SEIKOWAVE

POLYGONALmeister Examples of Analysis

- 3D measurement
- Metal Loss analysis
- Fitness For Service (FFS) evaluation

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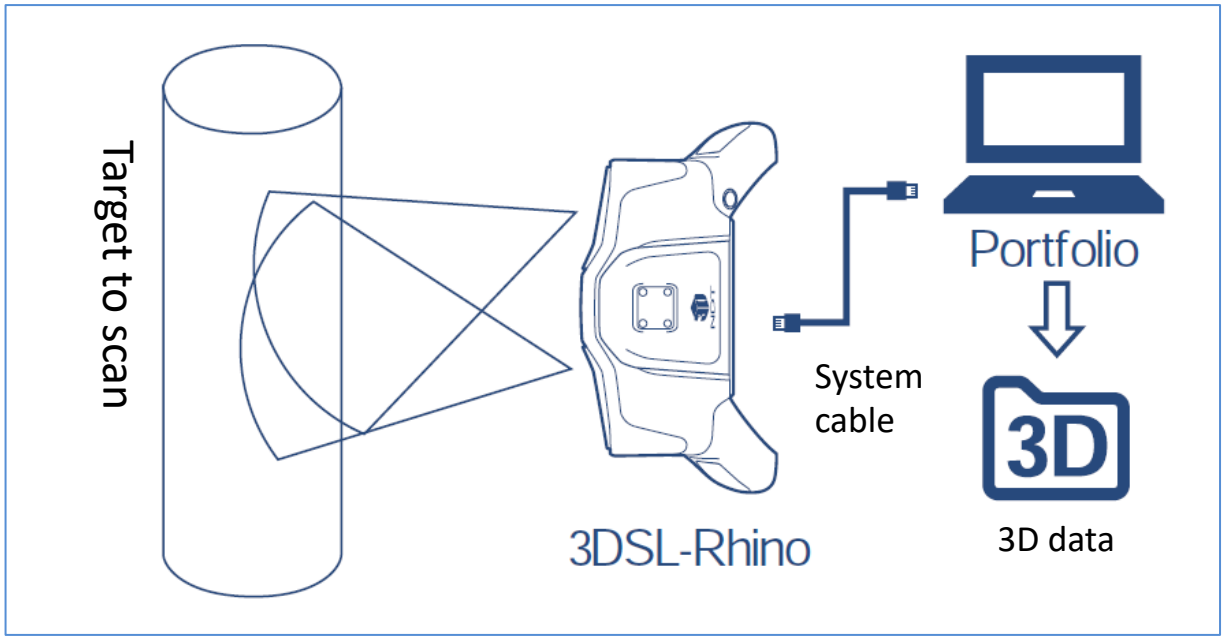
Contents

- Procedure of 3D measurement and evaluation
- Introduction of POLYGONALmeister
- Example of evaluation
  - Half-sphere type of shell head, case 1
  - Half-sphere type of shell head, case 2
  - Half-sphere type of shell head, case 3
  - Pressured-pipe, elbow portion

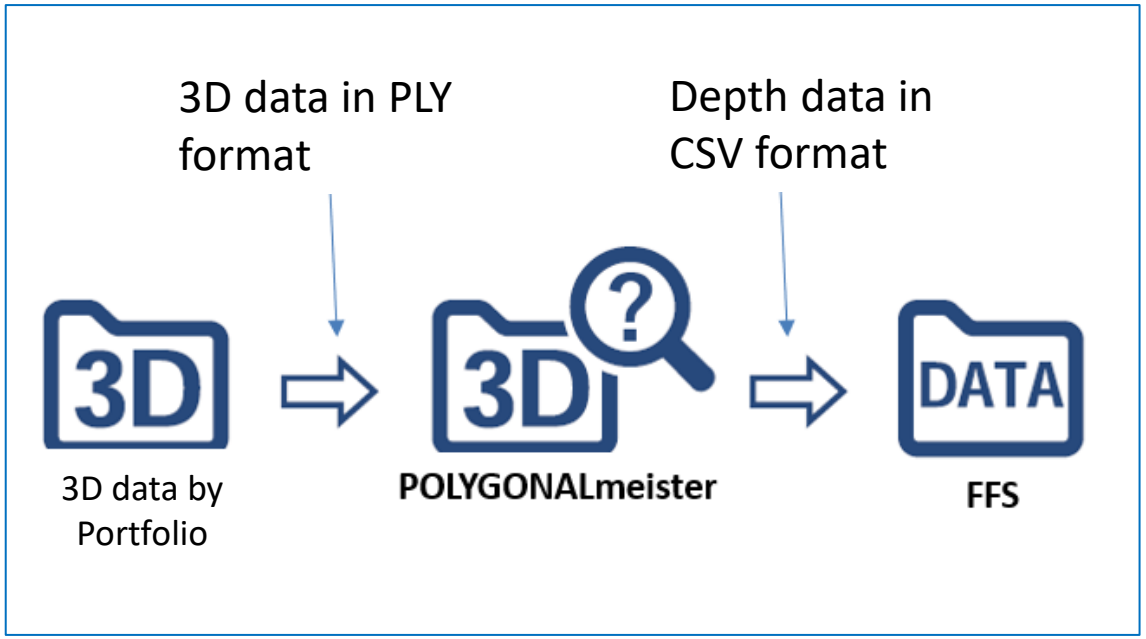
- User hardware and software
  - 3D scanner
    - SEIKOWAVE 3DSL-Rhino
  - 3D measurement software
    - SEIKOWAVE 3DSL-NDT Software Suite
  - Analysis software
    - POLYGONALmeister (UEL)
  - FFS assessment software
    - Uni-Fitness (IMC)

Procedure of 3D measurement and Evaluation

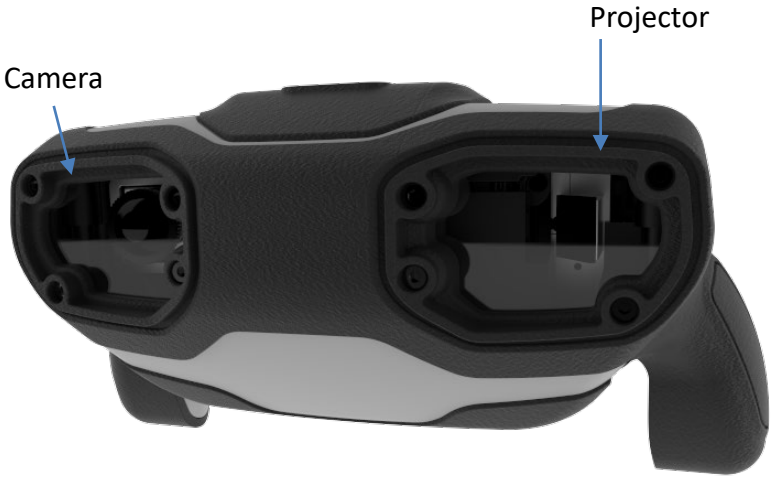
3D measurement



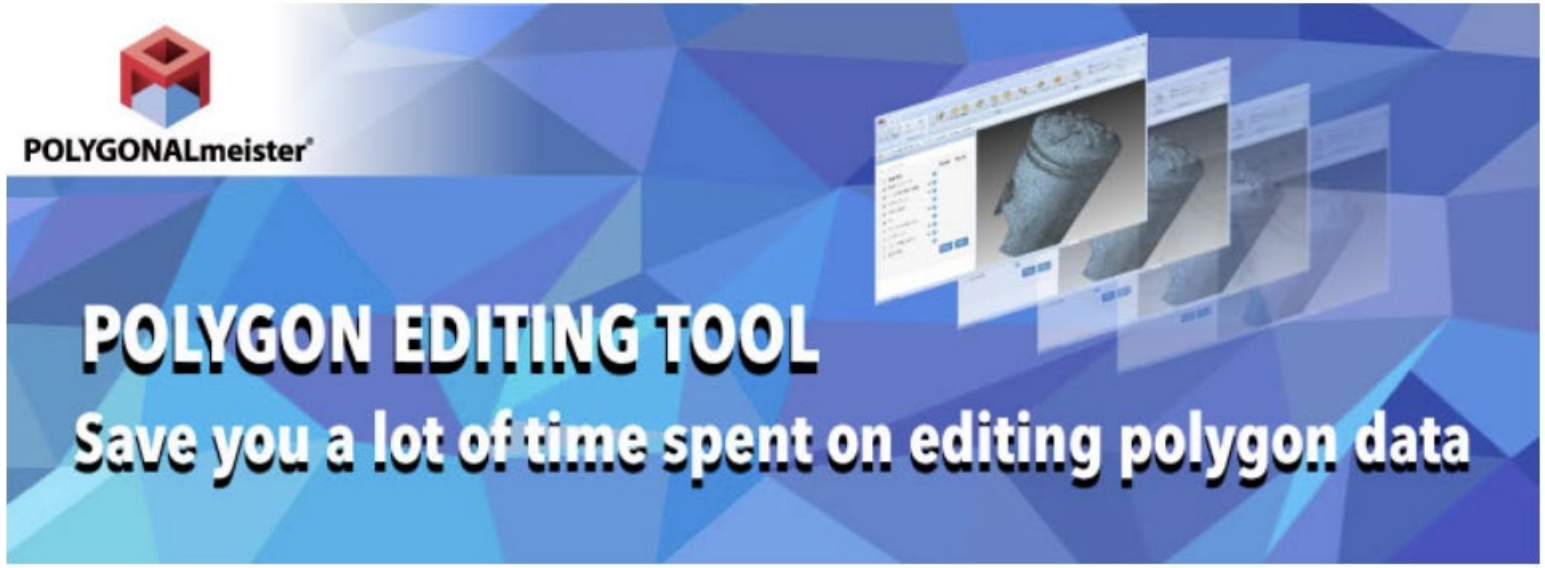
Evaluation



3D scanner：3DSL-Rhino



What is POLYGONALmeister



- POLYGONALmeister
- Features
- Cases by Application
  - Engineering
  - Human Body Shape
  - Terrain, Civil Engineering
  - Research
- Video

UEL Corporation is a leading company in editing processing technology for 3D polygon data.
In recent years, with the evolution of input / output devices such as 3D printers, 3D scanners, CT devices, and photogrammetry using drones, business improvement activities that utilize 3D measurement data are progressing.
UEL Corporation has utilized the polygon data editing technology accumulated through joint research with RIKEN to develop a software package (POLYGONALmeister). In particular, it has excellent performance for editing polygon data obtained from 3D measurement.
UEL Corporation supports customer's business improvement activities through the provision of POLYGONALmeister.

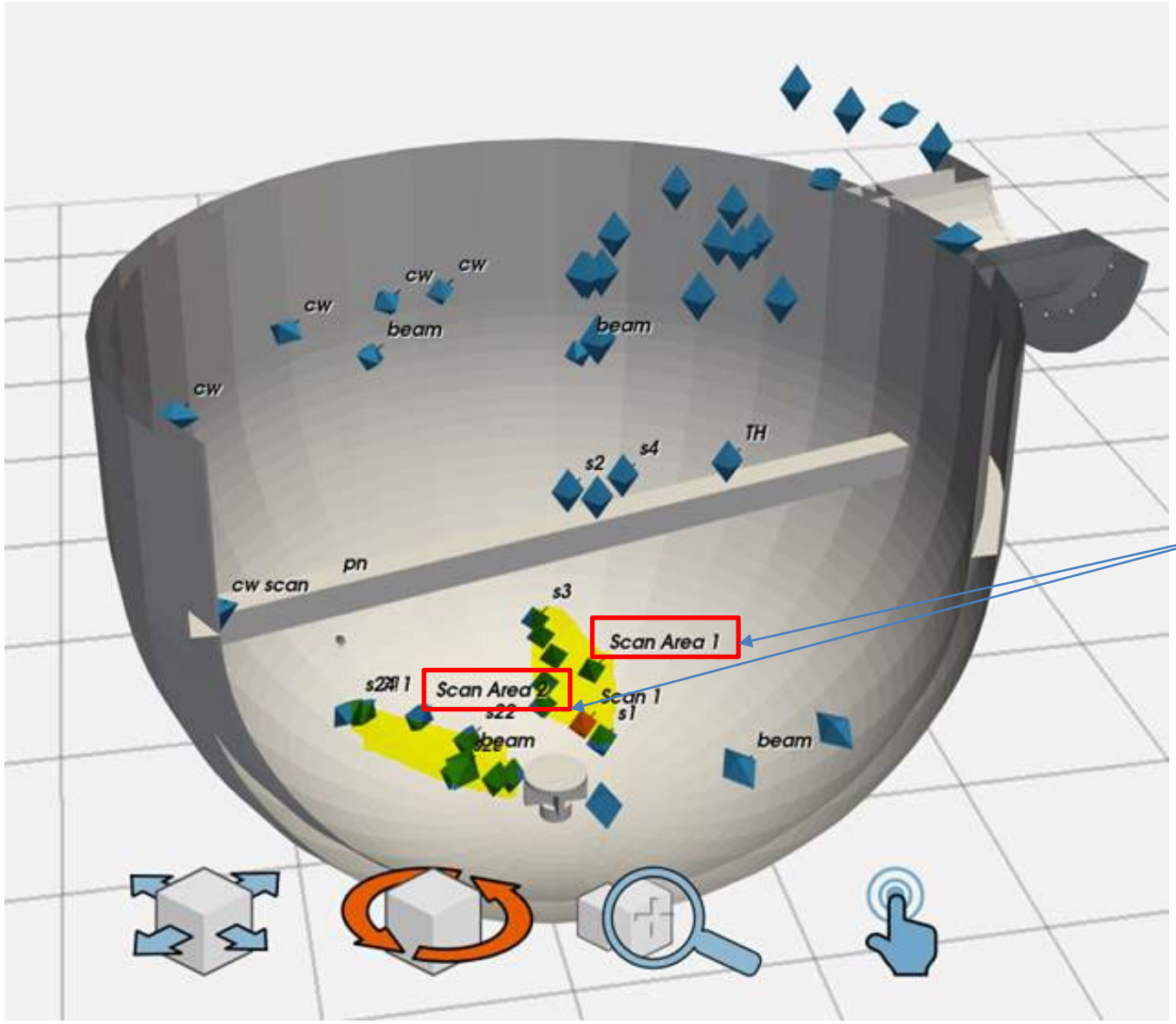
POLYGONALmesiter, SEIKOWAVE custom version

