Wosley

ISR-BT/BdeR/EEK 14th January, 1971

ISR RUNNING-IN

Run 9 - 11th January, 18.00 h - 20.00 h
Run 11 - 13th January, 12.00 h - 14.30 h

The first two hours of run 9 were used to check the beam positions along the transfer line TT2 and to set up injection into Ring 1. The central field value of the ISR was B_o = 15.343 GeV/c, as in the November runs. With the same settings of the beam transfer magnets as last November, the beam positions were everywhere the same within a few millimeters. The average beam position for B_o = 15.343 GeV/c was measured by Hansen during run 10 with 20 bunches and was found to be $\langle r \rangle = -33.2$ mm corresponding to an average mid F position $\langle r_F \rangle = -40.0$ mm.

For run 11 we tried to inject onto the nominal injection orbit $\langle r_F \rangle = -44.5$ mm as defined in the ISR parameter list. The magnetic field was set to B_o = 15.372 GeV/c. The beam positions measured by Hansen during the subsequent run 12 were $\langle r \rangle = -37.0$ mm corresponding to $\langle r_F \rangle = -44.6$ mm.

The adjustment of the injection into the ISR amounts essentially to adjusting the horizontal and vertical position and angle of the injection beam such that the coherent betatron oscillations around the injection closed orbit are minimized. Up to now this had been done by looking on a CRT at the video pulses from one of the pick-up stations. It is rather difficult to look at these fast pulses and therefore this method requires a second operator to adjust the magnet currents by typing the desired changes into the computer.

We have now available the envelope of the video pulses as the output signal from the filters in the Q-meter. These signals are displayed on a memoscope directly above the computer keyboard and give a very convenient picture of the status of the injection adjustment. This method of adjusting the injection was tested successfully during run 11. It proved to be much better than looking at the video pulses and the oscilloscope for the signals from the Q-meter filters will therefore be permanently installed above the computer keyboard and used in all future runs for injection adjustment.

With the injection adjusted as well as possible a number of measurements were made with a beam coasting on the injection orbit (4 bunch injection), while moving the inflector or dump.

Figure 1 shows the surviving coasting beam as a function of the horizontal inflector position. The horizontal coordinate is the radial position of the inner edge (at the side of the stack) of the shutter which will be called G. During these measurements the shutter was closed. When the inflector is displaced towards more negative values of G the beam is scraped by the closed shutter. When the inflector is displaced towards more positive values of G, the beam is scraped off on the magnet conductor. On the basis of data from previous runs we had chosen G = - 13.5 mm as the best inflector position for injection. Figure 1 shows that the inflector can be moved about 6 mm to either side of this position, before beam loss occurs. The width of the beam is larger than expected and moreover the beam profile is asymmetrical. On the high energy side the half width is about 13.5 mm and on the low energy side it is about 18 mm. For comparison it can be mentioned that for a generously estimated beam emittance of $2\pi\ 10^{-6}$ m x rad and no injection errors the half width should be about 9 mm. We do not understand the reason for this discrepancy. During the November runs it looked as if the beam in the horizontal plane was not matched to the ISR. During the runs 9 - 12 the SEM monitors in the ring did not yet work properly, due to 50 Hz noise on the cables, so that further study of this problem must wait until future runs.

Figure 2 shows the surviving coasting beam as a function of the vertical inflector position. When injecting we had placed the inflector at z = - 1 mm. From Figure 2 it can be seen that z = - 1.5 mm is actually the best position. From the right hand side of the curve one estimates a half height of slightly less than 4 mm corresponding to a vertical emittance of $1\pi \times 10^{-6}$ m x rad.

Figure 3 was measured to find out how much room there was still available between the beam and the vacuum chamber wall when injecting on the injection orbit corresponding to B_o = 15.372. For this purpose the inflector was withdrawn entirely from the ISR aperture after a single pulse had been injected and the magnetic field increased until the coasting beam started to get scraped off on the vacuum chamber wall. If we disregard the 0.5 mA beam loss occurring after a very small increase in B, and which might be caused by passing through a resonance (?), we see that B can still be increased by about 2 ^{oo}/oo, corresponding to 4.5 mm at mid-F, before beam is scraped on the inner vacuum chamber wall. The measurement was interrupted by vacuum troubles*) and was repeated afterwards only by plotting on a recorder with the automatic scanning facility of the main magnet current (Fig. 4).

