# GRIF | Flex module

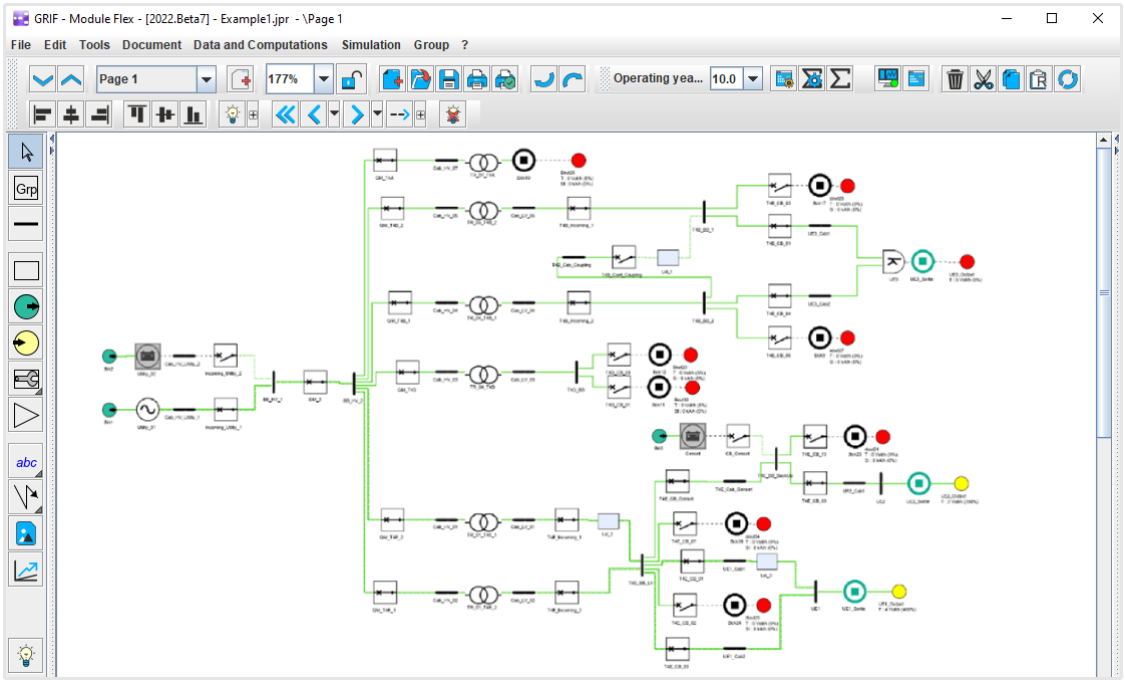
## Technical sheet

To evaluate the performance of dynamic systems using MBSA based on Petri Nets

**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. Flex module is one of the four modules belonging to Simulation package.**

**Flex uses Monte-Carlo Simulation to model systems and their logistics support and to calculate their production availability and results**. This decision-making tool helps to optimise the design of a given installation by comparing the production availabilities of different possible architectures, to identify the weak points and check that the targets defined for the system are met. This module is based on **MOCA-RP** (for MOnte-CArlo - Petri nets), **owned by TotalEnergies**: **an ultra-fast calculation engine based on Monte-Carlo simulation** and which pushes the limits of modeling, as its name indicates.

Flex




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

- As a **model-based Safety Assessment tool**, Flex relies on **blocks/components that can be created** (or chosen in a library) **and linked together.** Components are blocks with several connection interfaces and their behavior is defined using Stochastic Petri Nets with predicates. The versatility of Petri Nets and the MOCA-RP language are real assets when creating components, to protect and assign transitions. The components created are configurable and can be used by users who are not familiar with Petri Nets but who do know how components interact with one other. Once the components are stored in the library, users can create a system model by assembling components.

- **When the system has been modelled, Flex runs a Monte-Carlo Simulation that provides the following results:**
  - Component failure (counting, duration).
  - System shutdown duration analysis.
  - Use of maintenance teams and spare parts consumption.
  - Sequences or cut sets leading to a specific event.

**GRIF**
GRaphical Interface for reliability Forecasting
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**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.

## Specificities and strengths:

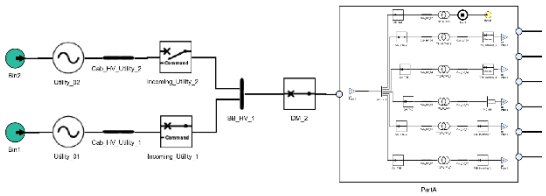
- **Modelling power**: to create a component, Petri Net experts can use the Petri module, a reference software application for Stochastic Petri Nets. The great strength of stochastic Petri nets lies both in their modelling power and in their capacity to describe the dysfunctional (component failures) and functional (architecture and support functions such as maintenance or reconfiguration procedures) parts of an installation.

- **Step by step interactive simulation**: Flex module provides **a step-by-step simulator** that is a key feature for model checking/validating. It will ensure the accuracy of the modeling before doing computation. Beyond the its initial purpose, this simulator is also used to explain system behavior to other people, and can be a good training support in order to help people understand how it works.

- **Scope**: whether for modelling an assembly line, an electrical grid, a production system or any other system, this module is suitable for all industrial sectors. Given that users can always create additional variables to be studied, they can therefore retrieve results about any aspect of their system. It can therefore be used either for safety considerations or performance assessments or SIL optimization.

- **Re-usable libraries**: once a library has been created for an initial study, it can be reused in other systems comprising the same kinds of components, without it being necessary for a Petri-Net expert to be present. The company can easily capitalize on past studies.

- **Hierarchical systems**: complex systems can't be described on a single page. That why it can be broken down into several sub-system that are not necessarily independent.



## 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 the document contains hundreds of pages.
- Interaction with the operating system: possibility of copying/pasting to or from word processing software, spreadsheets, or presentation tools.
- The "Attribute" feature (a custom property system) can be used to add any required information to each object in the document, either for a more precise description, for traceability or for result grouping.

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Trial version available on
grif.totalenergies.com