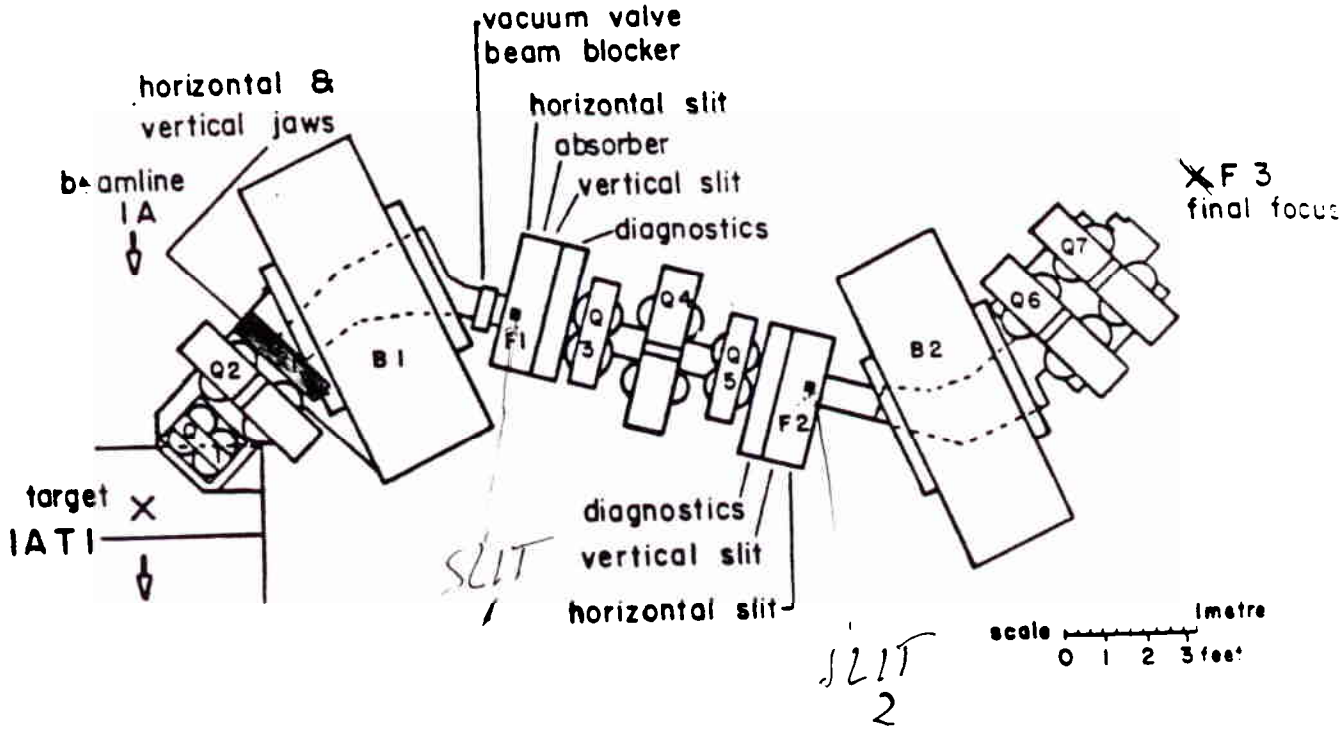
Transparencies of a presentation
Jan Doornbos to the E614 Beams Subgroup
2000/06/12

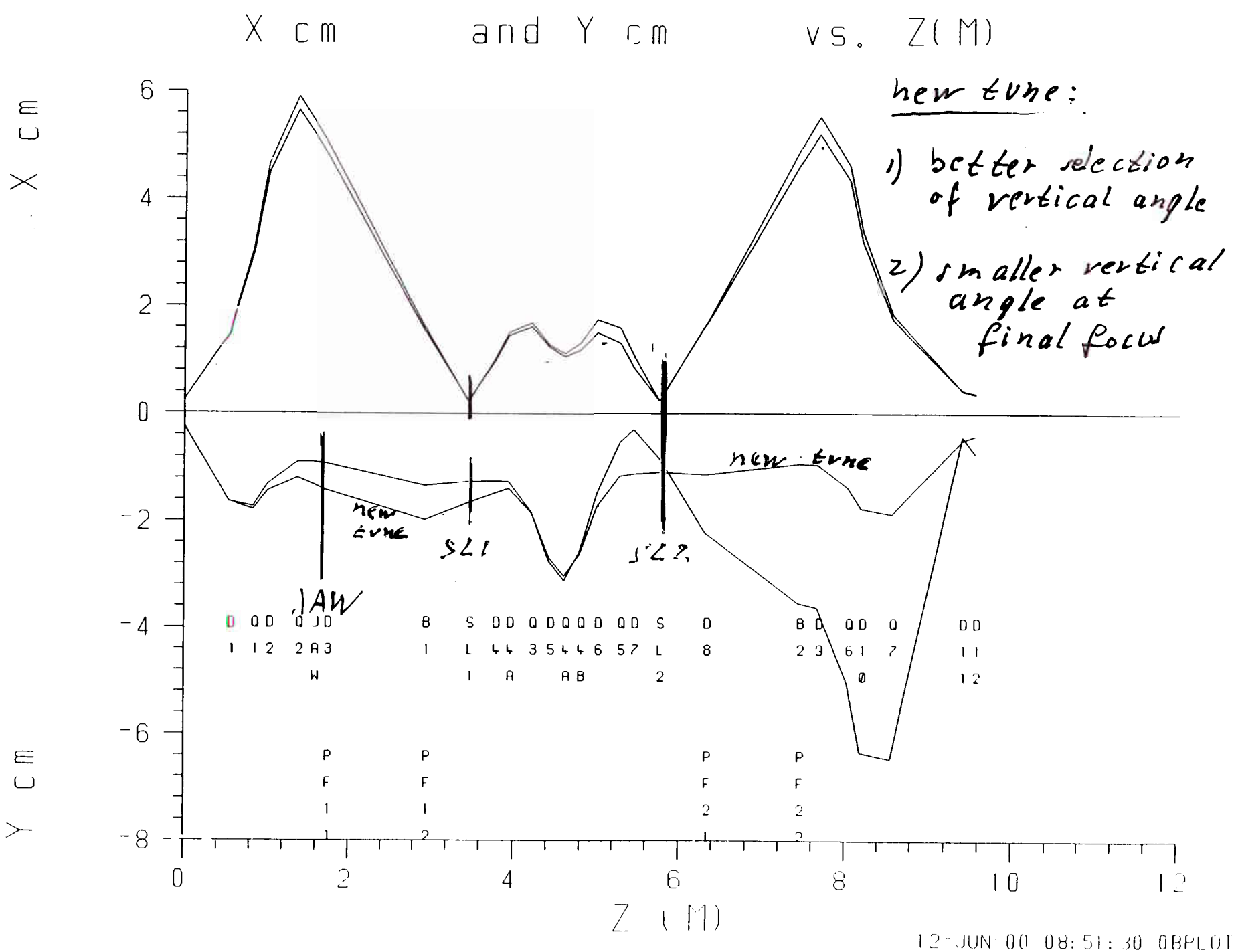


JAWS: Horizontal angle
Vertical angle

SLIT 1: Momentum bite

SLIT 2: Vertical spot size

target length: Horizontal spot size


X cm and Y cm vs. Z(M)
X cm
Y cm
Z (M)
new tune:
1) better selection of vertical angle
2) smaller vertical angle at final focus
new tune
new tune
SL1
SL2
IAW
12-JUN-00 08:51:30 OBPLOT

