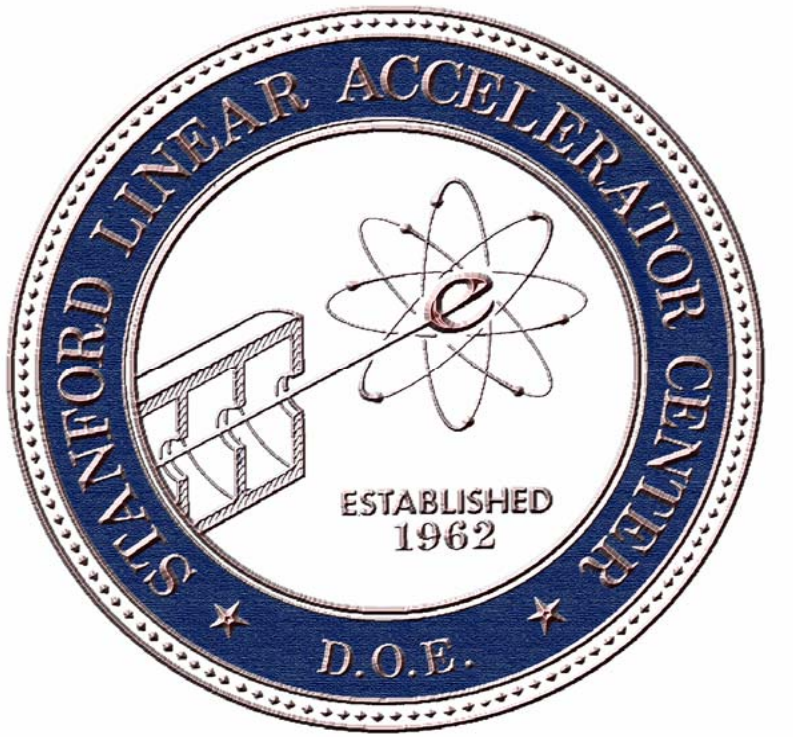
Director's Report



By Jonathan Dorfan, Director

DOE Annual HEP Program Review

June 2-4, 2004

Two Main Programs

- **High Energy Physics / Particle Astrophysics**

  Experiments, theory, accelerator development for studies of the ultimate structure of matter, the forces between the fundamental entities, the birth and evolution of the universe

- **X-ray Science (SSRL)**

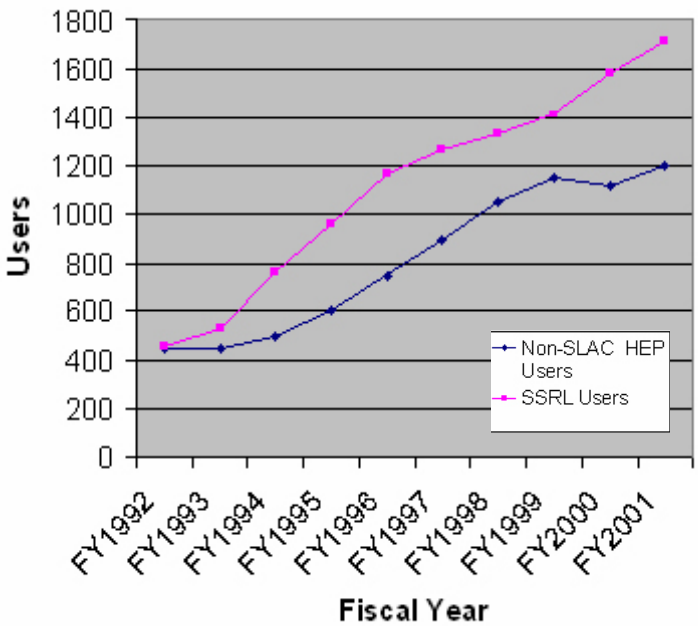
  The use of ultra high-intensity x-ray beams (ten million times the intensity of x-ray tubes) for studies in physics, biology, chemistry, medicine, and environmental sciences

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

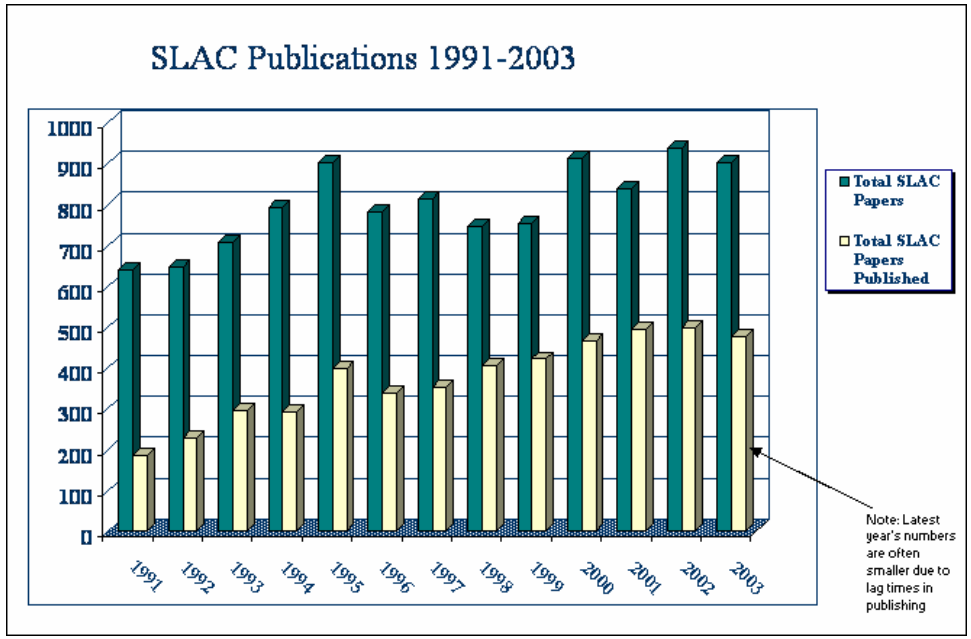
- **Science Program at SLAC generates 800-900 publications / year – about half HEP/Astro, half SSRL**

Scientific Productivity Continues to Grow

Users for HEP and SSRL



SLAC Publications 1991-2003



- **Laboratory has transitioned from a relatively small, mostly US user community to a large, multi-national (25 nations) user community**

Stanford University – A Key Ingredient to Our Success

- SLAC has deep roots in one of the world's leading research universities – Stanford. Without question, this has been a key ingredient in the Laboratory's success
- In the past 4 years, the University has taken aggressive steps to make larger investments at SLAC. The University's motive is simple – enhancing the opportunity to do world class science

  (Stanford charges no fee for the use of its land or for the operation of SLAC)
- With strong support from all elements of the university, third party financing has become a powerful new element in SLAC's growth ⇒ Guest House, Kavli Institute are two examples

