



# THE FULL SCOPE SIMULATOR FOR THE N4-TYPE NUCLEAR POWER PLANTS >>

**EDF, THE FRENCH ELECTRICAL UTILITY, HAS AWARDED ATOS ORIGIN (PRIME CONTRACTOR) AND THALES THE CONTRACT FOR THE FULL SCOPE SIMULATOR FOR THE 1450 MW NUCLEAR POWER PLANTS. IT IS A "FULL REPLICA" SIMULATOR REPRODUCING THE ENTIRE CONTROL ROOM AND MOST PLANT SUBSYSTEMS. IN ADDITION TO OPERATOR TRAINING, ITS PURPOSE IS THE FUNCTIONAL VALIDATION OF THE CONTROL SYSTEM SOFTWARE AND DATA.**

## OPERATOR TRAINING

In order to make the trainees feel as if they were operating a real plant, the Full Scope Simulator provides a full replica of the control room and the accurate representation of the realtime processes, as the operators in a real plant control room would experience them.

The scope of simulation covers most operating conditions, from cold shutdown to normal full power, normal transients, incidental and accidental situations. The extent of simulation is sizeable, to fit with the whole power plant systems equipped with physical and I&C modeling.

Specific training functions include:

- > repository of initial conditions,
- > snapshot or periodic recording,
- > recording and replay of continuous sequences,
- > remote controls for the instructor,
- > failures of plant and control, equipment, down to PLCs, CPUs or IO cards,
- > loss of power supply,
- > accelerate, slow speed, freeze,
- > management of trainees and training program.

## ATOS ORIGIN IN THE NUCLEAR GENERATION INDUSTRY

With more than 30 years experience serving the energy and utilities industries, Atos Origin is one of the very few recognized integrators able to provide customized best of breed information solutions across the entire nuclear generation chain.

Atos Origin's extensive solutions combine the power of real-time control information systems and proven client process knowledge. The company has a unique track record in the realization and delivery of systems to worldwide electricity generating companies. Atos Origin has delivered systems in France, China, Russia and UK for more than 60 nuclear power plants which represent more than 65,000 MW.

# The Full Scope Simulator for the N4-type nuclear power plants

## PLANT CONTROL ENGINEERING

The real plant's control system includes a fully computerized control room and PLCs for most of the instrumentation and plant control. Both systems are downloaded with the data from EDF's CAD system (PLC algorithms, operator displays, automated operating procedures, alarm logic, equations, on-line data sheets).

The simulator is designed for operator training and also validates the real plant control system's data and software.

The computerized control room is an adaptation of the real plant. It can handle simulated controls and time management, and still accept its configuration data from the CAD system.

The PLCs simulation is generated automatically from the real plant PLCs source code. New versions of control system software and data can be validated in a real environment, including the plant's incidental and accidental situations.

## SYSTEM ARCHITECTURE

PLCs and process simulations are implemented on a pair of R10000 SGI PowerChallenge servers, with a total of 18 processors. These computers are interconnected by a high-speed link (100 Mb/s).

Data exchanges between other subsystems of the simulator use an FDDI backbone and several Ethernet LANs.

## PROJECT ORGANIZATION

The project's total duration was 3 years, half of which was dedicated to systems integration and functional qualification.

Atos Origin, as the consortium leader, was in charge of project management, the computerized control room, PLCs and turbine control simulation, the conventional control room and its industrial interface.

Thales was in charge of physical process simulation and the software workshop, simulation of the remaining control systems, and the instructor station.

## ADACS™ (Advanced Data processing And Control System)

It is a well-known fact in industry that main risks come from human errors. The main advantage of this real-time technical platform is to assist operators to take faster and proper actions and therefore to greatly reduce risks in case of cascade of alarms. Improved safety mainly comes from an intelligent highly efficient alarm processing based on plant conditions and from operating procedures in normal, incidental and accidental unit conditions.

Operators are computer guided and stress-relieved in a consistent environment to investigate problems and plan recovery actions.

ADACS™ is the solution to build a safe and reliable control system in continuous industries, with full hot redundancy, openness and high performances.

ADACS™ is already running in different industry sectors, such as Nuclear Power Generation, Electrical Network and Water Treatment, in France and abroad.

## KEY FIGURES

- > 50,000 simulated failures,
- > 350 simulated PLCs with 3,000 I/O boards,
- > 10,000 simulated process objects,
- > 25 computer servers,
- > 50 workstations,
- > 18 processors for PLC and process

## CONTACTS

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Atos Origin is an international information technology services company. Its business is turning client vision into results through the application of consulting, systems integration and managed operations.

The company's annual revenues are EUR 5.8 billion and it employs over 50,000 people in 40 countries.

Atos Origin is the Worldwide Information Technology Partner for the Olympic Games and has a client base of international blue-chip companies across all sectors.

Atos Origin is quoted on the Paris Eurolist Market and trades as Atos Origin, Atos Worldline and Atos Consulting.