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## Reactor Physics Studies for the APCI RACE Project: Reactor-Accelerator Coupling Experiments Project: Quarterly Progress Report September-December 2004

Denis Beller  
*University of Nevada, Las Vegas*

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# Reactor Physics Studies for the AFCI RACE Project (Reactor-Accelerator Coupling Experiments Project)

## Quarterly Progress Report September-December 2004

UNLV Transmutation Research Project Task 27  
Principle Investigator: Denis Beller, Ph.D.

### Purpose and Problem Statement

In the RACE Project of the U.S. Advanced Fuel Cycle Initiative (AFCI), a series of accelerator-driven subcritical systems (ADSS) experiments will be conducted at the Idaho State University's Idaho Accelerator Center (ISU-IAC), at the University of Texas (UT) at Austin, and at the Texas A&M University. In these experiments we will use electron accelerators to induce bremsstrahlung photon-neutron reactions in heavy-metal targets; this source of about  $10^{12}$  to  $10^{13}$  n/s will then initiate fission reactions in the subcritical systems. These systems will include a compact, transportable assembly at ISU and TRIGA reactors at UT-Austin and Texas A&M. These experiments will provide a variety of cores, fuel types and enrichments, and target/reactor configurations for many separate accelerator coupling studies. The UNLV portion of this project will be a three-year, three-phase project employing a principal investigator (as well as the UNLV TRP RACE Project Director), a graduate student, and an undergraduate student to support computational and experimental research at the ISU and the Texas universities, to integrate the UNLV Transmutation Research Project with this accelerator-driven transmutation research, and to further develop UNLV's computational infrastructure for reactor physics research.

### Personnel

**Principle Investigator:** Research Prof. Denis Beller, Department of Mechanical Engineering, UNLV.

**Students:** Mr. Evgeny Stankovskiy, graduate student (Ph.D.), Department of Mechanical Engineering, came to UNLV from the Institute of Nuclear Power Engineering in Obninsk, Russia, to pursue a Ph.D. degree. He will design, conduct, and analyze an accelerator-driven subcritical experiment at UT-Austin or Texas A&M University. Mr. Timothy Beller, undergraduate student, Department of Mechanical Engineering, performed MCNPX calculations in support of experiments at the Idaho Accelerator Center.

**UNLV Graduate Student Thesis Advisor:** Prof. Robert Boehm, Department of Mechanical Engineering, UNLV.

**National Laboratory Collaborators:** Dr. George Imel, Idaho National Laboratory (director of experiments in the MUSE and TRADE programs in Europe)

**DOE Collaborators:** Dr. Thomas Ward, TechSource, Inc. (UNLV Russian Collaboration Science Adviser)

- The Radiation Safety Information Computational Center (RSICC) at Oak Ridge National Laboratory granted Evgeny Stankovskiy access to a set of export-controlled codes and databases for reactor physics studies.
- Modeling with MCNPX was initiated in support of subcritical experiments at the Idaho Accelerator Center. Electron beam/target interactions were studied for maximizing and characterizing photoneutron production from accelerated neutrons.
- We began collaborations with Texas RACE Project participants to develop a plan to conduct an accelerator-driven subcritical experiment at UT-Austin or Texas A&M University. The Texas Principle Investigators and grad students visited UNLV in December.
- In his role as national RACE Project Director, the PI visited Idaho State University several times, attended the Eighth Information Exchange Meeting on Actinide and Fission Product Partitioning & Transmutation, Nov. 9-11 in Las Vegas, Nevada, and attended the Winter Meeting of the American Nuclear Society, Nov. 14-17, 2004 in Washington, DC to coordinate national RACE Project activities. Students Evgeny Stankovskiy and Timothy Beller also attended the meeting in Las Vegas.