

ATAP All-Hands Meeting

Wim Leemans

Division Director

Accelerator Technology & Applied Physics

July 28th, 2016



U.S. DEPARTMENT OF
ENERGY

Office of
Science

ACCELERATOR TECHNOLOGY &
APPLIED PHYSICS DIVISION



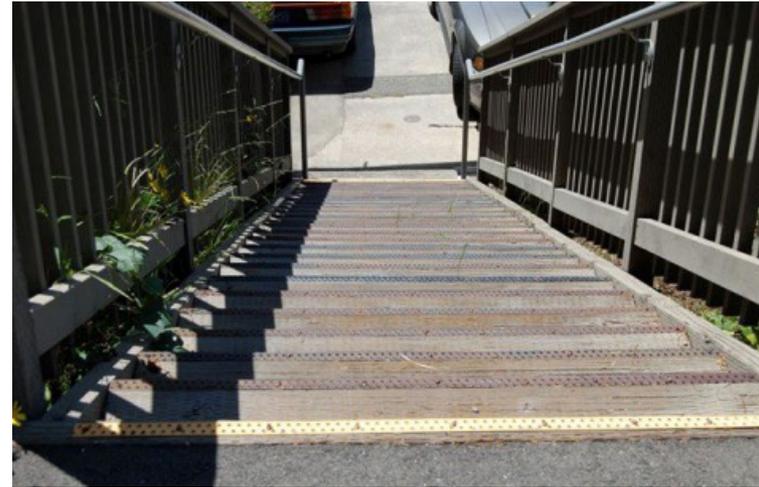
Today's Agenda

- **Our People**
 - Welcoming New Colleagues
 - Recognizing Accomplishments
- **Science and Technology Highlights**
- **Operations Update**
 - Outreach and Diversity
 - Communication
 - Safety
- **Picnic!** (Noon, Codornices Park)



First, A Minute for Safety: Preventing Slips, Trips, and Falls

- **Slips, Trips, and Falls = #2 injury cause at LBNL in FY16**
 - 6 recordable slips & falls Lab-wide; 1 ATAP first aid
- **Greatest risk: stairs, wet surfaces, construction zones**
- **Prevention:**
 - Be aware of walking surface, avoid distractions
 - Watch for signs and changes in construction zones
 - Use handrails
 - Wear appropriate shoes
- **If you fall, report it immediately**



Our Progress Is Made Possible By Our People

ATAP Touch or click here for divisional information
ACCELERATOR TECHNOLOGY & APPLIED PHYSICS DIVISION



ENGINEERING DIVISION >
Arbelaz, Diego
Baptiste, Ken



POSTDOCS >

STUDENTS >
Barth, Daryl
Brown, Hunter Hayes
Blaciard, Guillaume
Chen, Qi
Daniels, Joost



AFFILIATES Retirees, alumni, and guests >



Office of Science

ACCELERATOR TECHNOLOGY & APPLIED PHYSICS DIVISION



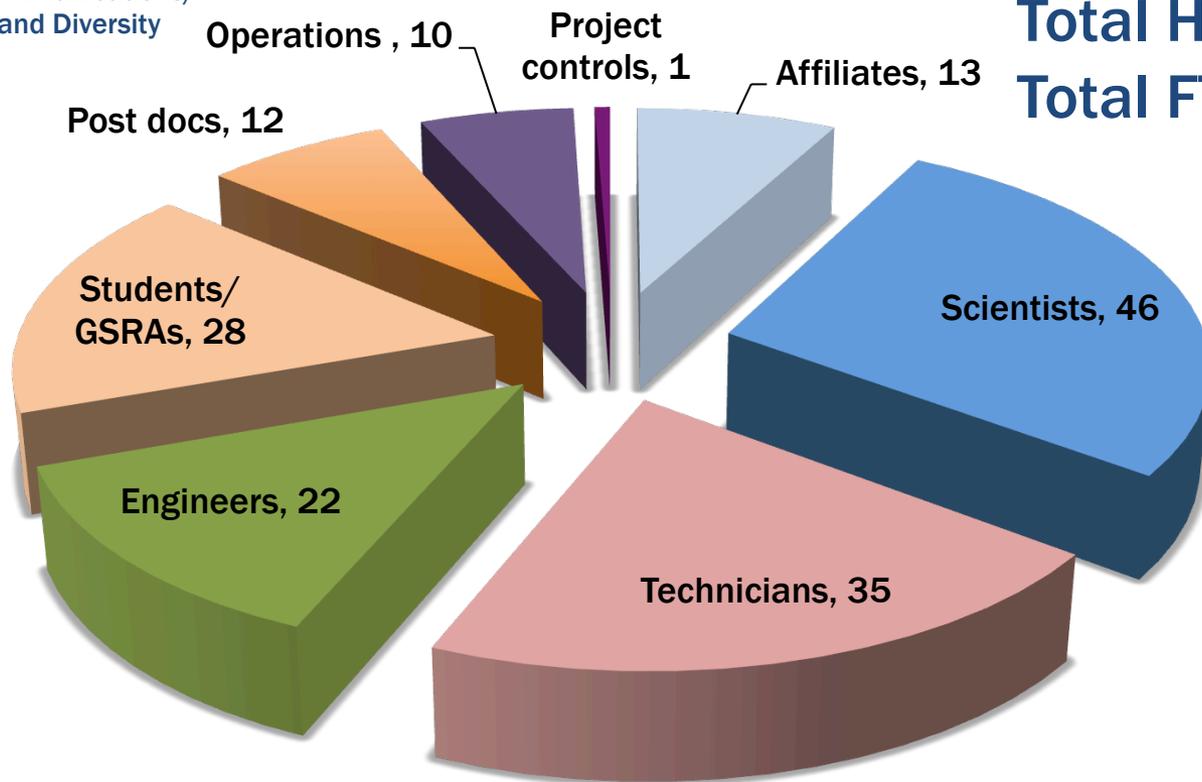
ATAP Works With a Significant Fraction of Matrixed Engineering Personnel As Well As Students And Postdocs

*Operations includes Finance/Business Development - Proposals/ EH&S/HR/Admin/Communications/ Outreach, Education and Diversity

FY 15

Total Headcount = 167

Total FTE count = 127



Typically 25-30 students and up to 20 postdocs each year
Senior and staff scientists are leaders in their field and attract top talent

We work with many divisions at LBNL and domestic and overseas labs/institutions

Welcome to the Recent Additions to the ATAP Division (since January 2015)



Samuel Barber
BELLA
Nov. 2015



Lucas Brouwer
SMP
June 2015



Stepan Bulanov
BELLA
June 2015



Kyung Ryun Hwang
CBP
June 2016



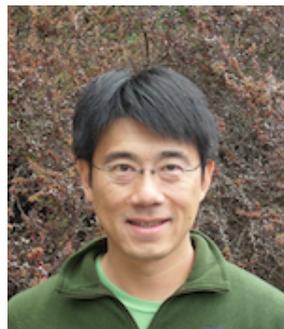
Serena Persichelli
CBP
May 2016



Emmanuele Ravaioli
SMP
Nov. 2015



Tengming Shen
SMP
October 2015



Hai-En Tsai
BELLA
Aug. 2015



Yawei Yang
CBP
Oct. 2015



Liyang Ye
SMP
January 2016

Two new 2016 awardees brings ATAP's Early Career Research Program projects to a total of four

- Prestigious and competitive Office of Science program
- Within 10 years since PhD



2016

Chad Mitchell,
Compensation of Non-Linear Space Charge Effects in Accelerator Lattices
Center for Beam Physics



2016

Jeroen van Tilborg,
A Compact Laser Plasma Accelerator Based FEL for Ultrafast Hyperspectral Experiments
BELLA Center



2014

Daniele Filippetto,
High Repetition Rate Ultrafast Electron Diffraction
Center for Beam Physics



2012

Tengming Shen,
Engineering High Field Superconducting materials for Frontier Accelerators
BCMT

Other Recent Major Awards



ELI 2016 Wolfgang Sandner Scientific Excellence Prize for Young Researchers:
Henri Vincenti, 2016



Society of Vacuum Coaters Nathaniel H. Sugerman Memorial Award:
André Anders, 2016



American Physical Society Nicholas Metropolis Award for Outstanding Doctoral Thesis Work in Computational Physics: Rémi Lehe, 2015*



US LHC Accelerator Research Program Toohig Fellowship:
Emmanuele Ravaoli, 2015



LBNL Director's Award for Exceptional Achievement: Christoph Steier (*r.*), ATAP, and Arnaud Madur, Engineering, on behalf of the ALS Brightness Upgrade Team, 2015



US Particle Accelerator School Iron Man Award
John Byrd (*r.*, receiving award from W.A. Barletta), 2016



IEEE Council on Superconductivity Award for Continuing and Significant Contributions in the Field of Applied Superconductivity Shlomo Caspi, 2016

* For work performed at École Polytechnique prior to LBNL appointment

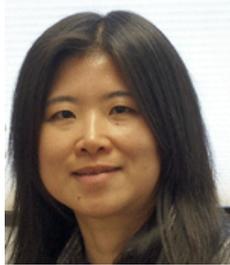
Five-Year Service Milestones, CY15-present

10



Gang Huang

15



Qing Ji



Soren Prestemon



GianLuca Sabbi



Carl Schroeder



Fernando Sannibale

20



Tom Scarvie



Thomas Schenkel



Derun Li

25

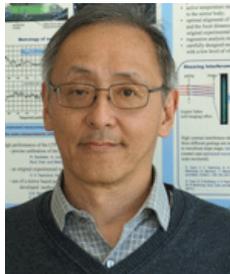


Dan Dietderich

30



Bernhard
Ludewigt



Hiroshi
Nishimura



Rob Ryne



Peter Seidl

Thanks to everyone for helping make ATAP and LBNL a workplace where good people find enduring satisfaction and opportunity

ATAP All-Hands Meeting

Status and Strategies



ATAP Strategy Has Three Key Elements

- **Contributing to today's national and international priorities**
 - DOE-BES: LCLS-II (gun, undulators, modeling)
 - DOE-HEP: LHC (magnets, modeling, RF feedback), LBNF with PIP-II
 - DOE-NP: FRIB (magnets, ECR sources)
- **Strengthening and reinventing our facilities**
 - ALS -> ALS-U
 - BELLA -> Part of national roadmap for advanced accelerators, including k-BELLA and BELLA-i initiatives
- **Discovery science and technological innovation**
 - Advanced accelerators and radiation sources
 - Advanced magnets
 - Discovery plasma science
 - Applications

Building for Discovery
Strategic Plan for U.S. Particle Physics in the Global Context



Report of the Particle Physics Project Prioritization Panel (P5)

May 2014

We are Partner Of Choice for Current Major National and International Priorities/Projects

A few examples...

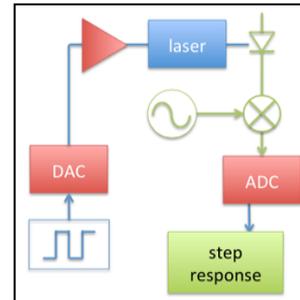
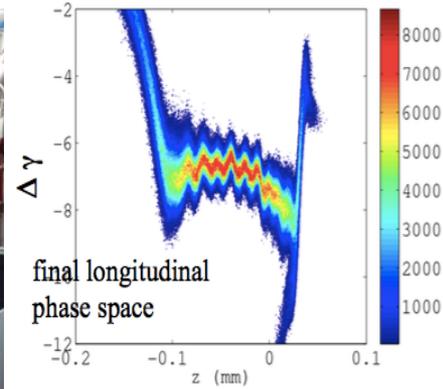
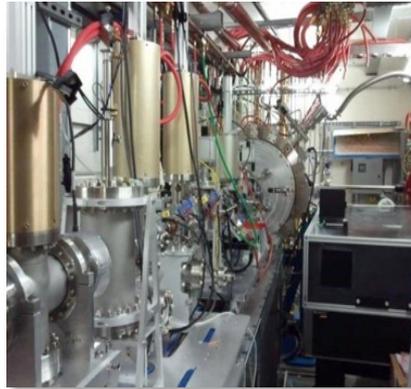
Prototype LCLS-II undulator in magnetic measurements facility

LCLS-II prototype APEX Injector Gun

LCLS-II Beam dynamics modeling

Timing, feedback, LLRF systems

BES

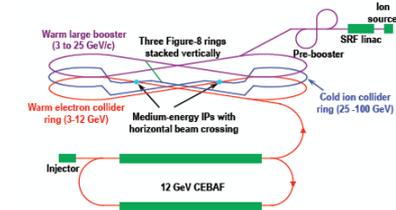
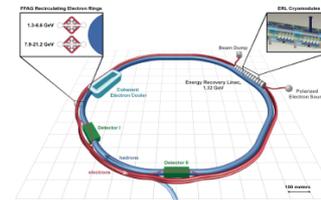
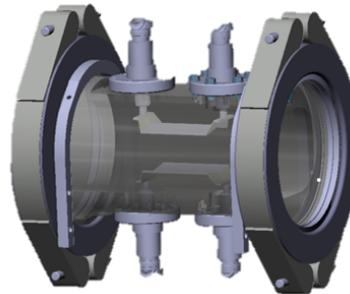
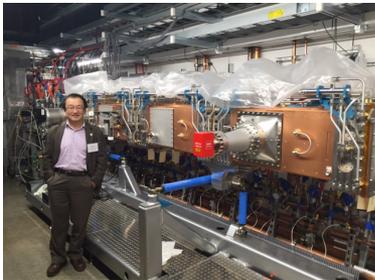


PIP-II Radio Frequency Quadrupole

SPS Kicker

Electron-Ion Collider

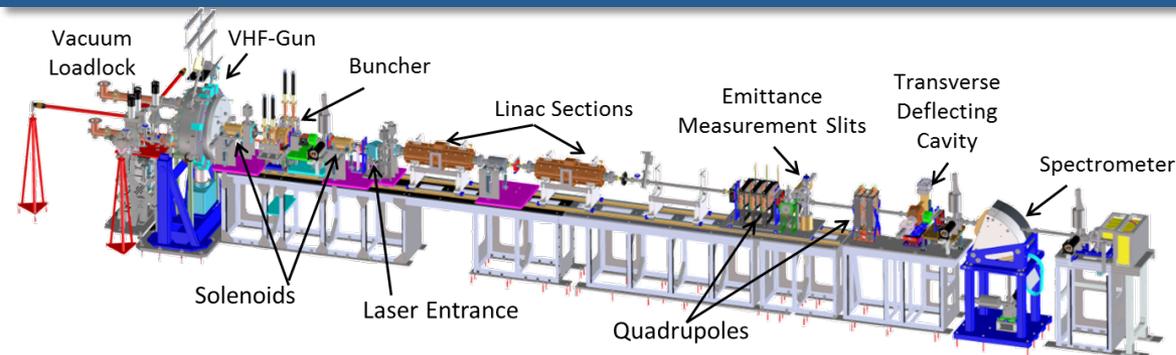
HEP



And Magnets...

