ARG Report

argonaut

June 23, 2020

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Introduction

The structure of this report was built by the Explorator component of ARG, which explored the following directory:
`/builds/AutomaticReportGenerator/arg/tests/crush/data`
and discovered the following relevant data:

- ExodusII mesh in `crush_assembly.g`

Chapter 1

Geometry

This chapter describes the geometry as specified in the parameters file.
The term Electronic Product Definition (EPD) is also often used to denote the CAD geometry of the case.

1.1 Geometry Files

This section provides an overview of the geometry files found in:
`/builds/AutomaticReportGenerator/arg/tests/crush/data/Interface`
We note that this is a particular case with a bijection between CAD and FEM items.

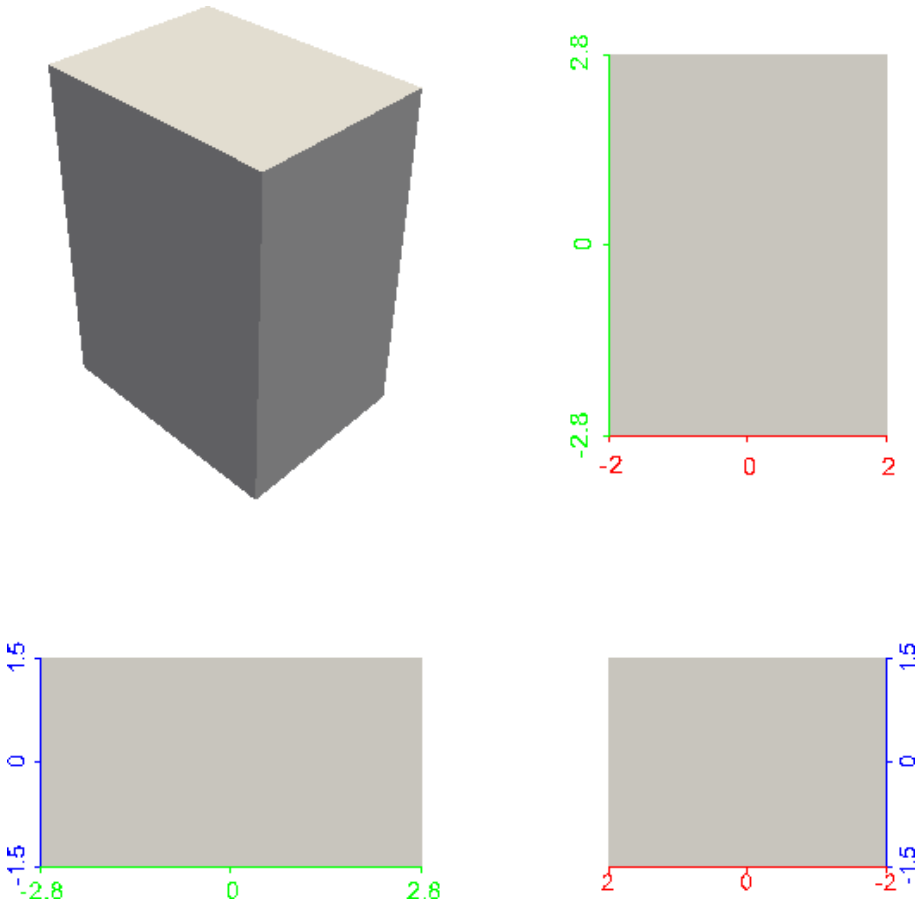

Figure 1.1: Perspective (top left) and parallel (top right: XY; bottom left: YZ; bottom right: XZ) rendering of `box_shell.stl`.

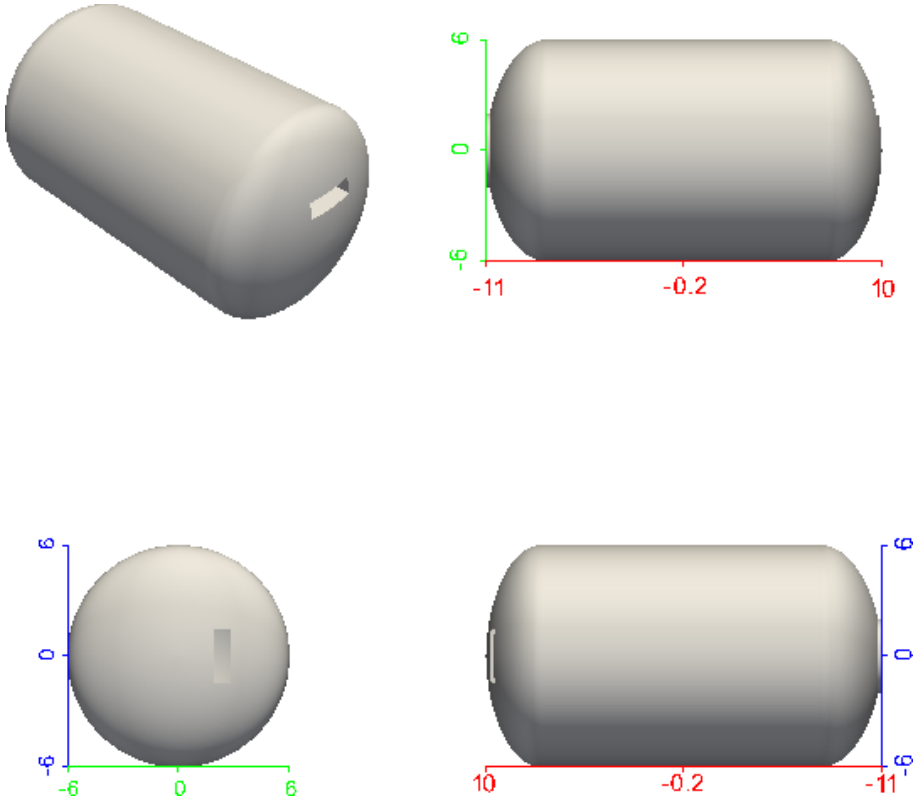

Figure 1.2: Perspective (top left) and parallel (top right: XY; bottom left: YZ; bottom right: XZ) rendering of `case.stl`.

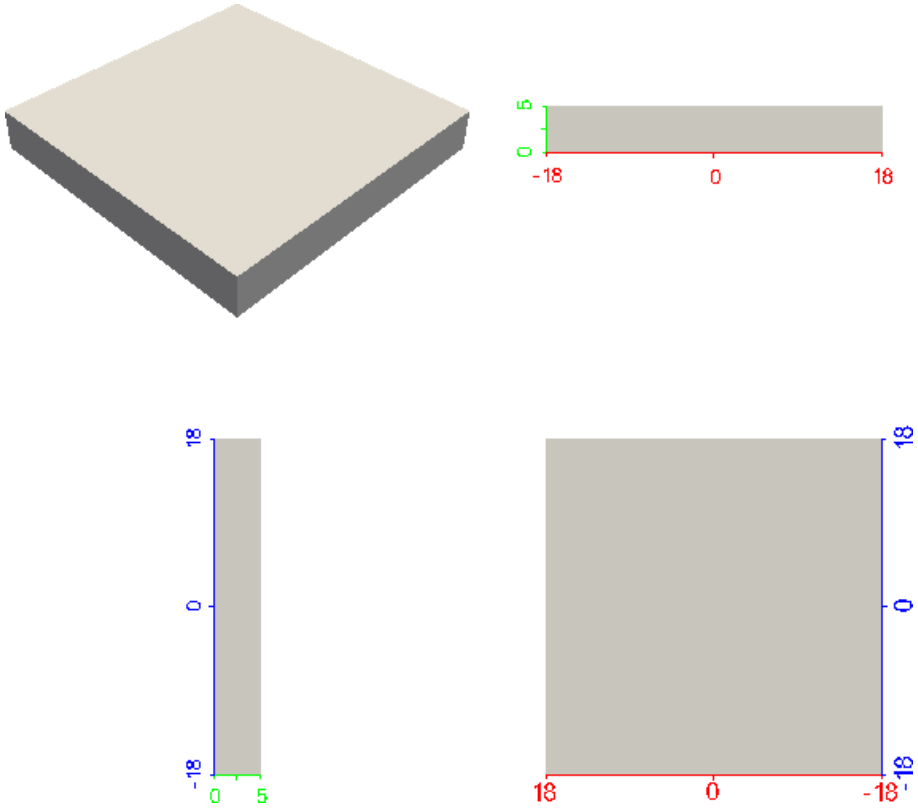

Figure 1.3: Perspective (top left) and parallel (top right: XY; bottom left: YZ; bottom right: XZ) rendering of `crusher.stl`.

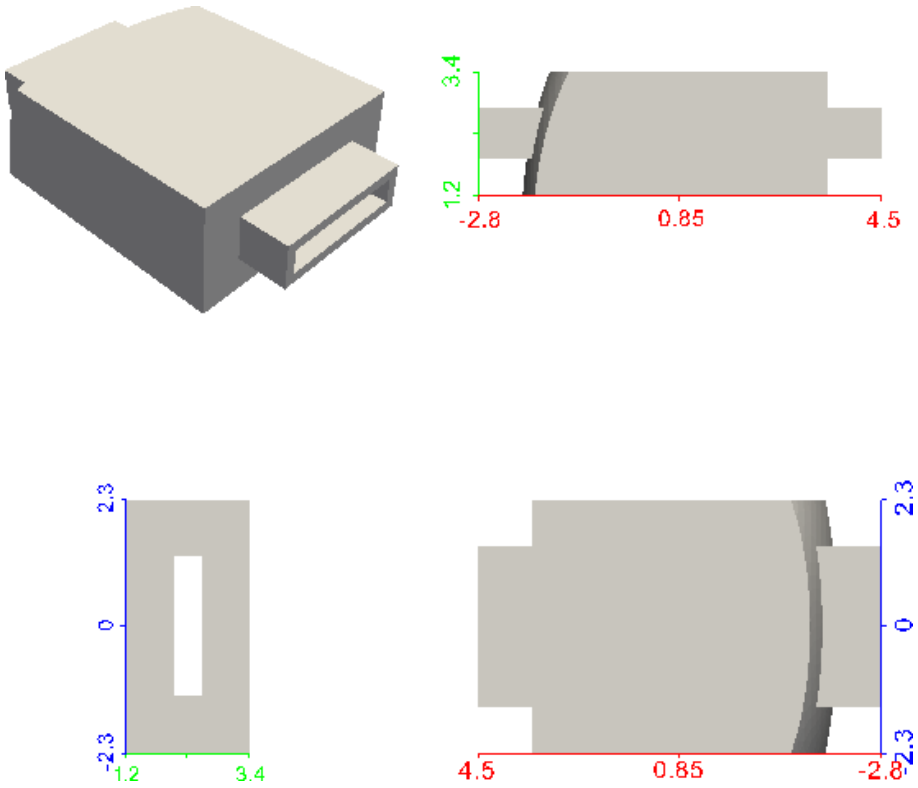

Figure 1.4: Perspective (top left) and parallel (top right: XY; bottom left: YZ; bottom right: XZ) rendering of `duct.stl`.

