



Full wwPDB X-ray Structure Validation Report ⓘ

May 15, 2020 – 03:18 am BST

PDB ID : 4G03
Title : High-resolution Crystal Structural Variance Analysis between Recombinant and Wild-type Human Serum Albumin
Authors : Cao, H.L.; Yin, D.C.
Deposited on : 2012-07-09
Resolution : 2.22 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 following versions of software and data (see [references ⓘ](#)) were used in the production of this report:

MolProbity : 4.02b-467
Xtriage (Phenix) : 1.13
EDS : 2.11
Percentile statistics : 20191225.v01 (using entries in the PDB archive December 25th 2019)
Refmac : 5.8.0158
CCP4 : 7.0.044 (Gargrove)
Ideal geometry (proteins) : Engh & Huber (2001)
Ideal geometry (DNA, RNA) : Parkinson et al. (1996)
Validation Pipeline (wwPDB-VP) : 2.11

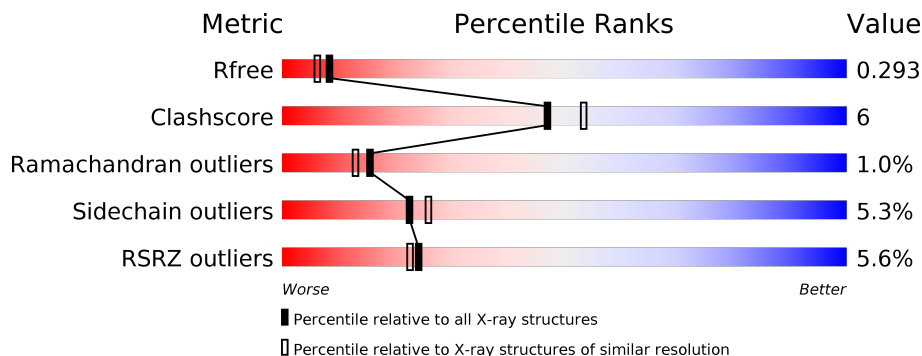
1 Overall quality at a glance

The following experimental techniques were used to determine the structure:

X-RAY DIFFRACTION

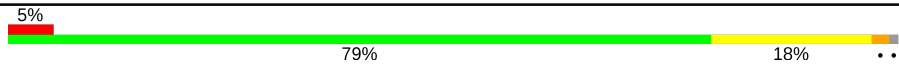
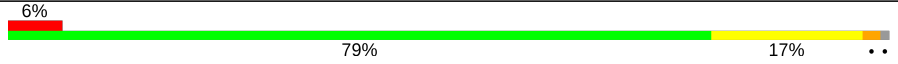
The reported resolution of this entry is 2.22 Å.

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}	130704	5912 (2.24-2.20)
Clashscore	141614	6646 (2.24-2.20)
Ramachandran outliers	138981	6543 (2.24-2.20)
Sidechain outliers	138945	6544 (2.24-2.20)
RSRZ outliers	127900	5797 (2.24-2.20)

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 on 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	585	
1	B	585	

2 Entry composition

There are 2 unique types of molecules in this entry. The entry contains 9279 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 Serum albumin.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
			Total	C	N	O	S			
1	A	578	4599	2903	776	879	41	0	0	0
1	B	578	4599	2903	776	879	41	0	0	0

