CALIBRATION WITH DIRECT OPTIMIZATION

BAYESIAN CALIBRATION

USE DIRECT OPTIMIZATION FOR CALIBRATION

- See Tutorial 12 for direct optimization
- See Tutorial 10 for calibration

A. Import DOE / Direct Optimization

B. If outputs of chosen simulator are functional variables

1. Define calibration / import exeprimental data
2. Define Optimization problem to change possibly the inputs bounds
   → define optimization problem formulation / change inputs info for optimization
3. Define initial inputs values
4. Launch initial values to run a first simulation
   → objective functions are built with default weights (set to 1)
5. Change possible the weights in Define calibration / define objective function

C. Define Optimization problem

Define objective function to be minimized

BAYESIAN CALIBRATION [1][2][3][4]

Solver = HubOpt Bayesian calibration

- Set maximal number of simulations *(maxeval)*
- Set the size of initial DoE *(nx0)*
- Set the number of simulations per iteration

see also advanced parameters for optimizer

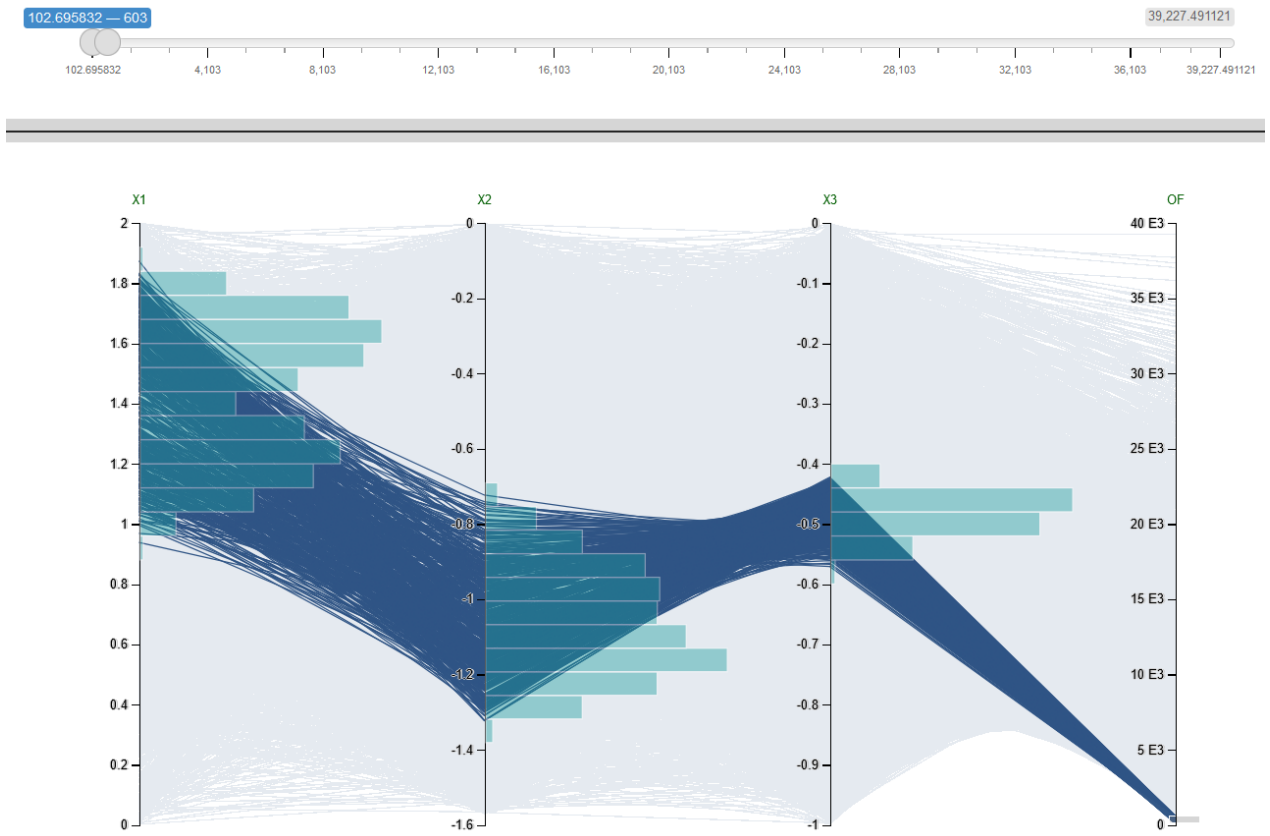
Export iterates of optimization

Outputs of HubOpt solver in lagun/Saved_Optimizations/yyyy-mm-dd_**h**m**s

- PostSample_X.txt : sample of the posterior inputs
- PostSample.txt : sample of the posterior inputs and associated objective function values
- Sample.RDS : R data structure containing kriging models, posterior samples, posterior quantiles, …

HOW TO ANALYZE AND VISUALIZE OUTPUTS WITH LAGUN ?

