

Dynamic Enhanced Bayesian Network for the risk assessment of coupled High Temperature Electrolysis Facilities and Nuclear Power Plants

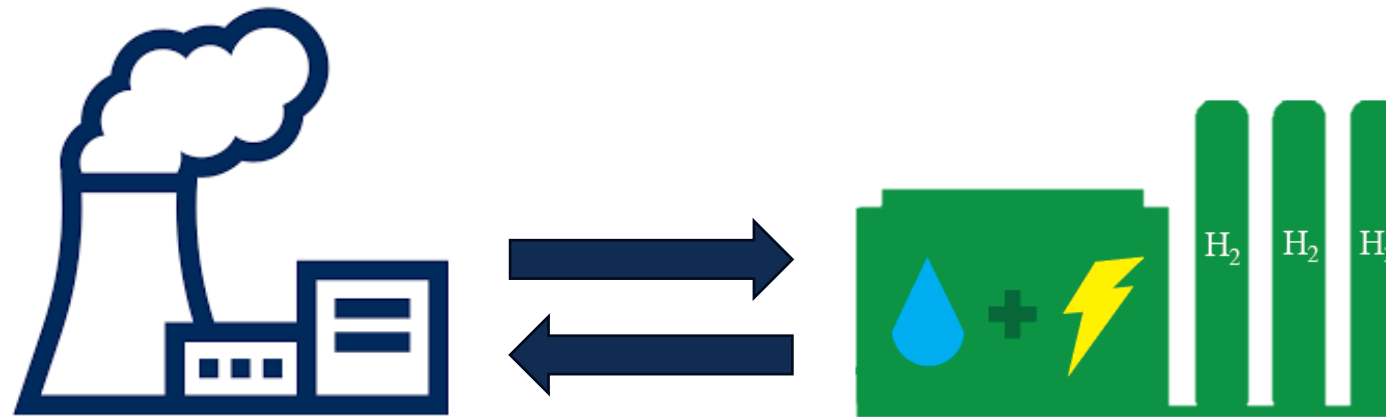


POLITECNICO
MILANO 1863

DIPARTIMENTO
DI ENERGIA

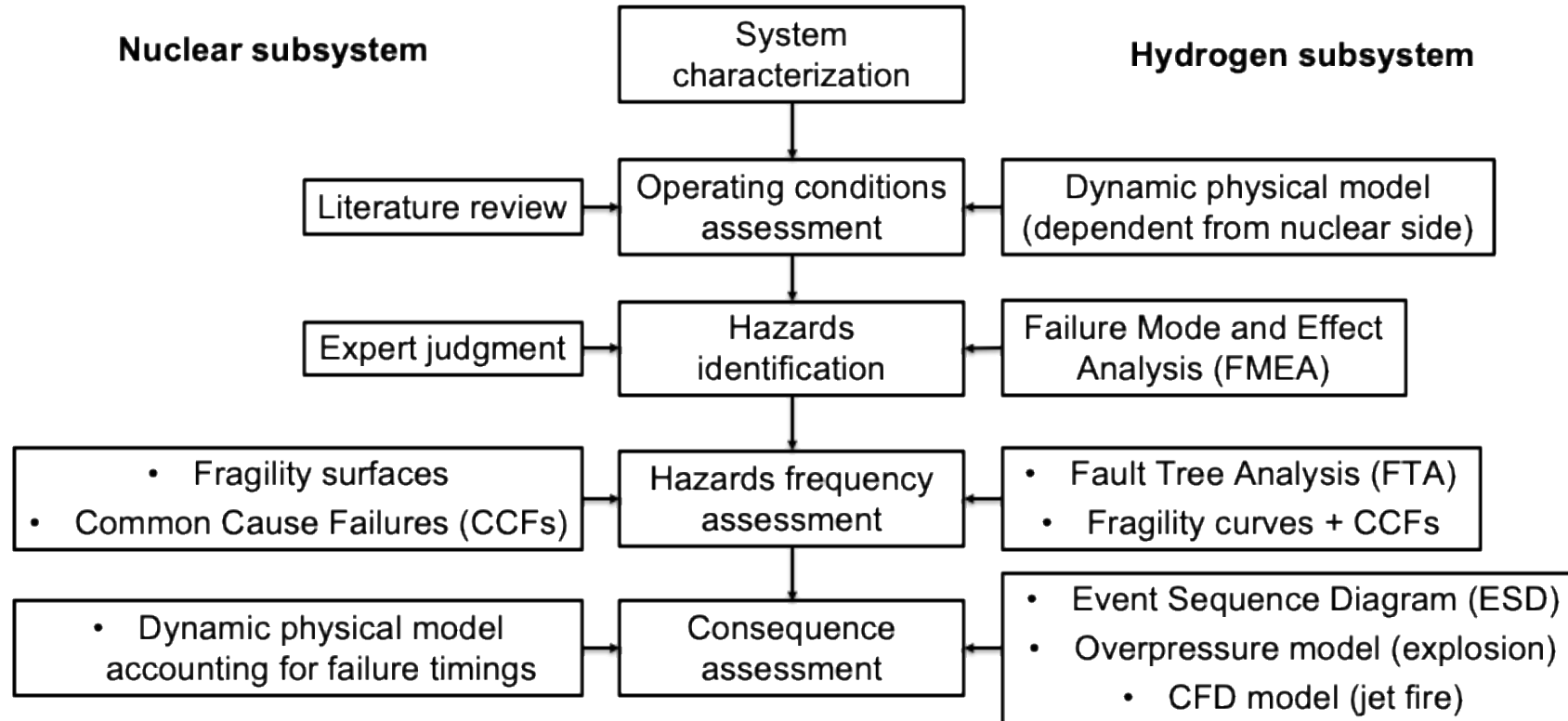
lasar³

Large scale hydrogen production with High Temperature Electrolysis Facilities (HTEF) coupled with Nuclear Power Plants (NPP)



The **licensing** of the integrated plants **requires assessing the increased risk to the NPP** due to the HTEF

