6 - 15 Development of the User Interface for C-ADS Accelerator System Using CS-Studio

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CSS (Control System Studio) is one of the interface development tools that can be used for the EPICS (Experimental Physics and Industrial Control System) distributed control system structure. It is composed of Java developments, independent of platform, that can provide monitoring control system interface display, data archiving and analysis, PV management and alarm system.

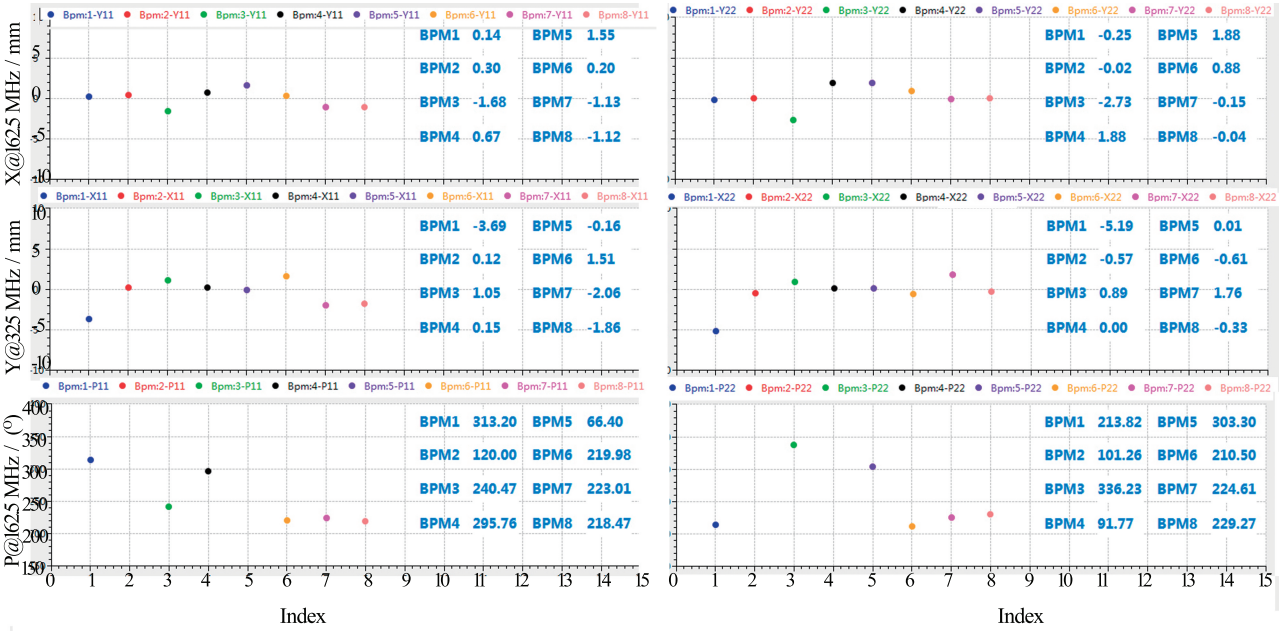

Fig. 1 (color online) Display interface of the BPM position using CSS.

Fig. 1 shows the user interface developed by CSS software, horizontal and vertical coordinates correspond to the number and the current position of 8 BPMs, display the beam transmission in the line, which greatly facilitates the accurate grasp and fault analysis for physics engineer during the experiments.

