

No.2020 ICDT-6011 : Special Software Design for Data Acquisition and Experimental Database Management of Electromagnetic Launch System



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•Introduction

Electromagnetic launching system is composed of electromagnetic launching device and large-scale pulse power supply. According to the different test requirements of Pulse Power Supply (PPS) and ELeCtroMagnetic RailGun (EMRG), the special master-slave distributed data acquisition software for electromagnetic launching system is designed by using LabVIEW graphic language. The test host and sub-machine are multi-channel transient data acquisition systems based on PXI bus.

The database management software uses C# programming language to design a friendly human-computer interaction interface, and uses SQL Server software to establish and manage the database, which realizes the comprehensive management of experimental data, tasks and resources involved in electromagnetic launch experiments. The experimental information and experimental data are classified and filed, and the experimental data can be queried, and the experimental results can be analyzed and compared.

The data acquisition and Experimental Data Management Platform (EDMP) software has perfect functions, friendly user interface, convenient operation, good versatility, and can also be used in other experimental occasions.

•Design of master-slave distributed DAQ system

The composition diagram of the PPS system and EMRG diagnosis system is shown in Figure 1, including the following main sensors and instrument equipment: Rogowski coil, B-probe, high-voltage probe, optical fiber isolator and PXI data acquisition system. The test host measures the comprehensive parameters related to the EMRG, Six test sub-machines measure the discharge current of each PFU of the PPS. Optical fiber network is used for communication between test host and test sub-machines.