APEX Demonstrates Major LCLS-II Milestones

All formal beam dynamics requirements for LCLS-II demonstrated with margin



Fabrication of the new VHF-Gun for the LCLS-II injector initiated at LBNL shops

Quantity	Required	Measured	Demonstrated
Charge per bunch [pC]	> ~ 20	20-25	😊
Normalized emittance [mm]	< ~ 0.25	~ 0.20*	😊
Bunch peak current [A]	> ~ 5	5 - 9	😊
Energy Spread (H.O. whole beam) [keV]	< ~ 15	< 9**	😊

* After accounting for space charge contribution

** Value affected by space charge. Much smaller values at LCLS-II injector energies.



APEX Phase-II Fully Installed in the BTF

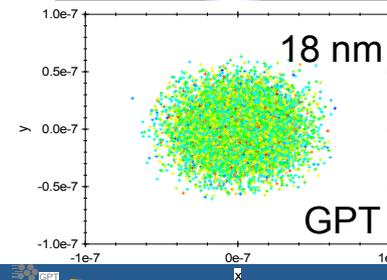
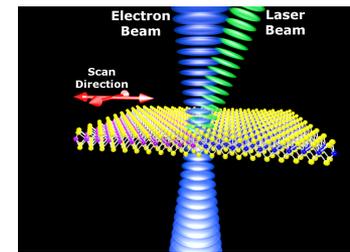
APEX Opens Up New Directions and Opportunities

APEX: a unique injector facility for testing

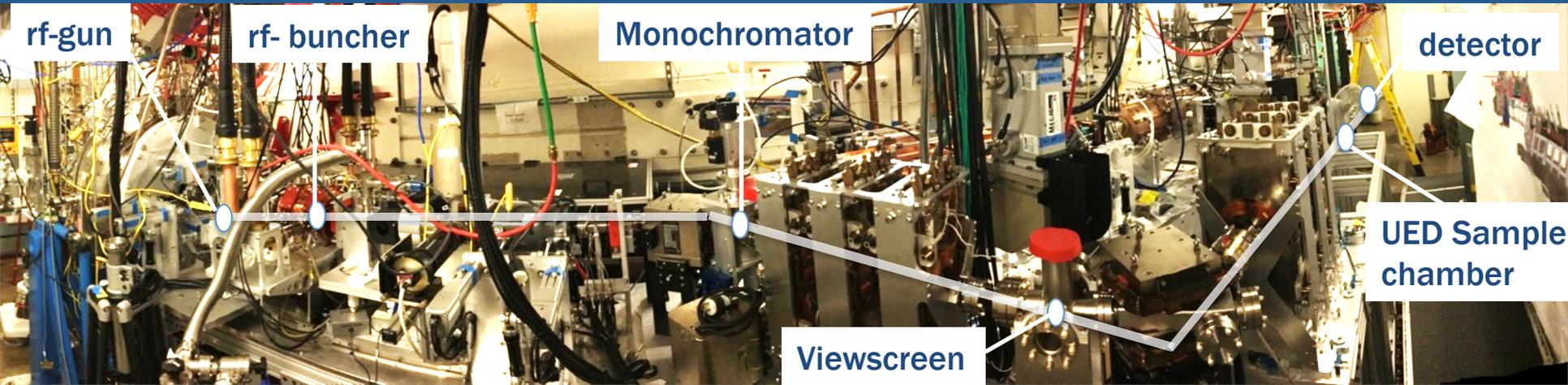
- High brightness beam dynamics studies for FEL UED, ... applications
- Cathodes for FEL, UED, UEM applications
- Exotic insertion device schemes (HTC tape undulator, ...)
- Plasma lenses
- ICS, THz, IR FEL production schemes
- Diagnostics systems for extremely low charge and/or high repetition rate

HiRES-U: Ultrafast beams at high repetition rates for science and technology R&D

- Femtosecond electron-laser synchronization
- Sub-femtosecond generation of laser and electron pulses
- Large bandwidth diagnostic tools with attosecond-nanometer accuracy
- Nano-sized electron beams for nanodiffraction and imaging
- Gas/droplet injectors for chemistry and biology experiments

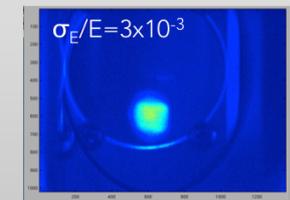
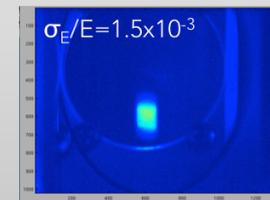
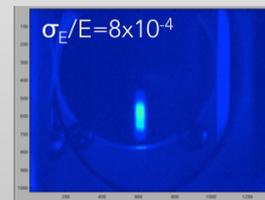
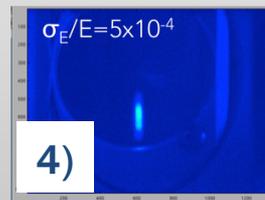
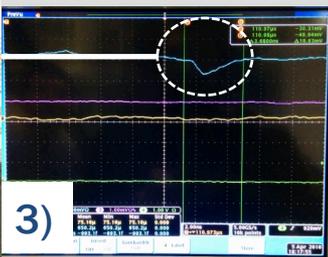
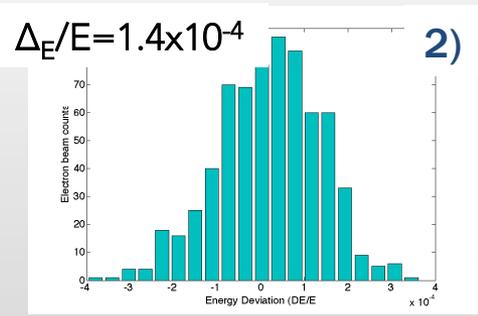
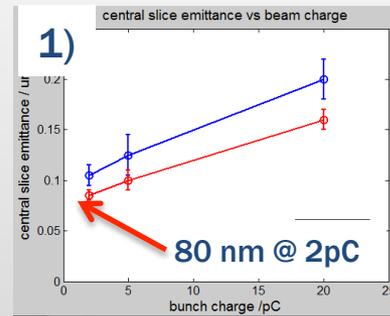


The HiRES Beamline Has Been Fully Installed, and e⁻ Beam Commissioning Started



Beam measurements on the UED line:

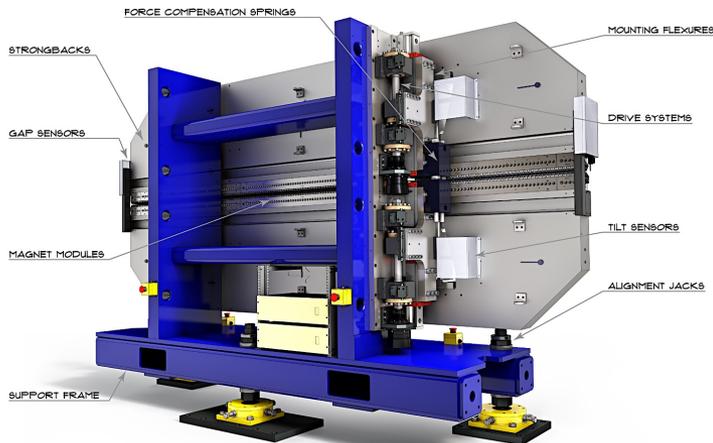
- 1) Beam emittance at the detector for small Q
- 2) Gun amplitude jitter through beam energy
- 3) Test diagnostic or ultralow charge beams (10 fC)
- 4) Measured monochromated beam at the viewscreen as function of slit aperture



Energy Axis

Rigorous Undulator Validation Program Coming to Fruition

- **SXR pre-production unit completed**
 - Magnetic measurements at LBNL this summer
- **Production contracts awarded**
 - First undulator delivered to SLAC winter 2016
 - Last undulator delivered to SLAC spring 2018
- **HGVP design completed**
 - Pre-production unit in fabrication
 - Magnetic measurements at LBNL this fall
- **Production contracts being finalized**
 - First undulator delivered to SLAC summer 2017
 - Last undulator delivered to SLAC summer 2018



MaRIE at LANL Could Become Another Major FEL Initiative Where ATAP Can Contribute

- **MaRIE (Matter-Radiation Interactions in Extremes) received CD-0**
 - Fills gap in fundamental understanding of materials important for key National Nuclear Security Administration (NNSA) missions
- **Challenging machine design**
 - X-ray pulses from 4 to 42–60 keV, 5×10^{10} ph/pulse, bandwidth $< 2 \times 10^{-4}$
 - 12 GeV superconducting linac
 - 0.1 nC, $\leq 0.2 \mu\text{m}$ emitt. (norm.), $\leq 0.015\%$ slice energy spread
- **Mutual interest in developing LBNL roles:**
 - Multiphysics, high-resolution modeling
 - Superconducting undulators
 - Hybrid (SC- and permanent-magnet) undulators
 - Low-level RF



MaRIE Timeframe: CDR within ~2 years

PIP-II CW RFQ Commissioned to Full RF Power, 5% DF Beam

Newsroom

- News and features
- Press releases
- Photo gallery
- Fact sheets and brochures
- Media contacts
- Subscribe to Fermilab Frontiers

Fermilab news Search

Useful links

- Symmetry magazine
- Interactions

Interact



Upgraded PIP-II RFQ successfully takes first beam

May 25, 2016 | [Rashmi Shivni](#)

[Share](#) [Tweet](#) [G+1](#) [Email](#)



This photo of the RFQ for the Fermilab PIP-II accelerator was taken during the assembly phase at Lawrence Berkeley National Laboratory. Photo courtesy of Andrew Lambert, Berkeley Lab

In March, the Fermilab Accelerator Division successfully sent beam through a newly commissioned linear accelerator. The brand new radio-frequency quadrupole (RFQ) linac, designed and built by a team of engineers and physicists at Lawrence Berkeley National Laboratory, will be the start for a proposed upgrade to Fermilab's 800-MeV superconducting linear accelerator.

"The RFQ is one of the biggest challenges faced by our group," said Derun Li, lead scientist on the RFQ development team and deputy head of the Center for Beam Physics at Berkeley Lab. "And seeing it take nearly 100 percent of the source beam on its first try is great!"

The new, front-end accelerator is one of several upgrade projects conducted under PIP-II, a plan to overhaul the Fermilab accelerator complex to produce high-intensity proton beams for the lab's multiple experiments. PIP-II is supported by the DOE Office of Science.

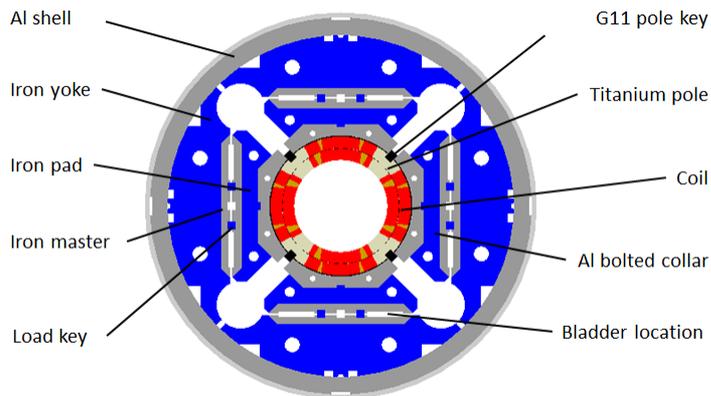
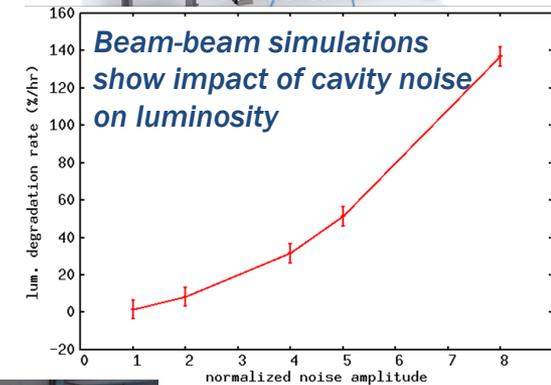
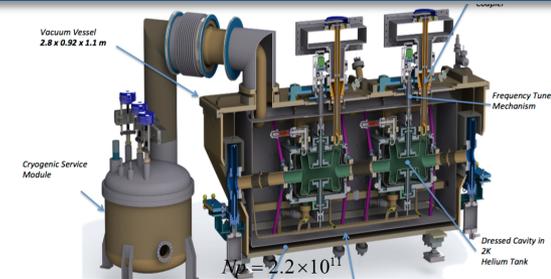
Currently located at the Cryomodule Test Facility, approximately 1.5 miles northeast of Wilson Hall, the RFQ took first beam – 100-microsecond pulses at 10 hertz – during its first testing phase. Since its first run in March, the team has been working on various commissioning activities, including running the pulsed beam

We built a similar RFQ as a SPP in China in 2015. Saved over \$1M for PIP-II RFQ. Delivers a world record >11 mA proton current.

Critical component of any high intensity proton beam accelerator. Major contribution to US High Energy Physics neutrino physics program.

We Provide Many Contributions to LARP, and the LHC HL-AUP has received CD-0!

