Shell structure in the vicinity of ^{132}Sn with an active target

R. Raabe[1], T. Marchi[2], S. Barlini[3], B. Bastin[4], M. Bini[3], M. Bruno[5], G. Casini[3], M. Cinausero[2], M. D'Agostino[5], F. de Oliveira Santos[4], M. Degerlier[6], G. De Angelis[2], A. Di Pietro[7], D. Fabris[8], P. Figuera[7], F. Flavigny[1], F. Gramegna[2], G. F. Grinyer[4], M. Lattuada[7], D. Mengoni[8], L. Morelli[5], G. Pasquali[3], S. Piantelli[3], E. Pollacco[9], G. Prete[2], F. Renzi[1], T. Roger[4], A. M. Sánchez-Benítez[10], O. Sorlin[4], D. Suzuki[11], C. Swartz[1], S. Valdré[3], J. J. Valiente Dobon[2], E. Vardaci[12], and the ACTAR TPC Collaboration

[1]KU Leuven, Instituut voor Kern- en Stralingsfysica, Leuven, Belgium • [2]INFN – Laboratori Nazionali di Legnaro, Italy • [3]INFN Firenze e Università di Firenze, Italy • [4]GANIL, Caen, France • [5]INFN Bologna e Università di Bologna, Italy • [6]University of Nevsehir, Science and Art Faculty – Physics Department, Nevsehir, Turkey • [7]INFN – Laboratori Nazionali del SUD e Università di Catania, Italy • [8]INFN Padova e Università di Padova, Italy • [9]CEA-Saclay, DSM/IRFU/SPhN, Gif-sur-Yvette, France • [10]Centro de Fsica Nuclear, Universidade de Lisboa, Lisbon, Portugal • [11]IPN Orsay, CNRS/IN2P3, Orsay, France • [12]INFN e Università di Napoli, Italy

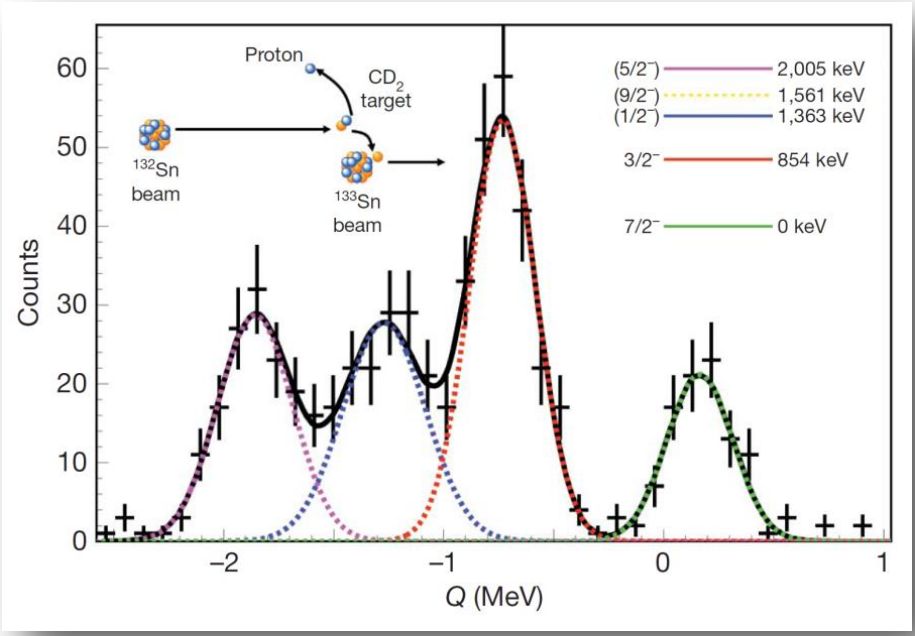
Beyond ^{132}Sn: a new magic number at N=90?

