Search for the dark vector boson

Hidden sector or dark sector states appear in many extensions to the Standard Model, to provide a particle candidate for dark matter in universe or to explain astrophysical observations such the as positron excess observed in the cosmic radiation flux. A hidden or dark sector can be introduced with an additional U(1)d dark gauge symmetry. The presence of the dark sector could be experimentally inferred at colliders as deviations from the SM-predicted rates of Drell-Yan (DY) events, from Higgs boson decays through exotic intermediate states, or other processes, which may depart from the SM predictions. The discovery of the Higgs boson during Run 1 of the Large Hadron Collider opens a new and rich experimental program based on the Higgs Portal. This discovery route uses couplings to the dark sector at the Higgs level, which were not experimentally accessible before. These search studies possible exotic decays: $H \rightarrow Z_d Z_d \rightarrow 4l$. Here Z_d is a dark vector boson. We have experience of this search from Run 1 and Run2 period of the LHC using the ATLAS detector at CERN. As things evolved, the search now further broadened and includes allowing the mass of the originating scalar to vary away from the SM Higgs : $S \rightarrow Z_d Z_d \rightarrow 4l$, where *S* is a scalar. This allows the search for the dark vector boson to also explore additional masses (instead of limiting the dark boson mass range [15 GeV, 60 GeV] as previous analysis). This extended search is efficient and could include a more general class of models, with the constraint of the SM Higgs portal lifted. This contribution focuses on the extension of the additional scalar by using full Run 2 with 13 TeV collision energy, which expands the search area, takes advantage of higher statistics, and substantially better performance of the ATLAS detector.