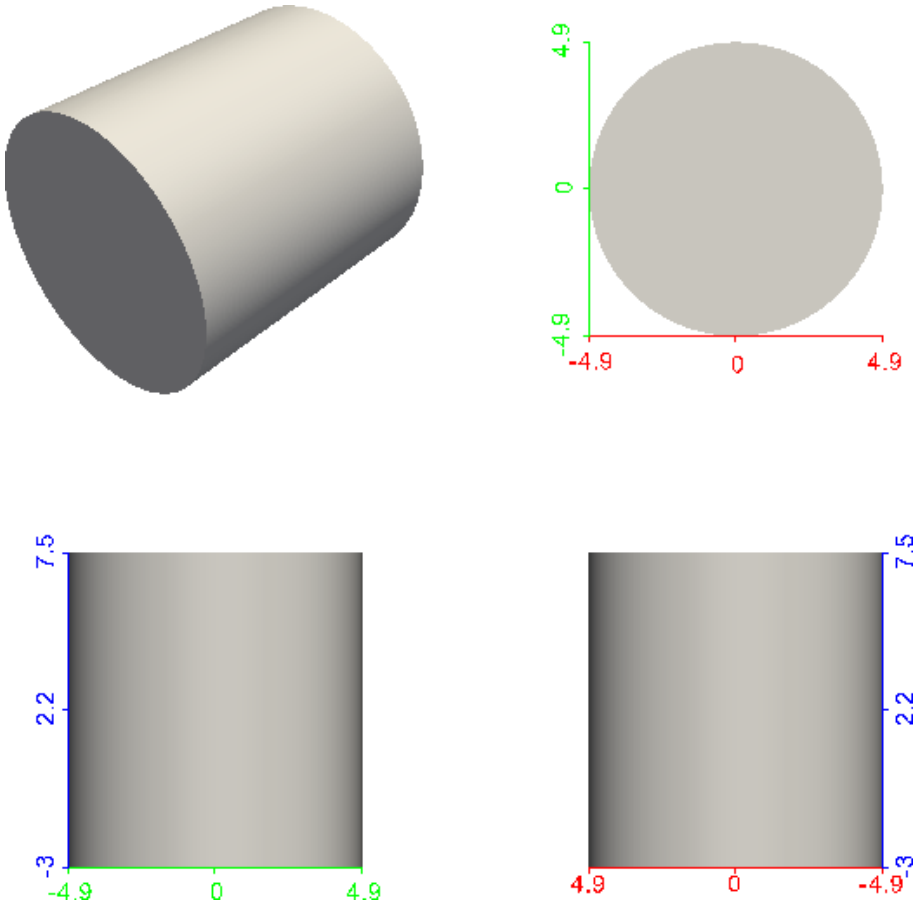

Figure 1.5: Perspective (top left) and parallel (top right: XY; bottom left: YZ; bottom right: XZ) rendering of `foam.stl`.

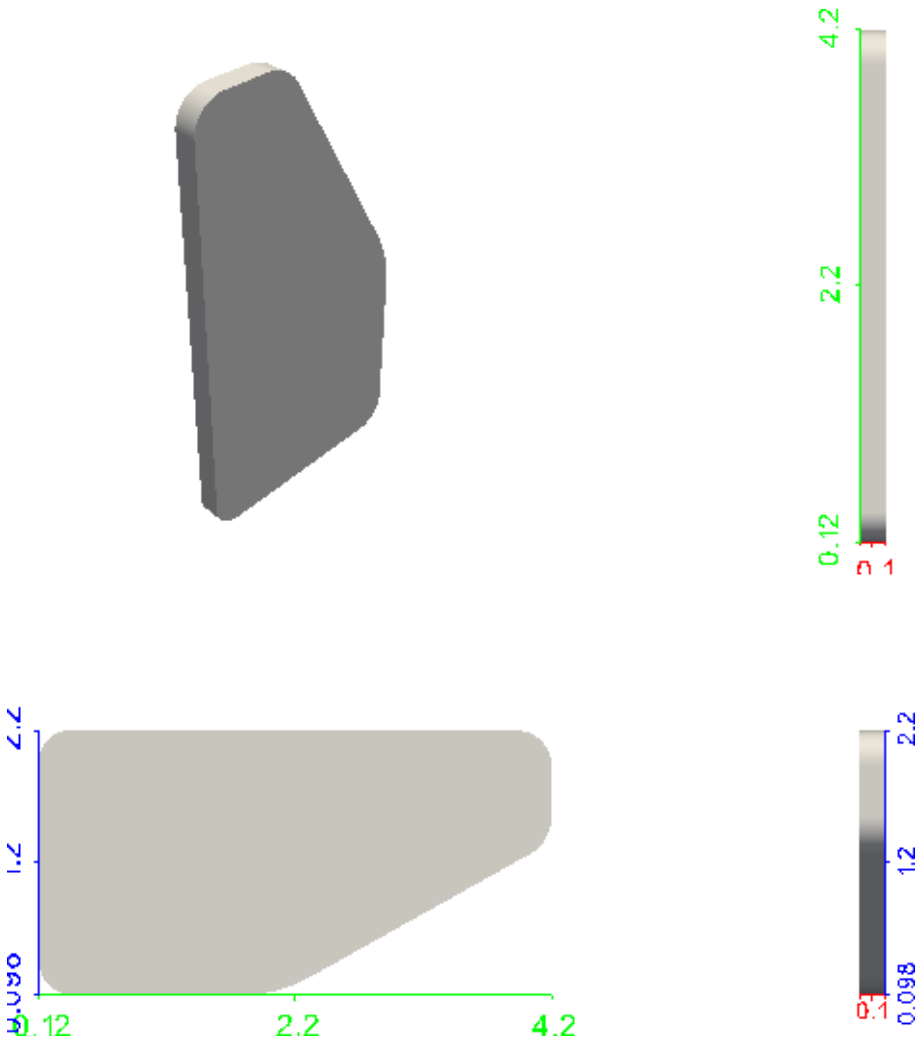

Figure 1.6: Perspective (top left) and parallel (top right: XY; bottom left: YZ; bottom right: XZ) rendering of `lid.stl`.

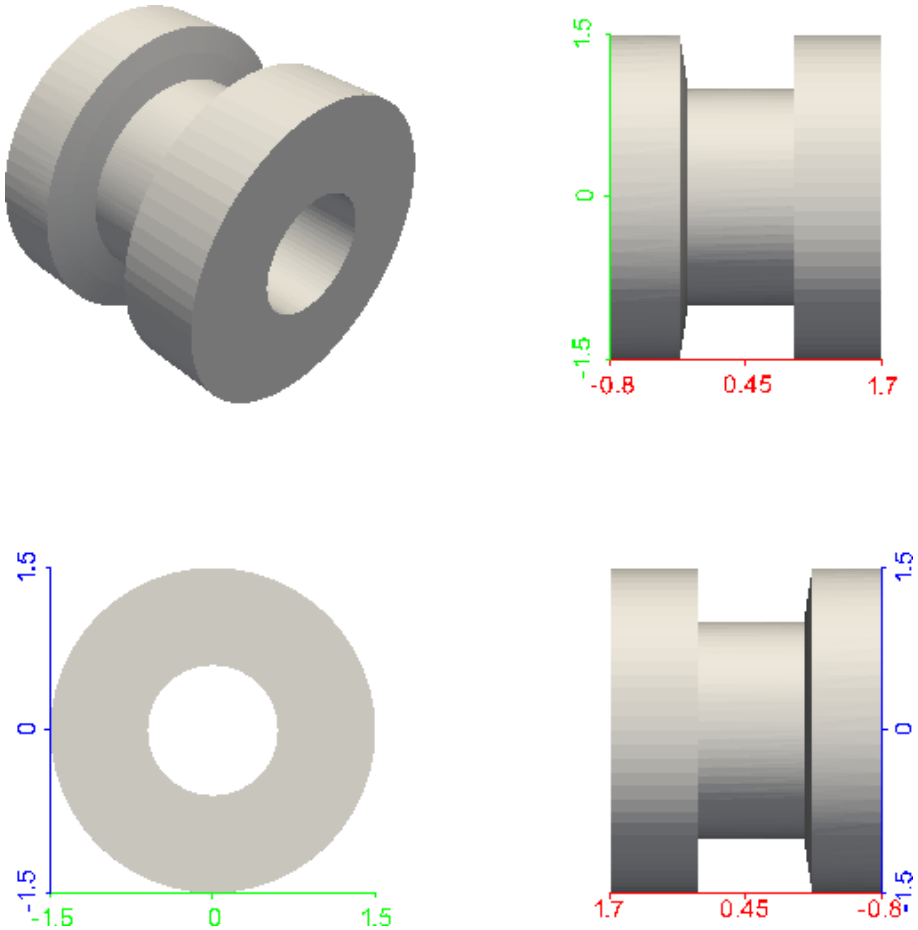

Figure 1.7: Perspective (top left) and parallel (top right: XY; bottom left: YZ; bottom right: XZ) rendering of `plug.stl`.