Current approach

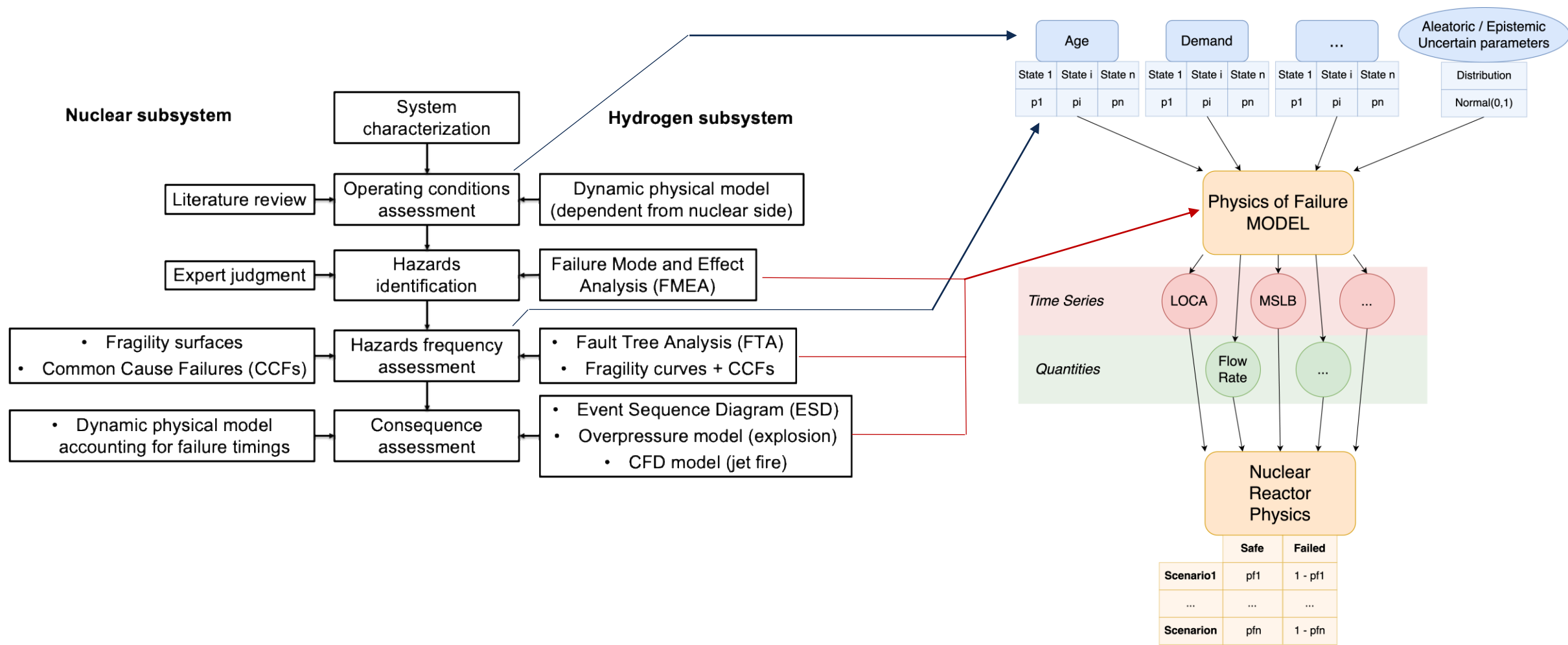


Limitations

