Fraunhofer
INT

FRAUNHOFER INSTITUTE FOR TECHNOLOGICAL TREND ANALYSIS INT


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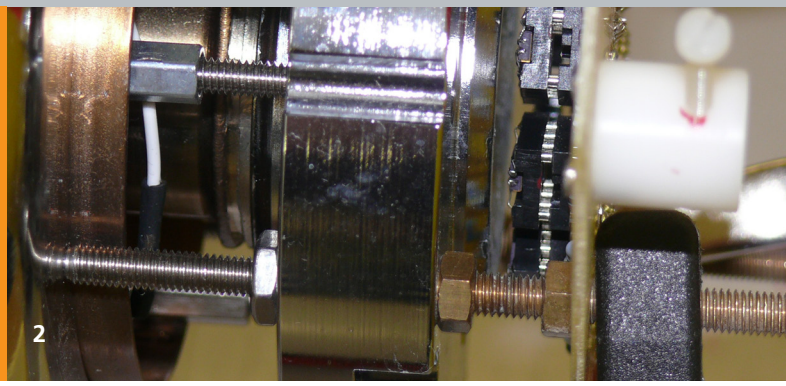
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1 *D-711 neutron generator*
2 *Samples during irradiation*

NEUTRON GENERATOR

Nuclear Effects in Electronics and Optics

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QUALITY SYSTEM CERTIFICATION
DNV·GL
ISO 9001

Fraunhofer INT offers two neutron generators which are suitable for investigating displacement-damage effects in electronic or optical components. They can also be employed to simulate single event effects (SEE) caused by atmospheric neutrons.

THERMO-Fisher D-711 neutron generator

The THERMO-Fisher D-711 neutron generator at Fraunhofer INT accelerates deuterium ions (D = ^{2}H) with a typical voltage of 150 kV. These nuclei are focused and hit onto deuterium or tritium targets (T = ^{3}H). Inside the target D-D or D-T fusion reactions are stimulated which produce helium isotopes (^{3}He or ^{4}He) and fast neutrons with energies of 2.5 MeV (for D-D reactions) or 14.1 MeV (in the case of D-T reactions).

At a typical acceleration voltage of 150 kV and 2.5 mA up to $3 \cdot 10^{10}$ neutrons/s in 4π-steradian are produced with a new tritium target.

Based upon the fact that the energy of the neutrons (14 MeV) is much larger than the kinetic energy of the deuterium ions (~150 keV) the emission is nearly isotropic and the intensity falls off as $1/r^2$ with r being the distance from the tritium target which can be as small as 1 cm. Even at such short distances the emission can be approximated as being isotropic with high certainty because the emission point has a very small diameter (2 mm).

Dosimetry at THERMO-Fischer D-711

The neutron fluence is monitored online during the irradiation with calibrated uranium fission chambers from LND, INC. The chambers have been calibrated in collaboration with the Physikalisch-Technische Bundesanstalt in Braunschweig (the National Metrology Institute of Germany).