Abstract Submitted
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Development and characterization of a high-reliability, extended-lifetime H^- ion source GABRIEL BECERRA, PRESTON BARROWS, Phoenix Nuclear Labs, JOSEPH SHERMAN, TechSource, Inc. — Phoenix Nuclear Labs (PNL) has designed and constructed a long-lifetime, negative hydrogen (H^-) ion source, in partnership with Fermilab for an ion beam injector servicing future Intensity Frontier particle accelerators. The specifications for the low-energy beam transport (LEBT) section are 5-10 mA of continuous H^- ion current at 30 keV with <0.2 π-mm-mrad emittance. Existing ion sources at Fermilab rely on plasma-facing electrodes, limiting their lifetime to a few hundred hours, while requiring relatively high gas loads on downstream components. PNL's design features an electron cyclotron resonance (ECR) microwave plasma driver which has been extensively developed in positive ion source systems, having demonstrated 1000+ hours of operation and >99% continuous uptime at PNL. Positive ions and hyperthermal neutrals drift toward a low-work-function surface, where a fraction is converted into H^- hydrogen ions, which are subsequently extracted into a low-energy beam using electrostatic lenses. A magnetic filter preferentially removes high-energy electrons emitted by the source plasma, in order to mitigate H^- ion destruction via electron-impact detachment. The design of the source subsystems and preliminary diagnostic results will be presented.

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