- Significant contributions on multiple fronts:
 - Crab cavities
 - Beam-beam modeling
 - Magnets:
 - Successful test of the final model magnet
 - Clear LBNL roles as we proceed towards a project
 - Responsible for all US cables
 - Responsible for all US magnet assemblies



ATAP All-Hands Meeting

Advanced Light Source & ALS-Upgrade



U.S. DEPARTMENT OF
ENERGY

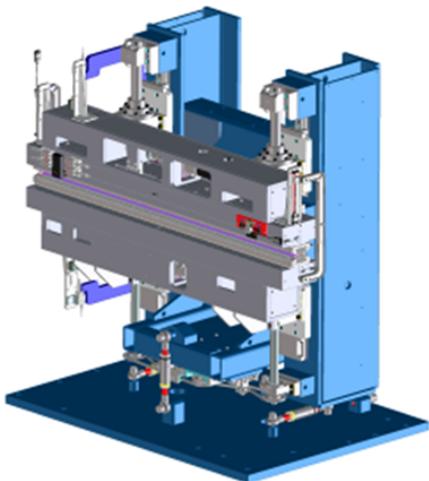
Office of
Science

ACCELERATOR TECHNOLOGY &
APPLIED PHYSICS DIVISION

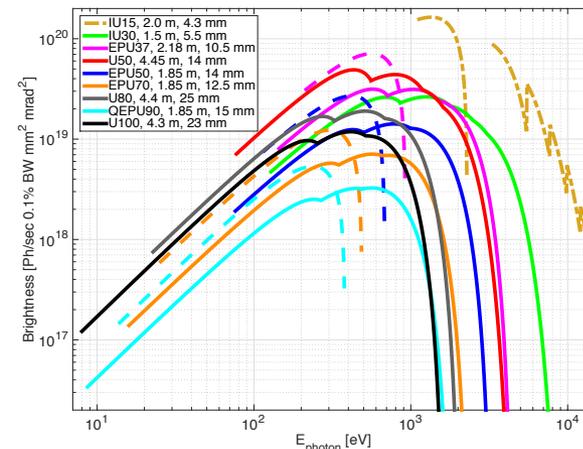
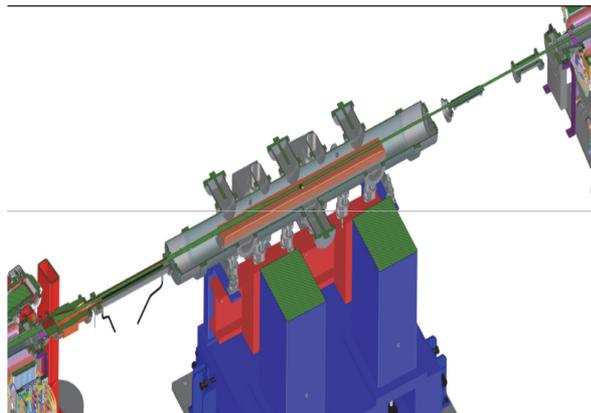


Major Progress on Near Term ALS Upgrades

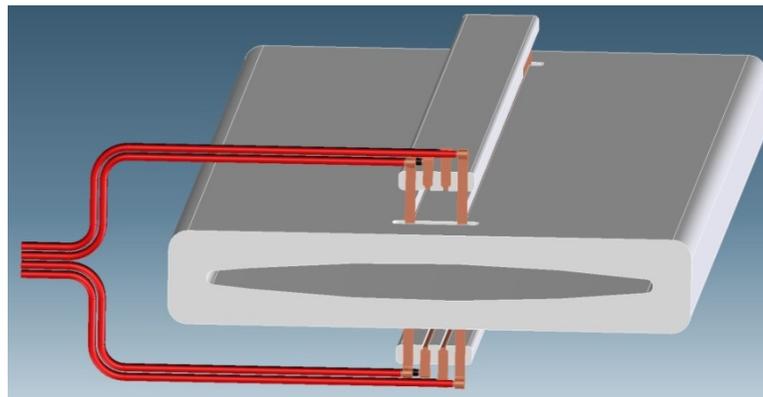
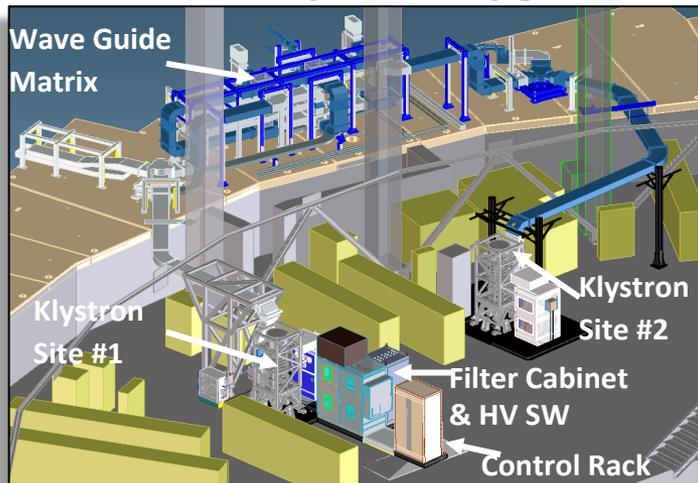
COSMIC EPU



LEDA Undulator for GEMINI: extending undulators to harder X-rays



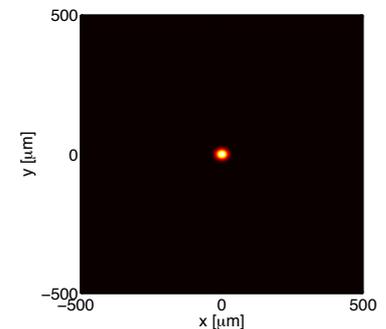
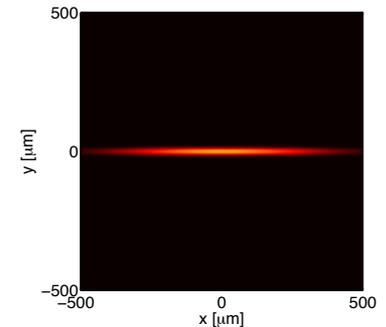
Accelerator component upgrades



Nonlinear storage ring injection kicker

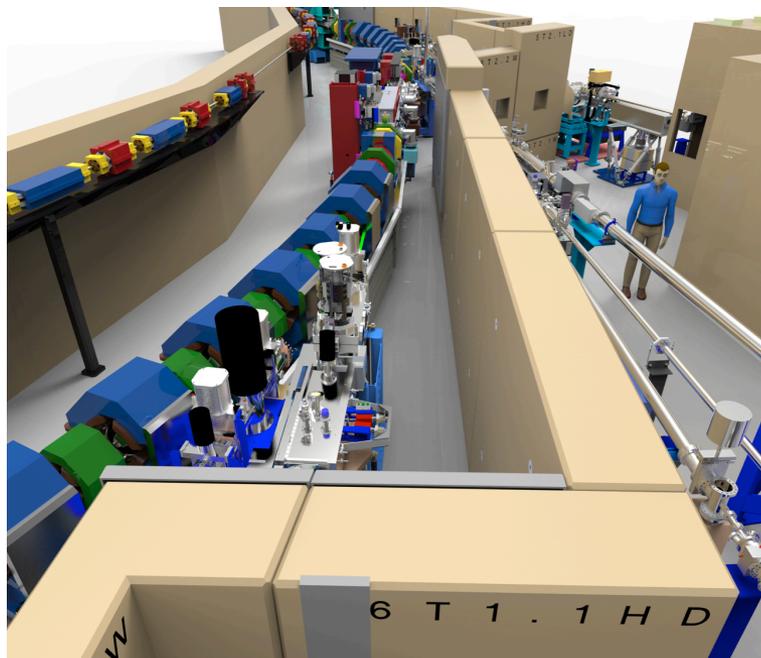
The Advanced Light Source Upgrade

- **ALS** is now the most productive source in the world for soft x-ray science
- **ALS-U** will provide orders of magnitude more coherent flux
 - The ALS-U design is based on the multibend achromat lattice that is being adopted by all new and upgraded facilities.
 - High coherent flux will make it possible to resolve nanometer-scale features and interactions and will allow real-time observation of chemical processes.

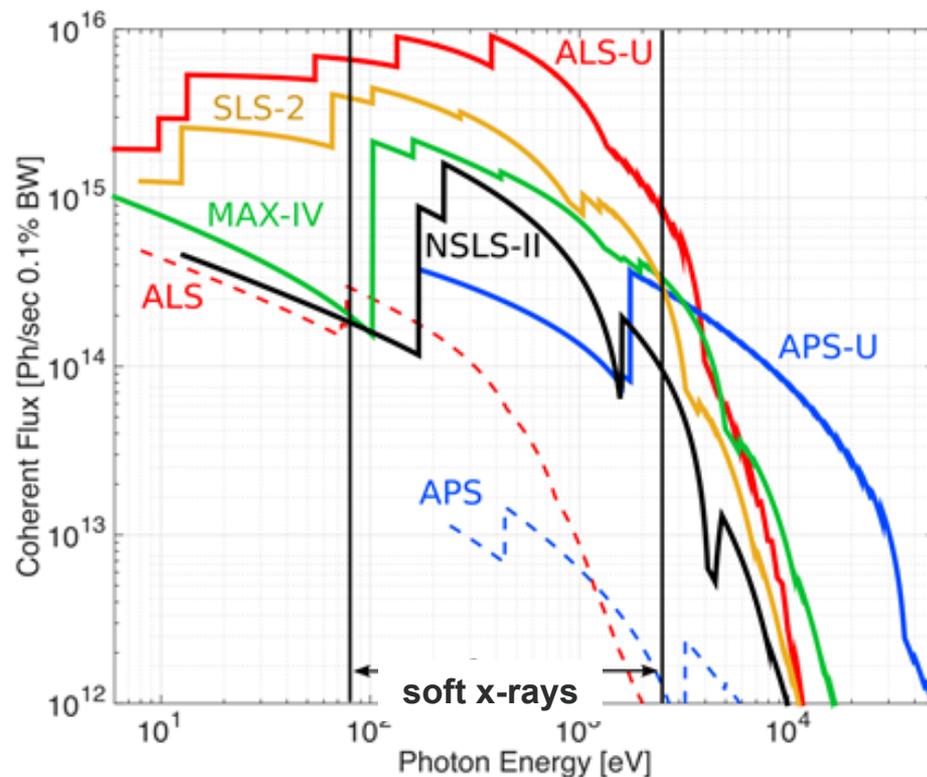


ALS-U: Designed to be the World's Highest Coherent Flux Soft X-ray Synchrotron Light Source

Major Upgrade of the ALS



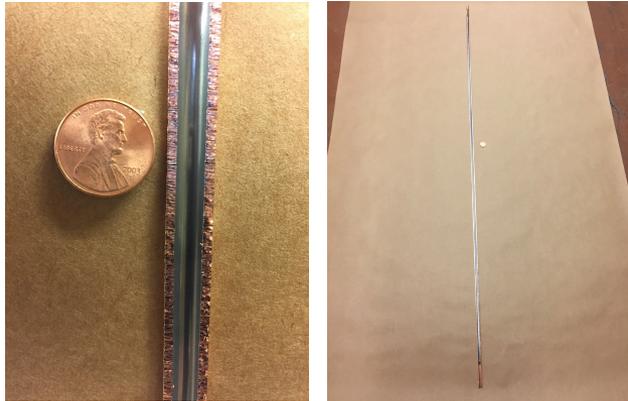
Highest Coherent Flux



ALS-U will not be surpassed by any currently envisioned storage ring technology

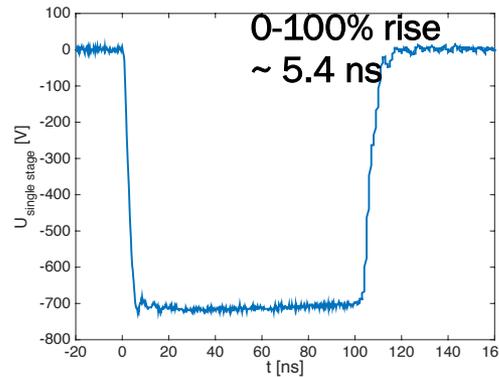
Excellent Progress On Accelerator R&D and Pre-Project Development; Awaiting CD-0

Very small NEG coated vacuum chambers

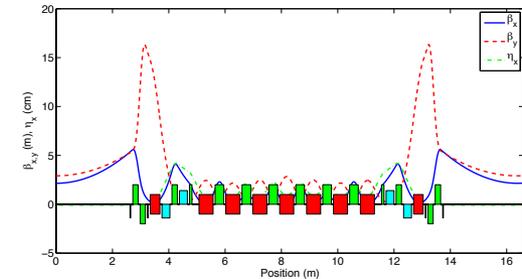


Coated 6 mm chamber (world record)

On-axis Injection – Fast pulsed magnets



Physics Design Optimization

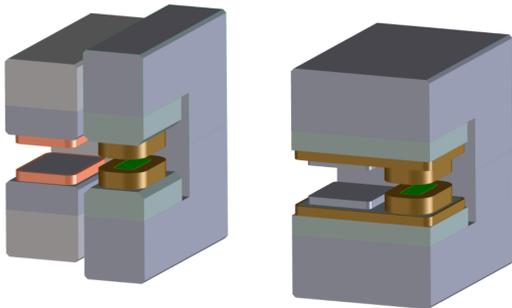


“Absolutely central... Ready to initiate construction”
—BESAC subcommittee

“Highest priority project at the Laboratory”
—LBNL Director Witherell

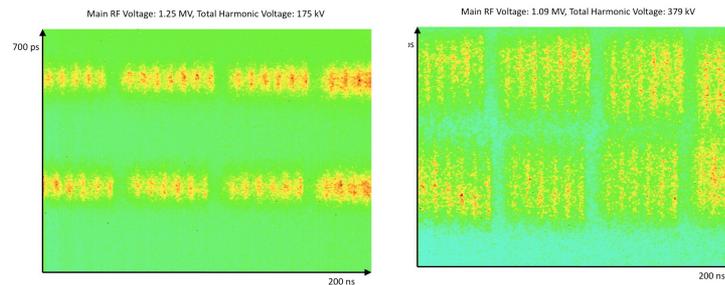
Proposal submitted
Awaiting CD 0 approval

Magnets – SR Production



Developing Superbend options

Harmonic Cavities - Transients



Achieved needed bunch lengthening with ALS-U bunch trains in ALS (3HC)

ATAP All-Hands Meeting

Advanced Ultra-Compact Accelerators



U.S. DEPARTMENT OF
ENERGY

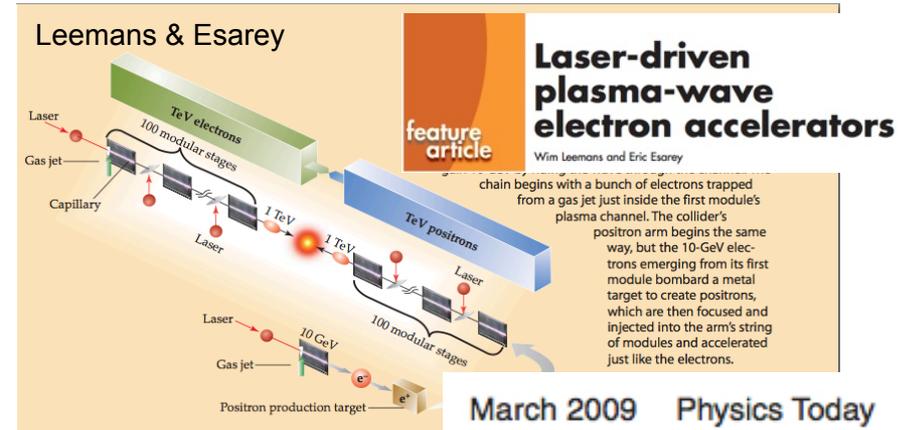
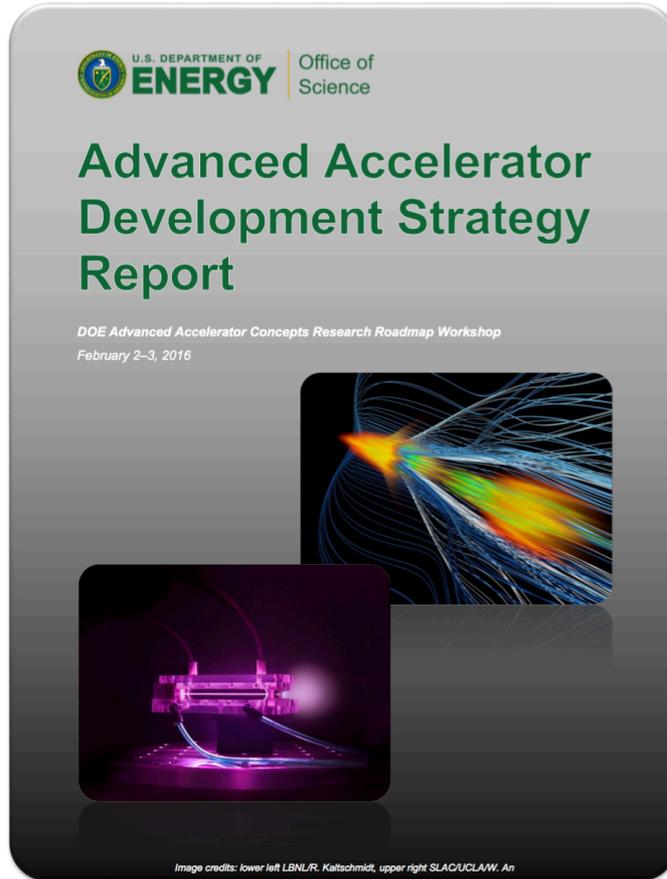
Office of
Science

