DRAGON: A NEW 18 GHZ RT ECRIS WITH A LARGE PLASMA CHAMBER

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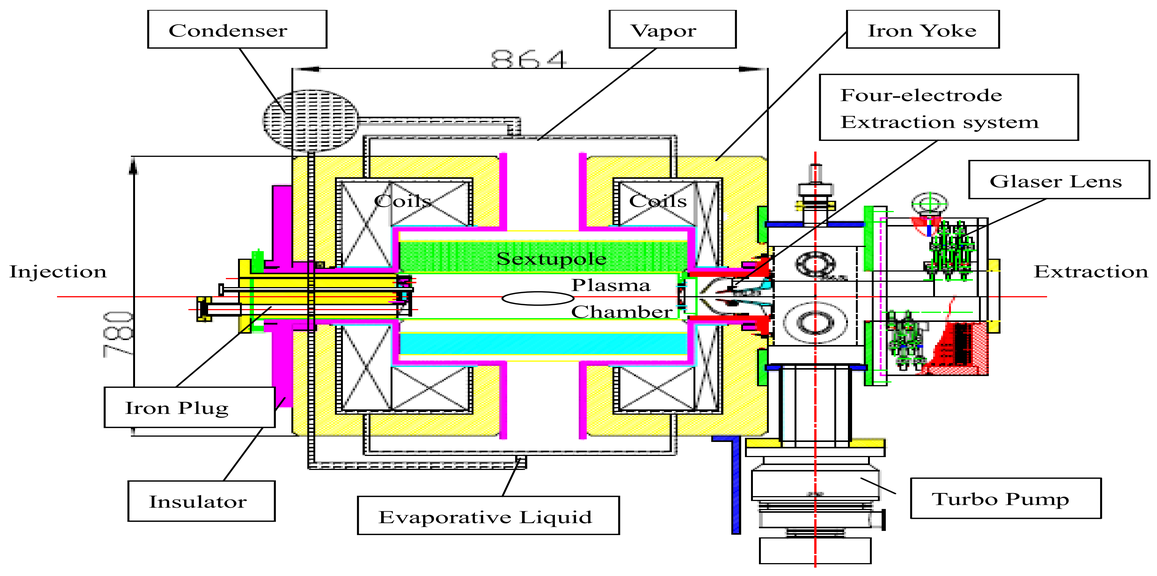
Abstract

A new 18 GHz RT ECRIS, DRAGON, with a large bore permanent sextupole has been designed and is under construction at IMP. Its plasma chamber is of ID of 126 mm, the same as that of the superconducting ion source SECRAL, with maximum radial field strength reaching 1.5 T at the plasma chamber wall. The overall magnetic strengths of DRAGON, with maximum axial fields of 2.7 T at the injection and 1.3 T at the extraction, are very similar to those of SECRAL operating at 18 GHz and hopefully its performance. The source solenoid magnets are cooled by medium evaporation at about 50 °C. In addition, the source is thickly insulated for beam extraction at 50 kV and higher voltage up to 100 kV can be explored. The main design parameters and comparison are presented here.

Main parameters and Comparison

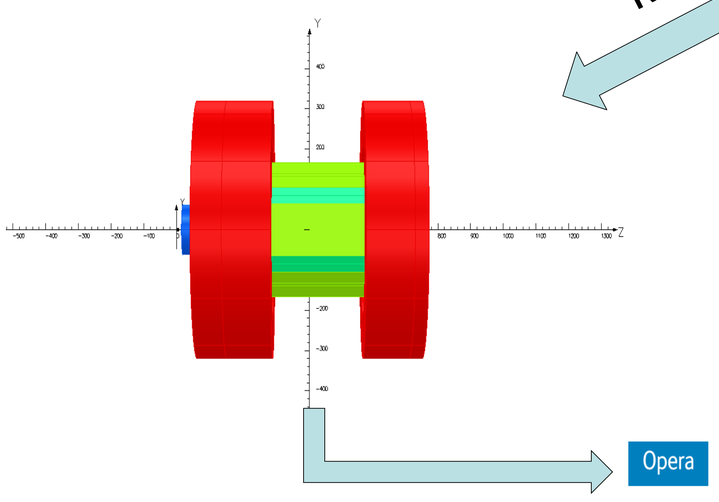
	DRAGON	GTS	SECRAL
Operating Frequency (GHz)	14. - 18	14 - 18	18
Resonance Length (mm)	14 GHz: 120 18 GHz: 135	14 GHz: 95 18 GHz: 145	105
Plasma Chamber (mm)	L: 480 ϕ: 126	L: 300 ϕ: 80	L: 420 ϕ: 126
Max. Axial Injection field (T)	2.7	2.5	2.5
Max. Chamber Radial field (T)	1.5	1.2	1.4



