



Multifidelity UQ Workflows with Dakota's Graphcal User Interface

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DAKOTA

FROM COMMAND LINE TO GRAPHICAL USER INTERFACE (GUI)



```
$ dakota -v
```

Dakota version 6.16+ (stable) released May 23 2022.

Repository revision 63d6cbe86 (2022-05-17) built May 23 2022 22:17:44.





Main features

- IDE for Dakota (as Visual Studio is to C++)
- Lightweight version of the Sandia Analysis Workbench (SAW)
- Support for Windows, Mac and RHEL7
- Open-source
- Publicly released every six months

DAKOTA GUI

FEATURES – WELCOME



File Edit Run Window Help

Welcome to the Dakota GUI

Getting Started

-  [Search the Dakota examples repository.](#)
Browse through various example projects curated by the Dakota team.
-  [Define a simulation model.](#)
Define a variable/response model for your black-box simulation.
-  [Create a new Dakota project.](#)
A project helps to organize and associate your files.

Dakota Studies

-  [Import a Dakota study from your filesystem.](#)
If you already have a Dakota study file, select this option.
-  [Open the default Dakota Editing perspective.](#)
Start from scratch in an empty workspace.

Getting Help

-  [Video Tutorials](#)
Learn about Dakota by watching videos on a variety of topics, from introductory examples to more sophisticated studies.
- [Dakota GUI Manual](#)
The Dakota GUI manual contains many step-by-step tutorials to help you get started.
- [Reference Manual](#)
Consult the reference manual for the Dakota language.
- [Mailing Lists](#)
Reach out to the Dakota user community.

DAKOTA GUI

FEATURES – ACCESS TO DAKOTA EXAMPLES REPOSITORY



File Edit Run Window Help

>Welcome X

?

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Dakota Examples Search

multilevel

Search Results

dakota-examples
dakota-examples/official/case_studies/bayesian_ml_emulator
dakota-examples/official/uncertainty_quantification/mlmf
dakota-examples/official/uncertainty_quantification/mlmf/cv
dakota-examples/official/uncertainty_quantification/mlmf/mc
dakota-examples/official/uncertainty_quantification/mlmf/mlmf
dakota-examples/official/uncertainty_quantification/mlmf/mlmf

Cancel Import

5/32

DAKOTA GUI

FEATURES – INPUT FILE EDITING AND RUNNING



File Edit Run Window Help

mimc/mimc/dakota_MLMC.in - Dakota GUI

Project Explorer

mimc

- run_results
- dakota_MLMC.base
- dakota_MLMC.dat
- dakota_MLMC.in
- environment
- interface
- method
- model
- responses
- variables
- dakota.rst
- LHS_2.out
- LHS_3.out
- LHS_7.out
- LHS_8.out
- LHS_9.out
- LHS_distributions.out
- LHS_samples.out
- README.md

dakota_MLMC.in | # DAKOTA INPUT FILE -- Multilevel MC

```
environment,
    tabular_data
    tabular_data_file = 'dakota_MLMC.dat'
    freeform

method,
    model_pointer = 'HIERARCH'
    multilevel_sampling
    pilot_samples = 10 seed_sequence = 1237
    max_iterations = 5
    convergence_tolerance = 0.001
    output silent

model,
    id_model = 'HIERARCH'
    variables_pointer = 'HF_VARS'
    surrogate_hierarchical
    ordered_model_fidelities = 'HF'

model,
    id_model = 'HF'
    variables_pointer = 'HF_VARS'
    simulation
    solution_level_control = 'N_x'
    solution_level_cost = 638. 1266. 2180. 4200.

variables,
    id_variables = 'HF_VARS'
    uniform_uncertain =
        lower_bounds = 7*-1.
        upper_bounds = 7* 1.
    discrete_state_set
        integer = 2
        num_set_values = 4 1
        set_values = 30 66 100 200 # number of spatial coords
        21 # number of Fourier solution modes
    initial_state = 30 21
    descriptors 'N_x' 'N_mod'

interface,
    direct
```

Console x Problems

Dakota Console

```
Sample moment statistics for each response function:
    Mean      Std Dev      Skewness      Kurtosis
response_fn_1  4.2354393013e+01  1.0730841742e+02  2.1815018405e+00  6.9915088646e+00

<===== Iterator multilevel_sampling completed.
<===== Environment execution completed.
DAKOTA execution time in seconds:
    Total CPU =      2.49118 [parent = 2.49108, child = 9.3e-05]
    Total wall clock = 1.27663
```

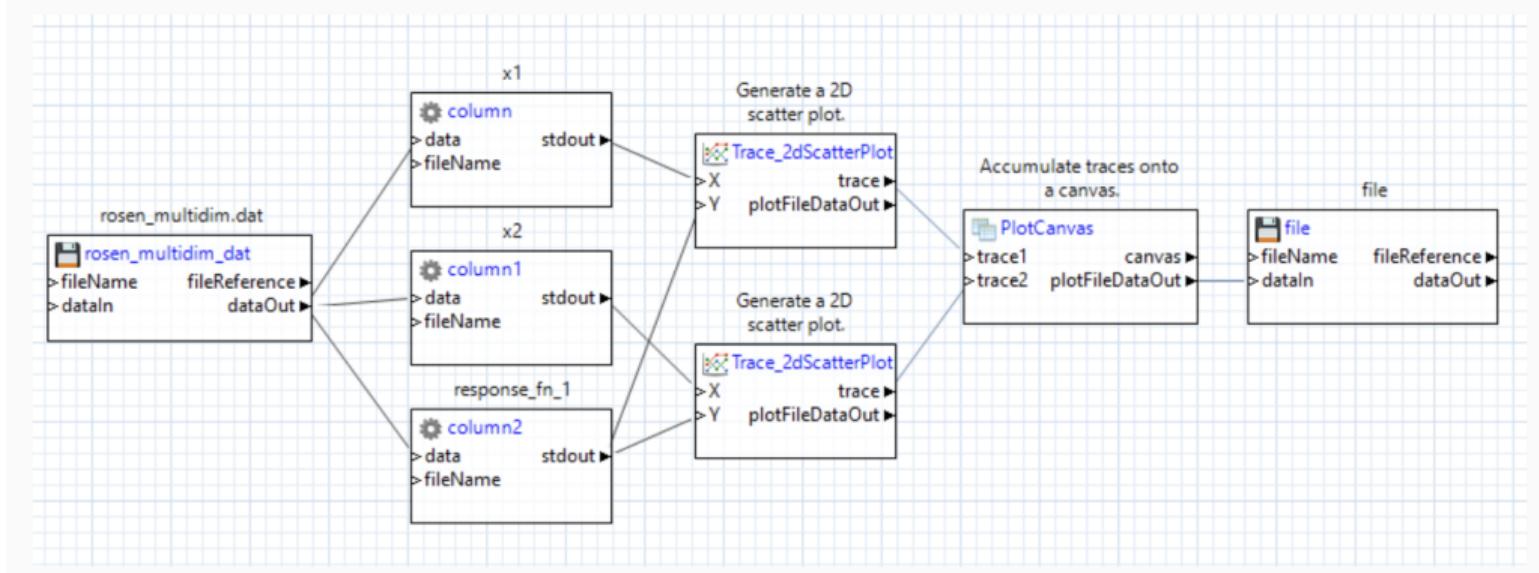
DAKOTA GUI FEATURES – WIZARD



The screenshot shows the Dakota GUI interface. The title bar reads "unordered_specification/unordered_specification.in - Dakota GUI". The menu bar includes File, Edit, Run, Window, and Help. The toolbar contains various icons for file operations. The Project Explorer on the left shows a folder named "unordered_specification" containing an "unordered_specification.in" file, with the latter being the active item. The main workspace is occupied by a "New Dakota Study" dialog box titled "Method Settings". The dialog contains the following questions and dropdown menus:

