Canadian Association of Physicists
Association canadienne des physiciens et physiciennes

Contribution ID: **4410** Type: **Oral (Non-Student) / Orale (non-étudiant(e))**

Characterization of laser-plasma betatron x-rays at 2.5 Hz

Tuesday 28 May 2024 11:30 (15 minutes)

Betatron x-rays from a laser wakefield accelerator provide a new avenue for high-resolution, high-throughput radiography of dense materials. Here, we demonstrate the optimization of betatron x-rays for high-throughput x-ray imaging of metal alloys at the laser repetition rate of 2.5 Hz. Using the Advanced Laser Light Source in Varennes, QC, we characterized the x-ray energy spectrum, spatial resolution, beam stability, and emission length from helium, nitrogen, and mixed gas (99.5% He, 0.5% N) targets to determine the conditions for optimized imaging quality with minimized acquisition time. The optimized betatron x-ray source at 2.5 Hz was used for high-resolution imaging of micrometer-scale defects in additively manufactured metal alloys, demonstrating the potential of these sources for high-throughput data collection, accelerating the characterization of complex mechanical processes in these materials.

Keyword-1

laser plasma accelerators

Keyword-2

x-ray imaging

Keyword-3

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Session Classification: (DPP) T1-6 Laser Plasma Interaction | Interaction laser-plasma (DPP)

Track Classification: Technical Sessions / Sessions techniques: Plasma Physics / Physique des plasmas (DPP)