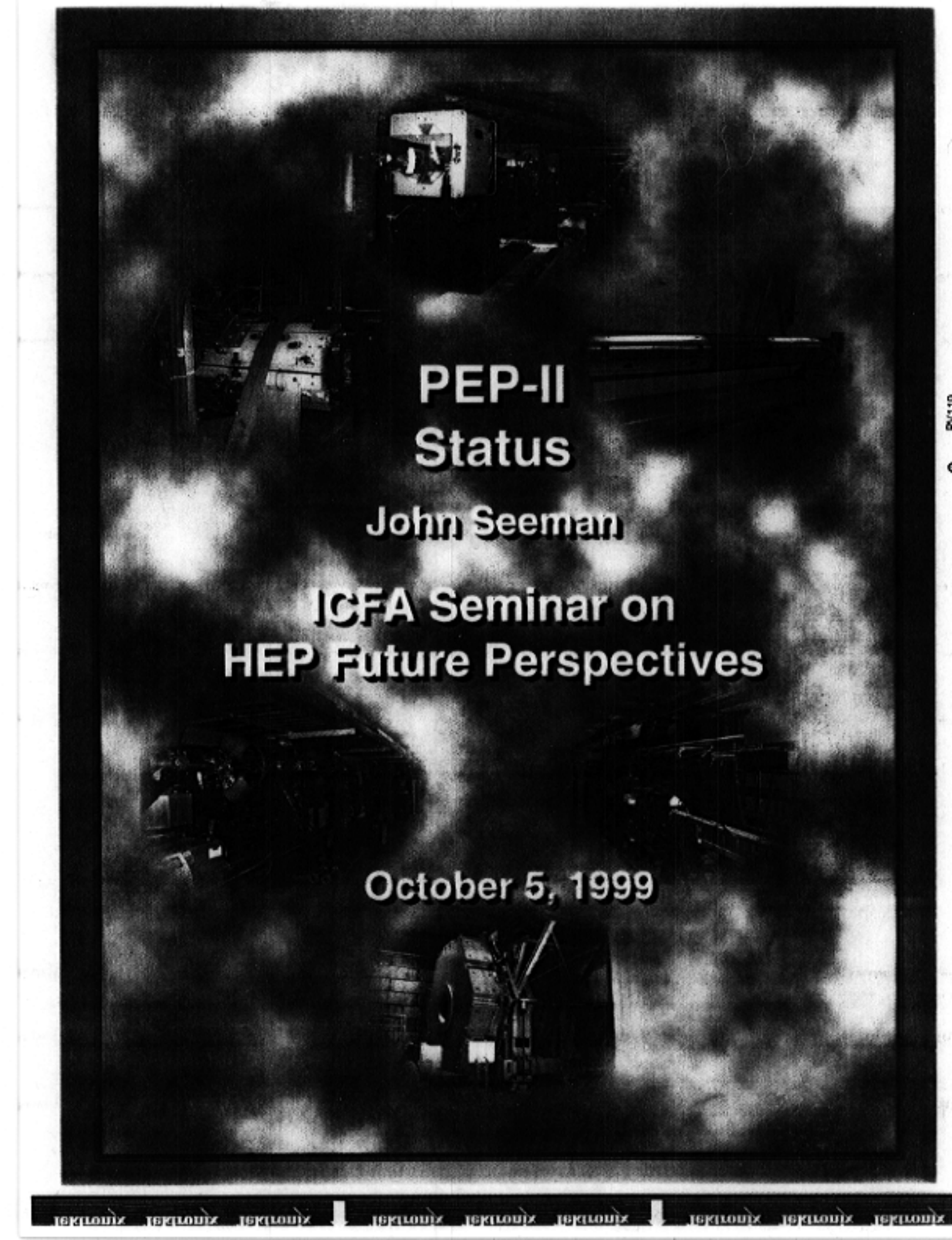


A black and white photograph of particle detector components, possibly from the PEP-II accelerator, set against a background of thick, swirling smoke or steam. The components are metallic and complex, with various pipes, valves, and structural elements visible. The lighting is dramatic, with bright highlights on the smoke and the detector parts.

PEP-II Status

John Seeman

**ICFA Seminar on
HEP Future Perspectives**

October 5, 1999

PEP-II

**PEP-II *B*-Factory was constructed
at SLAC in PEP Tunnel**

by

**Stanford Linear Accelerator Center
Lawrence Berkeley National Laboratory
Lawrence Livermore National Laboratory**

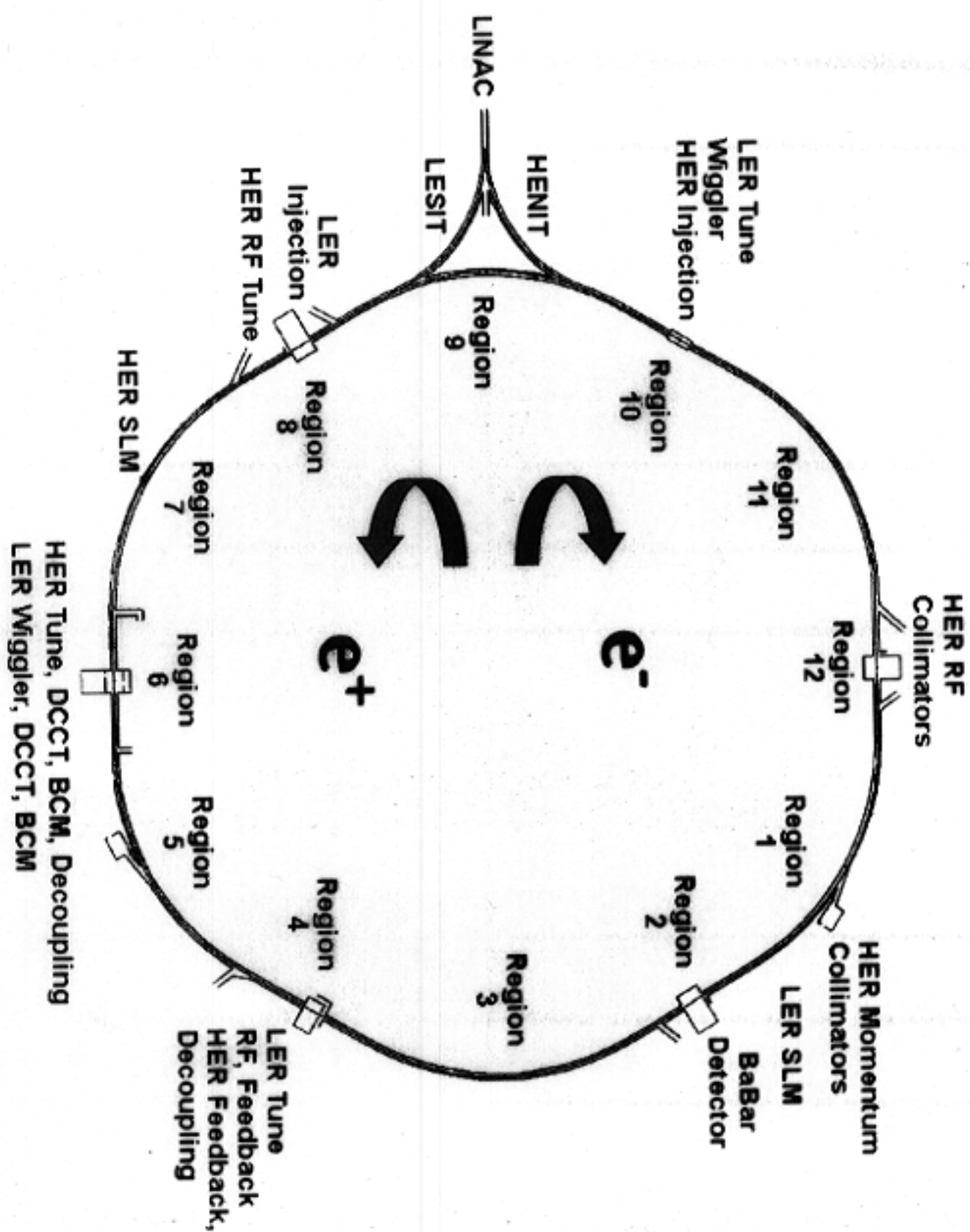
Design Luminosity = $3 \times 10^{33} \text{ cm}^{-2} \text{ sec}^{-1}$

Beam Energy (e^+ / e^-) = 3.1 GeV / 9.0 GeV



PEP-II Parameters

	e^+	e^-
CM energy (GeV)	10.580	
Beam energy (GeV)	3.119	8.973
Beam current (A)	2.15	0.75
$\beta_x^* \beta_y^*$ (cm)	50 1.5	50 1.5
$\epsilon_x \epsilon_y$ (nm)	49 1.5	49 1.5
σ_x^* (μm)	157	
σ_y^* (μm)	4.7	
σ_z (mm)	12.3	11.5
Luminosity	$3 \times 10^{33} \text{ cm}^{-2}\text{s}^{-1}$	
Tune shift	0.03	
Beam aspect ratio (v / h at IP)	0.03	
Number of colliding bunches	1658	
Bunch spacing (m)	1.26	
Beam crossing angle	0 (head-on)	



Commissioning Team

J. Seeman
T. Himmel

PEP-II Commissioning
PEP-II Run Coordinator

M. Zisman (LBNL)
U. Wienands
R. Iverson
T. Mattison, W. Kozanecki (Saclay)
M. Sullivan, W. Kozanecki (Saclay)

LER Commissioning
HER Commissioning
Injection Commissioning
Backgrounds
Collisions

Regular Shift Takers - 29 total

SLAC:

Y. Cai
M. Donald
T. Fieguth
T. Himmel
A. Kulikov
N. Phinney
M. Ross
M. Sullivan

J. Clendenin
S. Ecklund
A. Fisher
R. Iverson
T. Mattison
K. Rathman
J. Seeman
J. Turner

F.J. Decker
R. Erickson
S. Helfets
P. Krejcik
M. Minty
I. Reichel
M. Stanek
U. Wienands

LBNL:

J. Corlett
C. Steier

M. Furman
M. Zisman

Saclay:

W. Kozanecki

KEK:

T. Urano

System Experts - Come in for specially scheduled activities

RF:

P. Corredoura
H. Schwartz

R. Rimmer (LBL)
R. Tighe

Transverse Feedback:

W. Barry (LBL)
A. Young

D. Li

Longitudinal FB:

J. Fox
D. Teytelman

S. Prabhakar

Backgrounds:

T. Geld
T. Mattison

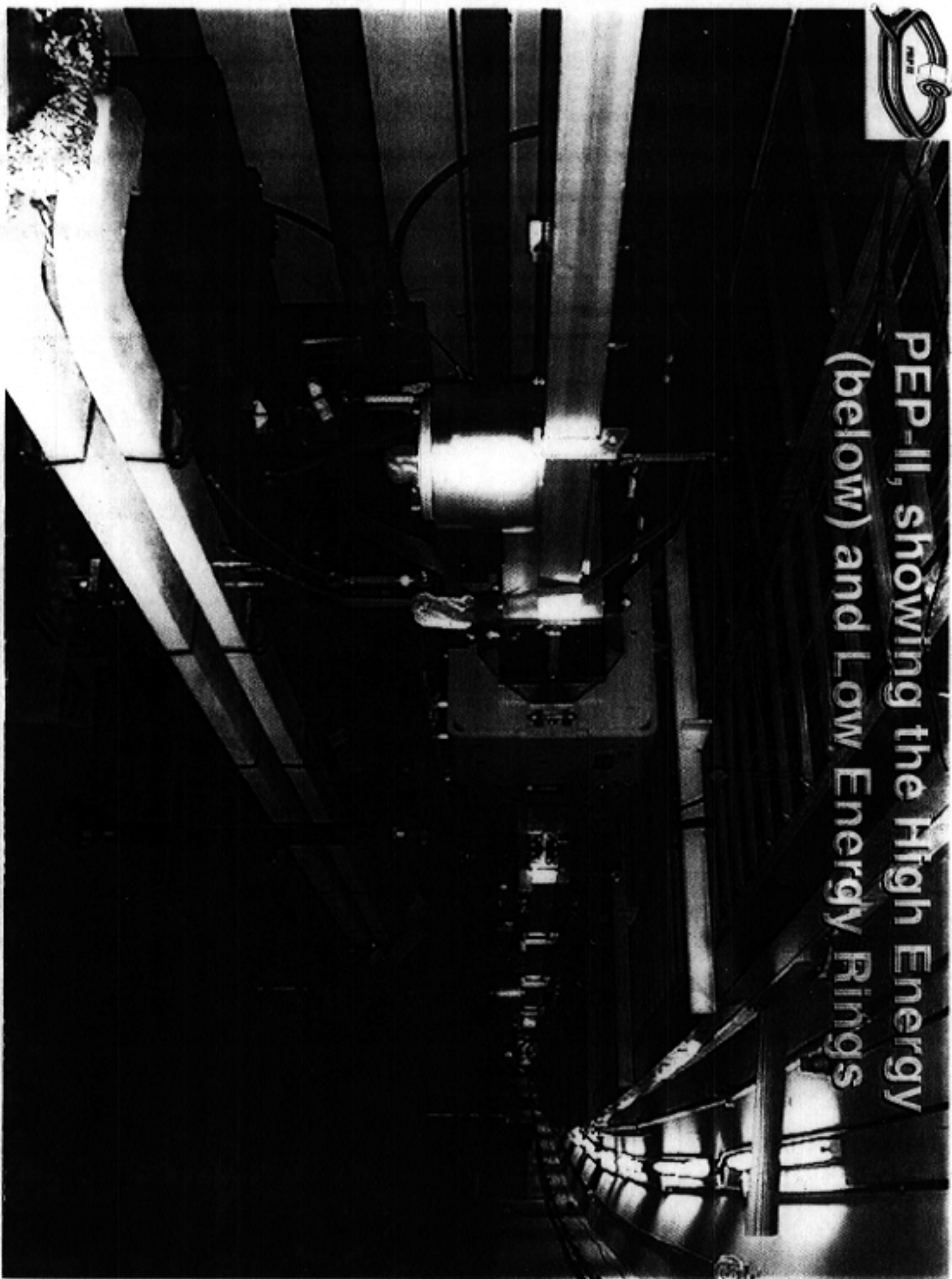
W. Kozanecki (Saclay)

PEP-II History

Start of construction	November 1993
First stored HER beam	June 16, 1997
First stored LER beam	July 16, 1998
First PEP-II collisions	July 23, 1998
BaBar installed	May 10, 1999
First detected events in BaBar	May 26, 1999
Upsilon 4S energy scan	June 1999
Luminosity passed 10^{33}	September 13, 1999