ACCELERATOR TECHNOLOGY &
APPLIED PHYSICS DIVISION



A Roadmap for Future Colliders Based on Advanced Accelerators Contains Key Elements for Experiments and Expansion of BELLA

- DOE Workshop resulted in national strategy report



- Key elements for laser based approach over next 10 years:
 - 10 GeV module: builds on 4.3 GeV result on BELLA from 2014 (W.L. et al., PRL2014)
 - Staging-2.0 on BELLA: builds on successful staging demonstration on TREX laser (Steinke et al., Nature 2016)
 - High average power demonstrator
 - Radiation sources:
 - FEL
 - Gamma ray source

Compact Accelerator Based Initiative was a Finalist at DOE's Big Idea Summit in Washington on April 21-22, 2016

U.S. DEPARTMENT OF ENERGY | Office of Science

April 22, 2016

SOLVING BIG PROBLEMS WITH SMALL ACCELERATORS

S. HENDERSON
Argonne National Laboratory

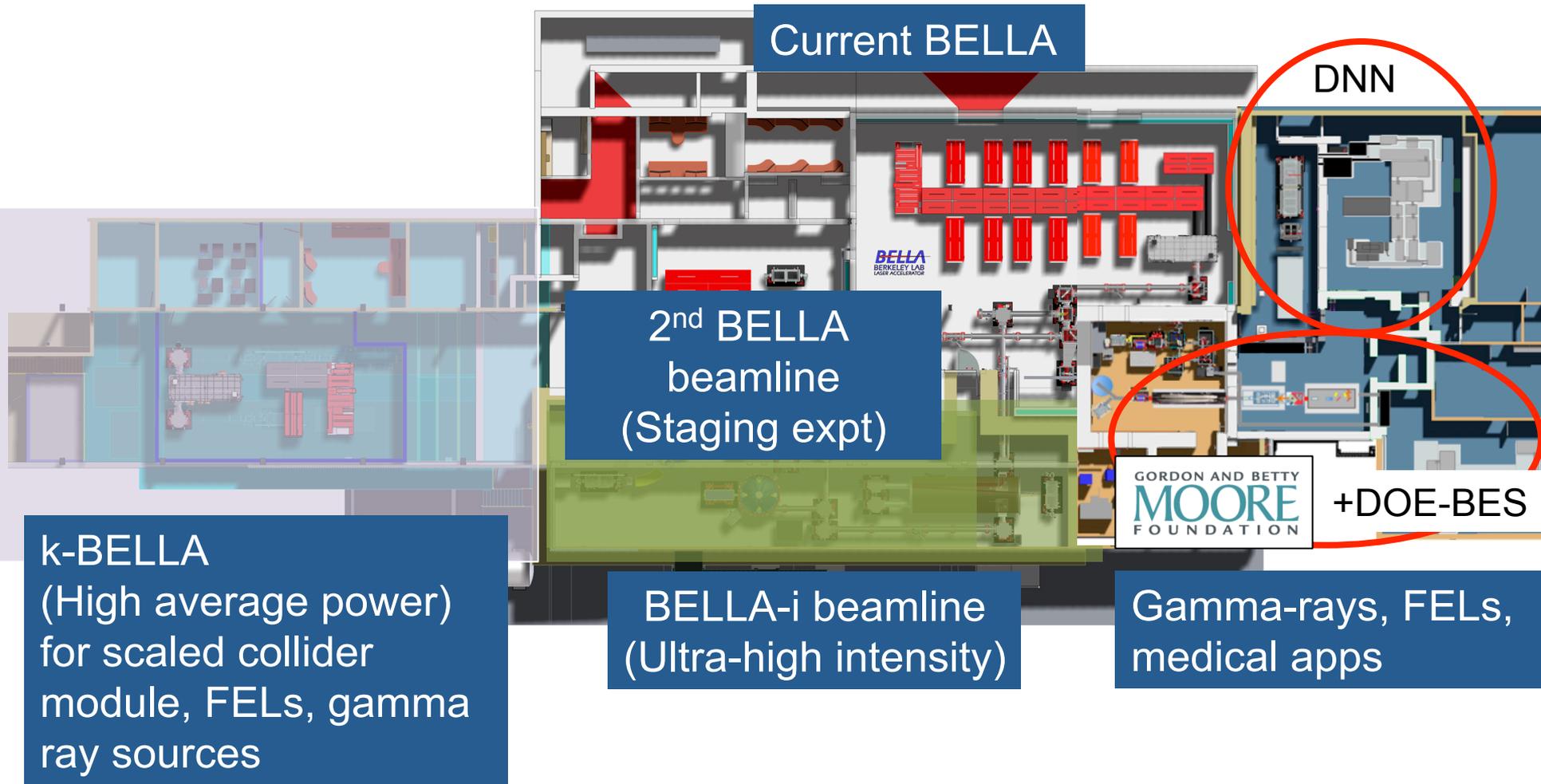
W. LEEMANS
Lawrence Berkeley National Laboratory

Argonne National Laboratory | Brookhaven National Laboratory | Fermilab | Jefferson Lab | SLAC

MIT Lincoln Laboratory | KMLABS | COHERENT | VARIAN | Lawrence Livermore National Laboratory | Laboratory for Laser Energetics

- **Stuart Henderson (ANL) & W.L. (LBNL)**
- **Multi-institution partnership**
- **SC's Office of High Energy Physics (HEP) and Basic Energy Sciences (BES) are evaluating a potential over-target request for FY18**

Expansion Of BELLA Facility for Laser Plasma Accelerator R&D and Applications Is Being Planned



High Energy Compact Accelerators Open New Applications But Require Higher Average Power

Industry and Science

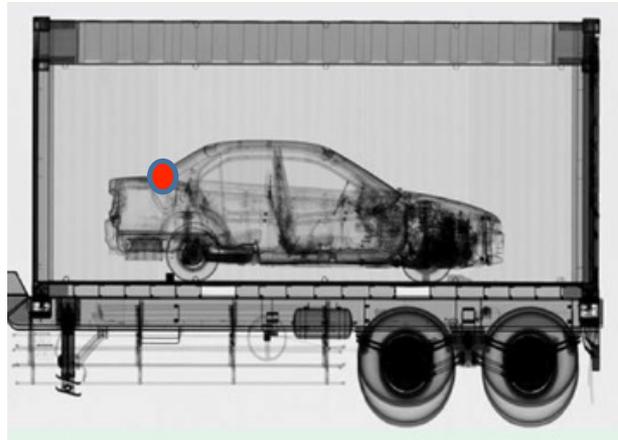
Bright, compact photon sources



Need to go from hours to seconds

Security

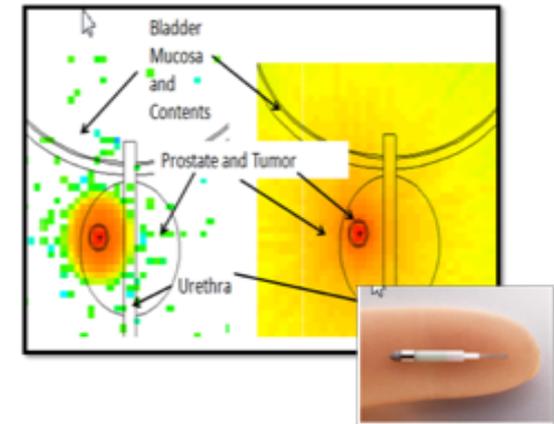
Compact high energy photon sources for detecting special materials



Cargo scanning needs 1000x more power

Medical

Arthroscopic accelerators for medical treatment and inspection

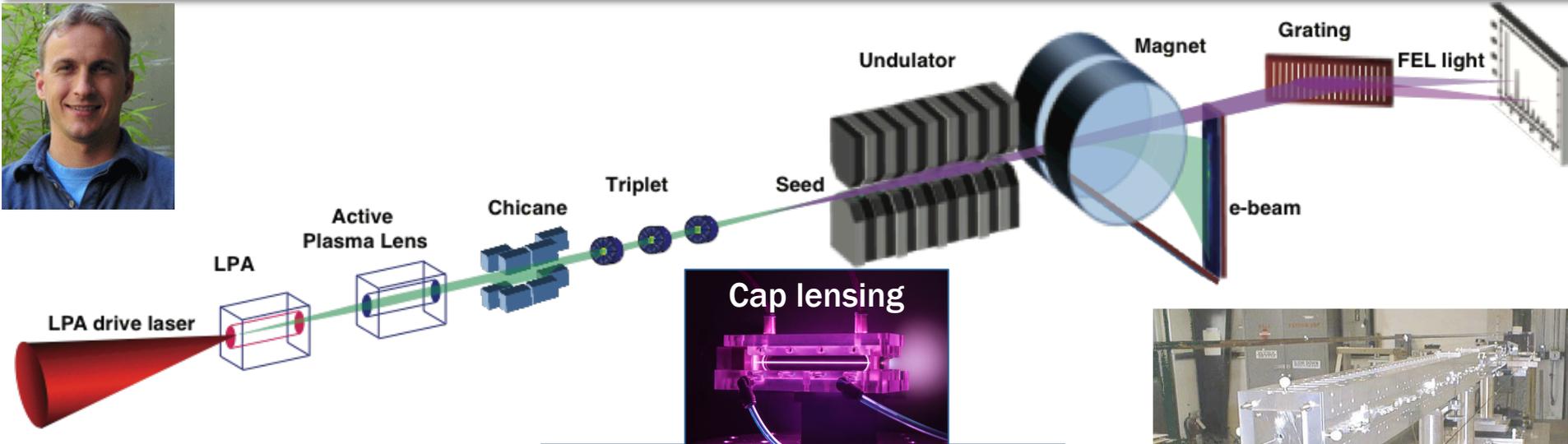


Performance demo is underway.

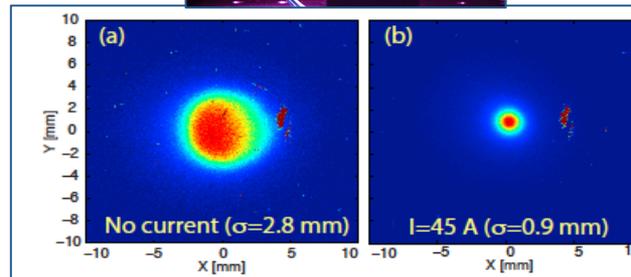
Key Challenges to be overcome:

Engineering for stability, tunability, and reliability and 100x higher average power using new laser technology

Free Electron Lasers Driven by Laser Plasma Accelerators is funded by Moore Foundation and ECRP from DOE-BES



- New 100 TW laser
- New lab built
- BNL's VISA undulator
- New concepts will be tested
- Start-to-end transport & FEL simulations

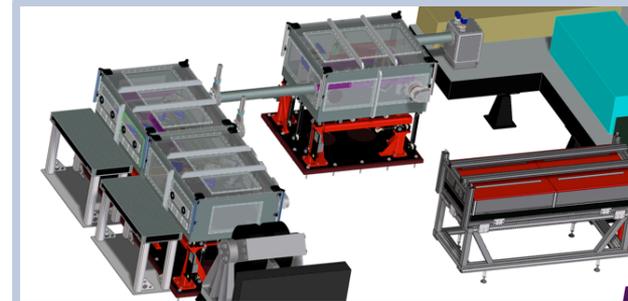
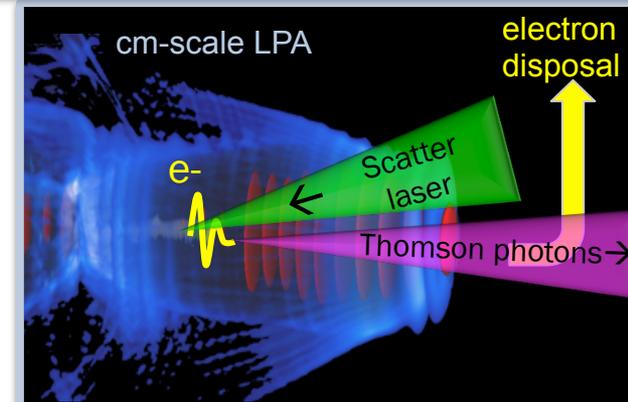


van Tilborg et al., PRL **115**, 184802 (2015)



Compact Monenergetic MeV Photon Source: Improve Nonproliferation/Security Performance & Dose

- **Dedicated LPA-based system**
 - Laser guiding & shaping
 - Deceleration proven on staging – reduce shielding
- **Application**
 - Monoenergetic, narrow divergence for radiography, photofission and nuclear resonance fluorescence
- **New facility**
 - Laser room complete, B & L caves, target systems, HVAC and interlock on track
 - Mechanical design complete, in fabrication
- **New laser – 100 TW, 5 Hz**
 - Front end operating, pump laser delivered, amplifier build in progress
 - Same design for FEL line
- **Experiments FY17 through FY19**
 - Control photon energy, energy spread, and flux



ATAP All-Hands Meeting

Advanced Magnet Technology

With the Berkeley Center for Magnet Technology, We Are Organized to Meet the Commitments and New Challenges