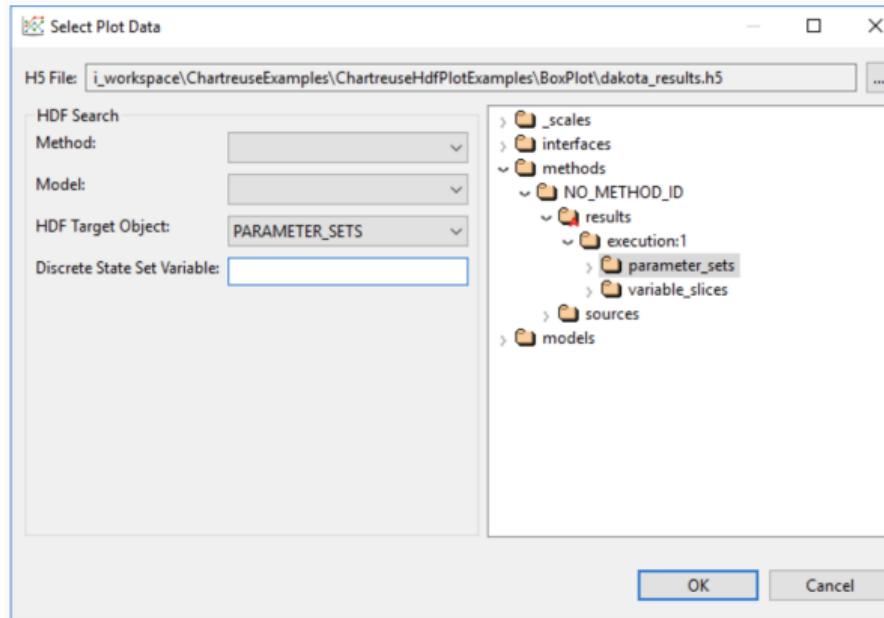
- Which type of study would you like to perform? (Uncertainty Quantification)
- What type of uncertainty? (Aleatory - inherent randomness characterized by probability distributions)
- Describe the expense associated with your function. (Expensive function evaluation)
- How would you describe your model? (Non-smooth)

Below these questions, a note says: "We recommend using the **sampling** method with the following options: lhs." At the bottom of the dialog are buttons for Preview, Help, Back, Next, Cancel, and Finish. To the right of the dialog, a portion of the main workspace is visible, showing a table with columns "Category" and "Cost".



DAKOTA GUI

FEATURES – HDF5 DATABASE BROWSING

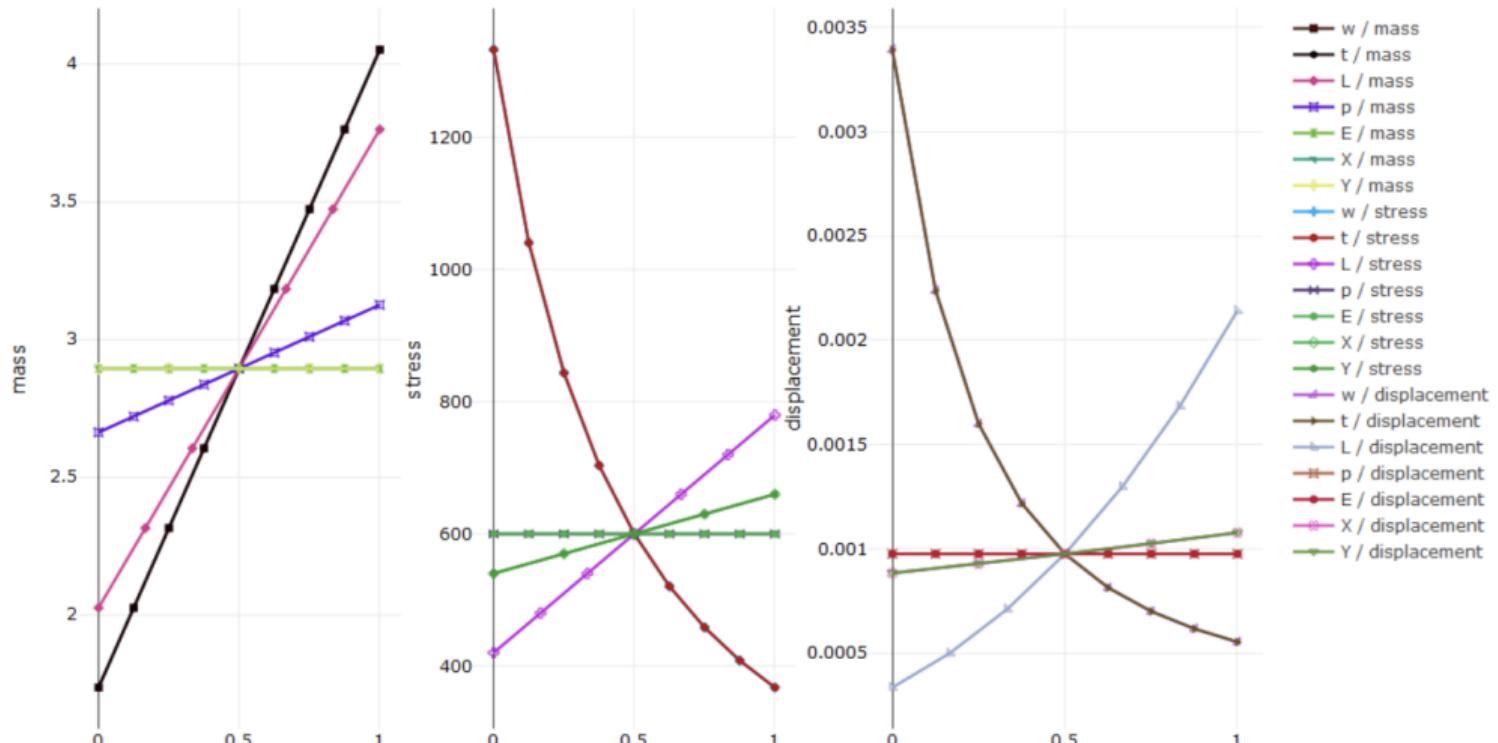


Dakota natively supports **HDF5 format for the result file**

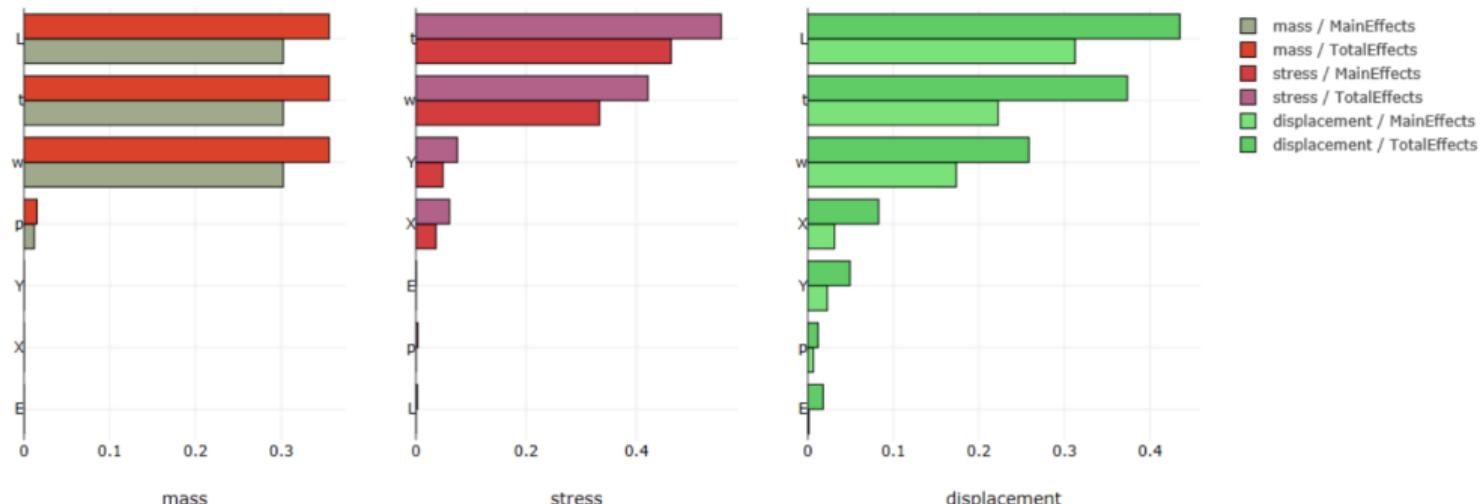
environment

```
results_output
  hdf5
  results_output_file 'my_results'  # The .h5 extension will be added
```

Centered Parameter Study Response Comparison - Tabular Data Set 1



Sobol Indices



Multilevel and Multifidelity Capabilities

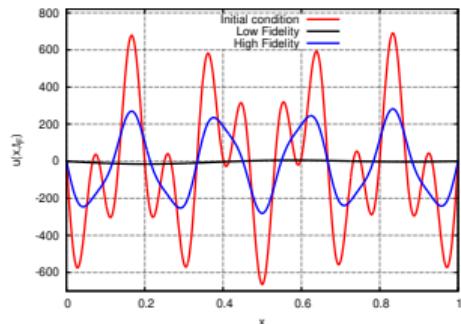
CONFIGURING A MLMC STUDY

STANDARD HEAT EQUATION CASE IN DAKOTA



Heat-equation in presence of uncertain thermal diffusivity and initial condition¹

