



wwPDB EM Validation Summary Report ⓘ

May 17, 2026 – 10:38 PM JST

PDB ID : 9X5U / pdb_00009x5u
EMDB ID : EMD-66597
Title : Arabidopsis thaliana URE transporter DUR3 - URE bound
Authors : Wang, Y.L.; Lin, H.J.; Zhang, J.R.; Fan, M.R.
Deposited on : 2025-10-14
Resolution : 3.19 Å(reported)

This is a wwPDB EM Validation Summary Report for a publicly released PDB entry.

We welcome your comments at validation@mail.wwpdb.org

A user guide is available at

<https://www.wwpdb.org/validation/2017/EMValidationReportHelp>

with specific help available everywhere you see the ⓘ symbol.

The types of validation reports are described at

<http://www.wwpdb.org/validation/2017/FAQs#types>.

The following versions of software and data (see [references ⓘ](#)) were used in the production of this report:

EMDB validation analysis : **FAILED**
Mogul : 1.8.5 (274361), CSD as541be (2020)
MolProbity : 4-5-2 with Phenix2.0
Buster-report : wwPDB partial adaption of 1.1.7 (2018)
Percentile statistics : 20250101.v01 (using entries in the PDB archive January 1st 2025)
EM percentile statistics : **NOT EXECUTED**
MapQ : **FAILED**
Ideal geometry (proteins) : Engh & Huber (2001)
Ideal geometry (DNA, RNA) : Parkinson et al. (1996)
Validation Pipeline (wwPDB-VP) : 2.49

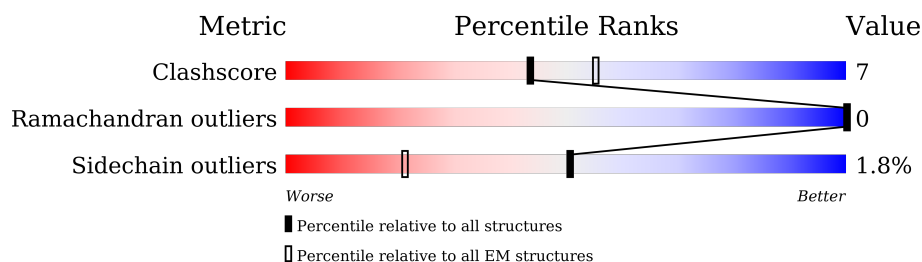
1 Overall quality at a glance

The following experimental techniques were used to determine the structure:

ELECTRON MICROSCOPY

The reported resolution of this entry is 3.19 Å.

Percentile scores (ranging between 0-100) for global validation metrics of the entry are shown in the following graphic. The table shows the number of entries on which the scores are based.



Metric	Whole archive (#Entries)	EM structures (#Entries)
Clashscore	229148	23984
Ramachandran outliers	224038	23583
Sidechain outliers	223484	23102

The table below summarises the geometric issues observed across the polymeric chains and their fit to the map. The red, orange, yellow and green segments of the bar indicate the fraction of residues that contain outliers for ≥ 3 , 2, 1 and 0 types of geometric quality criteria respectively. A grey segment represents the fraction of residues that are not modelled. The numeric value for each fraction is indicated below the corresponding segment, with a dot representing fractions $\leq 5\%$.

Mol	Chain	Length	Quality of chain
1	A	746	76% 13% 11%
1	B	746	76% 13% 11%
1	C	746	75% 14% 11%
1	D	746	75% 14% 11%

The following table lists non-polymeric compounds, carbohydrate monomers and non-standard residues in protein, DNA, RNA chains that are outliers for geometric or electron-density-fit criteria:

Mol	Type	Chain	Res	Chirality	Geometry	Clashes	Electron density
2	URE	A	801	-	X	-	-
2	URE	B	801	-	X	-	-

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Mol	Type	Chain	Res	Chirality	Geometry	Clashes	Electron density
2	URE	C	801	-	X	-	-
2	URE	D	801	-	X	-	-

2 Entry composition

There are 2 unique types of molecules in this entry. The entry contains 20232 atoms, of which 0 are hydrogens and 0 are deuteriums.

In the tables below, the AltConf column contains the number of residues with at least one atom in alternate conformation and the Trace column contains the number of residues modelled with at most 2 atoms.

- Molecule 1 is a protein called Urea-proton symporter DUR3.

Mol	Chain	Residues	Atoms					AltConf	Trace
1	A	665	Total	C	N	O	S	0	0
			5054	3320	830	877	27		
1	B	665	Total	C	N	O	S	0	0
			5054	3320	830	877	27		
1	C	665	Total	C	N	O	S	0	0
			5054	3320	830	877	27		
1	D	665	Total	C	N	O	S	0	0
			5054	3320	830	877	27		

There are 168 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
A	705	VAL	-	expression tag	UNP F4KD71
A	706	ASP	-	expression tag	UNP F4KD71
A	707	GLU	-	expression tag	UNP F4KD71
A	708	LEU	-	expression tag	UNP F4KD71
A	709	THR	-	expression tag	UNP F4KD71
A	710	SER	-	expression tag	UNP F4KD71
A	711	ARG	-	expression tag	UNP F4KD71
A	712	GLY	-	expression tag	UNP F4KD71
A	713	ARG	-	expression tag	UNP F4KD71
A	714	ASP	-	expression tag	UNP F4KD71
A	715	TYR	-	expression tag	UNP F4KD71
A	716	LYS	-	expression tag	UNP F4KD71
A	717	ASP	-	expression tag	UNP F4KD71
A	718	ASP	-	expression tag	UNP F4KD71
A	719	ASP	-	expression tag	UNP F4KD71
A	720	ASP	-	expression tag	UNP F4KD71
A	721	LYS	-	expression tag	UNP F4KD71
A	722	TRP	-	expression tag	UNP F4KD71
A	723	SER	-	expression tag	UNP F4KD71
A	724	HIS	-	expression tag	UNP F4KD71
A	725	PRO	-	expression tag	UNP F4KD71
A	726	GLN	-	expression tag	UNP F4KD71

