SLAC PUB 4585
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(N)

(TPC/2γ) - PEP Update

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SUBMITTED FOR PUBLICATIONS

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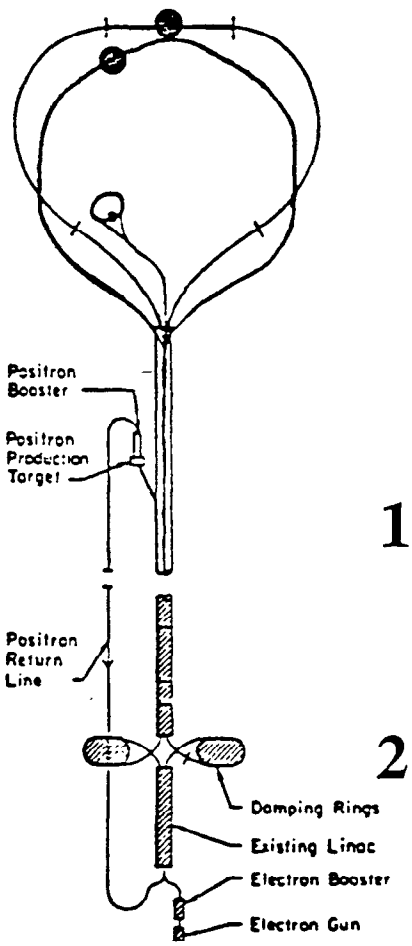
SPC PRESENTATION
NOVEMBER 7, 1987

(TPC/2γ) - PEP Update



Elliott Bloom
SLAC

1. PEP Injection.
(John Seeman)

2. PEP/TPC Progress.
(Tom Taylor)

3. PHYSICS OBJECTIVES for HiLum

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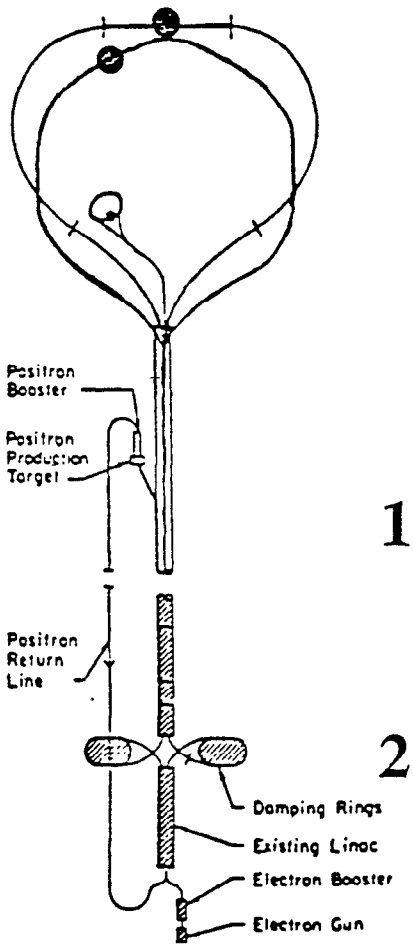

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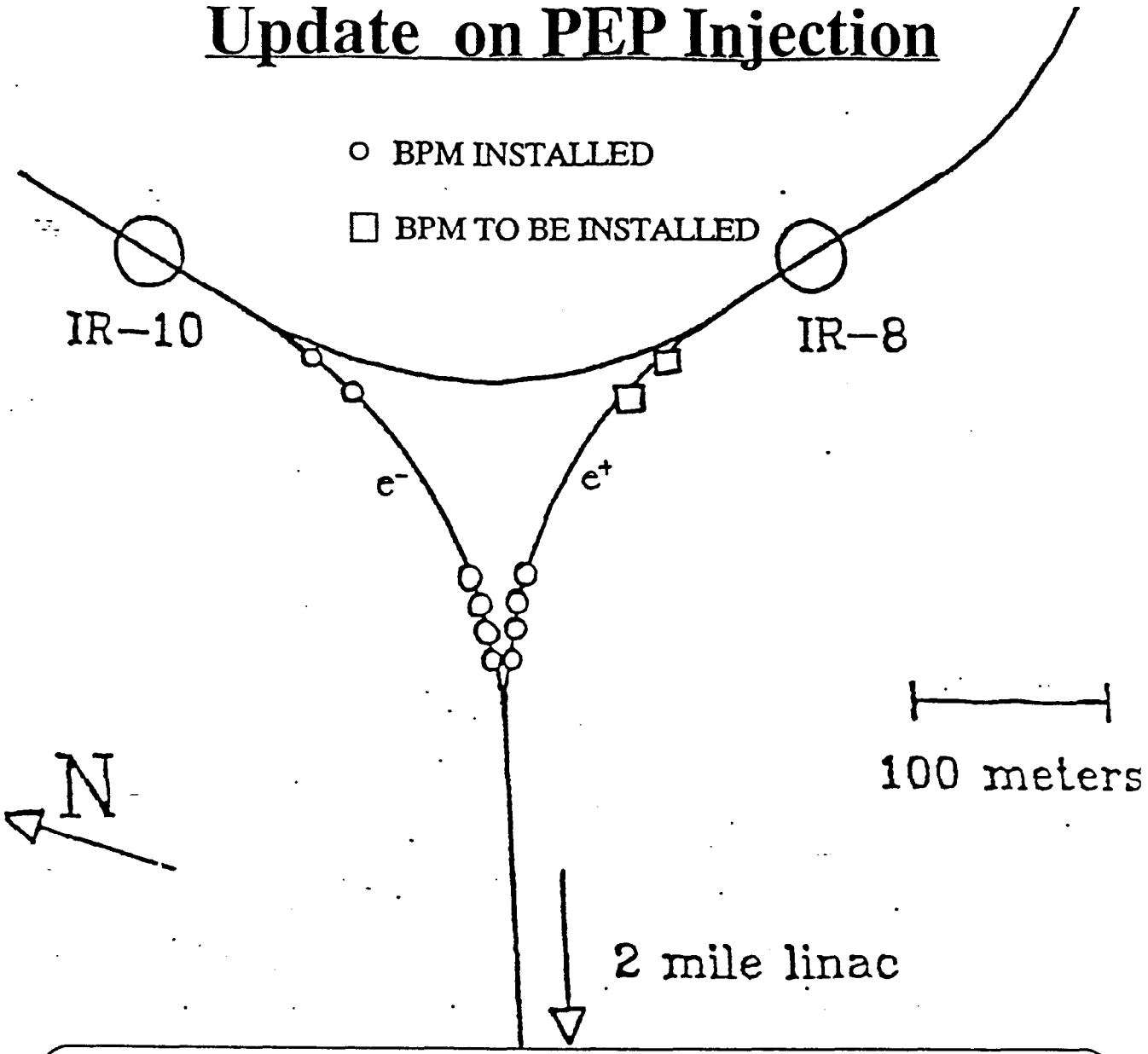
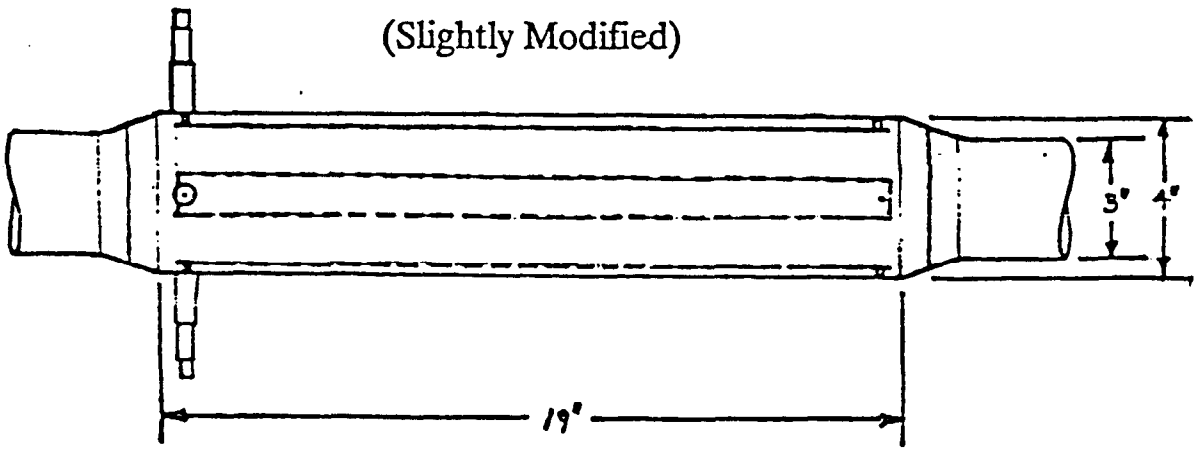
3. PHYSICS OBJECTIVES for HiLum