- Added functions on top of the standard POLYGONALmeister
  - Function
    - Accurately quantify unevenness of various shapes
      - » Generation of color contour of the depth
      - » Statistics (max, min, average, standard deviation)
      - » Output the amount of unevenness to a CSV file with an arbitrary grid size Purposes
  - Use for
    - Grasping the amount of thinning caused by pitting corrosion (local thinning) that occurred on the tank bottom plate with large distortion
    - Ascertaining the amount of localized thinning that occurred on the surface of pressure pipes with increased strain
    - Ascertaining the amount of local thinning that occurred on the surface of the pressure pipe elbow
    - Ascertaining the amount of local thinning that occurred on the surface of the head plate of various shapes

Analysis and evaluation of the corrosion on the shell head, case 1

SHELL HEAD (HALF SPHERE SHAPE)

Location of measurement (yellow areas)

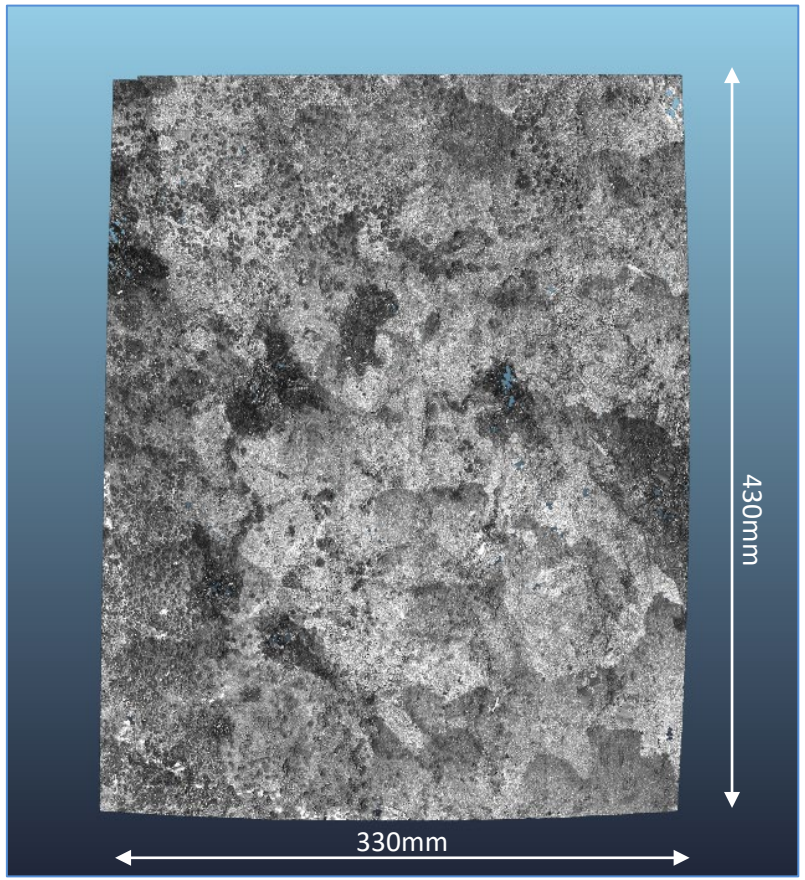


Measured by Rhino on BIKE

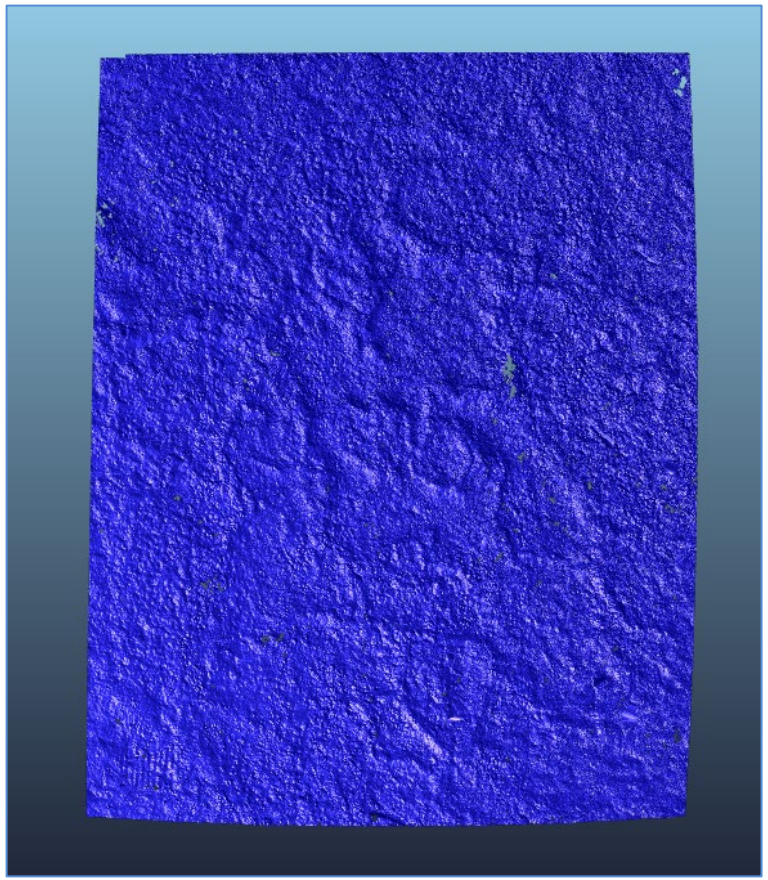
Diameter of sphere part = 2400mm

3D data

With texture

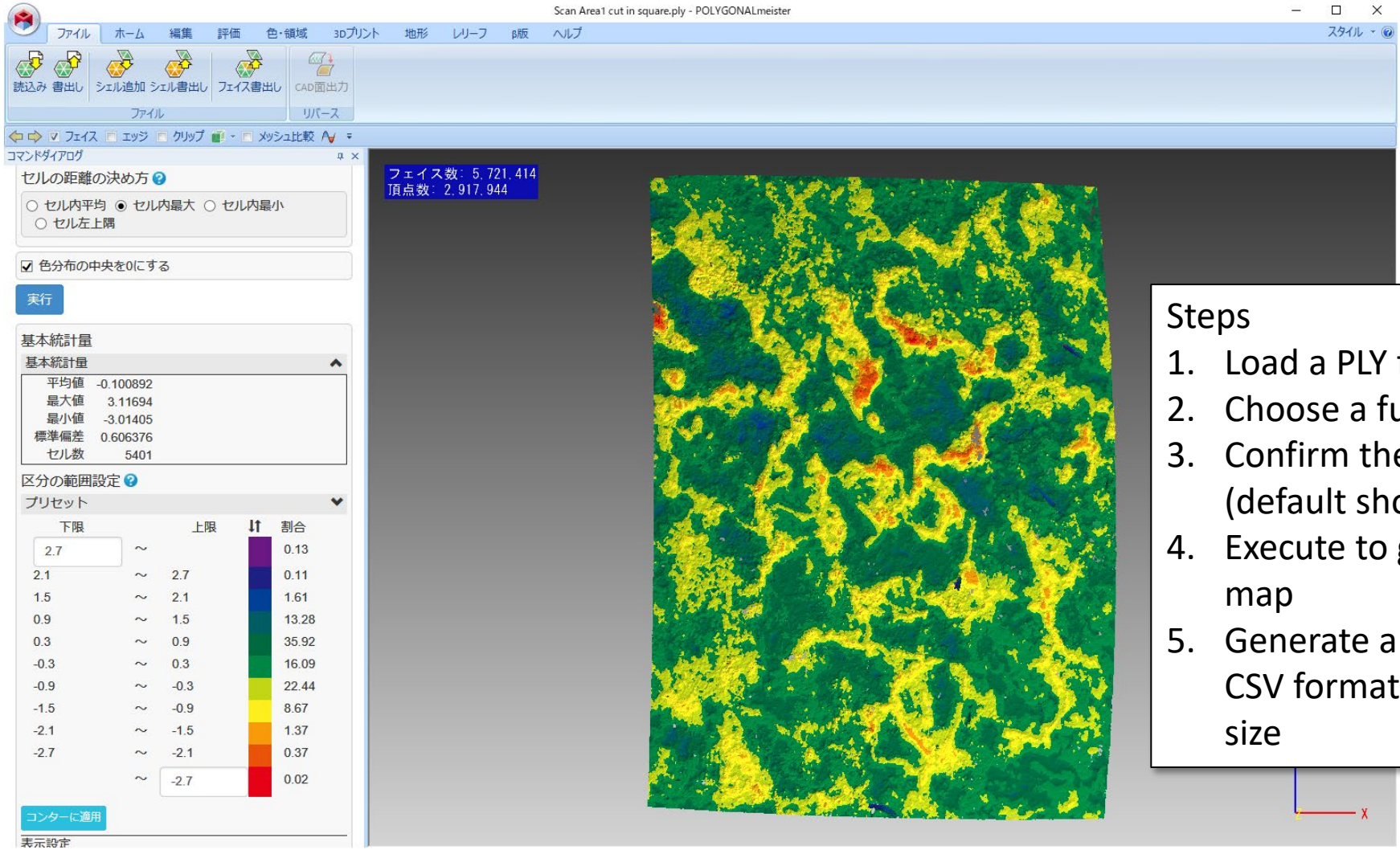


Without texture



“Scan Area1 cut in square.ply”