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Chain	Residue	Modelled	Actual	Comment	Reference
A	727	PHE	-	expression tag	UNP F4KD71
A	728	GLU	-	expression tag	UNP F4KD71
A	729	LYS	-	expression tag	UNP F4KD71
A	730	GLY	-	expression tag	UNP F4KD71
A	731	GLY	-	expression tag	UNP F4KD71
A	732	GLY	-	expression tag	UNP F4KD71
A	733	GLY	-	expression tag	UNP F4KD71
A	734	SER	-	expression tag	UNP F4KD71
A	735	GLY	-	expression tag	UNP F4KD71
A	736	GLY	-	expression tag	UNP F4KD71
A	737	SER	-	expression tag	UNP F4KD71
A	738	ALA	-	expression tag	UNP F4KD71
A	739	TRP	-	expression tag	UNP F4KD71
A	740	SER	-	expression tag	UNP F4KD71
A	741	HIS	-	expression tag	UNP F4KD71
A	742	PRO	-	expression tag	UNP F4KD71
A	743	GLN	-	expression tag	UNP F4KD71
A	744	PHE	-	expression tag	UNP F4KD71
A	745	GLU	-	expression tag	UNP F4KD71
A	746	LYS	-	expression tag	UNP F4KD71
B	705	VAL	-	expression tag	UNP F4KD71
B	706	ASP	-	expression tag	UNP F4KD71
B	707	GLU	-	expression tag	UNP F4KD71
B	708	LEU	-	expression tag	UNP F4KD71
B	709	THR	-	expression tag	UNP F4KD71
B	710	SER	-	expression tag	UNP F4KD71
B	711	ARG	-	expression tag	UNP F4KD71
B	712	GLY	-	expression tag	UNP F4KD71
B	713	ARG	-	expression tag	UNP F4KD71
B	714	ASP	-	expression tag	UNP F4KD71
B	715	TYR	-	expression tag	UNP F4KD71
B	716	LYS	-	expression tag	UNP F4KD71
B	717	ASP	-	expression tag	UNP F4KD71
B	718	ASP	-	expression tag	UNP F4KD71
B	719	ASP	-	expression tag	UNP F4KD71
B	720	ASP	-	expression tag	UNP F4KD71
B	721	LYS	-	expression tag	UNP F4KD71
B	722	TRP	-	expression tag	UNP F4KD71
B	723	SER	-	expression tag	UNP F4KD71
B	724	HIS	-	expression tag	UNP F4KD71
B	725	PRO	-	expression tag	UNP F4KD71
B	726	GLN	-	expression tag	UNP F4KD71

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Chain	Residue	Modelled	Actual	Comment	Reference
B	727	PHE	-	expression tag	UNP F4KD71
B	728	GLU	-	expression tag	UNP F4KD71
B	729	LYS	-	expression tag	UNP F4KD71
B	730	GLY	-	expression tag	UNP F4KD71
B	731	GLY	-	expression tag	UNP F4KD71
B	732	GLY	-	expression tag	UNP F4KD71
B	733	GLY	-	expression tag	UNP F4KD71
B	734	SER	-	expression tag	UNP F4KD71
B	735	GLY	-	expression tag	UNP F4KD71
B	736	GLY	-	expression tag	UNP F4KD71
B	737	SER	-	expression tag	UNP F4KD71
B	738	ALA	-	expression tag	UNP F4KD71
B	739	TRP	-	expression tag	UNP F4KD71
B	740	SER	-	expression tag	UNP F4KD71
B	741	HIS	-	expression tag	UNP F4KD71
B	742	PRO	-	expression tag	UNP F4KD71
B	743	GLN	-	expression tag	UNP F4KD71
B	744	PHE	-	expression tag	UNP F4KD71
B	745	GLU	-	expression tag	UNP F4KD71
B	746	LYS	-	expression tag	UNP F4KD71
C	705	VAL	-	expression tag	UNP F4KD71
C	706	ASP	-	expression tag	UNP F4KD71
C	707	GLU	-	expression tag	UNP F4KD71
C	708	LEU	-	expression tag	UNP F4KD71
C	709	THR	-	expression tag	UNP F4KD71
C	710	SER	-	expression tag	UNP F4KD71
C	711	ARG	-	expression tag	UNP F4KD71
C	712	GLY	-	expression tag	UNP F4KD71
C	713	ARG	-	expression tag	UNP F4KD71
C	714	ASP	-	expression tag	UNP F4KD71
C	715	TYR	-	expression tag	UNP F4KD71
C	716	LYS	-	expression tag	UNP F4KD71
C	717	ASP	-	expression tag	UNP F4KD71
C	718	ASP	-	expression tag	UNP F4KD71
C	719	ASP	-	expression tag	UNP F4KD71
C	720	ASP	-	expression tag	UNP F4KD71
C	721	LYS	-	expression tag	UNP F4KD71
C	722	TRP	-	expression tag	UNP F4KD71
C	723	SER	-	expression tag	UNP F4KD71
C	724	HIS	-	expression tag	UNP F4KD71
C	725	PRO	-	expression tag	UNP F4KD71
C	726	GLN	-	expression tag	UNP F4KD71