- ^{133}Sn well described by doubly-magic ^{132}Sn+n

- Beyond? Behaviour of $\nu f_{7/2}$ similar to that beyond ^{40}Ca

- Empirical or realistic interactions Role of n-n interaction and 3-body forces

K.L. Jones et al., Nature 465 (2010) 454

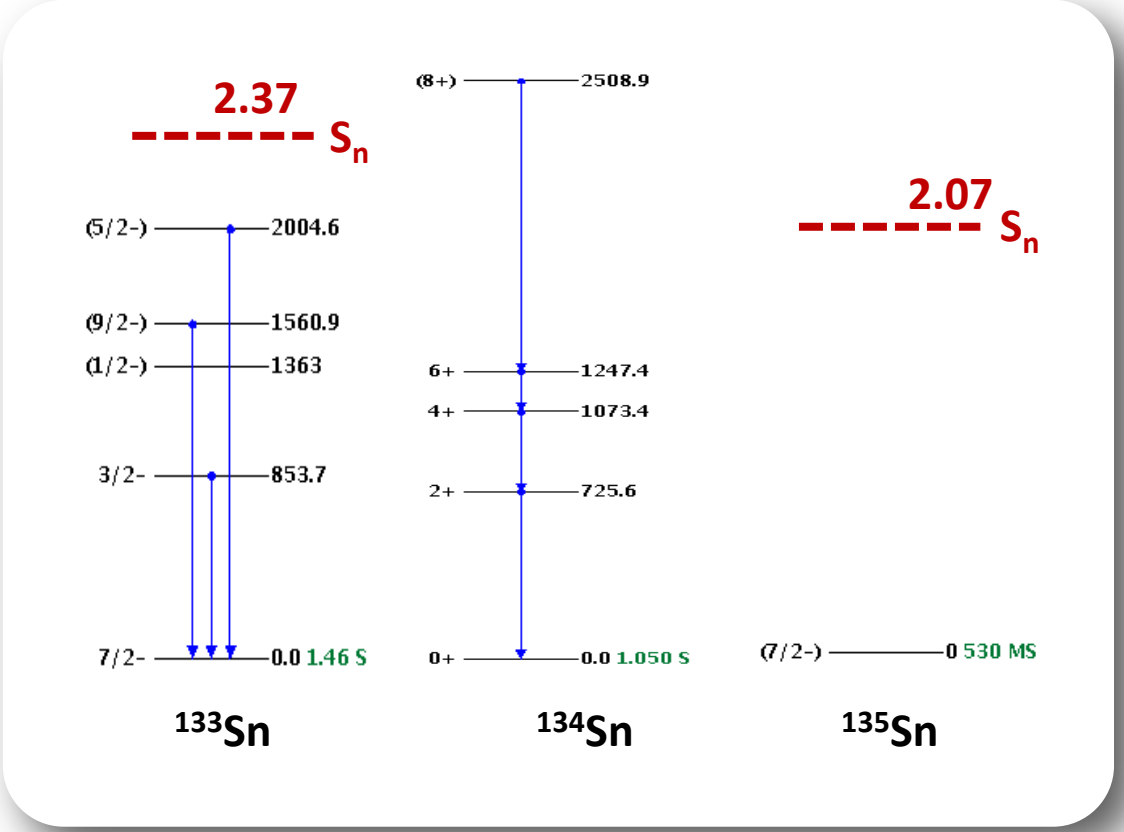


KU LEUVEN
NUCLEAR AND RADIATION PHYSICS

Beyond ^{132}Sn: a new magic number at N=90?

