Validation Suite™ Guide

Applies to:
Phoenix 8.4

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Validation Suite

The Phoenix Validation Suite provides automated functionality-based testing of Phoenix's analytic capabilities to assist customers in validating their Phoenix installation. The Validation Suite provides a set of test cases that are used to test the corresponding version of Phoenix on your system in your environment.

Note: *The Validation Suite tests do not provide the appropriate technical controls to ensure a 21 CFR Part 11 compliant implementation.*

This section contains the following topics:

Validation overview

Validation tests

Access validation reports

Validation templates

WNL Test cases

NLME test cases

Validation overview

The Phoenix Validation Suite focuses on numerical testing of Phoenix's analytical tools to verify the accuracy of software computations on the processors in your environment. The test cases demonstrate that Phoenix computational engines perform as intended in your environment. Each test case uses Phoenix to execute the operational objects from an input project in your environment. The output worksheets from the executed project are exported from Phoenix as CSV files with column headers and column units if used. The exported CSV files are referred to as the 'run' files from your environment. Your run files are then compared to a set of CSV files that have verified results. The CSV files with the verified results are referred to as the 'reference' files. The comparison is done by computing the differences in the numeric results and by testing for differences in text results.

Reference files

The reference files have been verified by comparing either to computations in other products or to published examples: NONMEM, Microsoft Excel, SAS code, SAS procedures, S-PLUS code, results given in textbook examples or journal references, and examples and results supplied by the National Institute for Standards and Technology (NIST). The methods for verification of each test case are explained in the document included with the Validation Suite titled "Computational Engines Verification Report for Phoenix WinNonlin x.x.pdf," where "x.x" is the version number.

"Passed" status

The test case will have a status of Passed when the following conditions are true:
  – Number of lines in the 'run' and 'reference' files are equal,
  – Text values all match exactly between the 'run' and 'reference' files, and
  – Numerical differences between the 'run' and 'reference' files are within the acceptable tolerance (described below).

Due to limitations in computer accuracy (which is 14 to 15 significant digits for double-precision arithmetic), when computing the differences of 'run' and 'reference' numbers, the 'run' and 'reference' numbers are each rounded to 14 significant digits prior to taking the difference. This is so that 'difference' file does not display differences smaller than $1e^{-14}$ which are beyond computer accuracy and so are meaningless.

In addition, when comparing numerical results in 'run' files to 'reference' files, the Validation Suite uses an acceptable numerical tolerance when determining whether a test case passes or fails, so as to not fail test cases for insignificant differences. The use of the acceptable tolerance is relative to the magnitude of the result being validated, not an absolute numerical tolerance. For validation of WinNonlin, the acceptable tolerance is $1e^{-6}$, and the computation is:

$$Relative\_Difference = \frac{abs(run - ref)}{average(run, ref)}$$

where 'run' is the value from the 'run' file and 'ref' is the value from the 'reference' file. Therefore, the 'difference' file may display differences <= $1e^{-6}$ for a test case with a Passed status.

Validation tests

The three **base tests** include an installation test case to verify that all Phoenix files have been installed in the correct locations and that they have not been modified. The other two base test cases verify that 1) two CSV files known to match will correctly be passed when compared on your system and 2) two CSV files known to differ will correctly be failed when compared on your system. These two test cases verify that the Validation Suite tool is functioning as intended.

The **Phoenix WinNonlin Validation Suite** provides automated tests to validate Phoenix WinNonlin functions and options, including PK, PD, PKPD, and Indirect modeling, and data manipulation. Following an automated test run, the Phoenix WinNonlin Validation Suite generates a report that details the tests and results.

For a complete list of tests, see "WNL Test cases".

Note: *The Phoenix WinNonlin Validation Suite includes test cases for the Phoenix Model Object with individual (non-population) modeling. The Phoenix Model Object (NLME engine) can only run on 64-bit systems, so any test cases for the Phoenix Model Object will have a status of "not applicable" (N/A) on 32-bit systems. These tests cases are: PHX LM 501, PHX MM 301, PHX PD 103, PHX PD 105, PHX PK 1 Clearance, PHX PK 1 PD 101, PHX PK 12, PHX PK 18, PHX PK 6, PHX PK 9.*

The **Phoenix NLME Validation Suite** provides automated tests to validate local execution of Phoenix NLME functions and options, including PK, PD, PKPD, and Indirect modeling and data manipulation. Following an automated test run, the Phoenix NLME Validation Suite generates a report that details the tests and results.

