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MPS/SR/Note 72-11
24.5.1972

STATUS OF CPS - SPS CONTINUOUS TRANSFER TESTS

After 8 - 10 May PS Shutdown

The installation of all the hardware was completed during the 8 - 10 May CPS shutdown. The instrumentation for internal and external beam observation works satisfactorily but still needs calibration. The equipment was tested successfully and has so far shown no surprises.

Studies of the effect on the beam have begun and the results obtained are reported below.

1. Effect on the beam of remanent field of kickers 71 and 95

The first test was made with only kicker 95 installed. No harmful influence could be observed. Same result for both kickers.

2. Deflection produced by kicker 95

Method: the CODD was used to measure several closed orbits and kicked orbits. After substraction of the closed orbit the best fitting sine with its origin in ss 95 was calculated. The CODD was calibrated just before. In addition, the deflection of kicker 95 was compared with the known deflection of kicker 97. Results: kicker 97 was operated at 24.5 kV and 19.9 GeV/c. With the known kick factor of $10.2 \left[\frac{\text{mm . GeV/c}}{\text{kV}}\right]$ for D-sections and a mean $\sqrt{\frac{\beta F}{\beta D}} = 1.34$ we expect a betatron oscillation amplitude of 16.85 mm. With the CODD we obtained 16.75 mm, which is in full agreement with the expected value.

FK 95: current 500 A, deflection measured at 10.0 GeV/c. Measured betatron oscillation amplitude $y = 6.3$ mm. With $\beta_{95} = 22.4$ and a mean $\beta_F = 21.74$ m we obtain the deflection angle $\alpha = 0.466$ mrad at 815 A excitation current (error estimated $\pm$ 5%).

The design value is 0.5 mrad for the same current.

3. Matching of kickers 71 and 95

Closed orbits and kicked orbits were measured with the use of CODD and the program QORME. The difference of orbits is shown in fig. 4 for two steps of the staircase generator. The orbit displacements in ss 83 meet the design figure well. The residual betatron oscillation is seen to be small. When looking for the best sine which fits the measured points outside the kicker region, we find an amplitude of 0.05 mm. With an amplitude of 5 mm inside the kicker region we obtain a mismatch of $\leq$ 1.1%.

4. Effect of quadrupoles 73 (def.) and 89 (foc.)

The quadrupoles were powered with 162 amps which corresponds to a normalized quadrupole strength of $\approx$ 0.073 at 10 GeV/c. Figs. 1, 2 and 3 show the closed orbits without and with quadrupoles and the difference of orbits.

5. β-function in ss 83 and kickers 71 + 95 matching, together with quadrupoles 73 + 89

Quadrupole current 162 amps, momentum 10 GeV/c, kickers excited with staircase from 380 A (1st step) to 550 A (11th step). Fig. 5 shows the measured orbits. The β-function can be obtained from the displacement in ss 83 with and without quadrupoles (figs. 5 and 4). Assuming $\beta_F = 21.9$ m we obtain

$$\text{for the 1st step} : \beta_{83} = \beta_F \cdot \left(\frac{y_q}{y_1}\right)^2 = 21.9 \cdot \left(\frac{12}{5}\right)^2 \approx 127 \text{ m}$$

and for the 2nd step : $\beta_{83} = 21.9 \cdot \left(\frac{12.5}{7}\right)^2 \approx 70$ m.

According to the quadrupole strength we expect $\beta_{83} \approx 85$ m. Figure 5 shows clearly a sausaging effect, but it is not understood why the orbit of the 1st step is disturbed in the section 43 to 71, which in principle should correspond to the time just before the kicker excitation. A possible explanation is that the orbit measurement was made during the 2nd step, which would also explain the unexpected amplitude increase in ss 83.

Anyway we can see that under the measuring conditions the residual betatron oscillation outside the kicker region is too big. This causes a coupling between the staircase steps which can eat up deflection power of the kickers.

