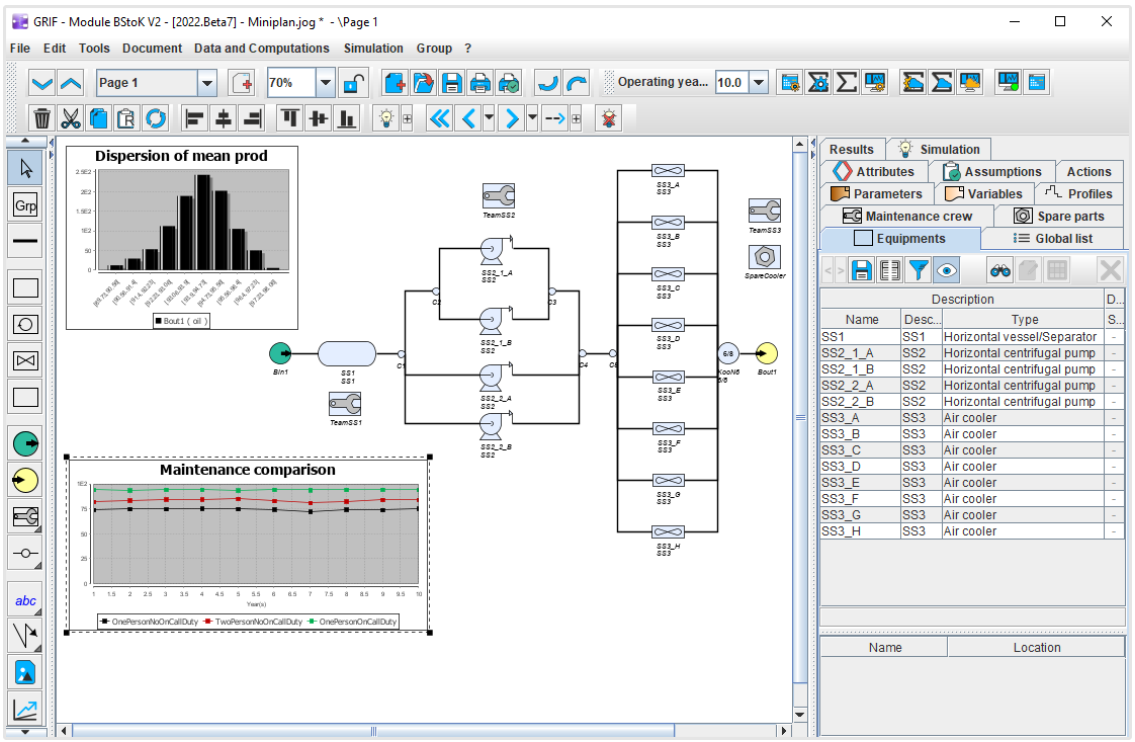
# GRIF | BStoK module

## Technical sheet

To evaluate the performance of dynamic systems using Stochastic Block Diagrams

**GRIF (GRaphical Interface for reliability Forecasting), a technology of TotalEnergies since the 80s, includes 3 packages and 12 modules allowing the user to choose the most appropriate modelling technique for the resolution of the studied system. BStoK module is one of the four modules belonging to Simulation package.**

**BStoK is used to model systems as stochastic block diagrams**. Unlike reliability block diagrams, **BStoK integrates the dynamic behaviour of systems**. The module uses the computation engine **MOCA-RP** (Monte-Carlo – Petri Nets), owned by TotalEnergies and, as its name suggests, is based on the Monte-Carlo simulation which enables the exhaustive recovery of all the information on the model. MOCA-RP has a dual advantage in that it generates accurate results without compromising calculation speed, making it one of the most high-performance computation engines on the market.




## Modelling and computations using the MOCA-RP engine:

– **Stochastic block diagrams** are created using **an intuitive graphical interface**. All the elements (input, block, link, output) required to build the desired model can be created in just a few clicks. Each block can then be configured according to its failures, repairs, start/stop condition, maintenance schedule, etc. When a block is created, **a Petri net is automatically generated**. This background use of Petri nets means that the BStoK module has a large library of block configurations and can model the interactions between the different system elements.

– **Once the block diagram is created, BStoK provides the following functionalities:**
  - Computation of availability, reliability and performance for each block and system.
  - Customized computation with additional observed variables.
  - Spare part and maintenance team management.
  - Incident duration analysis.
  - List of main contributors to unavailability.

