Laser ultrasonic inspection (LUI) is the name given to the techniques in which a laser beam interacts with the surface of a test sample and replaces piezoelectric transducers for launching and probing elastic sound waves. When this wave returns to the surface, a separate laser interferometer detects the small resulting displacement. This technique is strictly non-contact and is therefore suitable for in-process inspection of parts while at high temperature or moving at high speed. In the field of non-destructive techniques (NDT), the association of laser generation with optical detection provides a completely remote inspection system.

As this process involves hitting of high power laser beam on to the surface to be inspected and ablation of the superficial layer of the surface, one of the objections from the conventional oil and gas industry to LUI system is apprehension of potential damage or adverse effect on the surface property and integrity. This possible problem is seen as severe on pressurized pipes to the extent of being dangerous to the system.

This work attempts to present a qualification methodology which was experimentally applied to known metallic samples and with standard LUI testing conditions. Binary image processing techniques have been used with hybrid filtering and statistical measurements to quantify the findings. A relational approach is used within the digital image processing domain to qualify the extent of metal loss that occurs during a prolonged exposure of the clean metallic surface to the laser beam. A comparative study has been done on Duplex steel (UNS S31803) and Carbon steel. Samples were studied for relative metal loss, possible changes in hardness and micro-structural anomalies (if any). A new qualification method has been developed using digital image processing to approximate the damage sustained by the exposure. The results are quite promising and alleviate many doubts that conventional NDT experts may have in connection with the LUI system, especially in the oil and gas scenarios.