A. Krusche

Distribution

O. Barbalat
D. Bloess
C. Bovet
D. Dekkers
D. Fiander
C. Germain
D. Grier
L. Henny
K.D. Metzmacher
W. Middelkoop
P. Pearce
G. Plass
B. de Raad
F. Rohner
P.H. Standley
C. Steinbach

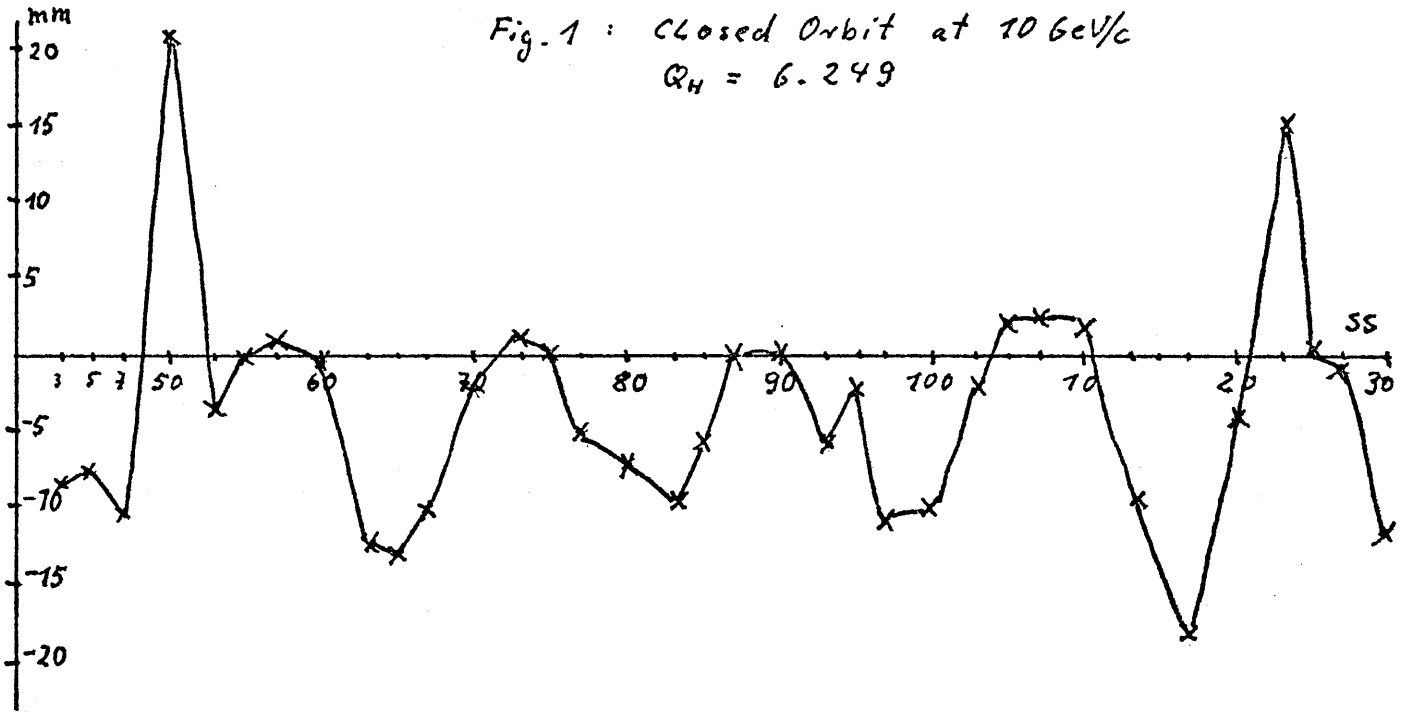

Fig. 1 : Closed Orbit at 10 GeV/c
Q_H = 6.249

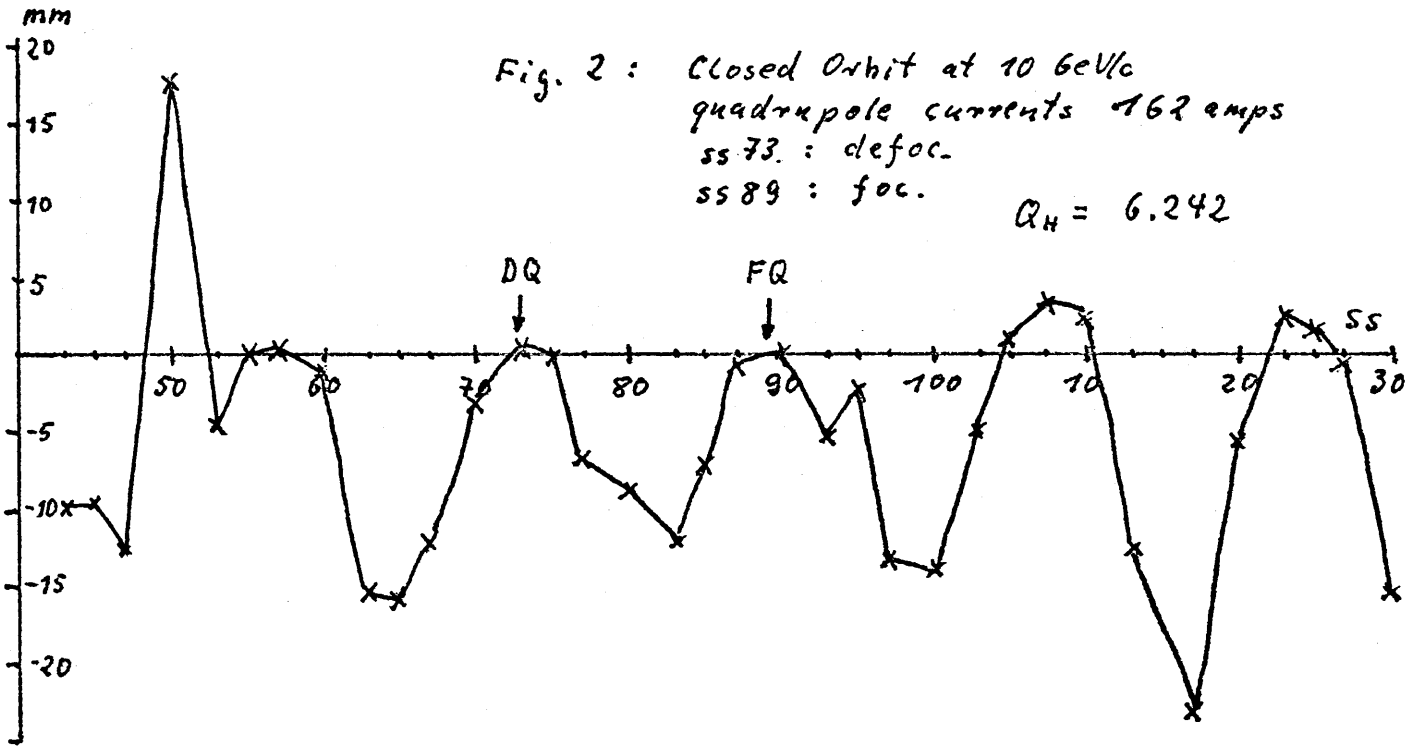

Fig. 2 : Closed Orbit at 10 GeV/c
quadrupole currents 162 amps
ss 73 : defoc.
ss 89 : foc.
Q_H = 6.242