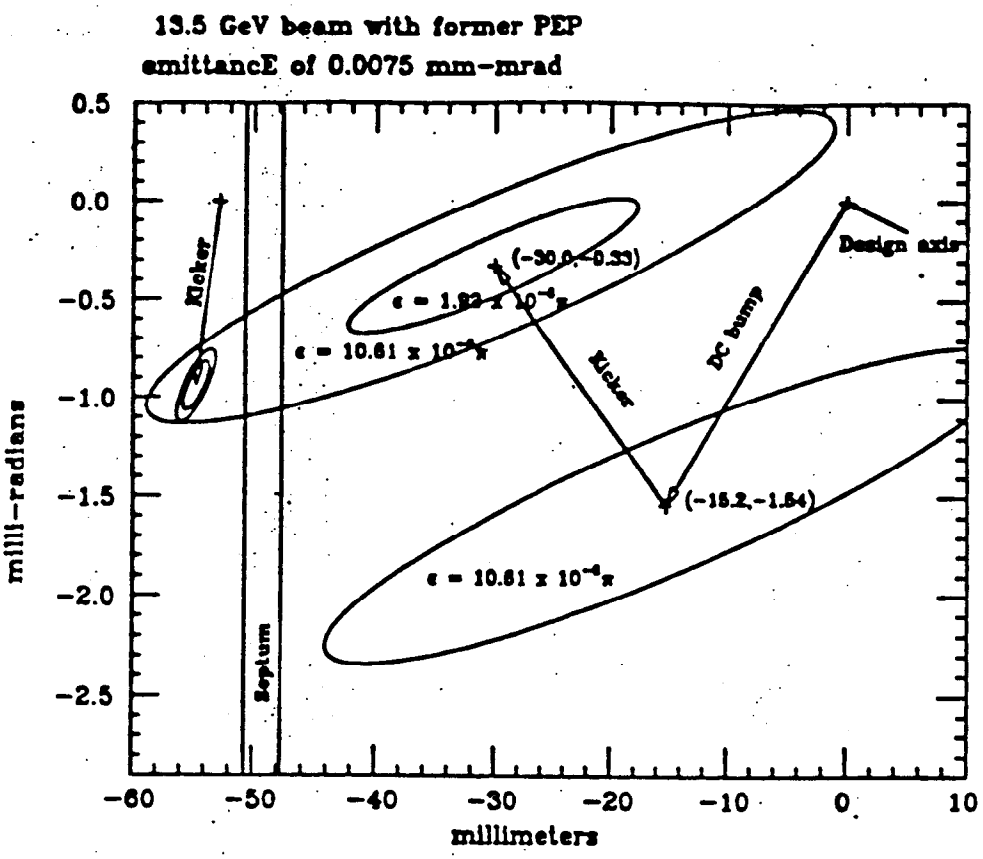
Update on PEP Injection



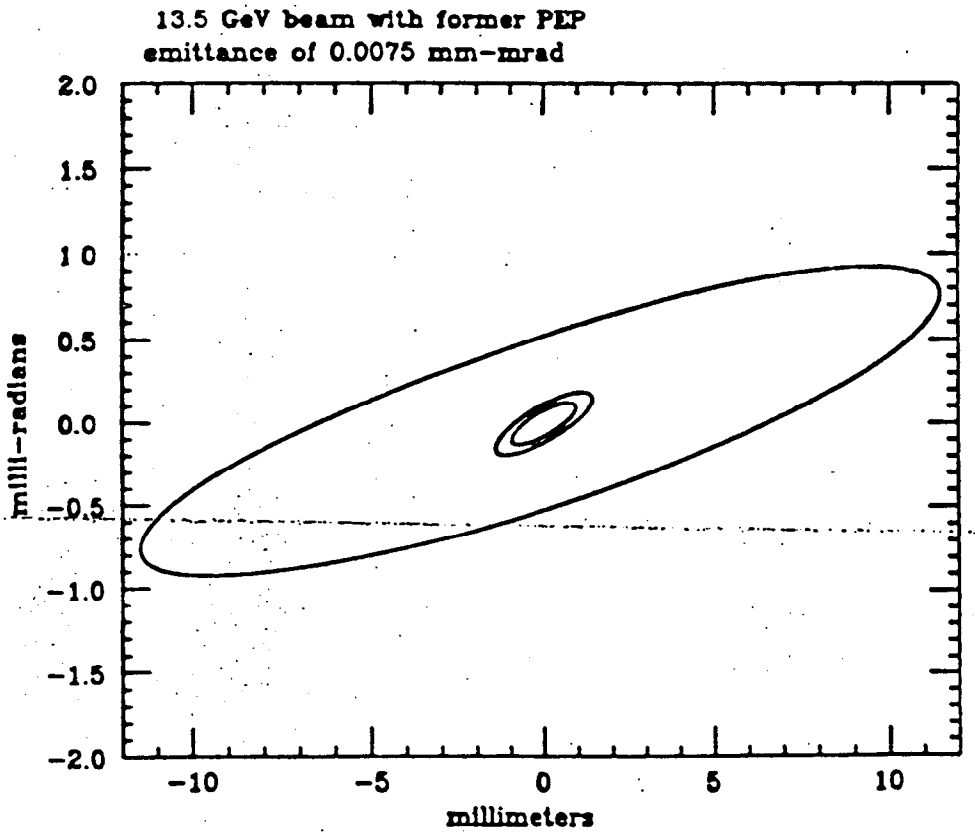
SLC STRIP 3" BPM

(Slightly Modified)

