SLAC Update and FY04 Budget

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Research Director
SLAC

Outline

- B-Factory Status and Plans
- Endstation Program
- Other Science with SLAC Beams
- Particle Astrophysics and Cosmology
- Budget
- Long Range Planning Exercise

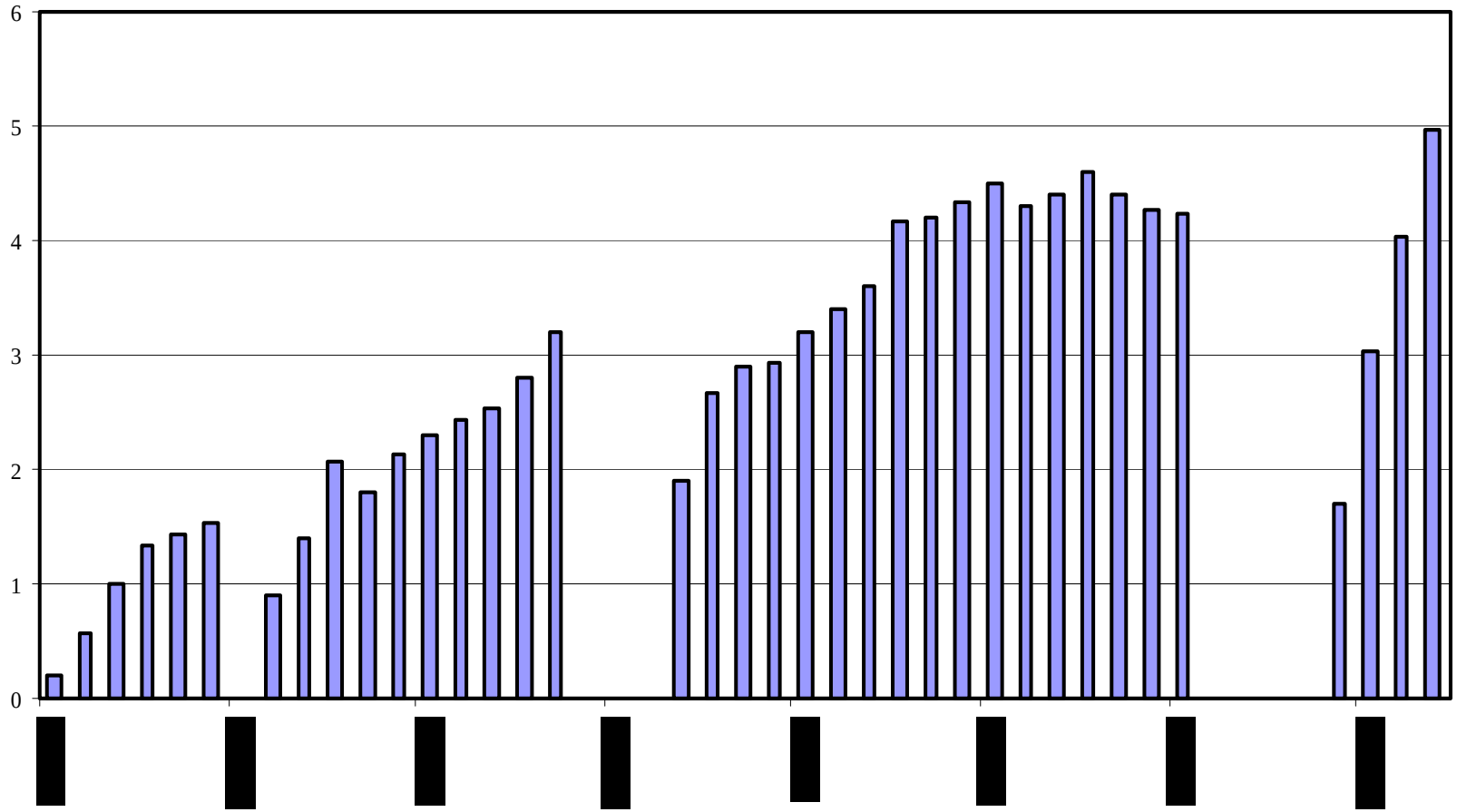
B-Factory

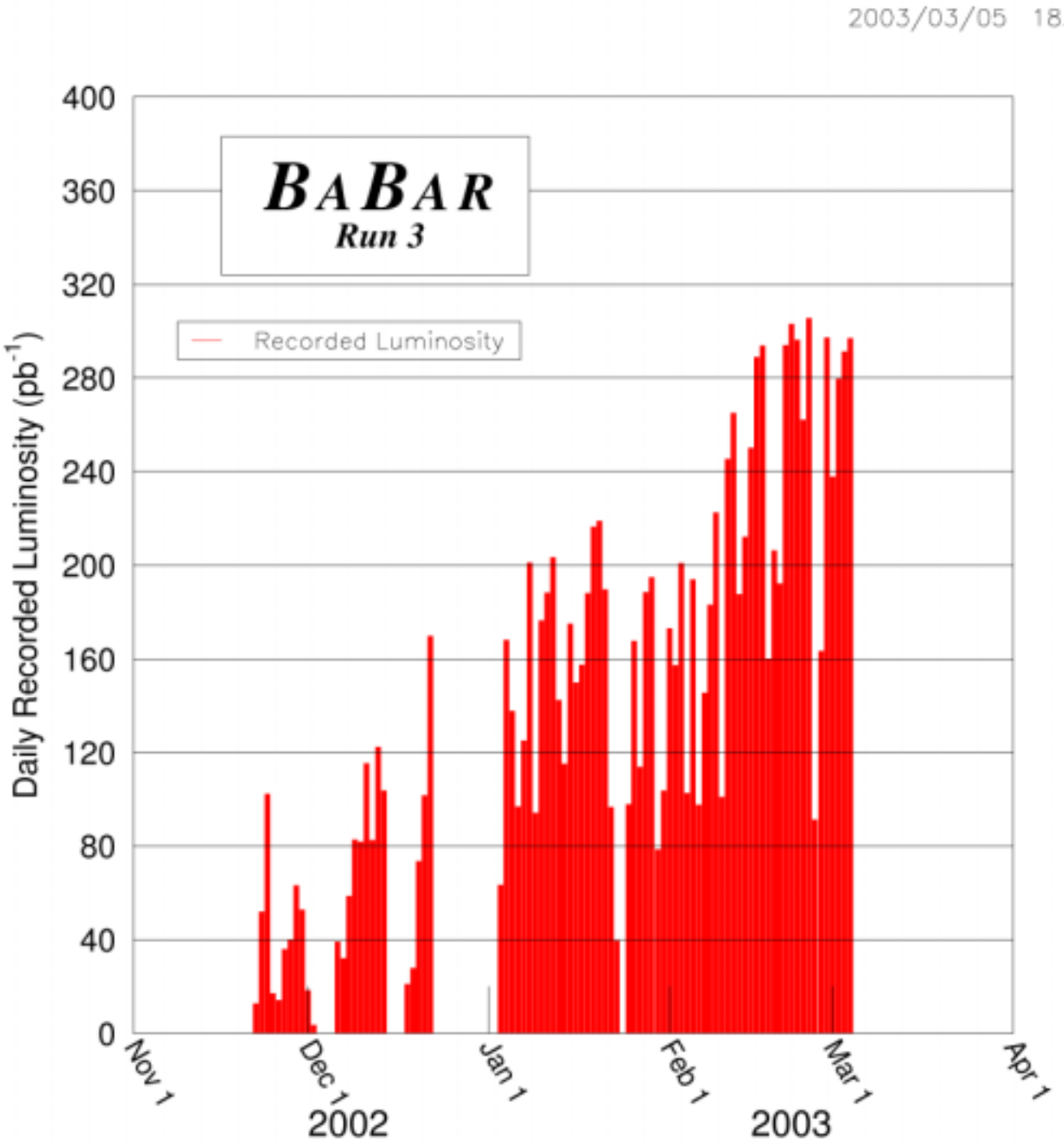
Status and Plans

PEP-II Status

- Long down (4.5 months) after 100 fb-1 run
- Shutdown goals:
  - Enable higher beam currents (x1.4)
    - Reduce heating in IR
    - Install and commission new RF stations.
    - Improve cooling and shielding
  - Lower β_y* from 13 to 9 mm
- Turn-on started November 15.
  - Winter shutdown Dec 23-Jan 1.
  - Power outages (spikes) in December caused hardware damage and run delays.
  - Running has now stabilized.

Peak PEP-II Luminosity (x1E33) per Month




2003/03/05 18.47
BABAR
Run 3
Recorded Luminosity
Daily Recorded Luminosity (pb^{-1})
400
360
320
280
240
200
160
120
80
40
0
Nov 1
Dec 1
Jan 1
Feb 1
Mar 1
Apr 1
2002
2003

Recent PEP-II Records

- Peak luminosity = 4.97×10^{33} $cm^{-2}s^{-1}$
- Int. luminosity per 8 hr shift = 117 pb^{-1}