Quadrupole settings

New compared to Normal

Q_1	-8.0%
Q_2	-1.7
$Q_{3/5}$	-0.5
Q_4	-12.4
Q_6	-1.5
Q_7	-2.4

TUNING

) set quads as best as possible

) close jaws

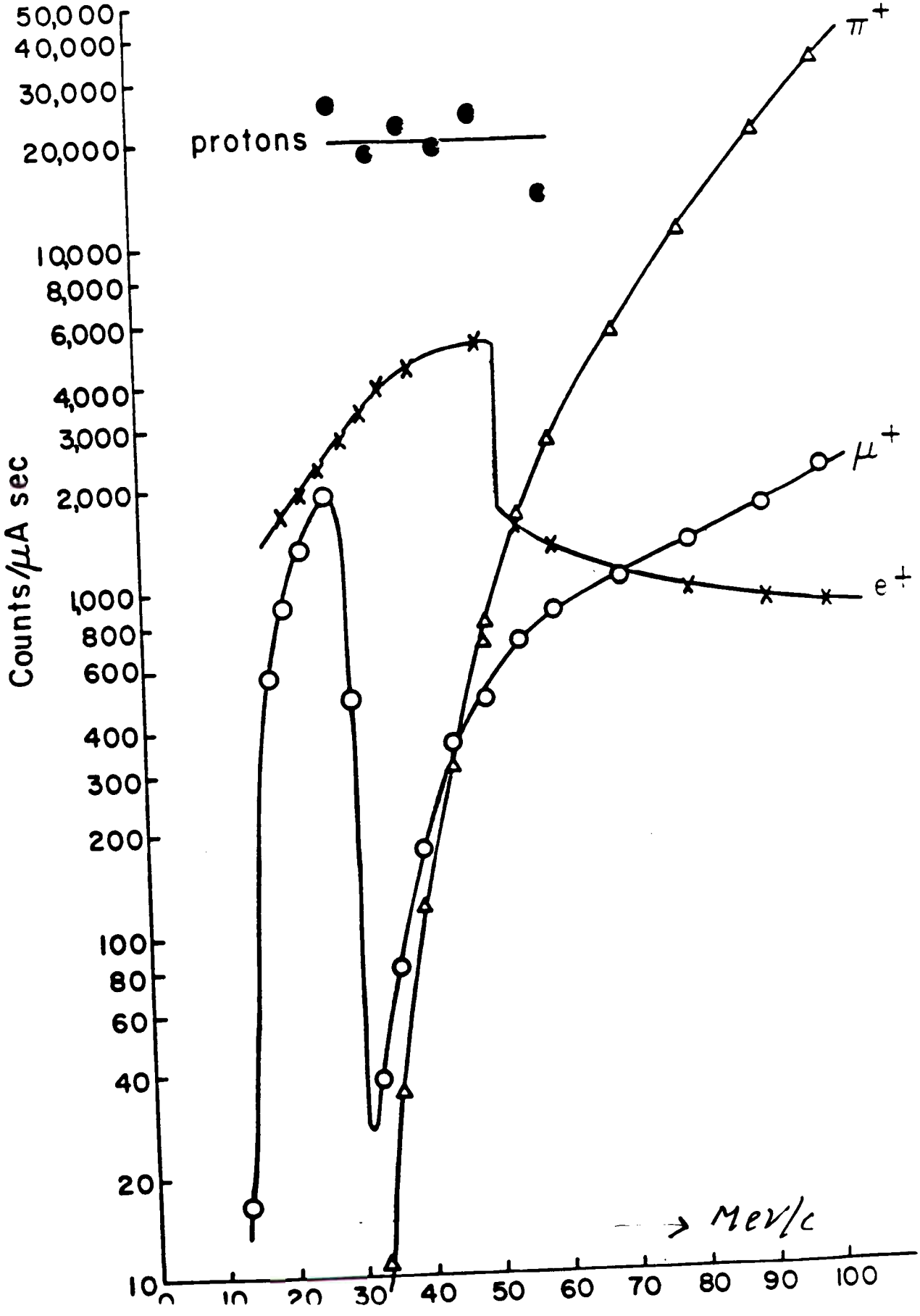
:) determine horizontal focus at F_1
by scanning Surface Muon Edge
and changing Q_2

