STATUS REPORT ON THE 800 MEV CYCLOTRON*

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Abstract.-The status of the K800 cyclotron project is reviewed as of August 1981.

1. Introduction.-The 800 MeV superconducting cyclotron has been in the construction phase since October 1979 and work on major components is well advanced. Eighteen sections of the magnet yoke have been cast and are in the process of machining. The wire conductor for the coil is now drawn and the operation of soldering the conductor to the substrate is completed and 80% of it is delivered. Welding of the coil bobbin is nearly complete and final machining operations are to begin shortly. The anode power supply for the rf system is under construction and approximately 50% assembled and the large central helium refrigerator is nearing final

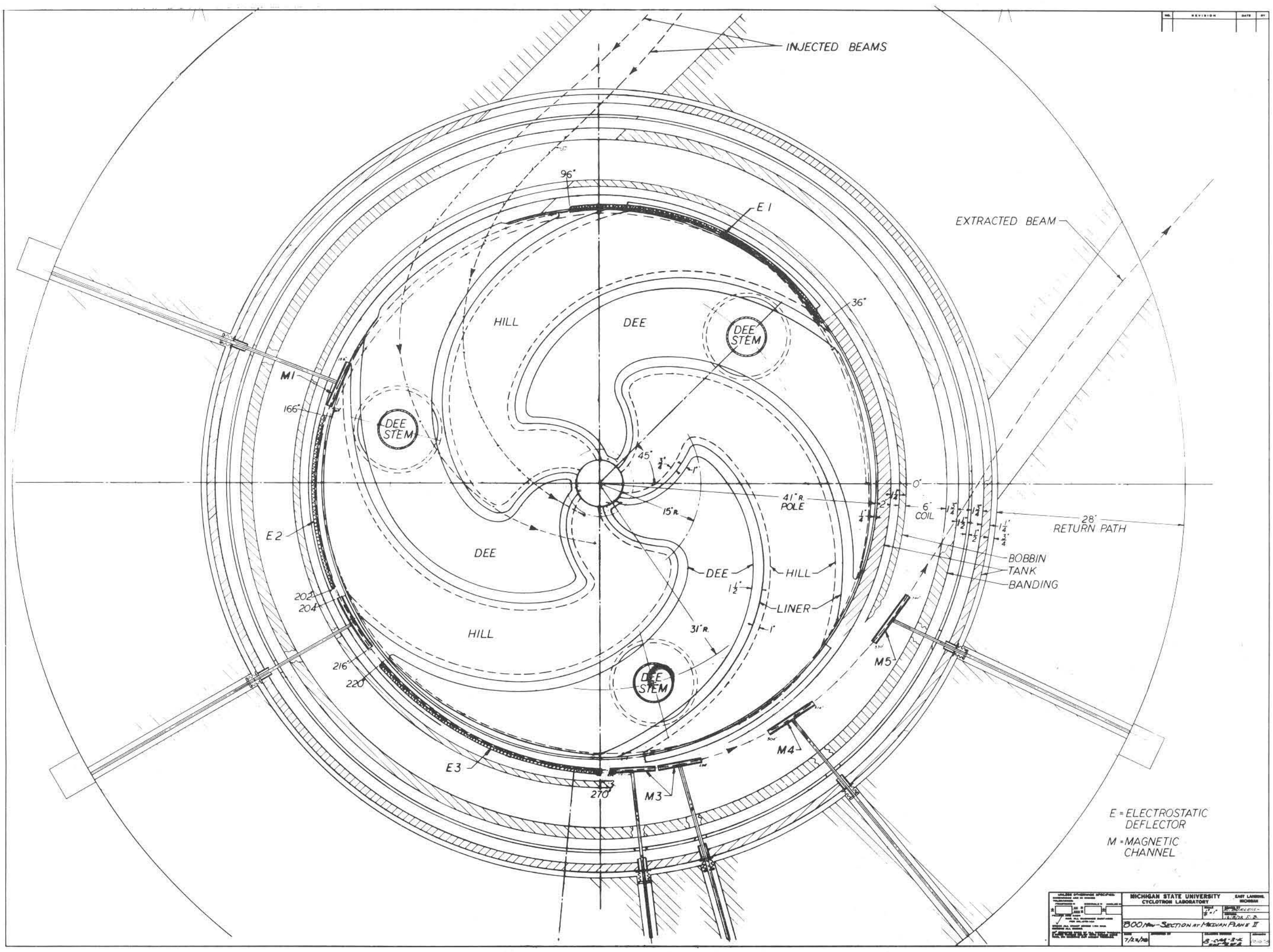

Fig. 1: A plan view of the cyclotron magnet is shown. The unique pole tip configuration was necessary to accommodate the various injected beam trajectories and allow stripping to a higher charge state outside the rf dee structure. The pole radius is 43.25" (including the cryostat inner wall).

assembly, with the compressor package already installed. The building addition to house the 800 cyclotron is now being utilized, and all outside contracted work will be finished within the month. Occupancy of the experimental area and office addition are planned for April 1982. In the following pages, 20 figures are presented; their captions give an up-to-date description of the project status.

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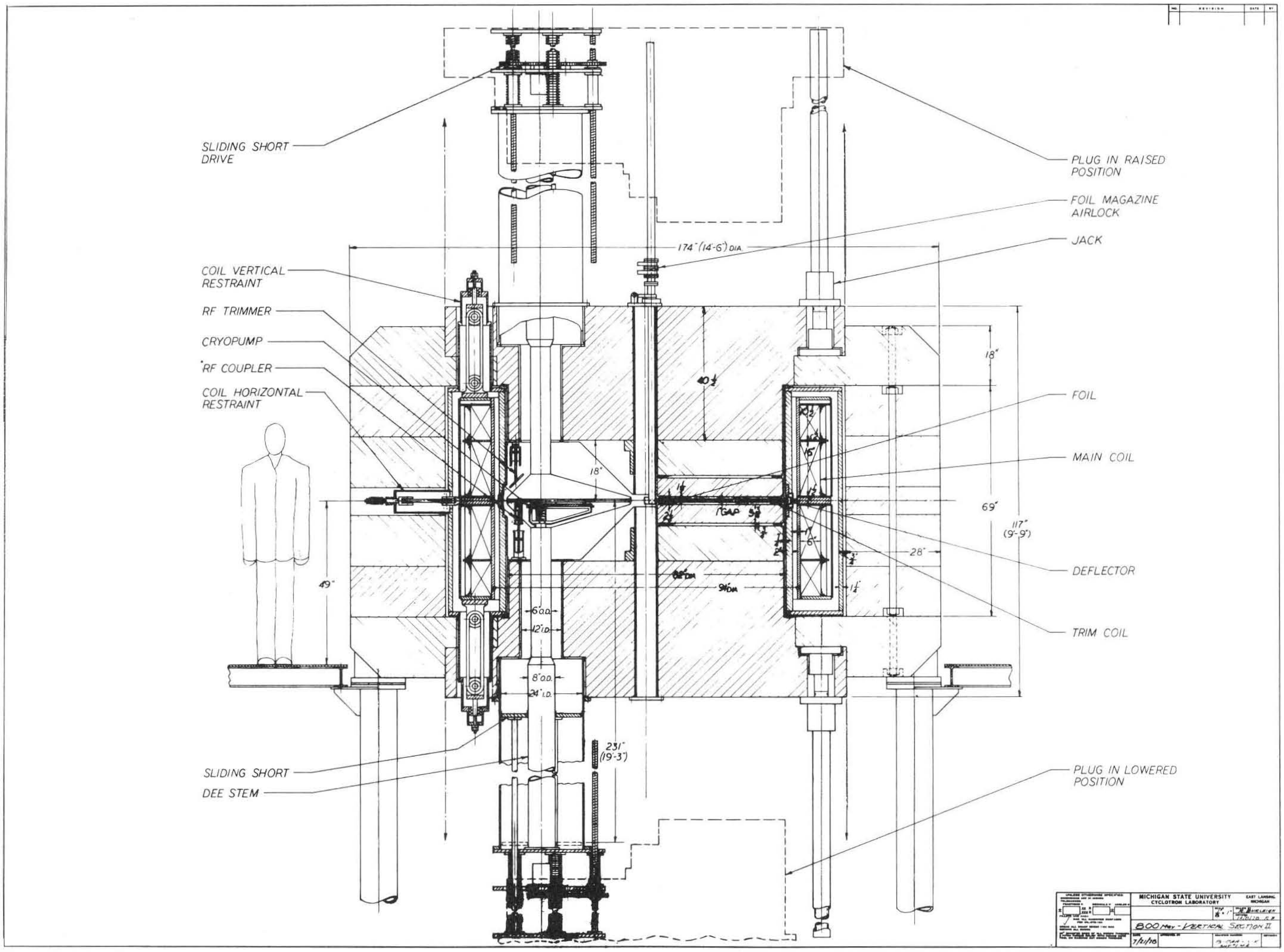

