RF-POWERED TURNKEY NEGATIVE ION SOURCE SYSTEM
ISV.RF-040
TRIUMF & University of Jyväskylä licensed¹, volume-cusp

- Long intervals between maintenance² (1 year) – no filaments to replace
- RF powered - no metal sputtering due to filaments (important for ion implantation)
- Ability to pulse beam
- Extensive beam instrumentation options

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SPECIFICATION: ISV.RF-040

<table>
<thead>
<tr>
<th>ION SOURCE</th>
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<tbody>
<tr>
<td>Particle</td>
<td>H⁺, D⁻, C₂⁻, C₂H⁻, C₂H₂⁻</td>
</tr>
<tr>
<td>Beam Kinetic Energy</td>
<td>20 to 30 keV</td>
</tr>
<tr>
<td>Normalized arms Emittance</td>
<td>&lt; 0.7 mm×mrad</td>
</tr>
<tr>
<td>Beam Purity</td>
<td>&gt; 99%</td>
</tr>
<tr>
<td>RF Window Lifetime¹,²</td>
<td>&gt; 1 year</td>
</tr>
<tr>
<td>Beam Current Stability³</td>
<td>± 1% over 24 hours</td>
</tr>
<tr>
<td>Beamline Flange</td>
<td>ISO 100</td>
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<tr>
<td>Instrument Port</td>
<td>ISO 250</td>
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</table>

POWER SUPPLIES

- Max Bias Supply: 40 mA, 30 keV
- RF Amplifier⁴,⁵: 3 kW, 13.56 MHZ
- Plasma Lens: 12 A, 70 V
- Extraction Lens: 60 mA, 5 kV
- X & Y Steering Magnet: 10 V, 10 A

VACUUM SYSTEM SPECIFICATIONS

- Turbo Pumps, 1X Upstream & 1X Downstream: 1700 l/s Flange ISO250F
- Dry Scroll Roughing, 1X Upstream & 1X Downstream: 35 m³/hr

GAS FLOW

- Mass Flow Controller: 11-30 sccm

CONTROLS

- Control PLC: Phoenix Contact ILC, Ethernet
- User Interface Options: D-Pace standalone or OPC command library for customer integration

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

- XY Steering Magnet: 1.0 LPM, 70 PSI (480 kPa)
- Turbo Pumps: 2.0 LPM, 70 PSI (480 kPa)
- COOLING WATER, DEIONIZED, 20°C (> 1.0 MOhm.cm)

- Source Body: 5.0 LPM, 40 PSI (275 kPa)
- RF Amplifier: 5.0 LPM, 40 PSI (275 kPa)
- RF Antenna: 1.0 LPM, 70 PSI (480 kPa)
- RF Window: 1.5 LPM, 70 PSI (480 kPa)
- Plasma Lens: 1.5 LPM, 70 PSI (480 kPa)
- Extraction Lens: 1.5 LPM, 70 PSI (480 kPa)
- Faraday Cup: 5.0 LPM, 40 PSI (275 kPa)

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ION | BEAM CURRENT (mA) | BEAM ENERGY (keV) |
--- | ------------------ | ------------------ |
H⁺ | 0-7.5             | 20-30             |
D⁻ | 0-3               | 20-30             |
C₂⁻ | 0-0.05           | 20-30             |
C₂H⁻ | 0-0.05        | 20-30             |
C₂H₂⁻ | 0-0.05       | 20-30             |

Beam Intensities for Various Ions

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RF window (L) and antenna (R), shown separated
**TUNE DATA FOR MAXIMUM BEAM CURRENT:**

<table>
<thead>
<tr>
<th></th>
<th>IONS</th>
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</thead>
<tbody>
<tr>
<td><strong>Max. Beam Current</strong> (mA)</td>
<td>8 3 0.05 0.05 0.02</td>
</tr>
<tr>
<td><strong>Bias Supply</strong> (mA, kV)</td>
<td>11, 30 4.5, 30 0.68, 10 0.68, 10 0.68, 10</td>
</tr>
<tr>
<td><strong>RF Power</strong> (kW)</td>
<td>3.1 2.6 0.5 0.5 0.5</td>
</tr>
<tr>
<td><strong>Plasma Lens Supply</strong> (A,V)</td>
<td>5.9, 36 5.3, 50 1.0, 0 1.0, 0 1.0, 0</td>
</tr>
<tr>
<td><strong>Extraction Lens Supply</strong> (mA, kV)</td>
<td>34, 3.0 39, 2.3 14, 1.2 14, 1.2 14, 1.2</td>
</tr>
<tr>
<td><strong>Steering Magnet X (A)</strong></td>
<td>0.5 3.0 0.0 0.0 0.0</td>
</tr>
<tr>
<td><strong>Steering Magnet Y (A)</strong></td>
<td>3.2 0.0 0.0 0.0 0.0</td>
</tr>
<tr>
<td><strong>H₂ (sccm)</strong></td>
<td>16 9 30 30 30</td>
</tr>
<tr>
<td><strong>Vacuum, Ion Source</strong> (Upstream) (10⁻⁴ Torr)</td>
<td>0.54 0.32 1.06 1.06 1.06</td>
</tr>
<tr>
<td><strong>Vacuum, V-Box</strong> (Downstream) (10⁻⁵ Torr)</td>
<td>0.39 0.082 3.30 3.30 3.30</td>
</tr>
<tr>
<td><strong>½ Beam Diameter at Waist (mm)</strong></td>
<td>1.8 2.1 3.7 3.7 3.7</td>
</tr>
<tr>
<td><strong>½ Beam Divergence at Waist (mrad)</strong></td>
<td>37.8 53.3 41.7 41.7 41.7</td>
</tr>
<tr>
<td><strong>Geometric 4rms Emittance (mm-mrad)</strong></td>
<td>69 112 154 154 154</td>
</tr>
<tr>
<td><strong>Normalized 4rms Emittance (mm-mrad)</strong></td>
<td>0.89 0.89 0.71 0.71 0.71</td>
</tr>
</tbody>
</table>

The ISV.RF-040 Ion Source system includes the following:
- Ion source & vacuum box
- Vacuum system & gauges
- Power supplies, PLC controls & software
- Low voltage and high voltage racks
- 40 kV isolation transformer
- Interlocks and HV grounding system
- User interface & Ethernet-based remote controls
- Ion source stand and RF stand
- Personnel access control interlocks
- Water flow gauges and interlocks
- Mass flow controller for feed gases
- RF amplifier & impedance matching systems

Optional:
- High-voltage Faraday cage / enclosure
- Water de-ionization and cooling system
- Sliding Faraday cup
- UniBEaM fiber optic beam profile monitor
- TRIUMF-licensed emittance scanner
- 1:500 mass spectrometer with slits

Enquire about other negative and positive ion beams, and our Filament ion sources

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1. Ion Source licenced from TRIUMF. RF technology licenced from the University of Jyväskylä.
2. Estimates - testing in progress.
3. Window lifetime estimate based on 10% RF transmission degradation.
4. Suitable for installation of optional pneumatically-actuated Faraday cup and D-Pace ES-4 Allison type emittance scanner.
5. 5kW amplifier recommended for beam currents > 5mA.
6. RF Amplifier can be installed in the RF as rack shown or installed remotely.
7. D-Pace reserves the right to update specifications as part of its ongoing product improvement program.