

S&I Unit : Sensing and Intellectualizing Technology



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Unit Policy

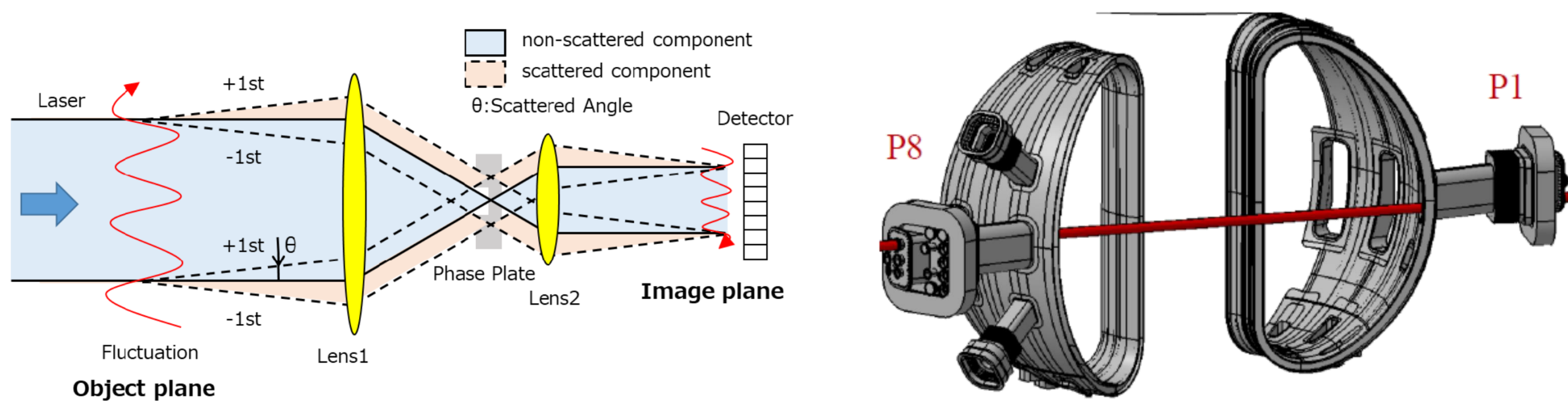
Observing, predicting, and controlling the behavior of ultra-high temperature plasma are essential subjects for improving the performance of fusion reactors.

We will develop dramatically high-precision plasma measurement methods and construct a system that enables holistic and precise plasma observation. Furthermore, we will analyze the data using data science and convert it into visual, auditory, tactile, and other information to make it “intellectualizable”.

This effort, in which researchers specializing in measurement, data analysis, and expression methods work together to systematize the intellectual inquiry process, will revolutionize the understanding of phenomena in fusion science and many other scientific fields.

