SLAC PUB 4585
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(N)

(TPC/2γ) - PEP Update

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SUBMITTED FOR PUBLICATIONS

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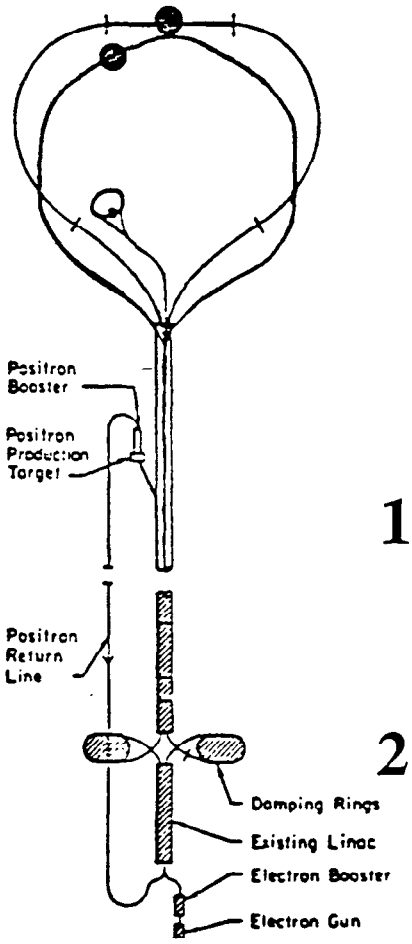
SPC PRESENTATION
NOVEMBER 7, 1987

(TPC/2γ) - PEP Update



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1. PEP Injection.
(John Seeman)

2. PEP/TPC Progress.
(Tom Taylor)

3. PHYSICS OBJECTIVES for HiLum

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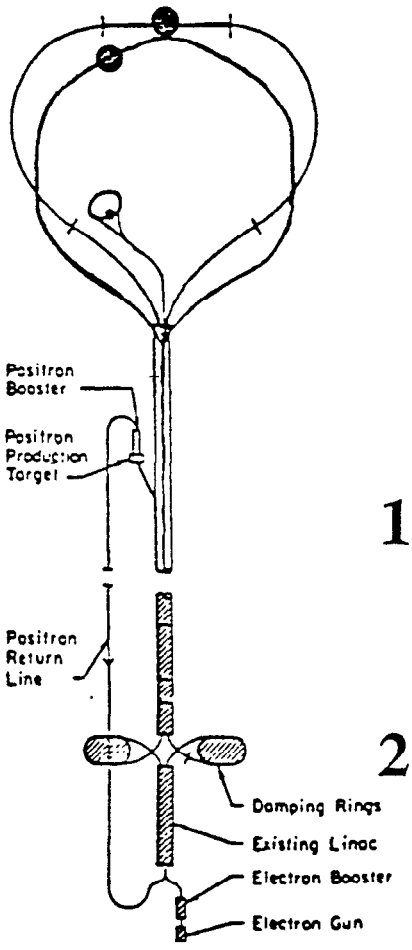