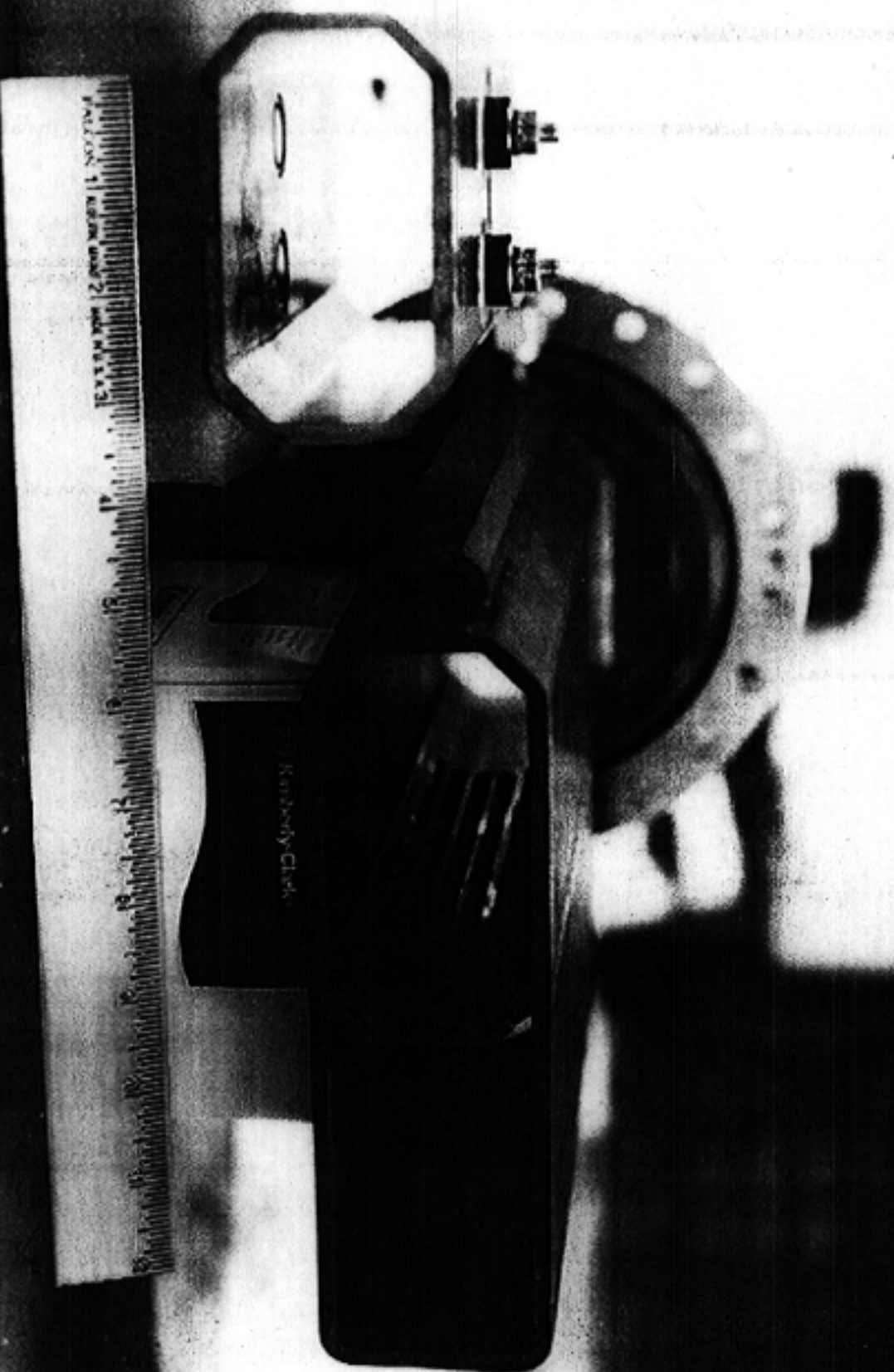
PEP-II, showing the High Energy (below) and Low Energy Rings