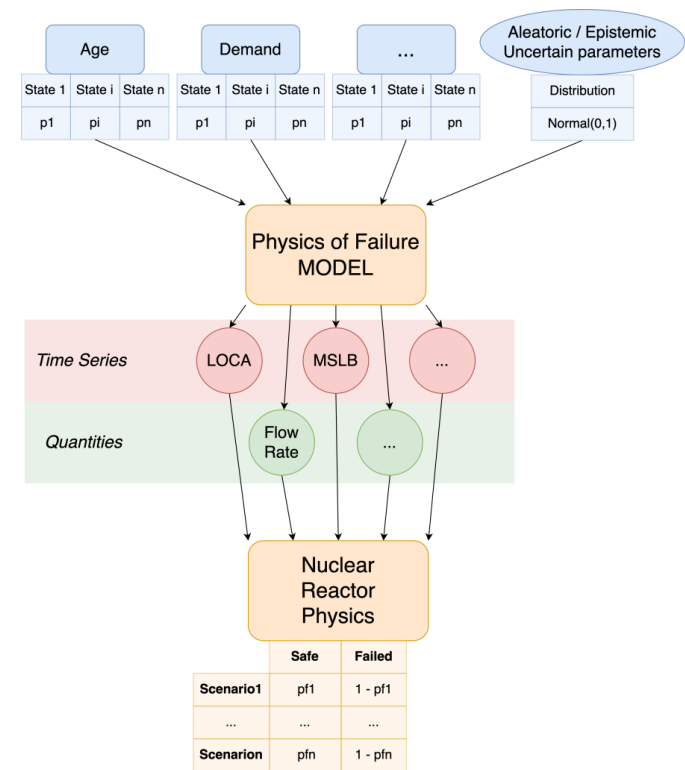
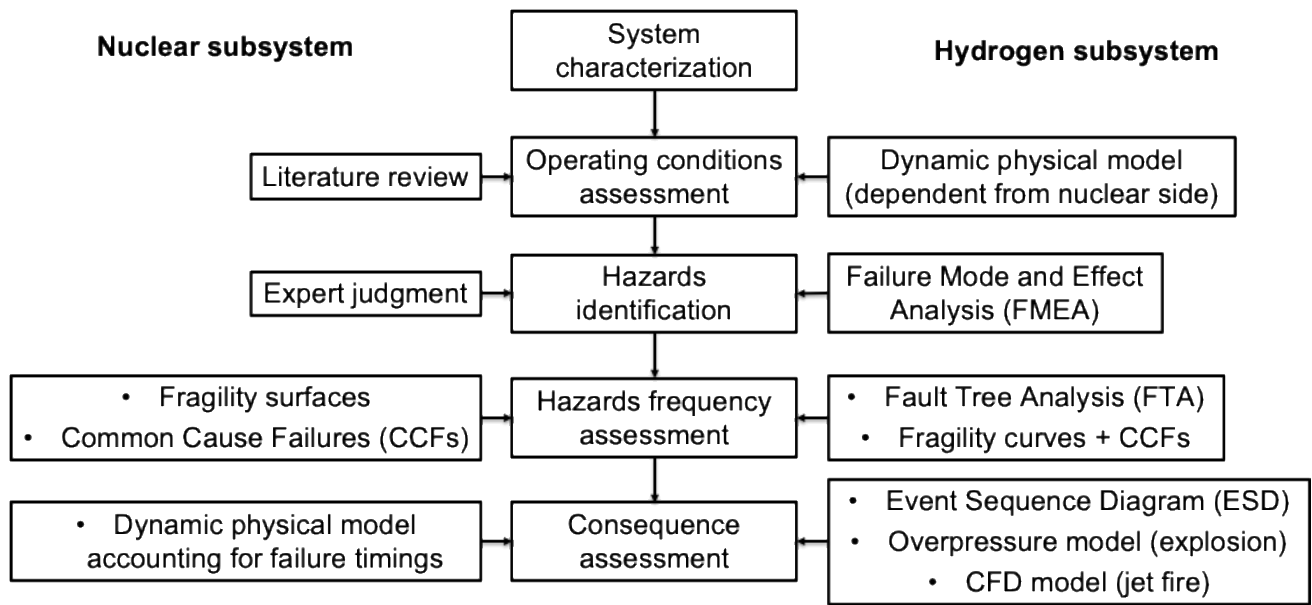