For a complete list of tests, see "NLME test cases".

Note: *The Phoenix Model Object (NLME engine) can only run on 64-bit systems, so any test cases for the NLME will have a status of "not applicable" (N/A) on 32-bit systems.*

To execute validation tests

1. Select the **Validation > Start Validation** menu option.
2. In the *Start Validation* dialog, specify the username to associate with the report.
3. Check the boxes for the product(s) to validate and click **Start Validation**.

   The validation tests are started immediately and a *Validation Status* dialog is displayed showing the progress.
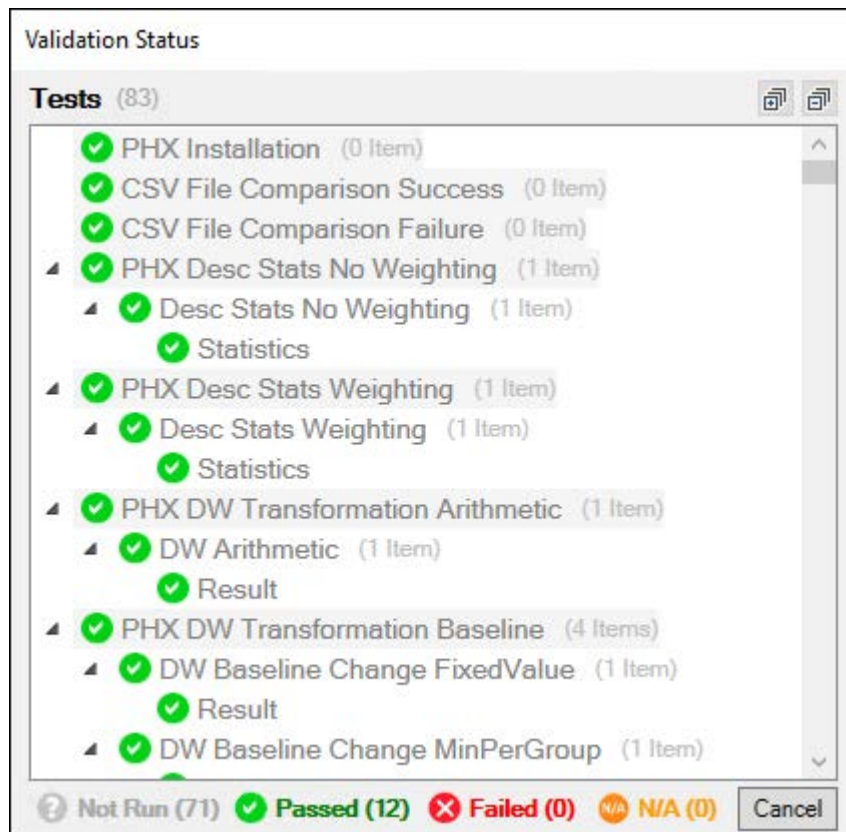
Use the ⧉ and ⧉ buttons in the upper right corner to expand and collapse the tree of tests, respectively, with a single click.

4. Once the validation tests complete, click **OK** in the message pop-up.

Access validation reports

After executing all test cases in the Validation Suite, a Validation Report PDF file is generated and saved in *<username>\Documents\Certara\Validation Reports*. The file contains your system information and, for each test case, the following:

- test case name
- test case objective,
- test case status (Passed, Failed, or N/A)
- error messages (N/A or the error message that occurred)
- links to three files: reference (reference result), run (your result from the Validation Suite run), and difference (differences between the reference and run results)

The report is also accessible through the **Validation > Validation Reports** menu option.

Note: *Only Adobe® Acrobat® is supported for opening the Validation Report.*

For more information on testing methodology and test cases, refer to "WNL Test cases" or "NLME test cases".

Validation templates

The following template documents are provided by each Validation Suite product to assist in documenting validation plans for the corresponding Phoenix product and the execution of the validation plan.

