

Waveform-feedback-physics events

S. C. Jardin

PPPL

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Waveform Categories:

1. Basis plasma parameters
2. Coil currents
3. Heating and current drive
4. Control parameters
5. Misc. and special purpose

Category 1 of 5: Basic plasma parameters

Time Dependent Prescribed Quantity	Symbol	Fortran
• Total Plasma Current	$I_p^0(t)$	apld0
• Central Plasma Pressure (prescribed)	$P_0(t)$	p0
• Central Plasma Normalized Density (prescribed)	$\hat{n}_0(t)$	r0
• Preprogrammed loop Voltage	$V_L^0(t)$	vloopp
• Enhanced Electron Transport Multiplier	$f_{\chi_e}^0(t)$	fbchiex
• Enhanced Ion Transport Multiplier	$f_{\chi_i}^0(t)$	fbchiix

Category 2 of 5: Coil Currents

Time Dependent Prescribed Quantity	Symbol	Fortran
• Preprogrammed coil group voltage	$V_N^{G0}(t)$	gvolt0(igr)
• Preprogrammed coil group current	$I_N^{G0}(t)$	gcur(igr)
• Toroidal Field Magnet Current	$RB_B^0(t)$	g0

Category 3 of 5: Heating and Current Drive

Time Dependent Prescribed Quantity	Symbol	Fortran
• Neutral Beam Power	$P_{NB}(t)$	beamp
• ICRH Heating Power	$P_{IC}(t)$	picrh
• LHCD Heating Power	$P_{LH}(t)$	plhamp
• ECRH Heating Power	$P_{EC}(t)$	pecamp

(note: there should be simplified models also available)

Category 4 of 5: Shape control parameters

Time Dependent Prescribed Quantity	Symbol	Fortran
• Nominal R position of Magnetic Axis	$R_A^0(t)$	xmagw
• Nominal Z position of Magnetic Axis	$Z_A^0(t)$	zmagw
• Preprogrammed Major Radius	$R_0^0(t)$	rzerw
• Preprogrammed Minor Radius	$a^0(t)$	azerw
• Preprogrammed Plasma Ellipticity	$\kappa^0(t)$	ezerw
• Preprogrammed Plasma Triangularity	$\delta^0(t)$	dzerw
• Preprogrammed Plasma (R) Point	$R_i(t)$	xcon0
• Preprogrammed Plasma (Z) Point	$Z_i(t)$	zcon0

Category 5 of 5: Misc. and special purpose

Time Dependent Prescribed Quantity	Symbol	Fortran
• Vacuum Temperature	$T_{vac}^0(t)$	tevv
• Halo Temperature	$T_H(t)$	thalos
• Halo Density		
• Halo Width	$W_H(t)$	whalos
• Helium Ash Confinement Time	$\tau_{He}(t)$	heact
• TSC Mass Enhancement	$F_M^0(t)$	ffac
• Preprogrammed Z-effective	$Z_{EFF}^0(t)$	zeff
• First exponent for Plasma Density	$\alpha_r^0(t)$	alphar
• Second exponent for Plasma Density	$\beta_r^0(t)$	betar
• Fraction of Beam Parallel to B for CD	$f_{\parallel}^B(t)$	fracpar
• Impurity concentrations	$n_{Z_i}(t)$	
• Pedestal Parameters (chi-values)		

Feedback Systems

1. Plasma Current Feedback:

$$V_{OH} = \alpha [I_P^0(t) - I_P]$$

2. Feedback on desired coil currents to control plasma shape parameters and vertical position.

$$I_i^{FB(j)} = \sum_{j=1}^{NFB} a_{i,j,k,l} (\psi_k - \psi_l)$$

3. Burn Control feedback via auxiliary power

$$P < P_{MAX}^0 - P_\alpha - P_{OHMIC}$$

4. Voltage feedback system for coil groups

$$V_i = f_p [I_i^0(t) + I_i^{FB} - I_i]$$