SLAC as an International Research Facility

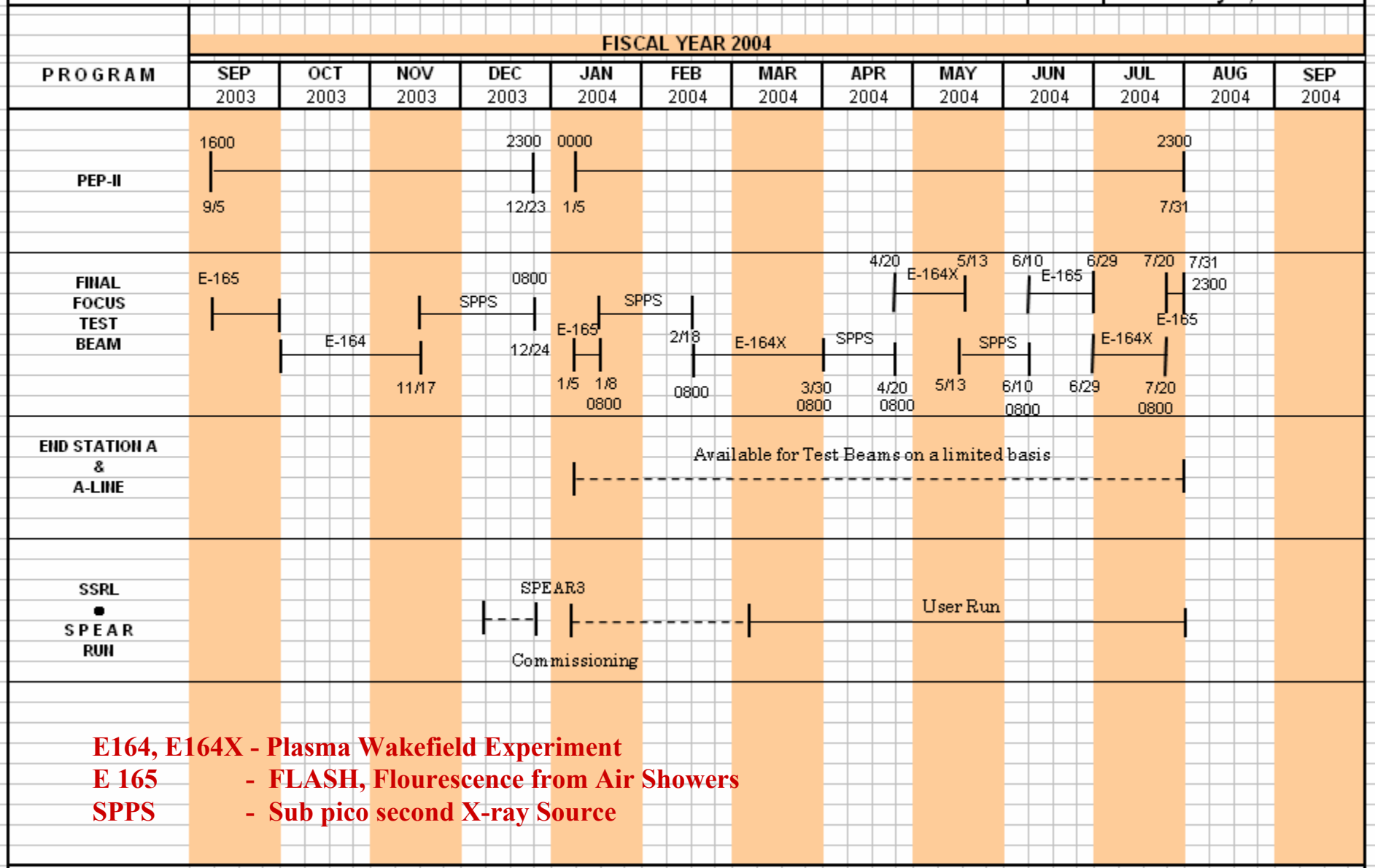
- **Our primary function is constructing and operating large research facilities for our users. This requires**
  - a) **Highly specialized technical staff and extensive infrastructure to design, construct and maintain large accelerators and detectors**
  - b) **Extremely efficient operation of complex accelerators and detectors**
  - c) **Highly specialized, state of the art, computing systems (running 24/7/12) for the analysis and worldwide distribution of data**
- **The operating efficiency of SLAC's machines is exceptionally high — a tribute to the enormous skill and dedication of the Laboratory staff**

SLAC OPERATING SCHEDULE

FISCAL YEAR 2004

December 1, 2003

Updated May 5, 2003

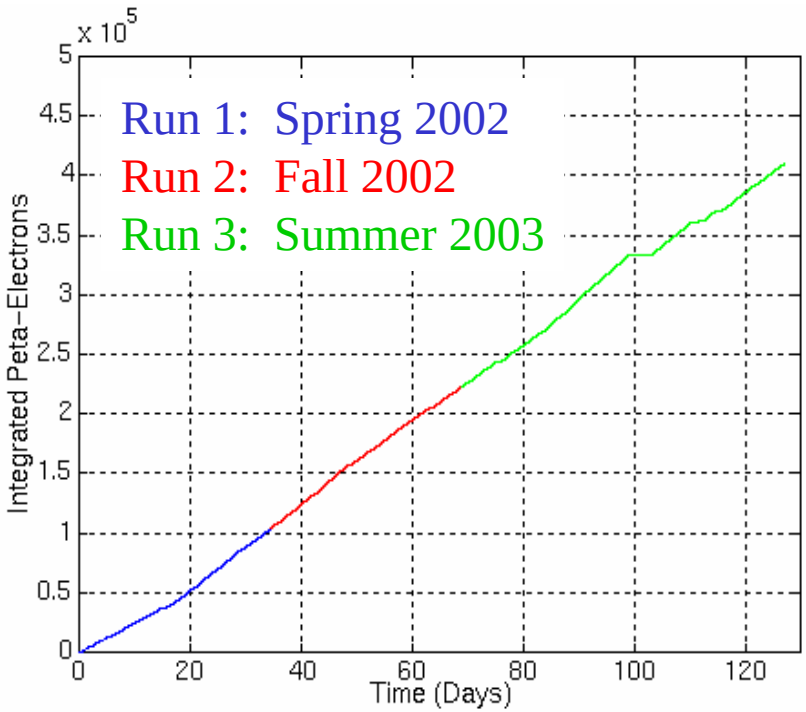


E164, E164X - Plasma Wakefield Experiment
E 165 - FLASH, Flourescence from Air Showers
SPPS - Sub pico second X-ray Source

Notes:

SLAC Machines Run with Very High Efficiency

E158 Physics Runs



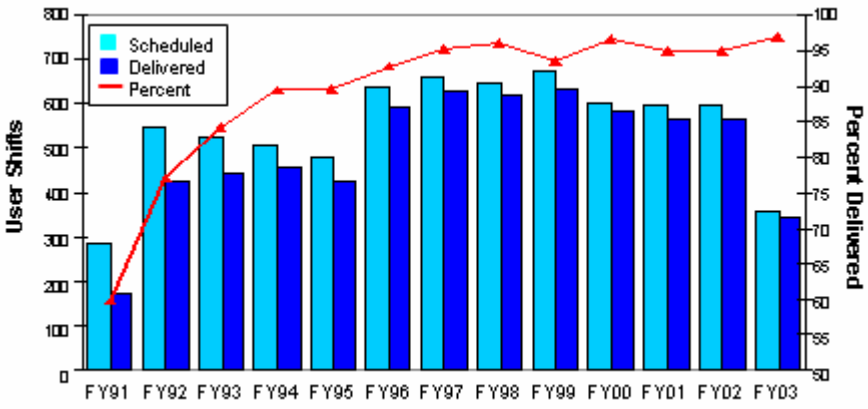
E-158 Beam Parameters

Parameter	Proposal	Achieved
Intensity at 48 GeV	6×10^{11} / pulse	5.3×10^{11}
Intensity at 45 GeV	3.5×10^{11}	4.3×10^{11}
Polarization	80%	85%
Repetition Rate	120 Hz	120 Hz
Intensity jitter / pulse	2% rms	0.5% rms
Energy jitter / pulse	0.4% rms	0.03% rms
Energy spread	-	0.15% rms
Delivered Charge* (Peta-E)	345K	410K

