioning of KEKB Superconducting Crab Cavities, Kenji Hosoyama (KEK High Energy Accelerator Research Organization) download

Oct. 16 (Tuesday)

Session TU1: Basic SRF Topics (Sunny Hall, Yingjie Exchange Center) **Chairman: P. Kneisel (JLab).** Each presentation includes 5 minutes for discussion	
08:30-09:00	Outstanding Issues in RF Superconductivity: What can Theory Tell Us? James Sethna (Cornell University) **download**
09:00-09:30	Review of high field Q slope, cavity measurements, Gianluigi Ciovati (Jefferson Lab) **download**
09:30-10:00	Review of high field Q-slope, surface measurement, Alexander Romanenko (Cornell University) **download**
10:00-10:30	Dynamics of vortex penetration, jumpwise instabilities, dissipation and nonlinear surface resistance in strong rf fields, Alex Gurevich (NHMFL, Florida State Univeristy) **download**
10:30-11:00	**Coffee Break**
Session TU2: Advances in SRF Technology I (Sunny Hall, Yingjie Exchange Center) **Chairman: S. Noguchi (KEK).** Each presentation includes 5 minutes for discussion	
11:00-11:30	Advances in Electropolishing / Rinsing and Assembly Techniques to Reduce Field Emission, John Mammosser (ORNL/SNS) (withdrawed)
11:30-12:00	Gradient Yield Improvement Efforts for Single and Multi-Cells AND Progress for very high gradient cavities, Kenji Saito (KEK) **download**
12:00-12:30	Prospects for higher Tc superconductors for SRF application, Xiaoxing Xi (Peking University and Pennsylvania State University) **download**
12:30-13:00	Review of SRF materials workshop, Genfa Wu (Fermilab) **download**
13:00-14:00	**Lunch**
Poster I Corridor and Press Hall, Yingjie Exchange Center	
14:00-16:00	Poster and Industry Exhibition
16:00-16:30	**Coffee Break**
16:30-17:00	Poster and Industry Exhibition
17:00-21:30	**Entertainment**

Oct. 17 (Wednesday)

Session WE1: Student and Young Researchers Session I - Basic SRF & Thin films (Sunny Hall, Yingjie Exchange Center) **Chairman: V. Palmieri (INFN and Padua Univ).** Each presentation includes 2 minutes for discussion	
08:30-08:40	Temperature Map studies on Nearly Oxide-Free, Thin-Oxide and Standart-Oxide Cavities, G. Eremeev (Cornell University) **download**
08:40-08:50	THERMAL DESIGN STUDIES OF NIOBIUM SRF CAVITIES, Ahmad Aizaz (Michigan State University/NSCL) **download**
08:50-09:00	R&D on the 3+1/2 cell DC-SC photo-cathode injector, Wencan Xu (IHIP, School of Physics, Peking University)**download**
09:00-09:10	Improved Characterization of the Electropolishing of Niobium with Sulfuric and Hydrofluoric Acid Mixtures, Hui Tian (Virginia Polytechnic Institute & State University) **download**
09:10-09:20	An investigation of the influence of grain boundaries on flux penetration in high purity large grain niobium for particle accelerators, ZuHawn Sung (Applied Superconductivity Center, Florida State University) **download**
Session WE2: Student and Young Researchers Session II - SRF Technology - Work on couplers, tuners, LLRF etc. (Sunny Hall, Yingjie Exchange Center) **Chairman: J. Knobloch (BESSY).** Each presentation includes 2 minutes for discussion	
09:20-09:30	Microphonics in CW TESLA cavities and their compensation with fast tuners, Axel Neumann (BESSY GmbH) **download**
09:30-09:40	Different sputtering configurations for coating 1.5 GHz copper cavities, Giulia Lanza (University of Rome, Rome, Italy) **download**
09:40-09:50	The progress at LNL on Nb3Sn and V3Si, Silvia Deambrosis (INFN-LNL, Padua University) **download**
09:50-10:00	Application of plasma cleaning to cavity processing, Niccolò Patron (INFN-LNL) **download**
10:00-10:10	Electro-Mechanical Properties of Spoke-Loaded Superconducting Cavities, Zachary Conway (Argonne National Laboratory) **download**
10:10-10:20	First Test Results of Half-Reentrant Single-Cell Superconducting Cavities, Mandi Meidlinger (Michigan State University) **download**
10:30-11:00	**Coffee Break**
Session WE3: Advances in SRF technology II (Sunny Hall, Yingjie Exchange Center) **Chairman: T. Grimm (MSU).** Each presentation includes 5 minutes for discussion	
11:00-11:20	Progress in Seamless Cavities, Waldemar Singer (DESY) **download**
11:20-11:40	Status of SC Spoke Cavity Development, Michael Kelly (Argonne National Laboratory) **download**
11:40-12:00	Review of New Tuner Designs, Shuichi Noguchi (KEK) **download**
12:00-12:20	Review of HOM couplers and broadband absorbers, Nikolay Solyak (Fermi National Accelerator Lab) (withdrawed)
12:20-12:40	Overview of Input Power Coupler Developments, Pulsed and CW, Sergey Belomestnykh (Cornell University) **download**
12:40-13:00	Superconducting RF Photoinjectors: an Overview, Sekutowicz Jacek (DESY) **download**
13:00-14:00	**Lunch**
Poster II Corridor and Press Hall, Yingjie Exchange Center	