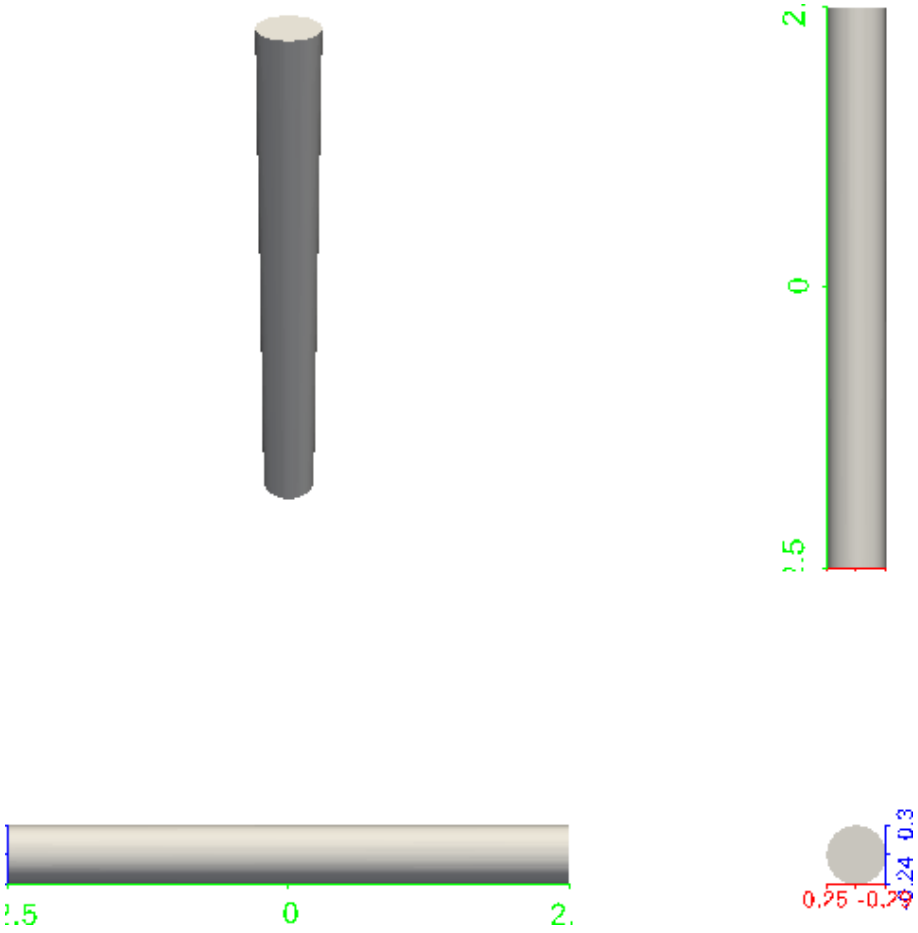

Figure 1.8: Perspective (top left) and parallel (top right: XY; bottom left: YZ; bottom right: XZ) rendering of `post.stl`.

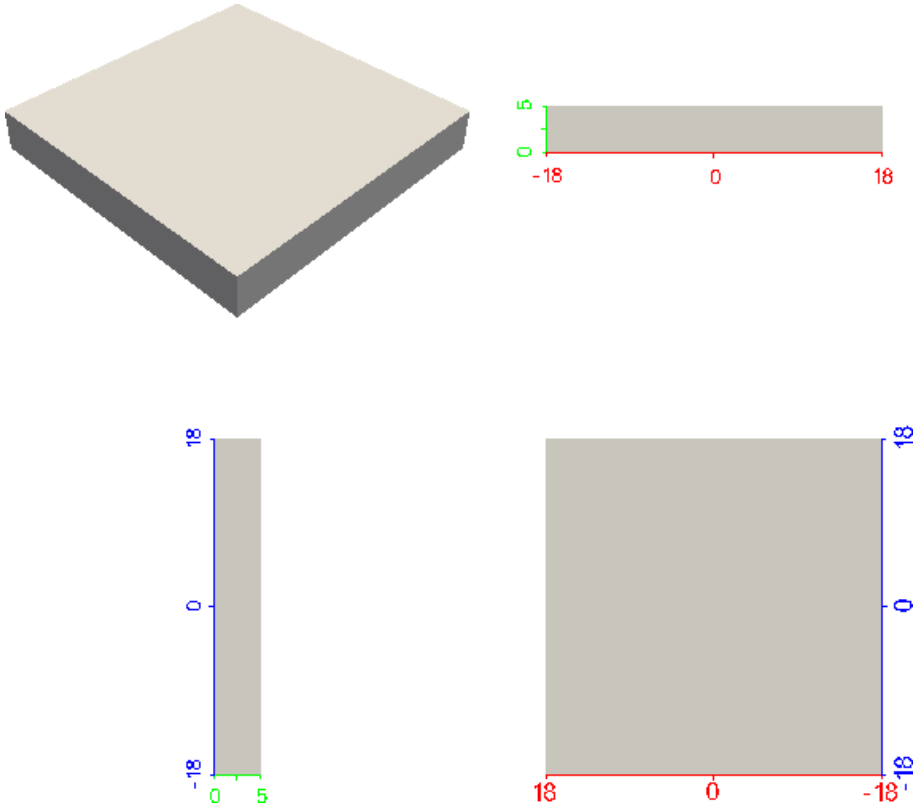

Figure 1.9: Perspective (top left) and parallel (top right: XY; bottom left: YZ; bottom right: XZ) rendering of `target.stl`.

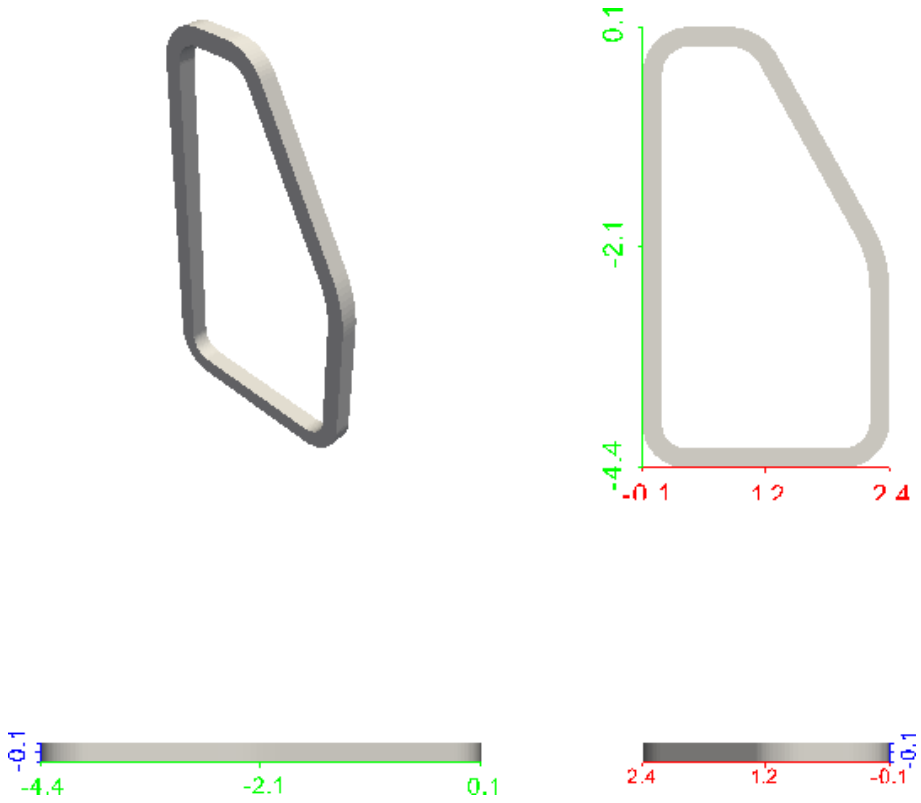

Figure 1.10: Perspective (top left) and parallel (top right: XY; bottom left: YZ; bottom right: XZ) rendering of `weld.stl`.

1.2 CAD metadata

This section describes the CAD metadata found in:
`/builds/AutomaticReportGenerator/arg/tests/crush/data/Interface`

CAD parameter	parameter value
DWG_TITLE1	NOT FOUND
UNITS	NOT FOUND
MATERIAL	NOT FOUND

Table 1.1: CAD metadata for part lid.

CAD parameter	parameter value
DWG_TITLE1	UNDEFINED
UNITS	INCH
MATERIAL	material_1

Table 1.2: CAD metadata for part box_shell.

CAD parameter	parameter value
DWG_TITLE1	UNDEFINED
UNITS	INCH
MATERIAL	material_5

Table 1.3: CAD metadata for part foam.

CAD parameter	parameter value
DWG_TITLE1	NOT FOUND
UNITS	NOT FOUND
MATERIAL	NOT FOUND

Table 1.4: CAD metadata for part duct.

CAD parameter	parameter value
DWG_TITLE1	NOT FOUND
UNITS	NOT FOUND
MATERIAL	NOT FOUND

Table 1.5: CAD metadata for part weld.

CAD parameter	parameter value
DWG_TITLE1	UNDEFINED
UNITS	INCH
MATERIAL	material_2

Table 1.6: CAD metadata for part target.

CAD parameter	parameter value
DWG_TITLE1	UNDEFINED
UNITS	INCH
MATERIAL	material_3

Table 1.7: CAD metadata for part case.

CAD parameter	parameter value
DWG_TITLE1	UNDEFINED
UNITS	INCH
MATERIAL	material_4

Table 1.8: CAD metadata for part crusher.

CAD parameter	parameter value
DWG_TITLE1	NOT FOUND
UNITS	NOT FOUND
MATERIAL	NOT FOUND

Table 1.9: CAD metadata for part post.

CAD parameter	parameter value
DWG_TITLE1	NOT FOUND
UNITS	NOT FOUND
MATERIAL	NOT FOUND

Table 1.10: CAD metadata for part plug.

Chapter 2

ExodusII Mesh

This chapter describes the ExodusII mesh in:
`/builds/AutomaticReportGenerator/arg/tests/crush/data/crush_assembly.g`

2.1 Overview

This section provides an overview of the meta-data and global properties of this ExodusII mesh.

item	number
Exodus II files	1
element blocks	10
elements	994848
node sets	2
nodes	1141300
side sets	8

Table 2.1: Topological properties of `crush_assembly.g`

block ID	block name
1	case
2	duct
3	plug
4	box_shell
5	lid
6	weld
7	post
8	target
9	crusher
10	foam

Table 2.2: Element blocks of `crush_assembly.g`

node set ID	node set name
1	z_symmetry_nodeset
2	target_bottom_nodeset

Table 2.3: Node sets of `crush_assembly.g`

side set ID	side set name
1	crusher_sideset
2	case_outer_sideset
3	case_inner_sideset
4	foam_outer_sideset
5	foam_inner_sideset
6	box_shell_outer_sideset
7	interface_case_sideset
8	interface_plug_sideset

Table 2.4: Side sets of `crush_assembly.g`

2.2 Mesh Blocks

This section provides a description of all blocks contained in the mesh.

