



# New experimental study of the ${}^3\text{He}(\alpha,\gamma){}^7\text{Be}$ reaction around the ${}^7\text{Be}$ known levels

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## Introduction

The  ${}^3\text{He}(\alpha,\gamma){}^7\text{Be}$  reaction is important in the production of  ${}^7\text{Li}$  during the Big Bang Nucleosynthesis and for neutrino production in the sun's core as a branching reaction in the solar fusion proton-proton chain.

## Activation method

Activation technique was used to determine the reaction cross section, utilising the Atomki MGC-20 cyclotron accelerator for the irradiations [1].

The produced  ${}^7\text{Be}$  activity was determined by counting the 477.6 keV  $\gamma$ -rays following its decay.

## Irradiation

- Beam particles: alpha
- Target:  ${}^3\text{He}$  gas with 99.999% purity
- A thin window gas cell with Al entrance and exit foils
- Length of gas cell:  $\sim 4$  cm
- Beam current:  $\sim 1 \mu\text{A}$
- Pressure:  $\sim 100$  mbar
- Temperature:  $\sim 23$  °C
- Typical irradiation length:  $\sim 20$  hours

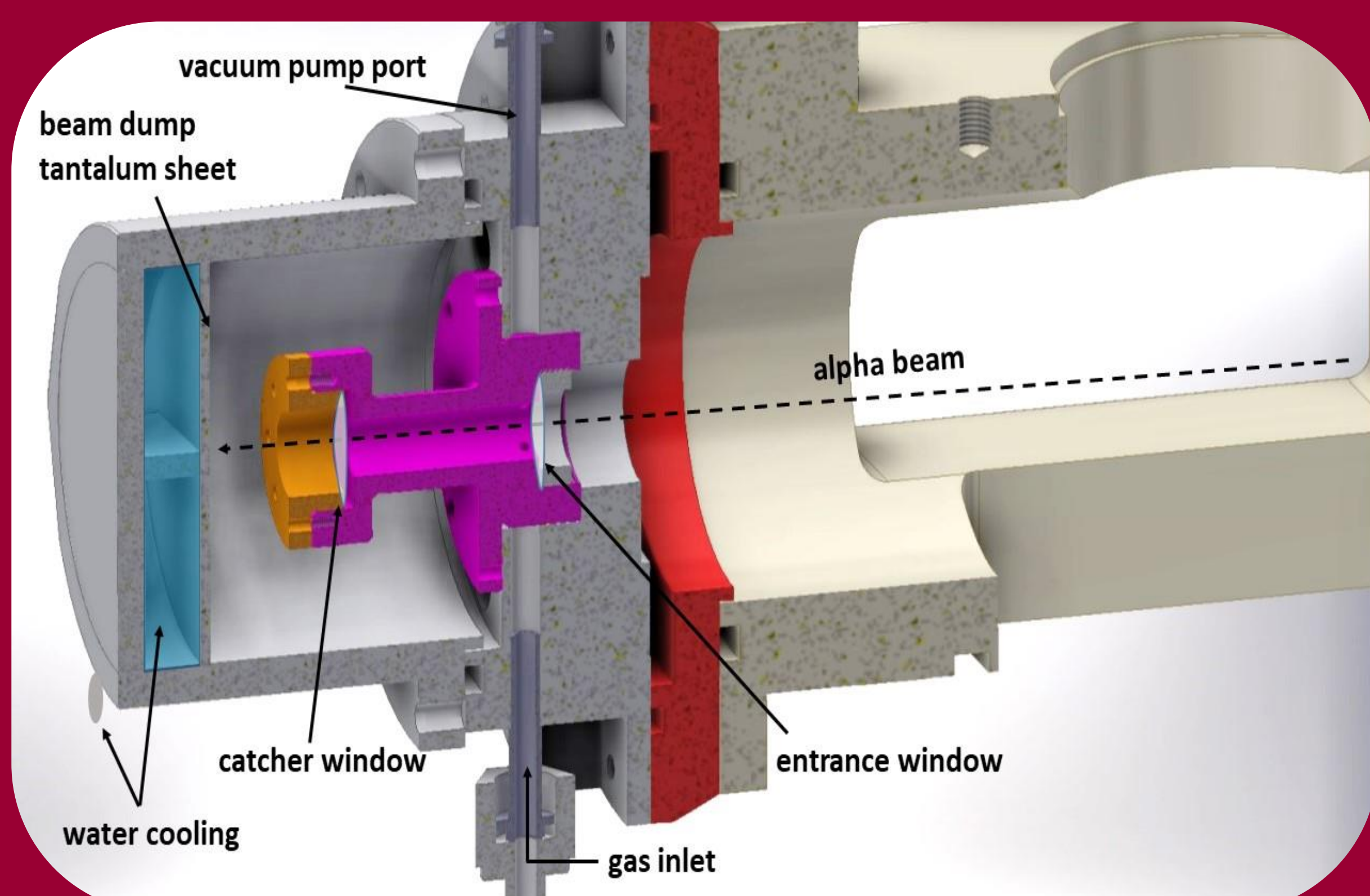


Figure 1.: A schematic view of the activation chamber with the gas-cell target.