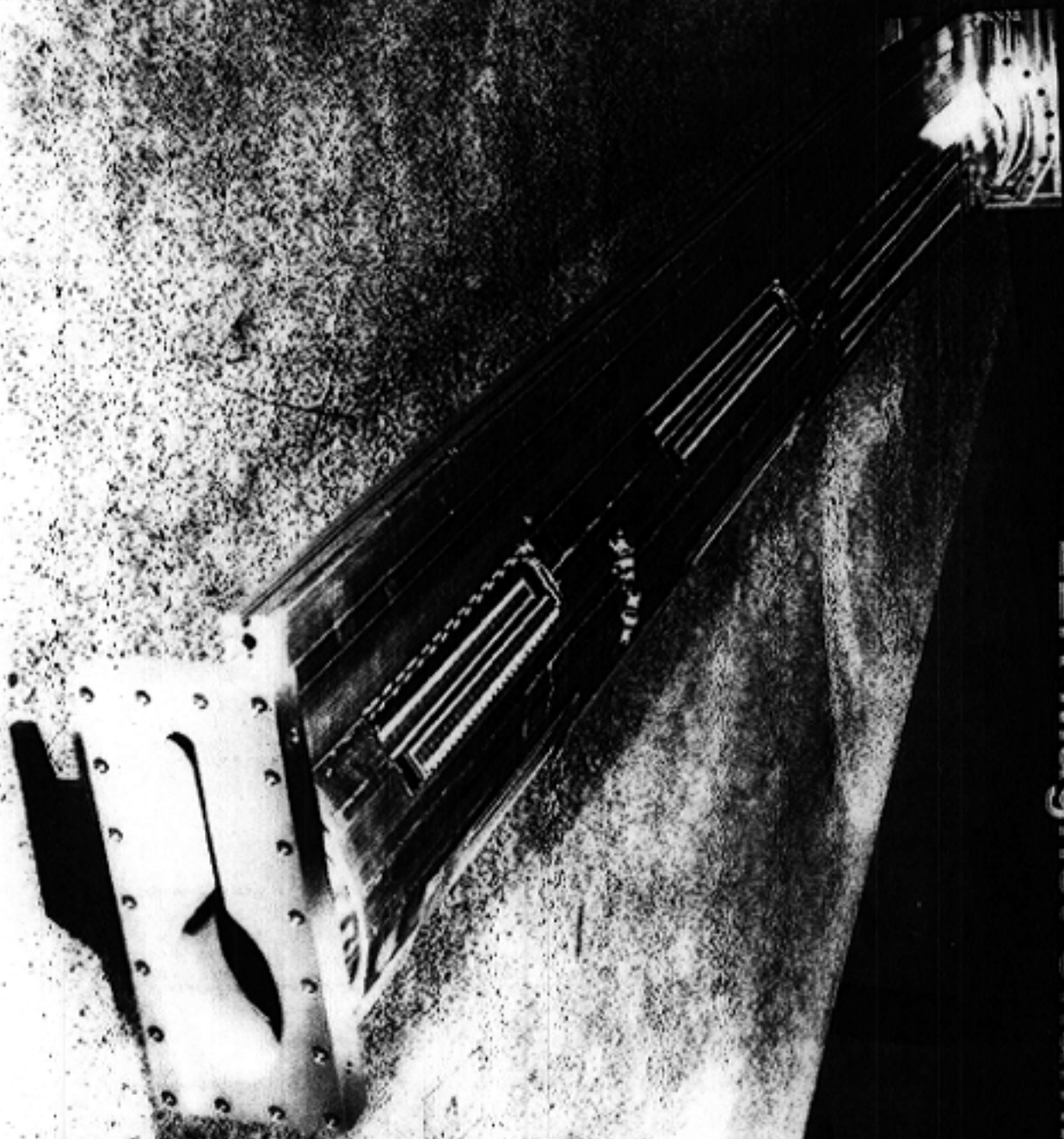
PEP-II B-Factor



HER Quadrupole and Dipole Copper Chambers



LEP Magnet Chamber

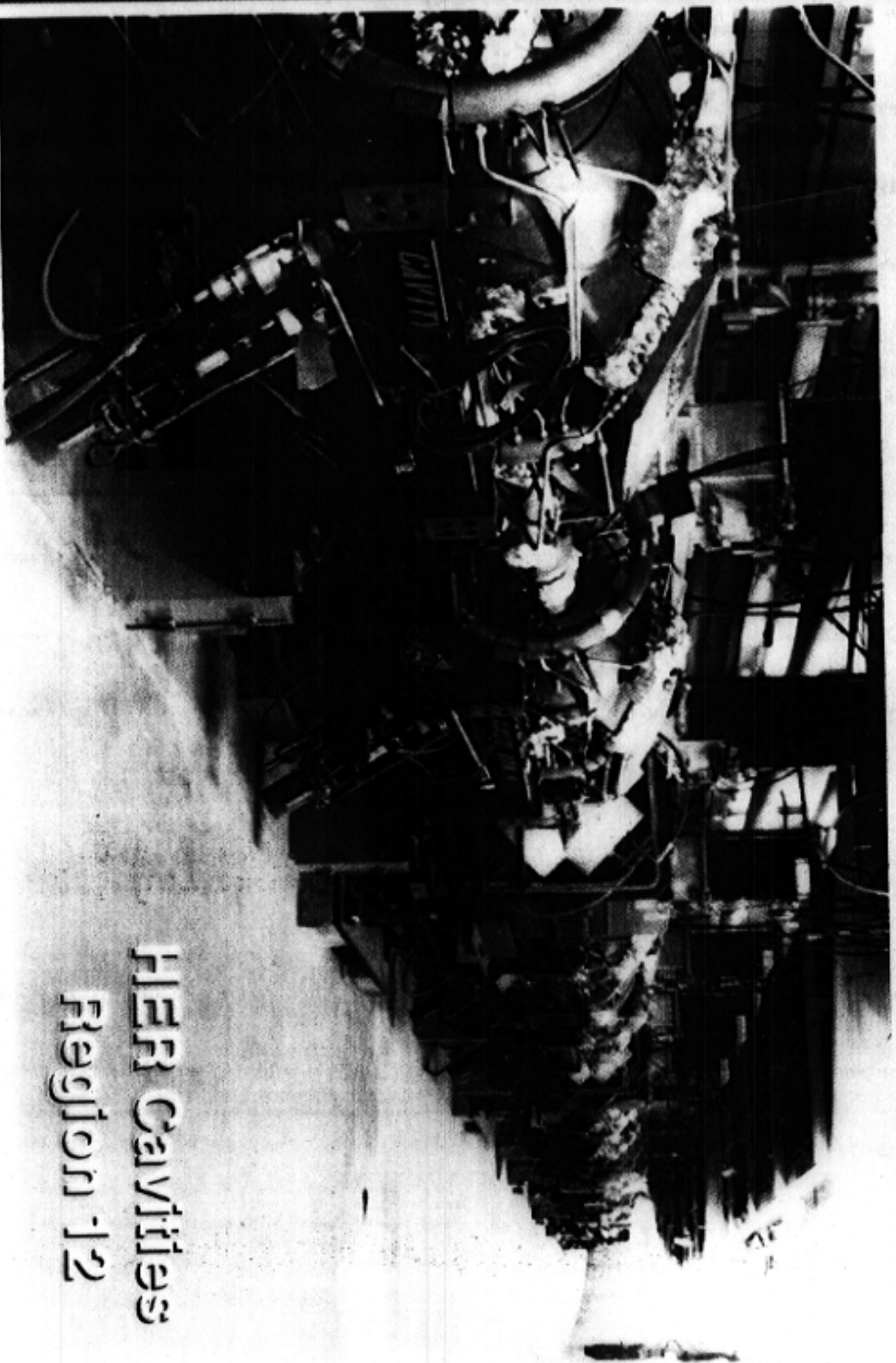


A

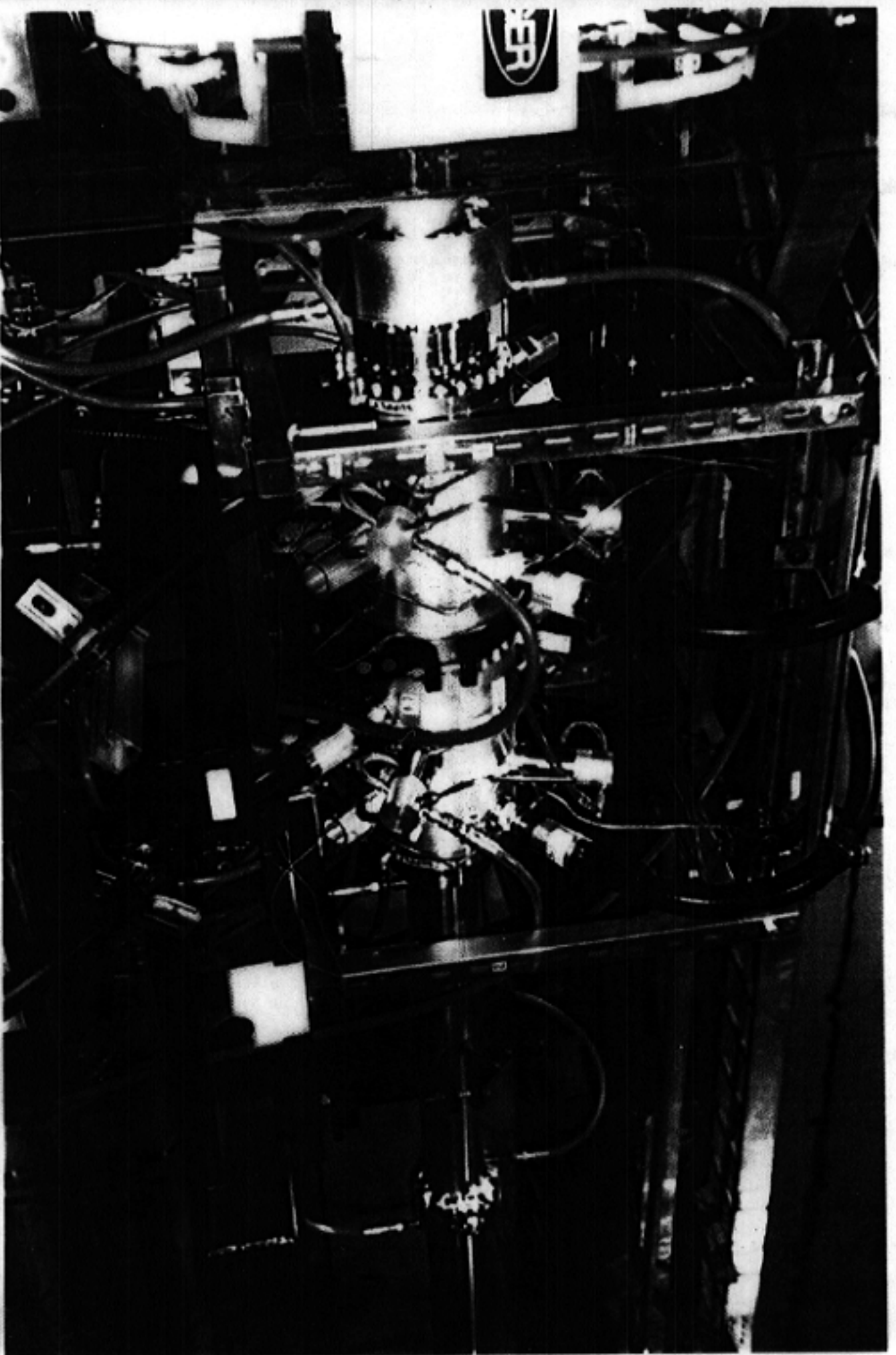
DV410

RF Cavity Production



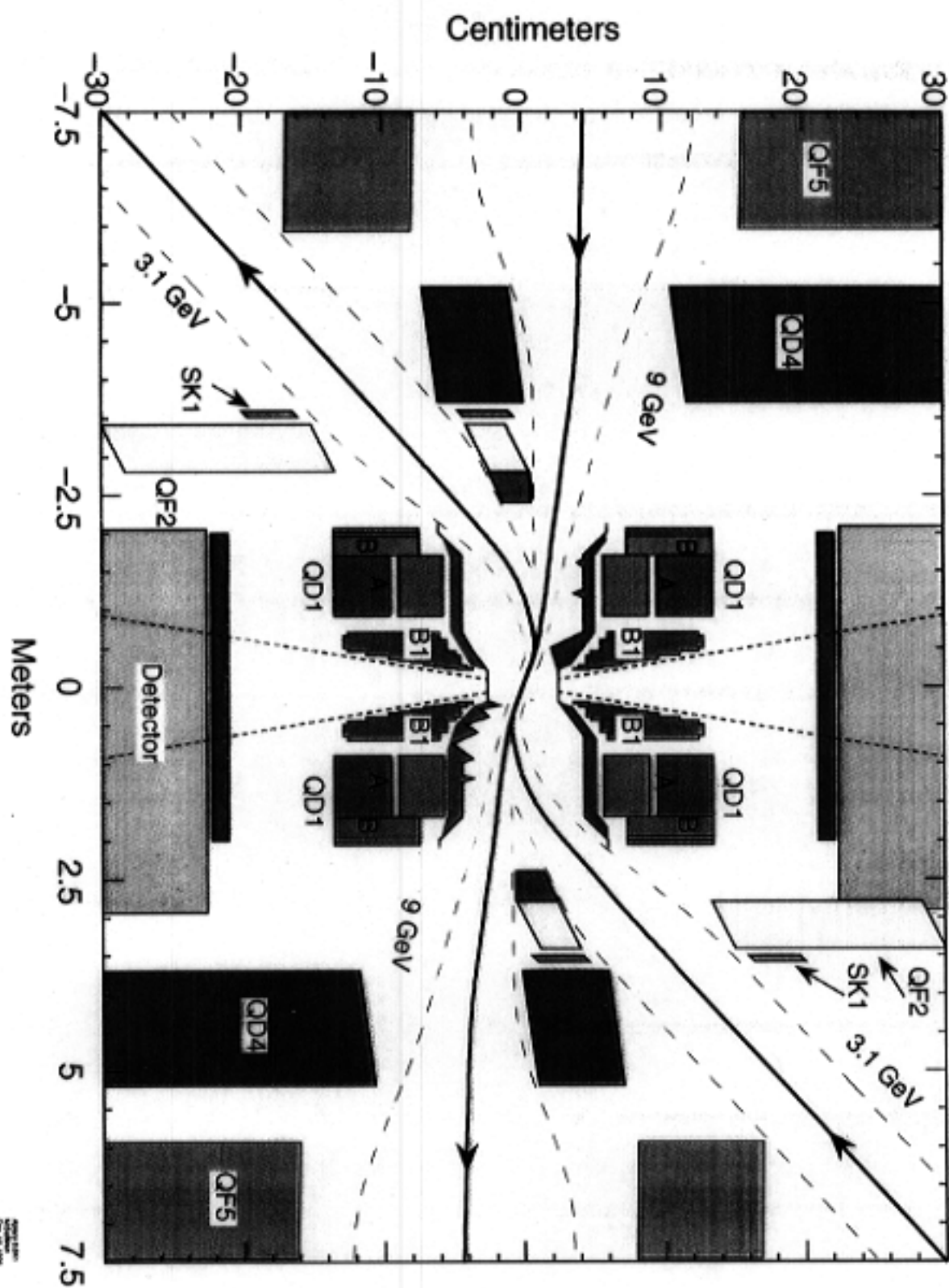


HER Cavities
Region -12



Low Energy Ring Longitudinal Kicker

PEP-II Interaction Region

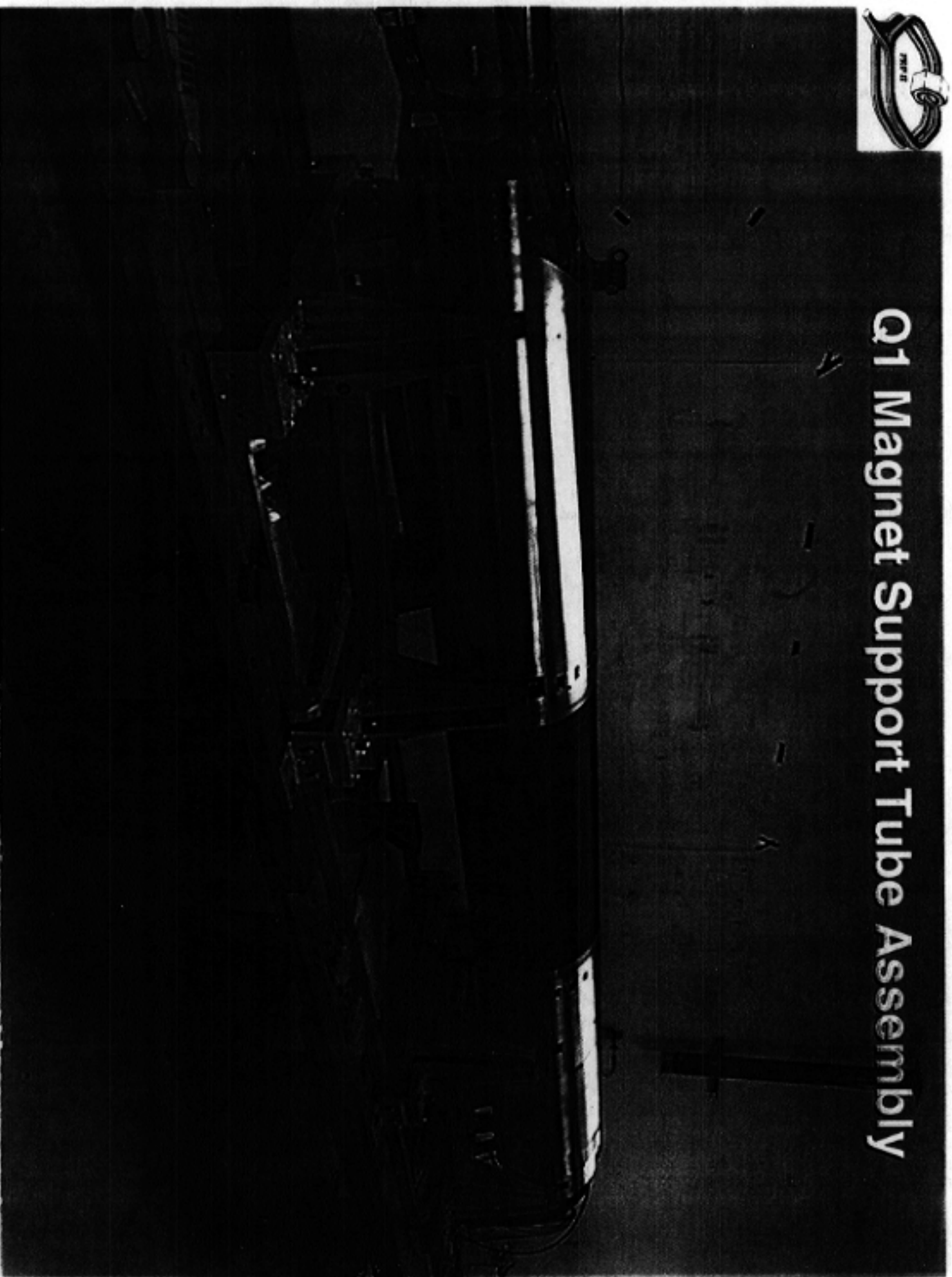




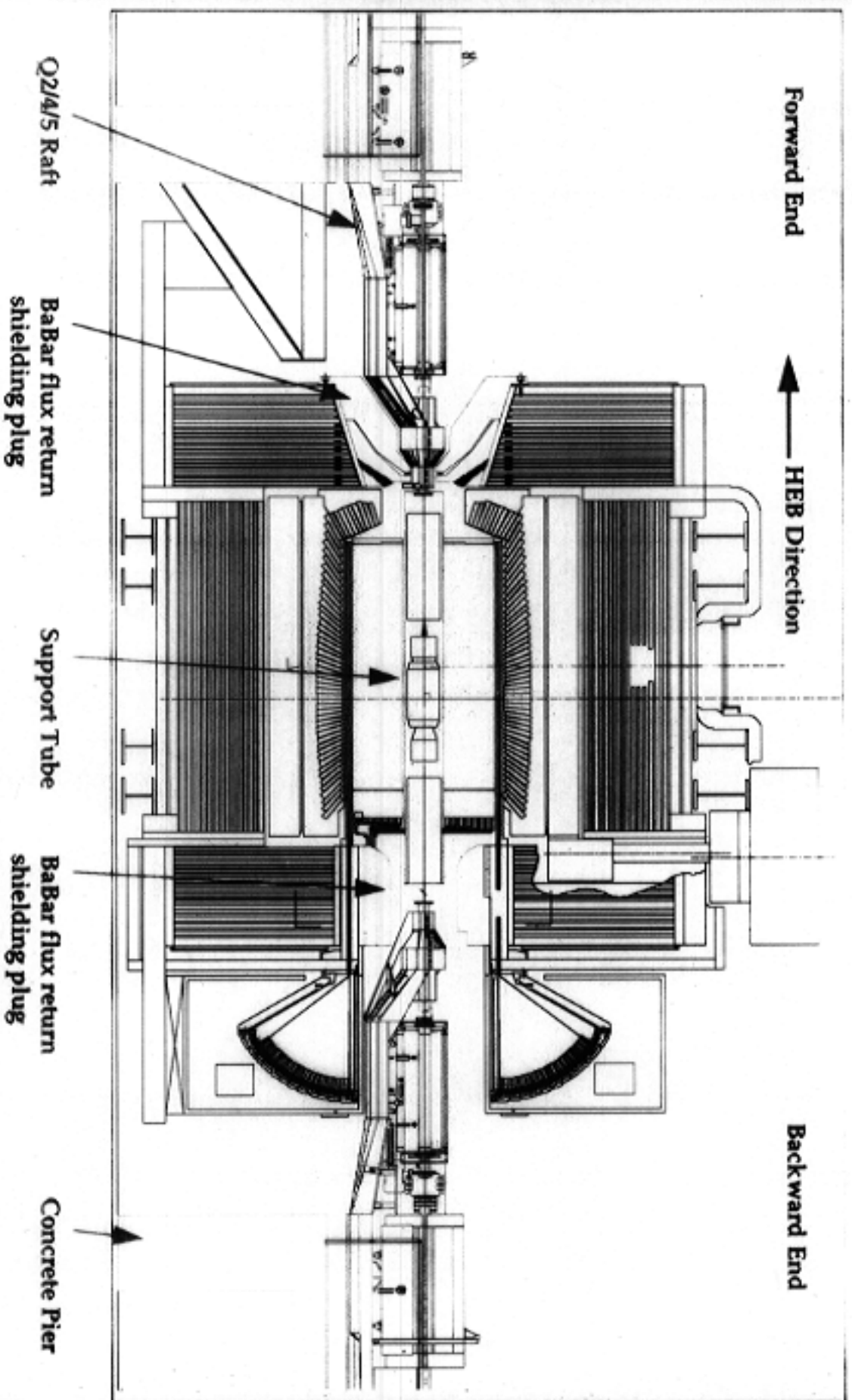
Permanent Magnet Crew - 04/09/98



Q1 Magnet Support Tube Assembly



PEP-II I.R. and BaBar Detector in IR-2



Elevation View of PEP-II I.R. and BaBar

PEP-II Bunch Injection HER

Print **Exit**

Bunch Currents

Raw-Ped

equiv mA

Filled Buckets

Fit Lifetimes based on

Current Transformer

DCCT-Ped

DI/DT

Linear

Exponential

BIC STATE:

