

Lawrence Berkeley National Laboratory

Recent Work

Title

WIGGLER SYNCHROTRON LIGHT ENVELOPE

Permalink

<https://escholarship.org/uc/item/9xq2d8tj>

Author

Hoyer, Egon.

Publication Date

1982-06-01



Lawrence Berkeley Laboratory

UNIVERSITY OF CALIFORNIA

Engineering & Technical
Services Division

RECEIVED
LAWRENCE
BERKELEY LABORATORY

OCT 11 1982

LIBRARY AND
DOCUMENTS SECTION

For Reference

Not to be taken from this room



LBID-573 Rev.
c.1

DISCLAIMER

This document was prepared as an account of work sponsored by the United States Government. While this document is believed to contain correct information, neither the United States Government nor any agency thereof, nor the Regents of the University of California, nor any of their employees, makes any warranty, express or implied, or assumes any legal responsibility for the accuracy, completeness, or usefulness of any information, apparatus, product, or process disclosed, or represents that its use would not infringe privately owned rights. Reference herein to any specific commercial product, process, or service by its trade name, trademark, manufacturer, or otherwise, does not necessarily constitute or imply its endorsement, recommendation, or favoring by the United States Government or any agency thereof, or the Regents of the University of California. The views and opinions of authors expressed herein do not necessarily state or reflect those of the United States Government or any agency thereof or the Regents of the University of California.

ENGINEERING NOTE

CODE

SLO712

SERIAL

M5936A

PAGE

1 of 19

AUTHOR

EGON HONEZ

DEPARTMENT

LOCATION

DATE

6/17/82

PROGRAM - PROJECT - JOB

SLF - WIGGLER / BEAM LINE VI

MASKS - GIRDEN CHAMBER

TITLE

WIGGLER SYNCHROTRON LIGHT ENVELOPE

THIS NOTE SUMMARIZES THE WIGGLER SYNCHROTRON LIGHT ENVELOPE IN THE TRANSVERSE X-Y PLANES

8/3/82 ADDED PG'S 16-19
ADDITION PG 2

BASIS

ELECTRON BEAM SIZE:

$\Delta y = \pm 1.5 \text{ mm} \rightarrow \text{USE } 2\Delta y = \pm 3.0 \text{ mm}$

$\Delta x = \pm 3.2 \text{ mm} \rightarrow \text{USE } 2\Delta x = \pm 6.4 \text{ mm}$

MAXIMUM ELECTRON ORBIT DEVIATIONS: (HARRIS 3/9/82)

$\Delta x_s = \pm 10 \text{ mm}$

$\Delta x'_s = \pm 1.34 \text{ mrad}$

$\Delta y_s = \pm 6 \text{ mm}$

$\Delta y'_s = \pm 0.802 \text{ mrad}$

BEAM LIFETIME WHEN COMING CLOSE TO A CONDUCTING SURFACE:

FOR 3.0 GeV:

CURRENT (mA)	BEAM-SURFACE DISTANCE (mm)	LIFETIME (SEC)
100	2.8	< 1
100	3.0	FEW
100	3.5	10'S
50	3.0	10'S

COMPARE TRAJECTORIES ON THE BASIS THAT THE ELECTRON BEAM DISAPPEARS WHEN THE BEAM-SURFACE SPACING DISTANCE IS 2.5 mm

LAWRENCE BERKELEY LABORATORY - UNIVERSITY OF CALIFORNIA		CODE	SERIAL	PAGE
ENGINEERING NOTE		SLO712	M 5936	2 OF 4
AUTHOR	DEPARTMENT	LOCATION	DATE	
ECON HOVER			6/17/82	

ENERGY:

DEDICATED SYNCHROTRON LIGHT OPERATION:

ENERGY RANGE: 2.4 - 3.7 eV

PARASITIC SYNCHROTRON LIGHT OPERATION

MINIMUM ENERGY: 1.5 eV

ELECTRON CURRENT:

A

100 mA

ENGINEERING NOTE

SLO712

M 5936

3 OF 19

AUTHOR

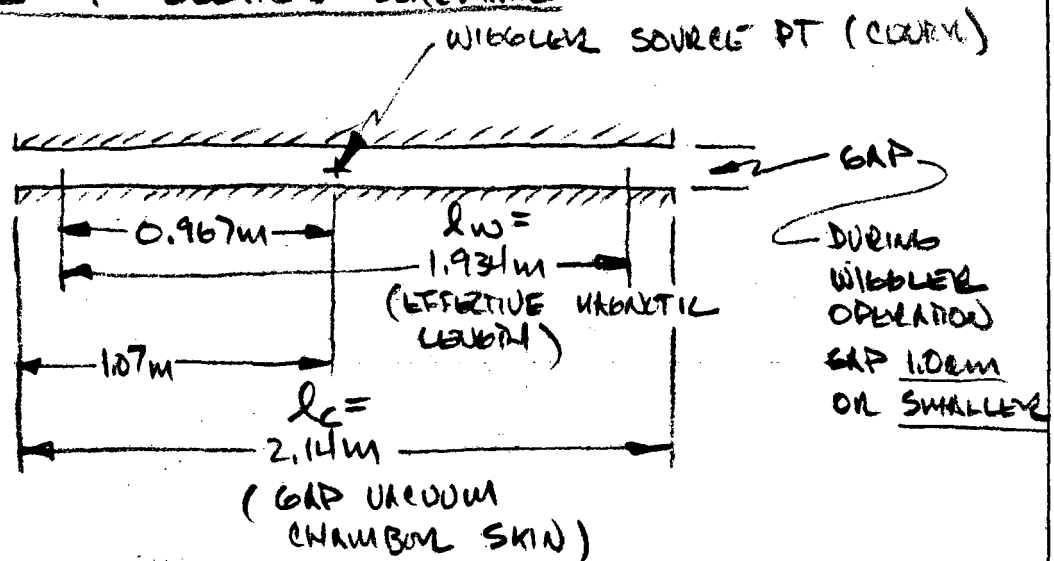
DEPARTMENT

LOCATION

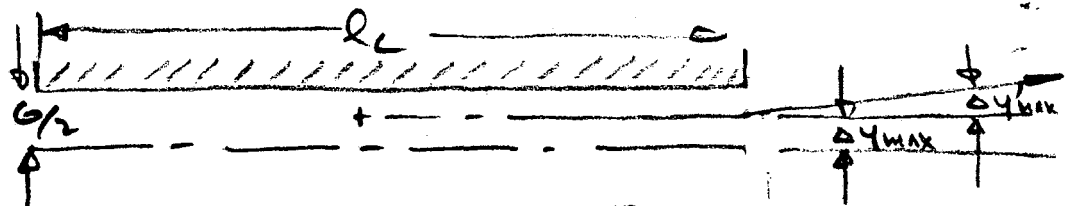
DATE

EGON HOVER

6/11/82

TRANSVERSE Y PLANE:WIBBLER Y SECTION SCHEMATIC:ELECTRON BEAM ORBIT LIMITS: (LIFETIME CONSIDERATION)

- $B \leq 1.30\text{TES} \rightarrow 1.0\text{cm GAP OPERATION!}$



$$\Delta y_{\text{max}} = \frac{G}{2} - 2.5\text{mm} = \frac{10\text{mm}}{2} - 2.5\text{mm} = \underline{2.5\text{mm}}$$

$$L_C \Delta y' \leq 2 \Delta y_{\text{max}} \leq (2)(2.5\text{mm}) \leq 5.0\text{mm}$$

$$\Delta y' \leq \frac{5.0\text{mm}}{2140\text{mm}} \leq 2.34\text{mRAD}$$

PLUS:

$$\Delta y'_{\text{max}} = \Delta y'_s = \underline{0.802\text{mRAD}}$$

- $B = 1.75\text{TES} \rightarrow 0.6\text{cm GAP OPERATION!}$

$$\Delta y_{\text{max}} = \frac{6\text{mm}}{2} - 2.5 = \underline{0.5\text{mm}}$$

ENGINEERING NOTE

SLO712

M 5936

4 OF 19

AUTHOR

DEPARTMENT

LOCATION

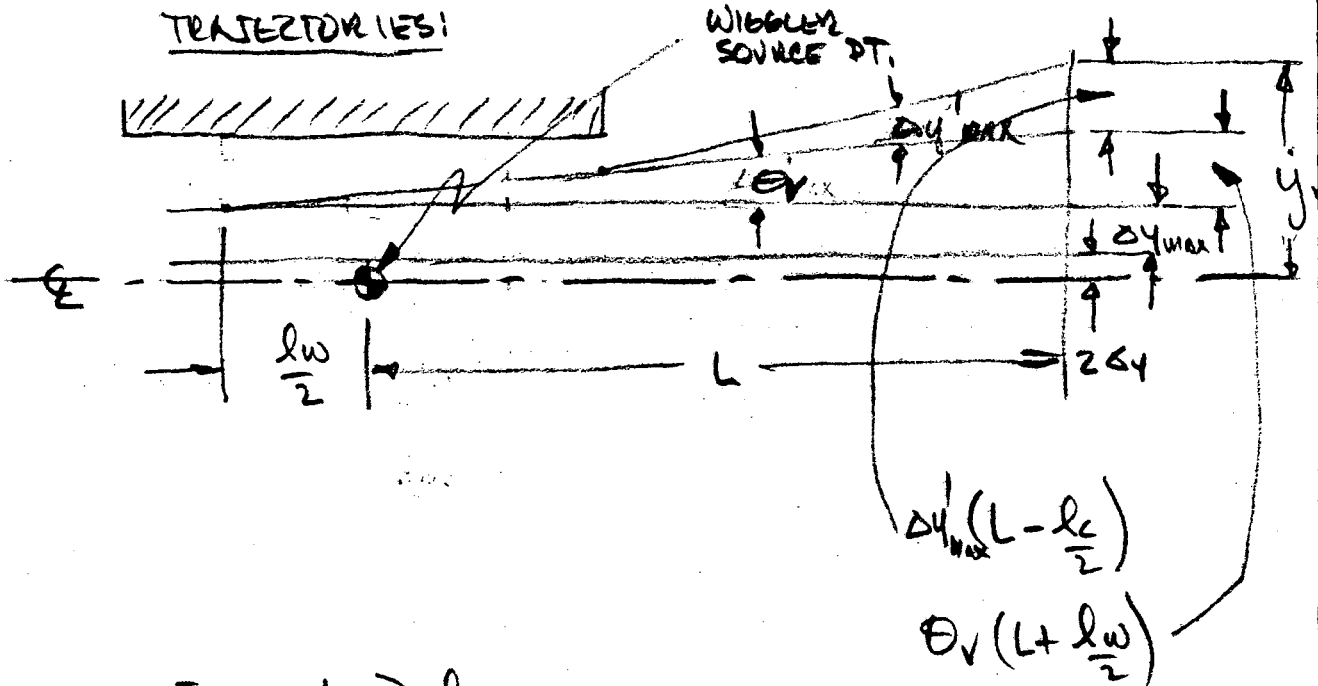
DATE

ECON HOYER

6/17/82

$$\Delta y' = \frac{1 \text{ mm}}{2140 \text{ mm}} = 0.467 \text{ mrad}$$

$$\Delta y'_{\text{max}} = \Delta y' = 0.467 \text{ mrad}$$



FOR $L \geq \frac{l_c}{2}$

$$y_{\text{max}} = 2\Delta y + \Delta y'_{\text{max}} + \Theta_V(L + \frac{l_w}{2}) + \Delta y'_{\text{max}}(L - \frac{l_c}{2})$$

