

Electron Capture of ${}^8\text{B}$ into highly excited states in ${}^8\text{Be}$

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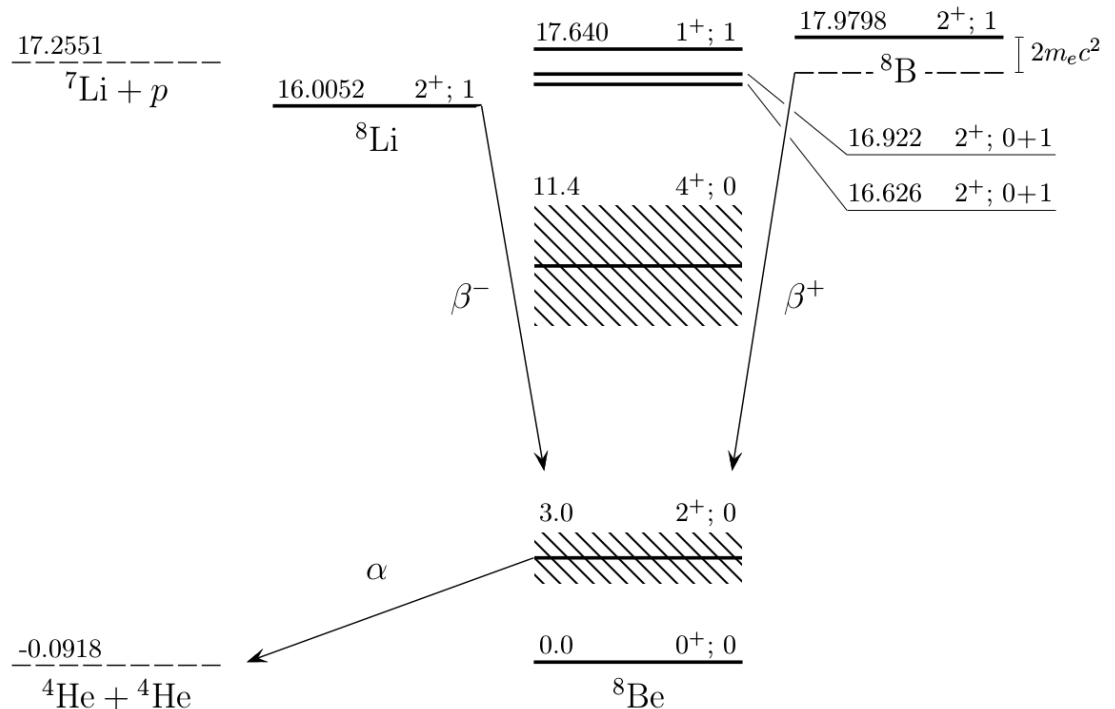
Introduction

Predominantly β^+ decay through 3.03 MeV state

However, most of the GT strength goes to the high-lying states

Decay through high-lying, isospin-mixed, 2^+ doublet also allowed

1^+ State at 17.64 MeV accessible only through EC

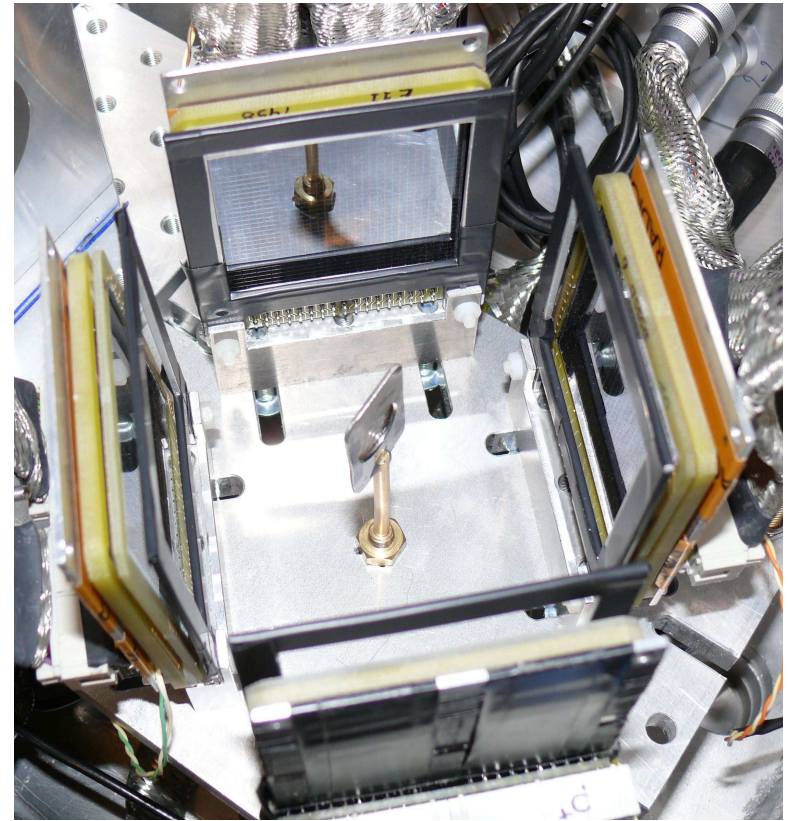


Previous measurement

Measurement at IGISOL in 2008 –
 $5.5 \cdot 10^7$ total implantations (200 /s)