Oct. 18 (Thursday)

Session TH1: Advances in SRF technology III (Sunny Hall, Yingjie Exchange Center) **Chairman: R. Losito (CERN).** Each presentation includes 5 minutes for discussion	
08:30-09:00	Review of the Thin Film Workshop, Vincenzo Palmieri (INFN and University of Padua) **download**
09:00-09:30	Progress on Large Grain and Single Grain Niobium – Ingots and Sheet and Review of Progress on Large Grain and Single Grain Niobium Cavities, Peter Kneisel (Jefferson Lab) **download**
Hot Topic I Sunny Hall, Yingjie Exchange Center. **outline, talk 1, talk 2, talk 3, talk 4**	
09:30-10:30	Is large grain/ single crystal Nb an alternative material to polycristallline niobium? Hasan Padamsee (Cornell University)
10:30-11:00	**Coffee Break**
Hot Topic II Sunny Hall, Yingjie Exchange Center. **outline**	
11:00-12:00	Is 35 MV/m still a good choice for ILC? Dieter Proch (DESY)
Session TH2: Industrialization on SRF Accelerators (Sunny Hall, Yingjie Exchange Center) **Chairman: K. Saito (KEK).** Each presentation includes 5 minutes for discussion	
12:00-12:30	Industrial Study of FLASH Module Production, B.Petersen (DESY) **download**
12:30-13:00	Industrialization process for XFEL Power couplers and Volume manufacturing, W.D. Moeller (DESY) **download**
13:00-14:00	**Lunch**
14:30-20:00	**Excursion & Banquet**

Oct. 19 (Friday)

Session FR1: Future projects and new ideas I (Sunny Hall, Yingjie Exchange Center) **Chairman: H. Edwards (Fermilab).** Each presentation includes 5 minutes for discussion	
08:30-09:00	BNL - electron cooling and electron-ion colliders, Ilan Ben-Zvi (Brookhaven National Laboratory)
09:00-09:30	High average power ERL FEL, George Neil (Center for Advanced Studies of Accelerators, Jefferson Laboratory)
09:30-10:00	Future High Intensity Proton Accelerators, Frank Gerigk (CERN)
10:00-10:30	CEBAF energy upgrade program including re-work of CEBAF cavities, Joseph Preble (Jefferson Lab)
10:30-11:00	**Coffee Break**
Session FR2: Future projects and new ideas II (Sunny Hall, Yingjie Exchange Center) **Chairman: I. Ben-zvi (BNL).** Each presentation includes 5 minutes for discussion	
11:00-11:45	ILC: Goals and Progress of SRF R&D, Hitoshi Hayano (KEK)
11:45-13:00	**Awards / Closing Ceremony**
13:00-14:00	**Lunch**
14:15-	**Lab Tours (Peking University, IHEP)**

Hot Topic 1

Is large grain/single grain an alternative to fine grain?

Maybe… not enough data yet

Hot Topic II: Is 35 MV/m still a good choice for ILC?

Guide for discussion

- Cavity performance at vertical test (VT)
  - Limit by field emission (FE)
  - Limit by quench
  - Scatter of performance
  - QA of preparation, diagnostics
  - Coordination of activities in different laboratories
  - Activation of additional resources (industry, laboratories)
- Cavity performance in module
  - Improvement / degradation compared to VT
  - Scatter of performance (adjustable RF power)
  - Diagnostics in module
- **Identify action items and give ranking**

