RCS updated characteristics and magnets design

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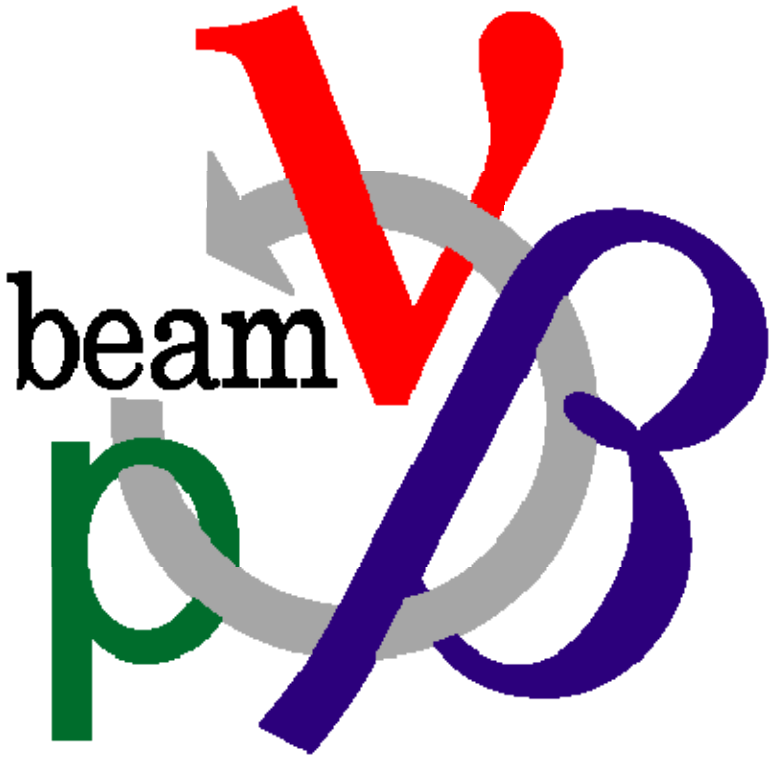


EURISOL

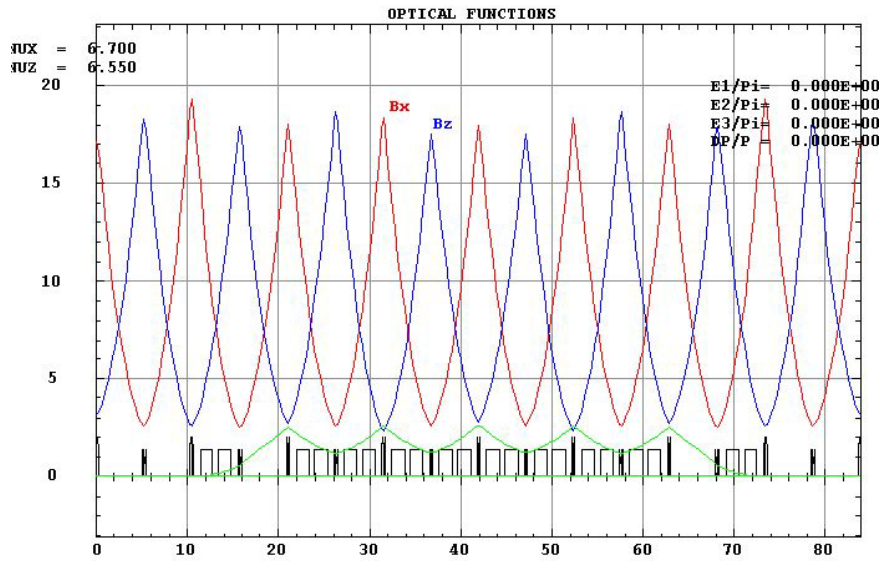
Summary

- Final design

- magnet parameters (dipole and quadrupole)

Final design of the ring

Injection energy	100 MeV/u
Extraction energy	3.5 GeV eq. Proton
Maximum rigidity	14.47 T.m
Number of FODO cells	24
superperiodicity	3
Repetition rate	10 Hz
Transition energy γ	5.35
Tunes (H,V)	6.7 ; 6.55
Momentum compaction	0.00349
Ring circumference	251.327m
Revolution time at injection	1.95 µs
RMS emittances at injection (H,V)	18.11 pi.mm.mrad 9.69 pi.mm.mrad



