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# **Accelerator Division All Hands Meeting**

**July 26, 2007**

**“Accelerator Overview”**  
S&T Review Presentation

**Andrew Hutton**

# New Associate Director of Accelerators

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- In March 2007, Swapan Chattopadhyay accepted the position of inaugural Director of the Cockcroft Institute
- I took over as Associate Director of Accelerators
- **Brief Bio**
  - 9 years at CERN: part of design team for LEP, responsible for all LEP parameters
  - 9 years at SLAC: building and commissioning SLC; leading the design team for the PEP-II B-factory
  - At Jefferson Lab since 1993: leading commissioning of CEBAF; then Director of Operations for CEBAF

# Safety Bio

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- Supervised the Radiological Control Group 1996 – 2005
- Supervised the Emergency Management Manager to establish an Emergency Management Program 1993 – 2002
- Served as Facilities Manager 2000 – 2003
- Served as the Accelerator Division Safety Officer 2005 – 2007

**Goal – Operate Safely**

- I believe good housekeeping sets the stage for safe work

# Source Lab Clean-Up (2005)



- The world-class results you will hear about were achieved here



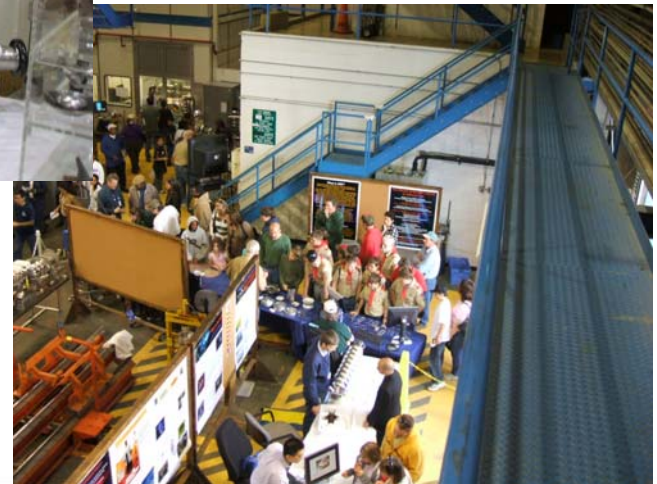
# Test Lab Clean-Up

- My first priority was a total clean-up of the Test Lab
- Included painting walls, increased lighting, new storage cabinets, replacing end-of-life storage trailers



# Open House 2007

~ 5200 people attended!!



# New Director of Operations

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- The position of Director of Operations was advertised nationally and internationally
  - Search Committee had Physics Division and User members in addition to Accelerator and Engineering
- Nine candidates were given a preliminary interview
  - 5 internal, 4 external
  - Really excellent candidates
  - We retained 5 candidates for a second round of in-depth interviews, seminar
- Selection process nearly complete



# Acting Director of Operations – Hari Areti

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- Hari Areti was appointed as Acting Director of Operations in April 2007 until a permanent Director can be appointed
- Hari is the Physics Liaison to the Accelerator Division and also coordinates the JLab education programs
- Hari will present the Accelerator Operations results





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# Long-Term Vision

# Priorities

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- **The Accelerator Division has five main responsibilities:**
  - 1. Provide support to the 12 GeV project**
  - 2. Operate CEBAF to deliver the 6 GeV Nuclear Physics program**
  - 3. Position JLab for a future beyond 12 GeV**
  - 4. Education**
  - 5. Continue outside collaborations which support the mission of the lab**

**List is in priority order**

# Provide support to the 12 GeV project

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- Most Groups in the Accelerator Division provide support for the 12 GeV Upgrade Project
- Support is led by Accelerator staff matrixed to the 12 GeV Project:
  - **Integration Engineer**
    - Steve Suhring
  - **Project Technical Director**
    - Warren Funk
  - **Three 12 GeV APMs**
    - Joe Preble - SRF
    - Mike Spata – Extraction, commissioning
    - Karen White – Controls and Instrumentation
  - **Accelerator Design**
    - CASA (Lia Meringa, Arne Freyberger, Jay Benesch, Alex Bogacz, Yu-Chiu Chao, Jean Delayen, Yves Roblin, Chris Tennant, Mike Tiefenback, Yuhong Zhang)



# 12 GeV Responsibilities

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- **The Accelerator Division has primary responsibility for the following areas, heavily supported by Engineering:**
  - **Developing and producing ten 100 MV cryomodules**
  - **Designing the accelerator beam optics and defining the component specifications**
  - **Designing and specifying the beam instrumentation, safety and controls systems**
  - **Defining and delivering the beam separation systems**
  - **Planning and executing accelerator beam commissioning**
- **Accelerator Division also provides support in other areas**
  - **Many of the improvements for the “6 GeV hardening” program will also benefit the 12 GeV Upgrade**

# Deliver the 6 GeV Nuclear Physics program

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- JLab Operations has a world-leading program
- Systems and protocols in place to structure operations
  - These systems enabled CEBAF Operations to function impeccably with reduced involvement of senior Group Leaders who now lead the 12 GeV Upgrade effort
    - Mike Spata, Steve Suhring, Karen White
  - Leadership is now provided by previous Deputy Group Leaders

**Demonstrates that processes and procedures are in place, enabling the 6 GeV program to continue at a high level during construction of the 12 GeV Upgrade**

# Accelerator Operations – A User Facility

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- We serve more Nuclear Physics Users than any other lab in the world – more than 1200
  - Nearest competitors – RHIC has 1100, GSI has 975
- 1174 Users have been active on multiple experiments at CEBAF
- DOE performance metrics are regularly exceeded
  - Used to be based on three-year running averages
  - Now compared to last three years of previous contract
    - Goals are not set artificially low



# Parity Quality Beams

- Parity experiments are the signature experiments of the facility
- Measurement precision unthinkable when CEBAF was proposed
- We expect ever-tighter specifications in upcoming experiments

Experiment	Physics Asymmetry	Max run-average helicity correlated Position Asymmetry		Max run-average helicity correlated Current Asymmetry	
		Spec	Achieved	Spec	Achieved
<a href="#">HAPPEx-I [1999]</a>	13 ppm	10 nm	10 nm	1 ppm	0.4 ppm
<a href="#">G<sup>0</sup> Forward [2003-4]</a>	2 to 50 ppm	20 nm	(4 ± 4) nm	1 ppm	(0.14 ± 0.3) ppm
<a href="#">HAPPEx-He [2004]</a> <a href="#">HAPPEx-He [2005]</a>	8 ppm	3 nm	3 nm 20* nm	0.6 ppm	0.08 ppm 0.1 ppm
<a href="#">HAPPEx-II-H [2004]</a> <a href="#">HAPPEx-II-H [2005]</a>	1.3 ppm	2 nm	8** nm 1 nm	0.6 ppm	2.6** ppm 0.1 ppm
<a href="#">G<sup>0</sup> 687 MeV [2006]</a>	2 to 50 ppm	40 nm	(24 ± 5) nm	1 ppm	(0.4 ± 0.24) ppm
<a href="#">G<sup>0</sup> 362 MeV [2006]</a>	10 to 20 ppm	40 nm	(12 ± 4) nm	2 ppm	(0.03 ± 0.12) ppm
Lead	0.5 ppm	1 nm	-	0.1 ppm	-
Q <sub>weak</sub>	0.3 ppm	20 nm	-	0.1 ppm	-

\* Results affected by electronic crosstalk at injector.

\*\* Results at Hall A affected by Hall C operation. Spec was met in 2005 run.

# 6 GeV Hardening

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- The 12 GeV User program requires:
  - 12 GeV Project must be completed successfully
  - Underlying CEBAF accelerator must be able to supply 6 GeV beams with high reliability – “6 GeV hardening”
- 6 GeV hardening program involves multi-year projects that will have to be re-prioritized annually depending on the budget and lab resources available
- Accelerator Division is directing this program
  - Relies on resources from other Divisions:
    - Engineering
    - Facilities

# 6 GeV Hardening Projects

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- Refurbish cryomodules (the C50 program)
  - Joe Preble, Accelerator
- Purchase new RF sources (klystrons or IOTs), rebuild old klystrons when economically viable, upgrade the HPAs for higher power
  - Rick Nelson, Engineering; Jay Benesch, Accelerator
- Replace older equipment to improve maintainability or reliability, creating underpinnings for 12 GeV Upgrade
  - Will Oren, Engineering
- Aggressive preventive maintenance on older electronic equipment (e.g. replacement of corroded connectors)
  - Ron Lauzé, Engineering; Steve Suhring, Accelerator



# Position JLab for a future beyond 12 GeV

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- Accelerator Division contains the core competencies in accelerator science and technology
  - SRF (SRF Institute) led by Bob Rimmer
  - Accelerator Physics (CASA) led by Lia Merminga
  - Center for Injectors and Sources led by Matt Poelker
  - Cryogenics R&D led by Dana Arenius and Rao Ganni
    - Matrixed from Engineering
- The FEL Division is also tightly coupled
- These core competencies define JLab accelerator science

High current, CW, superconducting, multi-pass linacs  
this explicitly includes energy recovery linacs

# Electron Ion Collider (ELIC)

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- **The top choice for a future facility at JLab is ELIC**
  - Slava Derbenev, and others from CASA and Physics, have been studying this option
  - Lia Merminga and Rolf Ent made a convincing case to the Nuclear Science Advisory Committee (NSAC)
- **We are currently seeking R&D funding**
  - R&D plan has been proposed
  - R&D would include accelerator physicists, scientists and engineers in CASA, SRF, cryogenics and injectors

# Other Options for an On-Site Facility

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- Other options for an on-site facility have been evaluated
  - Positron option for CEBAF
  - FEL User Facility
- Other options may be studied
  - 25 GeV CEBAF
  - ERL-based 4<sup>th</sup> generation synchrotron light source
- All of these options build on our core competencies
  - Current R&D is applicable to any of these options



# External Collaborations

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- **We are currently collaborating on other forefront facilities**
  - 4GLS at Daresbury (design, wigglers, magnets, commissioning)
  - Cornell (ERL technologies, source)
  - FRIB (RF controls, preparing CDR, SRF)
  - ILC (SRF, source)
  - RHIC (cryogenics, ERL for electron cooling)
  - SNS (cryogenics, SRF)
- **We are actively seeking collaborations on other facilities**
  - SNS Upgrade (SRF)
  - Synchrotron Light Sources (APS, ALS)

**Our skills are in high demand!**

# Vision for Accelerator Education

- JLab will continue to strongly support education for accelerator physics and related technologies
- Goal – become a net producer of accelerator specialists

Program initiated by Swapan Chattopadhyay  
Managed by Hari Areti

# HEPAP Recommendation

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High Energy Physics Advisory Panel (HEPAP),  
Advanced R&D Sub-panel (Jay Marx, Chair;  
Presently Executive Director of LIGO, Caltech):

*“The subpanel finds that **there is an urgent need to strengthen accelerator science, technology and education in the US** in order to address long-term needs of particle physics, other sciences and the nation”*

*“The subpanel is concerned that there will not be enough accelerator scientists and engineers to meet future needs  
**Biggest challenge - overcoming the issues that limit the number of universities that provide opportunities to study accelerator science/engineering... Few incoming graduate students are aware of its existence or its contributions, challenges, and promise**”*

<http://www.science.doe.gov/hep/AARDReport.pdf>

# Education – Accelerator Physics at ODU

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- **New Accelerator Physics Group and associated Program were created at Old Dominion University (ODU)**
  - **3 JLab staff members hold faculty positions**
- **Established:**
  - **One graduate level course**
    - **Low Temperature Physics**
  - **One course for graduates and senior undergraduates**
    - **Introduction to Accelerator Physics**
- **Senior Lab at ODU will include accelerator experiments**
  - **One experiment in RF measurements done this year**
  - **Plan to expand to 3 experiments next year**



# Accelerator Education Activities at JLab

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- Staff with University Affiliation 6
- Staff who have taught at USPAS 5
- Staff who mentor graduate students 14
- Staff who have taught at other institutions 7
- Graduate students      *Present*      *Total thru 2001*
  - PhD      18 + 4\*      12
  - Masters      1 + 3\*
- In addition,
  - 2 ODU undergraduate theses were completed in 2007
  - High school students are mentored in special topics during the school year

**\*Staff Members**

# Collaborations and Work-for-Others

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- WFO should develop our capabilities in our core competencies and enhance our international visibility
  - FEL – SRF, cryogenics, source, ERL accelerator physics
  - ILC R&D – SRF
  - RIA/FRIB – RF Controls, SRF
    - Effort so far has been modest – want to do more
  - SNS projects – SRF, cryogenics
- Also provides additional funding to help bridge 12 GeV Upgrade funding gaps and keep critical staff
  - Collaborations preserved critical skills in recent years

**We are more interested in becoming full partners in projects that fit our core competencies than job-shopping**

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# Organization and Budget

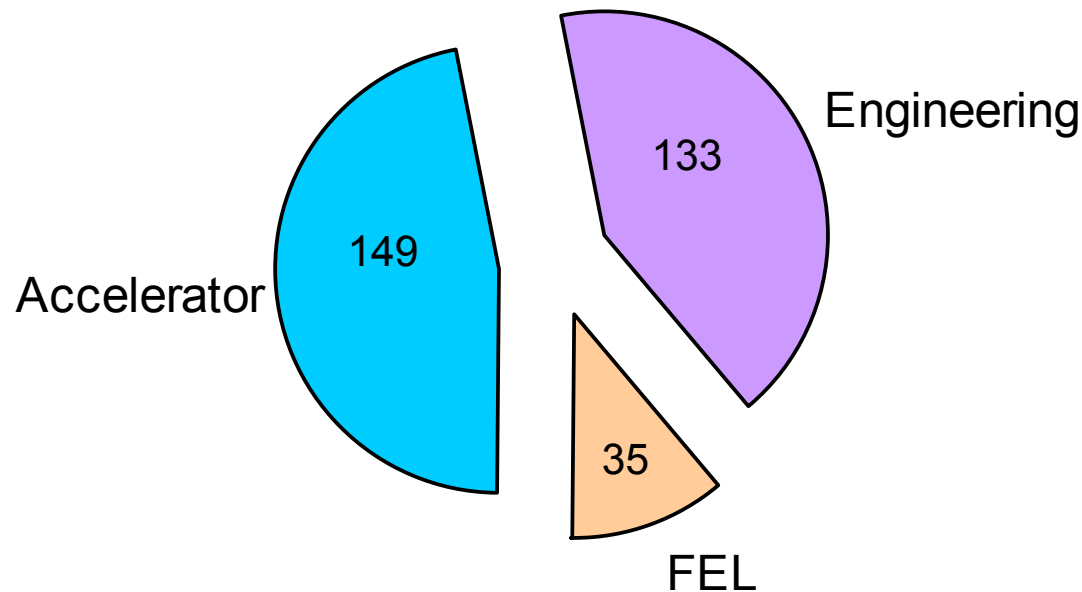
# Organizational Background

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- The Engineering Department, which was a part of the Accelerator Division, is now a separate Engineering Division to better support multiple projects and provide professional support and development for Engineering staff
  - About 20 technicians are matrixed to Accelerator Operations for first-response repair and maintenance
- Similarly, the FEL is also a separate Division
- The Source Group, which was an integral part of Accelerator Operations, is now a separate Center for Injectors and Sources within the Accelerator Division
  - Underlines the fact that the reliability of the source and lasers is now extremely high