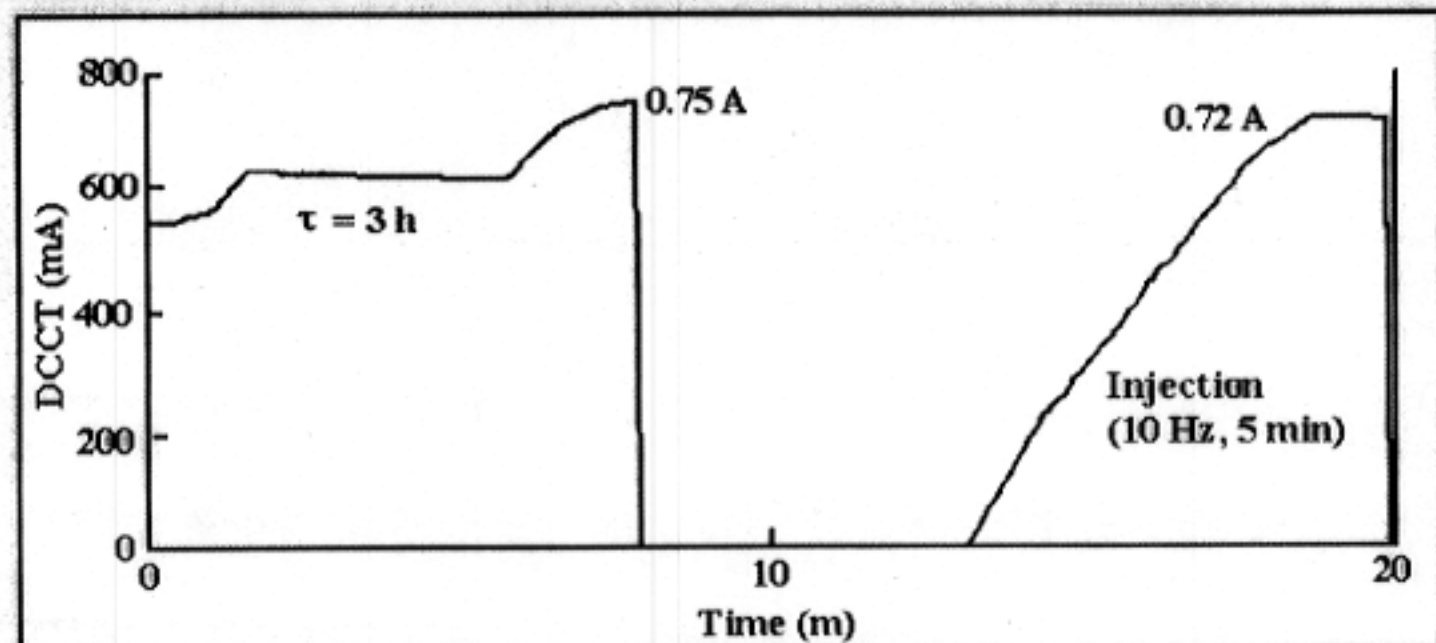
Calib Status

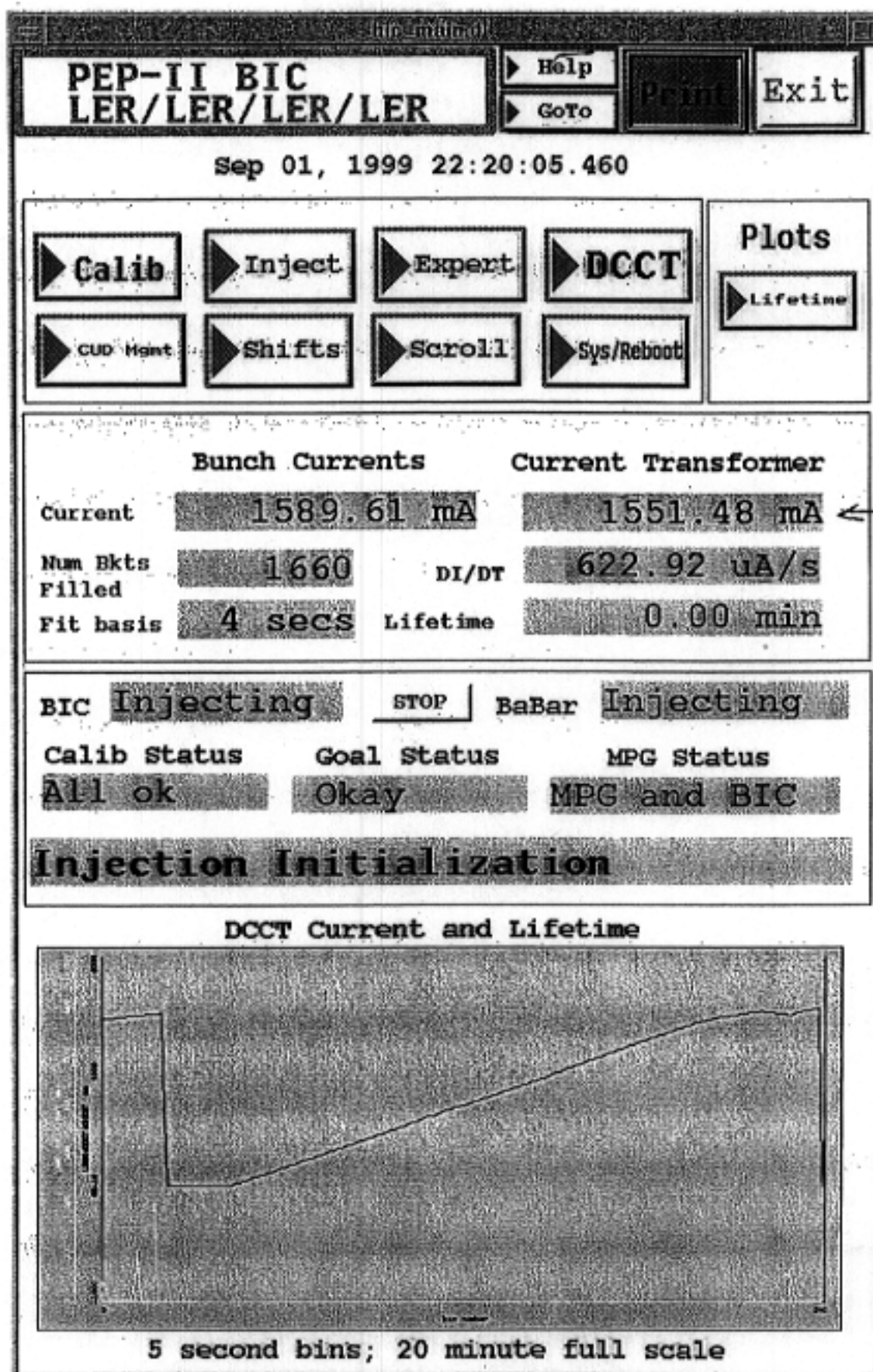
Goal Status

MPG Status

Injection Stopping

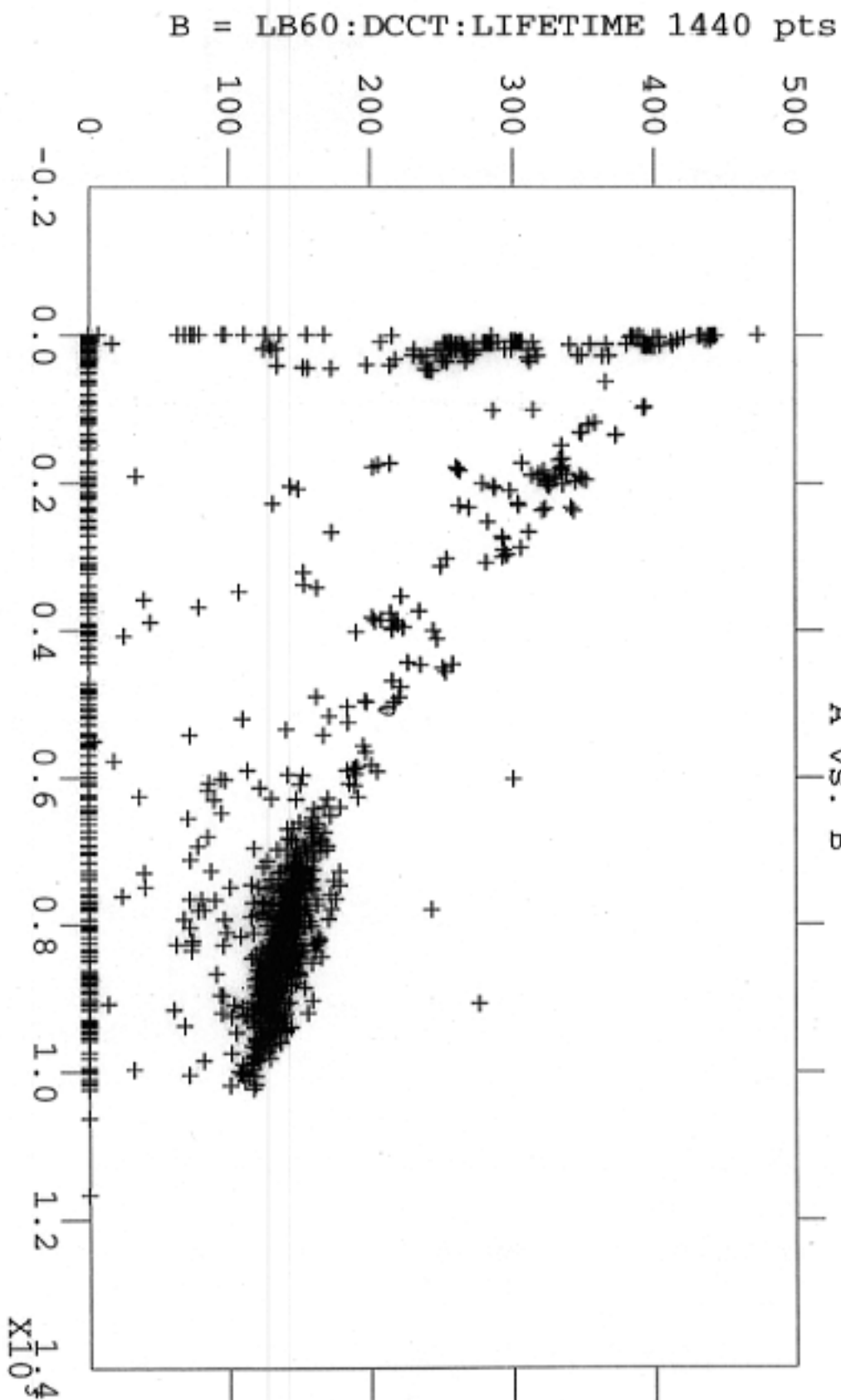
DCCT Current; 5 second bins; 20 minute full scale





HISTORY CORRELATION

A vs. B



17-SEP-99 08:48:15

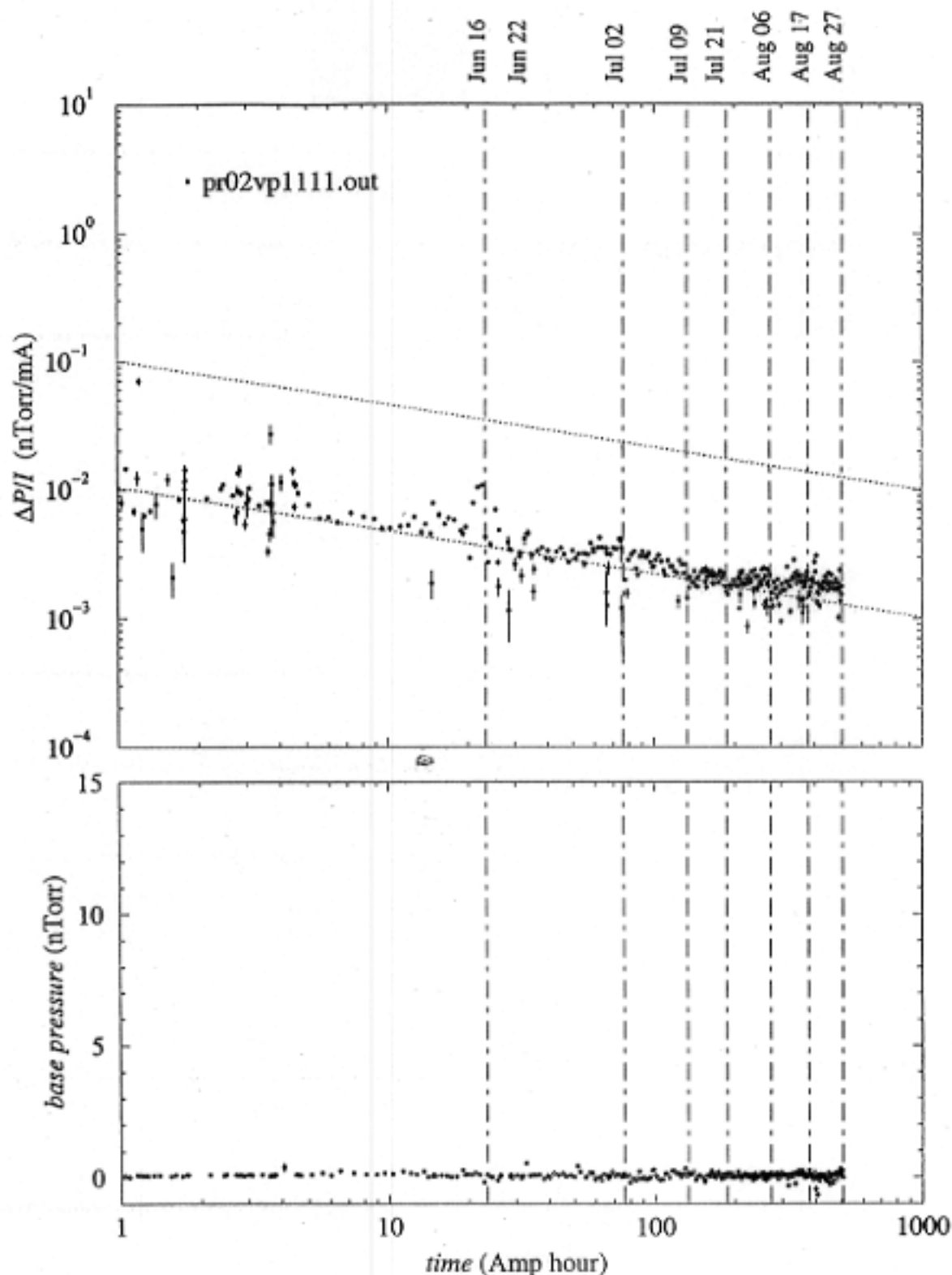
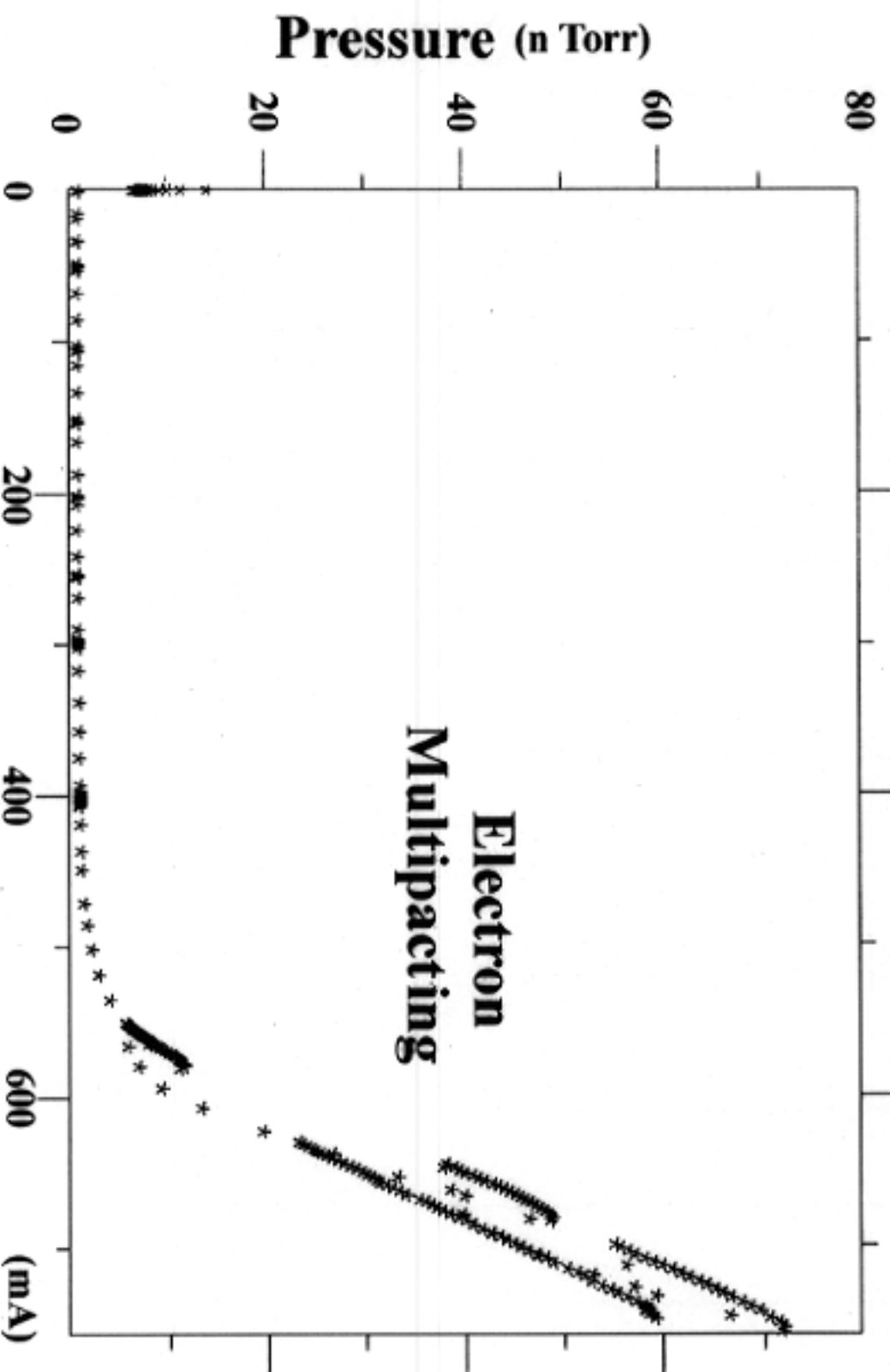


Figure 1: The coefficient relating pressure with beam current $\Delta P/I$ (upper) and the base pressure (lower) plotted versus time. The dotted lines indicates the estimated cleaning rate for the system. The dash-dotted lines show when the nearby TSP:s were flashed.

Electron Multipacting



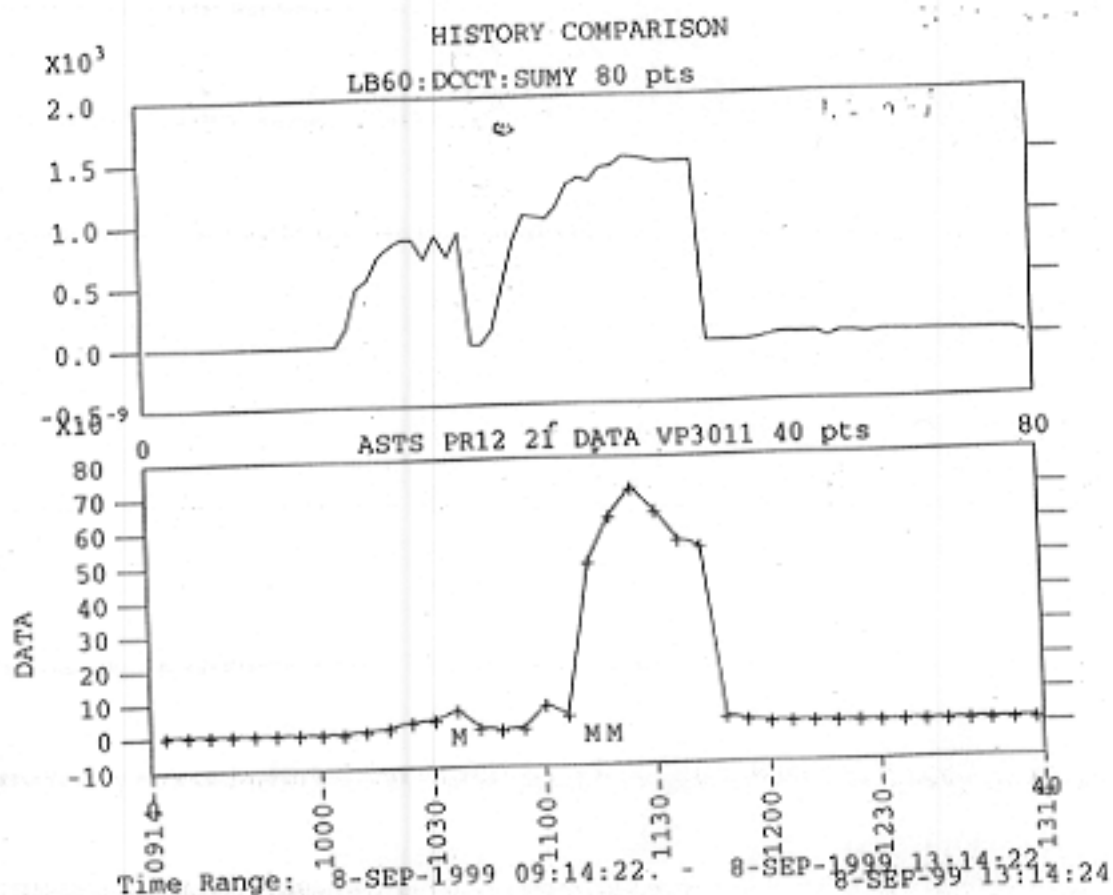
e^+ LER Beam Current

23-FEB-99 15:27:14

LER vacuum pressure versus time

Pressure rise is very nonlinear with current but “scrubs” very quickly with integrated current (~1 hour).

Figure: Beam current above and vacuum pressure below vs time.



