

ESR12



A. Ohlson (Lund U)



P. Christiansen (Lund U)



A. Sopasakis (Ximantis)



R. Shahoyan (CERN)

Fellow ESR11	Host ULUND	Ph.D. Yes	Start (mo.) 8	Duration (mo.) 36	Deliverables 6.1,6.2,6.3
Work Package: WP3,6		Doctoral programme: ULUND		Real-time calibration of ALICE TPC and ML traffic predictions	
<p>Objectives: ESR11 will study and commission the ALICE Time Projection Chamber (TPC) detector. In 2019-2020 the LHC will be shut down to upgrade and prepare the experiments for Run 3. The goal of the ALICE upgrade is to be able to analyze the full rate of 50000 events per second, increasing the sensitivity for most measurements by between one and two orders of magnitude. The main goal on the detector side is the upgrade of the TPC with a Gas Electron Multiplier (GEM) readout that will allow continuous operation. This continuous readout requires a whole new software framework denoted O2 (online-offline), whose goal is to do full calibration and reconstruction in real time. ESR11's first objective will be to contribute to the development of the ALICEO2 framework and use this expertise in the analysis of the first data from Run 3, which will start in 2021. Particularly, due to the space charge build up fluctuations, the upgraded TPC will have to be calibrated every 5 milliseconds over a space volume of 90 cubic meters. This demands fast, effective and robust algorithms that ESR11 will have to develop, tune and benchmark. The subtraction of noise at the earliest possible stage for future developments of these algorithms will benefit from a secondment at XIMANTIS to work on hybrid networks (e.g. Convolutional Neural Network followed by Long Short-Term Memory recurrent networks) which can capture features in different dimensionalities (e.g. space and time for traffic monitoring and forecasting, position and timing of noise in the detector). A 6-months secondment at CERN will allow the implementation of the real-time calibration algorithms in the ALICE software, as well as training and interaction with the core of the ALICE O2 development team. The second objective of ESR11 is the analysis of heavy-ion data, which will first be available at the end of 2021. This analysis will be a measurement of the nuclear modification factor, since this measurement will be very sensitive to the corrections and a perfect testing ground for the algorithms developed.</p>					
<p>Expected Results: 1. Contribute to development of the O2 algorithms for ALICE TPC reconstruction (peer-reviewed ALICE paper). 2. Apply algorithms to the measurement of the nuclear modification factor (peer-reviewed ALICE paper). 3. Improvements of XIMANTIS app using hybrid networks ESR11 will receive a PhD in experimental HEP at Lund University.</p>					
<p>Secondments: CERN, 5 months, Shahoyan, implementation of algorithms in ALICE trigger software. XIMANTIS, 3 months, Sopasakis. Enhancement of AI modelling algorithms for traffic prediction, using hybrid networks.</p>					