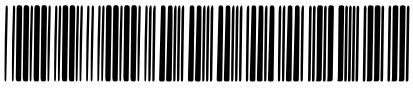
M1



ISR-ES-RF/AH/cs

28th May 1976

ISR PERFORMANCE REPORT

Run 707, 26 GeV, R2, 7.4.76
Run 723, 26 GeV, R2, 14.5.76

ACTIVE LANDAU CAVITY

Summary

The experimental cavity was powered with the 1kW amplifier on the 6th harmonic of the RF frequency and used to provide Landau damping for longitudinal bunched beam instabilities. Stable bunches were achieved but the bunch form was asymmetric. Long term stability was not very good because the bunch length often exceeded the wavelength of the cavity oscillation. By powering the cavity with the opposite phase long bunches with a flat top were produced.

Experiments

In Run 707 the impedance of the cavity was set to ~15 kΩ (Q = 240). The cavity was powered on the sixth harmonic of the RF frequency with the 1kW amplifier. The matching between amplifier and cavity was not good. Stable bunches with a strange form were achieved (fig. 1). We had no time to adjust the phase of the cavity correctly.

For Run 723 the loop through which the cavity is powered, was reduced in area from 149 cm^2 to 55 cm^2. This provided a better matching for the drive.

However this change increased the minimum impedance to~85 kΩ (Q = 1400) which in turn gave large beam-induced voltages. We could make stable bunches (fig. 2) but the bunch form was asymmetric due to the beam induced voltage. The bunches were slightly longer than the wavelength of the cavity oscillation and often an instability started at the edges of the bunches after a while.

We also changed the phase of the cavity oscillation by~180° such that the slope of the RF voltage was reduced. In this way the phase oscillation frequency for particles in the centre of the bunch gets smaller and the bunches become longer having a flat top (fig. 3).

By increasing the cavity voltage under this condition the slope of the total voltage (RF + cavity) becomes negative in the centre of the bunch and a dip develops (fig. 4).

Finally we used the cavity in a passive way driven by the beam (because a cable in the powering circuit burned up) and made stable bunches.

P. Bramham, S. Hansen, A. Hoffmann, E. Peschardt

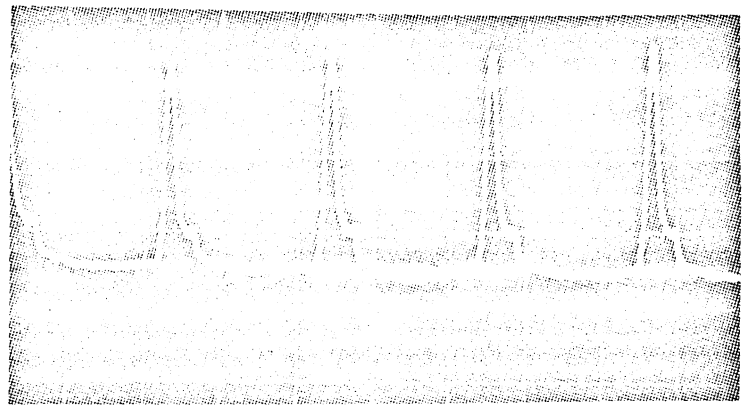


Fig. 1. Run 707, stable bunches, I = 130 mA.

