



CHARGE BREEDING

Project reference: HPRI-CT-1999-50003

Funded under: FP5-HUMAN POTENTIAL

Charge breeding -charge breeding of intense radioactive beams

From 2000-01-01 to 2003-12-31 | [CHARGE BREEDING Website](#)

Project details

Total cost:

EUR 1 856 285

EU contribution:

EUR 1 200 000

Coordinated in:

Germany

Topic(s):

1.4.1.-2. - Access to Research Infrastructures

Funding scheme:

CSC - Cost-sharing contracts

Objective

Description:

Objectives:The development of an efficient charge breeding scheme for Radioactive Ion Beam will have a strong impact on the post accelerators planned at European large scale facilities. At ISOLDE/CERN there will be the unique possibility to carry out experiments with the two possible charge breeding set-ups with a large variety of radioactive isotopes. One charge breeding set-up is the Penning trap-EBIS combination which feeds the REX-ISOLDE linear accelerator and which has bred radioactive ions for the first time to $A/q < 4.5$. Cooled and bunched beams of radioactive isotopes from REXTRAP have been injected into REXEBIS and the charge states have been analysed with the achromatic mass separator. The second charge breeder is the ECRIS PHOENIX developed at the ISN ion source laboratory at Grenoble.

This ECRIS is under investigation with a 14 GHz amplifier. Comparisons to measurements with the MINIMAFIOS source show higher efficiencies and shorter breeding times. The experiments are accompanied by theoretical studies with computer simulations. A second PHOENIX ECRIS is installed at the Daresbury Laboratory for charge breeding test measurements, which prepare the final set-up and experiments with radioactive ions at ISOLDE in 2002. The final goals are the comparison of breeding efficiencies and loss measurements with radioactive ions with simulation calculations and with results from the Penning trap-EBIS charge breeder.

Results:**Project Manager:**

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A new ECR ion source (PHOENIX) at ISN Grenoble has been developed and characterized on a test bench;

- A second PHOENIX ECRIS has been acquired and purchased by Daresbury Laboratory. There a test beam line for 1+ n+ operation with stable beams has been assembled and used for charge breeding experiments with stable beams;

- An ECRIS test beam line at ISOLDE for test measurements with radioactive ion beams;

- A complete evaluation of the properties and scaling laws of the first charge breeder using a Penning trap EBIS assembly, the REX-ISOLDE charge state breeder, has been performed;

- The direct comparison of the two charge breeding schemes using the ECRIS or the Penning trap-EBIS combination concerning breeding efficiency, maximum intensities, repetition rate and emittances has been performed;

- A characterization of existing low-charge ion sources to be used as injectors for charge breeders has been

performed at CERN / ISOLDE;

- Development of ECRIS sources for low charged radioactive noble gas ions at GANIL and ISOLDE;
- Publications of data from the charge breeding systems concerning efficiencies, emittances, repetition rates, and achievable charge-to-mass-ratios on conferences and refereed journals. Publications of the concepts of efficient charge breeding and results in refereed journals;
- Technical mid term reports on the different phases of design and operation of the PHOENIX ECRIS and of the REXEBIS.

Related information

Report Summaries

- Comparison of the two charge breeding schemes using the ECRIS and the penning trap-EBIS combination concerning breeding efficiency, maximum intensities, repetition rate and emittances
- Development of a dedicated ECR ion source (PHOENIX) and characterization on a test bench
- Development of ECRIS sources for low charged radioactive noble gas ions at GANIL
- Evaluation of the properties and scaling laws of the penning trap EBIS charge breeder at REX-ISOLDE
- Evaluation of the properties of an ECRIS based charge state breeder
- Simulation and theory of injection of ions into ECRIS plasma and ionisation

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Subjects

[Scientific Research - Social Aspects](#)

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