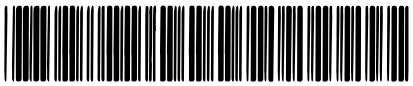
ISR-BOM/KB/GB/JPG/afm



3 December 1976

CM-P00072219

PERFORMANCE REPORT

Run 783 - 29 November 1976

Ring 2 - 26 GeV/c

Test of the magnetic beam detector

1. Summary and conclusion

Two stacks of 5 A around CL were displaced in I5 by applying local bumps and the vertical and horizontal positions of their centers of gravity were measured with the magnetic beam position detector. For the purpose of comparison, the vertical positions of these stacks were also measured by scraping them to zero with the I5 scraper.

The results are :

- the R2 beam position detector is operational (only from the A5 auxiliary building for the time being). It provides a direct readout of the vertical and horizontal positions of coasting beams.
- for 5A beams modulated vertically by ±0.1 mm at 80 Hz, the stability of the measurements is 0.01 mm for the vertical position and 0.05 mm for the horizontal one ; the vertical displacements measured with this system agree to better than 0.5 % with those obtained with the I5 scraper.
- with only single pulses in the other ring, the effect of the 80 Hz modulation on background and on dI/dt was unnoticeable (<0.1 ppm/min ?).

2. Measurements

Beam conditions :	working line	FP (with space charge compensation)
	stack width	-5 mm to 12 mm
	current	4.89 A
	max. density	0.4 A/min (see Fig. 1)

Modulation : 0.2 mm peak-to-peak at 80 Hz applied in I5 using the modulators mounted on the H-magnets H448 and H516. With only single pulses in the other ring, the effect of this modulation on background and dI/dt was unnoticeable (table 1).

Bumps : Table 2 gives the measured positions of the stacks for various vertical and horizontal bumps. In order to take account for hysteresis effects, the four H-magnets contributing to the I5 vertical bump were first set to 100 % (2H416 = + 100 %, 2H448 = -100 %, 2H516 = -100 %, 2H552 = +100 %) and changed with the program XINC to produce a bump of -5 mm ; the first stack of 5 A was then made and the position was measured (no. 1 in table 2) ; the second measurement was taken after having applied an additional bump of +10 mm. For the subsequent measurements, the beam was simply moved vertically between these two extreme positions.

The discrepancy between the first measured vertical displacements (10.28 mm, bracket 1^V in table 2) and the 3 subsequent ones (10.24 mm, bracket 2^V) is due to hysteresis in the H-magnets ; under stable hysteresis conditions, these 3 measurements agree to within 0.01 mm ; the horizontal position remains constant to within 0.07 mm.

The difference between bracket 2^V and 3^V or 4^V gives the variation (less than ±0.5 %) of a vertical bump when it is superposed to an horizontal bump of ±20 mm.

The non-reproducibility of the horizontal position (measurements no. 5, 9, 13) and the discrepancies between the measured horizontal bumps (brackets 1^H, 2^H, 3^H and 4^H) and the expected values of 20 mm can be attributed , at least for a large part, to hysteresis effects in the main magnet correction windings (CR's). According to old magnetic measurements made on these windings, the hysteresis is indeed quite large but this has to be confirmed by other measurements.

Comparison with positions measured with the I5 scraper

After these experiments, the remaining stack at CL with a vertical bump of -5 mm was scraped down to zero, using the I5 scraper. Then a new and identical

stack was done but with a bump of +5 mm and scraped in the same way. According to the scraper scans (table 3), the displacement of the center of gravity of these stacks is :

10.26 mm using a gaussian fit (Luc Vos' program),
10.17 mm from a direct evaluation of the results (K. Potter's program)

These results agree perfectly with the measurements done in the same conditions with the detector ($10.23^{\pm 0.01}$ mm, brackets 2^V and 5^V in table 2).

