E-6 ISR PERFORMANCE REPORT

Run 883 - 29 September 1977

Rings 1 and 2 - 26 GeV/c

Check on coupling excited by experimental magnets

Conclusion

No large coupling effects were found and the excitation from the individual magnets was on the limit of the measurement accuracy. In general, the change in the coupling coefficient will be 10^{-3} or less when cycling any of the experimental magnets (except the solenoid). The coupling arising from the rest of the ISR is dominant.

Introduction

Background conditions during some recent runs have been considerably improved (factor of 10) by small adjustments ($\sim$3 %) of the Q2 skew quadrupole chain. It is not, however, in the nature of coupling to influence loss rates as the $Q_h = Q_v$ resonance is stable. The beam movements from excitation of α_{pv} are small (e.g. 3 % change at 26 GeV/c gives Δz = 0.12 mm at +45 mm on 8C - derived from measurements). Thus, the exact mechanism by which the background has been improved is not clear. It should be mentioned that in addition to the above, the coupling arising in both rings has reached a level (Ring 1: $|C| \simeq 1.5 \times 10^{-2}$; Ring 2: $|C| \simeq 10^{-2}$) far above that to be expected from random magnet tilts ($|C| \simeq 2 \times 10^{-3}$).

The experimental magnets are not at first sight expected to excite strong coupling, but it was nevertheless decided to measure them under different conditions. It was felt to be unlikely that these measurements would solve either of the above problems, but at least the uncertainty about unforeseen effects would be replaced by measured values.

Measurements

The measurements in Ring 1 were made on the ELAC line and in Ring 2 on the LB26 line. The magnets measured were:

Intersection 2 :	EM1 (R209)	R1	R2
Intersection 6 :	EM1 (double septum)	R1	--
	EM2 (20 kA septum)	--	R2
	EM3 (lampshade)	--	R2
Intersection 7 :	EM1 (2 thin dipoles)	--	R2 .

The solenoid and the SFM were omitted as their characteristics are already well known. EM3 in I6 was not measured in Ring 1, but its effect should be less than that measured in Ring 2. EM1 in I7 was only measured in Ring 2 since by symmetry the effect should be equal in both rings.

In most cases, the coupling was measured on the outer orbit $\overline{x}$ = +35 mm for the magnet settings 0, 100, 0, -100, 0 %. For each case, 8 to 10 readings were averaged. The results are summarized in Table 1.

TABLE 1

Coupling measurements

Magnet	Ring	$\overline{x}$ (mm)	Cycle	Spread in $\lvert C \rvert$ $\times 10^{-3}$
EM1 I2 R209	1	35	0, 100, 0, -100, 0 degaussed	0.3
	2	inj.	0, 100, 0, -100, 0 degaussed	0.5 *
EM1 I6 douple sept.	1	35	0, 100, 0, -100, 0	0.9
EM2 I6 20 kA septum	2	35	0, 100, 0	0.6
EM3 I6 lampshade	2	35	0, 100, 0, -100, 0	1.1
EM1 I7 2 thin dipoles	2	35	0, 100, 0, -100, 0	1.0

* This neglects the point at 0 % after returning from -100 %, which appears to lie outside the cycle. If this point is included, the spread in $\lvert C \rvert$ becomes 1.6×10^{-3}.

Discussion of results

The results indicate that the effects are small, but it is difficult to say exactly how meaningful the numbers are. With the basic ISR coupling compensated, these coupling levels are below the threshold for the present coupling meter and for this reason, some of the basic ISR coupling was left uncompensated. This, however, introduces the vector sum of two coupling sources and the differences measured for the experimental magnets will be somewhat underestimated. Each point was made from the average of eight to ten readings. In Ring 1, the filter signals were very pure and the spread over the $|C|$ readings was typically 0.2×10^{-3}, which although very good is not ideal for measuring changes of 0.3×10^{-3} and 0.9×10^{-3} (see Table 1). In Ring 2, the filter signals were distorted and finally, the R209 magnet was measured at injection rather than at +35 mm in order to improve the quality of these signals. Despite these difficulties, the coupling values do, with a little imaginative help, follow cycles with the current cycle of the magnets. With reference to this effect, see Table 2 and Fig. 1 for EM1 in I7, Ring 2. Table 2 gives the variation in $\Delta = |Q_h - Q_v|$ which is also measured by the coupling meter. This variation (0.0044) agrees very well with values measured by D. Lewis (0.004 for both rings, see page 5 of Performance Report dated 15 July 1976, Effect of I7 experimental magnet on working line and closed orbits, Run 745).