## Gamma counting

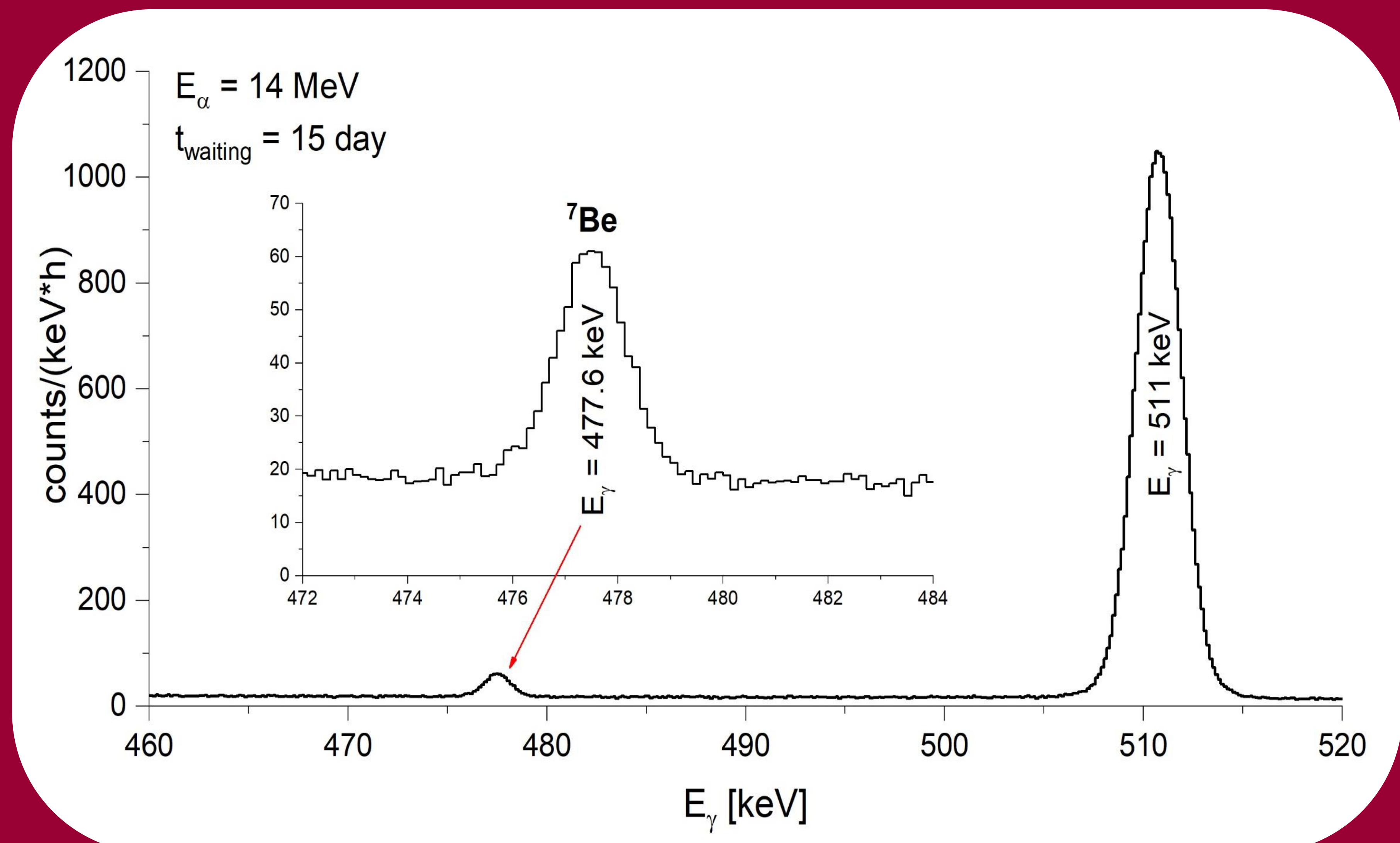


Figure 2.: Typical  $\gamma$ -ray spectrum of a catcher foil. The counting time varied between 5-22 days, with a HPGe detector.