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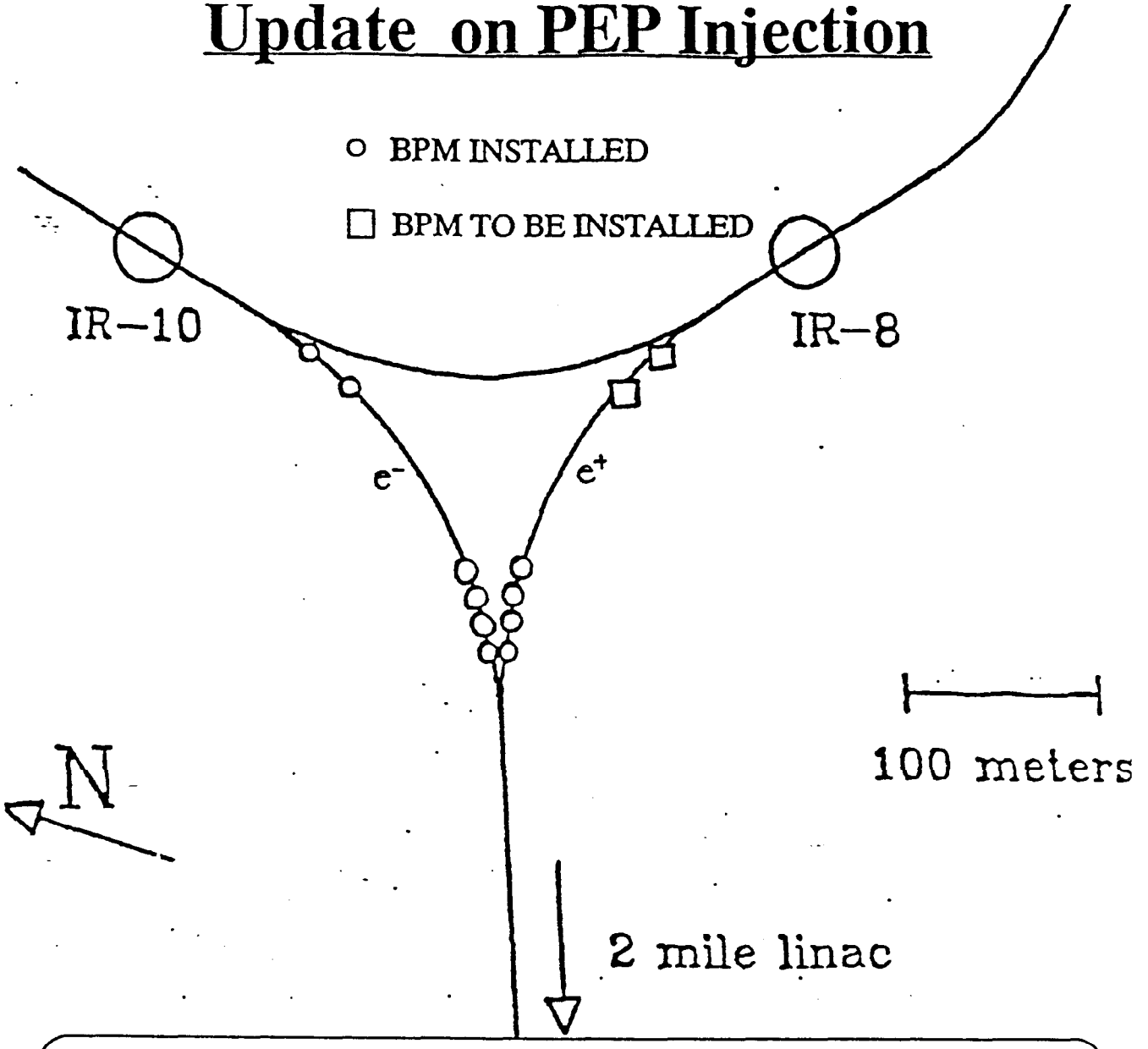
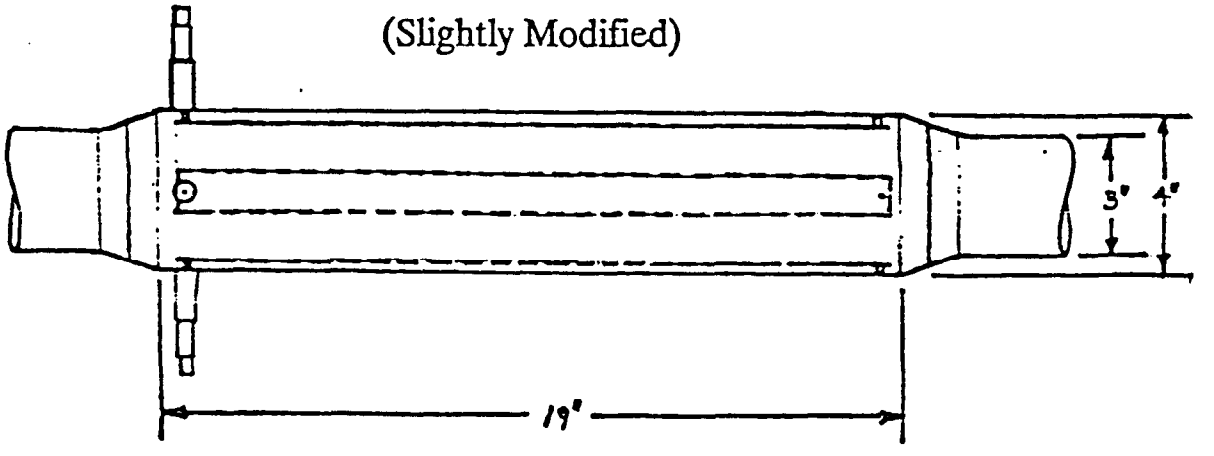
3. PHYSICS OBJECTIVES for HiLum