Fig. 2: The vertical section of the K800 cyclotron is shown. The magnet yoke is 11 ft 7" high and 174" in diameter. Total iron weight is 260 tons. The rf stem heights above and below the magnet are 20 ft. The magnet will have 22 trim coils mounted on each pole tip. The minimum hill gap is 2.5".

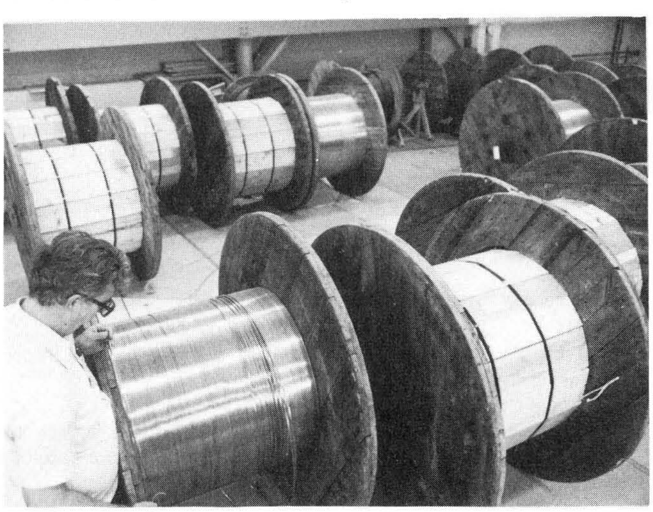

Fig. 4: Photo of spools of superconducting wire as received in East Lansing. The wire is made in 10,000 ft sections. The wire is composed of a superconducting insert soldered into a copper substrate. All samples of the wire had carried current greater than 1200 amperes in a 5T field before going normal.