# Staffing

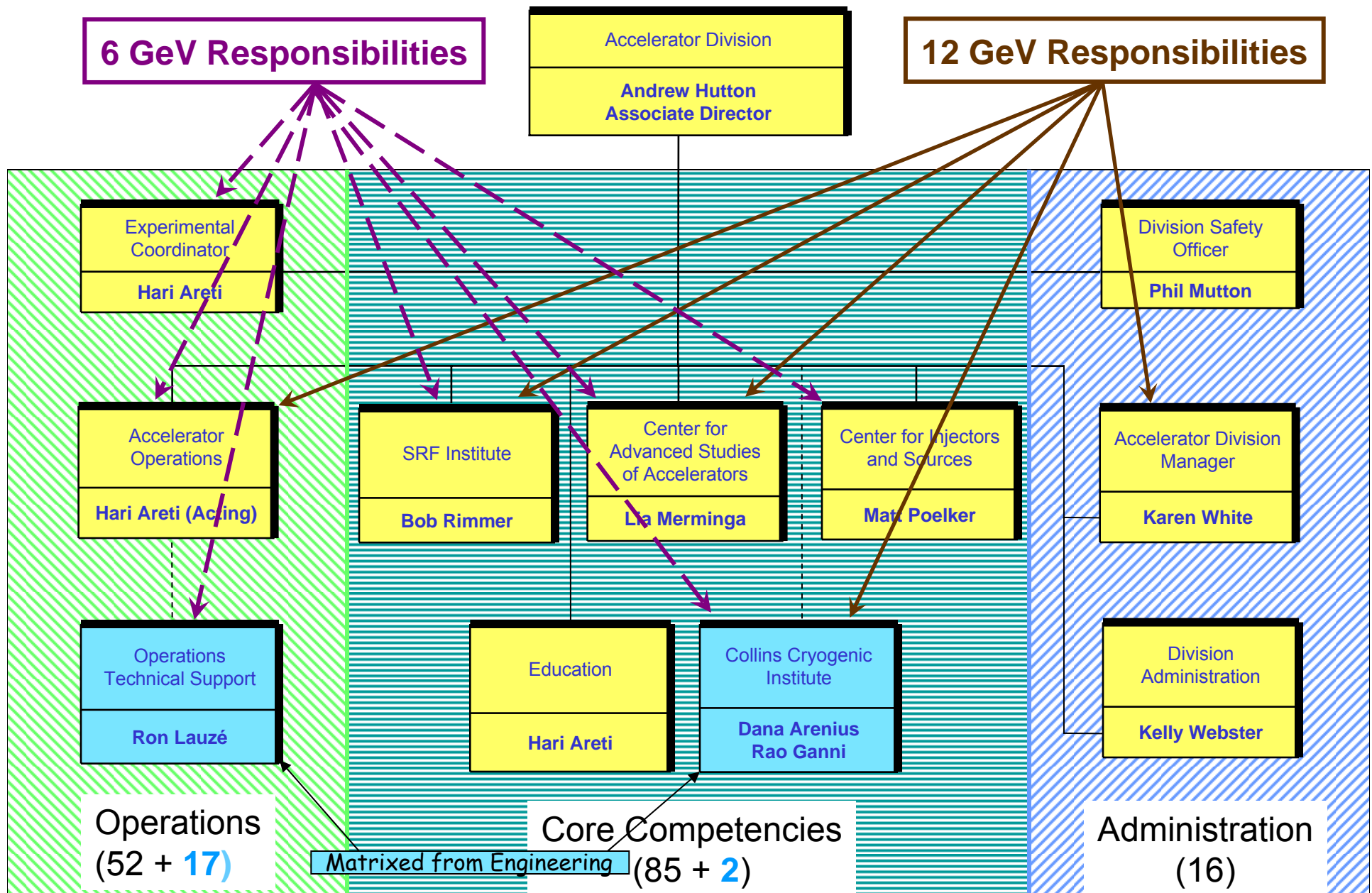
- In October 06, FEL Division was created as a separate entity
- In January 07, Accelerator and Engineering Divisions were separated organizationally
- FY 07 budget for Accelerator and Engineering Divisions have not been separated



**Staff numbers after reorganization**

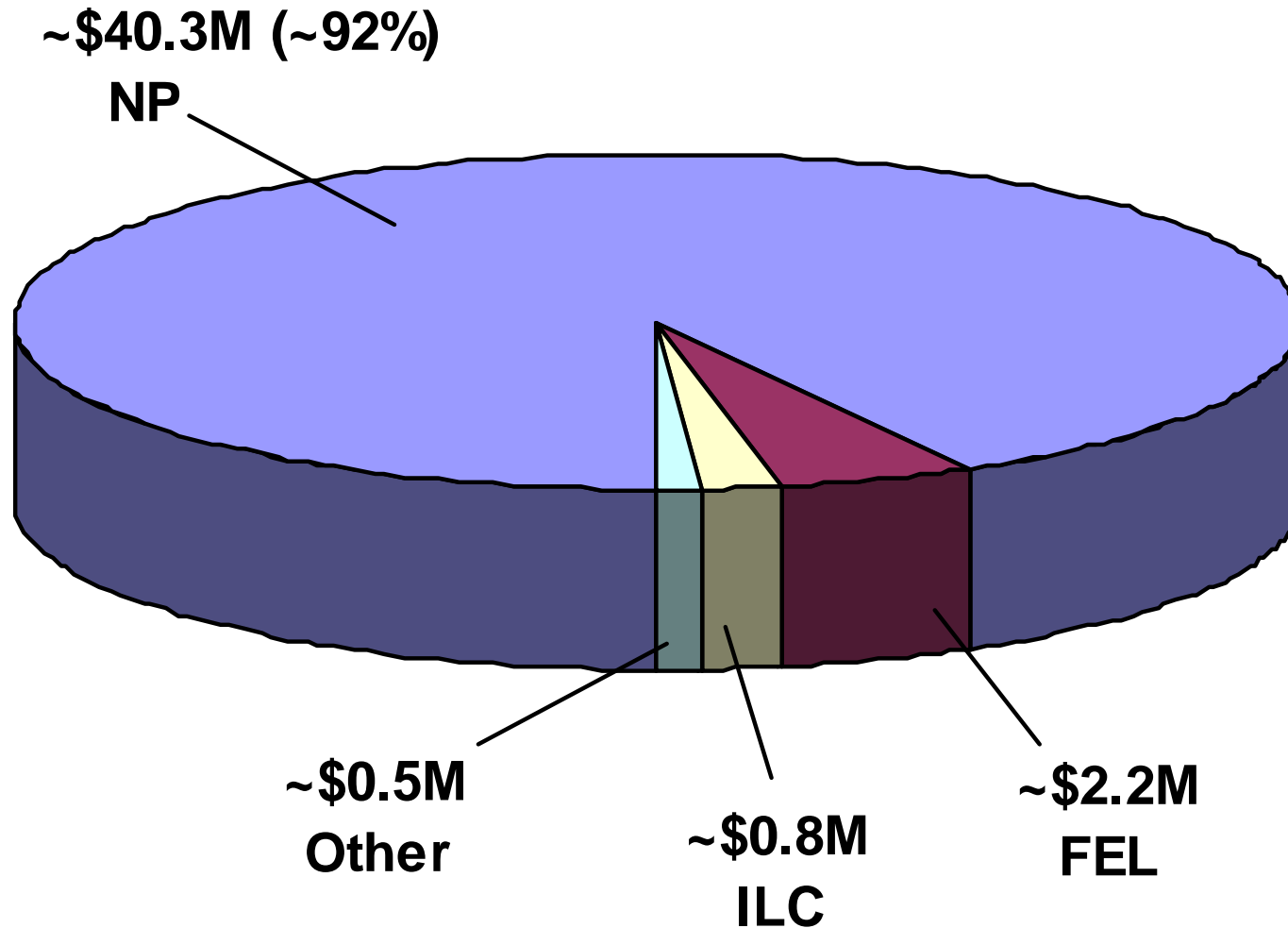


# Accelerator Division Organization



# Current Accelerator + Engineering Budget \$FY07

Budgets include overhead



# Accelerator and Engineering Budget

		Acc. Ops \$K	Acc R&D \$K	AIP \$K	FTEs FY07
Research	KB0101021	240			2
Accelerator Operations	KB0102011	38,117	1,000		261
Experiment Support	KB0102012				1.8
AIP	KB0102011 (AIP)			375	0.2
GPP	KB0102011 (GPP)				
Capital Equipment	KB0102012 (EQU)	570			3.0
Total NP Funding		38,927	1,000	375	268

Does not include any carryover

More details in supplemental slides

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# 12 GeV and 6 GeV Program for FY07

# 12 GeV Deliverables in FY07

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- **Deliverables for CD-2**

- ✓ **Finalize and document the beam optics and component layout**
- ✓ **Completion of the quarter-cryomodule demonstrating the performance required for the Upgrade cryomodules**
- ✓ **Multiple other smaller R&D deliverables**
- ✓ **Contribute to CD-2 documentation packages**
- ✓ **Prepare for two major Reviews**
  - **“Lehman” Review in June 2007**
  - **External Independent Review (EIR) is upcoming**

**This timetable keeps us on track to receive  
12 GeV construction funding in FY09**



# Lehman Review

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- “The Committee highly appreciates the work that JLab has done . . . in advancing the understanding of the accelerator physics issues. . . .”
- “The cryomodule and cryogenic designs for the 12 GeV Upgrade are technically sound and should meet performance goals”
- “Baseline costs for both cryomodules and cryogenics are appropriate ”
- “Overall we find the cost, schedule and scope . . . credible and ready to be baselined” for the Accelerator Systems and Control Systems & Instrumentation
- “The Committee was pleased by the evident hard work of the JLab team in preparing for the Review and the professionalism of the presentations”

## 6 GeV Deliverables in FY07

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- Operated the published CEBAF schedule through July 13
  - Ceased operations for the rest of the fiscal year
- During the Downtime
  - Commission Renascence and two C-50 cryomodules
- Carry out maintenance safely and efficiently
  - We have an extensive list of maintenance tasks
    - Includes some “6 GeV hardening” projects
    - All “6 GeV hardening” projects that cannot be done this year will be done before 12 GeV comes on line
- Operations for Physics will resume October 13
  - There will be an eleven-week down January – March 2008 to install and commission two more C-50 cryomodules

## 5.75 GeV and 6 GeV Operation

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- **Reach 5.75 GeV by March 2008**
  - Install Renascence and a total of five C-50 cryomodules
  - Commission cryomodules summer 07 and February 08
- **Reach 6.0 GeV by October 2008**
  - Install 2 more C-50 cryomodules
  - Commission cryomodules summer 08
- **C-50 fabrication schedule**
  - 3 per year until 12 GeV construction begins
    - February, June, October
- **Installation and commissioning depends on accelerator schedule**

# 10 Year Energy Strategy

Installation	FY07	FY08	FY09	FY10	FY11	FY12	FY13	FY14	FY15	FY16
Renascence	1	-	-	-	-	-	-	-	-	-
C50	3	3	3	1	-	-	1	2	2	2
C100 build	-	-	-	3	4	3	-	-	-	-
C100 install	-	-	-	-	-	-	10	-	-	-
<b>New/Refurbished Cryomodule Capability</b>										
Renascence	60 * MeV	-	-	-	-	-	-	-	-	-
C50	3x50 MeV	3x50 MeV	3x50 MeV	50 MeV	-	-	50 MeV	2x50 MeV	2x50 MeV	2x50 MeV
C100	-	-	-	-	-	-	10x100 MeV	-	-	-
Hall A, B, C Max Energy	5.1 ° GeV	5.9 ° GeV	6 GeV	6 GeV	6 GeV	6 GeV	11 GeV	11 GeV	11 GeV	11 GeV
Overhead	-	-	0.5 GeV	0.6 GeV	0.6 GeV	0.6 GeV	1.1 GeV	1.2 GeV	1.3 GeV	1.4 GeV
Hall D Max Energy	-	-	-	-	-	-	12 GeV	12 GeV	12 GeV	12 GeV
Overhead							1.1 GeV	1.2 GeV	1.3 GeV	1.4 GeV

