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Preparations for the control of HL-2M first plasma campaign

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This work mainly describes the progress and preparations for first plasma control in HL-2M, a medium-size copper tokamak currently under construction in China, with 16 poloidal field coils and one central solenoid (CS) coil (or Ohmic coil). Significant progress has been made in plasma control system (PCS), first plasma scenario. The proposed framework of PCS is consisted of plasma discharge scheduling platform, feedback control system, timing control system and central interlock system. The discharge scheduling platform has been completed and tested successfully by experiments, it incorporates a platform for the preset of discharge parameters which is based on eXtensible Markup Language (XML) and contains a software tools for preprogrammed discharge waveform based on MATLAB. The most frequently used RZIP control algorithm for first plasma campaign has been developed and preliminary results have been obtained, further development and verification of feedback control algorithm is on the way. Plasma shape and position feedback control in HL-2M is achieved by implementing control algorithm in RT-LabView with 1ms control cycle to adjust the current of control actuators (16 poloidal field coils), plasma current is sustained via the control of CS current. Device protection strategy, detection and response to off-normal events have been identified and implemented in the newly developed central interlock system (CIS) based on WinCC and PLC, both hardware and software of CIS is ready for first plasma campaign, integrated system test is required in the future. Timing control system generates the trigger according to the desired sequential defined in the timing XML, 96 output channels of 5V TTL trigger are provided for subsystem by Field — Programmable Gate Array (FPGA). In order to minimize the risks and difficulties of first plasma control, only small parts of PF coils are used in first plasma campaign. Two scenarios including one limiter and one divertor configuration, for first plasma are designed by using a MATLAB-based tool for tokamak modeling and plasma scenario development. Initial magnetization is not exploited, zero-crossing of PF current is not allowed and no VDE is expected in these two scenarios.

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