Study of rare Λ_b decay using multivariate analysis techniques

The b-Baryon decay

$$\Lambda_b \to \Lambda_c^* \, 3\pi$$

has never been observed, however it is a fundamental ingredient for the studies of lepton universality in semileptonic Λ_b decays. Using a sample of LHCb data prepared with observables useful for discriminating signal from background events, the student is required to perform a signal selection separating interesting events from background using multivariate analysis techniques, including Deep Neural Networks. The student will consider Boosted Decision Tree first. After having selected the best figure-of-merit able to successfully solve the problem, a detailed study of the effect on the multivariate analysis due to different fractions of the total sample used for training the network is required (minimizing the overtraining if present). The performances of the sample selection will be studied as a function of the different regularization algorithms used. After this the sample selection will be performed with the Deep Neural Network, where an optimization of the number of neurons, the activation function type and the cost function is required.