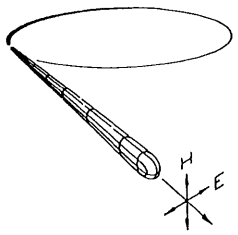


Synchrotron Radiation Center
University of Wisconsin-Madison

ALADDIN UPDATE

January 1983

The purpose of this newsletter is to update the scientific community in general and our user group in particular of recent progress on the Aladdin storage ring at the Wisconsin Synchrotron Radiation Center.

The Microtron

The function of the microtron is to provide pulses of 100 MeV electrons for injection into the storage ring. It has been working reliably and efficiently for the last 15 months. It is the highest energy microtron in operation in the western world and represents a major success in accelerator design and construction. At present, it produces one pulse every 100 ms with a peak current of 2 ma and a pulse length of 600 ns. The microtron is located in the center of the storage ring to make effective use of otherwise relatively useless space - see Fig. 1 of this newsletter. Modifications that are planned but presently deferred because of the higher priorities of bringing Aladdin on line and the development of beamlines should increase the beam current from the microtron by a factor of ten.

The Storage Ring

The storage ring is composed of four long straight sections, 12 dipole bending magnets, and 24 multipole magnets. These have been installed, surveyed-in, and repeatedly run over the last several months. The first beam was injected into the storage ring in December 1981 and a stored beam was achieved six weeks later with successful operation of the radio frequency accelerating cavity (beam half-life of ~3 sec.) - see Fig. 1.

Efforts during the spring and summer of 1982 emphasized the debugging of the storage ring, its computer system, and its ancillaries. By April, the beam half-life had been increased to ~5 min. with peak currents of ~1 ma. Stacking of the beam was attempted but has thus far been unsuccessful because of stray fields discussed below. Beam acceleration to 120 MeV was accomplished and further accelerating, which appears possible, has been deferred until higher beam currents are achieved. Considerable energy has gone into identifying optimal operating conditions for the microtron, the injection/transport sections, the inflector, and the ring magnets. No fundamental problems have been detected in the design of any component of the storage ring or injector.

During November, the inflector system of Aladdin was carefully examined to observe and eliminate stray magnetic fields. Basically, it was found that deflecting fields of ~3 kg-cm near the inflector distorted the beam orbit and precluded beam stacking. The initial attempt at shielding near the inflector reduced stray fields by a factor of ~50 but mechanically constrained the beam; a second shield was installed in early December. Other magnetic field studies showed that two commercial ion pumps had incorrectly aligned magnets and each produced 15 gauss stray fields in the orbital plane; both were corrected. The storage ring is now reassembled and efforts are underway to inject and stack the beam. Several consulting accelerator scientists will be visiting during January and February of 1983 to help with the commissioning of Aladdin and to interact with the SRC staff.

The Beamlines

Aladdin has 12 bending magnets with at least three beamlines per bending magnet. As shown in Fig. 1, twenty-one of those beamlines are committed to laboratory or user beamlines.

The Synchrotron Radiation Center is installing ten beamlines for general use by the User Community in a fashion similar to that which has proven effective during the thirteen years of operation of Tantalus. Scheduling of beamtime on those lines is done by the Director and his advisory board. At the moment, the complement of monochromators includes three grasshopper grazing incidence monochromators, a 3m and a 6m toroidal grating monochromator, a double 6m-10m toroidal grating monochromator, two normal incidence monochromators, a 4m high resolution normal incidence monochromator, and a proposed x-ray crystal monochromator. The spectral ranges for these instruments is given in Table 1. As indicated, they span the range from the visible to the x-ray and provide highly-focussed, uhv-compatible photons with high flux or high resolution, depending on the instrument. All are available for Users and all are maintained by the laboratory. Details of operation for these instruments are available upon request.