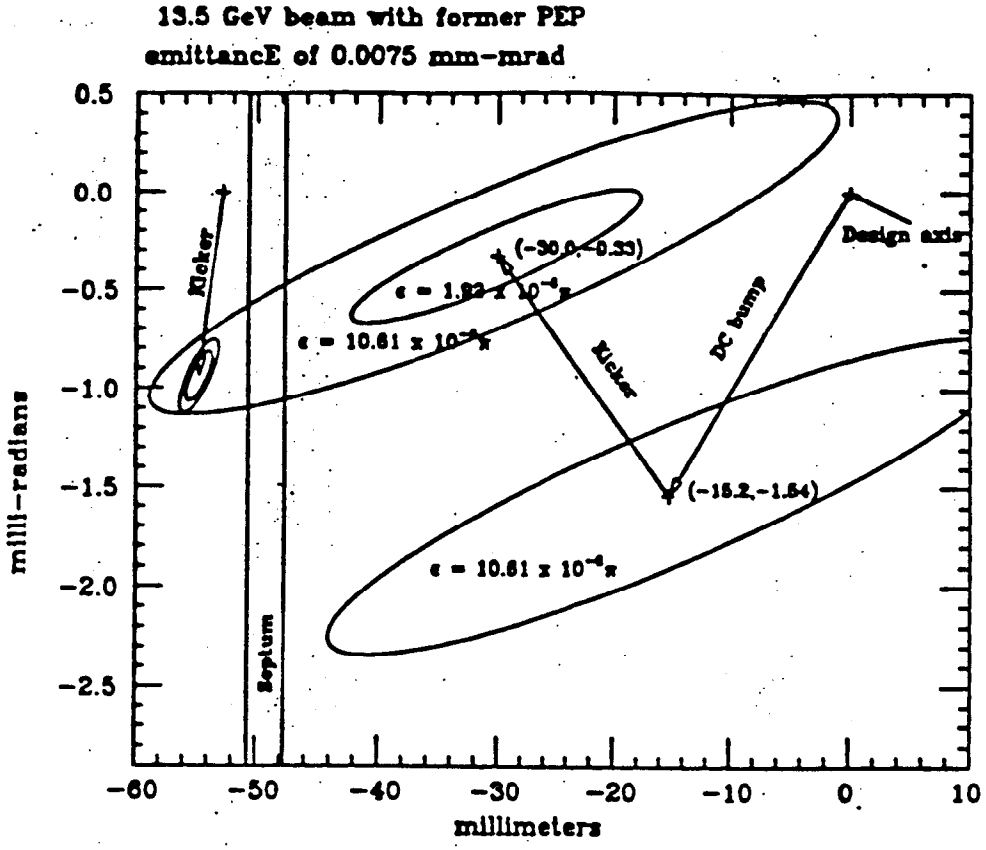
Update on PEP Injection



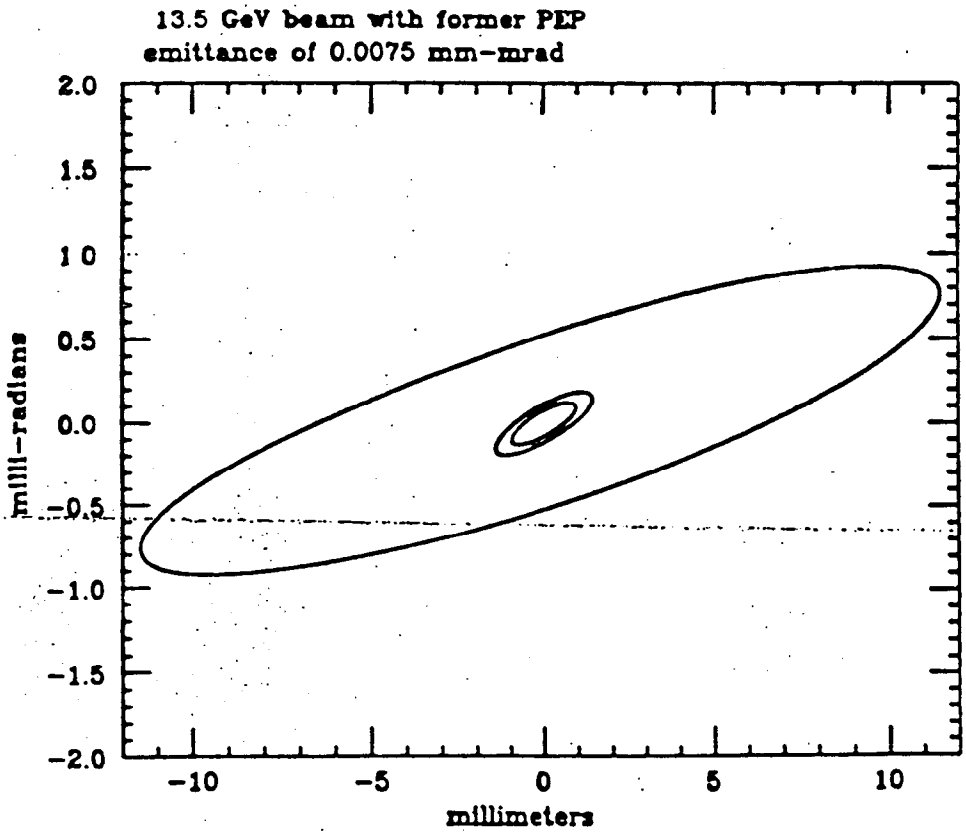
SLC STRIP 3" BPM

(Slightly Modified)





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



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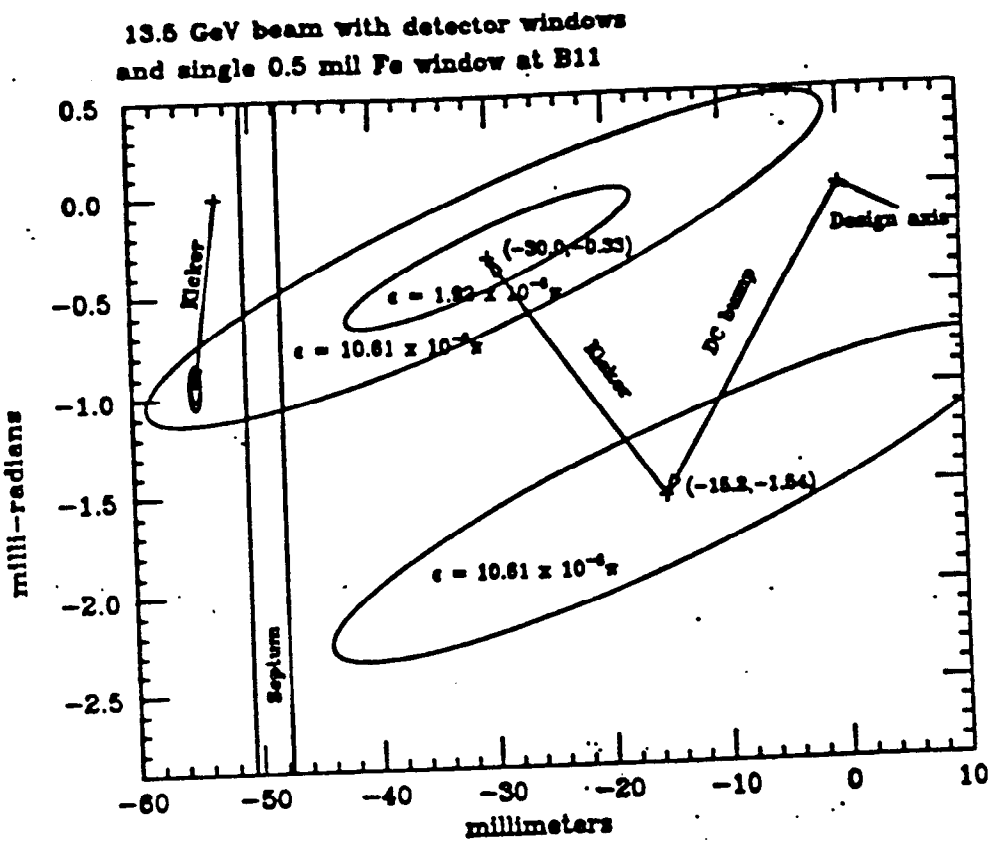