## Experimental results

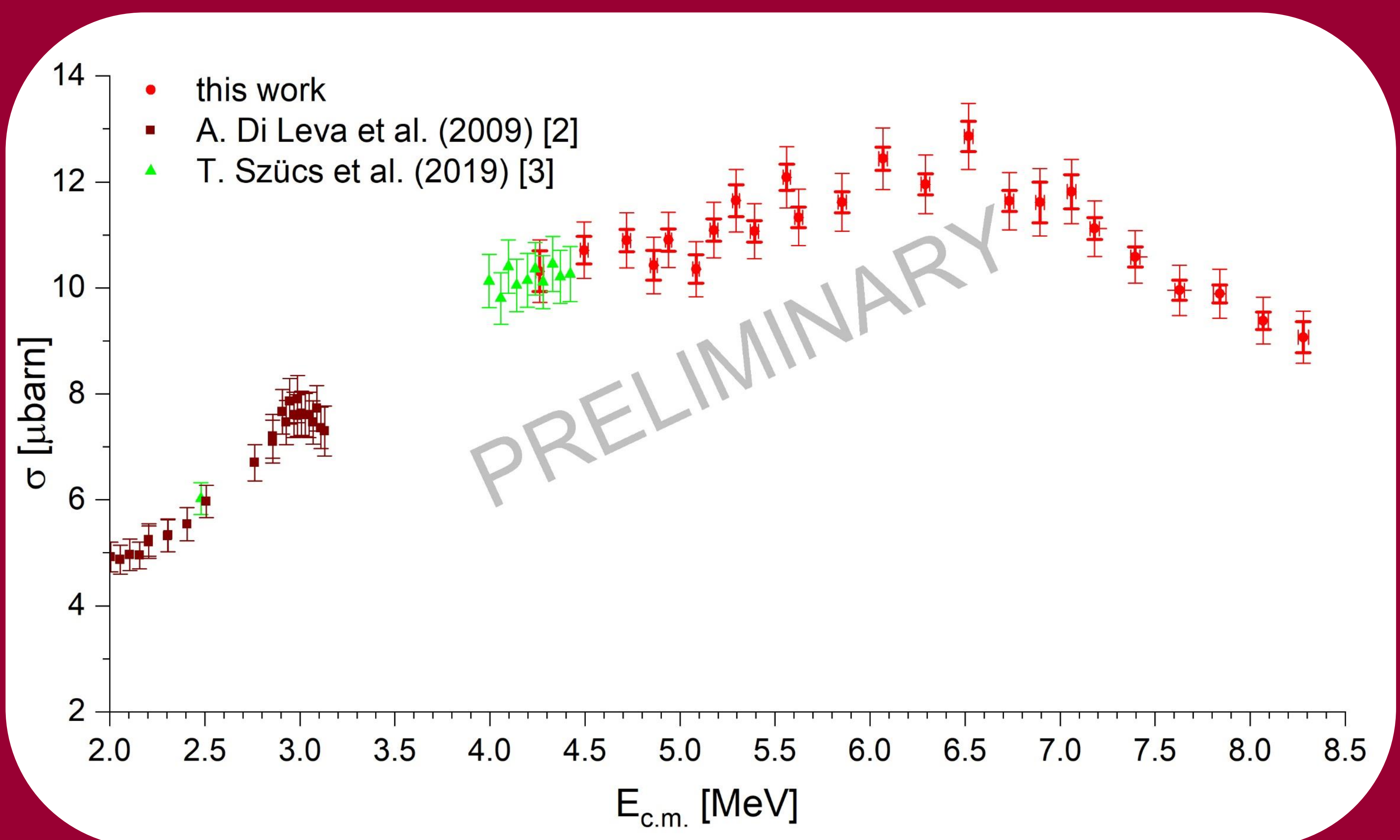


Figure 3.: High energy  ${}^3\text{He}(\alpha,\gamma){}^7\text{Be}$  cross sections together with the previous literature data. Statistical (bold) and total (faint) uncertainty are shown on the new dataset.

## References

- [1] S. Biri et al., Eur. Phys. J. Plus **136**, 247 (2021).
- [2] A. Di Leva et al., Phys. Rev. Lett. **102**, 232502 (2009), Erratum: **103**, 159903 (2009).
- [3] T. Szücs et al. Phys. Rev. C **99**, 055804 (2019), Erratum: **105**, 069901 (2022).