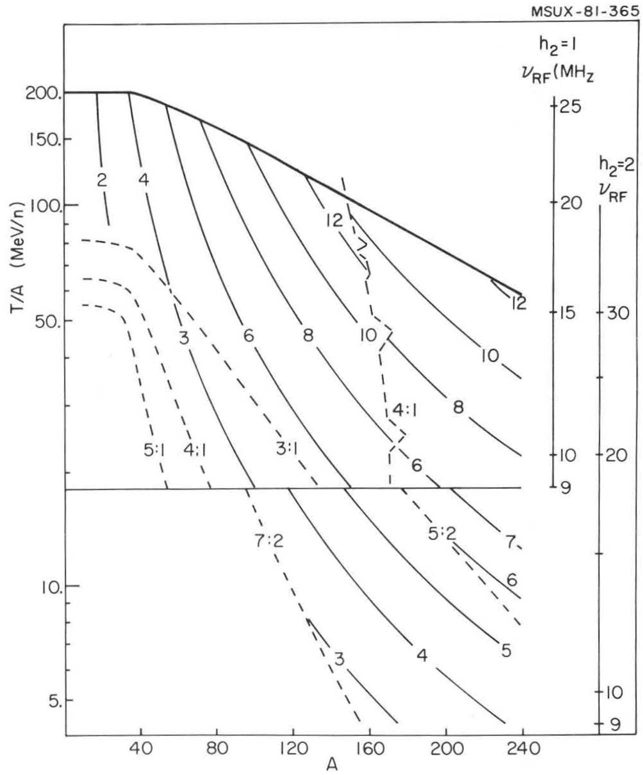

Fig. 3: The performance of the coupled cyclotron system is illustrated in terms of energy/nucleon vs. ion mass number. The second cyclotron acts as an energy multiplier in this arrangement (subject to focusing and bending limits) and the final energy is therefore determined by the charge state which is accelerated in the first cyclotron, the upper energy limit for various charge states being given by the solid curves with the numerical label on the curve indicating the charge state. The smooth dashed curves indicate the lower limits of various coupling modes where the two integers refer to the harmonic number of the first cyclotron and the second cyclotron respectively. The broken dashed curve indicates an optional change to a 4:l mode which tends to give better intensity for the heaviest ions. (For a given energy, the 4:l mode works with a lower ion source charge state and hence higher source intensity - this more than compensates for a less favorable charge state matching at the injection point of the second cyclotron.)

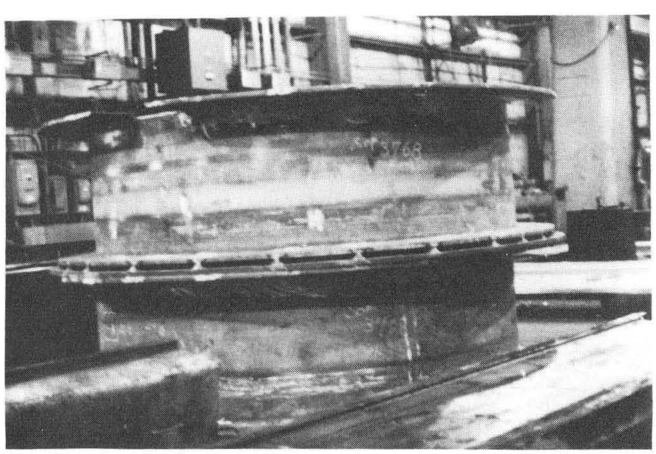

Fig. 5: Photo of the stainless steel coil bobbin ready for its final stage of welding. The coil wire of Fig. 4 will be wound on the bobbin in the same manner as for the K500 cyclotron.

Fig. 6: A detailed picture of the coil bobbin showing the median plane support block. Two other blocks are located ± 120° away. The holes will contain the coil leads, instrument lines and serve as the liquid helium passage.

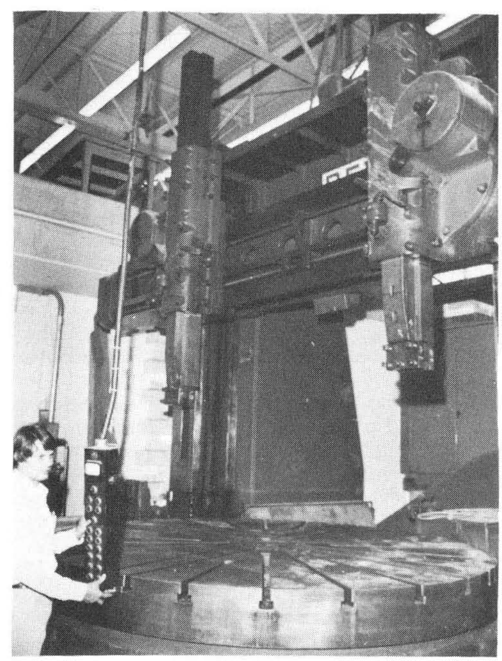

Fig. 7: Photo of a 10 ft diameter rotary bed lathe which will be used for winding the superconducting coil. The winding line will include a tensioning device, a cleaning bath, a dimension checking system and several visual inspection stations.

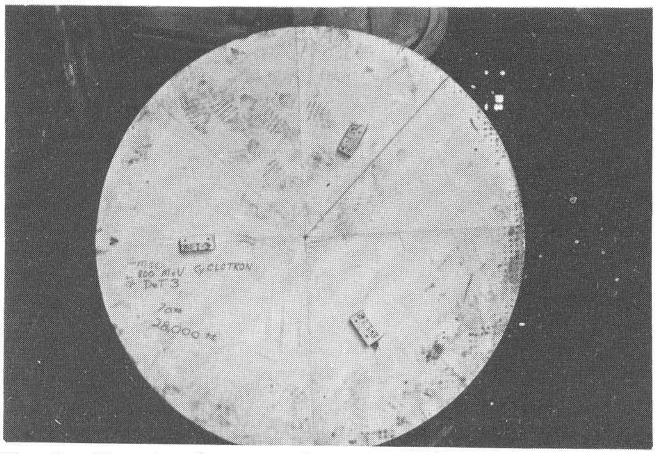

Fig. 8: The styrofoam casting pattern for the magnet yoke top is shown. It is the largest iron section and weighs 28,000 lbs. The small rectangular sections act as metal sample pieces to be cut off and analyzed after casting.

