framatome

ARGOS

Core Monitoring System for Nuclear Power Plants

On-line core monitoring for safe and efficient plant operation

Challenge

The nuclear industry is facing more demanding safety requirements and increasing competition from other energy sources, both of which increase the pressure on reactors to operate more economically with the highest levels of safety. The key drivers targeting cost reduction and improved operations include accurate predictions, operational automation and operational flexibility. In responding to these industry challenges, key nuclear reactor core parameters need to be constantly monitored to ensure the highest levels of safety are maintained while supporting flexible and lowest cost operations.

ARGOS

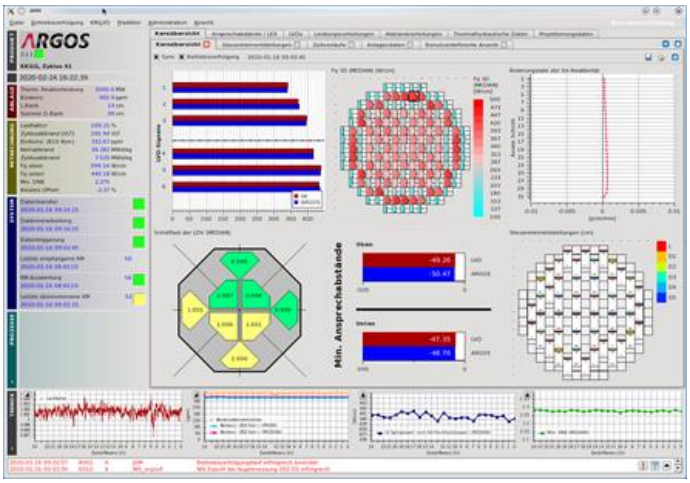

Fig. 1: Users can easily configure the ARGOS GUI according to their individual needs

Solution

To help reactor operators meet these demands, Framatome has developed ARGOS. This core monitoring system provides greater insight into the state of the core through calculations and comparisons with online measurement of key parameters. These calculations include shut-down margin, critical condition predictions and core follow calculations, which assist operations in maintaining the highest levels of safety and flexibility.

ARGOS also helps reactor operators with flexible operations through a configurable graphical user interface that is adaptable to various reference measurement systems and can be coupled to different neutronic simulators.

Through automation of many of the ARGOS calculations and their high level of accuracy, reactor operations will benefit from time savings and error reduction, which helps drive down operating costs.

Customer benefits

- Continuous margin control
- Visualization of operating limits
- Increased operating flexibility
- Decreased time to return to full power
- Lower operating costs by reducing boron processing through optimized power maneuvers
- Easy planning of efficient load follow maneuvers
- Improved ergonomics by flexibly configurable GUI
- Offer a fleet-wide solution with common look and feel, independent of the core simulator or power reconstruction methodology
- Full data access and cloud solution possible

Your performance
is **our** everyday **commitment**

Technical information

- Process flux trace data from various measurement systems
- Various proven flux and power reconstruction methodologies available
- Ex-core/in-core detector calibration support
- Automatic on-line core follow calculations with core parameter trending and monitoring of thermal limits
- Configurable reporting for plant operators
- Isotopic tracking

Any calculation the core simulator is capable of, such as:

- Estimated critical conditions
- Shutdown boron concentrations
- Shut-down margin
- Predictive core calculations in the adaptive and non-adaptive mode
- Flux mapping for steady state conditions
- Flux mapping based on accurate time and power dependent xenon calculations for operational transients
- Reactivity monitoring (e.g., Xenon Distribution)

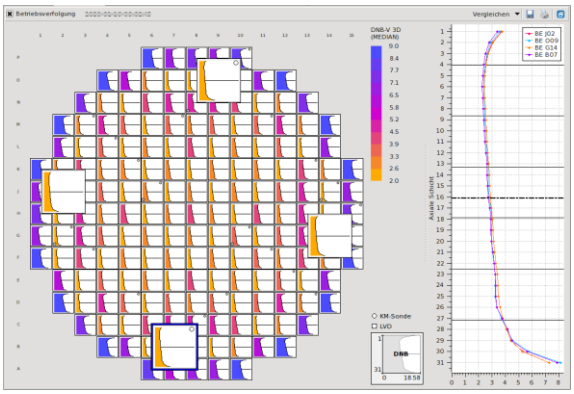

Fig. 2: Detailed information on the (e.g., 3 D DNB)

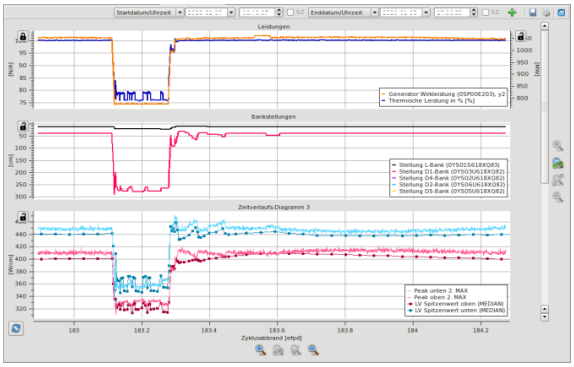

Fig. 3: accurate transient description capability

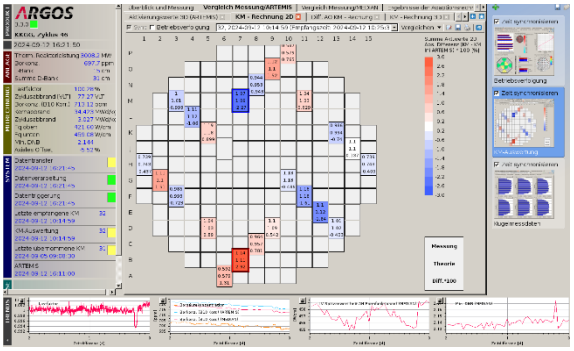

Fig. 4: Incore Detector and their calibration

References

Framatome has more than 40 years of global experience in core design and core monitoring for a variety of pressurized and boiling water reactors. The ARGOS development is based on the experience feedback and successfully in operation in:

- Switzerland
- Finland

Key figures

- In since **2019**
- **PWR**, **BWR** and **VVER**
- **Ongoing development**
  e.g OAPS, in-core detector models

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