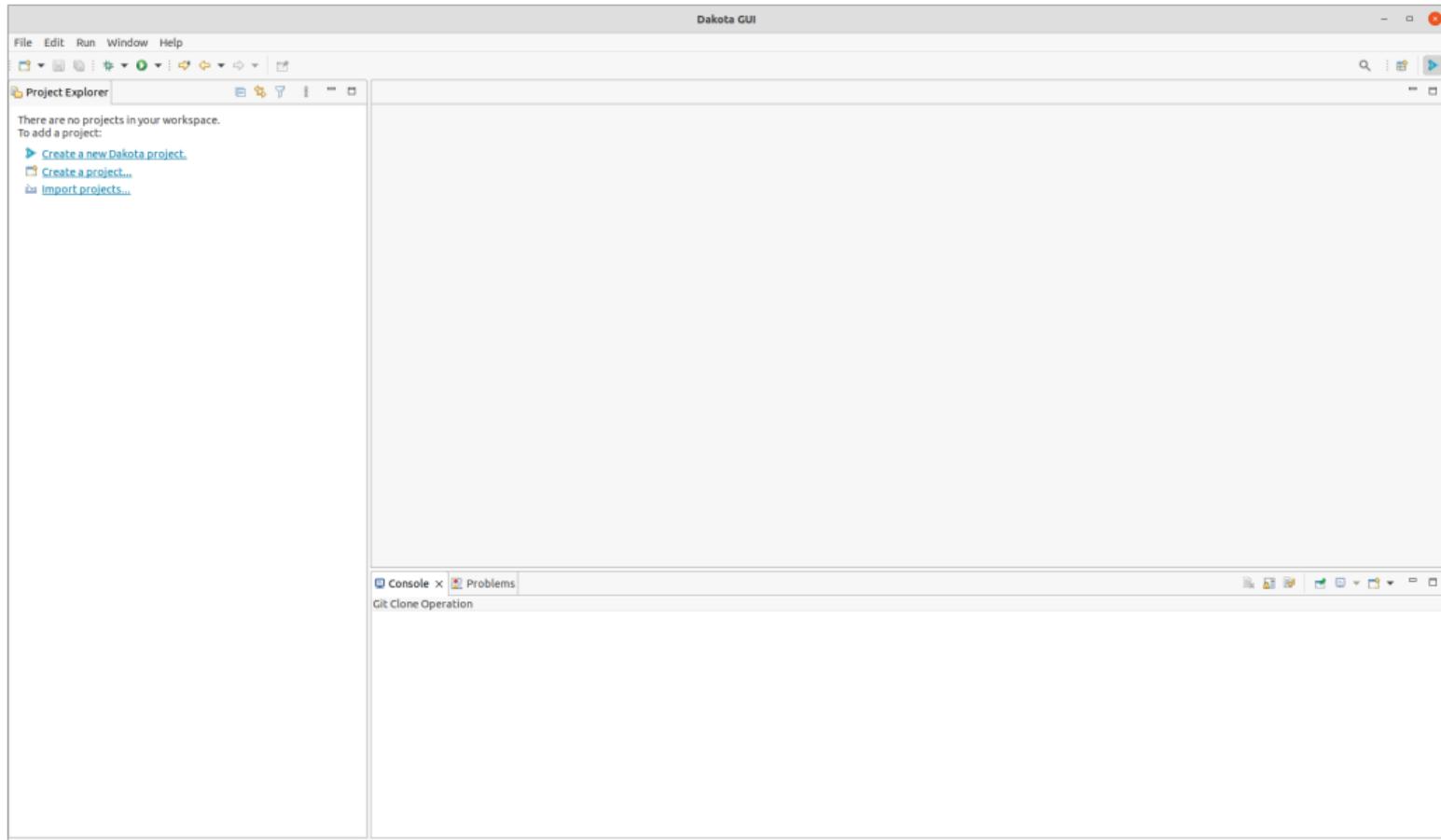
$$\begin{cases} \frac{\partial u(x, \xi, t)}{\partial t} - \alpha(\xi) \frac{\partial^2 u(x, \xi, t)}{\partial x^2} = 0, & \alpha > 0, x \in [0, L] = \Omega \subset \mathbb{R} \\ u(x, \xi, 0) = u_0(x, \xi), & t \in [0, t_F] \quad \text{and} \quad \xi \in \Xi \subset \mathbb{R}^d \\ u(x, \xi, t)|_{\partial\Omega} = 0 \\ u_0(x, \xi) = \mathcal{G}(\xi) \mathcal{F}_1(x) + \mathcal{I}(\xi) \mathcal{F}_2(x) \end{cases}$$



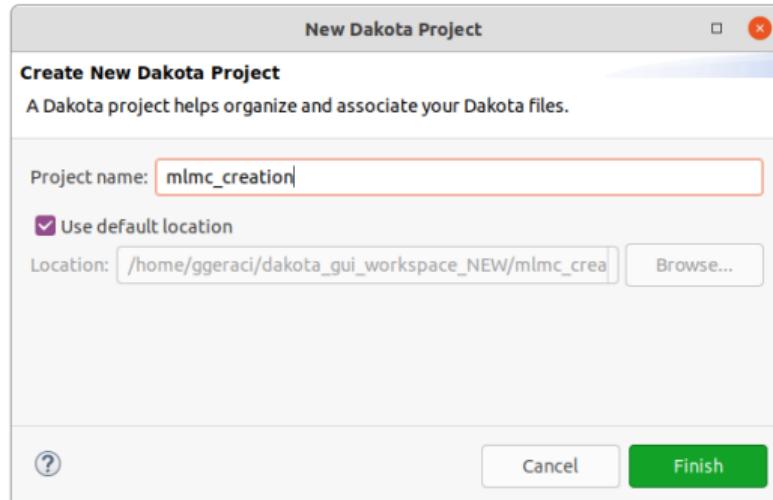
	LF	HF	
# modes	3	21	
	N_x	w_ℓ	
$\ell = 0$	5	30	42
$\ell = 1$	15	60	28
$\ell = 2$	30	100	23
$\ell = 3$	60	200	23

¹ G. Geraci, M.S. Eldred, and G. Iaccarino. "A multifidelity control variate approach for the multilevel Monte Carlo technique". In: *Center for Turbulence Research 2015* (2015).

MLMC STUDY EDITOR CREATION



MLMC STUDY EDITOR CREATION



MLMC STUDY EDITOR CREATION



Dakota GUI

File Edit Run Window Help

Project Explorer mlmc_creation

Select a wizard

Create a new multi-level/multi-fidelity study configuration.

Wizards:

- General
- Basic Model Format (BMF)
- Dakota
 - Dakota Project
 - Dakota Study
 - Dakota Wrapper Workflow
 - MLMF Study**
- Dakota Drivers

