**C-AD**
**Radiation**
**Safety**
**Committee**

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# Relocation of HEBT Gate from N63 to N132

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J.W. Glenn provided the committee with a description of the issues related to moving the gate (see attachment 1).

The location of the gate was originally chosen to allow access to the BLIP line but prevent the need to re-sweep the HEBT tunnel. This gate predates the Booster and the TtB line. This gate must be reset for the TtB beam stops to be open. This prevents potential exposure from ion faults in the TtB beam line, the Booster (LTB and TtB injection areas), and the AGS. The linac must be off if personnel are in the linac tunnel, which means the faults are limited to ion intensities delivered from the Tandem.

The polarimeter for the linac is the HEBT tunnel, in the area enclosed by this gate. In addition, an SNS experiment is located downstream of the polarimeter. It is expected that the Spin Program will require frequent access to the polarimeter for the next several years. Last year, access was allowed by a work permit process, which required placing jumpers into the interlock system. For the future it would be more practical to move the gate downstream of the polarimeter and the SNS experiment. It has been proposed to move the gate to N132, which is 69 feet downstream.

The expanded linac area is not expected to have routine radiation levels from neutrons. However, the LTB injection area will be part of the expanded Linac area. In addition, the new gate location is closer to several potential sources. Under fault conditions it is expected that there could be an increase of neutron dose rates. Simple formulas by Tesch have been used to estimate these potential fault levels (see reference 1).

The only sources for faults are the beams from the Tandem. The beam that is expected to produce the highest possible fault levels is deuterons. The source term for faults was estimated using the maximum deuteron intensity of 200 nano-amps ($1.2*10^{12}$ deuterons per second). For the Booster, a maximum energy per nucleon of 1 GeV was used. For the AGS, a maximum energy of 14 GeV per nucleon was used. In addition, a duty factor of 0.5 was used for the AGS to account for the acceleration cycle. The source term for deuteron faults in TtB was based on a 13.3 MeV deuteron fault study, which gives 36 rem/hr at one foot at 0 degrees and approximately 12 rem/hr at 90 degrees. The following fault levels have been estimated:

LtB Headwall: 700 mrem/hr
: This would be in the expanded Linac area.

TtB head wall: 3.5 rem/hr
: This is in the enclosed area by the gate. Using the attenuation formula by Goebel, the levels at the gate are estimated to be 2 mrem/hr.

AGS faults to gate N322: 12.7 rem/hr
: This is in the enclosed area. Using the labyrinth attenuation formula and neglecting the bend in the tunnel, a level of 2.5 mrem/hr is estimated to be at gate N132.

TtB faults on a value: 36 rem/hr at a foot.
: This is in the enclosed area. Reducing by1/(r*r) and a factor of 3 for 90 degrees gives 58 mrem/hr at gate N132.

**The Committee recommends that the gate be move to the proposed location**. The interlocks on the gate must be dual. The gate maintains the sweep for the HEBT tunnel for proton operations. **(CK-fy2003-LINAC-317**).

The following fault studies must be done: **(CK-fy2003-linac-318)**

1) Place the valve into the deuteron beam and measure the levels at the gate.
2) Fault a beam in the Booster at approximately 1 GeV and measure the dose rate at LtB headwall.
3) Fault a 1 GeV beam on the B6 beam dump and measure the radiation levels at the gate and in the TtB stub tunnel.

The SRDs will underestimate that dose equivalent for the neutrons by approximately a factor of ten. This should be taken into account when the final access requirements for this area are established.

Pending completion of the fault studies, work in the area for the polarimeter and SNS experiment can be conducted with the work permit conditions used last year. In addition, work on the gate can be conducted with beam operations in TtB with an appropriate work permit.

The dose estimates for faults were done assuming 100% of the beam is lost in a single location. It is not expected that this is possible in the Booster and the AGS and that the actual potential fault levels are substantially lower. The B6 dump was chosen for a source of the TtB fault study since it is expected that a large percentage of the beam can be lost on the dump. In addition, this represents a forward fault, which may create more radiation into the TtB stub tunnel.

**References**:

K. Tesch, "A simple estimation of the laterial Shielding for Proton Acelerators in the Energy Range 50 to 1000 MeV ", Radiation Protection Dosimetry, Vol. 11, no. 3 pp165-172 (1985).

**Attachments**: (File only)

1) J.W. Glenn to D. Beavis Oct. 21, 2002, "Relocation of HEBT Gate near LTB-DH1 at N63"

**CC**:

RSC
Present
J. Young