3TU.

Fluid Survival Tool: A model checker for Hybrid Petri nets

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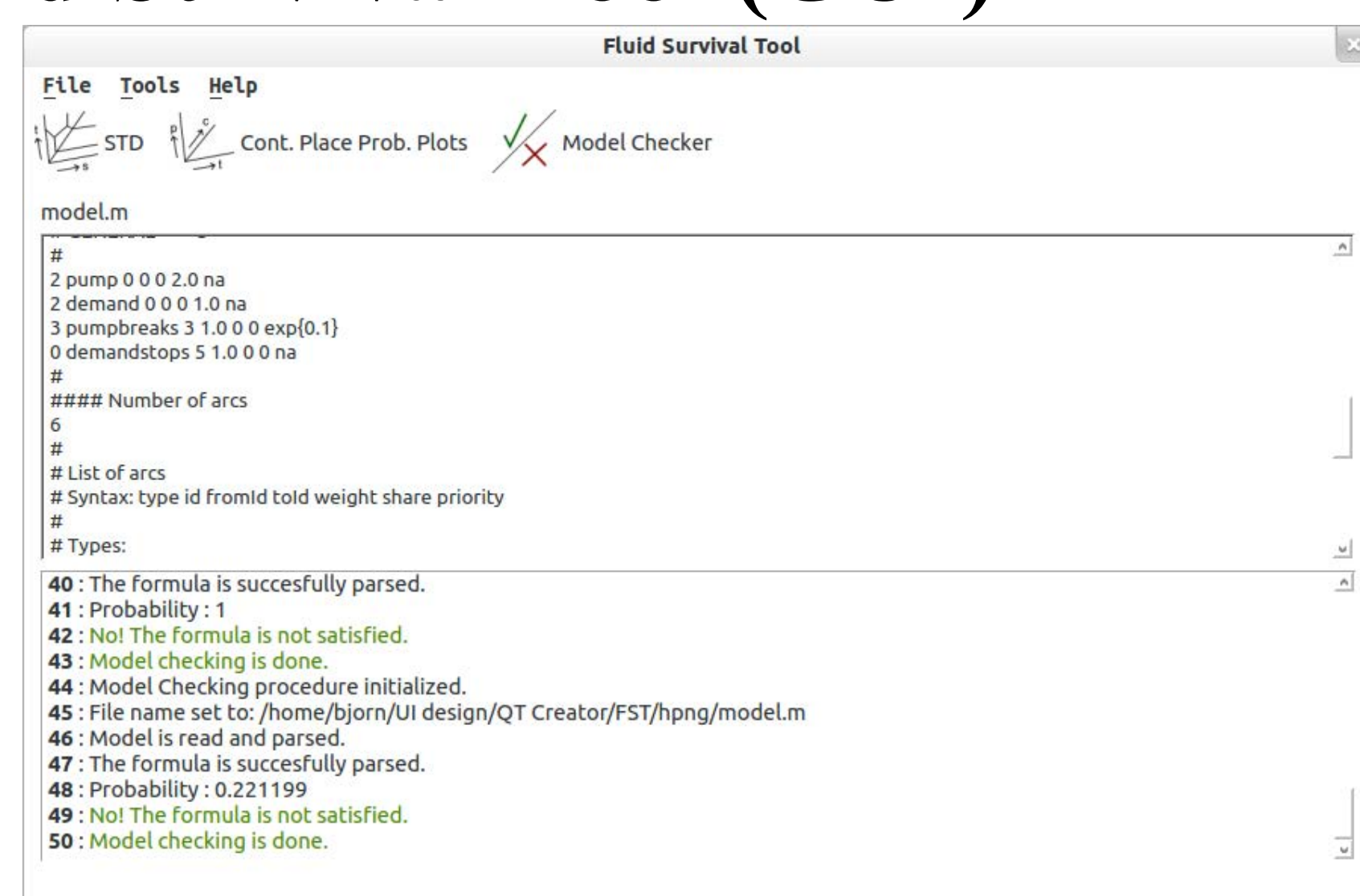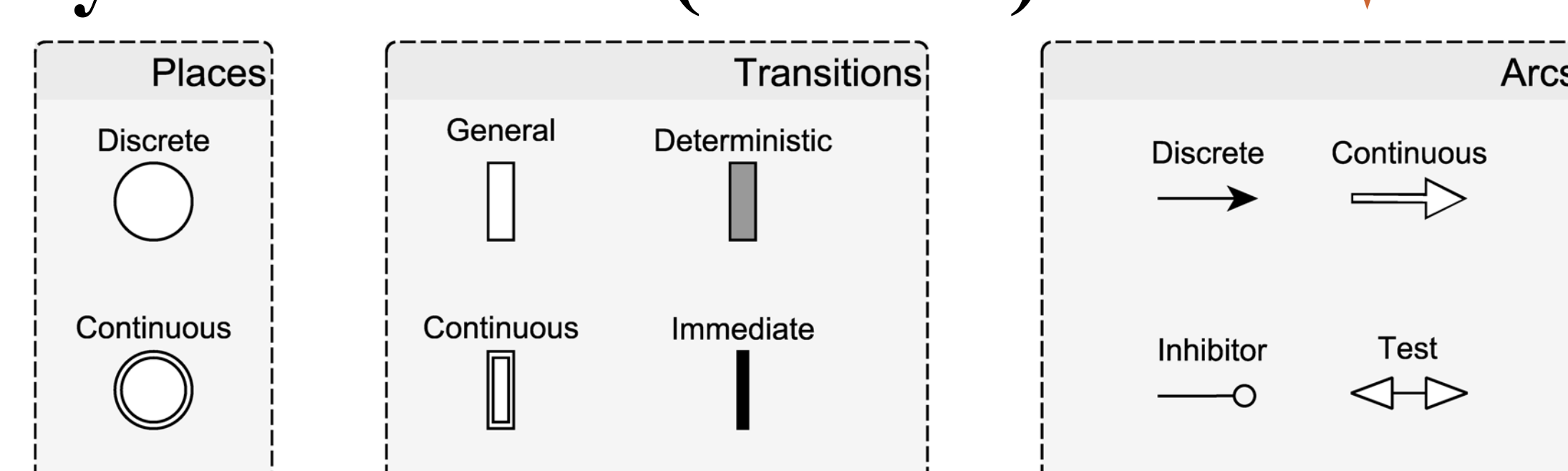http://www.utwente.nl/ewi/dacs/