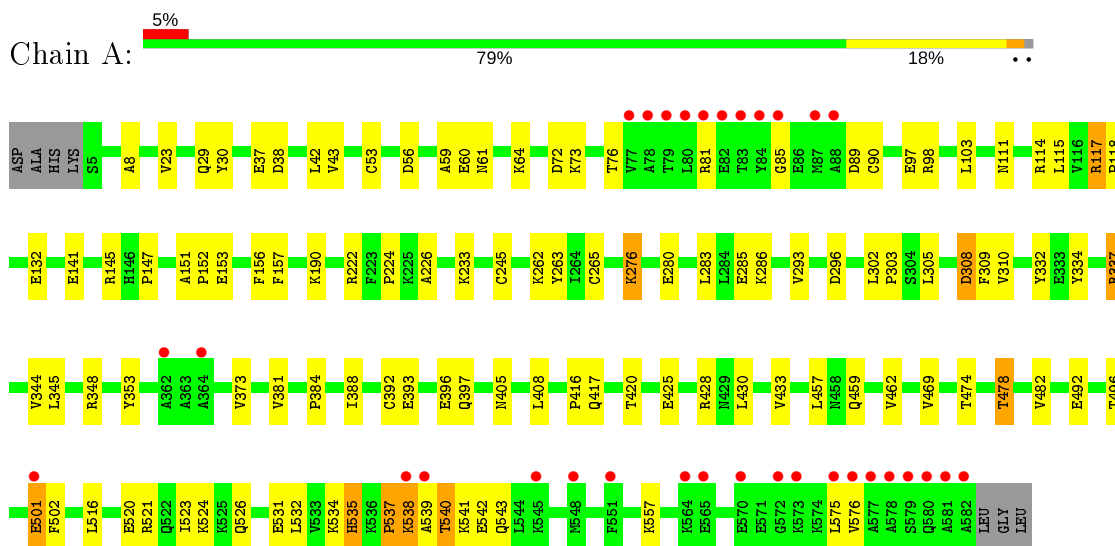
- Molecule 2 is water.

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
2	A	32	Total 32	O 32	0	0
2	B	49	Total 49	O 49	0	0

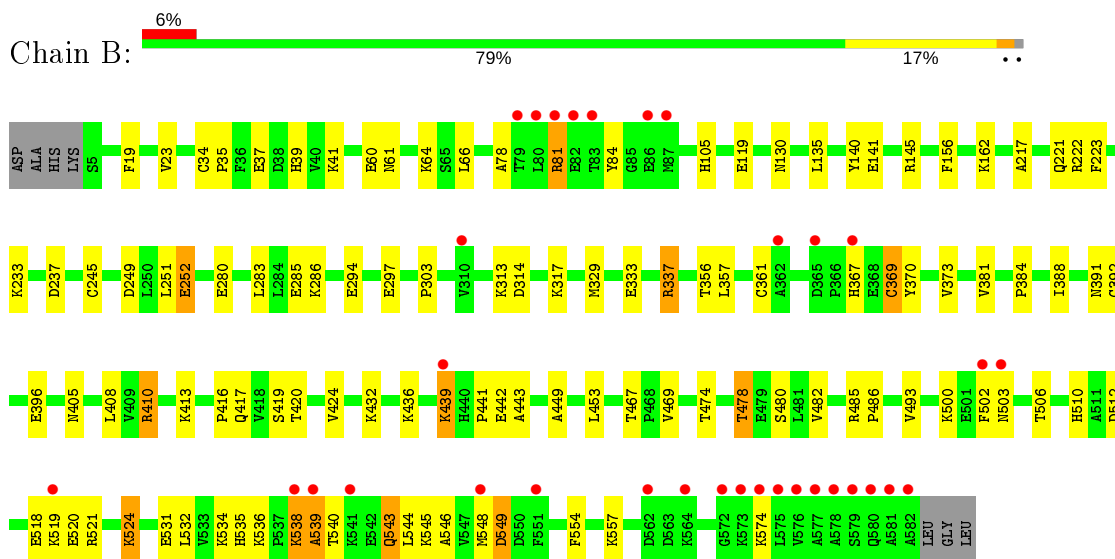
3 Residue-property plots [i](#)

These plots are drawn for all protein, RNA and DNA 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: Serum albumin



