

First Plasma Scenario Development for HL-2M

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HL-2M tokamak is now under construction in China as a modification to the HL-2A facility, with nominal parameters as follows: $I_p=1.5-3.0\text{MA}$, $B=2.2\text{T}$, major radius= 1.78m, minor radius=0.65m, elongation =1.6-1.8, triangularity >0.5 . It is a real challenge to build a new machine in fusion community, HL-2M suffers from a long delay for the first plasma. In order to fulfil the requirement of engineering and government qualification of the machine in a short time, two first plasma scenarios for HL-2M are designed with a powerful plasma scenario design tool based on Matlab.

The two scenarios, one for circular limited configuration and one for larger aspect ratio and lower elongation divertor configuration, are compatible with the magnetic diagnostic system and power supply system, which are not fully equipped and well tested. The PF current and voltage waveform for these two scenarios have been calculated with the plasma scenario design tool through a plasma resistive model which can estimate the resistive flux consumption. The key parameters for these two scenarios are as follows: toroidal field 1.4T, plasma current 200 kA with 1000 microsecond flat top. For the sake of simplicity and safety in first plasma campaign, only small parts of PF coils are used in the plasma discharge, no initial magnetization is exploited, no PF current zero-crossing is allowed, no vertical displacement event is allowed. To facilitate obtaining the plasma, two gyrotrons of 68GHz with 500kW each are exploited for preionization and assisted startup. The vacuum vessel baking temperature will reach to 300 Celsius degree during machine conditioning.

In this paper, the geometric parameters of PF and CS, together with that of TF coils and Vacuum Vessel (VV). Also presented are an original matlab-based tool for tokamak modeling and plasma scenario development. With this tool, the current waveforms and voltage waveforms of CS and PF coils are calculated by a given plasma resistance model.

The parameters of CS and PF coils presented here can provide reference for later plasma scenario design for HL-2M; the ideas for simple and safe first plasma scenarios can apply to other new machine in its first plasma campaign.

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