$\Theta_V = f(\text{VERTICAL INTENSITY PROFILES})$

FROM M 5927, PG 2, AT 4.0M, FOR THE INTENSITY TO BE $\sim 50 \text{ W/cm}^2$, $\Theta_V = \frac{3}{\gamma}$
 FOR $B_{\text{wigg}} = 1.75 \text{ TES}$, $E_{\text{SPIN}} = 3.7 \text{ GeV}$, $I_{\text{SPIN}} = 100 \text{ mA}$

USE:

$$\Theta_V = \pm \frac{3.0}{\gamma} = \pm \frac{1.53}{E(\text{GeV})} \text{ (mrad)}$$

E (GeV)	2.4	3.0	3.7	1.5
Θ_V (mrad)	± 0.633	$\pm .511$	$\pm .414$	± 1.020

$$y_{MAX} = \pm \left[0.30 + \Delta y_{MAX} + \Theta_V (L + 967mm) + \Delta y' (L - 1070mm) \right]$$

- FOR B ≤ 1.30 TES (1.0cm GAP OPERATION)

$$y_{MAX} \leq 1.30 TES = \pm \left[0.30 + 2.50 + \Theta_V (L + 967mm) + 0.802^{(mm)} (L - 1070mm) \right]$$

$$y_{MAX} \leq 1.30 TES = \pm \left[1.942 + .802 L(m) + \Theta_V (mm) (L(m) + 0.967) \right]_{mm}$$

ENERGY (GeV)	Θ_V (±mrad)	$y_{MAX} \leq 1.30 TES$ (mm)
2.4	.638	2.558 + 1.440 L(m)
3.0	.571	2.436 + 1.313 L(m)
3.7	.414	2.342 + 1.216 L(m)
1.5	1.020	2.928 + 1.822 L(m)

- FOR B = 1.75 TES (0.6cm GAP OPERATION)

$$y_{MAX} \leq 1.75 TES = \pm \left[0.30 + 0.50 + \Theta_V (L + .967m) + 0.467 (L - 1.07m) \right]$$

$$= \pm \left[0.300 + .467 L(m) + \Theta_V (mrad) (L(m) + .967) \right]$$

ENGINEERING NOTE

SL0712

M 5936

6 OF 19

AUTHOR

DEPARTMENT

LOCATION

DATE

ECON HOYLE

6/18/82

ENERGY (keV)	σ_V (\pm MRAD)	y_{MAX} 1.75 σ_V (\pm CM)
2.4	.638	0.917 + 1.105 LCM)
3.0	.511	0.794 + 0.978 LCM)
3.7	.414	0.700 + 0.881 LCM)
1.5	1.020	1.286 + 1.487 LCM)

THE TRANSVERSE VERTICAL BEAM ENVELOPES (Y)
CALCULATED ABOVE ARE SHOWN GRAPHICALLY ON
PAGE 7.