POLYGONALmeister：color map for corrosion



Steps

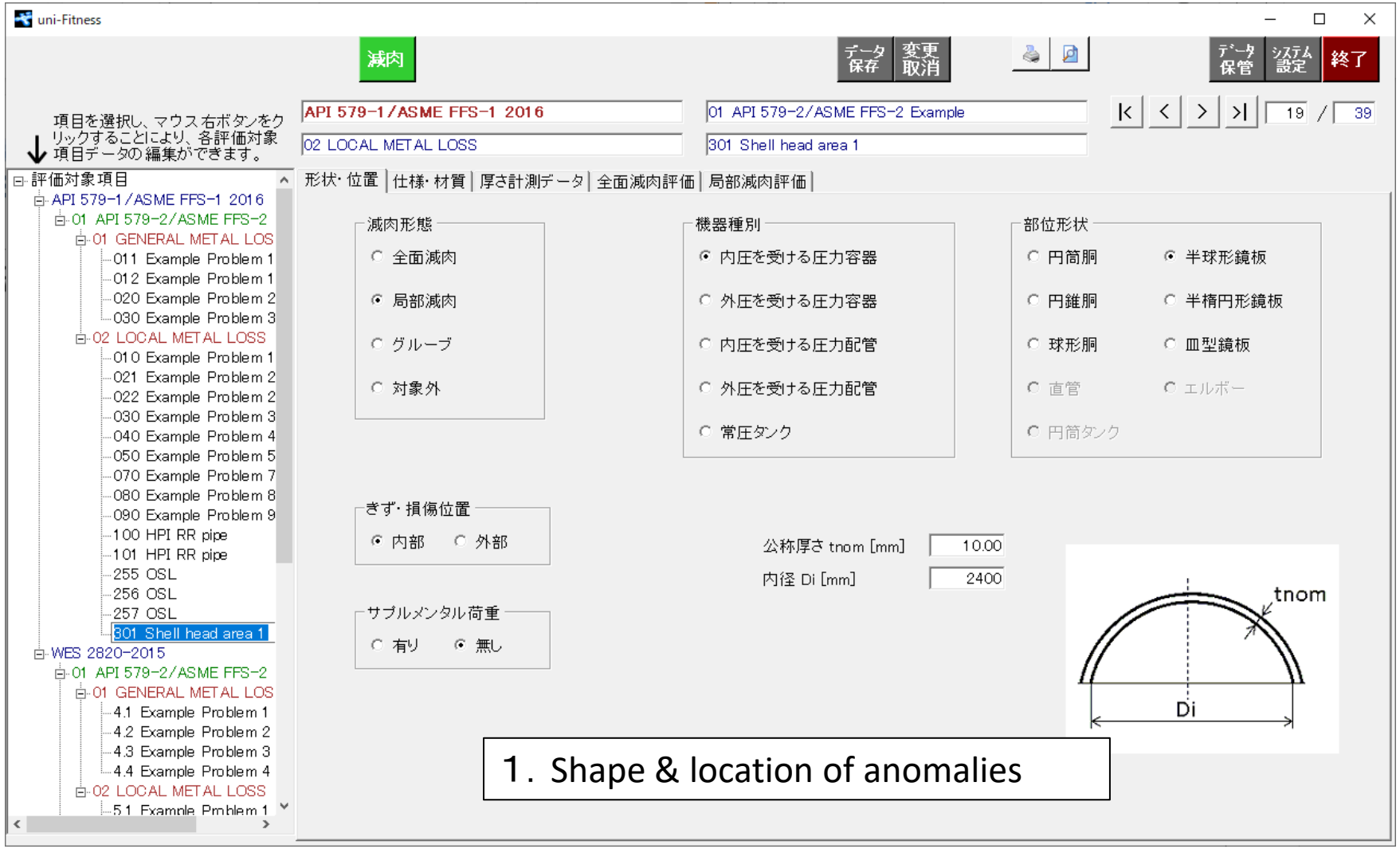
1. Load a PLY file
2. Choose a function
3. Confirm the settings (default should work)
4. Execute to generate a color map
5. Generate a depth data in CSV format with a given grid size

Colormap by Excel on CSV data

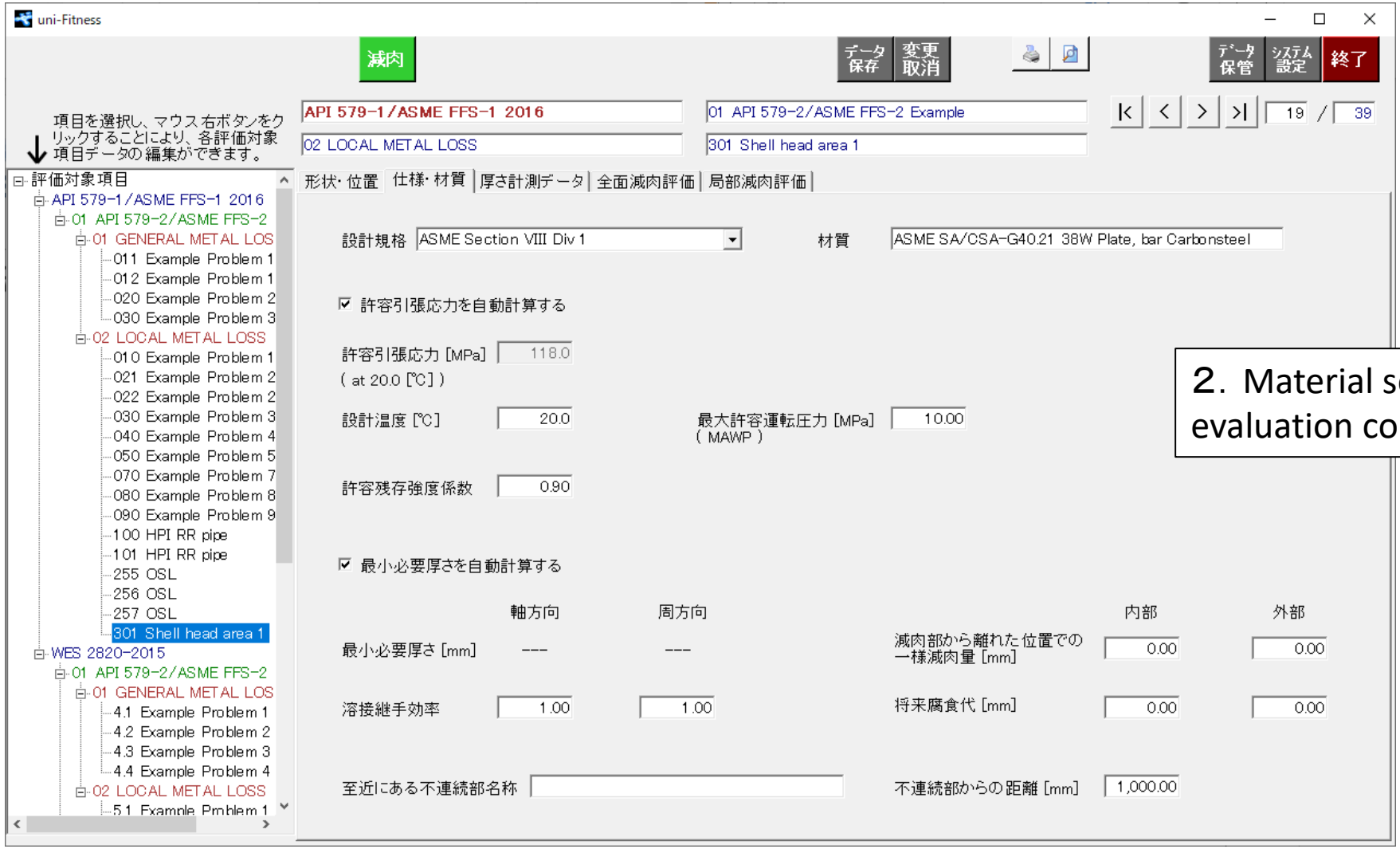
“Scan Area1 cut in square_distance 5mm grid.xlsx”

Nominal thickness = 10mm

Use Uni-Fitness for FFS, preparation 1



Use Uni-Fitness for FFS, preparation 2



2. Material selection and evaluation conditions

Use Uni-Fitness for FFS, preparation 3

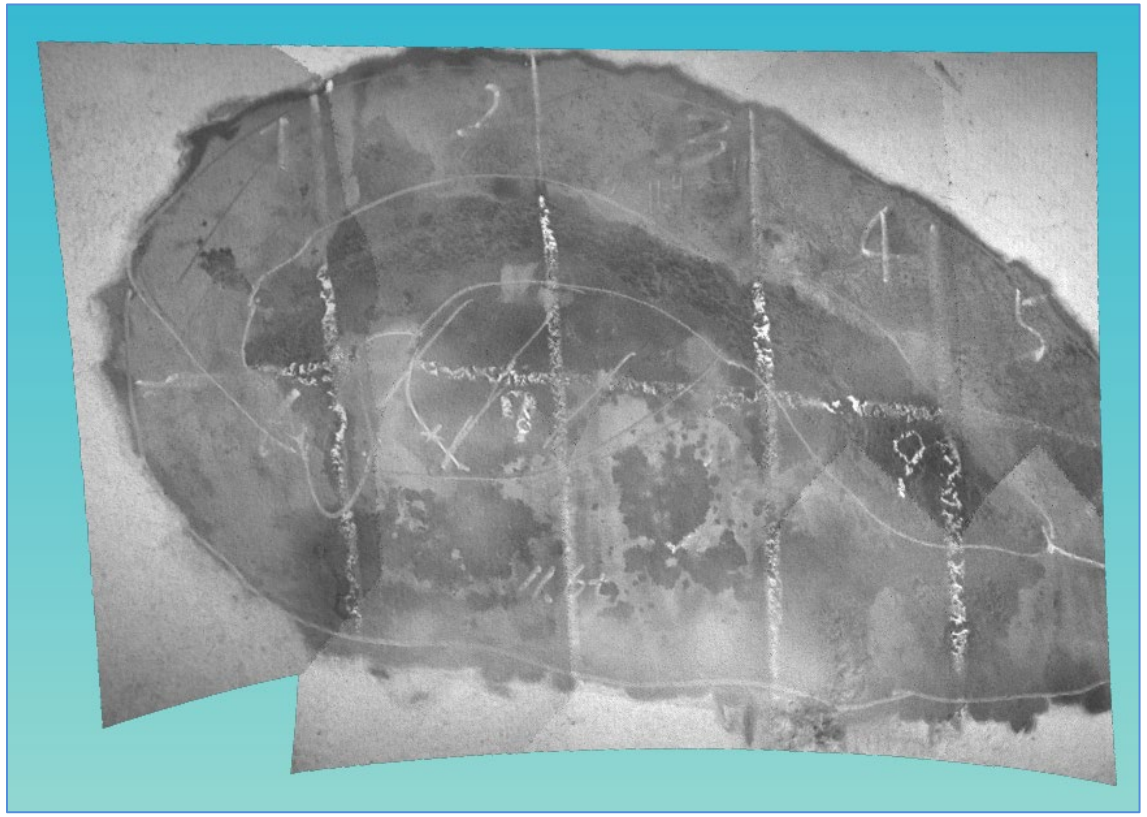
3. Load CSV file

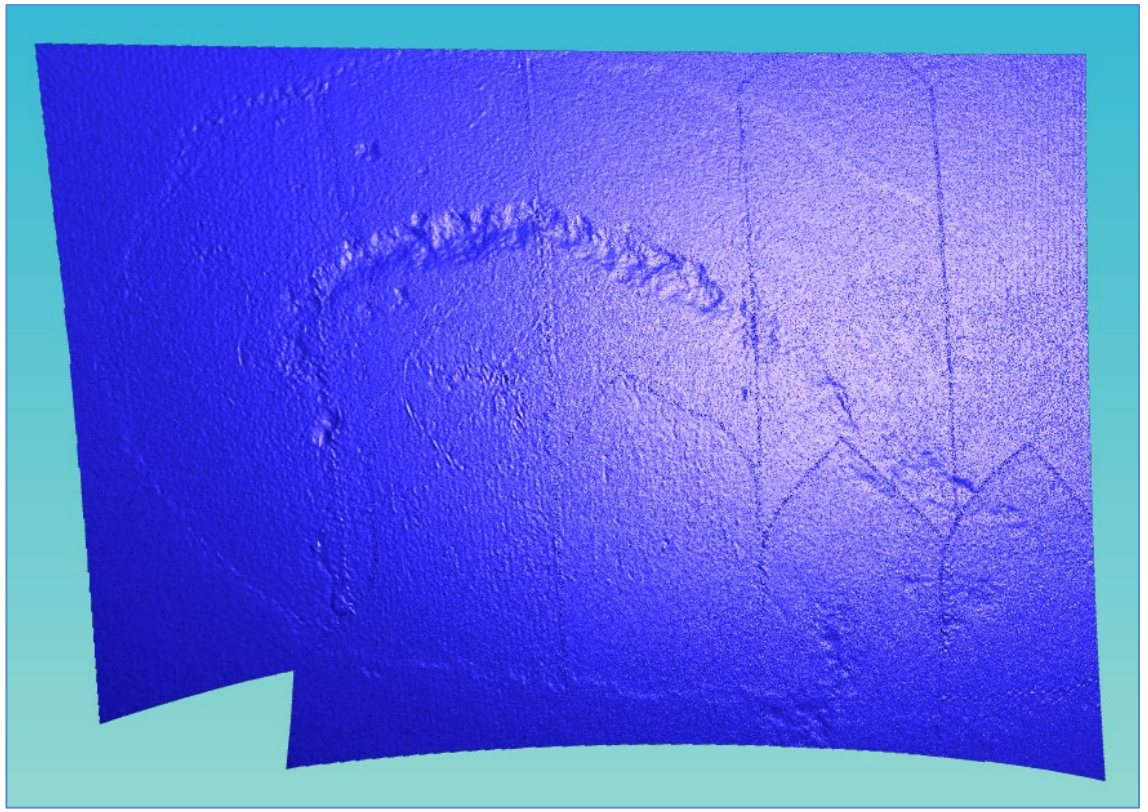
Uni-Fitness: evaluation result (API-579)

