

High precision mass measurements of exotic nuclei at SHIPTRAP

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SHIPTRAP is a Penning trap mass spectrometer located at GSI in Darmstadt/Germany. It was designed to deliver slow beams and clean samples of exotic nuclei to a number of experiments. The main focus in the moment rests on high precision mass measurements of short-lived nuclei and especially of nuclei beyond uranium.

The radioactive nuclei are produced in fusion-evaporation reactions and then separated from the primary beam using the velocity filter of Wien type SHIP, the GSI separator for heavy ion products. The fusion-evaporation residues are decelerated in a micro meter thin window before they come to rest in a gas stopping cell filled with 50 mbar of helium. They remain charged and are then extracted using electric fields and gas flow towards an extraction radiofrequency structure and into a cooler and buncher structure. The ion bunches created there are efficiently trapped in the first Penning trap where unwanted species can be separated with a resolving power of up to 100 000. The purified sample is then sent to the second trap to measure the mass via the cyclotron frequency of the stored ion using the well established time-of-flight technique. Mass values with a relative uncertainty between 10 and 100 ppt are the result.

SHIPTRAP is now running since more than two years routinely and more than 50 exotic nuclei have been investigated. Using the strength of the production technique, especially nuclei close to the proton drip-line and along the astrophysical rp-process were the target of our measurements. Recent results and some of their implications will be presented.