

FinPSA: New Features in PRA Software



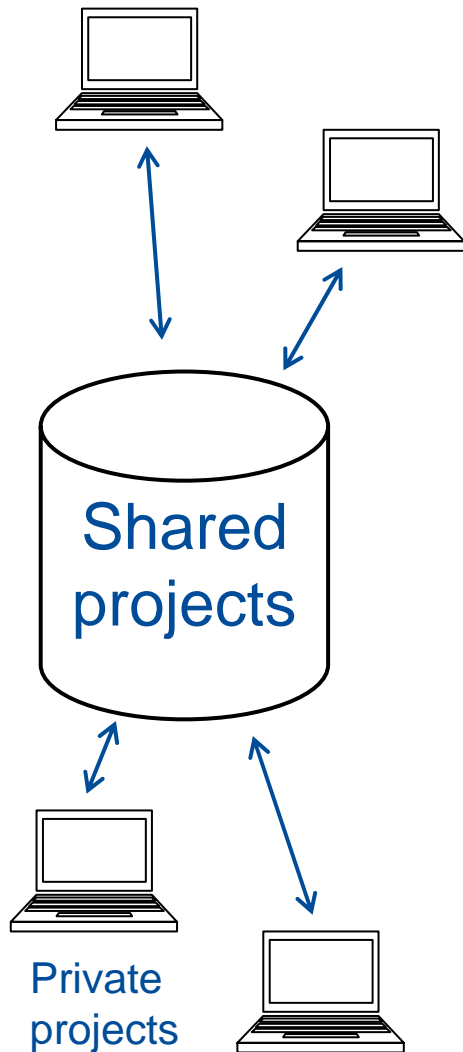
Topics

- Multi-PC system
- Integration to Windows
- Traceability
- Hazard table
- Capacity
- Importance map

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Multi-PC system



Teamwork

Several users can work with one project

Parallel computation

- Snapshot allows editing while computing
- Enter & leave calculation on the fly

Single-button daily backup

Integration to Windows

Copy / paste model parts - data records, fault trees, fault tree branches, event trees, tables, etc.

Copy results - large variety of results, tables and summaries.

Variety of results and formats for automated documents.

Excel, Word, etc.

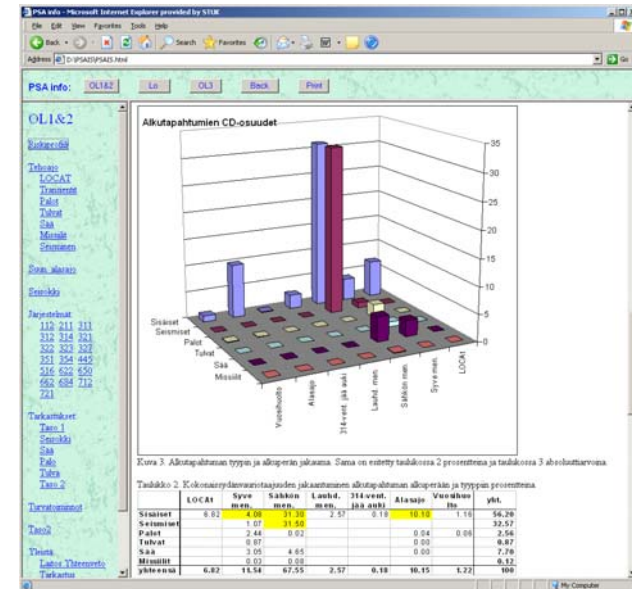
data

results

PSA info system (web)

The screenshot shows an Excel spreadsheet with two sections. The first section, titled 'Fault tree logic <transfer data>', contains a list of logic gates and their associated components. The second section, titled 'Data records <transfer data>', contains a table with columns for Name, Comment, Time, User, Distributor, UCP1, Rel model, RelP1, RelP2, and RelP3.