Figure 5 shows the surviving coasting beam on the injection orbit as a function of the vertical position of the dump, which has a total vertical aperture of 32 mm. The possible movement of the dump is only ± 10 mm and this is just too little to get much useful information from Fig. 5.

B. de Raad

Distribution

Parameter Committee
Running-In Committee
Engineers in Charge
Scientific Staff BT Group
E. Brouzet (MPS)

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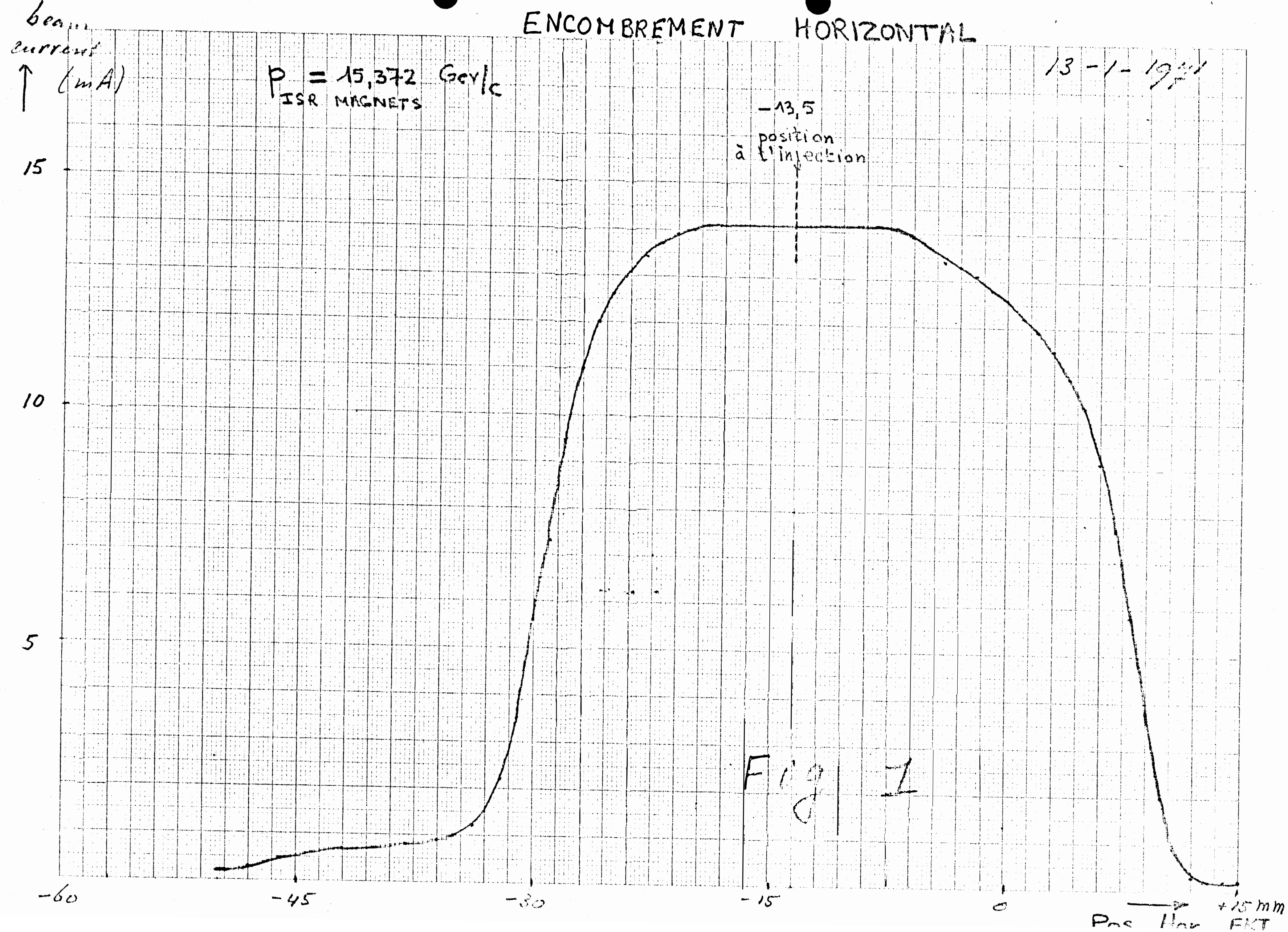
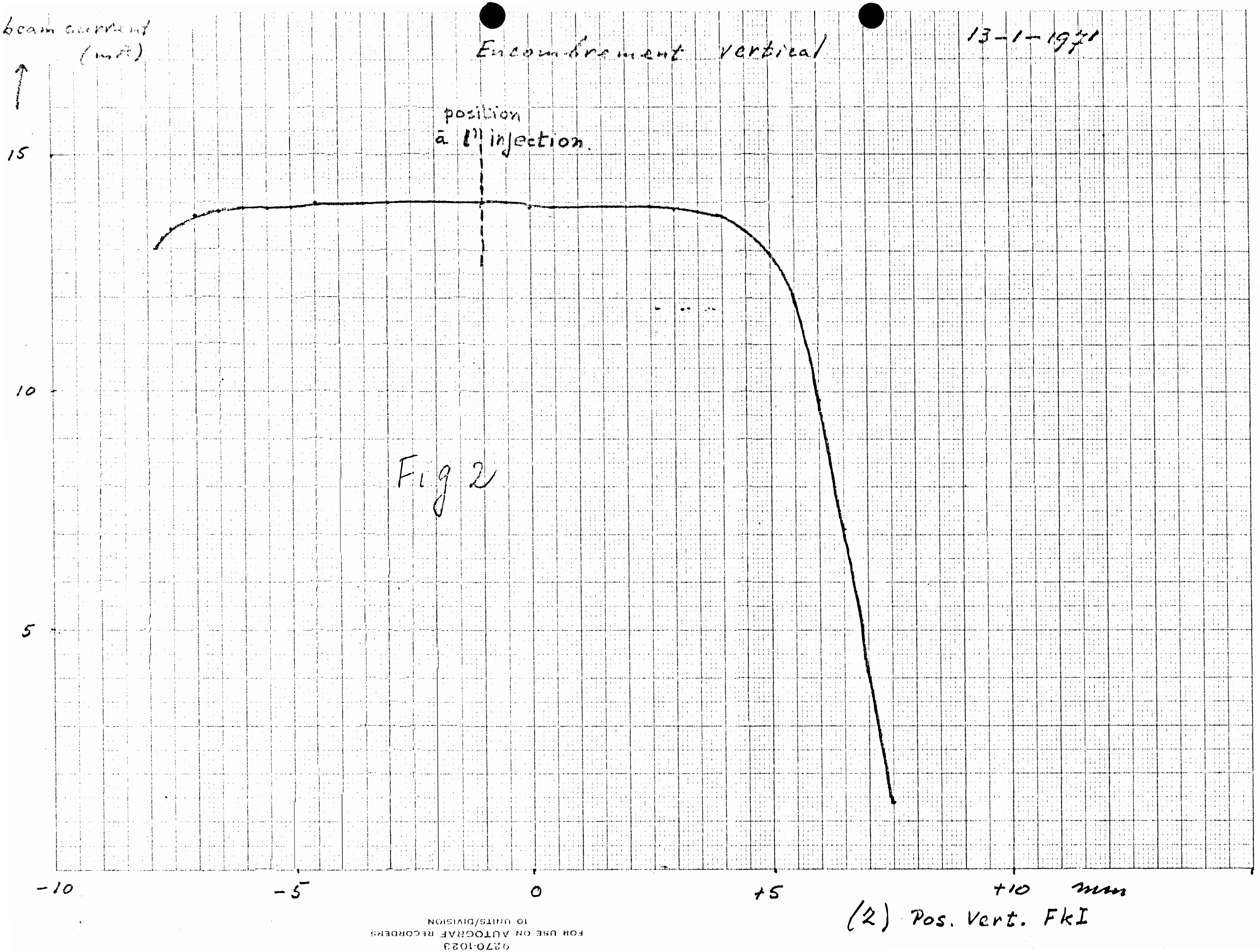
*) The ISR operation during this run was interrupted 3 times, with a total loss in operating time of 45 minutes, by spurious tripping out and closing of vacuum pumps and valves caused by people working in auxiliary buildings.