Maybe…
But quench and field emission are still limitations

Summary

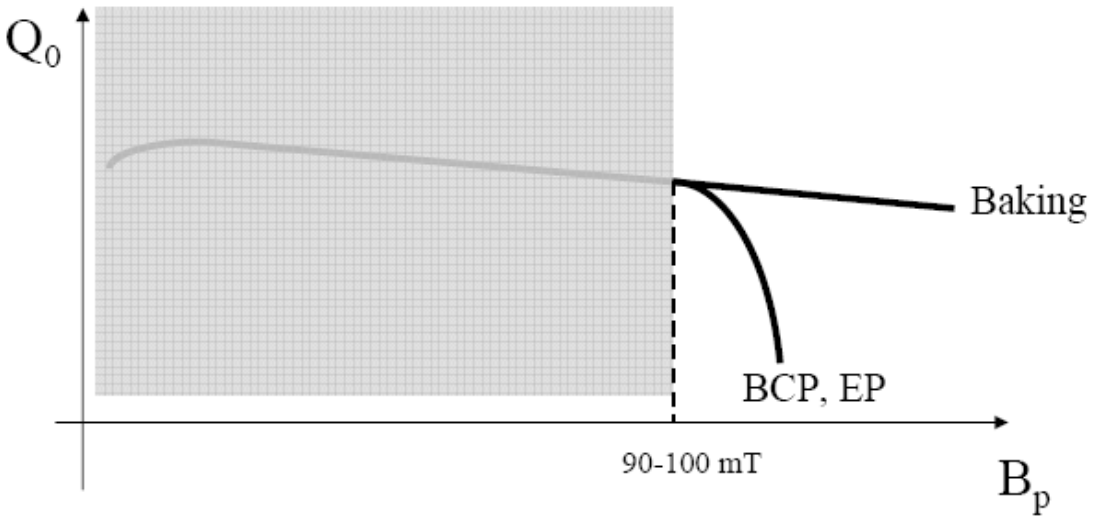
From Peter Kneisel's talk on large- and single-grain cavities

- Large grain material provides some challenges in fabrication of cavities, but is no "show stopper"
- Single crystal sheets would be desirable, but no significant performance improvements over large grain niobium
- Performance is comparable with fine grain niobium
- But does not need electro-polishing, BCP is fine and very smooth surfaces can be achieved
- For projects such as the XFEL or cw applications cavities from large grain niobium offer "streamlined" procedures:
  - Bcp, shorter "in situ" baking times, high Q-values at high fields
- Reproducibility of performance after bcp treatment seems to be quite good – to be further " hardened"
- Cost advantage over poly-crystalline niobium needs to be realized , effective cutting method presently only pursued by W.C. Heraeus
- Further confidence will be "built up" with add. 9-cell cavities (cryomodule)

From G. Ciovati's talk on high-field Q slope

Introduction

- Typical $Q_0(B_p)$ curve for high-purity bulk niobium L-band cavities



- High field Q-slope (or Q-drop): exponential increase of RF losses with no X-rays (field emission). First observed in 1997.
- In 1998 it was found that a low-temperature (100 – 140 ° C, 48 h) bake strongly reduced the Q-drop

Student & Young Reseachers Presentations

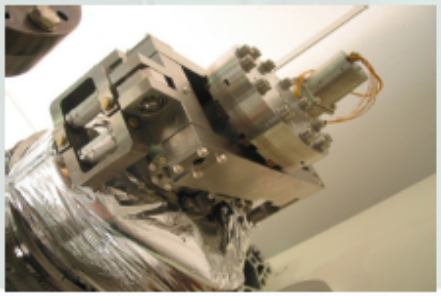
Session WE1: Student and Young Researchers Session I - Basic SRF & Thin films (Sunny Hall, Yingjie Exchange Center) **Chairman: V. Palmieri (INFN and Padua Univ).** Each presentation includes 2 minutes for discussion	
08:30-08:40	Temperature Map studies on Nearly Oxide-Free, Thin-Oxide and Standart-Oxide Cavities, G. Eremeev (Cornell University) **download**
08:40-08:50	THERMAL DESIGN STUDIES OF NIOBIUM SRF CAVITIES, Ahmad Aizaz (Michigan State University/NSCL) **download**
08:50-09:00	R&D on the 3+1/2 cell DC-SC photo-cathode injector, Wencan Xu (IHIP, School of Physics, Peking University)**download**
09:00-09:10	Improved Characterization of the Electropolishing of Niobium with Sulfuric and Hydrofluoric Acid Mixtures, Hui Tian (Virginia Polytechnic Institute & State University) **download**
09:10-09:20	An investigation of the influence of grain boundaries on flux penetration in high purity large grain niobium for particle accelerators, ZuHawn Sung (Applied Superconductivity Center, Florida State University) **download**
Session WE2: Student and Young Researchers Session II - SRF Technology - Work on couplers, tuners, LLRF etc. (Sunny Hall, Yingjie Exchange Center) **Chairman: J. Knobloch (BESSY).** Each presentation includes 2 minutes for discussion	
09:20-09:30	Microphonics in CW TESLA cavities and their compensation with fast tuners, Axel Neumann (BESSY GmbH) **download**
09:30-09:40	Different sputtering configurations for coating 1.5 GHz copper cavities, Giulia Lanza (University of Rome, Rome, Italy) **download**
09:40-09:50	The progress at LNL on Nb3Sn and V3Si, Silvia Deambrosis (INFN-LNL, Padua University) **download**
09:50-10:00	Application of plasma cleaning to cavity processing, Niccolò Patron (INFN-LNL) **download**
10:00-10:10	Electro-Mechanical Properties of Spoke-Loaded Superconducting Cavities, Zachary Conway (Argonne National Laboratory) **download**
10:10-10:20	First Test Results of Half-Reentrant Single-Cell Superconducting Cavities, Mandi Meidlinger (Michigan State University) **download**