(A) Development of advanced plasma fluctuation measurements

Phase contrast imaging

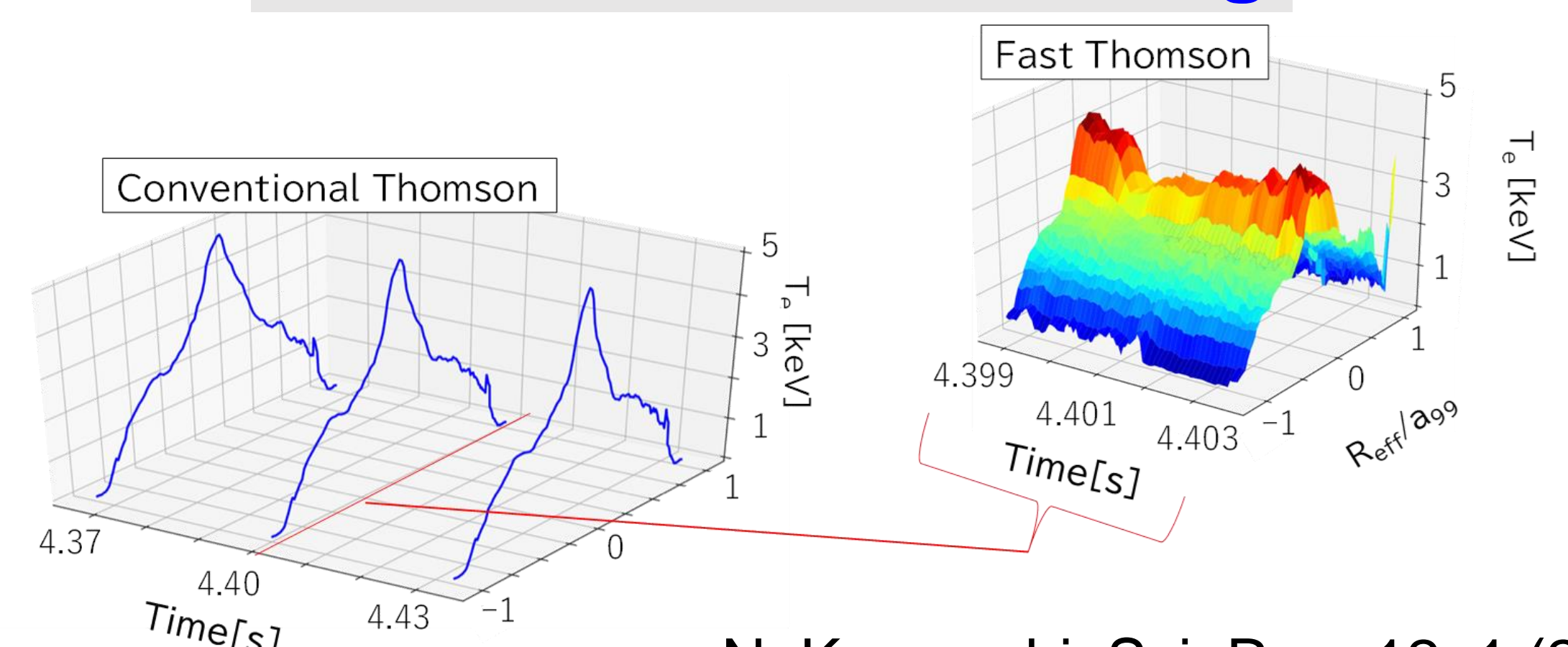


K. Tanaka, Rev. Sci. Instrum. 79, 10E702 (2008).

Measurement system application to JT-60SA

Work with data science members to understand transport physics

Fast Thomson scattering



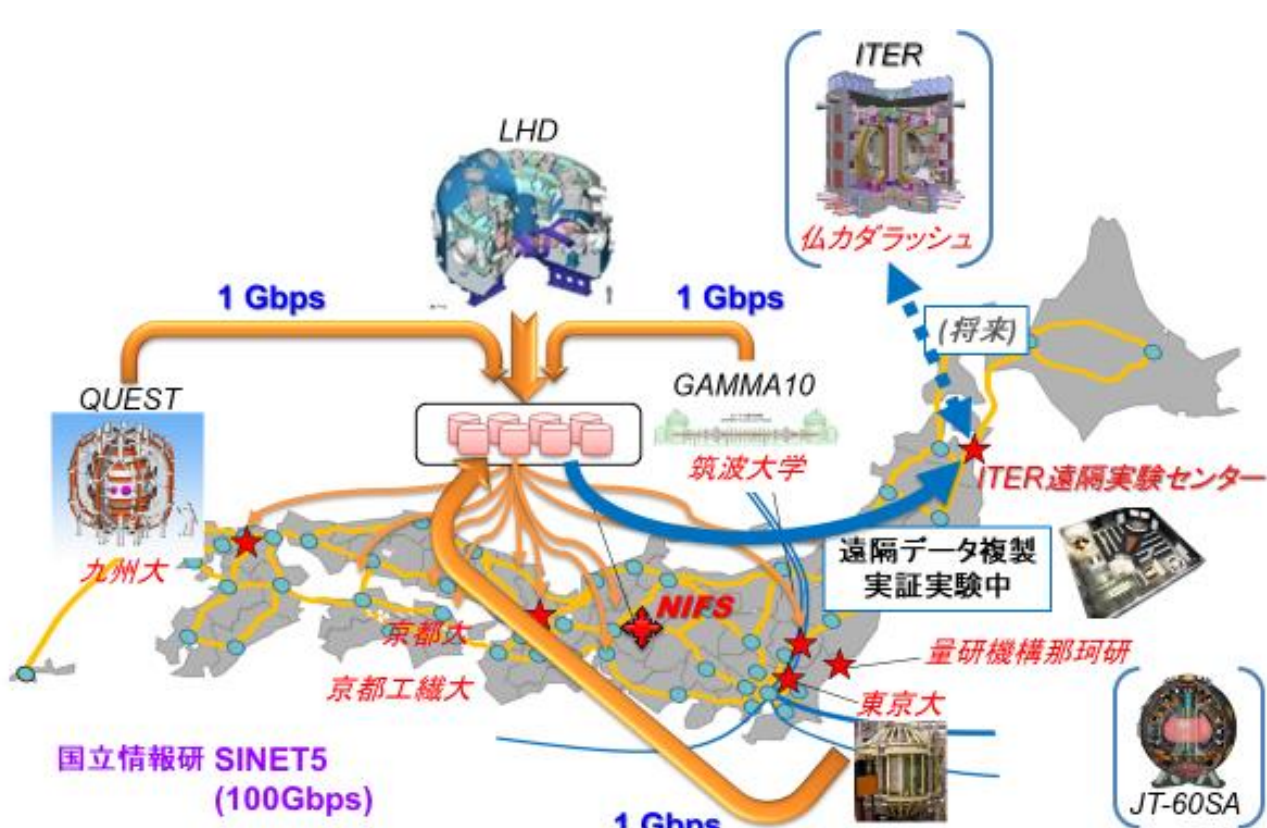
N. Kenmochi, Sci. Rep. 12, 1 (2022).

