# Dynamics of laser-metal interactions in additive manufacturing alloys

Laser based manufacturing processes like cutting, welding and recently additive manufacturing are key techniques in the manufacturing world with a multi-billion-dollar market. However, to further optimize and advance these methods a detailed understanding of the light material interactions must be obtained theoretically and experimentally. Ideally one can observe the interaction process in real time, however the time scale of the interaction process is in the nanosecond range, so imaging is challenging.

Experiments at the Dynamic Compression Sector of the Advanced Photon Lightsource of Argonne National Lab use a total of 4 ICCD cameras to accomplish this task. The cameras are operated in a double image feature mode that allows to take 2 consecutive images with as low as 450ns time between images. The X-Ray radiation monitoring the materials is converted by a scintillator into visible light that and guided through beam splitters that are aligned such that each camera is observing the identical section of the sample. By precise, correlated triggering of the cameras a total sequence of 8 images with less than 100ns time resolution can be acquired to study the ultrafast dynamics of the laser interaction process.

**Featured Paper/Publication:** Ultrafast dynamics of laser-metal interactions in additive manufacturing alloys captured by in situ X-ray imaging, Materials Today Advances, 2019

**Reference Lab:** Dynamic Compression Sector, APS, Argonne National Lab, USA

**Featured Product:** PI-MAX4