Name	Comment	Time	User	Distributor	UCP1	Rel model	RelP1	RelP2	RelP3
714P003B6D	PUMPPU PYS:061101	IJAP	Beta	5.74E-04	Operating	0	1.40E-05	0	17
714V103B2B	TAKAISU EI	061101	IJAP	Beta	6.97E-04	Standby	2.00E-05	0	6
J714A22	PUMPPULINJA	061012	tpu	Point Valu	0	Operating	0	0	0
T672D401	EI SAHKÖÄ	69061012	tpu	Point Valu	0	Operating	0	0	0
T672D401	EI SAHKÖÄ	111061012	tpu	Point Valu	0	Operating	0	0	0
T679D401	EI SAHKÖÄ	24061012	tpu	Point Valu	0	Operating	0	0	0
T714AC00	PUMPPU	714P061012	tpu	Point Valu	0	Operating	0	0	0
T714AC11	SAHKÖNSYÖTÖ	061012	tpu	Point Valu	0	Operating	0	0	0
T714AC13	RIIPPUJUUDE	061012	tpu	Point Valu	0	Operating	0	0	0
T714AC21	OHJAUSJÄNNI	061012	tpu	Point Valu	0	Operating	0	0	0



Traceability

Double-click any minimal cut set to see failure propagation

Event trees

Event tree results

Consequence results

The workflow starts with event trees (left), which are analyzed to produce event tree results (middle) shown as pie charts. These results are then used to generate consequence results (right), which include a detailed table of event trees and their associated consequences.

Event trees	Num	Freq.	%	cumul. %	Description	Date
1	5.68E-06	33.71	33.71		EXT-TE	050826 11:32
2	4.10E-06	24.33	58.04		INT-TE	050826 11:32
3	2.09E-06	12.40	70.44		INT-TF	050826 11:32
4	1.58E-06	9.27	79.71		INT-TP	050826 11:32
5	1.34E-06	8.00	87.70		EXT-TF	050826 11:32
6	4.98E-07	2.96	90.66		INT-S2	050826 11:32
7	4.28E-07	2.54	93.20		INT-TT	050826 11:32
8	2.71E-07	1.61	94.81		INT-RO	050826 13:52
9	2.98E-07	1.41	96.23		INT-S1	050826 11:32
10	1.93E-07	1.14	97.37		INT-A2H	050826 11:32
11	1.18E-07	0.82	98.19		INT-80	050826 11:33
12	1.28E-07	0.76	98.95		INT-T3	050826 11:32

Hazard table

Name	Probability	Target	Active	Comment	Distribution	UcPar1	UcPar2	Population	Tii
Last value	-	-	-	-	-	-	-	-	-
Fire1	0.100	E-3	N	E-1 fails E-2 with prob. 0.1	Point Value				06
Fire1	1.00	E-2	Y	E-1 fails E-2	Point Value				06
G1	0.200	E-3	N		Point Value				06

CCI event,
e.g. fire

Probability of
equipment to fail
due to fire

Equipment
failed by fire

Uncertainty data

CCI dependencies in one self-documenting table

- Automatically mapped to fault trees
- No modifications necessary in fault trees
- External event modelling is done by creating the hazard table