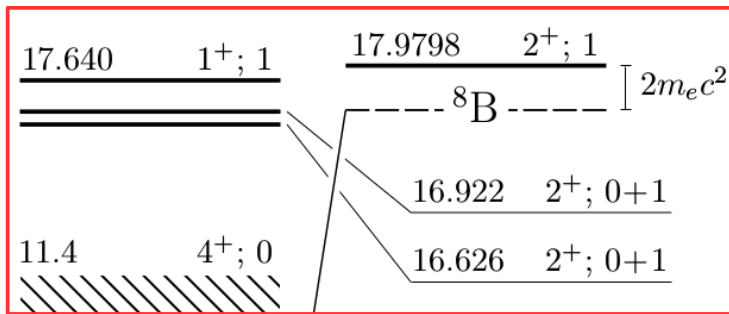
Primary goal – precision
measurement of α -particle emission to
constrain ${}^8\text{B}$ neutrino spectrum

Is there any evidence for populating
high-lying states in the data?



O. Kirsebom *et al.*, Phys. Rev.
C **83** (2011) 065802

The 2^+ doublet

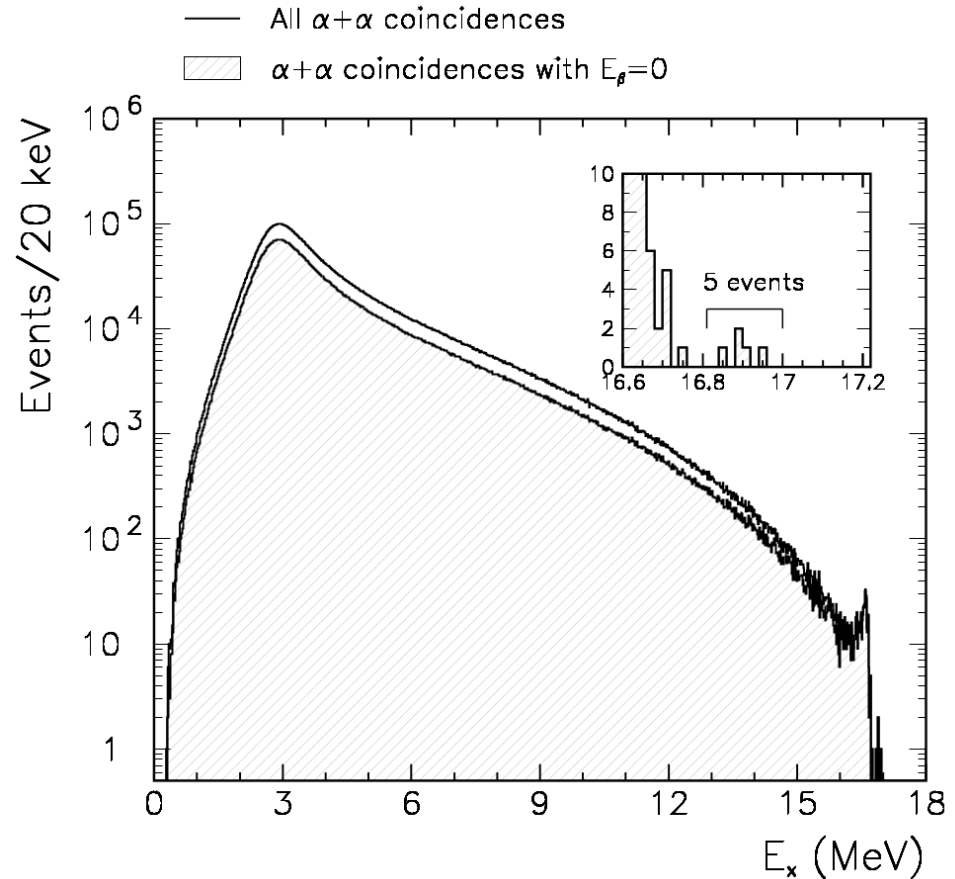


Expected ratio of decay rates

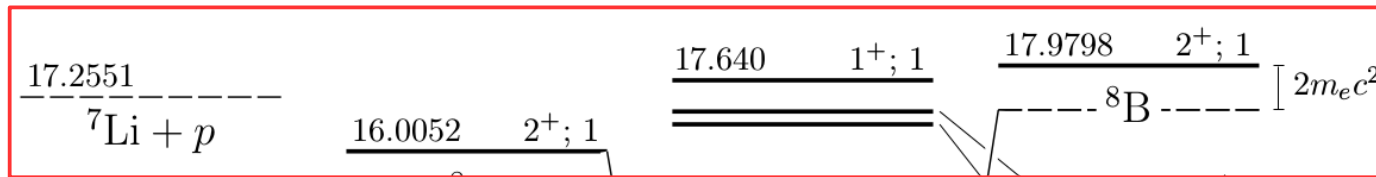
$$\frac{r_{16.9}}{r_{16.6}} = 2.4 \times 10^{-2}$$

Assumes zero GT strength to $T=1$ component

Consistent with the 5 events seen in the region of interest



β -delayed proton emission



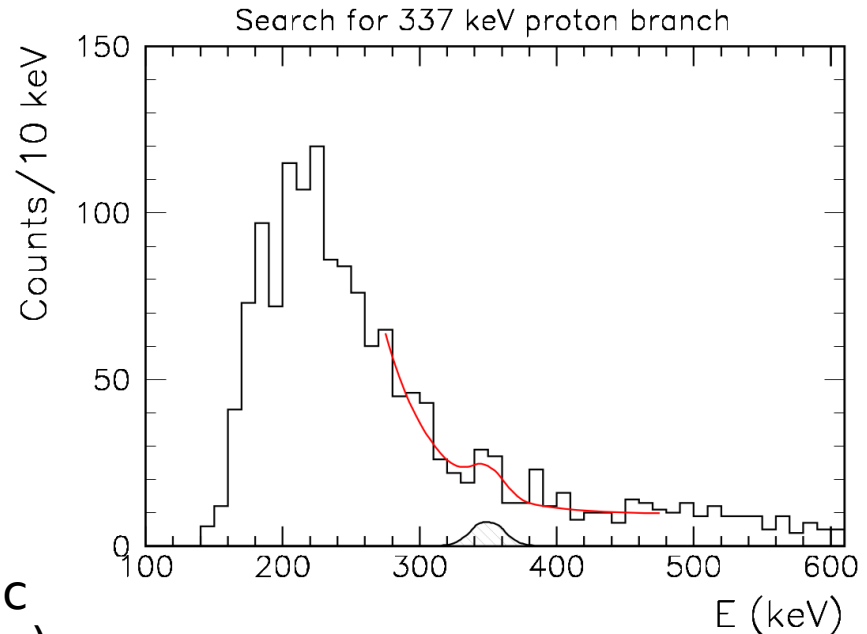
Look for evidence of 337-keV proton emission

Expected branching ratio is $2.3 \cdot 10^{-8}$ (0.3 decays expected)

Based on p spectator + 7Be core decay

Upper limit set at $1.3 \cdot 10^{-5}$

Background primarily from cosmic muons (observed in beam off runs)



Current situation

In both cases the ${}^8\text{B}$ yield is a limiting factor

${}^8\text{BF}_2$ yield of $2.8 \cdot 10^4 / \mu\text{C}$ now available – corresponds to $\sim 4.2 \cdot 10^4 / \text{s}$

Measurement of proton emission at the expected level will be challenging

C. Seiffert, contribution to the ISOLDE workshop 2015

Proposed approach

Expt. 1

Determine the doublet branching ratios
Improve sensitivity to low-energy proton branch