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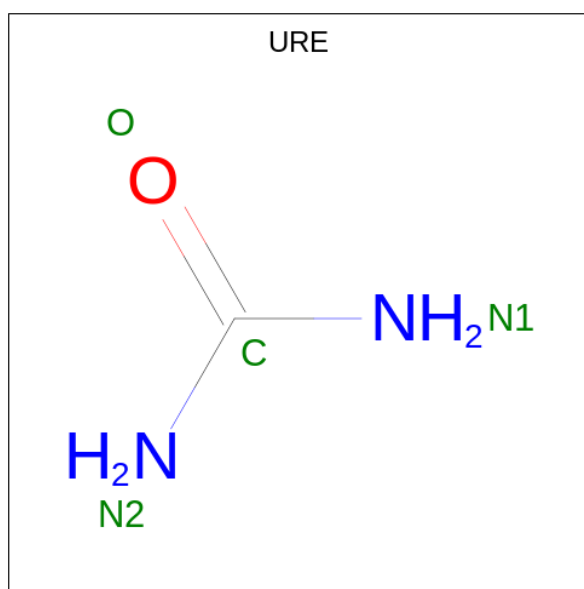
Chain	Residue	Modelled	Actual	Comment	Reference
C	727	PHE	-	expression tag	UNP F4KD71
C	728	GLU	-	expression tag	UNP F4KD71
C	729	LYS	-	expression tag	UNP F4KD71
C	730	GLY	-	expression tag	UNP F4KD71
C	731	GLY	-	expression tag	UNP F4KD71
C	732	GLY	-	expression tag	UNP F4KD71
C	733	GLY	-	expression tag	UNP F4KD71
C	734	SER	-	expression tag	UNP F4KD71
C	735	GLY	-	expression tag	UNP F4KD71
C	736	GLY	-	expression tag	UNP F4KD71
C	737	SER	-	expression tag	UNP F4KD71
C	738	ALA	-	expression tag	UNP F4KD71
C	739	TRP	-	expression tag	UNP F4KD71
C	740	SER	-	expression tag	UNP F4KD71
C	741	HIS	-	expression tag	UNP F4KD71
C	742	PRO	-	expression tag	UNP F4KD71
C	743	GLN	-	expression tag	UNP F4KD71
C	744	PHE	-	expression tag	UNP F4KD71
C	745	GLU	-	expression tag	UNP F4KD71
C	746	LYS	-	expression tag	UNP F4KD71
D	705	VAL	-	expression tag	UNP F4KD71
D	706	ASP	-	expression tag	UNP F4KD71
D	707	GLU	-	expression tag	UNP F4KD71
D	708	LEU	-	expression tag	UNP F4KD71
D	709	THR	-	expression tag	UNP F4KD71
D	710	SER	-	expression tag	UNP F4KD71
D	711	ARG	-	expression tag	UNP F4KD71
D	712	GLY	-	expression tag	UNP F4KD71
D	713	ARG	-	expression tag	UNP F4KD71
D	714	ASP	-	expression tag	UNP F4KD71
D	715	TYR	-	expression tag	UNP F4KD71
D	716	LYS	-	expression tag	UNP F4KD71
D	717	ASP	-	expression tag	UNP F4KD71
D	718	ASP	-	expression tag	UNP F4KD71
D	719	ASP	-	expression tag	UNP F4KD71
D	720	ASP	-	expression tag	UNP F4KD71
D	721	LYS	-	expression tag	UNP F4KD71
D	722	TRP	-	expression tag	UNP F4KD71
D	723	SER	-	expression tag	UNP F4KD71
D	724	HIS	-	expression tag	UNP F4KD71
D	725	PRO	-	expression tag	UNP F4KD71
D	726	GLN	-	expression tag	UNP F4KD71

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Chain	Residue	Modelled	Actual	Comment	Reference
D	727	PHE	-	expression tag	UNP F4KD71
D	728	GLU	-	expression tag	UNP F4KD71
D	729	LYS	-	expression tag	UNP F4KD71
D	730	GLY	-	expression tag	UNP F4KD71
D	731	GLY	-	expression tag	UNP F4KD71
D	732	GLY	-	expression tag	UNP F4KD71
D	733	GLY	-	expression tag	UNP F4KD71
D	734	SER	-	expression tag	UNP F4KD71
D	735	GLY	-	expression tag	UNP F4KD71
D	736	GLY	-	expression tag	UNP F4KD71
D	737	SER	-	expression tag	UNP F4KD71
D	738	ALA	-	expression tag	UNP F4KD71
D	739	TRP	-	expression tag	UNP F4KD71
D	740	SER	-	expression tag	UNP F4KD71
D	741	HIS	-	expression tag	UNP F4KD71
D	742	PRO	-	expression tag	UNP F4KD71
D	743	GLN	-	expression tag	UNP F4KD71
D	744	PHE	-	expression tag	UNP F4KD71
D	745	GLU	-	expression tag	UNP F4KD71
D	746	LYS	-	expression tag	UNP F4KD71

- Molecule 2 is UREA (CCD ID: URE) (formula: $\text{CH}_4\text{N}_2\text{O}$) (labeled as "Ligand of Interest" by depositor).



Mol	Chain	Residues	Atoms				AltConf
2	A	1	Total	C	N	O	0
			4	1	2	1	

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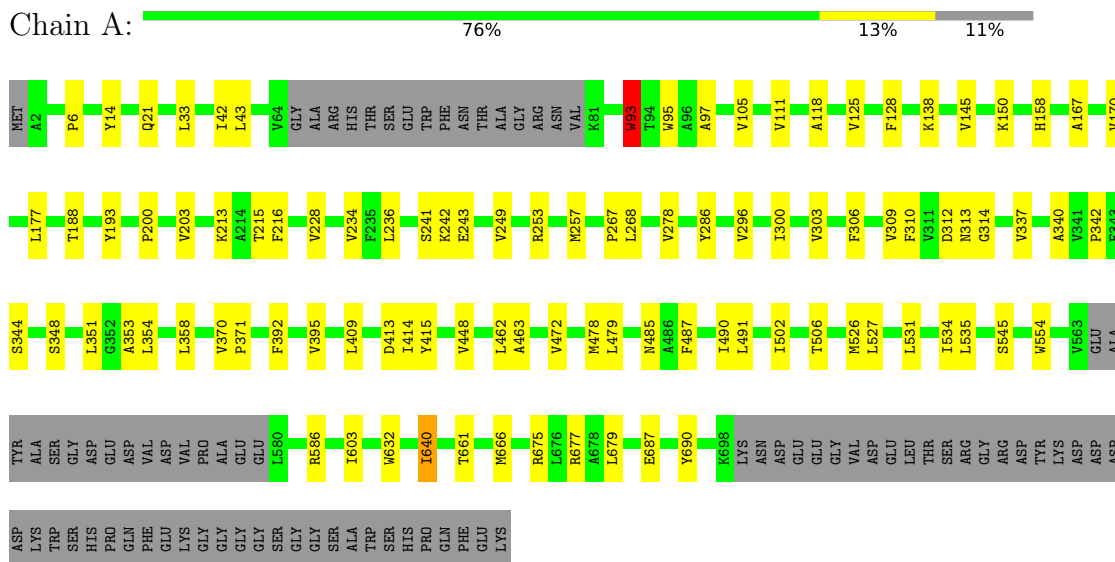
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Mol	Chain	Residues	Atoms				AltConf
2	B	1	Total 4	C 1	N 2	O 1	0
2	C	1	Total 4	C 1	N 2	O 1	0
2	D	1	Total 4	C 1	N 2	O 1	0

