



# Test Report

**for the 1<sup>st</sup> test round of  
the OCX Interoperability Forum**  
held on September 2023 - October 2024

Version: January 2025

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# Test Round 1

## 1. Executive Summary

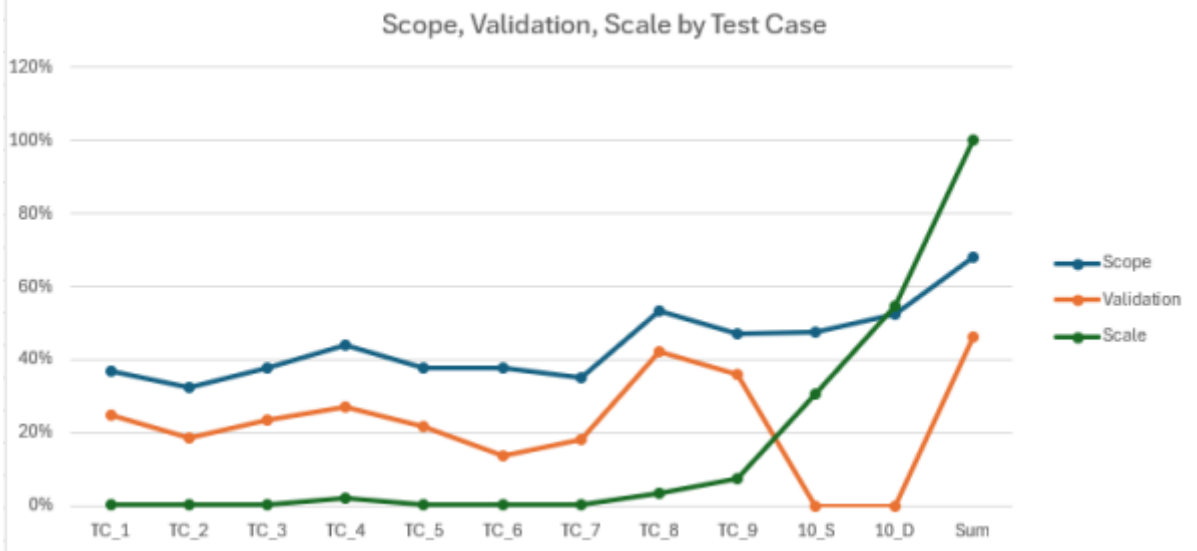
The OCX Interoperability Forum Test Report documents the results of the first interoperability test round, conducted between September 2023 and October 2024. The primary objective was to evaluate schema capabilities for geometry and scantling representation across various CAD systems, focusing on both basic and moderately complex shipbuilding models.

The testing approach, framework, and data collection and reporting benefitted greatly from cooperative efforts with other International Standards testing organizations—namely the prostep Integrated Virtual Product (iViP) Association and the CAx Interoperability Forum.

### Key findings include:

- Establish a standardized test process and validate schema capabilities for geometry and scantling representation.
- Test Scope: Nine test cases were executed, ranging from simple geometry models to more complex configurations.
- Participating Systems: Major CAD platforms, including AVEVA E3D, AITAC, Bureau Veritas, Cadmatic, Det Norske Veritas, Lloyds Register, Korean Register, Napa, ProSTEP, and others, contributed to the evaluation.
- Test Coverage across all test cases spanned ~68% of the Schema Elements, 46% of which were validated through statistics. More than 1.1 M occurrences of schema elements were generated.

<b>Element Name</b>	<b>Number of Occurrences</b>
<b>OCX Schema Elements</b>	<b>283</b>
<b>Unsupported Elements</b>	
<b>Scope (Unique Elements)</b>	<b>193</b>
<b>Scale (Number of Occurrences)</b>	<b>1,123,809</b>
<b>Number of Statistics</b>	
<b>Number Explicitly Validated</b>	<b>28</b>
<b>Number Implicitly Validated</b>	<b>103</b>
<b>Scope</b>	<b>68%</b>
<b>Validation</b>	<b>46%</b>
<b>Scale</b>	<b>100%</b>



**Results Overview:**

Test Case Performance: Success rates varied significantly across test cases, with primary challenges arising from discrepancies in how CAD systems handle parameters like plate thickness, center of gravity (COG), and geometry constraints.

- Root Causes of Failures: Errors were primarily due to:
  - Inconsistent interpretations of geometry schema.
  - Differences in volumetric versus surface-based CAD modeling approaches.
  - Mismatches between native and target system data outputs.

**Recommendations:**

- **Standardization:** Improve clarity in schema definitions.
- **Process Refinement:** Address recurring errors, particularly in geometry and COG calculations.
- **Future Testing Rounds:** Adjust test cases to address system-specific limitations and improve interoperability outcomes.

The report highlights both successes and areas for improvement, offering a roadmap for enhancing cross-platform interoperability in future testing iterations. For more detailed metrics, test results, and root cause analyses, refer to the full report.

## 2. Motivation

The main motivation of test round 1 has been to establish the test process and procedures and to execute one full test round in a year. The functionality to be tested is the basic schema capabilities for geometry and scantling representation. The test models 1-7 are designed to test specific capabilities of the schema and are simple in complexity by design. Test models 8 and 9 are more complex with typical shipbuilding details but are still of low complexity compared to actual ship designs.

## 3. How We Test

### 3.1 The OCX Interoperability Forum

The “Open Class eXchange” (OCX) Interoperability Forum (OCX-IF) is a logical collection of a user group and an implementer group, focused on specific capabilities of a named standard, in this case the OCX Schema.

- The User Group is comprised of industry representatives, all members of at least one of the Interoperability Forum hosting organizations. The group will define and prioritize use cases, derive requirements and related validation properties as well as document user best practices.
- The Implementor Group is a group of software vendors, 3rd party integrators, and independent implementors, all members of at least one of the Interoperability Forum hosting organizations, that define recommended practices based on the prioritized use cases provided by the user group and validate them in test rounds.

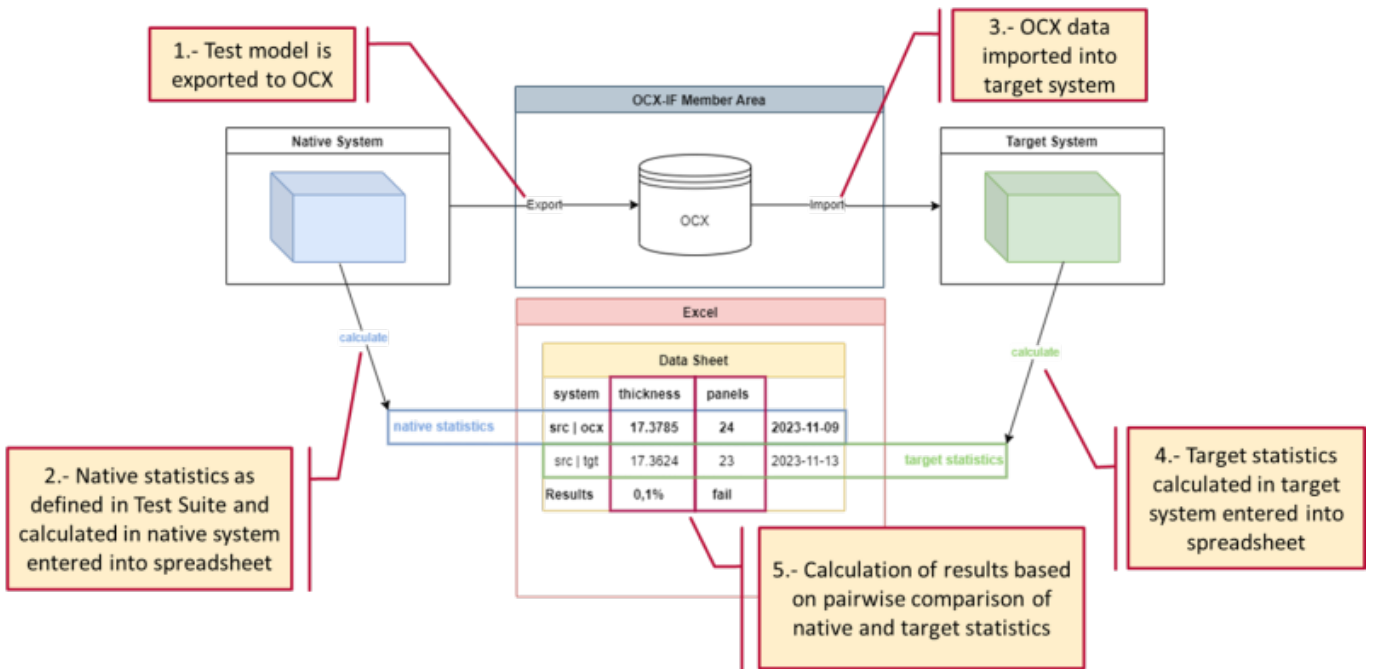
The objectives of the OCX-IF concentrate primarily on testing the interoperability and compliance of Export and Import processors based on the published and draft versions of the OCX Schema, and include documenting and prioritizing use cases, requirements and best practices to ensure completeness and consistency of the OCX Schema and its implementations, implementing new functionalities based on users’ requirements while ensuring these do not adversely affect existing implementations, avoiding roadblocks by establishing agreed-upon approaches, and increasing user confidence in OCX by providing interoperable commercial software products.

