Mutltivariate Analysis of MOx Based Nuclear Scenarios

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Making Scenario Analyses More Consistent

Some expectations:

- Evaluate different strategies
- Support in decision making process

Things to cope with:

- Control "uncertainty" at every level
  - ✓Physics description
  - ✓Meta-models used (see M. ERNOULT)
- Robustness of the results (sensitivity to hypothteses) (see JB CLAVEL)

Challenges:

1. Can we draw conclusions from our observations ?
2.Does it hold in the variability of the hypotheses ?

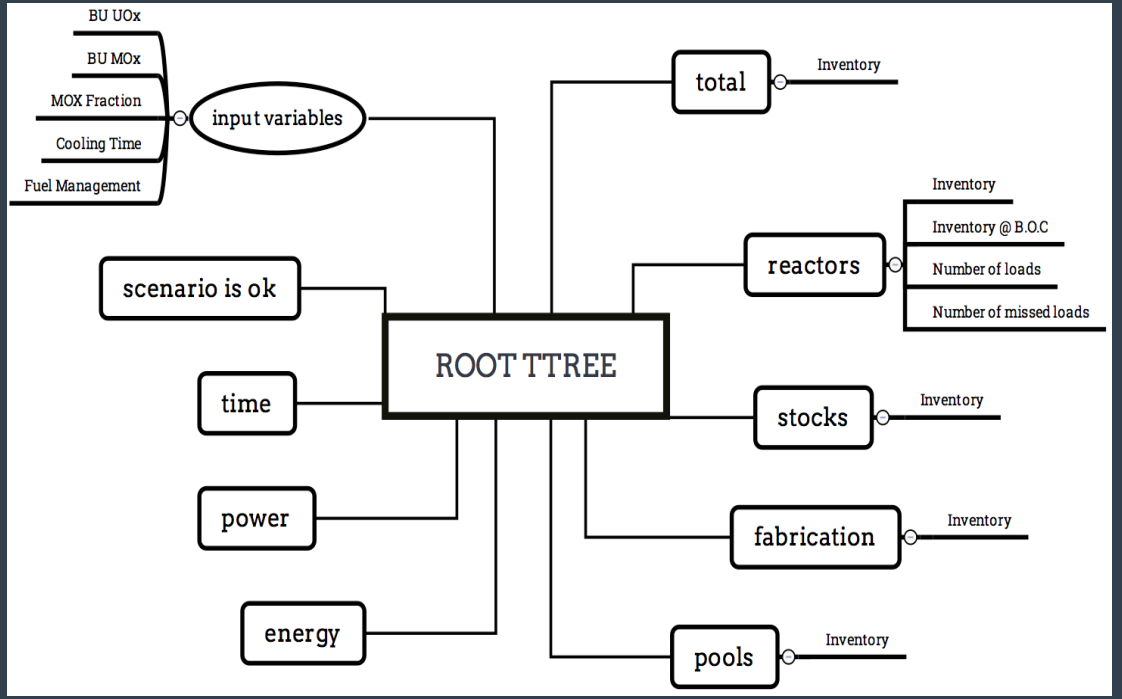
Global Observation Analysis

Courtesy of N. Thiollière

A Mixed Oxide Fleet: Design Of Experience

Variables	Min	Max
BU UOx	30	65
BU MOx	30	65
Fr MOx	0	0.2
Cooling UOx	0	20

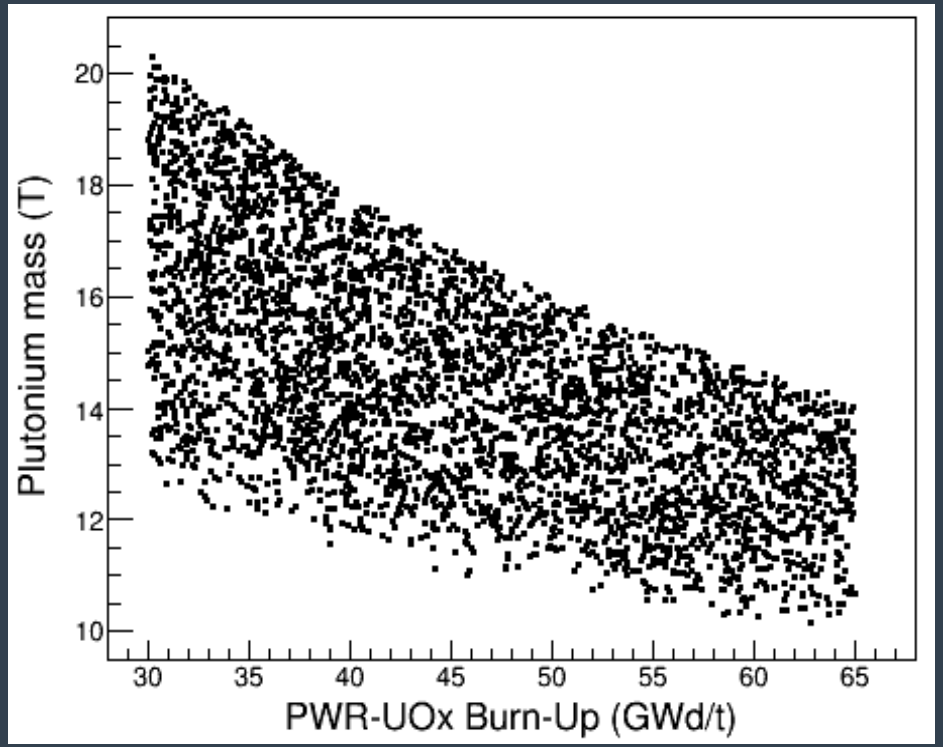
Inputs are sampled : 10 000 entries
≈ 0.5 TB of data

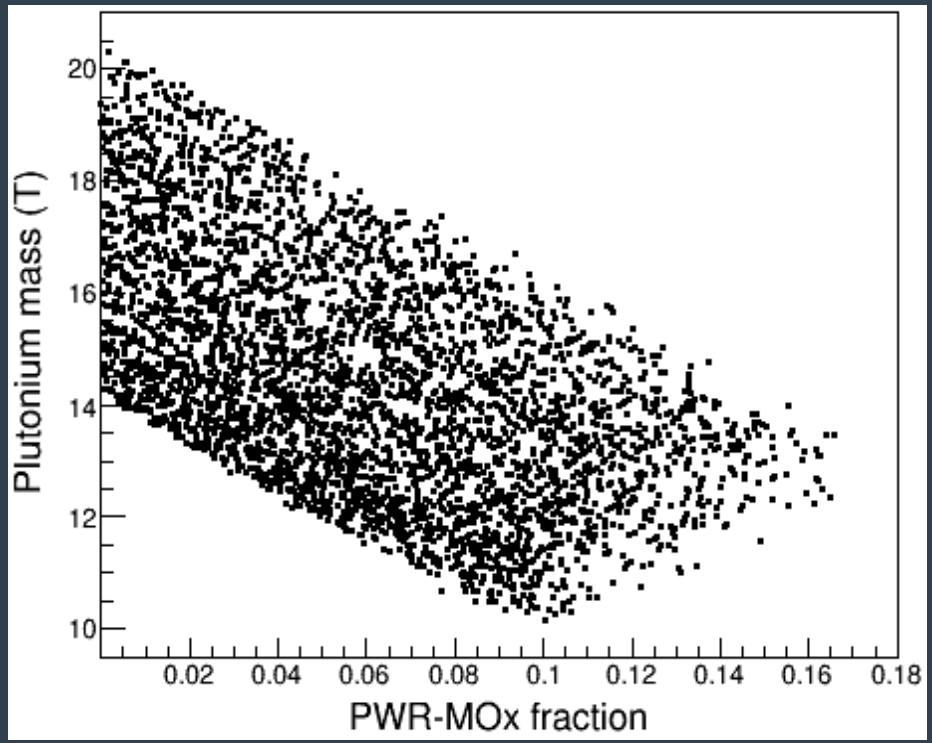


Retrieve the inventory of elements anywhere in the cycle
Compute any observable from all inputs all together