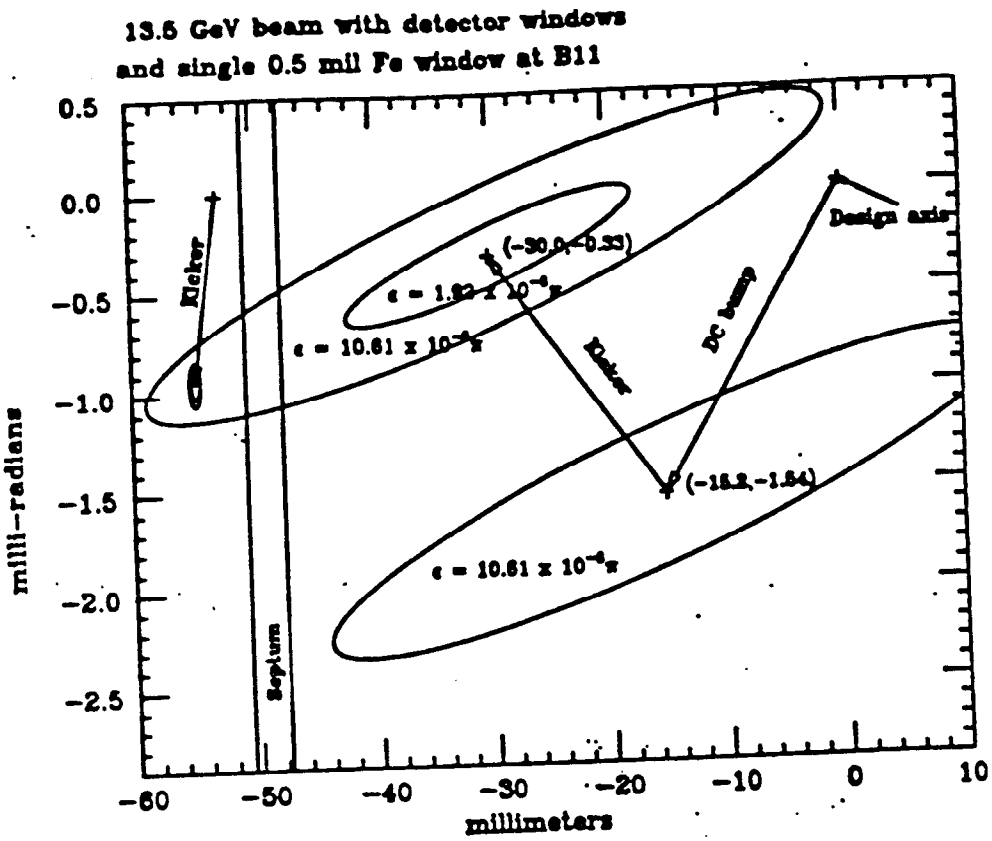




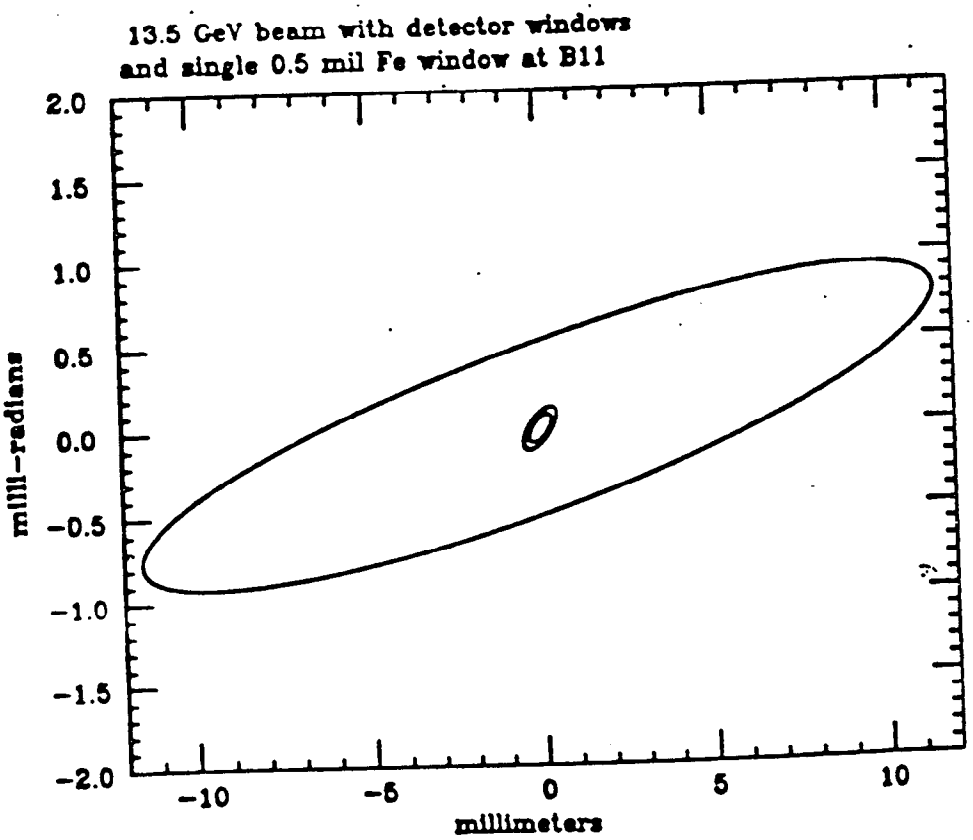
Horizontal phase space at exit of kicker magnet K2, showing injection for colliding beams.



