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The HOTNES thermal neutron facility

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HOTNES (HOmogeneous Thermal NEutron Source) is a thermal neutron irradiation facility jointly developed by INFN and ENEA at the ENEA Frascati research center. HOTNES was designed as a user facility for multi-purpose thermal neutron testing and detector calibration.

HOTNES consists of a polyethylene assembly with dimensions of 70 cm x 70 cm in square section and 100 cm in height, accommodating a cylindrical cavity measuring 30 cm in diameter and 70 cm in height with an 241Am-B source placed at the cavity's base. A cylindrical shadow-bar separates the source from the irradiation volume, so that neutrons can only reach the irradiation volume after multiple scattering with the cavity walls. Therefore, the spectrum in the useful irradiation volume is highly thermalized.

As a consequence of this design, the irradiation volume presents iso-fluence surfaces that are disks, parallel to the facility base, having about 30 cm in diameter. Across any iso-fluence surface, the thermal fluence exhibits remarkable uniformity, with deviations below 2-3%. The fluence rate can be easily varied by moving along the cylindrical axis, with attainable values in the range from 700 to 1000 cm−2 s−1.

The facility's design was previously optimized through Monte Carlo simulation and proven by experimental validation. This communication describes the facility design, the Monte Carlo simulations and the results of the validation measurements. Furthermore, it summarizes the experiments performed within the first external user program.

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