Status of new 18 GHz ECRIS HIISI

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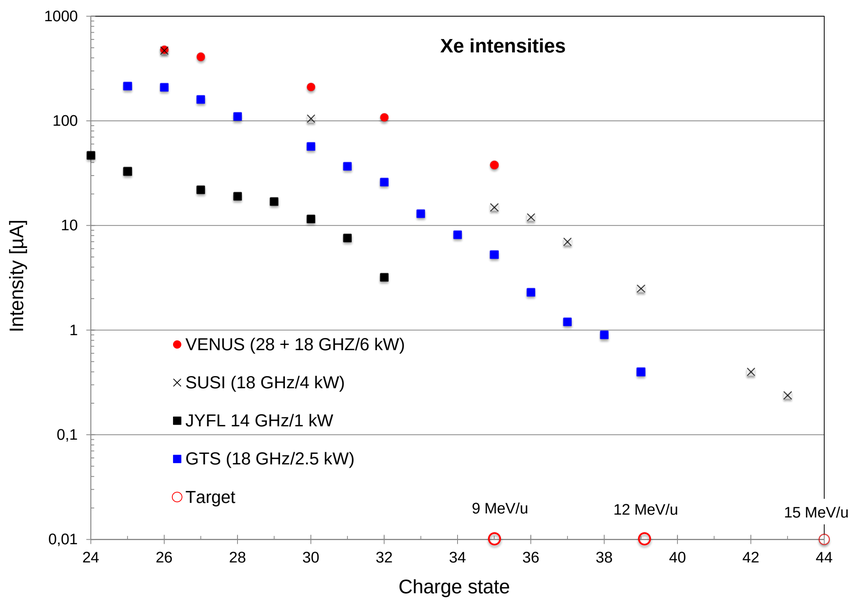
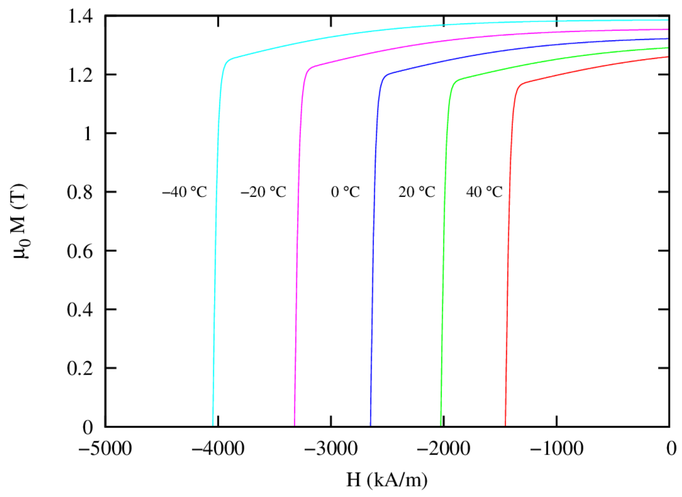
Background and requirements

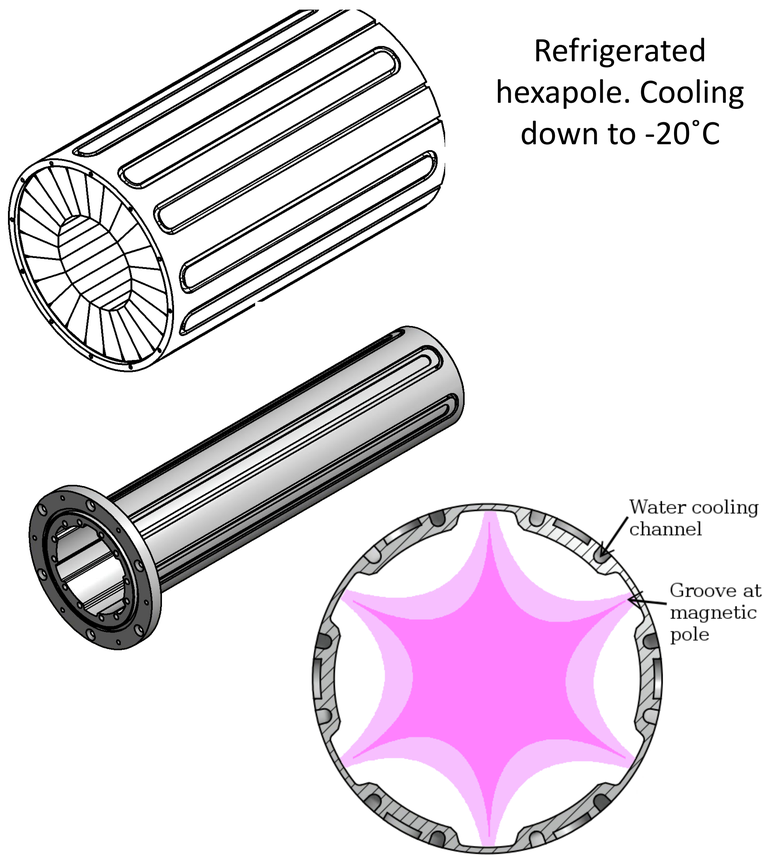
- JYFL 14 GHz ECRIS is not able to meet future requirements set by nuclear physics community and by radiation effect testing of space electronics.
- Intensity of medium/high charge states (≈ 5 MeV/u) have to be increased by factor of >5.
- Beam energy, required by radiation testing, has to be increased from 9 MeV/u to 15 MeV/u.
- Academy of Finland granted funding which allowed the project for RT-ECRIS.
- RT-ECRIS meeting the requirements does not exist.
- SUSI (NSCL/MSU) at 18 GHz operation mode has demonstrated adequate performance. This source was used as a design base of new JYFL 18 GHz ECRIS: HIISI.