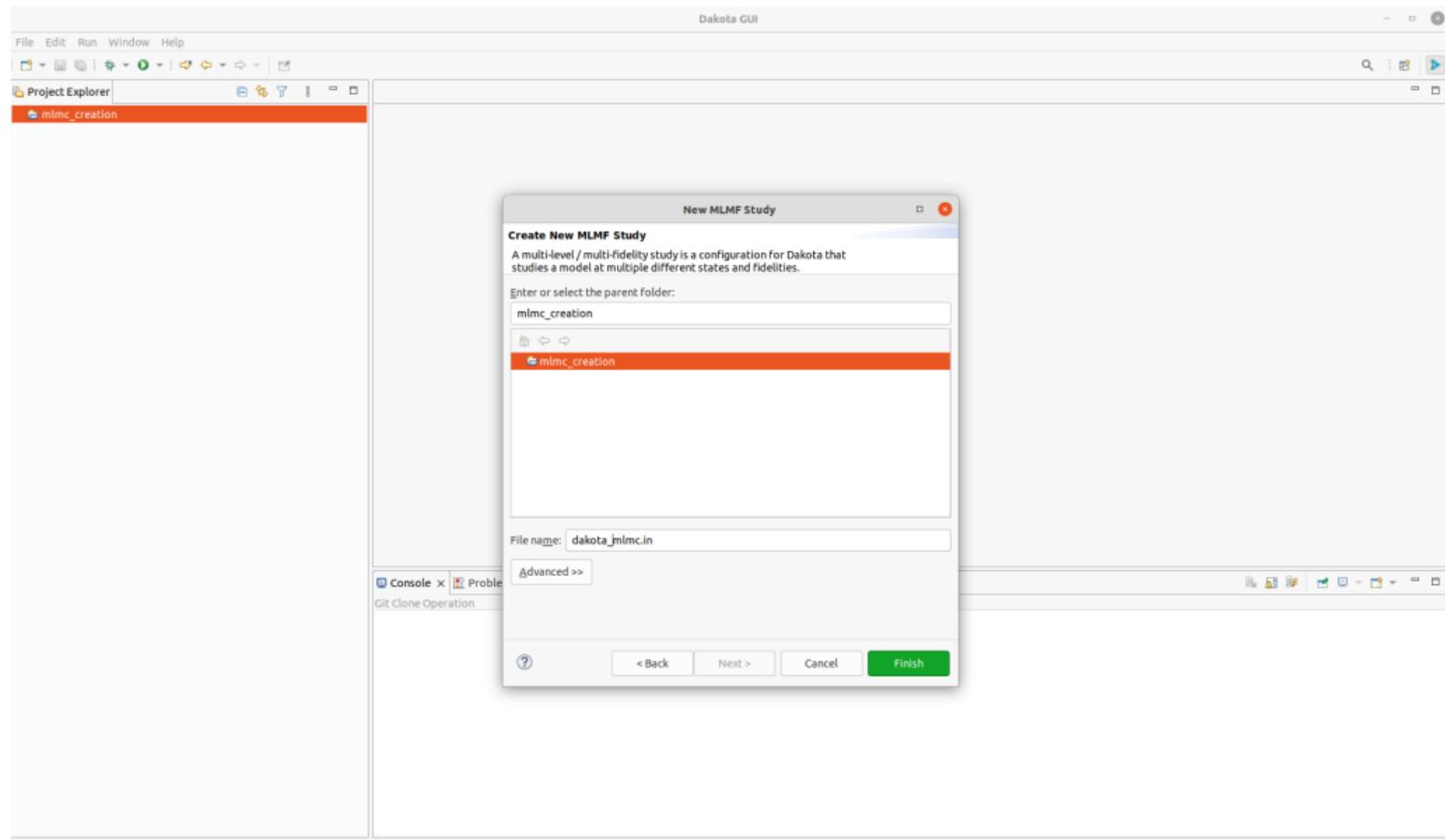
Next > Cancel Finish

Console X Problems

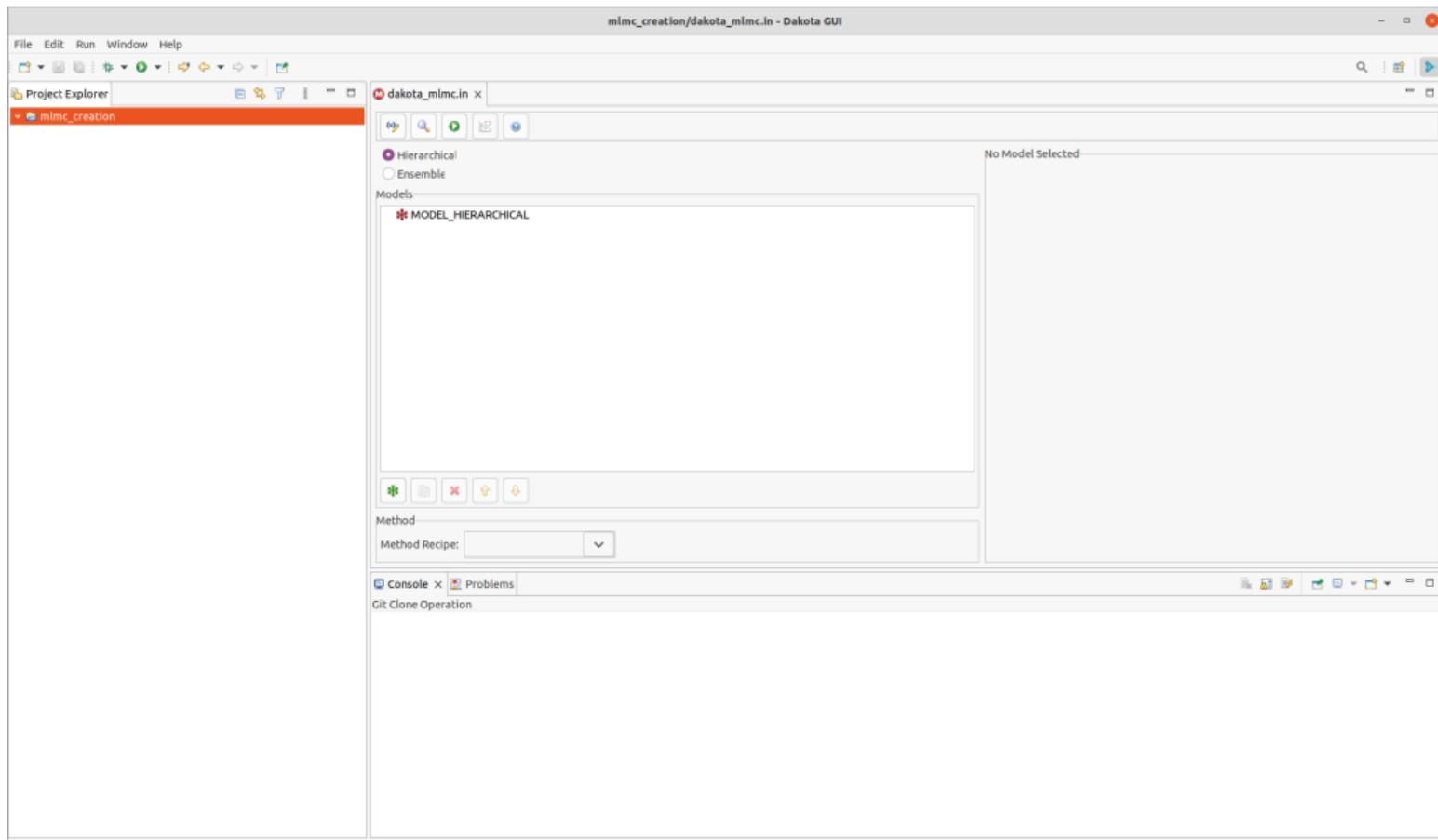
Git Clone Operation

mlmc_creation

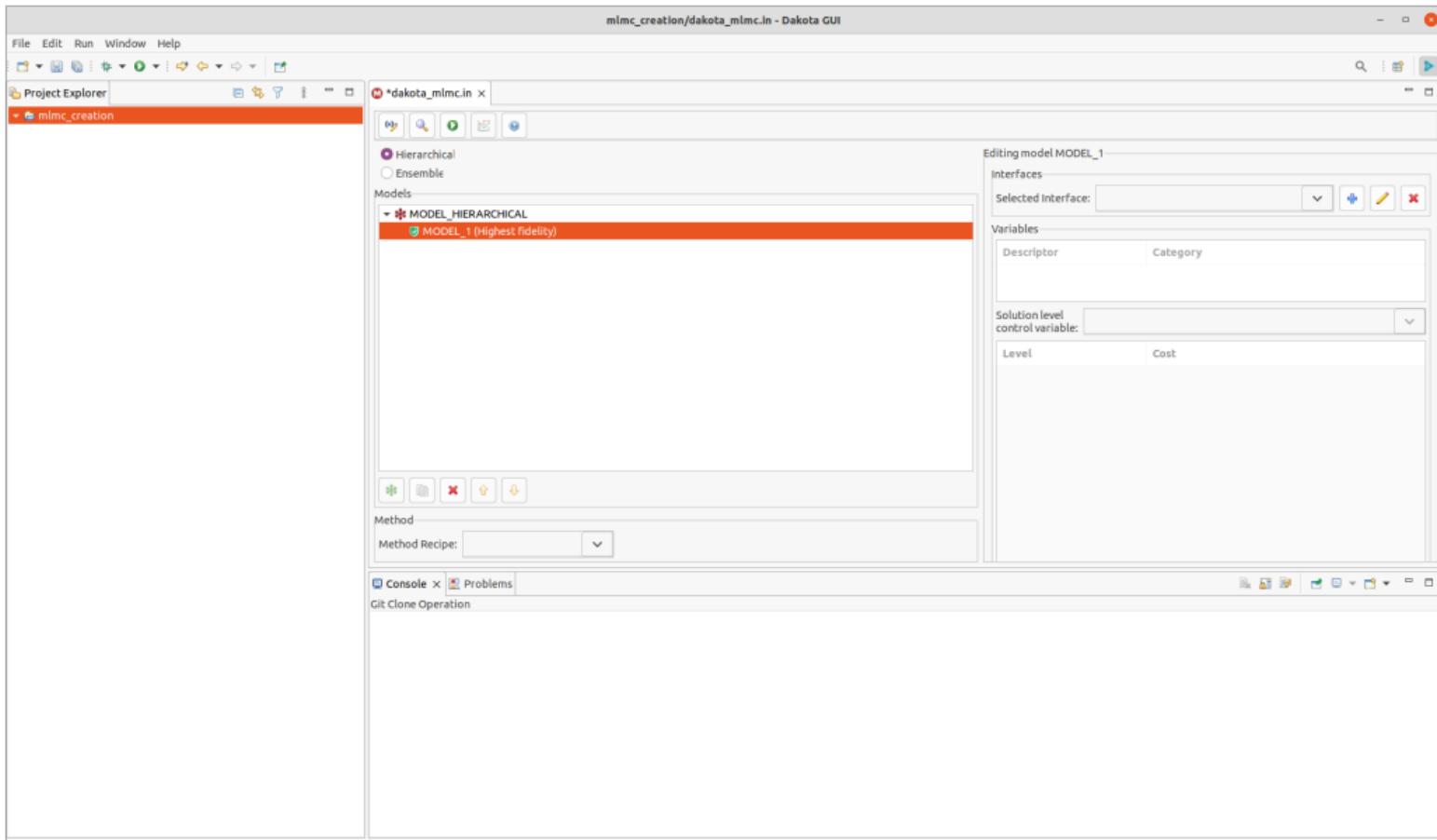
MLMC STUDY EDITOR CREATION



MLMC STUDY EDITOR CREATION



MLMC STUDY EDITOR CREATION



MLMC STUDY EDITOR CREATION



mcmc_creation/dakota_mcmc.in - Dakota GUI

File Edit Run Window Help

Project Explorer **mcmc_creation**

Hierarchical Ensemble

Models

- MODEL_HIERARCHICAL
- MODEL_1 (Highest Fidelity)

Method

Method Recipe:

Editing model MODEL_1

Interfaces

Selected Interface: <None>

Add External Analysis Driver **Add Direct Analysis Driver**

Variables

Descriptor	Category

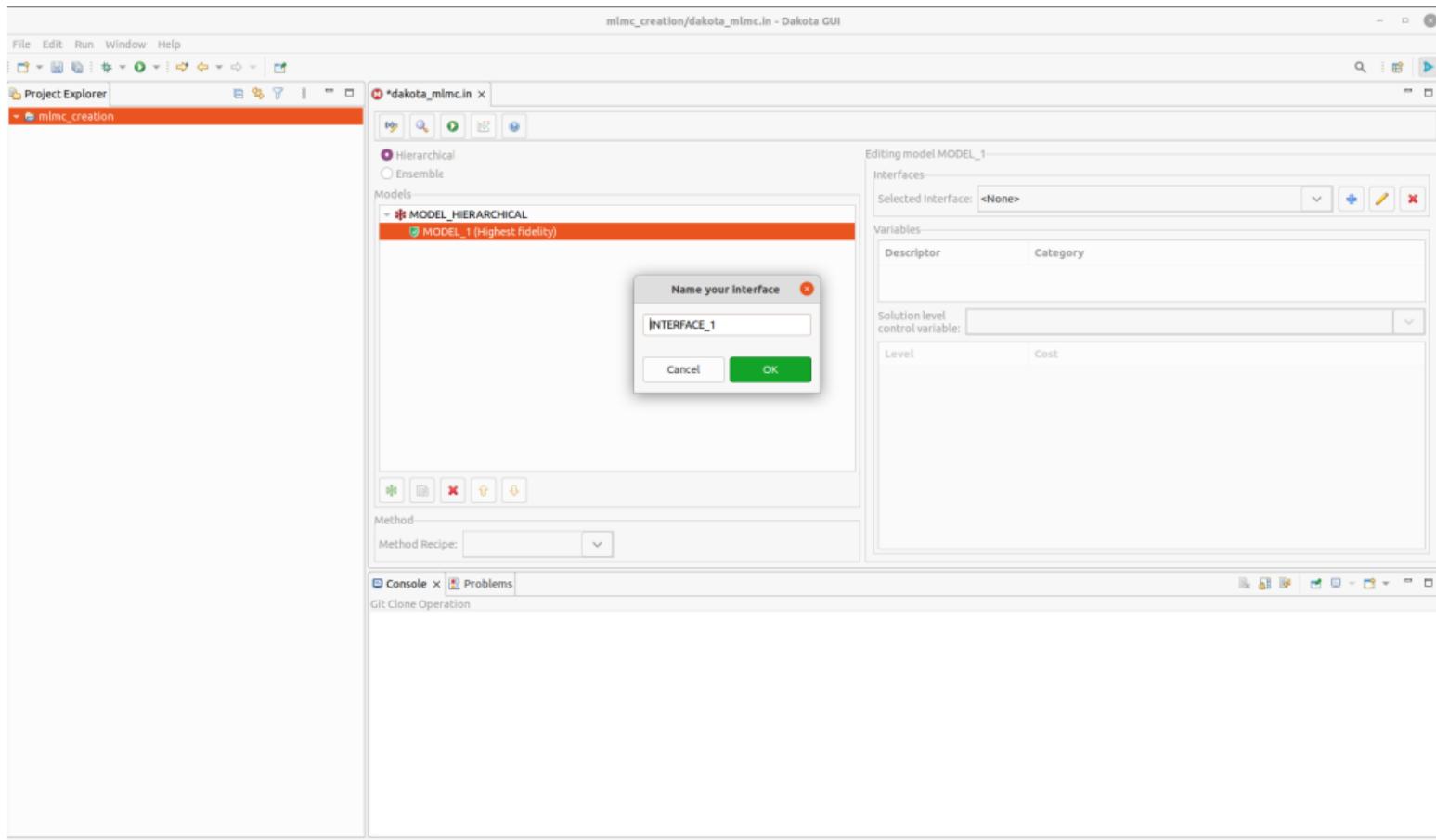
Solution level control variable:

Level	Cost

Console Problems

Git Clone Operation

MLMC STUDY EDITOR CREATION



MLMC STUDY EDITOR CREATION



mlmc

dakota_mlmc.in

Project Explorer

mlmc_creation

File Edit Run Window Help

mlmc

ir_rosenbrock

lf_short_column

log_ratio

mc_api_run

mf_rosenbrock

mf_short_column

mod_cantilever

modelcenter

modified_rosenbrock

mogatest1

mogatest2

mogatest3

multimodal

poly_prod

predator_prey

problem18

rosenbrock

salinas

scalable_gerstner

scalable_monomials