PEP-II Instability Thresholds (1571 bunches)

Longitudinal :

	<u>Current Limit without feedback</u>	<u>Current Limit with feedback</u>	<u>Cause of Instability</u>
LER:	330 mA	>1550 mA	Cavity modes
HER:	500 mA	>650 mA	Cavity modes

Transverse (vertical):

	<u>Current Limit without feedback</u>	<u>Current Limit with feedback</u>	<u>Cause of Instability</u>
LER:	>>100 mA	>1550 mA	Resistive wall / PEI
HER:	~20 mA	>650 mA	IR mode

Transverse (horizontal):

	<u>Current Limit without feedback</u>	<u>Current Limit with feedback</u>	<u>Cause of Instability</u>
LER:	~100 mA	>1650 mA	Resistive wall / PEI?
HER:	~20 mA	>650 mA	IR mode



Stewart Smith, David Hiltin and Bill Frazzawa enjoying the first events

The PEP-II Accelerator crew which produced the first events



Ulf Wickens, Mike Sullivan and Wlodek Kozanecki discussing the first events



Burton Richter, John Seeman and Halrick Kerjcek enjoying the first events

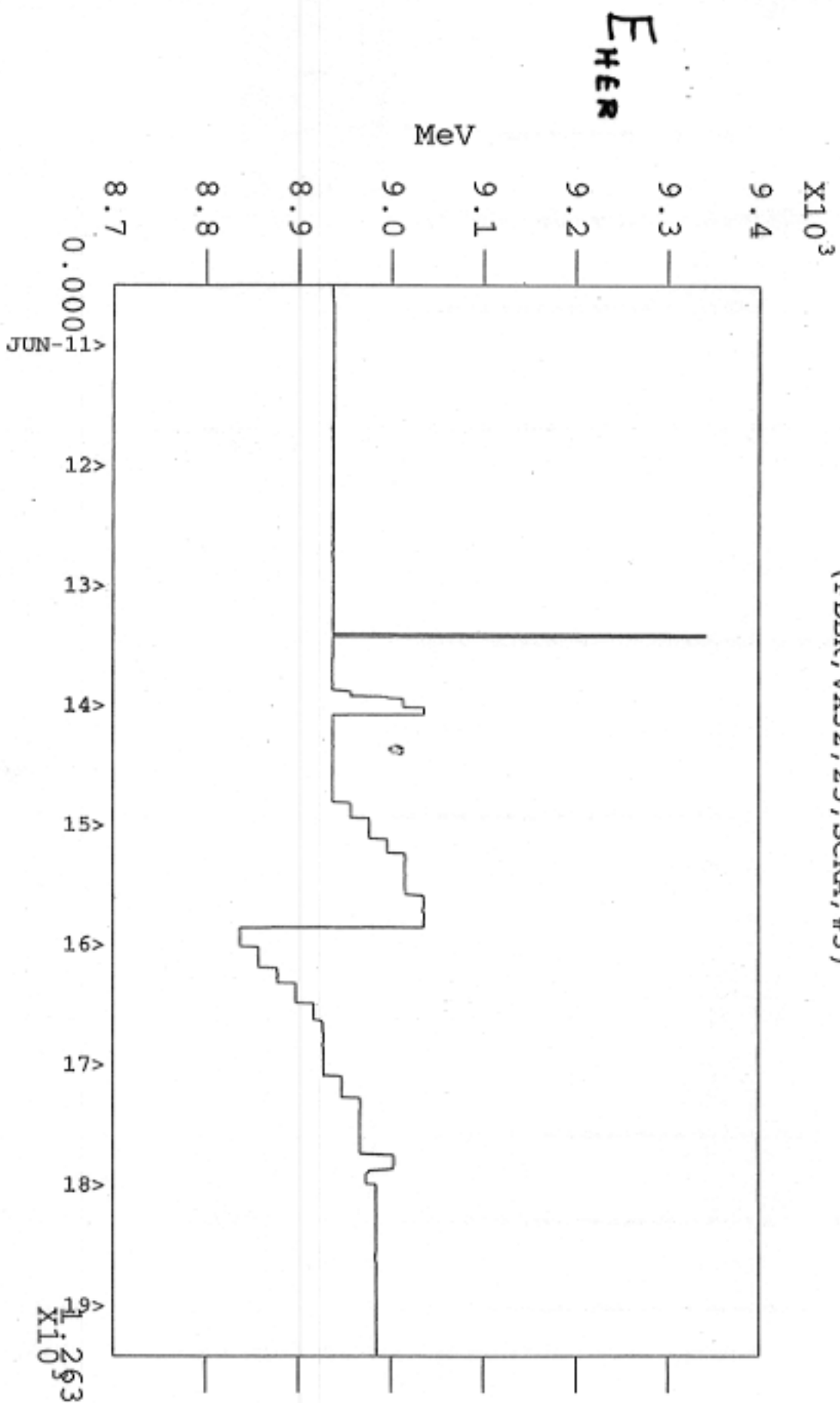


PEP-II Delivers First

BABAR Events

May 26, 1999

Enmrs HER
(FDBK, VX32, 25, SCRA, #3)

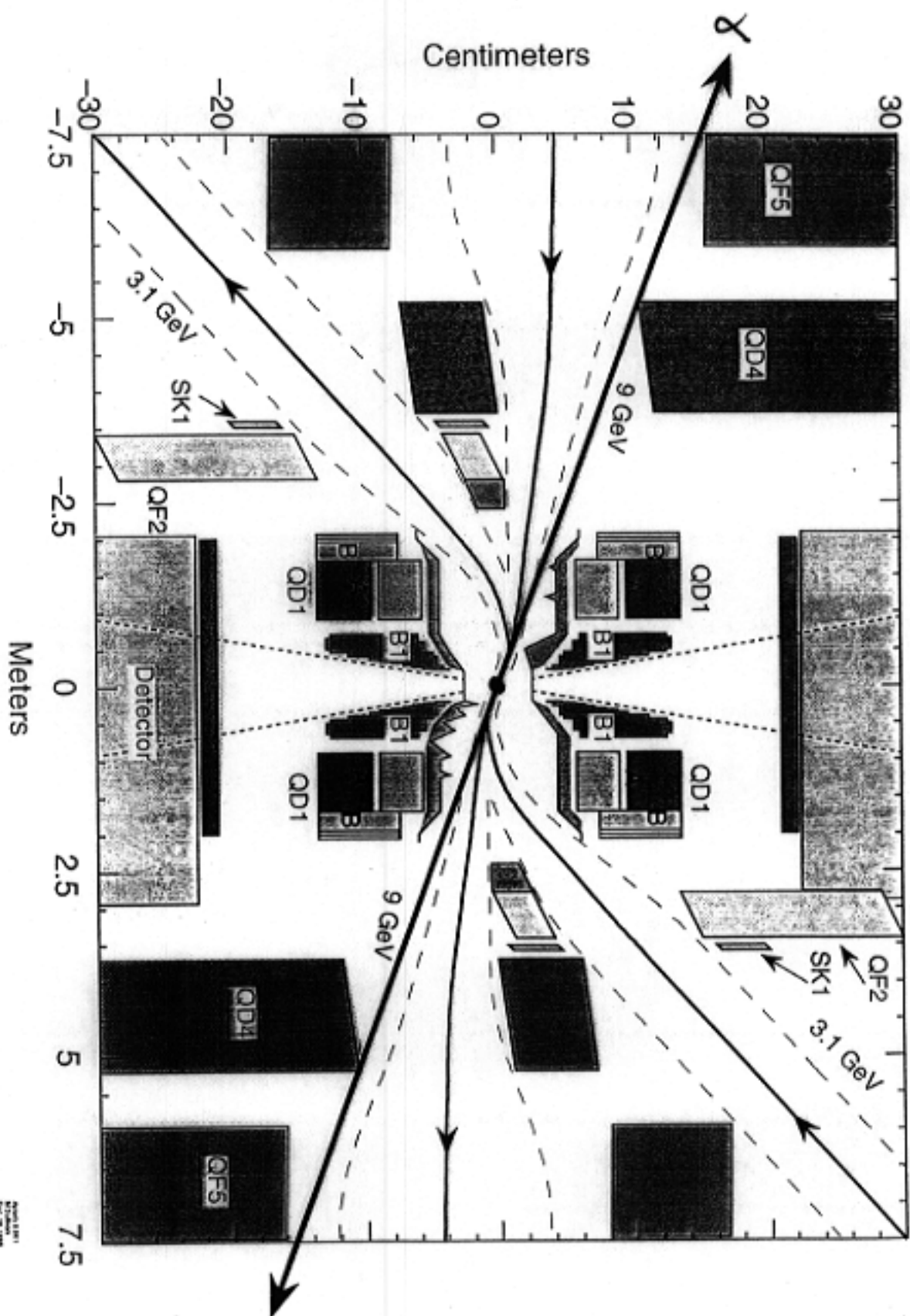


INTERVAL: 360
LAST DATA POINT: 19-JUN-1999 09:54:42

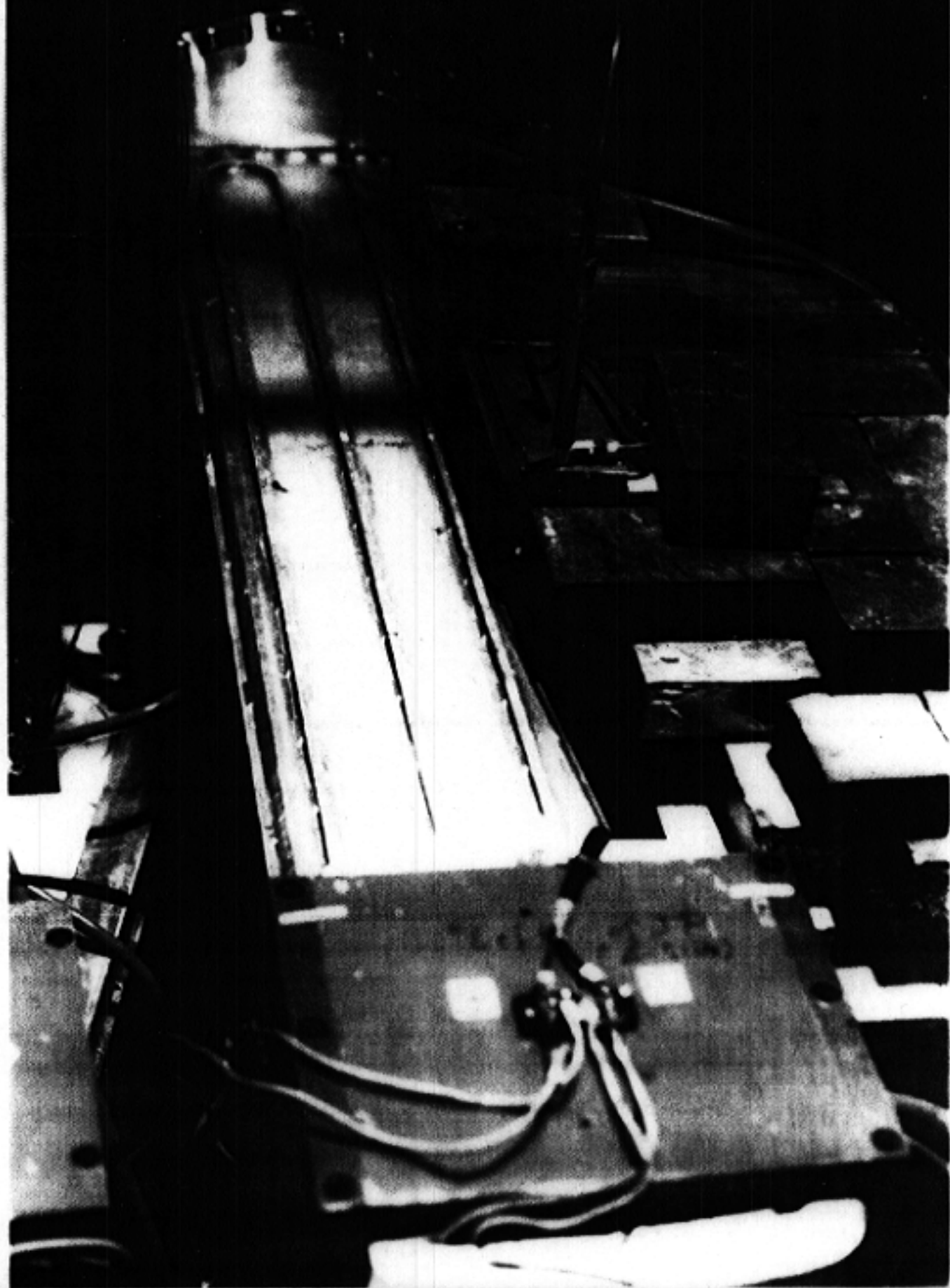
MEAN: 8954.1
STDEV: 44.179

MIN: 8837.2
MAX: 9341.3
MAX-MIN: 504.05
19-JUN-99 10:45:30

PEP-II Interaction Region

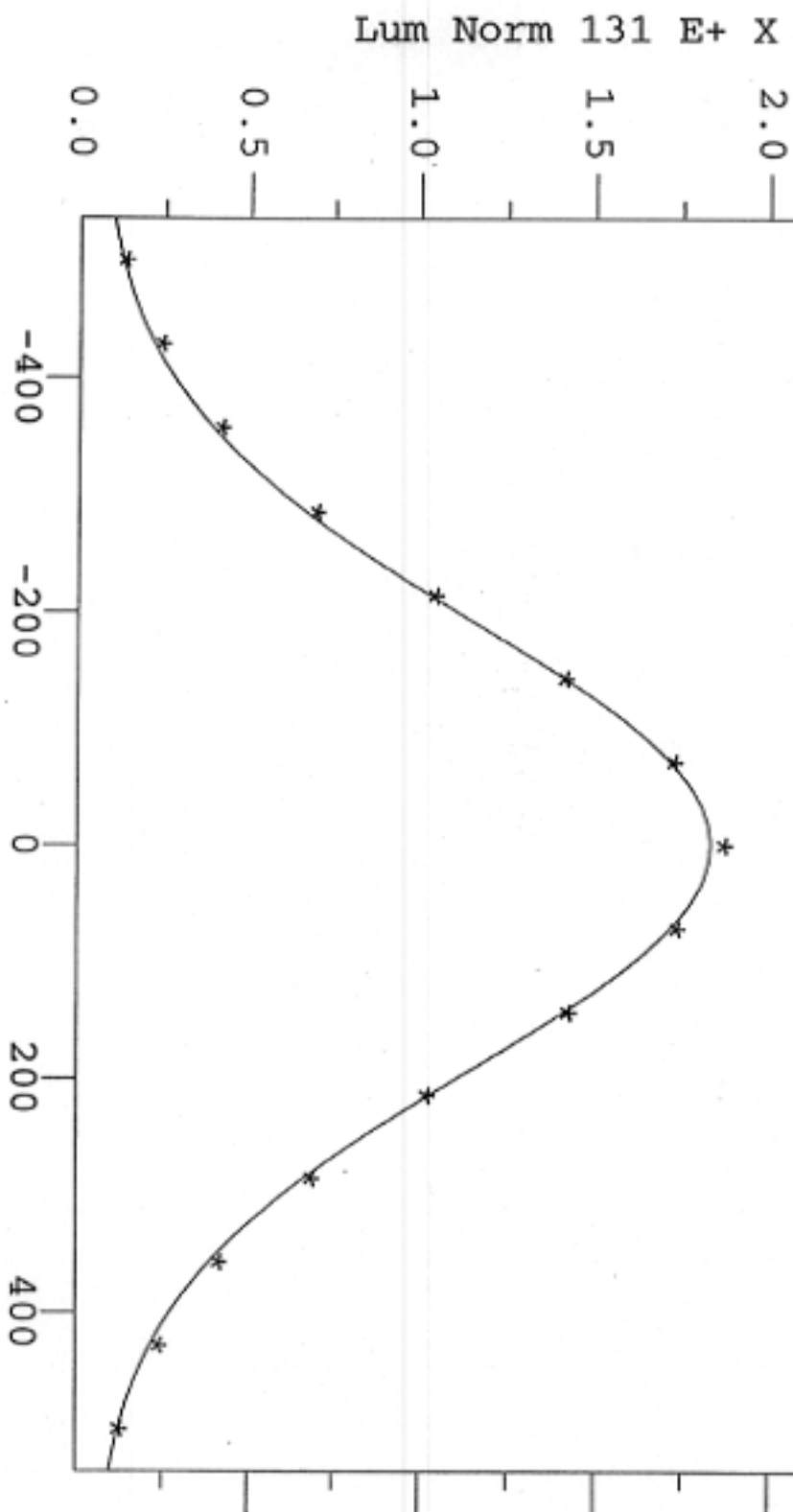


Luminosity Monitor and Chamber



$$Y = A + B * \exp(-(X - D)^2 / (2 * C^2))$$

Parameter	Value	STD DEV
A	5.8244E-02	1.1530E-02
B	1.776	1.1799E-02
C	195.0 <i>(μm)</i>	1.909
D	-0.5212	0.9934
AREA	867.8	12.17
INT	0.0000E+00	0.0000E+00
RMS FIT ERROR	1.2039E-02	



