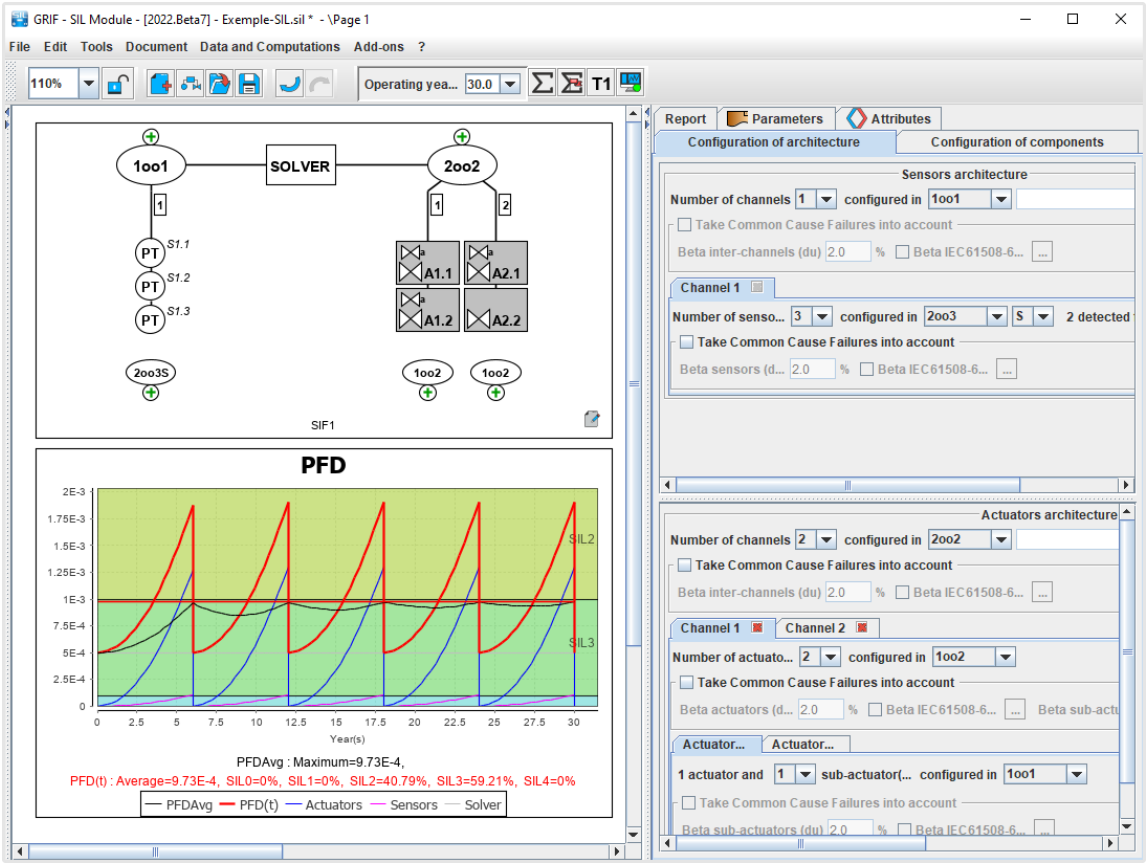
GRIF | SIL module

Technical sheet

To assess the availability level of Safety Instrumented Systems (SIS)

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. SIL module is one of the 7 modules belonging to Boolean package.

Certified by INERIS (National institute under French ministry of ecological transition), **SIL** is a module allowing to analyse, validate and/or optimize the design and the maintenance of **SIS** (**Safety Instrumented System**) architectures that evaluate the **SIL** (**Safety Integrity Level**) of safety instrumented loops, **in line with IEC standards 61508 & 61511**. It is equipped with **ALBIZIA**, the Binary Decision Diagram (BDD) computation engine developed by TotalEnergies, able to perform accurate analytical calculations.



Modelling and computations:

You can define the **SIS architecture** to be **evaluated** by **interactively selecting the components** of the Safety Instrumented Function (sensors, solver, actuators, KooN voting logic). They then characterise each component of the safety loop by specifying: **Reliability parameters** (failure rate, diagnostic coverage, common modes, etc.); **Maintenance parameters** (test frequency and duration, time to repair, etc. The SIL module involves transcribing the SIS architecture into fault trees to run the SIL computations to obtain the **PFD Average (Probability of Failure on Demand)** and **PFH (Probability of Failure per Hour)**.

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.

