



Full wwPDB X-ray Structure Validation Report ⓘ

Mar 6, 2026 – 09:45 PM UTC

PDB ID : 2WFE / pdb_00002wfe
Title : Structure of the Candida albicans cytosolic leucyl-tRNA synthetase editing domain
Authors : Seiradake, E.; Mao, W.; Hernandez, V.; Baker, S.J.; Plattner, J.J.; Alley, M.R.K.; Cusack, S.
Deposited on : 2009-04-04
Resolution : 2.90 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

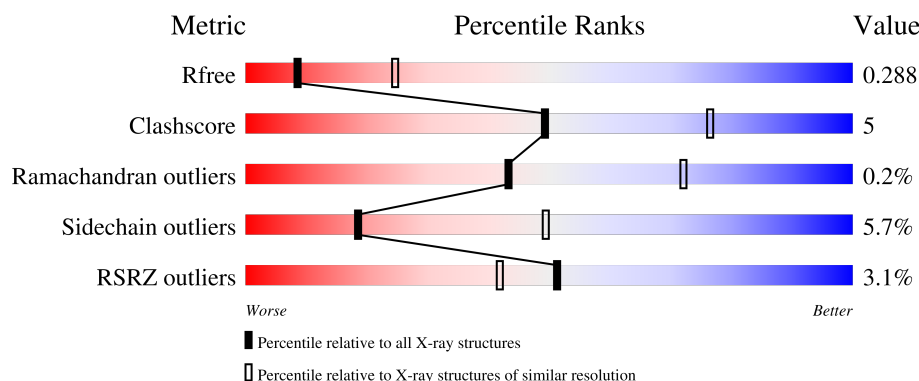
1 Overall quality at a glance

The following experimental techniques were used to determine the structure:

X-RAY DIFFRACTION

The reported resolution of this entry is 2.90 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	2481 (2.90-2.90)
Clashscore	190562	2690 (2.90-2.90)
Ramachandran outliers	187476	2623 (2.90-2.90)
Sidechain outliers	187428	2625 (2.90-2.90)
RSRZ outliers	180081	2481 (2.90-2.90)

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	261	2% 77% 16% 6%
1	B	261	2% 81% 14% 3%
1	C	261	4% 75% 18% 6%
1	D	261	3% 77% 14% 8%

2 Entry composition

There is only 1 type of molecule in this entry. The entry contains 7760 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.

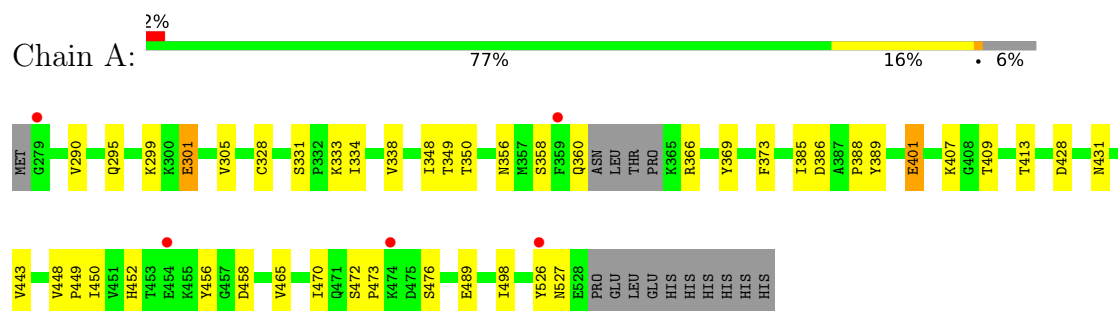
- Molecule 1 is a protein called CYTOSOLIC LEUCYL-TRNA SYNTHETASE.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
1	A	246	Total	C	N	O	S	0	0	0
			1944	1248	315	373	8			
1	B	250	Total	C	N	O	S	0	0	0
			1974	1267	320	379	8			
1	C	246	Total	C	N	O	S	0	0	0
			1943	1249	315	371	8			
1	D	241	Total	C	N	O	S	0	0	0
			1899	1220	305	366	8			

