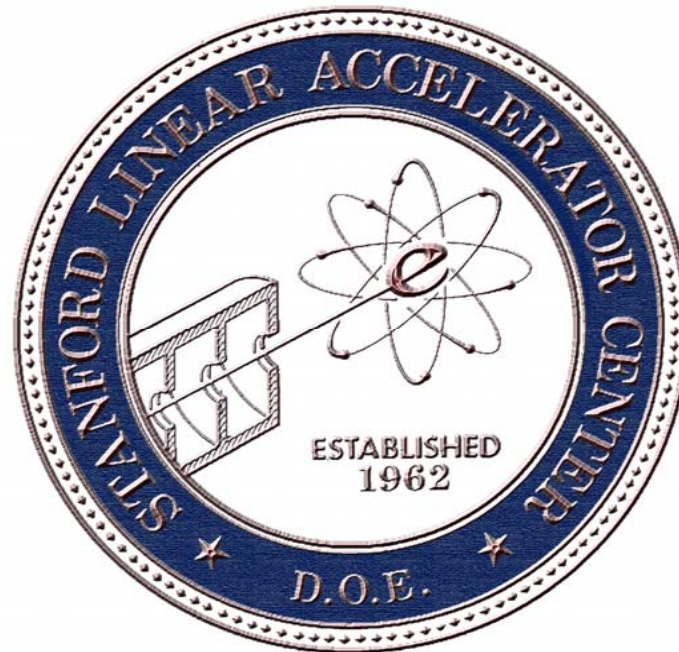


Director's Report



Jonathan Dorfan
DOE High Energy Physics Review
June 14, 2005



Mission

○ Photon Science Discoveries

- To make discoveries in photon science at the frontiers of the ultrasmall and ultrafast in a wide spectrum of physical and life sciences

○ Particle and Astroparticle Physics Discoveries

- To make discoveries in particle and astroparticle physics to redefine humanity's understanding of what the universe is made of and the forces which control it

○ Operate Safely; Train the Best

- To operate a safe laboratory that employs and trains the best and brightest, helping to ensure the future economic strength and security of the nation



SLAC as an International Research Facility

- **3000 scientists from ~25 nations use SLAC facilities to do their research**

The facilities require:

- a) **Highly specialized technical staff and extensive infrastructure to design, construct and maintain large accelerator-facilities and detectors**
 - b) **Extremely efficient operation of complex accelerators and detectors**
 - c) **State of the art computing systems (running 24/7/12) for the analysis and worldwide distribution of data**
- **Science program at SLAC generates 800-900 publications per year**





Crucial Assets

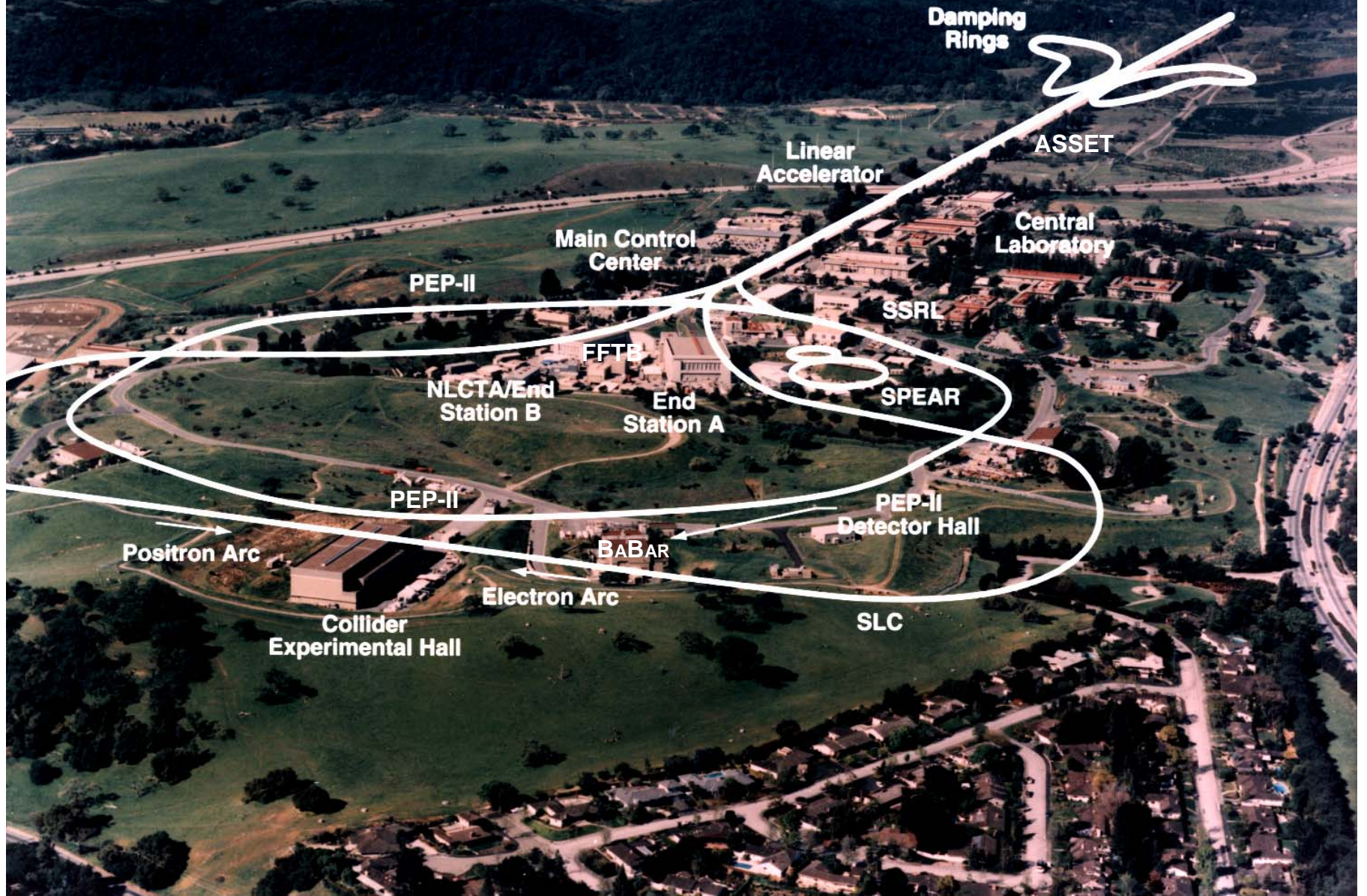
○ **Intellectual Capital: SLAC Staff (1300)**

