Orion: Target diagnostic

Neutron Diagnostic – Total Yield

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 Neutron Total Yield diagnostic on Orion uses a pneumatic transfer system to transport irradiated copper sample material in a timely manner from the Target Chamber to the Nuclear Physics Laboratory. This method for recovering the sample ensures the irradiated material is delivered to the Nuclear Physics Laboratory with as little delay as possible.

The system includes a sliding sleeve send / receive terminal located in Orion Nuclear Physics Laboratory and tube that extends to the Target Chamber and terminates at a re-entrant tube. The system is supplied with three re-entrant tubes having different carrier assembly 'rabbit' stopping positions. The picture below shows a 'rabbit' with a copper sample installed.

Specification

Power supply:	240 V, 32 A
Sample material:	Copper

The method used for measuring the neutron yield during an indirect drive Deuterium-Tritium (DT) implosion is to let the 14.1 MeV neutron signal emitted during the reaction activate a piece of copper placed close to the experiment, and then infer the neutron signal from the induced activation and the reaction cross section. The 63 Cu(n,2 n)62 Cu reaction has a threshold of 11 MeV and a beta+ decay half life of 9.74 minutes. If one measures how much activity is induced in the copper and the efficiencies of the complete counting system, the number of neutrons originally interacting with the copper can be recovered.

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