- No uncertainty quantification
- No imprecision
- No Bayesian update as new evidence becomes available
- No tool to perform inference

Proposed solution: Enhanced Imprecise Bayesian Network



Proposed solution: Enhanced Imprecise Bayesian Network



Added values

- Uncertainty quantification
- Imprecise CPTs
- Inference (forward and backward)
- Bayesian update

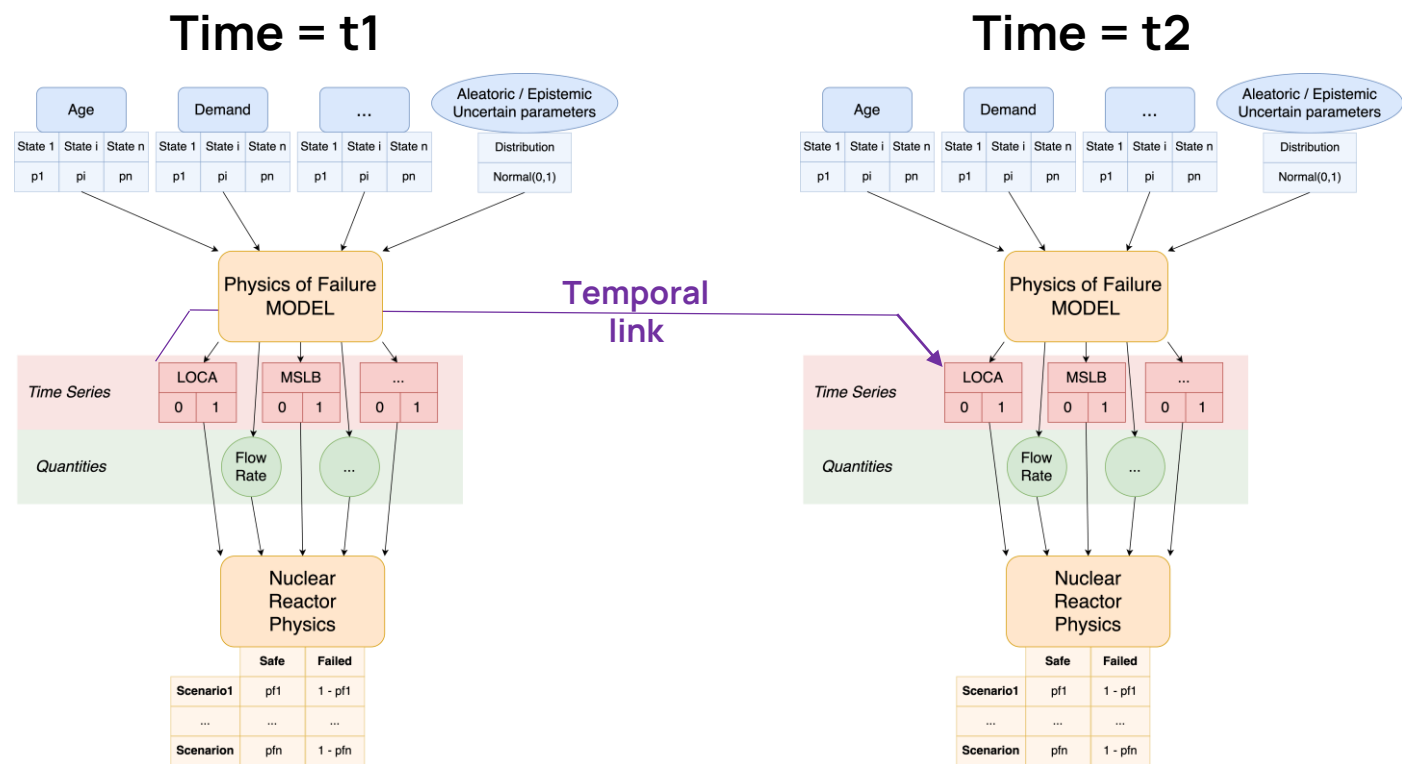
Issues

- Time-dependent variables discretization (too many states!)



LOCA	P(LOCA)
t = 0	
t = 1	
...	
t = 1199	
t = 1200	

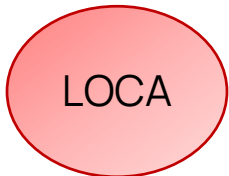
Proposed solution: Dynamic Enhanced Imprecise Bayesian Network



Added values

- Uncertainty quantification
- Imprecise CPTs
- Inference (forward and backward)
- Bayesian update

Inference on temporal nodes
(e.g., failure times, physical quantities...)



LOCA	P(LOCA)
Yes	
No	

Only two states

Enhanced Bayesian Networks for the risk assessment and management of Oil and Gas plants