- Int. luminosity per 3 shifts = 322 pb^{-1}

- Total Luminosity Delivered: 113 fb^{-1}

Near Term: Luminosity Improvements to PEP-II

- New ring correction algorithms (MIA)
- New local β_y* knobs in HER/LER
- Move horizontal tunes to near half integer
- Increase number of bunches and currents
- Continuous injection

Longer Term Goals: Luminosity Improvements to PEP-II

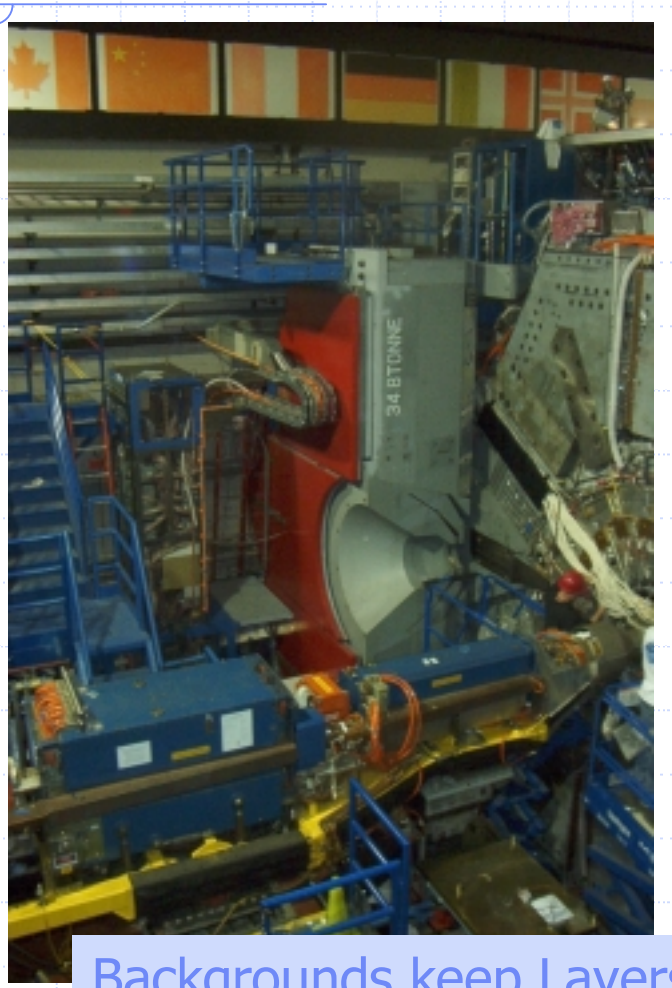
- 6/03:
  - Peak luminosity = 7×10^{33} $cm^{-2}s^{-1}$
  - Integrated luminosity = 150/fb
- 2006:
  - Peak luminosity = 2×10^{34} $cm^{-2}s^{-1}$
  - Integrated luminosity = 500/fb
- Working on a path to:
  - Peak luminosity = 4×10^{34} $cm^{-2}s^{-1}$
  - Integrated luminosity = 1-2/ab

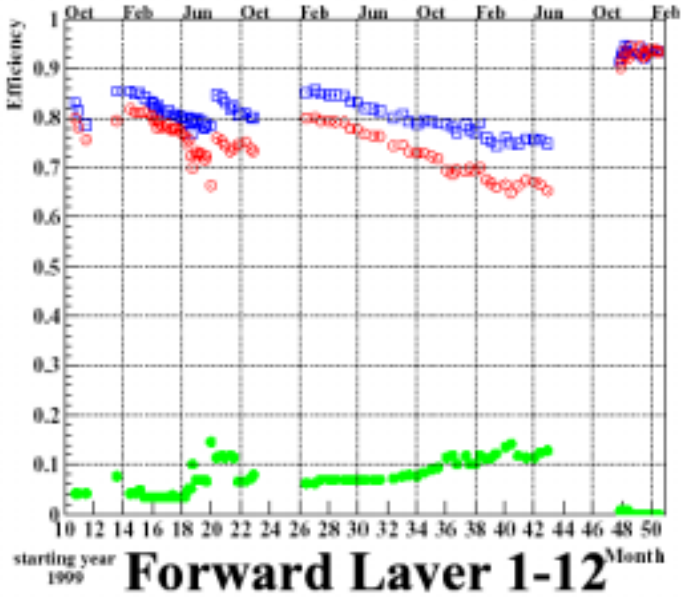
BaBar Status

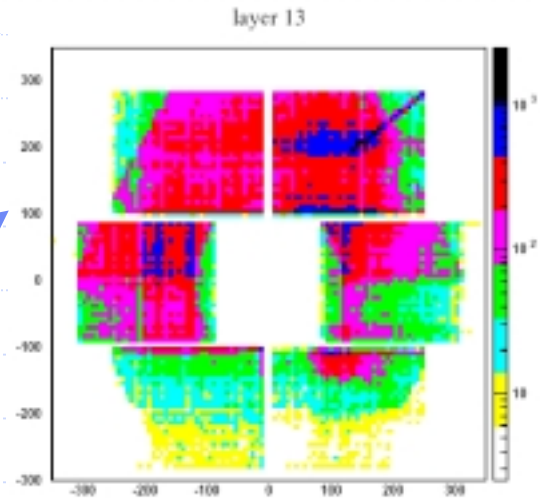
- Summer down time work
  - TDC Upgrade for DIRC (French effort)
  - SVT Work (Italy & US)
  - IFR Endcap upgrade (Italy & US)
    - Replace dying RPCs with efficient chambers which have been carefully Q/C'd
  - Drift Chamber damage and repair
    - Damaged during support tube extraction
    - Full remediation within shutdown schedule

