



Full wwPDB EM Validation Report ⓘ

Jul 16, 2025 – 02:08 AM JST

PDB ID : 8ZSB / pdb_00008zsb
EMDB ID : EMD-60410
Title : Cryo-EM structure of human ZnT1, in the absence of zinc, determined in outward-facing conformation
Authors : Ma, J.; Zheng, S.
Deposited on : 2024-06-05
Resolution : 3.26 Å(reported)

This is a Full wwPDB EM Validation 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**
MolProbity : 4-5-2 with Phenix2.0rc1
Percentile statistics : 20231227.v01 (using entries in the PDB archive December 27th 2023)
MapQ : **FAILED**
Ideal geometry (proteins) : Engh & Huber (2001)
Ideal geometry (DNA, RNA) : Parkinson et al. (1996)
Validation Pipeline (wwPDB-VP) : 2.44

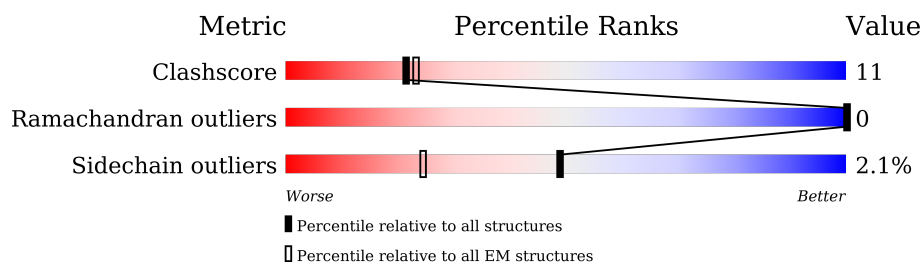
1 Overall quality at a glance

The following experimental techniques were used to determine the structure:

ELECTRON MICROSCOPY

The reported resolution of this entry is 3.26 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	210492	15764
Ramachandran outliers	207382	16835
Sidechain outliers	206894	16415

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	507	
1	B	507	

2 Entry composition

There are 2 unique types of molecules in this entry. The entry contains 4798 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 Proton-coupled zinc antiporter SLC30A1.

Mol	Chain	Residues	Atoms					AltConf	Trace
1	A	307	Total	C	N	O	S	1	0
			2398	1557	405	415	21		
1	B	307	Total	C	N	O	S	1	0
			2398	1557	405	415	21		

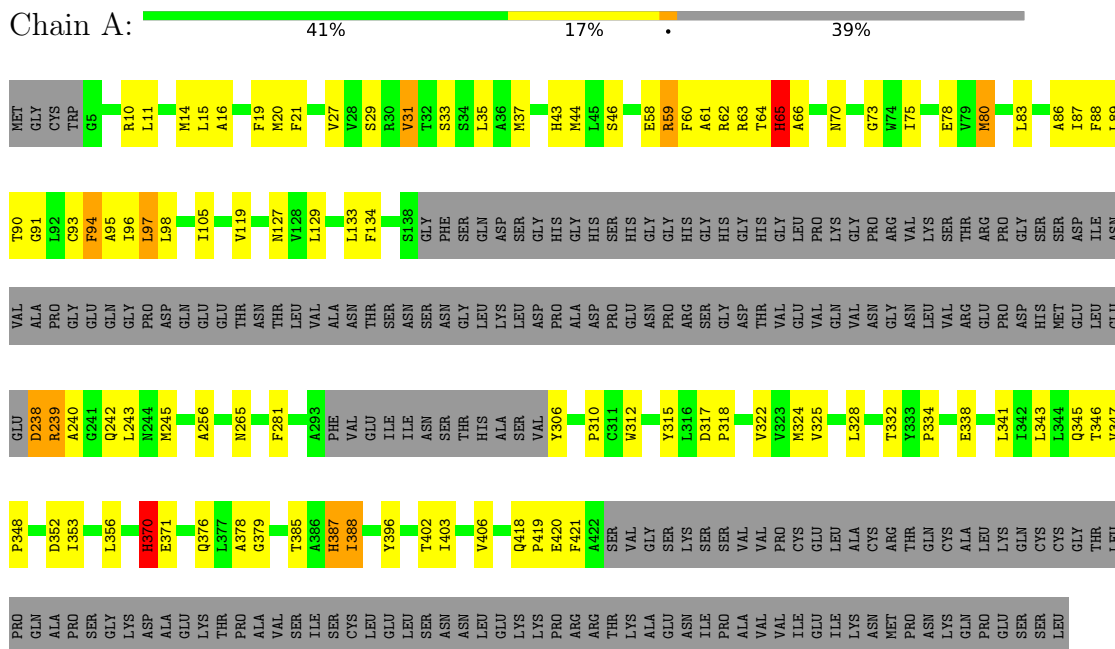
- Molecule 2 is ZINC ION (CCD ID: ZN) (formula: Zn) (labeled as "Ligand of Interest" by depositor).