Vertical phase space at exit of kicker magnet K2, showing injection for colliding beams.

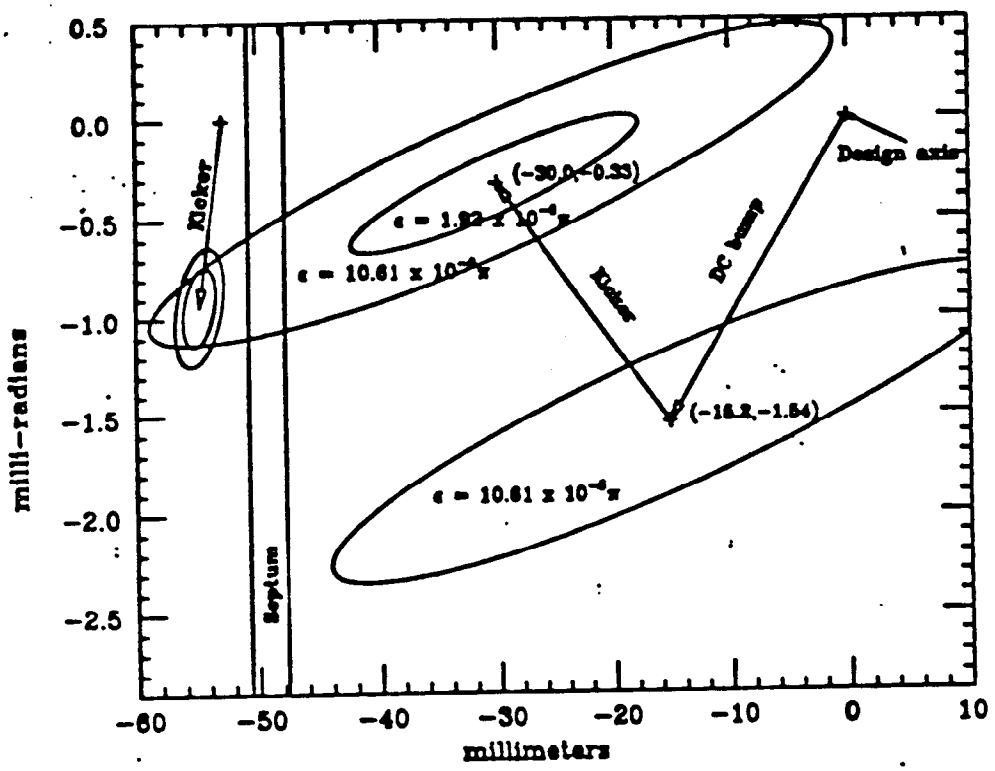


Horizontal phase space at exit of kicker magnet K2, showing injection for colliding beams.



Vertical phase space at exit of kicker magnet K2, showing injection for colliding beams.

8 GeV NPI beam with 4 B11 windows



Horizontal phase space at exit of kicker magnet K2, showing injection for colliding beams.

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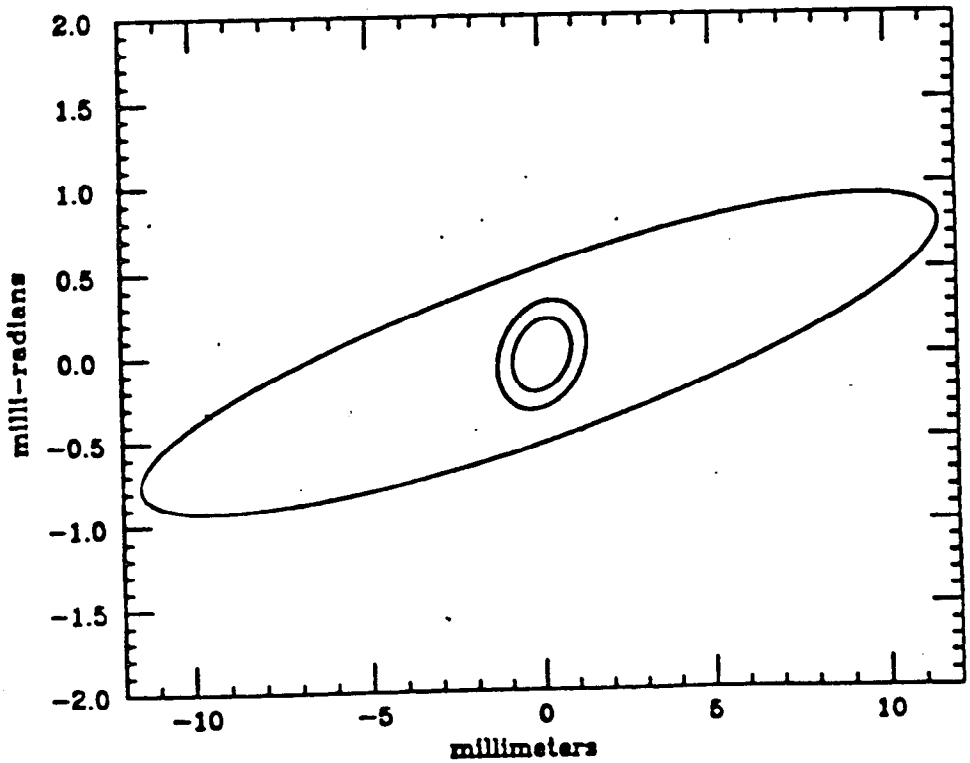

Vertical phase space at exit of kicker magnet K2, showing injection for colliding beams.