New RPCs restore efficiency

IFR Endcap Upgrade







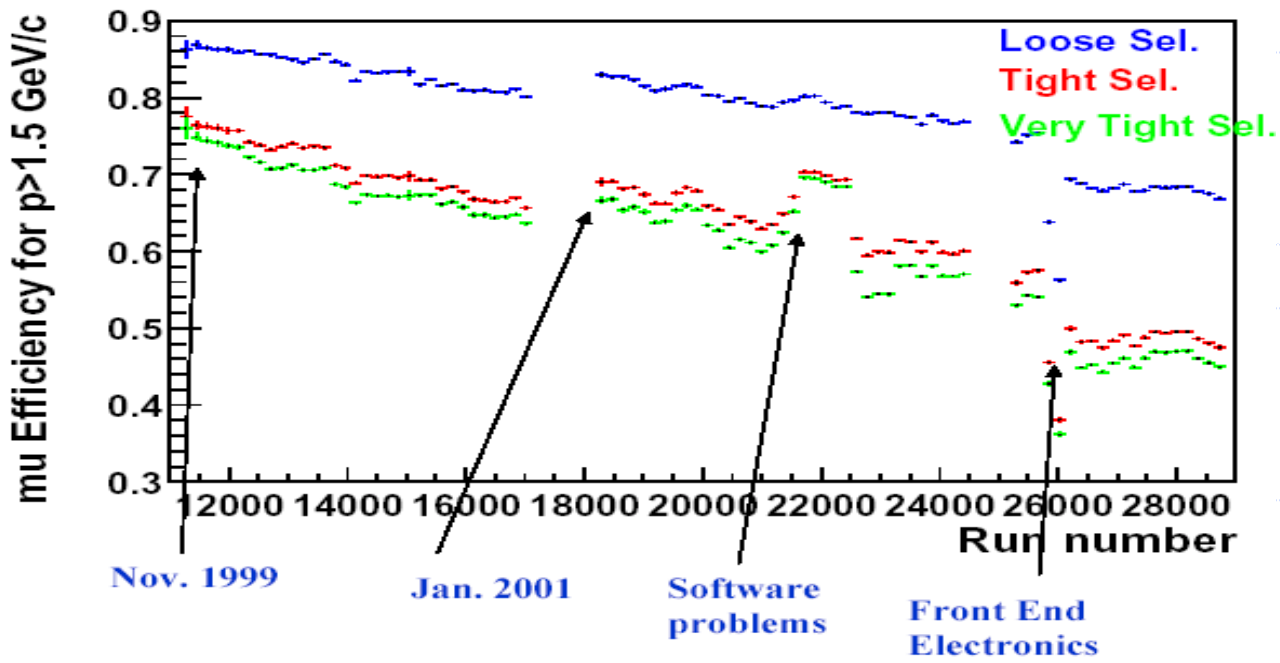
Backgrounds keep Layers 14-16 off

BaBar: Near Term Upgrades

- BaBar assigned 2 task forces to work on on improvement & upgrade strategy
  - Estimate physics reach for important modes
  - Recommend detector, accelerator improvements
- Studies fully shared by international community
- Conclusion: Only modest upgrades essential for physics(through end of the decade).
  - IFR
  - Computing

Barrel IFR Upgrade

- The Problem: Dying RPCs
- Muon selectors losing efficiency, impacting physics
- No 'Remediation' attempts have been successful.

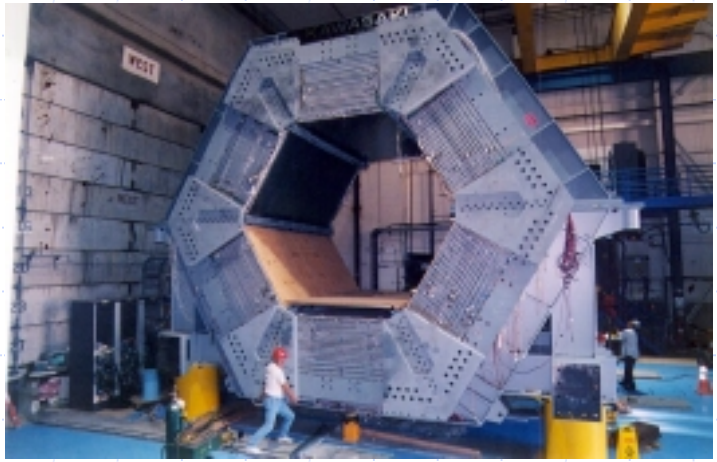


IFR Barrel Upgrade Plans

- Replace RPCs with Limited Streamer Tubes in the barrel
- Time line for installation

  2004 3 months to install 2 sextants

  2005 6 months to install 4 sextants as well as replacement of radiation damaged SVT elements and mod of IP for higher luminosity



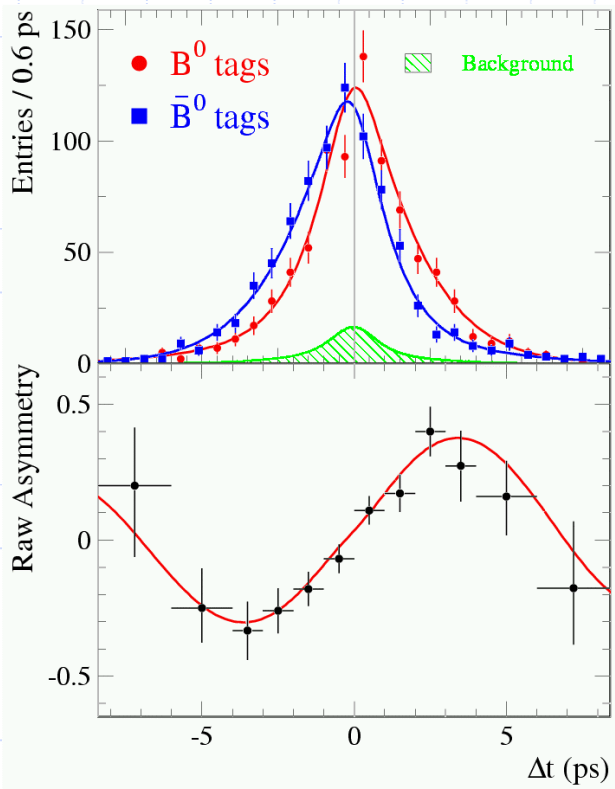
Barrel showing IFR (before BaBar completion)