scalable_text_book

short_column

shubert

side_impact_cost

side_impact_perf

smooth_herbie

sobol_g_function

sobol_ishigami

sobol_rational

steady_state_diffusion_1d

steel_column_cost

steel_column_perf

text_book

text_book1

text_book2

text_book3

text_book_ouu

transient_diffusion_1d

Editing model MODEL_1

Interfaces

Selected Interface: <None>

Variables

Descriptor Category

Solution level control variable:

Level Cost

Console Problems

Git Clone Operation

MLMC STUDY EDITOR CREATION



File Edit Run Window Help

mimc_creation/dakota_mimc.in - Dakota GUI

Project Explorer **mimc_creation**

*dakota_mimc.in

Variable Set Editor

Variable INTERFACE_1

N_mod ✓

N_x ✓

uvv_1 ✓

uvv_2 ✓

uvv_3 ✓

uvv_4 ✓

uvv_5 ✓

uvv_6 ✓

uvv_7 ✓

Method

Method Recipe:

Console X Problems

Git Clone Operation

INTERFACE_1

Category: normal_uncertain, normal_uncertain

Cost

Welcome to the MLMF variable editor. In order to prepare multiple interfaces for use in a multi-level/multi-fidelity study, you must assign each interface's UQ variables to uncertain categories. Additionally, if the study has multiple levels (ML or MLMF) you must indicate which are the "solution level control variables" by specifying a category of "discrete_state_set".