Data from ENSDF

- ^{133}Sn well described by doubly-magic ^{132}Sn+n
- Beyond? Behaviour of $\nu f_{7/2}$ similar to that beyond ^{40}Ca
- Empirical or realistic interactions Role of n-n interaction and 3-body forces

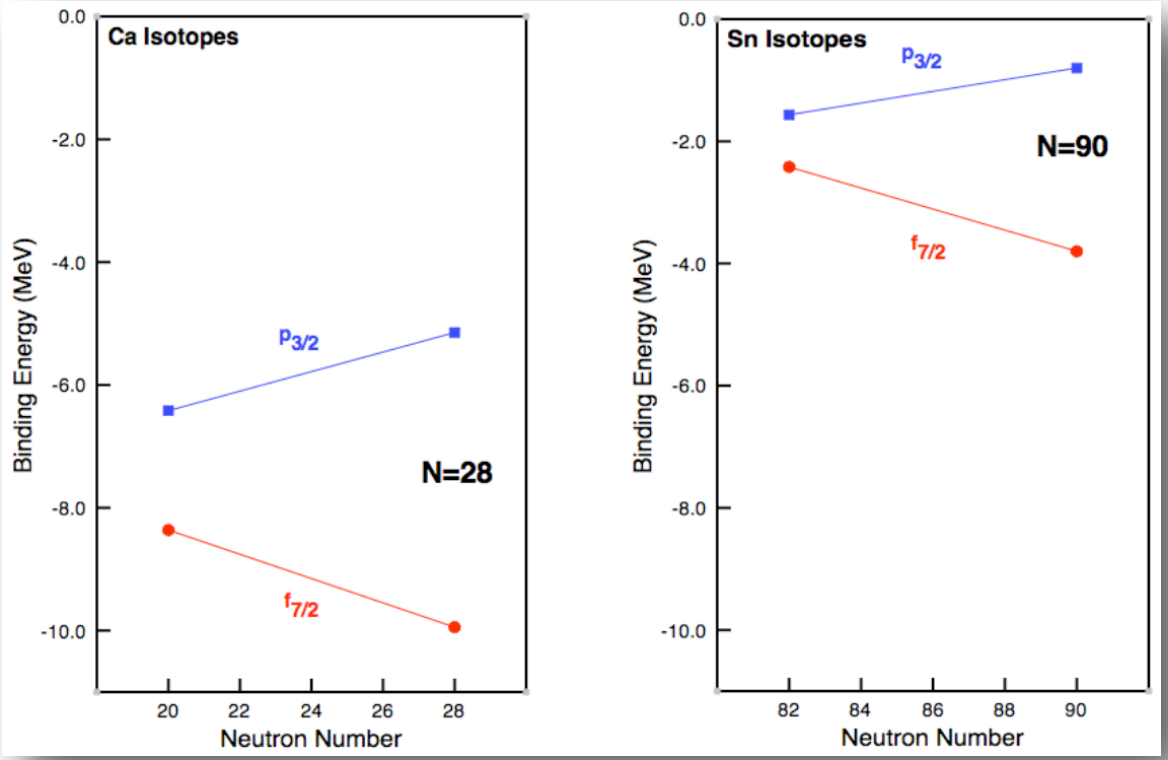


KU LEUVEN
NUCLEAR AND RADIATION PHYSICS

Beyond ^{132}Sn: a new magic number at N=90?

- ^{133}Sn well described by doubly-magic ^{132}Sn+n
- Beyond? Behaviour of $\nu f_{7/2}$ similar to that beyond ^{40}Ca
- Empirical or realistic interactions Role of n-n interaction and 3-body forces

