NEXT GENERATION ECR ION SOURCES:
FIRST RESULTS OF THE SUPERCONDUCTING 28 GHZ ECRIS – VENUS

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VENUS (Versatile ECR ion source for NUclear Science) is a next generation superconducting ECR ion source, designed to produce high current, high charge state ions for the 88-Inch Cyclotron at the Lawrence Berkeley National Laboratory. VENUS also serves as the prototype ion source for the RIA (Rare Isotope Accelerator) front end. The magnetic confinement configuration consists of three superconducting axial coils and six superconducting radial coils in a sextupole configuration. The nominal design fields of the axial magnets are 4T at injection and 3T at extraction; the nominal radial design field strength at the plasma chamber wall is 2T, making VENUS the world most powerful ECR plasma confinement structure. The magnetic field strength has been designed for optimum operation at 28 GHz.

At the HCI 2000 conference in Berkeley, we described the ongoing construction of the VENUS ECR ion source [1]. Since then, the six year project has made impressive progress. In June 2002, the first plasma was ignited at 18 GHz. During 2003 the VENUS ECR ion source was commissioned at 18 GHz, while preparations for 28 GHz operation were being conducted. During this commissioning phase with 18 GHz, tests with various gases and metals have been performed with up to 2000 W RF power [2]. Record ion beam intensities have been extracted at 18 GHz. For example, 1100 eμA of O^{6+}, 180 eμA of Ar^{12+}, 160 eμA of Xe^{20+}, 160 eμA of Bi^{25+} and 100 eμA of Bi^{30+} and 11 eμA of Bi^{41+} were produced.

In May 2004 the 28 GHz microwave power has been coupled into the VENUS ECR ion source. The paper will briefly describe the design of the VENUS source and its beam analyzing system. First results at 28 GHz including first emittance measurements will be presented.

[1] M.A. Leitner, C.M. Lyneis, D. Wutte, C.E. Taylor and S.R. Abbott, Physica Scripta,T92, 171-173,2001

[2] C.M. Lyneis, D. Leitner, S.R. Abbott, R.D. Dwinell, M. Leitner, C.S. Silver, C. Taylor, RSI**75**, 5, 1389, 2004