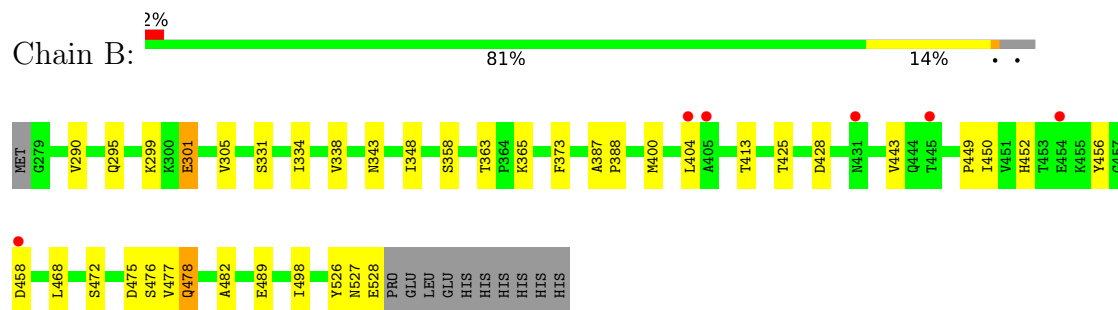
3 Residue-property plots [i](#)

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.

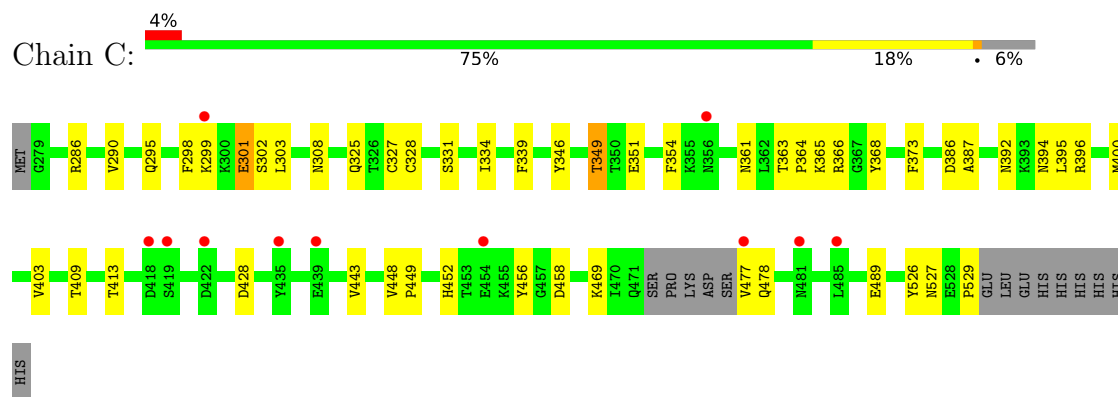
• Molecule 1: CYTOSOLIC LEUCYL-TRNA SYNTHETASE



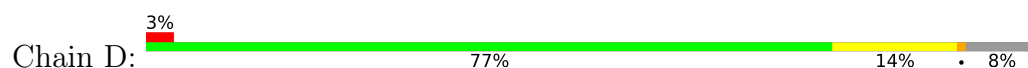
• Molecule 1: CYTOSOLIC LEUCYL-TRNA SYNTHETASE

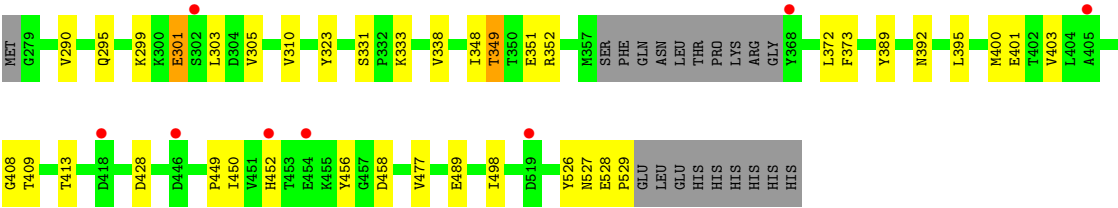


• Molecule 1: CYTOSOLIC LEUCYL-TRNA SYNTHETASE



• Molecule 1: CYTOSOLIC LEUCYL-TRNA SYNTHETASE





4 Data and refinement statistics

Property	Value	Source
Space group	P 1 2 1	Depositor
Cell constants a, b, c, α , β , γ	101.06Å 43.04Å 122.17Å 90.00° 107.57° 90.00°	Depositor
Resolution (Å)	28.83 – 2.90 28.83 – 2.90	Depositor EDS
% Data completeness (in resolution range)	95.0 (28.83-2.90) 94.8 (28.83-2.90)	Depositor EDS
R_{merge}	0.15	Depositor
R_{sym}	(Not available)	Depositor
$\langle I/\sigma(I) \rangle$ ¹	2.77 (at 2.90Å)	Xtriage
Refinement program	REFMAC 5.5.0070	Depositor
R, R_{free}	0.241 , 0.301 0.234 , 0.288	Depositor DCC
R_{free} test set	1112 reflections (5.13%)	wwPDB-VP
Wilson B-factor (Å ²)	35.6	Xtriage
Anisotropy	0.160	Xtriage
Bulk solvent k_{sol} (e/Å ³), B_{sol} (Å ²)	0.33 , 30.2	EDS
L-test for twinning ²	$\langle L \rangle = 0.45$, $\langle L^2 \rangle = 0.28$	Xtriage
Estimated twinning fraction	No twinning to report.	Xtriage
F_o, F_c correlation	0.89	EDS
Total number of atoms	7760	wwPDB-VP
Average B, all atoms (Å ²)	28.0	wwPDB-VP