CRITICAL INFRASTRUCTURE

Characteristics of critical infrastructures

- Essential for economy and society
- Exposed to variety of attacks and failures
- Highly complex systems
- Hybrid Characteristics:
  - **Discrete** variables
  - **Continuous** variables
  - **Stochastic** behavior

Fluid Survival Tool (GUI)

Hybrid Petri net (HPNG*) models

Stochastic Time Logic (STL) specification

- To specify dependability measures

$$\Psi := tt \mid x_{\mathcal{P}} \leq c \mid m_{\mathcal{P}} = a \mid \neg\Psi \mid \Psi_1 \wedge \Psi_2 \mid \Psi_1 \, \mathcal{U}^{[T_1,T_2]} \, \Psi_2$$

* = An Hybrid Petri net with one general one-shot transition (HPNG)

Tool Functionalities

Functionality	Input	Output
Model checking	HPNG model STL formula Time to check	✓ ✗
Stochastic time diagram	HPNG model	
Transient probabilities	HPNG model STL formula Time range	

Tool output

Model Checking Verdict
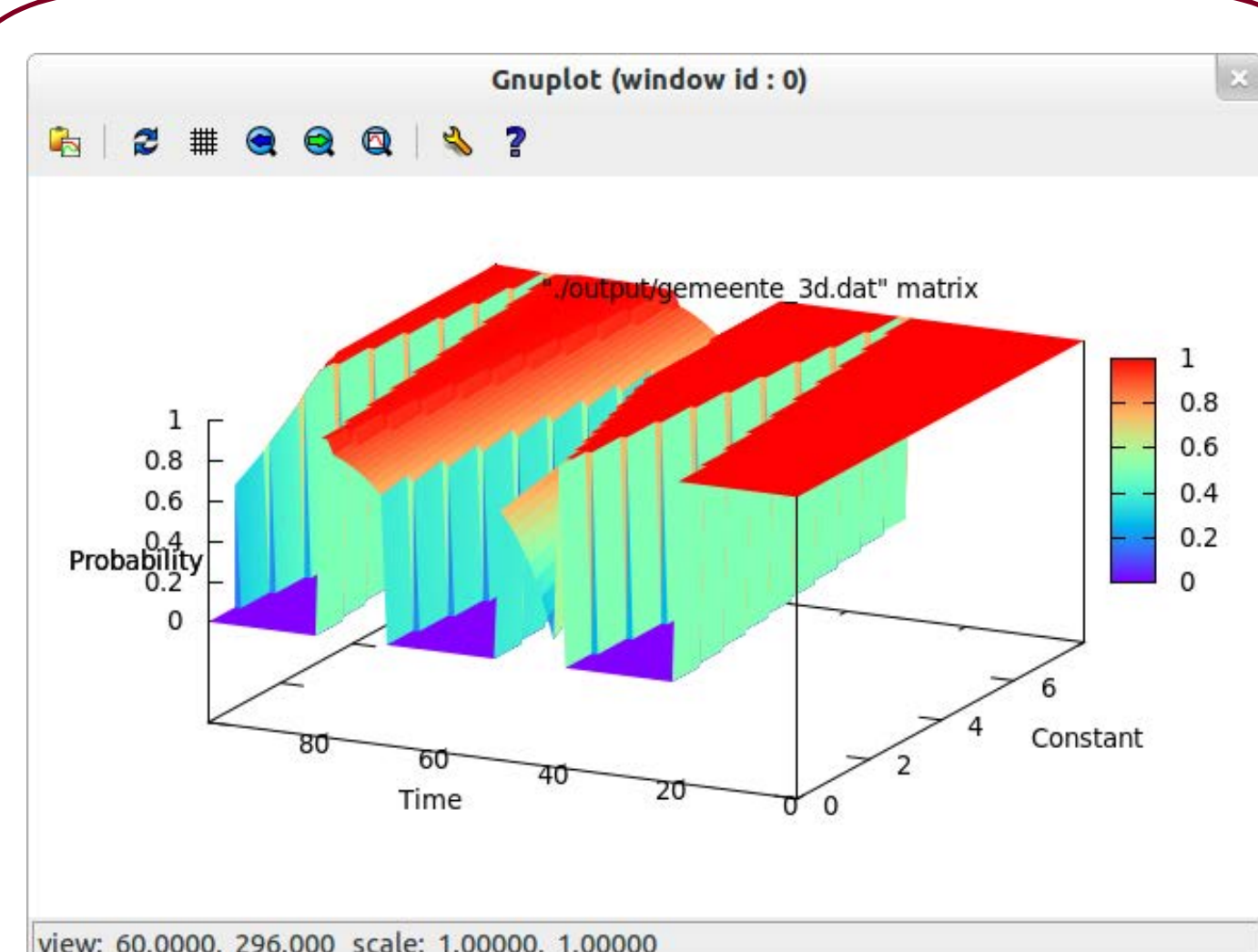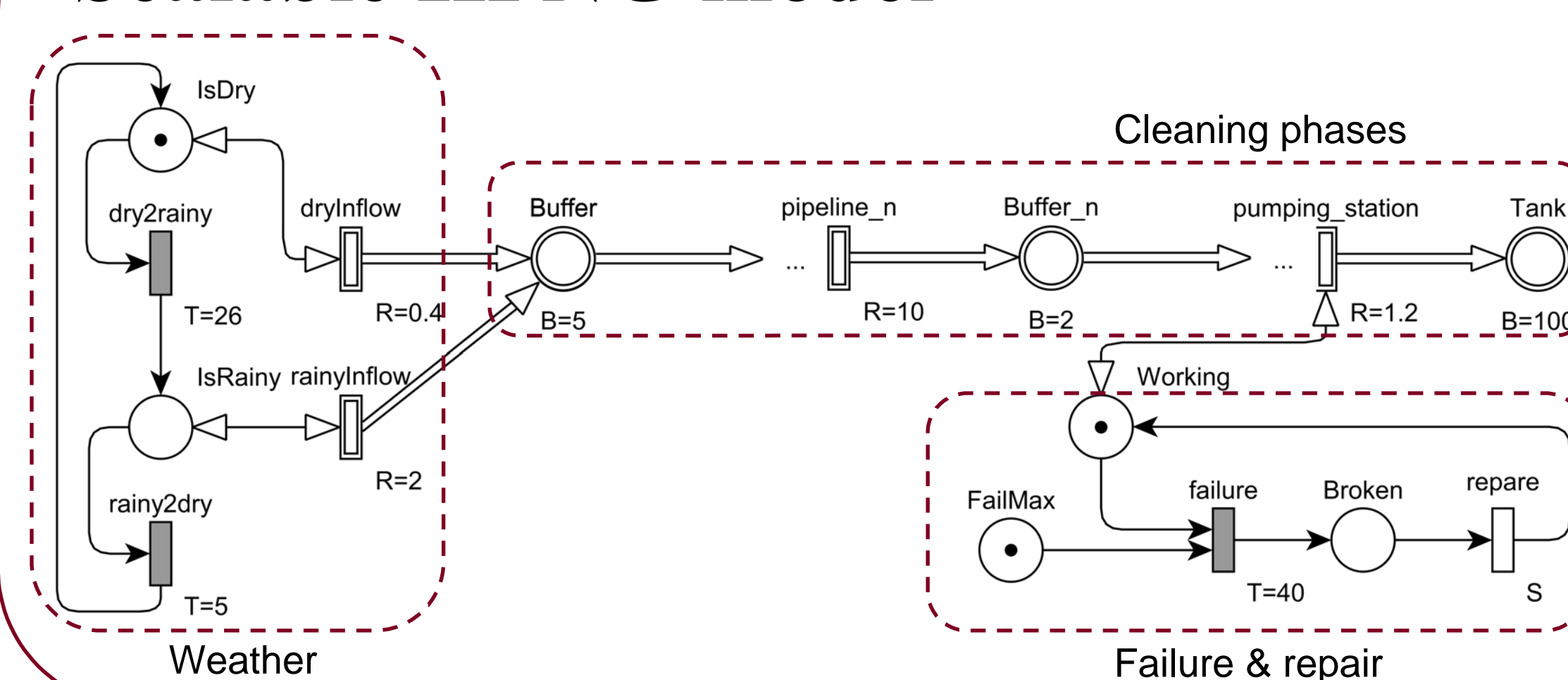✓ Yes! The formula PR<=0.25(X.reservoir<=5.0) is satisfied. OK
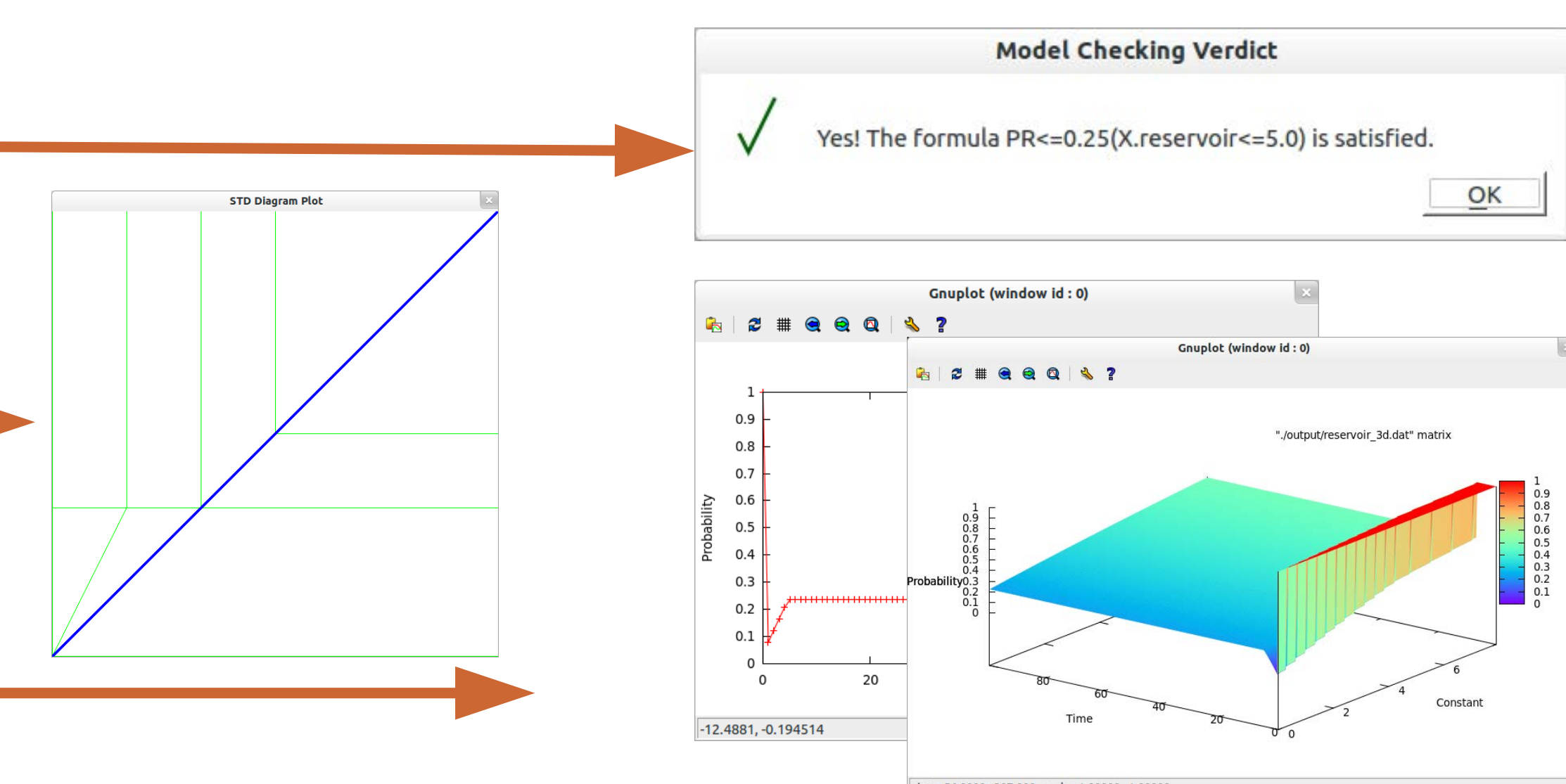
Case Study: Sewage water treatment facility

