TASISpec – Heading towards its first experiment.

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TASISpec (*TA*sca *S*mall *I*mage mode *Spec*troscopy) [1, 2] is a Si and Ge detector setup optimised for particle-γ-X-ray coincidence spectroscopy of superheavy elements in conjunction with the TASCA separator [3]. The detection system consists of 192 Si strips distributed over one double sided silicon strip detector (DSSSD) and four single sided silicon strip detectors (SSSSD). The DSSSD is the focal plane detector into which the residual nuclei are implanted and their subsequent decay products such as fission fragments or α particles are detected. The SSSSDs form a "box" upstream from the DSSSD and they are used to detect α particles which have escaped detection in the DSSSD, conversion electrons (CE) and possibly the second fission fragment. A seven-crystal Ge cluster detector is mounted directly behind the DSSSD and four clover detectors are mounted behind the four SSSSDs. The complete setup is thus composed of a total of 23 Ge crystals.

The setup is constructed to enable multi-coincidence spectroscopy such as α-γ-CE and α-γ-γ with unprecedented γ-ray efficiency and thus reveal essential information necessary to build reliable level schemes for superheavy elements.

During 2009 a thorough evaluation of the commissioning experiments was performed [2]. This involved amongst others detection efficiencies and implant-decay correlation times. As an example, the decay of ^{253}No has been explored. The half life of the ground state was previously determined to $T_{1/2} = 1.56(2)$ min [4]. In the present analysis the half life is determined to $T_{1/2} = 1.61(21)$ min where the uncertainty originates mainly from the small number of α particles, which could be included in the analysis. In Fig. 1 the DSSSD hitpattern is shown. It shows the pixels in which the 8.0 MeV α particles relating to the decay of the ground state of ^{253}No were detected. As can be seen in this figure the implants are nicely focused into a very narrow spot. Since the half life of ^{253}No is rather long the pixels in the very centre of the focal spot where the implantation rates are at its highest, were excluded when determining the half life. This minimises the risk of random correlations between the incoming evaporation residues and the α particles.

In a commissioning run in July 2009 was the reaction ^{208}Pb(^{48}Ca,$1n$)^{255}No applied to explore the benefits gained from the usage of pulse-shape electronics. Pulse shape analysis could yield particle identification due to distinct ionisation schemes in the semiconductor material for different incidenting particles, like e.g. α particles and CE.

In the beginning of 2009 TASISpec was granted beamtime for its first main beam experiment. The experiment is scheduled for spring 2010 and will aim to explore K-isomers in ^{253}No in detail.

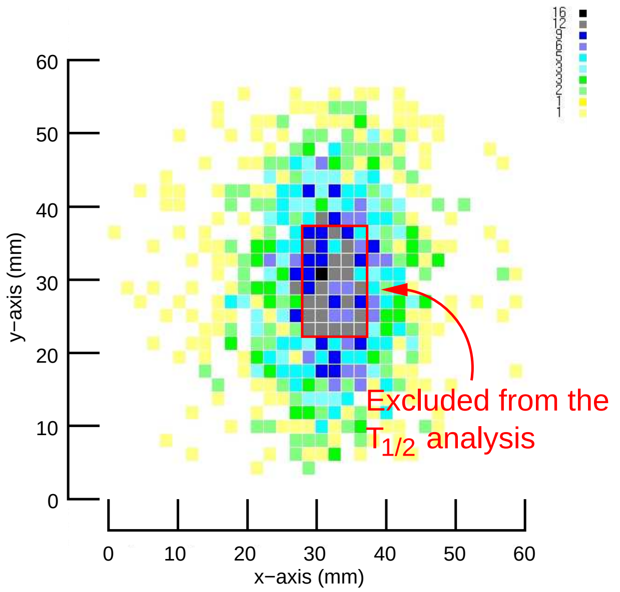

Figure 1: The position of the detected ^{253}No correlated alpha particles in the DSSSD. On the x and y-axis the size of the DSSSD is indicated.

References

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