Fig. 9: Photo showing pouring of steel for a section of the magnet. The melted iron is poured from the ladle onto the top of a sand mold built around the styrofoam piece and flows into a pour hole, burning out the styrofoam and making the iron piece. Three 10 ton ladles pouring simultaneously were required to cast the piece in Fig. 8.

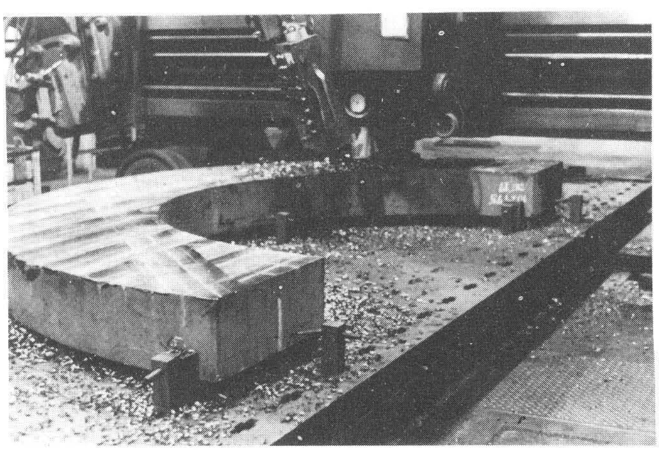

Fig. 10: A machining operation of the magnet yoke is shown. The finished yoke is expected to be received Dec. 1981 in East Lansing.

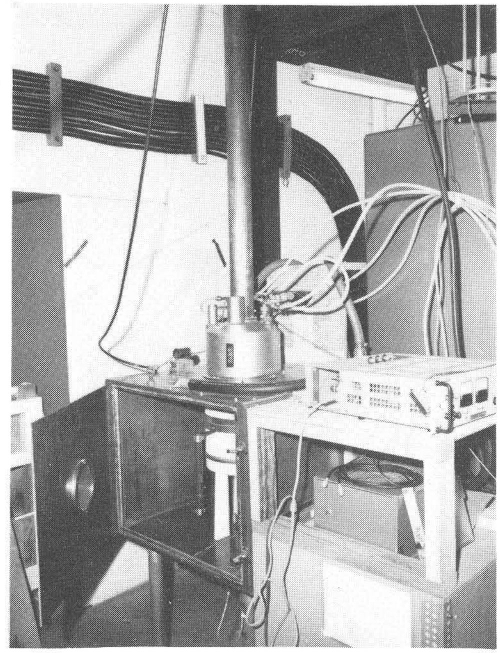

Fig. 11: Photo of prototype power amplifier for the K800. The rf frequency range is 9-27.4 MHz and beam harmonics will be 1st and 2nd. Peak dee voltage is 200 kV to ground and maximum rf power per dee 150 kW.