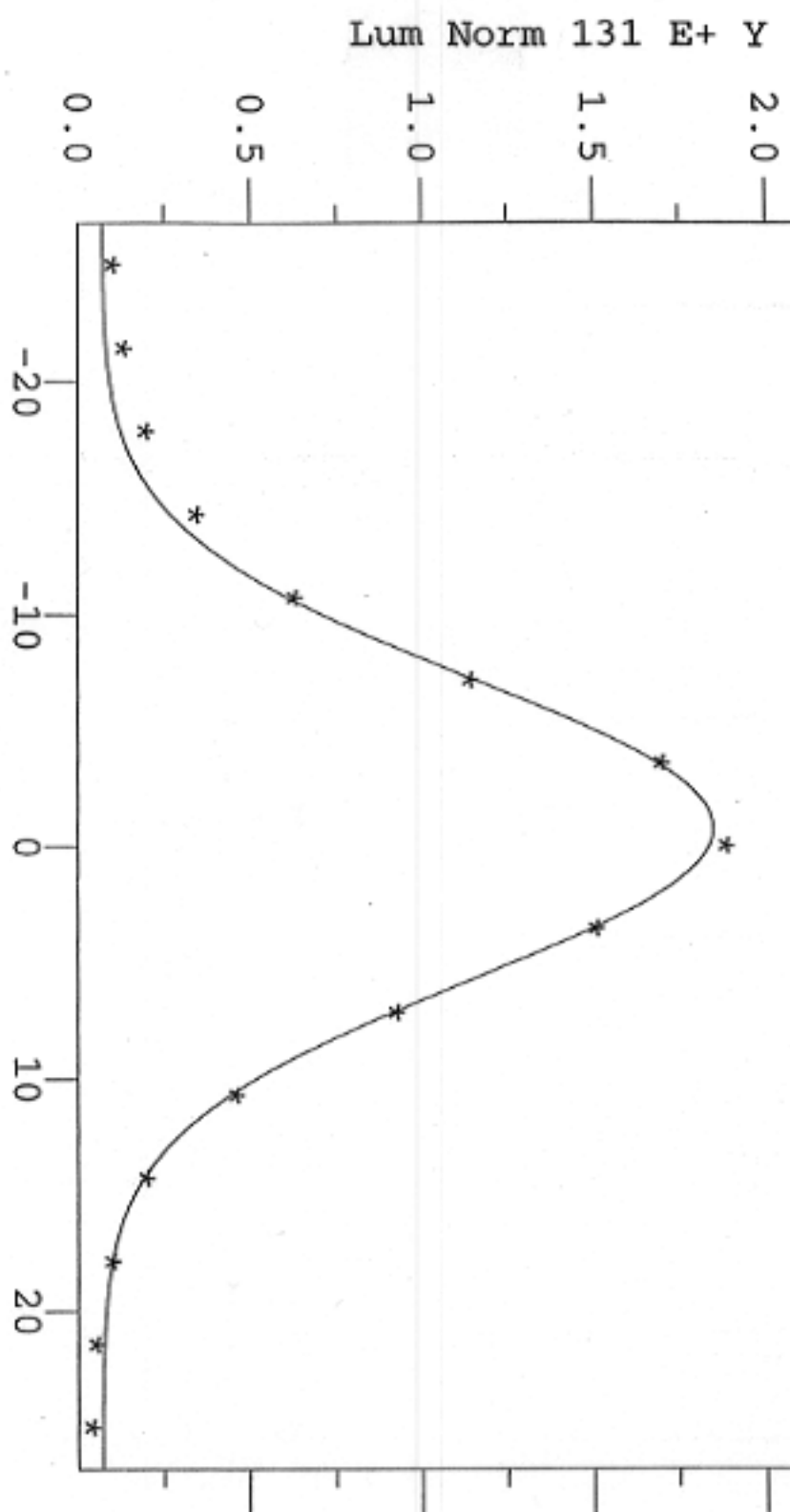
KNOB (HERIP_Y) STRT=-25.00 STEPS= 15 SIZE= 3.571
 XPOS KNOB *****

10-SEP-99 03:58:23

Σy

Y = A + B * EXP(-(X - D)**2 / (2 * C**2))

Parameter	Value	STD DEV
A	7.1040E-02	1.5514E-02
B	1.7777	2.6964E-02
C	6.462 μm	0.1306
D	-0.7428	0.1034
AREA	28.78	0.6656
INT	28.69	6.002
RMS FIT ERROR	3.0835E-02	



YPOS KNOB *****

KNOB (HERIP_Y) STRT=-25.00 STEPS= 15 SIZE= 3.571

SHOW-ALL

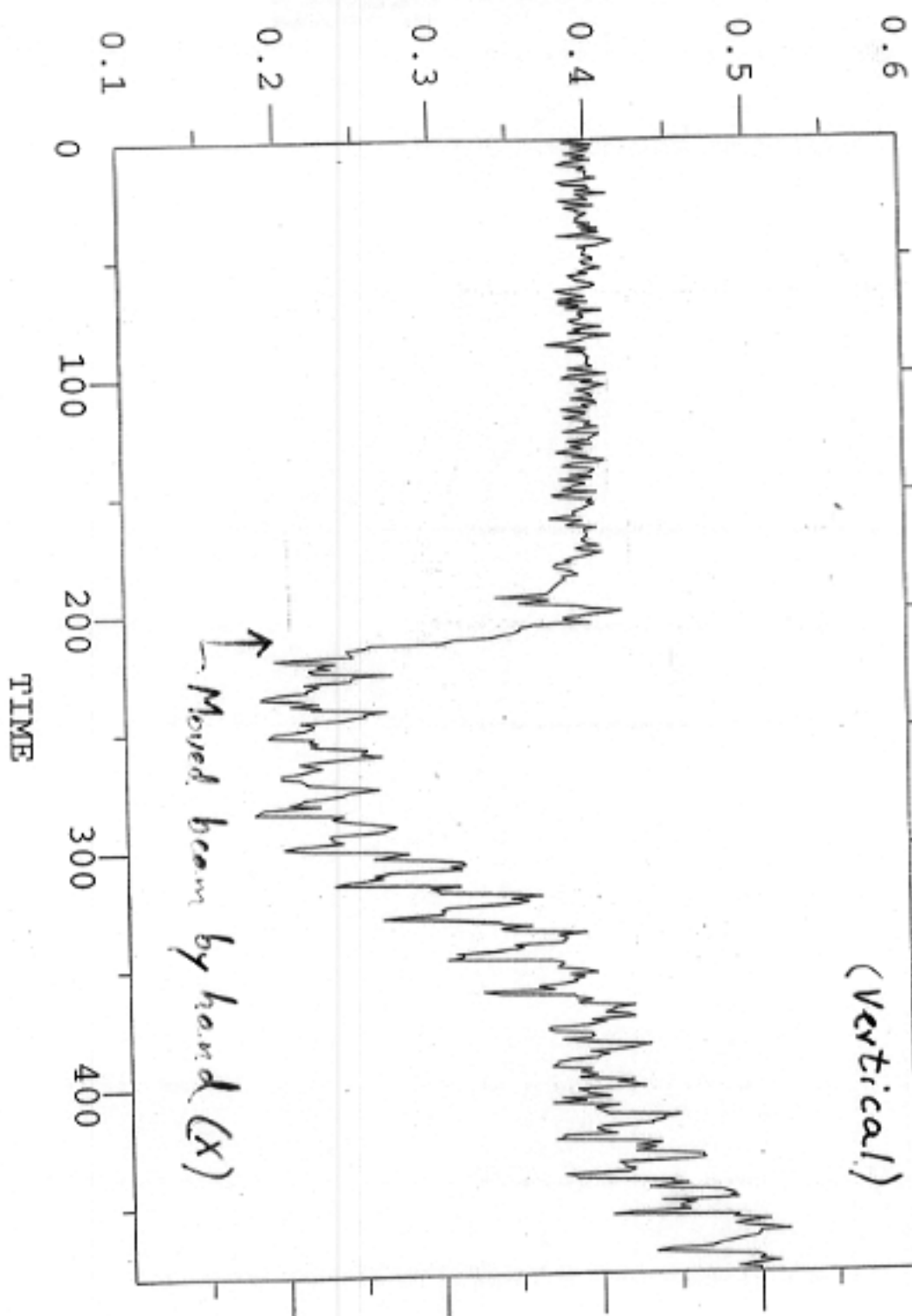
THE AMULETS HOBIAN GROUP, Ltd
DUBLIN, IRELAND

10-SEP-99 03:59:22

IP Feed back

(Vertical)

