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Measurements of proton –induced reactions on ruthenium-96 in the ESR at GSI

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Storage rings offer the possibility of measuring proton- and alpha-induced reactions in inverse kinematics. The combination of his approach with a radioactive beam facility allows, in principle, the determination of the respective cross sections for radioactive isotopes. Such data are highly desired for a better understanding of astrophysical nucleosynthesis processes like the p process.
A pioneering experiment has been performed at the Experimental Storage Ring (ESR) at GSI using a stable 96Ru beam at 9-11 AMeV and a hydrogen target. Stored and cooled bare ions may pick up a proton in the ESR whenever they cross the hydrogen jet. The products of the 96Ru(p,γ) reaction were detected by two Double Sided Silicon Strip Detectors (DSSSD) mounted in a pocket on the inside of the ESR. Each detector had 16 strips in X- and Y- direction. The efficiency for (p,γ) events was close to 100%. As the experiment was performed at energies of 9-11 AMeV, competing (p,n) and (p,α) reactions occured too and could not be neglected. These events have to be discriminated from the desired proton capture reactions based on the position on the DSSSD. An additional background component is elastic scattering of ruthenium ions on protons. A Multi-Wire Proportional counter (MWPC) allowed the detection of electron-pick-up reaction, hence a determination of the luminosity based on this well known reaction.
Monte-Carlo simulations of the experiment were made using the Geant4 code. In these simulations, the experimental setup is described in detail and all reaction channels can be investigated. Based on the Geant4 simulations, a prediction of the shape of different spectral components can be performed. A comparison of simulated predictions with the experimental results shows a good agreement and allows the extraction of the cross section.

Primary author: Ms RASTREPINA, Ganna (GSI Helmholtzzentrum für Schwerionenforschung GmbH)

Co-authors: Dr KELIC, Aleksandra (GSI Helmholtzzentrum für Schwerionenforschung GmbH, Darmstadt, 64291, Germany); Dr FRANZKE, Bernhard (GSI Helmholtzzentrum für Schwerionenforschung GmbH, Darmstadt, 64291, Germany); RIESE, Björn (GSI Helmholtzzentrum für Schwerionenforschung GmbH, Darmstadt, 64291, Germany); Dr RIGOLLET, C (Kernfysisch Versneller Instituut , Netherlands); Dr BRANDAU, Carsten (GSI Helmholtzzentrum für Schwerionenforschung GmbH, Darmstadt, 64291, Germany); LANGER, Christoph (GSI Helmholtzzentrum für Schwerionenforschung GmbH, Darmstadt, 64291, Germany); Prof. SCHEIDENBERGER, Christoph (GSI Helmholtzzentrum für Schwerionenforschung GmbH, Darmstadt, 64291, Germany); Dr KOZHUHAROV, Christophor (GSI Helmholtzzentrum für Schwerionenforschung GmbH, Darmstadt, 64291, Germany); Dr WINTERS, Danyal (GSI Helmholtzzentrum für Schwerionenforschung GmbH, Darmstadt, 64291, Germany); KÄPPELER, Franz (Forschungszentrum Karlsruhe, Institut für Kernphysik, Karlsruhe, Germany); Prof. BOSCH, Fritz (GSI Helmholtzzentrum für Schwerionenforschung GmbH, Darmstadt, 64291, Germany); Dr NOLDEN, Fritz (GSI Helmholtzzentrum für Schwerionenforschung GmbH, Darmstadt, 64291, Germany); Dr LOTAY, Gavin (University of Edinburgh, Edinburgh, UK); Prof. MÜNZENBERG, Gottfried (GSI Helmholtzzentrum für Schwerionenforschung GmbH, Darmstadt, 64291, Germany); Dr GYÜRKY, György (Institute of Nuclear Research of the Hungarian Academy of Sciences, Hungary); Dr WEBER, Günter (GSI Helmholtzzentrum für Schwerionenforschung GmbH, Darmstadt, 64291, Germany); GIESSEL, H (GSI Helmholtzzentrum für Schwerionenforschung GmbH, Darmstadt, 64291, Germany); Dr

