

STATUS OF THE ALADDIN PROJECT *

E.M. Rowe, M.A. Green, J.W. Hicks,
W.S. Trzeciak, and W.R. Winter, Jr.
Synchrotron Radiation Center
University of Wisconsin
3725 Schneider Drive
Stoughton, WI 53589

SUMMARY

The first description of an electron storage ring designed specifically to be a source of synchrotron radiation appeared in the proceedings of an earlier meeting in this series.¹ We now report on the status of the 1 GeV electron storage ring Aladdin which is a development of the earlier work cited. This machine, now nearing completion, will be an intense source of synchrotron radiation over the wavelength range extending from the far infrared (100 μ) to the Beryllium window cut-off (-3 \AA). The machine incorporates a number of novel design features: a 100 MeV microtron injector, a simple but powerful computer based control system and an extremely flexible lattice.

DESCRIPTION

The parameters of Aladdin are given in Table I and a lattice element is shown in Fig. 1. The ring is made up of twelve lattice elements arranged in four quadrants separated by four long straight sections. The long straight sections include 4m drift spaces. Three of the long straights will be used in the future for the installation of wigglers, undulators and free electron lasers. The fourth long straight is taken up by the RF cavity and the injection system. The ring is shown schematically in Fig. 2.

Table I

Energy	1 GeV
Circumference	88 Meters
Magnetic Radius	2.08 Meters
Focussing Order	F D B O
Periods	12
Super Periods	4
$\left. \begin{matrix} v_x \\ v_y \end{matrix} \right\}$ nominal	$\left. \begin{matrix} 7.15 \\ 7.15 \end{matrix} \right\}$
Injection Energy	0.1 GeV
Injector	Race Track Microtron
Harmonic No.	15
Accelerating Voltage	250 KV
Energy loss per turn	42.5 KV
λ_c	11.6 \AA
σ_ϕ	66 mm
σ_x	0.52 mm
σ_y	0.075 mm
ϵ_x	0.063 mm mr
ϵ_y	0.001 mm mr

at the SR source points

The vacuum chamber is constructed of stainless steel and includes both "in tank" pumps in the dipoles and "house keeping" pumps in the straight sections. The pumps in each quadrant are powered by two power supplies operating through vacuum relays. Individual pump currents are monitored by the Aladdin control computer.¹

All magnets except the sextupoles are laminated. The dipoles are excited by a SCR regulated supply. Control signals for the quadropole and sextupole supplies are derived, via the control computer, from the dipole current.

The RF cavity, which has both automatic tuning and coupling, is constructed of aluminum. The method of connection of the aluminum cavity to the stainless steel vacuum chamber is described in another paper in the proceedings of this conference.²

The injection system utilizes a pulsed magnetic inflector and two kickers for five turn injection.^{3,4} The injector is a 100 MeV race track microtron.

Control of the machine is through a computer based system consisting of three head end processors and an executive computer. All sub-system statuses and parameters are available for monitor and control to the machine operators through this system. The computer system also monitors photon beam line vacuua and area radiation safety interlocks.

The ring is installed in the basement of a 33,000 ft² steel building twelve feet below ground level on bedrock. Heat rejection from the building and machine is through cooling towers. However, a portion of the waste heat is saved in an 80,000 gallon pool. The energy stored is sufficient to maintain the building at 70°F for 48 hours against a mean outside air temperature of -10°F, a condition that often occurs in the Wisconsin winter. In the future, as improved Servel cycle refrigerators become available, it may also be possible to use the waste heat to reduce the energy demand for air conditioning in the summer.

CURRENT STATUS

At this time, construction and installation of the ring are complete and the pressure in the vacuum chamber has reached $<5 \times 10^{-9}$ without baking. Check out of the computer and the various sub-systems is proceeding.

Completion of the construction and installation of the microtron is expected by the end of March. Ring injection studies will begin when the microtron is commissioned.

References

- 1 W.S. Trzeciak, The Aladdin Control Computer, IEEE Transactions on Nuclear Science, June 1981.
- 2 F. Middleton, An All Metal UHV Flange Seal for Dissimilar Materials, IEEE Transactions on Nuclear Science, June 1981.
- 3 M. Green, et. al., Design and Operation of the 100 MeV Aladdin Microtron Injector, IEEE Transactions on Nuclear Science, June 1981.
- 4 M. Green, Orbit Studies for the 100 MeV Aladdin Race Track Microtron Injector, IEEE Transactions on Nuclear Science, June 1981.