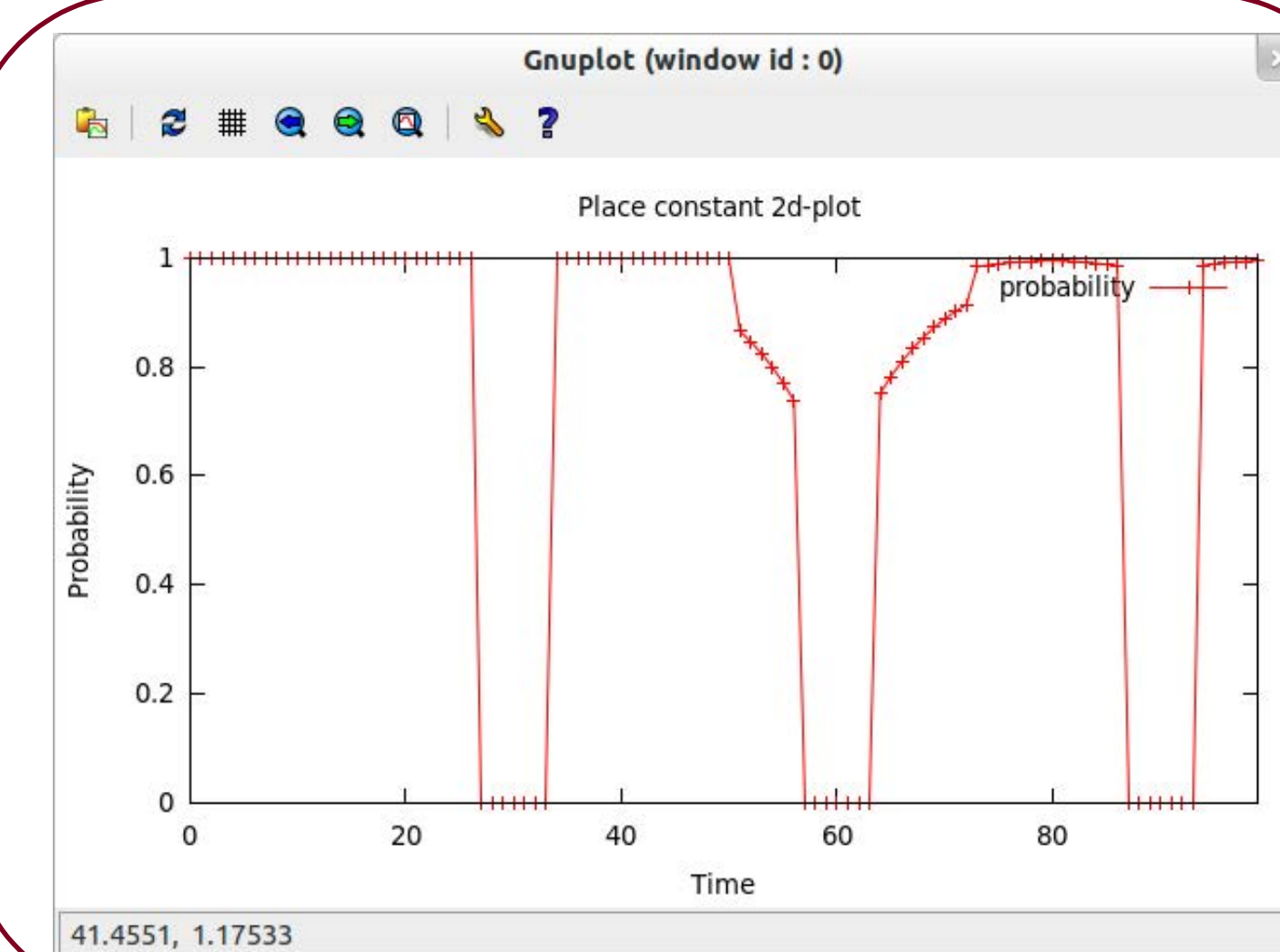## Scalable HPNG model

- 7 to 30 places
- 8 to 31 transitions
- Computation times:

Model checking	1 to 13 ms
2D plot	158 to 182 ms
3D plot	277 to 896 ms

[1] Postema, B.F.: Fluid Survival Tool: A model checker for Hybrid Petri nets. MSc thesis, University of Twente. (2013)

[2] Ghasemieh, H., Remke, A., Haverkort, B.R., Gribaudo, M.: Region-based analysis of hybrid Petri nets with a single general one-shot transition. In: 10th Int. Conf. FORMATS. 139-154 (2012)

[3] Ghasemieh, H., Remke, A., Haverkort, B.R.: Analysis of a sewage treatment facility using hybrid Petri nets. In: 7th Int. Conf. VALUETOOLS. (to be published) (2013)

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