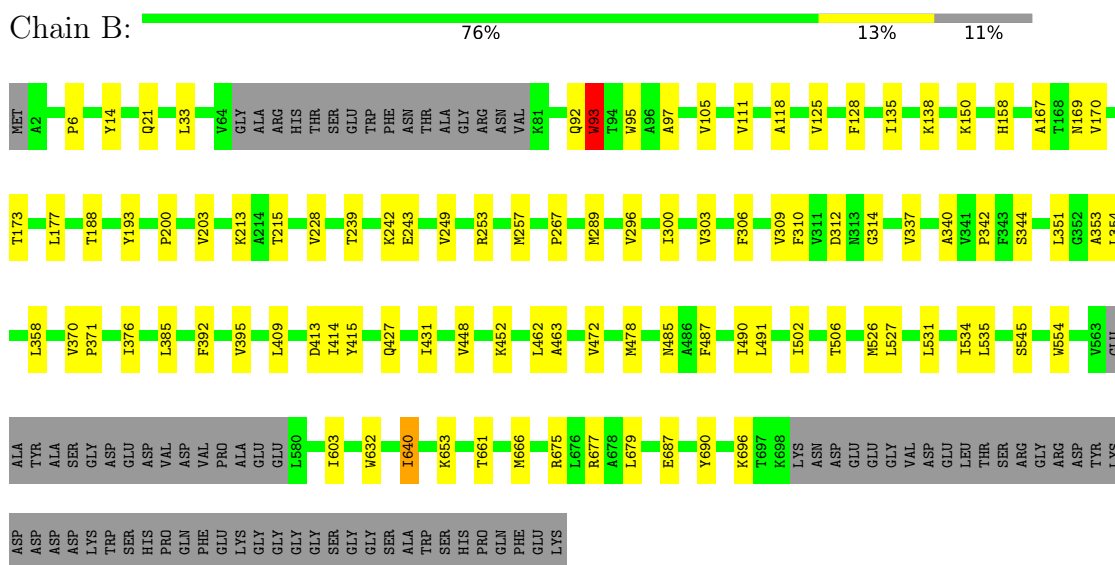
3 Residue-property plots

These plots are drawn for all protein, RNA, DNA and oligosaccharide chains in the entry. The first graphic for a chain summarises the proportions of the various outlier classes displayed in the second graphic. The second graphic shows the sequence view annotated by issues in geometry. Residues are color-coded according to the number of geometric quality criteria for which they contain at least one outlier: green = 0, yellow = 1, orange = 2 and red = 3 or more. Stretches of 2 or more consecutive residues without any outlier are shown as a green connector. Residues present in the sample, but not in the model, are shown in grey.

• Molecule 1: Urea-proton symporter DUR3

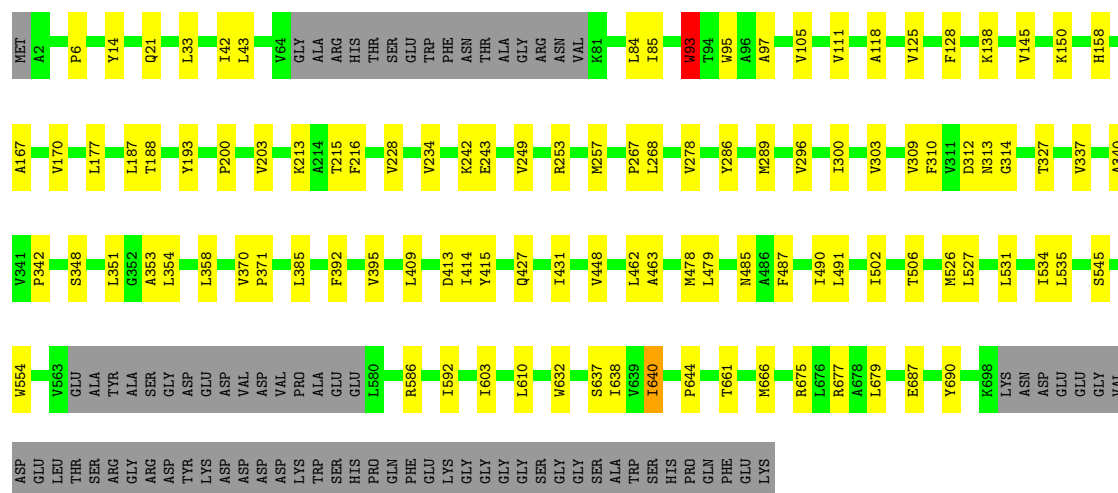


• Molecule 1: Urea-proton symporter DUR3



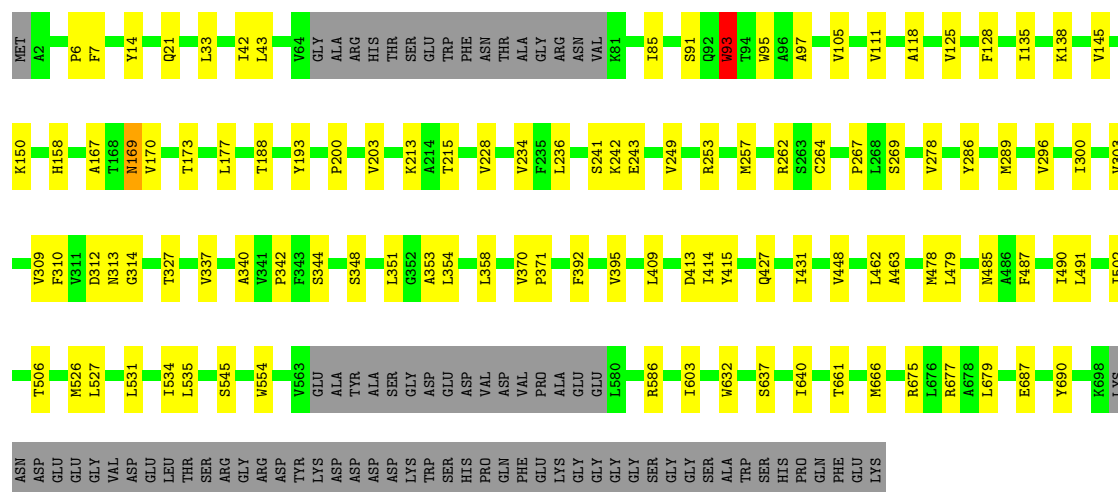
• Molecule 1: Urea-proton symporter DUR3

