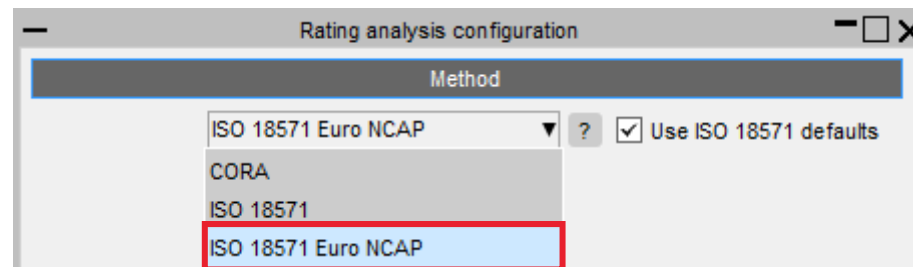


T/HIS CORA tool with ISO 18571 Euro NCAP option

Early access version, 29 Sep 2023

Introduction

- The T/HIS CORA tool featured in T/HIS 20.0 has two rating methods: CORA and ISO 18571.
- With the upcoming [Euro NCAP Virtual Far Side Simulation and Assessment Protocol](#), we checked the [Euro NCAP Python script](#) against ISO 18571 and found some differences (see [T/HIS CORA tool Rating Methods](#) for details), so we have introduced a new **“ISO 18571 Euro NCAP”** option in the T/HIS CORA tool, which aims to provide the same results as the Euro NCAP implementation.