ENGINEERING NOTE

CODE
SL0712

SERIAL
M 5936

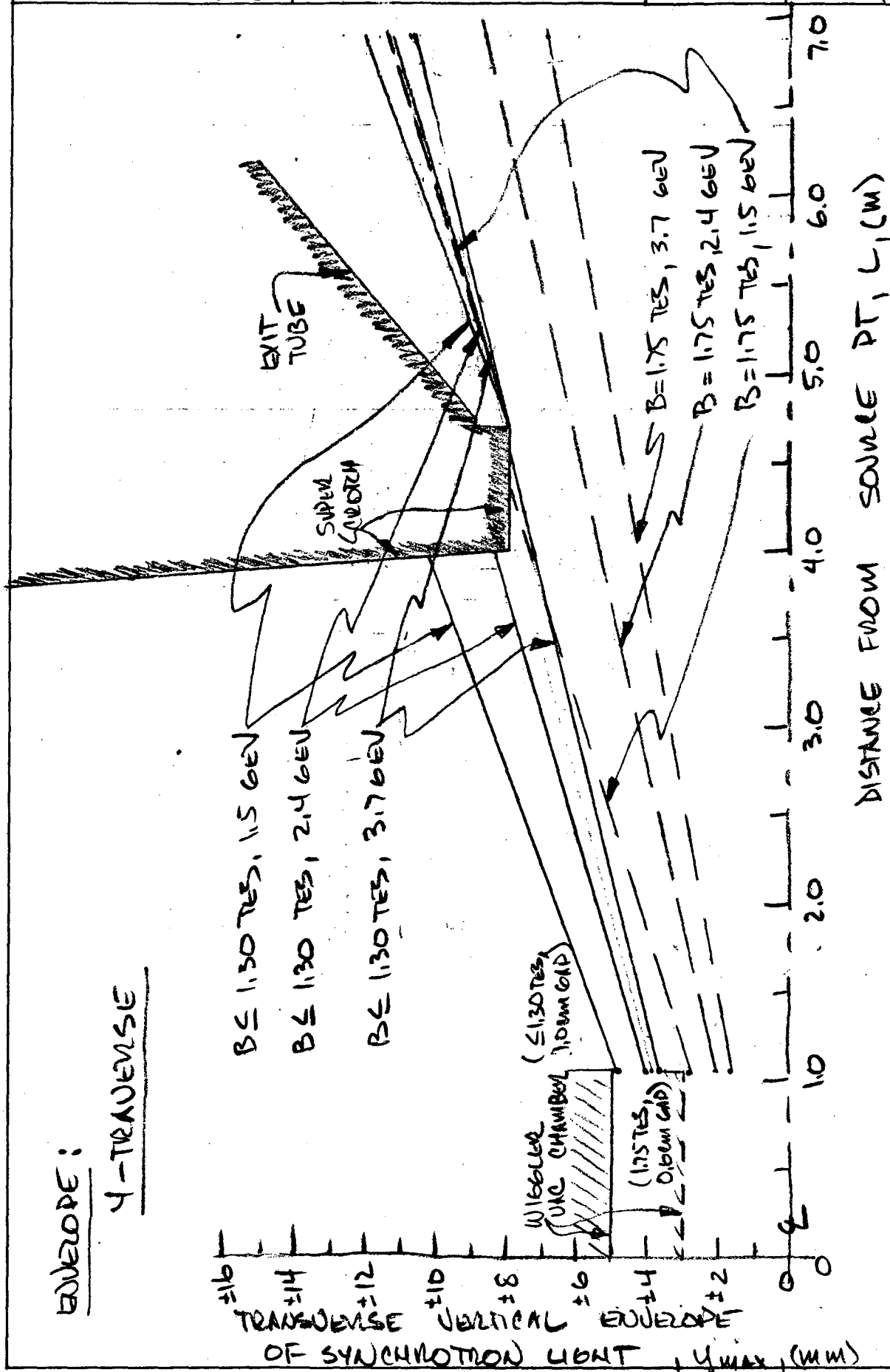
PAGE
7 OF 19

AUTHOR
EGON HOLER

DEPARTMENT

LOCATION

DATE
6/18/82



ENGINEERING NOTE

SLO 712

M 5936

8 OF 19

AUTHOR

DEPARTMENT

LOCATION

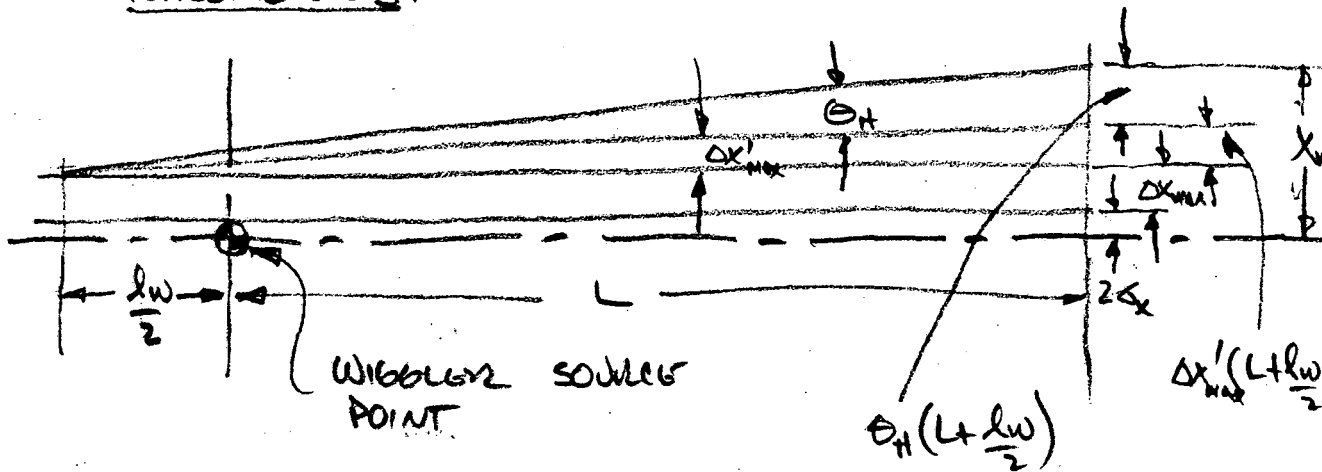
DATE

EGON HOFER

6/18/82

TRANSVERSE X PLANE

THIS HAS NO LIFE TIME CONSIDERATIONS IN
THE TRANSVERSE X-PLANE

TRAJECTORIES:

$$\text{FOR } L \geq -\frac{l_w}{2}$$

$$X_{\max} = 2\delta_x + \delta x_{\max} + \theta_H + \delta x_{\max}' \left(L + \frac{l_w}{2}\right)$$

$$\theta_H = \pm \frac{.4775 \lambda_{wigg}(\text{cm}) B_{wigg}(\text{TES})}{E(\text{GeV})} \quad (\text{MRAD})$$

$$\text{FOR } \lambda_{wigg} = 7\text{cm}$$

$$\theta_H = \pm 3.343 \frac{B(\text{TES})}{E(\text{GeV})} \quad (\text{MRAD})$$

B (TES)	E (GeV)	θ_H (MRAD)
1.30	1.5	2.897
	2.4	1.811
	3.7	1.174
1.75	1.5	3.900
	2.4	2.437
	3.7	1.581

$$X_{max} = \pm \left[(2)(3.20 \text{ mm}) + 10 \text{ mm} + (\theta_H + 1.34 \text{ (mrad)}) (L + .967 \text{ m}) \right]$$

$$X_{max} = \pm \left[16.4 + (\theta_H + 1.34 \text{ (mrad)}) (L \text{ (m)} + .967 \text{ m}) \right] \text{ (mm)}$$