• Molecule 1: Serum albumin



4 Data and refinement statistics

Property	Value	Source
Space group	P 1	Depositor
Cell constants a, b, c, α , β , γ	58.57Å 58.67Å 95.67Å 75.71° 88.07° 73.63°	Depositor
Resolution (Å)	47.22 – 2.22 47.22 – 2.22	Depositor EDS
% Data completeness (in resolution range)	96.5 (47.22-2.22) 90.2 (47.22-2.22)	Depositor EDS
R_{merge}	0.07	Depositor
R_{sym}	0.07	Depositor
$\langle I/\sigma(I) \rangle$ ¹	2.54 (at 2.22Å)	Xtrriage
Refinement program	PHENIX (phenix.refine: 1.6.4_486)	Depositor
R, R_{free}	0.236 , 0.301 0.230 , 0.293	Depositor DCC
R_{free} test set	1999 reflections (3.52%)	wwPDB-VP
Wilson B-factor (Å ²)	38.5	Xtrriage
Anisotropy	0.039	Xtrriage
Bulk solvent k_{sol} (e/Å ³), B_{sol} (Å ²)	0.30 , 35.2	EDS
L-test for twinning ²	$\langle L \rangle = 0.49$, $\langle L^2 \rangle = 0.33$	Xtrriage
Estimated twinning fraction	No twinning to report.	Xtrriage
F_o, F_c correlation	0.94	EDS
Total number of atoms	9279	wwPDB-VP
Average B, all atoms (Å ²)	52.0	wwPDB-VP

Xtrriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 5.30% of the height of the origin peak. No significant pseudotranslation is detected.*

¹ Intensities estimated from amplitudes.

² Theoretical 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	0.41	0/4688	0.54	0/6324
1	B	0.42	0/4688	0.55	0/6324
All	All	0.42	0/9376	0.55	0/12648

There are no bond length outliers.

There are no bond angle outliers.

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	4599	0	4518	57	0
1	B	4599	0	4518	56	0
2	A	32	0	0	0	0
2	B	49	0	0	0	0
All	All	9279	0	9036	113	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 (113) 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:B:303:PRO:O	1:B:337:ARG:NH1	2.09	0.86

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:A:303:PRO:O	1:A:337:ARG:NH1	2.13	0.80
1:A:502:PHE:HZ	1:A:576:VAL:HB	1.54	0.73
1:A:516:LEU:O	1:A:521:ARG:NH2	2.23	0.70
1:A:405:ASN:HA	1:A:408:LEU:HD12	1.75	0.68
1:B:156:PHE:HE1	1:B:285:GLU:HG3	1.58	0.67
1:A:417:GLN:HB3	1:A:469:VAL:HG12	1.78	0.64
1:B:135:LEU:HD21	1:B:162:LYS:HB2	1.80	0.64
1:B:356:THR:HG21	1:B:373:VAL:HG22	1.82	0.61
1:B:156:PHE:CE1	1:B:285:GLU:HG3	2.36	0.60
1:B:531:GLU:O	1:B:535:HIS:ND1	2.35	0.59
1:A:224:PRO:HD2	1:A:296:ASP:HB3	1.85	0.59
1:A:353:TYR:HD1	1:A:373:VAL:HG11	1.68	0.58
1:B:384:PRO:O	1:B:388:ILE:HG12	2.04	0.58
1:B:416:PRO:O	1:B:534:LYS:HE2	2.04	0.58
1:B:313:LYS:HA	1:B:367:HIS:CE1	2.39	0.57
1:B:518:GLU:OE1	1:B:521:ARG:NH1	2.37	0.56
1:A:384:PRO:O	1:A:388:ILE:HG12	2.06	0.56
1:B:540:THR:HB	1:B:544:LEU:HG	1.86	0.56
1:A:392:CYS:O	1:A:396:GLU:HG2	2.05	0.56
1:A:474:THR:O	1:A:478:THR:OG1	2.20	0.56
1:B:392:CYS:O	1:B:396:GLU:HG2	2.05	0.56
1:A:531:GLU:O	1:A:535:HIS:ND1	2.39	0.55
1:B:417:GLN:HB3	1:B:469:VAL:HG12	1.89	0.55
1:B:405:ASN:HA	1:B:408:LEU:HD12	1.88	0.55
1:A:29:GLN:HG2	1:A:147:PRO:HA	1.88	0.54
1:B:369:CYS:SG	1:B:370:TYR:N	2.81	0.54
1:A:276:LYS:O	1:A:280:GLU:HG2	2.08	0.54
1:B:249:ASP:HB3	1:B:252:GLU:CG	2.38	0.53
1:A:540:THR:HA	1:A:543:GLN:HE21	1.74	0.53
1:A:56:ASP:HB3	1:A:59:ALA:HB2	1.92	0.52
1:B:536:LYS:O	1:B:540:THR:HG21	2.09	0.52
1:B:314:ASP:HB3	1:B:317:LYS:HB3	1.92	0.52
1:A:156:PHE:HE1	1:A:285:GLU:HG3	1.75	0.51
1:B:520:GLU:O	1:B:524:LYS:HG2	2.10	0.51
1:A:308:ASP:HB2	1:A:309:PHE:CD2	2.46	0.51
1:B:249:ASP:HB3	1:B:252:GLU:HG2	1.94	0.50
1:A:420:THR:OG1	1:A:531:GLU:OE2	2.23	0.50
1:B:546:ALA:HA	1:B:549:ASP:HB2	1.93	0.50
1:B:391:ASN:OD1	1:B:410:ARG:NH2	2.43	0.50
1:A:156:PHE:CE1	1:A:285:GLU:HG3	2.47	0.49
1:A:428:ARG:NE	1:A:526:GLN:OE1	2.45	0.49

