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SUPPRESSION OF VERTICAL COHERENCE IN THE AGS

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Recent investigations have revealed a simple method for suppressing the early vertical coherence when it appears. As in the case of the high energy occurrence of this phenomena (when dv_v/dr passes through zero) it can be suppressed by programming the vertical sextupole. This increases the spread in the quantity $(n-v_v)\omega_o$ and permits Landau damping to predominate.

At present the vertical sextupoles can be programmed from zero to seven amperes in about 40 milliseconds. This produces a 50% increase in dv_v/dr at 73 milliseconds and is close to the limit of the sextupole power supply. Currents much higher than this at this time in the acceleration cycle can produce beam loss since it is in this region that the horizontal half integral resonance is crossed. Thus, this method of coherence suppression has definite limitations.

However, during recent operation when for one reason or another the vacuum has been poor so that early coherence as large as .7cm peak to peak was present a program starting at 50 milliseconds and stopping at 150 milliseconds completely suppressed the oscillations. The beam intensity was as high as 1.3×10^{12} and the I-10 vacuum $> 10^{-5}$mm.

It should be noted that the beam position during this time was on the inside as given by the radial error signal i.e., $> {}^{+}1$ volt. Past measurements indicate that the coherence threshold is lowered if one operates further outside i.e., near zero on the radial error signal though the reason for this is not yet understood. Fortunately, the inside position gives higher intensity and hence is the normal operating point.

Because of the above mentioned limitations on using the vertical sextupoles to suppress the early coherence it is felt that in the near future as the AGS intensity is increased a feedback stabilization system will be needed. Since only a pure n=9 mode has been observed early, the system need not accommodate higher order modes nor must it act on the bunches individually. However, it shall have to operate over a range in ν_v from 8.90 to 8.75 and in f_o from 240 to 372 kc. A bandwidth of 20kc to 100kc will cover this range satisfactorily but one will, of course, have to provide a 90^o phase shift over this spectrum.

A future report will discuss the vertical instability in detail and a separate design study of a damping system is also planned.

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