Adapted from Sorlin and Porquet, PPNP 61 (2008) 602

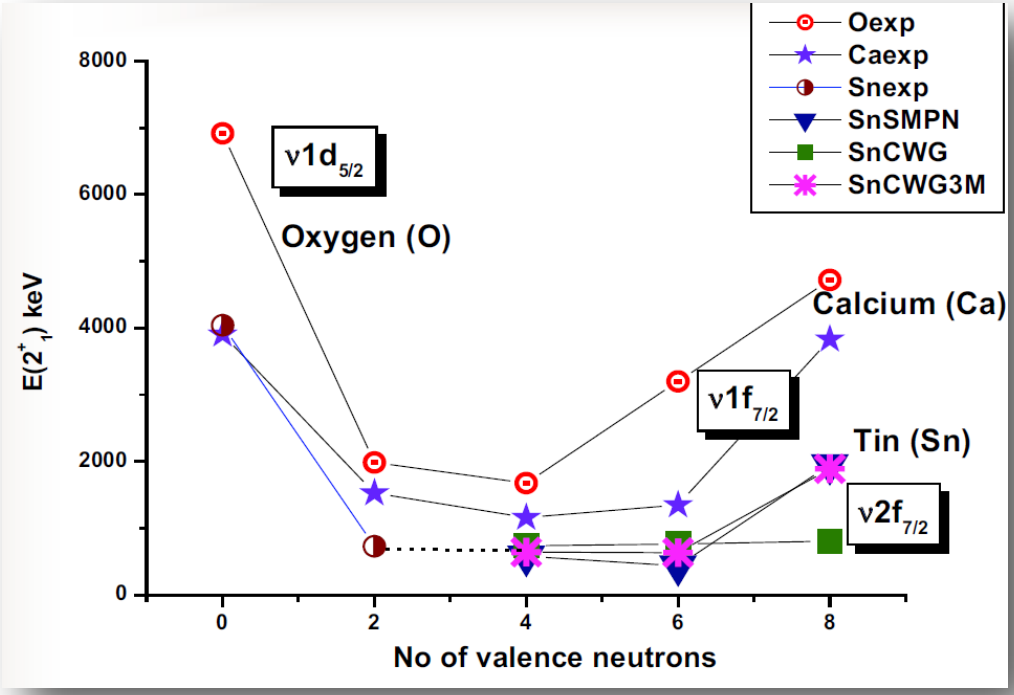


KU LEUVEN
NUCLEAR AND RADIATION PHYSICS

Beyond ^{132}Sn: a new magic number at N=90?

- ^{133}Sn well described by doubly-magic ^{132}Sn+n
- Beyond?
  Behaviour of $\nu f_{7/2}$ similar to that beyond ^{40}Ca
- Empirical or realistic interactions
  Role of n-n interaction and 3-body forces

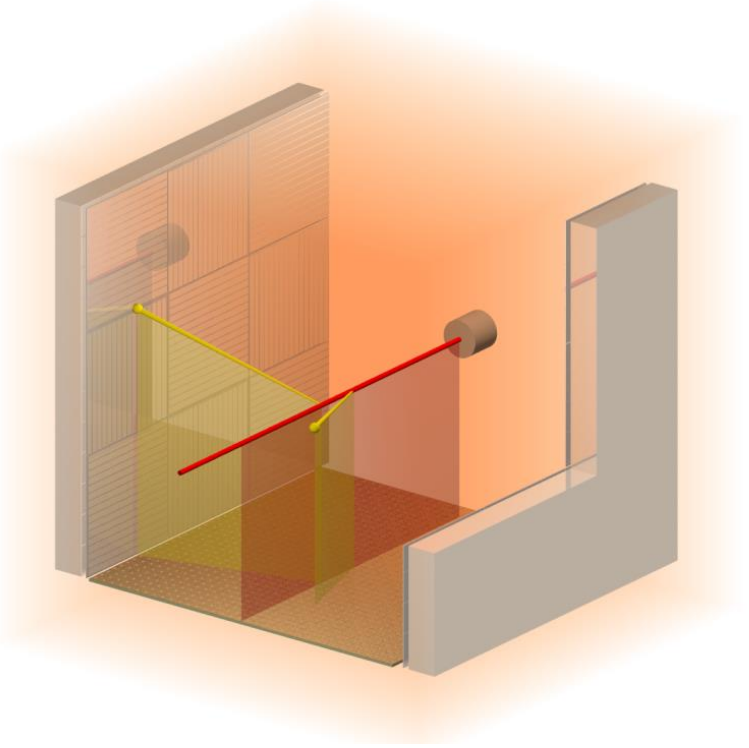
Sarkar and Saha Sarkar, JoP:CS 267 (2011) 012040