Computational Engines Verification Report for Phoenix <product><version>.pdf: This document is a report showing the means used to verify the reference results.

Requirements Specification template.docx

Test Plan template.docx

Traceability Document template.docx

Validation Plan template.docx

Validation Summary Report template.docx

To access template documents

1. From the Phoenix **Validation** menu, select the **Validation Template Documents** option for the desired product. Menu choices will depend on correct licensing of the products.

2. In the file browser dialog, select the template document and click **Open**.

WNL Test cases

Framework Tests

- PHX Installation: Proper installation of all files in the correct location.

- CSV File Comparison Success: Correct identification of identical CSV files by the comparison tool.

- CSV File Comparison Failure: Correct identification of differing CSV files by the comparison tool.

WinNonlin Tests

- PHX Desc Stats No Weighting: Descriptive Statistics with no weighting, including confidence intervals, specified number of SD, standard percentiles, and user-defined percentiles.

- PHX Desc Stats Weighting: Descriptive Statistics with weighting, including confidence intervals and units.

- PHX DW Transformation Arithmetic: Data Wizard Transformation with each of the predefined arithmetic transformations.

- PHX DW Transformation Baseline: Data Wizard Baseline Transformations including change from fixed value, change from minimum per group, percent change from fixed value, and ratios using minimum per group.

- PHX DW Transformation Functions: Data Wizard Transformation to perform inverse, absolute, exponential, ln, log10, and square root calculations.

- PHX Indiv LM 501: Non-population Phoenix Model with constant linear model. This test case is not applicable when run on a 32-bit system.

- PHX Indiv MM 301: Non-population Phoenix Model with one compartment, bolus input, and Michaelis-Menten output. This test case is not applicable when run on a 32-bit system.

- PHX Indiv PD 103: Non-population Phoenix Model with an inhibitory effect E0 model. This test case is not applicable when run on a 32-bit system.

- PHX Indiv PD 105: Non-population Phoenix Model with Sigmoid Emax model. This test case is not applicable when run on a 32-bit system.

- PHX Indiv PK 1 Clearance: Non-population Phoenix Model with one compartment, IV bolus input, and first-order output with clearance parameterization. This test case is not applicable when run on a 32-bit system.

- PHX Indiv PK 1 PD 101: Non-population Phoenix Model with an effect compartment PK/PD link model. This test case is not applicable when run on a 32-bit system.

- PHX Indiv PK 12: Non-population Phoenix Model with two compartments, first-order input, first-order output, lag time, and with micro-constants as primary parameters. This test case is not applicable when run on a 32-bit system.

- PHX Indiv PK 18: Non-population Phoenix Model with three compartments, IV bolus input, first-order output, and with macro-constants as primary parameters. This test case is not applicable when run on a 32-bit system.

- PHX Indiv PK 6: Non-population Phoenix Model with one compartment, equal first-order input and output, and with lag time. This test case is not applicable when run on a 32-bit system.

- PHX Indiv PK 9 Units: Non-population Phoenix Model with two compartments, constant IV infusion input, first-order output, and with micro-constants as primary parameters, with units for the primary and secondary parameter results. This test case is not applicable when run on a 32-bit system.

- PHX Ratios and Differences: Ratios and Differences from one input worksheet, from two input worksheets, and using means of non-unique values.

- WNL Bioeq Average Crossover 2x2: Average Bioequivalence using the default models for non-replicated two-period crossover data, both the fixed and random effects default model and the all fixed-effects default model.The fixed-effects model also specifies numerator and denominator for an additional F-test.

- WNL Bioeq Average Crossover 2x4: Average Bioequivalence using the default model for replicated crossover data, in this case with four periods.

- WNL Bioeq Average Parallel: Average Bioequivalence using the default model for parallel data.

- WNL Bioeq Population Individual: Population and individual Bioequivalence using the predefined model.

- WNL Crossover Separate: Crossover nonparametric analysis using separate input data columns.

- WNL Crossover Stacked: Crossover nonparametric analysis using stacked input data columns.

