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SEC Efficiency vs Integrated Beam Intensity

I. H. Chiang

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Collider Accelerator Department

Brookhaven National Laboratory

U.S. Department of Energy

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AGS Complex Machine Studies (AGS Studies Report No. 346) SEC Efficiency vs. Integrated Beam Intensity
Study Period: March 1 - June 15, 1996
Participants: I.H. Chiang
Reported by: I.H. Chiang
Machine: External Beam Line C
Beam: C Line
Tools: C-SEC
Aim: Study of SEC stability

1. Introduction: It was known that the SEC efficiency deteriorated through time. It was believed that it is proportional to number of proton pass through the same area of the SEC foil. The report by Yamin and Repeta (1) indicated that 10**18 protons could change the efficiency by 1%. Since AGS intensity is now reaching 6x10**14 .Proton per pulse, the SEC efficiency question need to be revisited.

2. Method: A X-Y table was design by A. Pendzick. The table and new SEC was installed in the C line just upstream of the CP3. it is about 3 ft from the C target. The drive is remotely controlled by AGS collimator controller unit. The readout is calibrated by T. Tallerico to be 2.4 volts per inch. The study is to monitor the change in SEC counts Vs total intensity on target. The method is by moving the SEC and compare the efficiency of fresh area and that of the "operating position". The C 90 degree telescope was used to normalized the intensity variation. Fig 1 shows the initial scan and the efficiency is quite flat.

3. Observation : The total beam on target is more than 2x10**19 protons . It is clear from the figure that the efficiency seems to reduce proportional to the integrated intensity until around 5x10**18 integrated protons. Fig. 3 shows the 5 pulses SEC, 90 degree tel and the SEC/tel ratio. The SEC efficiency is shown to be reduced by 10%. It is then flatten off after day 64 (fig 2.). The beam size is estimated to be .5x.7 cm (FWHM) (fig 4 and 5).. Since targeting position did change during the run, the beam area estimate should be consider very rough. Using the FWHM estimate of the beam area is 0.3 cm**2 . The proton / cm**2 on the SEC is then estimate to be 6x10**19/ cm**2. It is interested to note that the efficiency near the beam area is higher than that of the edge by about 5 %. The quoted efficiency is the average of outer area. This could be interpreted as that the efficiency increase by small number of beam and then reduce after much larger of beam pass through the area.

fig 1. Initial Scan of SEC. SEC counts vs. position
fig 2. Intensity and Efficiency loss Vs day of running
fig 3. Day 58 scan, SEC, Tel and SEC/TEL Vs horizontal position
fig 4. Fine scan of X at day 102
fig 5. Fine scan of Y at day 102.
Table numerical value of fig 4. and 5.

ref 1. Test of a new secondary emission chamber at the AGS. Peter Yamin and Louis Repeta. IEEE. Transactions of Nuclear science, Vol. NS-26. No. 3. p. 3415 June 1979.