\* RF power limited, cryomodule capability >80 MV

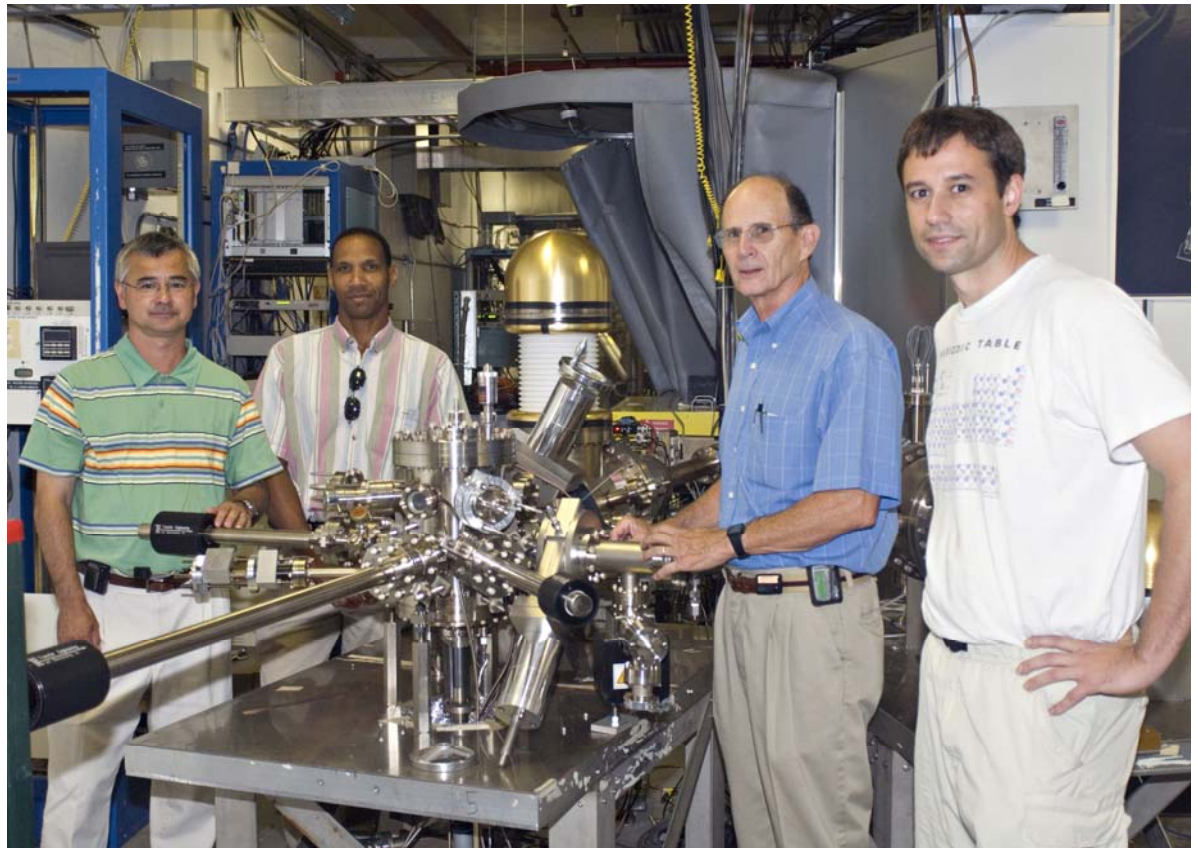
° Energy available at the end of the fiscal year

# Prepare 6 GeV Deliverables for FY08 and Beyond

- Some experiments have new, harder beam specifications
  - $Q_{\text{weak}}$  requires beam current of 180  $\mu\text{A}$  with better parity specifications than ever achieved
    - Parity beam studies started at the end of March 07
  - Load-Lock Gun
    - Being installed right now

Load-Lock Gun enables rapid change of cathodes and longer cathode lifetime

Goal is to develop solutions early



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# Research and Development Portfolio



# Goal

Our goal is

## World Leadership

in all our core competencies

- ◆ CW SRF (world class in pulsed SRF)
- ◆ Accelerator physics (special focus on ELIC and ERLs)
- ◆ Electron injectors (high current, CW, polarized and unpolarized)
- ◆ High-efficiency cryogenics

- We will continue to excel in all accelerator science and technologies required for designing and operating a forefront User facility
- In the breakout sessions, you will be hearing from the experts who are leading the effort in these areas

**Hari Areti**

**Bob Rimmer**

**Lia Merminga**

**Jean Delayen**

**Dana Arenius**

**Matt Poelker**

Operations  
SRF Program  
Accelerator Physics  
FRIB Participation  
Cryogenics  
Source

# SRF Cavity Varieties

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- The SRF Institute has fabricated and/or processed a wider variety of multi-cell SRF cavities than anyone else
- 549 multi-cell cavities fabricated and/or processed
  - 25 different cavity types, including:
    - 9 different frequencies
    - 6 different beta values
    - Both CW and pulsed
- In addition a large number of single cell test cavities have been fabricated and/or processed
  - So many, we do not even have an exact count!

Project	# of Cavities built @ Jlab	# of Cavities processed / tested	Frequency (MHz)	Beta	# of Cells	Duty Factor
CEBAF (OC cell shape)	20	358	1497	1	5	CW
CEBAF (OC) - C50 rework		28	1497	1	5	CW
CEBAF Upgrade Style (OC)	8	8	1497	1	7	CW
CEBAF Upgrade Style (LL)	5	5	1497	1	7	CW
CEBAF Upgrade Style (HG)	9	9	1497	1	7	CW
C100 - (LL)	2	2	1497	1	7	CW
FEL IR DEMO (OC)	10	10	1497	1	5	CW
FEL 10 kW Upgrade (OC)	8	8	1497	1	7	CW
FEL HCCM (HC)	3	1	1497	1	5	CW
FEL HCCM (HC)	1		750	1	5	CW
APT	2	2	700	0.64	3	CW
APT		3	700	0.64	5	CW
SNS	4	37	805	0.61	6	Pulsed
SNS	1	49	805	0.81	6	Pulsed
RIA	2	2	805	0.47	6	Pulsed
INFN Legnaro - seamless		1	1500	1	5	CW
INFN Milan - TRASCO		1	703	0.5	5	CW
DESY - seamless		3	1300	1	2	CW
KEK	1	1	1300	1	10	Pulsed
ILC-like - superstructure	1	1	1497	1	10	Pulsed
BNL		1	704	1	5	CW
FLASH - FNAL/DESY	5		3900	1	9	Pulsed
ILC - (TESLA)		6	1300	1	9	Pulsed
ILC - (LL)	1	1	1300	1	7	Pulsed
ILC - (TESLA)	4		1300	1	9	Pulsed

# SRF Operating Experience

- A comparison of the accumulated operational experience at each of the major SRF-based facilities was carried out during the TTC meeting at KEK in November 2005
- The unit for comparison was “cryomodule-centuries” C-C
  - Ten cryomodules operated for five years correspond to 0.5 C-C
- In November 05, the SRF operational experience in the world was:
  - **CEBAF** **5 C-C**
  - ATLAS 3.75 C-C (Added after the meeting)
  - LEP-II 3.7 C-C
  - KEKB 0.56 C-C
  - Cornell 0.31 C-C
  - TTF/FLASH 0.27 C-C
  - (XFEL 11.6 C-C for 10 years operation)
  - (ILC Main Linacs 186 C-C for 10 years operation)

**> 35% of the SRF operating experience in the world  
has been at CEBAF, > 60% DOE NP!**

# Surface Science Lab

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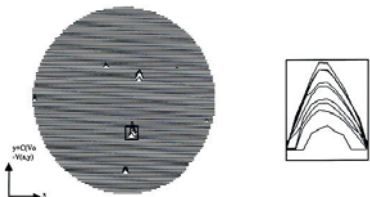
- One of only a few Surface Science labs in the world dedicated to the study of the surfaces relevant to Superconducting Radio-Frequency cavities (SRF)
- Eight different systems
- State-of-the-art sample preparation rooms
- Total investment of more than \$2 million

**Seeking Surface Science Collaborations with  
other National Labs, Universities, etc**

# What makes Surface Science Lab Unique?

- **Scanning Field Emission Microscope (SFEM)**

- Largest scanning diameter in the world (25 mm)
- Only one available in the US
- Coupled with the scanning electron microscope (SEM) and energy dispersive x-ray (EDX) systems, which allows coordinate of a sample to be transferred



Typical plots from field emission scan on a Nb sample (left), with the local scan at the outlined emitter shown at the right. The higher the peak, the stronger the field emitter.



- **Well-equipped Sample Preparation room**





# Other Surface Science Lab Systems

SAM System



SEM and EDX System



3-D Profilometer



- Scanning Auger Microscope (SAM):
- Scanning Electron Microscope (SEM) equipped with Energy Dispersive X-ray analysis (EDX)
- Transmission Electron Microscope (TEM) and Scanning Transmission Electron Microscope (STEM)
- Secondary Ion Mass Spectrometry (SIMS)
- 3-D Profilometer
- Metallographic Optical Microscope (MOM)



TEM and STEM System



MOM System



SIMS System

# Role of JLab in ILC

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- **We are actively supporting ILC**
  - Leading role in SRF R&D program
  - Membership in GDE
  - Leading participants in meetings
- **However, ILC funding has been limited**
  - FY06 funding was \$ 1.35 M\* (5.4% of ILC SRF R&D in US)
  - FY07 funding was \$ 0.80 M\* (2.0% of ILC SRF R&D in US)
- **We want to take a more active role in the R&D stage**
- **JLab has unrivaled facilities and experience**

**US position in ILC will be stronger  
if JLab has a well-defined long-term role**

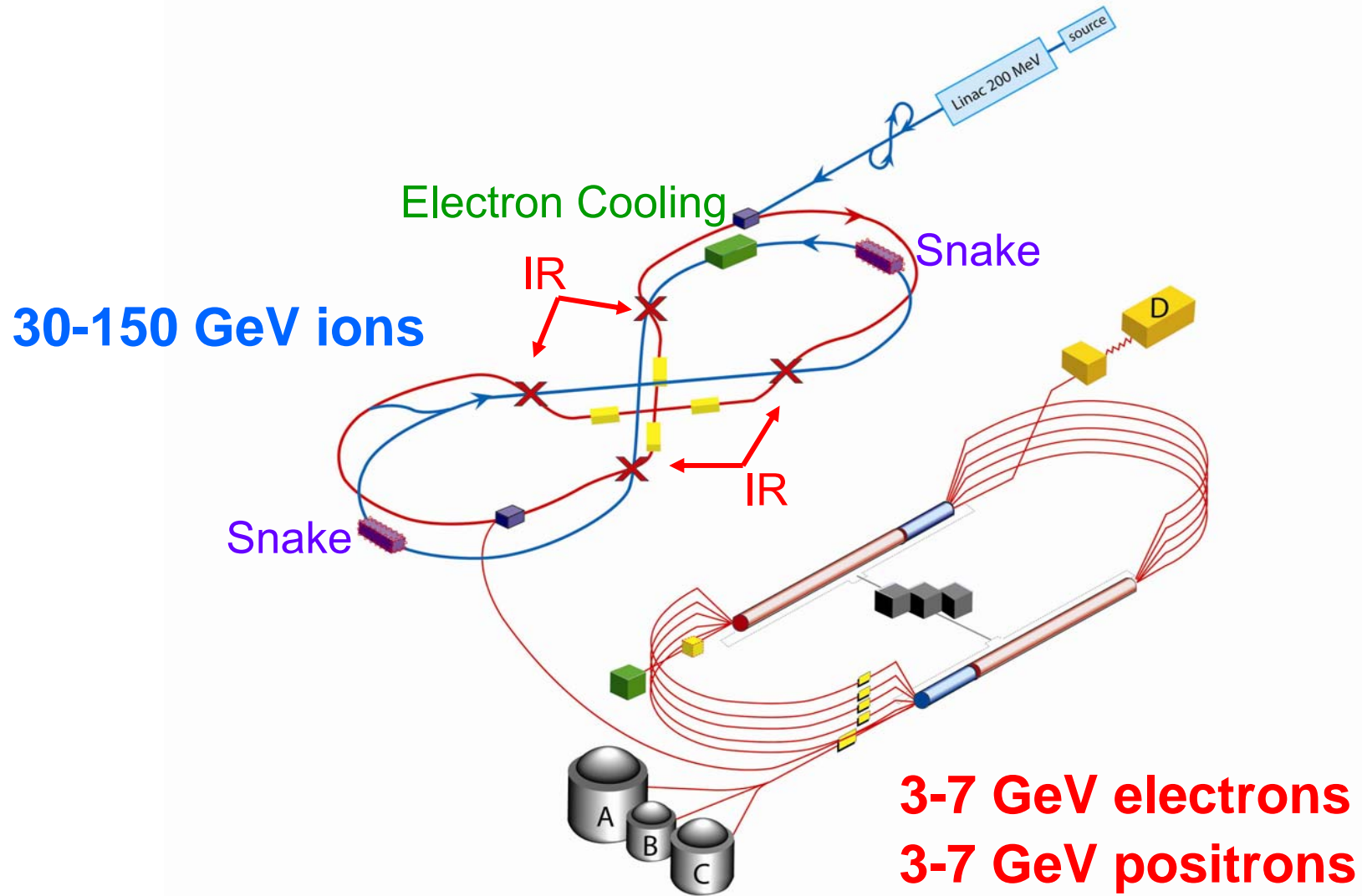
\*Includes direct funding from ILC and WFO for Fermilab,  
FY07 budget augmented by \$0.57 M carryover

# ELIC

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- A ZDR (Zero-order Design Report) will be written by Fall
- CASA (Lia Merminga, Slava Derbenev et al) leading the effort
  - **Many Groups in Accelerator and Engineering assisting**
    - Matt Poelker, Joe Grames, Reza Kazimi - source/injector,
    - Bob Rimmer and Haipeng Wang - crab cavities
    - John Musson - kicker design
- DOE asked for an R&D List, which has been submitted
  - **Requested \$6.4M over five years starting in FY09**
  - Hope that DOE will provide funding

# ELIC



Details in talk by Lia Merminga

# Center for Injectors and Sources

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- JLab leads the world in delivery of CW beams
  - At CEBAF, world record polarized beams
    - > 85% polarization measured by the Users at the Hall
    - 16 Coulombs delivered in one 24 hr period
      - An average of 185  $\mu\text{A}$  for 24 hours
    - Load-lock gun has operated at 1 mA in test stand
      - Nearest competitors – Bates 120  $\mu\text{A}$ , Mainz 50  $\mu\text{A}$
  - At the FEL, world record unpolarized beams
    - > 9 mA achieved daily for months at a time
      - Nearest competitor - Cornell ERL test stand 5 mA

More from Matt Poelker

# Cryogenics

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- **12 GeV design**
  - Doubling present 4600W @ 2K CHL refrigeration
  - Installation of 200W @ 4.5K Hall D refrigeration system
- **Collins Cryogenic Institute**
  - Graduate Engineering R+D Program
  - R&D collaborations with NP laboratories, industrial, and NASA collaborations
  - Commercial licensing of JLab's "Ganni Helium Process Cycle" and "Floating Pressure" technology
- **Environmental Impact Improvement Recognition**
  - 2006 DOE "Best in Class" P2 Award
  - 2007 White House Closing the Circle Award