ASTS PR02 DATA CH130

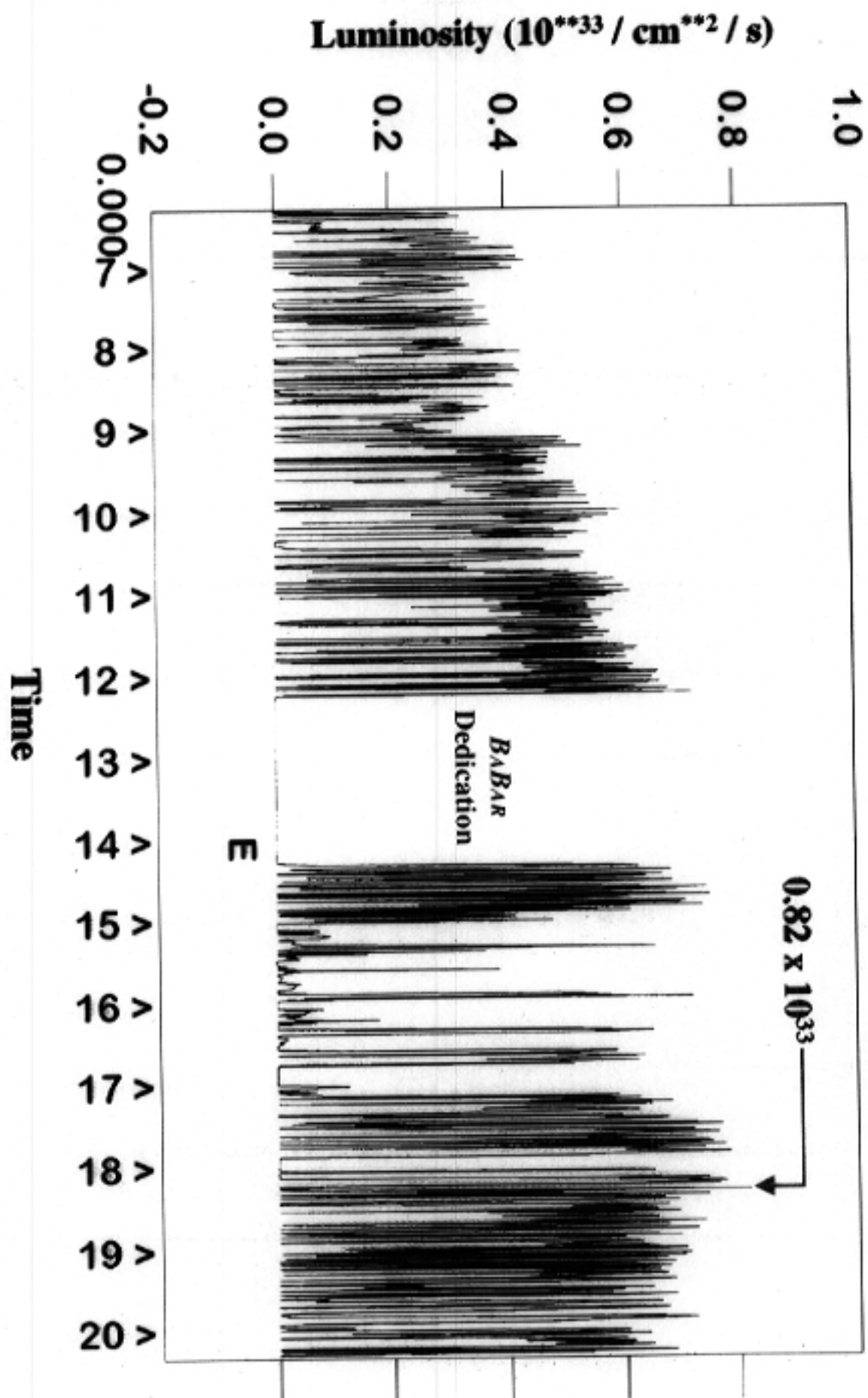


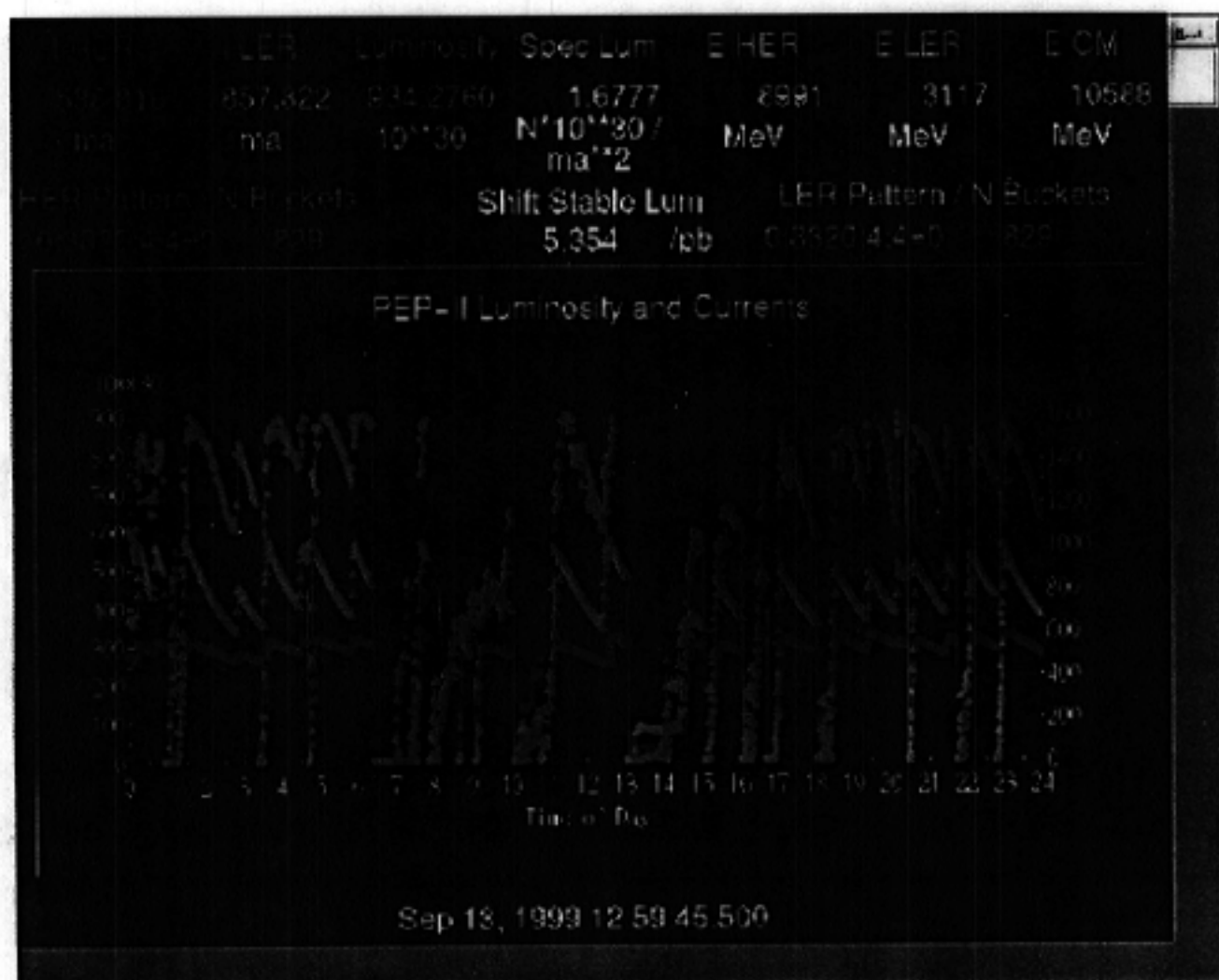
MANUAL STEPPING. STEPS = 472

8-DEC-98 21:54:27

--- SLOW KNOB & ACTS : PRO2IP_Y 300-250-200-150-100-50 0
 TIME
 8-DEC-98 20:07:31

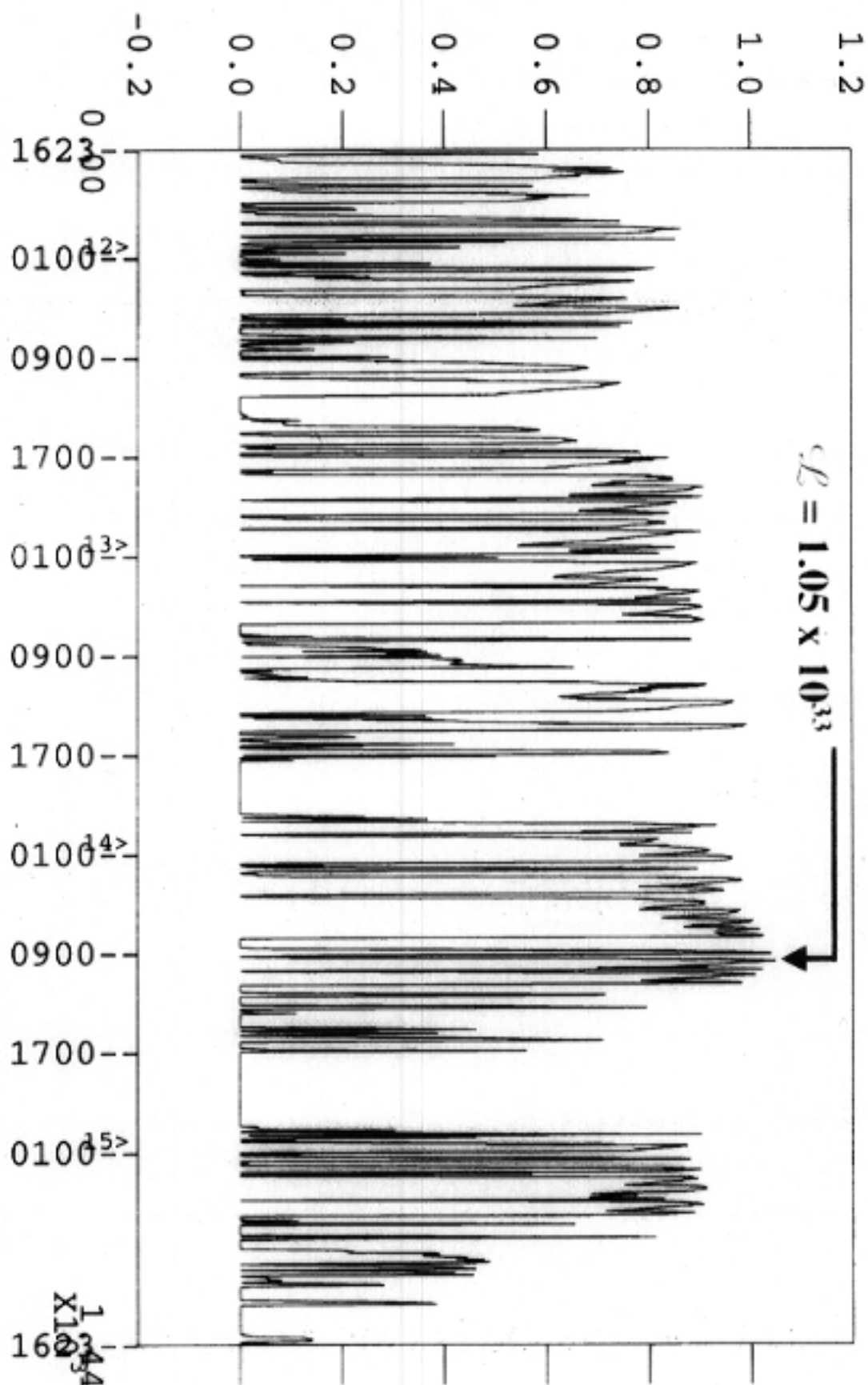
PEP-II Luminosity (August 7-20, 1999)





PEP-II Luminosity

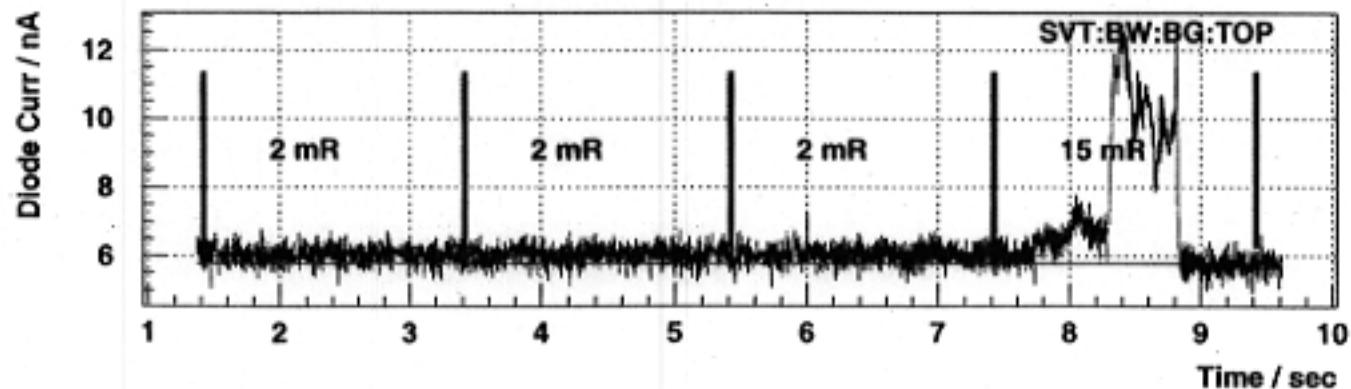
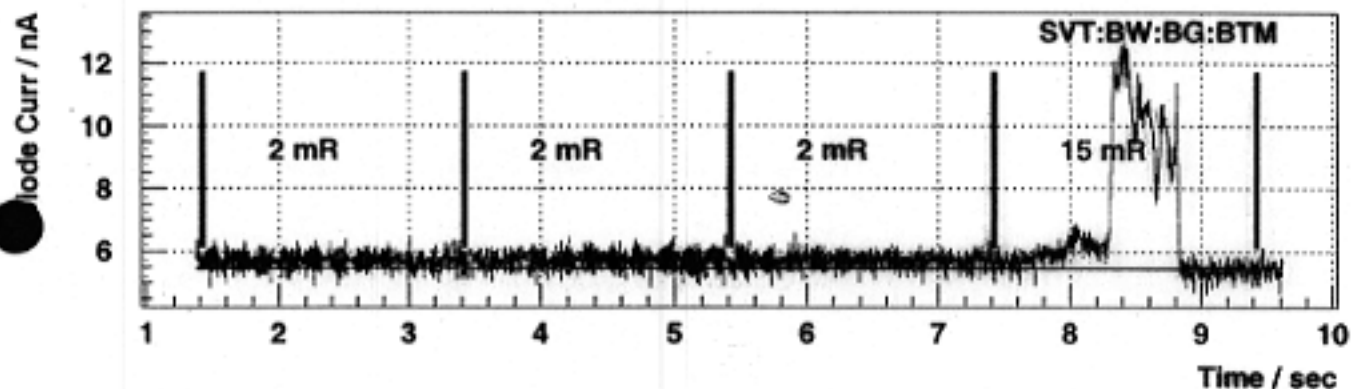
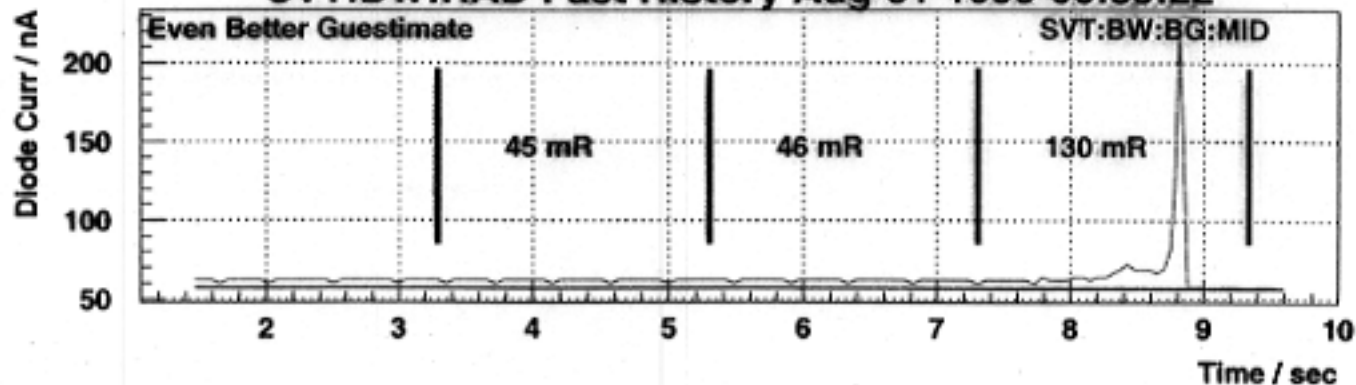
$10^{33} / \text{cm}^2 / \text{s}$ or $/\text{nb} / \text{s}$



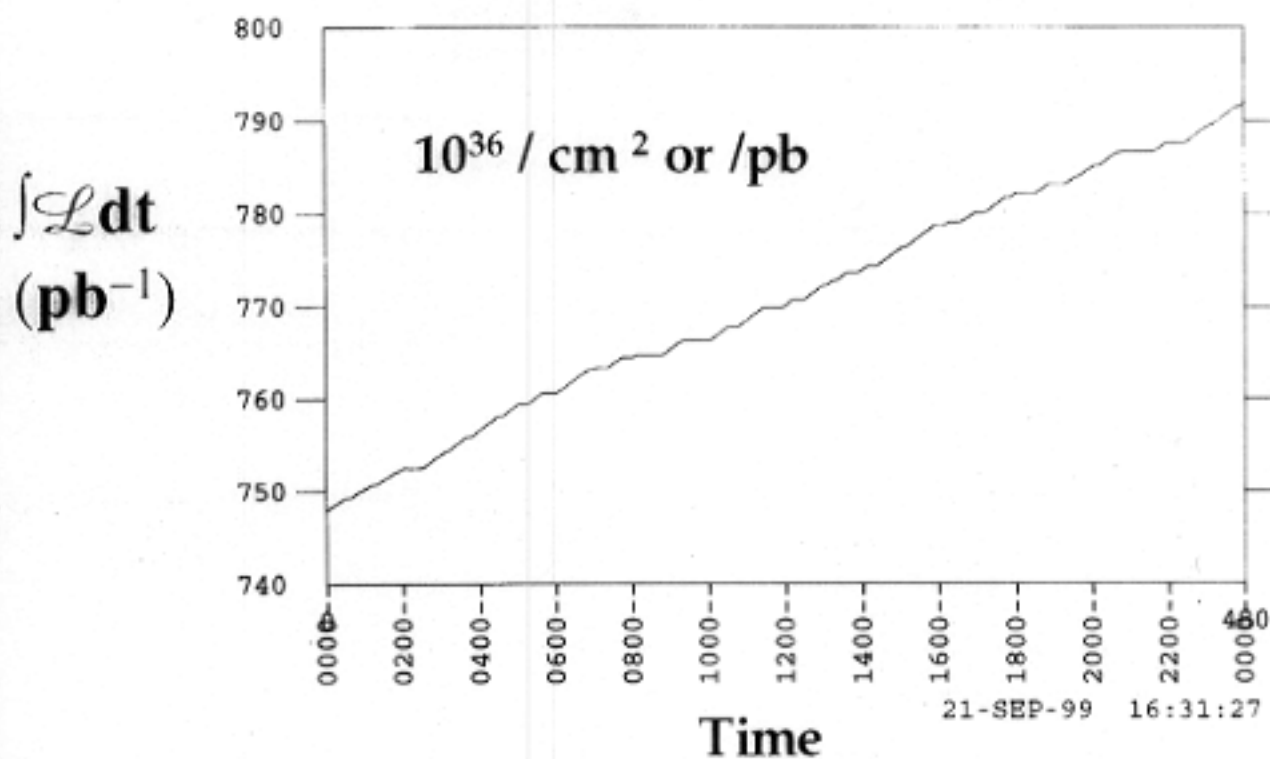
Time

15-SEP-99 16:23:16

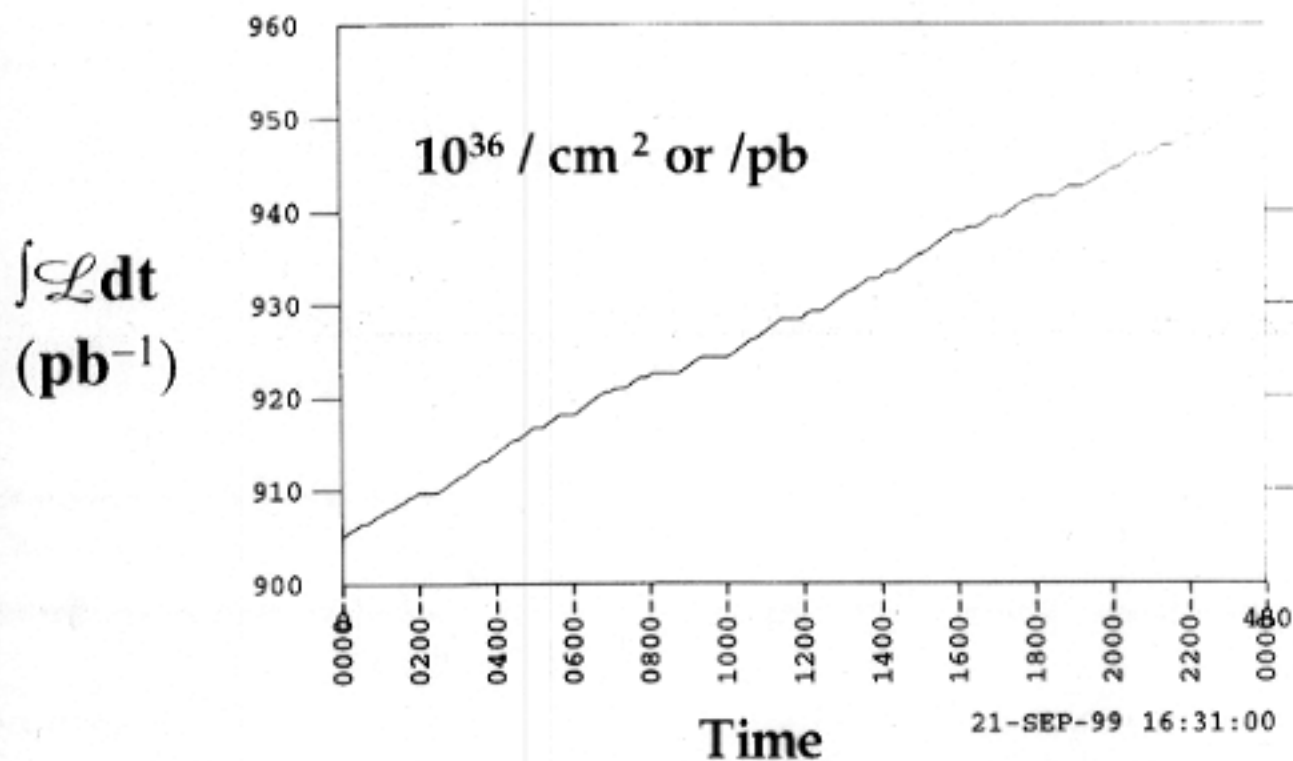
SVT:BW:RAD Fast History Aug-31-1999-06:39:22