Analysis and evaluation of the corrosion on the shell head, case 2 and case 3

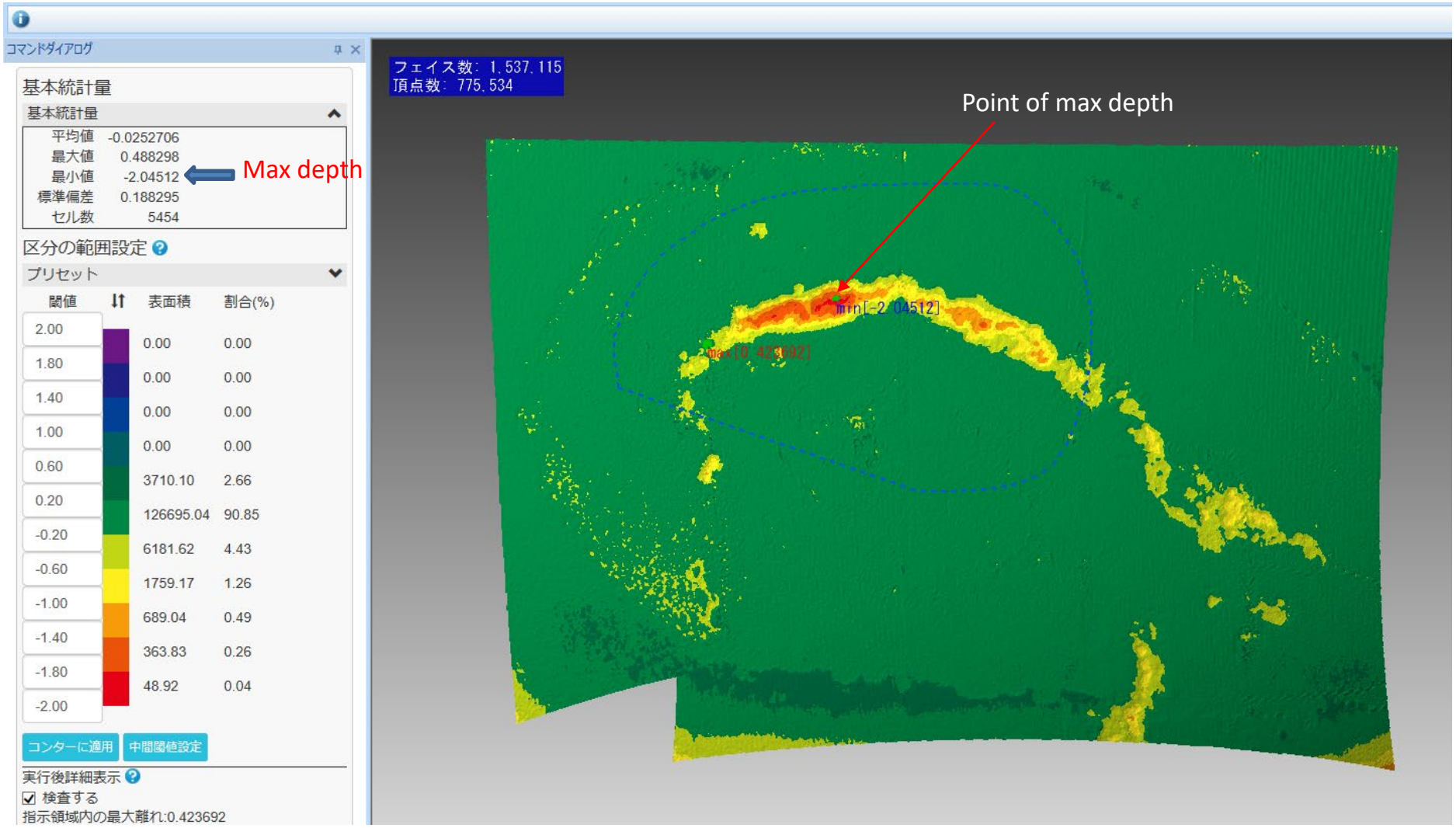
SHELL HEAD (HALF SPHERE SHAPE)

Shell head (half sphere shape), case 2



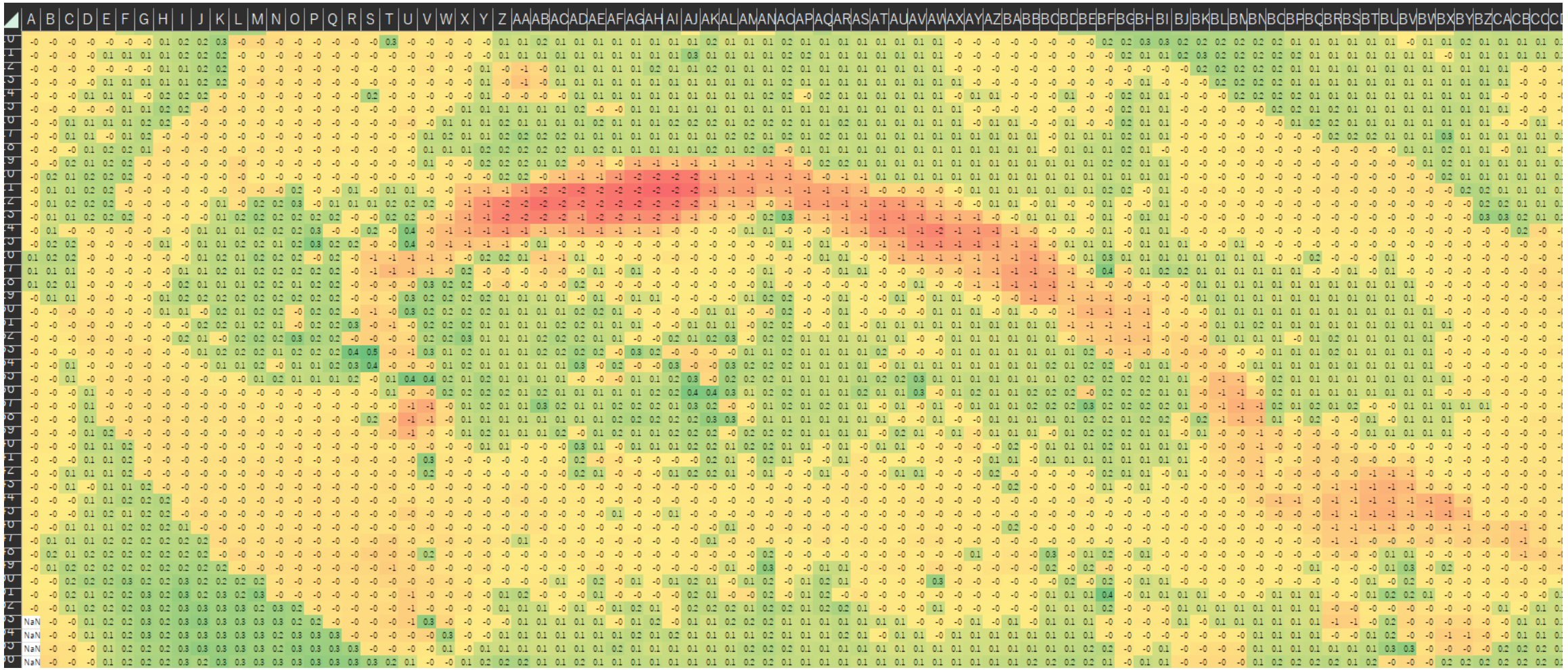


POLYGONALmeister : color map for corrosion



CSV data generated by POLYGONALmeister

5mm grid

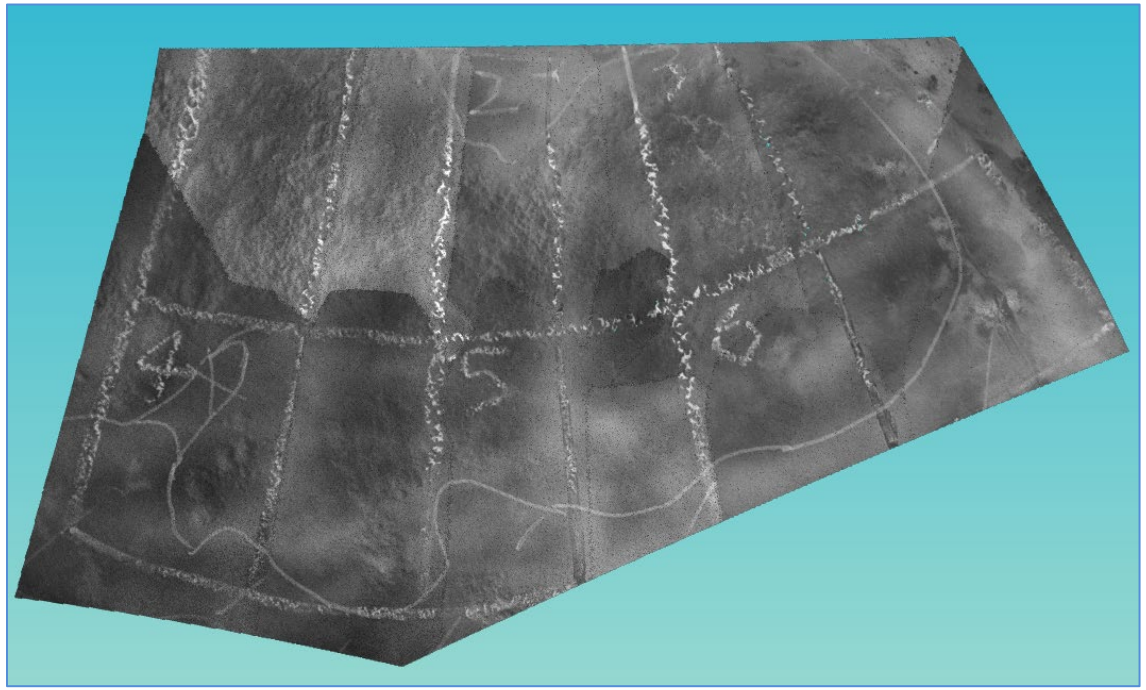


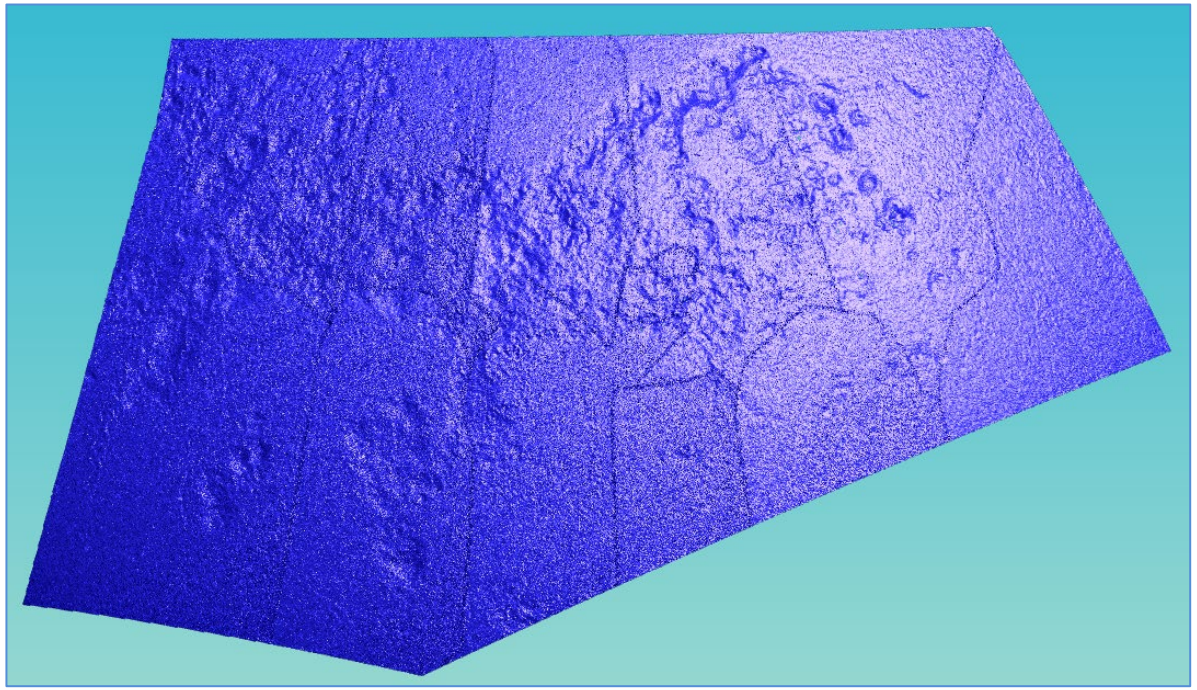
Use Uni-Fitness for FFS, preparation 1 (WES2820)

