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Features of the E-144 CCD Spectrometer, V
Tests of the γ-Line in January 1995

We propose to use 1 shift of FFTB checkout time in early January 1995 to study:
a) synchrotron-radiation backgrounds in the new vacuum system for the E-144 γ-line;
b) operation of the linac with alternating high and low intensity pulses.
E-144-specific beam configs will be needed for this.

1. Synchrotron-Radiation Backgrounds

Synchrotron radiation appears to be the main background in the CCD spectrometer. The new vacuum line supposedly masks the CCD's from all direct and singly scattered x-rays – but has never been tested. Because the collimators are not remotely adjustable it is important to test their effectiveness prior to the March '95 run.

For a background test we plan to install one CCD in an aluminum vacuum tank on the CCD table just downstream of the 5D36 magnet. The attached drawings show this setup. The goal is to install the gear on Dec. 14-16, 1994.

Support items needed from SLAC prior to Dec. 14 include

1. A 7/16″-diameter vacuum pipe with 2.75″-Conflat flanges on both ends that extends from 36″ upstream of the downstream end of the CCD table to Clive's CCM2 monitor. This is a modification of a pipe fabricated but never installed.

2. A valve with a 1/4″ Swagelok fitting that taps into the compressed-air line next to the CCD table. This is for the air-actuated shutoff valve on the Varian turbo/diaphragm dry pump station we will use to pump the CCD tank. The shutoff valve is a safety device to prevent the tank (and hence the linac) from going up to air in case of power failure. [The dry pump station will include a Granville-Phillips convectron gauge and a broad-range hot-cathode ion gauge.]

3. A steel plate 1/2″ × 28″ × 32″ to serve as the roof of the lead-brick stack that will surround the CCD tank.

4. The pad and shelter for the ethylene-glycol chiller, to be located outside the FFTB tunnel near the N_2 six pack next to the FFTB dump. Three 12-amp chillers will be installed for March '95 but only one for Jan. '95.

We anticipate that studies of the synchrotron radiation with this setup will require about 4 hours, including the time to re-establish a typical E-144 beam config.

2. Alternate High/Low Pulses in the Linac

The CCD spectrometer will be overwhelmed by Compton conversions during high-intensity laser-electron collisions. For example, we expect about 1% of the electron beam to be backscattered, yielding $\approx 10^7$ γ's for a bunch of 10^9 electrons. Using the 7-μm carbon wire of the γ-convertor, we have about 3×10^{-5} of a radiation length that intercepts about 10% of the γ's. Hence we would have about 3 pair conversions per pulse under these conditions (which already assumes an unusually weak electron beam). But we anticipate that reliable matching of the electron and positron from a γ conversion will only be possible for a single pair in the spectrometer each pulse.

Hence we would like the option to observe e-laser collisions with only 10^7-10^8 electrons per bunch during use of the CCD spectrometer to study nonlinear Compton scattering.

Joe Frisch advises use that this might be readily obtained at the linac gun by control of a relevant Pockels cell via PAU units on the SCP. It can be arranged that every other pulse is attenuated by factors up to several hundred.

However, it appears that this scheme has never been tried. We would like to spend half a shift during the January '95 checkout run to explore the viability of the high/low running.

Apparently the FFTB is limited to 30 Hz total, so we propose 15 high and 15 low pulses per second. There is an issue whether the feedback systems of the damping ring will operate successfully in this mode.