More from Dana Arenius



# Role of JLab in RIA/FRIB

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- **Highlights from RIA R&D**
  - Design and development of low- $\beta$  elliptical cavities
  - Design and development of spoke cavities
  - Measurement and mitigation of microphonics
  - Design of low level RF control systems
  - Member of ANL team preparing RIA proposal
- **Future desires for FRIB**
  - Continue to have a significant role in R&D
  - Contribute to the preparation of proposals
  - Be a full partner in the physics and engineering design
  - Be a full partner in the construction

More from Jean Delayen



# Summary

- **The Accelerator Division is functioning extremely well!**
  - **My task is to balance many exciting priorities**
    - **12 GeV Upgrade**
    - **6 GeV operations and hardening**
    - **Long-term future**
    - **Education**
    - **Collaborations**
  - **Staff is experienced, competent, and highly motivated**
- **Bright future ahead with 12 GeV and beyond (ELIC, other)!**
  - **We would like greater involvement with ILC**
  - **We anticipate participation in SNS Upgrade and FRIB**

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# Appended Supplemental Materials

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# Appendix 1

## Accelerator Improvement Project (AIP)

# Funded AIP Projects FY07 (\$375)

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- Cryomodule refurbishment to improve availability and energy reach (Removed from AIP)
- Beam Position Monitor Electronics Upgrade (\$375k)
  - Begin conversion of 4-Channel West ARC Energy Lock BPM's to SEE – remove energy lock

# Funded AIP Projects FY08 (\$1,200k)

---

- **New RF Source Efficiency Upgrade** (\$630k)
  - New RF sources and explore RF efficiency upgrades
- **Beam Position Monitor Electronics Upgrade** (\$360k)
  - Continue conversion of 4-Channel West ARC Energy Lock BPM's to SEE and removal of energy lock
- **Central Helium Liquefier (CHL) Control System Upgrade** (\$210k)
  - Begin CHL 4.5K Refrigerator Control System Upgrade

# Funded AIP Projects FY09 (\$1,200k)

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- **New RF Source** (\$610k)
  - Procure/test/install 20 klystrons continues
- **Beam Position Monitor Electronics Upgrade** (\$410k)
  - Continue conversion of 4-Channel West ARC Energy Lock BPM's to SEE – remove energy lock
- **Central Helium Liquefier (CHL) Control System Upgrade** (\$180k)
  - Complete CHL 4.5K Refrigerator Control System Upgrade

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## Appendix 2

### Accelerator R&D



# Accelerator R&D

Continual Operational Development (Ops funded)		Actual FY06	Planned FY07	Planned FY08	FY09 -5%	FY09 flat-flat	FY09 +3.5%	Proposed FY09
		\$k	\$k	\$k	\$k	\$k	\$k	\$k
<b>Existing Facility</b>								
<b>Activity</b>	<b>Brief description</b>							
SRF cryomodule R&D	In-situ processing of cryomodules	50	0	250	115	121	125	130
	Horizontal test-bed rework		135					
Unbalanced Linac Raytrace	Energy Plan Contingency	120	70	0	0	0	0	0
ODR	Non-invasive diagnostic		170	170	166	175	0	0
<b>Total existing facility</b>		<b>170</b>	<b>375</b>	<b>420</b>	<b>281</b>	<b>296</b>	<b>125</b>	<b>130</b>
<b>Next Generation and Generic R&amp;D (SRF R&amp;D funded)</b>								
<b>Next generation</b>								
<b>Activity</b>	<b>Brief description</b>							
SRF process improvement	process and procedure improvement, electropolishing, cleaning methods, process modeling and DAQ, quality	305	107	146	139	146	170	168
SRF structures	cavity, HOM, FPC and cryomodule improvements.	85	157	168	160	168	171	180
Electron-Ion Collider (ELIC)	Next major facility	280	211	405	380	400	404	140
R&D in support of ELIC	New Funding Initiative	0	0	0	0	0	0	3000
<b>Total next generation</b>		<b>670</b>	<b>475</b>	<b>719</b>	<b>679</b>	<b>714</b>	<b>744</b>	<b>3488</b>
<b>Generic</b>								
<b>Activity</b>	<b>Brief Description</b>							
SRF materials	SRF properties of bulk materials	85	150	121	120	125	130	129
SRF thin films	fabrication and characterization of SRF thin films	95	135	280	238	250	255	328
SRF surface science	maintain and develop specialized surface analytical techniques and equipment in support of SRF R&D and production	0	100	300	314	330	335	362
CSR/BBU	Generic Accelerator Physics R&D	140	140	110	105	111	125	280
<b>Total generic</b>		<b>320</b>	<b>525</b>	<b>811</b>	<b>776</b>	<b>816</b>	<b>843</b>	<b>1099</b>

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# Appendix 3

## Education

# Education: Graduate Students Presently Enrolled

## By Discipline #Students

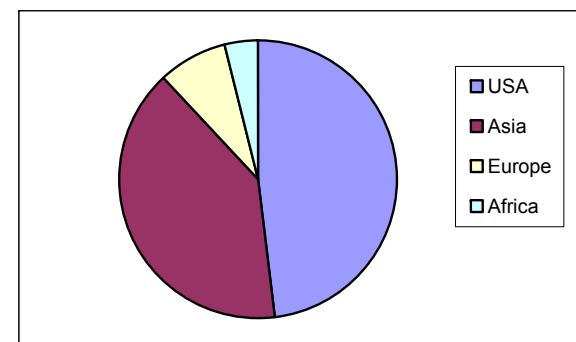
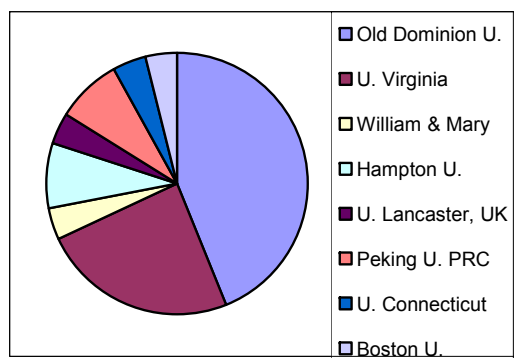
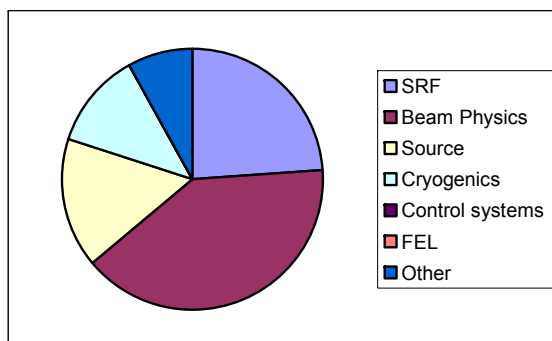
SRF	6
Beam Physics	10
Source	4
Cryogenics	3
Control systems	0
FEL	0
Other	2
(.magnets, secondary sources)	

## University Affiliation #Students

Old Dominion U.	11
U. Virginia	6
William & Mary	1
Hampton U.	2
U. Lancaster, UK	1
Peking U. PRC	2
U. Connecticut	1
Boston U.	1

## Country/Continent of origin #Students

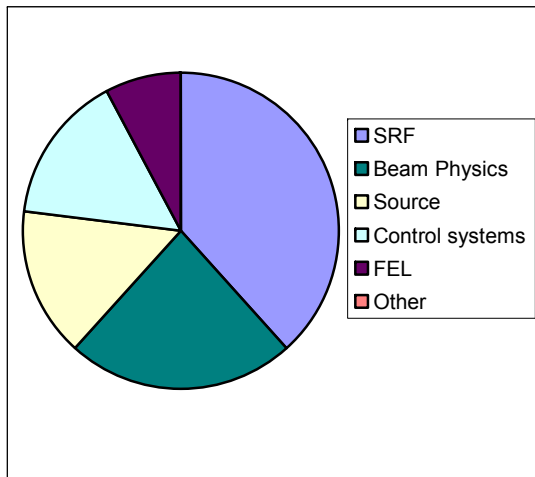
USA	12
Asia	10
Europe	2
Africa	1
includes 6 staff members (3 in engineering)	



# Education: Students Who Have Graduated

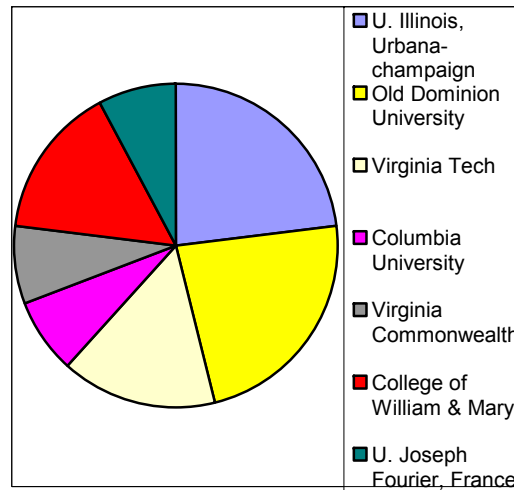
**By Discipline #Students**

SRF	5
Beam Physics	3
Source	2
Control systems	2
FEL	1
Other	0
(.magnets, secondary sources)	



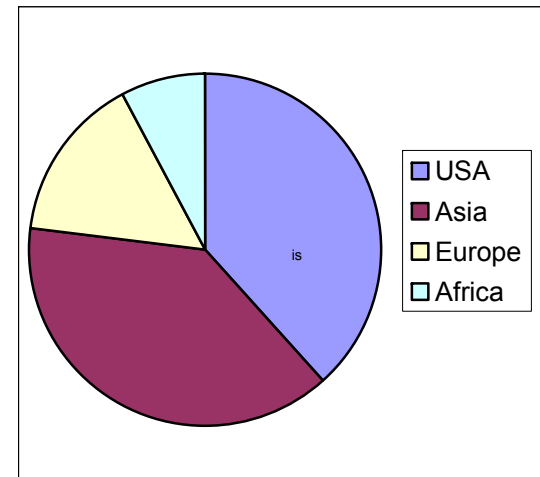
**University Affiliation #Students**

U. Illinois, Urbana-champaign	3
Old Dominion University	3
Virginia Tech	2
Columbia University	1
Virginia Commonwealth	1
College of William & Mary	2
U. Joseph Fourier, France	1



**Country/Continent of origin #Students**

USA	5
Asia	5
Europe	2
Africa	1



# Education: PhD Theses Completed in Accelerator Research at JLAB

Year	# Degrees	
1994	1	Ph.D.
1995	1	Ph.D.
1996	1	Ph.D.
1997	0	Ph.D.
1998	1	Ph.D.
1999	1	Ph.D.
2000	1	Ph.D.
2001	0	Ph.D.
2002	3	Ph.D.
2003	1	Ph.D.
2004	1	M.S.
2005	1	Ph.D.
2006	1	Ph.D.

- Nick Sereno (1994). *Experimental Studies of Multipass Beam Breakup and Energy Recovery Using the CEBAF Injector Linac*. U. Illinois, Urbana-Champaign.
- Zenghai Li (1995). *Beam Dynamics in the CEBAF Superconducting Cavities*. College of William and Mary.
- Mahesh Chowdhary (1996). *Online System Identification for Control System Applications in Particle Accelerators*. Old Dominion University.
- David Engwall (1998). *High-Brightness Electron Beams from a DC, High-Voltage GaAs Photoemission Gun*. U. Illinois, Urbana-Champaign.
- Philippe Piot (1999). *High Brightness Electron Beam Diagnostics and their Applications to Beam Dynamics in a Superconducting Energy-Recovering Free-Electron Laser*. Université Joseph Fourier Grenoble I, France.
- Joseph Grames (2000). *Measurement of a Weak Polarization Sensitivity to the Beam Orbit of the CEBAF Accelerator*. U. Illinois, Urbana-Champaign
- Raphael Akogyaram (2002). *Basis Function Repetitive and Feedback Control with Application to a Particle Accelerator*. Columbia University.
- Genfa Wu (2002). *Energetic Deposition of Niobium Thin Film in Vacuum*. Virginia Tech.
- Tong Wang (2002). *Enhanced Field Emission Studies on Niobium Surfaces Relevant to High Field Superconducting Radio-Frequency Devices*. Virginia Tech.
- Changkun Dong (2003). *Field Emission Based Sensors using Carbon Nanotubes*. Old Dominion University
- David Smith (2004). *Surface Analysis of acid treated SRF niobium cavities using SIMS and other surface analysis instruments*. Virginia Commonwealth University.
- Gianluigi Ciovati (2005). *Investigation of the superconducting properties of niobium radio-frequency cavities*. Old Dominion University.
- Christopher Tennant (2006). *Studies of Energy Recovery Linacs at Jefferson Laboratory*. College of William and Mary.