*1 Peta-Electron = 10^{15} electrons

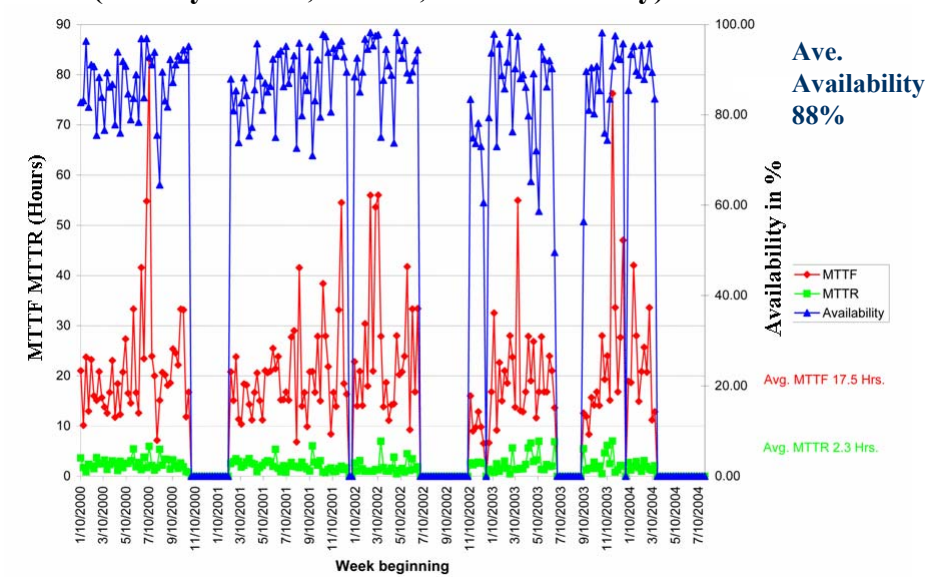
SLAC Machines Run with Very High Efficiency

SPEAR Annual Performance

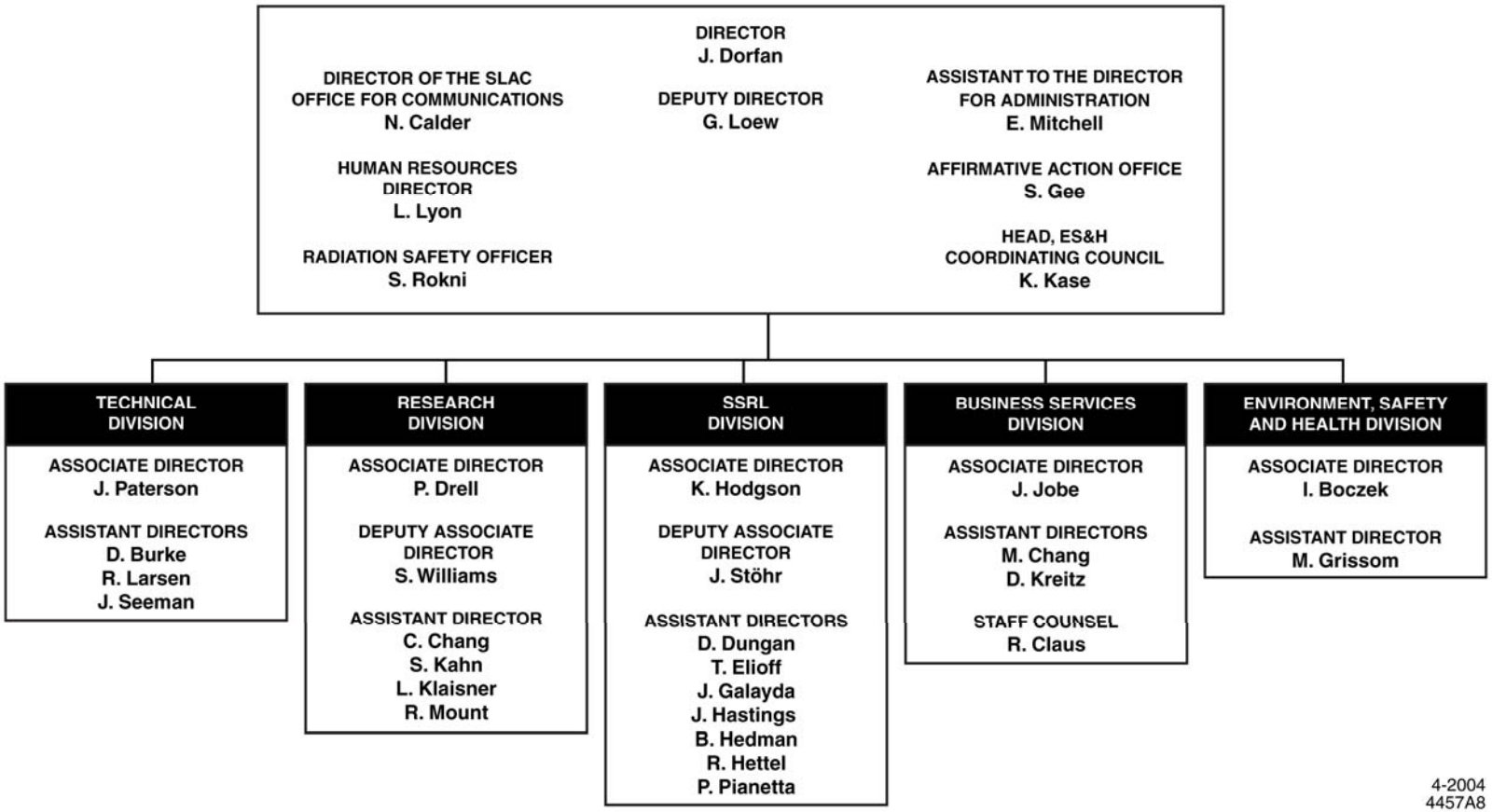


For FY03 run that ended in March – SSRL delivered a record-tying 96.8%. In comparison, up time in 1975 was 60%

Linac + PEP-II Rings: Uptime Performance
(Weekly MTTF, MTTR, and Availability)