- ↗ **The Laboratory's greatest asset - exceptional quality, extensive skills and experience, and knowledge base**
- ↗ **Staff provides national and international scientific and technical leadership**
- ↗ **Unique relationship with Stanford University is key to our world-class staff**

○ **Physical Infrastructure:**

- ↗ **Accelerators that are uniquely positioned to drive photon science, particle physics and accelerator R&D into the next decade and beyond**
- ↗ **High energy, low emittance, high intensity and short pulse length of our electron and positron beams are unique**
- ↗ **Extensive physical space available to develop and construct complex and/or large scientific instruments**

Stanford Linear Accelerator Center





**END STATTON A
& SPEAR3**

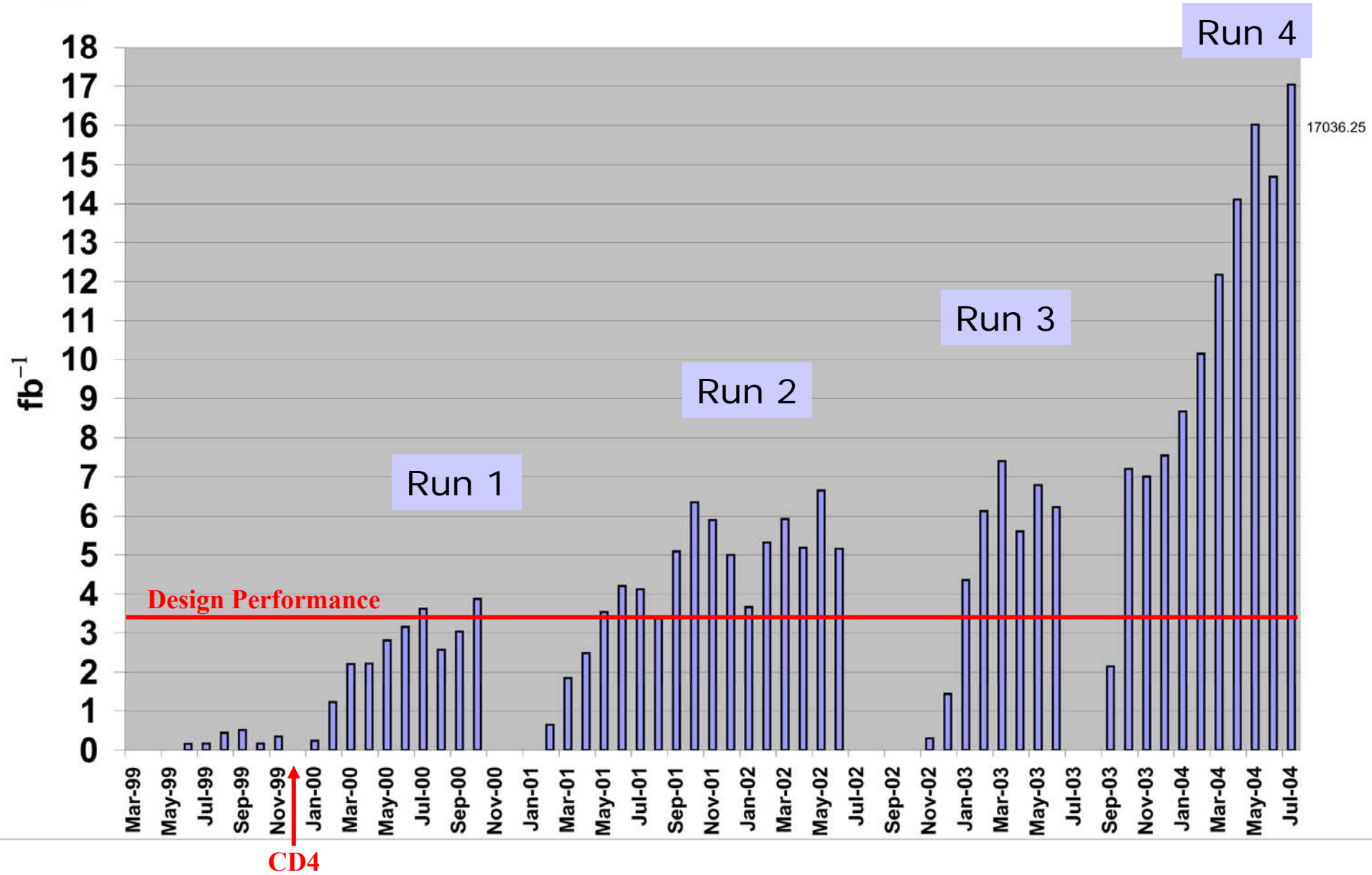


FY2004 – A Banner Year for SLAC

- **FY2004 was a wonderful year for SLAC– one of major successes on many fronts, including**
 - ↗ **Outstanding PEP-II/BABAR performance and scientific productivity**
 - ↗ **On-budget, on-time completion of complete rebuild of the SPEAR light source; outstanding start of the SPEAR3 operating program**
 - ↗ **Expansion of Linac Coherent Light Source into the Nation’s choice for near and long-term commitment to XFEL research**
 - ↗ **Major X band milestones for NLC group. Impressive turnaround from ITRP decision as part of joining the International LC collaboration**
 - ↗ **Birth and rapid flourishing of Kavli Institute**
 - ↗ **GLAST transition to flight hardware construction**
 - ↗ **High level of productivity of the Final Focus Test Beam facility**

Last updated:
7/31/2004
03:04

PEP-II Monthly Integrated Luminosity





FY2005 Is A Challenging Year

- **FY2005 began with a very serious electrical accident. Laboratory operations have been significantly impacted at all levels.**