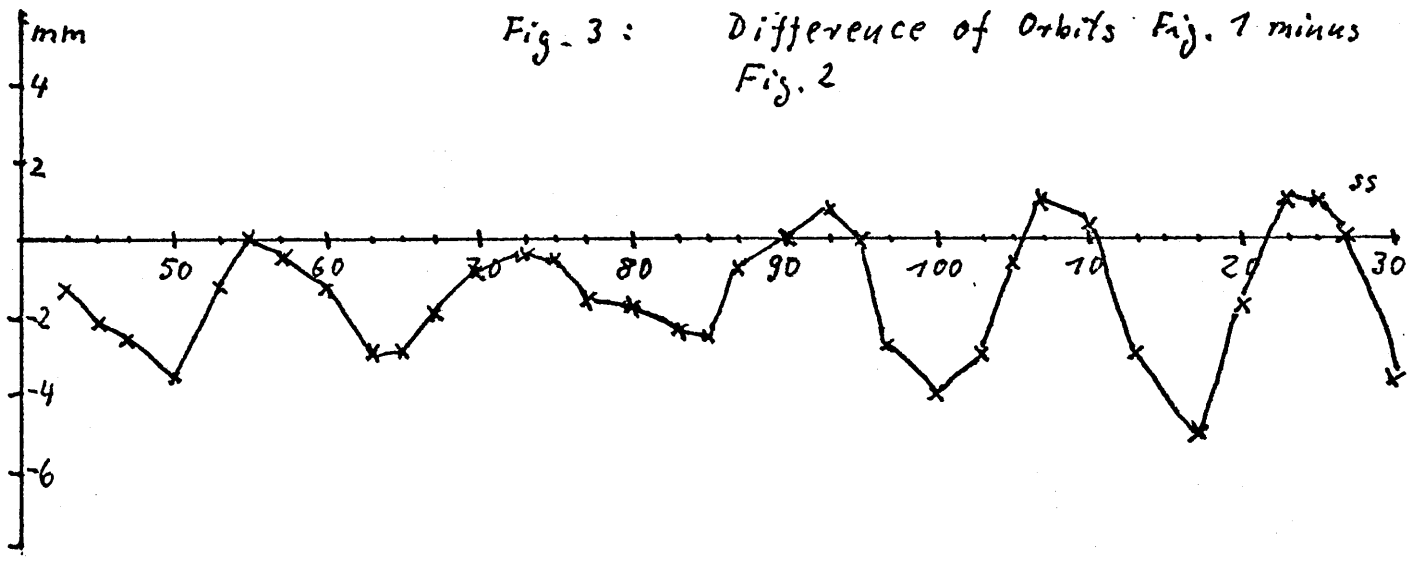

Fig. 3 : Difference of Orbits Fig. 1 minus Fig. 2

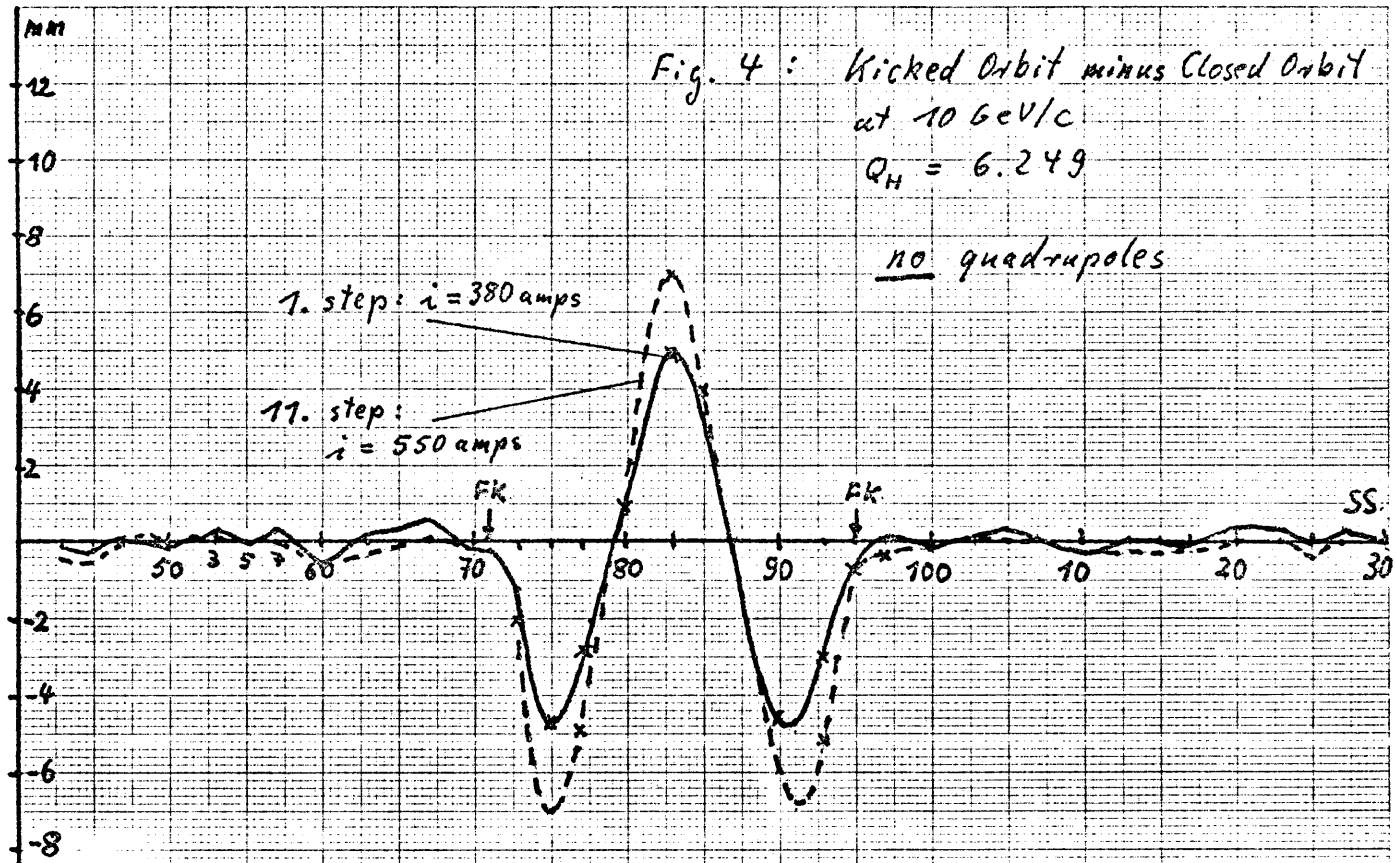

Fig. 4 : Kicked Orbit minus Closed Orbit
at 10 GeV/c
$Q_H = 6.249$
no quadrupoles