- WNL Deconv 1exp None TimesFromCol Units: Deconvolution using one-exponent unit impulse response (UIR) function, with no smoothing, output times from a worksheet, and units.

- WNL Deconv 2exp User Rate Change ToLastPt: Deconvolution using two-exponent UIR function with specified smoothing parameter, initial rate and initial change in rate set to 0, and output times generated from 0 to the last observed time point.

- WNL Deconv 3exp Auto Rate NumPts FromTo: Deconvolution using three-exponent UIR function, using the Phoenix-determined optimal smoothing parameter value, initial change in rate set to 0, and output times generated for specified time range.

- WNL LinMix Ancova Options: Linear Mixed Effects using ANCOVA model (classification and regressors), with an interaction term, random intercept, dependent variable transformation, contrasts, and estimates.

- WNL LinMix AR ARH CSH FA0: Linear Mixed Effects models with autoregressive, heterogeneous autoregressive, heterogeneous compound symmetry, and no-diagonal factor analytic types of covariance structure, one model tests no intercept for fixed effects.

- WNL LinMix CS TOEP UN: Linear Mixed Effects models with compound symmetry, Toeplitz, and unstructured types of covariance structure, and with using a weight variable.

- WNL LinMix VC Contrasts Estimates LSMs: Linear Mixed Effects models with variance components covariance structure type, contrasts, estimates, least squares means and pairwise differences, and residual DF.
- WNL LM 501 Constant: Least-Squares Regression Modeling, Linear model 501 (constant).
- WNL LM 502 Linear: Least-Squares Regression Modeling, Linear model 502 (linear).
- WNL LM 503 Quadratic: Least-Squares Regression Modeling, Linear model 503 (quadratic).
- WNL LM 504 Cubic: Least-Squares Regression Modeling, Linear model 504 (cubic).
- WNL MM 301: Least-Squares Regression Modeling, one compartment model with IV bolus input and Michaelis-Menten output.
- WNL MM 302: Least-Squares Regression Modeling, one compartment model with constant IV input and Michaelis-Menten output.
- WNL MM 303: Least-Squares Regression Modeling, one compartment model with first-order input and Michaelis-Menten output.
- WNL MM 304: Least-Squares Regression Modeling, one compartment model with first-order input, Michaelis-Menten output, and a time lag.
- WNL NCA Extravascular NonSS PartialAUC: NonCompartmental Analysis for non-steady state, plasma, extravascular data, using the linear trapezoidal linear interpolation calculation method and including partial areas.
- WNL NCA Infusion NonSS PartialAUC Rules: NonCompartmental Analysis for non-steady state, plasma, IV infusion data, using the linear trapezoidal linear interpolation calculation method and Lambda Z Best Fit rules, and including partial areas.
- WNL NCA IV Bolus NonSS PartialAUC LinearLog Trap: NonCompartmental Analysis for non-steady state, plasma, IV bolus data using the linear log trapezoidal calculation method and including a partial area.
- WNL NCA IV Bolus SS InsertC0 UserDefined: NonCompartmental Analysis for steady state, plasma, IV bolus data, using the linear trapezoidal linear interpolation calculation method and including methods for inserting C0, partial areas, user-defined parameters, and concentrations (computed at specified times).
- WNL NCA PartialAUC LinearUpLogDown Units: NonCompartmental Analysis for plasma, extravascular data, using the linear up log down calculation method and including partial areas and units.
- WNL NCA PartialAUC LinTrapLinLogInterp Units: NonCompartmental Analysis for plasma, extravascular data, using the linear trapezoidal linear/log interpolation calculation method and including partial areas and units.
- WNL NCA PD UserDefined: NonCompartmental Analysis for drug effect data, using the linear trapezoidal linear interpolation calculation method, with baseline and threshold values, user-defined time ranges for slopes, partial area, user-defined parameter, and effects computed at specified x-values.
- WNL NCA SparseSampling Extravascular: NonCompartmental Analysis for sparse-sampling, plasma, extravascular data, using the linear trapezoidal linear interpolation calculation method, includes case with missing values.

