SLAC-CN--383

DE91 005772

CN - 383

W. K. H. Panofsky

November 21, 1990

SPIN MOTION OF ELECTRONS IN THE SLC LINAC

It is generally expected that the depolarizing effects of the linear accelerator R.F. fields will be small. Recently Bill Atwood* raised the question whether this conclusion is still correct in view of the fact that the particles in the SLC spend a larger fraction of their time at phase angles "off crest" due to BNS damping; since radial fields are in quadrature with the accelerating field this might imply that depolarizing effects are larger. On the other hand, because of the smaller emittance of the SLC relative to the earlier linac radial excursions would be smaller. The anticipation is therefore that the depolarizing effect will again be negligible but it might be worthwhile to update the early calculations of SLAC TN-63-97 revised. That earlier TN had minor errors which were pointed out by Ed McMillan and others.

In the rest frame of the electron the spin will rotate at an angular velocity Ω_R given by

$$\vec{\Omega}_R = \frac{ge}{2m_o}\vec{B}_o, \tag{1}$$

where the magnetic field $\vec{B}_o$ in the rest frame is related to the fields in the lab by

$$\vec{B}_o = \gamma\left[\vec{B} - \left(\frac{\gamma}{\gamma+1}\right)\left(\vec{v}\cdot\vec{B}\right)\vec{v} - \vec{v}\times\vec{E}\right] \tag{2}$$

In the paraxial approximation the radial electric field E_r and azimuthal magnetic

---

* November 14, 1990

Work supported by the Department of Energy Contract DE-AC03-76SF00515.