Table 2. Dimensional [engineering] Parameters of Burning Plasma Experiments [Q=10 case]

Parameters	Symbol	Unit	IGNITOR	FIRE	ITER
Major/minor radius:	R/a	m/m	1.32/0.47	2.14/0.595	6.2/2.0
Elongation (X-point/95%flux)	κ_x/κ_{95}		κ_a= 1.83	2.0/1.81	1.85/1.70
Triangularity (X-point/95%flux)	δ_x/δ_{95}		δ_a= 0.4	0.7/0.4	0.49/0.33
Plasma volume	V_p	m^3	10	26	837
Plasma surface area	A_p	m^2	34	67	678
Configuration		—	Extended limiter	DN divertor	SN divertor
Number of toroidal field coils	N	—	24	16	18
Toroidal magnetic field ripple	$\delta B/B$	%	<1.5	0.3	0.5
Toroidal magnetic field	B (at $R = R_O$)	T	13	10	5.3
Plasma current	I	MA	11	7.7	15(17.4)
Kink safety factor	q^*		1.81	1.94	1.94(1.68)
Safety factor (95% flux or edge)	$q_\psi(95\%)$		q_a=3.5	3.05	3.0(2.6)
Ion temperature	$T_i(0)$	keV	10.5	11	19
Ion temp. /Electron temp.	T_i / T_e		~1	~ 1	~ 1
Temperature profile peaking	$T(0)/\langle T\rangle_n$		2	1.7	1.7
Electron density	$n_{e20}(0)$	$10^{20}\ m^{-3}$	10	5.5	1.0
Density profile peaking	$n_e(0)/\langle n_e\rangle$		2	1.2	1.1
Line average density/Greenwald	$\langle n\rangle_l/n_G$		0.4	0.7	0.85
Plasma Energy (inc. alphas)	W_p	MJ	12	38	320
Required energy confinement time	τ_E	s	0.6	1.0	3.7
Fusion triple product (core)	$T_i(0)n_{i20}(0)\tau_E$	$10^{20}\ keV\ m^{-3}\ s$	63	52	74
Fusion triple product - $p\tau$	$p(0)\tau_E$	$atm\text{-}sec$	10	8.3	12
Fusion Power Gain	$Q = P_f/P_{heat}$		10	10	10
Fusion Power	P_f	MW	100	150	400
Auxiliary Power Installed	P_{aux} or P_{CD}	MW	18-24	20 (30)	73(130)
Pulse length (inductive)	τ_{pulse}	sec	4	20	400
Normalized pulse length (upgrades/second phase)	τ_{pulse}/τ_{CR}		1.1	1.5	2

The parameters for ITER and FIRE are typical values calculated using a *0-D* steady state power balance with alpha heating and alpha ash buildup calculated self-consistently for a $Q = 10$ scenario. In this model, the required confinement time is determined from the power balance and is then compared with empirical scalings derived from the International Confinement Data Base as described in the ITER Physics Basis, Nuclear Fusion Vol. **39**, no. 12, p 2208, 1999. The parameters for IGNITOR were calculated using a 1-D JETTO code for an ohmically heated case.

Table 3. Dimensionless Parameters Describing Physics Performance in Burning Plasmas

Parameters	Symbol	Unit	IGNITOR	FIRE	ITER
Base Burning Plasma Mode [*Q=10 case*]					
Normalized collisionality ν^* @ *a/2*			0.043	0.058	0.045
Normalized size (a/ρ_i)	$1/\rho^*$		390	352	483
Normalized pressure (beta tor.)	β_{tor}	%	1.2	2.4	2.6
Normalized pressure (beta pol.)	β_{pol}		0.2	0.72	0.62
Normalized beta $\beta_{tor}/(I/aB)$	β_N	%	0.7	1.84	1.81
Normalized density	$\langle n \rangle_l / n_G$		0.4	0.7	0.85
Confinement relative to L-Mode	*H89-P*		1.5	2.6	2.0
Confinement relative to H-Mode	*H(y,2)-IPB98*		0.6	1.1	0.99
Loss power / H-mode threshold	P_{loss}/P_{L-H}		NA	1.3	2.4
Helium Ash pumping			No	Yes	Yes
Effective Helium Ash confinement	τ_{He} / τ_E		>5	5	5
Impurity content	Z_{eff}		1.2	1.41	1.7
(Alpha /Total) plasma heating	f_α		0.67	0.67	0.67
Alpha heating/power losses	P_α/P_{losses}		1	0.67	0.67
Alpha beta	β_α	%	0.05	0.15	0.34
Alpha instability driving term	$R\nabla\beta_\alpha$		0.02	0.039	0.077
Normalized alpha particle velocity	$v_\alpha/v_{Alfvén}$		1.6	2	1.6
Advanced Tokamak (AT) Mode(*)			Reverse shear	AT	AT
Toroidal magnetic field	*B (at $R=R_o$)*	*T*	12	8.5	5.3
Plasma current	*I*	*MA*	7	5.5	9.1
Safety factor (at 95% flux)	$q_\psi(95\%)$, q_{95}		4.9	3.6	5.0
Minimum *q*	q_{min}		1.5	2.2	3.0
Minor radius corresponding to q_{min}	r_{min} / a		0.4	0.8	0.7
Current drive	*LH/ECH/ICH*	*MW*	0	(LH: 20)	40/20/00
(Bootstrap/Total) current	f_B		~ 0.2	0.64	0.4
Normalized beta	β_N		1.1	3.0	2.8
Res. wall mode number stabilized	*n (mode num)*		None	1	1
Confinement relative to H-mode	*H(y,2)-IPB98*	*T*	1.1	1.6	1.4
Fusion gain	$Q = P_f/P_{heat}$		~ 7.5	7.5	5.0
Pulse length	τ_{pulse}	*sec*	~ 5	35	>3000
Normalized pulse time	τ_{pulse} / τ_{CR}		~ 1	~ 1.5	>10

(*) AT mode parameters are examples of some representative cases that are available at this time. These are under active development by all teams. Some values supplied by the panel.