INITIAL OPERATION OF THE K800 SUPERCONDUCTING CYCLOTRON MAGNET*

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INTRODUCTION

First operating tests of the magnet for the MSU K800 Superconducting Cyclotron occured on May 3, 1984, during the final session of the 10th International Cyclotron Conference. Details of the initial test were reported at the conference and are presented below. Later, on May 9, 1984, the tests were extended to include the extreme full current operating points. The magnet operated in excellent accord with design expectations in all tests.

MAGNET ASSEMBLY AND TEST

Figure 1 is a picture of the top of the completed K800 magnet. The magnet was completely assembled during the week of April 25, with cooldown completed by April 28. Transferring of liquid helium started on April 29, and it was discovered that the liquid helium line had a large internal leak to its vacuum jacket. The liquid helium line was repaired on May 1 and the coil completely filled with liquid helium at 2:40 am on May 2.

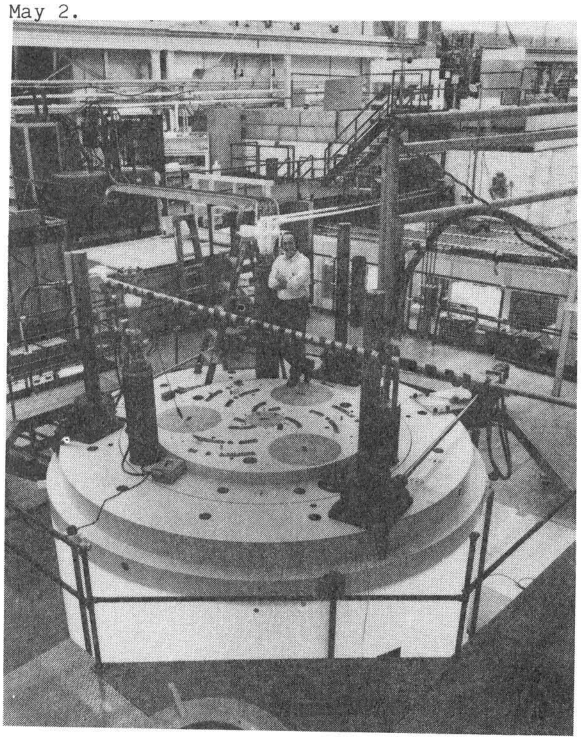

Fig. 1. The top of the K800 magnet is depicted. The magnet weighs 265 tons and is 14 ft. and 7 inches in diameter. It has a bending limit of 1200 kG-in.

Operating tests of the magnet were then scheduled for the early morning of May 3 (the last day of the Tenth International Conference on Cyclotrons). Initial current was supplied to the magnet at 5:33 am. Except for a minor wiring error on a monitoring instrument, which was quickly diagnosed and fixed, the

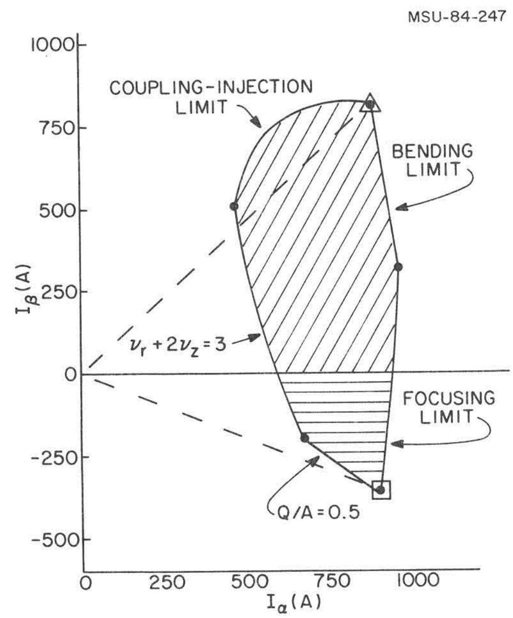

Fig. 2. The currents of the two superconducting coils of the K800 magnet are given along the axis. Various combinations of coil current can be used, but the normal operating range is indicated by the shaded area. The technical reasons for the boundaries are indicated. The first ramp of the magnet occurred along the upper dashed line. The second ramp was along the lower dashed line.

test proceeded smoothly but were terminated at 11:00 am with the magnet at approximately three-quarter of maximum operating excitation, in order to report the results to the conference. Figure 2 shows the current in both the small (β) and large (α) coils of the magnet. The operating region of the cyclotron is shaded and the various technical limits for each part of the curve is indicated. The initial ramp curve chosen for energizing the magnet, (the upper dashed line) was to test the maximum force point on the coil and magnet.

On May 9, tests were resumed and at 11:37 am the magnet reached the full bending limit excitation (K=1200). Later that afternoon the small coil polarity was reversed, and the coil was ramped to its other extreme operating point (lower dashed curve in figure 2) corresponding to its focusing limit of K_f=400 MeV or 200 MeV/n for Q/A=.5.

All tests proceeded very smoothly with only one indication of possible wire movement detected on the accoustic detector, just below the K=1200 point, but it appears to be spurious since no signal appeared on the flux change detector and it has not reappeared.

The cryostat insulating vacuum was improved when the external vacuum pumps were valved off, indicating no helium leaks in the cryostat system.

Strain gauges monitored forces on the magnet coil cryostat support system. From the observed force distribution we infer that frictional forces transmitted through the superinsulation and nitrogen shield are present.

SUMMARY

The K800 cyclotron magnet has been successfully tested over its extreme operating range and all basic characteristics of the magnet are in excellent conformity with design goals.

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