Progress with ELETTRA, the Synchrotron Light Source in Trieste

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I. INTRODUCTION

ELETTRA [1], the 3rd generation synchrotron radiation source under construction in Trieste has passed the design phase. The present schedule calls for a start of commissioning by the second half of 1993. The buildings are under construction and prototypes for all main components of the accelerator complex have been constructed and industrial production has started. A high power cavity fully equipped with cooling circuit and input coupling loop, as well as mechanical tuning system, has been tested and measured. Prototype cavities equipped with higher order mode supressors are under developement. In-house prototypes for each magnet type have been built and magnetic measurements have been performed. The vacuum chamber prototype has been baked under vacuum and tested with its pumping system. A prototype pure permanent magnet undulator has been assembled and measured. The first 100 MeV sections of the 1.5 GeV injection linac will go in operation in August 1990.

Figure 1. Excavation and foundation of the linac tunnel.

II. BUILDINGS AND INFRASTRUCTURE

The underground linac tunnel and transfer line tunnel have been excavated and the erection of the building is in progress (Fig.1). The deadline for the completion is given by the delivery of the first 100 MeV part of the linac at the beginning of August. The construction of a workshop and storage building, that will also house the magnetic measurement systems, is in progress, and the excavation concerning the main buildings are going on.

The main devices of the electrical substations are under construction. Mechanical and electrical installation work has been started.

III. DC MAGNETS AND DC POWER SUPPLIES

The complete set of magnets for the storage ring includes 24 bending magnets (Fig.2), 108 quadrupoles (Fig.3), 72 sextupoles and 82 combined horizontal and vertical correctors [2]; for the transfer line 5 long and 2 short bending magnets, as well as 30 quadrupoles are neeeded [3].

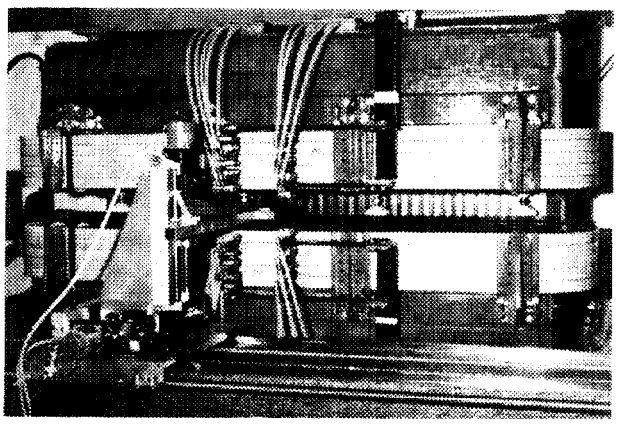

Figure 2. Storage ring bending magnet with hall probe measurement system.

In-house prototypes for all storage ring magnets have been built, company prototypes will be delivered in June (bending magnet) and September (quadrupoles). Company prototypes for the short bending magnet and the quadrupole of the transfer line have been delivered and are currently under test.

The contract for the storage ring power supplies is on schedule. The test power supply for the magnet measurement was delivered in April and has passed successfully the acceptance tests. All other power supplies will arrive at the beginning of 1992. The contract for the transfer line power supplies is also on schedule and the power part has been completed. The delivery will be in September '91.

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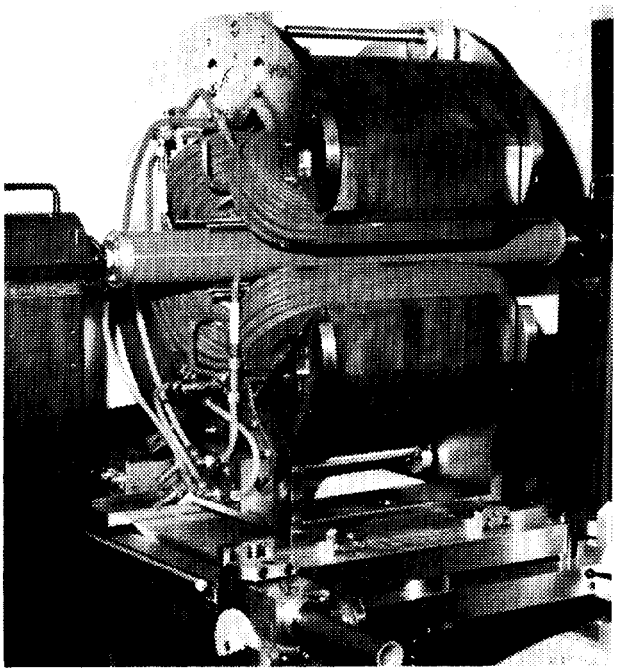

Figure 3. Storage ring quadrupole.