Eleven beamlines are being constructed by groups of Users who have construction funds independent of the Synchrotron Radiation Center. These include the Canadian Synchrotron Radiation Facility (Research Council of Canada), the Iowa State University/Montana State University beamline (NSF), the University of Illinois (NSF and MRL), the Minnesota/Argonne beamline (Minnesota Center for Microelectronics and Information Sciences and Department of Energy), the Tennessee/NBS beamline (NSF), the University of Wisconsin Chemistry-Physics beamline (NSF), the Texas beamline (proposed) and the Cornell beamline (proposed). Others are in various stages of negotiation. It should be noted that these beamlines will be available to other Users through scheduling by the SRC director and discussion with the primary users.

Installation of beamlines on Aladdin will wait until a reasonably stable full-energy beam is stored in Aladdin so that radiation shielding for personnel can

be installed and the final position of the beam in the storage ring can be determined. Four beamlines are ready to be installed and four or five more should be ready in January 1983. The new 6m and 6m-10m toroidal grating monochromators should be ready for installation by late spring or early summer 1983. The date of transfer of instruments now operating on Tantalus will be determined by the rate at which Aladdin becomes fully operational and by plans for upgrading/ refurbishing.

Personnel

The SRC optics group has been increased in number by the recent addition of Franco Cerrina to the staff. A second addition is being considered. Michael Green of the accelerator group is presently contributing substantially to beamline design and implementation.

The in-house scientific staff was temporarily reduced this year when both members were offered faculty appointments outside the University of Wisconsin. It is anticipated that at least one position will be filled within the next 12 months.

Scheduling

Requests for beamtime for Tantalus are still be accepted. However, the lead times for the high energy grasshopper and toroidal grating monochromators are presently 8 months. Time on the lower energy monochromators is available for scheduling in the spring. No schedules have yet been made for Aladdin.

User Executive Committee

The User Executive Committee, which functions to advise the SRC Director on matters of program development and science, is now constituted to include

D.E. Eastman - IBM
Z. Hurych - Northern Illinois
K.L. Kliewer - Argonne
G.J. Lapeyre - Montana State
D.W. Lynch -Iowa State/Ames Lab
R.P. Madden - NBS
J.W. Taylor - UW Chemistry
J.H. Weaver - Minnesota

TABLE I

Spectral ranges of monochromators shown in Fig. 1.

Seya - Normal Incidence - 5-50 eV
ERG - Extended Range Grasshopper - 20-1200 eV
NIM - Normal Incidence - 5-40 eV
TGM - Toroidal Grating - 6-180, 225, 700 eV
Grasshopper - Grazing Incidence - 20-1000 eV
X-ray - Crystal - 800-4000 eV

