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First experiment with the NUSTAR/FAIR Decay Total Absorption Gamma-Ray Spectrometer at the IGISOL IV facility

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A new Total Absorption Gamma-Ray Spectrometer for beta-decay studies (DTAS) has been developed within the DESPEC experiment of the NUSTAR collaboration [1]. The instrument has been designed [2] to determine accurately the beta-decay intensity distribution for exotic nuclei produced in high-energy reactions, which will be separated and identified by means of the Super Fragment Separator at the future FAIR facility. DTAS has a modular construction with up to 18 large NaI(Tl) detector modules (module dimension: 25cmx15cmx15cm) which can be assembled in a 4pi geometry with little dead material around the AIDA implantation detector, a stack of double sided Si strip-detectors [2].

We have recently performed the first experiment with this setup at the upgraded IGISOL IV (Jyväskylä, Finland) facility. The low energy radioactive beams have been further purified with the JYFLTRAP Penning trap [3]. The experiment aimed to study fission products of relevance in neutrino physics and reactor decay heat time evolution. The measurements allowed us to perform a careful characterization of the detector and to study the overall performance of the setup. The results of this work will be presented, including the performance of the gain stabilization system, the correction of electronic pulse pileup, the sensitivity to neutrons and the calibration of the response of the spectrometer to decay radiation by means of Geant4 Monte Carlo simulations.

[1] <http://www.fair-center.eu/for-users/experiments/nustar.html>

[2] <http://www.fair-center.eu/for-users/experiments/nustar/nustar-documents/technical-design-reports.html>

[3] <https://www.jyu.fi/fysiikka/en/research/accelerator/igisol>

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