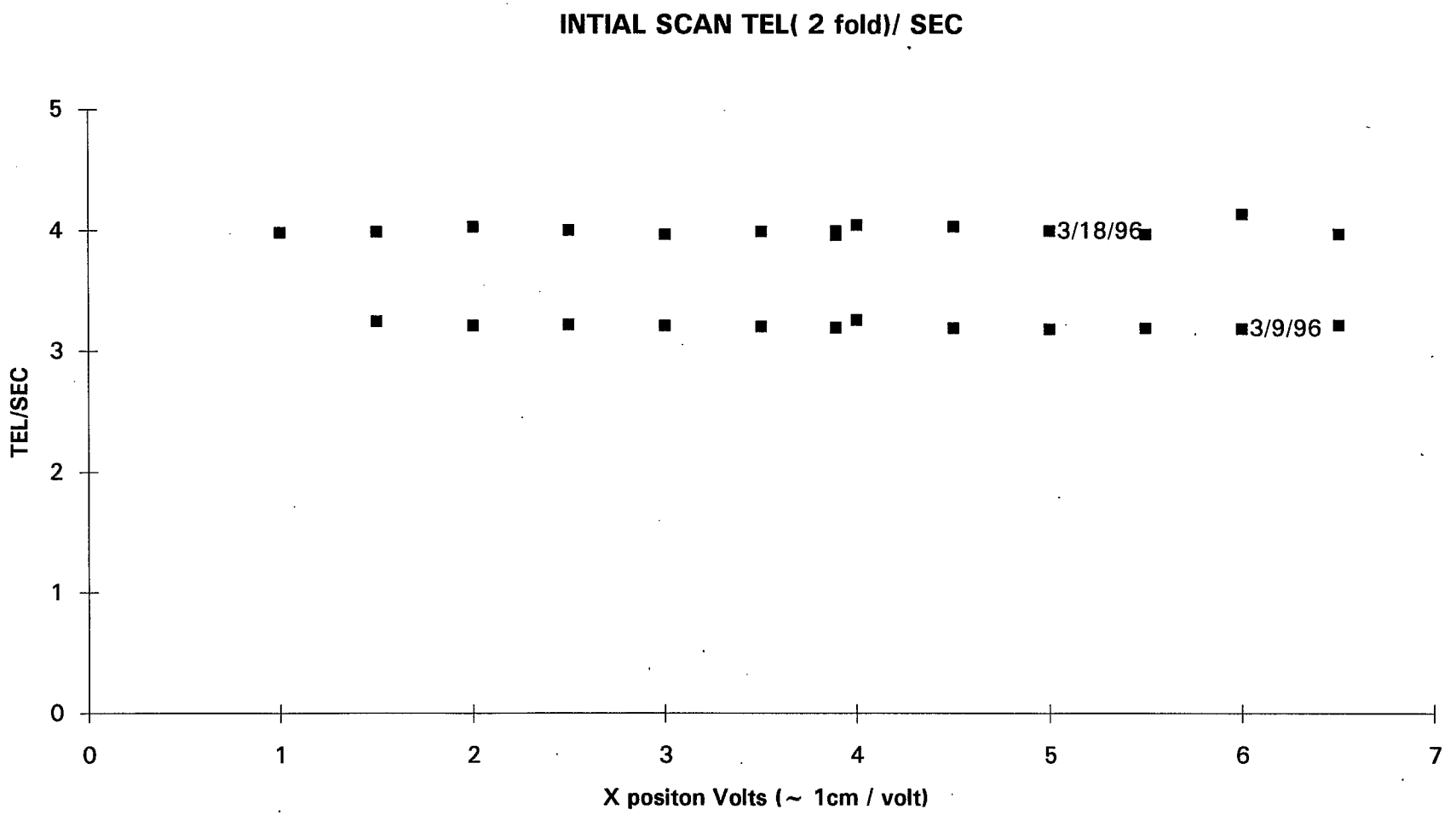
INTIAL SCAN TEL(2 fold)/ SEC
TEL/SEC
X positon Volts (~ 1cm / volt)
3/18/96
3/9/96
0
1
2
3
4
5
6
7

Fig 1.