Stability measurements

To evaluate the stability of position measurements, the stack was left in stable conditions and the readings of the positions were registered every 10 s (which is the time constant of the system) for 10 min. The histogram of these readings is given in Fig. 2. The maximum spread is 0.01 mm for the vertical position and 0.05 mm for the horizontal position. These values correspond indeed to the minimum step of the mechanical positioning system.

K. Brand
G. Brun
J.P. Gourber

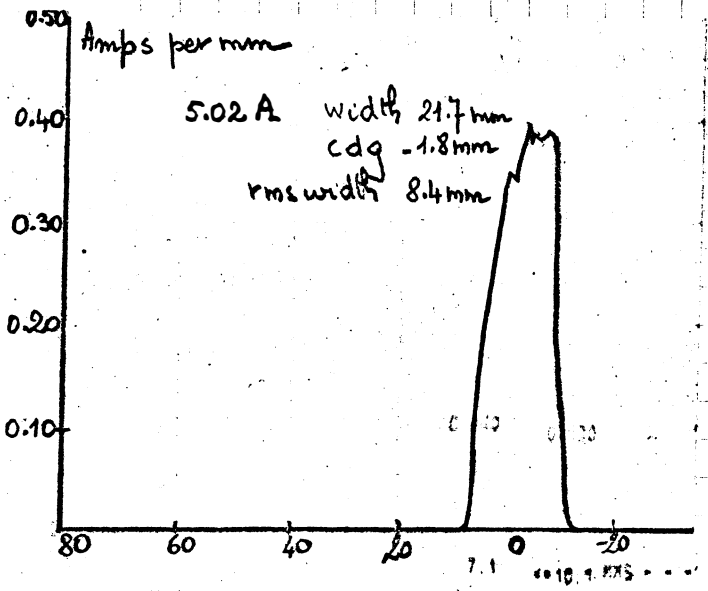


Fig. 1 Longitudinal Schottky scan

time (min)	dI/dt ppm/min		
0	4.1	mod. pol. ON	Average
1	2.0		
2	4.1		
3	8.2		4.08
4	2.0		
5	6.1	mod. pol. OFF	Average
6	2		
7	6.1		
8	2		4.05
9	4.1	mod. pol. ON	

Table 1 (the fluctuations every minute are due to the smallness of the integration time for this current level and to the activity in the other ring.)