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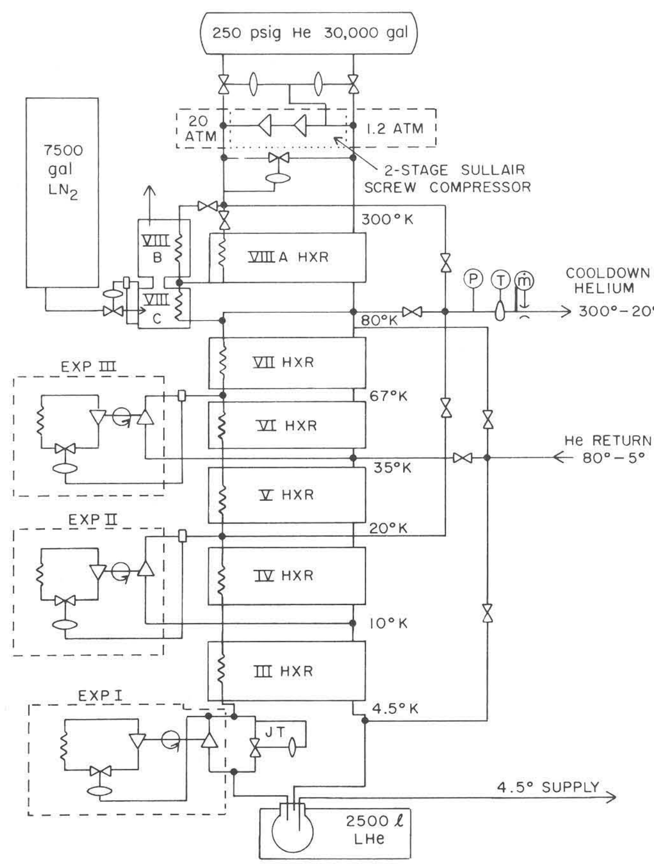


Fig. 12: The liquid helium refrigerator-liquifier operation schematic is shown. The refrigerator performance specifications with no liquid nitrogen are 200 W (both at 4.5 K) and 50 l/hr of liquid helium and 400 W and 100 l/hr when using 41 l/hr of liquid nitrogen.

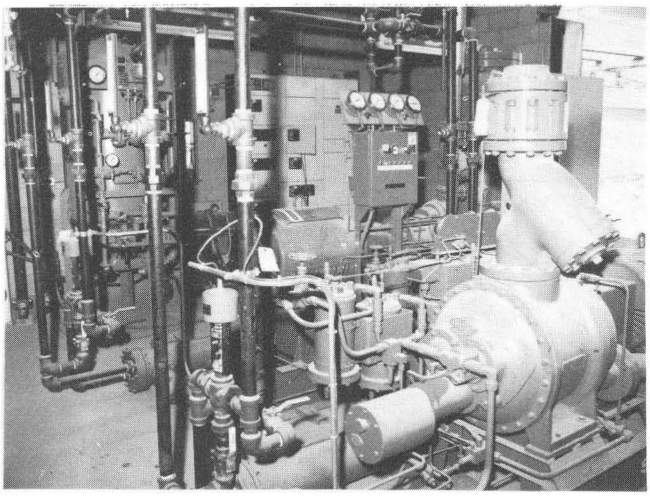


Fig. 13: The liquid helium refrigerator compressor is shown in its building. It is a 2 stage Sullair screw capable of delivering 62 g/sec of helium at 250 psi. The oil removal system is in the far left background.

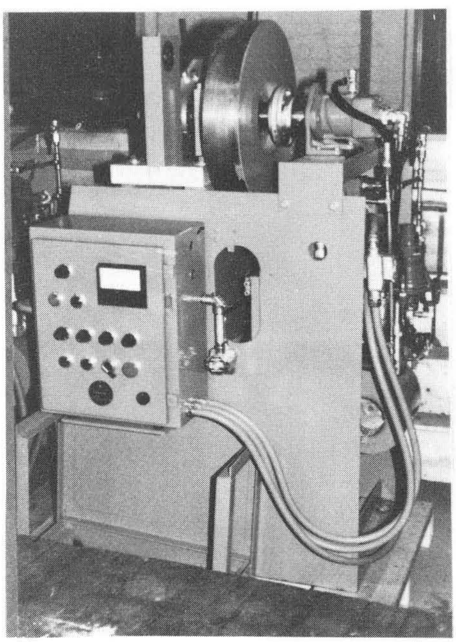


Fig. 14: The helium refrigerator uses three expansion engines. Shown is the engine which will be used at 67 K or 20 K. The engines are connected to the coldbox by transfer lines; valving exists to bypass an engine and remove it while continuing to operate. A spare engine has been bought, it will be used to substitute in case of failures or during maintenance. The third expansion engine, operated below 10 K, has a parallel JT value as a bypass in case of engine failure.

