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# Test setup for registration of coincident signals from reactions with the emission of charged particles and neutrons on the RADEX channel

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The neutron beam of the RADEX channel of the INR RAS is used by us to study few-nucleon reactions caused by neutrons with an energy of $10 - 100$ MeV. The registration in the coincidence of neutrons and charged particles, their identification and energy determination are necessary for study such reactions. For the preliminary test measurements, the reaction $n + {}^6\mathrm{Li} \rightarrow \alpha + d + n$ with the registration of secondary alpha particles and neutrons was chosen.
The kinematic simulation according to the technique described in [1] showed that it's possible to register alpha particles and neutrons on opposite sides of the beam axis at angles of $\sim 90^\circ$ and $\sim 30^\circ$ respectively.
Test measurements can be considered successful if there are peaks in the energy spectrum of alpha particles corresponding to the breakup of the ground and excited states of the $^6$Li nucleus in coincidence with the neutron signal.
To test the possibility of registration in the coincidence of charged particles and neutrons a prototype of the setup was created (fig. 1). The setup prototype includes a small vacuum scattering chamber with an installed $^6Li_2CO_3$ target and an $\Delta E - E$ telescope of silicon. A neutron detector based on an organic scintillator makes it possible to distinguish signals from neutrons and gamma quanta by the pulse shape. To measure the neutron energy by time-of-flight the fast $\Delta E - E$ signals of the telescope are used as start impulse.
The setup was tested on the neutron beam of the RADEX channel. The obtained experimental data are currently being processed.
It's assumed that the use of the second arm for the registration of charged particles and a thin target will make it possible to significantly expand the program of investigated few-nucleon reactions on the neutron beam of the RADEX channel. It will also be possible to reconstruct the complete kinematics of such reactions with the separation of background and investigated reactions.

1. S.V. Zuyev, A.A. Kasparov and E.S. Konobeevski // Bull. Russ. Acad. Sci.: Phys. 2017. V.81. №6. P.679.

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