Stanford Linear Accelerator Center
Total Organization

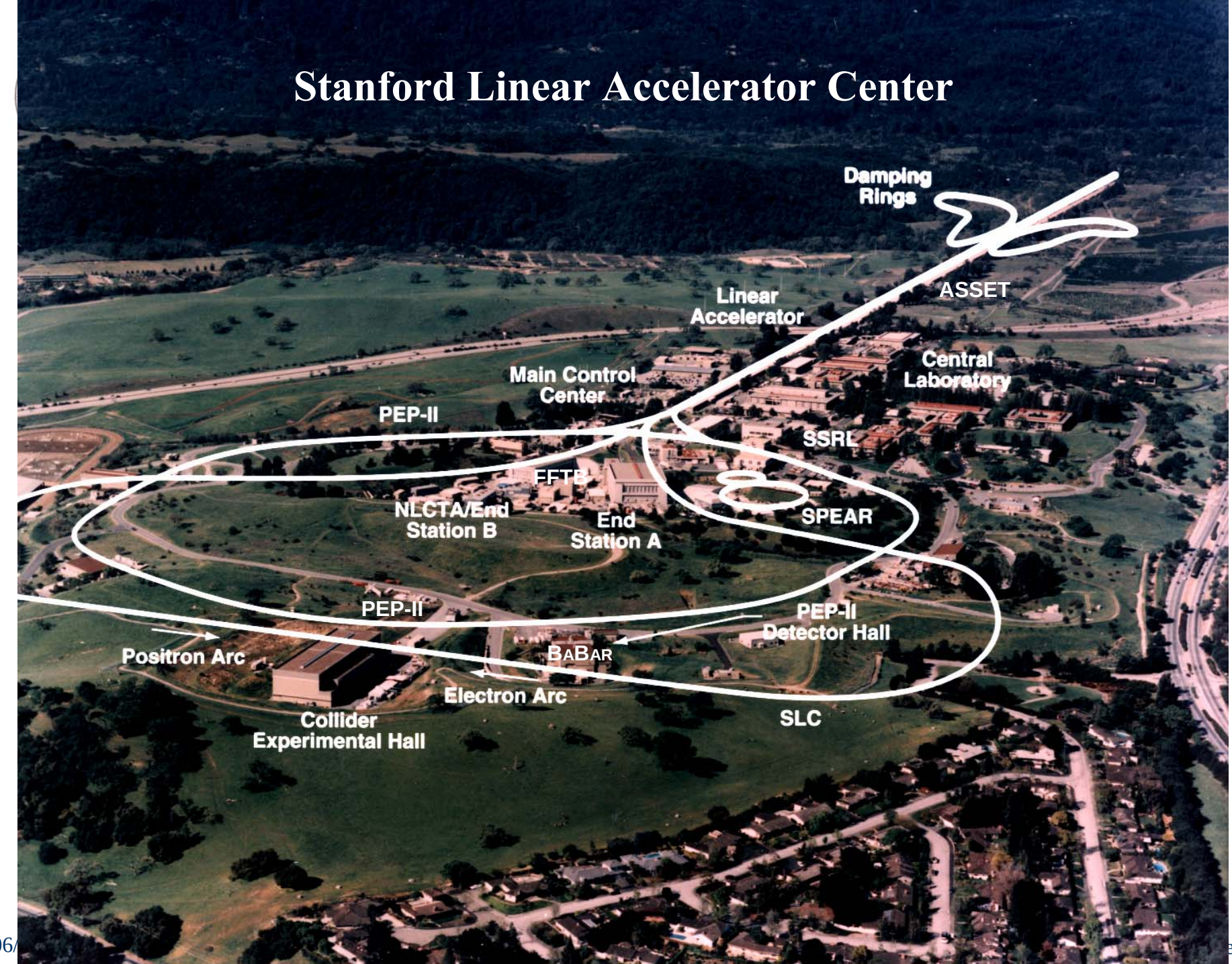


SLAC Experimental Program Advisory Committee

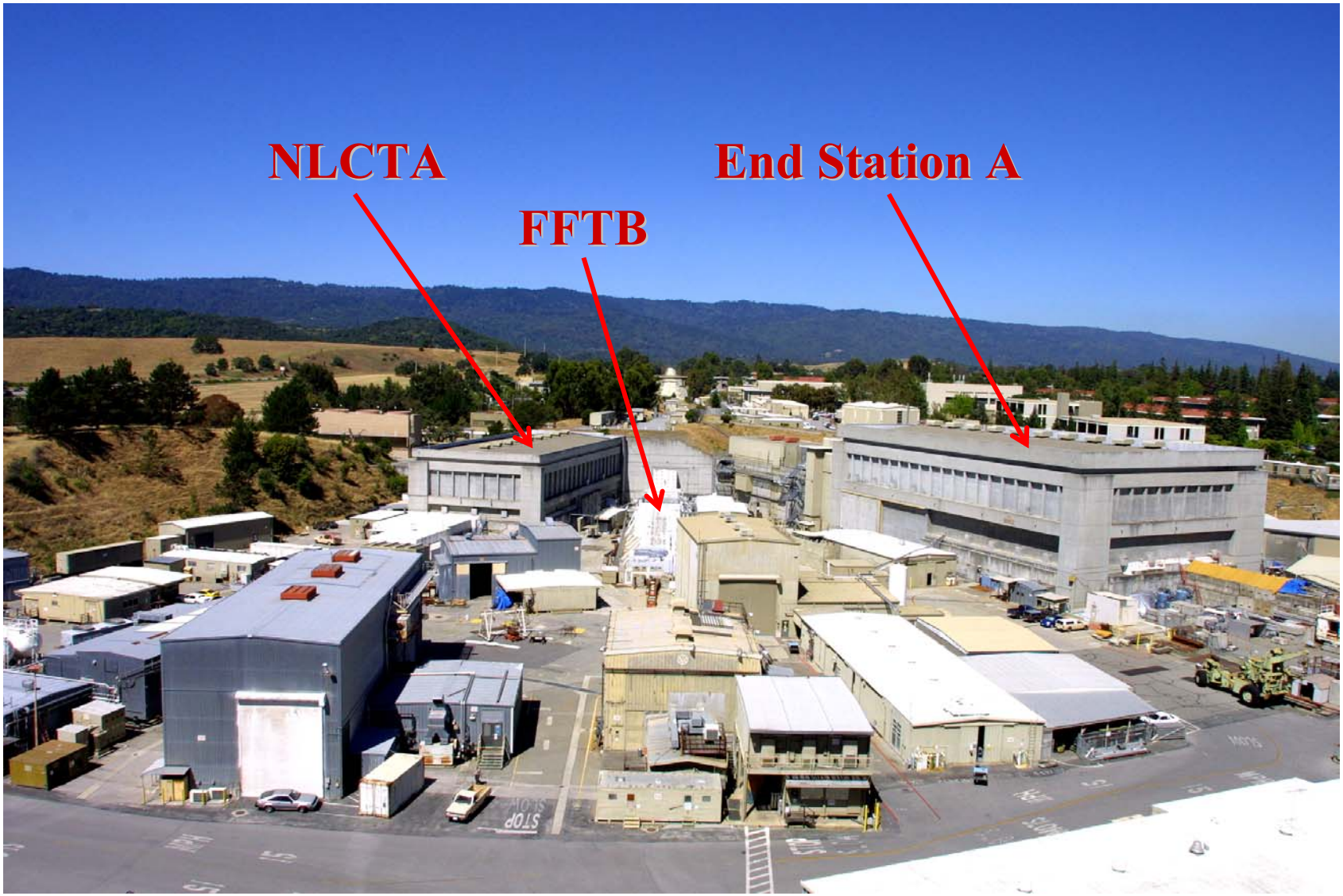
Phil Burrows	Oxford University
Allen Caldwell	MPI Munich
Tatsuya Nakada	CERN and PSI
Eckhard Elsen	DESY (Chair)
Emlyn Hughes	Caltech
Joseph Lykken	Fermi National Accelerator Laboratory
Shamit Kachru	Stanford University and SLAC
Rene Ong	UCLA
Chris Adolphsen	SLAC
David Rice	Cornell University
Aaron Roodman	SLAC
Elizabeth Simmons	Boston University