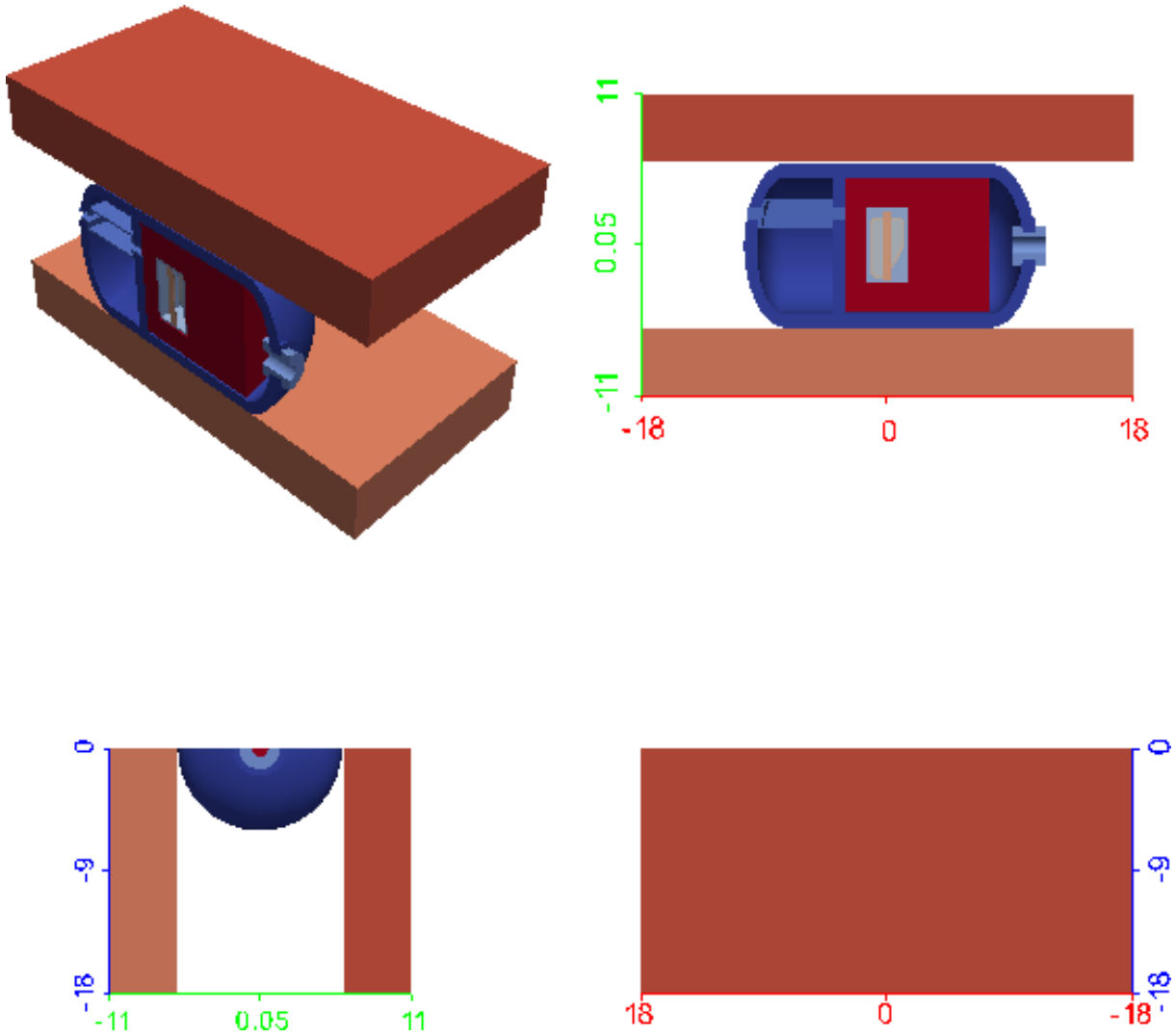

Figure 2.1: Perspective (top left) and parallel (top right: XY; bottom left: YZ; bottom right: XZ) rendering of `crush_assembly.g`.

Block `1` (`case`) summary

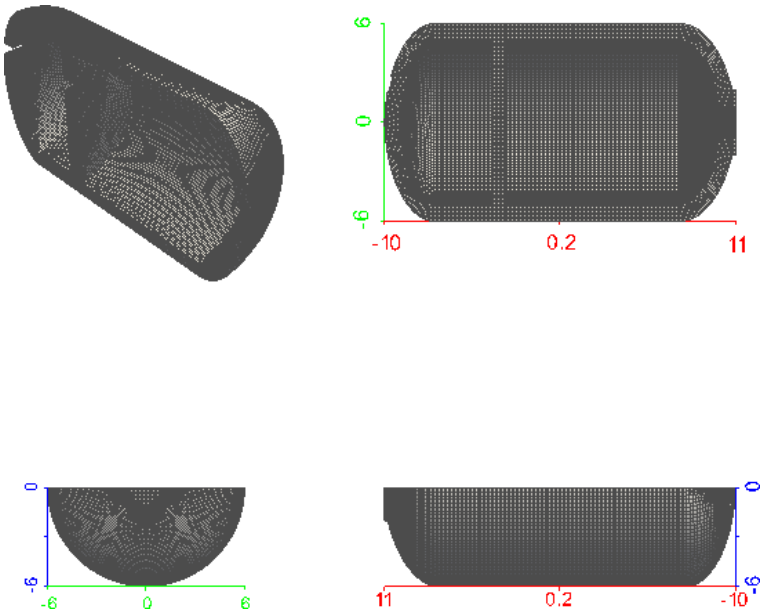

Figure 2.2: Perspective (top left) and parallel (top right: XY; bottom left: YZ; bottom right: XZ) rendering of `block 1`.

property	value
number of nodes	163818
number of elements	143240
type of first element in block	`HEX8`

Table 2.5: Properties of block `case`.

Block 1 (case) element quality

$\mathcal{Q}$	$\min(\mathcal{Q})$	$\mu(\mathcal{Q})$	$\max(\mathcal{Q})$	$\sigma(\mathcal{Q})$	$\sigma/\mu(\mathcal{Q})$
scaled Jacobian	0.4061	0.9816	1	0.04298	0.04379
shape	0.5047	0.8758	0.9999	0.05902	0.06739

Table 2.6: Element quality statistics of block case.

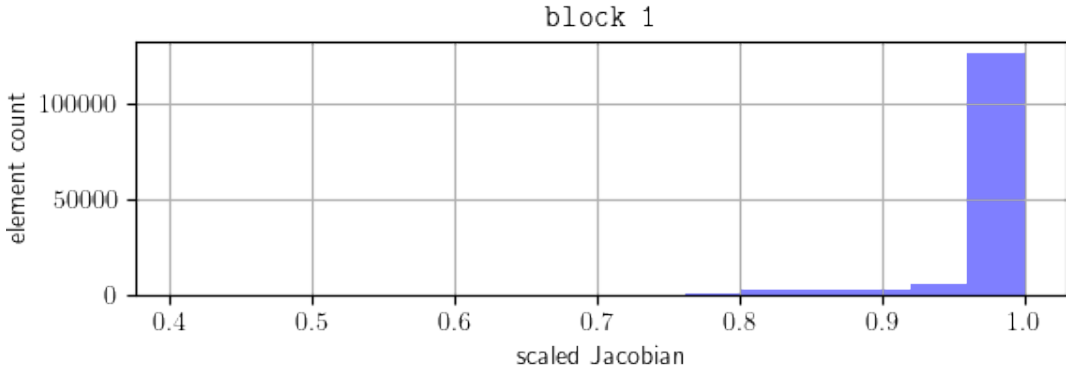

Figure 2.3: Histogram of scaled Jacobian element quality in block case.

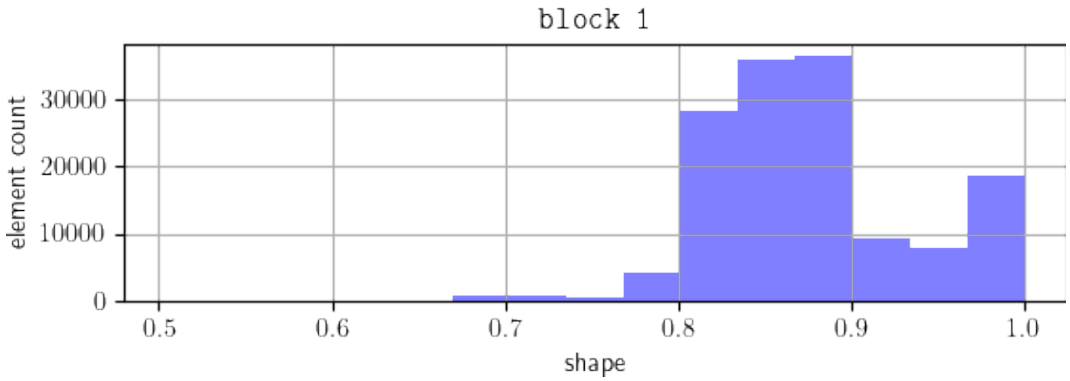

Figure 2.4: Histogram of shape element quality in block case.