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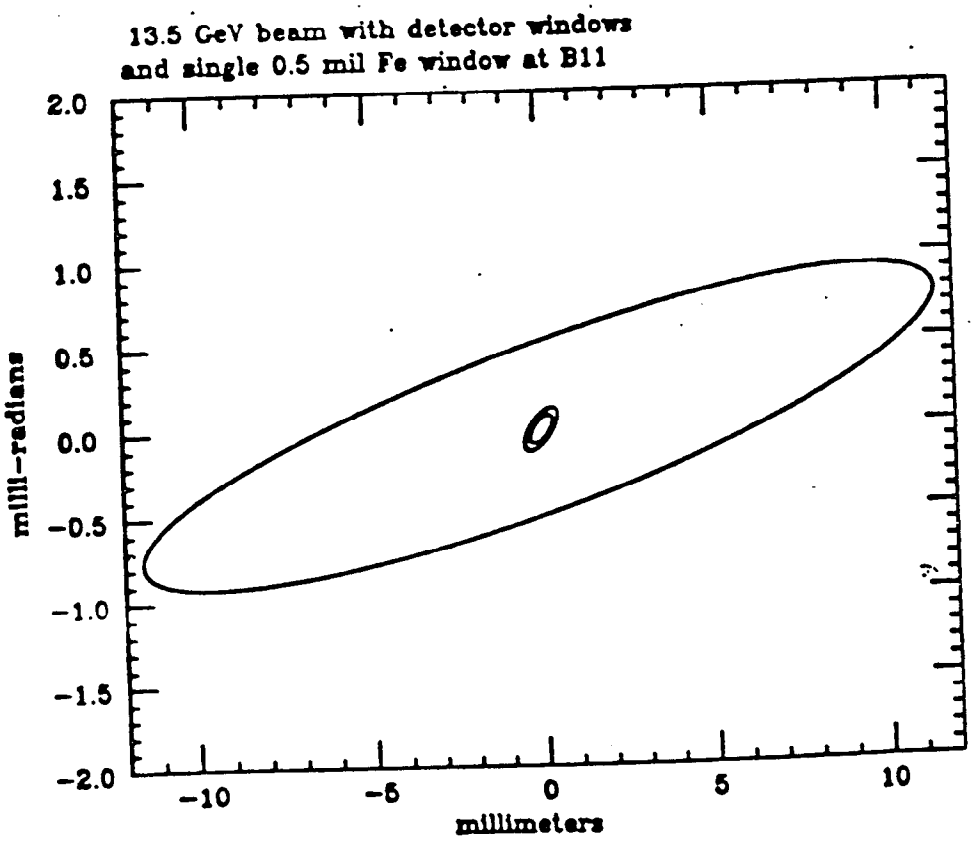
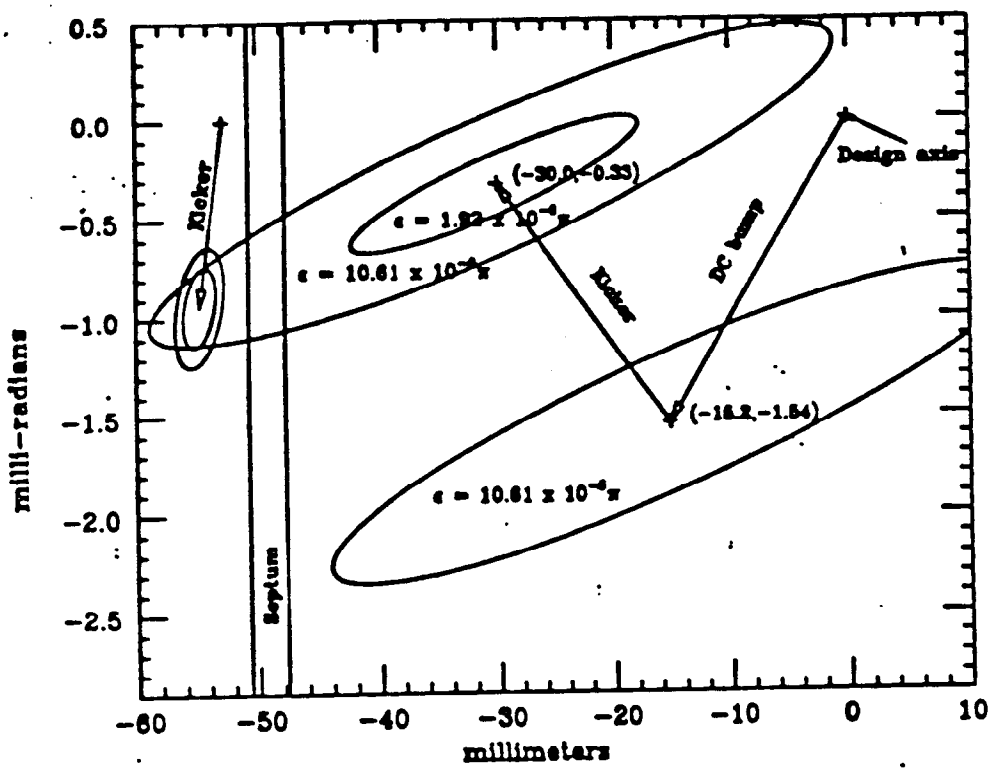


Vertical phase space at exit of kicker magnet K2, showing injection for colliding beams.