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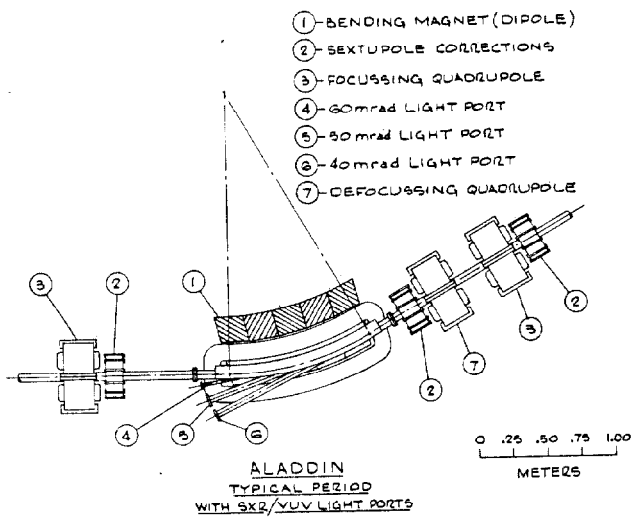


Fig. 1

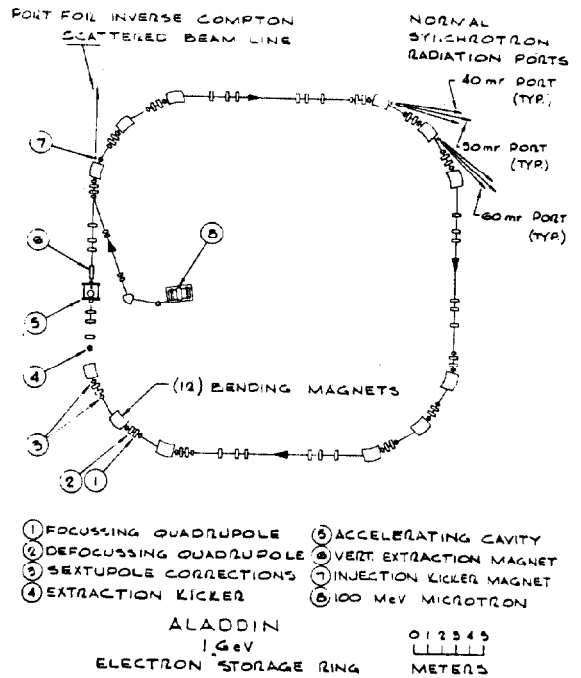


Fig. 2

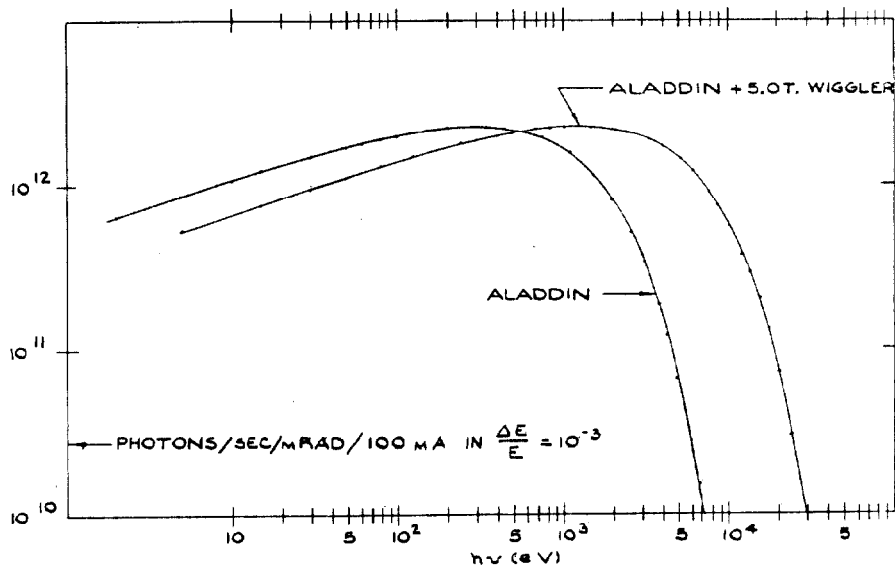


Fig. 3 Spectrum of Synchrotron Radiation from Aladdin at 1 GeV.