Block 2 (duct) summary

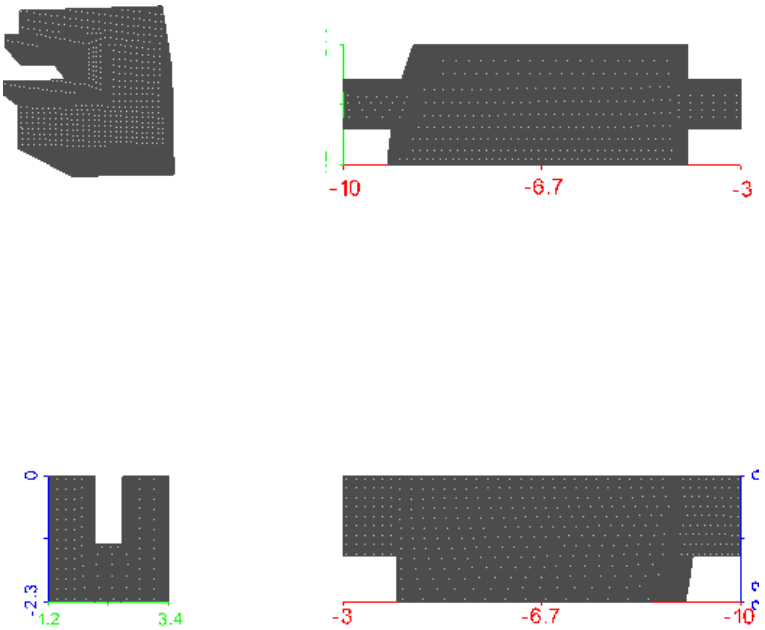

Figure 2.5: Perspective (top left) and parallel (top right: XY; bottom left: YZ; bottom right: XZ) rendering of block 2.

property	value
number of nodes	378701
number of elements	327424
type of first element in block	HEX8

Table 2.7: Properties of block duct.

Block 2 (`duct`) element quality

$\mathcal{Q}$	$\min(\mathcal{Q})$	$\mu(\mathcal{Q})$	$\max(\mathcal{Q})$	$\sigma(\mathcal{Q})$	$\sigma/\mu(\mathcal{Q})$
scaled Jacobian	0.8379	0.9732	1	0.0309	0.03175
shape	0.8821	0.9745	0.9998	0.02051	0.02105

Table 2.8: Element quality statistics of block `duct`.

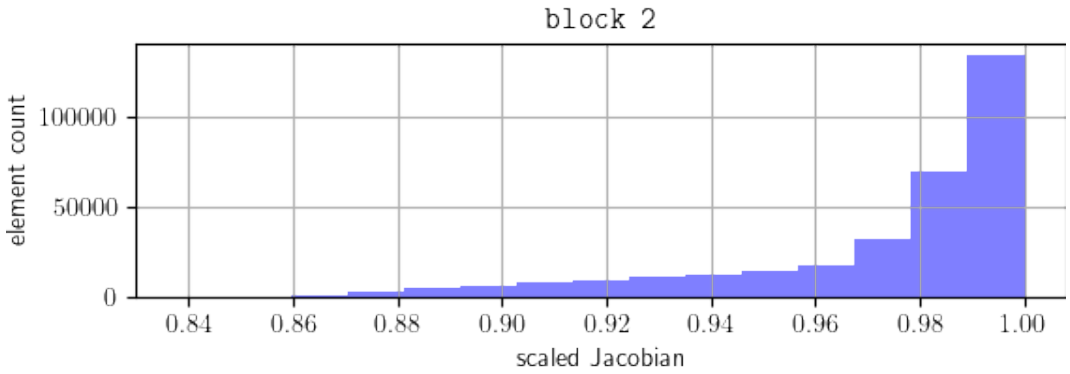

Figure 2.6: Histogram of scaled Jacobian element quality in block `duct`.

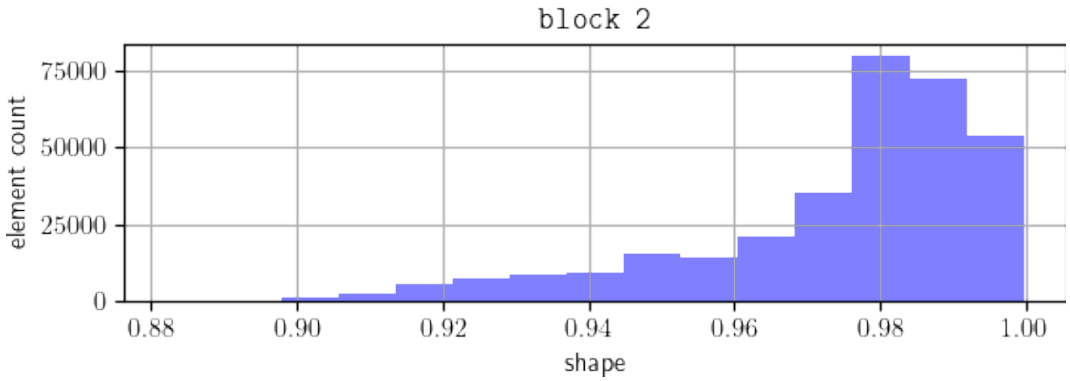

Figure 2.7: Histogram of shape element quality in block `duct`.

Block `3` (`plug`) summary

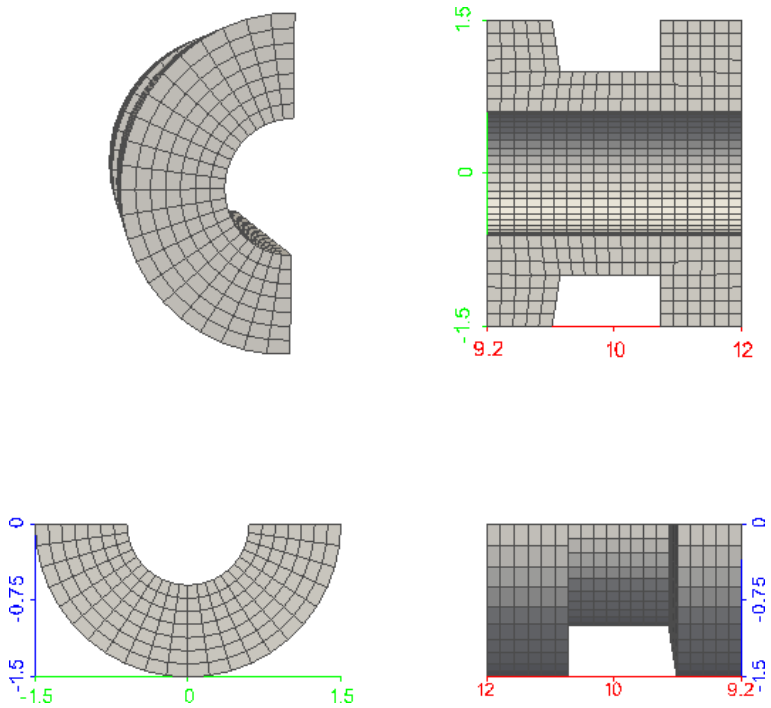

Figure 2.8: Perspective (top left) and parallel (top right: XY; bottom left: YZ; bottom right: XZ) rendering of `block 3`.

property	value
number of nodes	3036
number of elements	2222
type of first element in block	`HEX8`

Table 2.9: Properties of block `plug`.

Block 3 (plug) element quality

$\mathcal{Q}$	$\min(\mathcal{Q})$	$\mu(\mathcal{Q})$	$\max(\mathcal{Q})$	$\sigma(\mathcal{Q})$	$\sigma/\mu(\mathcal{Q})$
scaled Jacobian	0.9818	0.9947	0.9974	0.003746	0.003766
shape	0.8666	0.9496	0.9957	0.03586	0.03776

Table 2.10: Element quality statistics of block plug.

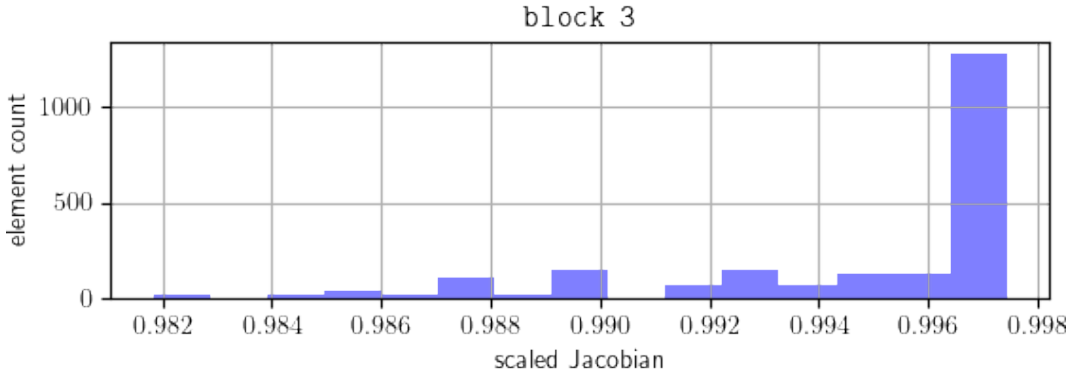

Figure 2.9: Histogram of scaled Jacobian element quality in block plug.

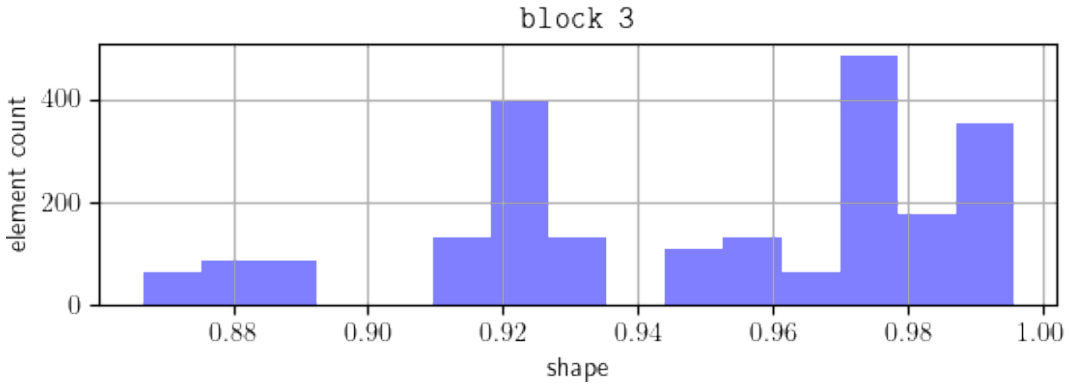

Figure 2.10: Histogram of shape element quality in block plug.