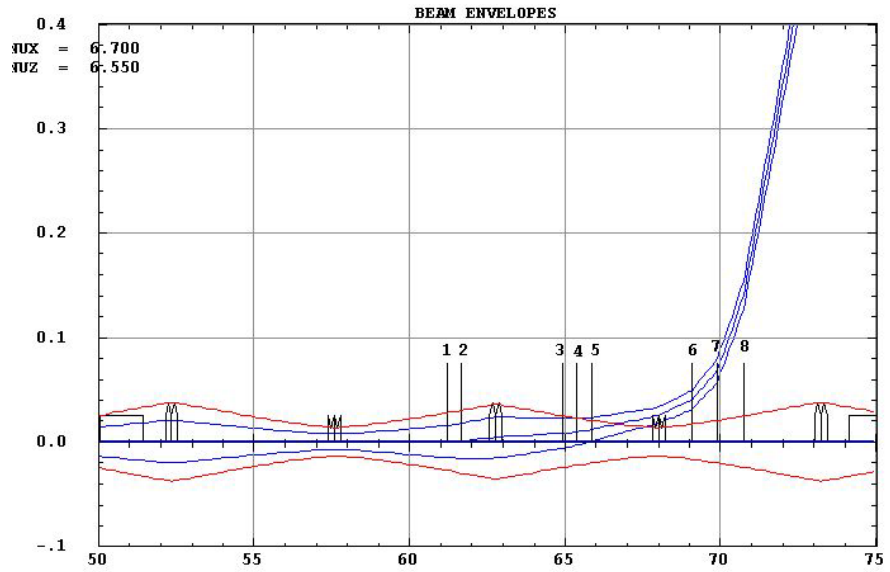
Optical functions for one superperiod

Final design of the ring

The Injection beam line, multiturn Injection, RF system and extraction elements have been updated according to the parameters of the final design of the RCS.

In particular, the multiturn injection has been updated to take into account 20 % blow-up during transfer between RCS and PS (now efficiency of 80 %) and the extraction system layout has been modified in order to use fast kickers proposed by GSI for the SIS18 extraction system.

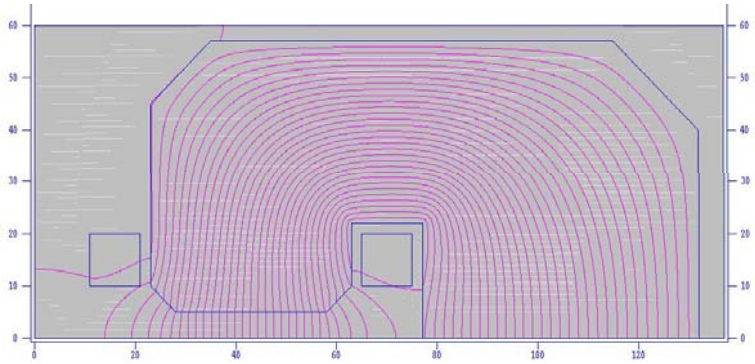
Fast kickers (1 , 2) , (3,4,5)	Deflection angle (mrad)	(3), (4.5)
	Maximum beam rigidity (T.m)	14.47
	Rise time (ns)	<800
	Pulse length (ns)	>100
	Aperture width and height (cm)	10, 8



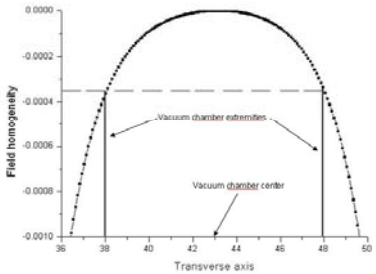
DIPOLE DESIGN

- Laminated warm magnets
- C-shaped for Ne decay products extraction

length	1.40m
transverse field aperture	± 5 cm
bending radius	13.369m
Magnetic field	0.199 - 1.08 T for Ne ions
Magnetic field	0.332 - 1.08 T for He ions
gap	10cm
Repetition rate	10 Hz
maximum Ampere-turn	85940 A.t for both ions
maximum current	I = 1719A for both ions
minimum current	I = 528.4 A for He I = 316.7 A for Ne
I_{Dc} DC current	I = 1123.7A for He I = 1017.8A for Ne
I_{AC} AC peak current	I = 595.2 A for He I = 701.1 A for Ne
Number of turns	2*25
size of the squared conductor	20*20mm
cooling hole diameter	Φ = 8mm
Number of cooling system	1 per coil
Resistance	$1.09*10^{-2}$ Ω for two coils
return yoke weight	12t
coil weight	0.36t per coil



Cross section calculated with POISSON-2D



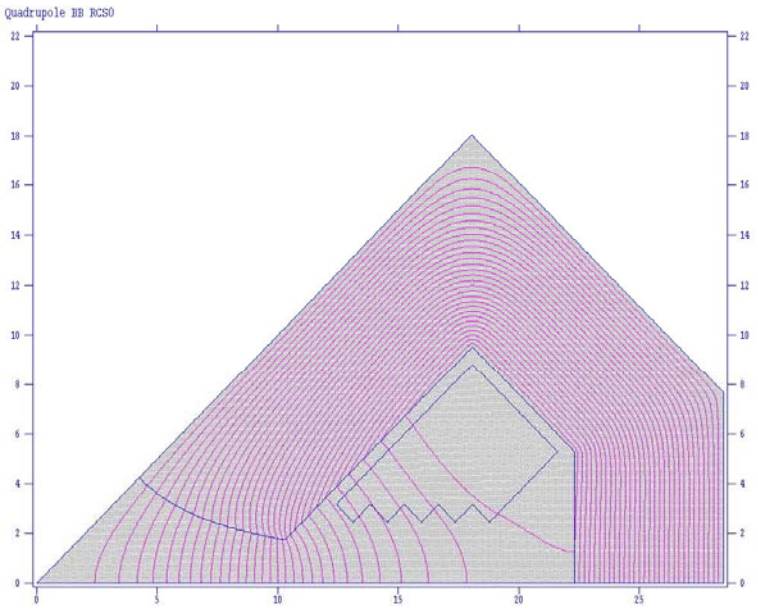
Field homogeneity on the horizontal transverse axis