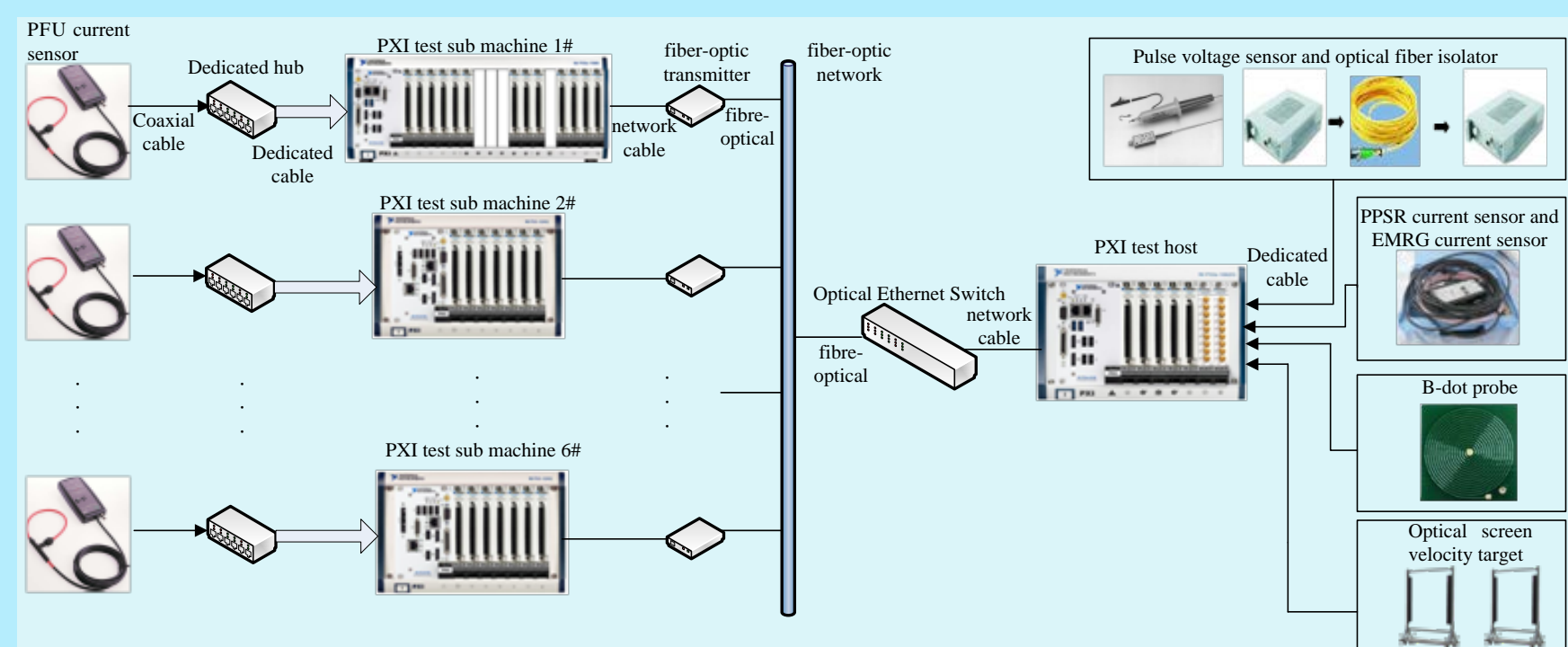


Figure 1. Composition diagram of the PPS and EMRG diagnosis system

The DAQ system adopts PXI bus structure and master-slave distributed architecture design, which is composed of 1 test host and 6 test sub-machines. The test host accesses and controls the operation of 6 sub-machines through remote desktop, as shown in Figure 2. Based on the graphic programming platform of LabVIEW, a special data acquisition and processing test software is designed and developed, which includes the host test software, the sub-machine test software and the data processing software.



Figure 2. Operation interface of test host

Software design of the test host

The test host measures the performance parameters of the EMRG, such as input current, muzzle and breech voltage, magnetic field at B-dot probe, muzzle velocity, and the discharge current and charge discharge voltage signal of the PPS racks. The five page tabs of "Channel setting", "Acquisition setting", "Current and voltage acquisition", "B-dot probe acquisition" and "Velocity measurement acquisition" are used to set various parameters. Click different page tabs, and the content of page parameter setting will change accordingly.



Figure 3. Host test software.

Software design of the test sub-machine

Six test sub-machines measure the discharge current of each Pulse Forming Unit (PFU) of the PPS.



Figure 4. Test sub machine software.

Data processing software design

As shown in Figure 5, the data processing software is mainly composed of six functional areas:

- (1) data file search, display and loading area;
- (2) loading data information display area;
- (3) processing command area;
- (4) curve editing area;
- (5) loading curve list area;
- (6) curve display area.