Aiming further improvement of time resolution ~ 100 kHz, and direct measurement of velocity distribution functions

(B) Prediction of plasma behavior and sustainable plasma control using data science

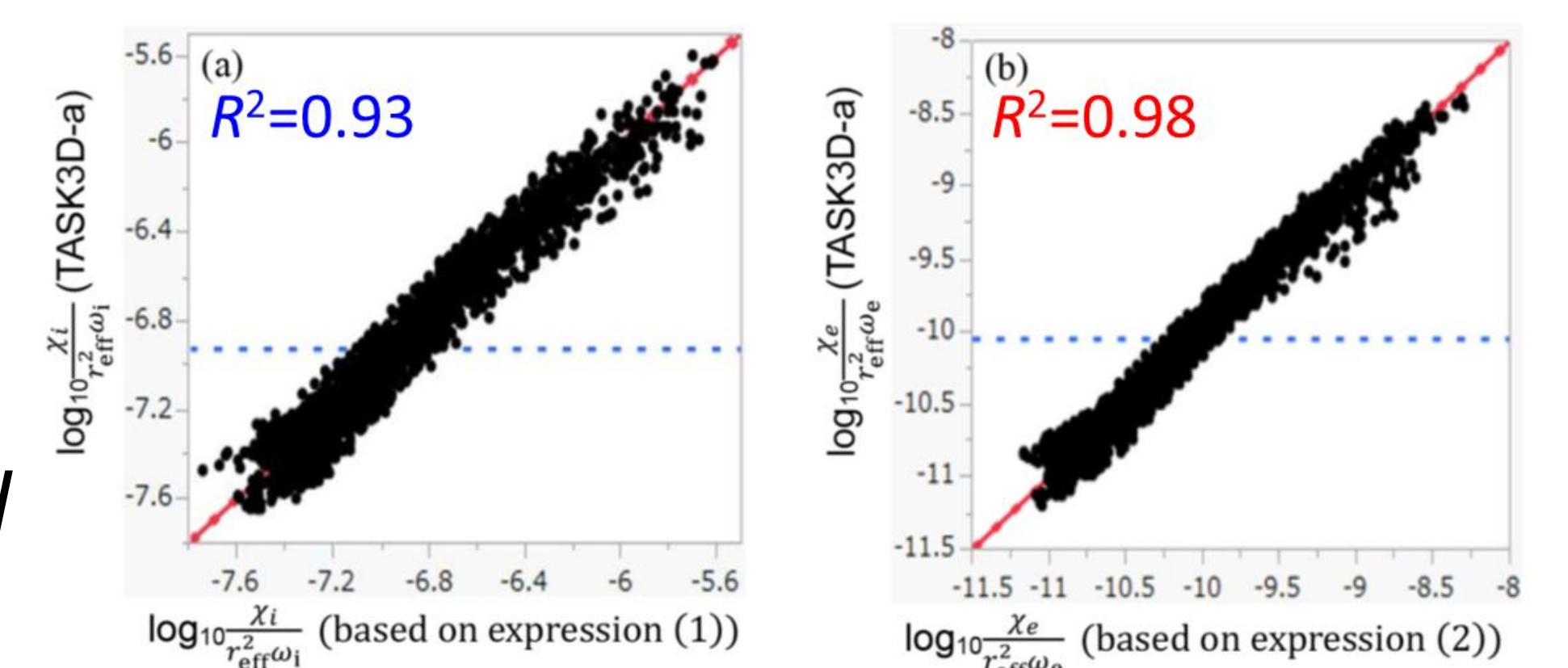
Establishment of real-time prediction and control methods for fusion plasma to realize fusion reactors

