

Current Drive in the Advanced Scenarios

1.) Our modeling with the ACCOME code indicates that the lower hybrid current drive efficiency ($\gamma=0.3$) assumed by ITER is too high, and therefore their goal of steady state operation at 9.0 MA with 52% bootstrap current, using 30 MW of NBI-CD and 30 MW of LHCD is not likely to be achieved. Our estimate indicates a total current of 7.6MA for the proposed AT scenario, including 59 % bootstrap current. Higher lower hybrid power, or a higher H-factor to maintain the beta, could make up for this deficiency. The projected 30 MW of negative NBI power at 1.0 MeV in ITER is sufficient to drive the required central seed current (2.0 MA) for AT operation (this could be replaced by a comparable amount of FWCD power since the current drive efficiencies are very similar). It should be noted that a desirable AT scenario should achieve at least 70% bootstrap current fraction at a $\beta_n = 3$ even without a conducting wall (beta limit) as an interim step toward DEMO-like requirements (80-90% bootstrap current fraction with reasonably low q_{ψ} to provide satisfactory confinement).

2.) In FIRE, at 8.5 T a desirable AT scenario (beta normal above 3, bootstrap fraction above 0.7, reversed shear) is obtained with 20 MW of LH power and up to 24 MW of ICRF power for on-axis current drive. LHCD modeling using the new AT reference parameters at 6.5 T was also carried out and owing to the relatively higher value of n/B^2 , a LH power of 30 MW is required to achieve the above AT parameters. q_{95} values of 3.5 are achieved in both cases.

3.) The present studies indicate that a frequency of order 5 GHz is sufficient to avoid alpha absorption of LH waves in both ITER and FIRE.