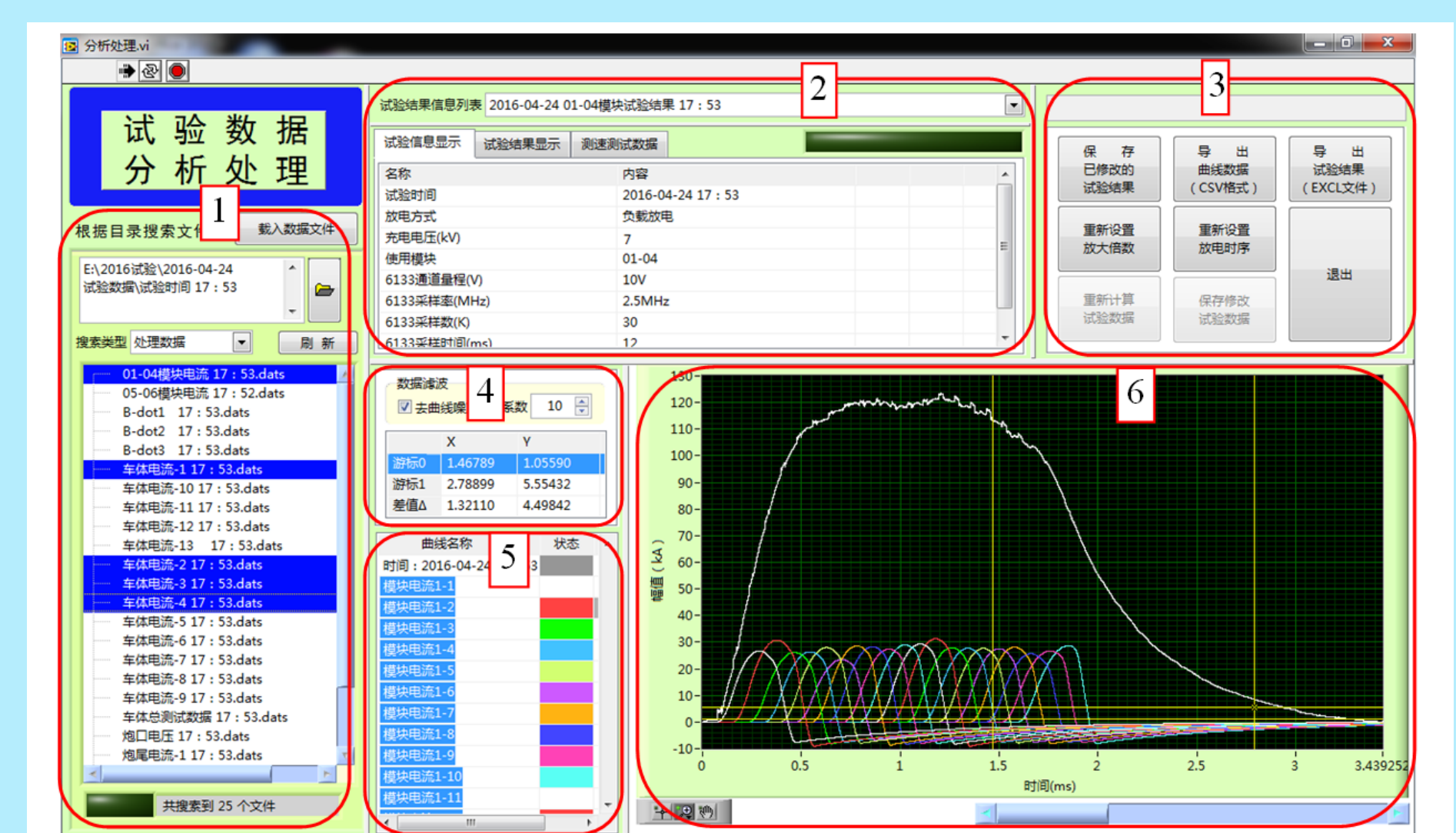


Figure 5. Data processing software.

Design of the EMRG experimental database management platform

The special EDMP for EMRG is designed and developed based on the object-oriented programming idea. It is mainly used to manage all data and information related to EMRG experiments, such as all experimental data (including video, image, etc.), all PFUs parameter information of PPS, experimental project information, researchers and experimenters, equipment information, etc. In particular, the detailed recording of the failure information of the PFU, instrument and equipment in the process of experiment, including failure phenomenon, failure reason and solution, is helpful for the rational allocation of PPS, instrument and equipment and other experimental resources, and prolonging their service life; it is also convenient for later equipment maintenance and experimental data query, analysis and summary, and provides data support for experimental scheme decision.

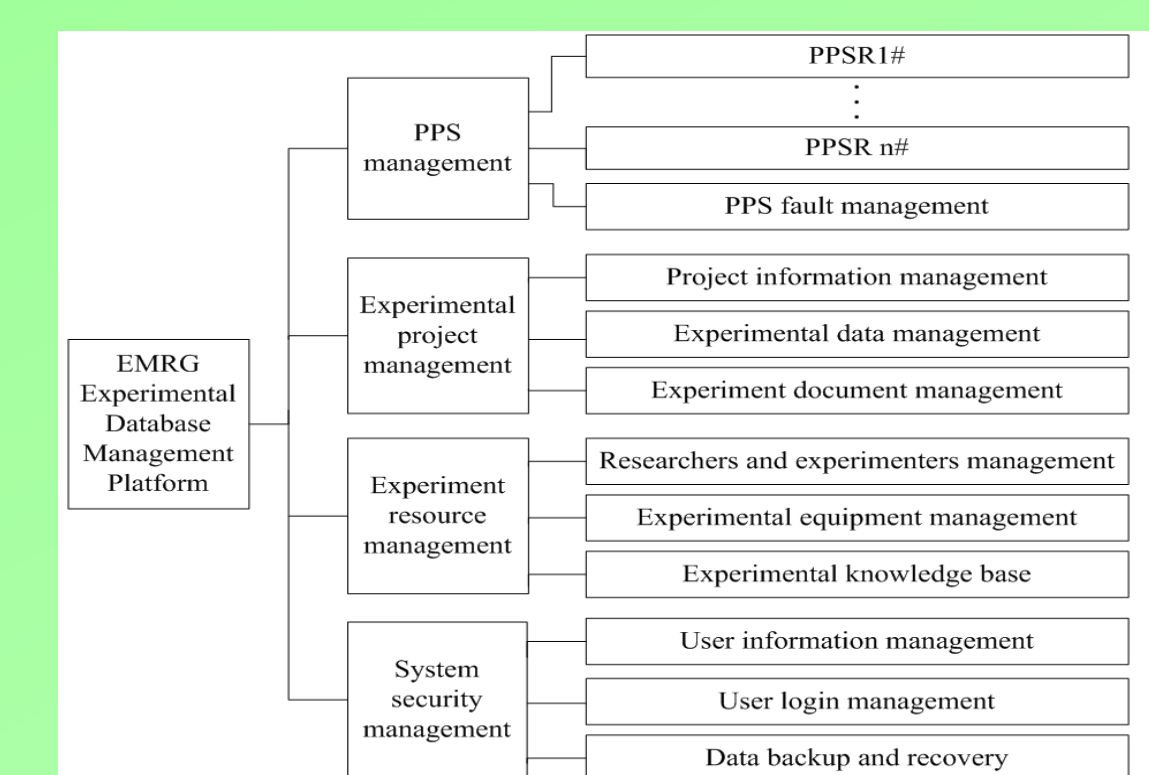


Figure 6. EDMP function structure diagram



Figure 7. User login management.