KU LEUVEN
NUCLEAR AND RADIATION PHYSICS

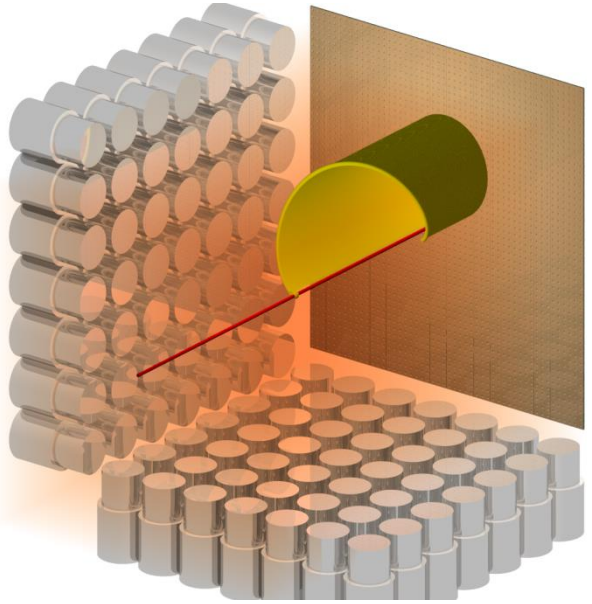
(d,p) and (p,p’) in an active target

- Large luminosity without loss in energy resolution
  → measurement feasible with weak intensities
- (d,p): protons at backward angles stopped in the gas or in auxiliary detectors
- (p,p’): protons in forward direction
- γ-ray detection possible



(d,p) and (p,p’) in an active target

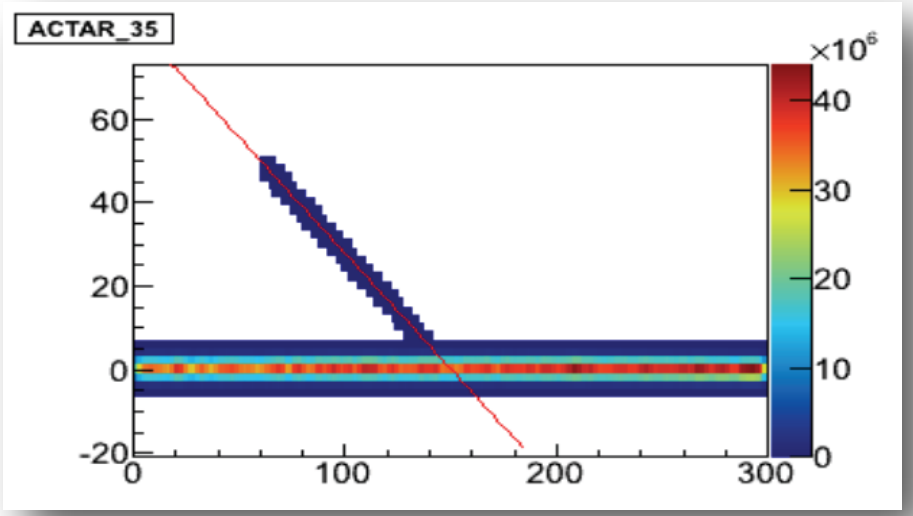
- Large luminosity without loss in energy resolution
  → measurement feasible with weak intensities
- (d,p): protons at backward angles stopped in the gas or in auxiliary detectors
- (p,p’): protons in forward direction
- γ-ray detection possible



Performances: ACTARsim

(D.Perez-Loureiro and G.F.Grinyer, 2013)

