2.1 Accelerator Physics

2.1.1 Findings

The Front End System has been handed off from LBNL to ORNL and commissioning at ORNL started October 31, 2002. LBNL demonstrated 50 mA at MEBT exit. This is a remarkable achievement; the required intensity is 38 mA. The emittance goal has also been achieved, but at 33 mA, somewhat less than nominal. Impressive round-the-clock operation has been demonstrated. The MEBT chopping system, and the MEBT halo suppression system have not yet been demonstrated.

Partially chopped bunches have been simulated and these simulations show that they stay within the linac acceptance and so should pose no threat to linac operation at full intensity.

There are no plans to characterize the beam at the exit of MEBT in all 6 phase space dimensions. This was a cost-saving decision made early on in the project. As a result, it is not possible to generate better distributions for end-to-end simulations than those that are obtained by tracking the measured DC emittance in LEBT through the RFQ and MEBT.

There has been excellent progress on the “laser wire” profile monitors. These can be used to measure beam halo in the linac online, and moreover Front End commissioning plans include using the laser wire to measure the amount of beam in the gap. This answers a recommendation of the previous review.

The extraction kicker in the ring has had a design modification that reduces its beam coupling impedance by a factor of 2.

Excellent progress was shown of simulations and analytical calculations relating to instabilities in the storage ring. These show that the ring is stable up to design intensity for all known and understood instability sources. Moreover, there is hardware in the baseline for both Landau and active damping.

The PSR instability is still not in the category of understood instabilities, since the measured variation of threshold with bunch length is not in agreement with simulations. In terms of electron production, there has been good progress in measuring and evaluating secondary electron yield for the Ti-N plated vacuum chamber material, with and without electron scrubbing.

2.1.2 Comments

There is no specification in the parameter list for beam pulse flatness. Since local intensity affects matching, lack of flatness can result in large projected emittance growth. The ion source has demonstrated flatness of intensity during a macropulse to the level of a few percent, which is probably sufficient, but there is no mechanism for maintaining flatness.

The parameter list specifies “expected” rms emittances. Since small halo can drastically change rms emittance, and in some cases, especially at low energy, halo can be scraped, this is not always a useful specification.

The commissioning team should use the opportunity afforded by the DTL delay to more fully characterize the beam from MEBT, and to measure the efficacy of the beam halo suppression system.

Lacking a fuller understanding of the PSR instability, it is advisable to use all possible means to reduce electron generation in the SNS ring. The proposed clearing electrode at the stripping foil and solenoids in the collimator straights should go ahead, as recommended by the ASAC review of Sept. 2002.

2.1.3 Recommendations

None.