In recent years, major development of X-ray detectors took place. Detectors are made using new materials and it’s construction is more sophisticated, also their spatial resolution was significantly improved. Therefore, detailed understanding of instrumental effects, namely: incomplete charge collection, simultaneous photon registration in two adjacent pixels, mutual illumination, plays crucial role. These processes intensify on borders between pixels and may be a source of misinterpretation of recorded spectra.

X-ray spectra and spatial observations of the solar flares allow to diagnose the properties of the magnetic field and the hot plasma in the solar atmosphere. Flares are generated by magnetic reconnection that produces sudden release of energy stored in the magnetic field configuration and gives rice to violent particle acceleration. The most interesting region of the solar x-ray spectra is the energy range from 4 to 150 keV. In this range thermal radiation from hot plasma (5-30 MK) is observed. Moreover, during impulsive phase of solar flares, electrons are accelerated due to magnetic reconnection and they emit bremsstrahlung radiation during deceleration in denser layers of solar atmosphere. Therefore detailed observations in this energy rage can be critical to understand the physical process in the solar flares. Previously mentioned instrumental effects deform measured spectrum and may generate significant errors in estimated parameters of thermal and no-thermal components. Numerical simulations of instrumental effects may help to minimize their influence on the scientific data interpretation.

We will perform numerical simulations of detector response to X-ray illumination with known energy spectrum. Photon spectra, reconstructed using RHESSI data, will be used as input to Geant4. This software uses the MonteCarlo method to simulate interaction between particles and matter, and  thus it provides information about photon absorption in the detector's crystal. Next step will be simulation of movement of charges generated by absorbed photon. As the result we will obtain counts spectrum. Finally, obtained count spectrum will be multiplied by the Detector Response Matrix in order to reproduce photon spectrum that may be compared to the original input spectrum. Therefore, we will be able to analyze differences caused by instrumental effects. Physical parameters obtained from input and resultant photon spectra will help to estimate how important are instrumental effects for interpretation of observational data.

Planned activities will help to understand detector effects in a case of CdTe crystals (such detectors will be used e.g. during planned ESA mission Solar Orbiter) which are still not well understood especially in a case of space experiments. In such experiments, when we have limited information about detector condition and the experiment may last several years, it seems to be crucial. Developed tools that are capable to simulate physical processes taking place in CdTe detector will help to minimize observational data misinterpretation. Therefore, this proposal will contribute to a better understanding of physical processes in solar flares.