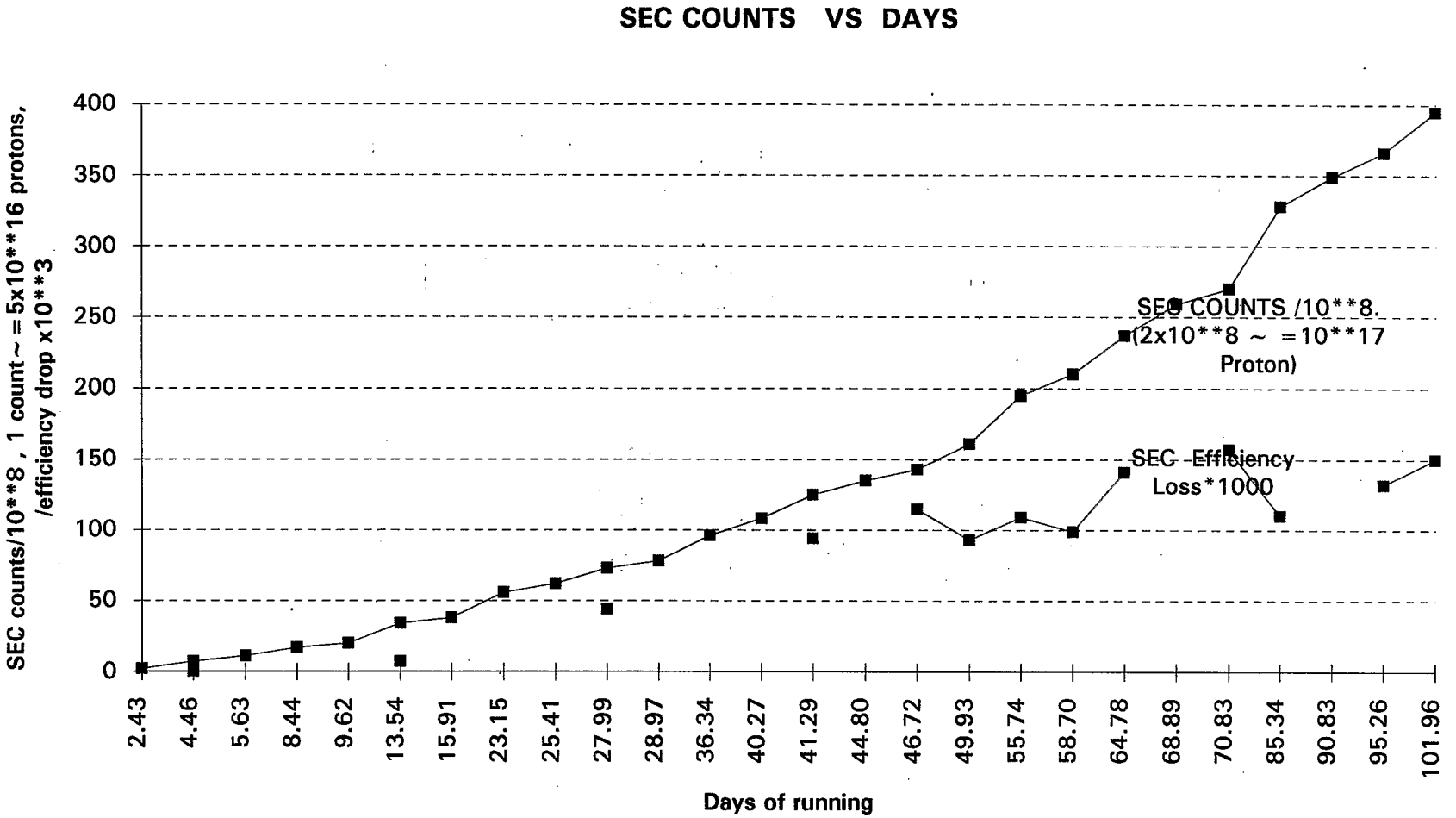
SEC COUNTS VS DAYS
SEC counts/10**8 , 1 count ~ =5x10**16 protons, /efficiency drop x10**3
400
350
300
250
200
150
100
50
0
2.43
4.46
5.63
8.44
9.62
13.54
15.91
23.15
25.41
27.99
28.97
36.34
40.27
41.29
44.80
46.72
49.93
55.74
58.70
64.78
68.89
70.83
85.34
90.83
95.26
101.96
Days of running
SEC COUNTS /10**8.
(2x10**8 ~ =10**17
Proton)
SEC Efficiency
Loss*1000