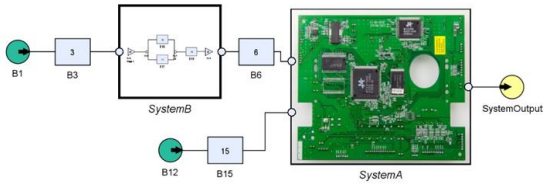

**GRIF**
GRaphical Interface for reliability Forecasting
August 2022

**TotalEnergies SE**
CSTJF
64018 Pau Cedex - FRANCE
Phone : +33 (5) 59 83 40 00
grif.totalenergies.com


**Hardware requirement**: Intel Core i3 or faster, 4 GB of free RAM, 1 GB of free space, no internet connection needed. **Software requirements**: Windows 10 or Linux or MacOS X with Java 11. **Licenses**: standalone with USB dongle or Floating licenses with Sentinel server. Installable, laptop.

The module has a MOCA-RP calculation simulator that allows you to quickly obtain the expected results and provides information on the level of confidence that can be placed in them.

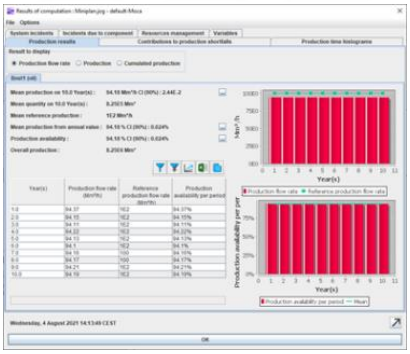
- **Groups and sub-systems**: this notion of hierarchy means that the model can be divided up according to the actual deconstruction of the system whatever the number of inputs/outputs. A preview can appear on the block so that its composition is always visible.




## Specificities and strengths:

- **User-friendliness**: no knowledge of Petri net modeling is required to use this module. The block diagram approach allows the user to graphically understand the architecture of the studied system.
- **Readability:** the block diagram approach gives the user a graphic representation of the architecture of the system studied. No previous knowledge of Petri Net is required to use this module.
- **Model construction time:** a model comprises just three different types of elements: blocks, connectors, and links. The user selects the characteristics for each block or system element from a configuration interface. The data tables can be used to modify one characteristic simultaneously on several blocks.
- **Interdependence between blocks:** the BStoK module incorporates the interactions among the different blocks, whether common cause failures, redundancies, or failures on shared resources (repairer, spare parts, etc.).
- **Compatibility with Petro:** finally, models from BStoK can be used in the Petro module to run calculations specific to processing flow.
- **Multi-core computing:** as in all the modules of the simulation package, calculations can be run simultaneously on several processors to radically reduce computation time. A high- performance computing plugin is also available for connections to supercomputers.


- **Computation speed:** the module includes a computation simulator (MOCA-RP) which rapidly generates the desired results and provides information on the level of confidence attributable to them.
- **Interactive simulation:** users can validate the model operation using step-by-step simulation, as in the Petri and Petro modules.
- **Synthesis of results:** a dedicated window summarizes all key results:
  - Mean production and production over years,
  - Incidents,
  - Main contributors,
  - Use of spare parts and maintenance team.



## BStoK is suitable with GRIF's Petri, Petro and BFiab modules:

- Petri module: it is possible to save and open a BStoK model in the Petri module. The created prototypes can then be integrated into a model in order to allow their use by engineers who are not Petri net specialists.
- BFiab module: it is possible to import reliability diagram blocks already created with BFiab on which one would like to add dependencies between blocks.
- Petro module: the models from BStoK can be used in the Petro module to perform specific calculations for flow processing.

## Using data and results:

- Possibility of automating calculations (batch runs) and drawing variations for sensitivity analysis.
- Results are stored in the document and can be exported in a variety of formats (csv, XML, Excel, etc.).
- Results can be viewed as line graphs, pie charts or histograms.
- Vectorial printing in PDF format generates high quality pictures, but the files are small enough to be sent by e-mail, even if they contain hundreds of pages.
- Interaction with the operating system: possibility of copying/pasting to or from word processing software, spreadsheets, or presentation tools.
- BStoK can read RBD from the BFiab module.
- A result-synthesis in a dedicated windows gives access to all pertinent results.

TotalEnergies

Trial version available on
grif.totalenergies.com