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SINGLE PASS COLLIDER MEMO CN- 233

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TITLE: Klystron Voltage Pulse Timing Experiment

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Introduction

SLAC has always operated with the voltage pulse applied to each klystron having a "flat-top" at least 2.5μs long. In this region, the voltage is held constant to ±0.5%, limiting the klystron contribution to beam energy spectrum broadening caused by phase and amplitude modulation of the RF wave travelling along the accelerator sections. Since the section filling time is 0.83μs and the maximum beam pulse length is 1.6μs, a minimum flat-top duration of 2.43μs is required, which when rounded up to 2.5μs allows for some timing error.

The advent of single-bun ı beam operation for SLC, coupled with the use of the SLED pulse compression system (which produces an RF output to the accelerator which changes drastically in one section filling time) and the rapidly rising cost of electrical power experienced in recent years, have made it desirable to review the specifications of the voltage pulse supplied by the modulator to the klystron.

Neglecting the possibilities of increasing modulator efficiency, which are being studied by others[1], one can ask whether some use can be made of the energy contained in the skirts of the voltage pulse on each side of the flat top region. The rise and fall times of a typical pulse are sufficiently slow that, even with the 5μs flat top necessary for SLC beam energies, about 20% of the total pulse energy is contained in the skirts and is wasted as collector dissipation rather than contributing to RF amplification.

Experiment

As a first step towards finding what penalties are paid for reducing the voltage pulse width so that the skirts encroach upon the time that the RF drive pulse is on, the following experiment was done at Station 9-6.

The station was triggered through a portable rate generator. The variable delay feature on the portable rate generator afforded a convenient, local means of varying the timing of the klystron high-voltage pulse V_k. As shown in Fig. 1, a pulse-generator driving a PIN diode modulator was used to gate the sampled SLED output RF waveform. The gate width and time were adjusted so that only the energy contained in the "useful" part of the SLED pulse (i.e., the last 0.83μs, starting at PSK time and finishing at the end of the klystron pulse) was transmitted to the power meter. Phase-shift through this part of the pulse could be displayed and measured using the phase bridge and a CW reference signal. Three scopes were used to display the various waveforms.

[1] R. Ecken, private communication

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