Block 4 (box_shell) summary

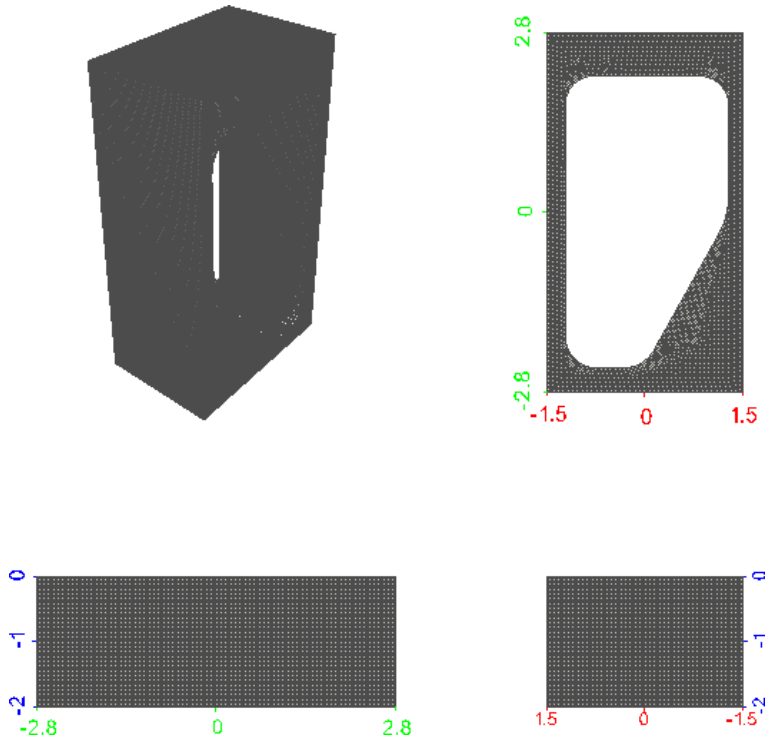

Figure 2.11: Perspective (top left) and parallel (top right: XY; bottom left: YZ; bottom right: XZ) rendering of block 4.

property	value
number of nodes	278453
number of elements	238000
type of first element in block	HEX8

Table 2.11: Properties of block box_shell.

Block 4 (box_shell) element quality

$\mathcal{Q}$	$\min(\mathcal{Q})$	$\mu(\mathcal{Q})$	$\max(\mathcal{Q})$	$\sigma(\mathcal{Q})$	$\sigma/\mu(\mathcal{Q})$
scaled Jacobian	0.6088	0.9951	1	0.01345	0.01352
shape	0.6524	0.9931	0.9998	0.0164	0.01652

Table 2.12: Element quality statistics of block box_shell.

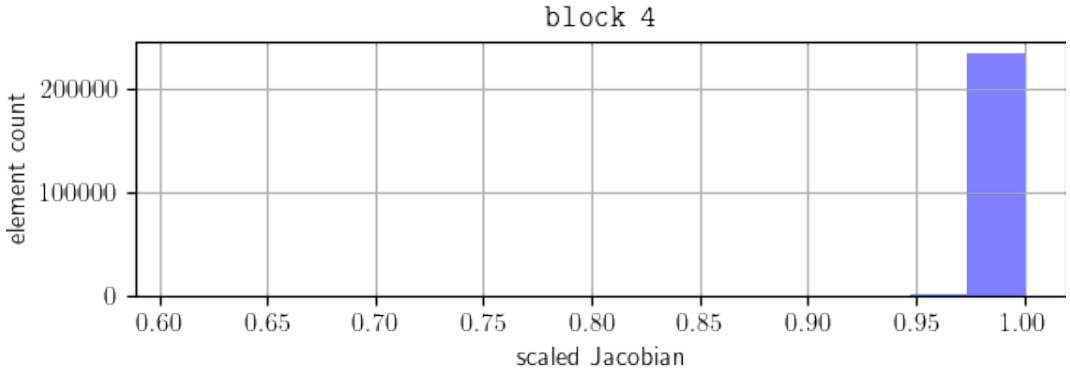

Figure 2.12: Histogram of scaled Jacobian element quality in block box_shell.

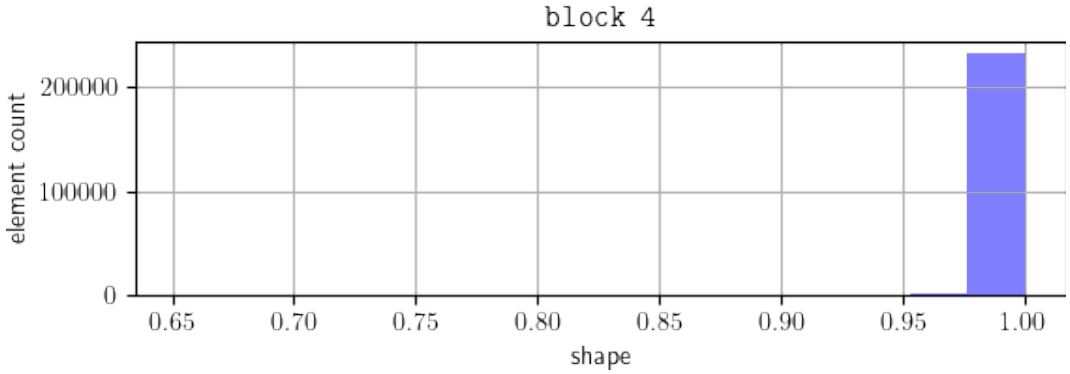

Figure 2.13: Histogram of shape element quality in block box_shell.

Block `5` (`lid`) summary

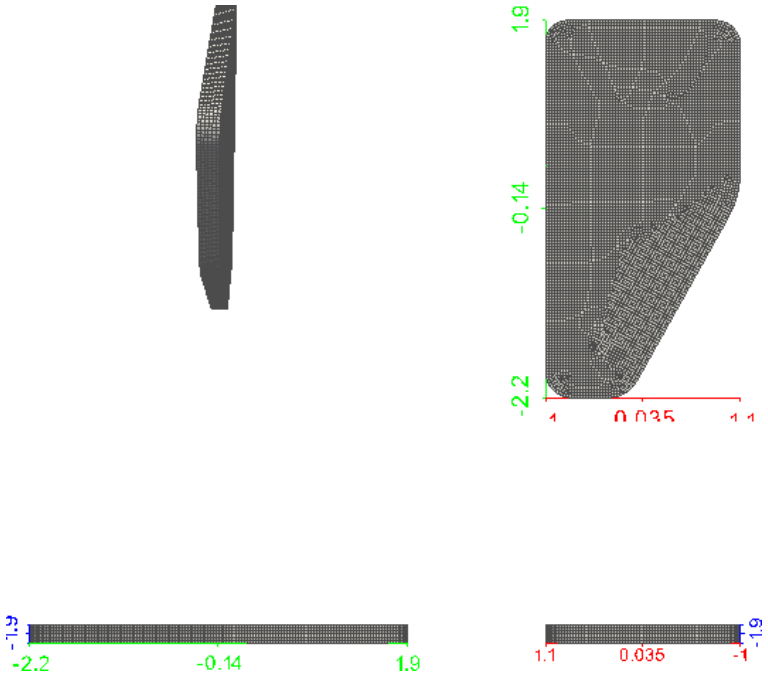

Figure 2.14: Perspective (top left) and parallel (top right: XY; bottom left: YZ; bottom right: XZ) rendering of `block 5`.

property	value
number of nodes	52563
number of elements	43986
type of first element in block	`HEX8`

Table 2.13: Properties of block `lid`.

Block `5` (`lid`) element quality

$\mathcal{Q}$	$\min(\mathcal{Q})$	$\mu(\mathcal{Q})$	$\max(\mathcal{Q})$	$\sigma(\mathcal{Q})$	$\sigma/\mu(\mathcal{Q})$
scaled Jacobian	0.7408	0.996	1	0.02035	0.02043
shape	0.7275	0.9933	0.9999	0.02438	0.02455

Table 2.14: Element quality statistics of block `lid`.

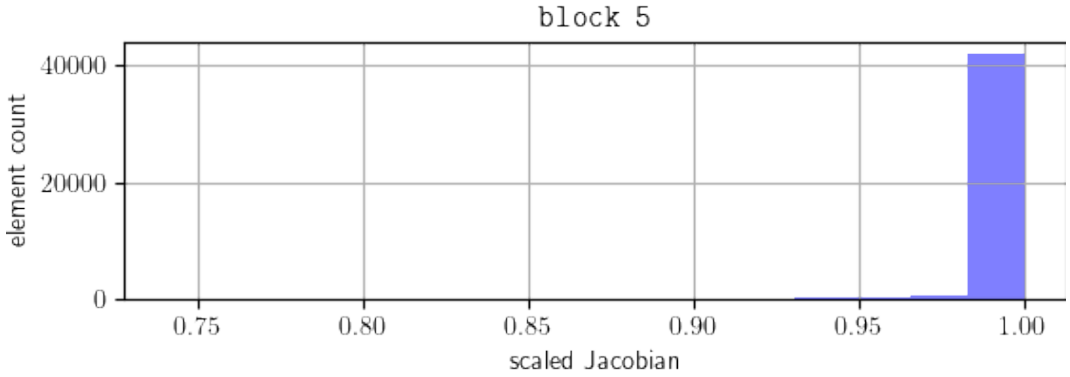

Figure 2.15: Histogram of scaled Jacobian element quality in block `lid`.

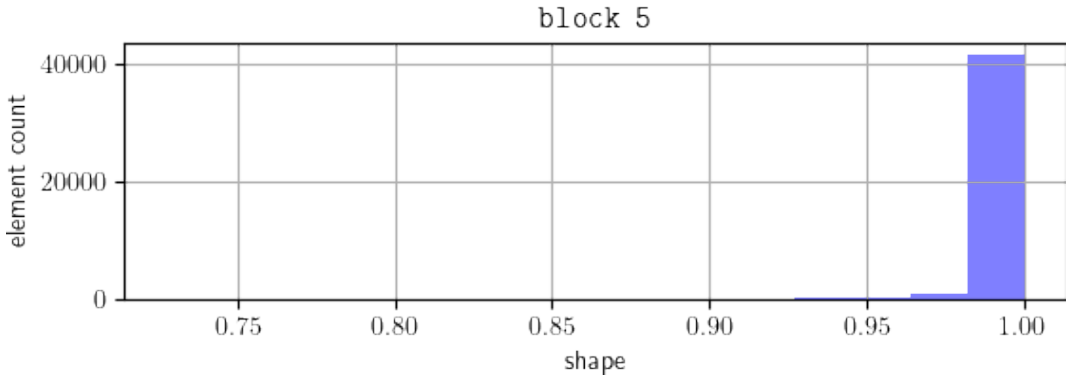

Figure 2.16: Histogram of shape element quality in block `lid`.