POLITECNICO
MILANO 1863

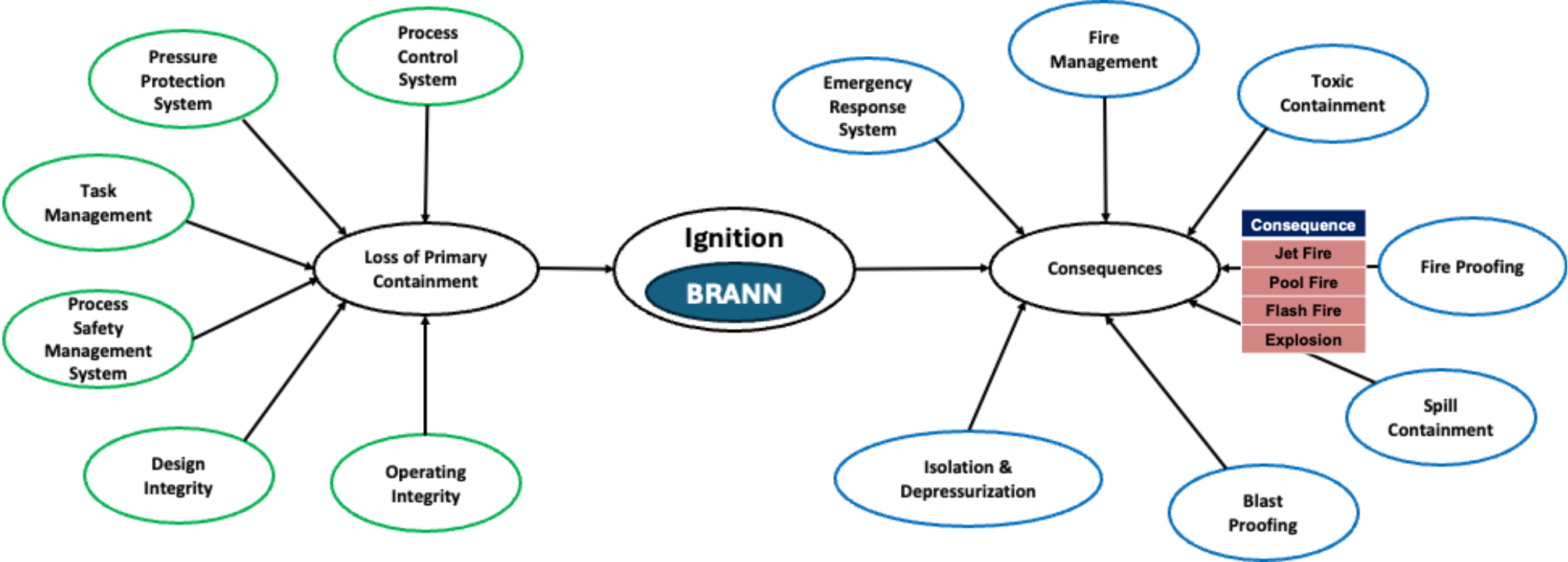
DIPARTIMENTO
DI ENERGIA

lasar³



