Coulomb dissociation of ^{16}O into ^{4}He and ^{12}C

Kathrin Göbel,[1] Michael Heil,[2] Aleksandra Kelić-Heil,[2] René Reifarth,[1]
Lukas Bott,[1] Christoph Caesar,[2] Bastian Löher,[2] Daniel Körper,[2]
Deniz Savran,[2] Haik Simon,[2] Hans Törnqvist,[3] and Stefan Typel[2]
(for the R^{3}B collaboration)

[1] *Goethe-Universität Frankfurt*

[2] *GSI Helmholtzzentrum für Schwerionenforschung GmbH, Darmstadt*

[3] *Technische Universität Darmstadt*

The fusion reaction of carbon and helium to oxygen is the key to understanding the evolution of stars and the relative abundances of both elements. The reaction rate of ^{12}C(α,γ)^{16}O has to be known with an uncertainty of lower than 10% at a center-of-mass energy of 300 keV during Helium burning conditions. So far, experiments have studied the reaction down to about 1 MeV.

We measured the Coulomb dissociation of ^{16}O into ^{4}He and ^{12}C at the R^{3}B setup in a first campaign within FAIR Phase-0 at GSI Helmholtzzentrum für Schwerionenforschung, Darmstadt. The goal is to improve the accuracy of the experimental data and to reach lower center-of-mass energies.

The experiment required beam intensities of 10^9 ^{16}O ions per second at an energy of 500 *A*MeV. The rare case of Coulomb breakup into ^{12}C and ^{4}He posed another challenge: we had to detect particles with the same magnetic rigidity as the primary beam, which are not separated by the super-conducting magnet GLAD. Radical changes of the R^{3}B setup were necessary: All detectors had slits to allow the passage of the unreacted ^{16}O ions, while ^{4}He and ^{12}C would hit the detectors' active areas. We developed and built detectors based on organic scintillators to track and identify the reaction products with sufficient precision.

The talk reviews the setup and the beamtime, and gives the current status of analysis.