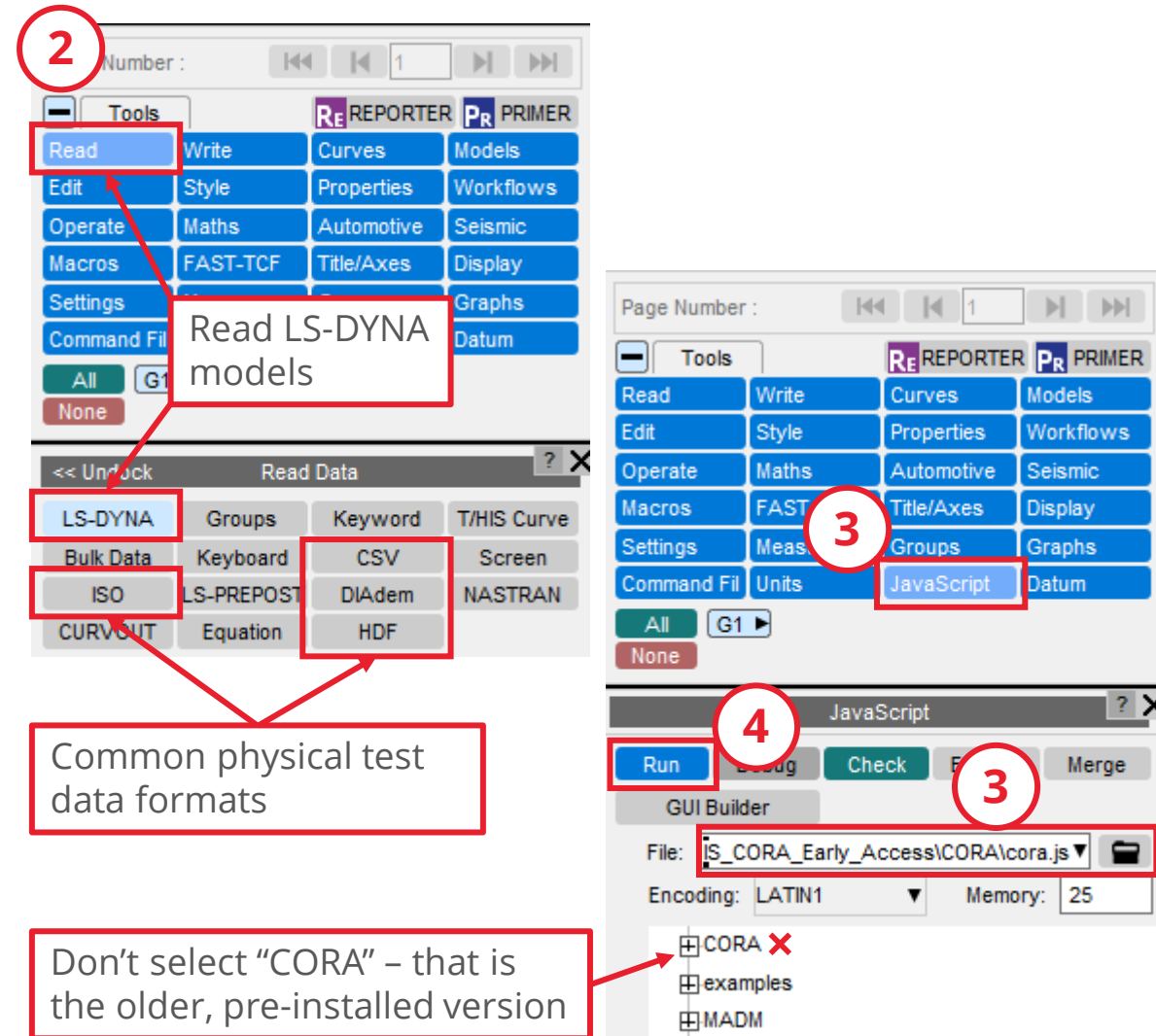
Early access version, 29 Sep 2023

- The updated T/HIS CORA tool containing the new ISO 18571 Euro NCAP option will be released with Oasys 21 in 2024.
- This early access version is provided to allow you to test and use the new T/HIS CORA tool to help develop your CAE virtual testing workflows.
- Although we have taken steps to validate this update against the Euro NCAP implementation, this early access version has not yet been subject to our full QA testing, and so we recommend you test it before use in production work and restrict its usage within your organisation appropriately.
- If you find any errors in the updated tool or have any feedback, please [contact us](#) so that we can make improvements.

How to use the early access version

- This updated early access version of the T/HIS CORA tool can be run on T/HIS 20.0, T/HIS 20.1, or any T/HIS 21 beta version.
- To run this version of the T/HIS CORA tool:

1. Open T/HIS
2. Read in any LS-DYNA models and physical test data as usual
3. Select **Tools** → **JavaScript** and browse for 2023-09-29_THIS_CORA_Early_Access_Bundle/CORA/cora.js
4. Click **Run**



How to use the early access version (continued)

- To use the new option:

