Intensive searches for new physics beyond the Standard Model (BSM) concentrate on two main frontiers represented by high-energy experiments performed at collider accelerators and low-energy precision experiments. High energy experiments look for exotic particles produced on-shell in high-energy collisions, low energy precision experiments seek for tiny deviations in low-energy observables which can be attributed to non-existing in the SM exotic interactions. Nevertheless, despite the great success of the SM, many open questions remain such as the origin of parity violation, the hierarchy of fermion masses, the number of particle generations, the mechanism of CP violation, the worrying large number of parameters of the theory, etc.

Free neutron beta decay is one of the most fundamental processes in nuclear physics and provides sensitive means to uncover the details of the weak interaction and serves as a testing ground for understanding of the electroweak standard model. One of the most important measurements with the neutron beta decay are the correlation experiments. The correlation coefficients *H, L, N, R, S, U, V* relating the transverse electron polarization with the electron and antineutrino momenta have several interesting properties. They vanish in the SM and reveal variable size of the FSI contributions, from very small to easily measurable in the present experiments. And, last but not least, the dependence on real and imaginary parts of the scalar and tensor couplings alternates exclusively from one correlation coefficient to another with varying linear combination coefficients. This feature allows one to deduce a complete set of constraints for scalar and tensor admixtures to weak interactions from the neutron decay alone.

The strategy of the BRAND experiment devoted to a measurement of the transverse electron related correlation coefficient in neutron decay consists of a number of subsequent phases. Each of them should deliver new physics data sufficient to reduce the systematic effects and the statistical uncertainty by a factor of two with respect to the previous step. Based on this approach, the main goal of this project is to measure the *H*, *L*, *N*, *R*, *S*, *U* and *V* correlation coefficients with both the statistical and systematic uncertainty on the level of 0.001. Five from them (*H*, *L*, *S*, *U*, *V*) would be measured for the first time. This should be achieved with the BRAND detecting system segment with full solid angle coverage of one meter long neutron beam decay volume. Such a step would be a milestone towards an ultimate experimental setup that guarantees the required efficiency and precision. *H*, *L*, *N*, *R*, *S*, *U* and *V* with the accuracy of about 0.0005 provide complementary and competitive information with respect to “classical” neutron decay experiments (correlation coefficients *a*, *b*, *A*, *B*, *D*) and to ongoing and planned high-energy experiments searching for not existing in the Standard Model but theoretically possible scalar and tensor couplings. Moreover, they offer completely different systematics. The analysis performed in the framework of the effective field theory (EFT) shows that the proposed method is sensitive to hypothetical processes that could appear in the weak interaction at the high energy scale.

The main goal of this application is to establish a new young team able to carry out the proposed research in order to continue the BRAND project after completing its R&D and demonstration phase. The preliminary results of that phase are very promising. Particular tasks in the project are focused on development and improvements of the experimental techniques successfully verified in the R&D phase in order to implement them in a much larger and more demanding experimental setup proposed for the second phase of the BRAND project.

The project assumes participation of international institutions that are members of the BRAND collaboration and maintain the leading role of the Jagiellonian University in this project.