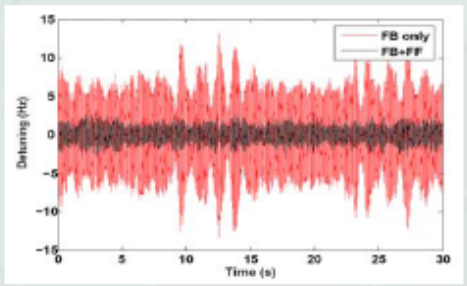
Two awards for outstanding talks

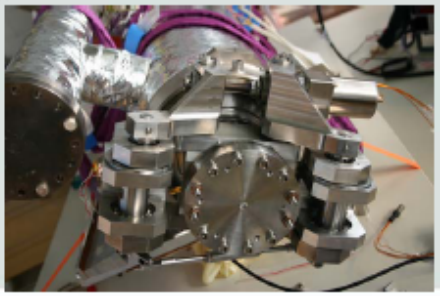
BESSY
Berliner Elektronenspeicherring-Gesellschaft
für Synchrotronstrahlung m.b.H.

EURO FEL

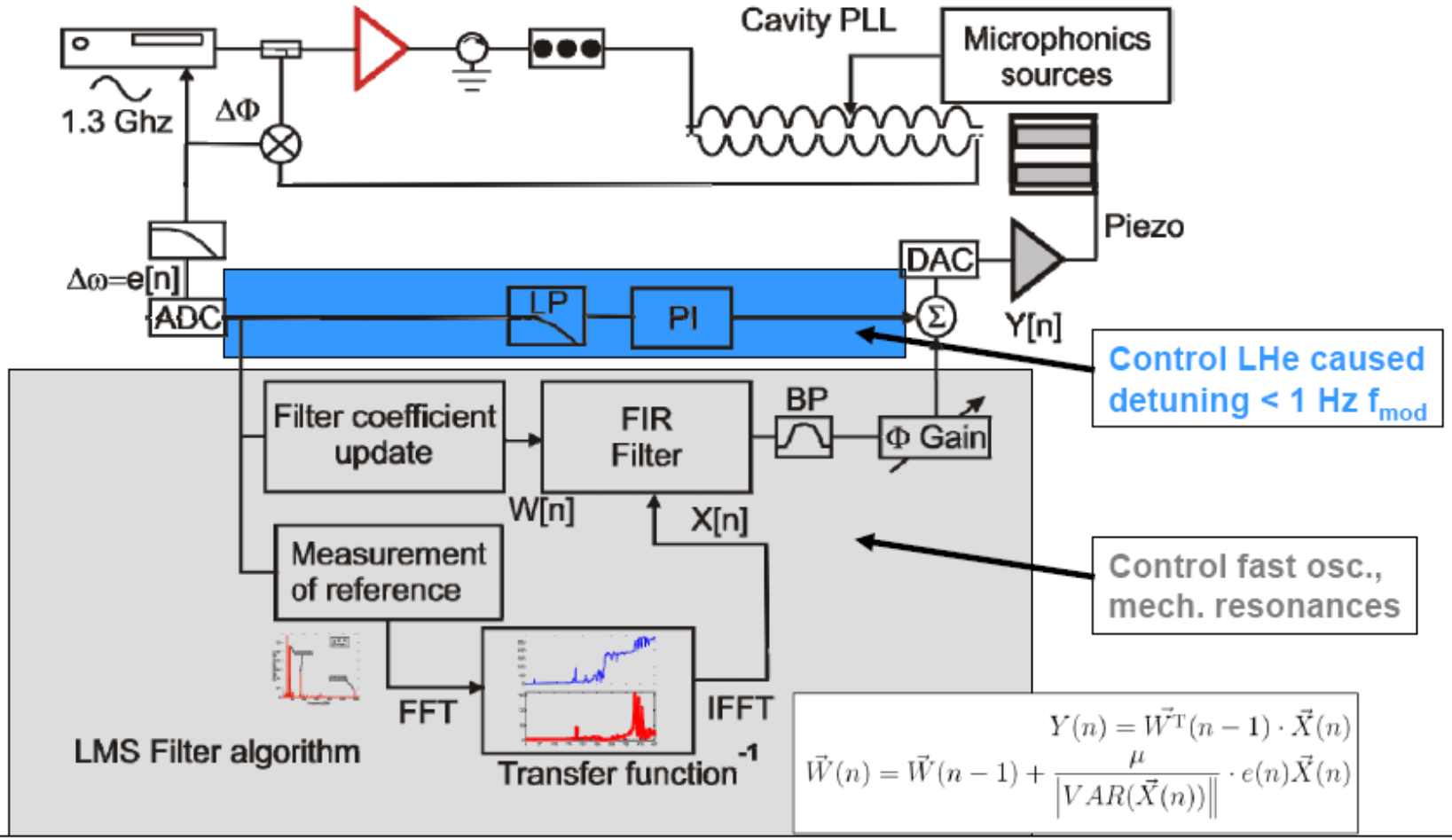
Microphonics in CW TESLA cavities and their compensation with fast tuners