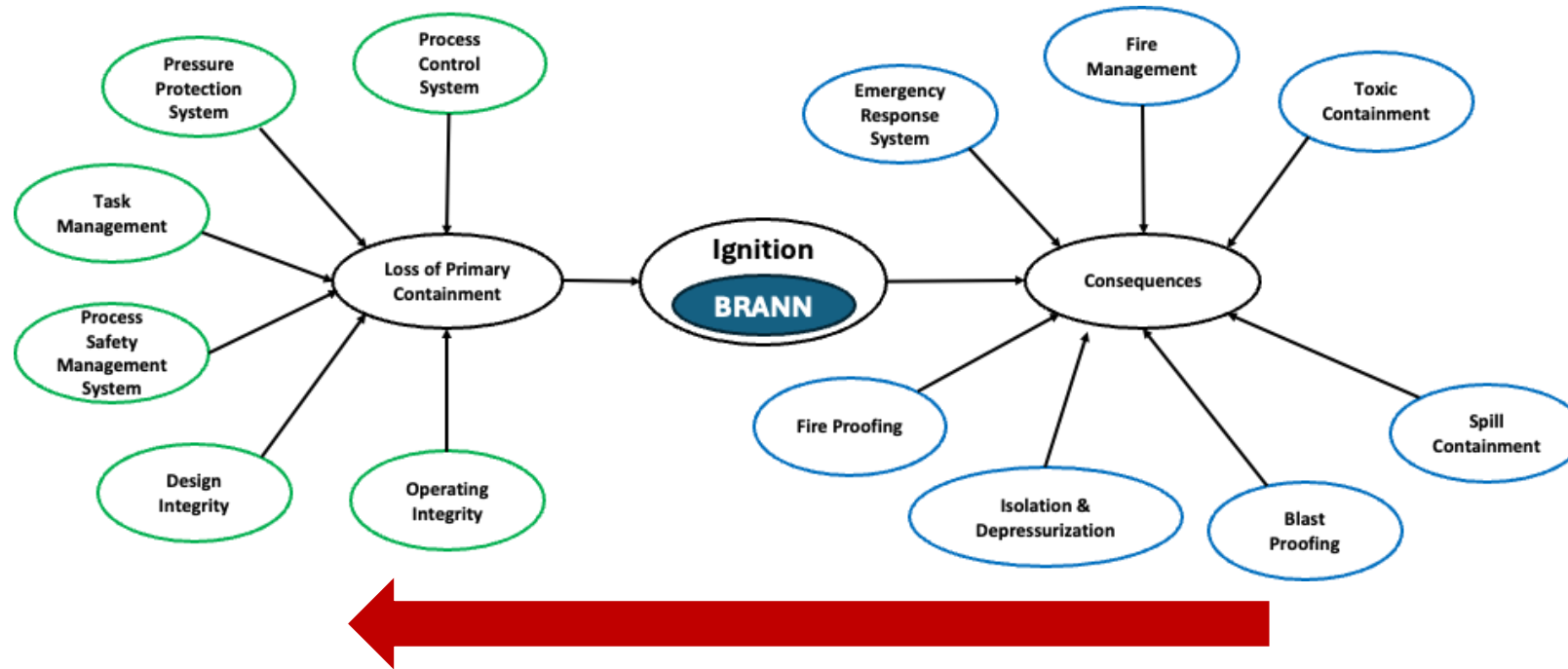
Risk assessment in O&G facilities by Bayesian Network (BN) Modeling

