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Proton radiography of a double shock into cerium to get densities of the second shock state FRANK CHERNE, BRIAN JENSEN, ZHAOWEN TANG, MATTHEW FREEMAN, Los Alamos National Laboratory — In traditional shock physics, the determination of density variations are inferred by applying the standard Rankine-Hugoniot jump conditions. Proton radiography (pRad) at LANL allows the direct measurement of density along with traditional particle and shock velocities via velocimetry. The introduction of the 40-mm powder driven gas gun in 2017 allows us to deliver well characterized shock profiles into a variety of materials. In this particular set of experiments, it will be shown that the densities obtained agree with a recently developed two-phase Mie-Gruneisen model for cerium. The model was tuned to capture the slowing down of the shock wave speed attributed to the crossing of the $\alpha - \epsilon$ phase boundary of cerium. Temperature measurements looking at similar shock loadings also suggest that we are below the melt boundary. In general, there is a good agreement between the calculations and the experimental densities in spite of the low proton transmission through the cerium samples.

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