TABLE 2

EM1 in I7, Ring 2

Magnet current %	$\|C\|$ $\times 10^{-3}$	Q-separation $\Delta = \|Q_h - Q_v\|$ $\times 10^{-3}$
0	8.09	4.3
100	8.44	7.1
0	8.14	4.3
-100	7.55	2.7
0	8.60	4.2

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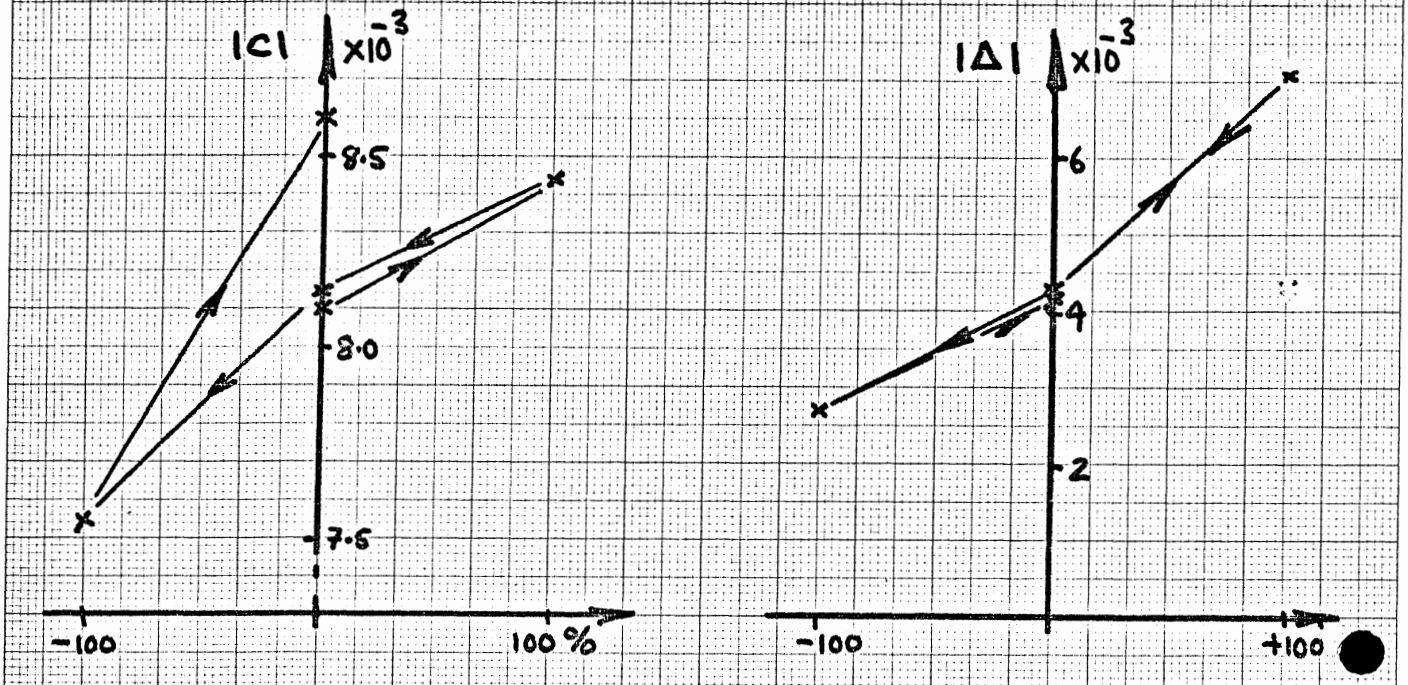

Figure 1. Variation of |C| and |Δ| while Cycling EM1 in I7 Ring 2.