Ion beam production and manipulation at IGISOL

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IGISOL-facility in the Accelerator Laboratory relies on the ion guide technique developed early 80's in the University of Jyväskylä. In the ion guide technique, reaction products recoiling out from the target matrix are stopped in a noble gas, usually He. During the slowing down process, the charge state of ions is reset mainly to 1+. The process is universal and very fast, thus being an interesting alternative for conventional ion source techniques, which usually suffer from physical and chemical selectivity. Ion guide technique has been developed over years and its variations have been implemented worldwide. At JYFL we continue developing and improving the ion guide technique. Our recent studies have concentrated on the laser ionization both in the gas cell but also in the gas jet evacuating the gas volume.

In the production side IGISOL-facility together with sensitive counting of ions with Penning trap has been applied for yield measurements of fission process. This program will be continued in the new IGISOL coming on-line in 2012. In connection to move of the IGISOL-laboratory to new location, preparations for the neutron-conversion target have been started allowing yield measurements of neutron induced fission in the future.

The extracted ion beam from IGISOL-separator can further be manipulated in a various way. A radiofrequency ion cooler and buncher has been developed and fully utilized at JYFL. The recent innovation deals with an optical pumping in the cooler. In this method ionic state of ions of interest is manipulated in such a way, that more efficient transition for further studies can be utilized. This technique has allowed, for example, a collinear laser spectroscopy of some refractory elements, like Y and Mo at JYFL.

In the ion trap technology, we have developed new purification technique called Ramsey-cleaning and multi-injection method to improve measurement efficiency especially for low duty cycle measurements. Both techniques have been employed in measurements requiting extreme precision, like QEC and half-life measurements for super allowed beta decay and double beta decay Q-value measurements. In the near future we will investigate new extraction methods from the Penning trap to improve ion beam properties after the trap.