Fig. 19: The experimental area is now under construction and the vault area for a superconducting spectrograph is shown. This area is scheduled for completion in April 1982.

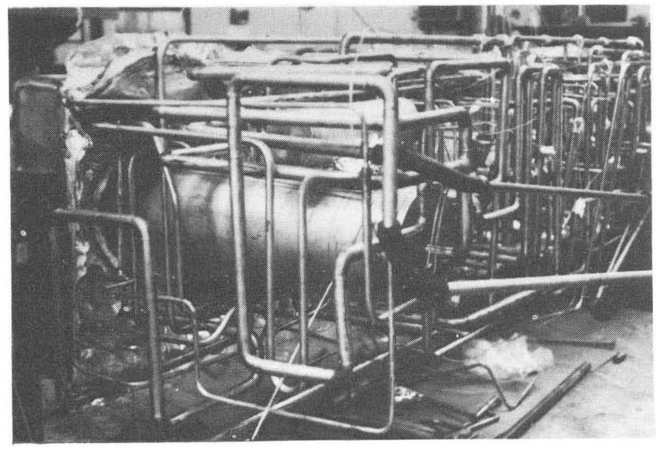
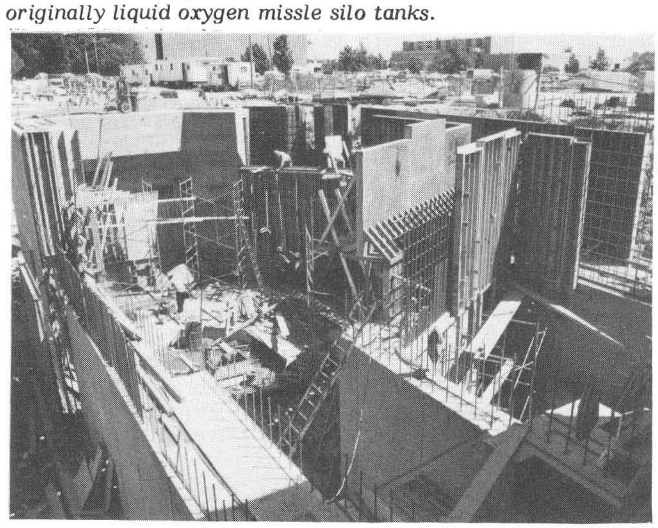


Fig. 15: A view of the coldbox under construction is shown. The coldbox has eight heat exchangers and over 50 valves. The output of the coldbox will feed a 2500 l liquid helium dewar.

Fig. 16: The liquid nitrogen storage facility is shown. Each tank holds 3600 gallons and is 30 feet tall. The tanks were originally liquid oxygen missle silo tanks.



