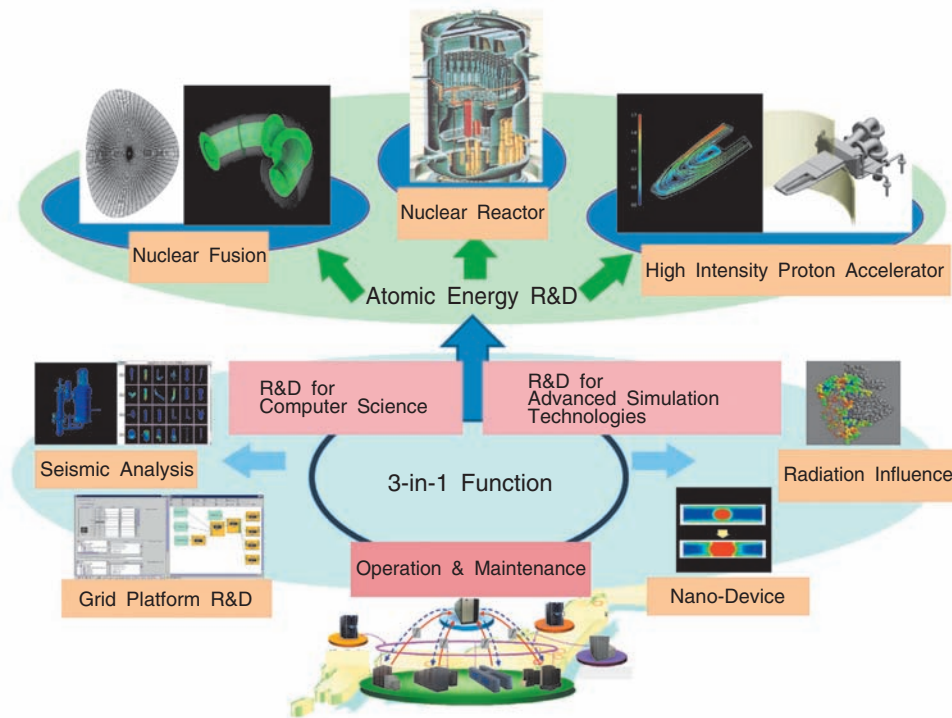## Atomic Energy Research by Computational Science
–Establishment of Advanced Technology for Atomic Energy R&D–

Fig.12-1 Computational Science in Atomic Energy Related Fields
The CCSE is carrying out three-fold coordinated R&D in advanced computational science: for computer science, for advanced simulations, and for better operation/maintenance of computer systems.

For the increased safety of atomic energy, we are carrying out R&D of computational science which could be used with theoretical and experimental advances to predict the safety state of an entire nuclear facility. Computational science is a third method along with "theory" and "experiment" to pursue R&D, and is currently expanding to new fields such as global warming predictions. Further development of computational science is expected also in the field of atomic energy.

The Center for Computational Science and e-Systems (CCSE) promotes three missions, "R&D for computer science to allow computational scientific research in the atomic energy field and to promote cooperative research", "R&D for advanced simulation technologies to make predictions with higher accuracy" and "operation & maintenance of computer systems allowing active research with the guaranty of information security" as depicted in Fig.12-1.

Presently, we are tackling the following seven topics in a mid-term plan to promote innovative atomic energy research and to drive domestic R&D in the computational science field; "distributed parallel computing through grid technology", "vibration simulator of an entire nuclear facility", "mechanisms of crack-propagation in nuclear reactor materials and of rim-structure formation in UO_2 nuclear fuel", "nano-scale device development for atomic energy", "multi-scale modeling incorporating micro to macro level simulations", "development of databases for genome analysis" and "tools for studying DNA/RNA repairing proteins".

CCSE has actively participated in various national projects. For instance, we participated in an ITBL (Information Technology Based Laboratory) project from FY2001 to FY2005, which was one of the e-Japan priority policy programs. In this project, we collaboratively constructed a virtual supercomputer consisting of distributed supercomputers. ITBL shares computer capacity of 60 TFLOPS (from 17 supercomputers) with 11 research communities in 64 research institutes and is continuously supporting their research activities. We also contributed to the "Development & Application of Advanced High-Performance Supercomputer" project through computational science technologies cultivated in the atomic energy field.

We are also promoting international cooperation with the United States (2 institutes), Germany (3) and France (5) in order to share in worldwide leading edge research on computational science for the atomic energy. Simulation and modeling technology has been selected as a one area of the Global Nuclear Energy Partnership (GNEP) activities of Japan and the United States, and we are cooperating with this partnership.

CCSE will keep accelerating computational science R&D in the field of atomic energy.