Cancel OK

MLMC STUDY EDITOR CREATION



The screenshot shows the Dakota GUI interface for a project named 'mlmc_creation/dakota_mlmc.in'. The 'Project Explorer' panel on the left lists 'mlmc_creation' and 'dakota_mlmc.in'. A central 'Variable Set Editor' dialog is open, showing the configuration for the variable 'N_x'. The 'Editing variable N_x' dialog includes fields for 'discrete_state_set' (set to 'discrete_state_set'), 'Type' (set to 'integer'), 'Initial State' (set to '30'), and an 'Elements' section with a list of discrete states: 'uvv_1', 'uvv_2', 'uvv_3', 'uvv_4', 'uvv_5', 'uvv_6', and 'uvv_7'. A checkbox for 'Categorical?' is unchecked. At the bottom of the dialog are 'Cancel' and 'Save' buttons. The background shows the main Dakota interface with a 'Variable INTER...' panel and a 'INTERFACE_1' panel.

MLMC STUDY EDITOR CREATION



*dakota mlmc.in

Hierarchical Ensemble

Models

- MODEL_HIERARCHICAL
- MODEL_1 (Highest fidelity)**

Method

Method Recipe:

Editing model MODEL_1

Interfaces

Selected Interface: INTERFACE_1

Variables

Descriptor	Category
N_x	discrete_state_set
N_mod	discrete_state_set

Solution level control variable:

Level	Cost

MLMC STUDY EDITOR CREATION



mlmc_creation/mlmc_pilot_proj.in - Dakota GUI

File Edit Run Window Help

Project Explorer

- dakota_mlmc.in
- mlmc_pilot_proj.in
- mlmc_pilot_proj.out

Editing model HF4

Interfaces

Selected interface: ID_INTERFACE_1

Variables

Descriptor	Category
uuv_1	uniform_uncertain
uuv_2	uniform_uncertain

Solution level control variable: N_x

Level	Cost
30	630.0

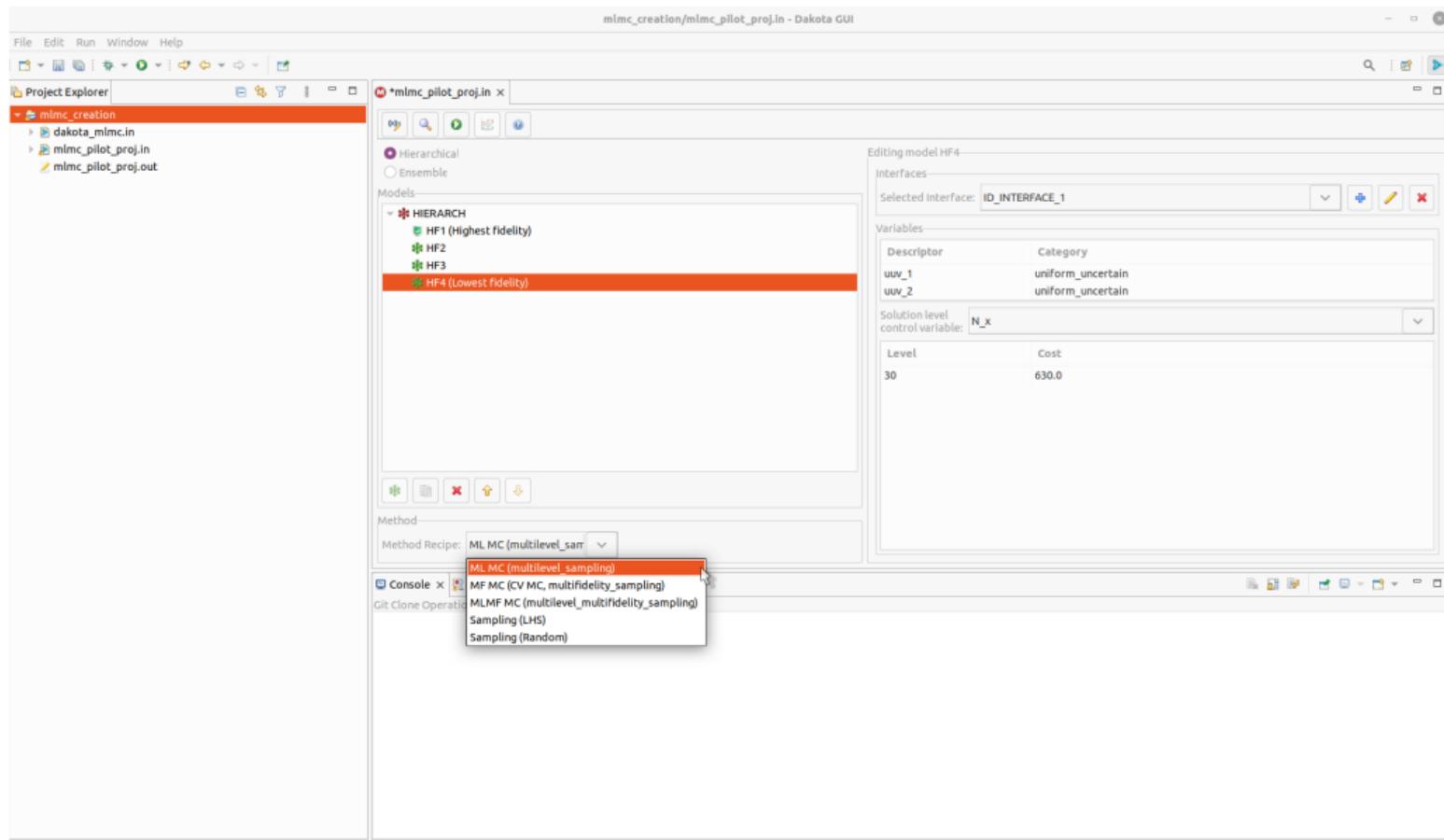
Method

Method Recipe: ML MC (multilevel_sam...

- ML MC (multilevel_sampling)
- MF MC (CV MC, multifidelity_sampling)
- MLMF MC (multilevel_multifidelity_sampling)
- Sampling (LHS)
- Sampling (Random)

Console

Git Clone Operation



MLMC STUDY EDITOR CREATION



File Edit Run Window Help

mimc_creation/mimc_pilot_proj.in - Dakota GUI

Project Explorer

- mlmc_creation
- run_results
- dakota_mlmc.in
- dakota.rst
- LHS_2.out
- LHS_3.out
- LHS_7.out
- LHS_8.out
- LHS_9.out
- LHS_distributions.out
- LHS_samples.out
- mimc_pilot_proj.in
- mimc_pilot_proj.out

*mimc_pilot_proj.in

Run Dakota...

HIERARCH

- HF1 (Highest fidelity)
- HF2
- HF3
- HF4 (Lowest fidelity)

Method

Method Recipe: ML MC (multilevel sam)

Editing model HF4

Interfaces

Selected interface: ID_INTERFACE_1

Variables

Descriptor	Category
uuv_1	uniform_uncertain
uuv_2	uniform_uncertain

Solution level control variable: N_x

Level	Cost
30	630.0

Console

Dakota Console

Model Form HF1: 25

```
***** Projected number of equivalent high fidelity evaluations: 5.607500000e+02
***** Variance for mean estimator:
  Initial MLMC (pilot samples): 6.8682015124e+02
  Projected MLMC (sample profile): 5.2600840619e+00
  Projected MLMC / pilot ratio: 7.6588047344e-03
  Equivalent MC ( 561 HF samples): 3.0668285752e+01
  Equivalent MLMC / MC ratio: 1.7151542491e-01

***** Iterator multilevel sampling completed.
***** Environment execution completed.
DAKOTA execution time in seconds:
  Total CPU      = 1.29859 [parent = 1.2985, child = 9e-05]
  Total wall clock = 0.160531
```

MLMC STUDY EDITOR CREATION



mlmc_creation/mlmc_pilot_proj.in - Dakota GUI

File Edit Run Window Help

Project Explorer

- run_results
- dakota_mlmc.in
- dakota.rst
- LHS_2.out
- LHS_3.out
- LHS_7.out
- LHS_8.out
- LHS_9.out
- LHS_distributions.out
- LHS_samples.out
- mlmc_pilot_proj.in
- mlmc_pilot_proj.out

Preview Dakota Study...