High capacity

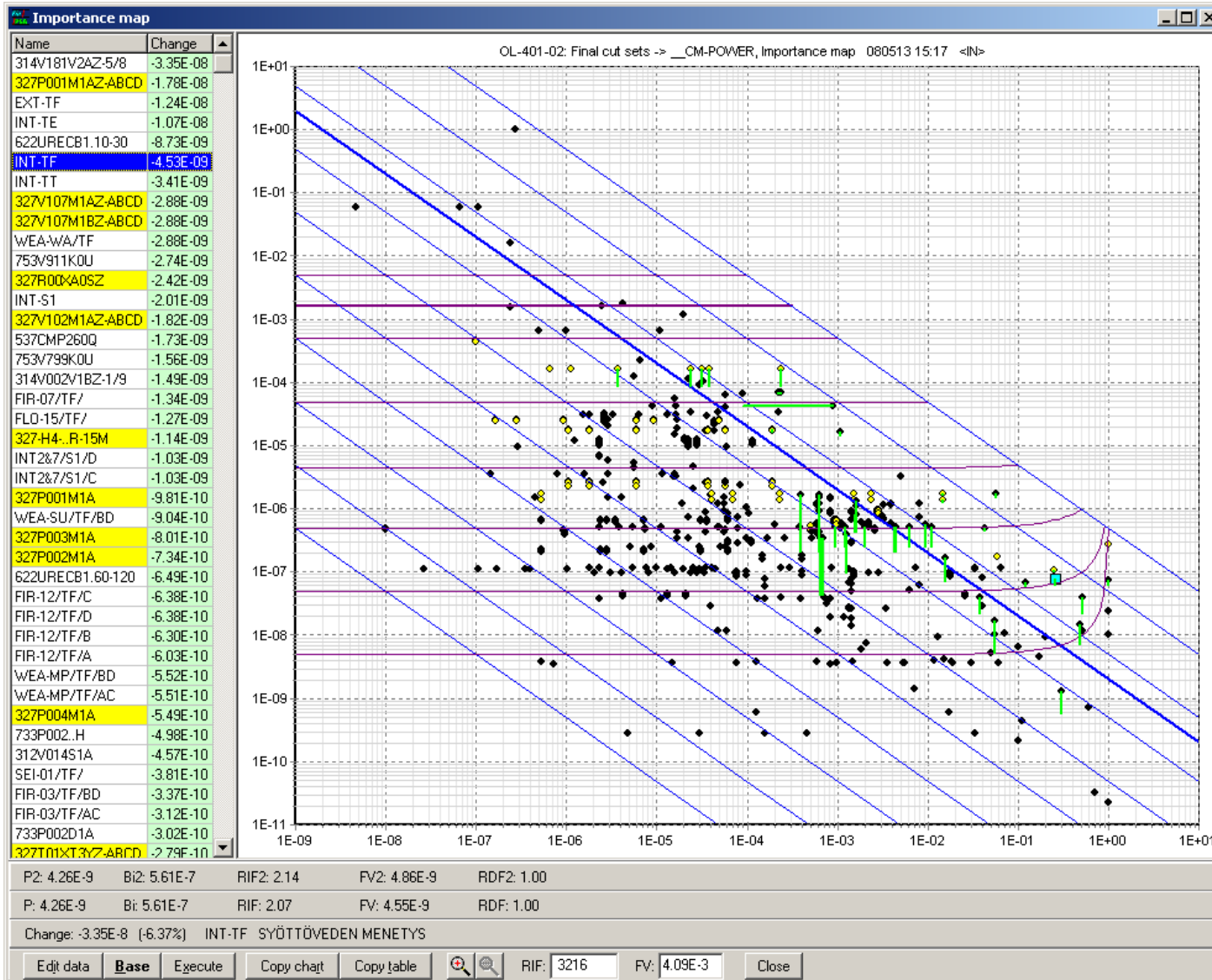
PRA model	Number of event trees	Number of quantified accident sequences	Number of minimal cut sets generated	Minimal cut set generation time
A	172	8 287	3 307 907 351	3 h 57 min
B	59	12 576	11 801 051 317	5 h 12 min
C	65	1 002	4.73238E+14	53 min
D	80	23 456	40 332 435 199	5 h 10 min (4 PC)
E	36	489	1.14404E+11	47 min
F	122	1 200	4 040 544 586	37 min

Times are for full generation of minimal cut sets for the entire PRA model.

Calculations with existing cut sets are mostly a matter of seconds.

Importance map: OL1/2 aux FW system

Interactive tool for risk-informed applications



Yellow points
belong in the Aux
FW

Black components
give safety margin
to aux FW system

Change:
opening of 6 valves
in pressure relief
system made 10
times more reliable

Conclusions

- Efficient minimal cut set search engine
 - Maximum number of generated minimal cut sets is $9.18 \cdot 10^{18}$
- Excellent traceability
 - Accident sequence of every minimal cut set is known
 - Every minimal cut set can be displayed in fault tree with a click
- New modelling features
 - Hazard table isolates CCIs from the internal events model
 - Addition of communication-based I&C model in the future
- For everyday use
 - Teamwork and parallel processing
 - Versatile outputs to Windows programs