Abstract of the Thesis by David Šálek

I present the first measurement of the longitudinal diffractive structure function F_L^D using the H1 detector at HERA. The structure function is extracted from first measurements of the diffractive cross section $ep \to eXY$ at centre of mass energies $\sqrt{s}$ of 225 and 252 GeV at high values of inelasticity y, together with a new measurement at $\sqrt{s}$ of 319 GeV, using data taken in 2006 and 2007. Previous H1 data at $\sqrt{s}$ of 301 GeV complete the kinematic coverage needed to extract F_L^D in the range of photon virtualities $2.5 < Q^2 < 100\,\mathrm{GeV}^2$ and fractional proton longitudinal momentum loss $10^{-4} < x_{I\!P} < 10^{-2}$.

I describe in detail all corrections factors and tuning of the simulation needed for the mesaurement. These involve the efficiency of reconstructing primary interaction vertex, track linking the vertex and the cluster of the scattered positron, efficiencies of various cuts in the DIS and diffractive selections. I compare the measured F_L^D with the predictions based on the NLO QCD fits to previous diffractive data as well a model derived from a colour dipole approach.

I also introduce the a diffractive physics programme at LHC. Both the physics topics and the hardware issues are briefly covered. Diffraction at LHC relies on fast timing electronics, and I present simulation of various techniques that lead to a picosecond resolution.