Chain C:  75% 14% 11%



- Molecule 1: Urea-proton symporter DUR3

Chain D:  75% 14% 11%



4 Experimental information

Property	Value	Source
EM reconstruction method	SINGLE PARTICLE	Depositor
Imposed symmetry	POINT, Not provided	
Number of particles used	174450	Depositor
Resolution determination method	FSC 0.143 CUT-OFF	Depositor
CTF correction method	PHASE FLIPPING AND AMPLITUDE CORRECTION	Depositor
Microscope	FEI TALOS ARCTICA	Depositor
Voltage (kV)	300	Depositor
Electron dose ($e^-/\text{\AA}^2$)	50	Depositor
Minimum defocus (nm)	1500	Depositor
Maximum defocus (nm)	3000	Depositor
Magnification	Not provided	
Image detector	FEI FALCON IV (4k x 4k)	Depositor

5 Model quality [i](#)

5.1 Standard geometry [i](#)

Bond lengths and bond angles in the following residue types are not validated in this section: URE

The Z score for a bond length (or angle) is the number of standard deviations the observed value is removed from the expected value. A bond length (or angle) with $|Z| > 5$ is considered an outlier worth inspection. RMSZ is the root-mean-square of all Z scores of the bond lengths (or angles).

Mol	Chain	Bond lengths		Bond angles	
		RMSZ	$\# Z > 5$	RMSZ	$\# Z > 5$
1	A	0.22	2/5176 (0.0%)	0.39	2/7049 (0.0%)
1	B	0.22	2/5176 (0.0%)	0.39	2/7049 (0.0%)
1	C	0.22	2/5176 (0.0%)	0.39	2/7049 (0.0%)
1	D	0.22	2/5176 (0.0%)	0.39	2/7049 (0.0%)
All	All	0.22	8/20704 (0.0%)	0.39	8/28196 (0.0%)

Chiral center outliers are detected by calculating the chiral volume of a chiral center and verifying if the center is modelled as a planar moiety or with the opposite hand. A planarity outlier is detected by checking planarity of atoms in a peptide group, atoms in a mainchain group or atoms of a sidechain that are expected to be planar.

Mol	Chain	#Chirality outliers	#Planarity outliers
1	A	0	1
1	B	0	1
1	C	0	1
1	D	0	1
All	All	0	4

The worst 5 of 8 bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
1	C	93	TRP	CA-C	-8.23	1.41	1.52
1	A	93	TRP	CA-C	-8.14	1.42	1.52
1	B	93	TRP	CA-C	-8.14	1.42	1.52
1	D	93	TRP	CA-C	-8.11	1.42	1.52
1	B	93	TRP	C-O	-7.04	1.14	1.24

The worst 5 of 8 bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
1	A	415	TYR	N-CA-C	-6.40	106.69	114.75
1	A	93	TRP	CB-CA-C	-6.13	99.32	109.99
1	C	93	TRP	CB-CA-C	-6.05	99.45	109.99
1	D	93	TRP	CB-CA-C	-6.03	99.50	109.99
1	B	93	TRP	CB-CA-C	-6.01	99.53	109.99

There are no chirality outliers.

All (4) planarity outliers are listed below:

Mol	Chain	Res	Type	Group
1	A	414	ILE	Peptide
1	B	414	ILE	Peptide
1	C	414	ILE	Peptide
1	D	414	ILE	Peptide

5.2 Too-close contacts ⓘ

In the following table, the Non-H and H(model) columns list the number of non-hydrogen atoms and hydrogen atoms in the chain respectively. The H(added) column lists the number of hydrogen atoms added and optimized by MolProbity. The Clashes column lists the number of clashes within the asymmetric unit, whereas Symm-Clashes lists symmetry-related clashes.

Mol	Chain	Non-H	H(model)	H(added)	Clashes	Symm-Clashes
1	A	5054	0	5199	69	0
1	B	5054	0	5199	66	0
1	C	5054	0	5199	70	0
1	D	5054	0	5199	70	0
2	A	4	0	4	0	0
2	B	4	0	4	0	0
2	C	4	0	4	0	0
2	D	4	0	4	0	0
All	All	20232	0	20812	267	0

The all-atom clashscore is defined as the number of clashes found per 1000 atoms (including hydrogen atoms). The all-atom clashscore for this structure is 7.

The worst 5 of 267 close contacts within the same asymmetric unit are listed below, sorted by their clash magnitude.

Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:C:487:PHE:O	1:C:490:ILE:HB	1.86	0.76

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:B:487:PHE:O	1:B:490:ILE:HB	1.86	0.75
1:D:487:PHE:O	1:D:490:ILE:HB	1.86	0.74
1:A:487:PHE:O	1:A:490:ILE:HB	1.86	0.73
1:D:95:TRP:HD1	1:D:97:ALA:H	1.42	0.67

There are no symmetry-related clashes.

5.3 Torsion angles [i](#)

5.3.1 Protein backbone [i](#)

In the following table, the Percentiles column shows the percent Ramachandran outliers of the chain as a percentile score with respect to all PDB entries followed by that with respect to all EM entries.

The Analysed column shows the number of residues for which the backbone conformation was analysed, and the total number of residues.

Mol	Chain	Analysed	Favoured	Allowed	Outliers	Percentiles	
1	A	659/746 (88%)	623 (94%)	36 (6%)	0	100	100
1	B	659/746 (88%)	621 (94%)	38 (6%)	0	100	100
1	C	659/746 (88%)	623 (94%)	36 (6%)	0	100	100
1	D	659/746 (88%)	622 (94%)	37 (6%)	0	100	100
All	All	2636/2984 (88%)	2489 (94%)	147 (6%)	0	100	100

There are no Ramachandran outliers to report.

5.3.2 Protein sidechains [i](#)

In the following table, the Percentiles column shows the percent sidechain outliers of the chain as a percentile score with respect to all PDB entries followed by that with respect to all EM entries.

The Analysed column shows the number of residues for which the sidechain conformation was analysed, and the total number of residues.

