ELECTRON CYCLOTRON RESONANCE ION SOURCE
IS.ECR-010

Neutron Therapeutics-licensed ECR ion source.

- Yields 30 mA of H⁺
- Three solenoid configurations provides multiple optimizable plasma confinement scenarios
- Yields high beam currents of 1+ charge state ions
- Compact, cost-effective ECR Ion Source

SPECIFICATION: IS.ECR-010

ION SOURCE CHARACTERISTICS

<table>
<thead>
<tr>
<th>Particle Types</th>
<th>H⁺, H₂⁺, He⁺, He+++, D⁺</th>
</tr>
</thead>
<tbody>
<tr>
<td>Frequency</td>
<td>2.45 GHz</td>
</tr>
<tr>
<td>Source Aperture Diameter</td>
<td>8 mm</td>
</tr>
<tr>
<td>Beam Current Stability</td>
<td>± 1% over 24 hours</td>
</tr>
</tbody>
</table>

NOMINAL BEAM CHARACTERISTICS FOR H⁺

| Divergence (5RMS) | ± 35 mrad   |
| Emittance (5RMS)  | 140 mm⋅mrad |
| Normalized Emittance (5RMS, 95% beam) | 1.29 mm⋅mrad |
| Distribution     | Gaussian    |

POWER SUPPLIES

- Microwave Generator: 450 A, 1.8 kW
- Max Bias Supply: 250 mA, 40 kV
- Suppression System: 12 mA, 5 kV
- Solenoid (each): 140 A, 12 V

VACUUM SYSTEM SPECIFICATIONS

- Turbo Pump: 2100 l/s
- Flange ISO250F
- Roughing Pump: 170 m³/hr

GAS FLOW

- Mass Flow Controller: 0-5 sccm of H₂

CONTROLS

- Control PLC: PLC, Ethernet Interface
- User Interface Options: D-Pace standalone or OPC command library for customer integration
- High Voltage Interlocks: HV grounding relay with access control locks

COOLING WATER, DEIONIZED, 20°C (>1.0 MΩm.cm)

- Extraction Assembly: 5.0 LPM, 70 PSI (480 kPa)
- Magnetron Head: >1.9 LPM, 70 PSI (480 kPa)
- Plasma Chamber: 6.0 LPM, 70 PSI (480 kPa)
- Waveguide: 6.0 LPM, 70 PSI (480 kPa)
- Heat Exchange Assembly: 6.0 LPM, 70 PSI (480 kPa)
- Solenoid Magnet Assembly: 10 LPM, 30 PSI (205 kPa)

COMMERCIALLY AVAILABLE IONS, CURRENTS, AND KINETIC ENERGIES

<table>
<thead>
<tr>
<th>ION</th>
<th>Beam Current (mA)</th>
<th>Beam Energy (keV)</th>
</tr>
</thead>
<tbody>
<tr>
<td>H⁺</td>
<td>30</td>
<td>40-50</td>
</tr>
<tr>
<td>H₂⁺</td>
<td>3</td>
<td>40-50</td>
</tr>
<tr>
<td>D⁺</td>
<td>30 (est.)³</td>
<td>40-50</td>
</tr>
<tr>
<td>He⁺</td>
<td>30</td>
<td>40-50</td>
</tr>
<tr>
<td>He++</td>
<td>0.5²</td>
<td>80-100</td>
</tr>
</tbody>
</table>

Ion Source Test Stand

Commercially Available Ions, Currents, and Kinetic Energies
The IS.ECR-010 Ion Source system includes the following:

- Ion source & vacuum box
- Vacuum system & gauges
- Power supplies, PLC controls & software
- Interlocks and HV grounding system
- User interface & Ethernet-based remote controls
- Ion source stand and microwave generator stand
- Water flow gauges and interlocks
- Mass flow controller for feed gasses
- RF amplifier & impedance matching systems

Optional:

- Contact us about steering, solenoid/quadrupole focusing system downstream of source
- High-voltage Faraday cage / enclosure
- Water de-ionization and cooling system
- Sliding Faraday cup
- UniBEam fiber optic beam profile monitor
- TRIUMF-licensed emittance scanner
- Mass spectrometer with slits
- Personnel access control interlocks

Enquire about other negative and positive ion beams from this source.

Section view of the ion source hardware

1. ECR technology is licenced from Neutron Therapeutics
2. 0.5 electrical mA (0.25 particle mA)
3. Estimate - Unable to measure due to neutrons released from D-D reaction in Faraday Cup.