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:A:81:ARG:HA	1:A:85:GLY:H	1.77	0.49
1:A:348:ARG:HG3	1:A:482:VAL:CG1	2.42	0.49
1:B:441:PRO:O	1:B:443:ALA:N	2.42	0.49
1:A:233:LYS:HE3	1:A:263:TYR:CZ	2.48	0.49
1:A:23:VAL:HG12	1:A:43:VAL:HG22	1.95	0.48
1:B:502:PHE:HA	1:B:535:HIS:HD2	1.78	0.48
1:B:510:HIS:HB3	1:B:512:ASP:OD1	2.13	0.48
1:A:222:ARG:HD3	1:A:293:VAL:HG12	1.96	0.48
1:B:474:THR:O	1:B:478:THR:HB	2.13	0.48
1:A:302:LEU:HB3	1:A:337:ARG:NH1	2.29	0.48
1:A:153:GLU:O	1:A:157:PHE:HD1	1.96	0.48
1:B:538:LYS:O	1:B:540:THR:N	2.46	0.48
1:B:329:MET:O	1:B:333:GLU:HG2	2.15	0.47
1:A:353:TYR:CD1	1:A:373:VAL:HG11	2.48	0.47
1:A:42:LEU:HD22	1:A:73:LYS:HG3	1.97	0.47
1:A:265:CYS:SG	1:A:286:LYS:HD2	2.54	0.46
1:B:313:LYS:HG3	1:B:367:HIS:HE1	1.81	0.46
1:B:432:LYS:O	1:B:436:LYS:HG3	2.16	0.46
1:A:61:ASN:HB3	1:A:64:LYS:HE2	1.97	0.45
1:B:34:CYS:HA	1:B:35:PRO:HD3	1.82	0.45
1:B:370:TYR:O	1:B:373:VAL:HG23	2.16	0.45
1:A:114:ARG:NH2	1:A:520:GLU:OE2	2.48	0.45
1:B:217:ALA:O	1:B:221:GLN:HG3	2.16	0.45
1:A:457:LEU:HA	1:A:457:LEU:HD23	1.80	0.45
1:A:141:GLU:OE1	1:A:145:ARG:NH1	2.36	0.45
1:A:537:PRO:HB2	1:A:538:LYS:H	1.66	0.45
1:B:233:LYS:NZ	1:B:237:ASP:OD2	2.46	0.45
1:A:30:TYR:HE1	1:A:103:LEU:HD23	1.82	0.44
1:A:416:PRO:O	1:A:534:LYS:HE2	2.16	0.44
1:A:90:CYS:O	1:A:98:ARG:HG3	2.17	0.44
1:A:537:PRO:O	1:A:539:ALA:N	2.50	0.44
1:B:19:PHE:O	1:B:23:VAL:HG23	2.18	0.44
1:B:81:ARG:HB2	1:B:81:ARG:HH11	1.83	0.44
1:B:449:ALA:O	1:B:453:LEU:HG	2.18	0.43
1:B:485:ARG:HB3	1:B:486:PRO:HD3	2.00	0.43
1:A:345:LEU:HD21	1:A:381:VAL:HG22	1.99	0.43
1:A:541:LYS:C	1:A:543:GLN:H	2.22	0.43
1:B:439:LYS:O	1:B:439:LYS:NZ	2.39	0.43
1:B:413:LYS:HB3	1:B:493:VAL:HG23	2.00	0.43
1:B:61:ASN:HB3	1:B:64:LYS:HD2	2.01	0.43
1:B:441:PRO:C	1:B:443:ALA:H	2.21	0.43