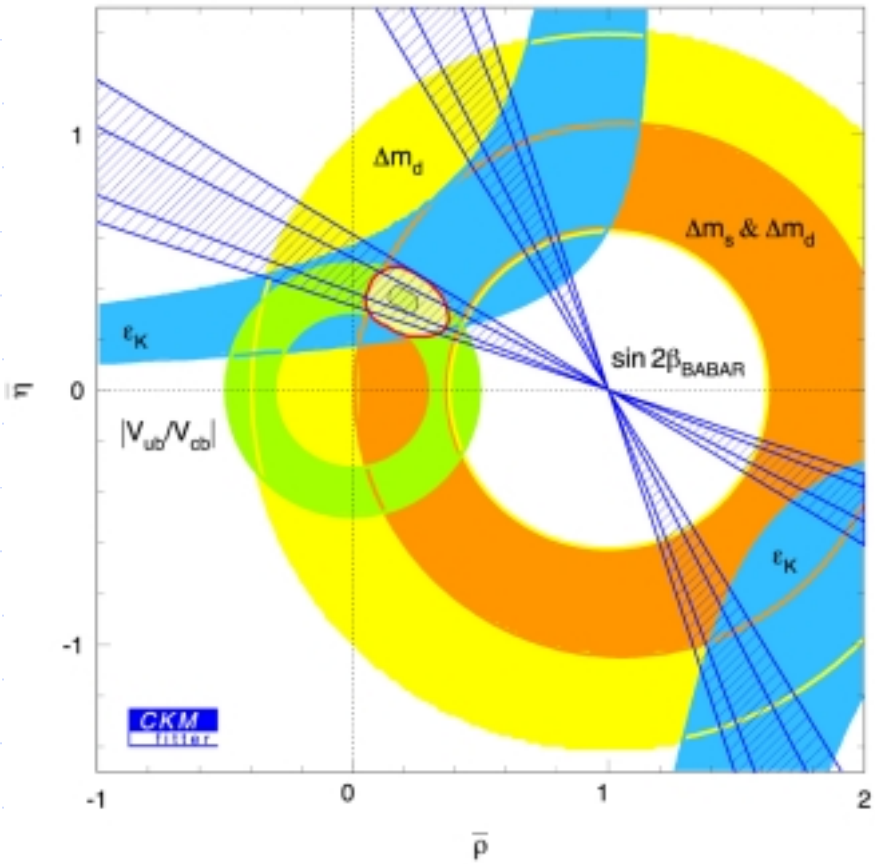
BaBar Computing Model Review

- Convened Fall 2002 to revise computing model
- CMWG2 focused in particular on:
  - Analysis Model
  - Data storage
  - Bookkeeping
- Recommended transition to a ROOT based EventStore
  - Building on existing Kanga technology
  - Must take care not to impact physics
  - Review recommended considering complete phase out of Objectivity

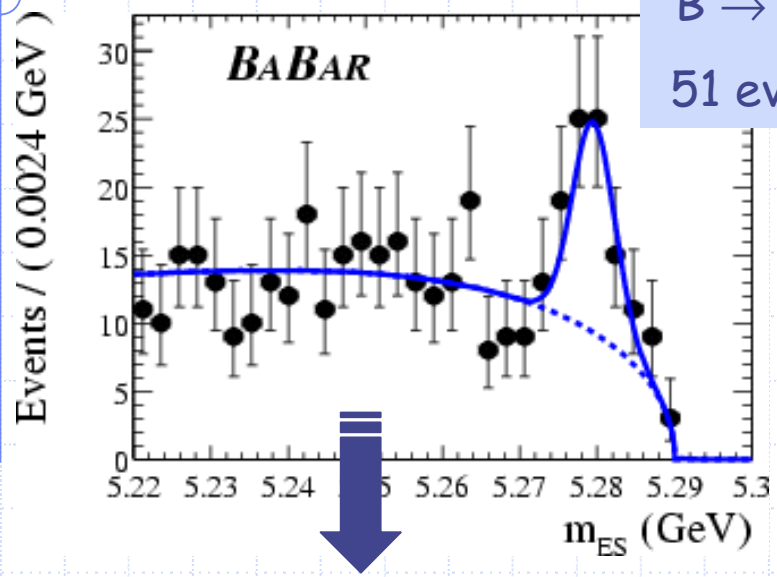
BaBar Physics

- $\sin 2\beta = 0.741 \pm 0.067\ (\text{stat}) \pm 0.034\ (\text{syst})$



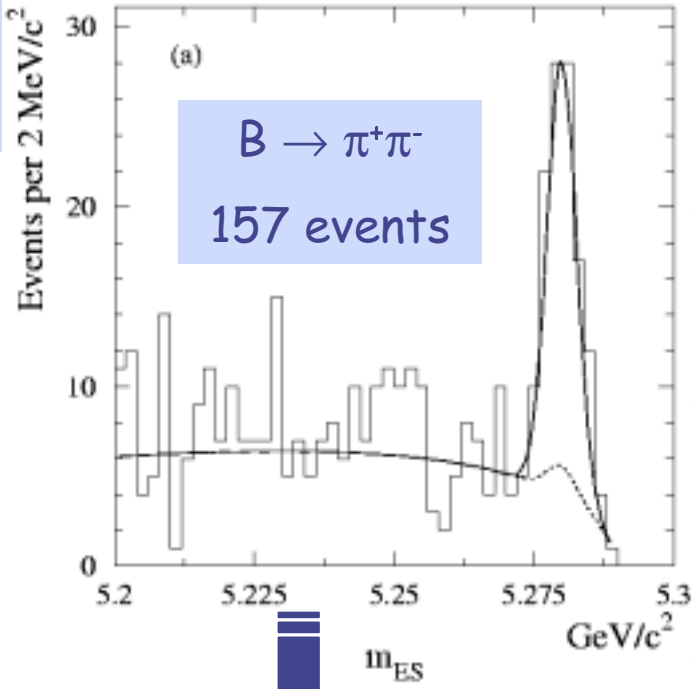


Pursuing leads to new sources of $\not{CP}$



$B \to \phi K^0_S$

51 events



$B \to \pi^+\pi^-$

157 events

$$\sin 2\beta = -0.19^{+0.52}_{-0.50}(\boldsymbol{stat}) \pm 0.09(\boldsymbol{syst})$$

Pure QCD Penguin, sensitive to New Physics

BaBar vs Belle

	$S_{\pi\pi} \propto \sin 2\alpha_{eff}$	$C_{\pi\pi}$
BaBar	***0.02±0.34±0.05***	***-0.30±0.25±0.04***
Belle	***1.23±0.41±0.08***	***-0.77±0.27±0.08***

Many new avenues of discovery

Some examples:

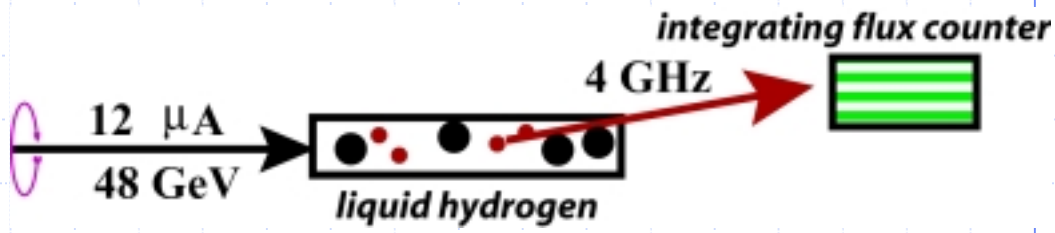
Process	Physics interest
$B \to J/\psi K^0_s$, φK^0_s, …	CPV: Unitarity triangle, $\sin 2\beta$
$B \to \pi\pi$, $\rho\pi$	CPV: Unitarity triangle, $\sin 2\alpha$
$B \to D^0(CP)K$	CPV: Unitarity triangle, γ
Semileptonic B decays	Unitarity triangle, $\lvert V_{cb}\rvert$, $\lvert V_{ub}\rvert$
$B \to X_s\gamma$, $K^{*0}\gamma$, $\rho(\omega)\gamma$ $B \to X_s l^+l^-$, $K^* l^+l^-$ $B \to X_s\nu\nu$, $K^*\nu\nu$	Radiative Penguins, sensitive to new physics in the loops
$B \to \tau\nu$	Leptonic decay: decay constant
D^0 mixing	Small in SM: sensitive to new physics

New phases?

Phases and rates

Endstation Program

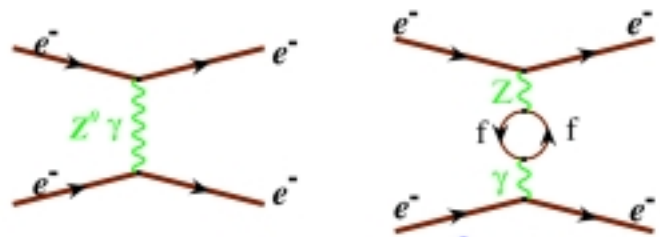
Status of 158



Parity-Violating Left-Right Asymmetry In Fixed Target Moller Scattering

$A_{LR} = 0.18$ ppm

$\delta(A_{LR}) = +/- 7\% +/- 3\%$

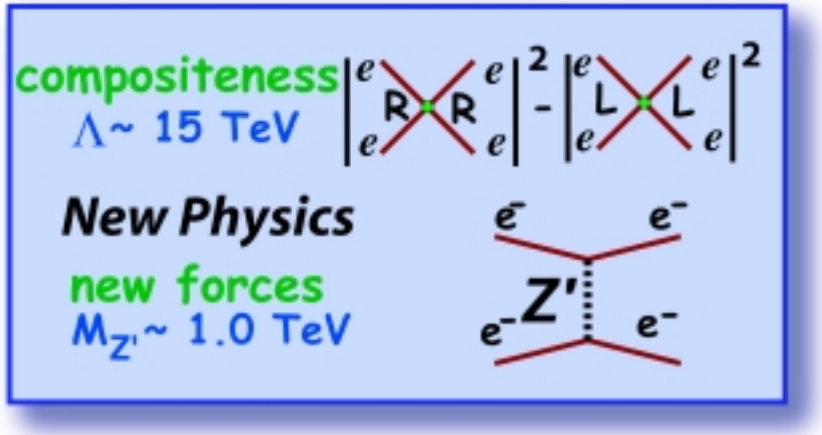


$g_{ee} \propto (1 - 4 \sin^2\theta_W)$

E158 Collaboration

- UC Berkeley
- Caltech
- Jefferson Lab
- Princeton
- Saclay
- SLAC
- Smith College
- Syracuse
- UMass
- Virginia

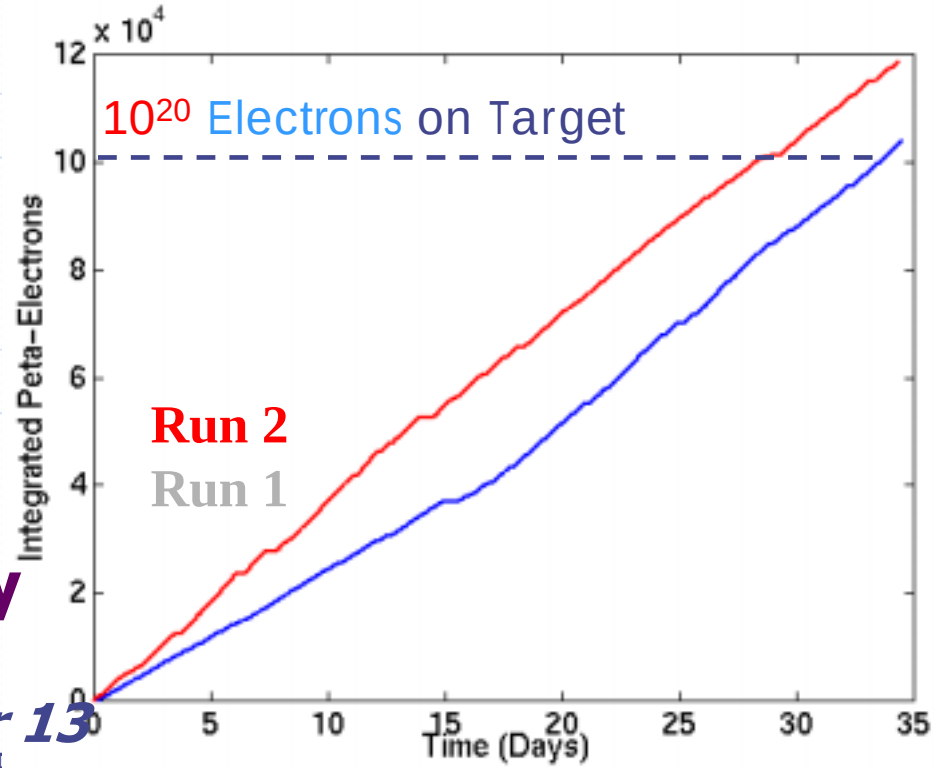
7 Ph.D. Students



SLAC E158

- *High intensity 48 GeV electron beam*
- *Submicron beam control and monitoring*
- *1.5 m long high power liquid hydrogen targe*
- *Precision spectrometer/collimator system*
- *Radiation-hard integrating calorimeter*
- *Low noise electronics*

- ∗ *Two successful physics runs*
- ∗ *Efficient beam delivery*
- ∗ *~50% of proposal statistics*



