



Full wwPDB X-ray Structure Validation Report ⓘ

Mar 6, 2026 – 05:33 PM UTC

PDB ID : 4RG6 / pdb_00004rg6
Title : Crystal structure of APC3-APC16 complex
Authors : Yamaguchi, M.; Yu, S.; Miller, D.J.; Schulman, B.A.
Deposited on : 2014-09-29
Resolution : 3.30 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

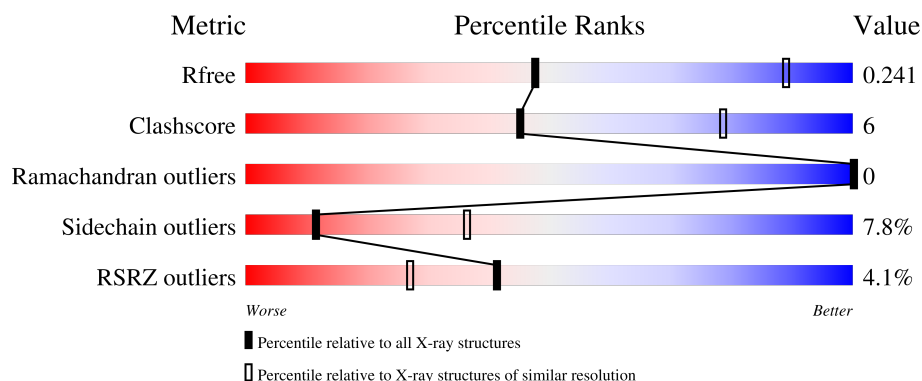
1 Overall quality at a glance

The following experimental techniques were used to determine the structure:

X-RAY DIFFRACTION

The reported resolution of this entry is 3.30 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	1169 (3.32-3.28)
Clashscore	190562	1209 (3.32-3.28)
Ramachandran outliers	187476	1188 (3.32-3.28)
Sidechain outliers	187428	1187 (3.32-3.28)
RSRZ outliers	180081	1169 (3.32-3.28)

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	560	3% 71% 12% . 15%
1	B	560	3% 71% 12% . 16%
2	S	43	7% 72% 7% . 19%

2 Entry composition

There are 2 unique types of molecules in this entry. The entry contains 7598 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 Cell division cycle protein 27 homolog.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
1	A	474	Total	C	N	O	S	0	0	0
			3623	2318	604	676	25			
1	B	473	Total	C	N	O	S	0	0	0
			3701	2372	619	685	25			

There are 4 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
A	-1	GLY	-	expression tag	UNP P30260
A	0	SER	-	expression tag	UNP P30260
B	-1	GLY	-	expression tag	UNP P30260
B	0	SER	-	expression tag	UNP P30260

- Molecule 2 is a protein called Anaphase-promoting complex subunit 16.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
2	S	35	Total	C	N	O	S	0	0	0
			274	177	47	49	1			

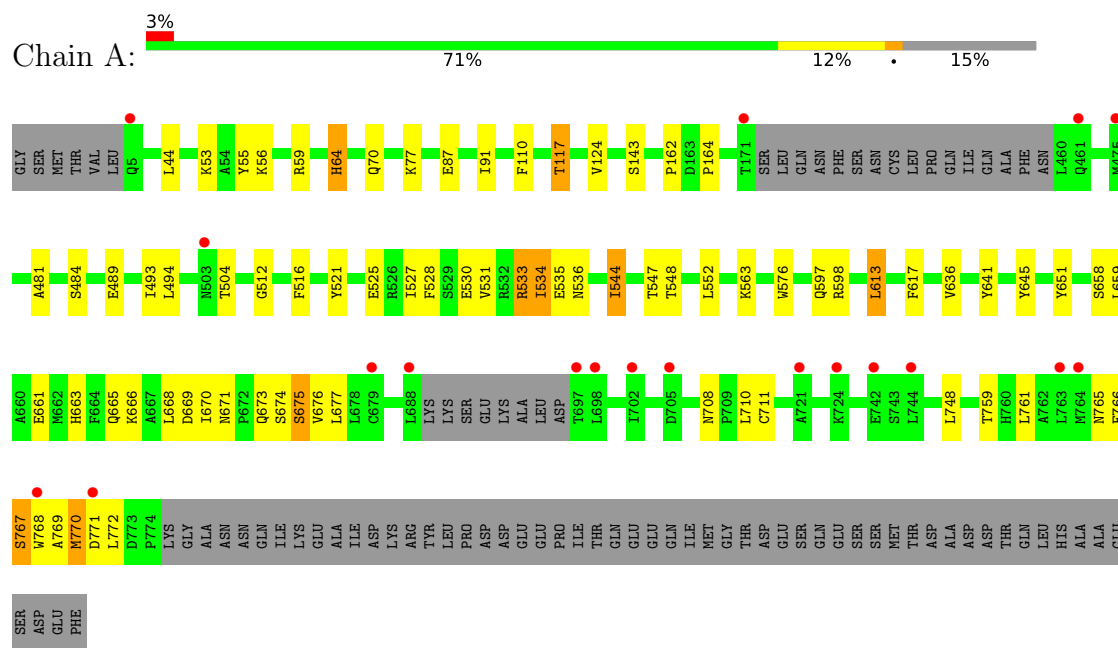
There are 7 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
S	73	MET	-	initiating methionine	UNP Q96DE5
S	110	GLU	-	expression tag	UNP Q96DE5
S	111	ASN	-	expression tag	UNP Q96DE5
S	112	LEU	-	expression tag	UNP Q96DE5
S	113	TYR	-	expression tag	UNP Q96DE5
S	114	PHE	-	expression tag	UNP Q96DE5
S	115	GLN	-	expression tag	UNP Q96DE5