# Education –Theses Completed in FY07

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- **Ph. D.**
  - **Adam Phillips, UVA 2007 - Jlab mentor: Ganapati Myneni**
    - **Absorption Studies in Nanoscale Materials through Surface Acoustic Wave Based Techniques**
- **Undergraduate Theses**
  - **Rachel Sparks ,ODU, 2007 - Jlab mentor: Anne-Marie Valente**
    - **Commissioning of the Field Emission Viewer**
  - **Wade Brock, ODU, 2007 - Jlab mentor: Mike Klopff**
    - **Polarization and Attenuation of Terahertz Radiation**

# Education – Courses Taught

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- **University of Virginia - Senior undergraduate/graduate**
  - **Introduction to Particle Accelerators 2003, 2004 and 2006**
- **Inter-University Accelerator Center, New Delhi, India**
  - **The Physics and Technology of RF Superconductivity Series of 10 lectures 5 - 9 February 2007**
- **Cockcroft Institute, Daresbury, England, (also live web cast to locations in England, Germany, US)**
  - **Superconducting RF, Series of 12 lectures, 30 May-6 June 2007**
- **USPAS**
  - ***Kelly Mahoney* – System Safety and Safety Systems for Accelerators**
  - ***Jean Delayen* - RF Superconductivity: Physics, Technology and Applications**



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# Appendix 4

## Planned Experiments

# FY 08 Planned Experiments

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- For FY08, the planned experiments are:
  - **Hall A**
    - E05-110 Coulomb Sum Rule
    - E05-010/E05-011 Transversity
    - E04-007  $\pi^0$  electroproduction
  - **Hall B**
    - g9
    - g12
  - **Hall C**
    - E03-109 SANE
    - E04-108 GEp

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## Appendix 5

# Accelerator & Engineering Divisions Scientific Profile

# Awards and Patents

Awards	Patents
<ul style="list-style-type: none"> <li>• US Particle Accelerator School (USPAS) Prize, 2007, Yaroslav Derbenev, CASA</li> <li>• APS Fellowship – Lia Merminga, CASA</li> <li>• DOE “Best in Class” Ps Environment Award, December 2006, Cryogenics Group</li> <li>• Office of the Federal Environmental Executive (OFEE) White House Closing the Circle Award, 2007, Cryogenics Group</li> <li>• SULI Mentorship Award, Marcy Stutzman, Center for Injectors and Sources</li> </ul>	<ul style="list-style-type: none"> <li>• Ganapati Myneni, SRF Bulk RRR Nb Cavities with Passivated SC Films. US Patent and Trade Mark Office issued patent US 7151347B1 on Dec 19, 2006</li> <li>• Venkataro Ganni and Dana Arenius, Ganni Helium Cycle, patent pending</li> <li>• Monty Lehmann, High Voltage device invented for safe FEL High Voltage Testing of 600KV power supply</li> </ul>

# Committee and Board Memberships, etc.

## **Dana Arenius**

- Cryogenics Operations Workshop, Organization Committee, SLAC 2006
- Cryogenic Society of America, Publications Committee
- Commonwealth of Virginia: Governor's Biotechnology

## **Matt Bickley:**

- Program Chair, 2006 International Workshop on Personal Computers and Particle Accelerator Controls (PCaPAC)

## **Alex Bogacz:**

- APS, Topical Group on Particle Beam Physics

## **Pavel Chevtsov:**

- Vice-chairman, 2006 International Workshop on Personal Computers and Particle Accelerator Controls (PCaPAC)

## **Jean Delaen**

- Member - International Steering Committee, SARAF, Yavne, Israel
- Member - PAC Program Committee
- Chair, Publication Committee DPB
- Member – Curriculum Committee USPAS

## **Yaroslav Derbenev**

- International Program Committee of Beam Cooling Workshop

## **Arne Freyberger:**

- Organizing Committee for the Beam Instrumentation Workshop (BIW)

## **Curt Hovater**

- 2007 LLRF Workshop Program Committee

## **Andrew Hutton**

- KEK Machine Advisory Committee Chairman
- LANCE Review Advisory Board
- ATLAS Review Advisory Board
- PAC Organizing Committee 09
- LINAC International Organizing Committee 08
- Technical Program Committee for the Eighth International Topical Meeting on Nuclear and Utilization of Accelerators (AccApp'07)
- Nominating Committee for the APS Division of Beams
- Member - DOE /HEP AARD Panel
- Member - PAC 2006 Program Committee
- Editorship: AIP

## **Peter Kneisel**

- Member - SNS Review Committee
- Member - Pressure Vessel Code Committee
- Member - Technical Board of TESLA Technology Collaboration
- Member - Program Committee for the SRF workshops
- Member - Review Board for the European CARE program
- Program Committee Member of the RF Superconducting Materials Workshop at Fermilab

## **Geoffrey Krafft:**

- Fellowship Committee: APS Division of Physics of Beams

## **Monty Lehmann**

- IEEE

## **Rui Li:**

- APS Division of Beams Doctoral Research Award Committee

## **Lia Merminga**

- DOE HEP Annual Review Committee, SLAC, 2007
- US Particle Accelerator School, Governing Board
- Physical Review Special Topics, Editorial Board
- Electron-Ion Collider (EIC) Collaboration Steering Committee, 2007
- NSAC Long Range Plan Writing Group, 2007
- University of Chicago APS Accelerator Review Committee, 2007
- DOE Committee of Visitors (Nuclear Physics Review Panel), 2007
- Muon Technical Advisory Committee (MUTAC), 2007 – 2011
- NSLS-II, Accelerator Systems Advisory Committee, 2006
- Plasma 2010 Committee, National Research Council, The National Academies, 2005 – 2007
- BNL Machine Advisory Committee, 2004
- Scientific Program Committee, Particle Accelerator Conference, 2005, 2007
- Scientific Advisory Board, European Particle Accelerator Conference, 2006, 2008
- Organizing Committee, 41<sup>st</sup> ICFA Advanced Beam Dynamics Workshop on Energy Recovery Linacs, ERL07, 2007
- International Program Committee, Free Electron Laser Conference, 2006, 2008
- Organizing Committee, Workshop on Future Prospects in QCD at High Energy, 2006

## **Ganapati Myneni**

- International Advisory Committee of the International Vacuum Symposium 2007 being hosted by BARC in India.
- Co-Chair of the Program and Organizing Committees of the Single Crystal Niobium Technology Workshop Oct – Nov 2006, Brazil
- Scientific Committee Member, International Vacuum Symposium 2007, BARC, India
- Extreme High Vacuum (XHV) Expert Associate, Karlsruhe Tritium Neutrino Experiment (KATRIN) International Collaboration Board, FZK, Karlsruhe, Germany
- US Representative on the Indian Cryogenics Council
- Founding Member and Co-Chairman, International Symposium On Hydrogen In Matter (ISOHIM)

## **Will Oren**

- Lehman Review panel member for: NSLS II, LCLS, SNS Power Upgrade Project
- JLab representative to the "Workshop on SC Engineering Workforce"

## **Larry Phillips**

- Program committee member of the International Workshop on Thin Films Applied to SRF

## **Matt Poelker**

- ERL 07 Working Group Convenor

## **Charlie Reece**

- Program committee member of the RF Superconducting Materials Workshop at Fermilab

## **Yves Roblin**

- ICALEPCS 2007 Program Committee

## **Michael Spata**

- Member - International Organizing Committee for the Workshop for Accelerator Operations (WAO)

## **Marcy Stutzman**

- Mid-Atlantic Chapter of AVS
- AVS History Committee

## **Karen White**

- Program Chair, International Conference for Accelerator and Large Experimental Control Systems (ICALEPCS) 2007
- International Scientific Advisory Committee for ICALEPCS 2007
- Facilities Advisory Committee for Linac Coherent Light Source 2004

## **Kelly Mahoney**

- Chair LCLS PPS design review committee
- Instrumentation, Systems, and Automation (ISA) Society SP84 Committee – Programmable Electronic Systems for Use in

# Conferences and Workshops

**Hosted at JLab and Jointly Hosted  
with other Institutions**



**The 6th International Workshop on Personal  
Computers and Particle Accelerator Controls  
(PCaPAC 2006)  
October 24-27, 2006  
Jefferson Lab  
Newport News, VA USA**

## **Single Crystal Niobium Technology Workshop**

**October 30 – November 1, 2006  
Araxá, Brazil**



**The 11<sup>th</sup> International Conference on  
Accelerator and Large Experimental  
Physics Control Systems (ICALEPCS  
2007),  
October 15-19, 2007  
Knoxville, TN**

## **Conference & Workshops Attended**

2006 Instrumentation Systems, and Automation (ISA) Society Expo, Houston  
APAC, 2007, India  
Autodesk Network Conference  
CEC-ICMC Conference  
Cryogenics Engineering Conference  
EPAC 06  
ERL07, Daresbury, United Kingdom  
FEL Conference  
IEEE MTT-S Int'l Microwave Symposium  
ILC (alignment focused)  
IMMW 15 Workshop  
International Computational Accelerator Physics Conference (ICAP 06)  
International Workshop on Thin Films Applied to SRF  
IWAA 07  
LINAC 2006  
LISA (Large Installation System Administration) Conference, Dec. 2006, Washington D.C.  
Low Emittance Muon Collider Workshop, Fermilab, IL  
Particle Accelerator Conference 2007, Albuquerque, NM  
PCaPAC 2006  
PCB Design Conference West  
PIC/REMEX Simulation Workshop, Fermilab, IL  
RF Superconducting Materials Workshop at Fermilab  
RFID Journal Live! Conference  
RUPAC 06  
Sensor Expo and Conference  
Single Crystal Nb Workshop  
Symposium on Surface Science 2007  
UGS Connection America 2007 Conference  
WAO 07 CONFERENCE

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# Appendix 6

## Collaborations



# Collaborations

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**Alameda Applied Sciences** – Characterization Of Niobium Thin Films

**ANL** – Spoke Cavity R&D

**Cryogenic Engineering Society of America (CEC)** - Optimal Helium Refrigeration Design Course

**Cornell University** – 500 MHz RF Cavity, ERL, LLRF  
**BNL**

- Phase III RHIC Refrigerator System
- Refrigerator Support
- Computer Simulations
- Electron Cooling for RHIC and SRF Collaborations Cavity Processing
- Joint EIC Study

**Daresbury Lab** – ERL Beam Dynamics

**FNAL**

- Fabricate 4 TESLA-style Cavities
- SMTF Cryo Options Study Continuation
- Weld 3.9 GHz Cavities
- ILC Cavity Processing Development
- Clean and Assembly 703 MHz Cavity String
- Cavity Development for Proton Driver

**FSU** – Cryogenic Cycle Studies; FEL Design

**ILC** – New Nb forms Studies

**Industrial R&D Collaboration Agreement Pending**

**JLab**

- FEL

**Linde** – Optimization Studies for Small 2K Refrigerators

**Michigan State University** – Power Failure Recovery, Elliptical Cavity R&D for RIA

**MIT Bates Lab** – Polarized Source Development and Generic Accelerator R&D

**MSU – Power Failure Recovery**

**Muons, Inc.**

- 6D Cooling (SBIR Phase II)
- Reverse Emittance Beam Cooling (SBIR Phase I)
- PIC (Parametric Induced Resonances) (SBIR Phase II)

**NASA** – Cryogenics Engineering Support

**PKU (China)** – Build 4 Cavity Cryomodules

**Reference Metals**

- High RRR Niobium Studies
- New Niobium Studies

**SLAC** – LCLS Magnets, Computer Simulations

**SNS** – Operations Engineering Collaboration

**Tech-X** – Computer Simulations ((VORPAL)

**TESLA** – Technology Collaboration

**TRIUMF** – Chemical Testing Requirements

**University of Nebraska & University of Virginia** – Spintronics

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# Appendix 7

## **Publications**

# Publications – Conferences, Workshops, etc.

1	<b>¼ Cryomodule Test for the CEBAF Energy Upgrade</b>	Joseph Preble *, Michael Bevins , Edward Daly , G. Davis et al.	PAC07, Albuquerque, NM, June 26-30, 2007
2	<b>1450 m<sup>3</sup> at 10<sup>-9</sup> Pa: One of the KATRIN Challenges</b>	Christian Day , Werner Herz , Rainer Gumbsheimer , Joachim Wolf et al.	53rd AVS Symposium
3	<b>A Beat Frequency RF Modulator for Generation of Low Repetition Rate Electron Microbunches for the CEBAF Polarized Source</b>	John Musson * , Joseph Grames , Benard Poelker , Reza Kazimi et al.	PAC07, Albuquerque, NM, June 26-30, 2007
4	<b>A Comparison of Short Rayleigh Range FEL Performance with Simulations</b>	Stephen Benson * , Pavel Evtushenko , Michelle Shinn , George Neil et al.	FEL 2007
5	<b>A CW POSITRON SOURCE FOR CEBAF</b>	Arne Freyberger * , Serkan Gogle , Charles Hyde	PAC07, Albuquerque, NM, June 26-30, 2007
6	<b>A Digital Self Excited Loop for Accelerating Cavity Field Control</b>	J. Hovater * , Trent Allison , Jean Delayen , John Musson et al.	PAC07, Albuquerque, NM, June 26-30, 2007
7	<b>A General Model of the Resistive Wall Instability in Linear Accelerators</b>	Jean Delayen and Juhao Wu	PAC07, Albuquerque, NM, June 26-30, 2007
8	<b>A Prototype of a Beam Steering Assistant GUI Tool for Accelerator Operations</b>	Pavel Chevtsov * , Matthew Bickley	PCaPAC 2006
9	<b>A PROTOTYPE OF A BEAM STEERING ASSISTANT TOOL FOR ACCELERATOR OPERATIONS</b>	Matthew Bickley * , Pavel Chevtsov	PCaPAC 2006
10	<b>A review of the mechanical properties of reactor grade, high purity and single crystal niobium</b>	Ganapati Rao Myneni	Howard K. Birnbaum Memorial Symposium
11	<b>A users Perspective on Software</b>	Isadoro Carlino *	PCaPAC 2006
12	<b>Addressing Physics Grand Challenges Using the Jefferson Lab FEL</b>	Gwyn Williams * , FEL Team	South-East American Physical Society
13	<b>Advantages of the Program-Based Logbook Submission GUI at Jefferson Lab</b>	Theodore McGuckin *	PCaPAC 2006
14	<b>An R&amp;D Proposal for the US Regional Interest Panel</b>	L. Funk *	ILC Workshop
15	<b>BNL superconducting RF guns - technology challenges as ERL sources</b>	Andrew Burrill , Ilan Ben-Zvi , Rama Calaga , X. Chang et al.	ERL2005
16	<b>Bunch Length Measurements at the JLab FEL Using Coherent Transition and Synchrotron Radiation</b>	Pavel Evtushenko * , James Coleman , Kevin Jordan , John Klopff et al.	BIW06
17	<b>Cavity Processing Development &amp; Training Center_Jlab Proposal for ILC Bid to Host Panel</b>	L. Funk *	ILC R&D Meeting
18	<b>CEBAF Cryomodule Refurbishment Program</b>	Joseph Preble, Edward Daly, G. Davis, John Fischer et al.	PAC07, Albuquerque, NM, June 26-30, 2007
19	<b>CEBAF Hall B Beam Intensity Modulation Suppression System and its Control</b>	Pavel Chevtsov * , Pavel Evtushenko	PCaPAC 2006