- WNL NCA Urine TimeRange Flags Sort: NonCompartmental Analysis for urine data, using the linear trapezoidal linear interpolation calculation method, with Lambda Z acceptance criteria, user-defined time ranges for slopes, and a sort variable.
- WNL NCA Weighting InsertC0: NonCompartmental Analysis for plasma, IV bolus data, using the linear trapezoidal linear interpolation calculation method, and including methods for inserting C0, partial areas, 1/Y weighting, and a sort variable.
- WNL NPS Regular Linear BestFit: NonParametric Superposition with dosing at regular intervals and using linear interpolation.
- WNL NPS Variable Log StartEnd: NonParametric Superposition with variable dosing intervals, a specified output time range, and using log interpolation.
- WNL PD 101: Least-Squares Regression Modeling, simple Emax model.
- WNL PD 102: Least-Squares Regression Modeling, simple Emax model with baseline effect.
- WNL PD 103: Least-Squares Regression Modeling, inhibitory effect Emax model.
- WNL PD 104: Least-Squares Regression Modeling, inhibitory effect model with a baseline effect parameter.
- WNL PD 105: Least-Squares Regression Modeling, sigmoid effect model without a baseline effect parameter.
- WNL PD 106: Least-Squares Regression Modeling, sigmoid Emax model with baseline effect.
- WNL PD 107: Least-Squares Regression Modeling, sigmoid inhibitory effect model.
- WNL PD 108: Least-Squares Regression Modeling, sigmoid inhibitory effect model with a baseline effect parameter.
- WNL PK 1 Clearance: Least-Squares Regression Modeling, one compartment PK model with IV bolus input and first-order output with clearance parameterization.
- WNL PK 1 PD 101 Linked: Least-Squares Regression Modeling, PK/PD linked model with effect compartment.
- WNL PK 10: Least-Squares Regression Modeling, two compartment PK model with constant IV infusion input and first-order output, with macro-constants as primary parameters.
- WNL PK 11: Least-Squares Regression Modeling, two compartment PK model with first-order input, first-order output, without lag time, with micro-constants as primary parameters.
- WNL PK 12: Least-Squares Regression Modeling, two compartment PK model with first-order input, first-order output, with lag time, with micro-constants as primary parameters.
- WNL PK 13: Least-Squares Regression Modeling, two compartment PK model with first-order input, first-order output, without lag time, with macro-constants as primary parameters.
- WNL PK 14: Least-Squares Regression Modeling, two compartment PK model with first-order input, first-order output, with lag time, with macro-constants as primary parameters.

- WNL PK 15: Least-Squares Regression Modeling, one compartment PK model with simultaneous IV bolus and constant IV infusion.

- WNL PK 16: Least-Squares Regression Modeling, two compartment PK model with simultaneous IV bolus and constant IV infusion input, with micro-constants as primary parameters.

- WNL PK 17: Least-Squares Regression Modeling, two compartment PK model with simultaneous IV bolus and constant IV infusion input, with macro-constants as primary parameters.

- WNL PK 18: Least-Squares Regression Modeling, three compartment PK model with IV bolus input, first-order output, with macro-constants as primary parameters.

- WNL PK 19: Least-Squares Regression Modeling, three compartment PK model with constant IV infusion, with macro-constants as primary parameters.

- WNL PK 2: Least-Squares Regression Modeling, one compartment PK model with constant IV infusion input and first-order absorption.

- WNL PK 3 Clearance: Least-Squares Regression Modeling, one compartment PK model with first-order input and output, without lag time but with clearance parameterization.

- WNL PK 4 Clearance: Least-Squares Regression Modeling, one compartment PK model with first-order input and output, with lag time and clearance parameterization.

- WNL PK 5: Least-Squares Regression Modeling, one compartment PK model with equal first-order input and output, without lag time.

- WNL PK 6: Least-Squares Regression Modeling, one compartment PK model with equal first-order input and output, with lag time.

- WNL PK 7 Clearance: Least-Squares Regression Modeling, two compartment PK model with IV bolus input and first-order output, with micro-constants as primary parameters and with clearance parameterization.

- WNL PK 8: Least-Squares Regression Modeling, two compartment PK model with IV bolus input and first-order output, with macro constants as primary parameters.

- WNL PK 9: Least-Squares Regression Modeling, two compartment PK model with constant IV infusion input and first-order output, with micro-constants as primary parameters.