STORAGE RING INJECTION GROUP

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J. Truher

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D. Lambert (LBL)
M. Ronan (LBL, timing)
G. Shapiro (LBL)
G. Zapalac (SLAC)

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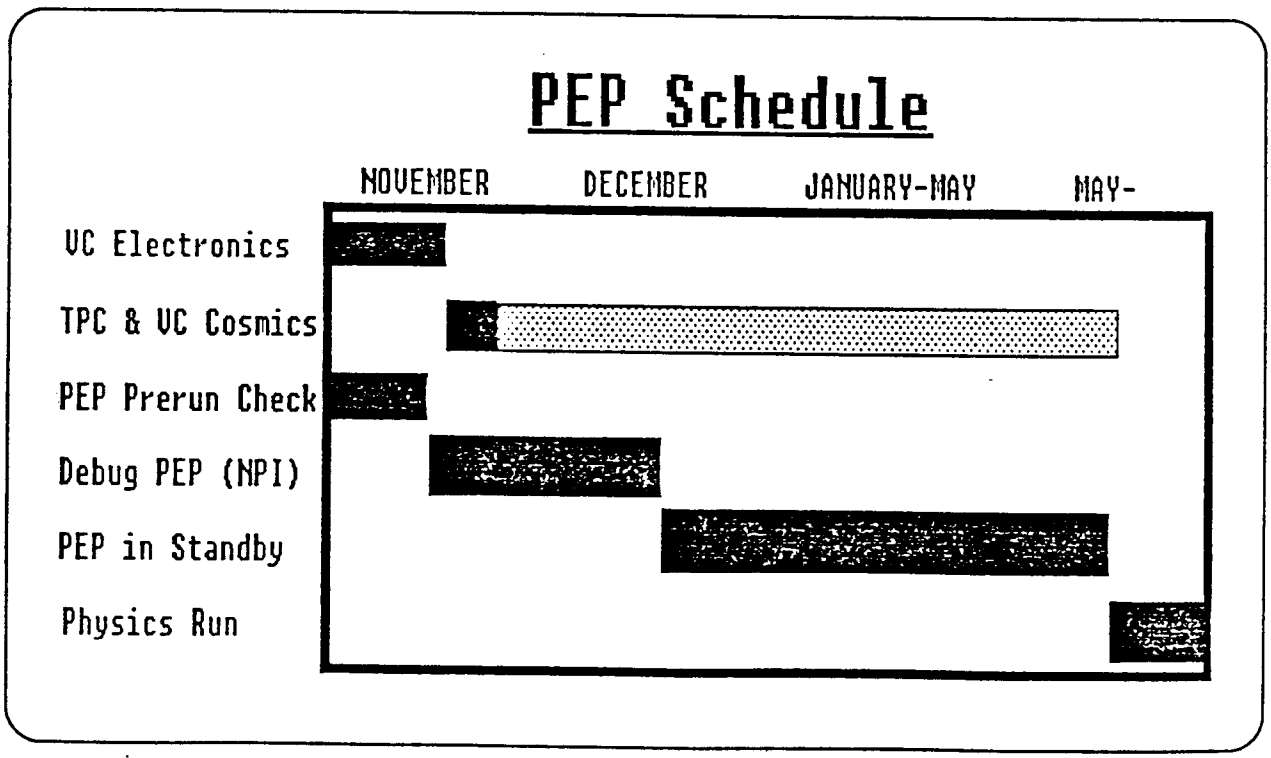
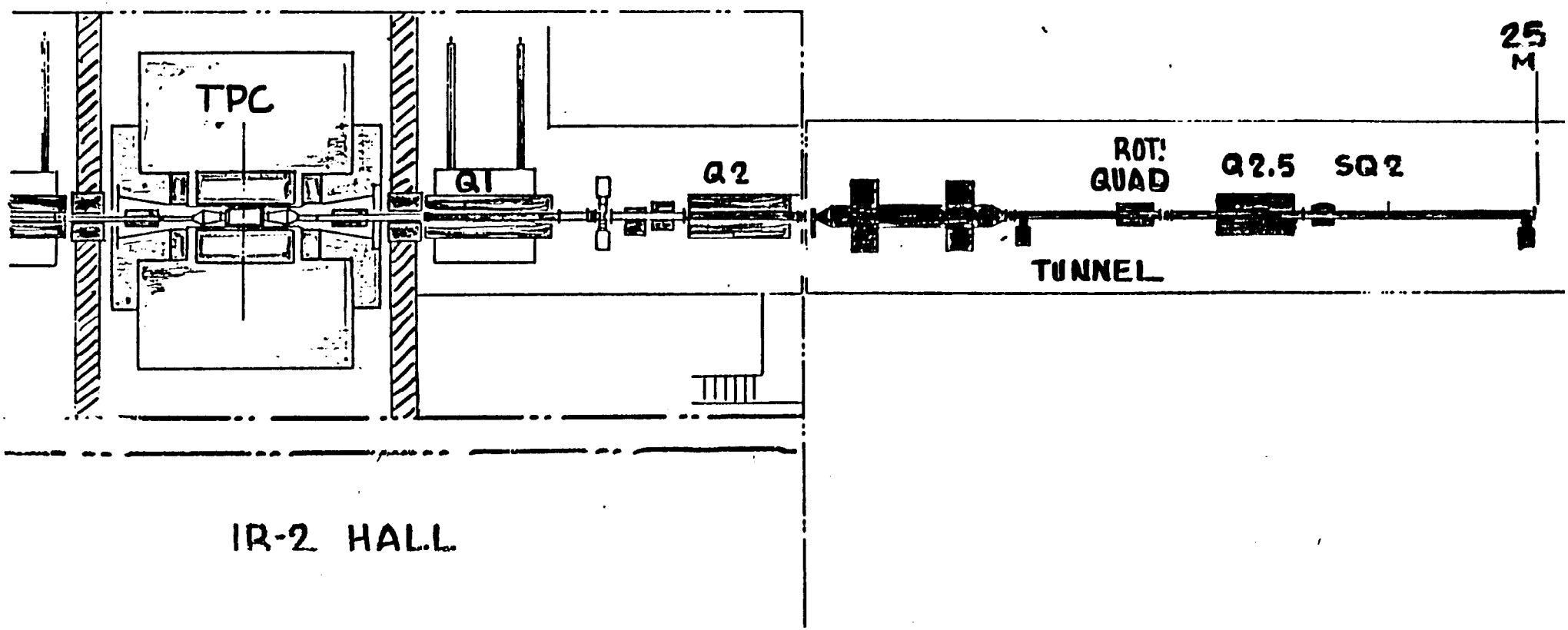
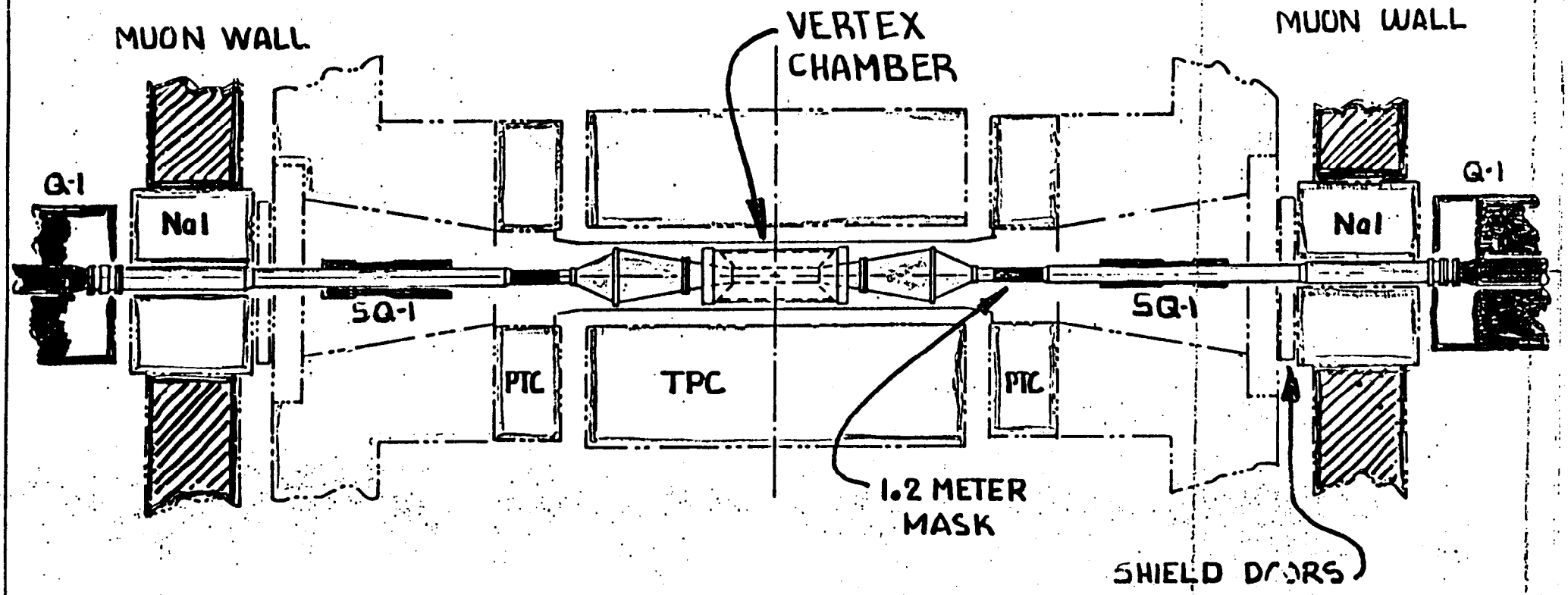
A. Odian (SLAC)
R. Schindler (SLAC)
W. Toki (SLAC)

