



Full wwPDB X-ray Structure Validation Report ⓘ

Mar 6, 2026 – 08:56 PM UTC

PDB ID : 4ZLN / pdb_00004zln
Title : Crystal structure of transporter AcrB deletion mutant
Authors : Ababou, A.; Koronakis, V.
Deposited on : 2015-05-01
Resolution : 3.56 Å(reported)

This is a Full wwPDB X-ray Structure 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/XrayValidationReportHelp>

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:

MolProbity : 4-5-2 with Phenix2.0
Xtriage (Phenix) : 2.0
EDS : 3.0
Percentile statistics : 20250101.v01 (using entries in the PDB archive January 1st 2025)
CCP4 : 9.0.010 (Gargrove)
Density-Fitness : 1.0.12
Ideal geometry (proteins) : Engh & Huber (2001)
Ideal geometry (DNA, RNA) : Parkinson et al. (1996)
Validation Pipeline (wwPDB-VP) : 2.49

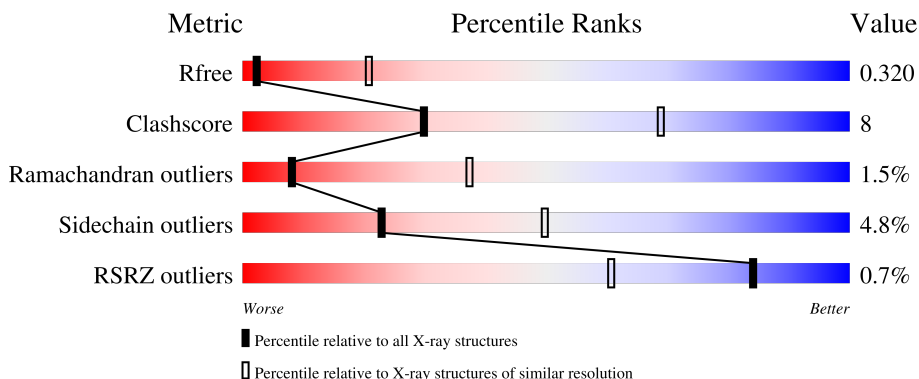
1 Overall quality at a glance

The following experimental techniques were used to determine the structure:

X-RAY DIFFRACTION

The reported resolution of this entry is 3.56 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)	Similar resolution (#Entries, resolution range(Å))
R_{free}	180053	1410 (3.62-3.50)
Clashscore	190562	1480 (3.62-3.50)
Ramachandran outliers	187476	1440 (3.62-3.50)
Sidechain outliers	187428	1441 (3.62-3.50)
RSRZ outliers	180081	1409 (3.62-3.50)

The table below summarises the geometric issues observed across the polymeric chains and their fit to the electron density. The red, orange, yellow and green segments of the lower 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 $\leq 5\%$. The upper red bar (where present) indicates the fraction of residues that have poor fit to the electron density. The numeric value is given above the bar.

Mol	Chain	Length	Quality of chain
1	A	1044	

2 Entry composition

There is only 1 type of molecule in this entry. The entry contains 7813 atoms, of which 0 are hydrogens and 0 are deuteriums.

In the tables below, the ZeroOcc column contains the number of atoms modelled with zero occupancy, 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 Multidrug efflux pump subunit AcrB.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
1	A	1029	Total	C	N	O	S	0	0	0
			7813	5026	1288	1455	44			