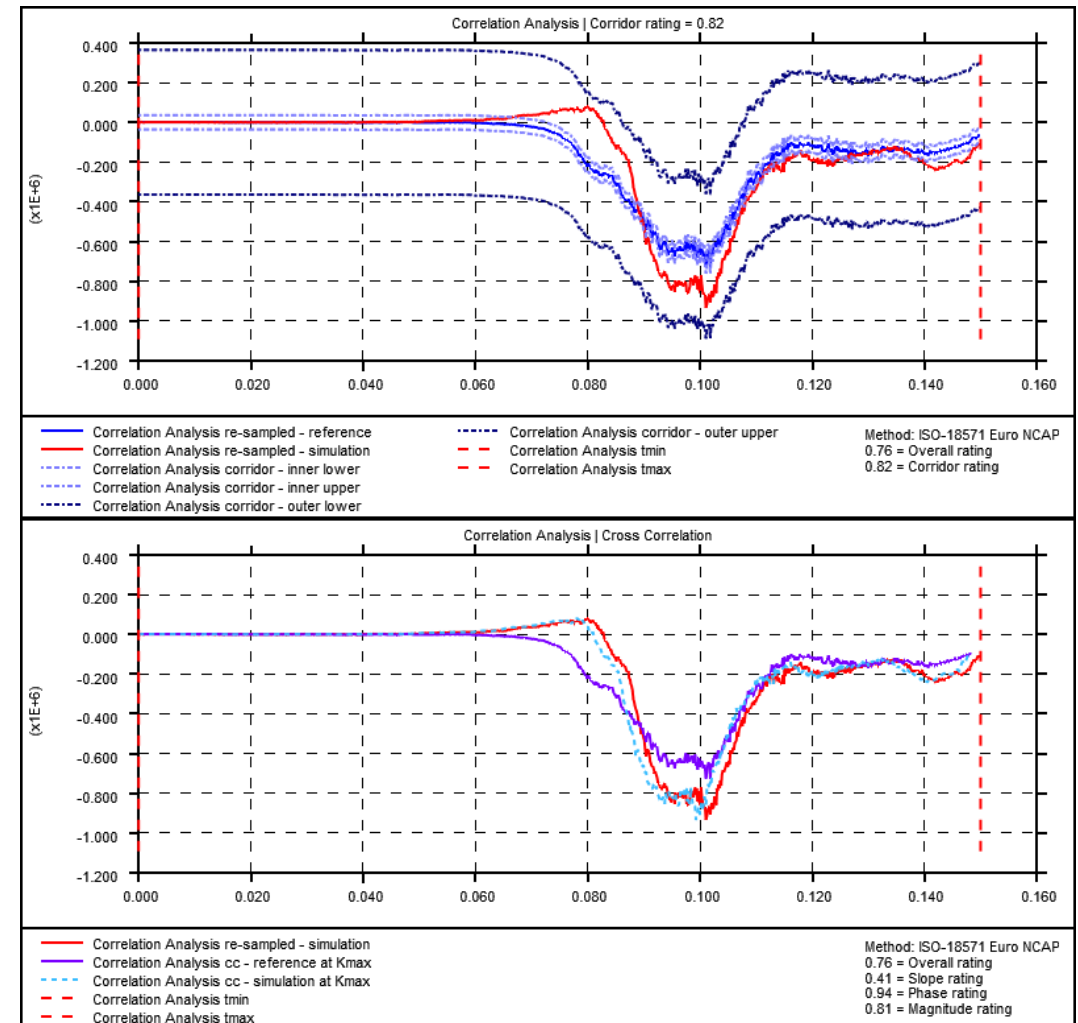
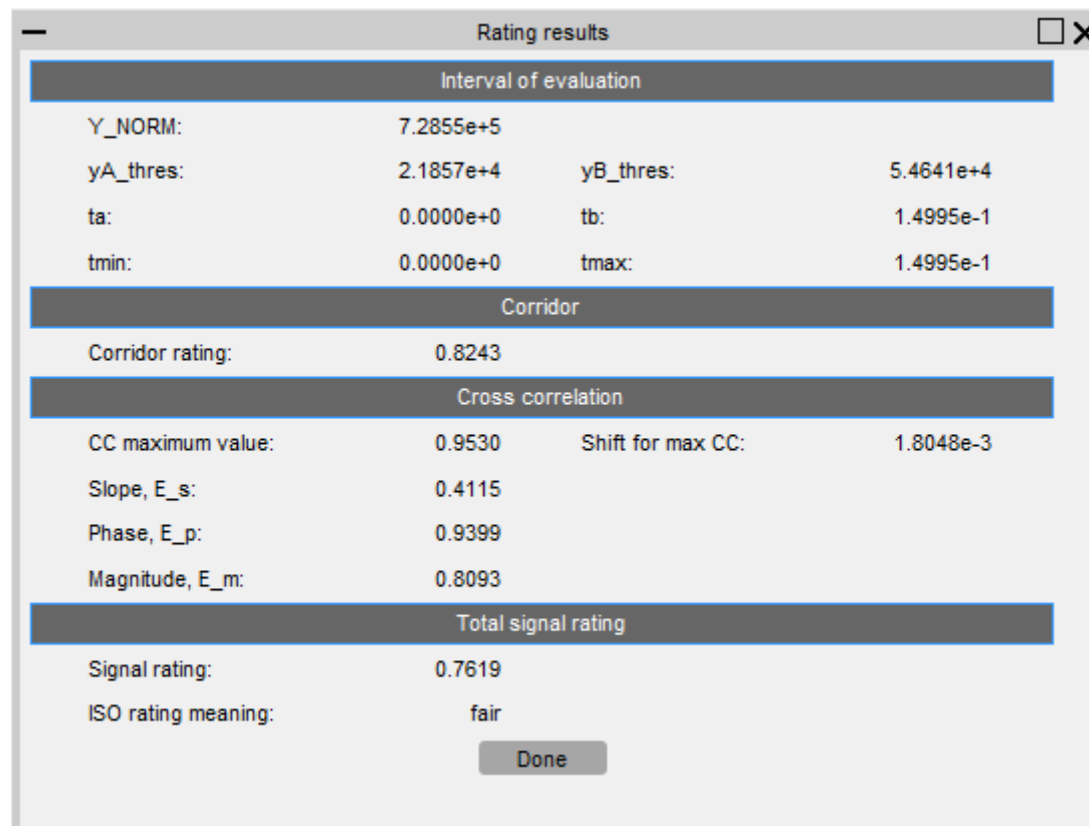
1. Select rating method: **ISO 18571 Euro NCAP**
2. Select a test curve and a simulation curve
3. Edit any of the configuration settings as necessary
4. Select output settings to control which graphs are plotted
5. Click **Calculate**

