The project concerns the mixed ionizing radiation – which consists of ionizing particles of different type and energy i.e. different biological effectiveness. For estimation of the exposure to ionizing radiation it is important to determine both absorbed dose and radiation quality factor which is dependent on ionization density along the ionizing particle tracks. Around the world there is a number of detectors, which can be applied for mentioned factor measurements. One of them was detector developed in Poland – known as recombination chamber i.e. specially constructed pressurized ionization chamber. The chamber is polarized by relative low voltage, so a part of ions generated inside recombine. It was proved that there is a correlation between so called recombination index of radiation quality, RIQ, measured with recombination chambers, and relative biological effectiveness.

Within the project both measurement experiments and computational experiments will be realized. The first ones will be carried out in well characterized isotopic neutron sources and/or in neutron collimated beams. The second ones will base on numerical Monte Carlo codes. The common field for both types of experiment and the object of analysis are the classical recombination theories whose authors were George C. Jaffé (columnar recombination, 1913), then Douglas E. Lea (recombination within the groups on ions, 1933) and universal theory developed by A.H. Sullivan (local recombination, 1969).

Recombination chambers were mainly used in radiation protection, and their wider application requires the development of theory being the basis of the method. The purpose of the project is to prepare the numerical models of recombination chambers and to perform the calculations of neutron interaction traversing the chamber after passing through the layers of moderating material of different thicknesses. Measurements will be carried out simultaneously. It allows to verify the theoretical relationships which were used so far, and also improves the accuracy of recombination methods. The collected data concerning the distribution of ionization density and implemented for these calculations codes, will be available for other research groups for studies on influence of radiation on live cells and for new detectors designing.