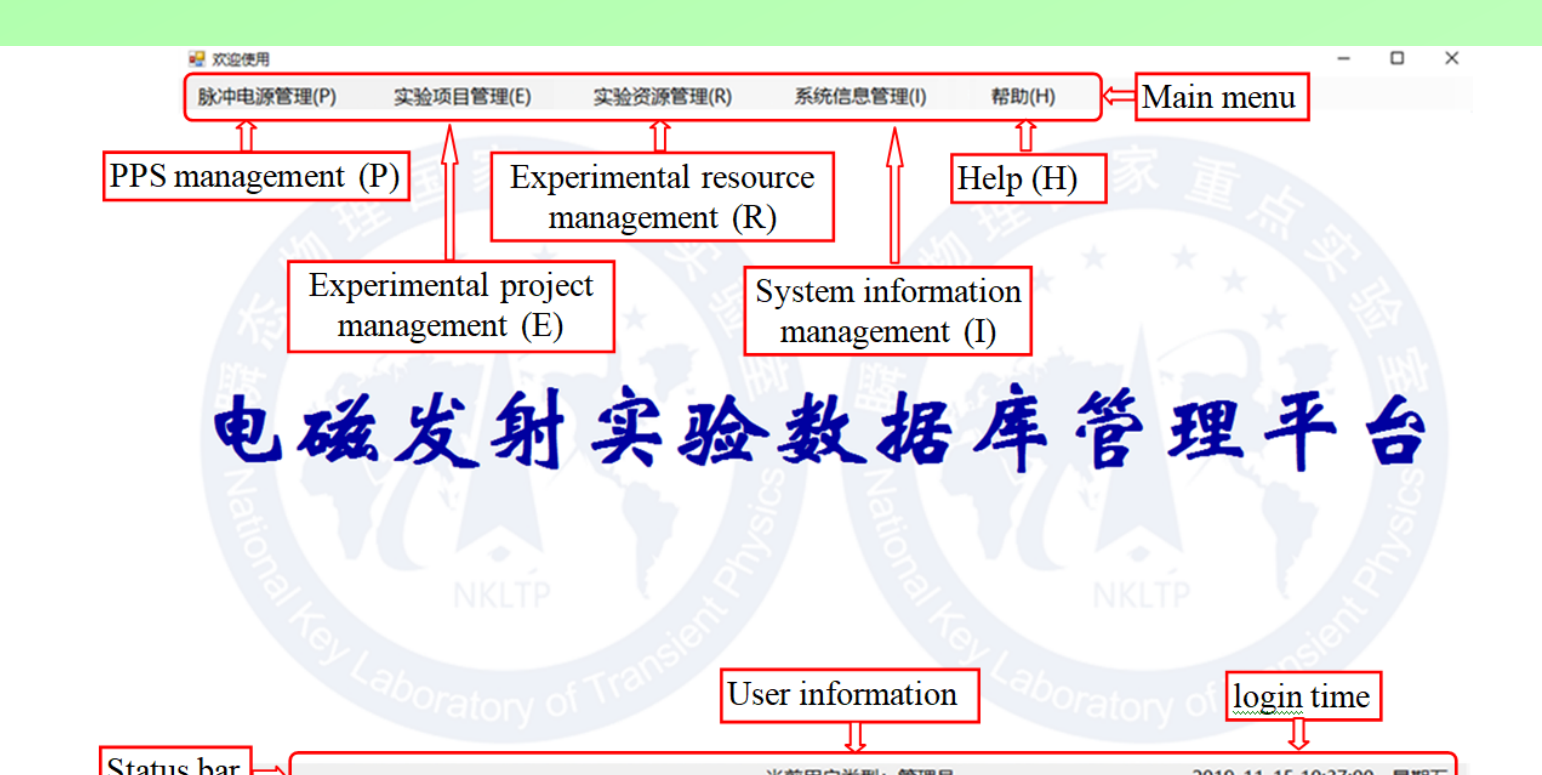


Figure 8. Main menu of operation interface.