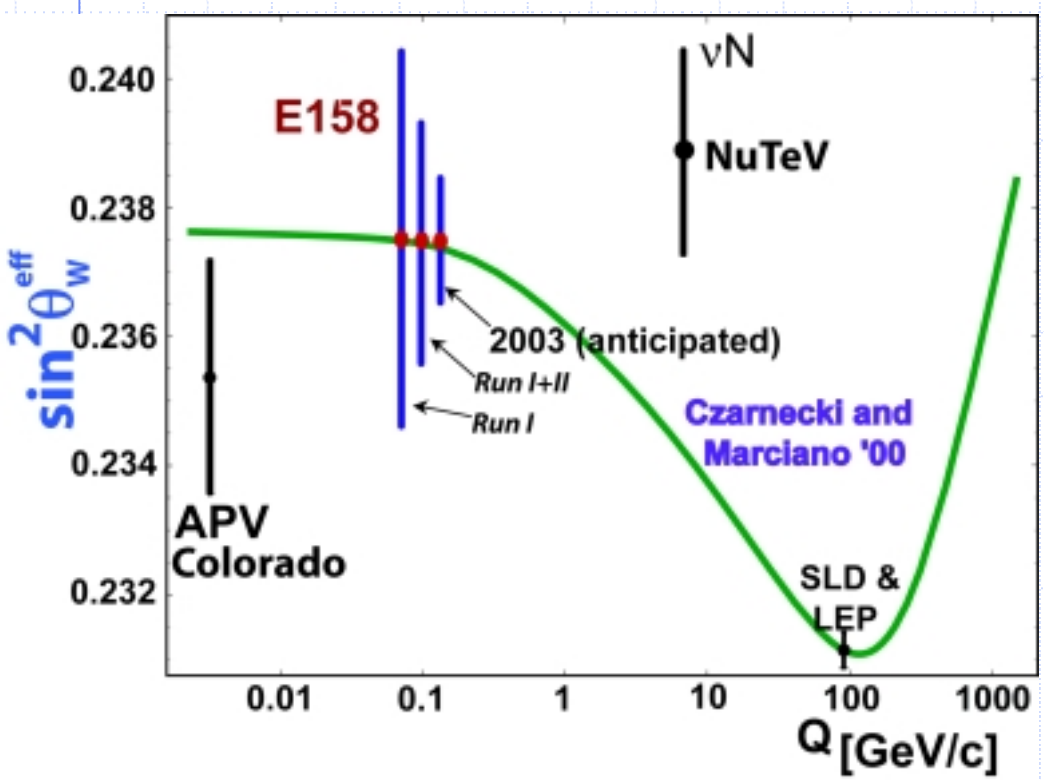
2002 E158 Beam Delivery

Run 1: April 23 – May 27

Run 2: October 10 – November 13

E158 Summary

- **Excellent beam delivery at high efficiency**
- **Experimental apparatus performing well**
- **High quality physics data collected in Runs I and II**
- **Poised to make world's most precise measurement of $\sin^2\theta_W$ at low Q^2 with final Run III in 2003**



Analysis in progress

Run I:

$\delta(\sin^2\theta_W)<0.003$

Run I + II:

$\delta(\sin^2\theta_W)<0.002$

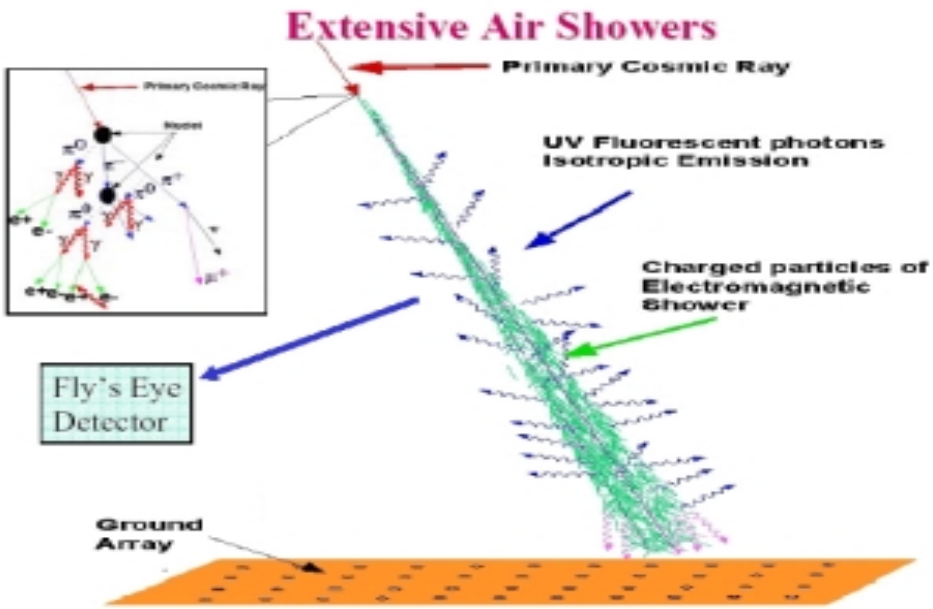
Run I data to be unblinded and released in the next few weeks

Other Science with SLAC Beams

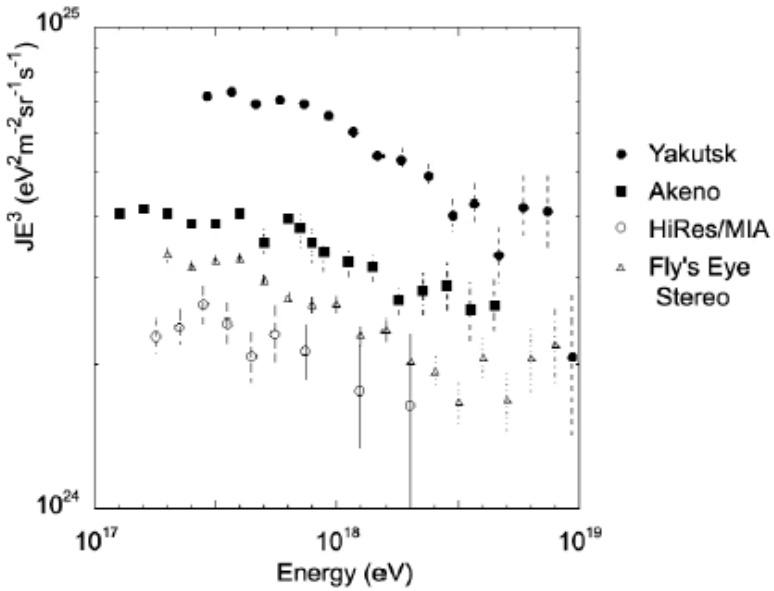
Continued Demand for SLAC Beams

- Advanced Accelerator R&D
  - E164/E164X – Plasma wake field acceleration program
  - LEAP – Laser Acceleration in a Plasma
- FLASH
  - Use a high energy electron beam to make measurements of the fluorescence yield from extensive air showers.
- SppS: Subpicosecond Pulse Science

FLASH (E165)