# Publications – Conferences, Workshops, etc.

20	<b>CEBAF New Digital LLRF System Extended Functionality</b>	Tomasz Plawski *, Trent Allison , G. Davis , Hai Dong et al.	PAC07, Albuquerque, NM, June 26-30, 2007
21	<b>Characteristics and properties of the Jefferson Lab ERL and applications of this high brightness 4th generation light source for high pressure research</b>	Gwyn Williams *	Future Frontiers in High-Pressure Science with ERL X-Ray Beams
22	<b>Combined Panofsky Quadrupole &amp; Corrector Dipole</b>	George Biallas *, Nathan Belcher , David Douglas , Tommy Hiatt et al.	PAC07, Albuquerque, NM, June 26-30, 2007
23	<b>Commissioning of the Digital LLRF for CEBAF Injector/Separator</b>	T. Plawski, H. Dong, C. Hovater, G. Lahti, L. King, J. Musson	LINAC 2006
24	<b>Computer Simulations of Beam-beam Effects of Electron- Light Ion Collider at CEBAF</b>	Yuhong Zhang *, Rui Li , Ji Jiang	PAC07, Albuquerque, NM, June 26-30, 2007
25	<b>Critical RF Magnetic Field and Power Dependence of MgB2 films</b>	J. Delayen	PAC07, Albuquerque, NM, June 26-30, 2007
26	<b>Current-Dependent Kick from Traveling-Waves in SRF Cavity Couplers *</b>	Genfa Wu , Haipeng Wang , Charles Reece , Robert Rimmer	PAC07, Albuquerque, NM, June 26-30, 2007
27	<b>Design of High Luminosity Ring-Ring Electron- Light Ion Collider at CEBAF</b>	S. Bogacz *, Antje Bruell , Jean Delayen , Yaroslav Derbenev et al.	PAC07, Albuquerque, NM, June 26-30, 2007
28	<b>Development of a Superconducting Connection for Niobium Cavities</b>	Peter Kneisel *, Gianluigi Ciovati , Jacek Sekutowicz , Axel Matheissen et al.	PAC07, Albuquerque, NM, June 26-30, 2007
29	<b>Device Control Tool for CEBAF Beam Diagnostics Software</b>	Pavel Chevtsov *	ICALEPCS
30	<b>Diagnosis, Analysis, and Resolution of Thermal Stability Issues with HOM Couplers on Prototype CEBAF SRF Cavities</b>	Charles Reece *, William Hicks , Genfa Wu , Edward Daly et al.	PAC07, Albuquerque, NM, June 26-30, 2007
31	<b>DRIFT Infrared Spectroscopy Studies of Organic Matter at Mineral Surfaces</b>	Joan Thomas *, Robert Schmidt , Michael Kelley , Elizabeth Canuel	18th World Congress of Soil Science
32	<b>EFFECTS OF THE NON AXISYMMETRIC ACCELERATING FIELDS IN THE JLAB FEL INJECTOR</b>	Fay Hannon	PAC07, Albuquerque, NM, June 26-30, 2007
33	<b>Energy Recovery Linacs 2005</b>	edited by S. Chattopadhyay and L. Merminga	NIM A557, 2006
34	<b>Energy recovery linacs in high-energy and nuclear physics</b>	Ilan Ben-Zvi , Yaroslav Derbenev , Vladimir Litvinenko , Nikolitsa Merminga	ERL2005
35	<b>ENERGY RECOVERY TRANSPORT DESIGN FOR PKU FEL</b>	Guimei Wang, Yu-Chiu Chao, KUI Zhao, Xiangyang Lu, Jiejia Zhuang and Others	PAC07, Albuquerque, NM, June 26-30, 2007
36	<b>Ethernet Based Embedded IOC for FEL Control Systems</b>	Jianxun Yan *, Daniel Sexton , Albert Grippo , Steven Moore et al.	ICALEPCS
37	<b>FEL-accelerator related diagnostics</b>	Kevin Jordan *	The Eighth International Topical Meeting on Nuclear Applications and Utilization of Accelerators (AccApp'07)

# Publications – Conferences, Workshops, etc.

38	<b>FIDUCIALIZATION OF SUPERCONDUCTING RADIO FREQUENCY CRYOMODULES AT JEFFERSON LAB</b>	Christopher Curtis * , James Dahlberg , William Oren , Joseph Preble et al.	9th International Workshop on Accelerator Alignment (IWAA06)
39	<b>Field study of surface nanolayer antimicrobial</b>	Michael Kelley * , Olga Trofimova , Dallas Hoover	American Chemical Society Fall Meeting
40	<b>Frontier Accelerator Technologies</b>	George Neil *	Eighth International Topical Meeting on Nuclear Applications and Utilization of Accelerators (AccApp'07)
41	<b>Further Measurements of Photocathode Operational Lifetime at Beam Intensity &gt; 1mA using the CEBAF 100 kV DC GaAs Photogun</b>	Joseph Grames * , Benard Poelker , Anthony Favale , Joshua Brittian et al.	17th International Spin Physics Symposium
42	<b>GENERATION AND CONTROL OF HIGH PRECISION BEAMS AT LEPTON ACCELERATORS</b>	Yu-Chiu Chao	PAC07, Albuquerque, NM, June 26-30, 2007
43	<b>High average power optical systems for the Jefferson Lab FEL</b>	Michelle Shinn *	Frontiers in Optics
44	<b>High Energy Positron Source at the Jefferson Lab Free Electron Laser</b>	Yves Roblin * , Bogdan Wojtsekhowski , S. Bogacz , Pavel Degtiarenko et al.	PAC07, Albuquerque, NM, June 26-30, 2007
45	<b>High Gradient Operation with the CEBAF Upgrade Digital LLRF System</b>	J. Hovater * , Hai Dong , Alicia Hofler , Tomasz Plawski	LINAC 2006
46	<b>High Gradient Operation with the CEBAF Upgrade RF Control System</b>	C. Hovater, K. Davis, H. Dong, A. Hofler, L. King, J. Musson, T. Plawski	LINAC 2006
47	<b>High Power Operation of the JLab IR FEL Driver Accelerator</b>	Stephen Benson * , Kevin Beard , George Biallas , James Boyce et al.	PAC07, Albuquerque, NM, June 26-30, 2007
48	<b>High power windows for WR650 waveguide couplers</b>	Mircea Stirbet * , Robert Rimmer , Thomas Elliott , Edward Daly et al.	PAC07, Albuquerque, NM, June 26-30, 2007
49	<b>Influence of "in situ" Baking Time on the Reduction of the "Q-drop" in High Purity Niobium Cavities</b>	Gianluigi Ciovati * , Peter Kneisel	PAC07, Albuquerque, NM, June 26-30, 2007
50	<b>Integrating Embedded IOCs with Custom Hardware Designs</b>	Douglas Curry , Hai Dong , Alicia Hofler	PCaPAC 2006
51	<b>Investigation of oxide layer structure on niobium surface using a secondary ion mass spectrometry</b>	A. T. Wu	Physica, Volume 441, Issue 1-2, p. 79-82
52	<b>JLAB and the International Linear Collider</b>	L. Funk *	S&T Review
53	<b>JLab High-Current CW Cryomodules for ERL and FEL Applications</b>	Robert Rimmer * , Richard Bundy , Guangfeng Cheng , Gianluigi Ciovati et al.	PAC07, Albuquerque, NM, June 26-30, 2007
54	<b>JLAMP: An Amplifier Based FEL in the JLab SRF ERL Driver</b>	Kevin Jordan * , Stephen Benson , David Douglas , Carlos Hernandez-Garcia et al.	PAC07, Albuquerque, NM, June 26-30, 2007

# Publications – Conferences, Workshops, etc.

55	<b>More Results from a Modified Coaxial HOM Coupler for Superconducting RF Cavities</b>	Peter Kneisel * , Gianluigi Ciovati , Jacek Sekutowicz	PAC07, Albuquerque, NM, June 26-30, 2007
56	<b>Multipass Steering Protocols at Jefferson Lab</b>	Ryan Bodenstein , Michael Tiefenback	PAC07, Albuquerque, NM, June 26-30, 2007
57	<b>New High Capacity Getter for Vacuum-Insulated Mobile Liquid Hydrogen Storage Systems</b>	H. Londer , Ganapati Rao Myneni , Anthony Favale , G. Bartlok et al.	International Symposium On Hydrogen In Matter -2005
58	<b>Observation And Comparison of the Phase Noise From Different Mode-locked Laser Systems</b>	Shukui Zhang * , Stephen Benson , Dave Hardy , George Neil et al.	28th International FEL Conference (FEL06)
59	<b>On the Design Implications of Incorporating an FEL in an ERL</b>	George Neil * , Stephen Benson , David Douglas , Pavel Evtushenko et al.	28th International FEL Conference (FEL06)
60	<b>Operational Experience with Synchrotron Light Interferometers for CEBAF Experimental Beam Lines.</b>	Pavel Chevtsov *	PCaPAC 2006
61	<b>Optics for Phase Ionization Cooling of Muon Beams</b>	Y. Derbenev, S.A. Bogacz	EPAC06, Edinburgh, Scotland
62	<b>Optimization of the SRF Cavity Design for the CEBAF 12 GeV Upgrade</b>	Charles Reece * , Genfa Wu , Haipeng Wang , William Hicks et al.	PAC07, Albuquerque, NM, June 26-30, 2007
63	<b>Overview of the RRR Nb Specifications and the Evolution of SRF Technology</b>	Ganapati Rao Myneni	SRF Materials Workshop
64	<b>Parameters for Absorber-based Reverse Emittance Exchange of Muon Beams</b>	Yaroslav Derbenev and Rolland Johnson	EPAC06, Edinburgh, Scotland
65	<b>Parametric Resonance Ionization Cooling and Reverse Emittance Exchange for Muon Collider</b>	Yaroslav Derbenev * , Rolland Johnson	COOL05
66	<b>PERFORMANCE ACHIEVEMENTS AND CHALLENGES FOR FELS BASED ON ENERGY RECOVERY LINACS</b>	Geoffrey Krafft *	28th International FEL Conference (FEL06)
67	<b>Performance of the CEBAF Prototype Cryomodule Renaissance</b>	Charles Reece * , Edward Daly , William Hicks , Michael Drury et al.	PAC07, Albuquerque, NM, June 26-30, 2007
68	<b>Performance of the First Refurbished CEBAF Cryomodule</b>	Michael Drury * , Edward Daly , G. Davis , John Fischer et al.	PAC07, Albuquerque, NM, June 26-30, 2007
69	<b>Photocathodes for the energy recovery linacs</b>	T. Rao , Andrew Burrill , X. Chang , J. Smedley et al.	ERL2005
70	<b>Preliminary Results from Polycrystalline and Large Grain 9-cell TESLA-type Niobium Cavities fabricated at Jlab*</b>	Peter Kneisel * , Gianluigi Ciovati , Richard Bundy , Bill Clemens et al.	PAC07, Albuquerque, NM, June 26-30, 2007
71	<b>Preliminary Results from Prototype Niobium Cavities for the JLab Ampere-Class FEL</b>	Peter Kneisel * , Gianluigi Ciovati , Richard Bundy , Bill Clemens et al.	PAC07, Albuquerque, NM, June 26-30, 2007
72	<b>Progress Toward an International Linear Collider</b>	L. Funk *	CIPANP 2006
73	<b>Real Beam Line Optics from a "Synthetic Beam"</b>	Michael Tiefenback * , Yves Roblin	PAC07, Albuquerque, NM, June 26-30, 2007

# Publications – Conferences, Workshops, etc.

74	<b>Recirculating and Energy Recovery Linacs, Handbook of Accelerator Physics and Engineering, Ed. Chao and Tigner, 3rd print (2006)</b>	L. Merminga	
75	<b>Report from Jefferson Lab for the ISRFST Team, TESLA Technology Collaboration Meeting</b>	L. Funk *	TESLA Technology Collaboration Meeting
76	<b>Report of the HEPAP Subpanel on the Assessment of Advanced Accelerator Research and Development</b>	A. Hutton	Report to the HEPAP Subpanel
77	<b>Residual Gas Analyzers As Total Pressure Gauges</b>	Michael Maskell , Ganapati Myneni , Ganapati Rao Myneni , Anthony Favale et al.	AVS 52nd International Symposium
78	<b>RF Gun Optimization Study</b>	Alicia Hofer * , Pavel Evtushenko	PAC07, Albuquerque, NM, June 26-30, 2007
79	<b>RF-Thermal-Structural Analysis of a Waveguide Higher Order Mode Absorber</b>	Guangfeng Cheng * , Robert Rimmer , Haipeng Wang , Mircea Stirbet et al.	PAC07, Albuquerque, NM, June 26-30, 2007
80	<b>Short Rayleigh Range Experiments using the IR Upgrade FEL at Jefferson Lab</b>	Stephen Benson * , Pavel Evtushenko , Michelle Shinn , George Neil	FEL 2007
81	<b>Simulation and Measurements of a Heavily HOM-Damped Multi-cell SRF Cavity Prototype*</b>	Haipeng Wang * , Robert Rimmer , Jared Nace , Genfa Wu	PAC07, Albuquerque, NM, June 26-30, 2007
82	<b>Simulation of a Muon Cooling Channel Using Parametric-Resonance Ionization Cooling</b>	David Newsham , S. Bogacz	PAC07, Albuquerque, NM, June 26-30, 2007
83	<b>Smooth niobium surfaces fabricated by buffered electropolishing</b>	Andy T. Wu, John Mammoscor, Larry Phillips, Jean Delayen, Charles Reece, Amy Wilkerson, David Smith, and Robert Ike	Applied Surface Science, Volume 253, Issue 6, 15 January 2007, Pages 3041-3052
84	<b>Software tools for operations and maintenance planning at Jefferson Lab</b>	T. Larrieu, S. Suhring	WAO 2007
85	<b>Spin sum rules and polarizabilities: results from Jefferson Lab</b>	Jian-ping Chen	5th International Workshop on Chiral Dynamics, theory and Experiment (CD 2006), Durham / Chapel Hill, North Carolina
86	<b>Status of R&amp;D Energy Recovery Linac at Brookhaven National Laboratory</b>	J. Delayen	PAC07, Albuquerque, NM, June 26-30, 2007
87	<b>Status of the CEBAF Control System at Jefferson Laboratory</b>	Matthew Bickley *	PCaPAC 2006
88	<b>Status of the Jefferson Lab Polarized Electron Beam Program</b>	Joseph Grames * , Anthony Favale , Joshua Brittan , James Clark et al.	17th International Spin Physics Symposium