- Meets roughly twice a year

Stanford Linear Accelerator Center



Research Yard – Looking West



Focus of Current and Future SLAC HEP/Particle Astro Program

- **SLAC program is addressing compelling scientific questions facing the field:**
  - **Where did the antimatter go? (B-Factory)**
  - **Are there new symmetries and forces of nature? (B-Factory, NLC)**
  - **Why are there so many particles? (B-Factory)**
  - **What is Dark Matter? How can we make it in the lab? (LSST, JDEM, GLAST, NLC)**
  - **Can we solve the mystery of Dark Energy? (LSST, JDEM, NLC)**
  - **Is there grand unification of particles and forces? (NLC, EXO)**
  - **What are neutrinos telling us? (EXO)**
  - **Are there extra dimensions of space? (NLC)**
- **SLAC HEP/Particle Astro program extremely broad**

Current SLAC HEP/Particle Astro Program

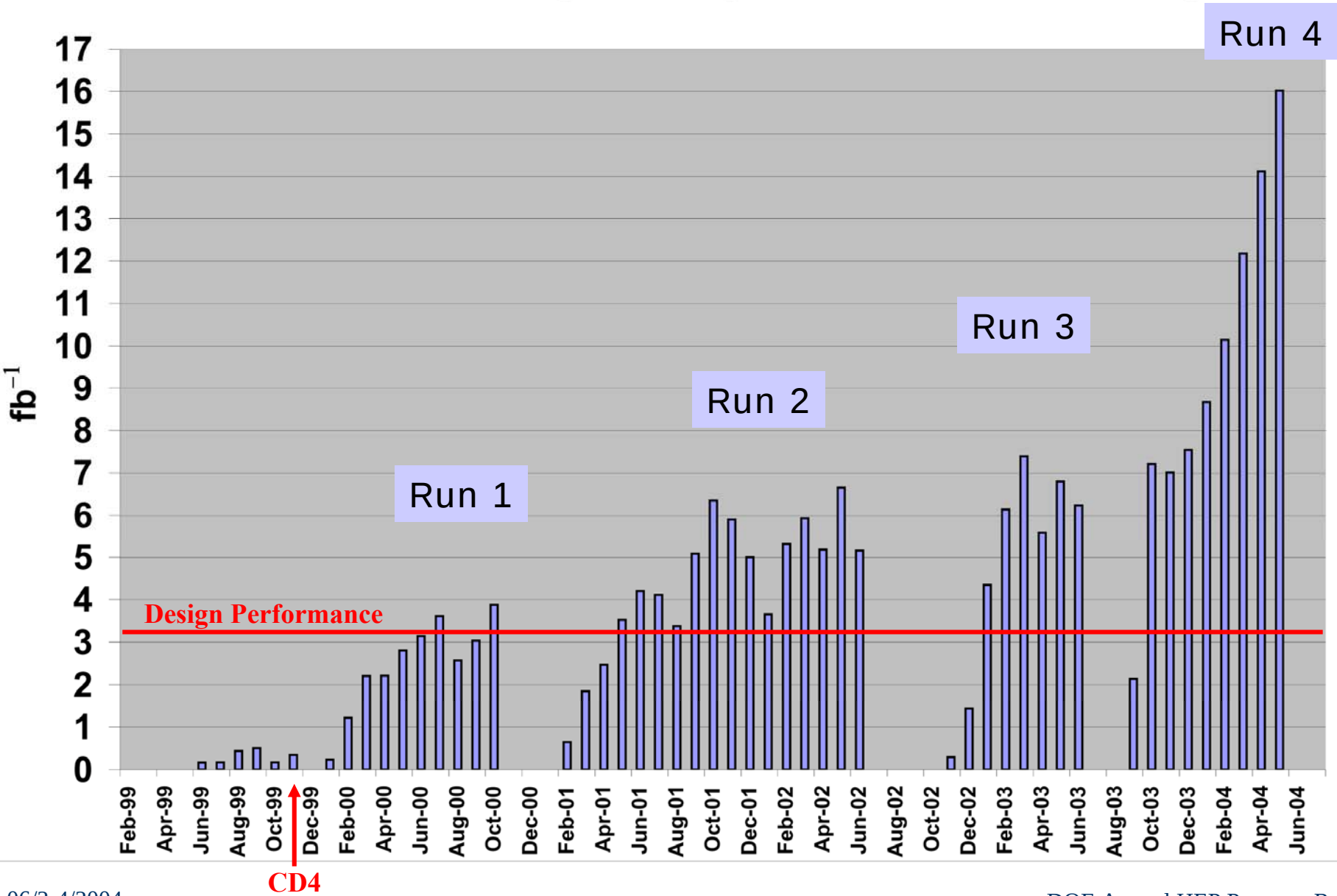
- **Main elements of the SLAC HEP/Particle Astro Program**
  - ***B* Factory Colliding Beam Program**
  - **End Station A fixed Target Program**
    - E158 – Precision Measurement of $\sin^2\theta_w$ at low q^2 . In final analysis
    - Proposal (LEP) to study LC Detector/IP Instrumentation
  - **Final Focus Test Beam $e^{\pm}$ Program**
    - FLASH, Flourescence Air Shower Calibration
    - E164, Wakefield Acceleration
  - **Accelerator R&D**
    - Linear Collider / NLCTA
    - Diverse, user-based program of advanced accelerator R&D experiments and theory
  - **Non Accelerator Physics**
    - Gamma Ray Large Area Space Telescope (GLAST) – in construction
    - EX0 – R&D study for expt. to measure ν_e mass
    - SLAC has recently joined SNAP (JDEM) and LSST
  - **Theory, HEP and Particle Astro**

