6 - 4 The Progress of Slow Control System for CEE Project

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The slow control system in the CSR External-target Experiment (CEE) aims to implement the monitoring of the spectrometer status, then further to record the operating parameters and realize the remote control of the different devices. Based on the development carried out last year, the detailed design review was completed in March 2022, and the project summary review is in progress. Joint testing between the slow control and other systems will be completed by October 2023. We will continue to improve and optimize the system functions and performance this year.

The major progresses in 2022 are listed as follows.

(1) Development of IOC and CSS

According to cotrol and monitoring requirements, the IOC package and CSS interface development for each subsystem have been completed. The initial version of slow control monitoring interfaces for each other subsystems has been completed. The remote joint testing with some subsystems and on-site joint testing with iTOF, DAQ, and other subsystems have been realized. The monitoring interfaces of some subsystems are shown in Fig. 1.

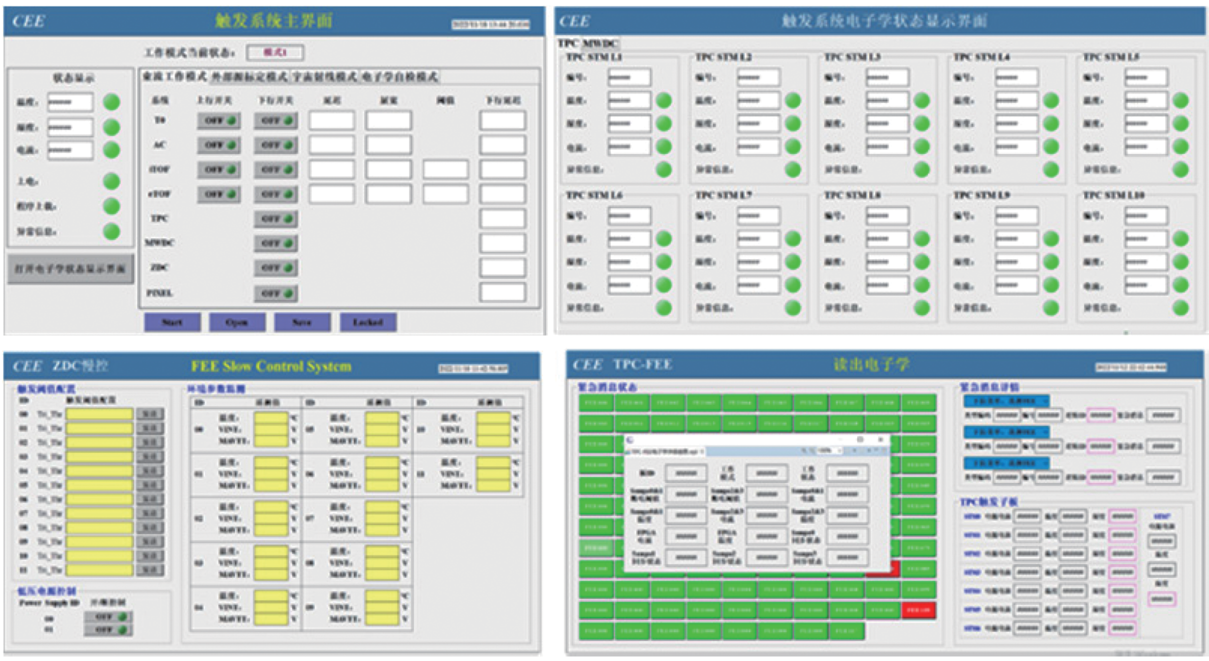

Fig. 1 (color online) Slow control GUIs of some subsytems.

(2) Development of a slow-extracting event parse module

This module has been developed and tested in the field, and the joining test verification with the trigger system was done in March 2022.

(3) Database design and development, data retrieval

All slow control data will be stored in a local database and periodically transferred to the CEE data center. The database design and functional verification based on MySQL have been completed. Meanwhile, the data archiving function was verified based on EPICS Archiver Appliance and the combination of Python+MySQL+Web.

(4) Electronic Logbook

The electronic logging system records date and time-stamp information on daily events or alarms for each subsystem. The initial version of the logging system based on ELOG has been developed, shown in Fig. 2.