Integrated Luminosity Logged by BABAR



Integrated Luminosity Delivered by PEP-II

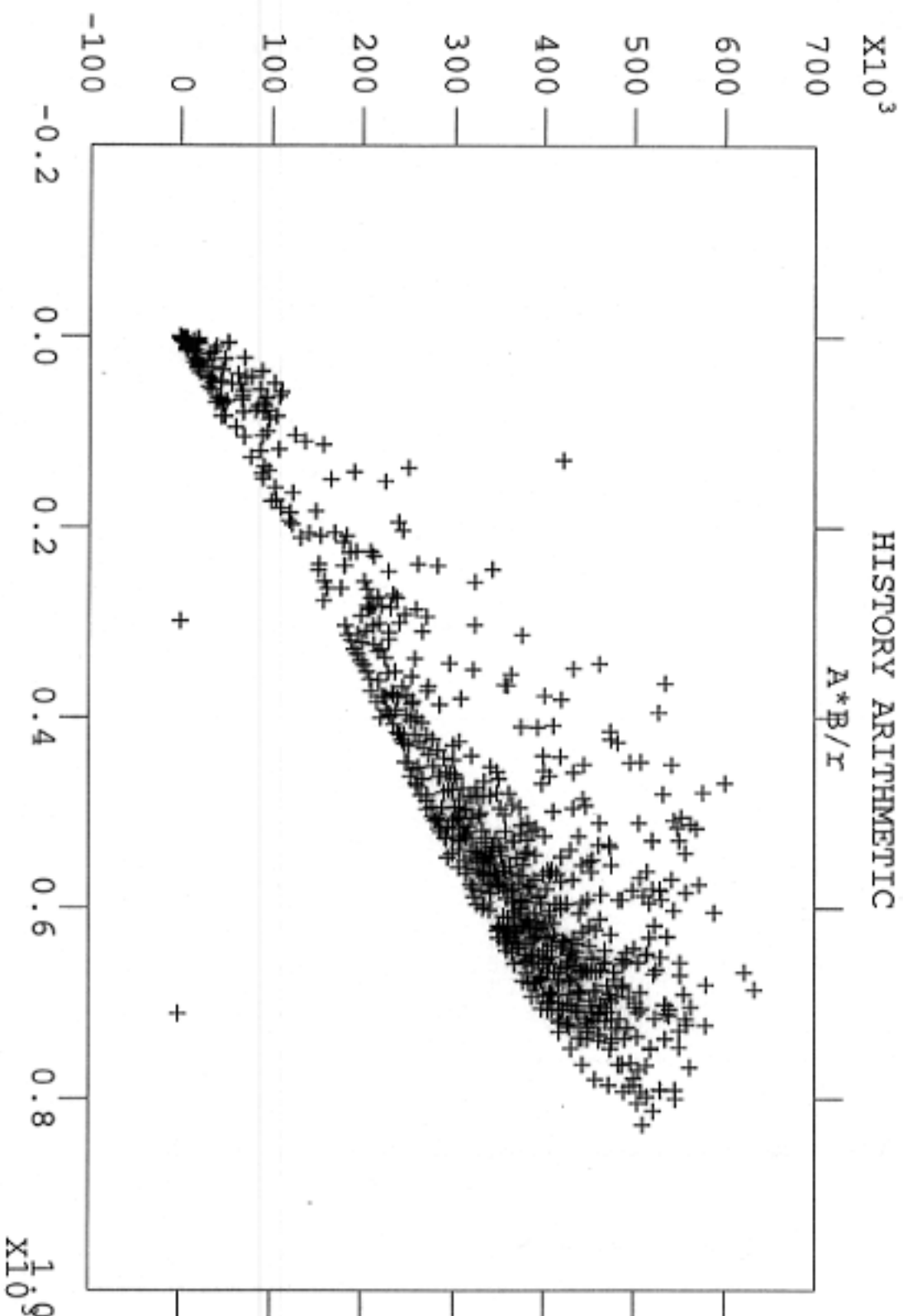


PEP-II Collisions and Beam-Beam

(September 15, 1999)

	<u>Achieved</u>	<u>Design</u>
Luminosity	$1.05 \times 10^{33} \text{ /cm}^2\text{/s}$	3.0×10^{33}
Number of bunches	829	1658
e+ current	960 mA	2140
e- current	610 mA	750
e+ lifetime	145 min	240
e- lifetime	400 min	240
Σy (low current)	6.7 microns	6.65
Σx (low current)	200 microns	222
βy^*	1.5 cm	1.5
βx^*	50 cm	50
Tune shift e+x	~ 0.044	0.03
Tune shift e+y	~ 0.024	0.03
Tune shift e-x	~ 0.025	0.03
Tune shift e-y	~ 0.013	0.03

HISTORY ARITHMETIC



A = HB60:DCCT:SUMY 960 pts
 B = LB60:DCCT:SUMY 960 pts
 r = 1.000
 Time Range: 27-SEP-1999 10:53:00. - 29-SEP-1999 10:53:00.

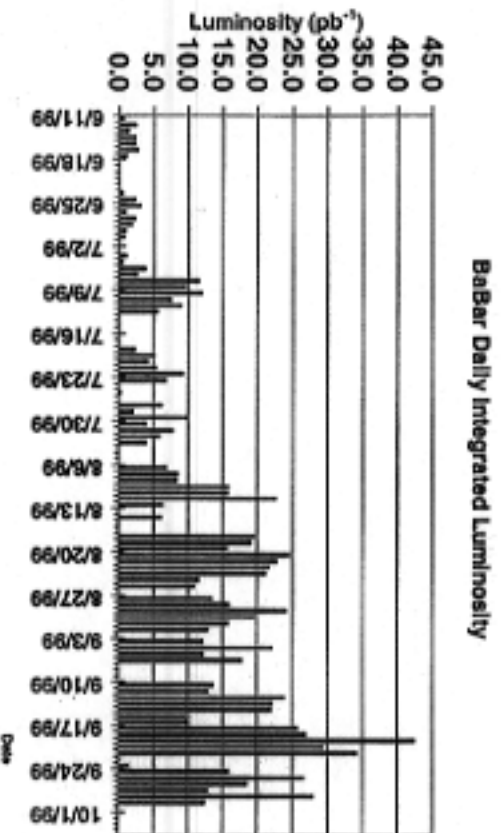
Lum inosity

30-SEP-99 10:55:56

BaBar Daily Report

Activities

- Some data taking
- Access to investigate IFR HV problem

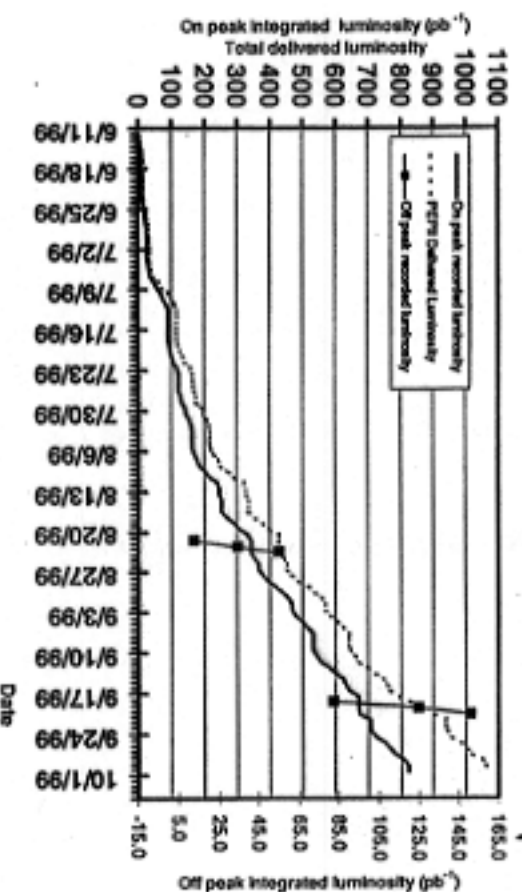


On peak recorded $L = 822 \text{ pb}^{-1}$
 Off peak $L = 151 \text{ pb}^{-1}$
 Daily Luminosity = 12 pb^{-1}
 Daily efficiency = 99 %

Thursday, September 30, 1999

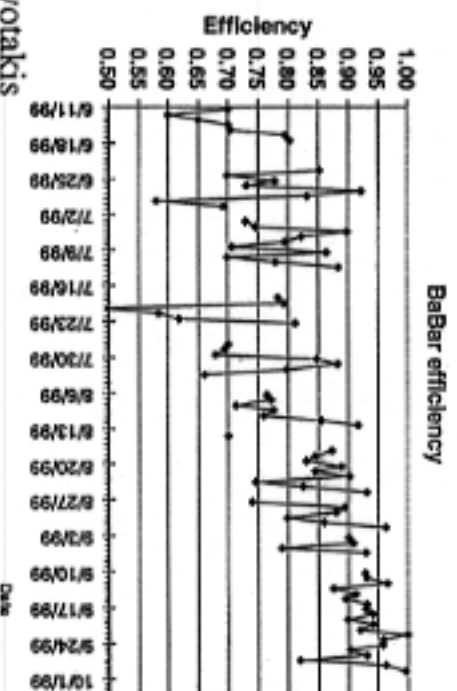
I. Adam, P. Bloom & Y. Karyotakis

BaBar Integrated Luminosity

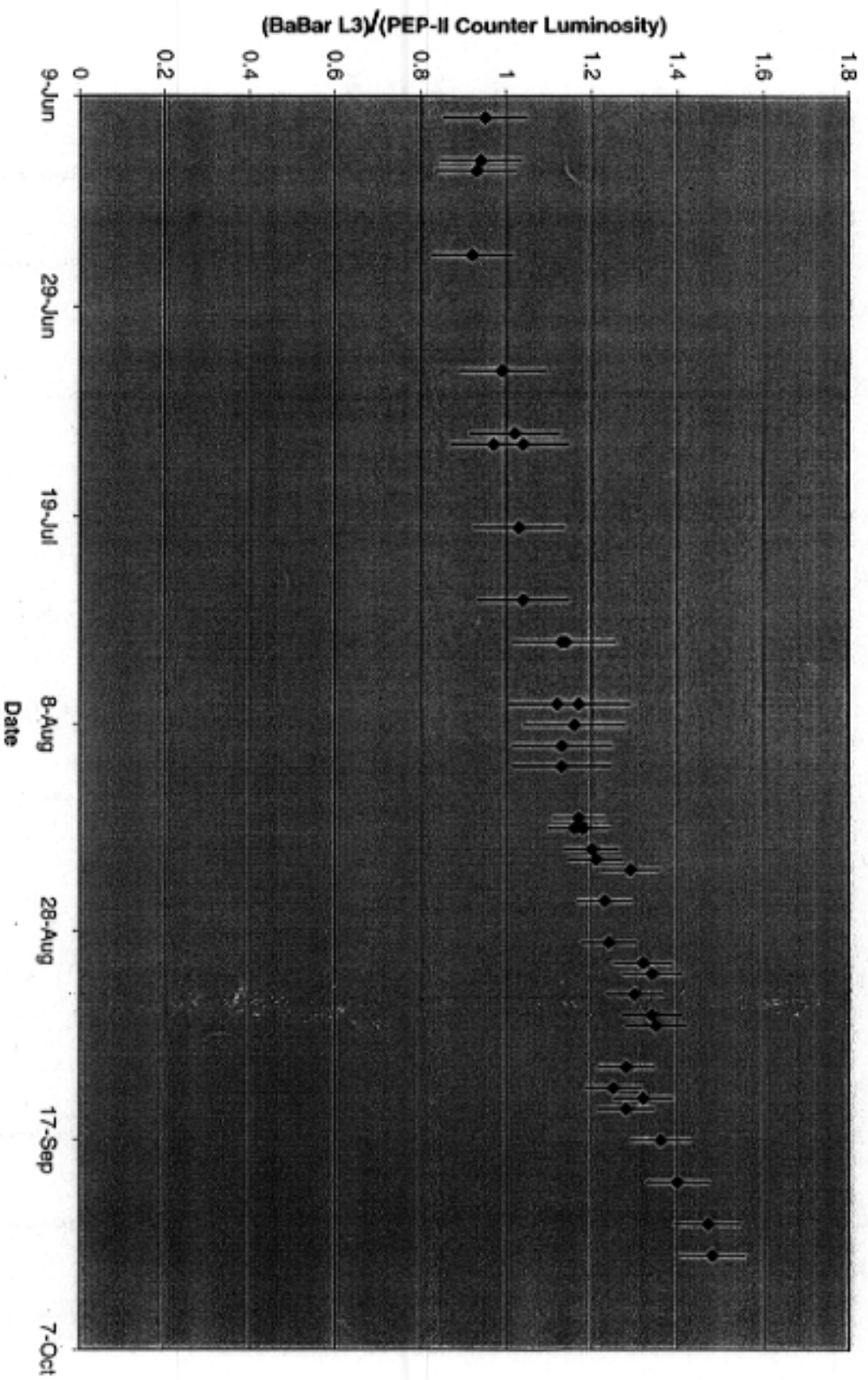


Problems

- IFR HV problem cured itself



Ratio of BaBar L3 Luminosity to PEP-II Luminosity Counter



	PEP-II Counter	Correction Factor	Corrected Value
Peak Instantaneous Luminosity	1.050×10^{33}	1.28	1.35×10^{33}
Integrated Delivered Luminosity	1191 pb^{-1}	1.24	1474 pb^{-1}
Integrated Recorded Luminosity	1020 pb^{-1}	1.24	1270 pb^{-1}
Best 24 Hours Recorded	42.5 pb^{-1}	1.36	57.8 pb^{-1}
Best 24 Hours Delivered	47.3 pb^{-1}	1.36	64.3 pb^{-1}

PEP-II Issues for Higher Luminosity

Find out why the IP coupling needs to be empirically adjusted to make a smaller vertical IP spot size.

Raise the LER current to 2140 mA from 1551 mA including RF tuning and reducing several bellows temperatures.

Raise the HER current from 650 mA to 750 mA (or 1000 mA) including RF tuning and fixing Q5 vacuum chamber overheating.

Reduce short burst background events which cause beam aborts (probably from tune changes).

Reduce the average radiation dose in BaBar.

Increase the number of bunches from 829 to (1100 or) 1658.

PEP-II Future Schedule

BaBar DIRC Bar installation October 4-18, 1999.

Run PEP-II and BaBar for 10 months in FY2000
(with New Year holiday break and February
down for collimator installation)

PEP-II Upgrade Phase I

(10^{34})

Some combination of:

1. Raise beam currents: ($< 3 \text{ A}$)

- ↳ Within present engineering limits
- ↳ Increase in RF and Feedback

2. Lower β_y^* : (1.0 cm)

- ↳ Nearly ready now

3. Increased beam-beam tune shifts
(0.045)

- ↳ orbit and coupling control

4. Relaxed energy transparency
conditions

May need:

- ↳ Increased radiation damping
- ↳ Improved background collimation

PEP-II Summary

Progress has been steady since BaBar's installation in May 1999.

The compensation of the 1.5 T solenoid was harder than we expected. (It is still not complete as empirical skew quadrupole adjustments are needed.)

The design beam sizes have been reached at low currents.

The HER vacuum is now better than design.

The LER vacuum still has a factor of about 7 to reach design beam lifetime but is scrubbing with integrated current (although slower than expected).

BaBar has taken data on and off the Upsilon resonance and has scanned the peak.

The present peak luminosity is 1.05×10^{33} with the PEP-II monitor and about 1.27×10^{33} using BaBar.

PEP-II will run about 10 months in FY2000.