Ramping Up the SNS Beam Power With the LBNL Baseline H^- Source

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To produce the promised neutron yields, SNS is aggressively ramping up the rep rate, pulse length, and the beam current during the initial seven production runs that span over a three year period. This challenges many of the accelerator components, including the Front-end with the H- source designed and built by Lawrence Berkeley National Laboratory.

After the second production run, the Low-Energy Beam-Transport needed to be modified to reliably deliver beam for duty factors >0.2 %. Before the fourth production run, the H- source needed to be modified for routinely producing the 25 mA LINAC beam current during the 0.5 ms long beam pulses at 60 Hz, which were required by the end of 2007. We continue to implement modifications for routinely producing the 30 mA LINAC beam current during the 0.8 ms long pulses at 60 Hz, which are required by June 1, 2008. The optimistic production goal of 1.4 MW requires 38 mA LINAC beam current, which was demonstrated for 4 hours on 12/24/07. When operated with the same parameters on the test stand, the LBNL baseline H- source and LEBT deliver about twice the beam current. On the Front-end, so far, the LBNL H- source has outperformed all other ion sources developed at ORNL [1].

After developing appropriate procedures and properly controlling its configuration, the LBNL Cs system allows for dosing minute quantities of Cs on the converter surface yielding optimal beam currents with a tiny fraction of the 30 mg of Cesium. This has enabled full-power beam recoveries within 8 hours of a source replacement. It has enabled cesiations with a minimum of arching. The loss of Cesium appears to be as small as ~1% per day. From time-to-time this loss is compensated with a tiny release of Cesium while beam production continues without interruption. Minimal Cesium use is highly desired due Cs collar being only 0.15 m in front of the RFQ entrance aperture.

References:

[1] R.F. Welton et al, this symposiuum.

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