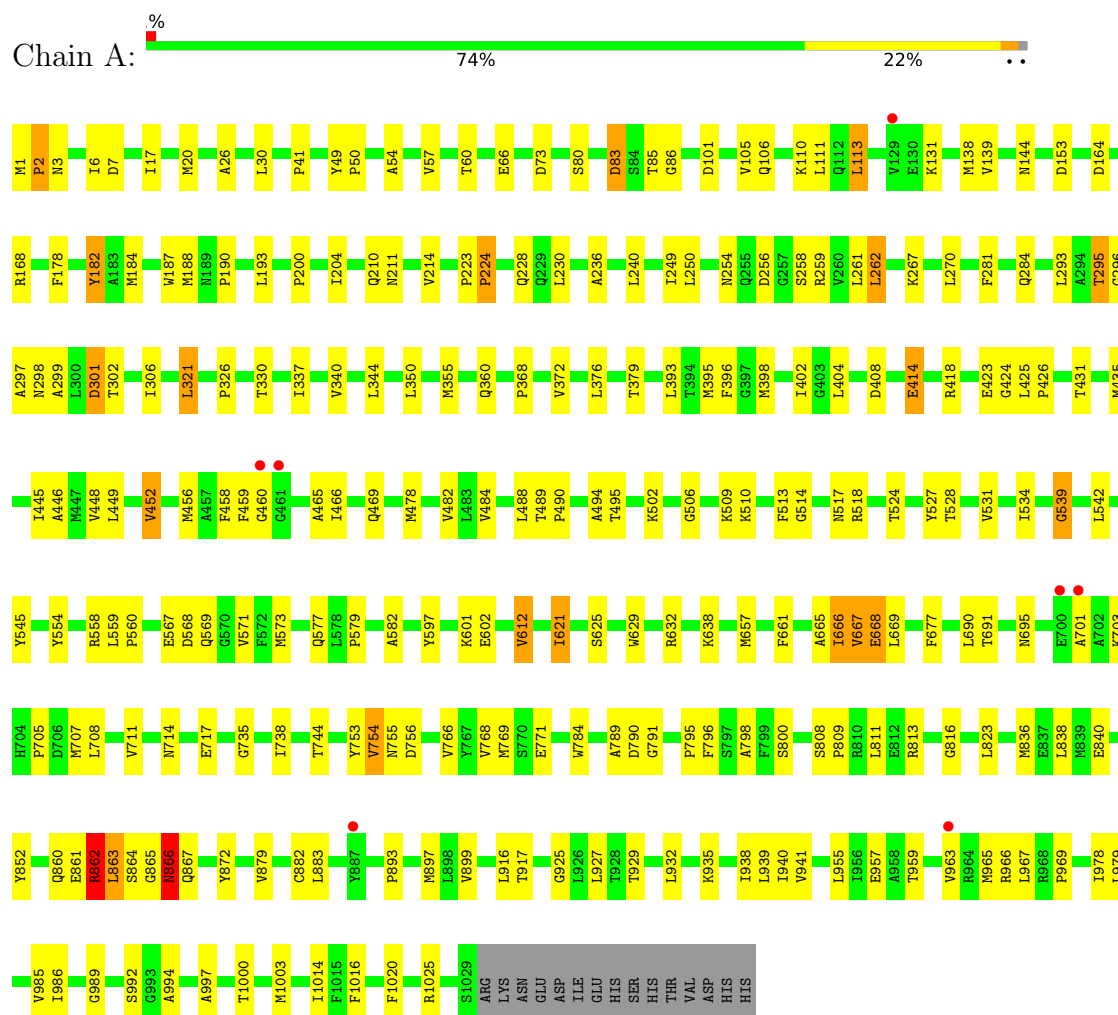
There are 6 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
A	615	GLY	PHE	engineered mutation	UNP P31224
A	?	-	GLY	deletion	UNP P31224
A	?	-	PHE	deletion	UNP P31224
A	?	-	ALA	deletion	UNP P31224
A	?	-	GLY	deletion	UNP P31224
A	?	-	ARG	deletion	UNP P31224

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 and electron density. 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. A red dot above a residue indicates a poor fit to the electron density ($RSRZ > 2$). 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: Multidrug efflux pump subunit AcrB



4 Data and refinement statistics

Property	Value	Source
Space group	H 3 2	Depositor
Cell constants a, b, c, α , β , γ	143.85Å 143.85Å 519.71Å 90.00° 90.00° 120.00°	Depositor
Resolution (Å)	19.95 – 3.56 19.95 – 3.56	Depositor EDS
% Data completeness (in resolution range)	99.2 (19.95-3.56) 97.8 (19.95-3.56)	Depositor EDS
R_{merge}	(Not available)	Depositor
R_{sym}	(Not available)	Depositor
$\langle I/\sigma(I) \rangle$ ¹	2.12 (at 3.58Å)	Xtriage
Refinement program	PHENIX 1.8.2_1309	Depositor
R, R_{free}	0.269 , 0.303 0.284 , 0.320	Depositor DCC
R_{free} test set	1262 reflections (4.96%)	wwPDB-VP
Wilson B-factor (Å ²)	98.2	Xtriage
Anisotropy	0.143	Xtriage
Bulk solvent k_{sol} (e/Å ³), B_{sol} (Å ²)	0.27 , 30.5	EDS
L-test for twinning ²	$\langle L \rangle = 0.36$, $\langle L^2 \rangle = 0.18$	Xtriage
Estimated twinning fraction	No twinning to report.	Xtriage
F_o, F_c correlation	0.88	EDS
Total number of atoms	7813	wwPDB-VP
Average B, all atoms (Å ²)	89.0	wwPDB-VP

Xtriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 2.41% of the height of the origin peak. No significant pseudotranslation is detected.*

¹Intensities estimated from amplitudes.