Choose Shape, material and pressure to evaluate

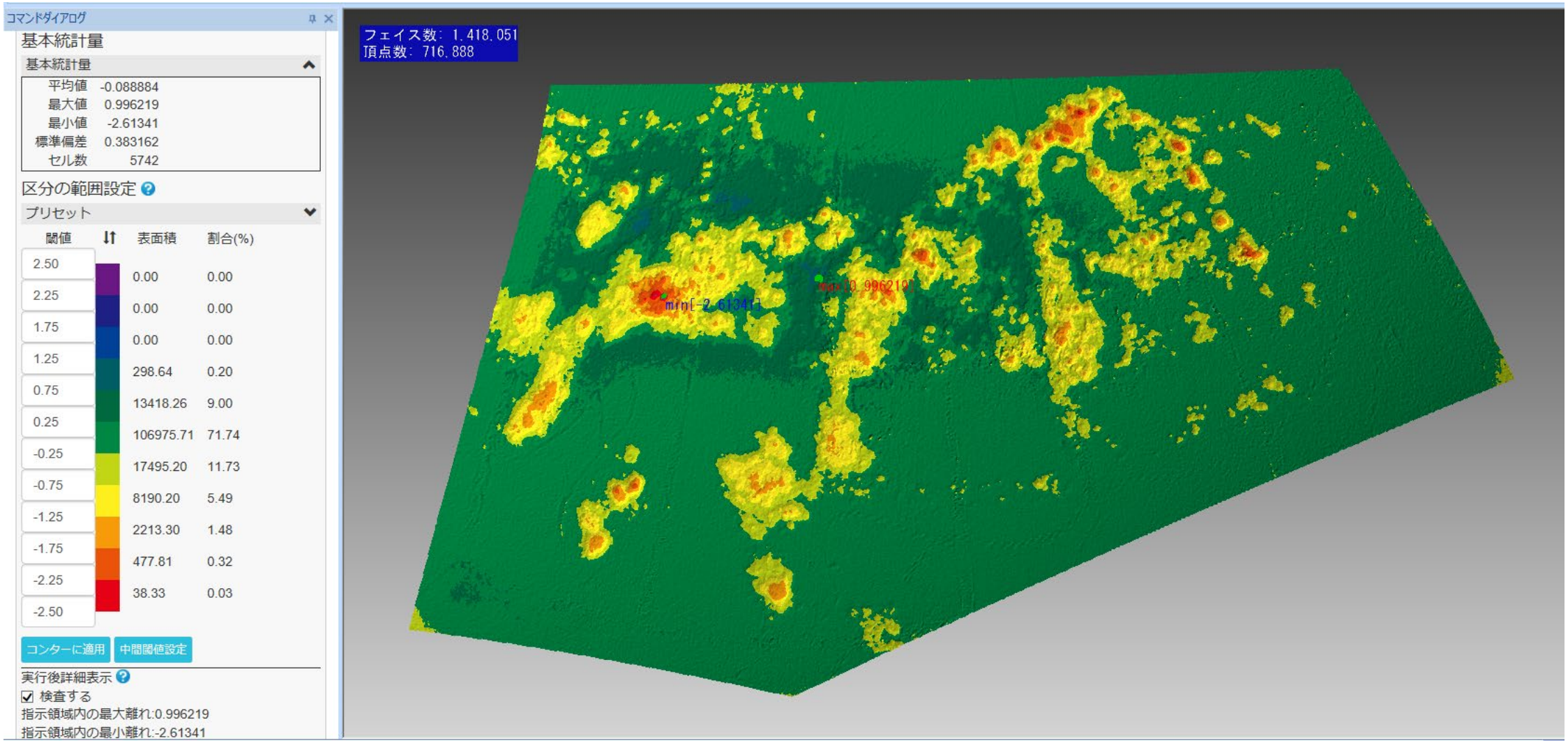
Uni-Fitness: evaluation result (WES2820)

Shell head (half sphere shape), case 3



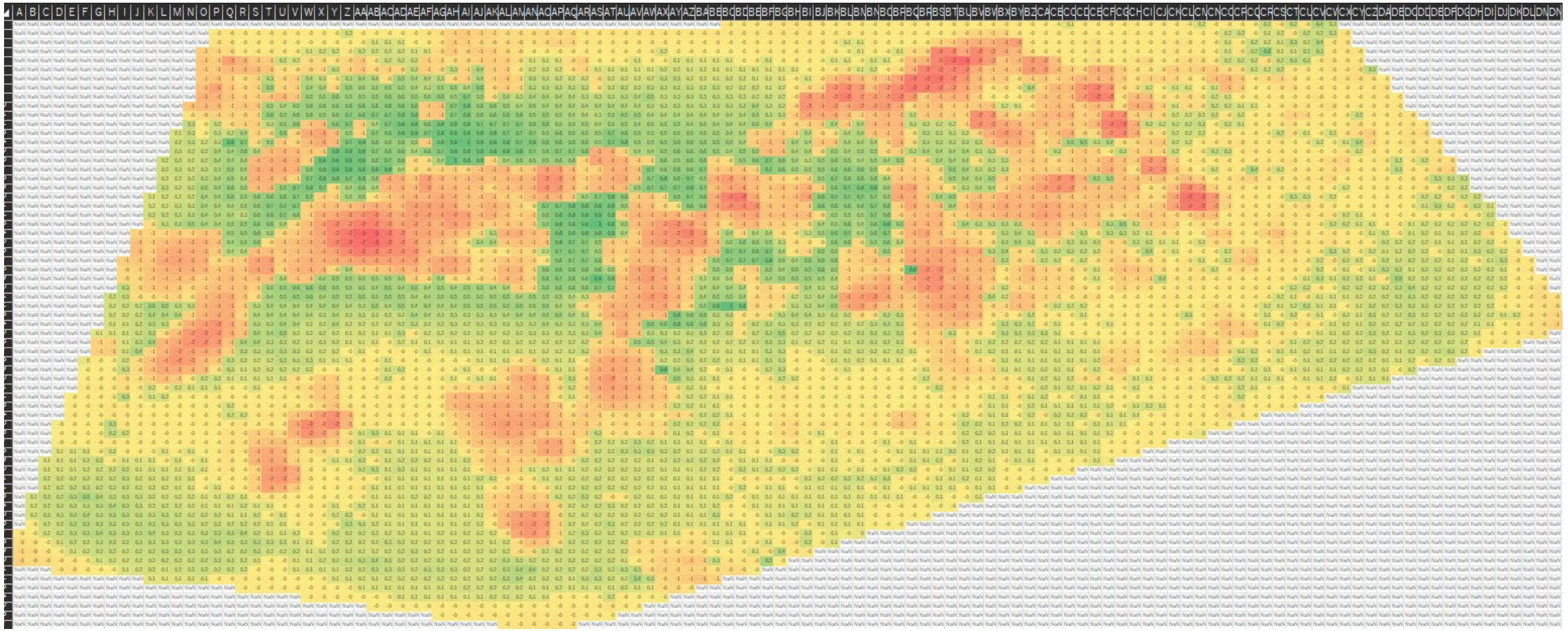


POLYGONALmeister：color map for corrosion



CSV data generated by POLYGONALmeister

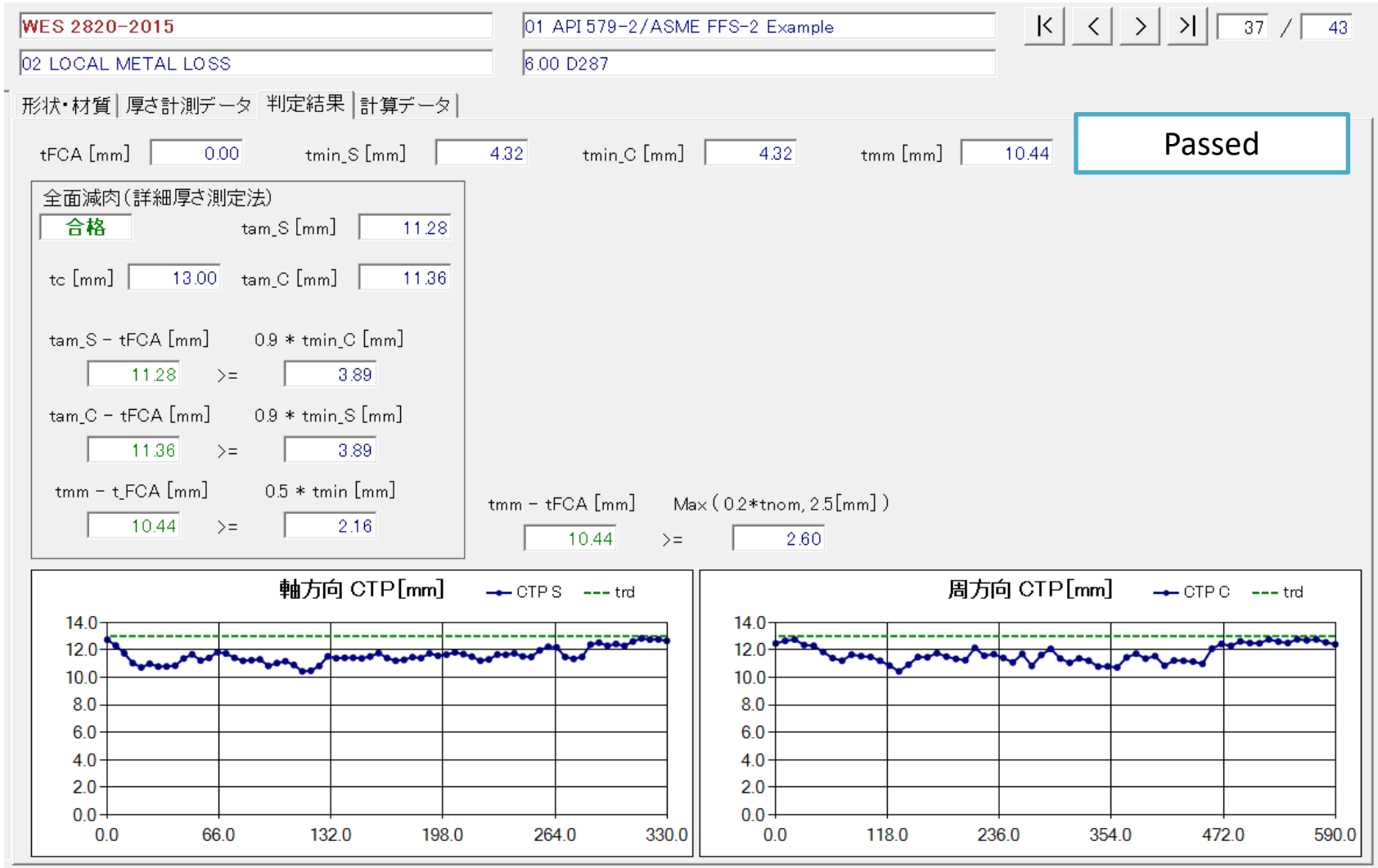
5mm grid



Use Uni-Fitness for FFS, preparation 1 (WES2820)

Choose Shape, material and pressure to evaluate

Uni-Fitness: evaluation result (WES2820)