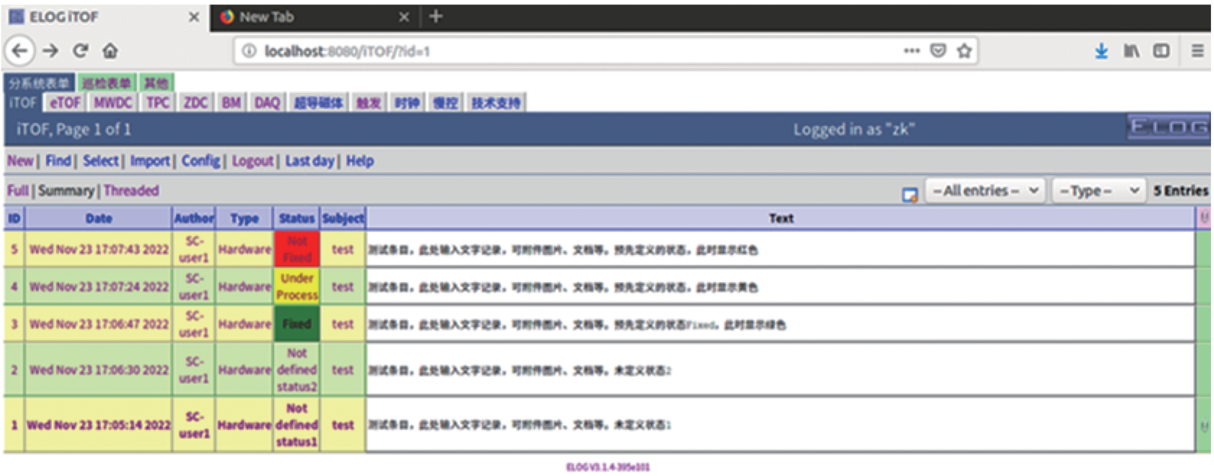

Fig. 2 (color online) GUI of ELOG.

6 - 5 Preliminary Study in ms-level Range Verification of Carbon Therapy

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The well-defined carbon ion beam Bragg peak is the main advantage for using a carbon ion beam for precise particle therapy. However, this advantage cannot be fully exploited due to uncertainty in the particle distribution range. To solve this problem, we build a secondary particle intensity (SPI) monitor system, which is completed a $CeBr_3$ detector array, an integral ionisation chamber (IC), and a data acquisition (DAQ) system, as shown in Fig. 1(a). The range feedback of the SPI system is completed at the millisecond level. The probability distribution of the secondary particles produced by the primary carbon beam is different for different irradiation ranges. The intensity distribution of secondary particles obtained with the $CeBr_3$ array can be used to invert the irradiation depth of the carbon ion beam by establishing a mapping between the probability distribution of the secondary particles and the irradiation of the carbon ion beam. Currently, this SPI system is capable of feeding a range of carbon ions with an accuracy of 0.57 mm±0.33 mm and a maximum deviation of 1.048 mm for every 44 ms, as shown in Fig. 1(b).

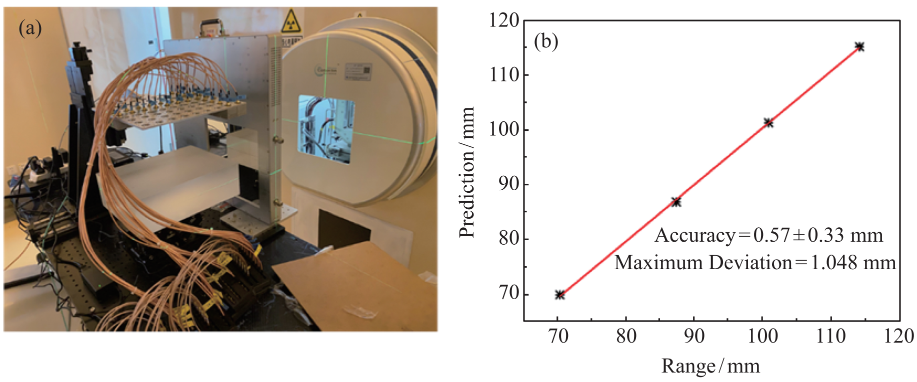

Fig. 1 (color online) (a) Diagram of the secondary particle intensity (SPI) monitor system, (b) Experimental range verification accuracy diagram of SPI system in every 44 ms.