A. Import DOE from file ***PostSample.txt*** (see Tutorial 2.2)
Preliminary exploration / parallePlot with histograms to analyze the posterior distribution



HOW TO ANALYZE AND VISUALIZE OUTPUTS WITH LAGUN ?

B. Export iterates → can be used in “import DOE” functionality

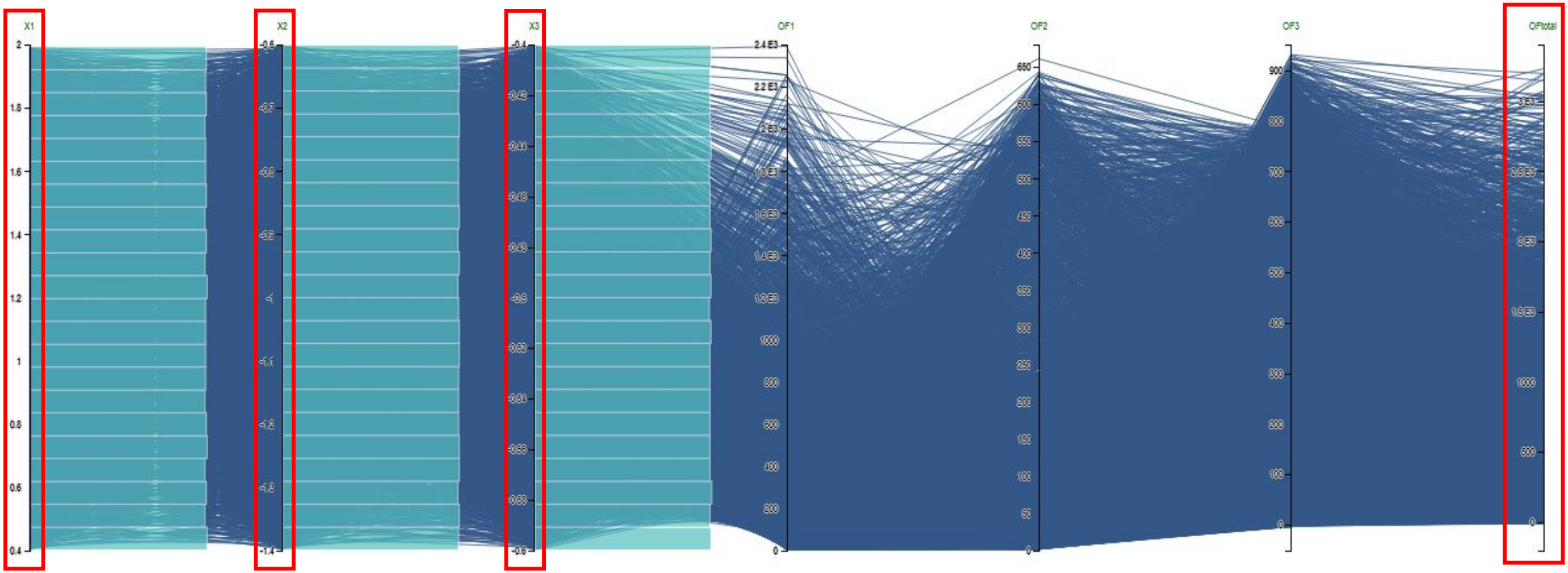
1. To build kriging model of objective function
2. Explore with surrogate model (see Tutorial 4)

Refine sampling
in reduced input domain

HOW TO ANALYZE AND VISUALIZE OUTPUTS WITH LAGUN ?

B. Export iterates → can be used in “import DOE” functionality

1. To build kriging model of objective function
2. Explore with surrogate model
3. Refine Sampling



HOW TO ANALYZE AND VISUALIZE OUTPUTS WITH LAGUN ?

B. Export iterates → can be used in “import DOE” functionality

1. To build kriging model of objective function
2. Explore with surrogate model

Inverse sampling for small values of objective function

HOW TO ANALYZE AND VISUALIZE OUTPUTS WITH LAGUN ?

