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#01-132 Autonomous Measurements Driven By Machine Learning

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During the last reactor cycle in 2020, a combined team from the Institut Laue-Langevin and Berkeley National Lab has commissioned and tested a self-learning algorithm capable to perform autonomous measurements. For the first time the computer took control of the three axis neutron spectrometer ThALES, without any human intervention. The algorithm was able to explore the reciprocal space and fully reconstruct the signal without any prior knowledge of the physics case under study. Thanks to autonomous learning gpCAM - developed by Marcus Noack of the CAMERA team at Berkeley Lab –estimates the posterior mean and covariance and uses them in a function optimization to calculate the optimal next measurement point. The posterior is based on a prior Gaussian probability density function,
which is repeatedly retrained on previously measured points. The main advantage of such an approach is clearly the possibility to drastically reduce the number of measurements with respect to a classical grid scan and therefore optimize the beam-time usage. In the present paper, the excellent results obtained will be discussed as well as the opportunities for further improve this technique.

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