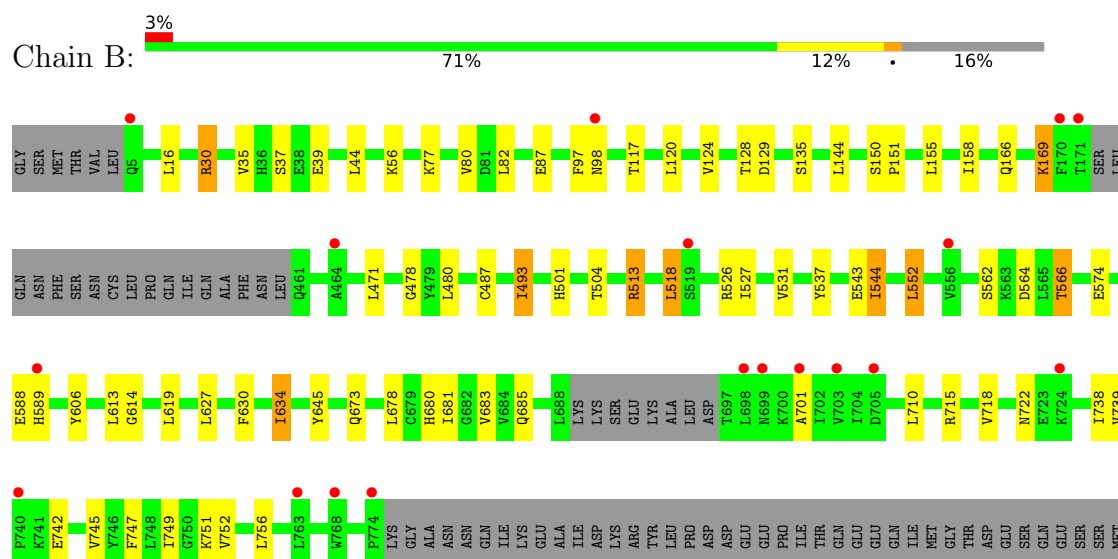
3 Residue-property plots

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: Cell division cycle protein 27 homolog