Editing model HF4-Interfaces

Models

- HIERARCH
 - HF1 (Highest fidelity)
 - HF2
 - HF3
 - HF4 (Lowest fidelity)

Method Recipe: ML MC (multilevel sam)

Console X Problems

Dakota Console

Model Form HF1: 25

```
<<<< Projected number of equivalent high
<<<< Variance for mean estimator:
    Initial MLMC (pilot samples): 6.1
    Projected MLMC (sample profile): 5.5
    Projected MLMC / pilot ratio: 7.1
    Equivalent MC ( 561 HF samples): 3.1
    Equivalent MLMC / MC ratio: 1.729595
```

Model Form HF2: 25

```
<<<< Projected number of equivalent high
<<<< Variance for mean estimator:
    Initial MLMC (pilot samples): 6.1
    Projected MLMC (sample profile): 5.5
    Projected MLMC / pilot ratio: 7.1
    Equivalent MC ( 561 HF samples): 3.1
    Equivalent MLMC / MC ratio: 1.729595
```

Model Form HF3: 25

```
<<<< Projected number of equivalent high
<<<< Variance for mean estimator:
    Initial MLMC (pilot samples): 6.1
    Projected MLMC (sample profile): 5.5
    Projected MLMC / pilot ratio: 7.1
    Equivalent MC ( 561 HF samples): 3.1
    Equivalent MLMC / MC ratio: 1.729595
```

Model Form HF4: 25

```
<<<< Projected number of equivalent high
<<<< Variance for mean estimator:
    Initial MLMC (pilot samples): 6.1
    Projected MLMC (sample profile): 5.5
    Projected MLMC / pilot ratio: 7.1
    Equivalent MC ( 561 HF samples): 3.1
    Equivalent MLMC / MC ratio: 1.729595
```

Dakota Study Preview

```
environment
method
  multilevel_sampling
    allocation_target
      mean
      goi_aggregation
      sum
      convergence_tolerance 0.1
      max_iterations 5
      model_pointer "HIERARCH"
model
  id_model "HF1"
  single
  interface_pointer "ID_INTERFACE_1"
  solution_level_control "N_X"
  solution_level_cost 4200.
  variables_pointer "HF1_VARS"
model
  id_model "HF2"
  single
  interface_pointer "ID_INTERFACE_1"
  solution_level_control "N_X"
  solution_level_cost 2100.
  variables_pointer "HF2_VARS"
model
  id_model "HF3"
  single
  interface_pointer "ID_INTERFACE_1"
  solution_level_control "N_X"
  solution_level_cost 1260.
  variables_pointer "HF3_VARS"
model
  id_model "HF4"
  single
  interface_pointer "ID_INTERFACE_1"
```

OK

File Edit Run Window Help

Project Explorer

- run_results
- dakota_mlmc.in
- dakota.rst
- LHS_2.out
- LHS_3.out
- LHS_7.out
- LHS_8.out
- LHS_9.out
- LHS_distributions.out
- LHS_samples.out
- mlmc_pilot_proj.in
- mlmc_pilot_proj.out

Preview Dakota Study...

Editing model HF4-Interfaces

Models

- HIERARCH
 - HF1 (Highest fidelity)
 - HF2
 - HF3
 - HF4 (Lowest fidelity)

Method Recipe: ML MC (multilevel sam)

Console X Problems

Dakota Console

Model Form HF1: 25

```
<<<< Projected number of equivalent high
<<<< Variance for mean estimator:
    Initial MLMC (pilot samples): 6.1
    Projected MLMC (sample profile): 5.5
    Projected MLMC / pilot ratio: 7.1
    Equivalent MC ( 561 HF samples): 3.1
    Equivalent MLMC / MC ratio: 1.729595
```

Model Form HF2: 25

```
<<<< Projected number of equivalent high
<<<< Variance for mean estimator:
    Initial MLMC (pilot samples): 6.1
    Projected MLMC (sample profile): 5.5
    Projected MLMC / pilot ratio: 7.1
    Equivalent MC ( 561 HF samples): 3.1
    Equivalent MLMC / MC ratio: 1.729595
```

Model Form HF3: 25

```
<<<< Projected number of equivalent high
<<<< Variance for mean estimator:
    Initial MLMC (pilot samples): 6.1
    Projected MLMC (sample profile): 5.5
    Projected MLMC / pilot ratio: 7.1
    Equivalent MC ( 561 HF samples): 3.1
    Equivalent MLMC / MC ratio: 1.729595
```

Model Form HF4: 25

```
<<<< Projected number of equivalent high
<<<< Variance for mean estimator:
    Initial MLMC (pilot samples): 6.1
    Projected MLMC (sample profile): 5.5
    Projected MLMC / pilot ratio: 7.1
    Equivalent MC ( 561 HF samples): 3.1
    Equivalent MLMC / MC ratio: 1.729595
```

Dakota Study Preview

```
environment
method
  multilevel_sampling
    allocation_target
      mean
      goi_aggregation
      sum
      convergence_tolerance 0.1
      max_iterations 5
      model_pointer "HIERARCH"
model
  id_model "HF1"
  single
  interface_pointer "ID_INTERFACE_1"
  solution_level_control "N_X"
  solution_level_cost 4200.
  variables_pointer "HF1_VARS"
model
  id_model "HF2"
  single
  interface_pointer "ID_INTERFACE_1"
  solution_level_control "N_X"
  solution_level_cost 2100.
  variables_pointer "HF2_VARS"
model
  id_model "HF3"
  single
  interface_pointer "ID_INTERFACE_1"
  solution_level_control "N_X"
  solution_level_cost 1260.
  variables_pointer "HF3_VARS"
model
  id_model "HF4"
  single
  interface_pointer "ID_INTERFACE_1"
```

OK

MLMC STUDY EDITOR CREATION



mlmc_creation/mlmc_pilot_proj.in - Dakota GUI

File Edit Run Window Help

Project Explorer mlmc_pilot_proj.in mlmc_pilot_proj.in x

environment

method

```
multilevel sampling
  pilot_samples 25 25 25
  solution_node
  pilot_projection
  max_function_evaluations 500
  model_pointer "HIERARCH"
```

model

```
id_model "HF4"
single
  interface_pointer "ID_INTERFACE_1"
  solution_level_control "N_x"
  solution_level_cost 630.
  variables_pointer "HF4_VARS"
```

del

```
id_model "HF3"
single
```

Open With

- Dakota Text Editor
- Dakota Visual Editor
- Generic Text Editor
- MLMF Study Editor
- Text Editor
- System Editor
- Default Editor
- Other...

INTERFACE_1*

"N_x"

266.

RS*

INTERFACE_1*

"N_x"

160.

RS*

del

```
id_model "HF1"
```

Run As

Debug As

Console

Model Form HF1:

Projected number of equivalent high fidelity evaluations: 5.6075000000e+02

Variance for mean estimator:

initial MLMC (pilot samples): 6.8682015124e+02

projected MLMC (sample profile): 5.2600840619e+00

projected MLMC / pilot ratio: 7.6580847344e-03

Equivalent MC (561 HF samples): 3.8668285752e+01

Equivalent MLMC / MC ratio: 1.7151542491e-01

<<<< Iterator multilevel_sampling completed.

<<<< Environment execution completed.

DAKOTA execution time in seconds:

Total CPU = 1.29859 [parent = 1.2985, child = 9e-05]

Total wall clock = 0.160531

File Edit Run Window Help

Project Explorer mlmc_pilot_proj.in mlmc_pilot_proj.in x

environment

method

```
multilevel sampling
  pilot_samples 25 25 25
  solution_node
  pilot_projection
  max_function_evaluations 500
  model_pointer "HIERARCH"
```

model

```
id_model "HF4"
single
  interface_pointer "ID_INTERFACE_1"
  solution_level_control "N_x"
  solution_level_cost 630.
  variables_pointer "HF4_VARS"
```

del

```
id_model "HF3"
single
```

Open With

- Dakota Text Editor
- Dakota Visual Editor
- Generic Text Editor
- MLMF Study Editor
- Text Editor
- System Editor
- Default Editor
- Other...

INTERFACE_1*

"N_x"

266.

RS*

INTERFACE_1*

"N_x"

160.

RS*

del

```
id_model "HF1"
```

Run As

Debug As

Console

Model Form HF1:

Projected number of equivalent high fidelity evaluations: 5.6075000000e+02

Variance for mean estimator:

initial MLMC (pilot samples): 6.8682015124e+02

projected MLMC (sample profile): 5.2600840619e+00

projected MLMC / pilot ratio: 7.6580847344e-03

Equivalent MC (561 HF samples): 3.8668285752e+01

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<<<< Iterator multilevel_sampling completed.