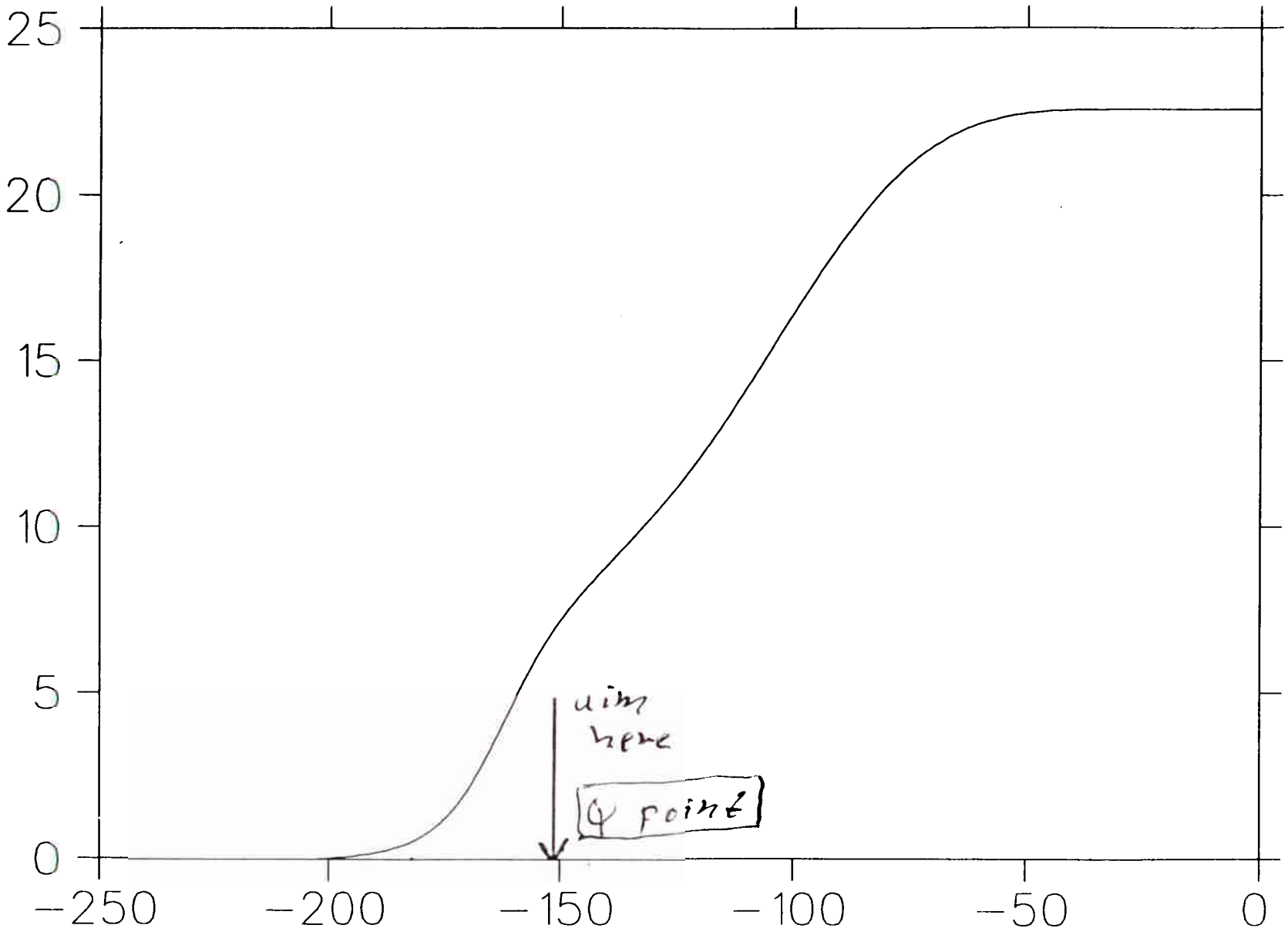
Take several settings of Q_1 and repeat

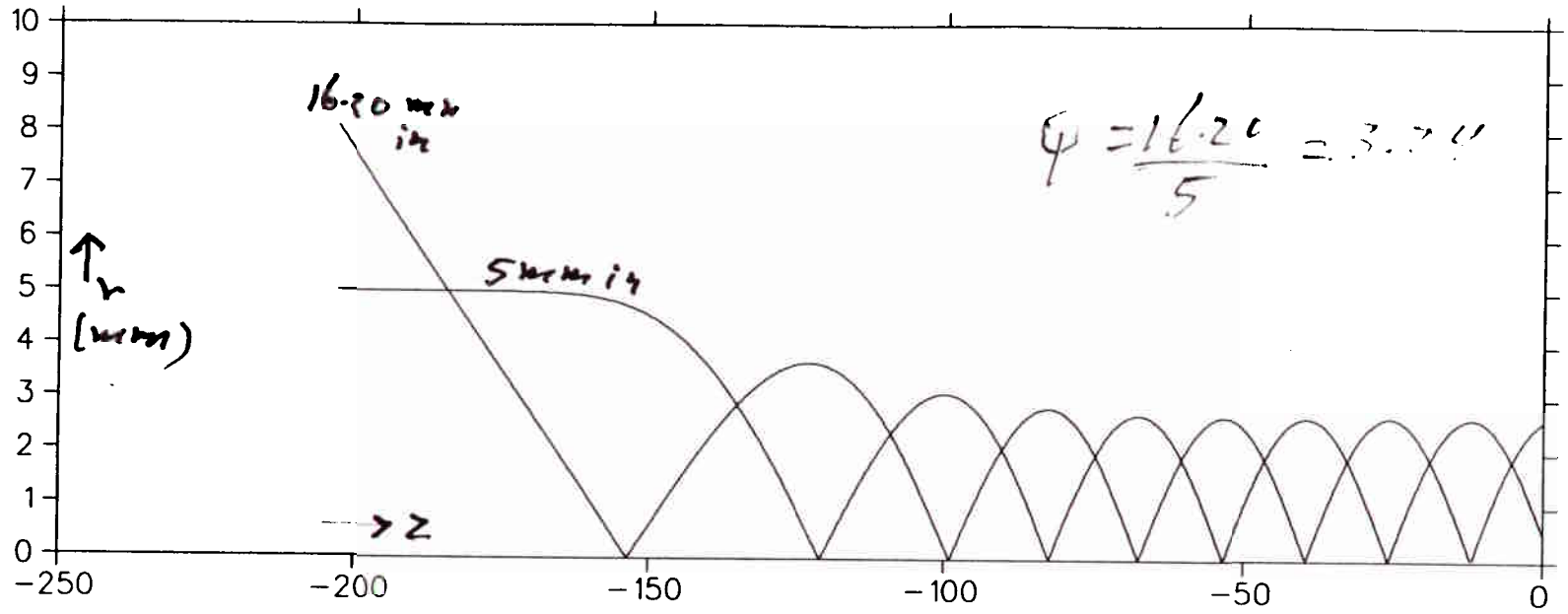
1) close horizontal slit F_1
close horizontal slit F_2
close vertical slit F_2