- Synergy and resource coordination – Alignment with DOE priorities

Berkeley Center for Magnet Technology
S. Gourlay, Director
R. Schlueter, Deputy

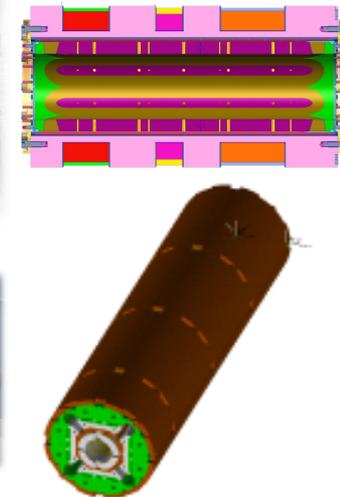
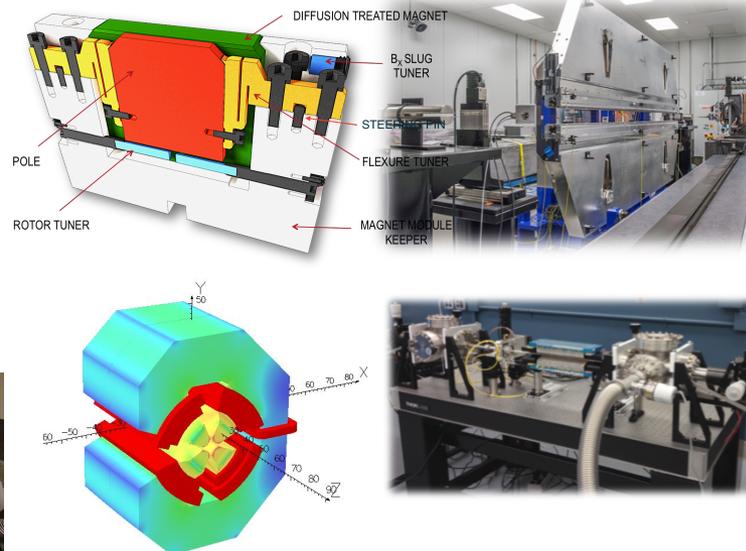
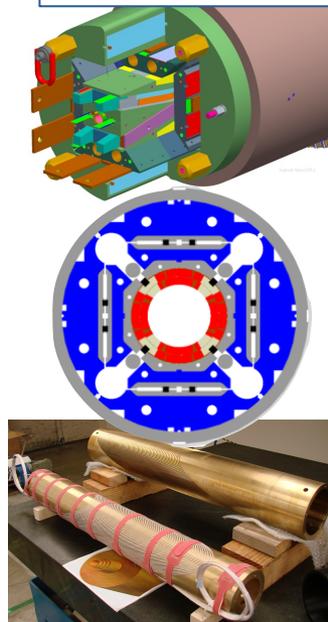
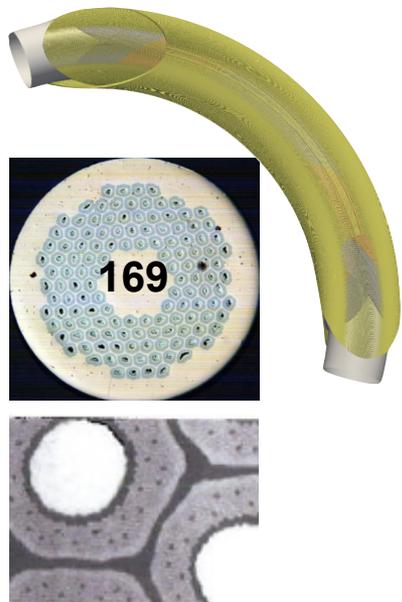
Advanced Concepts and Materials
S. Prestemon

SC Accelerator Magnets
S. Gourlay

Magnets for Light Sources
R. Schlueter

Testing/QA
GL Sabbi

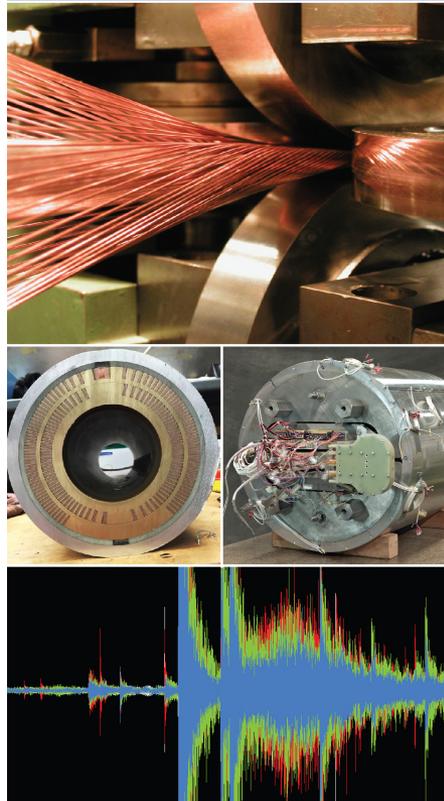
Production/Projects
D. Leitner



In November 2015, DOE appointed LBNL as Lead Laboratory for High Field Magnet R&D



The U.S. Magnet Development Program Plan



S. A. Gourlay, S. O. Prestemon
*Lawrence Berkeley National Laboratory
Berkeley, CA 94720*

A. V. Zlobin, L. Cooley
*Fermi National Accelerator Laboratory
Batavia, IL 60510*

D. Larbalestier
*Florida State University and the
National High Magnetic Field Laboratory
Tallahassee, FL 32310*

JUNE 2016



- In response to P5 and HEPAP subcommittee report
- Increasing the performance of magnets and reducing their cost through advanced concepts and our know-how
- Initial Participants: LBNL, FNAL, FSU/NHMFL

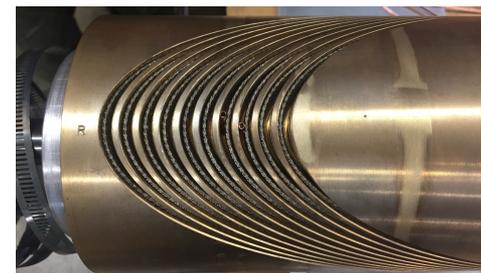


Canted Cosine-Theta Superconducting Dipoles: Potential for Cost-Effective High-field Accelerator Magnets

First demonstration of Nb₃Sn with this geometry

- 1 m NbTi prototype tested reached 90% of short-sample field
- 1 m Nb₃Sn prototype tested
 - Reached 75% of short sample (likely due to cable damage)
 - Groove design has been modified to reduce damage risk
 - Preparations for next prototype are under way
- Excellent agreement between measured and calculated field
- State-of-the-art instrumentation, including acoustic sensors and quench antennas, has been implemented in testing

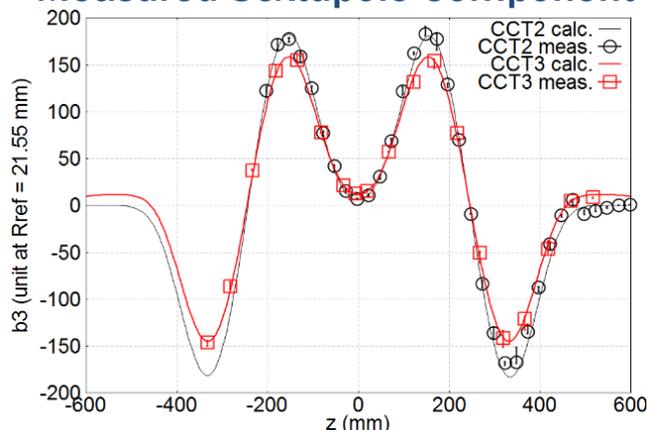
Modified Groove Design



Nb₃Sn CCT Dipole Magnet



Measured Sextupole Component



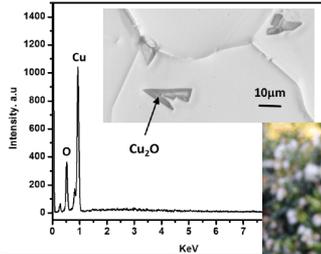
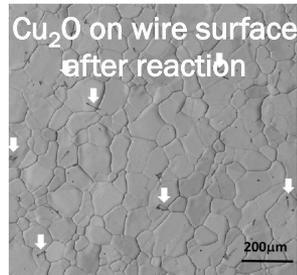
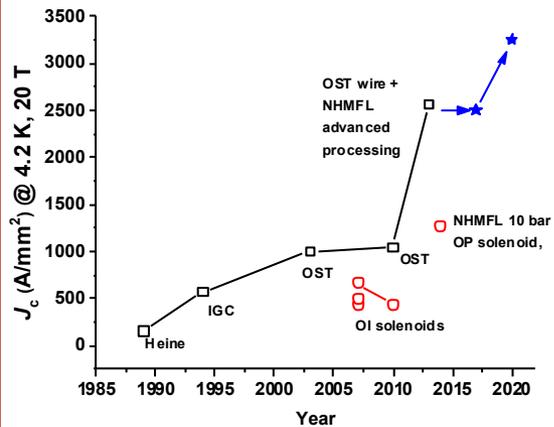
CCT Inner and Outer Layer Mandrels



Development of Accelerator Magnets Based on High-temperature Superconductors: Potential for a Breadth Of Applications

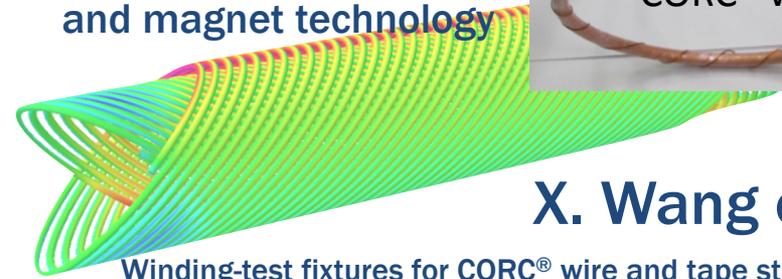
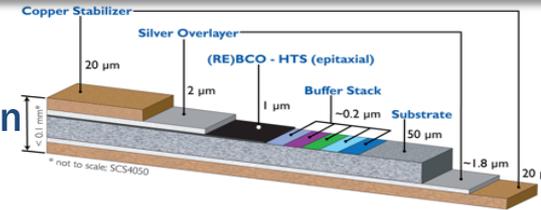
• Bi-2212 material:

- Demonstrate high critical current density in Rutherford cable in a coil environment
- Explore the mechanical and quench limits of Bi-2212 coil technology
- Proof-of-principle fabrication of CCT dipoles



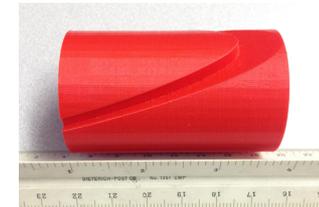
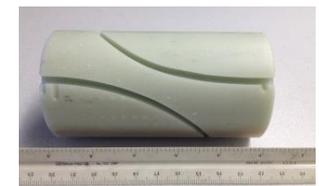
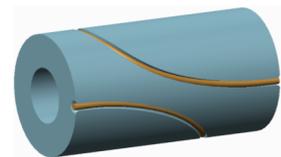
• REBCO material:

- Develop fabrication technologies for subscale magnets
- Test magnets to provide feedback to conductor and magnet technology



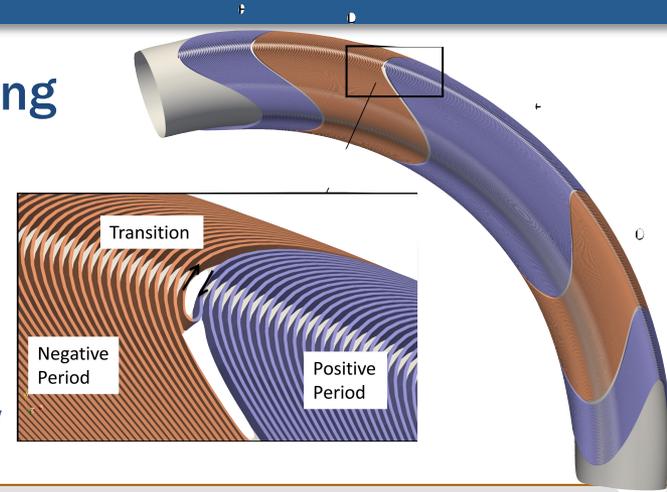
X. Wang et al.

Winding-test fixtures for CORC® wire and tape stack

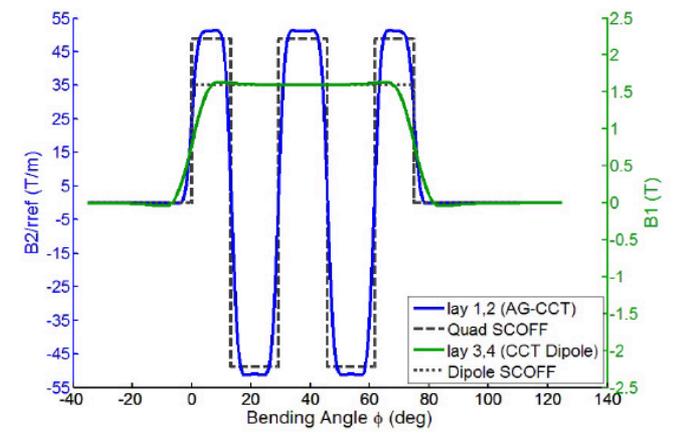
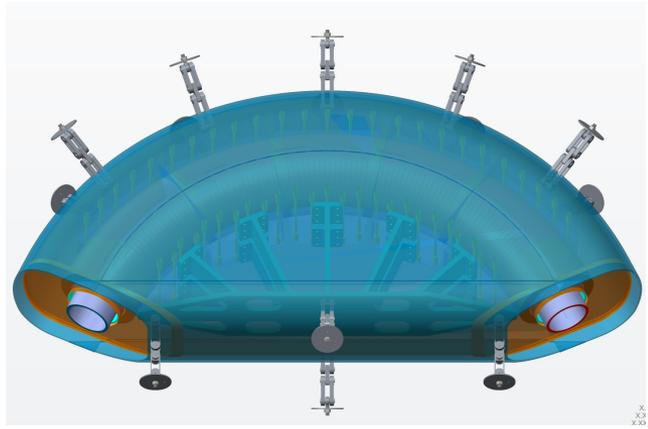


We Are Developing a Superconducting Gantry Magnet for Medical Therapy to Dramatically Reduce Gantry Weight and Size

- HEP Stewardship grant to develop superconducting magnet technology for medical gantries
 - Collaboration between LBNL, Varian, and PSI
 - Motivation: reduce weight by $\sim x10$, reduction in size
- Optics design results in $dp/p \sim 25\%$ acceptance
 - Less/no ramping facilitates superconducting technology
 - May enable new treatment modalities

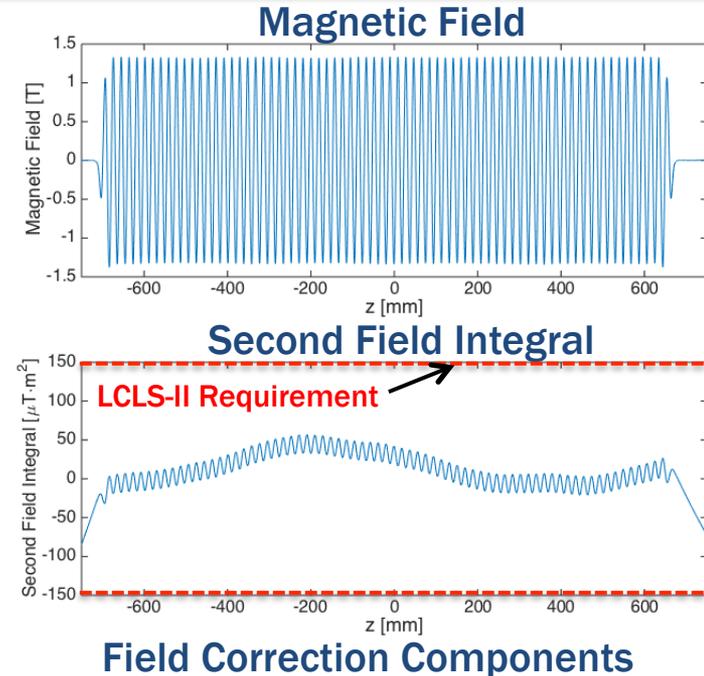


W. Wan et al., PRSTAB 18, 2015

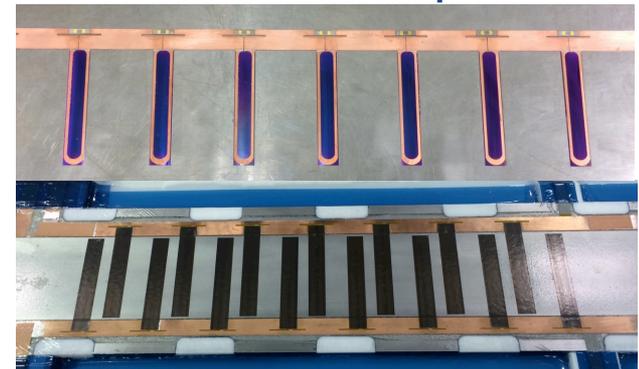


Nb₃Sn Superconducting Undulator R&D Yielded Excellent Trajectory, First Demonstration of Active Phase-Error Correction