Mol	Chain	Residues	Atoms		AltConf
2	A	1	Total	Zn	0
			1	1	
2	B	1	Total	Zn	0
			1	1	

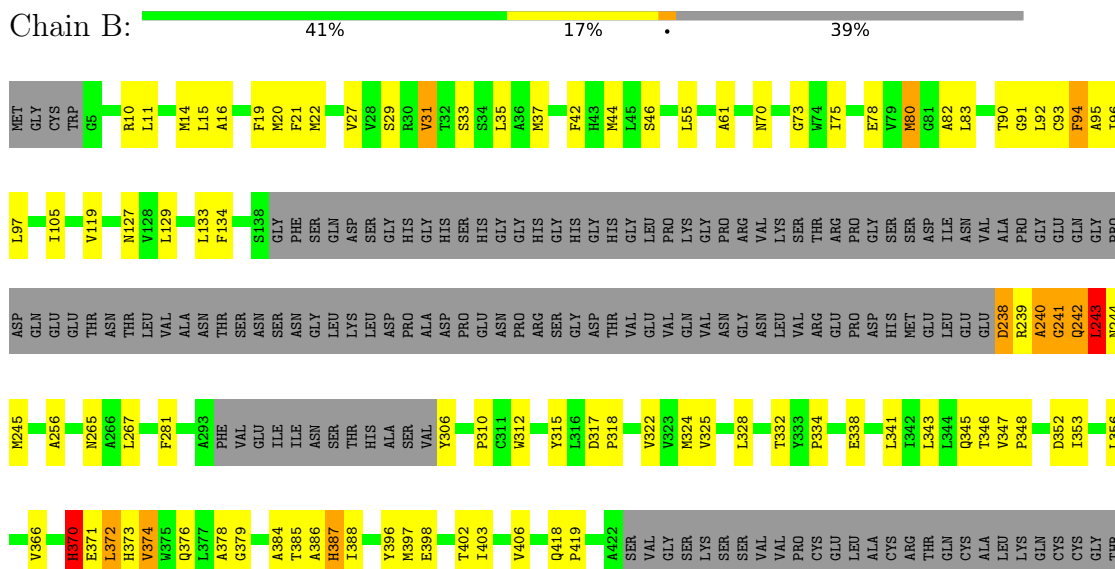
3 Residue-property plots

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: Proton-coupled zinc antiporter SLC30A1



• Molecule 1: Proton-coupled zinc antiporter SLC30A1



LEU
PRO
GLN
ALA
PRO
SER
GLY
LYS
ASP
ALA
GLU
LYS
THR
PRO
ALA
VAL
SER
ILE
SER
CYS
LEU
GLU
LEU
SER
ASN
ASN
LEU
GLU
LYS
LYS
PRO
ARG
ARG
THR
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LYS
ALA
GLU
ASN
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ALA
VAL
VAL
ILE
GLU
ILE
LYS
LYS
ASN
MET
PRO
ASN
LYS
GLN
PRO
GLU
SER
SER
LEU

4 Experimental information

Property	Value	Source
EM reconstruction method	SINGLE PARTICLE	Depositor
Imposed symmetry	POINT, Not provided	
Number of particles used	709780	Depositor
Resolution determination method	FSC 0.143 CUT-OFF	Depositor
CTF correction method	PHASE FLIPPING AND AMPLITUDE CORRECTION	Depositor
Microscope	FEI TITAN KRIOS	Depositor
Voltage (kV)	300	Depositor
Electron dose ($e^-/\text{\AA}^2$)	50	Depositor
Minimum defocus (nm)	1230	Depositor
Maximum defocus (nm)	3250	Depositor
Magnification	64000	Depositor
Image detector	GATAN K3 BIOQUANTUM (6k x 4k)	Depositor