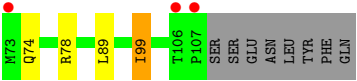


- Molecule 1: Cell division cycle protein 27 homolog



THR
ASP
ALA
ASP
ASP
THR
GLN
LEU
HIS
ALA
ALA
GLU
SER
SER
ASP
GLU
PHE

● Molecule 2: Anaphase-promoting complex subunit 16



4 Data and refinement statistics

Property	Value	Source
Space group	P 43	Depositor
Cell constants a, b, c, α , β , γ	116.66Å 116.66Å 184.97Å 90.00° 90.00° 90.00°	Depositor
Resolution (Å)	50.00 – 3.30 50.00 – 3.30	Depositor EDS
% Data completeness (in resolution range)	99.8 (50.00-3.30) 99.9 (50.00-3.30)	Depositor EDS
R_{merge}	(Not available)	Depositor
R_{sym}	0.10	Depositor
$\langle I/\sigma(I) \rangle$ ¹	3.63 (at 3.33Å)	Xtriage
Refinement program	REFMAC 5.8.0049	Depositor
R, R_{free}	0.203 , 0.242 0.204 , 0.241	Depositor DCC
R_{free} test set	1867 reflections (5.03%)	wwPDB-VP
Wilson B-factor (Å ²)	100.7	Xtriage
Anisotropy	0.025	Xtriage
Bulk solvent k_{sol} (e/Å ³), B_{sol} (Å ²)	0.29 , 53.5	EDS
L-test for twinning ²	$\langle L \rangle = 0.49$, $\langle L^2 \rangle = 0.32$	Xtriage
Estimated twinning fraction	0.042 for h,-k,-l	Xtriage
F_o, F_c correlation	0.94	EDS
Total number of atoms	7598	wwPDB-VP
Average B, all atoms (Å ²)	107.0	wwPDB-VP

Xtriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 2.83% 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	0.49	0/3709	0.86	2/5041 (0.0%)
1	B	0.50	0/3788	0.84	2/5135 (0.0%)
2	S	0.55	0/278	0.84	0/374
All	All	0.50	0/7775	0.85	4/10550 (0.0%)

There are no bond length outliers.

All (4) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
1	A	767	SER	N-CA-C	8.43	120.16	110.97
1	B	518	LEU	N-CA-C	-5.97	101.65	110.48
1	B	552	LEU	N-CA-C	-5.68	101.64	110.10
1	A	674	SER	N-CA-C	-5.09	105.92	111.82

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	3623	0	3344	54	0
1	B	3701	0	3509	34	0
2	S	274	0	266	4	0
All	All	7598	0	7119	87	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 6.

All (87) 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:668:LEU:HA	1:A:671:ASN:O	1.28	1.25
1:A:668:LEU:CA	1:A:671:ASN:O	2.11	0.97
1:A:765:ASN:O	1:A:769:ALA:HB2	1.66	0.94
1:A:531:VAL:HA	1:A:534:ILE:CG2	2.00	0.90
1:A:531:VAL:HA	1:A:534:ILE:HG22	1.53	0.89
1:A:55:TYR:O	1:A:59:ARG:HG2	1.80	0.81
1:A:768:TRP:HD1	1:A:769:ALA:N	1.83	0.75
1:A:531:VAL:CA	1:A:534:ILE:HG22	2.18	0.73
1:A:645:TYR:OH	1:A:675:SER:HB3	1.89	0.72
1:B:166:GLN:OE1	1:B:169:LYS:HE3	1.91	0.70
1:A:768:TRP:C	1:A:768:TRP:CD1	2.70	0.70
1:A:768:TRP:HA	1:A:771:ASP:HB2	1.74	0.70
1:B:562:SER:O	1:B:566:THR:HB	1.94	0.68
1:A:766:PHE:O	1:A:770:MET:HG3	1.93	0.68
1:A:768:TRP:CD1	1:A:769:ALA:N	2.62	0.67
1:A:673:GLN:O	1:A:673:GLN:HG3	1.94	0.66
1:B:478:GLY:N	1:B:493:ILE:HD11	2.11	0.65
1:A:765:ASN:O	1:A:769:ALA:CB	2.43	0.63
1:B:701:ALA:HB3	1:B:715:ARG:NH2	2.15	0.62
1:A:768:TRP:HD1	1:A:768:TRP:C	2.07	0.61
1:B:742:GLU:O	1:B:745:VAL:HG12	2.01	0.60
1:B:645:TYR:HB3	1:B:678:LEU:CD2	2.32	0.60
1:A:665:GLN:O	1:A:669:ASP:HB2	2.02	0.59
1:A:531:VAL:HA	1:A:534:ILE:HG21	1.85	0.58
1:B:718:VAL:O	1:B:722:ASN:ND2	2.38	0.56
1:B:80:VAL:HG21	1:B:120:LEU:HD11	1.86	0.56
1:B:501:HIS:O	1:B:504:THR:HG22	2.06	0.56
1:A:481:ALA:O	1:A:484:SER:O	2.24	0.56
1:A:661:GLU:OE1	1:A:711:CYS:N	2.38	0.55
1:A:531:VAL:C	1:A:534:ILE:HG22	2.32	0.55
1:A:668:LEU:C	1:A:671:ASN:O	2.49	0.54
1:A:516:PHE:CD2	1:A:548:THR:HG22	2.42	0.54
1:A:162:PRO:O	1:A:164:PRO:HD3	2.09	0.53
2:S:74:GLN:HG3	2:S:78:ARG:HE	1.74	0.53
1:A:665:GLN:OE1	1:A:710:LEU:HD11	2.10	0.52
1:B:645:TYR:HB3	1:B:678:LEU:HD22	1.92	0.52
1:B:745:VAL:O	1:B:749:ILE:HG13	2.11	0.51
1:A:534:ILE:HD12	1:A:534:ILE:O	2.10	0.51