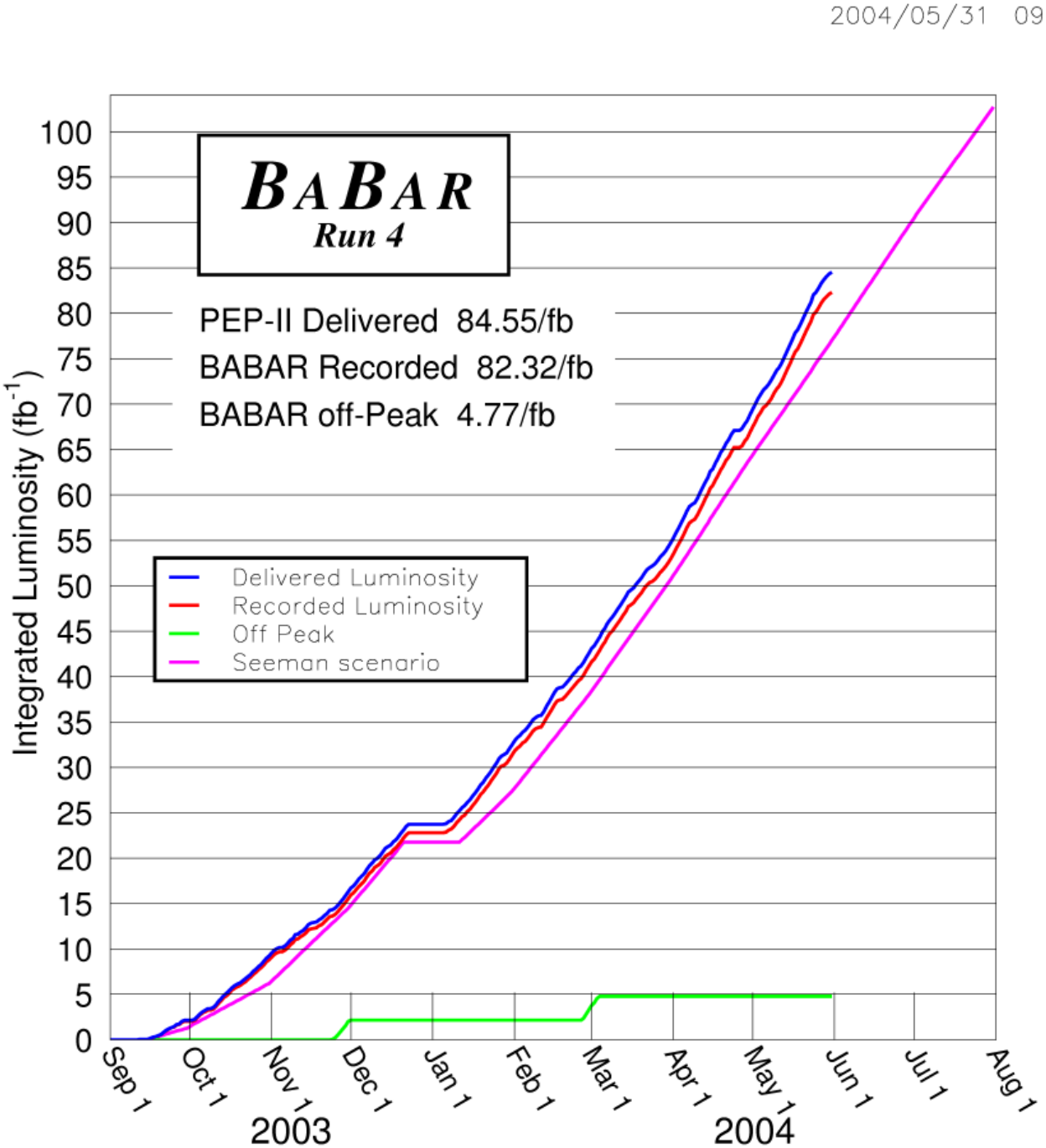
Progress in Past Year — Highlights

- ***B* Factory Program is flourishing and has shown astonishing performance growth**
  - **FY04 run alone will double BABAR's total data as of end of FY03**
    - As of FY03 monthly record for integrated luminosity was 7.3 fb^{-1}; its now 16.0 fb^{-1}
  - **BABAR is a physics "fountain" – collaboration has produced 96 journal articles. Continues to lead the way with first results in new CP modes (ex. $B \rightarrow \rho\rho$, $B \rightarrow f^0 K_s^0$, $B \rightarrow \pi^0 K_s^0$, …)**
- **GLAST LAT was successfully baselined despite withdrawal of one major foreign partner. Project is now successfully transitioning from prototypes to production of flight hardware**
- **NLC R&D has successfully met its two TRC R1 demonstration challenges. In addition, eight structures are running at NLCTA with 65 MeV/m gradient and below-spec breakdown rates**

Last updated:
6/1/2004 7:32

PEP-II Monthly Integrated Luminosity




2004/05/31 09.20
BABAR
Run 4
PEP-II Delivered 84.55/fb
BABAR Recorded 82.32/fb
BABAR off-Peak 4.77/fb
Delivered Luminosity
Recorded Luminosity
Off Peak
Seeman scenario
Integrated Luminosity (fb-1)
100
95
90
85
80
75
70
65
60
55
50
45
40
35
30
25
20
15
10
5
0
Sep 1
Oct 1
Nov 1
Dec 1
Jan 1
Feb 1
Mar 1
Apr 1
May 1
Jun 1
Jul 1
Aug 1
2003
2004

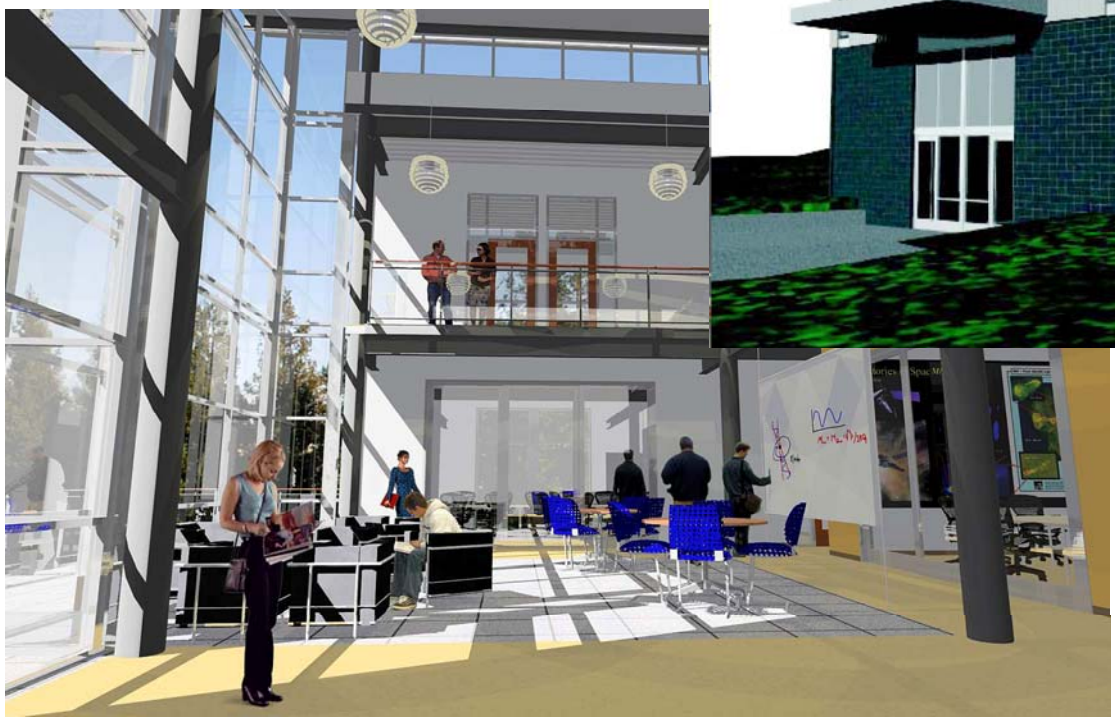
Progress in Past Year — Highlights

- **Kavli Institute is off to a brilliant start – already a force in the field of theoretical and experimental particle-astro and cosmology**
- **E158 run completed – first results are published, expect results from full statistics this summer**

…. And lots more as you will see in the next two days

Kavli Institute for Particle Astrophysics & Cosmology

Institute building on SLAC site.
Occupancy in Fall 2005



University has committed funds to construct the building, endow the Directorship, and has dedicated 9 new faculty hires to the Institute. This is a major investment at the >$20M scale

Program for Coming Year – Keep on "Trucking"

- **Key elements of program and their relative priorities remain the same for FY05**
- **Major concern is the level of funding in the President's FY05 budget**

FY04 Funding	President's FY05 Budget
$168.8M	$167.9M

Issues:

- **No inflation adjustment – we will have a several % salary program**
- **42 year-old contract for site-wide power ends Dec. 2004. Anticipate a $6-7M increase in power in FY05 for HEP Program**
  - Overlap of these two issues makes FY05 a challenge
  - Congress is aware of the stringencies of the HEP Budget. Hopefully they or DOE can find a way to provide relief to HEP in FY05

The Future Program – A Carefully Considered and Coordinated Plan

- **Driven by the changing scientific imperatives of the new millennium, during the past five years we have crafted a new vision for SLAC**
- **In developing the plan we have invited and incorporated extensive input from the scientific community**

  We have been strongly guided by the highest levels of peer review including National Academy studies (Astronomy Decadal Study, High Density Physics, Connecting Quarks with the Cosmos), Quantum Universe, HEPAP, SAGENAP, etc.