5 Model quality ⓘ

5.1 Standard geometry ⓘ

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

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	0.87	18/2453 (0.7%)	0.89	21/3334 (0.6%)
1	B	0.88	21/2453 (0.9%)	0.74	12/3334 (0.4%)
All	All	0.88	39/4906 (0.8%)	0.82	33/6668 (0.5%)

All (39) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
1	B	372	LEU	CA-C	-8.59	1.42	1.52
1	A	59	ARG	CA-C	-8.45	1.42	1.52
1	B	244	ASN	CA-C	-8.29	1.42	1.52
1	B	243	LEU	C-O	-8.24	1.14	1.24
1	B	95	ALA	CA-CB	-8.16	1.40	1.53
1	A	95	ALA	CA-CB	-8.12	1.40	1.53
1	B	90	THR	C-O	-7.74	1.15	1.24
1	A	90	THR	CA-C	-7.65	1.42	1.52
1	B	90	THR	CA-C	-7.37	1.43	1.52
1	B	90	THR	C-N	-7.35	1.25	1.33
1	A	90	THR	CA-CB	-6.90	1.42	1.53
1	A	418	GLN	CA-C	-6.90	1.44	1.52
1	A	89	LEU	C-O	-6.80	1.16	1.24
1	B	91	GLY	C-O	-6.73	1.15	1.23
1	B	373	HIS	C-O	-6.65	1.16	1.24
1	A	90	THR	C-O	-6.55	1.16	1.24
1	A	62	ARG	CA-C	-6.50	1.43	1.52
1	A	387	HIS	CA-CB	-6.47	1.43	1.53
1	A	87	ILE	C-O	-6.24	1.16	1.24
1	A	90	THR	C-N	-6.22	1.25	1.33
1	B	418	GLN	CA-C	-6.20	1.45	1.52
1	B	91	GLY	CA-C	-6.01	1.45	1.52
1	A	88	PHE	C-O	-5.91	1.17	1.24
1	B	374	VAL	C-O	-5.66	1.18	1.24

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Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
1	B	90	THR	CA-CB	-5.62	1.44	1.53
1	B	242	GLN	C-O	-5.44	1.17	1.24
1	B	373	HIS	N-CA	-5.43	1.39	1.46
1	B	97	LEU	C-O	-5.40	1.17	1.24
1	B	93	CYS	CA-C	-5.39	1.45	1.52
1	A	97	LEU	C-O	-5.29	1.18	1.24
1	B	93	CYS	C-O	-5.25	1.18	1.24
1	A	93	CYS	C-N	-5.25	1.27	1.33
1	B	93	CYS	C-N	-5.25	1.27	1.33
1	A	388	ILE	CA-C	-5.21	1.46	1.52
1	A	93	CYS	CA-C	-5.21	1.46	1.52
1	B	92	LEU	C-O	-5.18	1.18	1.24
1	A	91	GLY	CA-C	-5.12	1.46	1.52
1	A	59	ARG	C-O	-5.11	1.18	1.24
1	B	241	GLY	CA-C	-5.05	1.46	1.52

All (33) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
1	A	65	HIS	N-CA-C	18.50	135.93	112.24
1	B	241	GLY	N-CA-C	-9.22	101.66	112.73
1	B	94[A]	PHE	O-C-N	-8.87	112.72	122.12
1	B	94[B]	PHE	O-C-N	-8.87	112.72	122.12
1	A	94[A]	PHE	CA-C-O	8.86	130.16	119.97
1	A	94[B]	PHE	CA-C-O	8.86	130.16	119.97
1	A	94[A]	PHE	O-C-N	-8.85	112.74	122.12
1	A	94[B]	PHE	O-C-N	-8.85	112.74	122.12
1	B	94[A]	PHE	CA-C-O	8.79	130.08	119.97
1	B	94[B]	PHE	CA-C-O	8.79	130.08	119.97
1	A	66	ALA	N-CA-C	8.21	122.70	111.54
1	A	370	HIS	N-CA-C	7.96	119.95	111.28
1	A	59	ARG	CB-CA-C	-7.70	99.11	110.96
1	A	387	HIS	CB-CA-C	-6.82	98.84	110.16
1	A	65	HIS	CB-CA-C	-6.46	101.30	111.51
1	A	91	GLY	N-CA-C	6.17	120.13	112.73
1	A	88	PHE	N-CA-C	-6.15	104.66	111.36
1	B	370	HIS	CB-CA-C	5.85	120.79	110.85
1	A	58	GLU	O-C-N	-5.83	115.94	122.12
1	A	86	ALA	O-C-N	-5.80	116.09	122.07
1	B	370	HIS	N-CA-C	5.75	117.62	111.36
1	A	62	ARG	CA-C-N	-5.56	113.21	120.44
1	A	62	ARG	C-N-CA	-5.56	113.21	120.44