²Theoretical values of $\langle |L| \rangle$, $\langle L^2 \rangle$ for acentric reflections are 0.5, 0.333 respectively for untwinned datasets, and 0.375, 0.2 for perfectly twinned datasets.

5 Model quality [i](#)

5.1 Standard geometry [i](#)

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	0.31	0/7961	0.77	3/10813 (0.0%)

There are no bond length outliers.

All (3) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
1	A	426	PRO	CA-C-N	5.91	127.22	119.84
1	A	426	PRO	C-N-CA	5.91	127.22	119.84
1	A	113	LEU	N-CA-C	-5.07	107.09	113.28

There are no chirality outliers.

There are no planarity outliers.

5.2 Too-close contacts [i](#)

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	7813	0	7967	134	0
All	All	7813	0	7967	134	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 8.

All (134) 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:862:ARG:HB2	1:A:863:LEU:HG	1.58	0.84
1:A:446:ALA:HB2	1:A:482:VAL:HG21	1.66	0.78
1:A:666:ILE:HG12	1:A:667:VAL:HG23	1.69	0.73
1:A:612:VAL:HG23	1:A:621:ILE:HG23	1.72	0.72
1:A:414:GLU:HG2	1:A:969:PRO:HB3	1.72	0.71
1:A:423:GLU:HB3	1:A:425:LEU:HD13	1.75	0.69
1:A:524:THR:HG22	1:A:967:LEU:HD12	1.76	0.68
1:A:985:VAL:HG23	1:A:1000:THR:HG22	1.75	0.67
1:A:200:PRO:HD2	1:A:744:THR:HG22	1.76	0.67
1:A:297:ALA:HA	1:A:298:ASN:HB2	1.82	0.61
1:A:445:ILE:HG21	1:A:935:LYS:HZ3	1.65	0.61
1:A:210:GLN:NE2	1:A:250:LEU:O	2.33	0.61
1:A:83:ASP:OD2	1:A:83:ASP:N	2.33	0.61
1:A:254:ASN:HB2	1:A:258:SER:HB2	1.83	0.61
1:A:340:VAL:HG11	1:A:395:MET:HB3	1.83	0.61
1:A:860:GLN:HB3	1:A:861:GLU:HA	1.84	0.60
1:A:188:MET:HE1	1:A:200:PRO:HA	1.82	0.60
1:A:344:LEU:HD23	1:A:402:ILE:HD11	1.84	0.59
1:A:567:GLU:OE2	1:A:994:ALA:N	2.36	0.59
1:A:484:VAL:HG13	1:A:488:LEU:HB3	1.84	0.58
1:A:144:ASN:O	1:A:284:GLN:NE2	2.36	0.58
1:A:408:ASP:OD1	1:A:935:LYS:NZ	2.36	0.58
1:A:571:VAL:HG12	1:A:625:SER:HA	1.86	0.58
1:A:73:ASP:OD2	1:A:106:GLN:NE2	2.36	0.58
1:A:568:ASP:OD2	1:A:632:ARG:NH2	2.30	0.57
1:A:701:ALA:HB1	1:A:711:VAL:HG11	1.86	0.57
1:A:456:MET:HE3	1:A:927:LEU:HD21	1.86	0.57
1:A:813:ARG:NH2	1:A:816:GLY:O	2.36	0.57
1:A:925:GLY:O	1:A:929:THR:OG1	2.21	0.57
1:A:211:ASN:O	1:A:755:ASN:ND2	2.38	0.57
1:A:707:MET:HG3	1:A:838:LEU:HD22	1.85	0.56
1:A:355:MET:HE2	1:A:368:PRO:HG3	1.86	0.56
1:A:753:TYR:OH	1:A:756:ASP:OD1	2.22	0.56
1:A:863:LEU:HD13	1:A:867:GLN:HB2	1.88	0.56
1:A:790:ASP:OD1	1:A:791:GLY:N	2.37	0.55
1:A:360:GLN:NE2	1:A:517:ASN:OD1	2.37	0.55
1:A:452:VAL:HG12	1:A:879:VAL:HG21	1.90	0.54
1:A:57:VAL:HG21	1:A:86:GLY:HA2	1.90	0.54
1:A:101:ASP:OD1	1:A:131:LYS:NZ	2.41	0.54
1:A:666:ILE:HG23	1:A:669:LEU:HB3	1.90	0.54
1:A:301:ASP:OD1	1:A:301:ASP:N	2.29	0.53
1:A:863:LEU:HB2	1:A:866:ASN:HB3	1.90	0.53