SSRL:
B. Hettel




TPC
Q1
Q2
ROT!
QUAD
Q2.5
SQ2
25
M
TUNNEL
IR-2 HALL


MUON WALL
VERTEX CHAMBER
MUON WALL
Q-1
NaI
SQ-1
PTC
TPC
PTC
SQ-1
NaI
Q-1
1.2 METER MASK
SHIELD DOORS

3. Physics Objectives for HiLum PEP.

Physics with $2fb^{-1}$ by 1991 (and more after).

* **140K B-decays**
* **420K τ decays**
* **560K C-decays**

a) B Physics.

i. B - Mixing
ii. $B^{\pm}_{d}$, B^{0}_{d}, B^{0}_{s} lifetimes
iii. B spectroscopy

b) Tau Physics.

i. Precision measurement of lifetime.
ii. 1-prong puzzle.

c) Fragmentation.

i. Energy Dependence, E_{cm} = 16 GeV, 27 GeV.
ii. High x measurements.
iii. Particle ratios for heavy baryons using VC.

d) $\gamma\gamma$ Physics

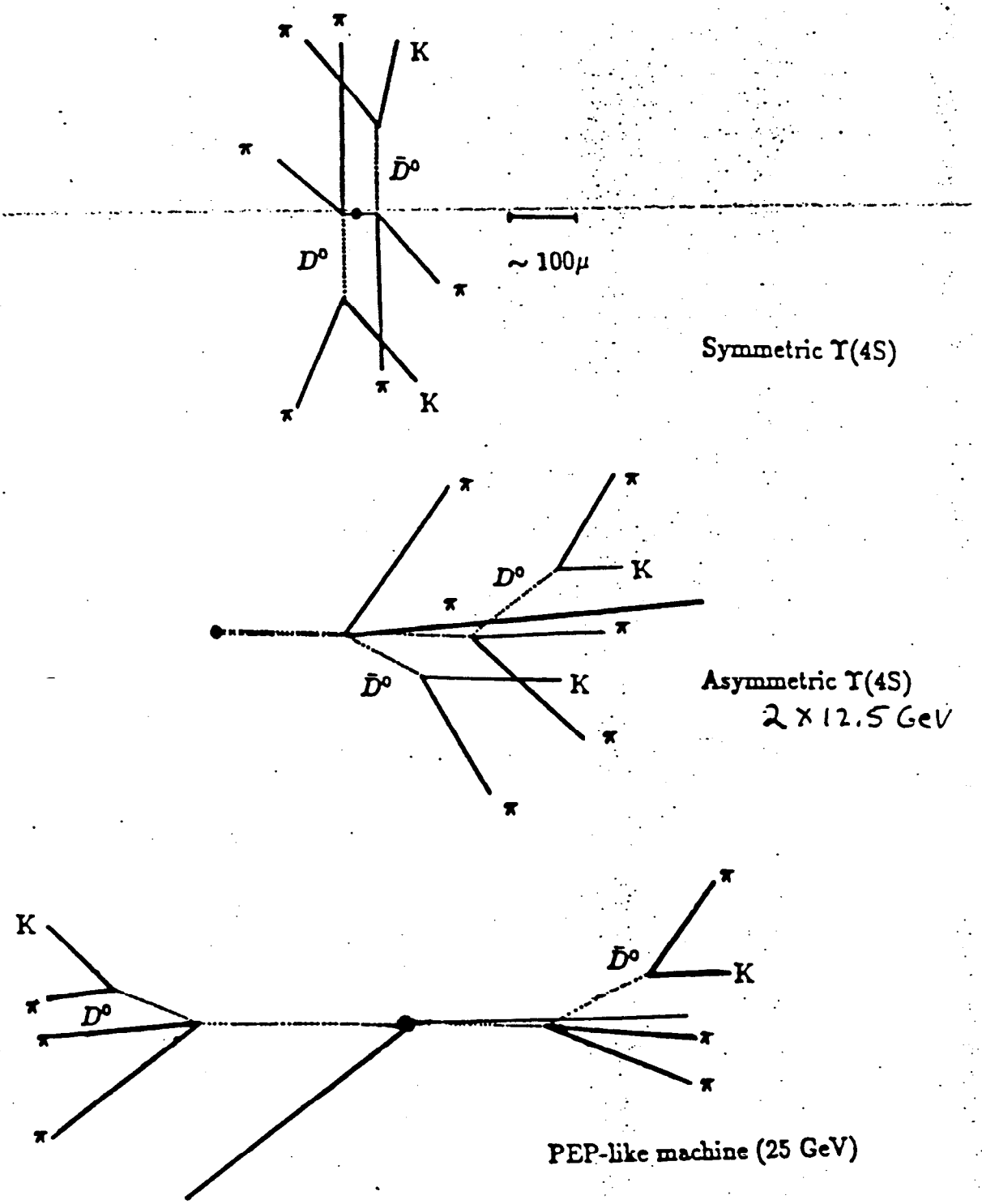
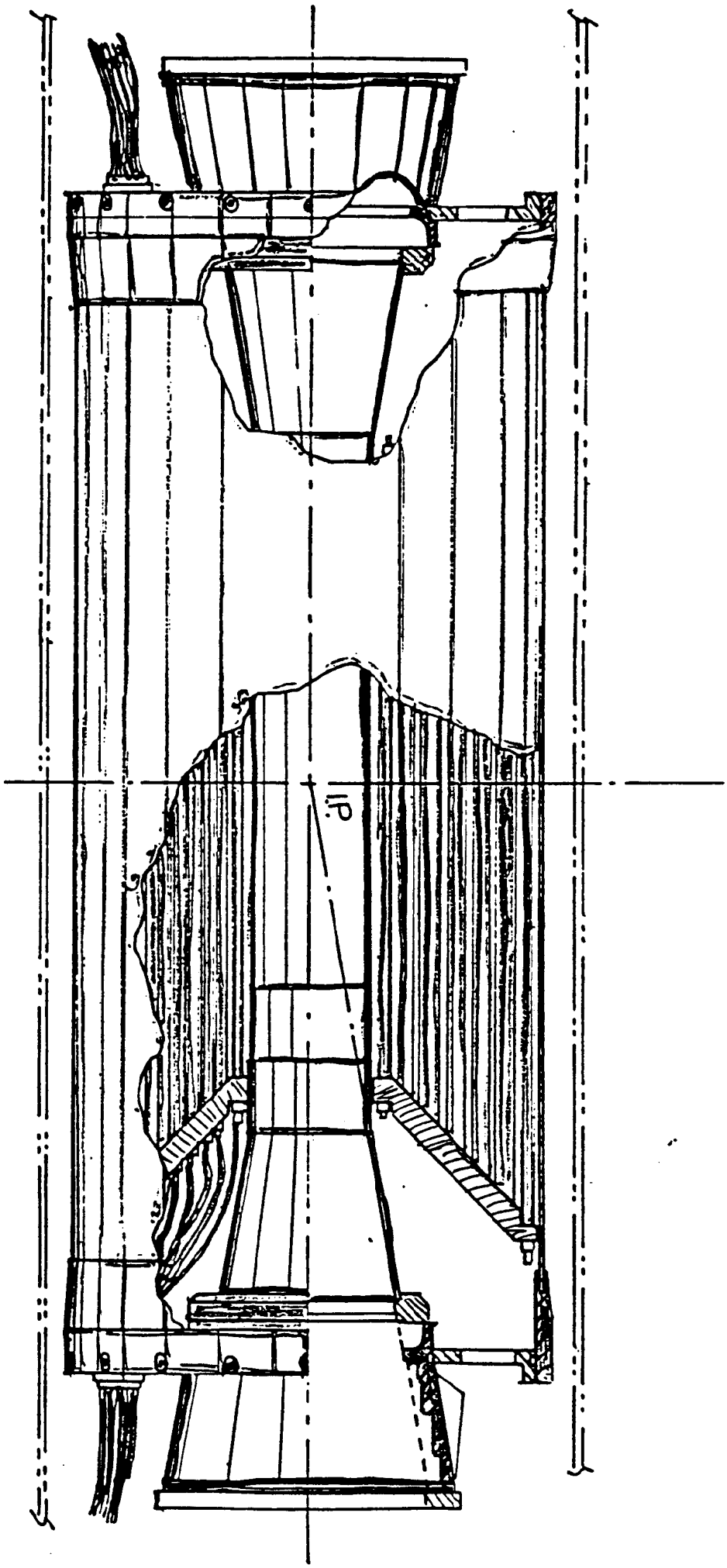
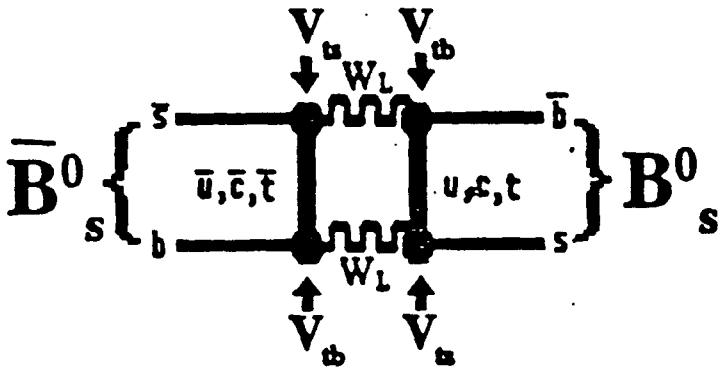


Figure 2: The decay $B^0 \to \bar{D}^0\pi^+\pi^-$, $\bar{D}^0 \to K^+\pi^-$ and its charge conjugate as seen in different machines.