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Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
1	B	373	HIS	N-CA-C	-5.48	99.50	108.76
1	B	240	ALA	N-CA-C	-5.44	105.35	111.28
1	B	387	HIS	N-CA-C	-5.43	100.54	109.40
1	A	62	ARG	N-CA-C	-5.26	106.86	113.28
1	A	87	ILE	O-C-N	-5.24	116.79	121.87
1	A	239	ARG	N-CA-C	-5.22	104.53	112.04
1	B	244	ASN	CB-CA-C	-5.17	102.06	110.85
1	A	371	GLU	CA-C-N	-5.03	116.08	122.77
1	A	371	GLU	C-N-CA	-5.03	116.08	122.77
1	B	387	HIS	CB-CA-C	-5.02	99.78	109.37

There are no chirality outliers.

There are no planarity outliers.

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	2398	0	2437	61	0
1	B	2398	0	2437	61	0
2	A	1	0	0	0	0
2	B	1	0	0	0	0
All	All	4798	0	4874	111	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 11.

All (111) 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:A:105:ILE:HD12	1:B:35:LEU:HD12	1.69	0.73
1:B:11:LEU:HD11	1:B:245:MET:HE1	1.73	0.69
1:B:310:PRO:HB2	1:B:312:TRP:HD1	1.59	0.68
1:A:310:PRO:HB2	1:A:312:TRP:HD1	1.58	0.67
1:B:371:GLU:O	1:B:386:ALA:HA	1.94	0.67
1:A:61:ALA:HB2	1:A:78:GLU:HB2	1.77	0.67

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:B:61:ALA:HB2	1:B:78:GLU:HB2	1.77	0.67
1:A:35:LEU:HD12	1:B:105:ILE:HD12	1.75	0.65
1:B:96:ILE:HD13	1:B:324:MET:HE1	1.80	0.64
1:B:37:MET:HE1	1:B:119:VAL:HG11	1.80	0.64
1:A:96:ILE:HD13	1:A:324:MET:HE1	1.80	0.63
1:A:37:MET:HE1	1:A:119:VAL:HG11	1.80	0.63
1:A:385:THR:HG21	1:B:385:THR:HG21	1.81	0.62
1:A:343:LEU:HB2	1:B:80:MET:HE1	1.83	0.60
1:B:370:HIS:CE1	1:B:387:HIS:HD2	2.19	0.60
1:A:388:ILE:CD1	1:A:403:ILE:HD13	2.33	0.59
1:B:372:LEU:HD12	1:B:386:ALA:HB2	1.84	0.59
1:A:80:MET:HE1	1:B:343:LEU:HB2	1.87	0.57
1:A:27:VAL:O	1:A:31:VAL:HG12	2.05	0.57
1:A:239:ARG:HD2	1:A:242:GLN:OE1	2.06	0.56
1:A:239:ARG:O	1:A:240:ALA:C	2.45	0.56
1:B:27:VAL:O	1:B:31:VAL:HG12	2.05	0.56
1:A:11:LEU:HD11	1:A:245:MET:HE1	1.87	0.56
1:A:345:GLN:HE21	1:B:345:GLN:HE21	1.52	0.56
1:A:310:PRO:HB2	1:A:312:TRP:CD1	2.40	0.56
1:A:239:ARG:O	1:A:242:GLN:N	2.39	0.54
1:B:388:ILE:HD13	1:B:403:ILE:HD13	1.89	0.54
1:A:388:ILE:HD12	1:A:403:ILE:HD13	1.90	0.54
1:B:370:HIS:CE1	1:B:387:HIS:CD2	2.96	0.54
1:B:348:PRO:HG3	1:B:376:GLN:HB2	1.91	0.53
1:B:310:PRO:HB2	1:B:312:TRP:CD1	2.40	0.53
1:A:348:PRO:HG3	1:A:376:GLN:HB2	1.91	0.52
1:B:70:ASN:ND2	1:B:73:GLY:O	2.42	0.52
1:B:75:ILE:HD12	1:B:378:ALA:HB3	1.92	0.52
1:B:366:VAL:HG13	1:B:388:ILE:HG23	1.91	0.52
1:A:70:ASN:ND2	1:A:73:GLY:O	2.43	0.51
1:A:75:ILE:HD12	1:A:378:ALA:HB3	1.92	0.51
1:B:322:VAL:O	1:B:325:VAL:HG22	2.11	0.51
1:A:322:VAL:O	1:A:325:VAL:HG22	2.11	0.51
1:A:238:ASP:OD1	1:A:238:ASP:N	2.45	0.50
1:A:94[B]:PHE:HZ	1:B:46:SER:HB3	1.76	0.50
1:B:15:LEU:HG	1:B:19:PHE:HE2	1.78	0.49
1:A:370:HIS:HD2	1:A:420:GLU:OE1	1.96	0.49
1:A:334:PRO:O	1:A:338:GLU:N	2.40	0.48
1:B:240:ALA:O	1:B:241:GLY:C	2.56	0.48
1:B:16:ALA:O	1:B:20:MET:HG2	2.13	0.48
1:A:15:LEU:HG	1:A:19:PHE:HE2	1.78	0.48