Mol	Chain	Analysed	Rotameric	Outliers	Percentiles	
1	A	534/598 (89%)	526 (98%)	8 (2%)	57	76
1	B	534/598 (89%)	524 (98%)	10 (2%)	50	73

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Mol	Chain	Analysed	Rotameric	Outliers	Percentiles	
1	C	534/598 (89%)	524 (98%)	10 (2%)	50	73
1	D	534/598 (89%)	524 (98%)	10 (2%)	50	73
All	All	2136/2392 (89%)	2098 (98%)	38 (2%)	51	74

5 of 38 residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	D	91	SER
1	D	603	ILE
1	D	93	TRP
1	D	169	ASN
1	D	661	THR

Sometimes sidechains can be flipped to improve hydrogen bonding and reduce clashes. 5 of 6 such sidechains are listed below:

Mol	Chain	Res	Type
1	B	485	ASN
1	C	270	HIS
1	D	270	HIS
1	B	92	GLN
1	A	270	HIS

5.3.3 RNA [i](#)

There are no RNA molecules in this entry.

5.4 Non-standard residues in protein, DNA, RNA chains [i](#)

There are no non-standard protein/DNA/RNA residues in this entry.

5.5 Carbohydrates [i](#)

There are no oligosaccharides in this entry.

5.6 Ligand geometry [i](#)

4 ligands are modelled in this entry.

In the following table, the Counts columns list the number of bonds (or angles) for which Mogul statistics could be retrieved, the number of bonds (or angles) that are observed in the model and the number of bonds (or angles) that are defined in the Chemical Component Dictionary. The Link column lists molecule types, if any, to which the group is linked. The Z score for a bond length (or angle) is the number of standard deviations the observed value is removed from the expected value. A bond length (or angle) with $|Z| > 2$ is considered an outlier worth inspection. RMSZ is the root-mean-square of all Z scores of the bond lengths (or angles).

Mol	Type	Chain	Res	Link	Bond lengths			Bond angles		
					Counts	RMSZ	# Z > 2	Counts	RMSZ	# Z > 2
2	URE	B	801	-	3,3,3	3.51	3 (100%)	3,3,3	0.73	0
2	URE	A	801	-	3,3,3	3.51	3 (100%)	3,3,3	0.75	0
2	URE	D	801	-	3,3,3	3.50	3 (100%)	3,3,3	0.74	0
2	URE	C	801	-	3,3,3	3.51	3 (100%)	3,3,3	0.76	0

The worst 5 of 12 bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
2	A	801	URE	C-N2	4.10	1.45	1.34
2	C	801	URE	C-N2	4.07	1.45	1.34
2	B	801	URE	C-N2	4.06	1.45	1.34
2	D	801	URE	C-N1	4.05	1.45	1.34
2	D	801	URE	C-N2	4.04	1.45	1.34

There are no bond angle outliers.

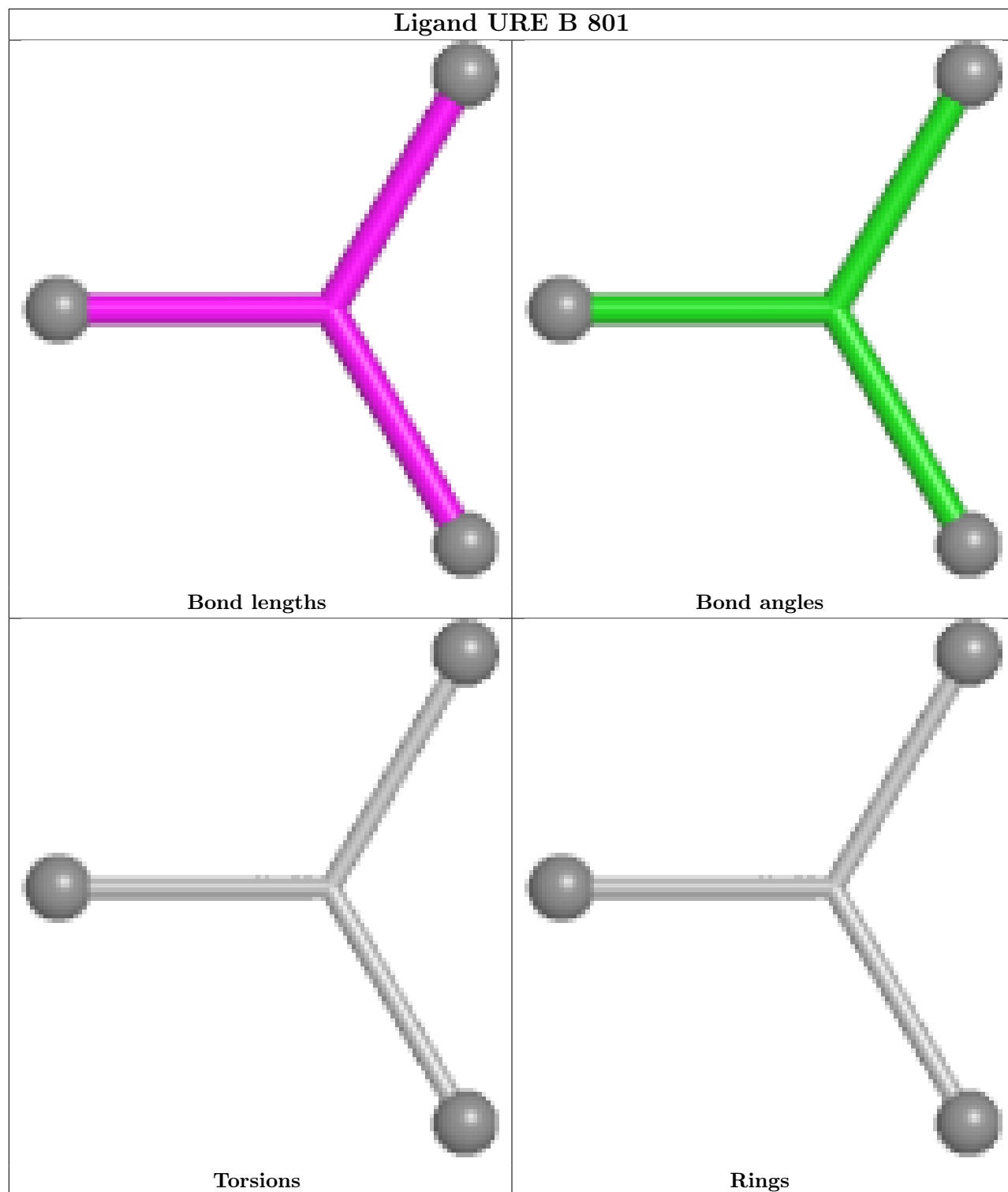
There are no chirality outliers.