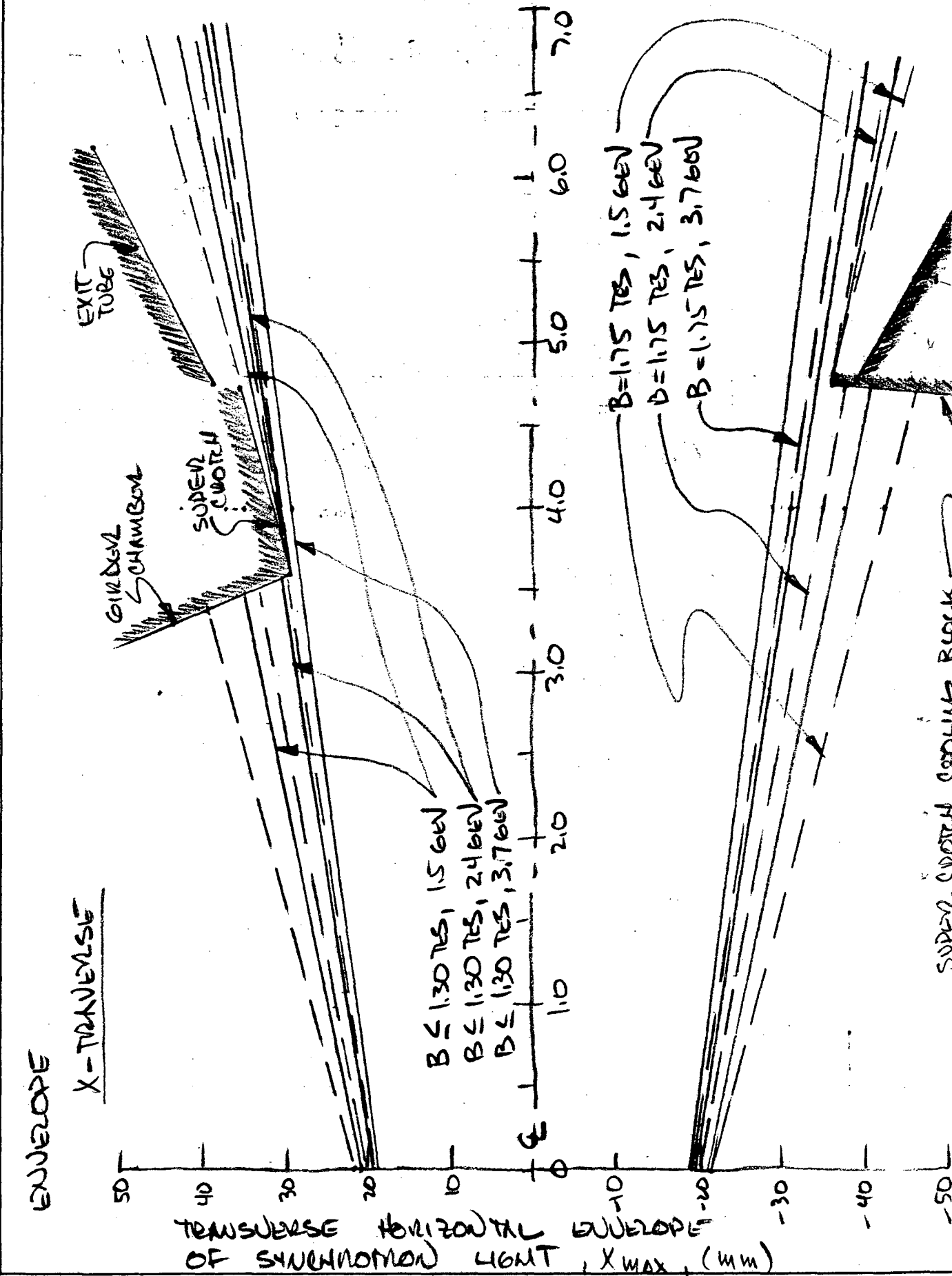
- FOL B \leq 1.30 TES (1.0cm GAP OPERATION)

ENERGY (GeV)	θ_H (\pm mrad)	$X_{max} \leq 1.30 \text{ TES}$ (mm)
1.5	2.897	20.50 + 4.237 L(m)
2.4	1.811	19.45 + 3.151 L(m)
3.7	1.174	18.83 + 2.514 L(m)

- FOL B = 1.175 TES (0.6cm GAP OPERATION)

ENERGY (GeV)	θ_H (\pm mrad)	$X_{max} 1.175 \text{ TES}$ (mm)
1.5	3.90	21.47 + 5.240 L(m)
2.4	2.437	20.05 + 3.777 L(m)
3.7	1.581	19.22 + 2.921 L(m)

THE TRANSVERSE HORIZONTAL ENVELOPES (X) CALCULATED ABOVE ARE SHOWN GRAPHICALLY ON PAGE 10.