ENCOMBREMENT HORIZONTAL
beam current (mA)
P ISR MAGNETS = 15,372 GeV/c
13-1-19
-13,5
position à l'injection
15
10
5
-60
-45
-30
-15
0
+15 mm
Pos. Hor. EXT
Fig 1



beam current (mA)
Encombrement vertical
13-1-1971
position à l'injection.
15
10
5
-10
-5
0
+5
+10
mm
(2) Pos. Vert. FkI
9270-1023
FOR USE ON AUTOGRAF RECORDERS
10 UNITS/DIVISION

Fig 2

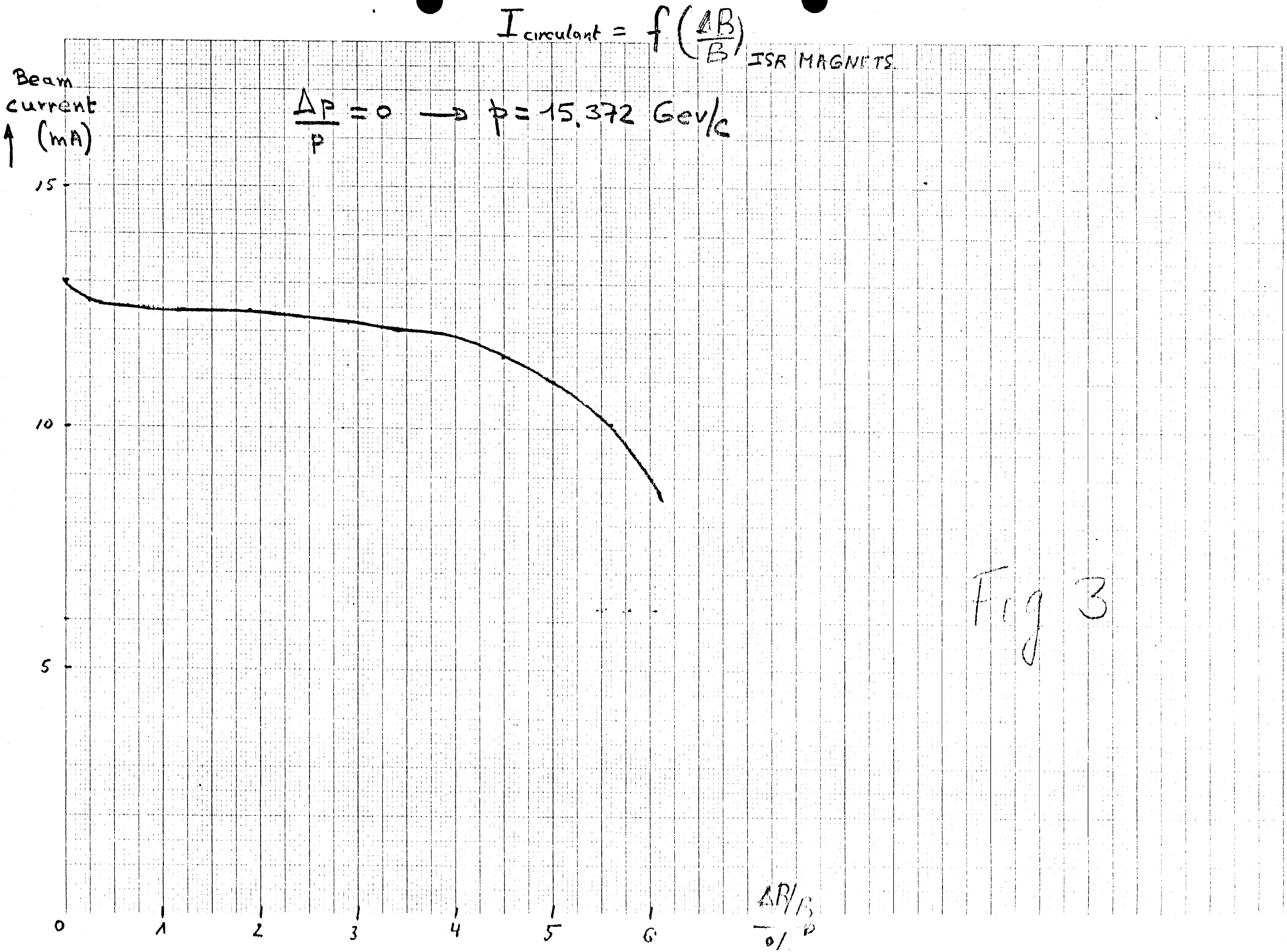

I circulant = f (ΔB/B) ISR MAGNETS
Δp/p = 0 → p = 15.372 Gev/c
Beam current (mA)
15
10
5
0
1
2
3
4
5
6
ΔB/B %

