D.I.S

D.I.S Germany GmbH

ECRIS-2.45

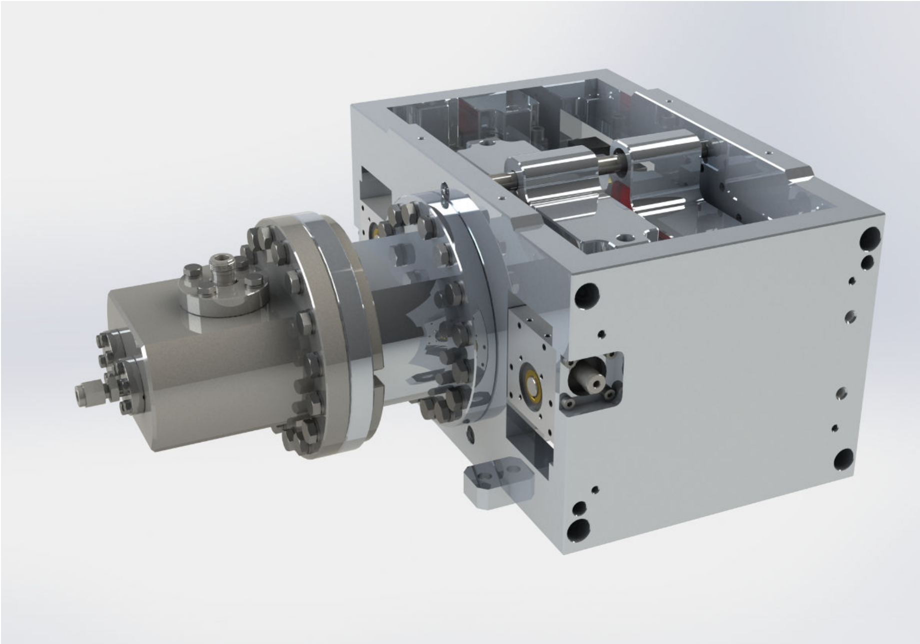
913-S7-09-00001

The D.I.S ECRIS-2.45 is an electron cyclotron resonance ion source (ECRIS) optimized for the production of ion beam currents of up to several hundreds of microamperes for a wide range of elements.

The modular and operator-friendly D.I.S ECRIS-2.45 is suitable for use in a wide variety of applications for basic research in various scientific disciplines, for teaching and training, and for technological applications.

further reading:

- *https://www.dis-eng.de/products/ion-sources/ecris/*
- *https://www.dis-eng.de/knowledge-base/ion-beam-technology/*



The D.I.S ECRIS-2.45 with movable magnet system.

Special Features:

- compact, electron cyclotron resonance ion source (ECRIS) with DN100 CF beamline interface flange
- RF injection chamber with two DN16 CF support flanges for gas inlet and optional diagnostics
- gas inlet for any gaseous elements and compounds
- 2.45 GHz RF antenna with type-N connector
- moveable magnet system for optimization of the "minimum B-configuration" (optionally in situ optimization with motorized positioning system)
- multi electrode extraction system with high voltage feedthroughs and additional interface ports for vacuum gauge, vacuum pump and beamline
- ion energy 1 kV to 50 kV × q (two stage acceleration) or 5 kV to 20 kV × q (single stage acceleration)

Please do not hesitate to contact us to find a suitable solution for your special application.

document no. 913-S7-08-00001- D-01

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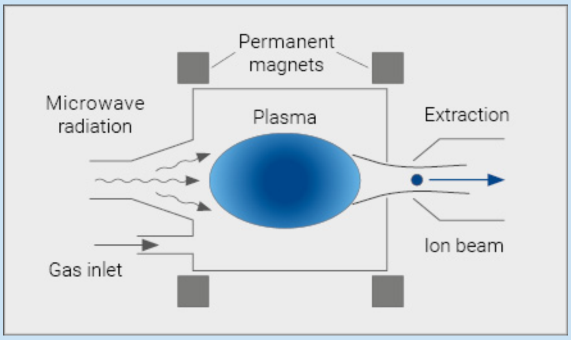
Operation principle

An electron cyclotron resonance ion source (ECRIS) uses the functional principle of resonant plasma heating by microwave irradiation. Due to the Lorentz force electrons in a magnetic field oscillate in spiral orbits around the magnetic field lines, with a frequency depending on the magnetic flux density.