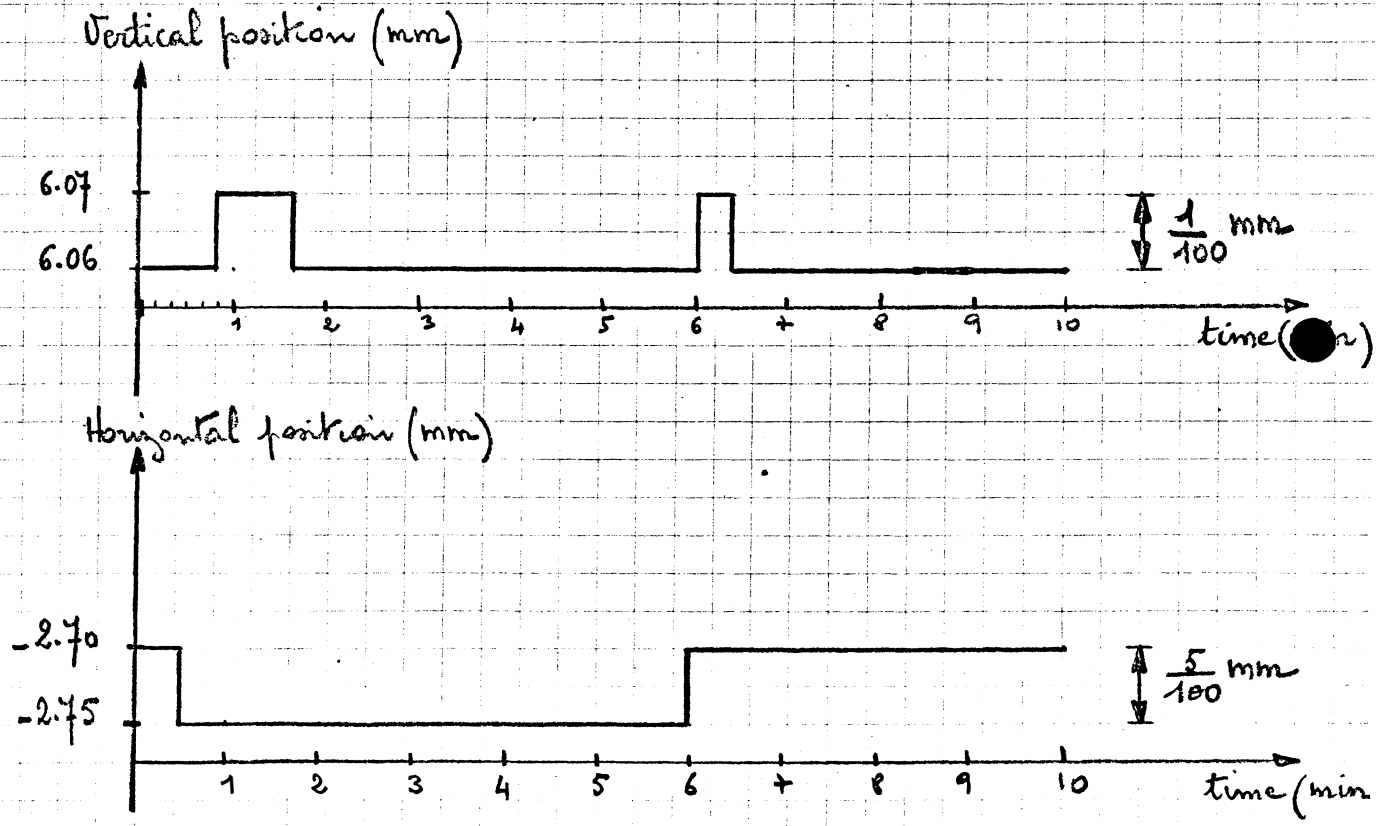


Fig. 2 Stability measurements

Meas^t n°	hor. bump mm	vert. bump mm	hor. position mm	vert. position mm	Δ horiz. mm	Δ vertical mm
1	0	-5	-1.30	-5.78		
					-0.03	+10.28] 1^V
2	0	+5	-1.33	+4.50		
					+0.03	-10.23
3	0	-5	-1.30	-5.73		2^V
					-0.07	+10.24
4	0	+5	-1.37	+4.51		
					+0.07	-10.23
5	0	-5	-1.30	-5.72		
					-19.31] 1^H	-0.01
6	-20	-5	-20.61	-5.73		
					-0.08	+10.29
7	-20	+5	-20.69	+4.56		3^V
					+0.08	-10.29
8	-20	-5	-20.61	-5.73		
					+17.00] 2^H	+0.01
9	0	-5	-3.61	-5.72		
					+17.69] 3^H	-0.01
10	20	-5	+14.08	-5.73		
					+0.07	+10.21
11	20	+5	+14.15	+4.48		4^V
					-0.02	-10.18
12	20	-5	+14.13	-5.70		
					-16.80] 4^H	-0.02
13	0	-5	-2.67	-5.72		
					-0.12	+10.22
14	0	+5	-2.79	+4.50		5^V
					+0.07	-10.22
15	0	-5	-2.72	-5.72		

Table 2 Positions measured by the b.p.d. for various applied bumps. (courant 4.88 A constant for all measurements)

	Stack n°1 (Vert. bump -5 mm)		Stack n°2 (bump +5 mm)
K. Potter prog.	beam pos.	-5.76 mm	+ 4.41 mm
			10.17 mm
			10.26 mm
L. Vos prog.	beam pos.	-5.80 mm	+ 4.46 mm
	quality fit	19	12
	coupling factor	1.66	6.69
	effective height	6.26 mm	5.80 mm

Table 3 Results of scraper scans