Development of the New DECRIS-PM Ion Source

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Super Heavy Element Factory

To enhance the efficiency of experiments for next few years it is necessary to obtain accelerated ion beams with the following parameters:

- Ion energy: 4÷8 MeV/n
- Ion masses: 10÷238
- Beam intensity (up to A=50): 10 pμA
- Beam emittance: less 30 π mm•mrad
- Efficiency of beam transfer: >50%

DC-280 Cyclotron

The axial injection system of the DC-280 cyclotron will include two high voltage platforms which will allow for efficient injection of ions from helium to uranium with an atomic mass to charge ratio in the range of 4÷7. High energy of the injected beam (up to 100 kV) will shift the space charge limits by a factor of 30. Each HV-platform will be equipped with the low power consuming ECR ion source. For production of ions with the medium masses (from He to Kr) the all permanent magnet (PM) ECR ion source will be used.

Parameters of DECRIS-PM

<table>
<thead>
<tr>
<th>Frequency</th>
<th>14 GHz</th>
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<tbody>
<tr>
<td>( B_{0x} )</td>
<td>≥ 1.3 T</td>
</tr>
<tr>
<td>( B_{0y} )</td>
<td>0.4 T</td>
</tr>
<tr>
<td>( B_{0z} )</td>
<td>1.9÷1.1 T</td>
</tr>
<tr>
<td>( B_\perp )</td>
<td>1.05÷1.15 T</td>
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<tr>
<td>Plasma chamber internal diameter</td>
<td>70 mm</td>
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Magnetic structure of DECRIS-PM

Some drawbacks of all PM ECR ion sources:

- Inflexibility of the magnetic system should be strongly optimized for the desired operation mode.
- Strong forces acting between the individual parts of the system almost impossible to correct errors in the magnetic field distribution without system degaussing.

The soft iron plates around the PM rings with the axial magnetization play an important role in the final magnetic field distribution. By changing the thickness, it is possible to tune the minimum field when necessary.

First magnetic field measurements:

Calculated: field in maximum 0.290 T, Measured: field in maximum 0.298 T