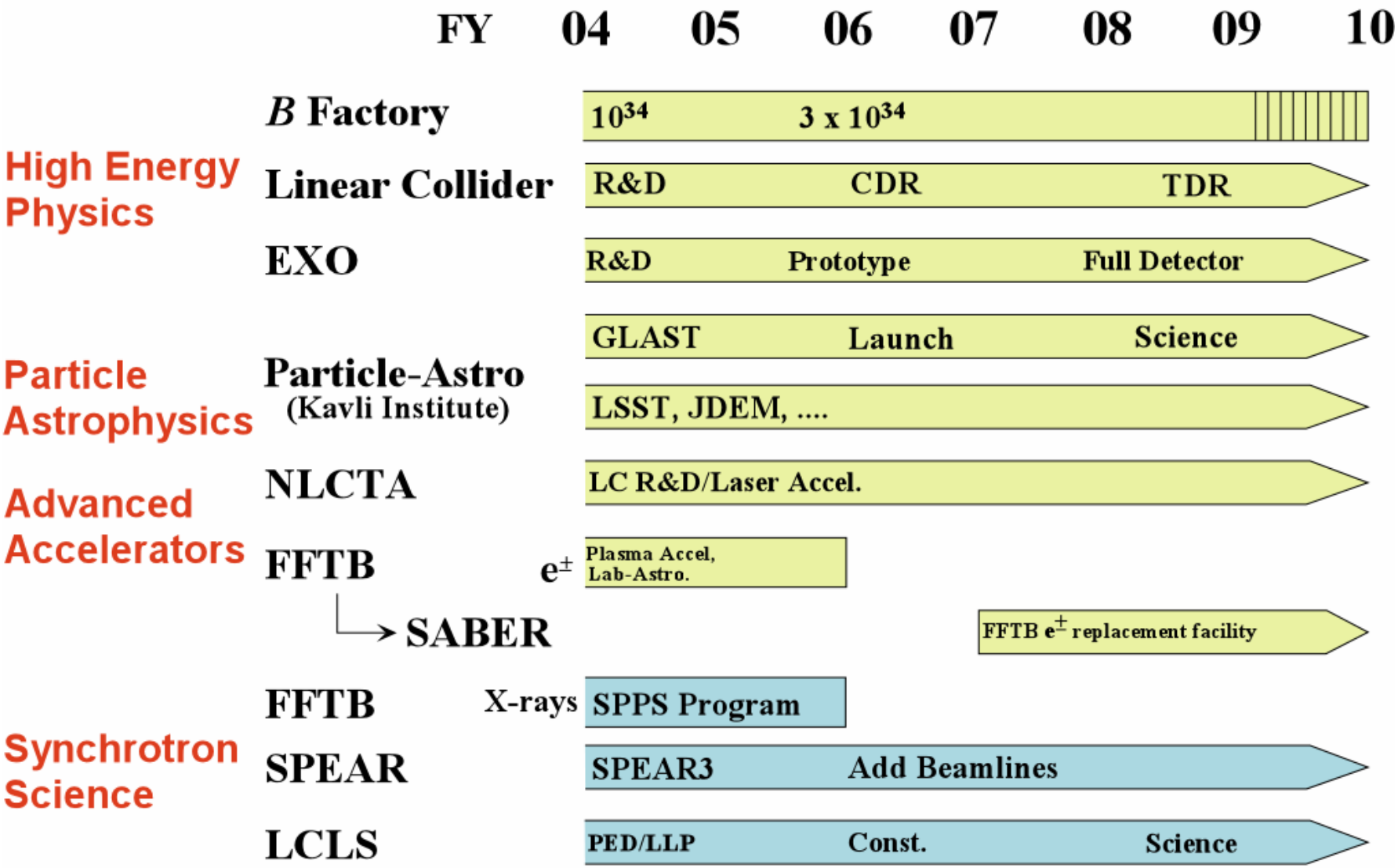
  Indeed all the program elements are strongly supported by such peer review

  Our future-looking program elements feature prominently in the DOE's 20 year facility outlook

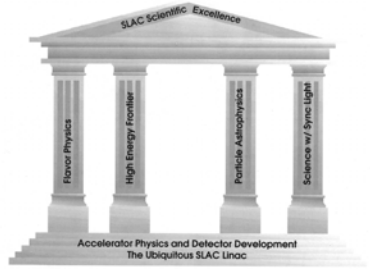
SLAC's Future Program is Strongly Allied to the DOE's Twenty Year Facility Outlook

Priority			
Near-Term			
1		FES	International Thermonuclear Experimental Reactor
2		ASCR	UltraScale Scientific Computing Capability
Tie for 3		HEP	Joint Dark Energy Mission
		BES	Linac Coherent Light Source
		BER	Protein Production and Tags
		NP	Rare Isotope Accelerator
Tie for 7		BER	Characterization & Imaging
		NP	Continuous Electron Beam Accelerator Facility 12GeV Upgrade
		ASCR	Esnet Upgrade
		ASCR	NERSC Upgrade
		BES	Transmission Electron Achromatic Microscope
12		HEP	BTeV
Mid-Term			
13		HEP	Linear Collider
Tie for 14		BER	Cellular Systems Analysis & Modeling
		BES	SNS 2-4 MW Upgrade
		BES	SNS Target Station II
		BER	Whole Proteome Analysis
Tie for 18		NP/HEP	Double Beta Decay Underground Detector
		FES	Next Step Spherical Tokamak
		NP	RHIC II
Far-Term			
Tie for 21		BES	National Synchrotron Light Source Upgrade
		HEP	Super Neutrino Beam
Tie for 23		BES	Advanced Light Source Upgrade
		BES	Advanced Photon Source Upgrade
		NP	eRHIC
		FES	Fusion Energy Contingency
		BES	High Flux Isotope Reactor Guide Hall II
		FES	Integrated Beam Experiment

Future SLAC Program

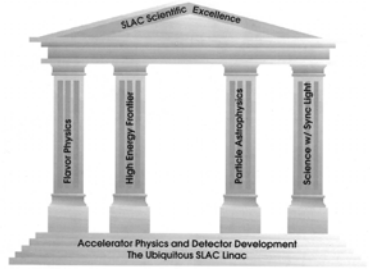


SLAC Scenarios Study
The Context



- There will be a linear collider built and SLAC will be a major participant
- PEP-II/BABAR program has a clear future to 2010
- Growth in particle astrophysics with initiation of KIPAC
- Future of SSRL to 2015 and beyond determined by SPEAR3 and LCLS
  - Includes doubling of SSRL staff by 2010