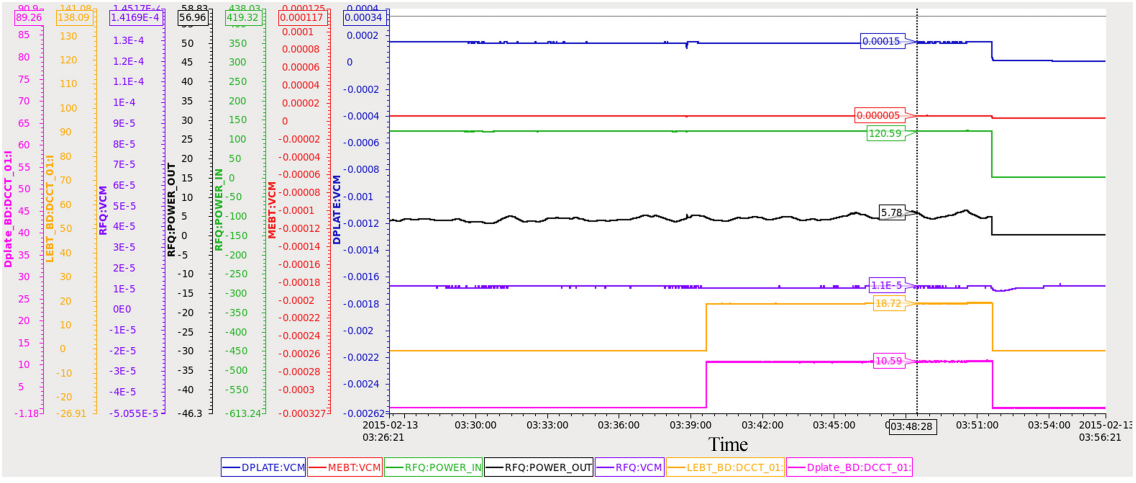

Fig. 2 (color online) Query and analyze historical experimental data using the Databrowser tool with CSS.

Fig. 2 shows the usage of Databrowser tool, which can query historical experimental data from database and do some intuitive and simple analysis. Through the comparison and analysis of several related information, we can help to explain and determining some phenomenon of the machine operation, and to do some investigation of the failures, in order to identify the failure causes, and provides an effective and necessary assistance for accelerator experiments smoothly.

CSS software can be used for the development of control system interface based on EPICS architecture, which is widely used in the large-scale scientific apparatus and high energy physics experiments, and has the advantages of high stability, cross platform, open system, *etc.* In addition, compared to other EPICS based tools such as MEDM, CSS is easier to use and feature rich, so in the C-ADS project, we choose CSS software as the tool for developing control system interface and other functions. The purpose is to get the best running state and control performance.

6 - 16 Progress of Electron Accelerators in 2014 at IMP

Zhang Zimin, Cao Shuchun and Li Zhongping

In 2014 some research works have been carried out by the Electron Accelerator Group at IMP, including the high energy electron radiography (HEER), the electron accelerator design with short pulse for HEER, and a new type low energy electrostatic electron accelerator for industrial applications.

The verification experiments of HEER have been accomplished on THU electron accelerator in 2013, so more experimental works were proposed to continue with complicated parameters. This year, a specialized beam line for HEER experiment was designed and built, which consists of two dipole magnets, ten quadrapole magnets and some vacuum chambers with diagnostic probes. This beam line uses several uniform quadrupoles as imaging lens to form two imaging mode. The first mode could image an 1:1 imaging and chromatic dispersion coefficient is very small. The second mode is 1:2.84 imaging system that use the same lattice with some parameters change of the quadrupoles. Now this beam has been assembled in Lanzhou and the vacuum degree could reach to 6.7×10^{-7} Pa. At the same time, we were preparing the future research work for HEER with electron energy up to 800∼1 000 MeV. Firstly，the RF gun with photocathode and pre-acceleration were studied, and the electron energy in this step was supposed to be 50∼100 MeV. The accelerators with both s-band and c-band were considered to implement the experiments at the beginning, and the c-band one was seemed to be the better choice because of its more compact structure. Then the c-band RF gun and acceleration structure were studied in theoretical approach with Superfish, CST and Parmela. The preliminary design of the c-band linac was finished and more detail works are ongoing.

In order to satisfy the industrial requirements, a low energy high current dc electron accelerator was developed in 2014, which adopting a voltage-doubling type generator to charge the high voltage up to 400 kV without load and 350 kV with 50 mA beam current. The high-voltage generator is designed with multi-player stack, consisting of ten voltage-doubling circuits. A switching-mode power supply based on IGBT inverter for higher efficiency, with 20 kHz frequency and 20 kV AC output voltage, was developed to drive the high-voltage generator. To extract such low energy electron into air for irradiation treatment, the special grid window was designed with 20 μm Ti-foil. A pair of deflecting magnets was used to make the electron beam into air in perpendicular way to enhance the extraction efficiency and scanning uniformity.

In the cooperation with ANL, a pre-research work of the positron target for the international linear collider (ILC) program, named rotation target with friction cooling, was started by EA group. The simulation works show that it is possible to cool down the target heated by 10 kW γ ray with friction cooling technology. Meanwhile, the experimental work was also taken into consideration. A prototype rotation plate wheel touched by a pair of graphite pad on both sides near the rim, was running in air instead of vacuum. The pads are connected the wheel with appropriate pressure to keep heat exchange well. On the end of pads there are Cu bodies who calming the pad tightly and cooled by fluid water. A spring assemble is used to support the Cu and pads and adjust the pressure between the pad and wheel.

Furthermore, there are some irradiation experiments implemented on the 2 MeV/40 mA electron accelerator in 2014, especially the radiation research for ADS target, which has continued for more than 3 months. The others were related to material, cell and protection irradiation.

All the items mentioned above would be indexed with more detailed description in this annual report.