Admissible pressure variation (bars)	2	3	4	5	6
Water flow (l/min)	2.851	3.954	4.237	4.813	5.341
Water velocity (m/s)	0.945	1.192	1.405	1.596	1.771
Temperature variation (degrees)	39.471	31.308	26.562	23.382	31.069
Admissible pressure variation (bars)	7	8	9	10	11
Water flow (l/min)	5.883	6.296	6.734	7.152	7.552
Water velocity (m/s)	1.934	2.087	2.233	2.371	2.504
Temperature variation (degrees)	19.292	17.875	16.711	15.735	14.901
Admissible pressure variation (bars)	12	13	14	15	16
Water flow (l/min)	7.937	8.309	8.668	9.017	9.355
Water velocity (m/s)	2.632	2.755	2.874	2.99	3.102
Temperature variation (degrees)	14.178	13.544	12.983	12.481	12.029
Admissible pressure variation (bars)	17	18	19	20	
Water flow (l/min)	9.685	10.007	10.321	10.628	
Water velocity (m/s)	3.211	3.318	3.422	3.524	
Temperature variation (degrees)	11.619	11.246	10.904	10.589	

Cooling parameters as a function of pressure variation

QUADRUPOLE DESIGN

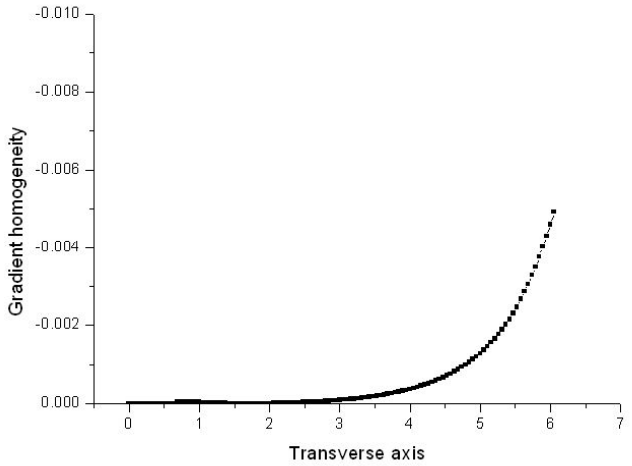
length	0.4m
bore radius	0.06m
maximum Gradient	10.825 T
maximum Ampere-turn	15545 A.t
maximum current	I = 517.8A for both ions
minimum current	I = 159 A for He I = 95.25 A for Ne
I_{Dc} DC current	I = 338.4A for He ; I = 306.52A for Ne
I_{AC} AC peak current	I = 179.4 A for He I = 211.27 A for Ne
Number of turns	4*30
size of the squared conductor	10*10mm
cooling hole diameter	Φ = 5mm
Number of cooling system	1 per coil
Resistance	$3.404*10^{-2}$ Ω for one quad
return yoke weight	0.525 t
coil weight	0.146 t per magnet (4 coils)



Cross-section for one quad (POISSON 2D)

Admissible pressure variation (bars)	2	3	4	5	6
Water flow (l/min)	1.433	1.806	2.129	2.418	2.864
Water velocity (m/s)	1.216	1.533	1.807	2.053	2.278
Temperature variation (degrees)	44.373	35.196	29.861	26.286	23.685
Admissible pressure variation (bars)	7	8	9	10	11
Water flow (l/min)	2.931	3.163	3.384	3.594	3.795
Water velocity (m/s)	2.488	2.685	2.872	3.05	3.221
Temperature variation (degrees)	21.688	20.095	18.787	17.689	16.752
Admissible pressure variation (bars)	12	13	14	15	16
Water flow (l/min)	3.988	4.175	4.355	4.53	4.701
Water velocity (m/s)	3.385	3.544	3.697	3.846	3.99
Temperature variation (degrees)	15.939	15.226	14.595	14.031	13.523
Admissible pressure variation (bars)	17	18	19	20	
Water flow (l/min)	4.866	5.028	5.186	5.34	
Water velocity (m/s)	4.131	4.268	4.402	4.533	
Temperature variation (degrees)	13.062	12.643	12.258	11.904	

Cooling parameters as a function of pressure variation



Gradient homogeniety along bore radius

CONCLUSION

-The ring design is now finalized.

- A first design of the main magnets is proposed, excitation coils and associated cooling system have to be optimized according to CERN standards.