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:A:16:ALA:O	1:A:20:MET:HG2	2.13	0.48
1:B:402:THR:O	1:B:406:VAL:HG23	2.13	0.48
1:A:402:THR:O	1:A:406:VAL:HG23	2.13	0.48
1:B:396:TYR:CZ	1:B:419:PRO:HG3	2.49	0.48
1:A:43:HIS:O	1:A:46:SER:OG	2.23	0.47
1:A:396:TYR:CZ	1:A:419:PRO:HG3	2.49	0.47
1:B:341:LEU:HD22	1:B:346:THR:HG21	1.97	0.47
1:A:238:ASP:O	1:A:242:GLN:HG3	2.14	0.46
1:B:328:LEU:O	1:B:332:THR:N	2.47	0.46
1:A:328:LEU:O	1:A:332:THR:N	2.47	0.46
1:B:80:MET:HE3	1:B:80:MET:HB2	1.67	0.46
1:A:63:ARG:O	1:A:64:THR:C	2.57	0.46
1:B:352:ASP:O	1:B:356:LEU:HD23	2.16	0.46
1:A:341:LEU:HD22	1:A:346:THR:HG21	1.97	0.46
1:A:352:ASP:O	1:A:356:LEU:HD23	2.16	0.46
1:A:80:MET:HE3	1:A:80:MET:HB2	1.67	0.45
1:B:127:ASN:HB3	1:B:256:ALA:HB2	1.98	0.45
1:A:127:ASN:HB3	1:A:256:ALA:HB2	1.98	0.45
1:A:21:PHE:HD2	1:A:44:MET:HE2	1.83	0.44
1:B:374:VAL:HG22	1:B:384:ALA:HB1	2.00	0.44
1:B:21:PHE:HD2	1:B:44:MET:HE2	1.83	0.44
1:A:10:ARG:NH1	1:A:133:LEU:O	2.51	0.43
1:A:94[B]:PHE:HZ	1:B:46:SER:CB	2.32	0.43
1:A:376:GLN:NE2	1:A:379:GLY:O	2.51	0.43
1:A:388:ILE:HD13	1:A:403:ILE:HD13	2.00	0.43
1:B:334:PRO:O	1:B:338:GLU:N	2.40	0.43
1:B:374:VAL:HG22	1:B:384:ALA:CB	2.48	0.43
1:A:239:ARG:HG3	1:A:243:LEU:HD13	1.99	0.43
1:B:347:VAL:HG21	1:B:353:ILE:HD11	2.01	0.43
1:A:421:PHE:HB2	1:B:397:MET:HE3	2.01	0.43
1:B:10:ARG:NH1	1:B:133:LEU:O	2.51	0.43
1:B:376:GLN:NE2	1:B:379:GLY:O	2.51	0.43
1:B:82:ALA:CB	1:B:243:LEU:HB3	2.49	0.43
1:A:64:THR:OG1	1:A:65:HIS:N	2.49	0.43
1:A:98:LEU:HG	1:B:42:PHE:HB3	2.01	0.42
1:B:238:ASP:O	1:B:242:GLN:HG3	2.20	0.42
1:B:239:ARG:HA	1:B:239:ARG:HD2	1.51	0.42
1:A:281:PHE:O	1:A:306:TYR:N	2.52	0.42
1:A:129:LEU:HD23	1:A:129:LEU:HA	1.90	0.42
1:B:55:LEU:HD23	1:B:55:LEU:HA	1.90	0.42
1:B:265:ASN:ND2	1:B:317:ASP:HB2	2.35	0.42