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:A:101:ASP:O	1:A:105:VAL:HG23	2.09	0.53
1:A:393:LEU:HD13	1:A:466:ILE:HG23	1.91	0.53
1:A:188:MET:HE2	1:A:193:LEU:HD11	1.90	0.53
1:A:153:ASP:OD1	1:A:182:TYR:OH	2.27	0.53
1:A:228:GLN:NE2	1:A:230:LEU:O	2.38	0.52
1:A:959:THR:O	1:A:963:VAL:HG23	2.10	0.52
1:A:940:ILE:HG12	1:A:966:ARG:HG2	1.92	0.51
1:A:527:TYR:OH	1:A:1014:ILE:O	2.17	0.51
1:A:256:ASP:OD1	1:A:258:SER:OG	2.24	0.50
1:A:554:TYR:OH	1:A:558:ARG:NH1	2.45	0.50
1:A:629:TRP:H	1:A:629:TRP:CD1	2.30	0.50
1:A:379:THR:HG21	1:A:398:MET:HE1	1.94	0.49
1:A:883:LEU:HB3	1:A:893:PRO:HB3	1.95	0.49
1:A:404:LEU:HD22	1:A:478:MET:HE1	1.94	0.49
1:A:418:ARG:HD3	1:A:965:MET:HG3	1.94	0.49
1:A:569:GLN:NE2	1:A:665:ALA:O	2.46	0.48
1:A:539:GLY:HA2	1:A:542:LEU:HB2	1.95	0.48
1:A:978:ILE:HG23	1:A:1003:MET:HG3	1.95	0.48
1:A:54:ALA:HB1	1:A:811:LEU:HD13	1.96	0.48
1:A:66:GLU:OE2	1:A:80:SER:OG	2.30	0.48
1:A:281:PHE:HE1	1:A:326:PRO:HB3	1.77	0.48
1:A:484:VAL:HG12	1:A:489:THR:HG23	1.96	0.48
1:A:714:ASN:HB2	1:A:823:LEU:HD13	1.95	0.47
1:A:187:TRP:HB2	1:A:267:LYS:HB2	1.96	0.47
1:A:3:ASN:HA	1:A:6:ILE:HB	1.97	0.47
1:A:350:LEU:HD23	1:A:979:LEU:HB3	1.97	0.47
1:A:691:THR:O	1:A:695:ASN:ND2	2.30	0.47
1:A:738:ILE:H	1:A:738:ILE:HD12	1.80	0.47
1:A:424:GLY:HA3	1:A:502:LYS:HB2	1.97	0.46
1:A:41:PRO:HA	1:A:295:THR:HG21	1.98	0.46
1:A:735:GLY:O	1:A:789:ALA:N	2.46	0.46
1:A:916:LEU:HD21	1:A:997:ALA:HA	1.98	0.46
1:A:435:MET:HG3	1:A:490:PRO:HB3	1.98	0.46
1:A:259:ARG:HD3	1:A:261:LEU:HD21	1.99	0.45
1:A:632:ARG:O	1:A:638:LYS:NZ	2.43	0.45
1:A:465:ALA:O	1:A:469:GLN:HG2	2.17	0.45
1:A:360:GLN:HG2	1:A:513:PHE:CG	2.52	0.45
1:A:939:LEU:HB3	1:A:966:ARG:HD3	1.98	0.45
1:A:164:ASP:O	1:A:168:ARG:NH2	2.50	0.45
1:A:573:MET:HE3	1:A:661:PHE:CZ	2.52	0.45
1:A:667:VAL:HG12	1:A:668:GLU:HG2	1.99	0.44

