Multi-Charged Beam Extraction from a Laser-Driven Magnetic Bucket, O.A. ANDERSON, LBNL; B. GRANT LOGAN, LLNL - Most multi-charged ion sources produce a wide spectrum of charge states and it may be difficult to obtain enough current after selecting a particular state. A newly proposed type of multi-charged ion source has several potential advantages over existing types. The basic principle is that multi-photon absorption in an intense uniform laser focus can give multiple charge states of high purity [1]. Thus, charge state separation downstream is simplified or made unnecessary. Another advantage is that currents of many amperes can be extracted if required. This type of source could be used for heavy-ion fusion drivers or storage ring injectors. There are also industrial applications such as materials processing. Previously, we modeled direct extraction from an expanding laser plasma [2] and showed that very large currents can be extracted but that the required focusing system was bulky. The present study investigates a compact alternative in which the high-purity multi-charged expanding plasma is captured in a magnetic bucket before extraction commences. For the large currents required for heavy-ion fusion, the extraction would be done in two stages, using multiple apertures in the first stage followed by a high perveance single-aperture stage. We describe a scheme designed to give low aberrations and low emittance in the combined beam. We test these ideas with a self-consistent particle code and present the results.

[1] B.G. Logan, M.D. Perry, and G.J. Caporaso, Concept for High-Charge-State Ion Induction Accelerators, proceedings of IAEA Technical Committee Meeting on Drivers and Ignition Facilities for Inertial Fusion, Osaka, Japan, March 10-14, 1997; also submitted for publication in Fusion Engineering and Design.

[2] O.A. Anderson and B. Grant Logan, "Modeling of Direct Beam Extraction for a High-Charge-State Fusion Driver," presented at 12th International Symposium on Heavy Ion Inertial Fusion, Heidelberg, Sept. 24-27, 1997; to be published in Nucl. Inst. and Meth.