IV. FAST MAGNETS

The design of the fast magnets has been completed. Experiments on a prototype septum magnet with 100 mm length have been completed successfully, giving excellent results both for the magnetic field inside the aperture and the field leakage outside. A full scale septum magnet is under construction in the laboratories. Kicker magnets will be ordered in June '91; extensive tests on a 200 mm prototype (Fig.4) have demonstrated the possibility of obtaining the required 4 μs pulse duration using 0.1 mm lamination.

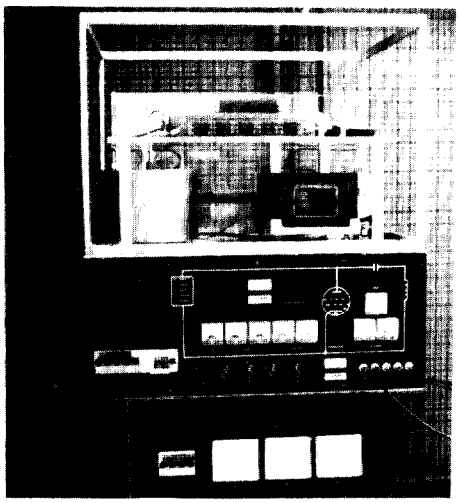

Figure 4. Kicker prototype (200 mm) and pulser.

V. VACUUM

A description of the ELETTRA vacuum system is found in [4]. The half achromat vacuum chamber (Fig.5) has been tested in the laboratory. After a first treatment at 400° C in the vacuum oven, it has been equipped with the final heating panels for the 150° C bakeout in situ. The order for the production will be placed before May '91 and the delivery will start in spring '92.

Sputter ion pumps (108 with 120 l/s and 24 with 400 l/s) and 24 NEG modules have been ordered. All of them have been tested in the laboratory. Thermal and mechanical resistance tests have been performed for the bellows with internal sliding contacts for RF continuity and 65 pieces have been ordered. Twelve gate valves, also with internal RF contacts, have been ordered, with an order for an additional 12 to be made at a later date. Gauges and flanges have been tested in the vacuum laboratory.

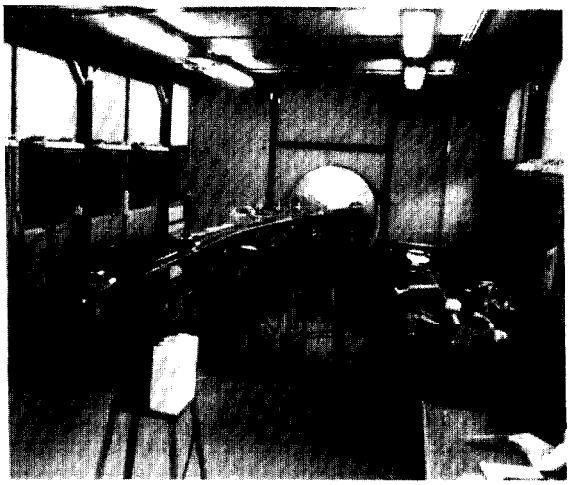

Figure 5. Half achromat vacuum chamber in front of the oven for bake-out.

VI. LINAC AND RADIO FREQUENCY

The first 100 MeV section of the linac [5], will be delivered and assembled in August 91. The extension to 1.5 GeV is on schedule, the first backward travelling wave section has been constructed and is now under test.

