ISR-OP/DN/1s

22nd June, 1971

ISR RUNNING-IN

Notes on Physics Runs 64, 66, and 72

a. Runs 64, 66. Beam adjustment

Two changes were introduced in the setting-up of the beams for physics experiments. One consists of using a globally corrected vertical orbit which reduces both angle and position errors of the beam with respect to the horizontal median plane. The other is an improvement of the signal to noise ratio in luminosity measurement by a parallel displacement of the two beams which keeps the beam-beam interaction rate constant while reducing the background.

The initial orbits are plotted on the upper part of Figures 1 and 2.

The initial and final positions of the vertical closed orbits, z and $z + \Delta z$ respectively are compared in Table 1. It can be seen that the initial settings are near the median plane and that the pick-up electrode measurements are confirmed by the final displacements in I-2, I-5, and I-6. At the other crossing points, I-1 and I-4, this agreement does not exist.

b. Beam conditions

Run 64, 22 GeV, 20 bunches

Ring 1 : FS 22, beam ~3 A, stacked at bottom out to + 32 mm. Scraping ; (about 1 % beam loss per operation) inner (- 10.3), outer (+ 44.6) and vertical with dump (- 6.5).

Ring 2 : beam ~2.3 A, stacked at the top, out to + 27 mm. Scraped as above; inner (- 2), outer (+ 54.7), vertical (+ 6.39).

Run 66, 22 GeV, 4 bunches

Ring 1 : CL 22, beam ~1 A, stacked at bottom out to + 35 mm. Scraped with beam probes.

Ring 2 : CL 22, beam ~1 A, stacked at bottom out to + 30 mm. Scraped with beam probes.

Run 72, 26 GeV, 20 bunches

Ring 1 : FS 26', beam ~2 A, stacked at bottom out to + 27 mm. Scraped only at inside and vertical.

Ring 2 : Same

c. Observations

Run 64, 64'

The beam were optimized in I-6, I-5, I-4, I-1 and a luminosity curve was measured for I-2.

The background during these operations was noted to be high.

Towards the end of these adjustments sudden beam losses occurred every few minutes in Ring 1. The current stepped down in the course of about 15 minutes, as follows : ~3.2 A, 2.4 A, 1.4 A, 0.8 A, 0.5 A, 0.3 A, 0.18 A, 0.10 A, 0.063 A and 0.036 A. The remaining 36 mA were dumped and a new stack was made under the same conditions but with the final current not exceeding 3 A.

No proper explanations were found for the phenomena observed. The SB reported (Bonaudi) that automatic tap changing (300 Volts on 18 kV) on a primary transformer feeding the power supply for the main magnet was operating from time to time. This was thought to be a possible explanation because the active filter of the power supply was switched off. However, the active filter of the power supply for Ring 2 was found afterwards to be switched off as well (accidentally) while this effect was not observed on beam 2. Also, a close examination of the SB voltage recordings showed no consistent correlation with beam losses.

The new beam in Ring 1 survived overnight. The initial decay rate (23.30 hr at 2.86 A) was 10^{-4}/min but became gradually worse.

Very small sudden losses were observed again later during the night and 2 large ones occurred at the end of the run, (05.56 hr, 1.8 A → 0.625 A ; 06.10 hr, 0.619 A → 0.407 A). Earlier losses were caused by 1 PFF 7 which went from OK to faulty.

The beam in Ring 2 remained fairly stable with a decay rate of 1 to $2 \cdot 10^{-4}$/min.

Run 66, 66'

The stack in Ring 1 at 23.00 hr was 979.2 mA with a decay rate of $6 \cdot 10^{-5}$/min and in Ring 2 996.7 mA with a rate of $3 \cdot 10^{-5}$/min.

The luminosity and background curves for I-5 taken before 23.00 hr are shown in Fig. 3. Curves were also taken for I-1 and I-6 but these are not very conclusive.

The beam decay rate remained constant until 04.43 hr when the clearing voltage dropped out in Ring 1 and, I believe, for a short time in Ring 2. There were losses in Ring 2 but the stable decay rate recovered after about 1 hour. The decay rate in Ring 1 became 100 times worse.

The beam probe scan results in Ring 2 are :

	inner	outer	lower	upper	i
23.00 hr	- 22.4	+ 52.4	- 14.1	+ 15.9	0.997 A
09.15 hr	- 22.2	+ 63.3	- 17.4	+ 19.2	0.985 A

Run 72, 72'

Stacks of about 2 A were made out to only + 27 mm and therefore we did not scrape the outside of the stack.

Small sudden losses of about 10 to 20 mA occurred again in Ring 1 every few minutes as observed during Run 64'. The experimenters complained about background in both rings (being often > 10 higher than usual).