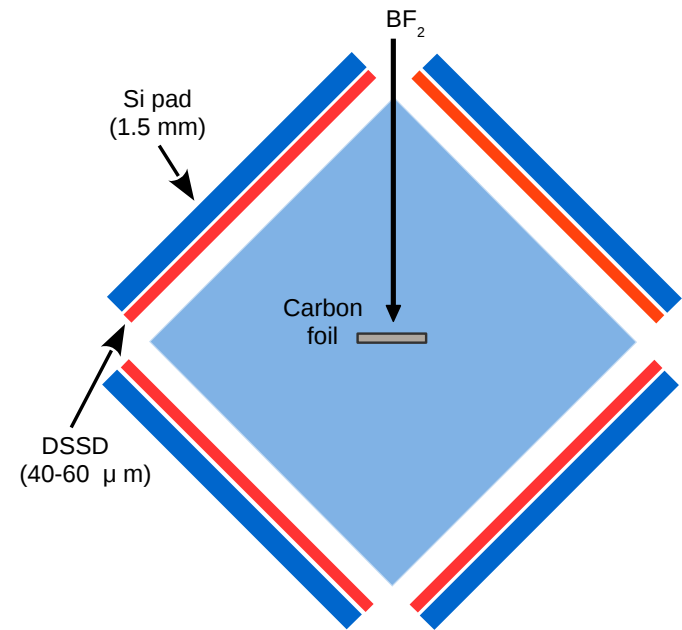
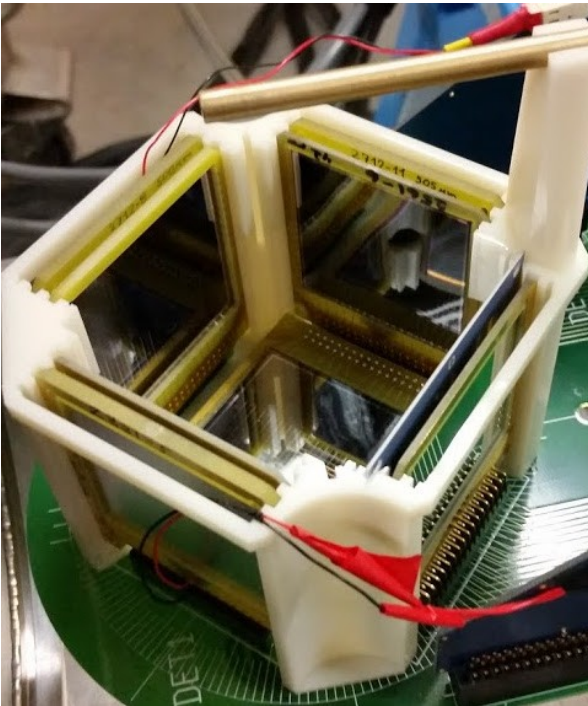
Assessment
of data



Expt. 2

Focus on measurement of proton emission
Experimental approach informed by data from expt. 1

Proposed setup (1)

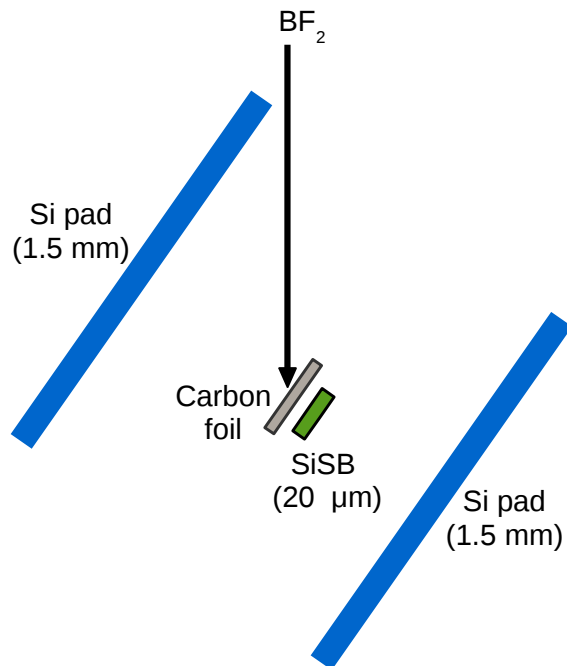


Unambiguous signal from decays to the doublet states from detection of both outgoing particles

In 6 shifts we expect a factor of 130 increase in statistics

Addition of thinner 40 μm DSSDs will increase sensitivity to low-energy proton branch

Proposed setup (2)



Focus on increasing sensitivity to low-energy proton branch

20- μm SiSB detector close to target, at least 10% coverage

Thick Si array surrounding for veto of coincident charge particles

In 9 shifts at least 25 counts at the predicted decay rate

Beam request

Estimates are based upon an implantation rate of $4.2 \cdot 10^4$ ions/s

6 shifts Measurement using DSSD + pad telescopes

Based on the IGISOL data we should observe ~ 500 decays through the 16.9-MeV member of the 2^+ doublet

Delay of ~ 1 month to assess data and setup

9 shifts Measurement using a thin SiSB detector

At the estimated branching ratio, at least 25 protons incident on the SiSB detector

Summary

^8B beam available at ISOLDE with yield sufficient for the study of high-lying weakly populated states in ^8Be

Experimental determination of the β -strength to the 2^+ doublet through measurement of the relative branching ratio

Halo structure of ^8B through ec-delayed proton emission (spectator plus core decay)

15 shifts requested in total, split into separate runs of 6 and 9 shifts

Thank you for your attention

