Abstract Submitted
for the DPP15 Meeting of
The American Physical Society

Measurement of electron density transients in pulsed RF discharges using a frequency boxcar hairpin probe[1] DAVID PETERSON, North Carolina State University, DAVID COUMOU, MKS Instruments ENI Power Division, Rochester NY, STEVEN SHANNON, North Carolina State University — Time resolved electron density measurements in pulsed RF discharges are shown using a hairpin resonance probe using low cost electronics, on par with normal Langmuir probe boxcar mode operation. Time resolution of 10 microseconds has been demonstrated. A signal generator produces the applied microwave frequency; the reflected waveform is passed through a directional coupler and filtered to remove the RF component. The signal is heterodyned with a frequency mixer and rectified to produce a DC signal read by an oscilloscope. At certain points during the pulse, the plasma density is such that the applied frequency is the same as the resonance frequency of the probe/plasma system, creating reflected signal dips. The applied microwave frequency is shifted in small increments in a frequency boxcar routine to determine the density as a function of time. A dc sheath correction is applied for the grounded probe, producing low cost, high fidelity, and highly reproducible electron density measurements. The measurements are made in both inductively and capacitively coupled systems, the latter driven by multiple frequencies where a subset of these frequencies are pulsed. Measurements are compared to previous published results, time resolved OES, and in-line measurement of plasma impedance.

[1]This work is supported by the NSF DOE partnership on plasma science, the NSF GOALI program, and MKS Instruments

David Peterson
North Carolina State Univ

Date submitted: 24 Jul 2015 Electronic form version 1.4