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:A:501:GLU:O	1:A:535:HIS:HB3	2.18	0.43
1:B:66:LEU:HD13	1:B:251:LEU:HD12	2.01	0.42
1:B:381:VAL:O	1:B:384:PRO:HD2	2.19	0.42
1:A:38:ASP:O	1:A:42:LEU:HG	2.20	0.42
1:A:72:ASP:O	1:A:76:THR:HG23	2.20	0.42
1:A:393:GLU:O	1:A:397:GLN:HG3	2.20	0.42
1:A:540:THR:HA	1:A:543:GLN:NE2	2.33	0.42
1:B:544:LEU:C	1:B:546:ALA:H	2.23	0.42
1:A:428:ARG:NE	1:A:523:ILE:HG12	2.35	0.42
1:B:39:HIS:HD2	1:B:140:TYR:HE1	1.68	0.42
1:B:503:ASN:HB2	1:B:506:THR:OG1	2.20	0.41
1:A:115:LEU:HA	1:A:115:LEU:HD12	1.79	0.41
1:A:226:ALA:O	1:A:332:TYR:OH	2.34	0.41
1:A:425:GLU:HG2	1:A:459:GLN:NE2	2.36	0.41
1:B:539:ALA:O	1:B:543:GLN:NE2	2.54	0.41
1:A:117:ARG:HG3	1:A:117:ARG:O	2.20	0.41
1:B:78:ALA:HA	1:B:84:TYR:CD2	2.55	0.41
1:A:8:ALA:HB2	1:A:53:CYS:HB3	2.03	0.41
1:B:420:THR:O	1:B:424:VAL:HG23	2.21	0.41
1:A:190:LYS:HE2	1:A:190:LYS:HB3	1.88	0.41
1:A:459:GLN:HA	1:A:462:VAL:HG22	2.03	0.41
1:B:574:LYS:HD3	1:B:574:LYS:HA	1.88	0.40
1:A:151:ALA:HB3	1:A:152:PRO:HD3	2.02	0.40
1:B:222:ARG:HG2	1:B:223:PHE:CE1	2.56	0.40
1:B:78:ALA:HA	1:B:84:TYR:HD2	1.87	0.40
1:A:117:ARG:HA	1:A:118:PRO:HD3	1.82	0.40
1:A:430:LEU:O	1:A:433:VAL:HG12	2.21	0.40
1:B:141:GLU:OE1	1:B:145:ARG:NH1	2.30	0.40
1:B:357:LEU:O	1:B:361:CYS:HB2	2.21	0.40
1:B:500:LYS:HG2	1:B:535:HIS:CE1	2.57	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	576/585 (98%)	542 (94%)	29 (5%)	5 (1%)	17	15
1	B	576/585 (98%)	539 (94%)	31 (5%)	6 (1%)	15	13
All	All	1152/1170 (98%)	1081 (94%)	60 (5%)	11 (1%)	15	13

All (11) Ramachandran outliers are listed below:

Mol	Chain	Res	Type
1	A	60	GLU
1	A	538	LYS
1	B	539	ALA
1	B	60	GLU
1	A	501	GLU
1	A	537	PRO
1	A	542	GLU
1	B	283	LEU
1	B	442	GLU
1	B	538	LYS
1	B	545	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	506/511 (99%)	481 (95%)	25 (5%)	25	29
1	B	506/511 (99%)	477 (94%)	29 (6%)	20	23
All	All	1012/1022 (99%)	958 (95%)	54 (5%)	22	26

All (54) residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	A	37	GLU
1	A	89	ASP