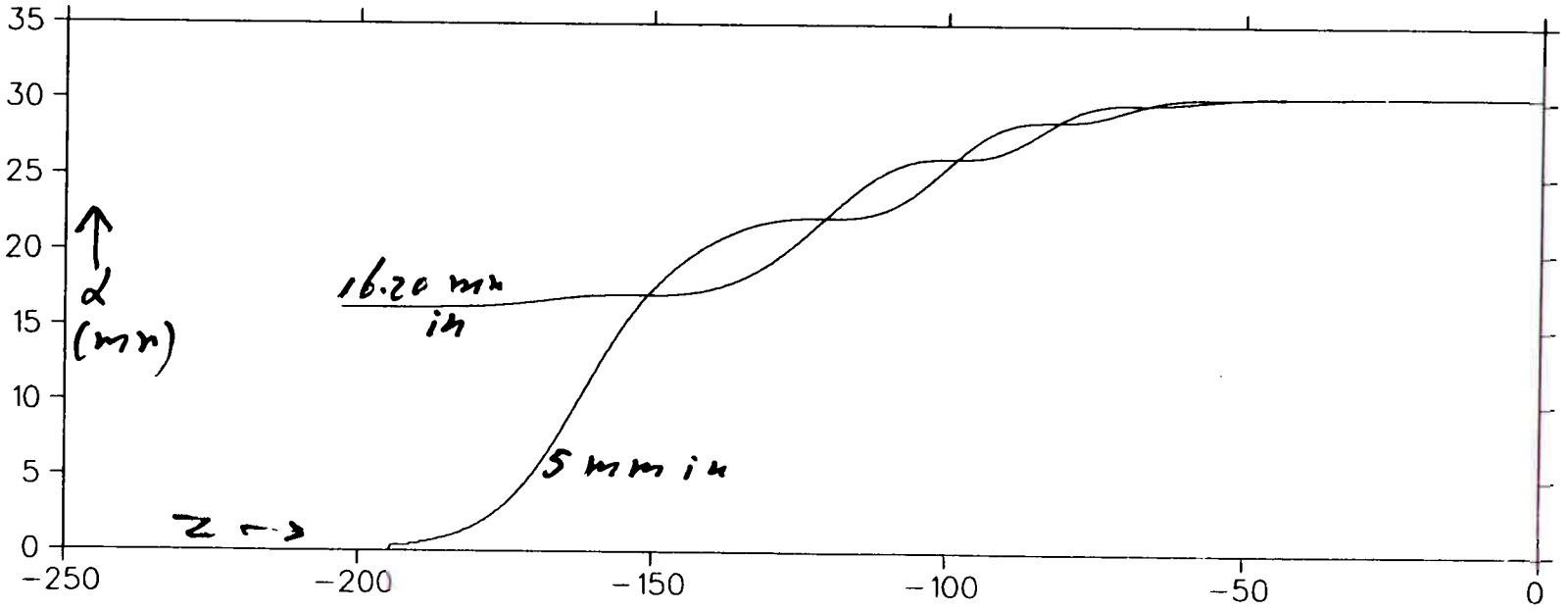
Optimize intensity with Q3/5 and Q4

-) Tune beam through 5 mm radius
hole at the end with Q6 and Q7

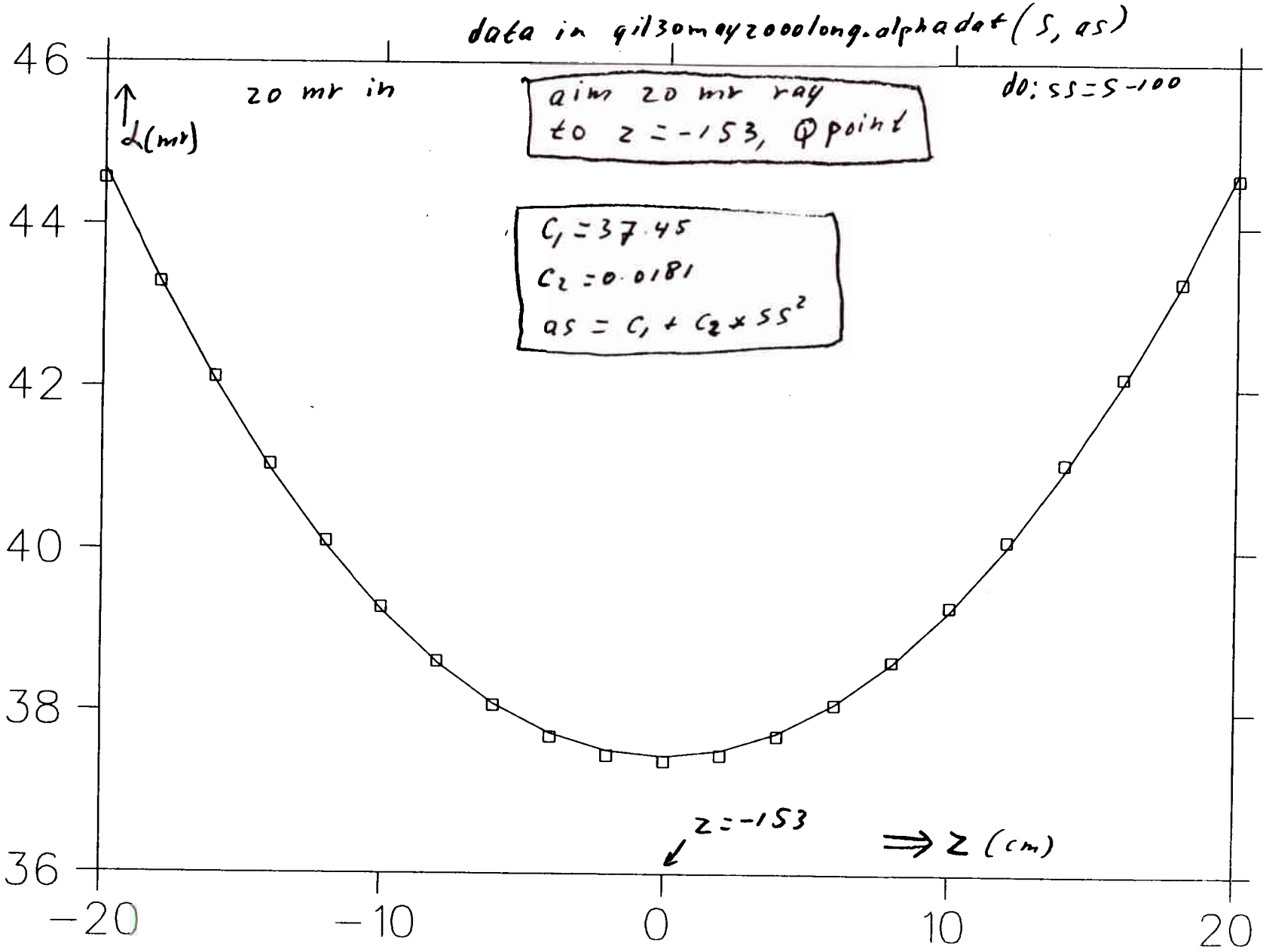

50,000
40,000
30,000
20,000
10,000
8,000
6,000
4,000
3,000
2,000
1,000
800
600
400
300
200
100
80
60
40
20
10
Counts/μA sec
protons
π+
μ+
e+
0
10
20
30
40
50
60
70
80
90
100
Mev/c


25
20
15
10
5
0
−250
−200
−150
−100
−50
0
aim here
Q point


10
9
8
7
6
5
4
3
2
1
0
−250
−200
−150
−100
−50
0
16.20 mm in
5 mm in
→ Z


35
30
25
20
15
10
5
0
−250
−200
−150
−100
−50
0
16.20 mm in
5 mm in
Z →

June 6, 2000


data in gil30may2000long.alphadat(S, as)
20 mr in
aim 20 mr ray
to z = -153, Φ point
do: ss = s - 100
$C_1 = 37.45$
$C_2 = 0.0181$
$as = C_1 + C_2 \times ss^2$
α(mr)
z = -153
⇒ z (cm)
46
44
42
40
38
36
-20
-10
0
10
20

$$a = \sqrt{\frac{1000}{\Phi \cdot 2p}\left(x^2 + (y - \Phi x)^2\right)}$$

$$r = \sqrt{\frac{2p \cdot \Phi}{1000}\left\{\left(x^2 + \frac{v^2}{\Phi^2}\right)\sin^2(\chi + \gamma) + \frac{y^2}{\Phi^2}\sin^2\gamma\right\}}$$

$$\chi = \arctan\left(\frac{\Phi x}{v}\right)$$

$$\gamma = \frac{z + z_{ref}}{2p}$$

$$B = 33 \times \frac{p \cdot z}{\sin\gamma}$$

$$r = \sqrt{r_a^2 + r_b^2}$$

$$r_a = \sqrt{\frac{2p \cdot \Phi}{1000}\left(x^2 + \frac{v^2}{\Phi^2}\right)}\sin(\chi + \gamma)$$

$$r_b = \sqrt{\frac{2p \cdot \Phi \cdot \Phi^2}{1000}}\sin(\gamma)$$

$$X_t = r_a \cos\gamma - r_b \sin\gamma \cdot \mathrm{sign}(\gamma)$$

$$Y_t = r_a \sin\gamma + r_b \cos\gamma \cdot \mathrm{sign}(\gamma)$$

$$\gamma = \gamma_{ref} - \gamma$$

---

new beam:

1) extrapolate x, x', y and y' to z of Q point
2) rotate coördinate system until new $y = 0$
3) use formulas to calculate beam parameters in homogeneous field region
4) rotate back to original orientation in x-y plane

