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Exploiting New Imaging Techniques to Provide Quantitative Data for Model Validation[1]

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Historically, data collected from explosives and shock physics experiments is qualitative and used as a snapshot to gain insight into the physics taking place. In order to advance the science of shock physics, experiments need to be designed that can directly validate the output from simulations, including their underlying material models. Recent advancements in electronics and subsequent imaging diagnostics can and should be leveraged to transition from qualitative, trend-based studies to repeatable, quantitative (digitized/digitizable) data collection and analysis. Within a single experiment, a rigorous process for data collection and analysis of concurrent, high-fidelity diagnostics is utilized producing large amounts of data. Three specific examples of these advanced diagnostics will be discussed: 1) digital holography for detonator fragmentation to obtain 3D positions and velocities, 2) micro-streak Schlieren imaging of bursting wires to visualize phase changes with time correlated energy deposition, and 3) x-ray phase contrast imaging with high-flux picosecond exposures to observe materials under extreme conditions. Utilizing these newly developed diagnostics from other fields, we have made large strides in data collection to gain insight for explosives research and shock physics.

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