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Development of a hardened imaging system for the Laser MegaJoule

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The Laser MegaJoule (LMJ) facility will host inertial confinement fusion experiments in order to achieve ignition by imploding a Deuterium-Tritium target. In order to understand reasons for failures, a X-ray imager is necessary to diagnose the core size and the shape of the DT-microballoon in the 10-100 keV band in complement of neutron imaging system. Such a diagnostic will be composed of two parts: an X-ray imaging system and a detection assembly. Each element might be affected by the harsh environment created by fusion reactions.

The design of this diagnostic will take into account optics and detectors vulnerability up to a maximum neutron yield of 1016 in 4π sr.

One way to protect the diagnostic from particles generated during the implosion consists in recording image in a shielded box. The X-ray image of the core will be formed on a scintillator through the X-ray optical system. Then the image is converted into visible light by the scintillator. It is easily transferred through an optical relay to shielded box and finally focused on a detector.

A work of optimization, including Monte-Carlo simulation and experimental studies, is led to maximize the X-ray core emission sensibility and minimize neutron and gamma ray response. Two optical relay systems have been exposed to harsh environment and have been compared in terms of robustness.

First experimental results tend to promote one solution but a compromise between optical performance and robustness might still be found.

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