B. Export iterates → can be used in “import DOE” functionality

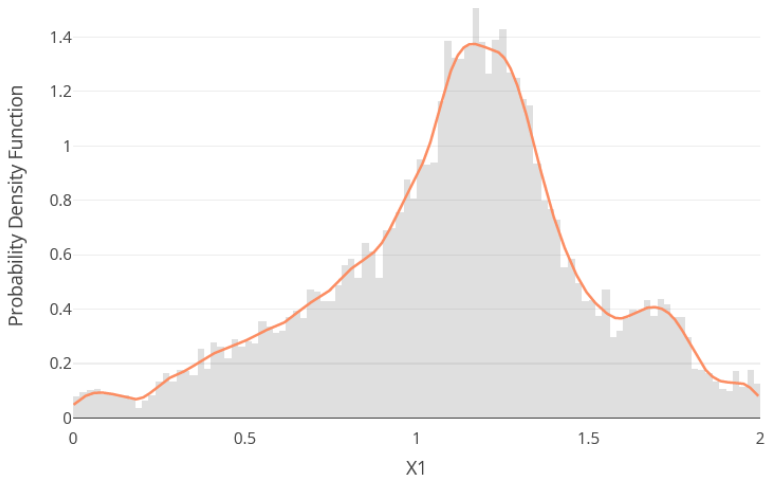
1. To build kriging model of objective function
2. Explore with surrogate model
3. Refine sampling
4. Inverse sampling

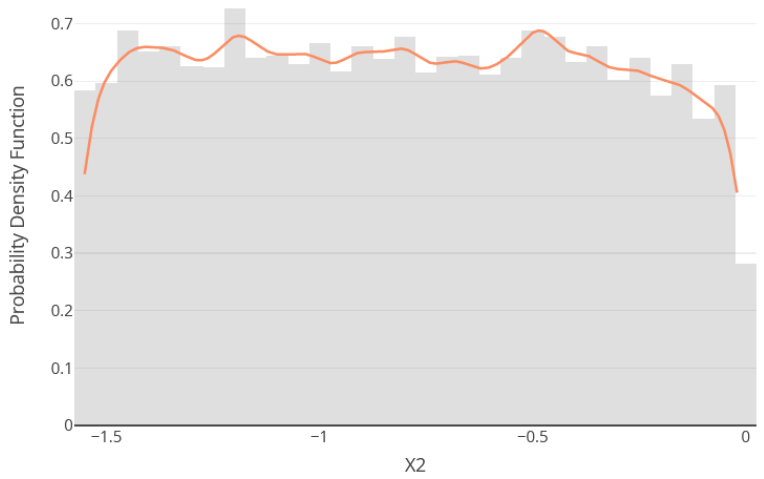
→ display sampling and export sampling

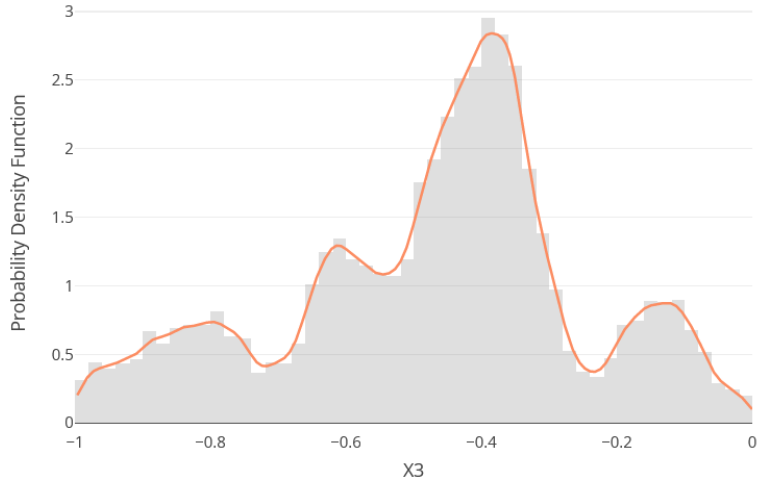
HOW TO ANALYZE AND VISUALIZE OUTPUTS WITH LAGUN ?

C. Export iterates → can be used in “import DOE” functionality

1. To build kriging model of objective function
2. Explore with surrogate model
3. UQ with surrogate model (see Tutorial 5)
4. Fit a model to posterior input laws
   - change uncertainty definition (marginals): set all to “estimated”
   - change uncertainty definition (dependence): groups unknown
   - distribution fitting (maginals) with file ***PostSample_X.txt :*** try parametric and then non-parametric
   - select distributions (marginals)







HOW TO ANALYZE AND VISUALIZE OUTPUTS WITH LAGUN ?