SIMON, Haik (GSI Helmholtzzentrum für Schwerionenforschung GmbH, Darmstadt, 64291, Germany); Dr BRÄUNING, Harald (GSI Helmholtzzentrum für Schwerionenforschung GmbH, Darmstadt, 64291, Germany); Dr WEICK, Helmut (GSI Helmholtzzentrum für Schwerionenforschung GmbH, Darmstadt, 64291, Germany); DILLMANN, Iris (Technische Universität München, 85748 Garching, Germany); Dr MARGANIEC, Justyna (GSI Helmholtzzentrum für Schwerionenforschung GmbH, Darmstadt, 64291, Germany); BECKERT, K (GSI Helmholtzzentrum für Schwerionenforschung GmbH, Darmstadt, 64291, Germany); Dr SONNABEND, Kerstin (GSI Helmholtzzentrum für Schwerionenforschung GmbH, Darmstadt, 64291, Germany); Prof. BLAUM, Klaus (Max-Planck-Institut für Kernphysik, 69117 Heidelberg, Germany); Dr SÜMMERER, Klaus (GSI Helmholtzzentrum für Schwerionenforschung GmbH, Darmstadt, 64291, Germany); Dr BORETZKY, Konstanze (GSI Helmholtzzentrum für Schwerionenforschung GmbH, Darmstadt, 64291, Germany); Dr STECK, Markus (GSI Helmholtzzentrum für Schwerionenforschung GmbH, Darmstadt, 64291, Germany); Dr HEIL, Michael (GSI Helmholtzzentrum für Schwerionenforschung GmbH, Darmstadt, 64291, Germany); WINTERS, Natalya (GSI Helmholtzzentrum für Schwerionenforschung GmbH, Darmstadt, 64291, Germany); PETRIDIS, Nikos (J.W. Goethe Universität, Frankfurt am Main, 60438, Germany); ERSHOVA, Olga (GSI Helmholtzzentrum für Schwerionenforschung GmbH, Darmstadt, 64291, Germany); BELLER, P (GSI Helmholtzzentrum für Schwerionenforschung GmbH, Darmstadt, 64291, Germany); Prof. WOODS, Philip (University of Edinburgh, Edinburgh, UK); ZHONG, Qiping (China Institute of Atomic Energy (CIAE) 102413 Beijing China); Dr PLAG, Ralf (GSI Helmholtzzentrum für Schwerionenforschung GmbH, Darmstadt, 64291, Germany); Prof. REIFARTH, Rene (J.W. Goethe Universität, Frankfurt am Main, 60438, Germany); Prof. BISHOP, Shawn (Technische Universität München, 85748 Garching, Germany); SZÜCS, Tamás (Institute of Nuclear Research of the Hungarian Academy of Sciences, Hungary); Prof. AUMANN, Thomas (GSI Helmholtzzentrum für Schwerionenforschung GmbH, Darmstadt, 64291, Germany); Prof. STÖHLKER, Thomas (GSI Helmholtzzentrum für Schwerionenforschung GmbH, Darmstadt, 64291, Germany); Dr DAVINSON, Tom (University of Edinburgh, Edinburgh, UK); LE BLEIS, Tudi (GSI Helmholtzzentrum für Schwerionenforschung GmbH, Darmstadt, 64291, Germany); POPP, Ulrich (GSI Helmholtzzentrum für Schwerionenforschung GmbH, Darmstadt, 64291, Germany); Dr LITVINOV, Yury (GSI Helmholtzzentrum für Schwerionenforschung GmbH, Darmstadt, 64291, Germany); Dr FÜLÖP, Zsolt (Institute of Nuclear Research of the Hungarian Academy of Sciences, Hungary)

Presenter: Ms RASTREPINA, Ganna (GSI Helmholtzzentrum für Schwerionenforschung GmbH)

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