The OCX-IF’s Implementor Group targets two test rounds per year for each domain and presents summary results to the user community. Furthermore, Recommended Practices are developed, and

issues are reported to the standards development community.

The test rounds in general combine testing of synthetic and production models. Production models will in most cases be provided by the user companies or the CAD Tool Vendor organizations. When production models are not available from the user companies, “production-like” models will be solicited from the various OCX-IF participants.

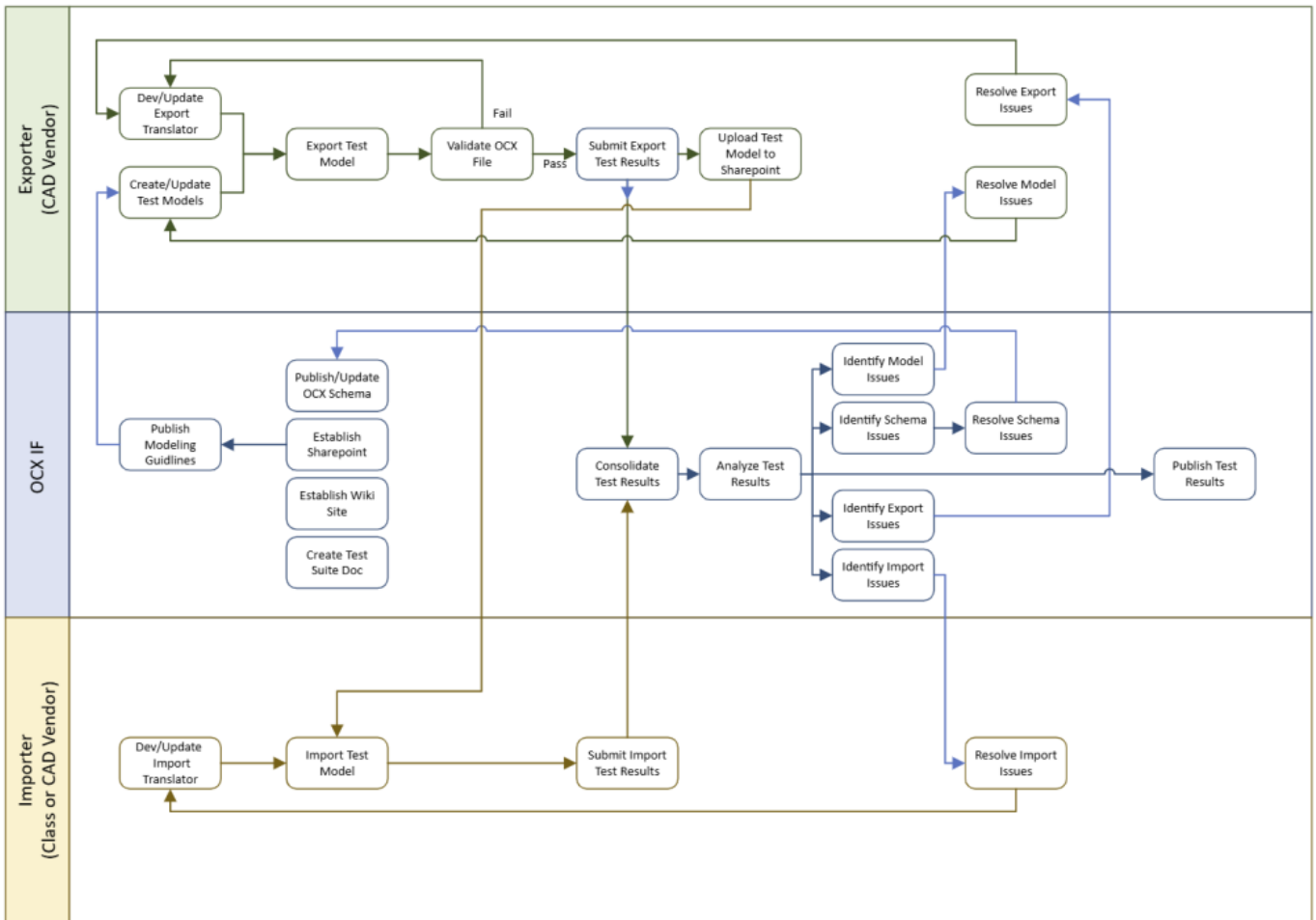
### 3.2 Native and Target Statistics



The native statistics for each test round are defined in the test suite for that particular test round. We collect native statistics from all participants **exporting** the OCX model and store these values in the test database. Then we collect the target statistics from participants **importing** the OCX model and store the values in the test database. The test framework will then evaluate each statistic by comparing target values against the native values and produce the test result report.

### 3.3 Test Process

The figure below represents a Process Workflow Diagram of the Testing process.



### 3.4 Statistics Threshold Values

Statistics	Pass	Partial	Fail
Physical Properties Dry Weight	value ≤ 10%	NA	value > 10%
Physical Properties Center of Gravity	value ≤ t/2	t/2 < value ≤ t	value > t
Object count	native = target	NA	native ≠ target
Visual observation	all	partial	none

where \$t\$ is the plate thickness. The visual observation statistics compare the native and target visual models.

## 4. Participating Implementors

System
AVEVA E3D
AITAC Group - Catia V5-3DX
BV Smart Shape
Cadmatic Hull
DNV Nauticus Hull
Korean Register Sea Trust
Lloyd's Register Ship Right

<b>System</b>
NAPA Steel
PROSTEP Aveva Marine

The table above shows the vendor systems that participated in Test Round 1.