# Publications – Conferences, Workshops, etc.

89	<b>Studies of a gas-filled helical muon beam cooling channel</b>	K. Yonehara (Fermilab) , Y. Derbenev (Jefferson Lab) , R.P. Johnson, T.J. Roberts (MUONS Inc., Batavia)	EPAC06, Edinburgh, Scotland
90	<b>Studies of Beam Halo Formation in the 12 GeV CEBAF Design</b>	Yves Roblin * , Arne Freyberger	PAC07, Albuquerque, NM, June 26-30, 2007
91	<b>Studies of Energy Recovery Linacs at Jefferson Laboratory: 1 GeV Demonstration of Energy Recovery at CEBAF and Studies of the Multibunch, Multipass Beam Breakup Instability in the 10 kW FEL Upgrade Driver</b>	C. Tennant	Thesis
92	<b>STUDY OF GENERIC FRONT-END DESIGNS FOR ERL BASED LIGHT SOURCES</b>	Guimei Wang, Yu-Chiu Chao, KUI Zhao, Xiangyang Lu, Jiejia Zhuang and Others	PAC07, Albuquerque, NM, June 26-30, 2007
93	<b>Successful Applications of a Low-Cost Embedded IOC in a Free Electron Laser</b>	Daniel Sexton * , Jianxun Yan , Kevin Jordan , Pavel Evtushenko et al.	ICALEPCS
94	<b>Surface analysis and performance of the GaAs photocathode in the JLab 10 kW IR Upgrade FEL DC Gun</b>	Stephen Benson * , George Biallas , Donald Bullard , H. Dylla et al.	28th International FEL Conference (FEL06)
95	<b>Surface Specific IR Studies of Organic Matter Interactions at Mineral Surfaces</b>	Joan Thomas * , Robert Schmidt , Michael Kelley , Elizabeth Canuel	American Chemical Society
96	<b>Tailoring UV Photochemistry to Manage Polymer Surface Bioactivity</b>	Zhengmao Zhu , Dallas Hoover , Michael Kelley	Materials Research Society
97	<b>Terahertz imaging using the Jefferson Lab - FEL high power broadband terahertz source</b>	J. Michael Klopff , Matthew Coppinger , Nathan Sustersic , James Kolodzey et al.	APS March Meeting
98	<b>The 12 GeV CEBAF Upgrade Project</b>	The 12 GeV CEBAF Upgrade Project	LINAC 2006
99	<b>The 4th Generation Light Source at Jefferson Lab</b>	Gwyn Williams * , JLab Team	APS March Meeting
100	<b>The Accelerator Markup Language and the Universal Accelerator Parser</b>	D. Sagan, et al. (Y. Roblin)	EPAC06, Edinburgh, Scotland
101	<b>The Impact of Bunch Tilt on the CSR Interaction for an Energy-Chirped Bunch</b>	Rui Li *	PAC07, Albuquerque, NM, June 26-30, 2007
102	<b>The International Linear Collider: A Brief History, Present Status and Future Plans</b>	L. Funk *	ILC/GDE Team Mtg.
103	<b>The Jefferson Lab Free High Power Light Source</b>	James Boyce *	The 7th International High energy Density and High Power RF Workshop
104	<b>The Jefferson Lab High Power THz User Facility</b>	Gwyn Williams * , John Klopff , FEL Team , Alan Todd	Optical Terahertz Science and Technology
105	<b>The Muon Cooling RF R&amp;D Program</b>	Y. Torun , Alan D. Bross , D. Li , A. Moretti et al.	COOL05

# Publications – Conferences, Workshops, etc.

106	<b>The status of normal conducting RF (NCRF) guns; a summary of the ERL2005 Workshop</b>	David Dowell , J. Lewellen , Dinh Nguyen , Robert Rimmer	ERL2005
107	<b>Transverse Effect of Short Range Resistive Wall</b>	J. Delayen	PAC07, Albuquerque, NM, June 26-30, 2007
108	<b>TRANSVERSE EFFECTS DUE TO RANDOM DISPLACEMENT OF RESISTIVE WALL SEGMENTS AND FOCUSING ELEMENTS</b>	Jean Delayen and Juhao Wu	PAC07, Albuquerque, NM, June 26-30, 2007
109	<b>Update: RF Projects at Jefferson Lab</b>	Richard Nelson * , J. Hovater , Tomasz Plawski , Richard Walker et al.	4th CW and High Average Power RF Workshop
110	<b>Using a 100 kV DC Load Lock Photogun to Measure Photocathode Lifetime of High Polarization Strained Superlattice GaAs/GaAsP at Beam Intensity &gt;1 mA</b>	Joseph Grames * , Benard Poelker	PAC07, Albuquerque, NM, June 26-30, 2007
111	<b>Venting the Beamline Vacuum of a Cold CEBAF Cryomodule</b>	Michael Drury * , Edward Daly , Frank Humphry , Joseph Preble	PAC07, Albuquerque, NM, June 26-30, 2007
112	<b>Vernier control of FEL power in an optical cavity with constant charge in the electron bunch</b>	Richard Evans * , Albert Grippo , George Neil , Michelle Shinn et al.	28th International FEL Conference (FEL06)
113	<b>Workshop Engages PCs in Accelerator Controls</b>	Matthew Bickley	CERN Courier, Jan 07
114	<b>Xtreme Optics - the behavior of cavity optics for the Jefferson Lab Free-Electron Laser</b>	Michelle Shinn * , Christopher Behre , Stephen Benson , David Douglas et al.	XXXVIII Boulder Damage Symposium
115	<b>Zeroth - Order Design Report for the Electron-Light Ion Collider at CEBAF, 2007</b>	edited by Ya. Derbenev, L. Merminga, Y. Zhang	

# Invited Talks (also Published)

1	201 MHz Cavity R&D for MUCOOL and MICE	Derun Li , Steve Virostek , Michael Zisman , Alan Bross et al.	EPAC 2006
2	A General Formalism of Cumulative Beam Breakup in Linear Accelerators	J. Delayen	LANL, 7 December 2006
3	A Review of Energetic Condensation	L. Phillips	International Workshop on Thin Films Applied to SRF
4	A Review of the Mechanical Properties of Reactor Grade, High Purity and Single Crystal Niobium	G. Myneni	Howard K. Birnbaum Memorial Symposium, University of Illinois at Urbana-Champaign June 2, 2006
5	Advances in ERLs and Microwave Superconductivity for Lepton Accelerators, Colliders, and Light Sources	J. Delayen	APAC 2007
6	ADVANTAGES OF THE PROGRAM-BASED LOGBOOK SUBMISSION GUI AT JEFFERSON LAB	Theodore McGuckin	PCaPAC 2006
7	Analysis of the medium field Q-slope in superconducting cavities made of bulk niobium	Gianluigi Ciovati * , Juergen Halbritter	12th SRF workshop ; Physica, Volume 441, Issue 1-2, p. 57-61
8	Applications of Several MeV CW Superconducting Radio Frequency Accelerators	G. Myneni	UVa Dept. of Physics Seminar, Sept 14, 2006
9	Beam dynamics of low energy muon acceleration	S. Bogacz *	Nuclear Physics B, 155, 334-335 (2006)
10	Cavity Preparation/assembly Techniques and Impact on Q, Realistic Q - Factors in a Module, Review of Modules	Peter Kneisel *	ERL2005; NIMA
11	CBMM - Jlab Large Grain/ Single Crystal Nb Technology	G. Myneni	the Bhabha Atomic Research Center, Mumbai, India Aug 7, 2006
12	Coaxial HOM Coupler designs tested on a single cell niobium cavity	Peter Kneisel * , Genfa Wu , Gianluigi Ciovati , Jacek Sekutowicz	LINAC 2006
13	Concepts for ELEC-A High Luminosity CEBAF Based Electron-Light Ion Collider	Ya. Derbenev, A. Bogacz, G. Krafft, R. Li, L. Merminga, B. Yunn, Y. Zhang	RUPAC06 (Sept. 2006, Novosibirsk, Russia)
14	Design and Testing of a 2K Superfluid Helium Heat Station	William Hicks * , Edward Daly , Joseph Preble , Mark Wiseman et al.	CEC-ICMC '05
15	Design of High Luminosity Ring-Ring Electron-Light Ion Collider at CEBAF	A. Bogacz, A. Bruell, J. Delayen, Y. Derbenev, R. Ent, J. Grames, A. Hutton, G. Krafft, R. Li, L. Merminga, M. Poelker, B. Wojtsehowski, B. Yunn, Y. Zhang	PAC07, Albuquerque, NM, June 26-30, 2007
16	Development of BPM Electronics at the JLAB FEL	Daniel Sexton * , Pavel Evtushenko , Kevin Jordan , Jianxun Yan et al.	BIW06
17	Development of gas cluster ion beam surface treatments for reducing field emission and breakdown in RF cavities	D.R. Swenson , Andy Wu , E. Degenkolb , Z. Insepov	12th Advanced Accelerator Concepts Workshop (AAC 2006)
18	Development of Large Grain/Single Crystal Niobium Cavity Technology at Jefferson Lab	P. Kneisel	Single Crystal Nb Workshop
19	Development of Large Grain/Single Crystal Niobium Cavity Technology at Jefferson lab	Peter Kneisel * , Jacek Sekutowicz , Gianluigi Ciovati	Single Crystal Niobium Technology Workshop

# Invited Talks (also Published)

20	ETHERNET BASED EMBEDDED SYSTEM FOR FEL DIAGNOSTICS AND CONTROLS	Jianxun Yan *, Daniel Sexton , Steven Moore , Albert Grippo et al.	PCaPAC 2006
21	HARMONIC LASING CHARACTERIZATION AT JEFFERSON LAB	Stephen Benson *, Michelle Shinn	28th International FEL Conference (FEL06)
22	High Gradient Operation with the CEBAF Upgrade RF Control System	J. Hovater *, G. Davis , Hai Dong , Alicia Hofler et al.	LINAC 2006
23	High Q at Low and Medium Field	Gianluigi Ciovati *	Pushing The Limits Of RF Superconductivity Workshop
24	Higher-order Mode Calculations, predictions and Overview of Damping Schemes for ERLs	Robert Rimmer *	ERL2005
25	HOM Damping Simulation and Measurement of JLab Ampere Class Cavity	H. Wang	ERL 2007 Workshop
26	Hydrogen Adsorption Studies Using Surface Acoustic Waves on Nanoparticles	Adam Phillips , Ganapati Rao Myneni , B.S. Shivaram	International Symposium On Hydrogen In Matter - 2005
27	Industrial Issues for SRF Nb Production, a tutorial presented at the Mini Workshop On SCRF Cavities	G. Myneni	Jan 28, 2007, Indore - India
28	Interstitial Solutes and Deformation in Nb and Nb Single Crystals	Ganapati Rao Myneni , R. E. Ricker , D. J. Pitchure	Single Crystal Niobium Technology Workshop
29	Introduction talk on SRF issues about materials and surfaces	G. Ciovati	RF Superconducting Materials Workshop at Fermilab
30	Introduction to PIC/REMEX	Ya. Derbenev	PIC Simulation Workshop
31	INVESTIGATION OF HOT-SPOTS AS A FUNCTION OF MATERIAL REMOVAL IN A LARGE-GRAIN NIOBIUM CAVITY	Gianluigi Ciovati *, Peter Kneisel	LINAC 2006
32	Investigation of Oxide Layer Structure on Niobium Surfaces using a Secondary Ion Mass Spectrometer	Andy Wu *	12th SRF workshop
33	Investigations of Residual Stresses and Mechanical Properties of Single Crystal Niobium for SRF Cavities	Ganapati Rao Myneni , Thomas Gnäupel-Herold , R. E. Ricker	Single Crystal Niobium Technology Workshop
34	Jefferson Lab's Distributed Data Acquisition	Trent Allison *, Thomas Powers	BIW06
35	Latest Developments in Superconducting RF Structures for beta=1 Particle Acceleration	Peter Kneisel *	EPAC 2006
36	LONGITUDINAL PHASE SPACE CHARACTERIZATION OF ELECTRON BUNCHES AT THE JLAB FEL FACILITY	Shukui Zhang *, Stephen Benson , David Douglas , David Hardy et al.	28th International FEL Conference (FEL06)
37	Material Science Challenges for ILC cavities	Ganapati Myneni *	APAC 2007
38	Measurements of the high field Q-drop in TE011/TM010 mode in a single cell cavity	Gianluigi Ciovati *, Peter Kneisel	Pushing The Limits Of RF Superconductivity Workshop
39	Motivation and goals of ERL 2005	Swapan Chattopadhyay	ERL2005
40	Multipass Beam Breakup in Energy Recovery Linacs	Christopher Tennant *, Eduard Pozdeyev , Joseph Bisognano , M Sawamura et al.	ERL2005
41	Nb-Pb superconducting RF gun	Jacek Sekutowicz *, J. Iversen , G. Krebs , W.D. Moller et al.	EPAC 2006
42	Niobium Properties and SRF Cavity Performances, a tutorial presented at the Mini Workshop on SCRF Cavities	G. Myneni	Jan 28, 2007, Indore - India