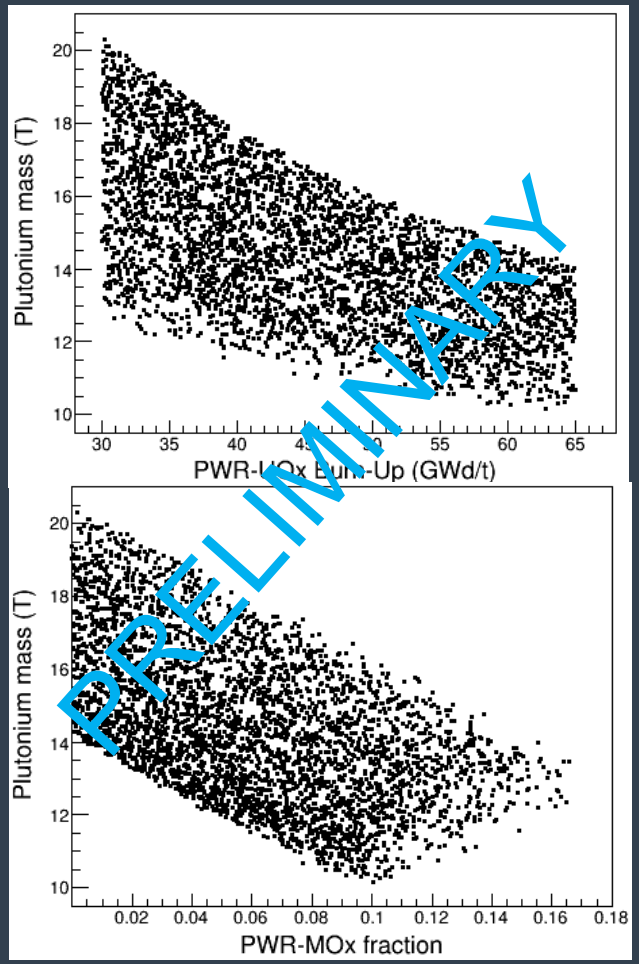
Results: Plutonium Production

Plutonium is an important strategic fissile material in transition scenarios





Results: Plutonium Production



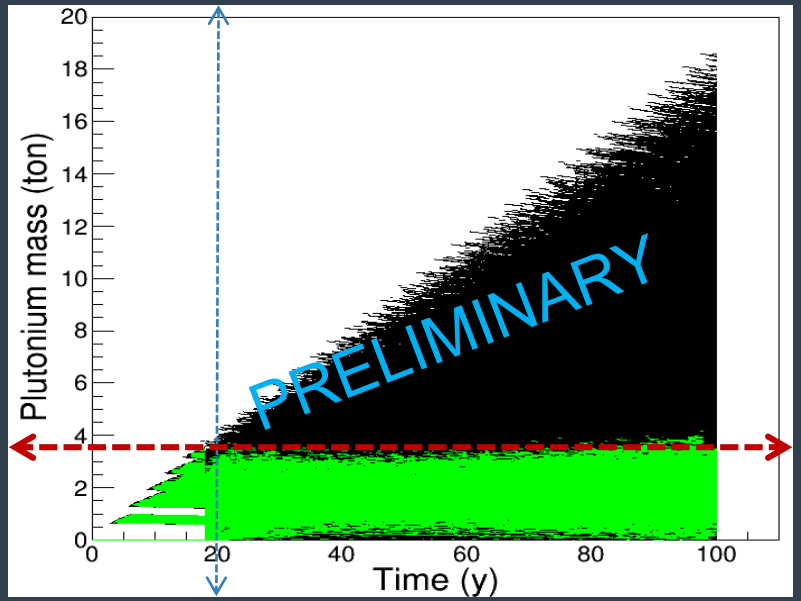
Pu Sobol	BU UOx	BU MOx	Fr MOx	Cooling
1st Ord	0.40	--	0.57	--
Total	0.42	--	0.60	--