## 5. Results

### 5.1 Test Case 1



# Round 1 - TC1



Sep 2023 - Nov 2024



## Functionalities tested:

- Flat Rectangular Plate

## Overall Success Rate:



## Participation:

- Files provided: 5
- Results submitted: 30
- Vendors participated: 9

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### 5.1.1 Test Metrics

Value	Column name	Description
Plate Physical Properties Dry Weight	dry_weight	value of dry weight [Mass Unit]
Plate Physical Properties Center of Gravity	cx, cy, cz	value of center of gravity [Length Unit]
<b>Overall Success</b>		
Status	Count	Result
pass	60	100%
partial	0	0%
fail	0	0%
total	60	

### 5.1.2 Detailed results

#### Number of Vessel Coordinate Systems

0 exchanges



#### Vessel Reference Planes X RefPlanes

0 exchanges



#### Vessel Reference Planes Y RefPlanes

0 exchanges



#### Vessel Reference Planes Z RefPlanes

0 exchanges



#### Physical Properties Weight

30 exchanges



#### Physical Properties Center of Gravity

30 exchanges



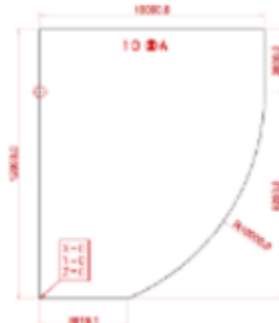
The **Count** statistics were excluded from the report because not all the implementors support count metrics.

## 5.2 Test Case 2

# Round 1 - TC2



Sep 2023 - Nov 2024

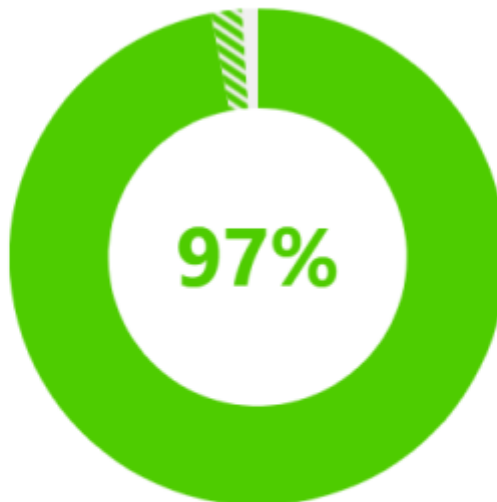


Test Case 2  
Plate 1000x1200x10mm in YZ Plane  
Fillet Arc with center at (0,0,0mm)

## Functionalities tested:

- Plate with Rounded Corner

## Overall Success Rate:



## Participation:

- Files provided: 5
- Results submitted: 30
- Vendors participated: 9

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## 5.2.1 Test Metrics

Value	Column name	Description
Plate Physical Properties Dry Weight	dry_weight	value of dry weight [Mass Unit]
Plate Physical Properties Center of Gravity	cx, cy, cz	value of center of gravity [Length Unit]

Overall Success		
Status	Count	Result
pass	58	97%
partial	1	2%
fail	1	2%
total	60	

### 5.2.2 Detailed results

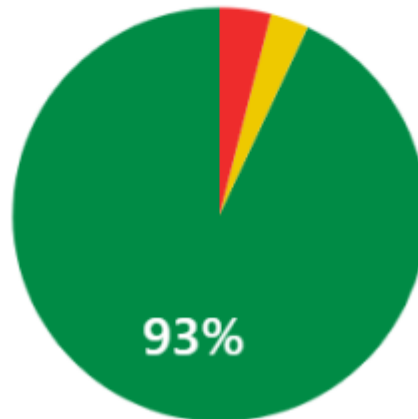
#### Physical Properties Weight

30 exchanges



#### Physical Properties Center of Gravity

30 exchanges



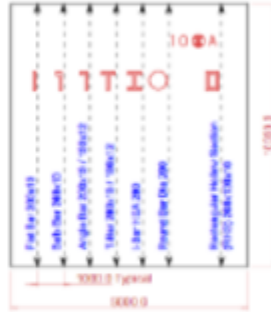
### 5.2.3 Root Cause Failure

The COG z value was reported above threshold values by some implementors. The main reason is due to how the different CAD systems treat the plate thickness. A surface-based CAD system will not account for the plate thickness when computing the COG, while a volumetric CAD system will include the plate thickness in the COG calculations. This is the reason for the deviation COG z values when the native and target systems differ in how plate thickness is modelled.

## 5.3 Test Case 3

# Round 1 - TC3

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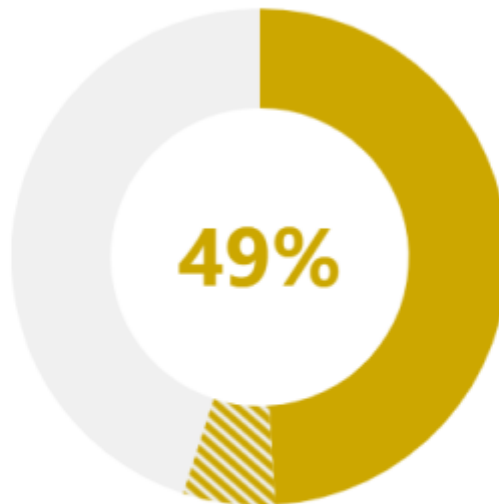


**Test Case 3**  
Plate 10m x 10m x 10 0mm  
7 Profiles 10m long with 1.0m spacing

## Functionalities tested:

- Stiffeners on Flat Plate

## Overall Success Rate:



## Participation:

- Files provided: 5
- Results submitted: 30
- Vendors participated: 9

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### 5.3.1 Test Metrics

Value	Column name	Description
<b>Panel</b> Physical Properties Dry Weight	dry_weight	value of dry weight [Mass Unit]. Sum of plate and stiffeners weights.
<b>Panel</b> Physical Properties Center of Gravity	cx, cy, cz	value of center of gravity [Length Unit] including effect of the stiffeners.
AngleBar200x10 at position 3000 mm: Physical Properties Weight	stiffener_1_weight	value of stiffener 1 weight numeric value [Mass Unit]
AngleBar200x10 at position 3000 mm: Physical Properties Center Of Gravity	st_1_cx, st_1_cy, st_1_cz	value of stiffener 1 center of gravity [Length Unit]
T-Bar200x10/100x12 at position 4000 mm: Physical Properties Weight	stiffener_2_weight	value of stiffener 2 weight numeric value [Mass Unit]
T-Bar200x10/100x12 at position 4000 mm: Physical Properties Center Of Gravity	st_2_cx, st_2_cy, st_2_cz	value of stiffener 2 center of gravity [Length Unit]
Stiffener Orientations	orientations	all/partial/none - indicates if all, some, or none of the stiffener orientations were processed correctly to successfully construct the overall model

Overall Success		
Status	Count	Result
pass	113	46%
partial	16	6%
fail	119	48%
total	248	

### 5.3.2 Detailed results

### Number of Bar Sections

30 exchanges



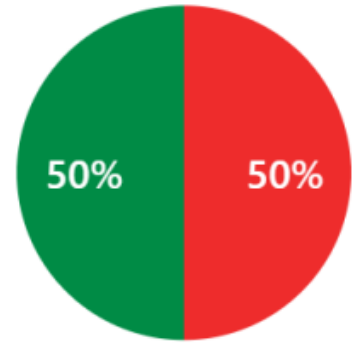
### Number of Panels Stiffened By Stiffener

30 exchanges



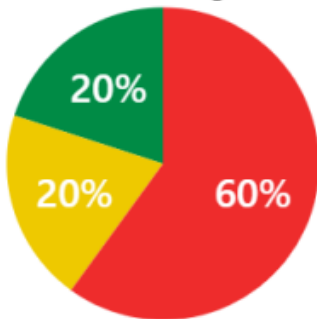
### Physical Properties Weight

30 exchanges



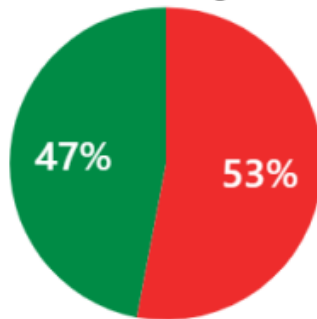
### Physical Properties Center of Gravity