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:B:513:ARG:HA	1:B:544:ILE:HD11	1.92	0.51
1:B:478:GLY:CA	1:B:493:ILE:HD11	2.41	0.51
1:A:530:GLU:O	1:A:534:ILE:HG22	2.12	0.49
1:A:651:TYR:CE2	1:A:663:HIS:CE1	3.01	0.49
1:B:97:PHE:O	1:B:98:ASN:OD1	2.32	0.48
1:A:59:ARG:HG3	1:B:537:TYR:HB3	1.96	0.48
1:B:739:VAL:HG13	1:B:739:VAL:O	2.13	0.48
1:A:512:GLY:HA2	1:A:527:ILE:HD11	1.96	0.48
1:A:676:VAL:HG13	1:A:677:LEU:N	2.29	0.48
1:B:487:CYS:HB2	1:B:518:LEU:HD21	1.96	0.47
1:A:766:PHE:O	1:A:770:MET:CG	2.62	0.46
1:A:666:LYS:O	1:A:670:ILE:HG13	2.16	0.46
1:A:651:TYR:CE2	1:A:663:HIS:HE1	2.34	0.46
1:A:651:TYR:CD1	1:A:659:LEU:HD11	2.50	0.46
1:B:35:VAL:C	1:B:37:SER:H	2.23	0.46
1:B:749:ILE:O	1:B:752:VAL:HG12	2.16	0.46
1:A:772:LEU:HD12	1:A:772:LEU:O	2.16	0.45
1:B:471:LEU:HD21	1:B:501:HIS:ND1	2.31	0.45
1:A:87:GLU:O	1:A:91:ILE:HG13	2.17	0.45
1:A:544:ILE:O	1:A:548:THR:HG23	2.17	0.45
1:B:681:ILE:O	1:B:685:GLN:HG3	2.17	0.45
1:A:528:PHE:HA	1:A:531:VAL:HG12	1.98	0.45
1:B:124:VAL:O	1:B:128:THR:HG23	2.17	0.45
1:B:673:GLN:HG3	1:B:747:PHE:CE2	2.52	0.44
1:A:613:LEU:HD22	1:A:617:PHE:CE2	2.52	0.44
1:B:680:HIS:O	1:B:683:VAL:HG22	2.17	0.44
1:A:489:GLU:O	1:A:493:ILE:HG12	2.18	0.43
1:A:665:GLN:O	1:A:669:ASP:CB	2.67	0.43
1:B:480:LEU:O	1:B:480:LEU:HD23	2.18	0.43
1:A:521:TYR:HB2	1:A:552:LEU:HD21	2.00	0.43
1:A:576:TRP:CH2	2:S:89:LEU:HD21	2.54	0.43
1:B:471:LEU:HD21	1:B:501:HIS:CE1	2.54	0.43
1:B:630:PHE:O	1:B:634:ILE:HG13	2.19	0.43
1:A:641:TYR:CD1	1:A:641:TYR:C	2.96	0.42
1:B:589:HIS:CE1	1:B:619:LEU:HD22	2.54	0.42
1:A:766:PHE:O	1:A:769:ALA:HB3	2.18	0.42
1:B:619:LEU:C	1:B:619:LEU:HD23	2.44	0.42
1:A:504:THR:HG21	1:B:30:ARG:NH2	2.33	0.42
1:A:563:LYS:HD2	2:S:78:ARG:HD2	2.01	0.42
1:A:761:LEU:N	1:A:761:LEU:HD12	2.34	0.42
1:B:614:GLY:HA3	1:B:630:PHE:CE1	2.54	0.42