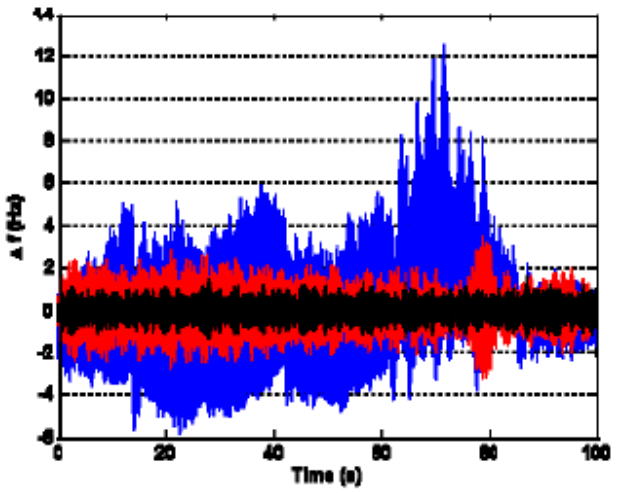




Two-folded approach: Low frequency feedback and adaptive feedforward



Detuning compensation at a nine-cell TESLA cavity

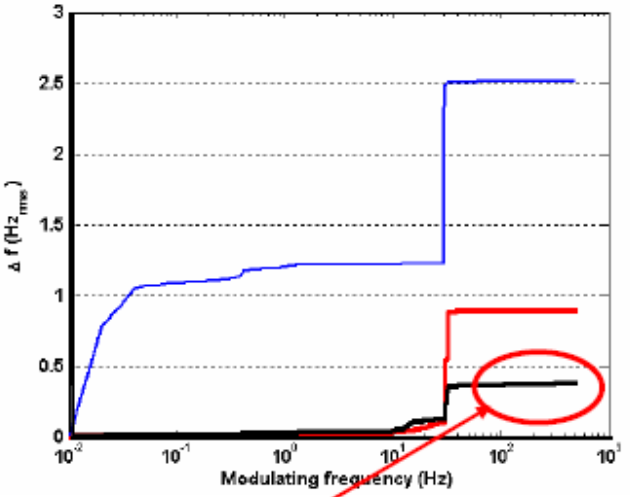