Capturing various issues in fusion science with concept of statistical mathematics
 \Rightarrow Prediction of radiative decay and disruption and its application to plasma control



Promoting open science by sharing huge data such as LHD experiments

Understanding tritium behavior in fusion reactor and in the environment



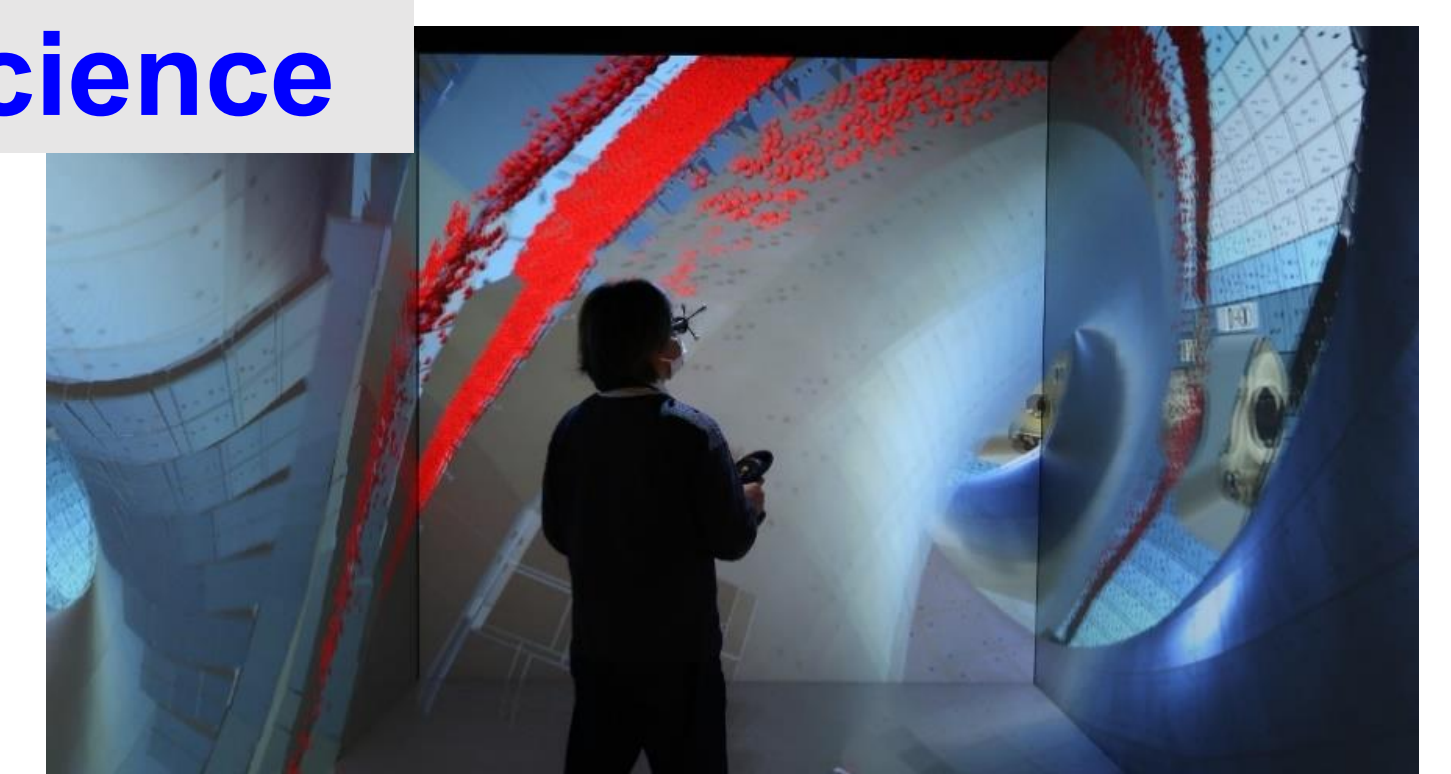
M. Yokoyama, Nucl. Fusion 59 (2019) 094004

(C) Challenges to data understanding ; “Intellectualizing Technology”

VR display that enables 3D+ α analysis and numerical modeling through data science

Systematization of the intellectual inquiry process from sensation through perception and cognition to scientific knowledge

Promote regulatory science and public communication through risk sharing of fusion applications



VR display device @NIFS