Scenarios Committee Membership



Tom Himel, Persis Drell co-chairs

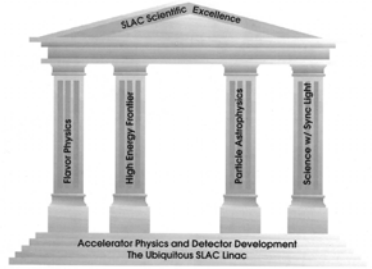
Subcommittee A (LC)

Ewan Paterson co-chair
Tor Raubenheimer co-chair
Jim Brau
Marty Breidenbach
John Galayda
Marc Ross
Bob Siemann
Andy Wolski

Subcommittee B (other opp)

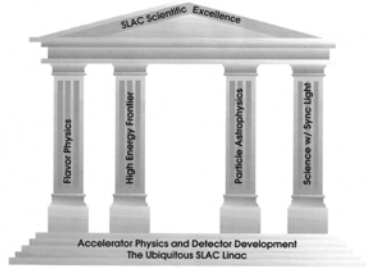
Lance Dixon co-chair
John Seeman co-chair
Pat Burchat
Eric Colby
Su Dong
JoAnne Hewett
Bob Jacobsen
Steve Kahn
Yannis Karyotakis
Homer Neal
Bruce Schumm

Models for SLAC Participation in LC



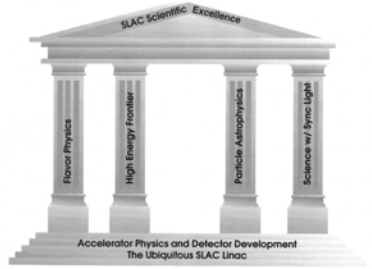
- **Linear Collider: the highest priority for the long-term future of the high energy program at the laboratory**
- **SLAC continues to champion x-band RF technology choice and strongly supports a US site for the facility**
- **SLAC is committed to the LC, independent of location and independent of technology**
- **Scenarios committee studied**
  - **what are the component pieces of that commitment**
  - **how does the laboratory's on-site effort change depending on downstream decisions:**
    - technology choice
    - location
- **Conclusion: The scope of SLAC's effort supporting LC is largely independent of LC location and technology**
  - **Details of the contribution would change, but level of effort largely invariant**

Pillars of the Program



- **High Energy Frontier**
  - Participation in LC
  - Possible participation in LHC upgrades
  - High Gradient Accelerator R&D
- **Science with Synchrotron Light**
  - SPEAR3
  - LCLS
  - Accelerator R&D aimed at upgrades of LCLS
- **Flavor Physics**
  - m_{ν_e}
  - Future *B*-factory program
  - High Luminosity Accelerator R&D
- **Particle Astrophysics and Cosmology**
  - GLAST Instrument Science Operations Center (ISOC)
  - Effort scaled to the examples of LSST, JDEM participation

Scenarios: Details

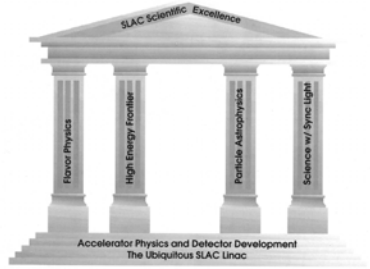


- **Invariance of SLAC's LC effort simplified things greatly**
  - **Type of effort not an invariant**
- **Not necessary to explicitly vary the type or existence of some of the smaller programs**
  - **not highly coupled to other programs**
- **Assume US 10^{36} *B*-factory cannot co-exist with US LC**
- **Common to All Scenarios:**
  - **Major participation in LC**
  - **SPEAR3, LCLS**
  - **Particle Astrophysics doubling in 10 years**

Scenarios: Details

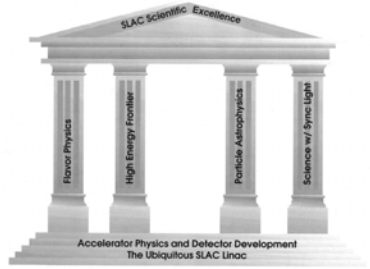
- **Scenario 1:**
  - LC Anywhere
  - no *B*-factory upgrade past 3×10^{34}
  - Full Linac capability preserved
  - Advanced accelerator R&D doubling in 10 years
- **Scenario 2**
  - LC Anywhere
  - 2×10^{35} *B*-factory at SLAC
  - Advanced accelerator R&D grows by 50% in 10 years
- **Scenario 3**
  - LC on shore
  - 10^{36} *B*-factory at KEK
  - Full Linac capability preserved
  - Advanced accelerator R&D doubling in 10 years
- **Scenario 4**
  - LC off shore
  - 10^{36} *B*-factory at SLAC
  - Advanced accelerator R&D grows by 50% in 10 years

Scenarios 1 & 4 :
Minimal and maximal growth



- **Scenario 1**
  - **LC Anywhere, no *B*-factory upgrades**
    - ~20% net growth overall in lab staff by 2015
    - Lab ~½ SSRL, ~½ HEP
    - HEP Program roughly divided between LC operations, particle astrophysics, accelerator R&D
- **Scenario 4**
  - **LC offshore, 10^{36} *B*-factory at SLAC**
    - ~30% growth overall in lab staff by 2015
    - Lab ~1/3 SSRL, ~2/3 HEP
    - HEP Program 40% ***B***-factory; 25% LC operations
- **Additional manpower will be needed during the construction phases of the projects in the various scenarios**

Future SLAC Program/Scenarios



		FY 04	05	06	07	08	09	10
Flavor	*B* Factory	10^{34}		3×10^{34}				
HE Frontier	Linear Collider	R&D		CDR			TDR	
Flavor	EXO	R&D		Prototype			Full Detector	
Part. Astro	Particle-Astro (Kavli Institute)	GLAST		Launch			Science	
		LSST, JDEM, ...						
HE Frontier	NLCTA	LC R&D/Laser Accel.						
HE Frontier	FFTB	$e^{\pm}$ Plasma Accel, Lab-Astro.						
Part. Astro	→ SABER					FFTB $e^{\pm}$ replacement facility		
Syn. Light	FFTB	X-rays SPPS Program						
	SPEAR	SPEAR3			Add Beamlines			
Syn. Light	LCLS	PED/LLP			Const.		Science	

ES&H Program

- The Laboratory has an extensive ES&H program, operating under the Integrated Safety Management System
- Safety is a line responsibility – nonetheless there are considerable resources available to the line managers within each of the Laboratory Divisions as well as highly specialized professionals within the ES&H Division
- Laboratory has received an "Outstanding" classification for ES&H from DOE 4 of the past 6 years
- We have an aggressive program in place to deal with the recent reversal of a five-year trend of reduction in accident rates

Conclusions

- **Scientific productivity and richness are the hallmarks of the SLAC program**
- **SLAC has a clear and exciting vision for the future – given the appropriate investments in HEP and Particle-Astro, SLAC will continue to play a crucial role in providing frontier scientific opportunities for the worldwide user community**