30 exchanges



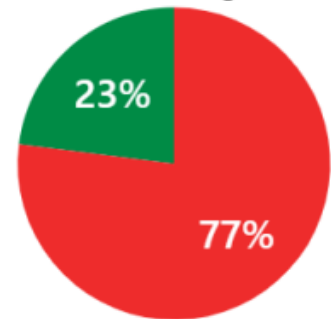
### Stiffener 1 Physical Properties Weight

30 exchanges



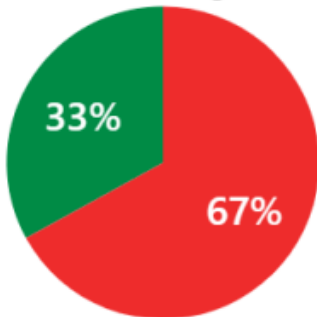
### Stiffener 1 Physical Properties Center of Gravity

30 exchanges



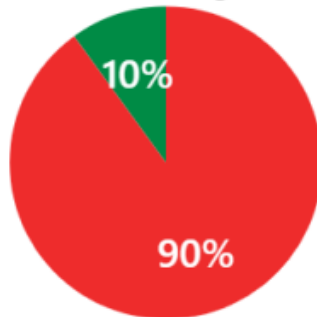
### Stiffener 2 Physical Properties Weight

24 exchanges



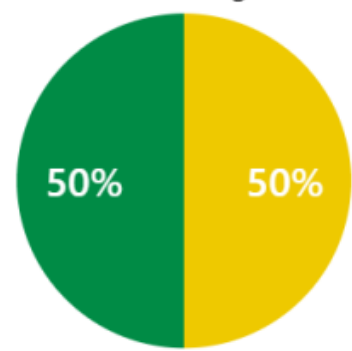
### Stiffener 2 Physical Properties Center of Gravity

29 exchanges



### Stiffener Orientations

20 exchanges



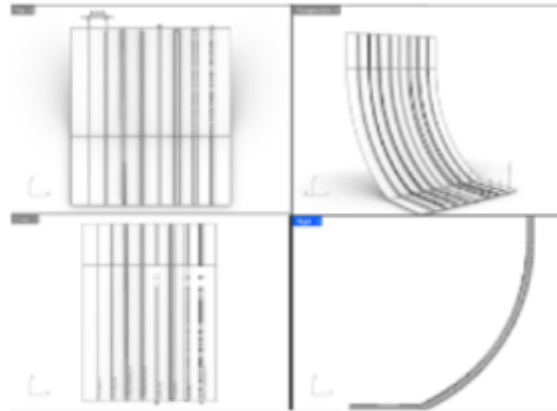
## 5.3.3 Root Cause Failure

The root cause of failures is due to limitations in some CAD systems for placing typical pillar cross sections (Box, Pipe, Channel) on a surface. These systems were not able to produce a model with all the specified cross-sections placed on the panel. This will impact both the dry weight values and the COG values. We will change this test case for future test rounds.

## 5.4 Test Case 4

# Round 1 - TC4

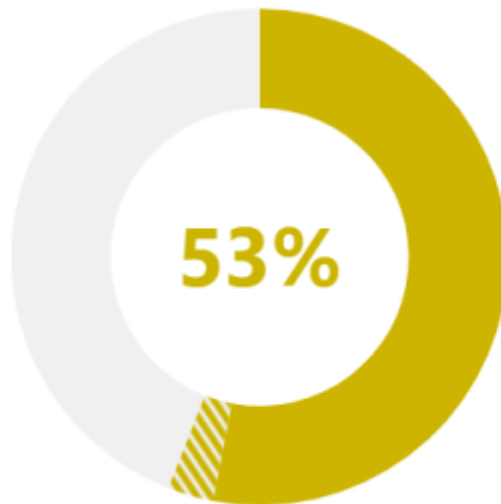
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### Functionalities tested:

- Stiffeners on Curved Shell

### Overall Success Rate:



### Participation:

- Files provided: 4
- Results submitted: 12
- Vendors participated: 7

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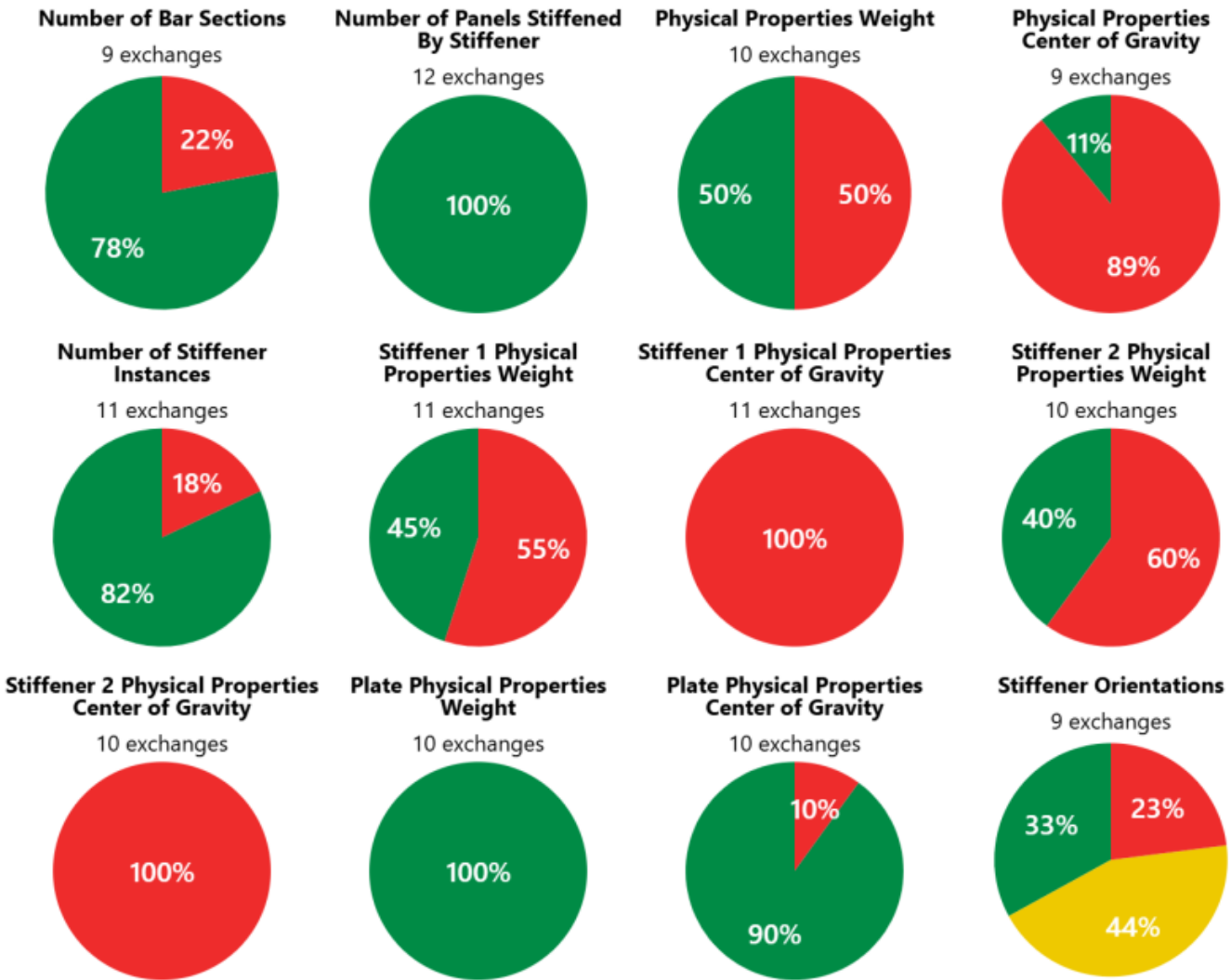
### 5.4.1 Test Metrics



