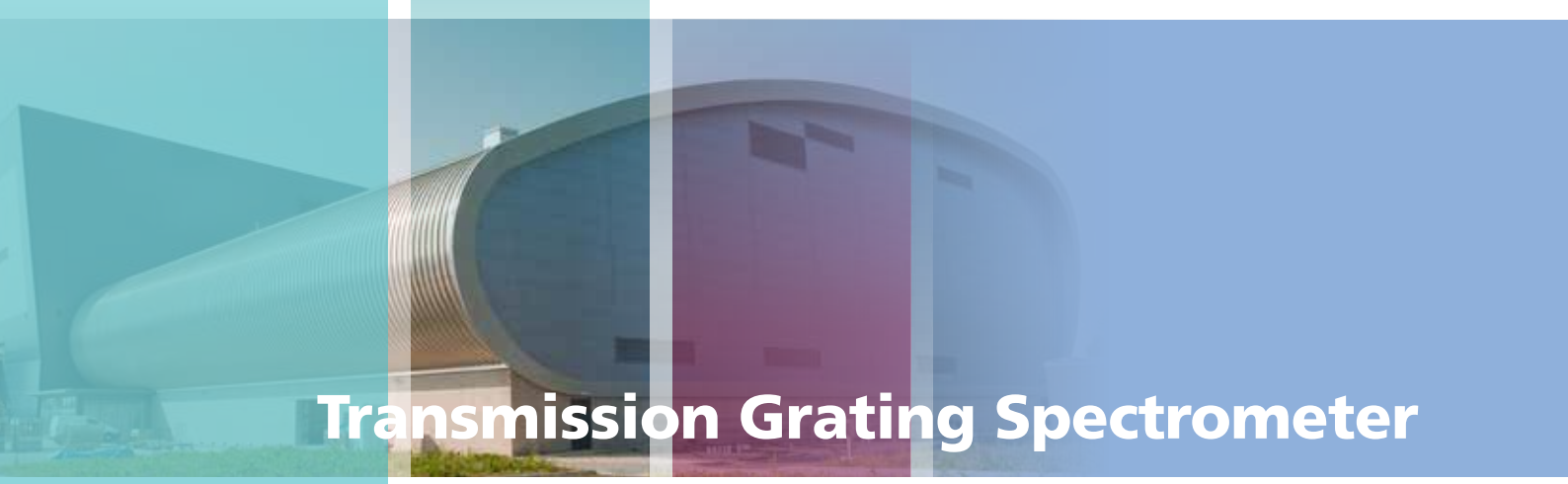
Orion: Target diagnostic



Transmission Grating Spectrometer

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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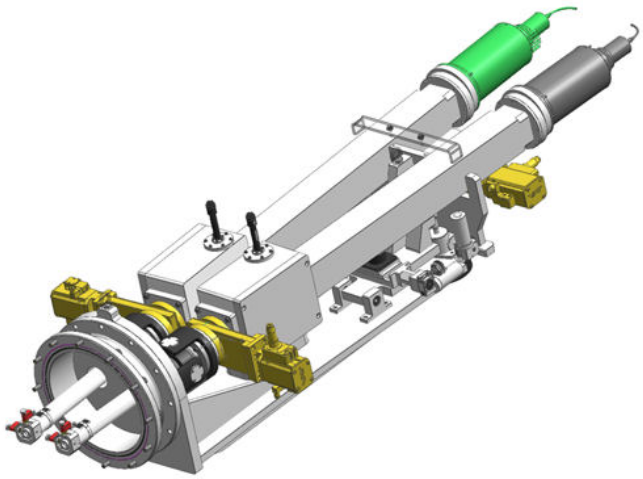
The Transmission Grating Spectrometer (TGS) is permanently mounted on the Orion Target Chamber. It is used to measure absolute spectral intensity from targets in the 10 - 100Å (0.12 - 1.2 keV) spectral range with 10% accuracy.

The purpose of the TGS is to complement the Dante, a filtered diode array soft X-ray power diagnostic, with the potential to achieve higher temporal and spectral resolution. The instrument consists of two independent transmission grating spectrometers consisting of a collimating aperture, a thin filter, a 0.5 mm period transmission grating and a detector that views the target along closely-coupled lines-of-sight. One spectrometer disperses the incident spectrum along the slit of a high time resolution electron-optic streak camera. Although the streak camera is capable of high time resolution (~10 ps) it is difficult to absolutely calibrate for input flux owing to the build up of errors in the instrument sub-components. To provide absolute flux calibration a second spectrometer uses a soft X-ray sensitive Charge Coupled Detector (CCD) with radiometric calibration. The X-ray sensitive CCD provides time integrated spectral information. Combining the data from both spectrometers permits the absolute time resolved spectrum to be unfolded.



Specification

Spectral range:	0.12 - 1.2 keV

Grating specification

Material:	Gold
Thickness:	0.5 µm
Grid:	20 µm x 20 µm
Source-grating distance:	2500 mm
Grating-detector distance:	555 mm
Grating period:	~5200 Å
Slit width:	70 µm

Streak camera specification

Spectral range:	10 Å –100 Å
Dispersion:	9 Å mm^{-1}

X-ray CCD camera specification

CCD full well capacity:	147,500 electrons
Pixel size:	13.5 µm x 13.5 µm

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