If the frequency of the incoming microwave radiation is approximately equal to the gyration frequency of the oszilating electrons, resonant heating of the electrons is observed as a result. Via electron impact ionization the heated free electrons generate ions, which in turn generate additional free electrons.

This snowball effect produces a plasma confined by the magnetic field, which is generated by external permanent magnets. Ions can be extracted from the plasma by applying an electrical field gradient. Depending on the operating parameters, ECR ion sources are able to produce lowly charged ions at ion beam currents of µA up to mA.

An ECRIS is capable of ionizing every gaseous medium which is introduced to the recipient. While gases can simply be introduced via a gas dosing valve, nearly every non-gaseous element and molecule can be introduced by certain techniques such as ovens or the metal ions from volatile compounds (MIVOC) technique.

Optional Equipment:

- vacuum equipment, vacuum gauges, vacuum pumps, gate valves
- ion beam optics and diagnostics (e.g. lenses, deflectors, Faraday cups) up to a complete beamline or ion irradiation facility
- Wien filter or dipole magnets for the separation of ion species by their charge-to-mass ratio
- different working gas injection solutions, for example gas dosing valves, ovens, or MIVOC, according to the desired ion species
- customization of final ion energy and customization of multi electrode extraction system
- high voltage power supplies
- 2.45 GHz RF-generator
- command & control center for control of the gas inlet, RF-generator, high voltage power supplies and the vacuum system

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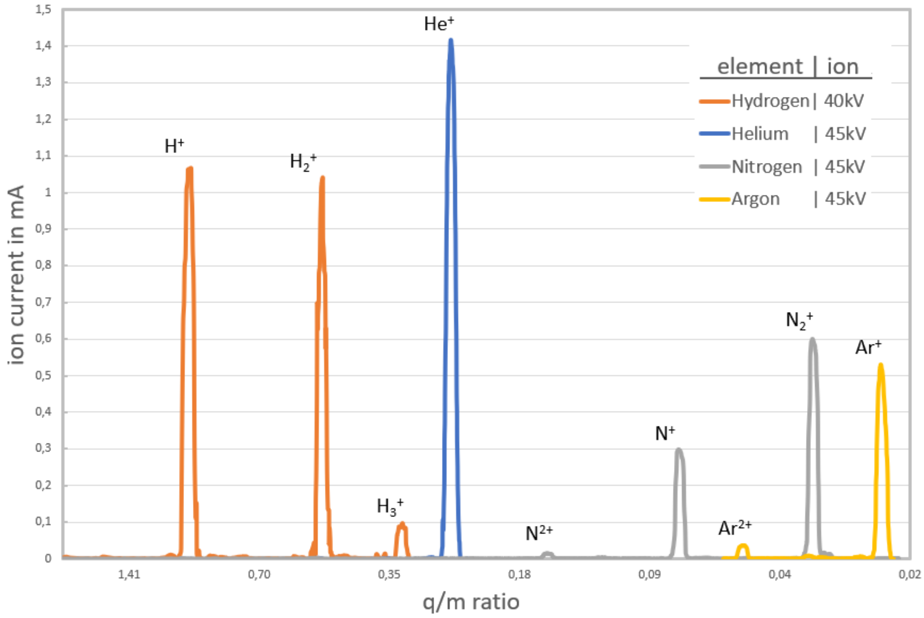
The D.I.S ECRIS-2.45 allows the generation of ions with single or double charged ions by varying the operation parameters, such as RF-power and gas pressure. The righthand graph shows a selection of superimposed ion beam extraction spectra of different working gases, such as Hydrogen, Helium, Nitrogen and Argon taken at the D.I.S commissioning beamline.



The righthand table shows a selection of values of extractable ion currents for different working gases. For assesment of the beam purity the extracted ions are analyzed by a dipole magnet at the D.I.S commissioning beamline. From there the values of ion current per species are presented in the table as well. These are no ultimate values, as the beamline is not optimized for transmission, but give a qualitative assesment of the fraction of components.

ION BEAM CURRENT VALUES

working gas	integral source output	ion species	ion current per species*
Hydrogen	2240 µA	H^+ H_2^+ H_3^+ other	1070 µA 1040 µA 90 µA <30 µA
Helium	1450 µA	He^{1+} He^{2+} other	1400 µA 3 µA <3 µA
Nitrogen	1000 µA	N^{1+} N^{2+} N_2^{1+} other	300 µA 13 µA 600 µA <40 µA
Argon	630 µA	Ar^{1+} Ar^{2+} other	530 µA 34 µA <8 µA

* The values for the individual species are measured at the D.I.S commissioning beamline using 40 mm gap dipole magnet.

