III-1. THE RF DRIVE SYSTEM FOR THE STANFORD TWO-MILE LINEAR ACCELERATOR

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The function of the rf drive system for the Stanford Two-Mile Linear Accelerator is to supply rf drive power at 2856 MHz to an array of 240 high power (24 Mw) klystron amplifiers and to assure that the correct phase relationship between each of these drive signals and the electron bunches in the accelerator is preserved over a tuning range of ± 0.1 MHz. This paper gives an overall description of the system which fulfills these requirements, and discusses some of the microwave engineering and measurement problems encountered in its design.

The rf drive system consists of the following subsystems:

1. One master oscillator tunable within 476 ± 0.017 MHz.

2. One "main booster" which amplifies the signal from the master oscillator to a level of 17 kW cw.

3. A two-mile long 3-1/8" diameter coaxial drive line which transmits this cw signal at 476 MHz over a two-mile length and includes 30 coupling points to feed 4 watts of cw power to each of the 30 sectors which make up the machine.

4. Thirty sectors, each containing:

(a) a varactor multiplier system which multiplies the frequency of the 476 MHz signal by 6 to the operating frequency of the accelerator, 2856 MHz.

(b) an isolator, phase shifter, attenuator unit which controls the signal at the output of each varactor multiplier, and a special phase shifter capable of introducing an extra 180° for positron acceleration.

(c) a pulsed klystron which amplifies the cw signal from the multiplier to a 60 kW, 2.5 microsecond pulse with a repetition rate of 360 pulse pairs per second.

(d) a 1-5/8" diameter coaxial drive line with 8 coupling points along its length to feed each of the eight 24 MW klystrons in a sector.

5. At each coupling point, an isolator, phase shifter, attenuator unit to control the drive signal to each 24 MW klystron.

Particular emphasis is given in the discussion to the specification and measurement of the group velocity of the two-mile drive line, the selection and operation of the varactor diodes which must be tuned according to a special technique to minimize phase shift as a function of drive power, and the voltage pulse flatness requirements on the pulsed klystrons to minimize phase shift as a function of time within each pulse and pulse to pulse.