- WNL SCM Linear: Semicompartmental Modeling using a linear piecewise PK model.

- WNL SCM LinearLog: Semicompartmental Modeling using a PK model that is linear to Tmax and then log-linear after Tmax.

- WNL SCM Log: Semicompartmental Modeling using a log-linear piecewise PK model.

NLME test cases

Framework Tests

- PHX Installation: Proper installation of all files in the correct location.
- CSV File Comparison Success: Correct identification of identical CSV files by the comparison tool.
- CSV File Comparison Failure: Correct identification of differing CSV files by the comparison tool.

NLME Tests

- NLME BQL LLOQ PK 1Cmpt IV Bolus Laplacian: NLME BQL with censor column and BQL with static LLOQ, for 1-cmpt PK model with IV bolus dose and multiplicative error, using Laplacian engine.
- NLME Count NegativeBinomial RandomBlocks Laplacian: NLME Count model with correlated random effect blocks, using LL statement for negative binomial count model and Laplacian engine.
- NLME Event 1Cmpt 1stOrderAbsorp ImaxHazard QRPEM: NLME Time-To-Event model, using joint PK 1cmpt 1st-order absorption model and time-to-event model, with hazard described by Imax model, using QRPEM engine
- NLME Indirect 1Cmpt 1stOrder StimLimitBuildup FOCE ELS: NLME indirect response built-in model, with 1cmpt 1st-order absorption PK model and limited stimulation of buildup, with multiplicative error, using FOCE-ELS engine
- NLME Indirect 1Cmpt IV InhibLimitLoss Effect FOCE ELS: NLME indirect response model, with 1-cmpt IV bolus PK model, limited inhibition of loss, and effect cmpt, with multiplicative error, using FOCEELS engine.
- NLME Logistic Regression Laplacian: NLME Logistic Regression model, using Laplacian engine.
- NLME PD Inhibitory AdditiveError FOCE ELS: NLME inhibitory PD model with additive error, using FOCE ELS engine.
- NLME PD Inhibitory AdditiveError FOCE LB Comparer: NLME inhibitory PD model with additive error, using FOCE L-B engine, compared with FOCE ELS using Model Comparer.
- NLME PD Stimulatory AddPlusMultError FOCE ELS: NLME stimulatory PD model with Add+Mult error model, using FOCE ELS engine.
- NLME PD Stimulatory Baseline PowerError Laplacian: NLME stimulatory PD model with baseline and power error model, using Laplacian engine.
- NLME PD Stimulatory MixRatioError FOCE ELS: NLME stimulatory PD model with Mix Ratio error model, using FOCE ELS engine.
- NLME PD Stimulatory Sigmoidal MultError FOCE ELS: NLME stimulatory sigmoidal PD model with multiplicative error, using FOCE ELS engine.
- NLME PK 1Cmpt 0OrderAbsorption ODE FO IT2S: NLME 1-cmpt graphical PK model with 0-order absorption and multiplicative error, as ODE, using FO and IT2S-EM engines to obtain initial estimates.
- NLME PK 1Cmpt 0OrderAbsorption ODE Laplacian: NLME 1-cmpt graphical PK model with 0-order absorption and multiplicative error, as ODE, using Laplacian engine.

- NLME PK 1Cmpt 1stOrderAbsorption SS FOCE ELS: NLME 1-cmpt PK model at steady-state, with 1st-order absorption and multiplicative error, using FOCE ELS engine.

- NLME PK 1Cmpt 1stOrder Absorption Tlag FOCE ELS: NLME 1-cmpt PK built-in model with a lag time, with 1st-order absorption and multiplicative error, using FOCE ELS engine.

- NLME PK 1Cmpt IV Bolus IOV Reset QRPEM MAP: NLME 1-cmpt PK model with IV bolus dose, interoccasion covariate, and Reset, using QRPEM engine with MAP Assist.

- NLME PK 1Cmpt IV Bolus MDV FOCE ELS: NLME 1-cmpt PK model with clearance parameterization, multiplicative error, IV bolus dose, and MDV column, using FOCE ELS engine.

