C-AD
Radiation
Safety
Committee

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Tandem Interlocks for Light Ions and Deuterons

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The beam intensity and energy of light ions must be limited to prevent radiation levels on the TtB berm, which is an uncontrolled area. The committee has approved the use of a beam harp monitored by dual chipmunks. It was intended that the intensity monitor be placed in the bypass line in the accelerator room. However, tests have shown that backgrounds from operating the Tandems make this location unsuitable (see attachment 1). The new location is to use a harp at location 12MW30, which is located in the TtB area just past the gate that isolates the tunnel from the accelerator room. This location has the advantage that it can be used for light ions from either Tandem. There is sufficient shielding along the beam transport to allow full intensity and full energy beam to this point, although only reduced intensity beams and lower energies will be allowed to this harp location. **The committee approved the plan to use this harp location**.

A test with deuterium beam will be done at this location to determine the final position of the two chipmunks. The requirement is that the chipmunks alarm at 120 nano-amps and interlocks at 200 nano-amps of deuterium beam (note: the minutes had 20 nano-amps. J. Alessi and myself have checked that it should have said 120 nano-amps). Tests have already been conducted with oxygen beam to demonstrate that backgrounds are not an issue.

The wires of the harp act as a scattering source for the deuterium beam. The harp has 32 horizontal wires and 32 vertical wires. The readout has every other wire instrumented. The beam size is sufficiently large that typically the beam hits a in excess of 24 wires. Therefore, the breaking of any one wire is not an issue. Harps in locations where the beam is large almost never break a wire. There was considerable discussion on how to check the integrity of the harp wires. A procedure must be written, which requires the operators to check the profile on the harp at least once a shift if light ions are being transported into TtB. The harp analogue signals will be used to provide the profiles to avoid potential software issues. (**CK-tandem-fy2003-deuterons-307)**. The purpose of the procedure is to check it for broken wires and to ensure that the beam size is large. The beam optics was presented. Normal operations have a large beam at this location. It is not expected that a small beam can be made at this location. The electronics should be examined to see if there is a non-administrative way to check the wire integrity of this harp can be developed for future operations **(CK-Tandem-FY2004-deuterons-308)**.

Two micro switches monitor the in position of the harp. Should either switch indicate that the harp is out, then the interlocks will close the beam stops of the Tandem delivering the light ion beam. The harp must be out for heavy ions, therefore the interlocks must only turn off the Tandem designated as the source of the light ions. Key switches will be used to indicate which tandem is the source of light ions. A procedure must be written, which will designate who has the authority to change the mode selection. It is recommended that a select group be allowed to change the designation of the machines. The key arrangement must be such as to prevent inadvertent changing of the designated state. **(CK-Tandem-deuterons-Fy2003-309)**.

The energy of the deuteron beam is to be limited to 12 MeV. RIS units were installed in the MP6 bypass beamline to limit the current the power supplies could deliver to the respective bending magnets. It is proposed that these units be relocated to the power supplies that operate the two 90-degree bends. These bends are part of the transport system, which delivers beam from the accelerator room to the TtB tunnel. An advantage of using these bends is that either Tandem could be used to deliver the light ion beams. **The committee approved the use of the 90-degree bends for the energy limitation.**

The proposed configuration allows light ions to the first beam stop which is close to the first 90-degree bend. The TtB tunnel can be occupied with beam to this location. Radiation levels from the deuteron beam striking the first beam stop must be documented to ensure that the TtB tunnel area stays within it's allowed limit. Potential radiation levels need to be documented to verify that the TtB tunnel does not exceed 50 rem/hr if a single fault in the interlocks allows the beam to the second beam stop, which is between the two 90 degree bend. (**CK-Tandem-deuterons-fy2003-310)**

Attachments: (file copy only)
1) J. Alessi, Sept. 5, 2002.

cc: Present, RSC
Tandem RSC File
Minutes File