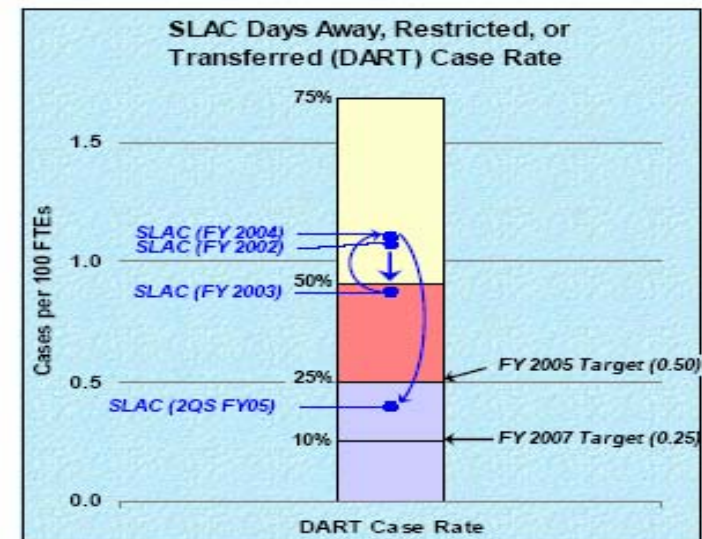
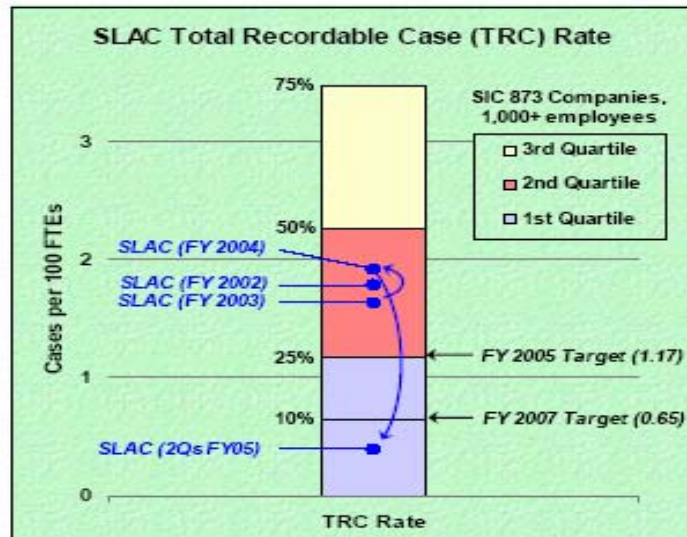
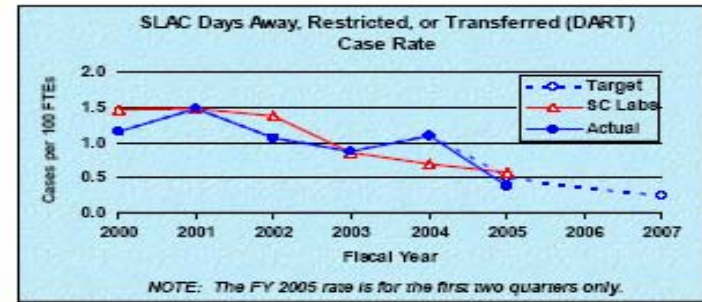
Halting operations was the correct and appropriate response -- our scientific program must be conducted in the safest possible manner

- **The Laboratory staff and the user community are to be commended for the manner in which they dedicated themselves to the Lab's "Safety First" program and to the diligent and safe manner in which operations were restored**
- **All the HEP facilities are back in operation**



ES&H – Safety Comes First

- Recovery from the type A accident is not complete. We still have to achieve full implementation of ISMS and a clearer alignment of roles and responsibilities for the key elements of the safety system
- Goals for accident rates are challenging, but we *must* achieve them





FY2005 Is A Challenging Year (continued)

- The start of the FY2005 HEP scientific program was delayed by 6 months. With help from the DOE, we have readjusted the program so that the linac and B Factory programs will run continuously through to late Summer 2006. In this way we will recoup almost all the time lost as a result of the accident**
- Budget appropriations only concluded in January 2005. Our HEP budget fell well short of expectations and we had to make program adjustments and lay off 55 HEP-supported people**



SLAC: A Laboratory Well Positioned for Future Success

- **SLAC built a world-class scientific laboratory because its program has always been:**

Driven by outstanding science which has

Pushed the limits of discovery

Sustained by exceptional technical innovation

- **These characteristics continue to flourish at SLAC and are the foundation of our strategic plans for the future. The core competencies needed for our future success are exactly those we possess so strongly today**
- **While the scientific drivers are changing, the core tasks remain the same and the staff skills-set we need remains the same**



SLAC Future – Responding to the Changing Scientific Landscape

The balance of the scientific elements of the Lab are changing:

The size of the photon science program will grow significantly in the next three years. By 2009, the on-site accelerators, SPEAR3 and Linac Coherent Light Source (LCLS), will both be doing Photon Science. By 2009, Basic Energy Science (BES) will be the dominant DOE fund source in the lab

B Factory will run through FY2008. Post FY2008, Particle and Astro physics will be focused on BABAR analysis, the ILC machine and detector, accelerator science/R&D, Gamma ray Large Area Space Telescope (GLAST), Large Synoptic Survey Telescope (LSST), Enriched Xenon Observatory and theory