After consideration we moved the stack in Ring 1 towards the inside by about 8 mm.

This stopped the losses and the beam was left. Ring 2 gradually became more stable. Time was lost also due to problems with computerised bump control. A luminosity curve could be made only for I-2. Intersections I-1, I-4 and I-5 were optimised as well as possible.

At 23.00 hr we had the following conditions :

Ring 1 : 1.762 A $1.7 \cdot 10^{-4}$/min

Ring 2 : 1.993 A $7.4 \cdot 10^{-5}$/min

During the night beam 1 remained stable, the decay rate of Ring 2 increased to $4 \cdot 10^{-4}$/min.

Relatively small beam losses were caused in both rings due to standby auxiliary supplies which changed status for some obscure reason : OK → fault, OK → local.

Current changes in the septum magnet in I-2 also caused current losses in Ring 2, (at 00.15 hr → 69 mA).

Luminosity measurements were made in the morning, before dumping, in I-5 and I-6.

B. Autin
F. Bonaudi (64,66)
D. Neet
N. Siegel (72)

Distribution

ISR Group Leaders
Running In Committee
Engineers in Charge
E. Brouzet MPS
M. Höfert HP
Members of experimental teams
in ISR

TABLE I

Intersection	Pick-up electrode	z(mm)	Δz(mm) Run 64	Run 66
I-1	865	- 1.6		
	crossing point(c.p.)		0	- 0.5
	105	4.7		
	860	1.4		
	c.p.		0	- 1.5
	104	- 0.8		
I-2	161	0.5		
	c.p.		- 0.5	- 0.5
	205	- 1.0		
	164	- 1.1		
	c.p.		0.5	0.5
	204	- 1.7		
I-4	361	- 1.2		
	c.p.		-	- 0.5
	405	- 0.2		
	364	- 0.9		
	c.p.		-	0.5
	404	- 0.4		
I-5	465	2.7		
	c.p.		- 0.5	1
	505	-		
	460	- 1.9		
	c.p.		+ 1.5	3
	504	- 0.3		
I-6	561	- 1.0		
	c.p.		0	0
	605	0.2		
	564	0.3		
	c.p.		0	0
	604	- 1.2		