Fig. 2

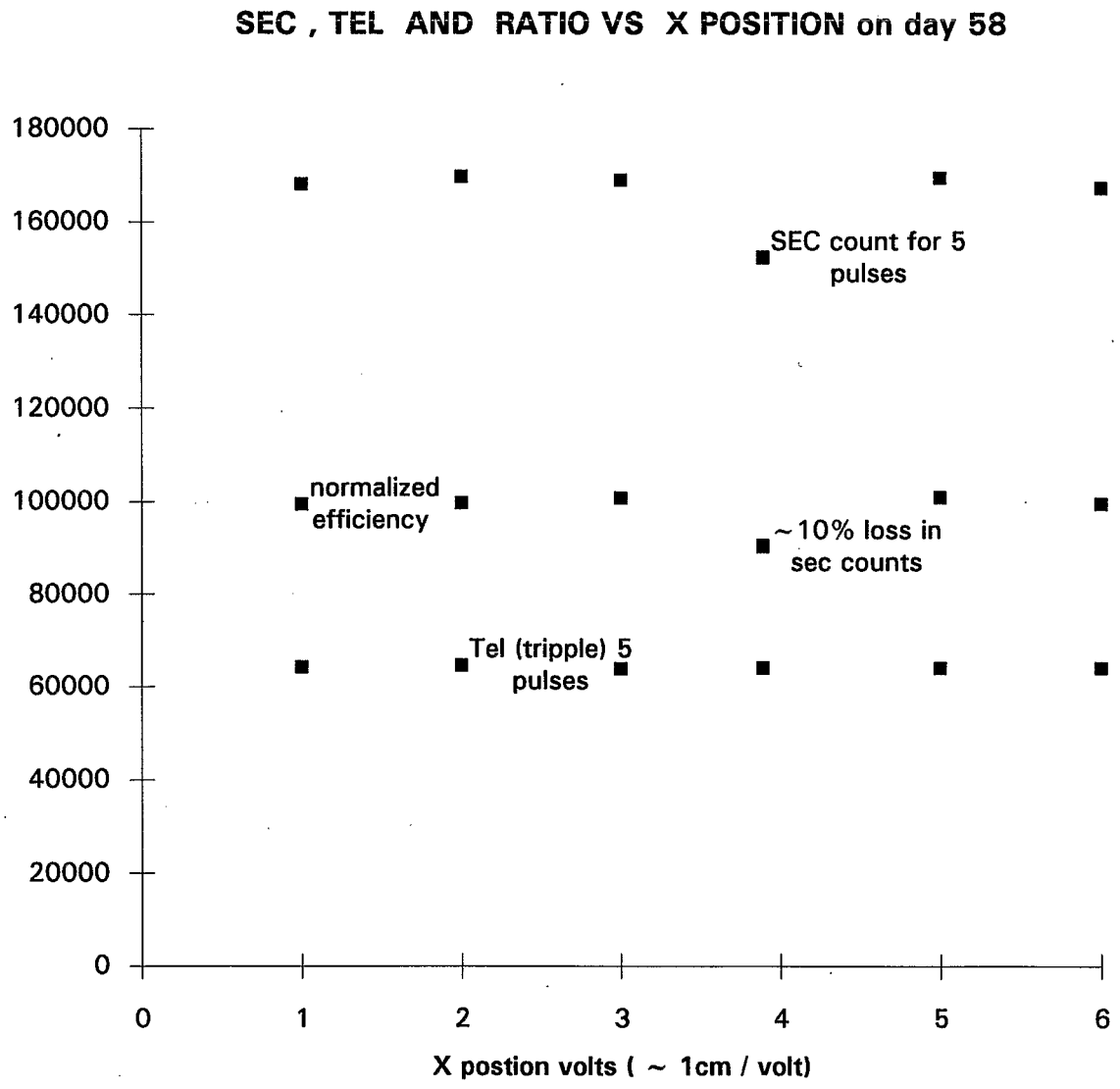
SEC , TEL AND RATIO VS X POSITION on day 58
180000
160000
140000
120000
100000
80000
60000
40000
20000
0
0
1
2
3
4
5
6
SEC count for 5 pulses
normalized efficiency
~10% loss in sec counts
Tel (tripple) 5 pulses
X postion volts (~ 1cm / volt)