Scientific Computing challenges abound in both focus areas

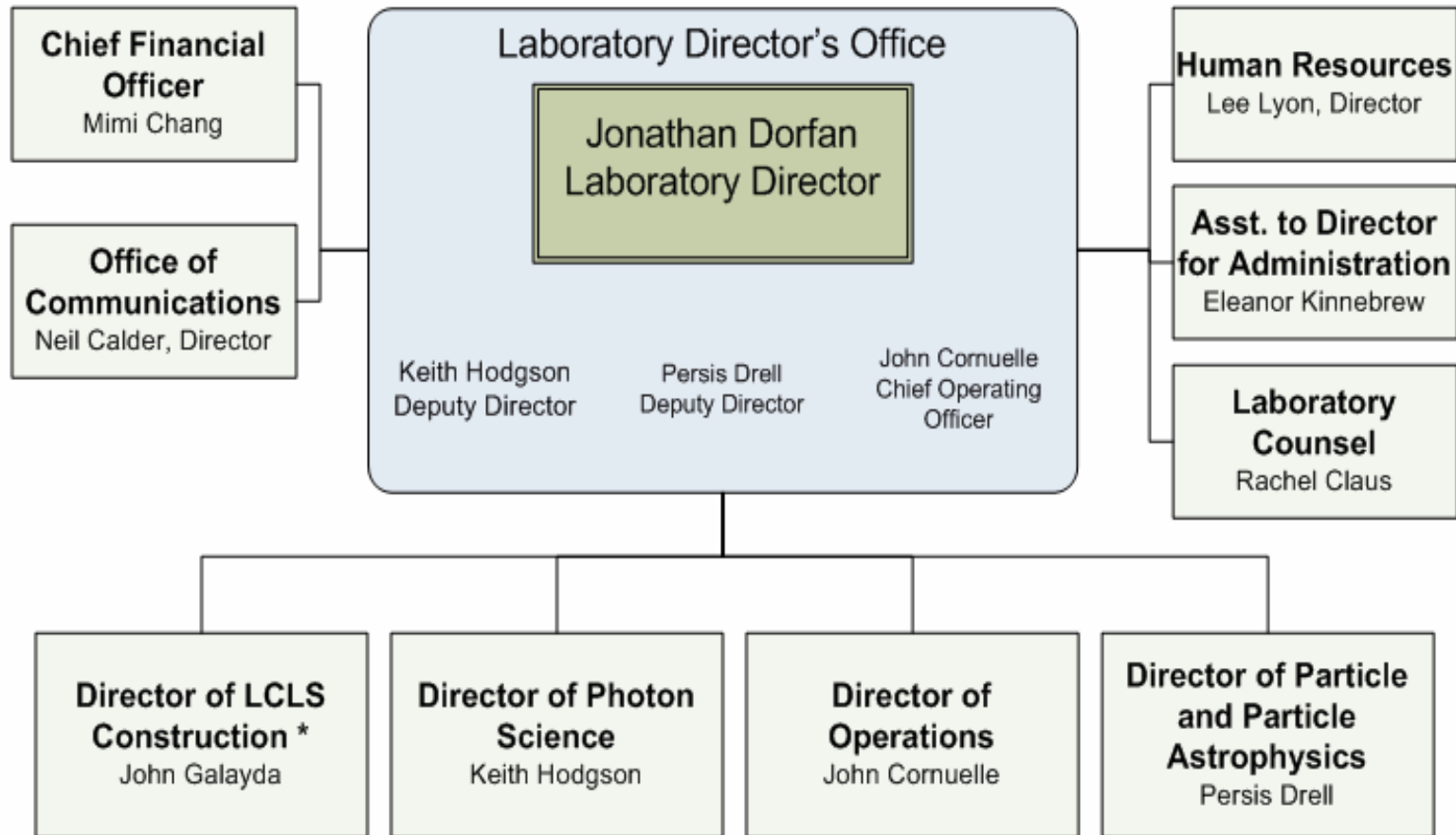


Reorganized for the New Era

- **As of May 24, The Laboratory's 43 year-old organizational structure has been changed**
The new organizational structure is built around four new directorates -- Particle & Particle Astrophysics, Photon Science, LCLS Construction, and Operations.
 - ↪ **It is better positioned to serve the two science focus areas**
 - ↪ **It enhances and stresses the primacy of administrative and operational efficiency and the importance of strong and effective line management at the laboratory**
- **An entirely revamped web site was released on May 12, 2005**

Stanford Linear Accelerator Center

Directorate Level Organization



* Reports directly to the Laboratory Director



New Web Site Released May 12, 2005

Stanford Linear Accelerator Center - Mozilla Firefox

http://68.20.251.170/slac/index_WKG.shtml#

SLAC

STANFORD LINEAR ACCELERATOR CENTER
Operated by Stanford University for the U.S. Dept. of Energy

Photon Science | Particle & Astroparticle Science

LCLS | PIXE | SSRL | UltraFast Center | more | BaBar | GLAST | ILC@SLAC | KIPAC | more

Search: GO

SLAC WEB | PEOPLE | Detailed Index

For Users | For Staff | For Students | For Educators | For Media and Press

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Office of Science/ U.S. D.O.E.

Stanford Linear Accelerator Center, Menlo Park, CA
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News

Barry Barish to Lead International Linear Collider Design.
Unique Global Light Source Website Launched
ES&H Safety Tip of the Week: Group Lifting - from SLAC Today
Science Highlight - Understanding the Mysteries of High-temp Superconductors - from SSRL Headlines
Science from a Hole in the Ground - from symmetry
Understanding the Mysteries of High-Temperature Superconductors - from Interaction Point

News Sources
SLAC Today | SSRL Headlines | symmetry | Interaction Point | Lightsources.org | Interactions.org

SLAC Celebrates 2005 World Year of Physics with Quantum Diaries

X-Ray Blaze on an Invisible World From symmetry, March, 2005

What LCLS can do is study very small things on a very fast time scale and there's no other way to do it," says Keith Hodgson, director of SSRL. "We're looking to discover new things about materials and techniques to study materials."
[Read more...](#)

Particle and Astroparticle Main Page

Stanford Linear Accelerator Center - Particle and Astroparticle Science - Microsoft Internet Explorer

http://home.slab.stanford.edu/public/particlescience/index.shtml

SLAC

STANFORD LINEAR ACCELERATOR CENTER
Operated by Stanford University for the U.S. Dept. of Energy

PARTICLE & ASTROPARTICLE SCIENCE

Searching for answers to fundamental questions about the ultimate structure of matter and the forces between these fundamental particles, scientists use accelerators which speed electrons and anti-electrons to nearly the speed of light, and study their collisions and collisions from fixed target experiments. Using similar technology in astrophysics, space-based detectors will help us understand the birth and evolution of the universe.

Accelerators
[Accelerator Research A](#)
[Accelerator Research B](#)
[ILC](#)
[Laser Acceleration \(E163\)](#)
[ORION](#)
[Plasma Wakefield \(E157/E162/E164\)](#)
[Polarized Positron Source Studies \(E166\)](#)

Experiments
[Astro Gamma](#)
[B Meson Decays \(Group B\)](#)
[BaBar](#)
[Enriched Xenon Observatory \(EXO\)](#)
[Experimental Physics \(Group C\)](#)
[FLASH \(E165\)](#)
[GLAST](#)
[LSST](#)
[Microdrop Particle Search](#)
[NuSTAR](#)
[Particle Physics \(Group K\)](#)
[SNAP](#)

BaBar
The BaBar detector was built at SLAC to study the millions of B mesons produced by the PEP-II storage ring. The BaBar Collaboration consists of approximately 600 physicists and engineers from 75 institutions in 10 countries.

KIPAC
The Kavli Institute for Particle Astrophysics and Cosmology: Our Mission is to bridge theoretical and experimental physics communities, and bring their combined strengths to bear on some of the most challenging and fascinating problems in particle astrophysics and cosmology.

