

NEUTRON FILTERS FOR THE JET GAMMA-RAY CAMERAS UPGRADE

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Neutron filters/attenuators have been designed and constructed as an upgrade of the JET Gamma-Ray Cameras (GRC's). This diagnostics upgrade should reduce the neutron flux at the gamma-ray detectors in a way that it would make possible gamma-ray imaging measurements in high power deuterium JET pulses, and eventually in deuterium-tritium discharges. Using the neutron attenuation factor as the main design parameter a set of three neutron attenuators of different shapes and attenuation lengths has been designed.

The attenuators will be placed within the GRC diagnostics system between the vacuum vessel port and the camera collimator radiation shields both in the case of the horizontal camera and vertical camera. When the neutron/gamma camera diagnostics is used for neutron measurements, the neutron attenuators have to be moved out of the detector line-of-sight (by about 600mm for the horizontal camera and by about 100mm for the vertical one). The operation of the neutron attenuators is controlled by means of an electro-pneumatic system.

A full scale prototype of the vertical camera neutron attenuator was constructed and successfully tested. The mechanical behaviour of the attenuator structure subject to the forces and torques produced by the JET disruptions was analysed by means of the finite element analysis method. The radiation performance of the GRC neutron attenuators as well as the response of the gamma-ray detectors have been addressed by means of neutron and gamma-ray transport calculations. The calculated attenuation factor is 10^2 for the attenuators of the two cameras and a value of 10^4 for a long version of the vertical camera attenuator. The numerical simulations are planned to be checked against experimental results to be obtained using the neutron attenuator prototype installed on a high power pulsed fusion neutron source, the Plasma Focus Installation PF1000 at IPPLM, Warsaw, Poland.

All the main components of the neutron attenuator assembly for the gamma-ray cameras (attenuator casings, attenuator support frames and steering and control system) have been manufactured and tested. Mechanical, electrical, pneumatically and hydraulic tests have been performed using a test stand that is a full scale replica of the JET gamma-ray cameras configuration.

*See Appendix of F. Romanelli et al., Proc. 22nd IAEA Fusion Energy Conference, Geneva, Switzerland, 2008