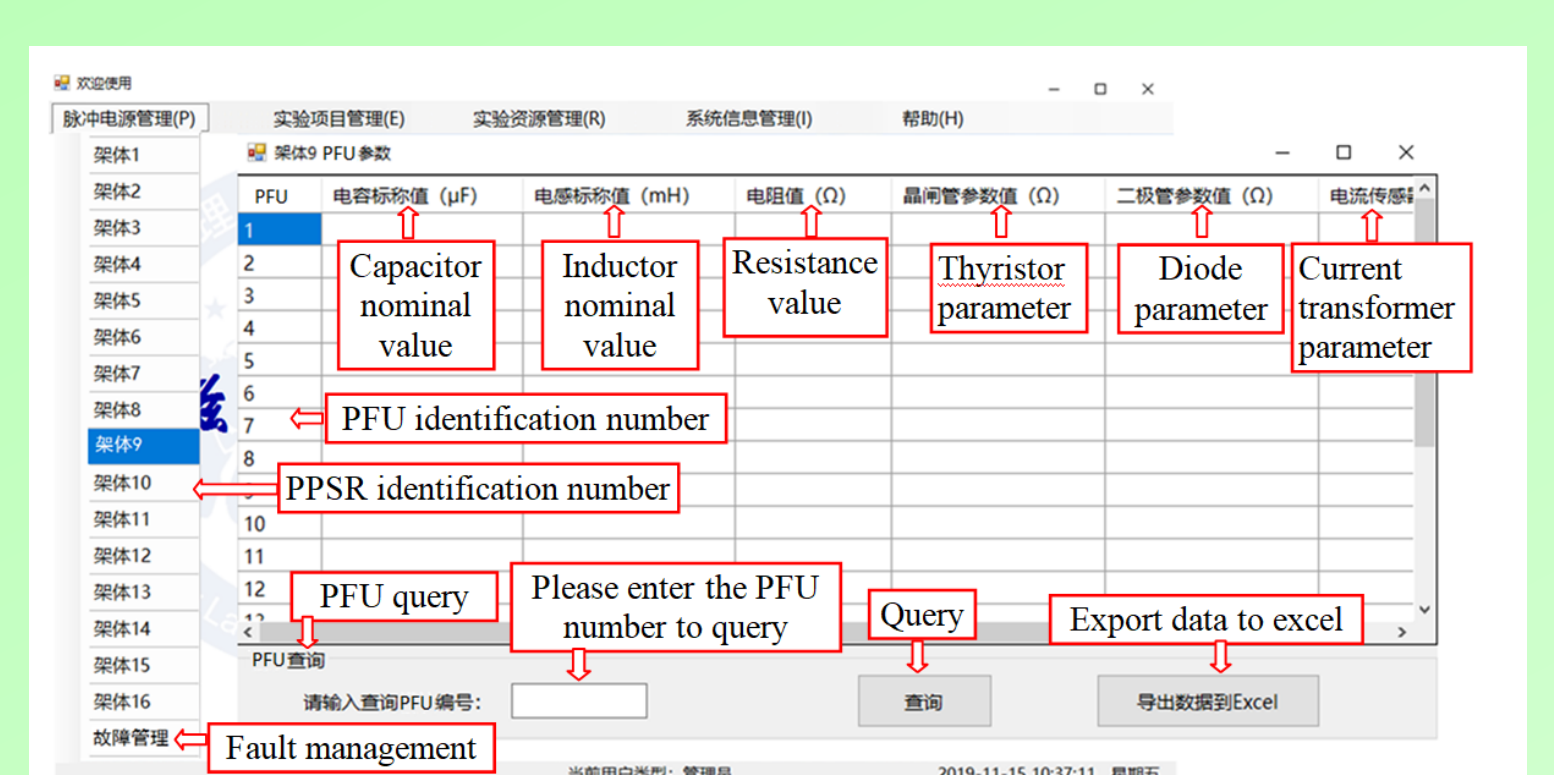


Figure 9. PPS management menu and parameter submenu of PPSR.