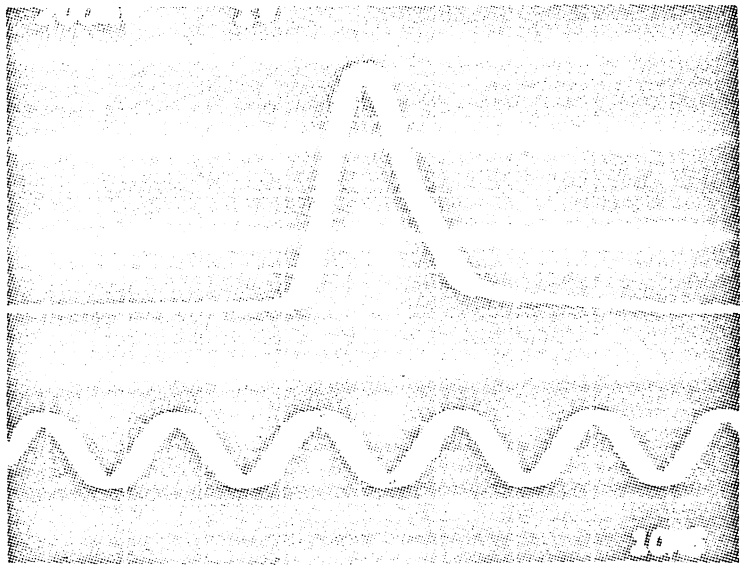


Fig. 2. Run 723, stable bunches, I = 48 mA.

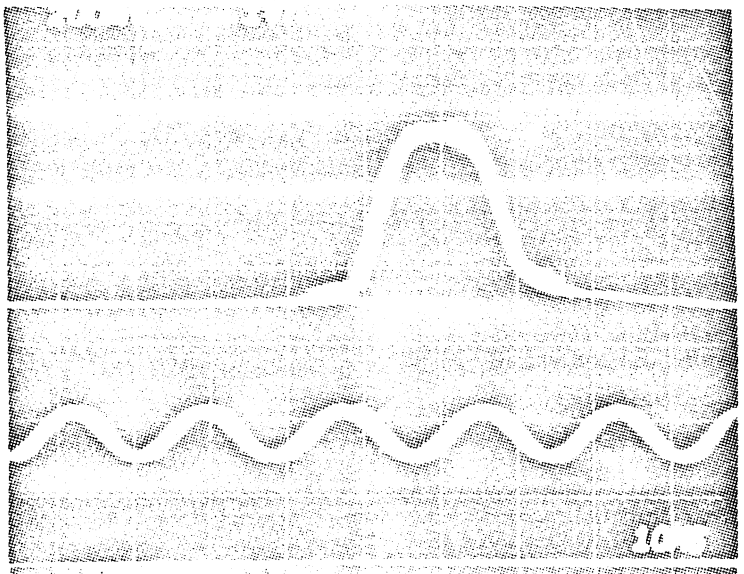


Fig. 3. Phase of the cacity oscillation changed by 180°.

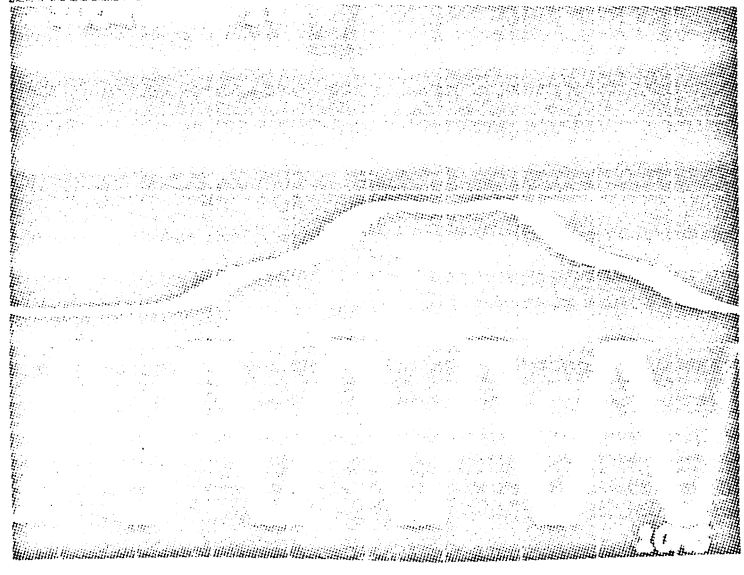


Fig. 4. As fig. 3 but larger cavity voltage.