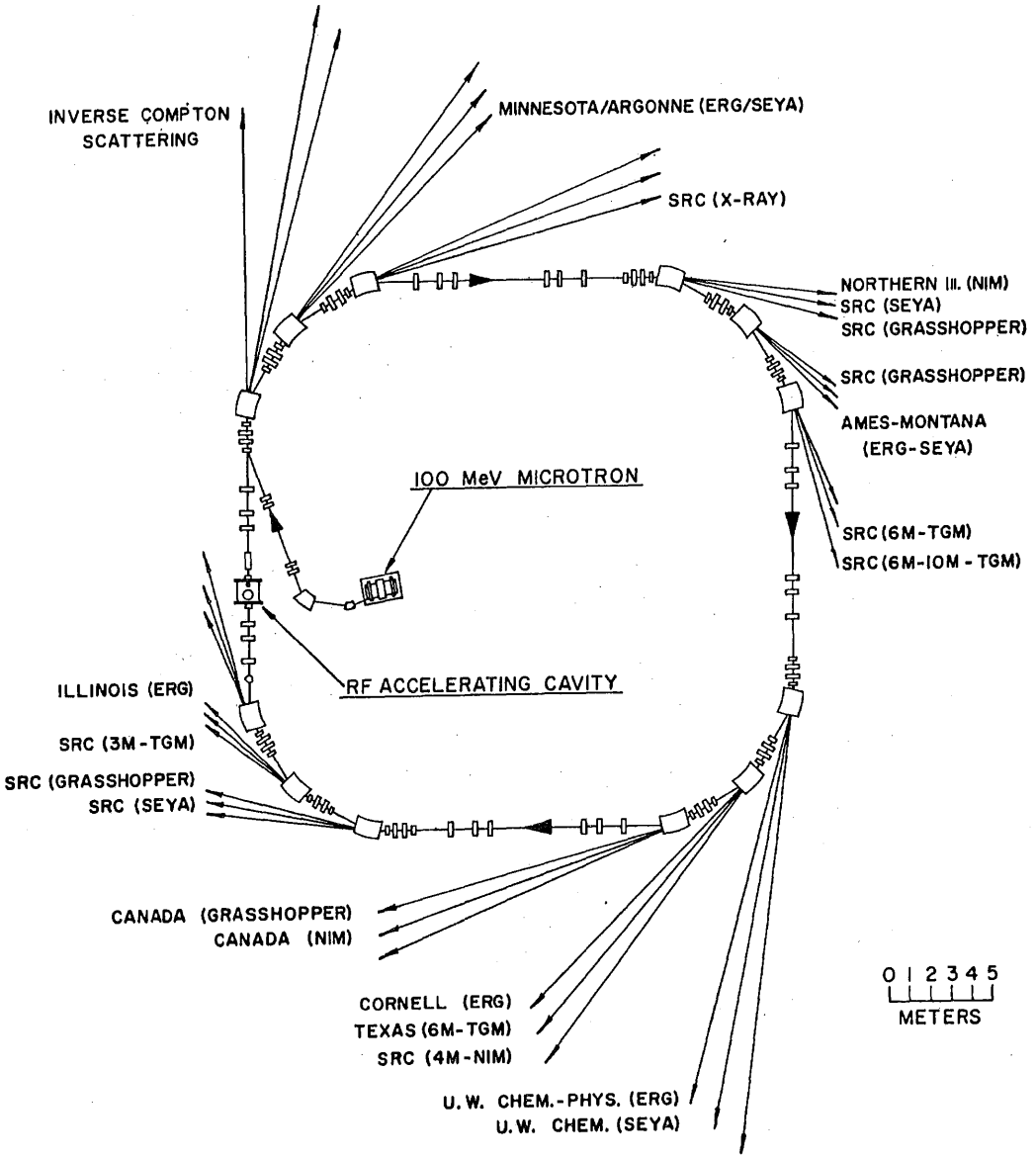


Fig. 1 Schematic of the Aladdin 1 GeV electron storage ring showing the microtron injector, the transport line, the storage ring, and the RF cavity. The twenty-one beamlines are identified according to principal investigators or the facility.

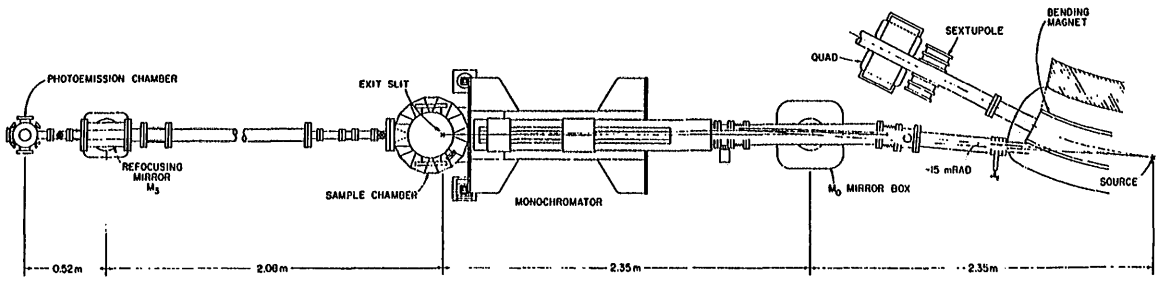
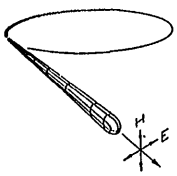


Fig. 2 A typical beamline on Aladdin showing a dipole bending magnet, a mirror box accepting 15 mr of beam, a grazing incidence monochromator and two alternate sample chambers.



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