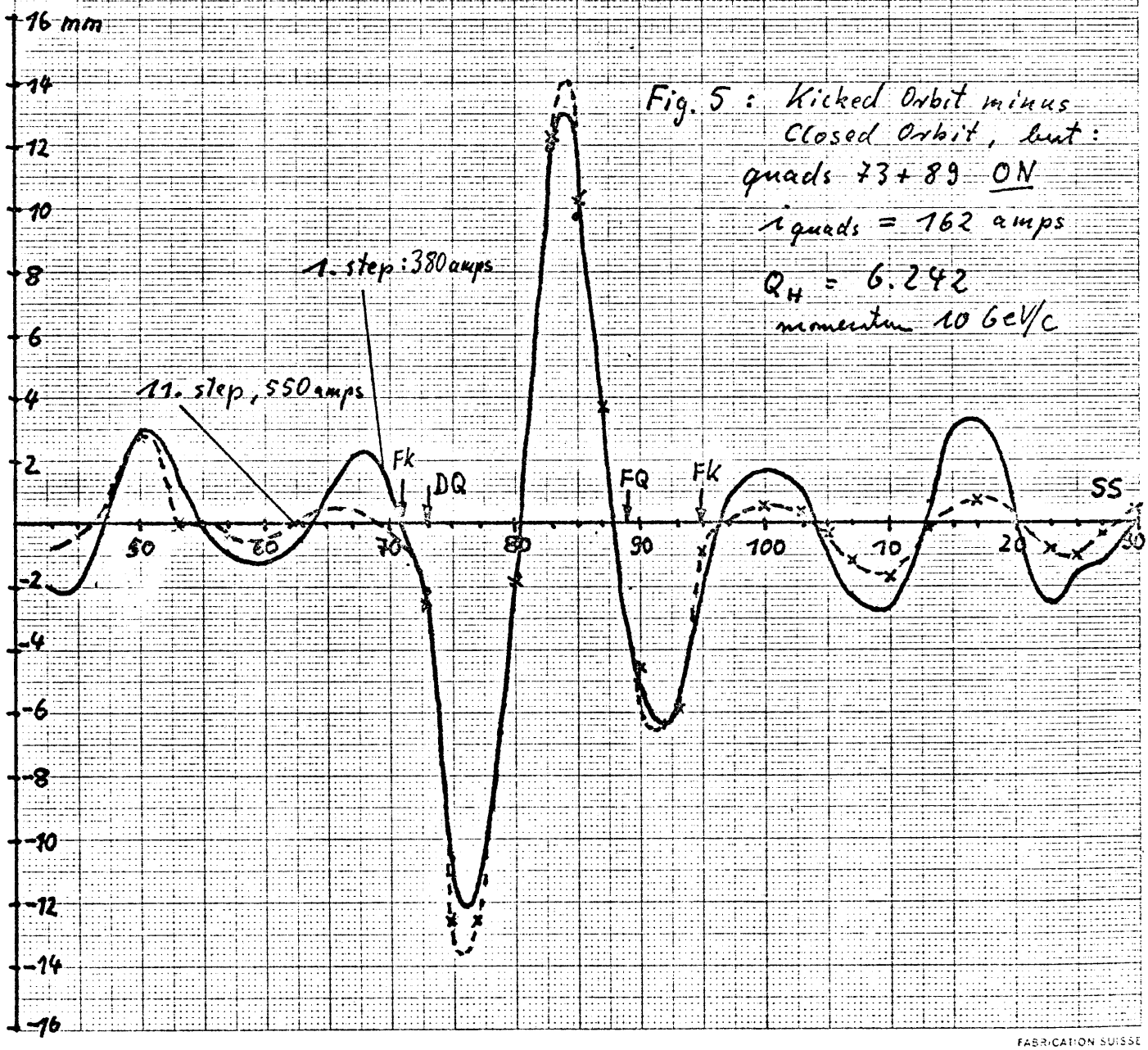

Fig. 5 : Kicked Orbit minus
Closed Orbit, but:
quads 73+89 ON
$i_{quads} = 162$ amps
$Q_H = 6.242$
momentum 10 GeV/c