8 GeV NPI beam with 4 B11 windows



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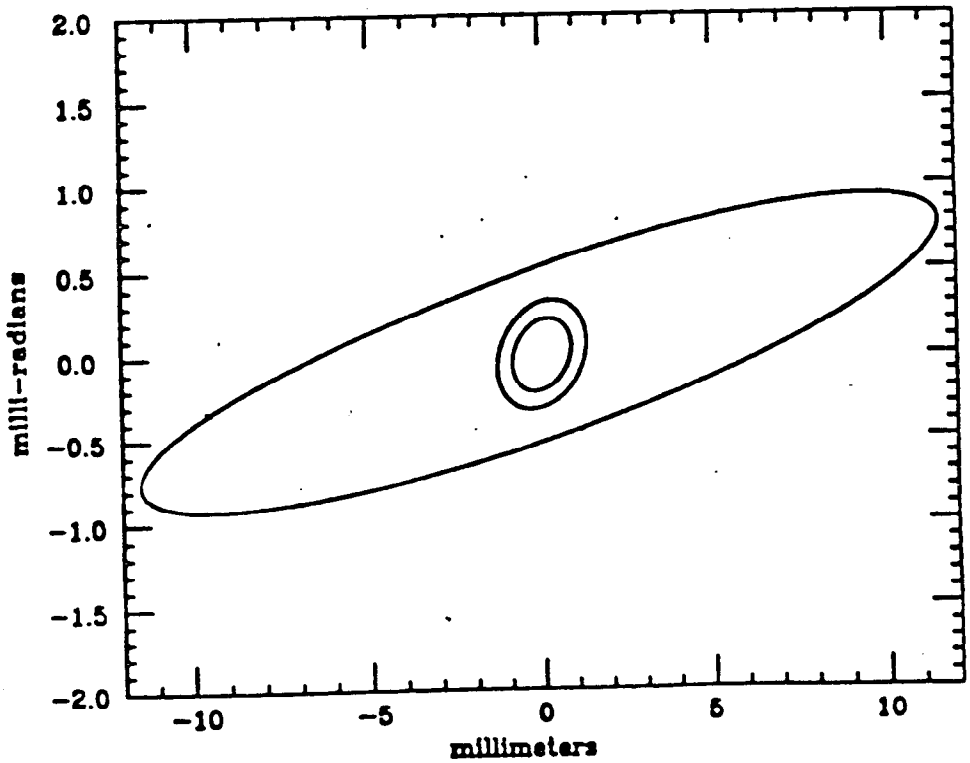

Vertical phase space at exit of kicker magnet K2, showing injection for colliding beams.

STORAGE RING INJECTION GROUP

SLC/PEP:

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E. Paterson
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J. Truher