Mitigative safety barriers



Preventive safety barriers

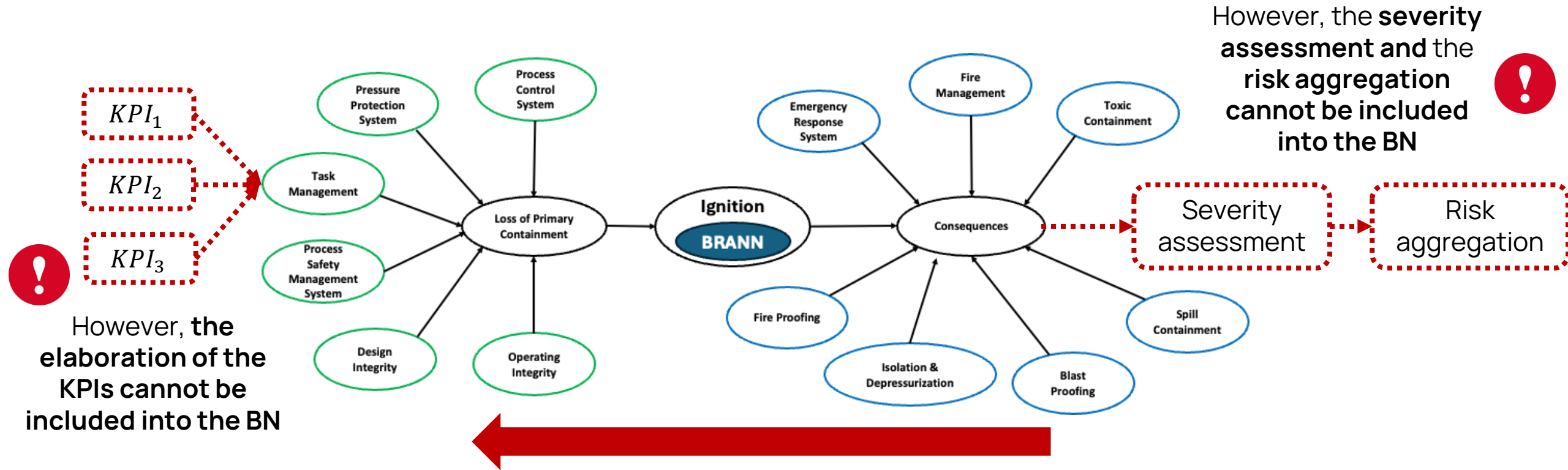
Problem statement



We want to perform **backward inference** to identify the optimal maintenance schedule and/or design improvements

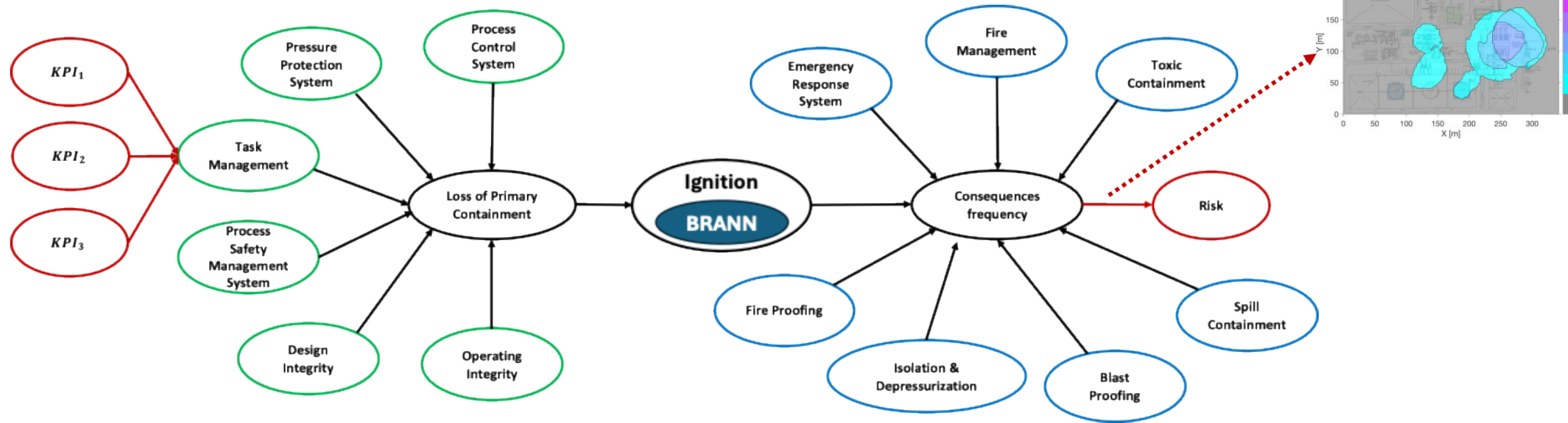
Problem statement

10



We want to perform **backward inference** to identify the optimal maintenance schedule and/or design improvements

Proposed solution: Enhanced Bayesian Network



Forward and backward inference on the risk and on the KPIs