Fig. 3

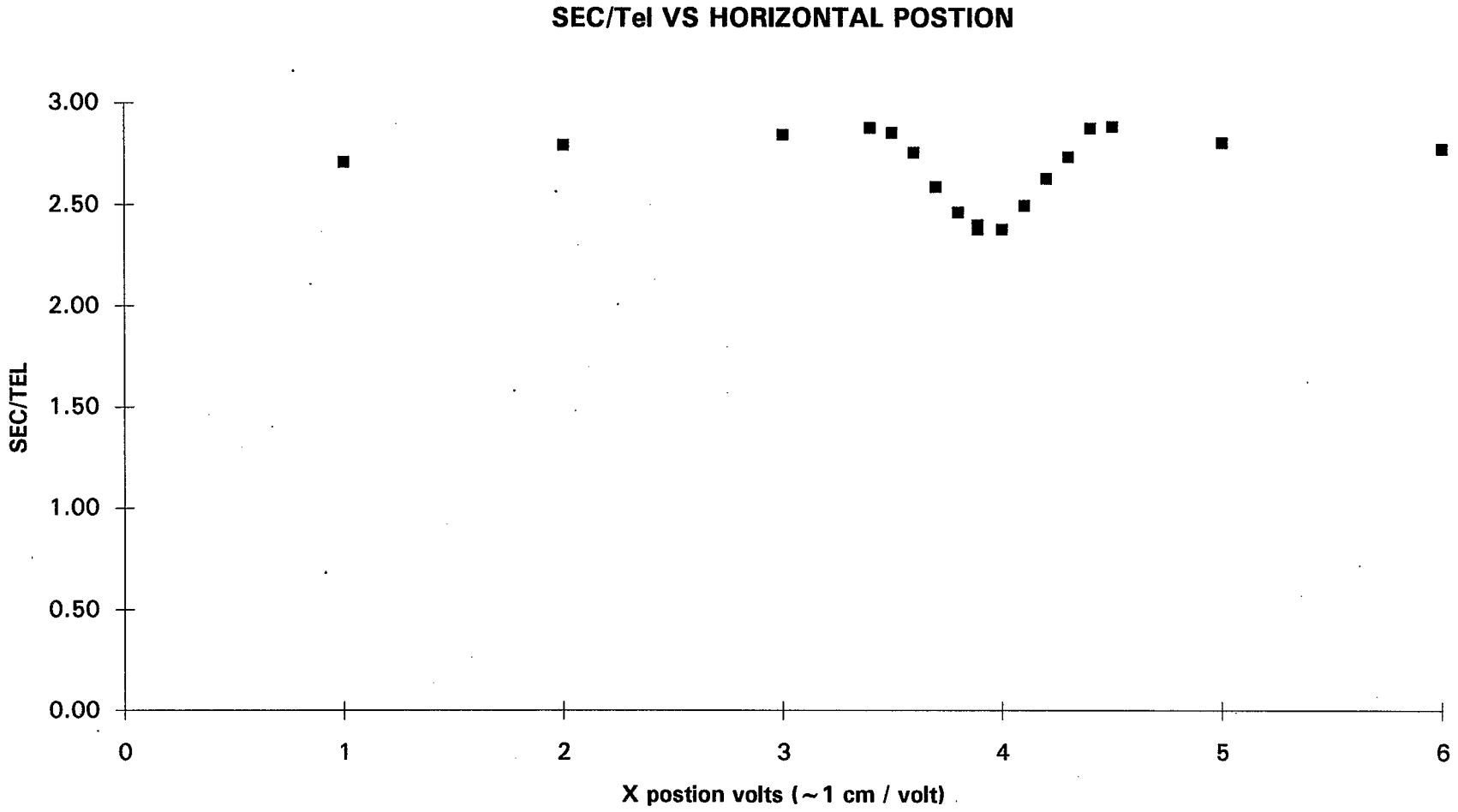
SEC/Tel VS HORIZONTAL POSTION
3.00
2.50
2.00
1.50
1.00
0.50
0.00
SEC/TEL
0
1
2
3
4
5
6
X postion volts (~1 cm / volt)