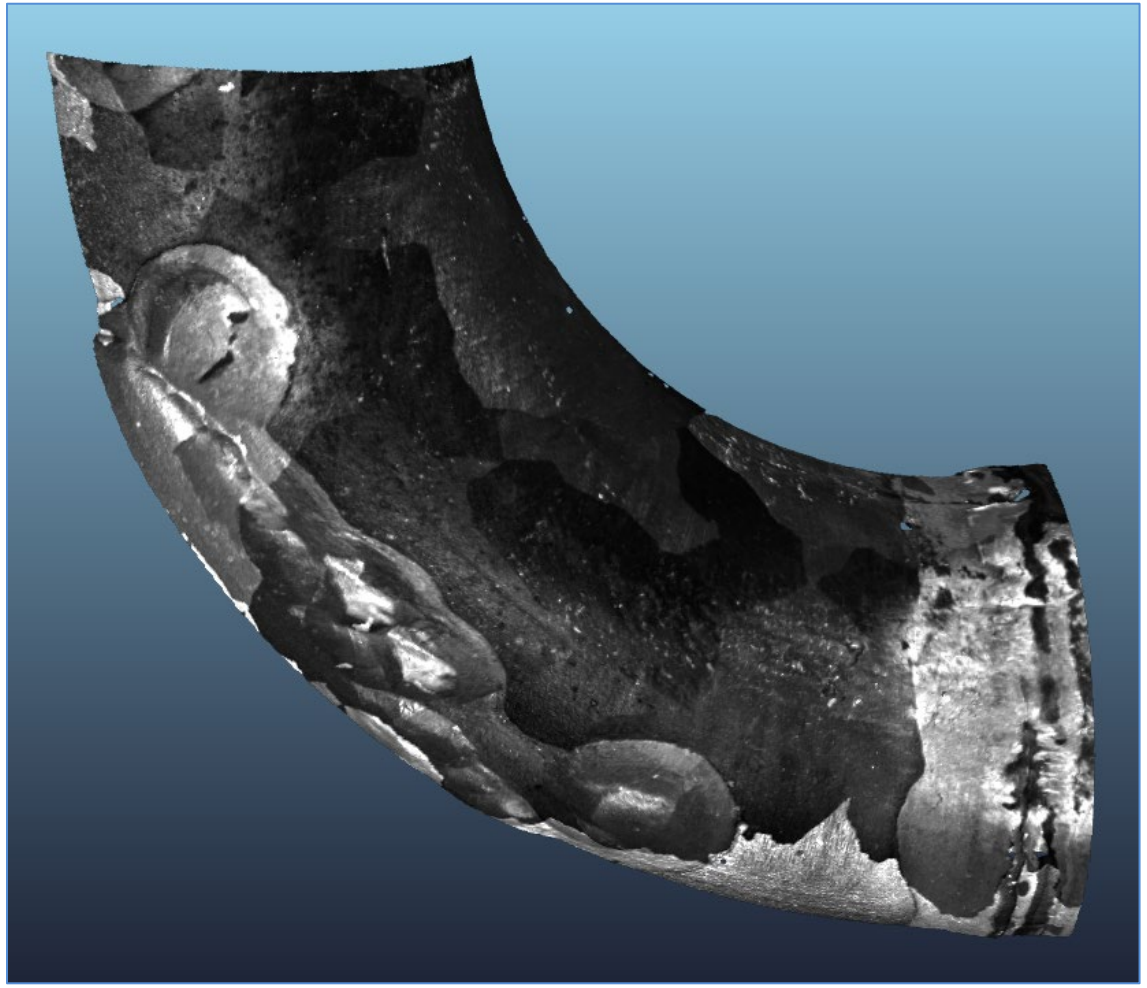


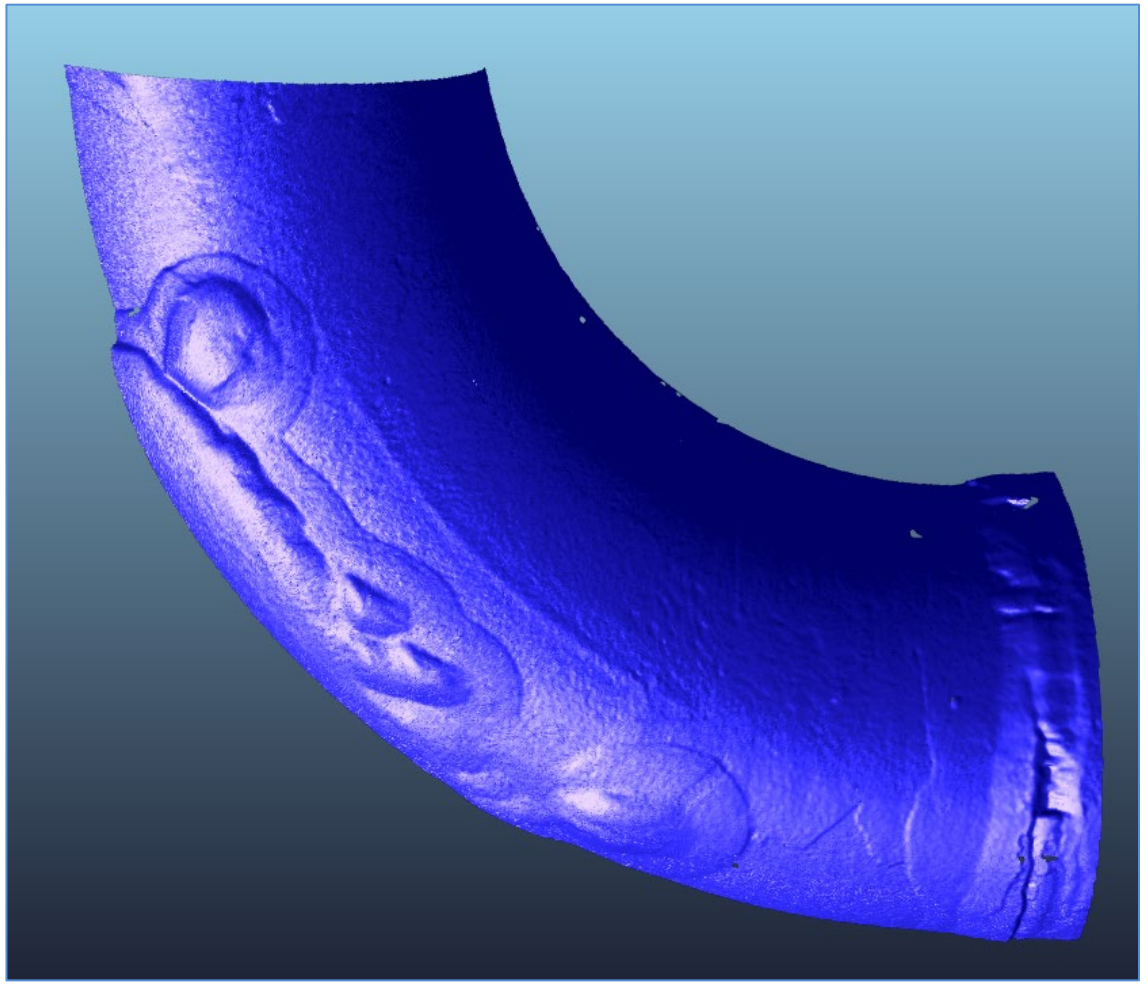
Analysis of corrosion on the inside surface of a pipe, elbow portion

ELBOW (METAL LOSS, INSIDE)

