Contribution ID: **7** Type: **Oral**

Design of diagnosis integrated management and control system and application of artificial intelligence technology in laser experiment

Wednesday, 7 July 2021 15:40 (10 minutes)

The driving, implosion and combustion processes of laser fusion take place in a very short time and a very small space scale, resulting in transient extremely high temperature and high density plasma environment. Plasma diagnosis is an important means to observe the physical phenomena in laser fusion process and obtain the parameters of extreme physical states. The object of laser inertial confinement fusion diagnosis includes a wide range of radiation from infrared, visible light, ultraviolet, to X-ray region, as well as high-energy particles such as hot electrons, neutrons, protons and gamma rays. The purpose of diagnostic measurement is to obtain the temporal and spatial behavior of physical processes, as well as the flux and spectral information.
In the large laser facility, we have developed a variety of diagnostic methods, including optics, X-ray and particle, and dozens of diagnostic systems with different principles and structures. A large number of different kinds of diagnostic systems and instruments should be used in the single shot experiment to measure and record the plasma time, space, spectrum and flux information timely and accurately. With the improvement of the scale of the device and the development of the diagnosis technology, it is necessary to equip a special integrated management and control system integrating the experimental preparation, safe operation, automatic data acquisition and computer real-time processing of each diagnosis system, so as to realize the stable, safe and reliable measurement of each diagnosis system and improve the operation efficiency of the experiment.
Aiming at the characteristics of many kinds of diagnostic systems, different principles, less matching number of the same diagnostic system, frequent arrangement changes and single shot measurement in laser fusion experiment, a design scheme of process driven diagnostic integrated management and control system based on physical experiment process is developed. The system adopts the micro service architecture to ensure the reliability and scalability of the system at the software level, greatly improves the operation efficiency and reliability of the whole experiment through the experimental task management and responsive process control, and provides the integrated display of real-time data and status for centralized monitoring during the operation of the experimental process. Aiming at the operation process of the process control node, such as parameter configuration of the diagnostic measurement system, aiming of the diagnostic system, and spatial interference of multiple diagnostic systems, which depend on the operator's experience and manual interpretation, a diagnostic system based on artificial intelligence is developed. The preliminary exploration of intelligent control method has been used, such as intelligent setting of oscilloscope range based on model training and deep learning technology, automatic aiming of image recognition, and spatial interference warning technology.
With the development and experimental application of integrated management and control system, intelligent operation control technology of diagnosis system based on artificial intelligence will play an increasingly important role in operation management and health management of diagnosis system.

Member State or IGO

China, People's Republic of

Speaker's Affiliation

Laser Fusion Research Center, China Academy of Engineering Physics, Mianyang

Primary authors: Mr WANG, Feng (Laser Fusion Research Center, China Academy of Engineering Physics, Mianyang, China); Mr CHEN, Bolun; Mr WANG, Peng; Ms XIA, Liqiong

Presenter: Mr WANG, Feng (Laser Fusion Research Center, China Academy of Engineering Physics, Mianyang, China)

Session Classification: Data Acquisition and signal processing 1

Track Classification: Data Acquisition and Signal Processing