ENGINEERING NOTE

CODE
SL0712SERIAL
M5936PAGE
11 OF 19AUTHOR
ELDON HONER

DEPARTMENT

LOCATION

DATE
6/22/82GIRDER CHAMBER ILLUMINATION:4 TPA VERSE:DEDICATED OPERATION (2.4-3.7 GeV):

@ 1.75 TES - BEAM CLEANS
GIRDER CHAMBER

@ ≤ 1.30 TES - BEAM HITS SUPER
CROUCH -
- 1/2 MM IMPINGEMENT
ON 3.9° BEV @ 240
OK - BASED ON M5927
PAGE 22

- STRAIGHT SECTION
OK - BASED ON M592
PAGE 27

PARASITIC OPERATION (1.5 GeV - 2.4 GeV)

@ 1.75 TES - BEAM HITS SUPER
CROUCH STRAIGHT SECTION
OK - SEE ABOVE

@ ≤ 1.30 TES - BEAM HITS SUPER
CROUCH
- 2.3 MM IMPINGEMENT
ON 3.9° BEV @ 1.5

POWER LEVEL @ 1.5 GeV, 100 mA, 1.3 TES

$$P_{1.5\text{GeV}} = (5206\text{ W}) \left(\frac{1.5}{3.7}\right)^2 \left(\frac{1.3}{1.75}\right)^2 = \underline{472\text{ W}}$$

ENGINEERING NOTE

CODE: SLO712 SERIAL: M5936 PAGE: 12 OF 19
 LOCATION: DATE: 6/22/82

AUTHOR: EGON HOFERZ DEPARTMENT:

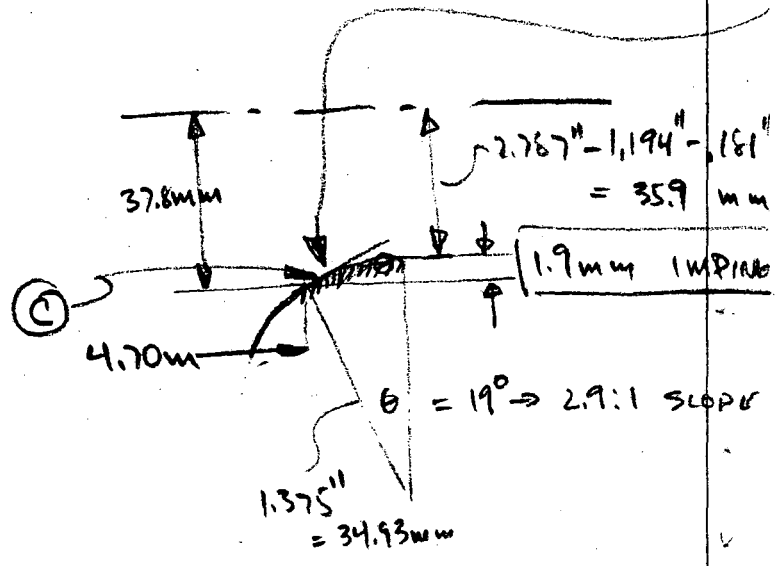
FROM PG 15, M 5927A, AVAILABLE COOLING FOR 2.3MM OF BEAM IMPINGEMENT $> 472 \text{ W}$
 ∴ OK

- STRAIGHT SECTION
 OK - SEE ABOVE

X TRAVERSE

DEDICATED OPERATION (2.4 - 3.7 GW) :

@ 1.75 TES - BEAM HITS SUPERCOOLED COOLING BLOCK @ 2.46 GW



MAXIMUM HEATING AT (C)

$$W_{\text{max}} = \left(\frac{44 \text{ kW}}{\text{cm}^2} \right) \left(\frac{2.4}{3.7} \right) \left(\frac{4.75}{4.7} \right) \left(\frac{2.4}{3.7} \right) \left(\frac{7.51}{7.51 + 3.2} \right) \left(\frac{.81}{.66 + .66} \right)$$

↑ PPK @ 4.75 ↑ 2.46 GW CONDUCTION ↑ 4.75m CONDUCTION ↑ 2.4m CONDUCTION ↑ EX CONDUCTION ↑ ε COE

= 0.532 kW/cm² - OK BASED ON PG'S 18+ 19, M 5927A

ENGINEERING NOTE

CODE

SL0712

SERIAL

M5936

PAGE

13 OF 19

AUTHOR

EGON HOYER

DEPARTMENT

LOCATION

DATE

6/22/82

- BEAM HITS GOLDEN CHAMBER @ 3.6 MV
- 2.1 MM IMPINGEMENT @ 3.7 GV - OK M5927a PG'S 18 & 19
- $33.64 - 27.6 = 6.0$ MM OF IMPINGEMENT @ 2.4 GV UNIT HOT DOWN BY $(\frac{2.4}{3.2})^2 = .42$ - OK FOR PG 19, M5927a

@ ≤ 1.30 TES

- BEAM CLEANS SUPER COOLING BLOCK
- BEAM HITS GOLDEN CHAMBER 3.2 MM @ 2.4 GV OK - BASED ON ABOVE

PARASITIC OPERATION (1.5 - 2.4 GV)

@ 1.75 TES

- BEAM HITS SUPER COOLING BLOCK
- @ 1.5 GV $46.1 - 37.8 = \underline{8.3}$ MM IMPINGEMENT

WORST HEATING CONDITION OCCURS ~ 3 MM IN FROM EDGE OF BLOCK (@ 5.3 MM)

ENGINEERING NOTE

SLO712

M 5936

14 OF 19

AUTHOR

DEPARTMENT

LOCATION

DATE

EGON HOVER

6/22/83

MAX. HEATING @ 5.3mm IMPINGEMENT POINT

$$W_{max} = \left(\frac{35 \mu W}{cm^2} \right) \left(\frac{1.5}{5.7} \right)^2 \left(\frac{4.75}{4.70} \right)^2 \left(\frac{1.5}{3.7} \right) \left(\frac{7.5}{7.5+3.2} \right) \left(\frac{.81}{.16+.15} \right)$$

