1C22

Diagnostic Issues for the Burning Plasma Experiment Ignitor*

F. Bombarda

ENEA – UTS Fusione, Progetto Ignitor, Frascati (Italy)

The main goal of the Ignitor experiment[1] is to reach ignition in a toroidal magnetically confined plasma in order to investigate plasma heating, transport process and stability of fusion generated alpha-particles, and to identify methods for control, heating and fueling of high density burning plasmas, for a duration (~ 4 s) that exceeds all the relevant intrinsic physical time scales. The strategy is to use a compact, high field device (R_0 1.32 m, a 0.47 m, κ 1.8, B_T 13 T, I_p 11 MA) to reach ignition at high density (10^{21} m^{-3}) and low temperature (11 keV). The deployment, use and maintenance of the compact, radiation-hard diagnostic systems being selected for Ignitor will provide a very useful experience for future fusion reactors, and in this respect the contribution of the physics-oriented Ignitor experiment will be uniquely valuable.

The range of plasma parameters to be measured and the required spatial and time resolutions are shown to be within the range of present day diagnostics capabilities. However, the high radiation background fluxes[2] and the compact size of the machine do represent significant challenges for diagnostics. Fluences are not expected to be a problem for Ignitor, but the port geometry will require remote handling installation and maintenance of all the in-vessel components irrespective of the activation conditions.

The high value of the plasma density in general limits the applicability of certain types of diagnostics, for example those relying on neutral beams (either heating or diagnostic beams). However, the same parameters can be measured by alternative methods. The absence of a separate divertor chamber greatly simplifies the diagnostic requirements at the edge.

The basic diagnostics chosen for Ignitor are generally conventional and of proven reliability, but more advanced ones are also considered. In the case of the neutron diagnostics, which will be fundamental to document the physics mission of the experiment, Ignitor has motivated the proposal of new diagnostic concepts[3] that have been built and tested on existing experiments[4]. A similar effort will be needed to develop new diagnostic techniques to measure the characteristics of the charged fusion products directly.

*Work supported in part by ENEA of Italy and the US DOE.

[1] B. Coppi, A. Airoldi, F. Bombarda, et al., *Nucl. Fusion* **41**, 1253 (2001).
[2] S. Rollet, P. Batistoni, R. Forrest, *Fus, Eng. & Des.* **51-52**, 599 (2000).
[3] G. Gorini and J. Källne, *Il Nuovo Cimento* **14D**, 1115 (1992).
[4] J. Källne and H. Enge, *Nucl. Instrum. Methods* **A311**, 595 (1992).