SESSION FT1

Tuesday, 20 October 1998, at 2 p.m.

Chairman: R.W. Conn (United States of America)

FUSION TECHNOLOGY 1

Paper IAEA-CN-69/FT1/1 (presented by G.S. Lee)

DISCUSSION

K. HANADA: Current drive is very important in the steady-state condition. What is the current drive scenario in KSTAR?

G.S. LEE: The main current drive of the central plasma will use tangential NBI and FWCD. LHCD will be used for tailoring the edge current profile. ECCD may also be utilized, provided there is experimental demonstration of current drive efficiency on existing tokamaks.

K.N. SATO: One of the key issues for the superconducting tokamak approach will be the choice of the aspect ratio. I understand that the aspect ratio chosen for KSTAR is 3.6. Is this definite or might it still be subject to change?

G.S. LEE: The design parameters are now fixed for fabrication. While the importance of the aspect ratio in tokamak design needs to be acknowledged, it is not the most important parameter. KSTAR represents the most compact design possible using superconducting solenoids.

Papers IAEA-CN-69/FTP/04-06 (rapporteured by Y.K.M. Peng)

DISCUSSION

B. COPPI: What are the main unknowns when devising an ignition experiment based on the ST concept?

Y.K.M PENG: Despite the very encouraging results from START, and attractive projections based on tokamak understanding to future ST devices, much awaits experimental verification by the upcoming generation of ST experiments (NSTX, MAST, Pegasus, Globus-M, ETE - Experimento Tokamak Esferico) and upgrades (CDX-U, HIT-II). These cover the entire range of physics topics identified in the paper. On the technology side, uncertainties exist regarding the centre leg of the TF coils and, to a significant degree, also for plasma and power fluxes on the divertor/limiter, unless large dispersion of these fluxes can be effected.

M. KATSURAI: The beta values referred to are values defined by the plasma pressure divided by the magnetic pressure, where the magnetic field corresponds to B_{to}, namely the toroidal field at the magnetic axis produced by the external toroidal field coil. However, since STs have strong paramagnetism, the net toroidal field at the magnetic axis is much larger than B_{to}, and the actual beta value defined by the plasma pressure divided by the net toroidal field pressure might be much smaller. How small are the net beta values for the conceptual ST reactors?

Y.K.M. PENG: It is quite correct to point out that the externally applied toroidal field can be significantly below the net toroidal field in an ST plasma; and that the average toroidal beta and average beta (defined by Troyon in his paper on "Troyon" scaling) can be significantly different. For $A \sim 1.4$, $\kappa \sim 2$, the former can be about twice that of the latter (when the average magnetic field in plasma also has to include the relatively comparable poloidal field in ST plasmas). Note here that the average toroidal beta (β_t) is defined relative to the applied toroidal field at the plasma major radius (R_o), not the major radius for the magnetic axis (R_{axis}); $R_{axis} > R_o$ by a significant amount.

The use of average toroidal beta is convenient for determining plasma pressure, an important parameter for estimating ST plasma performance. The average magnetic field in a ST is subject to many variations in plasma conditions, rendering the average beta less convenient for this purpose. Nevertheless, average beta is important in physics discussion.

Papers IAEA-CN-69/FTP/01-03 (rapporteured by H. Wobig)

DISCUSSION

B. COPPI: What is the value of the auxiliary heating system and what is the corresponding energy confinement time?

H. WOBIG: The effective heating power (α-particle heating minus bremsstrahlung) is about 600 MeV. The corresponding confinement time is about 1.7 s.

R.J. GOLDSTON: The United States stellarator power plant study concluded very firmly that the closest distance between the plasma edge and the centre of the coils must exceed 1.98 m. How do the designs reported here compare with that criterion, and how valid do you consider that criterion to be?

H. WOBIG: In the Helias reactor, this distance is about 1.8 m, which should be sufficient to accommodate blanket and shield. In the case of FFHR-2, this distance is much smaller. Calculations are in progress to optimize blanket and shield and to make maximum use of this geometry.

Papers IAEA-CN-69/FTP/23-24 (rapporteured by K. Sakamato)

There was no discussion.

Paper IAEA-CN-69/FT1/5 (presented by P. Massmann)

There was no discussion.