- GEANT4-based simulation with addition of drift and amplification

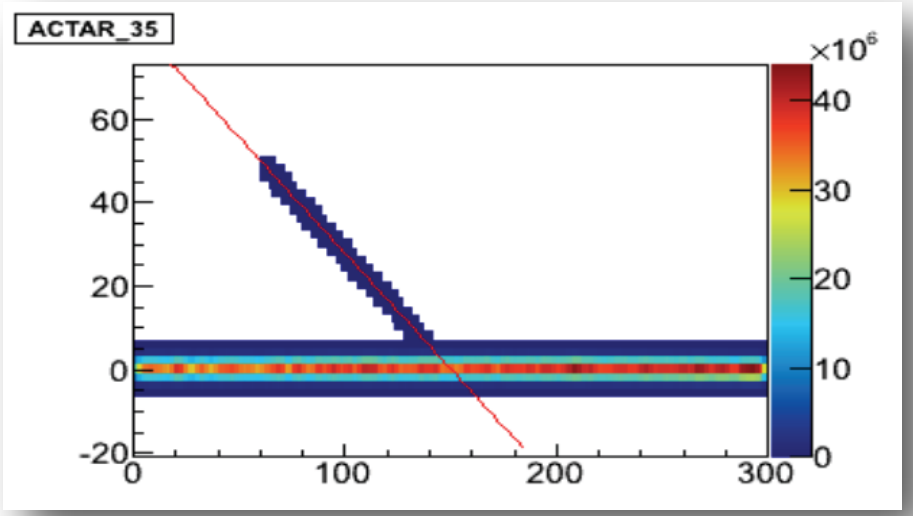


KU LEUVEN
NUCLEAR AND RADIATION PHYSICS

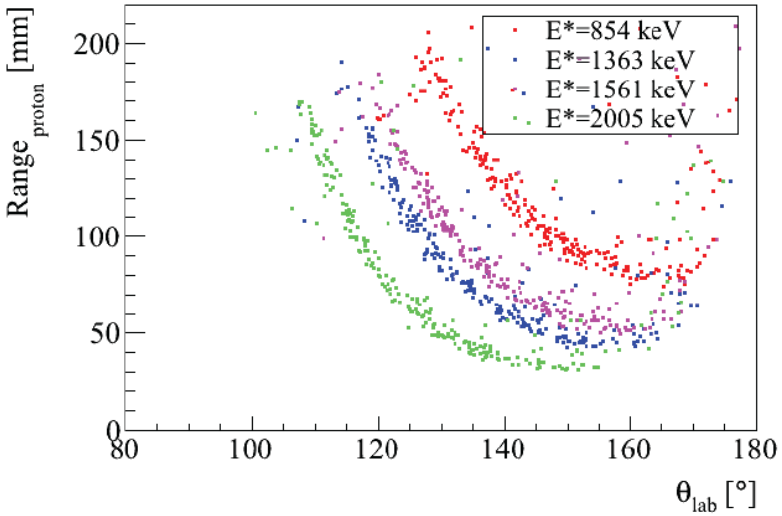
Performances: ACTARsim

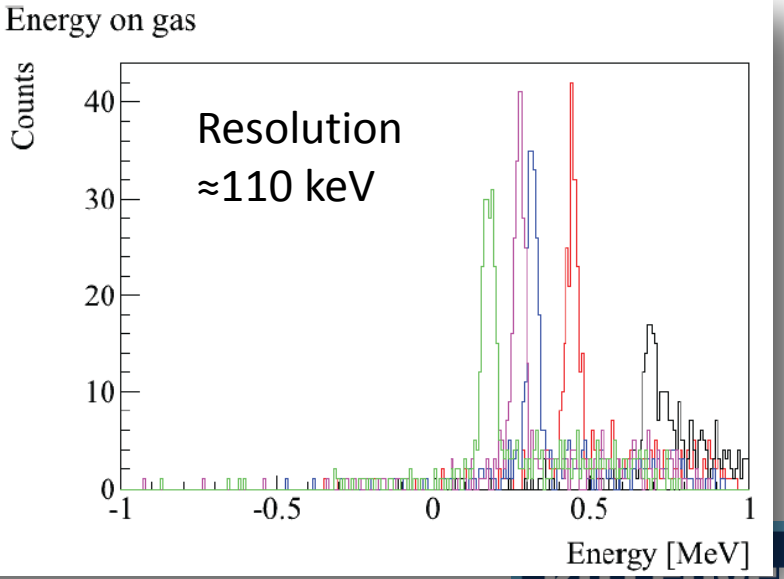
(D.Perez-Loureiro and G.F.Grinyer, 2013)