↑ ↑ ↑ ↑ ↑ ↑
 PEAK 1.5 SEEV 4.7μW 0.4 6x 64
 2mm COOL COOL COOL COOL COOL
 FROM COOL COOL COOL COOL COOL
 EDWARDS COOL COOL COOL COOL COOL
 EDGE

$$= 0.837 \text{ kW/cm}^2$$

$$\Delta T = \frac{W L}{K S} = \frac{(837 \text{ W/cm}^2)(2)(.066+.05) \text{ cm}}{(3.92 \frac{\text{W}}{\text{cm} \cdot \text{K}})(1.0)} = 35^\circ \text{C}$$

$$\Delta = \frac{\alpha E \Delta T}{(1-\nu)} = \frac{(16.7 \times 10^{-6})(17 \times 10^9)(35)}{(1-.355)} = 15,200 \text{ PSI}$$

FOR OF HC COPPER

$$\Delta y = 6200 \text{ PSI} / \Delta u = 28600 \text{ PSI} (20^\circ \text{C})$$

$$\Delta u = 24,500 \text{ PSI} (100^\circ \text{C})$$

$$\Delta u = 20,600 \text{ PSI} (200^\circ \text{C})$$

SURFACE YIELDING WILL OCCUR - ON THOSE

— BEAM HITS GIRDOR CHAMBER? - OK - BASED ON ABOVE

@ ≤ 1.30 TES

— BEAM HITS SUPPL EDGED COOLING BLOCK - OK - BASED ON ABOVE

— BEAM HITS GIRDOR CHAMBER OK - BASED ON ABOVE

CONCLUSION:

BASED ON THIS ABOVE, ALL AREAS OF THE GIRDOR CHAMBER ILLUMINATED BY RIK WIGGLOW SYNCHROTRON LIGHT ARE CAPABLE OF WITHSTANDING THE INDICATED ILLUMINATION INTENSITIES.

ENGINEERING NOTE

CODE

SL 0712

SERIAL

W 5936

PAGE

15 OF 19

AUTHOR

EGON HOVERZ

DEPARTMENT

LOCATION

DATE

6/23/82

PEAK SYNCHROTRON LIGHT FLUX IN EXIT TUBE:

@ 5.64 μm - FIXED MASK GEOMETRY

$$\begin{aligned}
 M_{\text{PEAK}} &= \left(\frac{62 \text{ kW}}{\text{cm}^2} \right) \left(\frac{4.00}{5.64} \right)^2 \left(\frac{0.736 (6.32) \left(\frac{5.64}{4} \right)}{(6.32) \left(\frac{5.64}{4} \right) + 3.2} \right) \left(\frac{0.835 (1.54) \left(\frac{5.64}{4} \right)}{(1.54) \left(\frac{5.64}{4} \right) + 1.15} \right) \\
 &\quad \uparrow \qquad \qquad \uparrow \qquad \qquad \uparrow \qquad \qquad \uparrow \\
 &\quad \text{PEAK @} \qquad \text{@} \qquad \qquad \epsilon_x \qquad \qquad \epsilon_y \\
 &\quad 4.00 \mu\text{m} \qquad 5.64 \mu\text{m} \qquad \text{CONVERSION} \qquad \text{CONVERSION} \\
 &\qquad \qquad \qquad \qquad \qquad \left(\frac{\theta_{xL}}{\theta_{xL} + \epsilon_x} \right) \qquad \left(\frac{\theta_{yL}}{\theta_{yL} + \epsilon_y} \right) \\
 &= \underline{19.2} \text{ kW/cm}^2 \qquad \qquad \qquad \theta_y = \frac{1}{2}
 \end{aligned}$$

LAWRENCE BERKELEY LABORATORY - UNIVERSITY OF CALIFORNIA		CODE	SERIAL	PAGE
ENGINEERING NOTE		SLO712	M 5936	16 OF 19
AUTHOR	DEPARTMENT	LOCATION	DATE	
EGON HOYER			7/29/82	

WIGGLER VACUUM CHAMBER VERTICAL MOTION

LIMITS :

THE FOLLOWING ANALYSIS WAS CARRIED OUT ON THE BASIS THAT THE WIGGLER VACUUM CHAMBER WAS FIXED TO THE BIRDBOX CHAMBER. IN REALITY, THE WIGGLER VACUUM CHAMBER CAN MOVE RELATIVE TO THE BIRDBOX CHAMBER.

USING THE INFO ON PAGES 7, 11, 12 AND INFO FROM M 5927A, LIMITS AT DIFFERENT ENERGIES AND FIELDS CAN BE EXAMINED TO SET A MAXIMUM ALLOWABLE EXCURSION.

DEDICATED OPERATION (2.4 - 3.76GV)

@ 1.75 TESLAS - @ 3.76GV

$$P_q \ 4 \Rightarrow \Delta y' = .467$$

FROM M 5927, PG 20 $\Rightarrow \Delta y' = .467$
PG 21

$$7.94 = .3 + \Delta y + (.467 + .150)(4.967)$$

$$\Delta y = 4.6 \text{ mm}$$

@ ≤ 1.30 TESLAS - @ 3.06GV - FROM M 5927, PG 21

$$\Delta y = 3.2 \text{ mm}$$

- @ 3.76GV

POUNCE IS DOWN BY ⊗

$$\left(\frac{1.3}{1.75}\right)^2 = .552$$

⊗ 1.75 TGS, 3.76GV, 100 mA

ENGINEERING NOTE

5L0712

M 5936

17 OF 19

AUTHOR

DEPARTMENT

LOCATION

DATE

EON HOYON

7/29/82

$$\text{TOTAL POWER} = (5206 \text{ W})(.552) = 2872 \text{ W}$$

BEAM SPREAD DECREASES BY: \oplus

$$y = \frac{1.3}{1.75} = .74$$

FOR INCREASED RADIATION
X .552 TO EQUAL ALLOWABLE
HEAT LOAD X .74 (SUB PG 27-22
M 5927)

