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Exploring the potential for Active Galactic Nuclei (AGN) emission line delays using LSST

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Active Galactic Nuclei (AGN) are variable sources, and analyzing the time delay of the strong broad optical emission lines relative to the underlying continuum serves as a crucial tool to investigate this important trait. This method aids in measuring black hole masses, and deciphering the structure of the Broad Line Region (BLR) responsible for these emission lines, which can be extended to test existing cosmological models. The relationship between an AGN's absolute luminosity and the measured time delay contributes to these investigations. To facilitate time delay measurements, we have developed a pipeline that simulates the efficiency of such measurements using the survey strategies for the Vera C. Rubin Observatory's Legacy Survey of Space and Time. This code incorporates simulated light curves, incorporating strong emission lines (e.g., Hbeta, MgII, CIV), iron pseudo-continuum in the optical and UV bands, and contamination from starlight. By identifying optimal bands representing the continuum and dominant lines for a given redshift, the code enables the recovery of time delay under any available LSST cadences. Simulations are conducted for both the main survey and the Deep Drilling Fields (DDFs) using representative cadence strategies. The pipeline is modular, and multi-faceted, and can be used to determine time delays from actual data (e.g., ZTF), and can be easily extended to forthcoming surveys. I will highlight the salient features of the pipeline and discuss relevant applications and plans in anticipation of the first light of the Observatory.

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