Xtriage's analysis on translational NCS is as follows: *The analyses of the Patterson function reveals a significant off-origin peak that is 23.32 % of the origin peak, indicating pseudo-translational symmetry. The chance of finding a peak of this or larger height randomly in a structure without pseudo-translational symmetry is equal to 4.7740e-03. The detected translational NCS is most likely also responsible for the elevated intensity ratio.*

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

5.1 Standard geometry

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	0.52	0/1983	0.83	0/2681
1	B	0.50	0/2015	0.85	0/2728
1	C	0.47	0/1982	0.84	1/2682 (0.0%)
1	D	0.47	0/1937	0.82	1/2622 (0.0%)
All	All	0.49	0/7917	0.83	2/10713 (0.0%)

There are no bond length outliers.

All (2) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
1	C	529	PRO	N-CA-CB	6.99	110.69	103.00
1	D	529	PRO	N-CA-CB	6.50	110.15	103.00

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	1944	0	1946	24	0
1	B	1974	0	1978	19	0
1	C	1943	0	1944	28	0
1	D	1899	0	1896	20	0
All	All	7760	0	7764	84	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 5.

All (84) 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:465:VAL:HA	1:A:470:ILE:HD12	1.51	0.91
1:A:333:LYS:HE2	1:A:401:GLU:HG2	1.65	0.78
1:B:468:LEU:HD12	1:B:482:ALA:HB2	1.78	0.66
1:D:452:HIS:ND1	1:D:458:ASP:OD1	2.31	0.64
1:B:301:GLU:HG2	1:B:373:PHE:CD2	2.35	0.61
1:D:301:GLU:HG2	1:D:373:PHE:CD2	2.35	0.61
1:D:323:TYR:HA	1:D:389:TYR:O	2.00	0.61
1:D:352:ARG:NH2	1:D:408:GLY:O	2.34	0.60
1:C:396:ARG:HH22	1:D:301:GLU:HG3	1.66	0.60
1:C:301:GLU:HG2	1:C:373:PHE:CD2	2.38	0.59
1:A:301:GLU:HG2	1:A:373:PHE:CD2	2.38	0.58
1:A:452:HIS:ND1	1:A:458:ASP:OD1	2.37	0.58
1:B:290:VAL:HG23	1:B:295:GLN:HG2	1.89	0.55
1:B:452:HIS:ND1	1:B:458:ASP:OD1	2.39	0.55
1:C:452:HIS:ND1	1:C:458:ASP:OD1	2.40	0.55
1:A:472:SER:OG	1:A:473:PRO:HD2	2.06	0.54
1:C:349:THR:CG2	1:C:409:THR:HB	2.37	0.54
1:D:349:THR:HG22	1:D:409:THR:HB	1.89	0.54
1:B:475:ASP:O	1:B:477:VAL:N	2.41	0.54
1:B:338:VAL:HG22	1:B:348:ILE:HG12	1.90	0.53
1:D:290:VAL:HG23	1:D:295:GLN:HG2	1.90	0.53
1:A:290:VAL:HG23	1:A:295:GLN:HG2	1.91	0.53
1:B:343:ASN:HA	1:C:368:TYR:CD2	2.44	0.52
1:A:449:PRO:HB3	1:A:458:ASP:HB3	1.92	0.52
1:C:290:VAL:HG23	1:C:295:GLN:HG2	1.92	0.51
1:C:286:ARG:HB3	1:C:386:ASP:HB2	1.93	0.51
1:A:358:SER:C	1:A:360:GLN:H	2.19	0.50
1:B:343:ASN:O	1:C:365:LYS:HD3	2.11	0.50
1:A:349:THR:CG2	1:A:409:THR:HB	2.43	0.49
1:C:400:MET:HB3	1:C:403:VAL:HG23	1.94	0.49
1:D:301:GLU:C	1:D:303:LEU:H	2.19	0.49
1:B:449:PRO:HB3	1:B:458:ASP:HB3	1.94	0.49
1:C:339:PHE:CD1	1:C:354:PHE:CD2	3.00	0.49
1:A:465:VAL:HG13	1:A:470:ILE:HB	1.94	0.48
1:C:392:ASN:HD21	1:C:448:VAL:HG22	1.78	0.48
1:A:338:VAL:HG22	1:A:348:ILE:HG12	1.94	0.48
1:C:295:GLN:O	1:C:299:LYS:HB2	2.13	0.48
1:D:290:VAL:CG1	1:D:305:VAL:HG21	2.43	0.48