Drift

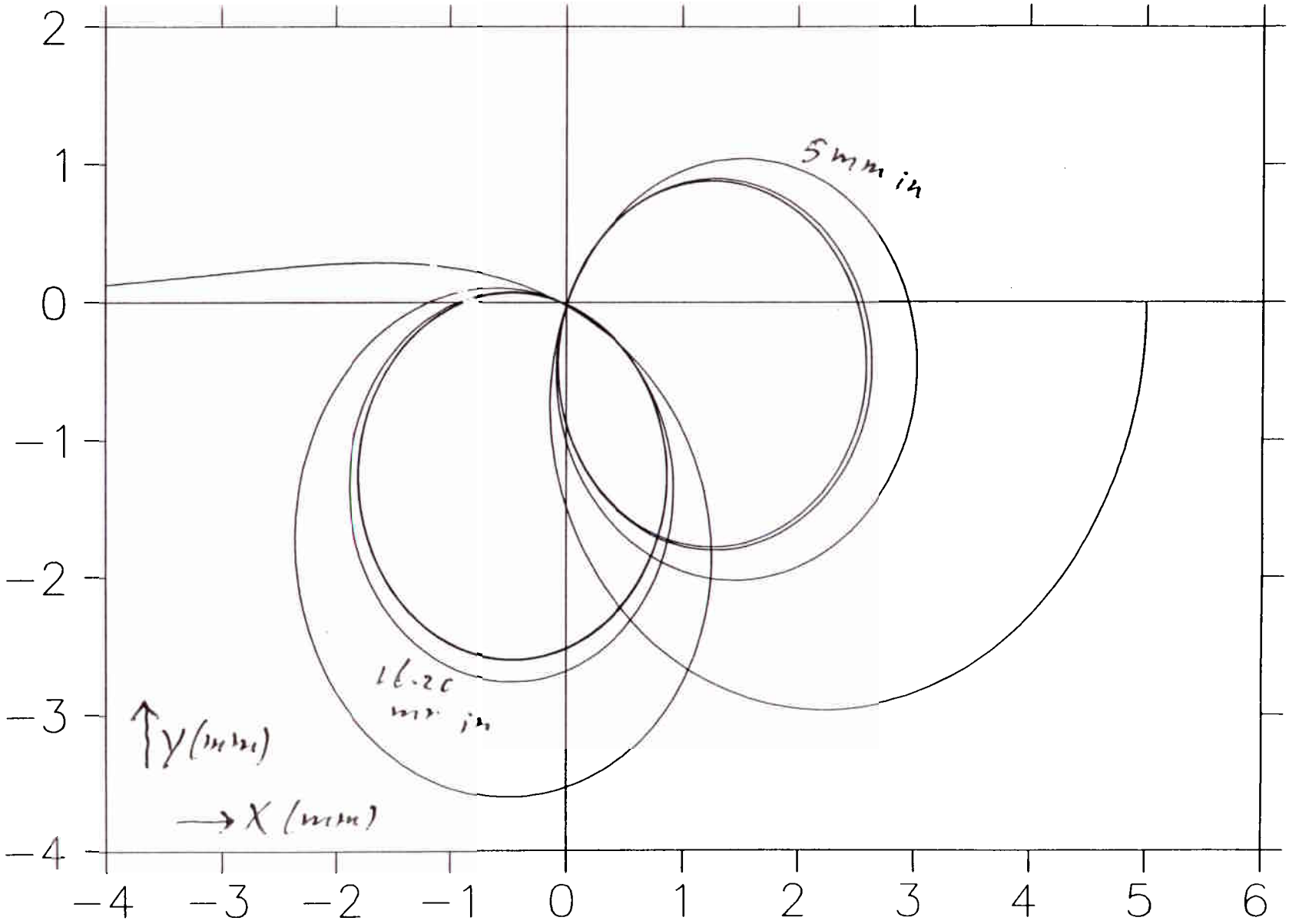
transformation

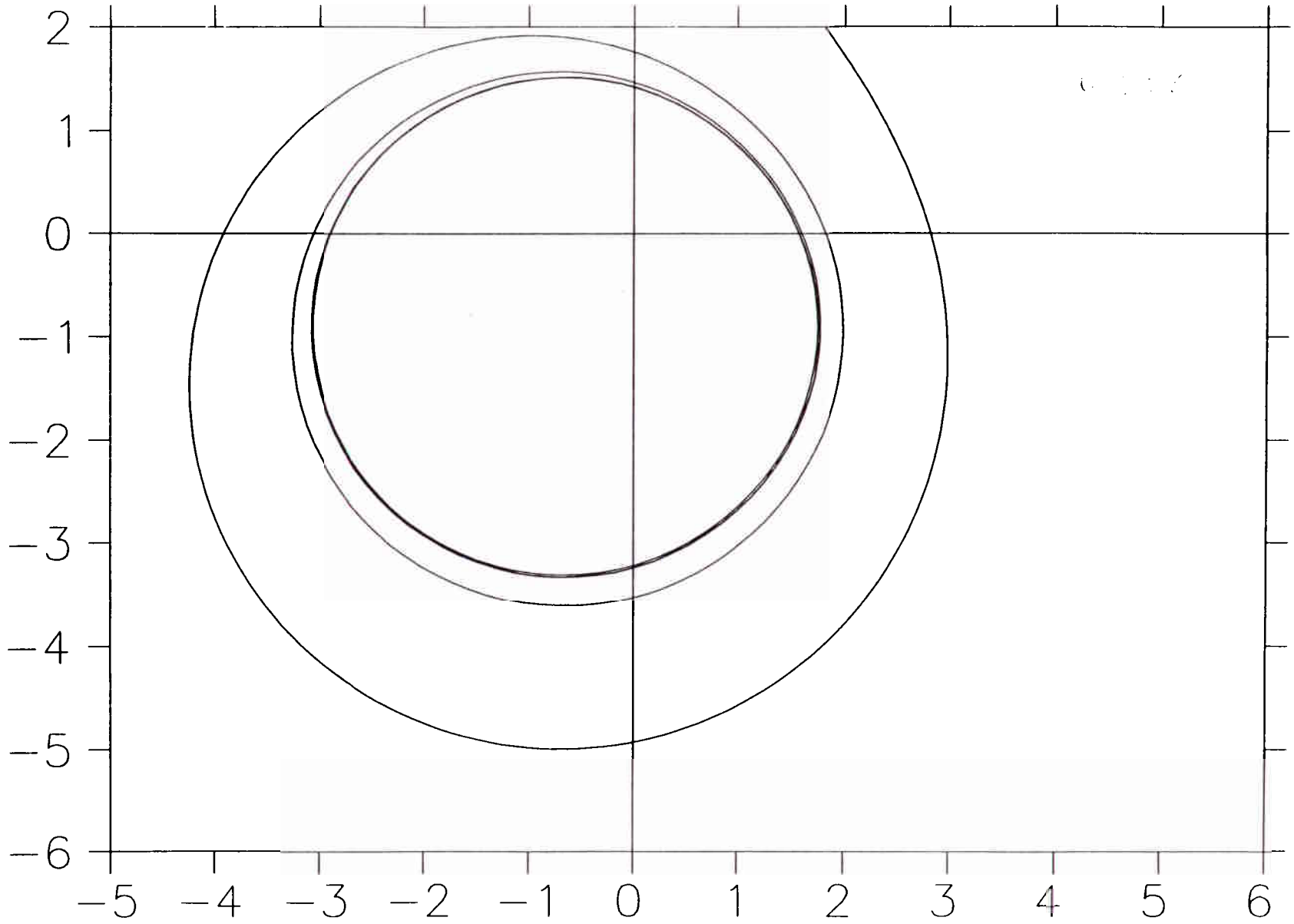
$$q = \frac{v_c}{x_c}$$

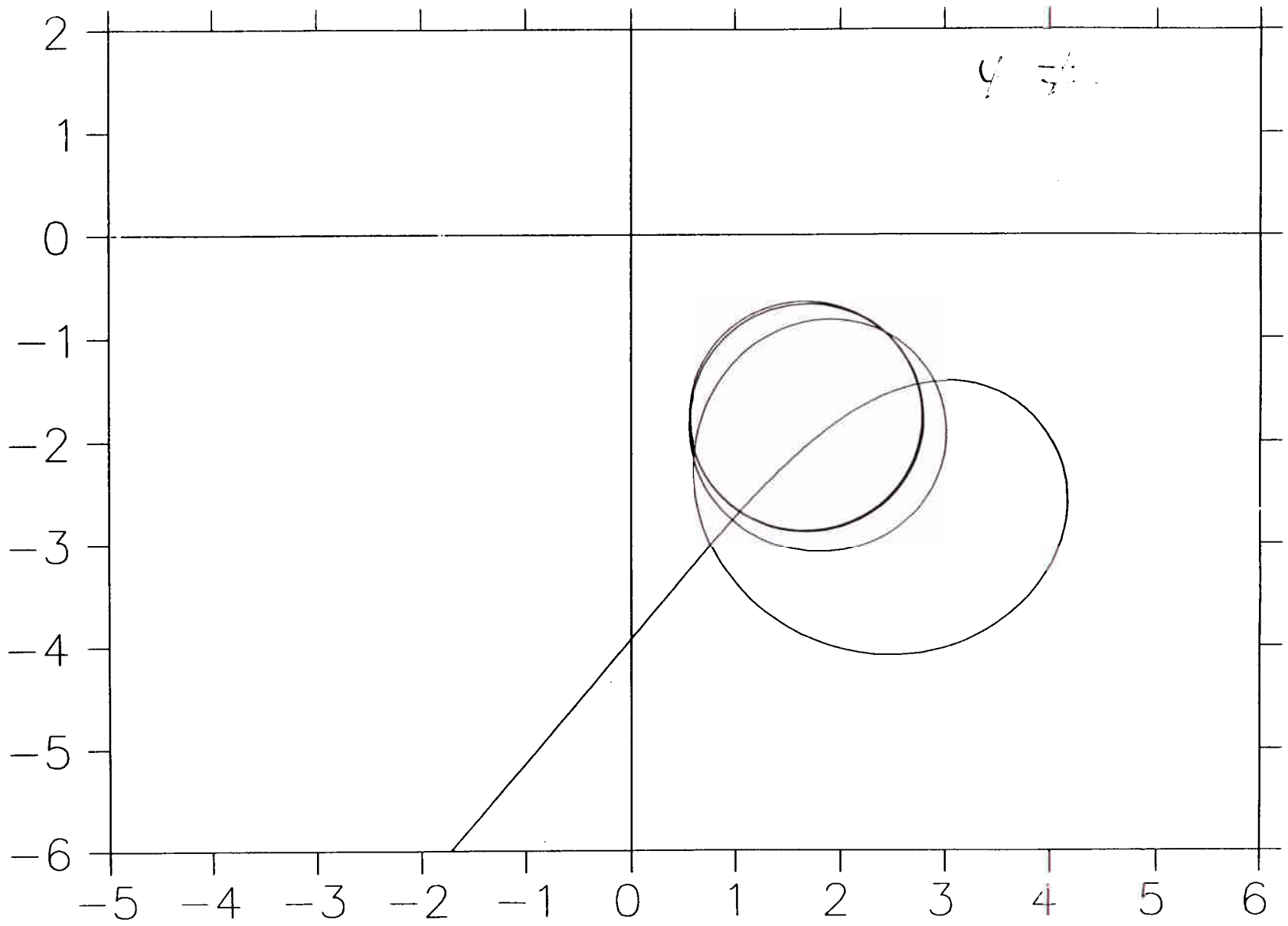
