# High Reynolds number HED shear experiments at varying Atwood numbers

Kirk FLIPPO [1], Forrest DOSS [1], Lynn KOT [1], Barbara G. DEVOLDER [1], Carlos DI STEFANO [1], Susan KURIEN [1], Theodore PERRY [1], Thomas MURPHY [1], Elizabeth MERRITT [1], Eric LOOMIS [1], Channing HUNTINGTON [2], Sabrina NAGEL [2] and John KLINE [1]

*1) Los Alamos National Laboratory, Los Alamos, New Mexico USA*

*E-mail: kflippo@lanl.gov*

*2) Lawrence Livermore National Laboratory, Livermore, California USA*

LANL has conducted a series of Kelvin-Helmholtz (KH) unstable experiments using the Shock/Shear platform on the NIF, which have now acquired time histories of 4 different materials and 2 different morphologies at interfaces spanning dynamic Atwood numbers from 0.63 to 0.88 and developed Reynolds numbers of $10^6$. The NIF Shear platform uses two hohlraums driven by 303kJ of laser energy to create temperatures of 250 eV, on either end of a 5 mm long, 1.5 mm diameter shock tube. This radiation bath launches and supports a pair of counter propagating shocks traveling at 130 km/s in a 100 mg/cc CH foam toward each other from opposite ends of the tube along opposing sides of a thin dividing tracer layer for 35 ns. The tracer layer is subjected to extreme shear forces when the shocks cross the center of the shock tube and produce two counter streaming flows across the layer, which quickly evolves into classical KH rollers from an unseeded (but naturally broadband) surface, as shown in Fig. 1, which persists into late times (35 ns).

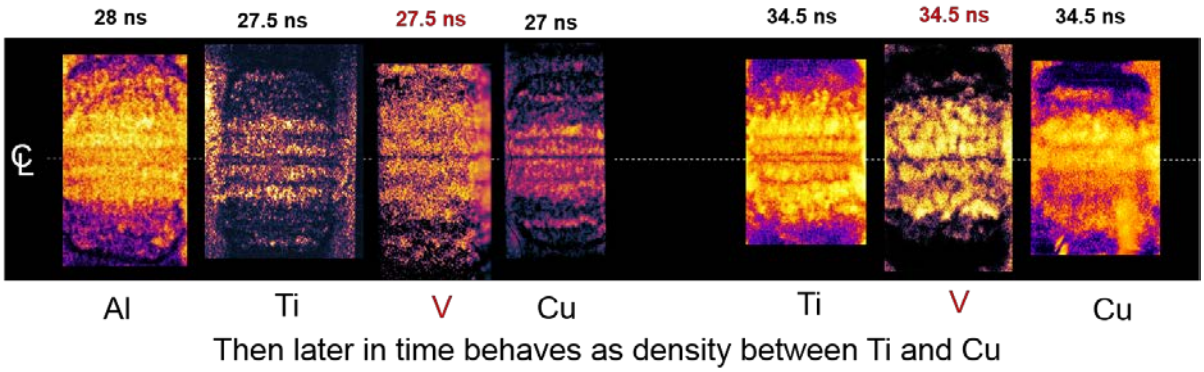


Figure 1: Al, Ti, V and Cu plan-view images at various late times showing structure.

Two sets of data are acquired for each material: the plan-view (shown above in Fig 1), looks through the plane of the material to watch the hydro-dynamic coherent structures evolve, and the edge-view (side-on view) of the layer observes the layer expand to measure the mixing width of the material. The edge view is compared to the Besnard-Harlow-Rauenzahn (BHR[3]) mix model implemented in the LANL multi-physics hydro-code RAGE. The BHR model matches the evolution and asymptotic behavior of the mixing layer well, even when the surface is roughened to control the layer's evolution from a highly coherent state to a very disordered turbulent-like state. The plan-view offers the completely new ability to use the coherent features from the instability to calculate the total turbulent kinetic energy in the layer, hinting at possible plasma physics effects of many electron materials. This plan-view also offers new insight into the BHR model, by giving us the novel ability to directly compare to the model's mix parameter, *b*, which informs the code as to what degree each cell in the RAGE code has mixed different materials into it.