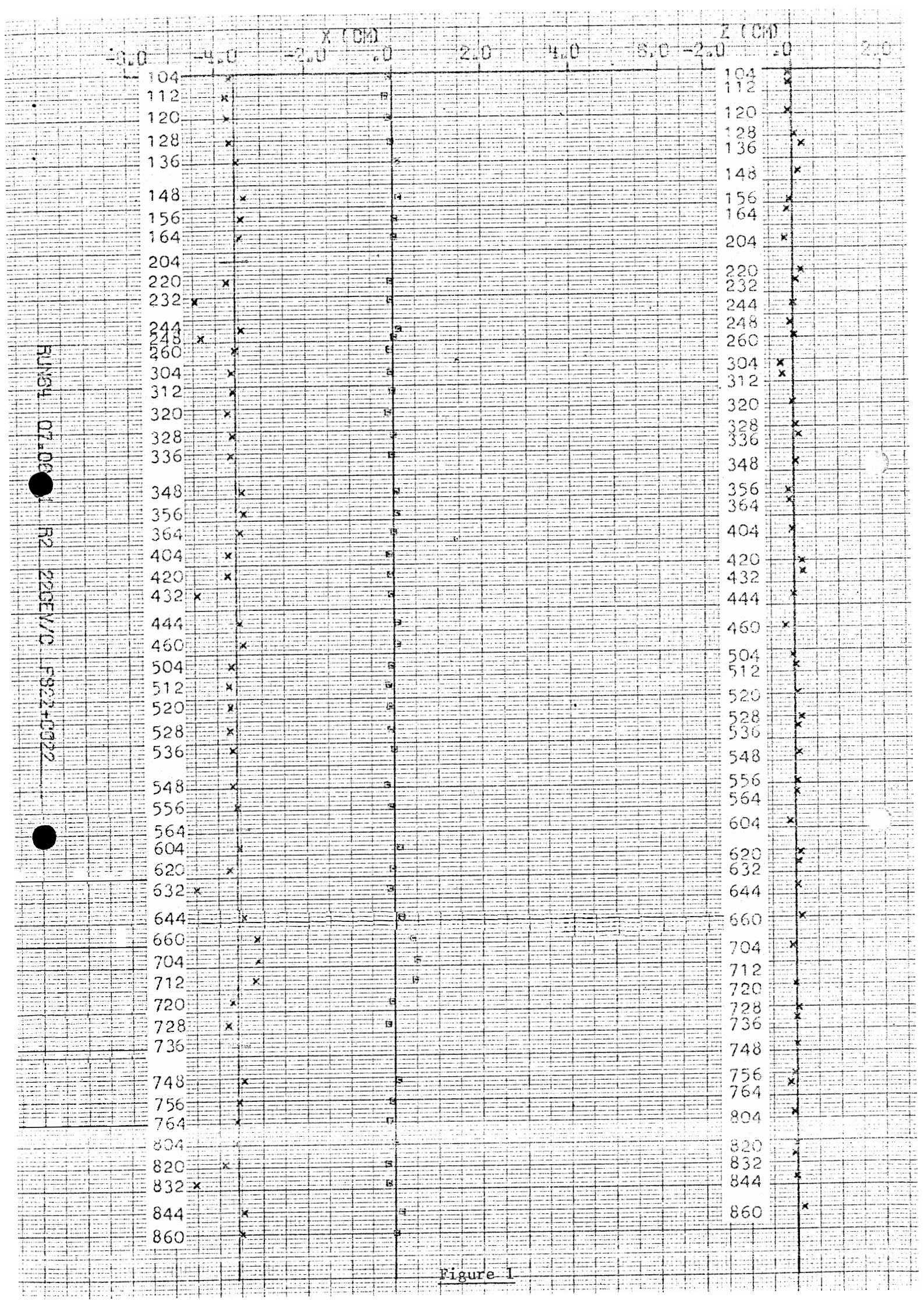

Figure 1

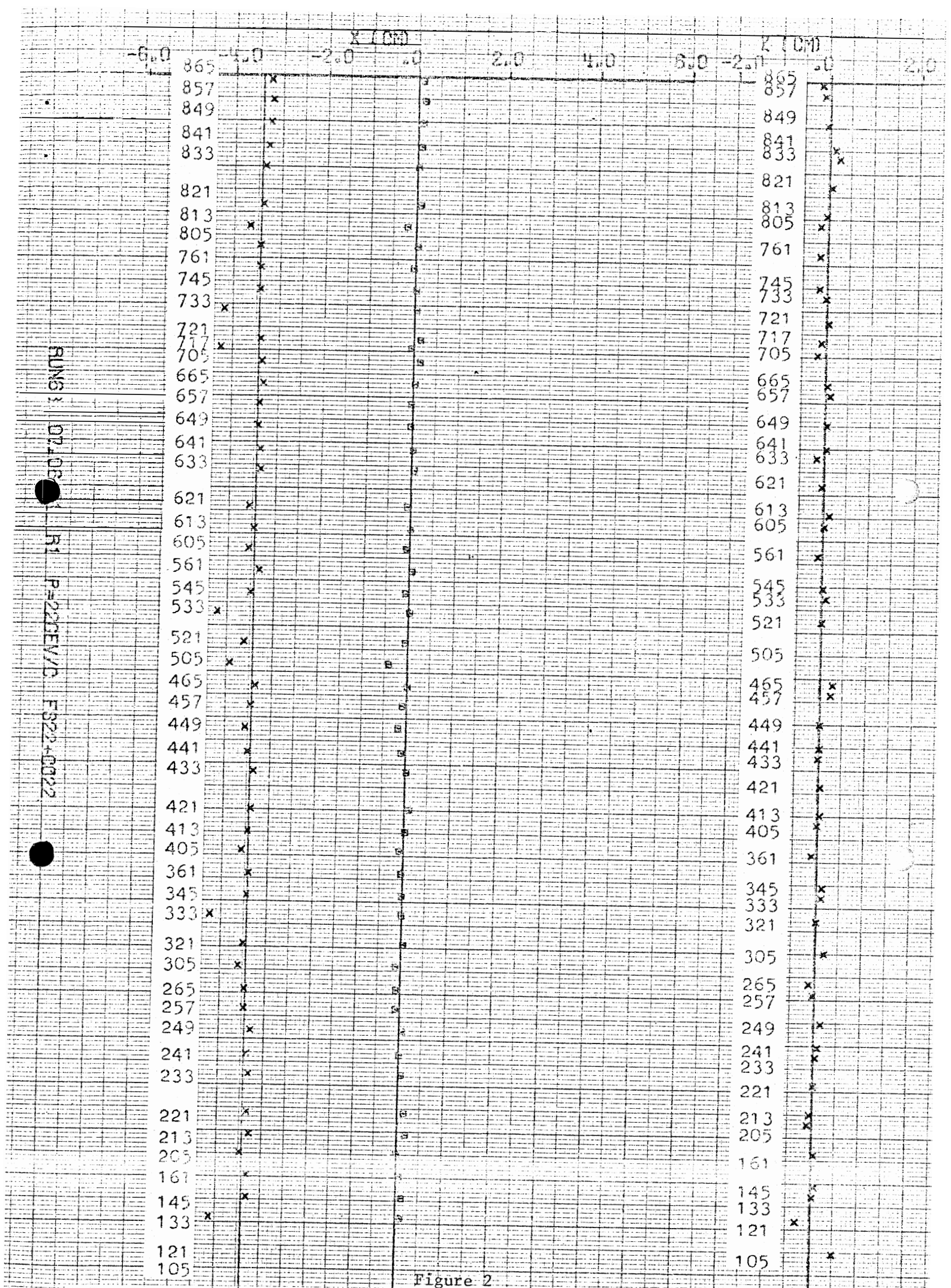

Figure 2

