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MD NOTE

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Suppression of Dipole Resonances

Since some time it is known that the beam excites strong resonances in the kicker dipoles which have a piece of ceramic vacuum chamber. Therefore, the beam is not screened and interacts with surrounding equipment. The resonances can be observed on the compact PU stations which are installed in the same straight sections as the kickers.

During the MD on 1st December, the upstream and downstream vacuum chambers at the septum bumper 40 for 800 MeV injection were short-circuited by an Al-strip along one side of the chamber. By this modification, the observed resonances decreased by a factor of 2,5.

The introduction of ferrite cores on the cables of the pick-up station 40 decreased the disturbances by a further factor of 2 or 3, of course without decreasing the resonances in the dipole.

During the last machine stop impedance measurements at the injection bumpers showed several resonances.

Fig. 1 shows the measured impedances versus frequency at input connection of the bumper in s.s. 40 (connected with supply cables and 22 ohm dampers). The highest impedance $|Z_t|$ = 880 ohm appeared at f = 30 MHz.

The highest impedances of the bumper 44 is $|Z_t|$ = 4 kOhm at f = 28 MHz. The impedances varied from bumper to bumper. The maximum impedance of the bumper 43 for example was only $|Z_t|$ = 80 ohm (the vacuum chamber of this bumper has a special longitudinal bypass by 4 screws). Bumper 42 could not be measured due to access problems.

During the following MD on 7th December, the power supply cables of the kicker 40 were disconnected but the resonances persisted.

The only way to damp the kicker resonances completely was a good beam current bypass by short-circuit between the up- and downstream vacuum chamber by several turns of a thick copper conductor. (This represents a short-circuited secondary loop to the primary bumper coil. It seems that the circular magnetic field of the beam current couples magnetically to the coil of the bumper which resonates and radiates as an antenna.)

Photo 1 shows the disturbed signal of PU station 40 without short-circuit at the bumper. Photo 2 shows the same PU signal with nothing but the described short-circuit at the bumper 40.

Conclusion

As the injection dipoles interact strongly with the beam and may cause transverse and longitudinal instabilities and furthermore disturb the PU stations, it seems indicated to provide short-circuits (at least high frequency short-circuits) of the discussed type, or metallization of the vacuum chamber.

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