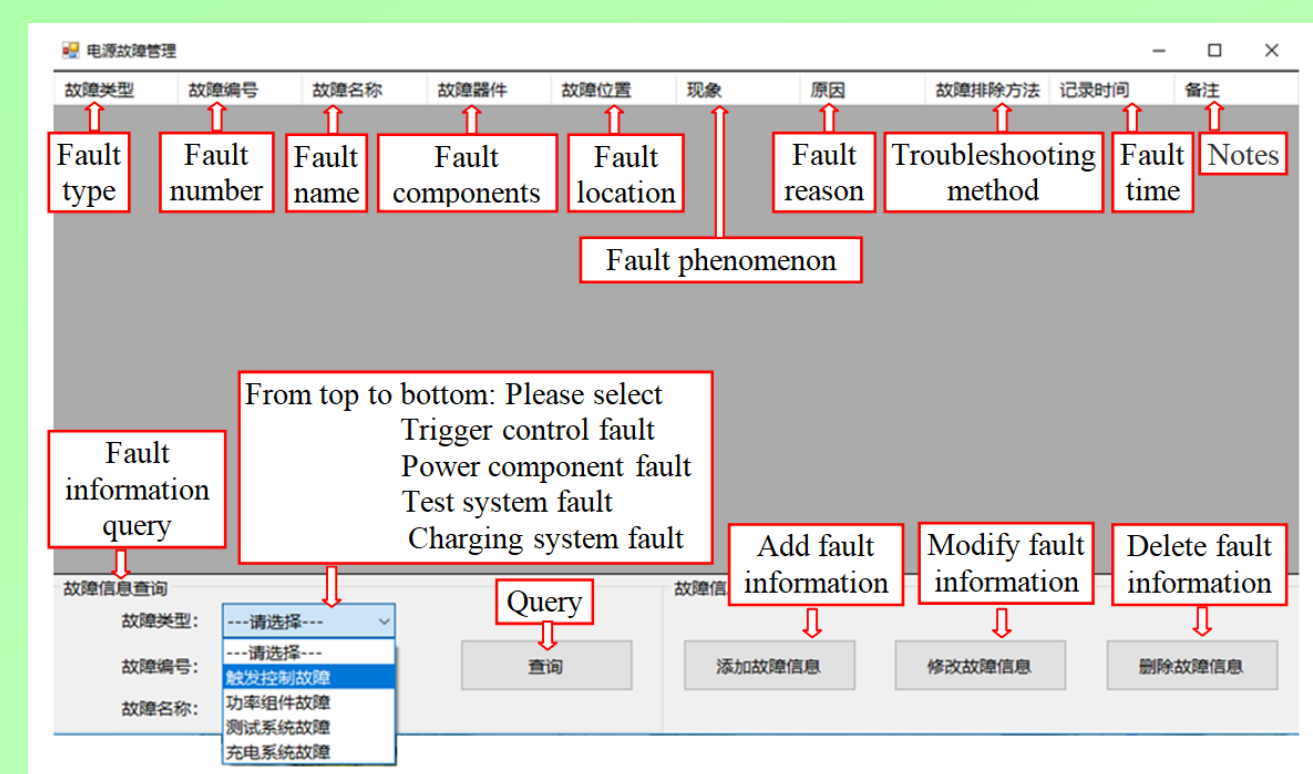


Figure 10. PPS fault management.