Fig 3

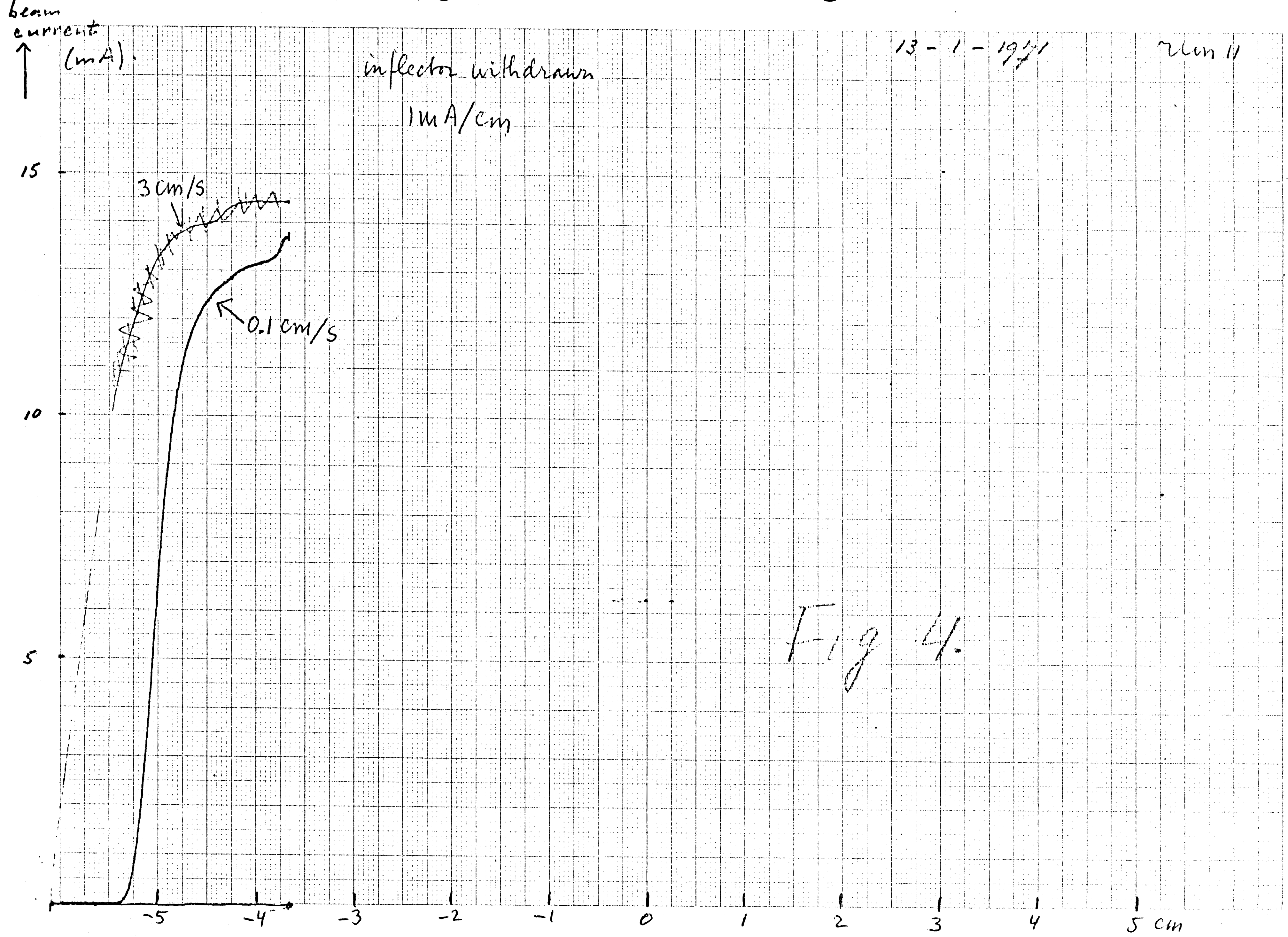

beam current (mA)
inflector withdrawn
1mA/cm
13 - 1 - 1971
run 11
15
10
5
3 cm/s
0.1 cm/s
-5
-4
-3
-2
-1
0
1
2
3
4
5 cm

Fig 4.

Encombrement du Dump.

Fig 5.