Recent progress on the light ion guide project

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The Light Ion Guide Project continued to be developed at our facility [1]. The focus was on the optimization of the overall efficiency. Several experiments were conducted using proton beam and ^{114}Cd and ^{90}Zr target. A mobile section of the Sextupole Ion Guide (SPIG) was used to check the production of the radioactive ions: ^{114}In and ^{90}Nb.

The main factors contributing to the optimization of the production of the radioactive ions are: pressure in the gas cell (or flow of Helium), the resonant frequency where the SPIG operates, the proton beam intensity, and various settings of the voltages on the vacuum barriers and the voltage applied to the gas cell. In Fig. 1 is presented a beta decay spectrum of the ^{114}In produced using protons with energy of 10.5 MeV and intensity of 6 μA.

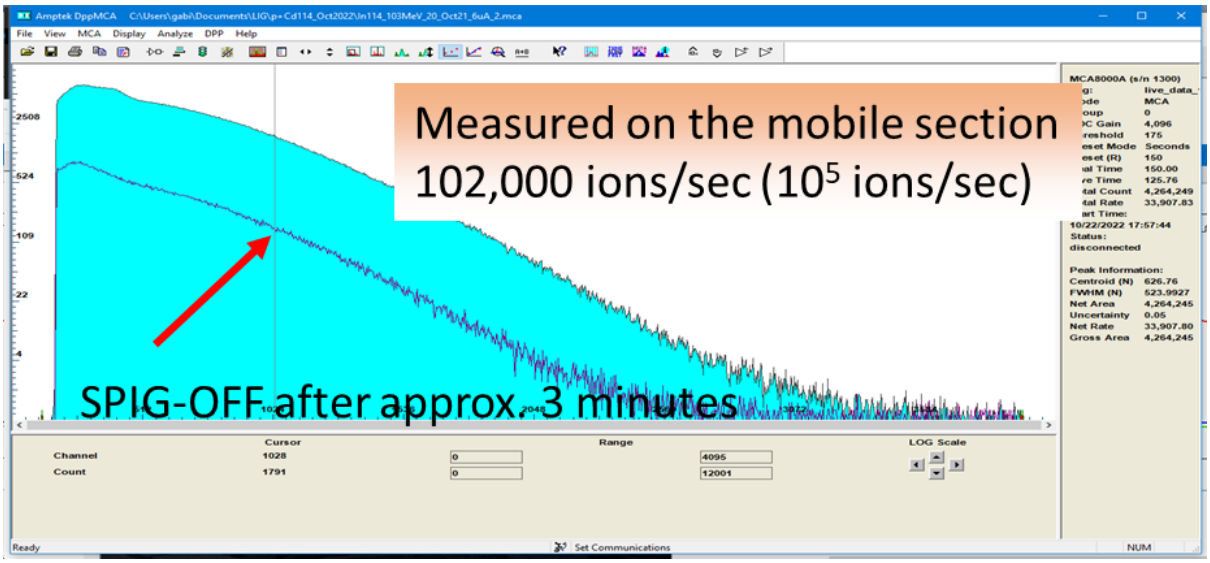

FIG.1. ^{114}In beta decay spectrum. Approximately 10^5 ions/sec were produced.

After the optimization the charge breeding tuning starts and various charge states are analyzed. We focused our efforts on the 19+, 20+ and 21+ charge states of ^{114}In. Based on our measurements we found out the following efficiencies respectively: 2.9%, 2.4% and 1.9%. In order to find the other charge states efficiencies, we have to do in depth measurements and for each charge state a different pilot beam needs to be tuned.

Another interesting result was found: the production of the radioactive ions does not scale with the proton beam intensity. In Fig. 2 the graph showed that increasing the beam intensity from 6 μA to 8 μA does not increase the production of the radioactive ions with 33 %.

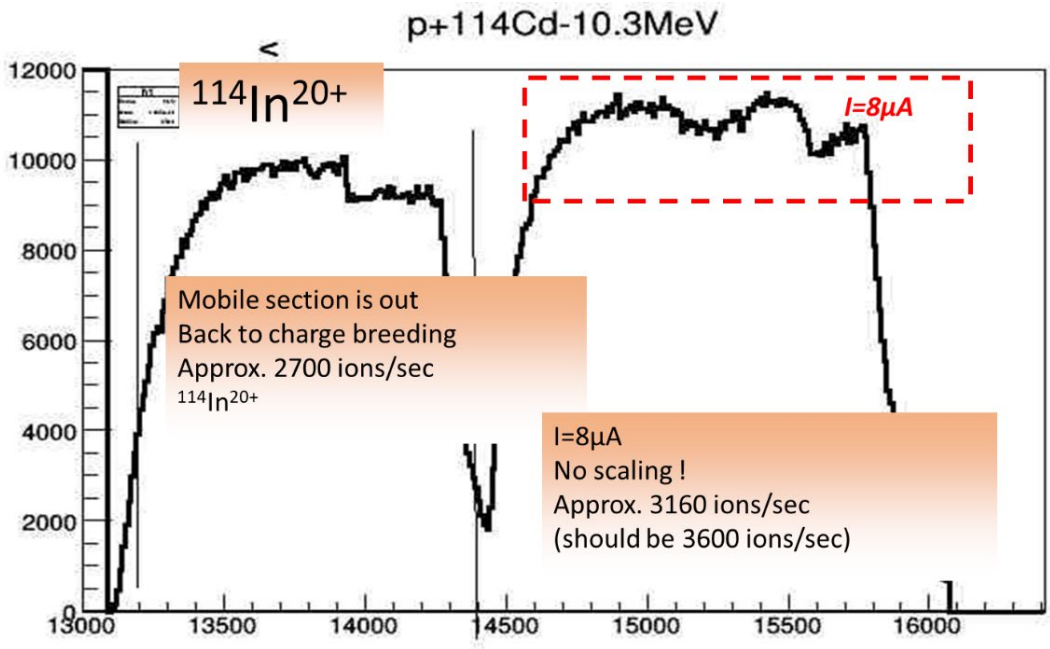

FIG. 2. Production of ^{114}In for 6 μA and 8 μA.

[1] G. Tabacaru *et al.*, *Progress in Research*, Cyclotron Institute, Texas A&M University (2020-2021), p. V-9.