Block `6` (`weld`) summary

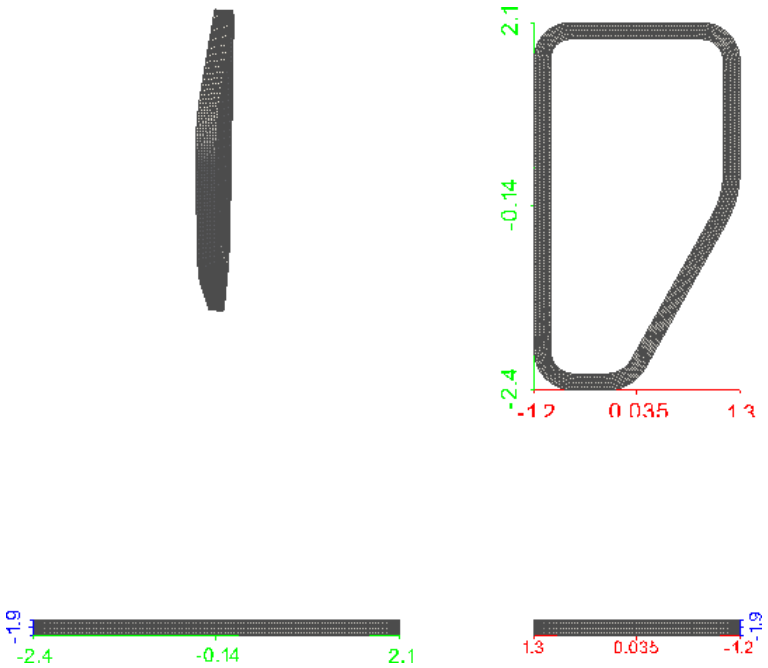

Figure 2.17: Perspective (top left) and parallel (top right: XY; bottom left: YZ; bottom right: XZ) rendering of `block 6`.

property	value
number of nodes	30699
number of elements	24256
type of first element in block	`HEX8`

Table 2.15: Properties of block `weld`.

Block `6` (`weld`) element quality

$\mathcal{Q}$	$\min(\mathcal{Q})$	$\mu(\mathcal{Q})$	$\max(\mathcal{Q})$	$\sigma(\mathcal{Q})$	$\sigma/\mu(\mathcal{Q})$
scaled Jacobian	0.3748	0.9057	0.9999	0.1082	0.1194
shape	0.4939	0.9138	0.9917	0.08219	0.08994

Table 2.16: Element quality statistics of block `weld`.

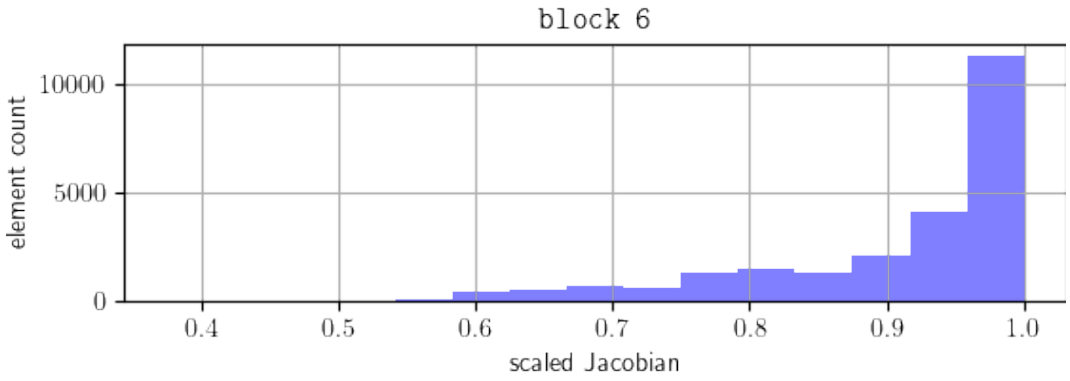

Figure 2.18: Histogram of scaled Jacobian element quality in block `weld`.

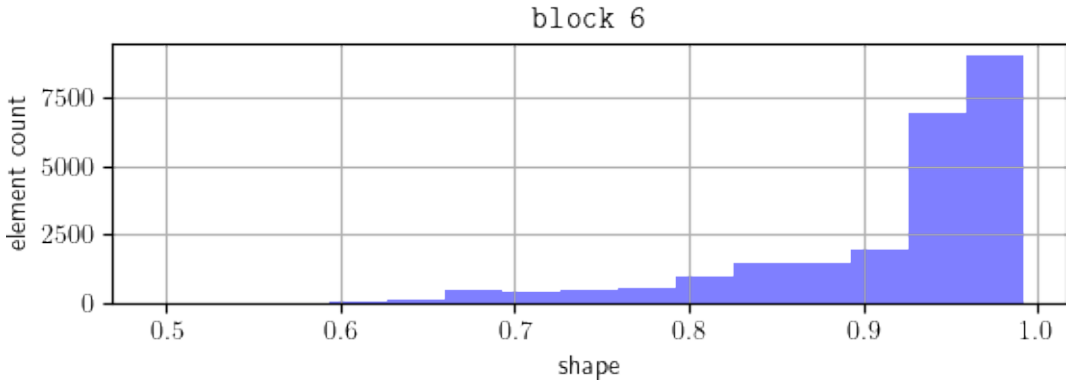

Figure 2.19: Histogram of shape element quality in block `weld`.

Block 7 (post) summary

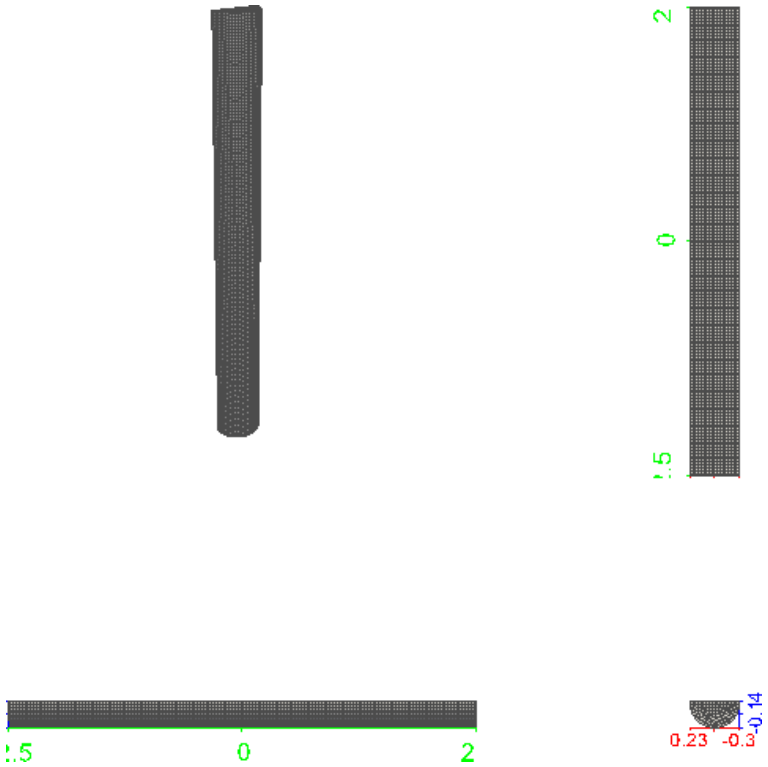

Figure 2.20: Perspective (top left) and parallel (top right: XY; bottom left: YZ; bottom right: XZ) rendering of block 7.

property	value
number of nodes	24928
number of elements	20864
type of first element in block	HEX8

Table 2.17: Properties of block post.

Block 7 (post) element quality

$\mathcal{Q}$	$\min(\mathcal{Q})$	$\mu(\mathcal{Q})$	$\max(\mathcal{Q})$	$\sigma(\mathcal{Q})$	$\sigma/\mu(\mathcal{Q})$
scaled Jacobian	0.7522	0.9528	0.9995	0.05798	0.06086
shape	0.7608	0.951	0.9988	0.05655	0.05947

Table 2.18: Element quality statistics of block post.

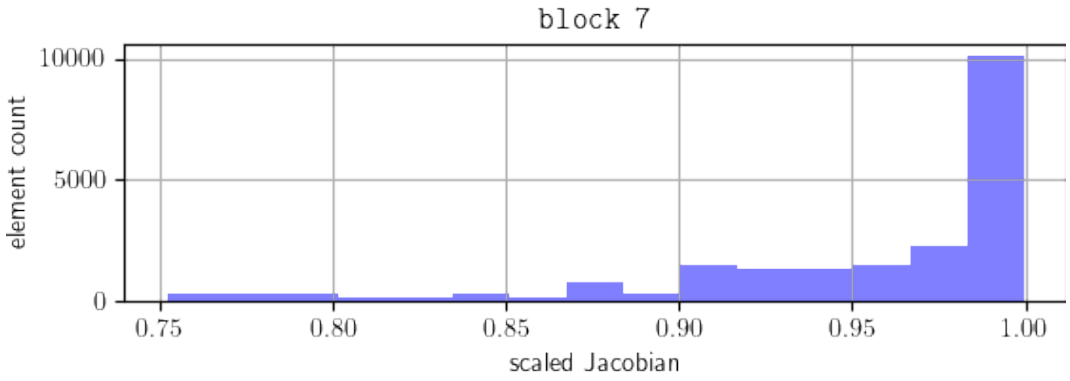

Figure 2.21: Histogram of scaled Jacobian element quality in block post.

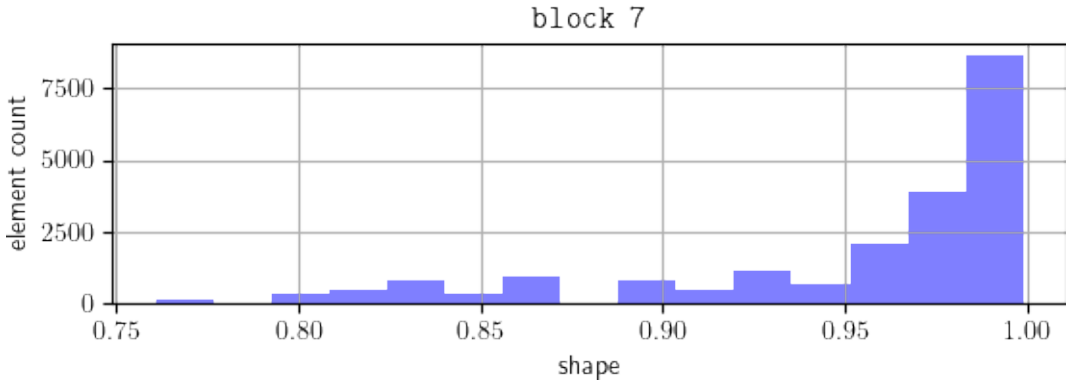

Figure 2.22: Histogram of shape element quality in block post.