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Mol	Chain	Res	Type
1	A	97	GLU
1	A	111	ASN
1	A	117	ARG
1	A	132	GLU
1	A	245	CYS
1	A	262	LYS
1	A	276	LYS
1	A	283	LEU
1	A	305	LEU
1	A	308	ASP
1	A	310	VAL
1	A	334	TYR
1	A	337	ARG
1	A	344	VAL
1	A	478	THR
1	A	492	GLU
1	A	496	THR
1	A	524	LYS
1	A	532	LEU
1	A	535	HIS
1	A	540	THR
1	A	557	LYS
1	A	575	LEU
1	B	37	GLU
1	B	41	LYS
1	B	81	ARG
1	B	105	HIS
1	B	119	GLU
1	B	130	ASN
1	B	245	CYS
1	B	252	GLU
1	B	280	GLU
1	B	286	LYS
1	B	294	GLU
1	B	297	GLU
1	B	337	ARG
1	B	369	CYS
1	B	410	ARG
1	B	419	SER
1	B	439	LYS
1	B	467	THR
1	B	478	THR

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Mol	Chain	Res	Type
1	B	480	SER
1	B	482	VAL
1	B	519	LYS
1	B	524	LYS
1	B	532	LEU
1	B	543	GLN
1	B	548	MET
1	B	549	ASP
1	B	554	PHE
1	B	557	LYS

Some sidechains can be flipped to improve hydrogen bonding and reduce clashes. All (2) such sidechains are listed below:

Mol	Chain	Res	Type
1	A	543	GLN
1	B	367	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 carbohydrates 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

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	578/585 (98%)	0.14	32 (5%) 25 23	34, 49, 87, 124	0
1	B	578/585 (98%)	0.11	33 (5%) 23 22	29, 46, 90, 117	0
All	All	1156/1170 (98%)	0.13	65 (5%) 24 23	29, 48, 89, 124	0

All (65) RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
1	A	577	ALA	11.4
1	B	581	ALA	10.5
1	B	575	LEU	9.9
1	B	539	ALA	9.9
1	A	83	THR	9.6
1	A	79	THR	7.6
1	A	539	ALA	7.4
1	A	81	ARG	7.3
1	A	82	GLU	6.1
1	B	564	LYS	5.5
1	B	577	ALA	5.2
1	B	582	ALA	5.2
1	A	78	ALA	5.0
1	A	87	MET	5.0
1	A	573	LYS	4.9
1	A	575	LEU	4.9
1	A	581	ALA	4.9
1	B	82	GLU	4.9
1	B	87	MET	4.8
1	A	582	ALA	4.7
1	B	548	MET	4.6
1	A	576	VAL	4.5
1	A	84	TYR	4.3
1	B	86	GLU	4.2

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Mol	Chain	Res	Type	RSRZ
1	B	580	GLN	4.2
1	B	81	ARG	4.1
1	A	580	GLN	4.1
1	B	574	LYS	4.1
1	B	576	VAL	4.1
1	B	80	LEU	3.9
1	B	579	SER	3.8
1	B	551	PHE	3.7
1	A	88	ALA	3.7
1	B	578	ALA	3.7
1	B	572	GLY	3.6
1	B	362	ALA	3.5
1	A	538	LYS	3.4
1	A	570	GLU	3.4
1	A	77	VAL	3.4
1	B	83	THR	3.1
1	A	564	LYS	3.1
1	A	364	ALA	3.1
1	B	541	LYS	2.9
1	A	565	GLU	2.8
1	A	579	SER	2.7
1	A	85	GLY	2.7
1	A	578	ALA	2.6
1	B	79	THR	2.6
1	B	573	LYS	2.6
1	A	572	GLY	2.5
1	B	367	HIS	2.5
1	B	439	LYS	2.5
1	A	551	PHE	2.4
1	B	503	ASN	2.4
1	B	538	LYS	2.3
1	A	548	MET	2.3
1	B	365	ASP	2.3
1	A	501	GLU	2.3
1	A	545	LYS	2.2
1	A	80	LEU	2.2
1	A	362	ALA	2.2
1	B	519	LYS	2.2
1	B	310	VAL	2.1
1	B	502	PHE	2.0
1	B	562	ASP	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 carbohydrates 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.