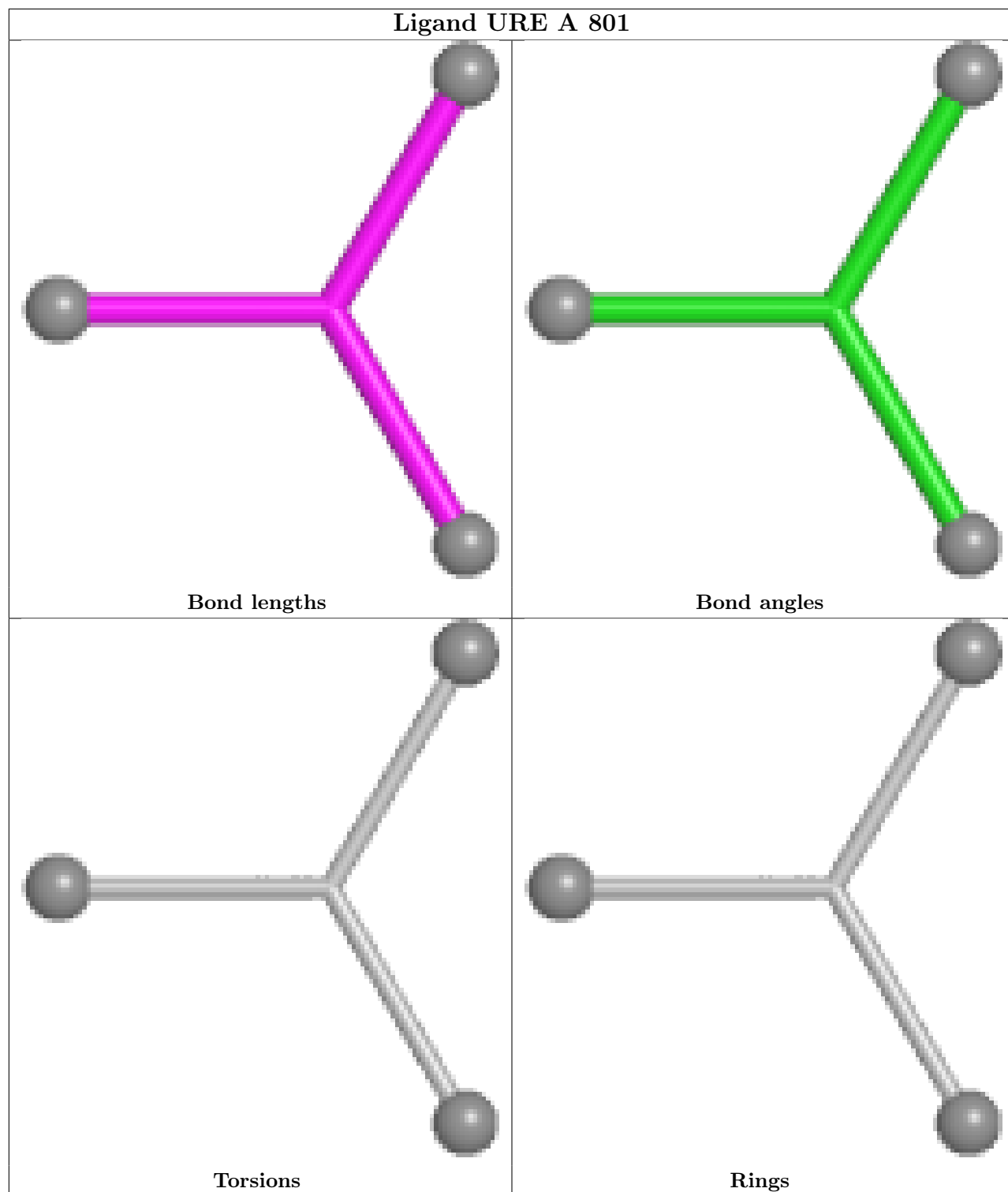
There are no torsion outliers.

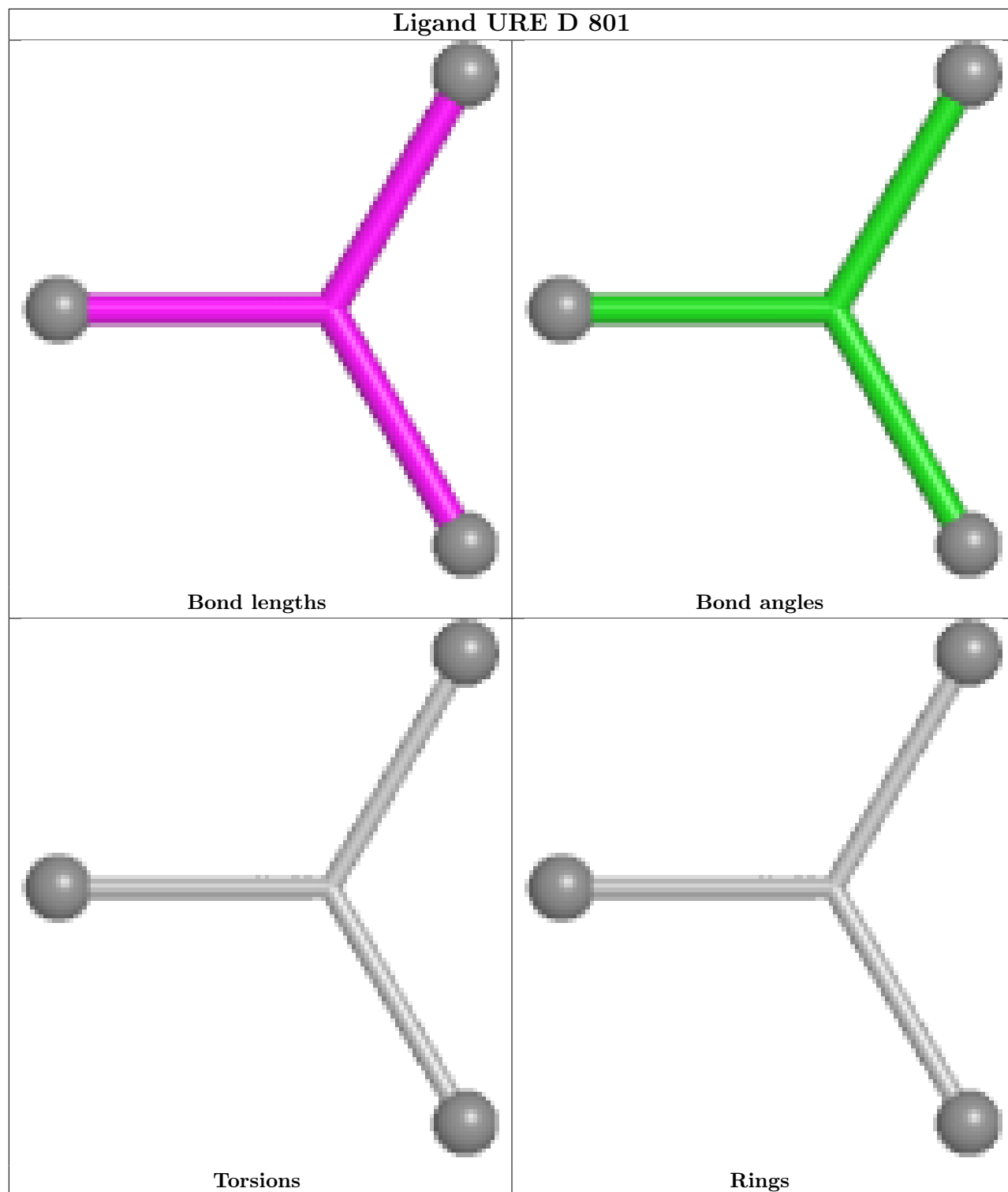
There are no ring outliers.