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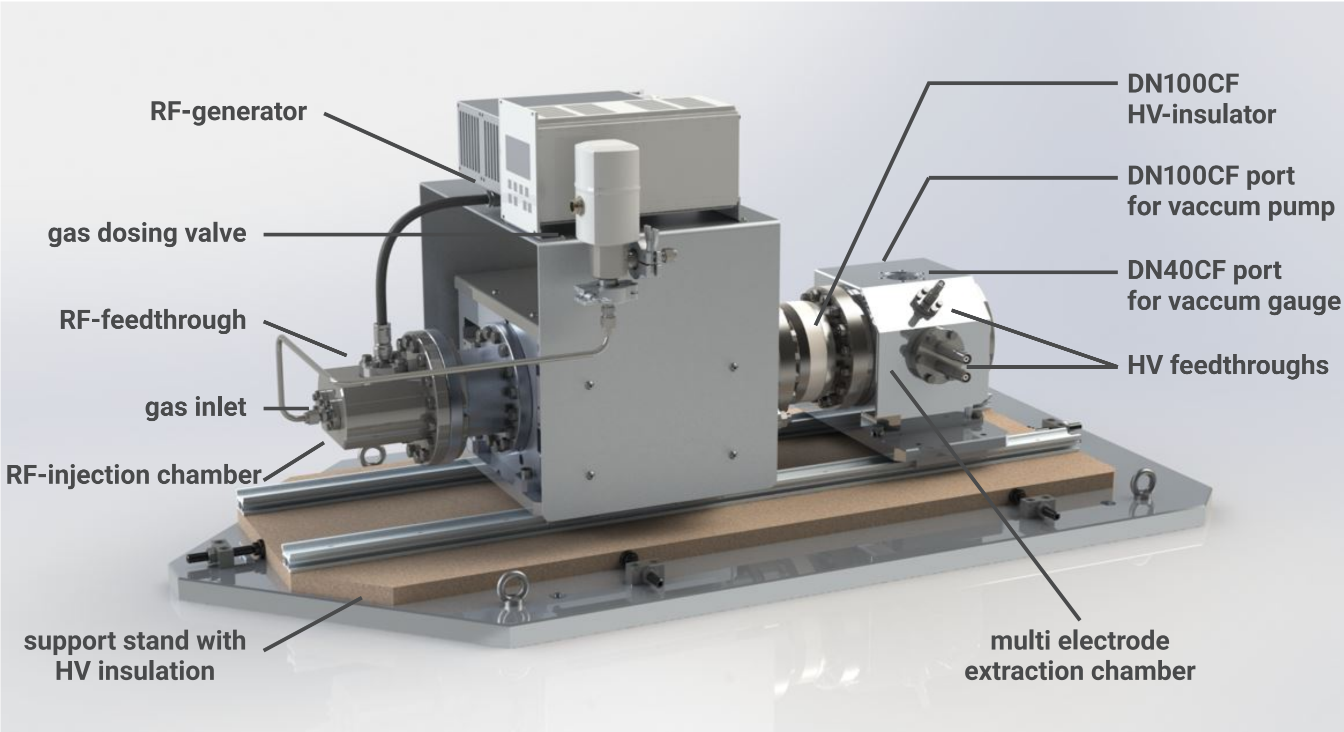

D.I.S ECRIS-2.45 with installed gas inlet system, RF-generator (2.45 MHz) and multi electrode extraction system.

TECHNICAL DATA

category	ion beam sources
RF-frequency	2.45 GHz
RF-power	up to 250 W
mounting flange	DN100CF beamline interface flange
support flange	1 x DN16CF gas inlet 1 x DN25CF RF-feedthrough 1 x DN100CF pumping port 2 x DN40CF vacuum gauge and HV feedthrough 1 x DN16CF HV feedthrough
base vacuum conditions	$<1 \times 10^{-7}$ mbar
operating vacuum conditions	$\sim 1 \times 10^{-5}$ mbar
maximum ion acceleration potential	5 kV to 20 kV single stage acceleration 1 kV to 50 kV dual stage acceleration
magnet system	permanent magnets
cooling	air-cooling
maximum bakeout temperature	120 °C
box size (length x width x height)	915 mm x 400 mm x 255 mm

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