# Invited Talks (also Published)

43	<b>Niobium Specifications and Performance of SRF Cavities</b>	Ganapati Myneni * , Peter Kneisel , R. E. Ricker et al.	APAC 2007
44	<b>Non-invasive Energy Spread monitoring for the JLAB Experimental Program Via SLI's</b>	Pavel Chevtsov * , Anthony Day , Jean-Claude Denard , Arne Freyberger et al.	ERL2005
45	<b>On Achromatic IP Design for Muon Collider</b>	Ya. Derbenev	Report at Muon Collider Task Force meeting, Fermilab, May 24, 2007
46	<b>OPERATIONAL ASPECTS OF HIGH POWER ENERGY RECOVERY LINACS</b>	Stephen Benson * , David Douglas , Pavel Evtushenko , Kevin Jordan et al.	LINAC 2006
47	<b>Overview: New Materials for SRF Cavities</b>	A-M. Valente-Feliciano	RF Superconducting Materials Workshop at Fermilab
48	<b>Parametric Resonance Ionization Cooling and Reverse Emittance Exchange for Low Emittance Muon Collider</b>	Ya. Derbenev	2nd Low Emittance Muon Collider Workshop (Fermilab)
49	<b>Parametric Resonance Ionization Cooling of Muons</b>	S. Bogacz * , Yaroslav Derbenev , Kevin Beard , Rolland Johnson	Nuclear Physics B, 155, 275-276 (2006)
50	<b>PCaPAC 2006 Proceedings</b>	Pavel Chevtsov * , Matthew Bickley	PCaPAC 2006
51	<b>Performance of Large grain and Single Crystal Niobium Cavities</b>	Peter Kneisel * , Gianluigi Ciovati , J. Sekutowicz	12th SRF workshop
52	<b>PERFORMANCES OF HIGH PURITY NIOBIUM CAVITIES WITH DIFFERENT GRAIN SIZES</b>	Gianluigi Ciovati * , Peter Kneisel , Ganapati Myneni , Ganapati Rao Myneni et al.	LINAC 2006
53	<b>Phase Noise Comparision of Short Pulse Laser Systems</b>	Shukui Zhang * , Stephen Benson , John Hansknecht , David Hardy et al.	28th International FEL Conference (FEL06)
54	<b>Phase Transfer Measurements at the Jefferson Lab Recirculated Linacs</b>	Geoffrey Krafft * , J. Hovater , Bruce Bowling , Mark Crofford	ERL2005
55	<b>PLASMA TREATMENT OF BULK NIOBIUM SURFACES FOR SRF CAVITIES</b>	H. Phillips * , Anne-Marie Valente , Marija Raskovic , L. Vuskovic et al.	EPAC 2006
56	<b>PONDEROMOTIVE INSTABILITIES AND MICROPHONICS - A TUTORIAL</b>	Jean Delayen *	12th SRF workshop
57	<b>Push-pull FEL, A New ERL Concept</b>	Andrew Hutton *	ERL2005
58	<b>RECENT DEVELOPMENTS IN SRF CAVITY SCIENCE AND PERFORMANCE</b>	Gianluigi Ciovati *	LINAC 2006
59	<b>Recent Innovations in Muon Beam Cooling</b>	Rolland Johnson , Alsharo'am Mohammed , Charles Ankenbrandt , Emanuela Barzi et al.	COOL05
60	<b>Research Opportunities - Applications and Evolution of SRF Science &amp; Technology</b>	G. Myneni	Dept. of Physics Graduate Students, UVa Sept 1, 2006
61	<b>Review of RF Measurement of SRF Samples</b>	C. Reece	RF Superconducting Materials Workshop at Fermilab
62	<b>Review of the Frontier Workshop and Q-slope results</b>	Gianluigi Ciovati *	12th SRF workshop; Physica, Volume 441, Issue 1-2, p. 44-50

# Invited Talks (also Published)

63	RF System High Power Amplifier Software Conversion at Jefferson Lab	George Lahti * , Hai Dong , T. Seegerger	PCaPAC 2006
64	SIMULATION AND OPTIMISATION OF A 100MA DC PHOTO-INJECTOR	Fay Hannon , Carlos Hernandez-Garcia	EPAC 2006
65	Simulations of MANX, A Practical Six Dimensional Muon Beam Cooling Experiment	Kevin Beard * , Katsuya Yonehara , S. Bogacz , Yaroslav Derbenev et al.	COOL05
66	Solar Energy – Hydrogen Powered Green Villages	G. Myneni	Siddartha Engineering College, Vijayawada, India Feb 5, 2007
67	SRF Cavity Design Optimization for High Current ERL	H. Wang	ERL 2007 Workshop
68	SRF Technology - Non-expert Perspective	G. Myneni	Raja Ramanna Center for Advanced Technology, Indore, India Aug 7, 2006
69	STATUS AND FUTURE DEVELOPMENTS IN LARGE ACCELERATOR CONTROL SYSTEMS	Karen White *	International Computational Accelerator Physics Conference
70	Status and Future Developments in Large Accelerator Control Systems	K. White	International Computational Accelerator Physics Conference
71	Status of DC High Voltage GaAs Photoguns	M. Poelker	PAC07, Albuquerque, NM, June 26-30, 2007
72	Summary of the Single Crystal Nb Workshop	Ganapati Myneni *	TESLA Technology Collaboration Meeting
73	Summary Report on Synchronization, Diagnostics and Instrumentation	Arne Freyberger * , Geoffrey Krafft	ERL2005
74	Superfluid Helium and the Bose-Einstein Condensation	J. Delayen	Inter-University Accelerator Center, New Delhi, India, 8 February 2007
75	Surface R&D for superconducting radio frequency cavities at Jefferson Lab	A. Wu	Symposium on Surface Science 2007
76	Technical Challenges of Muon Colliders	Rolland P. Johnson , Yaroslav Derbenev	NuFact05
77	TEM and SIMS Analysis of (100), (110), and (111) Single Crystal Niobium	A.D. Batchelor , D.N. Leonard , P.E. Russell , F.A. Stevie et al.	Single Crystal Niobium Technology Workshop
78	The Interactions of Surface Damage on RF Cavity Operation	Jim Norem , Ahmed Hassanein , Z. Insepov , Alan Bross et al.	EPAC 2006
79	THE JLAB AMPERE-CLASS CRYOMODULE CONCEPTUAL DESIGN	Robert Rimmer * , Edward Daly , William Hicks , James Henry et al.	EPAC 2006
80	The JLab high power ERL light source	George Neil * , Christopher Behre , Stephen Benson , Michael Bevins et al.	ERL2005
81	The MUCOOL RF Program	Jim Norem , Alan Bross , Alfred Moretti , Barry Norris et al.	EPAC 2006
82	The Spoke Cavity: Genesis and Properties	J. Delayen	LANL, 7 December 2006
83	TRANSIENT PONDEROMOTIVE EFFECTS IN SUPERCONDUCTING CAVITIES	G. Davis * , Thomas Powers	12th SRF workshop
84	Tuning Concepts for PIC and REMEX	Ya. Derbenev	PIC and REMEX Simulation Workshop (Fermilab, May 2007)

# Invited Talks (also Published)

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85	<b>Two Topics in Accelerator Science: 1-A General Model of Cumulative Beam Breakup in Linear Accelerators, 2-The Critical Field of Superconductors as Fundamental Limitations in Superconducting Accelerating Structures</b>	J. Delayen	Old Dominion University, 12 September 2006
86	<b>Upgrading the CEBAF Accelerator to 12 GeV</b>	Leigh Harwood *	PANIC05
87	<b>Using high-pressure gas in the front end of a muon source</b>	K. Paul , Rolland Johnson , T.J. Roberts , David Neuffer et al.	NuFact05
88	<b>XHV: the need, production and measurement</b>	M. Stutzman	53rd AVS Symposium
89	<b>XTREME OPTICS: THE BEHAVIOR OF CAVITY OPTICS FOR THE JEFFERSON LAB FREE-ELECTRON LASER</b>	Michelle Shinn * , Christopher Behre , Stephen Benson , David Douglas et al.	XXXVIII Boulder Damage Symposium
90	<b>Zeroth Design Report for the Electron-Ion Collider at CEBAF</b>	Ya. Derbenev	



# Refereed Publications

<b>Physics Review E</b>		
Canonical Formulations and Cancellation Effect in Electrodynamics of Relativistic Beams on a Curved Trajectory	Rui Li * , Yaroslav Derbenev	To Appear in 2007
Thomson scattering of polarized photons in an intense laser beam	Byung Yunn *	To Appear in 2007
<b>Physics Review C</b>		
Extraction of the neutron magnetic form-factor from quasi-electric polarized-He-e (polarized, e-prime) at $Q^2 = 0.1 - 0.6 \text{ (GeV/c)}^2$ .	Jefferson Lab E95-001 Collaboration (Y. Roblin)	Phys.Rev.C75:034003, 2007
<b>Physics Review Special Topics AB</b>		
Field Emission in CEBAF's RF Cavities and Implications for Future Accelerators	Jay Benesch *	To Appear in 2007
Beam breakup due to resistive-wall wake with arbitrary beam current profile	Jean Delayen * , Juhao Wu	To Appear in 2007
A high average current polarized electron source with long cathode operational lifetime	Charles Sinclair , Anthony Favale , Bruce Dunham , John Hansknecht et al.	Vol 10, Issue 2, Pg 023501
Generation of Electron Bunches at Low Repetition Rates Using a Beat-Frequency Technique	Benard Poelker * , Joseph Grames , John Hansknecht , Reza Kazimi et al.	Vol 10, Issue 5, Pg 053502
Experimental Investigation of Multibunch, Multipass Beam Breakup in the Jefferson Laboratory Free Electron Laser Upgrade Driver	Christopher Tennant * , David Douglas , Kevin Jordan , Nikolitsa Merminga et al.	Vol 9, Issue 6, Pg 064403
Synchronous Photoinjection Using a Frequency-Doubled Gain-Switched Fiber-Coupled Seed Laser and ErYb-Doped Fiber Amplifier	John Hansknecht * , Benard Poelker	Vol 9, Issue 6, Pg 063501
The effects of surface damage on RF cavity operation	Robert Rimmer * , Ahmed Hassanein , J. Norem , A. Moretti et al.	Vol 9, Issue 6, Pg 062001
Measurement of the high-field Q-drop in a high-purity large-grain niobium cavity for different oxidation processes	G. Ciovati, P. Kneisel, A. Gurevich,	Vol. 10, Issue 6, id. 062002
Development of a high average current polarized electron source with long cathode operational lifetime, 2007	C.K. Sinclair, P. Adderley, B.M. Dunham, J. Hansknecht, P. Hartmann, M. Poelker, J.S. Price, P.M. Rutt, W.J. Schneider, M. Steigerwald	Phys.Rev.ST Accel.Beams

# Refereed Publications

<b>Physical Review Letters</b>		
Scaling tests of the cross-section for deeply virtual Compton scattering.	By Jefferson Lab Hall A Collaboration and Hall A DVCS Collaboration (C. Munoz, Camachoet al.) (Y. Roblin)	97:262002, 2006
<b>Nuclear Instruments and Methods in Physics Research</b>		
Investigation of local losses as a function of material removal in a large-grain superconducting niobium cavity	Gianluigi Ciovati *, Peter Kneisel	To Appear in 2007
Characterization of the CEBAF 100 kV DC GaAs Photoelectron Gun Vacuum System	M. Stutzman, et al.	Vol 574, Issue 2, Pg 213-220
Plasma Treatment of Bulk Niobium Surface for SRF Cavities	Marija Raskovic , H. Phillips , Anne-Marie Valente	Vol 569, Issue 3, Pg 663-670
Design, construction and performance of all niobium superconducting radio frequency electron gun	T. Rao , Ilan Ben-Zvi , Andrew Burrill , H. Hahn et al.	Vol 562, Issue , Pg 22-33
Non-invasive Energy Spread monitoring for the JLAB Experimental Program Via SLI's	Pavel Chevtsov *, Anthony Day , Jean-Claude Denard , Arne Freyberger et al.	Vol 557, pg 324-327
"Energy Recovery Linacs 2005"	edited by S. Chattopadhyay and L. Merminga	Vol 557, 2006
<b>Nuclear Physics B</b>		
The Scattering of Muons in Low Z Materials	J.W., Murray, et a. (A. Bogacz)	B251 41-55, (2006)
Parametric Resonance Ionization Cooling of Muons	S. A. Bogacz	B155, 334-335 (2006)
Gas cluster ion beam surface treatments for reducing field emission and breakdown of electrodes and SRF cavities	D.R. Swenson, A.T. Wu, E. Degenkolb, and Z. Insepov,	B261 (2007) P630
<b>Applied Optics</b>		
A Single-Lens Laser Beam Shaper for Uniform Flat-Top Profiles	Shukui Zhang *, George Neil , Michelle Shinn	To Appear

# FY08 Lab Director's Priorities

*President's Budget = \$103.2M*

- Obtain 12 GeV CD-3 Approval
- Achieve Scientific Objectives:
  - Coulomb Sum Rule (E05-110) → Test of in-medium modification of proton structure.
  - G9 FROST → Baryon resonance search.
  - G12 Initial Search for Exotic Mesons → Test of understanding of non-perturbative QCD.
  - Proton Electric Form Factor at Highest Possible  $Q^2$  → Is there a cross over?
  - LQCD calculation of excited baryon and hybrid meson resonance spectrum using anisotropic clover lattices.
  - Fully Staff EBAC → Complete analysis of h and k photoproduction; continue development of coupled channel analysis tools.



# FY08 Lab Director's Priorities

*President's Budget = \$103.2M*

- Meet Facility Performance Goals:
  - Weeks of Operation = 34.2
  - Research Hours  $\geq 4,435$
  - Beam Studies Hours  $\approx 370$
  - Setup/Tuning Hours  $\leq 246$
  - Operating Hours  $\geq 5,051$
  - Unscheduled Shutdown  $\leq 689$
- Extend Beam Energy Reach to Support Physics Program
  - 5.7 GeV by March 24, 2008
  - 5.9 GeV by July 30, 2008
- Complete Experiments:
  - Hall A
    - E05-110 Coulomb Sum Rule
    - E05-010/E05-011 Transversity
    - E04-007  $\pi^0$  electroproduction
  - Hall B
    - g9
    - g12
  - Hall C
    - E03-109 SANE
    - E04-108 GEp
    - Polarization transfer in Wide angle Compton Scattering
- Construct Experimental Apparatus for FY08 and Beyond
- Increase Staff Research (add specifics)



# FY08 Lab Director's Priorities

*President's Budget = \$103.2M*

- Complete Funded 6 GeV Hardening Projects:
  - Refurbish Three Cryomodules (C-50)
  - Rebuild 30 Klystrons
  - Procure New RF Sources (AIP)
  - Continue BPM Upgrade (AIP)
  - Upgrade CHL Control Systems (AIP)
- Initiate process improvements needed for ISO-9001
- Meet Maintenance Investment Index Goal of at Least 2%
- Achieve CD-2 for Technical Engineering Development Facility (SLI)
- Upgrade Fire Alarm System (GPP)
- Start Construction of Technical Support Building (GPP)
- Procure Computer Infrastructure Upgrade (UPS Prep)



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# Questions??