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

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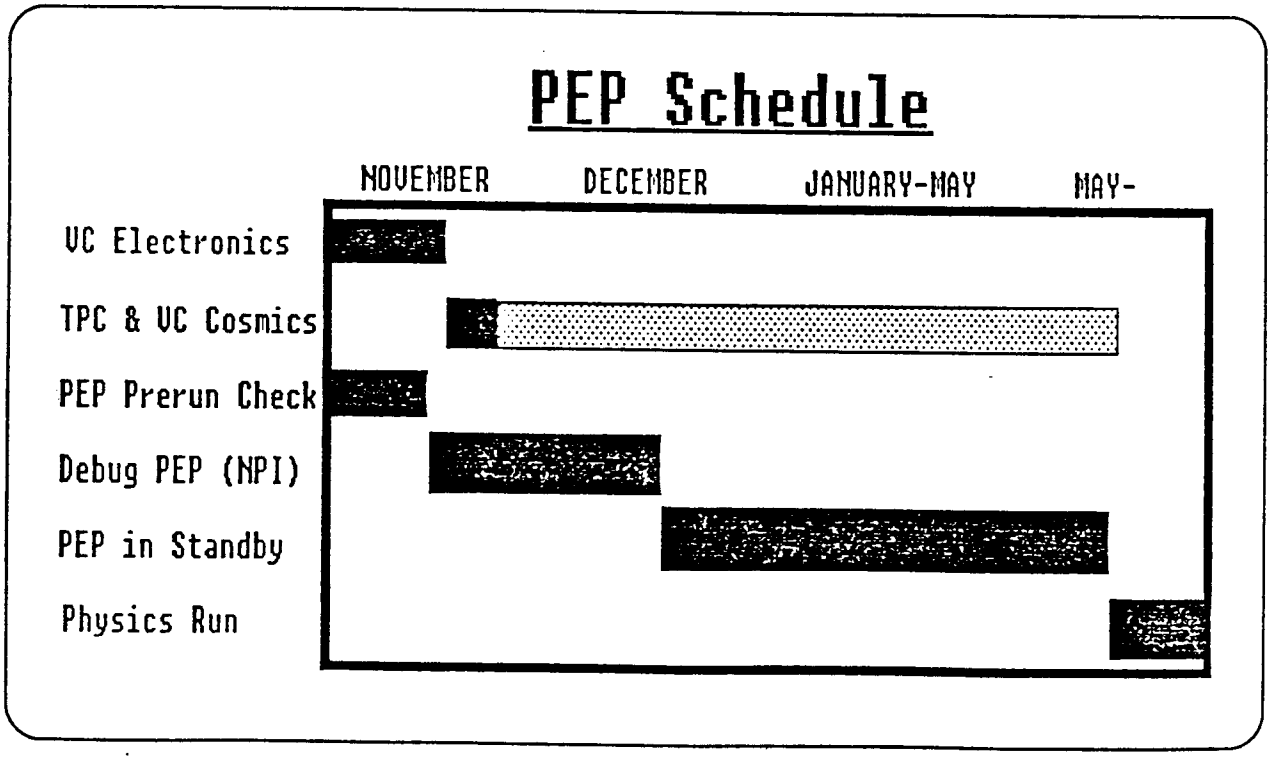
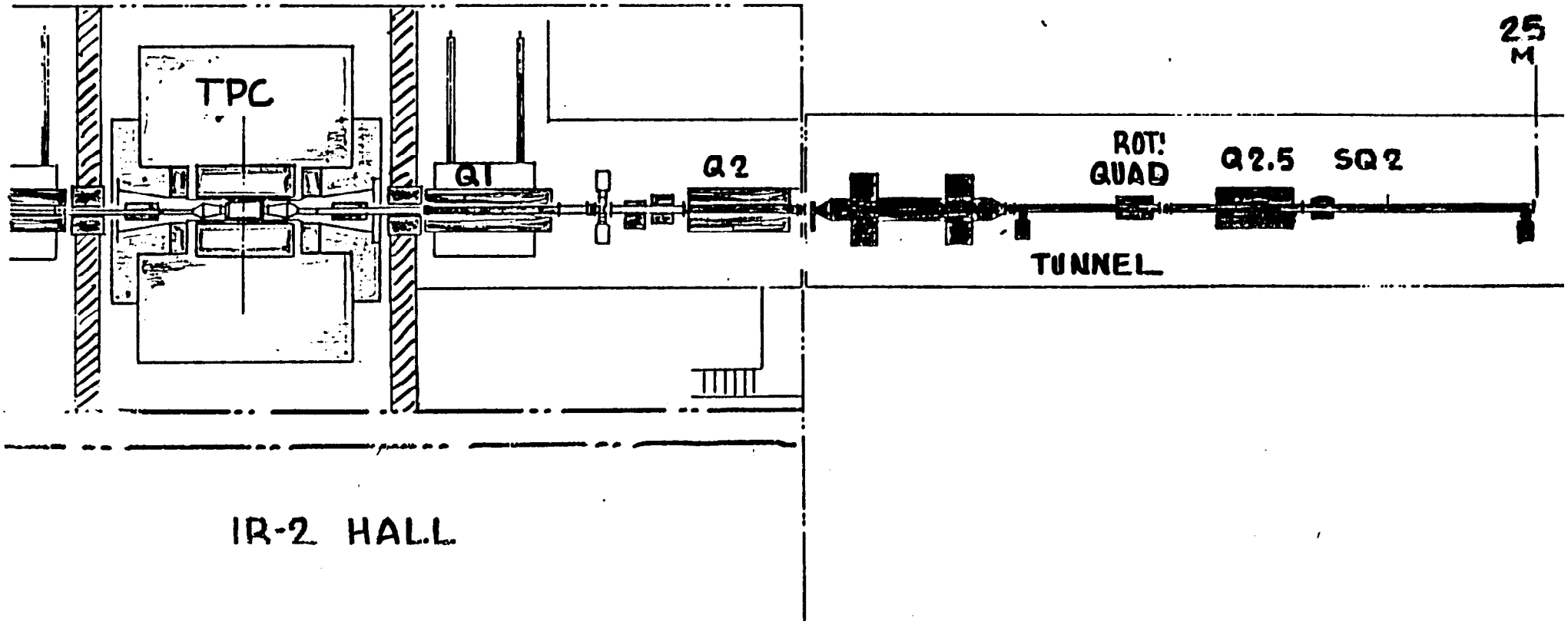
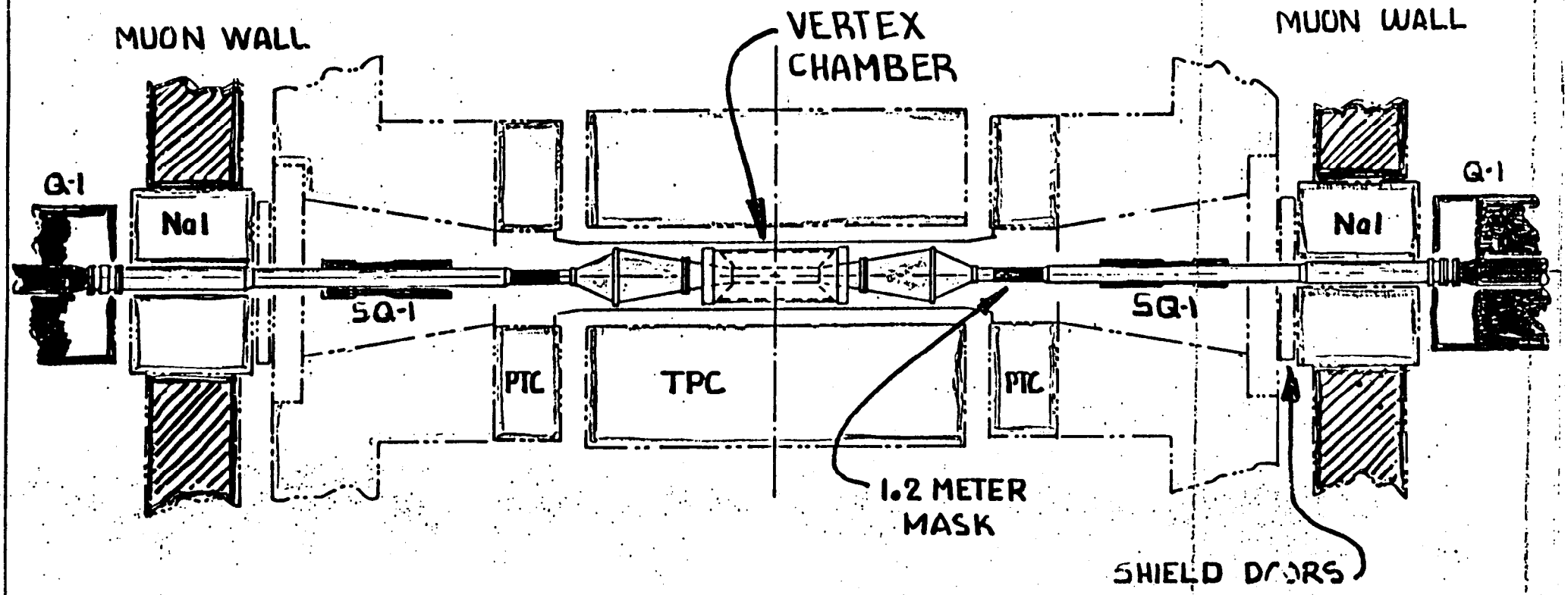
B. Lockman (UCSC)
A. Odian (SLAC)
R. Schindler (SLAC)
W. Toki (SLAC)