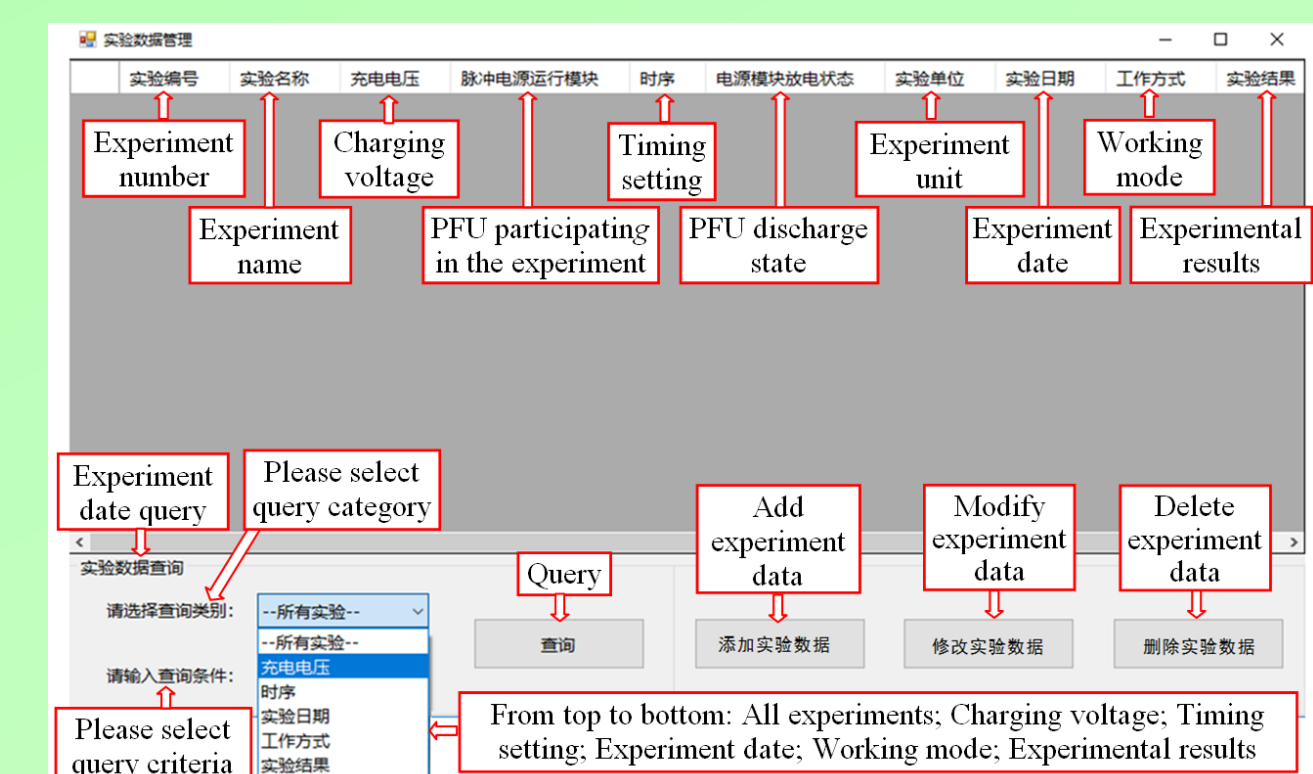


Figure 11. Experimental data management windows.

