

Ion-optical design of the focusing system in front of the Super-FRS target

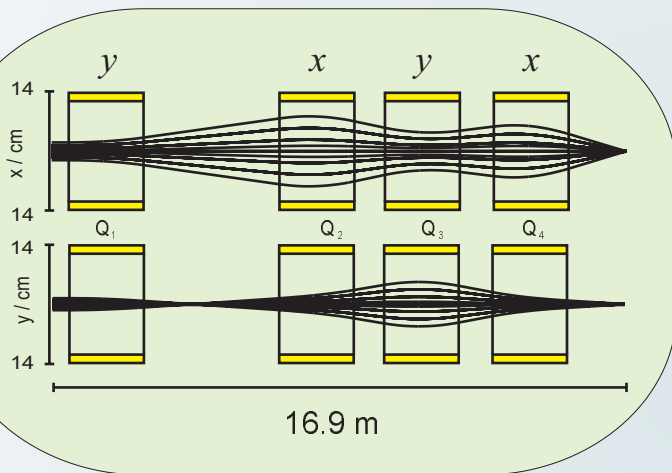
D. Boutin, W. Plass, Giessen University, Germany

H. Geissel, H. Weick, M. Winkler, GSI, Germany

M. Yavor, Inst. of Analytical Instr., St. Petersburg, Russia

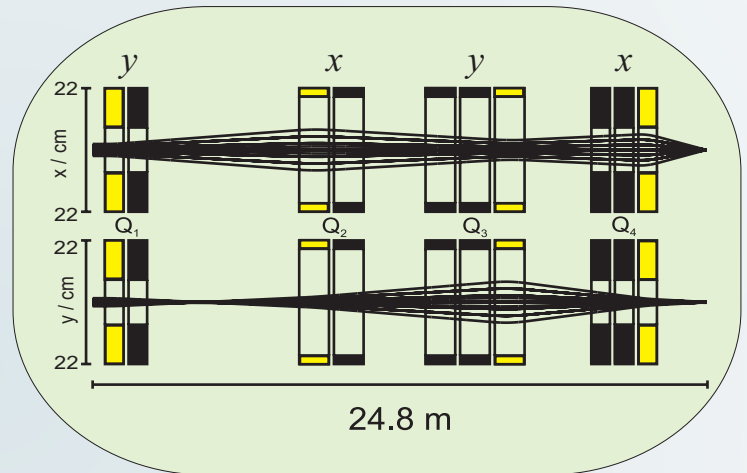
The Super-FRS [1], as part of the FAIR project, will become one of the leading facilities for the production, separation and study of very exotic nuclei. The production target will play a key role in this facility. The beam which will interact with the target should have ideal properties in terms of beam spot size in position (and possibly angle). In order to achieve the planned requirements of $\sigma_x = 1$ mm and $\sigma_y = (2-12)$ mm, a strong focusing system is designed. It consists of four quadrupole magnets, focusing alternatively in x and y direction. Such system will have to handle various ion beams with a large range in magnetic rigidity ($18 \text{ Tm} < B\rho < 100 \text{ Tm}$) and will be provided beams from both the present SIS18 and the future SIS100 synchrotrons. There are two options presently being planned, one with single unit magnets (cos(θ) design), and the other where the magnets are split into 2 or 3 units (superferric design). All simulations have been performed with the GICOSY [2] ion optical program.

① Single magnet design



This simulation has been done with a U^{28+} beam at $E = 400 \text{ MeV/u}$ (SIS100 beam with lowest energy). The magnets focusing in x or y direction are labelled with the corresponding letter. The main advantages of this system are that it is more compact, and that it has only one type of magnet, which both reduce strongly the construction costs. It can also generate higher field strengths.

② Split magnet design



The simulation shown above has also been performed with a U^{28+} beam and $E = 400 \text{ MeV/u}$. The magnets not used for this simulation are marked in black. The main advantage of this design is that it gives more flexibility, since the units can be switched on or off depending on the beam energy and optical properties. All units are required at the maximum magnetic rigidity of 100 Tm. Another advantage of this design is that it employs magnets which will also be used in the Super-FRS.

Systems specifications

System	Length [m]	Momentum acceptance	Magnet type	Length [m]	Aperture radius [mm]	Maximum gradient [T/m]	Working range [T/m]	Number of units	Comments
1	16.9	1 %	Cos(θ)	2.2	120	30	3 - 26	4	Iron free
2	24.8	1 %	Superferric	0.75	80	20	6.5 - 20	2 to 5	Also used in Super-FRS
			Superferric	1.2	190	10	2.5 - 9	2 to 5	

In the near future the focusing system will be coupled to the Super-FRS.

References

- [1] <http://www.gsi.de/fair/experiments/superfrs/>
- [2] GICOSY program main page: <http://www-linux.gsi.de/~weick/gicosy/>

This work has been supported by the European Community under the FP6 program DESIGN STUDY (contract 515873 - DIRACsecondary-Beams)