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:A:597:GLN:HG2	2:S:99:ILE:HG21	2.01	0.41
1:A:533:ARG:HG3	1:A:534:ILE:N	2.35	0.41
1:B:543:GLU:OE2	1:B:606:TYR:OH	2.39	0.41
1:B:166:GLN:OE1	1:B:169:LYS:CE	2.66	0.41
1:A:64:HIS:CD2	1:A:64:HIS:N	2.89	0.41
1:A:110:PHE:CG	1:A:117:THR:HG21	2.55	0.41
1:B:150:SER:N	1:B:151:PRO:CD	2.84	0.41
1:A:53:LYS:HB3	1:A:56:LYS:HG3	2.03	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	468/560 (84%)	440 (94%)	28 (6%)	0	100	100
1	B	467/560 (83%)	438 (94%)	29 (6%)	0	100	100
2	S	33/43 (77%)	31 (94%)	2 (6%)	0	100	100
All	All	968/1163 (83%)	909 (94%)	59 (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 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	356/485 (73%)	331 (93%)	25 (7%)	14	41
1	B	377/485 (78%)	344 (91%)	33 (9%)	9	32
2	S	26/38 (68%)	25 (96%)	1 (4%)	29	57
All	All	759/1008 (75%)	700 (92%)	59 (8%)	11	36

All (59) residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	A	44	LEU
1	A	64	HIS
1	A	70	GLN
1	A	77	LYS
1	A	117	THR
1	A	124	VAL
1	A	143	SER
1	A	494	LEU
1	A	525	GLU
1	A	533	ARG
1	A	534	ILE
1	A	535	GLU
1	A	536	ASN
1	A	544	ILE
1	A	547	THR
1	A	598	ARG
1	A	613	LEU
1	A	636	VAL
1	A	658	SER
1	A	675	SER
1	A	708	ASN
1	A	748	LEU
1	A	759	THR
1	A	767	SER
1	A	770	MET
1	B	16	LEU
1	B	30	ARG
1	B	39	GLU
1	B	44	LEU
1	B	56	LYS
1	B	77	LYS
1	B	82	LEU
1	B	87	GLU
1	B	117	THR

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Mol	Chain	Res	Type
1	B	129	ASP
1	B	135	SER
1	B	144	LEU
1	B	155	LEU
1	B	158	ILE
1	B	169	LYS
1	B	493	ILE
1	B	513	ARG
1	B	526	ARG
1	B	527	ILE
1	B	531	VAL
1	B	544	ILE
1	B	552	LEU
1	B	564	ASP
1	B	566	THR
1	B	574	GLU
1	B	588	GLU
1	B	613	LEU
1	B	627	LEU
1	B	634	ILE
1	B	710	LEU
1	B	738	ILE
1	B	751	LYS
1	B	756	LEU
2	S	99	ILE

Sometimes sidechains can be flipped to improve hydrogen bonding and reduce clashes. All (11) such sidechains are listed below:

Mol	Chain	Res	Type
1	A	581	ASN
1	A	663	HIS
1	A	671	ASN
1	B	64	HIS
1	B	70	GLN
1	B	103	HIS
1	B	523	GLN
1	B	551	HIS
1	B	642	ASN
1	B	671	ASN
1	B	708	ASN

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](#)

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	474/560 (84%)	0.21	19 (4%) 42 28	68, 113, 158, 232	0
1	B	473/560 (84%)	-0.01	18 (3%) 44 30	69, 96, 148, 208	0
2	S	35/43 (81%)	0.54	3 (8%) 16 12	80, 117, 150, 169	0
All	All	982/1163 (84%)	0.12	40 (4%) 41 27	68, 103, 155, 232	0

All (40) RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
1	B	171	THR	5.9
1	B	705	ASP	4.5
1	B	5	GLN	4.3
1	B	698	LEU	3.9
1	A	768	TRP	3.7
1	A	698	LEU	3.6
1	B	170	PHE	3.5
1	A	705	ASP	3.4
1	A	5	GLN	3.4
1	A	171	THR	3.4
1	B	98	ASN	3.3
1	B	774	PRO	3.3
2	S	107	PRO	3.2
1	A	697	THR	3.2
1	A	688	LEU	3.1
1	B	556	VAL	3.1
2	S	73	MET	2.9
1	B	740	PRO	2.8
1	B	768	TRP	2.8
1	A	764	MET	2.7
1	A	702	ILE	2.5
1	B	701	ALA	2.5
2	S	106	THR	2.4

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Mol	Chain	Res	Type	RSRZ
1	A	744	LEU	2.3
1	B	703	VAL	2.3
1	A	679	CYS	2.3
1	A	503	ASN	2.2
1	A	742	GLU	2.2
1	B	724	LYS	2.2
1	B	589	HIS	2.2
1	A	771	ASP	2.1
1	A	763	LEU	2.1
1	B	699	ASN	2.1
1	B	763	LEU	2.1
1	B	464	ALA	2.1
1	A	461	GLN	2.1
1	B	519	SER	2.1
1	A	724	LYS	2.1
1	A	475	MET	2.1
1	A	721	ALA	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.