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JYFLTRAP at IGISOL-4: Separating isomers and nailing down nuclear masses

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The JYFLTRAP Penning trap setup [1] as a part of the IGISOL facility is not only used in high-precision atomic mass spectrometry of exotic nuclei but it also provides isomerically clean ion beams.

After relocation to the new experimental hall and its commissioning, the trap setup has been mostly used as a high-resolution mass filter. Recent tests with Xe-133 that has an isomeric state at 233 keV (requiring about 2 ppm separation) showed that JYFLTRAP with present settings provides better than 1 ppm mass resolution in a two-step cleaning process requiring less than 500 ms. With the demonstration of such a high resolving power, production of Xe-133m samples for comprehensive test ban treaty organization (CTBTO) will soon commence [2]. These samples provide valuable contaminant-free calibration sources for noble gas detectors. Various post-trap spectroscopy experiments have been performed including studies of beta delayed neutron emitters with BELEN (BEta deLayEd Neutron Detector) [3] setup and measurements of beta decay strengths of fission reactor products with total absorption spectroscopy (TAS) method.

In the mass measurement side, light neutron deficient nuclei masses near $A=30$ region were measured for nuclear astrophysics studies. Currently, cross-reference mass measurements are being carried out to study systematic characteristics of JYFLTRAP.

As the further development of IGISOL-4 is concerned, the major upcoming improvements to JYFLTRAP setup will be the installation of a position sensitive MCP to enable phase-imaging ion-cyclotron-resonance (PI-ICR) technique to further improve mass measurement precision and speed. Additionally, a multi-reflection time-of-flight (MR-TOF) mass separator will be added in front of the Penning trap to provide faster isobaric purification allowing mass measurements of even shorter-lived isotopes. Due to its faster cycle, MR-TOF also boosts the purification efficiency as it allows a few orders of magnitude worse ion-of-interest to contamination ratio than the purification Penning trap.

This contribution will concentrate on current status of JYFLTRAP, especially on high-resolution beam purification. Also overview and status of the on-going developments are given.

[1] T. Eronen et al. Eur. Phys. J. A 48 (2012) 46

[2] K. Peräjärvi et al. 2010 Appl. Radiat. Isotopes 68 450-453

[3] M B Gómez-Hornillos et al. 2011 J. Phys.: Conf. Ser. 312 052008

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