Value	Column name	Description
<b>Panel</b> Physical Properties Dry Weight	dry_weight	value of dry weight [Mass Unit]. Sum of plate and stiffeners weights.
<b>Panel</b> Physical Properties Center of Gravity	cx, cy, cz	value of center of gravity [Length Unit] including effect of the stiffeners.
HP200x10 at position 2000 mm: Physical Properties Weight	stiffener_1_weight	value of stiffener 1 weight numeric value [Mass Unit]
HP200x10 at position 2000 mm: Physical Properties Center Of Gravity	st_1_cx, st_1_cy, st_1_cz	value of stiffener 1 center of gravity [Length Unit]
T-Bar200x10/100x12 at position 4000 mm: Physical Properties Weight	stiffener_2_weight	value of stiffener 2 weight numeric value [Mass Unit]
T-Bar200x10/100x12 at position 4000 mm: Physical Properties Center Of Gravity	st_2_cx, st_2_cy, st_2_cz	value of stiffener 2 center of gravity [Length Unit]
Stiffener Orientations	orientations	all/partial/none - indicates if all, some, or none of the stiffener orientations were processed correctly to successfully construct the overall model

<b>Overall Success</b>		
Status	Count	Result
pass	64	52%
partial	6	5%
fail	52	43%
total	122	

### 5.4.2 Detailed results



### 5.4.3 Root Cause Failure

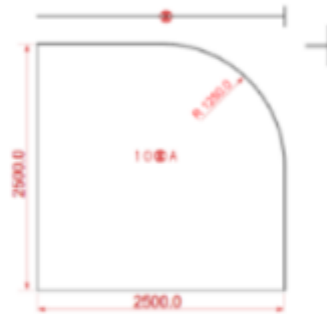
The root cause of failures is due to limitations in some CAD systems for placing typical pillar cross sections (Box, Pipe, Channel) on a surface. These systems were not able to produce a model with all the specified cross-sections placed on the panel. This will impact both the dry weight values and the COG values. We will change this test case for future test rounds.

## 5.5 Test Case 5

# Round 1 - TC5



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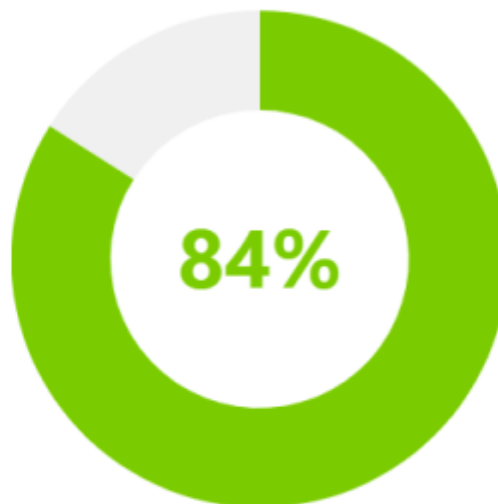


**Test Case 6**  
Plate 2.5m x 2.5 x 10mm on XY Plane  
1.25m Fillet Arc at top right corner  
Flange FB 200x10 on Right Edge

## Functionalities tested:

- Plate with Rounded Corner
- Face Plate

## Overall Success Rate:



## Participation:

- Files provided: 4
- Results submitted: 17
- Vendors participated: 8

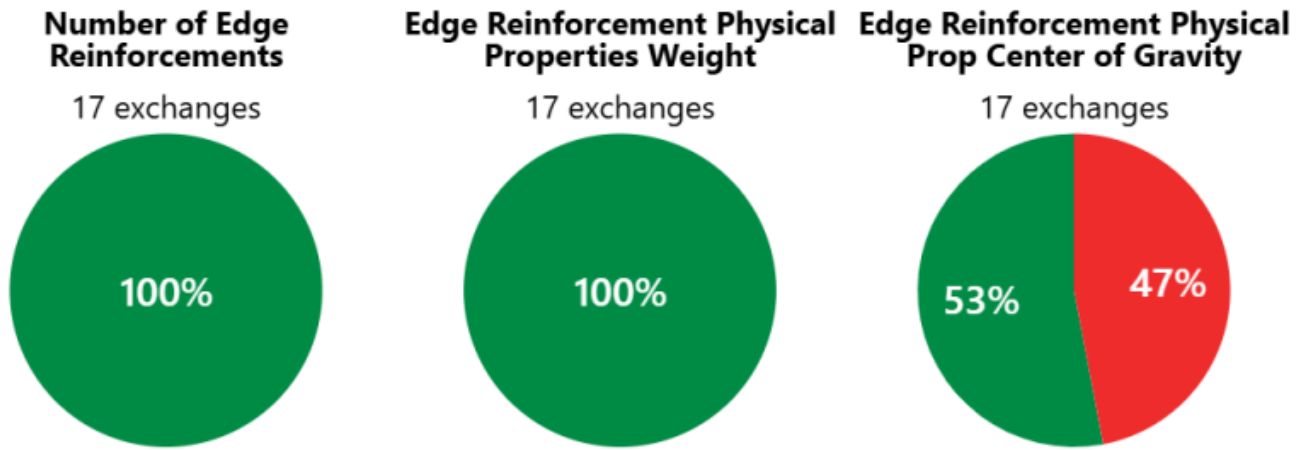
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### 5.5.1 Test Metrics

Value	Column name	Description
Panel Stiffened By Edge Reinforcement	num_edge_reinf	number of edge reinforcement instances
Edge Reinforcement Physical Properties Weight	edge_reinf_weight	value of edge reinforcement weight [Mass Unit]
Edge Reinforcement Physical Properties Center Of Gravity	er_cx, er_cy, er_cz	value of edge reinforcement center of gravity [Length Unit]

Overall Success		
Status	Count	Result
pass	43	84%
partial	0	0%
fail	8	16%
total	51	

### 5.5.2 Detailed results



### 5.5.3 Root Cause Failure

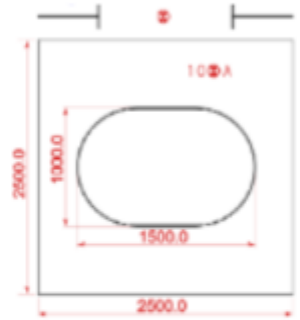
The root cause for some of the failed tests is an error in the output of the unbounded geometry specification from some vendors. This error causes a wrong size of the panel in some target systems and impacts the calculation of both dry weight and COG. Due to time restrictions, this error was not fixed before the tests were carried out.