3D data of the corrosion, inside of a pipe

Diameter of elbow = 65mm

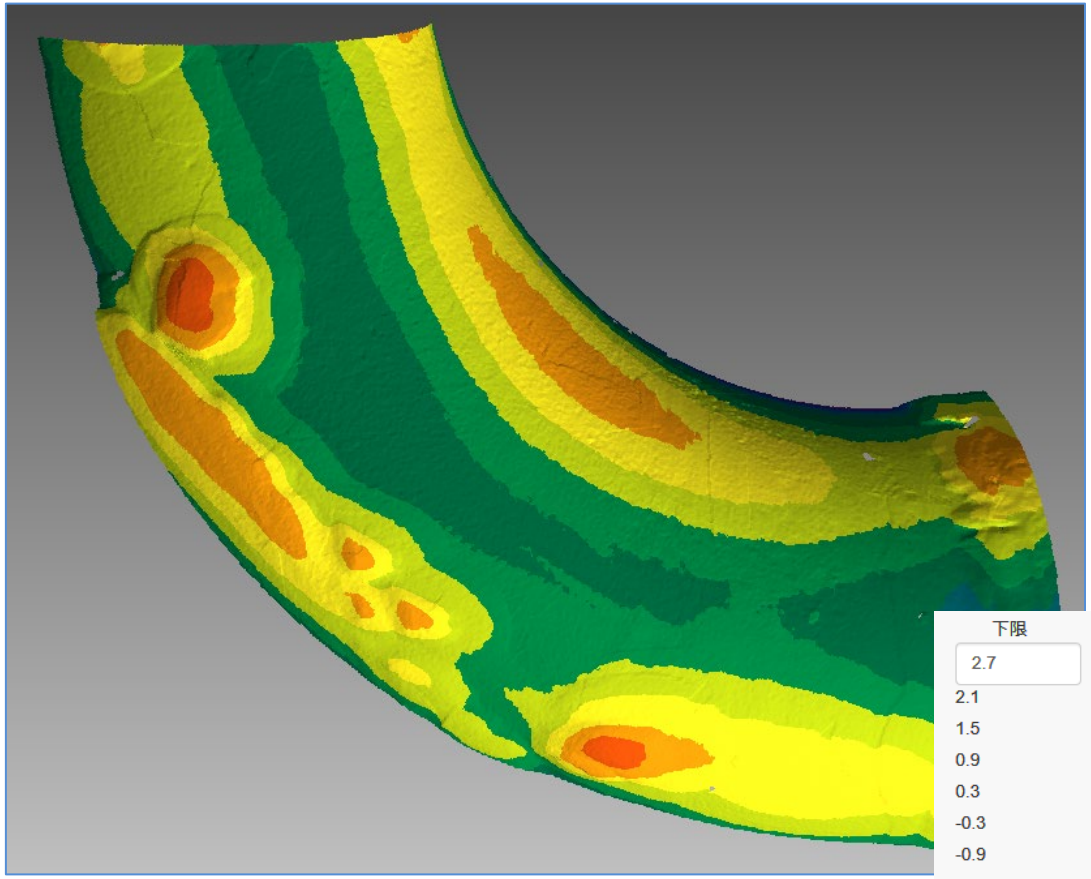




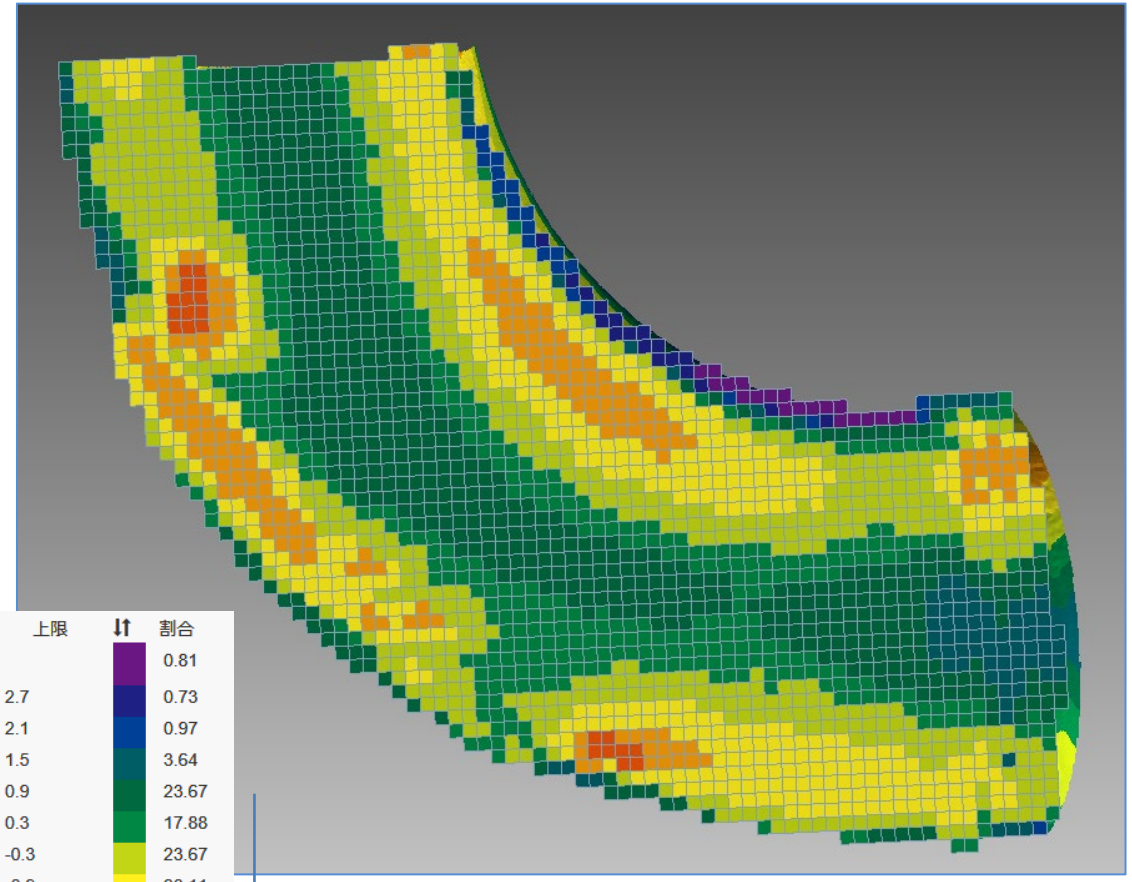
No.10 large elbow edited.ply

POLYGONALmeister : color map for corrosion

Corrosion map on points



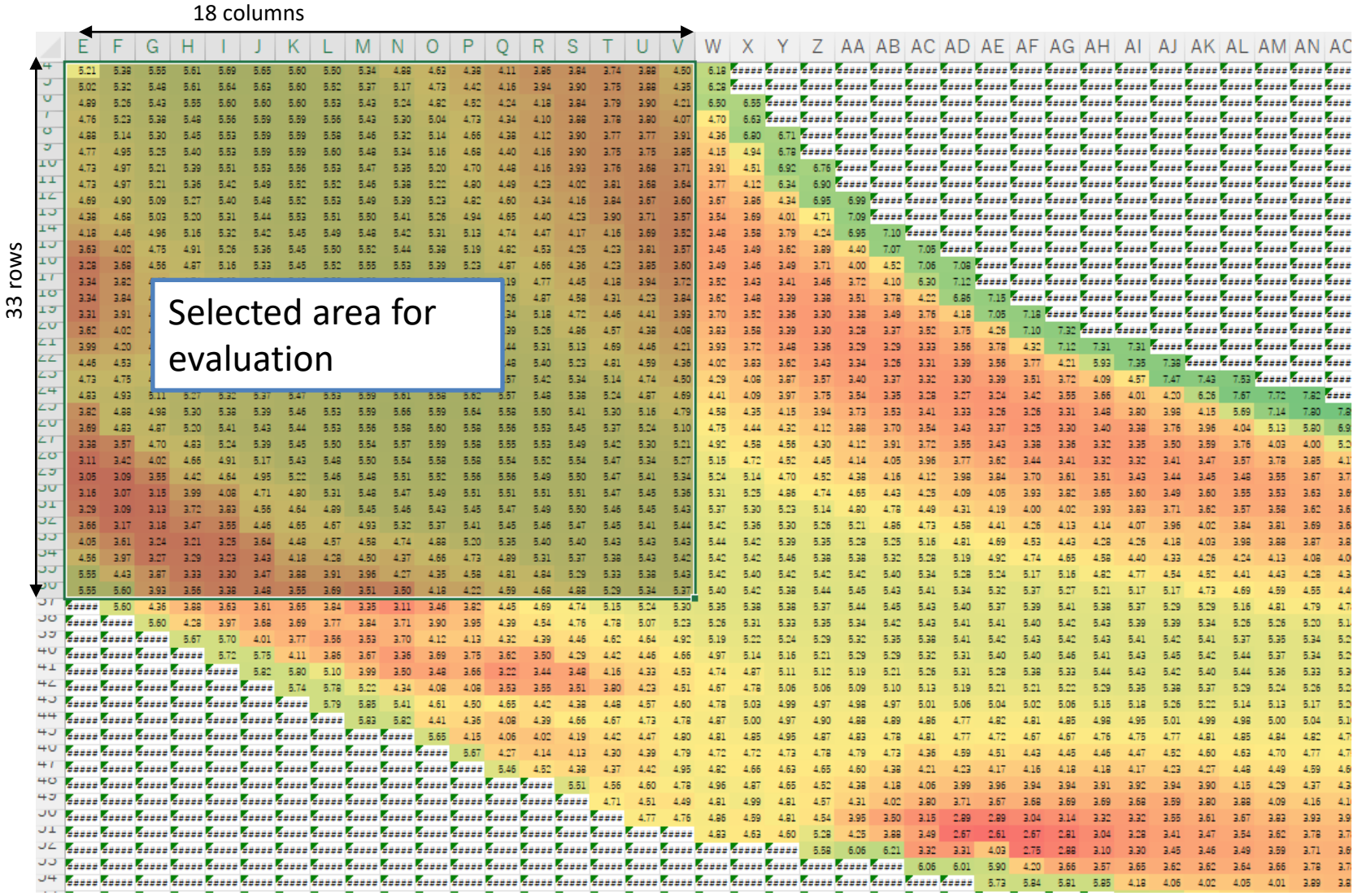
Heat map with 2mm grid (projection from above)



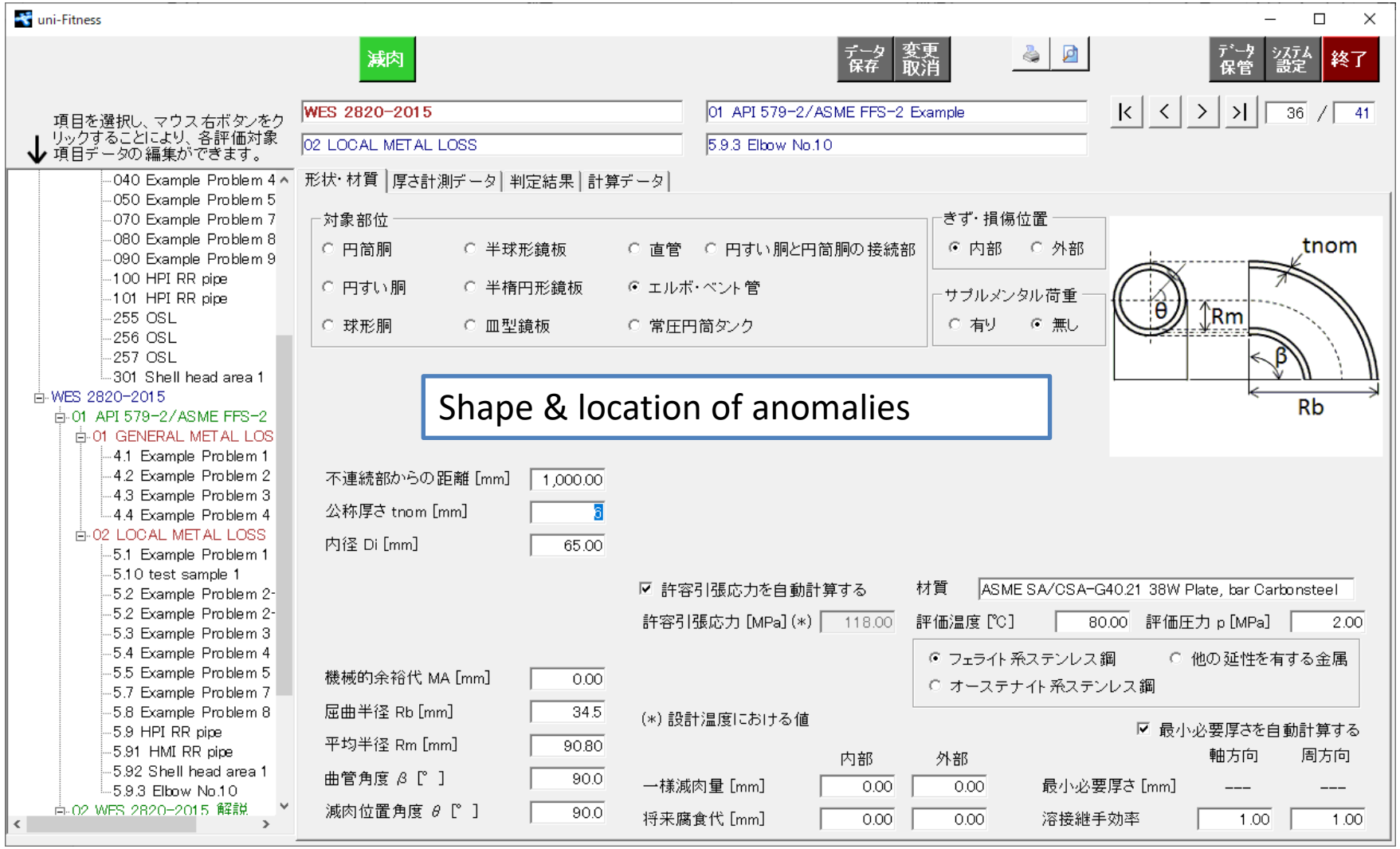
下限		上限	割合
2.7	~		0.81
2.1	~	2.7	0.73
1.5	~	2.1	0.97
0.9	~	1.5	3.64
0.3	~	0.9	23.67
-0.3	~	0.3	17.88
-0.9	~	-0.3	23.67
-1.5	~	-0.9	20.11
-2.1	~	-1.5	7.69
-2.7	~	-2.1	0.85
	~	-2.7	0.00

Depth of metal loss [mm]