$$x^2 + \frac{v_c^2}{q^2} = x_c^2$$

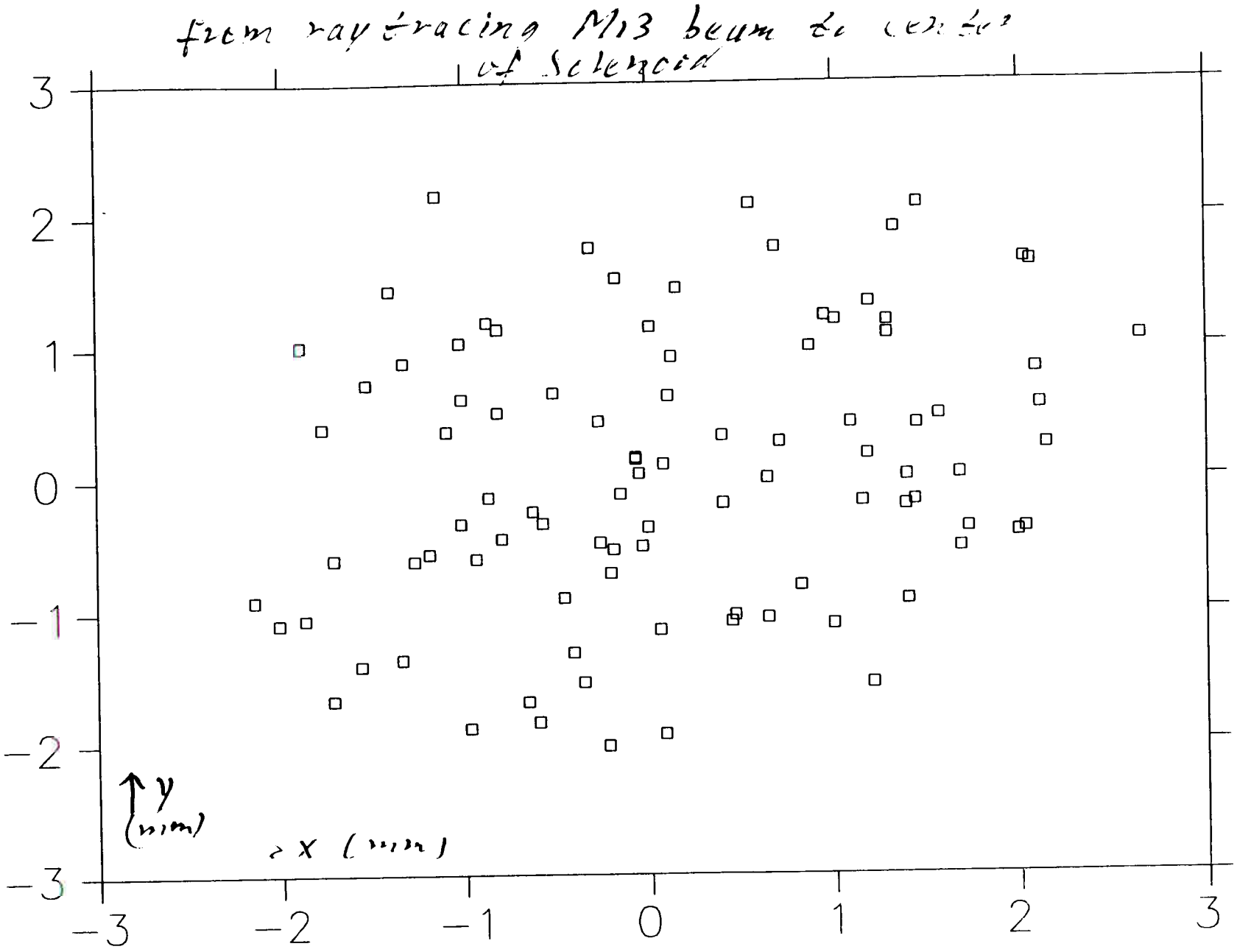
$$\varepsilon = q \cdot x_0 \cdot v_0 = q \cdot x_c^2 = q\left(x^2 + \frac{v_c^2}{q^2}\right)$$

