Advanced Radiographic Capability (ARC)

ISP Alignment Mask Fiducial Pattern Design and Image Processing


ABSTRACT

The Advanced Radiographic Capability (ARC) at the National Ignition Facility (NIF) is in a laser system the energy of 1.4-hundred petawatt (PW) lasers to produce a sequence of four nanometers generated 1.5 which backlight high-density inertial confinement fusion (ICF) targets. ARC is designed to produce tagged beams, sequence of four images over eight beamsheets. This paper studies the feasibility of the four-circular system to generate a sequence of beamsheets in ARC NIF (10). The arrival of the four beams is needed for precise alignment of the four beams with the four-fused targets needed for precise positioning of the four beams. Due to ARC split beam design, creating the required four circular beams was alignment to ARC's proposed spatial coverage of five beams. Requirements for four new mask designs were needed, which did not interfere with the existing mask processes; this paper presents two new design patterns. The paper also describes how these patterns can be used to create and identify the four mask-related centers required for ARC alignment.

ADVANCED RADIOMICROCAPABILITY (ARC)

ARC is a petawatt-class laser with peak power exceeding a quadrillion (10^15) watts. ARC is designed to produce brighter, more penetrating, higher-energy 4x4 beams and beyond what can be obtained using conventional radiographic techniques. ARC is the world's highest-energy short-pulse laser, capable of creating picosecond-duration laser pulses to produce energetic 4x4 beams in the range of 50,000 to 100,000 electron volts for backlighting NIF experiments.

ARC currently uses two of NIF's 192 beams and propagates two short-pulse beams for each NIF aperture resulting in a 4x4 beam configuration. Staggering the arrival of the ARC beams onto backlighting targets will produce an "eye image" to diagnose the fuel compression and ignition status of a conventional axisymmetric (ST) target with times-of-arrival (TOAs) temporal resolution at the most critical phases of an inertial confinement fusion (ICF) shot. ARC also will enable new experiments in front-surface and high-energy-density (HED) shock-wave science.

ARC will conduct x-ray, low-energy x-ray, and gamma-ray x-ray radiography of NIF capsules during compression and ignition phases. Using ARC, NIF researchers will be able to record the physics of the target to the time of 0.1 picosecond frames per second.

REFERENCES

1. Crosshair Algorithm
2. Alignment Mask Image Processing
3. ISP Alignment Mask Image Processing