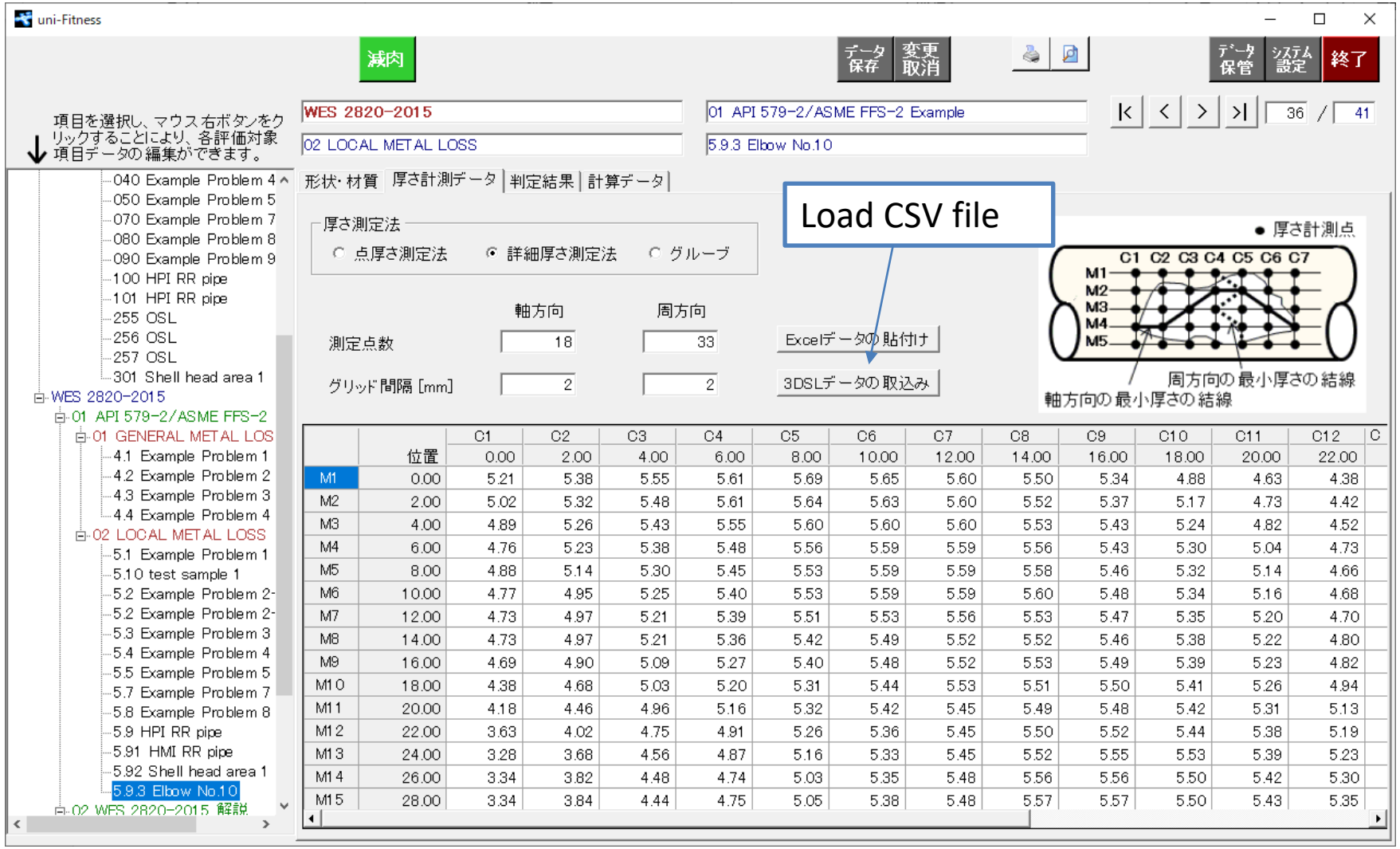
Extraction of the data to evaluate



Use Uni-Fitness for FFS, preparation 1

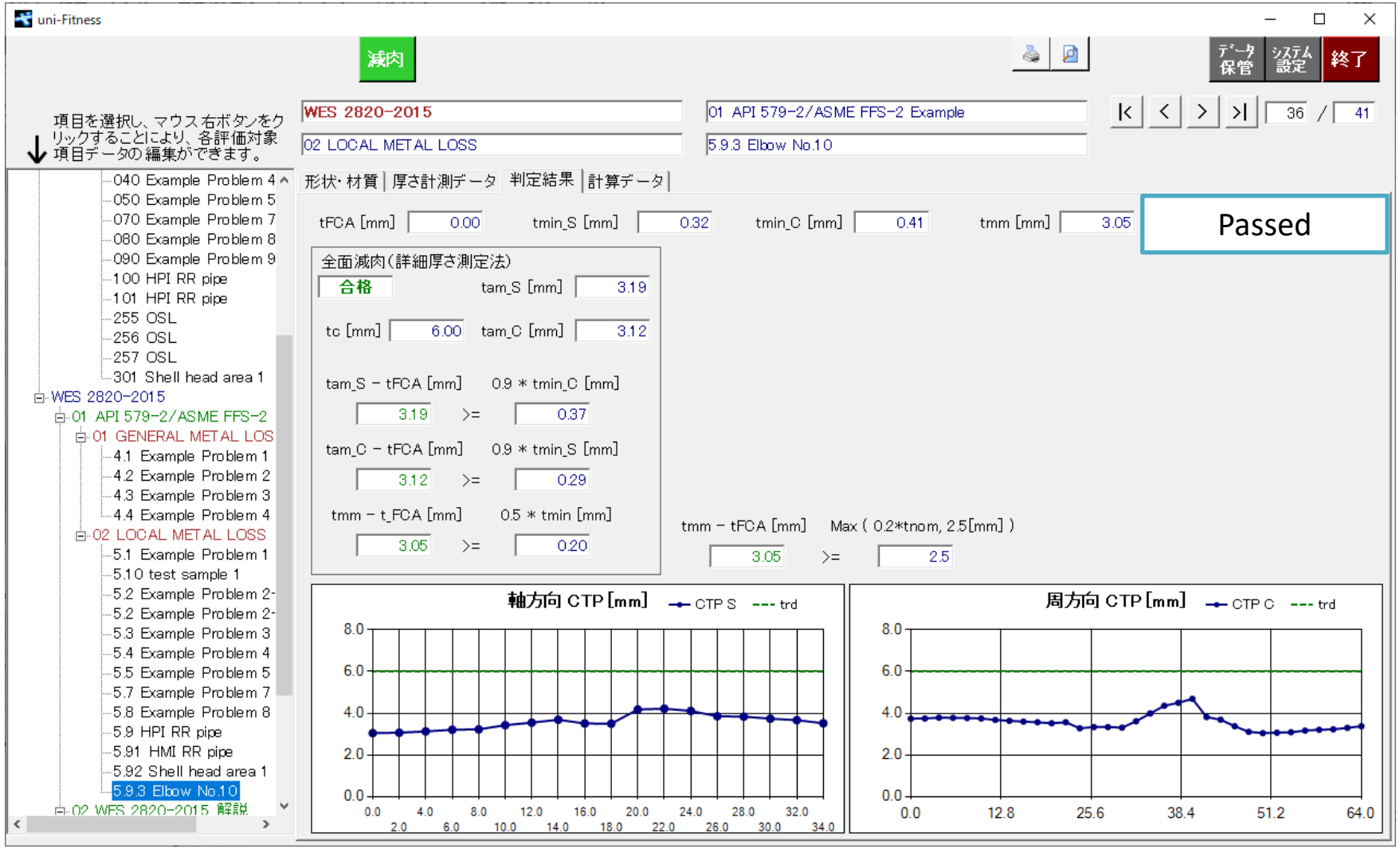


Use Uni-Fitness for FFS, preparation 2

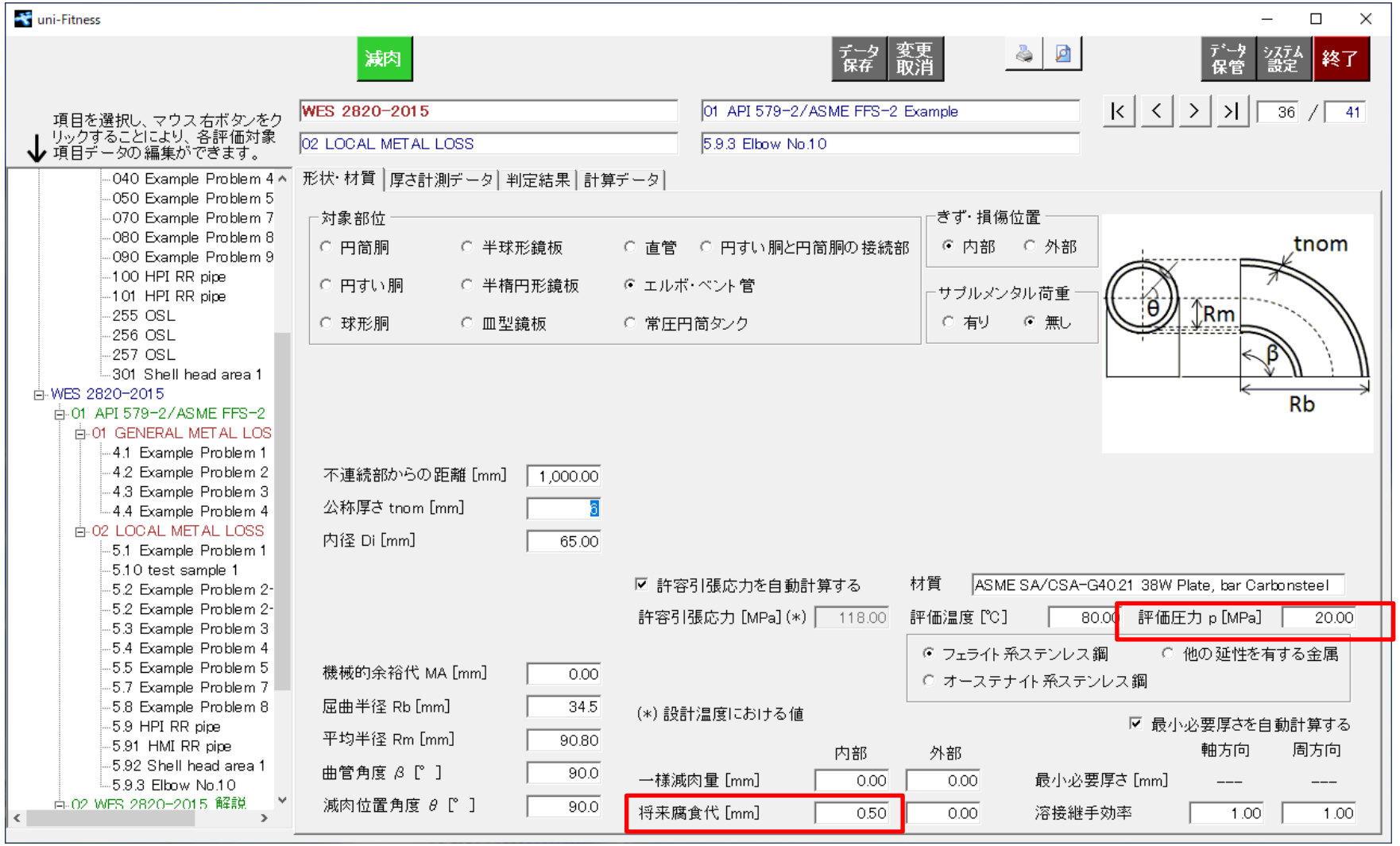


	位置	C1	C2	C3	C4	C5	C6	C7	C8	C9	C10	C11	C12	C
		0.00	2.00	4.00	6.00	8.00	10.00	12.00	14.00	16.00	18.00	20.00	22.00	
M1	0.00	5.21	5.38	5.55	5.61	5.69	5.65	5.60	5.50	5.34	4.88	4.63	4.38	
M2	2.00	5.02	5.32	5.48	5.61	5.64	5.63	5.60	5.52	5.37	5.17	4.73	4.42	
M3	4.00	4.89	5.26	5.43	5.55	5.60	5.60	5.60	5.53	5.43	5.24	4.82	4.52	
M4	6.00	4.76	5.23	5.38	5.48	5.56	5.59	5.59	5.56	5.43	5.30	5.04	4.73	
M5	8.00	4.88	5.14	5.30	5.45	5.53	5.59	5.59	5.58	5.46	5.32	5.14	4.66	
M6	10.00	4.77	4.95	5.25	5.40	5.53	5.59	5.59	5.60	5.48	5.34	5.16	4.68	
M7	12.00	4.73	4.97	5.21	5.39	5.51	5.53	5.56	5.53	5.47	5.35	5.20	4.70	
M8	14.00	4.73	4.97	5.21	5.36	5.42	5.49	5.52	5.52	5.46	5.38	5.22	4.80	
M9	16.00	4.69	4.90	5.09	5.27	5.40	5.48	5.52	5.53	5.49	5.39	5.23	4.82	
M10	18.00	4.38	4.68	5.03	5.20	5.31	5.44	5.53	5.51	5.50	5.41	5.26	4.94	
M11	20.00	4.18	4.46	4.96	5.16	5.32	5.42	5.45	5.49	5.48	5.42	5.31	5.13	
M12	22.00	3.63	4.02	4.75	4.91	5.26	5.36	5.45	5.50	5.52	5.44	5.38	5.19	
M13	24.00	3.28	3.68	4.56	4.87	5.16	5.33	5.45	5.52	5.55	5.53	5.39	5.23	
M14	26.00	3.34	3.82	4.48	4.74	5.03	5.35	5.48	5.56	5.56	5.50	5.42	5.30	
M15	28.00	3.34	3.84	4.44	4.75	5.05	5.38	5.48	5.57	5.57	5.50	5.43	5.35	

Uni-Fitness: evaluation result (WES2820)



Uni-Fitness: Future corrosion allowance

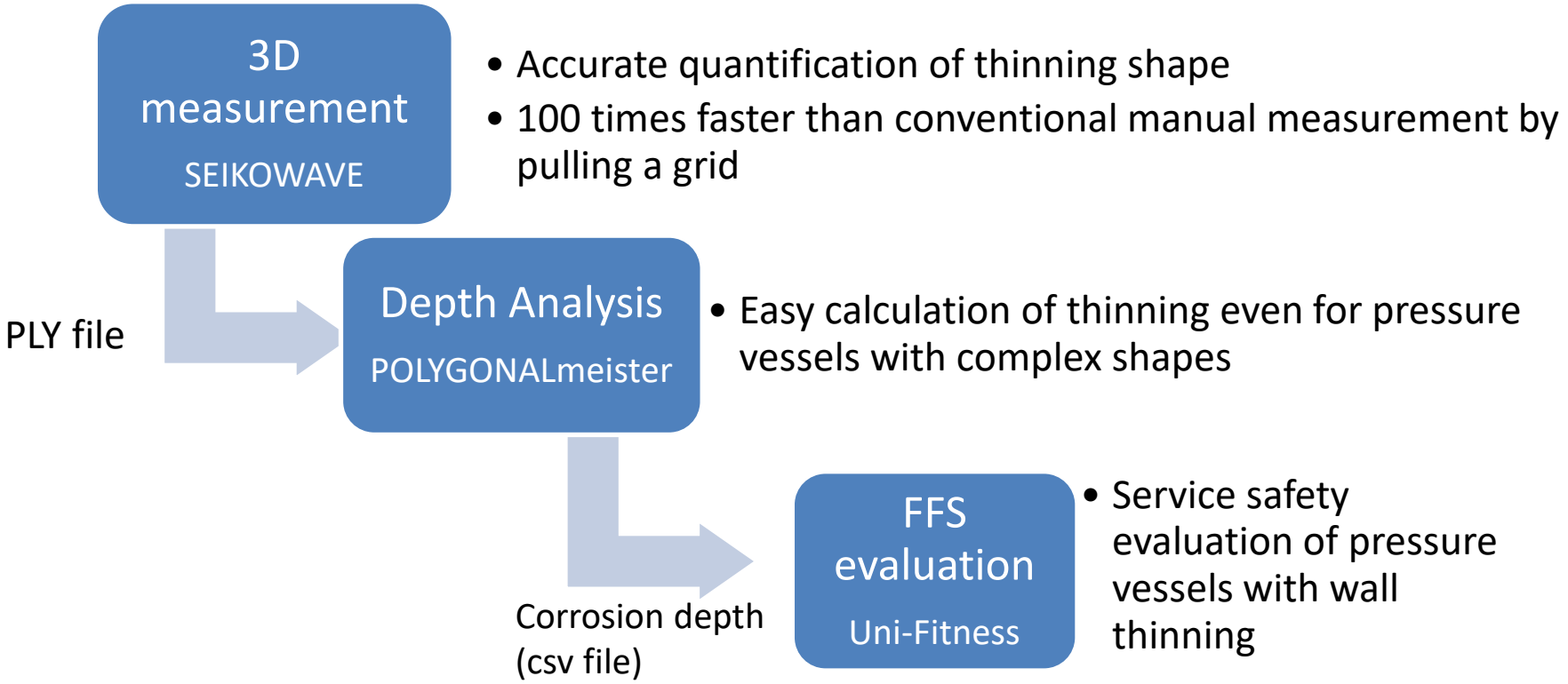


FCA = 0.5mm (equivalent to 5 years from now)

Evaluation by WES2820, General & Local Metal Loss

- Fails the general thinning method (evaluated by the minimum thickness), but passes the local thinning method (evaluated by the maximum allowable pressure).

Conclusion


3D measurement
SEIKOWAVE
• Accurate quantification of thinning shape
• 100 times faster than conventional manual measurement by pulling a grid
PLY file
Depth Analysis
POLYGONALmeister
• Easy calculation of thinning even for pressure vessels with complex shapes
Corrosion depth (csv file)
FFS evaluation
Uni-Fitness
• Service safety evaluation of pressure vessels with wall thinning