The screenshot shows the 'Rating analysis configuration' dialog box with the following settings and callouts:

- 1** (Method): Rating method: ISO 18571 Euro NCAP. Use ISO 18571 defaults: ☒.
- 2** (Signal): test(s): 1 (Select), simulation: 2 (Select).
- 3** (Evaluation interval): Y_NORM: extremum, L_TYPE: cubic spline (natural), T_STEP: 0, STEP_FACTOR: 1.0, T_INTERP: yes, STEP_TYPE: max.
- 4** (Output): Signal rating weighting: G_1: 0.5, G_2: 0.5. Output: ☒ Output calculation curves, ☒ Plot corridor graph, ☒ Plot cross correlation graph, ☒ Add scores to graph title, ☒ Add scores to legend, ☒ Add method to legend. Case title: Correlation Analysis. ☐ File output, ☒ Append. File path: C:\Users\T\Access Versions\2023-09-29_THIS_CORA_Early_Access\CORA\output.csv.
- 5** (Calculate): Calculate button.

How to use the early access version (continued)

- The correlation analysis results are presented in the **rating results** window, and graphs showing the **corridor** and **cross-correlation** can be plotted.



T/HIS CORA tool Rating Methods

Three rating methods are available, described in the following sections:

- CORA
- ISO 18571
- ISO 18571 Euro NCAP

CORA

The T/HIS CORA tool was benchmarked against the [PDB CORA software](#) CORAplus 4.0.4. The benchmarks indicated that the results will not always be consistent, because of differences in the cross correlation shifted and truncated curve used to perform the rating. In March 2022, [PDB](#) acknowledged some issues with its implementation, and intends to make corrections once ISO 15781 is next updated.

ISO 18571

The rating methods described in ISO 18571 have been implemented in T/HIS and are available by selecting the ISO 18571 rating method. This method in the T/HIS tool was also benchmarked against the [PDB CORA software](#) CORAplus 4.0.4. The benchmarks indicated that the results will not always be consistent, because of differences in the dynamic time warping algorithms used. In March 2022, [PDB](#) acknowledged these differences, which relate to issues in ISO 18571 itself. PDB intends to make corrections once ISO 15781 is next updated.

ISO 18571 Euro NCAP

The ISO 18571 Euro NCAP method is based on the ISO 18571 [Validation Metrics Tool](#) released by Euro NCAP and aims to provide the same results.

We checked the Euro NCAP Validation Metrics Tool and ([as of 21 September 2023](#)) identified two deviations from the ISO 18571 method, which we have also implemented in our "ISO 18571 Euro NCAP" method to provide consistent results:

1. Dynamic Time Warping Constraint

In the Phase score calculation, the Dynamic Time Warping (DTW) algorithm is implemented with a Sakoe-Chiba window constraint with relative window size 0.1, as opposed to an unconstrained DTW algorithm used in standard ISO 18571.

2. Alternative Slope Method

In the Slope score calculation, an alternative slope method is used. In the ISO 18571 standard, the gradient is calculated by dividing the signal into intervals (10 data points in length) and computing the average slope within each interval. In the Euro NCAP method, the gradient of the original 10 kHz signal is computed using:

- forward difference for the first point (1st order accurate)
- backward difference for the last point (1st order accurate)
- central difference for all the other points (2nd order accurate)

such that the gradient curve is the same size as the input curve. The algorithm then applies a smoothing function to the gradient curve. For each point on the curve, the smoothing function takes the average of the point and the four neighbouring points on either side (reducing to zero points either side as one approaches the ends of the curve).