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Multicusp ion source with external RF antenna for production of H⁻ ions

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A multicusp ion source with modular design was developed for production of H⁻ ions. The source consists of a front plate, two multicusp front chambers, a quartz flange with external 2.5 loop RF antenna and a rear multicusp chamber. The source has LaB₆ sputtering target on the rear chamber for lowering work function of the surfaces by coating them with LaB₆. The front plate of the source has an integrated collar and filter magnets for cooling plasma near the extraction. The collar also enables the use of cesium and LaB₆ surface effects. The source is equipped with three gas feed-throughs for two-gas operation and pressure measurements.

Current density of over 10 mA/cm² of H⁻ with only 1000 W of CW RF power has been achieved with the help of Xe gas mixing and LaB₆ deposition to the source surfaces. The source has also exceptionally good performance in producing H⁺ when the filter magnets are removed. Current density of 110 mA/cm² with 1800 W RF power at 15 mTorr source pressure was measured with over 90 % atomic species. A long lifetime of source is expected as the external RF antenna is not exposed to plasma.