## 5.6 Test Case 6

# Round 1 - TC6



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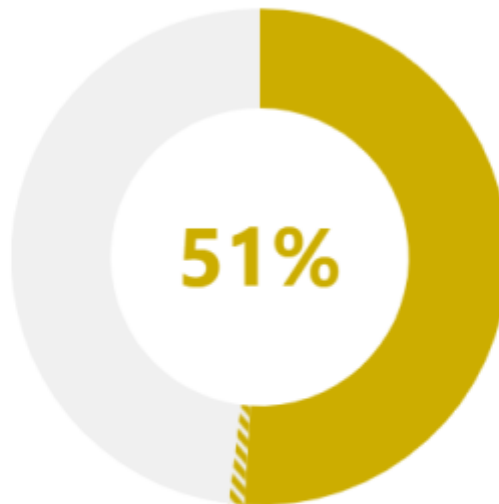
### Test Case 7

Plate 2.5m x 2.5 x 10mm on XY Plane  
1.5m x 1m hole on center of plate  
Flange FB 200x10 in hole

## Functionalities tested:

- Plate with Inner Hole
- Face Plate

## Overall Success Rate:



## Participation:

- Files provided: 5
- Results submitted: 27
- Vendors participated: 9

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## 5.6.1 Test Metrics

Value	Column name	Description
Panel Physical Properties Dry Weight	dry_weight	value of dry weight [Mass Unit]. The sum of plate and edge reinforcement weights.
Panel Physical Properties Center of Gravity	cx, cy, cz	value of center of gravity [Length Unit]

Overall Success		
Status	Count	Result
pass	40	51%
partial	1	1%
fail	37	47%
total	78	

### 5.6.2 Detailed results

**Class Cat. Hole Shape Catalogue Hole2D**

6 exchanges



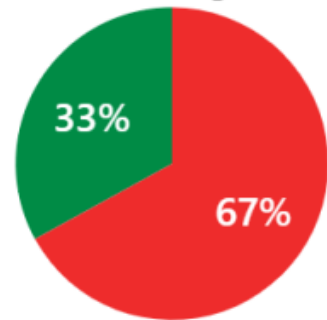
**Number of Panel Cutby Hole 2D Contours**

6 exchanges



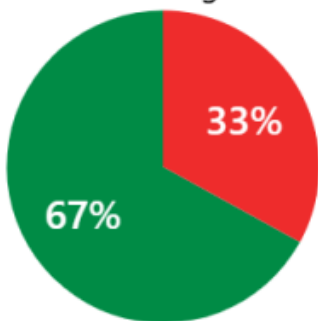
**Number of Panel Cutby Inner Contours**

6 exchanges



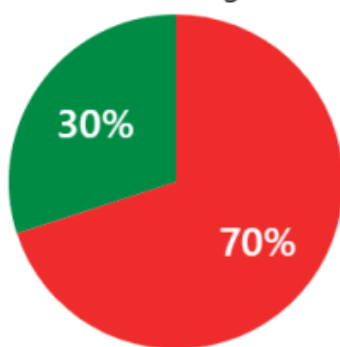
**Number of Physical Properties**

6 exchanges



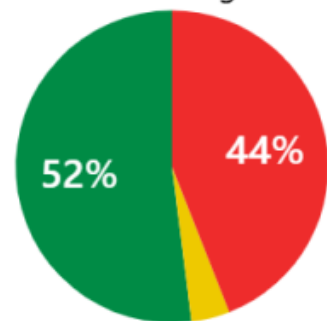
**Physical Properties Weight**

27 exchanges



**Physical Properties Center of Gravity**

27 exchanges



### 5.6.3 Root Cause Failure

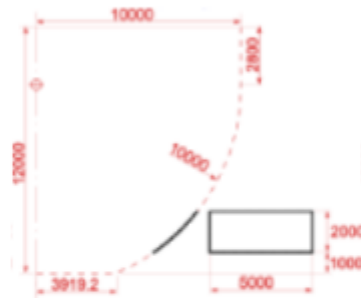
Wrong units in some tests were one source of error in this test case and were not corrected before the test was carried out. The COG z values were wrong in some cases due to the same reason as described in [5.3.3 Root Cause Failure](#)

## 5.7 Test Case 7

# Round 1 - TC7



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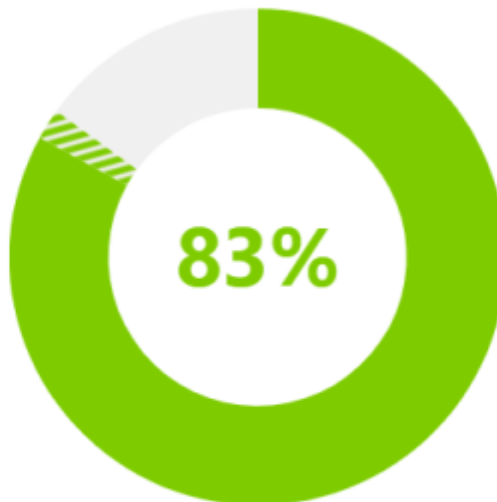


**Test Case 8**  
Shell Plate 5m long,  
with vertical seams at 1m and 3m  
Longitudinal Cylindrical Surface  
with axis at (0, 9.2m), Radius 10m

### Functionalities tested:

- Shell Plate

### Overall Success Rate:



### Participation:

- Files provided: 4
- Results submitted: 16
- Vendors participated: 8

### 5.7.1 Test Metrics

Value	Column name	Description
Number of Plate Instances in Panel's Composed Of	num_plates	number of plate instances in panel's composed of element
Plate Physical Properties Dry Weight	plate_weight	value of plate weight [Mass Unit]
Plate Physical Properties Center Of Gravity	pl_cx, pl_cy, pl_cz	value of plate center of gravity [Length Unit]

Overall Success		
Status	Count	Result
pass	40	83%
partial	1	2%
fail	7	15%
total	48	

### 5.7.2 Detailed results

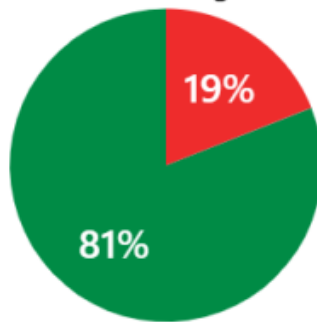
**Plate Instances in Panel's Composed Of**

16 exchanges



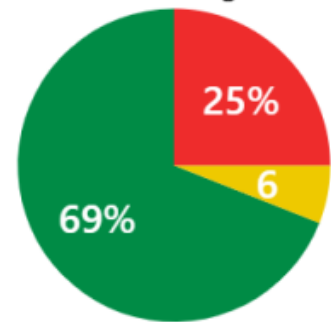
**Plate Physical Properties Weight**

16 exchanges



**Plate Physical Properties Center of Gravity**

16 exchanges



### 5.7.3 Root Cause Failure

The root cause for some of the failed tests is an error in the output of the unbounded geometry specification from some vendors. This error causes a wrong size of the panel in some target systems and impacts the calculation of both dry weight and COG. Due to time restrictions, this error was not fixed before the tests were carried out.

