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Record Performance of the Spallation Neutron Source H^- Injector

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In July 2017 SNS will resume 1.2 MW proton beam operations to produce world record beams for neutron scattering experiments. This is enabled by the excellent performance of the SNS H^- ion source and the compact electrostatic LEBT that inject up to 60 mA into the RFQ. To reduce inefficiencies and downtime the source service cycle periods have been increased and up to 96 days have been demonstrated. During the long service cycles up to 7 Amp-hours of H^- ions are injected into the RFQ, which is at least 10 times more H^- ions than are produced with other pulsed H^- sources for accelerators during a single service cycle.
The high user demand at SNS no longer allows for risking downtime. Increasing the SNS H^- source service cycle only became possible after careful wear measurements showed that sputtering reduces the porcelain coating of the antenna at the most exposed location by less than 1% per week. That means that during a ˜20 week target cycle, only ˜20 % of the insulation would be lost. This is not a problem because the 0.5 mm coating is much thicker than what is needed to hold off the typical voltages generated in high power plasma operations. Running a single H^- source per target service cycle yields the absolute minimum of source related unavailability.

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