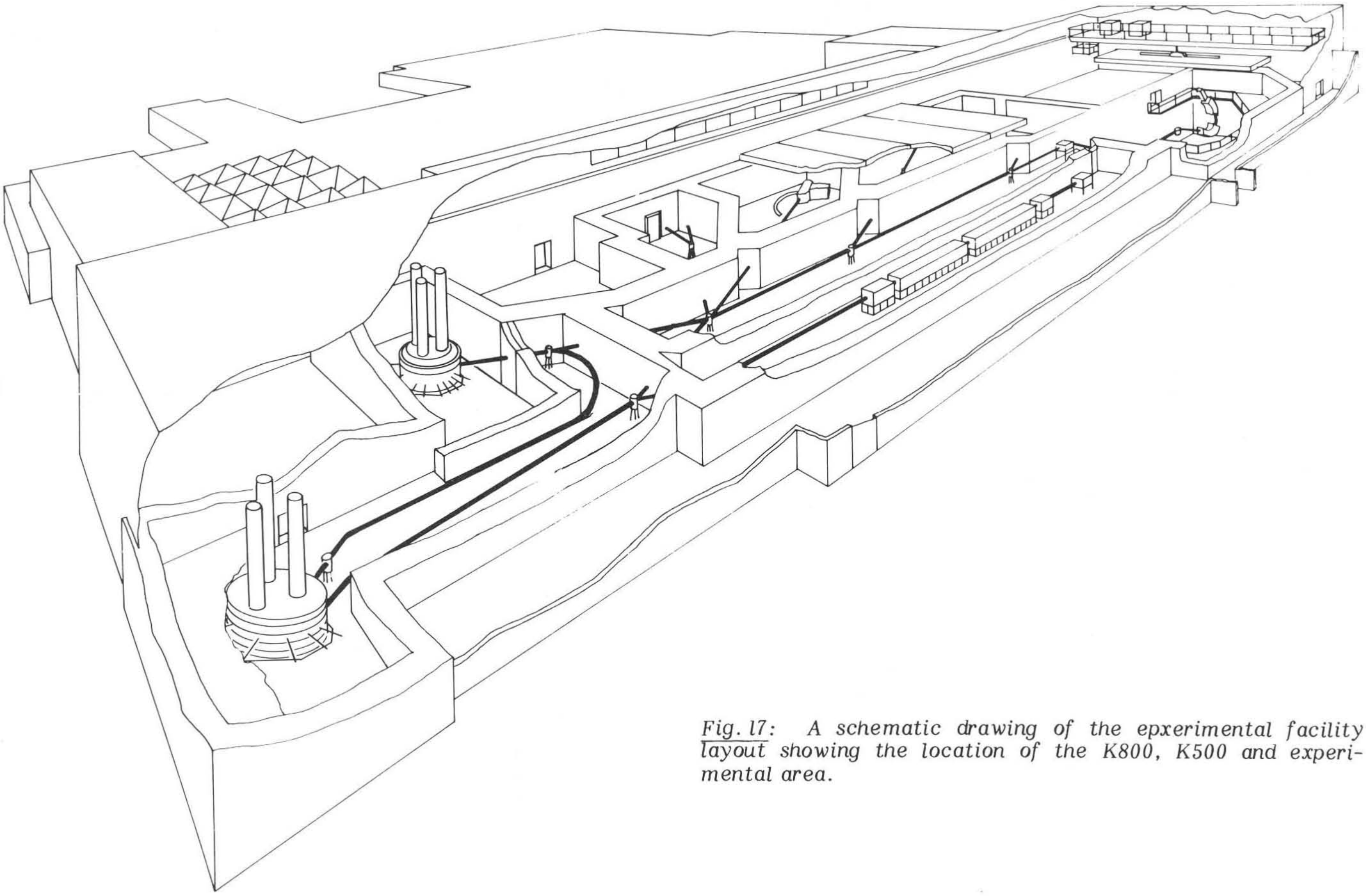


Fig. 17: *A schematic drawing of the epxerimental facility layout showing the location of the K800, K500 and experimental area.*

Fig. 20: *A view of the office addition of approximately 16,600 square feet is shown. The addition will include a seminar room, eleven new offices, plus a large open office area. An additional 3500 square feet of the existing building has been modified.*

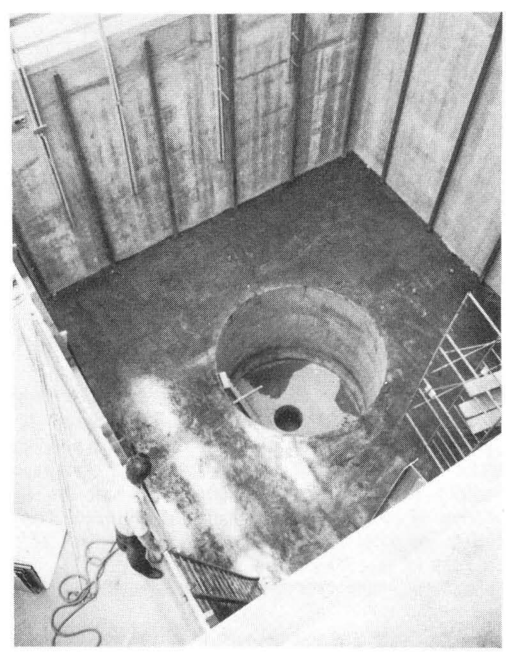


Fig. 18: *Photo of the finished K800 cyclotron pit. The K800 area is 60' x 77' and is adjacent to the K500 vault. Poured concrete walls on the south and west side of the machine provide permanent shielding.*