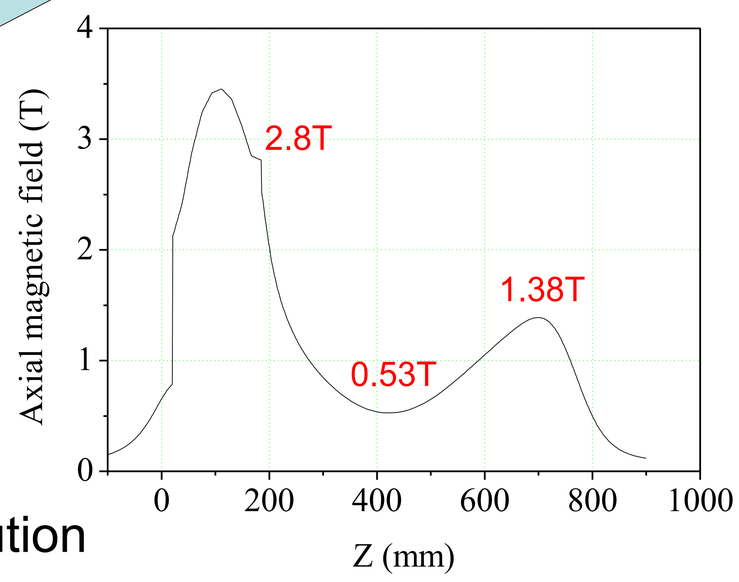
The layout of DRAGON

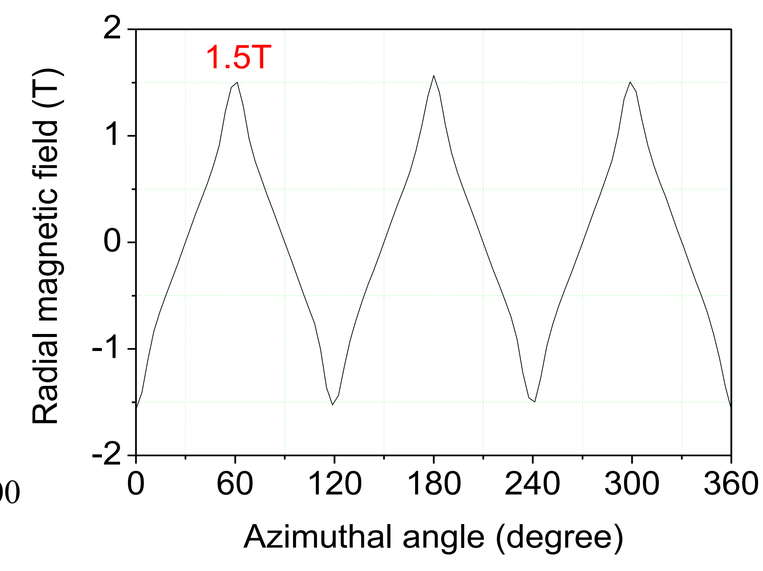
There is no mechanical pumping , at least in the early development, in the injection side of the Dragon for simplicity .