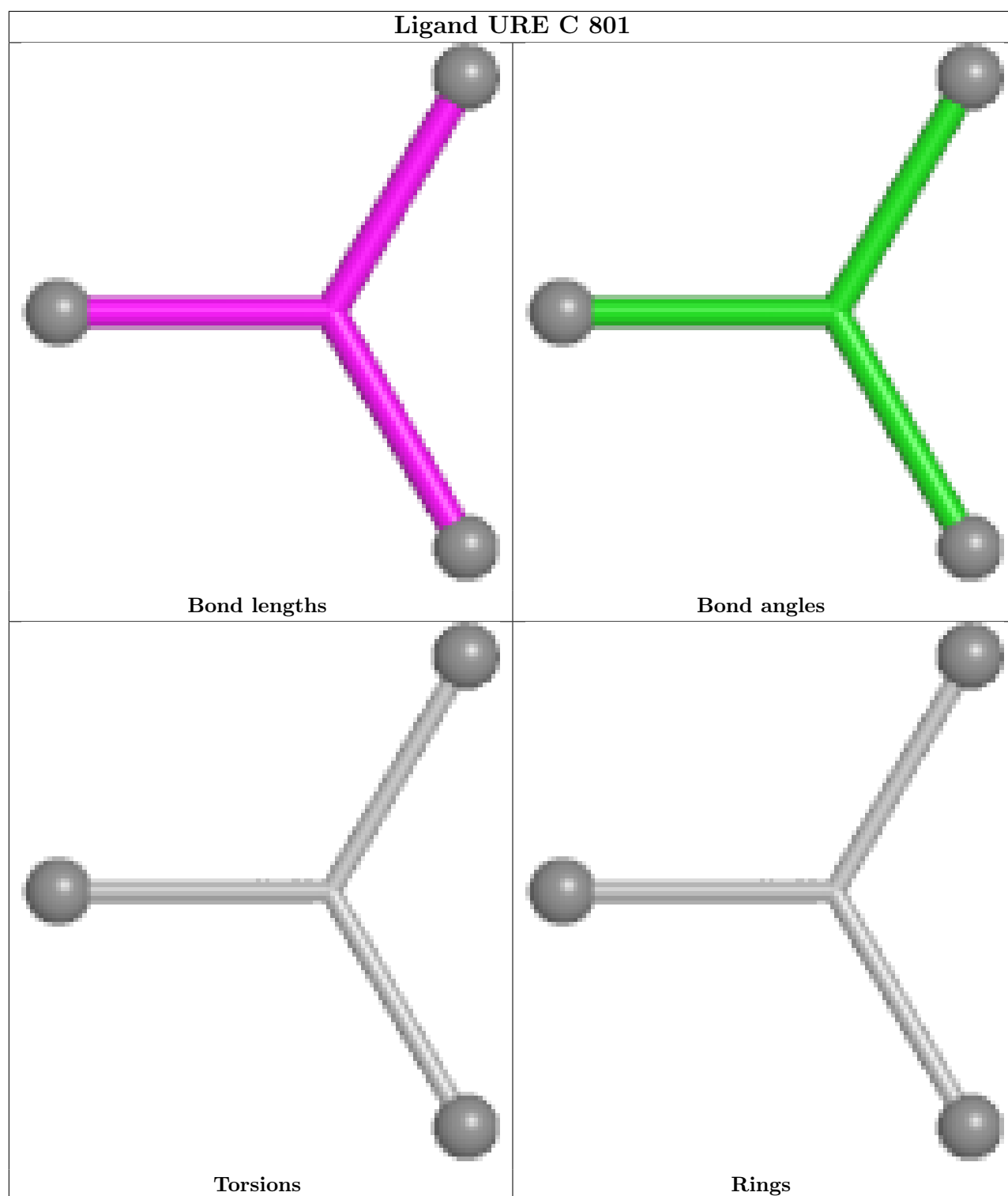
No monomer is involved in short contacts.

The following is a two-dimensional graphical depiction of Mogul quality analysis of bond lengths, bond angles, torsion angles, and ring geometry for all instances of the Ligand of Interest. In addition, ligands with molecular weight > 250 and outliers as shown on the validation Tables will also be included. For torsion angles, if less than 5% of the Mogul distribution of torsion angles is within 10 degrees of the torsion angle in question, then that torsion angle is considered an outlier. Any bond that is central to one or more torsion angles identified as an outlier by Mogul will be highlighted in the graph. For rings, the root-mean-square deviation (RMSD) between the ring in question and similar rings identified by Mogul is calculated over all ring torsion angles. If the average RMSD is greater than 60 degrees and the minimal RMSD between the ring in question and any Mogul-identified rings is also greater than 60 degrees, then that ring is considered an outlier. The outliers are highlighted in purple. The color gray indicates Mogul did not find sufficient equivalents in the CSD to analyse the geometry.









5.7 Other polymers [i](#)

There are no such residues in this entry.

5.8 Polymer linkage issues ⓘ

There are no chain breaks in this entry.