Fusion Engineering and Design 89 (2014) 572–575

Contents lists available at ScienceDirect

Fusion Engineering and Design

journal homepage: www.elsevier.com/locate/fusengdes

A web application for poloidal field analysis on HL-2M

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HIGHLIGHTS

- An original way to develop web application with a new framework (jQuery + PHP + Matlab) is introduced.
- A convenient but powerful application for electromagnetic calculation is implemented.
- The web application can run in any popular browser, on any hardware and in any operating system.
- No any plugin is needed; no any maintenance is required.

ARTICLE INFO

Article history:
Received 25 May 2013
Received in revised form
13 December 2013
Accepted 18 December 2013
Available online 31 January 2014

Keywords:
HL-2M
jQuery
PHP
Matlab
Web application
PF coils

ABSTRACT

Recently, many web tools [1–3] in fusion society have been designed and demonstrated, which has been proved to be powerful and convenient to fusion researchers. Many physicists and engineers need a tool to compute the poloidal magnetic field for some purposes (for example, the calibration of magnetic probes for EFIT, the field null structure analysis for control, the design of some plasma diagnostic systems), so to develop a powerful and convenient web application for the calculation of magnetic field and magnetic flux produced by PF coils is very important. In this paper, a web application tool for poloidal field analysis on HL-2M with a totally original framework is presented. This web application is full of dynamic and interactive interface, and can run in any popular browser (IE, safari, firefox, opera), on any hardware (smart phone, PC, ipad, Mac) and operating system (ios, android, windows, linux, Mac OS). No any plugins is needed. The three layers (jQuery + PHP + Matlab) of this framework are introduced. The front top client layer is developed by jQuery code. The middle layer, which plays a role of a bridge to connect the server and client through socket communication, is developed by PHP code. The behind server layer is developed by Matlab, which compute the magnetic field or magnetic flux through a Special Function called Complete Elliptic Integral, and returns the results in the client favorite way, either by table or by JPG image. The field null structure and the vertical and radial field structure calculated by this tool are introduced with details. The idea to design a web tool with jQuery + PHP + Matlab framework may apply to other machines. The address for this application is http://dp.swip.ac.cn/hl2m.

1. Introduction

HL-2M, the modification of HL-2A, is a magnetic confinement fusion device under construction in China, the electromagnetic field analysis involved is very important during its design and operation phase. It is involved with the design of supporting structures against electromagnetic forces, the design of vacuum vessel, the design and reconstruction of plasma shape, the error field calculation, the design of diagnostic systems. There are two professional working groups in the HL-2M design team, which are dedicated to electromagnetic calculation, one is the electromagnetic force calculation group who run ANSYS code. The other is plasma shape design group who run the Fortran EFIT code. In addition, HL-2M control group has developed a Matlab code to calculate the control involved magnetic field and flux. However, general engineers and physicists, who are not familiar with electromagnetic calculation need to perform this calculation from time to time. It is hard for them to use the above mentioned ANSYS code, Fortran code or Matlab code, because the installation and maintenance of these codes are difficult, and the learning curves are also very flat. So, it is very important and urgent to provide a powerful and convenient tool for electromagnetic calculation on HL-2M. In this paper, a powerful and convenient web application for poloidal field analysis on HL-2M is introduced, it is the web version of the Matlab code developed by control group for control involved magnetic field calculation. In Section 2, the framework of this application is introduced; in Section 3, the calculation results for HL-2M field null structures and the vertical and radial field structures are presented; summary and acknowledgements are given in Section 4.

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0920-3796/$ – see front matter © 2014 Published by Elsevier B.V.
http://dx.doi.org/10.1016/j.fusengdes.2013.12.044

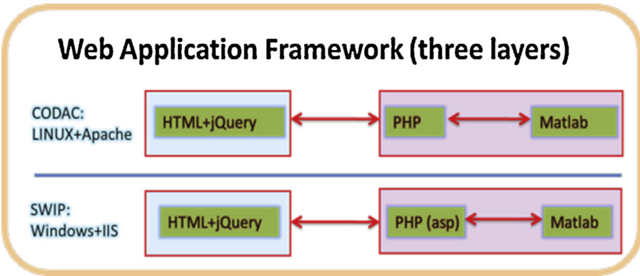

Fig. 1. The framework of web application.

2. The framework of the web application

The framework for this web application consists of three layers. As shown in Fig. 1, the front top client layer is developed by jQuery code, together with HTML element as well as CSS code. The middle layer, which plays a role of a bridge to connect the server and client through socket communication is developed by PHP code. The behind server layer is developed by Matlab, which compute the magnetic field or magnetic flux through a Special Function called Complete Elliptic Integral, and returns the results in the client favorite way, either by tables or by JPG images. More than 95 percent of the codes, including some HTML element preparation codes and XML element manipulation codes, are Matlab codes. Thanks to Matlab powerful debug tools, the codes can be debugged quickly and conveniently. Thanks to the JPG format, which has a small size but clear image, researchers can have a good user experience and forget that the codes are running on a remote server.