ILC
The International Linear Collider is a proposed future international particle accelerator. It would create high-energy particle collisions between electrons and positrons, their antimatter counterparts.

GLAST@SLAC
The Gamma Ray Large Area Telescope. The GLAST project is funded in the United States by NASA and the Department of Energy and by government agencies in France, Italy, Japan, and Sweden.

Particle & Astroparticle Science Links

Main Home Page

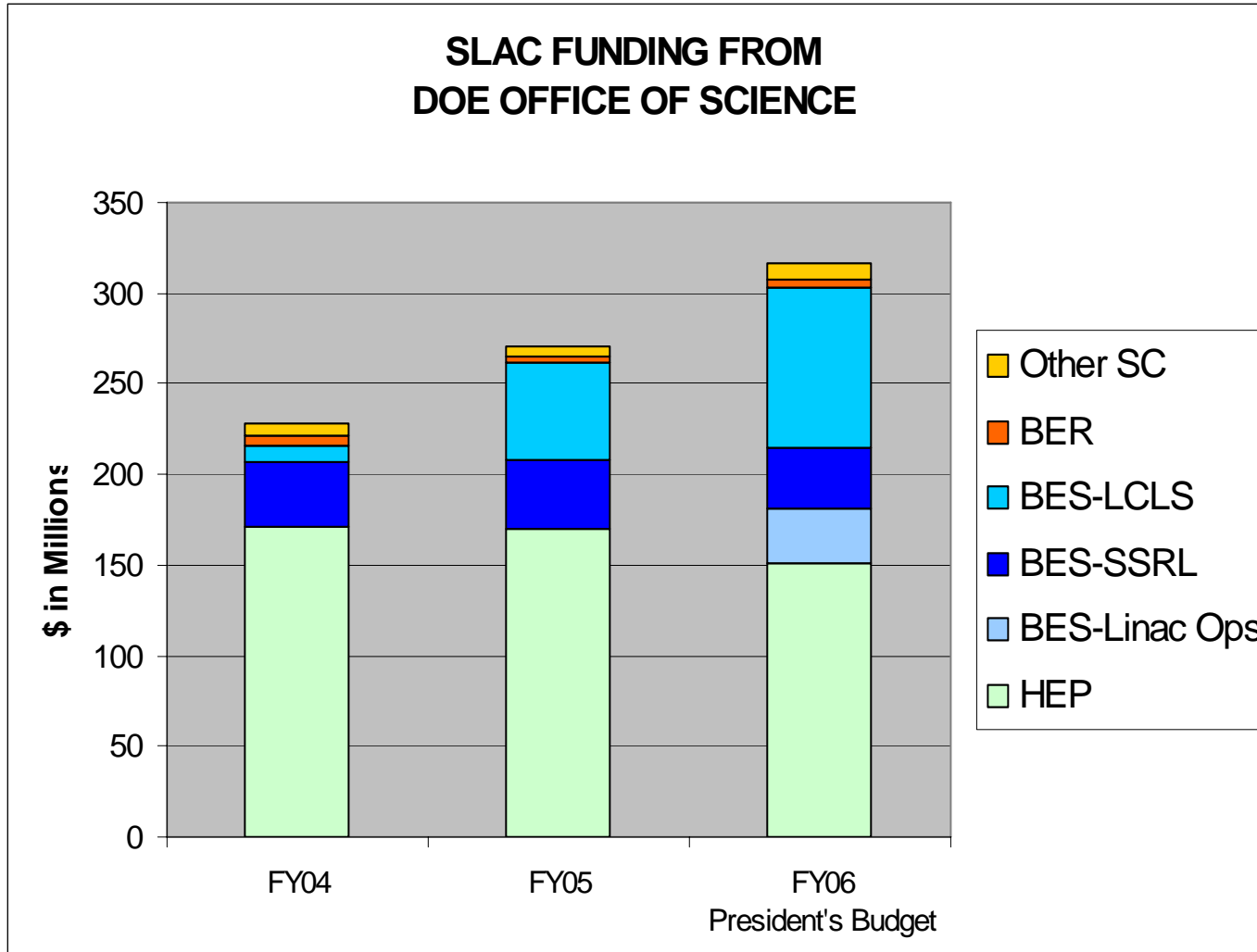


Our Major Stakeholders are Investing in Our Future

- **Our primary stake-holders, DOE/Congress and Stanford University, are both making large investments at SLAC**
 - ↪ **The President's FY06 budget strongly supports the SLAC HEP program, including full utilization of the B Factory program**
 - ↪ **DOE has entrusted SLAC with the long-term stewardship of one of the world's most exciting accelerator-based scientific landscapes — ultra-fast science. This complements the recent investment in SPEAR3**
 - ↪ **Stanford University is likewise investing in major ways in our long-term future**
 - **Kavli Institute for Particle Astrophysics and Cosmology**
 - **Ultra-Fast Science Center**
 - **Guest House**



Total DOE Funding is Increasing



SC – Science
BES – Basic Energy Sciences

BER – Biological and Environmental Research
HEP - High Energy Physics



What are the Scientific Drivers?

○ Particle and Astrophysics:

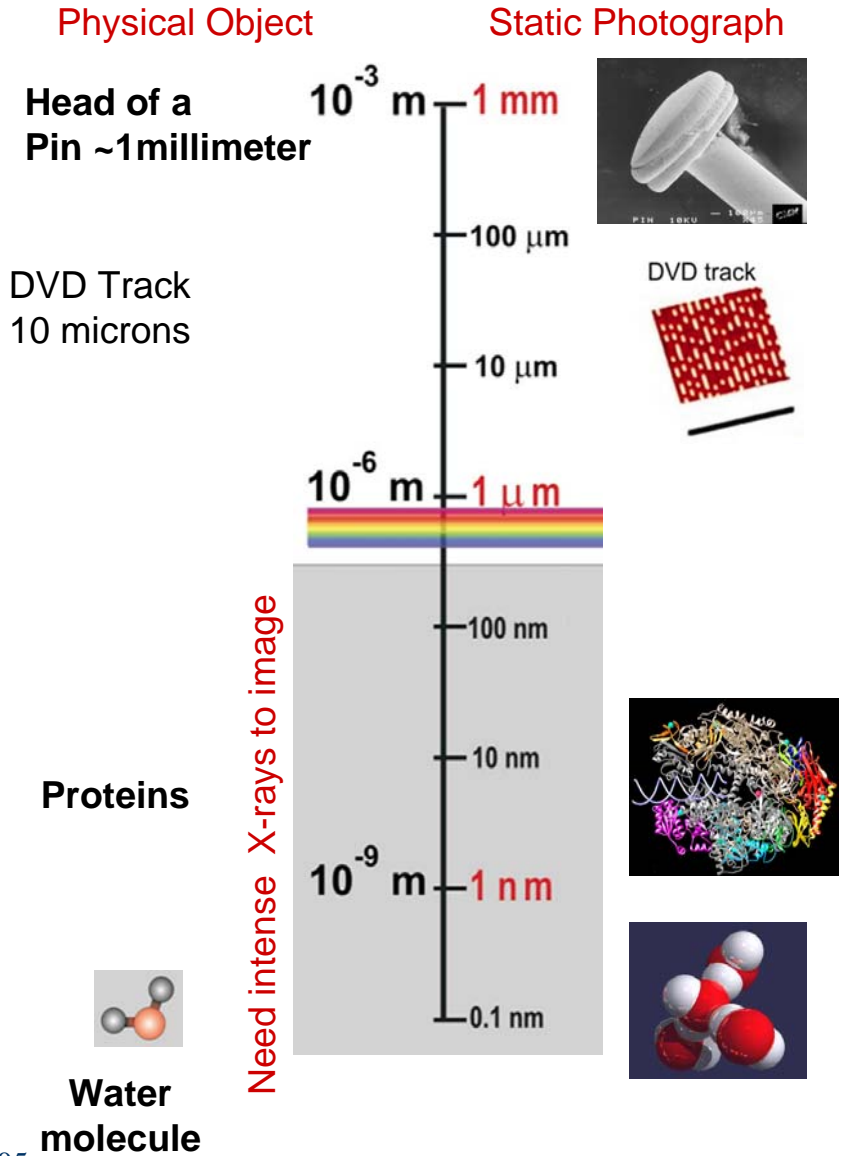
↪ **Study of Nature's fundamental building blocks and forces – but with the recent revolution that leaves us not understanding 95% of our Universe**

○ Photon Science Program:

↪ **Study of the ultra-small and the ultra-fast at atomic scales**



X-Rays have opened the Ultra-Small World -- Realm of SPEAR3



There is still an enormous amount to be learnt about the ultra-small world of the physical, chemical, biological, materials, environmental and medical sciences

SPEAR3 has a long and exciting life ahead!



SPEAR3 – A Long Life of Exciting Science





X-Rays have opened the Ultra-Small World -- Realm of SPEAR3

X-ray Lasers will open the Ultra-Small and Ultra-Fast Worlds –Realm of LCLS

Physical Object

Static Photograph

Head of a Pin ~1 millimeter

10^{-3} m

1 mm



DVD Track 10 microns

100 μ m

DVD track



10 μ m

10^{-6} m

1 μ m



Need intense X-rays to image

100 nm

Proteins

10 nm



10^{-9} m

1 nm

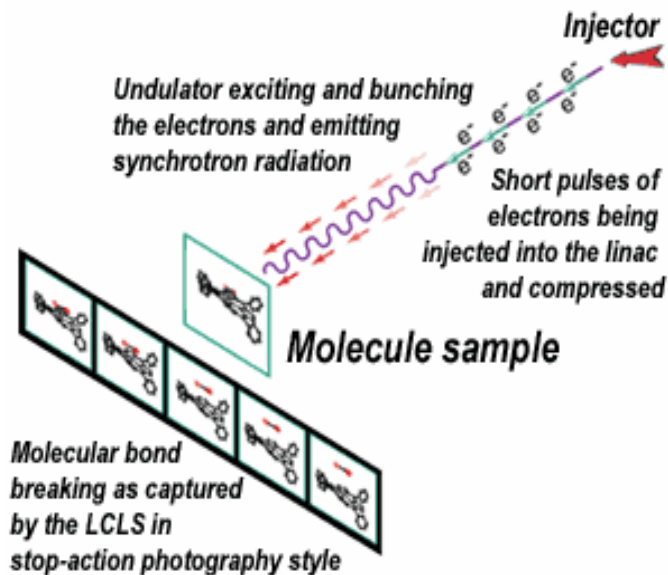


Water molecule

0.1 nm



What if I wanted to see the ultra-fast motion of ultra-small objects?
Can I take a “movie” of ultra-small objects performing their tasks?

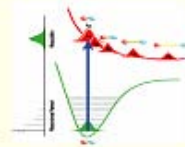




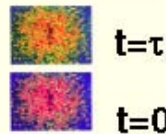
LCLS Science Program – Remarkable Opportunities for Discovery



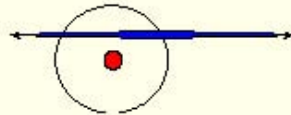
Program* developed by international team of scientists working with accelerator and laser physics communities



Femtochemistry and Biology – watching motions of atoms and molecules



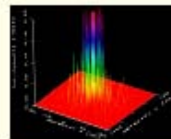
Nanostructured materials – their structure and function



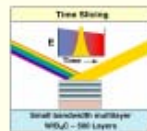
Atomic Physics – exploring how electrons move