HIISI exploits the property of permanent magnets: H_c and B_{rem} increases when T decreases --> higher B_{rem} grade can be used.

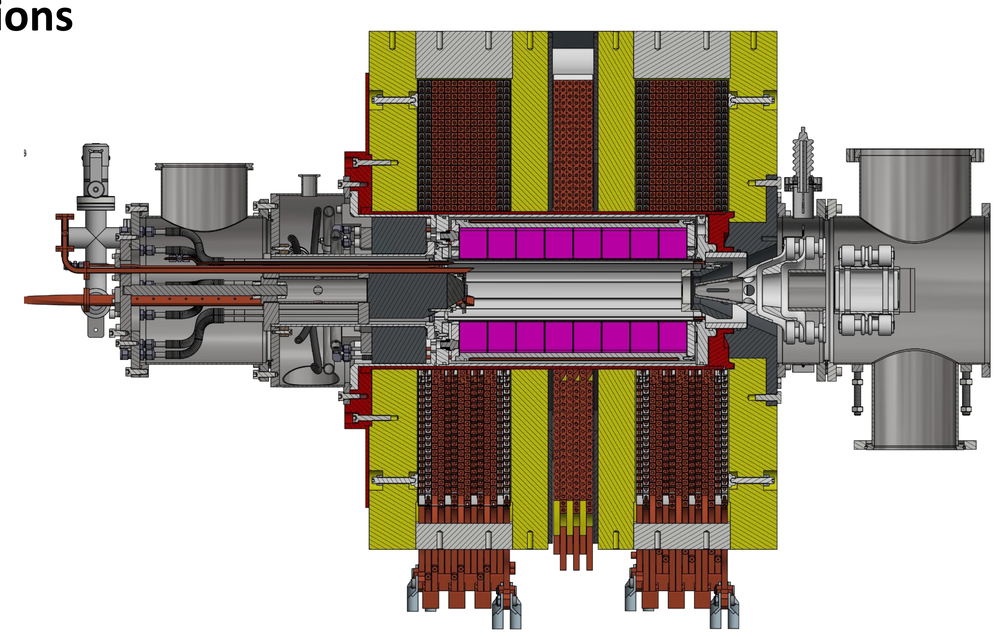


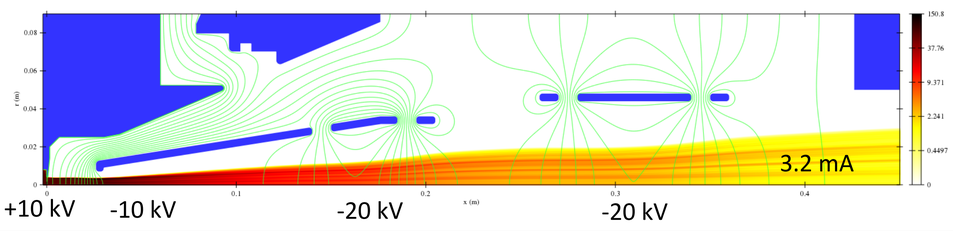
HIISI design and specifications



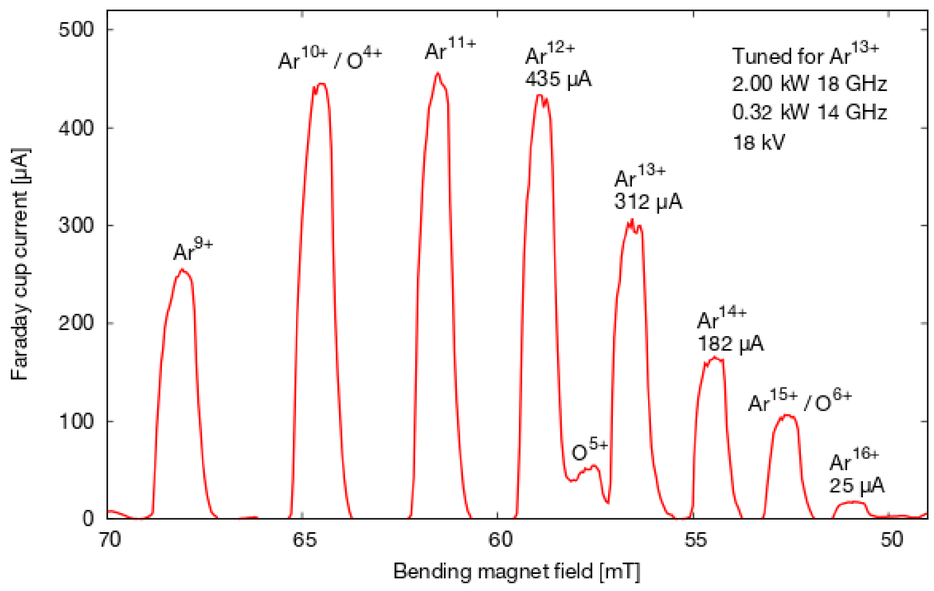
Refrigerated hexapole. Cooling down to -20˚C

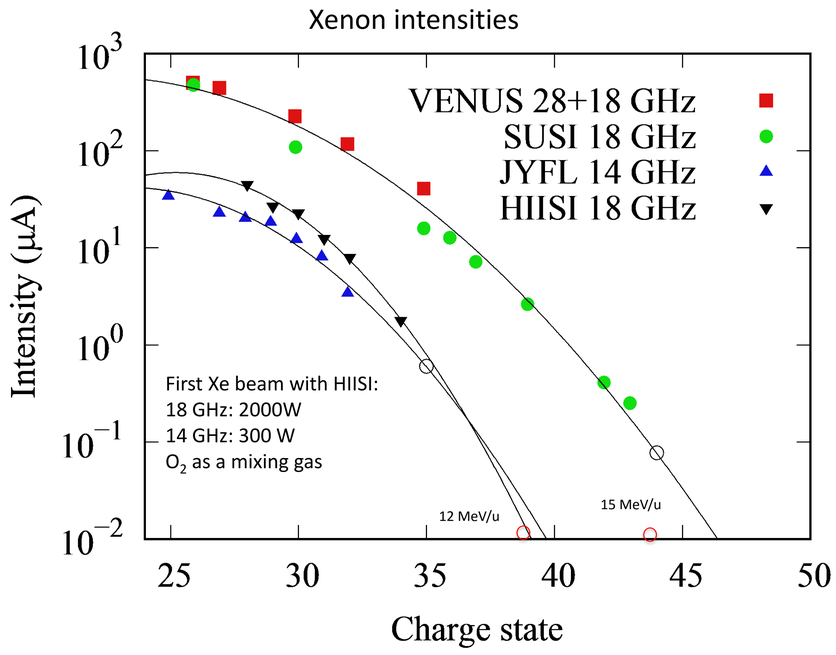
HIISI specifications	
Frequency	18 GHz + 14 GHz
Klystron power	2.4 kW + 2.4 kW
TWTA 8-18 GHz	P_{max}: 250 W 2 oscillators available
B_{rad} (24-segm)	1.3 T
B_{rad} (36-segm)	1.4 T
B_{inj}	2.8 T
B_{ext}	1.3 T
L (plasma)	120-150 mm
L plasma chamber	400 mm
D plasma chamber	100 mm
T hexapole	-20 --> +15˚C





First results with HIISI using 24-segment PM Halbach





Designed cocktail:
$^{126}Xe^{44+}$
$^{83}Kr^{29+}$
$^{57}Fe^{20+}$
$^{40}Ar^{14+}$
$^{20}Ne^{7+}$
$^{17}O^{6+}$

Results of two weeks commissioning tests using 24-segment Halbach

Ion	JYFL 14 GHz ECRIS 1 kW with TWTA	GTS 14+ 18 kW 0.2 kW + 2.4 kW	HIISI 14 + 18 GHZ 0.3 kW + 2 kW
O^{6+}	627	1950	1080
O^{7+}	222	-	560
Ar^{12+}	103	380	462
Ar^{13+}	51	255	312
Ar^{14+}	49	174	182
Ar^{16+}	10	50	31
Xe^{29+}	17	-	27
Xe^{30+}	11.6	60	23
Xe^{31+}	7.6	40	12.5
Xe^{32+}	3.8	-	8
Xe^{34+}	-	8	2

Commissioning during the coming months:

- TWTA tests will be started during the coming weeks
- 36-segment hexapole will be constructed and tested during 1 Q of 2018
- Cooling for the permanent magnet vacuum chamber has to be improved. Presently this limits the tuning of HIISI
- 18 GHz RF power has to be increased.

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