On the missing yield of in-beam radiative proton-capture cross section measurements relevant to the p process

A. Chalil¹, C. Ducoin¹, O.Stézowski¹, O. Litaize², N. Millard-Pinard¹, Y. Demane¹, T.J. Mertzimekis³

¹Université Claude-Bernard Lyon 1, CNRS/IN2P3, IP2I, Lyon, F-69622 Villeurbanne, France ²CEA, DES, IRESNE, DER, Cadarache F-13108 Saint-Paul-Lez-Durance, France ³Dept. Of Physics, National and Kapodistrian University of Athens, Zografou Campus, GR-15784, Athens, Greece

Introduction and Motivation

- are responsible for their



The FIFRELIN Code



e⁺e⁻

Continuous part









Fig.7 Experimental γ -spectrum of the reaction ¹¹²Cd(p, γ)¹¹³In and FIFRELIN spectrum normalized to the full yield peak $E_{Y} = 638$ keV.



Fig.8 Experimental cross sections of the reaction ${}^{112}Cd(p,\gamma){}^{113}In_{is}$ and **corrected** value for E_p = 3.4 MeV.

Discussion and Future Directions

Challenges of in-beam measurements:

- **Complex spectra** need to be analyzed (all gammas to ground/isomeric states)
- Yield below the detection limit can be **missed**
- (esp. at higher energies)
- Can lead to underestimation of the cross section

- Missing yield for in-beam measurements can be estimated using FIFRELIN
- A wide application of this correction could lead to more accurate cross sections
- Tests for other reactions and excitation energies

References

1. M. Arnould and S. Goriely, Phys. Rep. **384** 1 (2003) 2.A. Psaltis et al., Phys Rev. C, 99 065807 (2019) 3.O. Litaize et al., Eur. Phys. J. A **51**, 1 (2015) 4.H. Almazan et al., Eur. Phys. J. A55 183 (2019) 5.A. Chalil et al., Eur. Phys. J. 58 30 (2022)

Acknowledgments

The authors are grateful to the LABEX Lyon Institute of Origins (ANR-10-LABX-0066) Lyon for its financial support within the Plan France 2030 of the French government operated by the National Research Agency (ANR).