

# Design Concept of Intelligent Integrated Control System for Neutral Beam Injection

*Tuesday, 13 June 2023 11:30 (30 minutes)*

Due to the specificity of Neutral Beam Injection (NBI) system, the control of its actual physical system is achieved through the Integrated Control System (ICS). The NBI ICS is used to coordinate the operation of various subsystems of NBI while ensuring steady-state operation of entire system and the safety of experimenters. The early NBI ICS in our lab was designed based on a centralized control structure. However, due to the poor robustness of centralized control structures, once the central computer fails, the whole control system will be in a paralyzed state, therefore, the current NBI ICS adopts a distributed design structure to balance the system load, which is also the mainstream system design and architecture model of ICS around the world. But from a practical point of view, the distributed system architecture is not perfect either. Most of the existing distributed frameworks are highly dependent on the underlying logic, and the implementation of additional functions usually requires an overall structured evaluation, which can lead to serious system problems if not properly decoupled. Therefore, exploring a new way to improve the current ICS to intelligence is of great significance in today's networked and intelligent era. Currently, Internet of Things (IoT), as an important part of the new generation information technology, can interconnect real substrates with the Internet and realize the control of everything through data exchange. There is no doubt that intelligence must be the development direction of future fusion, and under the current development status and shackles faced by ICS, combining Artificial Intelligence (AI), IoT and ICS with each other may be a good breakthrough point. This is because on the one hand, IoT has wide compatibility and powerful scenario-based capabilities, it not only has the advantages and features of distributed design, but also can pull the NBI subsystems into the same level scenario, laying the foundation for further construction of digital NBI; on the other hand, the intervention of AI makes IoT have some new typical features such as intelligent sensing, ubiquitous connectivity, precise control, digital modeling, real-time analysis and iterative optimization, which is enough to pull the current NBI ICS into a new intelligent control era. Finally, it is worth mentioning that due to its inherent design structure and functional characteristics, ICS tends to be broadly generic, so it is not used exclusively for NBI operations in nuclear fusion, and it can provide a degree of insight into other areas of application.

## Speaker's Affiliation

ASIPP

## Member State or IGO/NGO

China

**Primary authors:** Prof. HU, Chundong (ASIPP); Dr GU, Yu (University of Science and Technology of China); Ms LI, Yang (University of Science and Technology of China); Ms ZHAO, Yuanzhe (ASIPP); Mr CUI, Qinglong (ASIPP); Mr XIE, Yahong (ASIPP)

**Presenter:** Prof. HU, Chundong (ASIPP)

**Session Classification:** DB/1 Information retrieval, dimensionality reduction and visualisation in fusion databases

**Track Classification:** Information retrieval, dimensionality reduction and visualisation in fusion databases