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

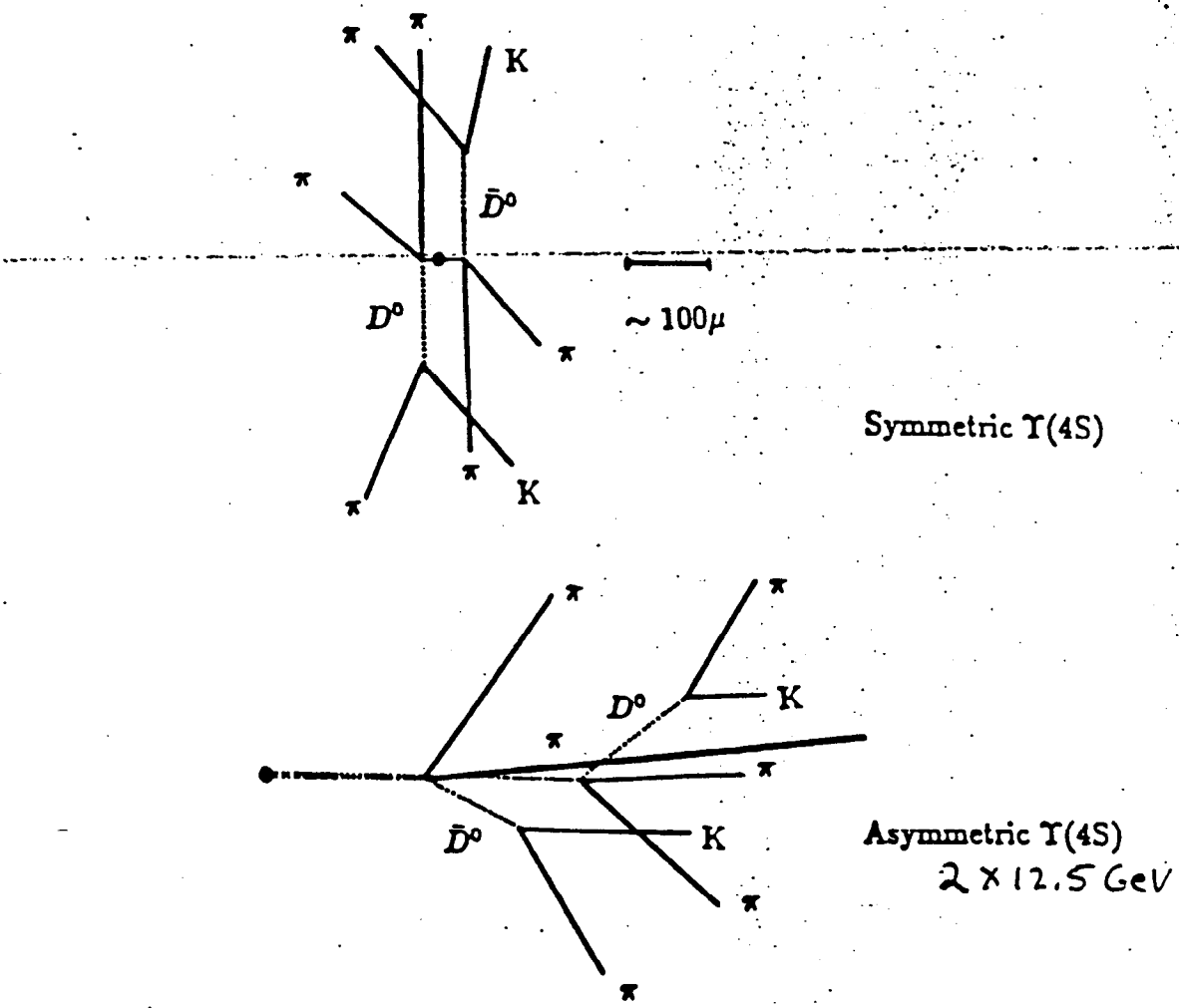
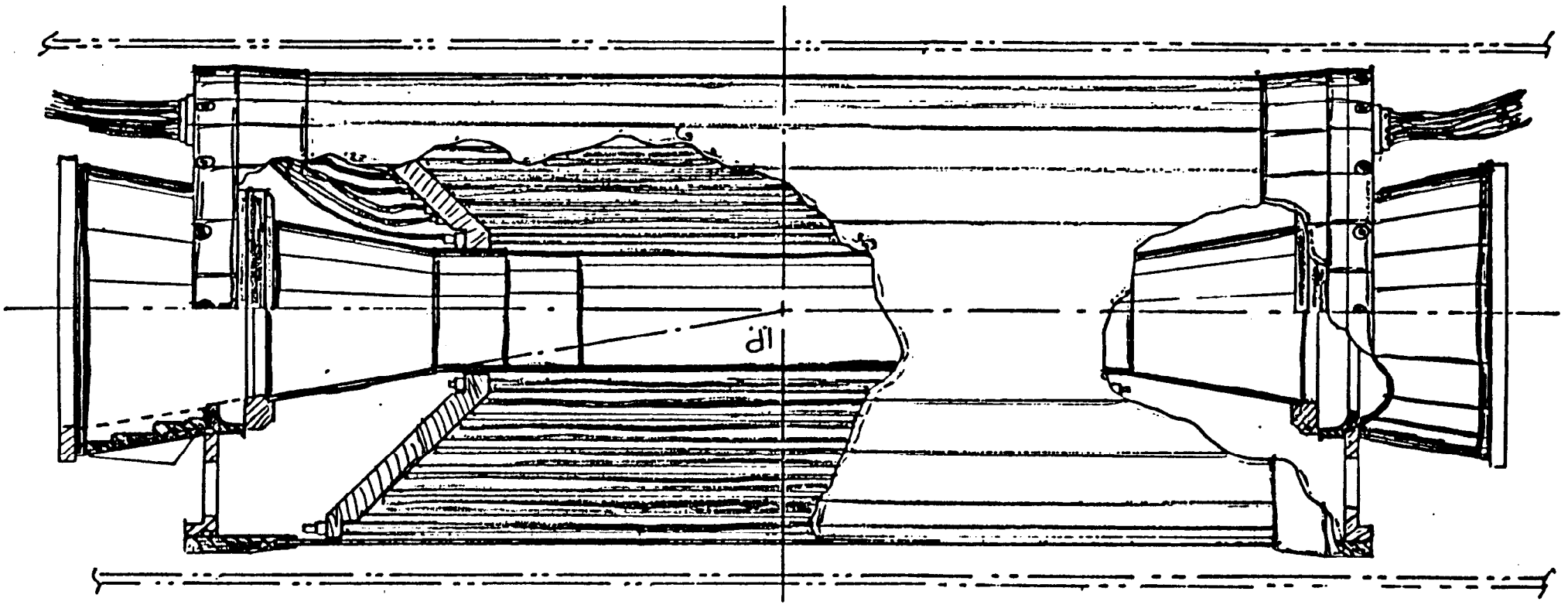
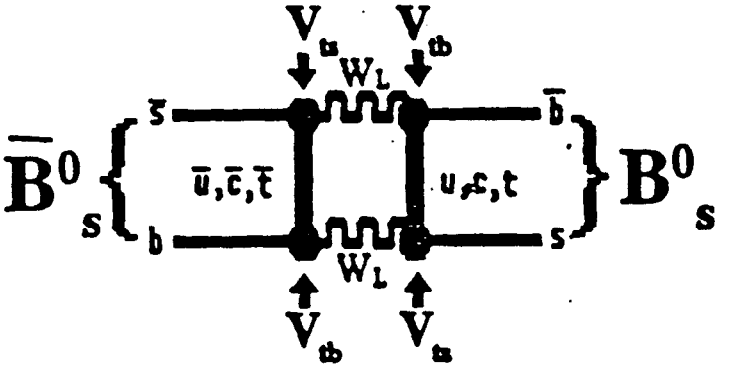


