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Ultrabroadband Relay Imaged GRENOUILLE as a Time-Resolved Diagnostic for Relativistic Hole Boring[1] CRAIG WAGNER, AARON BERNSTEIN, GILLISS DYER, TODD DITMIRE, Univ of Texas, Austin
— In a highly intense laser-solid interaction, the surface of the resultant plasma is pushed into the interior of the target at a significant fraction of the speed of light as a result of the intense radiation pressure from the focused laser beam. This is known as hole boring. During the hole boring process laser interactions with electrons at the receding target surface generate light at frequency harmonics of the incident laser. The frequency shift of these harmonics is proportional to the velocity of the target surface. In previous experiments at the Texas Petawatt we observed red-shifts in the 351nm harmonic up to 513nm, corresponding to a recession velocity of 0.18c. We designed an ultra-broadband GRENOUILLE to conduct time resolved measurements of spectral shifting of second harmonic light over the duration of the incident laser pulse. This GRENOUILLE is relay imaged from the target plane to prevent spectral splitting, and is an all reflective design to reduce pulse broadening and chromatic aberrations. With an f/3.15 optic focusing into a thick BBO crystal, the system accepts wavelengths from 526nm to 766nm with 4.8nm spectral resolution and 5.6fs temporal resolution.

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