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12Be in the Maya active target

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Experiment IS520 aimed at studying the ground state of the unbound system 13Be.

The determination of the sequence of its low-lying states can shed light on the evolution of the N = 8 shell closure towards the dripline.
While a resonance in 13Be at about 2 MeV above the neutron emission threshold is confirmed and identified as a d5/2 state, the situation regarding other lower-lying states is more controversial and there are indications of a disappearance of the N=8 shell closure.

13Be also provides important information for the modeling of the two-neutron halo nucleus 14Be. According to theoretical works [1], the d5/2 resonance would have to be lower than the observed 2 MeV in order to reproduce the two-neutron separation energy in 14Be.
The discrepancy can be solved by an inversion of the 2s1/2 and 1p1/2 orbitals or including excitations or deformations of the 12Be core in the models.

To study the ground state of 13Be, we populate its isobaric analog resonance in 13B through the resonant scattering of 12Be nuclei on protons.
Once the IAS is populated, isospin conservation allows decay (to the entrance channel) via emission of a proton that will be detected in our setup.

The 12Be beam (post-accelerated for the first time in REX) was sent into Maya, an active target, in which the detection gas isobutane contained the protons that were the target of the reaction.
Maya is a gaseous detector [2], providing three-dimensional reconstruction of the tracks of the charged particles traversing the gas volume. Identification of the particles is achieved via the specific energy loss, the total energy deposited and the length of the paths.
An array of Si and CsI detectors covers the wall opposite to the beam entrance, to detect forward-emitted light ions which are not stopped in the gas volume. The detector has been successfully used in a number of reaction experiments [3-6].

The particular timing characteristics of REX beam, combined with those of the gas detector, made the experiment particularly challenging.
Furthermore, an important problem was represented by the contamination of 12C4+ ions in the 12Be beam. Indeed, 12C was about 10ˆ4 times more intense than 12Be in our detector.
By modifying our detector we succeeded in eliminating the direct signals of the 12C beam, but 12C-induced events still represent the majority of events recorded in our data. 12Be-induced events will have to be carefully filtered out by applying coincidence conditions.

Preliminary results will be presented during the oral presentation.

References:

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