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Initial debuncher tests

J. Sheehan

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Collider Accelerator Department

Brookhaven National Laboratory

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Subject Initial Debuncher Tests

OBSERVATIONS AND CONCLUSION

Setup - The debuncher was operated at 200 kW of excitation to measure its effect of the momentum spread as measured at the scanning SEM wire near quadrupole Q16 (NQ 299).

Procedure - A beam of approximately 50 mA, 30 microseconds at 5 pps was transported to the linac beam stop (NZ 304). The beam was run through a 1.0 mm vertical slit at NE 202. About 5 mA of beam passes through the slit. The SEM wire scan as displayed on a storage scope is calibrated to give approximately 1% $\Delta p/p$ full scale width on the scope sweep.

With debuncher rf excitation off and the cavity tuned to resonance the 50 mA of beam excites the cavity to a monitor probe level of 1.3 volts. Detuning the cavity with a motor driven slug tuner reduces this probe voltage to less than 0.05 volts.

Running the cavity at 1.8 probe volts (approximately 160 kW) and plotting energy out versus relative debuncher phase gives a peak-to-peak energy shift of 4.8 MeV or a peak debuncher voltage of 2.4×10^6 volts. From this the detuned cavity voltage of about 70 kV is obtained. Further cavity detuning is possible if this value is too high.

Results - Operating the debuncher at power levels between 25 kW and 200 kW shows that energy spreads of 450 keV for 100% of the beam is possible at about 125 kW. As the power level is raised the FWHM energy spread continues to decrease, but the energy spread for the remainder of the beam increases. These measurements are compared to the full width energy spread of about 3 MeV for no debuncher.

The debuncher phase and amplitude control systems do not compensate completely for the severe reactive loading caused by the beam. This system is being studied to see what improvements can be made.