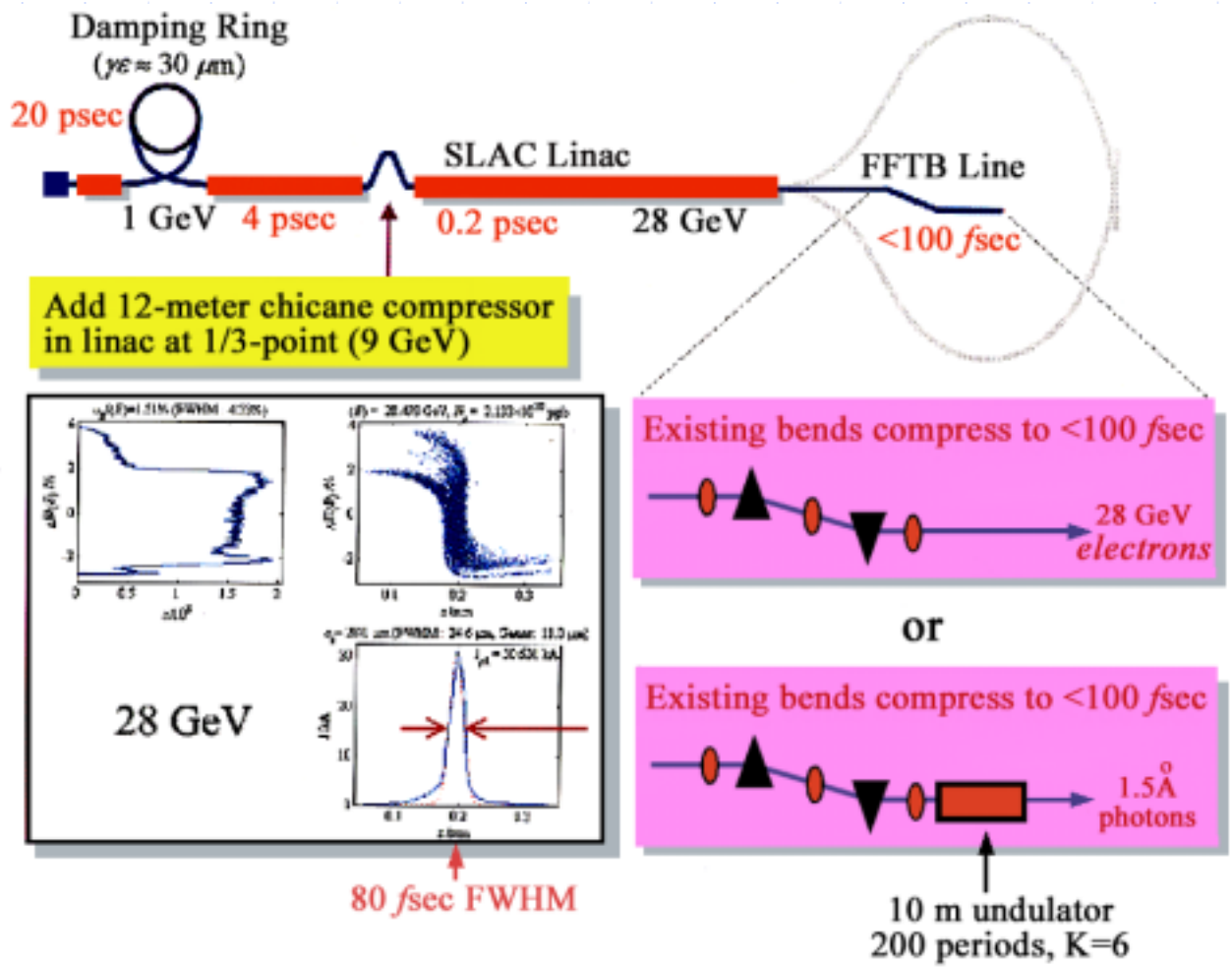


- Uses the high energy electron beam to make measurements of the fluorescence yield from extensive air showers



- Goal 10% or better in energy of cosmic ray

Sub-Picosecond Pulse Source



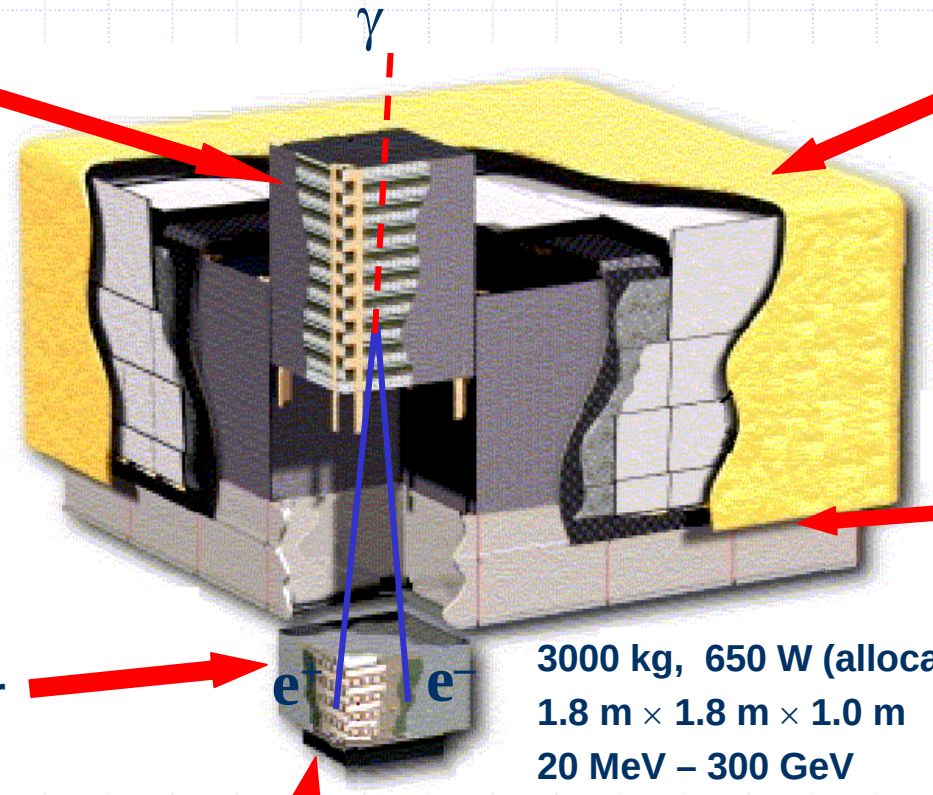
Particle Astrophysics and Cosmology

GLAST: γ Ray Large Area Space Telescope

- GLAST measures direction, energy and time of celestial gamma rays from 20MeV – 300 GeV
- Collaboration of Particle Physicists and Astrophysicists from France, Italy, Sweden, Japan and US
- Collaboration of Space and HEP funding agencies from France, Italy, Japan and US
- Project in transition from design to flight hardware fabrication
- On schedule for launch: September 2006

GLAST/LAT Instrument

Si Tracker
pitch = 228 μm
8.8 10^5 channels
12 layers × 2.8% X_0
+ 4 layers × 18% X_0
+ 2 layers



ACD
Segmented scintillator tiles
0.9997 efficiency
⇒ minimize self-veto

Grid (& Thermal Radiators)

3000 kg, 650 W (allocation)
1.8 m × 1.8 m × 1.0 m
20 MeV – 300 GeV

CsI Calorimeter
Hodoscopic array
8.4 X_0 8 × 12 bars
2.0 × 2.7 × 33.6 cm
⇒ cosmic-ray rejection
⇒ shower leakage correction

