Collider-Accelerator Department

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# Memo

*date:* *October 11, 2012*

*to:* *RSC*

*from:* *D. Beavis*

*subject:* *Miscellaneous ATF Linac Tunnel Shielding Issues*

There are several miscellaneous items that have not been addressed for the ATF Linac Tunnel. These will be discussed in this note. Simple shielding methods will be used to discuss the potential radiological impact.

**High Energy Slits (HES)**

The high energy slits are used to reduce the beam intensity and to remove off-momentum particles in the beam. The slits are adjustable and can be fully closed. The slits represent both a routine source of external radiation and if mistakenly closed on the beam can introduce beam faults. The level of radiation will depend on the mode the accelerator is being operated. The high energy slits are located 1.3 meters downstream of the 20-degree dipole in the Linac tunnel.

The shielding on the side of the HES is slightly thinner on the west side than for most of the linac. The shielding appears to be 40cm of light concrete, 40 cm of heavy concrete and 10cm of Pb. The 40 cm of heavy concrete has not be verified but is consistent with the methodical shielding design used for the construction of the Linac. The radiation levels will be assessed assuming 80cm of light concrete and then for 40 cm of heavy concrete in place of light concrete.

The 90 degree photon dose is estimated to be 6.8 mrads/hr for 100% of 5.1 Watts of 85 MeV beam lost on the slits. If the 40 cm is heavy concrete, then the Photon dose is reduced to 3 mrads/hr. **Low power testing with 0.14 Watts of beam will have a photon dose rate of approximately 0.1 mrads/hr with 100% of the beam lost on the slits.**

The neutron dose for all light concrete is estimated to be 56 mrem/hr for 5.1 watts of 85 MeV beam on the slits**. If 40 cm of the concrete is heavy concrete the potential neutron dose is reduced to 28 mrem/hr.** Low power operations can have a neutron dose rate for the entire beam on the slit of 0.8 mrem/hr. TLD 80 has shown an integrated neutron dose for several years of up to 250 mrem of neutrons. The slits may be the source of the radiation for this area. Clearly a simple fault study can determine the potential radiation levels due to the high energy slits.

**Vertical Utility Penetration**

A large utility penetration at the end of the Linac tunnel provides a pathway for cables into the end of the Linac tunnel downstream of the movable W-plug. The location in the tunnel cannot be inspected. The cable way can be seen from the mezzanine platform and is approximately 15 inches by 6 inches. It was not measures as it was difficult to access. No calculations have been made for the penetration. **It is recommended that the area be roped off pending a fault study. The penetration may be at a location where it is difficult to create a large beam fault.**

**Niches for Linac Devices**

There are a series of small niches in the shielding over the linac to provide vertical space for devices. Either 2 or 3 layers of patio blocks have been removed which is 7-12 inches of concrete. This reduces the effectiveness of the shielding by a factor of 2-4 depending on the amount of shielding that has been removed. Since the niches are small in size the increased radiation will disperse as it travels though the shielding and this full increase is not expected to occur outside. Several of the niches were inspected. They are approximately 8 inch diameter holes cut in the support plate and the concrete above remover. The largest is the niche over the 20-degree dipole which has two layers of blocks removed. The dose on the mezzanine could be measured in a mis-steering event into the side of the dipole.

**Roof**

Sections of the concrete roof have been examined. There are some regions where one layer of patio block has been removed. Section CC, upstream of the 20-degree dipole, has one layer of block removed over the internal walkway and section BB may have one layer removed over the walkway. These impact of the missing layer can be measured during studies.