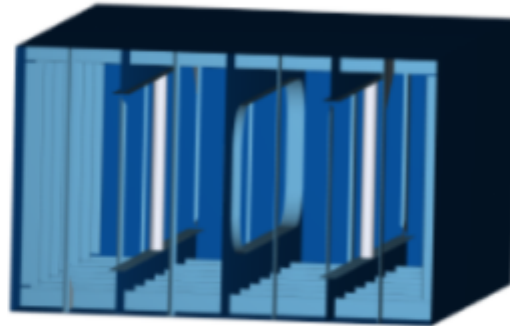
## 5.8 Test Case 8



# Round 1 - TC8



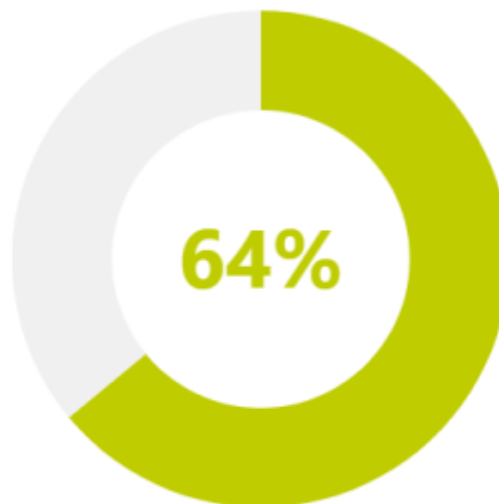
Sep 2023 - Nov 2024



## Functionalities tested:

- Box Model

## Overall Success Rate:



## Participation:

- Files provided: 2
- Results submitted: 9
- Vendors participated: 7

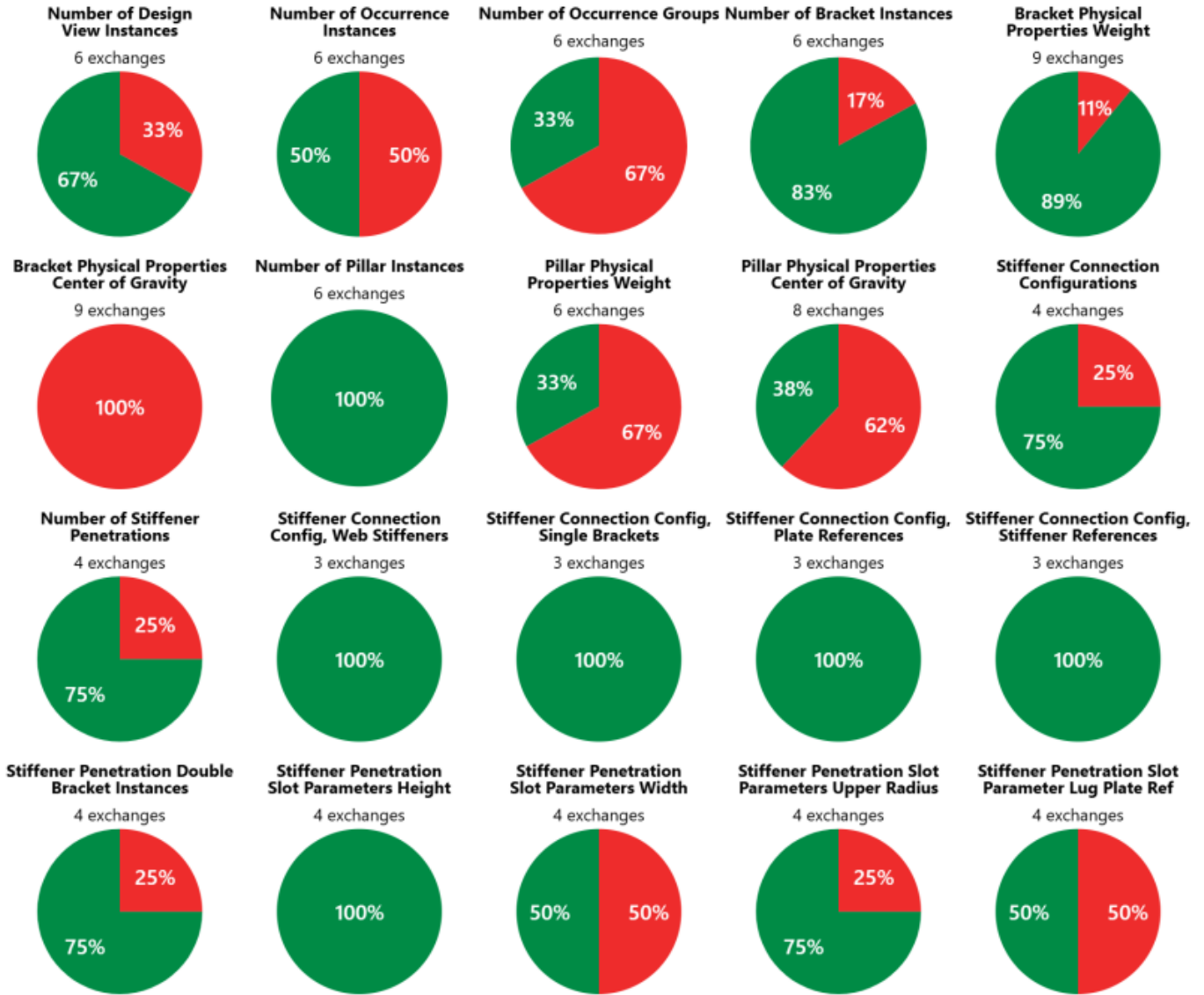
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## 5.8.1 Test Metrics

Value	Column name	Description
Number of Bracket Instances	bracket	number of bracket instances
Bracket GUIDRef	bracket_guid	value of bracket GUID reference corresponding to the bracket instance at the stiffener end as described in the model description
Bracket Physical Properties Dry Weight	bracket_weight	value of bracket dry weight [Mass Unit]
Bracket Physical Properties Center of Gravity	br_cx, br_cy, br_cz	value of bracket center of gravity [Length Unit]
Number of Pillar Instances	pillar	number of pillar instances
Pillar GUIDRef	pillar_guid	value of pillar id GUID reference used for the following statistics
Pillar Physical Properties Dry Weight	pillar_weight	value of pillar dry weight numeric value [Mass Unit]
Pillar Physical Properties Center Of Gravity	pi_1_cx, pi_1_cy, pi_1_cz	value of pillar center of gravity [Length Unit]
Stiffener Connection Configurations	stiff_connect	number of stiffener connection configuration instances
Number of Stiffener Penetrations	stiff_penetrate	number of stiffener penetration instances
Stiffener GUIDRef	stiffener_guid	value of stiffener GUID reference used for the following statistics
Stiffener Connection Configuration Id	st_conn_configid	value of stiffener connection configuration at end id used for the following statistics
Stiffener Connection Config, Web Stiffeners	st_conn_webstiff	number of stiffener connection configuration's web stiffener with single bracket instances
Stiffener Connection Config, Single Brackets	st_conn_bracket	number of stiffener connection configuration's single bracket instances
Stiffener Connection Config, Plate References	st_conn_plate	number of stiffener connection configuration's plate reference instances
Stiffener Connection Config, Stiffener References	st_conn_stiffener	number of stiffener connection configuration's stiffener reference instances
Stiffener Penetration Id	st_pen_id	value of stiffener penetration id used for the following statistics
Stiffener Penetration Double Bracket Instances	st_pen_bracket	number of stiffener penetration's double bracket instances
Stiffener Penetration Slot Parameters Height	st_pen_slot_height	value of stiffener penetration's slot parameters height numeric value [Length Unit]
Stiffener Penetration Slot Parameters Width	st_pen_slot_width	value of stiffener penetration's slot parameters width numeric value [Length Unit]
Stiffener Penetration Slot Parameters Upper Radius	st_pen_slot_upper	value of stiffener penetration's slot parameters upper radius numeric value [Length Unit]
Stiffener Penetration Slot Parameters Lug Plate Ref	st_pen_lugplate	number of stiffener penetration's slot parameters' lug plate reference instances
<b>Overall Success</b>		
Status	Count	Result

pass	64	62%
partial	9	9%
fail	31	30%
total	104	

### 5.8.2 Detailed results



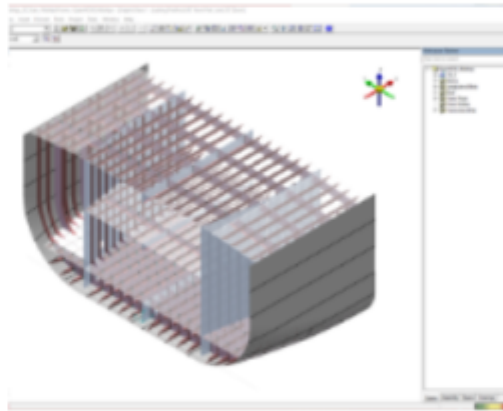
### 5.8.3 Root Cause Failure

Some errors were simply due to a mismatch between native and target system reporting: for some statistics values were reported for different brackets or pillars. Due to time restrictions, these errors were not corrected.

