Section 8 VLER RF System

The RF system for the VLER is much simpler than that for PEP-II. Only a single cavity is needed to provide the required RF voltage of about 100 kV for a beam energy of 500 MeV. A prototype RF cavity was built for PEP-II several years ago. This cavity operated successfully at full PEP-II parameters and produced 800 kV acceleration. This cavity is shown in Figure 8-1. With the addition of HOM dampers this cavity is ready for PEP-N.

The synchrotron radiation parameters for VLER are shown in Table 8-1 for different energies and currents. At full energy and power the RF system needs to deliver to the beam 365 W with a voltage of 100 kV. At 100 kV the RF power going into the cavity wall is 1.32 kW and the reflected power is 0.68 kW. Thus, the total power needed is 2.36 kW. PEP-II klystrons deliver 1.2 MW. So a much smaller power source is sufficient.

The bunch length versus RF voltage and beam energy is shown in Figure 8-2. A voltage of 100 kV is sufficient to deliver the required bunch lengths of about 1 to 1.5 cm.

The controls for the RF system are similar to those of PEP-II but can be made simpler as the power levels are much smaller. The timing and phase signals are available in IR12 as there are PEP-II HER RF stations nearby.

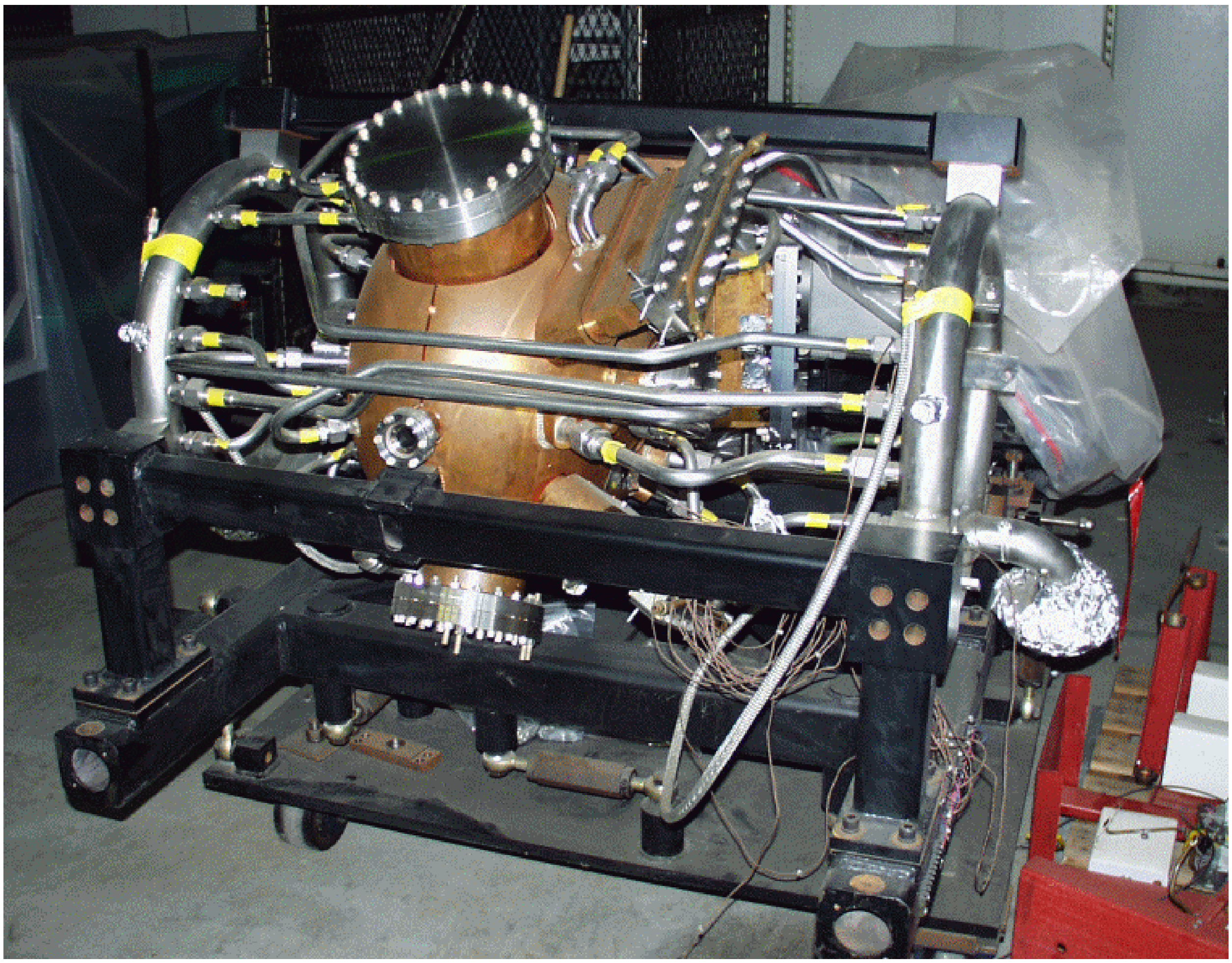

Fig. 8-1: Existing RF cavity for VLER.

Table 8-1: Synchrotron radiation parameters for VLER at several energies.