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:A:345:GLN:NE2	1:B:345:GLN:HE21	2.17	0.41
1:B:22:MET:HE2	1:B:22:MET:HB3	1.97	0.41
1:B:129:LEU:HD23	1:B:129:LEU:HA	1.90	0.41
1:A:265:ASN:ND2	1:A:317:ASP:HB2	2.35	0.41
1:A:96:ILE:O	1:A:97:LEU:C	2.60	0.41
1:A:347:VAL:HG21	1:A:353:ILE:HD11	2.01	0.41
1:A:315:TYR:C	1:A:318:PRO:HD2	2.46	0.41
1:A:83:LEU:HD22	1:A:343:LEU:HD12	2.03	0.41
1:A:324:MET:HE2	1:A:324:MET:HB3	1.98	0.41
1:B:80:MET:HE2	1:B:343:LEU:HD13	2.03	0.41
1:B:281:PHE:O	1:B:306:TYR:N	2.52	0.41
1:B:239:ARG:O	1:B:240:ALA:C	2.64	0.41
1:B:267:LEU:HD23	1:B:267:LEU:HA	1.95	0.41
1:B:14:MET:HG3	1:B:134:PHE:HE2	1.86	0.41
1:B:83:LEU:HD22	1:B:343:LEU:HD12	2.03	0.41
1:B:315:TYR:C	1:B:318:PRO:HD2	2.46	0.41
1:A:243:LEU:HD11	1:A:338:GLU:CD	2.46	0.40
1:B:29:SER:O	1:B:33:SER:N	2.53	0.40
1:A:29:SER:O	1:A:33:SER:N	2.53	0.40
1:A:14:MET:HG3	1:A:134:PHE:HE2	1.86	0.40
1:A:387:HIS:HD2	1:A:420:GLU:CD	2.29	0.40
1:B:398:GLU:O	1:B:402:THR:HG23	2.22	0.40
1:A:59:ARG:O	1:A:60:PHE:C	2.61	0.40

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	302/507 (60%)	293 (97%)	9 (3%)	0	100	100
1	B	302/507 (60%)	293 (97%)	9 (3%)	0	100	100

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Mol	Chain	Analysed	Favoured	Allowed	Outliers	Percentiles	
All	All	604/1014 (60%)	586 (97%)	18 (3%)	0	100	100

There are no Ramachandran outliers to report.

5.3.2 Protein sidechains ⓘ

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	263/433 (61%)	258 (98%)	5 (2%)	52	71
1	B	263/433 (61%)	256 (97%)	7 (3%)	40	63
All	All	526/866 (61%)	514 (98%)	12 (2%)	49	67

All (12) residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	A	31	VAL
1	A	65	HIS
1	A	80	MET
1	A	238	ASP
1	A	370	HIS
1	B	31	VAL
1	B	80	MET
1	B	94[A]	PHE
1	B	94[B]	PHE
1	B	238	ASP
1	B	243	LEU
1	B	370	HIS

Sometimes sidechains can be flipped to improve hydrogen bonding and reduce clashes. All (4) such sidechains are listed below:

Mol	Chain	Res	Type
1	A	7	ASN
1	A	345	GLN
1	A	387	HIS

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Mol	Chain	Res	Type
1	B	387	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](#)

Of 2 ligands modelled in this entry, 2 are monoatomic - leaving 0 for Mogul analysis.

There are no bond length outliers.

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.

5.7 Other polymers [i](#)

There are no such residues in this entry.

5.8 Polymer linkage issues [i](#)

There are no chain breaks in this entry.