

Abstract Submitted
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Hairpin Lock-in Circuit for Real-Time Plasma Density Measurements¹ SHON MACKIE, TROY CARTER, PATRICK PRIBYL, XINGXHEN FAN, YHOSHUA WUG, University of California, Los Angeles — We describe a circuit which allows a hairpin resonator probe to measure the plasma density in real time. Recent work has demonstrated that hairpin probes can be implemented cheaply and without too much difficulty using commercial off the shelf microwave electronics (see X. Fan, also at this conference). Using such a probe to diagnose the density has typically involved sweeping over a band of frequencies that includes the resonant peak, then identifying the resonance and deriving the corresponding density for that sweep. The present work adapts a lock-in type of circuit, which is commonly used to actively maintain resonance in high precision lasers, to find and lock onto the hairpins resonance in real-time. An error signal is generated by introducing a small oscillation to the input of a voltage-controlled oscillator, and monitoring the output of the mixer that detects the transmitted signal from the probe. The response is then fed into a PID controller to maintain the control voltage at resonance. One goal of the current work is to shorten the time response of the lock-in circuit to 1 us or less. This would be sufficiently fast to allow the hairpin probe to be used as a diagnostic of the plasma density during an Alfvén wave in the Large Plasma Device at UCLA.

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