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:A:190:PRO:HB3	1:A:784:TRP:CE3	2.53	0.44
1:A:184:MET:HB3	1:A:766:VAL:HG22	1.99	0.44
1:A:396:PHE:HE1	1:A:994:ALA:HB1	1.81	0.44
1:A:1:MET:H2	1:A:2:PRO:HD3	1.81	0.44
1:A:703:LYS:C	1:A:705:PRO:HD3	2.43	0.44
1:A:861:GLU:O	1:A:862:ARG:HG3	2.17	0.44
1:A:423:GLU:HA	1:A:502:LYS:HE3	1.99	0.43
1:A:597:TYR:HD1	1:A:601:LYS:HD2	1.83	0.43
1:A:808:SER:HA	1:A:809:PRO:HD3	1.88	0.43
1:A:448:VAL:O	1:A:452:VAL:HG13	2.18	0.43
1:A:514:GLY:O	1:A:518:ARG:HG3	2.18	0.43
1:A:49:TYR:HD2	1:A:50:PRO:HD2	1.83	0.43
1:A:864:SER:HA	1:A:865:GLY:HA2	1.83	0.43
1:A:449:LEU:O	1:A:452:VAL:HG22	2.19	0.42
1:A:545:TYR:HB2	1:A:1016:PHE:CE1	2.54	0.42
1:A:677:PHE:CZ	1:A:852:TYR:HB2	2.54	0.42
1:A:26:ALA:O	1:A:30:LEU:HB2	2.19	0.42
1:A:254:ASN:HD22	1:A:258:SER:HB2	1.85	0.42
1:A:466:ILE:H	1:A:466:ILE:HD12	1.83	0.42
1:A:524:THR:O	1:A:528:THR:HG23	2.19	0.42
1:A:448:VAL:HG12	1:A:882:CYS:HB2	2.01	0.42
1:A:83:ASP:HB2	1:A:85:THR:HG22	2.01	0.42
1:A:559:LEU:HD12	1:A:560:PRO:HD2	2.01	0.42
1:A:110:LYS:HD3	1:A:110:LYS:HA	1.82	0.42
1:A:249:ILE:HD12	1:A:262:LEU:HD12	2.01	0.42
1:A:1016:PHE:HB3	1:A:1020:PHE:CZ	2.55	0.42
1:A:506:GLY:HA2	1:A:509:LYS:HD2	2.02	0.41
1:A:708:LEU:HB2	1:A:838:LEU:HD23	2.02	0.41
1:A:204:ILE:HD13	1:A:754:VAL:HG22	2.01	0.41
1:A:531:VAL:HA	1:A:534:ILE:HG12	2.02	0.41
1:A:836:MET:O	1:A:840:GLU:HG3	2.21	0.41
1:A:577:GLN:HB2	1:A:657:MET:HE2	2.01	0.41
1:A:396:PHE:CE1	1:A:994:ALA:HB1	2.56	0.41
1:A:431:THR:HG21	1:A:494:ALA:HB2	2.02	0.41
1:A:211:ASN:HA	1:A:240:LEU:HD13	2.03	0.41
1:A:458:PHE:HA	1:A:459:PHE:HA	1.81	0.41
1:A:139:VAL:O	1:A:326:PRO:HD2	2.21	0.41
1:A:989:GLY:N	1:A:992:SER:OG	2.54	0.41
1:A:17:ILE:HA	1:A:20:MET:HE3	2.03	0.41
1:A:795:PRO:HG2	1:A:798:ALA:HB2	2.03	0.41
1:A:883:LEU:HD21	1:A:938:ILE:HD11	2.03	0.41

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:A:302:THR:O	1:A:306:ILE:HG12	2.21	0.41
1:A:527:TYR:OH	1:A:1014:ILE:HG13	2.21	0.41
1:A:872:TYR:CE2	1:A:927:LEU:HD11	2.56	0.41
1:A:178:PHE:CD1	1:A:612:VAL:HG11	2.56	0.40
1:A:223:PRO:HA	1:A:224:PRO:HD3	1.82	0.40
1:A:214:VAL:HG23	1:A:236:ALA:HB3	2.01	0.40
1:A:321:LEU:HD23	1:A:321:LEU:HA	1.90	0.40
1:A:368:PRO:O	1:A:372:VAL:HG23	2.21	0.40
1:A:862:ARG:HA	1:A:863:LEU:HA	1.76	0.40
1:A:187:TRP:HA	1:A:769:MET:O	2.21	0.40

There are no symmetry-related clashes.