## 5.9 Test Case 9

# Round 1 - TC9

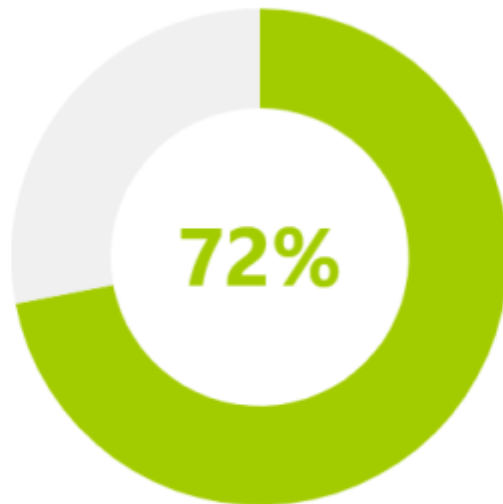
Sep 2023 - Nov 2024



### Functionalities tested:

- Mid-Ship Section

### Overall Success Rate:



### Participation:

- Files provided: 1
- Results submitted: 3
- Vendors participated: 3

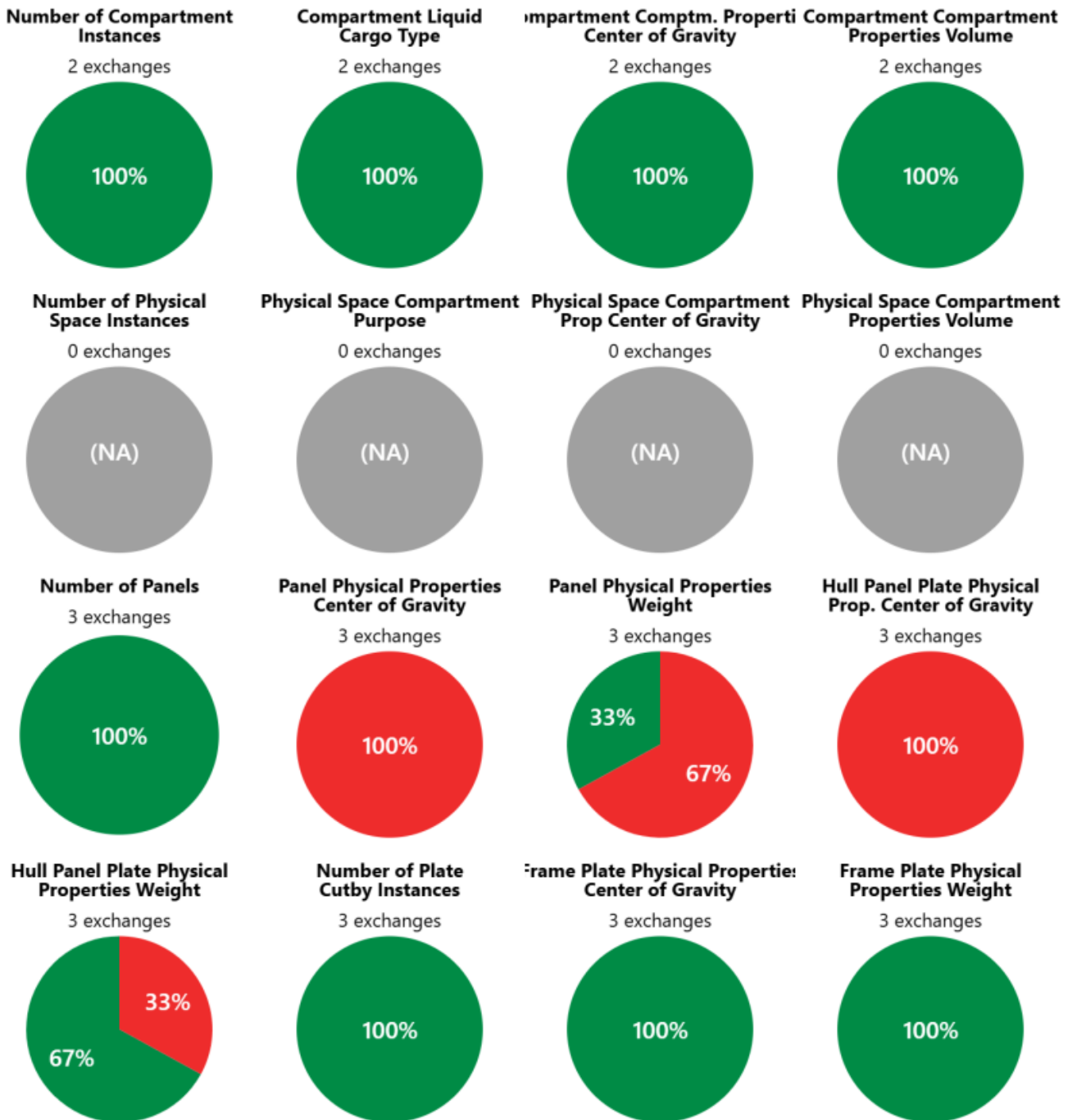
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## 5.9.1 Test Metrics

Value	Column name	Description
Number of Compartment Instances	compartment	number of compartment instances
Compartment Liquid Cargo Type	liquid_cargo_type	value of compartment's liquid cargo type enumeration
Compartment Compartment Properties Center Of Gravity	cpt_cx, cpt_cy, cpt_cz	value of compartment's compartment properties center of gravity point3d coordinates [Length Unit]
Compartment Compartment Properties Volume	cpt_volume	value of compartment's compartment properties volume numeric value [Length Unit]
Number of Physical Space Instances	phys_space	number of physical space instances
Physical Space Compartment Purpose	ps_purpose	value of physical space's compartment purpose enumeration
Physical Space Compartment Properties Center Of Gravity	ps_cx, ps_cy, ps_cz	value of physical space's compartment properties center of gravity point3d coordinates [Length Unit]
Physical Space Compartment Properties Volume	ps_volume	value of compartment's compartment properties volume numeric value [Length Unit]
Number of Panel Instances	num_panels	number of panel instances
Panel GUIDRef	panel_guid	value of panel GUID reference to be used for the following statistics
Panel Physical Properties Center Of Gravity	pnl_cx, pnl_cy, pnl_cz	value of panel's physical properties center of gravity coordinates [Length Unit]
Panel Physical Properties Dry Weight	panel_weight	value of panel's dry weight numeric value [Mass Unit]
Hull Plate GUIDRef	hull_plate_guid	value of plate GUID reference for plate on the hull panel to be used for the following statistics
Hull Panel Plate Physical Properties Center Of Gravity	hpl_cx, hpl_cy, hpl_cz	value of plate's physical properties center of gravity coordinates [Length Unit]
Hull Panel Plate Physical Properties Dry Weight	hull_plate_weight	value of plate's dry weight numeric value [Mass Unit]
Plate GUIDRef	frame_plate_guid	value of panel GUID reference for plate at Frame 3 to be used for the following statistics
Number of Plate Cutby Instances	num_cutby	number of plate cutby instances
Frame Plate Physical Properties Center Of Gravity	fpl_cx, fpl_cy, fpl_cz	value of plate's physical properties center of gravity coordinates [Length Unit]
Frame Plate Physical Properties Dry Weight	frame_plate_weight	value of plate's dry weight [Mass Unit]

<b>Overall Success</b>		
Status	Count	Result
pass	23	72%
partial	0	0%
fail	9	28%
total	32	

### 5.9.2 Detailed results



### 5.9.3 Root Cause Failure

The reporting of PhysicalSpace properties was removed because none of the vendors supported this in their exports. Some errors were simply due to a mismatch between native and target system reporting: Native and target systems reported values for not the same panel. Due to time restrictions, these errors were not corrected.