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Wide-Field Single Molecule Fluorescence Lifetime, Position, and Orientation: Instrumentation and Implementation JAMES MARR, Maryland Nanocenter, University of Maryland and Center for Nanoscale Science and Technology, National Institute of Standards and Technology, J. ALEXANDER LIDDLE, ROBERT ILIC, MUZHOU WANG, MARCELO DAVANCO, National Institute of Standards and Technology — The combination of super-resolution imaging with single-molecule lifetime determination would allow the collection of structural and environmental detail at the nanoscale. A new class of detector known as a 'High-temporal and High-spatial resolution, High-throughput 3-Dimensional' (H33D) detector, allows wide-field imaging with sub-nanosecond timing resolution. We present the detailed characterization of the detector, to understand the underlying structure. This information is used to eliminate artifacts from the sample data and maximize localization accuracy. After initial calibration, a thin polymer film, doped with bright, long-lived fluorescent dye is deposited on wedges of silica atop gold, ITO or hafnium oxide to probe the interaction of a fluorophore with conducting and dielectric materials as a function of distance. The wedge slope is chosen such that lateral localization uncertainty in the x-y plane contributes a sub-nanometer uncertainty in z. In this way, lifetime as a function of distance from and orientation relative to the surface is investigated. The data obtained will help in the understanding of dye/interface interactions. This will minimize localization errors and allow for lifetime changes to be directly linked to distance from and orientation relative to a surface.

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