Beta-delayed (multi-)particle emission from ^{21}Mg utilising DSSSD telescopes and HPGe Clovers at IDS*

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β-delayed particle emission provides an attractive means of probing the nuclear structure of nuclei far from stability – in principle across the entire energy spectrum from the low-lying single-nucleon separation energies of the emitter up to the large Q-value of β-decay from the precursor [1].
The experiment IS507 carried out at the ISOLDE Decay Station at CERN studies the β-decays of ^{20,21}Mg in a series of measurements [2,3]. The focus of this poster is on ^{21}Mg. A low-energy radioactive beam of ^{21}Mg is produced and stopped in a thin catcher foil from which it β-decays. The foil is surrounded by Double-Sided Silicon Strip Detector (DSSSD) telescopes in close geometry, and the telescopes are backed by High-Purity Germanium Clover detectors.
For nuclear physics cases such as ^{21}Mg, the ability to extract particle energy spectra towards low energy is crucial. For DSSSD telescopes, this implies extracting data not only from the ΔE-E configurations, but from the ΔE detectors on their own – below punch through. There are inherent problems in doing so, and for some deposited energies (spanning several hundreds of keV for close setup geometries), the corresponding particle kinetic energies cannot be uniquely assigned [4].
By accommodating these inherent problems, clean low-energy spectra from DSSSD telescopes can be extracted around the relevant punch through energies. As a result, the βp, βpγ as well as the exotic βpα decay channels are studied in great detail. The Gamow-Teller strength of the emitter, ^{21}Na, is accurately mapped and the level schemes of the daughter nuclides are clarified [5].

[1] B. Blank, M.J.G. Borge, Prog. Part. Nucl. Phys. **60** (2008) 403.
[2] M.V. Lund *et al.*, Eur. Phys. J. A **51** (2015) 113.
[3] M.V. Lund *et al.*, Eur. Phys. J. A **52** (2016) 304.
[4] E.A.M. Jensen *et al.*, "Extracting clean low-energy spectra from silicon strip detector telescopes around punch through energies" (under publication).
[5] E.A.M. Jensen *et al.*, "The beta-decay of ^{21}Mg" (in preparation).

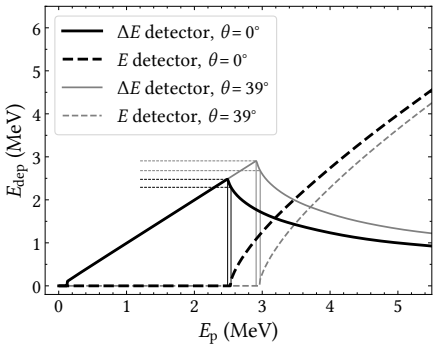

FIG. 1: Example of energy deposition $E_{\rm dep}$ vs. kinetic energy $E_{\rm p}$ of a proton in the active silicon layers of a detector telescope at two extremes of angle of incidence θ. The horizontal and vertical lines outline spurious energy regions for this telescope with ΔE detector thickness 67 μm.

*For the MAGISOL and IDS collaborations