<<<< Environment execution completed.

DAKOTA execution time in seconds:

Total CPU = 1.29859 [parent = 1.2985, child = 9e-05]

Total wall clock = 0.160531

MFMC STUDY EDITOR

IMPORT CAPABILITY (1/2)



test_import/mfmc_pilot_proj.in - Dakota GUI

File Edit Run Window Help

Project Explorer: test_import

mfmc_pilot_proj.in x mfmc_pilot_proj.in

NONHIER

HF1 (Truth model)

HF2

HF3

HF4

LF1

LF2

LF3

LF4

Method

Method Recipe:

Editing model HF1

Interfaces

Selected Interface: ID_INTERFACE_1

Variables

Descriptor	Category
UVV_1	uniform_uncertain
UVV_2	uniform_uncertain

Solution level control variable:

Level Cost

Console X Problems

Dakota Console

Model Form HF1:

```
26
<<< Projected number of equivalent high fidelity evaluations: 5.0711785714285713e+02
<<< Variance for mean estimator:
Initial MC ( 25 HF samples): 5.0405757739179883e+02
Projected MC ( 26 HF samples): 4.8543997826134506e+02
Projected MFMC (sample profile): 6.3611691628817979e-01
Projected MFMC ratio (1 - R^2): 1.3103925197238359e-03
Equivalent MC ( 587 HF samples): 2.4888572265834174e+01
Equivalent MFMC ratio: 2.5558594100691355e-02

<<< Iterator multifidelity_sampling completed.
<<< Environment execution completed.
DAKOTA execution time in seconds:
Total CPU = 1.49162 [parent = 1.49159, child = 3.7e-05]
Total wall clock = 0.207925
```

MFMC STUDY EDITOR

IMPORT CAPABILITY (2/2)



test_import/mfmc_pilot_proj.in - Dakota GUI

File Edit Run Window Help

Project Explorer mfmc_pilot_proj.in mfmc_pilot_proj.in x

test_import

```
1 environment
2   output_precision = 16
3   tabular_data
4   tabular_data_file = 'dakota_heat_eq_ACV_pilot_proj.dat'
5
6 method,
7   model_pointer = 'NONHIER'
8   multifidelity_sampling
9   solution_mode pilot projection
10  max_function_evaluations = 500
11  pilot_samples = 25
12  convergence_tolerance = .1
13  output verbose
14
15 model,
16   id_model = 'NONHIER'
17   variables_pointer = 'HF1_VARS' 'HF2_VARS' 'HF3_VARS' 'HF4_VARS' 'LF1_VARS' 'LF2_VARS' 'LF3_VARS' 'LF4_VARS'
18   surrogate_model_ensemble
19   truth_model = 'HF1'
20   unordered_model_fidelities = 'HF2' 'HF3' 'HF4' 'LF1' 'LF2' 'LF3' 'LF4'
21
22 model,
23   id_model = 'HF1'
24   variables_pointer = 'HF1_VARS'
25   simulation
26   solution_level_control = 'N_x'
27   solution_level_cost = 4200.
28
29 model,
30   id_model = 'HF2'
31   variables_pointer = 'HF2_VARS'
32   simulation
33   solution_level_control = 'N_x'
34   solution_level_cost = 2100.
35
36 end
```

Console x Problems

Dakota Console

Model Form HF1:

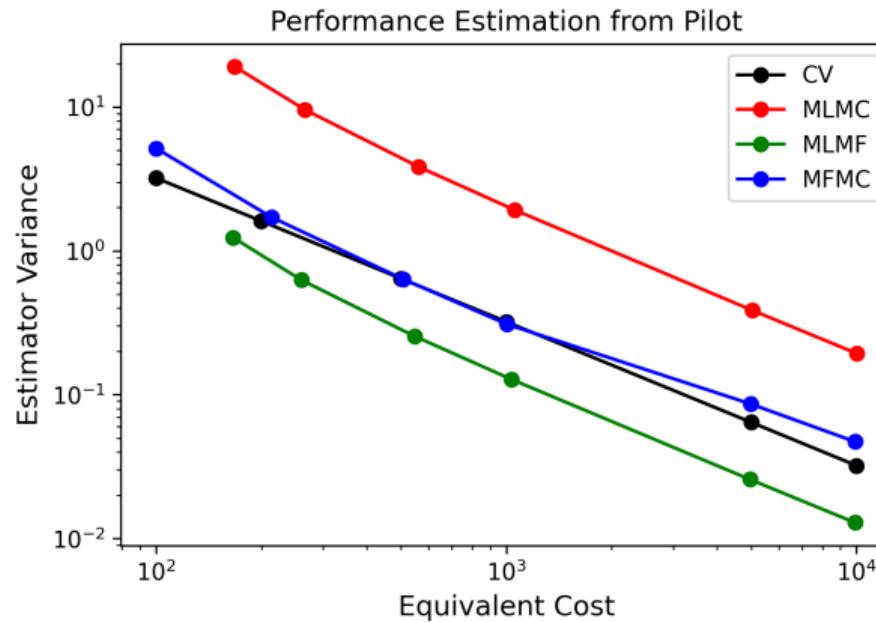
26

```
<<< Projected number of equivalent high fidelity evaluations: 5.0711785714285713e+02
<<< Variance for mean estimator:
  Initial MC ( 25 HF samples): 5.0405757739179083e+02
  Projected MC ( 26 HF samples): 4.8543997826134506e+02
  Projected MFMC (sample profile): 6.3611691628817979e-01
  Projected MFMC ratio (1 - R^2): 1.3103925197238359e-03
  Equivalent MC ( 507 HF samples): 2.4888572265834174e+01
  Equivalent MFMC ratio: 2.5558594100691355e-02

<<< Iterator multifidelity_sampling completed.
<<< Environment execution completed.
DAKOTA execution time in seconds:
  Total CPU          = 1.49162 [parent = 1.49159, child = 3.7e-05]
  Total wall clock = 0.207925
```

Coming Soon...

- 1 Unordered models specification, e.g. 8 models for the heat equation
- 2 Dakota unrolls the models and obtains the pilot samples, e.g. 25 samples per model
- 3 Several estimators are evaluated (from pilot, no additional cost!) and compared for different convergence or cost targets
- 4 Recommendation on the best estimators are issued



Closing remarks



Summary

- Dakota GUI allows you to easily edit Dakota input files, run Dakota, and visually plot Dakota's output data
- The Dakota GUI also aids in the process of defining a simulation model and connecting Dakota to that simulation model, without the need to write pre-processing or post-processing scripts
- The novel *MLMF Study Editor* supports a variety of features aiding ensemble/hierarchy definition and processing

The screenshot shows the Dakota GUI Version 6.15 User Manual page. At the top, there is a header with the Sandia National Laboratories logo, a search bar, and links for Home, Download, Documentation, Community, About, and Login (SNL Only). Below the header, the Dakota logo is displayed with the tagline "Explore and predict with confidence". The main title is "Dakota GUI Version 6.15 User Manual" and the version is "Version 6.15.0". Below the title, it says "Manual by Elliott Ridgway". A brief description of the manual follows, along with a note that it is a reference guide. The "Quick Start" section is highlighted in blue, and a list of frequently asked questions (FAQs) is provided.

Quick Start

- I'm completely new to Dakota. Where do I start?
 - Watch the Introductory series of Dakota screencasts.
 - Peruse the Eclipse section of this manual to get up to speed on basic GUI terminology and concepts.
- Where do I find an example Dakota study to start from?
 - Use the Dakota Examples Search dialog.
- I already have a Dakota study. How do I import it into the GUI?
 - Use basic file importing functionality.
 - If the input file has outdated syntax, use the "Dakota Order Input Utility" context menu tool.
- I already have a Dakota study, but I just want to change one block.
 - Try one of the Dakota block recipes available in the Dakota Text Editor.
- My Dakota study has long arrays of numbers. Can I modify these numbers without manually editing the text of the input file?
 - Use the Dakota Visual Editor for editing long number arrays.



THANKS!

Sandia National Laboratories is a multimission laboratory managed and operated by National Technology and Engineering Solutions of Sandia LLC, a wholly owned subsidiary of Honeywell International Inc. for the U.S. Department of Energy's National Nuclear Security Administration under contract DENA0003525. This paper describes objective technical results and analysis. Any subjective views or opinions that might be expressed in the paper do not necessarily represent the views of the U.S. Department of Energy or the United States Government.