SINGLE PASS COLLIDER MEMO CN-245

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Subject: Occupancy of the SLC Arcs during Linac Operation.

SLAC-CN--245

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In this note, we consider how close we can come to the linac along the SLC arc during linac operation. In this case, radiation will come from beam striking a beam line component in the linac transport system. Radiation actually penetrating the shielding wall between the linac and the arc isn't considered since it will be orders of magnitude smaller than radiation which enters the arc through one of two openings in the shielding; a) the opening through which the SLC beam transport components pass, and b) a personnel accessway some fifty seven feet downstream of the first opening.

We make the assumption that with a little judicious placing of shielding small angle radiation can be eliminated, leaving only large angle radiation (e.g., 90°) to enter the SLC arcs. The source then is essentially opposite either of the two openings. Because the personnel opening is further downstream, it dominates the shielding requirements.

The neutron dose rate, H_n , at the opening into the SLC arc is

$$H_n = \frac{3.8 \cdot 4 \times 10^{-10}}{305^2} \cdot 20 \cdot 1.13 \times 10^{18} \\ = 3.69 \times 10^2 \text{ rem-hr}^{-1} = \text{kW}^{-1}$$

where H_n is the giant resonance neutron dose rate, 3.8 is the build-up in the linac tunnel, the distance from the linac to the SLC tunnel is 305 cm, the energy is 20 GeV, and there are 1.13×10^{18} electrons per hour per kW at that energy.

The photon dose rate, H_γ , is

$$H_\gamma = \frac{1.5 \times 10^4}{3.05^2} \\ = 1.61 \times 10^2 \text{ rad-hr}^{-1} = \text{m}^2 \cdot \text{kW}^{-1}$$

The personnel accessway opening into the SLC arc is essentially a small area opening into a larger area. We make the assumption that the fluence, and hence the dose, will be proportional to the ratio of areas, which in this case is 0.36. At this point, the radiation can travel either upstream or downstream, i.e., we should be able to make a further reduction of 0.5. However, being conservative in nature, the dose rate is reduced by an overall factor of 0.25 and thence followed down the arc using ducting formulae (see below).

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