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Beam development and tests with developed detectors and electronics

Dissemination level: *PU*Issued by: **CSIC**Reference: **EURONS- D-J04-4**Status: *Final***Summary:**

At the IGISOL Jyväskylä facility a strong ^8B beam was developed for experiment of Astro Physical interest. The required ^8B activity was produced by bombarding a 1.9 mg/cm^2 LiF target with 14 MeV ^3He -beam from K-130 cyclotron. The activity was turned into a high quality ^8B beam by using IGISOL (Ion Guide Isotope Separator On-Line) technique. The developed beam could be used in an On-line experiment in January 2008. Profiting from our R&D, the new detectors and electronics was used in the setup, and we managed to extend the alpha spectrum further down in the energy.

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Integrated Infrastructure Initiative for European Nuclear Structure Research (EURONS)

Joint Research Activity JRA04: *Detection of Low Energy Particles from Exotic β -decays (DLEP)*

Task T-J04-4: Beam development and tests with developed detectors and electronics

1 Introduction

The solar-neutrino detectors Super-Kamiokande, SNO and ICARUS are primarily sensitive to neutrinos from ^8B decay. The neutrino spectrum from the Sun is now being measured with increasingly good statistics; it becomes thus possible to identify differences between the spectrum measured from the Sun and from laboratory measurements. There are several measurements on the subject in recent years [1, 2, 3] the latter two works give fully consistent results, but they disagree with the first one. Our collaboration has made a precision measurement of the energy spectrum of the alpha-particles emitted in the beta-decay of ^8B .

Before an actual run, the beam of ^8B was developed at JYFL (first ^8B beam at an ISOL facility). This work included target preparations, tests with different target materials, analysis of tests. This work was mainly performed by the IGISOL-group with the help of target laboratory at JYFL. In the week 28 September to 4 October 2007, the developed detectors and electronics (in particular the telescope array detector with monolithic detectors) to be used, was tested at ISOLDE in an experiment on the beta-decay of ^{11}Li [4].

The experiment on the beta-decay of ^8B could then finally be done in January 2008 at the IGISOL facility at the Accelerator laboratory of University of Jyväskylä. The required ^8B activity was produced by bombarding a 1.9 mg/cm^2 LiF target with 14 MeV ^3He -beam from K-130 cyclotron. The activity was turned into a high quality ^8B beam by using IGISOL (Ion Guide Isotope Separator On-Line) technique. The ^8B beam was implanted into a thin carbon foil situated in the middle of detection setup shown in Fig. 1. The setup consisted of a combination of the monolithic telescope with thin DSSSDs (Double Sided Silicon Strip Detector), backed with thick silicon pad detectors,

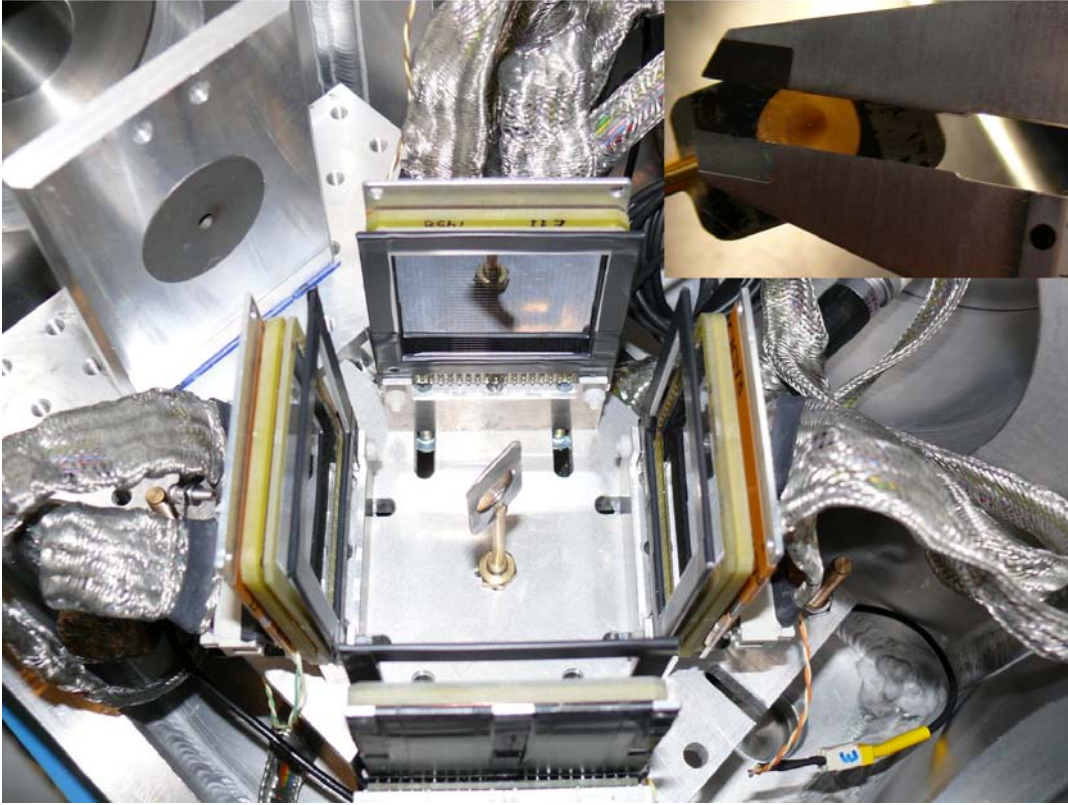


Figure 1. Detection setup used to measure decay of ^8B . Mass-separated beam of ^8B was implanted into the thin C-foil in the centre of detectors.

We managed to produce a very clean beam of ^8B with good intensity for the measurements. During the week over 10 million coincident alpha decay events following the beta-decay of ^8B were measured, improving existing statistics significantly. With the setup used, we managed to extend the alpha spectrum further down in the energy. Preliminary analysis shows that the shape of our spectrum agrees with the results e.g. in [3]. In a Bachelor of Science thesis work [5] at Chalmers/Göteborg University Johan Simu performed a theoretical calculation of the solar neutrino spectrum including neutrino oscillations.

The analysis of the experiment has so far been done by O. Kirsebom and A. Saastamoinen from JYFL under supervision of H. Fynbo and K. Riisager. O. Kirsebom and A. Saastamoinen has presented the preliminary results at three meetings (the JYFL users' workshop in March, the Nuclei in Cosmos conference in Michigan in July, the ENAM conference in Poland in September),

References:

- [1] C.E. Ortiz et al., Phys. Rev. Lett. 85 (2000) 2909
- [2] W.T. Winter et al., Phys. Rev. C73 (2006) 25503
- [3] M. Bhattacharya et al., Phys. Rev. C73 (2006) 55802
- [4] M. Madurga <http://www.targisol.csic.es/dlep/reportMMis41708.pdf>
- [5] J. Simu, Bachelor of Science thesis (2007), Göteborg University