C. Export iterates → can be used in “import DOE” functionality

1. To build kriging model of objective function
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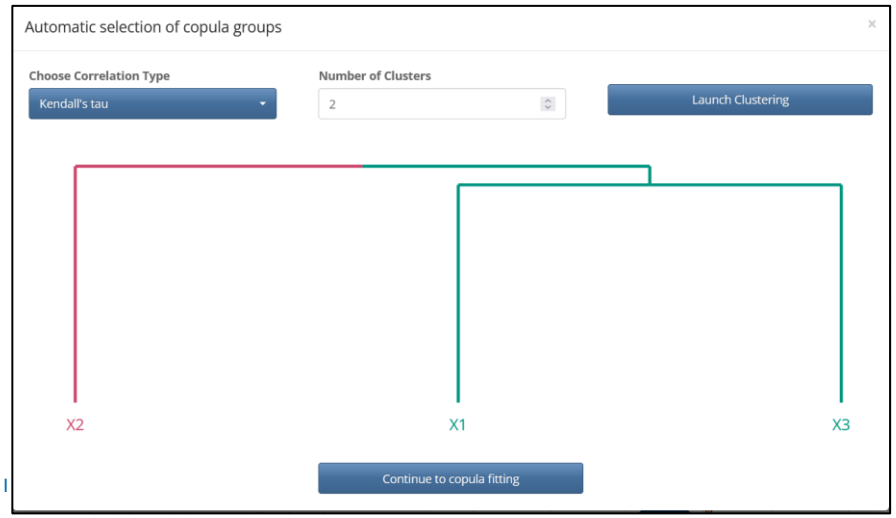
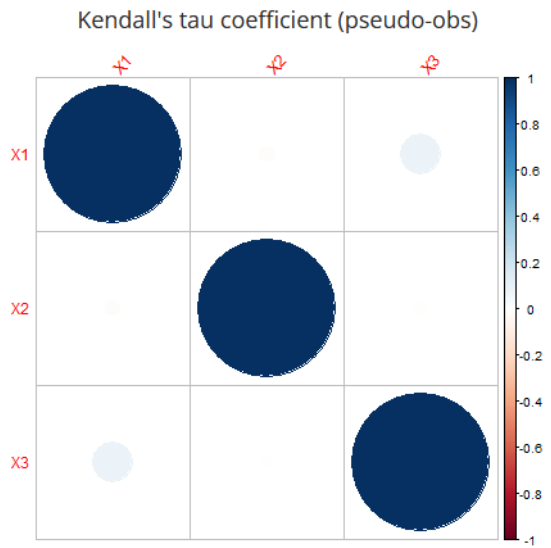
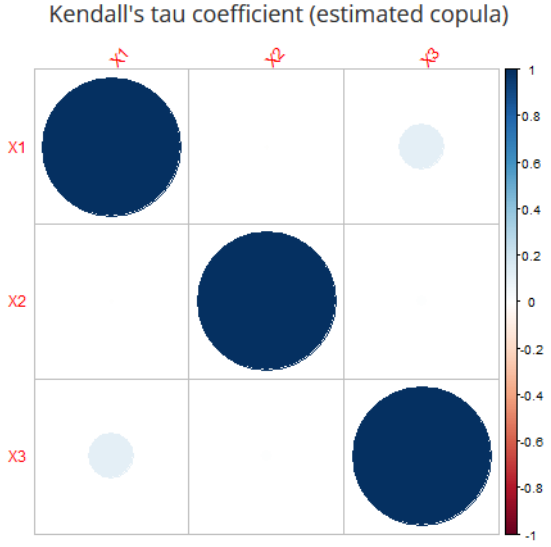