I.P.

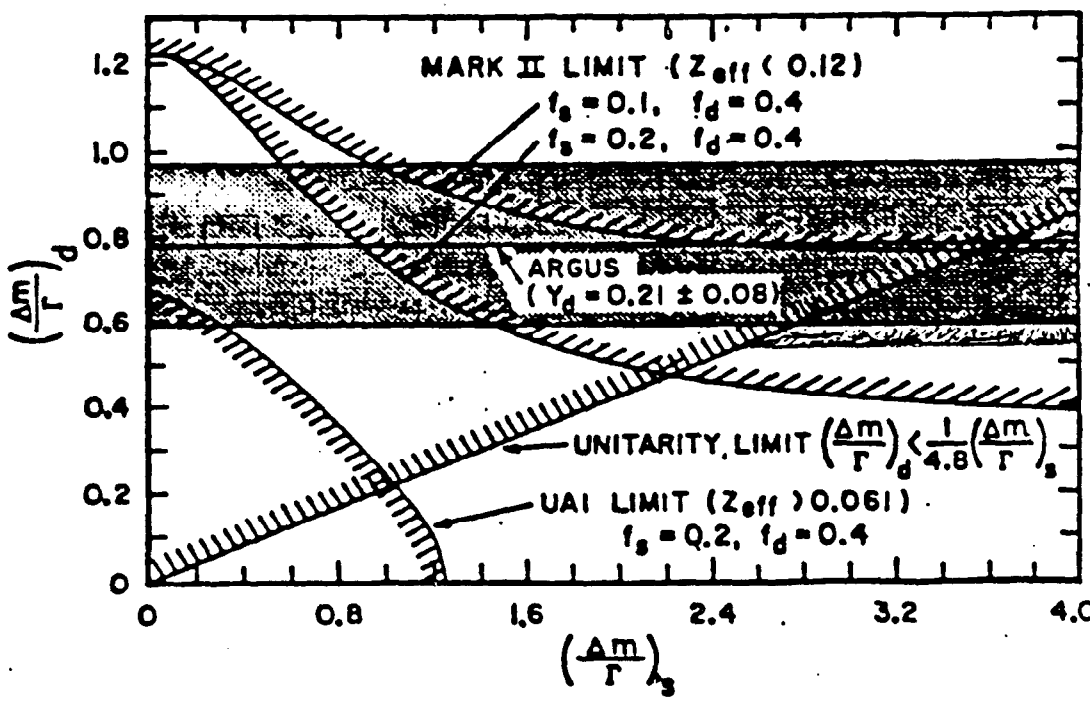
B^0_s Mixing



$$\Delta M/\Gamma)_{Bs} = (32\pi/3)\times(\mathcal{RE}\{V_{ts}V_{tb}^*\}/|V_{cb}|^2)\times(B_B f_B^2 \eta_2 m_t^2/m_b^4)$$

$$Y = [N(B^0B^0) + N(\bar{B}^0\bar{B}^0)]/N(B^0\bar{B}^0)]$$

$$Y = \begin{cases} ((\Delta M/\Gamma)^2 + 0.5(\Delta M/\Gamma)^4)/(1+(\Delta M/\Gamma)^2 + 0.5(\Delta M/\Gamma)^4) & \text{(CONTINUUM)} \\ (\Delta M/\Gamma)^2/(2+(\Delta M/\Gamma)^2) & \text{(4-S)} \end{cases}$$



← $Y_s = 1$

Tau 1-Prong Puzzle

Gaussian World Averages

Decay Mode $\tau \to \nu +$	1-Prong Branching Ratio (%) Experiment	Theory
νe	17.7 ± 0.4	17.7
$\nu \mu$	17.6 ± 0.4	17.2
π	10.9 ± 0.6	10.7
K	0.7 ± 0.2	0.7
ρ	22.7 ± 1.0	21.8
K^*	1.4 ± 0.1	1.1
$\pi\omega$	0.14 ± 0.03	0.1–0.2
$\pi\pi^0\pi^0$	7.4 ± 0.8	7.1
$\pi 3\pi^0$	"1.0"	1.0
$\pi\pi^0\eta$	"0.15"	0.15
$\pi\pi^0\pi^0\eta$		< 0.40
$\pi\eta\eta$		< 1.5
$\pi 4\pi^0 + \pi 5\pi^0$		< 0.22
Sum	79.7 ± 1.5	
Topological 1-prong	86.8 ± 0.3	
Difference	7.1 ± 1.5	

TPC/2γ Numbers Different (?)

World Ave.: $B_1 = (86.8 \pm 0.3)\%$

TPC/2γ : $B_1 = (84.7 \pm 1.0)\%$ (77pb-1)

Tau 1-Prong Puzzle

Recent Crystal Ball Results Downplays Role of Neutrals

Summary of Crystal Ball Tau Results		
τ Decay Mode	Exclusive Analysis	Inclusive Analysis[6]
$\nu\pi\pi^0$ *	$22.6 \pm 0.5 \pm 1.4\%$	
$\nu\pi\pi^0\pi^0$ †	$7.4 \pm 0.6 \pm 1.3\%$	
$\nu\pi\pi^0\pi^0\pi^0$ *	$0.54 \pm 0.28 \pm 1.06\%$	
$\nu\pi\eta$ *	$< 0.3\%$	$< 0.3\%$
$\nu\pi\pi^0\eta$ *	$< 2.5\%$	$< 0.9\%$
$\nu\pi\eta\eta$	$< 1.4\%$	$< 2.5\%$
$\nu\pi\pi^0\pi^0\eta$	$< 5.9\%$	$< 3.1\%$
$\nu\pi\pi^0\eta\eta$	$< 9.8\%$	

* World's best measurement/upper limit at present
† First proof this decay mode exists

TPC/2γ Can Make a Major Contribution in Solving the Puzzle:

* ~20 times the data.
* Run at Two energies, E_{cm} = 16 GeV, 27 GeV.
* VC can also help:
  - i. Lifetime measurement.
  - ii. Better $e^{\pm}$ identification.