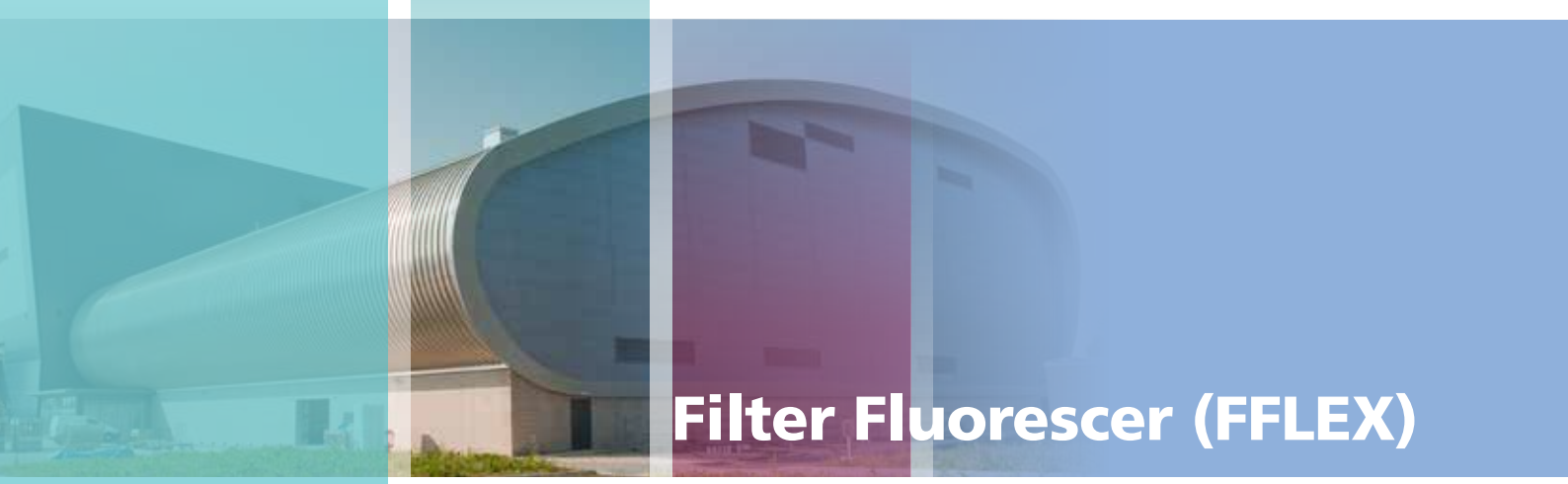
Orion: Target diagnostic



Filter Fluorescer (FFLEX)

The Orion laser facility at AWE Aldermaston, one of the largest scientific capital investments in the UK, houses a large neodymium glass laser system and a target chamber in which the high energy density physics experiments are performed. This is necessary to support certification of performance and safety of the UK deterrent.

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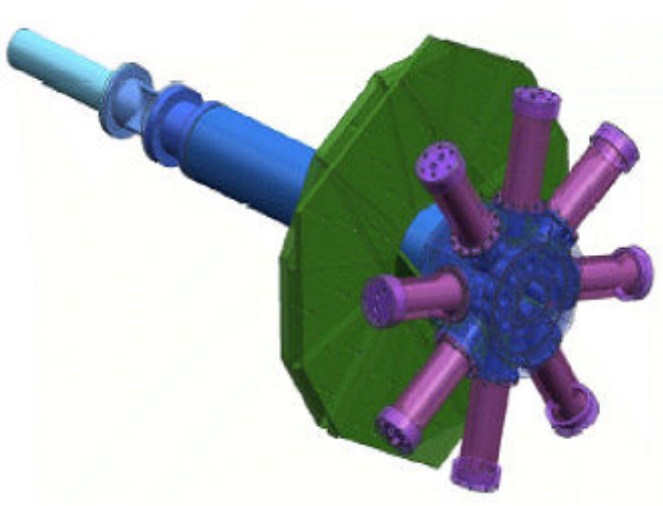
The Filter Fluorescer (FFLEX) is designed to diagnose the conditions created in long pulse laser/plasma interaction. The FFLEX detects absolute, time-integrated hard X-ray spectra, from 20 keV to 100 keV, using eight measurement channels. It also detects hot electron temperature measurements for short-pulse laser-target interactions at 10^{18} – 10^{21} Wcm^{-2} intensities, and has reduced sensitivity to high-energy scattered radiation using filters, lead shielding and specific scintillator thicknesses. The precise form of detector response function is determined by the choice of filter and fluorescer materials and thicknesses. Hard X-rays are produced by propagation of hot electrons, generated via collisionless absorption at the laser-target boundary in the target material.



Specification

Number of channels:	8
Spectral range:	20 – 100 keV

In each measurement channel, radiation from the target is collimated, passes through a pre-filter, and subsequently falls on a fluorescer foil. The pre-filter preferentially transmits radiation at photon energies below (and also significantly above) its K absorption edge. K-shell absorption by the fluorescer results in the emission of K-shell fluorescent radiation, and this fluorescent radiation is detected by a scintillator-photomultiplier combination. Calculation of the response function takes into account the thicknesses of the filter and fluorescer materials, the photoelectric-absorption and scattering cross-sections, the fluorescence yields, and the geometry of the detector and the sensitivity of the scintillation detector. Several such detector channels operated in parallel constitute the filter-fluorescer diagnostic.

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