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:D:331:SER:HB2	1:D:403:VAL:HB	1.95	0.48
1:A:366:ARG:HB2	1:A:369:TYR:CZ	2.48	0.48
1:D:449:PRO:HB3	1:D:458:ASP:HB3	1.97	0.47
1:C:449:PRO:HB3	1:C:458:ASP:HB3	1.96	0.47
1:D:400:MET:HB3	1:D:403:VAL:HG23	1.96	0.46
1:A:356:ASN:C	1:A:358:SER:H	2.24	0.46
1:C:363:THR:HB	1:C:364:PRO:HD2	1.98	0.46
1:C:331:SER:HB2	1:C:403:VAL:HB	1.97	0.45
1:A:295:GLN:O	1:A:299:LYS:HB2	2.16	0.45
1:D:290:VAL:HG13	1:D:305:VAL:HG21	1.99	0.45
1:B:456:TYR:CE2	1:B:489:GLU:HG3	2.52	0.45
1:A:388:PRO:O	1:A:389:TYR:HB2	2.17	0.45
1:C:349:THR:HG21	1:C:409:THR:HB	1.98	0.44
1:D:295:GLN:O	1:D:299:LYS:HB2	2.16	0.44
1:C:394:ASN:ND2	1:D:372:LEU:HD21	2.33	0.43
1:C:308:ASN:OD1	1:C:346:TYR:HE2	2.01	0.43
1:C:394:ASN:CG	1:D:372:LEU:CD2	2.91	0.43
1:B:475:ASP:O	1:B:478:GLN:NE2	2.52	0.43
1:A:349:THR:HG21	1:A:409:THR:HB	1.99	0.42
1:B:365:LYS:HB2	1:C:302:SER:HB2	2.01	0.42
1:A:450:ILE:HD12	1:A:498:ILE:HG21	2.01	0.42
1:A:456:TYR:CE2	1:A:489:GLU:HG3	2.54	0.42
1:B:387:ALA:HA	1:B:388:PRO:HD3	1.95	0.42
1:B:295:GLN:O	1:B:299:LYS:HB2	2.19	0.42
1:B:400:MET:HG3	1:B:425:THR:HG21	2.02	0.42
1:C:325:GLN:OE1	1:C:387:ALA:HB1	2.19	0.42
1:C:349:THR:HG22	1:C:409:THR:HB	2.00	0.42
1:C:456:TYR:CE2	1:C:489:GLU:HG3	2.54	0.42
1:D:456:TYR:CE2	1:D:489:GLU:HG3	2.55	0.42
1:C:331:SER:HB3	1:C:334:ILE:HD12	2.02	0.41
1:C:327:CYS:SG	1:C:328:CYS:N	2.93	0.41
1:A:349:THR:HB	1:A:350:THR:H	1.78	0.41
1:A:356:ASN:C	1:A:358:SER:N	2.78	0.41
1:D:333:LYS:HE2	1:D:401:GLU:HG2	2.01	0.41
1:A:348:ILE:O	1:A:349:THR:HG23	2.20	0.41
1:B:343:ASN:HA	1:C:368:TYR:CE2	2.56	0.41
1:D:338:VAL:HG22	1:D:348:ILE:HG12	2.03	0.41
1:D:450:ILE:HD12	1:D:498:ILE:HG21	2.03	0.40
1:A:448:VAL:HA	1:A:449:PRO:HD3	1.88	0.40
1:C:298:PHE:HB3	1:C:303:LEU:O	2.21	0.40
1:B:358:SER:HA	1:B:363:THR:OG1	2.21	0.40