Plasmas and Warm Dense Matter – creating And studying exotic states of matter



Imaging of Nanoclusters and Single Biomolecules – structures without crystals

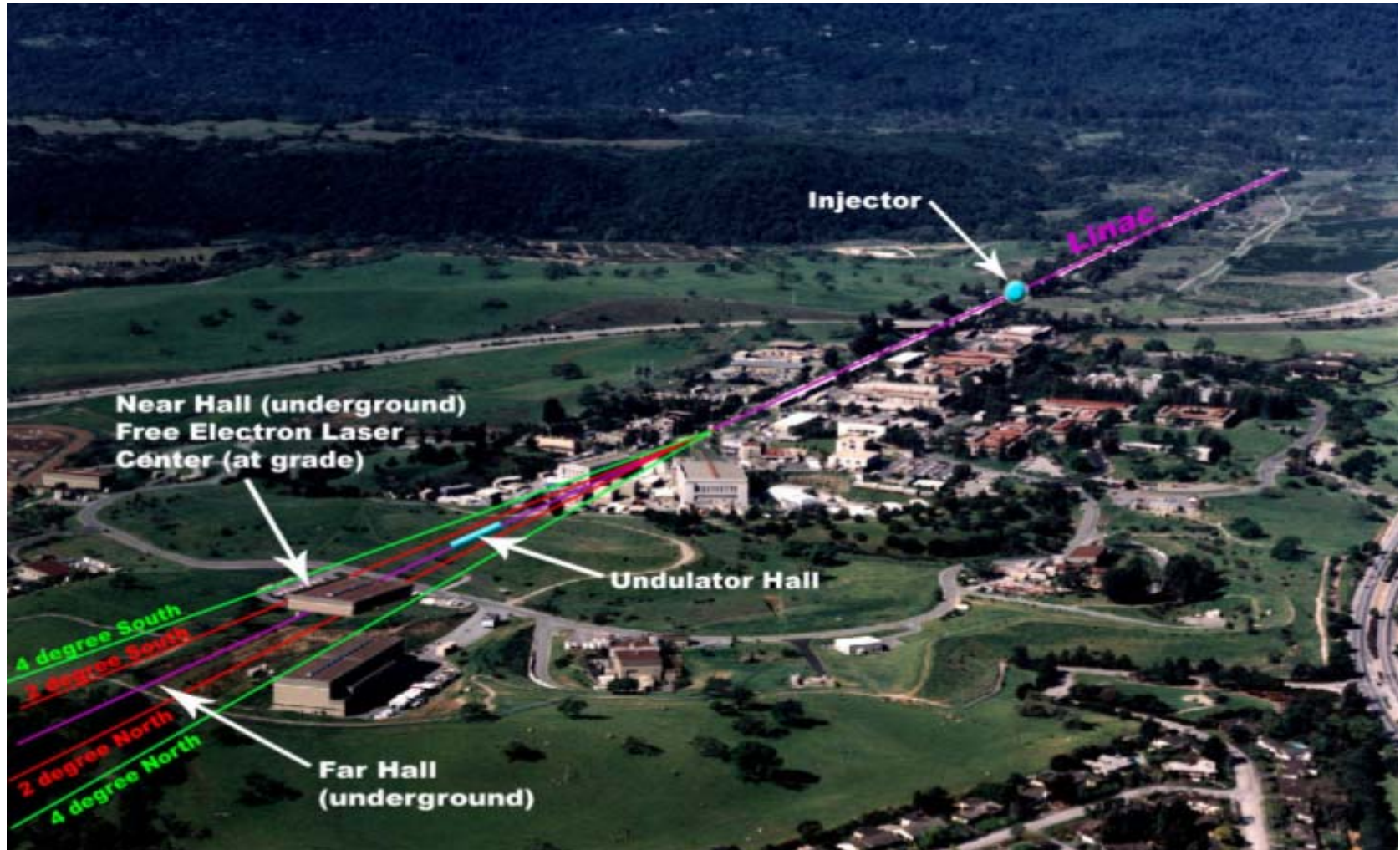


X-ray Laser Physics – pushing the boundaries of x-ray properties

*See http://www-ssrl.slac.stanford.edu/LCLS/papers/LCLS_Experiments_2.pdf



Linac Coherent Light Source at SLAC: The Next Revolution in X-Ray Science



LCLS Will Be The World's First X-ray Laser



LCLS Construction

- **Budget - \$379M through 2009. Commissioning in FY2008. Operations start in April 2009**

Linac Coherent Light Source Funding Profile (AYM\$)									
	FY02	FY03	FY04	FY05	FY06	FY07	FY08	FY09	Total
TEC Funding	0.00	5.93	7.46	50.08	85.54	105.50	50.50	10.00	315.00
OPC Funding	1.50	0.00	2.00	4.00	3.50	16.00	15.50	21.50	64.00
Total Funding	1.50	5.93	9.46	54.08	89.04	121.50	66.00	31.50	379.00

- **LCLS is a major endeavor**
- **Anticipate major upgrades to begin ~2012**
- **Stanford/SLAC in partnership with DOE has created the Ultrafast Science Center to provide a broad-based intellectual focus to underpin the LCLS program**