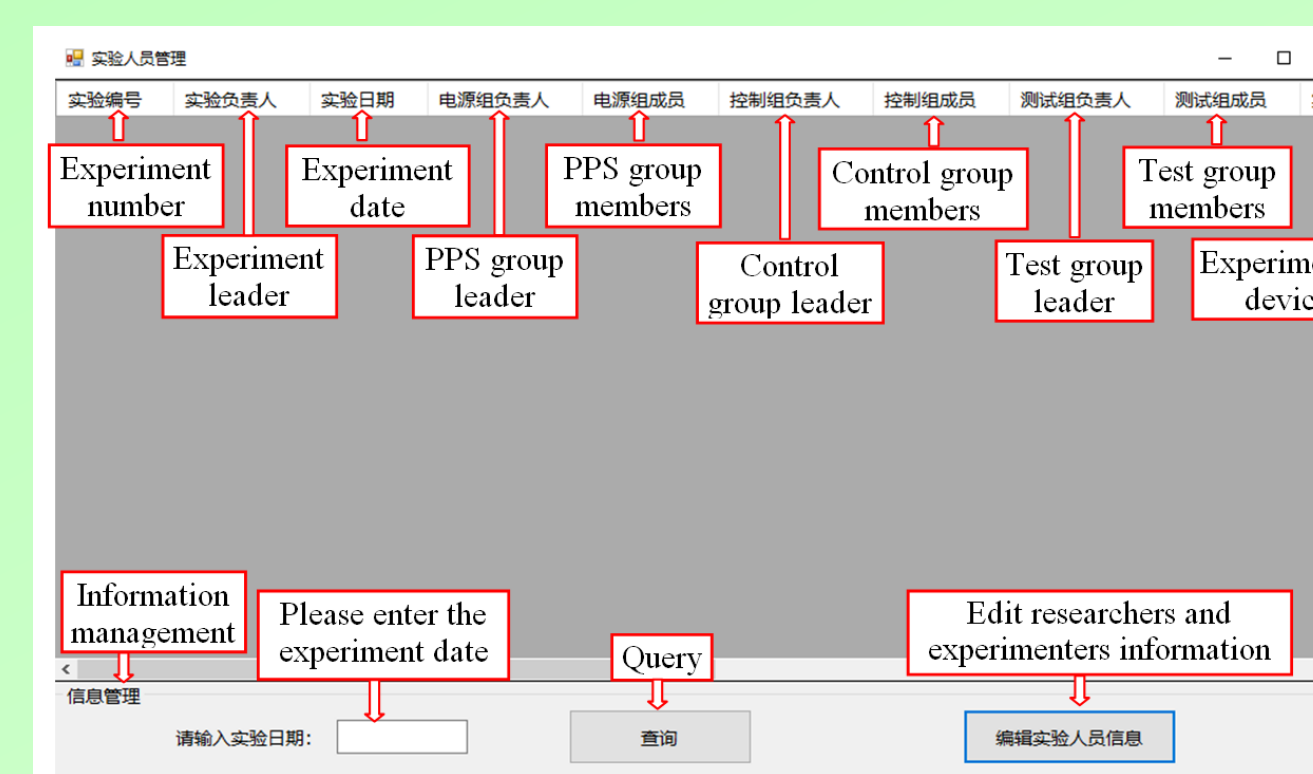


Figure 12. Researchers and experimenters management windows.

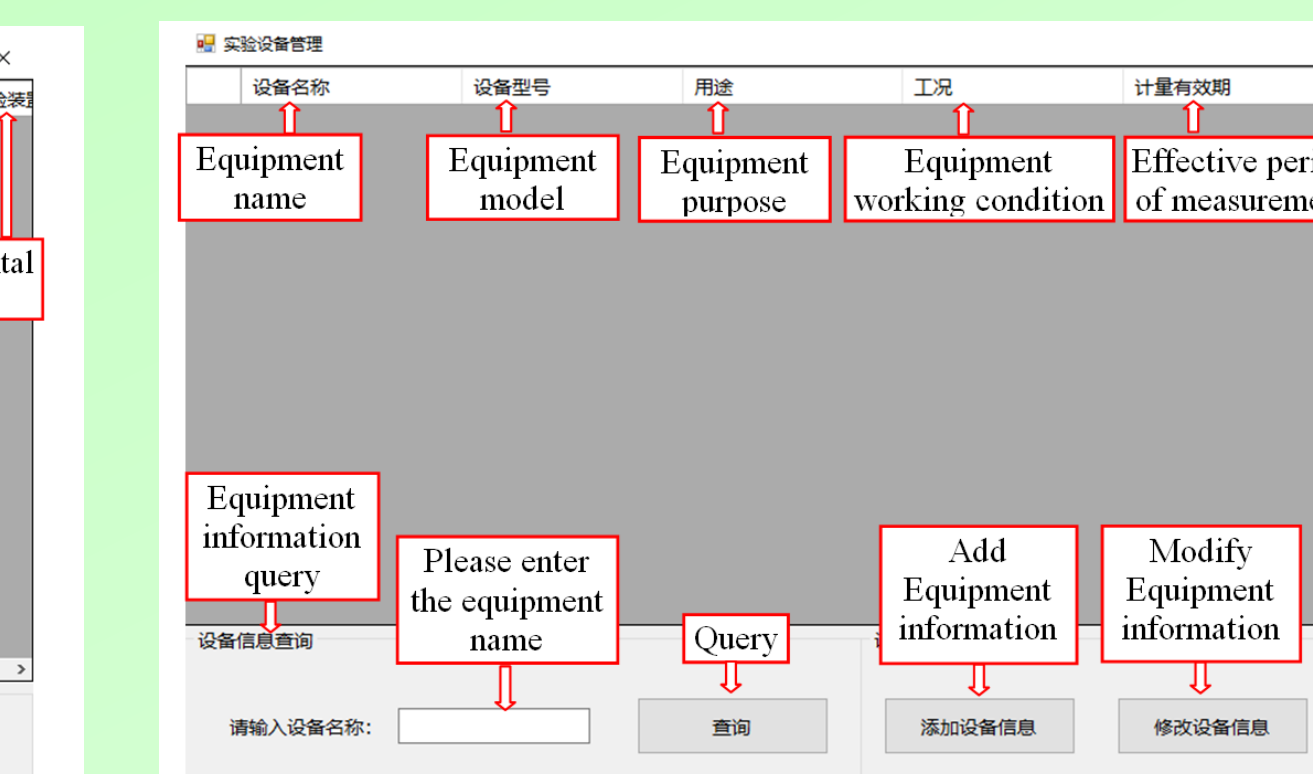


Figure 13. Add experimental device information dialog box.