^{17}F breakup reactions: a touchstone for indirect measurements

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Dissociation has become an essential tool in several domains of nuclear physics. It provides useful information about the structure of halo nuclei [1], and Coulomb breakup can be used as an indirect method to measure radiative-capture cross sections at stellar energies [2]. Indeed, Coulomb breakup, simulated as the exchange of virtual photons between the projectile and the target, can be seen as its time-reversed reaction. The radiative-capture cross section can thus be obtained from the Coulomb-dissociation cross section via a detailed balance [2]. Though simple it may seem, this indirect technique relies on peculiar assumptions. Recent theoretical analyses of the Coulomb breakup of ^{8}B (e.g. [3]) have shown that these assumptions are not all satisfied. This may explain the discrepancy found between direct and indirect methods of measuring the cross section of the ^{7}Be(p,γ)^{8}B reaction. Whereas many experimental investigations on such a phenomenon have been conducted on ^{8}B, the case of ^{17}F has been poorly addressed up to now. Yet the Coulomb dissociation of ^{17}F is the ideal test case to study the accuracy of the indirect technique [2]. An exclusive study of ^{17}F breakup reactions has thus been performed at the FRIBs facility of the Laboratori Nazionali del Sud, Catania (Italy). This facility produces, since a few years, Radioactive Ion Beams (RIBs) at intermediate energies, by projectile fragmentation [4]. In order to discriminate the number of nuclei at the exit of the fragment separator, the leading idea of FRIBs is to apply the tagging technique: namely, the identification, on an event-by-event basis, of each nucleus of the secondary beam cocktail, before it impinges on the secondary target. A primary beam of 45 AMeV ^{20}Ne interacting with a ^{9}Be production target has lead to the formation of a radioactive cocktail containing ^{17}F of about 40AMeV. The experimental setup and the detector systems allowed the measurement, event-by- event, of the X-Y coordinates of the interaction point on the target as well as the momenta and angles of all outgoing decay particles in a solid angle of 0.34 str around zero degree with a geometrical efficiency of 72% and a resolution of approximately 300 keV. The first results and preliminary model comparison will be presented.

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