PAUL SCHERRER INSTITUT

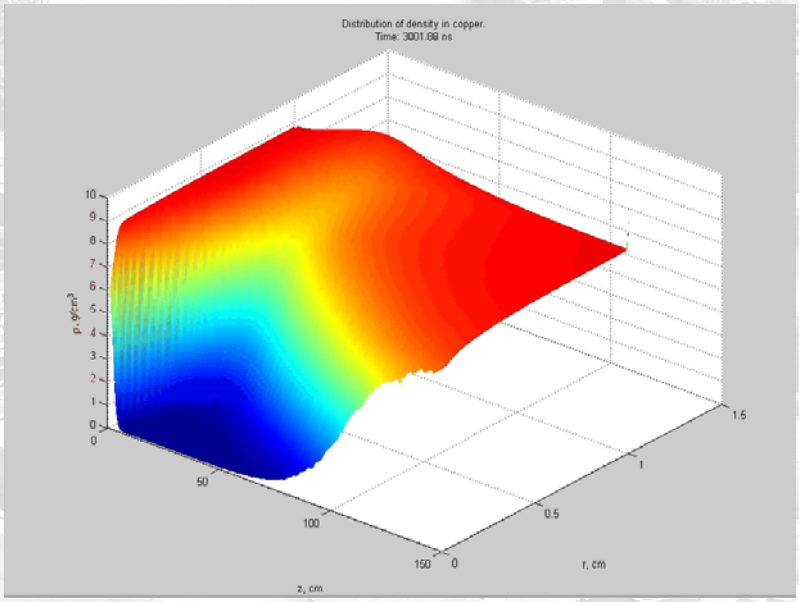
PSI

GFA and SwissFEL Accelerator Seminar

Investigations of radiation resistance of fission and fusion structural materials in RRC KI using charged particle accelerators

Monday, 15 March 2010, 16.00 h, WBGB/019

Prof. Alexander Ryazanov
Russian Research Centre “Kurchatov Institute” (RRC KI), Moscow, Russia



Impact of the LHC beam on a collimator: Numerical modeling of a material density distribution involving shock wave formation in a copper collimator at LHC. The 7 TeV proton beam penetrates along the *z* direction (from 0 to 150 cm). The shown distribution corresponds to an irradiation time of t = 3000 ns.

Radiation resistance of fission and fusion structural materials is characterized by such physical phenomena as radiation swelling and creep, radiation hardening, helium and hydrogen embrittlement. All these physical phenomena depend on microstructure changes in irradiated structural materials, which are determined by the generation rate of point defects, cascade efficiency, irradiation temperature and dose dependence. All these values can be obtained and reproduced at different temperatures using accelerators of charged particles. Experimental tests in atomic reactors are very expensive and time consuming. The irradiation of these materials by fast charged particles with accelerators allow to obtain representive experimental data concerning radiation resistance of structural materials in a short time as compared to reactor based methods and without high activation levels on irradiated samples. Each physical phenomenon can be studied at fixed temperatures and varying irradiation doses. A review of experimental methods and results concerning radiation swelling and creep, helium embrittlement phenomena obtained on accelerators of RRC KI for different types of structural materials for fission and fusion reactors, including modern theoretical models will be presented. New experimental methods and results for the analysis of micro-structure changes in irradiated materials including X-ray methods using synchrotron light sources and transmission electron microscopy will be discussed as well.

Contact: Mike Seidel (3378)