Contribution ID: **51** Type: **CATHI poster**

Upgrade of the REX-ISOLDE charge breeder

Monday 17 December 2012 18:05 (1h 25m)

In order to comply with the extended requirements of the experimental program at ISOLDE after the upgrade to HIE-ISOLDE and with the prospective of the TSR@ISOLDE an upgrade of the existing REXEBIS charge breeder is being investigated. The new breeder is aiming to provide ions for reacceleration with A/q< 4.5 required by the linac and with a repetition rate of 100 Hz (linac limit). To reach these values the new breeder needs an electron beam of current density je exceeding the parameters of REXEBIS by a factor of 20.

The TSR@ISOLDE project sets even more challenging requirements, such as an increase of the electron energy up to 150 keV in order to ionize inner shell electrons for production of bare ions up to Z=60 and Na-like configurations of heavier ions up to Th and U. For breeding to such configurations one needs high ionization factors, and even at injection rate of ˜1 Hz the required current density in the breeder is in the range of je ˜10E+4 A/cm. sq. The breeding efficiency of ˜10 % for such charge states is possible only with a combination of vacuum enhancement by an order of magnitude to ˜10E-12 mbar and ion-ion cooling to suppress ion losses during the breeding process.

Altogether it sums up into a design concept which requires a complete replacement of the REXEBIS rather than partial upgrade of its subsystems. In the new breeder the immersed gun electron optics will be replaced with a high compression electron beam providing necessary current density. A new 6 T magnet is planned to be used to confine and compress the electron beam. A new three-stage vacuum system with distributed pumping is being designed to improve the vacuum and assure serviceability of the system.

In the presented poster we would like to introduce the early design concept of the new EBIS for High Energy, Compression and Current electron beam –HEC2EBIS, including the report on our first steps towards the construction of the advanced electron gun for it. We also would like to show to the future HIE-ISOLDE/TSR@ISOLDE users the fundamental limits of the charge breeding system.

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Session Classification: Poster session