The JRC laboratory for Neutron Physics

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The JRC-IRMM operates two accelerator facilities for the measurement of neutron cross-section data: a pulsed white-spectrum neutron source for high-resolution neutron time-of-flight (TOF) measurements, and a quasi-monoenergetic neutron source.

The TOF facility is based on a 150 MeV linear electron accelerator (GELINA) producing pulsed electron beams with a pulse length between 10 ns and 2 μ s, repetition rates between 1 Hz and 800 Hz, and up to 12 A peak current (100 μ A average current). Using a unique post-acceleration pulse compression system, the electron pulse width can be reduced to approximately 1 ns (FWHM) resulting in a peak current of up to 120 A. The accelerated electrons produce Bremsstrahlung in a uranium target which in turn, by photonuclear reactions, produces neutrons. Within a 1 ns pulse a peak neutron production of 4.3·10¹⁰ neutrons is achieved at 800 Hz repetition rate. Experiments can be carried out simultaneously at 12 neutron flight paths, at distances between 8 and 400 metres, and in an energy range between 1 meV and 20 MeV.

Quasi-monoenergetic neutron beams in the energy range 0.1-24 MeV are produced at a 7 MV Van de Graaff (VdG) accelerator. The VdG can produce continuous or pulsed proton, deuteron or helium ion beams with a current of up to 60 μ A on target in DC mode and up to 5 μ A in pulsed mode. The pulse repetition rates are 2.5, 1.25 or 0.625 MHz and the ion pulse lengths are between 1.25 and 2.50 ns FWHM depending on the ion energy. The neutron energy is defined by using lithium, deuterium or tritium targets and choosing appropriate emission angles. Depending on the neutron energy up to 10⁸ neutrons/s can be obtained. Six beam lines and experimental set-ups are available, although only in single-user mode.

With support from the FP6 Euratom programme for Transnational Access JRC-IRMM has opened these facilities to external users offering a total of 3000 supplementary data acquisition hours over a three year period. Over 22 experiments were proposed to this project (NUDAME: Nuclear Data Measurements at IRMM). The experiments addressed a wide range of topics, from specific cross-section measurements for neutron induced reactions to feasibility tests for more elaborated long-term investigations, test and calibration of equipment (such as, e.g., Bonner Spheres or dose meters), leakage spectra measurements in well defined neutron fields, etc.

Following the good response from the community to the NUDAME call JRC-IRMM submitted a new proposal (EUFRAT: European facility for innovative reactor and transmutation neutron data) to the Euratom-FP7 programme. In the past, JRC-IRMM was member of the n_TOF collaboration and contributed to the FP6-IP EUROTRANS (domain NUDATRA). Presently it is participating actively in the FP6-I3 project EFNUDAT (European Facilities for Nuclear Data Measurements) and the facilities are also used by external users in the frame of bilateral collaboration agreements for work on selective topics.