- NLME PK 1Cmpt IV Bolus MM ODE FOCE ELS: NLME 1-cmpt PK model with IV bolus dose and Michaelis-Menten elimination, as ODE, using FOCE ELS engine.

- NLME PK 1Cmpt IV Bolus Nonparametric: NLME 1-cmpt PK model with clearance parameterization, multiplicative error, and IV bolus dose, using Nonparametric engine.

- NLME PK 1Cmpt IV Infusion ADDL Cov CorrRandom FOCE ELS: NLME 1-cmpt PK model with IV infusion and ADDL dosing, continuous covariate, and correlated random effects, using FOCE ELS engine.

- NLME PK 1Cmpt IV Infusion QRPEM: NLME 1-cmpt PK model with clearance parameterization, multiplicative error, and IV infusion dose, using QRPEM engine.

- NLME PK 2Cmpt 1stOrderAbsorption Cov FOCE ELS: NLME 2-cmpt PK model with 1st-order absorption, multiplicative error, and a categorical covariate, using FOCE ELS engine.

- NLME PK 2Cmpt IV Bolus EliminationCmpt ODE Laplacian: NLME 2-cmpt PK model with elimination compartment (plasma and urine observations) and IV bolus dose, as ODE, using Laplacian engine.

- NLME PK 2Cmpt IV Bolus LogAdditiveError FOCE ELS: NLME 2-cmpt PK built-in model with IV bolus dose and log-additive residual error, using FOCE ELS engine.

- NLME PK 3Cmpt IV Bolus Micro FOCE ELS: NLME 3-cmpt PK built-in model with micro parameterization, multiplicative error, and IV bolus dose, using FOCE ELS engine.

- NLME PKPD 1Cmpt 1stOrderAbsorption Inhibitory QRPEM: NLME PKPD model with 1-cmpt 1st-order absorption PK model and inhibitory PD model, with multiplicative error, using QRPEM engine.

- NLME PKPD Seq 1Cmpt IV Stim Baseline AddError FOCE ELS: NLME sequential PKPD model with 1-cmpt IV bolus PK model and stimulatory PD model with baseline, with additive error, using FOCE-ELS engine.

- NLME Profile PK 2Cmpt IV Bolus: NLME Profile option with 10% and -10% perturbations, for 2-cmpt PK model with IV bolus dose.

- NLME Resampling Bootstrap PK 1Cmpt IV Bolus: NLME Bootstrap for 1-cmpt PK model with IV bolus dose, using 100 samples.

- NLME RunMPI PKPD 1Cmpt 1stOrderAbsorp Inhibitory QRPEM

- NLME Simulation PK 1Cmpt IV Bolus: NLME Simulation for 1-cmpt PK model with IV bolus dose, for 1000 subjects, with simulation tables for observations at specified times and for parameter estimates

- NLME Stepwise Shotgun Cov Search PK 1Cmpt: NLME Stepwise and Shotgun Covariate Searches for 1-cmpt PK model with continuous and categorical covariates.

- NLME VPC ExplicitBin CovStrat PK 2Cmpt: NLME Visual Predictive Check (VPC) with explicit-centers binning and stratification by categorical covariate, for 2-cmpt PK model with 1st-order absorption

- NLME VPC NoBin NoStrat PK 2Cmpt: NLME Visual Predictive Check (VPC) for 2-cmpt PK model with covariate, without binning or stratification.

- PHX Desc Stats No Weighting: Descriptive Statistics with no weighting, including confidence intervals, specified number of SD, standard percentiles, and user-defined percentiles.

- PHX Desc Stats Weighting: Descriptive Statistics with weighting, including confidence intervals and units.

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- PHX Indiv LM 501: Non-population Phoenix Model with constant linear model.

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- PHX Indiv PK 6: Non-population Phoenix Model with one compartment, equal first-order input and output, and with lag time.

- PHX Indiv PK 9 Units: Non-population Phoenix Model with two compartments, constant IV infusion input, first-order output, and with micro-constants as primary parameters, with units for the primary and secondary parameter results.

- PHX Ratios and Differences: Ratios and Differences from one input worksheet, from two input worksheets, and using means of non-unique values.

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