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:B:450:ILE:HD12	1:B:498:ILE:HG21	2.02	0.40
1:B:331:SER:HB3	1:B:334:ILE:HD12	2.02	0.40
1:A:328:CYS:HB2	1:A:385:ILE:CD1	2.51	0.40
1:A:331:SER:HB3	1:A:334:ILE:HD12	2.03	0.40
1:C:448:VAL:HA	1:C:449:PRO:HD3	1.87	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 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	242/261 (93%)	234 (97%)	8 (3%)	0	100	100
1	B	248/261 (95%)	236 (95%)	11 (4%)	1 (0%)	30	59
1	C	242/261 (93%)	233 (96%)	8 (3%)	1 (0%)	30	59
1	D	237/261 (91%)	227 (96%)	10 (4%)	0	100	100
All	All	969/1044 (93%)	930 (96%)	37 (4%)	2 (0%)	43	72

All (2) Ramachandran outliers are listed below:

Mol	Chain	Res	Type
1	B	476	SER
1	C	469	LYS

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 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	212/227 (93%)	200 (94%)	12 (6%)	18	49
1	B	216/227 (95%)	205 (95%)	11 (5%)	21	53
1	C	211/227 (93%)	198 (94%)	13 (6%)	16	46
1	D	207/227 (91%)	195 (94%)	12 (6%)	18	49
All	All	846/908 (93%)	798 (94%)	48 (6%)	18	49

All (48) residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	A	301	GLU
1	A	305	VAL
1	A	386	ASP
1	A	401	GLU
1	A	407	LYS
1	A	413	THR
1	A	428	ASP
1	A	431	ASN
1	A	443	VAL
1	A	476	SER
1	A	526	TYR
1	A	527	ASN
1	B	301	GLU
1	B	305	VAL
1	B	404	LEU
1	B	413	THR
1	B	428	ASP
1	B	443	VAL
1	B	472	SER
1	B	478	GLN
1	B	526	TYR
1	B	527	ASN
1	B	528	GLU
1	C	301	GLU
1	C	349	THR
1	C	351	GLU
1	C	361	ASN
1	C	366	ARG
1	C	395	LEU
1	C	413	THR
1	C	428	ASP

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Mol	Chain	Res	Type
1	C	443	VAL
1	C	477	VAL
1	C	478	GLN
1	C	526	TYR
1	C	527	ASN
1	D	301	GLU
1	D	310	VAL
1	D	349	THR
1	D	351	GLU
1	D	392	ASN
1	D	395	LEU
1	D	413	THR
1	D	428	ASP
1	D	477	VAL
1	D	526	TYR
1	D	527	ASN
1	D	528	GLU

Sometimes sidechains can be flipped to improve hydrogen bonding and reduce clashes. All (13) such sidechains are listed below:

Mol	Chain	Res	Type
1	A	360	GLN
1	A	394	ASN
1	B	343	ASN
1	B	376	ASN
1	B	444	GLN
1	B	478	GLN
1	B	515	GLN
1	C	376	ASN
1	C	392	ASN
1	C	394	ASN
1	C	515	GLN
1	D	394	ASN
1	D	444	GLN

5.3.3 RNA ⓘ

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](#)

There are no ligands in this entry.

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.

6 Fit of model and data ⓘ

6.1 Protein, DNA and RNA chains ⓘ

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	246/261 (94%)	0.08	5 (2%) 65 56	5, 21, 39, 46	0
1	B	250/261 (95%)	0.09	6 (2%) 59 50	7, 23, 42, 54	0
1	C	246/261 (94%)	0.42	11 (4%) 38 30	11, 29, 59, 78	0
1	D	241/261 (92%)	0.31	8 (3%) 49 40	16, 32, 51, 58	0
All	All	983/1044 (94%)	0.23	30 (3%) 51 42	5, 26, 50, 78	0

All (30) RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
1	C	477	VAL	3.6
1	A	359	PHE	3.3
1	C	454	GLU	3.2
1	B	454	GLU	3.2
1	D	302	SER	3.2
1	C	435	TYR	3.1
1	B	431	ASN	3.0
1	B	404	LEU	2.8
1	D	454	GLU	2.8
1	D	405	ALA	2.7
1	C	481	ASN	2.6
1	D	452	HIS	2.6
1	B	458	ASP	2.4
1	B	445	THR	2.4
1	C	356	ASN	2.4
1	D	519	ASP	2.4
1	A	526	TYR	2.4
1	A	474	LYS	2.4
1	A	454	GLU	2.4
1	C	485	LEU	2.2
1	D	368	TYR	2.2

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Mol	Chain	Res	Type	RSRZ
1	C	422	ASP	2.2
1	D	418	ASP	2.2
1	D	446	ASP	2.2
1	C	419	SER	2.2
1	C	418	ASP	2.1
1	A	279	GLY	2.1
1	C	299	LYS	2.0
1	B	405	ALA	2.0
1	C	439	GLU	2.0

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.