Block `8` (`target`) summary

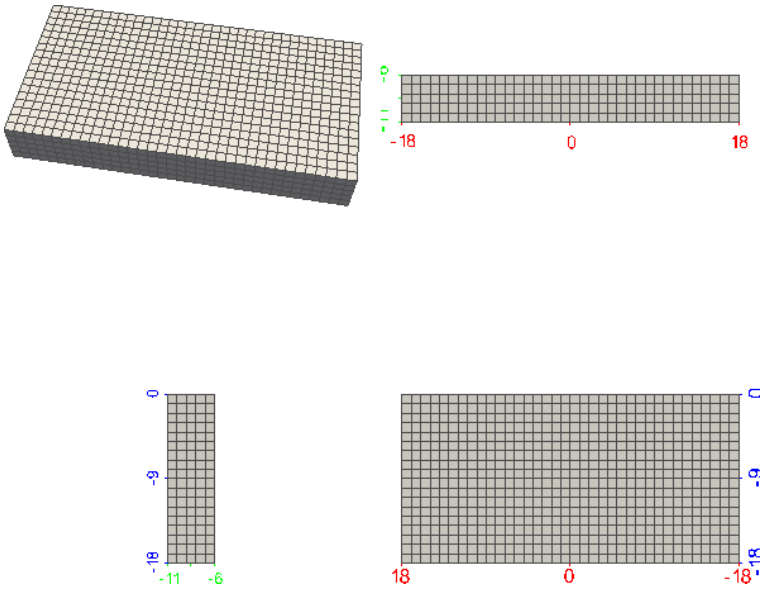

Figure 2.23: Perspective (top left) and parallel (top right: XY; bottom left: YZ; bottom right: XZ) rendering of `block 8`.

property	value
number of nodes	4218
number of elements	3240
type of first element in block	`HEX8`

Table 2.19: Properties of block `target`.

Block 8 (target) element quality

$\mathcal{Q}$	$\min(\mathcal{Q})$	$\mu(\mathcal{Q})$	$\max(\mathcal{Q})$	$\sigma(\mathcal{Q})$	$\sigma/\mu(\mathcal{Q})$
scaled Jacobian	1	1	1	0	0
shape	1	1	1	0	0

Table 2.20: Element quality statistics of block target.

Block 9 (crusher) summary

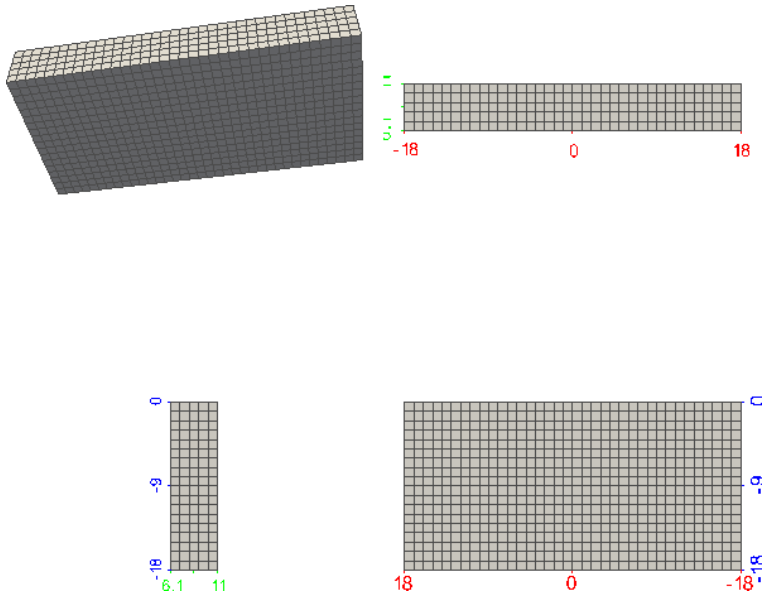

Figure 2.24: Perspective (top left) and parallel (top right: XY; bottom left: YZ; bottom right: XZ) rendering of block 9.

property	value
number of nodes	4218
number of elements	3240
type of first element in block	HEX8

Table 2.21: Properties of block crusher.

Block 9 (crusher) element quality

$\mathcal{Q}$	$\min(\mathcal{Q})$	$\mu(\mathcal{Q})$	$\max(\mathcal{Q})$	$\sigma(\mathcal{Q})$	$\sigma/\mu(\mathcal{Q})$
scaled Jacobian	1	1	1	0	0
shape	1	1	1	0	0

Table 2.22: Element quality statistics of block crusher.

Block `10` (`foam`) summary

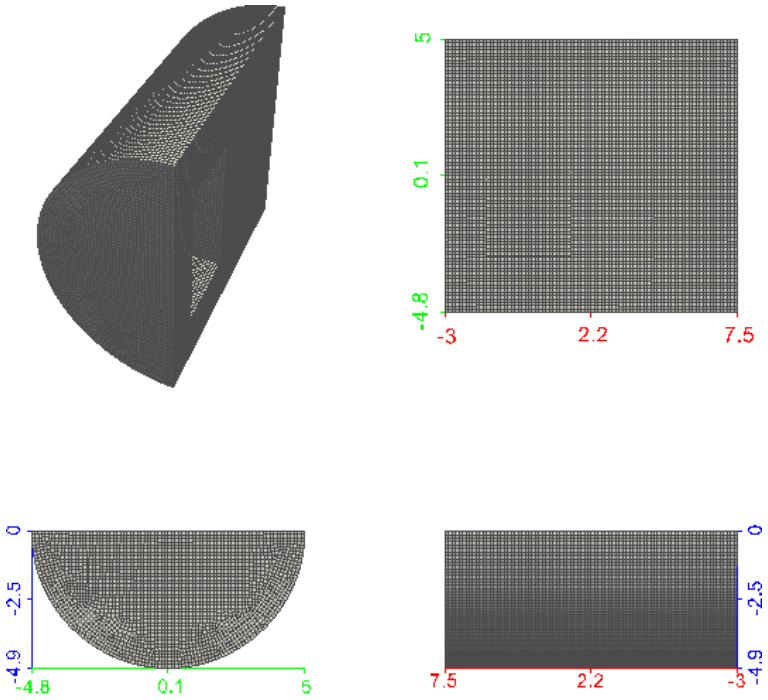

Figure 2.25: Perspective (top left) and parallel (top right: XY; bottom left: YZ; bottom right: XZ) rendering of `block 10`.

property	value
number of nodes	200666
number of elements	188376
type of first element in block	`HEX8`

Table 2.23: Properties of block `foam`.

Block `10` (`foam`) element quality

$\mathcal{Q}$	$\min(\mathcal{Q})$	$\mu(\mathcal{Q})$	$\max(\mathcal{Q})$	$\sigma(\mathcal{Q})$	$\sigma/\mu(\mathcal{Q})$
scaled Jacobian	0.6998	0.9903	1	0.03133	0.03164
shape	0.7526	0.9884	1	0.03306	0.03344

Table 2.24: Element quality statistics of block `foam`.

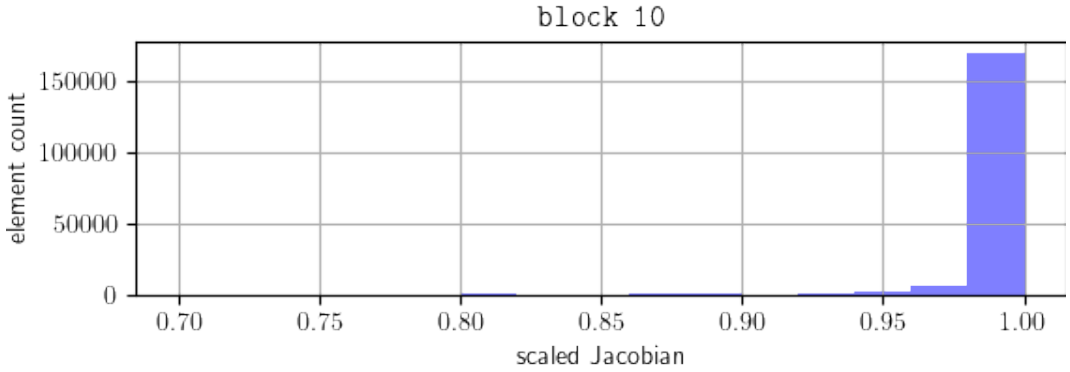

Figure 2.26: Histogram of scaled Jacobian element quality in block `foam`.

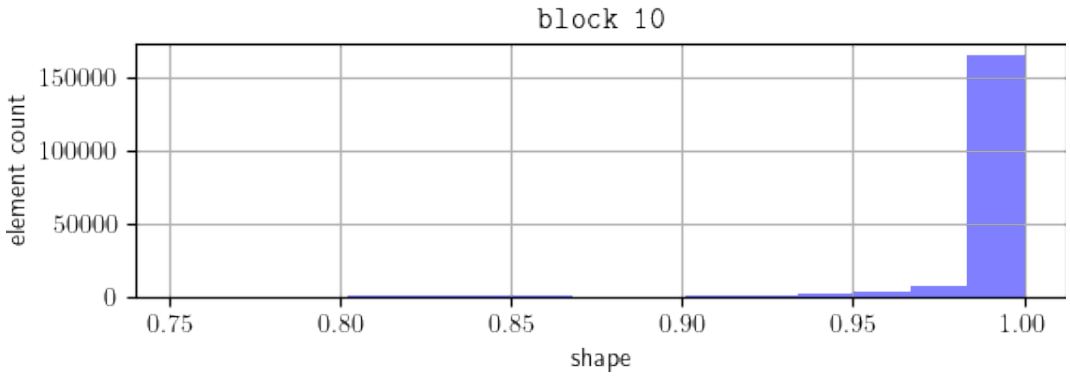

Figure 2.27: Histogram of shape element quality in block `foam`.