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Improved coupling structures for microwave interferometry of detonation fronts. OWEN MAYS, EMER BALUYOT, MARK CONVERSE, LISA LAUDERBACH, RONALD KANE, CLARK SOUERS, JOSEPH TRINGE, Lawrence Livermore Natl Lab — Microwave interferometry (MI) provides several advantages over more traditional shock and deflagration front diagnostics. Most importantly, it directly interrogates these fronts, instead of measuring the evolution of containment surfaces or light from detonation breakout. The copper cylinders commonly employed in cylinder tests act as microwave cavities or waveguide structures. Experimental geometries with large dimensions (relative to the ˜cm-scale MI wavelength) result in artifacts in the MI signal due to higher order modes propagating in the explosive/metal system. We have developed a microwave coupling design to suppress higher order modes present in 1" diameter cylinder tests (CYLEX) of high explosives. We demonstrate the effectiveness of this structure and show nanosecond-scale microwave tracking of detonation front velocity in cylinder tests with a variety of explosives diameters, materials, and MI frequencies. These results illustrate the importance of selecting appropriate microwave frequencies and coupling for specific experimental geometries. This work was performed under the auspices of the U.S. Department of Energy by Lawrence Livermore National Laboratory under contract DE-AC52-07NA27344. Lawrence Livermore National Security, LLC. LLNL-ABS-768453.

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