ΣFFT

Open loop

Feedback

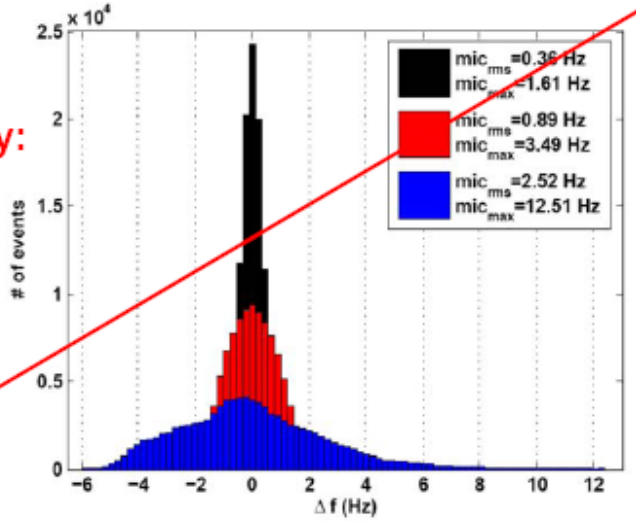
FB+Feed forward



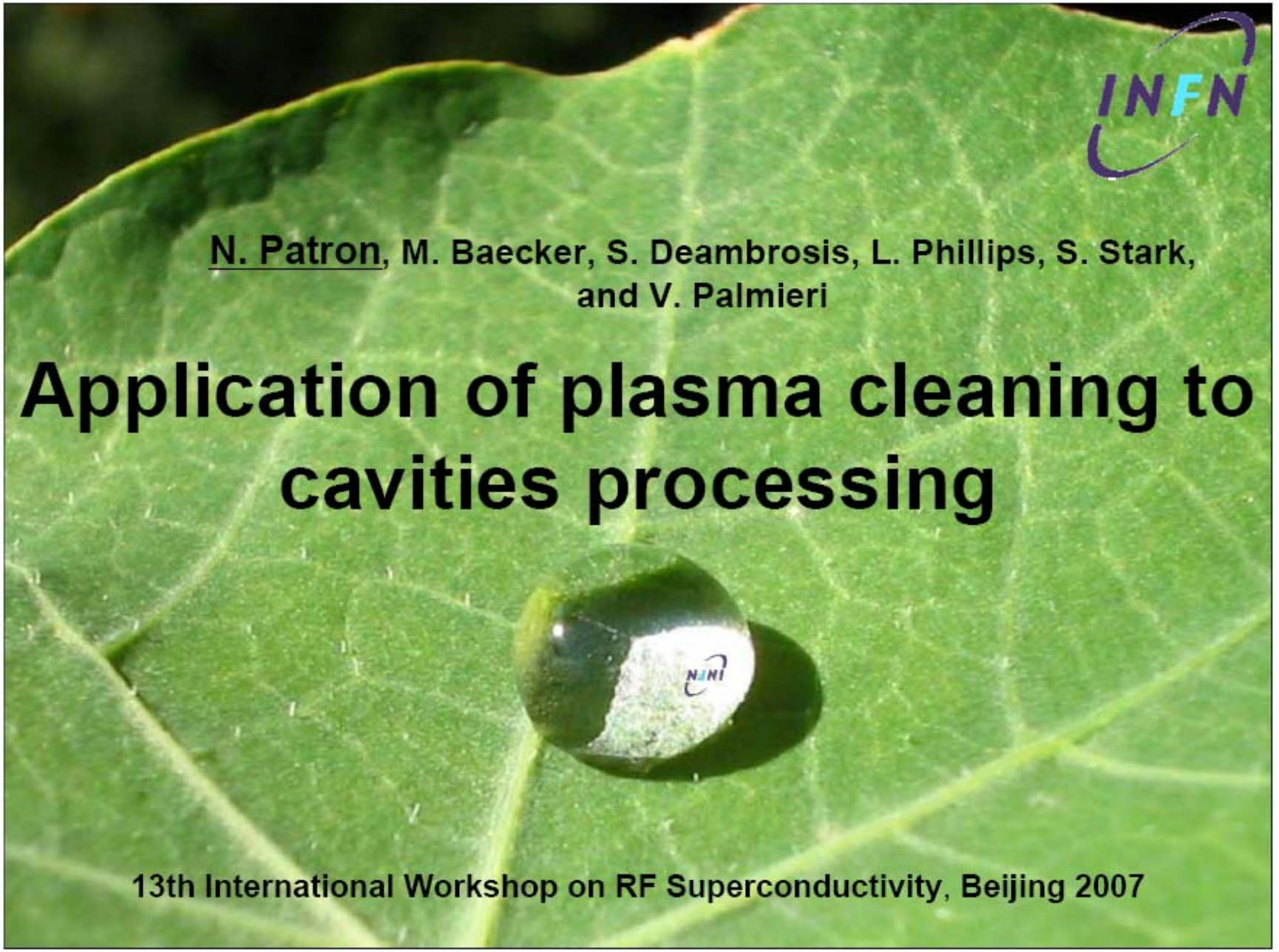
Factor 7.6 of compensation

Improved open loop phase stability:

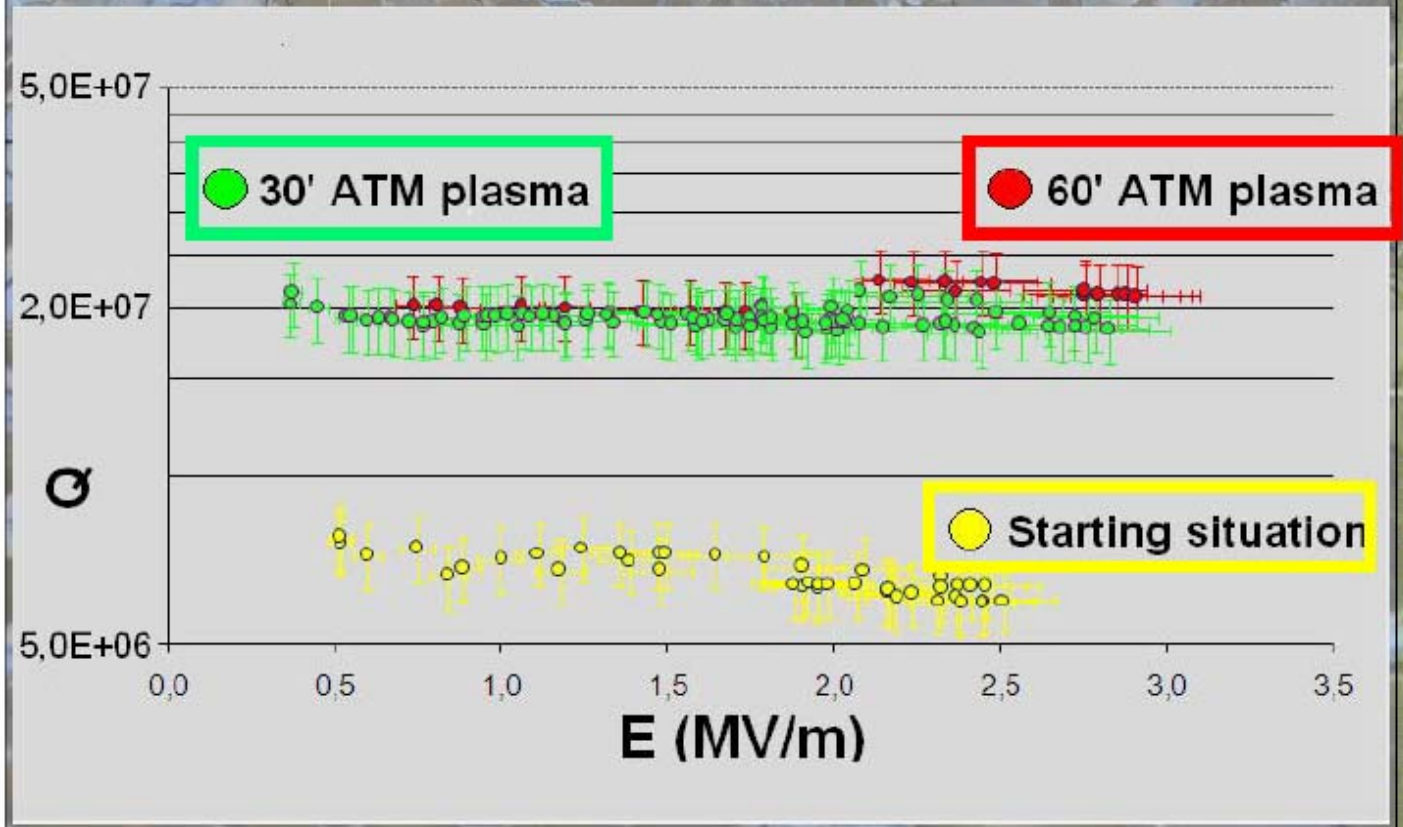
13.2→ 2.0°



Limit by piezo-tuner resolution


INFN
N. Patron, M. Baecker, S. Deambrosis, L. Phillips, S. Stark,
and V. Palmieri
Application of plasma cleaning to cavities processing
13th International Workshop on RF Superconductivity, Beijing 2007

