R. Nonintercepting Beam Position Monitor, J. S. Fraser, CRNL

The following is a summary of a paper by J. McKeown, CRNL, to appear in Proc. 1979 Particle Acceleration Conference.

Beam tests have been carried out with a cylindrical cavity tuned to 2.415 GHz which is the third harmonic of the accelerator frequency. The beam excites a TM_{110}-like mode when the beam centroid is displaced horizontally and an orthogonal mode when the beam is displaced vertically. The phase reversal detected when the beam crosses the plane of symmetry identifies the quadrant occupied by the beam. The signal voltages are proportional to beam current and displacement with an average slope of 0.35 $mW^{1/2}.mm^{-1}.mA^{-1}$.

The beam couples to the longitudinal electric fields of two TM_{110} modes of a cylindrical cavity. A bimodal cavity was constructed in which quadrupolar symmetry is created by introducing tuning plungers at radial positions near the electric field maxima and four magnetic coupling loops on the circumference.

The bunched beam passes through a 3.8-cm-diameter hole in a cavity which internally is 14.75-cm diam and 6-cm long. Bench tests, in which a common oscillator was used to excite both modes simultaneously through two probes, showed that the relative phase and amplitude of the modes could be varied independently and that the isolation was greater than 40 dB.

In the beam tests the bimodal cavity was traversed horizontally and vertically across the beam. A change of phase of π radians was observed as the signal dropped to zero when the beam was on axis. The signal power was shown to be proportional to the square of the beam current. Mode isolation consistent with the theory was also demonstrated.

S. Beam Light Profile Monitor, J. S. Fraser, CRNL

Studies will shortly be under way at Chalk River National Laboratory on the light emitted by the residual gas in a beam pipe carrying a high-current proton beam. The object of the study is to search for emission bands in the molecular spectra (H_2 or N_2) that are independent of the free-electron density in the vicinity of the beam. If there is sufficient intensity in the visible range (say 400 nm to 800 nm) a beam profile monitor based on light may then be feasible. Various optical devices, for example, linear photo-diode arrays, vidicons, fiber optics, microchannel plate image intensifiers, might be used for recording the profiles.

Using multiple profiles (three or more), the beam current density distribution can be reconstructed using tomographic techniques. If the transfer matrix for high current beams in a drift space is known theoretically, an estimate of the transverse emittance may be made by reconstruction techniques with a nonintercepting beam profile monitor.