Title: Prototype of detector for detection of reactor's antineutrinos

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Abstract: This master thesis is related to the development of the complex detector of reactor's antineutrinos, so called S^3, which is based on the polystyrene scintillation detectors. The detector S^3 (dimensions 40 x 40 x 40 cm^3) will be located in the close vicinity of a nuclear reactor (5-12 m) and its purpose will be to measure reactor's power, isotopic composition of the nuclear fuel and moreover verification of the sterile neutrino hypothesis by detecting reactor's antineutrinos via the Inverse Beta Decay (IBD) interaction.

Within the thesis, the first prototype of the antineutrino detector was constructed. It is composed of 18 scintillation plates (40 x 20 x 1 cm^3) and corresponding electronics. With this prototype the first test with cosmic muons were performed. Within the thesis, the energy resolution of the scintillation plates was significantly improved by the optimization of their chemical composition and selection of the optimal refractive material. The proper energy resolution is very important for the detector functionality. In addition, a new methods for the production of coating layer with Gd were proposed and tested. The newly produced Gd layer is significantly cheaper compared to commercially produced foils. For the thesis, the Geant4-based simulations were developed and results (the optimization of the light collection, the efficiency of the antineutrino detection, etc.) are presented.

Keywords: reactor's antineutrinos, scintillating detectors, Geant4, S^3