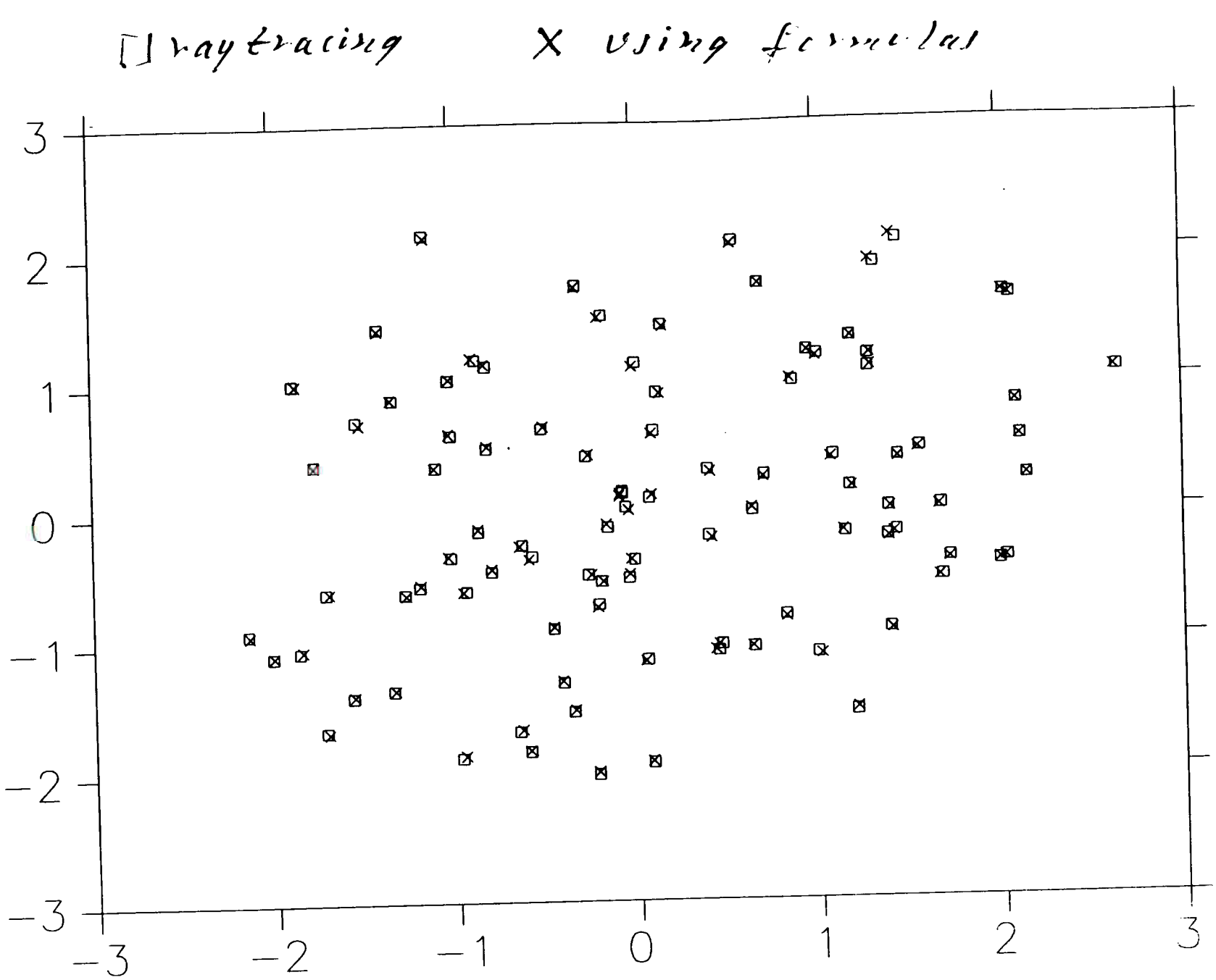
$$x = \sqrt{\frac{1000}{2\pi} \cdot q\left(x^2 + \frac{v_c^2}{q^2}\right)} = \sqrt{\frac{1000}{2\pi} * \varepsilon}$$


5 mm in
16.2 c
mm in
y (mm)
x (mm)
2
1
0
−1
−2
−3
−4
−4
−3
−2
−1
0
1
2
3
4
5
6

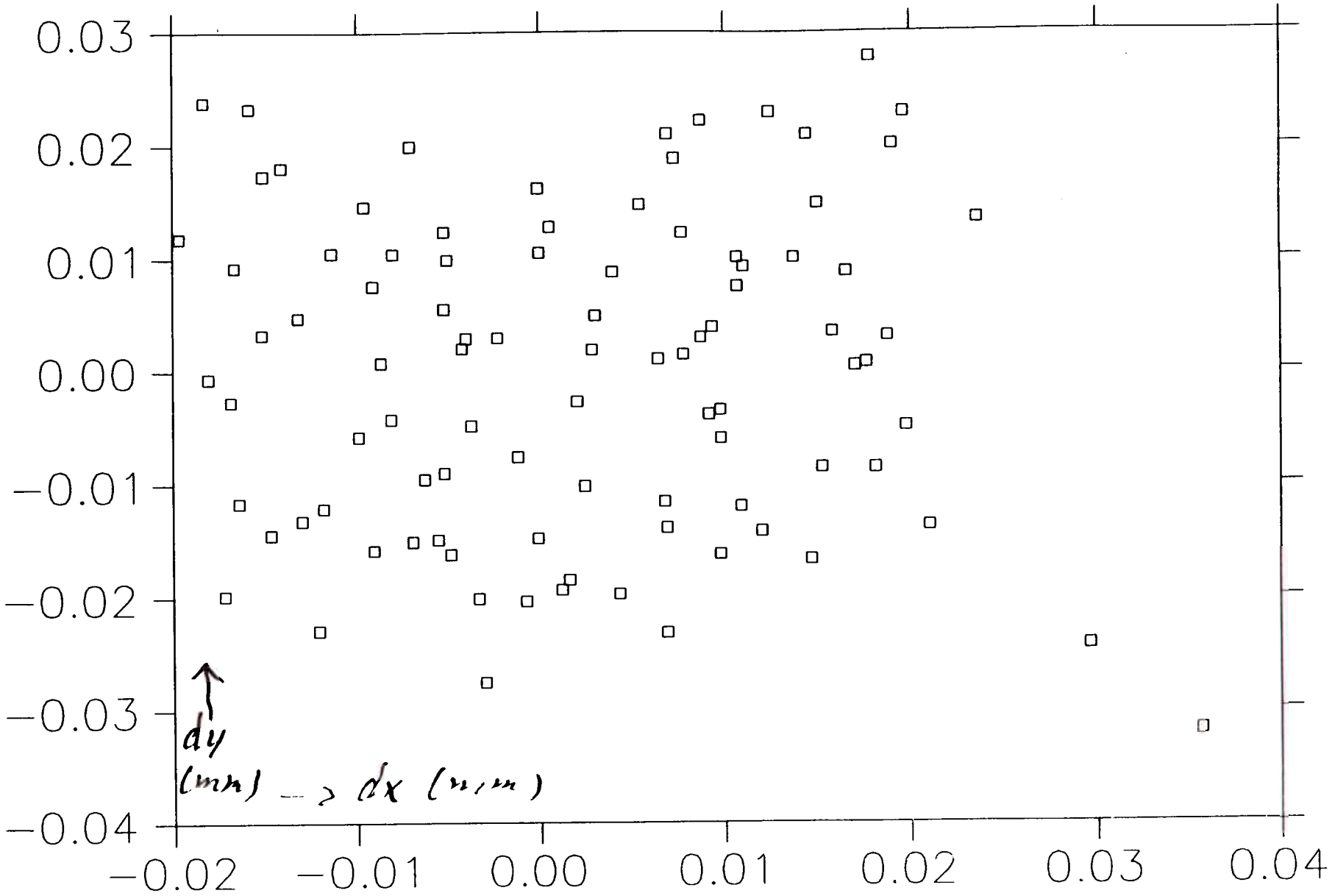

2
1
0
−1
−2
−3
−4
−5
−6
−5
−4
−3
−2
−1
0
1
2
3
4
5
6


2
1
0
−1
−2
−3
−4
−5
−6
−5
−4
−3
−2
−1
0
1
2
3
4
5
6


from ray tracing M13 beam to center of Sclerocid
3
2
1
0
−1
−2
−3
−3
−2
−1
0
1
2
3
y (mm)
x (mm)