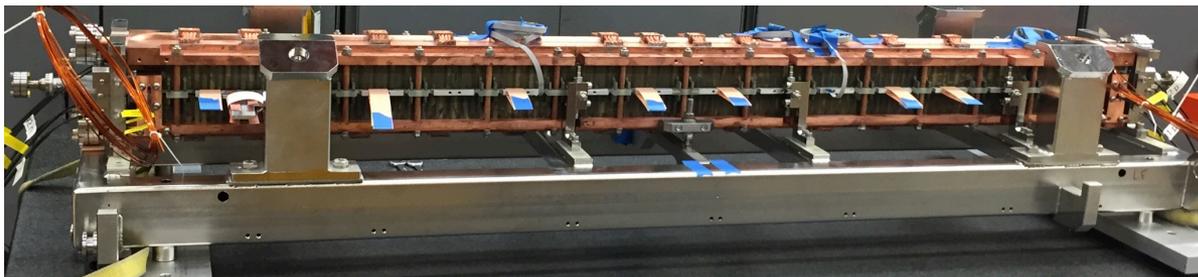
- 1.5 m Nb₃Sn SCU prototype fabricated at LBNL and tested at ANL
 - Fast quench protection system developed
 - Individual coils reached 95% of design current
 - Good field quality was measured at ANL
 - Field correction method was successfully tested
 - Maximum current achieved at ANL test was ~70% of the design value (possible damage)
- Dewar test with full undulator configuration will be performed at LBNL after replacing damaged coil



Field Correction Components



1.5 m Nb₃Sn Superconducting Undulator



ATAP All-Hands Meeting

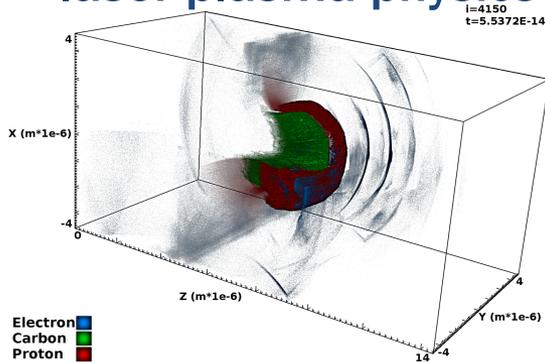
Other New Initiatives



We Have Proposed Three Pillars of Activities to Fusion Energy Sciences in Three Key Areas Relevant to their Mission

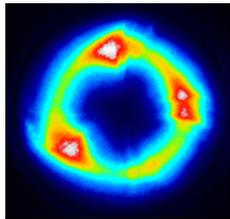
Discovery Plasma Science

- High energy density laser plasma physics



Fundamental physics of relativistic plasmas with BELLA-i

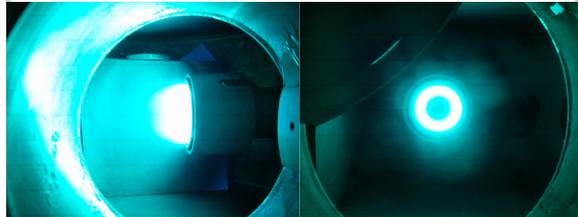
- General Plasma Science



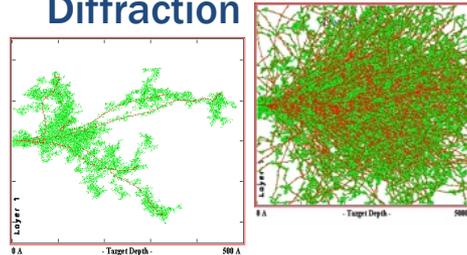
- Self-organization in magnetron plasmas

Burning Plasma Science

- Structural evolution of fusion materials



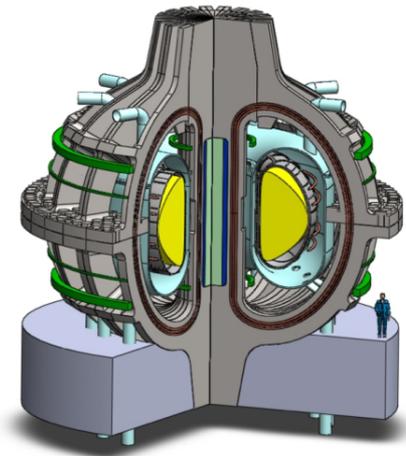
- Pulsed plasmas at $10\text{MW}/\text{m}^2$ + *in situ* Ultrafast Electron Diffraction



- Pulsed ion beams to access the time domain of radiation damage

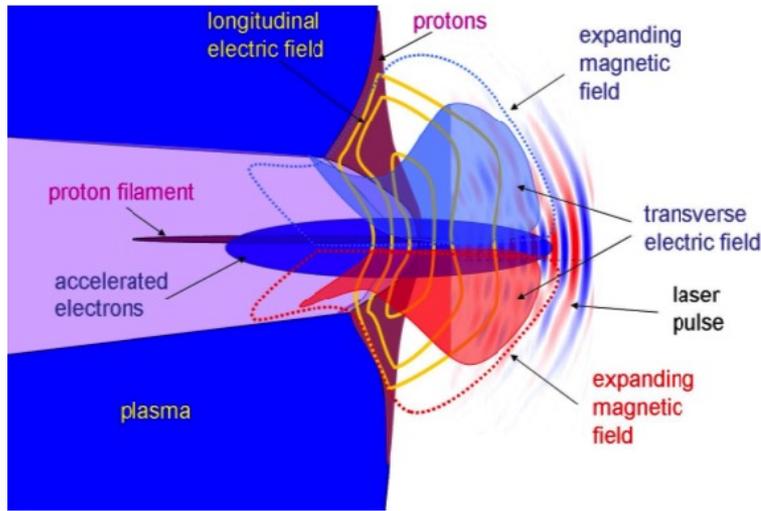
Magnets for Fusion Reactors

- High Temperature Superconductors for Fusion Reactors

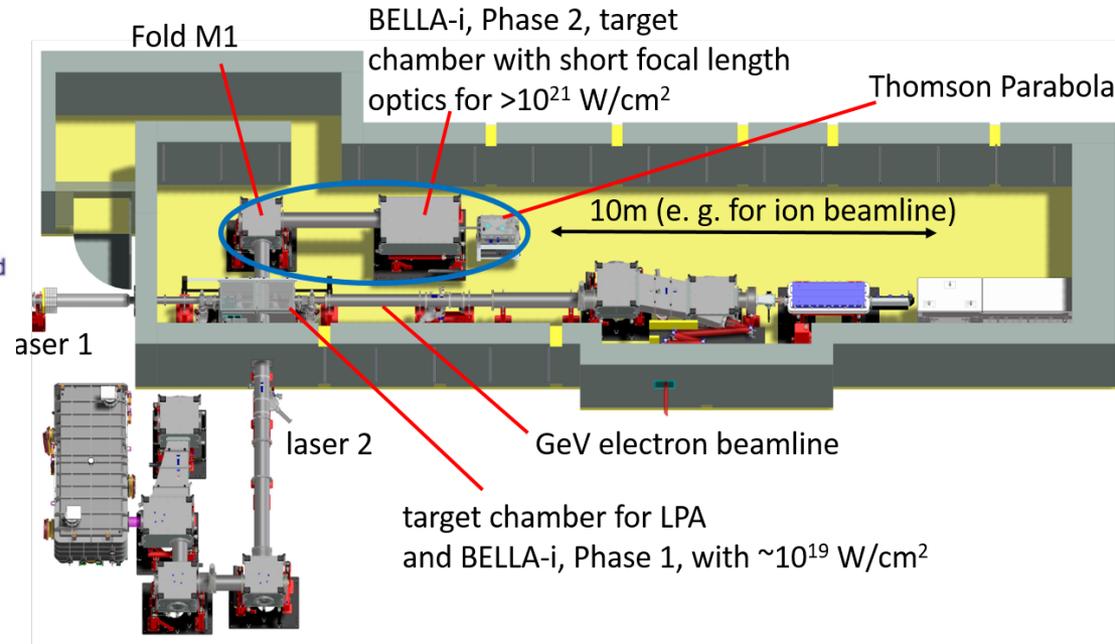


- 20 T magnets
- Leverages Magnet Development Program from HEP
- FWP submitted

The BELLA-i Initiative For High Energy Density Physics Has Now Taken Off With Phase 1 Funding From DOE-FES

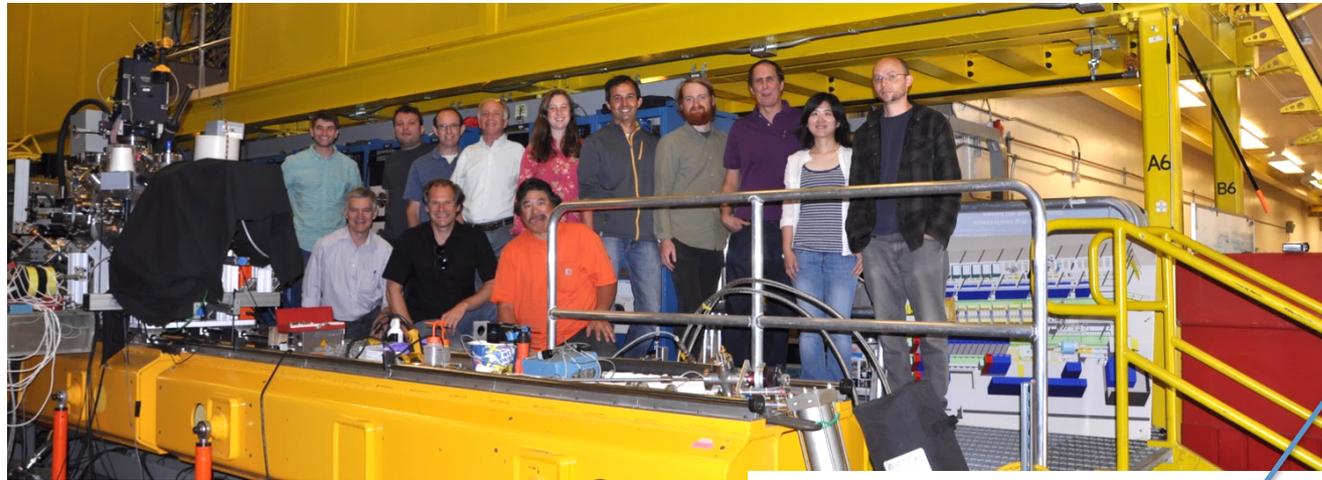


Visualization of magnetic vortex type ion acceleration, S.S. Bulanov et al., IPAC 2016

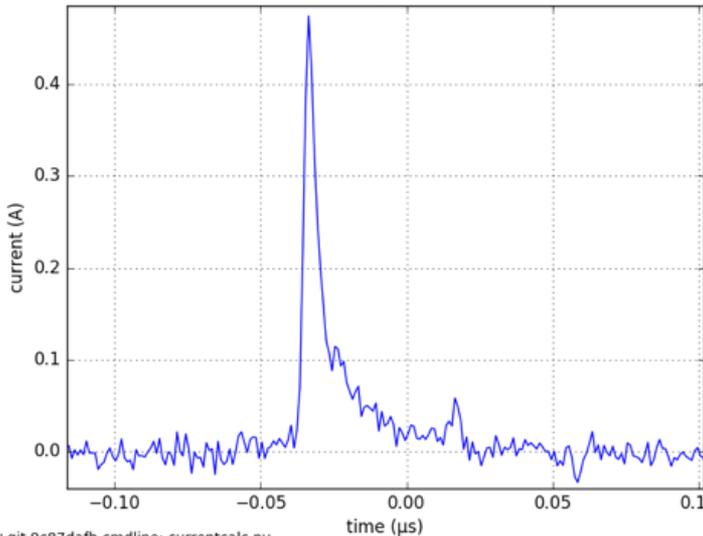


- We have received Phase 1 funding for experiments with solid targets at BELLA
- BELLA-i team with Sven, Qing and Stepan working a start-up LDRD
- Great community feedback and support at APS Division of Plasma Physics satellite meeting (Nov. 2015) and at our BELLA-i workshop, Jan. 2016

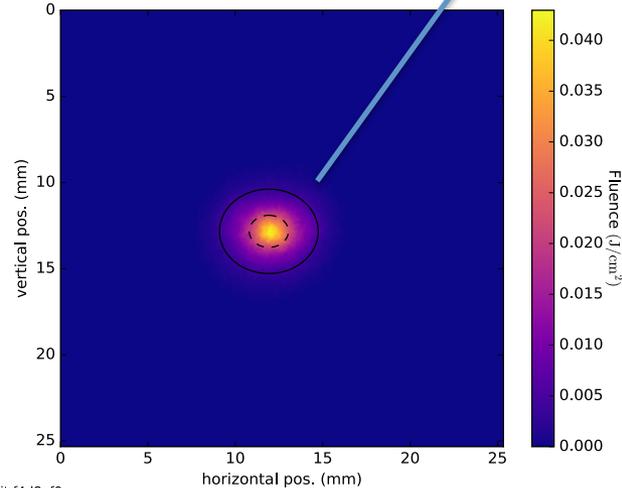
We Have Achieved Single Shot Melting and Fracturing of Foil Targets With Ion Pulses at NDCX-II, Steady Progress in Beam Fluence



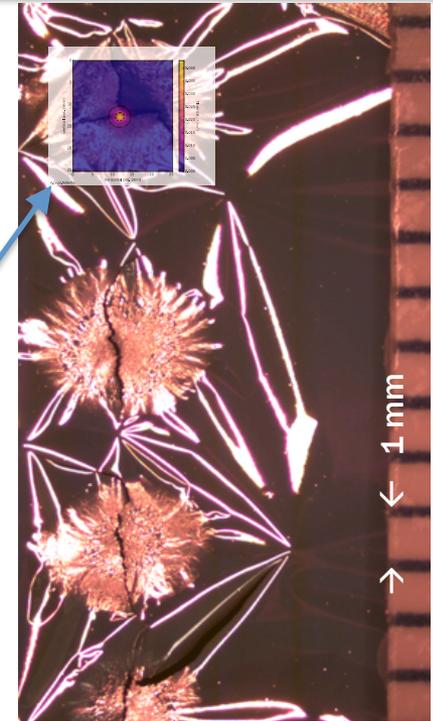
3550269823



0.1+git.9c87dafb cmdline: currentcalc.py



0.1+git.f4d8ef0a



- 300 nm Tin (Sn)
- 4 nC, 6 ns (FWHM)
- 2.5×10^{10} ions/pulse
- $E_{\text{kin}} = 0.8$ MeV He^+
- 40 mJ/cm^2
- **FY16 goal: $>1 \text{ J/cm}^2$**