Niobium 6 GHz cavity @ 4.2 K



HYDROPHILICITY
HYDROPHOBICITY

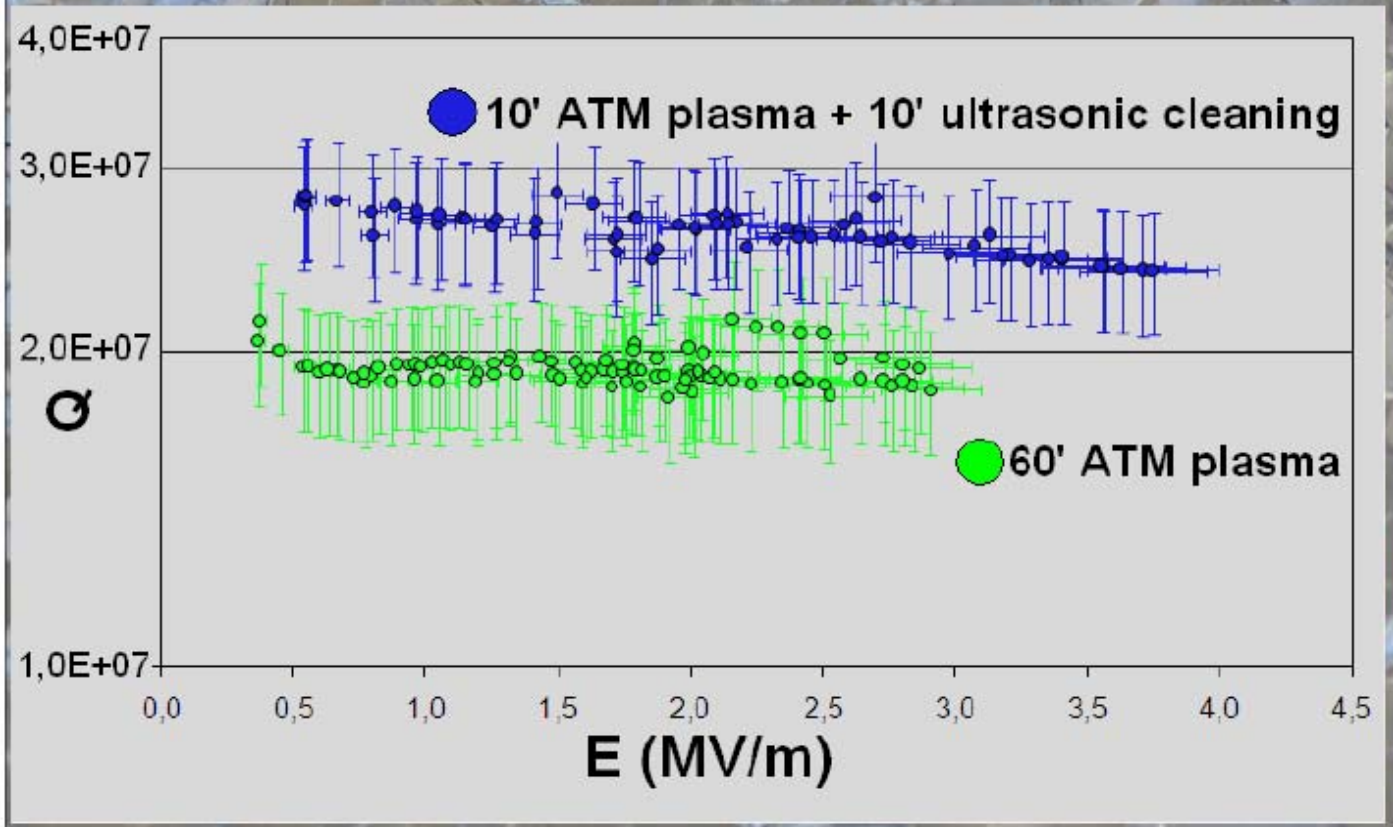
ATMOSPHERIC PLASMA

CLEANING MECHANISM

RESULTS ON 6 GHz CAVITIES

Niccolò Patron,
INFN-LNL Legnaro

Niobium 6 GHz cavity @ 4.2 K



HYDROPHILICITY
HYDROPHOBICITY

ATMOSPHERIC PLASMA

CLEANING MECHANISM

RESULTS ON 6 GHz CAVITIES

Niccolò Patron,
INFN-LNL Legnaro

Summary

- There is much activity in the field
  - European XFEL project is started
  - SNS achieved 1 GeV operation and staying on the planned power ramp up
  - FLASH at DESY recently achieved 1 GeV
  - ILC R&D program
  - ERLs, FELs, light sources
  - SRF Workshop attendance is increasing
- Field Emission and Quench remain as performance limitations
  - Role of sulfur: results from electro-polishing; difficult to remove
  - Alcohol rinse, plasma cleaning, dry ice cleaning, …
- The large grain versus small grain question is not yet answered
  - So far no clear performance differences
  - But large grain might offer lower material and processing costs
  - Large grain cavity fabrication is not a problem
- The cause of high-field Q slope is not yet well understood
  - Oxide layers, interstitial oxygen, flux pinning, …

- SRF2009 will be hosted jointly by BESSY and Rossendorf in Berlin