Figure 2: The decay $D^0 \to \bar{D}^0\pi^+\pi^-$, $\bar{D}^0 \to K^+\pi^-$ and its charge conjugate as seen in different machines.



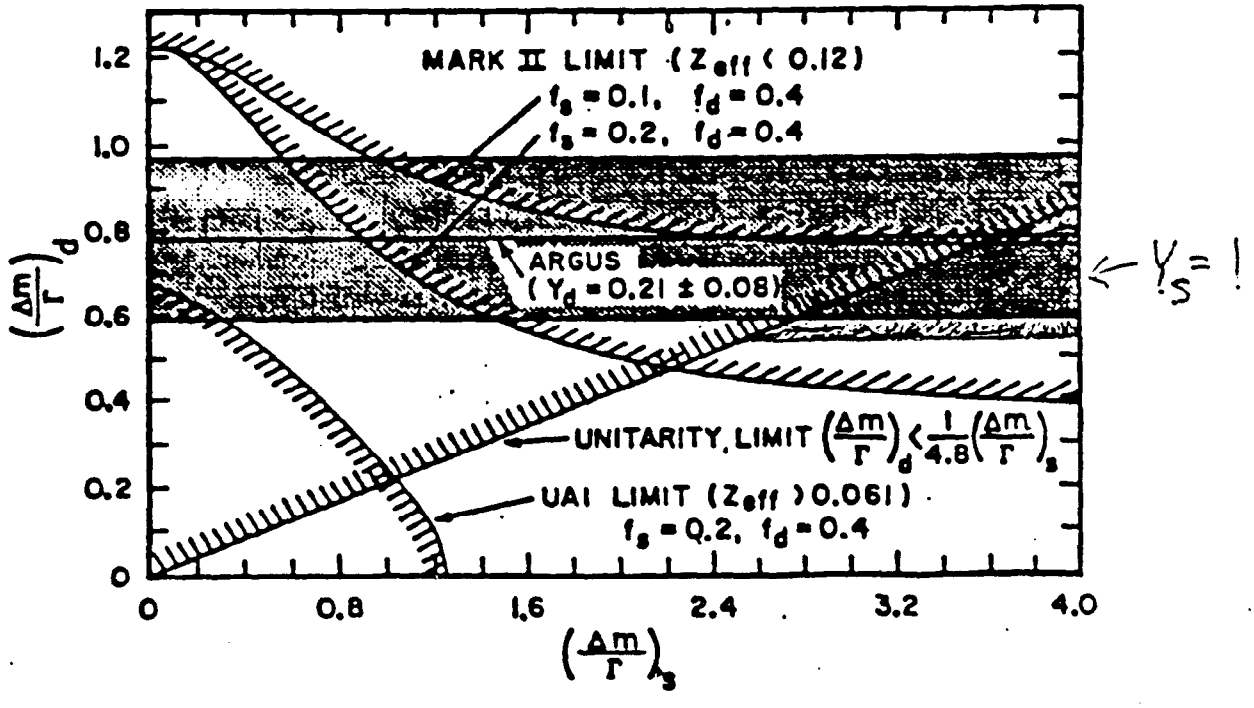
B^0_s Mixing



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

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

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



← $Y_s = 1$

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.