Fig. 4

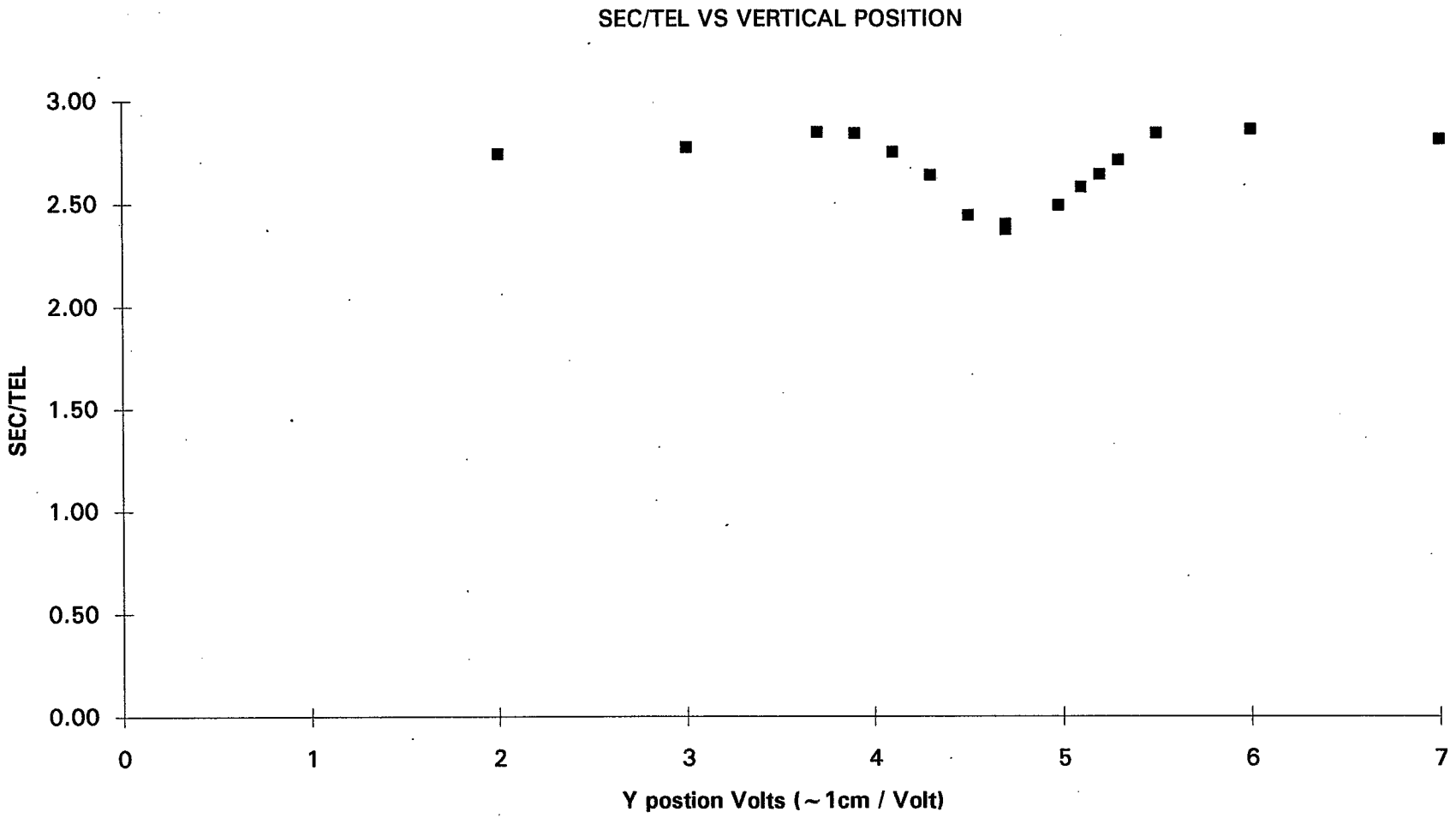
SEC/TEL VS VERTICAL POSITION
3.00
2.50
2.00
1.50
1.00
0.50
0.00
SEC/TEL
0
1
2
3
4
5
6
7
Y postion Volts (~1cm / Volt)

Fig. 5

SEC_96.XLS

6/6/96	horizontal and vertical sweep				
V	H	Tel	SEC	SEC/TEL	2.38
4.7	3.89	51808	123106	2.38	0.998402
	4	51010	121169	2.38	0.998066
	4.1	51133	127382	2.49	1.046718
	4.2	51336	134775	2.63	1.103089
	4.3	52790	144138	2.73	1.147228
	4.4	52589	150991	2.87	1.206366
	4.5	52650	151664	2.88	1.210339
	5	52923	148323	2.80	1.177571
	6	53629	148622	2.77	1.164411
	3.8	52196	128370	2.46	1.033355
	3.7	53169	137402	2.58	1.085819
	3.6	53155	146380	2.75	1.157073
	3.5	52209	148869	2.85	1.198069
	3.4	51505	148122	2.88	1.208351
	3	53061	150668	2.84	1.193077
	2	55349	154501	2.79	1.172856
	1	55509	150244	2.71	1.137252
4.7	3.89	55435	132856	2.40	1.006978
4.98	3.89	57775	143811	2.49	1.045864
5.3		57838	156625	2.71	1.137813
5.5		57125	162241	2.84	1.193321
6		57354	163887	2.86	1.200615
7		57076	160310	2.81	1.180131
5.2		56933	150209	2.64	1.108549
5.1		53505	137845	2.58	1.08248
4.5		57072	139225	2.44	1.024984
4.3		56200	148134	2.64	1.107494
4.1		57193	157113	2.75	1.15423
3.9		55799	158451	2.84	1.193141
3.7		55621	158143	2.84	1.194632
3		57350	159009	2.77	1.164961
2		56846	155814	2.74	1.151674
4.7	3.89	57981	137370	2.37	0.995472