MEMS Based Ion Beams for Fusion

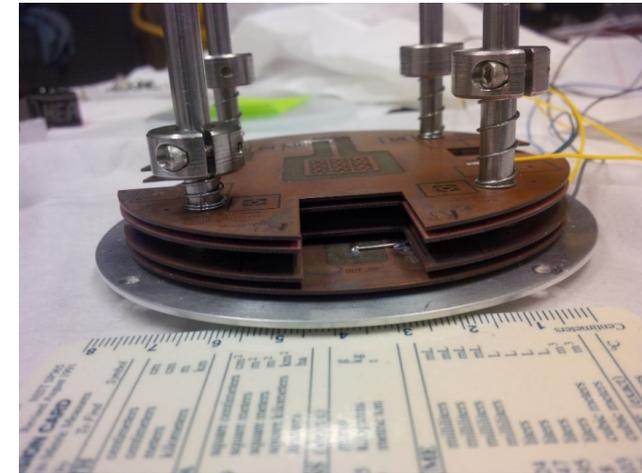
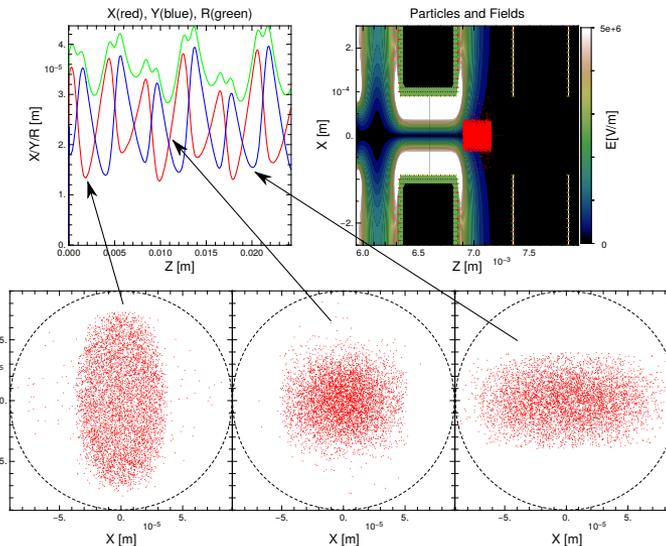
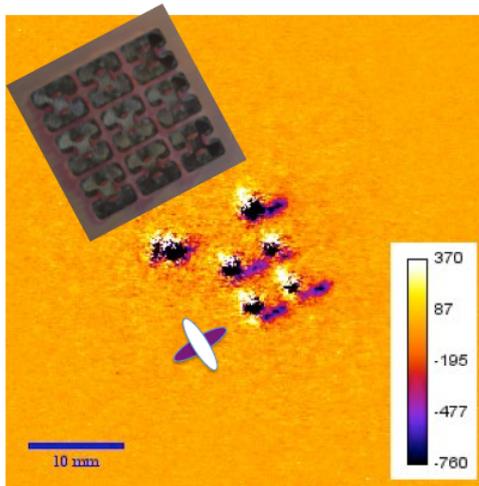


Sonic MEMS
Cornell ECE

T. Schenkel, P. A. Seidl, A. Persaud, Q. Ji, W. L. Waldron

A. Lal, S. Ardanuc, J. Miller, K.B. Vinayakumar

- Ion beams are promising drivers for magnetized target fusion
- Delivering the required MJ of ion beam energy in short pulses is challenging
- We are exploring MEMS based multi-beamlet ion accelerators that could be scaled to very high peak power



We have demonstrated RF ion-acceleration and focusing, the basic building blocks of a multi-beam MEMS based accelerator



U.S. DEPARTMENT OF
ENERGY

Office of
Science

ACCELERATOR TECHNOLOGY &
APPLIED PHYSICS DIVISION

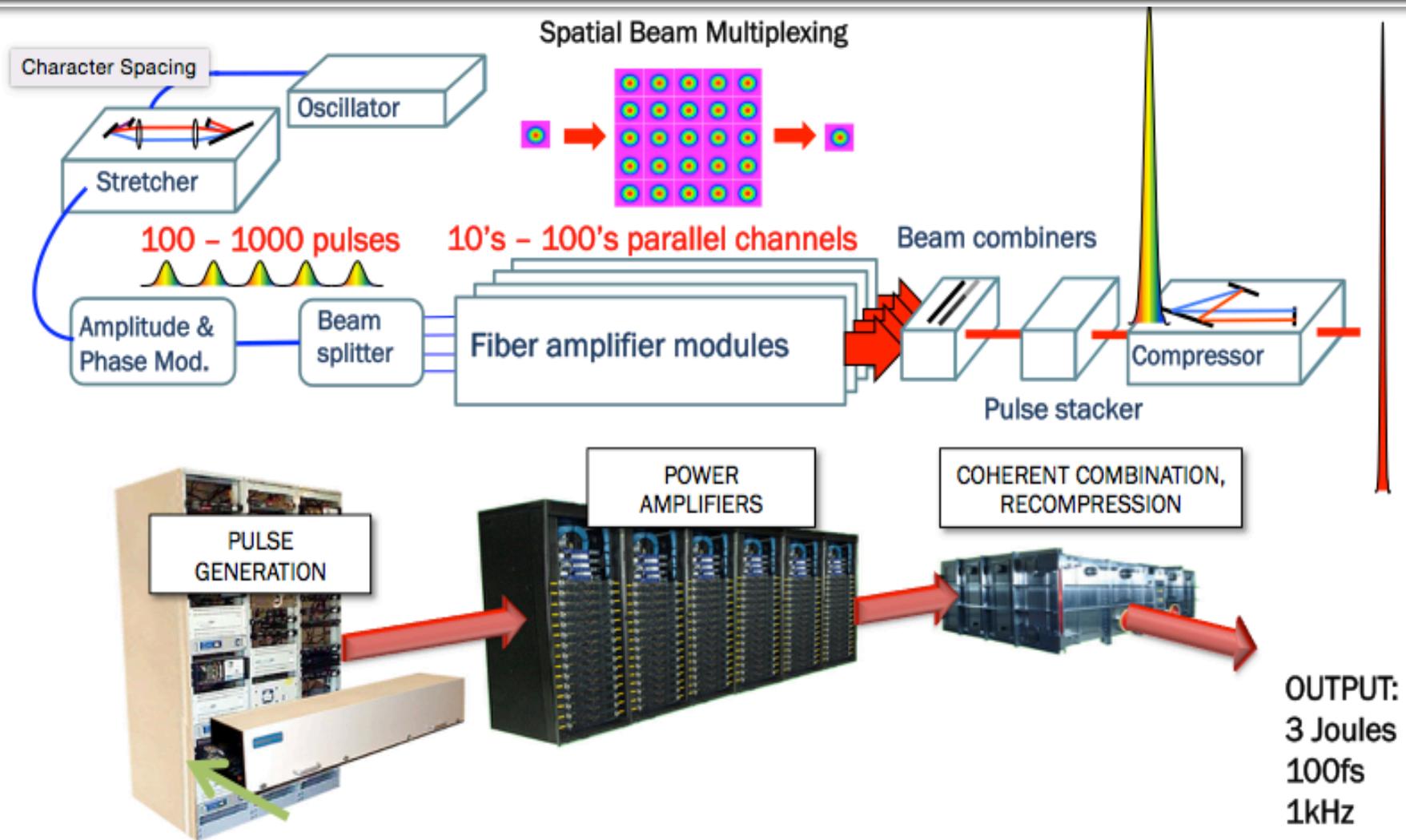


ATAP is in the Process of Forming Two New Programs



- **Motivation:** Better alignment of existing CBP activities with HEP GARD priorities
- **Opportunity:** We see these two groups as new opportunities for Berkeley to lead
 - Accelerator modeling can lead in adapting and creating codes for exascale computing.
 - RF/Instrumentation can combine resources from ATAP/Eng to address new accelerator technology challenges within and outside Berkeley Lab.
- John Byrd and Fernando Sannibale have been tasked with developing a strategic vision for instrumentation at LBNL – Talk to them if you are interested!

Innovative Laser Concepts Using Coherent Pulse Stacking, Spectral Combining and Beam Combining are Pursued

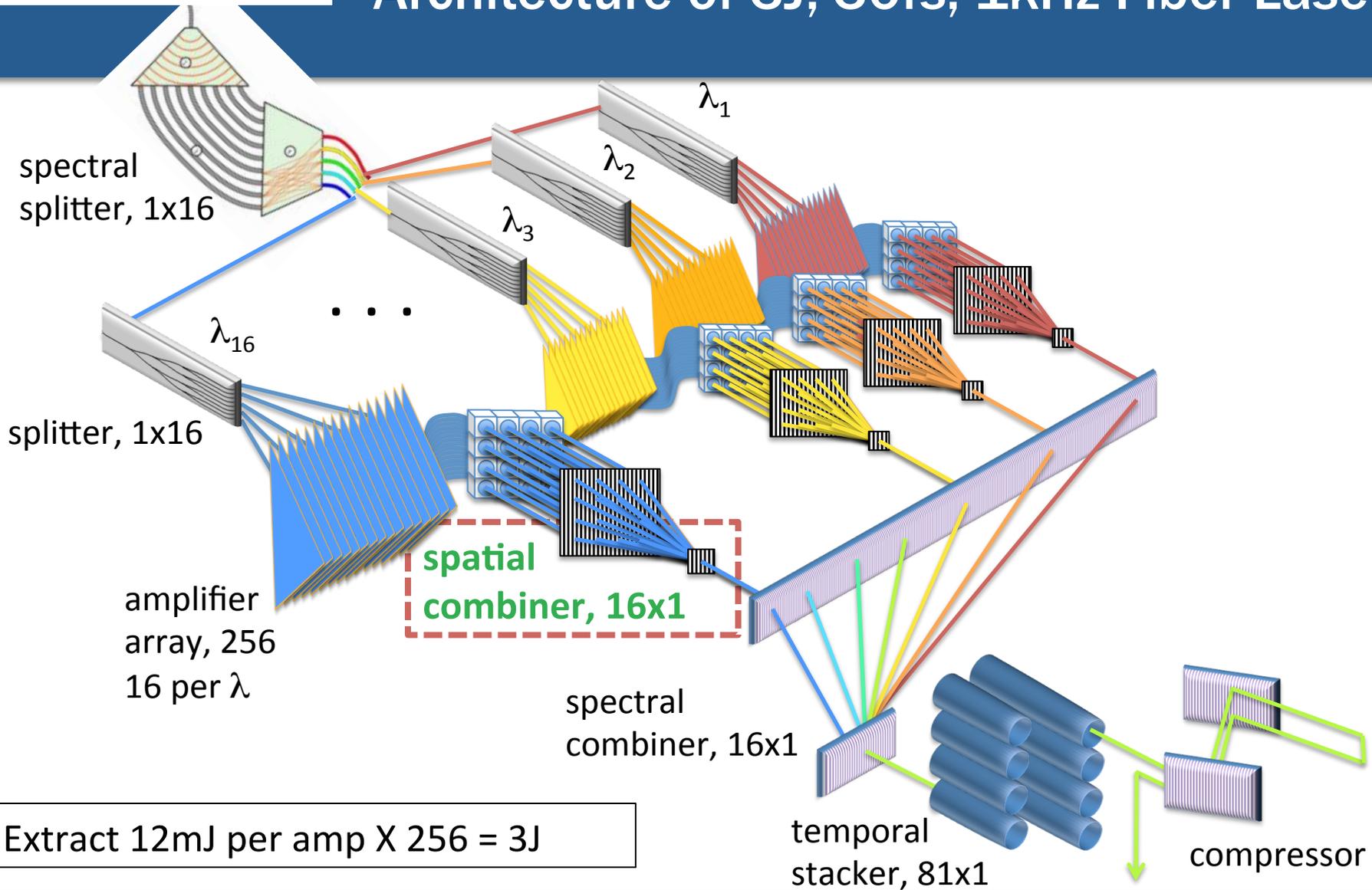


LBNL, LLNL, U Michigan partnership
Funded through DOE Stewardship

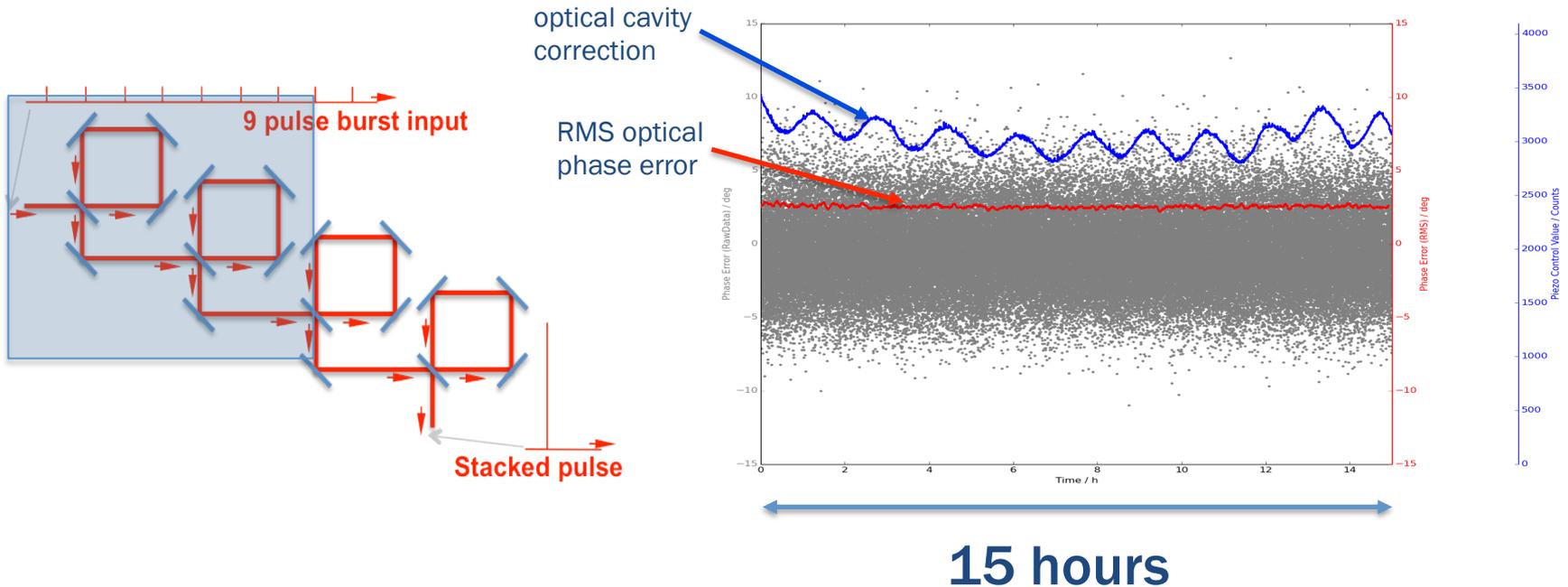
Also: A. Tunnerman/J. Limpert et al.;
U. Keller et al., and several other groups

stretched pulse train
from front end

Architecture of 3J, 30fs, 1kHz Fiber Laser



Success in Optical Pulse Stacking Shows Promise towards High Average Power Ultrafast Lasers

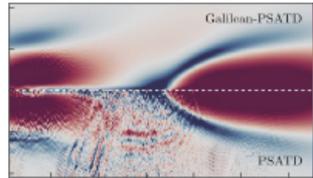
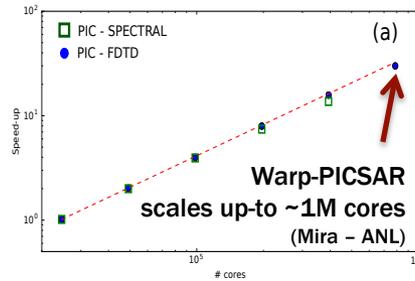


- Two cavities show excellent locking over long time periods
 - $\sim 2.5^\circ$ optical phase (RMS)
 - Correction of optical cavity length of $\sim 120^\circ$ with A/C cycle
- Funded by the Accelerator Stewardship program

Modeling Activities: Cutting-Edge Computing, Support of Major Research Activities and Facilities

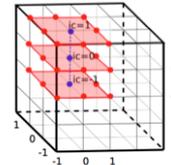
Continue pushing state-of-the-art in accelerator computing:

- **Extensions of capabilities** - IMPACT, Warp, INF&RNO and BeamBeam3D
- **New module PICSAR** - developed with NERSC Exascale Applications Program
- **New GPU module FBPIC** - developed with DESY
- **New algorithms** - spectral solvers in 3-D and R-Z, vectorization, Galilean solver, ...