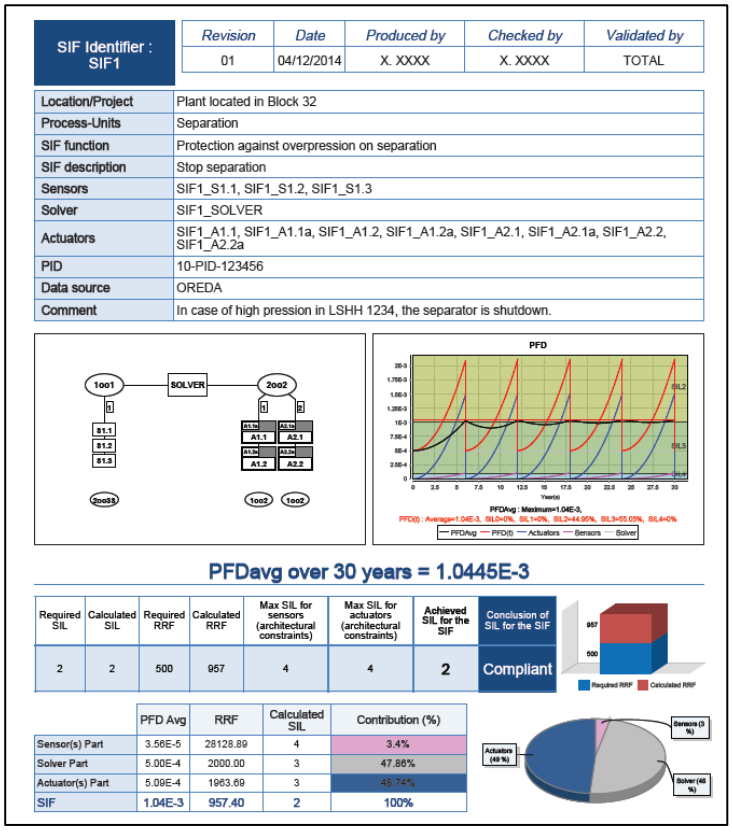
Specificities and strengths:

- **Analytical computations:** SIL can be used to evaluate the temporal indicators for each part (sensors, solver and actuators) of the Safety Instrumented Function (SIF**).** Computations are run using the **computation engine ALBIZIA** and serve to assess the PFD or PFH. The computation technique produces **accurate results**, which are the instantaneous values, average values and maximum values over the period and the percentage of time spent in each SIL.

- **Main Features:**
  - PFD and PFH computations with accurate algorithms (not a simple approximation of the average).
  - HFT and architectural constraints according to IEC61508 and IEC61511.
  - User-friendly graphic user interface.
  - Advanced configuration for components (Proof Test Coverage, Partial stroking, Human error, etc.).
  - Spurious Trip computation.
  - Multi-Loop systems, components can be shared.
  - Management of 16 sensor channels containing up to 24 sensors each.
  - Management of 24 actuator channels containing up to 8 actuators each.
  - Implementation of IEC standard 61508-6, part D for Beta factor definition (Separation/Segregation, Diversity/Redundancy, etc.).
  - PDF report with SIF synthesis, maintenance schedule (testing period for each component).
  - The SIFs created can be reused as safety barriers with an Event Tree or in the Risk module.

Using data and results:

- Database for components: creation and management of generic component models (sensors, actuators, solvers).
- Input data summarized in tables making it easier to check the quality of an entry.
- 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.
- External files (PDF certificates, system pictures, ...) can be included in the document and be part of the full report.
- Interaction with the operating system: possibility of copying/pasting curves, systems or results to word processing software, spreadsheets or presentation tools.



SIF Identifier : SIF1	Revision	Date	Produced by	Checked by	Validated by
	01	04/12/2014	X. XXXX	X. XXXX	TOTAL

Location/Project	Plant located in Block 32
Process-Units	Separation
SIF function	Protection against overpression on separation
SIF description	Stop separation
Sensors	SIF1_S1.1, SIF1_S1.2, SIF1_S1.3
Solver	SIF1_SOLVER
Actuators	SIF1_A1.1, SIF1_A1.1a, SIF1_A1.2, SIF1_A1.2a, SIF1_A2.1, SIF1_A2.1a, SIF1_A2.2, SIF1_A2.2a
PID	10-PID-123456
Data source	OREDA
Comment	In case of high pression in LSHH 1234, the separator is shutdown.

PFDavg over 30 years = 1.0445E-3

Required SIL	Calculated SIL	Required RRF	Calculated RRF	Max SIL for sensors (architectural constraints)	Max SIL for actuators (architectural constraints)	Achieved SIL for the SIF	Conclusion of SIL for the SIF
2	2	500	957	4	4	2	Compliant

	PFD Avg	RRF	Calculated SIL	Contribution (%)
Sensor(s) Part	3.56E-5	28128.89	4	3.4%
Solver Part	5.00E-4	2000.00	3	47.86%
Actuator(s) Part	5.09E-4	1963.69	3	48.74%
SIF	1.04E-3	957.40	2	100%

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