

DPUNS - A Differential-Plunger for Lifetime measurements of Tagged Exotic- and Unbound nuclear states*.

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This talk will discuss the development of a new Differential-Plunger for lifetime measurements of tagged unbound nuclear states, DPUNS, at the University of Manchester (See Fig. 1). DPUNS will be used in conjunction with the existing GREAT spectrometer at the University of Jyväskylä to preferentially select weak nuclear channels ($\sigma \approx \mu\text{b}$) by the detection of recoils, isomeric states or proton/alpha decays at the focal plane of the RITU gas-filled separator. The low-background environment produced by these sensitive tagging techniques allows the lifetimes of the states above these isomers and alpha- or proton-unbound states to be measured for the first time. Such lifetime information provides crucial information about the deformation and underlying configuration of the isomer-, alpha-, proton-decaying state which is often required in theoretical tunnelling calculations. One aim of this work is to study the effect of the triaxiality on proton-decay tunnelling rates. As an example, the results of the first isomer-tagged differential-plunger measurement (using an existing Köln plunger) to determine the lifetimes of the unbound states above a low-spin shape isomer in ^{144}Ho will be discussed [1,2] in terms of the development of triaxiality and Critical-Point symmetries in nuclei [3] near the proton drip line in the mass 140 region.

DPUNS has been optimised to work within the RITU gas, removing the windows required with the Köln differential plunger, and thereby reducing the additional scattering of beam and recoils. DPUNS makes use of the Lyrtec digital electronics from the SAGE and LISA projects producing a more efficient setup which will be able to study lifetimes and deformations in nuclei with smaller production cross sections than is presently possible.

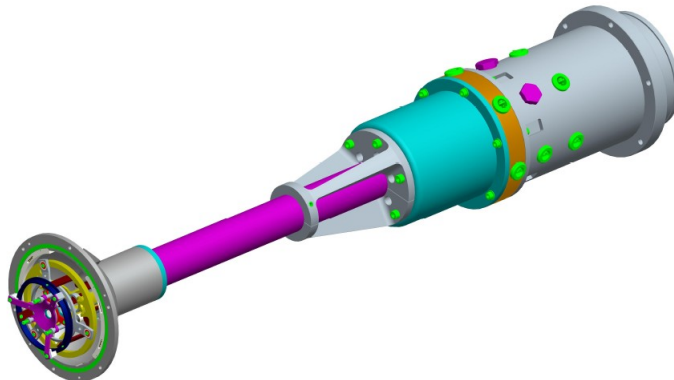


Figure 1:DPUNS – a differential-plunger for unbound nuclear states.

* This work is supported by the UK STFC under contract number ST/G008787/1.

[1] P.J.R. Mason, D.M. Cullen *et al.*, Phys. Lett. **B683**, 17 (2009) .

[2] P.J.R. Mason, D.M. Cullen *et al.*, Phys. Rev. **C79**, 024318 (2009) .

[3] M. Procter, D.M. Cullen *et al.*, To be published.