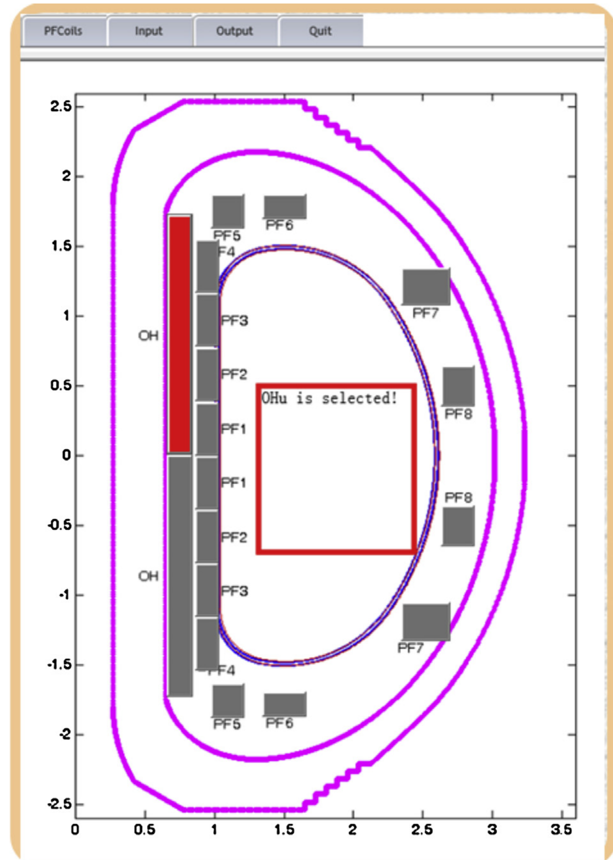

Fig. 2. PF coil selection interface.

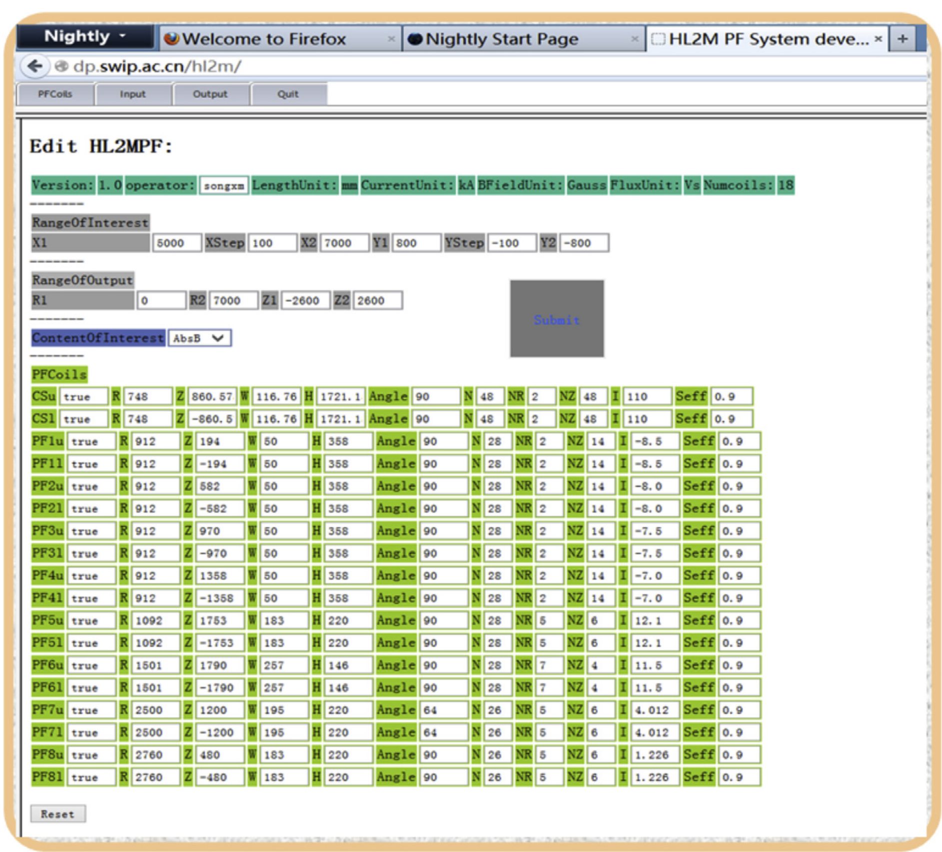

Fig. 3. PF coil parameter input interface.