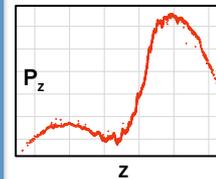
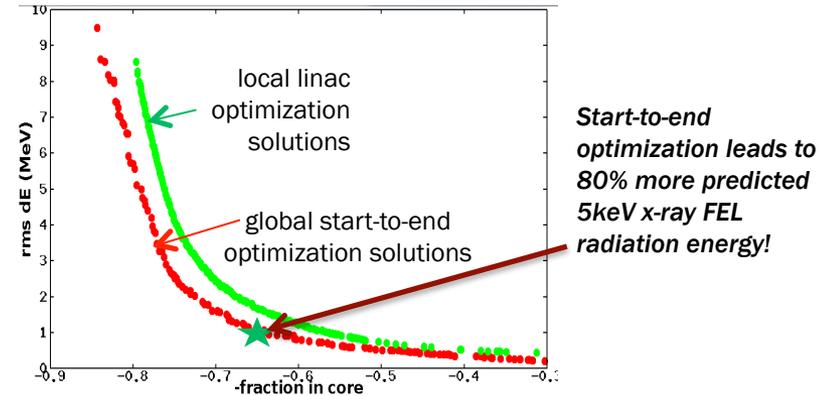
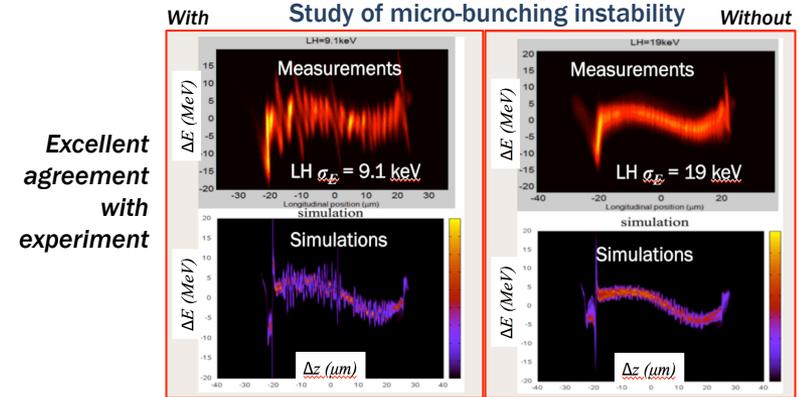


New "Galilean" solver cures numerical Cherenkov (collab. DESY)

Novel vectorization algorithm takes advantage of new Intel manycore architectures

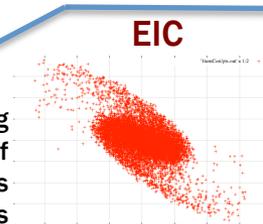


Ongoing support of LCLS-II and FEL research



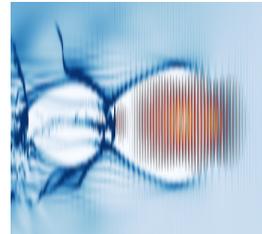
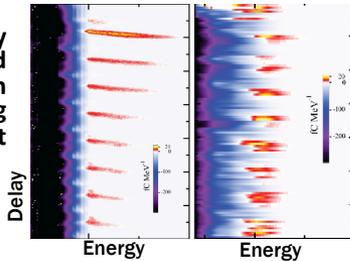
Simulations influenced and validated design of APEX injector

Engaging in modeling of Beam Beam effects for electron ion colliders



Increasing support in modeling of laser-plasma acceleration and interactions

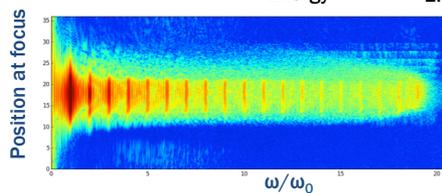
Modeling key in design and interpretation of staging experiment



Simulations support injection experiment and prepare design of 10 GeV range stage



Ramping up modeling of Ion acceleration



New spectral solver enables Hi-Fi modeling of high-harmonics at unprecedented accuracy

Next Generation of Accelerators *Needs* Next Generation of Modeling Tools

Our vision

Fast – runs in seconds to minutes

Hi-Fi – full & accurate physics

Link – integrated ecosystem

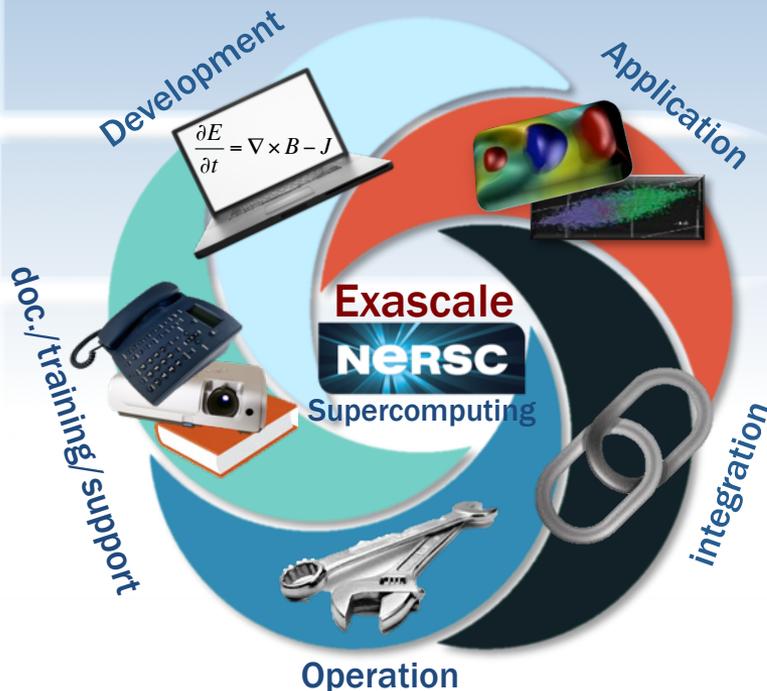
Real-time

virtual prototyping

of entire accelerator



with intuitive interface, dissemination & user support.



Need to expand:

- Base funding + CAMPA
- LCLS-II, BES, IEC, LARP
- ECRP “Compensation Space Charge in Intense Beams” – *C. Mitchell*
- Proposal on “Exascale Modeling of Advanced Particle Accelerators”



ATAP All-Hands Meeting

Operations Update



Backup Care Program

The Lab offers backup care through Bright Horizons

Can be used for, e.g.,

- Regular caregiver ill/(pre-)school closed
- Child/adult mildly ill and can't stay home alone
- Transition between different caregivers
- During conference travel (within the US)

Low cost thanks to Lab subsidy

More info at backupcare.lbl.gov

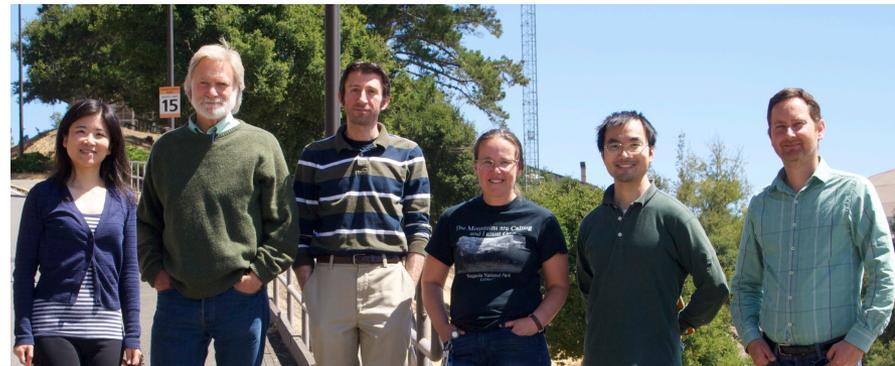


Diversity in Hiring Task Force

Chaired by Qing Ji, full report available online soon.

Some of the suggestions:

- **Assemble and maintain list** of minority and women scientists in our field(s); use list to advertise open positions (if you want to contribute to the list, contact Ina Reichel)
- **Promote guidelines** regarding neutral language in job postings
- **Provide Diversity and Inclusion checklist** for hiring committees
- **Promote more openness** in hiring process
- **Encourage one-on-one mentoring**
- **Establish regular gatherings**



Improving Our Web Presence



Active, public-facing sites converted to or created in Wordpress

- Examples include ATAP, BELLA, and most recently BCMT (*left*)
- Forward-looking aesthetic and technical model Labwide
- Nontrivial *conversion* rather than just movement; fortunately expert help is available from Creative Services



Legacy HTML sites move to Labwide server

- Piloted; looks like a low-effort process
- Retire the old lbl-afrd rack server
- Focus our resources on content, not system administration

Major update cycle for ATAP websites during remainder of 2016

- Let's look at program- and group-level sites too
- Is content up to date and on message? Could appearance use a fresh-up?

If you can't remember when you updated a site, it's probably time

ATAP Newsletter: Reaching Out to Sponsors, Lab Management, and Colleagues

Every other month; occasional special issue

Standard content elements

ATAP NEWS
ACCELERATOR TECHNOLOGY & APPLIED PHYSICS DIVISION

June 2016

Director's Corner

There has been much exciting news in ATAP. The Basic Energy Sciences Advisory Committee just gave its highest recommendation to LBNL's ALS-Upgrade proposal. Not one but two of our promising young scientists were named to the prestigious Early Career Research Program of the DOE Office of Science. They join two previous honorees in ATAP. And an RFQ linac we developed with Engineering Division performed splendidly at Fermilab, where it will play a key role in their Proton Improvement Plan-II project.

[MORE](#)

We use catchy headlines to intrigue readers

For science topics:

FEATURED SCIENTIFIC ARTICLES

BESAC Calls ALS-U "Absolutely Central," "Ready"
ALS-U, a proposal for a diffraction-limited upgrade to the Advanced Light Source, has been given highest marks by the Basic Energy Sciences Advisory Committee, which called it "absolutely central" to the future of their network of light sources and "ready to initiate construction." LBNL Director Michael Withereff called it LBNL's highest-priority project. [MORE](#)

Two from ATAP Receive 2016 ECRP Awards...
Chad Mitchell of the Center for Beam Physics and Jeroen van Tilborg of BELLA Center are among LBNL's five 2016 winners of program awards. [MORE](#)

Company
and Tengming Shen of the Berkeley... are PIs of ongoing ECRP accomplished. [MORE](#)

m; LBNL RFQ Plays Key Role
ent Plan" or PIP-II had a noteworthy diofrequency quadrupole linac input beam on the first attempt. ing Division, longtime partners in advanced RFQs, designed and fabricated this unit. [MORE](#)

Industry average view rate for eNewsletters is about 22%
View rate of ATAP Newsletter was 56% in 2015 and has progressively increased to 72% in FY16

Issue

Articles on safety and workplace life important to all audiences

WORKPLACE LIFE

Daughters and Sons, Science Fair and Scouts: A Busy Spring for Outreach, and ATAP Volunteers Are There
April and May brought the annual, Labwide Daughters & Sons to Work Day, Nuclear Science Day for Scouts, and the Oakland Unified School District's Dinner with a Scientist, ATAP Diversity and Outreach Coordinator Ina Reichel, a mainstay of these events, was among the volunteers making it happen. [MORE](#)

SAFETY: THE BOTTOM LINE

Summer's Here—How to Avoid, Deal With Heat Stress
Summer in Berkeley means cool, foggy days interrupted by a sudden heat wave, making it difficult for our bodies to adjust and potentially causing heat stress. Family vacations to hotter parts of the country are also part of the season. Learn how to beat the heat—and what to do if the heat starts beating you. [MORE](#)



Office of Science

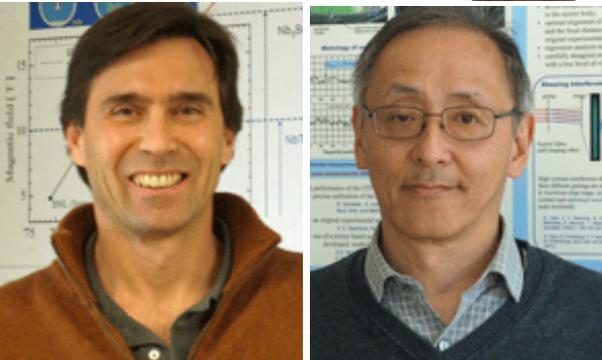
ACCELERATOR TECHNOLOGY & APPLIED PHYSICS DIVISION



ATAP Safety in FY16



No major (recordable or lost time) accidents!



Two new Safety Committee members

- GianLuca Sabbi – Superconducting Magnet Program
- Hiroshi Nishimura – ALS Accelerator Physics



A successful Safety Day

- Clean-up
- QUest
- Management walkarounds

ATAP Safety FY16



Work Planning and Control:

- 46 approved Activities



Electrical Safety:

- 12 approved LOTO procedures
- Equipment fixes are in progress
- Qualified Electrical Workers are being trained



3 Focus Area Self-Assessments:

- Configuration Control
- Communication of Lessons Learned
- Physical Sciences Multi-Division Incidents

ATAP Picnic

Date: Thursday, July 28, 2016

Location: Codornices Park, 1 Euclid Avenue – Area 1

Starting Time: 12:00 noon

Menu: Tri-Tip, Links,

Sausages, Salads, Desserts & Beverages

