Progress on the light ion guide facility

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The construction of the light ion guide is part of the Cyclotron Institute Upgrade Project. In the previous report [1] we have briefly described its principle.

In the last year extensive tests were performed for developing a transport system using a sextupole resonant structure. The sextupole consist in an assembly of six metallic rods (in our case, brass) connected to an RF generator. The sextupole has only one resonant frequency fixed by its length, and there is no mass selection involved. The rods are 2 mm diameter and are placed on a circular pattern of 4 mm diameter. We have tested a sextupole of 30 cm length and a longer one of 100 cm. Tests were performed also with the 100 cm long sextupole together with the 30 cm long sextupole, using only one RF generator. As ion sources, a spark chamber and an ion gun were used. Figure 1 shows a view of the spark chamber coupled with the 100 cm long sextupole and the vacuum chamber.

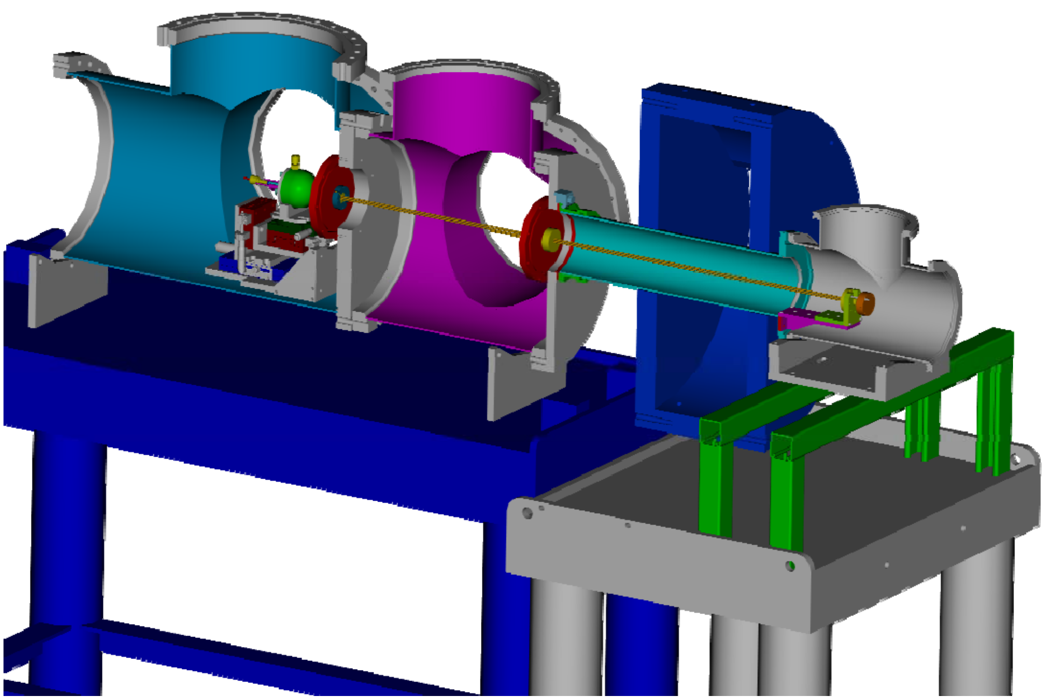

Figure 1. View of the spark chamber, 100 cm sextupole and the vacuum chambers.

The measurements were performed in various conditions and we found: 1) we are able to transport 1^+ ions from the source to long distances (130 cm); 2) the efficiency is relatively constant for a range of pressures in the target chamber (P_{tc} on the Figure 2); 3) absolute efficiency is impossible to verify due to the impossibility of estimation in the impurities level; 4) using the ion gun we can transport ^{24}Mg and ^{85}Rb without changing the resonant frequency of the sextupole, so as expected there is no selection in mass involved. We have to mention here that the ion gun measurements are made in vacuum; Helium gas cannot be used due to its high cooling capacity. In the Figure 2 we present an example of measurement using the spark chamber and the 100 cm sextupole for different pressures of helium in the target chamber.

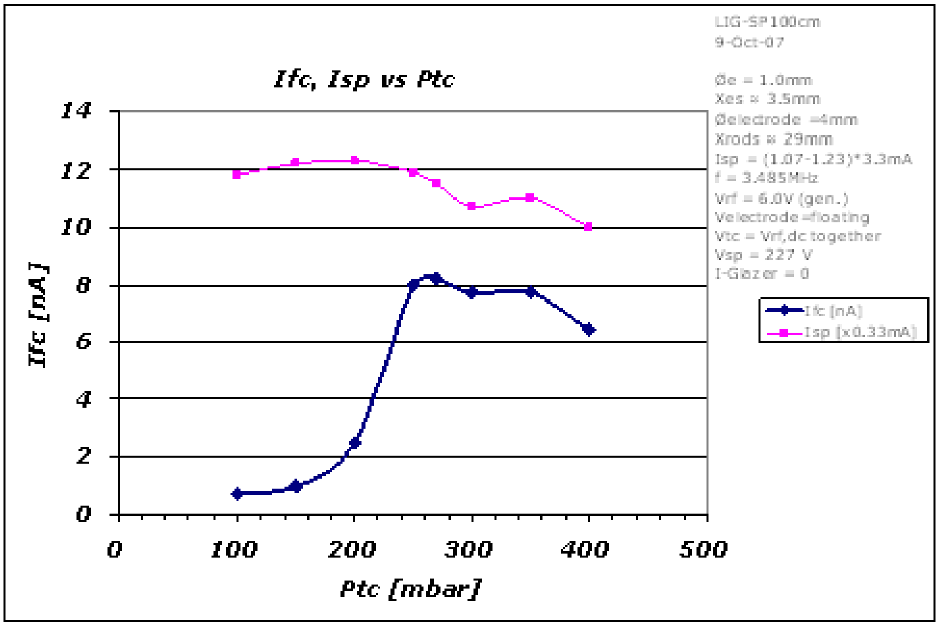

Figure 2. Current vs. pressure measurements with 100 cm long sextupole.

The next challenge in this project will be the coupling of the sextupole into the Charge Breeding ECR source [2]. But for this development a radioactive source is needed. It is known that the background current out of the ECR source is big compared with the injected current. Only using a radioactive source we can identify charge boosted ions (from 1^+ to higher charge state) and diagnose the coupling of the sextupole with the ECR source. We already have acquired a ^{228}Th open source and at the time when this report is being written, the experiments are in progress. We hope that next year will have a successful report on making highly charged radioactive ions using the light ion guide in conjunction with the Charge Breeding ECR.

[1] G. Tabacaru, J. Arje, and H. L. Clark, *Progress in Research*, Cyclotron Institute, Texas A&M University (2006-2007), p.V-20; http://cyclotron.tamu.edu/publication.html.

[2] H. L. Clark, Progress in Research, Cyclotron Institute, Texas A&M University (2006-2007), p.V-8; http://cyclotron.tamu.edu/publication.html.