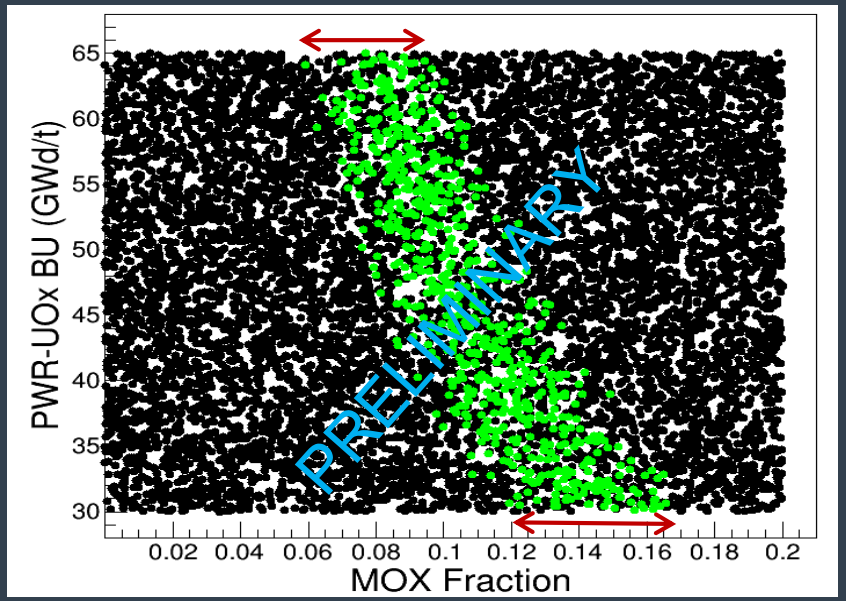
Under Review, N. Thiollière

OUTPUT Θ INPUTS

- Sobol indices are obtained from independent DOE
- The method complements Sobol Indices Calculation

Results: Plutonium Stabilization



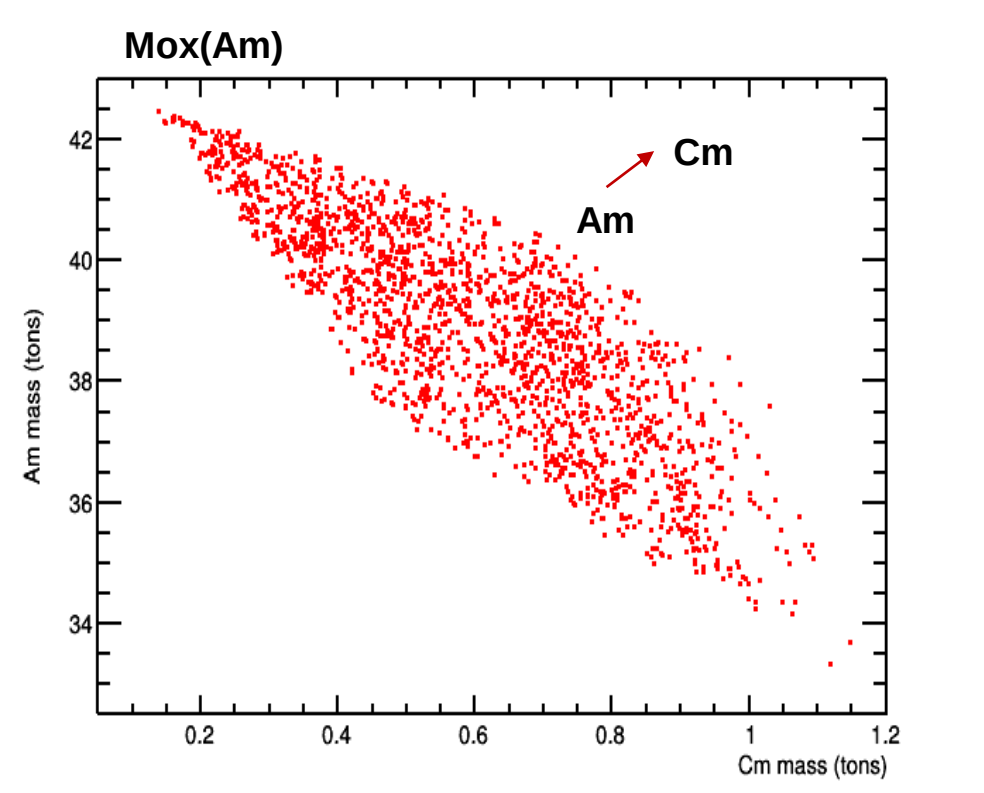


Optimization:
- Ensure Power supply
- WO Growing Pu in Storage

Projection:
Determines solution space

INPUT
Θ
INPUT

Outputs Θ Outputs



Beyond sensitivity analysis

- Shows correlation between observables
- Less biased interpretation of results

Next Step / Extension

- Customized DOE from influential Inputs
- Are we still unbiased ?