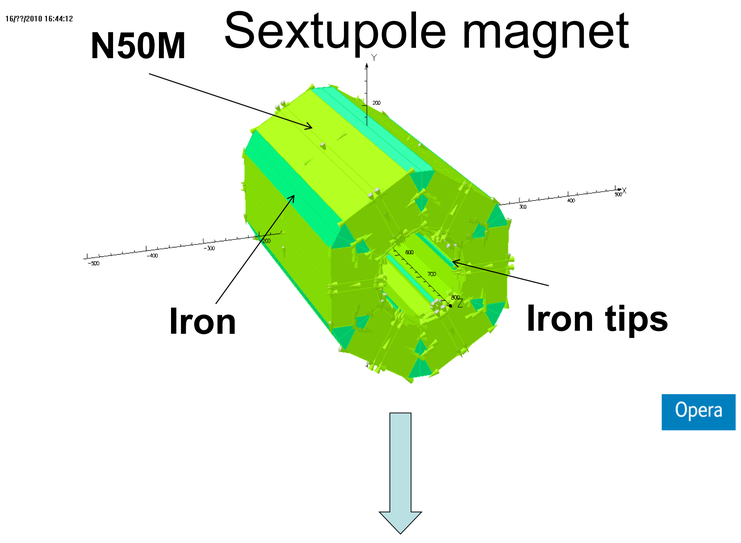
Magnet design



Magnetic field distribution



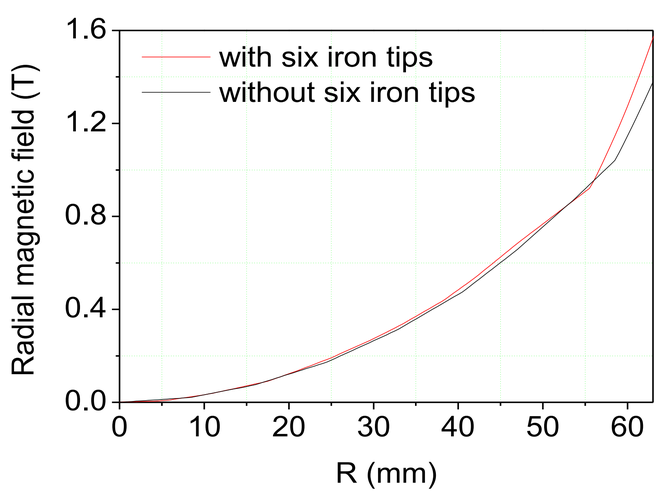




A simplified large-bore non-Halbach-sextupole with easier fabrication is being constructed for Dragon. It is made of many simply-shaped N50M magnet blocks with simple easy-axis. The sextupole is designed with an ID of 134.5 mm, an OD of 320mm and a length of 526mm.

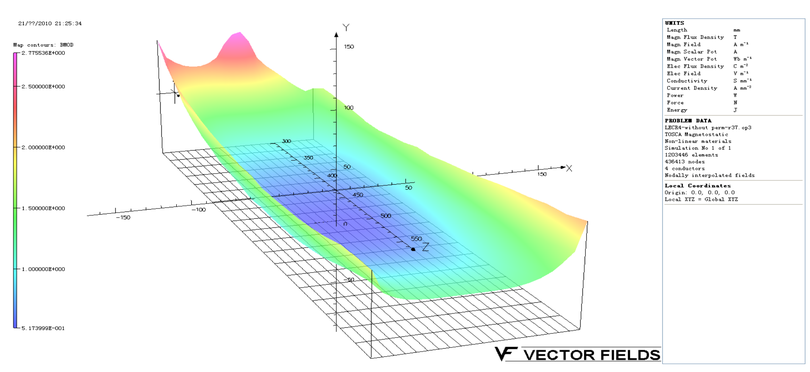
New Features

- *Large plasma chamber*
- *Evaporative medium cooled solenoids*
- *Up to 50kV extraction HV with a Four-electrode extraction system*



Radial magnetic field profiles

The calculated radial field at the surface of plasma chamber of ID of 126mm reaches 1.4T and more than 1.5T with six small iron tips embedded in the cooling channels.

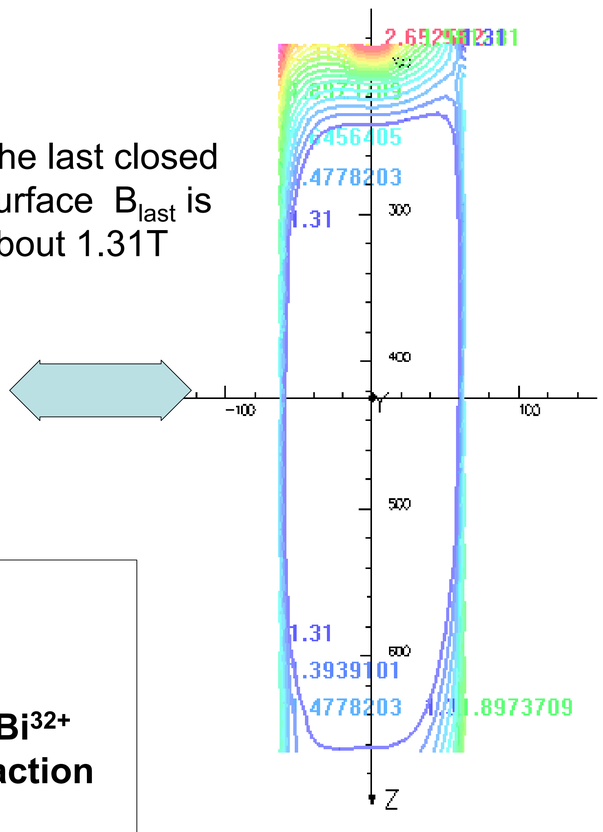


3-D magnetic field distribution

Outlook in the Future

Dragon is expected to produce compatible intense multiply-charged heavy ion beams, such as Xe^{27+}, Bi^{32+} and U^{33+}. In addition, the higher voltage beam extraction will help the heavy beam transport.

The last closed surface B_{last} is about 1.31T



Line map of Bmod

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