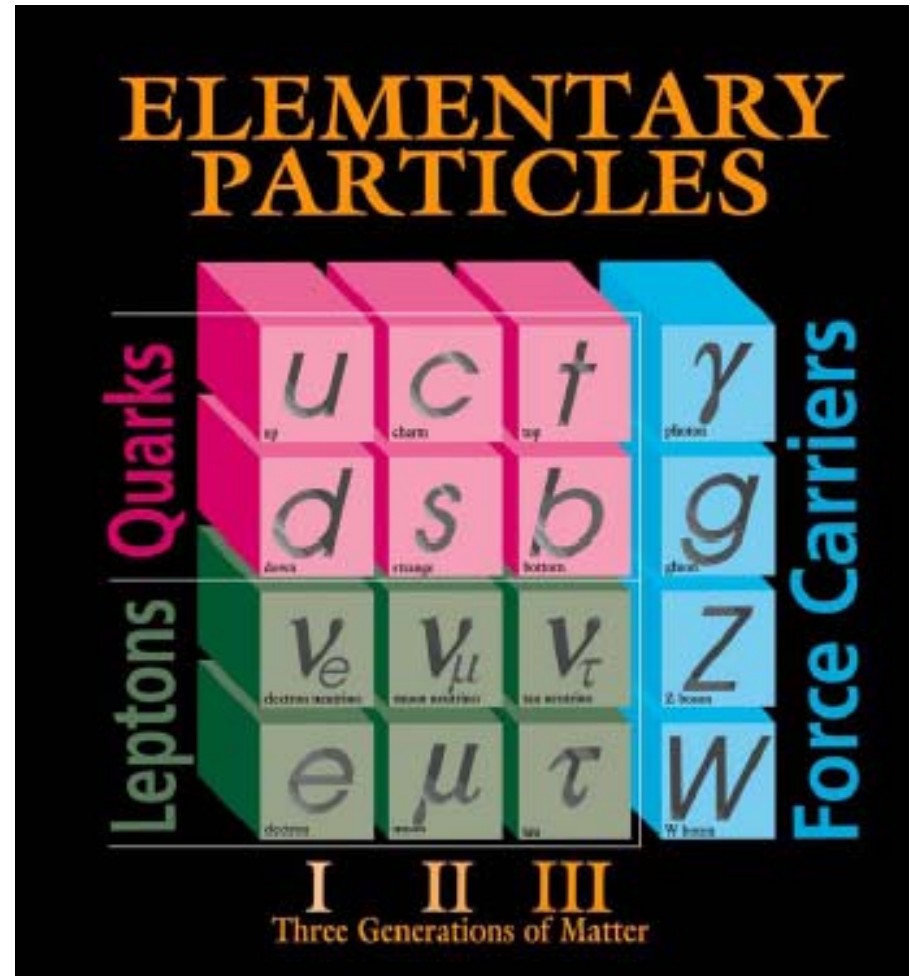


Particle Physics

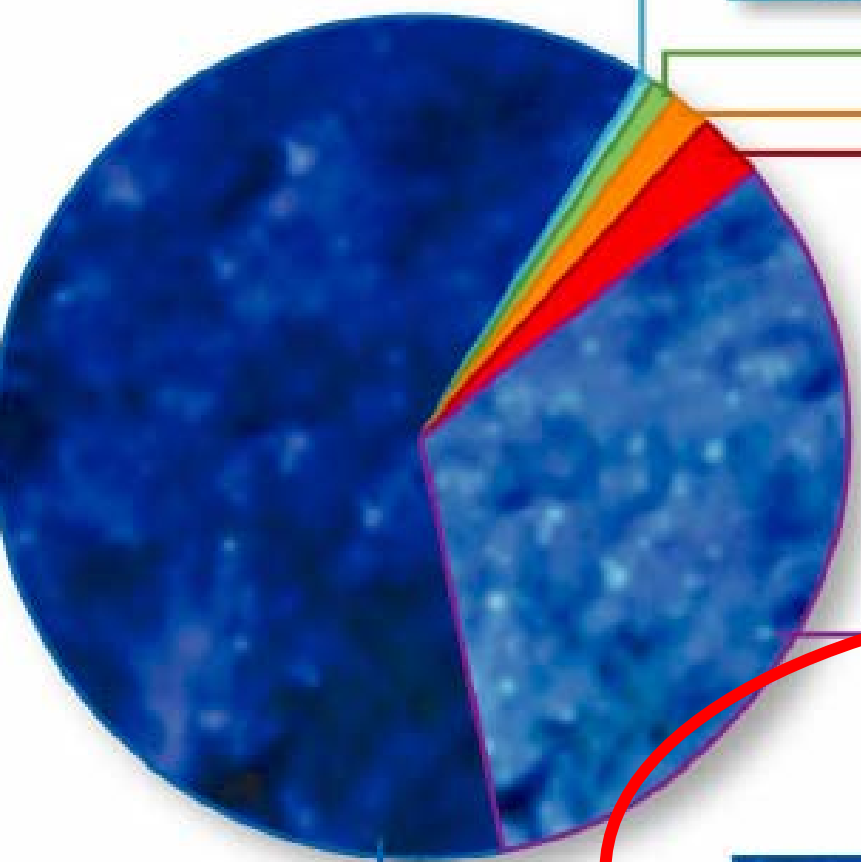
○ 50 years of intense effort have led to detailed picture of physical world

- ↪ Composed of quarks and leptons
- ↪ Interacting via force carriers called gauge bosons: EM, strong, and weak force

While this is only 5% of our Universe, there remain major questions still to be answered concerning the world of quarks and leptons



Cosmic Pie



Chemical Elements:
(other than H & He) 0.03%



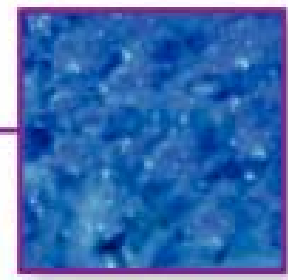
Neutrinos:
0.47%



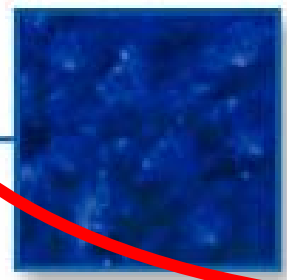
Stars:
0.5%



**Free H
& He:**
4%



Dark Matter:
25%



Dark Energy:
70%

**Fundamental
Mysteries**



How will SLAC Program Engage the Particle Physics Agenda?

- ***B* Factory** — run it “flat out” until 2008. It still has considerable *discovery potential* for understanding the matter/anti-matter mystery and for physics beyond the Standard-Model. In addition, it has enormous relevance to the detailed understanding of heavy quark interactions and spectroscopy
- **International Linear Collider** — Compelling scientific need for this facility. Ultimately the phenomena we see in our cosmic measurements must show up as particles. ILC is required if we are to fully understand our newly mysterious Universe
- **Particle Astro/Cosmology Program** — space-based and terrestrial telescopes plus theory and advanced simulations to attack the Dark Energy & Dark Matter mysteries. Telescopes like GLAST, LSST, SNAP, NuStar,
- **Enriched Xenon Observatory (EXO)** — What is the identity of the ubiquitous e^- neutrino – majorana or dirac? What is its mass?



Kavli Institute for Particle Astrophysics and Cosmology



Founded 2003

Director: Roger Blandford

Deputy Director: Steve Kahn

~60 members (30 new)

Two new buildings, labs

**Instrumentation, data analysis,
particle astrophysics, relativity,
computational astrophysics,
observational cosmology,
theoretical cosmology...**

KIPAC is a major commitment by Stanford



We Have a Crucial Role To Play in Advanced Accelerator Technology, Computing and Theory

- **Advanced accelerator technology will continue to be a central focus for SLAC. SLAC is a powerful, national treasure-trove of accelerator science talent and capabilities:**
 - ↗ **Realizing the full potential of LCLS will advance linac accelerator technology in new and broadly useful ways**
 - ↗ **Realizing the ILC *requires* the powerful SLAC “team”**
 - ↗ **Creating the acceleration strategies, techniques and instrumentation that will carry accelerators forward into the second half of this century is of prime importance – SLAC is leading the way**
- **Every scientific focus area of the Lab needs major advances in scientific computing capabilities. We will continue to lead the community into those challenging arenas**
- **Particle and astroparticle theory will grow yet stronger at SLAC as we attempt to understand our mysterious Universe**



Summary -- This will Come on Thursday Morning

- **You have a full agenda of plenary talks and breakout sessions through till Thursday morning. So I will hold my summary and review of issues until then**