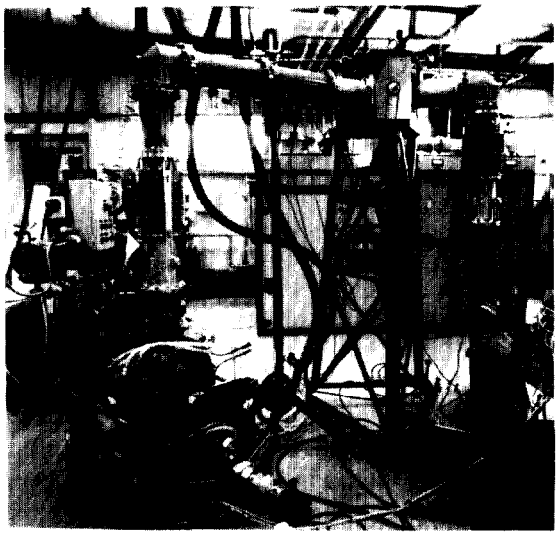

Figure 6. RF power station with prototype cavity.

Before the end of July an RF plant with one section of the CIDR pulse compression system will be completed and tested.

The first 60 kW amplifier for the storage ring RF system [6] is operating at full power in our laboratory. A prototype of the RF power plant has been assembled and the first water cooled cavity has been tested in air up to 26 kW without sparking, including the prototype of the mechanical tuning system (Fig. 6).

The fast phase control loop is under developement and the low level RF distribution system has been designed and its construction has started.

VII. BEAM DIAGNOSTIC AND INSTRUMENTATION

With regards to the storage ring instrumentation [7] the 94 beam position monitors and the prototype of their electronics are under construction.

The linac instrumentation, the first to be operational, consists of the timing system (under test), 3 fluorescent screens (in fabrication), one collimator and 2 Faraday cups (in design); further 4 double ceramic gaps and 2 beam position monitors (being built).

In the transfer line the 11 fluorescent screens, two toroids (to measure the current) and a scraper to measure the energy spread are in fabrication. Six beam position monitors are ready to be ordered.

VIII. CONTROL SYSTEM

For the ELETTRA control system [8] a working prototype of the man-machine interface, based on a complete standard platform (Unix, X-window and Motif), is ready and available for development of distributed application programs among consoles and local process computers. A configuration system based on the Oracle relational database is now available for management of machine data.

A new version of the 1553 bus is available for development of application protocols. Apart from having been inproved in terms of functions and speed, the new version also allows the use of multiprocessing. The evaluation of application software has been started, whereby the controls of the power supplies has been completed and the controls of insertion devices is under way.

IX. INSERTION DEVICES (ID)

A prototype of the ID support structure, as a standard design for both undulators and wigglers, has been built and succesfully tested, and has been used for the assembly of a prototype pure permanent magnet undulator (Fig.7). In the following months a prototype of a 1.5 T hybrid multipole wiggler will be constructed, as well as a prototype of a novel electromagnetic elliptical wiggler for generating circularly polarized radiation whose helicity can be switched at up to 100 Hz. Construction of a prototype 20 mm gap ID vacuum chamber is under way. Further details are given in [9] .

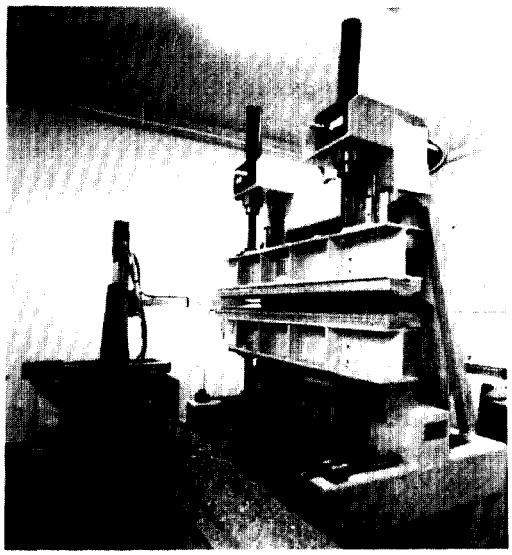

Figure 7. Prototype of a pure permanent magnet undulator with support and magnetic measurement system.

X. REFERENCES

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