5.3 Torsion angles ⓘ

5.3.1 Protein backbone ⓘ

In the following table, the Percentiles column shows the percent Ramachandran outliers of the chain as a percentile score with respect to all X-ray entries followed by that with respect to entries of similar resolution.

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	1027/1044 (98%)	933 (91%)	79 (8%)	15 (2%)	8	37

All (15) Ramachandran outliers are listed below:

Mol	Chain	Res	Type
1	A	299	ALA
1	A	2	PRO
1	A	579	PRO
1	A	862	ARG
1	A	295	THR
1	A	510	LYS
1	A	582	ALA
1	A	667	VAL
1	A	330	THR
1	A	460	GLY
1	A	866	ASN

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Mol	Chain	Res	Type
1	A	754	VAL
1	A	296	GLY
1	A	224	PRO
1	A	539	GLY

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 X-ray entries followed by that with respect to entries of similar resolution.

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	837/852 (98%)	797 (95%)	40 (5%)	23	50

All (40) residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	A	7	ASP
1	A	60	THR
1	A	83	ASP
1	A	111	LEU
1	A	113	LEU
1	A	138	MET
1	A	182	TYR
1	A	262	LEU
1	A	270	LEU
1	A	293	LEU
1	A	301	ASP
1	A	321	LEU
1	A	337	ILE
1	A	376	LEU
1	A	414	GLU
1	A	452	VAL
1	A	495	THR
1	A	602	GLU
1	A	612	VAL
1	A	621	ILE
1	A	666	ILE
1	A	668	GLU

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Mol	Chain	Res	Type
1	A	690	LEU
1	A	717	GLU
1	A	768	VAL
1	A	771	GLU
1	A	796	PHE
1	A	800	SER
1	A	862	ARG
1	A	863	LEU
1	A	866	ASN
1	A	897	MET
1	A	899	VAL
1	A	917	THR
1	A	932	LEU
1	A	941	VAL
1	A	955	LEU
1	A	957	GLU
1	A	986	ILE
1	A	1025	ARG

Sometimes sidechains can be flipped to improve hydrogen bonding and reduce clashes. All (6) such sidechains are listed below:

Mol	Chain	Res	Type
1	A	108	GLN
1	A	109	ASN
1	A	161	ASN
1	A	189	ASN
1	A	254	ASN
1	A	415	ASN

5.3.3 RNA ⓘ

There are no RNA molecules in this entry.

5.4 Non-standard residues in protein, DNA, RNA chains ⓘ

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

5.5 Carbohydrates ⓘ

There are no oligosaccharides in this entry.

5.6 Ligand geometry

There are no ligands in this entry.

5.7 Other polymers

There are no such residues in this entry.

5.8 Polymer linkage issues

There are no chain breaks in this entry.

6 Fit of model and data [i](#)

6.1 Protein, DNA and RNA chains [i](#)

In the following table, the column labelled ‘#RSRZ> 2’ contains the number (and percentage) of RSRZ outliers, followed by percent RSRZ outliers for the chain as percentile scores relative to all X-ray entries and entries of similar resolution. The OWAB column contains the minimum, median, 95th percentile and maximum values of the occupancy-weighted average B-factor per residue. The column labelled ‘Q< 0.9’ lists the number of (and percentage) of residues with an average occupancy less than 0.9.

Mol	Chain	Analysed	<RSRZ>	#RSRZ>2		OWAB(Å ²)	Q<0.9
1	A	1029/1044 (98%)	-0.09	7 (0%)	84 61	31, 87, 140, 169	0

All (7) RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
1	A	461	GLY	3.5
1	A	460	GLY	3.2
1	A	701	ALA	2.2
1	A	887	TYR	2.2
1	A	129	VAL	2.1
1	A	700	GLU	2.1
1	A	963	VAL	2.1

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

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

6.3 Carbohydrates [i](#)

There are no oligosaccharides in this entry.

6.4 Ligands [i](#)

There are no ligands in this entry.

6.5 Other polymers [i](#)

There are no such residues in this entry.