Run 63, 7.6.1971, R1, P' = 22 GeV/c, FS22 + C022

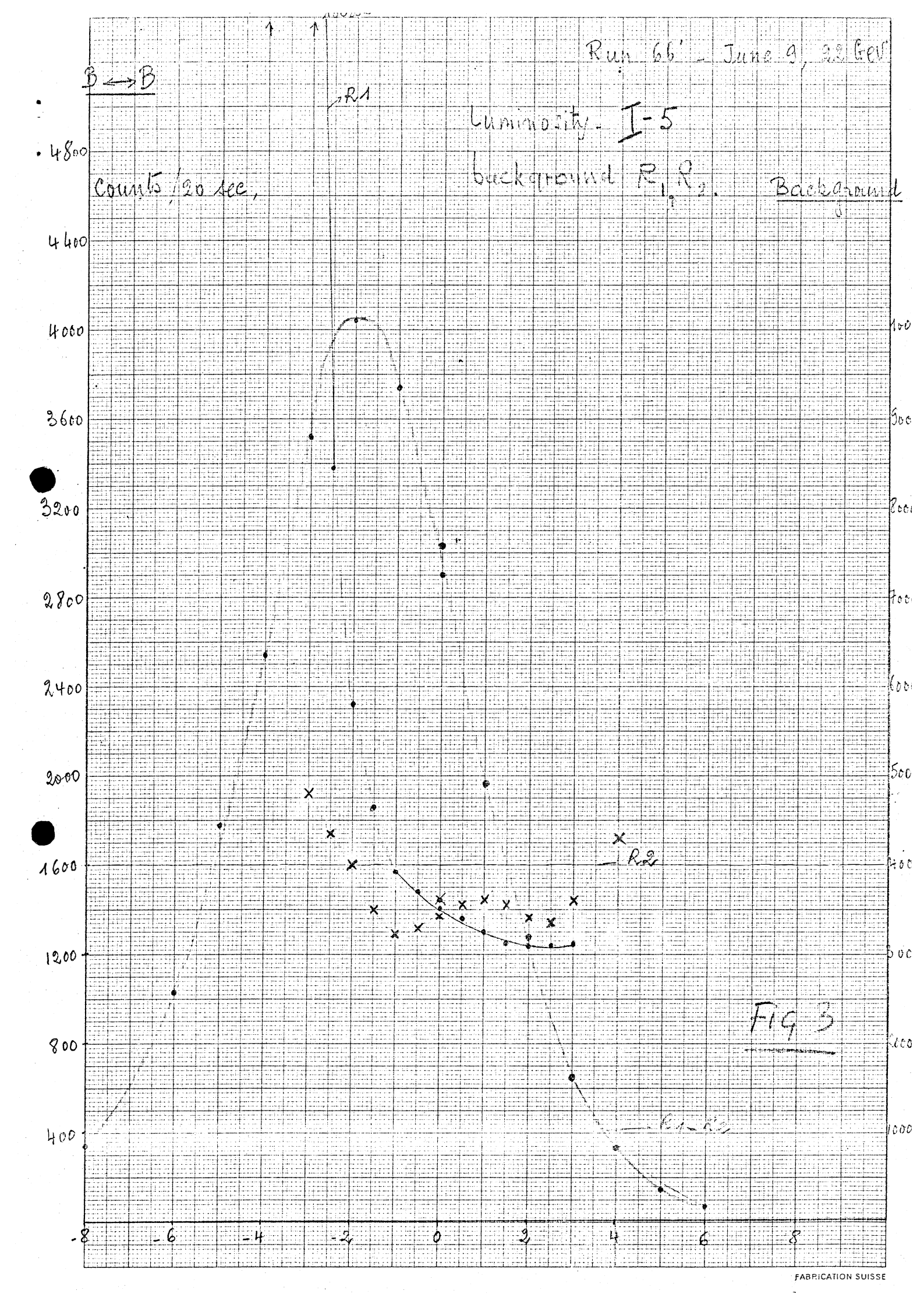

FIG 3