

# Presentation 75

## Existing Transverse Feedback System

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### 75.1 Introduction

The transverse mode coupling instability is expected to be a major current limitation in LEP. The threshold current can be raised by compensating the mode 0 frequency shift with a reactive feedback system [1]. A transverse feedback system has therefore been developed [2], with two pick-ups spaced a quarter betatron wavelength apart so that any combination of reactive and resistive feedback can be applied. The latter can be used to ensure stability of high intensity beams in the absence of positive chromaticity.

### 75.2 Results with beam

The first tests were mainly done in the vertical plane where the instabilities occur first. Resistive feedback was demonstrated by decreasing the stability limit and applying feedback to one bunch only. Current could only be accumulated in this particular bunch.

The system is set-up by measuring open loop transfer functions with a two-channel FFT spectrum analyzer. When the phase shift at the amplitude peak is  $-90^\circ$  the system is purely reactive with a positive frequency shift. If the phase shift is  $-180^\circ$  the feedback is purely resistive. Figure 75.1 demonstrates resistive feedback and Figure 75.2 reactive feedback. In the latter case the Q-shift was only 0.007 but 0.067 has been obtained with higher gain settings. However, high gain requires excellent phase stability; an error is fatal for the beam.

### 75.3 Outlook

After the LEP start-up in March this year the vertical systems will be tested and made operational as soon as possible. At present the application software is being written. The present system is only operational with four bunches. During this year the upgrading to eight bunches will take place. This requires a redesign of the timing system, a replacement of the digital signal processor and a doubling of the number of analogue channels.

### References

- [1] S. Myers, "Stabilization of the fast head-tail instability by feedback", Proc. 1987 IEEE Particle Accelerator Conf., pp 503-06.
- [2] L. Arnaudon, S. Myers, R. Olsen, "Commissioning of the LEP transverse feedback system", Proc. 1990 European Particle Accelerator Conf., pp. 1554-56.

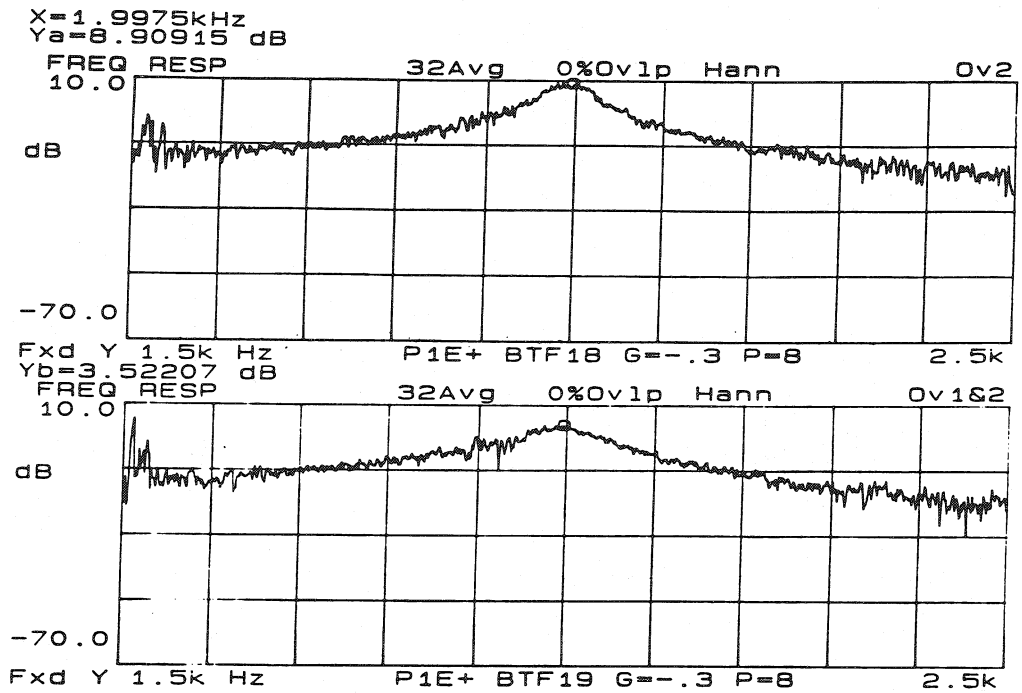


Figure 75.1: Transfer functions with open (upper) and closed (lower) loop. Resistive feedback

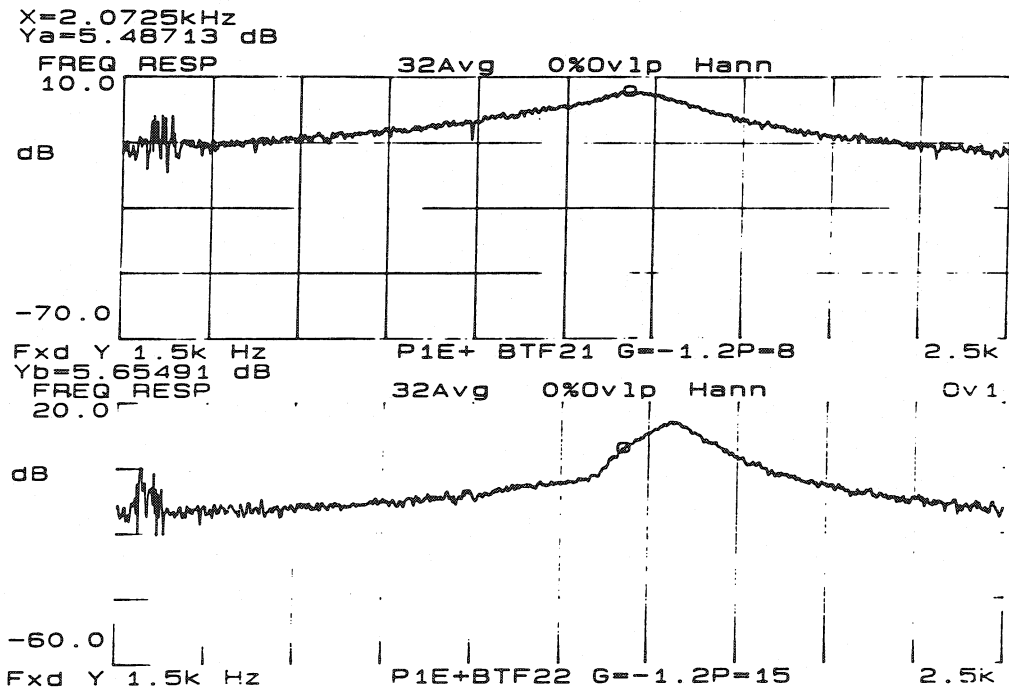


Figure 75.2: Transfer functions with open (upper) and closed (lower) loop. Reactive feedback with a Q-shift of 0.007