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Neutral Atomic-Hydrogen Measurements in a Mirror/FRC Plasma Device using fs-TALIF[1] ARTHUR DOGARIU, Princeton University, EUGENE EVANS, SANGEETA VINOTH, SAMUEL COHEN, Princeton Plasma Physics Laboratory — We report on temporally- and spatially-resolved neutral atomic H density measurements carried out in a mirror/field-reversed configuration plasma device. The facility uses multiple RF-heating techniques with powers exceeding 100 kW to create 5-100ms duration quasi- and fully-steady-state magnetized (50-500G and mirror ratio ˜10) plasmas from various gases, achieving densities approaching 10^{14} cm^{--3} and electron temperatures in excess of 100 eV. The density of neutral H atoms 50cm off-midplane is imaged and time-resolved via fs two-photon absorption laser-induced fluorescence using a fs laser system at 205nm with 200μJ/pulse at 1kHz rep rate. A fast CMOS camera with a 5ns gated image intensifier records the H-α fluorescence at 656nm for every laser shot. By varying the delay between the RF trigger and laser pulses, the temporal dynamics of the H atoms is measured across multiple discharges to better than 15μs resolution. For high-power RF, the measured H atom density rises to 10^{12} cm^{-3} in 10's of μs, resolving axial and temporal dynamics of the neutrals near the device's central region. The steady-state "seed" plasma generated using low-power (10-500W) RF exhibits unexpectedly slow production and depletion of neutrals. Comparing the dynamics of the H neutrals and plasma-excited H atoms yields a measured lifetime of 160μs for the neutrals. Calibration is performed using 1mTorr of Kr.

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