Data acquisition

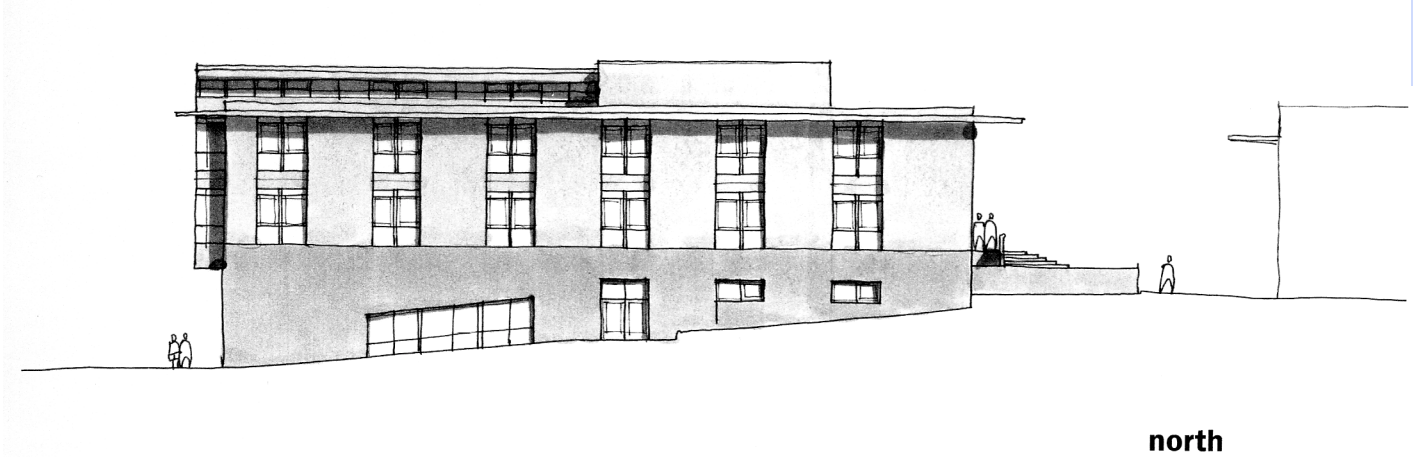
Flight Hardware & Spares
16 Tracker Flight Modules + 2 spares
16 Calorimeter Modules + 2 spares
1 Flight Anticoincidence Detector
Data Acquisition Electronics + Flight Software

Kavli Institute

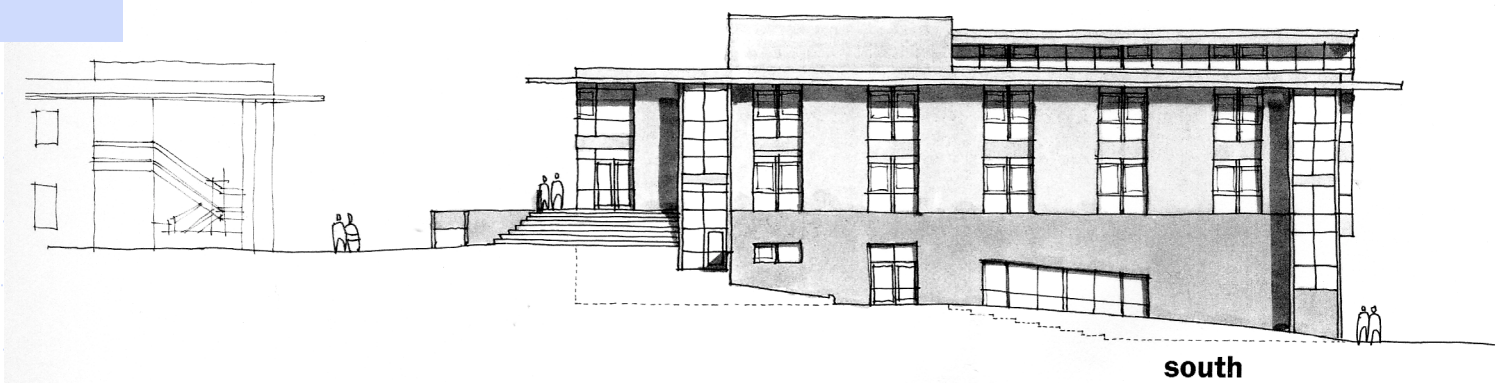
- Institute building on SLAC site
- Director reports to Stanford Dean of Research
  - Operates as independent research center
  - 9 new faculty
    - Most (if not all) will be joint SLAC/Campus
- Director and Deputy Director recruited!
  - Roger Blandford (CalTech)
  - Steve Kahn (Columbia)
- Discussions beginning on the scientific directions that the institute will take
- It is anticipated the institute will bring in funds from NASA and NSF that will flow through campus in addition to DOE funds that will flow through SLAC

KIPAC

View from the entrance gate



View from the central lab



Budget

FY04 Budget

- President's Request for SLAC
  - $169.9M
    - Up 5.9% from FY03 allocation
    - We recognize and appreciate the help in a very tough year
- Continue to strongly support efforts to get more resources into all Office of Science Programs
- Can only be descriptive about FY04 program
  - Still focused on making ends meet in FY03

Status of FY03

- Program Cuts:
  - Committed to run E158 5 weeks instead of requested 16 weeks
  - Stopped Real Photon Program
  - Some decrease in funding for NLC
  - Squeezed hard all M&S budgets
  - Cut PEP-II AIP
  - Cut 5 weeks of BaBar running (39 -> 34 weeks)

Status of FY03 (cont.)

- Staff Measures
  - Voluntary Lay-offs
    - ~40 staff took advantage
    - Cannot replace them
  - All HEP funded staff to take vacation during FY03 equal to at least the vacation earned in FY03
  - All HEP-funded staff to take leave without pay for one week.

FY04 Budget Discussion

- Science Program
  - Full priority to B factory
    - Full AIP for PEP-II
    - Upgrade BaBar IFR
  - NLC R&D held flat
  - GLAST on schedule
  - LC detector R&D very low level
  - Start Kavli Institute (but limited)

FY04 Budget Discussion(cont.)

- Staff Measures
  - Stanford is anticipating major increase in the benefits rate (~$4M)
  - Will not repeat leave without pay for staff
- Committed to staying competitive on B-Factory
- FY04 will not be easy but deeply appreciate some help after struggles (not yet finished) of FY03

SLAC Long Range Planning Exercise

Long Range Planning Exercise

- 'Scenarios for the Future of SLAC'
  - Develop models of SLAC as a partner in a future LC under different assumptions
    - What might the ownership pieces of an LC be for SLAC in various scenarios?
  - As we look towards our future, what are the other exciting physics opportunities for SLAC to be engaged in?
    - What is the physics case?
    - Cost and technical difficulty?
    - Consider which activities might be appropriate in on-shore vs off-shore LC scenarios.
  - How do scenarios fit into an overall picture of lab manpower and budget?

Long Range Planning Exercise

- Process involves SLAC Staff, Faculty & Users
- Chairs: Tom Himel & Persis Drell

Subcommittee A
Raubenheimer (co-Ch)
Paterson (co-Ch)
Brau
Breidenbach
Galayda
Wolski
TBD

Subcommittee B
Dixon (co-Ch)
Seeman (co-Ch)
Burchat
Colby
Su Dong
Hewett
Jacobsen
Kahn
Schumm

- Goal: Report to Dorfan Fall 2003