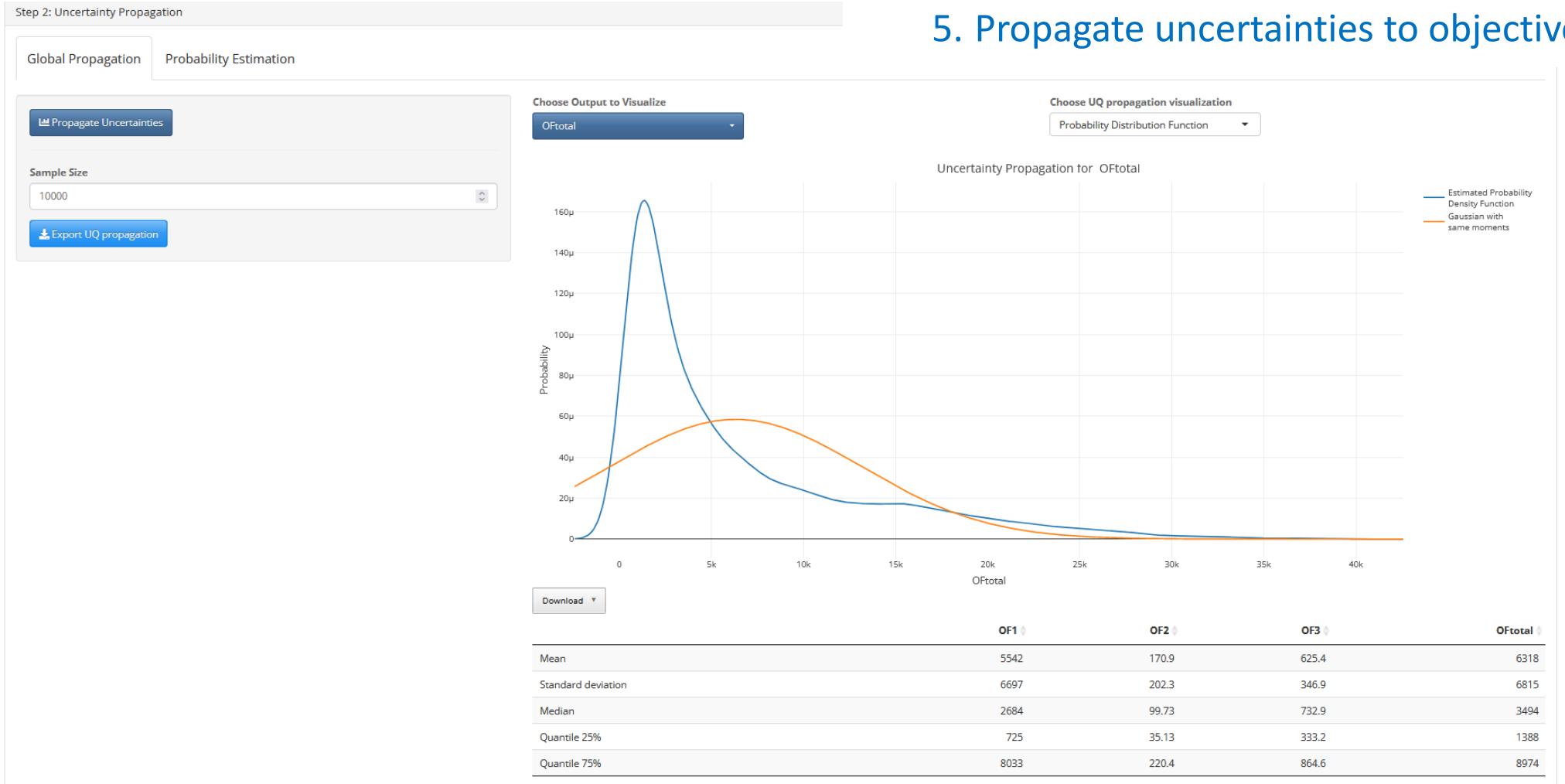




HOW TO ANALYZE AND VISUALIZE OUTPUTS WITH LAGUN ?

C. Export iterates → can be used in “import DOE” functionality

1. To build kriging model of objective function
2. Explore with surrogate model
3. UQ with surrogate model (see Tutorial 5)
4. Fit a model to posterior input laws
5. Propagate uncertainties to objective function



	OF1	OF2	OF3	OFtotal
Mean	5542	170.9	625.4	6318
Standard deviation	6697	202.3	346.9	6815
Median	2684	99.73	732.9	3494
Quantile 25%	725	35.13	333.2	1388
Quantile 75%	8033	220.4	864.6	8974

RÉFÉRENCES

[1] Da Veiga, S., Sinoquet, D. and Gervais-Couplet, V., Tests et améliorations envisagées pour l'optimisation Bayésienne, implémentation dans Condor via la plateforme HubOpt, 2010, Note technique

[2] Da Veiga, S., Nouvelle formulation de l'optimisation Bayésienne, 2011, Note technique 56_NT_SDV_07_2011

[3] Kennedy, M.C., O'Hagan, A., Bayesian calibration of computer models», 2001, J Royal Stat Soc: Series B (Stat Methodol) 63:425–464

[4] Perrin, G., Adaptive calibration of a computer code with time-series output, 2020, Reliab Eng Syst Saf, 196