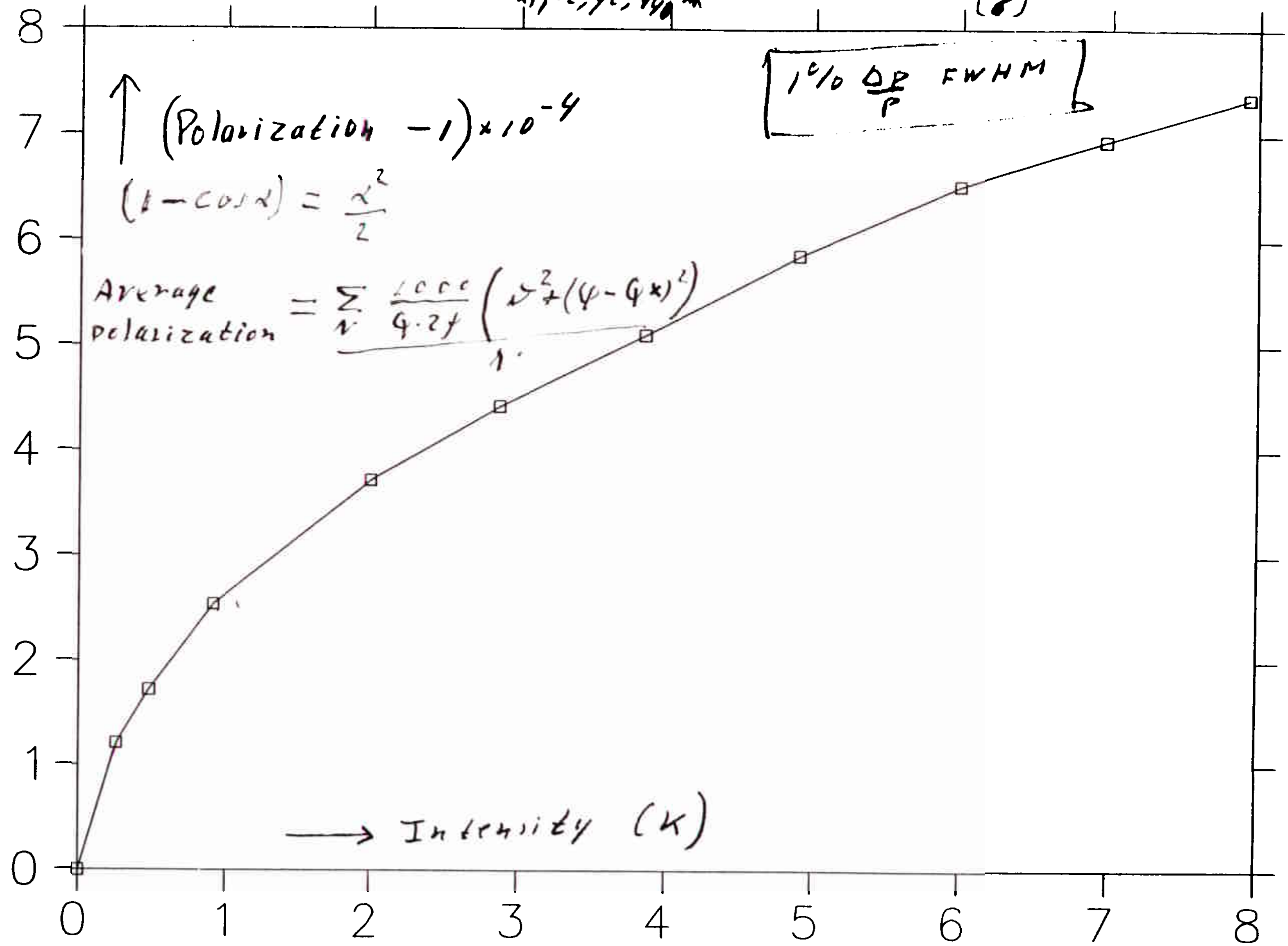

[] raytracing
X using formulas
3
2
1
0
−1
−2
−3
−3
−2
−1
0
1
2
3

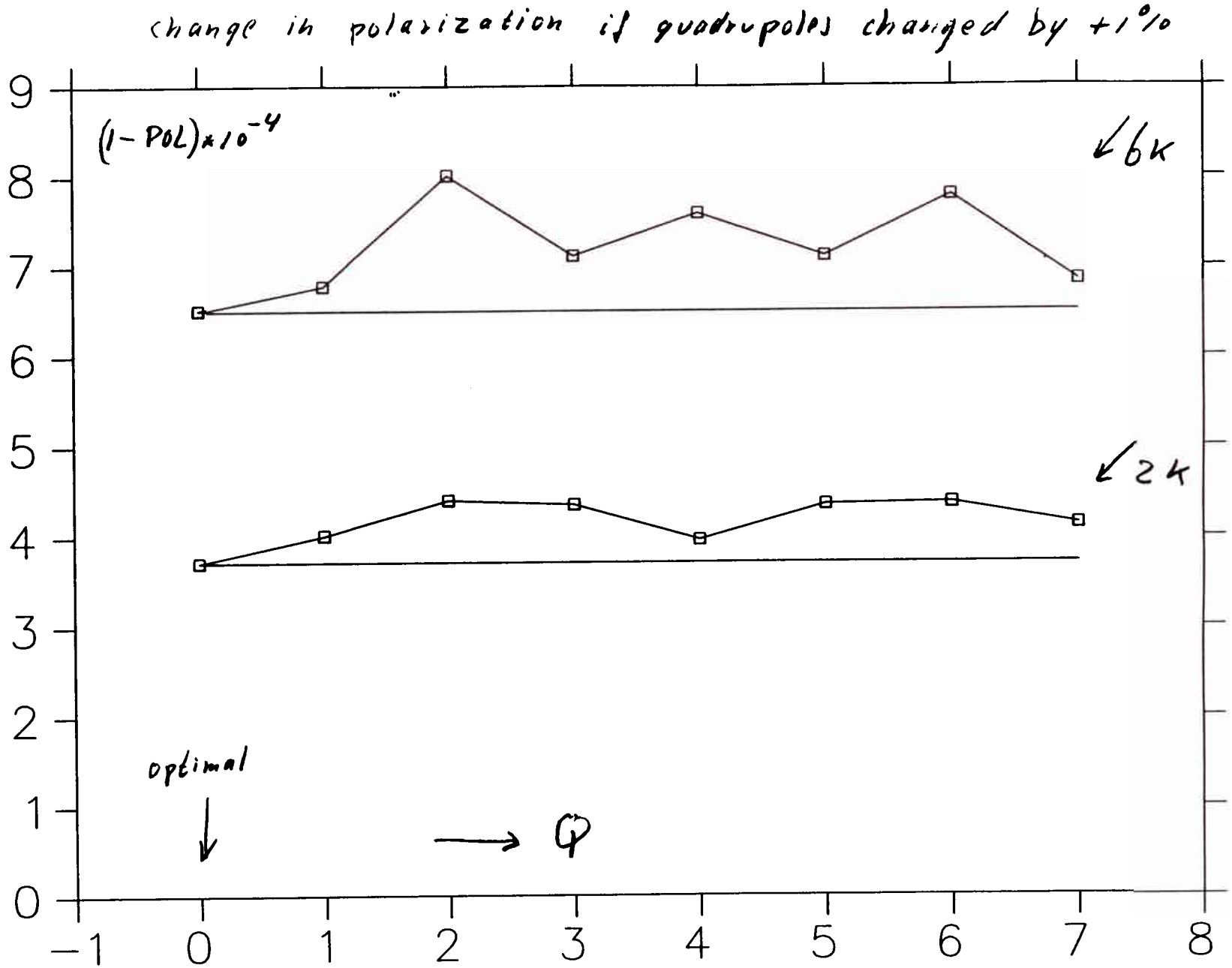
difference between raytracing and formula



gilg8longzer.map

leave x_3 at ±6 mm (1% Δp/p FWHM)
select slitsettings for 6K (5 mm × 16 mm, 3 mm ... at position ...)
and then close by $\sqrt{\sqrt{I/6}}$ or $(I/6)^{1/4}$ to vary intensities
x_1, x_2, y_1, y_4




change in polarization if quadrupoles changed by +1%
(1-POL)*10^-4
6K
24
optimal
Q
9
8
7
6
5
4
3
2
1
0
-1
0
1
2
3
4
5
6
7
8