

Neutron emission spectroscopy diagnosis of JET D and DT plasmas with the new MPRu instrument

E.Andersson Sundén¹, S.Conroy¹, G.Ericsson¹, M.Gatu Johnson¹, L.Giacomelli¹, C.Hellesen¹, A.Hjalmarsson¹, J.Källne¹, E.Ronchi¹, H.Sjöstrand¹, M.Weiszflog¹, G.Gorini², M.Tardocchi², A.Murari³, S.Popovichev⁴, J.Sousa⁵, R.C.Pereira⁵, A.Combo⁵, N.Cruz⁵, and JET EFDA contributors^{*}.

¹ INF, Uppsala University, EURATOM-VR Association, Uppsala, Sweden

² Istituto di Fisica del Plasma, EURATOM-ENEA-CNR Association, Milan, Italy

³ EURATOM-ENEA-CNR Association, Padova, Italy

⁴ JET, Culham Science Centre, ABINGDON, UK, EURATOM-UKAEA Association

⁵ Associação EURATOM/IST, Centro de Fusão Nuclear, Instituto Superior Técnico, Av. Rovisco Pais 1, 1049-001 Lisboa, Portugal.

From 2006 two new neutron spectrometers at JET will make it possible to perform advanced neutron emission spectroscopy (NES) diagnosis of most plasmas produced in either deuterium (D) or mixed deuterium-tritium (DT). One of the spectrometers, MPRu, is an upgrade of the magnetic proton recoil (MPR) neutron spectrometer. MPRu will allow diagnosis of the 2.5-MeV neutrons in D operations in addition to its improved 14-MeV neutron measurements in DT plasmas. NES diagnosis of JET D plasmas can now be performed with two spectrometers with complementary capabilities and functions (see TOFOR contribution, M.Weiszflog, these proceedings).

In this contribution the principles of the MPRu will be presented. The MPRu offers a significant enhancement in the immunity to background. The importance of this improvement for extending its use to NES diagnosis of D plasmas will be discussed. A new High Immunity to Background (HIB) detector system has been designed and built, based on pulse-shape discrimination using phoswich scintillators. Examples of results will be taken from the TTE campaign and the MPRu test and commissioning phase. Of special interest is the complementary use of the MPRu, with its high calibration accuracy, and the new TOFOR with its data of high statistical accuracy. The NES results with the MPRu on JET will be projected to ITER conditions, where the diagnostic capabilities will increase in proportion to the fusion power.

^{*} See the Appendix of J.Pamela et al., Fusion Energy 2004 (Proc. 20th Int. Conf. Vilamoura, 2004) IAEA, Vienna (2004)