- GEANT4-based simulation with addition of drift and amplification



^{132}Sn(d,p): protons stopped in gas

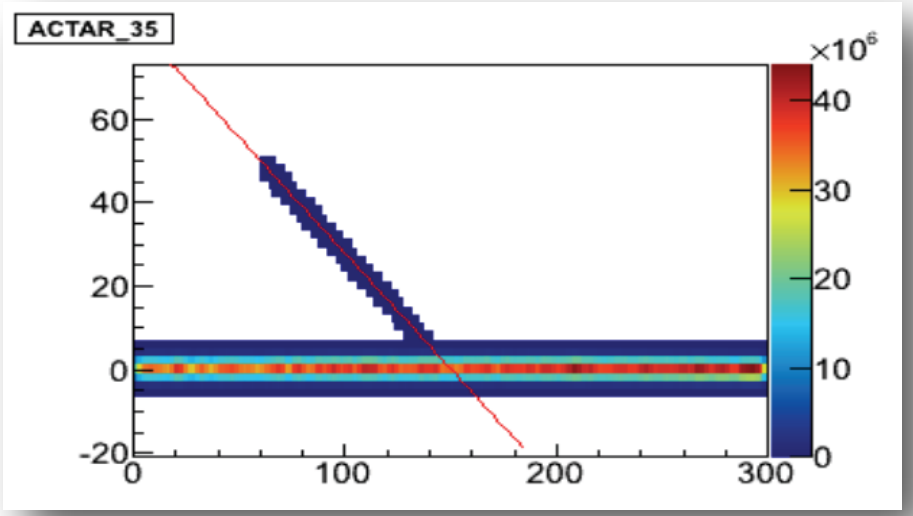




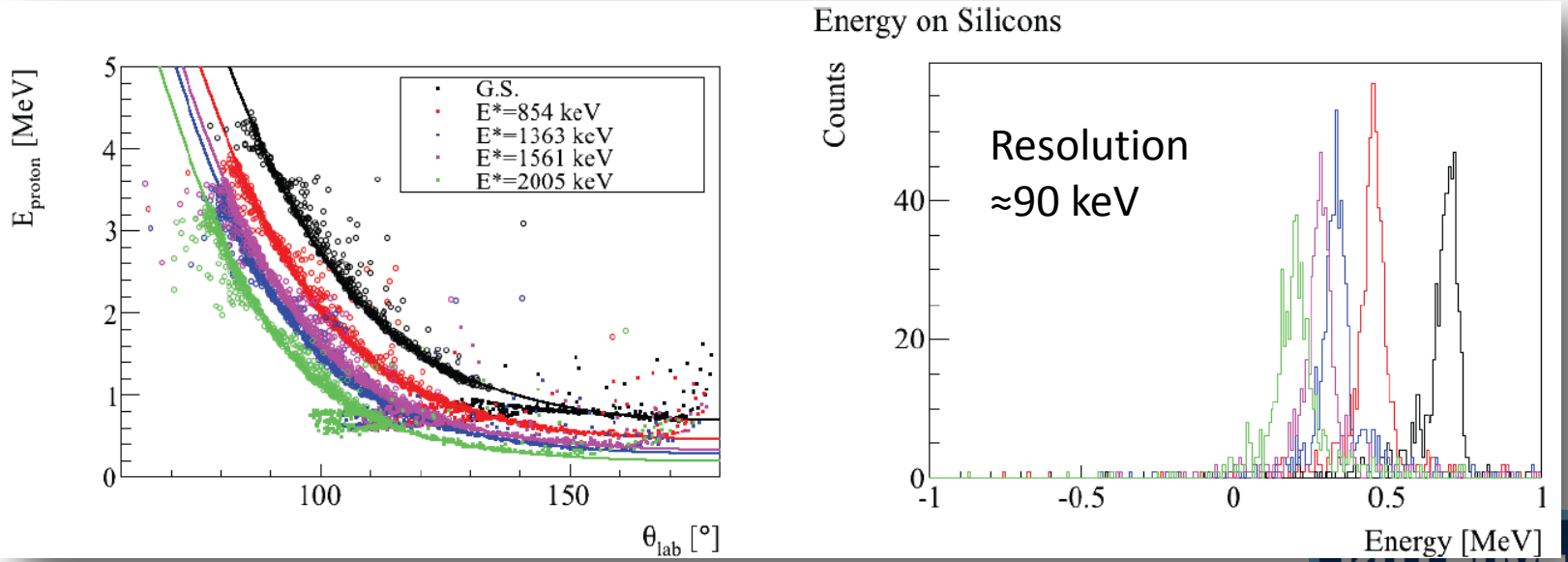
Performances: ACTARsim

(D.Perez-Loureiro and G.F.Grinyer, 2013)

- GEANT4-based simulation with addition of drift and amplification



^{132}Sn(d,p): protons stopped in Si

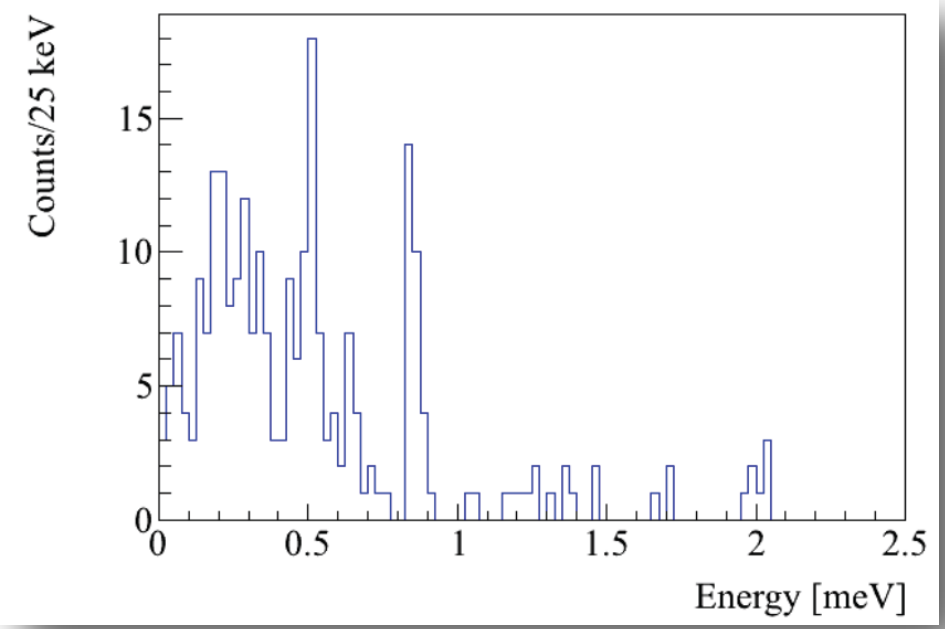


KU LEUVEN
NUCLEAR AND RADIATION PHYSICS

Performances: ACTARsim

(D.Perez-Loureiro and G.F.Grinyer, 2013)

- GEANT4-based simulation with addition of drift and amplification
- γ-rays in PARIS-like detectors from population of 854, 1363, 2005 keV states
- Statistics corresponding to 2 days of beam time at 10^3 pps (total cross section 10 mb, photopeak eff 17%)



KU LEUVEN
NUCLEAR AND RADIATION PHYSICS

Active Target at SPES

- Spectroscopy of exotic nuclei
  using the most exotic and weak beams
- Transfer and inelastic reactions possible
  with a few days beam time at 10^3 pps
- First measurements possible
  with proton intensity at 5 µA
- Beam purity: can be checked with in-beam detectors
  if necessary
- Well-established programme with strong local support

KU LEUVEN
NUCLEAR AND RADIATION PHYSICS