Energy (MeV)	Beam Current (mA)	Number of part.	Bending radius (m)	Synchrotron radiation loss/turn (eV)	Synchrotron radiation power (Watts)	Synchrotron radiation critical energy (eV)
150.	10	7.35 e+09	1.216	3.68 e+01	0.37	6.16
300.	40	2.94 e+10	1.216	5.90 e+02	23.58	49.25
500.	80	5.88 e+10	1.216	4.55 e+03	363.90	228.0

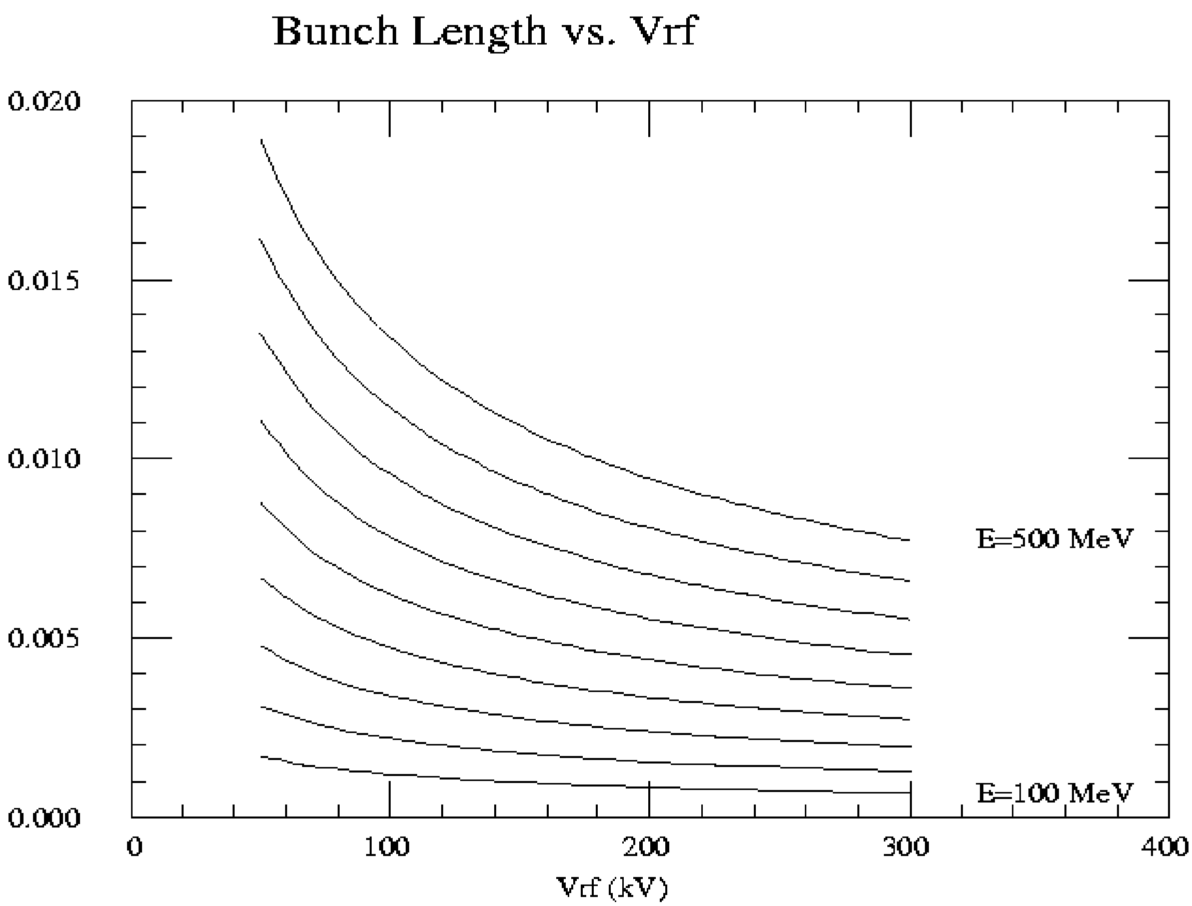

Fig. 8-2: VLER bunch length in meters versus RF voltage, for different energies in 50 MeV steps.

Section 9 VLER Vacuum System

The vacuum system for the PEP-N VLER must provide for a good beam lifetime, have a low beam impedance, and dissipate synchrotron radiation power. This system must be as reliable as the PEP-II system as the two systems are connected.

The vacuum system will be aluminum cylindrical chambers with stainless-steel conflat flanges. The diameter in the quadrupoles and drift sections will be 3.5 inches or 90 mm. This provides for beam-stay-clears of over 10 sigma. This size is the same as the PEP-II straight section chambers allowing many common components. For example, VLER can use the straight section bellows modules as-is. In fact, there are sufficient PEP-II bellows spares to provide for nearly all that are need in the VLER. The chambers in the dipole magnets will be flattened to 70 mm x 100 mm to match the aperture.

The synchrotron radiation power is below 400 W (see Table 8-1). Thus, each dipole produces less than 50 W. This power is distributed over about 1 m of chamber which is 0.5 W per cm. At this power level no water cooling is needed.

There will be six sputter ion pumps to hold the vacuum pressure when PEP-N is not running. The dipole magnets will have distributed ion pumps (DIPs) used during operation. There are sufficient spare units from PEP-II HER construction to build the eight units needed for PEP-N. The position monitor buttons are the same.

The injection and transverse feedback systems need ceramic chambers. The PEP-II ceramic chamber design works for VLER except shorter units are needed. The ceramics will have an internal metal coating as in PEP-II.

Section 10 VLER Controls

The controls and diagnostics for VLER are mainly shared or copied from PEP-II. The local computer will be shared with PEP-II in IR12. Two or three new CAMAC crates will be needed. The position monitors will copied from PEP-II. Most of the parts for simple synchrotron light, tune, and current monitors can be made from old PEP components and prototype PEP-II parts. The software has been already developed for magnet and diagnostic control.