CLIPPING

1.0 mm

 $\frac{\Delta P}{\Delta D}$

$$(600)(.552) = 331 \text{ W}$$

$$\frac{9}{(545)(.74)} = 403 \text{ W}$$

← or →

1.1 mm

$$(850)(.552) = 469 \text{ W}$$

$$(515)(.74) = 425 \text{ W}$$

← 100 HIGH

$$\Theta V = \frac{1.5 - 1.0}{4000} = .125 \text{ mRAD}$$

$$\Delta y = 7.94 - (.3 + (.804)(.125))(4.90)$$

$$= \underline{3.0 \text{ mm}}$$

- @ 30 66V, 200 mA

POWER DOWN BY: \oplus

$$\eta = (.363)(2) = \underline{.726}$$

TOTAL POWER IS

$$P = (5206)(.726) = \underline{3780 \text{ W}}$$

BEAM SPREAD DECREASES BY \oplus

.74

FOR INCREASED RADIATION X .726
TO EQUAL ALLOWABLE HEAT LOAD
X .74

\oplus 1.75 TES, 3.760V, 100 mA

BWMM CLIPPING

0.9 mm
1.0

$\frac{\Delta P}{q}$
 $(410)(.726) = 298 \text{ W}$
 $(600)(.726) = 436 \text{ W}$
 $(515)(.74) = 381 \text{ W}$
 $(540)(.74) = 400 \text{ W}$
 OK \rightarrow 100 HIGH

$$EV = \frac{(1.5 - .9)(3.7)}{4000 \cdot 3.0} = .185$$

$$7.94 = .37 \Delta y + (.802 + .185)(4.967)$$

$$\Delta y = 2.7 \text{ mm}$$

CONCLUSION IS THAT AT 1.3 TESLAS, 3.7 GEV/100 MA CASE IS VERY CLOSE TO THE 3.0 GEV/200 MA CASE IN TERMS OF VERTICAL EXCURSION (0.3 MM DIFFERENCE)

PARASITIC OPERATION (1.5 GEV - 2.4 GEV)

@ 1.75 TESLAS - @ 2.4 GEV
 POWER DOWN BY: \odot

$$\eta = \left(\frac{2.4}{3.7}\right)^2 = .421$$

BWMM SPREAD INCREASES BY: \otimes

$$f = \frac{3.7}{2.4} = 1.542$$

FOR INCREMENTAL RADIATION X .421 TO EQUAL ALLOWABLE HEAT LOADS Y 1.233

CLIPPING

1.2 mm
1.5 mm

$\frac{\Delta P}{q}$
 $(1250)(.421) = 526 \text{ WATTS}$
 $(2403)(.421) = 1095 \text{ WATTS}$
 $(605)(1.542) = 932 \text{ WATTS}$
 $(700)(1.542) = 1080 \text{ WATTS}$
 OK \rightarrow CLOSE LOADING

\otimes 1.75 TES, 3.7 GEV, 100 MA

THUS $\theta_v = 0$

$$\Delta y = 7.94 - 1.3 - (.467)(4.967)$$

$$= \underline{5.3 \text{ mm}}$$

@ ≤ 1.30 TEXAS - @ 2.4 66V

POWER IS DOWN BY: ⁽⁴⁾

$$\eta = \left(\frac{1.3}{1.75} \right)^2 - \left(\frac{2.4}{3.7} \right)^2 = 1232$$

TOTAL POWER IS:

$$(1232)(5206) = \underline{1207 \text{ WATTS}}$$

BEAM SPREAD INCREASES BY: ⁽⁴⁾

$$y = \left(\frac{3.7}{2.4} \right) \left(\frac{1.3}{1.75} \right) \left(\frac{3.2 + 6.32}{6.32} \right)$$

\uparrow 6x COLL.

$$= 1.73$$

FOR RADIATION X 1232 TO EQUAL ALLOWABLE HEAT LOAD X 1.73

CLIPPING

$$1.5 + 0.5 = 2.0 \text{ cm}$$

DP

$$(2603 + 2110)(1232) \quad (860)(1.73)$$

1093 WATTS ← → 1488 WATTS

OK

CHAMBER CAN TAKE FULL WIGGLOW POWER AT THIS ENERGY & FIELD LEVEL

— BASED ON THE ABOVE, THE MAXIMUM WIGGLOW VERTICAL EXCURSION IS $\pm 2.7 \text{ mm}$. WITH ALIGNMENT CONSIDERATIONS, LIMIT VERTICAL EXCURSION TO $\pm 2 \text{ mm}$.

⁽⁴⁾ 1.75 TES, 3.7 66V, 100 mA

This report was done with support from the Department of Energy. Any conclusions or opinions expressed in this report represent solely those of the author(s) and not necessarily those of The Regents of the University of California, the Lawrence Berkeley Laboratory or the Department of Energy.

Reference to a company or product name does not imply approval or recommendation of the product by the University of California or the U.S. Department of Energy to the exclusion of others that may be suitable.

TECHNICAL INFORMATION DEPARTMENT
LAWRENCE BERKELEY LABORATORY
UNIVERSITY OF CALIFORNIA
BERKELEY, CALIFORNIA 94720